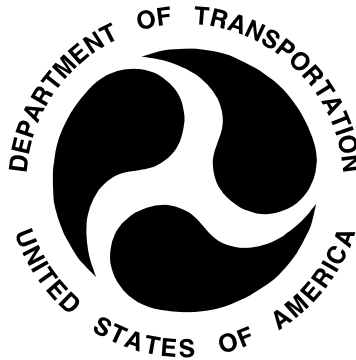


REPORT NO. 208-MGA-2005-DC012

DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208

**Volvo Gothenburg Sweden
2005 Volvo S40 Passenger Car
NHTSA NO.: C55901**

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



Test Date: September 30, 2004 – July 21, 2005

Report Date: August 4, 2005

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**

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EXTERNAL DIMENSIONS

HYBRID III 5 th SN #511, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	782.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	455.8
C	H-POINT HEIGHT	Reference	81.3-86.3	85.2
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	75.7
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	130.9
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.5
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.2
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	282.7
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	196.3
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	540.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	358.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	406.3
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.4

HYBRID III 5 th SN #511, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	186.4
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	222.3
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	476.3
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	299.9
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	361.2
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	83.7
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	539.4
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	851.9
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	762.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	340.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test ID: D051761

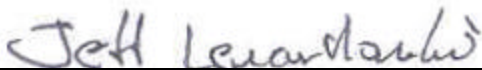
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	250 - 300	267	Pass
Peak Lateral Acceleration	G's	+/- 15	9	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

06/23/2005

Test Date

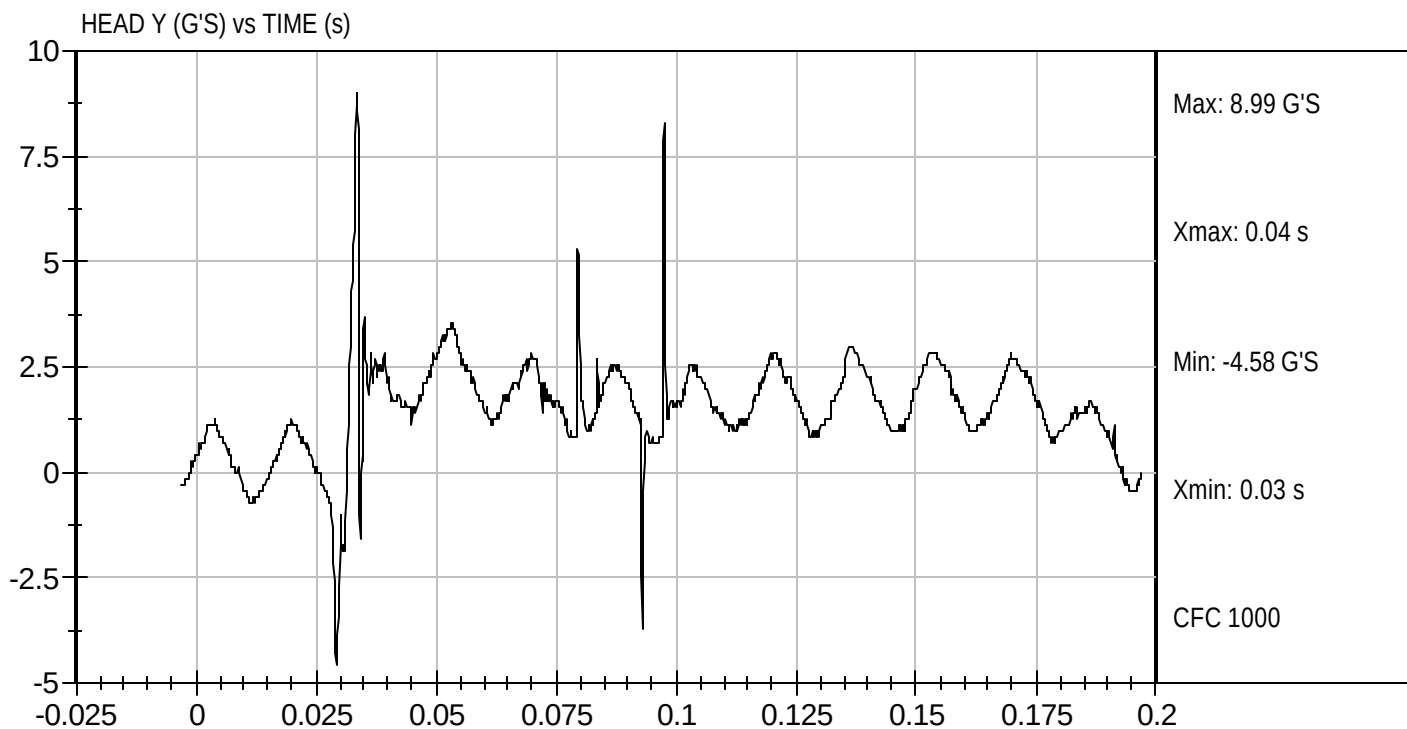
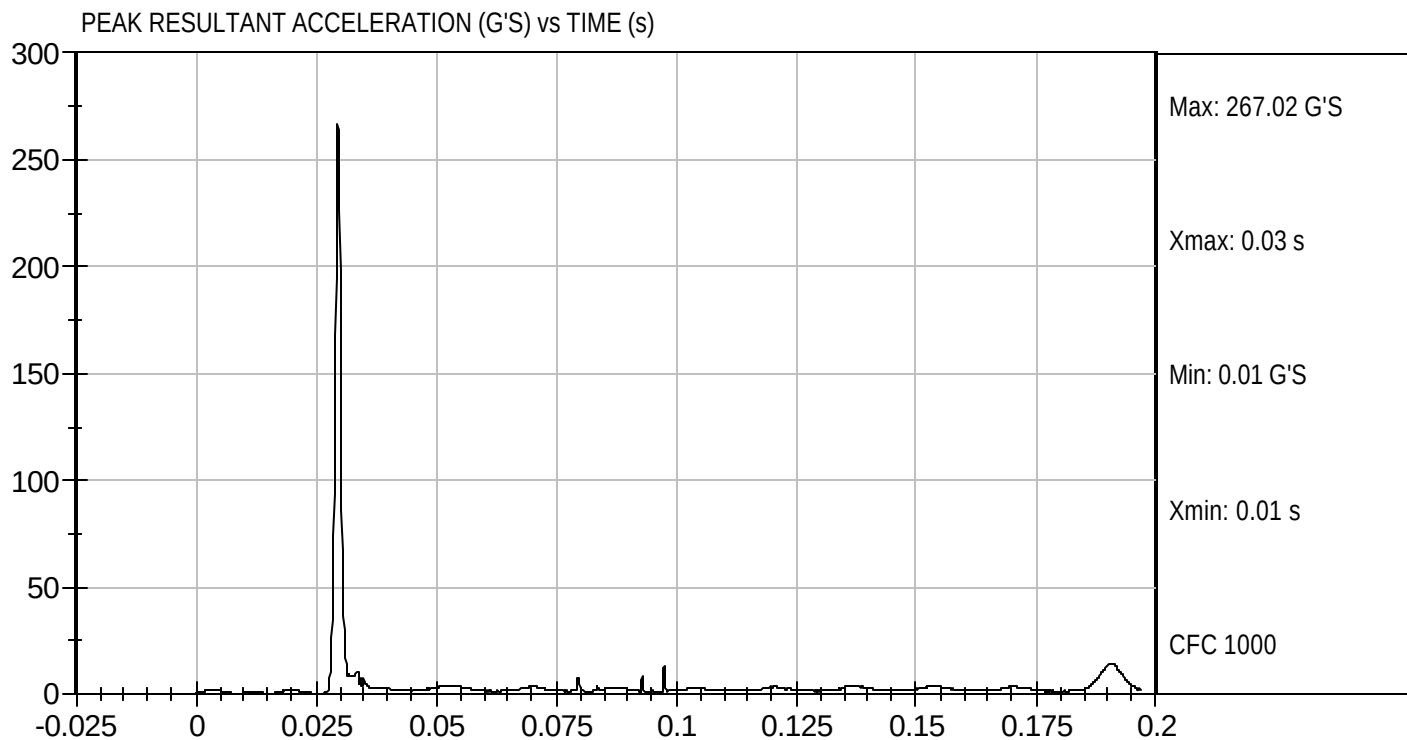


Approved By



Test Desc: Head Drop
Componet ID: D051761

Test Date: 06/23/2005
Velocity: 0 ft/s, 0 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 6/23/05

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>44%</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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	267
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 $\leq 15 \text{ g}$	9

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

Joe Flack
Signature

6/23/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

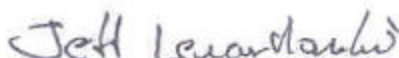
Test I.D: D051762

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.01	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.7	Pass
	30 msec	m/sec	5.8 to 7.0	6.6	Pass
D Plane Rotation	Max	deg	77 to 91	86	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	74	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	88	Pass
Overall Results				Pass	


 Laboratory Technician

06/24/2005

Test Date

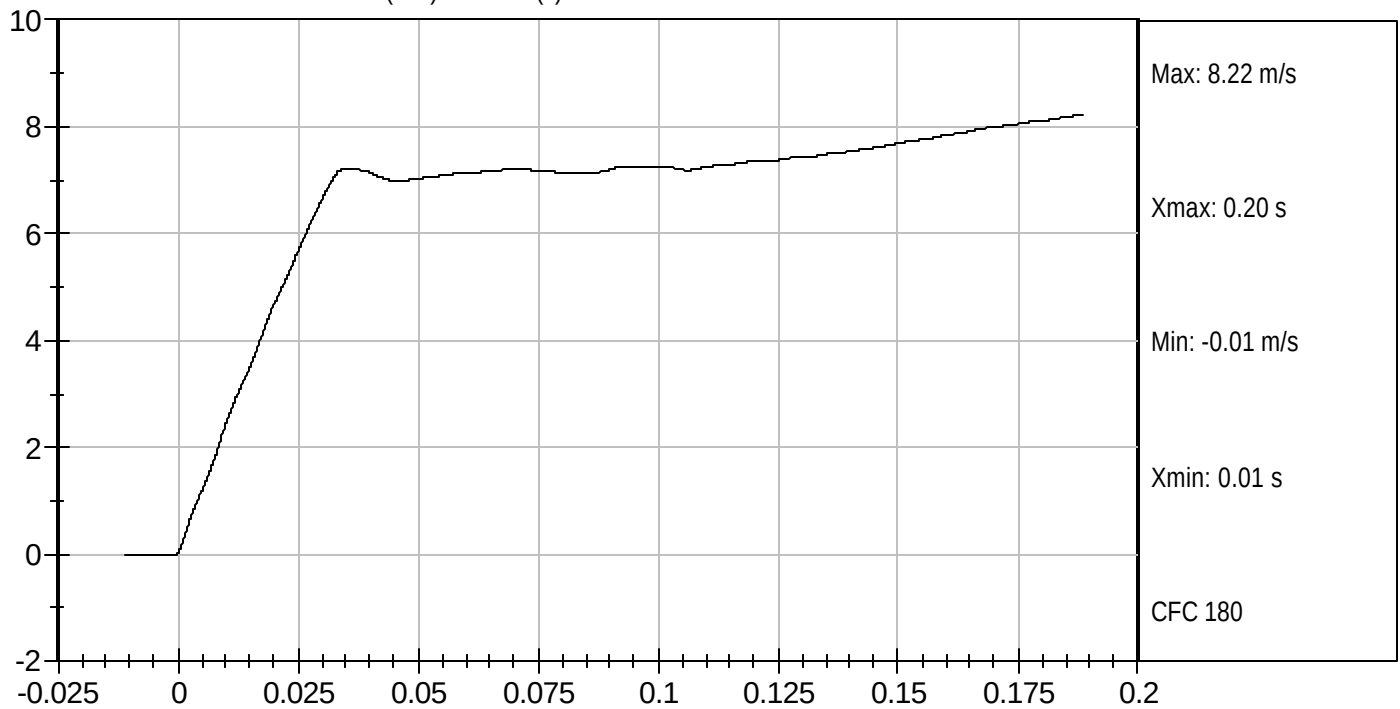

 Approved By



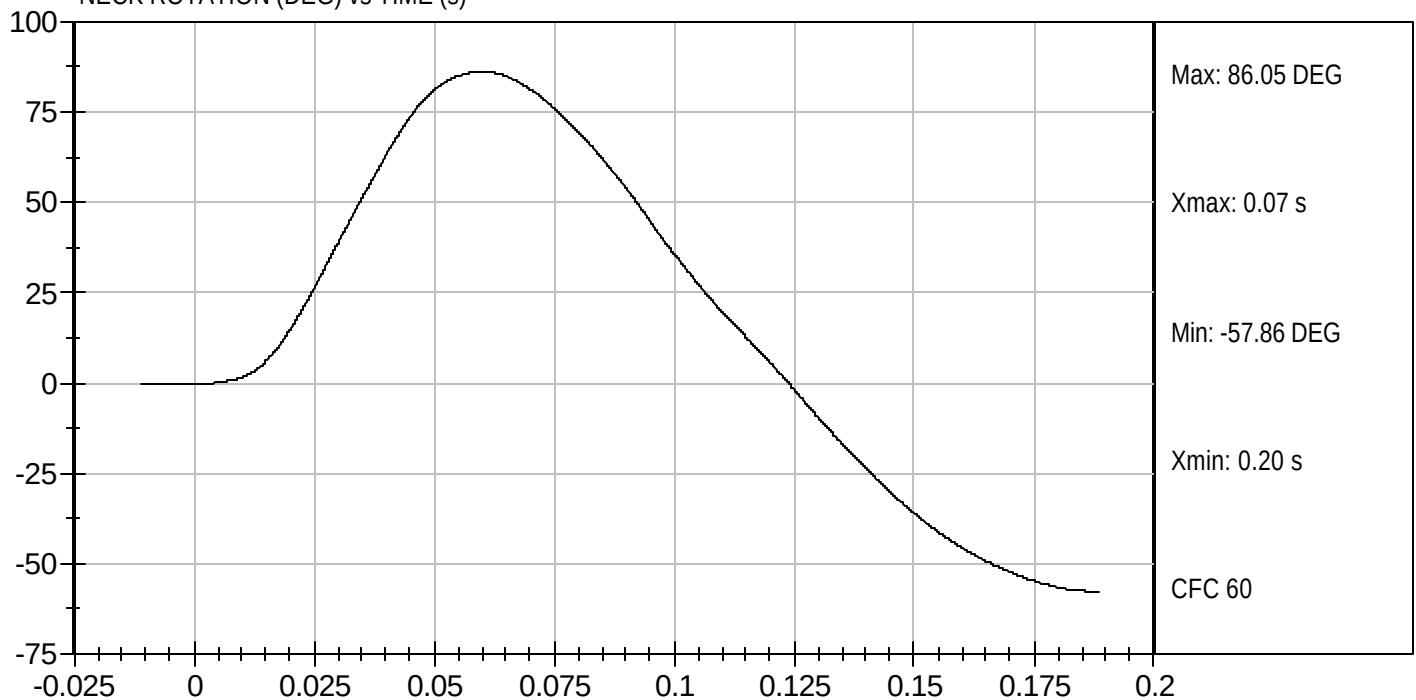
Test Desc: Neck Flexion
Componet ID: D051762

Test Date: 06/24/2005
Velocity: 23.01 ft/s, 7.01 m/s

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



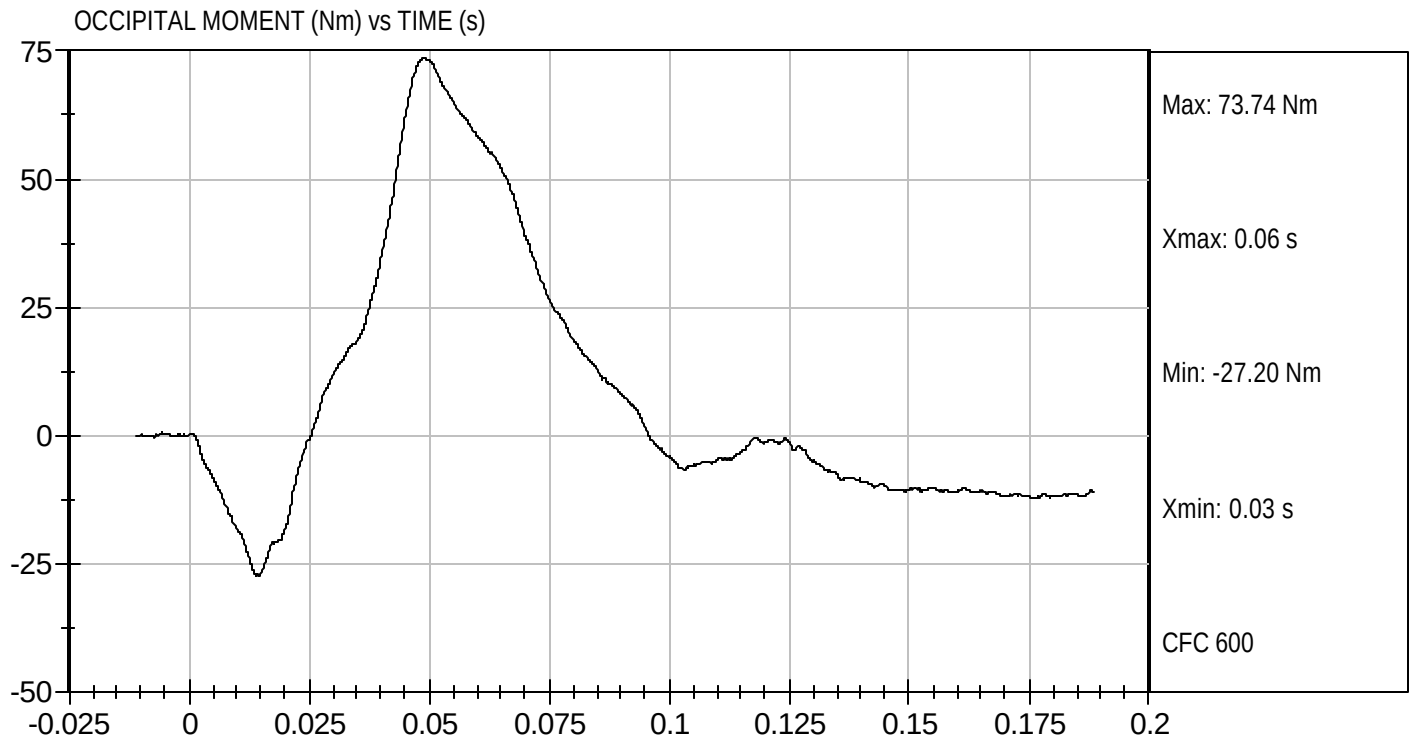
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D051762

Test Date: 06/24/2005
Velocity: 23.01 ft/s, 7.01 m/s



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 511

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 21.8

Record the minimum temperature 21.0

Record the maximum humidity 44%

Record the minimum humidity 41%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 89; Back 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.01 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.4 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.7 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.6 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>74</u> Nm @ <u>86</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	88 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

6/24/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

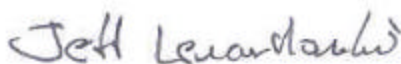
Test I.D: D051763

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	43	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.18	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	102	Pass
Overall Results				Pass	


 Laboratory Technician

06/24/2005

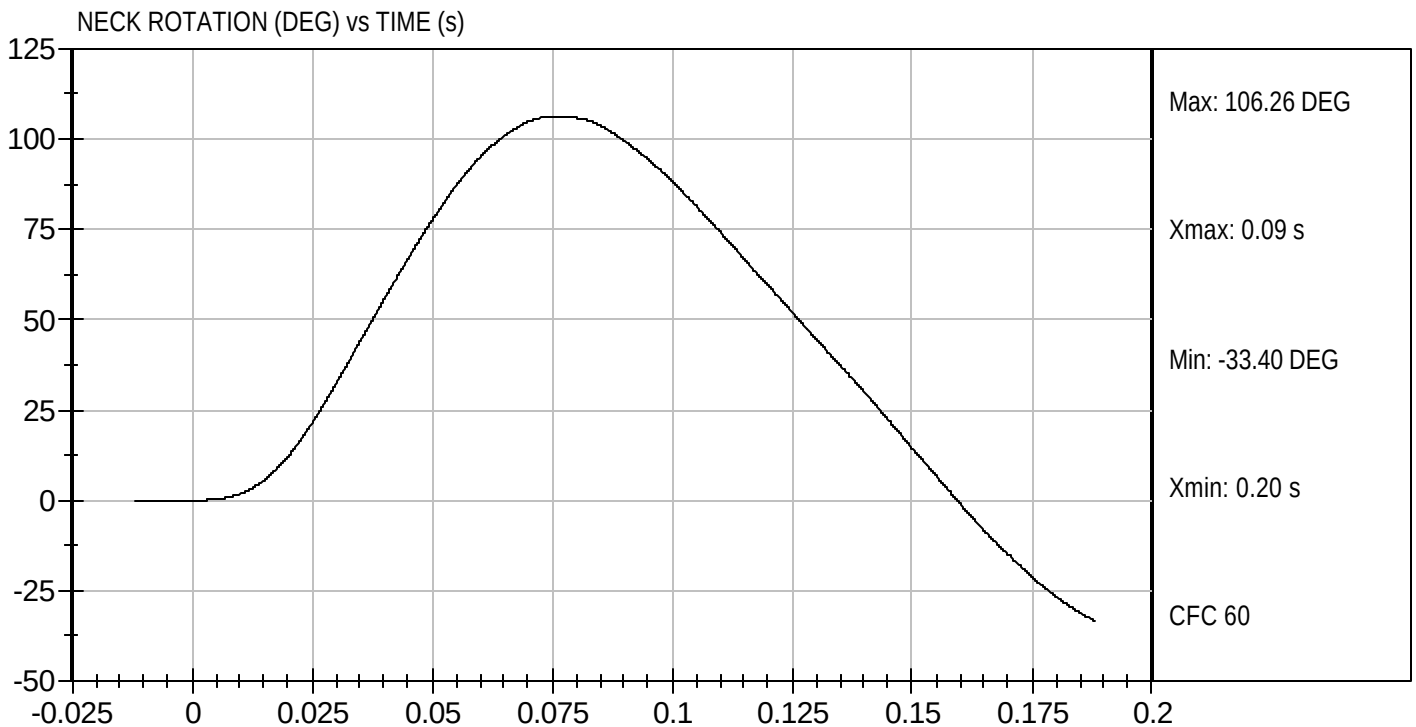
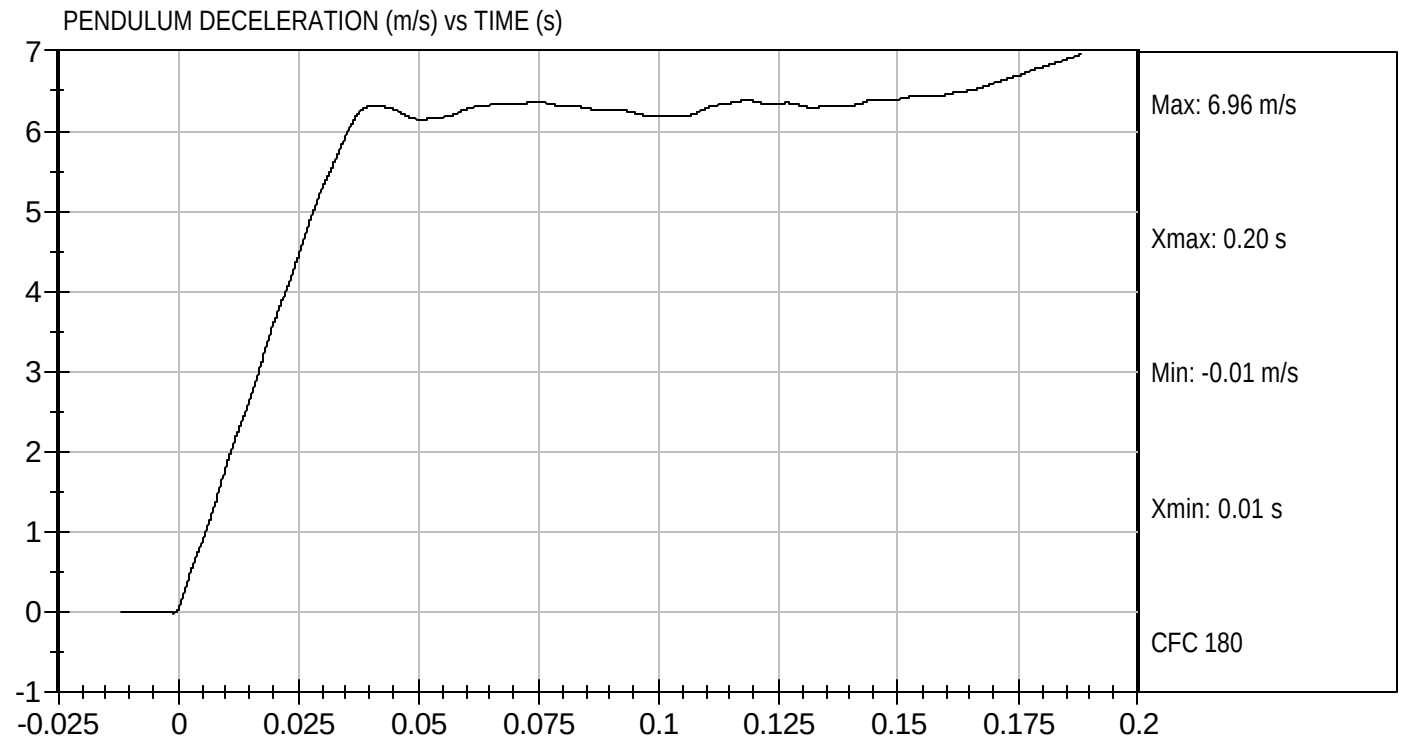
Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D051763

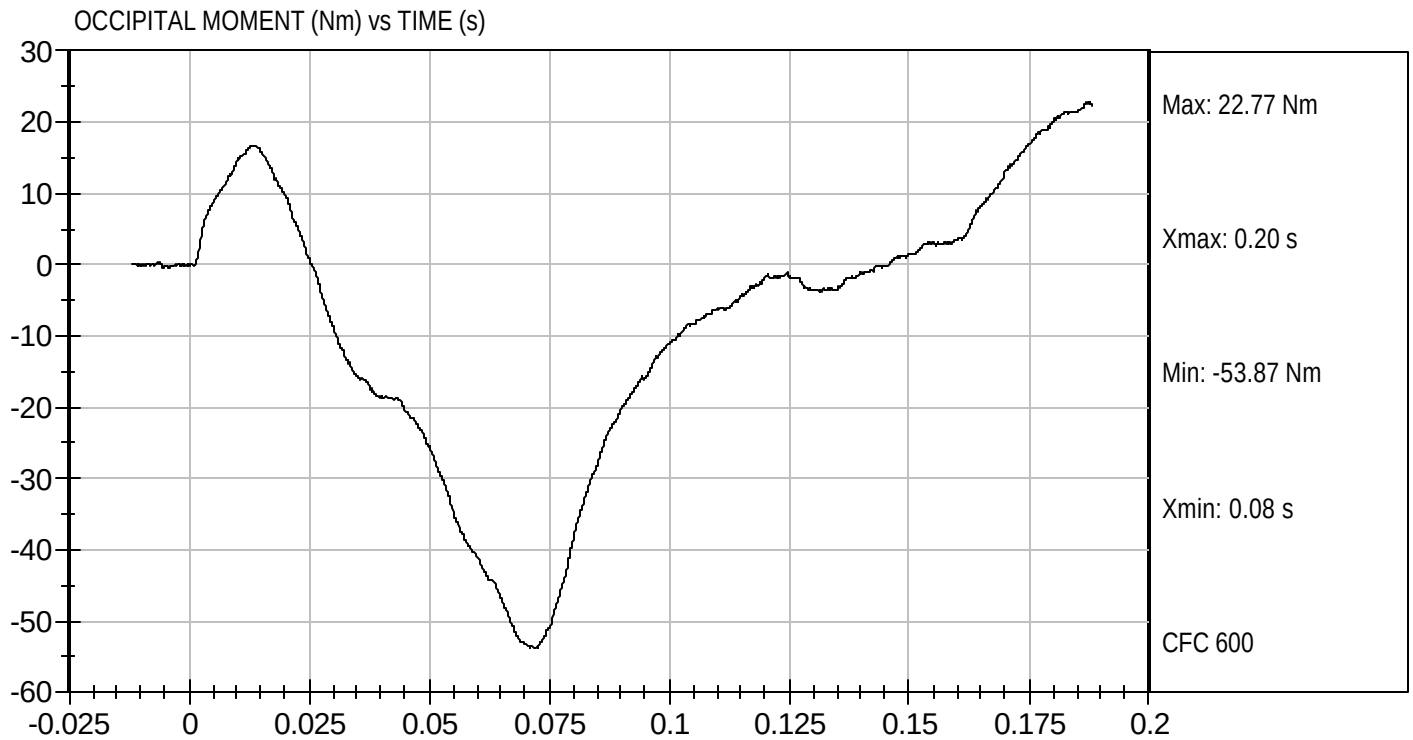
Test Date: 06/24/2005
Velocity: 20.27 ft/s, 6.18 m/s





Test Desc: Neck Extension
Componet ID: D051763

Test Date: 06/24/2005
Velocity: 20.27 ft/s, 6.18 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.8

Record the minimum temperature 21.0

Record the maximum humidity 44%

Record the minimum humidity 41%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 89; Back 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.18 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.8 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.6 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.3 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>106</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	102 ms

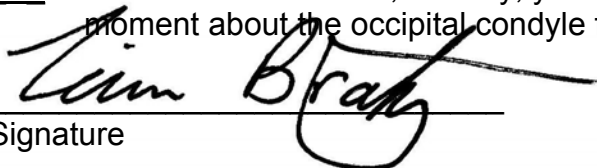
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

6/24/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D051764

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	6.59 to 6.83	6.61	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	3.9	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	≤ 4600 N	3857	Pass
Overall Test Results				Pass



Laboratory Technician

06/24/2005

Test Date

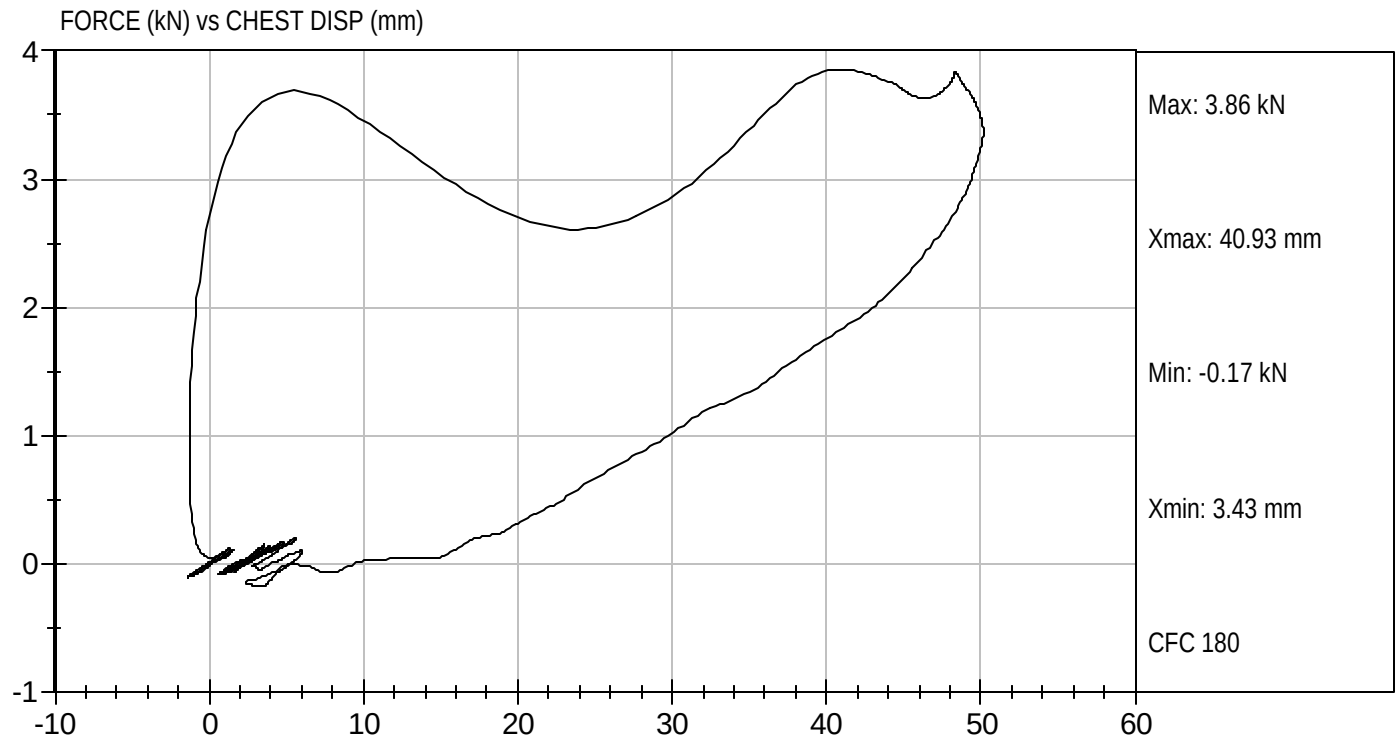


Approved By



Test Desc: Thorax Impact
Componet ID: D051764

Test Date: 06/24/2005
Velocity: 21.7 ft/s, 6.61 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511

Test Date 6/24/05

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 21.8

Record the minimum temperature 21.0

Record the maximum humidity 44%

Record the minimum humidity 41%

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

☒ - No damage

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

☐ - The following repairs or replacement was performed. Record _____

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

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

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

- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 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° 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° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$. (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.61 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	3940 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3857 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	73%

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

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

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

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



Signature

6/24/05

Date

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

ATD Serial No: 511

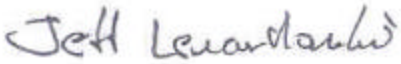
Test I.D: D051765

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.76	Pass
Overall Test Results				Pass


Laboratory Technician

06/24/2005

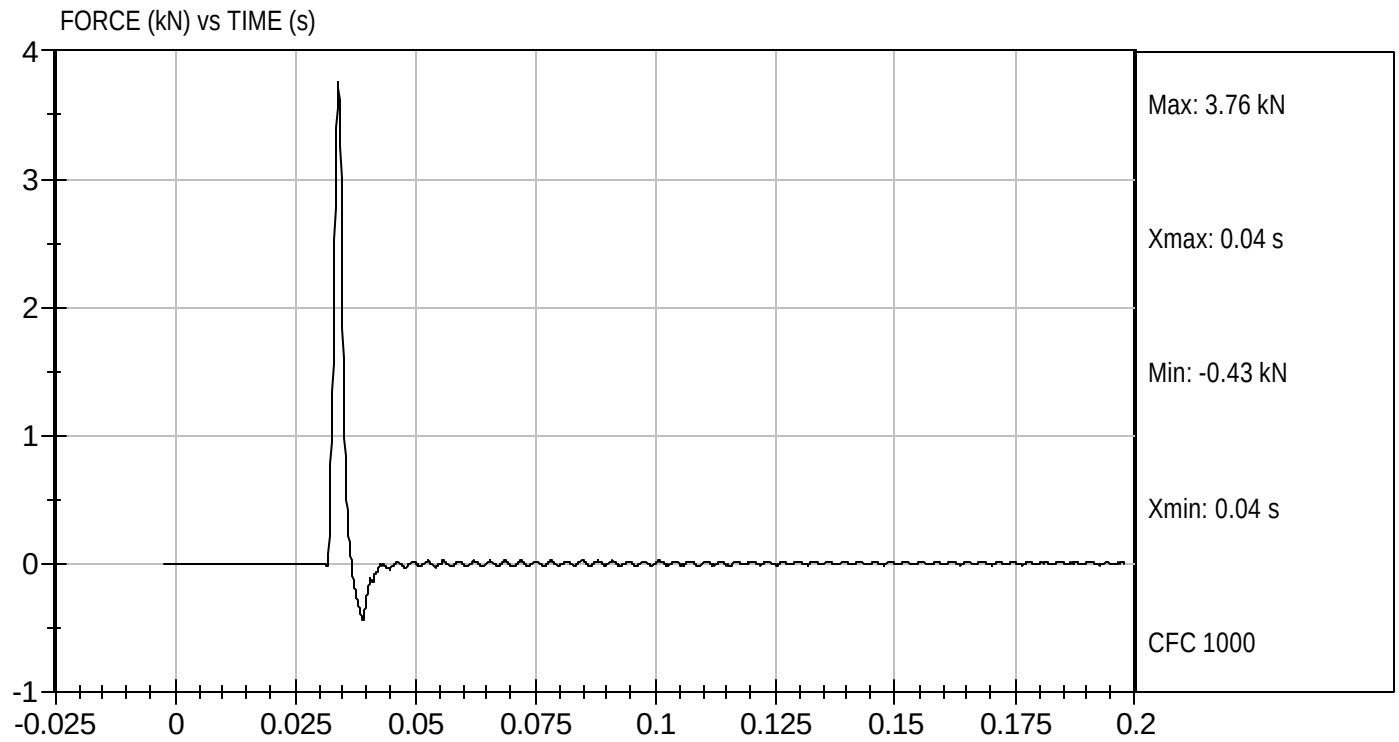
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D051765

Test Date: 06/24/2005
Velocity: 6.89 ft/s, 2.10 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.8

Record the minimum temperature 21.0

Record the maximum humidity 44 %

Record the minimum humidity 41 %

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3760 N

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

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


Signature

6/24/05
Date

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

ATD Serial No: 511

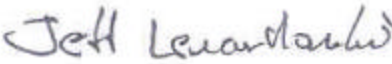
Test I.D: D051766

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.69	Pass
Overall Test Results				Pass


Laboratory Technician

06/24/2005

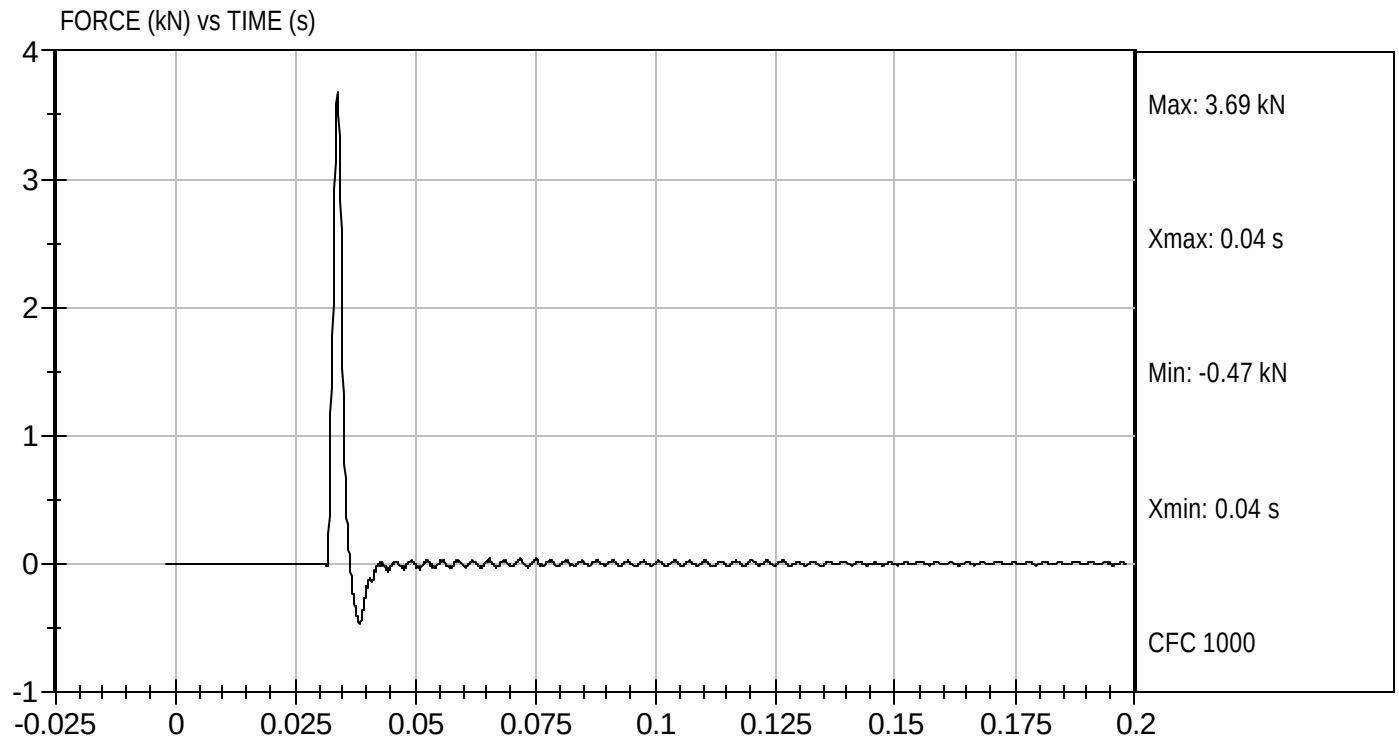
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D051766

Test Date: 06/24/2005
Velocity: 6.91 ft/s, 2.11 m/s



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.8

Record the minimum temperature 21.0

Record the maximum humidity 44%

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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3690 N

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

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


Signature

6/24/05
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

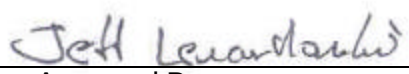
Test I.D: D051767

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	17	Pass
Force at 45 deg	N	320 to 390	390	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

06/24/2005

Test Date


Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511 Test Date 6/24/05

Technician Dave 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>21.8</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity | <u>44%</u> |
| Record the minimum humidity | <u>41%</u> |
- ☒ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- ☒ 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- ☒ 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- ☒ 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))
- ☒ 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- ☒ 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- ☒ 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))
- | | |
|---|------------|
| Record reference plane angle (max. allowed 20°) | <u>15°</u> |
|---|------------|
- ☒ 12. Attach the pull cable and the load cell. (572.135(c)(8))

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° 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°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	390 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	17°


 Signature

6/24/05
 Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

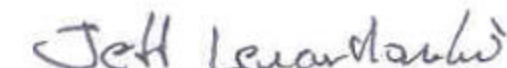
ATD Serial No: 511

Test ID: D052011

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	250 - 300	283	Pass
Peak Lateral Acceleration	G's	+/- 15	-12.6	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

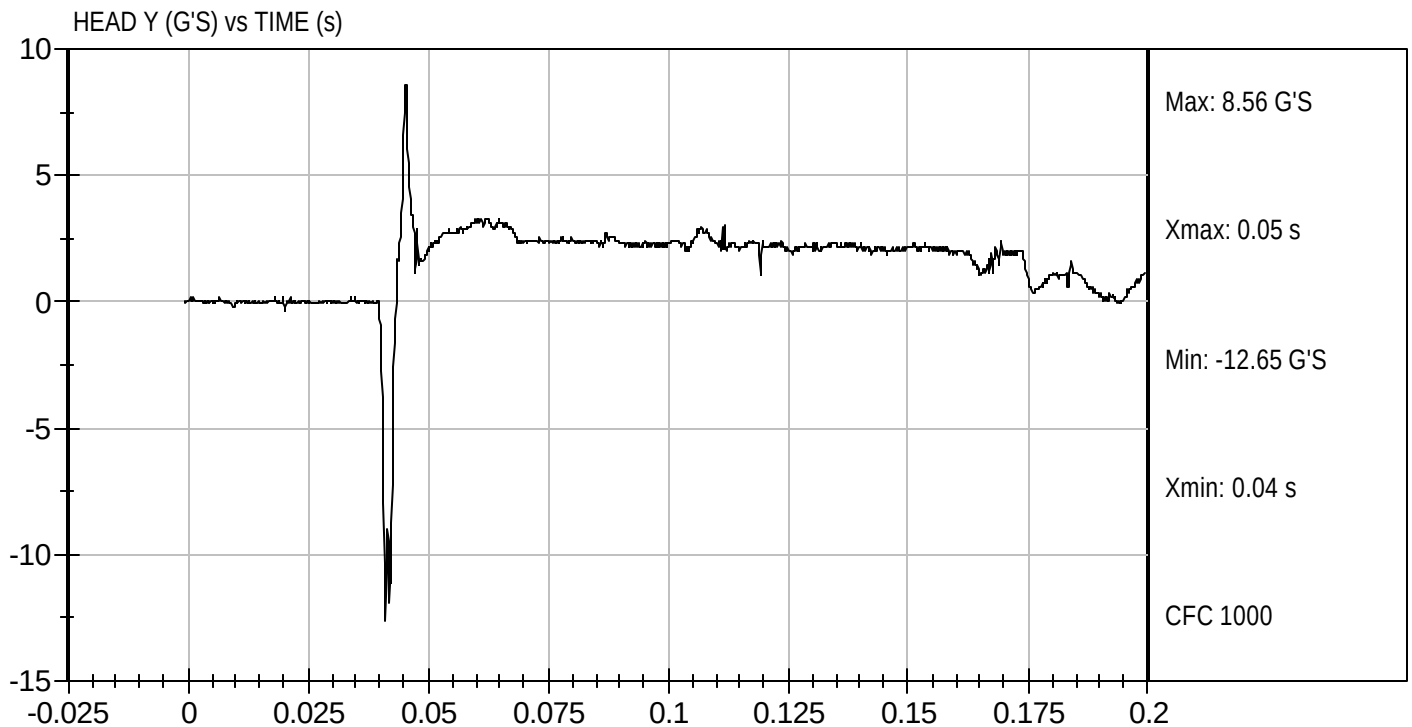
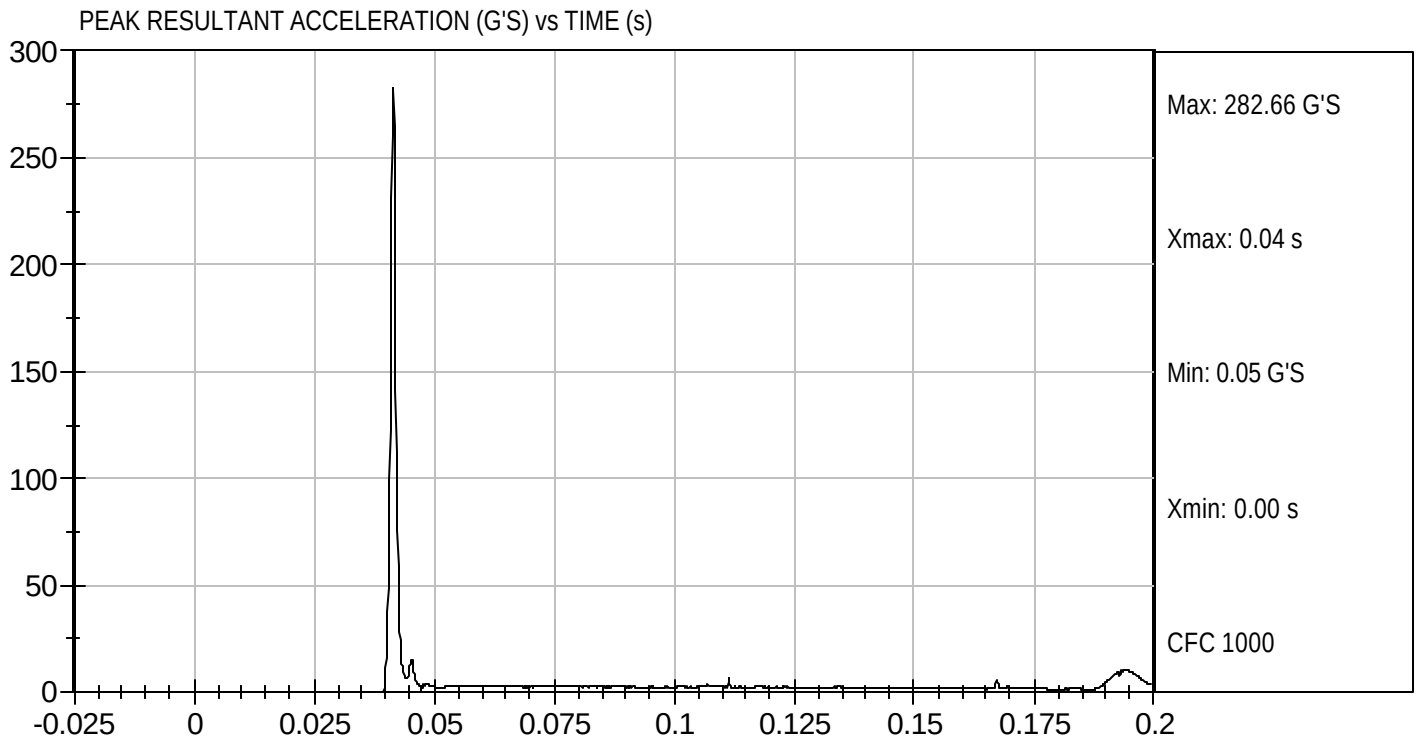
07/22/2005
Test Date


Approved By



Test Desc: Head Drop
Componet ID: D052011

Test Date: 07/22/2005
Velocity: 0 ft/s, 0 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 7/22/05

Technician Tim Bratz

☐ Pretest calibration
☒ Post test calibration verification

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

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>22.0</u> |
| Record the minimum temperature | <u>21.3</u> |
| Record the maximum humidity | <u>46%</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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	283
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 $\leq 15 \text{ g}$	-12.6

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


Signature

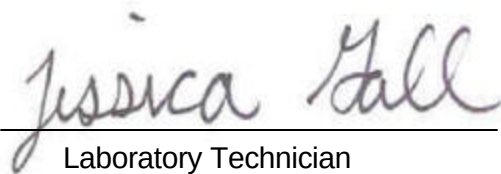
7/22/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

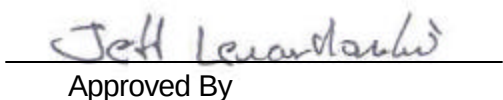
ATD Serial No: 511

Test I.D: D052012

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.13	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.7	Pass
	30 msec	m/sec	5.8 to 7.0	6.6	Pass
D Plane Rotation	Max	deg	77 to 91	83	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	79	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	84	Pass
Overall Results				Pass	


Laboratory Technician

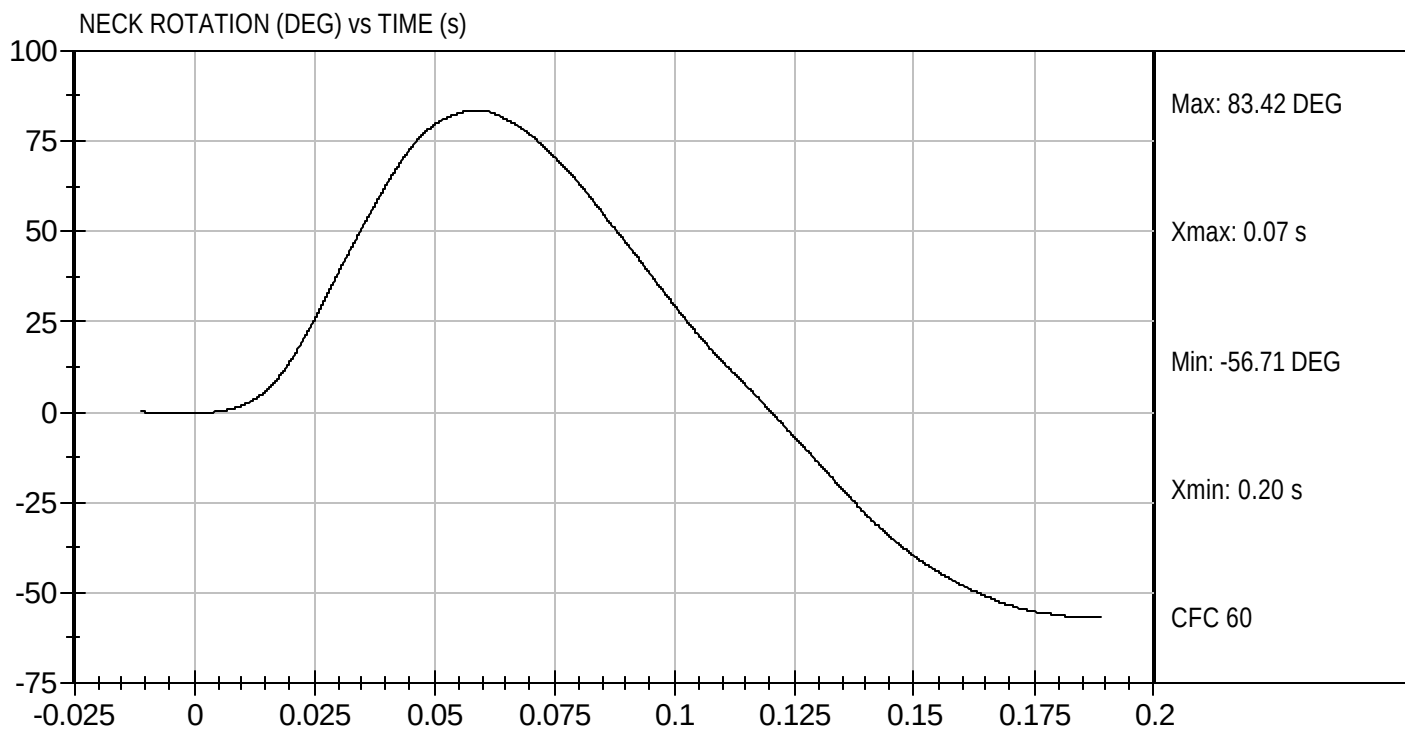
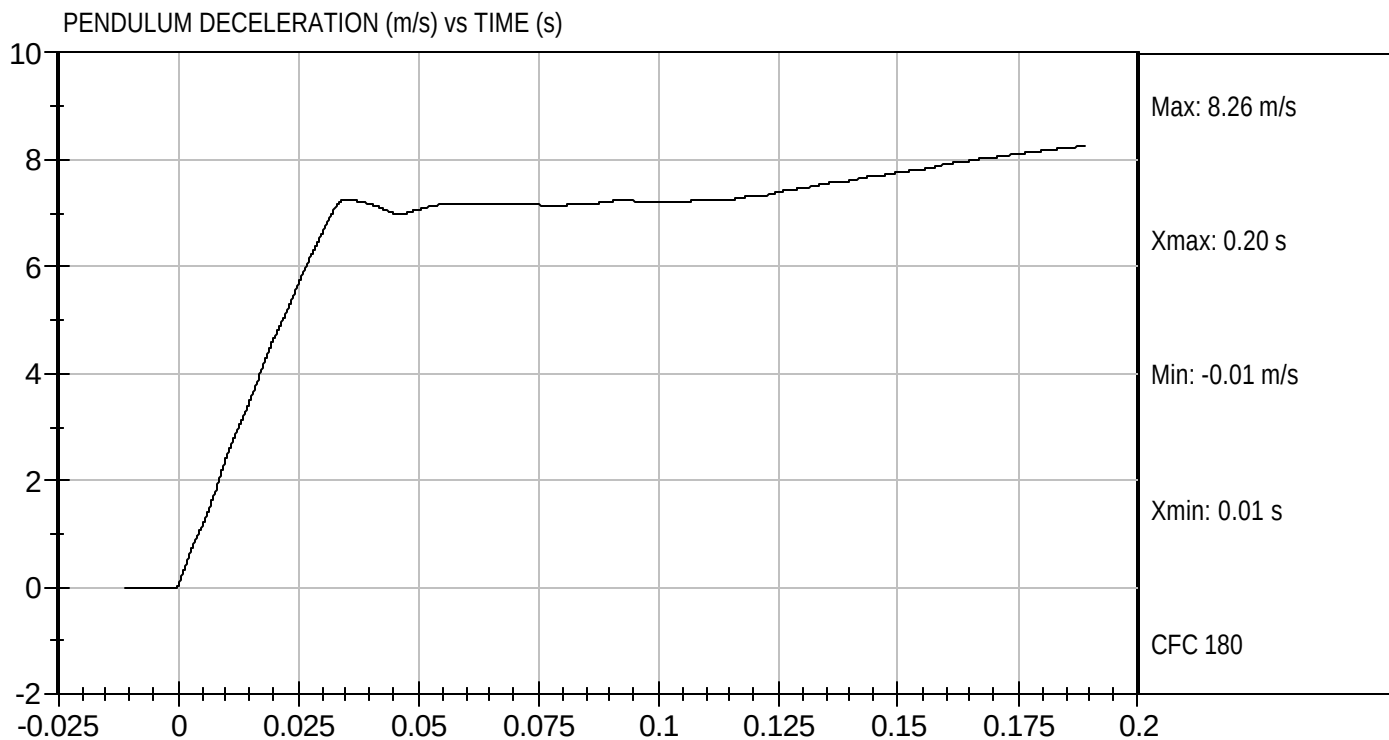
07/22/2005
Test Date


Approved By



Test Desc: Neck Flexion
Componet ID: D052012

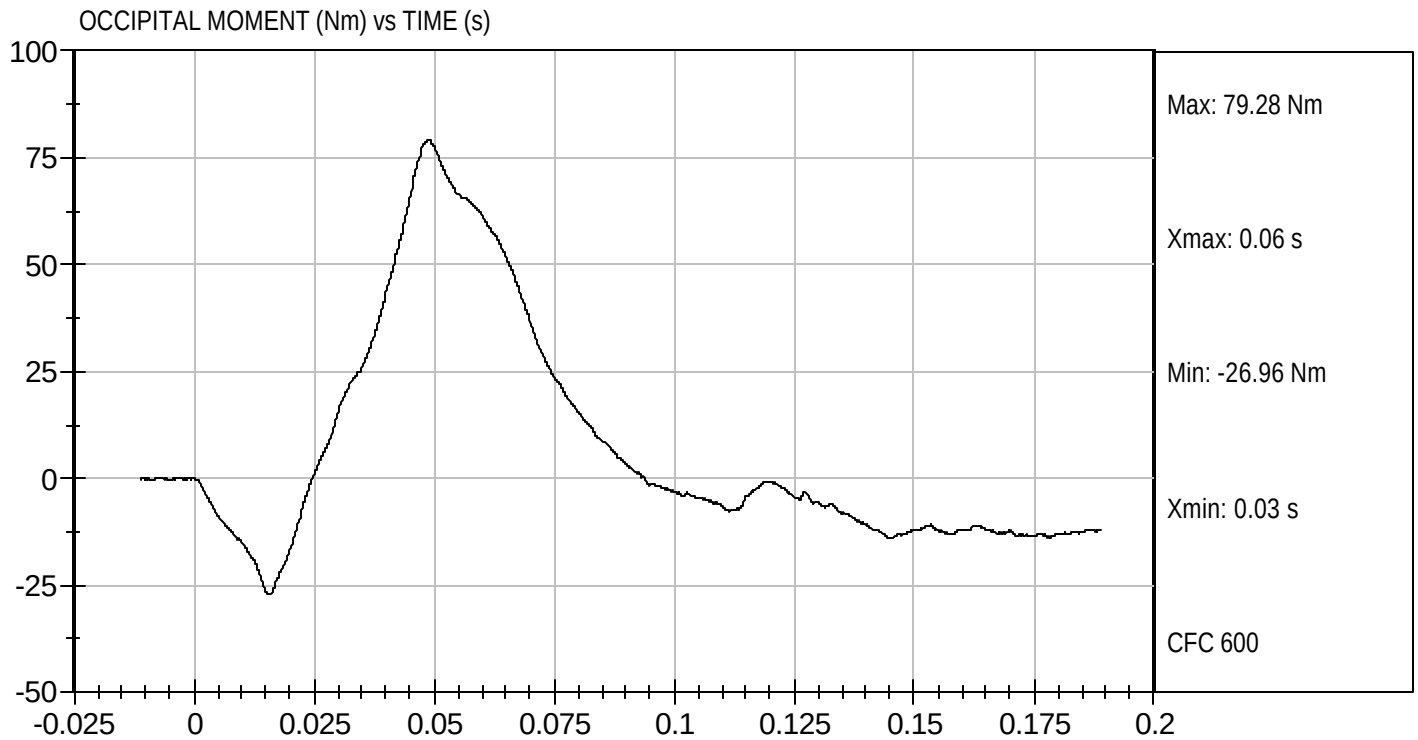
Test Date: 07/22/2005
Velocity: 23.39 ft/s, 7.13 m/s





Test Desc: Neck Flexion
Componet ID: D052012

Test Date: 07/22/2005
Velocity: 23.39 ft/s, 7.13 m/s



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 511

Test Date 7/22/05

Technician Jessica Gall

☐ 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>22.0</u> |
| Record the minimum temperature | <u>21.3</u> |
| Record the maximum humidity | <u>46%</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 89; Back 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.13 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.4 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.7 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.6 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>79</u> Nm @ <u>83</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	84 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.

Jessica Hall
Signature

7/22/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

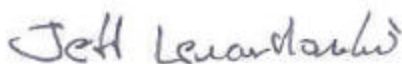
Test I.D: D052013

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
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	3.7	Pass
	30 msec	m/sec	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	108	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

07/26/2005

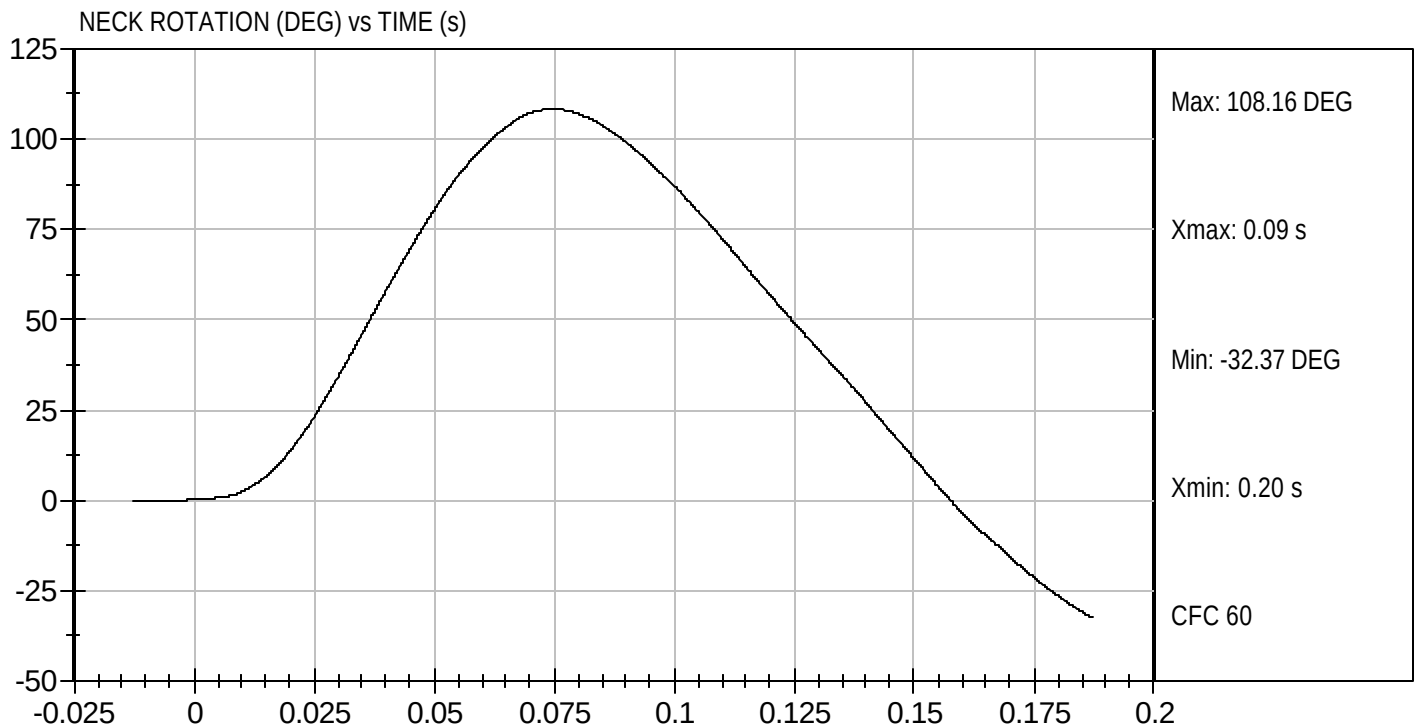
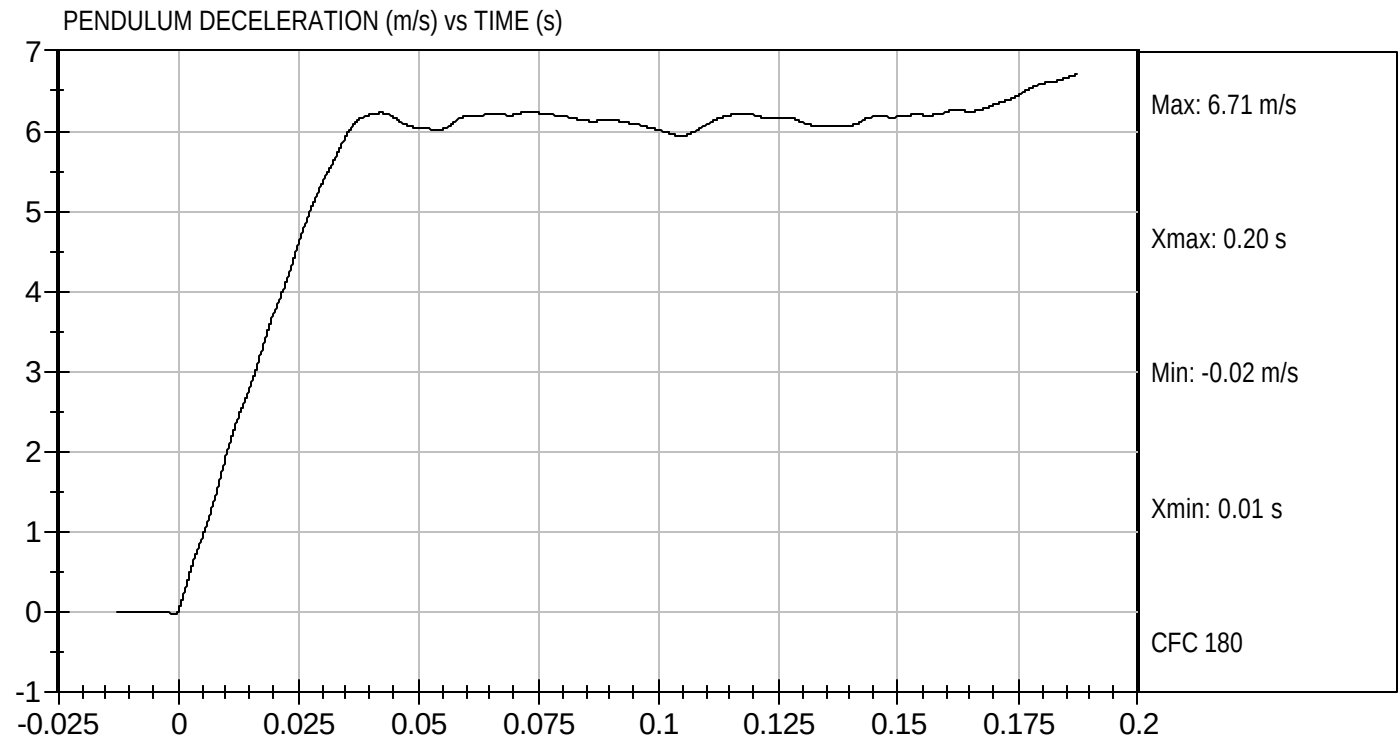
Test Date


Approved By



Test Desc: Neck Extension
Componet ID: D052013

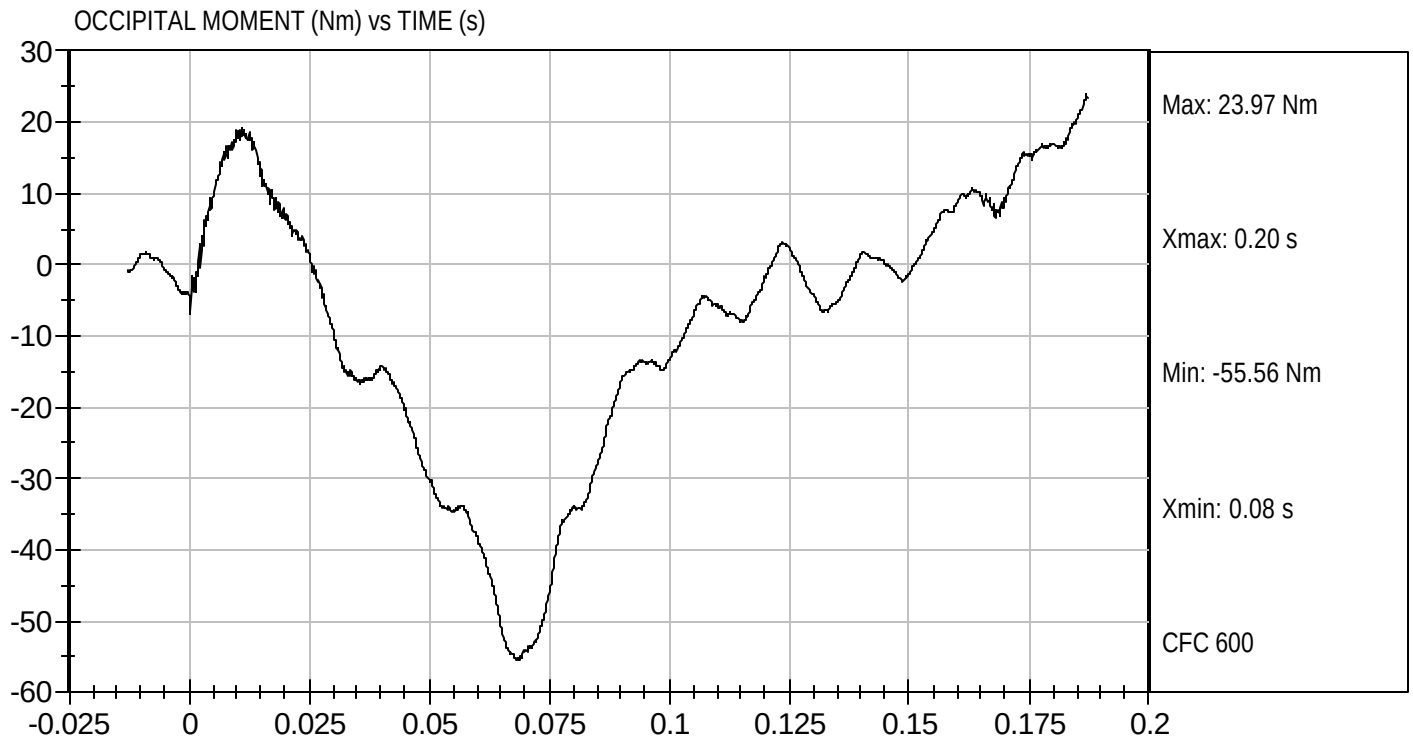
Test Date: 07/26/2005
Velocity: 20.22 ft/s, 6.16 m/s





Test Desc: Neck Extension
Componet ID: D052013

Test Date: 07/26/2005
Velocity: 20.22 ft/s, 6.16 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511

Test Date 7/26/05

Technician Jessica Gall

☐ 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 22.0

Record the minimum temperature 21.3

Record the maximum humidity 46%

Record the minimum humidity 43%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 89; Back 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.16 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.9 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.7 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.3 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>-56</u> Nm @ <u>108</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.

Jessica Hall
Signature

7/26/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

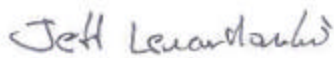
Test I.D: D052014

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	6.59 to 6.83	6.76	Pass
Peak Deflection	mm	50 to 58	55	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	4143	Pass
Overall Test Results				Pass


Laboratory Technician

07/25/2005

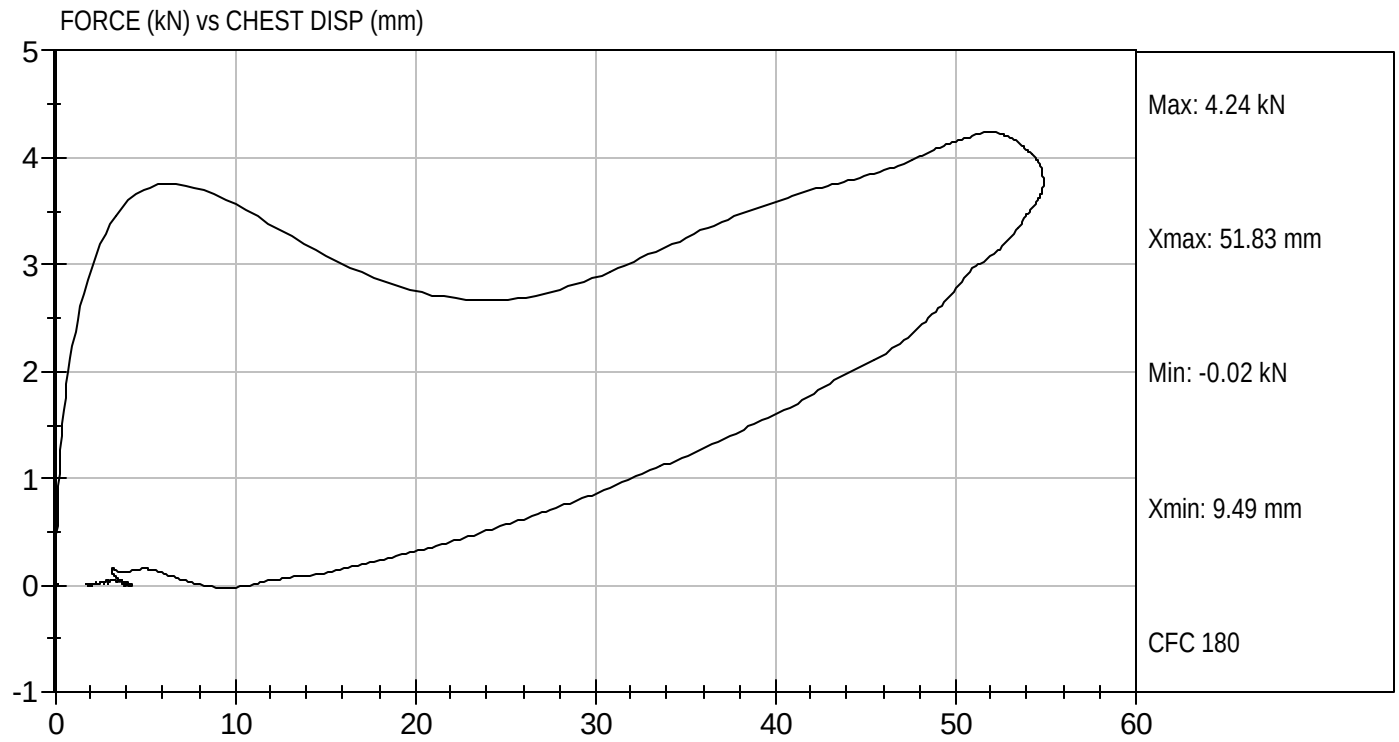
Test Date


Approved By



Test Desc: Thorax Impact
Componet ID: D052014

Test Date: 07/25/2005
Velocity: 22.18 ft/s, 6.76 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511

Test Date 7/25/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 46%

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 ± 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° 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° 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.76 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	54.9 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4240 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4143 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

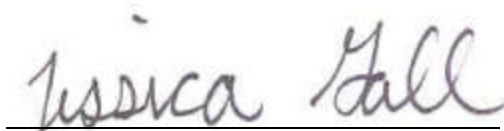
7/25/05
Date

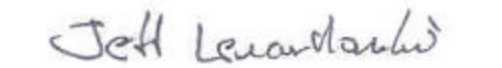
MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D052015

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.74	Pass
Overall Test Results				Pass


Laboratory Technician

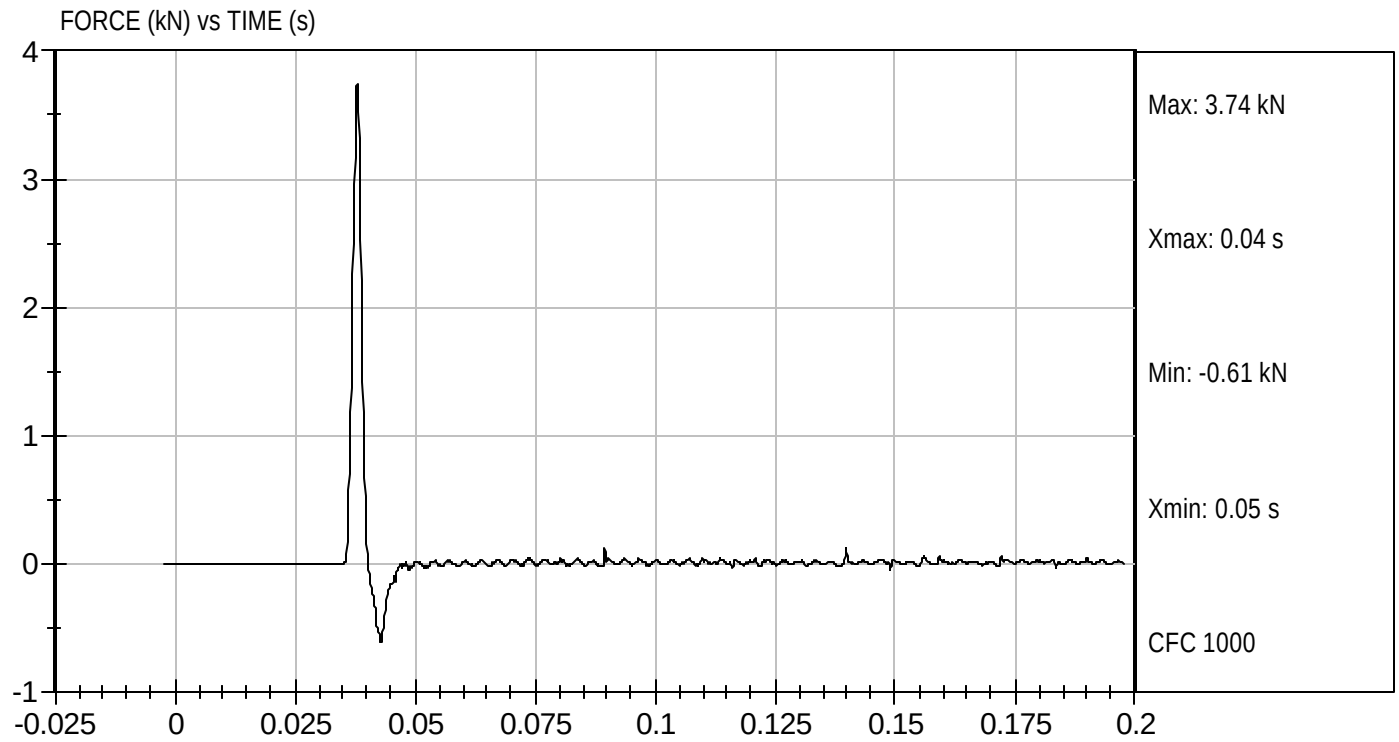

Approved By

07/22/2005
Test Date



Test Desc: Right Knee
Componet ID: D052015

Test Date: 07/22/2005
Velocity: 6.89 ft/s, 2.10 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 7/22/05

Technician Jessica Gall

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 46 %

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))

☒ 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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3740 N

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

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

Jessica Hall
Signature

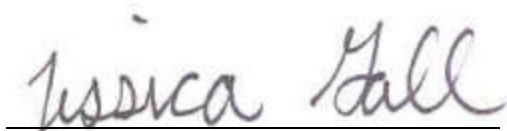
7/22/05
Date

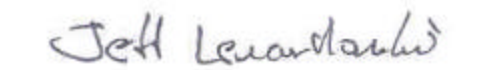
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D052016

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	45	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.52	Pass
Overall Test Results				Pass


Laboratory Technician

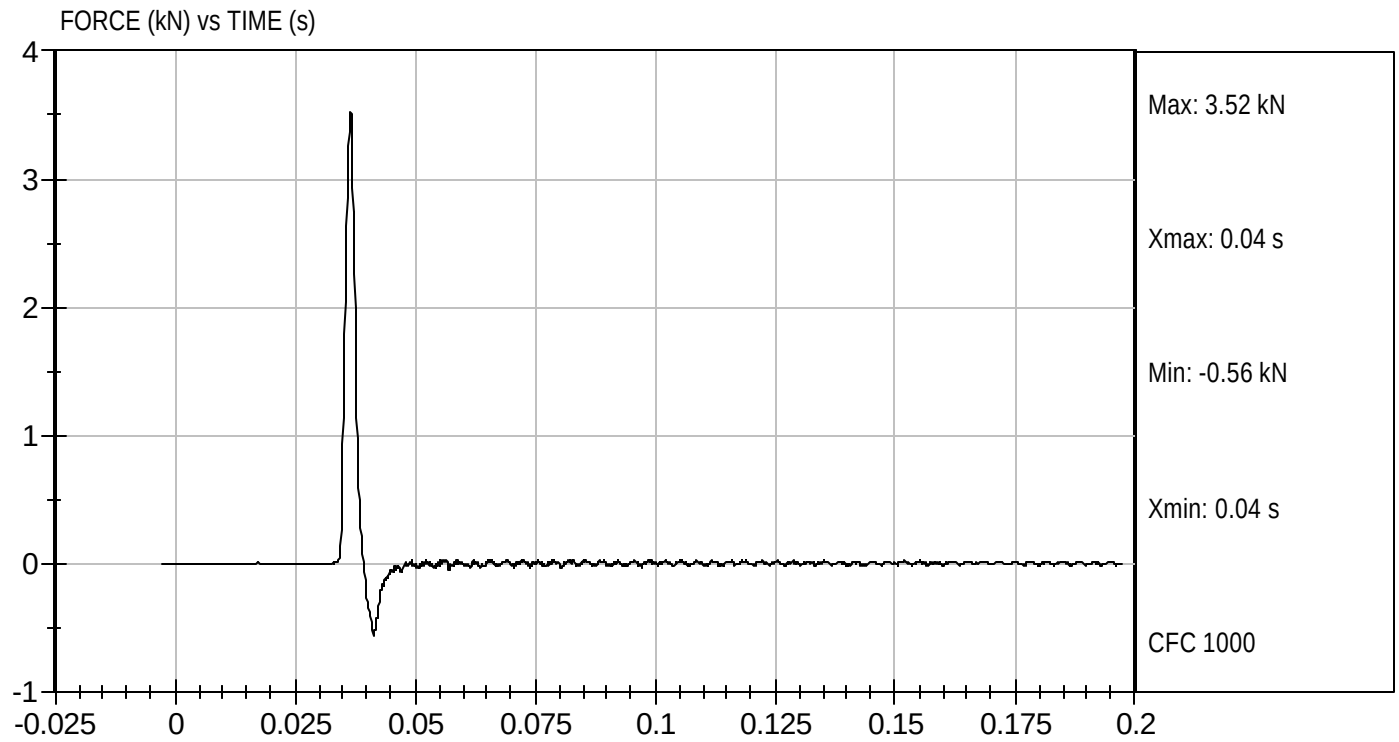

Approved By

07/22/2005
Test Date



Test Desc: Left Knee
Componet ID: D052016

Test Date: 07/22/2005
Velocity: 6.9 ft/s, 2.10 m/s



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 7/22/05

Technician Jessica Gall

 Pretest calibration

X Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 46%

Record the minimum humidity 43%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 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.

Jessica Hall
Signature

7/22/05
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

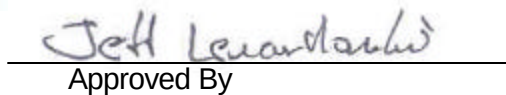
ATD Serial No: 506

Test I.D: D052017

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	375	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass


 Laboratory Technician

07/22/2005
 Test Date


 Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511

Test Date 7/22/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 46%

Record the minimum humidity 43%

☒ 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° and 1.5° 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°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	375 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	18°


Signature

7/22/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #511, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	782.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	455.8
C	H-POINT HEIGHT	Reference	81.3-86.3	85.2
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	75.7
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	130.9
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.5
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.2
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	282.7
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	196.3
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	540.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	358.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	406.3
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.4

HYBRID III 5 th SN #511, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	186.4
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	222.3
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	476.3
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	299.9
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	361.2
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	83.7
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	539.4
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	851.9
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	762.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	340.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 511

Test Date 7/26/05

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall
Signature

7/26/05
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard
Signature

7/26/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #516, 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	783.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	450.8
C	H-POINT HEIGHT	Reference	81.3-86.3	83.9
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	147.4
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.3
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	128.5
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.5
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.6
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	283.9
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	196.9
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	542.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	359.9
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.1
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	436.4

HYBRID III 5 th SN #516, 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	177.8
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	223.1
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	480.4
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.2
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.3
U	HIP BREADTH	The widest part of the hip	299.7-314.9	302.5
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	361.9
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	82.1
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.3
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	865.4
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	783.3
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	340.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

Test ID: D051771

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	267	Pass
Peak Lateral Acceleration	G's	+/- 15	-6.3	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

06/23/2005

Test Date

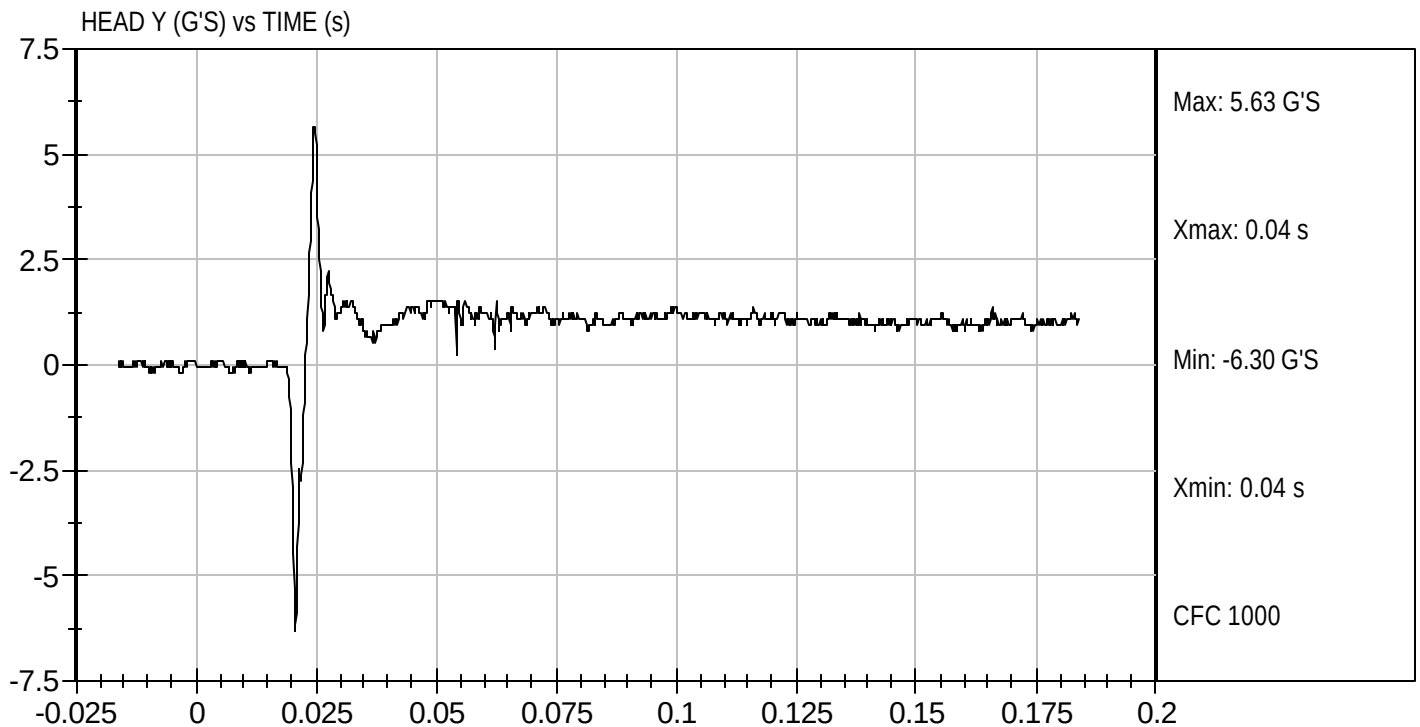
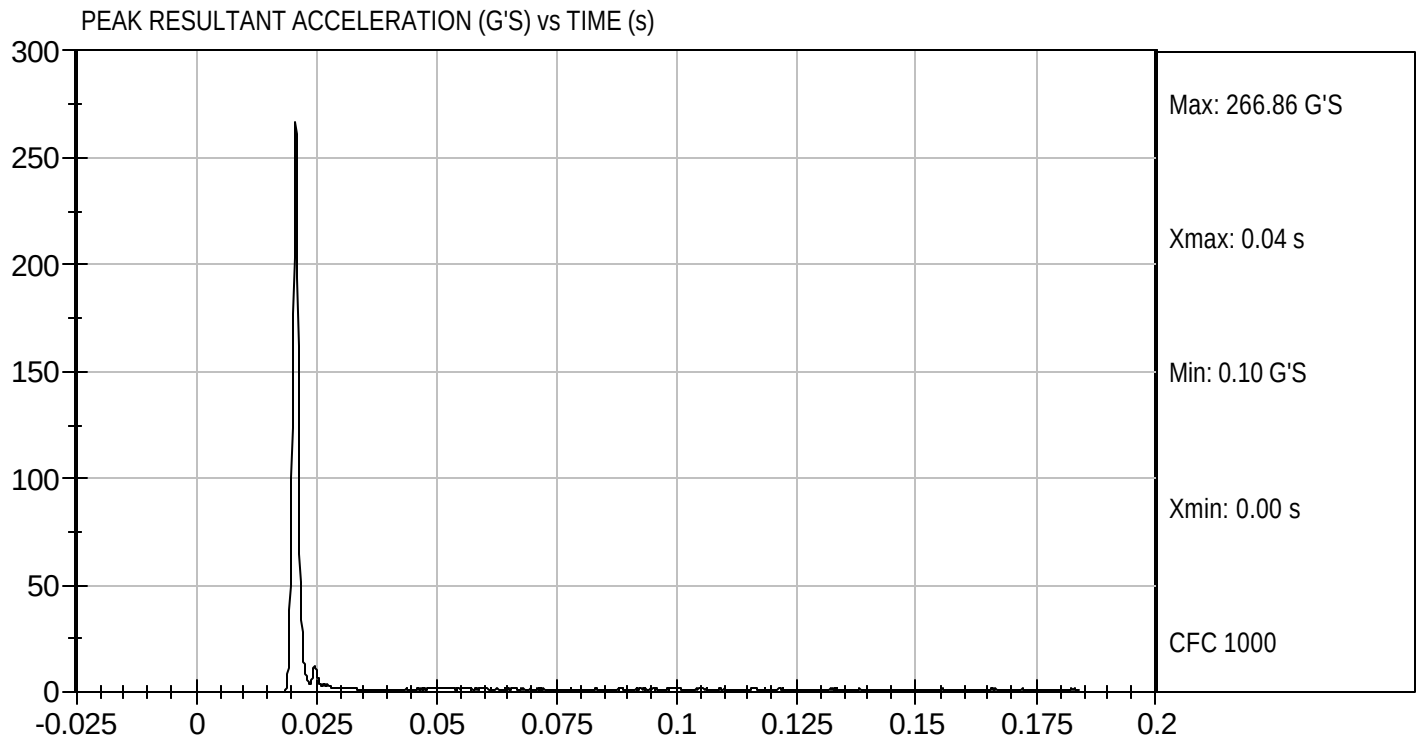


Approved By



Test Desc: Head Drop
Componet ID: D051771

Test Date: 06/23/2005
Velocity: 0 ft/s, 0 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 516 Test Date 6/23/05

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>20.9</u> |
| Record the maximum humidity | <u>44%</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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	267
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 $\leq 15 \text{ g}$	-6

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

Joe Fleck
Signature

6/23/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

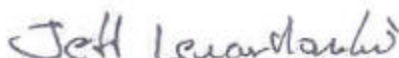
Test I.D: D051772

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	42	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	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	78	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

06/24/2005

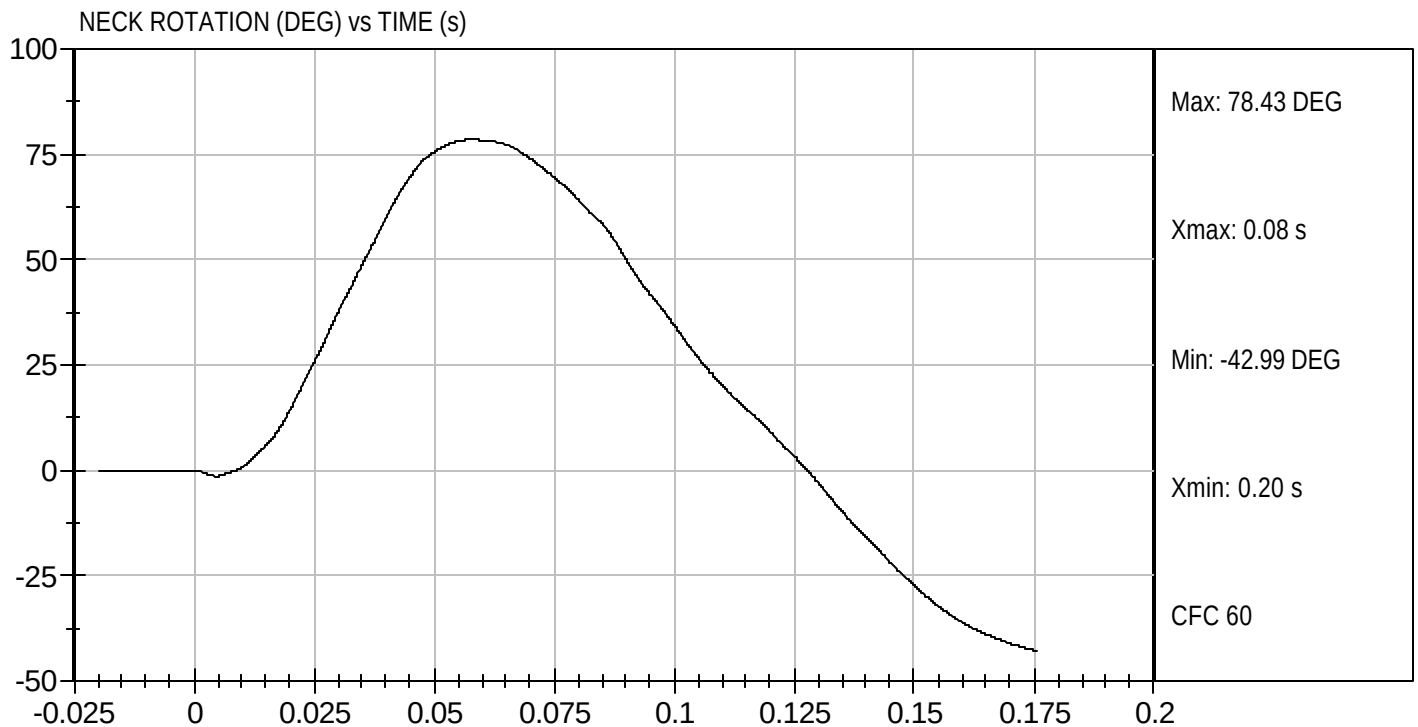
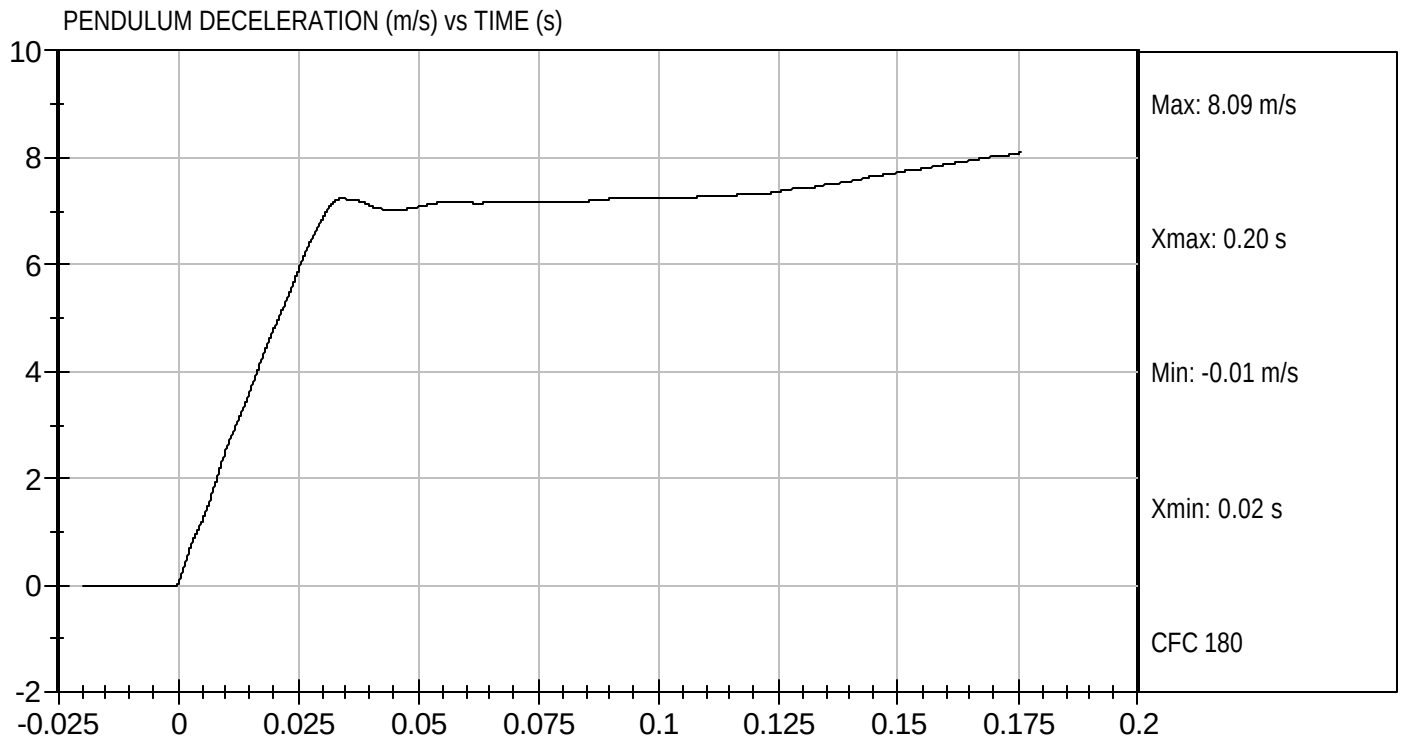
Test Date


 Approved By



Test Desc: Neck Flexion
Componet ID: D051772

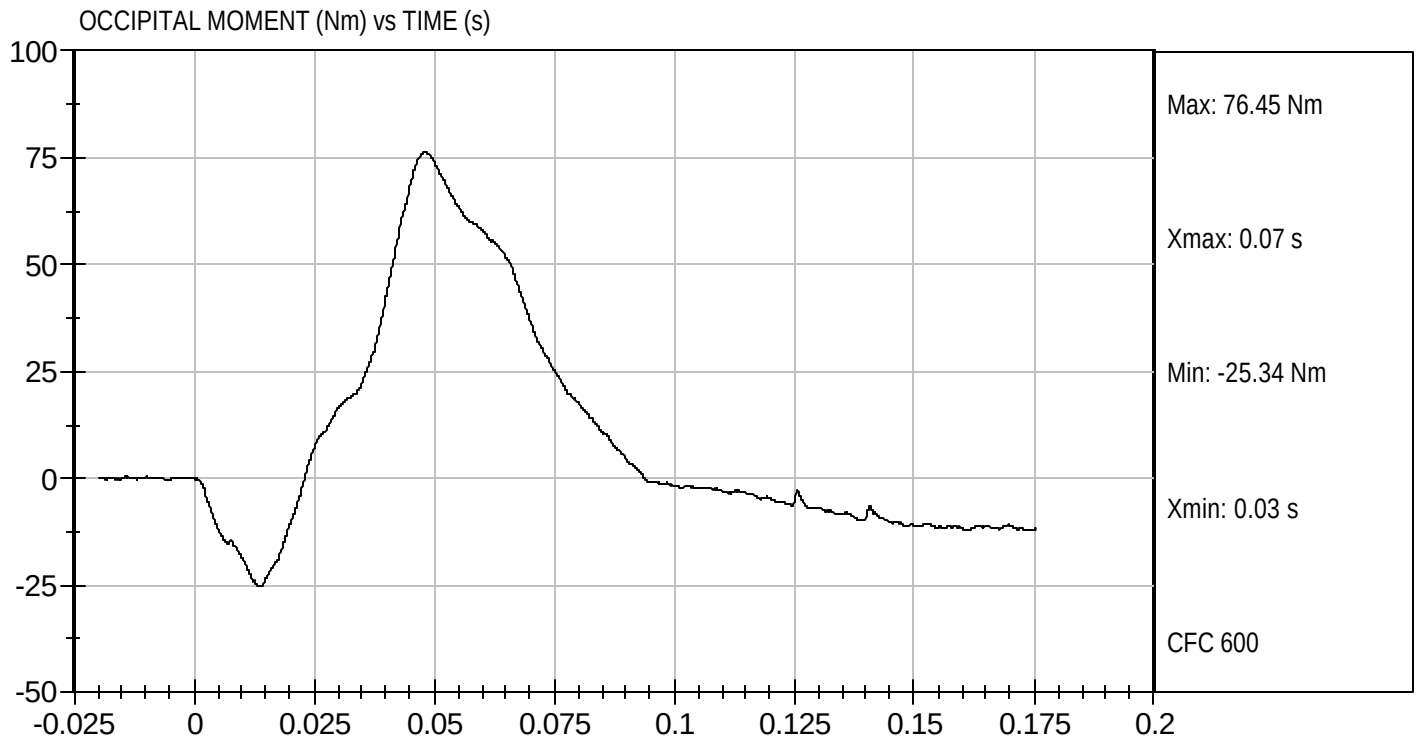
Test Date: 06/24/2005
Velocity: 23.19 ft/s, 7.07 m/s





Test Desc: Neck Flexion
Componet ID: D051772

Test Date: 06/24/2005
Velocity: 23.19 ft/s, 7.07 m/s



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 516 Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 42%

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

Record findings and actions: No Damage.

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

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

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.07 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.5 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.8 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.8 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>76</u> Nm @ <u>78</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	86 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

6/24/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

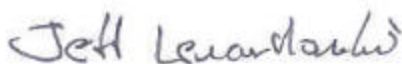
Test I.D: D051773

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	43	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.11	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	108	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	105	Pass
Overall Results				Pass	


 Laboratory Technician

06/24/2005

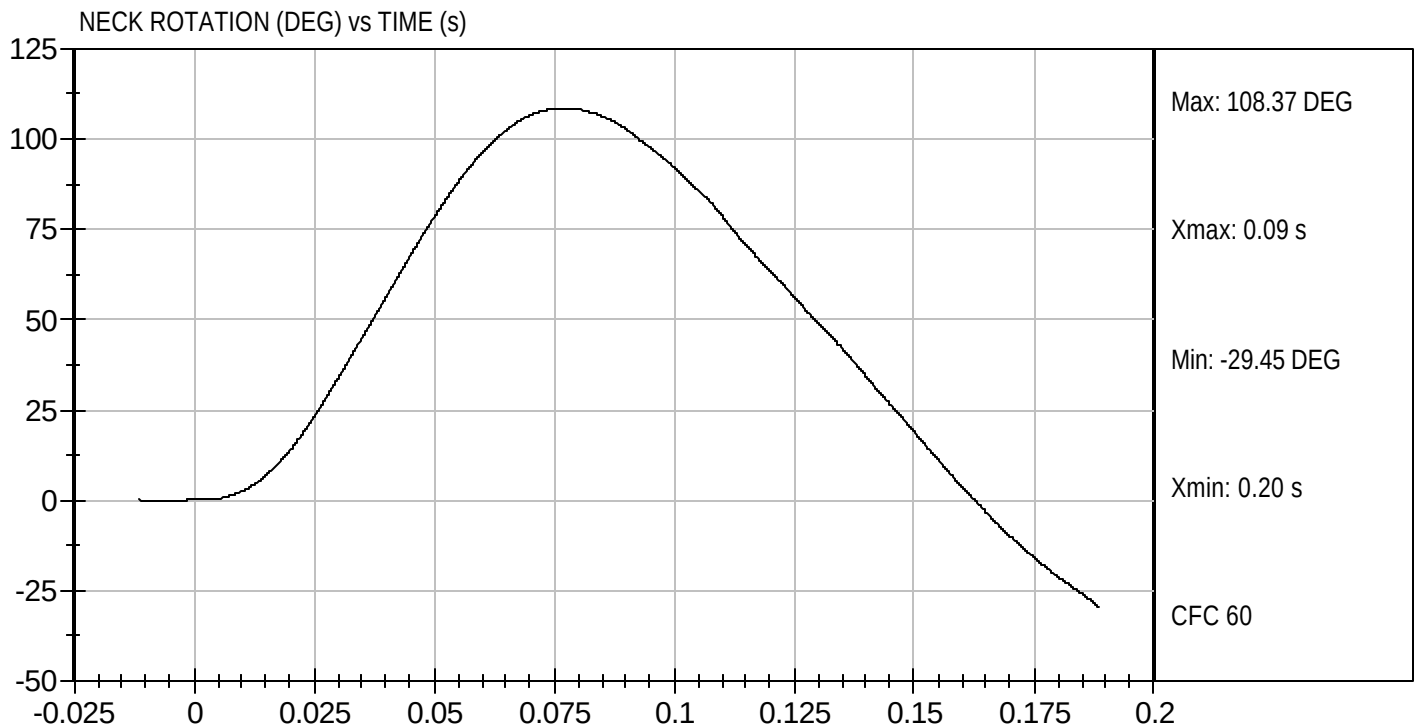
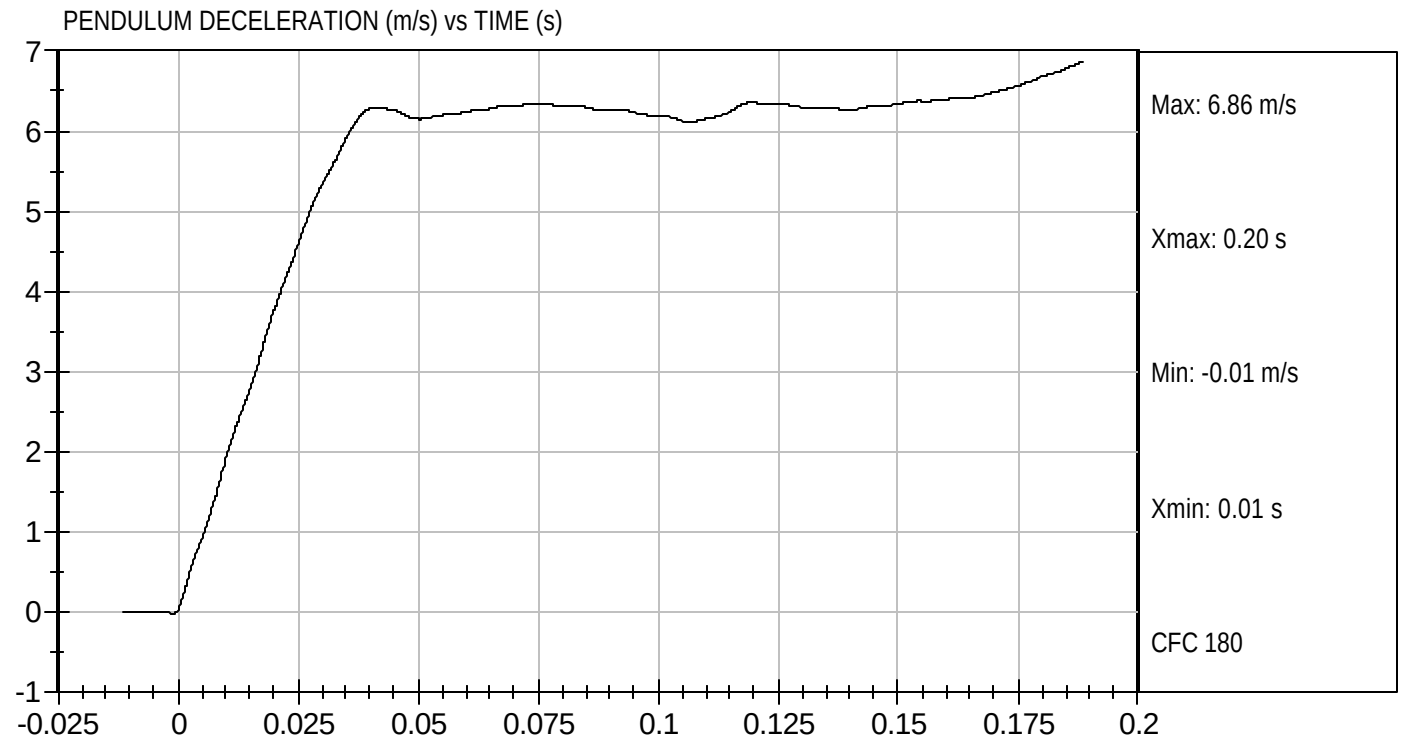
Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D051773

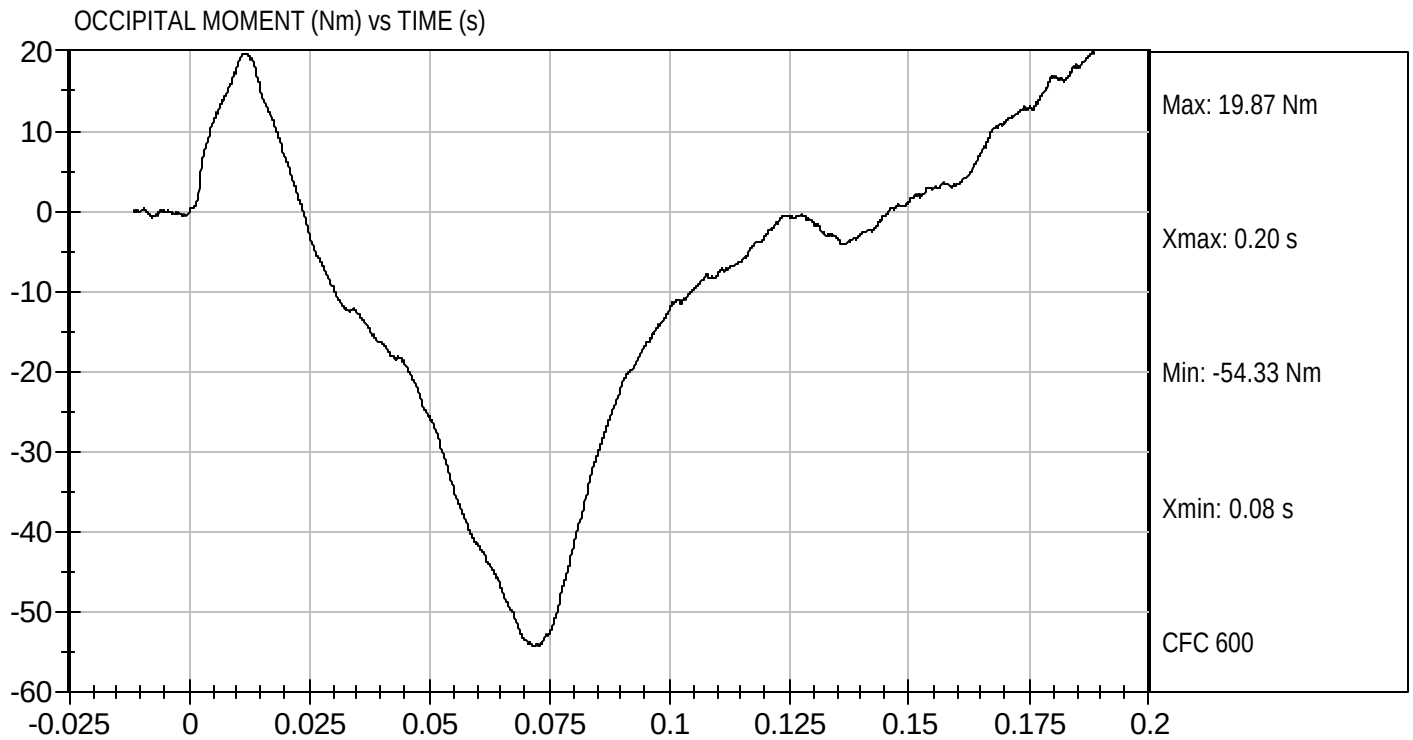
Test Date: 06/24/2005
Velocity: 20.05 ft/s, 6.11 m/s





Test Desc: Neck Extension
Componet ID: D051773

Test Date: 06/24/2005
Velocity: 20.05 ft/s, 6.11 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 516

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 42%

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

Record findings and actions: No Damage.

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

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

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.11 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.9 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.8 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.3 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>108</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	105 ms

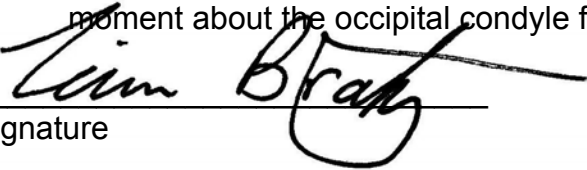
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

6/24/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

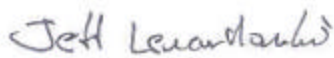
Test I.D: D051774

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	6.59 to 6.83	6.67	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.1	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	≤ 4600 N	4148	Pass
Overall Test Results				Pass


Laboratory Technician

06/24/2005

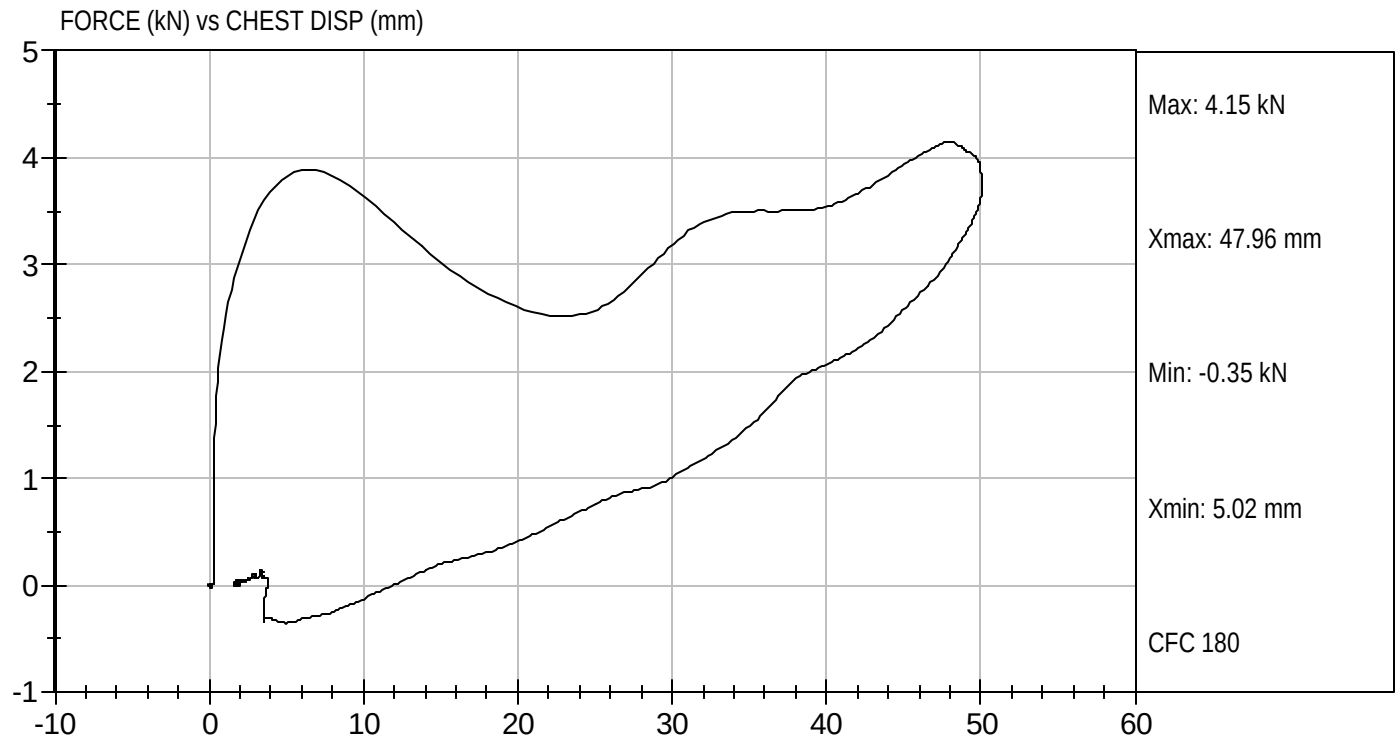
Test Date


Approved By



Test Desc: Thorax Impact
Componet ID: D051774

Test Date: 06/24/2005
Velocity: 21.89 ft/s, 6.67 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 516

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.9

Record the maximum humidity 44%

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 ± 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° 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° 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.67 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	50.1 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4120N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4148 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	70%

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

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

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

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


Signature

6/24/05
Date

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

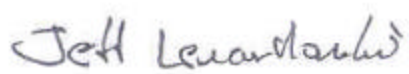
ATD Serial No: 516

Test I.D: D051775

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.65	Pass
Overall Test Results				Pass


Laboratory Technician

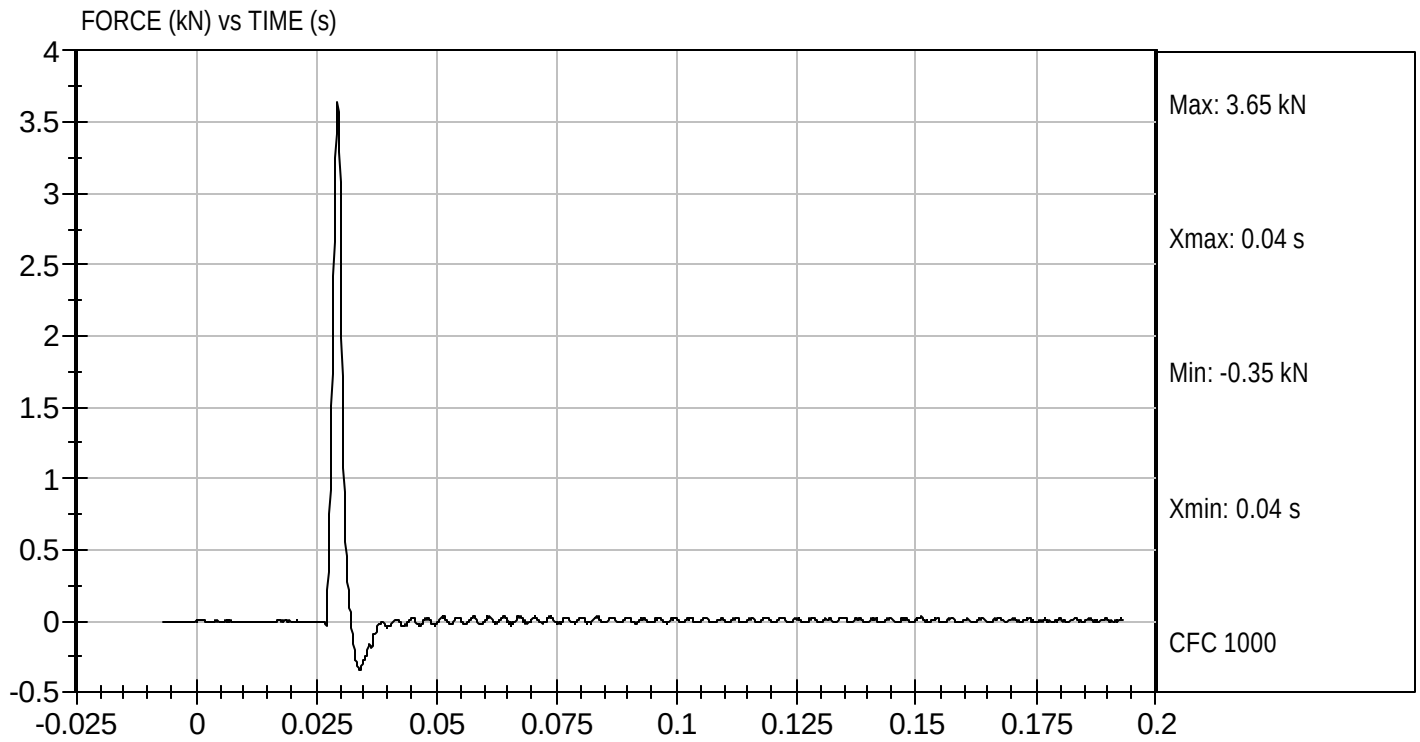
06/24/2005
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D051775

Test Date: 06/24/2005
Velocity: 6.88 ft/s, 2.10 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 516

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.9

Record the maximum humidity 44%

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))

☒ 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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3650 N

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

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


Signature

6/24/05
Date

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

ATD Serial No: 516

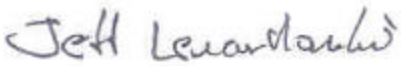
Test I.D: D051776

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.68	Pass
Overall Test Results				Pass


Laboratory Technician

06/24/2005

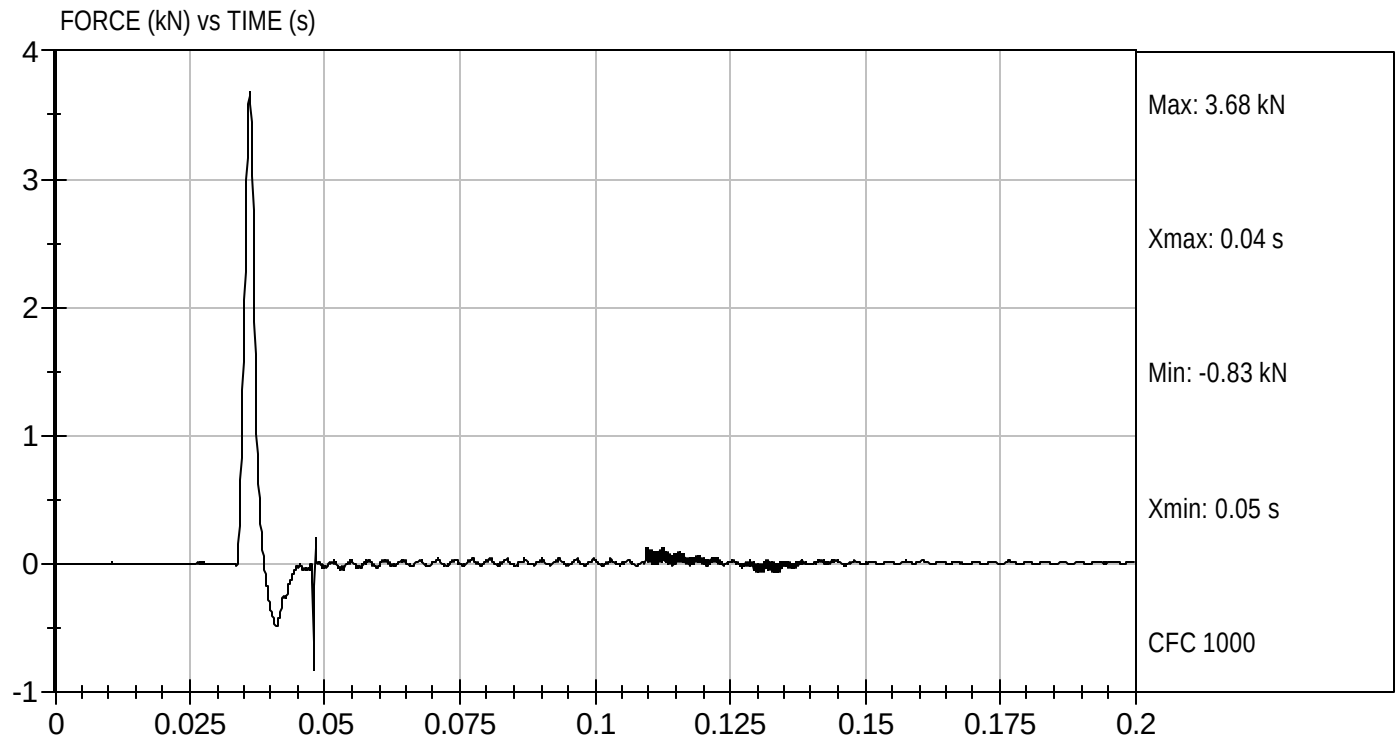
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D051776

Test Date: 06/24/2005
Velocity: 6.92 ft/s, 2.11 m/s



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 516

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.9

Record the maximum humidity 44%

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:

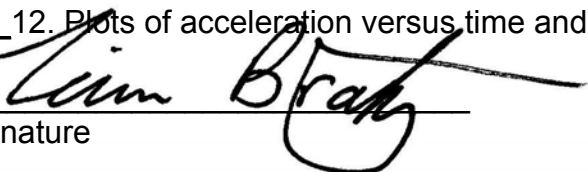
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3680 N

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

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

Signature



6/24/05

Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

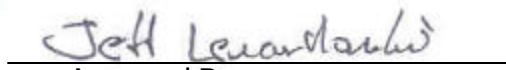
Test I.D: D051777

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	354	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
			Overall Result	Pass


Laboratory Technician

06/24/2005

Test Date


Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 516

Test Date 6/24/05

Technician Tim Bratz

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 21.6

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 42%

☒ 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° and 1.5° 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°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	354 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	18°


Signature

6/24/05
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

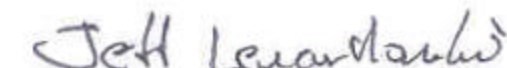
ATD Serial No: 516

Test ID: D052021

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	250 - 300	255	Pass
Peak Lateral Acceleration	G's	+/- 15	-13.9	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

07/22/2005
Test Date

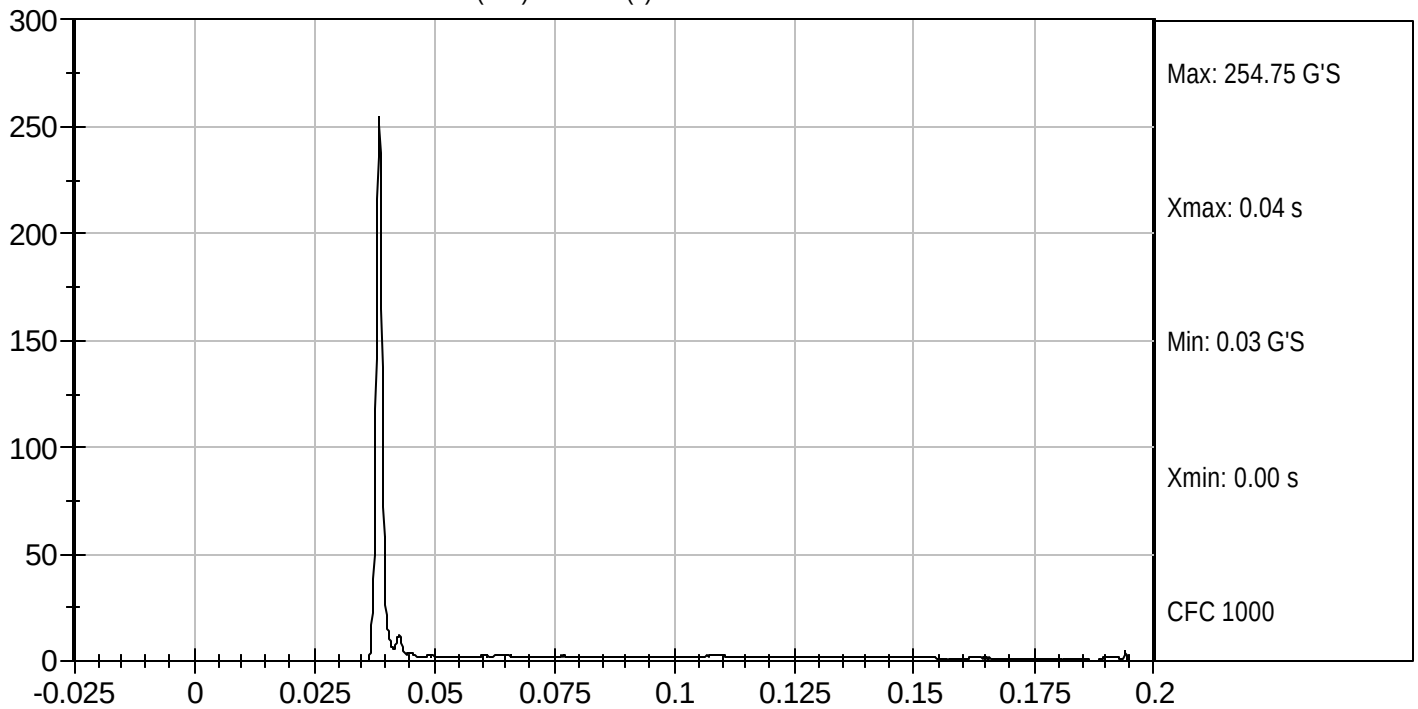

Approved By



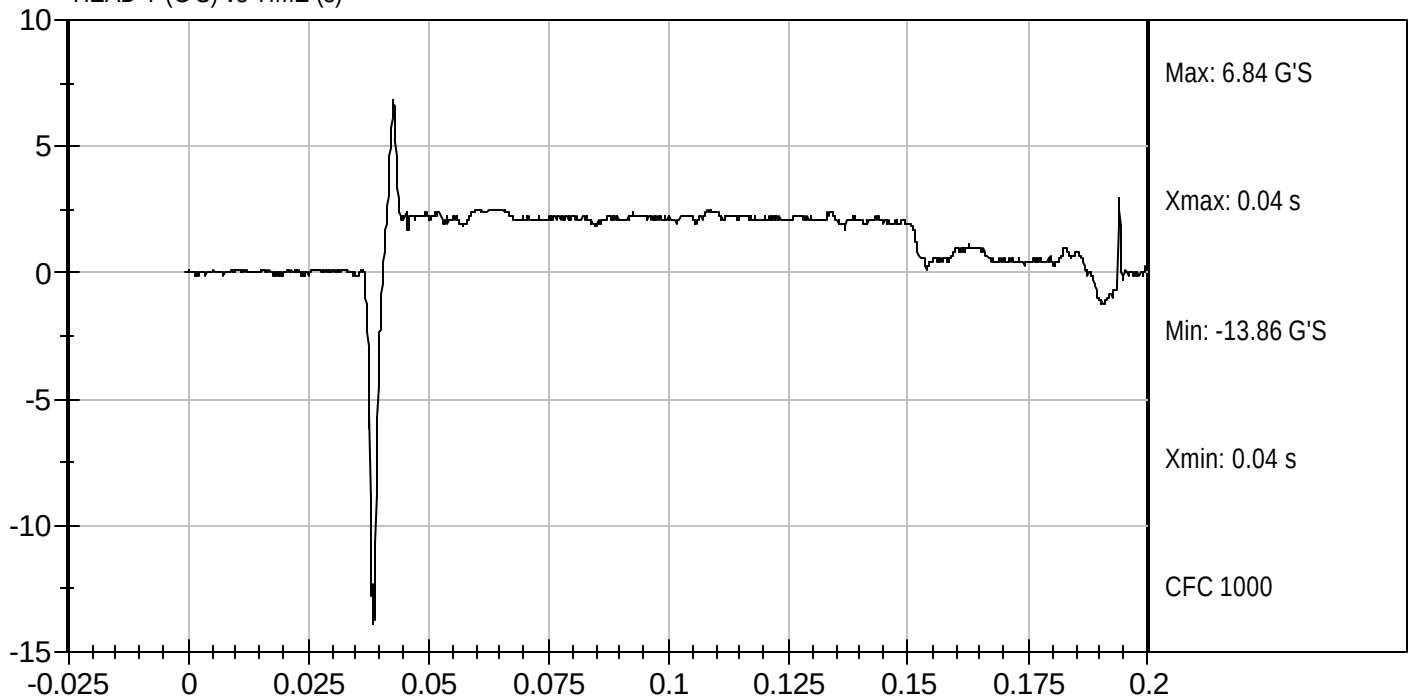
Test Desc: Head Drop
Componet ID: D052021

Test Date: 07/22/2005
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 516 Test Date 7/22/05

Technician Tim Bratz

 Pretest calibration

X 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))

X N/A, ONLY one head drop performed

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

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

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

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

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

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

Record the maximum temperature 22.1

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

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

Record findings and actions: No Damage.

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

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

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	255
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 $\leq 15 \text{ g}$	-13.9

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


Signature

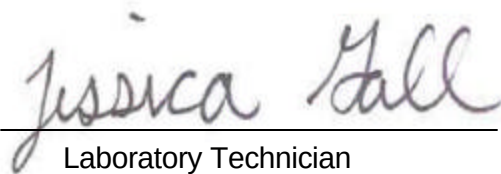
7/22/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

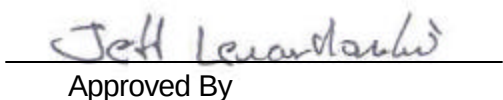
ATD Serial No: 516

Test I.D: D052022

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	6.99	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.6	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	74	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	88	Pass
Overall Results				Pass	


Laboratory Technician

07/21/2005
Test Date

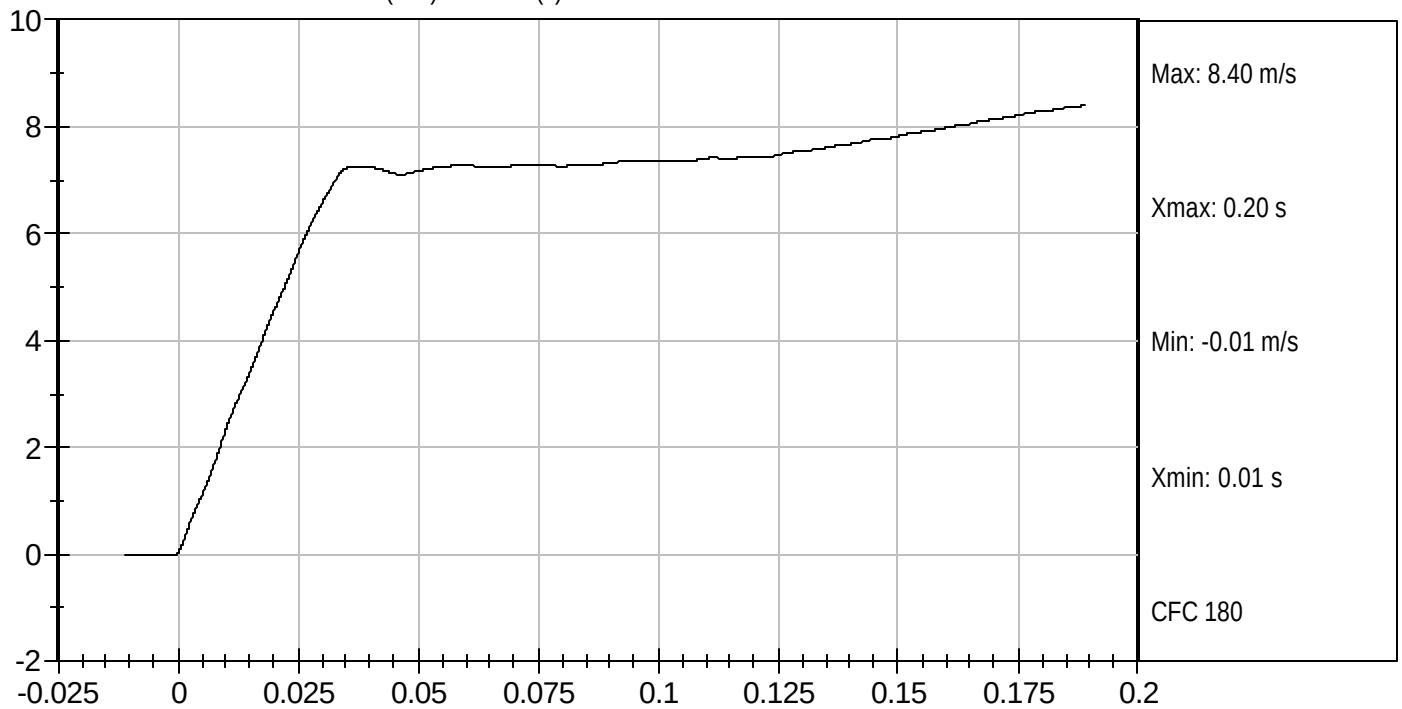

Approved By



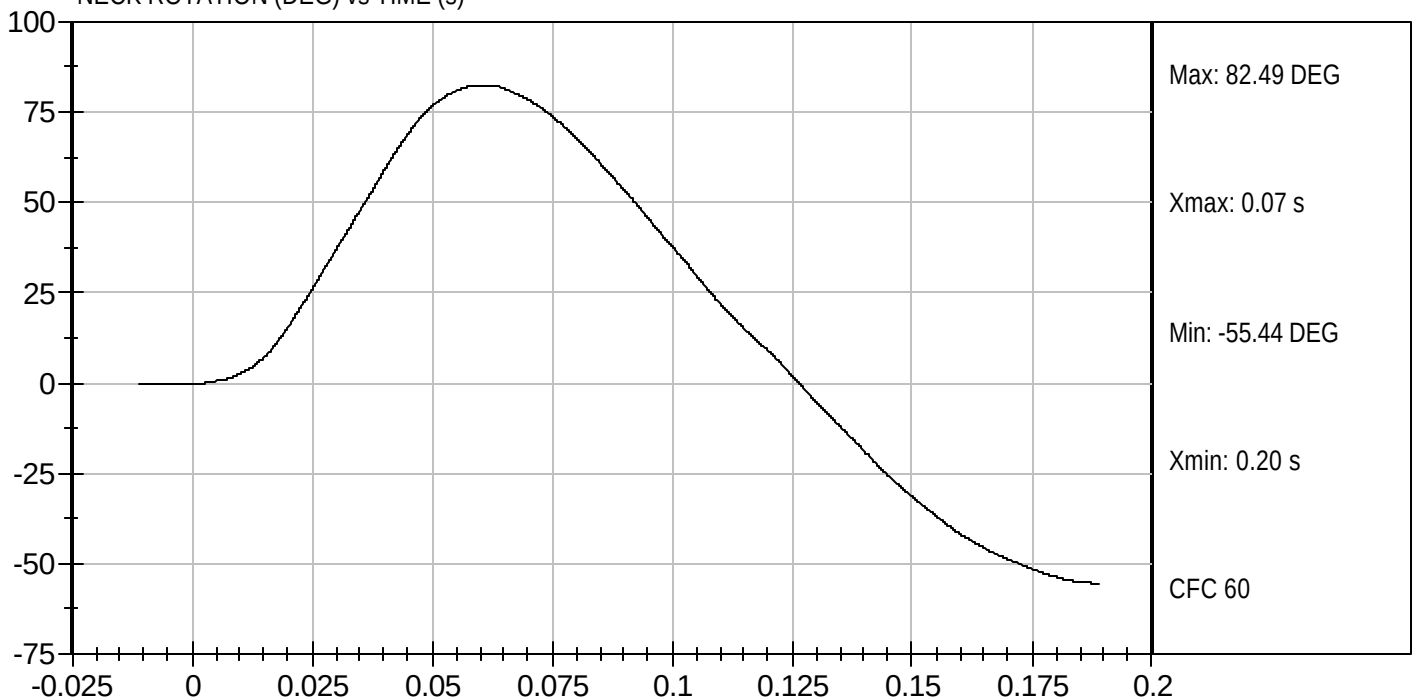
Test Desc: Neck Flexion
Componet ID: D052022

Test Date: 07/21/2005
Velocity: 22.93 ft/s, 6.99 m/s

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



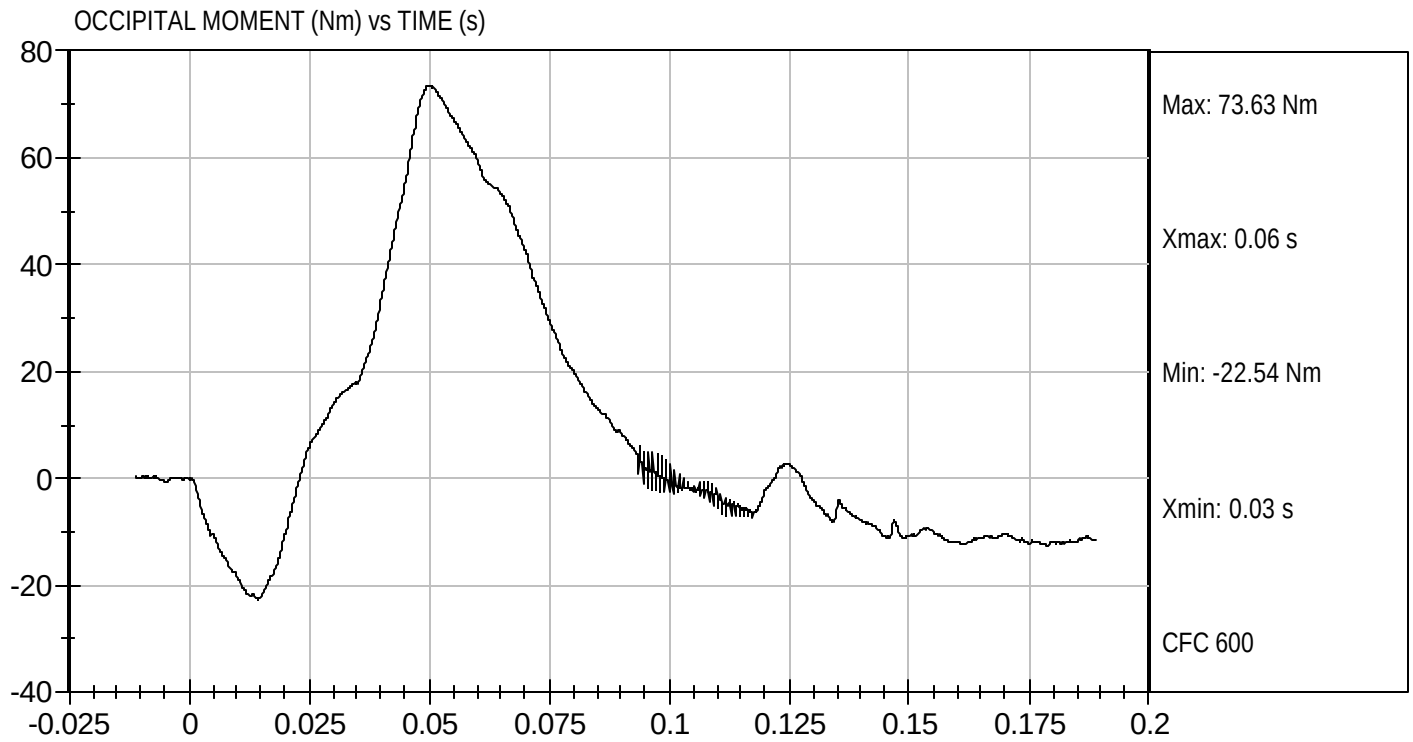
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D052022

Test Date: 07/21/2005
Velocity: 22.93 ft/s, 6.99 m/s



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 516

Test Date 7/21/05

Technician Jessica Gall

☒ 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 22.1

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

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

Record findings and actions: No Damage.

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

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

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	6.99 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.3 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.6 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.5 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>74</u> Nm @ <u>82</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	88 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Jessica Hall
Signature

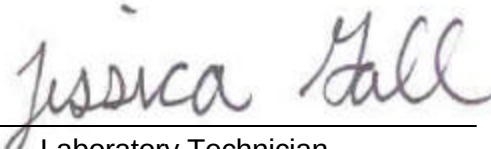
7/21/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

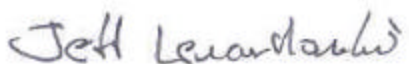
ATD Serial No: 516

Test I.D: D052023

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	5.95 to 6.19	6.15	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	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	104	Pass
Overall Results				Pass	


 Laboratory Technician

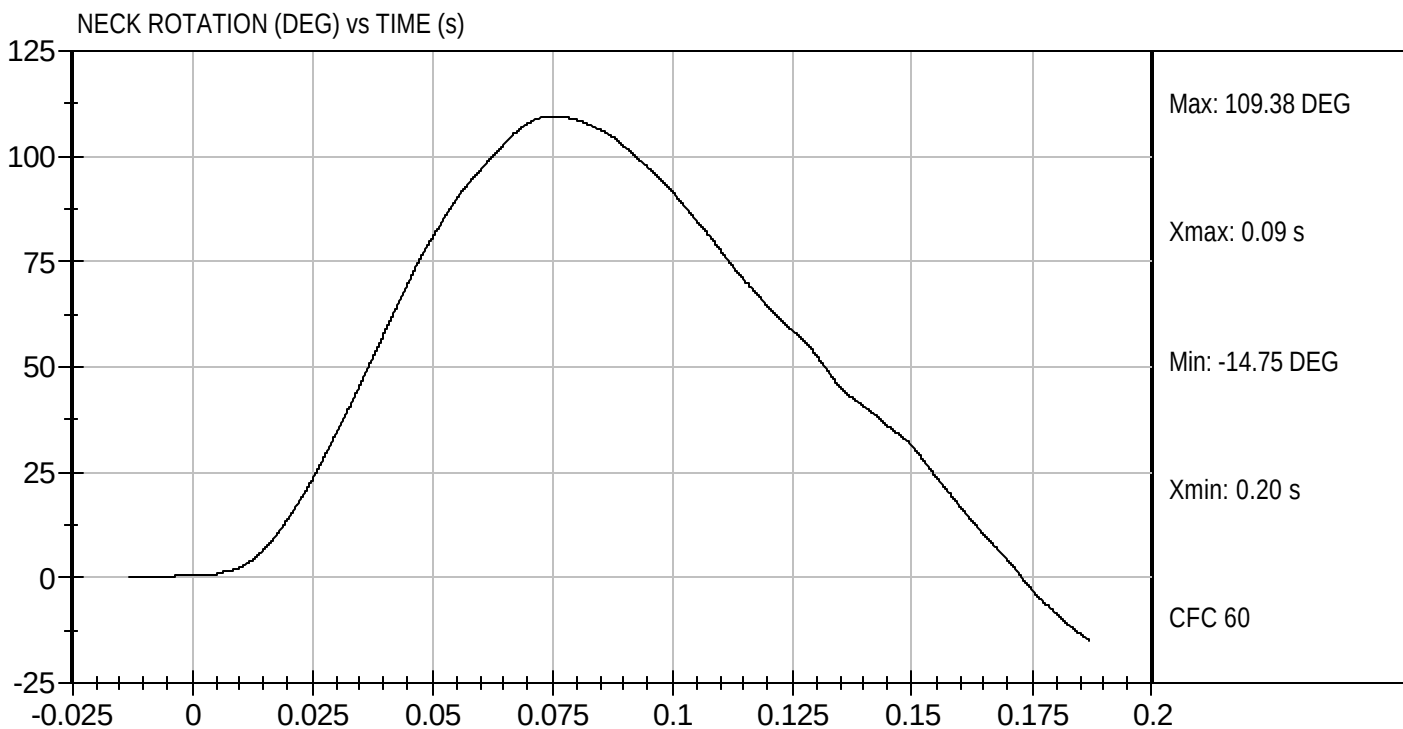
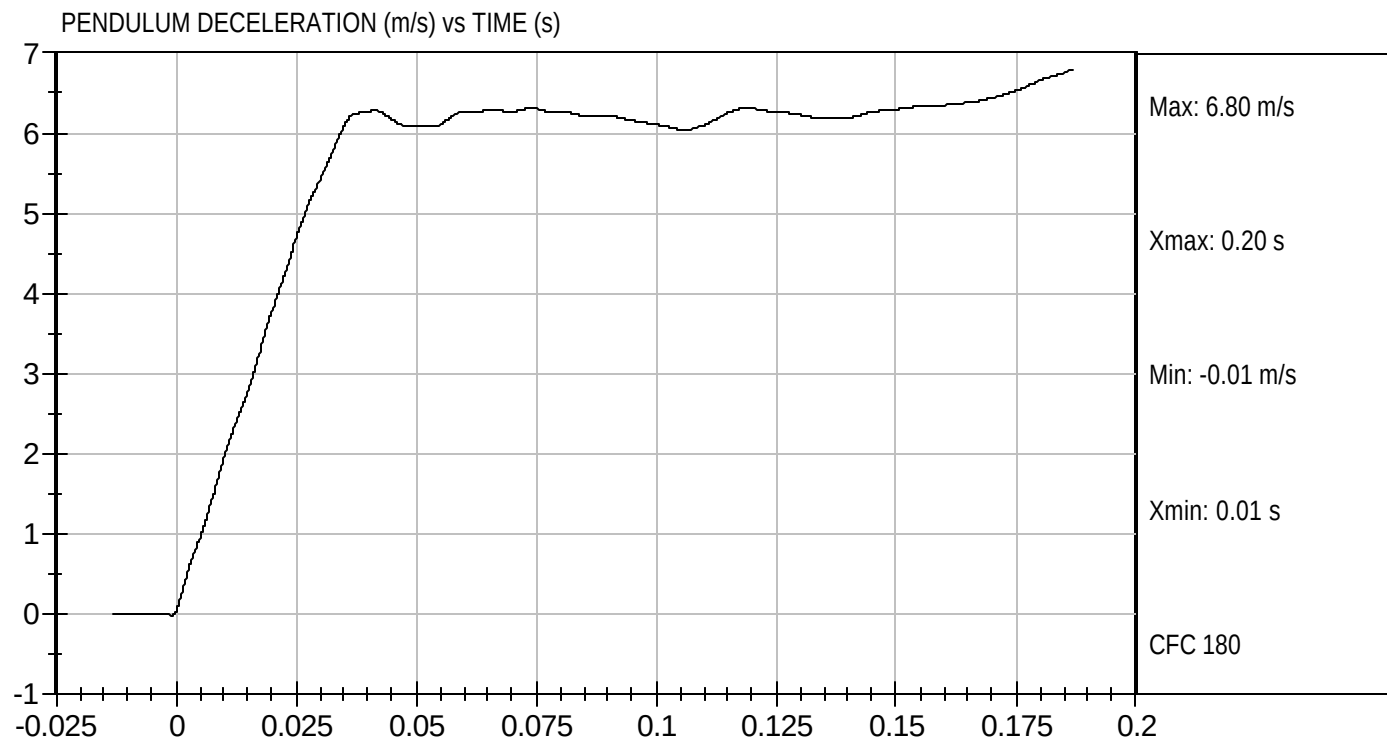
07/21/2005
 Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D052023

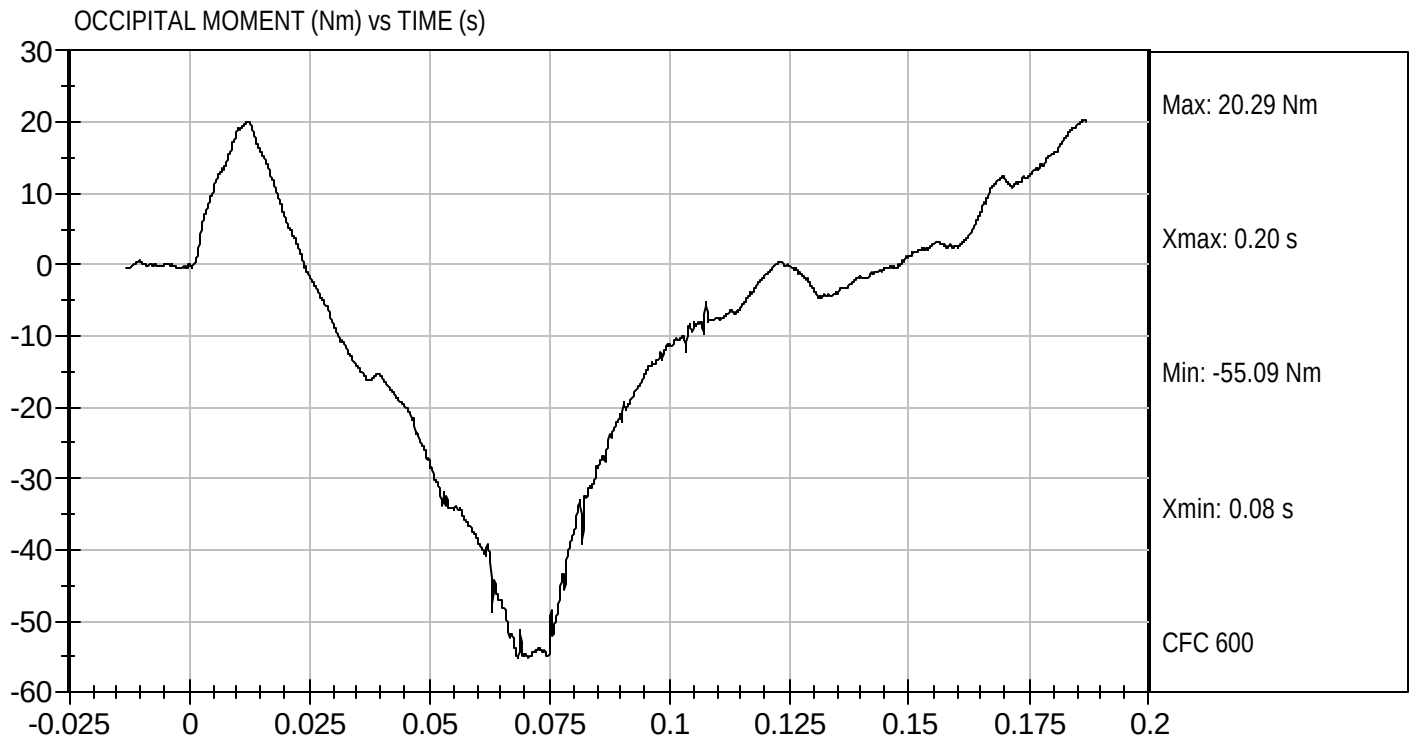
Test Date: 07/21/2005
Velocity: 20.18 ft/s, 6.15 m/s





Test Desc: Neck Extension
Componet ID: D052023

Test Date: 07/21/2005
Velocity: 20.18 ft/s, 6.15 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 516

Test Date 7/21/05

Technician Jessica Gall

☐ 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 22.1

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

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

Record findings and actions: No Damage.

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

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

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.15 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.9 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.8 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.4 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	$\frac{-55}{109} \text{ Nm @ degrees}$
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	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.

Jessica Hall
Signature

7/21/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

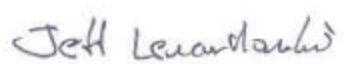
ATD Serial No: 516

Test I.D: D052024

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	6.59 to 6.83	6.69	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	3.9	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	≤ 4600 N	3896	Pass
Overall Test Results				Pass


 Laboratory Technician

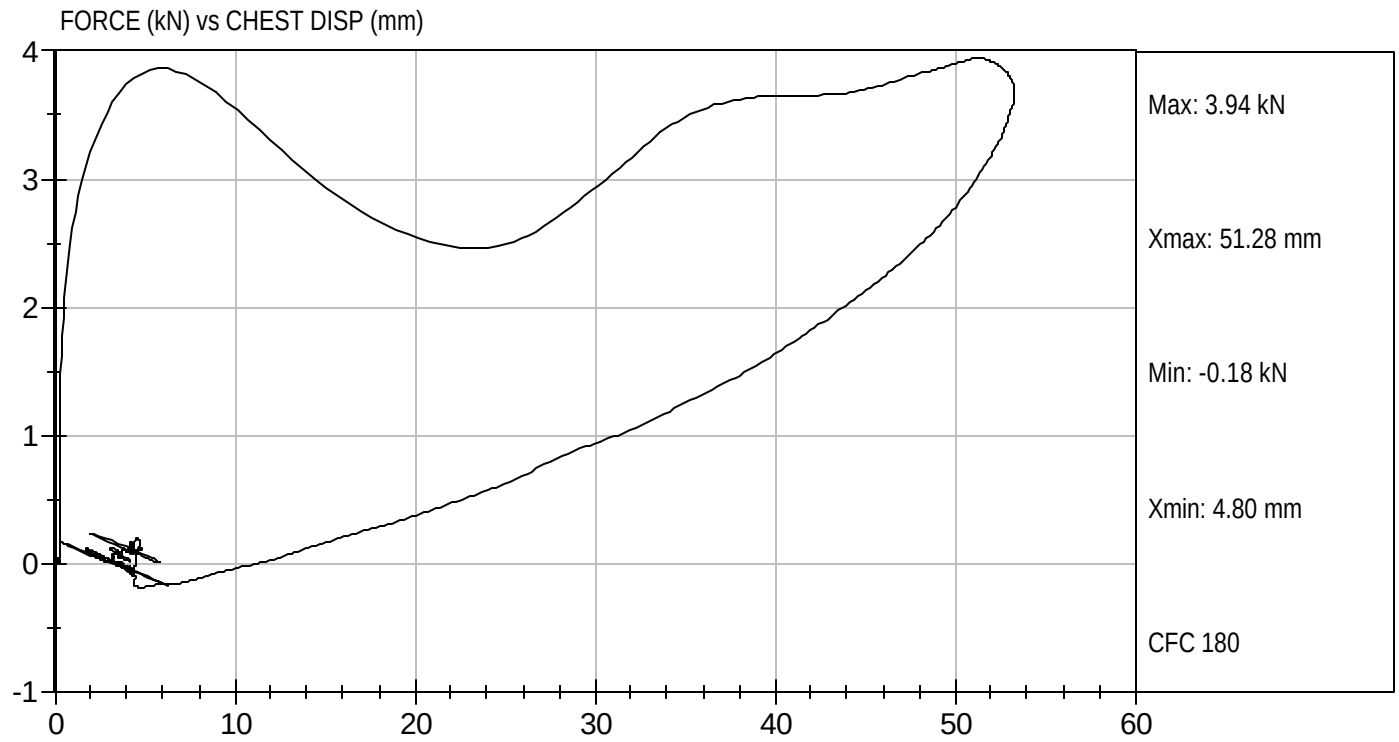
07/22/2005
 Test Date


 Approved By



Test Desc: Thorax Impact
Componet ID: D052024

Test Date: 07/22/2005
Velocity: 21.94 ft/s, 6.69 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 516

Test Date 7/22/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, 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 ± 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° 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° 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.69 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	53.0 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	3940N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3896 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

7/22/05
Date

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

ATD Serial No: 516

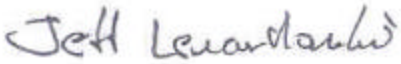
Test I.D: D052025

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.47	Pass
Overall Test Results				Pass


Laboratory Technician

07/22/2005

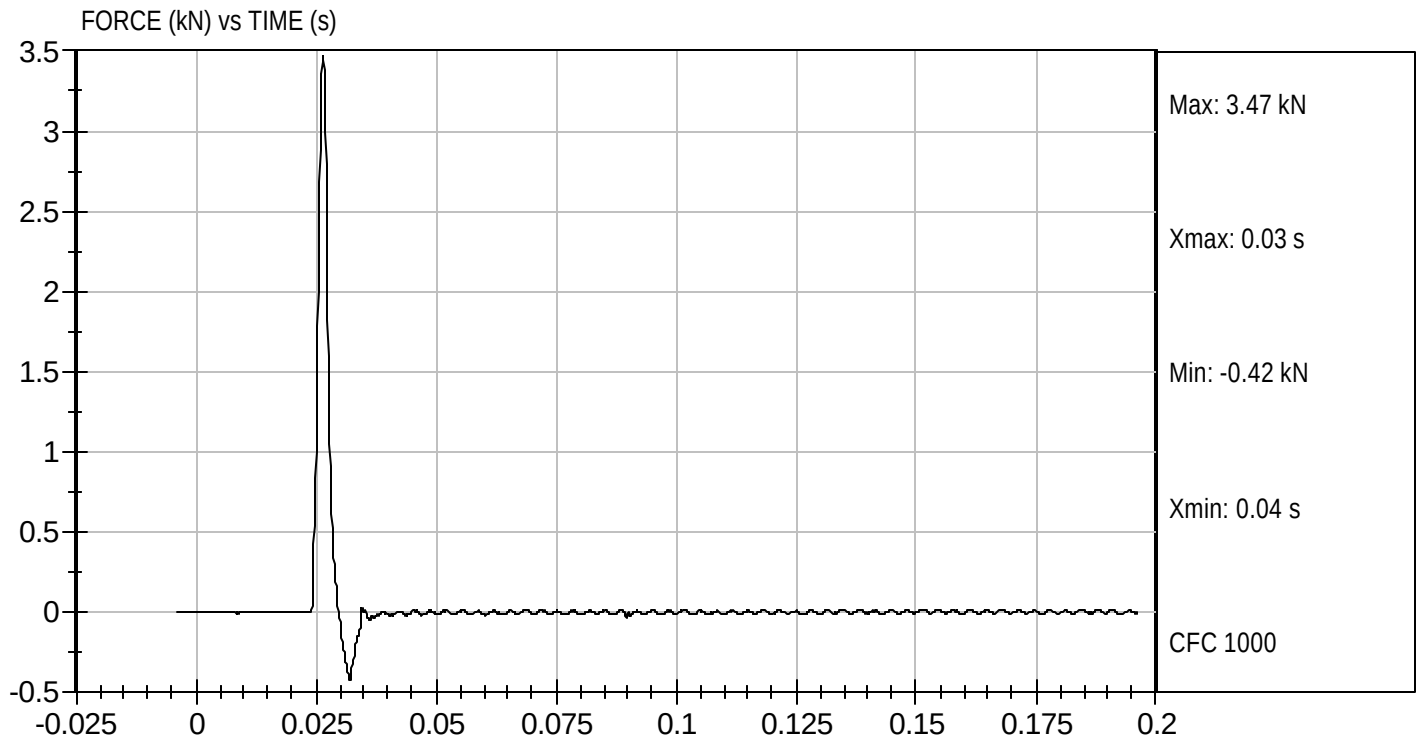
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D052025

Test Date: 07/22/2005
Velocity: 6.91 ft/s, 2.11 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 516

Test Date 7/22/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.1

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3470 N

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

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


Signature

7/22/05
Date

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

ATD Serial No: 516

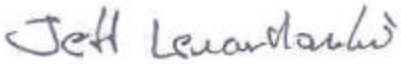
Test I.D: D052026

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	47	Pass
Probe Speed	m/sec	2.07 to 2.13	2.08	Pass
Maximum Force	kN	3.45 to 4.06	3.50	Pass
Overall Test Results				Pass


Laboratory Technician

07/22/2005

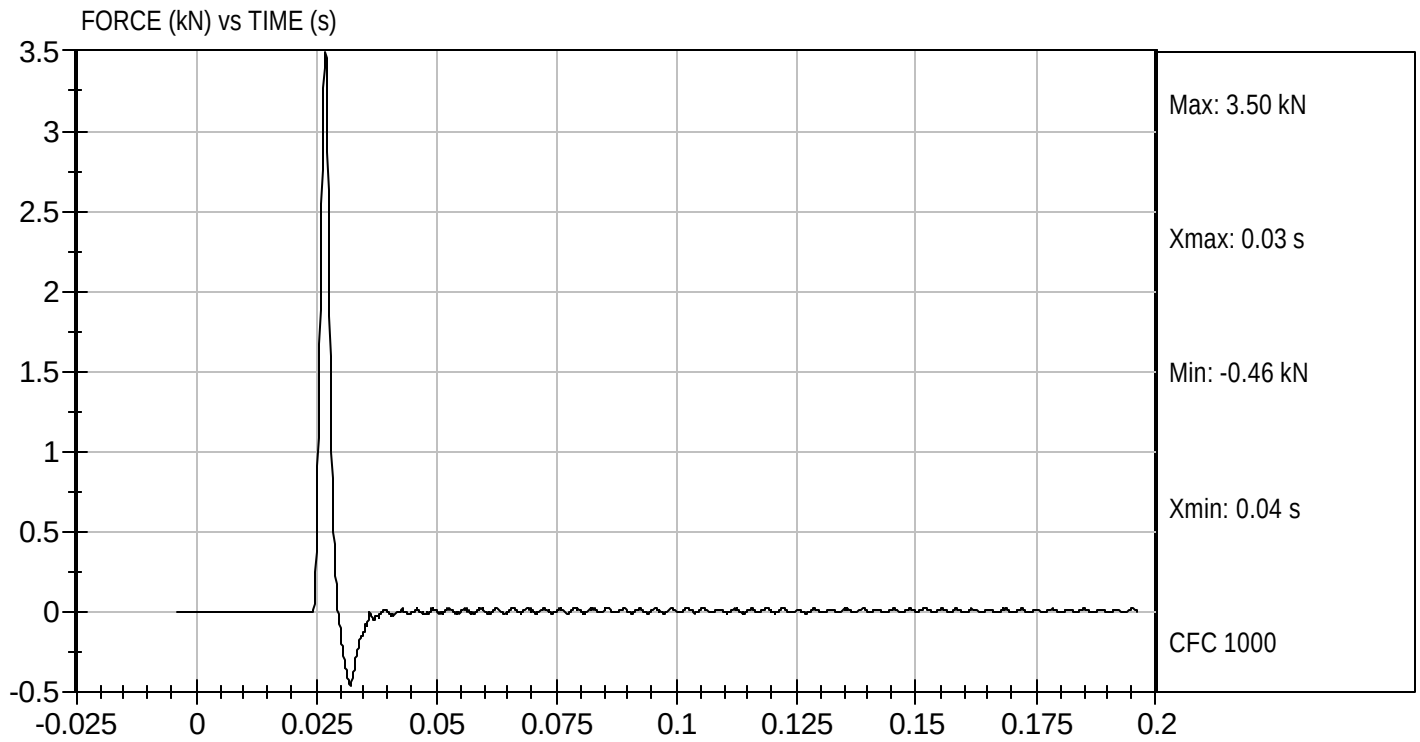
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D052026

Test Date: 07/22/2005
Velocity: 6.83 ft/s, 2.08 m/s



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 516

Test Date 7/22/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.1

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

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

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

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

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

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

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

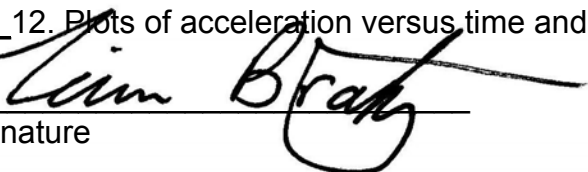
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.08 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3500 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



7/22/05
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

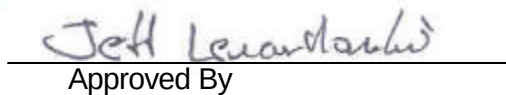
Test I.D: D052027

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Initial Angle	deg	0 to 20	13	Pass
Return Angle	deg	+/- 8	17	Pass
Force at 45 deg	N	320 to 390	361	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician

07/22/2005

Test Date


Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 516

Test Date 7/22/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 22.1

Record the minimum temperature 21.2

Record the maximum humidity 47%

Record the minimum humidity 45%

☒ 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°) 13°

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

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at $45^\circ \pm 0.5^\circ$ 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 $\leq 20^\circ$	13°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	361 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	17°


Signature

7/22/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #516, 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	783.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	450.8
C	H-POINT HEIGHT	Reference	81.3-86.3	83.9
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	147.4
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.3
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	128.5
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.5
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.6
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	283.9
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	196.9
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	542.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	359.9
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.1
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	436.4

HYBRID III 5 th SN #516, 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	177.8
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	223.1
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	480.4
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.2
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.3
U	HIP BREADTH	The widest part of the hip	299.7-314.9	302.5
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	361.9
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	82.1
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.3
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	865.4
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	783.3
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	340.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 516

Test Date 7/22/05

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall
Signature

7/22/05
Date

Describe the repair or replacement of parts:

Checked by

Jeff Levanowski
Signature

7/22/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #507, 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	781.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	455.4
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	79.2
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	130.3
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	249
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	44.8
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.1
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.0
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	544.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	356.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	394.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.2

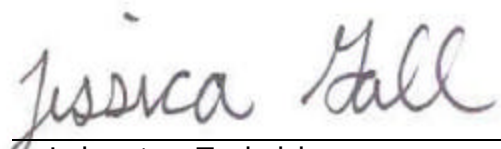
HYBRID III 5 th SN #507, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	186.7
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	222.0
Q	STANDING 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	481.3
S	HEAD BREADTH	The widest part of the head	137.1-147.3	138.4
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	178.1
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.6
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.9
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	89.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	539.4
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	863.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	787.1
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	342.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	168.0

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

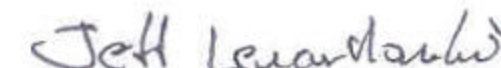
ATD Serial No: 507

Test ID: D051621

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	250 - 300	256	Pass
Peak Lateral Acceleration	G's	+/- 15	4.3	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

06/14/2005
Test Date

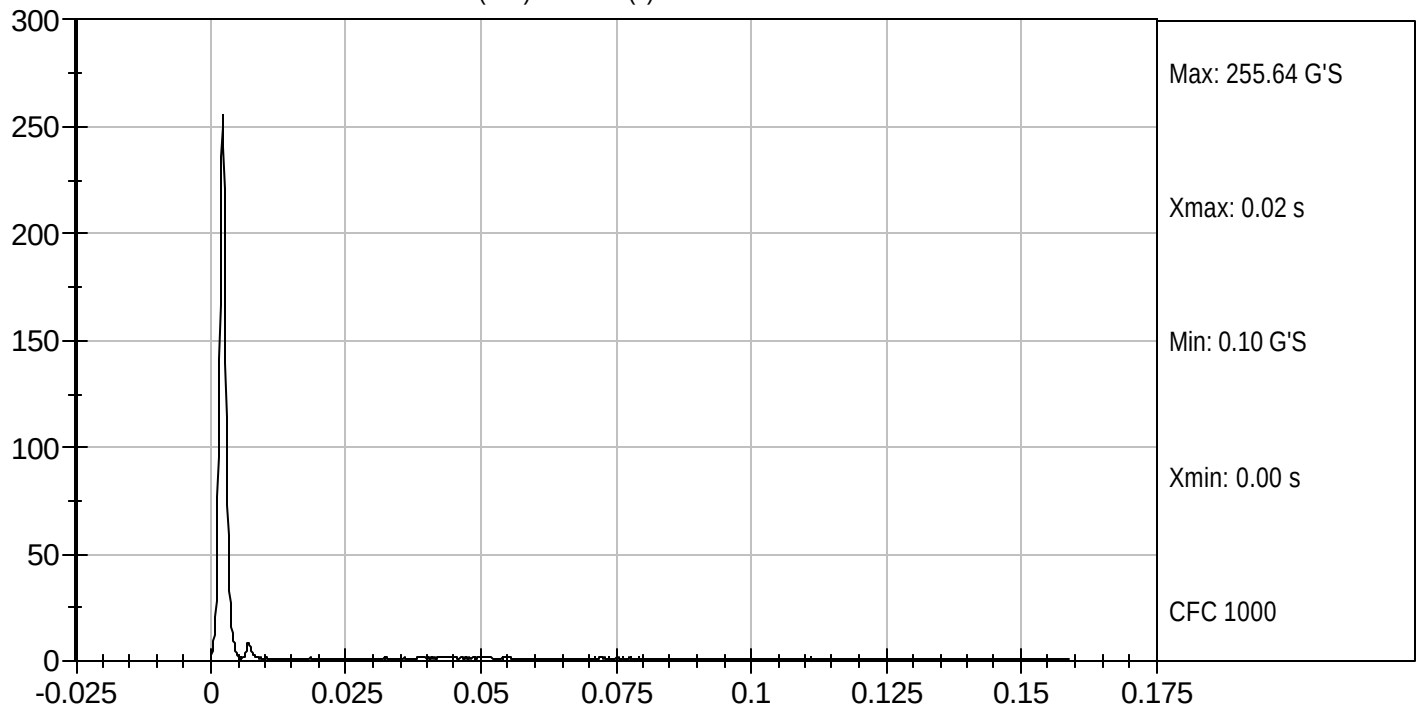

Approved By



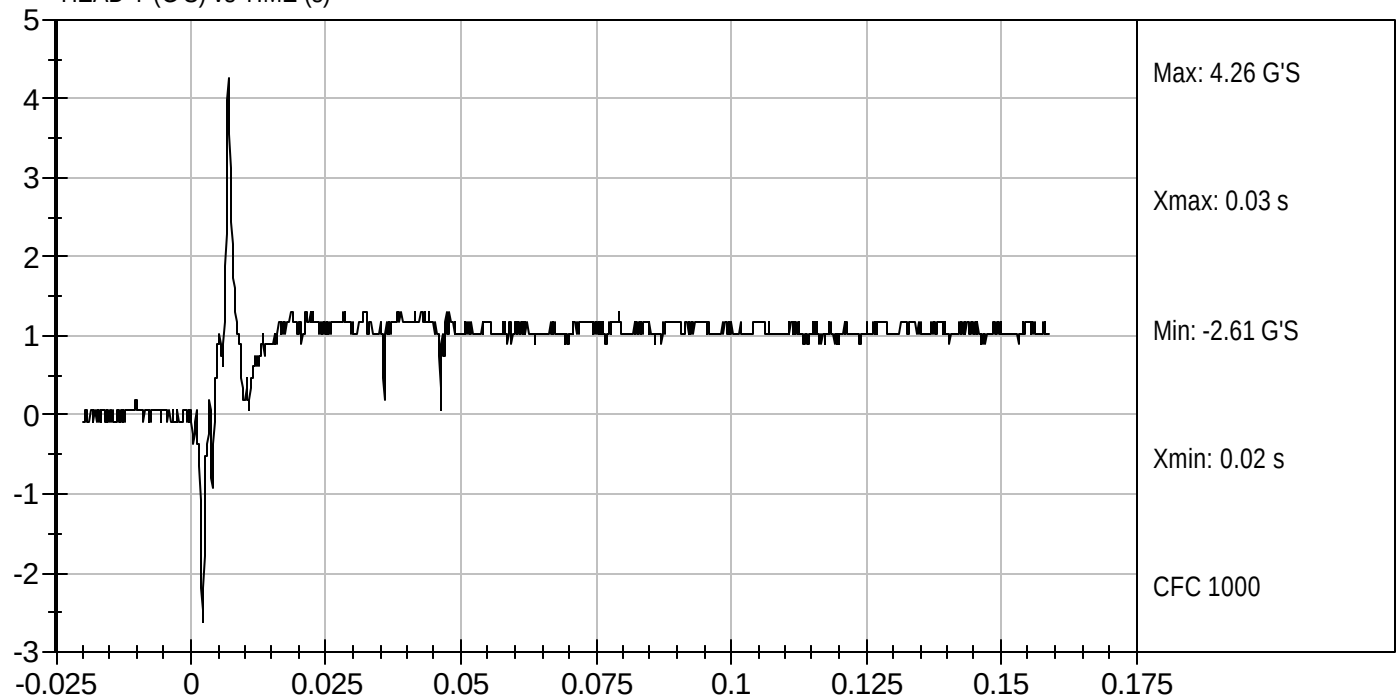
Test Desc: Head Drop
Componet ID: D051621

Test Date: 06/14/2005
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 507 Test Date 6/14/05

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>21.9</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity | <u>43%</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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	256
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	4

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

Jessica Hall
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

Test I.D: D051622

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	41	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	83	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	84	Pass
Overall Results					Pass



Laboratory Technician

06/14/2005

Test Date

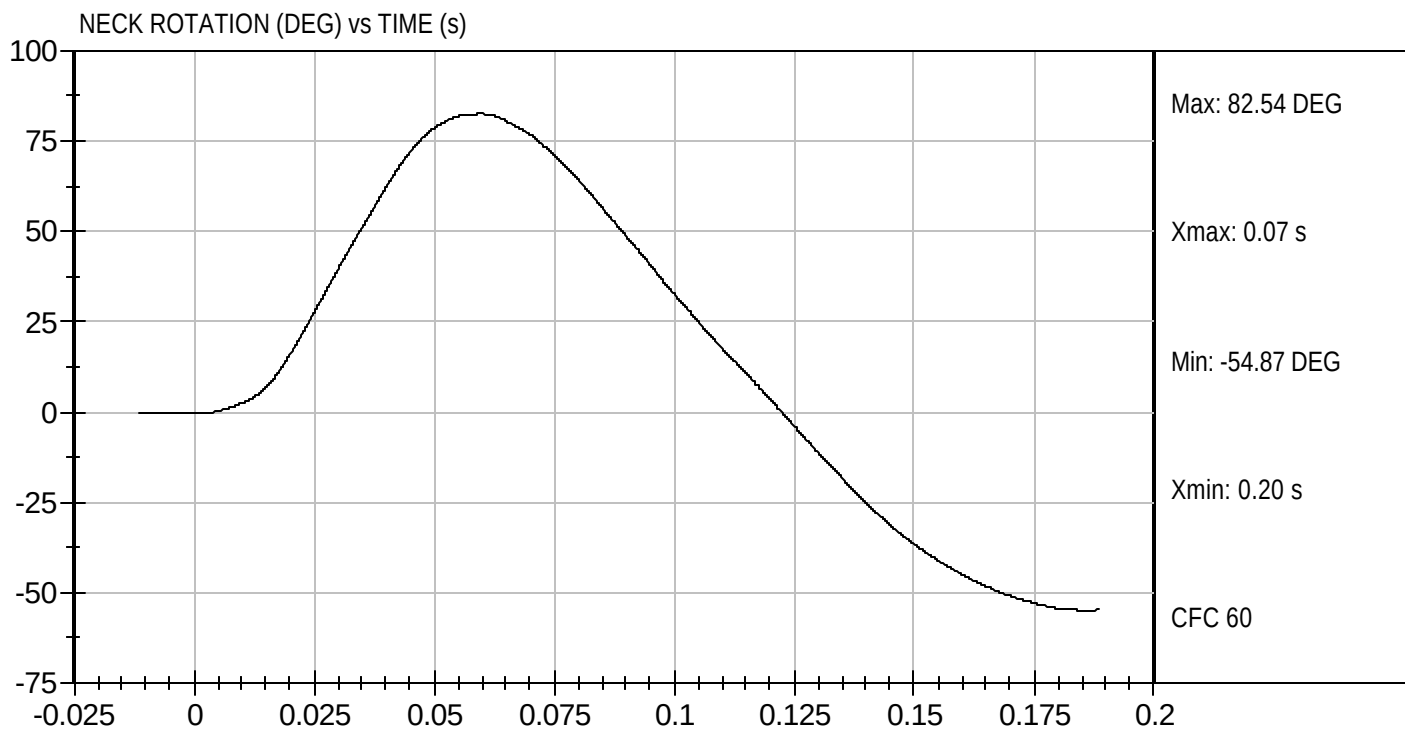
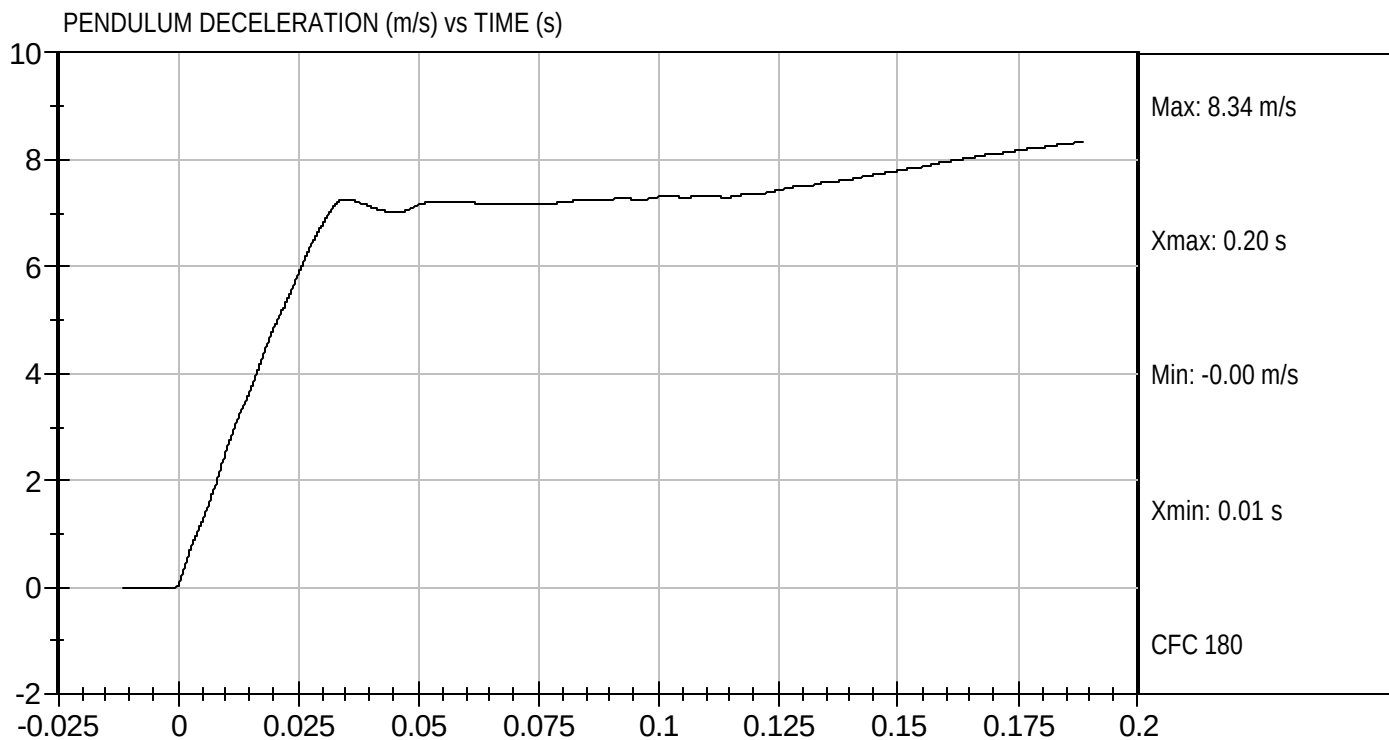


Approved By



Test Desc: Neck Flexion
Componet ID: D051622

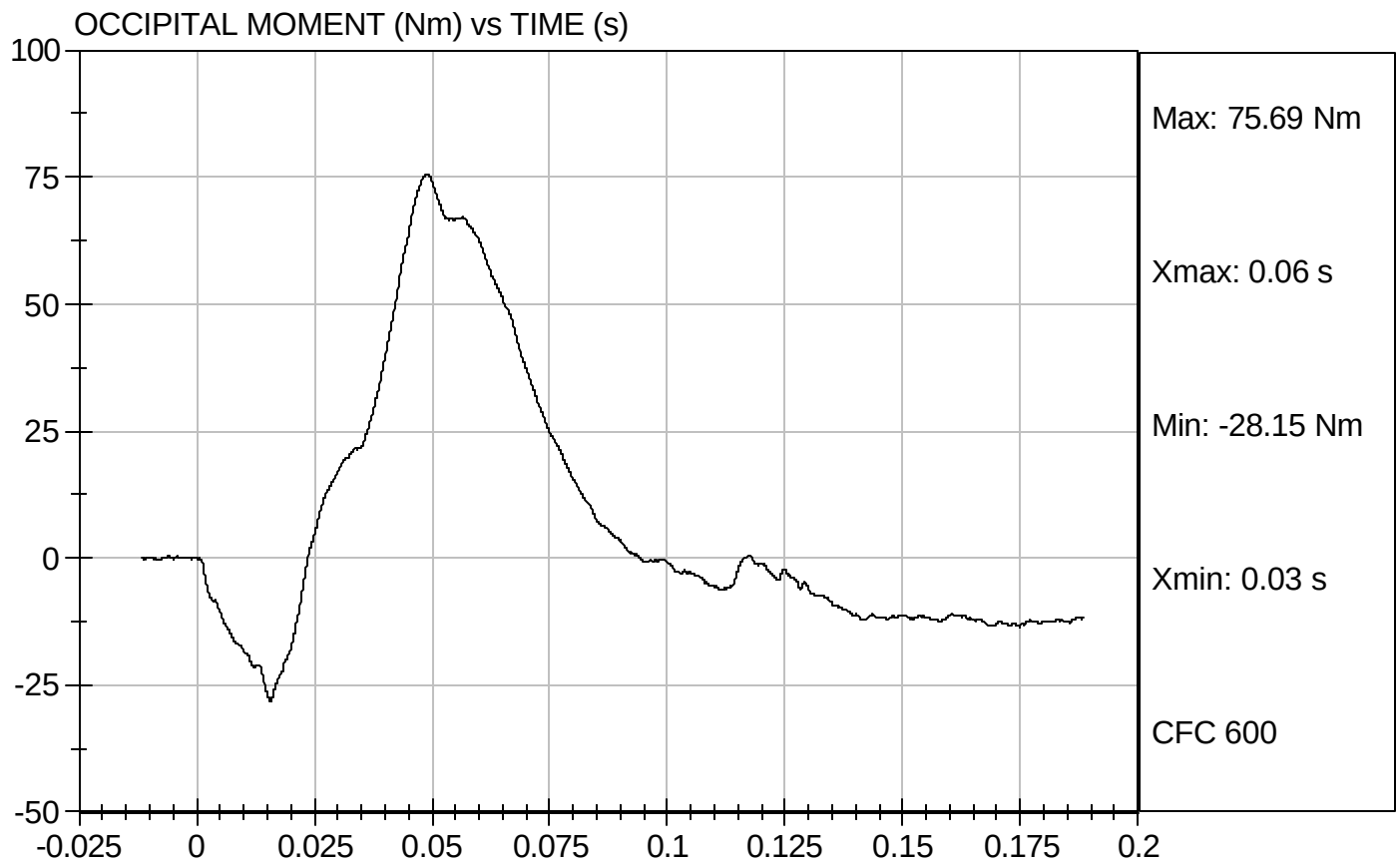
Test Date: 06/14/2005
Velocity: 23.05 ft/s, 7.03 m/s





Test Desc: Neck Flexion
Component ID: D051622

Test Date: 06/14/2005
Speed: 23.05 ft/sec, 7.03 m/sec



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 507 Test Date 6/14/05

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 21.9

Record the minimum temperature 20.7

Record the maximum humidity 43%

Record the minimum humidity 41%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 86; 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.03 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.5 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.8 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.8 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>76</u> Nm @ <u>83</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	84 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

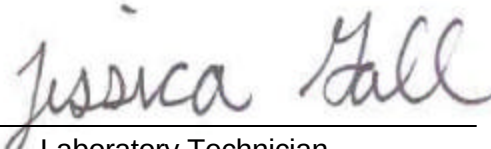
6/14/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

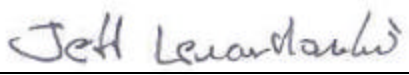
ATD Serial No: 507

Test I.D: D051623

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.14	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.8	Pass
	30 msec	m/sec	4.6 to 5.6	5.5	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	104	Pass
Overall Results				Pass	


 Laboratory Technician

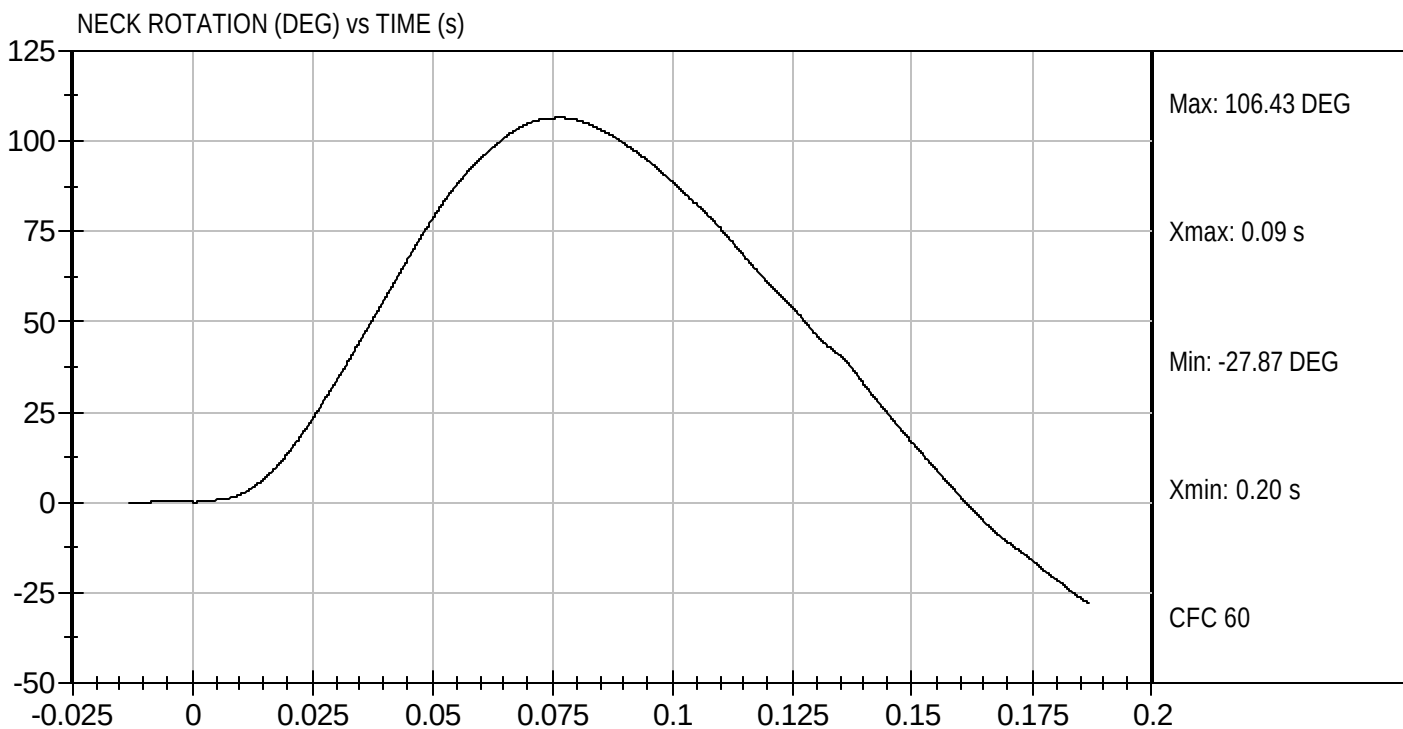
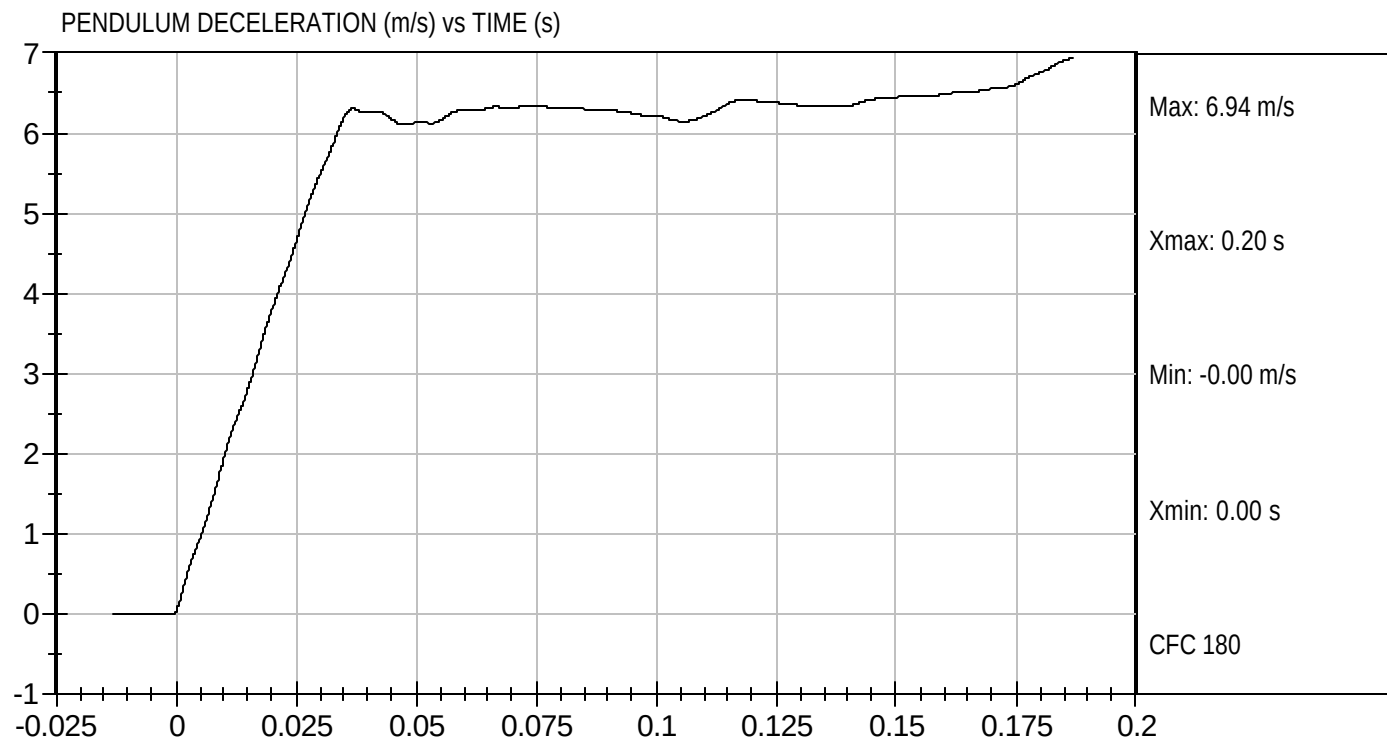
06/14/2005
 Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D051623

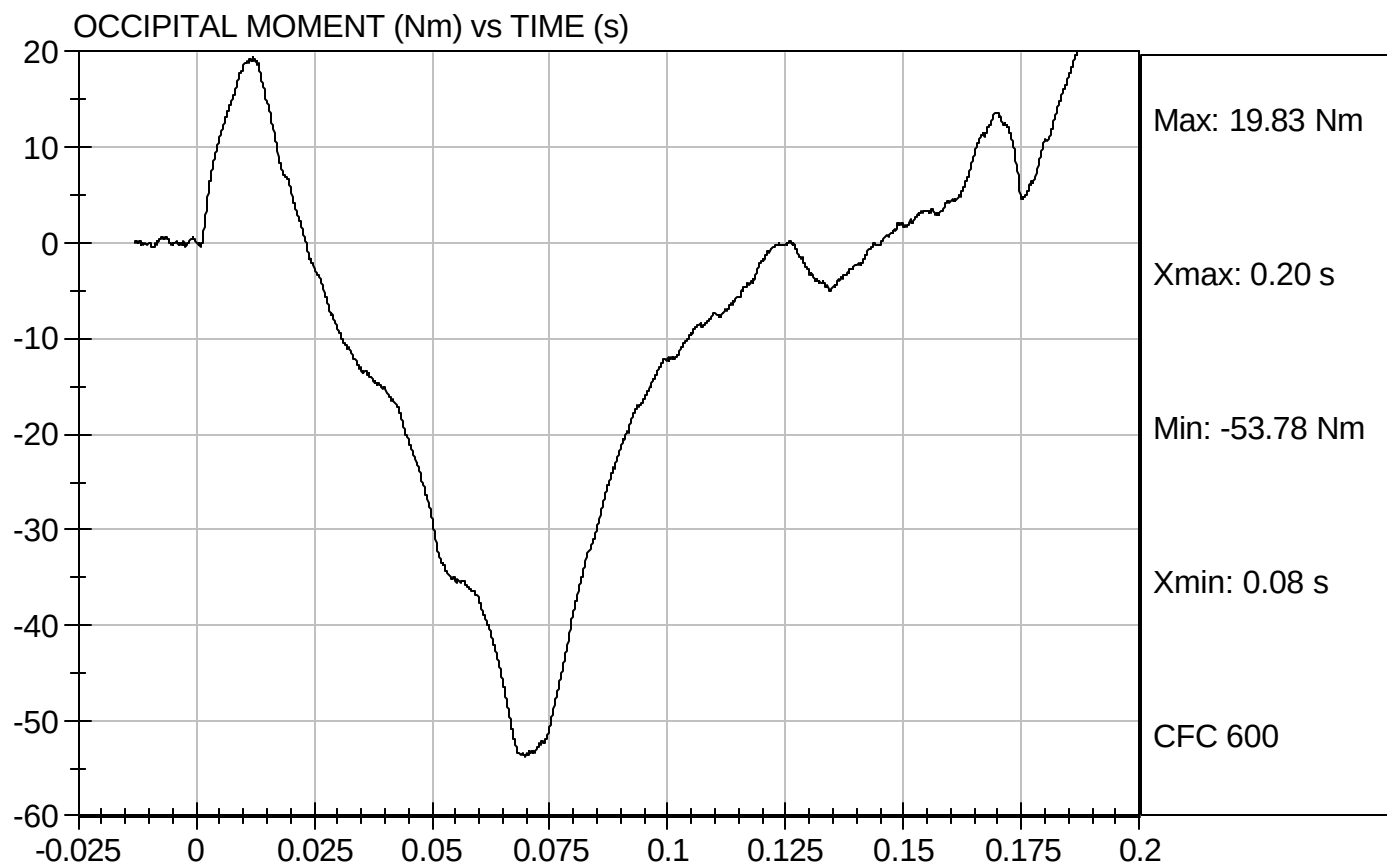
Test Date: 06/14/2005
Velocity: 20.16 ft/s, 6.14 m/s





Test Desc: Neck Extension
Component ID: D051623

Test Date: 06/14/2005
Speed: 20.16 ft/sec, 6.14 m/sec



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 507

Test Date 6/14/05

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.7

Record the maximum humidity 43%

Record the minimum humidity 41%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 86; 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.14 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.9 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.8 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.5 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	<u>-54</u> Nm @ <u>106</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	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.

Jessica Hall
Signature

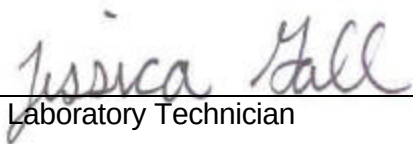
6/14/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

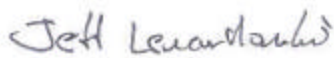
Test I.D: D051624

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	6.59 to 6.83	6.81	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.0	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	≤ 4600 N	4,144	Pass
Overall Test Results				Pass


Laboratory Technician

06/14/2005

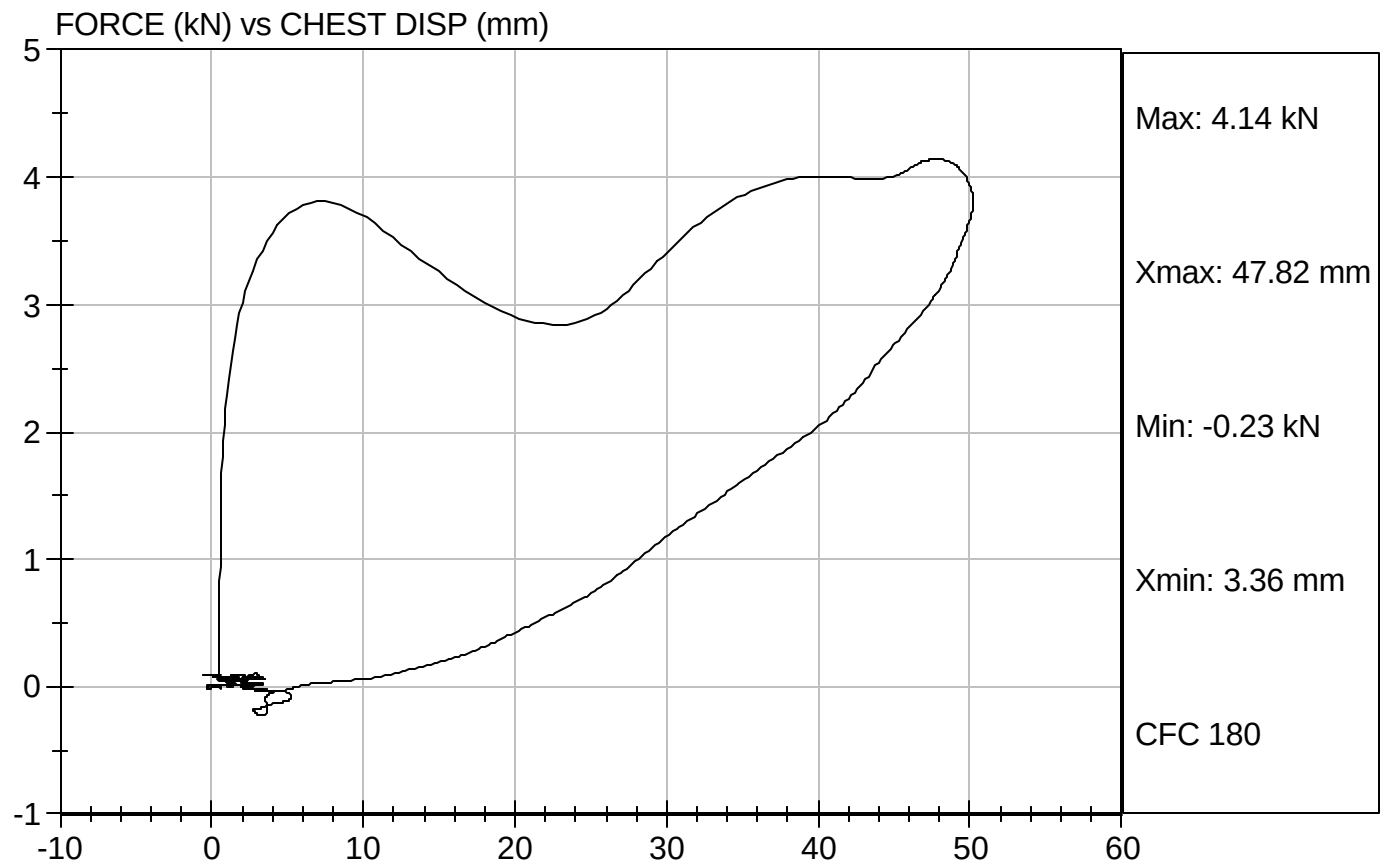
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D051624

Test Date: 06/14/2005
Speed: 22.35 ft/sec, 6.81 m/sec



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 507

Test Date 6/14/05

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.7

Record the maximum humidity 43%

Record the minimum humidity 41%

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

☒ - No damage

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

☐ - The following repairs or replacement was performed. Record _____

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

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

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

- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 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° 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° 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.81 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	3983 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4144 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.

Jessica Hall
Signature

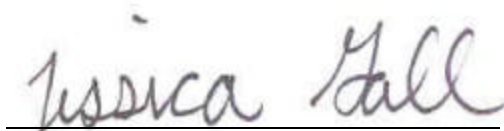
6/14/05
Date

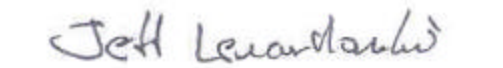
MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

Test I.D: D051625

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.64	Pass
Overall Test Results				Pass


Laboratory Technician

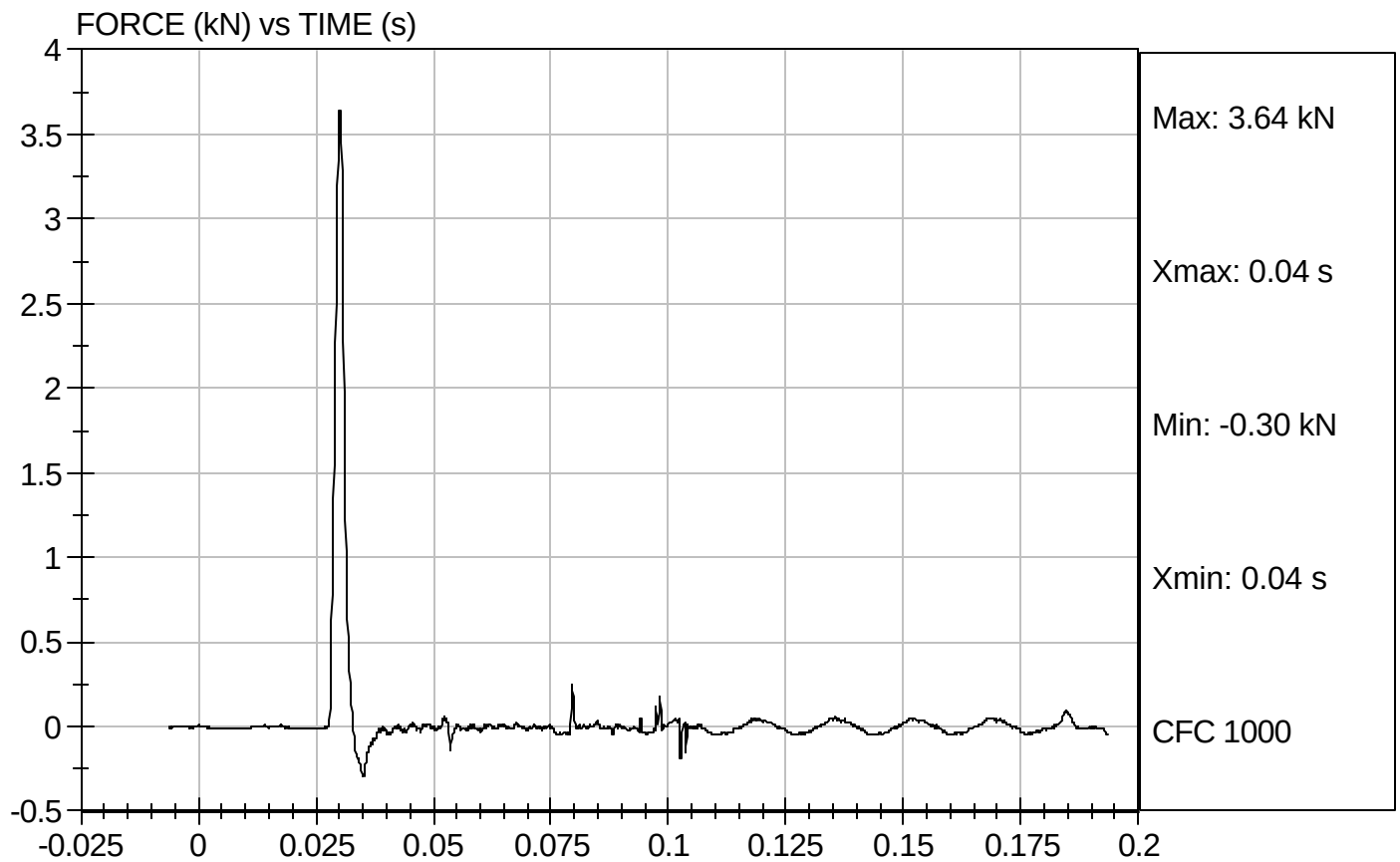

Approved By

06/14/2005
Test Date



Test Desc: Right Knee
Component ID: D051625

Test Date: 06/14/2005
Speed: 6.88 ft/sec, 2.10 m/sec



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 507

Test Date 6/14/05

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 21.9

Record the minimum temperature 21.6

Record the maximum humidity 43 %

Record the minimum humidity 41 %

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 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))

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



Signature

6/14/05

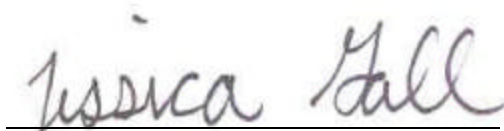
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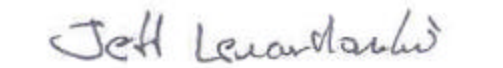
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

Test I.D: D051626

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.59	Pass
			Overall Test Results	Pass


Laboratory Technician

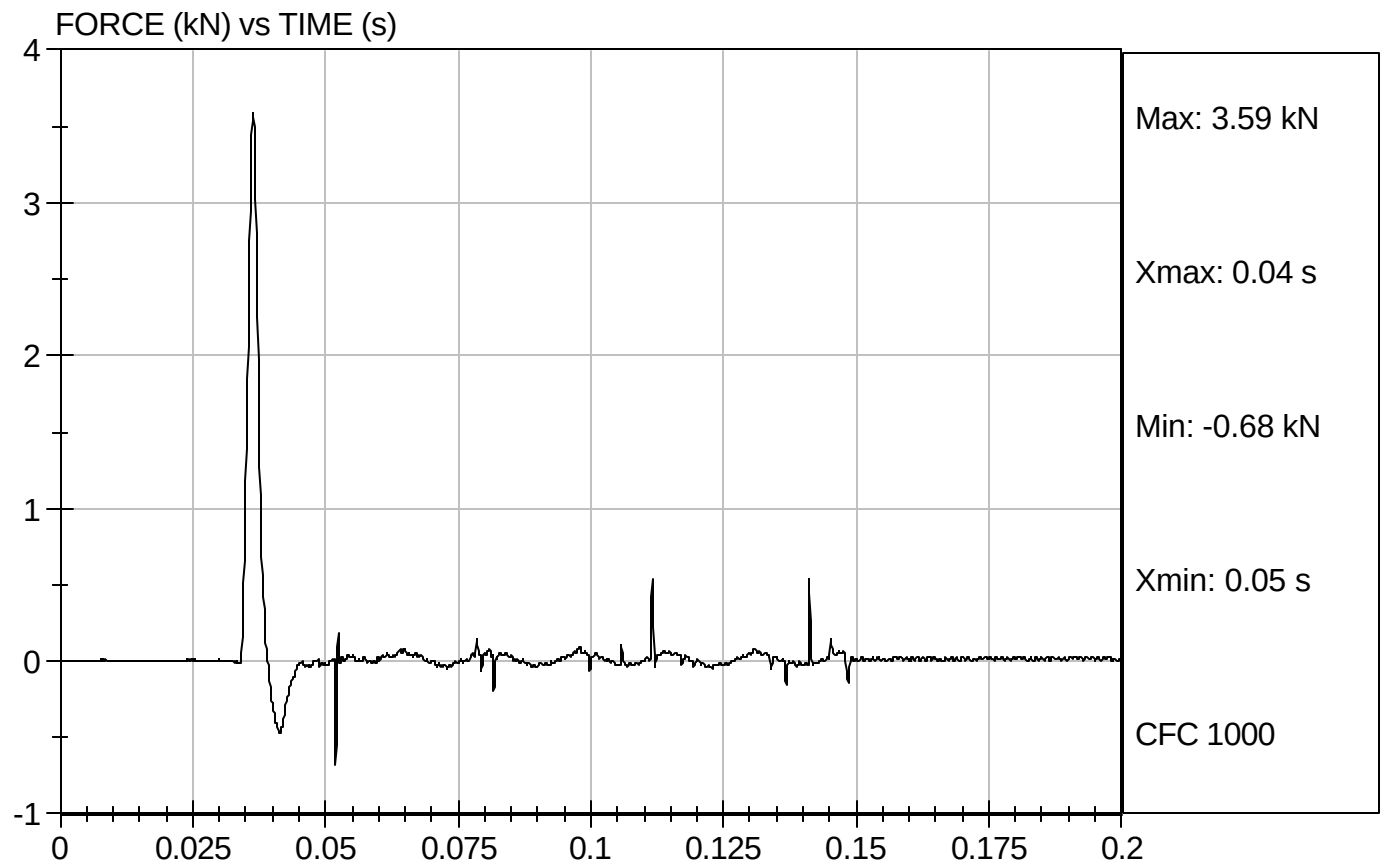

Approved By

06/14/2005
Test Date



Test Desc: Left Knee
Component ID: D051626

Test Date: 06/14/2005
Speed: 6.87 ft/sec, 2.09 m/sec



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 507

Test Date 6/14/05

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.7

Record the maximum humidity 43%

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	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.09 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3590 N

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

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

Jessica Hall
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

Test I.D: D051627

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	14	Pass
Return Angle	deg	+/- 8	14	Pass
Force at 45 deg	N	320 to 390	372	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result			Pass	



Laboratory Technician

06/14/2005

Test Date



Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 507

Test Date 6/14/05

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 21.9

Record the minimum temperature 20.7

Record the maximum humidity 43%

Record the minimum humidity 41%

☒ 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°) 14°

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

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at $45^\circ \pm 0.5^\circ$ 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 $\leq 20^\circ$	14°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	372 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	14°

Joe Fleck
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

Test ID: D051711

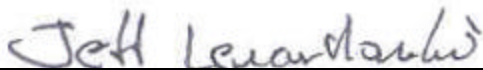
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	250 - 300	270	Pass
Peak Lateral Acceleration	G's	+/- 15	6.1	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

06/21/2005

Test Date

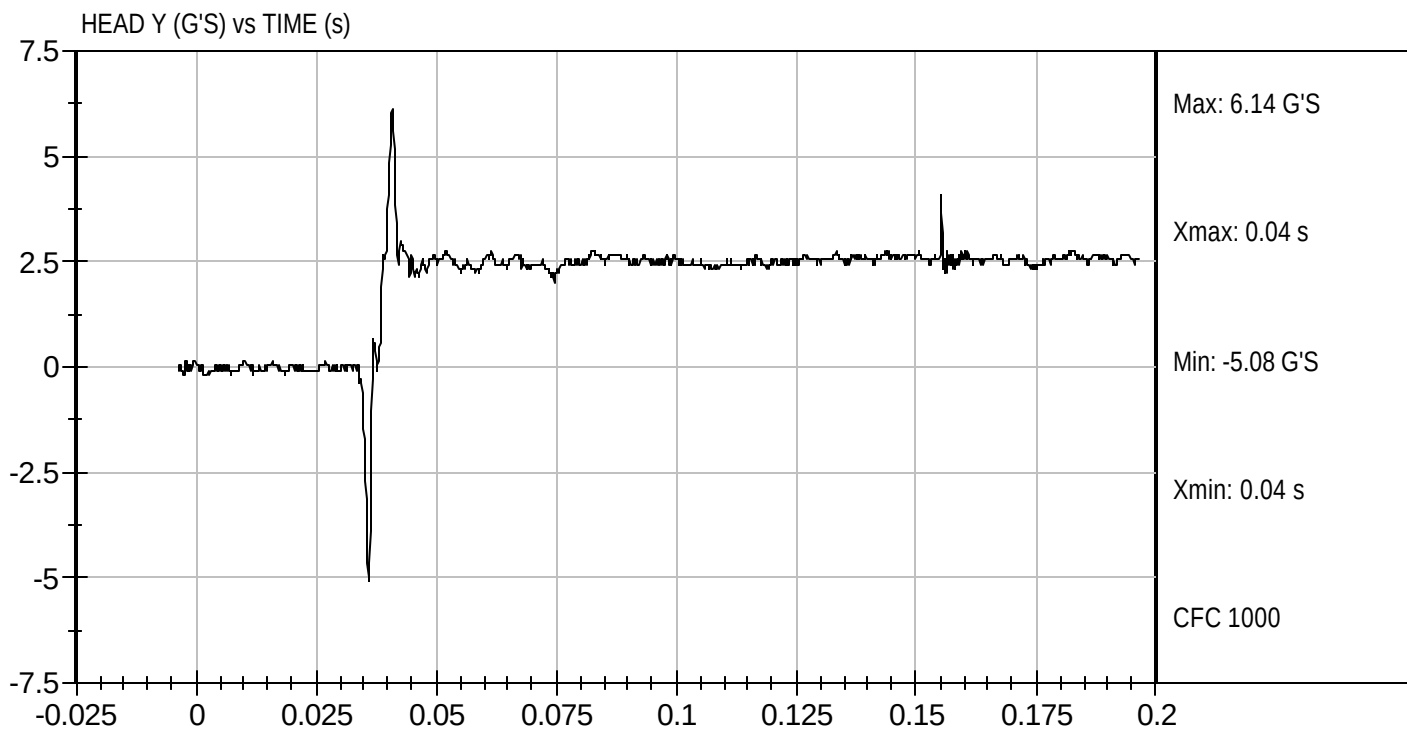
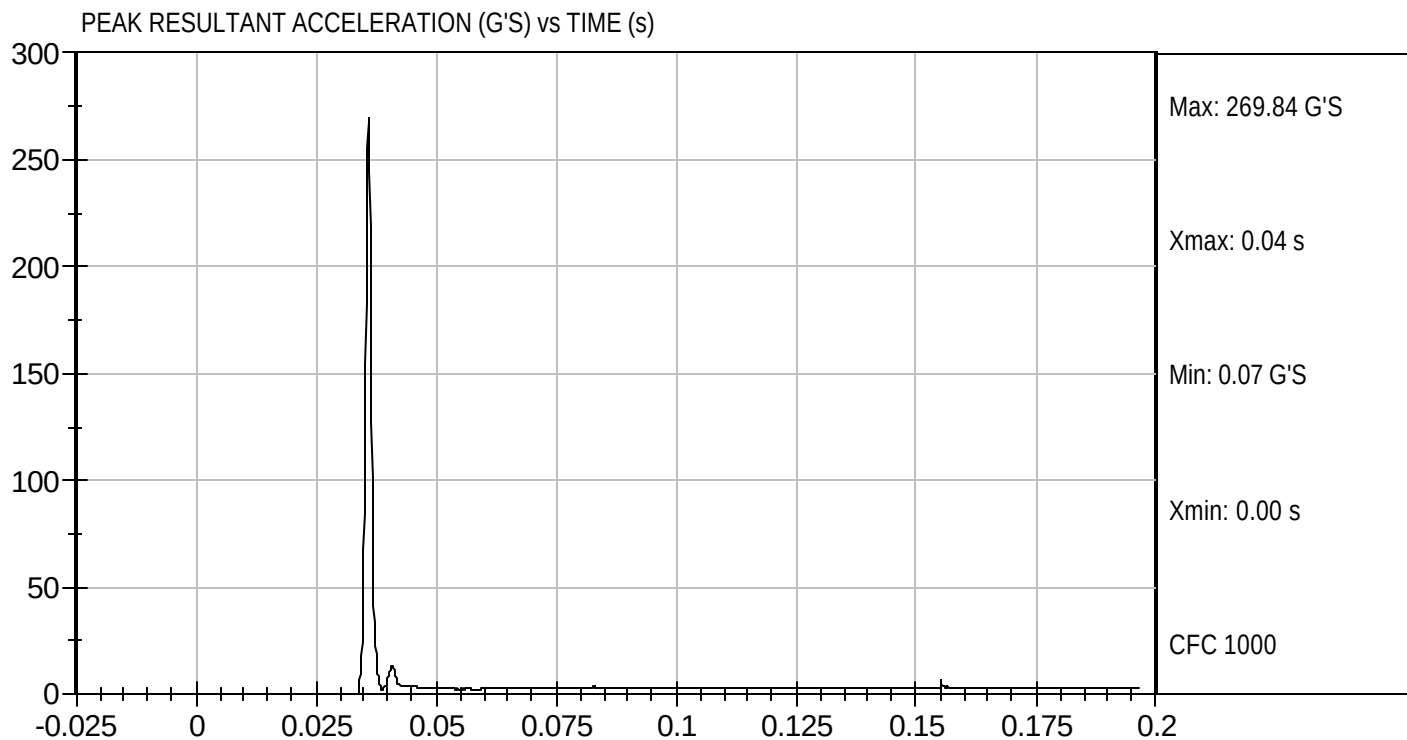


Approved By



Test Desc: Head Drop
Componet ID: D051711

Test Date: 06/21/2005
Velocity: 0 ft/s, 0 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 507 Test Date 6/21/05

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>21.9</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity | <u>43%</u> |
| Record the minimum humidity | <u>37%</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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	270
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 $\leq 15 \text{ g}$	6.1

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

Joe Fleck
Signature

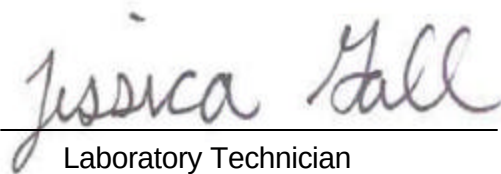
6/21/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

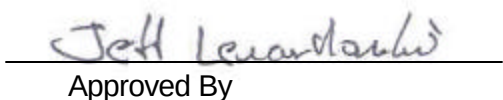
ATD Serial No: 507

Test I.D: D051712

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	38	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.6	Pass
	30 msec	m/sec	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	80	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	84	Pass
Overall Results				Pass	


Laboratory Technician

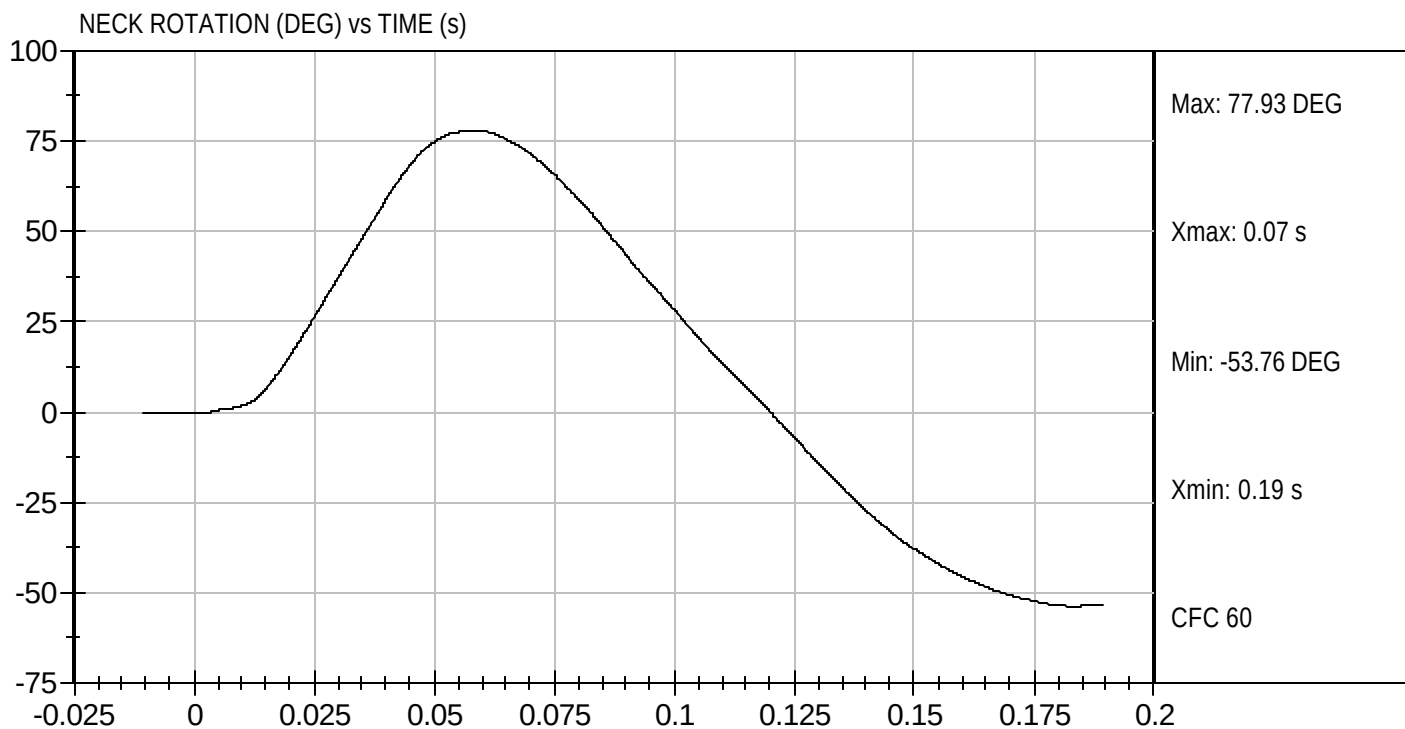
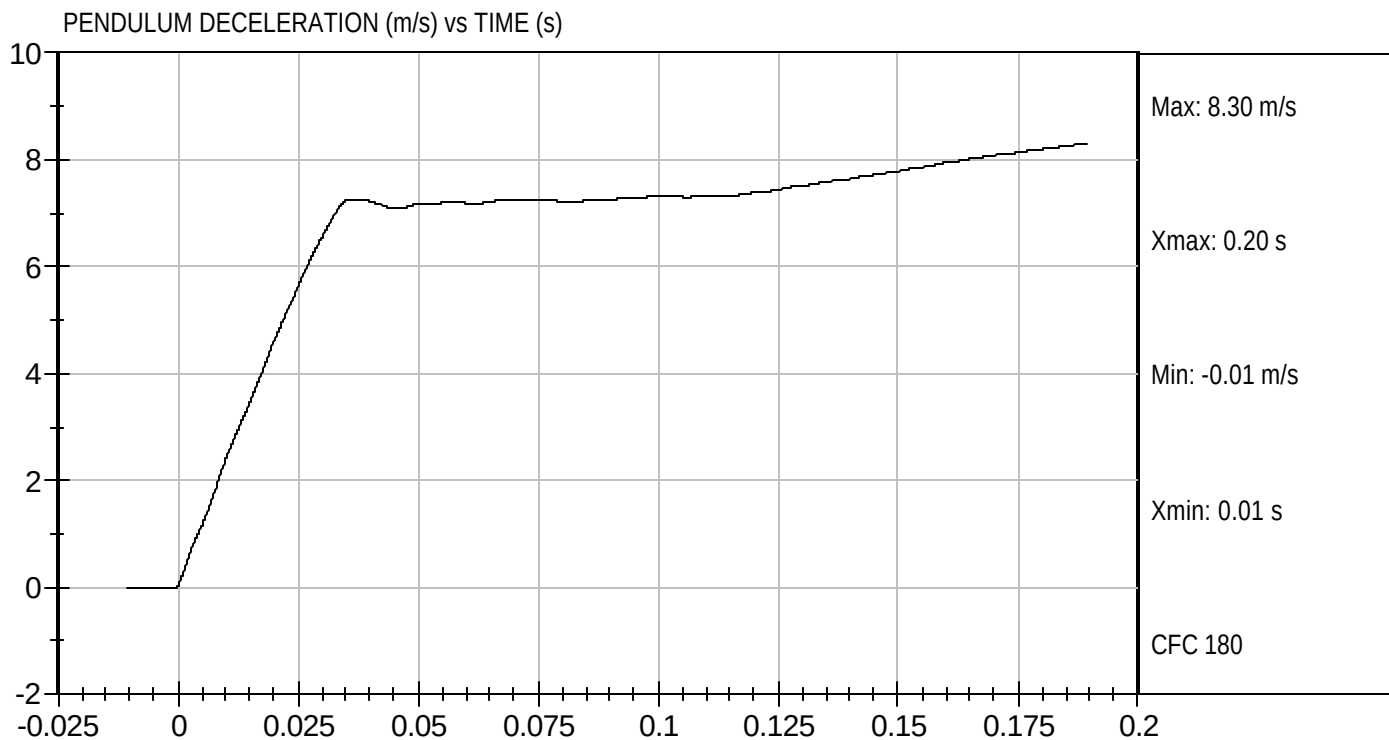
06/22/2005
Test Date


Approved By



Test Desc: Neck Flexion
Componet ID: D051712

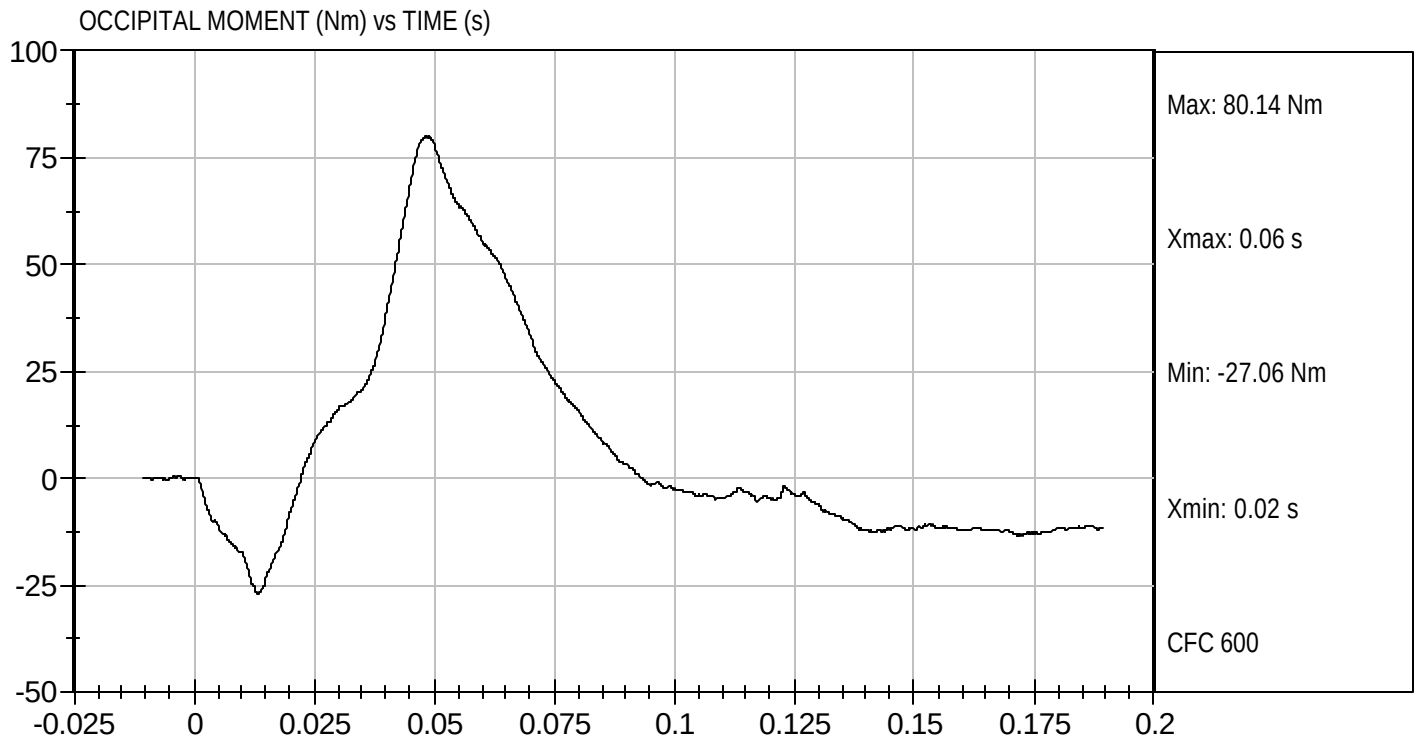
Test Date: 06/22/2005
Velocity: 23.06 ft/s, 7.03 m/s





Test Desc: Neck Flexion
Componet ID: D051712

Test Date: 06/22/2005
Velocity: 23.06 ft/s, 7.03 m/s



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 507 Test Date 6/22/05

Technician Jessica Gall

☐ 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>21.9</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity | <u>43%</u> |
| Record the minimum humidity | <u>37%</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 86; 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.03 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.4 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.6 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.5 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>80</u> Nm @ <u>78</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	84 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.

Jessica Hall
Signature

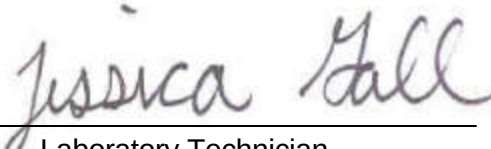
6/22/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

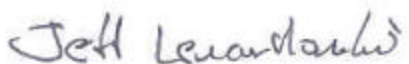
ATD Serial No: 507

Test I.D: D051713

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	37	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	3.8	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	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	103	Pass
Overall Results					Pass


 Laboratory Technician

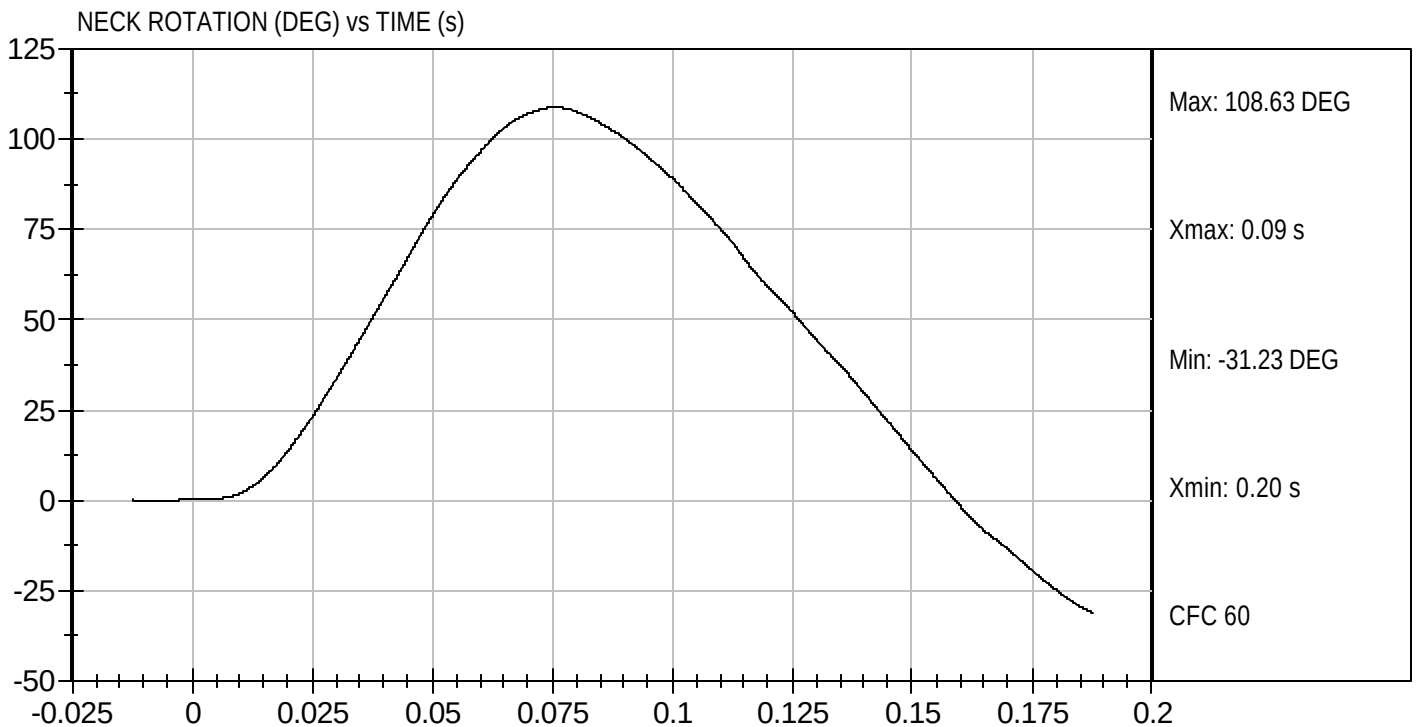
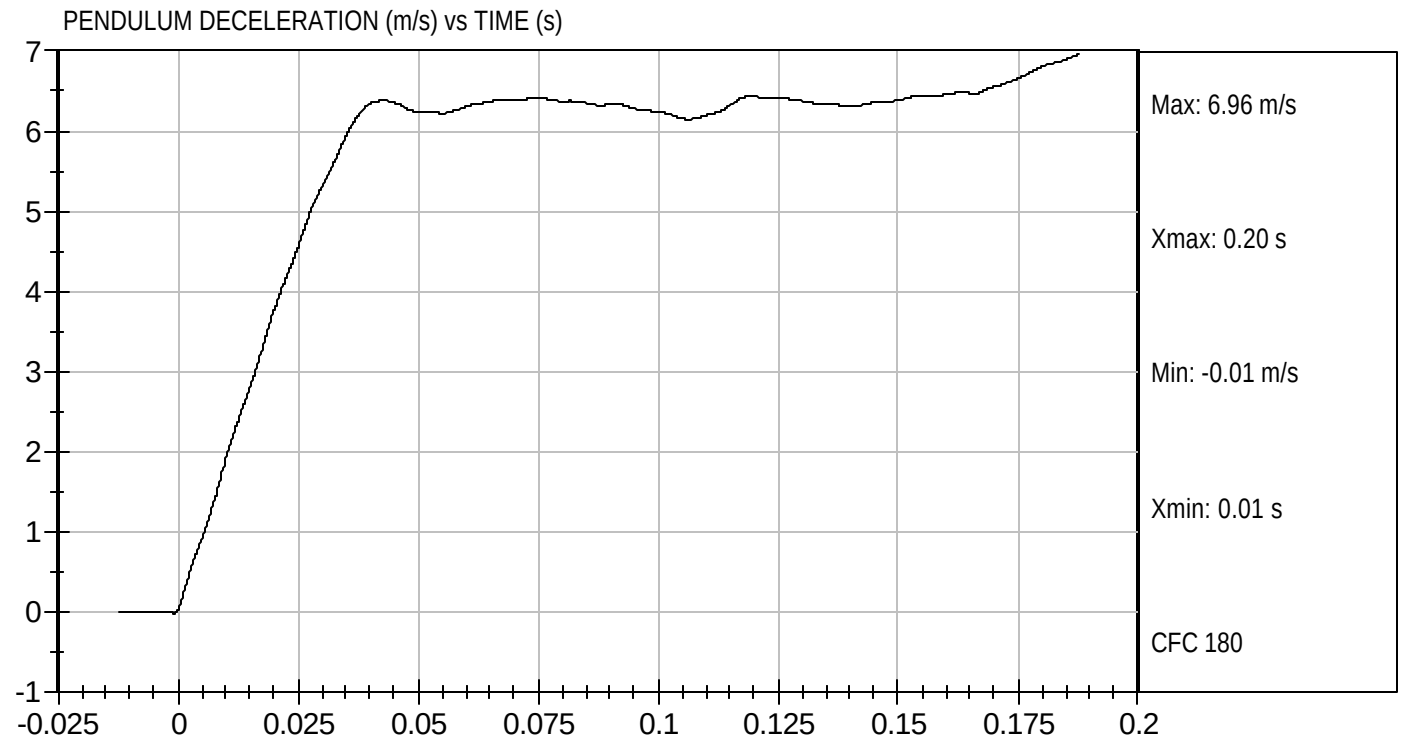
06/22/2005
 Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D051713

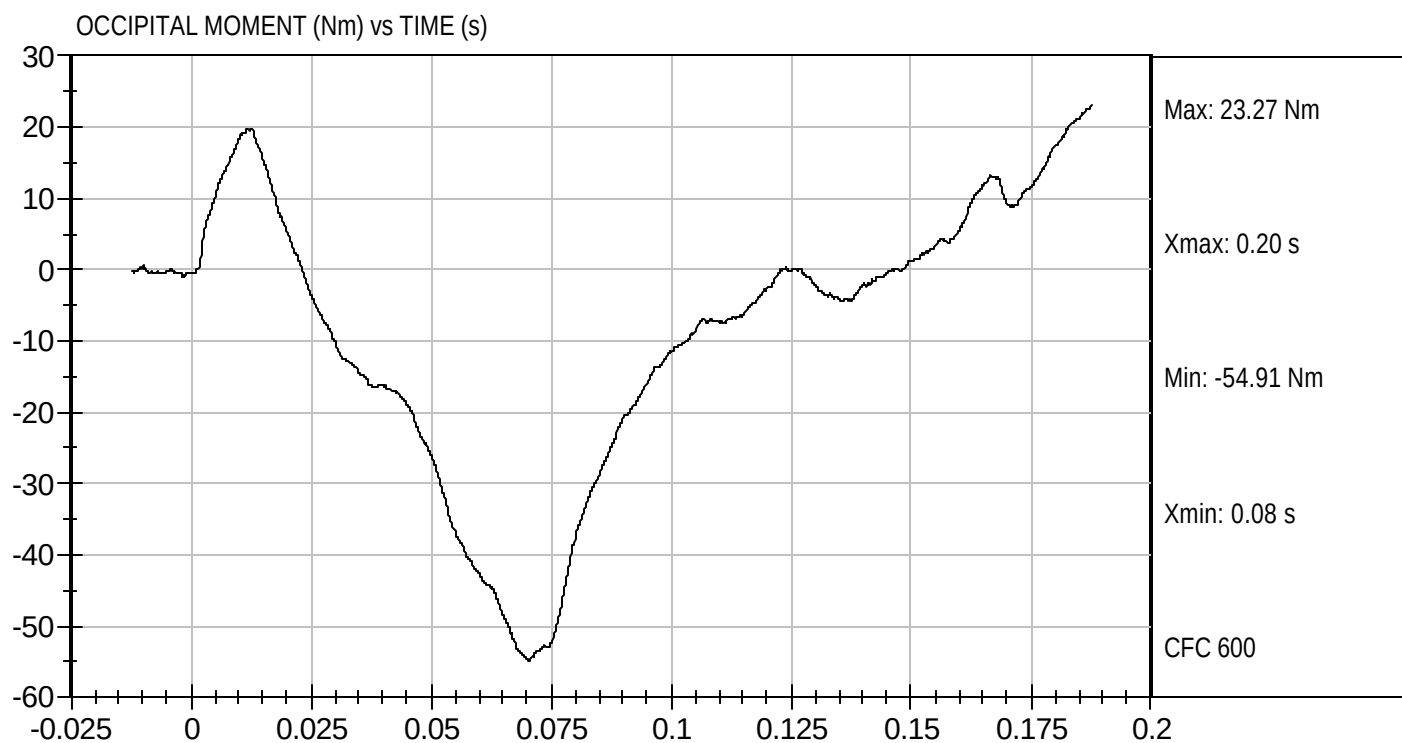
Test Date: 06/22/2005
Velocity: 20.09 ft/s, 6.12 m/s





Test Desc: Neck Extension
Componet ID: D051713

Test Date: 06/22/2005
Velocity: 20.09 ft/s, 6.12 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 507

Test Date 6/22/05

Technician Jessica Gall

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 43%

Record the minimum humidity 37%

☒ 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 86; 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 ± 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 ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.9 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.8 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.3 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>-55</u> Nm @ <u>109</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	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.

Jessica Hall
Signature

6/22/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

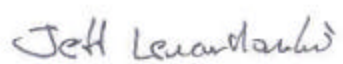
ATD Serial No: 507

Test I.D: D051714

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	37	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.1	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	≤ 4600 N	3997	Pass
Overall Test Results				Pass


 Laboratory Technician

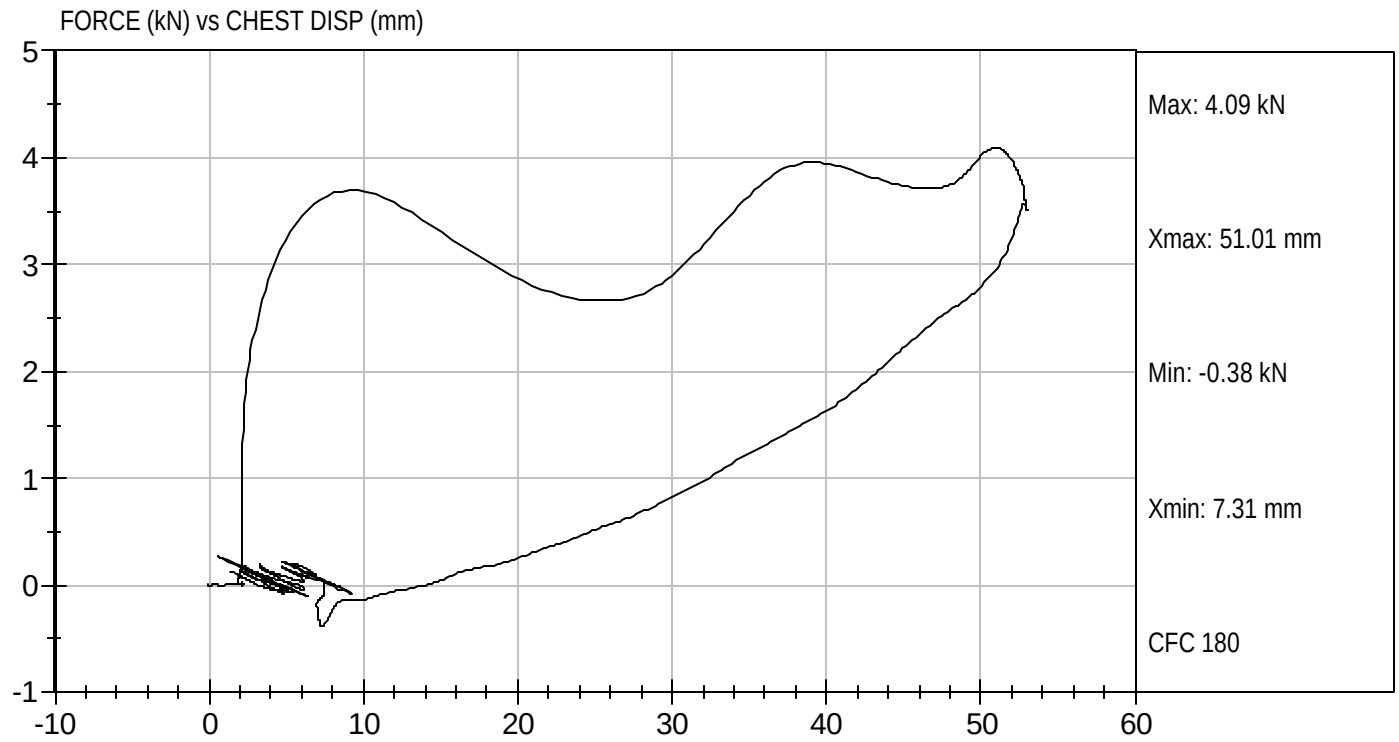
06/22/2005
 Test Date


 Approved By



Test Desc: Thorax Impact
Componet ID: D051714

Test Date: 06/22/2005
Velocity: 21.9 ft/s, 6.68 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 507

Test Date 6/22/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 43%

Record the minimum humidity 37%

☒ 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 ± 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° 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° 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	53 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4090 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3997 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	71%

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

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

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

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


Signature

6/22/05
Date

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

ATD Serial No: 507

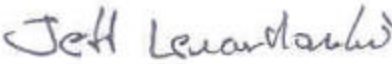
Test I.D: D051715

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.53	Pass
Overall Test Results				Pass


Laboratory Technician

06/21/2005

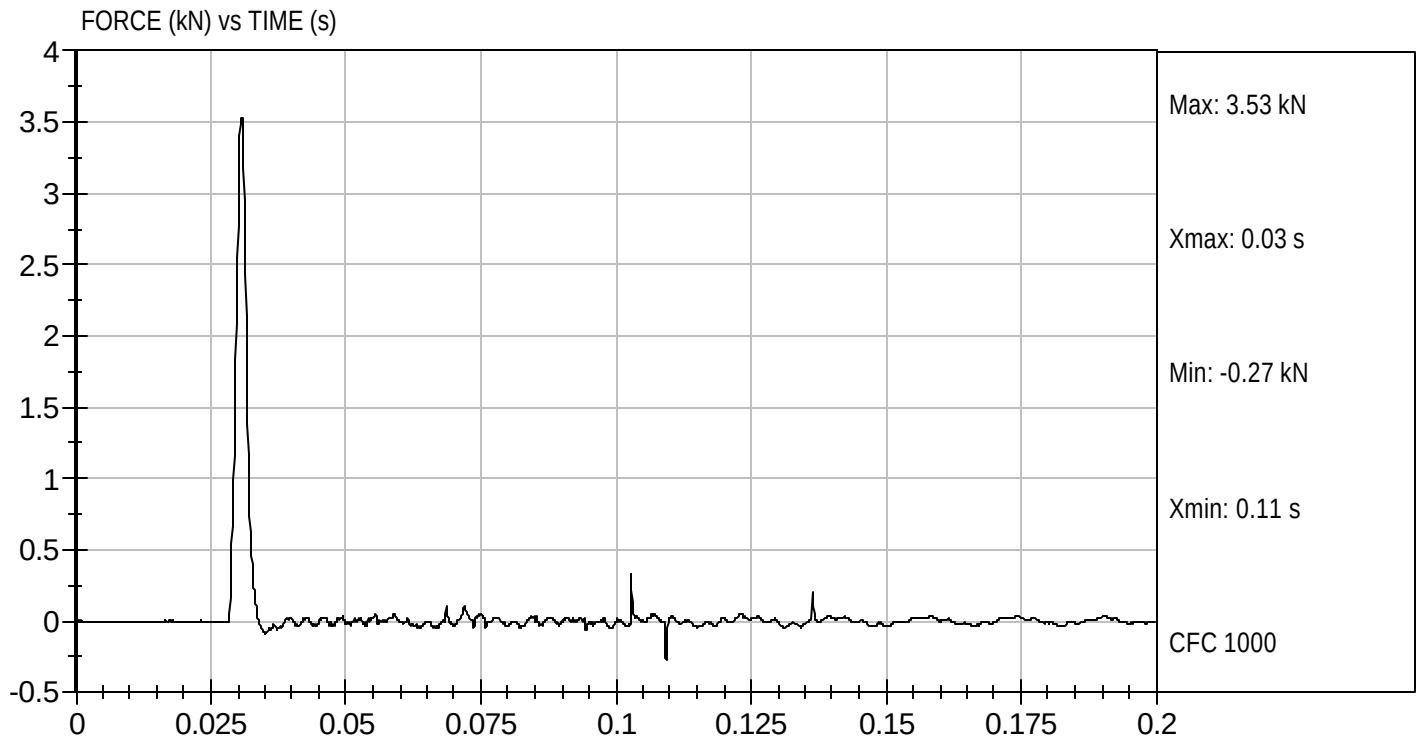
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D051715

Test Date: 06/21/2005
Velocity: 6.87 ft/s, 2.09 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 507

Test Date 6/21/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 43 %

Record the minimum humidity 37 %

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.09 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3530 N

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

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


Signature

6/21/05
Date

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

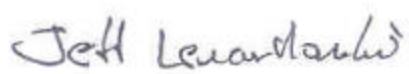
ATD Serial No: 507

Test I.D: D051716

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.46	Pass
Overall Test Results				Pass


Laboratory Technician

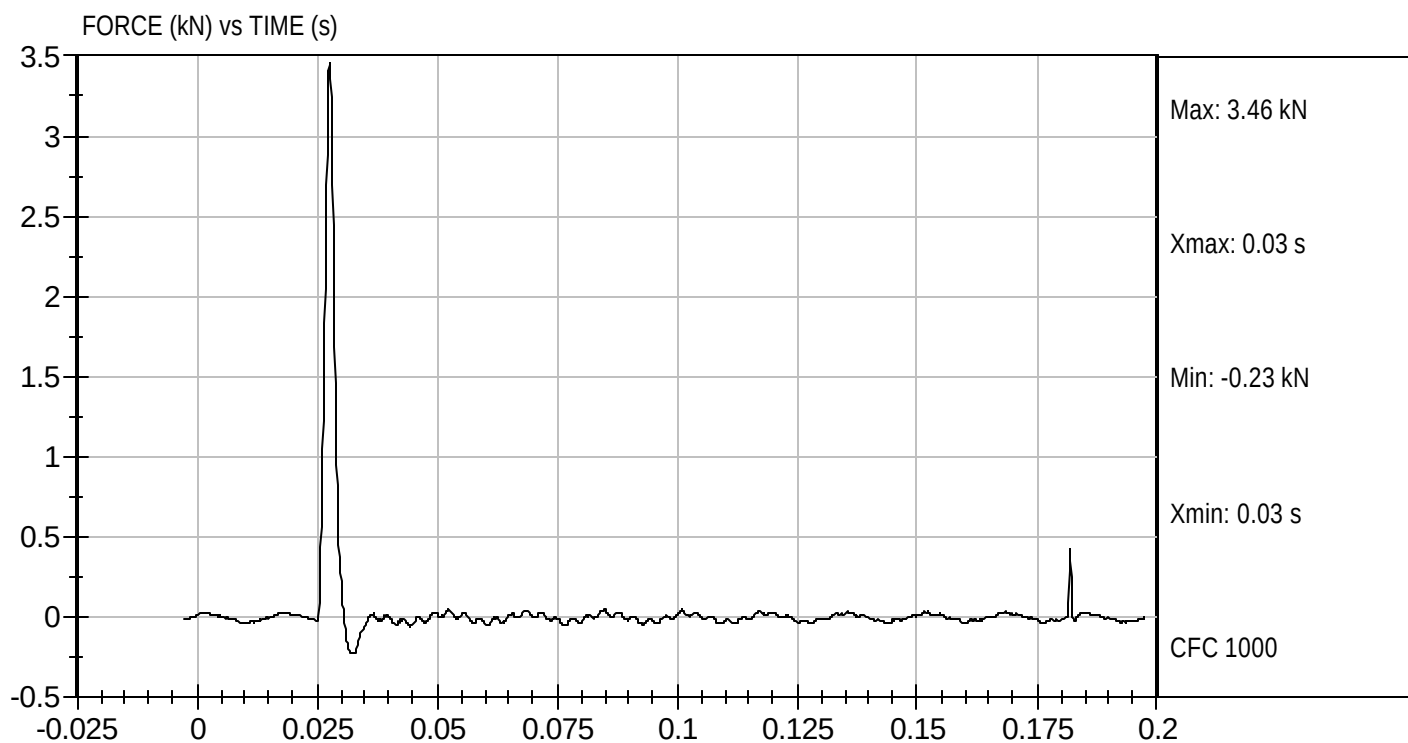
06/21/2005
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D051716

Test Date: 06/21/2005
Velocity: 6.96 ft/s, 2.12 m/s



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 507

Test Date 6/21/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 43%

Record the minimum humidity 37%

☒ 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))

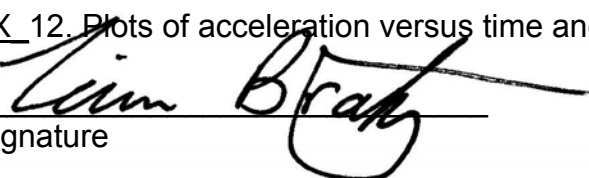
X 11. Complete the following table:

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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3460 N

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

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


Signature

6/21/05
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 507

Test I.D: D051717

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	379	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result			Pass	



Laboratory Technician

06/21/2005

Test Date



Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 507

Test Date 6/21/05

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 21.9

Record the minimum temperature 20.9

Record the maximum humidity 43%

Record the minimum humidity 37%

☒ 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° and 1.5° 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°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	379 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	18°

Joe Fleck
Signature

6/21/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #507, 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	781.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	455.4
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	79.2
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	130.3
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	249
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	44.8
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.1
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.0
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	544.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	356.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	394.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.2

HYBRID III 5 th SN #507, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	186.7
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	222.0
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	481.3
S	HEAD BREADTH	The widest part of the head	137.1-147.3	138.4
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	178.1
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.6
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.9
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	89.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	539.4
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	863.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	787.1
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	342.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	168.0

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 507

Test Date 6/22/05

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall
Signature

6/22/05
Date

Describe the repair or replacement of parts:

Checked by

Jeff LevanMarx
Signature

6/22/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #510, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	786.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	450.0
C	H-POINT HEIGHT	Reference	81.3-86.3	84.1
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	82.7
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	133.9
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.6
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	44.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	278.5
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	202.1
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	543.6
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	358.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	397.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.2

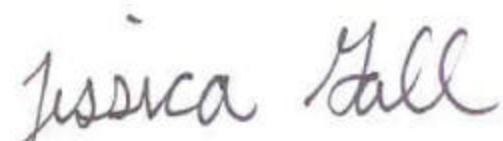
HYBRID III 5 th SN #510, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	181.0
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	221.4
Q	STANDING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

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

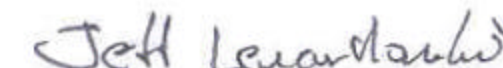
ATD Serial No: 510

Test ID: D051631

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	250 - 300	263	Pass
Peak Lateral Acceleration	G's	+/- 15	9	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass


Laboratory Technician

06/14/2005
Test Date

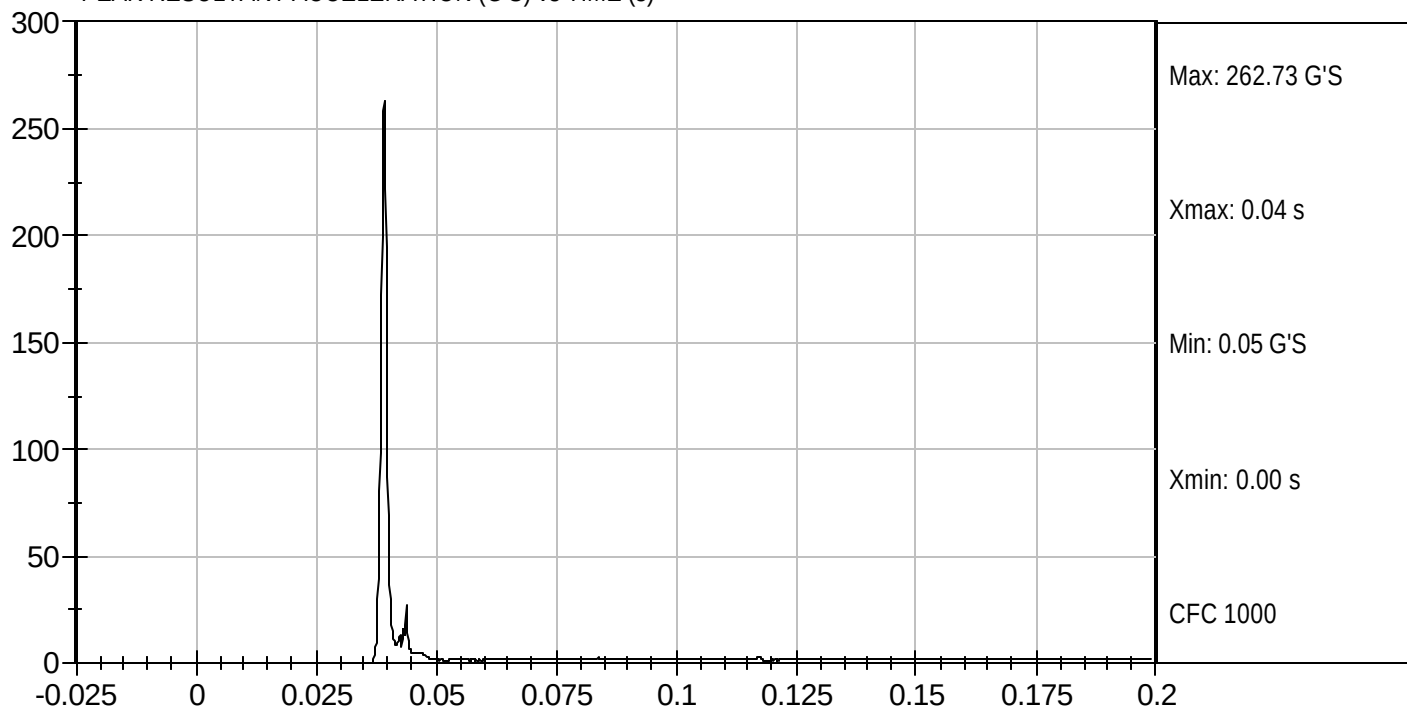

Approved By



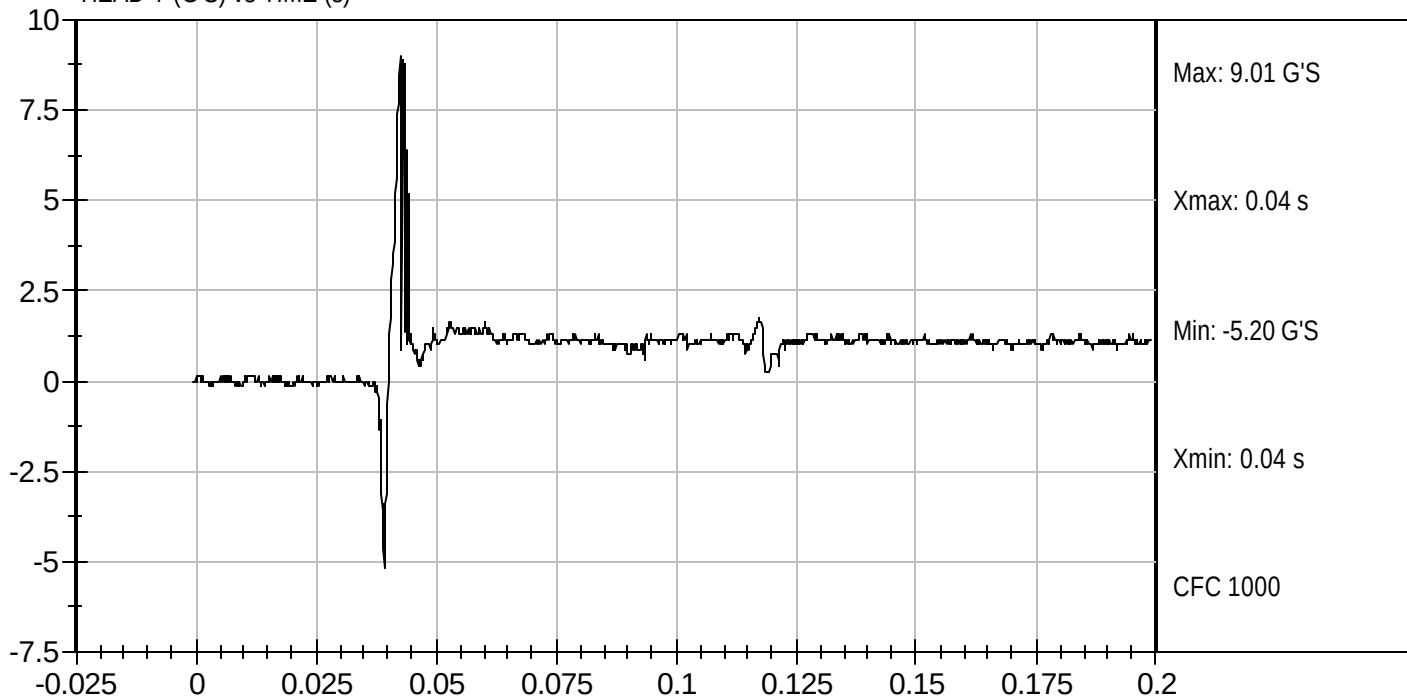
Test Desc: Head Impact
Componet ID: D051631

Test Date: 06/14/2005
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 510

Test Date 6/14/05

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 21.4

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 41%

☒ 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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	263
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 $\leq 15 \text{ g}$	9

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

Jessica Hall
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 516

Test I.D: D051632

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	44	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.09	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	87	Pass
Overall Results					Pass



Laboratory Technician

06/14/2005

Test Date

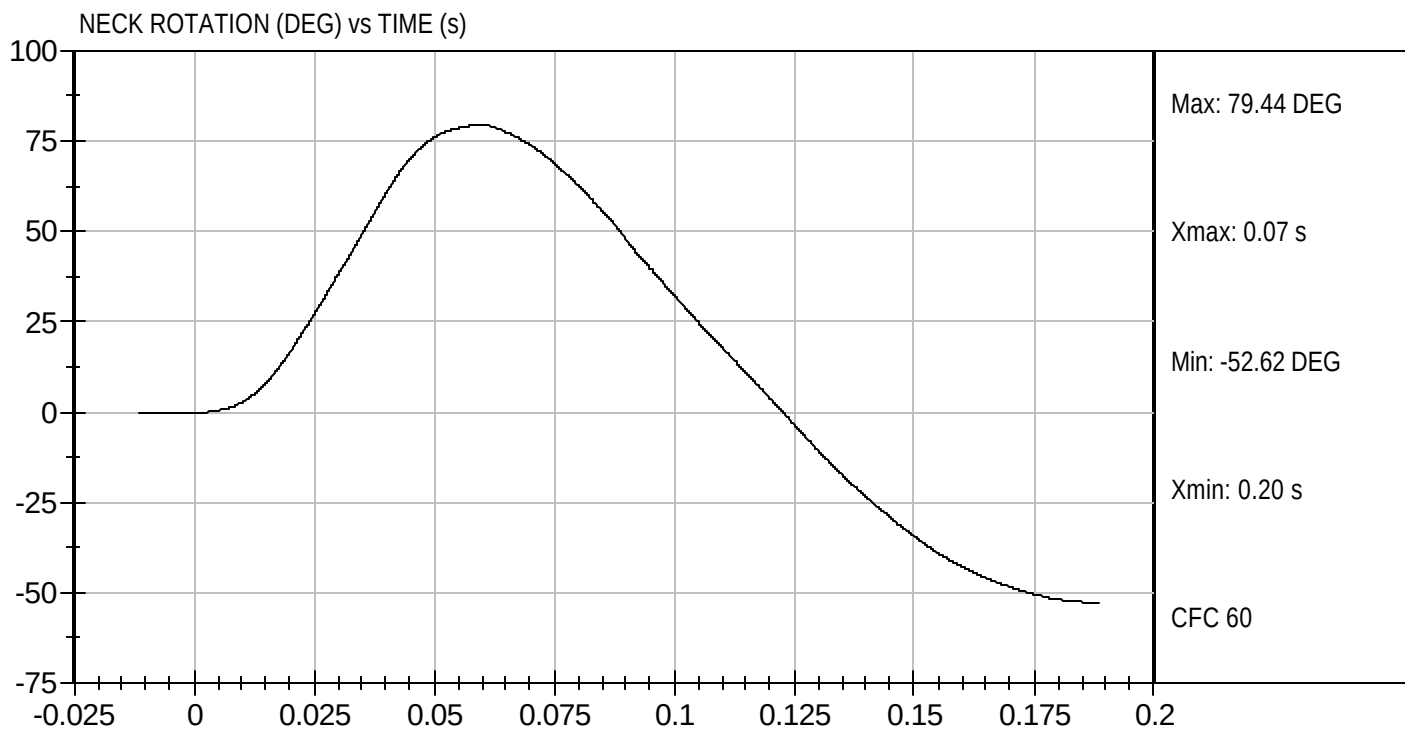
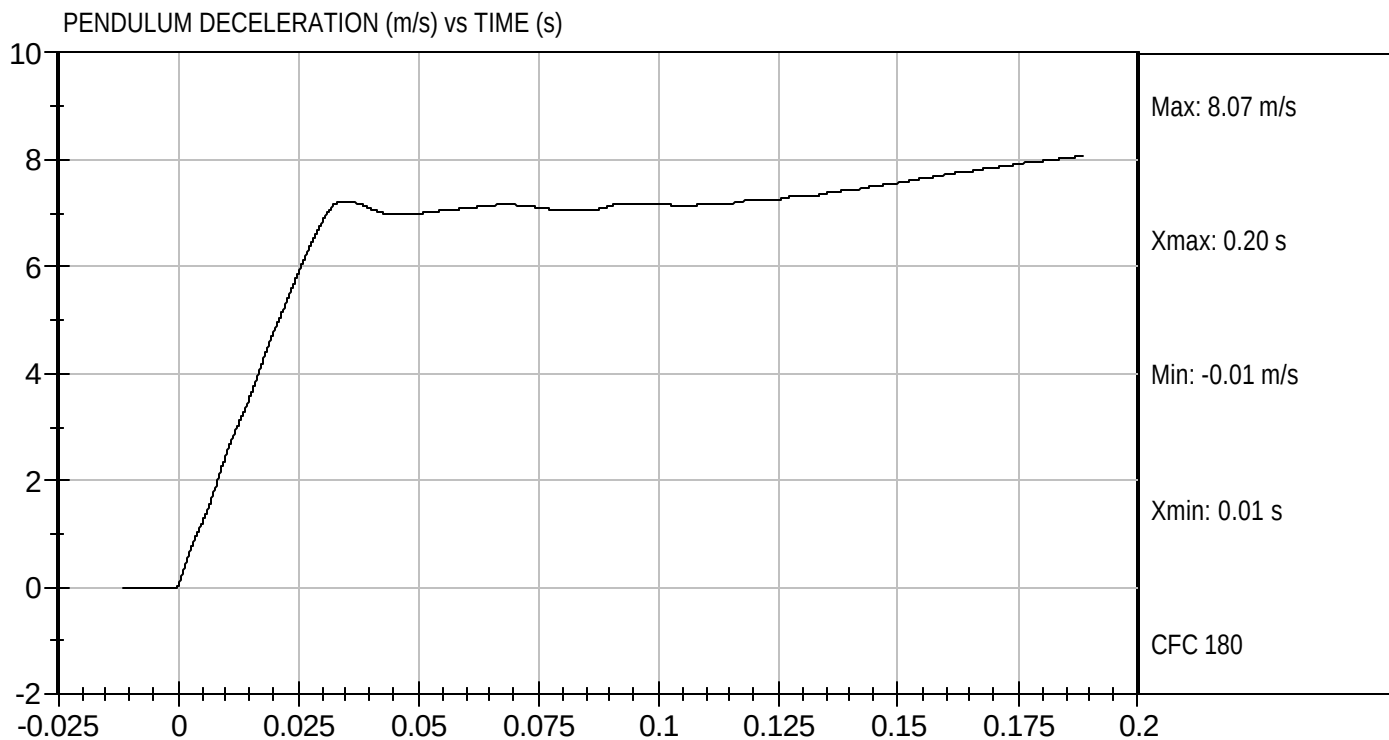


Approved By



Test Desc: Neck Flexion
Componet ID: D051632

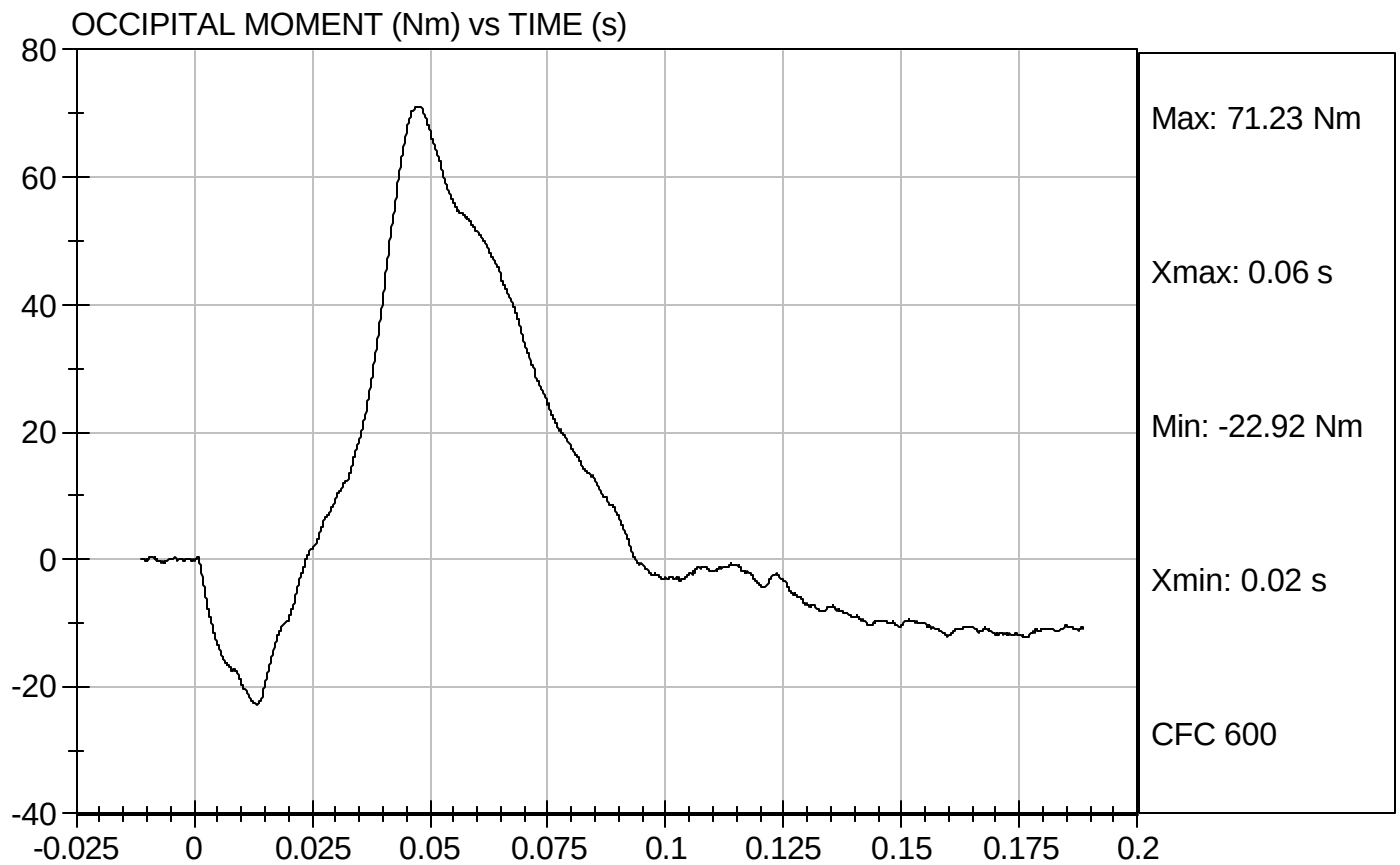
Test Date: 06/14/2005
Velocity: 23.25 ft/s, 7.09 m/s





Test Desc: Neck Flexion
Component ID: D051632

Test Date: 06/14/2005
Speed: 23.25 ft/sec, 7.09 m/sec



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 510

Test Date 6/14/05

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 21.4

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 41%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 89; Back 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.09 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.5 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.8 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.8 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>71</u> Nm @ <u>79</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	87 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Joe Fleck
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D051633

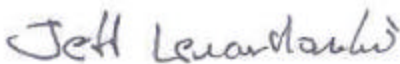
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.04	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.7	Pass
	30 msec	m/sec	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	104	Pass
Overall Results					Pass



Laboratory Technician

06/14/2005

Test Date

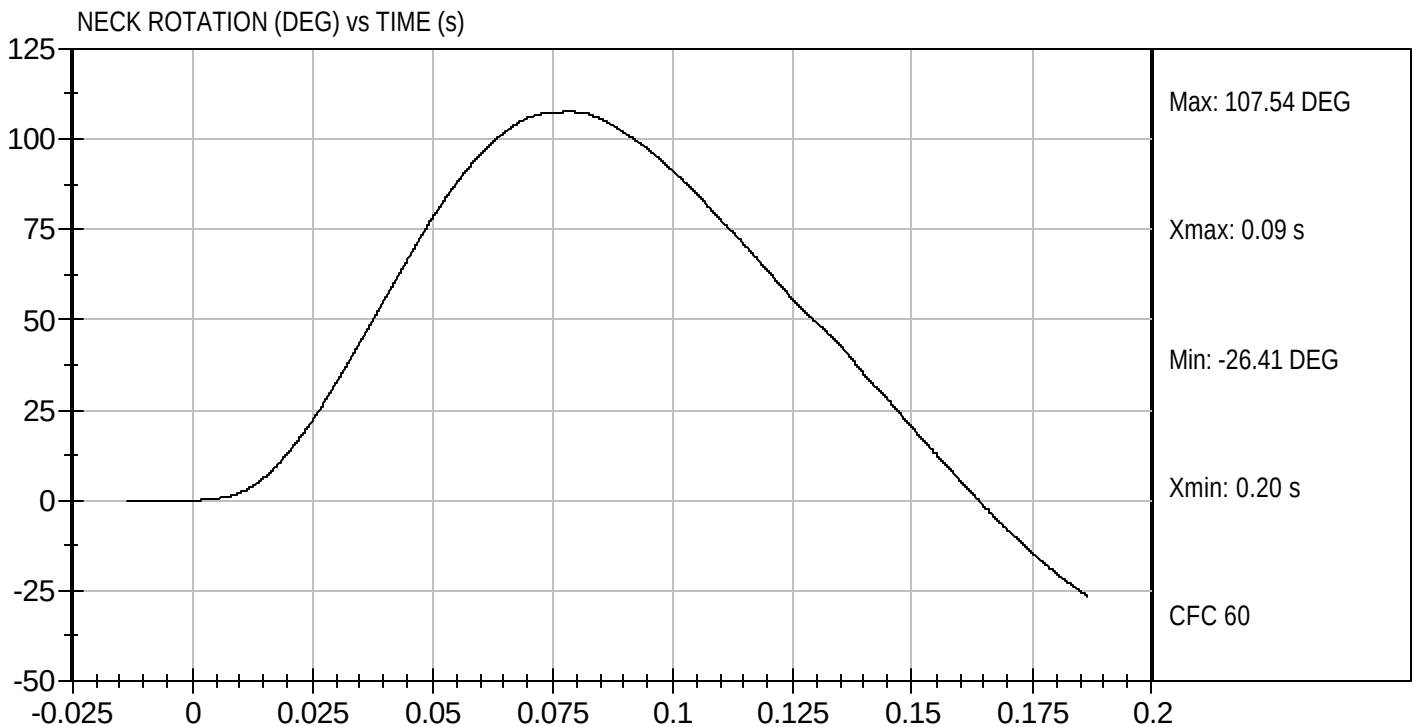
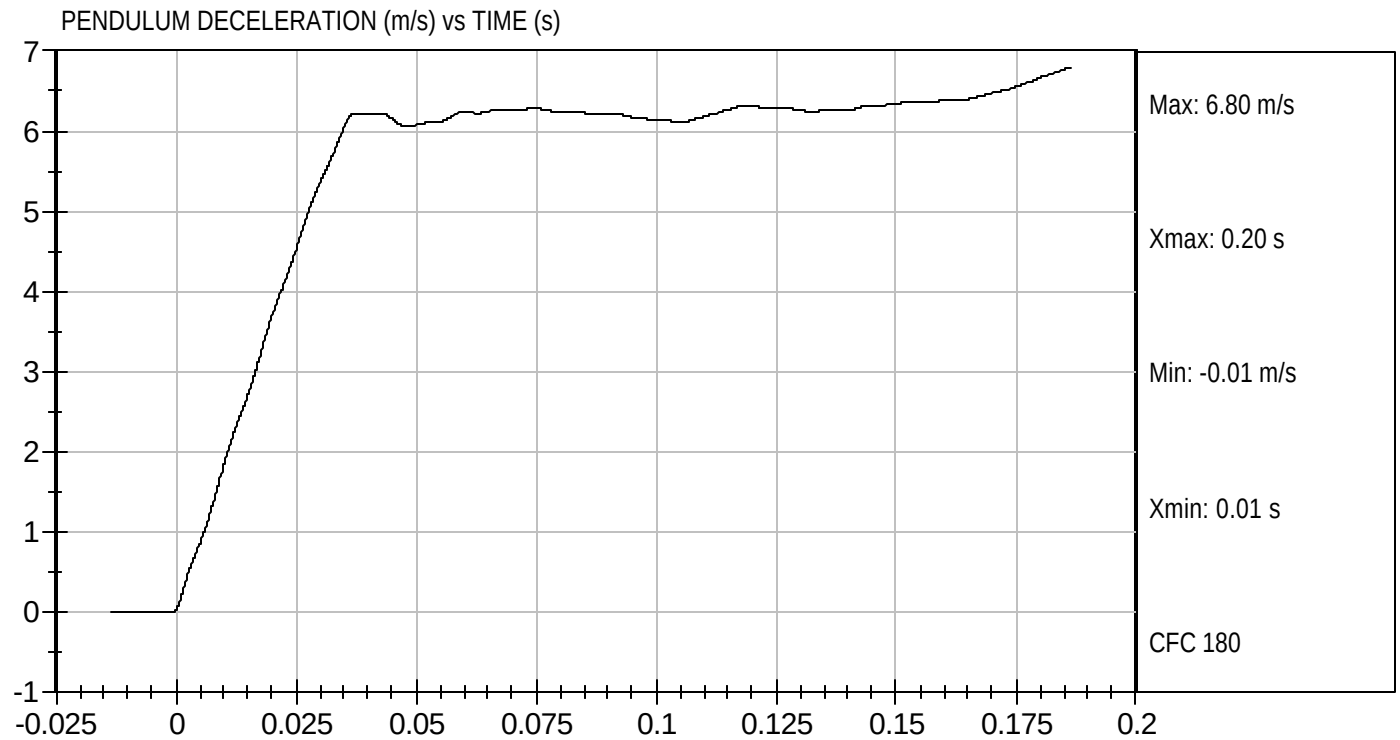


Approved By



Test Desc: Neck Extension
Componet ID: D051633

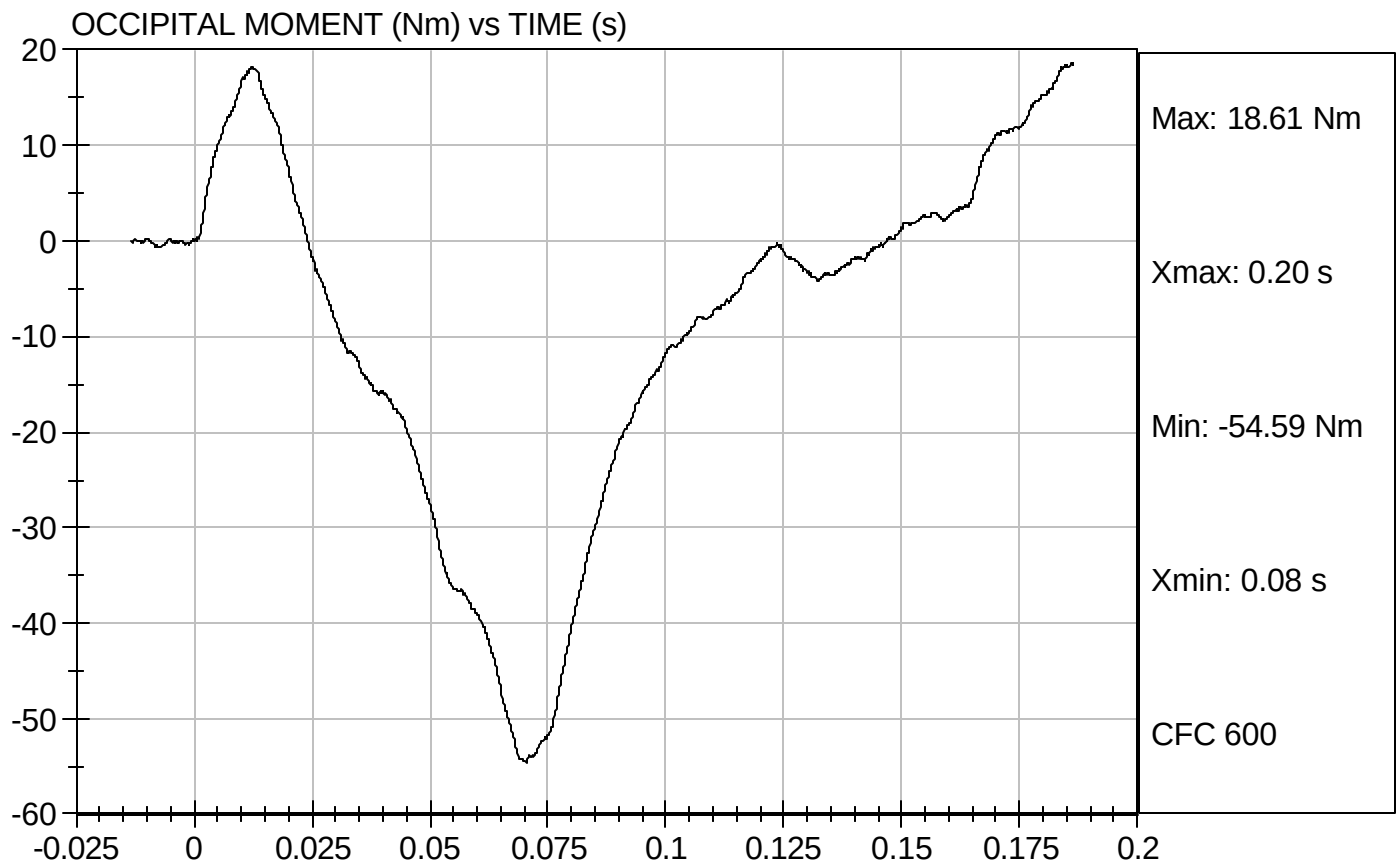
Test Date: 06/14/2005
Velocity: 19.81 ft/s, 6.04 m/s





Test Desc: Neck Extension
Component ID: D051633

Test Date: 06/14/2005
Speed: 19.81 ft/sec, 6.04 m/sec



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 510

Test Date 6/14/05

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 21.4

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 41%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 89; Back 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.04 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.8 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.7 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.3 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>-55</u> Nm @ <u>108</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	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

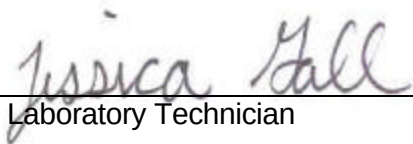
6/14/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

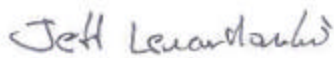
Test I.D: D051634

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	6.59 to 6.83	6.72	Pass
Peak Deflection	mm	50 to 58	54	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	N	≤ 4600 N	3,982	Pass
Overall Test Results				Pass


Laboratory Technician

06/14/2005

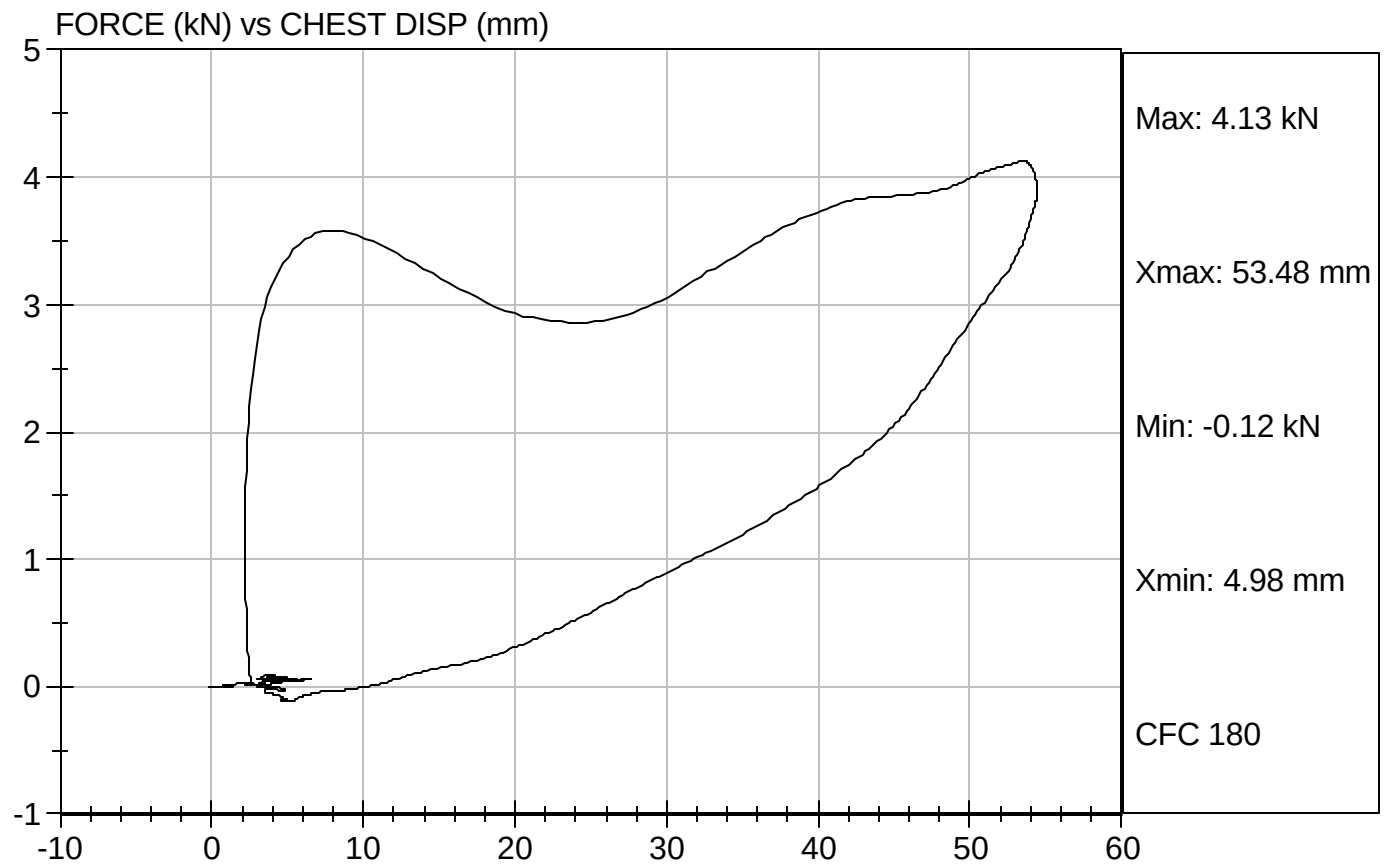
Test Date


Approved By



Test Desc: Thorax Impact
Component ID: D051634

Test Date: 06/14/2005
Speed: 22.06 ft/sec, 6.72 m/sec



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 510

Test Date 6/14/05

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 44%

Record the minimum humidity 41%

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

☒ - No damage

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

☐ - The following repairs or replacement was performed. Record _____

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

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

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

- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 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° 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° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$. (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.72 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	54 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4130 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3982 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.

Jessica Hall
Signature

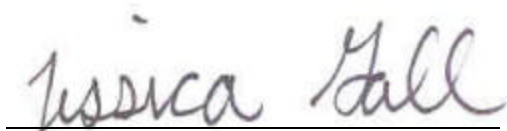
6/14/05
Date

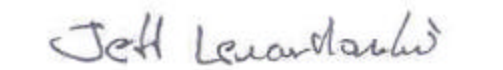
MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D051635

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.95	Pass
Overall Test Results				Pass


Laboratory Technician

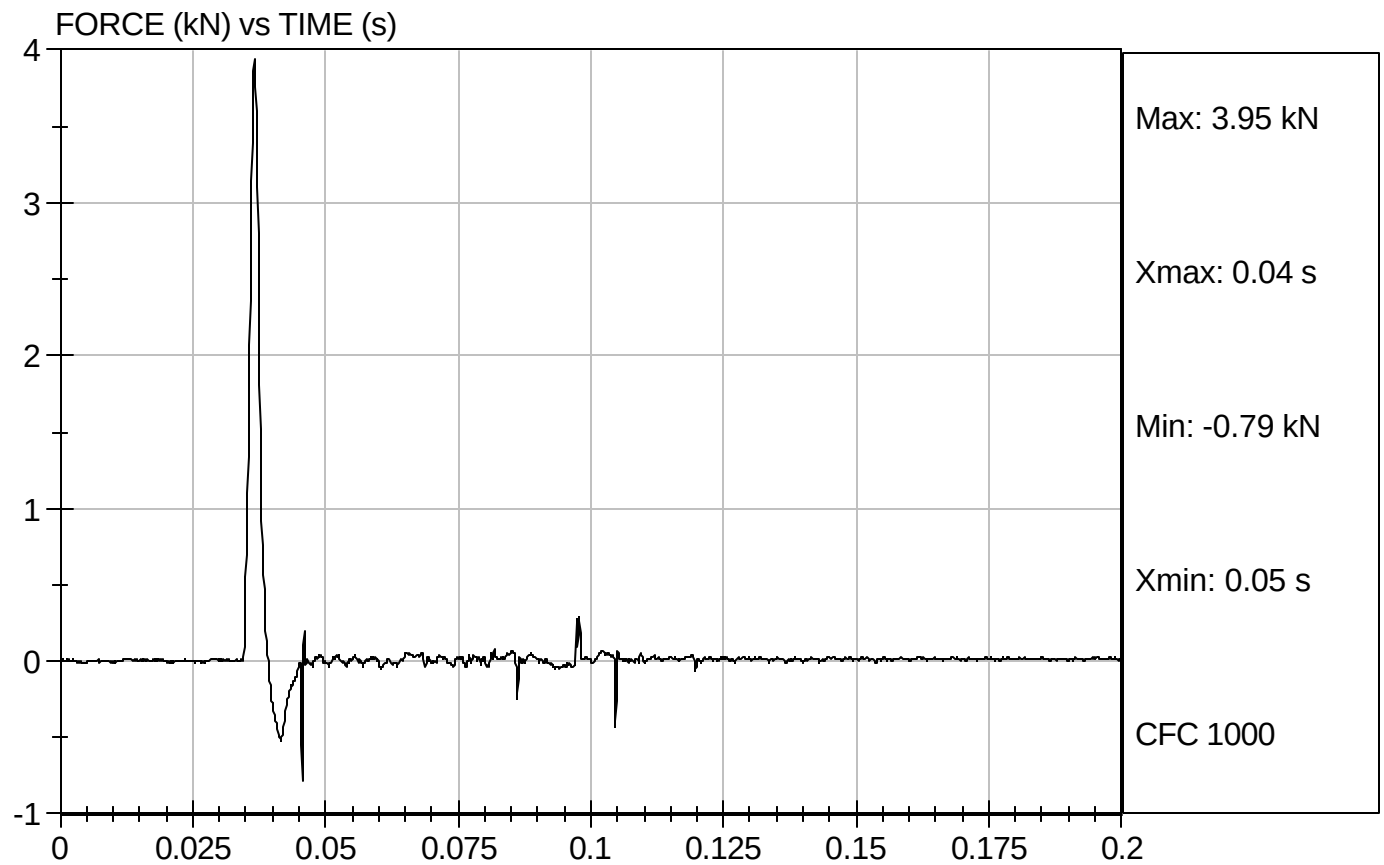

Approved By

06/14/2005
Test Date



Test Desc: Right Knee
Component ID: D051635

Test Date: 06/14/2005
Speed: 6.88 ft/sec, 2.10 m/sec



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 510

Test Date 6/14/05

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 41%

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3950 N

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

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

Jessica Hall
Signature

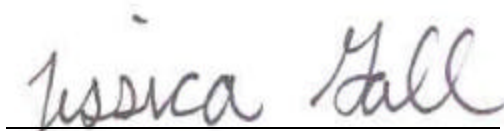
6/14/05
Date

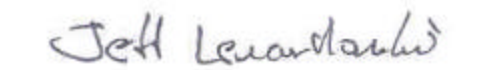
MGA RESEARCH CORPORATION
LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D051636

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.66	Pass
Overall Test Results				Pass


Laboratory Technician

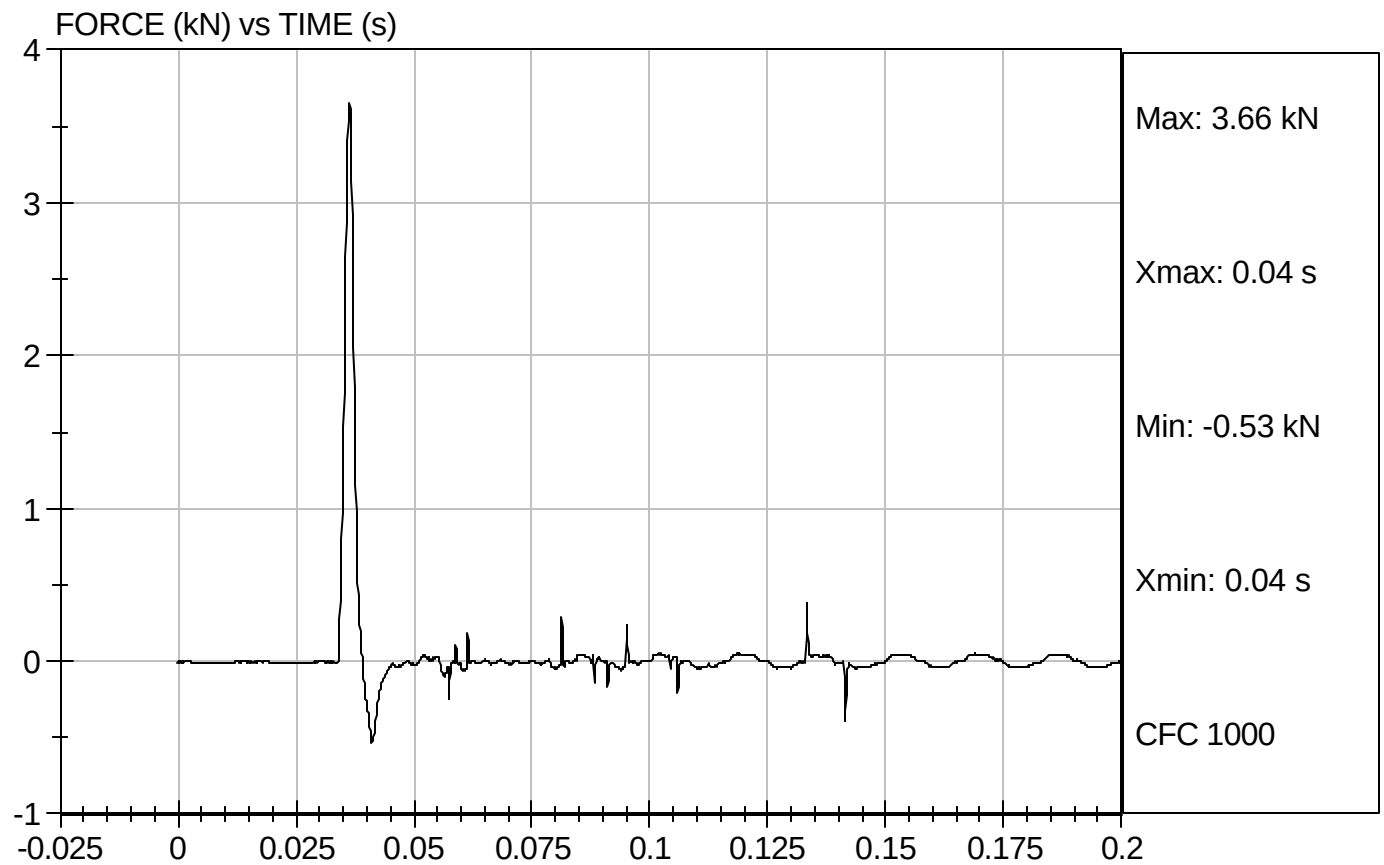

Approved By

06/14/2005
Test Date



Test Desc: Left Knee
Component ID: D051636

Test Date: 06/14/2005
Speed: 6.89 ft/sec, 2.10 m/sec



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 510

Test Date 6/14/05

Technician Jessica Gall

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 44%

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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3660 N

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

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

Jessica Hall
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D051637

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	380	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result			Pass	



Laboratory Technician

06/14/2005

Test Date



Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 510

Test Date 6/14/05

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 21.4

Record the minimum temperature 20.9

Record the maximum humidity 44%

Record the minimum humidity 41%

☒ 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° and 1.5° 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°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	380 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	18°

Joe Fleck
Signature

6/14/05
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

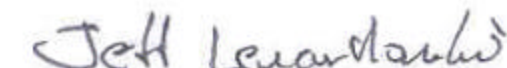
ATD Serial No: 510

Test ID: D051721

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	250 - 300	268	Pass
Peak Lateral Acceleration	G's	+/- 15	7.4	Pass
Unimodal	NA	Yes	Yes	Pass
Oscillations	NA	within 10% of peak	Yes	Pass
Overall Test Results				Pass


 Laboratory Technician

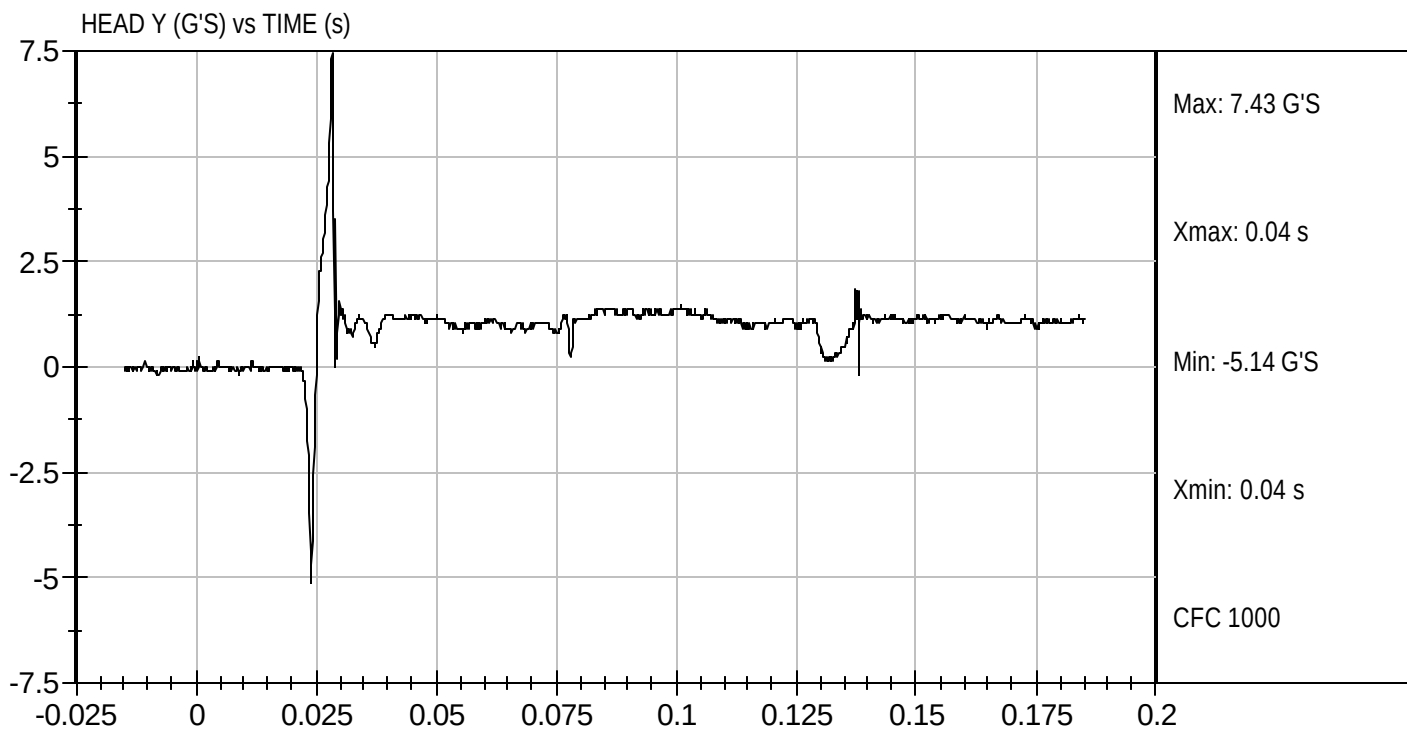
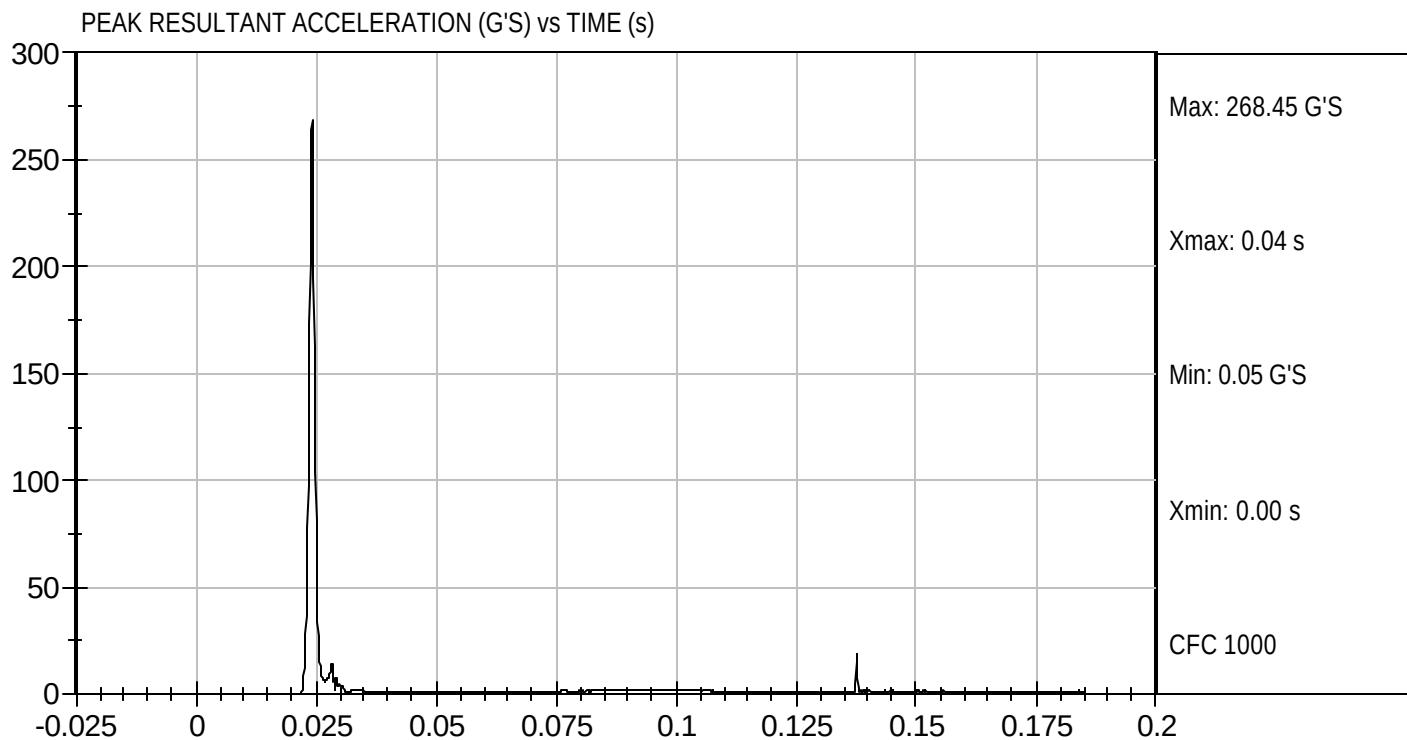
06/21/2005
 Test Date


 Approved By



Test Desc: Head Drop
Componet ID: D051721

Test Date: 06/21/2005
Velocity: 0 ft/s, 0 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 510 Test Date 6/21/05

Technician Tim Bratz

☐ Pretest calibration
☒ Post test calibration verification

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

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>22.0</u> |
| Record the minimum temperature | <u>21.3</u> |
| Record the maximum humidity | <u>44%</u> |
| Record the minimum humidity | <u>37%</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 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))

Record the actual distance 376 mm

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

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

Record the right side distance 501mm

Record the left side distance 501mm

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

Record actual micro finish 656×10^{-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 ± 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	268
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 $\leq 15 \text{ g}$	7.4

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


Signature

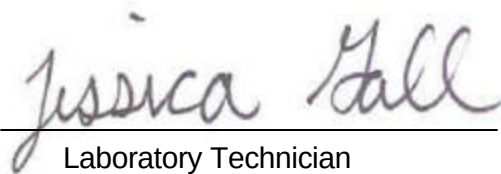
6/21/05
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

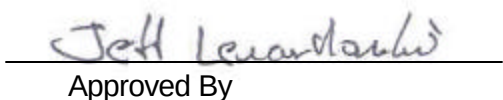
ATD Serial No: 510

Test I.D: D051722

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	38	Pass
Pendulum Speed		m/sec	6.89 to 7.13	6.95	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.8	Pass
D Plane Rotation	Max	deg	77 to 91	84	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	


Laboratory Technician

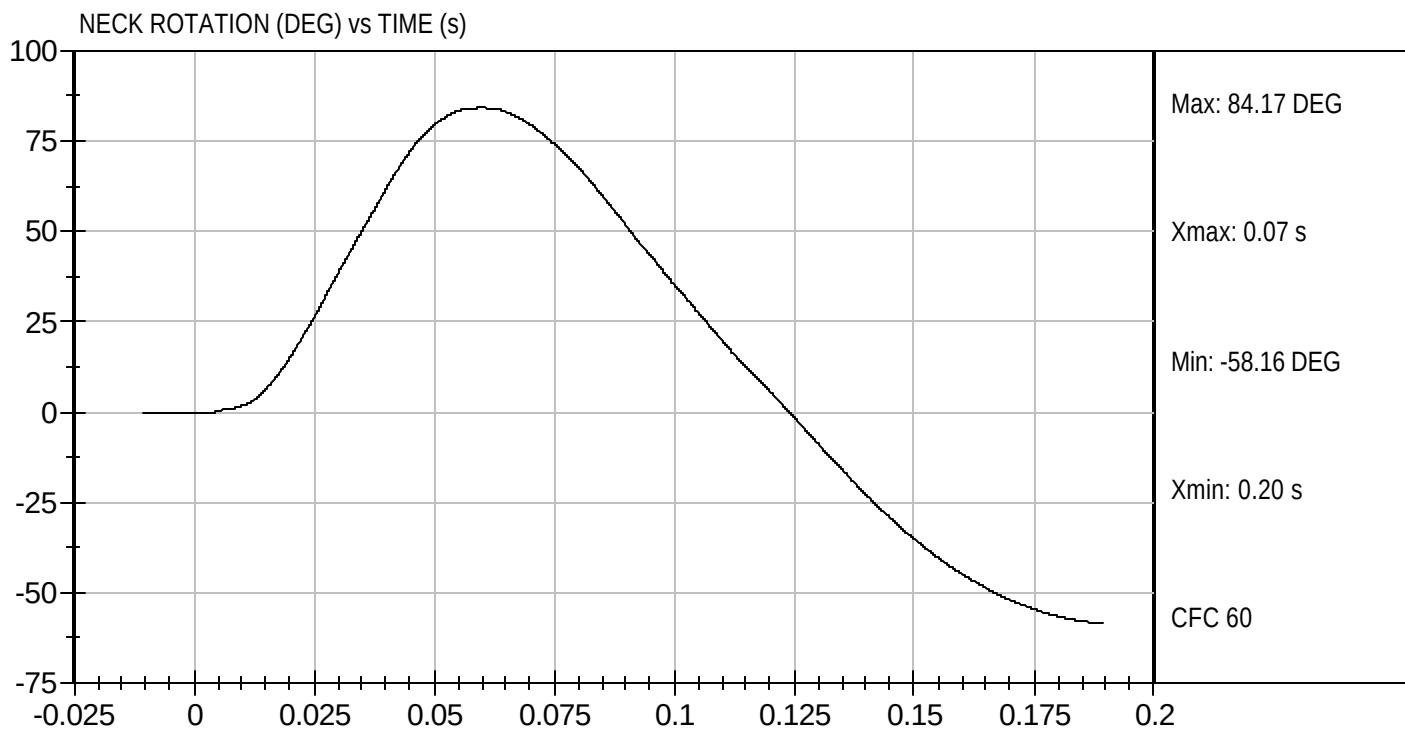
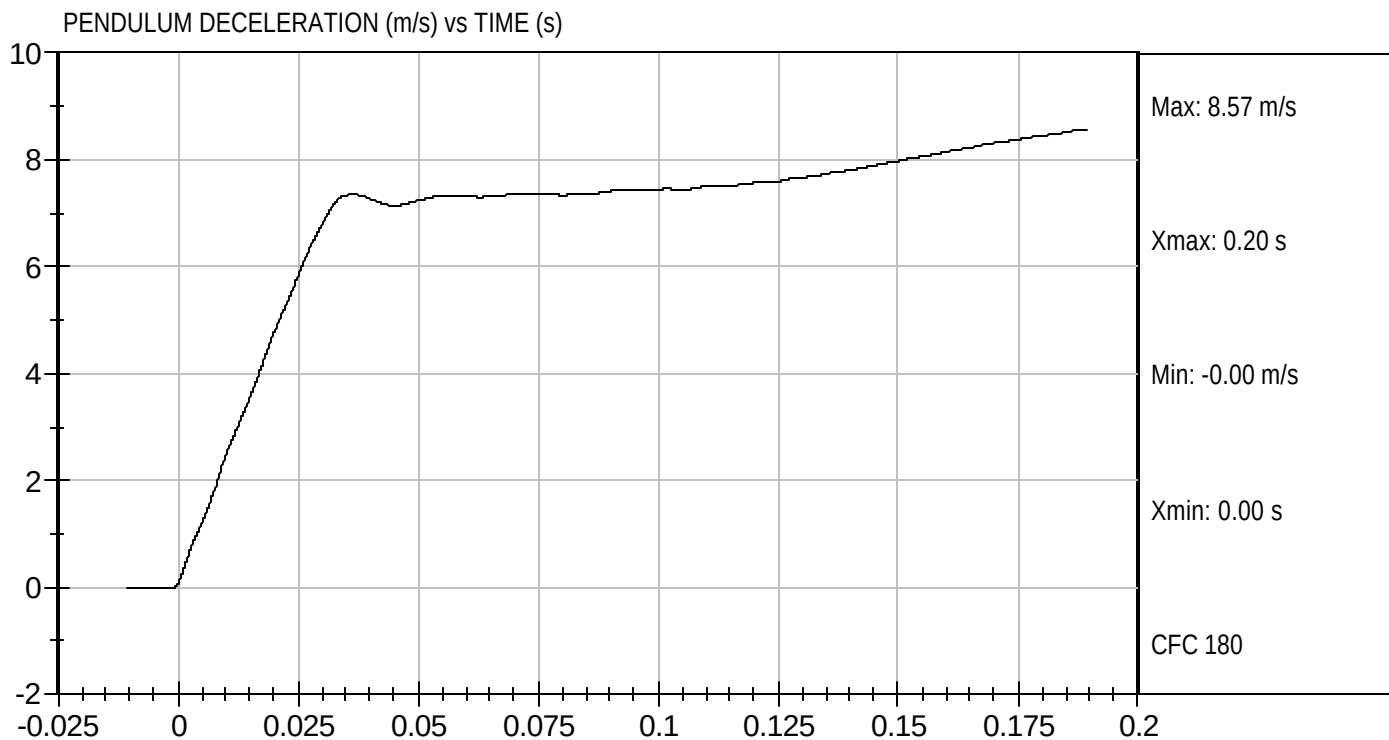
06/22/2005
Test Date


Approved By



Test Desc: Neck Flexion
Componet ID: D051722

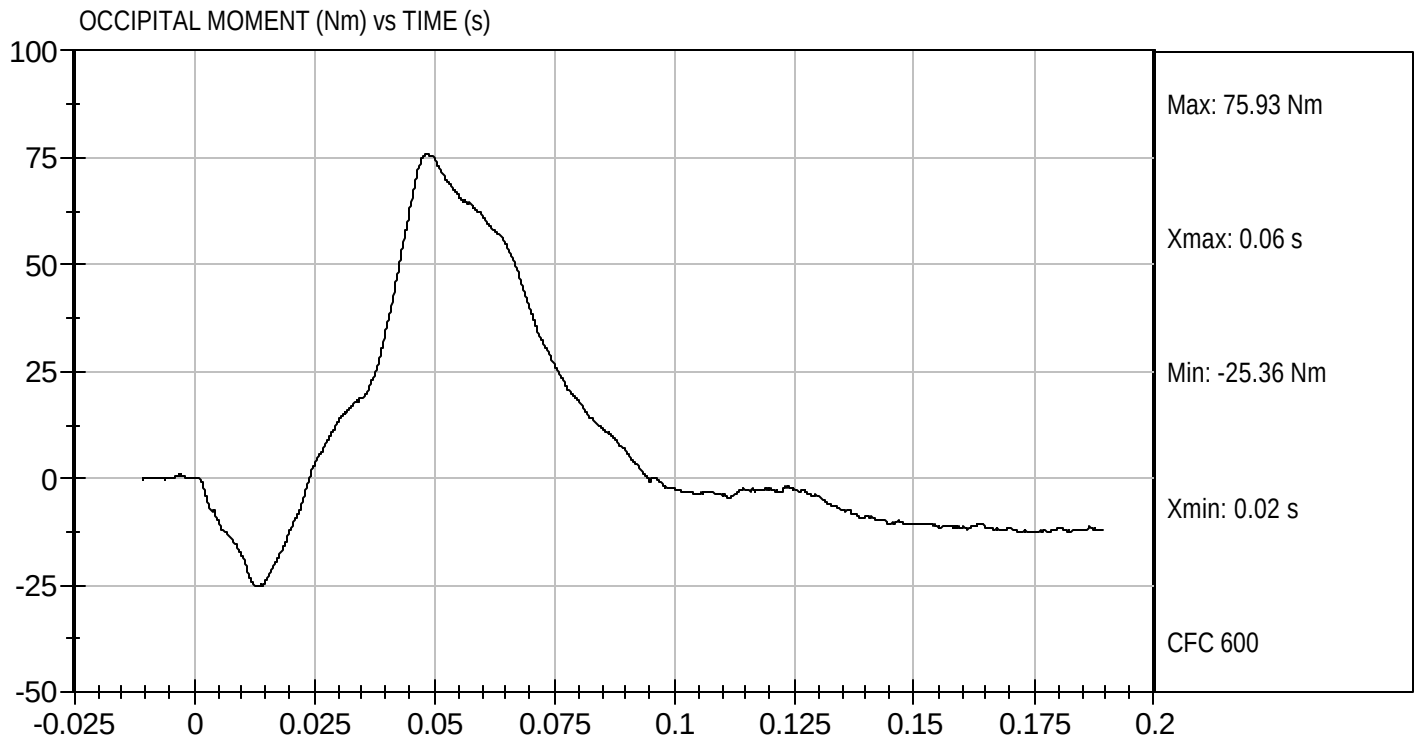
Test Date: 06/22/2005
Velocity: 22.8 ft/s, 6.95 m/s





Test Desc: Neck Flexion
Componet ID: D051722

Test Date: 06/22/2005
Velocity: 22.8 ft/s, 6.95 m/s



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 510

Test Date 6/22/05

Technician Jessica Gall

☐ 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>22.0</u> |
| Record the minimum temperature | <u>21.3</u> |
| Record the maximum humidity | <u>44%</u> |
| Record the minimum humidity | <u>37%</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 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 ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	6.95 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.5 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.8 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.8 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	<u>76</u> Nm @ <u>84</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	87 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Jessica Gall
Signature

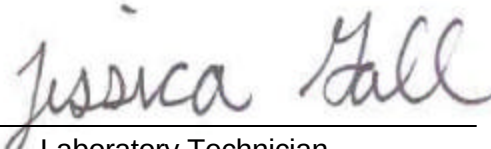
6/22/05
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

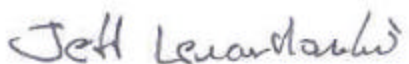
ATD Serial No: 510

Test I.D: D051723

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	37	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.07	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	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-63	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	95	Pass
Overall Results				Pass	


 Laboratory Technician

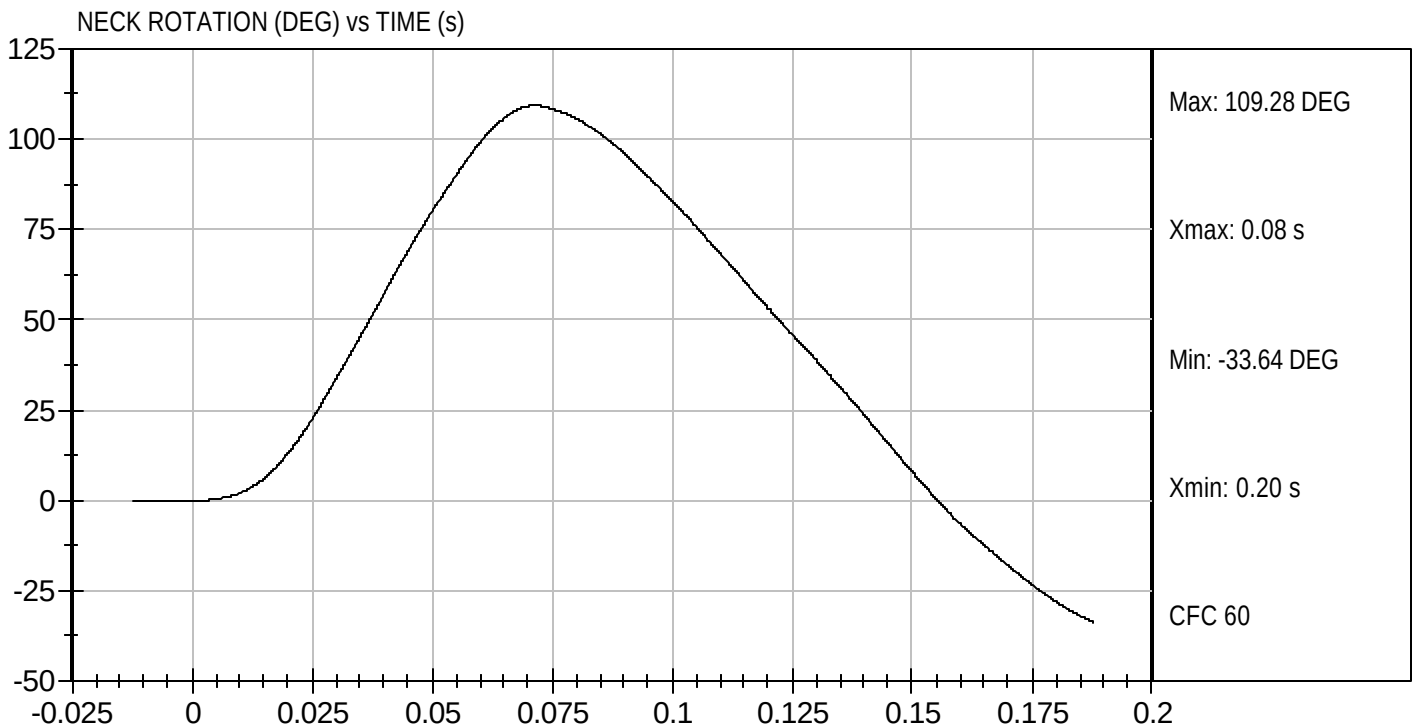
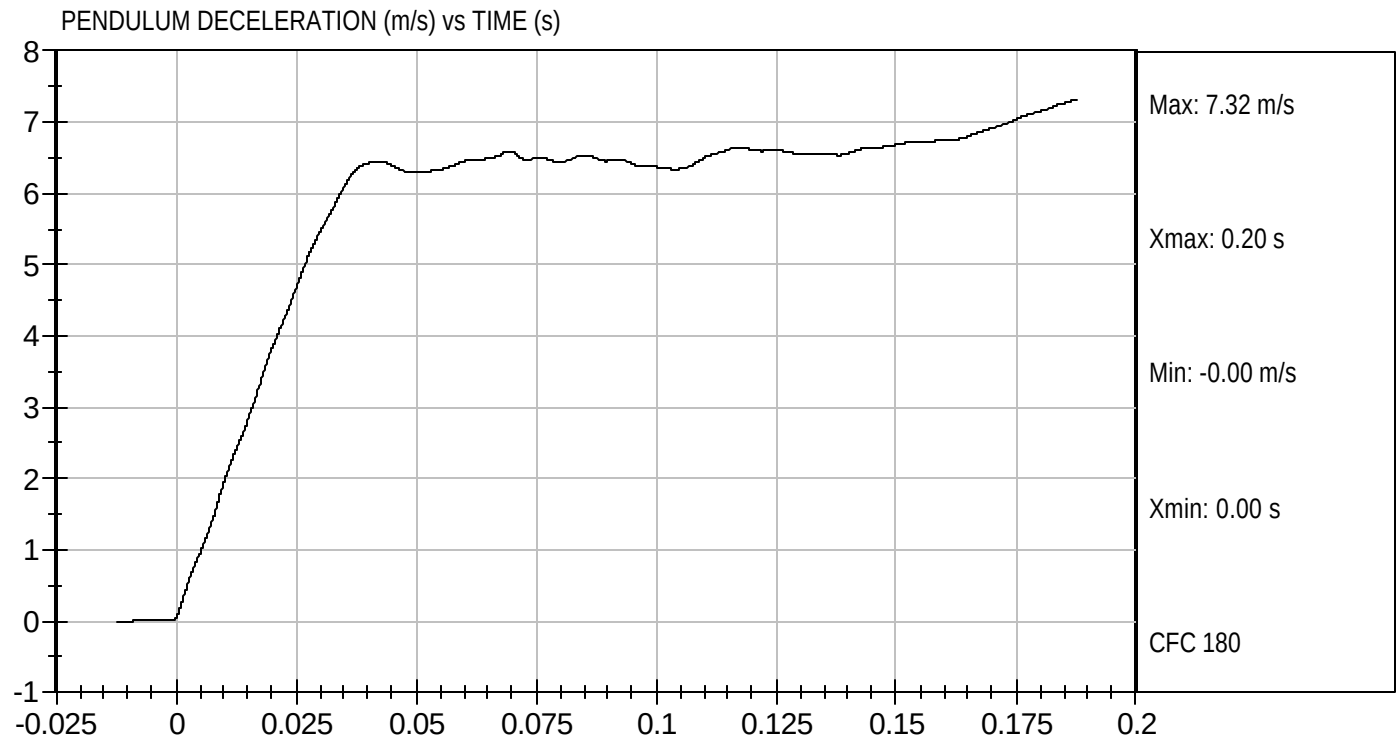
06/22/2005
 Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D051723

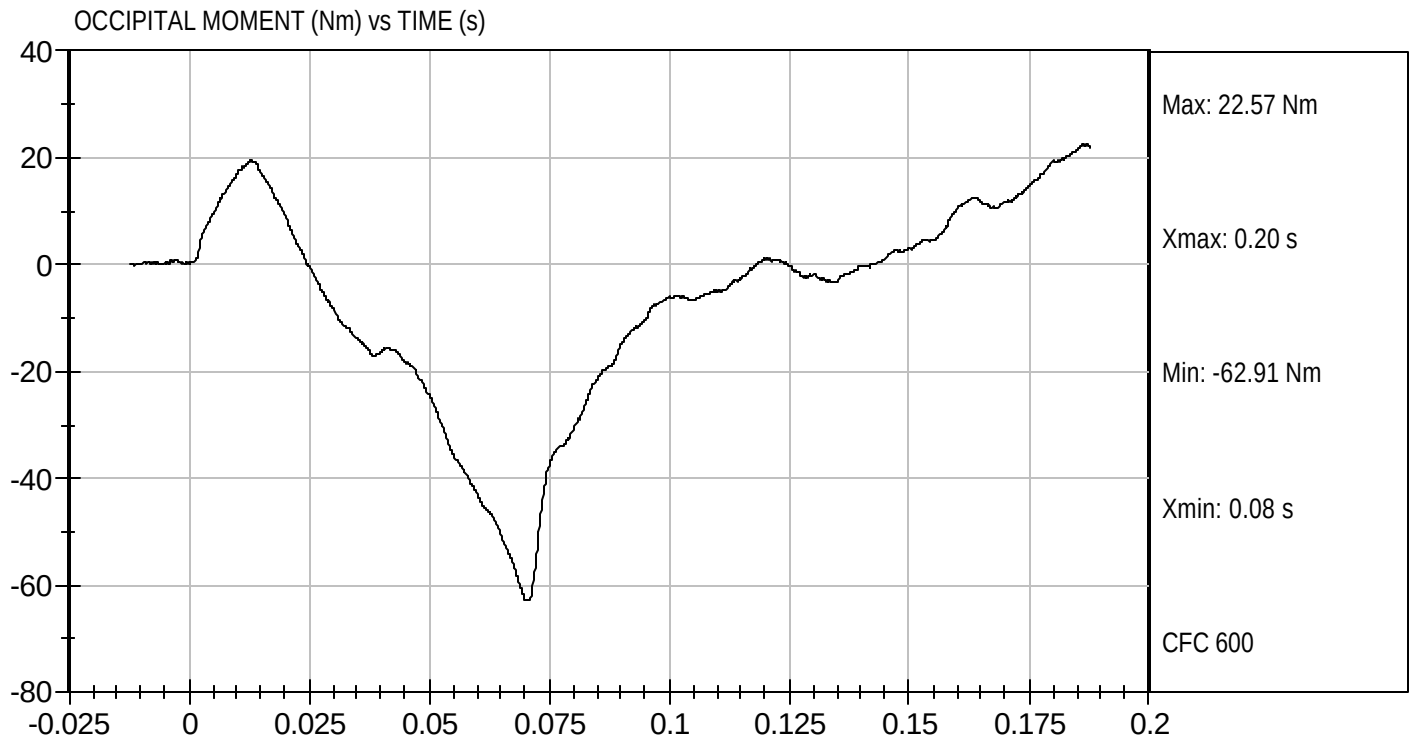
Test Date: 06/22/2005
Velocity: 19.91 ft/s, 6.07 m/s





Test Desc: Neck Extension
Componet ID: D051723

Test Date: 06/22/2005
Velocity: 19.91 ft/s, 6.07 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 510

Test Date 6/22/05

Technician Jessica Gall

☐ 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 22.0

Record the minimum temperature 21.3

Record the maximum humidity 44%

Record the minimum humidity 37%

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

Record findings and actions: No Damage.

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

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

☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 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 ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.07 m/s
Pendulum ΔV with respect to impact speed	@ 10ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.9 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.8 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.4 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>-63</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.

Jessica Hall
Signature

6/22/05
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

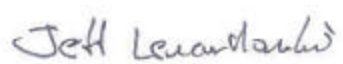
ATD Serial No: 510

Test I.D: D051724

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	54	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	N	≤ 4600 N	4025	Pass
Overall Test Results				Pass


 Laboratory Technician

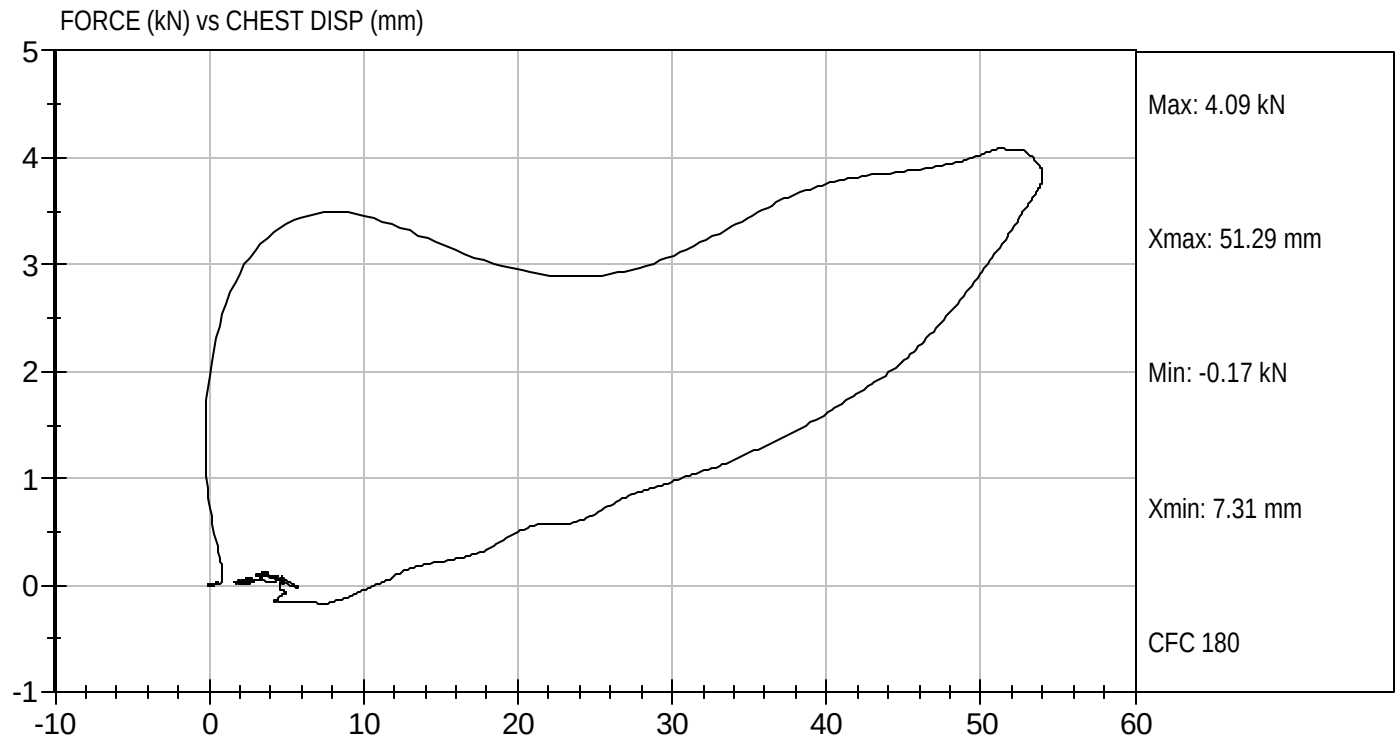
06/21/2005
 Test Date


 Approved By



Test Desc: Thorax Impact
Componet ID: D051724

Test Date: 06/21/2005
Velocity: 21.93 ft/s, 6.68 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 510

Test Date 6/21/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 44%

Record the minimum humidity 37%

☒ 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 ± 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° 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° 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 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	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4090 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4025 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	69%

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

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

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

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


Signature

6/21/05
Date

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

ATD Serial No: 510

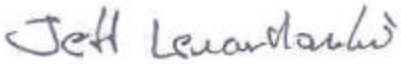
Test I.D: D051725

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.78	Pass
Overall Test Results				Pass


Laboratory Technician

06/21/2005

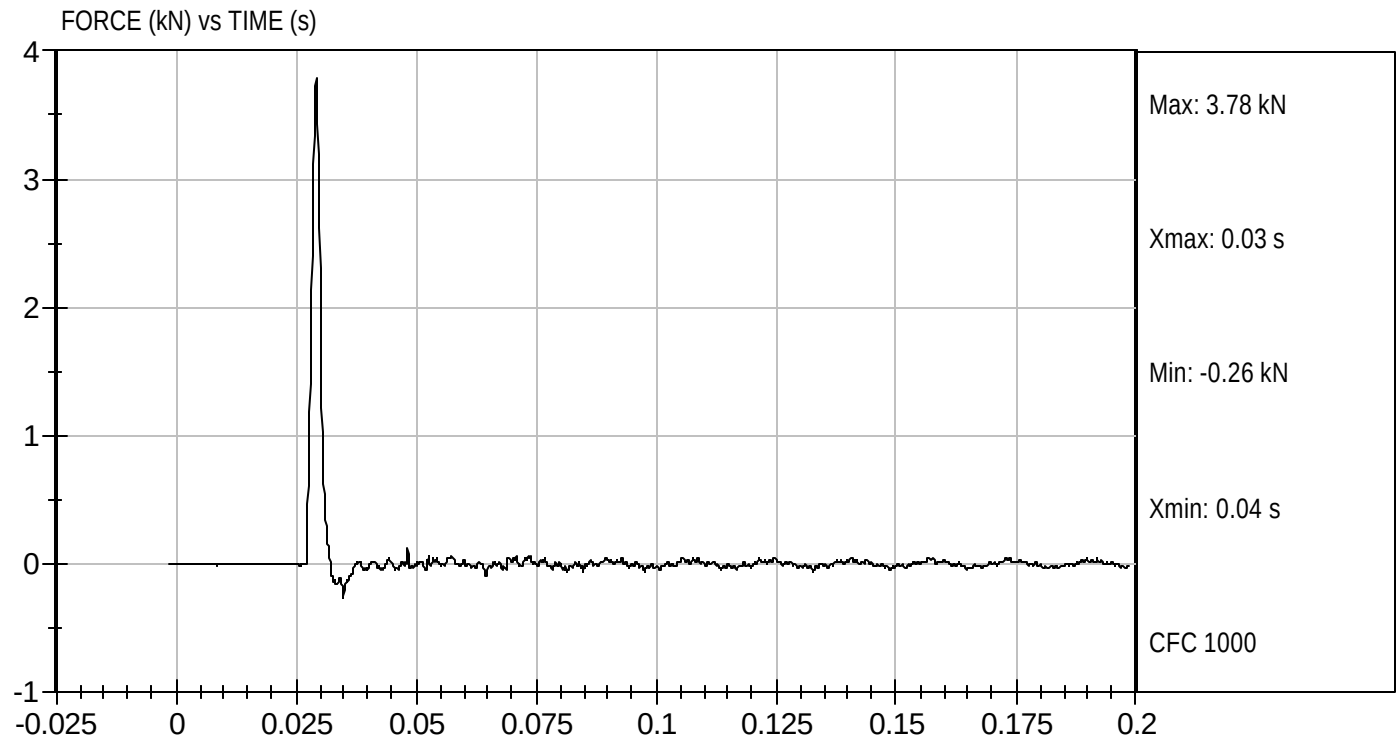
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D051725

Test Date: 06/21/2005
Velocity: 6.9 ft/s, 2.10 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 510

Test Date 6/21/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 44%

Record the minimum humidity 37%

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3780 N

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

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


Signature

6/21/05
Date

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

ATD Serial No: 510

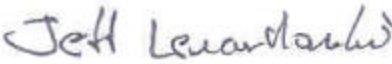
Test I.D: D051726

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.08	Pass
Maximum Force	kN	3.45 to 4.06	3.48	Pass
Overall Test Results				Pass


Laboratory Technician

06/21/2005

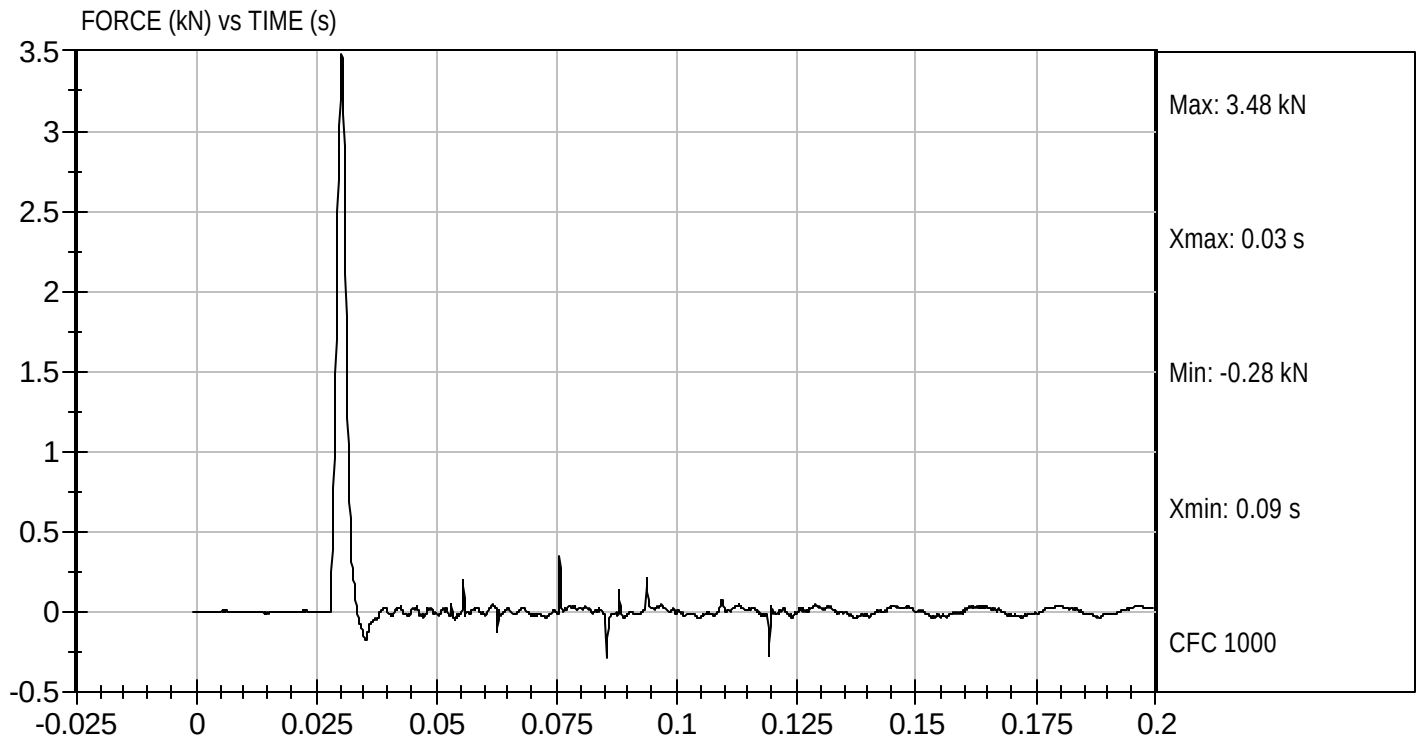
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D051726

Test Date: 06/21/2005
Velocity: 6.81 ft/s, 2.08 m/s



DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 510

Test Date 6/21/05

Technician Tim Bratz

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 44%

Record the minimum humidity 37%

☒ 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	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.08 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3480 N

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

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

Signature



6/21/05

Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D051727

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	14	Pass
Return Angle	deg	+/- 8	16	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

06/21/2005

Test Date



Approved By

DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 510

Test Date 6/21/05

Technician Joe Fleck

 Pretest calibration

X Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

 with legs below the femurs.

X without legs below the femurs.

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

Record the maximum temperature 22.0

Record the minimum temperature 21.3

Record the maximum humidity 44%

Record the minimum humidity 37%

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

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

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

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

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

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

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

Record reference plane angle (max. allowed 20°) 14°

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

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at $45^\circ \pm 0.5^\circ$ 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 $\leq 20^\circ$	14°
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 $\pm 8^\circ$	16°

Joe Fleck
Signature

6/21/05
Date

EXTERNAL DIMENSIONS

HYBRID III 5 th SN #510, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	786.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	450.0
C	H-POINT HEIGHT	Reference	81.3-86.3	84.1
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	82.7
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	133.9
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249.6
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	44.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	278.5
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	202.1
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	543.6
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	358.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	397.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.2

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

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 510

Test Date 6/22/05

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall
Signature

6/22/05
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard
Signature

6/22/05
Date