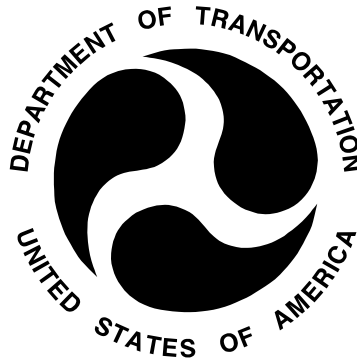


REPORT NO. 208-MGA-2004-DC013

DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208

**Ford Motor Company
2005 Ford Escape MPV
NHTSA No.: C50200**

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



Test Dates: September 3, 2004

Final Report Date: September 8, 2004

FINAL REPORT

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

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EXTERNAL DIMENSIONS

SN506, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	780.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	443.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.1
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	76.4
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	128.0
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	255.8
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	193.0
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	365.2
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	438.0

SN506, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	183.0
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	226.2
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	475.8
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.0
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	305.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	359.0
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.5
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	538.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	857.6
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	789.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 506 Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration
☐ Post test calibration verification

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

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.9</u> |
| Record the minimum temperature | <u>20.9</u> |
| Record the maximum humidity | <u>52%</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 502mm

Record the left side distance 501mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-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	$250 \text{ g} \leq x \leq 300 \text{ g}$	277
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	14.1

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

Joe Fleck
Signature

8/30/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

Test ID: D042041

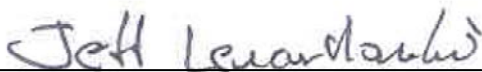
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Peak Resultant Acceleration	G's	250 - 300	277	Pass
Peak Lateral Acceleration	G's	+/- 15	14.1	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

08/30/2004

Test Date



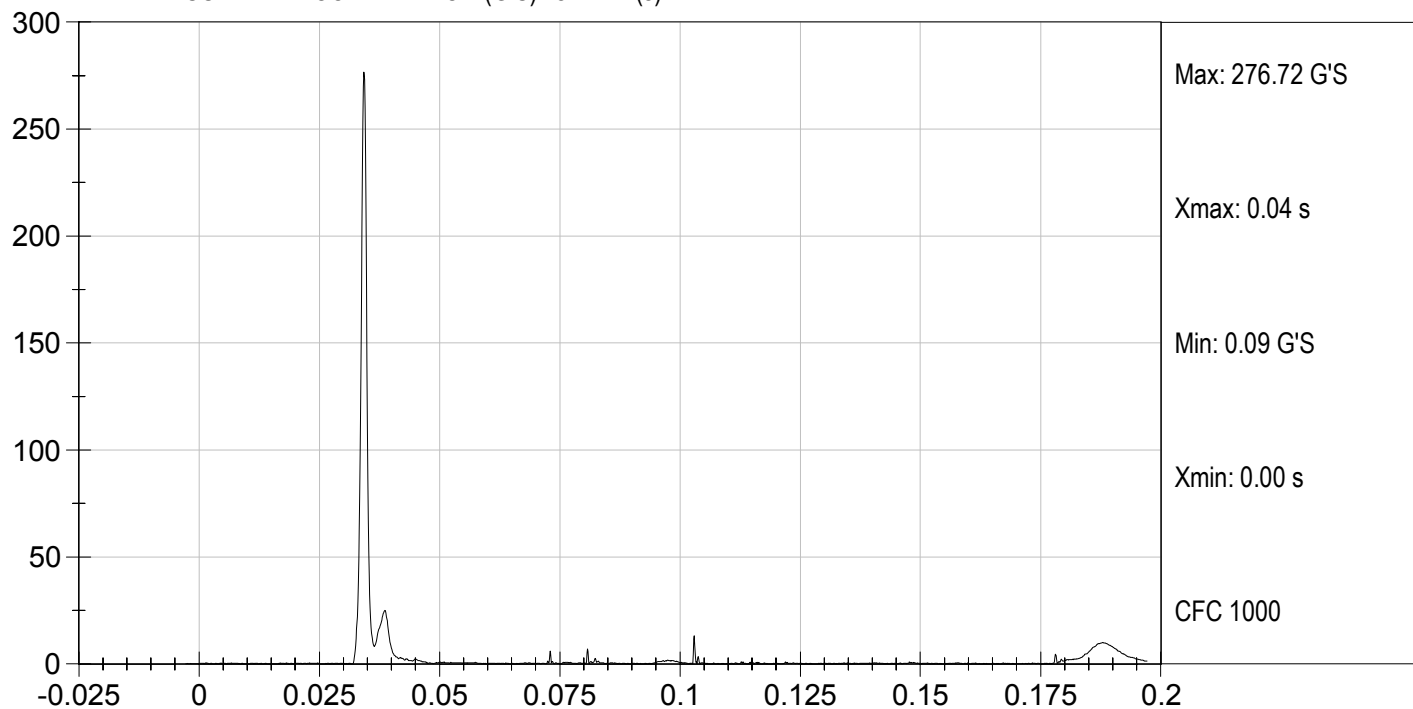
Approved By



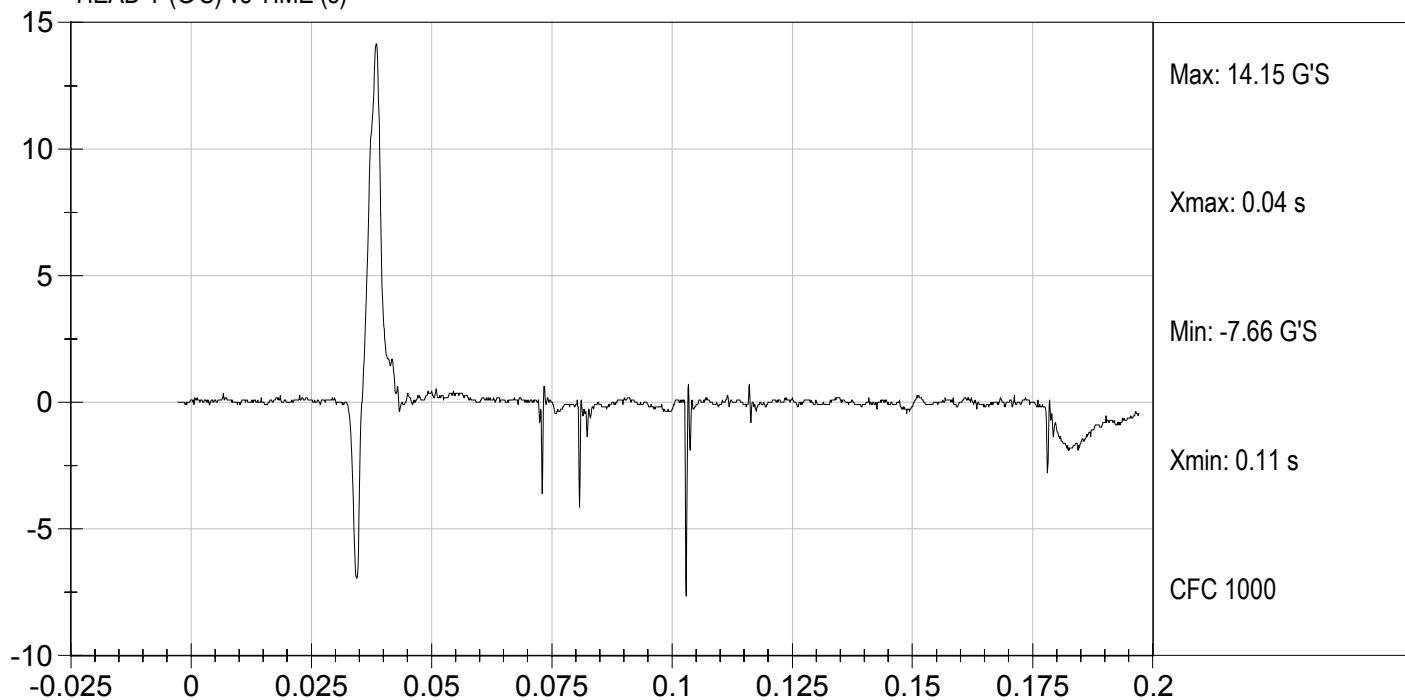
Test Desc: Head Drop
Componet ID: D042041

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

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 506 Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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 90.

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.02 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	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.7 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.

Joe Fleck
Signature

8/30/04
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

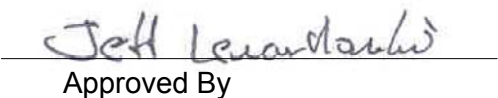
Test I.D: D042042

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.02	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.6	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	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

08/30/2004

Test Date

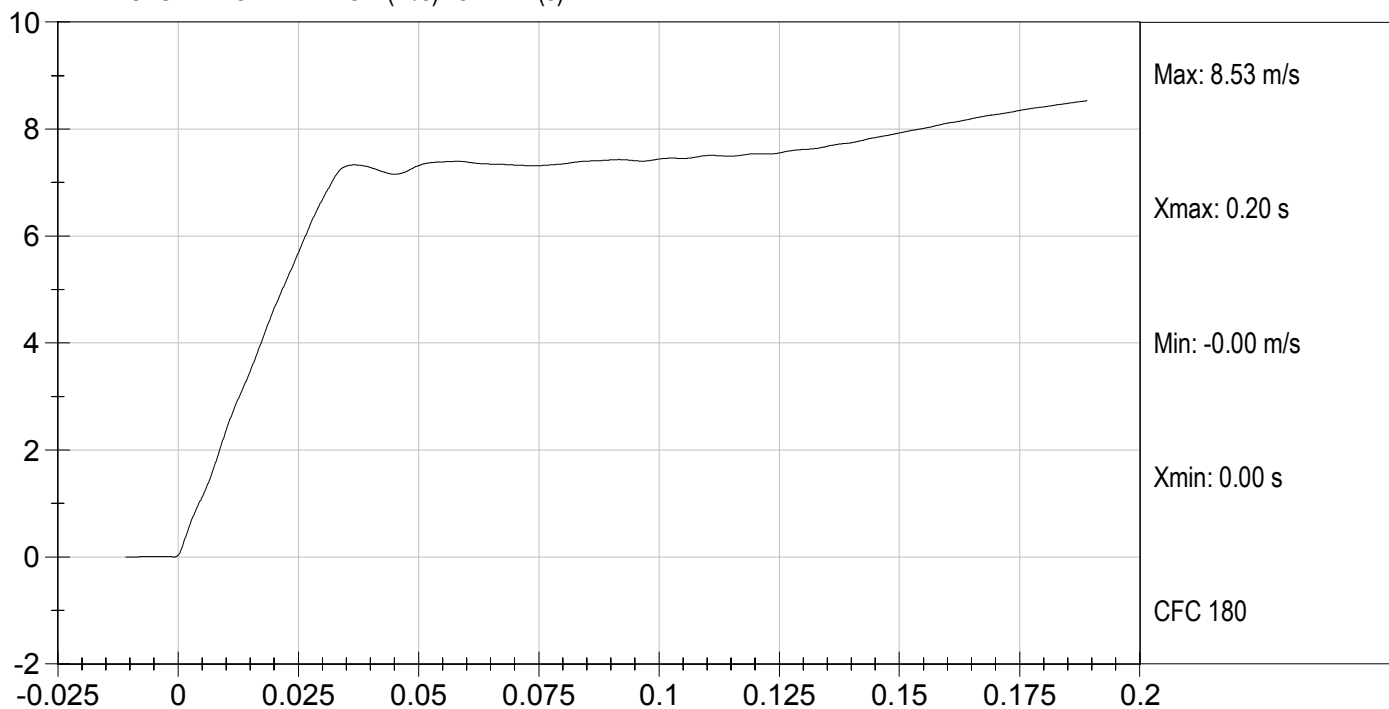

Approved By



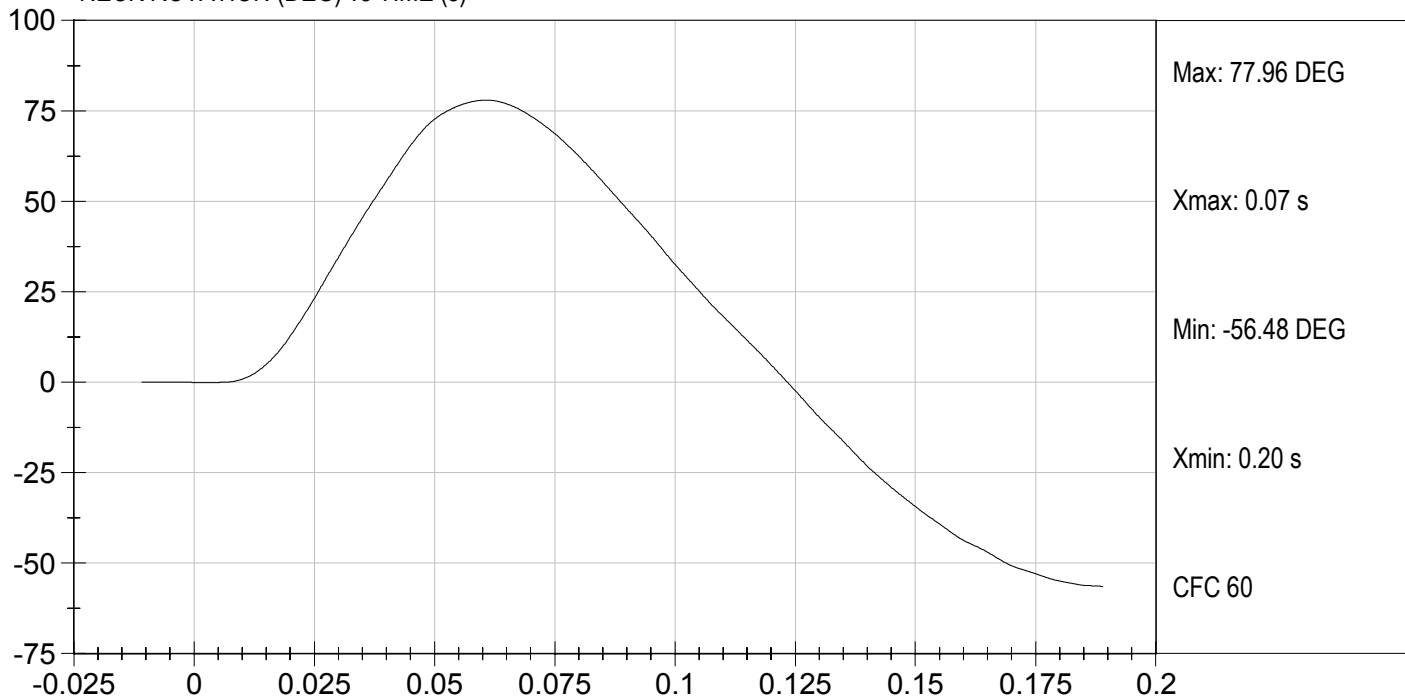
Test Desc: Neck Flexion
Componet ID: D042042

Test Date: 08/30/2004
Velocity: 23.02 ft/s, 7.02 m/s

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



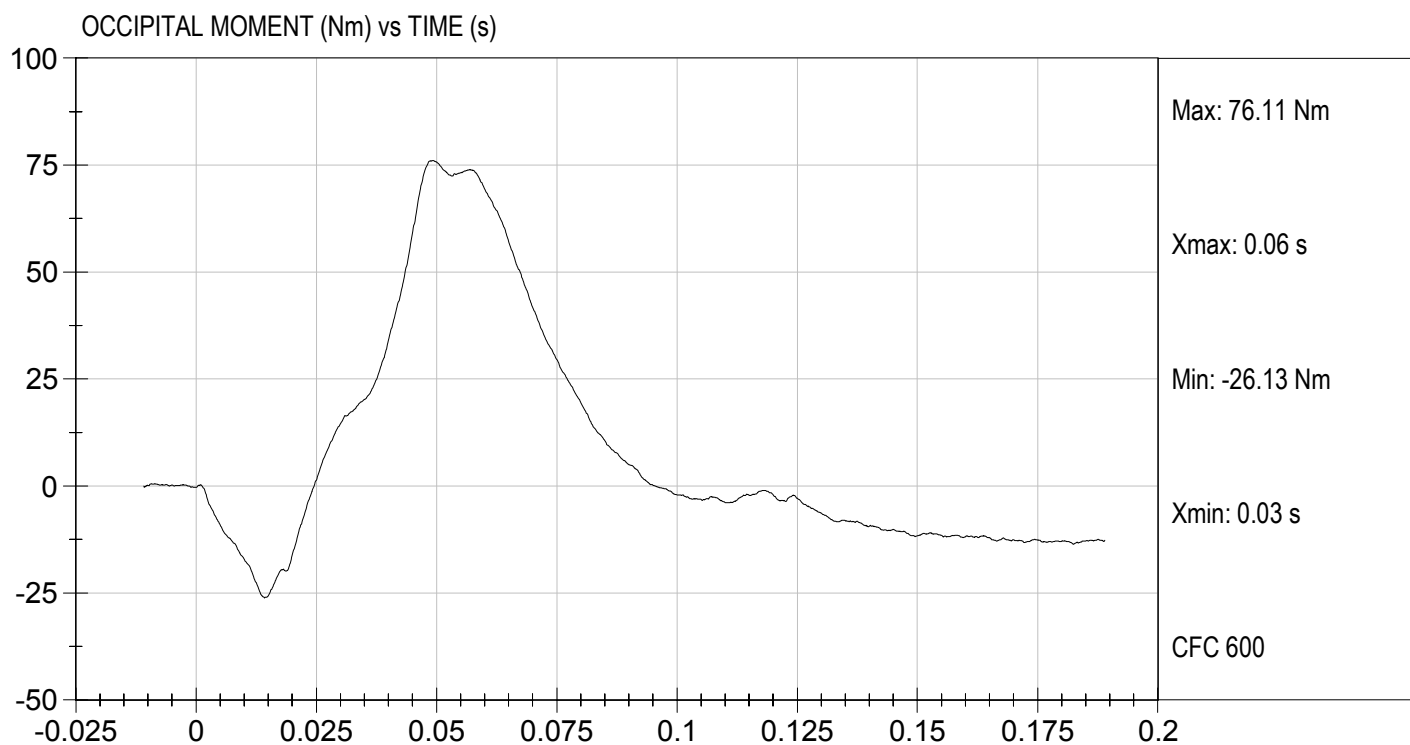
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D042042

Test Date: 08/30/2004
Velocity: 23.02 ft/s, 7.02 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 506

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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 90.

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.09 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	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.5 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.1 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	$\frac{-59}{100} \text{ Nm @ degrees}$
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	99 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

8/30/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

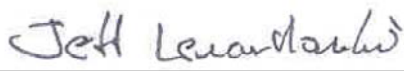
Test I.D: D042043

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	6.09	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.5	Pass
	30 msec	m/sec	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	100	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-59	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	99	Pass
Overall Results					Pass


 Laboratory Technician

08/30/2004

Test Date

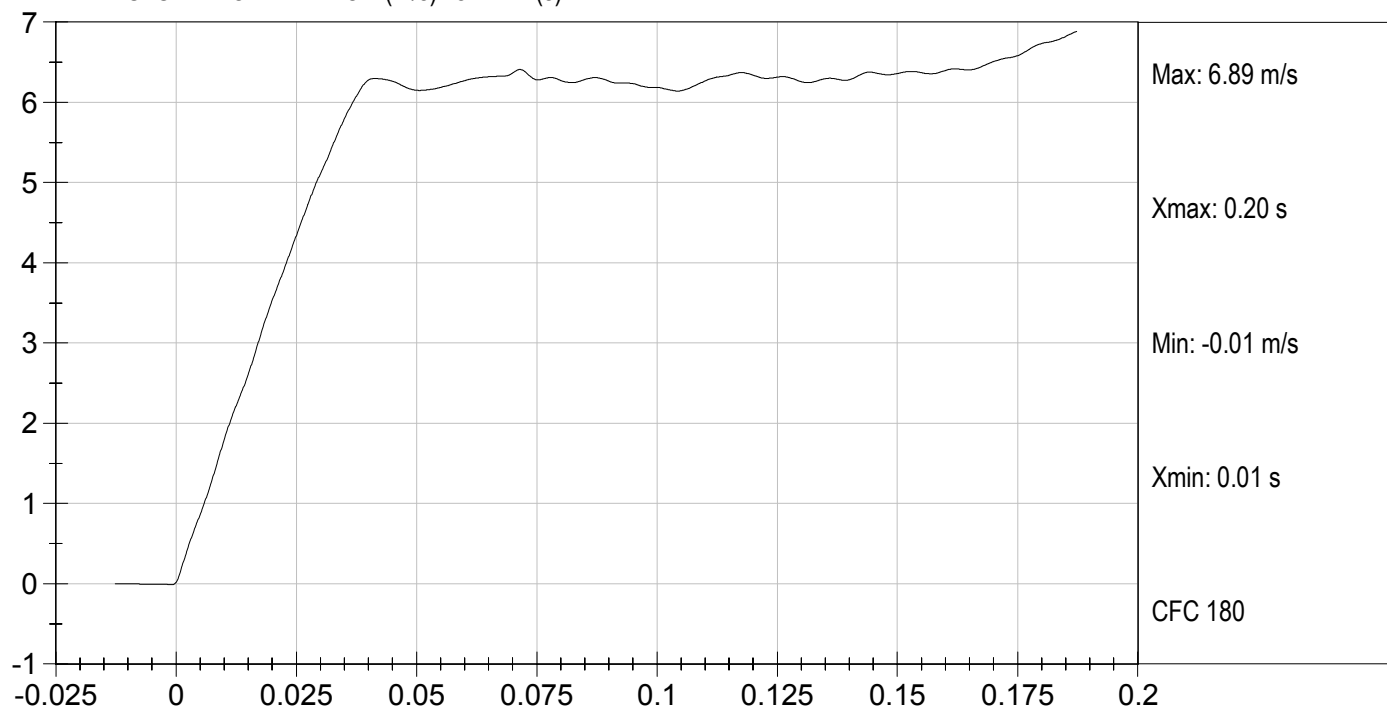

 Approved By



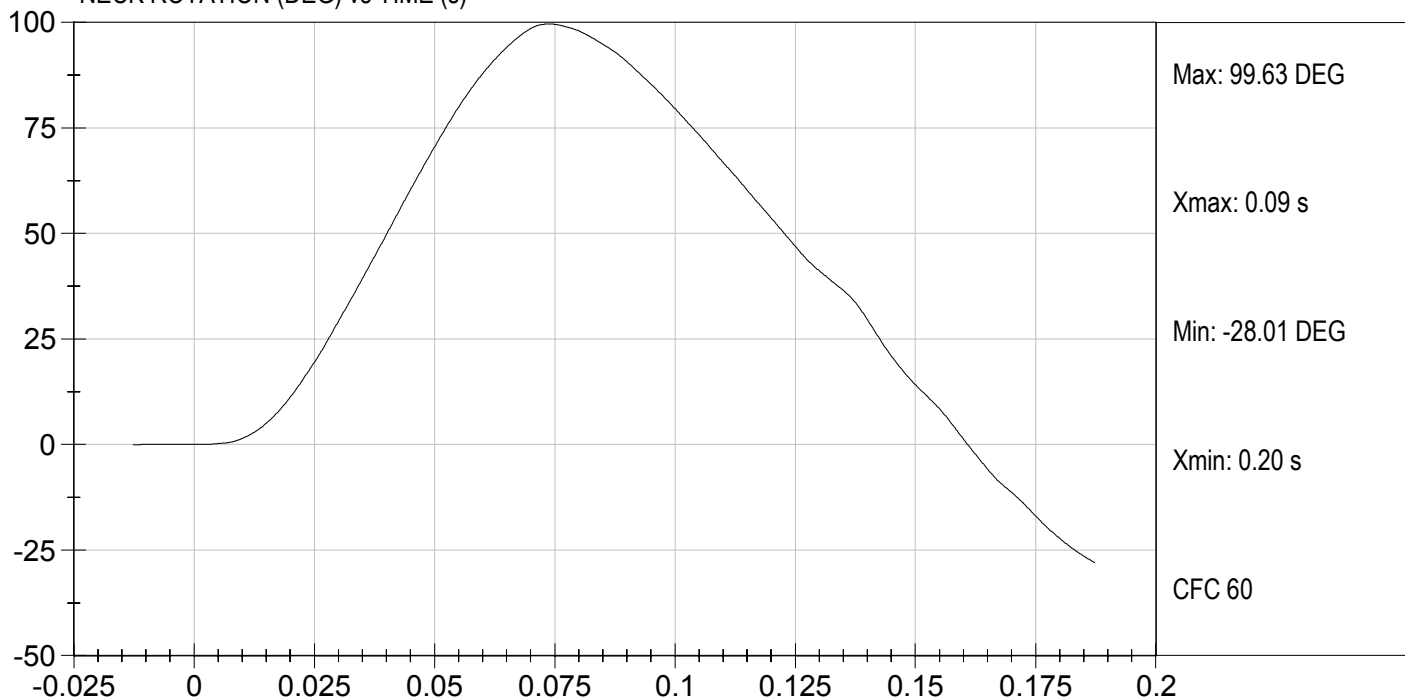
Test Desc: Neck Extension
Componet ID: D042043

Test Date: 08/30/2004
Velocity: 19.97 ft/s, 6.09 m/s

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



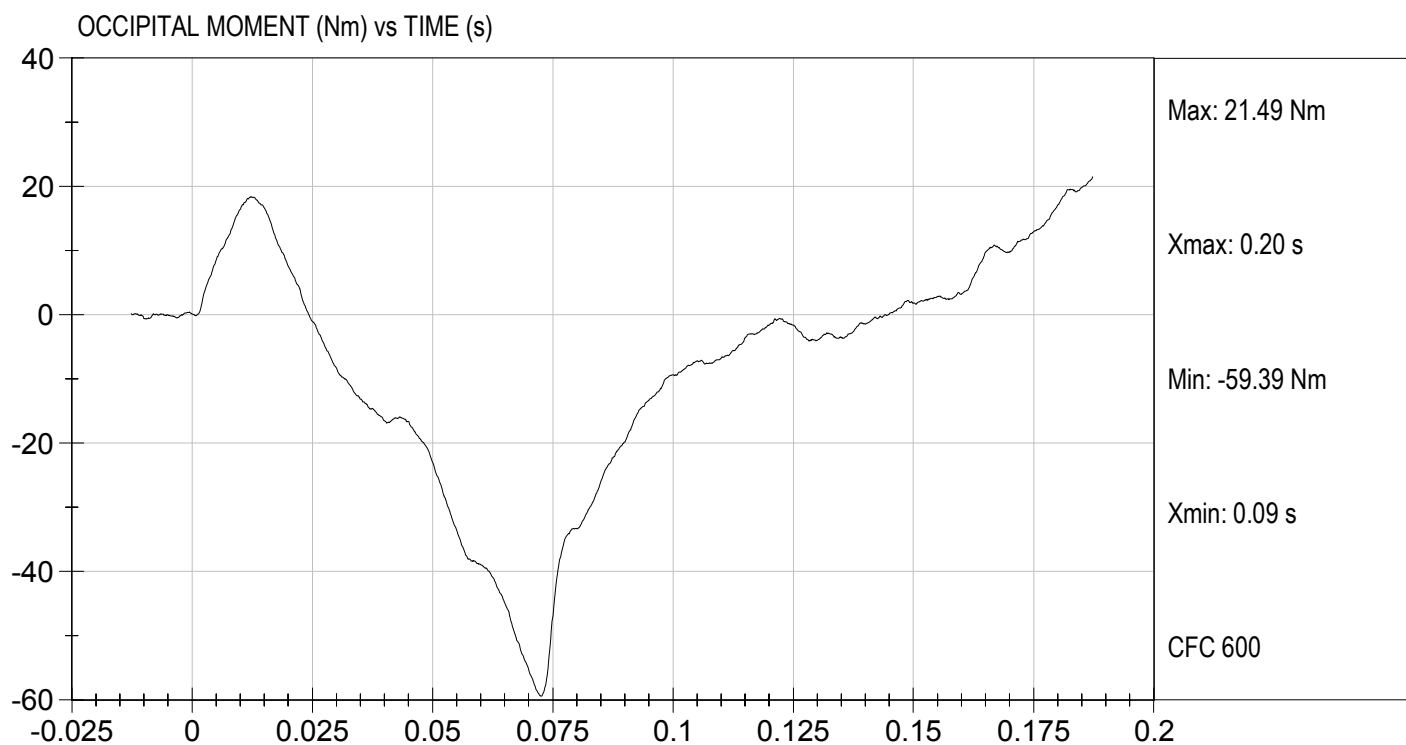
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension
Componet ID: D042043

Test Date: 08/30/2004
Velocity: 19.97 ft/s, 6.09 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 506

Test Date 8/31/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.7

Record the minimum temperature 20.8

Record the maximum humidity 56%

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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.80 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4100 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3967 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.

Joe Fleck
Signature

8/31/04
Date

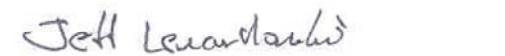
MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

Test I.D: D042044

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	6.59 to 6.83	6.80	Pass
Peak Deflection	mm	50 to 58	54.9	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	3,967	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

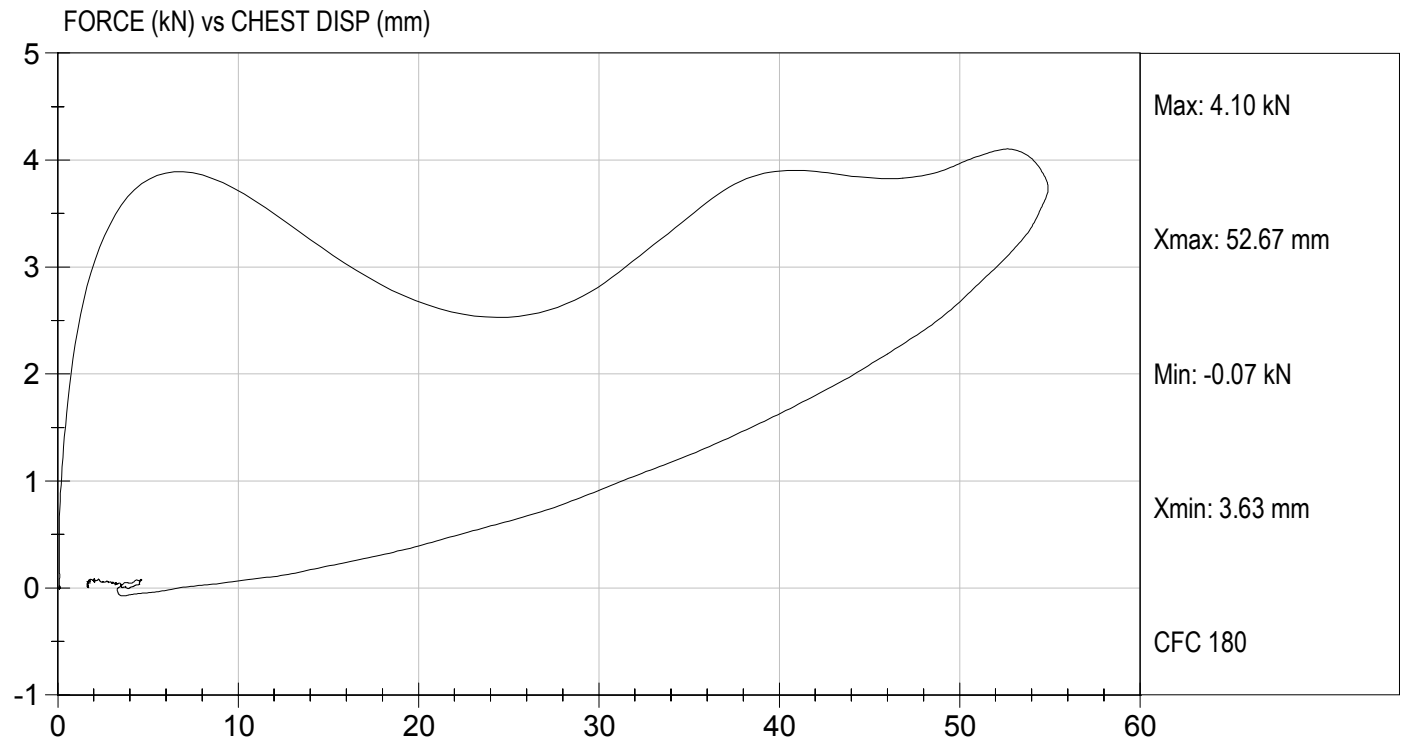
08/31/2004

Test Date



Test Desc: Thorax Impact
Componet ID: D042044

Test Date: 08/31/2004
Velocity: 22.3 ft/s, 6.80 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 506

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☐ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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°) 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 $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	340 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	16°

Joe Fleck
Signature

8/30/04
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

Test I.D: D042047

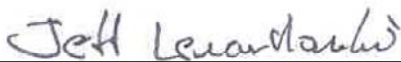
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	16	Pass
Force at 45 deg	N	320 to 390	340	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/30/2004

Test Date



Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3570 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

8/30/04
Date

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

ATD Serial No: 506

Test I.D: D042046

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.57	Pass
Overall Test Results				Pass



Laboratory Technician

08/30/2004

Test Date

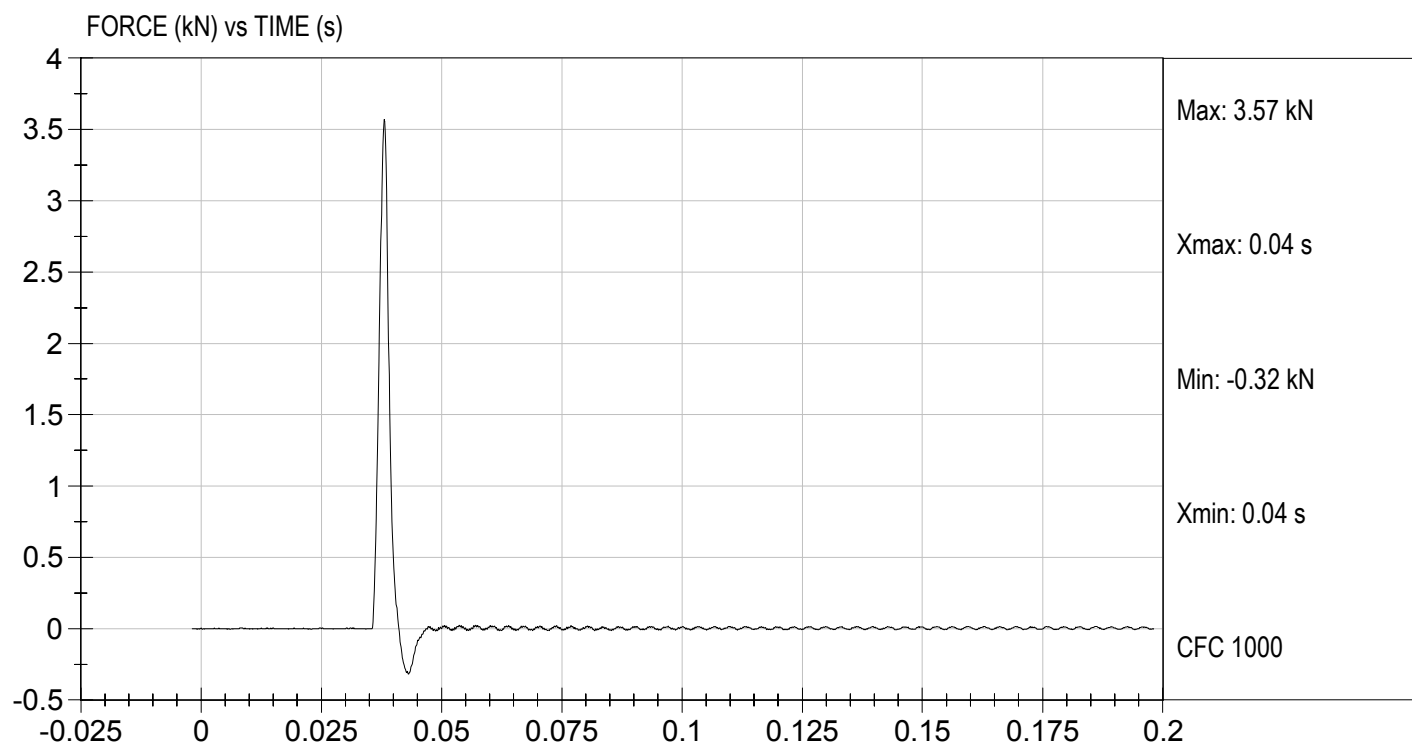


Approved By



Test Desc: Left Knee
Componet ID: D042046

Test Date: 08/30/2004
Velocity: 6.95 ft/s, 2.12 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52 %

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	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 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.

Joe Fleck
Signature

8/30/04
Date

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

ATD Serial No: 506

Test I.D: D042045

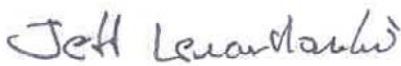
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.64	Pass
Overall Test Results				Pass



Laboratory Technician

08/30/2004

Test Date

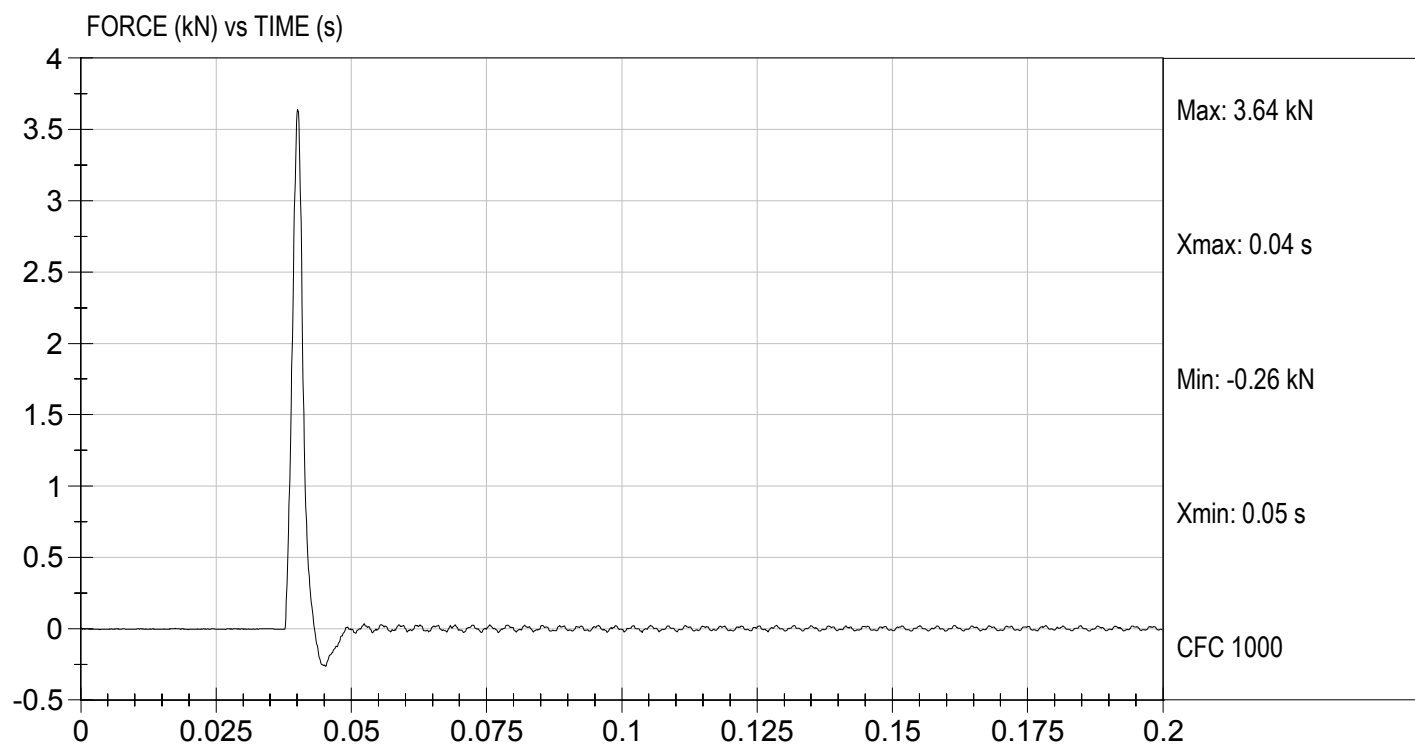


Approved By



Test Desc: Right Knee
Componet ID: D042045

Test Date: 08/30/2004
Velocity: 6.94 ft/s, 2.12 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 506 Test Date 9/06/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one head drop performed

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

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

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

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 53%

Record the minimum humidity 40%

☒ 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 502mm

Record the left side distance 501mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-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

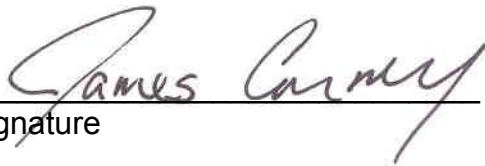
Record length 595 mm

- 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	272
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	14

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


Signature

9/06/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

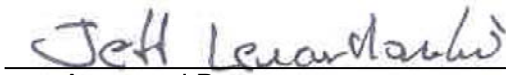
ATD Serial No: 506

Test ID: D042121

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


 Laboratory Technician

09/06/2004
 Test Date

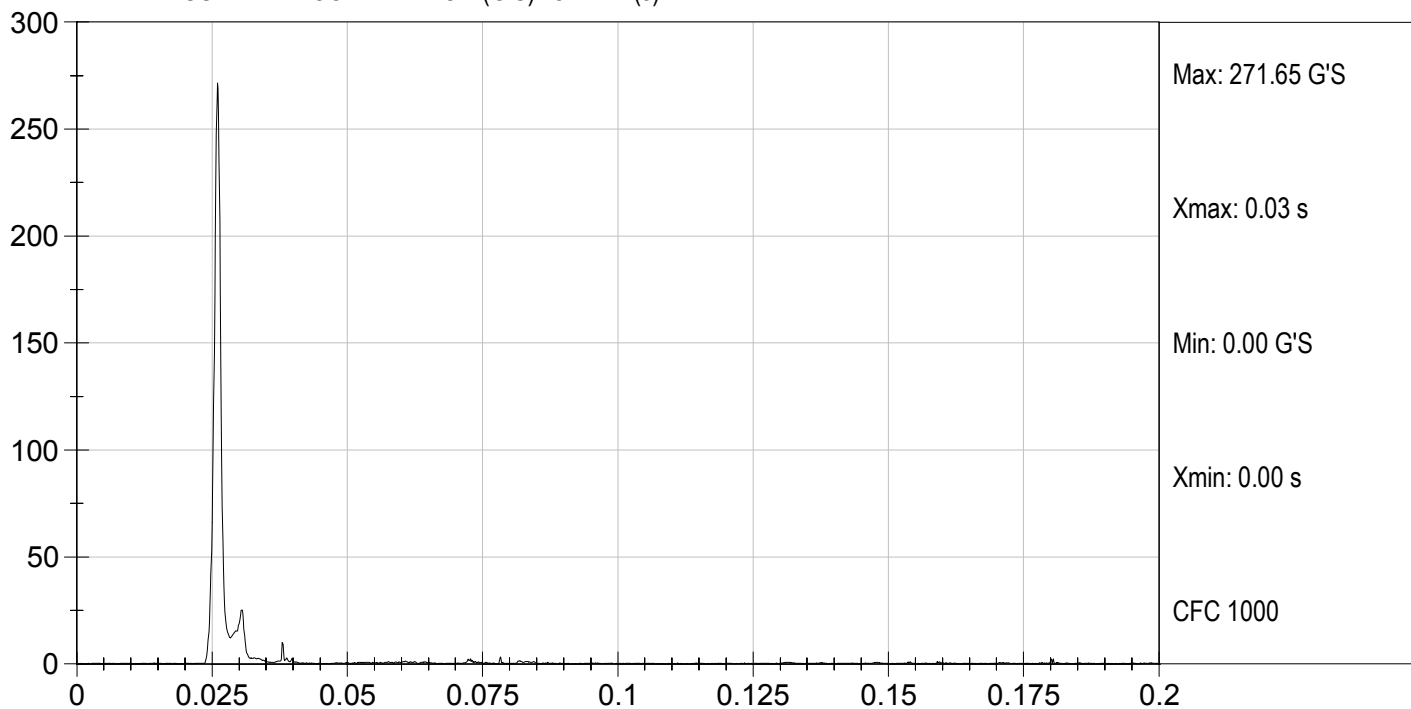

 Approved By



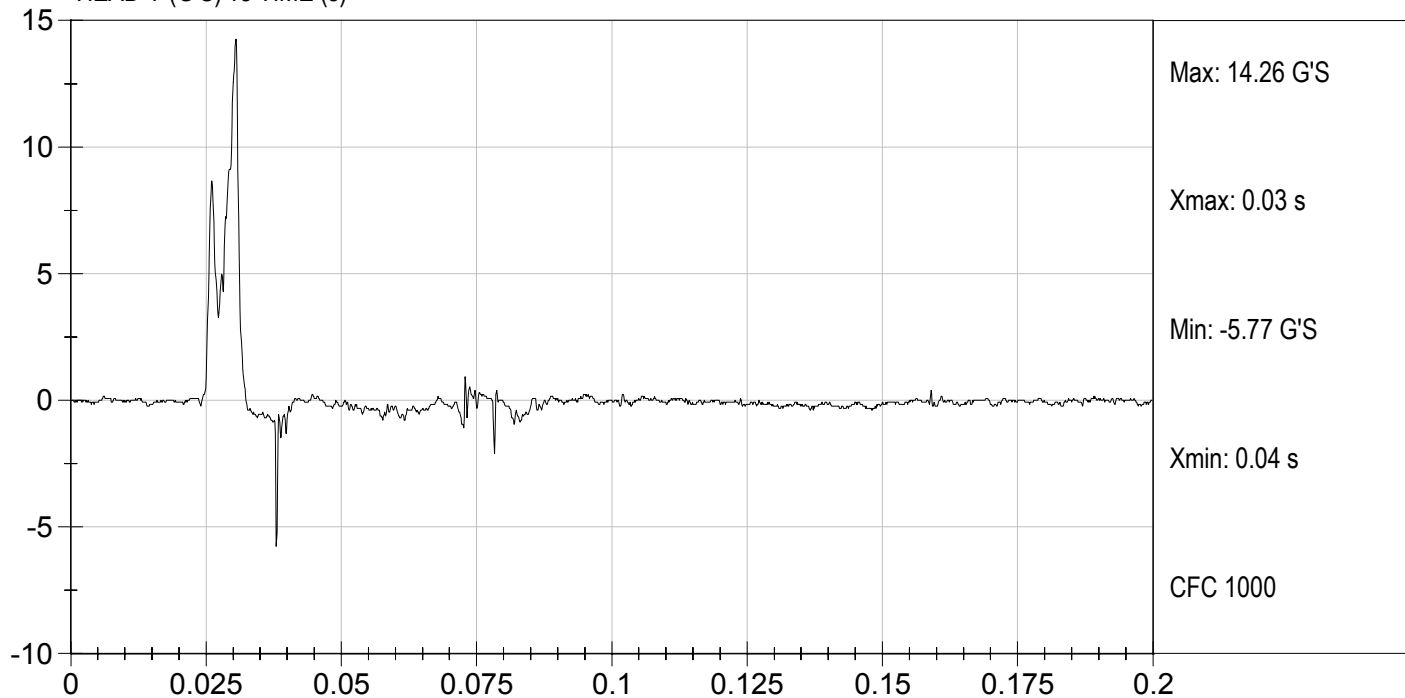
Test Desc: Head Drop
Componet ID: D042121

Test Date: 09/06/2004
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 506

Test Date 9/06/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

- ☐ 1. It has been at least 30 minutes since the last flexion test. (572.137(q))
☒ N/A, ONLY one flexion test performed
- ☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.4</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity | <u>53%</u> |
| Record the minimum humidity | <u>40%</u> |
- ☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
 Record findings and actions: No Damage.
- ☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
 Record findings and actions: No Deterioration. Hardness Front 89; Back 90.
- ☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))
- ☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- ☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	6.96 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	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.5 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.4 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>81</u> Nm @ <u>85</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	85 ms

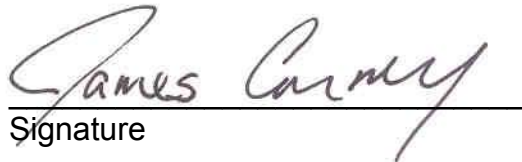
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

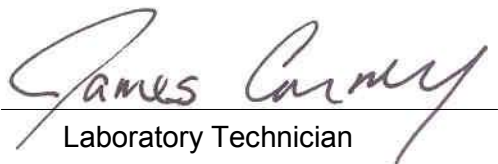
9/06/04
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

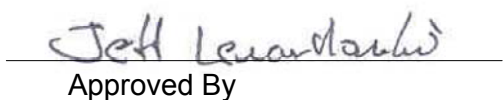
Test I.D: D042122

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.5	Pass
	30 msec	m/sec	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	85	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	81	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	85	Pass
Overall Results				Pass	


Laboratory Technician

09/06/2004

Test Date

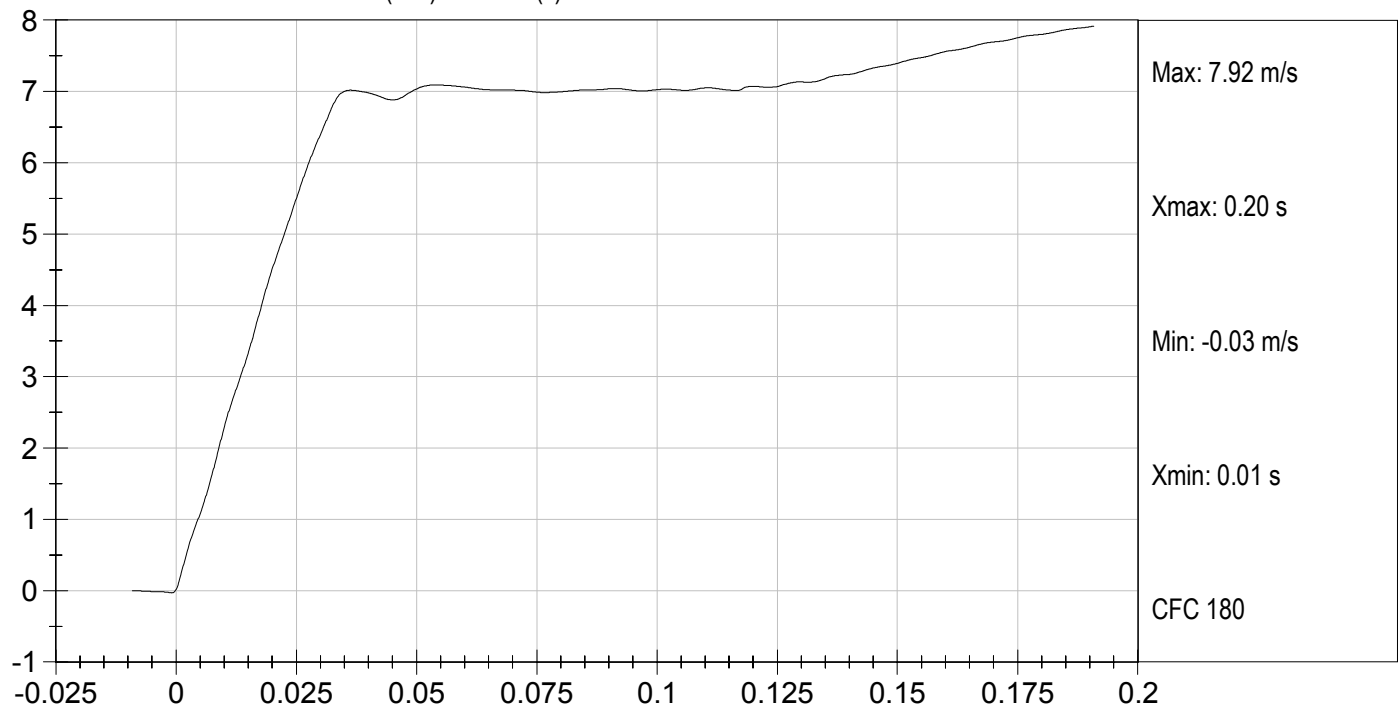

Approved By



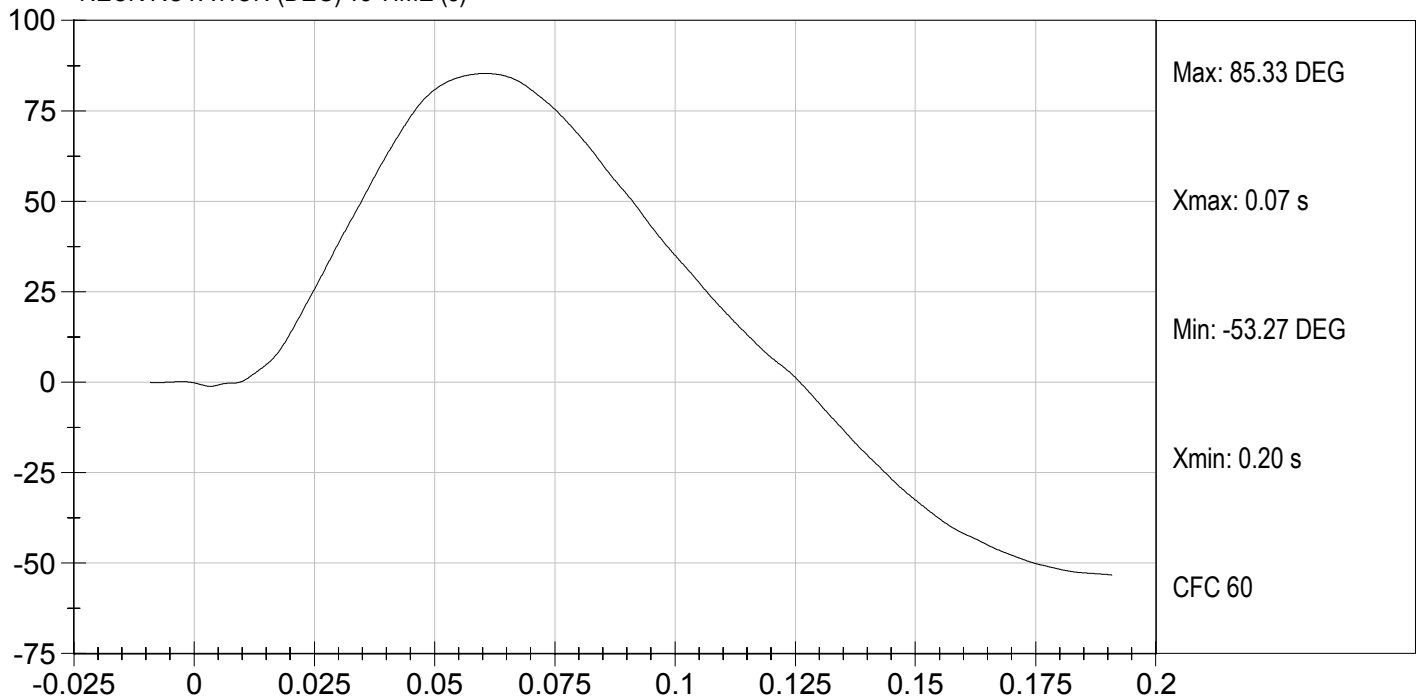
Test Desc: Neck Flexion
Componet ID: D042122

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

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



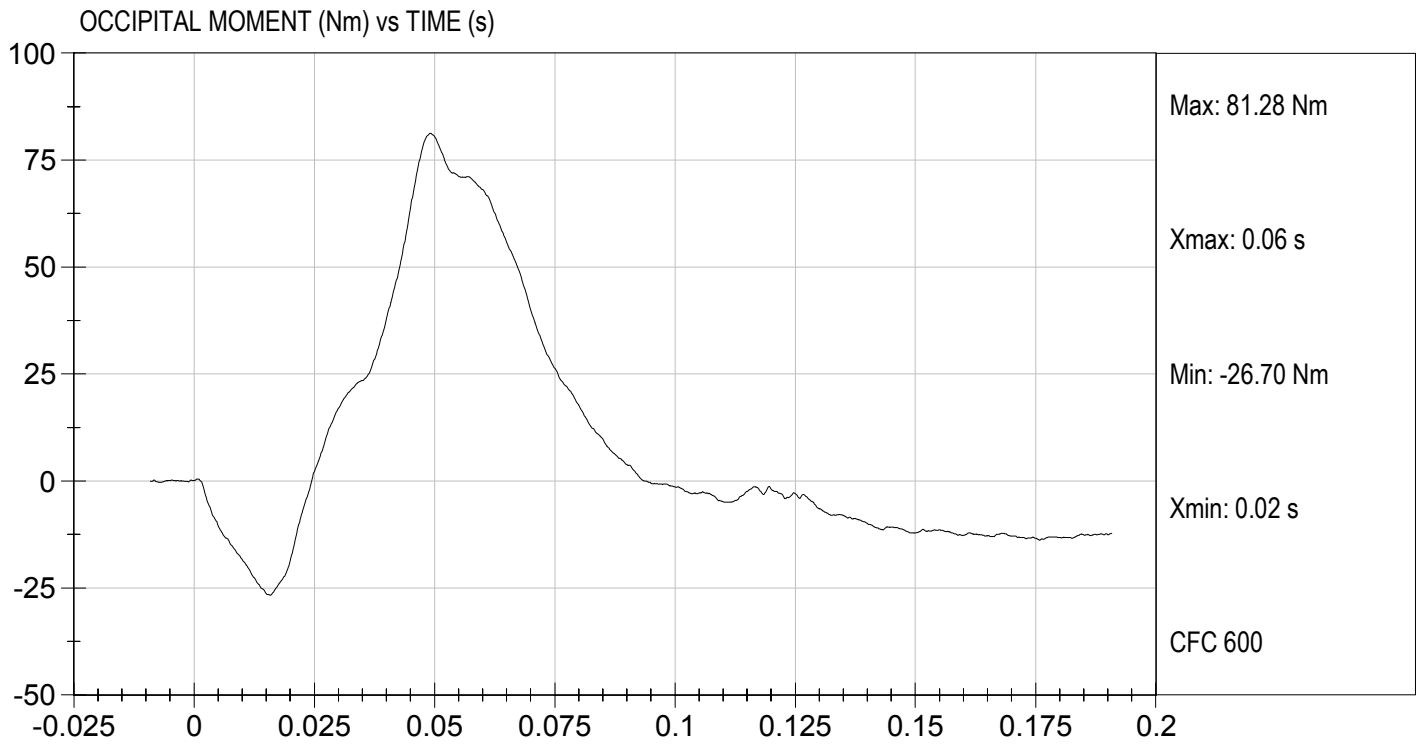
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D042122

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



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 506

Test Date 9/06/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 53%

Record the minimum humidity 40%

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

Record findings and actions: No Damage.

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

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

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

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

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

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

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

Parameter		Specification	Result
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.08 m/s
Pendulum 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	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.2 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	<u>-61</u> Nm @ <u>111</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	101 ms

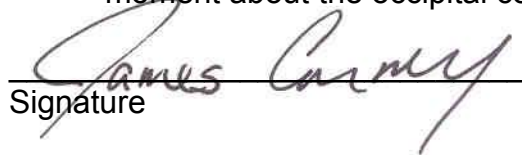
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

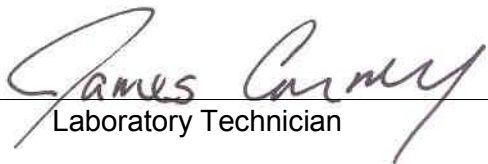
9/06/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

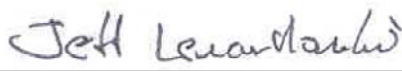
Test I.D: D042123

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.08	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	111	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	101	Pass
Overall Results					Pass


 Laboratory Technician

09/06/2004

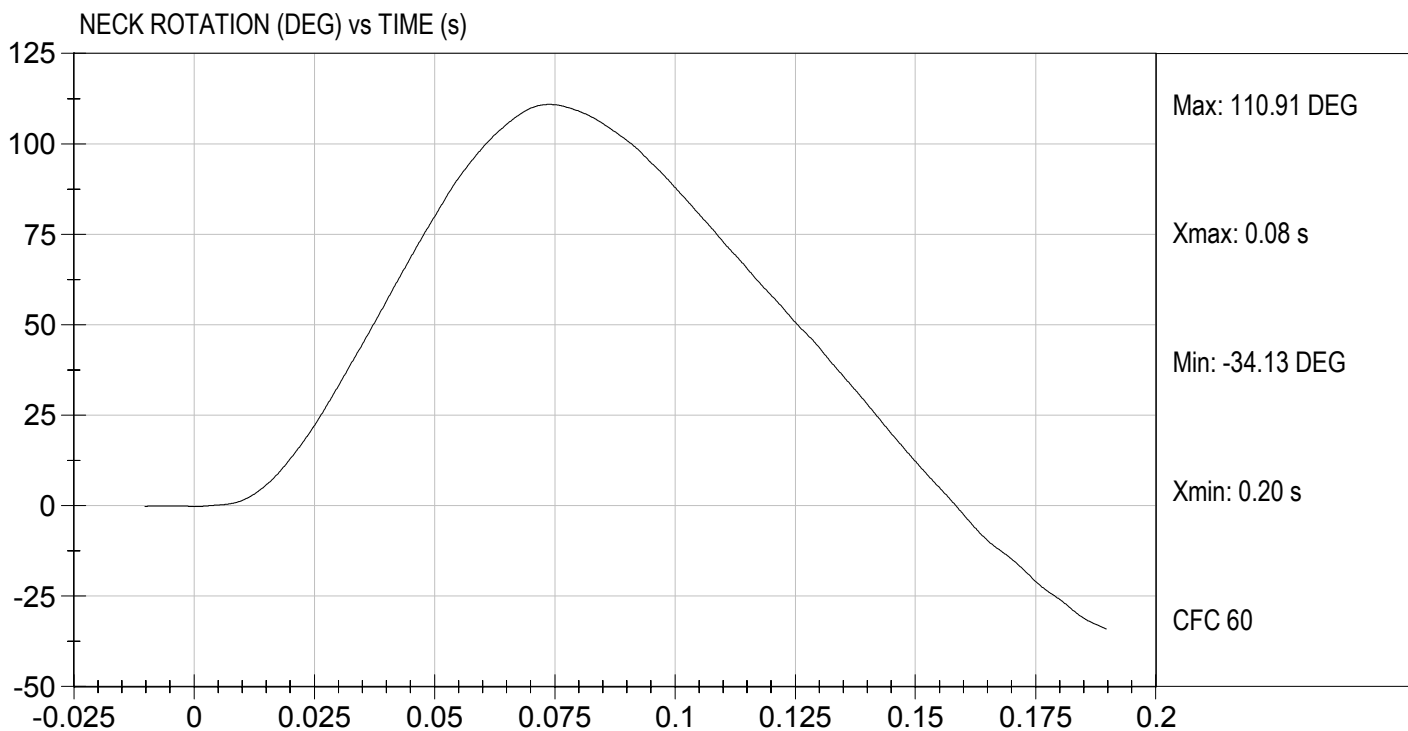
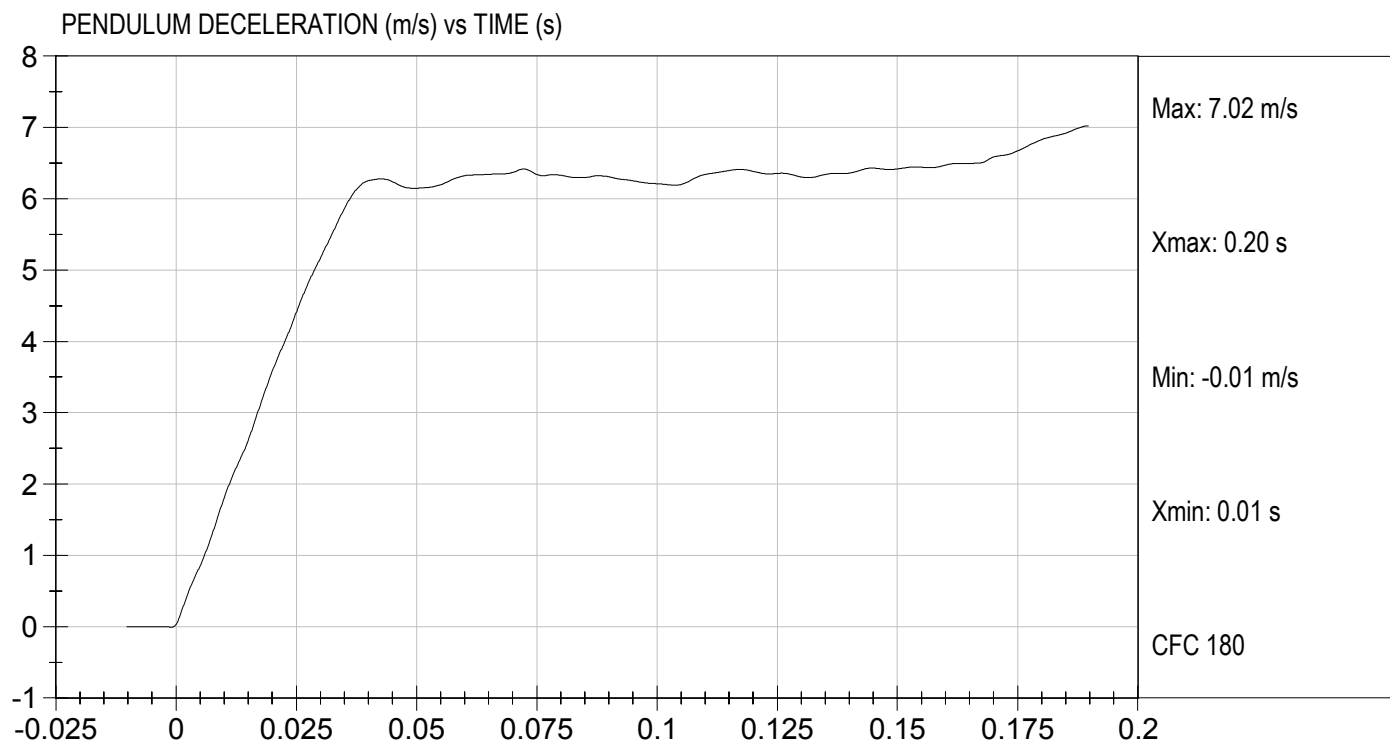
Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D042123

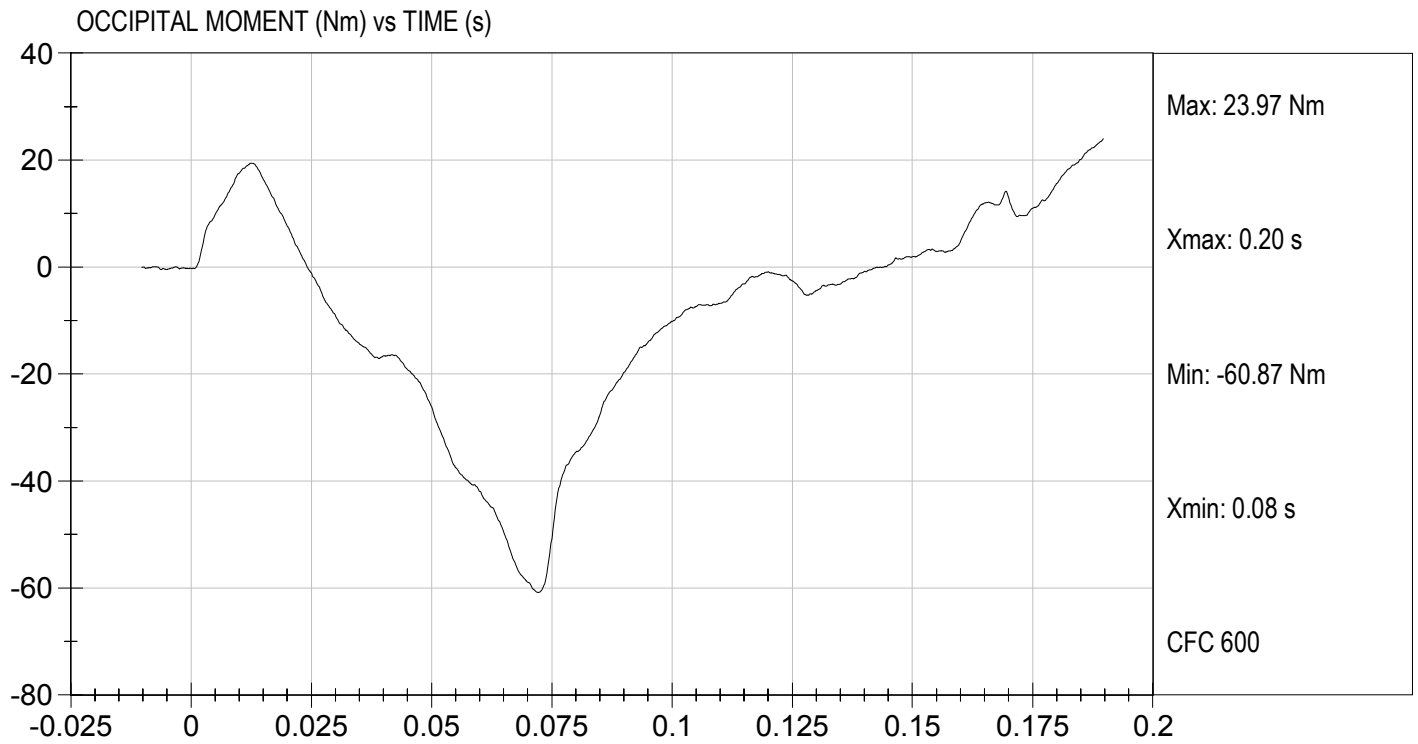
Test Date: 09/06/2004
Velocity: 19.94 ft/s, 6.08 m/s





Test Desc: Neck Extension
Componet ID: D042123

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



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 506

Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 48%

Record the minimum humidity 40%

☒ 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	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	54 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4120 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4124 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

9/07/04
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

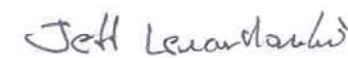
ATD Serial No: 506

Test I.D: D042124

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


Laboratory Technician

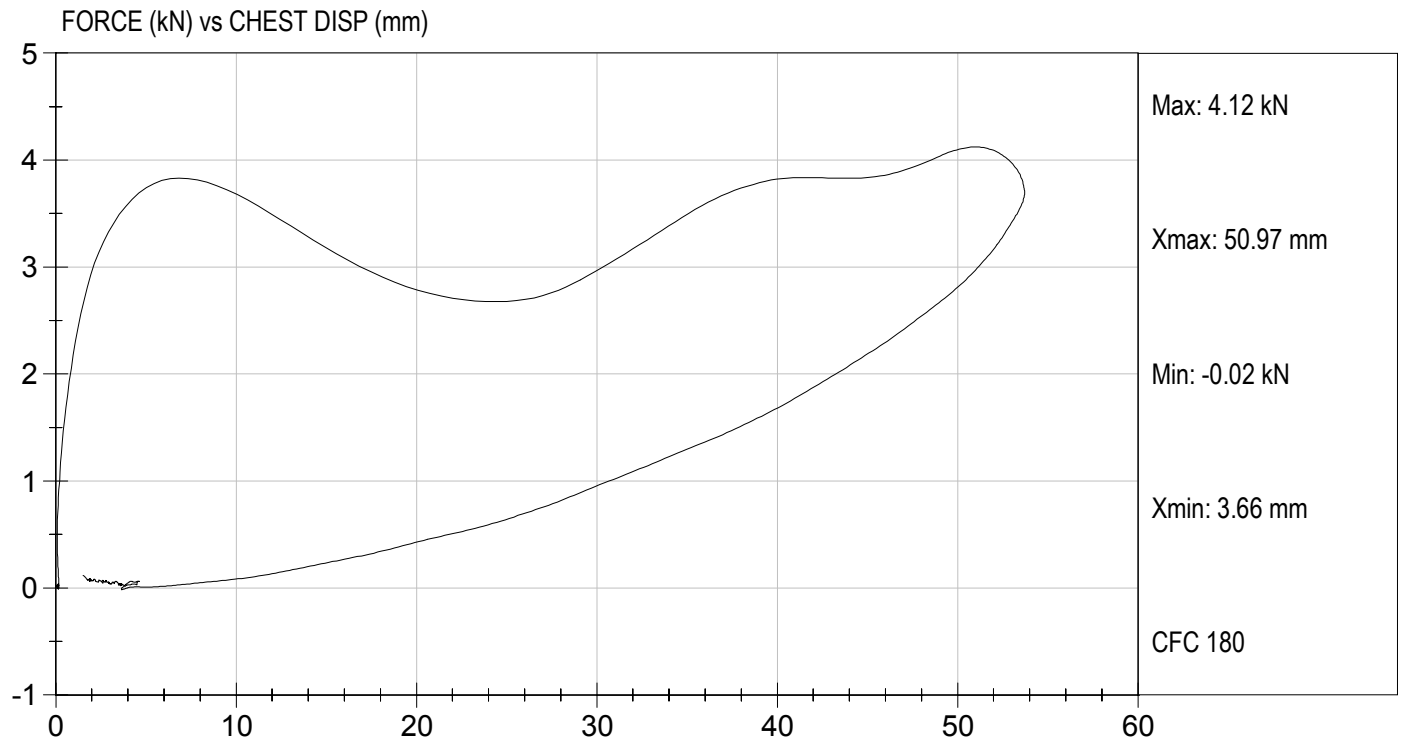
09/07/2004
Test Date


Approved By



Test Desc: Thorax Impact
Componet ID: D042124

Test Date: 09/07/2004
Velocity: 21.7 ft/s, 6.61 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 506

Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

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

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

☐ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 48%

Record the minimum humidity 40%

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

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

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

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

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

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

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

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

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

- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° 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 $\leq 20^\circ$	18°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	378 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	21°



 Signature

9/07/04

 Date

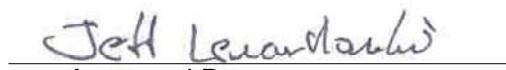
MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 506

Test I.D: D042127

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


Laboratory Technician


Approved By

09/07/2004
Test Date

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506

Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 48%

Record the minimum humidity 40%

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

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

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

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

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

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

X 11. Complete the following table:

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

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

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

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


Signature

9/07/04
Date

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

ATD Serial No: 506

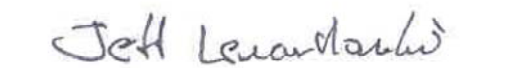
Test I.D: D042126

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


Laboratory Technician

09/07/2004

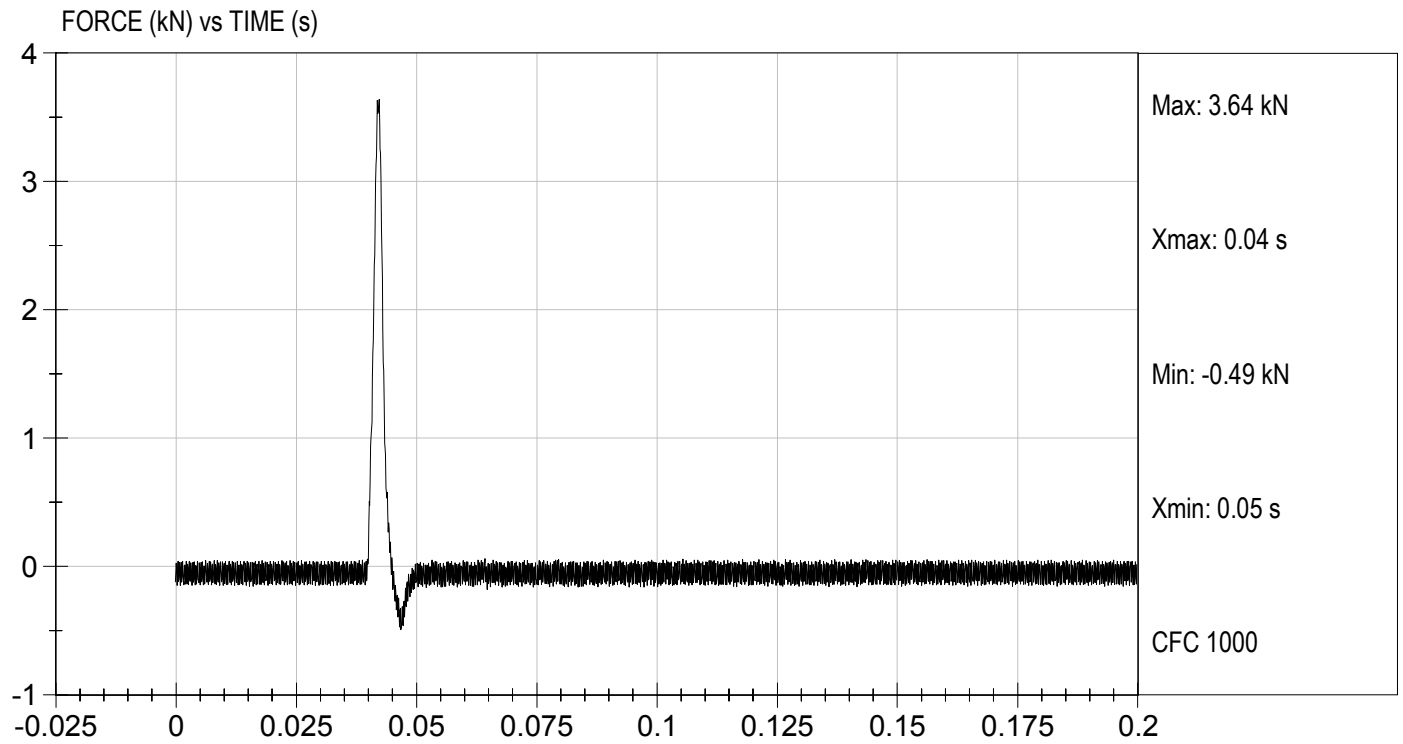
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D042126

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



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 506

Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.9

Record the maximum humidity 48 %

Record the minimum humidity 40 %

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

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

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

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

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

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

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

9/07/04

Date

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

ATD Serial No: 506

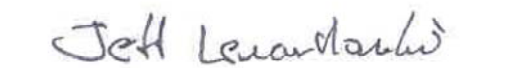
Test I.D: D042125

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.47	Pass
Overall Test Results				Pass


Laboratory Technician

09/07/2004

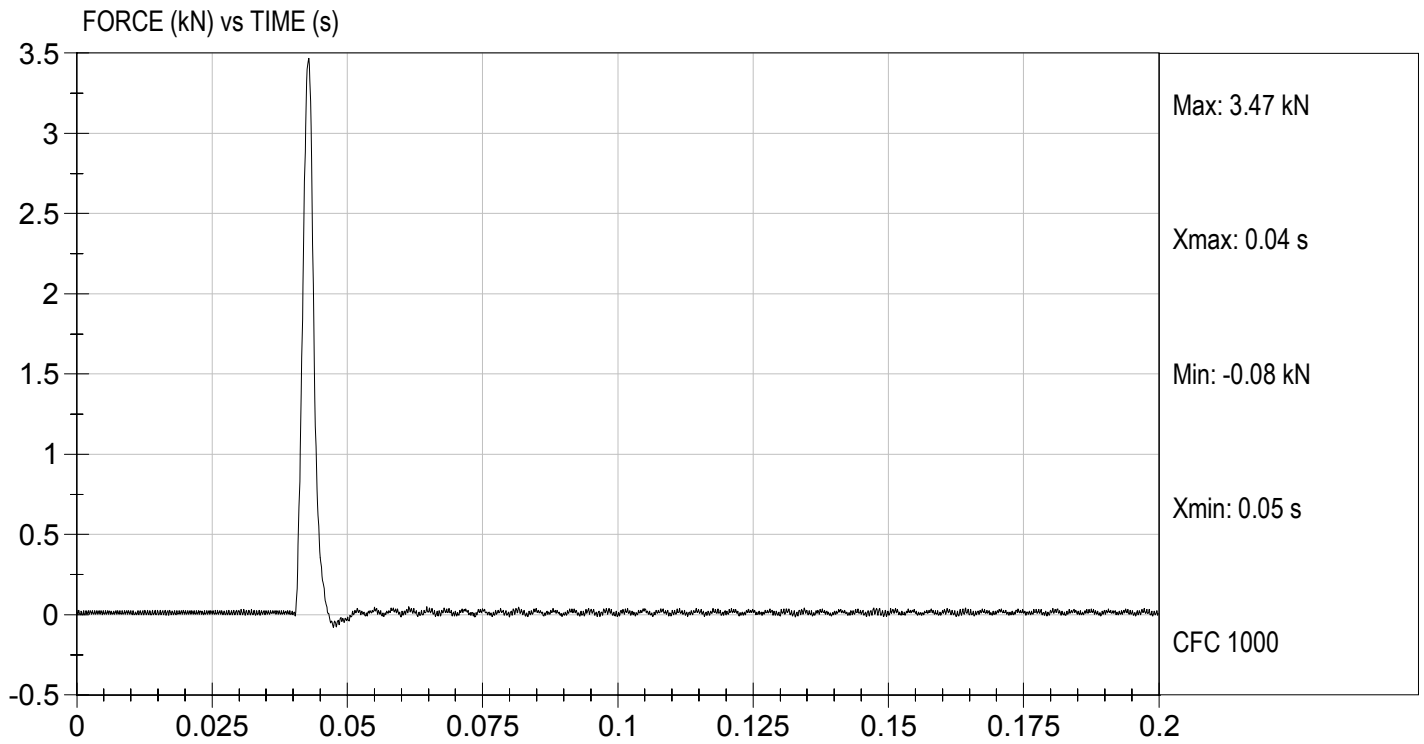
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D042125

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



DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 506 Test Date 9/03/04

Technician Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damaged	OK
Outer skin	Gashes, rips, cracks			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

9/06/04
Date

Describe the repair or replacement of parts:

Checked by

Jeff Levanthaler
Signature

9/06/04
Date

EXTERNAL DIMENSIONS

SN506, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	780.2
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	443.0
C	H-POINT HEIGHT	Reference	81.3-86.3	85.1
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	145.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	76.4
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	128.0
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	255.8
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	45.0
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	193.0
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	365.2
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	400.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	438.0

SN506, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	183.0
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	226.2
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	475.8
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.0
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	305.1
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	359.0
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.5
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	538.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	857.6
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	789.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

EXTERNAL DIMENSIONS

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

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

DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one head drop performed

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

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

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

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

Record the minimum humidity 42%

☒ 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 500mm

Record the left side distance 500mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-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	$250 \text{ g} \leq x \leq 300 \text{ g}$	266
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	10

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

Joe Flock
Signature

8/30/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test ID: D042031

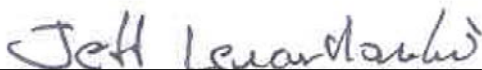
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Peak Resultant Acceleration	G's	250 - 300	266	Pass
Peak Lateral Acceleration	G's	+/- 15	9.7	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

08/30/2004

Test Date



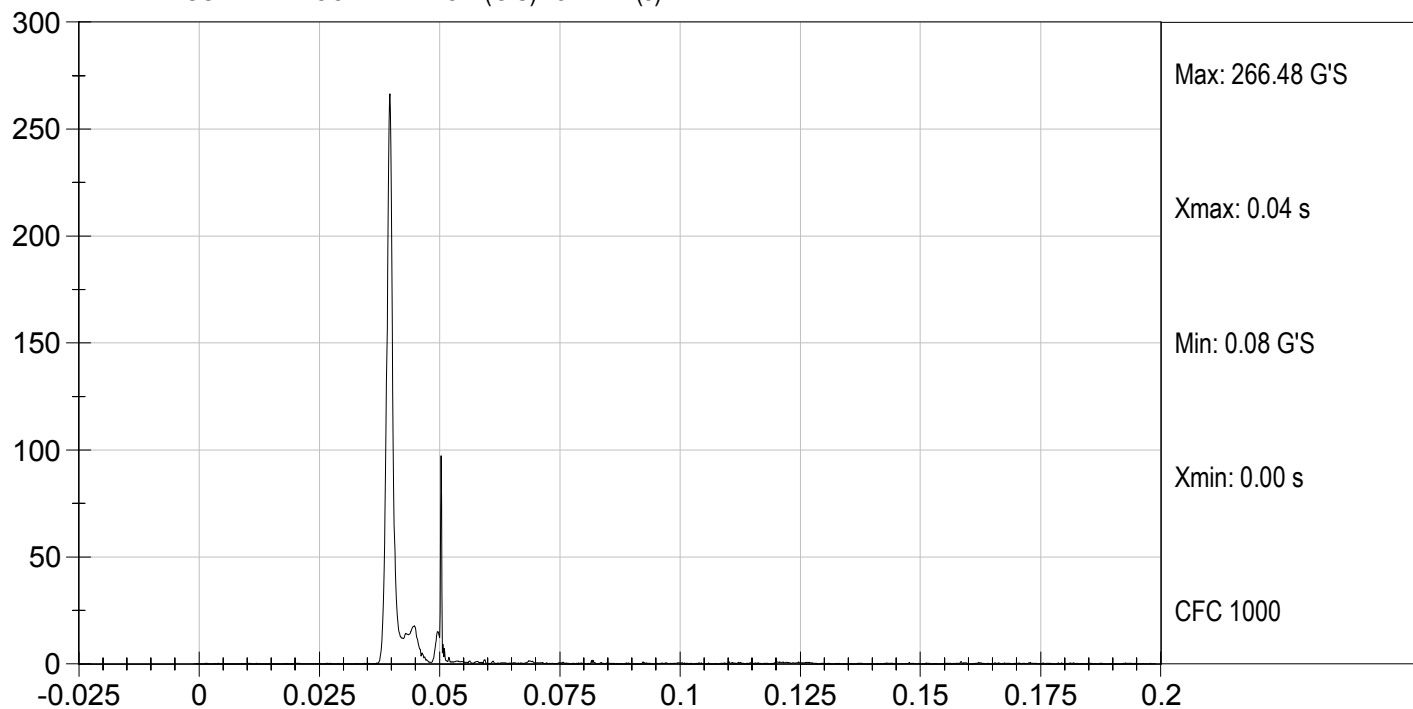
Approved By



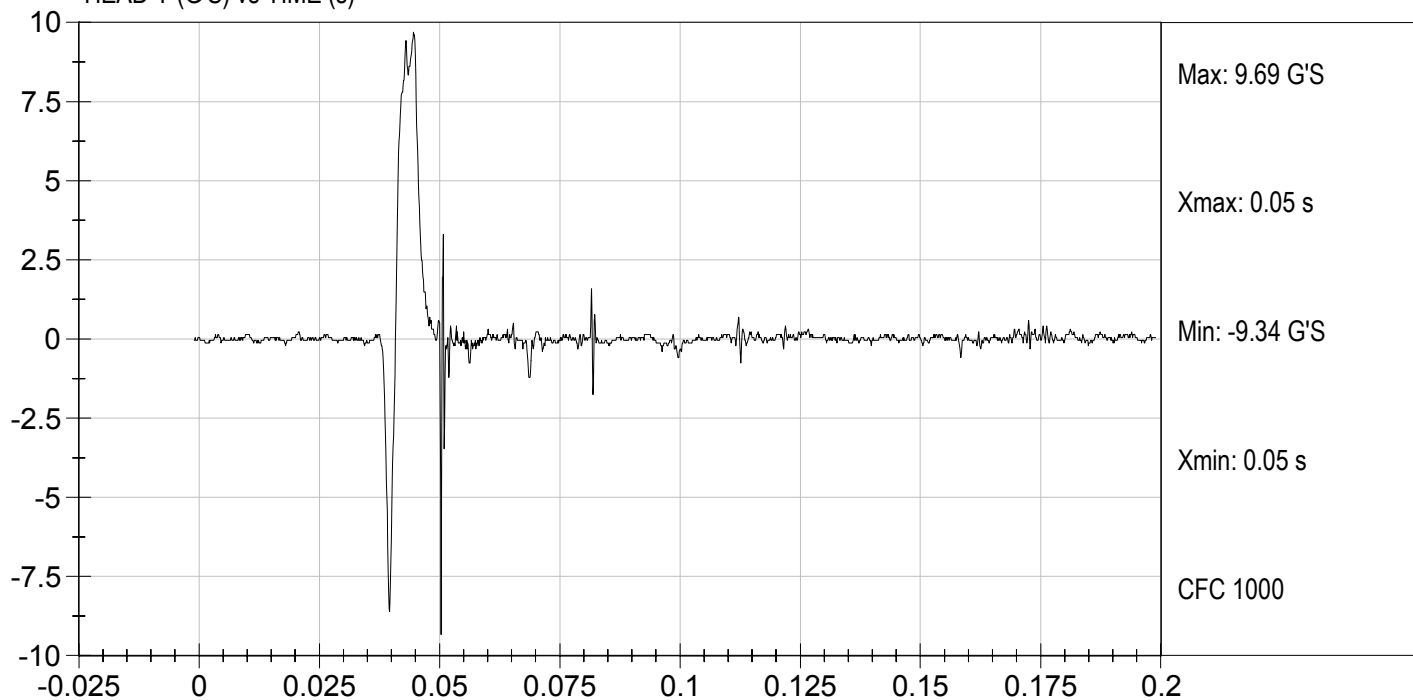
Test Desc: Head Drop
Componet ID: D042031

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

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 505

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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 85; Back 88.

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	6.91 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	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.7 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>71</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

8/30/04
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D042032

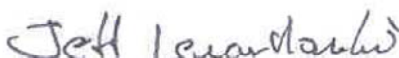
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Speed		m/sec	6.89 to 7.13	6.91	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	79	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	87	Pass
Overall Results					Pass



Laboratory Technician

08/30/2004

Test Date



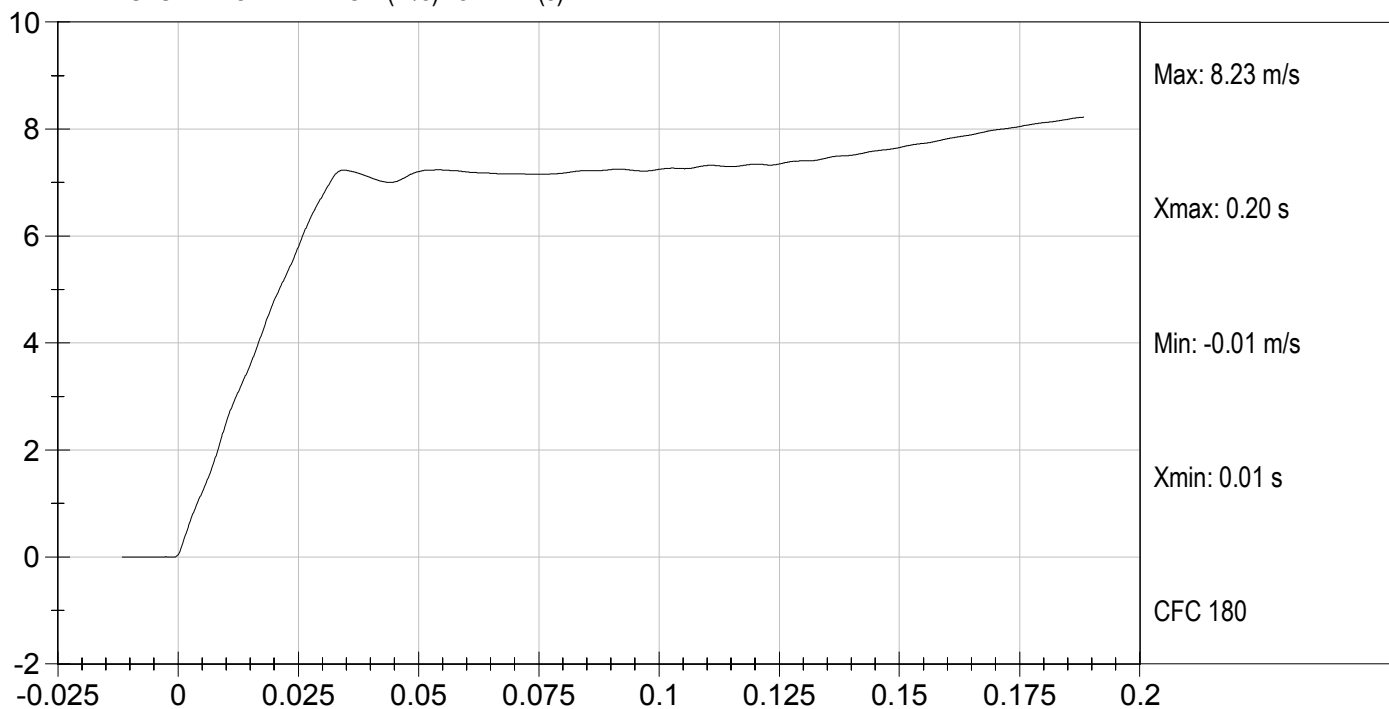
Approved By



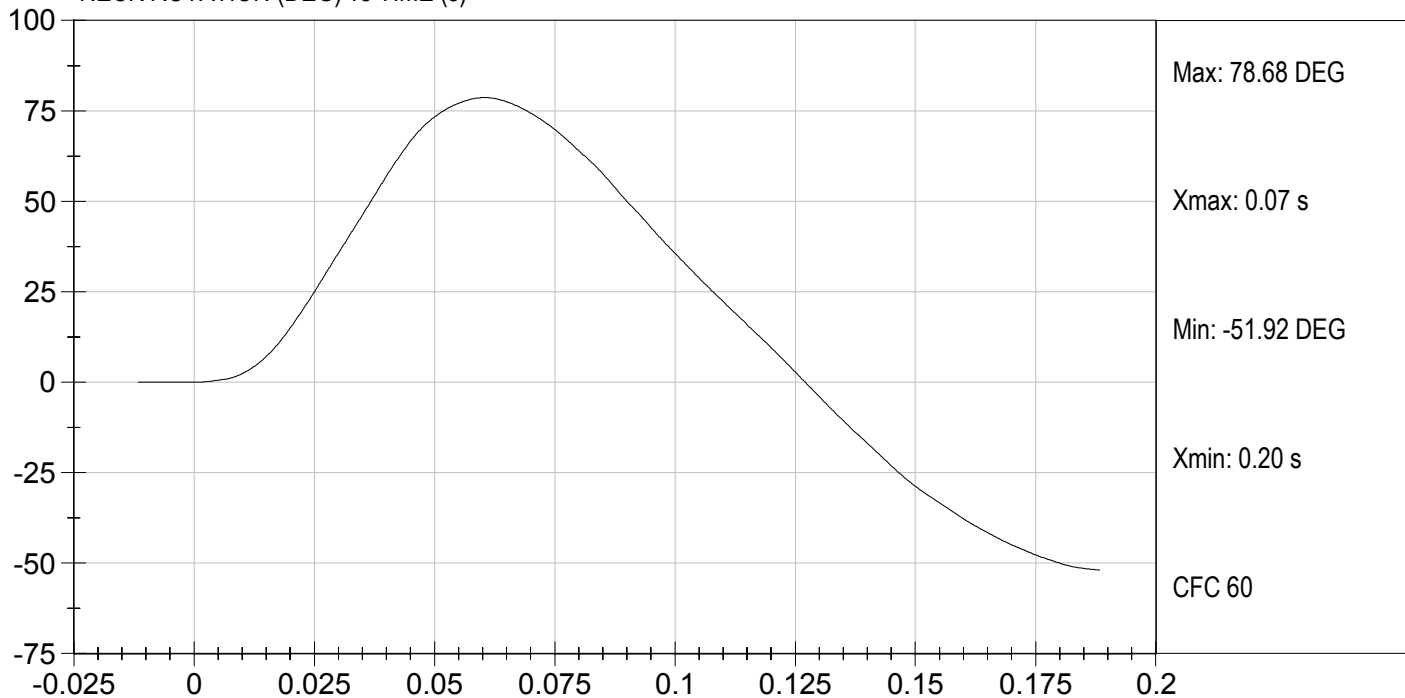
Test Desc: Neck Flexion
Componet ID: D042032

Test Date: 08/30/2004
Velocity: 22.66 ft/s, 6.91 m/s

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



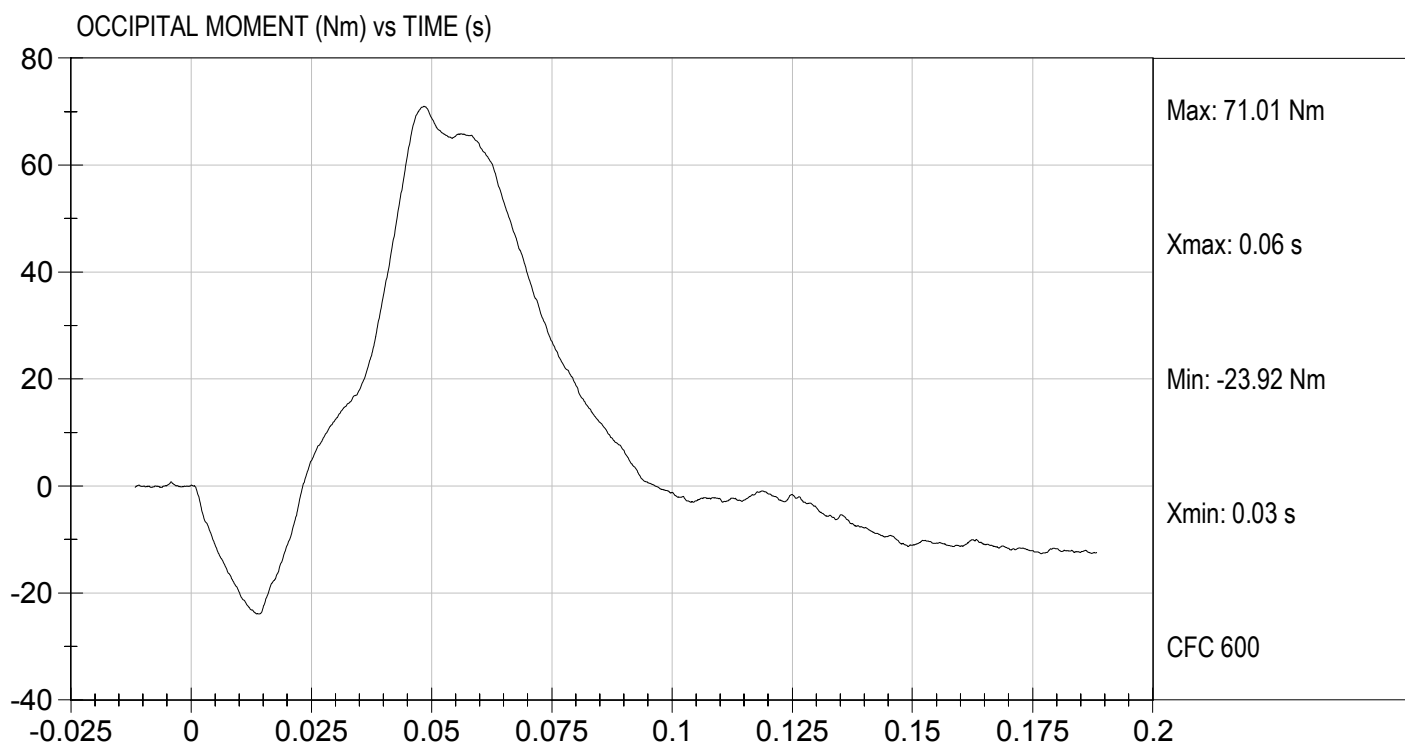
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D042032

Test Date: 08/30/2004
Velocity: 22.66 ft/s, 6.91 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505 Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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 85; Back 88.

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.05 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>-61</u> Nm @ <u>100</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	96 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Joe Flack
Signature

8/30/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D042033

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	47	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.05	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	100	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	96	Pass
Overall Results					Pass



Laboratory Technician

08/30/2004

Test Date



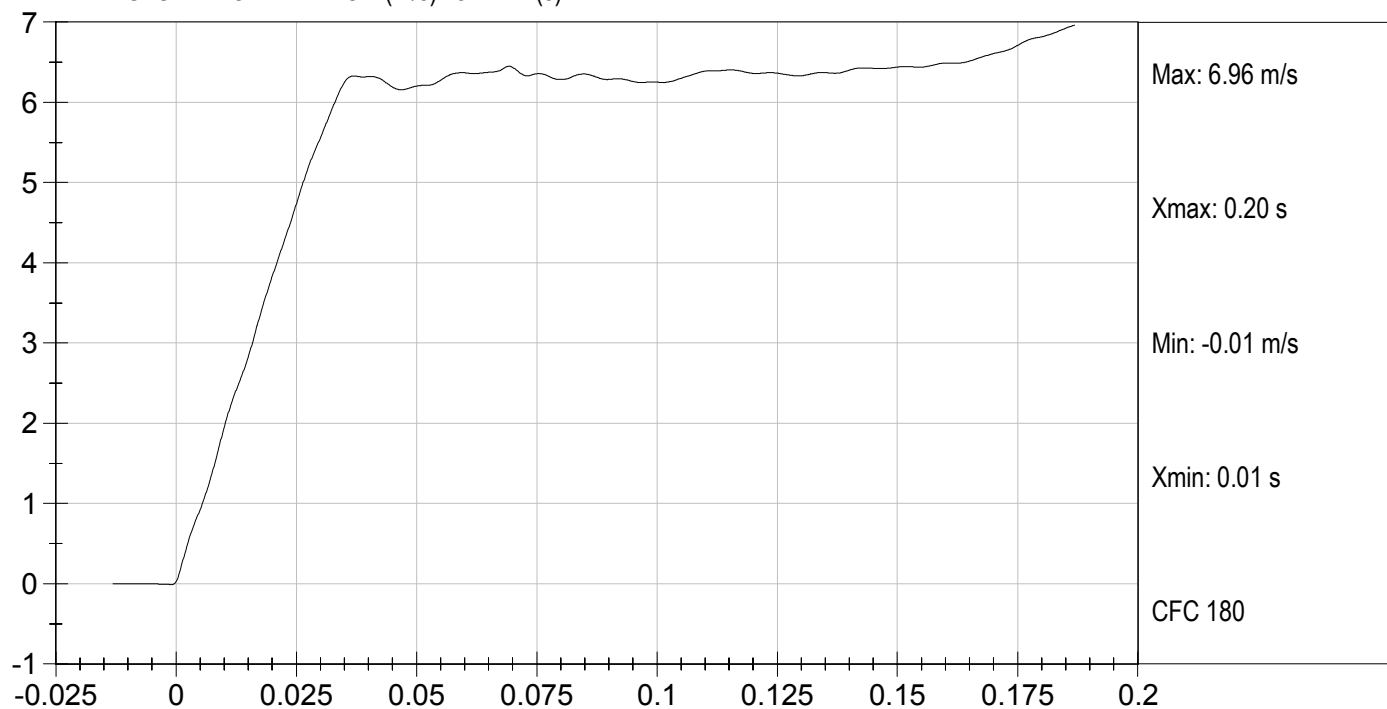
Approved By



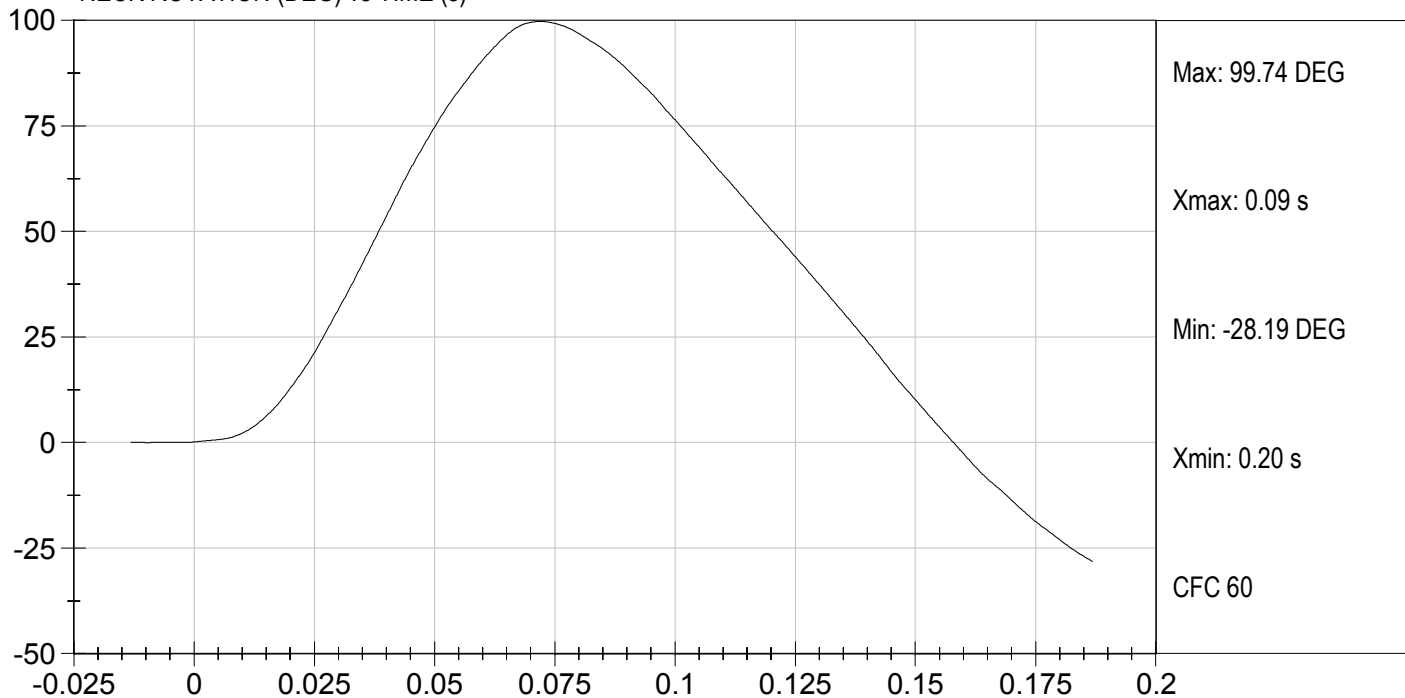
Test Desc: Neck Extension
Componet ID: D042033

Test Date: 08/30/2004
Velocity: 19.85 ft/s, 6.05 m/s

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



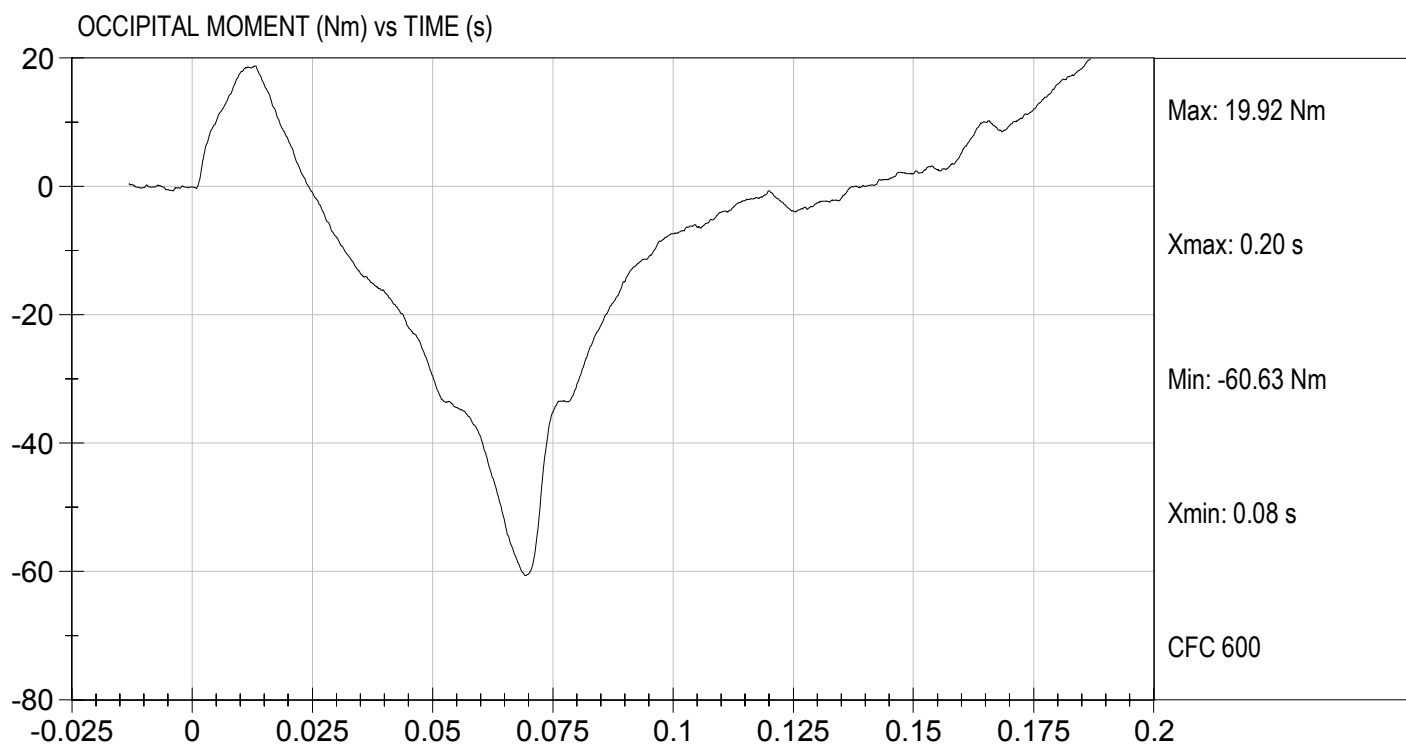
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Extension
Componet ID: D042033

Test Date: 08/30/2004
Velocity: 19.85 ft/s, 6.05 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 8/31/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.7

Record the minimum temperature 20.8

Record the maximum humidity 56%

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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.78 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4290 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4287 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	70%

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

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

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

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


Signature

8/31/04
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

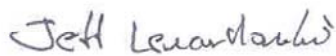
Test I.D: D042034

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.78	Pass
Peak Deflection	mm	50 to 58	54.8	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.3	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	< 4600 N	4,287	Pass
Overall Test Results				Pass


Laboratory Technician

08/31/2004

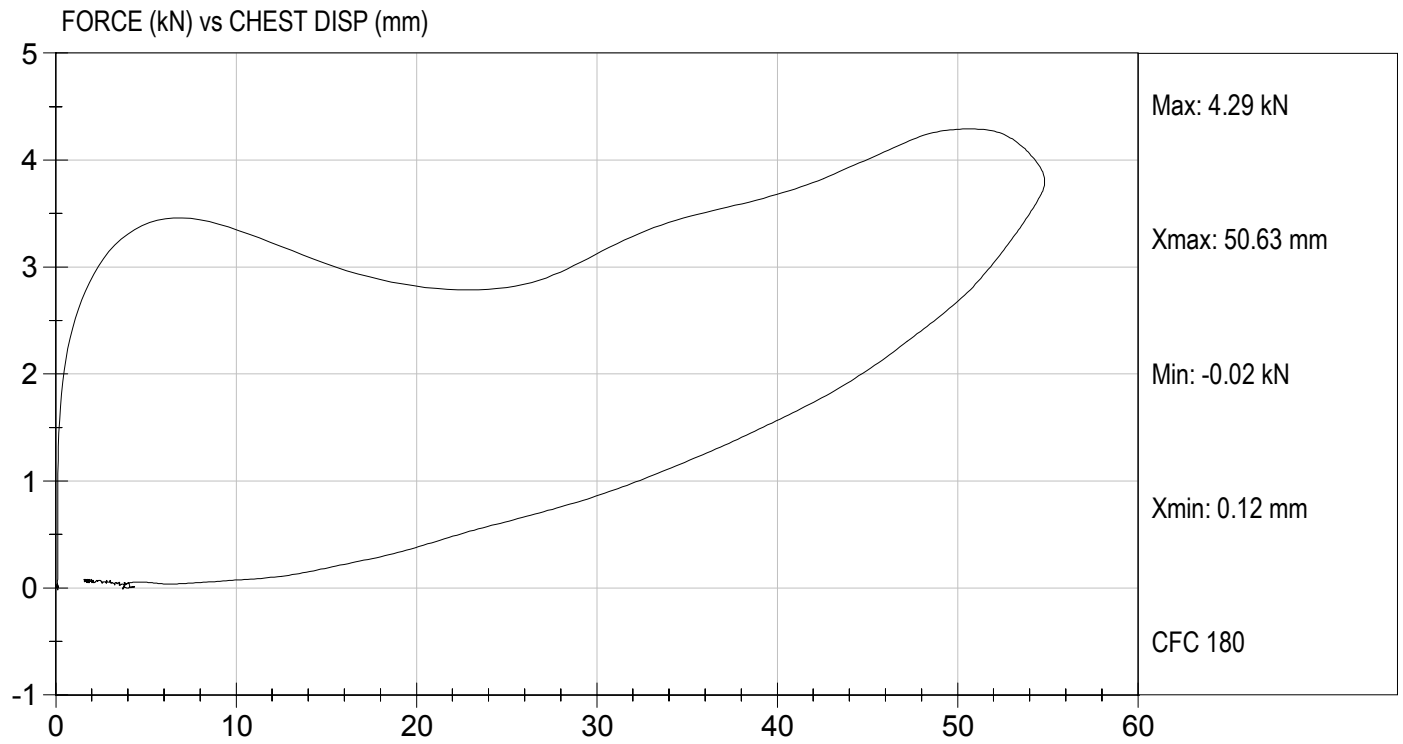
Test Date


Approved By



Test Desc: Thorax Impact
Componet ID: D042034

Test Date: 08/31/2004
Velocity: 22.26 ft/s, 6.78 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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°) 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 $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	387 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	17°

Joe Fleck
Signature

8/30/04
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D042037

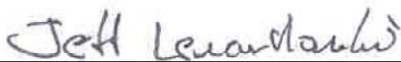
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	17	Pass
Force at 45 deg	N	320 to 390	387	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/30/2004

Test Date



Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.9

Record the minimum temperature 20.9

Record the maximum humidity 52%

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	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3860 N

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

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

Joe Fleck
Signature

8/30/04
Date

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

ATD Serial No: 505

Test I.D: D042036

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.86	Pass
Overall Test Results				Pass



Laboratory Technician

08/30/2004

Test Date

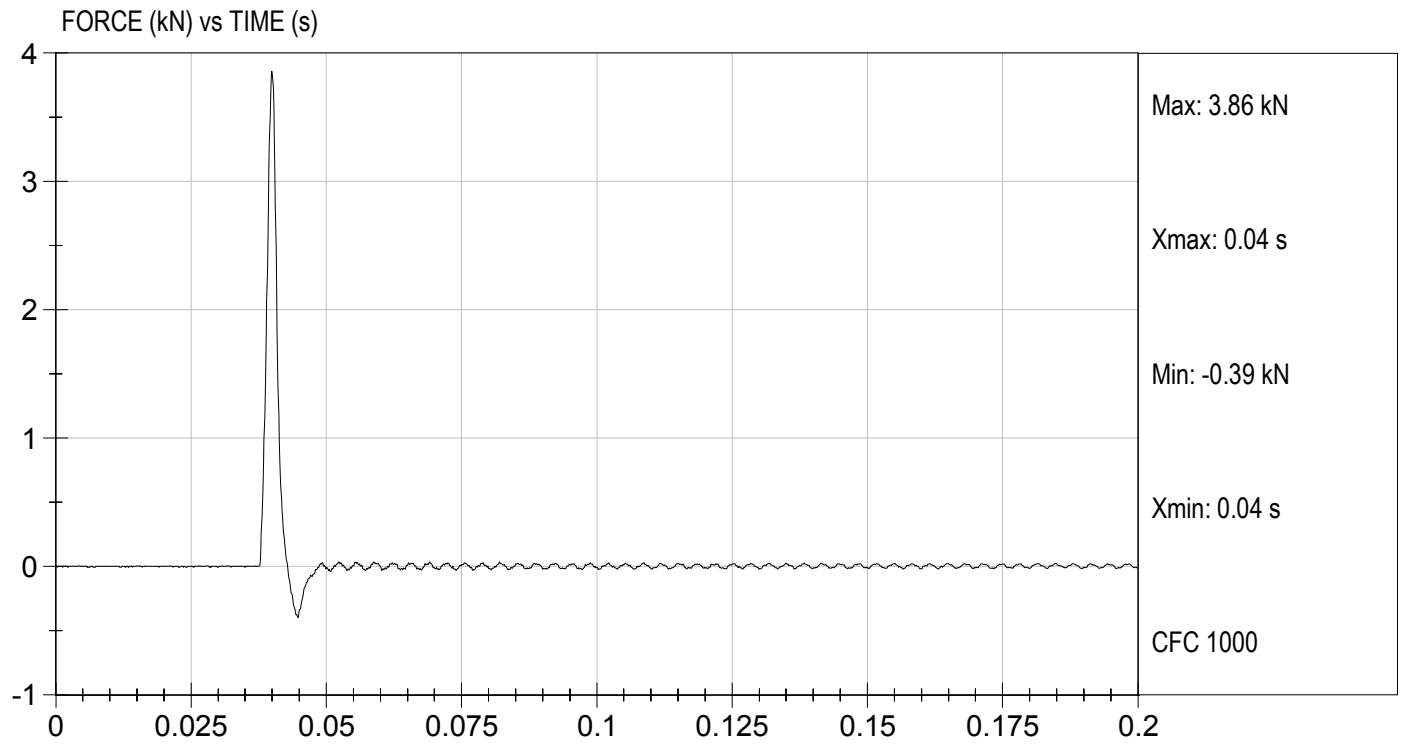


Approved By



Test Desc: Left Knee
Componet ID: D042036

Test Date: 08/30/2004
Velocity: 6.96 ft/s, 2.12 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 8/30/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

Test attempt no. 2 (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 52 %

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.

Joe Fleck
Signature

8/30/04
Date

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

ATD Serial No: 505

Test I.D: D042035

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	47	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

08/30/2004

Test Date

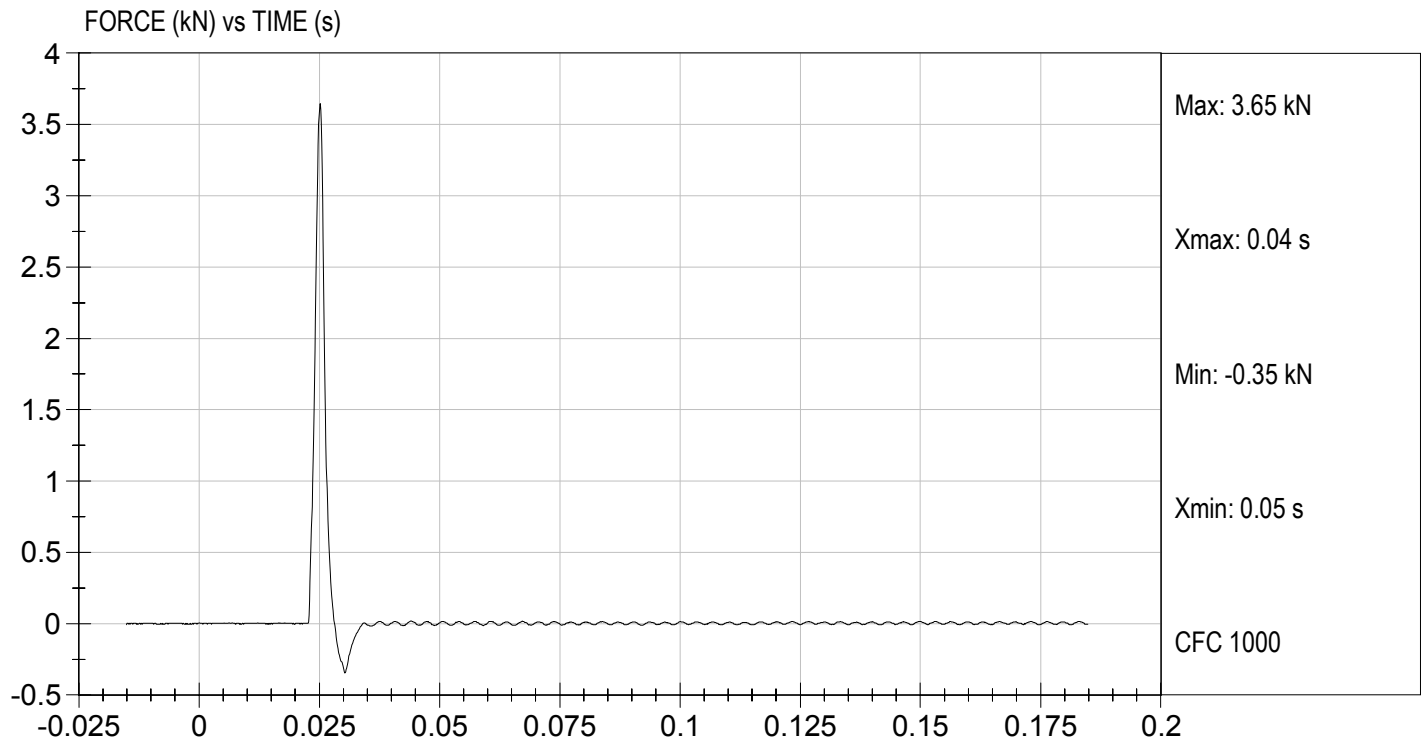


Approved By



Test Desc: Right Knee
Componet ID: D042035

Test Date: 08/30/2004
Velocity: 6.9 ft/s, 2.10 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 9/06/04

Technician Jim Carney

 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 21.4

Record the minimum temperature 21.0

Record the maximum humidity 53%

Record the minimum humidity 40%

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 500mm

Record the left side distance 500mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-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

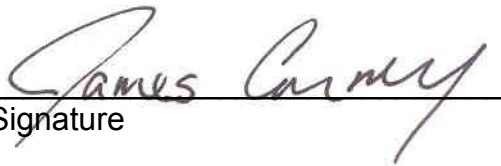
Record length 595 mm

- 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 $\leq 15 \text{ g}$	13

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


Signature

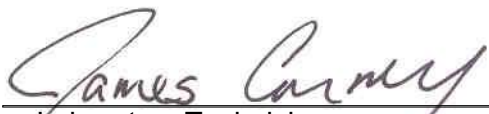
9/06/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

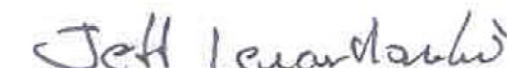
ATD Serial No: 505

Test ID: D042111

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Peak Resultant Acceleration	G's	250 - 300	268	Pass
Peak Lateral Acceleration	G's	+/- 15	13.3	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass


 Laboratory Technician

09/06/2004
 Test Date

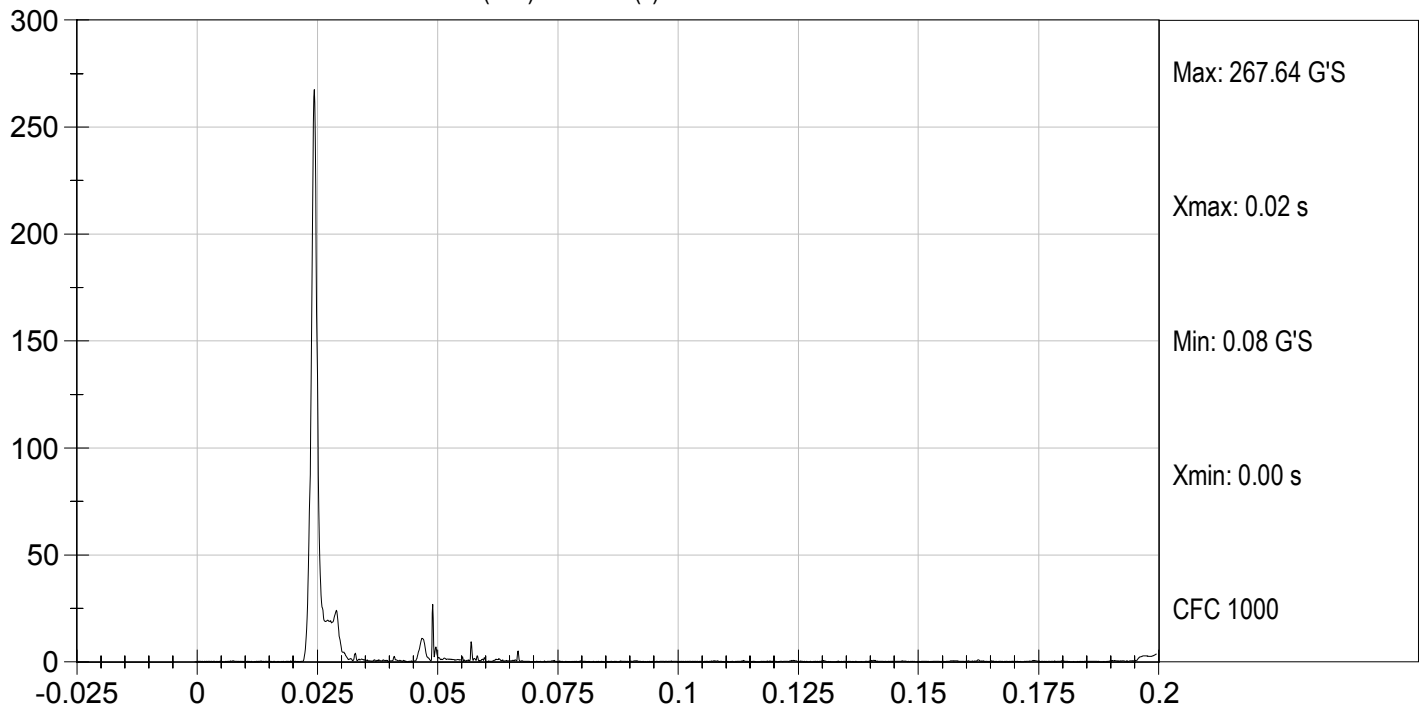

 Approved By



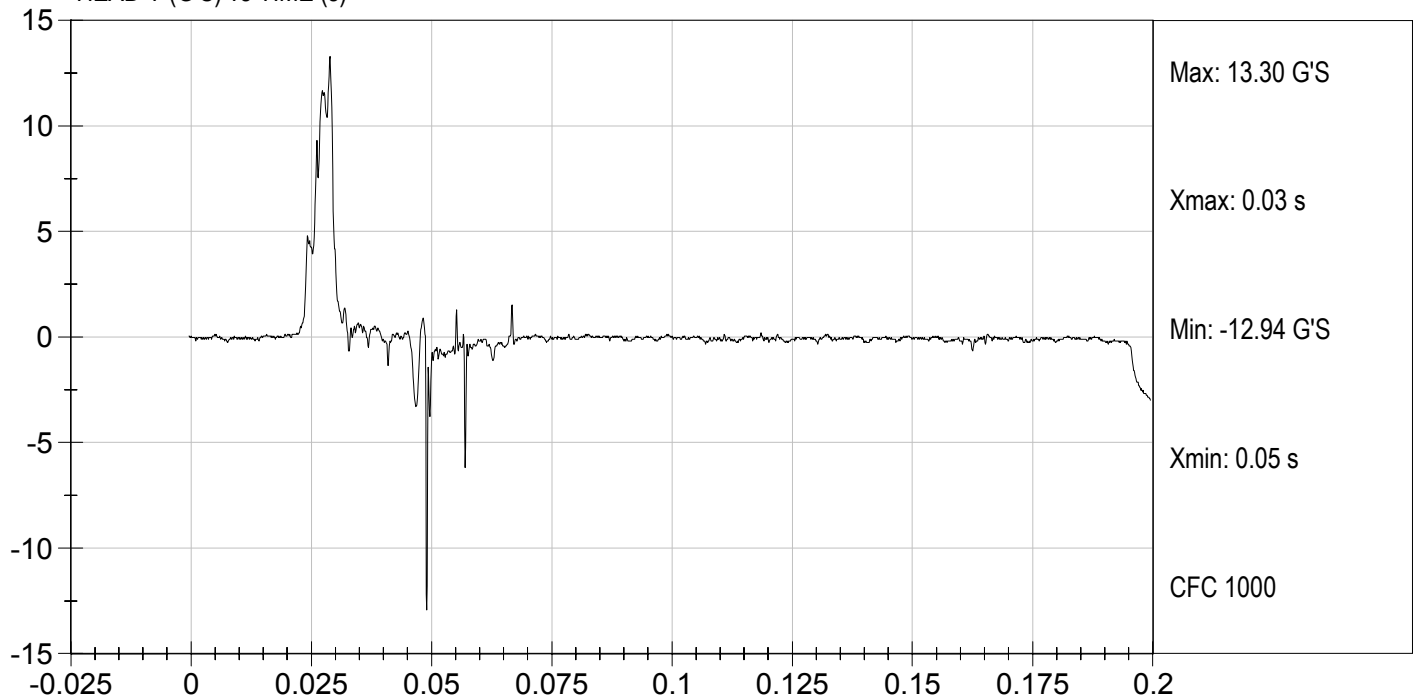
Test Desc: Head Drop
Componet ID: D042111

Test Date: 09/06/2004
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 505

Test Date 9/06/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 53%

Record the minimum humidity 40%

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

Record findings and actions: No Damage.

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

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

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	6.98 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	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.5 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.4 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>78</u> Nm @ <u>87</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	87 ms

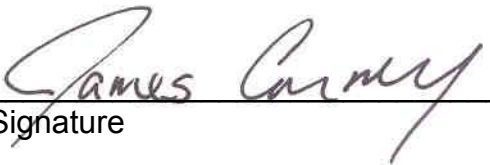
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

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.


Signature

9/06/04
Date

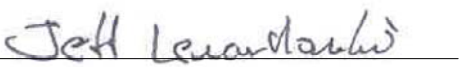
MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D042112

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	6.89 to 7.13	6.98	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.3	Pass
	20 msec	m/sec	4.0 to 5.0	4.5	Pass
	30 msec	m/sec	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	87	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	78	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	87	Pass
Overall Results					Pass


Laboratory Technician


Approved By

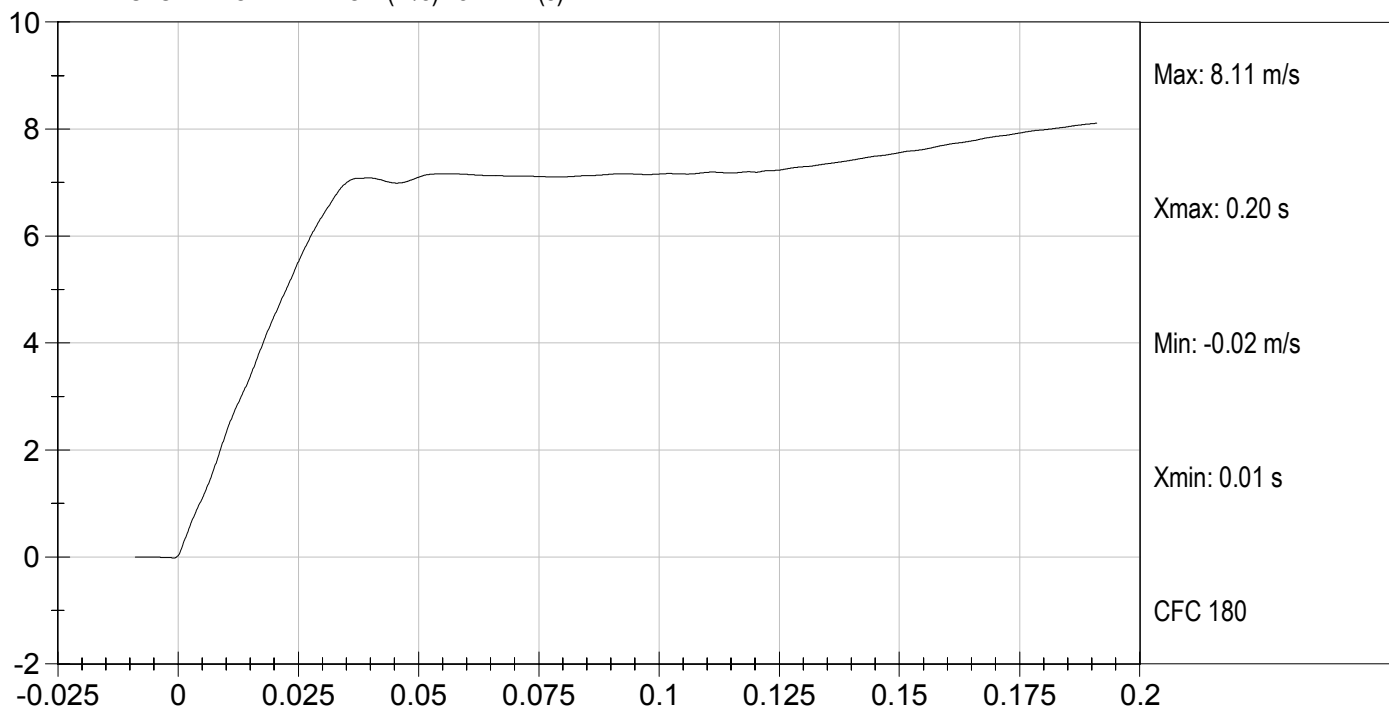
09/06/2004
Test Date



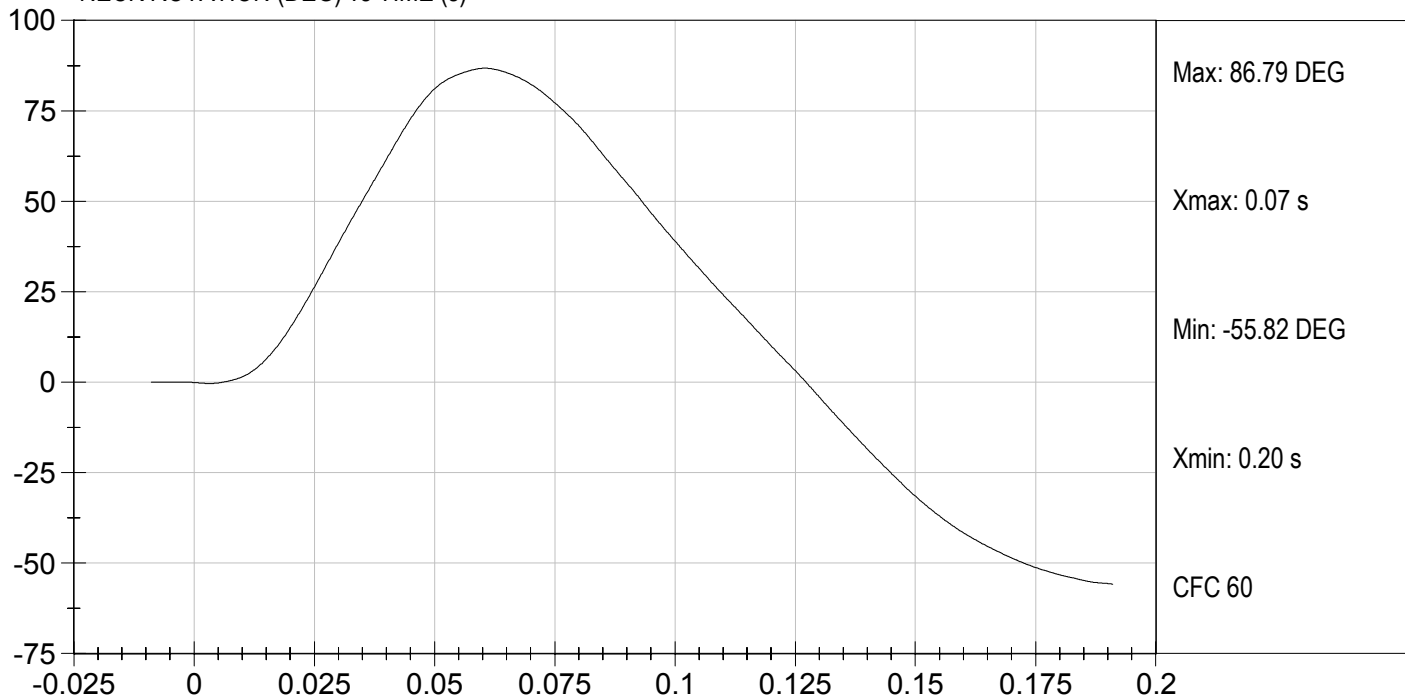
Test Desc: Neck Flexion
Componet ID: D042112

Test Date: 09/06/2004
Velocity: 22.89 ft/s, 6.98 m/s

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



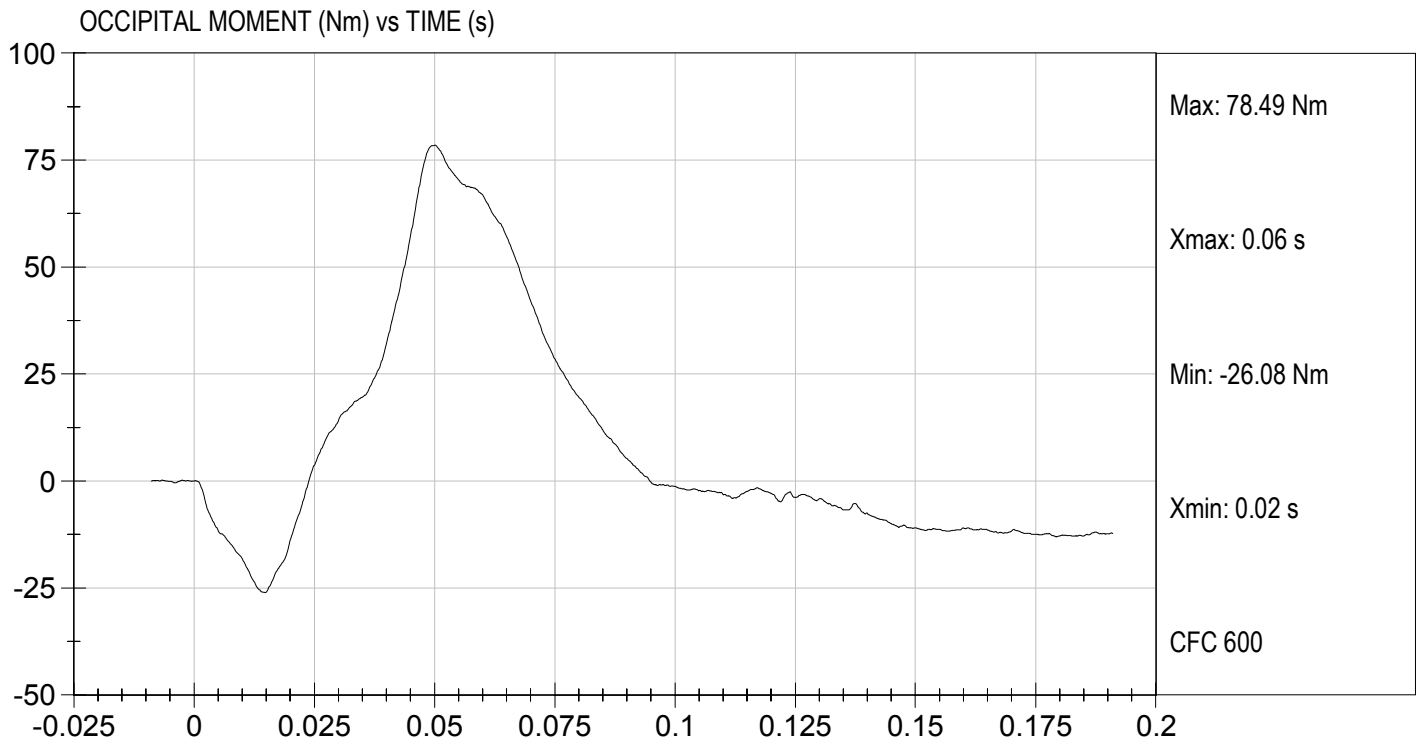
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D042112

Test Date: 09/06/2004
Velocity: 22.89 ft/s, 6.98 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505 Test Date 9/06/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 53%

Record the minimum humidity 40%

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

Record findings and actions: No Damage.

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

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

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.8 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.7 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.2 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	$\frac{-65}{109} \text{ Nm @ degrees}$
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	96 ms

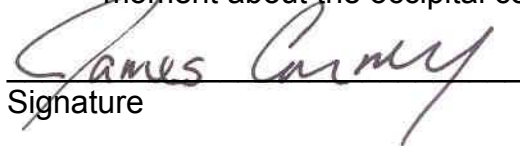
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

9/06/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

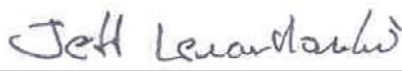
Test I.D: D042113

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.11	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	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-65	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	96	Pass
Overall Results					Pass


 Laboratory Technician

09/06/2004

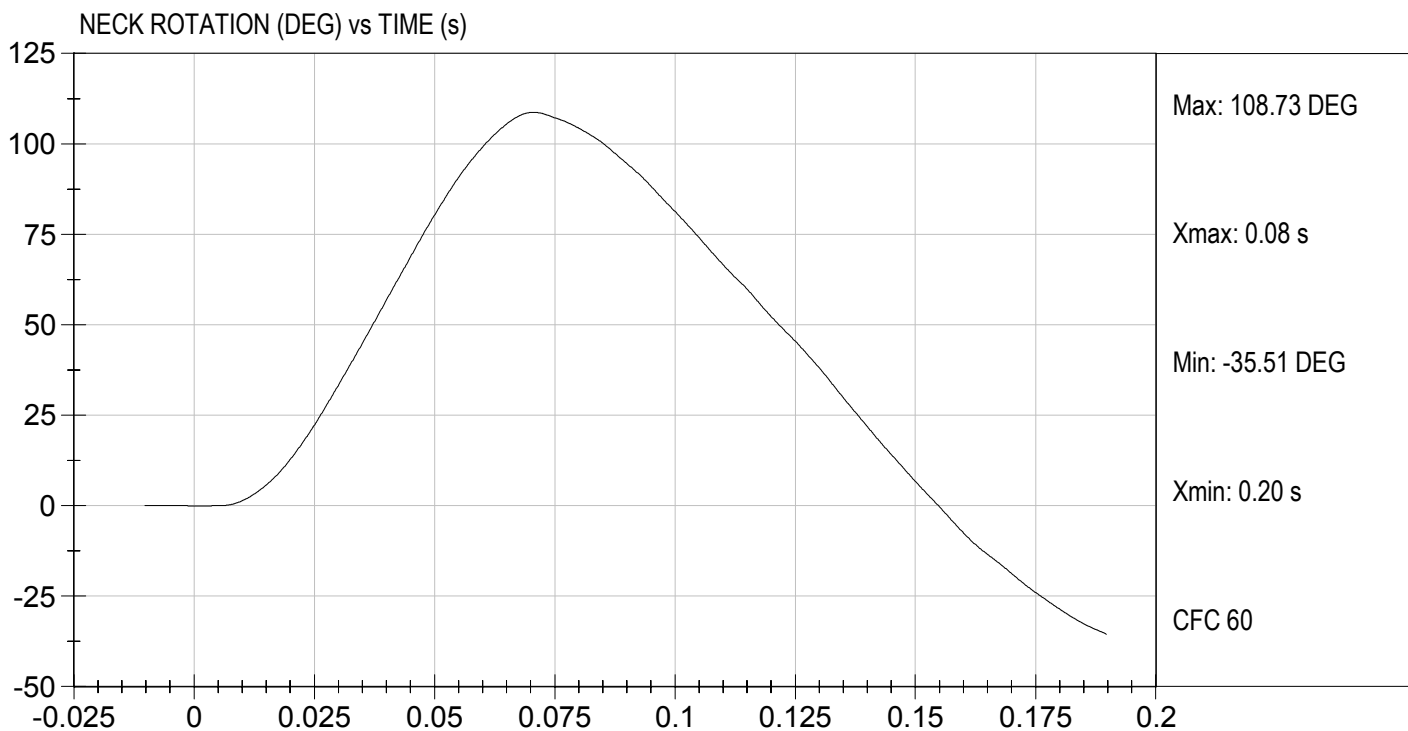
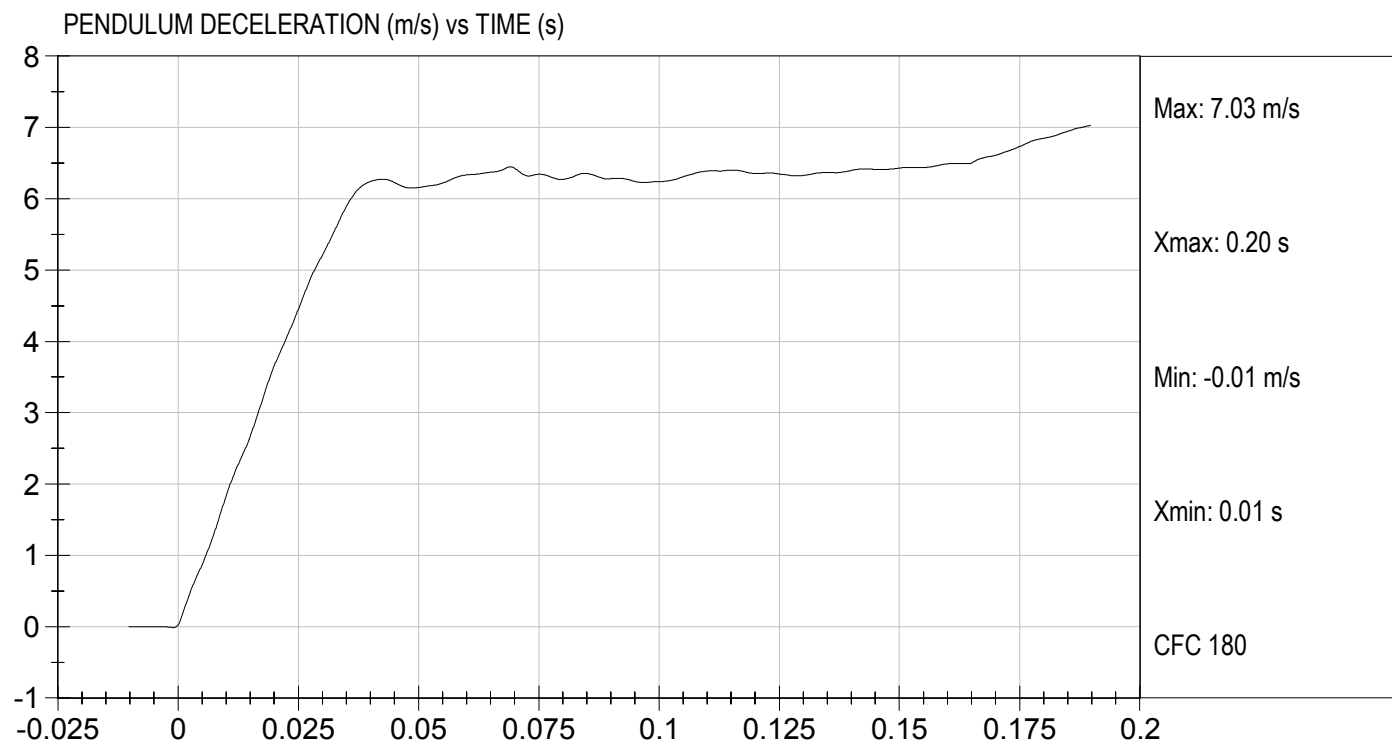
Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D042113

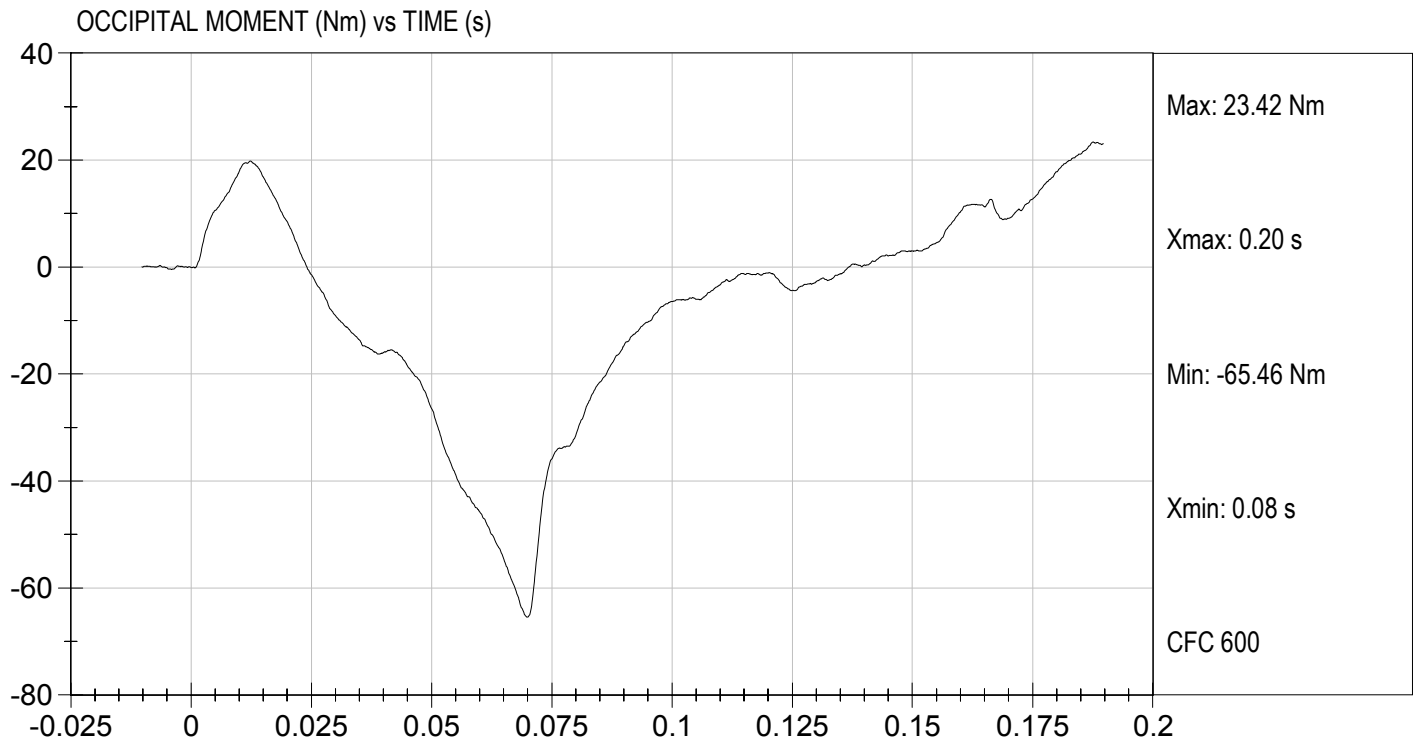
Test Date: 09/06/2004
Velocity: 20.05 ft/s, 6.11 m/s





Test Desc: Neck Extension
Componet ID: D042113

Test Date: 09/06/2004
Velocity: 20.05 ft/s, 6.11 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 9/07/04

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 20.6

Record the maximum humidity 48

Record the minimum humidity 40

☒ 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.64 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	53
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4250 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4246 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	70%

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

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

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

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

Jessica Hall
Signature

9/07/04
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

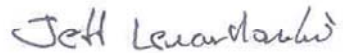
ATD Serial No: 505

Test I.D: D042114

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.6	Pass
Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	6.59 to 6.83	6.64	Pass
Peak Deflection	mm	50 to 58	53.4	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4246	Pass
			Overall Test Results	Pass


 Laboratory Technician

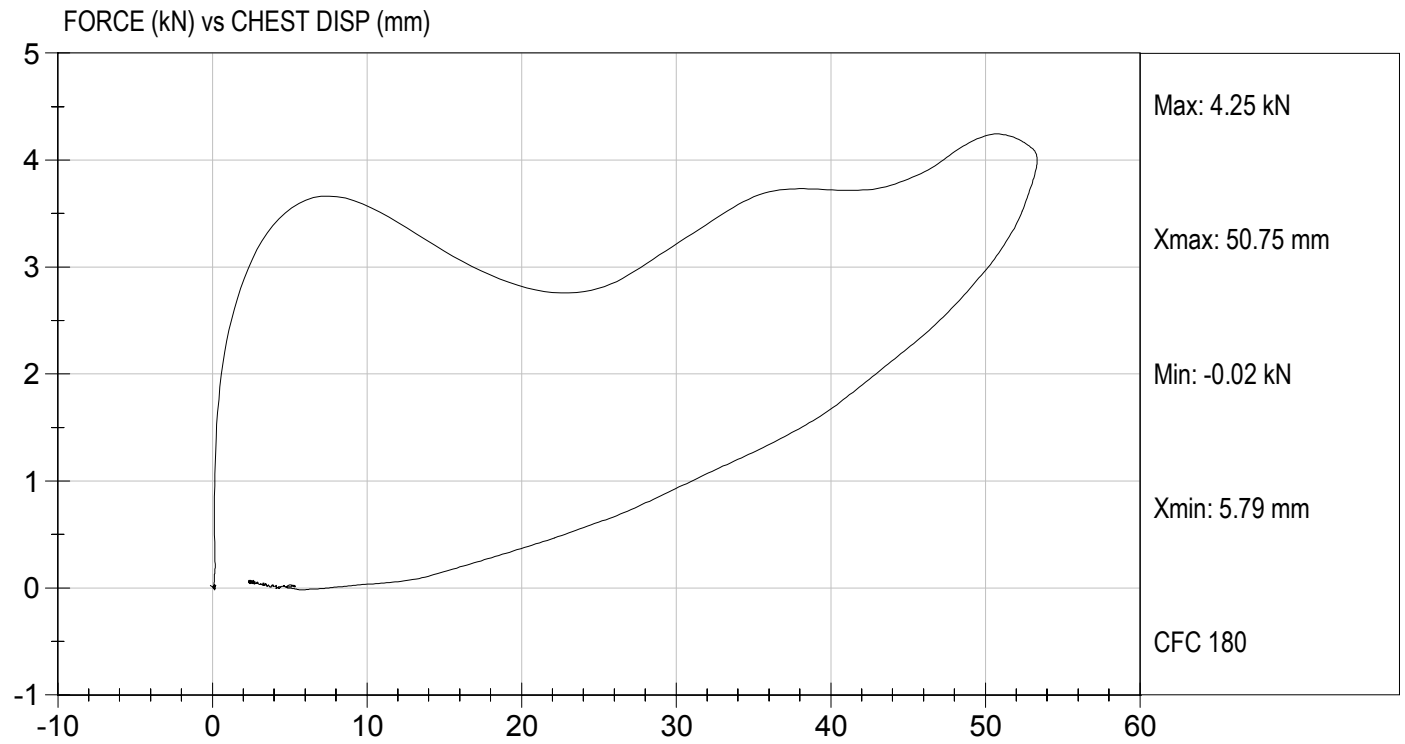
09/07/2004
 Test Date


 Approved By



Test Desc: Thorax Impact
Componet ID: D042114

Test Date: 09/07/2004
Velocity: 21.8 ft/s, 6.64 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505 Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 21.4

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 40%

☒ 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 $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	387 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	21°



 Signature

9/07/04

 Date

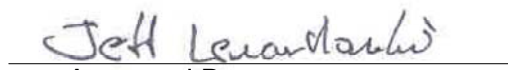
MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D042117

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	387	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician


Approved By

09/07/2004
Test Date

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 20.6

Record the maximum humidity 48%

Record the minimum humidity 40%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 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))

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


Signature

9/07/04
Date

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

ATD Serial No: 505

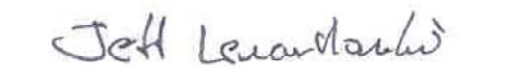
Test I.D: D042116

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.65	Pass
Overall Test Results				Pass


Laboratory Technician

09/07/2004

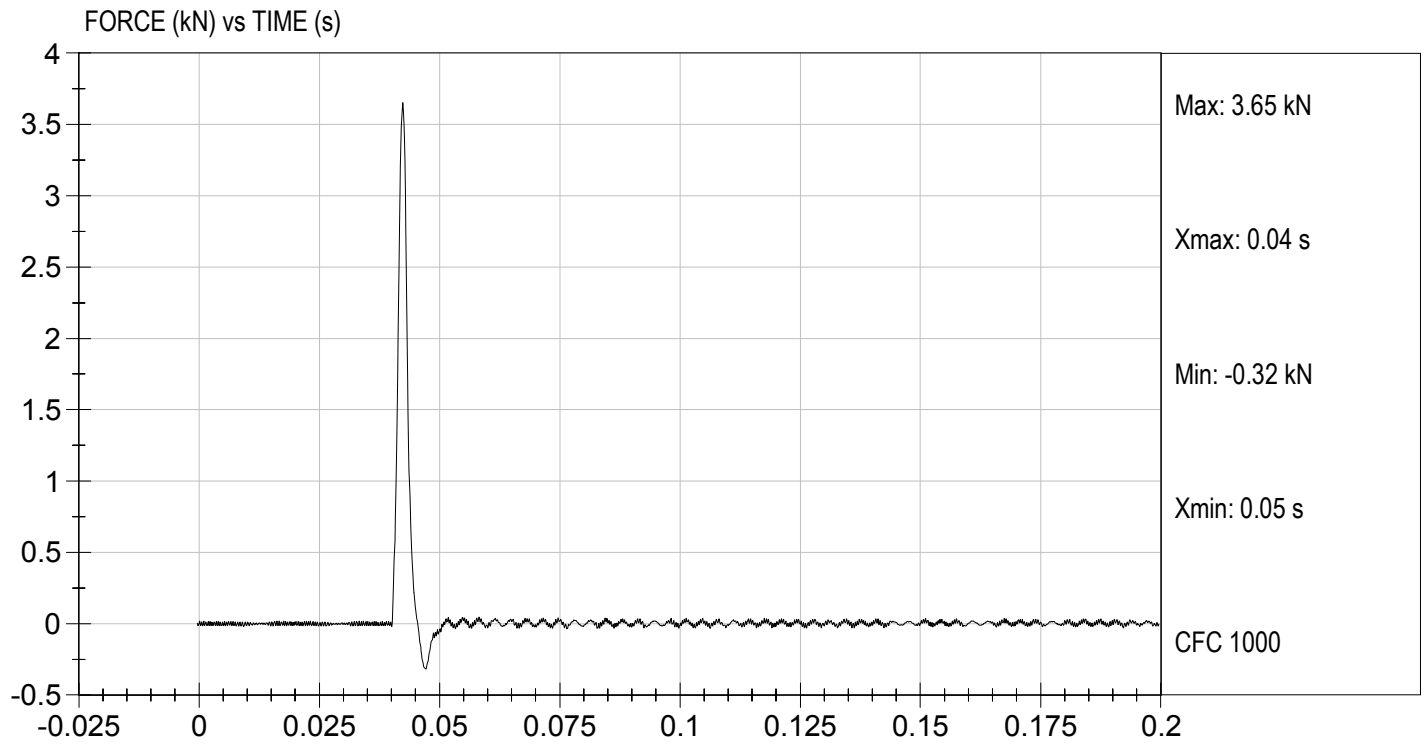
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D042116

Test Date: 09/07/2004
Velocity: 6.92 ft/s, 2.11 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 9/07/04

Technician David Wilcox

☐ Pretest calibration

☒ Post test calibration verification

Test attempt no. 2 (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 20.6

Record the maximum humidity 48 %

Record the minimum humidity 40 %

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

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

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

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

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

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

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

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

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



Signature

9/07/04

Date

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

ATD Serial No: 505

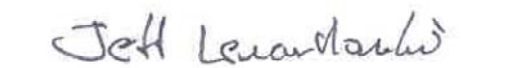
Test I.D: D042115

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.66	Pass
Overall Test Results				Pass


Laboratory Technician

09/07/2004

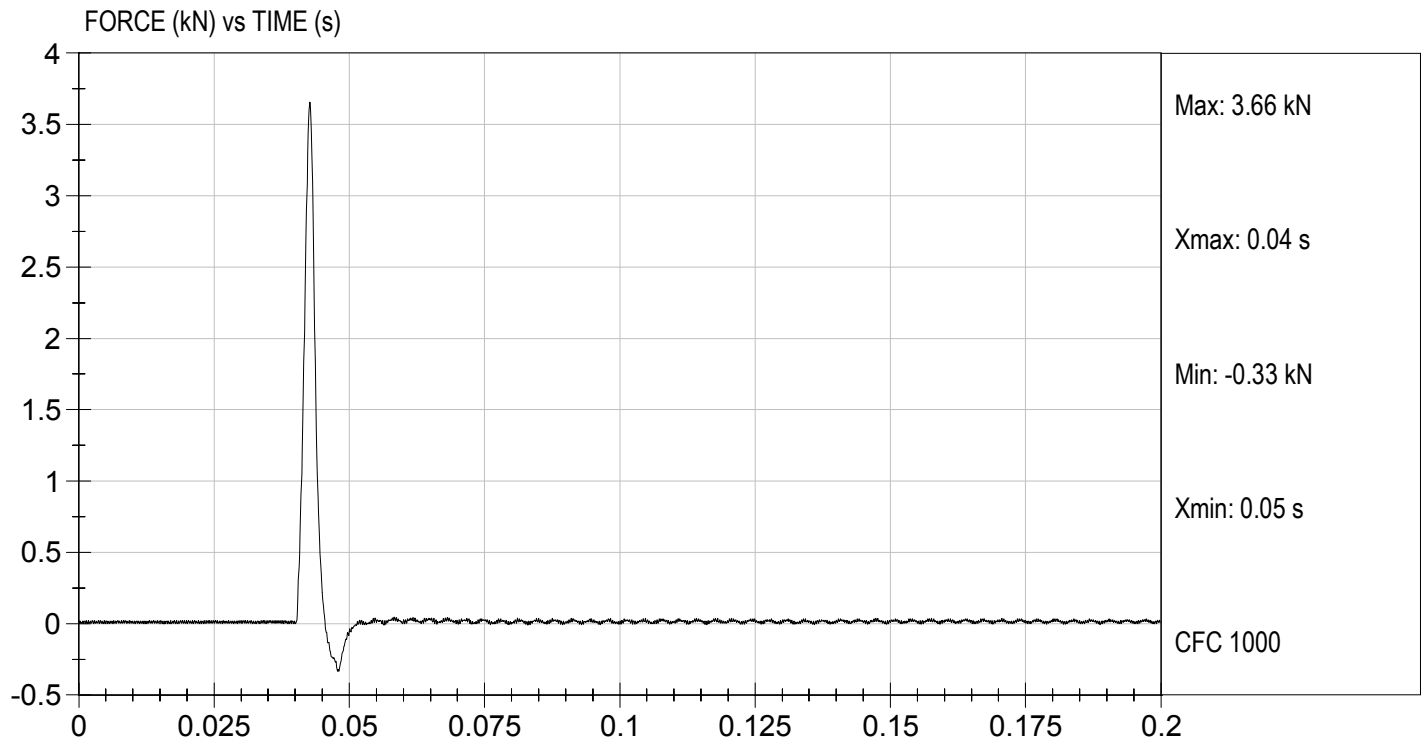
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D042115

Test Date: 09/07/2004
Velocity: 6.92 ft/s, 2.11 m/s



DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 505

Test Date 9/03/04

Technician Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damaged	OK
Outer skin	Gashes, rips, cracks			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

9/06/04
Date

Describe the repair or replacement of parts:

Checked by

Jeff Levan-Markus
Signature

9/06/04
Date

EXTERNAL DIMENSIONS

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

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

SN401, HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.6
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.4
C	H-POINT HEIGHT	Reference	3.3-3.5	3.4
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.5
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.6
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.1
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.6
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.7
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.5
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.4
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. “K”.	17.8-18.8	18.6

SN401, HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.5
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.3
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.6
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	3.8
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	38.9
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.6
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

DATA SHEET A3
HEAD DROP TEST (572.32)

Dummy Serial Number 401 Test Date 4/27/04

Technician Jessica Gall

☒ Pretest calibration
☐ Post test calibration verification

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

- ☒ 1. It has been at least 3 hours since the last head drop. (572.32(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))
- ☒ 3. Torque the skull cap screws to 160 lbf-in.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(ii))
- ☒ 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. (572.32(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.7</u> |
| Record the minimum temperature | <u>21.5</u> |
| Record the maximum humidity | <u>26%</u> |
| Record the minimum humidity | <u>25%</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, 1,1,1 trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 10. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))
Record the actual distance 14.8"

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

- X 11. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.
Record the right side distance 469mm
Record the left side distance 469mm
- X 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). (572.32(c)(4))
Record actual micro finish 656×10^{-6} mm
- X 13. The impact surface is rigidly supported. (572.32(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. (Figure 6A)
Record thickness 50.9mm
Record width 60.4mm
Record length 595mm
- 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. (572.32(b) & (572.32(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	$225 \text{ g} \leq x \leq 275 \text{ g}$	246
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	11

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

Jessica Hall
Signature

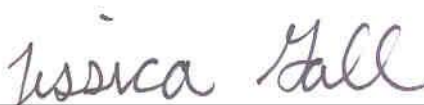
4/27/04
Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Head Drop Calibration

ATD Serial No: 401

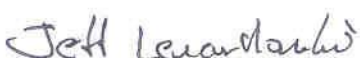
Test I.D: D04971

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	26	Pass
Peak Resultant Acceleration	G's	225.0 to 275.0	246.1	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	11.4	Pass
Is Acceleration Unimodal?	Yes/No	< 10% Peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

04/27/2004
Test Date



Approved By



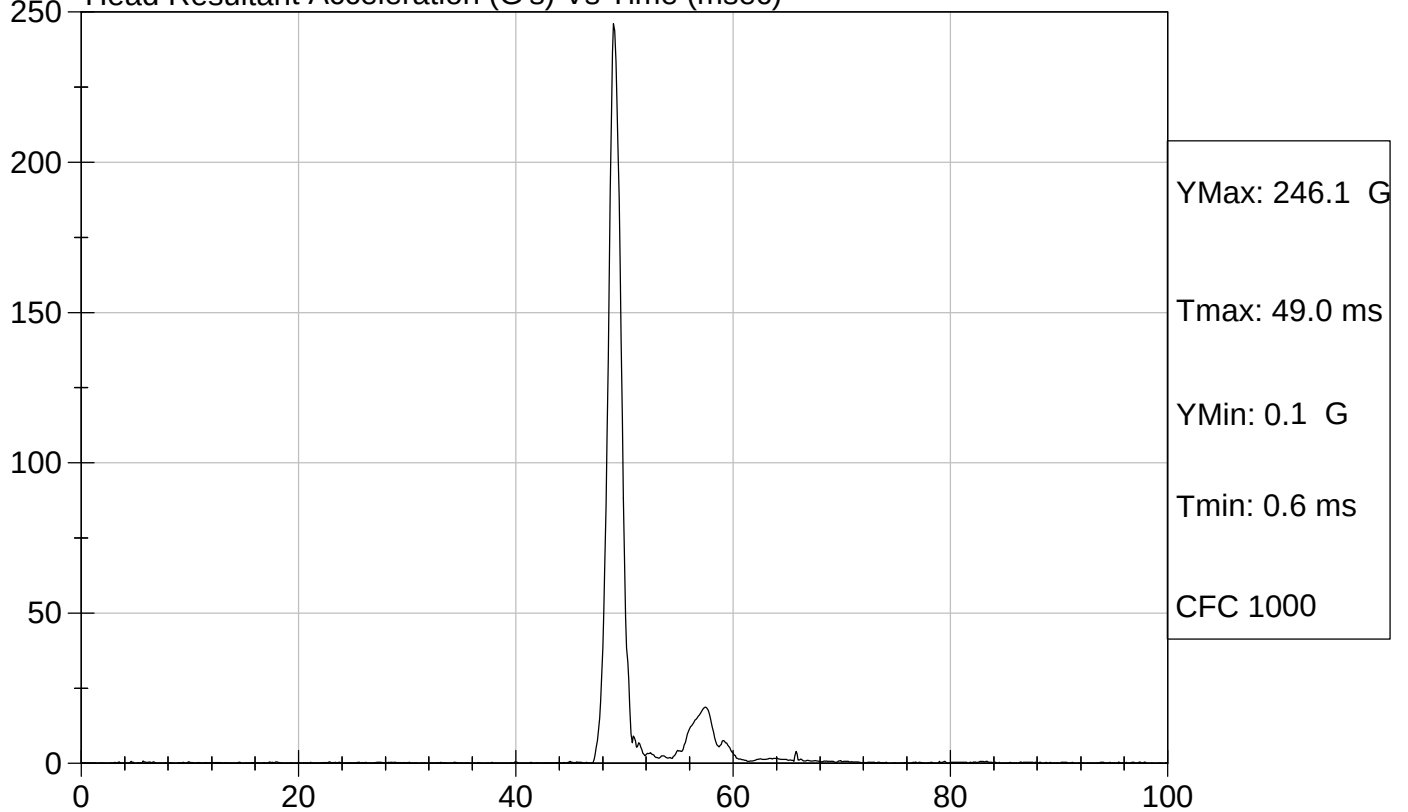
Test Description: Head Drop

Test Date: 04/27/2004

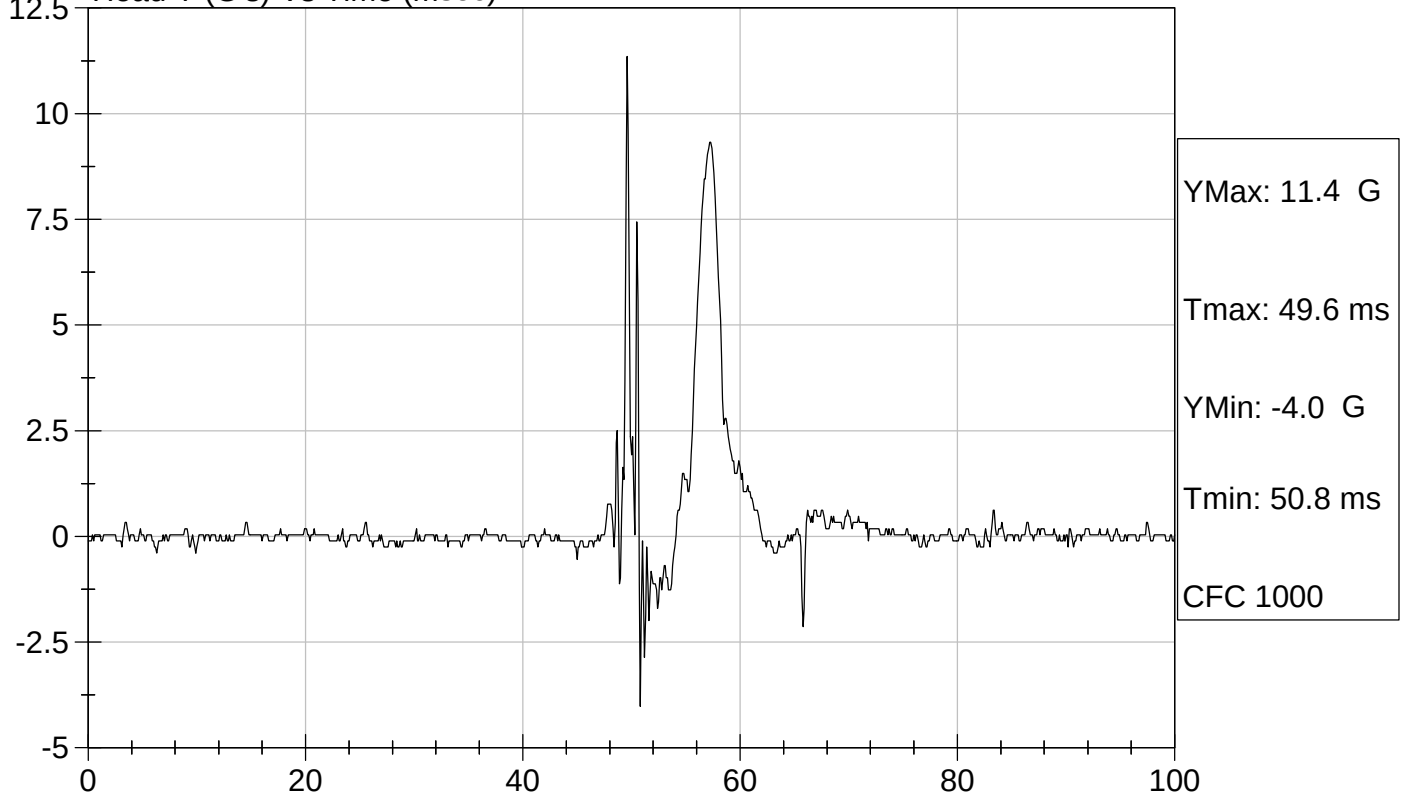
Component: D04971

Speed: 0 ft/s, 0.00 m/s

Head Resultant Acceleration (G's) Vs Time (msec)



Head Y (G's) Vs Time (msec)



DATA SHEET A4
NECK FLEXION TEST (572.33)

Dummy Serial Number 401

Test Date 4/27/04

Technician Dave Wilcox

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 21.7

Record the minimum temperature 21.5

Record the maximum humidity 26%

Record the minimum humidity 25%

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

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

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

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

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

☐ N/A – post test calibration

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

X 13. Complete the following table:

Neck Flexion Test Results (572.33(b)(1) & (572.33(c)(4))		
Parameter	Specification	Result
Pendulum impact speed	$22.6 \text{ ft/sec} \leq \text{speed} \leq 23.4 \text{ ft/sec}$	22.8
Pendulum Deceleration Versus Time Pulse	@ 10ms	$22.5 \leq g \leq 27.5$
	@ 20 ms	$17.6 \leq g \leq 22.6$
	@30ms	$12.5 \leq g \leq 18.5$
	Above 30 ms	29 g maximum
First Pendulum Decay to 5g	$34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$	36
Plane D Rotation	$64^\circ \leq \text{max. rotation} \leq 78^\circ$	75
	$57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$	58
Time for Plane D Rotation to Cross 0° During First Rebound	$113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$	117
Maximum Moment	$65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$	67
	$47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$	50
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)	$97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$	97

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

M_y = Moment in lbf-ft measured by the transducer

F_x = Force, in lbf measured by the transducer

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

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



Signature

4/27/04

Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Neck Flexion Test

ATD Serial No: 401

Test I.D: D04972

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	25	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 msec	G's	22.50 to 27.50	24.78	Pass
	20 msec	G's	17.60 to 22.60	21.08	Pass
	30 msec	G's	12.50 to 18.50	15.71	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 29.0	15.71	Pass
Deceleration Decay Time to Cross 5 G's		msec	34.0 to 42.0	36.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	64.0 to 78.0	74.8	Pass
	Time	msec	57.0 to 64.0	58.3	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	113.0 to 128.0	117.0	Pass
Moment About Occipital Condyle	Maximum	N m	88.1 to 108.5	90.5	Pass
	Time	msec	47.0 to 58.0	49.7	Pass
Positive Moment Decay Time To Zero Crossing		msec	97.0 to 107.0	97.2	Pass
Overall Test Results					Pass


 Laboratory Technician

04/27/2004
 Test Date

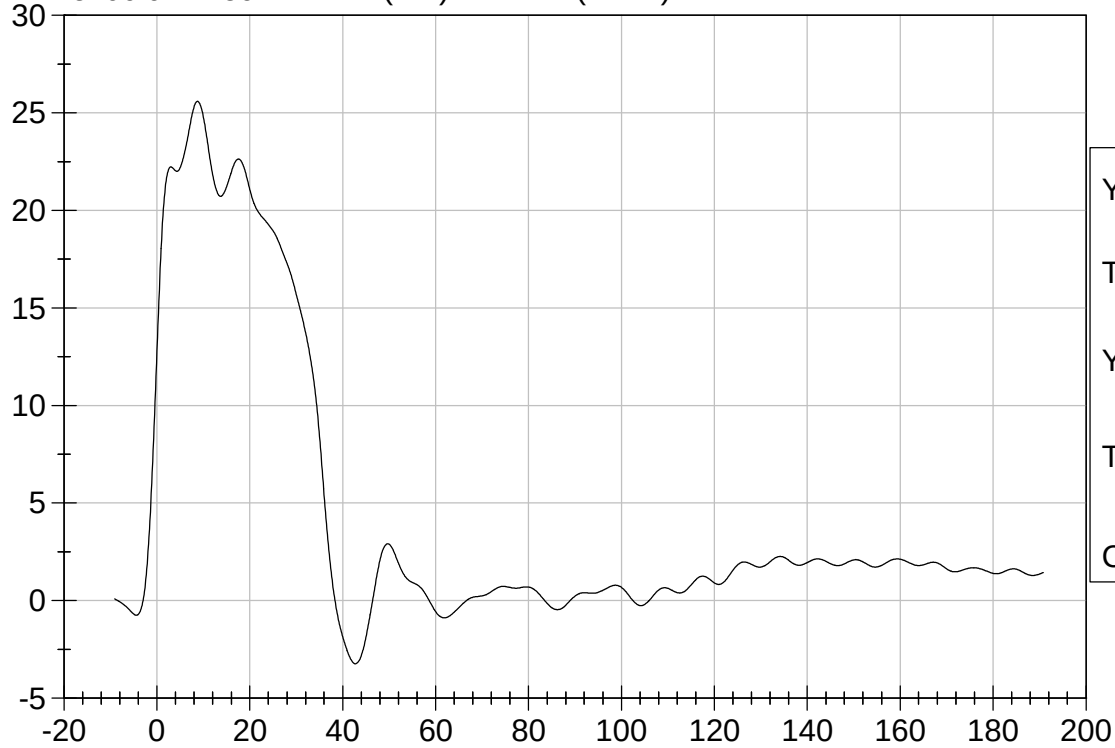

 Approved By



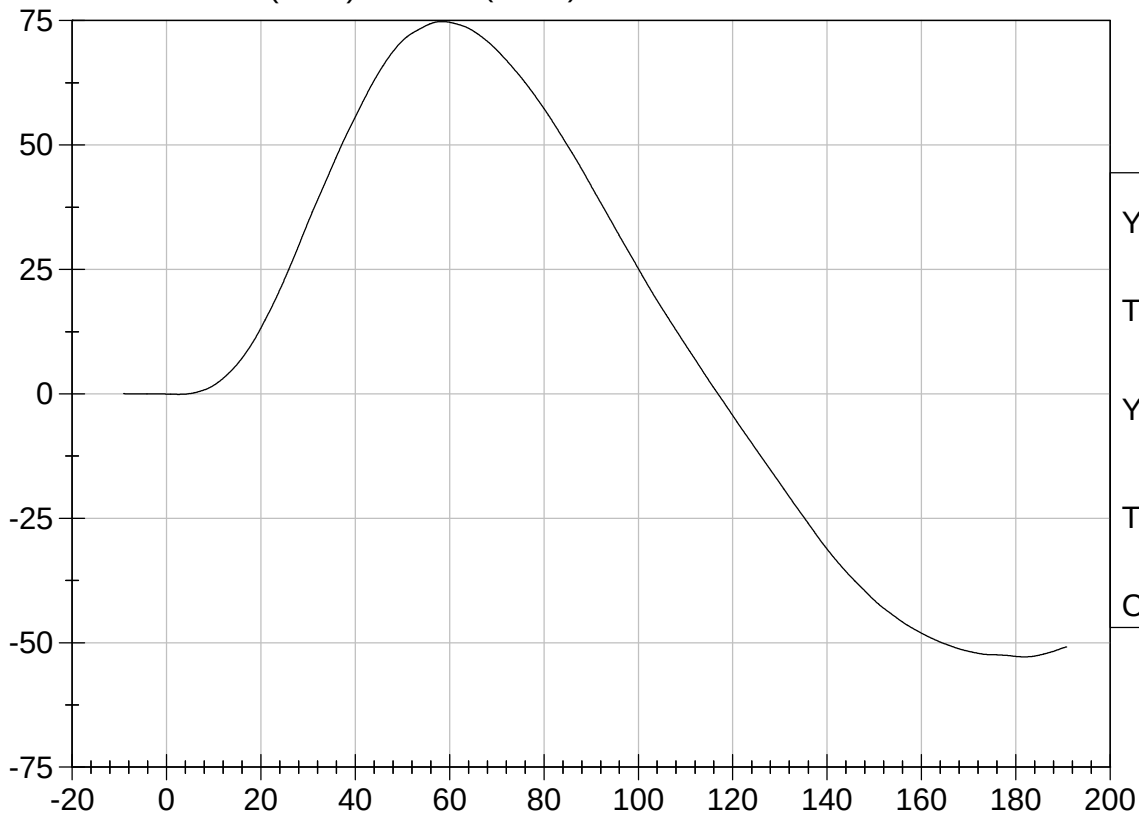
Test Desc: Neck Flexion
Component ID: D04972

Test Date: 04/27/2004
Speed: 22.84 ft/sec, 6.96 m/sec

Pendulum Deceleration (G's) vs Time (msec)



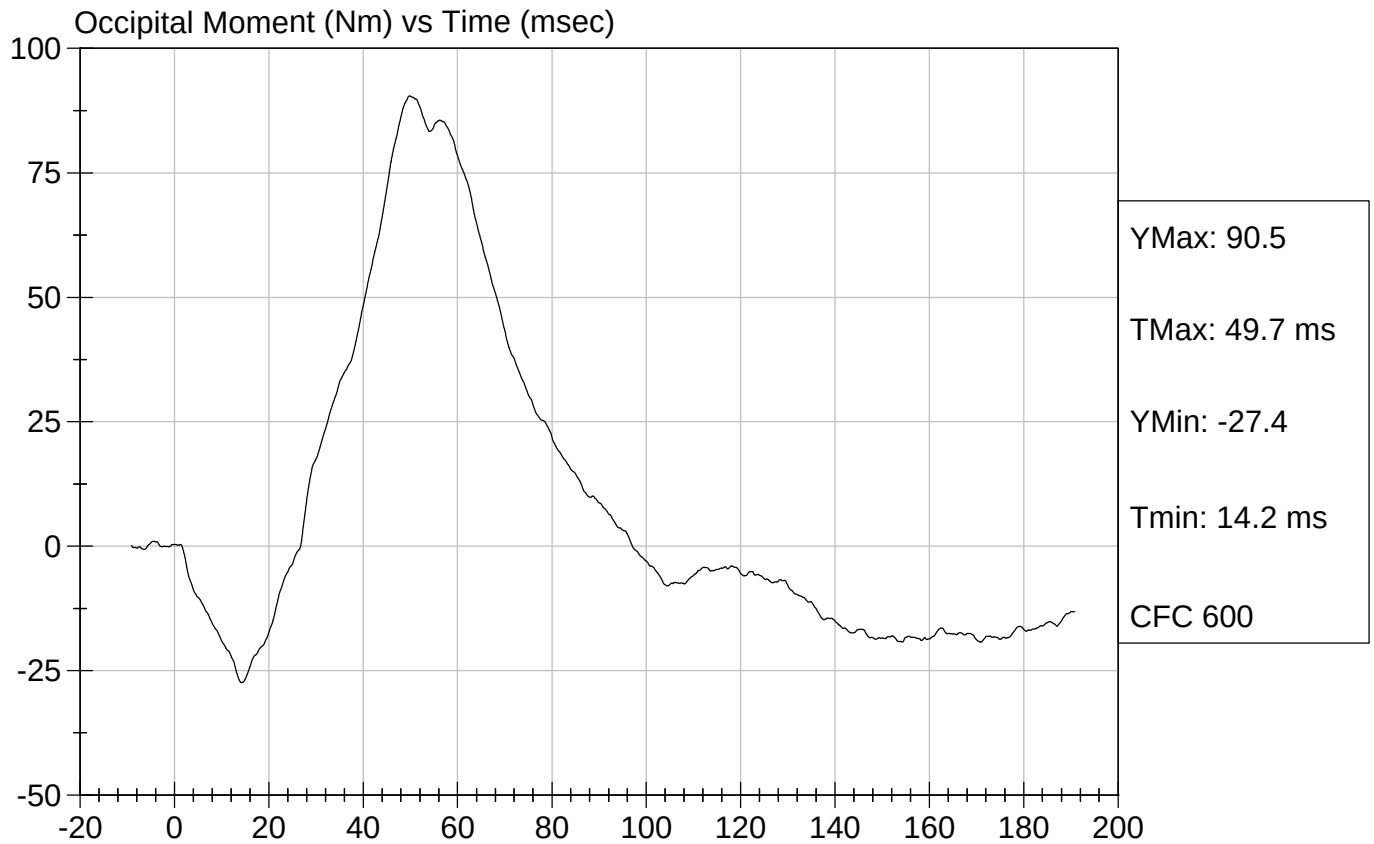
Neck Rotation (DEG) vs Time (msec)





Test Desc: Neck Flexion
Component ID: D04972

Test Date: 04/27/2004
Speed: 22.84 ft/sec, 6.96 m/sec



DATA SHEET A5
NECK EXTENSION TEST (572.33)

Dummy Serial Number 401 Test Date 4/27/04
Technician Dave Wilcox

☒ Pretest calibration
☐ Post test calibration verification

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

- ☐ 1. It has been at least 30 minutes since the last extension test. (572.36(m))
☒ N/A, ONLY one extension test performed
- ☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.33(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.7</u> |
| Record the minimum temperature | <u>21.5</u> |
| Record the maximum humidity | <u>26%</u> |
| Record the minimum humidity | <u>25%</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 88; Rear 85

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

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		$19.5 \text{ ft/sec} \leq \text{speed} \leq 20.3 \text{ ft/sec}$	20.2
Pendulum Deceleration versus time pulse	@ 10ms	$17.2 \leq g \leq 21.2$	19.3
	@ 20 ms	$14 \leq g \leq 19$	14.3
	@30ms	$11.0 \leq g \leq 16.0$	12.3
	Above 30 ms	22 g maximum	12
First Pendulum Decay to 5g		$38 \text{ ms} \leq \text{time} \leq 46 \text{ ms}$	44
Plane D Rotation		$81^\circ \leq \text{max. rotation} \leq 106^\circ$	100
		$72 \text{ ms} \leq \text{time of max. rotation} \leq 82 \text{ ms}$	79
Time for Plane D Rotation to Cross 0° During First Rebound		$147 \text{ ms} \leq \text{time} \leq 174 \text{ ms}$	160
Maximum Moment		$-59 \text{ lbf-ft} \leq \text{moment} \leq -39 \text{ lbf-ft}$	-47
		$65 \text{ ms} \leq \text{time} \leq 79 \text{ ms}$	75
Time of first decay to 0 lbf-ft Negative Moment Decay** (Extension)		$120 \text{ ms} \leq \text{time} \leq 148 \text{ ms}$	142

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Signature 

4/27/04
Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Neck Extension Test

ATD Serial No: 401

Test I.D: D04973

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	25	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.14	Pass
Pendulum Deceleration	10 msec	G's	17.20 to 21.20	19.28	Pass
	20 msec	G's	14.00 to 19.00	14.32	Pass
	30 msec	G's	11.00 to 16.00	12.30	Pass
Peak Pendulum Deceleration After 30 msec		G's	<= 22.0	12.3	Pass
Deceleration Decay Time to Cross 5 G's		msec	38.0 to 46.0	44.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	99.8	Pass
	Time	msec	72.0 to 82.0	78.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		msec	147.0 to 174.0	159.6	Pass
Moment About Occipital Condyle	Minimum	N m	-52.9 to -79.9	-63.1	Pass
	Time	msec	65.0 to 79.0	74.6	Pass
Negative Moment Decay Time To Zero Crossing		msec	120.0 to 148.0	142.0	Pass
Overall Test Results					Pass



Laboratory Technician

04/27/2004

Test Date



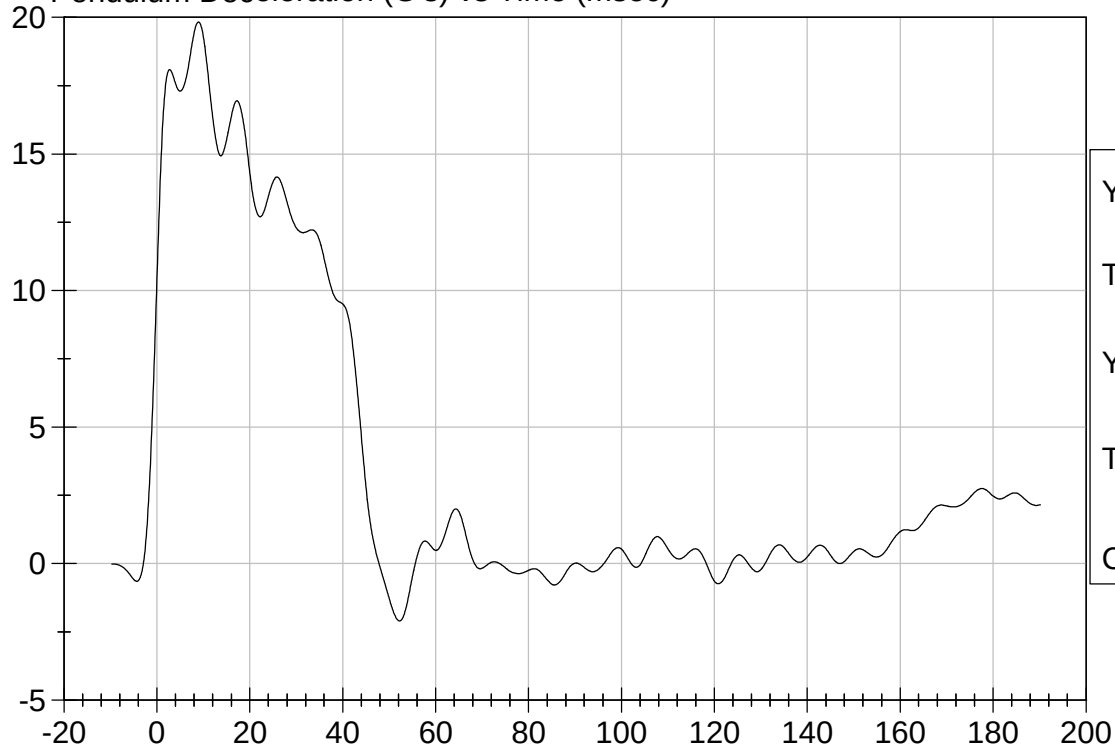
Approved By



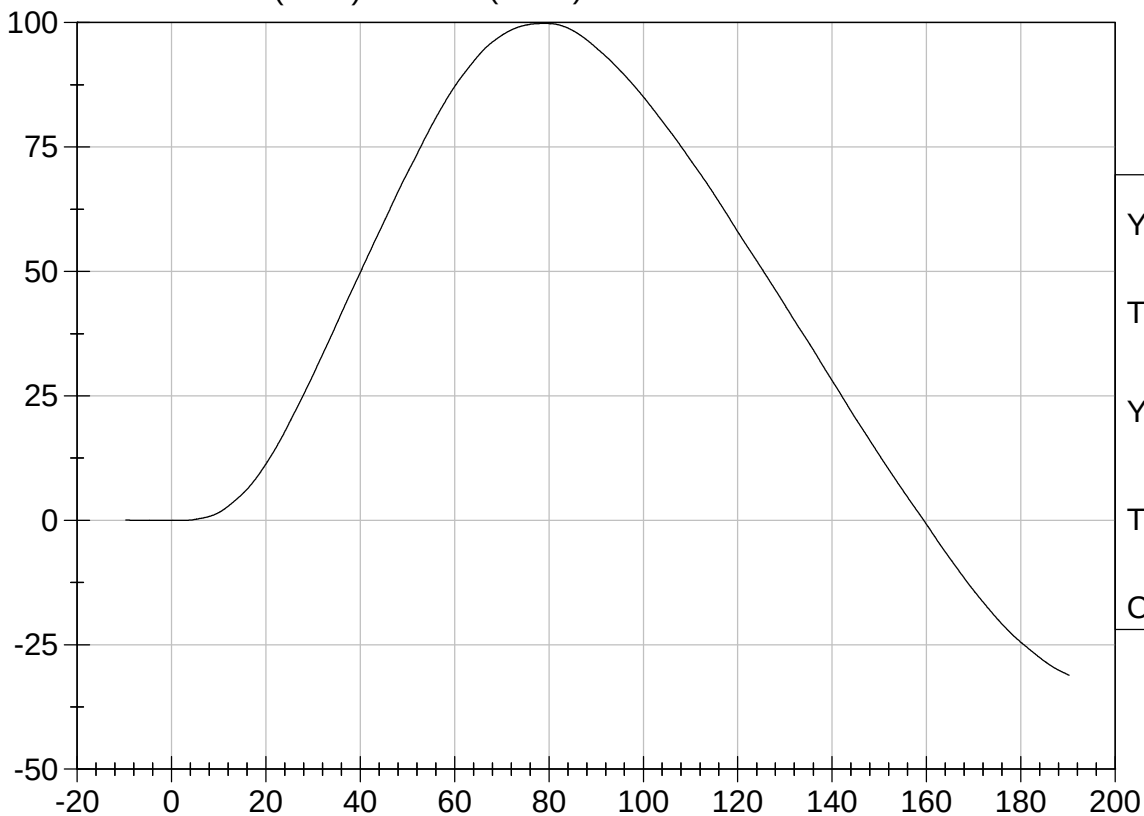
Test Desc: Neck Extension
Component ID: D04973

Test Date: 04/27/2004
Speed: 20.15 ft/sec, 6.14 m/sec

Pendulum Deceleration (G's) vs Time (msec)



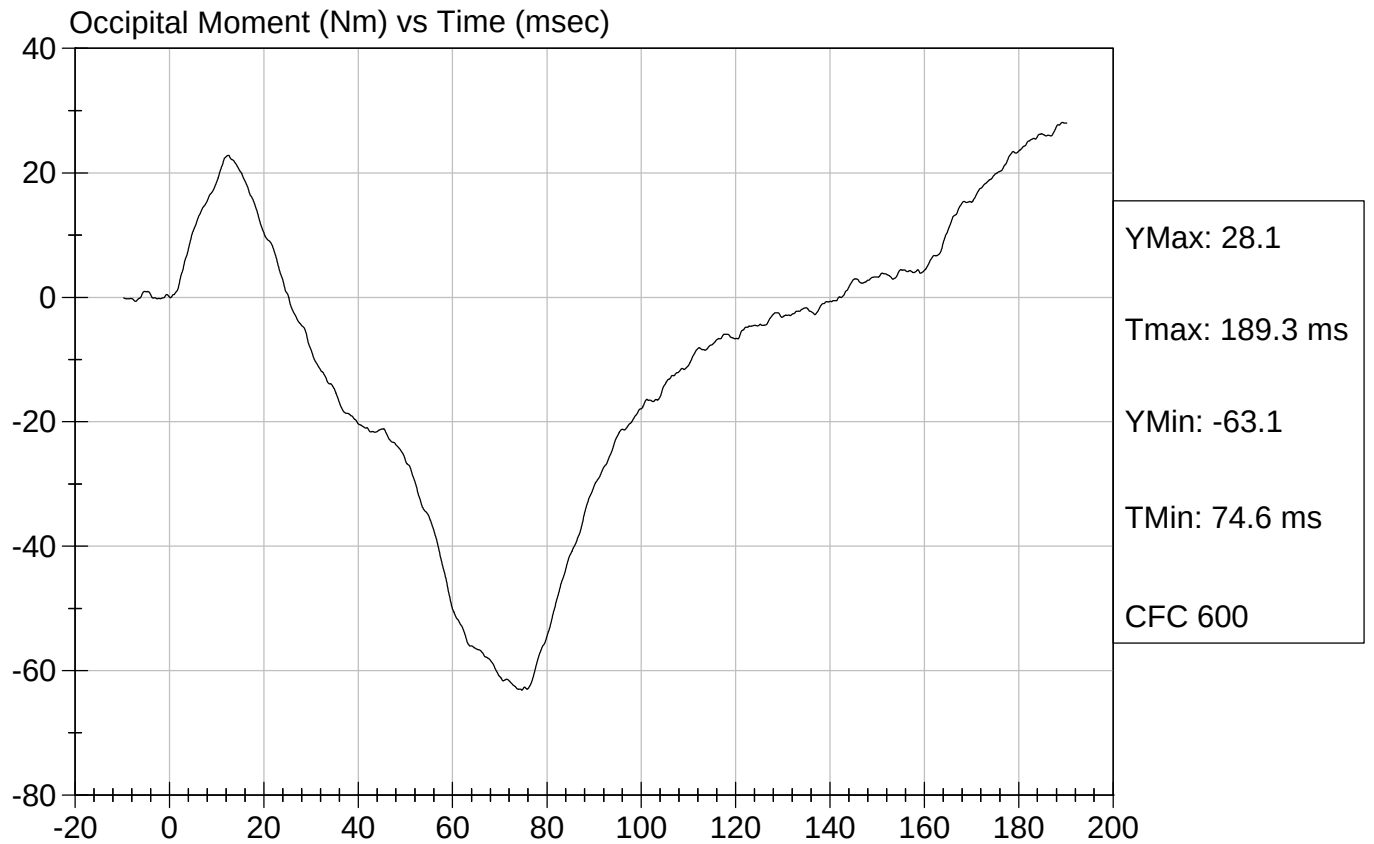
Neck Rotation (DEG) vs Time (msec)





Test Desc: Neck Extension
Component ID: D04973

Test Date: 04/27/2004
Speed: 20.15 ft/sec, 6.14 m/sec



DATA SHEET A6
THORAX IMPACT TEST (572.34)

Dummy Serial Number 401 Test Date 4/27/04

Technician James Carney

☒ Pretest calibration
☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 22.1

Record the minimum temperature 21.7

Record the maximum humidity 26%

Record the minimum humidity 25%

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

☒ - No damage

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

☐ - The following repairs or replacement was performed. Record

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

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

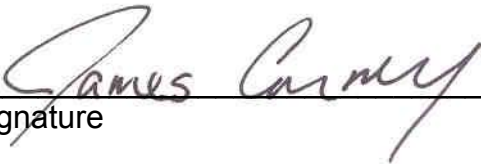
Parameter*	Specification	Result
Test Probe Speed	$21.6 \text{ f/s} \leq \text{speed} \leq 22.4 \text{ f/s}$	21.6
Chest Compression	$2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$	2.69
Peak resistance force**	$1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$	1247
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	72%

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

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

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

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


Signature

4/27/04
Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Thorax Impact Test

ATD Serial No: 401

Test I.D: D04974

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.1	Pass
Laboratory Relative Humidity	%	10 to 70	26	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	Newtons	5159 to 5893	5,545	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.83	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

04/27/2004
Test Date

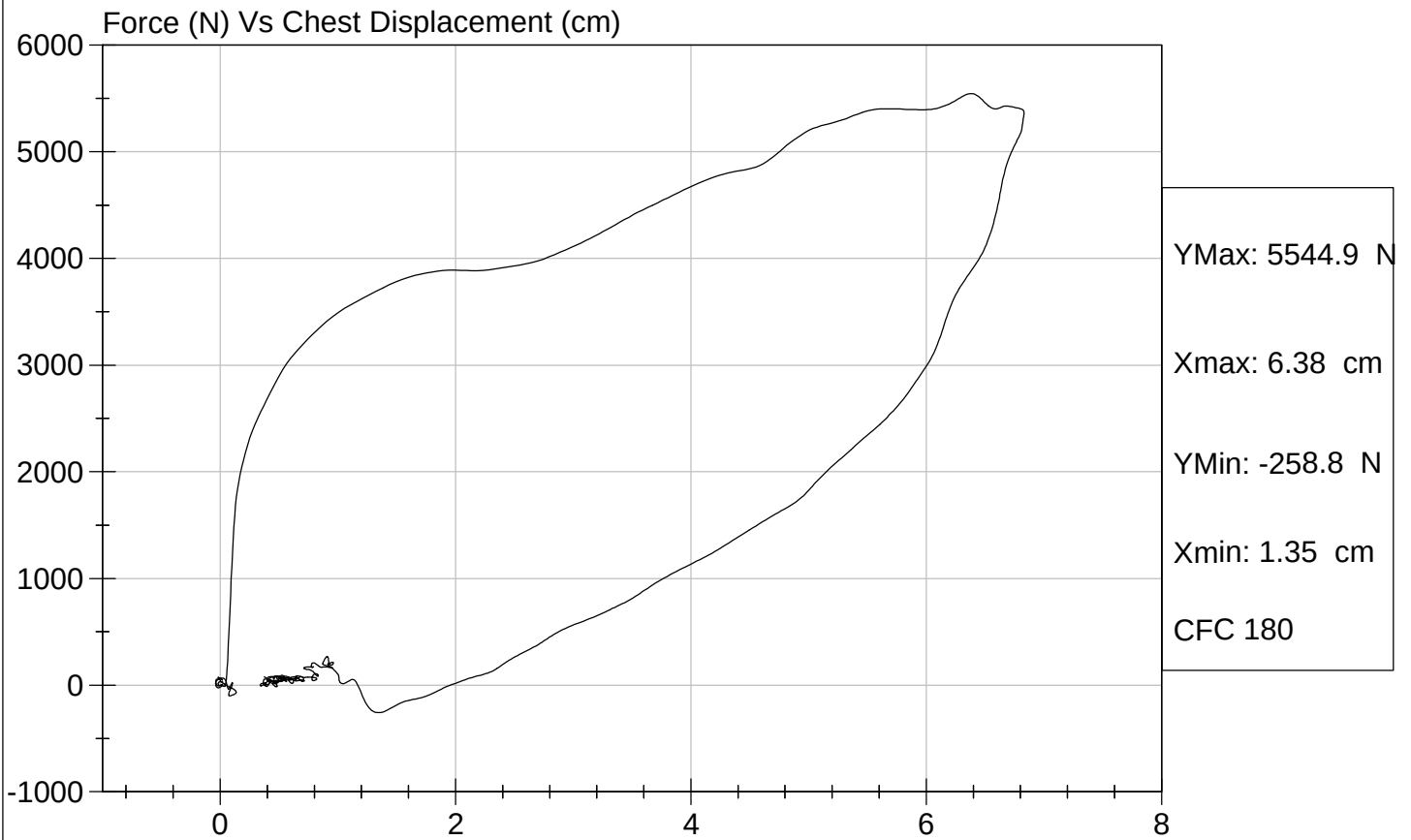


Test Description: Thorax Impact

Test Date: 04/27/2004

Component: D04974

Speed: 21.64 ft/sec, 6.60 m/sec



DATA SHEET A7
LEFT KNEE IMPACT TEST (572.35)

Dummy Serial Number 401

Test Date 4/27/04

Technician Dave Wilcox

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.2

Record the minimum temperature 21.6

Record the maximum humidity 26%

Record the minimum humidity 25%

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

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

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

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

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

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

☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s	6.8
Peak resistance force*	1060 lb $\leq$ force $\leq$ 1300 lb	1128

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

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



Signature

4/27/04

Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Left Knee Impact Test

ATD Serial No: 401

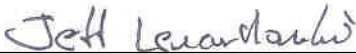
Test I.D: D04976

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.2	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	Newtons	4715 to 5782	5,017	Pass
Overall Test Results				Pass



Laboratory Technician

04/27/2004
Test Date



Approved By

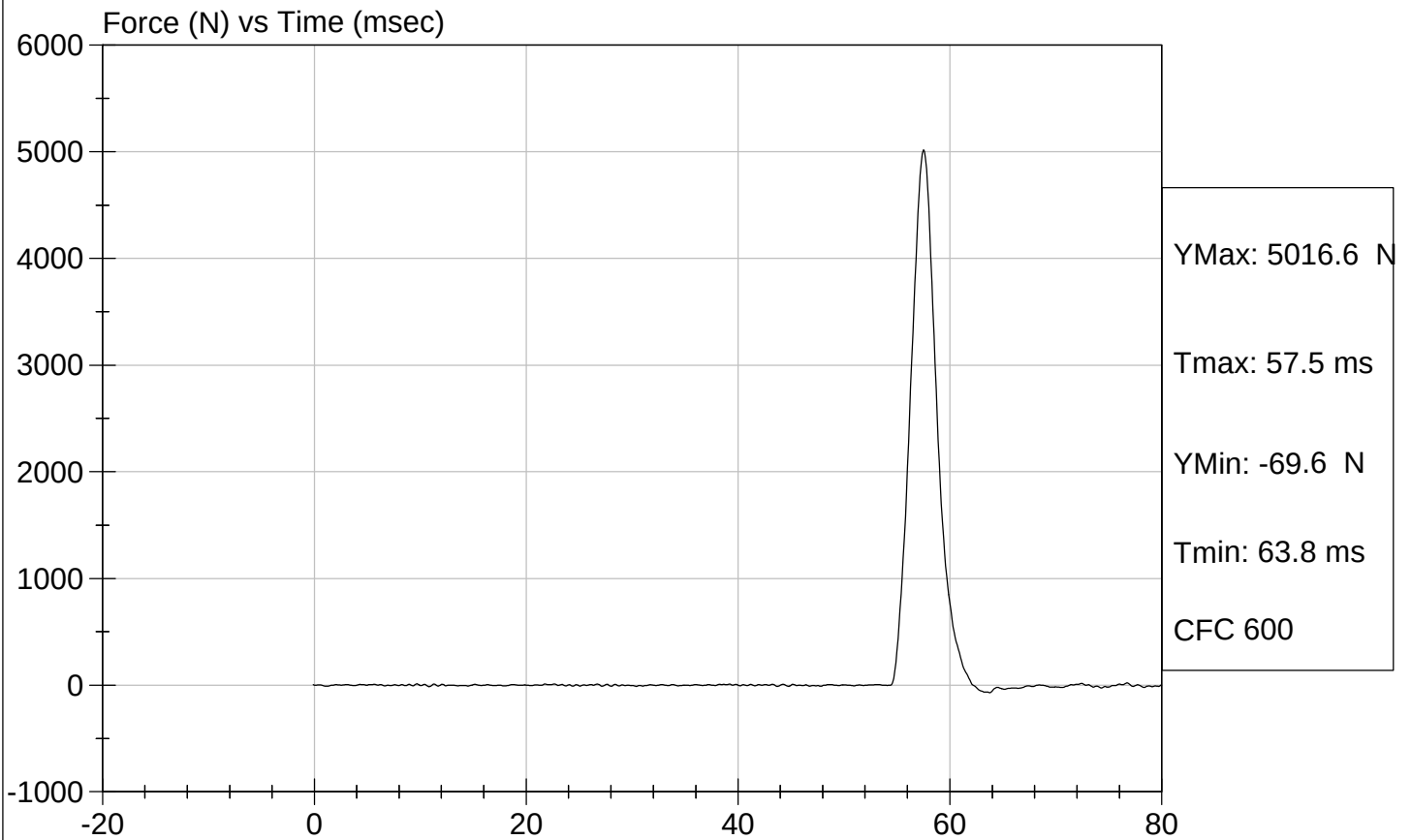


Test Description: Left Knee

Test Date: 04/27/2004

Component: D04976

Speed: 6.81 ft/sec, 2.076 m/sec



DATA SHEET A8
RIGHT KNEE IMPACT TEST (572.35)

Dummy Serial Number 401

Test Date 4/27/04

Technician James Carney

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.2

Record the minimum temperature 21.6

Record the maximum humidity 26%

Record the minimum humidity 25%

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

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

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

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

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

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

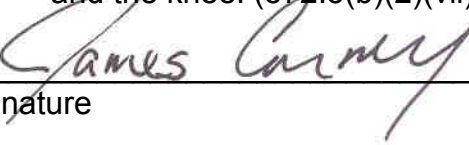
☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s $\leq$ speed $\leq$ 7.0 ft/s	6.9
Peak resistance force*	1060 lb $\leq$ force $\leq$ 1300 lb	1136

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

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


Signature

4/27/04
Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Right Knee Impact Test

ATD Serial No: 401

Test I.D: D04975

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	22.2	Pass
Laboratory Relative Humidity	%	10 to 70	25	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	Newtons	4715 to 5782	5,052	Pass
Overall Test Results				Pass


Laboratory Technician


Approved By

04/27/2004
Test Date

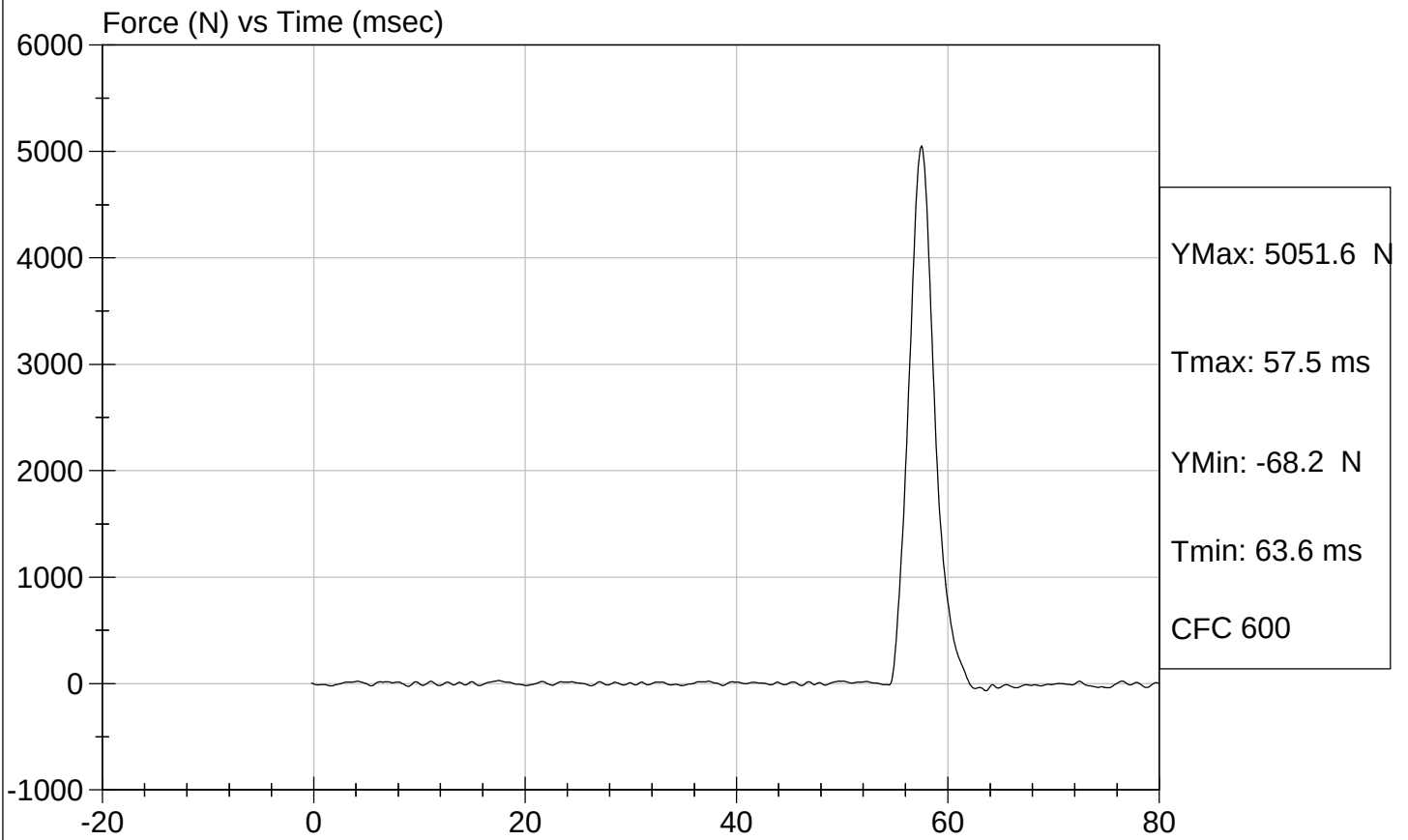


Test Description: Right Knee

Test Date: 04/27/2004

Component: D04975

Speed: 6.89 ft/sec, 2.100 m/sec



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

Dummy Serial Number 401

Test Date 4/27/04

Technician James Carney

☒ Pretest calibration

☐ Post test calibration verification

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

- ☐ 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))
☒ N/A, ONLY one hip joint-femur flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 17A.
- ☒ 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):
☒ 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)
☒ 3.2 remove the abdominal insert (78051-52)
☒ 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- ☒ 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>22.6</u> |
| Record the minimum temperature | <u>21.8</u> |
| Record the maximum humidity | <u>26%</u> |
| Record the minimum humidity | <u>25%</u> |
- ☒ 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- ☒ 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- ☒ 7. Adjust the threaded rods until plane B is horizontal.
- ☒ 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))
- ☒ 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$	8
Femur Torque at 30°	$\text{torque} \leq 70 \text{ ft-lbf}$	51
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	44

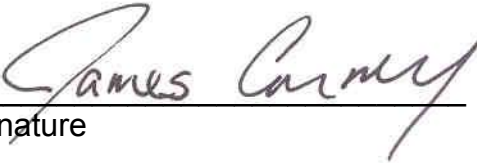
X 11. Secure the lever arm into the right femur shaft opening of the upper leg structure assembly (78051-44) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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

X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ} \leq \text{rotation rate} \leq 10^{\circ}$	8
Femur Torque at 30°	$\text{torque} \leq 70 \text{ ft-lbf}$	58
Rotation at 15 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	43


Signature

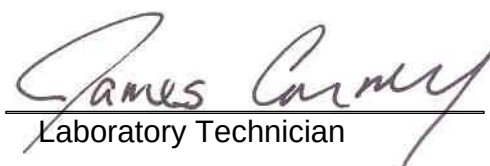
4/27/04
Date

Hybrid III Calibration Data Sheet
50th Percentile Male
Hip-Femur Flexion Test

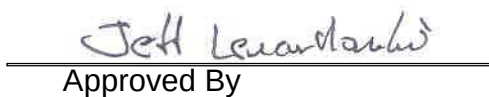
ATD Serial No: 401

Test I.D: D04970

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22.6	22.6	Pass
Laboratory Relative Humidity	%	10 to 70	26	26	Pass
Rotation Rate	deg/sec	5 -10	8	8	Pass
30 Degrees	Nm	94.9 Nm Max	79.0	68.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40- 50 Degree Max Rotation	43	44	Pass
Overall Test Results					Pass


 Laboratory Technician

04/27/2004
 Test Date


 Approved By

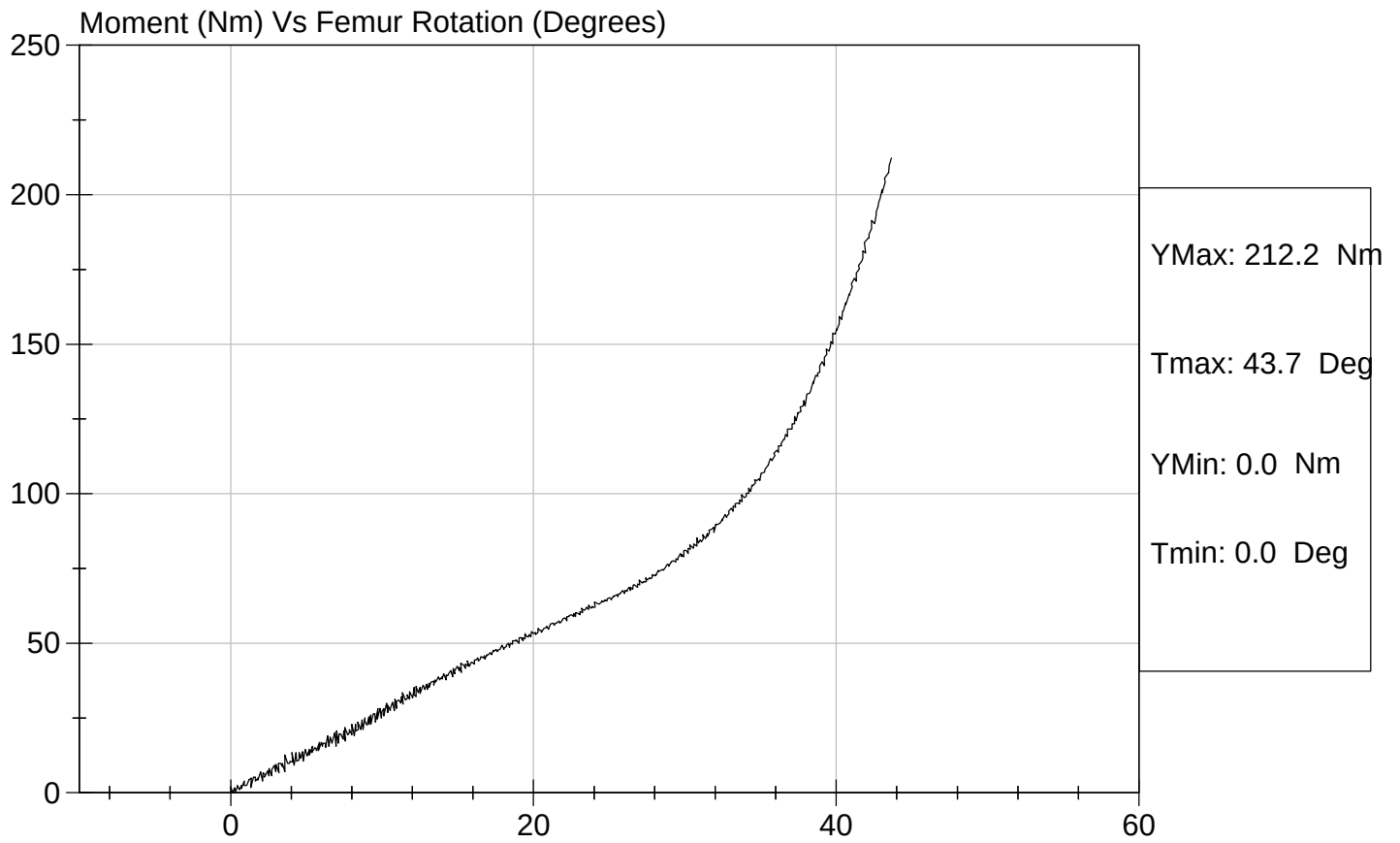


Test Description: Hip Femur Flexion

Test Date: 04/27/2004

Component: D04979

Speed: 0 ft/sec, 0.00 m/sec



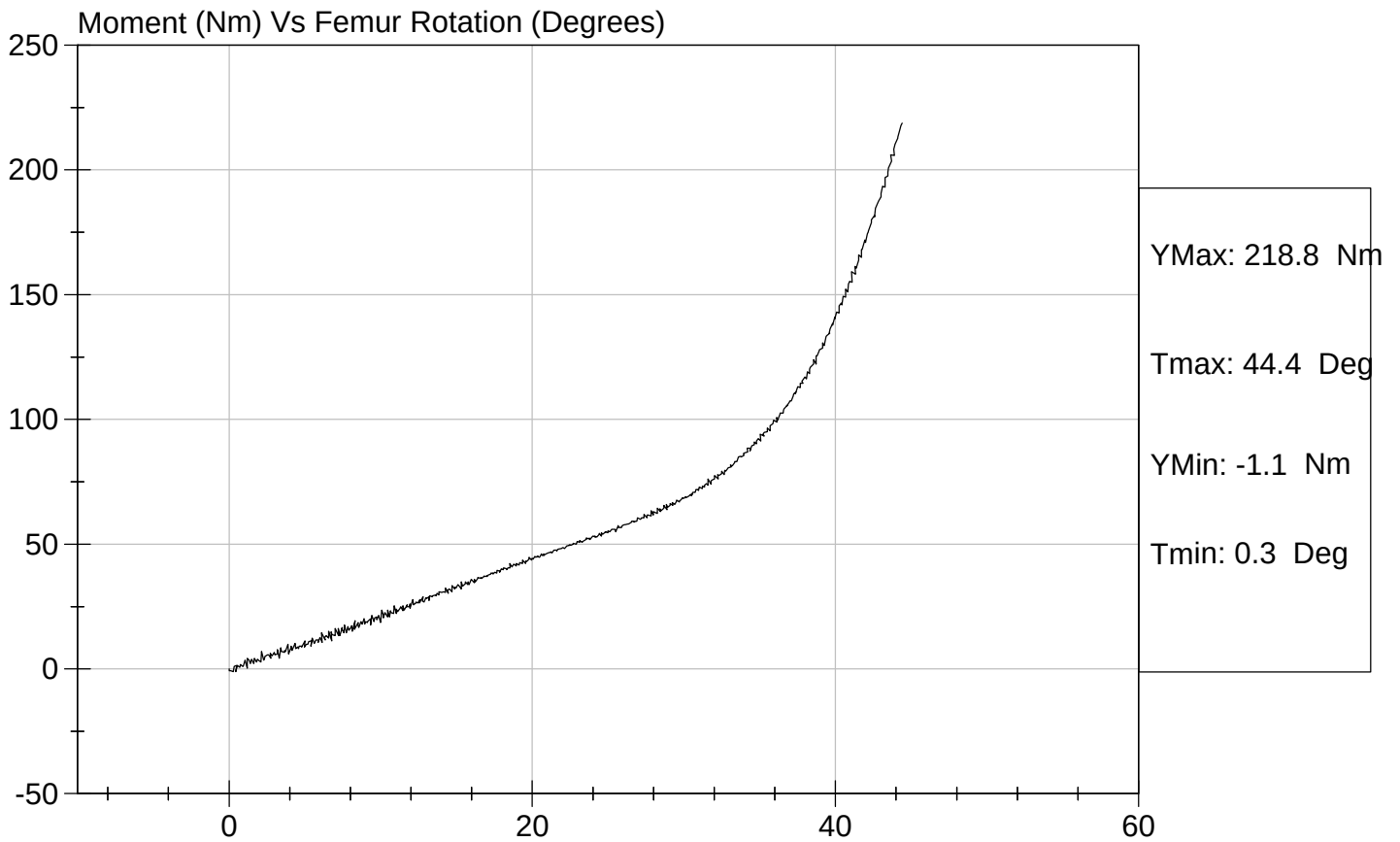


Test Description: Hip Femur Flexion

Test Date: 04/27/2004

Component: D04970

Speed: 0 ft/sec, 0.00 m/sec



DATA SHEET A1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 401

Test Date 9/03/04

Technician Jessica Gall

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

X Perform general cleaning.

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

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

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

Repair or Replacement approved by:

Jessica Hall
Signature

9/06/04
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard
Signature

9/06/04
Date

SN401, HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.6
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.4
C	H-POINT HEIGHT	Reference	3.3-3.5	3.4
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.5
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.6
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.1
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.6
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.7
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.5
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.1
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.4
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	17.8-18.8	18.6

SN401, HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.5
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.3
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.6
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	3.8
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	38.9
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.6
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

EXTERNAL DIMENSIONS

SN511, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	794.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.5
C	H-POINT HEIGHT	Reference	81.3-86.3	82.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	82.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	131.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.5
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	278.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	195.2
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	361.7
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	399.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	415.1

SN511, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	180.2
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	225.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	465.2
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.1
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	87.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	873.8
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	788.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 511

Test Date 7/19/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one head drop performed

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

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

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

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

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

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

Record the maximum temperature 21.2

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 48%

☒ 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 502mm

Record the left side distance 502mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-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	$250 \text{ g} \leq x \leq 300 \text{ g}$	278
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	9

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


Signature

7/19/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test ID: D041611

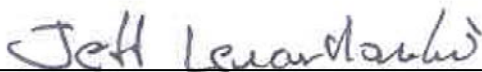
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Peak Resultant Acceleration	G's	250 - 300	278	Pass
Peak Lateral Acceleration	G's	+/- 15	9.3	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

07/19/2004

Test Date



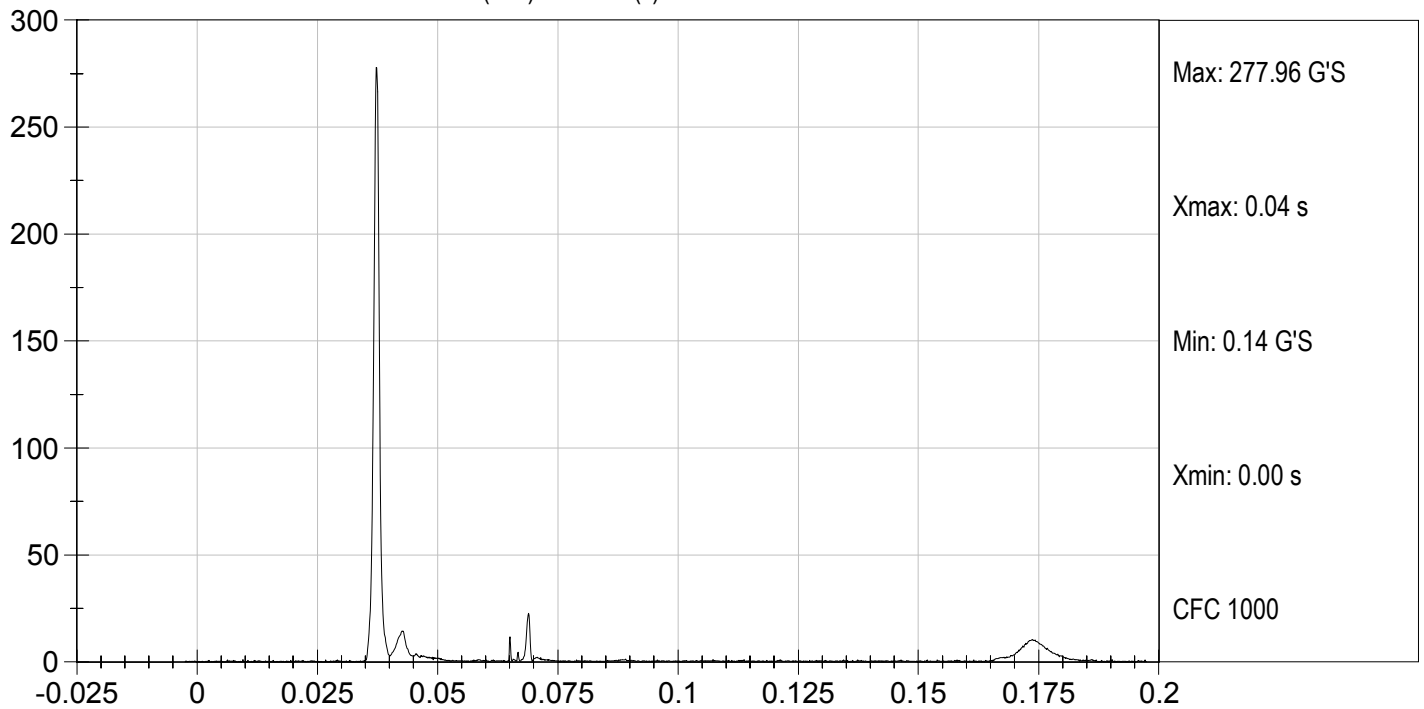
Approved By



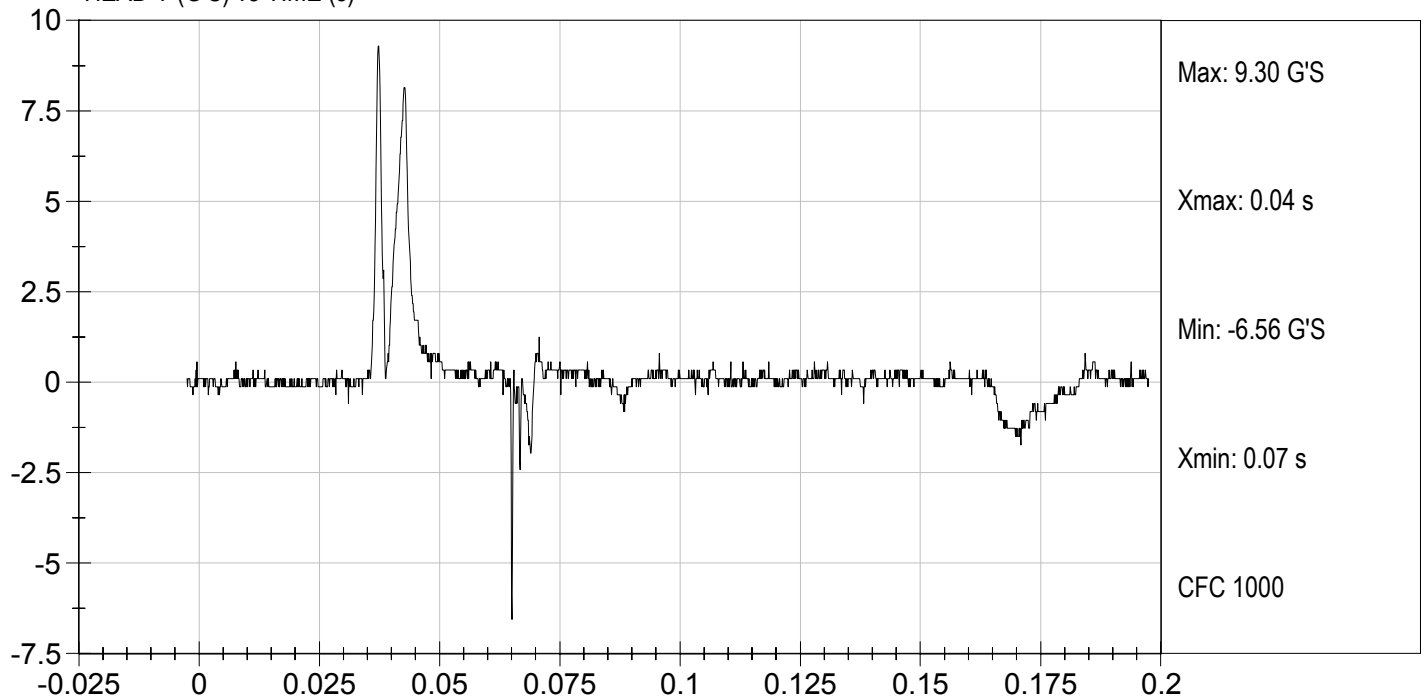
Test Desc: Head Drop
Componet ID: D041611

Test Date: 07/19/2004
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 511 Test Date 7/19/04

Technician Jim Carney

☒ Pretest calibration

☐ Post test calibration verification

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

- ☐ 1. It has been at least 30 minutes since the last flexion test. (572.137(q))
☒ N/A, ONLY one flexion test performed
- ☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.2</u> |
| Record the minimum temperature | <u>21.0</u> |
| Record the maximum humidity | <u>49%</u> |
| Record the minimum humidity | <u>48%</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. Front 81; Rear 89
- ☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))
- ☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- ☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.11 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	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.6 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>81</u> Nm @ <u>83</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	87 ms

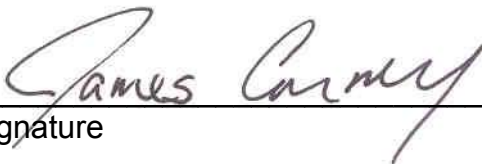
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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


Signature

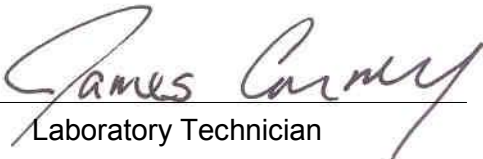
7/19/04
Date

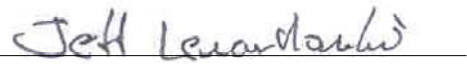
MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041612

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	48	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.11	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.6	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	81	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	87	Pass
Overall Results				Pass	


Laboratory Technician


Approved By

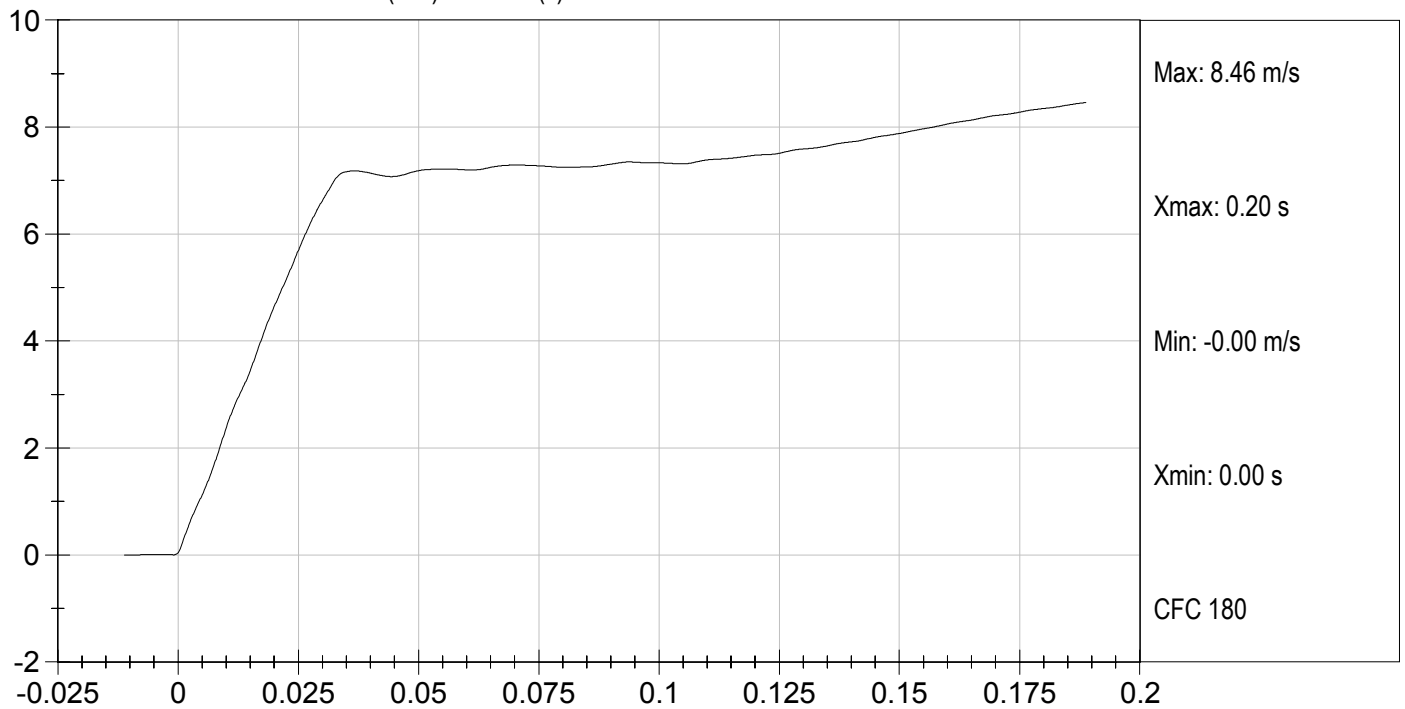
07/19/2004
Test Date



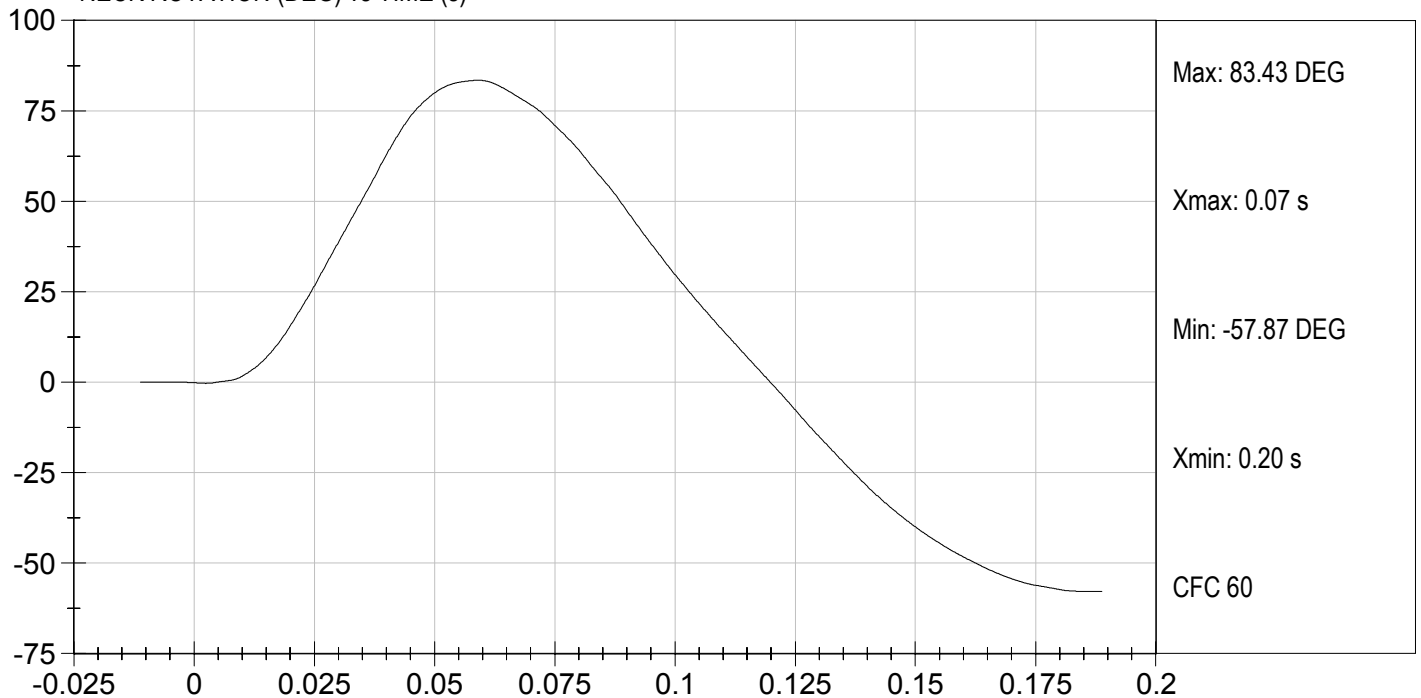
Test Desc: Neck Flexion
Componet ID: D041612

Test Date: 07/19/2004
Velocity: 23.33 ft/s, 7.11 m/s

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



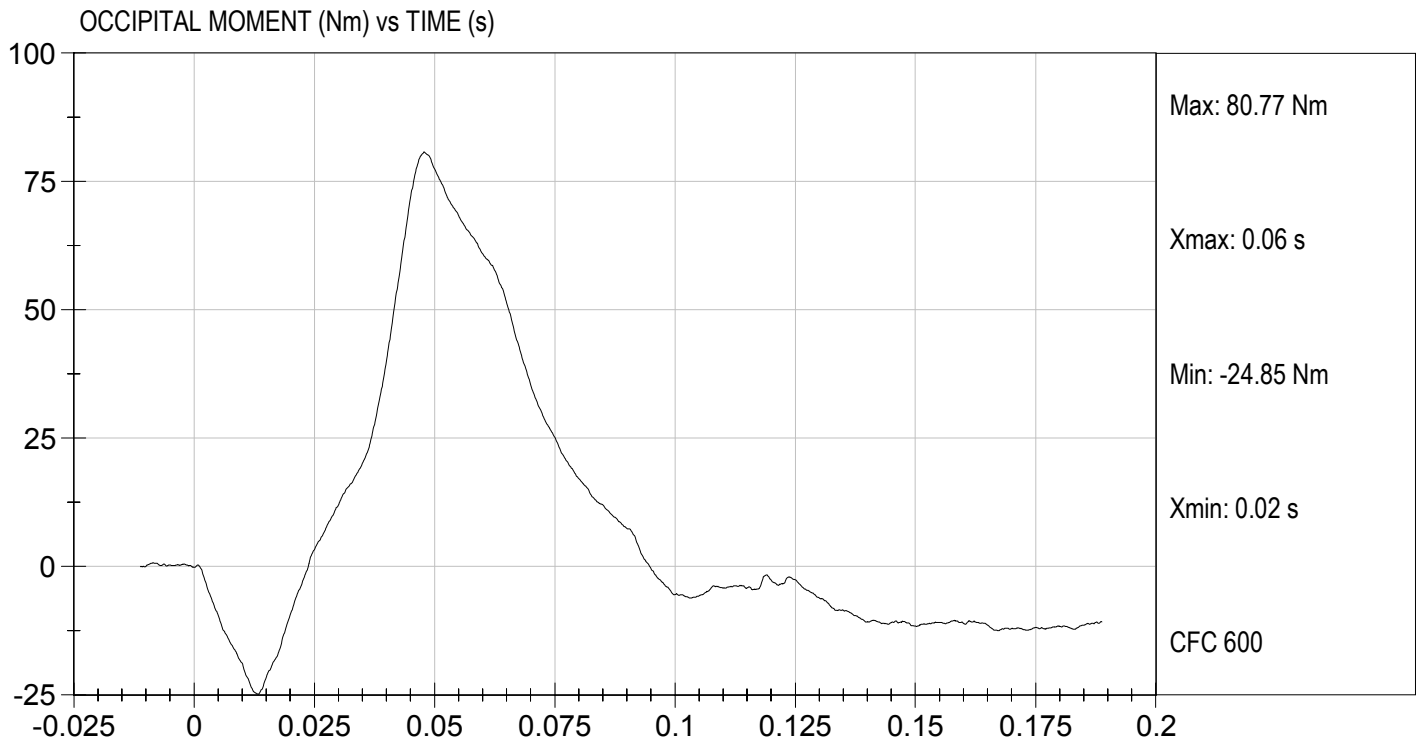
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D041612

Test Date: 07/19/2004
Velocity: 23.33 ft/s, 7.11 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511

Test Date 7/19/04

Technician Jim Carney

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.2

Record the minimum temperature 21.0

Record the maximum humidity 49%

Record the minimum humidity 48%

☒ 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. Front 81; Rear 89

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

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

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

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

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

Parameter		Specification	Result
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.17 m/s
Pendulum 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	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.4 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>-59</u> Nm @ <u>112</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	99 ms

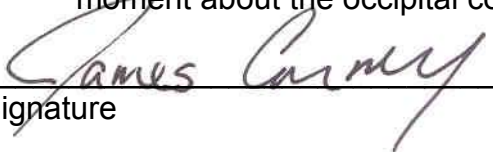
*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

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

7/19/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

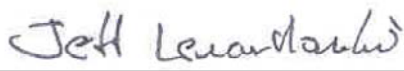
Test I.D: D041613

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	48	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.17	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.8	Pass
	20 msec	m/sec	3.1 to 3.9	3.7	Pass
	30 msec	m/sec	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	112	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-59	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	99	Pass
Overall Results					Pass


 Laboratory Technician

07/19/2004

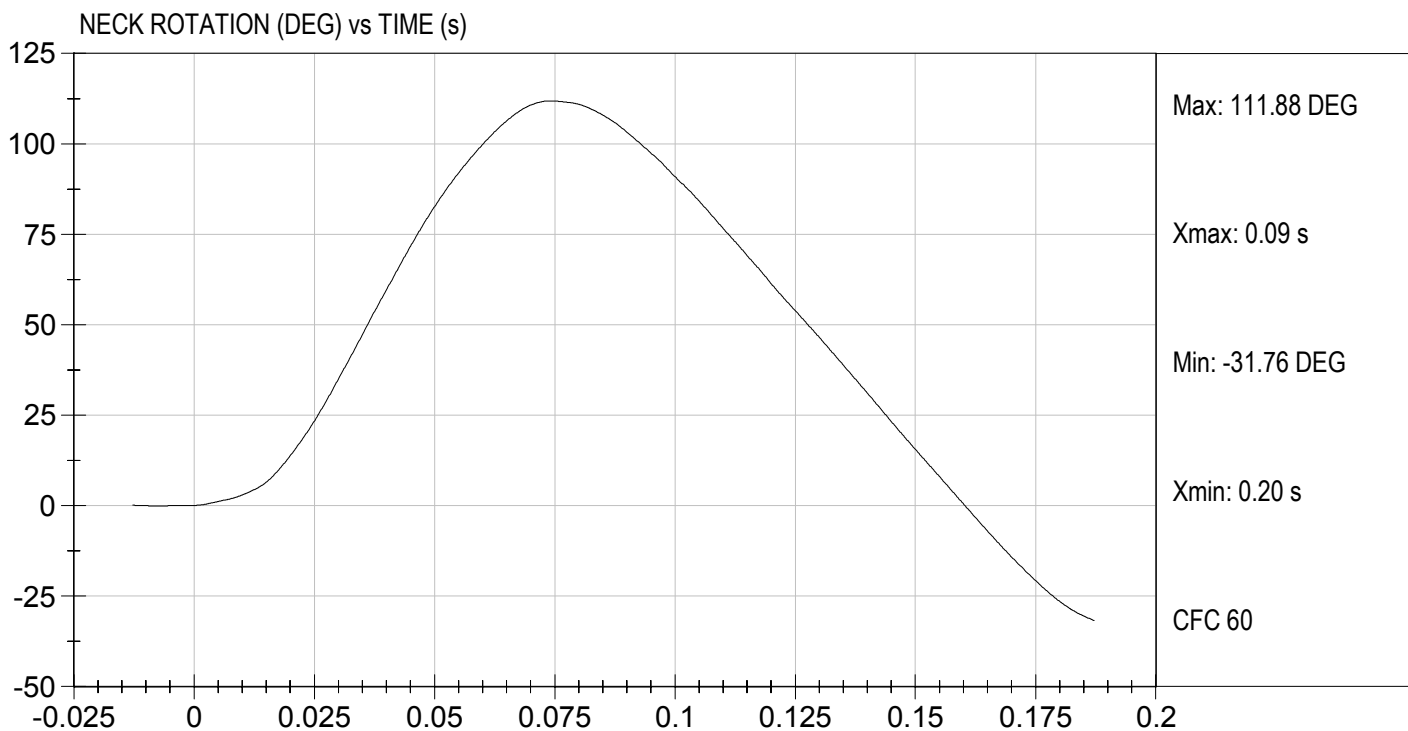
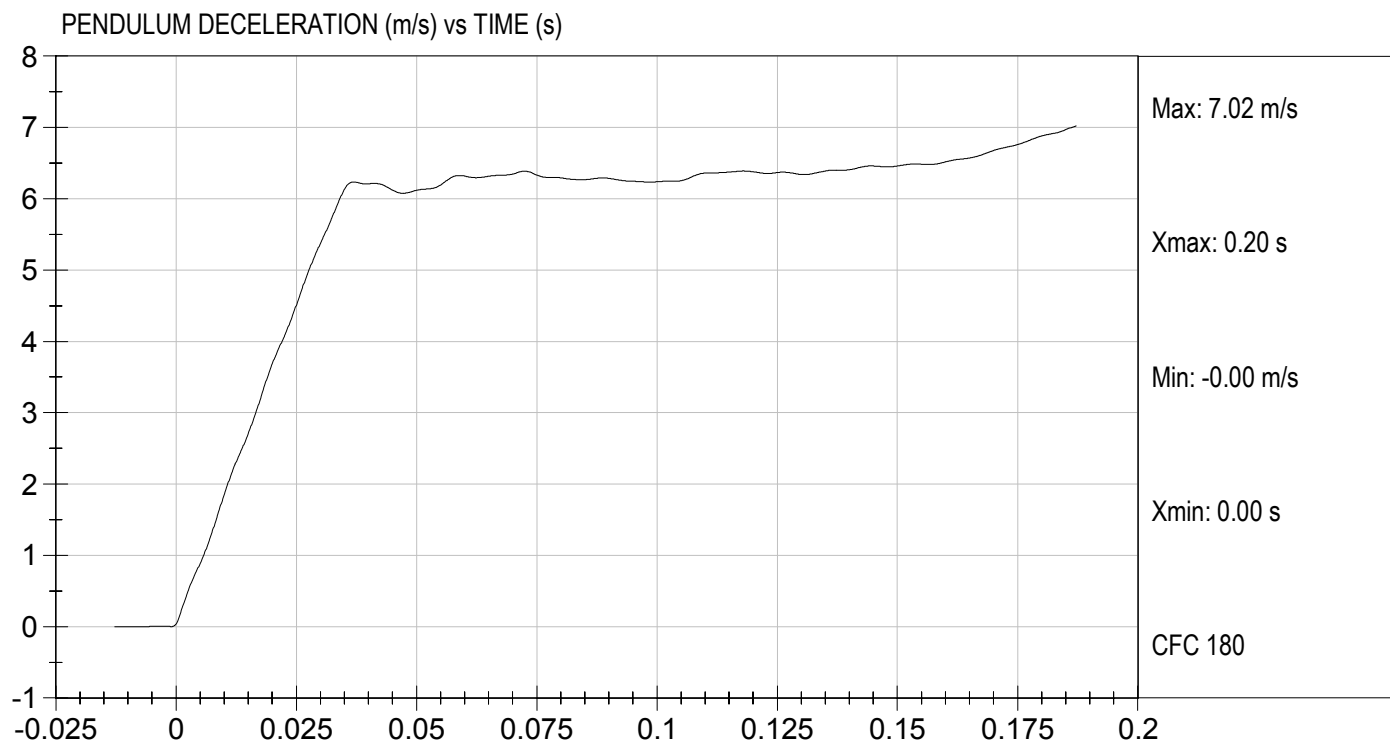
Test Date


 Approved By



Test Desc: Neck Extension
Componet ID: D041613

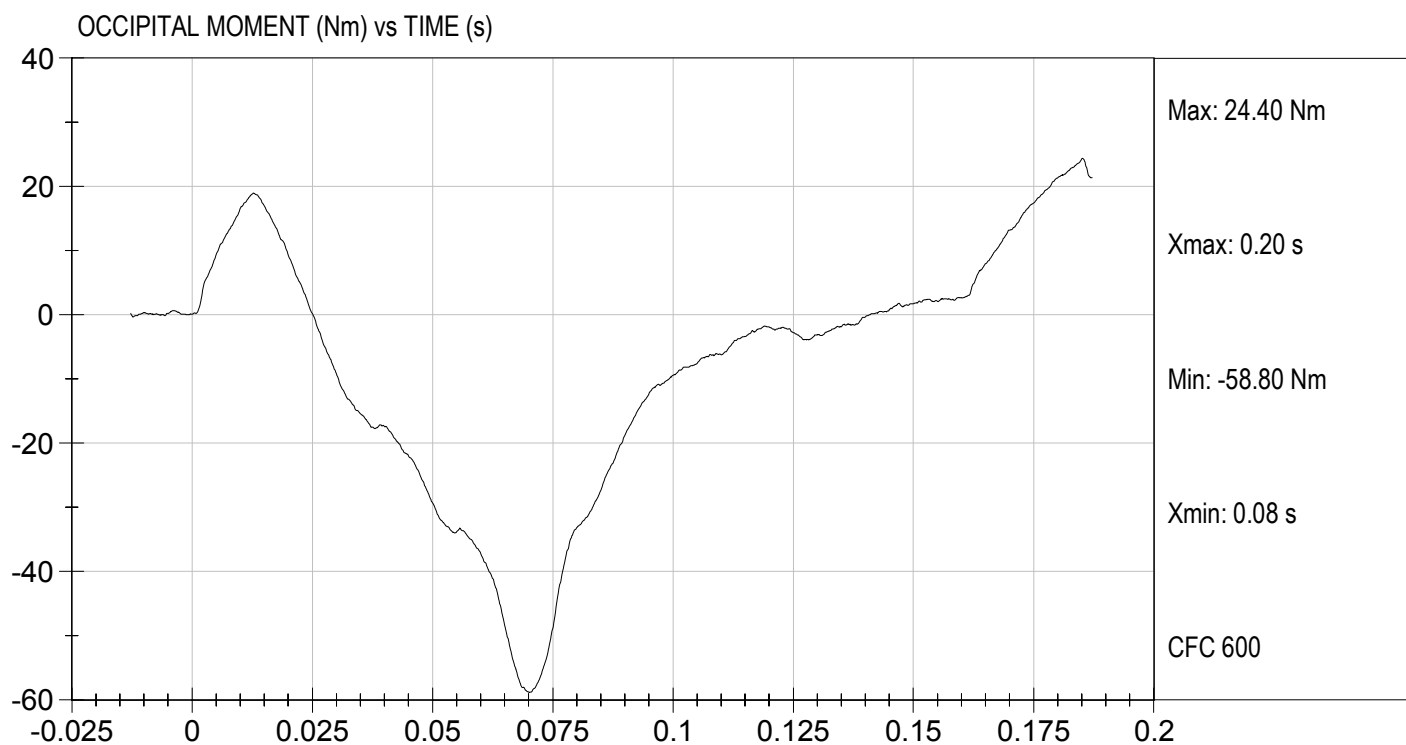
Test Date: 07/19/2004
Velocity: 20.23 ft/s, 6.17 m/s





Test Desc: Neck Extension
Componet ID: D041613

Test Date: 07/19/2004
Velocity: 20.23 ft/s, 6.17 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511

Test Date 7/20/04

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 50%

Record the minimum humidity 48%

☒ 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.65 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	3910 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3913 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

7/20/04
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041614

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	6.59 to 6.83	6.65	Pass
Peak Deflection	mm	50 to 58	51.6	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	3.9	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	3913	Pass
			Overall Test Results	Pass


Laboratory Technician

07/20/2004

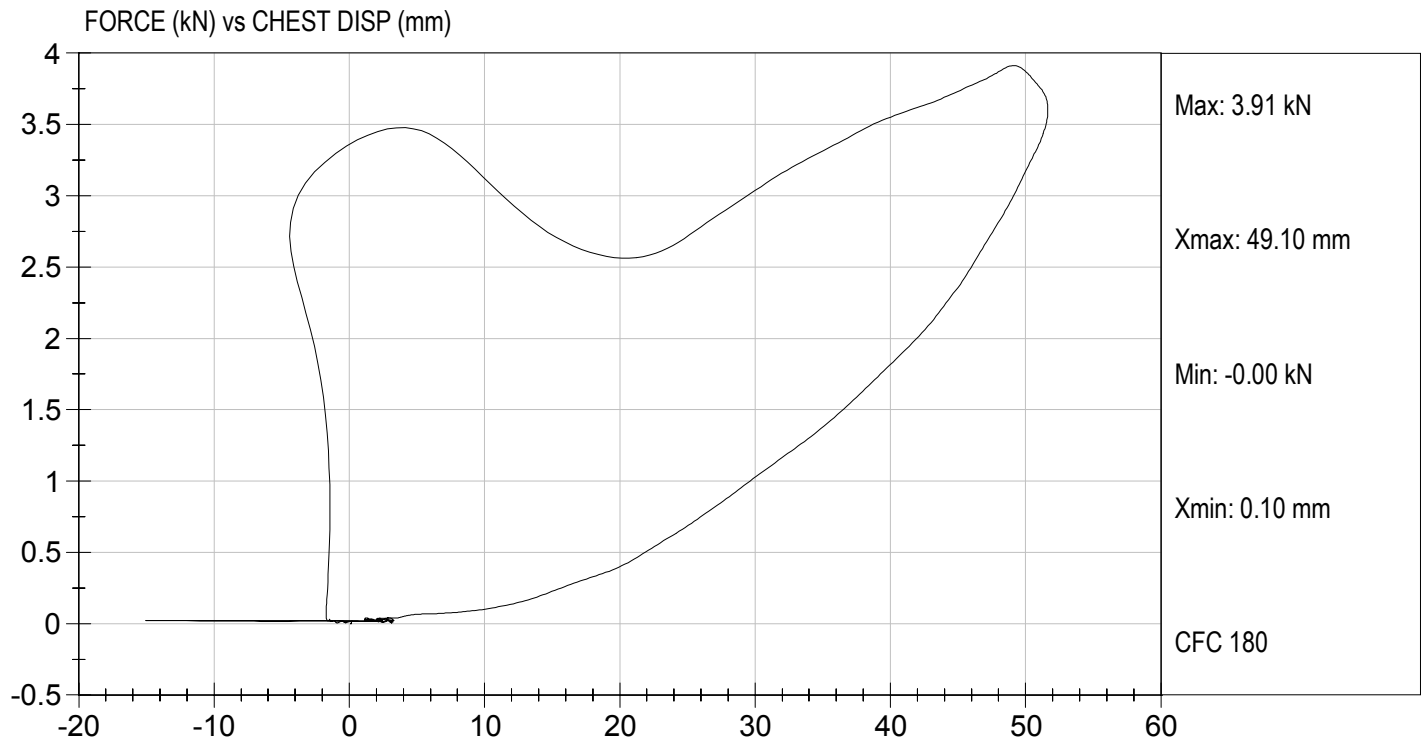
Test Date


Approved By



Test Desc: Thorax Impact
Componet ID: D041614

Test Date: 07/20/2004
Velocity: 21.81 ft/s, 6.65 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511

Test Date 7/20/04

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 21.4

Record the minimum temperature 21.0

Record the maximum humidity 50%

Record the minimum humidity 48%

☒ 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 $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	384 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	18°



 Signature

7/20/04

 Date

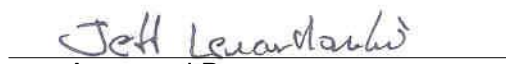
MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041617

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	384	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass


Laboratory Technician


Approved By

07/20/2004
Test Date

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 7/20/04

Technician Jim Carney

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 50%

Record the minimum humidity 48%

☒ 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:

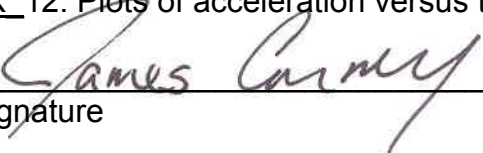
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

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



7/20/04

Date

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

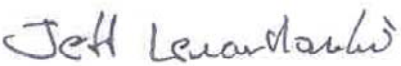
ATD Serial No: 511

Test I.D: D041616

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/sec	2.07 to 2.13	2.09	Pass
Maximum Force	kN	3.45 to 4.06	3.46	Pass
Overall Test Results				Pass


Laboratory Technician

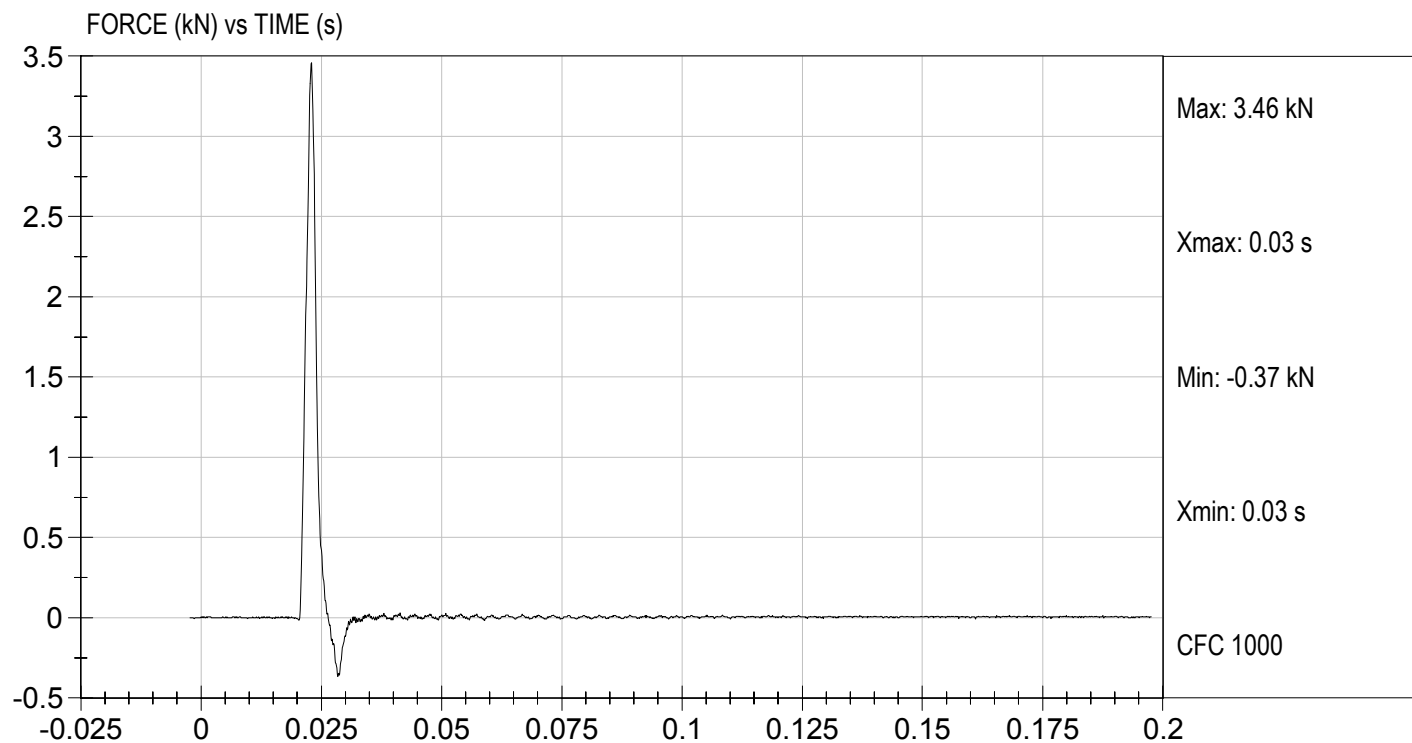
07/20/2004
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D041616

Test Date: 07/20/2004
Velocity: 6.86 ft/s, 2.09 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 7/20/04

Technician Jim Carney

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.4

Record the minimum temperature 21.0

Record the maximum humidity 50 %

Record the minimum humidity 48 %

☒ 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))

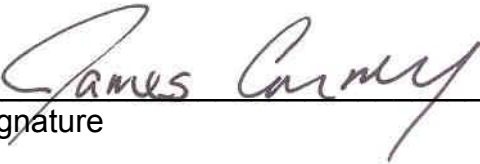
☒ 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.13 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3720 N

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

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


Signature

7/20/04
Date

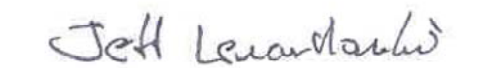
MGA RESEARCH CORPORATION
RIGHT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041615

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/sec	2.07 to 2.13	2.13	Pass
Maximum Force	kN	3.45 to 4.06	3.72	Pass
Overall Test Results				Pass


Laboratory Technician

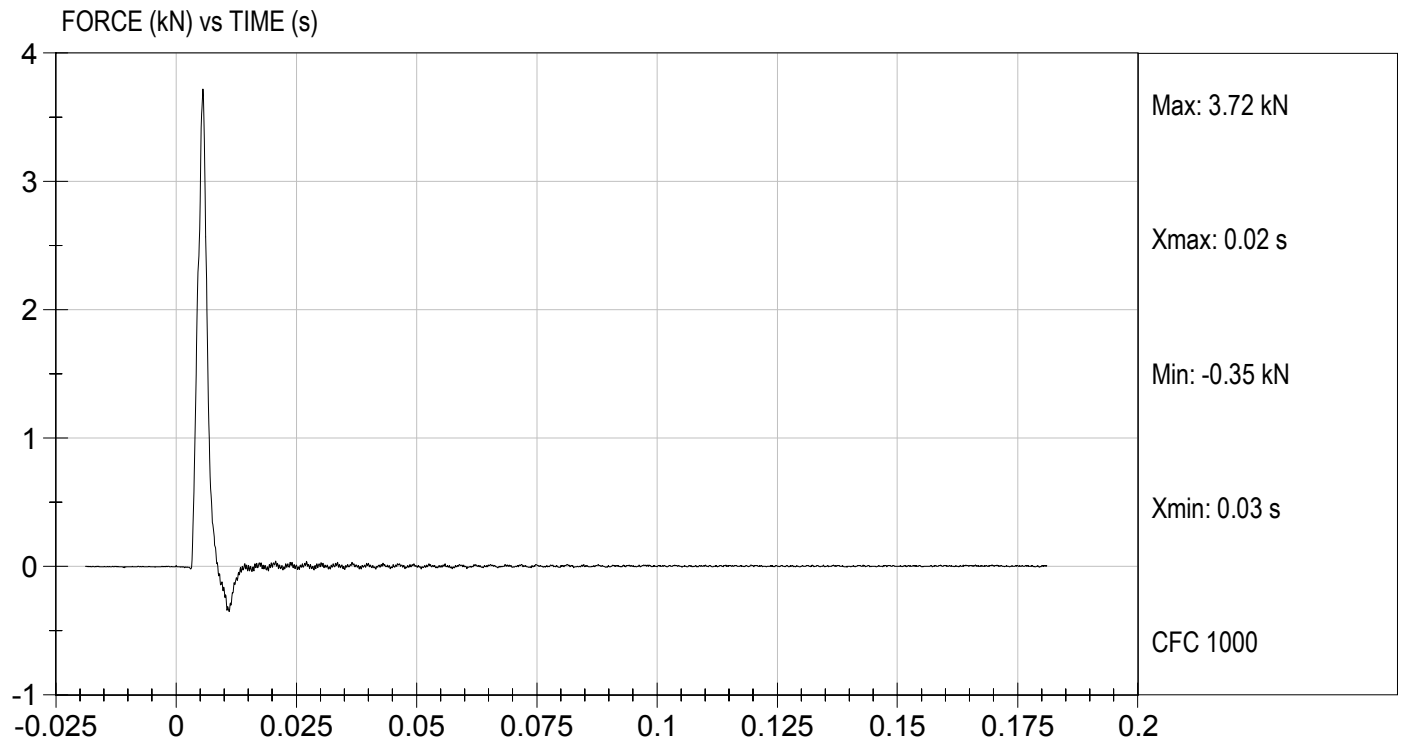

Approved By

07/20/2004
Test Date



Test Desc: Right Knee
Componet ID: D041615

Test Date: 07/20/2004
Velocity: 7.0 ft/s, 2.13 m/s



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

 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 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53%

Record the minimum humidity 42%

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 502mm

Record the left side distance 502mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-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	$250 \text{ g} \leq x \leq 300 \text{ g}$	280
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	10

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

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test ID: D041761

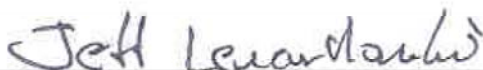
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	250 - 300	280	Pass
Peak Lateral Acceleration	G's	+/- 15	9.9	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within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



Laboratory Technician

08/02/2004

Test Date



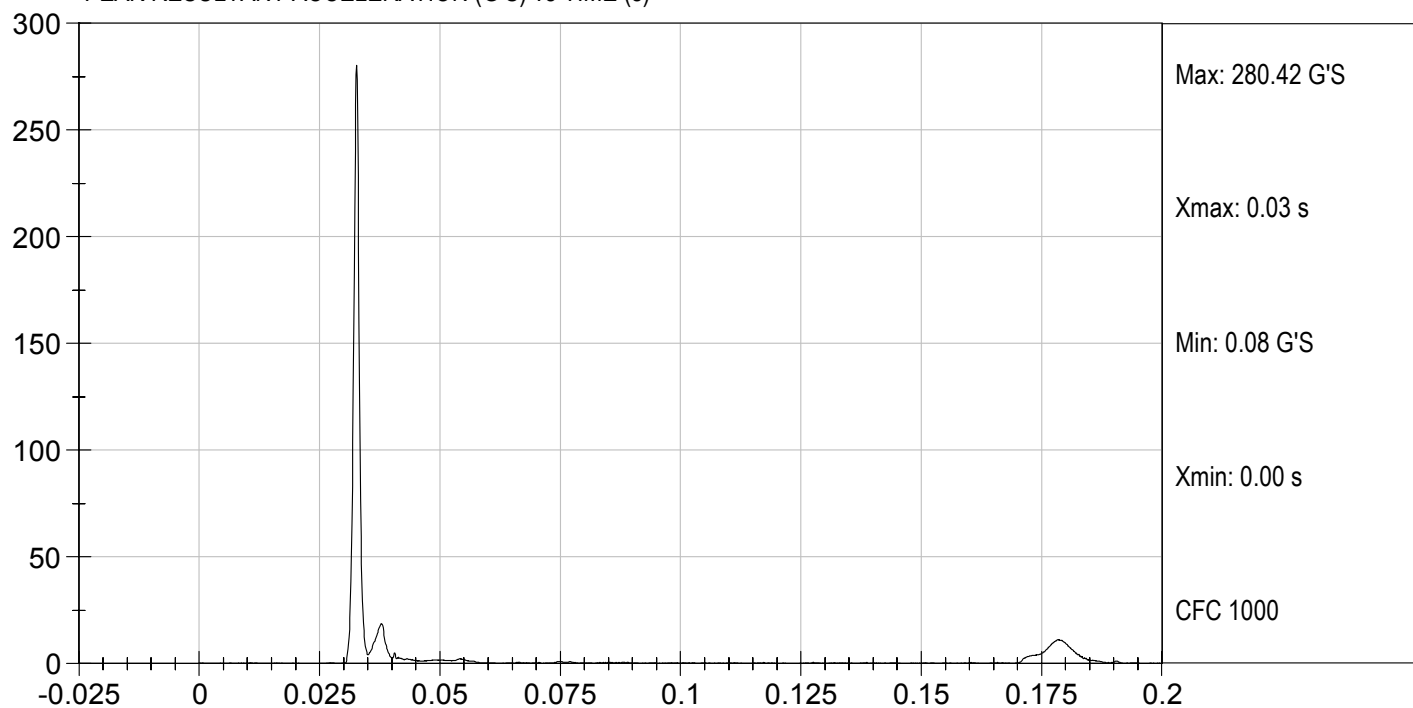
Approved By



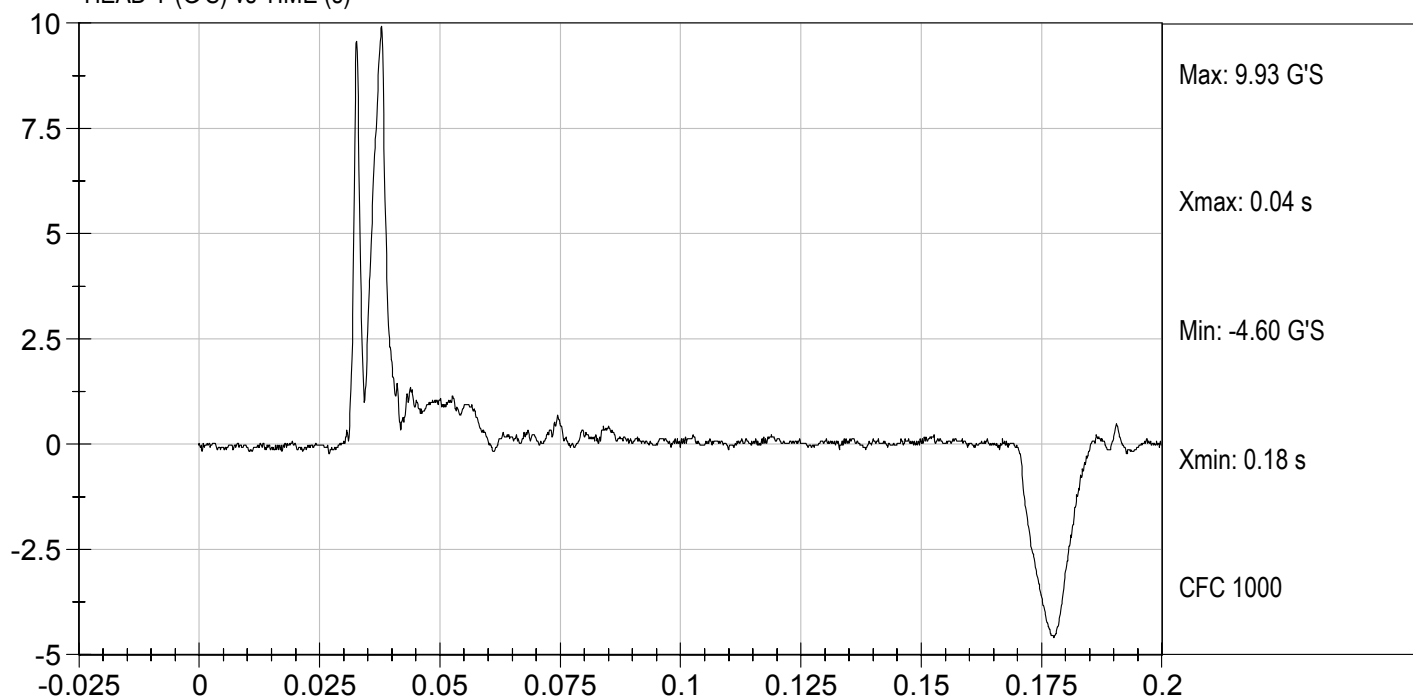
Test Desc: Head Drop
Componet ID: D041761

Test Date: 08/02/2004
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 511

Test Date 8/02/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.7 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>83</u> Nm @ <u>79</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	83 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041762

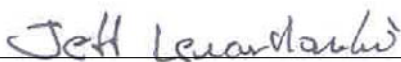
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.03	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.5	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec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



Laboratory Technician

08/02/2004

Test Date

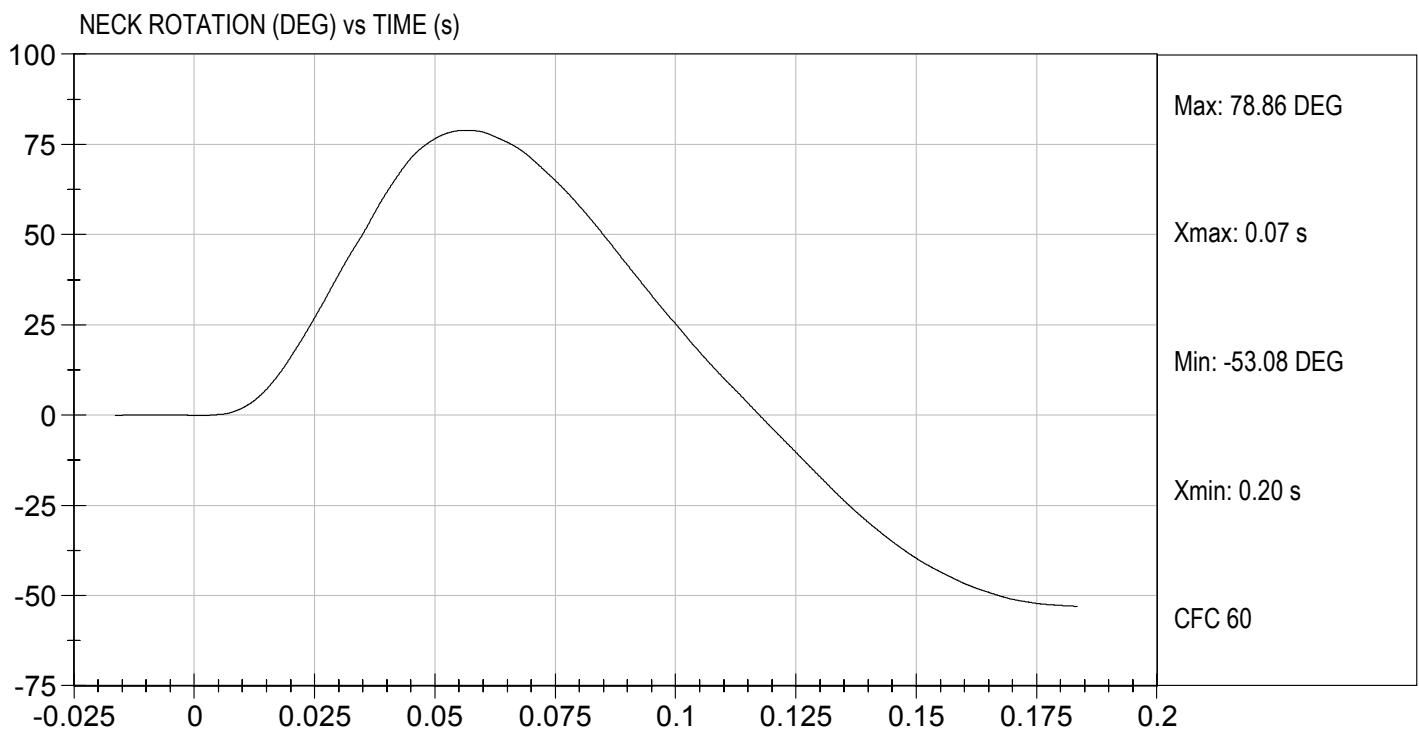
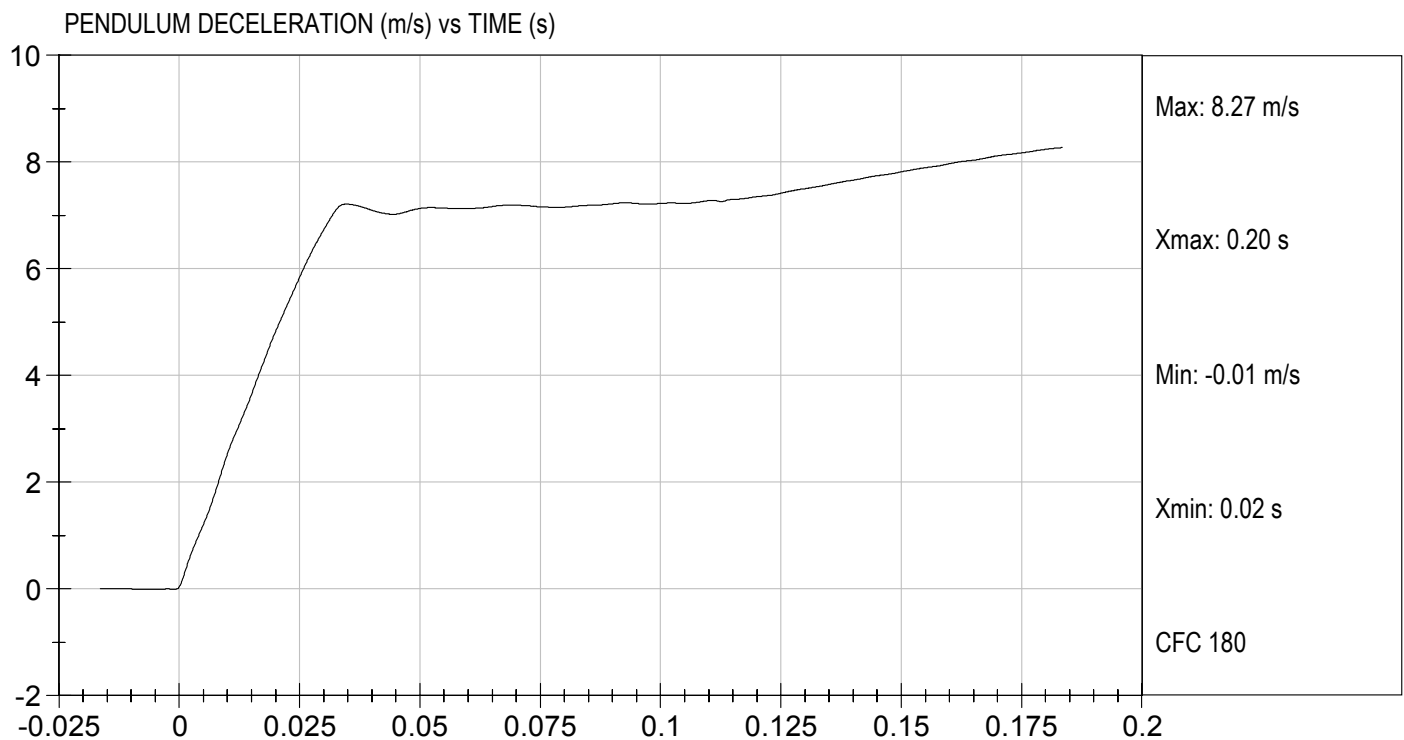


Approved By



Test Desc: Neck Flexion
Componet ID: D041762

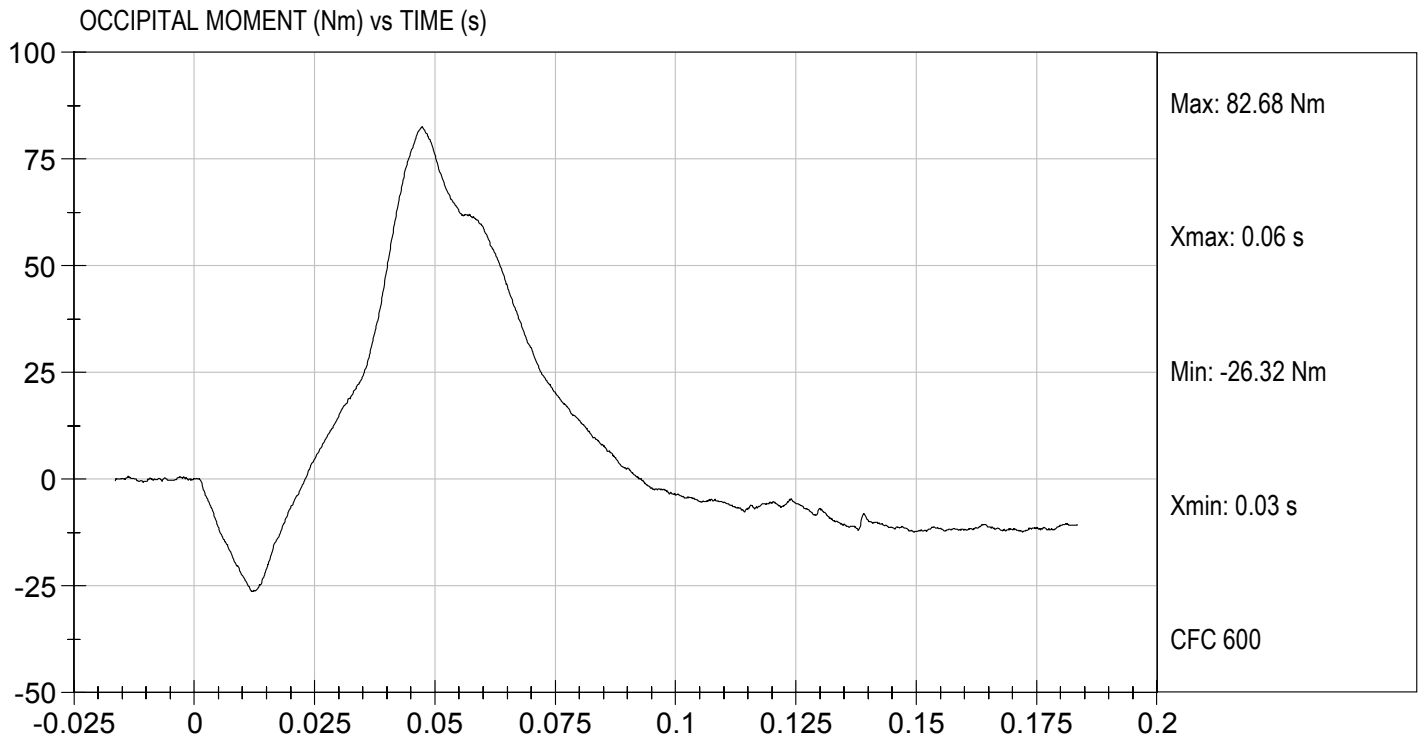
Test Date: 08/02/2004
Velocity: 23.08 ft/s, 7.03 m/s





Test Desc: Neck Flexion
Componet ID: D041762

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



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 511 Test Date 8/02/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53%

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. Front 81; Rear 89.

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

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

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

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.6 m/s
	@30ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.1 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>-57</u> Nm @ <u>109</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	104 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041763

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.16	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.6	Pass
	30 msec	m/sec	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	104	Pass
Overall Results					Pass



Laboratory Technician

08/02/2004

Test Date

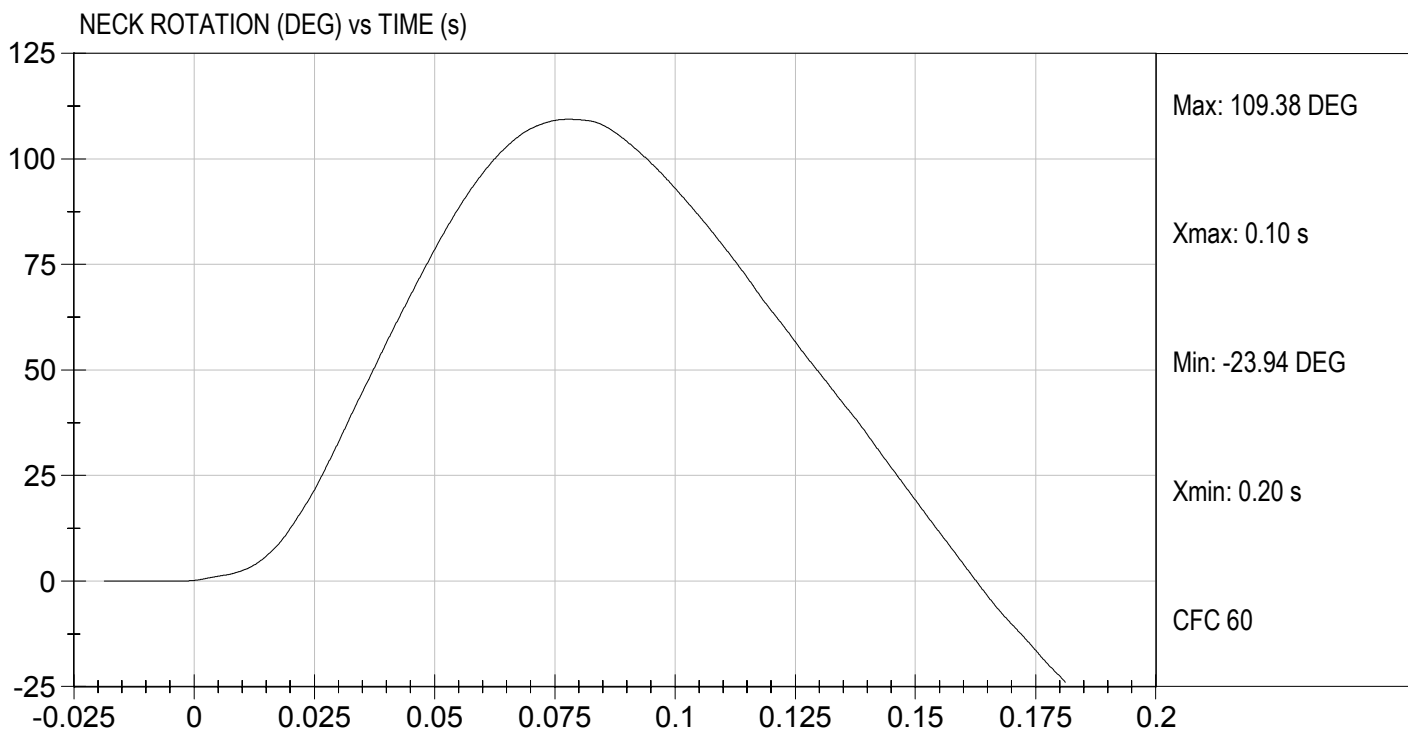
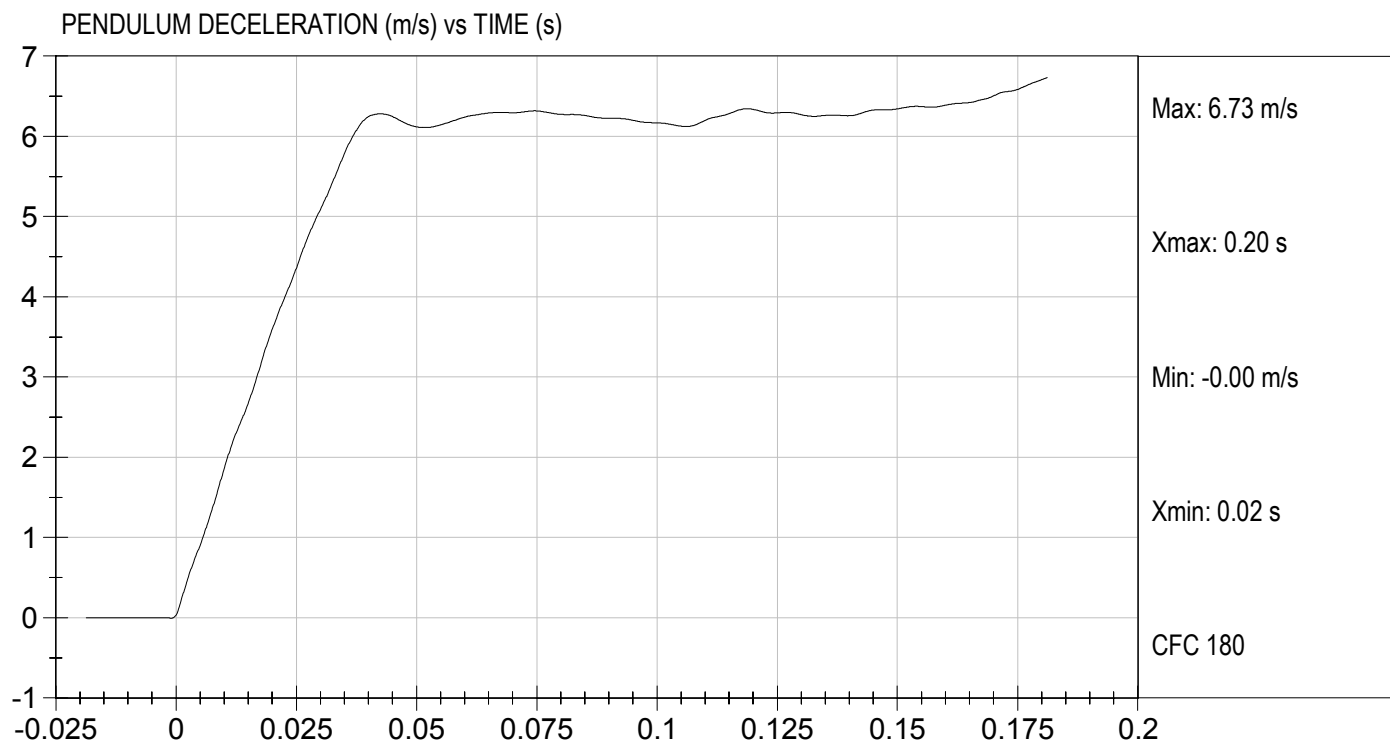


Approved By



Test Desc: Neck Extension
Componet ID: D041763

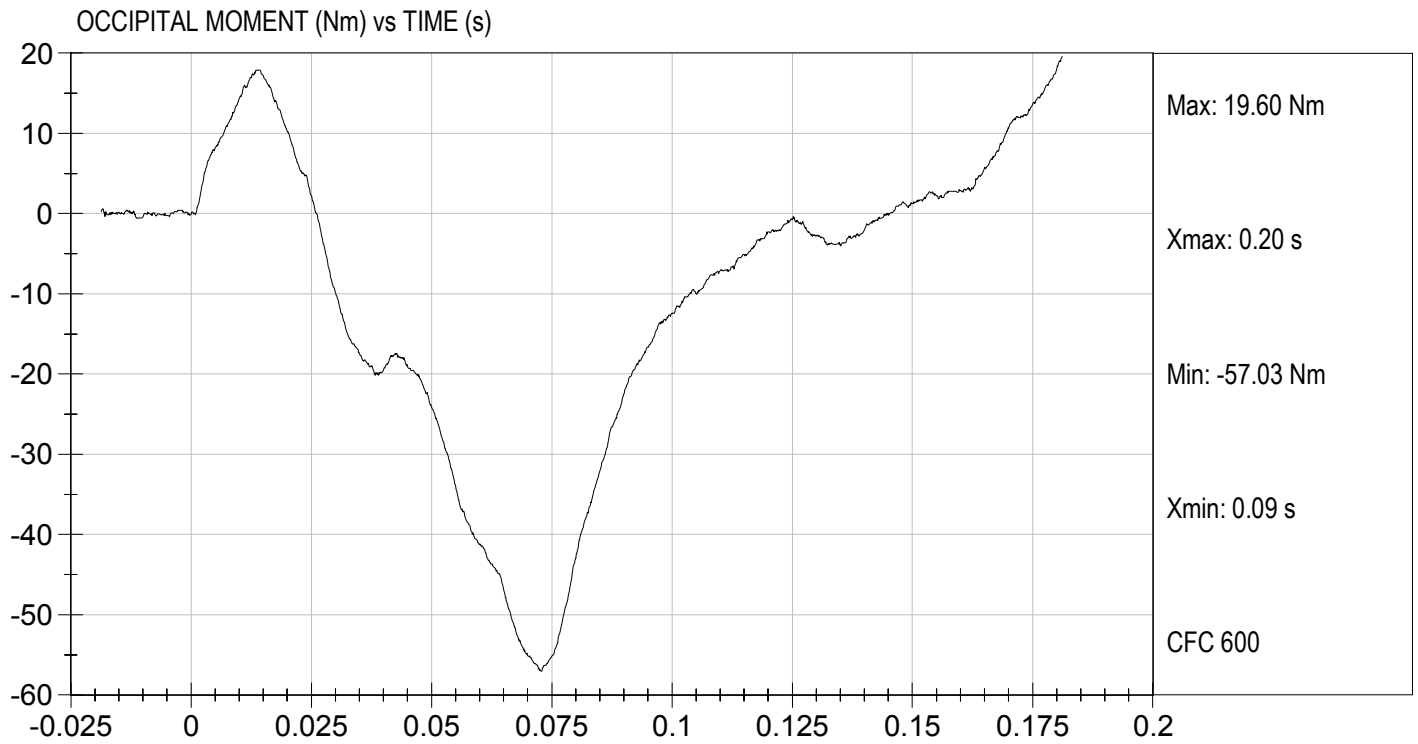
Test Date: 08/02/2004
Velocity: 20.22 ft/s, 6.16 m/s





Test Desc: Neck Extension
Componet ID: D041763

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



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 511

Test Date 8/02/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53%

Record the minimum humidity 42%

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

☒ - No damage

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

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

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

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

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

- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.62 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4010 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4013 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	70%

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

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

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

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


Signature

8/02/04
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041764

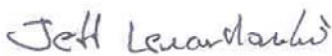
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	6.59 to 6.83	6.62	Pass
Peak Deflection	mm	50 to 58	54.7	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.0	Pass
Internal Hysteresis	%	69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



Laboratory Technician

08/02/2004

Test Date

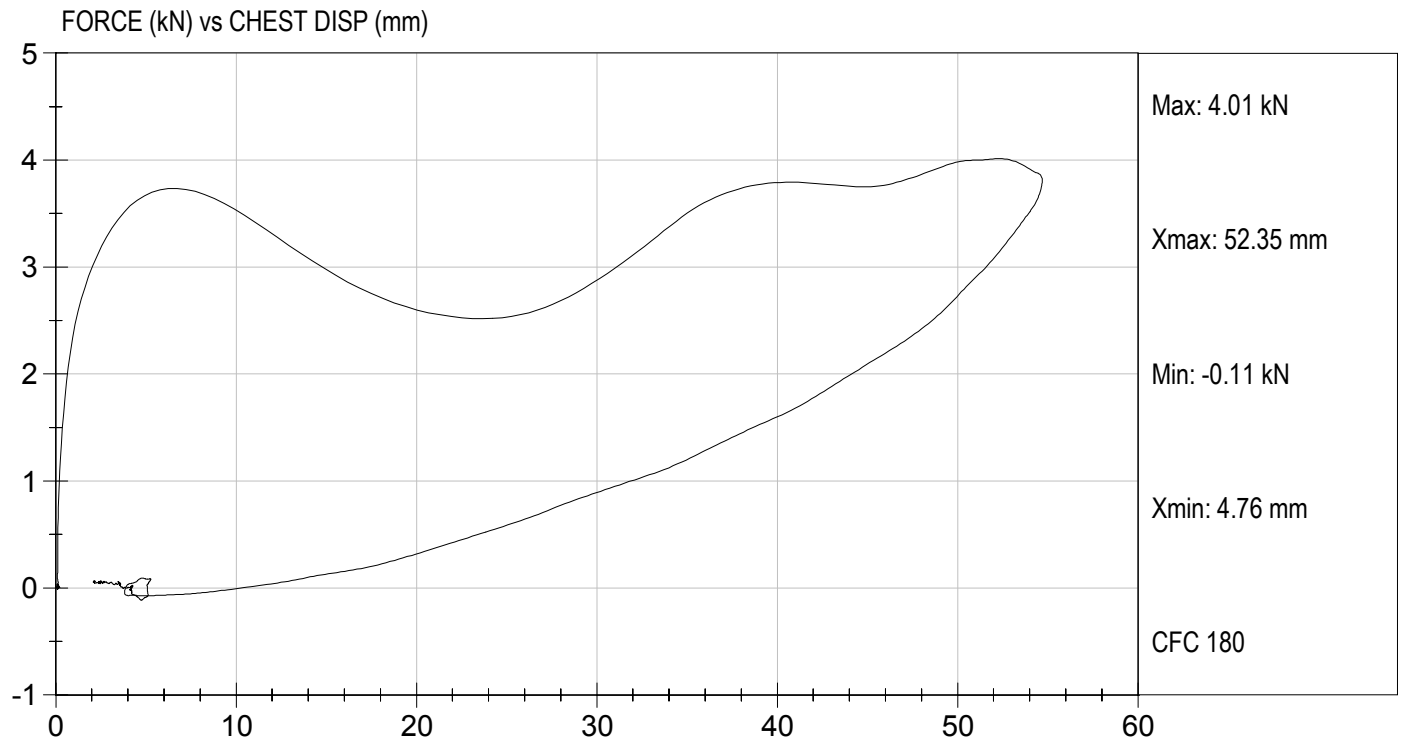


Approved By



Test Desc: Thorax Impact
Componet ID: D041764

Test Date: 08/02/2004
Velocity: 21.71 ft/s, 6.62 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 511

Test Date 8/02/04

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 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53%

Record the minimum humidity 42%

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°) 15°

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 $\leq 20^\circ$	15°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	368 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	18°

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 511

Test I.D: D041767

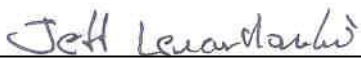
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Initial Angle	deg	0 to 20	15	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	368	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5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



Laboratory Technician

08/02/2004

Test Date



Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 8/02/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53%

Record the minimum humidity 42%

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

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

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

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

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

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

X 11. Complete the following table:

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

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

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

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

Joe Fleck
Signature

8/02/04
Date

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

ATD Serial No: 511

Test I.D: D041766

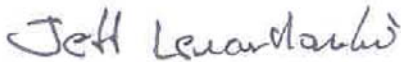
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.64	Pass
Overall Test Results				Pass



Laboratory Technician

08/02/2004

Test Date

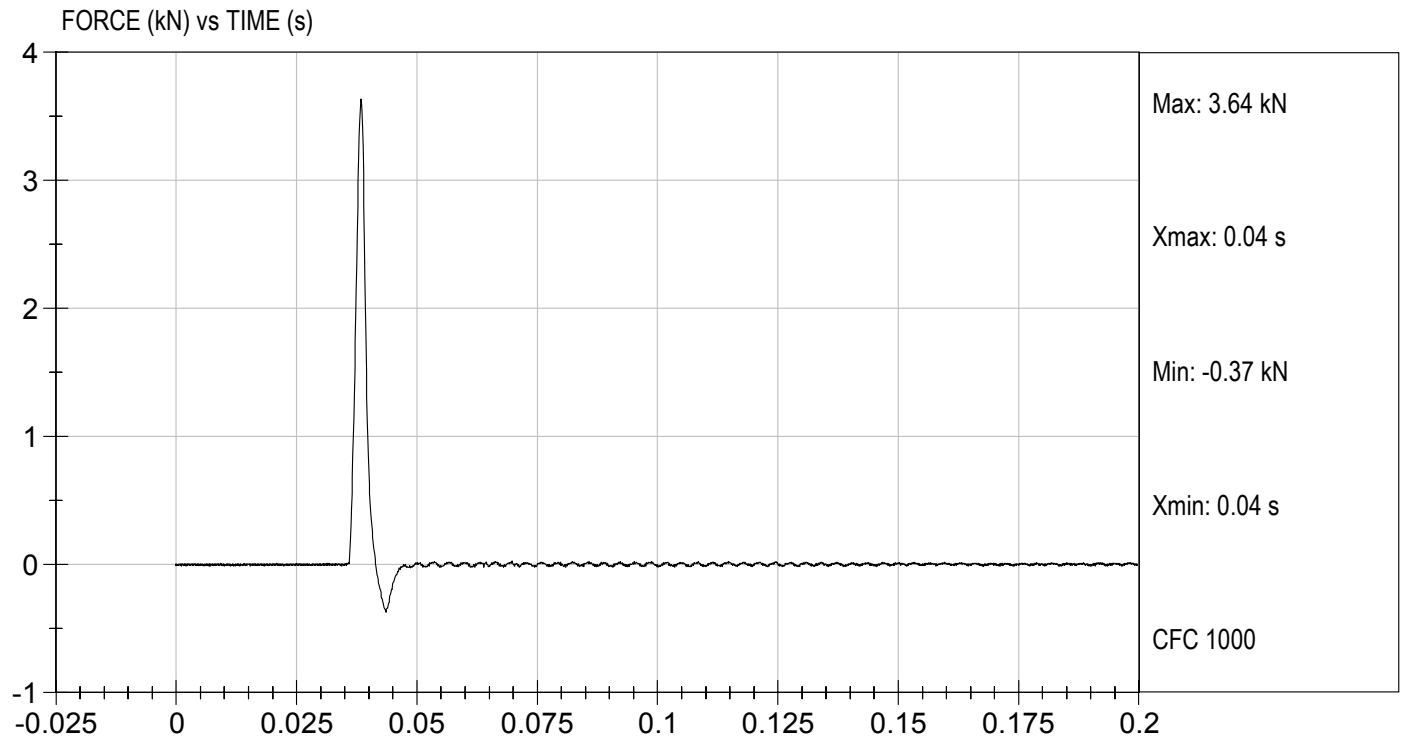


Approved By



Test Desc: Left Knee
Componet ID: D041766

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



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 511

Test Date 8/02/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.6

Record the minimum temperature 20.7

Record the maximum humidity 53 %

Record the minimum humidity 42 %

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

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

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

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

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

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

☒ 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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3700 N

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

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

Joe Fleck
Signature

8/02/04
Date

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

ATD Serial No: 511

Test I.D: D041765

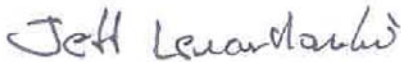
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.70	Pass
Overall Test Results				Pass



Laboratory Technician

08/02/2004

Test Date

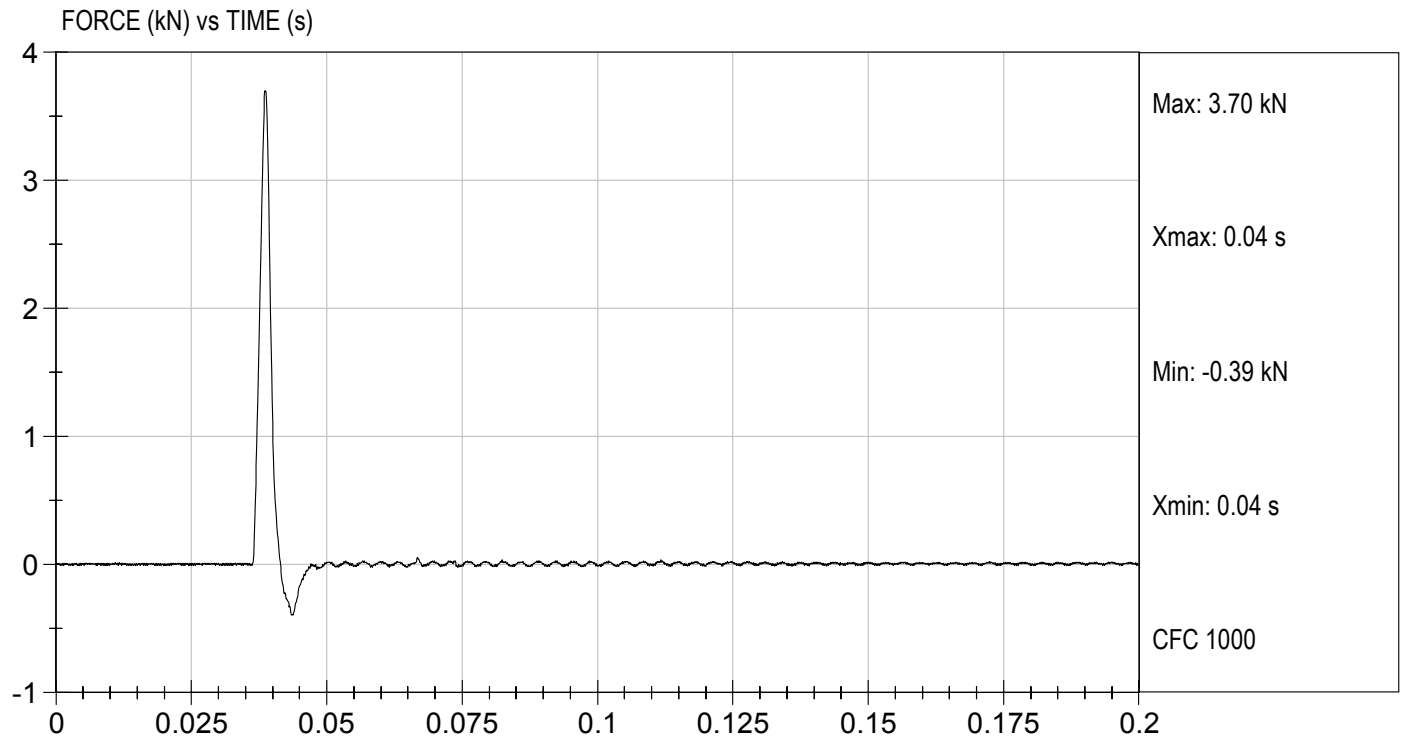


Approved By



Test Desc: Right Knee
Componet ID: D041765

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



DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 511

Test Date 7/29/04

Technician Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damaged	OK
Outer skin	Gashes, rips, cracks			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

7/30/04
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard
Signature

7/30/04
Date

EXTERNAL DIMENSIONS

SN511, HYBRID III, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	794.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	449.5
C	H-POINT HEIGHT	Reference	81.3-86.3	82.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	82.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	131.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	250.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	43.5
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	276.8-297.2	278.0
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	195.2
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	545.0
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	361.7
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	399.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414-439.4	415.1

SN511, HYBRID III, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	180.2
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	225.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	465.2
S	HEAD BREADTH	The widest part of the head	137.1-147.3	143.6
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	180.0
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.1
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	87.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	545.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	873.8
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	788.0
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

EXTERNAL DIMENSIONS

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

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

DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration
☐ Post test calibration verification

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

- ☐ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws ((10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.7</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity | <u>52%</u> |
| Record the minimum humidity | <u>46%</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 503mm

Record the left side distance 503mm

- 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	$250 \text{ g} \leq x \leq 300 \text{ g}$	260
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	9

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

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test ID: D041751

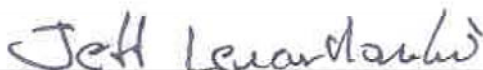
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	250 - 300	260	Pass
Peak Lateral Acceleration	G's	+/- 15	-9.2	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

08/02/2004

Test Date



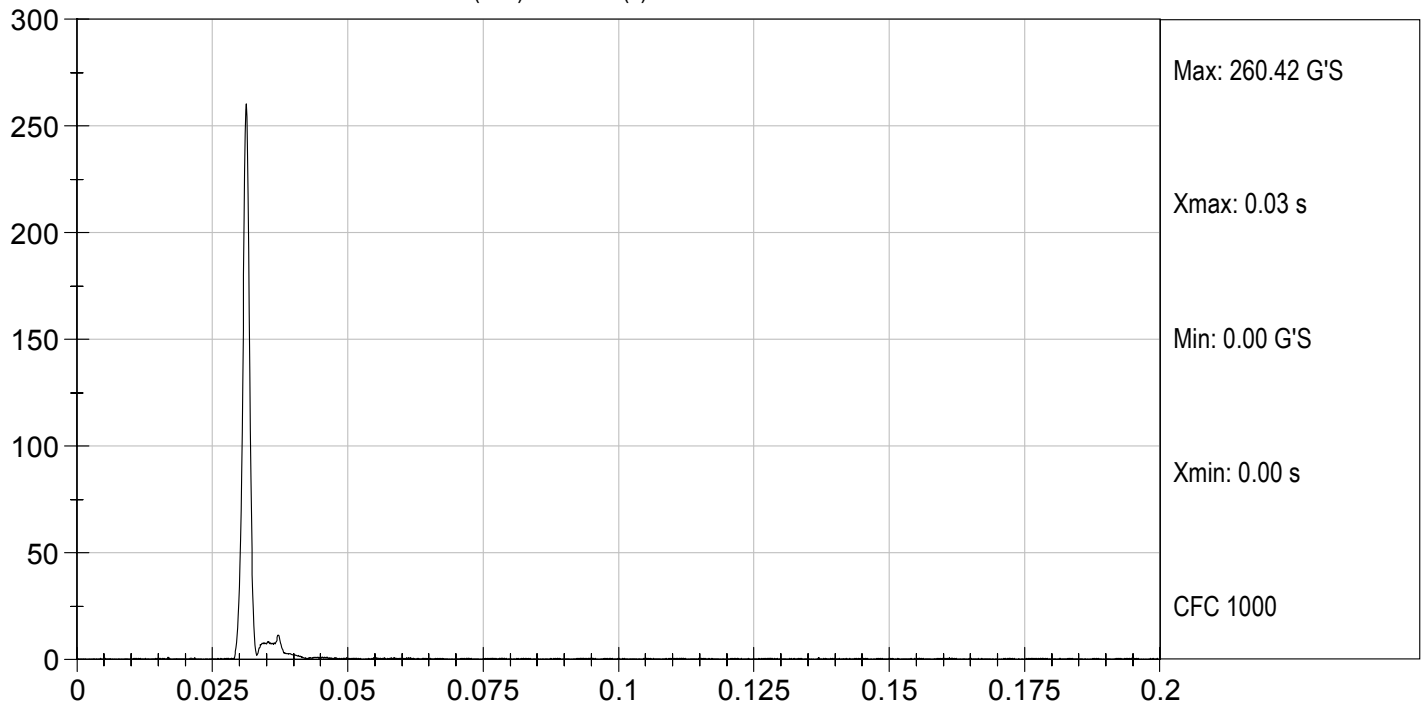
Approved By



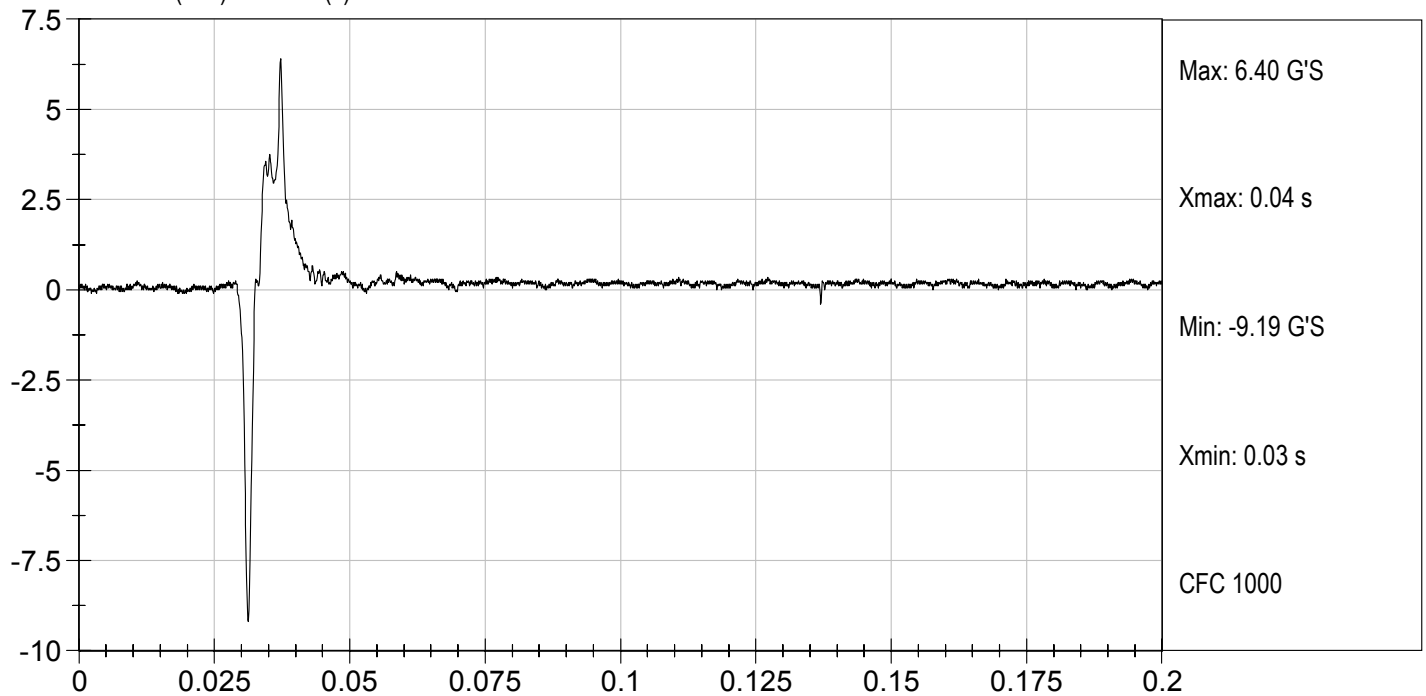
Test Desc: Head Drop
Componet ID: D041751

Test Date: 08/02/2004
Velocity: 0 ft/s, 0 m/s

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 505 Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

- ☐ 1. It has been at least 30 minutes since the last flexion test. (572.137(q))
☒ N/A, ONLY one flexion test performed
- ☒ 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- ☒ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- | | |
|--------------------------------|-------------|
| Record the maximum temperature | <u>21.7</u> |
| Record the minimum temperature | <u>20.7</u> |
| Record the maximum humidity | <u>52%</u> |
| Record the minimum humidity | <u>46%</u> |
- ☒ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
 Record findings and actions: No Damage.
- ☒ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
 Record findings and actions: No Deterioration. Hardness Front 85; Back 88.
- ☒ 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))
- ☒ 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- ☒ 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))

- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 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	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.4 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.6 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.6 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>76</u> Nm @ <u>83</u> degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm $80 \text{ ms} \leq \text{time} \leq 100 \text{ ms}$	86 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041752

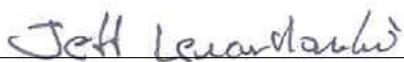
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.09	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.6	Pass
	30 msec	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	76	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	86	Pass
Overall Results				Pass	



Laboratory Technician

08/02/2004

Test Date

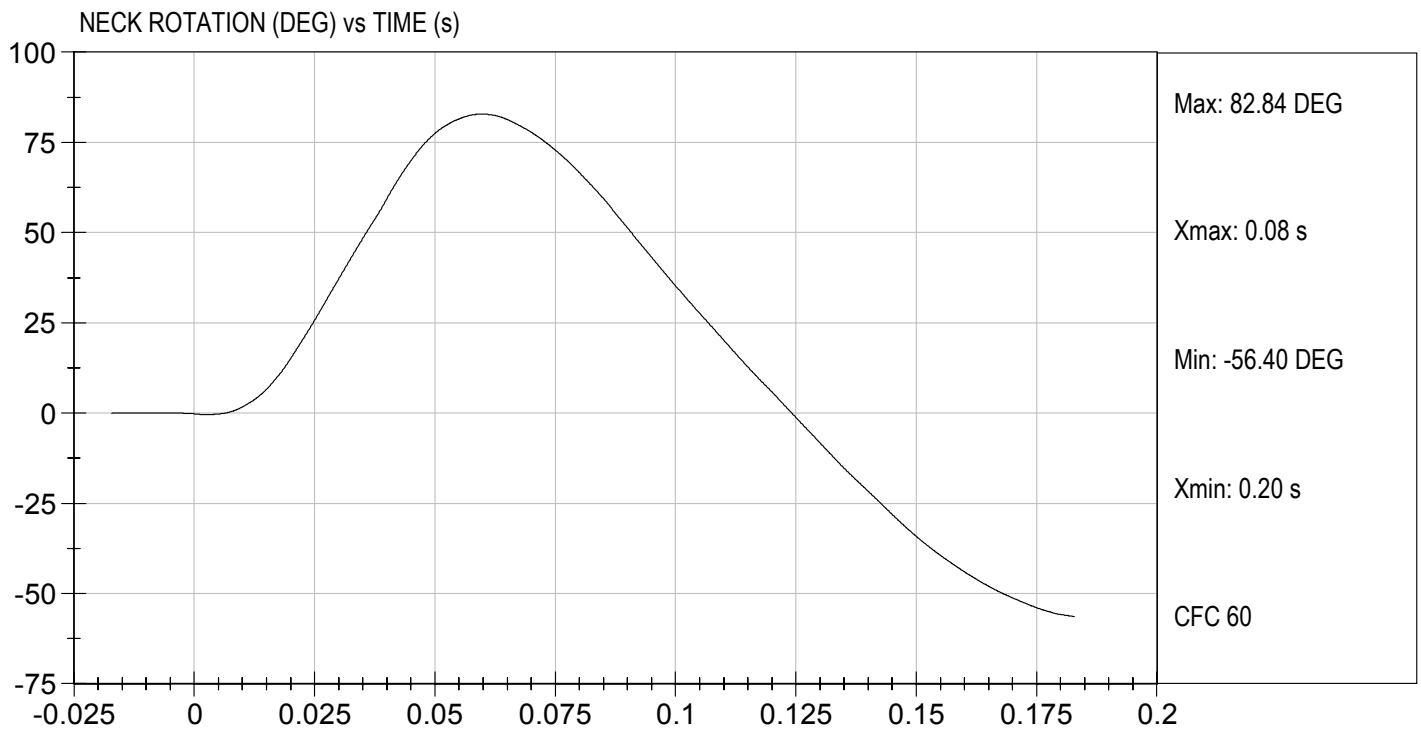
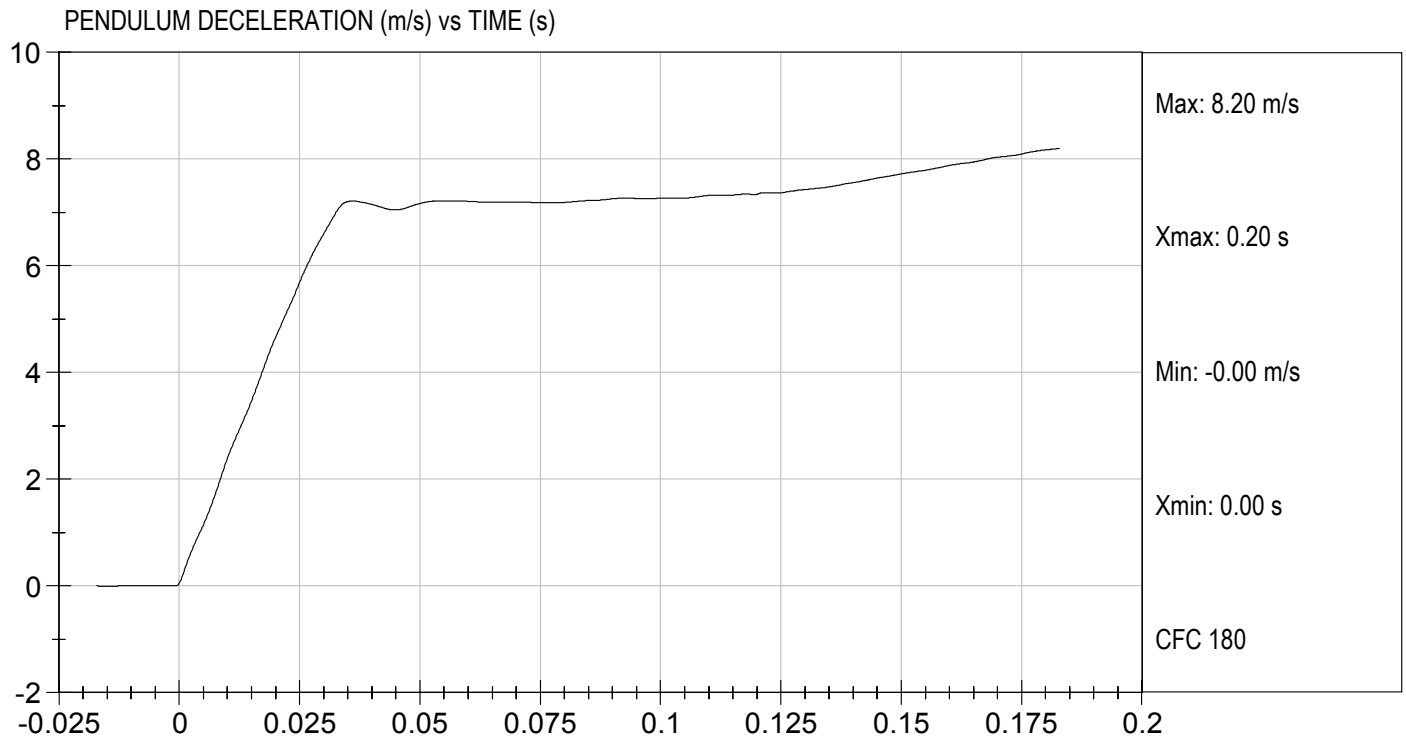


Approved By



Test Desc: Neck Flexion
Componet ID: D041752

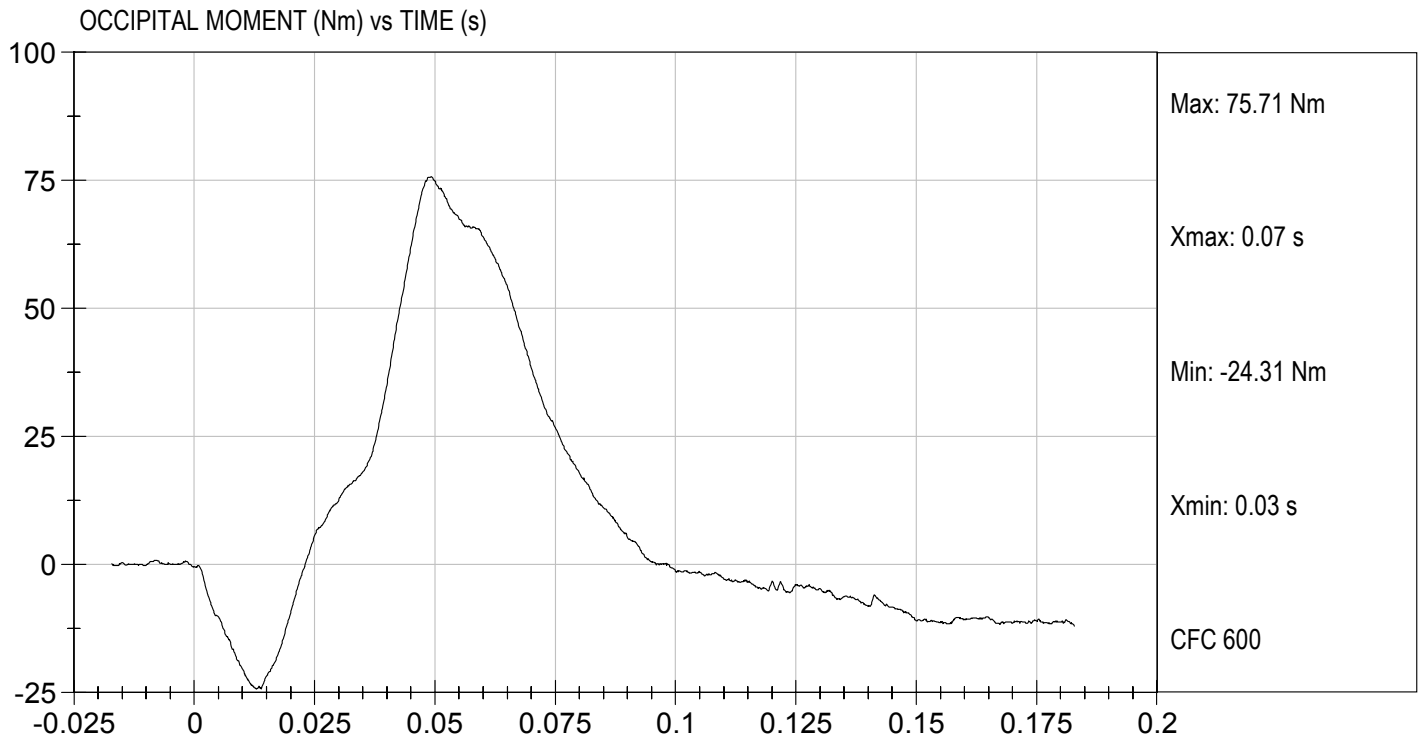
Test Date: 08/02/2004
Velocity: 23.2579 ft/s, 7.09 m/s





Test Desc: Neck Flexion
Componet ID: D041752

Test Date: 08/02/2004
Velocity: 23.2579 ft/s, 7.09 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505 Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 21.7

Record the minimum temperature 20.7

Record the maximum humidity 52%

Record the minimum humidity 46%

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

Record findings and actions: No Damage.

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

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

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

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

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

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

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

Parameter		Specification	Result
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.10 m/s
Pendulum 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>-61</u> Nm @ <u>110</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	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.

Joe Flores
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041753

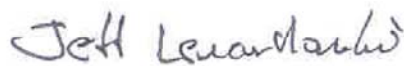
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	50	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.10	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.7	Pass
	30 msec	m/sec	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	95	Pass
Overall Results					Pass



Laboratory Technician

08/02/2004

Test Date

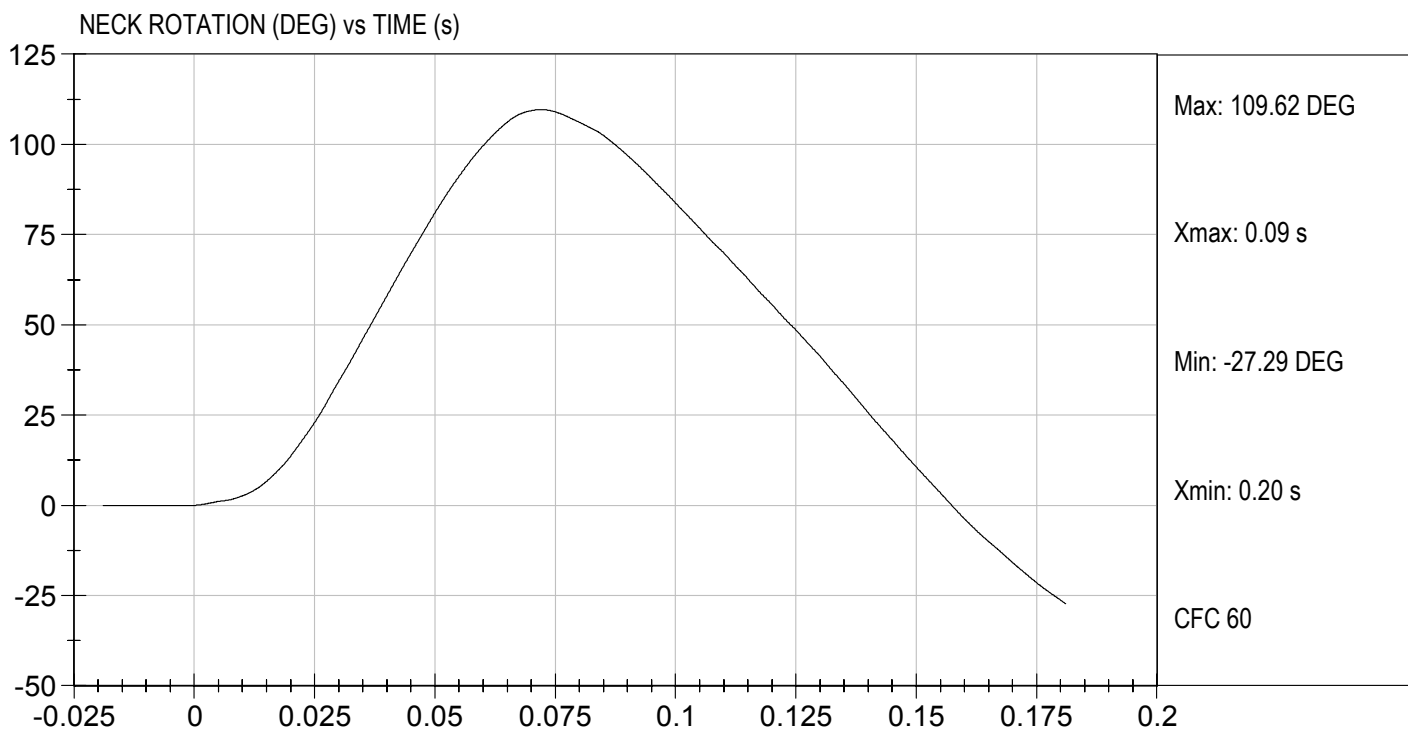
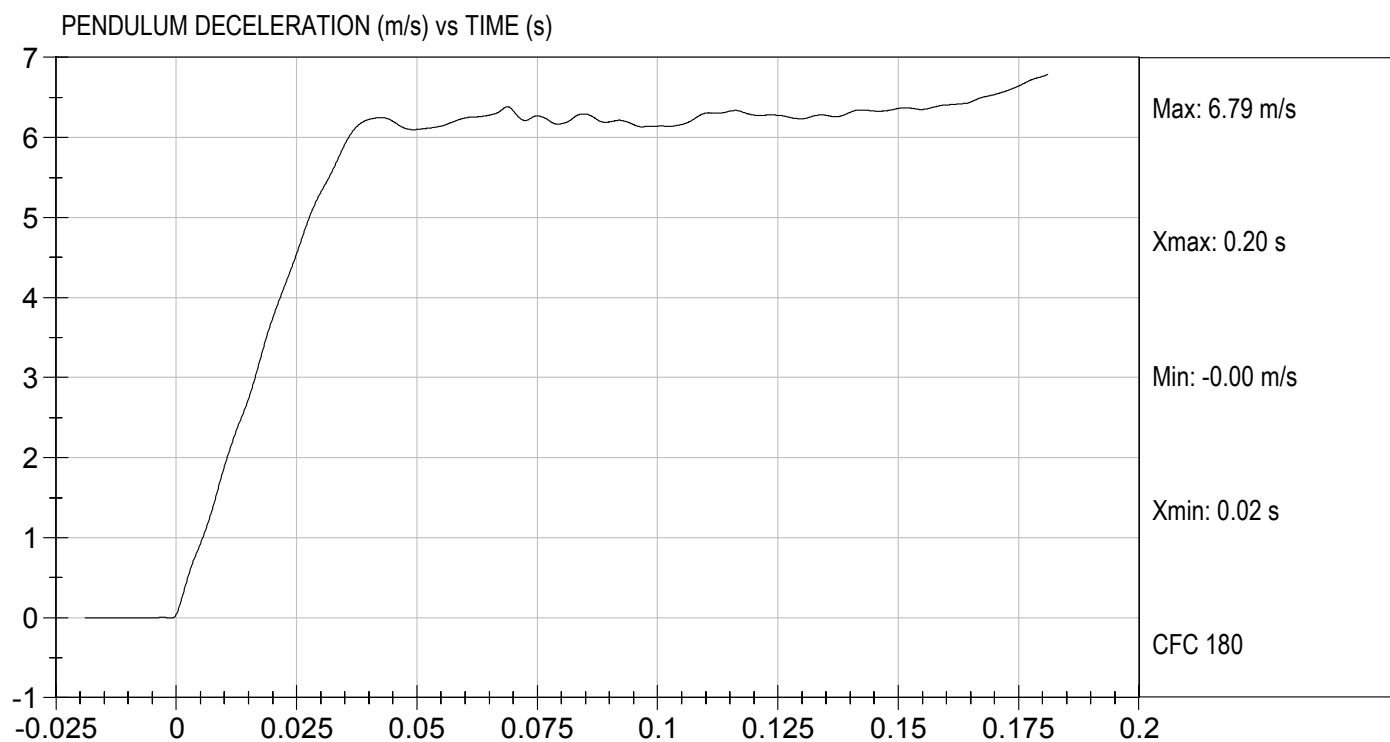


Approved By



Test Desc: Neck Extension
Componet ID: D041753

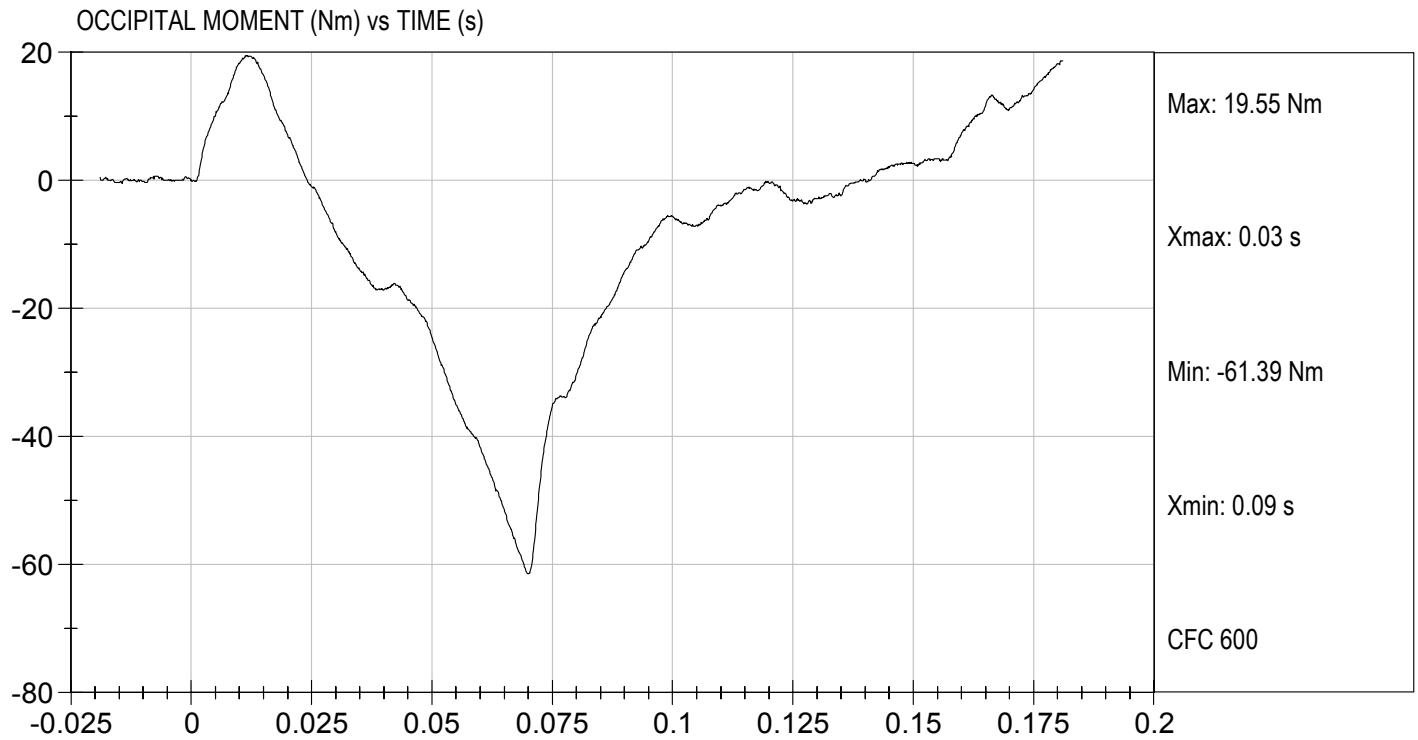
Test Date: 08/02/2004
Velocity: 20.01 ft/s, 6.10 m/s





Test Desc: Neck Extension
Componet ID: D041753

Test Date: 08/02/2004
Velocity: 20.01 ft/s, 6.10 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 21.7

Record the minimum temperature 20.7

Record the maximum humidity 52%

Record the minimum humidity 46%

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

☒ - No damage

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

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

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

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

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

- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.63 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	55.9 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4020 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	3791 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	69%

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

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

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

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


Signature

8/02/04
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041754

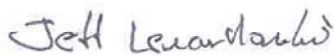
Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.7	Pass
Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	6.59 to 6.83	6.63	Pass
Peak Deflection	mm	50 to 58	55.9	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.0	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	< 4600 N	3,791	Pass
Overall Test Results				Pass



Laboratory Technician

08/02/2004

Test Date

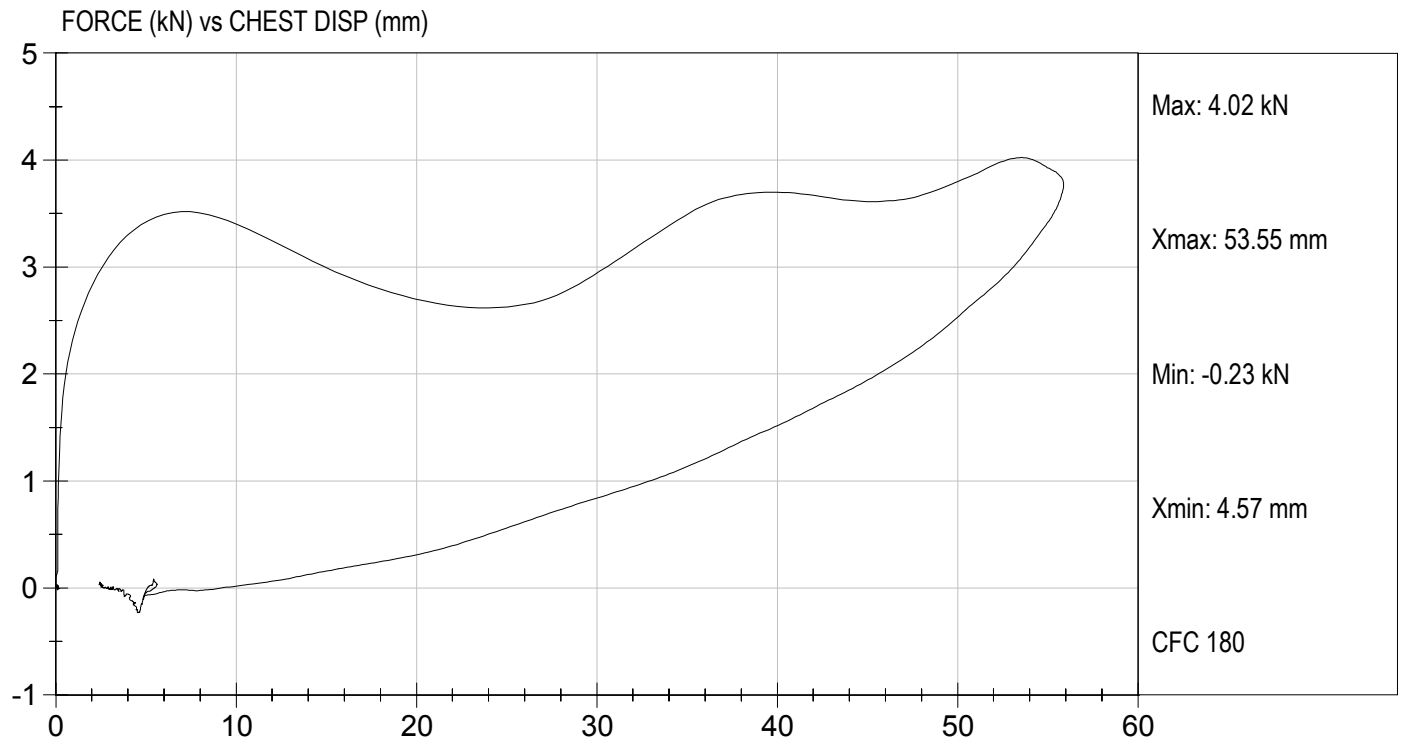


Approved By



Test Desc: Thorax Impact
Componet ID: D041754

Test Date: 08/02/2004
Velocity: 21.74 ft/s, 6.63 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505

Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

☐ with legs below the femurs.

☒ without legs below the femurs.

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

Record the maximum temperature 21.7

Record the minimum temperature 20.7

Record the maximum humidity 52%

Record the minimum humidity 46%

☒ 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 $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	381 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	17°

Joe Fleck
Signature

8/02/04
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041757

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	17	Pass
Force at 45 deg	N	320 to 390	381	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/02/2004

Test Date



Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.7

Record the minimum temperature 20.7

Record the maximum humidity 52%

Record the minimum humidity 46%

☒ 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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3850 N

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

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

Joe Fleck
Signature

8/02/04
Date

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

ATD Serial No: 505

Test I.D: D041756

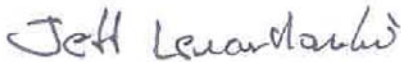
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/sec	2.07 to 2.13	2.12	Pass
Maximum Force	kN	3.45 to 4.06	3.85	Pass
Overall Test Results				Pass



Laboratory Technician

08/02/2004

Test Date

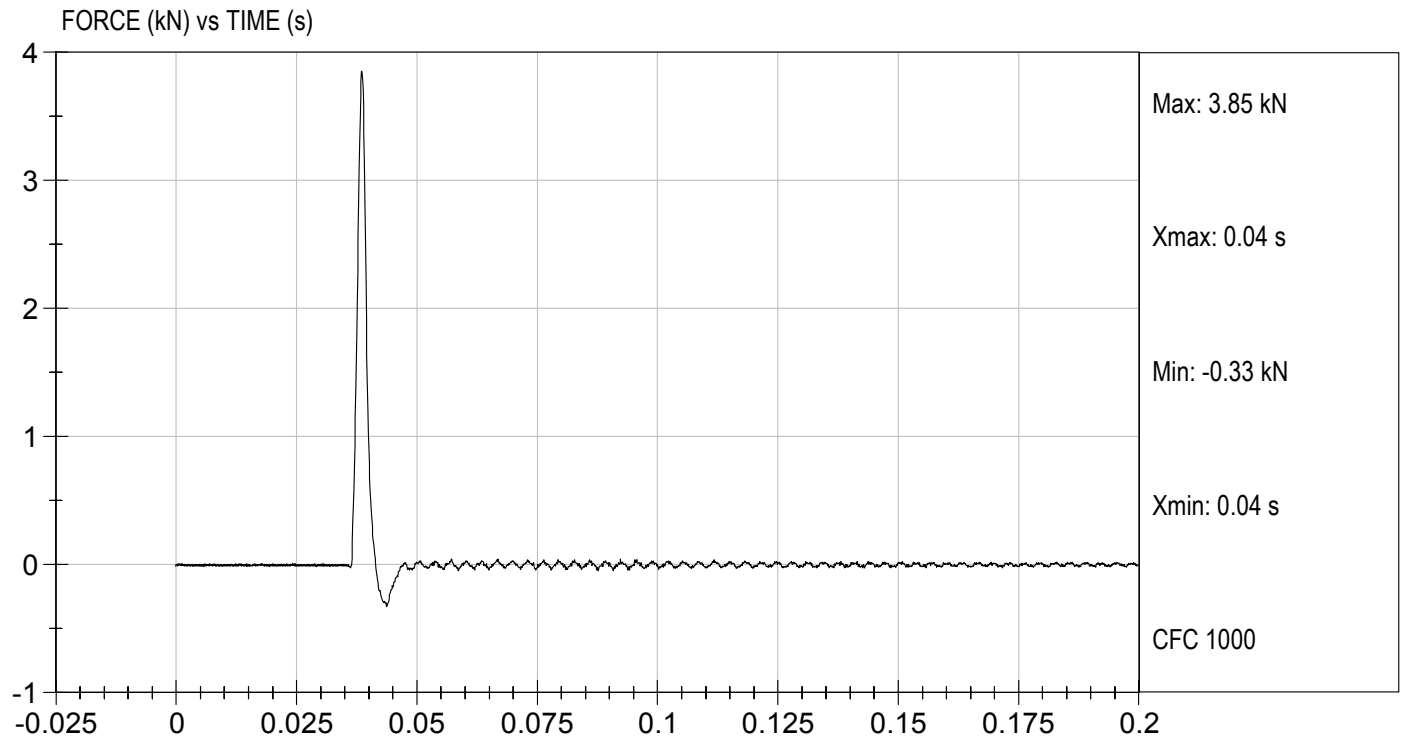


Approved By



Test Desc: Left Knee
Componet ID: D041756

Test Date: 08/02/2004
Velocity: 6.95 ft/s, 2.12 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 8/02/04

Technician Joe Fleck

☒ Pretest calibration

☐ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 21.7

Record the minimum temperature 20.7

Record the maximum humidity 52 %

Record the minimum humidity 46 %

☒ 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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3560 N

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

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

Joe Fleck
Signature

8/02/04
Date

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

ATD Serial No: 505

Test I.D: D041755

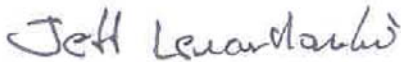
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/sec	2.07 to 2.13	2.11	Pass
Maximum Force	kN	3.45 to 4.06	3.56	Pass
Overall Test Results				Pass



Laboratory Technician

08/02/2004

Test Date

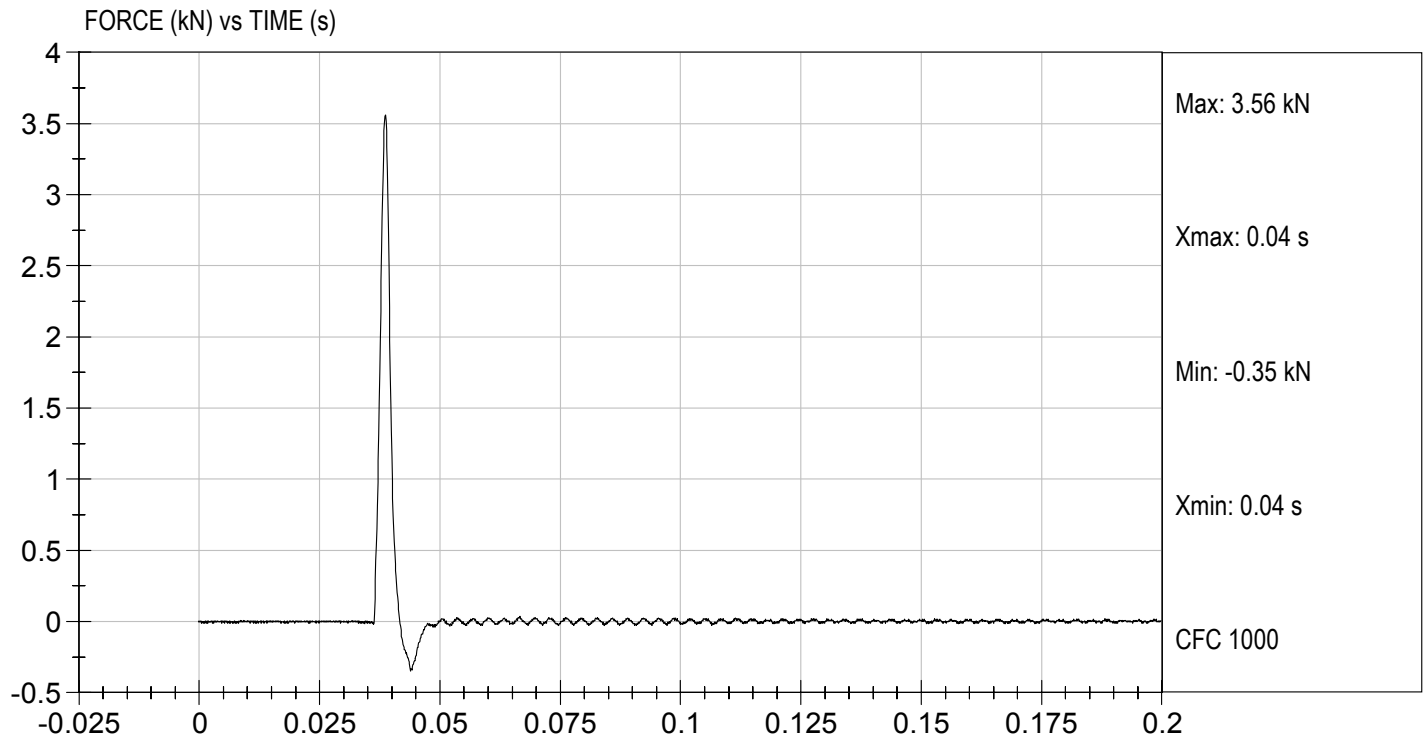


Approved By



Test Desc: Right Knee
Componet ID: D041755

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



DATA SHEET B3
HEAD DROP TEST (572.132)

Dummy Serial Number 505 Test Date 8/16/04

Technician Joe Fleck

 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 22.0

Record the minimum temperature 21.1

Record the maximum humidity 50%

Record the minimum humidity 40%

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 500mm

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 $\leq 15 \text{ g}$	10

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

Joe Fleck
Signature

8/16/04
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test ID: D041921

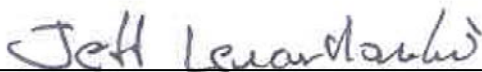
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	250 - 300	270	Pass
Peak Lateral Acceleration	G's	+/- 15	9.5	Pass
Unimodal	Yes/No	NA	Yes	Pass
Oscillations	Yes/No	within 10% of peak	Yes	Pass
Overall Test Results				Pass



Laboratory Technician

08/16/2004

Test Date



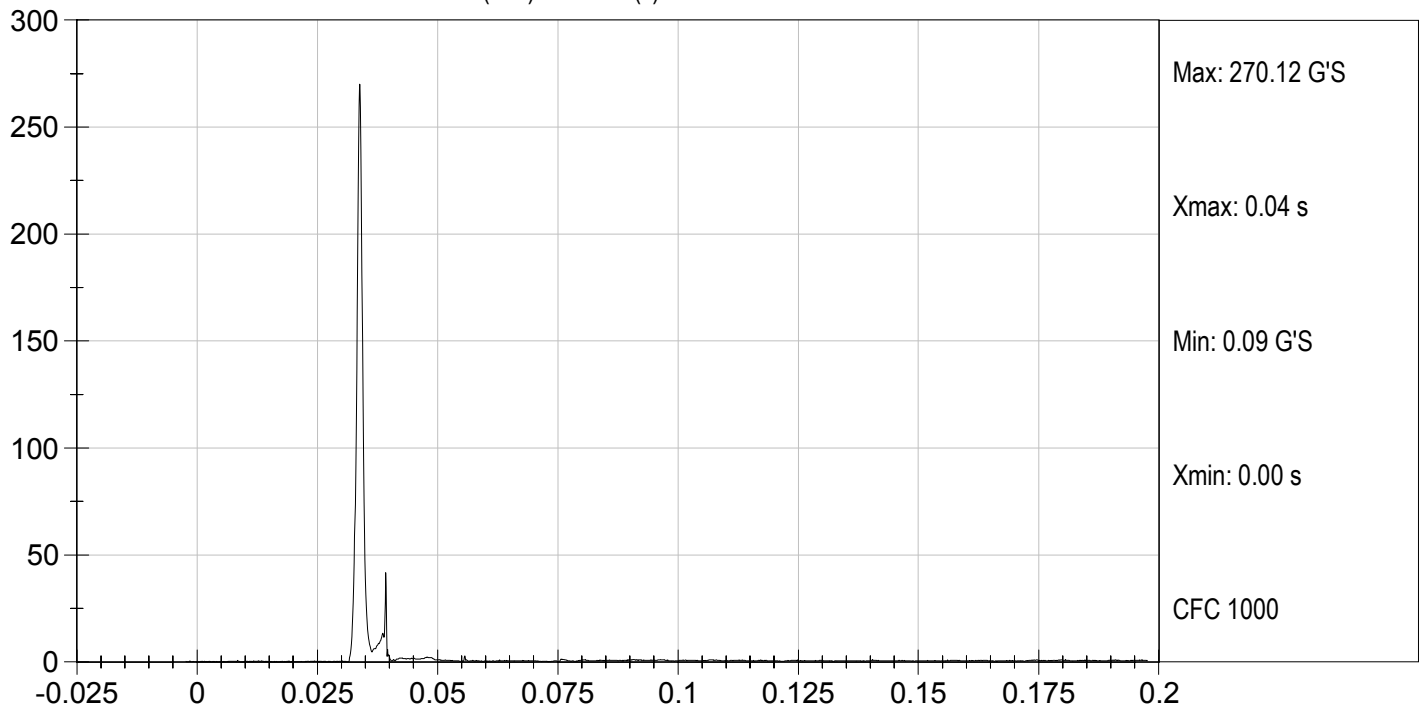
Approved By



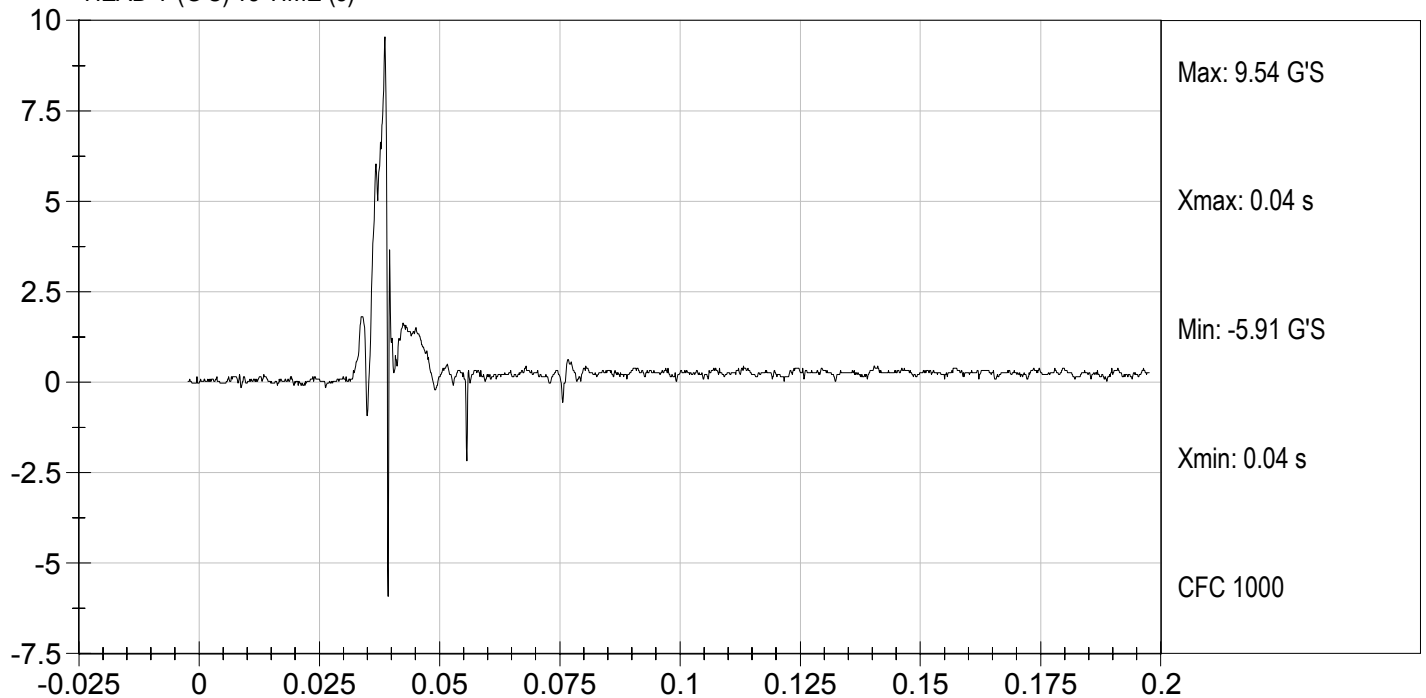
Test Desc: Head Drop
Componet ID: D041921

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

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



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



DATA SHEET B4
NECK FLEXION TEST (572.133)

Dummy Serial Number 505 Test Date 8/16/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one flexion test performed

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.1

Record the maximum humidity 50%

Record the minimum humidity 40%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 85; Rear 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		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	7.10 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	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.8 m/s
	@30ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	6.7 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>73</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.

Joe Flack

Signature

8/16/04

Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041922

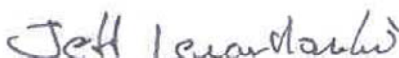
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Speed		m/sec	6.89 to 7.13	7.10	Pass
Pendulum Deceleration	10 msec	m/sec	2.1 to 2.5	2.4	Pass
	20 msec	m/sec	4.0 to 5.0	4.8	Pass
	30 msec	m/sec	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		msec	80 to 100	86	Pass
Overall Results				Pass	



Laboratory Technician

08/16/2004

Test Date



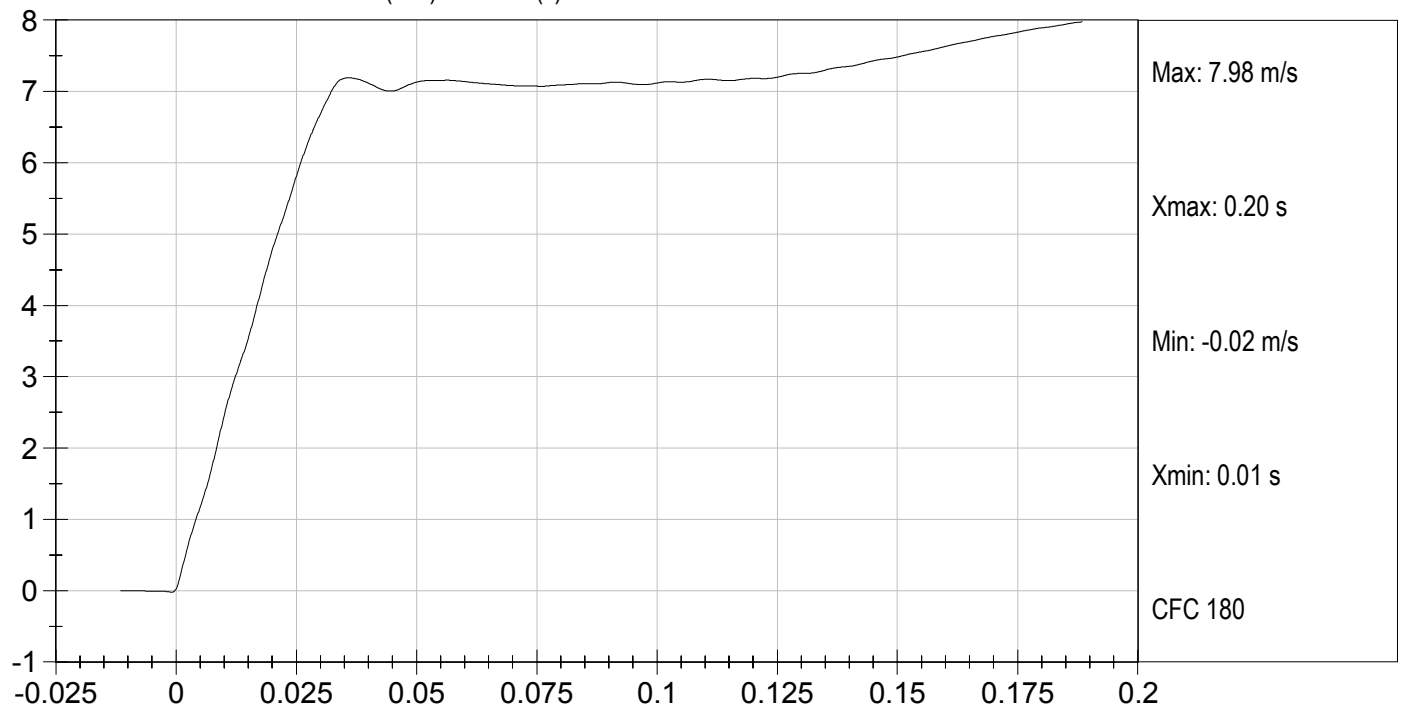
Approved By



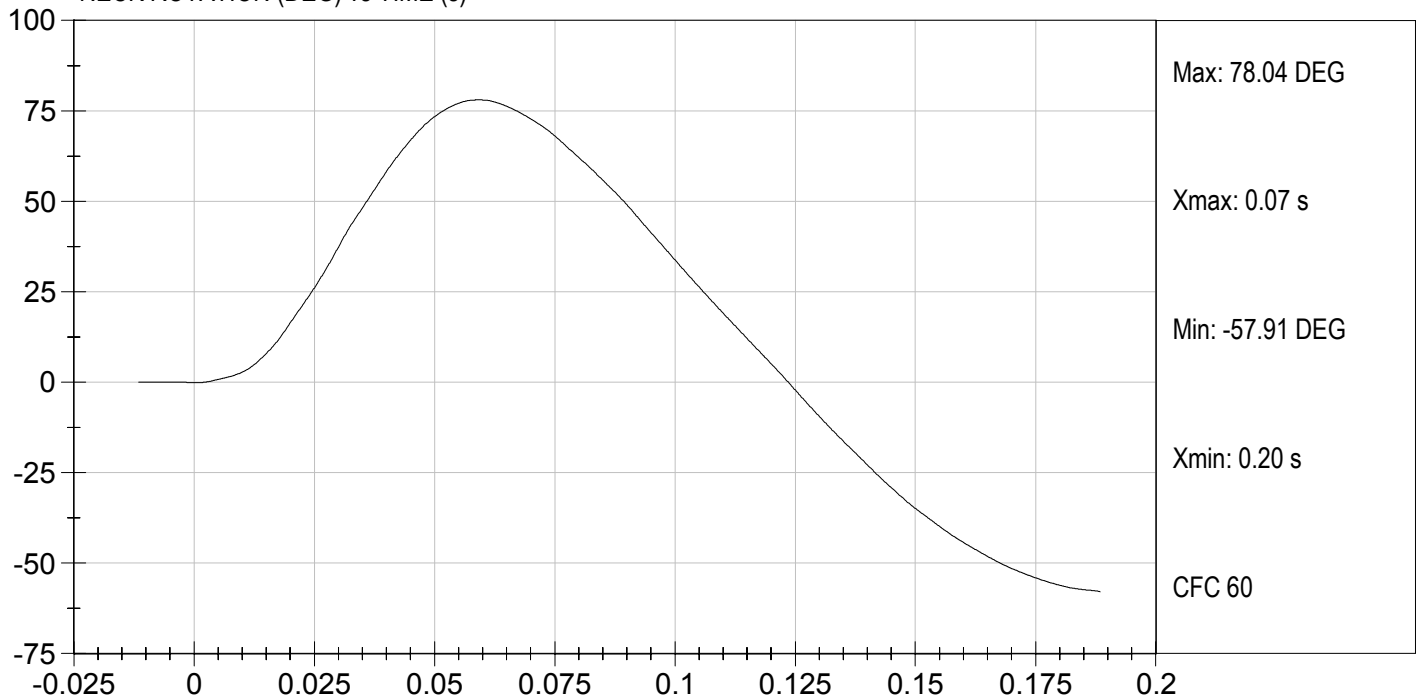
Test Desc: Neck Flexion
Componet ID: D041922

Test Date: 08/16/2004
Velocity: 23.3 ft/s, 7.10 m/s

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



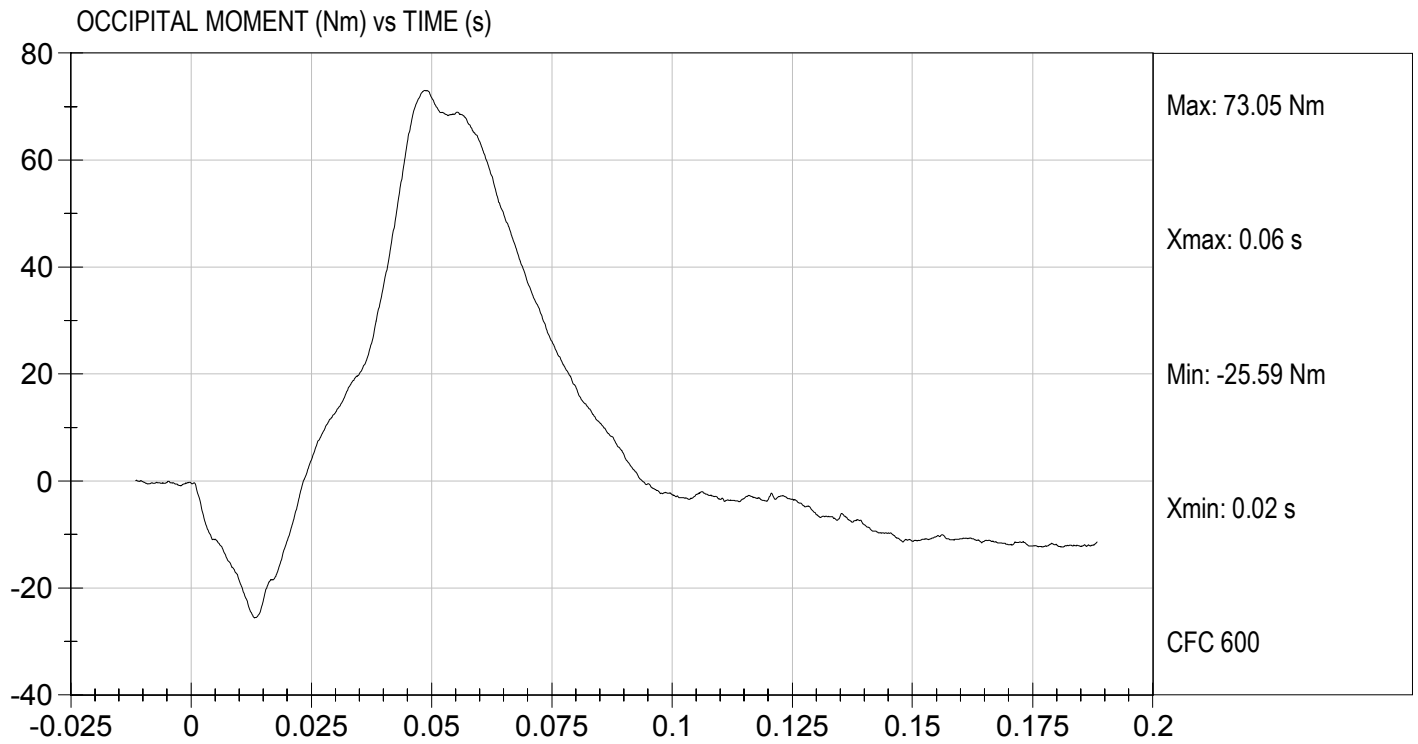
NECK ROTATION (DEG) vs TIME (s)





Test Desc: Neck Flexion
Componet ID: D041922

Test Date: 08/16/2004
Velocity: 23.3 ft/s, 7.10 m/s



DATA SHEET B5
NECK EXTENSION TEST (572.133)

Dummy Serial Number 505 Test Date 8/16/04

Technician Joe Fleck

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one extension test performed

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.1

Record the maximum humidity 50%

Record the minimum humidity 40%

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

Record findings and actions: No Damage.

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

Record findings and actions: No Deterioration. Hardness Front 85; Rear 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		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.13 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>-61</u> Nm @ <u>106</u> degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	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.

Joe Flick
Signature

8/16/04
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041923

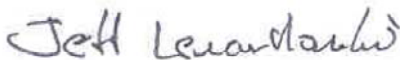
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/sec	5.95 to 6.19	6.13	Pass
Pendulum Deceleration	10 msec	m/sec	1.5 to 1.9	1.9	Pass
	20 msec	m/sec	3.1 to 3.9	3.8	Pass
	30 msec	m/sec	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		msec	94 to 114	95	Pass
Overall Results					Pass



Laboratory Technician

08/16/2004

Test Date

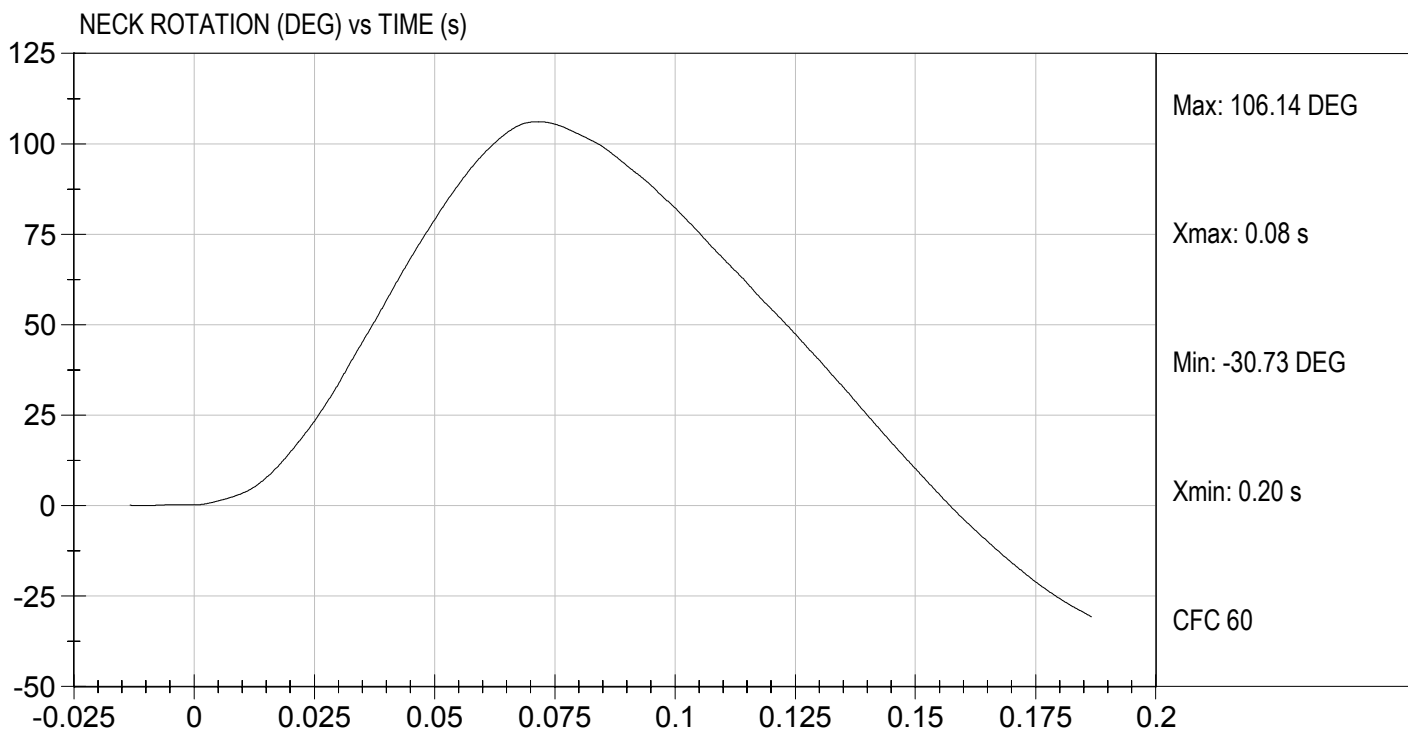
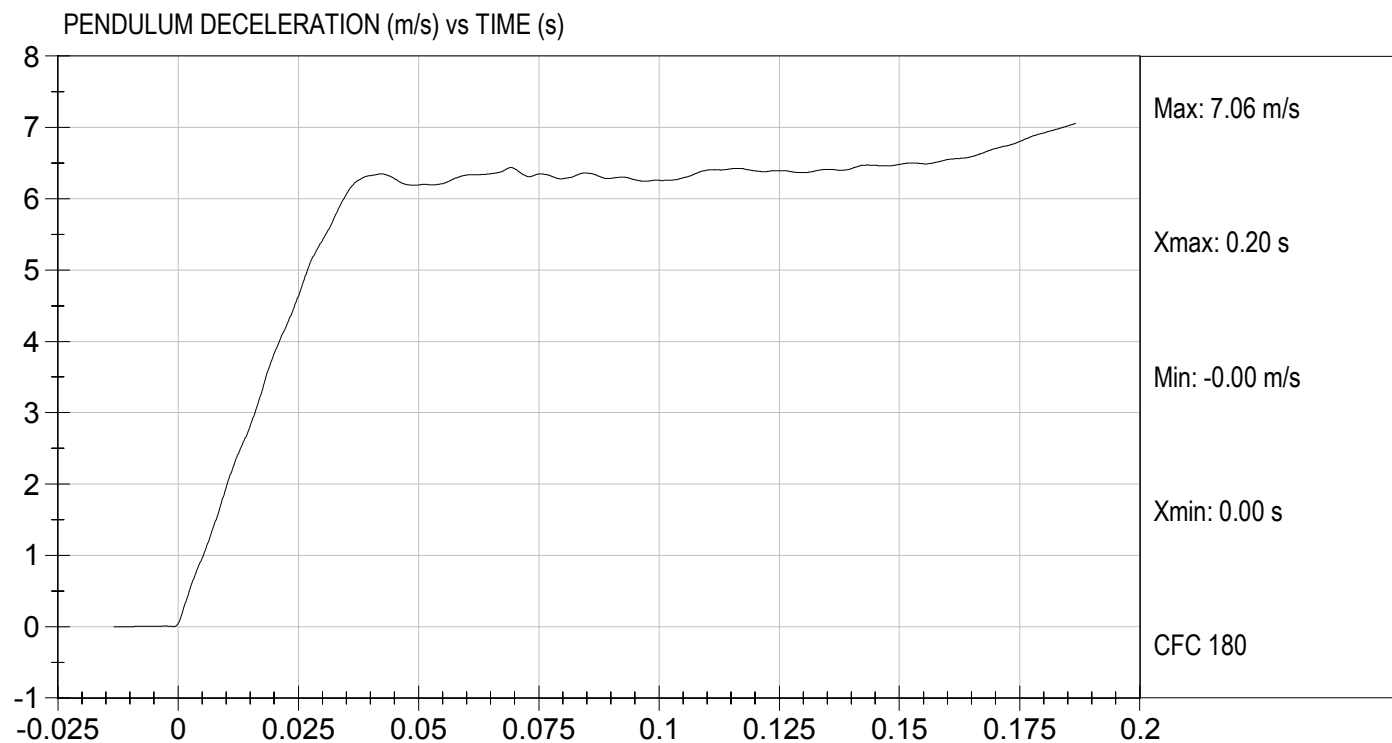


Approved By



Test Desc: Neck Extension
Componet ID: D041923

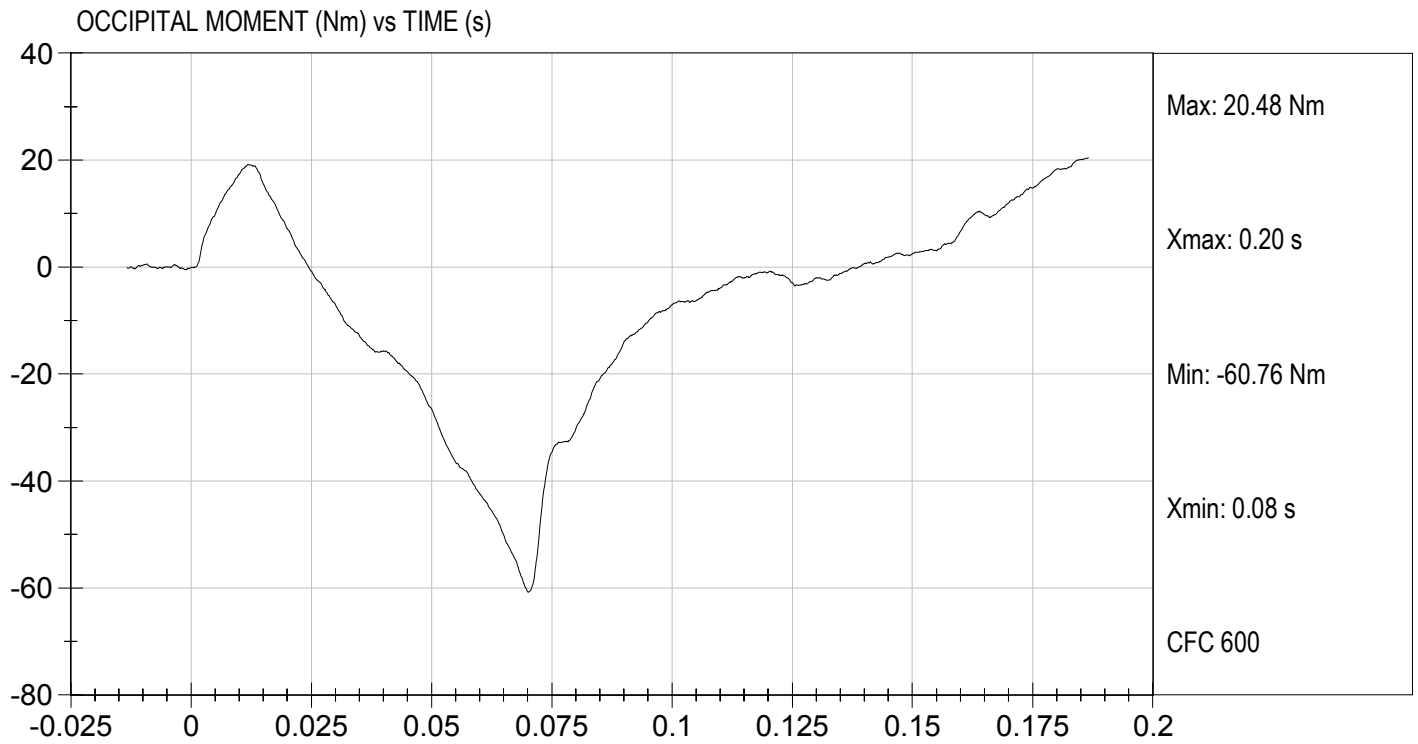
Test Date: 08/16/2004
Velocity: 20.11 ft/s, 6.13 m/s





Test Desc: Neck Extension
Componet ID: D041923

Test Date: 08/16/2004
Velocity: 20.11 ft/s, 6.13 m/s



DATA SHEET B6
THORAX IMPACT TEST (572.134)

Dummy Serial Number 505

Test Date 8/16/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.1

Record the maximum humidity 50%

Record the minimum humidity 40%

☒ 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))

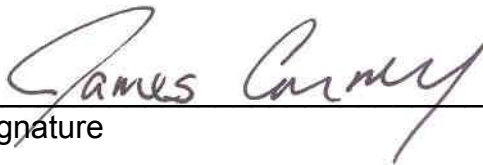
Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.79 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	55 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4200 N
Peak force** between 18.0 and 50.0 mm chest compression	$\text{peak force} \leq 4600 \text{ N}$	4210 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	69%

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

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

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

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


Signature

8/16/04
Date

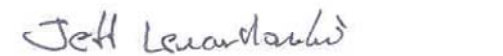
MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041924

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/s	6.59 to 6.83	6.79	Pass
Peak Deflection	mm	50 to 58	55.4	Pass
Peak Resistive Force w/in Deflection Corridor	kN	3.9 to 4.4	4.2	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	Yes/No	< 4600 N	4210	Pass
			Overall Test Results	Pass


Laboratory Technician

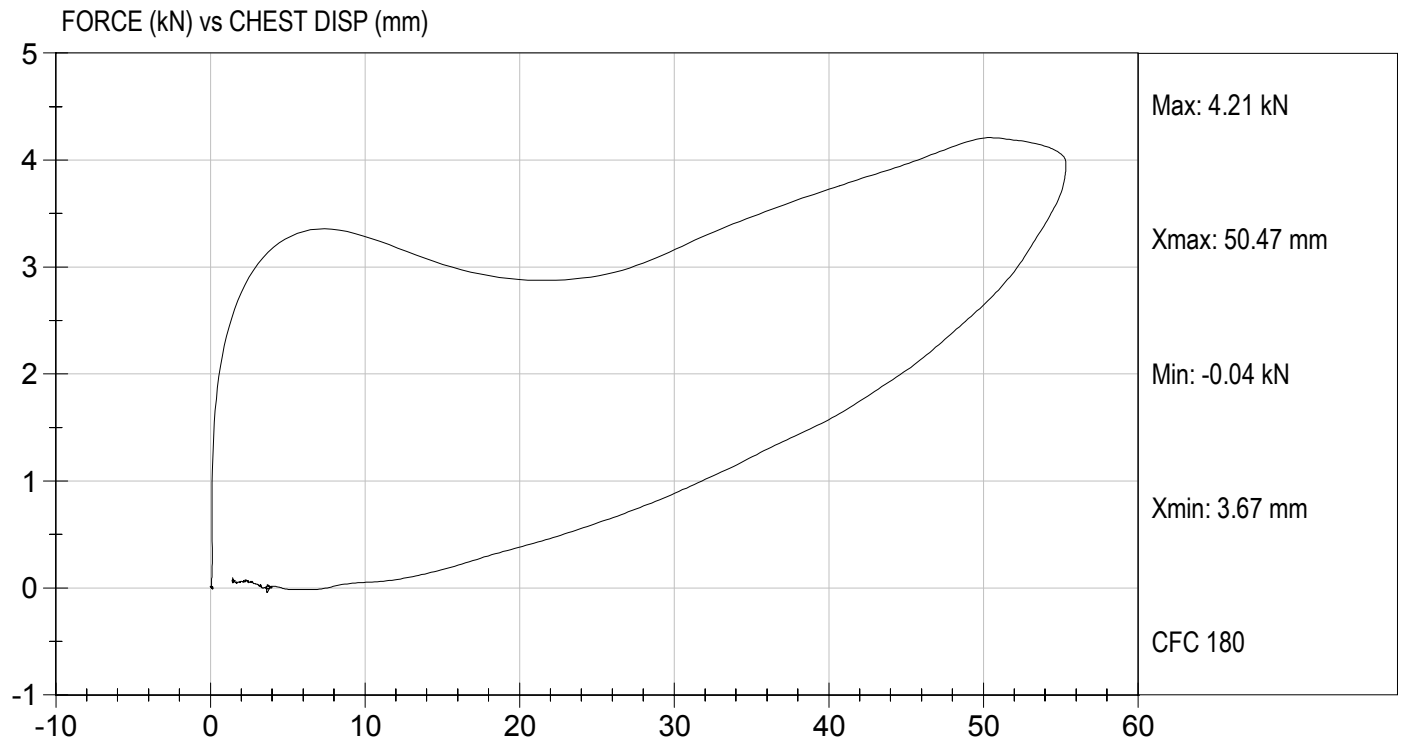

Approved By

08/16/2004
Test Date



Test Desc: Thorax Impact
Componet ID: D041924

Test Date: 08/16/2004
Velocity: 22.27 ft/s, 6.79 m/s



DATA SHEET B7
TORSO FLEXION TEST (572.135)

Dummy Serial Number 505

Test Date 8/16/04

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 21.1

Record the maximum humidity 50%

Record the minimum humidity 40%

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°) 19°

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 $\leq 20^\circ$	19°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	1.0
Force at $45^\circ \pm 0.5^\circ$	$320 \text{ N} \leq \text{force} \leq 390 \text{ N}$	364 N
Final ref. plane angle	Initial ref. plane angle $\pm 8^\circ$	23°

Joe Fleck
Signature

8/16/04
Date

MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 505

Test I.D: D041927

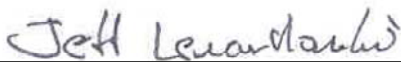
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 - 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	23	Pass
Force at 45 deg	N	320 to 390	364	Pass
Upper Torso Deflection Rate	Deg/sec	0.5 - 1.5	1.0	Pass
Overall Result				Pass



Laboratory Technician

08/16/2004

Test Date



Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 8/16/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.1

Record the maximum humidity 50%

Record the minimum humidity 40%

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

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

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

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

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

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

X 11. Complete the following table:

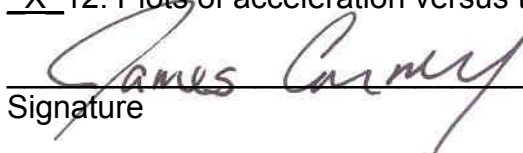
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.08 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3710 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



8/16/04

Date

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

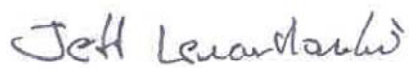
ATD Serial No: 505

Test I.D: D041926

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.08	Pass
Maximum Force	kN	3.45 to 4.06	3.70	Pass
Overall Test Results				Pass


Laboratory Technician

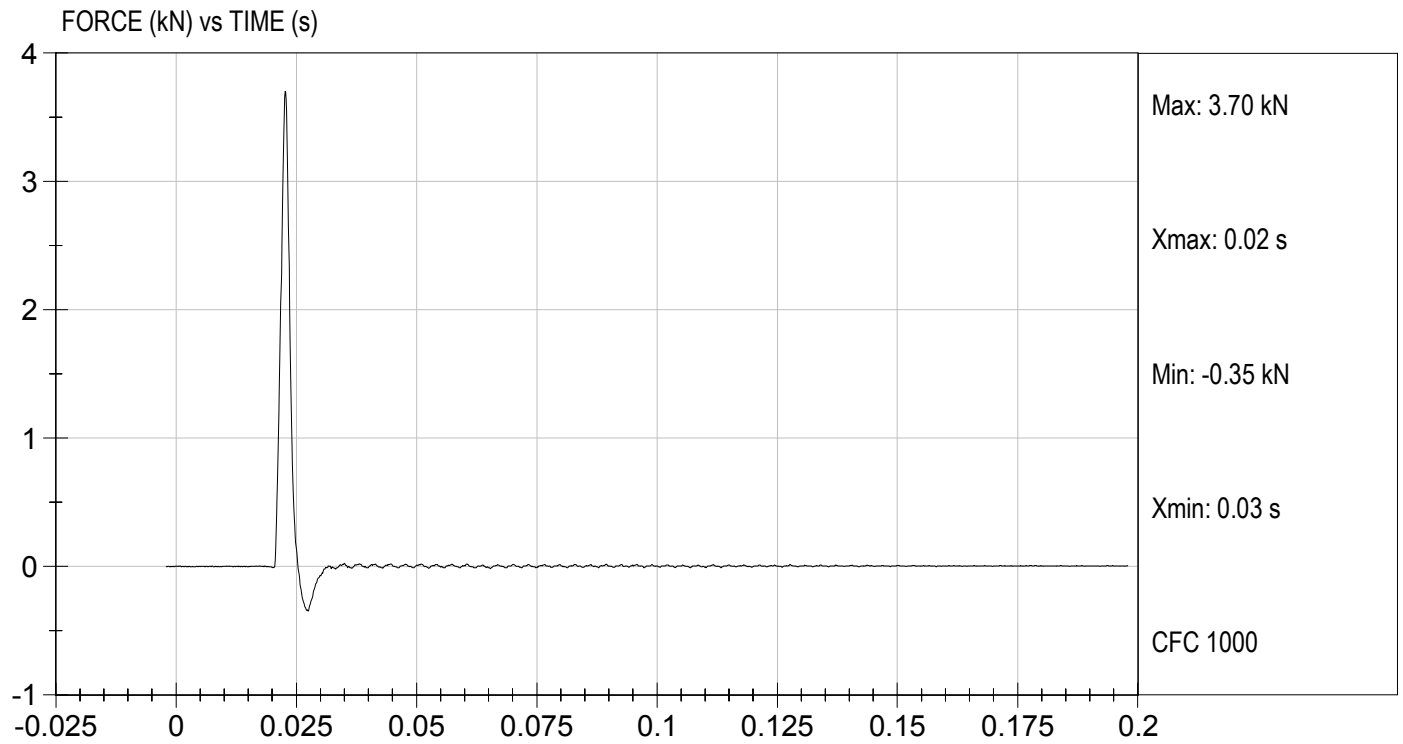
08/16/2004
Test Date


Approved By



Test Desc: Left Knee
Componet ID: D041926

Test Date: 08/16/2004
Velocity: 6.82 ft/s, 2.08 m/s



DATA SHEET B9
RIGHT KNEE IMPACT TEST (572.136)

Dummy Serial Number 505

Test Date 8/16/04

Technician Jim Carney

☐ Pretest calibration

☒ Post test calibration verification

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

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

☒ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature 22.0

Record the minimum temperature 21.1

Record the maximum humidity 50 %

Record the minimum humidity 40 %

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

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

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

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

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

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

☒ 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*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3670 N

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

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


Signature

8/16/04
Date

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

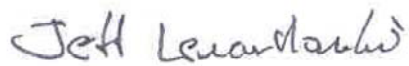
ATD Serial No: 505

Test I.D: D041925

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	43	Pass
Probe Speed	m/sec	2.07 to 2.13	2.10	Pass
Maximum Force	kN	3.45 to 4.06	3.67	Pass
Overall Test Results				Pass


Laboratory Technician

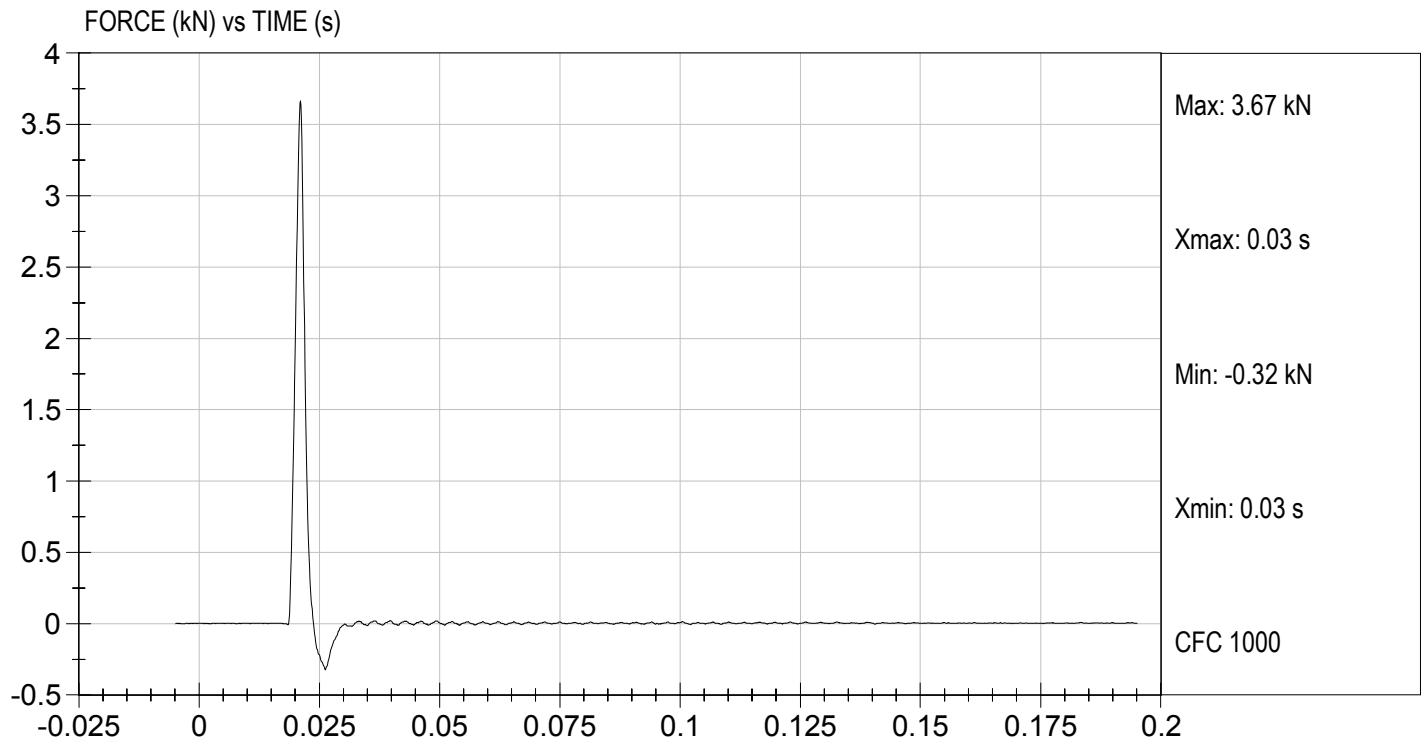
08/16/2004
Test Date


Approved By



Test Desc: Right Knee
Componet ID: D041925

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



DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number 505

Test Date 8/12/04

Technician Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damaged	OK
Outer skin	Gashes, rips, cracks			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

8/13/04
Date

Describe the repair or replacement of parts:

Checked by

Jeff Leonard
Signature

8/13/04
Date

EXTERNAL DIMENSIONS

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

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