

REPORT NO. 208-MGA-2014-DC018

**DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208**

**CHRYSLER GROUP LLC
2014 JEEP PATRIOT MPV
NHTSA NO.: C20140300**

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



TEST DATES: JUNE 5, 2014 – DECEMBER 15, 2014

FINAL REPORT DATE: MARCH 3, 2015

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVENUE, S.E., NVS-220
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HYBRID III 50 th SN #401, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.7
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.2
C	H-POINT HEIGHT	Reference	3.3-3.5	3.5
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.4
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.6
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.0
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.5
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.8
I	SHOULDER TO ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.5
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.8
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	17.8-18.8	18.5

HYBRID III 50 th SN #401, PART 572, SUBPART E EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.8
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.2
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.7
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	4.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	38.5
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.3
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

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

Dummy Serial Number: 401

Test Date: 12/01/2014

Technician: David Schoedel

- ☒ Pre test 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. (572.32(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))
- ☒ 3. Torque the skull cap screws to 160 lbf-in.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(i))
- ☒ 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.5°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- ☒ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- ☒ 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))
 Record the actual distance: 0.5 inches
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.
 Record the right side distance: 501 mm
 Record the left side distance: 501 mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.32(c)(4))
 Record actual micro finish: 40.9 micro inches
- X 12. The impact surface is rigidly supported. (572.132(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)
 Record thickness: 50.9 mm
 Record width: 604 mm
 Record length: 595 mm
- X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	$225 \text{ g} \leq x \leq 275 \text{ g}$	243 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-8.5 g

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

David Schoedel
 Signature

12/01/2014
 Date

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

ATD Serial No: 401

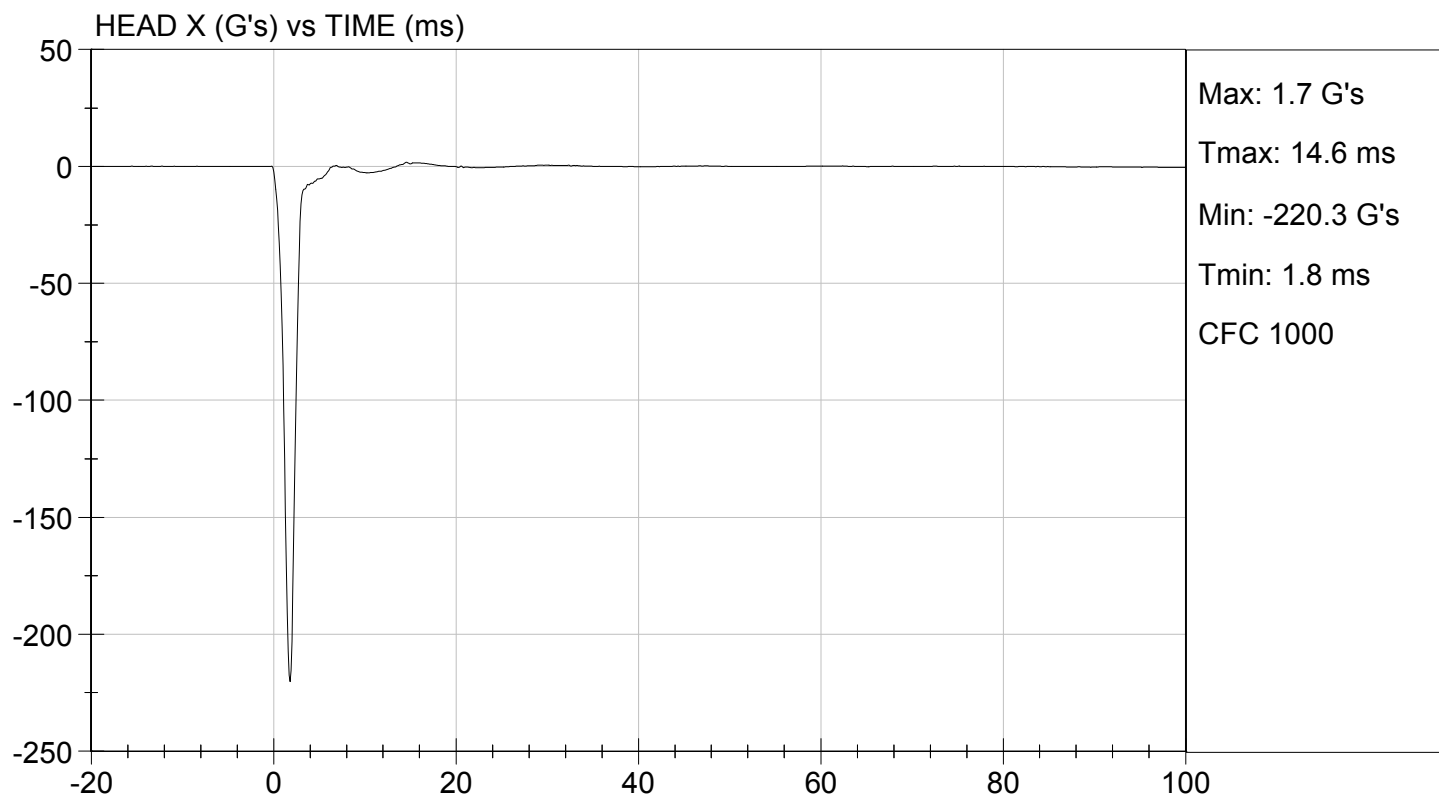
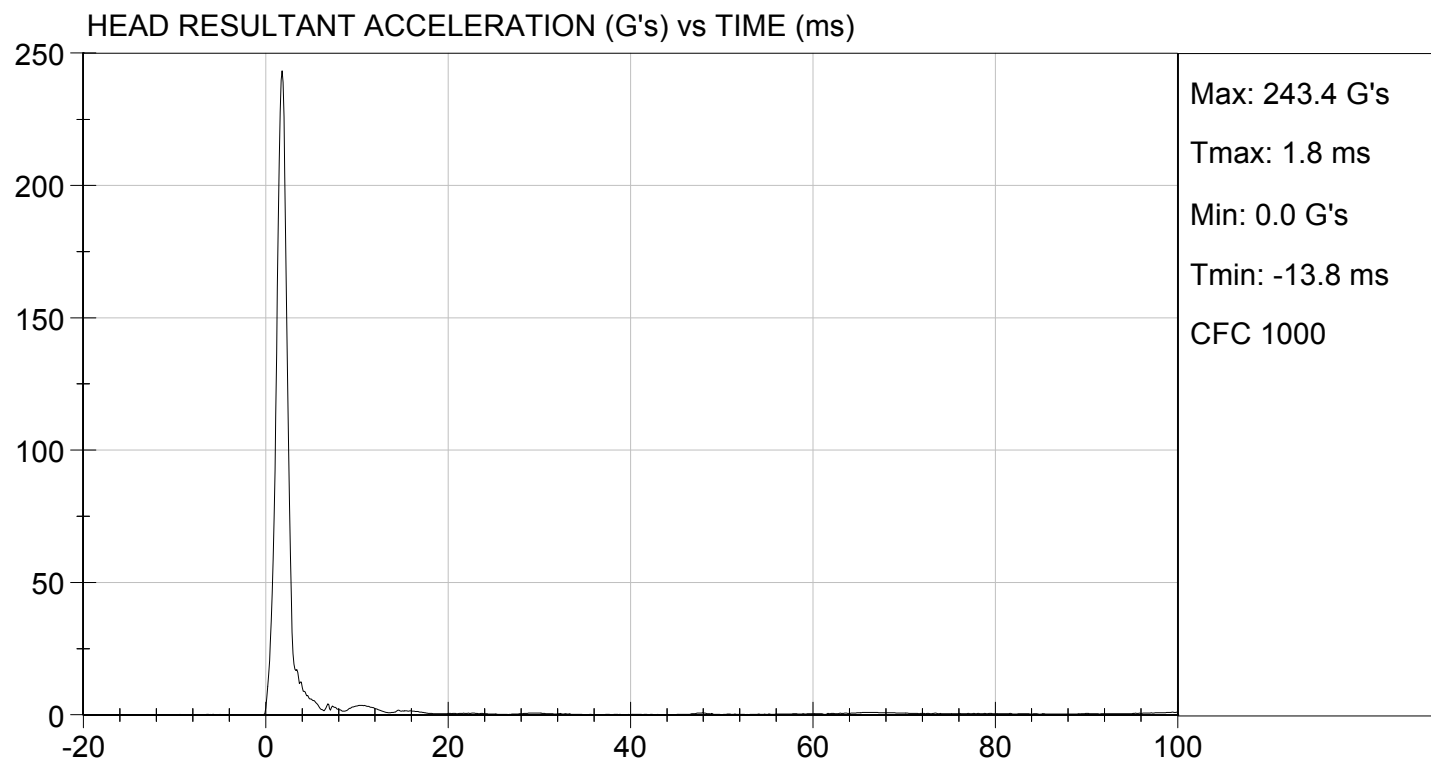
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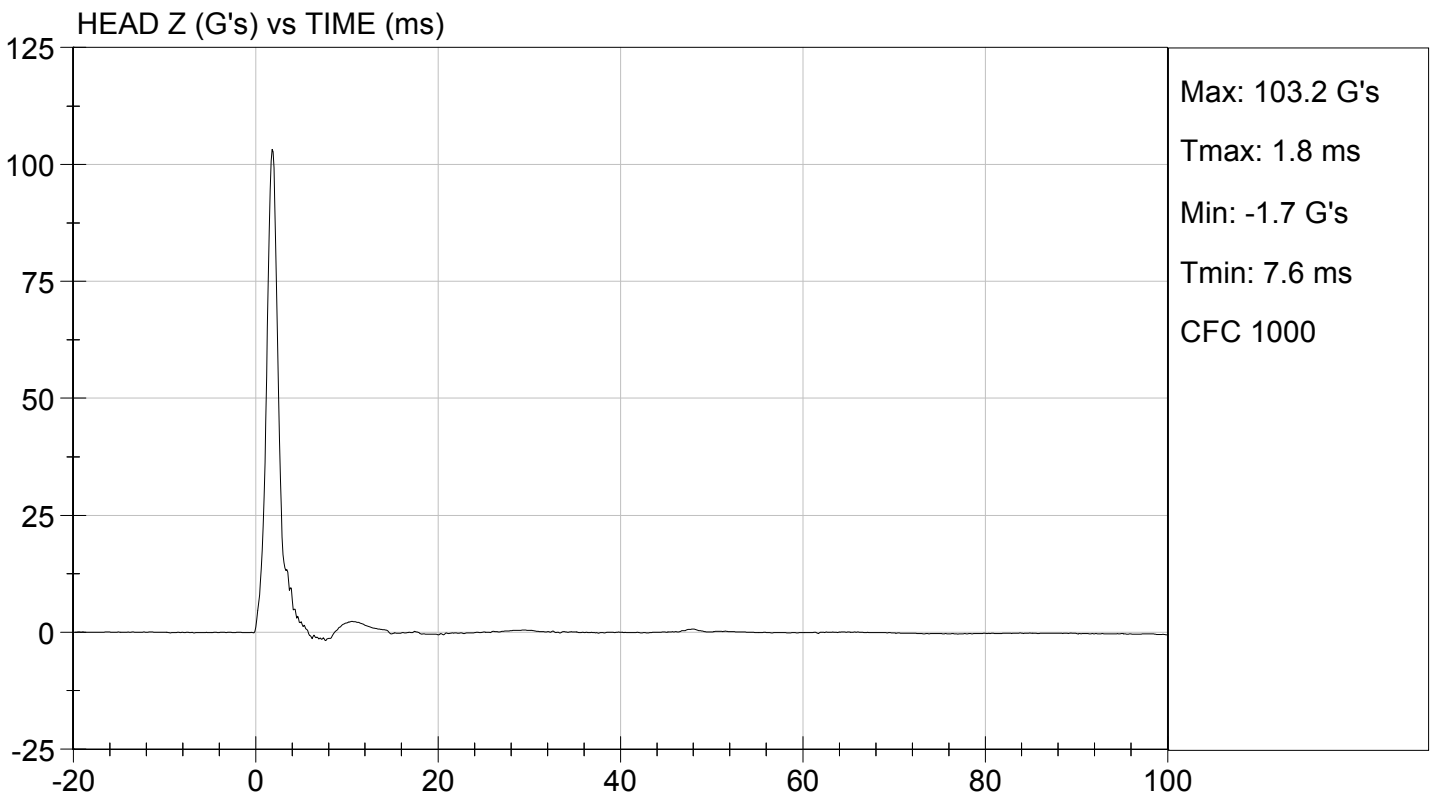
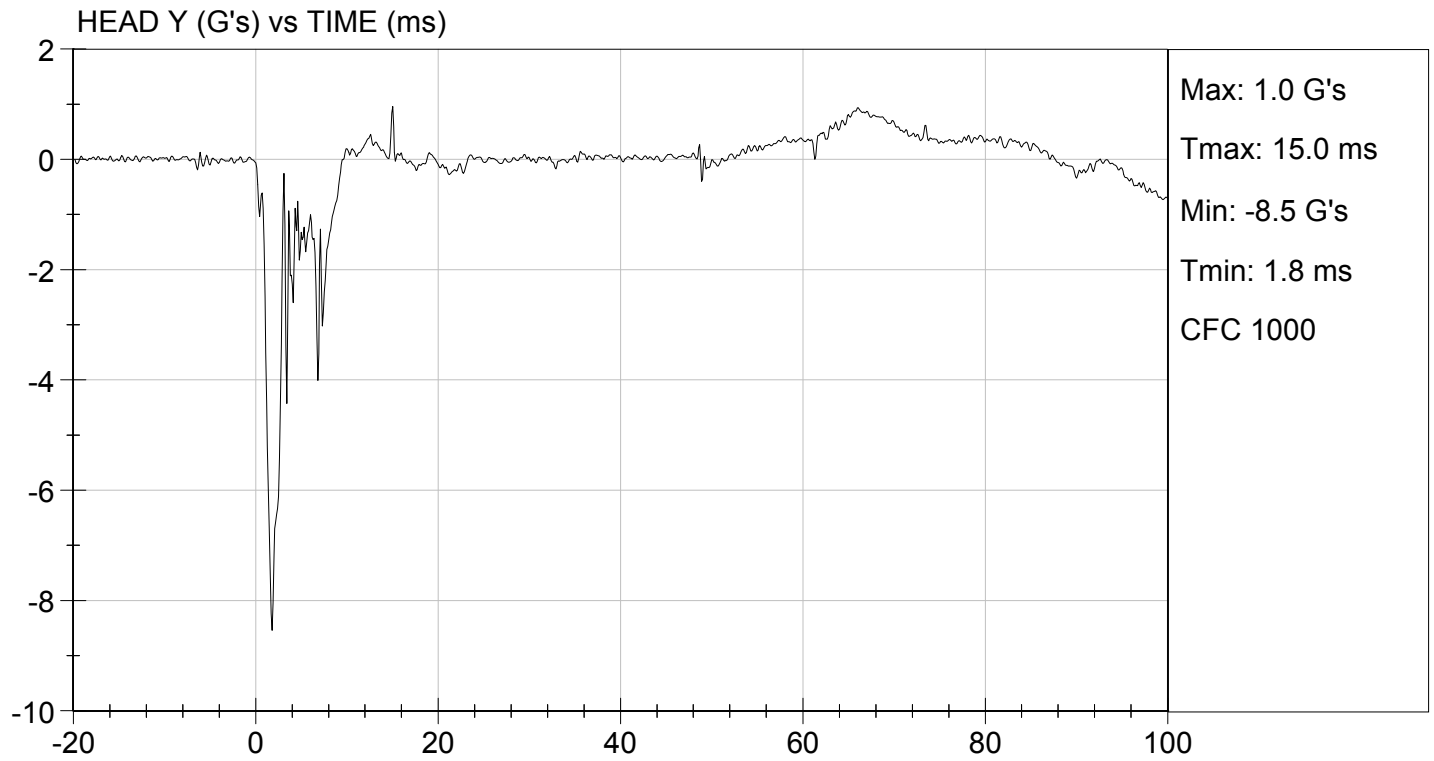
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Peak Resultant Acceleration	G's	225 to 275	243	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

12/01/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A4
NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401

Test Date: 12/01/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

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

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

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

Record the maximum temperature: 21.5°C

Record the minimum temperature: 21.1°C

Record the maximum humidity: 18%

Record the minimum humidity: 15%

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

Record findings and actions: No damage

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

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

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

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		$22.6 \text{ ft/s} \leq \text{speed} \leq 23.4 \text{ ft/s}$	22.83 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	$22.5 \leq g \leq 27.5$	24.11 g's
	@ 20 ms	$17.6 \leq g \leq 22.6$	18.87 g's
	@ 30 ms	$12.5 \leq g \leq 18.5$	14.77 g's
	Above 30 ms	29 g maximum	14.7 g's
First Pendulum Decay to 5g		$34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$	38.4 ms
Plane D Rotation		$64^\circ \leq \text{max. rotation} \leq 78^\circ$	69.7°
		$57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$	59.2 ms
Time for Plane D Rotation to Cross 0° During First Rebound		$113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$	113.3 ms
Maximum Moment		$65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$	67.5 lbf-ft
		$47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$	51.9 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		$97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$	97.3 ms

*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. (572.33(b)(3))

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

David Schoedel
Signature

12/01/2014
Date

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

ATD Serial No: 401

Test I.D: D144212

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	17	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.11	Pass
	20 ms	G's	17.60 to 22.60	18.87	Pass
	30 ms	G's	12.50 to 18.50	14.77	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	38.4	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	69.7	Pass
	Time	ms	57.0 to 64.0	59.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.3	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.5	Pass
	Time	ms	47.0 to 58.0	51.9	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.3	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

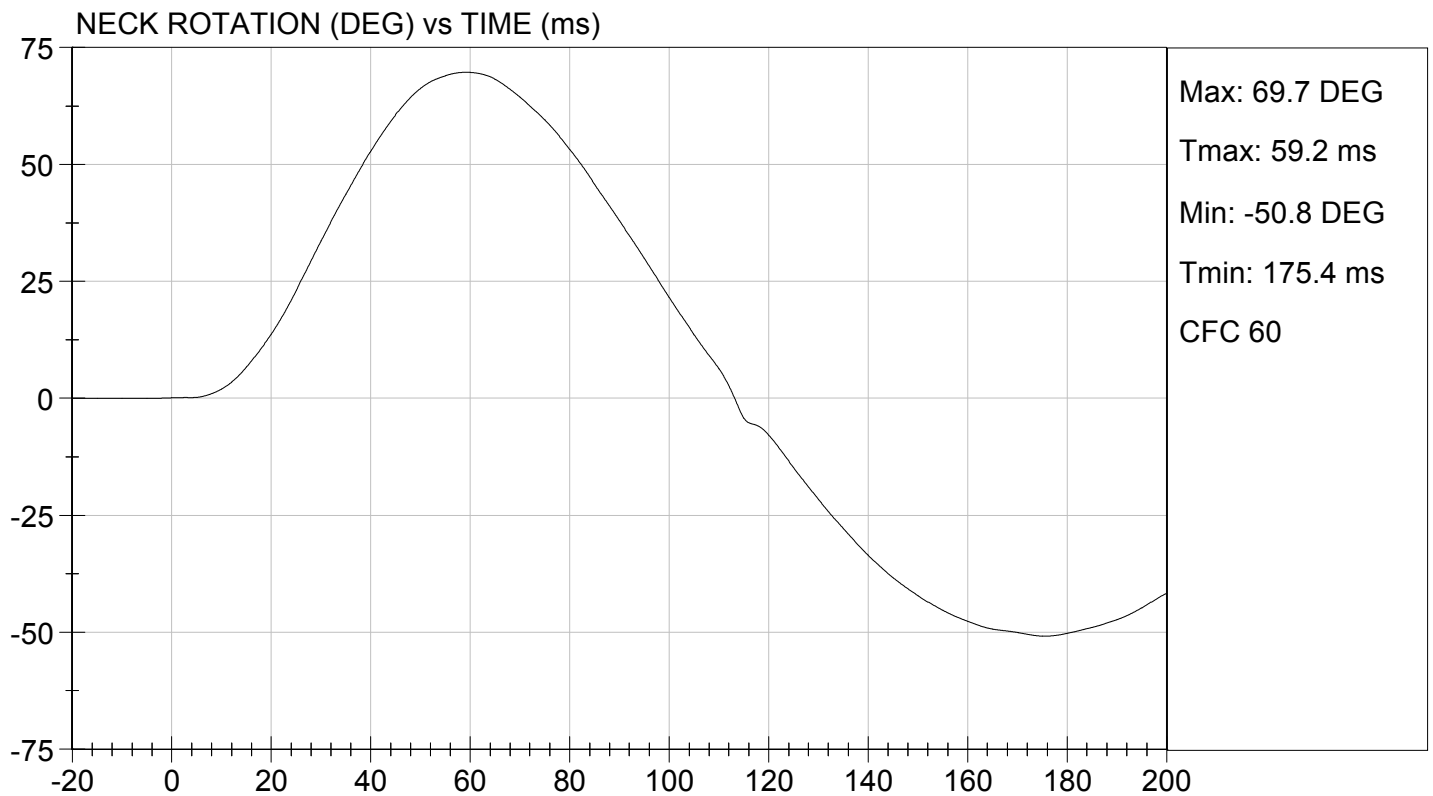
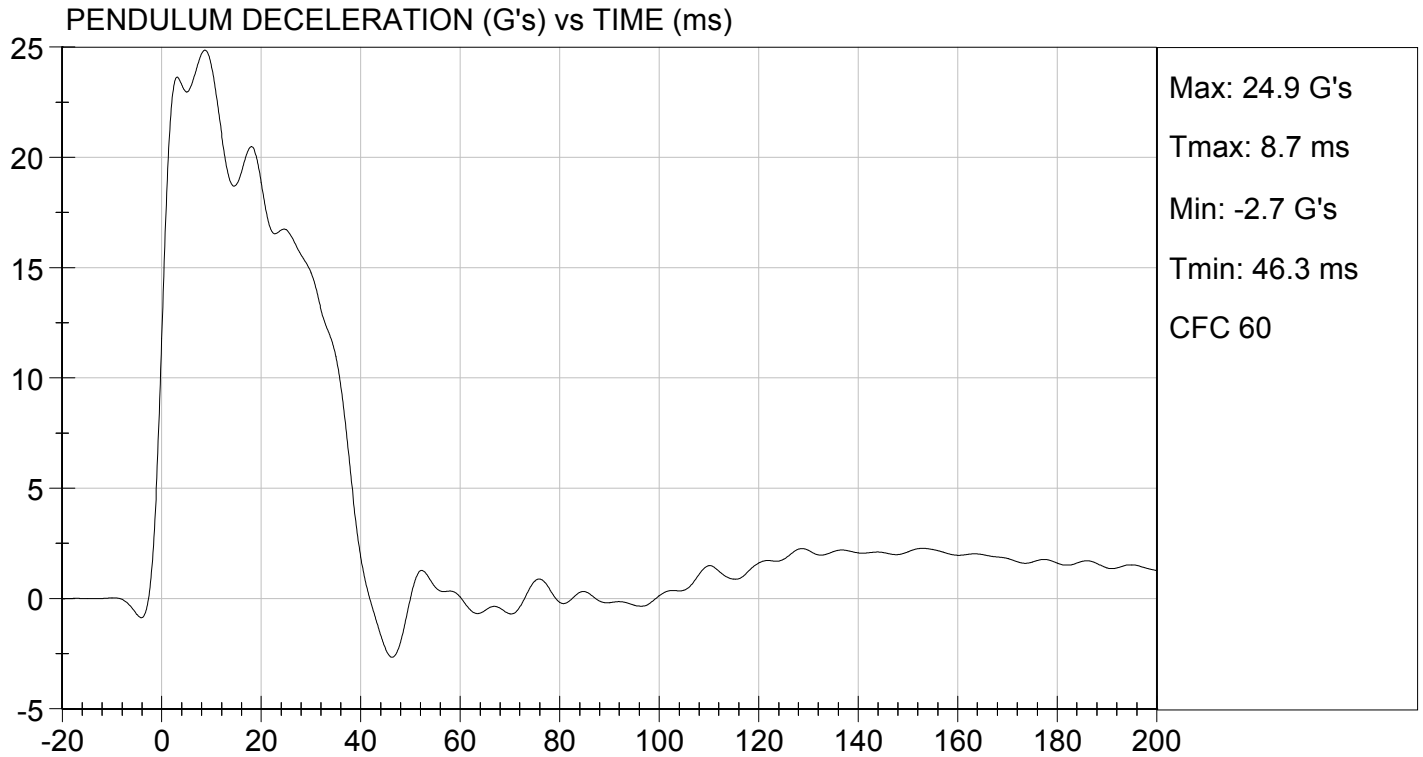
12/01/2014
Test Date

Jeff Leonard
Approved By



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

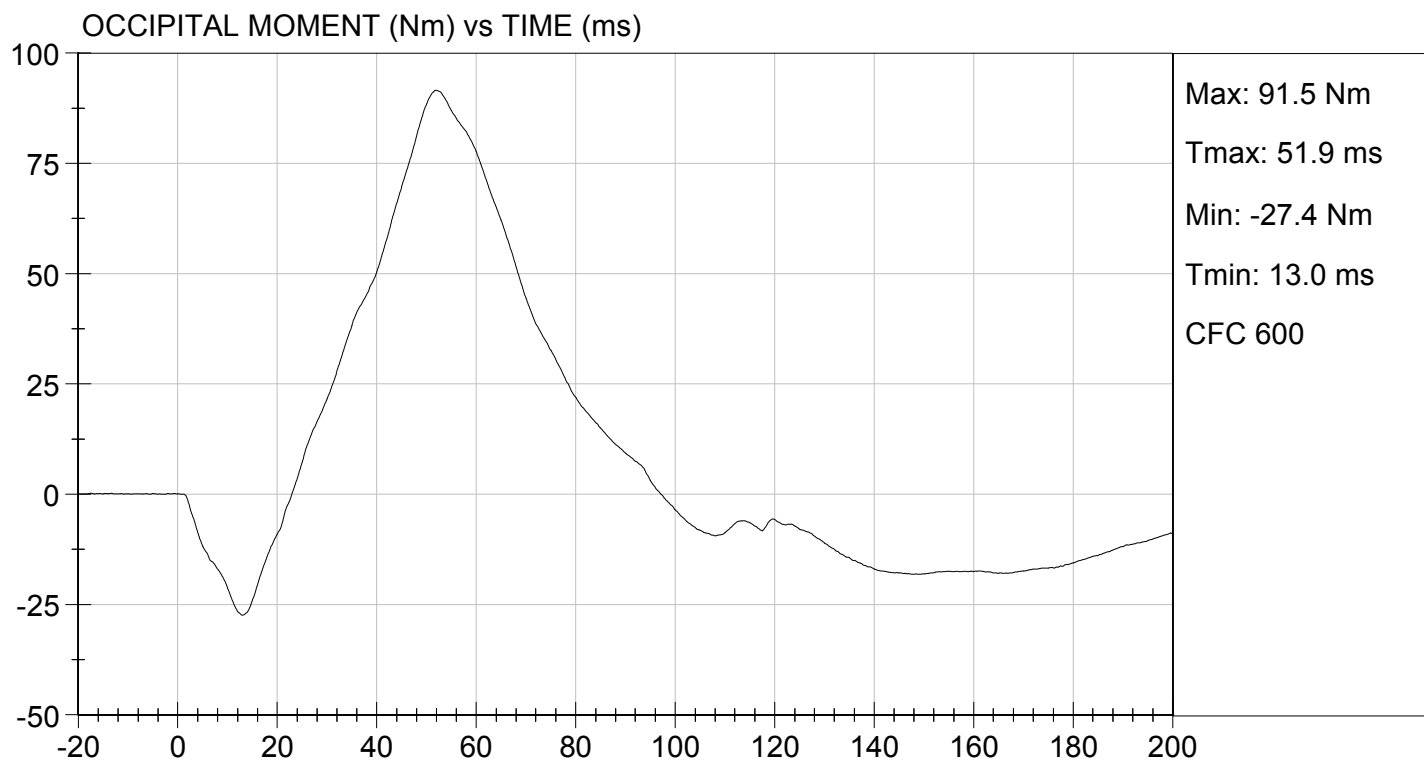
TEST DATE: 12/01/2014
TEST #: D144212





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

TEST DATE: 12/01/2014
TEST #: D144212



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

Dummy Serial Number: 401

Test Date: 12/01/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last extension test. (572.36(m))
X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.5°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to 1.0 ± 0.2 lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:
Neck Extension Test Results (572.33(b)(2) & 572.33(c)(4))

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s $\leq$ speed $\leq$ 20.3 ft/s	19.84 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 $\leq$ g $\leq$ 21.2	17.36 g's
	@ 20 ms	14 $\leq$ g $\leq$ 19	15.88 g's
	@ 30 ms	11.0 $\leq$ g $\leq$ 16.0	12.08 g's
	Above 30 ms	22 g maximum	12.1 g's
First Pendulum Decay to 5g		38 ms $\leq$ time $\leq$ 46 ms	45.1 ms
Plane D Rotation		81° $\leq$ max. rotation $\leq$ 106°	94.4°
		72 ms $\leq$ time of max. rotation $\leq$ 82 ms	78.4 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms $\leq$ time $\leq$ 174 ms	159.7 ms
Maximum Moment		-59 lbf-ft $\leq$ moment $\leq$ -39 lbf-ft	-41.5 lbf-ft
		65 ms $\leq$ time of max. moment $\leq$ 79 ms	70.5 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms $\leq$ time $\leq$ 148 ms	144.9 ms

*Moment about the occipital condyle = $M_y - (0.058 \text{ ft} \times F_x)$ (572.33(b)(2)(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. (572.33(b)(3))

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

David Schoedel
Signature

12/01/2014
Date

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

ATD Serial No: 401

Test I.D: D144213

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	17	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	17.36	Pass
	20 ms	G's	14.00 to 19.00	15.88	Pass
	30 ms	G's	11.00 to 16.00	12.08	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	45.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.4	Pass
	Time	ms	72.0 to 82.0	78.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	159.7	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-56.2	Pass
	Time	ms	65.0 to 79.0	70.5	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.9	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

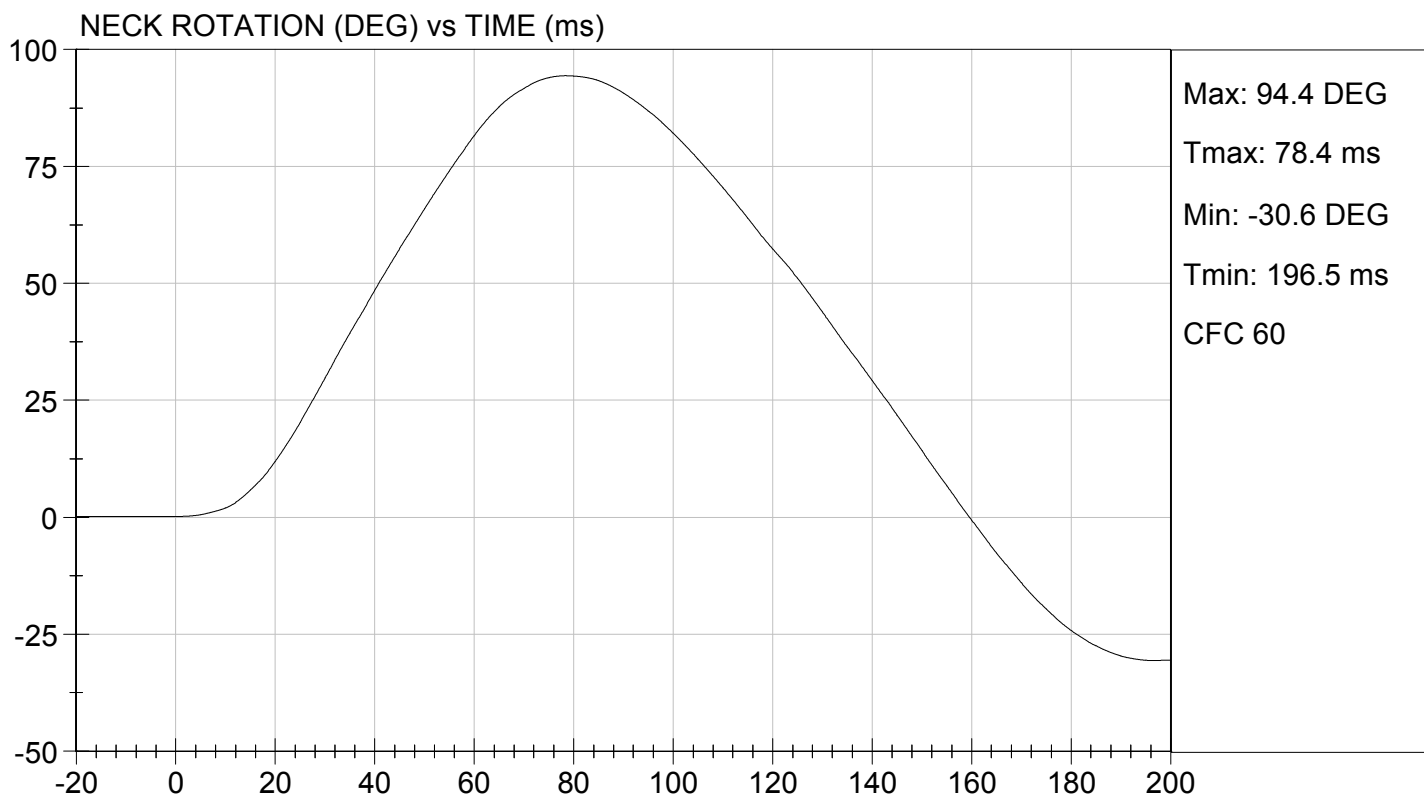
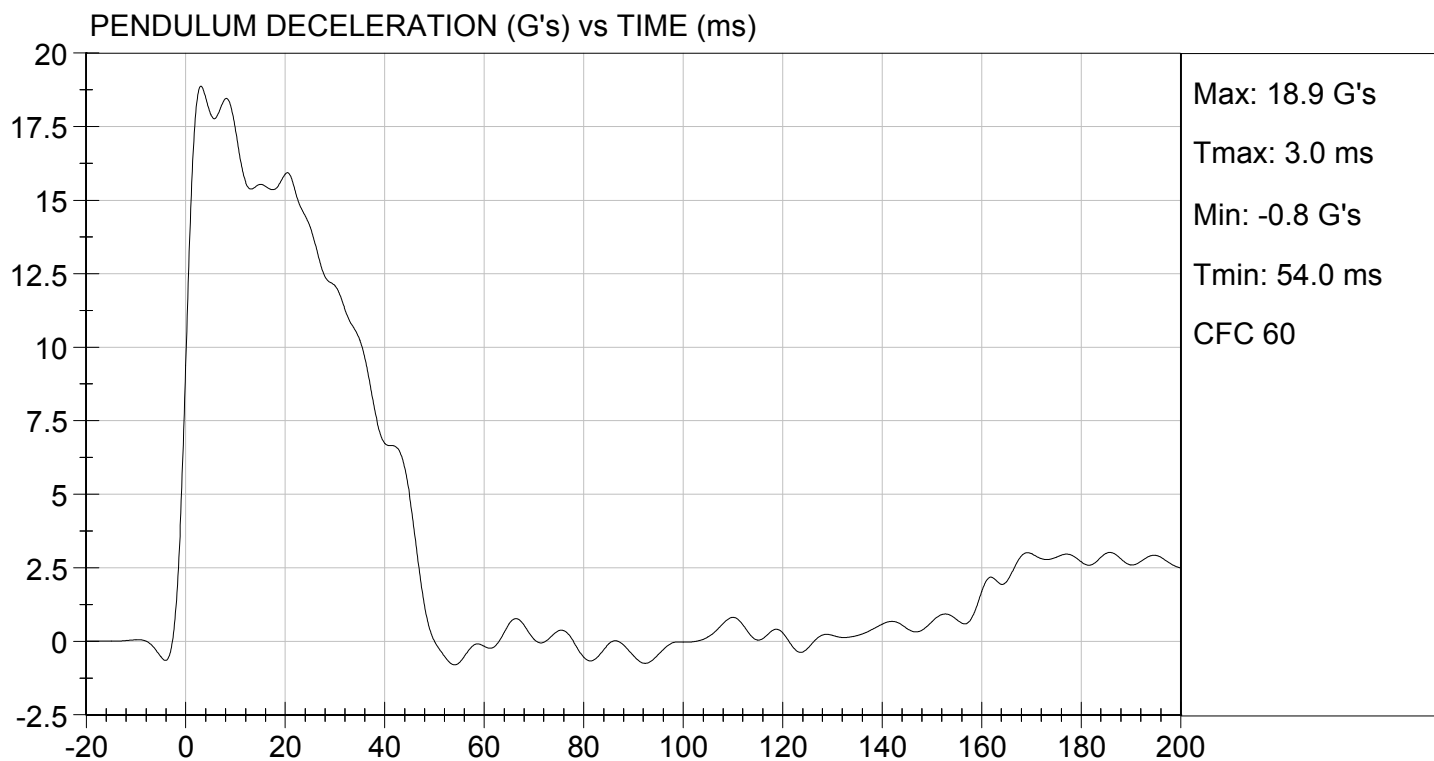
12/01/2014
Test Date

Jeff Levanthasi
Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

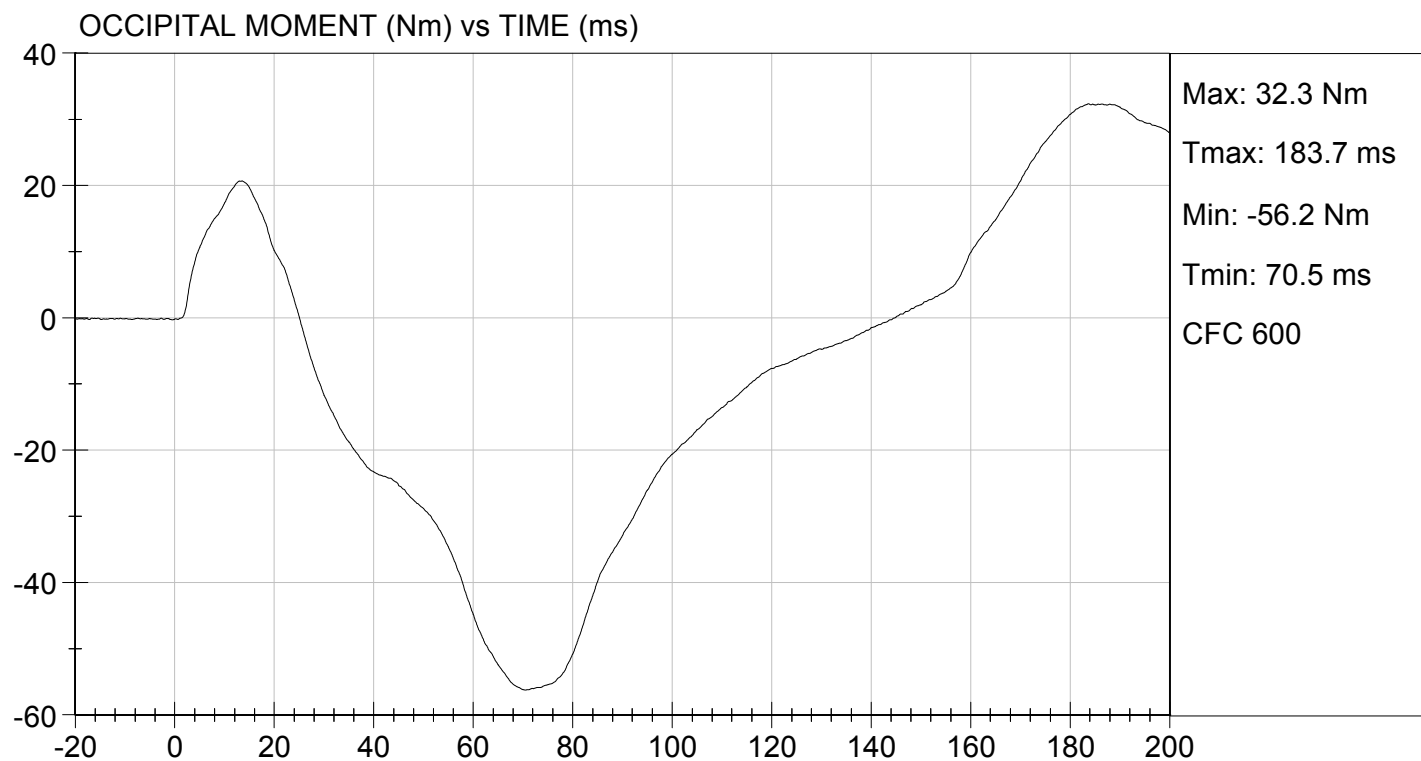
TEST DATE: 12/01/2014
TEST #: D144213





TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 12/01/2014
TEST #: D144213



DATA SHEET A6
THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401

Test Date: 12/03/2014

Technician: Maxime Chamberland

X Pre test calibration
 Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	<u>21.5°C</u>
Record the minimum temperature:	<u>21.1°C</u>
Record the maximum humidity:	<u>18%</u>
Record the minimum humidity:	<u>15%</u>

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

X - No Damage

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

 - The following repairs or replacement was performed. Record:

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ 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	$21.6 \text{ ft/s} \leq \text{speed} \leq 22.4 \text{ ft/s}$	22.22 ft/s
Chest Compression	$2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$	2.60 in.
Peak resistance force**	$1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$	1223 lb
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.

Maxime Chamberland

Signature

12/03/2014

Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401

Test I.D: D144214

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	17	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,440	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.60	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass

Maxime Chamberland

Laboratory Technician

12/03/2014

Test Date

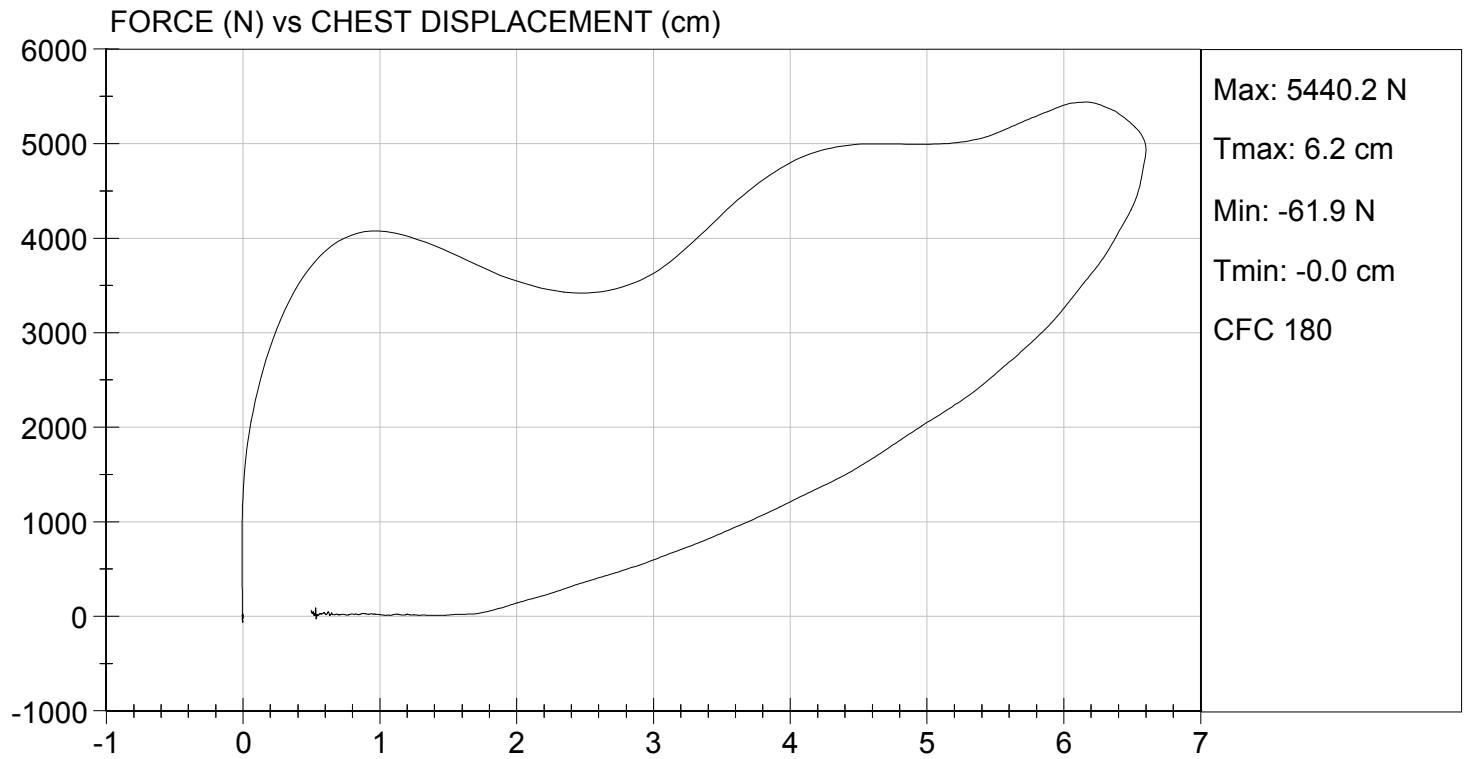
Jeff Leonard

Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/03/2014
TEST #: D144214



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

Dummy Serial Number: 401

Test Date: 12/01/2014

Technician: David Schoedel

- ☒ Pre test 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 (86-5001-001) 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: | <u>21.5°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- ☒ 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))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	6.80 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1289 lb

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

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

David Schoedel
Signature

12/01/2014
Date

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

ATD Serial No: 401

Test I.D: D144216

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	5,734	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

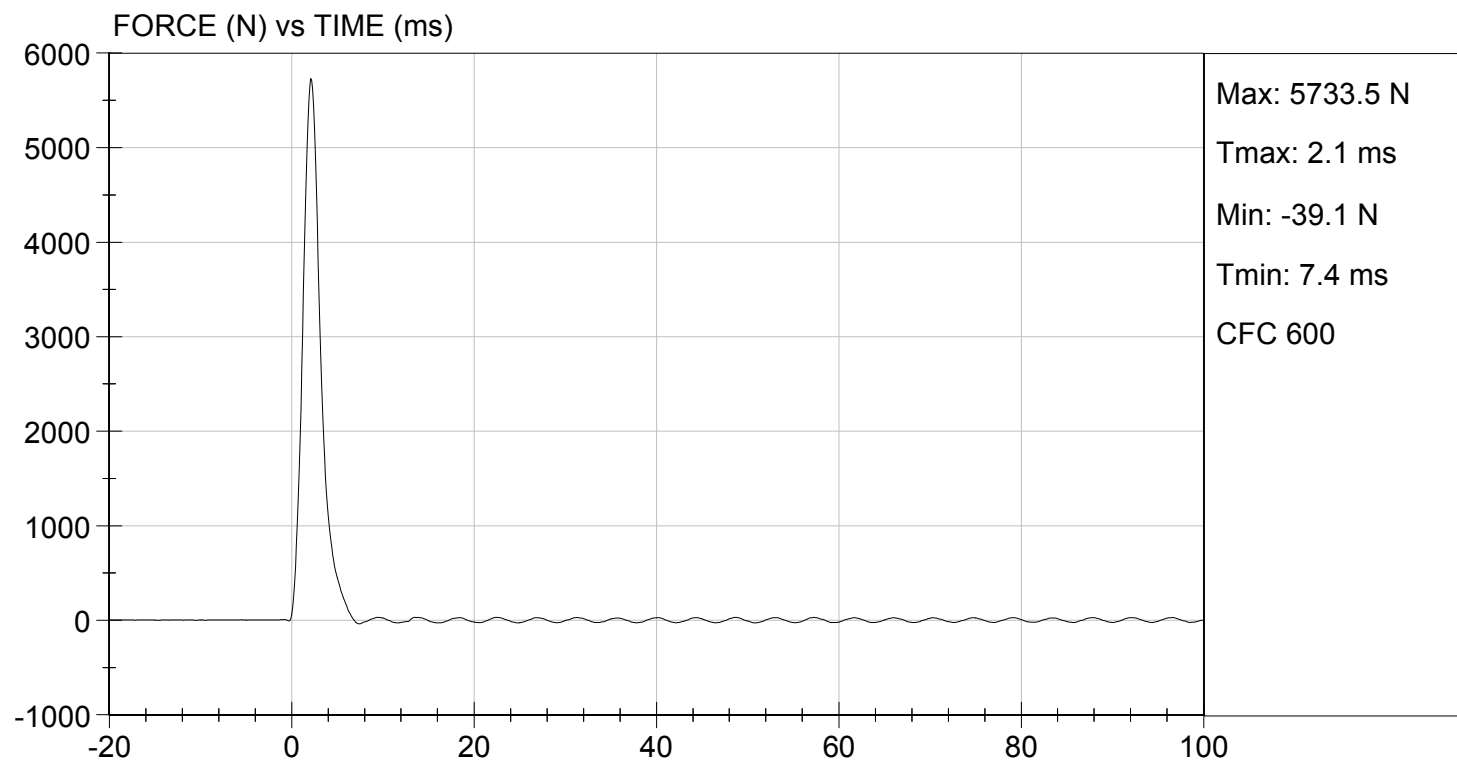
12/01/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 12/01/2014
TEST #: D144216



DATA SHEET A8
RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 401

Test Date: 12/01/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.5°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	7.00 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1109 lb

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

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

David Schoedel
Signature

12/01/2014
Date

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

ATD Serial No: 401

Test I.D: D144215

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	4,935	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

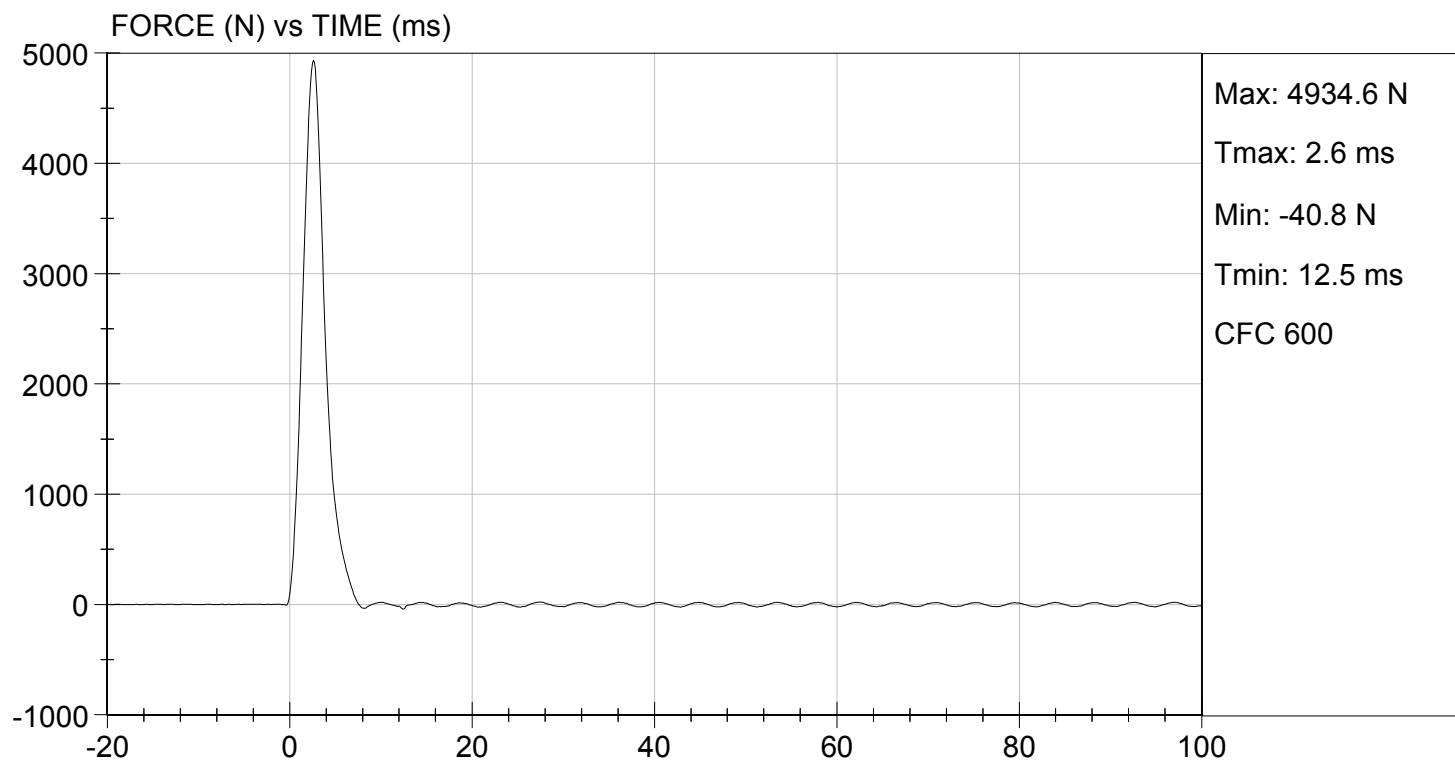
12/01/2014
Test Date

Jeff LevanMarx
Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 12/01/2014
TEST #: D144215



DATA SHEET A9
HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 401

Test Date: 12/01/2014

Technician: David Schoedel

- ☒ Pre test calibration
☐ Post test calibration verification

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

- ☒ 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))
☒ N/A, ONLY one hip joint-femur flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 17A.
- ☒ 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):
- ☒ 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)
 - ☒ 3.2 remove the abdominal insert (78051-52)
 - ☒ 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- ☒ 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.5°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</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))

- X 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.2°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	65.3 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	40.6°

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

- X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	67.3 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	40.9°

David Schoedel
Signature

12/01/2014
Date

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

ATD Serial No: 401

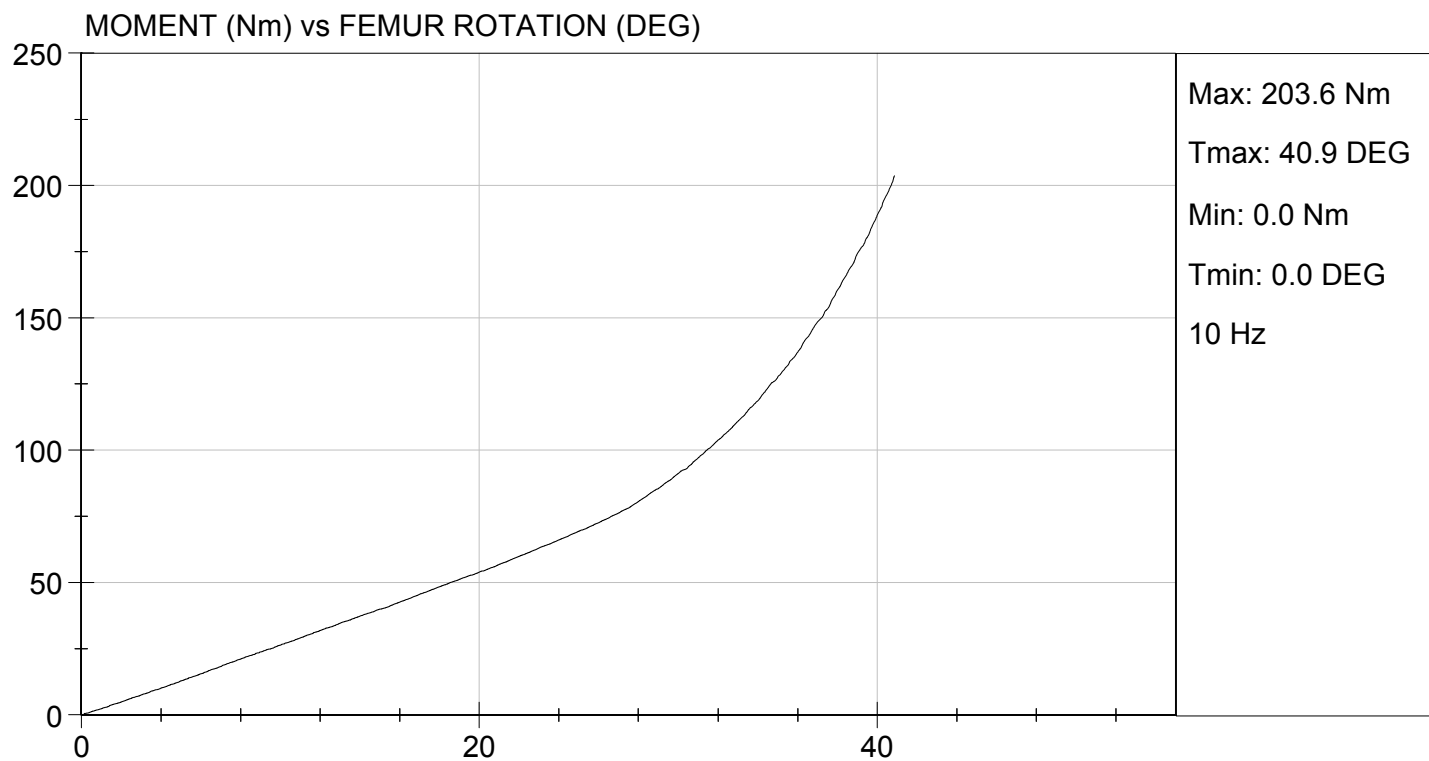
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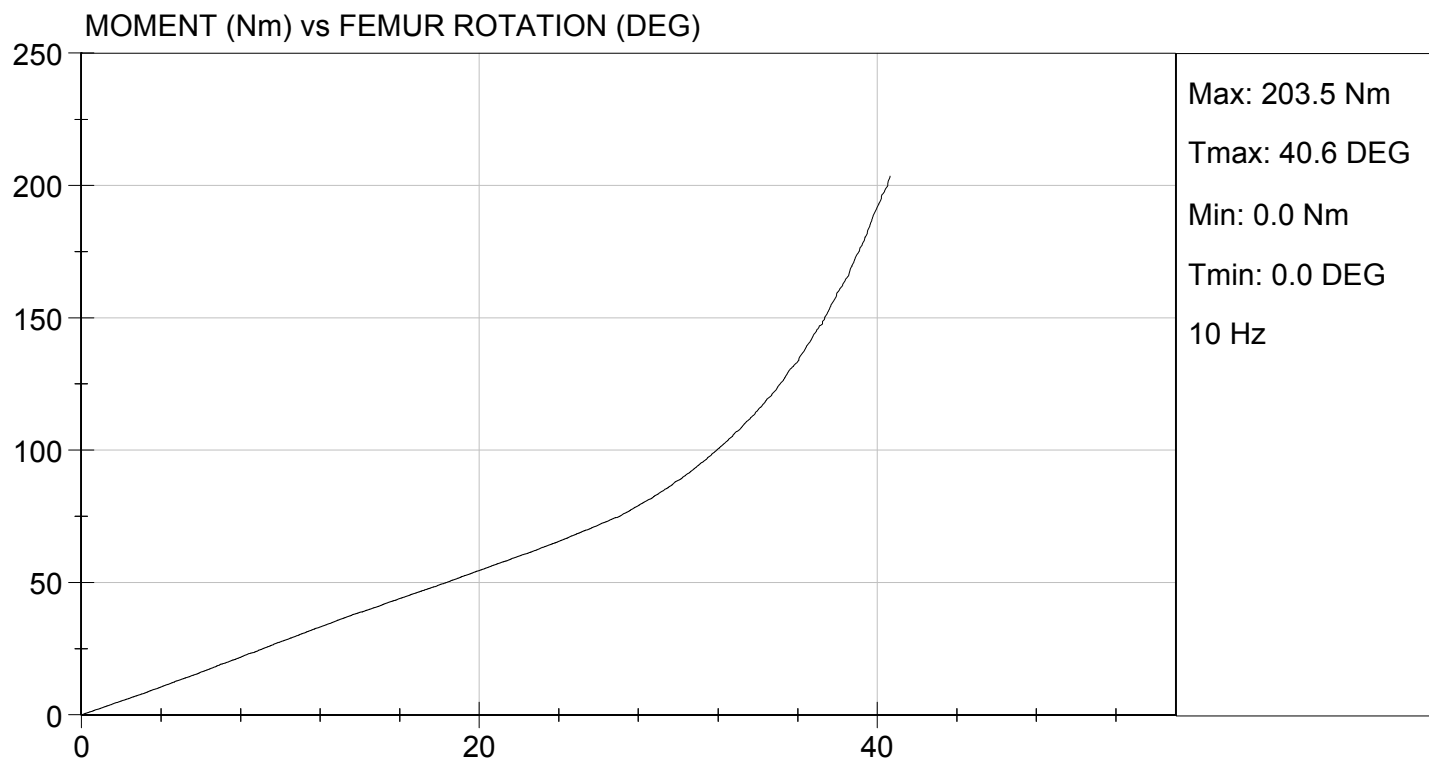
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	16	16	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	91.2	88.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	40.9	40.6	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

12/01/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AH5D9	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	AH5L1	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	AH5N9	12/01/2014	06/01/2015
NECK TRANSDUCER	Denton	1716	937	11/19/2014	05/19/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH55	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	AGH55	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	C12863	12/01/2014	06/01/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	401	12/02/2014	06/02/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8806	12/01/2014	06/01/2015
(2) LEFT FEMUR	Denton	2121	8807	12/01/2014	06/01/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

HEAD DROP TEST (572.32) (50th Male)

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: David Schoedel

_____	Pre test calibration
X	Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.32(c)(5))
X N/A, ONLY one head drop performed

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

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

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

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

X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))

Record the maximum temperature: 21.9°C

Record the minimum temperature: 21.5°C

Record the maximum humidity: 41%

Record the minimum humidity: 39%

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

Record findings and actions: No Damage

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

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))
 Record the actual distance: 0.5 inches
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.
 Record the right side distance: 501 mm
 Record the left side distance: 501 mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.32(c)(4))
 Record actual micro finish: 40.9 micro inches
- X 12. The impact surface is rigidly supported. (572.132(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)
 Record thickness: 50.9 mm
 Record width: 604 mm
 Record length: 595 mm
- X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	$225 \text{ g} \leq x \leq 275 \text{ g}$	240 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-5.8 g

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

David Schoedel
 Signature

12/15/2014
 Date

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

ATD Serial No: 401

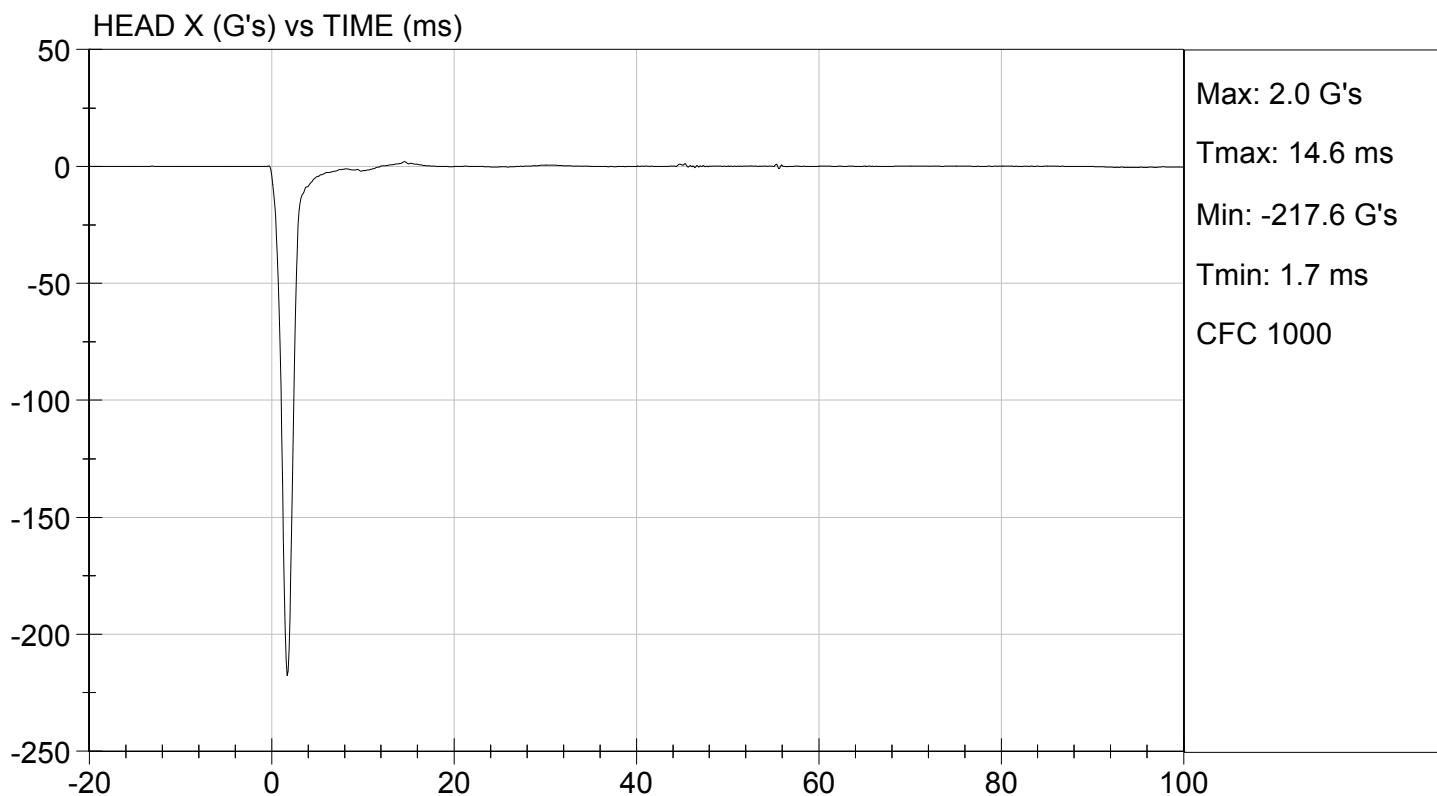
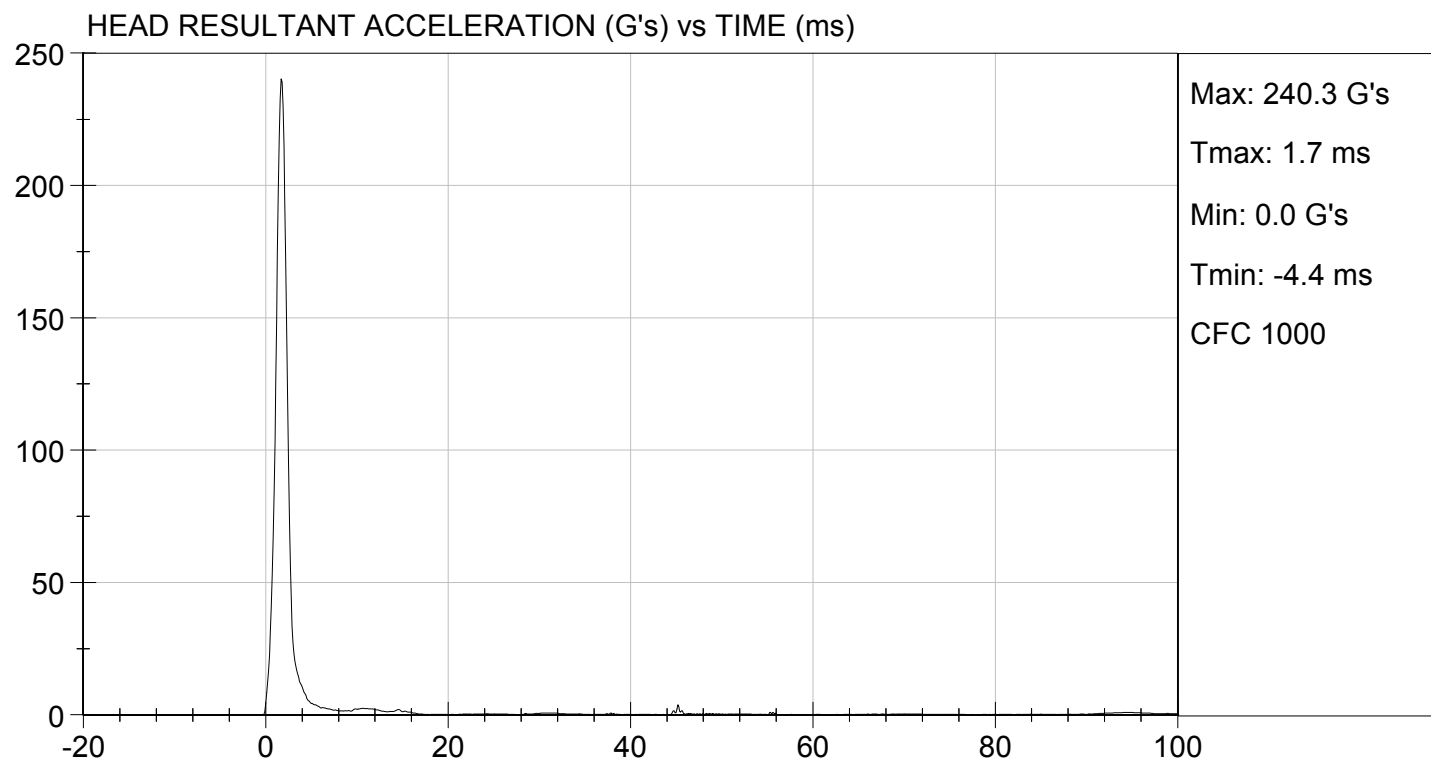
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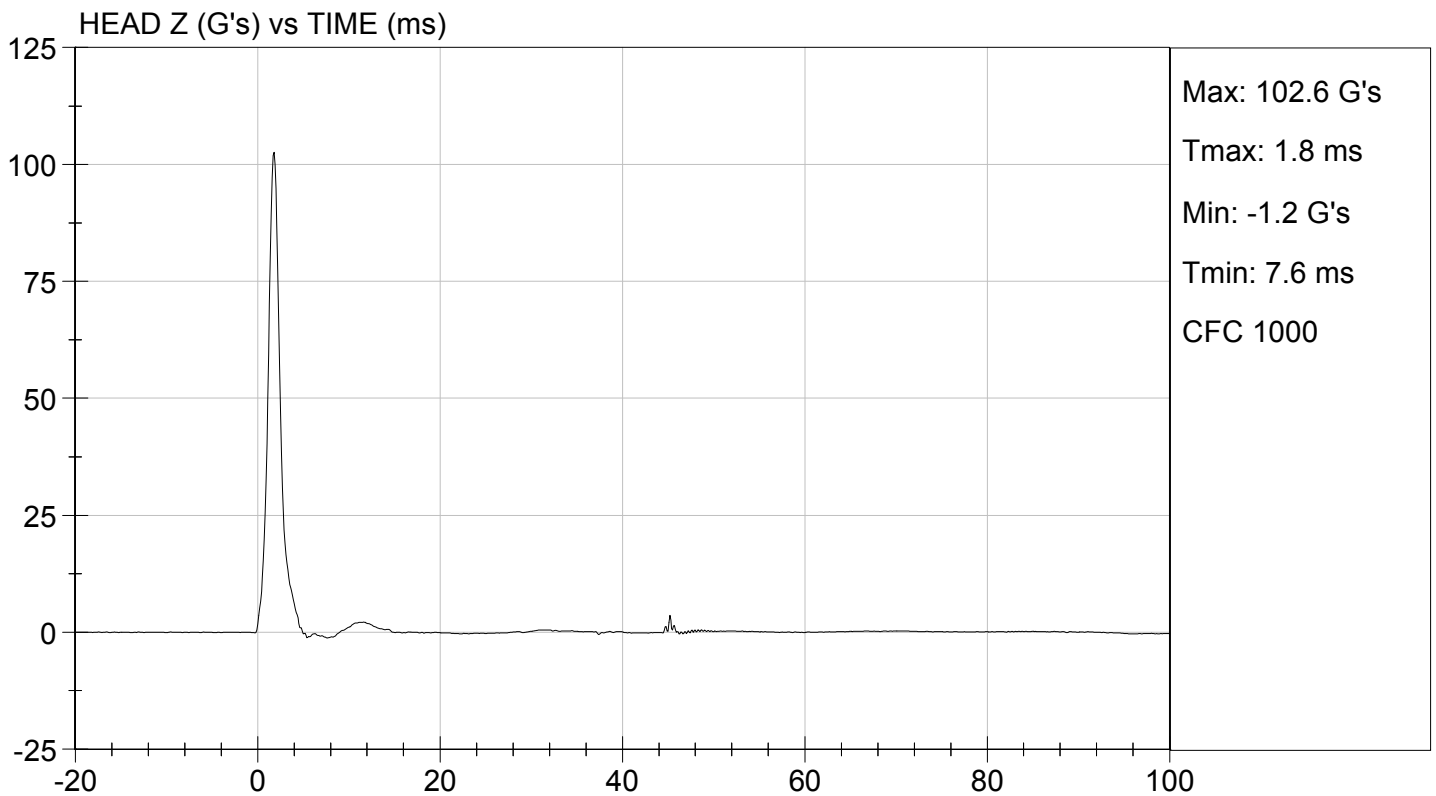
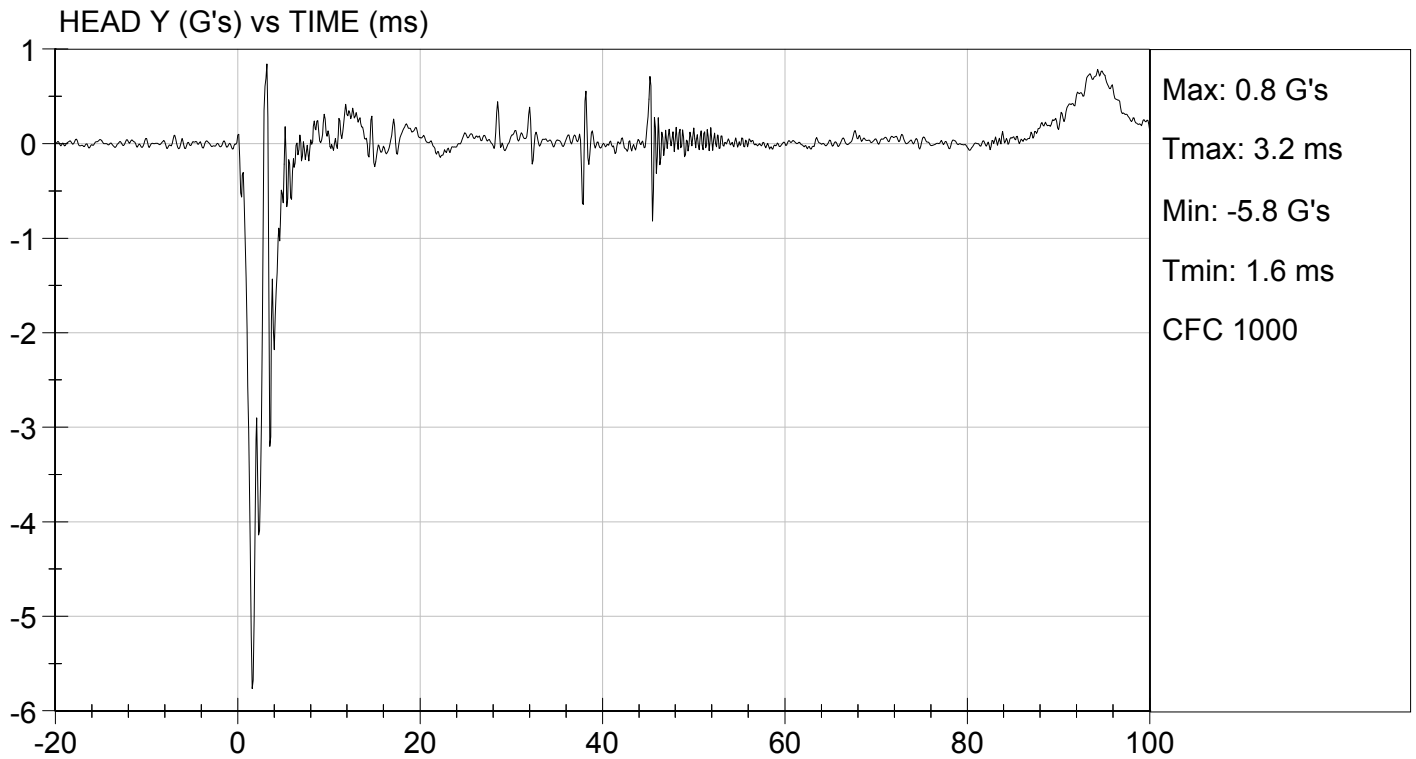
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Peak Resultant Acceleration	G's	225 to 275	240	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

12/15/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A4
NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

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

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

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

Record the maximum temperature:	<u>21.9°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>41%</u>
Record the minimum humidity:	<u>39%</u>

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

Record findings and actions: No damage

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

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

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

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		$22.6 \text{ ft/s} \leq \text{speed} \leq 23.4 \text{ ft/s}$	23.15 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	$22.5 \leq g \leq 27.5$	25.20 g's
	@ 20 ms	$17.6 \leq g \leq 22.6$	18.96 g's
	@ 30 ms	$12.5 \leq g \leq 18.5$	14.36 g's
	Above 30 ms	29 g maximum	14.4 g's
First Pendulum Decay to 5g		$34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$	40.6 ms
Plane D Rotation		$64^\circ \leq \text{max. rotation} \leq 78^\circ$	67.4°
		$57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$	60.0 ms
Time for Plane D Rotation to Cross 0° During First Rebound		$113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$	114.9 ms
Maximum Moment		$65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$	67.4 lbf-ft
		$47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$	52.8 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		$97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$	98.6 ms

*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. (572.33(b)(3))

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

David Schoedel
Signature

12/15/2014
Date

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

ATD Serial No: 401

Test I.D: D144412

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	40	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	25.20	Pass
	20 ms	G's	17.60 to 22.60	18.96	Pass
	30 ms	G's	12.50 to 18.50	14.36	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	40.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	67.4	Pass
	Time	ms	57.0 to 64.0	60.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.9	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.4	Pass
	Time	ms	47.0 to 58.0	52.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.6	Pass
Overall Test Results					Pass


 Laboratory Technician

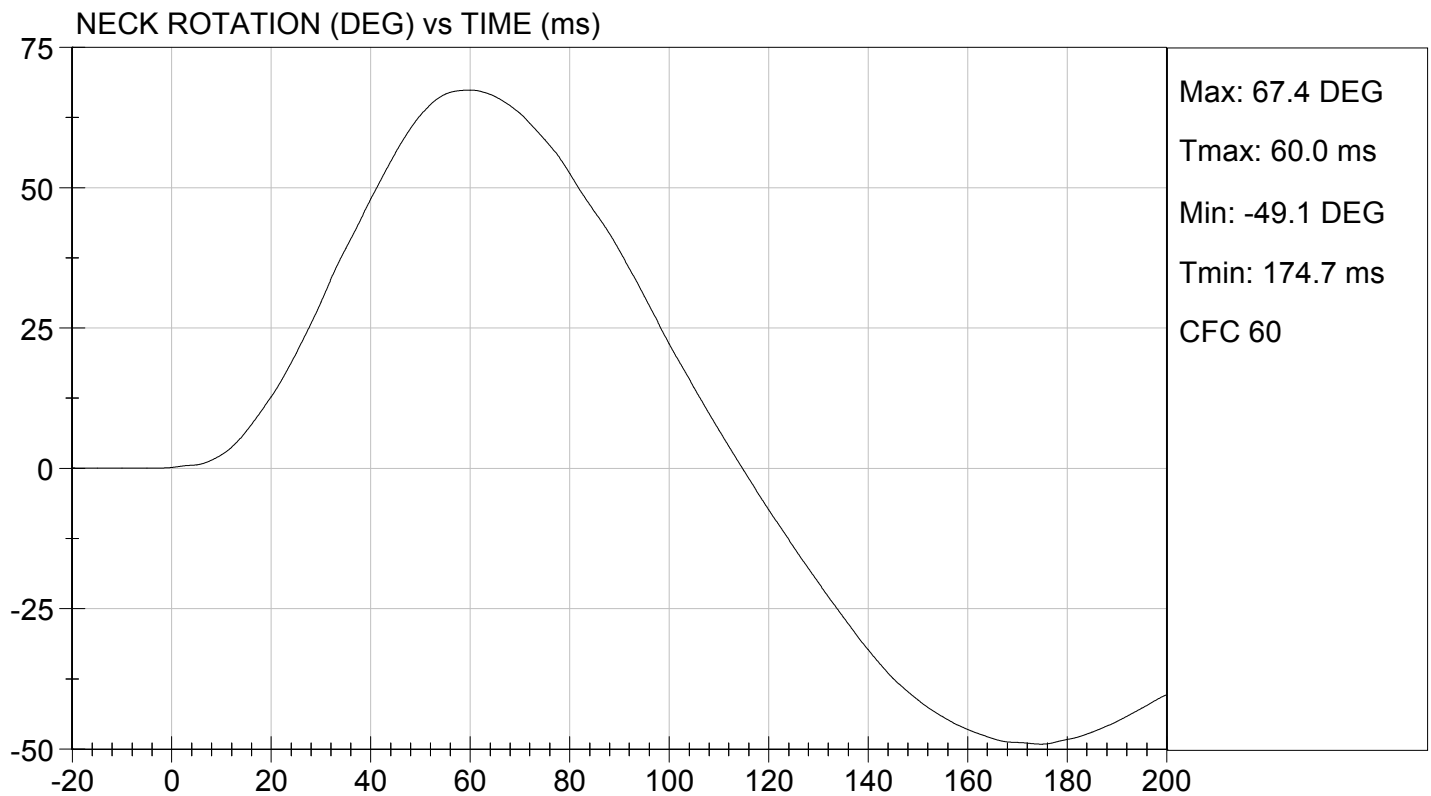
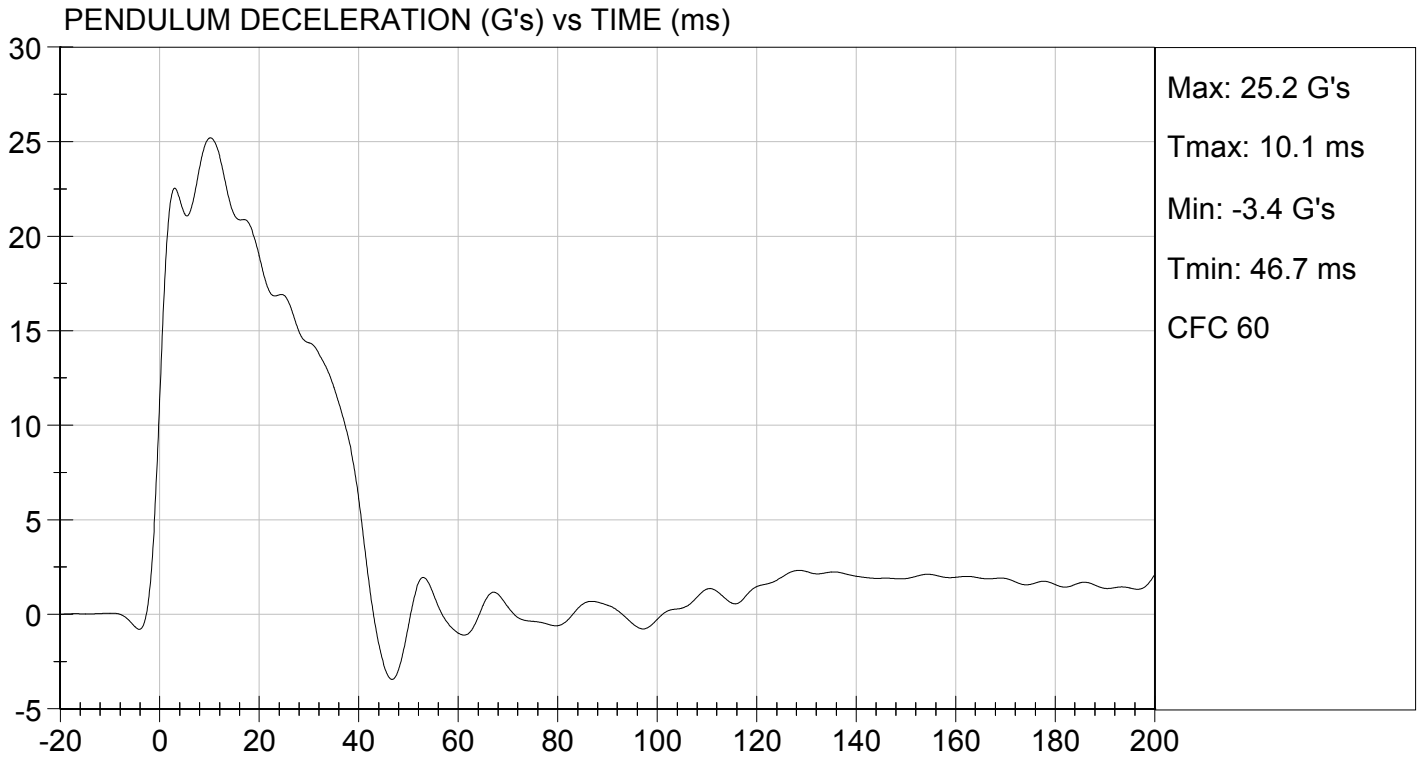
12/15/2014
 Test Date


 Approved By



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

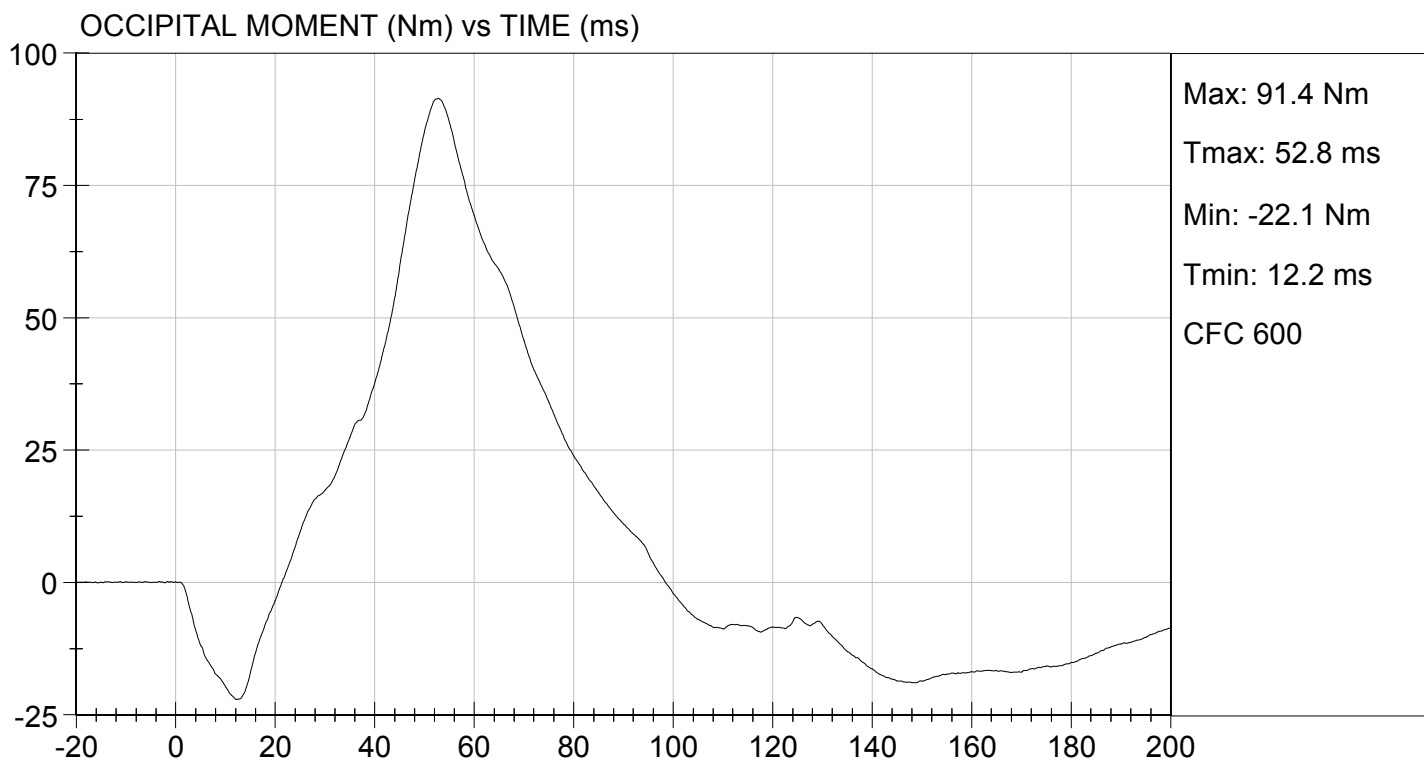
TEST DATE: 12/15/2014
TEST #: D144412





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

TEST DATE: 12/15/2014
TEST #: D144412



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

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

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

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

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

Record the maximum temperature:	<u>21.9°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>41%</u>
Record the minimum humidity:	<u>39%</u>

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

Record findings and actions: No damage

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

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

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

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:
Neck Extension Test Results (572.33(b)(2) & 572.33(c)(4))

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s $\leq$ speed $\leq$ 20.3 ft/s	20.30 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 $\leq$ g $\leq$ 21.2	18.30 g's
	@ 20 ms	14 $\leq$ g $\leq$ 19	15.48 g's
	@ 30 ms	11.0 $\leq$ g $\leq$ 16.0	11.57 g's
	Above 30 ms	22 g maximum	12.5 g's
First Pendulum Decay to 5g		38 ms $\leq$ time $\leq$ 46 ms	40.1 ms
Plane D Rotation		81° $\leq$ max. rotation $\leq$ 106°	94.2°
		72 ms $\leq$ time of max. rotation $\leq$ 82 ms	78.4 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms $\leq$ time $\leq$ 174 ms	158.8 ms
Maximum Moment		-59 lbf-ft $\leq$ moment $\leq$ -39 lbf-ft	-39.1 lbf-ft
		65 ms $\leq$ time of max. moment $\leq$ 79 ms	71.3 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms $\leq$ time $\leq$ 148 ms	143.7 ms

*Moment about the occipital condyle = $M_y - (0.058 \text{ ft} \times F_x)$ (572.33(b)(2)(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. (572.33(b)(3))

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

David Schoedel
Signature

12/15/2014
Date

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

ATD Serial No: 401

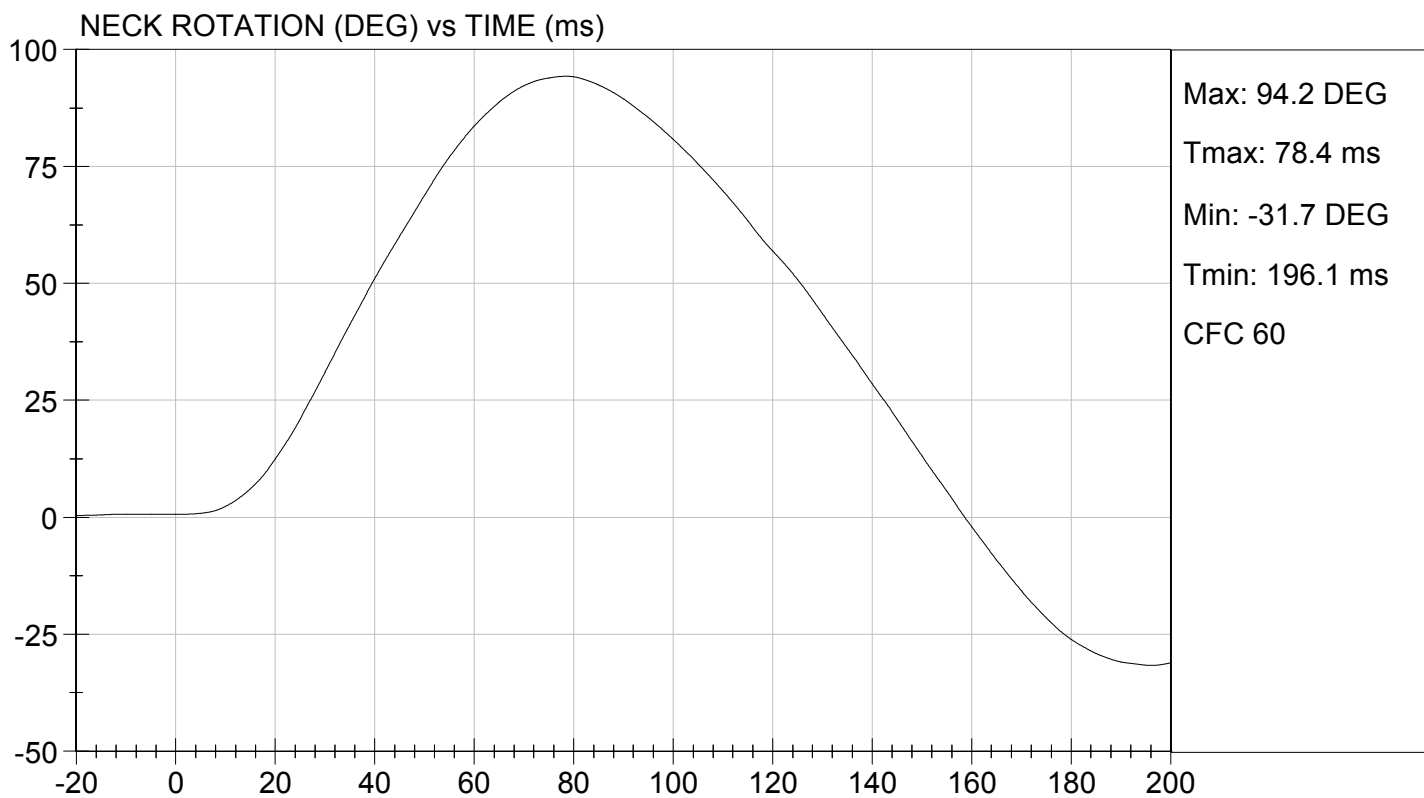
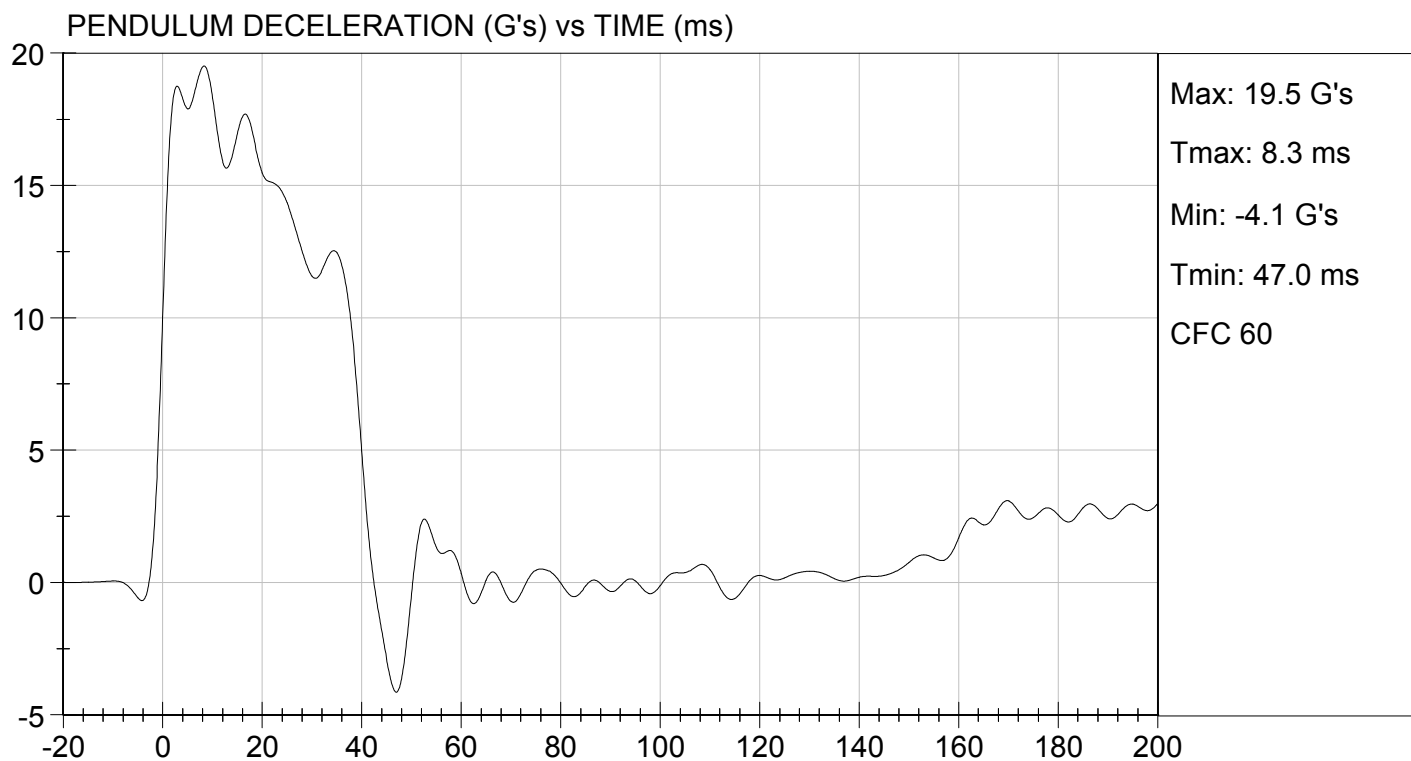
Test I.D: D144413

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	40	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.30	Pass
	20 ms	G's	14.00 to 19.00	15.48	Pass
	30 ms	G's	11.00 to 16.00	11.57	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.1	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.2	Pass
	Time	ms	72.0 to 82.0	78.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-53.0	Pass
	Time	ms	65.0 to 79.0	71.3	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.7	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

12/15/2014
Test Date

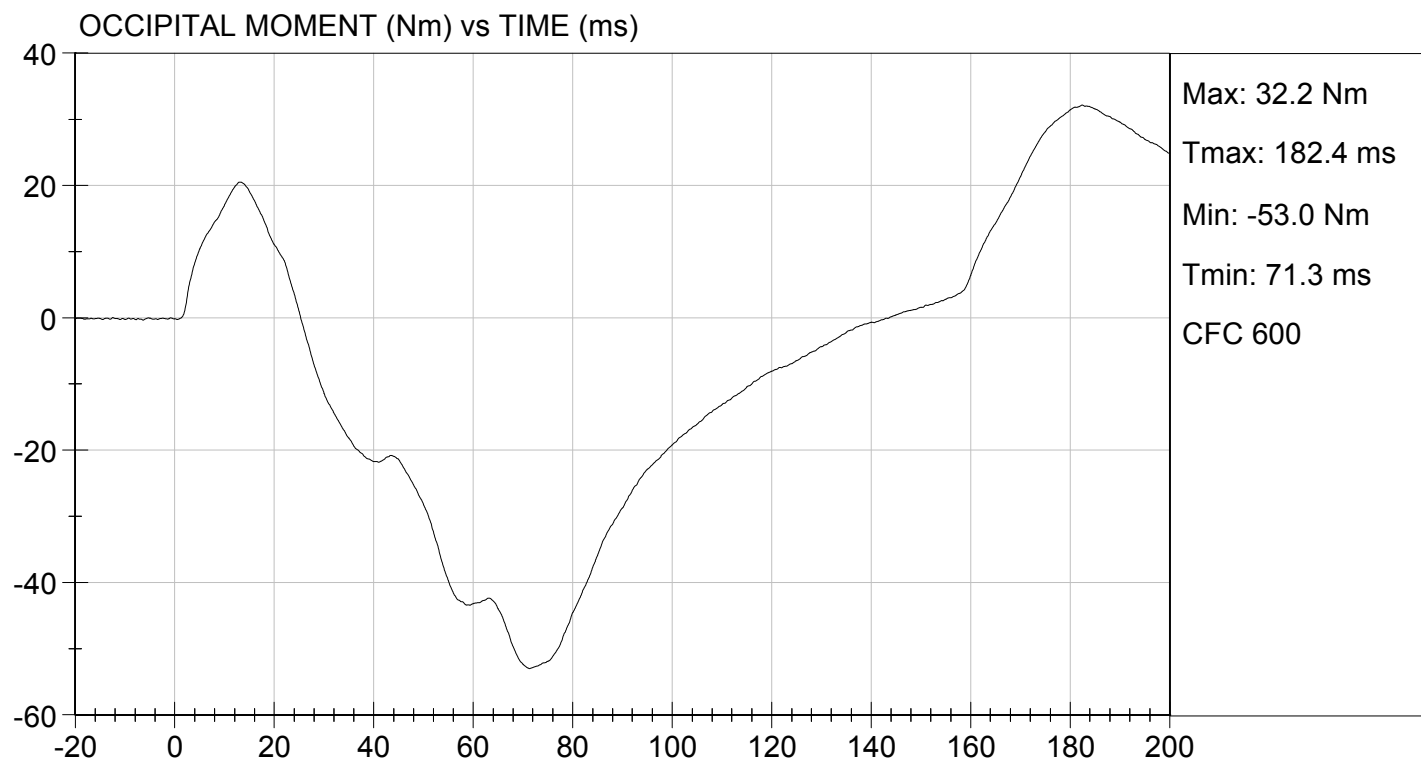
Jeff Leonard
Approved By





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 12/15/2014
TEST #: D144413



DATA SHEET A6
THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401

Test Date: 12/16/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	<u>21.9°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>41%</u>
Record the minimum humidity:	<u>39%</u>

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

X - No Damage

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

 - The following repairs or replacement was performed. Record:

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ 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	$21.6 \text{ ft/s} \leq \text{speed} \leq 22.4 \text{ ft/s}$	22.22 ft/s
Chest Compression	$2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$	2.57 in.
Peak resistance force**	$1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$	1237 lb
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	70 %

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

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

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

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

Maxime Chamberland
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401

Test I.D: D144414

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,502	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.53	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Overall Test Results			Pass	

Maxime Chamberland
Laboratory Technician

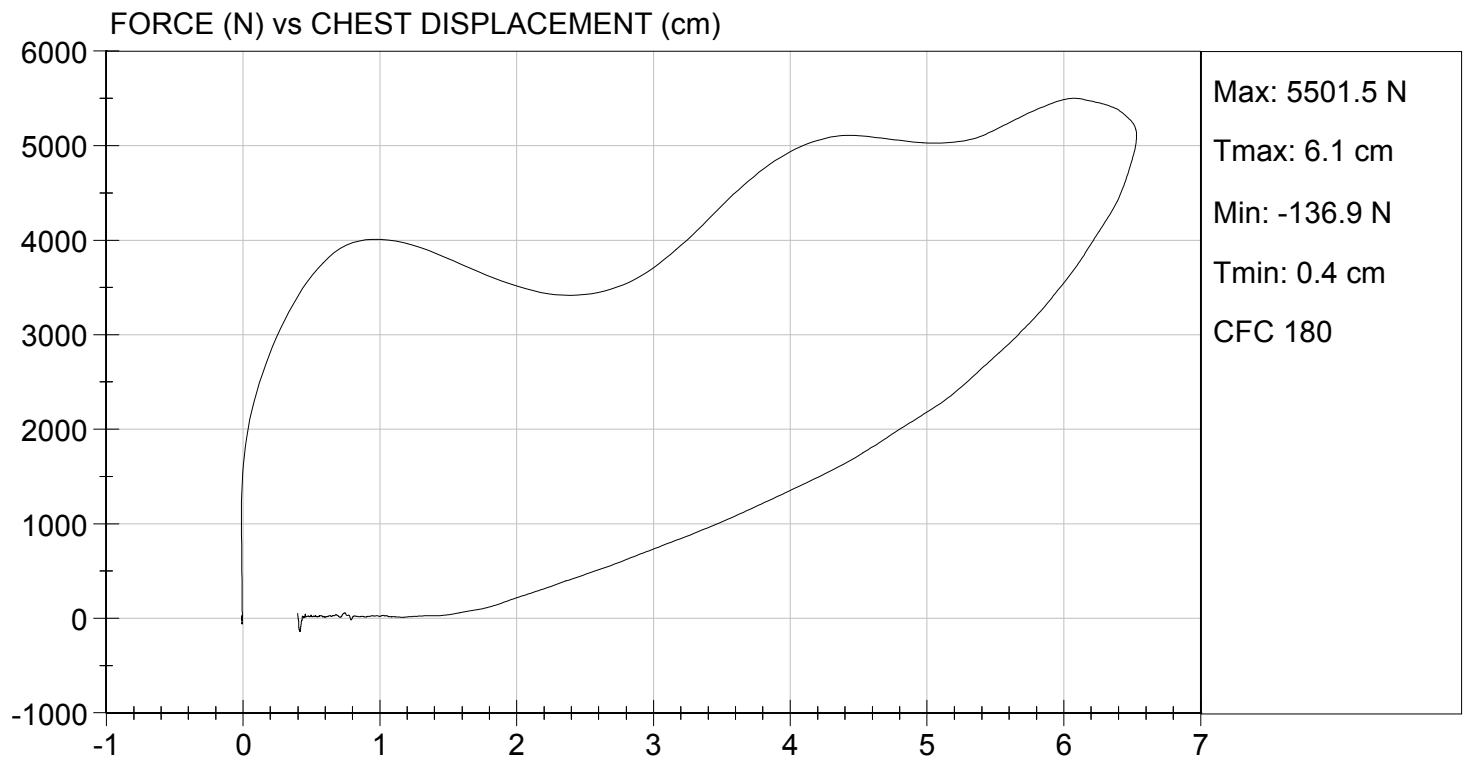
12/16/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/16/2014
TEST #: D144414



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

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity: | <u>41%</u> |
| Record the minimum humidity: | <u>39%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	6.89 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1152 lb

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

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

Maxime Chamberland
Signature

12/15/2014
Date

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

ATD Serial No: 401

Test I.D: D144416

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,123	Pass
Overall Test Results				Pass

Maxime Chamberland
Laboratory Technician

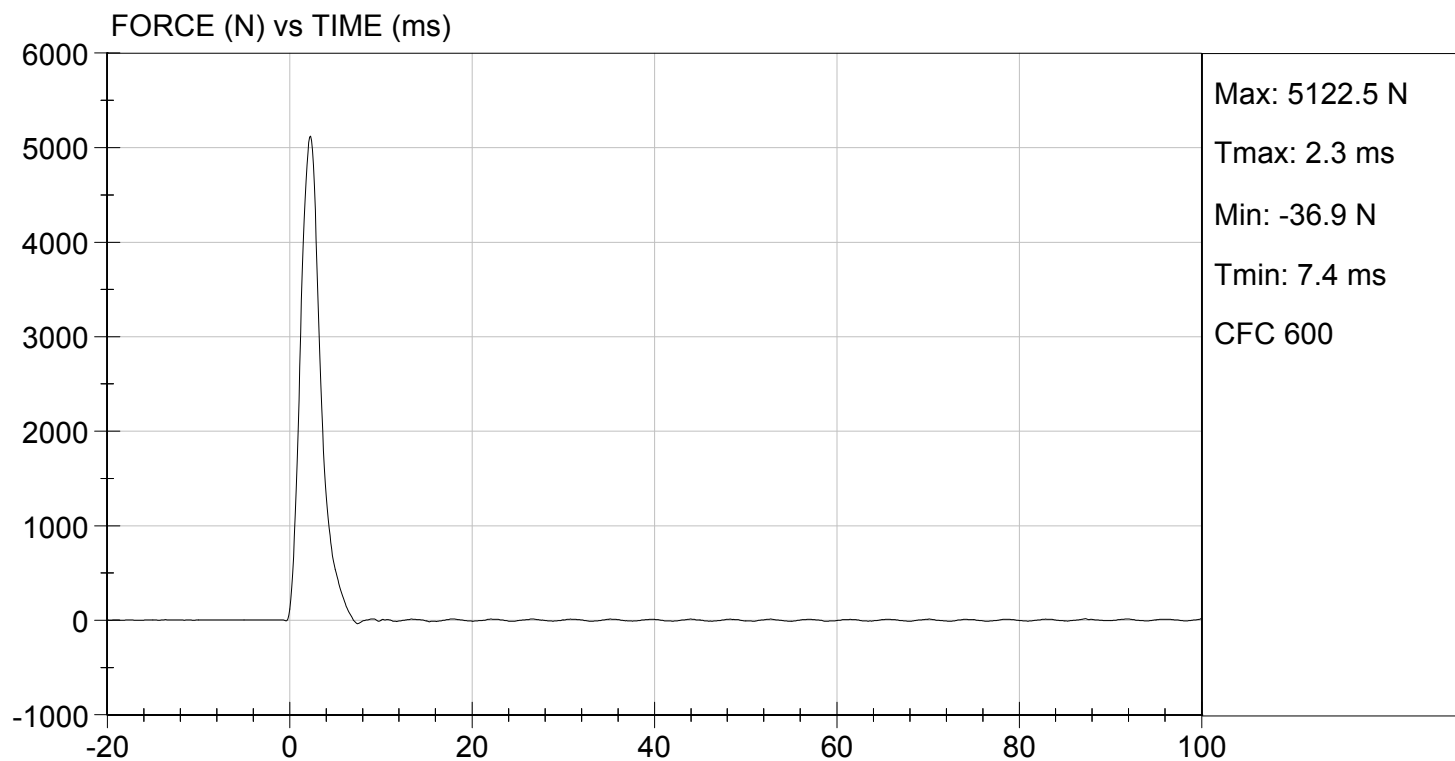
12/15/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 12/15/2014
TEST #: D144416



DATA SHEET A8
RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity: | <u>41%</u> |
| Record the minimum humidity: | <u>39%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	6.97 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1110 lb

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

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

Maxime Chamberland
Signature

12/15/2014
Date

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

ATD Serial No: 401

Test I.D: D144415

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,937	Pass
Overall Test Results				Pass

Maxime Chamberland
Laboratory Technician

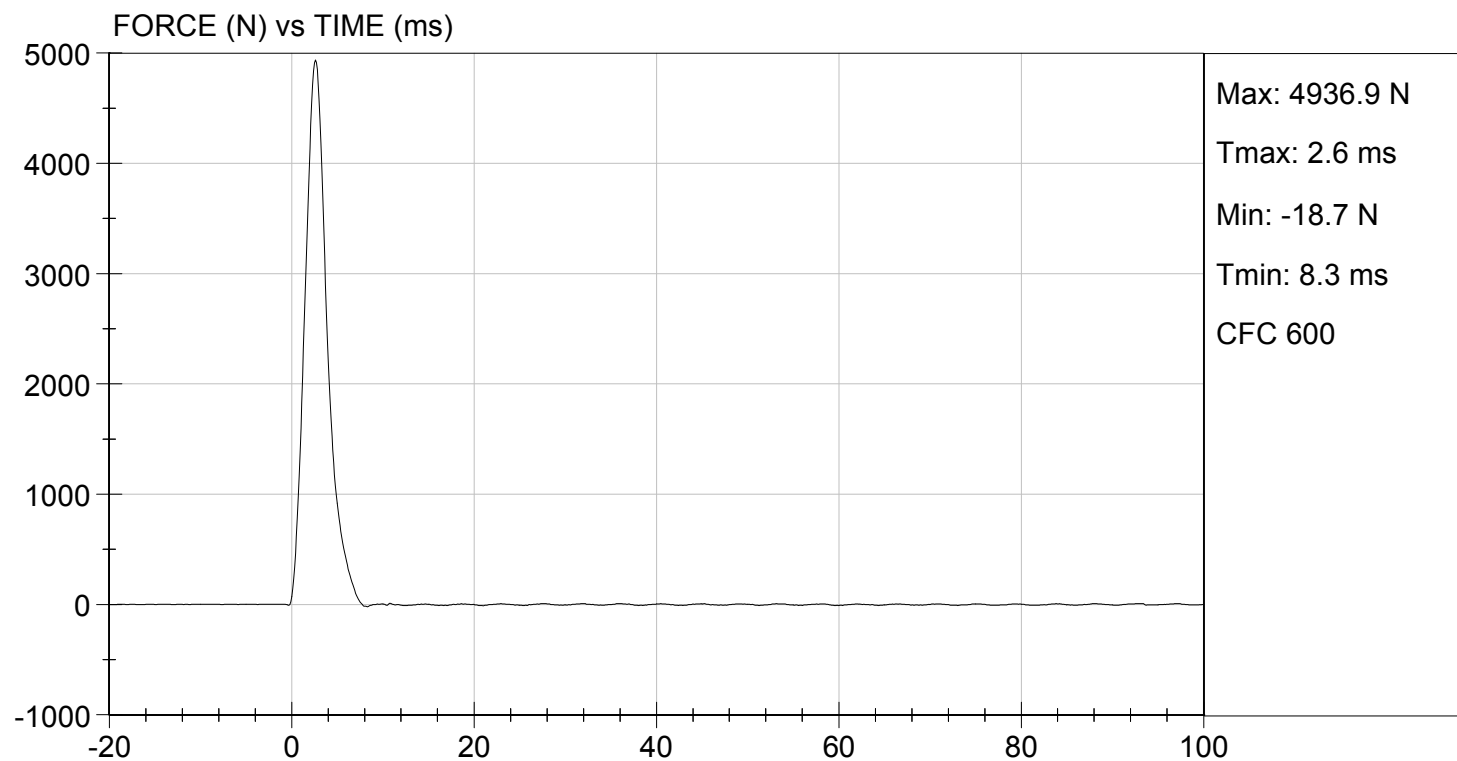
12/15/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 12/15/2014
TEST #: D144415



DATA SHEET A9
HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: Maxime Chamberland

- Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))
 X N/A, ONLY one hip joint-femur flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 17A.
- X 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):
- X 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)
 - X 3.2 remove the abdominal insert (78051-52)
 - X 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- X 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity: | <u>41%</u> |
| Record the minimum humidity: | <u>39%</u> |
- X 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- X 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- X 7. Adjust the threaded rods until plane B is horizontal.
- X 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

- X 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.2°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	64.2 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	40.9°

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

- X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	64.7 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	41.3°

Maxime Chamberland
Signature

12/15/2014
Date

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

ATD Serial No: 401

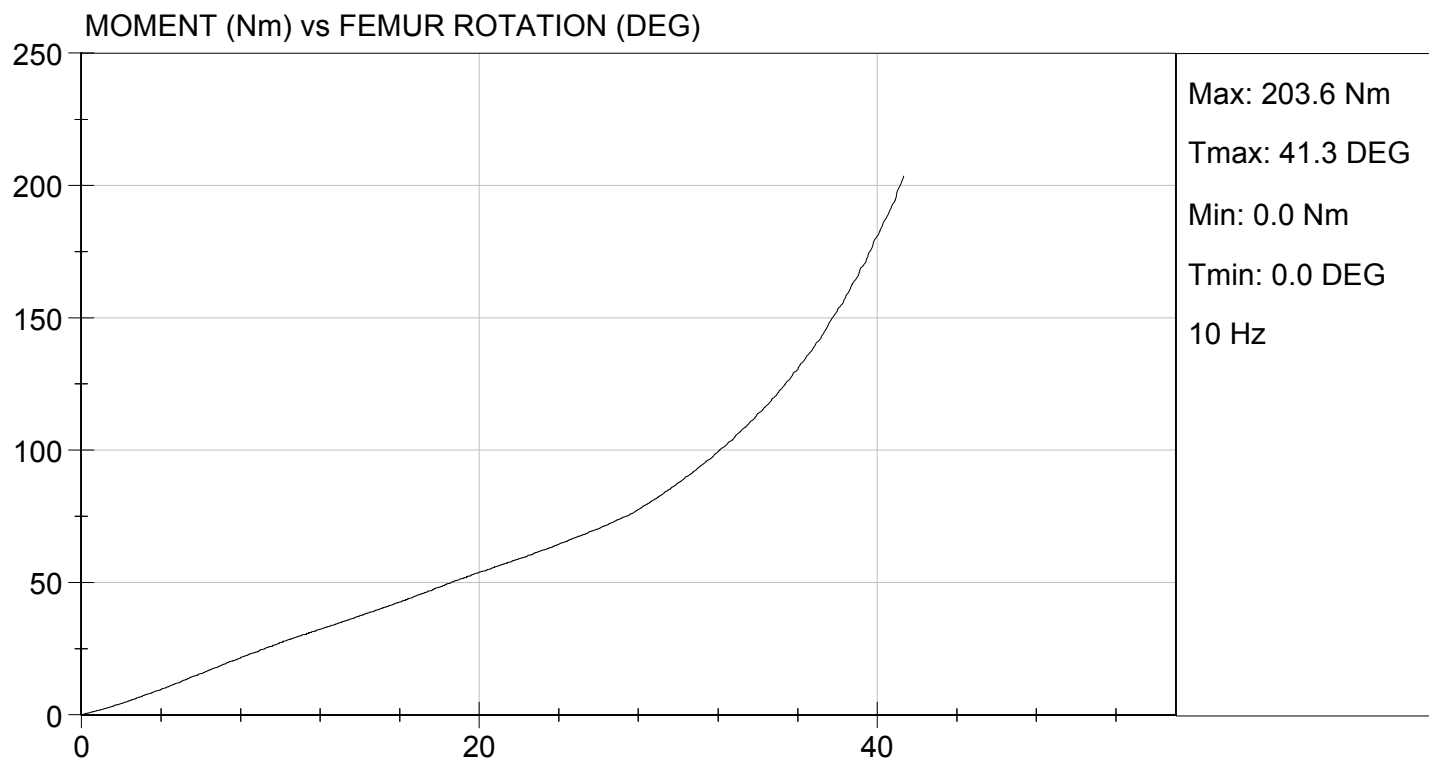
Test I.D: D144410

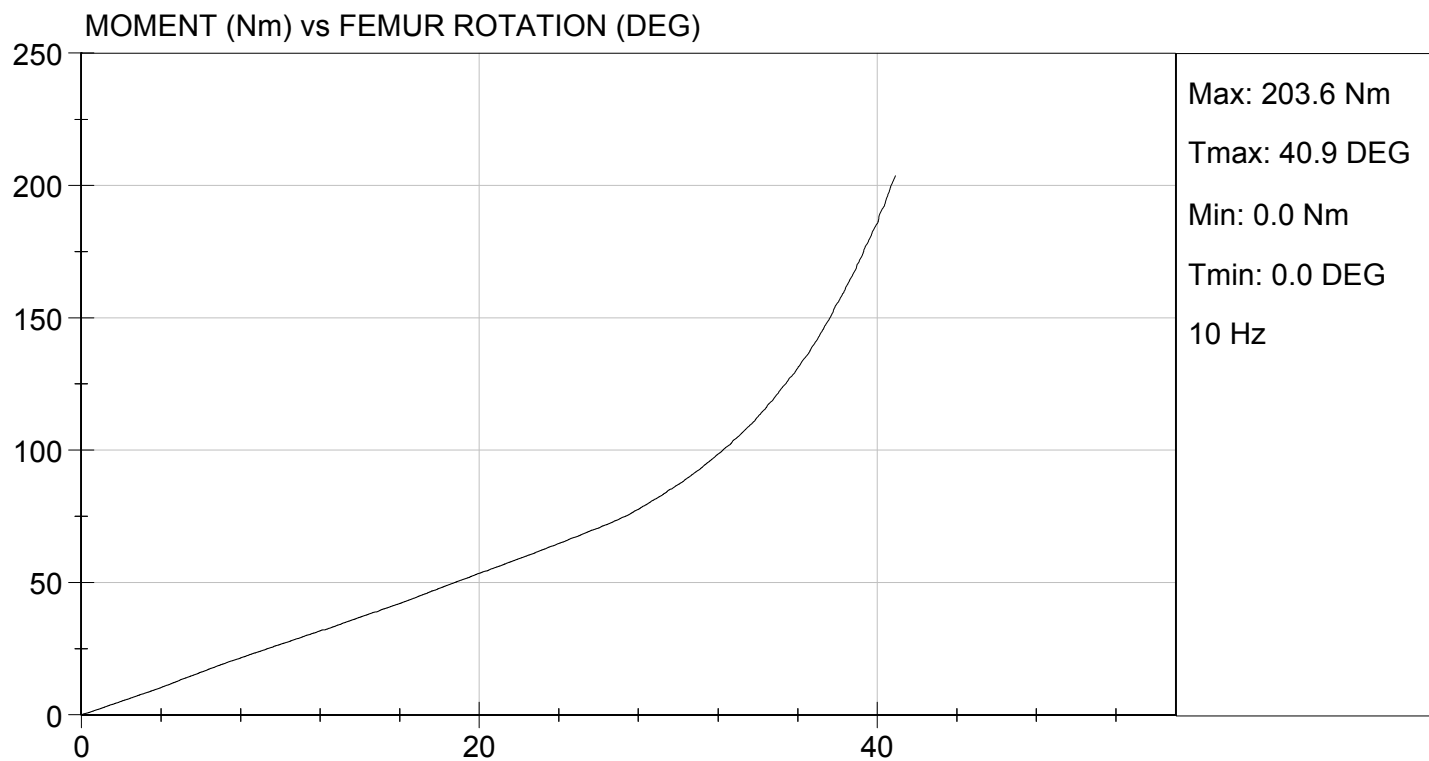
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	40	40	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	87.7	87.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	41.3	40.9	Pass
Overall Test Results					Pass

Maxime Chamberland
Laboratory Technician

12/15/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A10**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AH5D9	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	AH5L1	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	AH5N9	12/01/2014	06/01/2015
NECK TRANSDUCER	Denton	1716	937	11/19/2014	05/19/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH55	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	AGH55	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	C12863	12/01/2014	06/01/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	401	12/02/2014	06/02/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8806	12/01/2014	06/01/2015
(2) LEFT FEMUR	Denton	2121	8807	12/01/2014	06/01/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 401

Test Date: 12/15/2014

Technician: Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damage	OK
Outer skin	Gashes, rips, cracks			X
Head	Ballast secure			X
	General appearance			X
Neck	Broken or cracked rubber			X
	Upper neck bracket firmly attached to the lower neck bracket			X
	Looseness at the condyle joint			X
	Nodding blocks cracked or out of position			X
Spine	Broken or cracks in rubber			X
Ribs	Broken or bent ribs			X
	Broken or bent rib supports			X
	Damping material separated or cracked			X
	Rubber bumpers in place			X
Chest Displacement Assembly	Bent shaft			X
	Slider arm riding in track			X
Transducer leads	Torn cables			X
Accelerometer Mountings	Head mounting secure			X
	Chest mounting secure			X
Knees	Skin condition			X
	Insert (do not remove)			X
	Casting			X
Limbs	Normal movement and adjustment			X
Knee Sliders	Wires intact			X
	Rubber returned to "at rest" position			X
Pelvis	Broken			X
Other				X

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

Repair or Replacement approved by:

Jessica Hall
Signature

12/16/2014
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard
Signature

12/16/2014
Date

HYBRID III 50 th SN #403, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.9
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.0
C	H-POINT HEIGHT	Reference	3.3-3.5	3.5
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.5
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.6
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	5.9
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.4
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.6
I	SHOULDER TO ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.5
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	8.3
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.5
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.6
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	17.8-18.8	18.5

HYBRID III 50 th SN #403, PART 572, SUBPART E EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.8
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.2
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.8
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	3.9
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	38.8
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.2
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

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

Dummy Serial Number: 403

Test Date: 12/01/2014

Technician: David Schoedel

- ☒ Pre test 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. (572.32(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))
- ☒ 3. Torque the skull cap screws to 160 lbf-in.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(i))
- ☒ 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- ☒ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- ☒ 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.32(c)(2))

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

Record the actual distance: 0.5 inches

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

- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.

Record the right side distance: 501 mm

Record the left side distance: 501 mm

- X 11. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.32(c)(4))

Record actual micro finish: 40.9 micro inches

- X 12. The impact surface is rigidly supported. (572.132(c)(4))

- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

- X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))

- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	$225 \text{ g} \leq x \leq 275 \text{ g}$	244 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-6.8 g

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

David Schoedel

Signature

12/01/2014

Date

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

ATD Serial No: 403

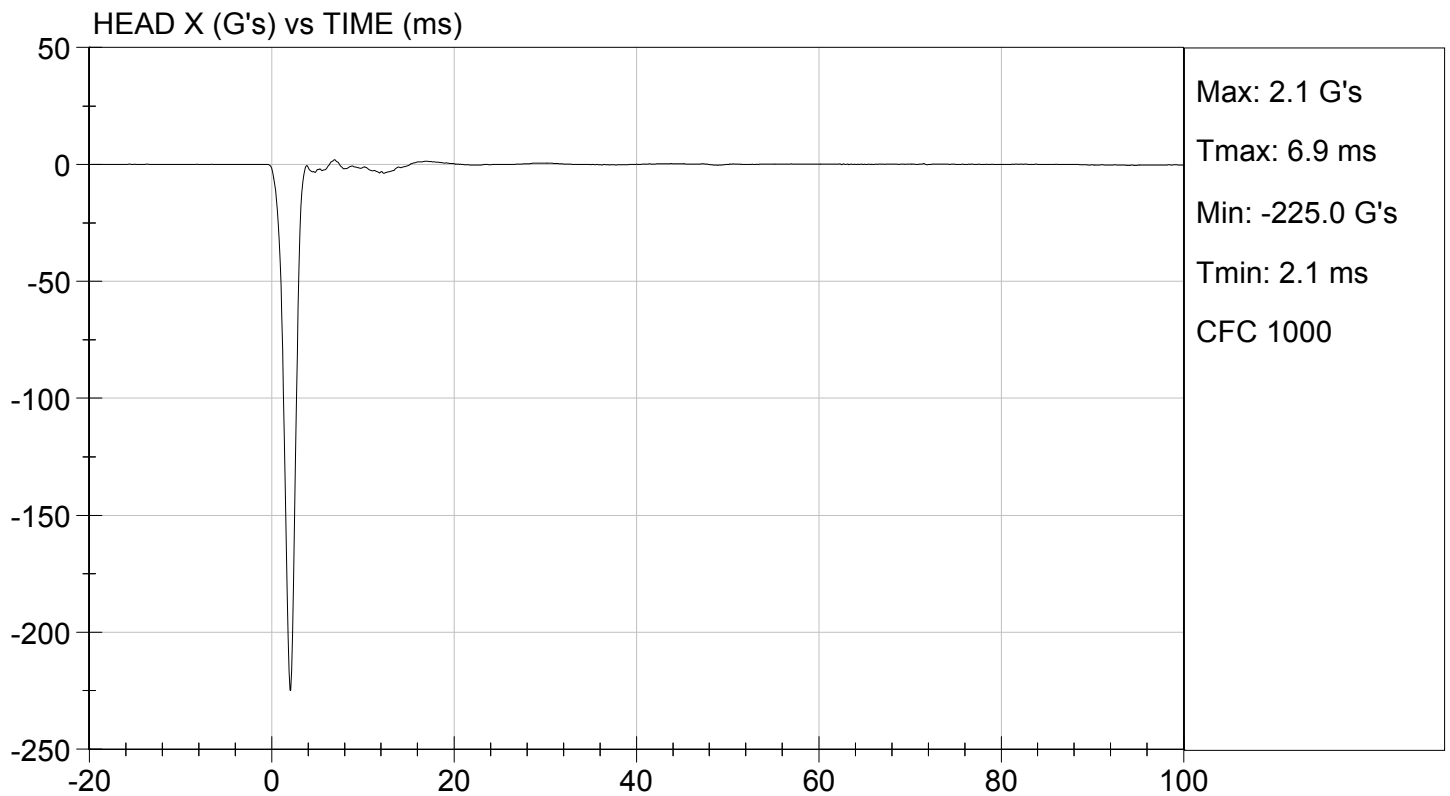
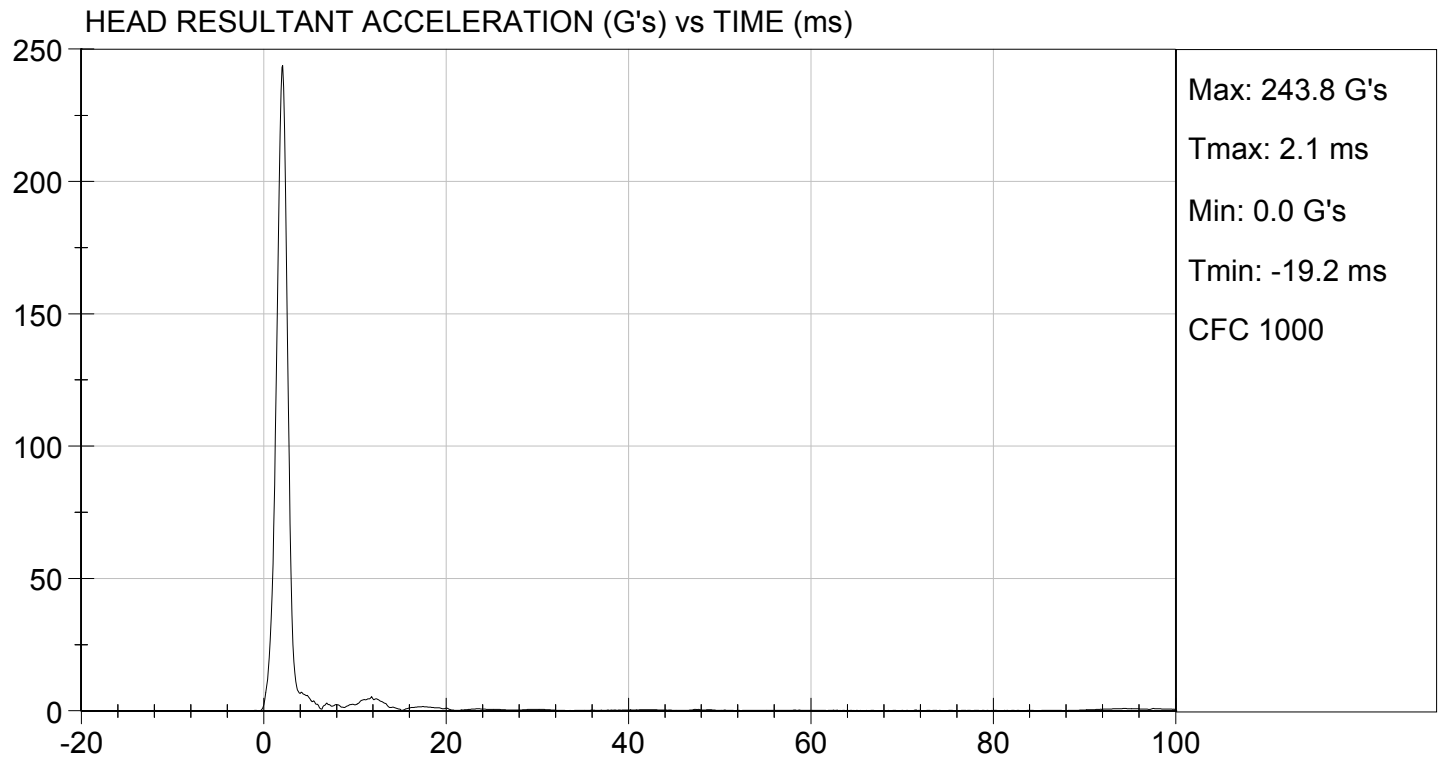
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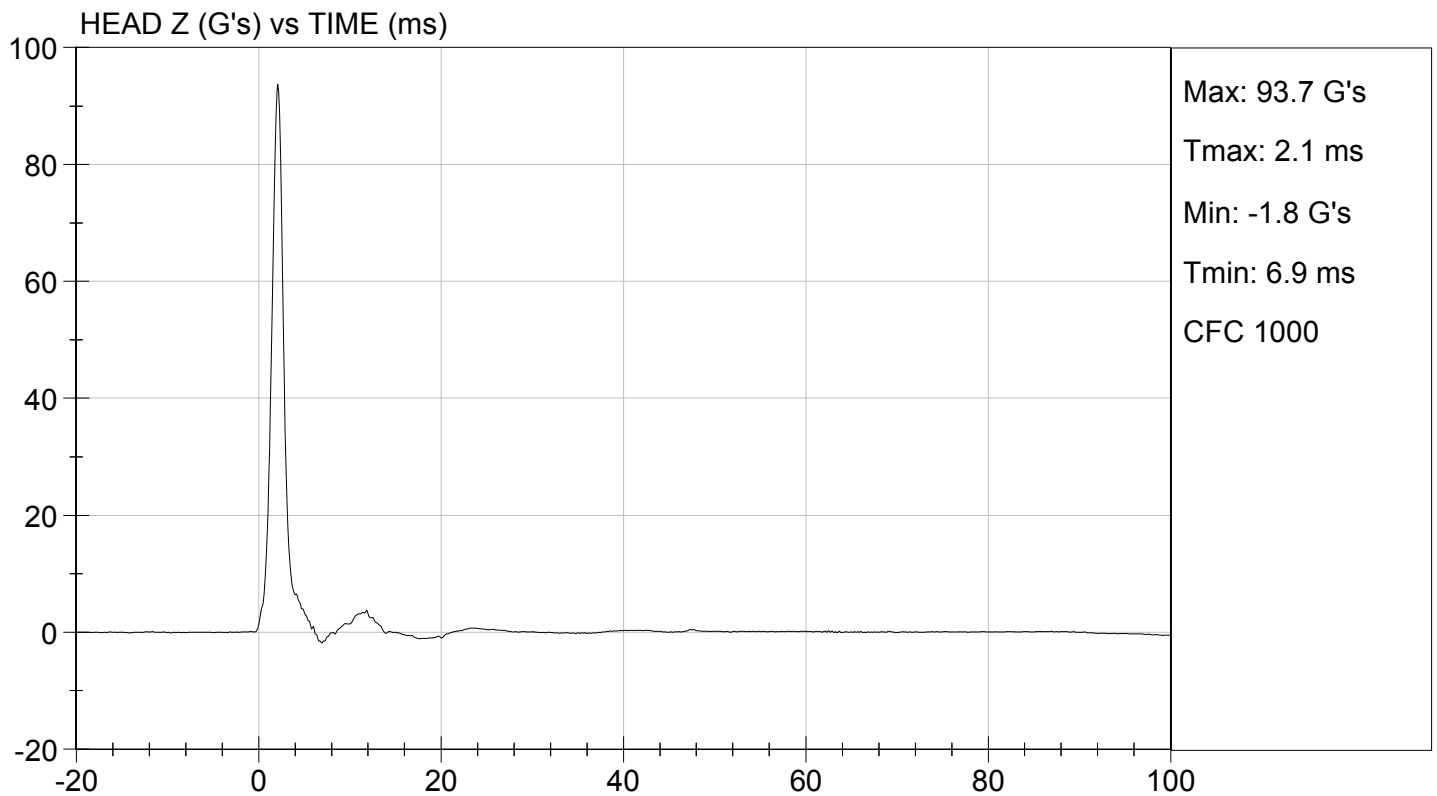
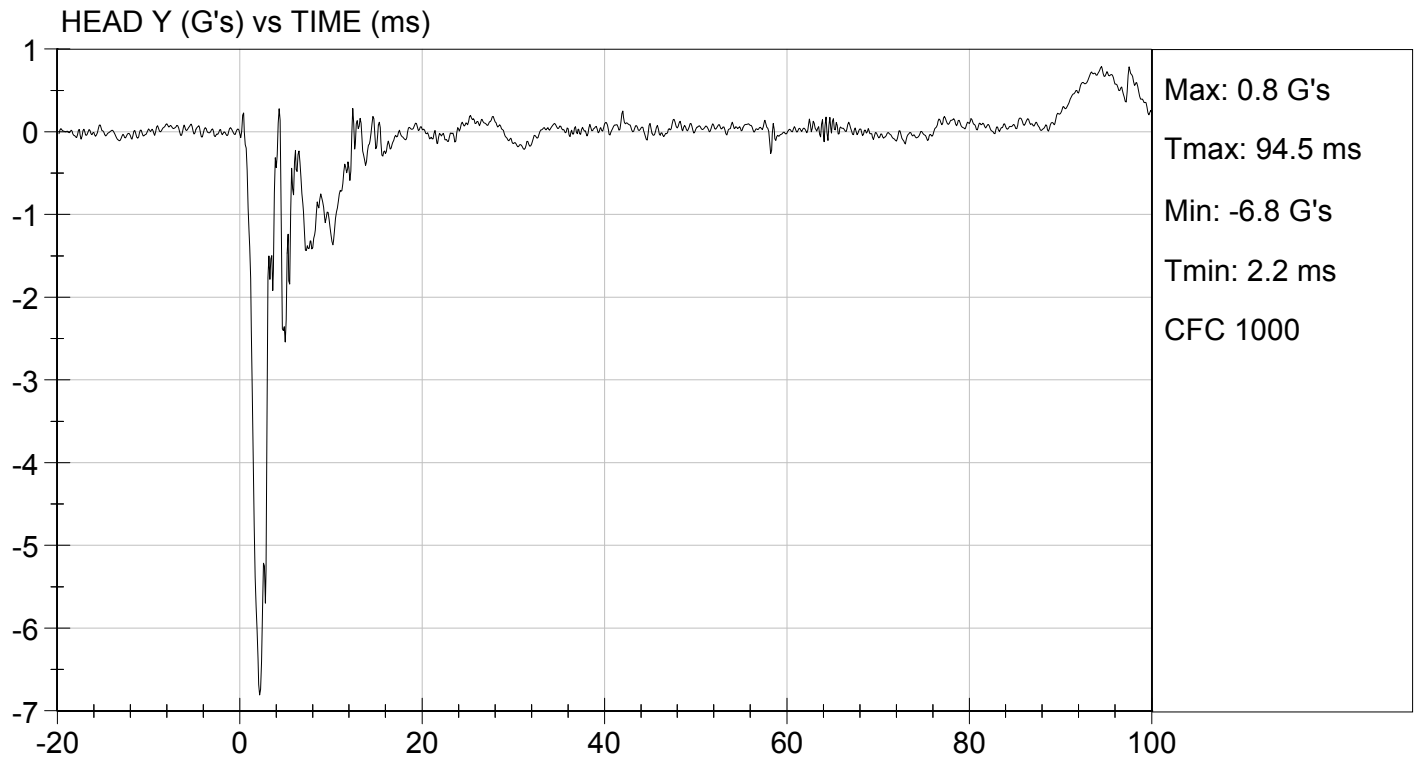
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Peak Resultant Acceleration	G's	225 to 275	244	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-6.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

12/01/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A4
NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403

Test Date: 12/01/2014

Technician: Jessica Gall

X Pre test calibration
 Post test calibration verification

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

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

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

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

Record the maximum temperature: 21.8°C

Record the minimum temperature: 21.1°C

Record the maximum humidity: 18%

Record the minimum humidity: 15%

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

Record findings and actions: No damage

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

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

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

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		$22.6 \text{ ft/s} \leq \text{speed} \leq 23.4 \text{ ft/s}$	22.83 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	$22.5 \leq g \leq 27.5$	23.10 g's
	@ 20 ms	$17.6 \leq g \leq 22.6$	18.40 g's
	@ 30 ms	$12.5 \leq g \leq 18.5$	12.79 g's
	Above 30 ms	29 g maximum	12.7 g's
First Pendulum Decay to 5g		$34 \text{ ms} \leq \text{time} \leq 42 \text{ ms}$	36.9 ms
Plane D Rotation		$64^\circ \leq \text{max. rotation} \leq 78^\circ$	66.6°
		$57 \text{ ms} \leq \text{time of max. rotation} \leq 64 \text{ ms}$	57.7 ms
Time for Plane D Rotation to Cross 0° During First Rebound		$113 \text{ ms} \leq \text{time} \leq 128 \text{ ms}$	114.1 ms
Maximum Moment		$65 \text{ lbf-ft} \leq \text{moment} \leq 80 \text{ lbf-ft}$	65.2 lbf-ft
		$47 \text{ ms} \leq \text{time of max. moment} \leq 58 \text{ ms}$	50.8 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		$97 \text{ ms} \leq \text{time} \leq 107 \text{ ms}$	100.8 ms

*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. (572.33(b)(3))

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

Jessica Hall
Signature

12/01/2014
Date

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

ATD Serial No: 403

Test I.D: D144222

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	16	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.10	Pass
	20 ms	G's	17.60 to 22.60	18.40	Pass
	30 ms	G's	12.50 to 18.50	12.79	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	12.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.9	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	66.6	Pass
	Time	ms	57.0 to 64.0	57.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.1	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	88.4	Pass
	Time	ms	47.0 to 58.0	50.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	100.8	Pass
Overall Test Results					Pass

Jessica Hall
Laboratory Technician

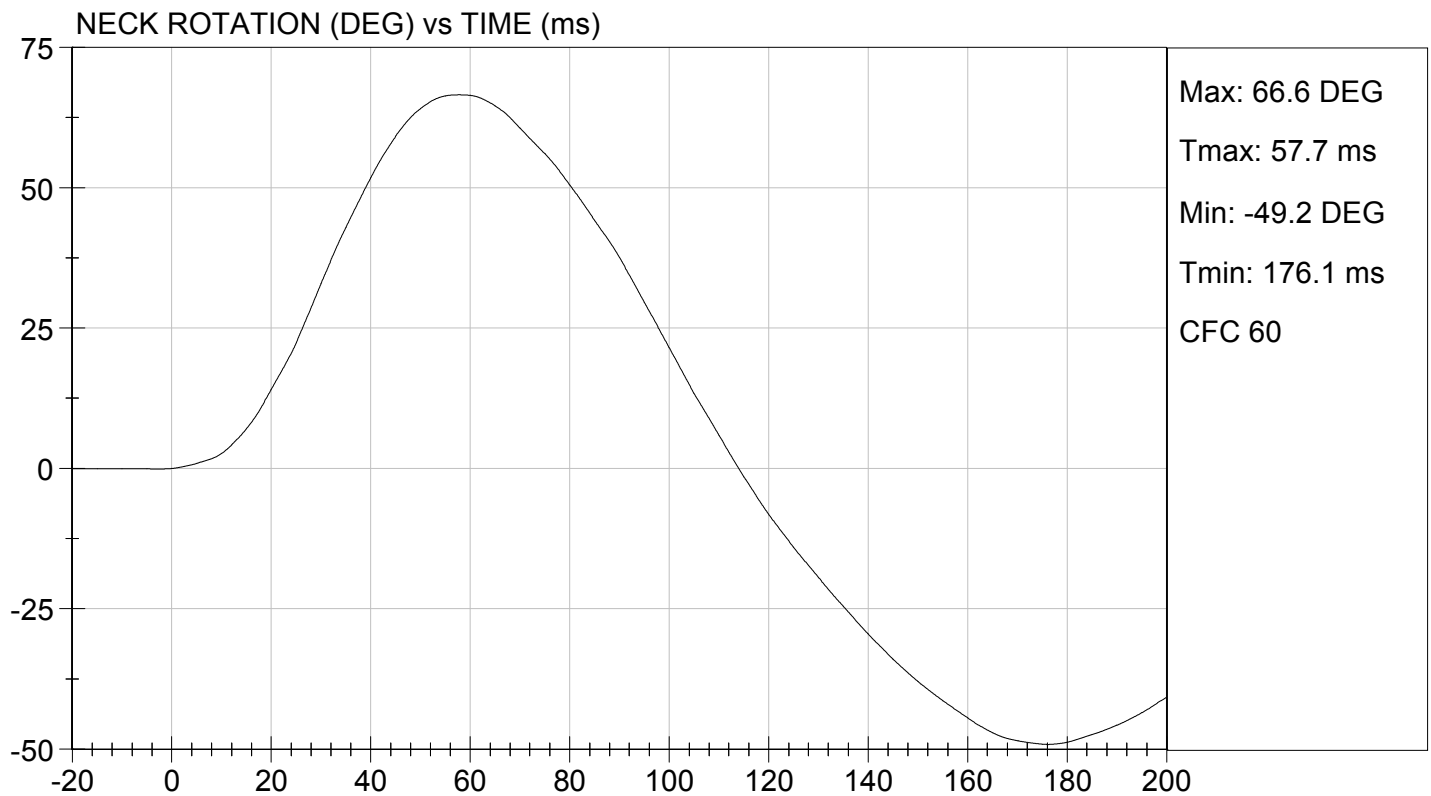
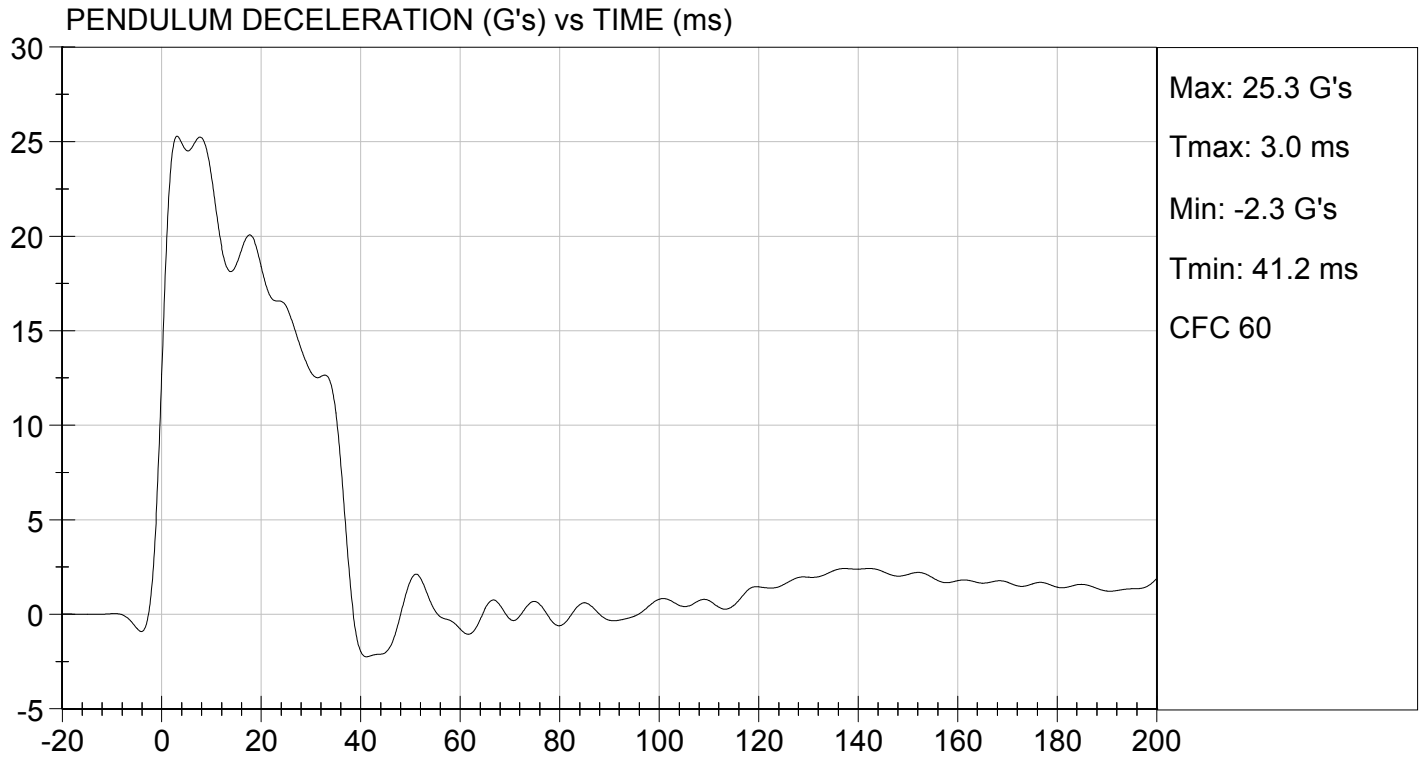
12/01/2014
Test Date

Jeff Leonard
Approved By



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

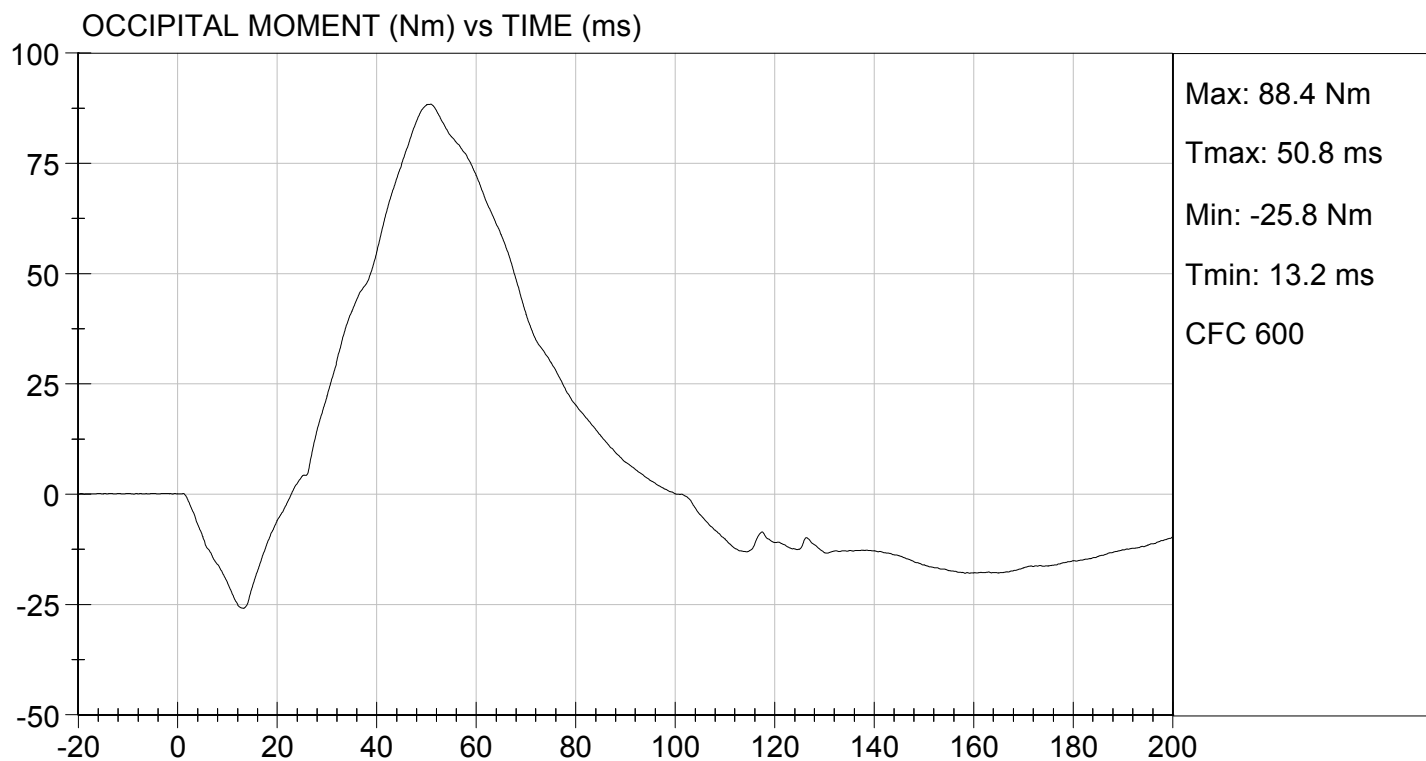
TEST DATE: 12/01/2014
TEST #: D144222





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

TEST DATE: 12/01/2014
TEST #: D144222



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

Dummy Serial Number: 403

Test Date: 12/01/2014

Technician: Maxime Chamberland

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last extension test. (572.36(m))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to 1.0 ± 0.2 lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:
Neck Extension Test Results (572.33(b)(2) & 572.33(c)(4))

Parameter		Specification	Results
Pendulum impact speed		$19.5 \text{ ft/s} \leq \text{speed} \leq 20.3 \text{ ft/s}$	20.08 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	$17.2 \leq g \leq 21.2$	19.59 g's
	@ 20 ms	$14 \leq g \leq 19$	15.35 g's
	@ 30 ms	$11.0 \leq g \leq 16.0$	12.00 g's
	Above 30 ms	22 g maximum	13.8 g's
First Pendulum Decay to 5g		$38 \text{ ms} \leq \text{time} \leq 46 \text{ ms}$	38.5 ms
Plane D Rotation		$81^\circ \leq \text{max. rotation} \leq 106^\circ$	96.7°
		$72 \text{ ms} \leq \text{time of max. rotation} \leq 82 \text{ ms}$	76.5 ms
Time for Plane D Rotation to Cross 0° During First Rebound		$147 \text{ ms} \leq \text{time} \leq 174 \text{ ms}$	158.4 ms
Maximum Moment		$-59 \text{ lbf-ft} \leq \text{moment} \leq -39 \text{ lbf-ft}$	-47.4 lbf-ft
		$65 \text{ ms} \leq \text{time of max. moment} \leq 79 \text{ ms}$	71.0 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		$120 \text{ ms} \leq \text{time} \leq 148 \text{ ms}$	143.9 ms

*Moment about the occipital condyle = $M_y - (0.058 \text{ ft} \times F_x)$ (572.33(b)(2)(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. (572.33(b)(3))

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

Maxime Chamberland
Signature

12/01/2014
Date

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

ATD Serial No: 403

Test I.D: D144223

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	16	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.59	Pass
	20 ms	G's	14.00 to 19.00	15.35	Pass
	30 ms	G's	11.00 to 16.00	12.00	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.7	Pass
	Time	ms	72.0 to 82.0	76.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	158.4	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.2	Pass
	Time	ms	65.0 to 79.0	71.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.9	Pass
Overall Test Results					Pass

Maxime Chamberland
Laboratory Technician

12/01/2014

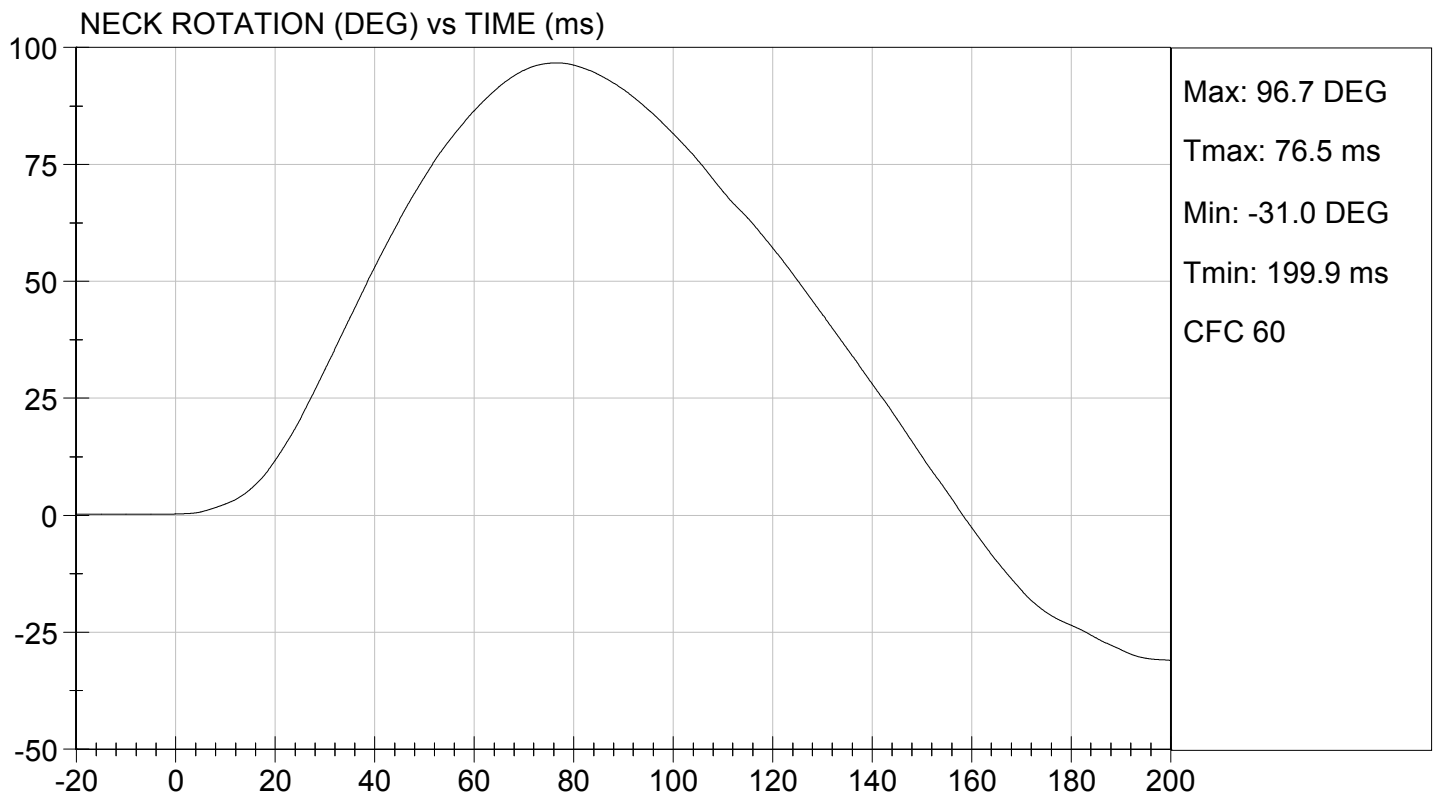
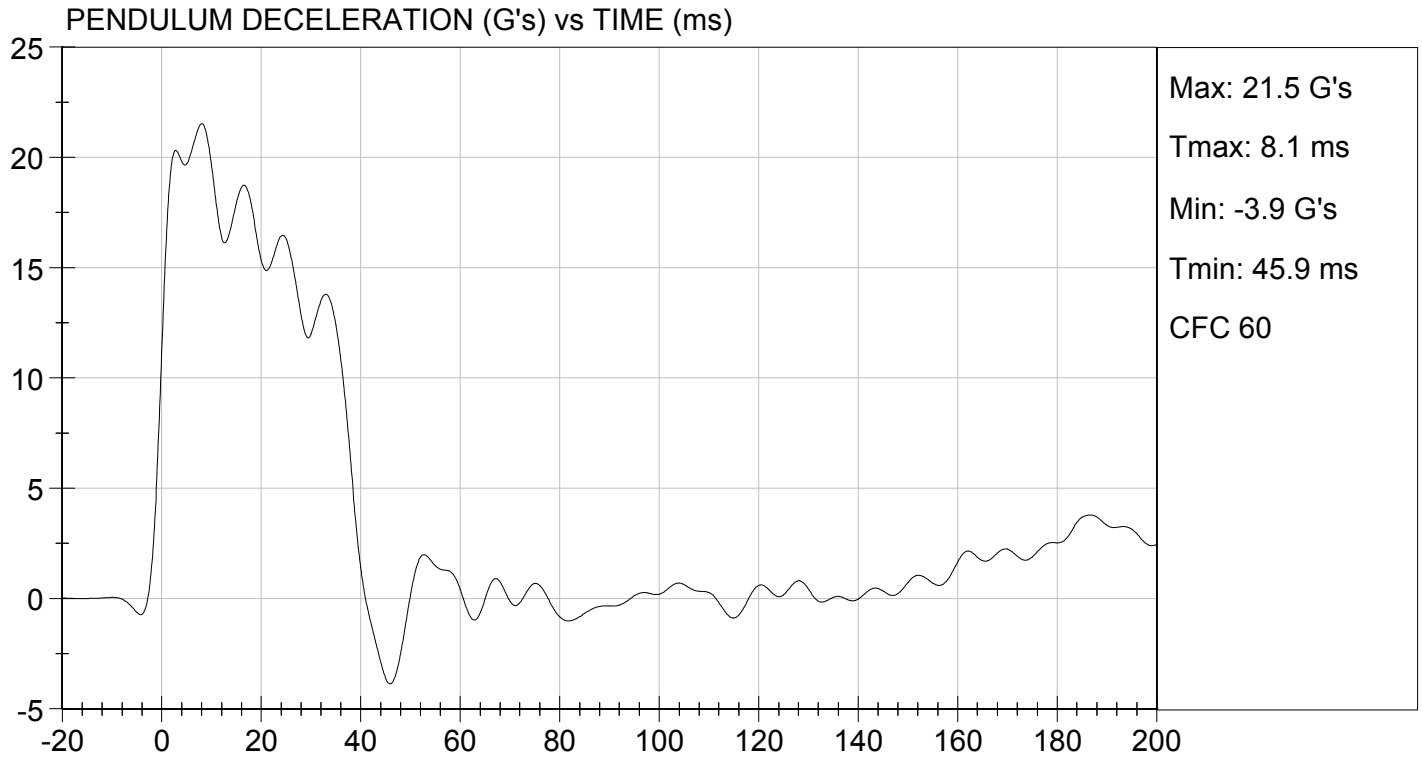
Test Date

Jeff Leonard
Approved By



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

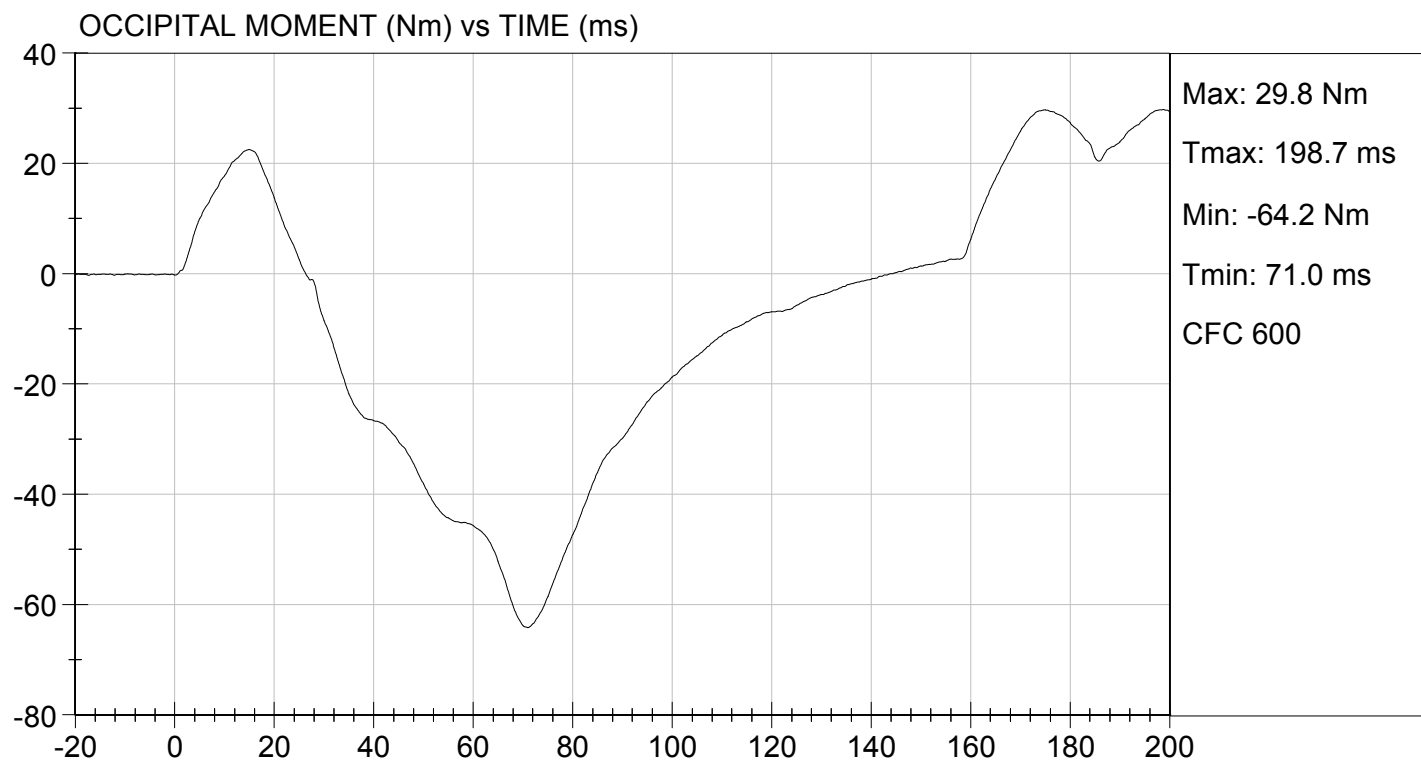
TEST DATE: 12/01/2014
TEST #: D144223





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

TEST DATE: 12/01/2014
TEST #: D144223



DATA SHEET A6
THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403

Test Date: 12/03/2014

Technician: Maxime Chamberland

- ☒ Pre test 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: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- ☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material (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	$21.6 \text{ ft/s} \leq \text{speed} \leq 22.4 \text{ ft/s}$	22.22 ft/s
Chest Compression	$2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$	2.62 in.
Peak resistance force**	$1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$	1236 lb
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.

Maxime Chamberland
Signature

12/03/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403

Test I.D: D144224

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	17	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,499	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.65	Pass
Internal Hysteresis	%	69 to 85	72	Pass
			Overall Test Results	Pass

Maxime Chamberland
Laboratory Technician

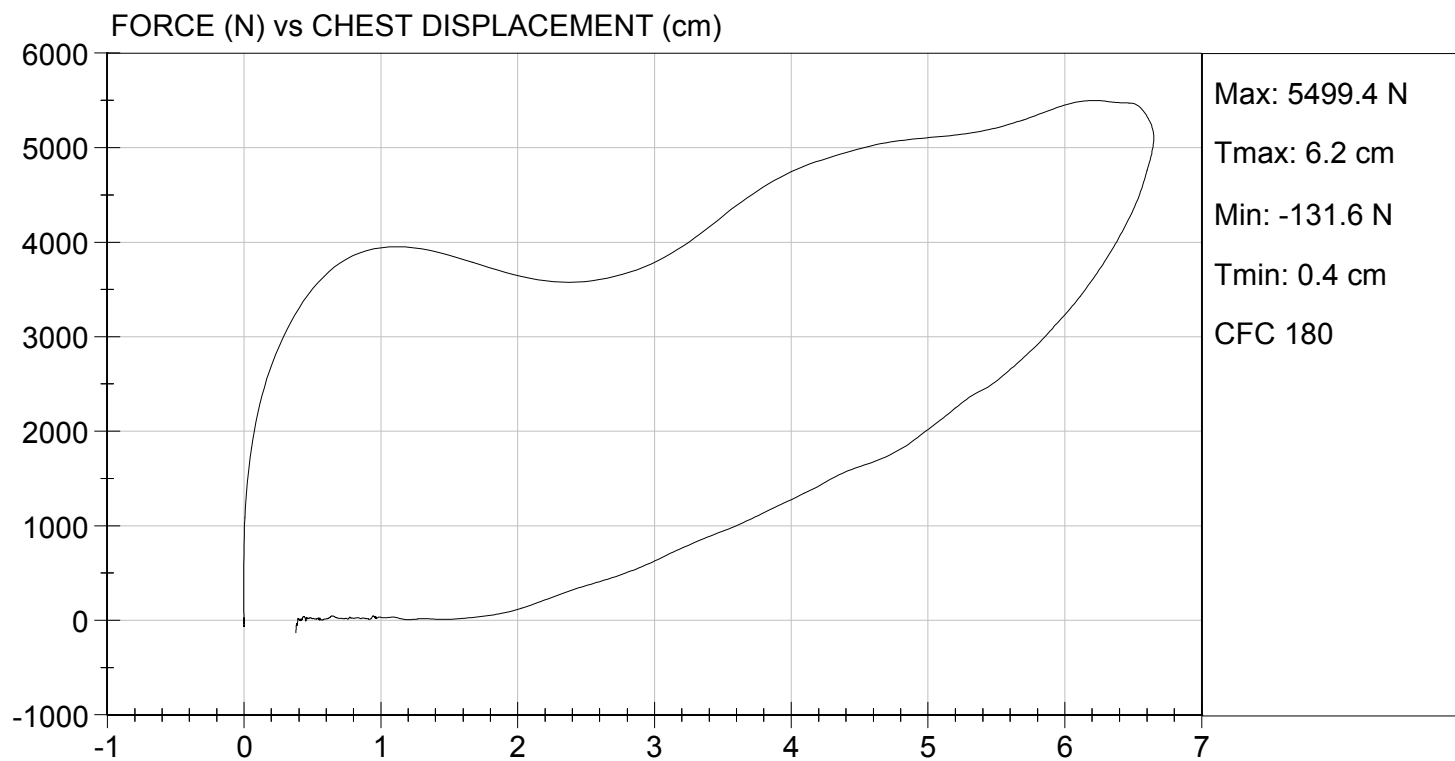
12/03/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/03/2014
TEST #: D144224



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

Dummy Serial Number: 403

Test Date: 12/01/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	7.00 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1257 lb

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

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

David Schoedel
Signature

12/01/2014
Date

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

ATD Serial No: 403

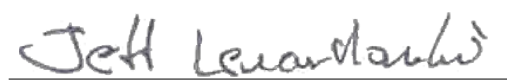
Test I.D: D144226

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	5,591	Pass
Overall Test Results				Pass


Laboratory Technician

12/01/2014

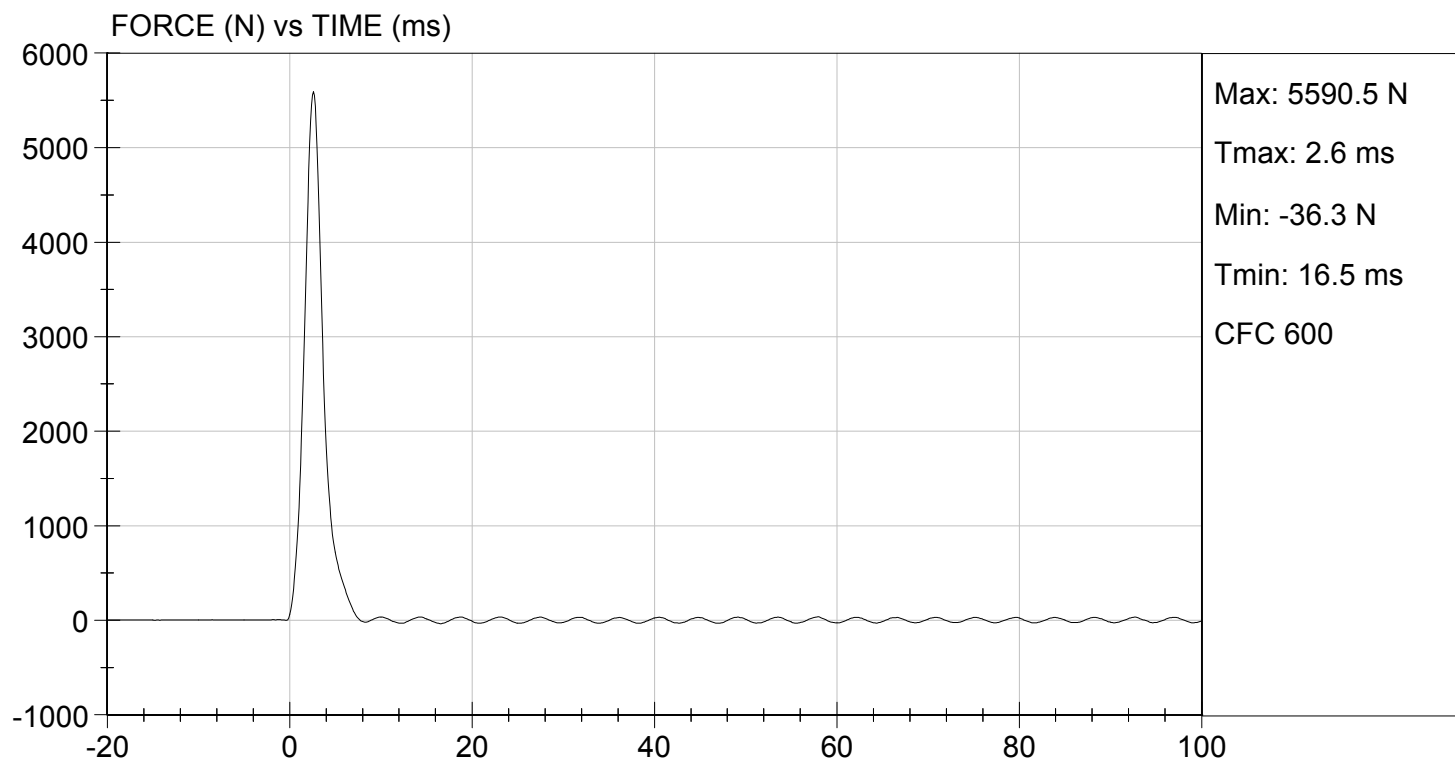
Test Date


Approved By



TEST DESC: LEFT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 12/01/2014
TEST #: D144226



DATA SHEET A8
RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 403

Test Date: 12/01/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	7.00 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1079 lb

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

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

David Schoedel
Signature

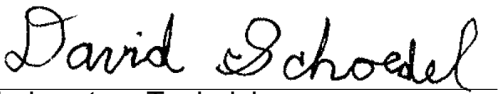
12/01/2014
Date

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

ATD Serial No: 403

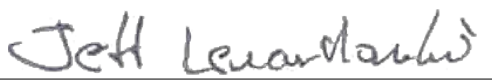
Test I.D: D144225

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	17	Pass
Probe Velocity	m/s	2.07 to 2.13	2.13	Pass
Peak Probe Force	N	4715 to 5782	4,800	Pass
Overall Test Results				Pass


Laboratory Technician

12/01/2014

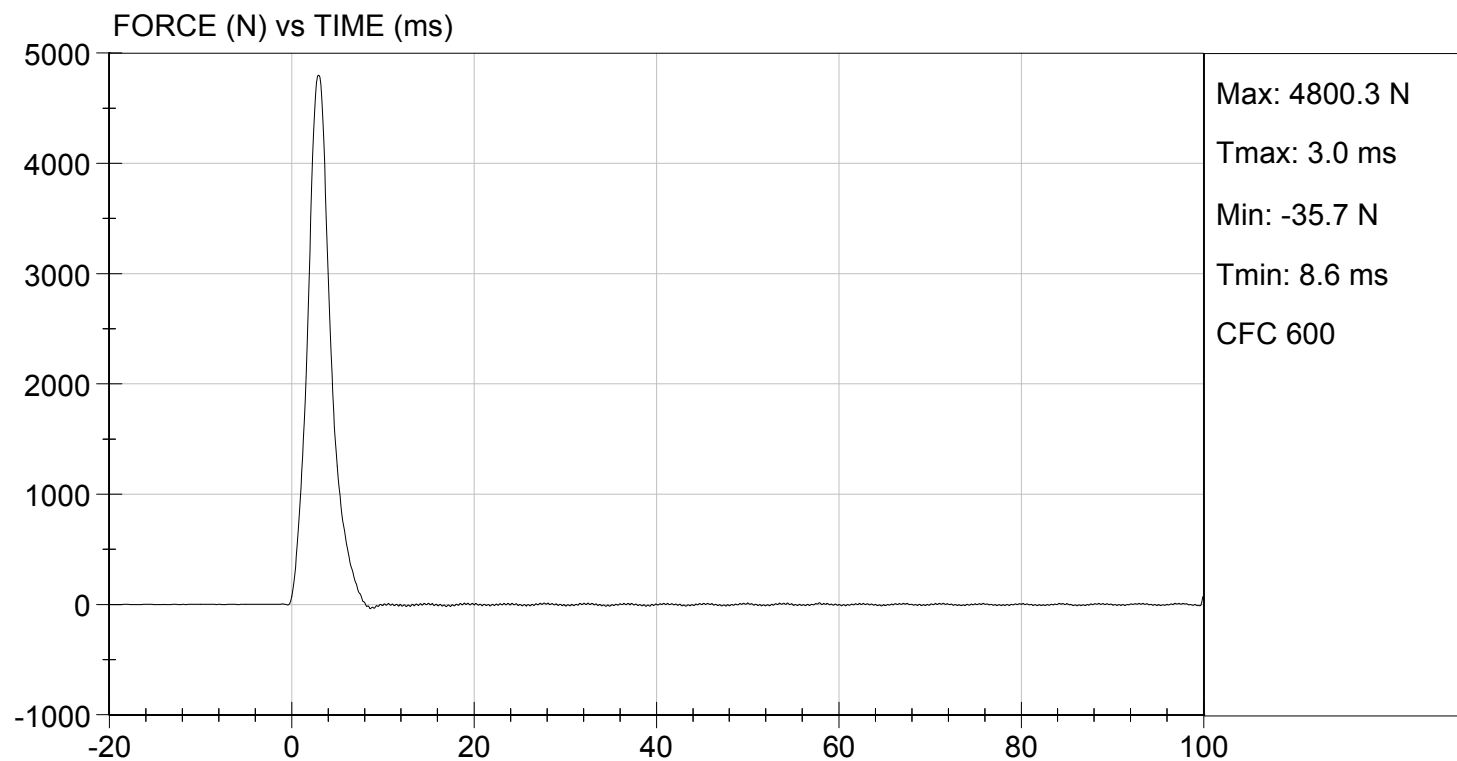
Test Date


Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 12/01/2014
TEST #: D144225



DATA SHEET A9
HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 403

Test Date: 12/01/2014

Technician: Maxime Chamberland

- ☒ Pre test calibration
☐ Post test calibration verification

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

- ☒ 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))
☒ N/A, ONLY one hip joint-femur flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 17A.
- ☒ 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):
- ☒ 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)
 - ☒ 3.2 remove the abdominal insert (78051-52)
 - ☒ 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- ☒ 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity: | <u>18%</u> |
| Record the minimum humidity: | <u>15%</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))

- X 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.3°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	48.4 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	47.1°

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

- X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	64.2 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	43.0°

Maxime Chamberland
Signature

12/01/2014
Date

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

ATD Serial No: 403

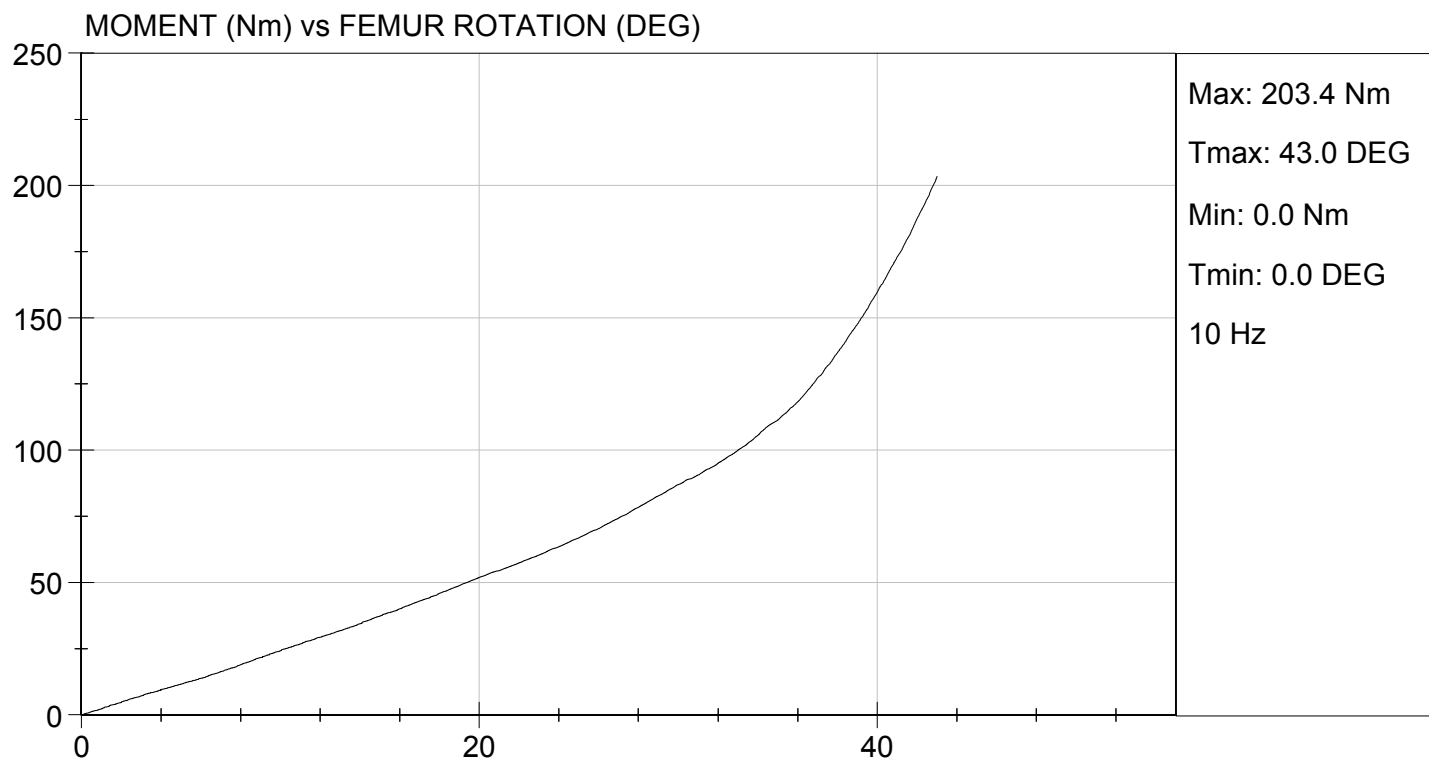
Test I.D: D144220

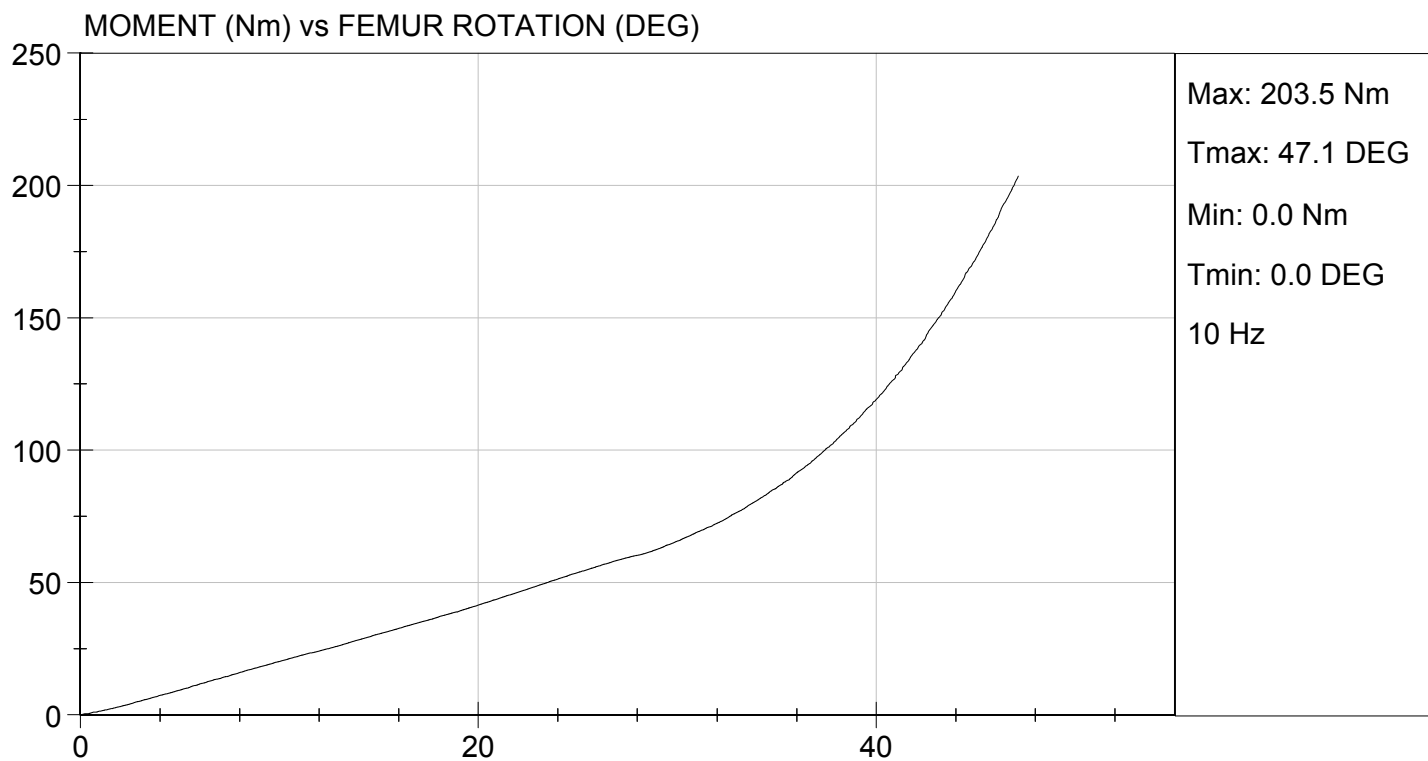
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.5	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	16	16	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	87.0	65.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	43.0	47.1	Pass
Overall Test Results					Pass

Maxime Chamberland
Laboratory Technician

12/01/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH74	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	C10686	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	C13046	12/01/2014	06/01/2015
NECK TRANSDUCER	Denton	1716	1865	08/04/2014	02/04/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH70	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	AH5E5	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	C10591	12/01/2014	06/01/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	403	12/02/2014	06/02/2014
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8804	12/01/2014	06/01/2015
(2) LEFT FEMUR	Denton	2121	8805	12/01/2014	06/01/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

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

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.32(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the complete head (78051-61X), the neck transducer structural replacement (78051-383X), and three (3) accelerometers. (572.32(b))
- X 3. Torque the skull cap screws to 160 lbf-in.
- X 4. Accelerometers and their respective mounts are smooth and clean.
- X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.35(i))
- X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>42%</u> |
| Record the minimum humidity: | <u>38%</u> |
- X 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.32(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 6A. The lowest point on the forehead is 0.5 in. below the lowest point on the dummy's nose when the midsagittal plane is vertical. (572.32(c)(3))
 Record the actual distance: 0.5 inches
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 10. The 1.6 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 7A.
 Record the right side distance: 501 mm
 Record the left side distance: 501 mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.32(c)(4))
 Record actual micro finish: 40.9 micro inches
- X 12. The impact surface is rigidly supported. (572.132(c)(4))
- X 13. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (Figure 6A)
 Record thickness: 50.9 mm
 Record width: 604 mm
 Record length: 595 mm
- X 14. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))
- X 15. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	$225 \text{ g} \leq x \leq 275 \text{ g}$	266 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-4.8 g

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

David Schoedel
 Signature

12/15/2014
 Date

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

ATD Serial No: 403

Test ID: D144421

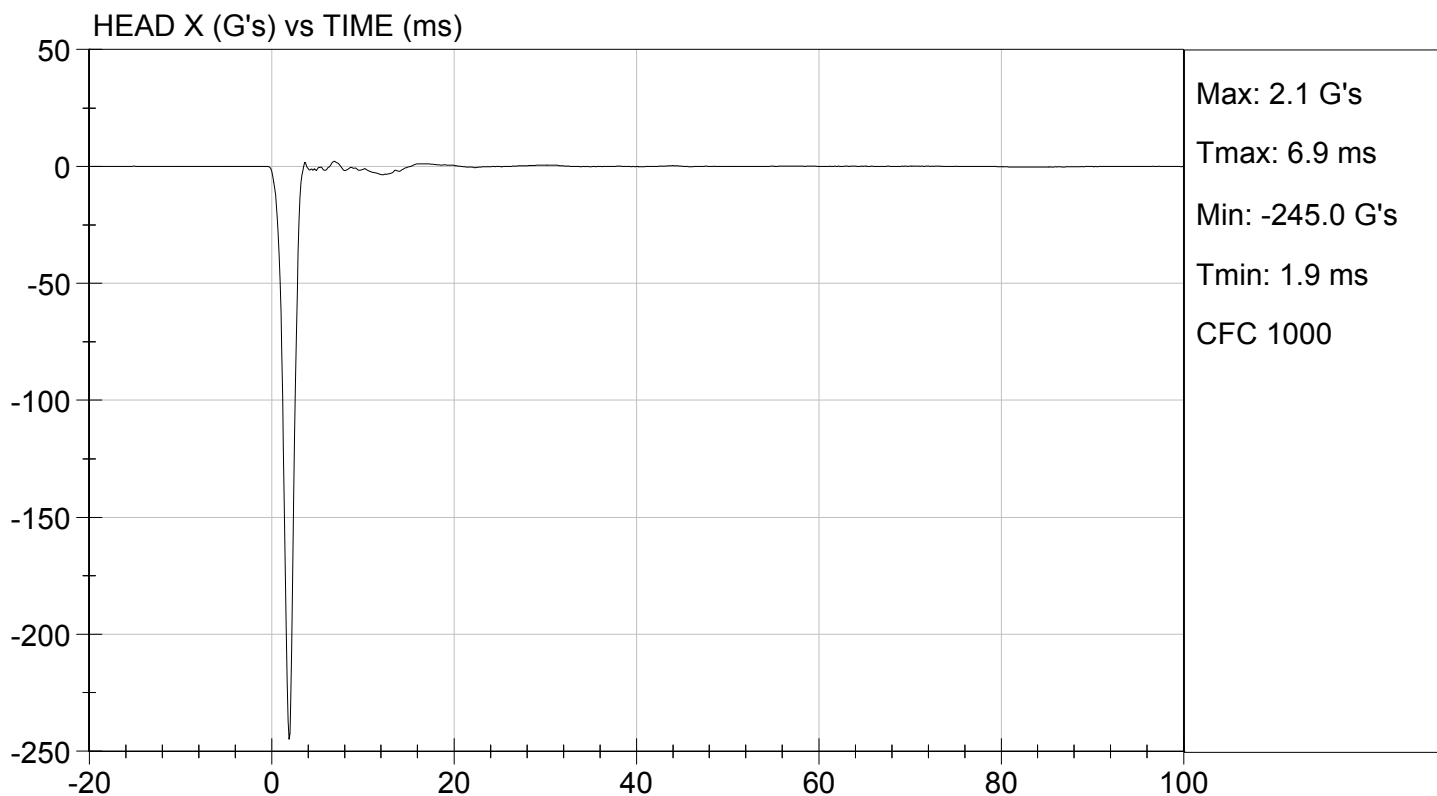
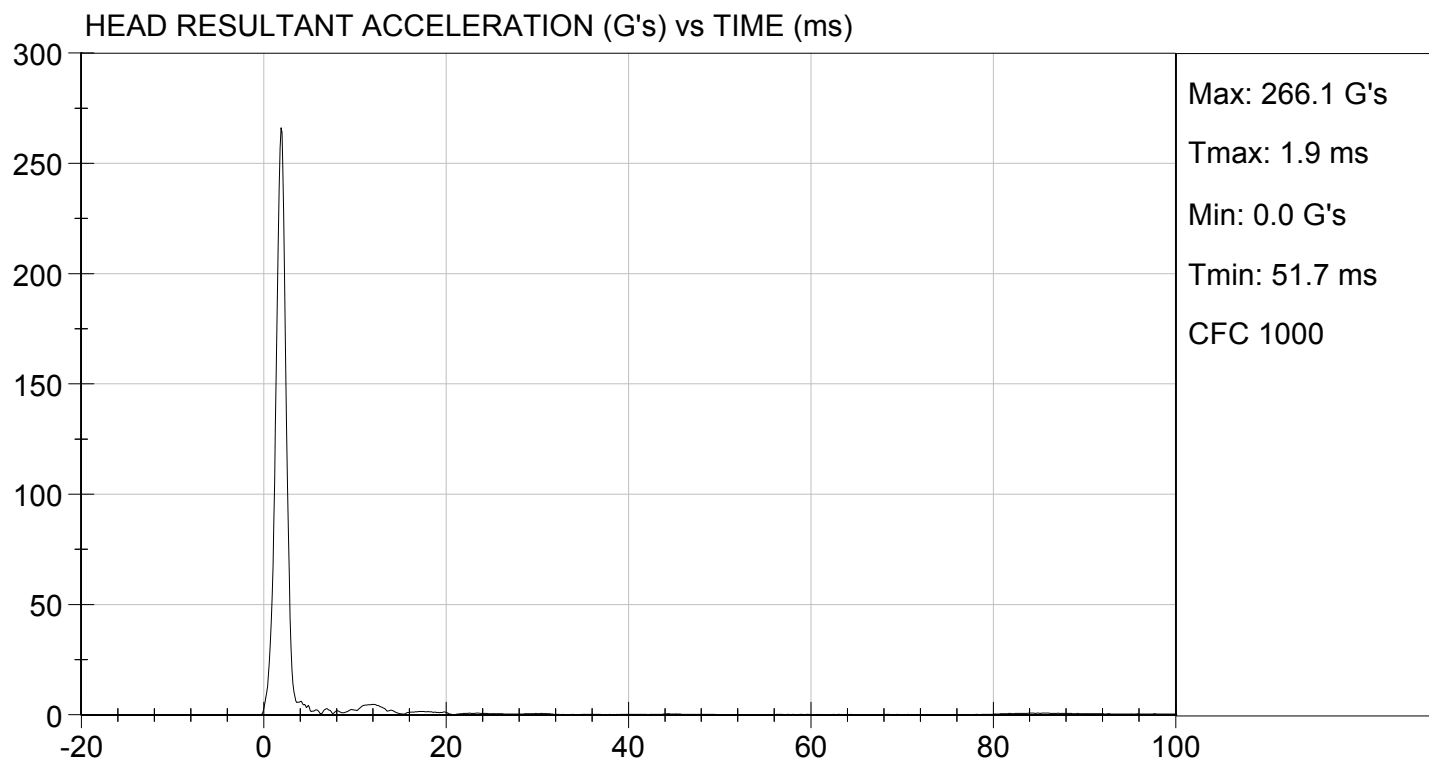
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Peak Resultant Acceleration	G's	225 to 275	266	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-4.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

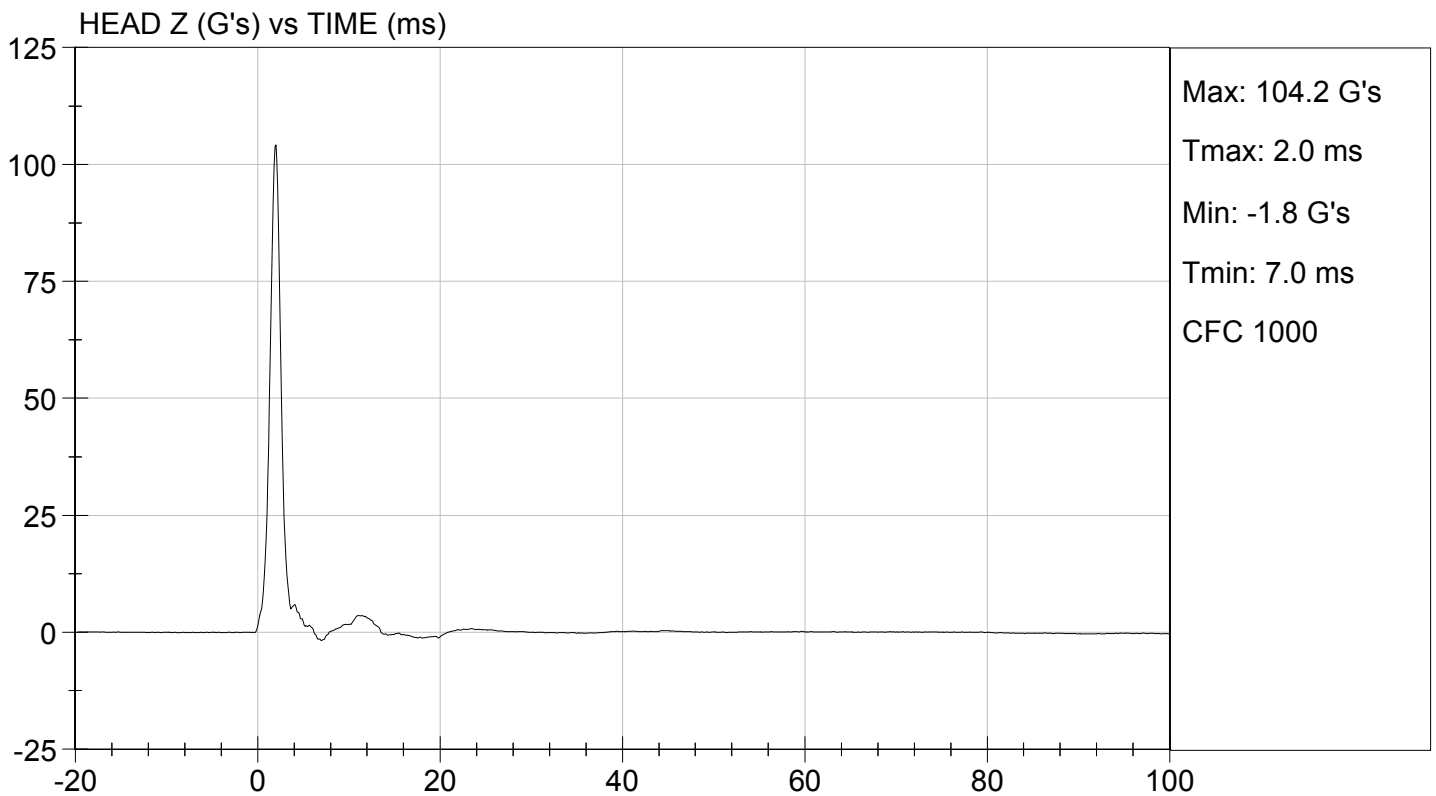
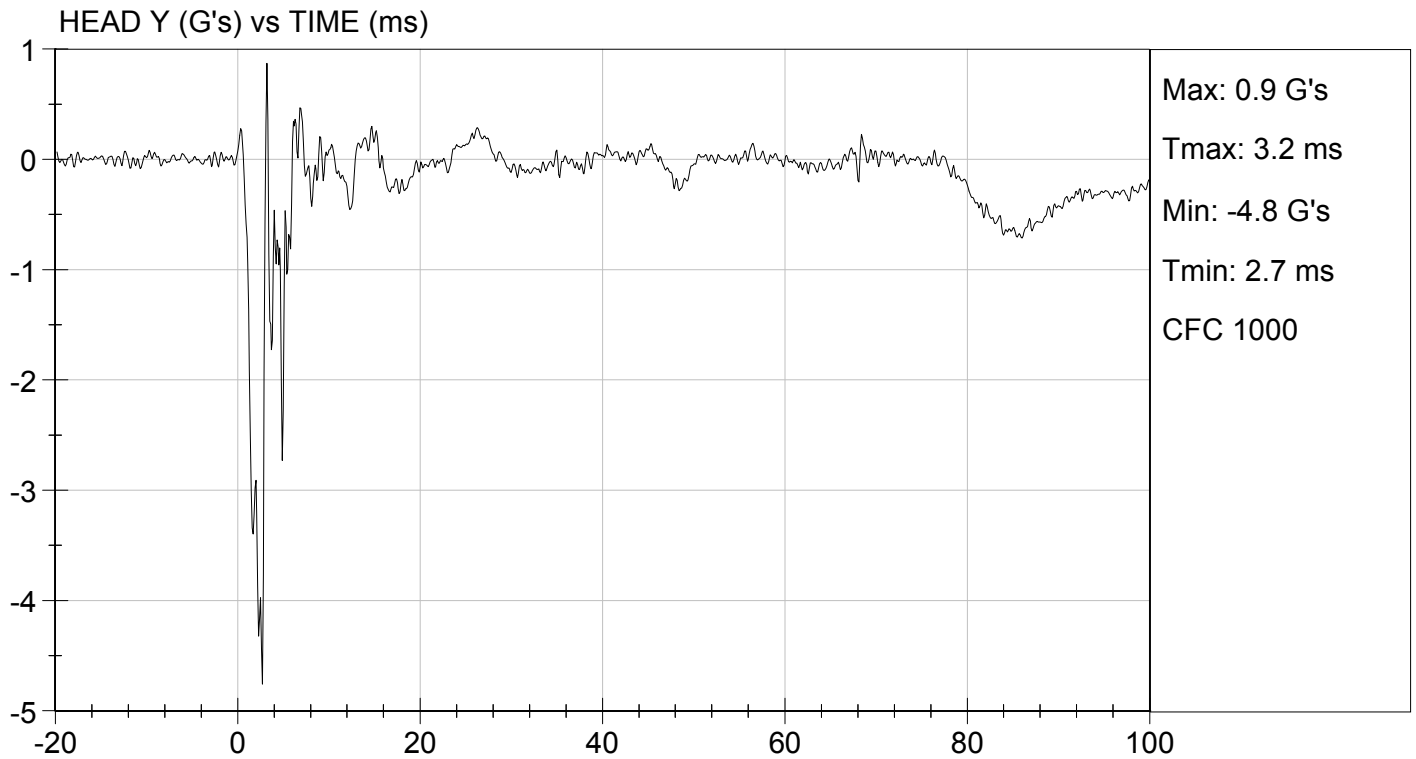
David Schoedel
Laboratory Technician

12/15/2014

Test Date

Jeff Leonard
Approved By





DATA SHEET A4
NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last flexion test. (572.36(m))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (78051-61X), neck assembly (78051-90), bib simulator (78051-84), upper neck adjusting bracket (78051-307), lower neck adjusting bracket (78051-303), six axis neck transducer (C-1709) and either three accelerometers or their mass equivalent installed in the head assembly. Data from the accelerometers are not required. (572.33(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.33(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>42%</u> |
| Record the minimum humidity: | <u>38%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Pre-test calibration Neck cable torque: Torque the jam nut (78051-64) on the neck cable (78051-301) to 1.0 ± 0.2 lb-ft by loosening the jam nut and relaxing the neck cable before torquing. (572.33(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s $\leq$ speed $\leq$ 23.4 ft/s	23.15 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 $\leq$ g $\leq$ 27.5	25.75 g's
	@ 20 ms	17.6 $\leq$ g $\leq$ 22.6	22.03 g's
	@ 30 ms	12.5 $\leq$ g $\leq$ 18.5	13.60 g's
	Above 30 ms	29 g maximum	13.8 g's
First Pendulum Decay to 5g		34 ms $\leq$ time $\leq$ 42 ms	40.8 ms
Plane D Rotation		64° $\leq$ max. rotation $\leq$ 78°	67.3°
		57 ms $\leq$ time of max. rotation $\leq$ 64 ms	60.8 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms $\leq$ time $\leq$ 128 ms	116.2 ms
Maximum Moment		65 lbf-ft $\leq$ moment $\leq$ 80 lbf-ft	65.2 lbf-ft
		47 ms $\leq$ time of max. moment $\leq$ 58 ms	55.5 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms $\leq$ time $\leq$ 107 ms	105.4 ms

*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. (572.33(b)(3))

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

David Schoedel
Signature

12/15/2014
Date

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

ATD Serial No: 403

Test I.D: D144422

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	40	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	25.75	Pass
	20 ms	G's	17.60 to 22.60	22.03	Pass
	30 ms	G's	12.50 to 18.50	13.60	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	40.8	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	67.3	Pass
	Time	ms	57.0 to 64.0	60.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	116.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	88.4	Pass
	Time	ms	47.0 to 58.0	55.5	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	105.4	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

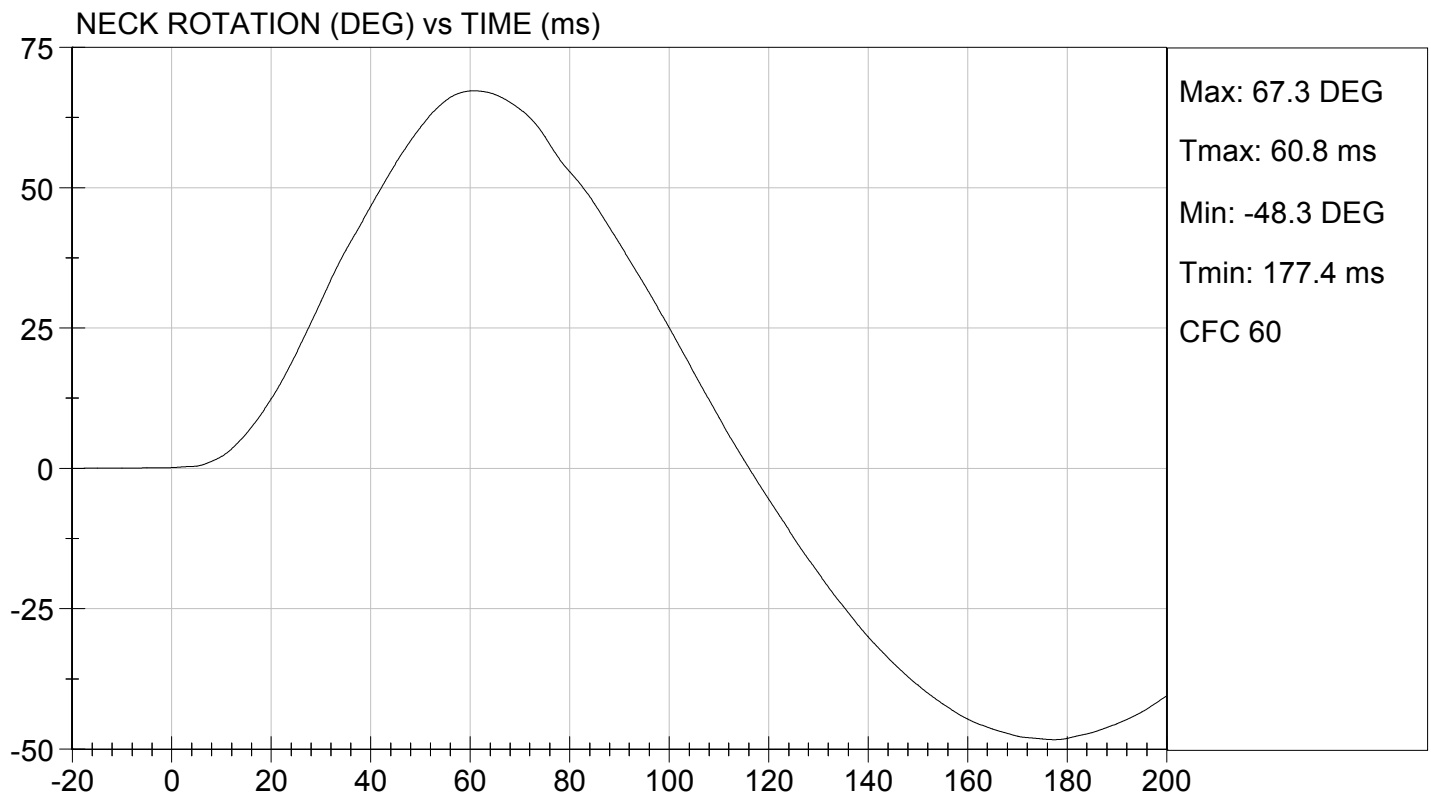
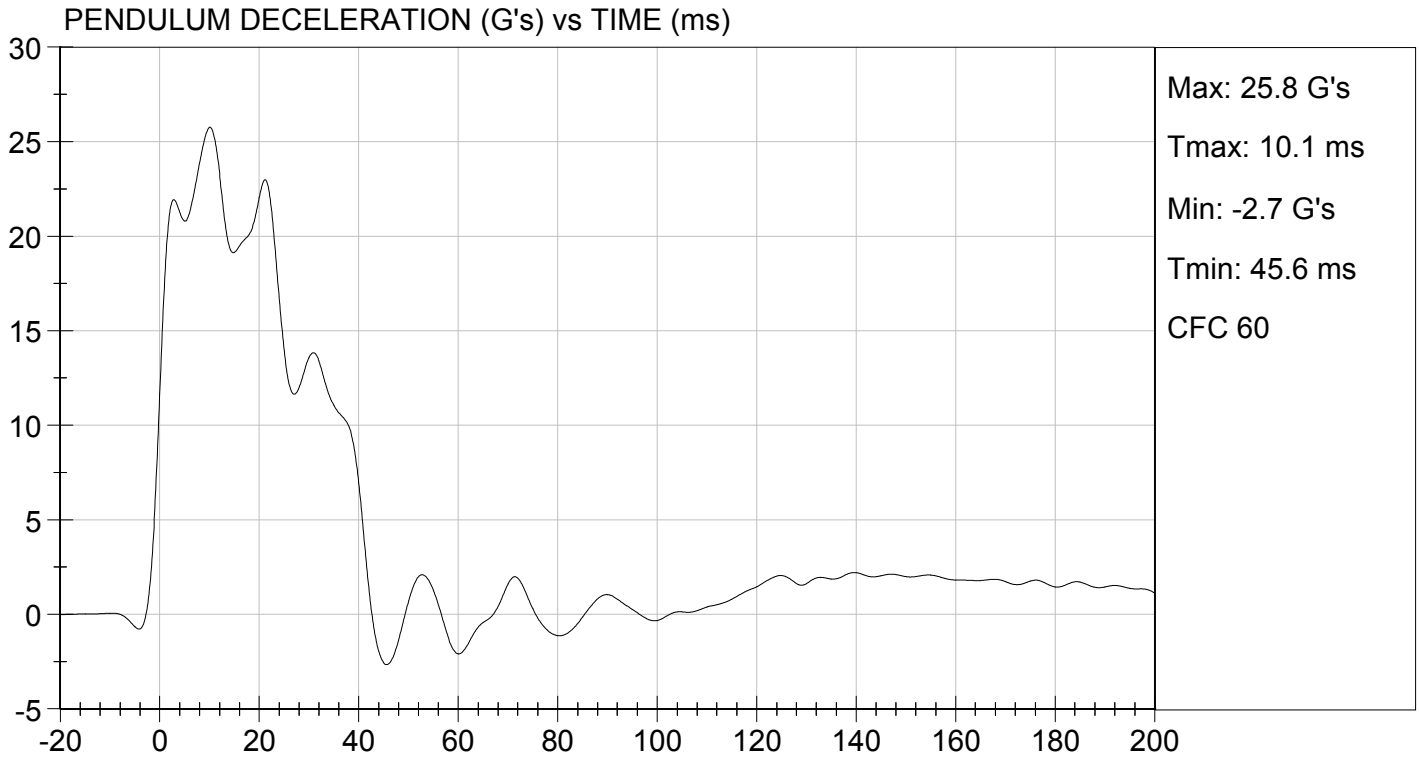
12/15/2014
Test Date

Jeff Leonard
Approved By



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

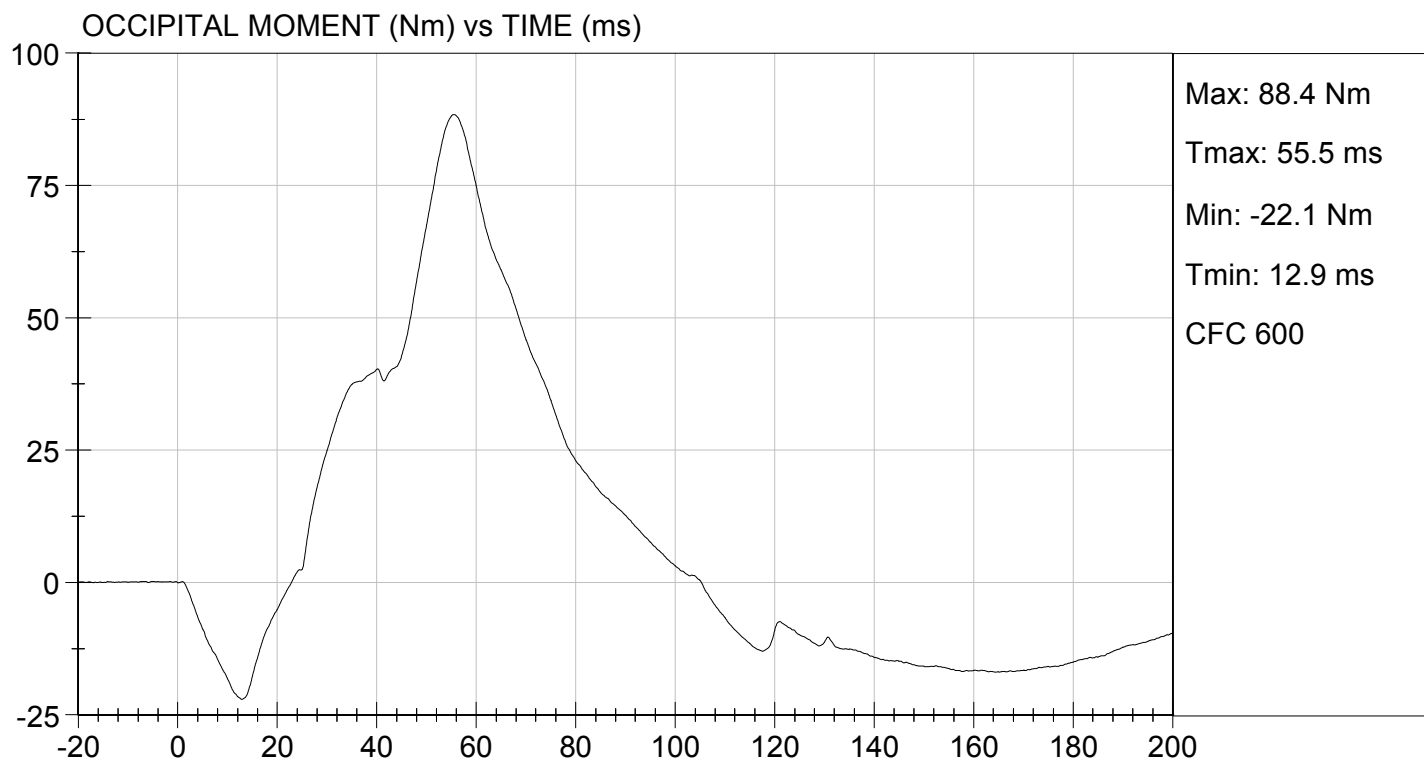
TEST DATE: 12/15/2014
TEST #: D144422





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

TEST DATE: 12/15/2014
TEST #: D144422



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

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: David Schoedel

 Pre test calibration
X Post test calibration verification

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

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

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

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

Record the maximum temperature: 21.9°C

Record the minimum temperature: 21.3°C

Record the maximum humidity: 42%

Record the minimum humidity: 38%

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

Record findings and actions: No damage

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

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

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

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))
- X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))
- X 13. Complete the following table:
Neck Extension Test Results (572.33(b)(2) & 572.33(c)(4))

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s $\leq$ speed $\leq$ 20.3 ft/s	20.30 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 $\leq$ g $\leq$ 21.2	18.62 g's
	@ 20 ms	14 $\leq$ g $\leq$ 19	15.76 g's
	@ 30 ms	11.0 $\leq$ g $\leq$ 16.0	12.94 g's
	Above 30 ms	22 g maximum	13.1 g's
First Pendulum Decay to 5g		38 ms $\leq$ time $\leq$ 46 ms	40.2 ms
Plane D Rotation		81° $\leq$ max. rotation $\leq$ 106°	96.1°
		72 ms $\leq$ time of max. rotation $\leq$ 82 ms	77.6 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms $\leq$ time $\leq$ 174 ms	160.2 ms
Maximum Moment		-59 lbf-ft $\leq$ moment $\leq$ -39 lbf-ft	-42.0 lbf-ft
		65 ms $\leq$ time of max. moment $\leq$ 79 ms	73.4 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms $\leq$ time $\leq$ 148 ms	144.4 ms

*Moment about the occipital condyle = $M_y - (0.058 \text{ ft} \times F_x)$ (572.33(b)(2)(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. (572.33(b)(3))

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

David Schoedel
Signature

12/15/2014
Date

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

ATD Serial No: 403

Test I.D: D144423

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	40	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.19	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.62	Pass
	20 ms	G's	14.00 to 19.00	15.76	Pass
	30 ms	G's	11.00 to 16.00	12.94	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.2	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.1	Pass
	Time	ms	72.0 to 82.0	77.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	160.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-57.0	Pass
	Time	ms	65.0 to 79.0	73.4	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.4	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

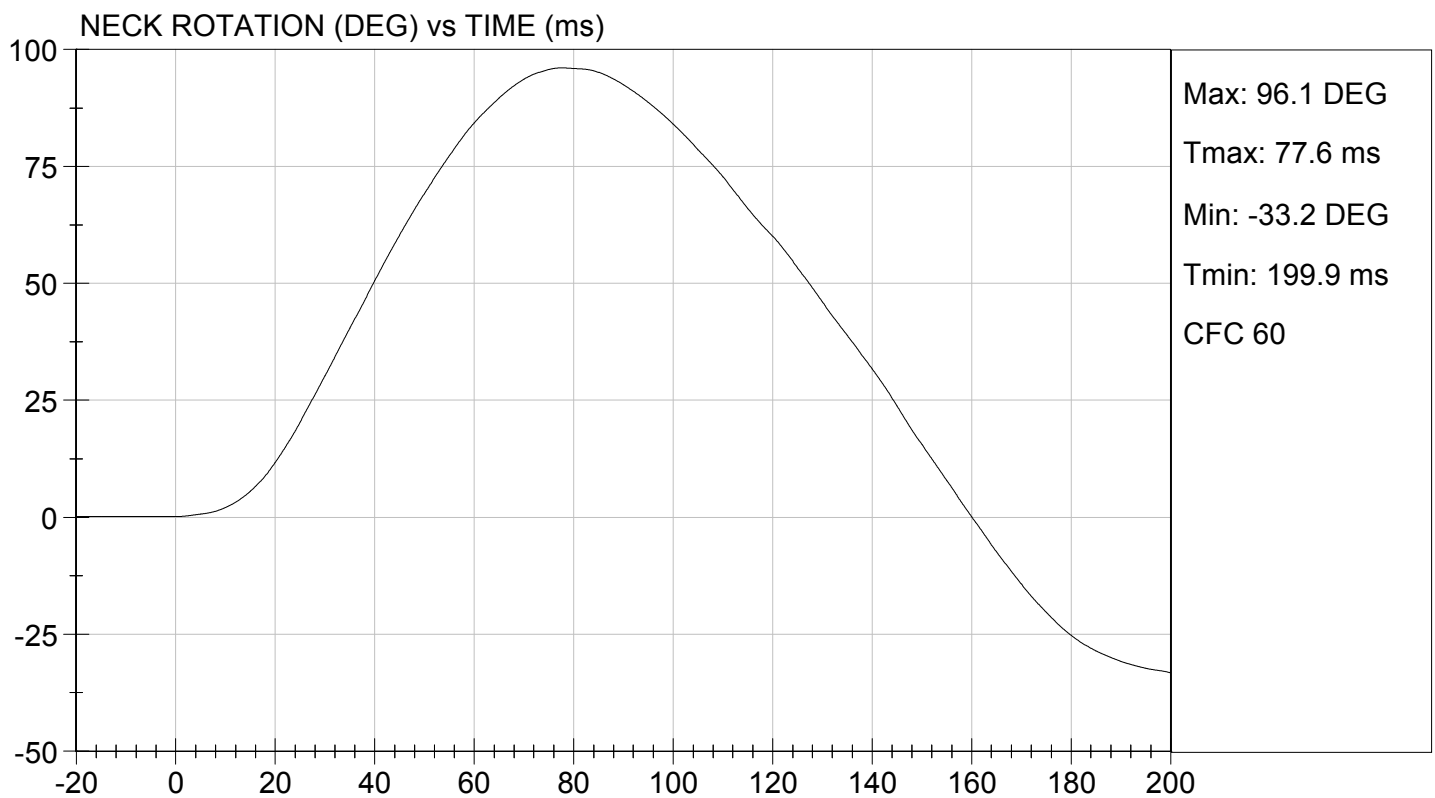
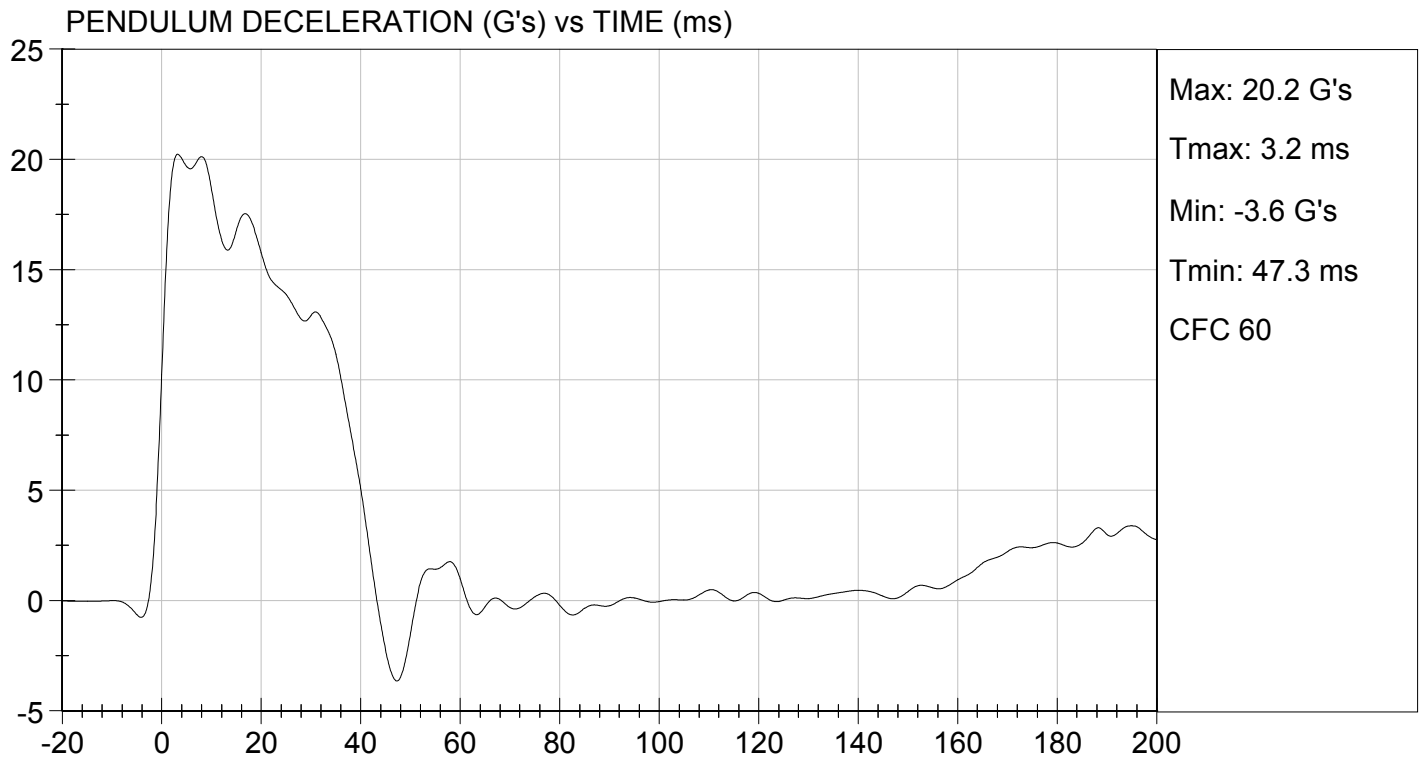
12/15/2014
Test Date

Jeff LevanMarx
Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

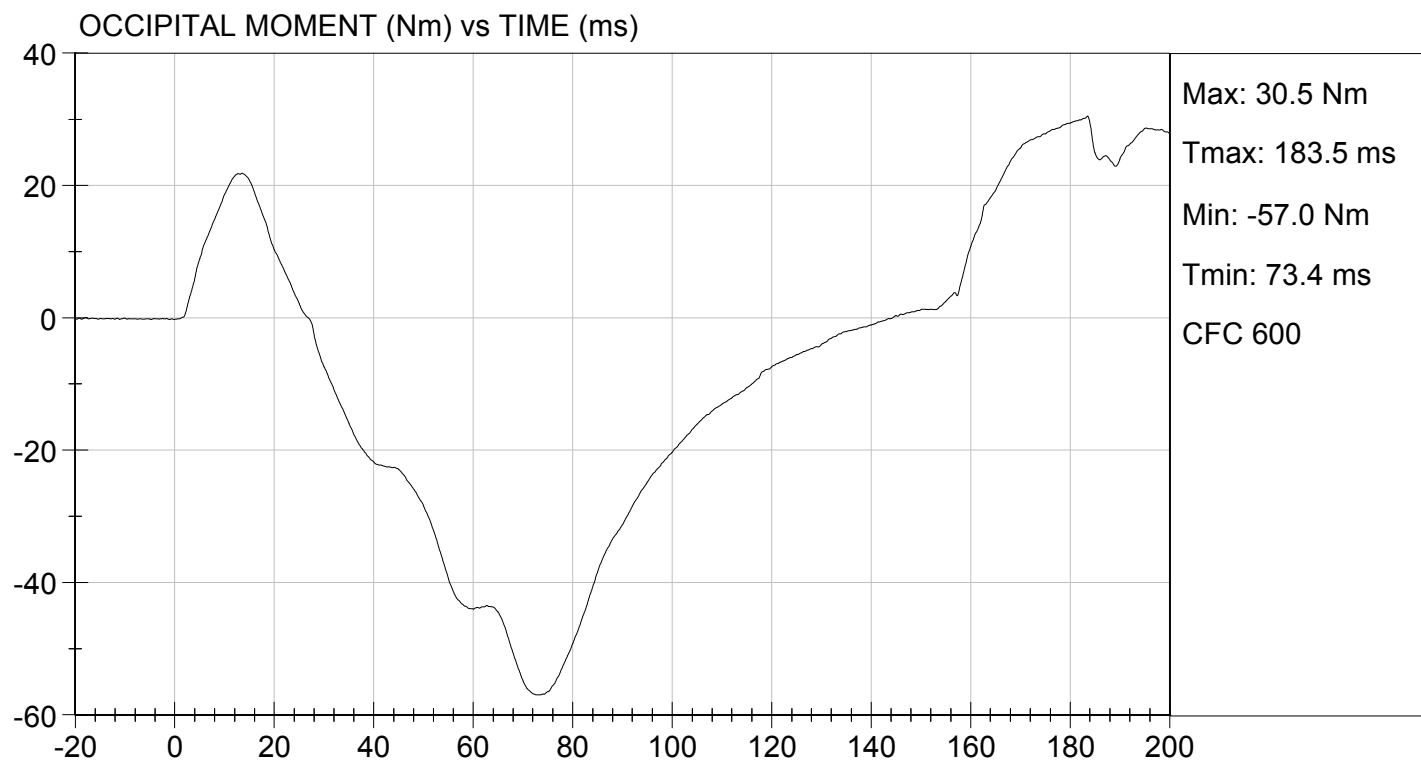
TEST DATE: 12/15/2014
TEST #: D144423





TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 12/15/2014
TEST #: D144423



DATA SHEET A6
THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403

Test Date: 12/16/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	<u>21.9°C</u>
Record the minimum temperature:	<u>21.3°C</u>
Record the maximum humidity:	<u>42%</u>
Record the minimum humidity:	<u>38%</u>

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

X - No Damage

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

 - The following repairs or replacement was performed. Record:

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572.34(c)(2))
- X 7. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ 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	$21.6 \text{ ft/s} \leq \text{speed} \leq 22.4 \text{ ft/s}$	22.22 ft/s
Chest Compression	$2.5 \text{ in.} \leq \text{compression} \leq 2.86 \text{ in.}$	2.55 in.
Peak resistance force**	$1160 \text{ lb} \leq \text{peak force} \leq 1325 \text{ lb}$	1244 lb
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.

Maxime Chamberland
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403

Test I.D: D144424

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	40	Pass
Probe Velocity	m/s	6.58 to 6.82	6.77	Pass
Peak Probe Force	N	5159 to 5893	5,534	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.48	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Overall Test Results				Pass

Maxime Chamberland
Laboratory Technician

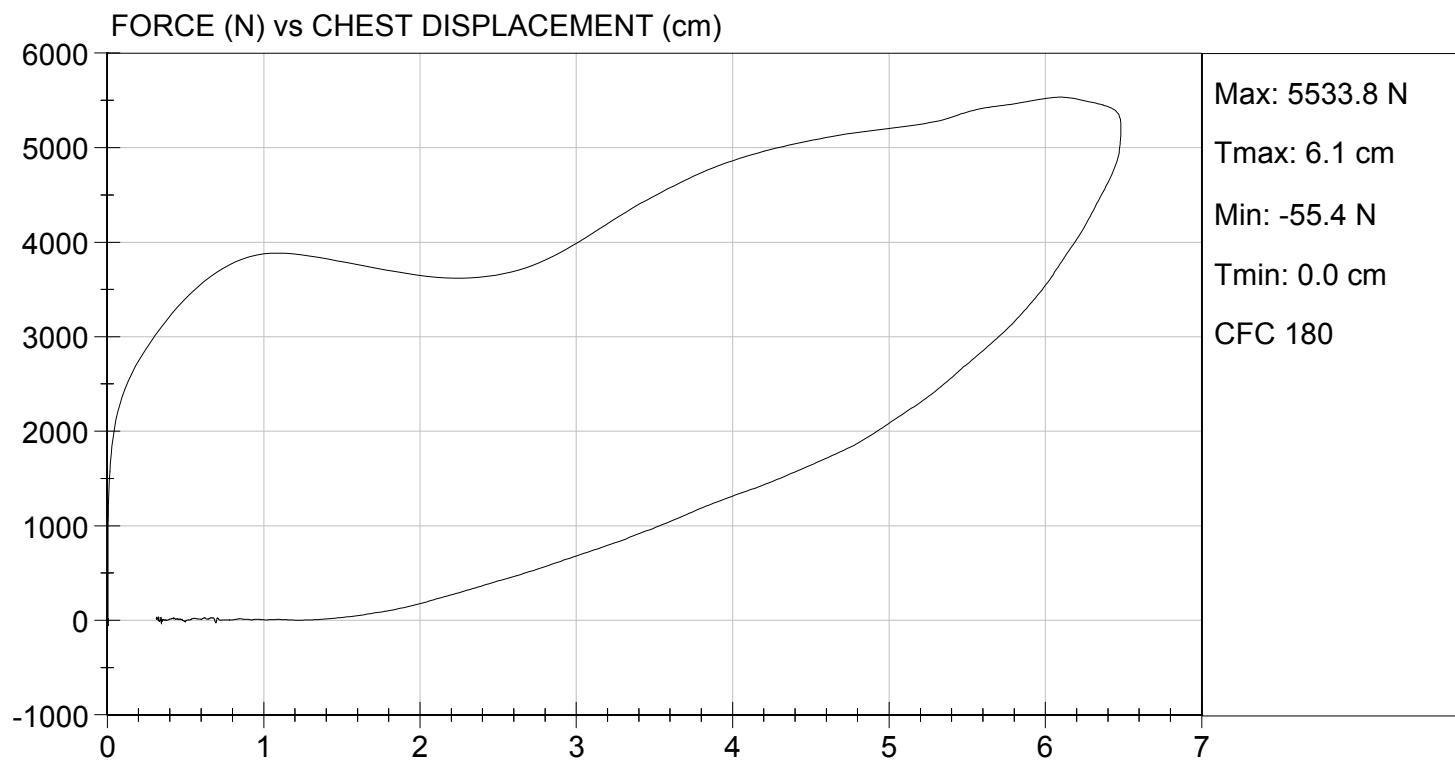
12/16/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 12/16/2014
TEST #: D144424



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

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-001) with the upper leg assembly (78051-46) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>42%</u> |
| Record the minimum humidity: | <u>38%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	6.94 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1236 lb

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

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

Maxime Chamberland
Signature

12/15/2014
Date

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

ATD Serial No: 403

Test I.D: D144426

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,497	Pass
Overall Test Results				Pass

Maxime Chamberland
Laboratory Technician

12/15/2014

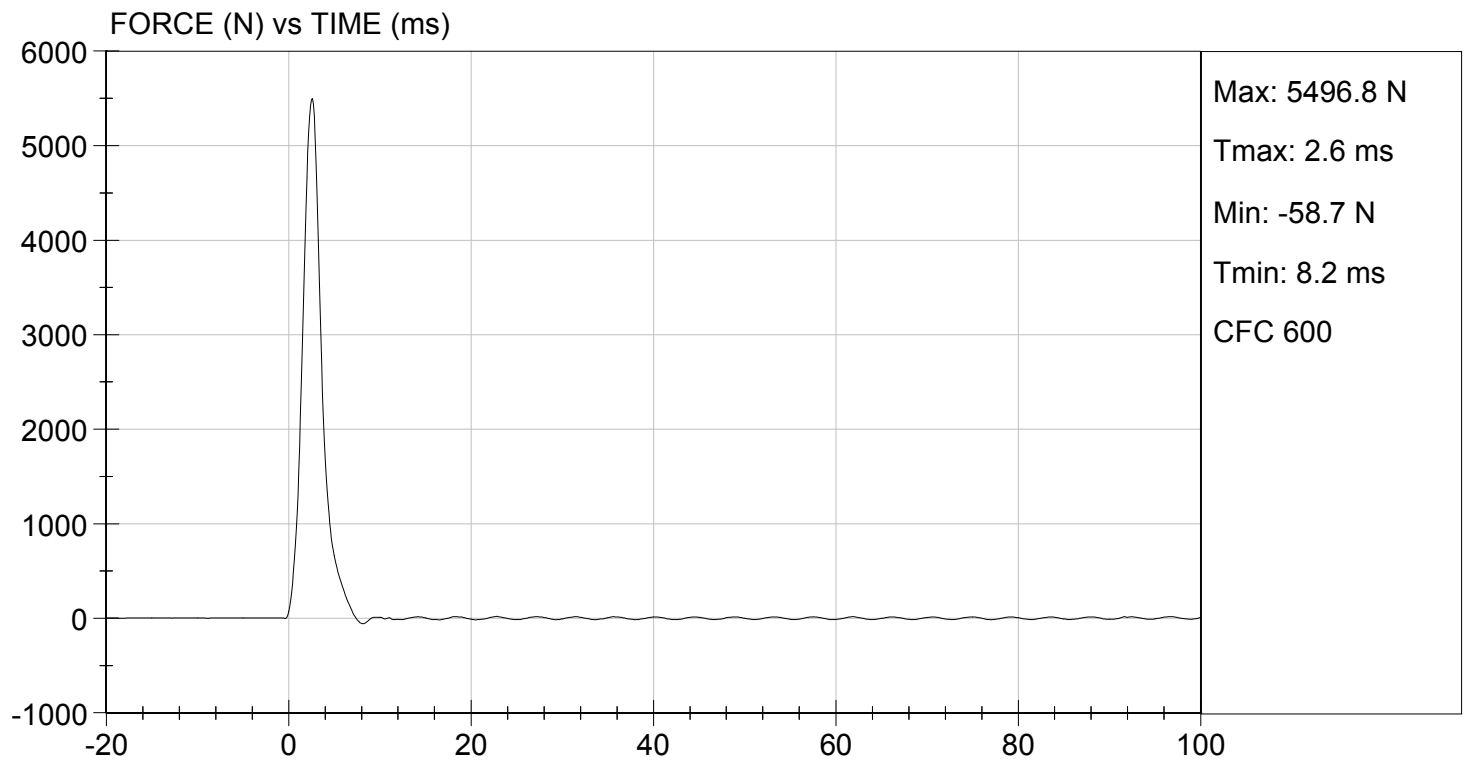
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 12/15/2014
TEST #: D144426



DATA SHEET A8
RIGHT KNEE IMPACT TEST (572.35) (50th Male)

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.36(m))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14A.
- X 3. The leg assembly (86-5001-002) with the upper leg assembly (78051-47) removed, and the load cell simulator (78051-319) is used. (572.35(b)(2))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(b)(2)(ii))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>42%</u> |
| Record the minimum humidity: | <u>38%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.35(b)(2)(iii)) (Figure 14A)
- X 6. No parts of the foot or tibia contact any exterior surface. (572.35(b)(2)(iii))
- X 7. Align the test probe so that at contact the longitudinal centerline of the probe is collinear within 2 degrees with the longitudinal centerline of the femur load cell simulator except it is within 0.5 degrees horizontally. (572.35(b)(2)(iv)&(vi))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.35(b)(2)(v))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 6.8 ft/s and 7.0 ft/s. (572.35(b))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$6.8 \text{ ft/s} \leq \text{speed} \leq 7.0 \text{ ft/s}$	6.97 ft/s
Peak resistance force*	$1060 \text{ lb} \leq \text{force} \leq 1300 \text{ lb}$	1069 lb

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

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

Maxime Chamberland

Signature

12/15/2014

Date

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

ATD Serial No: 403

Test I.D: D144425

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,754	Pass
Overall Test Results				Pass

Maxime Chamberland
Laboratory Technician

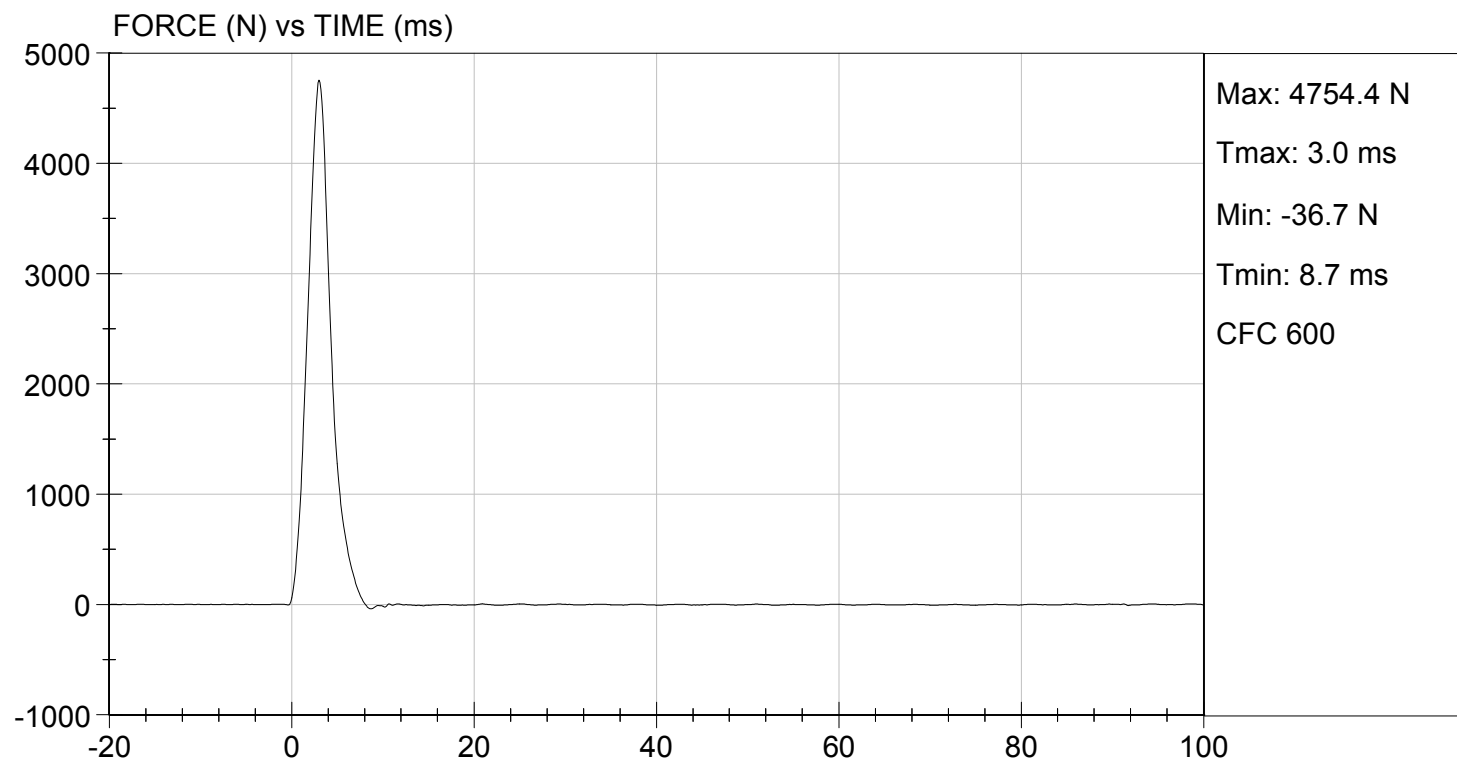
12/15/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 12/15/2014
TEST #: D144425



DATA SHEET A9
HIP JOINT-FEMUR FLEXION (572.35(c)) (50th Male)

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: David Schoedel

- Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last hip joint-femur flexion test. (572.36(m))
 X N/A, ONLY one hip joint-femur flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 17A.
- X 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):
- X 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)
- X 3.2 remove the abdominal insert (78051-52)
- X 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).
- X 4. The assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.35(c)(v))
- | | |
|---------------------------------|--------|
| Record the maximum temperature: | 21.9°C |
| Record the minimum temperature: | 21.3°C |
| Record the maximum humidity: | 42% |
| Record the minimum humidity: | 38% |
- X 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))
- X 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))
- X 7. Adjust the threaded rods until plane B is horizontal.
- X 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

- X 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.1°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	61.0 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	40.4°

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

- X 12. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

- X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	$5^{\circ}/s \leq \text{rotation rate} \leq 10^{\circ}/s$	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	56.1 ft-lbf
Rotation at 150 lbf-ft	$40^{\circ} \leq \text{rotation} \leq 50^{\circ}$	44.5°

David Schoedel

Signature

12/15/2014

Date

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

ATD Serial No: 403

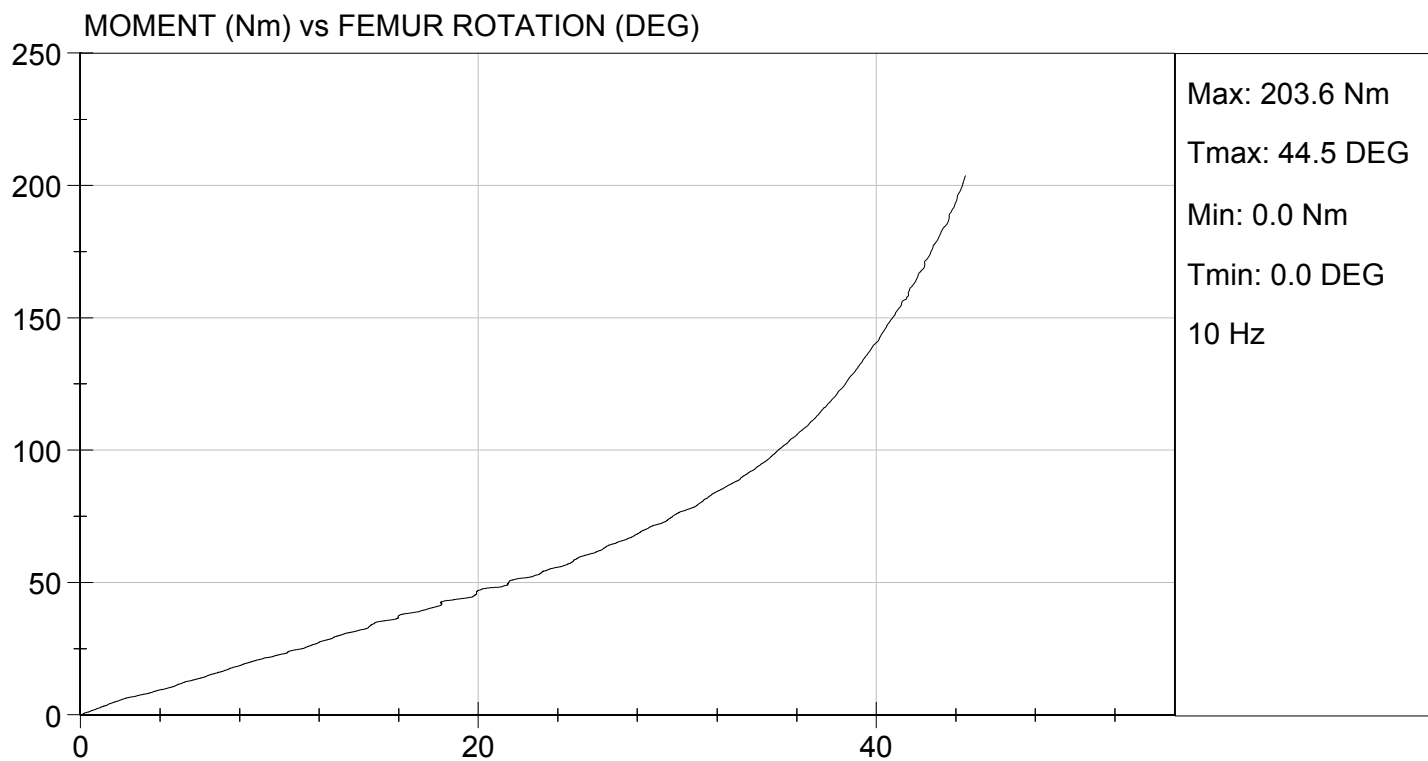
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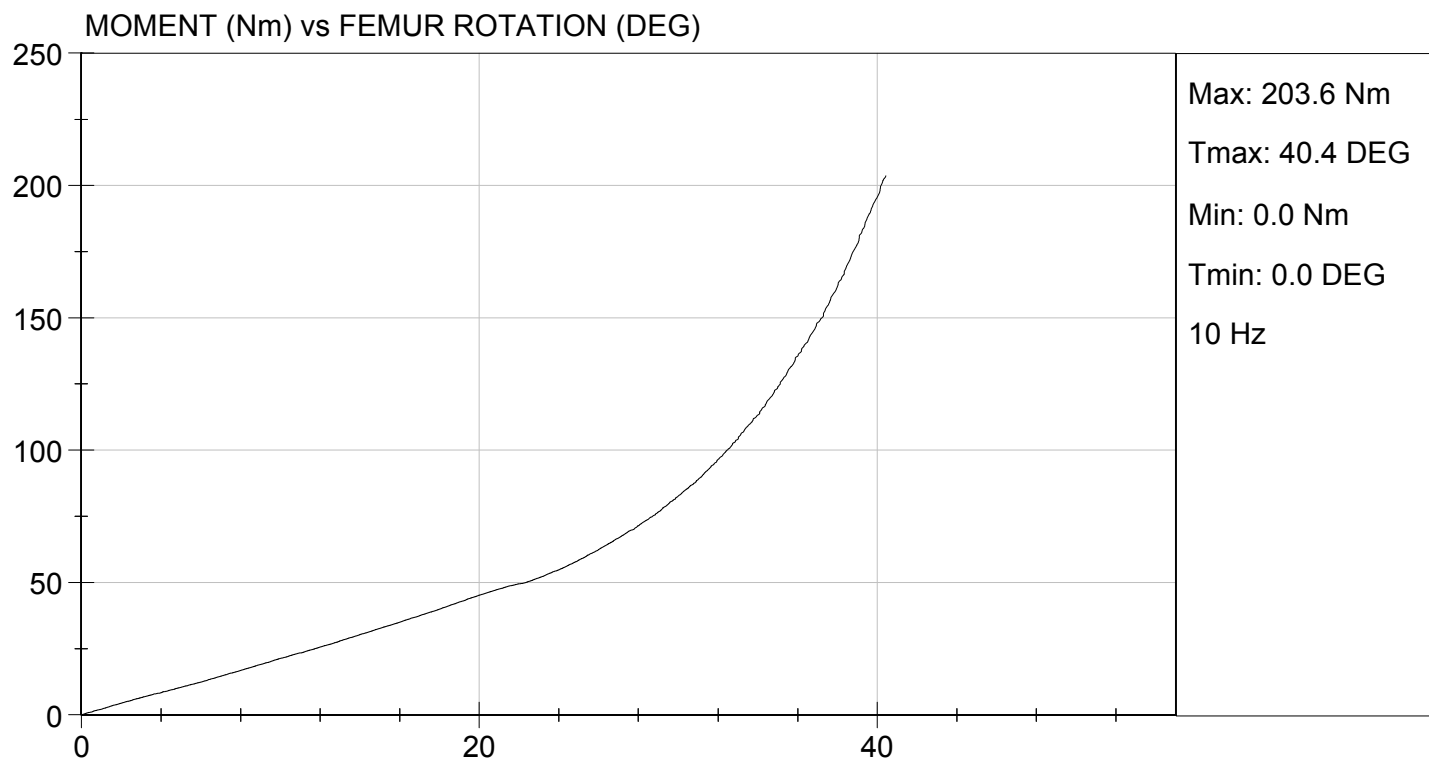
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.7	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	40	40	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.1	Pass
30 Degrees	Nm	94.9 Nm Max	76.1	82.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	44.5	40.4	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

12/15/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH74	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	C10686	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	C13046	12/01/2014	06/01/2015
NECK TRANSDUCER	Denton	1716	1865	08/04/2014	02/04/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH70	12/01/2014	06/01/2015
(2) LATERAL	Endevco	7231C-750	AH5E5	12/01/2014	06/01/2015
(3) VERTICAL	Endevco	7231C-750	C10591	12/01/2014	06/01/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	403	12/02/2014	06/02/2014
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8804	12/01/2014	06/01/2015
(2) LEFT FEMUR	Denton	2121	8805	12/01/2014	06/01/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 403

Test Date: 12/15/2014

Technician: Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damage	OK
Outer skin	Gashes, rips, cracks			X
Head	Ballast secure			X
	General appearance			X
Neck	Broken or cracked rubber			X
	Upper neck bracket firmly attached to the lower neck bracket			X
	Looseness at the condyle joint			X
	Nodding blocks cracked or out of position			X
Spine	Broken or cracks in rubber			X
Ribs	Broken or bent ribs			X
	Broken or bent rib supports			X
	Damping material separated or cracked			X
	Rubber bumpers in place			X
Chest Displacement Assembly	Bent shaft			X
	Slider arm riding in track			X
Transducer leads	Torn cables			X
Accelerometer Mountings	Head mounting secure			X
	Chest mounting secure			X
Knees	Skin condition			X
	Insert (do not remove)			X
	Casting			X
Limbs	Normal movement and adjustment			X
Knee Sliders	Wires intact			X
	Rubber returned to "at rest" position			X
Pelvis	Broken			X
Other				X

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

Repair or Replacement approved by:

Jessica Hall
Signature

12/16/2014
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard
Signature

12/16/2014
Date

EXTERNAL DIMENSIONS

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

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

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

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: David Schoedel

- ☒ Pre test calibration
☐ Post test calibration verification

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

- ☒ 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- ☒ 3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- ☒ 4. Accelerometers and their respective mounts are smooth and clean.
- ☒ 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- ☒ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- ☒ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity: | <u>44%</u> |
| Record the minimum humidity: | <u>36%</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

- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
- X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))
Record the actual distance: 376 mm
- NOTE:** The masses of the suspension device and the accelerometer cables are to be kept as lightweight as possible to minimize their effect on the test results.
- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))
Record the right side distance: 501 mm
Record the left side distance: 501 mm
- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.132(c)(4))
Record actual micro finish: 40.9 micro inches
- X 13. The impact surface is rigidly supported. (572.132(c)(4))
- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))
Record thickness: 50.9 mm
Record width: 604 mm
Record length: 595 mm
- X 15. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.132(b) & (572.132(c)(4))
- X 16. Complete the following table using channel class 1000 data. (572.132(b)):

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	269 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	1.7 g

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

David Schoedel
Signature

10/28/2014
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test ID: D143781

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Peak Resultant Acceleration	G's	250 to 300	269	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	1.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel

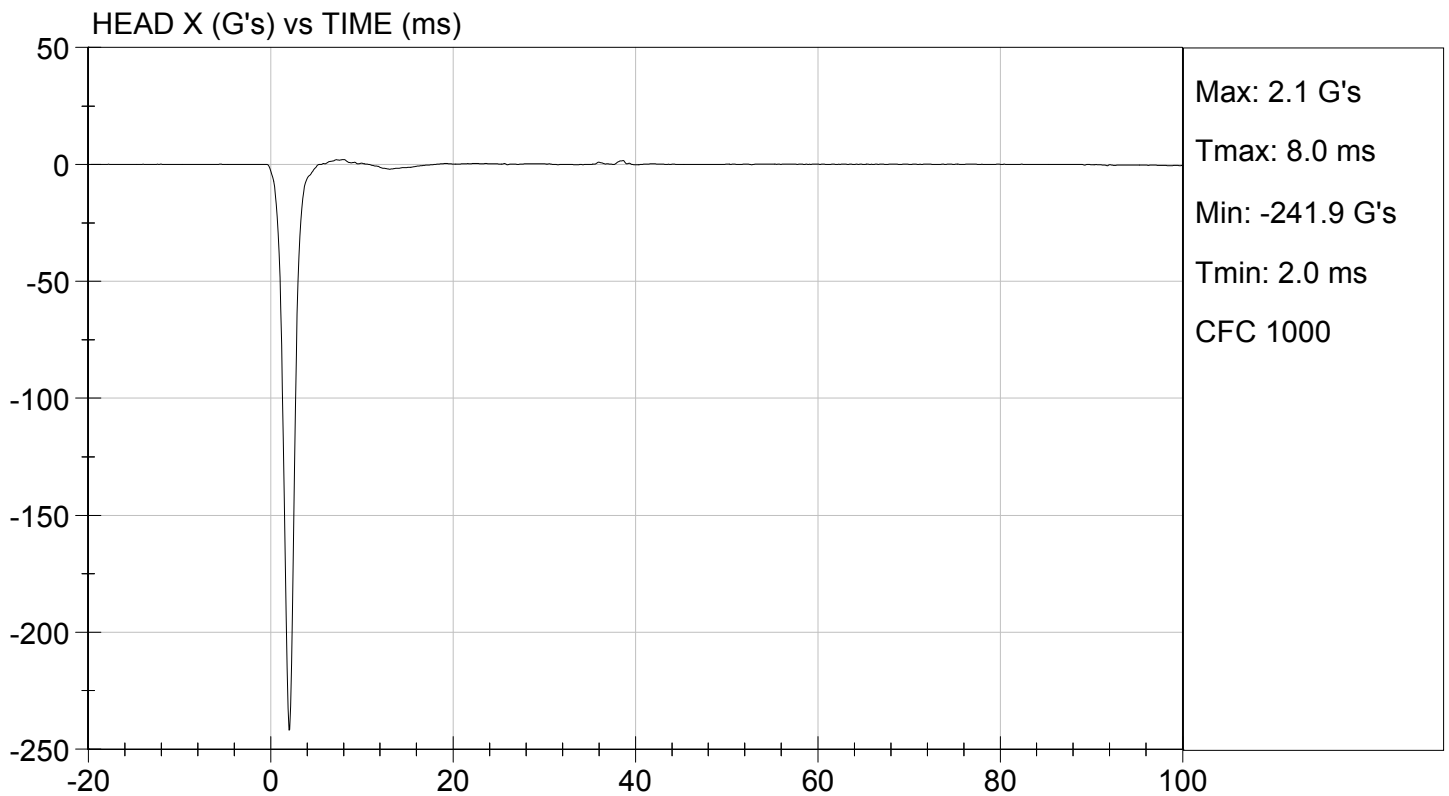
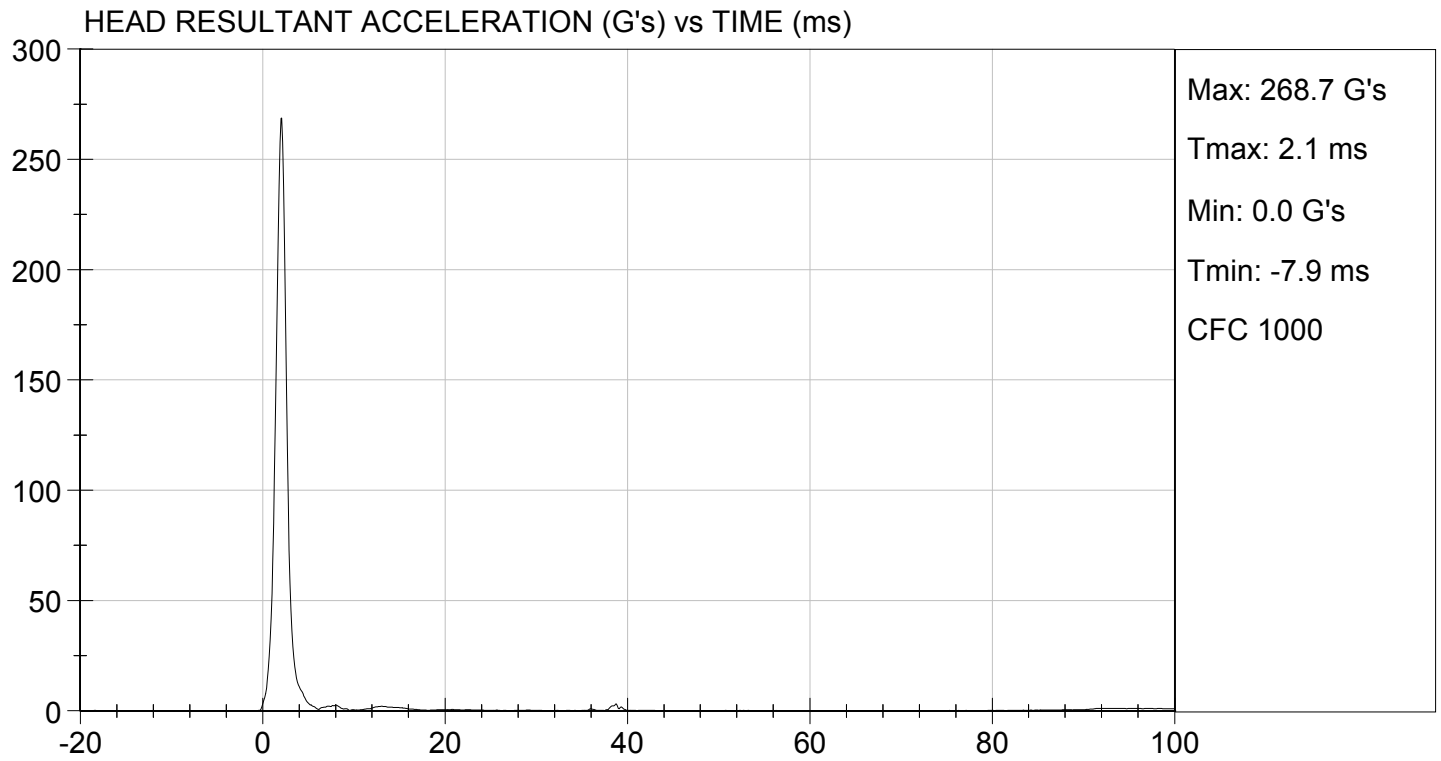
Laboratory Technician

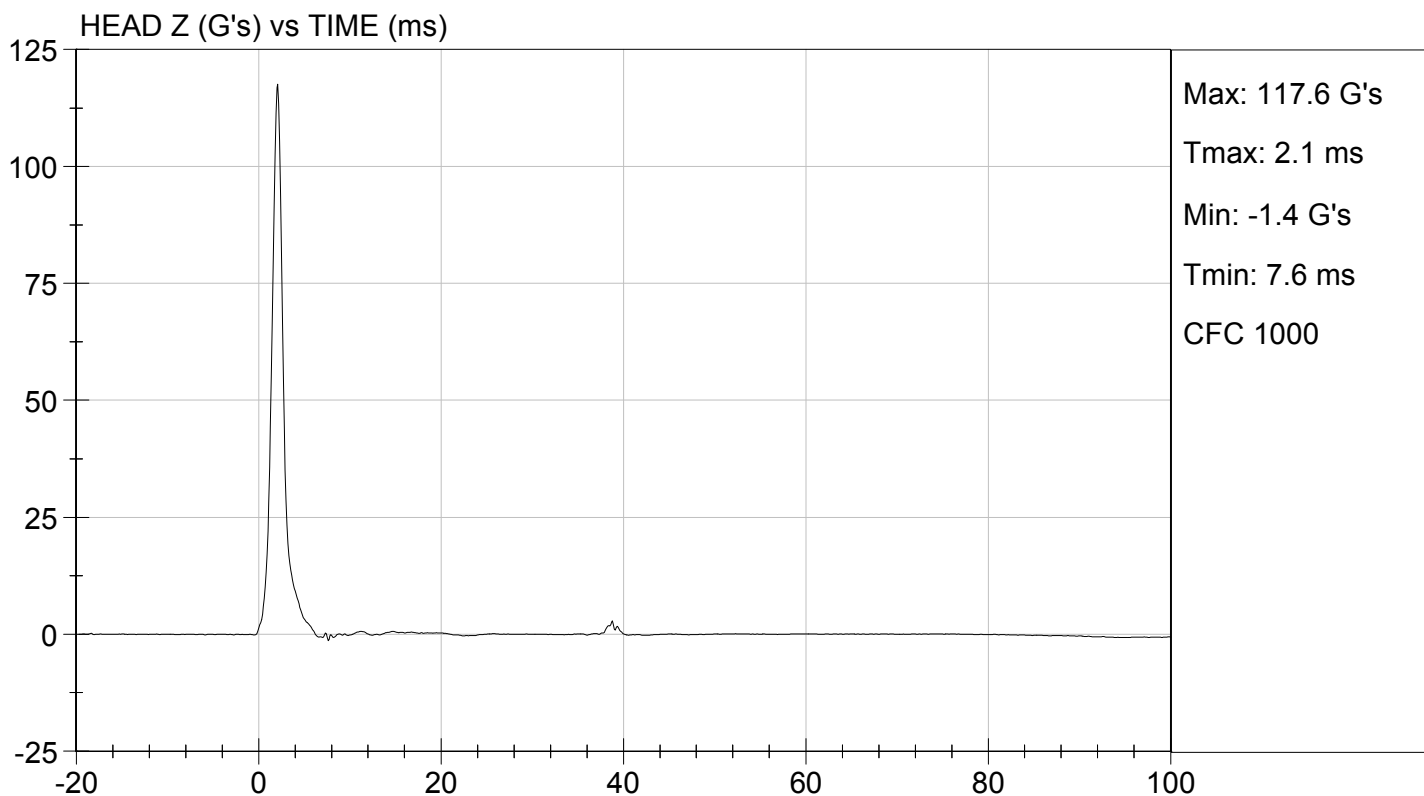
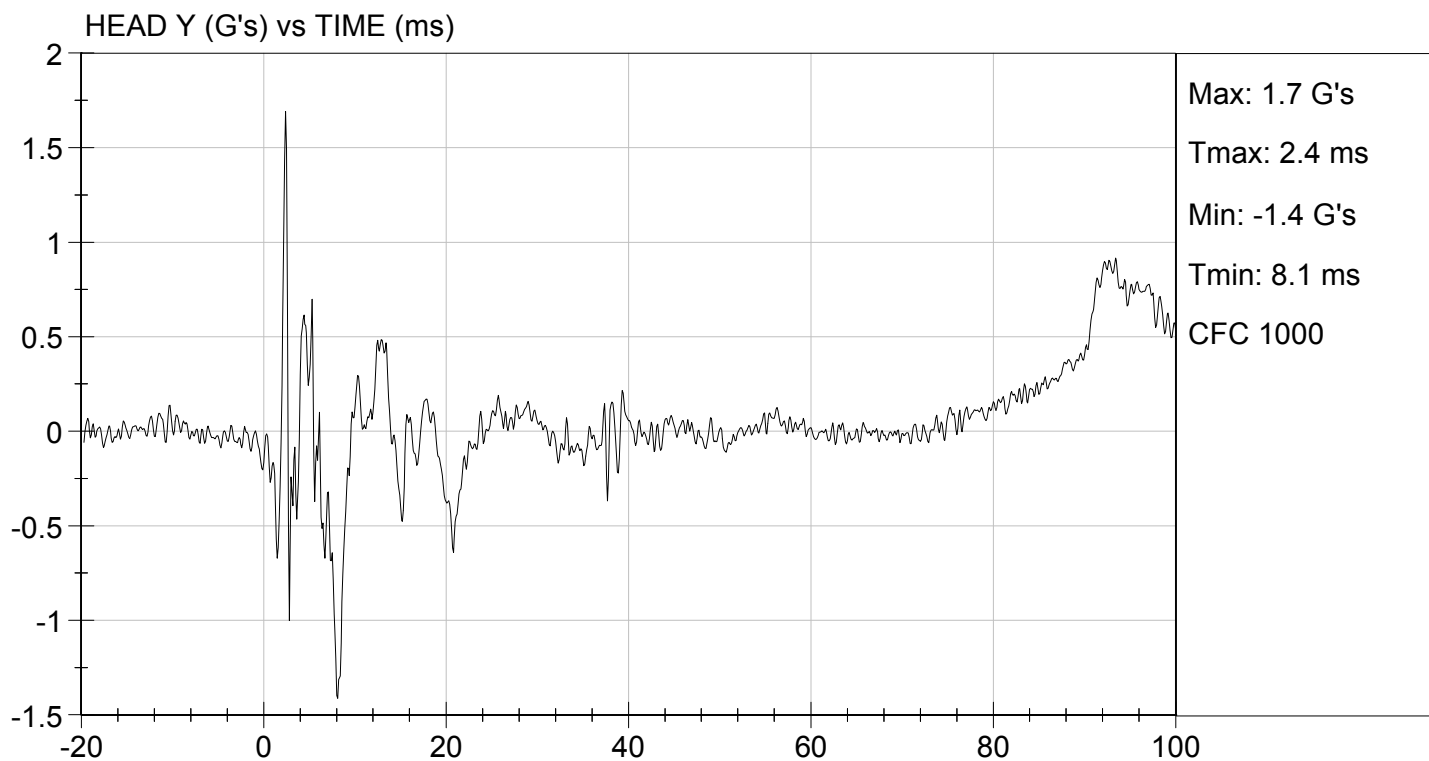
10/28/2014

Test Date

Jeff Leonard

Approved By





DATA SHEET B4
NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: Maxime Chamberland

X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last flexion test. (572.137(q))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity: | <u>44%</u> |
| Record the minimum humidity: | <u>36%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

Parameter		Specification	Results
Pendulum impact speed		$6.89 \text{ m/s} \leq \text{speed} \leq 7.13 \text{ m/s}$	6.96 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$2.1 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$	2.4 m/s
	@ 20 ms	$4.0 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.3 m/s
	@ 30 ms	$5.8 \text{ m/s} \leq \Delta V \leq 7.0 \text{ m/s}$	5.9 m/s
Plane D Rotation		Peak moment* $69 \text{ Nm} \leq \text{moment} \leq 83 \text{ Nm}$ during the following rotation range $77^\circ \leq \text{angle} \leq 91^\circ$	71 Nm @ 80 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.

Maxime Chamberland

Signature

10/28/2014

Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D143782

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.96	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	5.9	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass

Maxime Chamberland

Laboratory Technician

10/28/2014

Test Date

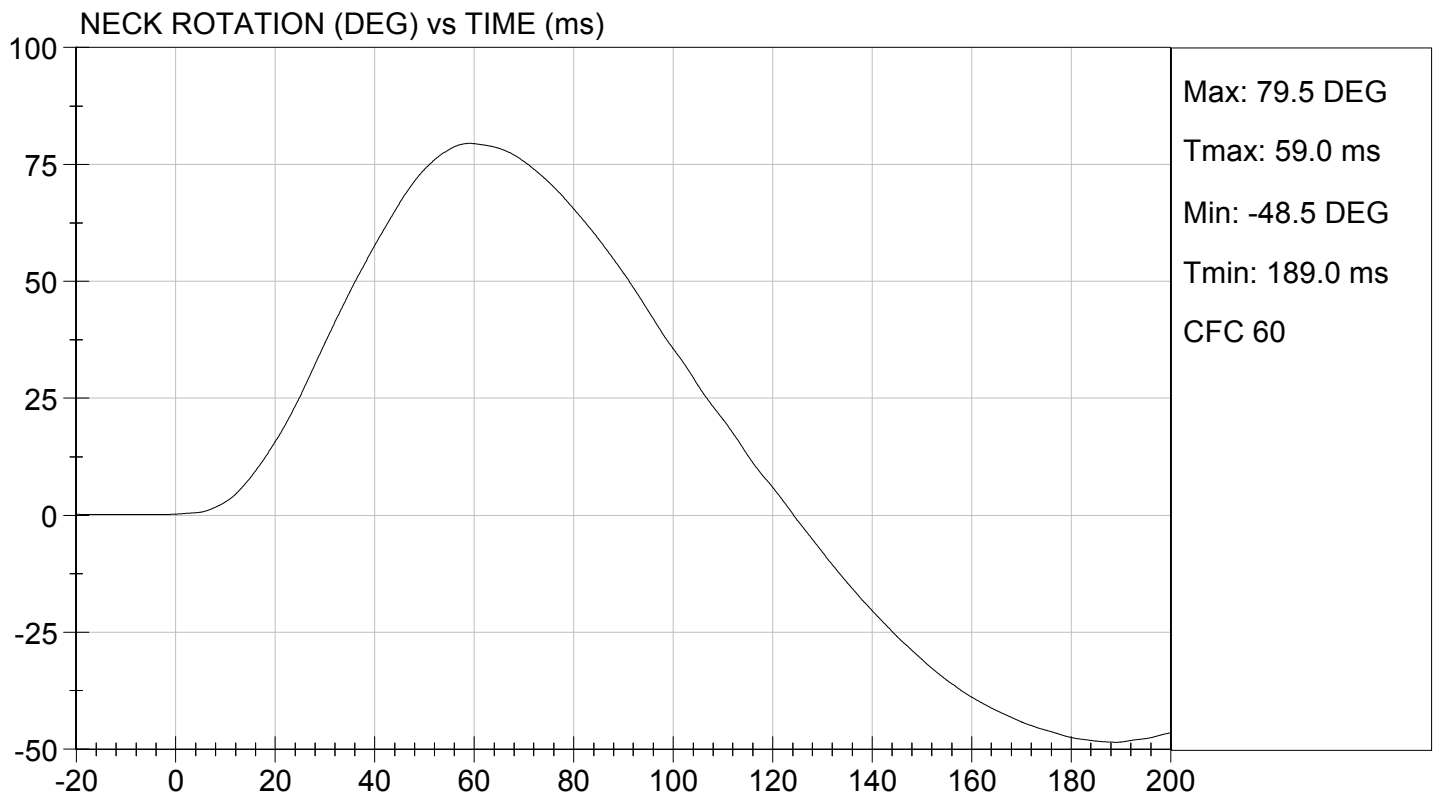
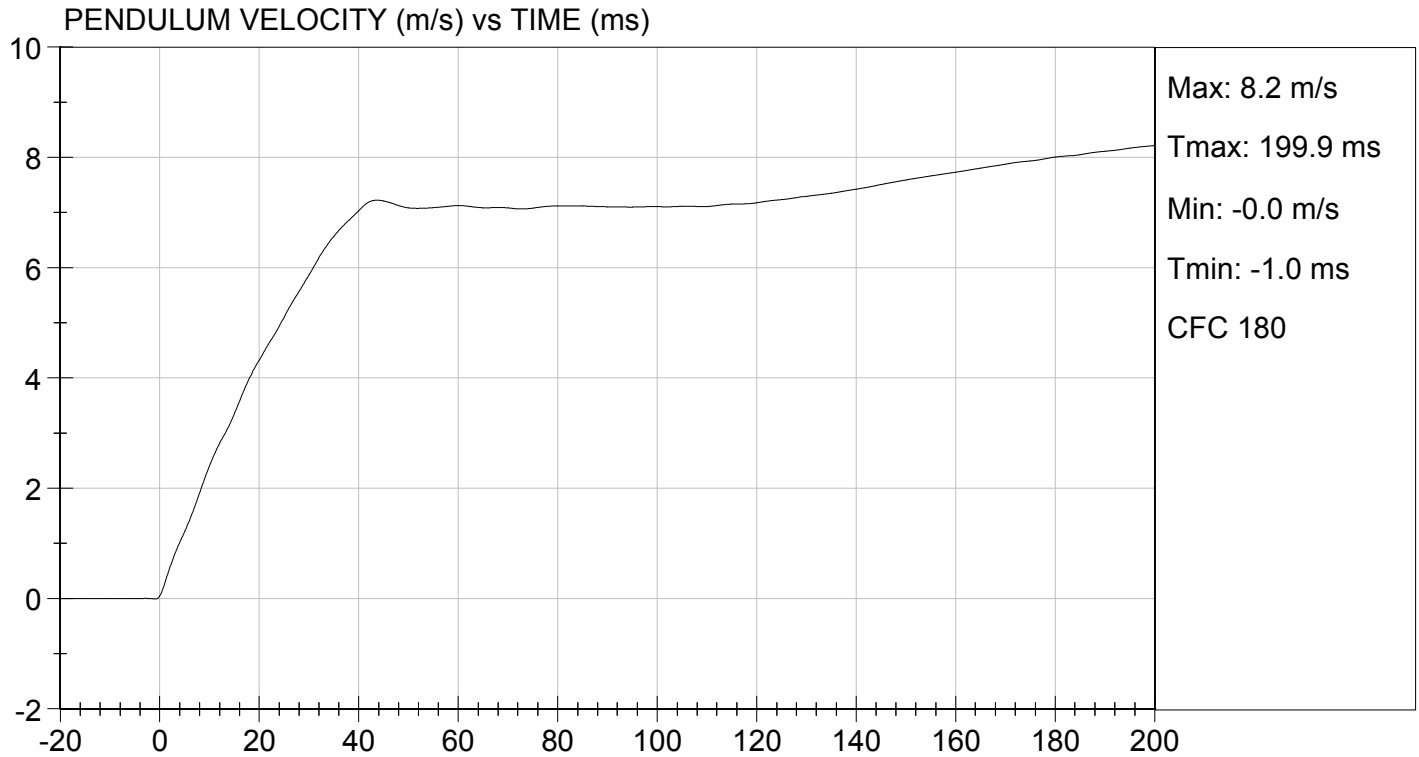
Jeff Levanowski

Approved By



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

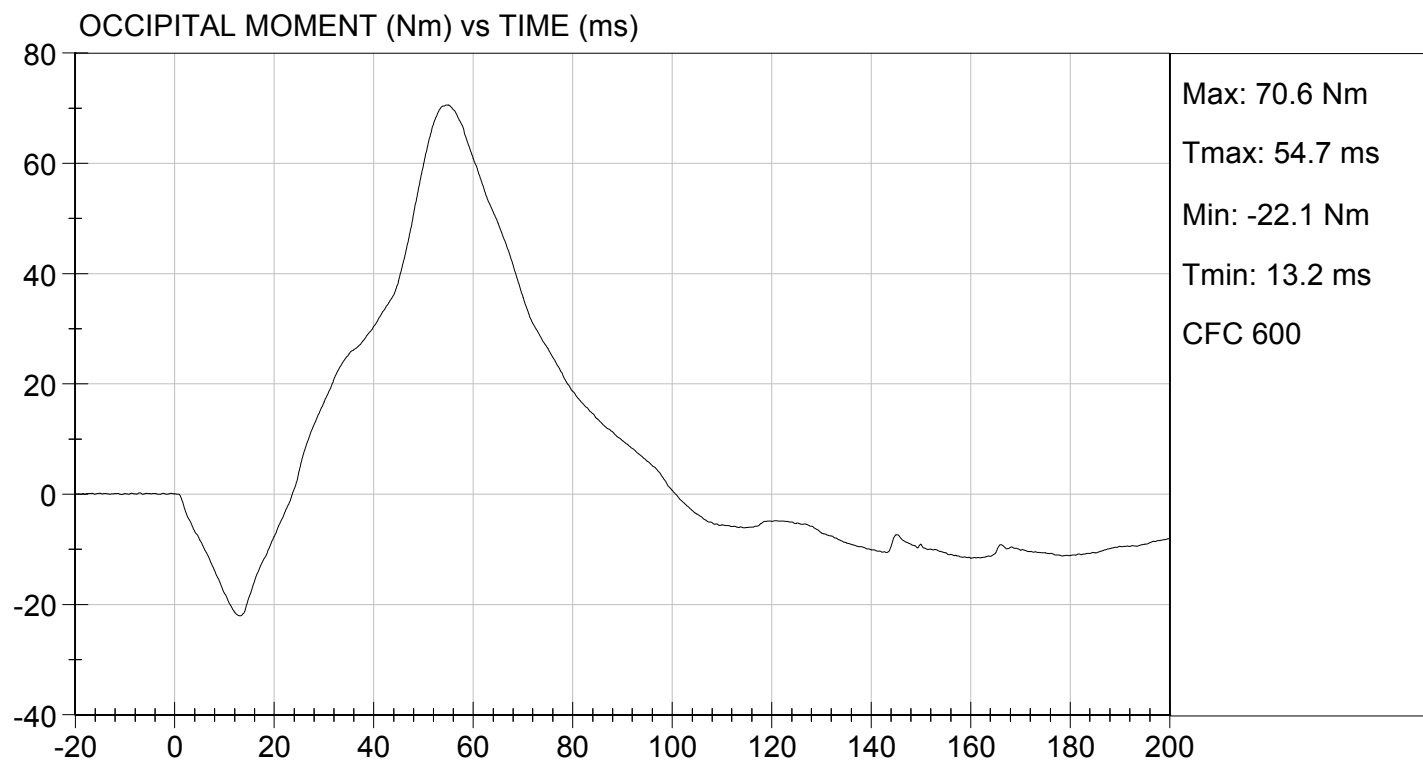
TEST DATE: 10/28/2014
TEST #: D143782





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

TEST DATE: 10/28/2014
TEST #: D143782



DATA SHEET B5
NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: Maxime Chamberland

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last extension test. (572.137(q))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity: | <u>44%</u> |
| Record the minimum humidity: | <u>36%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.8 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.6 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.0 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-56 Nm @ 102 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	100 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

Maxime Chamberland
Signature

10/28/2014
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

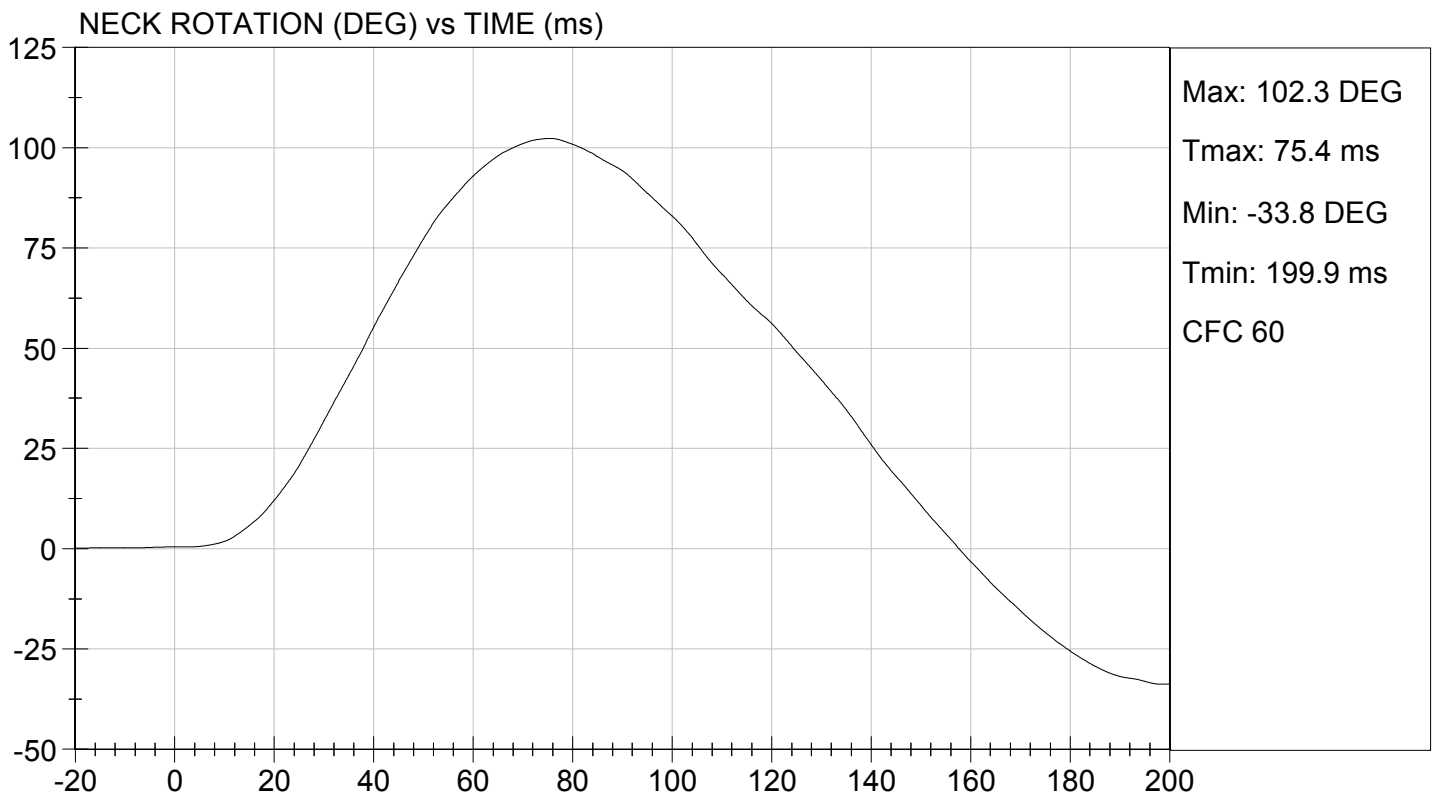
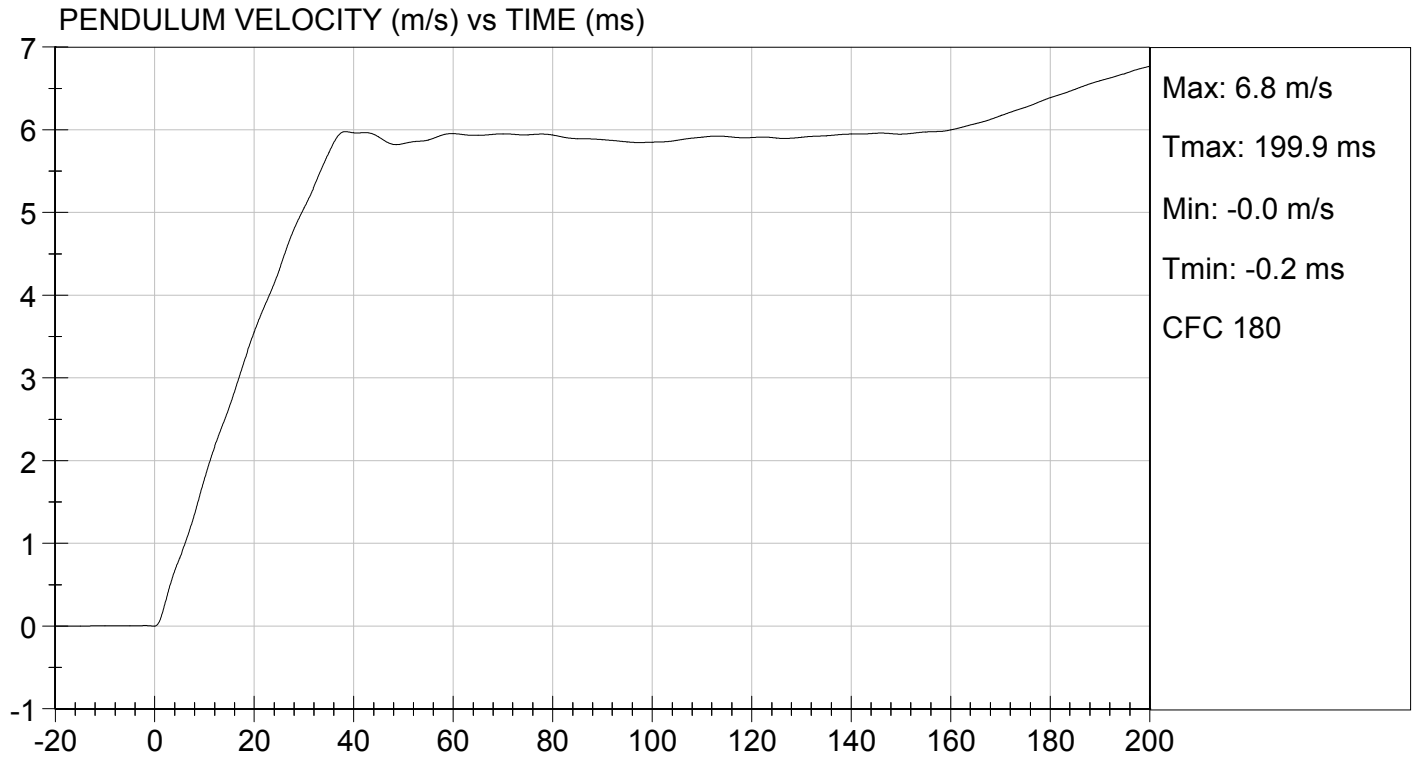
Test I.D: D143783

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	38	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.0	Pass
D Plane Rotation	Max	deg	99 to 114	102	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	100	Pass
Overall Results					Pass

Maxime Chamberland
Laboratory Technician

10/28/2014
Test Date

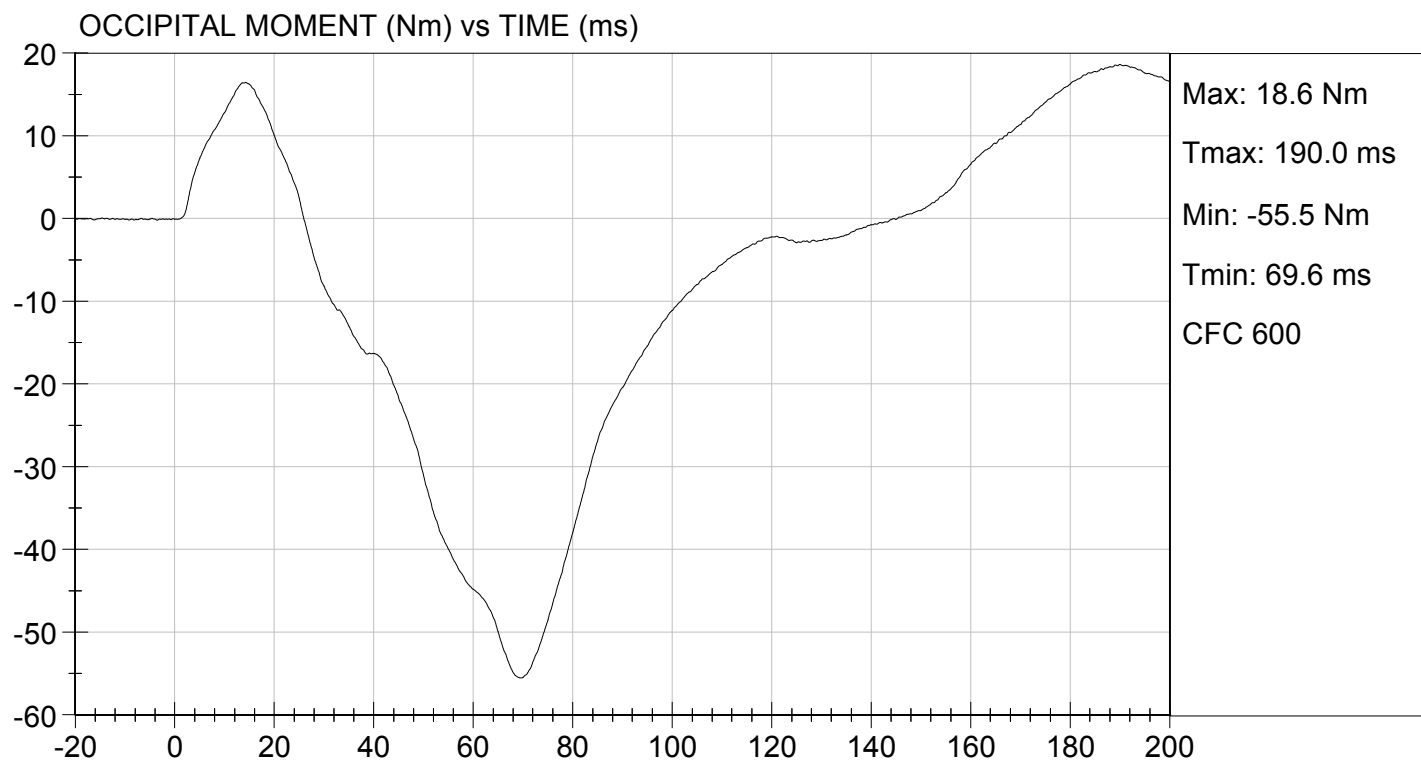
Jeff Leonard
Approved By





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

TEST DATE: 10/28/2014
TEST #: D143783



DATA SHEET B6
THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: Jack Coleman

- ☒ Pre test calibration
☐ Post test calibration verification

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

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

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.0°C</u>
Record the maximum humidity:	<u>44%</u>
Record the minimum humidity:	<u>36%</u>

- ☒ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
- ☒ - No Damage
- ☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage
- ☐ - The following repairs or replacement was performed. Record:

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X 7. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ and adjust the pelvis angle to $7^\circ \pm 2^\circ$. The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 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	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.77 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	51 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4013 N
Peak Force** between 18.0 and 50.0 mm chest compression	$\text{Peak Force} \leq 4600 \text{ N}$	4029 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.

Jack Coleman
Signature

10/28/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

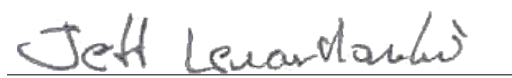
Test I.D: D143784

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	36	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4013	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4029	Pass
Overall Test Results				Pass


Laboratory Technician

10/28/2014

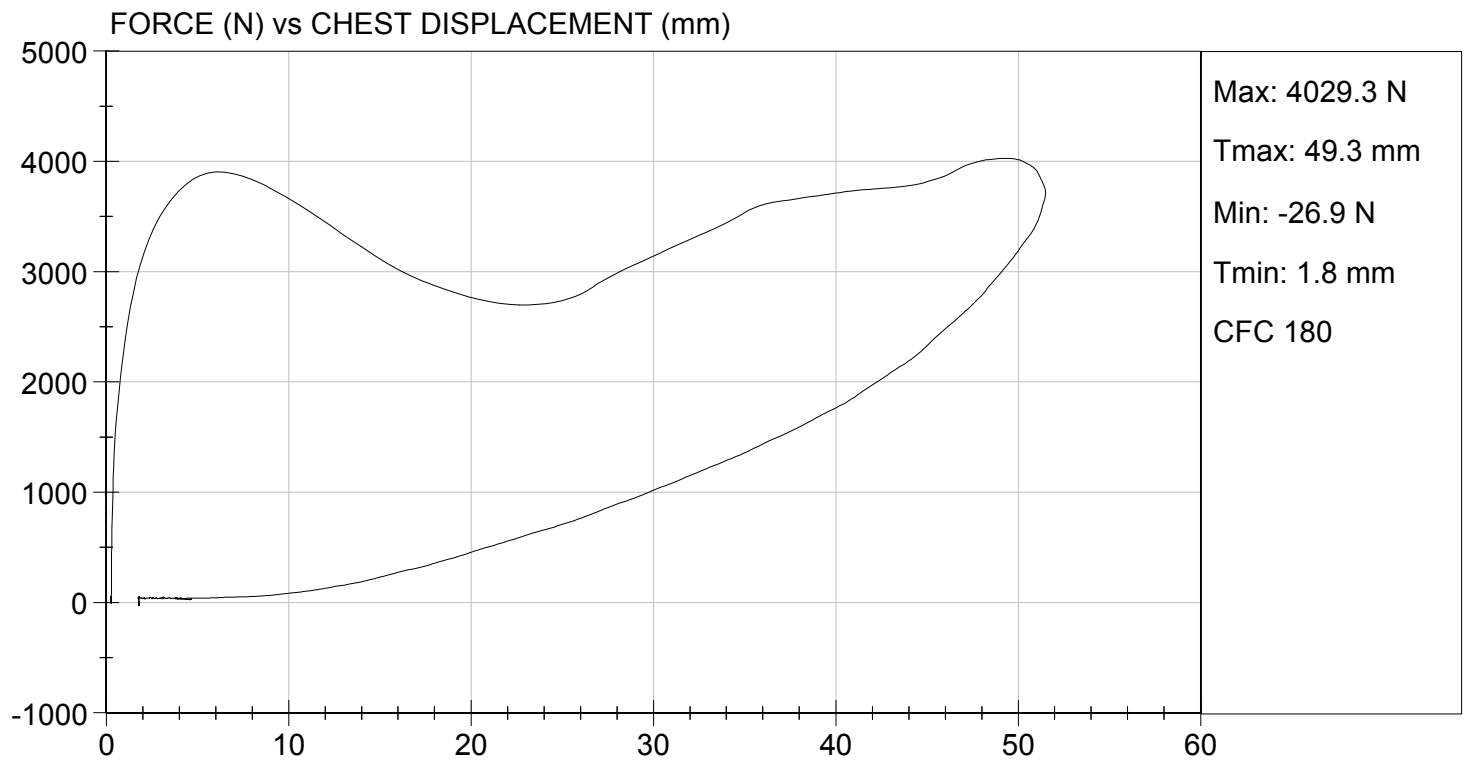
Test Date


Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 10/28/2014
TEST #: D143784



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

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))
 X N/A, ONLY one torso flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 13B.
- X 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).
 With legs below femurs.
 X Without legs below femurs.
- X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity: | <u>44%</u> |
| Record the minimum humidity: | <u>36%</u> |
- X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- X 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- X 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))
 Record reference plane angle (max. allowed 20°): See Result Table
- X 12. Attach the pull cable and the load cell. (572.135(c)(8))
- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X 14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X 17. Complete the following table:
 Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	20 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.9 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	353 N
Final ref. plane angle	Initial ref. plane angle ± 8°	24 deg

David Schoedel
 Signature

10/28/2014
 Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D143787

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	24	Pass
Force at 45 deg	N	320 to 390	353	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Result				Pass

David Schoedel
Laboratory Technician

10/28/2014

Test Date

Jeff Leonard
Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))
X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.0°C</u>
Record the maximum humidity:	<u>44%</u>
Record the minimum humidity:	<u>36%</u>

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

 X 11. Complete the following table:
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.13 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3755 N

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

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

David Schoedel
Signature

10/28/2014
Date

MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D143786

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3755	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

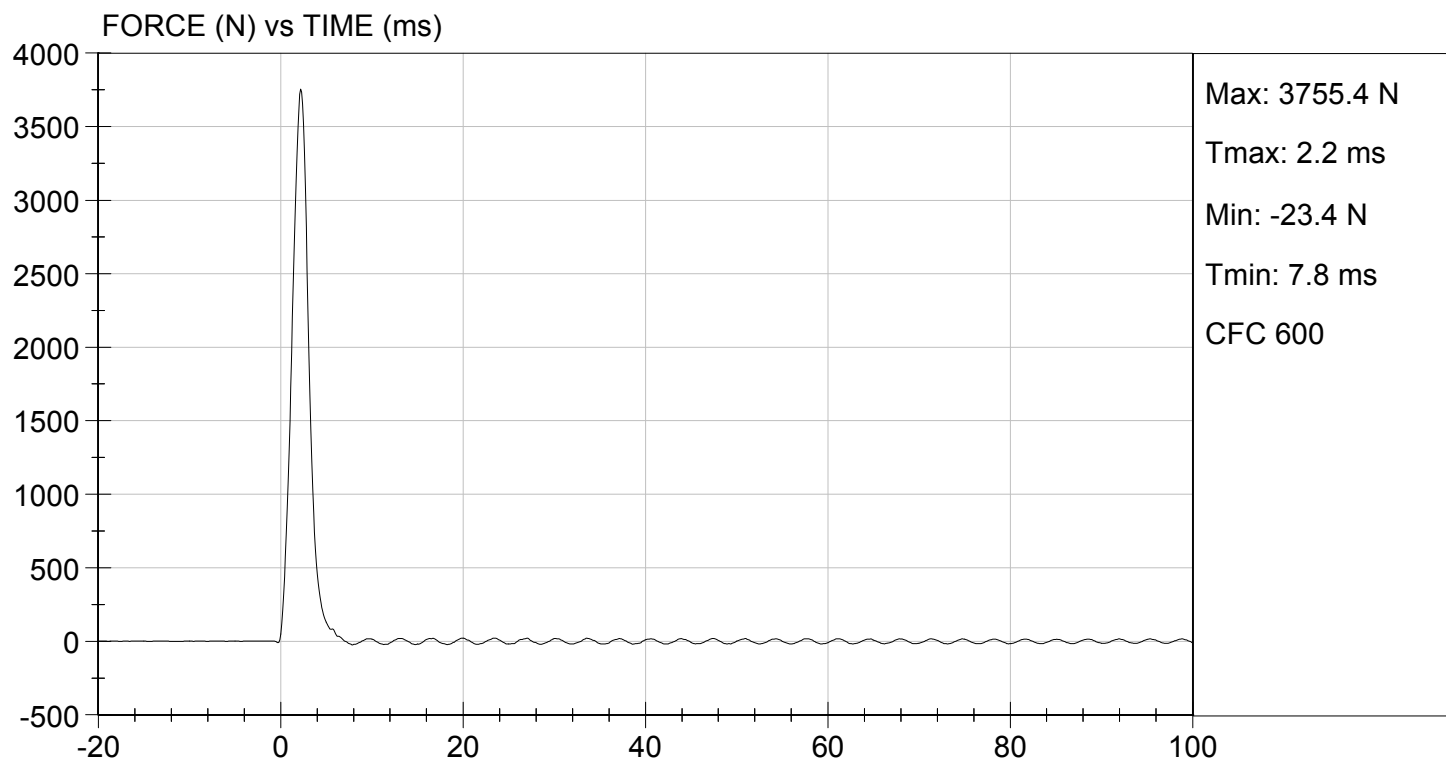
10/28/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: LEFT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 10/28/2014
TEST #: D143786



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

Dummy Serial Number: 510

Test Date: 10/28/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

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

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.0°C</u>
Record the maximum humidity:	<u>44%</u>
Record the minimum humidity:	<u>36%</u>

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

 X 11. Complete the following table:
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3826 N

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

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

David Schoedel
Signature

10/28/2014
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D143785

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3826	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

10/28/2014

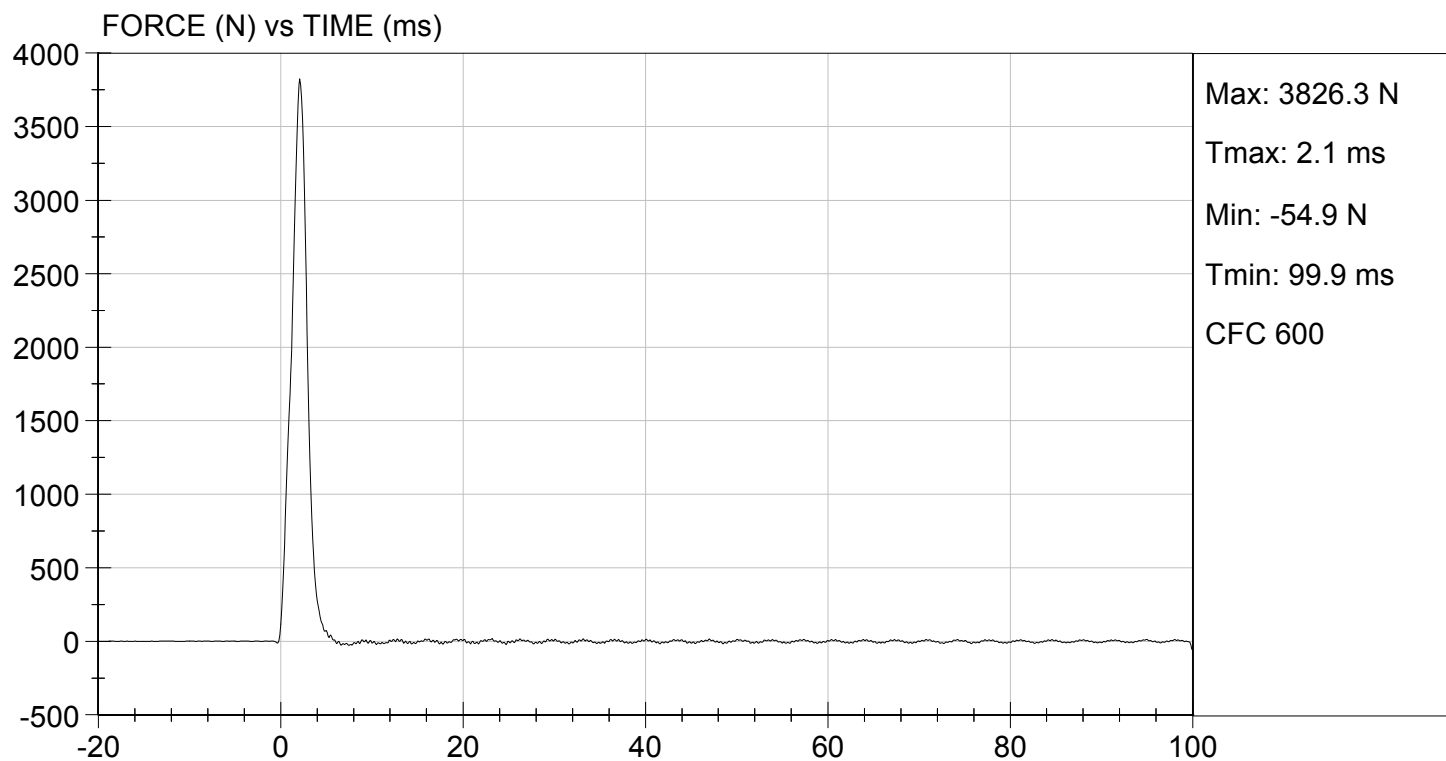
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 10/28/2014
TEST #: D143785



DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82668	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82669	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82670	08/20/2014	02/20/2015
NECK TRANSDUCER	Denton	1716	1159	08/26/2014	02/26/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79418	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79439	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79614	08/20/2014	02/20/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	510	08/20/2014	02/20/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	737	07/11/2014	01/11/2015
(2) LEFT FEMUR	Denton	2121	799	07/11/2014	01/11/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P83176	05/01/2014	11/01/2014
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

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

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: Maxime Chamberland

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.132(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
- X 3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X 4. Accelerometers and their respective mounts are smooth and clean.
- X 5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
- X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity: | <u>16%</u> |
| Record the minimum humidity: | <u>13%</u> |
- X 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

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

X 10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.132(c)(3))
Record the actual distance: 376 mm

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

X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 6B. (572.132(c)(3))
Record the right side distance: 501 mm
Record the left side distance: 501 mm

X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.132(c)(4))
Record actual micro finish: 40.9 micro inches

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

X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))
Record thickness: 50.9 mm
Record width: 604 mm
Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	284 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	7.1 g

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

Maxime Chamberland
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test ID: D144051

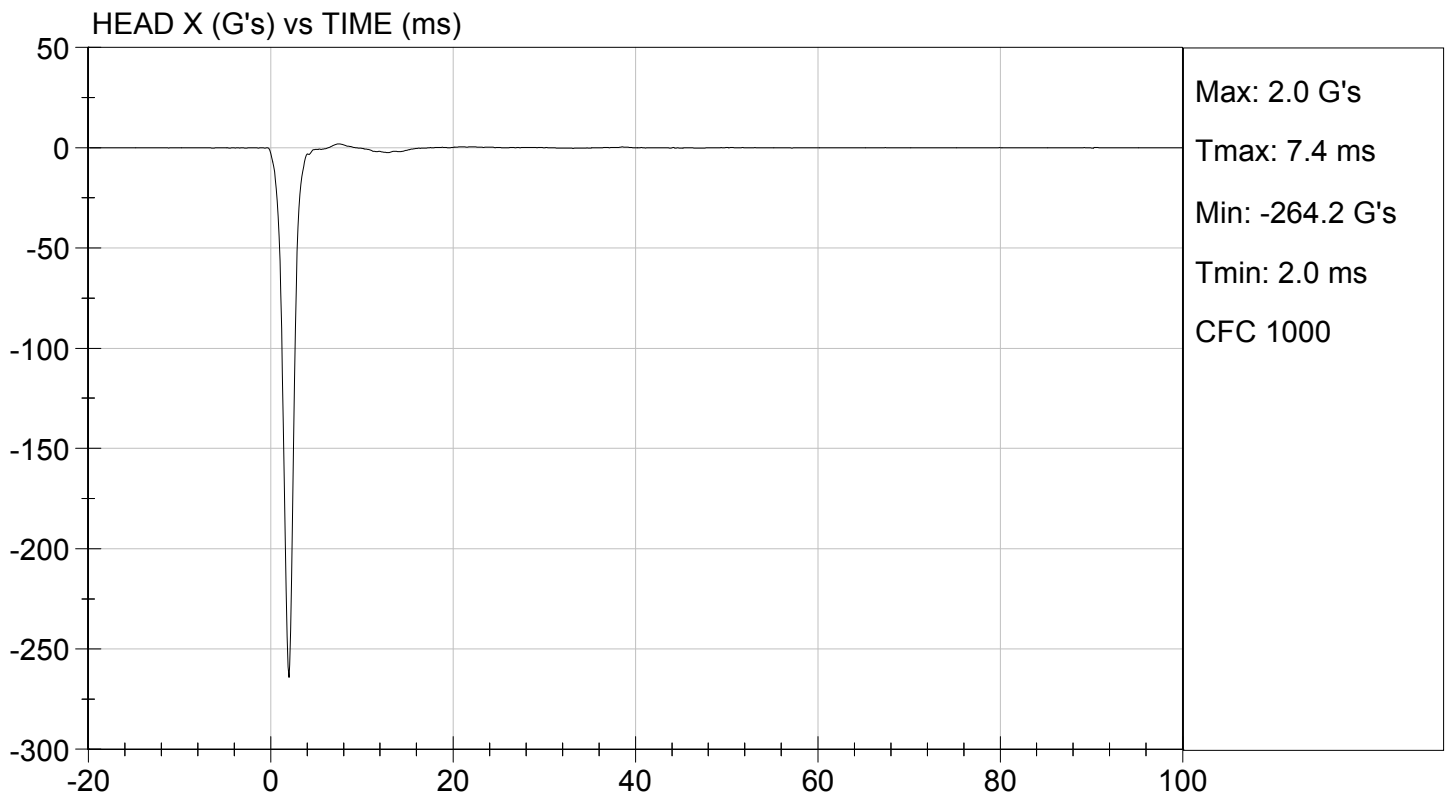
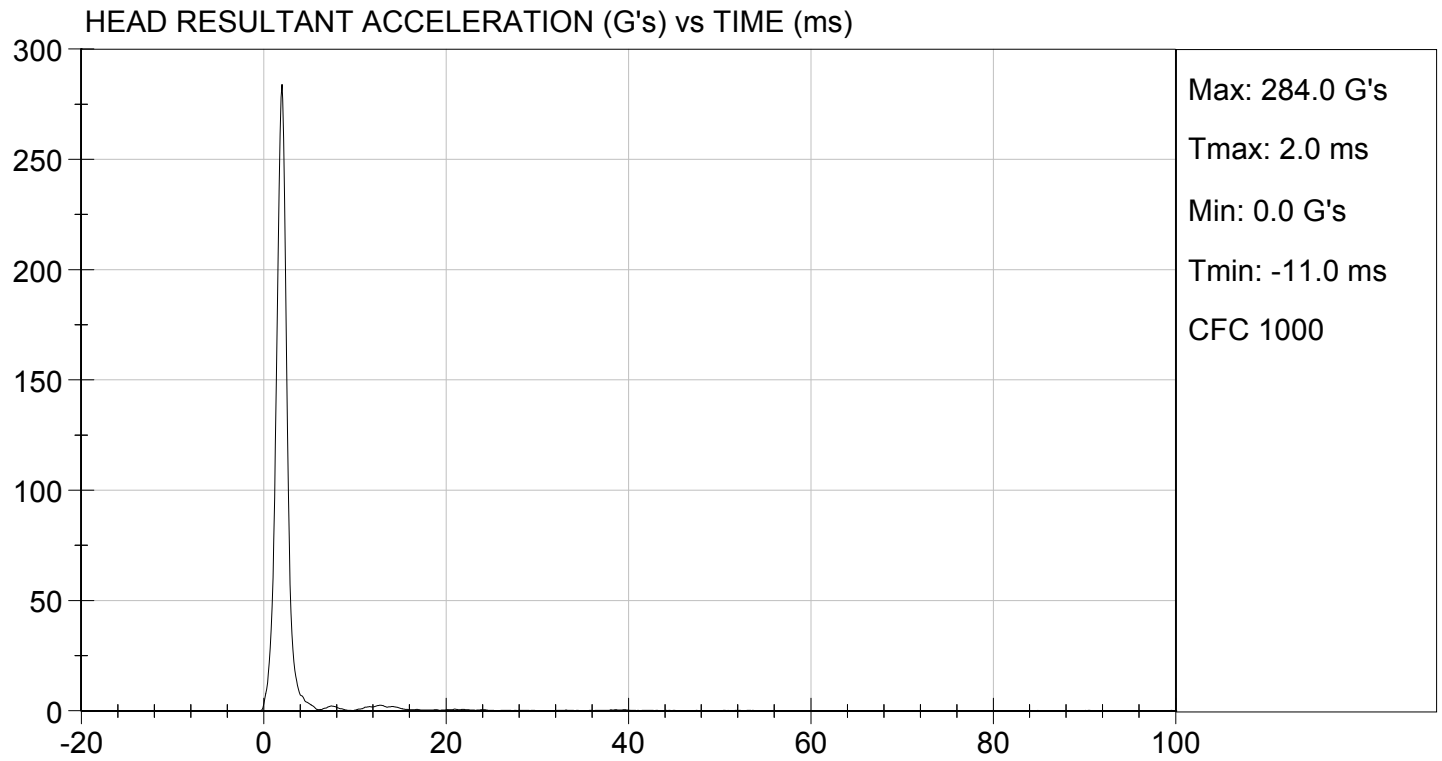
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Peak Resultant Acceleration	G's	250 to 300	284	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

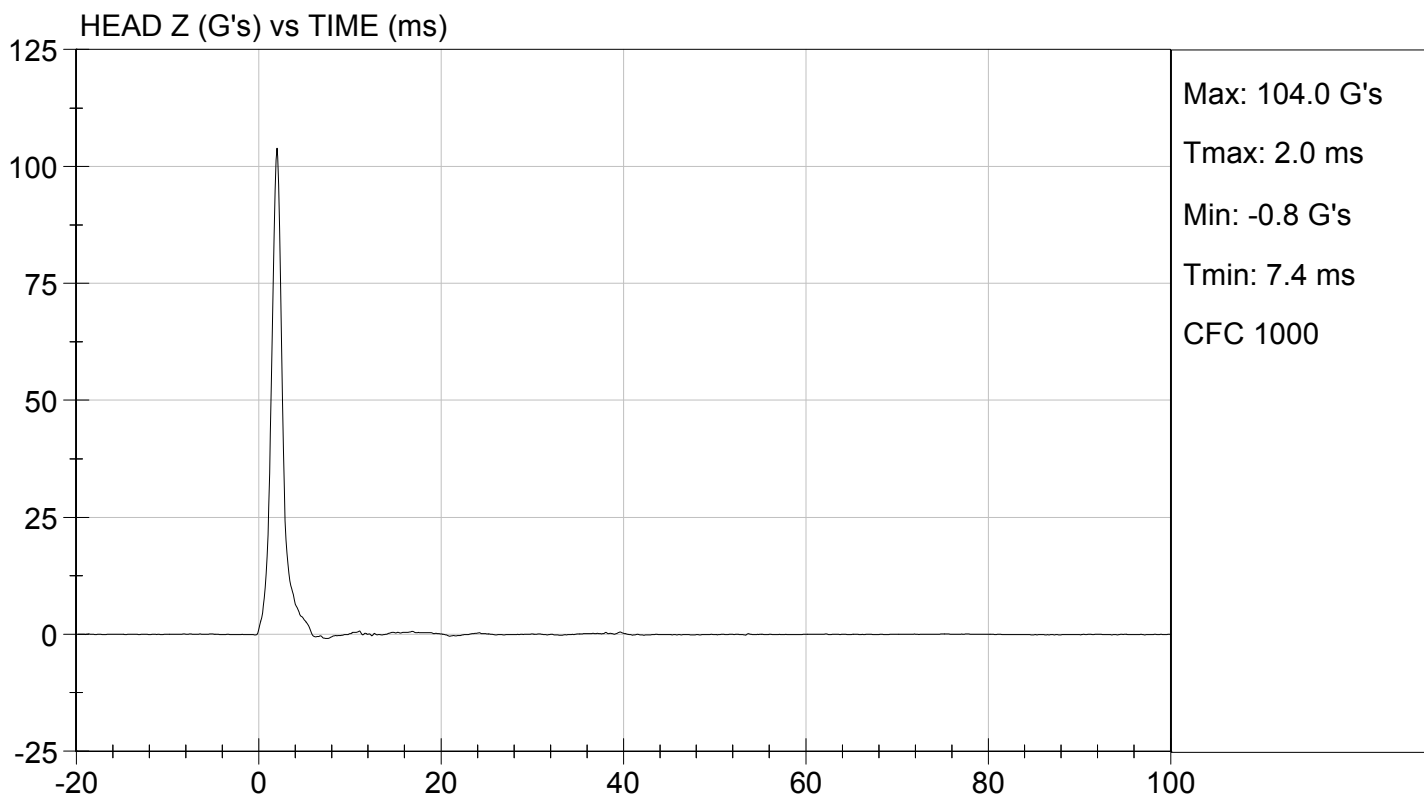
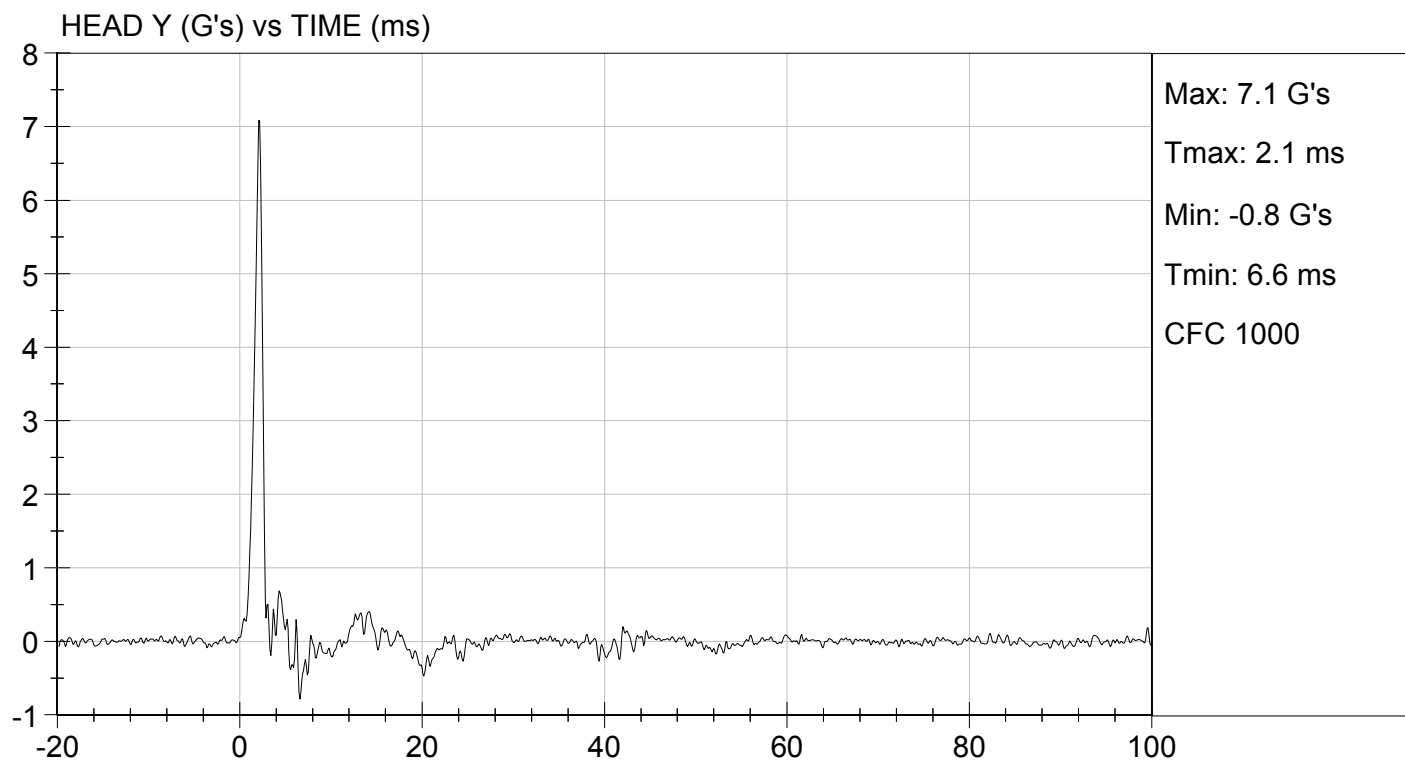
Maxime Chamberland
Laboratory Technician

11/18/2014

Test Date

Jeff Leonard
Approved By





DATA SHEET B4
NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: Jack Coleman

 Pre test calibration
X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last flexion test. (572.137(q))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity: | <u>16%</u> |
| Record the minimum humidity: | <u>13%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
- X 6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(i & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.3 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	5.8 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	69 Nm @ 81 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	89 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

11/18/2014
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D144052

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	16	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	5.8	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	69	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	89	Pass
Overall Results					Pass

Jack Coleman
Laboratory Technician

11/18/2014

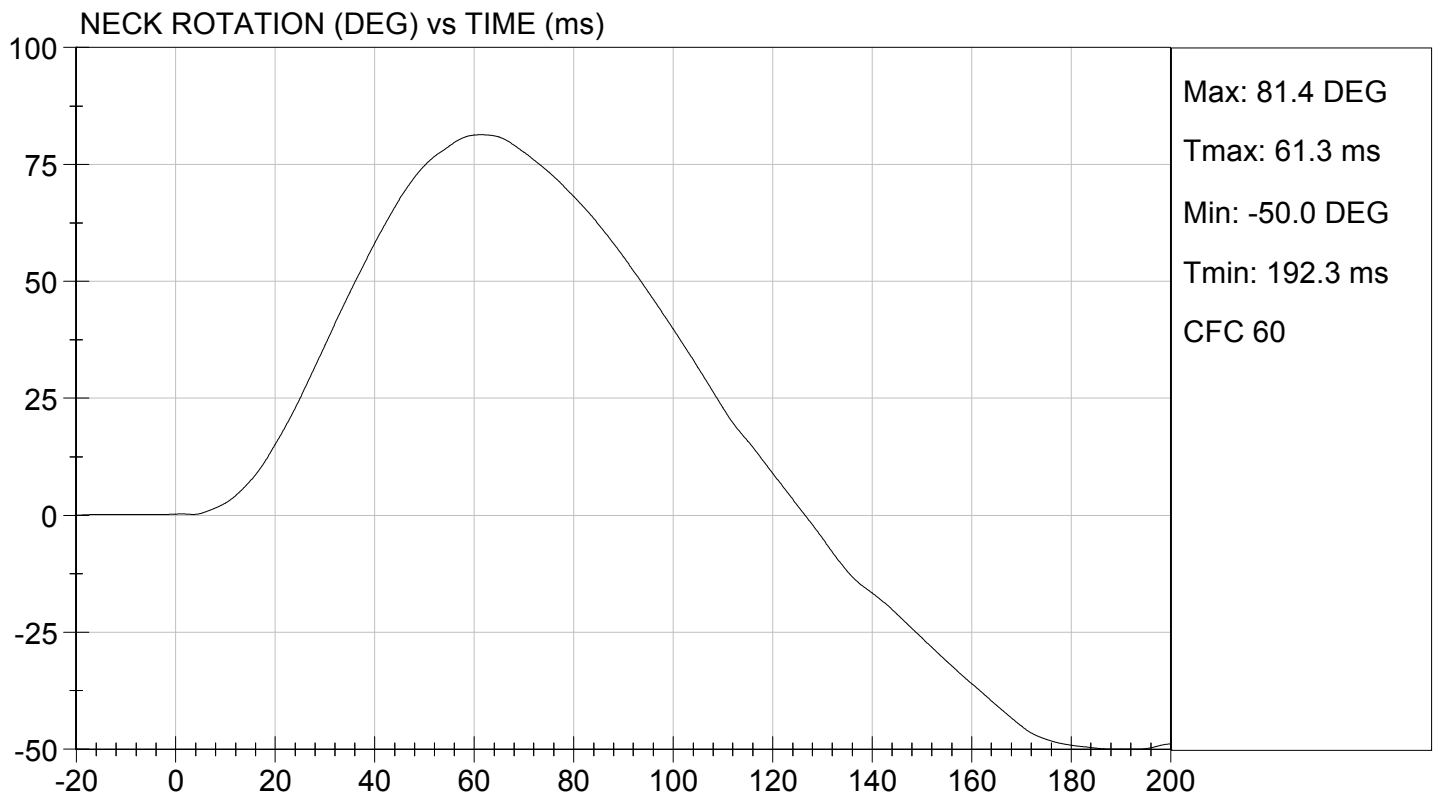
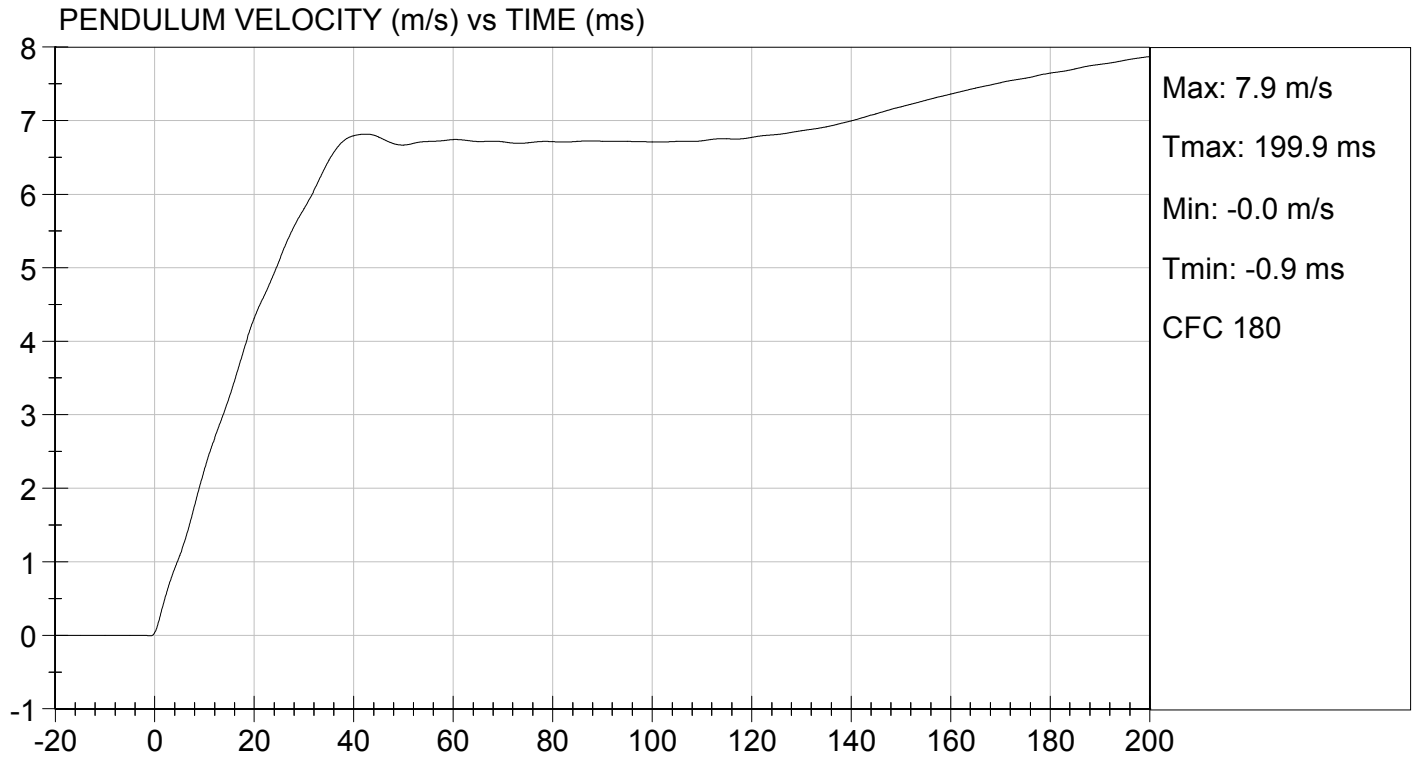
Test Date

Jeff Leonard
Approved By



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

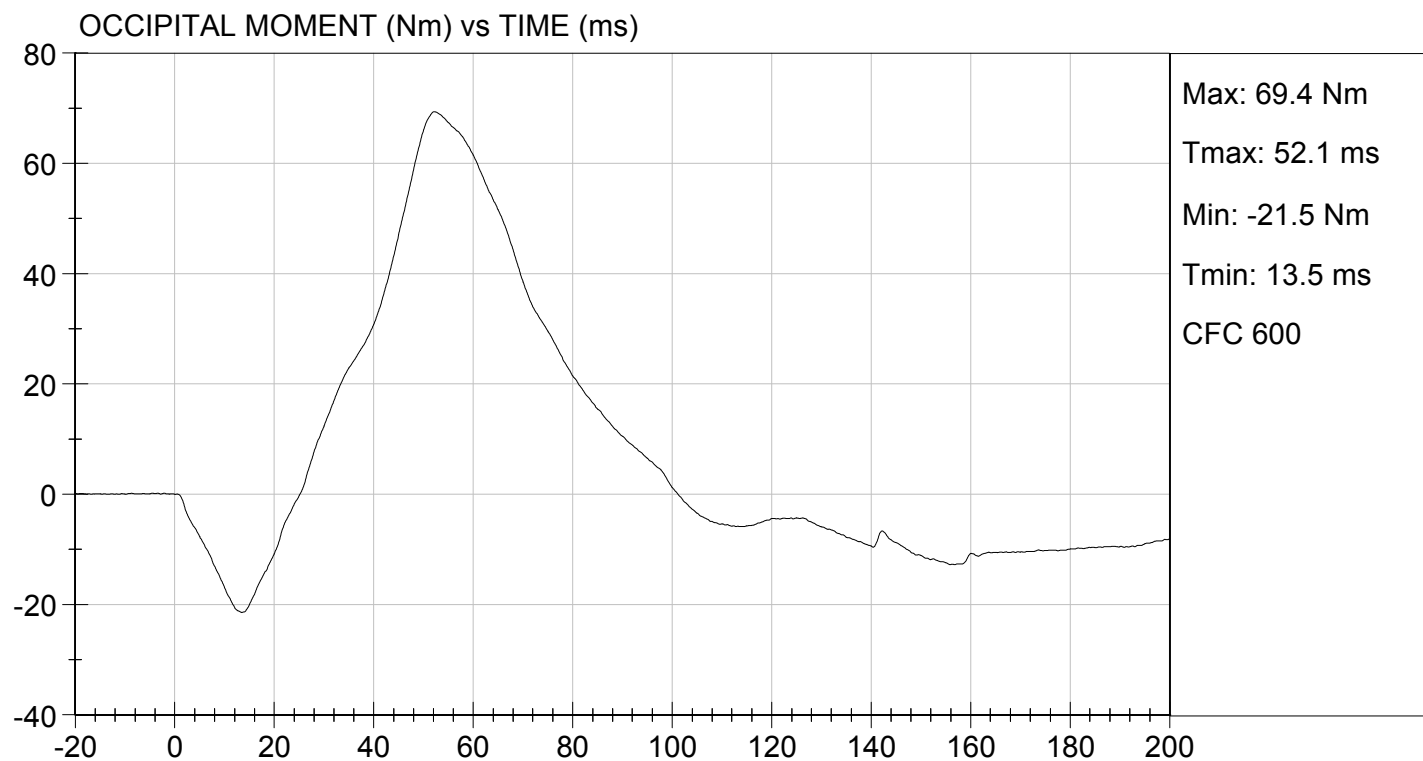
TEST DATE: 11/18/2014
TEST #: D144052





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

TEST DATE: 11/18/2014
TEST #: D144052



DATA SHEET B5
NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: David Schoedel

 Pre test calibration
X Post test calibration verification

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

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

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

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

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>16%</u>
Record the minimum humidity:	<u>13%</u>

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

Record findings and actions: No damage

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

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

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

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:
Neck Extension Test Results (572.133(b)(2) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.6 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.4 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	4.9 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-57 Nm @ 99 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	102 ms

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

M_y = Moment in Nm measured by the transducer

F_x = Force, in N measured by the transducer

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

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

David Schoedel
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D144053

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity		%	10 to 70	16	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	99	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	102	Pass
Overall Results					Pass

David Schoedel
Laboratory Technician

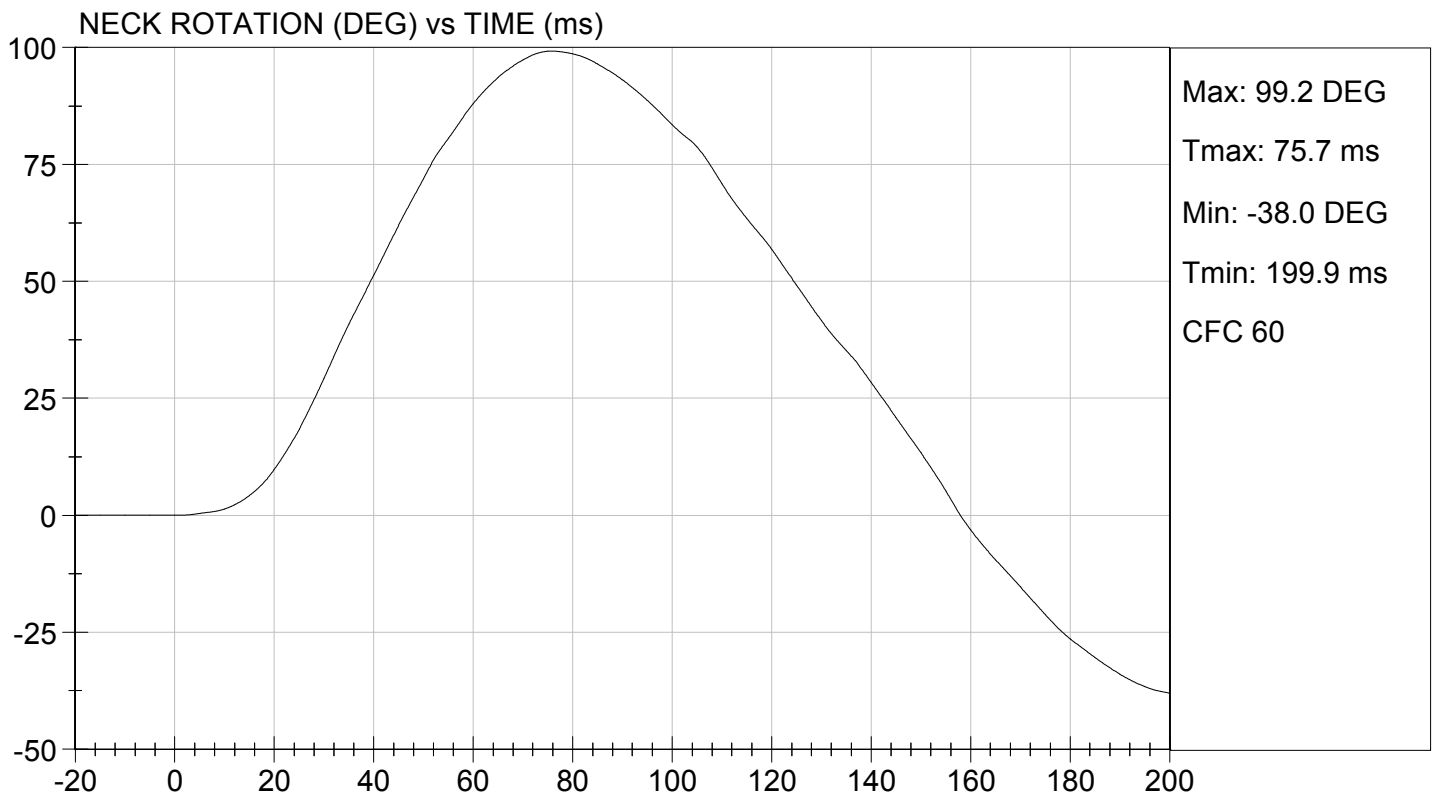
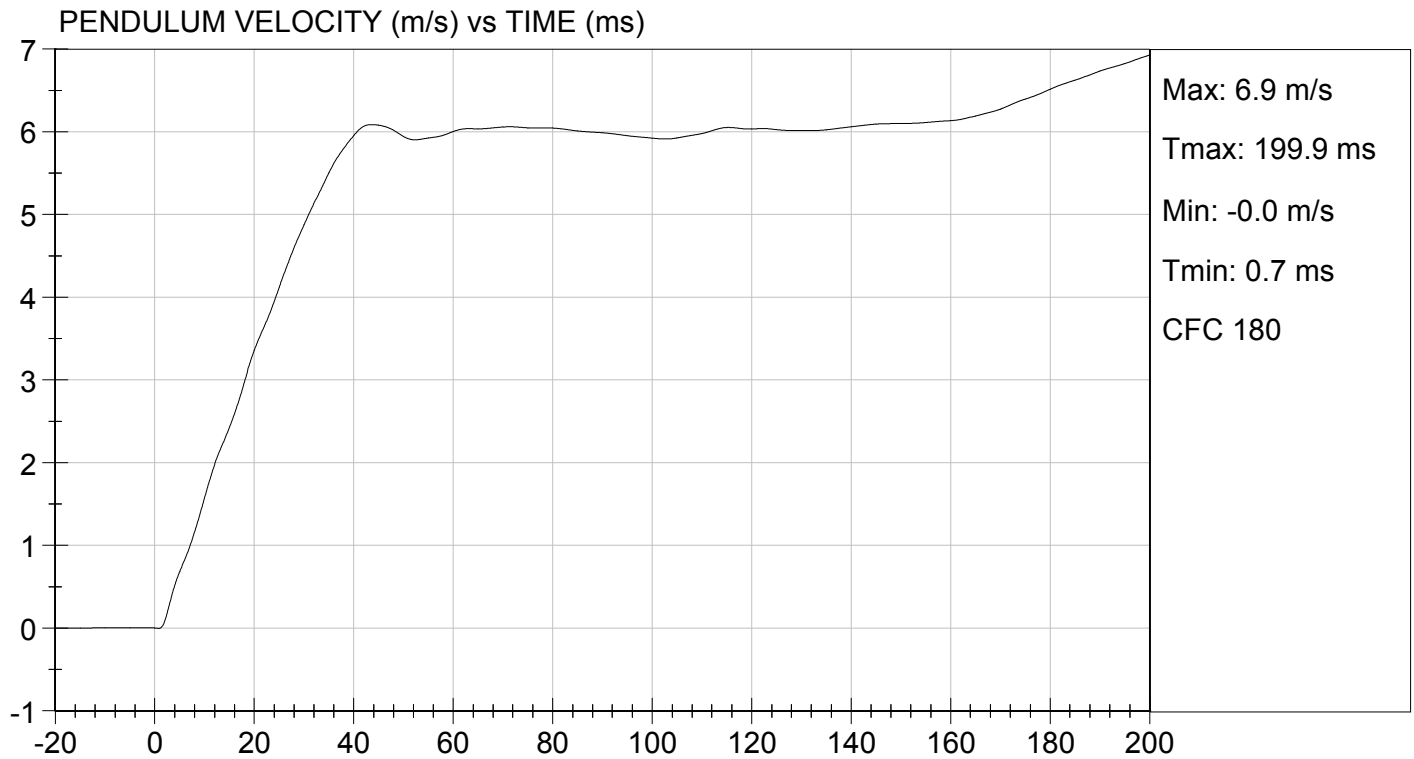
11/18/2014
Test Date

Jeff Leonard
Approved By



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

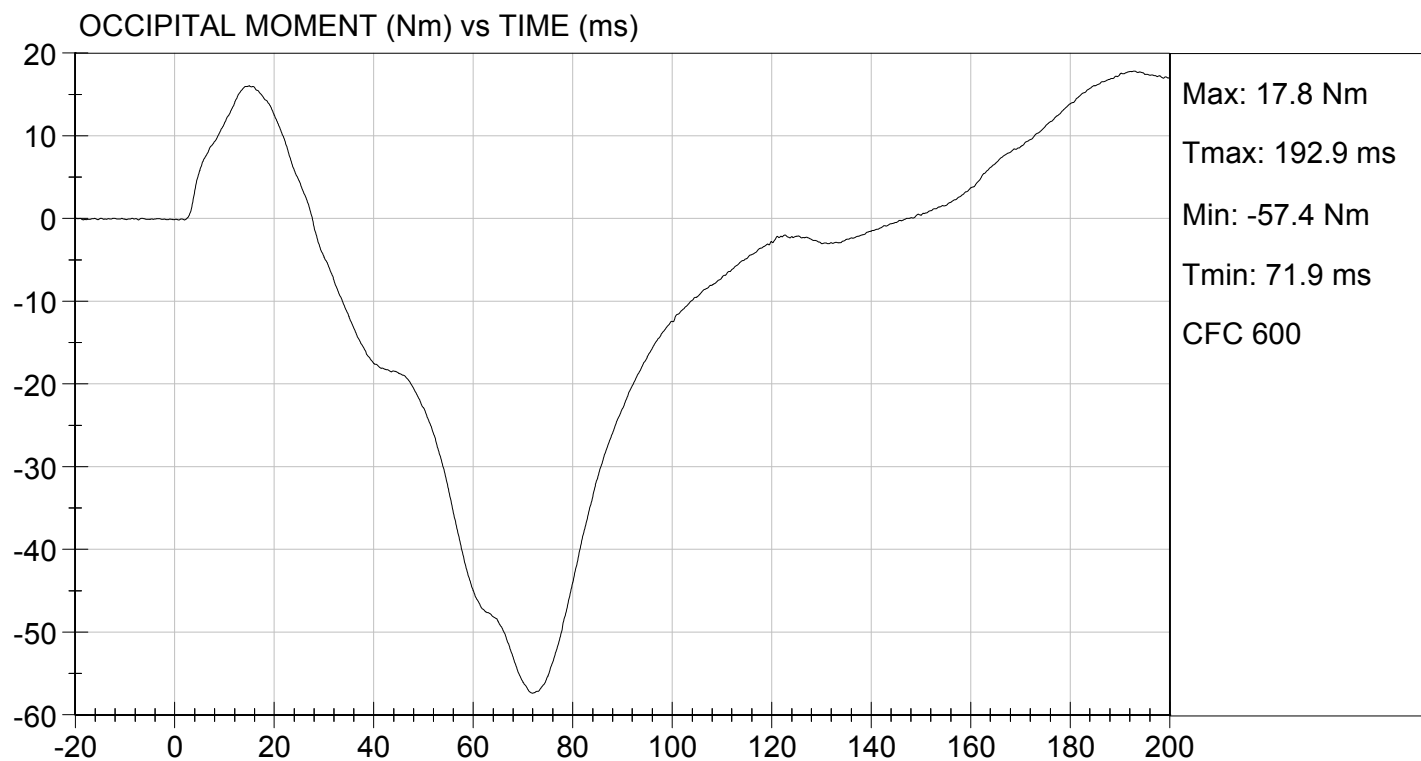
TEST DATE: 11/18/2014
TEST #: D144053





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

TEST DATE: 11/18/2014
TEST #: D144053



DATA SHEET B6
THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

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

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>16%</u>
Record the minimum humidity:	<u>13%</u>

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

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

 - The following repairs or replacement was performed. Record:

- X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 11B. The surface must be long enough to support the pelvis and outstretched legs. (572.134(c)(3))
- X 7. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ and adjust the pelvis angle to $7^\circ \pm 2^\circ$. The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.
- X 8. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.134(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is $12.7 \text{ mm} \pm 1 \text{ mm}$ below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))
- X 10. Align the adjustable neck bracket index marks to the "zero" position.
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. Place the arm assemblies horizontal $\pm 2^\circ$ and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$. (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

- X 16. Complete the following table:
Thorax Impact Results (572.134(b) and 572.134(b)(1)&(2))

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	3924 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4271 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.

David Schoedel
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D144054

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Relative Humidity	%	10 to 70	16	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	3924	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4271	Pass
Overall Test Results				Pass

David Schoedel

Laboratory Technician

11/18/2014

Test Date

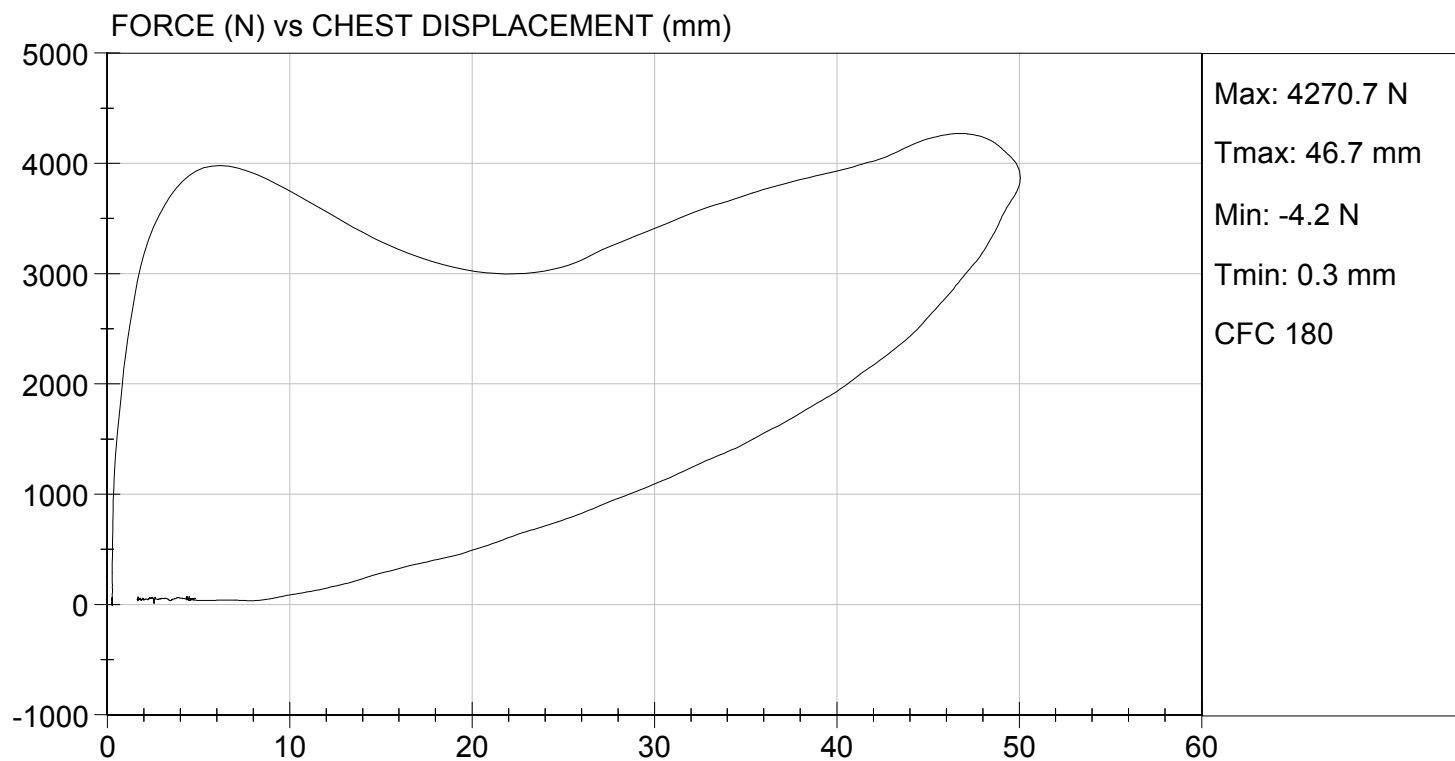
Jeff Leonard

Approved By



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

TEST DATE: 11/18/2014
TEST #: D144054



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

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: Jack Coleman

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))
 X N/A, ONLY one torso flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 13B.
- X 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).
 With legs below femurs.
 X Without legs below femurs.
- X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>22.0°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity: | <u>16%</u> |
| Record the minimum humidity: | <u>13%</u> |
- X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
- X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
- X 7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
- X 8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

- X 9. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.135(c)(6))
- X 10. Remove all external support that was implemented in 9 above. (572.135(c)(7))
- X 11. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(7))
 Record reference plane angle (max. allowed 20°): See Result Table
- X 12. Attach the pull cable and the load cell. (572.135(c)(8))
- X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))
- X 14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))
- X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))
- X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))
- X 17. Complete the following table:
 Torso Flexion Results (572.135(b), 572.135(c)(7), 572.135(c)(9))

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	20 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.8 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	365 N
Final ref. plane angle	Initial ref. plane angle ± 8°	25 deg

Jack Coleman
 Signature

11/18/2014
 Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D144057

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	25	Pass
Force at 45 deg	N	320 to 390	365	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
Overall Result			Pass	


Laboratory Technician

11/18/2014

Test Date


Approved By

DATA SHEET B8
LEFT KNEE IMPACT TEST (572.136) (5th Female)

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: Jack Coleman

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.137(q))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 14B.
- X 3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>16%</u>
Record the minimum humidity:	<u>13%</u>

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

 X 11. Complete the following table:
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3713 N

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

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

Jack Coleman
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION

**LEFT KNEE IMPACT TEST
HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D144056

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3713	Pass
Overall Test Results				Pass

Jack Coleman
Laboratory Technician

11/18/2014

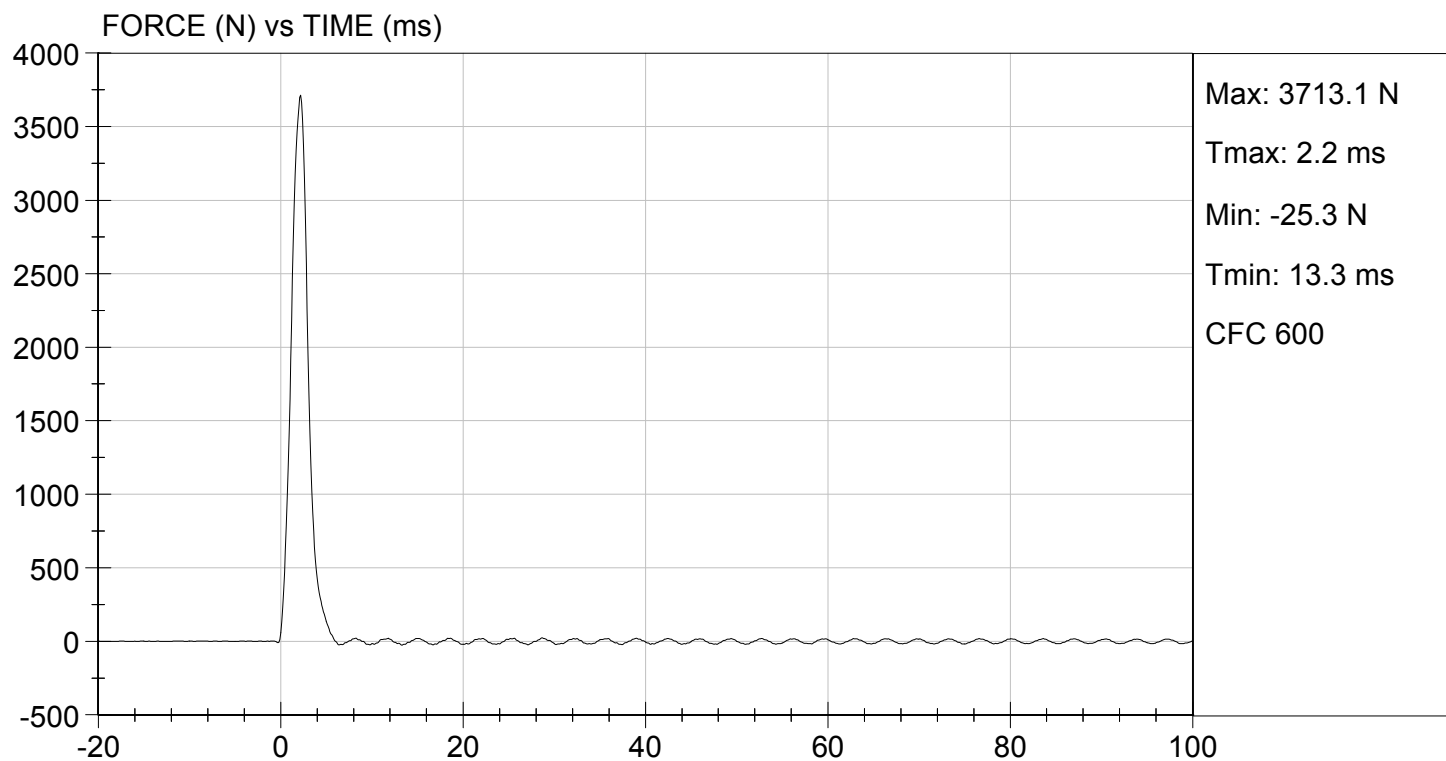
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 11/18/2014
TEST #: D144056



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

Dummy Serial Number: 510

Test Date: 11/18/2014

Technician: Jack Coleman

 Pre test calibration
 X Post test calibration verification

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

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

Record the maximum temperature:	<u>22.0°C</u>
Record the minimum temperature:	<u>21.5°C</u>
Record the maximum humidity:	<u>16%</u>
Record the minimum humidity:	<u>13%</u>

- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

 X 11. Complete the following table:
Knee Impact Results (572.136(b)(1) and 572.136(c)(5))

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.13 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3988 N

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

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

Jack Coleman
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D144055

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3988	Pass
Overall Test Results				Pass

Jack Coleman
Laboratory Technician

11/18/2014

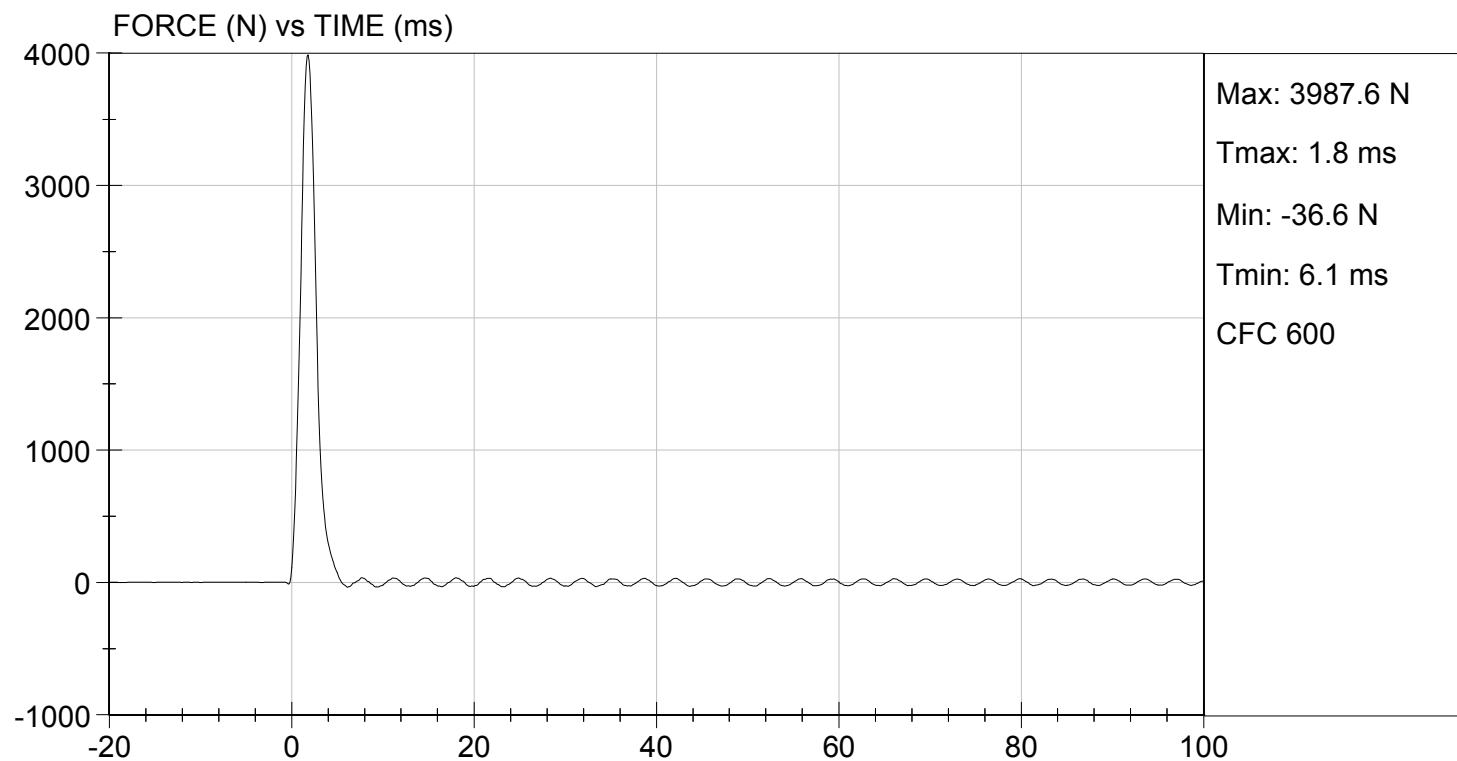
Test Date

Jeff Leonard
Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 7.00 ft/s, 2.13 m/s

TEST DATE: 11/18/2014
TEST #: D144055



DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82668	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82669	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82670	08/20/2014	02/20/2015
NECK TRANSDUCER	Denton	1716	1159	08/26/2014	02/26/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79418	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79439	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79614	08/20/2014	02/20/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	510	08/20/2014	02/20/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	737	07/11/2014	01/11/2015
(2) LEFT FEMUR	Denton	2121	799	07/11/2014	01/11/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 510

Test Date: 11/17/2014

Technician: Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damage	OK
Outer skin	Gashes, rips, cracks			X
Head	Ballast secure			X
	General appearance			X
Neck	Broken or cracked rubber			X
	Upper neck bracket firmly attached to the lower neck bracket			X
	Looseness at the condyle joint			X
	Nodding blocks cracked or out of position			X
Spine	Broken or cracks in rubber			X
Ribs	Broken or bent ribs			X
	Broken or bent rib supports			X
	Damping material separated or cracked			X
	Rubber bumpers in place			X
Chest Displacement Assembly	Bent shaft			X
	Slider arm riding in track			X
Transducer leads	Torn cables			X
Accelerometer Mountings	Head mounting secure			X
	Chest mounting secure			X
Knees	Skin condition			X
	Insert (do not remove)			X
	Casting			X
Limbs	Normal movement and adjustment			X
Knee Sliders	Wires intact			X
	Rubber returned to "at rest" position			X
Pelvis	Broken			X
Other				X

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

Repair or Replacement approved by:

Jessica Hall
Signature

11/18/2014
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard
Signature

11/18/2014
Date

EXTERNAL DIMENSIONS

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

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

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

Dummy Serial Number: 155

Test Date: 10/30/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
- X 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
- X 4. Accelerometers and their respective mounts are smooth and clean.
- X 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
- X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity | <u>32%</u> |
| Record the minimum humidity | <u>30%</u> |
- X 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

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

Record the actual distance: 376 mm

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

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2155.0×10^{-6} mm (80 micro inches) (RMS). (572.122(c)(4))

Record actual micro finish: 40.9 micro inches

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

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$245 \text{ g} \leq x \leq 300 \text{ g}$	256 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-10.8 g

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

David Schoedel

Signature

10/30/2014

Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 6 YEAR OLD

ATD Serial No: 155

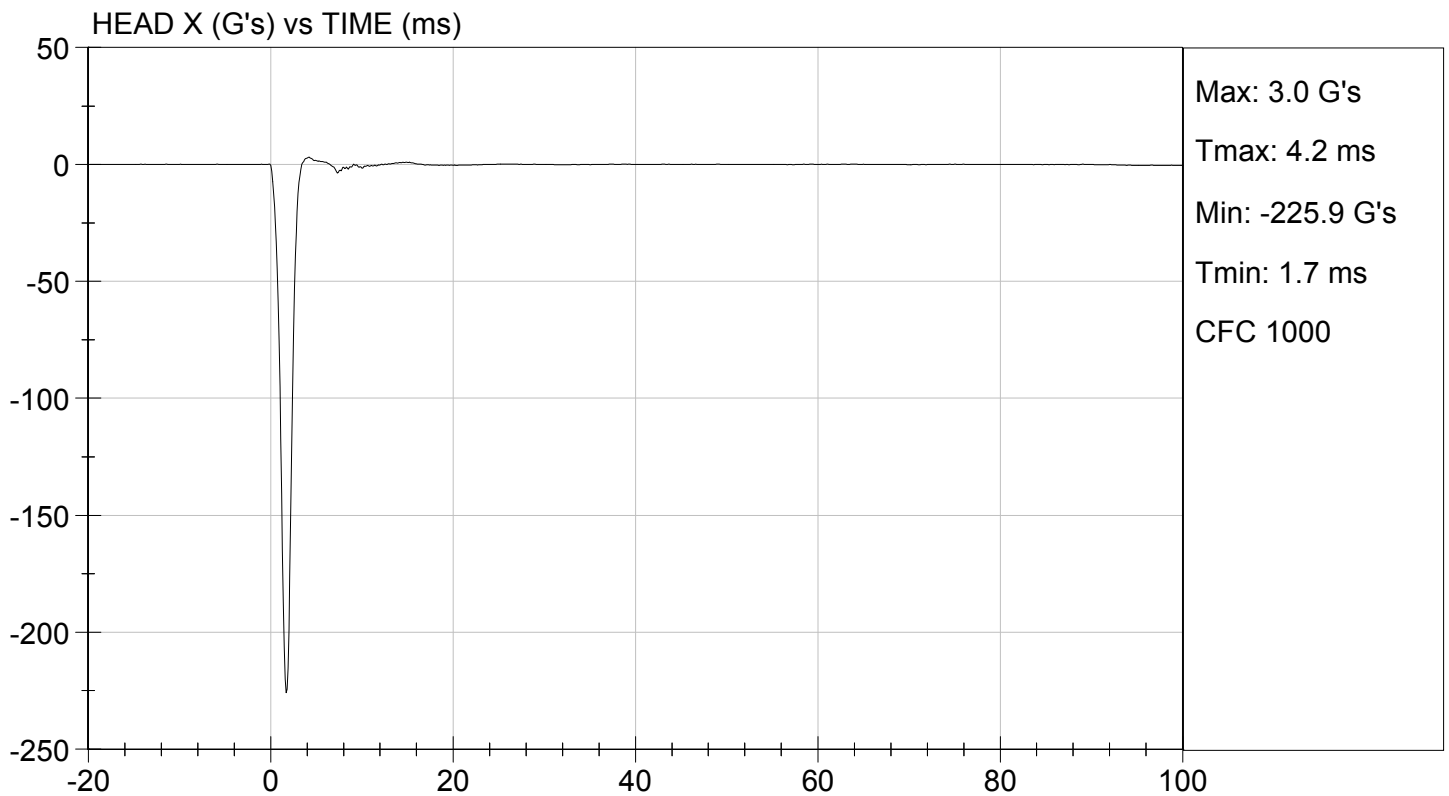
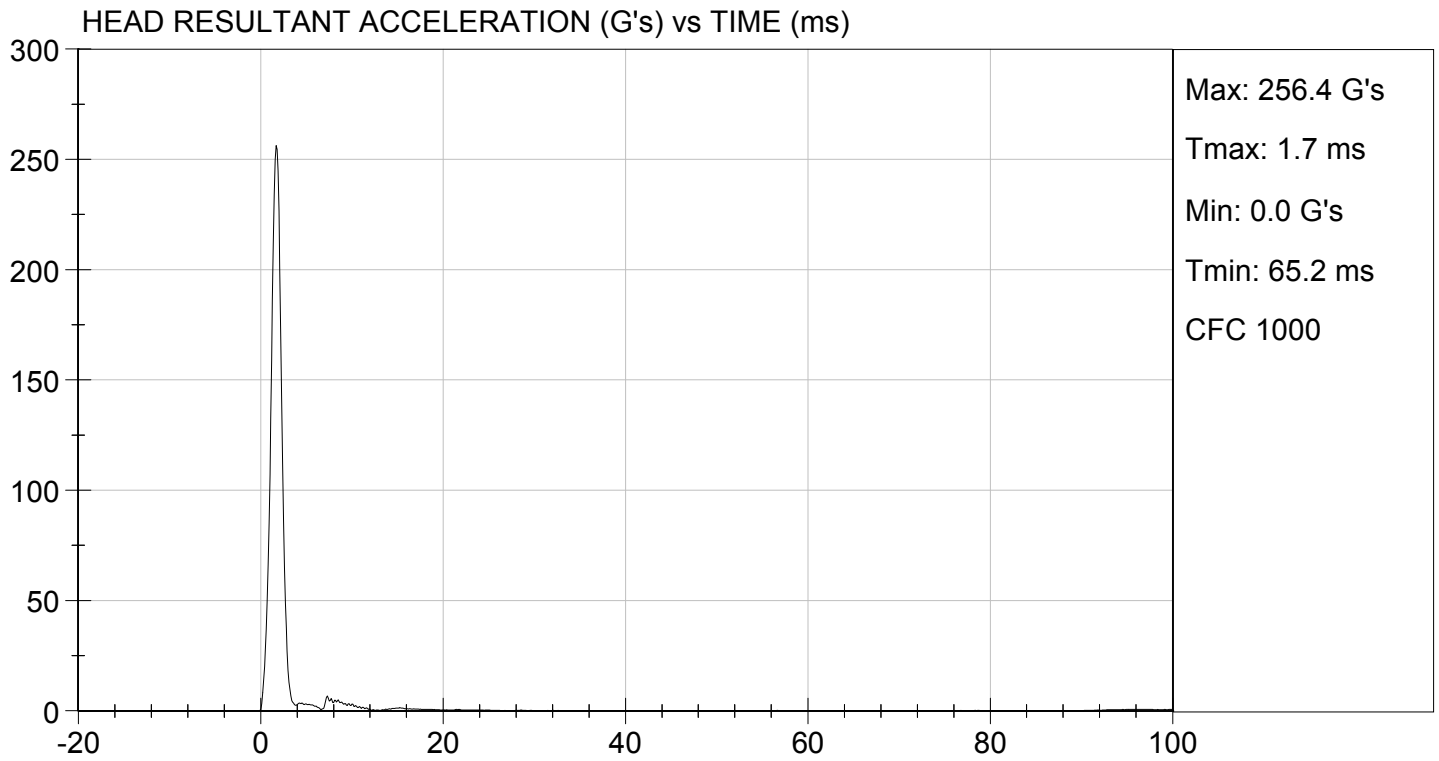
Test ID: D143841

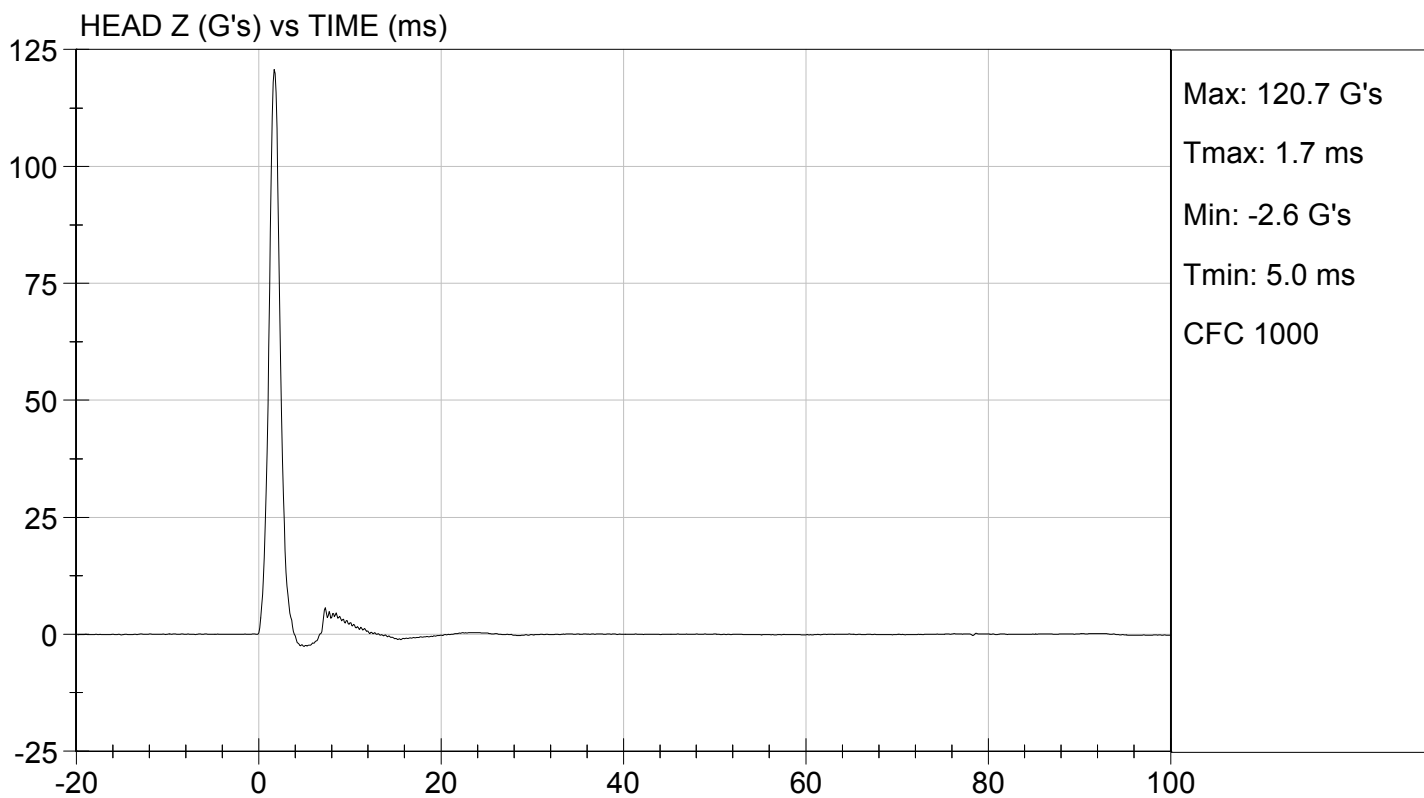
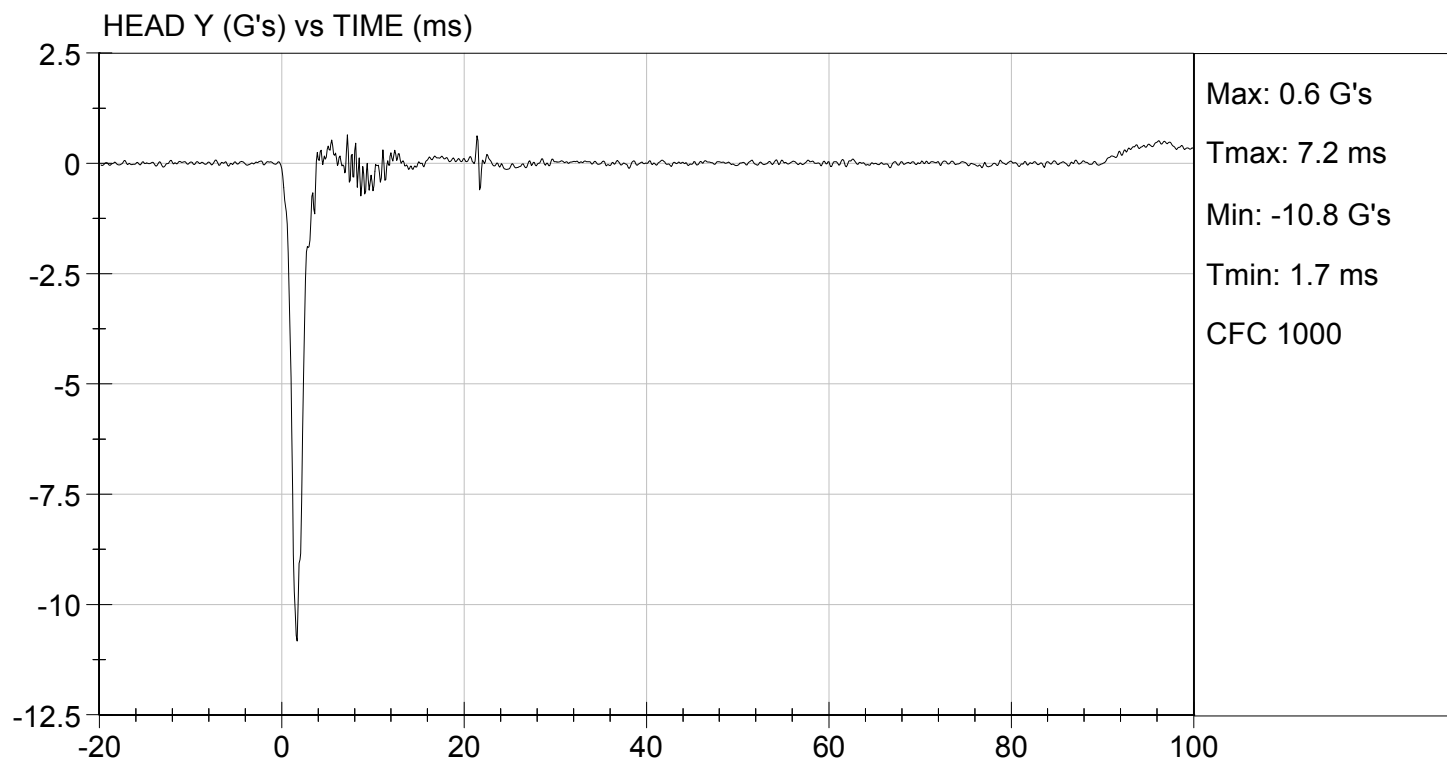
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Peak Resultant Acceleration	G's	245 to 300	256	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-10.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

10/30/2014
Test Date

Jeff Leonard
Approved By





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

Dummy Serial Number: 155

Test Date: 10/30/2014

Technician: Jessica Gall

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.127(o))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity | <u>32%</u> |
| Record the minimum humidity | <u>30%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage
- X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

- X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123I(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123I(3))
- X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123I(4)(i))
- X 12. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		$4.83 \text{ m/s} \leq \text{speed} \leq 5.07 \text{ m/s}$	4.98 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.2 \text{ m/s} \leq \Delta V \leq 1.6 \text{ m/s}$	1.6 m/s
	@ 20 ms	$2.4 \text{ m/s} \leq \Delta V \leq 3.4 \text{ m/s}$	2.9 m/s
	@ 30 ms	$3.8 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.0 m/s
Plane D Rotation		Peak moment* $27 \text{ Nm} \leq \text{moment} \leq 33 \text{ Nm}$ during the following rotation range $74^\circ \leq \text{angle} \leq 92^\circ$	27 Nm @ 74 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm $103 \text{ ms} \leq \text{time} \leq 123 \text{ ms}$	110 ms

*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.123(b)(1)(iii))

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. (572.123(b)(3))

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

 Jessica Hall
Signature

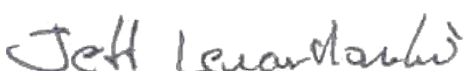
 10/30/2014
Date

MGA RESEARCH CORPORATION**NECK FLEXION TEST
HYBRID III 6 YEAR OLD****ATD Serial No:** 155**Test I.D:** D143842

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	32	Pass
Pendulum Speed		m/s	4.83 to 5.07	4.98	Pass
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.6	Pass
	20 ms	m/s	2.4 to 3.4	2.9	Pass
	30 ms	m/s	3.8 to 5.0	4.0	Pass
D Plane Rotation	Max	deg	74 to 92	74	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	27 to 33	27	Pass
Positive Moment Time Curve Decay to 5 Nm		ms	103 to 123	110	Pass
Overall Results					Pass


Laboratory Technician

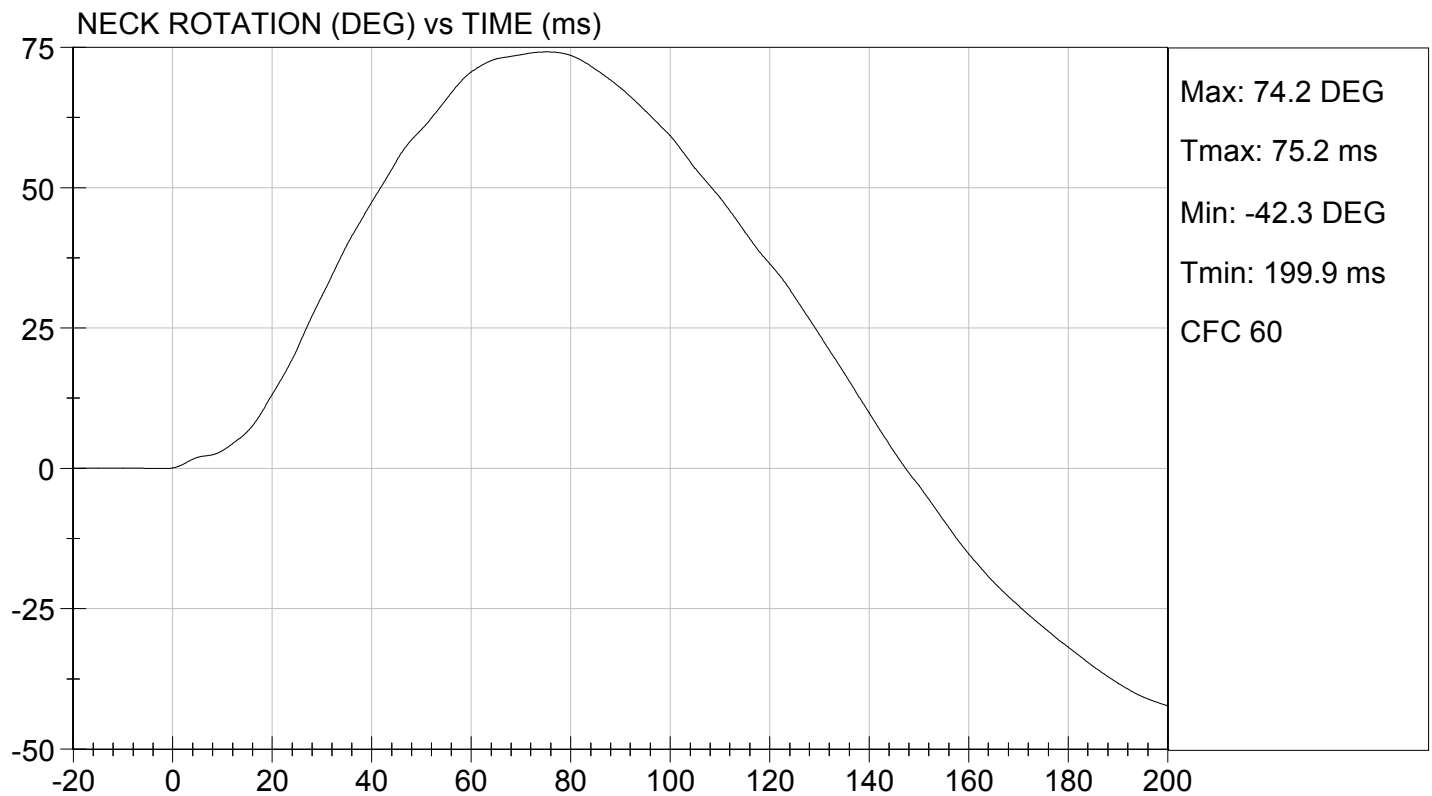
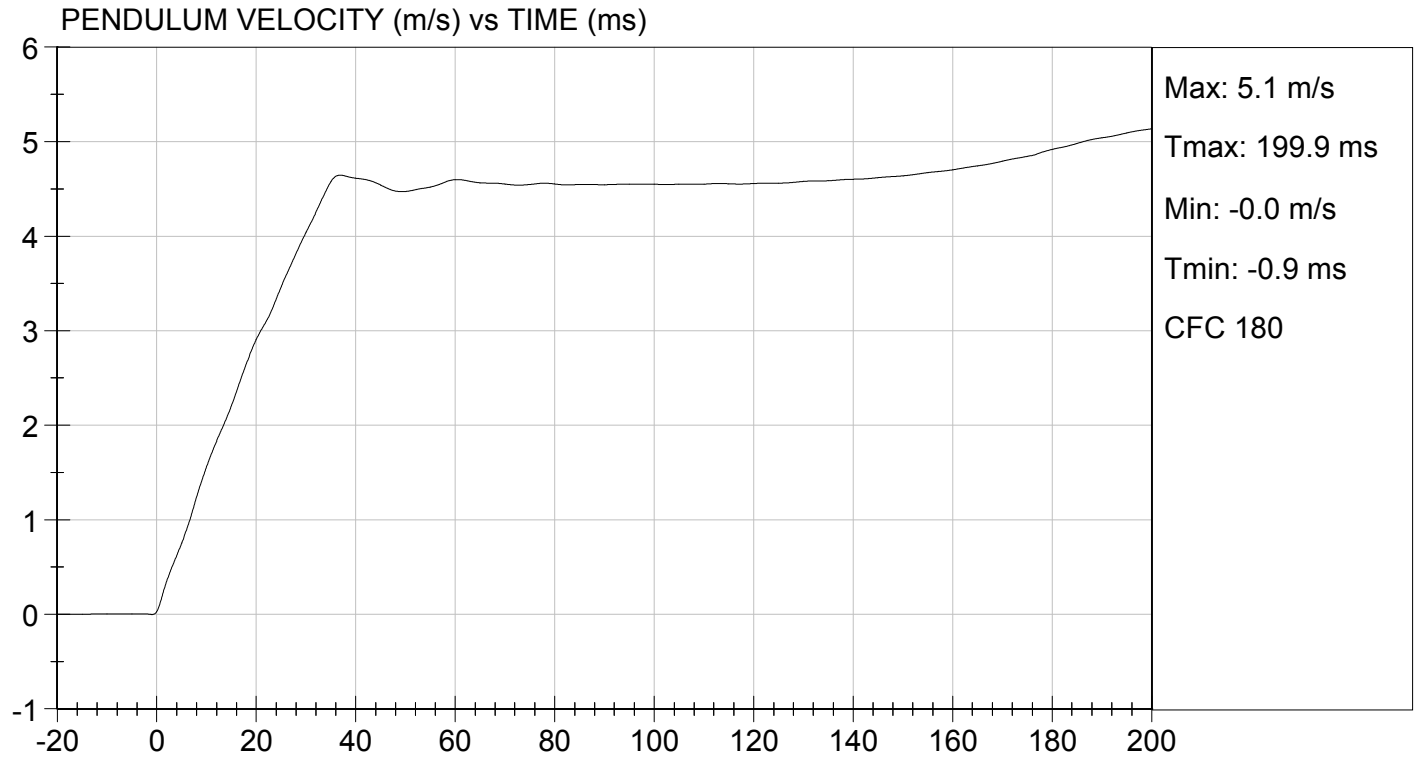
10/30/2014
Test Date


Approved By



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

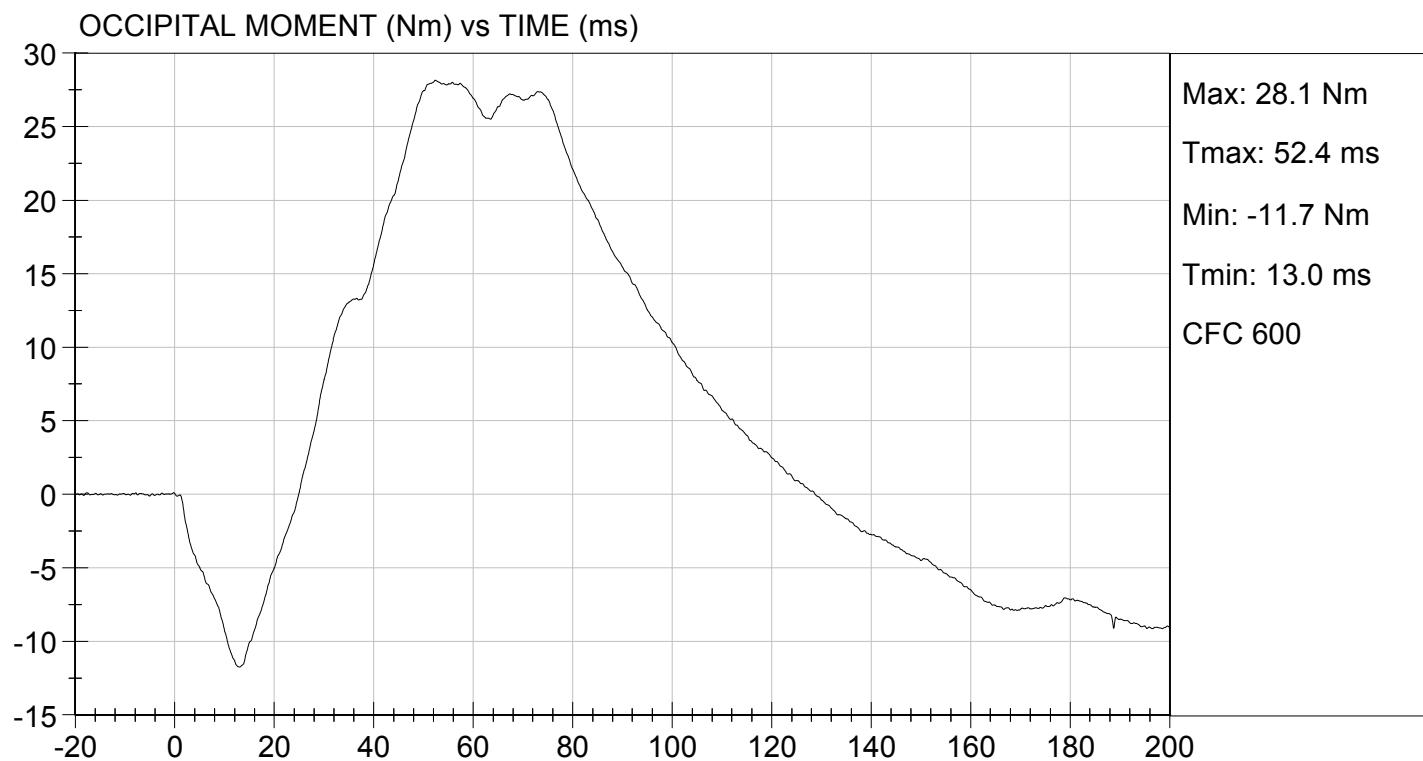
TEST DATE: 10/30/2014
TEST #: D143842





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

TEST DATE: 10/30/2014
TEST #: D143842



DATA SHEET C5
NECK EXTENSION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155

Test Date: 10/30/2014

Technician: Jessica Gall

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.127(o))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity | <u>32%</u> |
| Record the minimum humidity | <u>30%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage

- X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
- X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))
- X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))
- X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		$4.18 \text{ m/s} \leq \text{speed} \leq 4.42 \text{ m/s}$	4.42 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$	1.3 m/s
	@ 20 ms	$2.2 \text{ m/s} \leq \Delta V \leq 3.0 \text{ m/s}$	2.5 m/s
	@ 30 ms	$3.2 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$	3.8 m/s
Plane D Rotation		Peak moment* $-24 \text{ Nm} \leq \text{moment} \leq -19 \text{ Nm}$ during the following rotation range $85^\circ \leq \text{angle} \leq 103^\circ$	-21 Nm @ 94 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm $123 \text{ ms} \leq \text{time} \leq 147 \text{ ms}$	132 ms

*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.123(b)(2)(iii))

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. (572.123(b)(3))

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

Jessica Hall
Signature

10/30/2014
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D143843

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.0	Pass
Laboratory Relative Humidity		%	10 to 70	32	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.42	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.3	Pass
	20 ms	m/s	2.2 to 3.0	2.5	Pass
	30 ms	m/s	3.2 to 4.2	3.8	Pass
D Plane Rotation	Max	deg	85 to 103	94	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-21	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	132	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

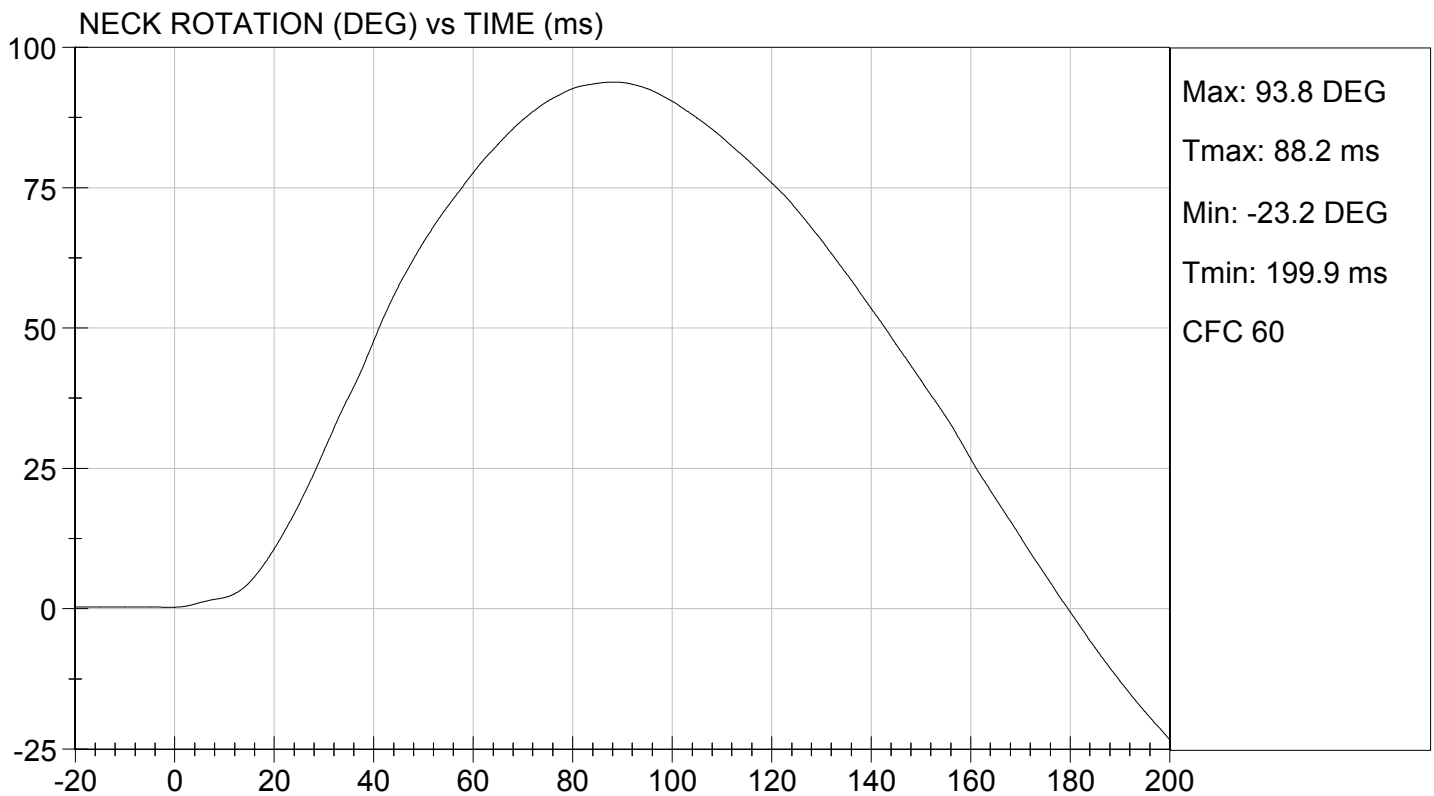
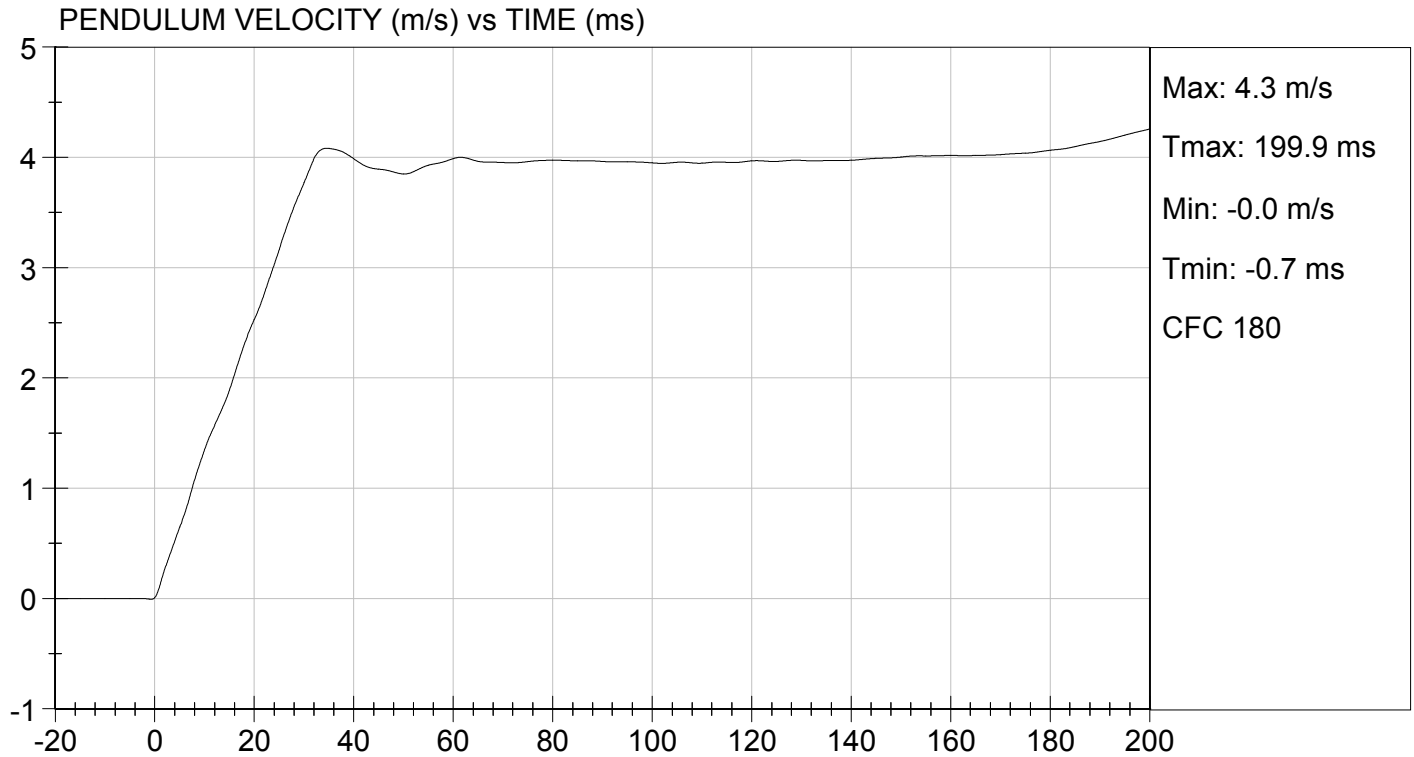
10/30/2014
Test Date

Jeff Leonard
Approved By



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

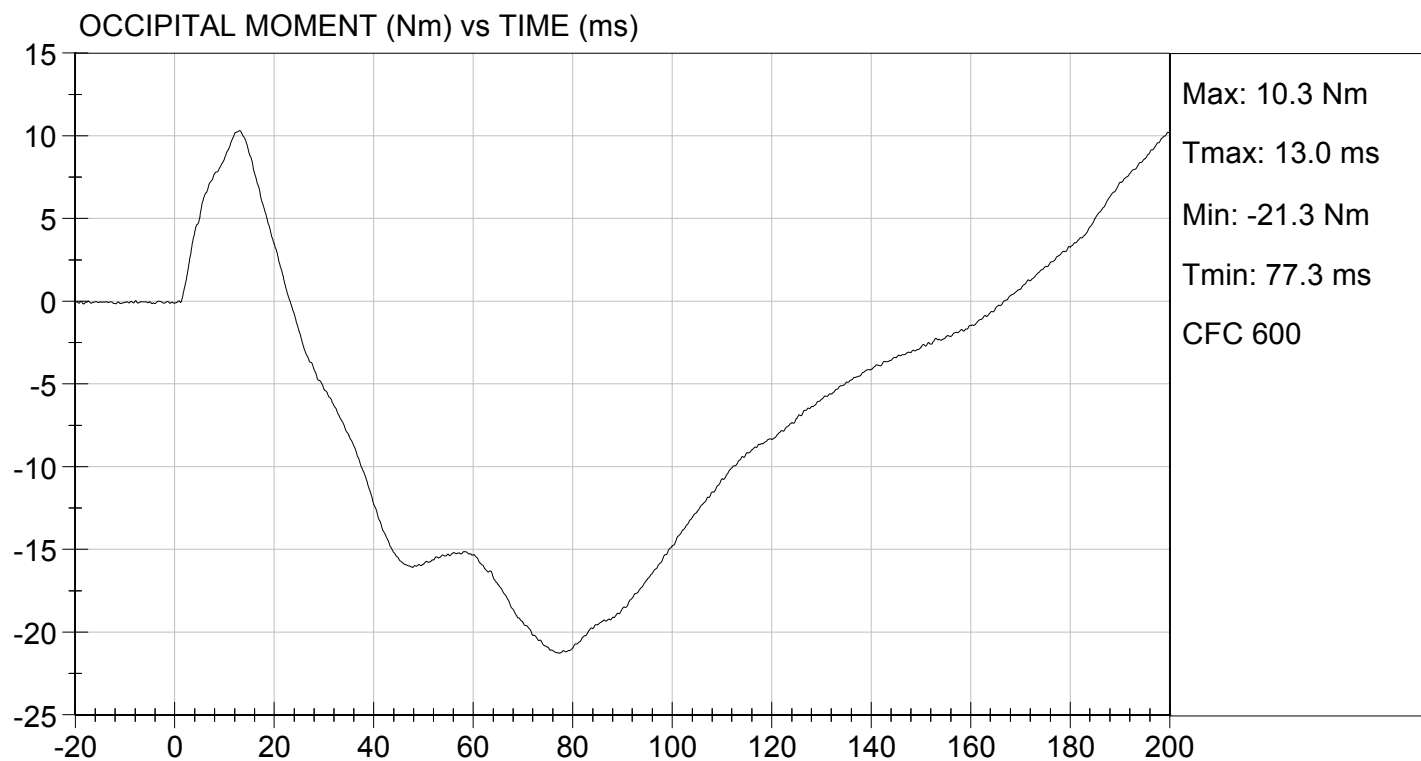
TEST DATE: 10/30/2014
TEST #: D143843





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

TEST DATE: 10/30/2014
TEST #: D143843



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

Dummy Serial Number: 155

Test Date: 10/31/2014

Technician: Jessica Gall

- ☒ Pre test 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. (572.127(o))
☒ N/A, ONLY one thorax impact test performed

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

- ☒ 3. The complete assembled dummy (127-0000) is used (572.124(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. (572.134(c)(1))

Record the maximum temperature	<u>21.5°C</u>
Record the minimum temperature	<u>21.0°C</u>
Record the maximum humidity	<u>32%</u>
Record the minimum humidity	<u>30%</u>

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

Record findings and actions:

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

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

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

- X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))
- X 8. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ and adjust the pelvis angle to $8^\circ \pm 2^\circ$. The angle may be measured at the pelvis lumbar joining surface.
- X 9. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.124(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is $12.7 \text{ mm} \pm 1 \text{ mm}$ 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. (572.124(c)(3))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- X 14. Place the arm assemblies horizontal $\pm 2^\circ$ and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$. (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2))		
Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.77 m/s
Chest Compression	$38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$	44.0 mm
Peak force** between 38.0 and 46.0 mm chest compression	$1150\text{N} \leq \text{peak force} \leq 1380\text{N}$	1276 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force $\leq 1500 \text{ N}$	1313 N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	70%

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

**Force = impactor mass x acceleration

***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

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

 Jessica Hall
Signature

 10/31/2014
Date

MGA RESEARCH CORPORATION**THORAX IMPACT****HYBRID III 6 YEAR OLD****ATD Serial No:** 155**Test I.D:** D143844

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Relative Humidity	%	10 to 70	30	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	38.0 to 46.0	44.0	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,276	Pass
Internal Hysteresis	%	65 to 85	70	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,313	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

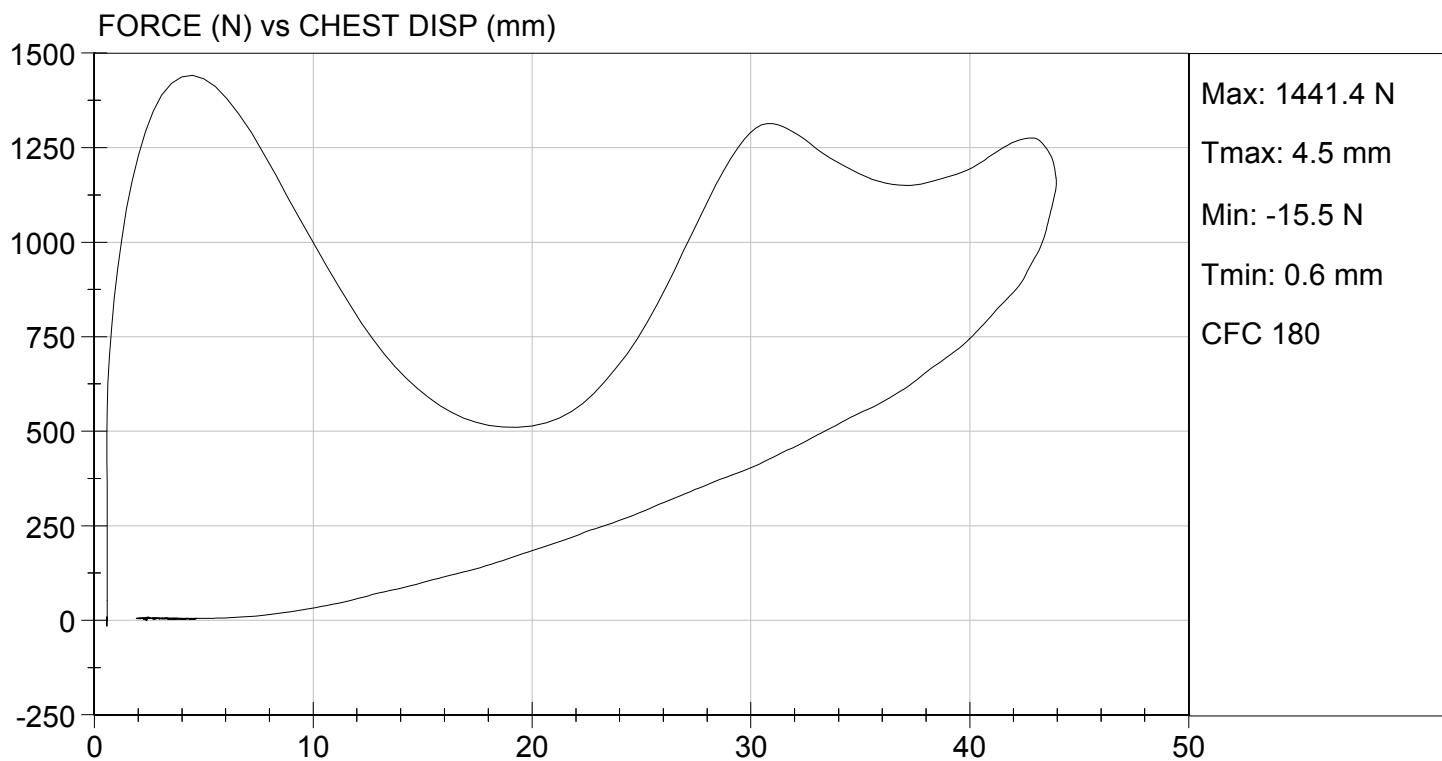
10/31/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 10/31/2014
TEST #: D143844



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

Dummy Serial Number: 155

Test Date: 10/31/2014

Technician: Jessica Gall

- ☒ Pre test 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. (572.127(o))
☒ N/A, ONLY one torso flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 11C.
- ☒ 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
☒ with legs below the femurs.
☐ without legs below the femurs.
- ☒ 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity | <u>32%</u> |
| Record the minimum humidity | <u>30%</u> |
- ☒ 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
- ☒ 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
- ☒ 7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
- ☒ 8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
- ☒ 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

- X 10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))
 Record reference plane angle (max. allowed 22°) See Result Table
- X 11. Attach the pull cable and the load cell. (572.125(c)(6))
- X 12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))
- X 13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))
- X 14. As quickly as possible release the force applied to the attachment bracket. (572.125(c)(9))
- X 15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))
- X 16. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 22°	22°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	1.1°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	149 N
Final ref. plane angle	Initial ref. plane angle ± 8°	26°

 Jessica Hall
 Signature

 10/31/2014
 Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D143847

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.0	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Initial Angle	deg	0 to 22	22	Pass
Return Angle	deg	+/- 8	26	Pass
Force at 45 deg	N	147 to 200	149	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.1	Pass
Overall Result				Pass

Jessica Hall
Laboratory Technician

10/31/2014

Test Date

Jeff Leonard
Approved By

DATA SHEET C8
LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155

Test Date: 10/30/2014

Technician: David Schoedel

- ☒ Pre test 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. (572.127(o))
☒ N/A, ONLY one knee impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 12C.
- ☒ 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- ☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity | <u>32%</u> |
| Record the minimum humidity | <u>30%</u> |
- ☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- ☒ 6. No parts of the foot or tibia contact any exterior surface. (572.126(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. (572.126(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.

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

 X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2541 N

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

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

David Schoedel

Signature

10/30/2014

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D143846

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	31	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	2000 to 3000	2541	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

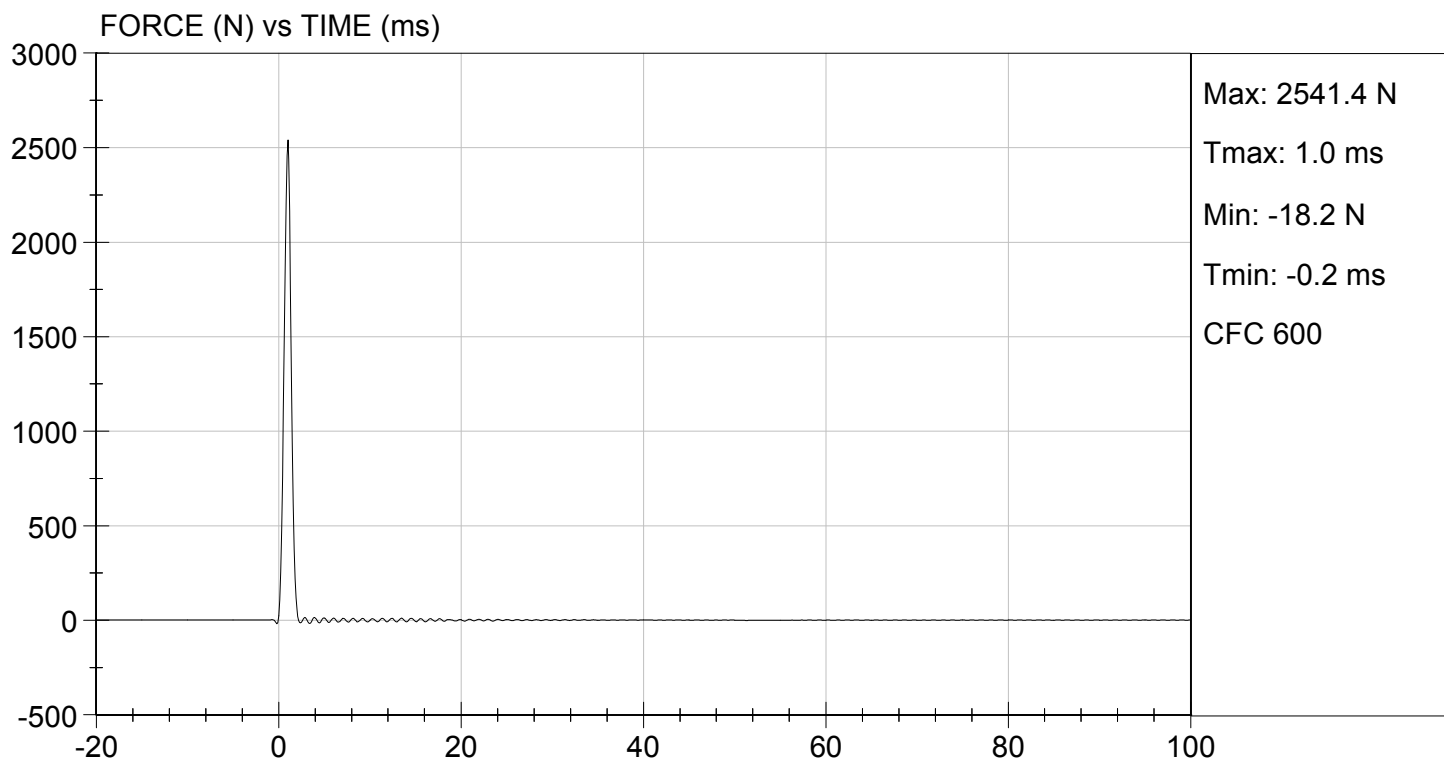
10/30/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 10/30/2014
TEST #: D143846



DATA SHEET C9
RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155

Test Date: 10/30/2014

Technician: David Schoedel

- ☒ Pre test 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. (572.127(o))
☒ N/A, ONLY one knee impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 12C.
- ☒ 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- ☒ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity | <u>32%</u> |
| Record the minimum humidity | <u>30%</u> |
- ☒ 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- ☒ 6. No parts of the foot or tibia contact any exterior surface. (572.126(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. (572.126(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.

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

 X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.07 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2418 N

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

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

David Schoedel

Signature

10/30/2014

Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D143845

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	31	Pass
Probe Speed	m/s	2.07 to 2.13	2.07	Pass
Maximum Force	N	2000 to 3000	2418	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

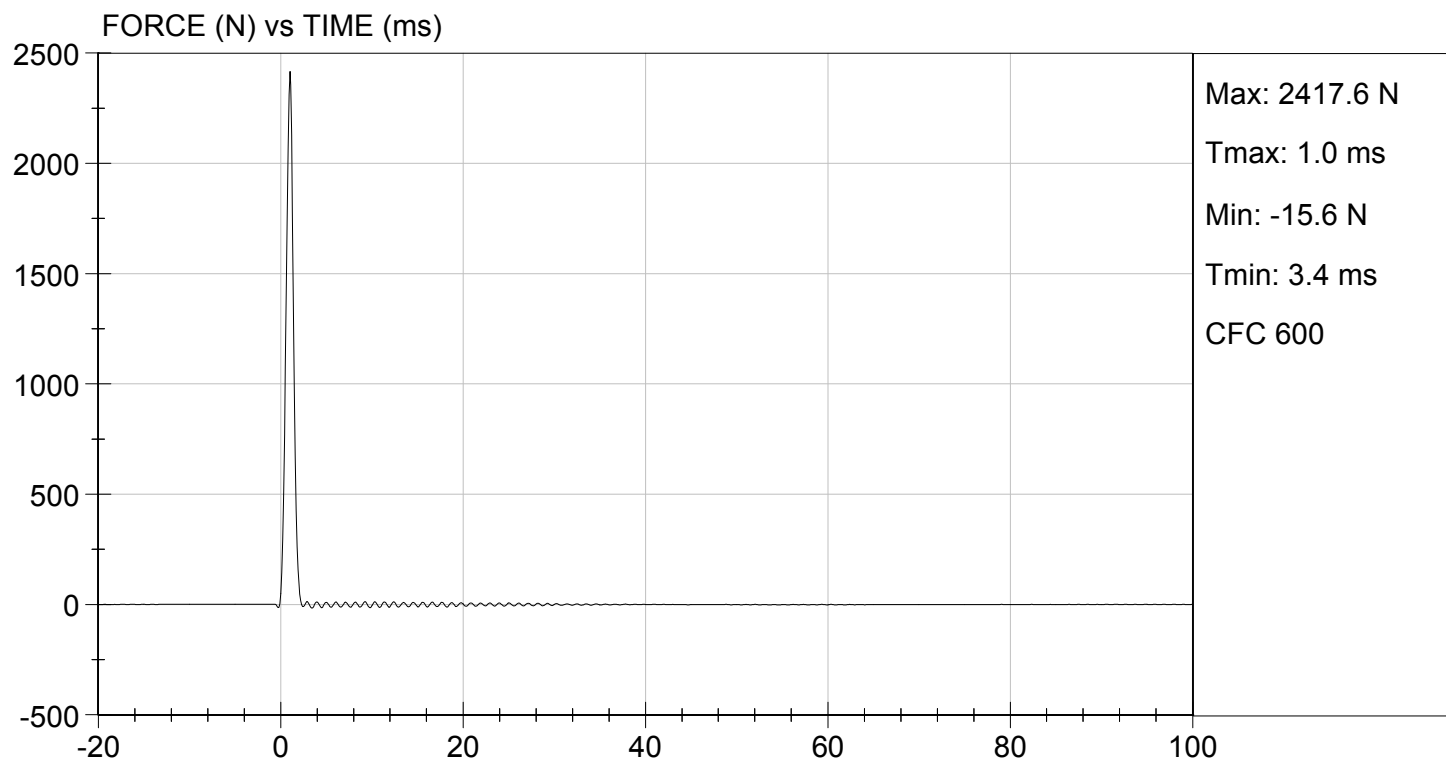
10/30/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: RIGHT KNEE
VELOCITY: 6.8 ft/s, 2.07 m/s

TEST DATE: 10/30/2014
TEST #: D143845



DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78692	07/02/2014	01/02/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P78776	07/02/2014	01/02/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79751	07/02/2014	01/02/2015
NECK TRANSDUCER	Denton	1716A	1562	10/18/2014	04/18/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78983	07/02/2014	01/02/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P78984	07/02/2014	01/02/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P78986	07/02/2014	01/02/2015
CHEST POTENTIOMETER	Servo	08C1-3179	155	07/09/2014	01/09/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2014
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P83176	05/01/2014	11/01/2014
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

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

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: David Schoedel

- Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
- X 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
- X 4. Accelerometers and their respective mounts are smooth and clean.
- X 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
- X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>22.1°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>16%</u> |
- X 8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

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

Record the actual distance: 376 mm

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

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))

Record the right side distance: 501 mm

Record the left side distance: 501 mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2155.0×10^{-6} mm (80 micro inches) (RMS). (572.122(c)(4))

Record actual micro finish: 40.9 micro inches

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

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$245 \text{ g} \leq x \leq 300 \text{ g}$	276 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-14.4 g

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

David Schoedel
Signature

11/20/2014
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 6 YEAR OLD

ATD Serial No: 155

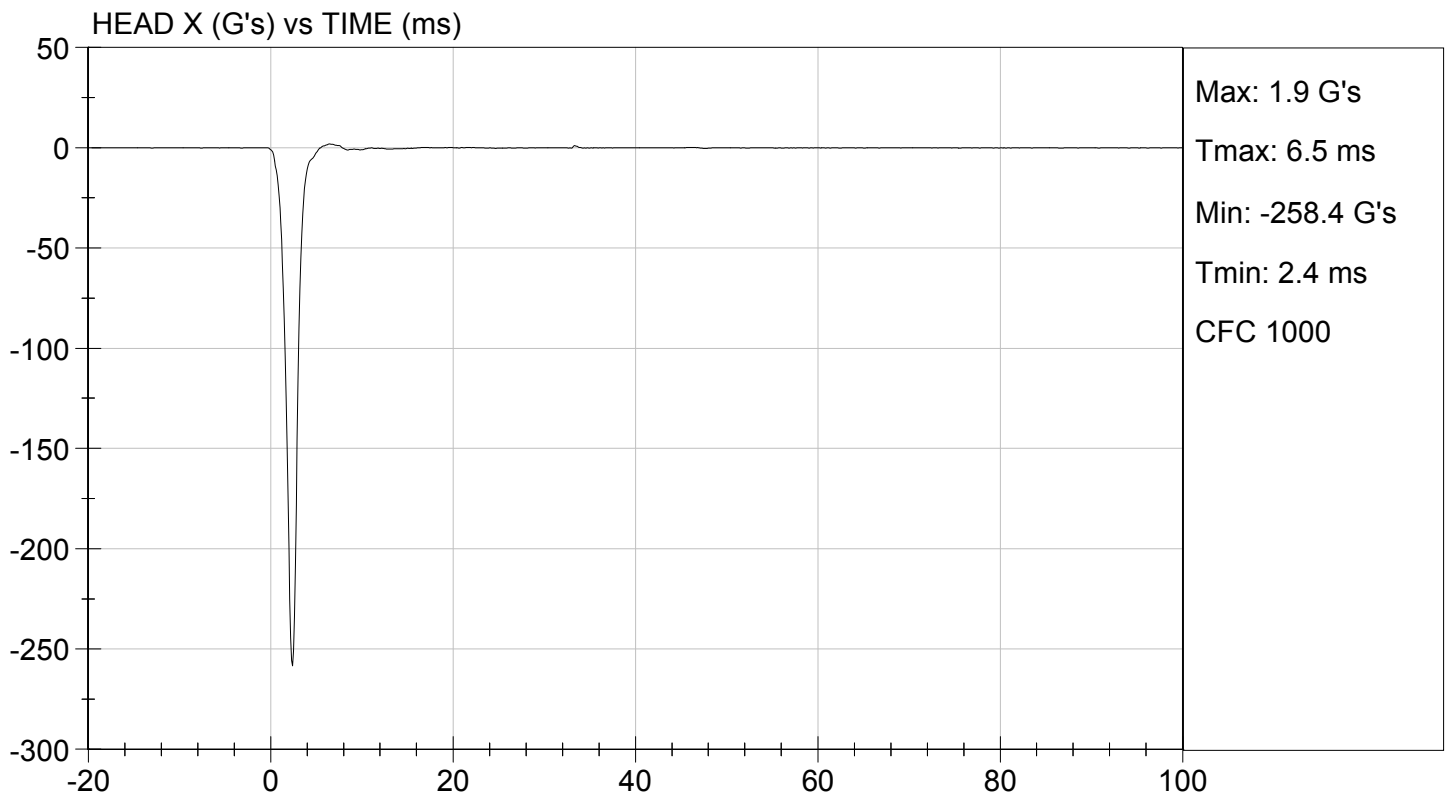
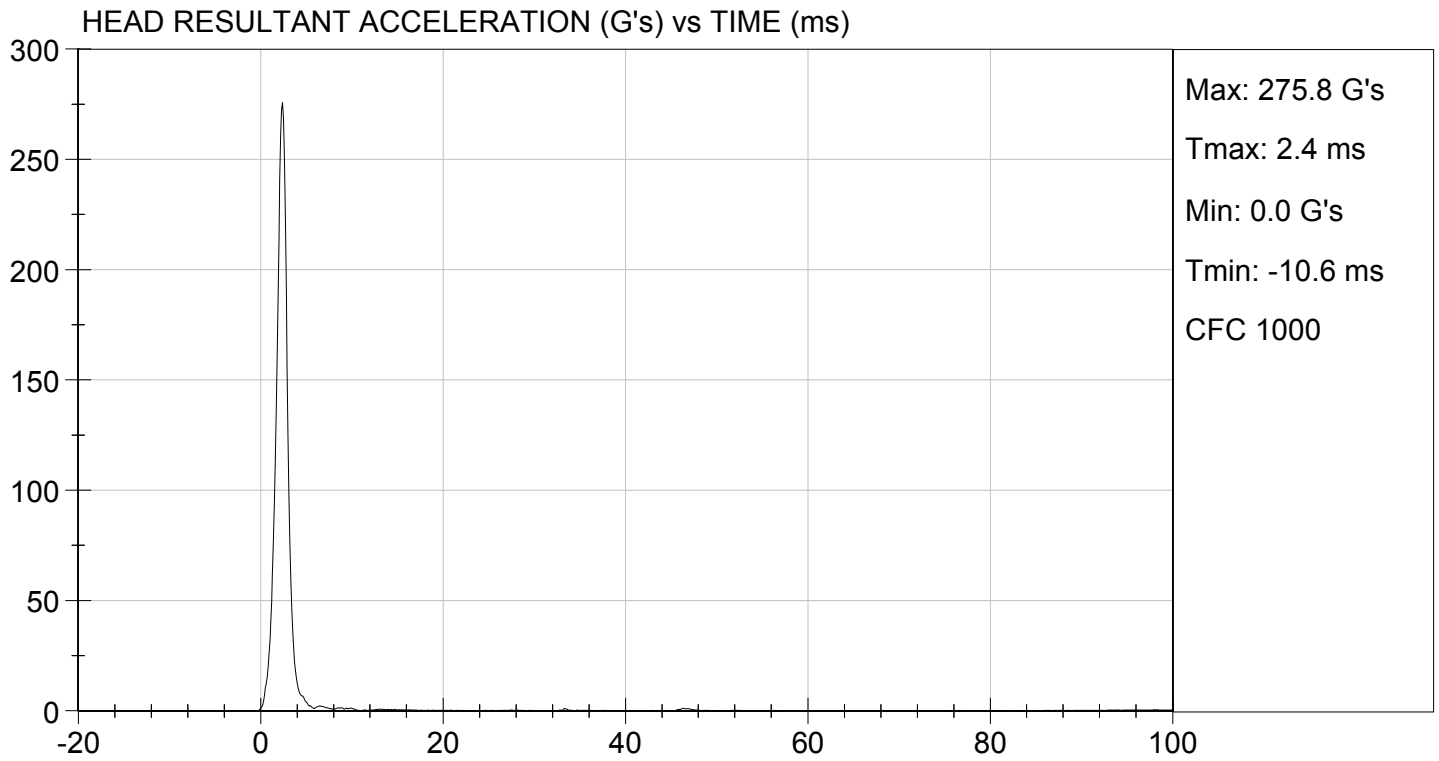
Test ID: D144121

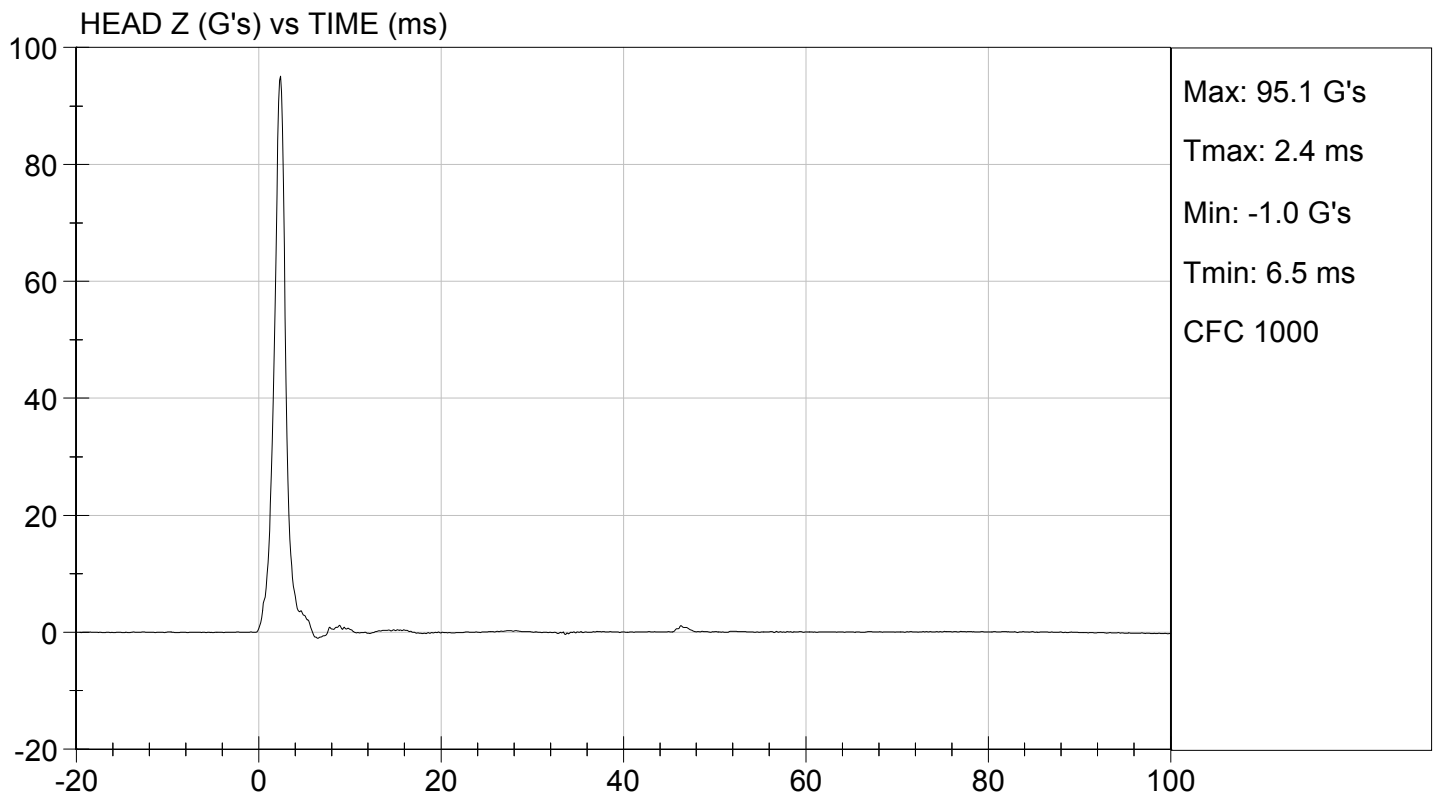
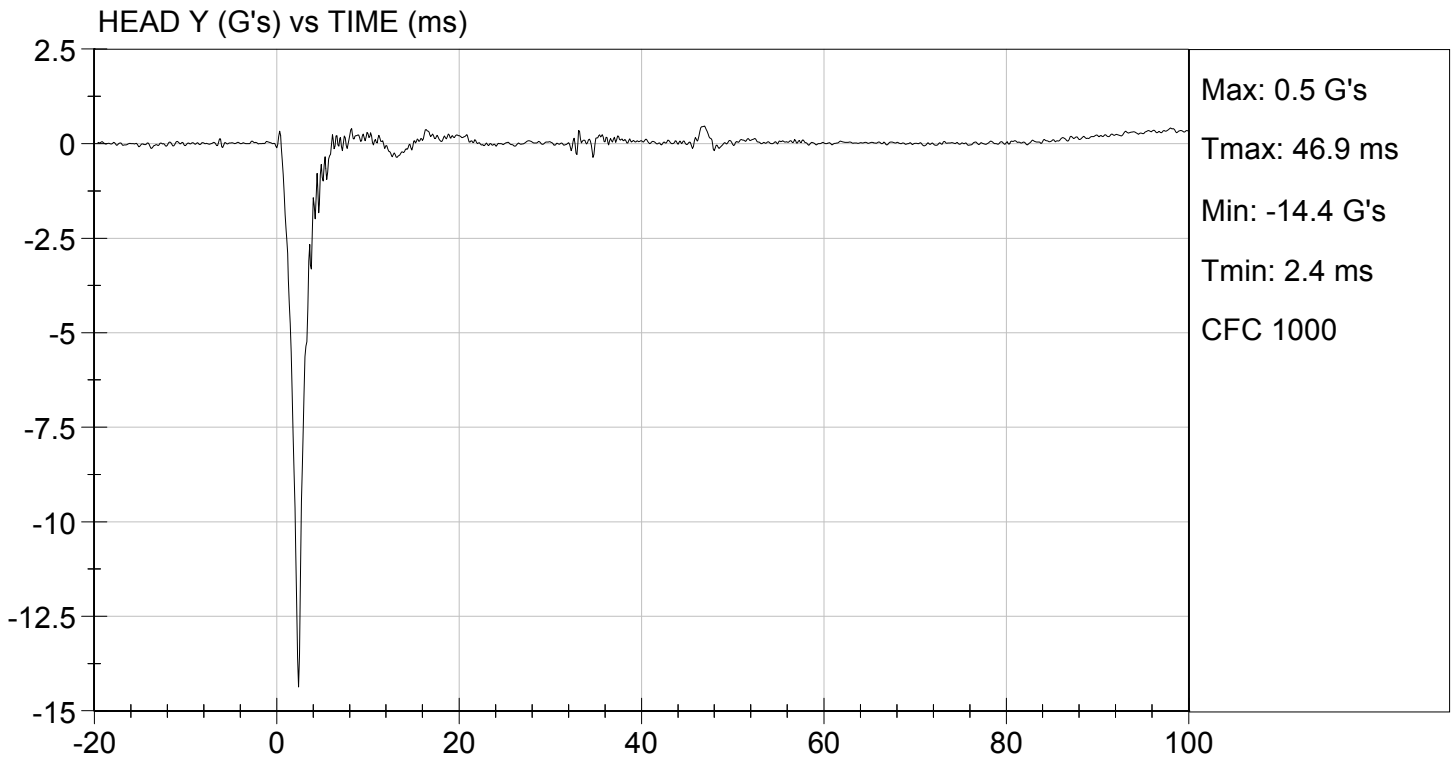
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	16	Pass
Peak Resultant Acceleration	G's	245 to 300	276	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-14.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

11/20/2014
Test Date

Jeff Leonard
Approved By





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

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: Jessica Gall

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.127(o))
 X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in 572.122. Data from the accelerometers are not required. (572.123(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>22.1°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>16%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage
- X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

- X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123I(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123I(3))
- X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123I(4)(i))
- X 12. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		$4.83 \text{ m/s} \leq \text{speed} \leq 5.07 \text{ m/s}$	4.98 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.2 \text{ m/s} \leq \Delta V \leq 1.6 \text{ m/s}$	1.6 m/s
	@ 20 ms	$2.4 \text{ m/s} \leq \Delta V \leq 3.4 \text{ m/s}$	3.0 m/s
	@ 30 ms	$3.8 \text{ m/s} \leq \Delta V \leq 5.0 \text{ m/s}$	4.3 m/s
Plane D Rotation		Peak moment* $27 \text{ Nm} \leq \text{moment} \leq 33 \text{ Nm}$ during the following rotation range $74^\circ \leq \text{angle} \leq 92^\circ$	28 Nm @ 78 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm $103 \text{ ms} \leq \text{time} \leq 123 \text{ ms}$	110 ms

*Moment about the occipital condyle = $My - (0.01778 \text{ m} \times Fx)$ (572.123(b)(1)(iii))

My = Moment in Nm measured by the transducer

Fx = Force, in N measured by the transducer

**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

 Jessica Hall
Signature

 11/20/2014
Date

MGA RESEARCH CORPORATION

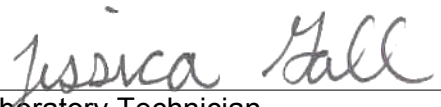
NECK FLEXION TEST

HYBRID III 6 YEAR OLD

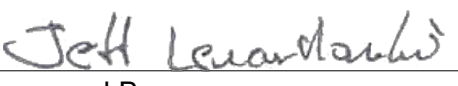
ATD Serial No: 155

Test I.D: D144122

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	17	Pass
Pendulum Speed		m/s	4.83 to 5.07	4.98	Pass
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.6	Pass
	20 ms	m/s	2.4 to 3.4	3.0	Pass
	30 ms	m/s	3.8 to 5.0	4.3	Pass
D Plane Rotation	Max	deg	74 to 92	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	27 to 33	28	Pass
Positive Moment Time Curve Decay to 5 Nm		ms	103 to 123	110	Pass
Overall Results					Pass


 Laboratory Technician

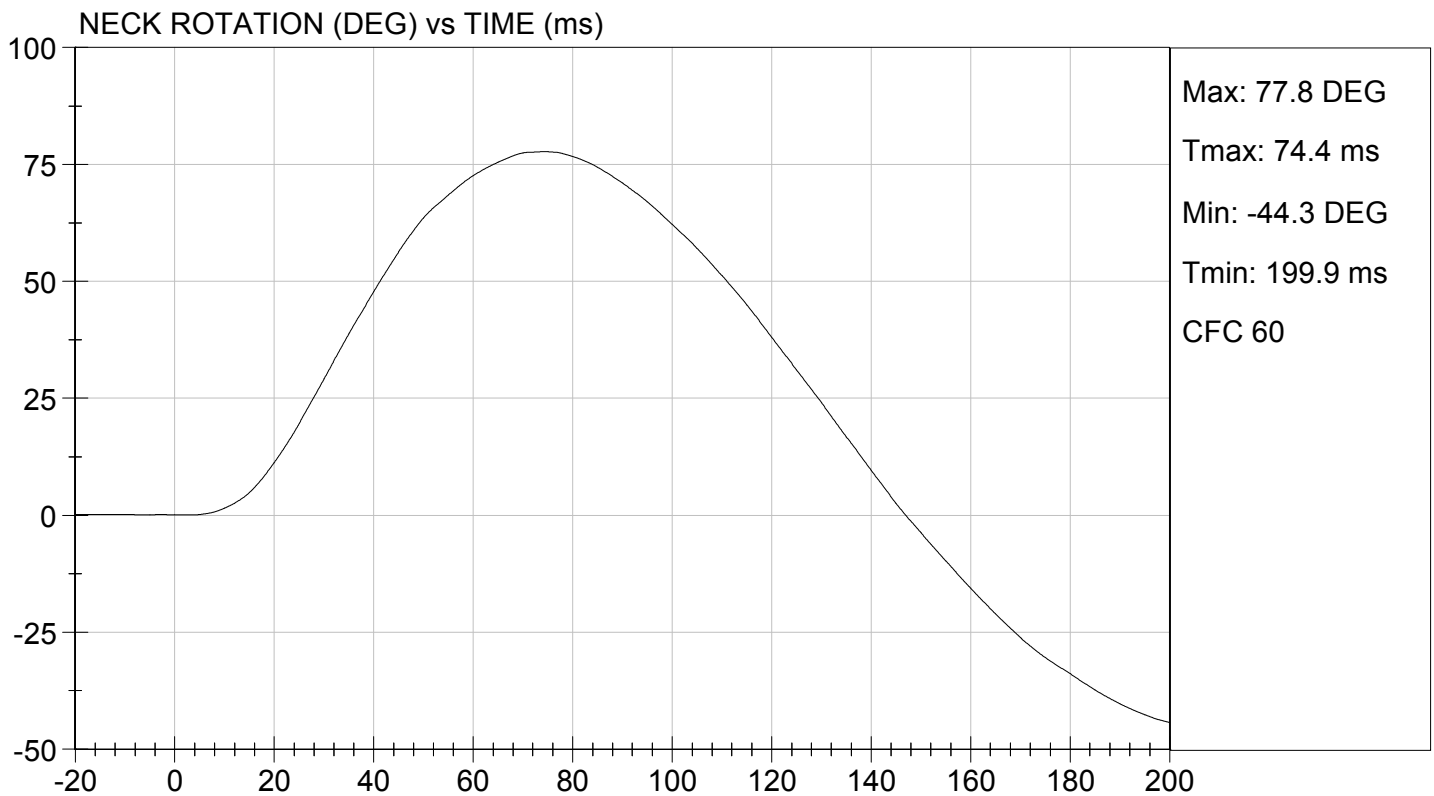
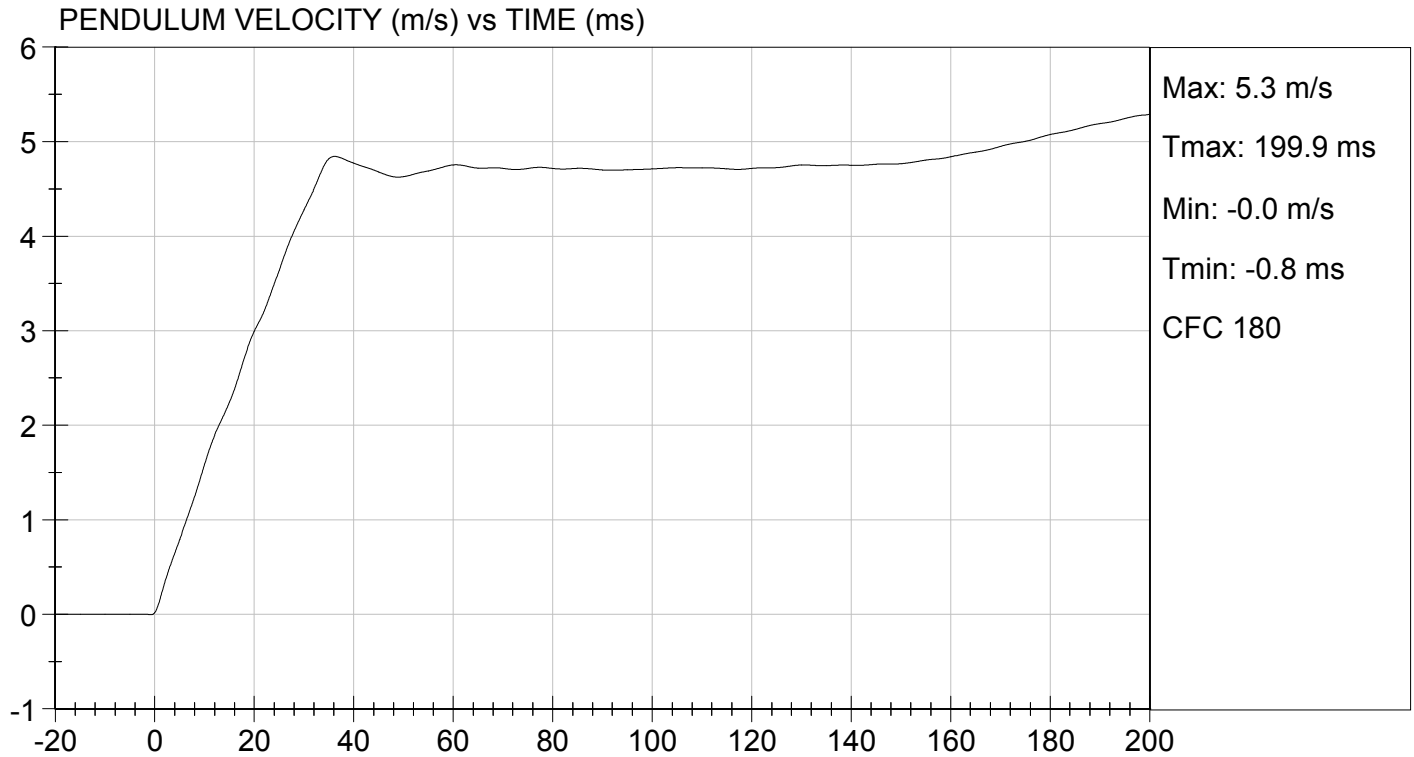
11/20/2014
 Test Date


 Approved By



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

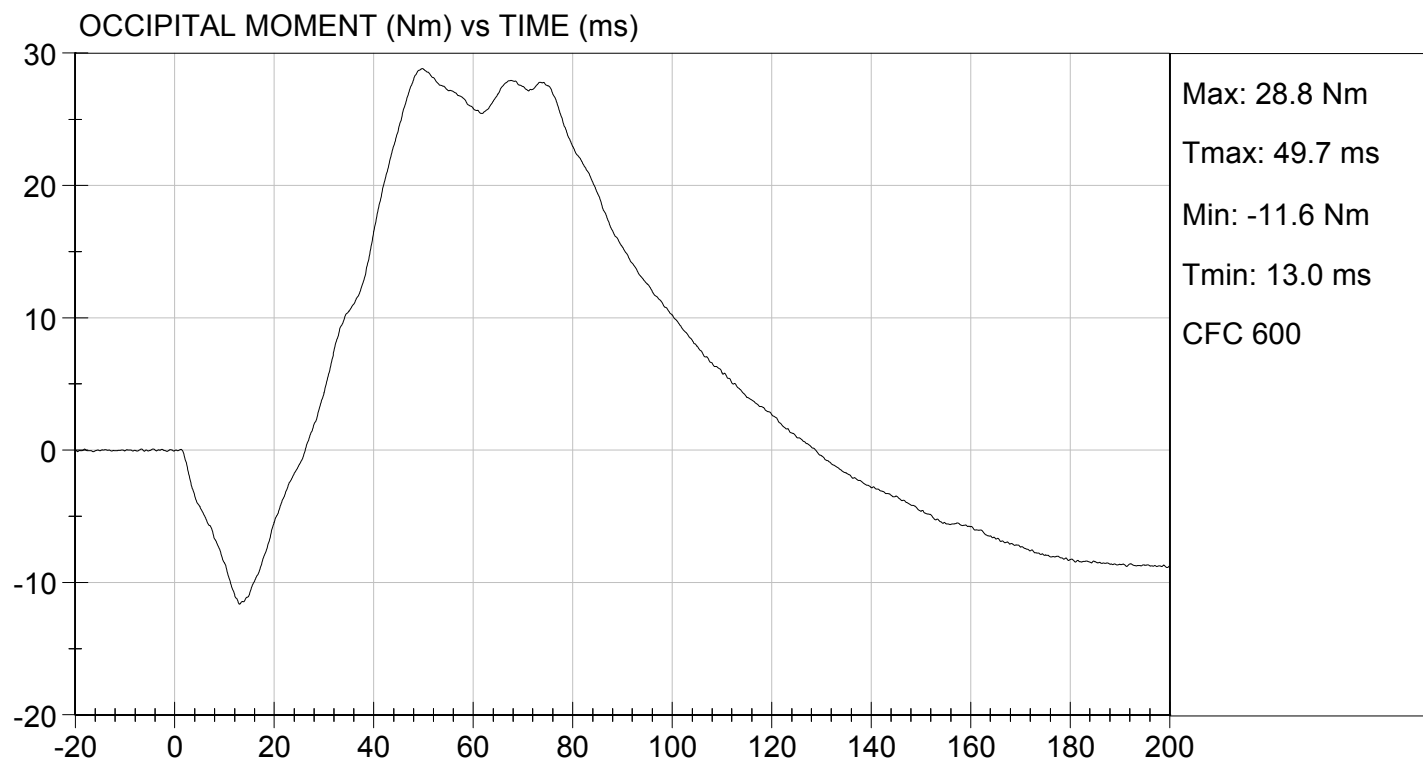
TEST DATE: 11/20/2014
TEST #: D144122





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

TEST DATE: 11/20/2014
TEST #: D144122



DATA SHEET C5
NECK EXTENSION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: Jessica Gall

 Pre test calibration
X Post test calibration verification

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

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

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

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))

Record the maximum temperature	<u>22.1°C</u>
Record the minimum temperature	<u>20.8°C</u>
Record the maximum humidity	<u>18%</u>
Record the minimum humidity	<u>16%</u>

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

Record findings and actions: No damage

X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.

Record findings and actions: No damage

- X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
- X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))
- X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.
- X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))
- X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		$4.18 \text{ m/s} \leq \text{speed} \leq 4.42 \text{ m/s}$	4.42 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$	1.4 m/s
	@ 20 ms	$2.2 \text{ m/s} \leq \Delta V \leq 3.0 \text{ m/s}$	2.8 m/s
	@ 30 ms	$3.2 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$	4.1 m/s
Plane D Rotation		Peak moment* $-24 \text{ Nm} \leq \text{moment} \leq -19 \text{ Nm}$ during the following rotation range $85^\circ \leq \text{angle} \leq 103^\circ$	-19 Nm @ 95 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm $123 \text{ ms} \leq \text{time} \leq 147 \text{ ms}$	132 ms

*Moment about the occipital condyle = $M_y - (0.01778 \text{ m} \times F_x)$ (572.123(b)(2)(iii))

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. (572.123(b)(3))

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

Jessica Hall
Signature

11/20/2014
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D144123

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	17	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.42	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.4	Pass
	20 ms	m/s	2.2 to 3.0	2.8	Pass
	30 ms	m/s	3.2 to 4.2	4.1	Pass
D Plane Rotation	Max	deg	85 to 103	95	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-19	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	132	Pass
Overall Results					Pass

Jessica Hall
Laboratory Technician

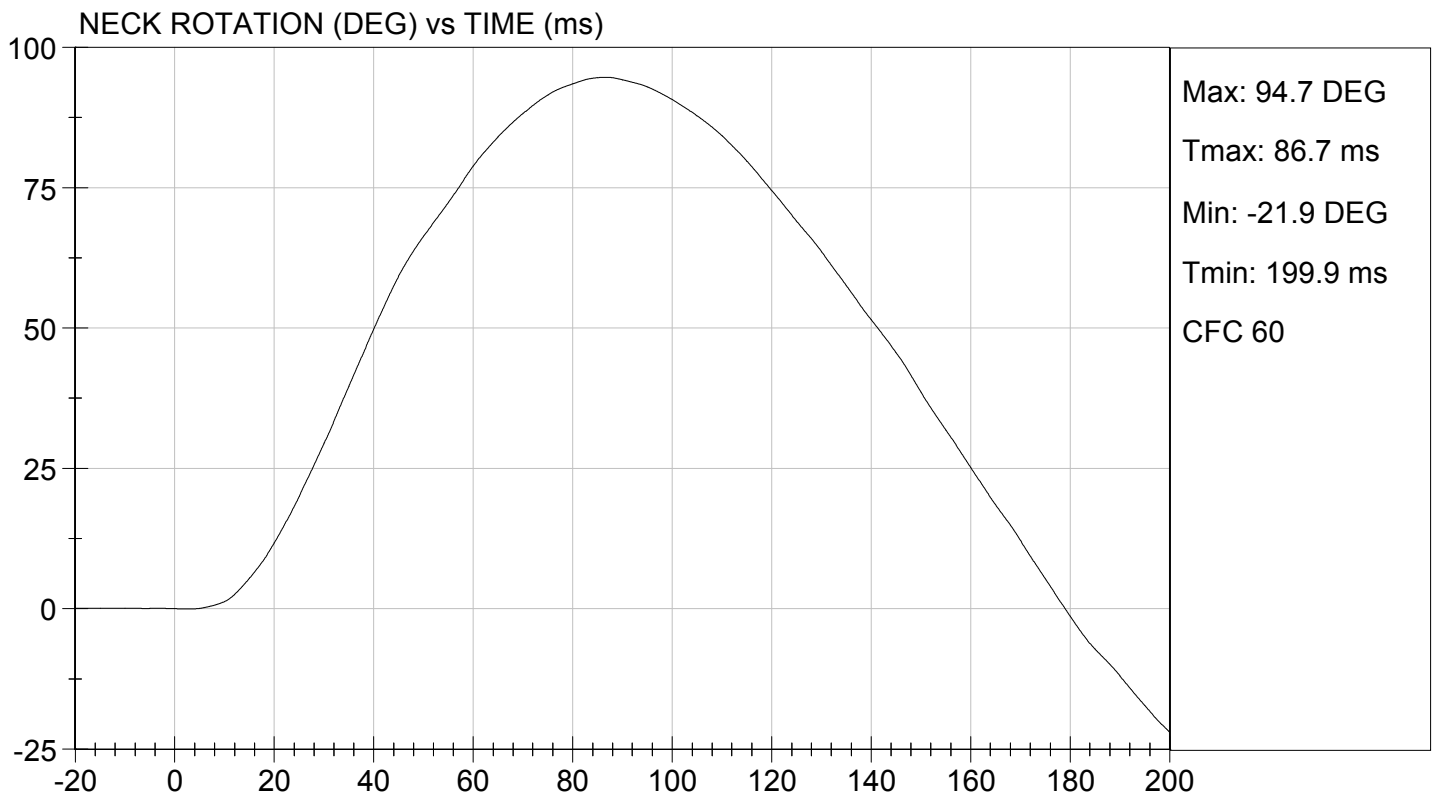
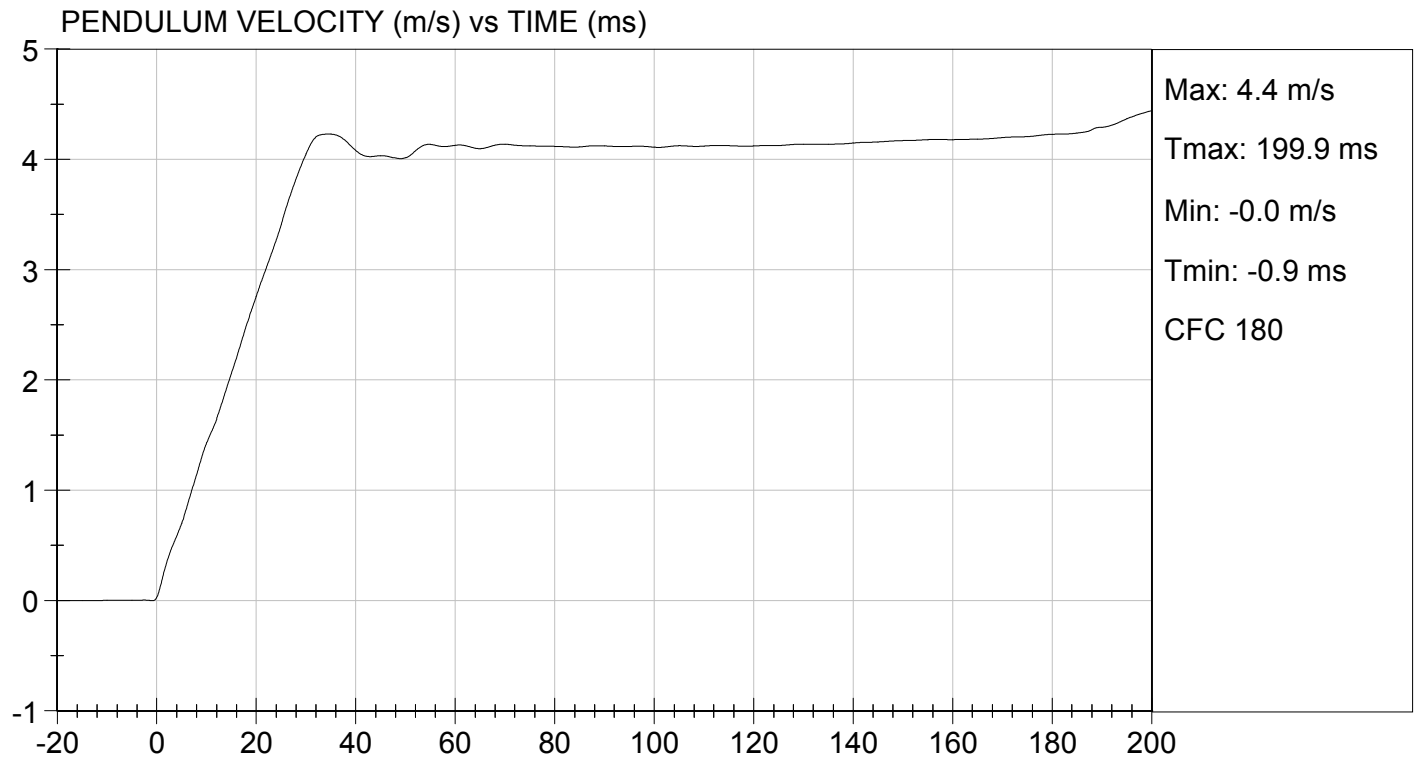
11/20/2014
Test Date

Jeff Leonard
Approved By



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

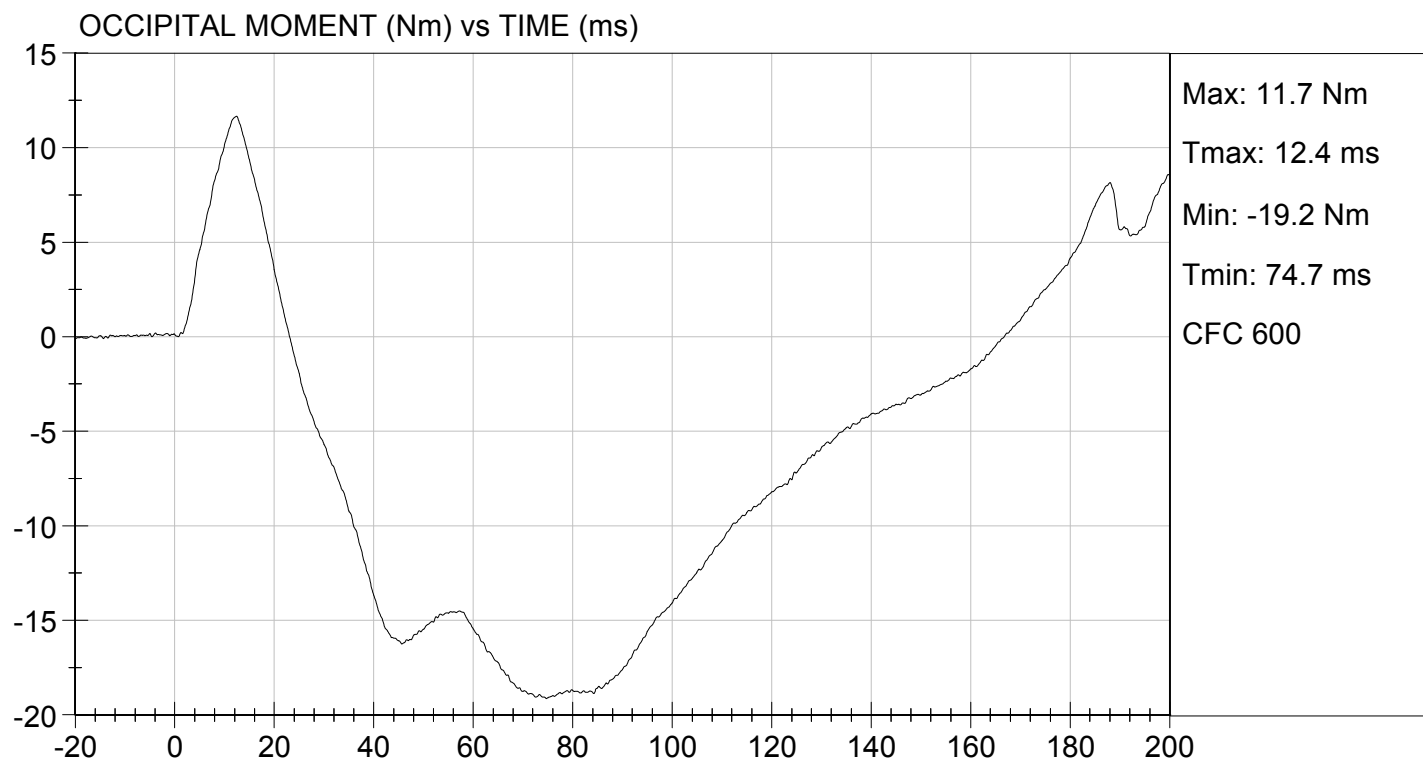
TEST DATE: 11/20/2014
TEST #: D144123





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

TEST DATE: 11/20/2014
TEST #: D144123



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

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: David Schoedel

 Pre test calibration
X Post test calibration verification

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

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

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

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

X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.134(c)(1))

Record the maximum temperature	<u>22.1°C</u>
Record the minimum temperature	<u>20.8°C</u>
Record the maximum humidity	<u>18%</u>
Record the minimum humidity	<u>16%</u>

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

Record findings and actions:

X - No damage

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

 - The following repairs or replacement was performed. Record damage.

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

- X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))
- X 8. Level the ribs both longitudinally and laterally $\pm 0.5^\circ$ and adjust the pelvis angle to $8^\circ \pm 2^\circ$. The angle may be measured at the pelvis lumbar joining surface.
- X 9. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.124(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is $12.7 \text{ mm} \pm 1 \text{ mm}$ 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. (572.124(c)(3))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- X 14. Place the arm assemblies horizontal $\pm 2^\circ$ and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$. (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

- X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2))		
Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$	42.4 mm
Peak force** between 38.0 and 46.0 mm chest compression	$1150\text{N} \leq \text{peak force} \leq 1380\text{N}$	1231 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force $\leq 1500 \text{ N}$	1294N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	70%

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

**Force = impactor mass x acceleration

***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

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

David Schoedel

Signature

11/20/2014

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D144124

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	22.1	Pass
Relative Humidity	%	10 to 70	17	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	38.0 to 46.0	42.4	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,231	Pass
Internal Hysteresis	%	65 to 85	70	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,294	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

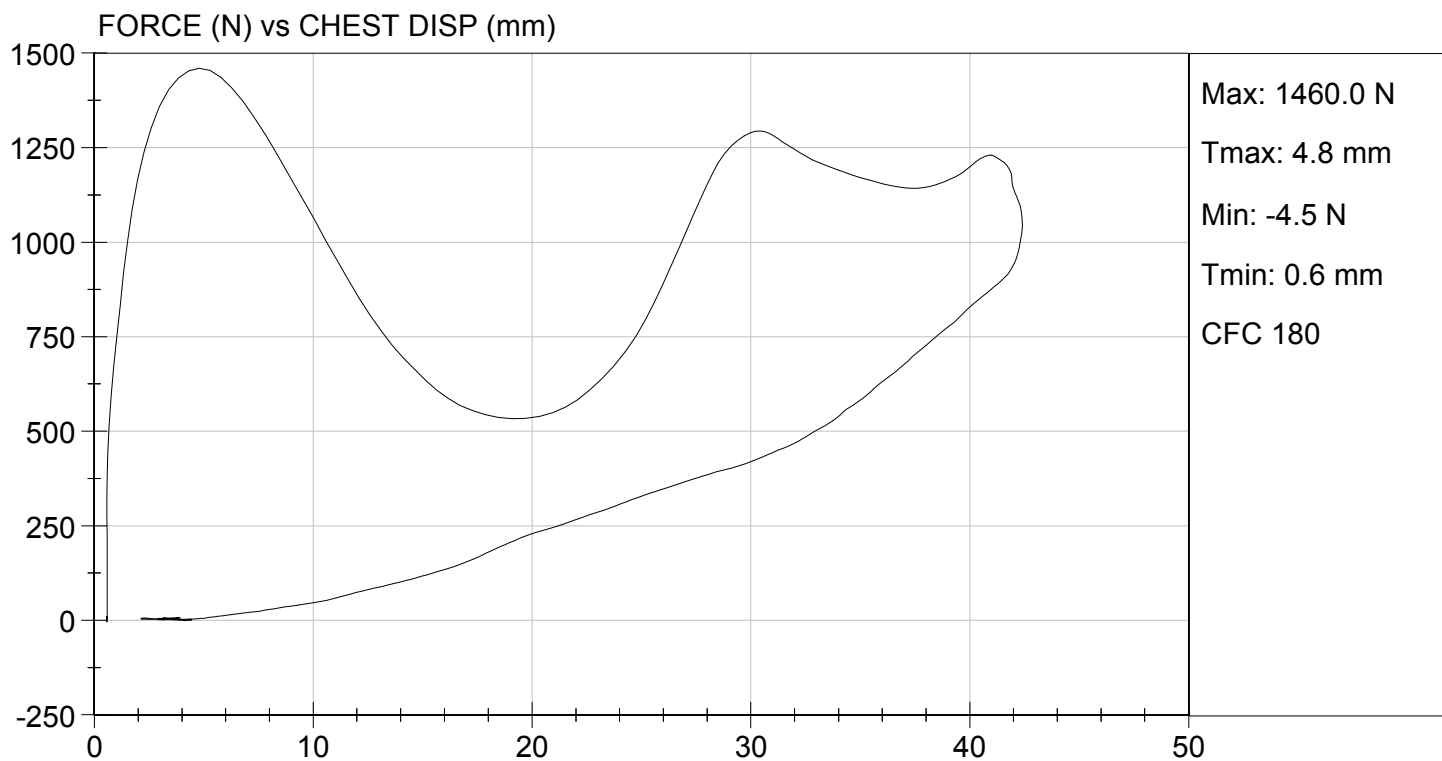
11/20/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 11/20/2014
TEST #: D144124



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

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))
 X N/A, ONLY one torso flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 11C.
- X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
 X with legs below the femurs.
 without legs below the femurs.
- X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>22.1°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>16%</u> |
- X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
- X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
- X 7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
- X 8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
- X 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

- X 10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))
 Record reference plane angle (max. allowed 22°) See Result Table
- X 11. Attach the pull cable and the load cell. (572.125(c)(6))
- X 12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))
- X 13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))
- X 14. As quickly as possible release the force applied to the attachment bracket. (572.125(c)(9))
- X 15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))
- X 16. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 22°	18°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	1.3°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	147 N
Final ref. plane angle	Initial ref. plane angle ± 8°	22°

David Schoedel
 Signature

11/20/2014
 Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D144127

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Initial Angle	deg	0 to 22	18	Pass
Return Angle	deg	+/- 8	22	Pass
Force at 45 deg	N	147 to 200	147	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.3	Pass
Overall Result			Pass	

David Schoedel

Laboratory Technician

11/20/2014

Test Date

Jeff Leonard

Approved By

DATA SHEET C8
LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 12C.
- X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>22.1°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>16%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

- X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.09 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2133 N

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

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

David Schoedel

Signature

11/20/2014

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D144126

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	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	2000 to 3000	2133	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

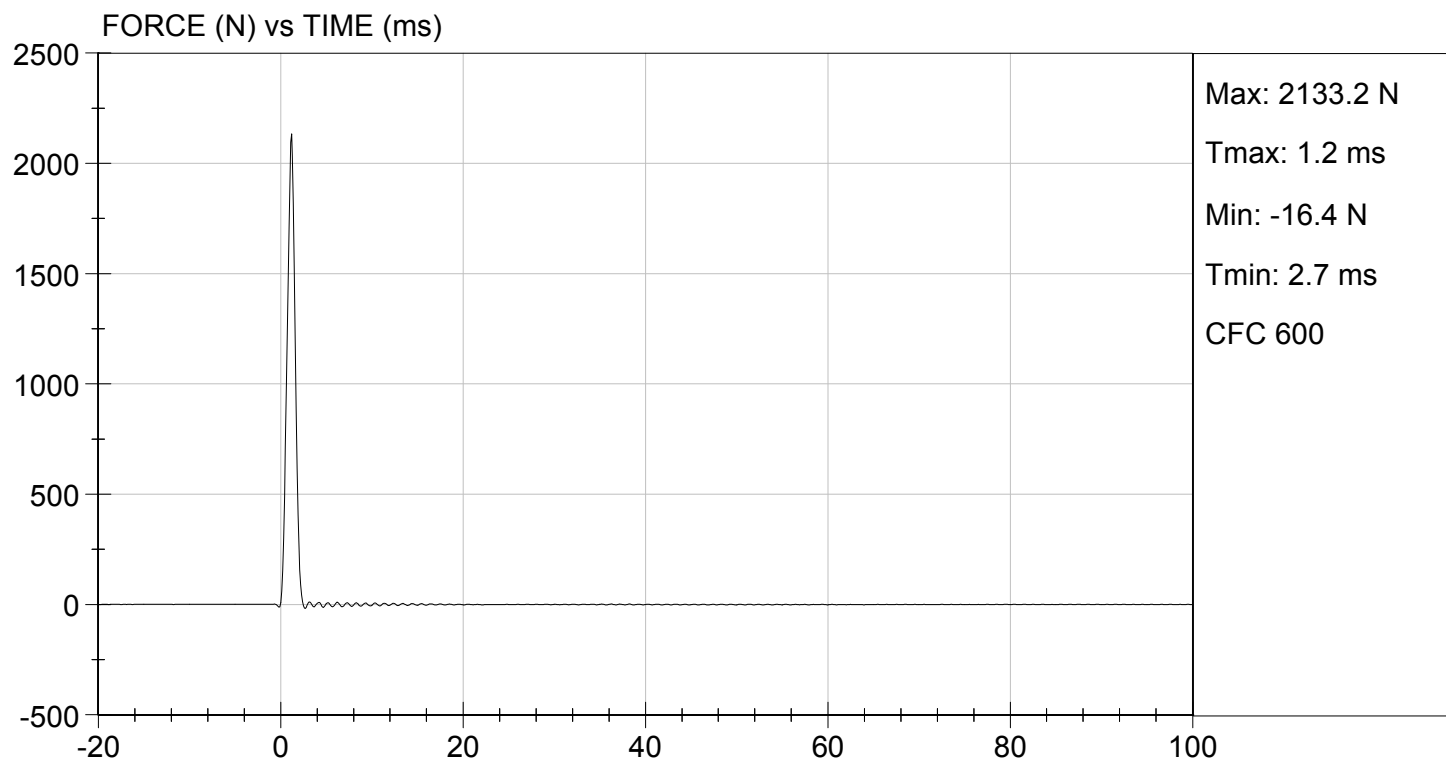
11/20/2014
Test Date

Jeff Leonard
Approved By



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

TEST DATE: 11/20/2014
TEST #: D144126



DATA SHEET C9
RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155

Test Date: 11/20/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))
 X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 12C.
- X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>22.1°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>16%</u> |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

 X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2279 N

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

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

David Schoedel

Signature

11/20/2014

Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D144125

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	18	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	2000 to 3000	2279	Pass
Overall Test Results				Pass

David Schoedel

Laboratory Technician

11/20/2014

Test Date

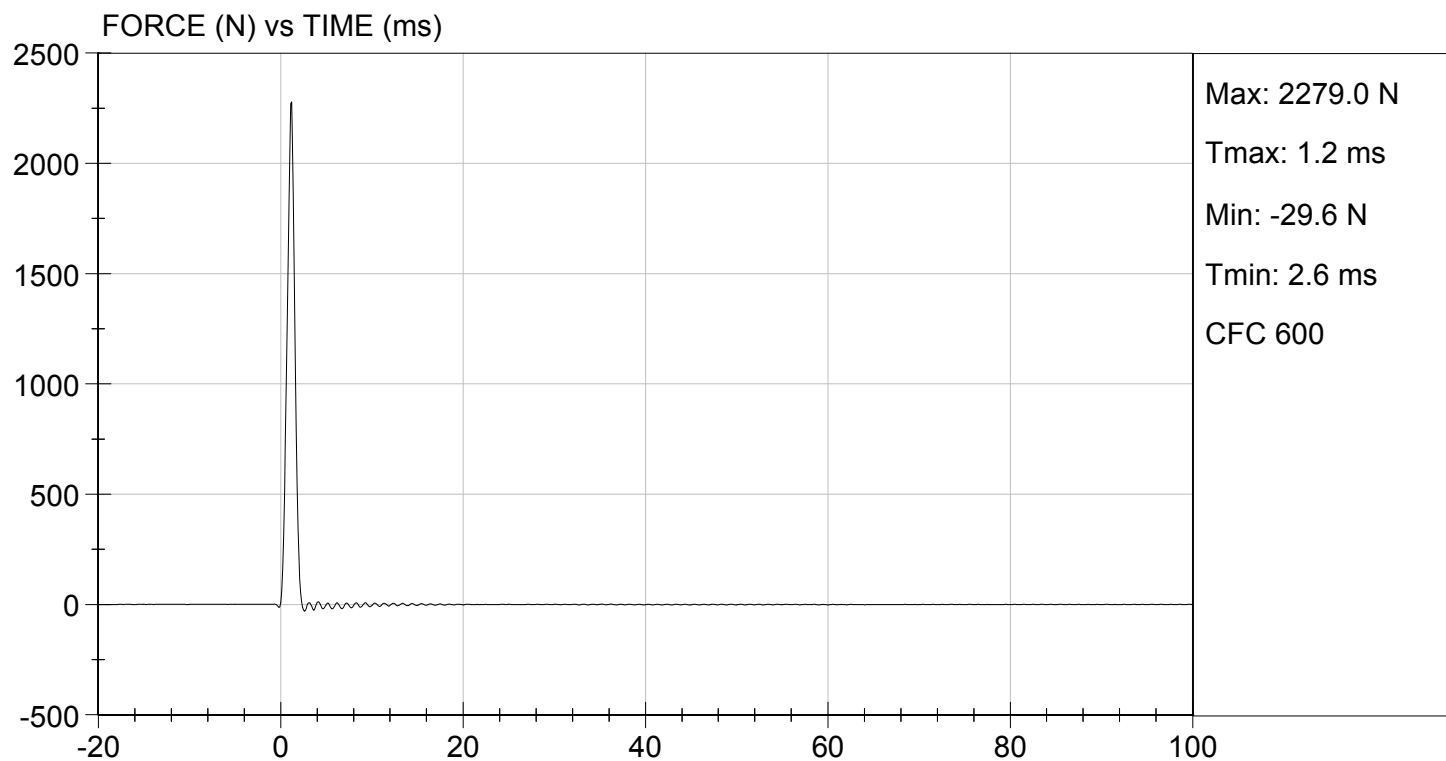
Jeff Leonard

Approved By



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

TEST DATE: 11/20/2014
TEST #: D144125



DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78692	07/02/2014	01/02/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P78776	07/02/2014	01/02/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79751	07/02/2014	01/02/2015
NECK TRANSDUCER	Denton	1716A	1562	10/18/2014	04/18/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78983	07/02/2014	01/02/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P78984	07/02/2014	01/02/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P78986	07/02/2014	01/02/2015
CHEST POTENTIOMETER	Servo	08C1-3179	155	07/09/2014	01/09/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2014
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2014
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 155

Test Date: 11/18-11/19/2014

Technician: Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damage	OK
Outer skin	Gashes, rips, cracks			X
Head	Ballast secure			X
	General appearance			X
Neck	Broken or cracked rubber			X
	Upper neck bracket firmly attached to the lower neck bracket			X
	Looseness at the condyle joint			X
	Nodding blocks cracked or out of position			X
Spine	Broken or cracks in rubber			X
Ribs	Broken or bent ribs			X
	Broken or bent rib supports			X
	Damping material separated or cracked			X
	Rubber bumpers in place			X
Chest Displacement Assembly	Bent shaft			X
	Slider arm riding in track			X
Transducer leads	Torn cables			X
Accelerometer Mountings	Head mounting secure			X
	Chest mounting secure			X
Knees	Skin condition			X
	Insert (do not remove)			X
	Casting			X
Limbs	Normal movement and adjustment			X
Knee Sliders	Wires intact			X
	Rubber returned to "at rest" position			X
Pelvis	Broken			X
Other				X

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

Repair or Replacement approved by:

Jessica Hall
Signature

11/20/2014
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard
Signature

11/20/2014
Date

EXTERNAL DIMENSIONS

HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	538.5-553.7	539.7
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	307.4-322.6	316.4
C	H-POINT HEIGHT	Reference	34.3-44.5	41.2
D	H-POINT LOCATION FROM BACKLINE	Reference	56.9-67.1	65.3
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder pivot bolt to the fixture's rear vertical surface.	60.9-71.1	65.8
F	THIGH CLEARANCE	Fixture's seat surface to highest point on the upper leg segment	81.0-91.2	85.7
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the finger tip, in line with the elbow and wrist centerlines	247.4-262.6	251.3
H	HEAD BACK TO BACKLINE	Rearmost surface of the head to the fixture's rear vertical surface (Reference)	48.2-58.4	53.1
I	SHOULDER TO - ELBOW LENGTH	Measure from the highest point on top of the shoulder to the lowest part of the flesh on the elbow in line with the shoulder and elbow pivot bolts.	185.4-200.6	199.3
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	133.6-148.8	141.4
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the fixture's rear vertical surface, in line with the knee and hip pivots.	284.8-300.0	288.6
L	POPLITEAL HEIGHT	Seat surface to the horizontal plane of the bottom of the feet.	218.5-233.7	225.9
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	241.6-256.8	251.3
N	BUTTOCK POPLITEAL LENGTH	The most forward portion of the crevice between the upper and lower legs behind the knee to the fixture's rear vertical surface.	218.0-233.2	230.1

HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITH JACKET	Measured 254.0 ± 5.1 mm above seat surface	138.5-153.7	151.7
P	FOOT LENGTH	Tip of toe to rear of heel	137.6-147.8	143.6
Q	STATURE	Lay the dummy out on a flat surface with the rear surfaces of the head, upper torso, buttocks and heels touching the surface and with the bottom of the feet perpendicular to that surface. Measure the distance from the bottom of the feet to the top of the head.	932.2-957.6	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	Knee pivot bolt to the fixture's rear vertical surface.	251.4-261.6	260.1
S	HEAD BREADTH	Distance across the widest of the head at its widest point	128.3-143.5	133.8
T	HEAD DEPTH	Distance from the forward most surface of the head to the rearmost surface of the head, in line with the midsagittal plane.	167.4-182.6	172.7
U	HIP BREADTH	Distance across the width of the hip at the widest point of the jacket	200.7-215.9	208.9
V	SHOULDER BREADTH	Distance between the outside edges of the shoulder flesh, in line with the shoulder pivot bolts	236.5-251.7	245.4
W	FOOT BREADTH	The widest part of the foot	53.6-63.8	57.3
X	HEAD CIRCUMFERENCE	At the largest location	500.4-515.6	513.2
Y	CHEST CIRCUMFERENCE WITH JACKET	Distance around chest at reference location AA, with jacket on.	527.1-552.5	541.3
Z	WAIST CIRCUMFERENCE	Distance around chest at reference location BB, with jacket on.	527.1-552.5	532.4
AA	REFERENCE LOCATION FOR DIMENSION Y	Reference: 254.0 ± 5.1 MM above the seat surface	248.9-259.1	254.0
BB	REFERENCE LOCATION FOR DIMENSION Z	Reference: 165.1 ± 5.1 MM above seat surface	160.0-170.2	165.0

DATA SHEET D3
HEAD DROP TEST (572.142) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 10/29/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
- X 3. Accelerometers and their respective mounts are smooth and clean.
- X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.8°C</u> |
| Record the minimum temperature | <u>20.9°C</u> |
| Record the maximum humidity | <u>31%</u> |
| Record the minimum humidity | <u>29%</u> |
- X 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.142(c)(3))
Record the actual distance: 376 mm

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

- X 10. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.142(c)(3))
Record the right side distance: 501 mm
Record the left side distance: 501 mm
- X 11. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.142(c)(4))
Record actual micro finish: 40.9 micro inches
- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))
Record thickness: 50.9 mm
Record width: 604 mm
Record length: 595 mm
- X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b)) & (572.142(c)(4))
- X 14. Complete the following table. (572.142(b)):

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 280 \text{ g}$	272 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	5.0 g

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

10/29/2014
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 031

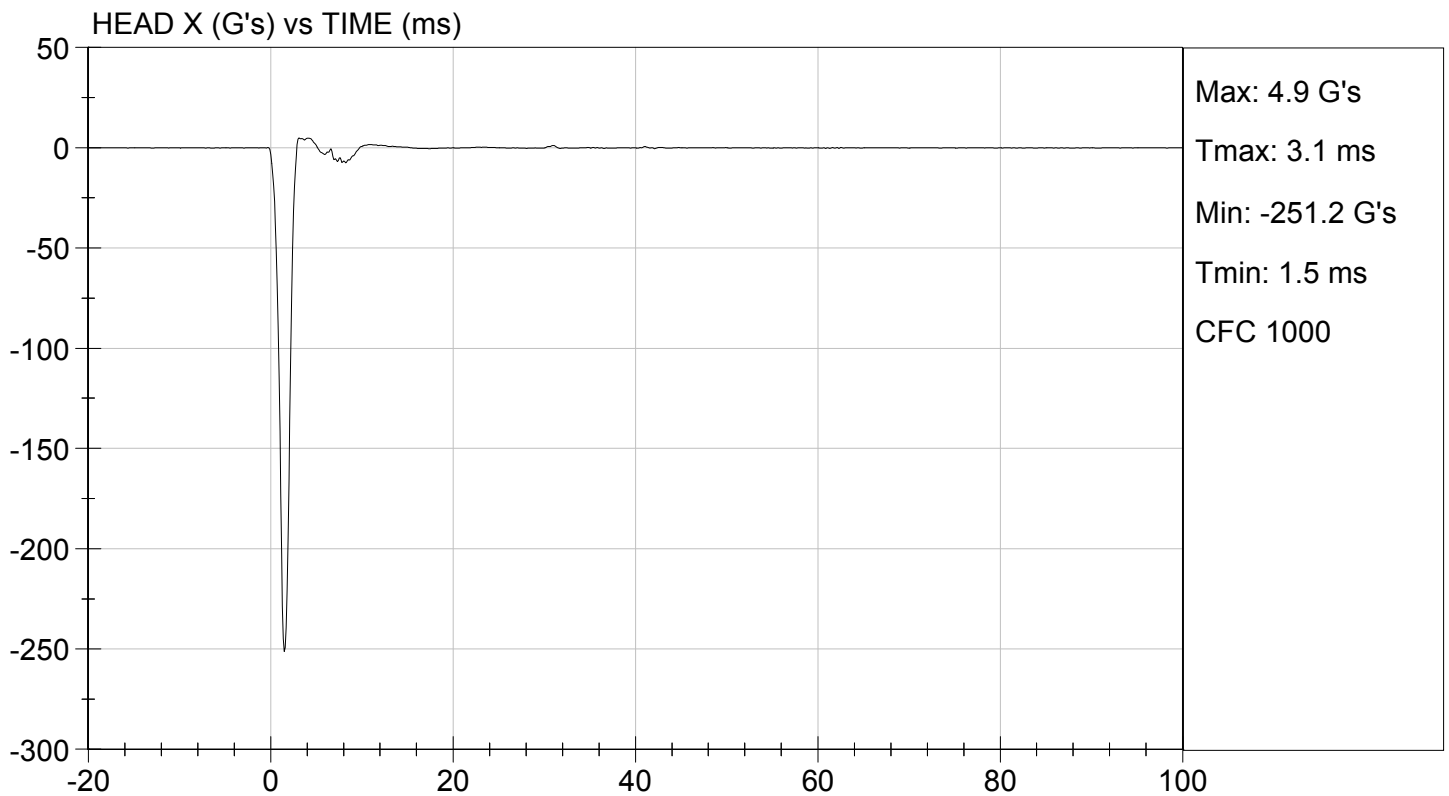
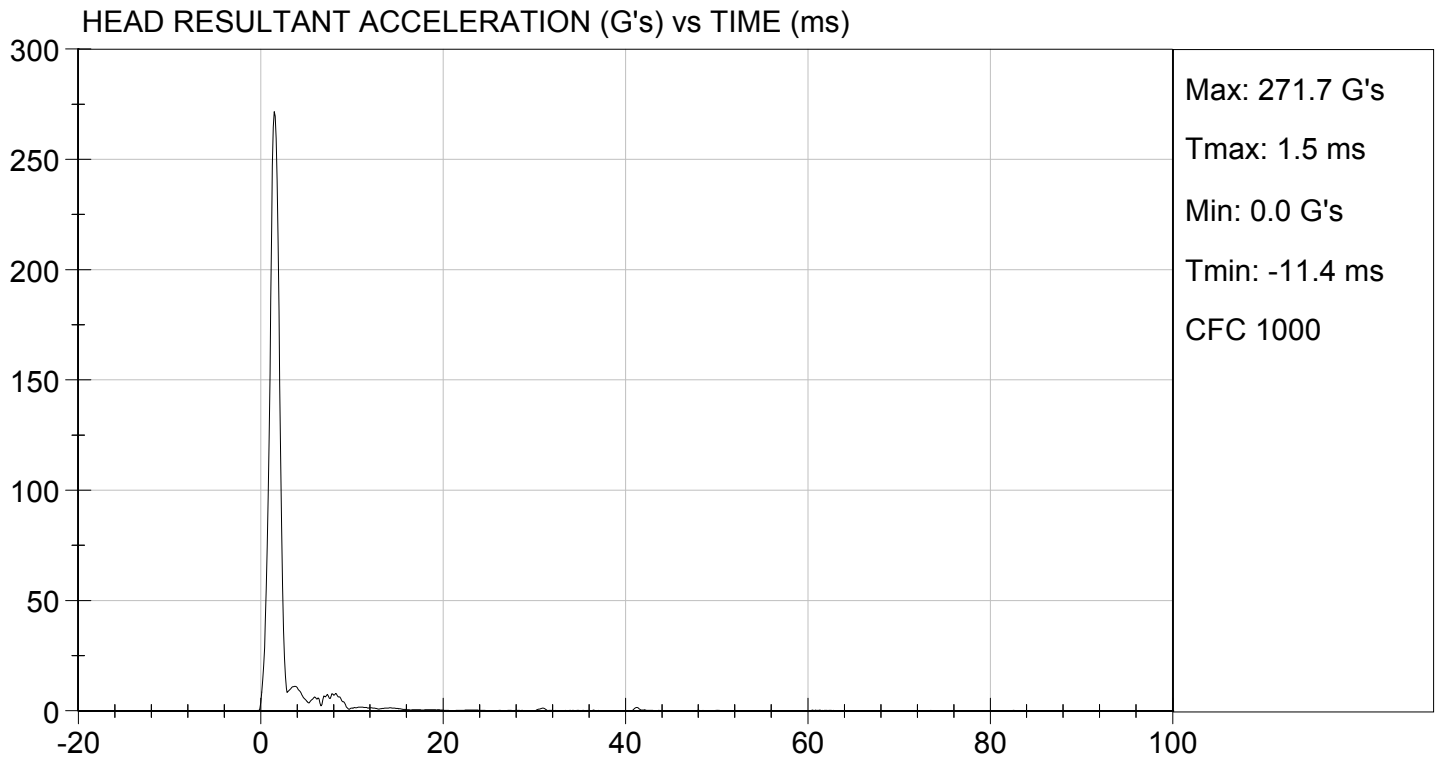
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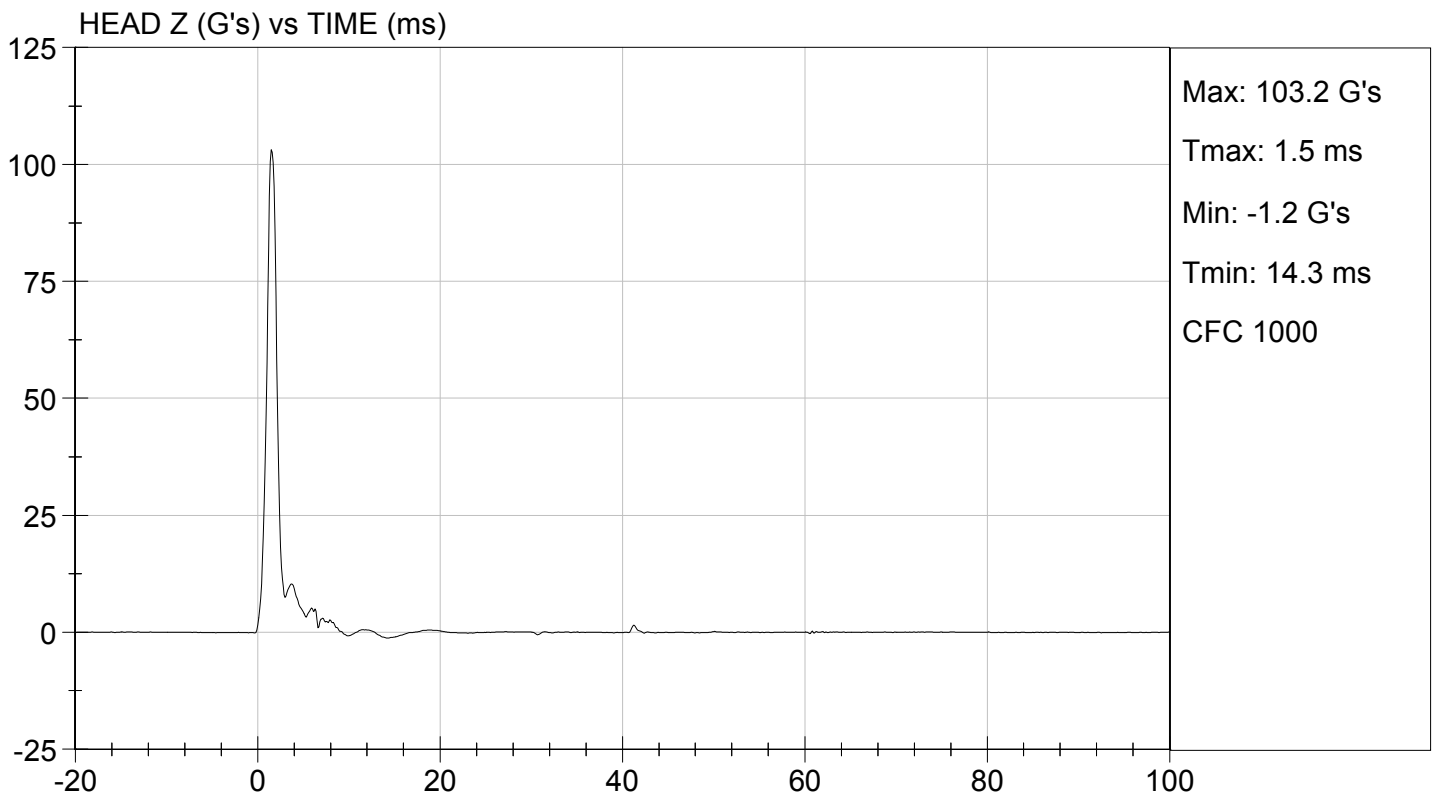
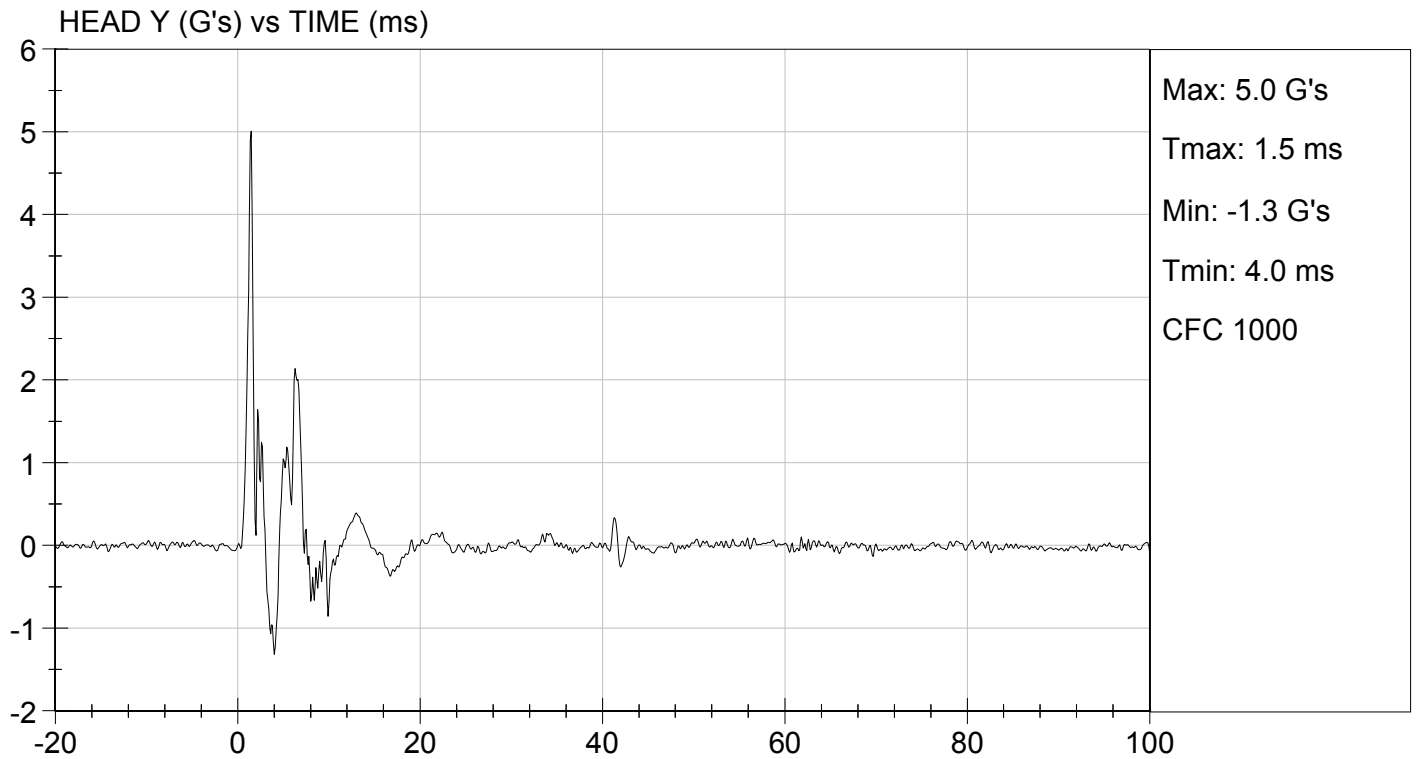
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Peak Resultant Acceleration	G's	250 to 280	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	5.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

10/29/2014
Test Date

Jeff LevanMarsh
Approved By





DATA SHEET D4
NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 10/29/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.8°C</u> |
| Record the minimum temperature | <u>20.9°C</u> |
| Record the maximum humidity | <u>31%</u> |
| Record the minimum humidity | <u>29%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))			
Parameter		Specification	Result
Pendulum impact speed		5.4 m/s $\leq$ speed $\leq$ 5.6 m/s	5.5 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.0 m/s $\leq \Delta V \leq$ 2.7 m/s	2.6 m/s
	@ 15 ms	3.0 m/s $\leq \Delta V \leq$ 4.0 m/s	3.7 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.1 m/s	4.8 m/s
Plane D Rotation		Peak moment* 42 Nm $\leq$ moment $\leq$ 53 Nm during the following rotation range $70^\circ \leq$ angle $\leq$ 82°	42.8 Nm @ 72 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 60 ms $\leq$ time $\leq$ 80 ms	68 ms

*The moment is a direct reading from the load cell

**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel
Signature

10/29/2014
Date

MGA RESEARCH CORPORATION**NECK FLEXION TEST****HYBRID III 3 YEAR OLD**ATD Serial No: 031Test I.D: D143832

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	30	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.5	Pass
Pendulum Velocity	10 ms	m/s	2.0 to 2.7	2.6	Pass
	15 ms	m/s	3.0 to 4.0	3.7	Pass
	20 ms	m/s	4.0 to 5.1	4.8	Pass
D Plane Rotation		deg	70 to 82	72	Pass
Peak Moment within Deflection Corridor		Nm	42.0 to 53.0	42.8	Pass
Positive Moment - Time Curve Decay to 10 Nm		ms	60.0 to 80.0	68	Pass
Overall Test Results				Pass	

David Schoedel
Laboratory Technician

10/29/2014

Test Date

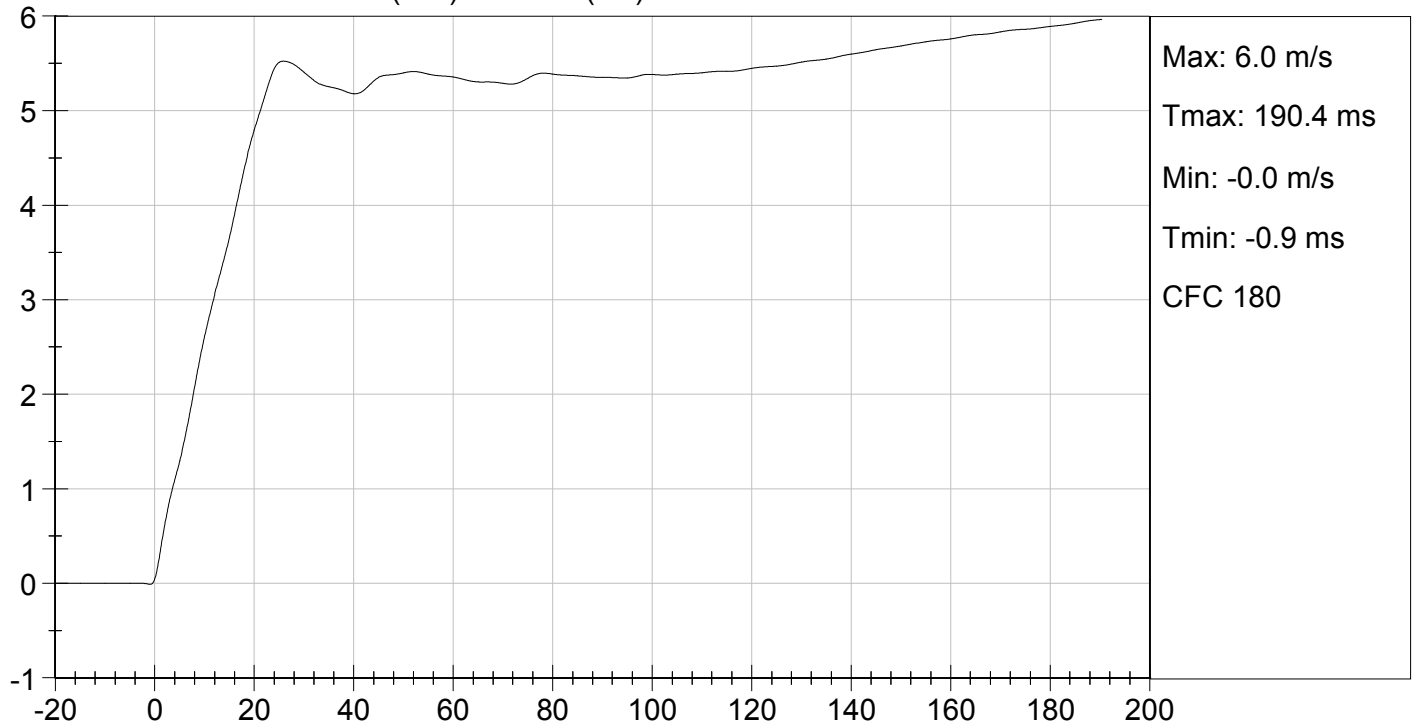
Jeff Leonard
Approved By



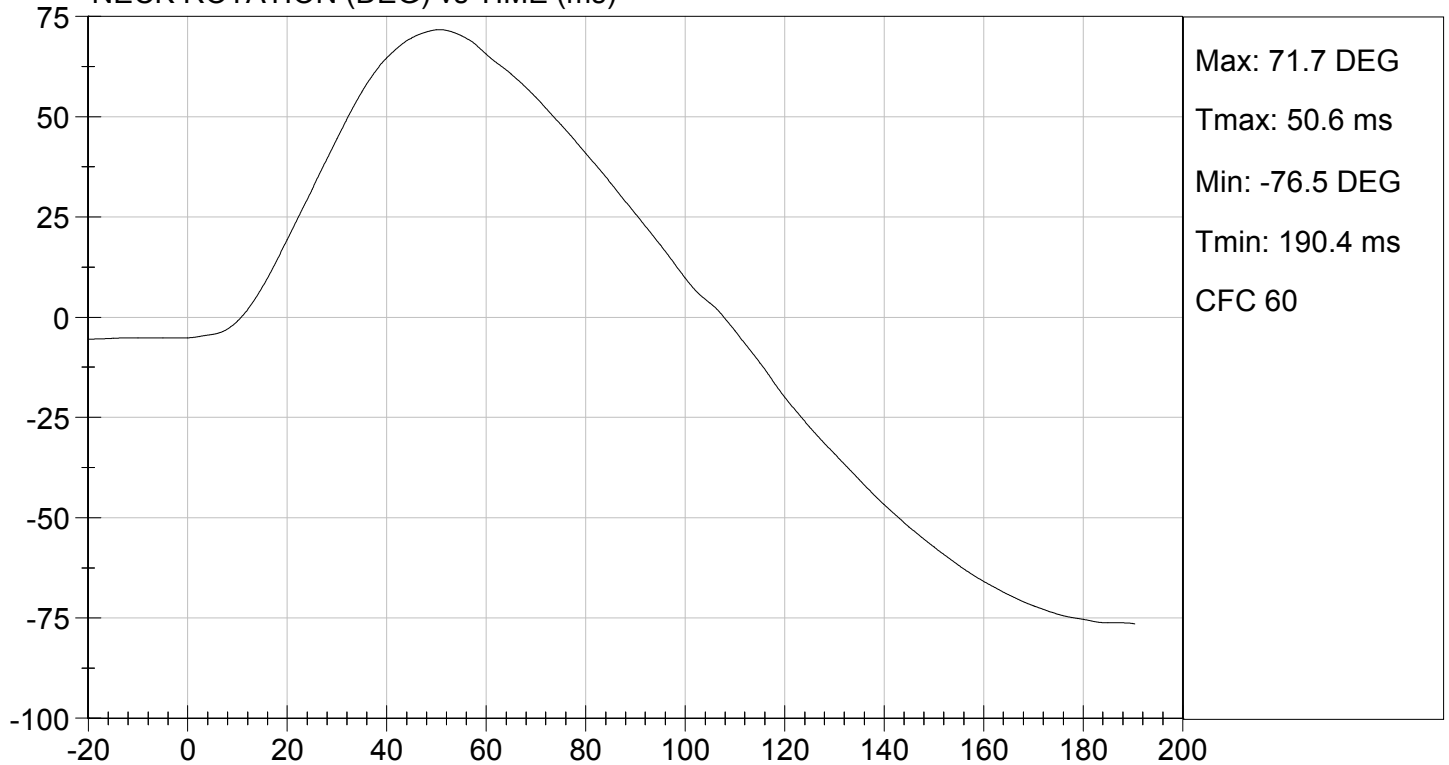
TEST DESC: NECK FLEXION
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 10/29/2014
TEST #: D143832

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



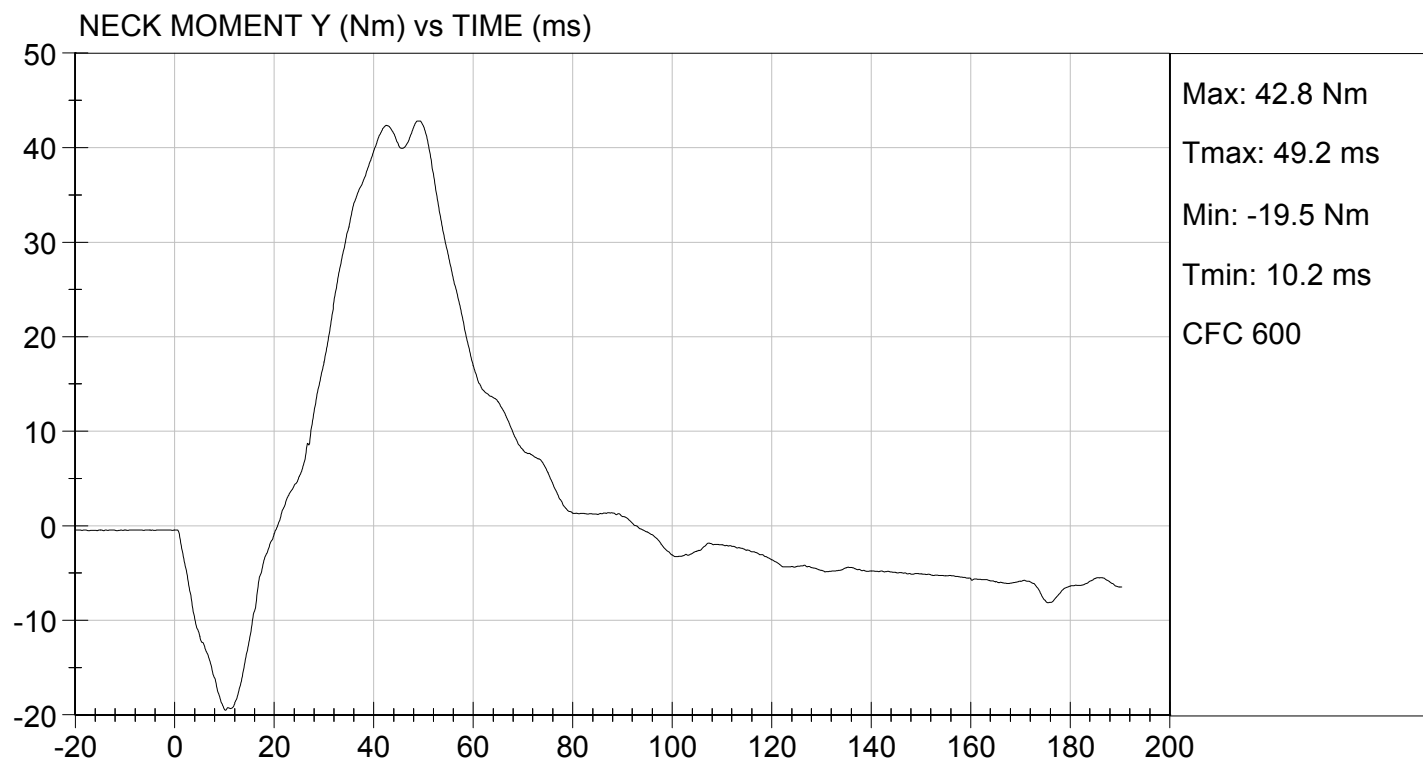
NECK ROTATION (DEG) vs TIME (ms)





TEST DESC: NECK FLEXION
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 10/29/2014
TEST #: D143832



DATA SHEET D5
NECK EXTENSION TEST (572.133) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 10/30/2014

Technician: David Schoedel

- X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
 X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.8°C</u> |
| Record the minimum temperature | <u>20.9°C</u> |
| Record the maximum humidity | <u>31%</u> |
| Record the minimum humidity | <u>29%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Extension Test Results (572.143(b)(2)) & (572.143(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		3.55 m/s $\leq$ speed $\leq$ 3.75 m/s	3.63 m/s
Pendulum ΔV with respect to impact speed	@ 6 ms	1.0 m/s $\leq \Delta V \leq$ 1.4 m/s	1.2 m/s
	@ 10 ms	1.9 m/s $\leq \Delta V \leq$ 2.5 m/s	2.2 m/s
	@ 14 ms	2.8 m/s $\leq \Delta V \leq$ 3.5 m/s	2.9 m/s
Plane D Rotation		Peak moment* -53.3 Nm $\leq$ moment $\leq$ -43.7 Nm during the following rotation range 83 $\leq$ angle $\leq$ 93	-48.7 Nm @ 85 degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm 60 ms $\leq$ time $\leq$ 80 ms	68 ms

*The moment is a direct reading from the load cell

**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel

Signature

10/30/2014

Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 031

Test I.D: D143833

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	29	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.63	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.2	Pass
	10 ms	m/s	1.9 to 2.5	2.2	Pass
	14 ms	m/s	2.8 to 3.5	2.9	Pass
D Plane Rotation		deg	83 to 93	85	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-48.7	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	68	Pass
Overall Test Results					Pass

David Schoedel
Laboratory Technician

10/30/2014

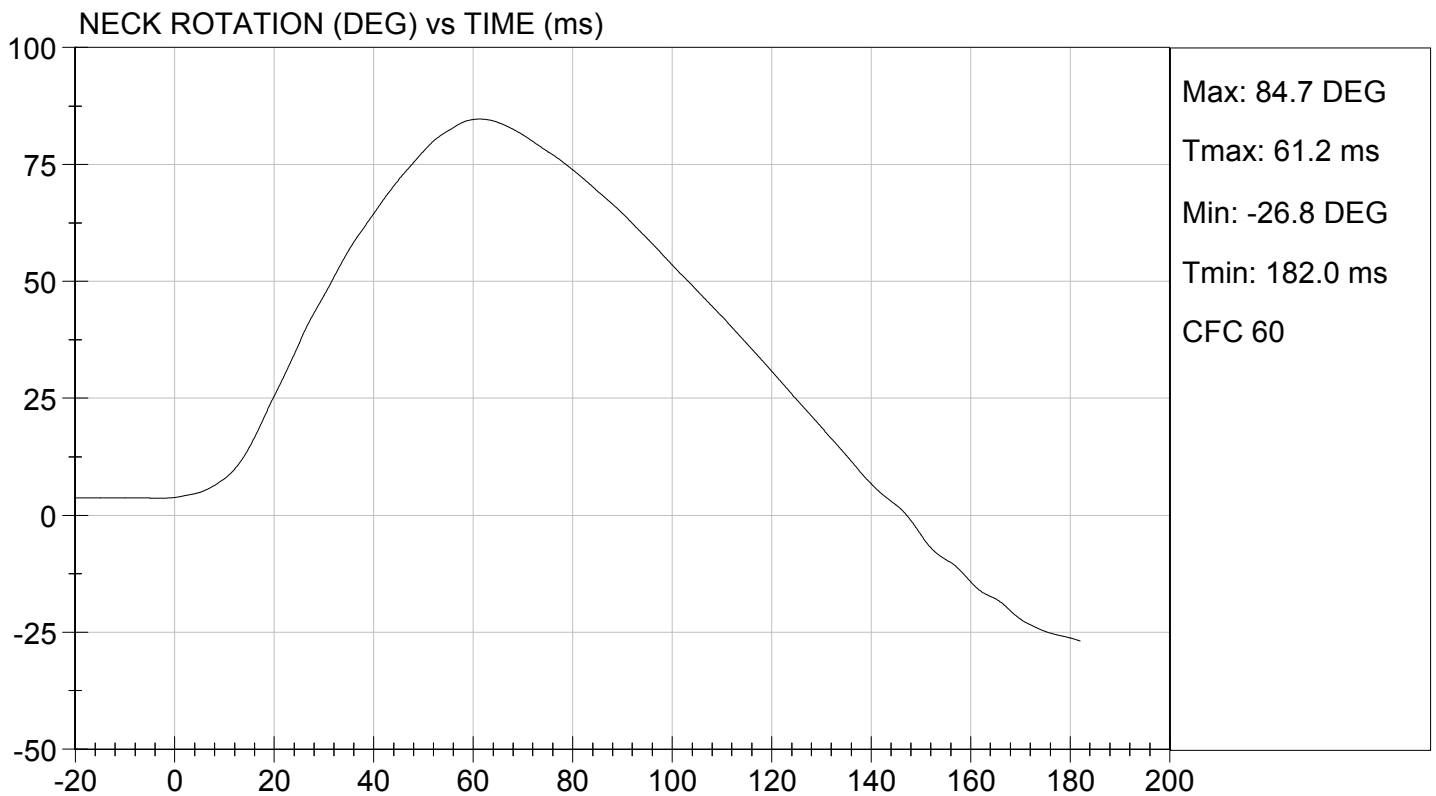
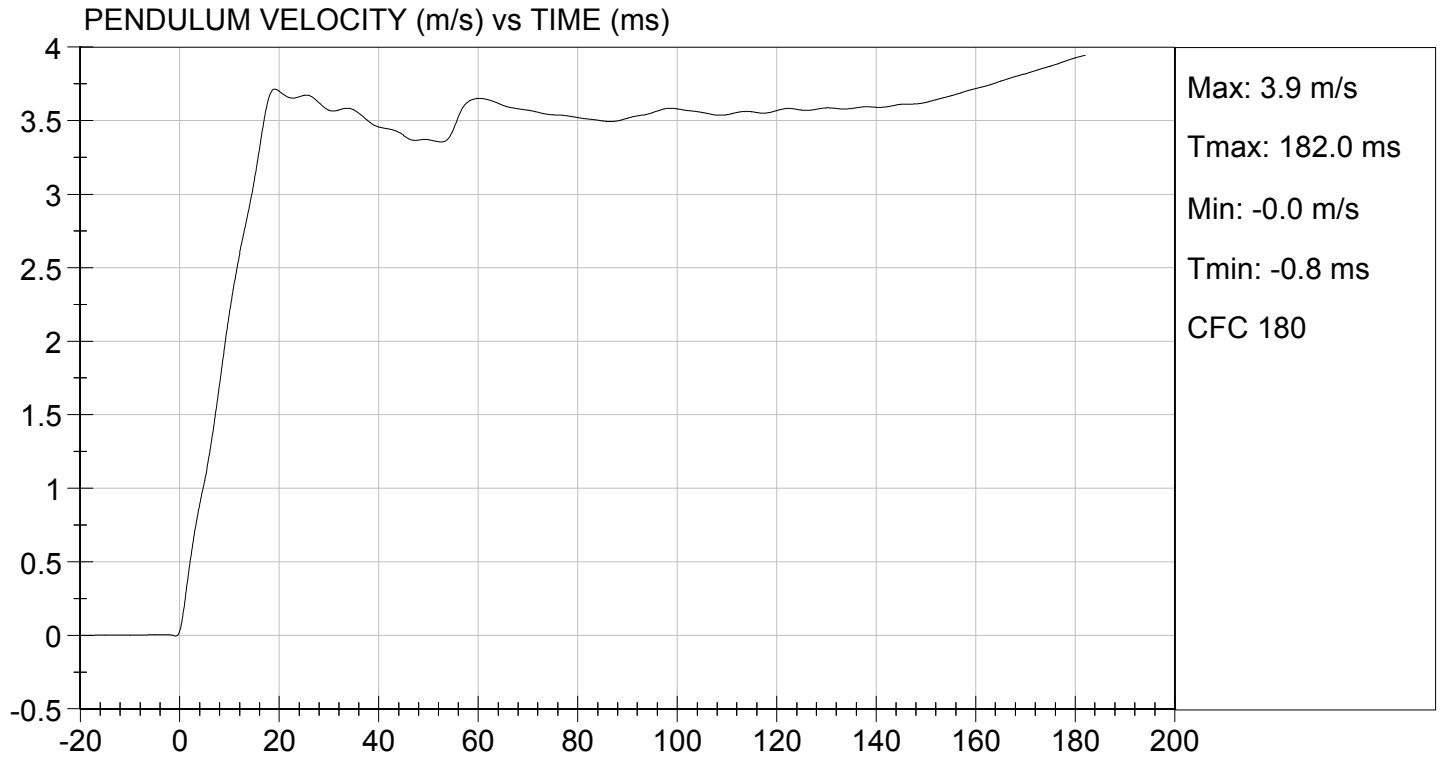
Test Date

Jeff Leonard
Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 11.90 ft/s, 3.63 m/s

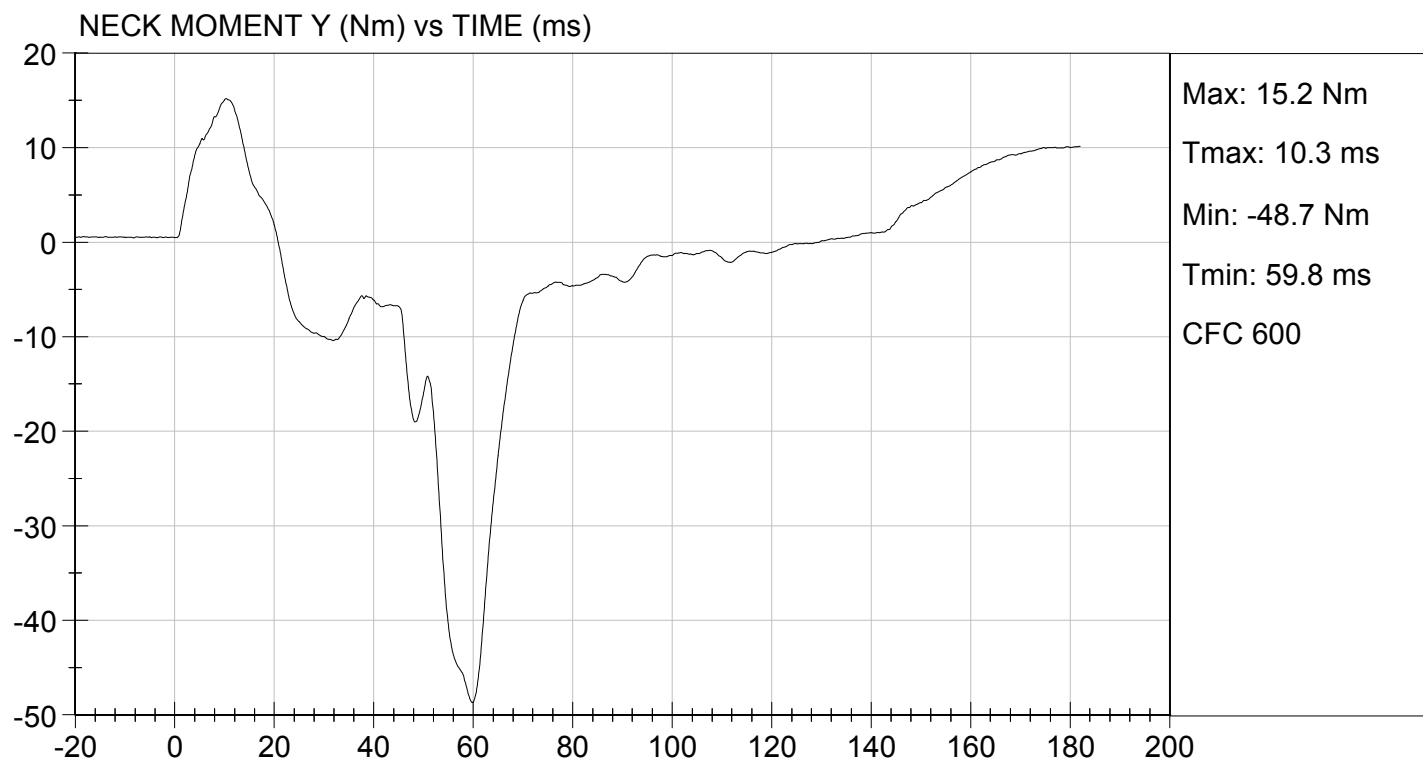
TEST DATE: 10/30/2014
TEST #: D143833





TEST DESC: NECK EXTENSION
VELOCITY: 11.90 ft/s, 3.63 m/s

TEST DATE: 10/30/2014
TEST #: D143833



DATA SHEET D6
THORAX IMPACT TEST (572.144) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 10/30/2014

Technician: Jack Coleman

- ☒ Pre test 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. (572.146(p))
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 11D.
- ☒ 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))
- ☒ 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.8°C</u> |
| Record the minimum temperature | <u>20.9°C</u> |
| Record the maximum humidity | <u>31%</u> |
| Record the minimum humidity | <u>29%</u> |
- ☒ 5. Remove the arms.
- ☒ 6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
- ☒ - No damage
- ☐ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.
- ☐ - The following repairs or replacement was performed. Record damage.

- X 7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))
- X 8. Level the middle rib both longitudinally and laterally $\pm 0.5^\circ$. (572.144(c)(3))
- X 9. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.144(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 2.5 mm within $\pm 0.5^\circ$ of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

- X 16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

Parameter*	Specification	Result
Test Probe Speed	$5.9 \text{ m/s} \leq \text{speed} \leq 6.1 \text{ m/s}$	6.0 m/s
Chest Compression	$32 \text{ mm} \leq \text{compression} \leq 38 \text{ mm}$	33 mm
Peak force** between 32 and 38 mm chest compression	$680 \text{ N} \leq \text{peak force} \leq 810 \text{ N}$	721 N
Peak force** between 12.5 and 32.0 mm chest compression	$\text{Peak force} \leq 910 \text{ N}$	815 N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	75%

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

**Force = impactor mass x acceleration (572.144(b)(3))

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

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

Jack Coleman
Signature

10/30/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 031

Test I.D: D143834

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	30	Pass
Probe Velocity	m/s	5.9 to 6.1	6.0	Pass
Peak Deflection	mm	32 to 38	33	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	721	Pass
Internal Hysteresis	%	65 to 85	75	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	815	Pass
Overall Test Results				Pass

Jack Coleman
Laboratory Technician

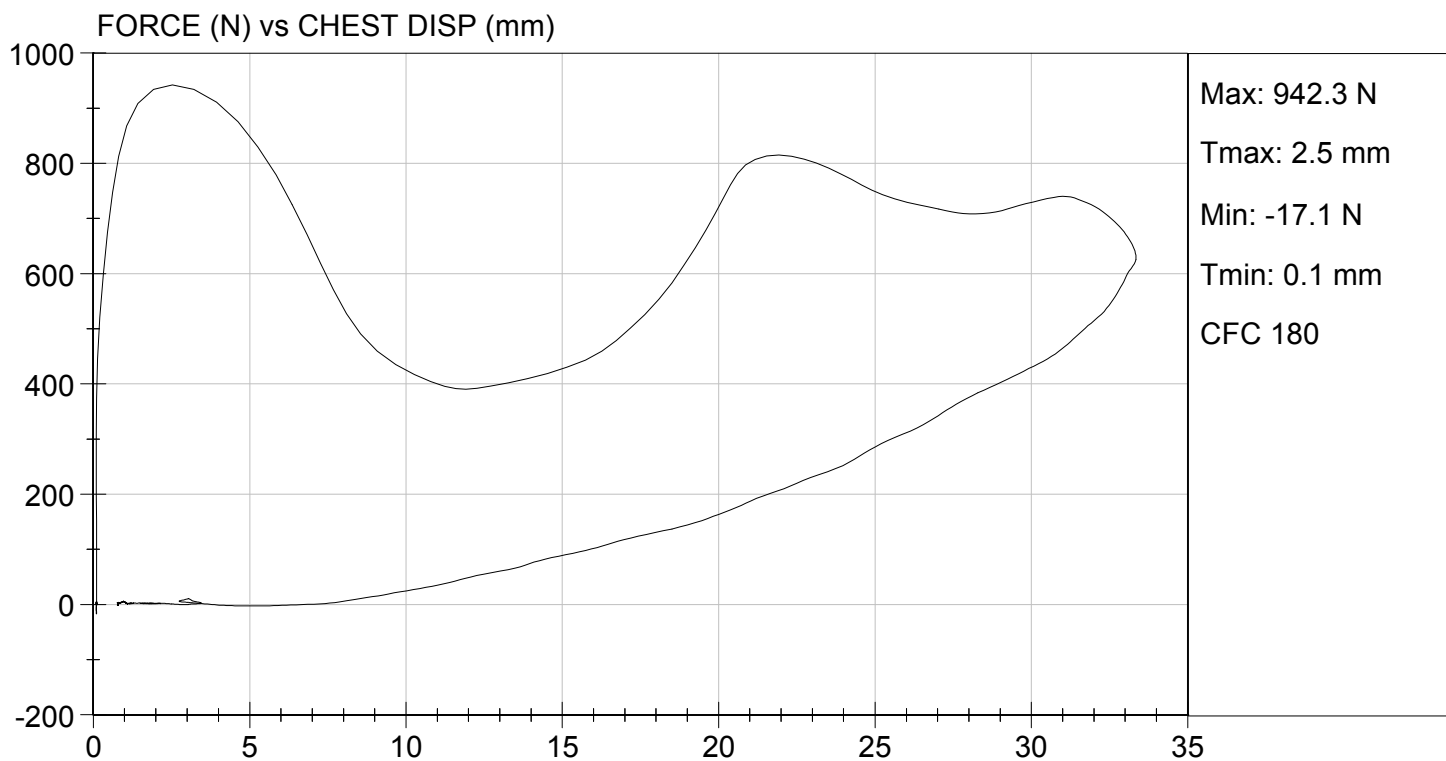
10/30/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 19.68 ft/s, 6.00 m/s

TEST DATE: 10/30/2014
TEST #: D143834



DATA SHEET D7
TORSO FLEXION TEST (572.145) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 10/30/2014

Technician: Jack Coleman

- ☒ Pre test 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. (572.146(p))
☒ N/A, ONLY torso flexion test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 13D.
- ☒ 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(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. (572.145(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.8°C</u> |
| Record the minimum temperature | <u>20.9°C</u> |
| Record the maximum humidity | <u>31%</u> |
| Record the minimum humidity | <u>29%</u> |
- ☒ 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))
- ☒ 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within $\pm 1^\circ$ and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))
- ☒ 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))
- ☒ 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

- X 9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° and $30^\circ \pm 2^\circ$. The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))
- X 10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0° . Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))
- X 11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))
- X 12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))
Record reference plane angle (max. allowed 15°) See Result Table
- X 13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))
- X 14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the torso reference plane reaches $45^\circ \pm 0.5^\circ$ of flexion relative to the vertical transverse plane. (572.145(c)(5))
- X 15. Maintain angle reference plane at $45^\circ \pm 0.5^\circ$ of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))
- X 16. As quickly as possible release the force applied to the attachment bracket. (572.145(c)(8))
- X 17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))
- X 18. Complete the following table:

Torso Flexion Results (572.145(b)(1)&(2)), (572.145(c)(4)), (572.145(c)(5))

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 15^\circ$	10°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	$0.8^\circ/\text{s}$
Force at $45^\circ \pm 0.5^\circ$	$130 \text{ N} \leq \text{force} \leq 180 \text{ N}$	148 N
Final ref. plane angle	Initial ref. plane angle $\pm 10^\circ$	11°

- X 19. A plot of the force versus time follows this sheet.

Jack Coleman
Signature

10/30/2014
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031

Test I.D: D143837

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	31	Pass
Initial Angle	deg	<= 15	10	Pass
Return Angle	deg	+/- 10	11	Pass
Force at 45 deg	N	130 to 180	148	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
Overall Test Results				Pass

Jack Coleman
Laboratory Technician

10/30/2014
Test Date

Jeff Leonard
Approved By

DATA SHEET D8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79758	05/14/2014	11/14/2014
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79759	05/14/2014	11/14/2014
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79761	05/14/2014	11/14/2014
NECK TRANSDUCER	Denton	3303	233	09/05/2014	03/05/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78269	08/26/2014	02/26/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79852	08/26/2014	02/26/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79856	08/26/2014	02/25/2015
CHEST POTENTIOMETER	Servo	08C1-3179	031	09/04/2014	03/04/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P83176	5/1/2014	11/1/2014
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET D3
HEAD DROP TEST (572.142) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 11/19/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
- X 3. Accelerometers and their respective mounts are smooth and clean.
- X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.2°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>15%</u> |
- X 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

- X 9. Suspend and orient the head assembly as shown in Figure 7D. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.142(c)(3))
Record the actual distance: 376 mm

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

- X 10. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.142(c)(3))
Record the right side distance: 501 mm
Record the left side distance: 501 mm

- X 11. The impact surface is clean and dry and has a micro finish in the range of 203.2×10^{-6} mm (8 micro inches) to 2032.0×10^{-6} mm (80 micro inches) (RMS). (572.142(c)(4))
Record actual micro finish: 40.9 micro inches

- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))
Record thickness: 50.9 mm
Record width: 604 mm
Record length: 595 mm

- X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.142(b)) & (572.142(c)(4))

- X 14. Complete the following table. (572.142(b)):

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 280 \text{ g}$	256 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	2.1 g

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

11/19/2014
Date

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 031

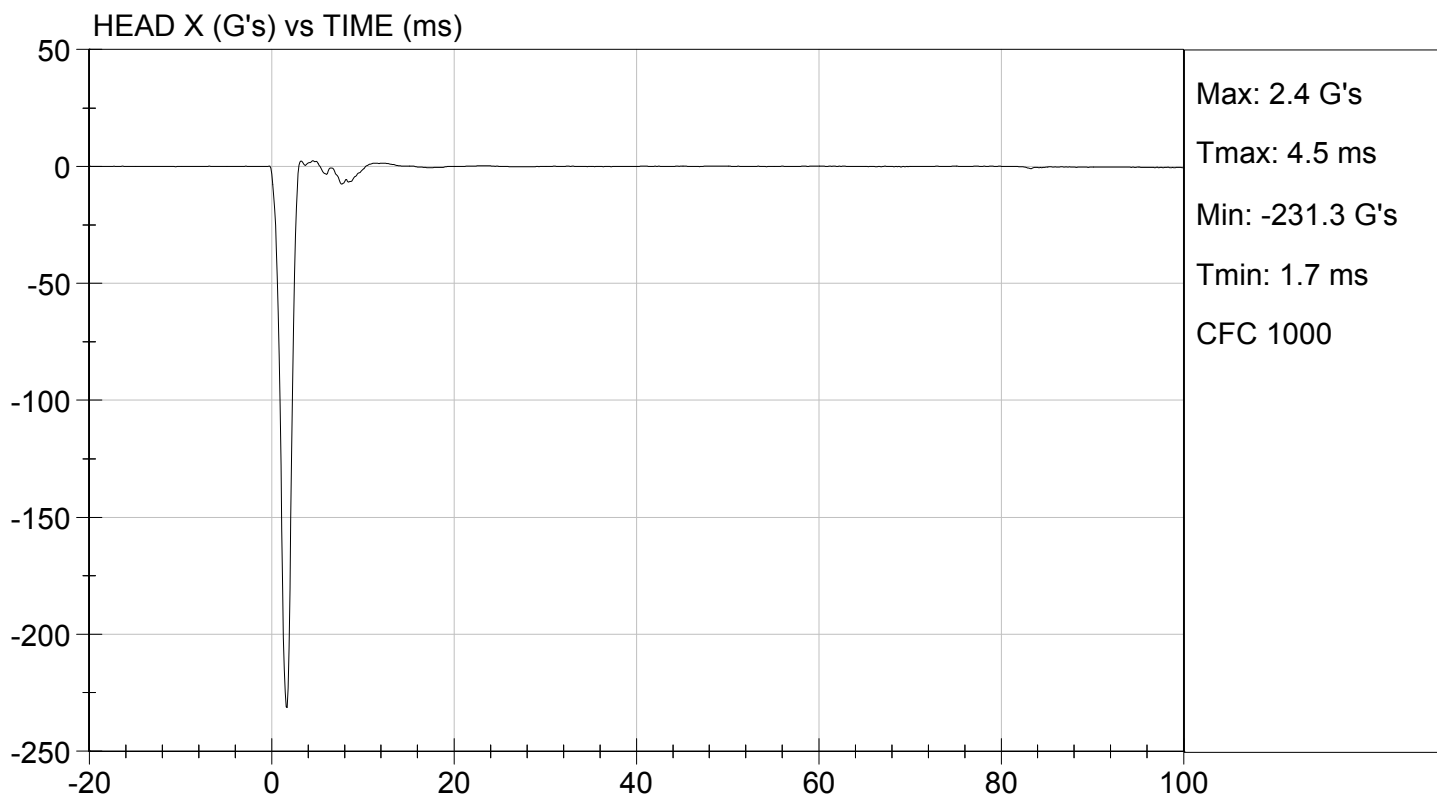
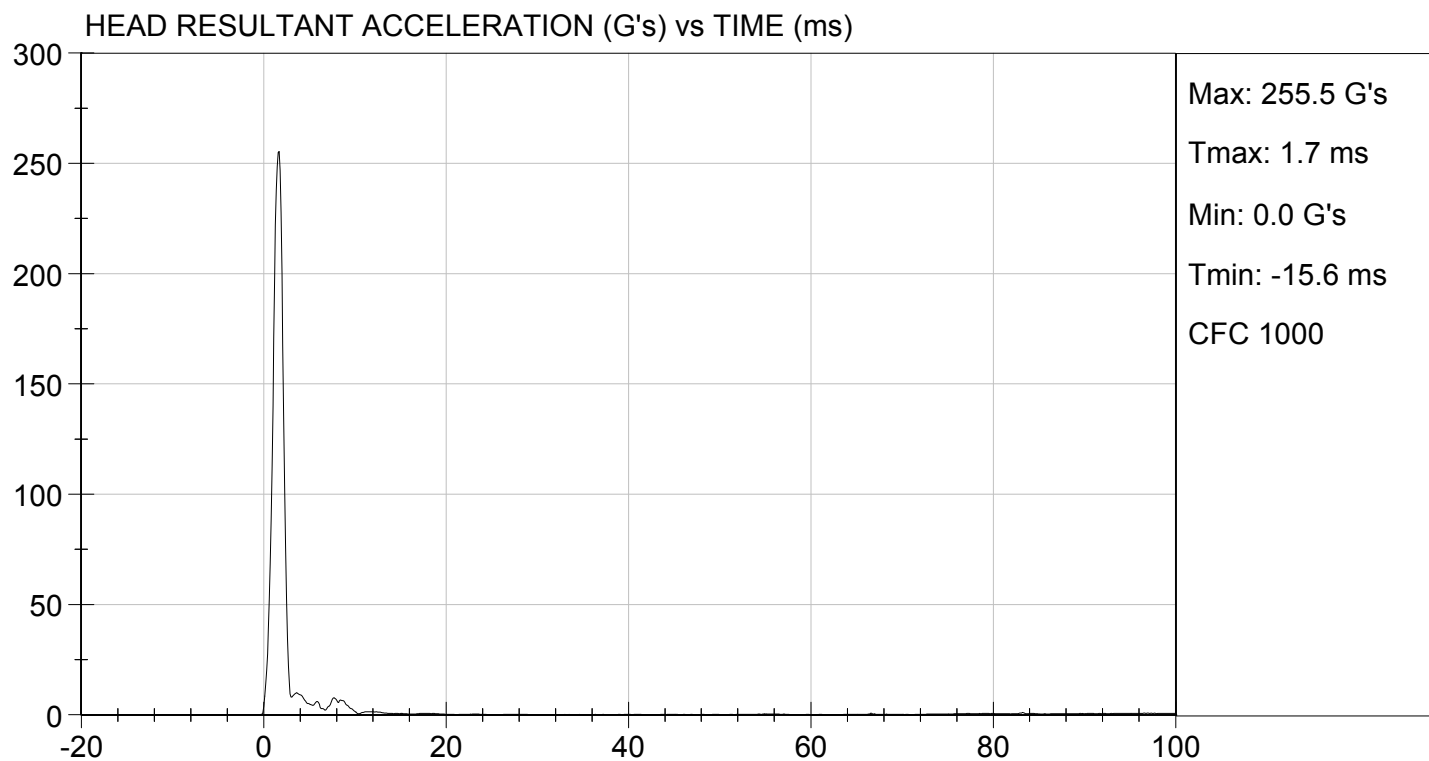
Test ID: D144081

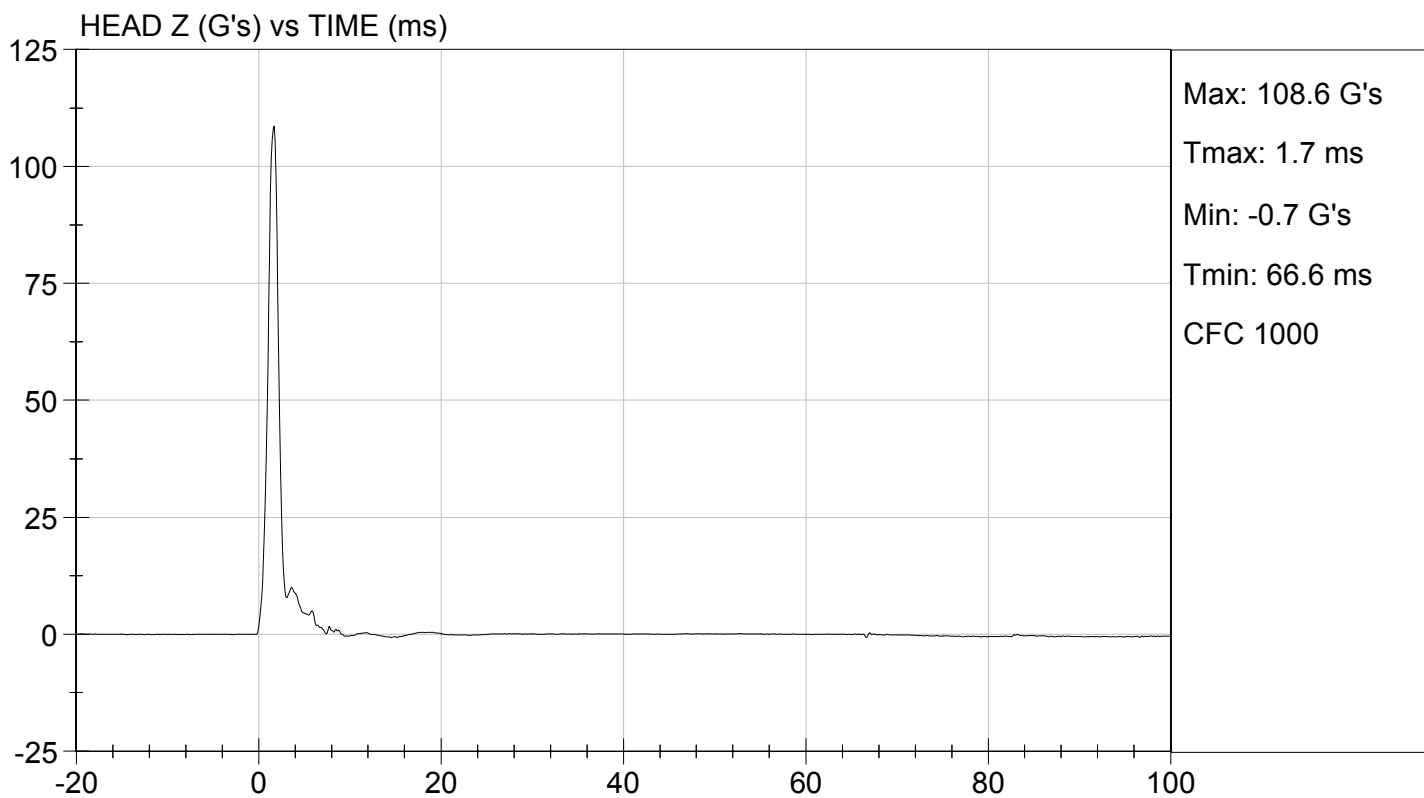
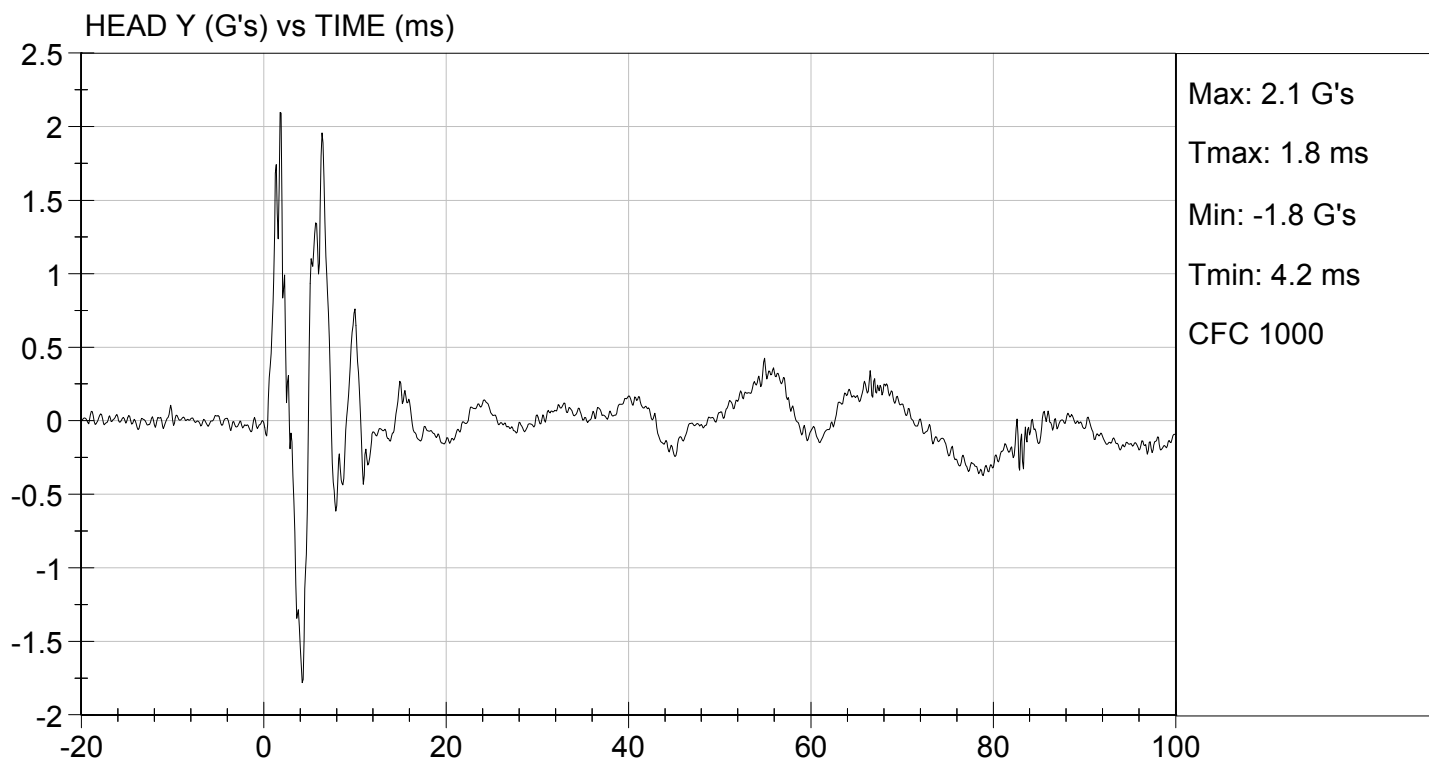
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Peak Resultant Acceleration	G's	250 to 280	256	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

11/19/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET D4
NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 11/19/2014

Technician: Jessica Gall

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
 X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.2°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>15%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 7. The test fixture pendulum conforms to the specifications in Figure 8D.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))			
Parameter		Specification	Result
Pendulum impact speed		5.4 m/s $\leq$ speed $\leq$ 5.6 m/s	5.6 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.0 m/s $\leq \Delta V \leq$ 2.7 m/s	2.6 m/s
	@ 15 ms	3.0 m/s $\leq \Delta V \leq$ 4.0 m/s	3.7 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.1 m/s	4.9 m/s
Plane D Rotation		Peak moment* 42 Nm $\leq$ moment $\leq$ 53 Nm during the following rotation range 70° $\leq$ angle $\leq$ 82°	43.1 Nm @ 72 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 60 ms $\leq$ time $\leq$ 80 ms	68 ms

*The moment is a direct reading from the load cell

**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

Jessica Hall
Signature

11/19/2014
Date

MGA RESEARCH CORPORATION

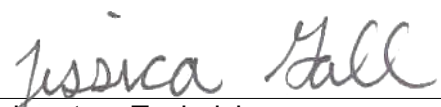
NECK FLEXION TEST

HYBRID III 3 YEAR OLD

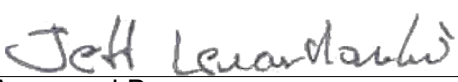
ATD Serial No: 031

Test I.D: D144082

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	18	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.6	Pass
Pendulum Velocity	10 ms	m/s	2.0 to 2.7	2.6	Pass
	15 ms	m/s	3.0 to 4.0	3.7	Pass
	20 ms	m/s	4.0 to 5.1	4.9	Pass
D Plane Rotation		deg	70 to 82	72	Pass
Peak Moment within Deflection Corridor		Nm	42.0 to 53.0	43.1	Pass
Positive Moment - Time Curve Decay to 10 Nm		ms	60.0 to 80.0	68	Pass
Overall Test Results					Pass


 Laboratory Technician

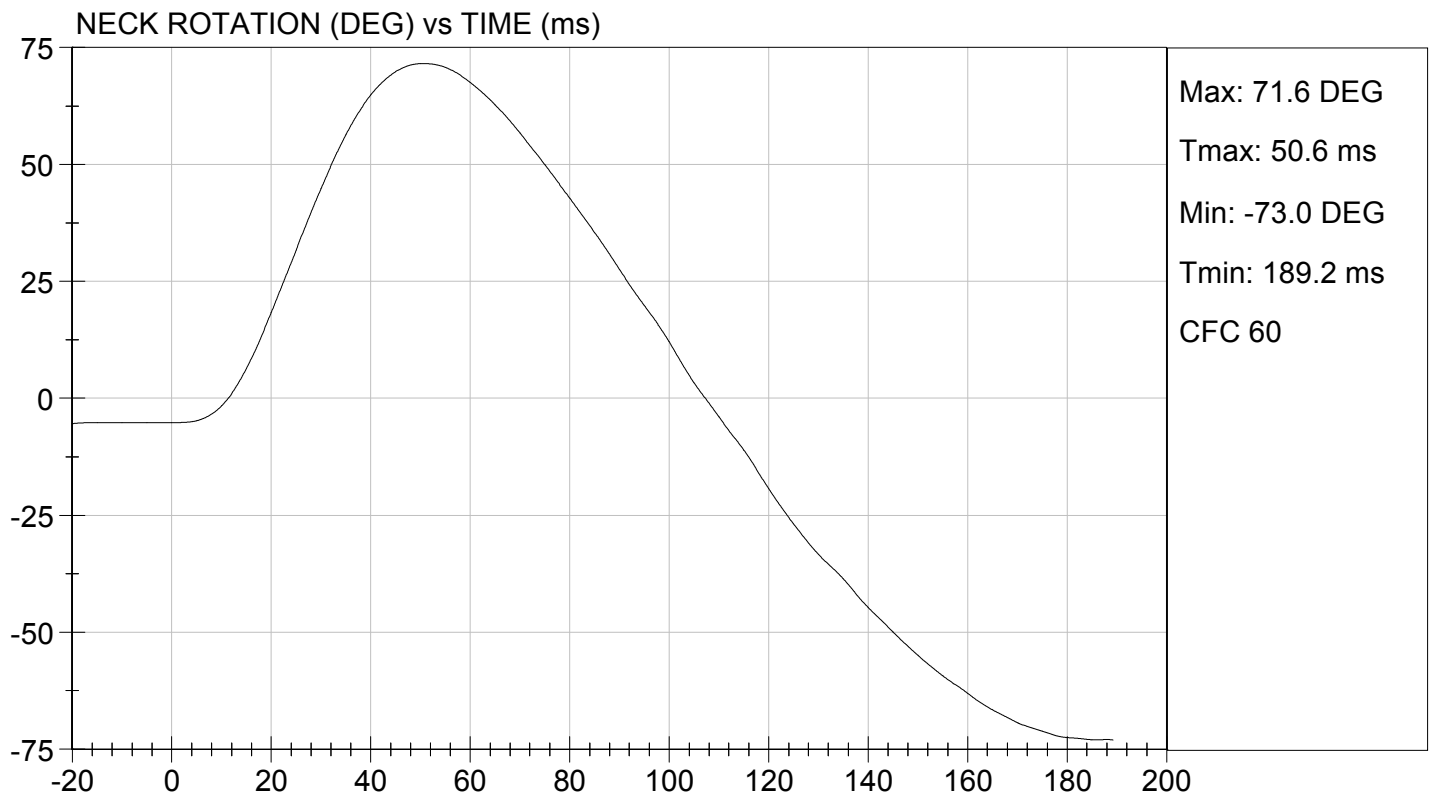
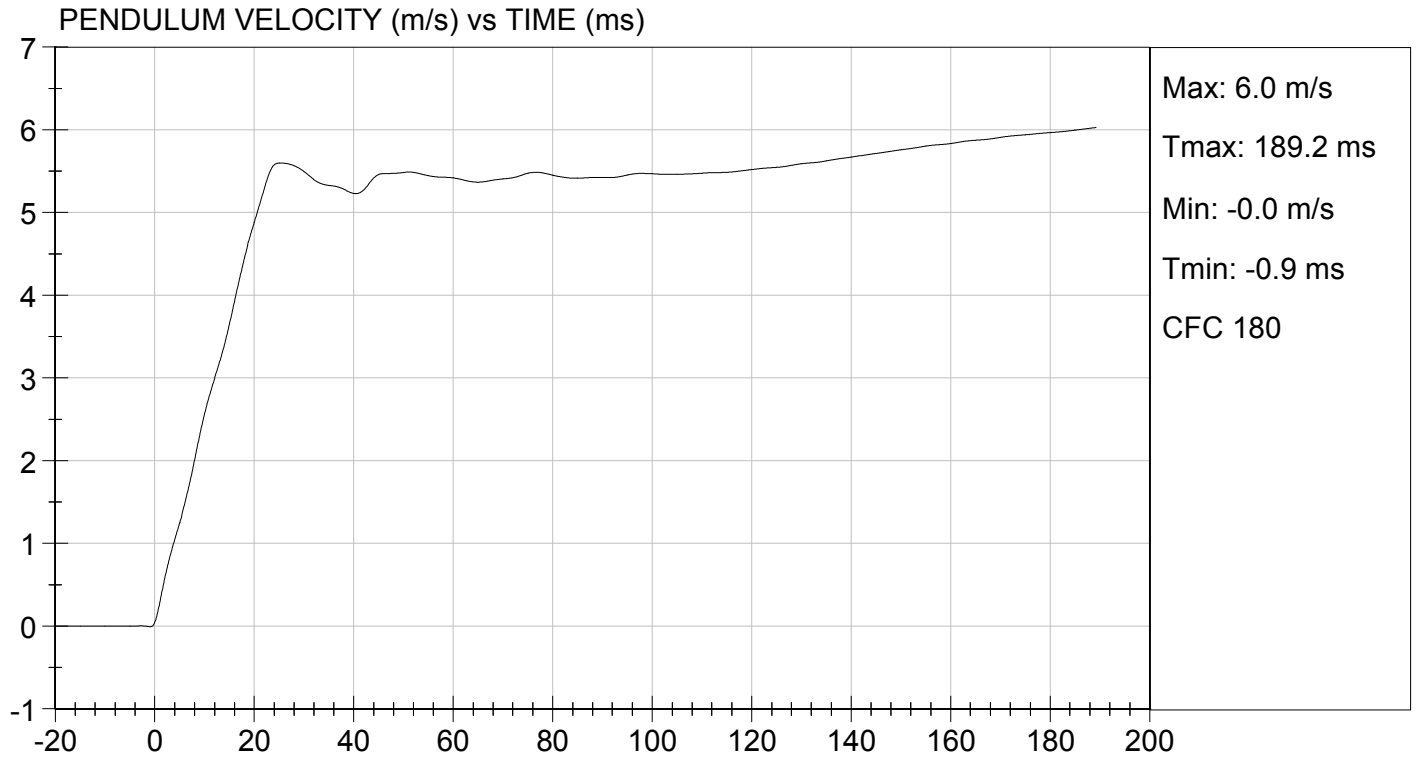
11/19/2014
 Test Date


 Approved By



TEST DESC: NECK FLEXION
VELOCITY: 18.31 ft/s, 5.58 m/s

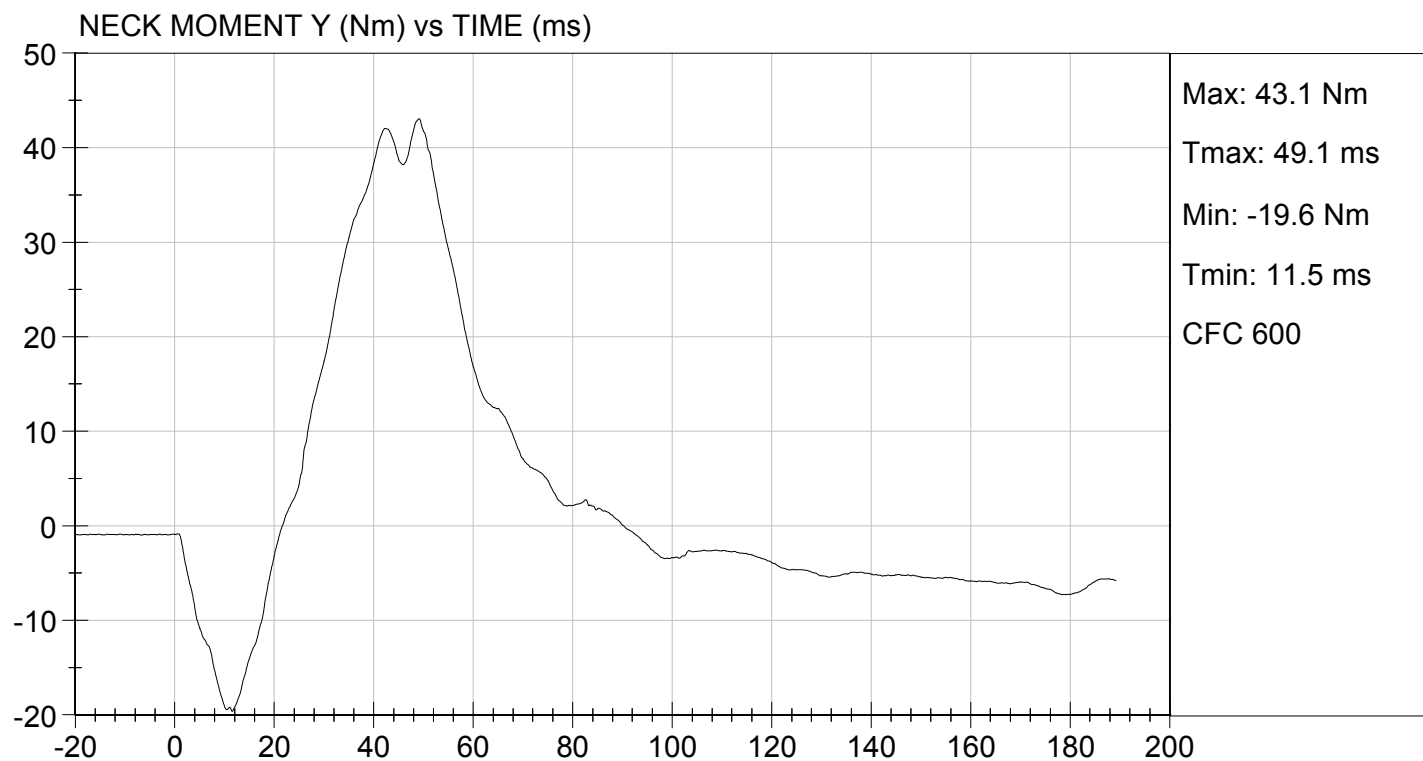
TEST DATE: 11/19/2014
TEST #: D144082





TEST DESC: NECK FLEXION
VELOCITY: 18.31 ft/s, 5.58 m/s

TEST DATE: 11/19/2014
TEST #: D144082



DATA SHEET D5
NECK EXTENSION TEST (572.133) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 11/19/2014

Technician: Jessica Gall

 Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
 X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))

Record the maximum temperature	<u>21.6°C</u>
Record the minimum temperature	<u>21.2°C</u>
Record the maximum humidity	<u>18%</u>
Record the minimum humidity	<u>15%</u>

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Extension Test Results (572.143(b)(2)) & (572.143(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		3.55 m/s $\leq$ speed $\leq$ 3.75 m/s	3.65 m/s
Pendulum ΔV with respect to impact speed	@ 6 ms	1.0 m/s $\leq \Delta V \leq$ 1.4 m/s	1.3 m/s
	@ 10 ms	1.9 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 14 ms	2.8 m/s $\leq \Delta V \leq$ 3.5 m/s	3.1 m/s
Plane D Rotation		Peak moment* -53.3 Nm $\leq$ moment $\leq$ -43.7 Nm during the following rotation range 83 $\leq$ angle $\leq$ 93	-43.9 Nm @ 87 degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm 60 ms $\leq$ time $\leq$ 80 ms	70 ms

*The moment is a direct reading from the load cell

**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

Jessica Hall
Signature

11/19/2014
Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 3 YEAR OLD

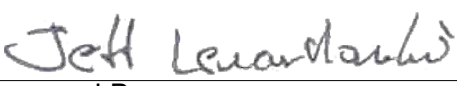
ATD Serial No: 031

Test I.D: D144083

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	18	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.65	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.3	Pass
	10 ms	m/s	1.9 to 2.5	2.3	Pass
	14 ms	m/s	2.8 to 3.5	3.1	Pass
D Plane Rotation		deg	83 to 93	87	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-43.9	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	70	Pass
Overall Test Results					Pass


 Laboratory Technician

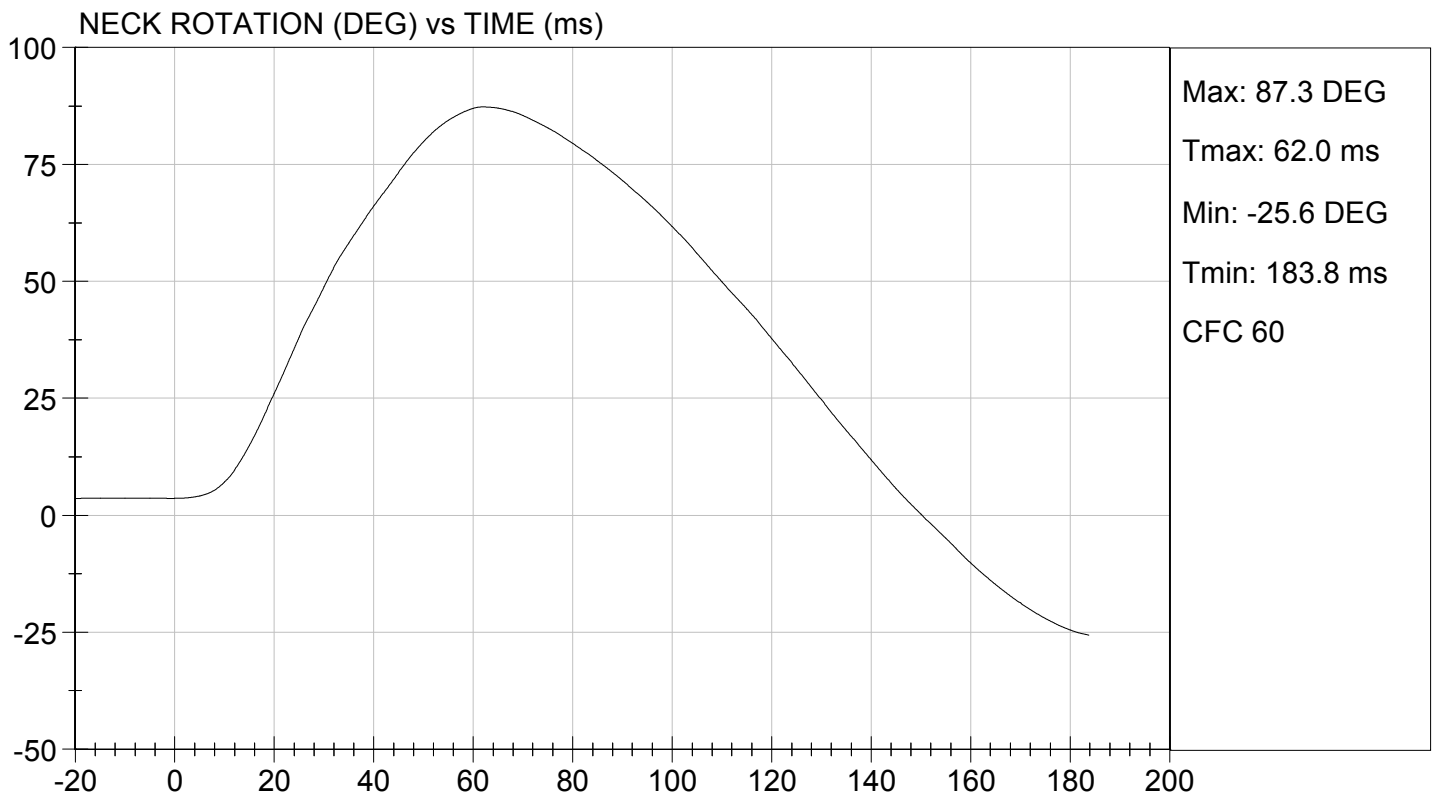
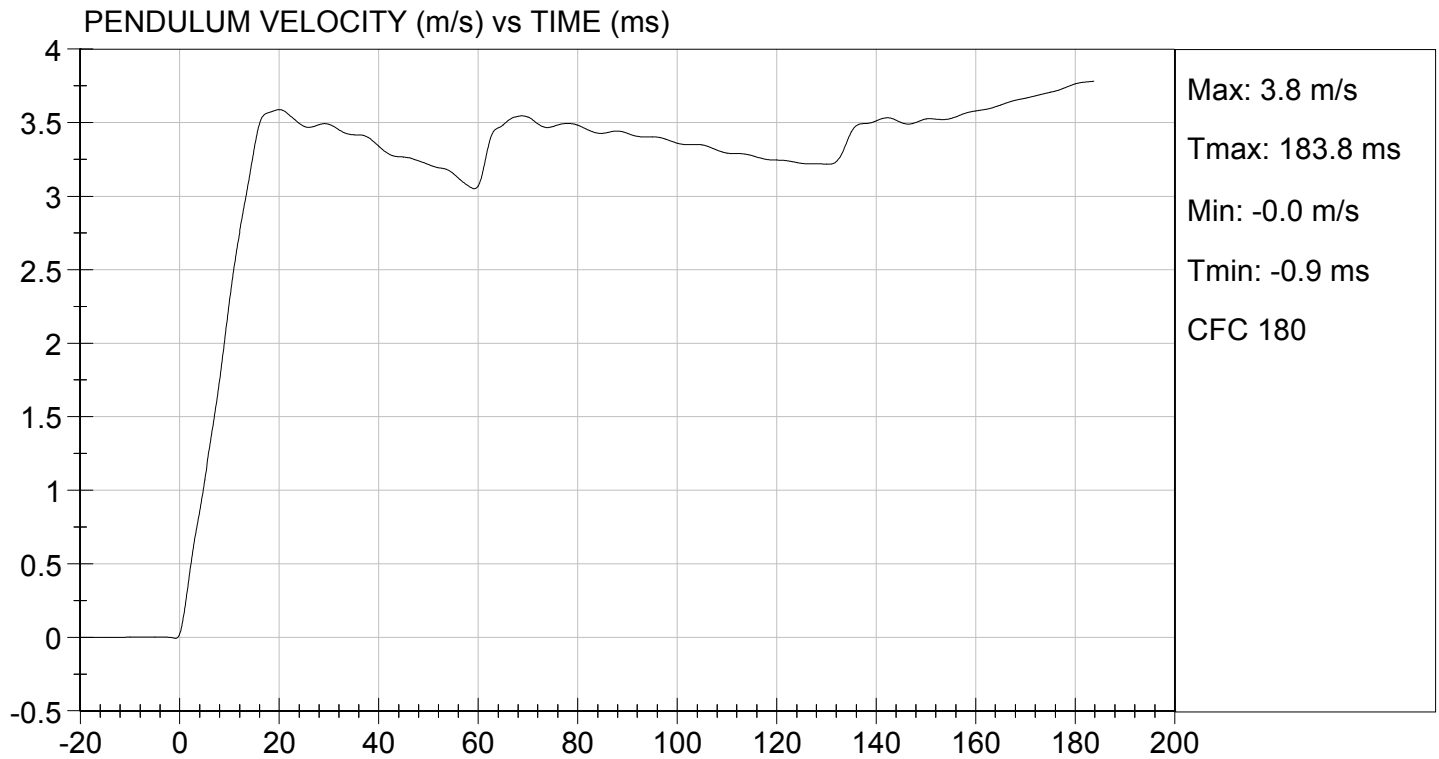
11/19/2014
 Test Date


 Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

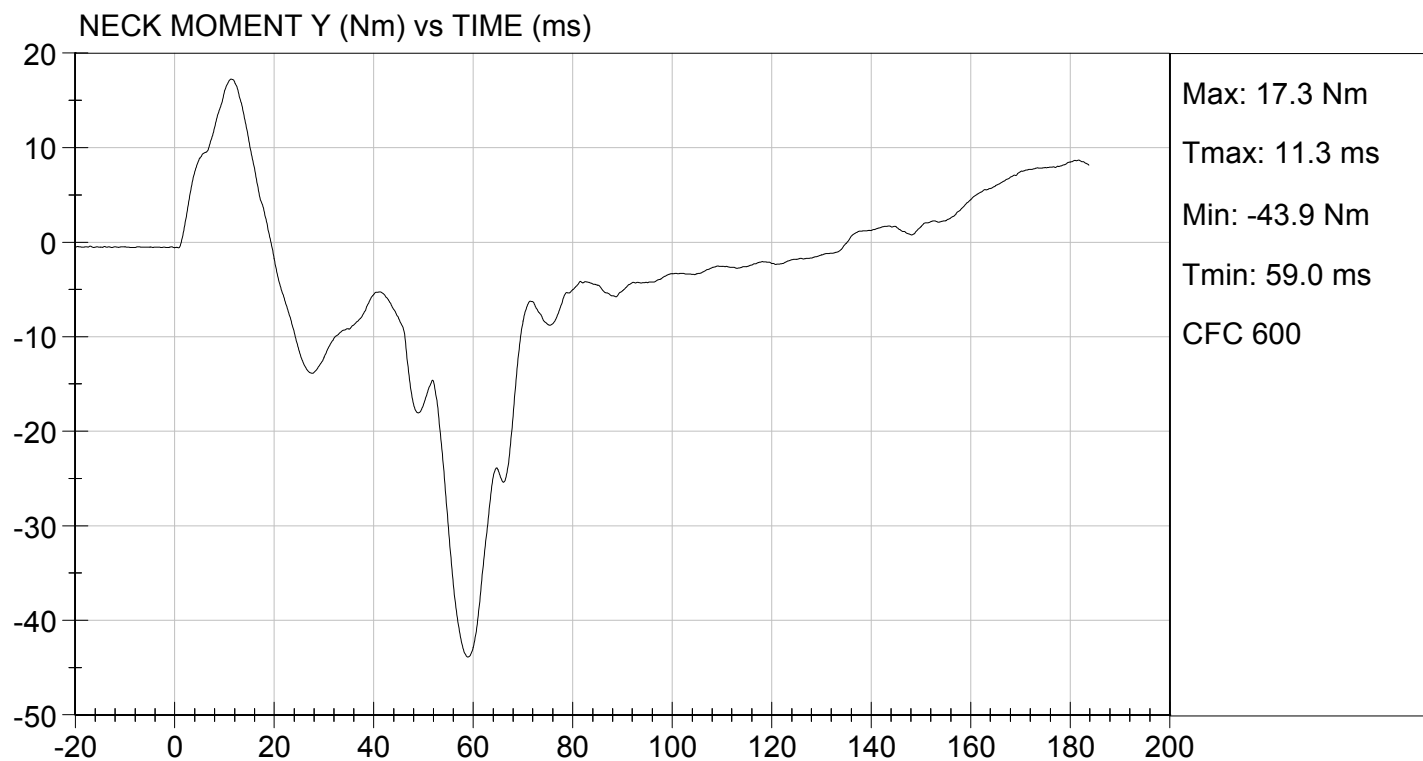
TEST DATE: 11/19/2014
TEST #: D144083





TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 11/19/2014
TEST #: D144083



DATA SHEET D6
THORAX IMPACT TEST (572.144) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 11/19/2014

Technician: David Schoedel

- Pre test calibration
X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))
 X N/A, ONLY one thorax impact test performed

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

- X 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))

- X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))

Record the maximum temperature	<u>21.6°C</u>
Record the minimum temperature	<u>21.2°C</u>
Record the maximum humidity	<u>18%</u>
Record the minimum humidity	<u>15%</u>

- X 5. Remove the arms.

- X 6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X - No damage

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

 - The following repairs or replacement was performed. Record damage.

- X 7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))
- X 8. Level the middle rib both longitudinally and laterally $\pm 0.5^\circ$. (572.144(c)(3))
- X 9. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.144(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 2.5 mm within $\pm 0.5^\circ$ of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

- X 16. Complete the following table:

Thorax Impact Results (572.144(b)(1)&(2))

Parameter*	Specification	Result
Test Probe Speed	$5.9 \text{ m/s} \leq \text{speed} \leq 6.1 \text{ m/s}$	6.0 m/s
Chest Compression	$32 \text{ mm} \leq \text{compression} \leq 38 \text{ mm}$	32 mm
Peak force** between 32 and 38 mm chest compression	$680 \text{ N} \leq \text{peak force} \leq 810 \text{ N}$	703 N
Peak force** between 12.5 and 32.0 mm chest compression	$\text{Peak force} \leq 910 \text{ N}$	818 N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	75%

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

**Force = impactor mass x acceleration (572.144(b)(3))

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

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

David Schoedel
Signature

11/19/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 031

Test I.D: D144084

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	15	Pass
Probe Velocity	m/s	5.9 to 6.1	6.0	Pass
Peak Deflection	mm	32 to 38	32	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	703	Pass
Internal Hysteresis	%	65 to 85	75	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	818	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

11/19/2014

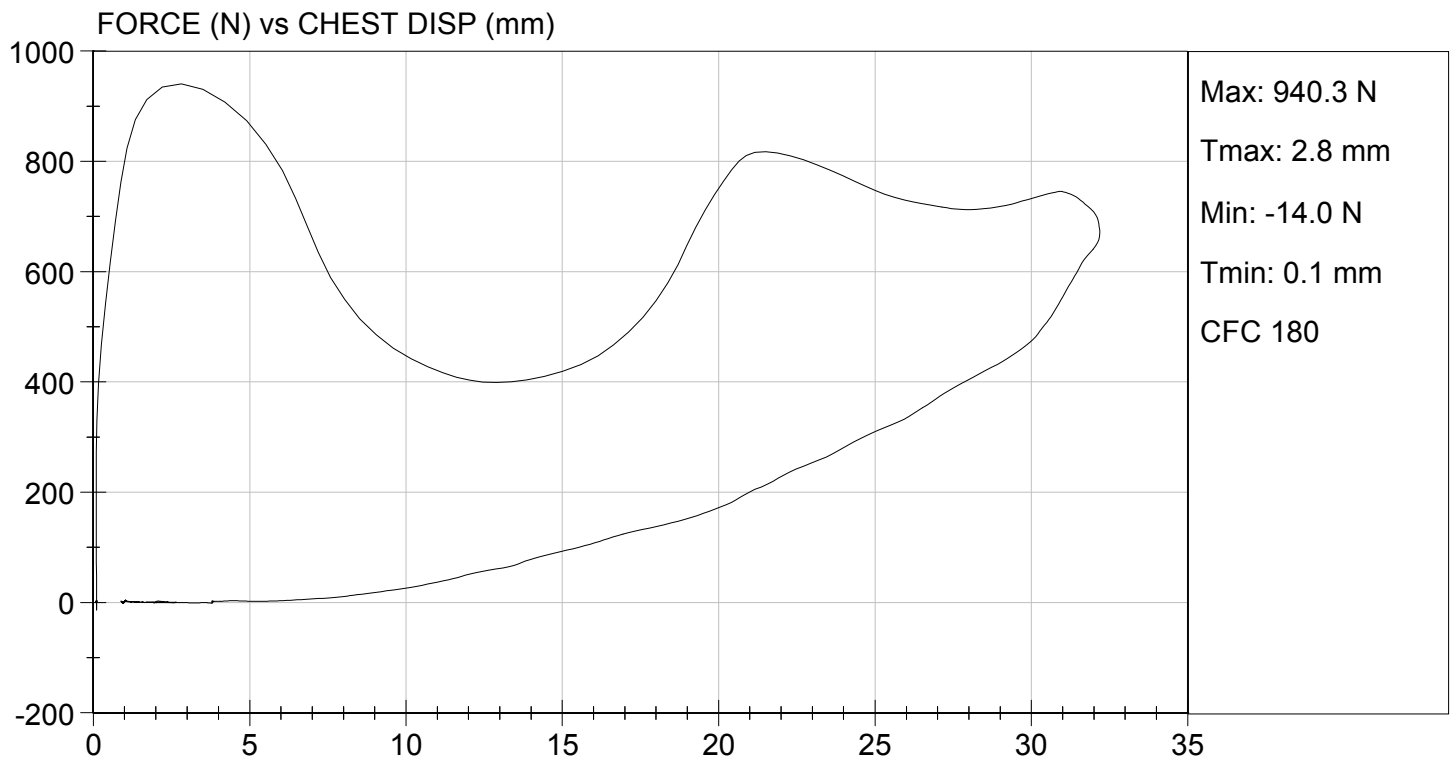
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 19.78 ft/s, 6.03 m/s

TEST DATE: 11/19/2014
TEST #: D144084



DATA SHEET D7
TORSO FLEXION TEST (572.145) (3 YEAR-OLD)

Dummy Serial Number: 031

Test Date: 11/19/2014

Technician: Jessica Gall

- Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))
 X N/A, ONLY torso flexion test performed
- X 2. The test fixture conforms to the specifications in Figure 13D.
- X 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).
 X with legs below the femurs.
 without legs below the femurs.
- X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))
- | | |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.2°C</u> |
| Record the maximum humidity | <u>18%</u> |
| Record the minimum humidity | <u>15%</u> |
- X 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))
- X 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within $\pm 1^\circ$ and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))
- X 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))
- X 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

- X 9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° and $30^\circ \pm 2^\circ$. The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))
- X 10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0° . Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))
- X 11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))
- X 12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))
Record reference plane angle (max. allowed 15°) See Result Table
- X 13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))
- X 14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the torso reference plane reaches $45^\circ \pm 0.5^\circ$ of flexion relative to the vertical transverse plane. (572.145(c)(5))
- X 15. Maintain angle reference plane at $45^\circ \pm 0.5^\circ$ of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))
- X 16. As quickly as possible release the force applied to the attachment bracket. (572.145(c)(8))
- X 17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))
- X 18. Complete the following table:

Torso Flexion Results (572.145(b)(1)&(2)), (572.145(c)(4)), (572.145(c)(5))

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 15^\circ$	8°
Torso rotation rate	$0.5^\circ/\text{s} \leq \text{rate} \leq 1.5^\circ/\text{s}$	$0.7^\circ/\text{s}$
Force at $45^\circ \pm 0.5^\circ$	$130 \text{ N} \leq \text{force} \leq 180 \text{ N}$	149 N
Final ref. plane angle	Initial ref. plane angle $\pm 10^\circ$	11°

- X 19. A plot of the force versus time follows this sheet.

Jessica Hall
Signature

11/19/2014
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031

Test I.D: D144087

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	18	Pass
Initial Angle	deg	<= 15	8	Pass
Return Angle	deg	+/- 10	11	Pass
Force at 45 deg	N	130 to 180	149	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
Overall Test Results				Pass

Jessica Hall
Laboratory Technician

Jeff Leonard
Approved By

11/19/2014
Test Date

DATA SHEET D8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78806	08/26/2014	02/26/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P78810	08/26/2014	02/26/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P78826	08/26/2014	02/26/2015
NECK TRANSDUCER	Denton	3303	233	09/05/2014	03/05/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P78269	08/26/2014	02/26/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79852	08/26/2014	02/26/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79856	08/26/2014	02/25/2015
CHEST POTENTIOMETER	Servo	08C1-3179	031	09/04/2014	03/04/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 031

Test Date: 11/17/2014

Technician: Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damage	OK
Outer skin	Gashes, rips, cracks			X
Head	Ballast secure			X
	General appearance			X
Neck	Broken or cracked rubber			X
	Upper neck bracket firmly attached to the lower neck bracket			X
	Looseness at the condyle joint			X
	Nodding blocks cracked or out of position			X
Spine	Broken or cracks in rubber			X
Ribs	Broken or bent ribs			X
	Broken or bent rib supports			X
	Damping material separated or cracked			X
	Rubber bumpers in place			X
Chest Displacement Assembly	Bent shaft			X
	Slider arm riding in track			X
Transducer leads	Torn cables			X
Accelerometer Mountings	Head mounting secure			X
	Chest mounting secure			X
Knees	Skin condition			X
	Insert (do not remove)			X
	Casting			X
Limbs	Normal movement and adjustment			X
Knee Sliders	Wires intact			X
	Rubber returned to "at rest" position			X
Pelvis	Broken			X
Other				X

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

Repair or Replacement approved by:

Jessica Hall
Signature

11/19/2014
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard
Signature

11/19/2014
Date

EXTERNAL DIMENSIONS

CRABI 12 month #083, PART 572, SUBPART R EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head with head pulled back to touch vertical surface of fixture.	456.0-471.2	470.0
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	276.6-291.8	288.2
C	HIP PIVOT HEIGHT	Centerline of hip pivot bolt to seat surface	27.9-38.1	31.3
D	HIP PIVOT FROM BACKLINE	Centerline of hip pivot bolt to vertical surface of seat	40.1-50.3	44.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder pivot bolt to the fixture's rear vertical surface.	50.3-60.5	53.8
F	THIGH CLEARANCE	Fixture's seat surface to highest point on the upper femur segment	63.0-73.2	71.1
G	ELBOW PIVOT TO FINGERTIP	Elbow pivot to the finger tip, in line with the elbow and wrist centerlines	176.6-191.8	186.0
I	SHOULDER PIVOT TO-ELBOW PIVOT	Shoulder pivot bolt to elbow pivot bolt	99.1-114.3	108.2
J	ELBOW REST HEIGHT	Seat surface to bottom of lower arm	150.1-165.3	156.5
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the fixture's rear vertical surface	202.7-217.9	204.1
L	POPLITEAL HEIGHT	Seat surface to the horizontal plane of the bottom of the feet.	138.7-153.9	151.4
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	165.1-180.3	174.6
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of buttocks used for dimension K	144.8-160	156.0

CRABI 12 month #083, SUBPART R EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITH JACKET	Measured 261.6 ± 5.1 mm above seat surface	107.5-122.7	110.3
P	FOOT LENGTH	Tip of toe to rear of heel	92.4-102.6	95.0
Q	STATURE	Place the dummy in supine position on the measurement surface. Place a block that is perpendicular to the table at both the head and feet of the dummy. Position the blocks perpendicular to the midsagittal plane of the dummy. Position the blocks so they are in contact with the head and the heels of the dummy. Measure the distance between the blocks.	727.7-753.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	Knee pivot bolt to the fixture's rear vertical surface.	178.5-188.7	184.7
S	HEAD BREADTH	Distance across the head at its widest point	124.4-134.6	127.4
T	HEAD DEPTH	Distance from the forward most surface of the head to the rearmost surface of the head, in line with the midsagittal plane.	149.9-165.1	164.0
U	HIP BREADTH	Distance across the width of the hip at the widest point of the jacket	158.5-173.7	170.6
V	SHOULDER BREADTH	Distance between the outside edges of the shoulder flesh, in line with the shoulder pivot bolts	200.7-215.9	209.3
W	FOOT BREADTH	The widest part of the foot	39.1-49.3	44.1
Y	CHEST CIRCUMFERENCE WITH JACKET	Distance around chest at reference location AA, with jacket on. Measured 261.6 ± 5.1 mm above the seat surface.	452.4-477.8	472.6
Z	WAIST CIRCUMFERENCE	Distance around waist at reference location BB, with jacket on. Measured 111.8 ± 5.1 mm above the seat surface.	447-472.4	467.8
AA	REFERENCE LOCATION FOR DIMENSION Y & O	Reference: 261.6 ± 5.1 mm above the seat surface	256.5-266.7	259.0

CRABI 12 month #083, SUBPART R EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
BB	REFERENCE LOCATION FOR DIMENSION Z	Reference: 111.8 ± 5.1 mm above seat surface	106.7-116.9	113.2
CC	SHOULDER HEIGHT	Top of arm to seat surface	299.7-314.9	310.0
DD	CHIN HEIGHT	Bottom of chin to seat surface	289.6-304.8	303.1

DATA SHEET E3
FRONTAL HEAD DROP TEST (572.152) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/06/2014

Technician: David Schoedel

- ☒ Pre test 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 frontal head drop and at least 30 minutes since the last rear head drop. (572.152(c)(5))
☒ N/A, ONLY one head drop performed
- ☒ 2. The head assembly consists of the head (921022-001), triaxial accelerometer mounting block (SA572-S80), and three (3) accelerometers (SA572-S4). (572.152(a))
- ☒ 3. Accelerometers and their respective mounts are smooth and clean.
- ☒ 4. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- ☒ 5. 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. (572.152(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>35%</u> |
| Record the minimum humidity: | <u>32%</u> |
- ☒ 6. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- ☒ 7. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.152(c)(2))

- X 8. Suspend and orient the head assembly as shown in Figure 5E. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.152(c)(3)(i))
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 9. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.152(c)(3)(i))
Record the right side distance: 501 mm
Record the left side distance: 501 mm

- X 10. The angle between the lower surface plane of the neck transducer mass simulator (910420-003) and the plane of the impact surface is 45 ± 1 degrees. (572.152(c)(3)(i))
Record the angle: 45 degrees

- X 11. 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). (572.152(c)(4))
Record actual micro finish: 40.9 micro inches

- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.152(c)(4))
Record thickness: 50.9 mm
Record width: 604 mm
Record length: 595 mm

- X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.152(b)) & (572.152(c)(4))

- X 14. Complete the following table. (572.152(b)):

Parameter	Specification	Result
Peak resultant acceleration	$100 \text{ g} \leq x \leq 120 \text{ g}$	113 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 17% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq \pm 15 \text{ g}$	3.6 g

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

11/06/2014
Date

MGA RESEARCH CORPORATION
FRONT HEAD DROP TEST
CRABI 12 MONTH

ATD Serial No: 083

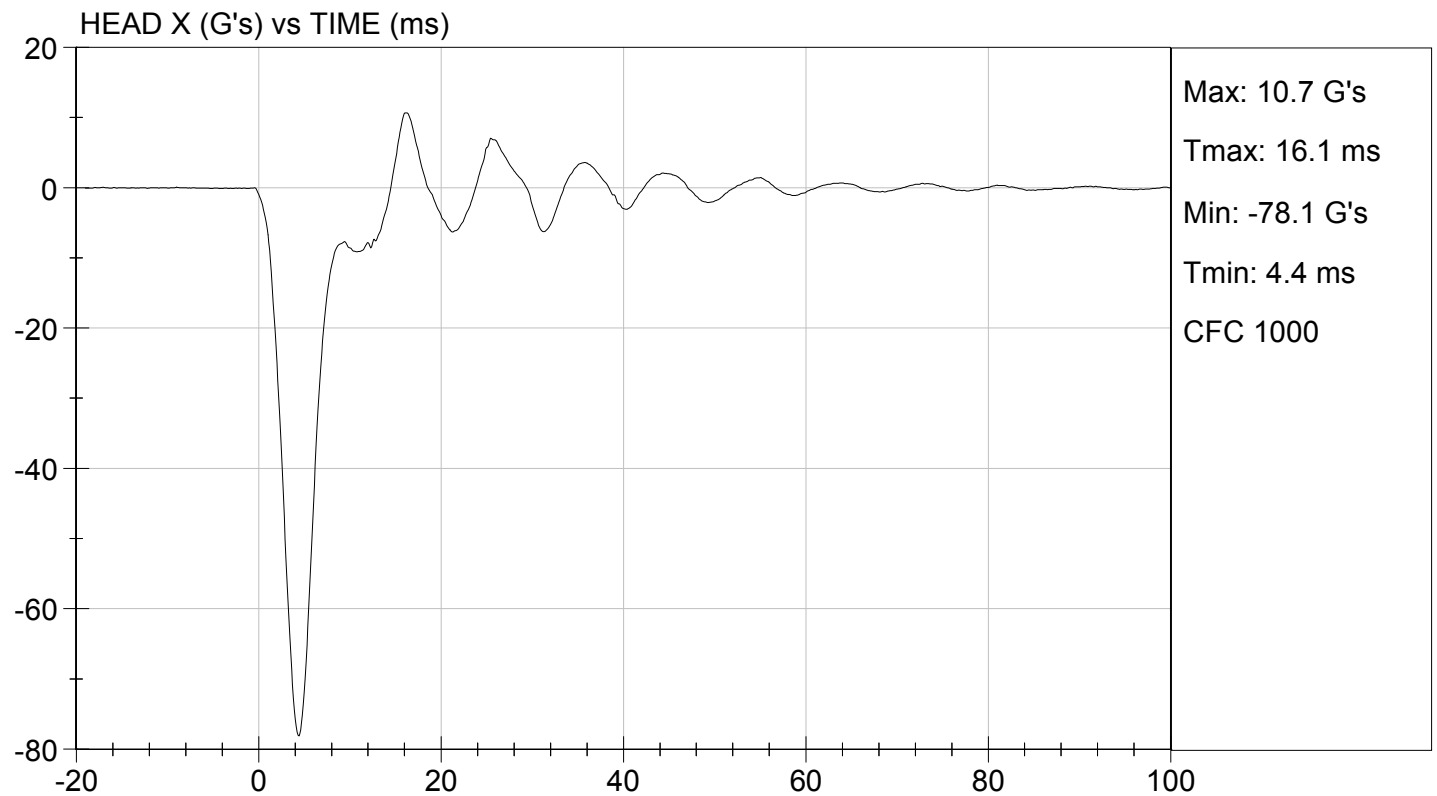
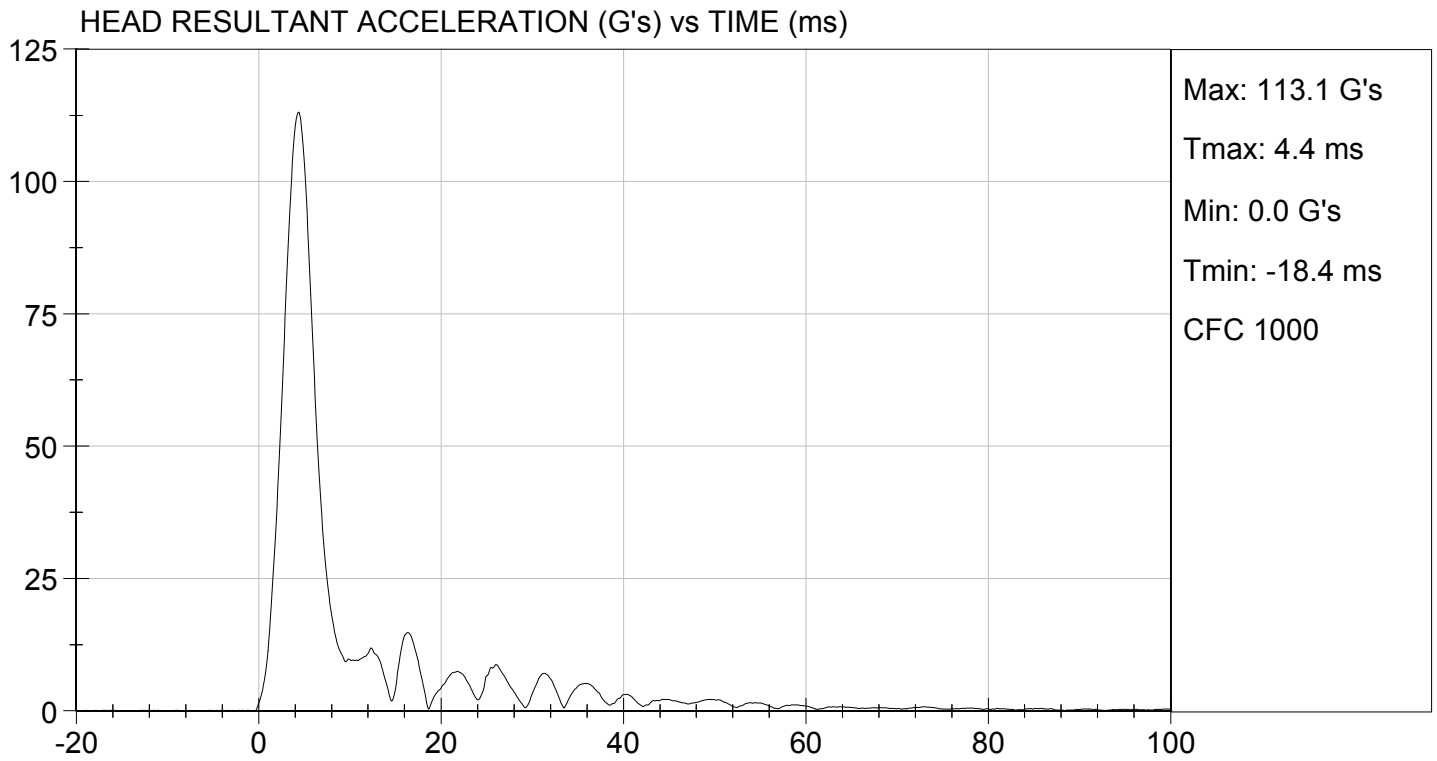
Test ID: D143931

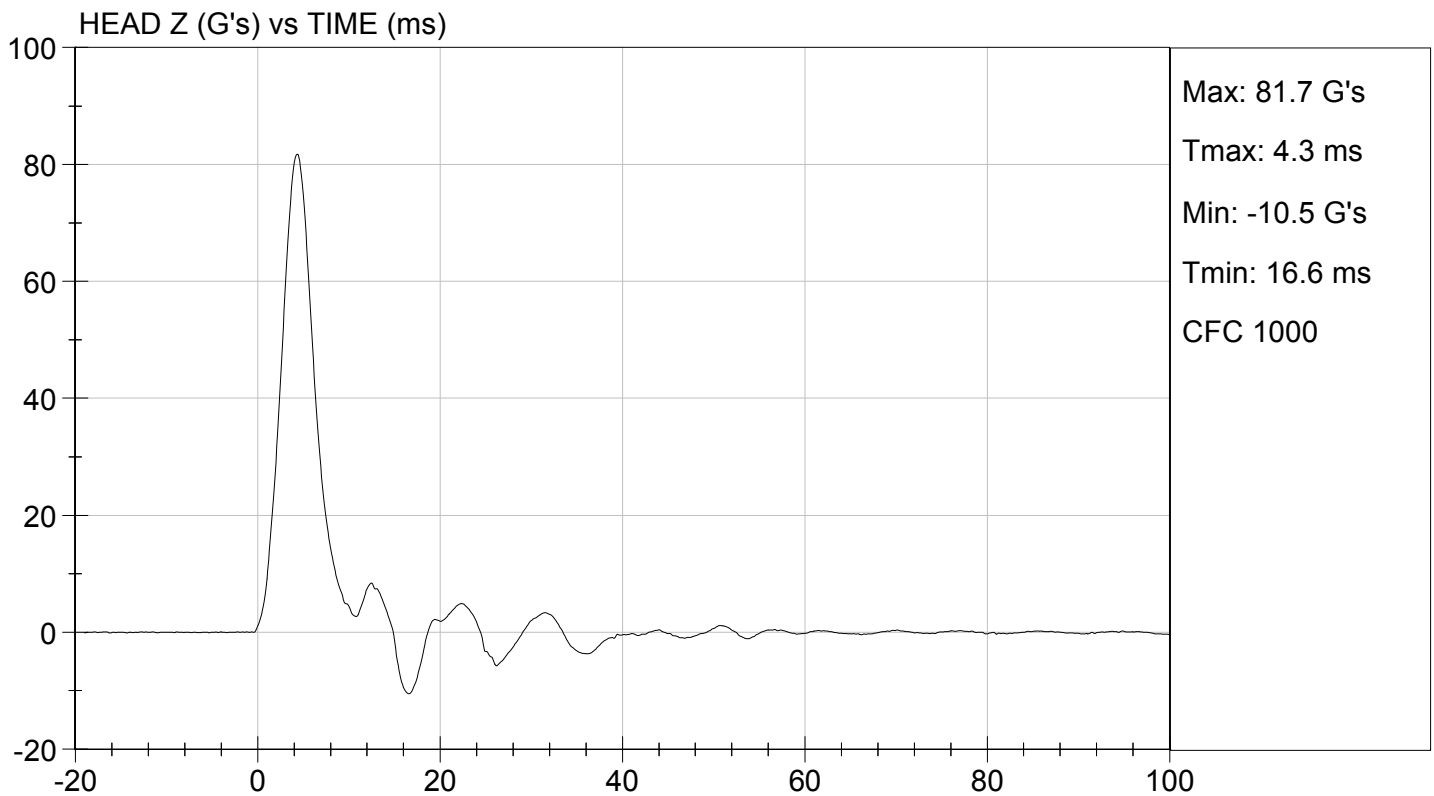
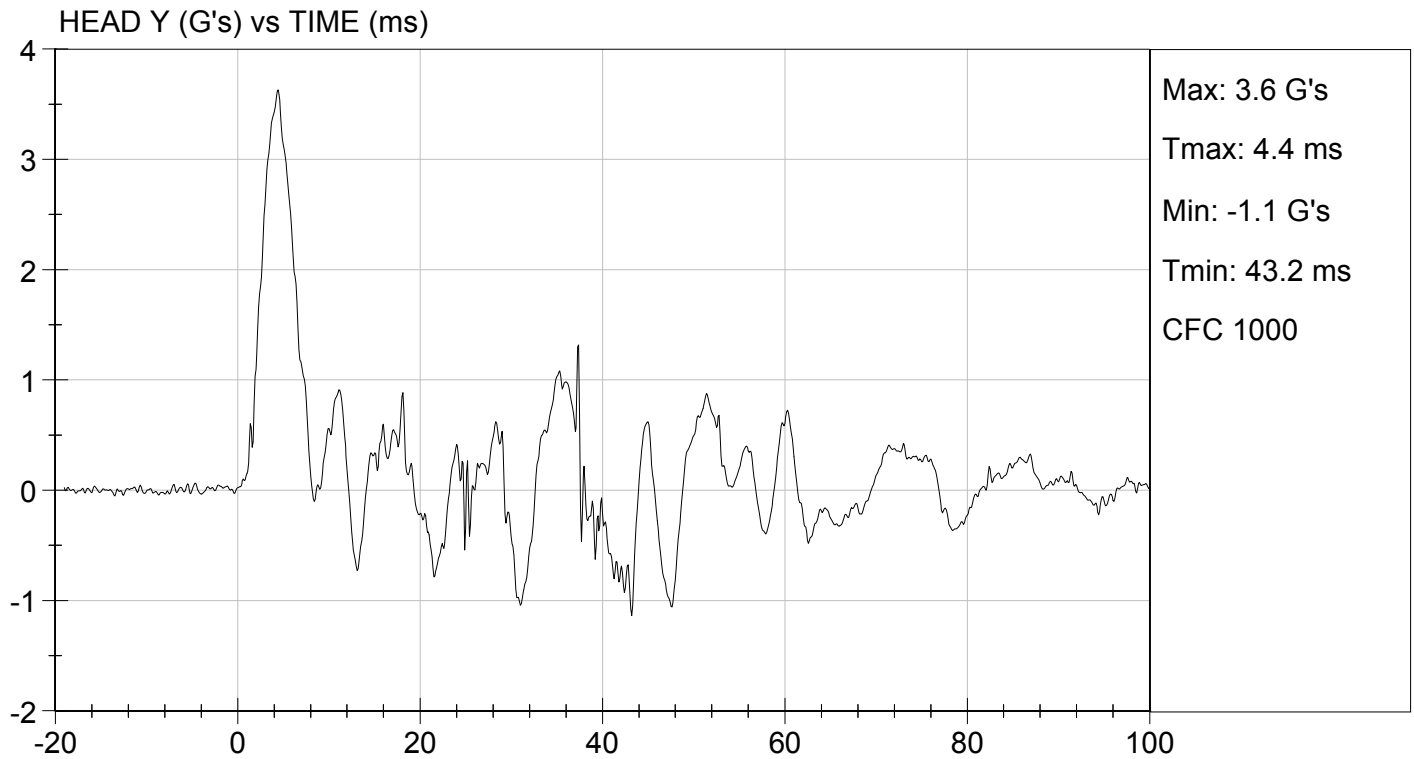
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	100 to 120	113	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 17% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

11/06/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET E4
REAR HEAD DROP TEST (572.152) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/06/2014

Technician: David Schoedel

- ☒ Pre test calibration
☐ Post test calibration verification

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

- ☒ 1. It has been at least 2 hours since the last rear head drop and at least 30 minutes since the last frontal head drop. (572.152(c)(5))
☒ N/A, ONLY one neck test performed
- ☒ 2. The head assembly consists of the head (921022-001), triaxial accelerometer mounting block (SA572-S80), and three (3) accelerometers (SA572-S4). (572.152(a))
- ☒ 3. Accelerometers and their respective mounts are smooth and clean.
- ☒ 4. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- ☒ 5. 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. (572.152(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>35%</u> |
| Record the minimum humidity: | <u>32%</u> |
- ☒ 6. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- ☒ 7. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.152(c)(2))

- X 8. Suspend and orient the head assembly as shown in Figure 6E. The lowest point on the back of the head is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.152(c)(3)(ii))

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 9. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.152(c)(3)(ii))

Record the right side distance 501 mm

Record the left side distance 501 mm

- X 10. The angle between the lower surface plane of the neck transducer mass simulator (910420-003) and the plane of the impact surface is 90 ± 1 degrees. (572.152(c)(3)(ii))

Record the angle: 90 degrees

- X 11. 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). (572.152(c)(4))

Record actual micro finish: 24.8 micro inches

- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.152(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

- X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.152(b)) & (572.152(c)(4))

- X 14. Complete the following table. (572.152(b)):

Parameter	Specification	Result
Peak resultant acceleration	$55 \text{ g} \leq x \leq 71 \text{ g}$	65 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 17% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq \pm 15 \text{ g}$	-1.8 g

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

11/06/2014
Date

MGA RESEARCH CORPORATION
REAR HEAD DROP TEST
CRABI 12 MONTH

ATD Serial No: 083

Test ID: D143935

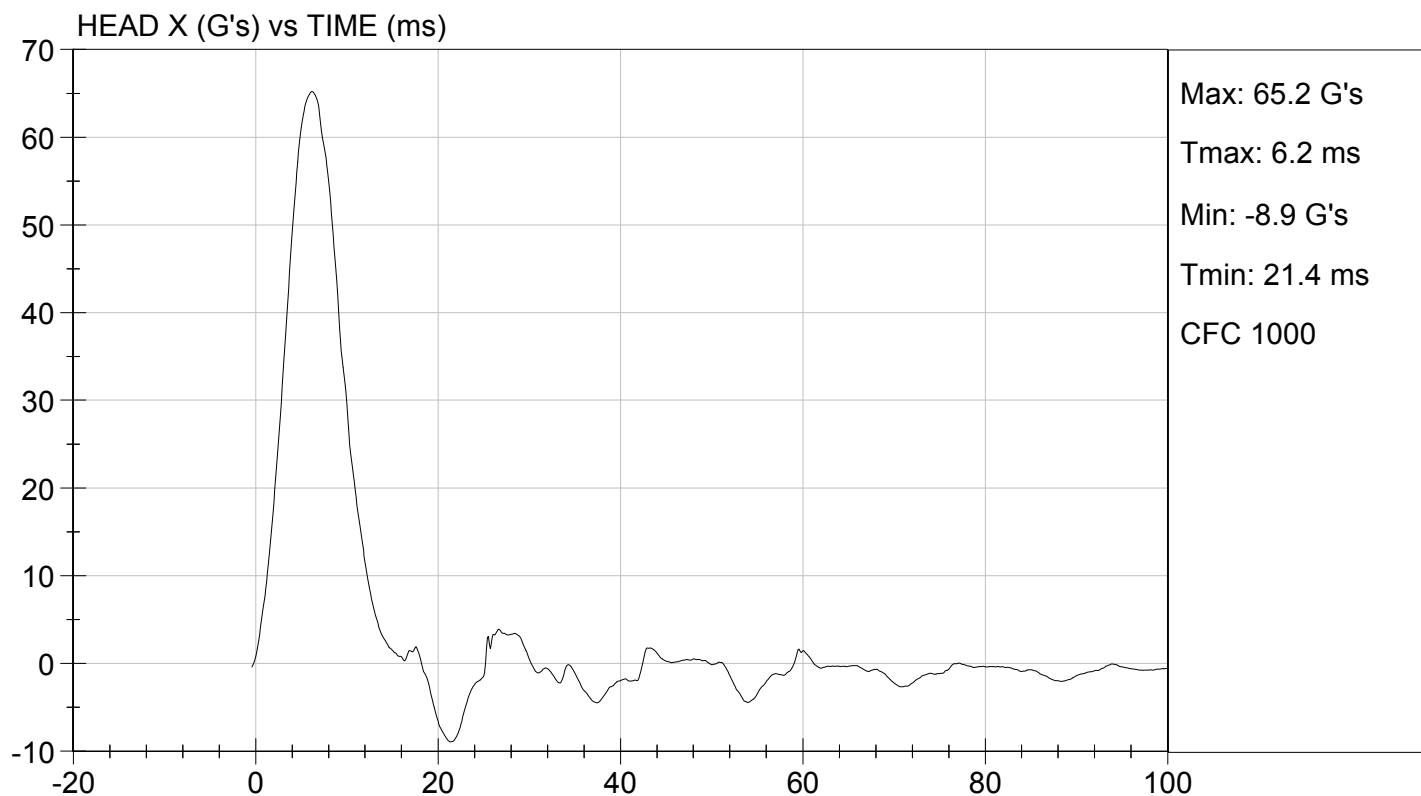
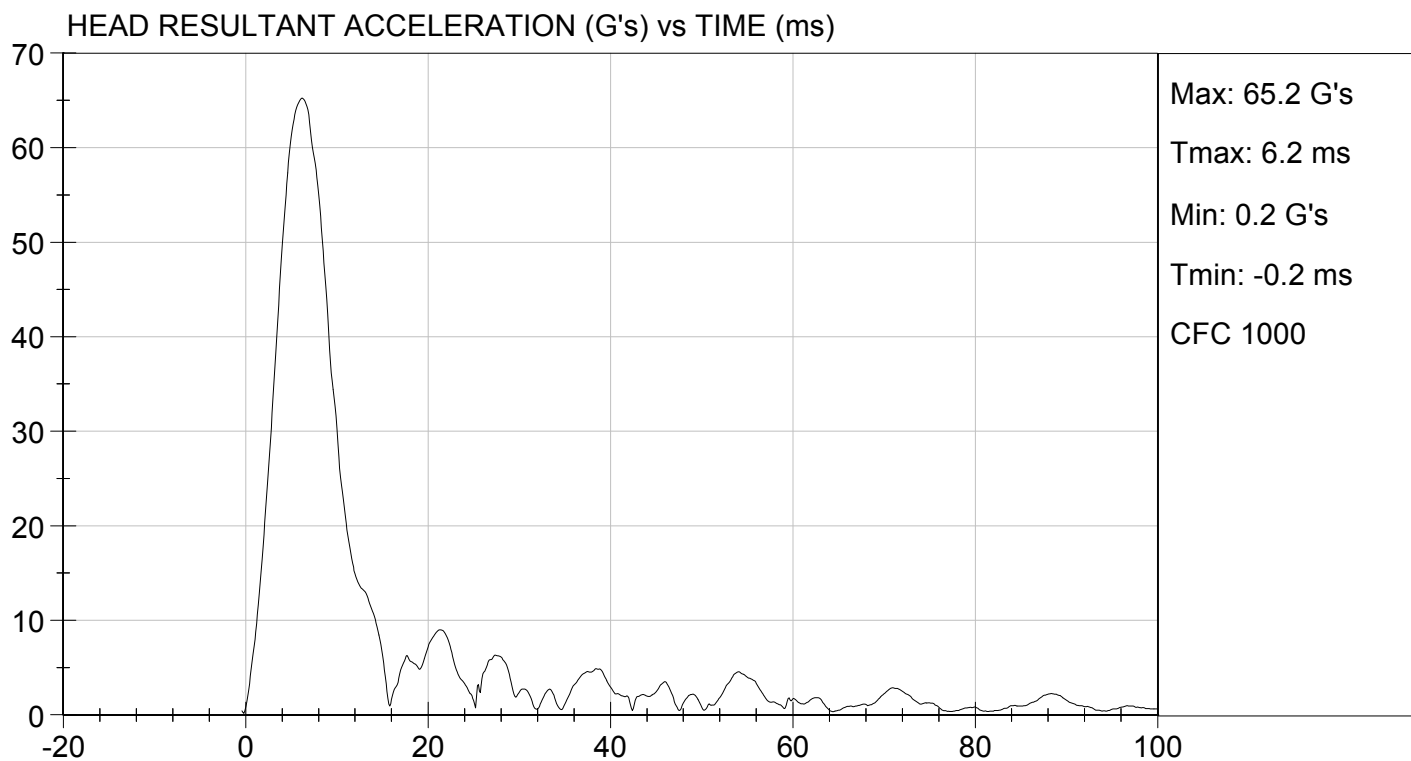
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Peak Resultant Acceleration	G's	55 to 71	65	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 17% of peak	Yes	Pass
			Overall Test Results	Pass

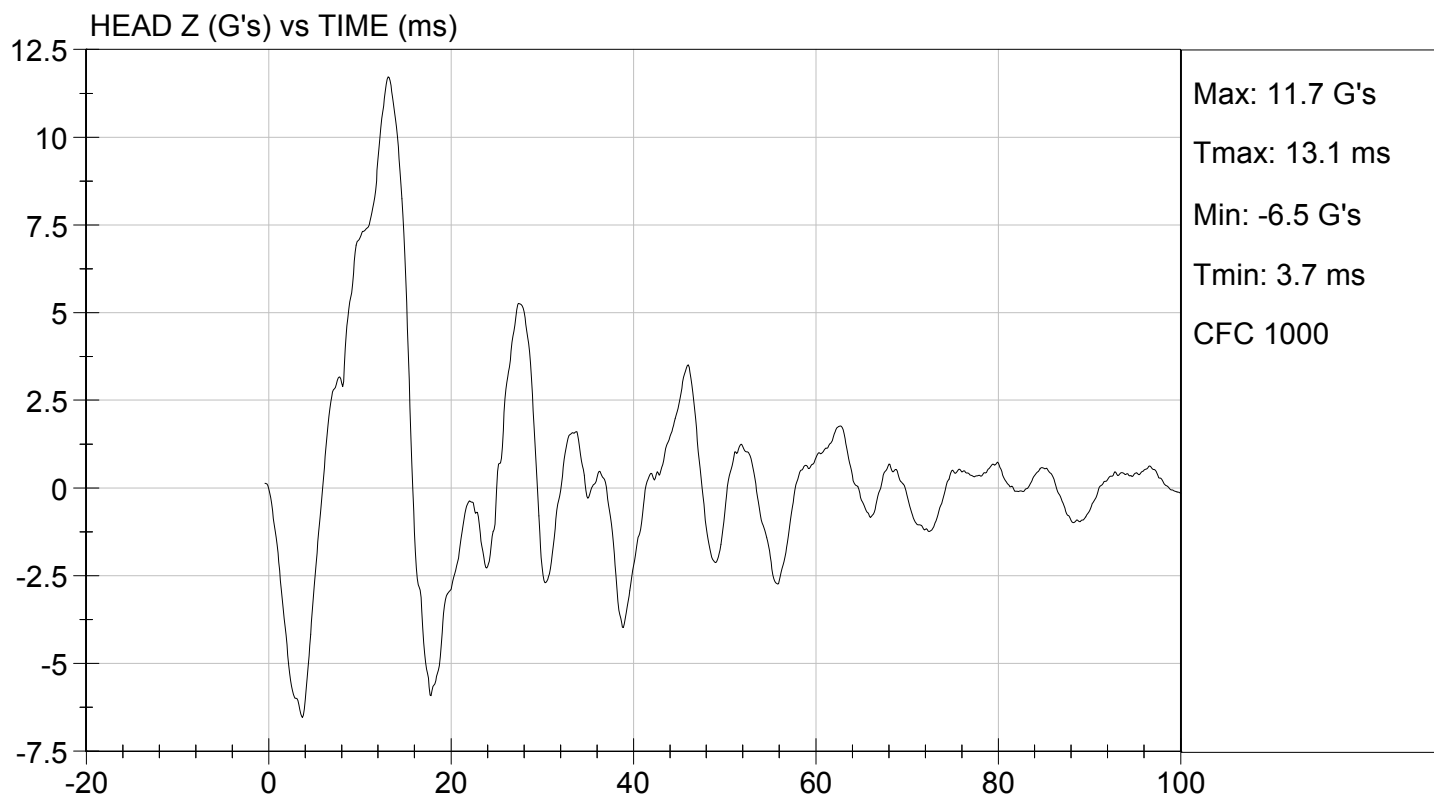
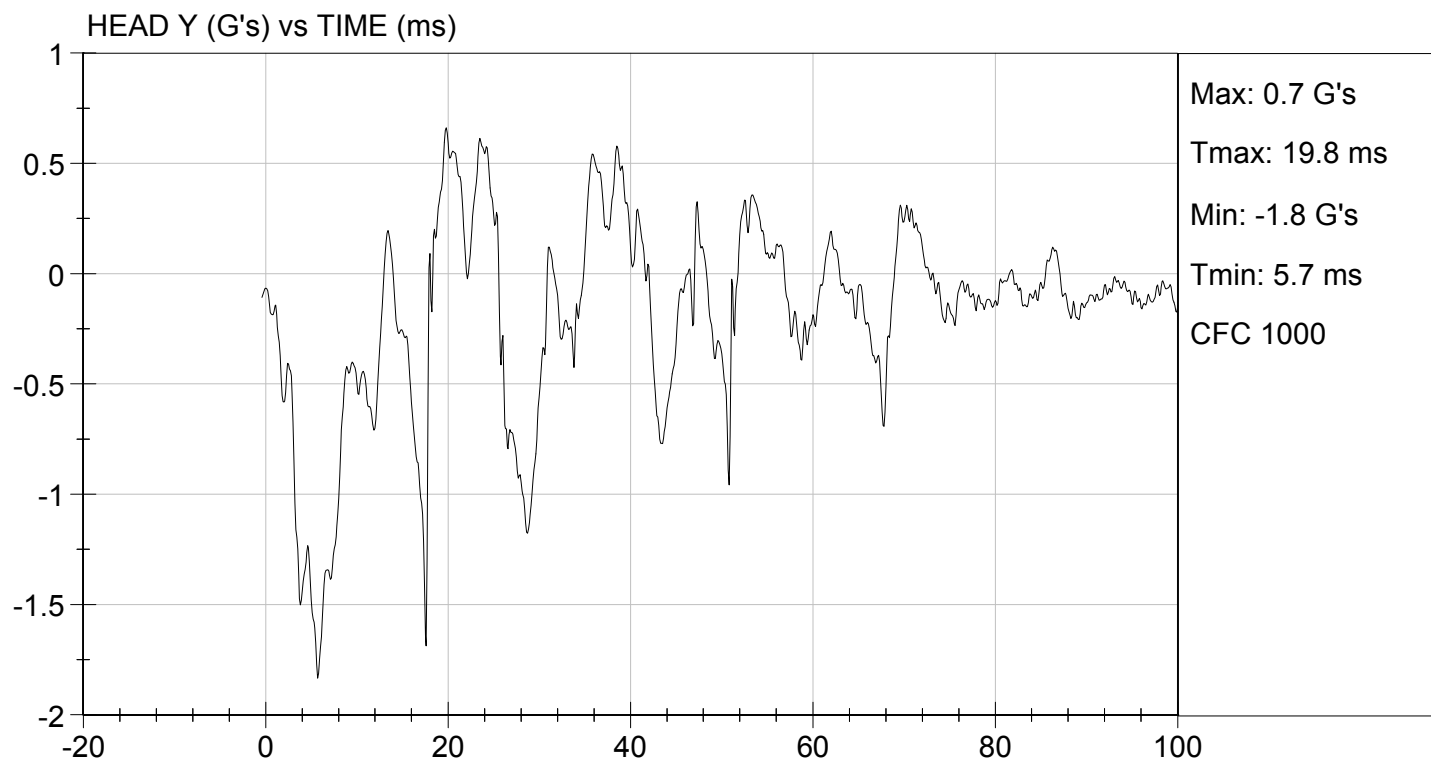
David Schoedel
Laboratory Technician

11/06/2014

Test Date

Jeff Levan-Marsh
Approved By





DATA SHEET E5
NECK FLEXION TEST (572.153) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/06/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.155(m))
 X N/A, this is first neck test performed

X 2. The components required for the neck tests include the neck assembly (921022-041), and headform (TE-3200-160). (572.153(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.153(c)(1))

Record the maximum temperature:	<u>21.9°C</u>
Record the minimum temperature:	<u>21.3°C</u>
Record the maximum humidity:	<u>35%</u>
Record the minimum humidity:	<u>32%</u>

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))

X 7. The test fixture pendulum conforms to the specifications in Figure 7E.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 8E for the flexion test. (572.153(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly and not induce neck torsion. (572.153(c)(3)(ii))
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.153(c)(3)(i))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.1 m/s to 5.3 m/s as measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb. (572.153(c)(4))
- X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.153(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		$5.1 \text{ m/s} \leq \text{speed} \leq 5.3 \text{ m/s}$	5.3 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.6 \text{ m/s} \leq \Delta V \leq 2.3 \text{ m/s}$	1.8 m/s
	@ 20 ms	$3.4 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$	3.5 m/s
	@ 25 ms	$4.3 \text{ m/s} \leq \Delta V \leq 5.2 \text{ m/s}$	4.3 m/s
Plane D Rotation		Peak moment* $36 \text{ Nm} \leq \text{moment} \leq 45 \text{ Nm}$ during the following rotation range $75^\circ \leq \text{angle} \leq 86^\circ$	37.6 Nm @ 75.5 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm $60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$	74.1 ms

*Moment about the occipital condyle = $M_y - (0.005842 \text{ m} \times F_x)$ (572.153(b)(1)(iii))

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. (572.153(c)(4)(i))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel
Signature

11/06/2014
Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
CRABI 12 MONTH

ATD Serial No: 083

Test I.D: D143932

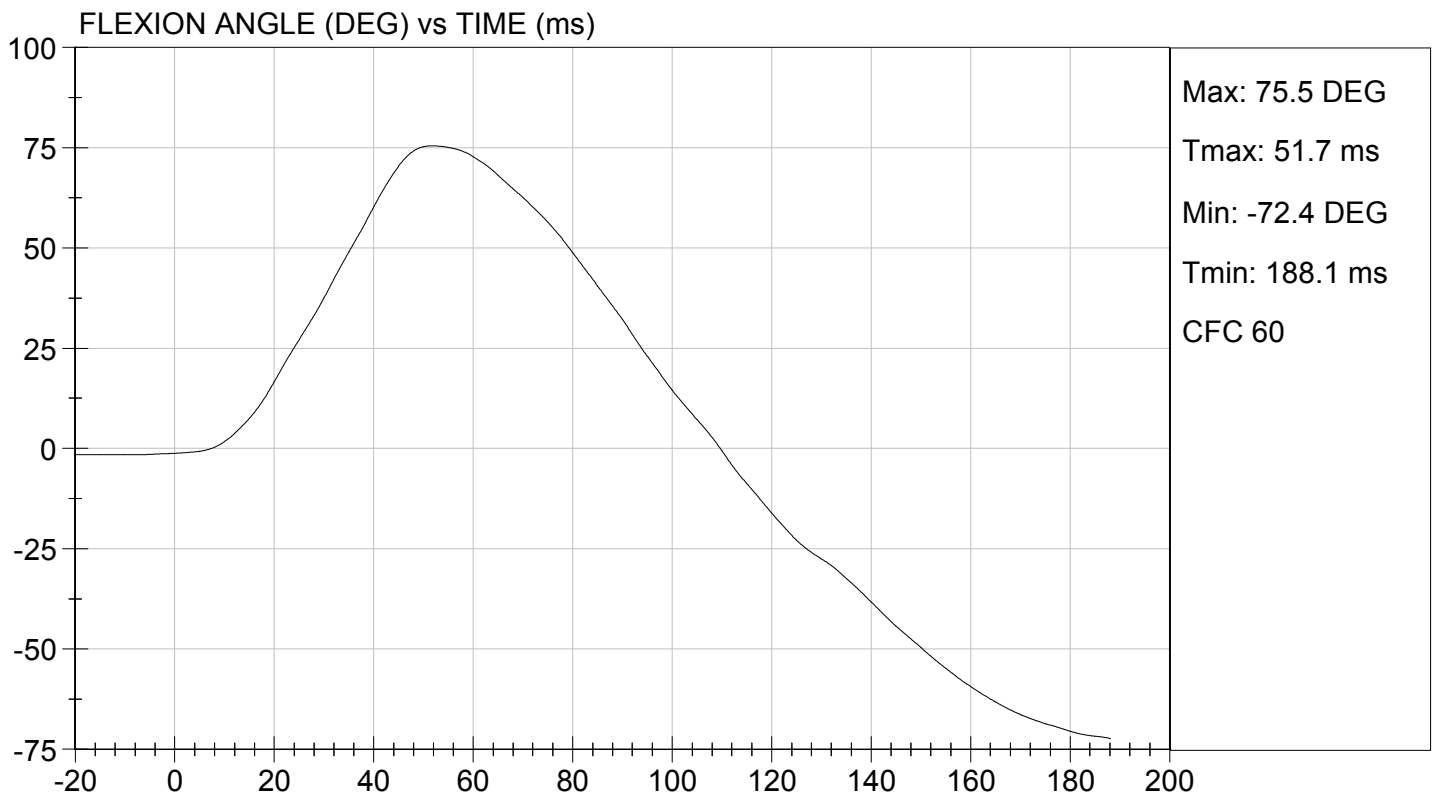
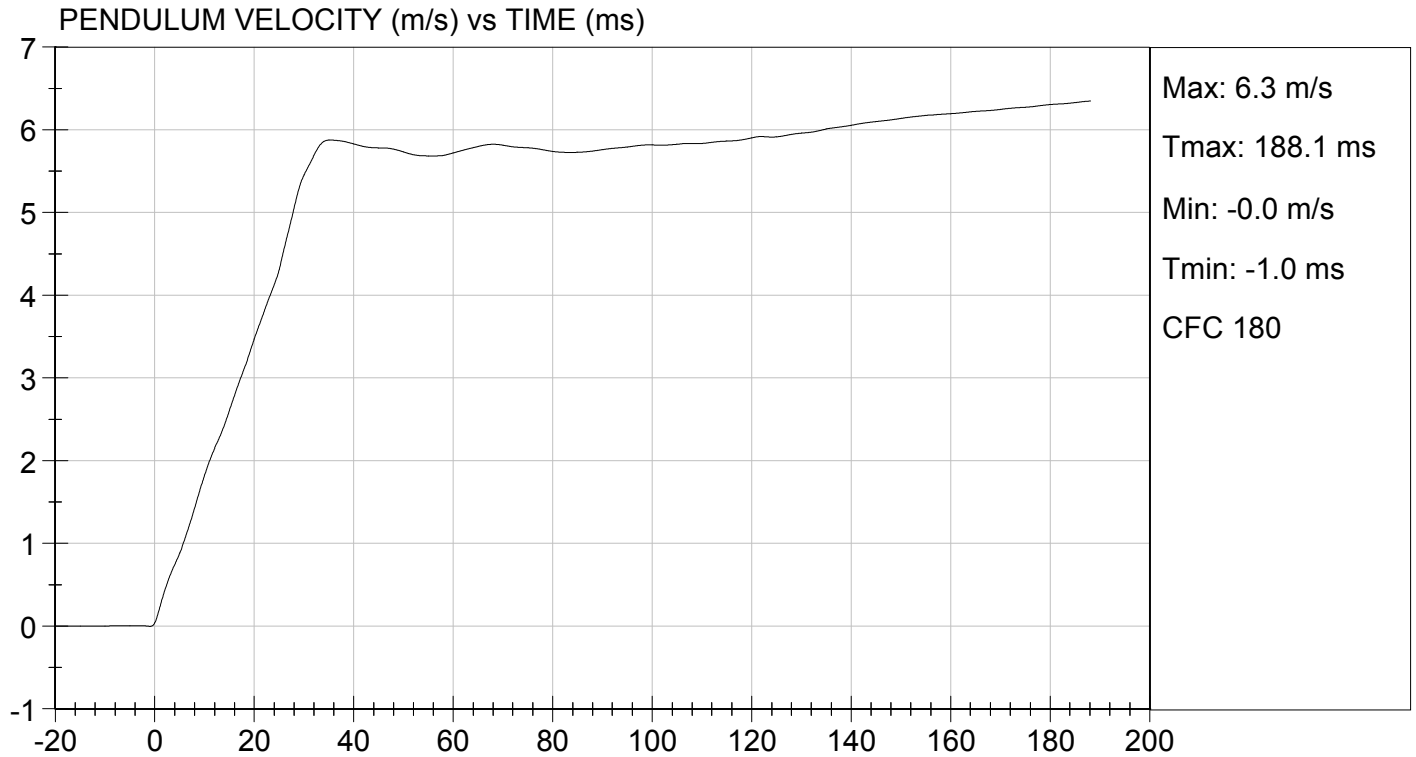
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	34	Pass
Pendulum Speed		m/s	5.1 to 5.3	5.3	Pass
Pendulum Velocity	10 ms	m/s	1.6 to 2.3	1.8	Pass
	20 ms	m/s	3.4 to 4.2	3.5	Pass
	25 ms	m/s	4.3 to 5.2	4.3	Pass
D Plane Rotation		deg	75.0 to 86.0	75.5	Pass
Peak Moment within Deflection Corridor		Nm	36.0 to 45.0	37.6	Pass
Positive Moment - Time Curve Decay to 5 Nm		ms	60.0 to 80.0	74.1	Pass
Overall Test Results				Pass	

David Schoedel
Laboratory Technician

11/06/2014

Test Date

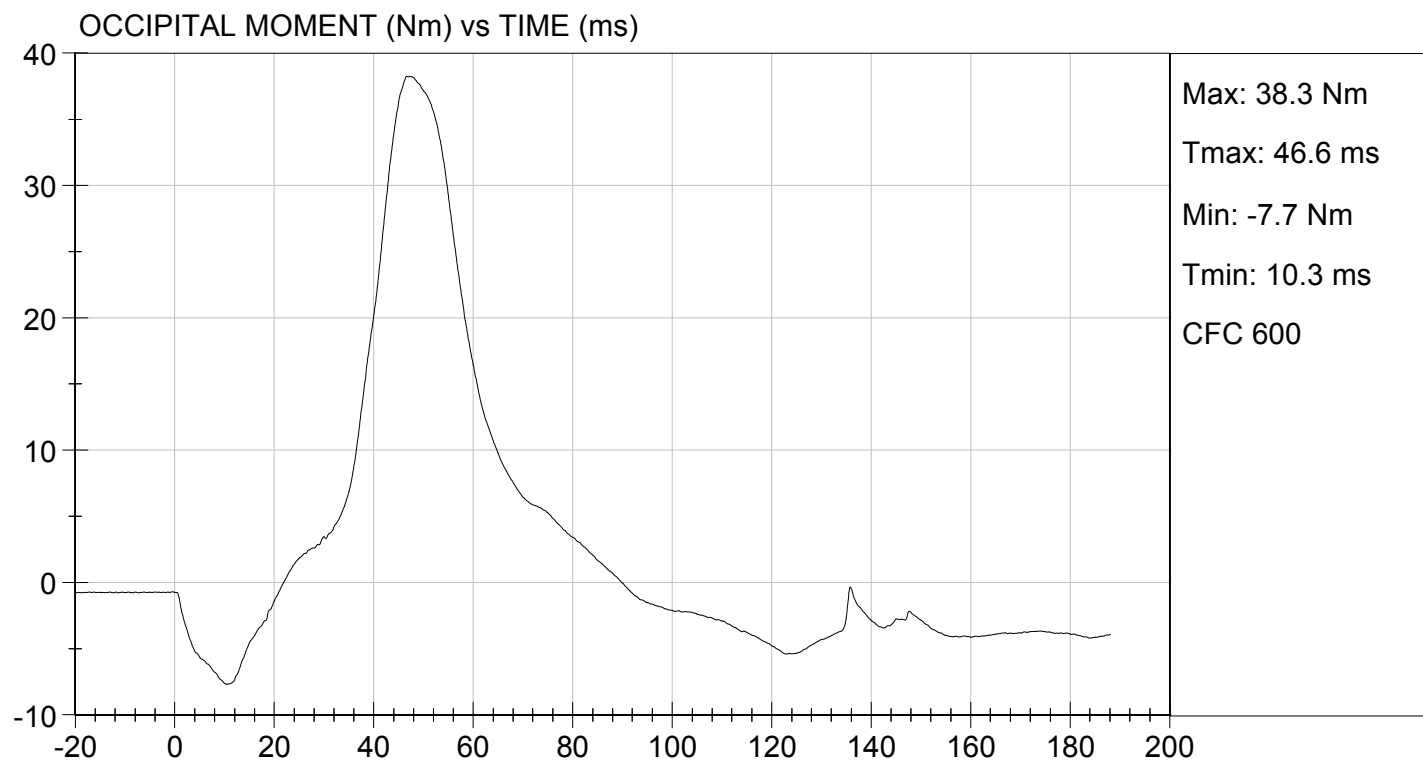
Jeff Levanthasi
Approved By





TEST DESC: NECK FLEXION
VELOCITY: 17.36 ft/s, 5.3 m/s

TEST DATE: 11/06/2014
TEST #: D143932



DATA SHEET E6
NECK EXTENSION TEST (572.153) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/06/2014

Technician: David Schoedel

X Pre test calibration
 Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.155(m))
 X N/A, this is the first neck test performed
- X 2. The components required for the neck tests include the neck assembly (921022-041), and headform (TE-3200-160). (572.153(a))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.153(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>35%</u> |
| Record the minimum humidity: | <u>32%</u> |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
Record findings and actions: No damage
- X 5. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))
- X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- X 7. The test fixture pendulum conforms to the specifications in Figure 7E.
- X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9E for the flexion test. (572.153(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly and not induce neck torsion. (572.153(c)(3)(ii))
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.153(c)(3)(i))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 2.4 m/s to 2.6 m/s as measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb. (572.153(c)(4))
- X 13. Complete the following table:

Neck Extension Results (572.143(b)(1)) & (572.153(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		$2.4 \text{ m/s} \leq \text{speed} \leq 2.6 \text{ m/s}$	2.6 m/s
Pendulum ΔV with respect to impact speed	@ 6 ms	$0.8 \text{ m/s} \leq \Delta V \leq 1.2 \text{ m/s}$	1.0 m/s
	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 2.1 \text{ m/s}$	1.8 m/s
	@ 14 ms	$2.2 \text{ m/s} \leq \Delta V \leq 2.9 \text{ m/s}$	2.3 m/s
Plane D Rotation		Peak moment* $-12 \text{ Nm} \leq \text{moment} \leq -23 \text{ Nm}$ during the following rotation range $80^\circ \leq \text{angle} \leq 92^\circ$	-22.6 Nm @ 86.5 degrees
Positive Moment Decay** (Extension)		Time to decay to -5 Nm $76 \text{ ms} \leq \text{time} \leq 90 \text{ ms}$	79.6 ms

*Moment about the occipital condyle = $M_y - (0.005842 \text{ m} \times F_x)$ (572.153(b)(1)(iii))

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. (572.153(c)(4)(i))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel

Signature

11/06/2014

Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
CRABI 12 MONTH

ATD Serial No: 083

Test I.D: D143933

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	34	Pass
Pendulum Speed		m/s	2.4 to 2.6	2.6	Pass
Pendulum Velocity	6 ms	m/s	0.8 to 1.2	1.0	Pass
	10 ms	m/s	1.5 to 2.1	1.8	Pass
	14 ms	m/s	2.2 to 2.9	2.3	Pass
D Plane Rotation		deg	80.0 to 92.0	86.5	Pass
Peak Moment within Deflection Corridor		Nm	-23.0 to -12.0	-22.6	Pass
Negative Moment - Time Curve Decay to -5 Nm		ms	76.0 to 90.0	79.6	Pass
Overall Test Results				Pass	

David Schoedel
Laboratory Technician

11/06/2014

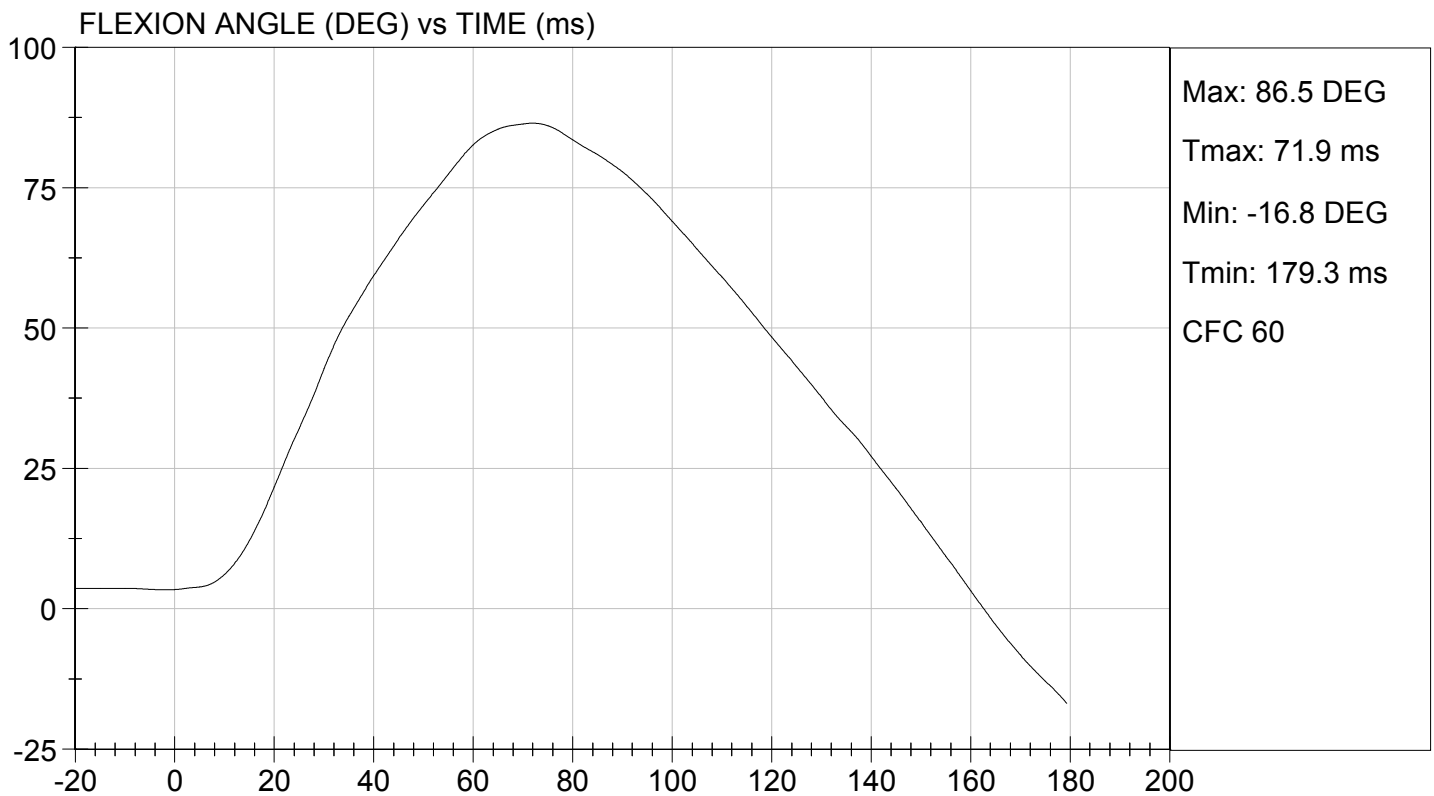
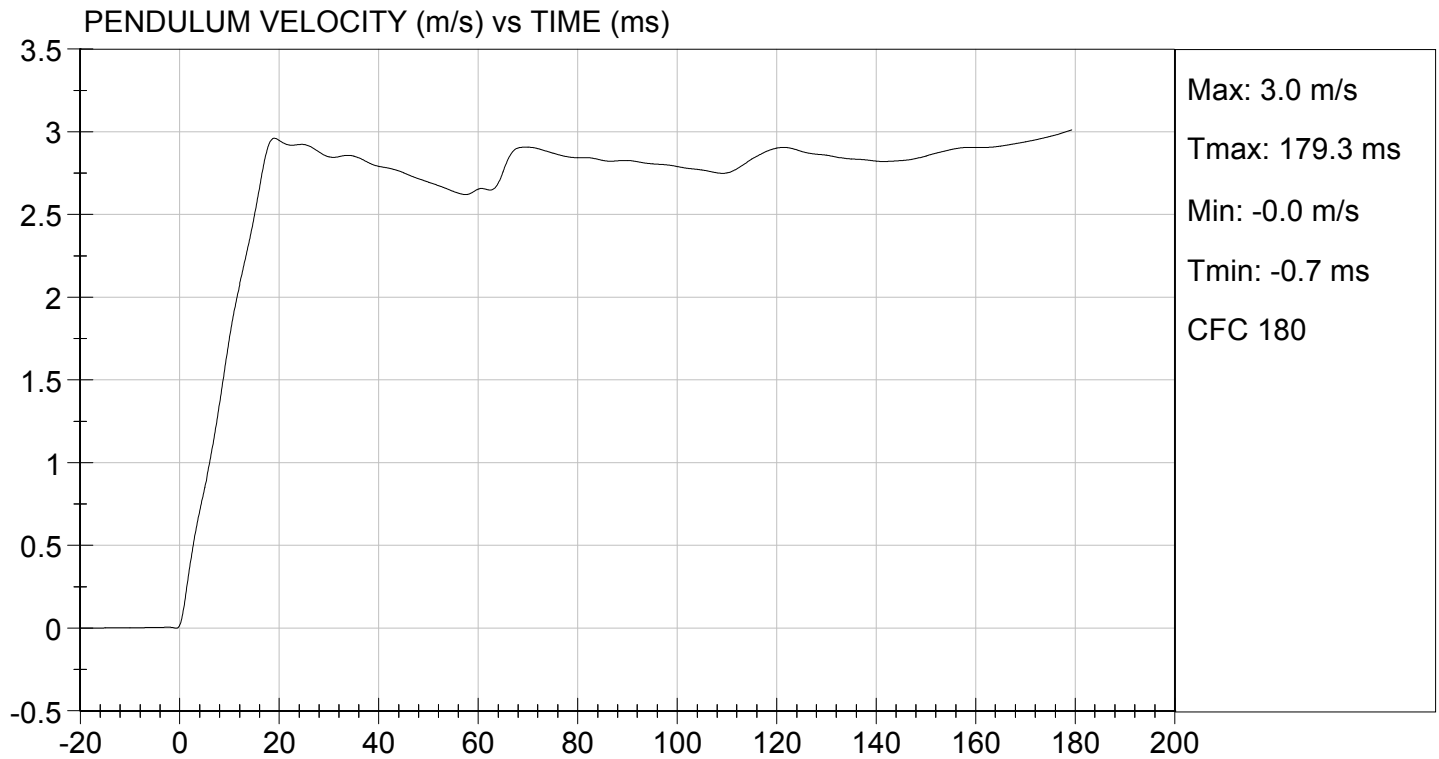
Test Date

Jeff Leonard
Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 8.42 ft/s, 2.57 m/s

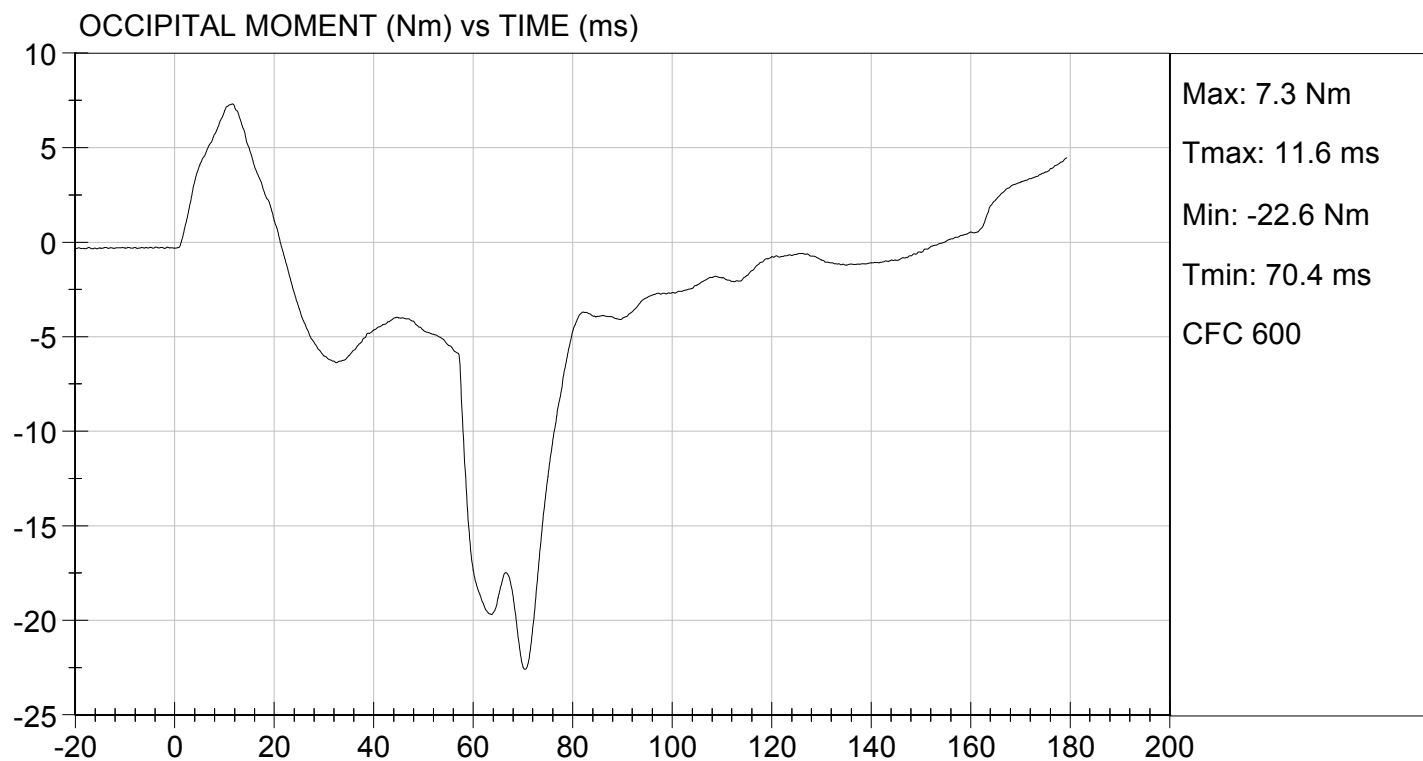
TEST DATE: 11/06/2014
TEST #: D143933





TEST DESC: NECK EXTENSION
VELOCITY: 8.42 ft/s, 2.57 m/s

TEST DATE: 11/06/2014
TEST #: D143933



DATA SHEET E7
THORAX IMPACT TEST (572.154) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/06/2014

Technician: David Schoedel

- ☒ Pre test 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. (572.155(m))
☒ N/A, ONLY one thorax impact test performed
- ☒ 2. The test fixture conforms to the specifications in Figure 10E.
- ☒ 3. The complete assembled dummy (921022-000) is used (572.154(b)) and is dressed in cotton-polyester-based tight-fitting long-sleeved sweat shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.154(c)(2))
- ☒ 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. (572.154(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.9°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity: | <u>35%</u> |
| Record the minimum humidity: | <u>32%</u> |
- ☒ 5. Seat the dummy, without back support on the test fixture surface as shown in Figure 10E. The legs are extended forward, parallel to the midsagittal plane. The surface must be long enough to support the pelvis and outstretched legs. (572.154(c)(3))
- ☒ 6. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.154(c)(3))
- ☒ 7. The posterior surface of the upper spine box is $90^\circ \pm 1^\circ$ from the horizontal. Shim material may be used under the upper legs to maintain the dummy's specified spine box surface alignment. (572.154(c)(3))
- ☒ 8. Place the upper arms parallel to the torso. Place the lower arms 0° to 5° forward of vertical. (572.154(c)(3))
- ☒ 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane, 196 ± 2.5 mm vertically from the plane of the seating surface and is within $\pm 0.5^\circ$ of a horizontal line in the dummy's midsagittal plane. (572.154(c)(4))

- X 10. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X 11. 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. (572.154(c)(5)) The velocity of the test probe at the time of impact is between 4.9 m/s and 5.1 m/s. (572.154(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.154(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.154(c)(7))
- X 12. Complete the following table:

Thorax Impact Results (572.154(b))		
Parameter*	Specification	Result
Test Probe Speed	4.9 m/s ≤ speed ≤ 5.1 m/s	5.08 m/s
Peak force**	1514 N ≤ peak force ≤ 1796 N	1641 N

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

**Force = impactor mass x acceleration (572.144(b)(3))

- X 13. Plots of pendulum acceleration, and pendulum force, follow this sheet.

David Schoedel

Signature

11/06/2014

Date

MGA RESEARCH CORPORATION
THORAX IMPACT TEST
CRABI 12 MONTH

ATD Serial No: 083

Test I.D: D143934

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	33	Pass
Probe Speed	m/s	4.9 to 5.1	5.1	Pass
Probe Force	N	1510 to 1800	1641	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

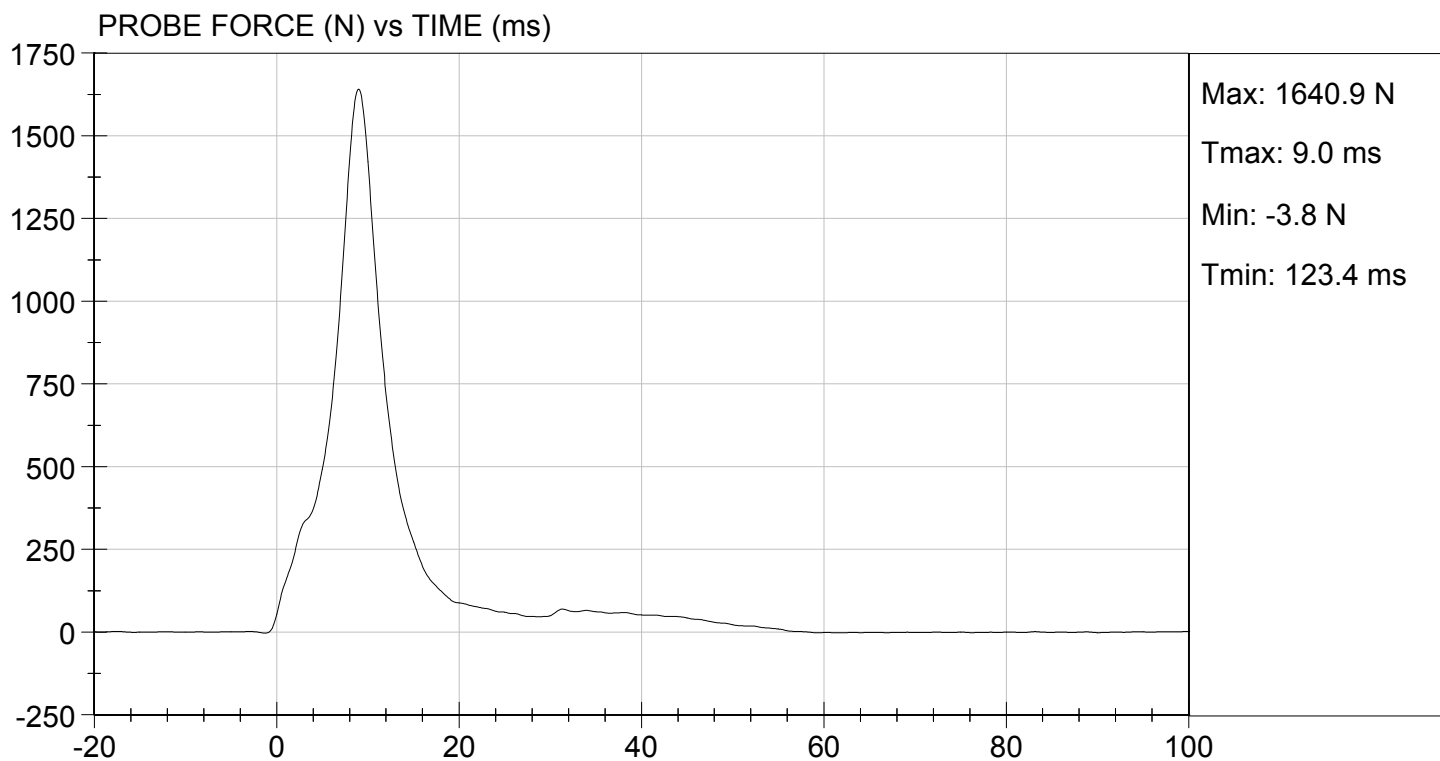
11/06/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 16.67 ft/s, 5.08 m/s

TEST DATE: 11/06/2014
TEST #: D143934



DATA SHEET E8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82104	10/21/2014	04/21/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P2105	10/21/2014	04/21/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P2106	10/21/2014	04/21/2015
NECK TRANSDUCER	Denton	2554	328	09/05/2014	03/05/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79680	10/21/2014	04/21/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82118	10/21/2014	04/21/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82120	10/21/2014	04/21/2015
CHEST POTENTIOMETER	N/A	N/A	N/A	N/A	N/A
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET E3
FRONTAL HEAD DROP TEST (572.152) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/21/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last frontal head drop and at least 30 minutes since the last rear head drop. (572.152(c)(5))
 X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the head (921022-001), triaxial accelerometer mounting block (SA572-S80), and three (3) accelerometers (SA572-S4). (572.152(a))
- X 3. Accelerometers and their respective mounts are smooth and clean.
- X 4. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- X 5. 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. (572.152(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.7°C</u> |
| Record the maximum humidity: | <u>14%</u> |
| Record the minimum humidity: | <u>11%</u> |
- X 6. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 7. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.152(c)(2))

- X 8. Suspend and orient the head assembly as shown in Figure 5E. The lowest point on the forehead is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.152(c)(3)(i))
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 9. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.152(c)(3)(i))
Record the right side distance: 501 mm
Record the left side distance: 501 mm

- X 10. The angle between the lower surface plane of the neck transducer mass simulator (910420-003) and the plane of the impact surface is 45 ± 1 degrees. (572.152(c)(3)(i))
Record the angle: 45 degrees

- X 11. 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). (572.152(c)(4))
Record actual micro finish: 40.9 micro inches

- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.152(c)(4))
Record thickness: 50.9 mm
Record width: 604 mm
Record length: 595 mm

- X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.152(b)) & (572.152(c)(4))

- X 14. Complete the following table. (572.152(b)):

Parameter	Specification	Result
Peak resultant acceleration	$100 \text{ g} \leq x \leq 120 \text{ g}$	114 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 17% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq \pm 15 \text{ g}$	-10.3 g

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

11/21/2014
Date

MGA RESEARCH CORPORATION
FRONT HEAD DROP TEST
CRABI 12 MONTH

ATD Serial No: 083

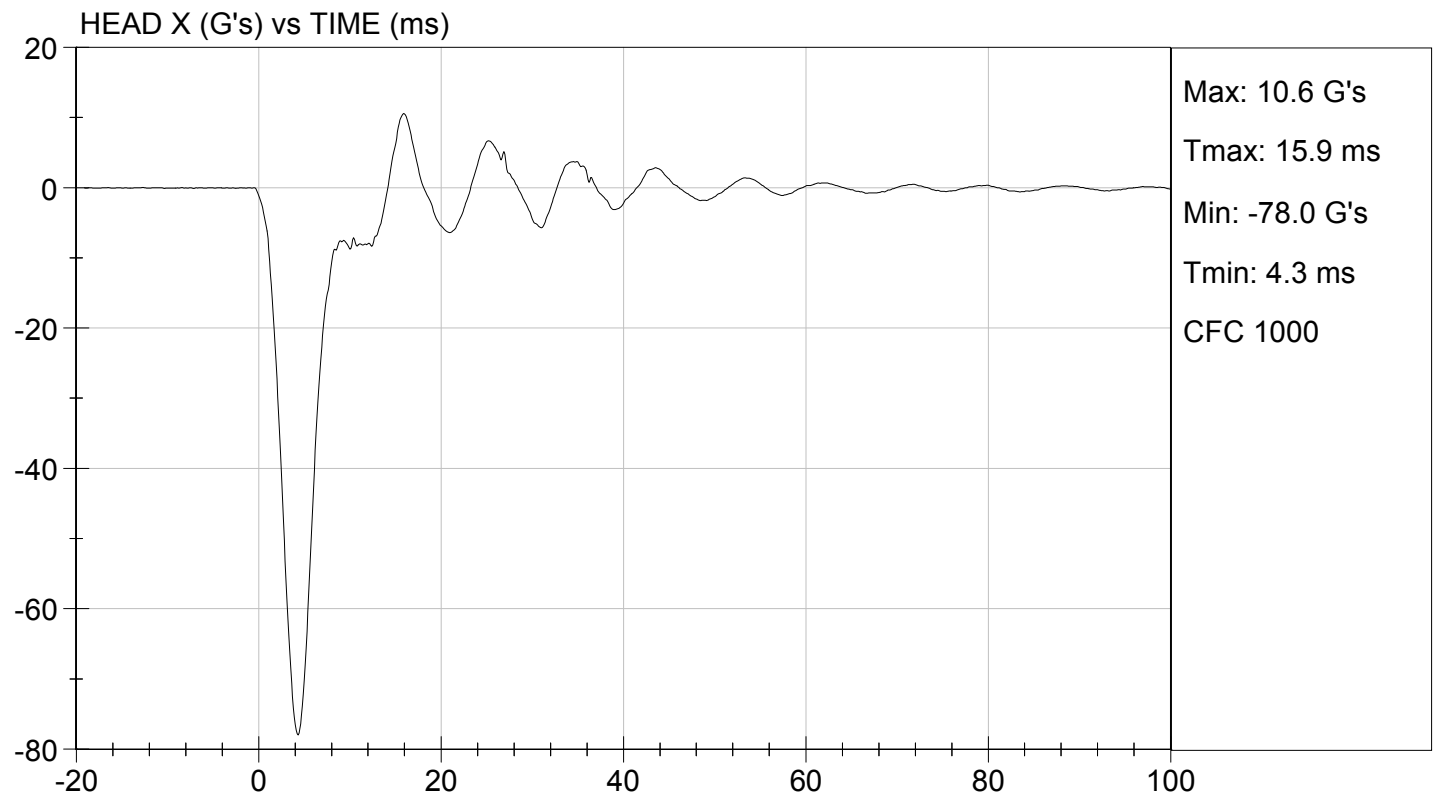
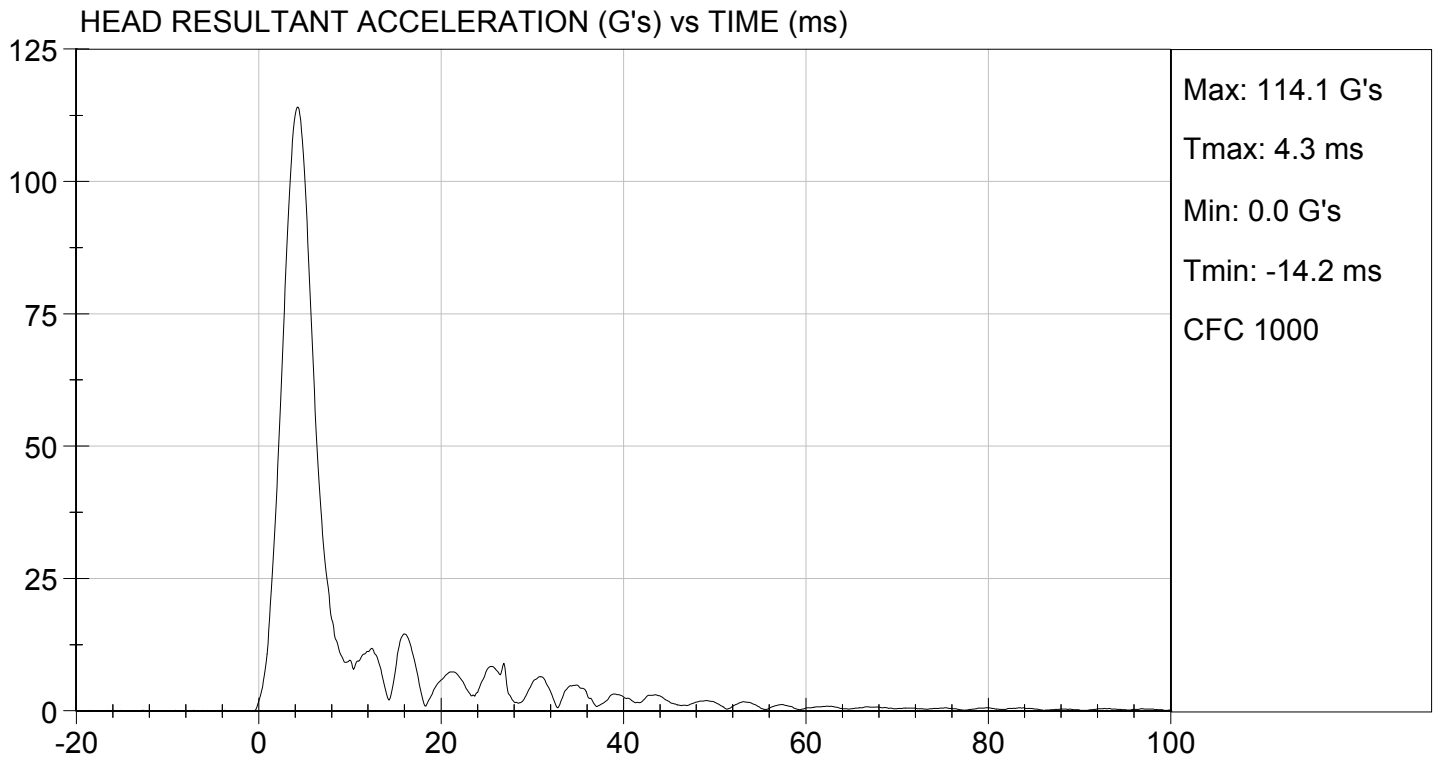
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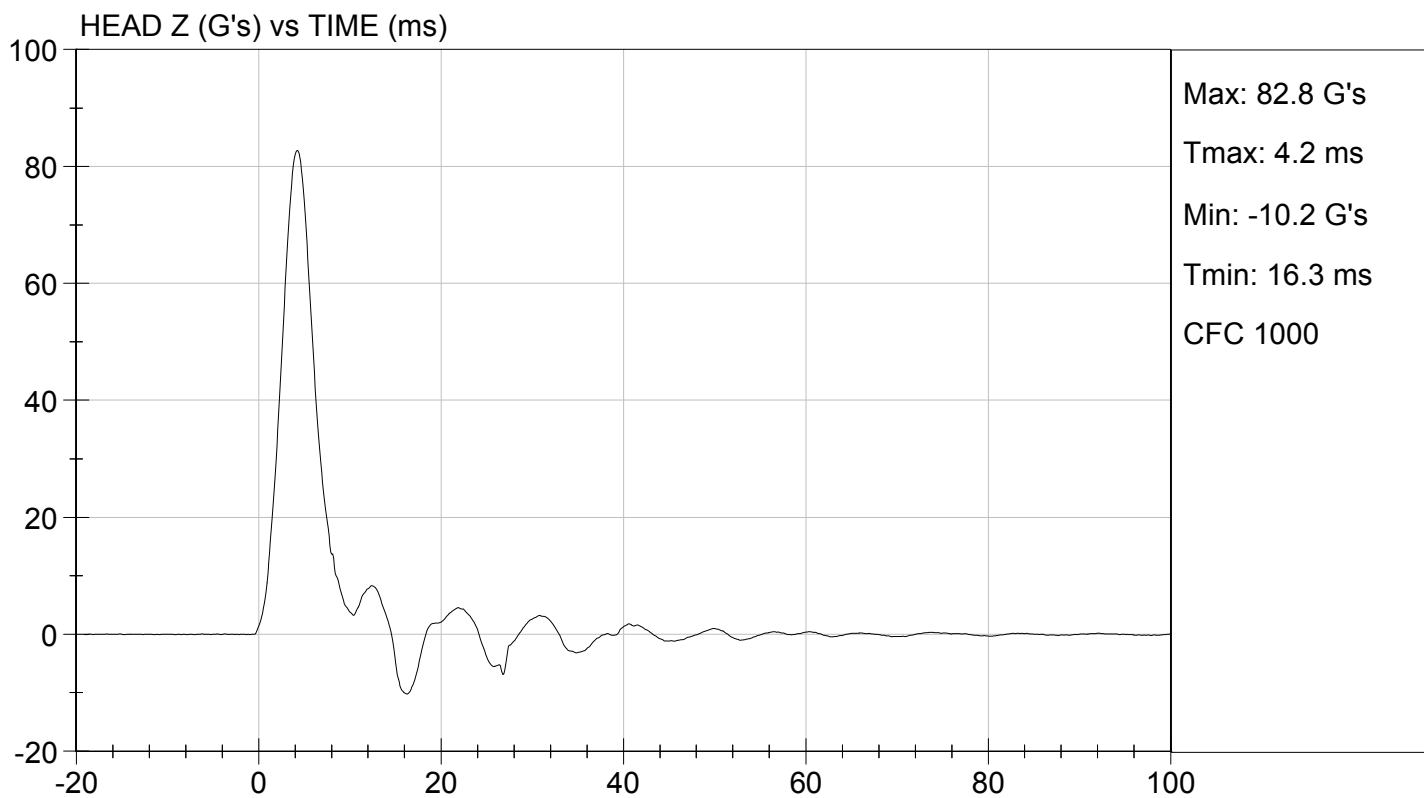
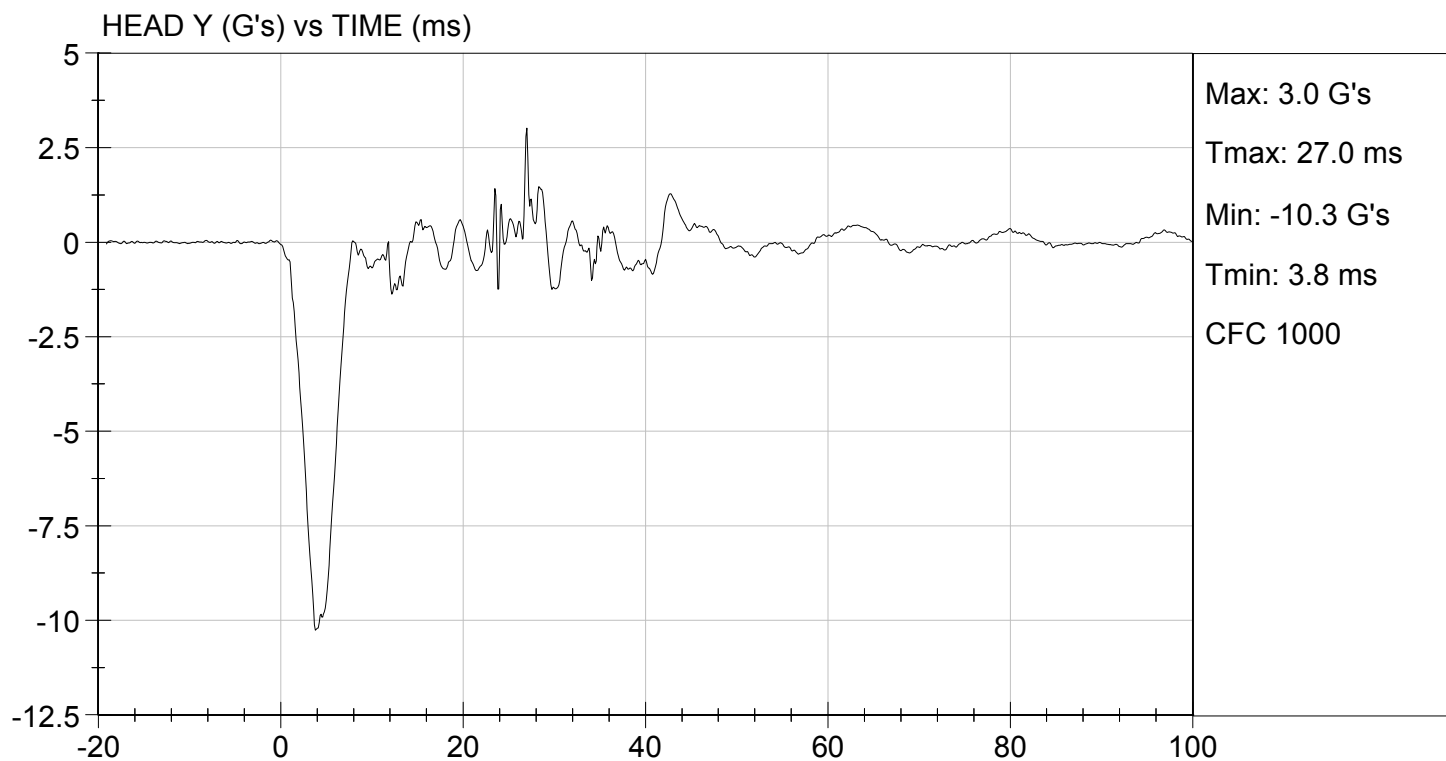
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Peak Resultant Acceleration	G's	100 to 120	114	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-10.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 17% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

11/21/2014
Test Date

Jeff Leonard
Approved By





DATA SHEET E4
REAR HEAD DROP TEST (572.152) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/21/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last rear head drop and at least 30 minutes since the last frontal head drop. (572.152(c)(5))
 X N/A, ONLY one neck test performed
- X 2. The head assembly consists of the head (921022-001), triaxial accelerometer mounting block (SA572-S80), and three (3) accelerometers (SA572-S4). (572.152(a))
- X 3. Accelerometers and their respective mounts are smooth and clean.
- X 4. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))
- X 5. 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. (572.152(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.7°C</u> |
| Record the maximum humidity: | <u>14%</u> |
| Record the minimum humidity: | <u>11%</u> |
- X 6. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 7. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.152(c)(2))

- X 8. Suspend and orient the head assembly as shown in Figure 6E. The lowest point on the back of the head is 376.0 ± 1.0 mm (14.8 ± 0.04 inch) from the impact surface. (572.152(c)(3)(ii))

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 9. The 3.3 mm (0.13 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. (572.152(c)(3)(ii))

Record the right side distance 501 mm

Record the left side distance 501 mm

- X 10. The angle between the lower surface plane of the neck transducer mass simulator (910420-003) and the plane of the impact surface is 90 ± 1 degrees. (572.152(c)(3)(ii))

Record the angle: 90 degrees

- X 11. 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). (572.152(c)(4))

Record actual micro finish: 24.8 micro inches

- X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.152(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

- X 13. Drop the head assembly from a height of 376.0 ± 1.0 mm (14.8 inches $\pm$ 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.152(b)) & (572.152(c)(4))

- X 14. Complete the following table. (572.152(b)):

Parameter	Specification	Result
Peak resultant acceleration	$55 \text{ g} \leq x \leq 71 \text{ g}$	66 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 17% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq \pm 15 \text{ g}$	3.5 g

- X 15. Plots of the x, y, z, and resultant acceleration data follow this sheet.

David Schoedel
Signature

11/21/2014
Date

MGA RESEARCH CORPORATION
REAR HEAD DROP TEST
CRABI 12 MONTH

ATD Serial No: 083

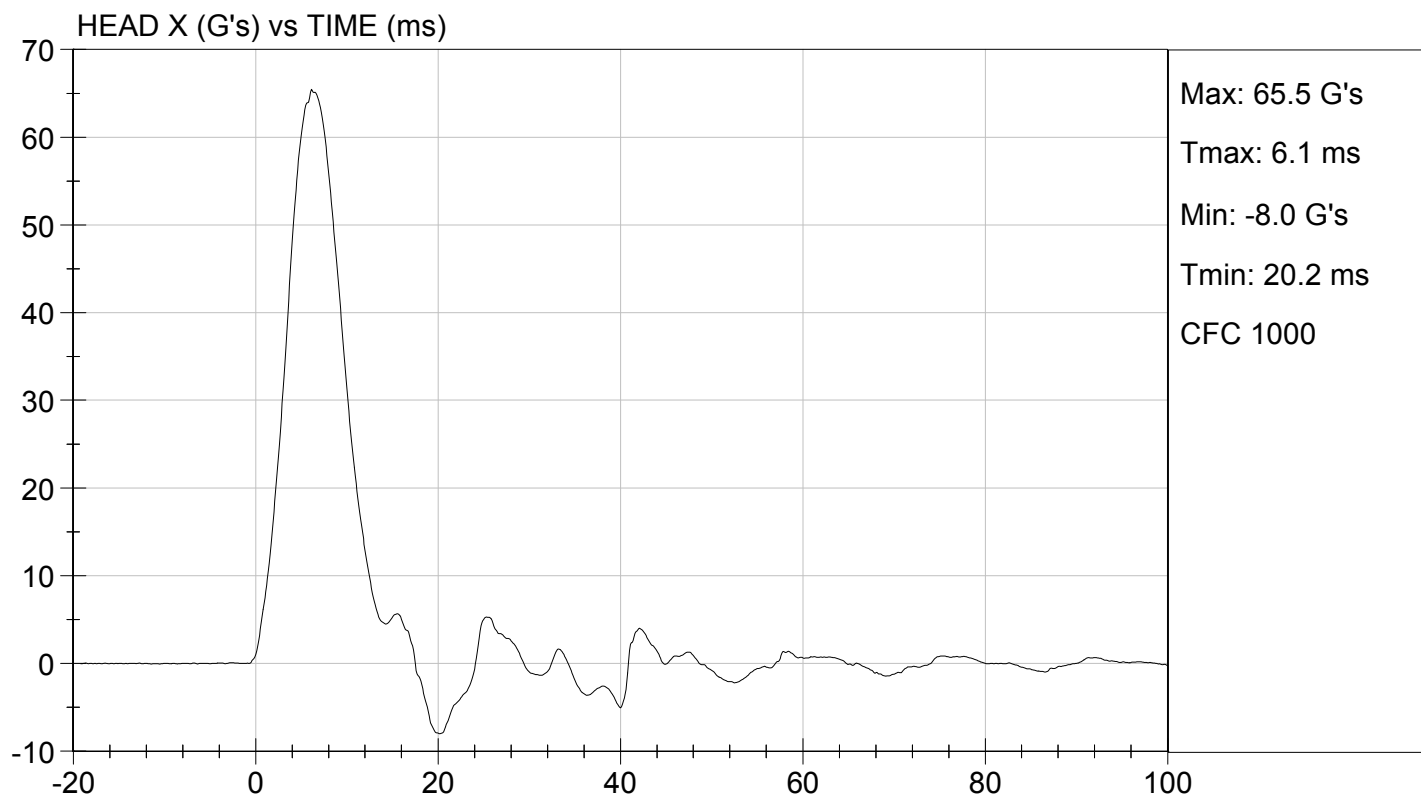
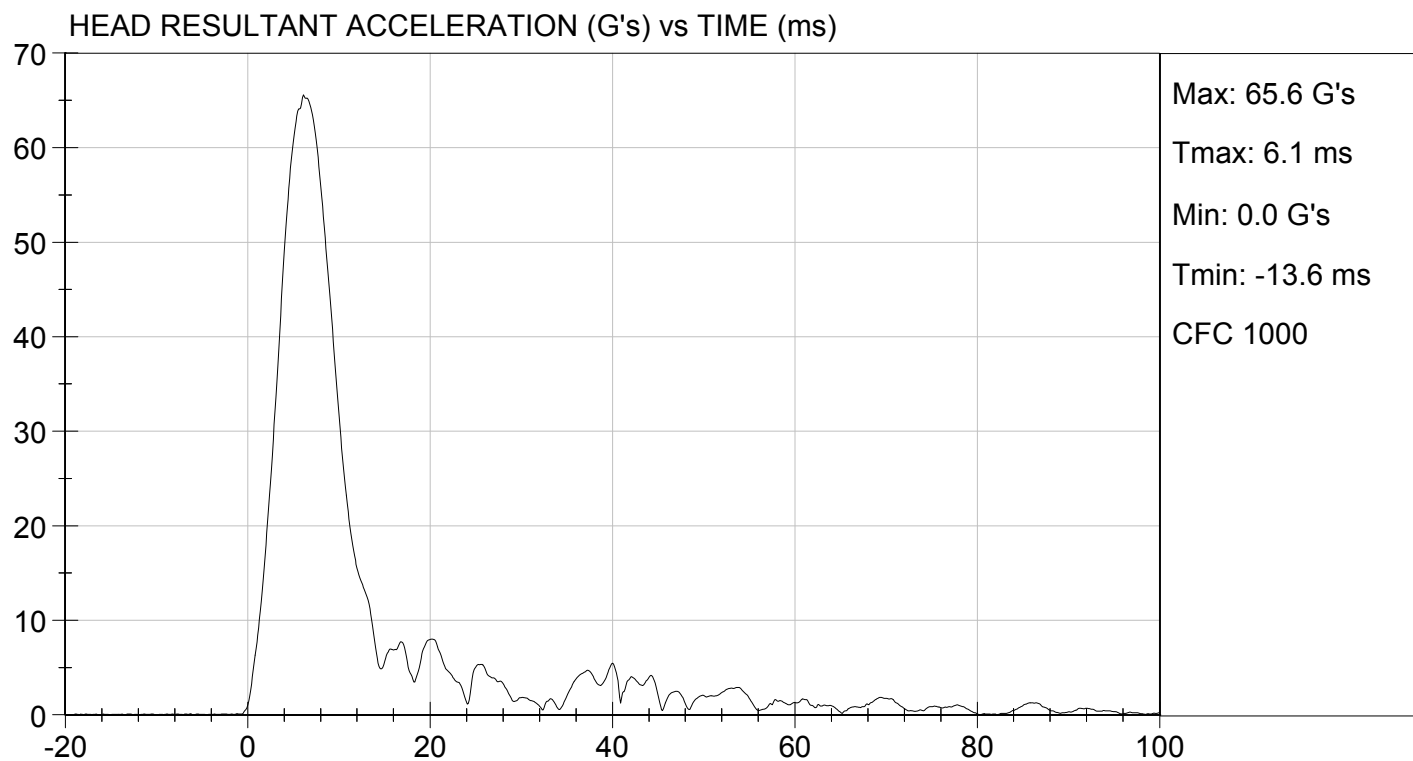
Test ID: D144135

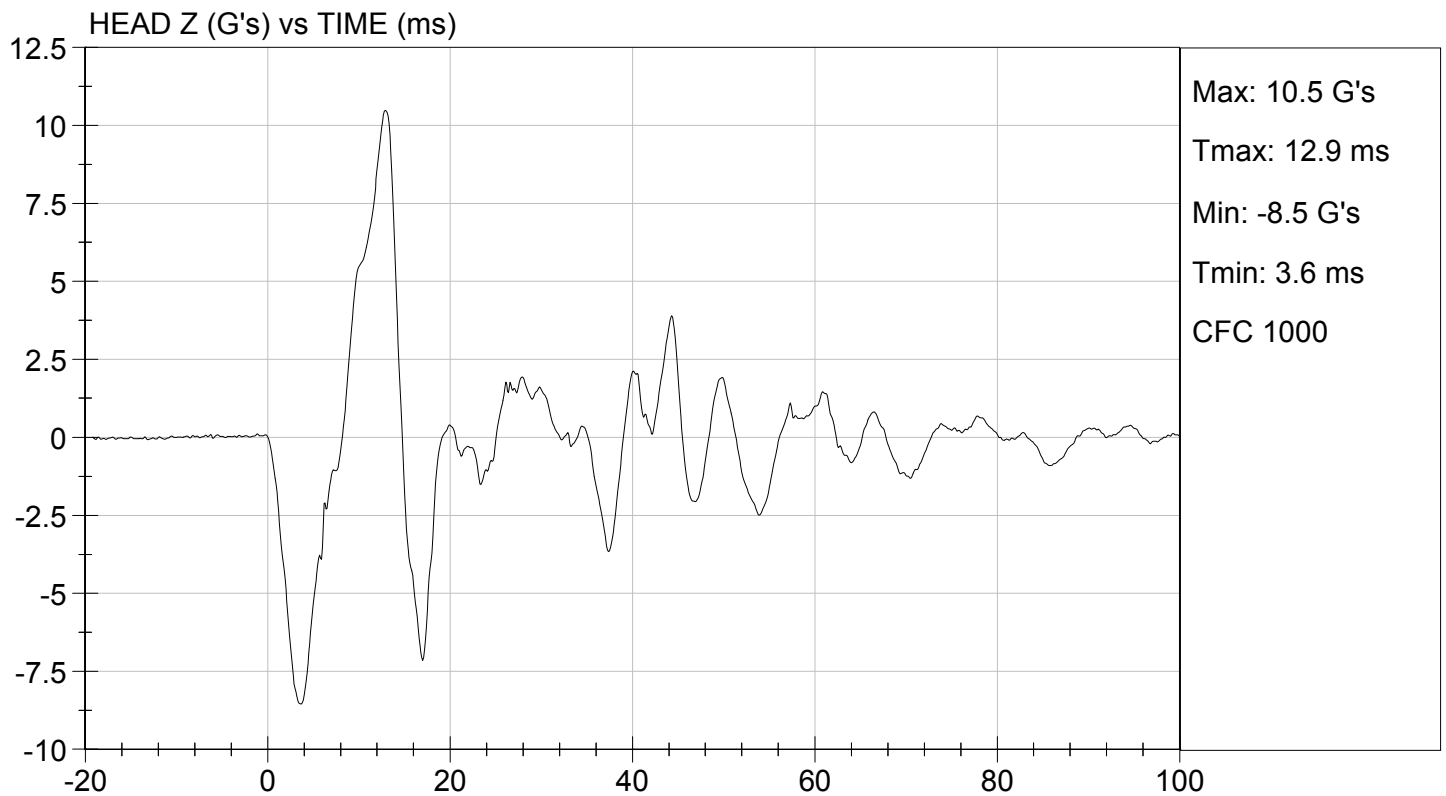
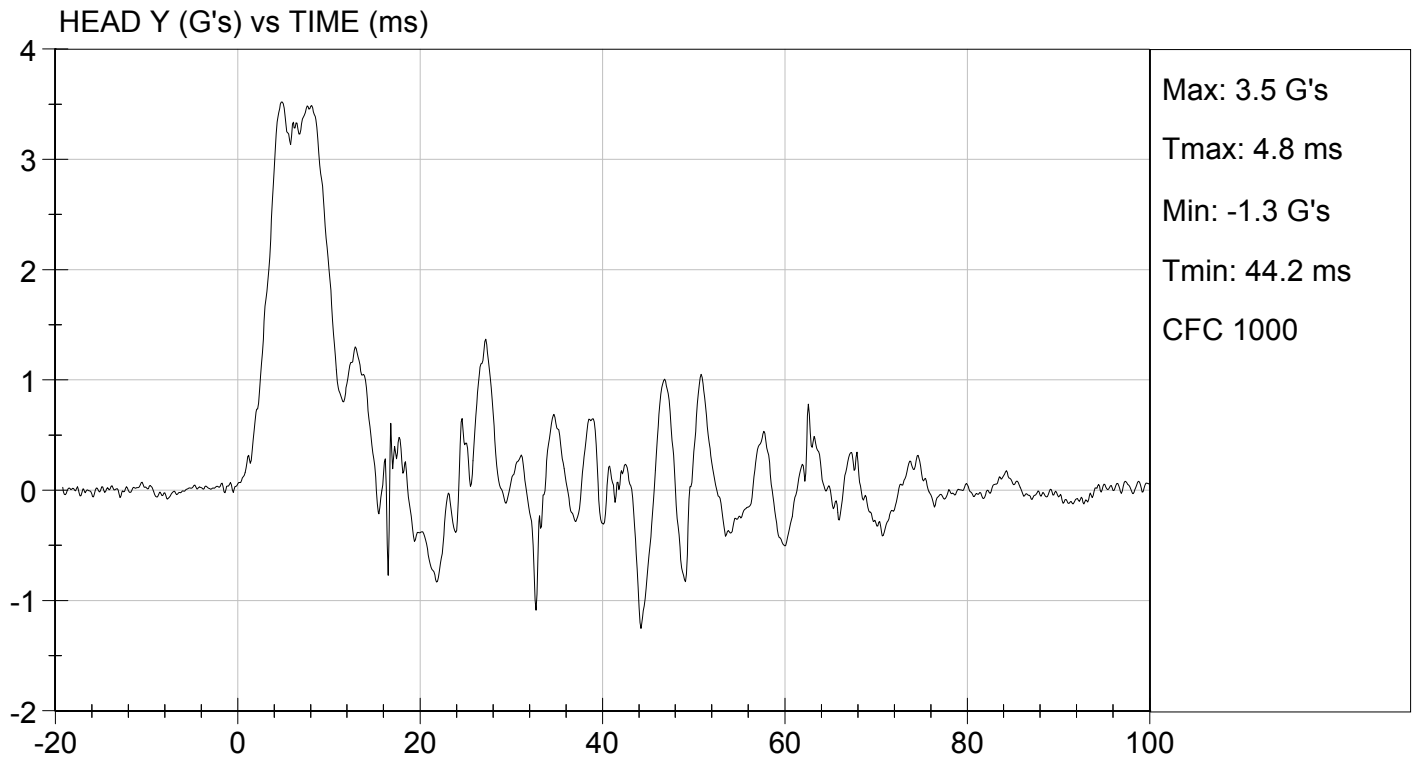
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	13	Pass
Peak Resultant Acceleration	G's	55 to 71	66	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 17% of peak	Yes	Pass
			Overall Test Results	Pass

David Schoedel
Laboratory Technician

11/21/2014
Test Date

Jeff LevanMarx
Approved By





DATA SHEET E5
NECK FLEXION TEST (572.153) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/21/2014

Technician: David Schoedel

 Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.155(m))
X N/A, this is first neck test performed

X 2. The components required for the neck tests include the neck assembly (921022-041), and headform (TE-3200-160). (572.153(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.153(c)(1))

Record the maximum temperature:	<u>21.0°C</u>
Record the minimum temperature:	<u>20.7°C</u>
Record the maximum humidity:	<u>14%</u>
Record the minimum humidity:	<u>11%</u>

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))

X 7. The test fixture pendulum conforms to the specifications in Figure 7E.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 8E for the flexion test. (572.153(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly and not induce neck torsion. (572.153(c)(3)(ii))
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.153(c)(3)(i))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.1 m/s to 5.3 m/s as measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb. (572.153(c)(4))
- X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.153(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		$5.1 \text{ m/s} \leq \text{speed} \leq 5.3 \text{ m/s}$	5.3 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	$1.6 \text{ m/s} \leq \Delta V \leq 2.3 \text{ m/s}$	2.2 m/s
	@ 20 ms	$3.4 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$	4.1 m/s
	@ 25 ms	$4.3 \text{ m/s} \leq \Delta V \leq 5.2 \text{ m/s}$	5.0 m/s
Plane D Rotation		Peak moment* $36 \text{ Nm} \leq \text{moment} \leq 45 \text{ Nm}$ during the following rotation range $75^\circ \leq \text{angle} \leq 86^\circ$	37.7 Nm @ 75.4 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm $60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$	70.1 ms

*Moment about the occipital condyle = $M_y - (0.005842 \text{ m} \times F_x)$ (572.153(b)(1)(iii))

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. (572.153(c)(4)(i))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel

Signature

11/21/2014

Date

MGA RESEARCH CORPORATION
NECK FLEXION TEST
CRABI 12 MONTH

ATD Serial No: 083

Test I.D: D144132

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	13	Pass
Pendulum Speed		m/s	5.1 to 5.3	5.3	Pass
Pendulum Velocity	10 ms	m/s	1.6 to 2.3	2.2	Pass
	20 ms	m/s	3.4 to 4.2	4.1	Pass
	25 ms	m/s	4.3 to 5.2	5.0	Pass
D Plane Rotation		deg	75.0 to 86.0	75.4	Pass
Peak Moment within Deflection Corridor		Nm	36.0 to 45.0	37.7	Pass
Positive Moment - Time Curve Decay to 5 Nm		ms	60.0 to 80.0	70.1	Pass
Overall Test Results				Pass	

David Schoedel
Laboratory Technician

11/21/2014

Test Date

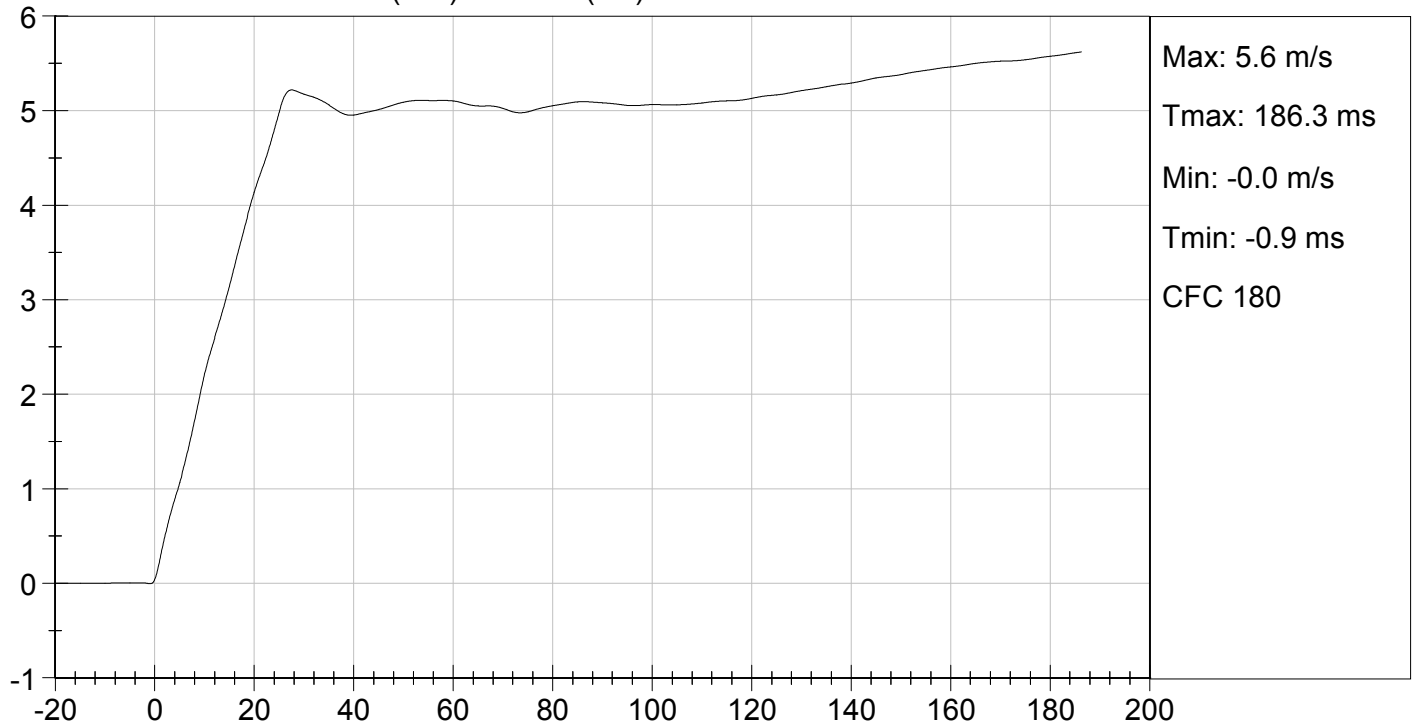
Jeff Leonardakis
Approved By



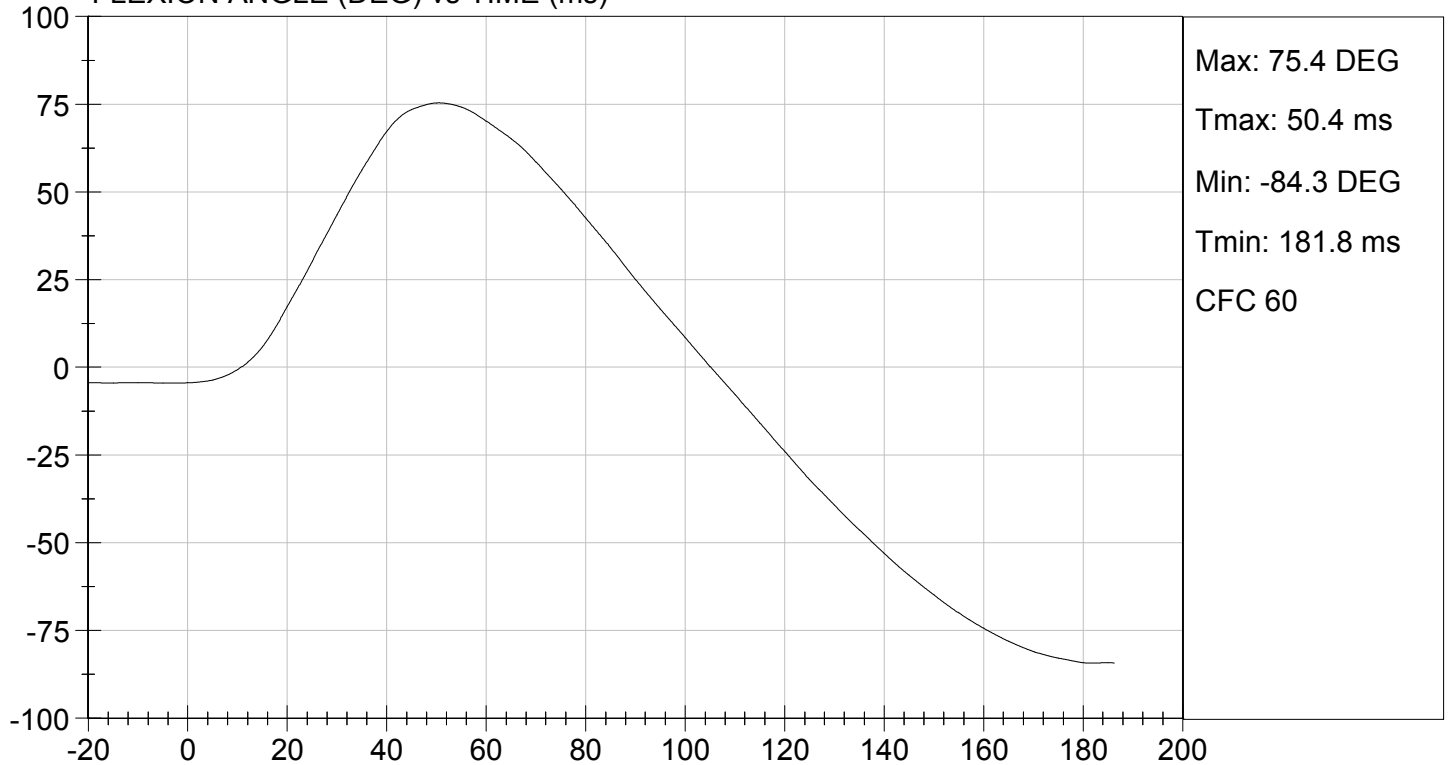
TEST DESC: NECK FLEXION
VELOCITY: 17.36 ft/s, 5.3 m/s

TEST DATE: 11/21/2014
TEST #: D144132

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



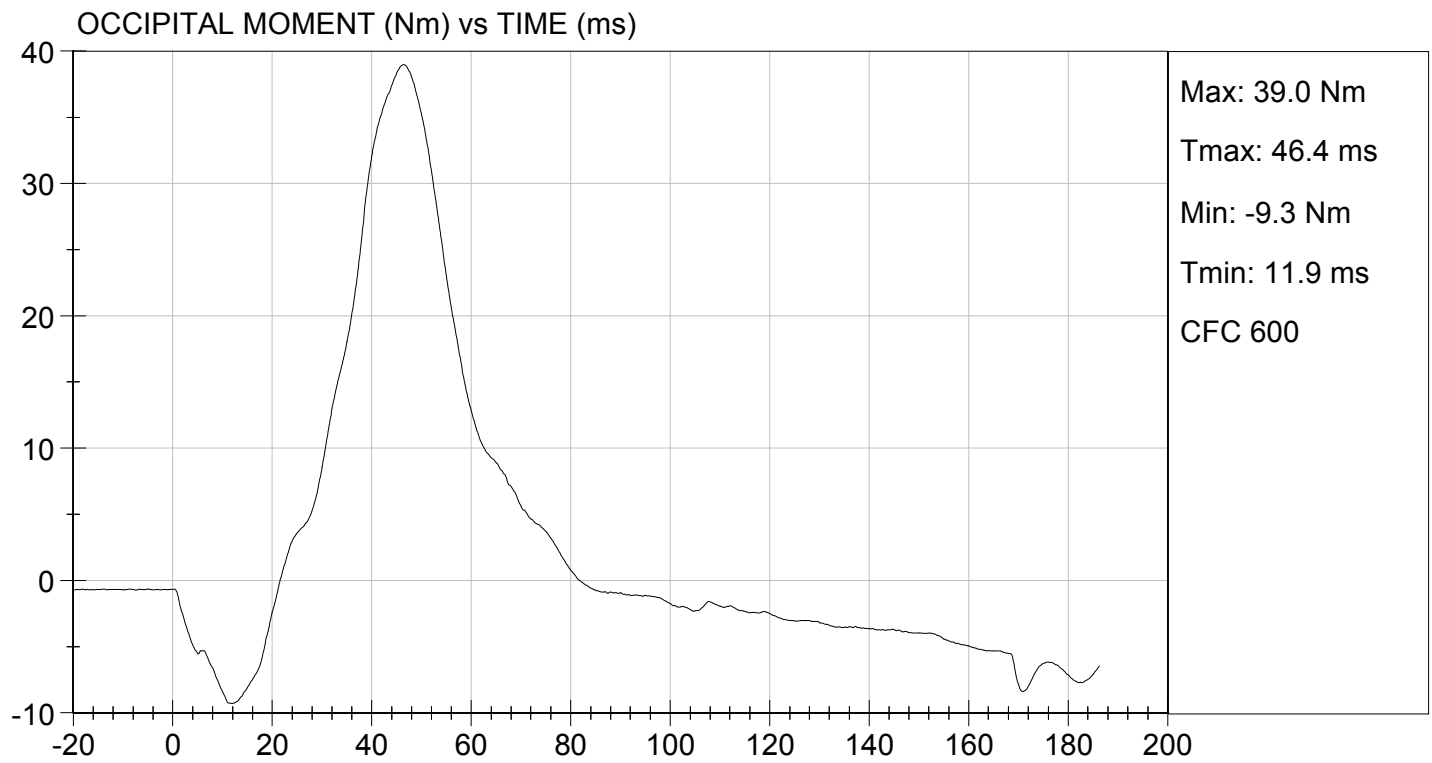
FLEXION ANGLE (DEG) vs TIME (ms)





TEST DESC: NECK FLEXION
VELOCITY: 17.36 ft/s, 5.3 m/s

TEST DATE: 11/21/2014
TEST #: D144132



DATA SHEET E6
NECK EXTENSION TEST (572.153) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/21/2014

Technician: David Schoedel

 Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.155(m))
 X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck assembly (921022-041), and headform (TE-3200-160). (572.153(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.153(c)(1))

Record the maximum temperature: 21.0°C

Record the minimum temperature: 20.7°C

Record the maximum humidity: 14%

Record the minimum humidity: 11%

X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (ATD-6206) between 0.2 Nm and 0.3 Nm. (572.153(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.155(i))

X 7. The test fixture pendulum conforms to the specifications in Figure 7E.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9E for the flexion test. (572.153(c)(3))

- X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly and not induce neck torsion. (572.153(c)(3)(ii))
- X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.153(c)(3)(i))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 2.4 m/s to 2.6 m/s as measured at the center of the pendulum accelerometer at the instant of contact with the honeycomb. (572.153(c)(4))
- X 13. Complete the following table:

Neck Extension Results (572.143(b)(1)) & (572.153(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		$2.4 \text{ m/s} \leq \text{speed} \leq 2.6 \text{ m/s}$	2.5 m/s
Pendulum ΔV with respect to impact speed	@ 6 ms	$0.8 \text{ m/s} \leq \Delta V \leq 1.2 \text{ m/s}$	1.2 m/s
	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 2.1 \text{ m/s}$	2.1 m/s
	@ 14 ms	$2.2 \text{ m/s} \leq \Delta V \leq 2.9 \text{ m/s}$	2.5 m/s
Plane D Rotation		Peak moment* $-12 \text{ Nm} \leq \text{moment} \leq -23 \text{ Nm}$ during the following rotation range $80^\circ \leq$ angle $\leq 92^\circ$	-13.2 Nm @ 82.4 degrees
Positive Moment Decay** (Extension)		Time to decay to -5 Nm $76 \text{ ms} \leq \text{time} \leq 90 \text{ ms}$	84.8 ms

*Moment about the occipital condyle = $M_y - (0.005842 \text{ m} \times F_x)$ (572.153(b)(1)(iii))

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. (572.153(c)(4)(i))

- X 14. Plots of pendulum acceleration, pendulum velocity, neck y-axis moment, and neck rotation about the y-axis follow this sheet.

David Schoedel

Signature

11/21/2014

Date

MGA RESEARCH CORPORATION
NECK EXTENSION TEST
CRABI 12 MONTH

ATD Serial No: 083

Test I.D: D144133

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	13	Pass
Pendulum Speed		m/s	2.4 to 2.6	2.5	Pass
Pendulum Velocity	6 ms	m/s	0.8 to 1.2	1.2	Pass
	10 ms	m/s	1.5 to 2.1	2.1	Pass
	14 ms	m/s	2.2 to 2.9	2.5	Pass
D Plane Rotation		deg	80.0 to 92.0	82.4	Pass
Peak Moment within Deflection Corridor		Nm	-23.0 to -12.0	-13.2	Pass
Negative Moment - Time Curve Decay to -5 Nm		ms	76.0 to 90.0	84.8	Pass
Overall Test Results				Pass	

David Schoedel
Laboratory Technician

11/21/2014

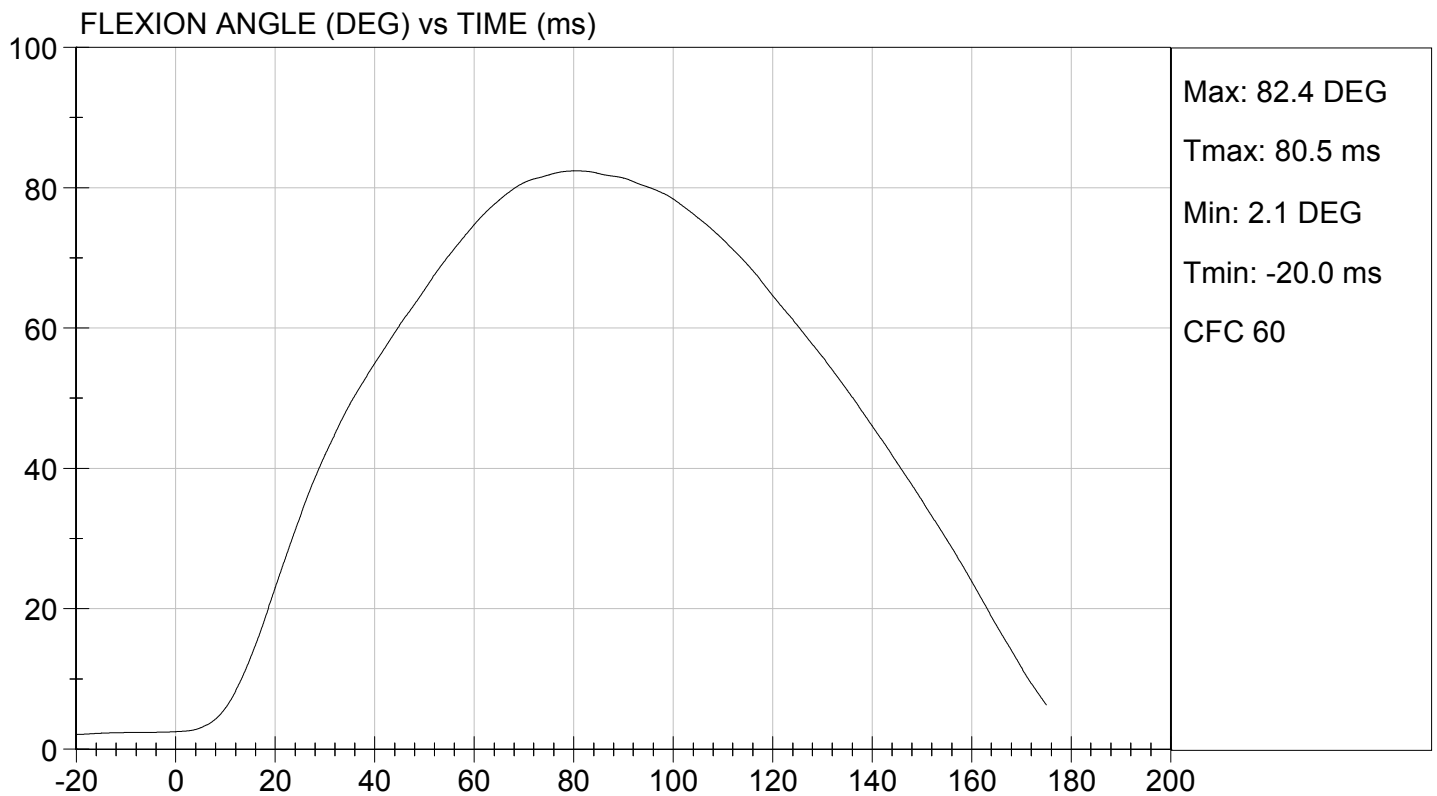
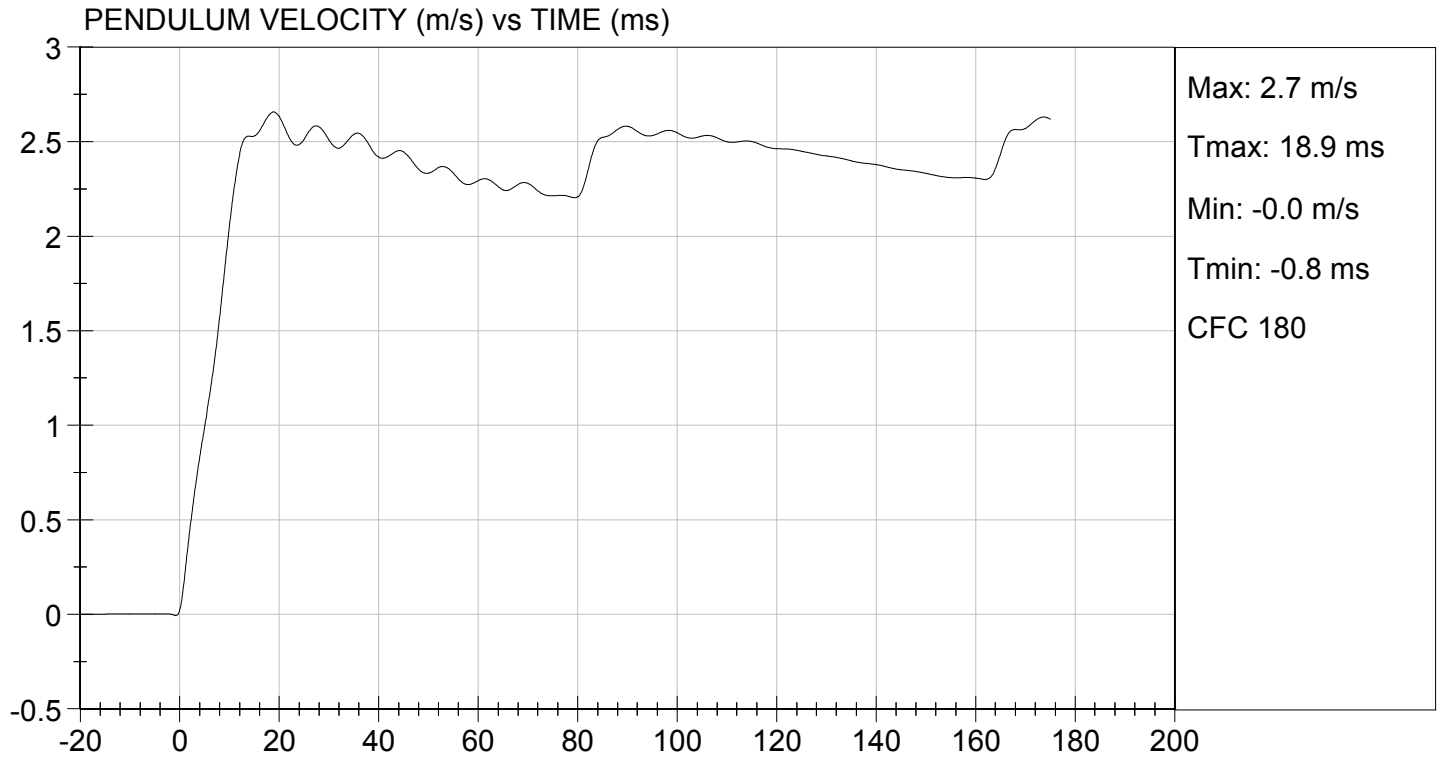
Test Date

Jeff Leonard
Approved By



TEST DESC: NECK EXTENSION
VELOCITY: 8.13 ft/s, 2.48 m/s

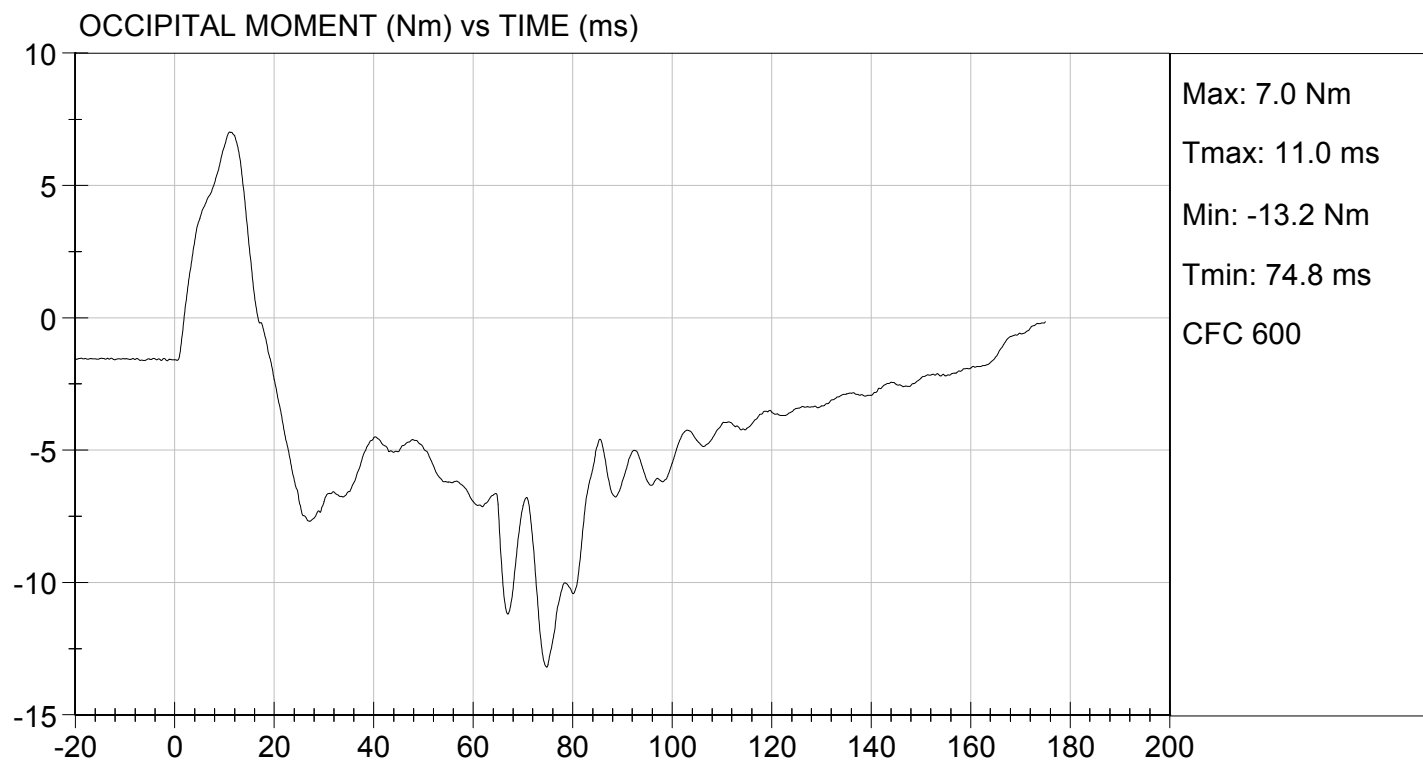
TEST DATE: 11/21/2014
TEST #: D144133





TEST DESC: NECK EXTENSION
VELOCITY: 8.13 ft/s, 2.48 m/s

TEST DATE: 11/21/2014
TEST #: D144133



DATA SHEET E7
THORAX IMPACT TEST (572.154) (12-MONTH-OLD)

Dummy Serial Number: 083

Test Date: 11/21/2014

Technician: David Schoedel

 Pre test calibration
 X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last thorax impact test. (572.155(m))
 X N/A, ONLY one thorax impact test performed
- X 2. The test fixture conforms to the specifications in Figure 10E.
- X 3. The complete assembled dummy (921022-000) is used (572.154(b)) and is dressed in cotton-polyester-based tight-fitting long-sleeved sweat shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.154(c)(2))
- X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.154(c)(1))
- | | |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.0°C</u> |
| Record the minimum temperature: | <u>20.7°C</u> |
| Record the maximum humidity: | <u>14%</u> |
| Record the minimum humidity: | <u>11%</u> |
- X 5. Seat the dummy, without back support on the test fixture surface as shown in Figure 10E. The legs are extended forward, parallel to the midsagittal plane. The surface must be long enough to support the pelvis and outstretched legs. (572.154(c)(3))
- X 6. The midsagittal plane of the dummy is vertical within $\pm 1^\circ$. (572.154(c)(3))
- X 7. The posterior surface of the upper spine box is $90^\circ \pm 1^\circ$ from the horizontal. Shim material may be used under the upper legs to maintain the dummy's specified spine box surface alignment. (572.154(c)(3))
- X 8. Place the upper arms parallel to the torso. Place the lower arms 0° to 5° forward of vertical. (572.154(c)(3))
- X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane, 196 ± 2.5 mm vertically from the plane of the seating surface and is within $\pm 0.5^\circ$ of a horizontal line in the dummy's midsagittal plane. (572.154(c)(4))

- X 10. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X 11. 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. (572.154(c)(5)) The velocity of the test probe at the time of impact is between 4.9 m/s and 5.1 m/s. (572.154(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.154(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.154(c)(7))
- X 12. Complete the following table:

Thorax Impact Results (572.154(b))		
Parameter*	Specification	Result
Test Probe Speed	4.9 m/s ≤ speed ≤ 5.1 m/s	5.0 m/s
Peak force**	1514 N ≤ peak force ≤ 1796 N	1570 N

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

**Force = impactor mass x acceleration (572.144(b)(3))

- X 13. Plots of pendulum acceleration, and pendulum force, follow this sheet.

David Schoedel
Signature

11/21/2014
Date

MGA RESEARCH CORPORATION
THORAX IMPACT TEST
CRABI 12 MONTH

ATD Serial No: 083

Test I.D: D144134

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	12	Pass
Probe Speed	m/s	4.9 to 5.1	5.0	Pass
Probe Force	N	1510 to 1800	1570	Pass
Overall Test Results				Pass

David Schoedel
Laboratory Technician

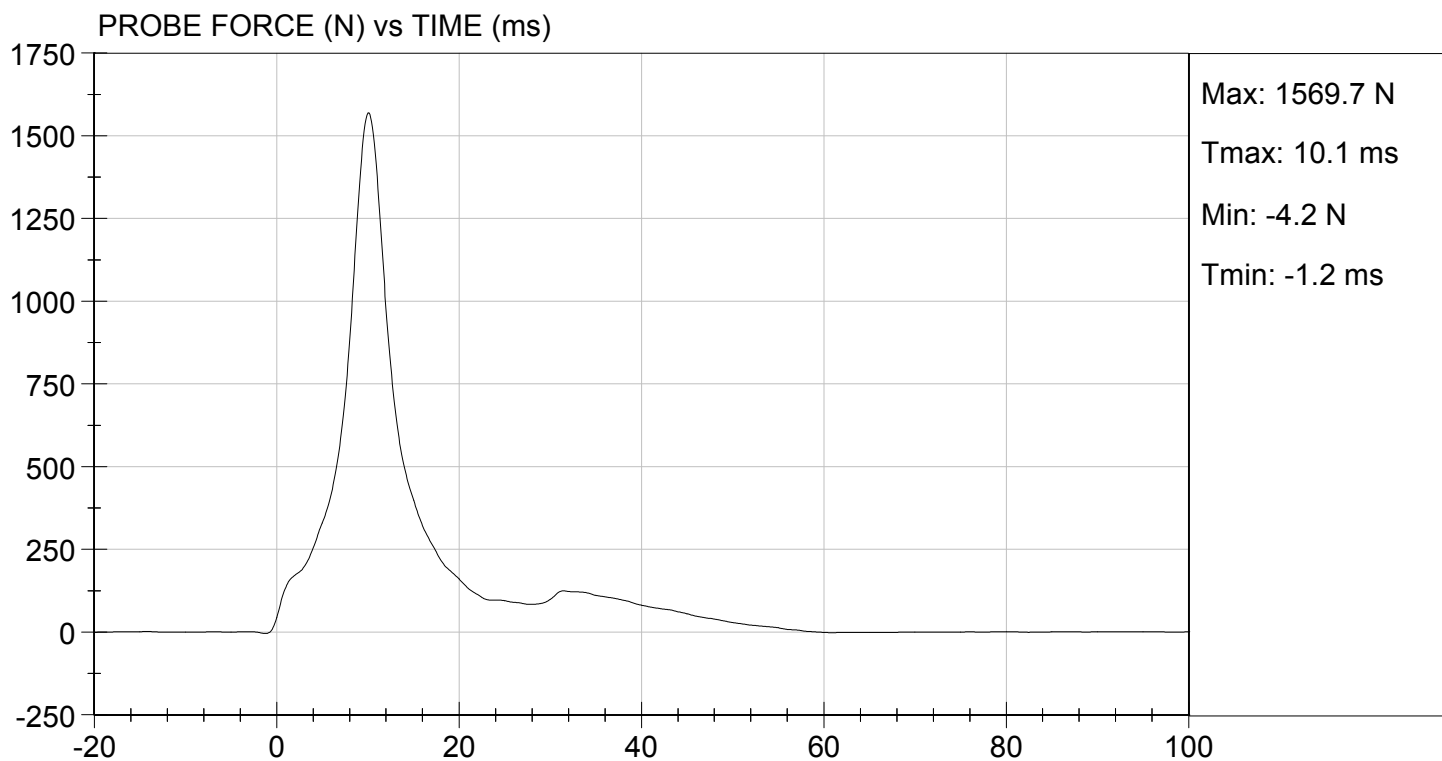
11/21/2014
Test Date

Jeff Leonard
Approved By



TEST DESC: THORAX IMPACT
VELOCITY: 16.34 ft/s, 4.98 m/s

TEST DATE: 11/21/2014
TEST #: D144134



DATA SHEET E8**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82104	10/21/2014	04/21/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82105	10/21/2014	04/21/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82106	10/21/2014	04/21/2015
NECK TRANSDUCER	Denton	2554	328	09/05/2014	03/05/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79680	10/21/2014	04/21/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82118	10/21/2014	04/21/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82120	10/21/2014	04/21/2015
CHEST POTENTIOMETER	N/A	N/A	N/A	N/A	N/A
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	10/09/2015

LABORATORY TECHNICIAN: _____

Jessica Hall

DATA SHEET E1
DUMMY DAMAGE CHECKLIST (12 MONTH OLD)

Dummy Serial Number: 083

Test Dates: 11/19-11/20/2014

Technician: Jessica Gall

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

X Perform general cleaning.

Dummy Item	Inspect for	Comments	Damage	OK
Outer skin	Gashes, rips, cracks			X
Head	Ballast secure			X
	General appearance			X
Neck	Broken or cracked rubber			X
	Upper neck bracket firmly attached to the lower neck bracket			X
	Looseness at the condyle joint			X
	Nodding blocks cracked or out of position			X
Spine	Broken or cracks in rubber			X
Ribs	Broken or bent ribs			X
	Broken or bent rib supports			X
	Damping material separated or cracked			X
	Rubber bumpers in place			X
Chest Displacement Assembly	Bent shaft			X
	Slider arm riding in track			X
Transducer leads	Torn cables			X
Accelerometer Mountings	Head mounting secure			X
	Chest mounting secure			X
Knees	Skin condition			X
	Insert (do not remove)			X
	Casting			X
Limbs	Normal movement and adjustment			X
Knee Sliders	Wires intact			X
	Rubber returned to "at rest" position			X
Pelvis	Broken			X
Other				X

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

Repair or Replacement approved by:

Jessica Hall
Signature

11/21/2014
Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard
Signature

11/21/2014
Date