REPORT NO. 208-MGA-2015-DC005

DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208

HONDA DE MEXICO S.A. DE C.V.
2015 HONDA CR-V MPV
NHTSA NO.: C20155300

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

TEST DATES: OCTOBER 14, 2015 – NOVEMBER 30, 2015

FINAL REPORT DATE: APRIL 15, 2016

FINAL REPORT

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

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

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

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

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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 ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))

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

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	261 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	14.4 g

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

David Schoedel

Signature

09/21/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test ID:** D152931

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	43	Pass
Peak Resultant Acceleration	G's	225 to 275	261	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

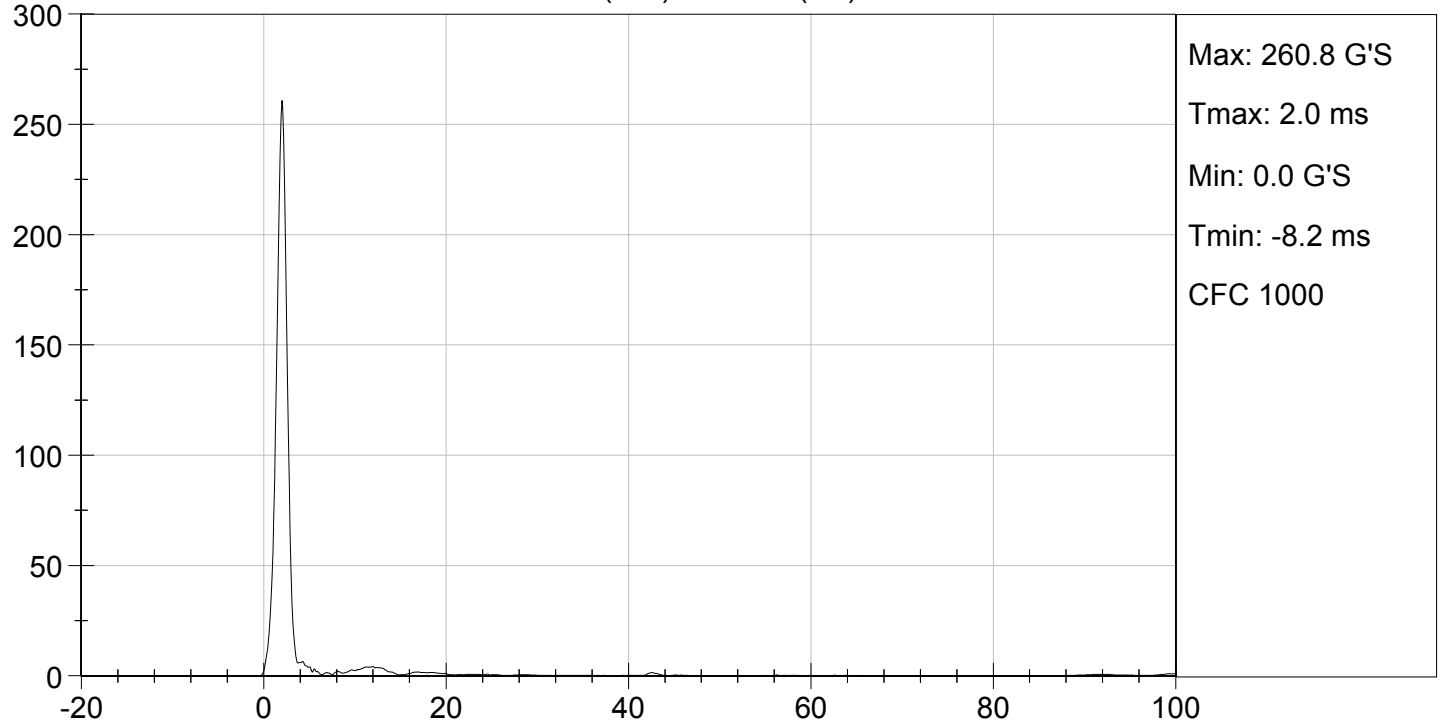
09/21/2015
Test Date

Jeff Leonardelli
Approved By

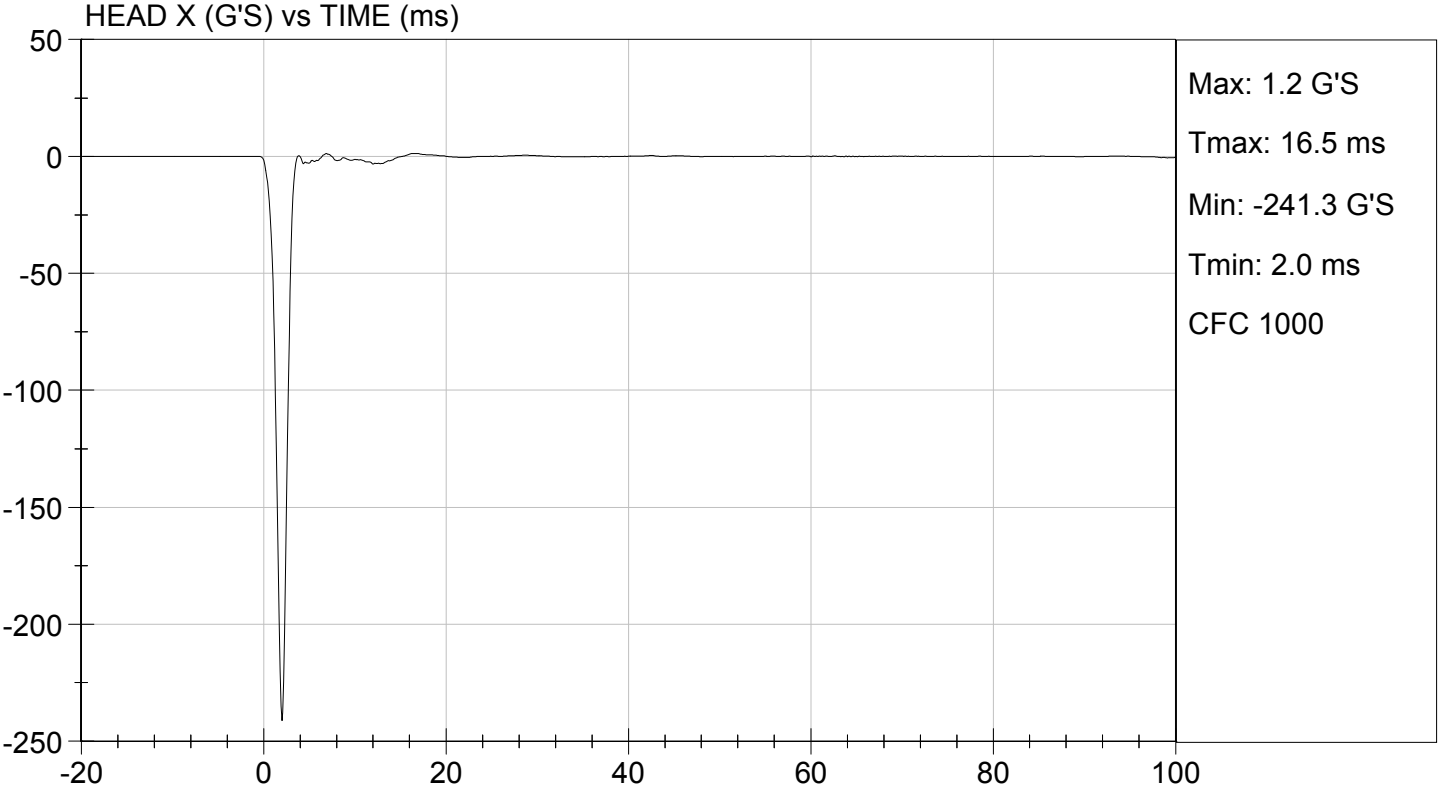
TEST DESC: HEAD DROP

TEST DATE: 09/21/2015
TEST #: D152931

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



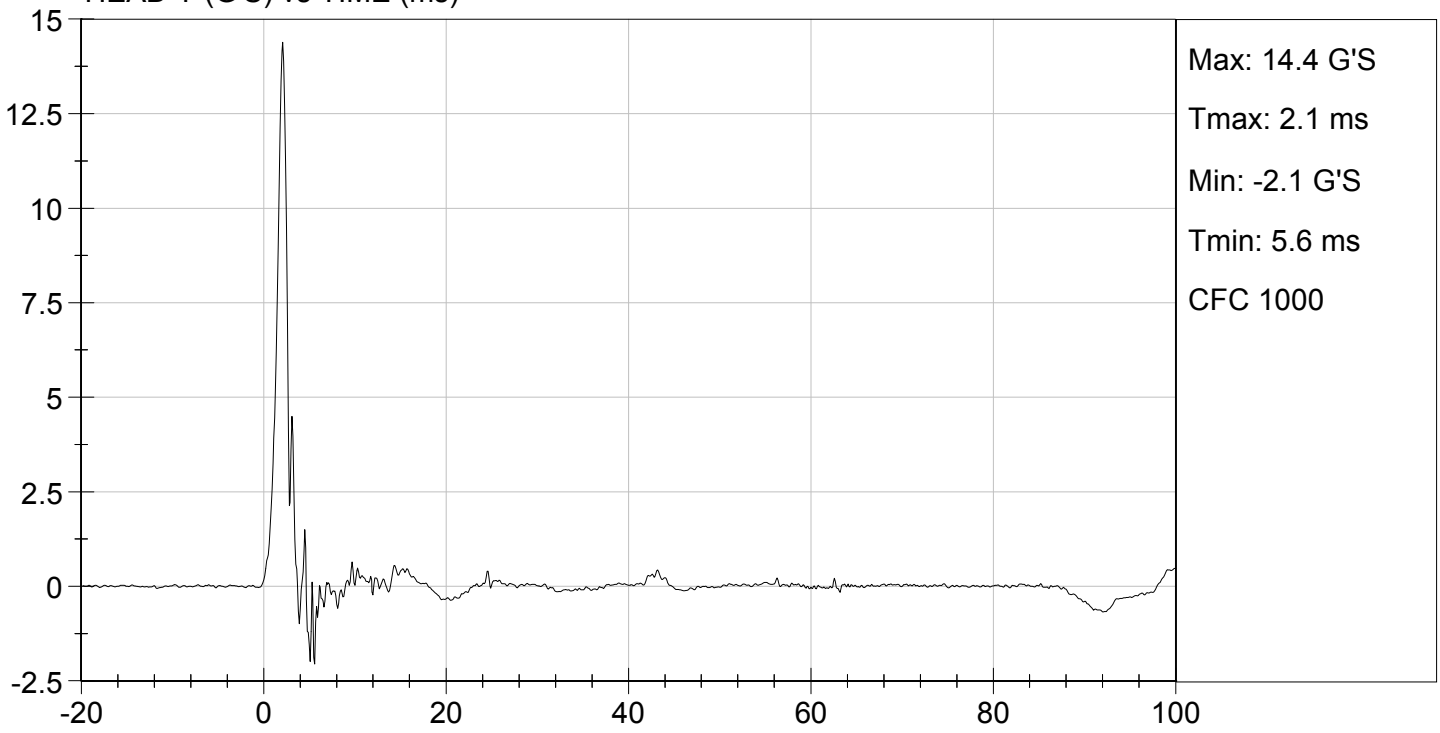
HEAD X (G'S) vs TIME (ms)



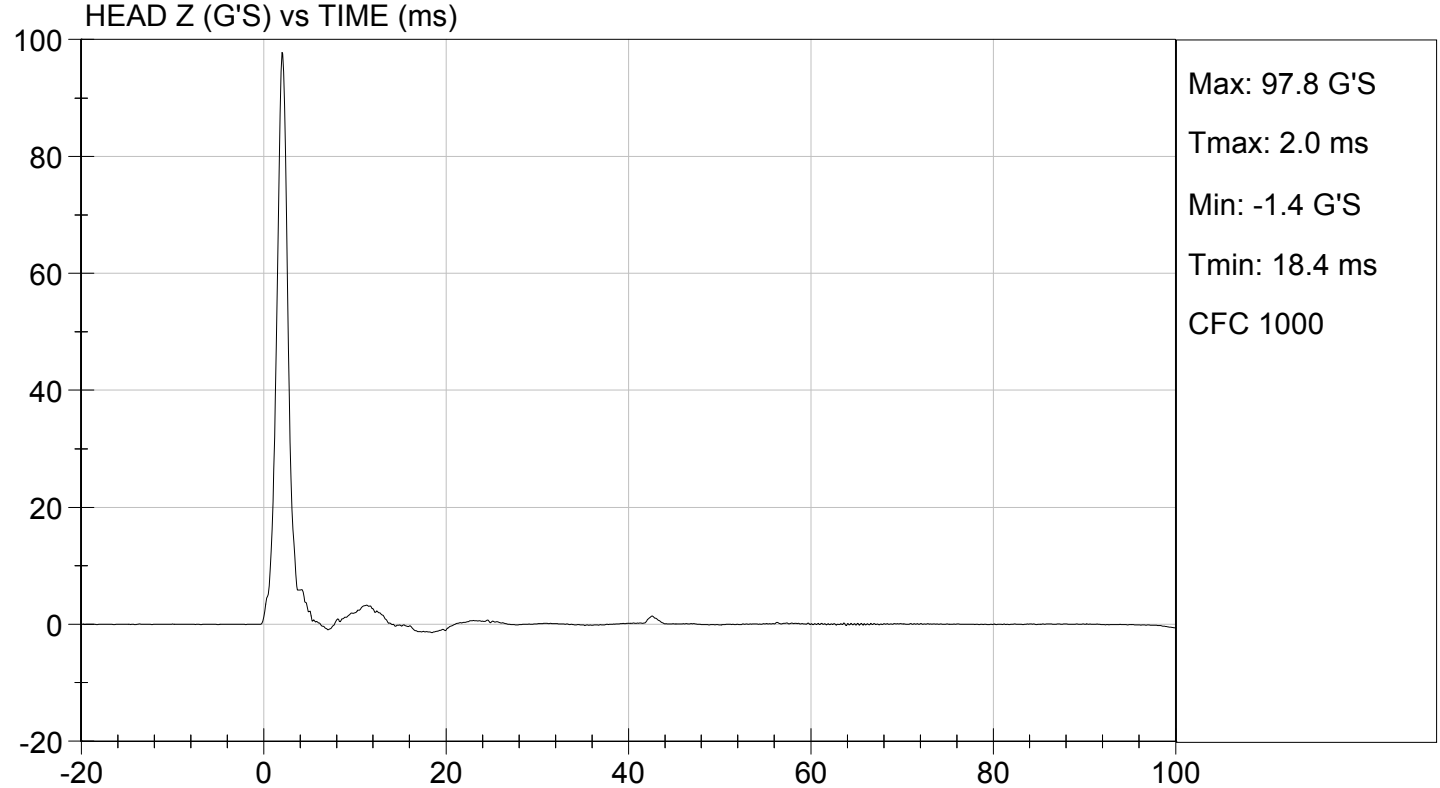
TEST DESC: HEAD DROP

TEST DATE: 09/21/2015
TEST #: D152931

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



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



DATA SHEET A4

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last flexion test. (572.36(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:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	23.15 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	25.28 g's
	@ 20 ms	17.6 ≤ g ≤ 22.6	19.43 g's
	@ 30 ms	12.5 ≤ g ≤ 18.5	12.62 g's
	Above 30 ms	29 g maximum	14.3 g's
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	38.2 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	71.0°
		57 ms ≤ time of max. rotation ≤ 64 ms	59.8 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	117.7 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	67.9 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	50.8 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	101.4 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

David Schoedel
Signature

09/21/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D152932

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	25.28	Pass
	20 ms	G's	17.60 to 22.60	19.43	Pass
	30 ms	G's	12.50 to 18.50	12.62	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	38.2	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	71.0	Pass
	Time	ms	57.0 to 64.0	59.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	117.7	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	92.0	Pass
	Time	ms	47.0 to 58.0	50.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	101.4	Pass
			Overall Test Results		Pass

David Schoedel

Laboratory Technician

09/21/2015

Test Date

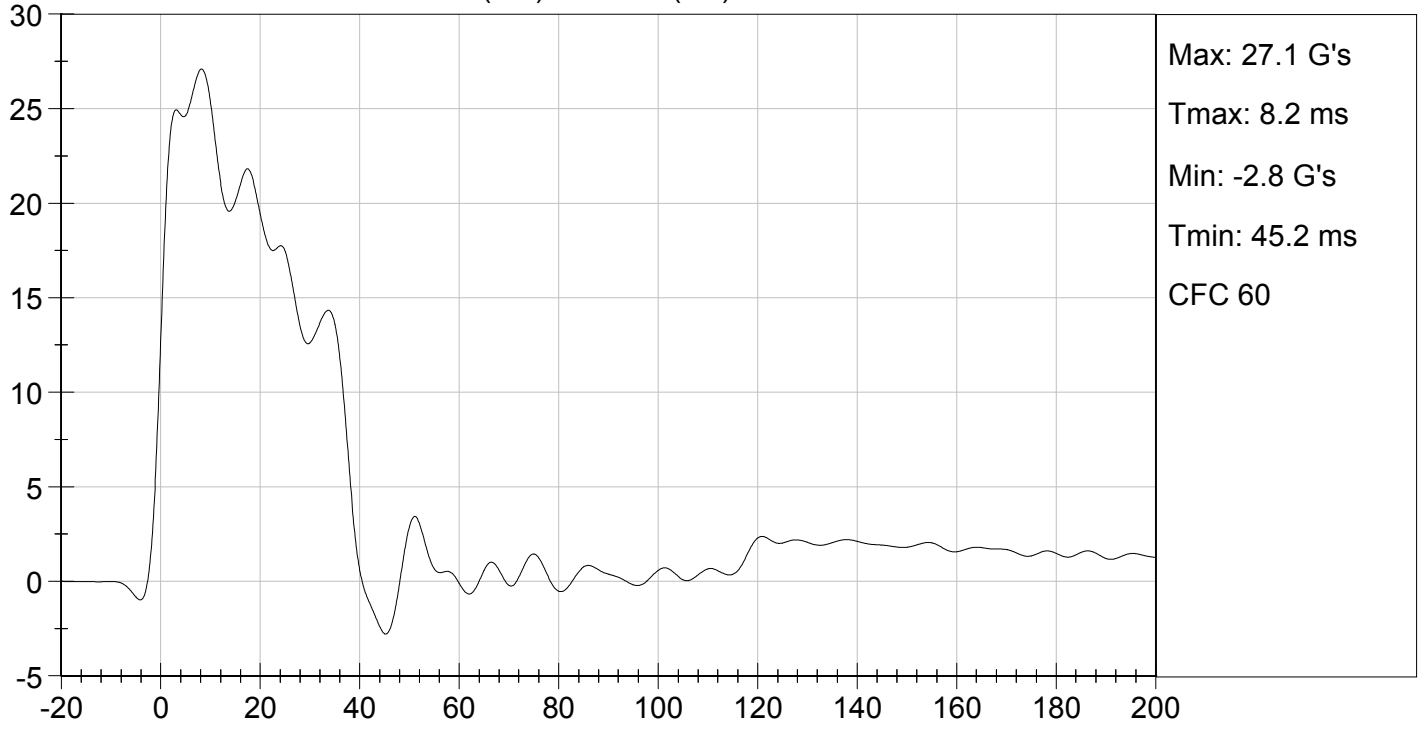
Jeff Leonardi

Approved By

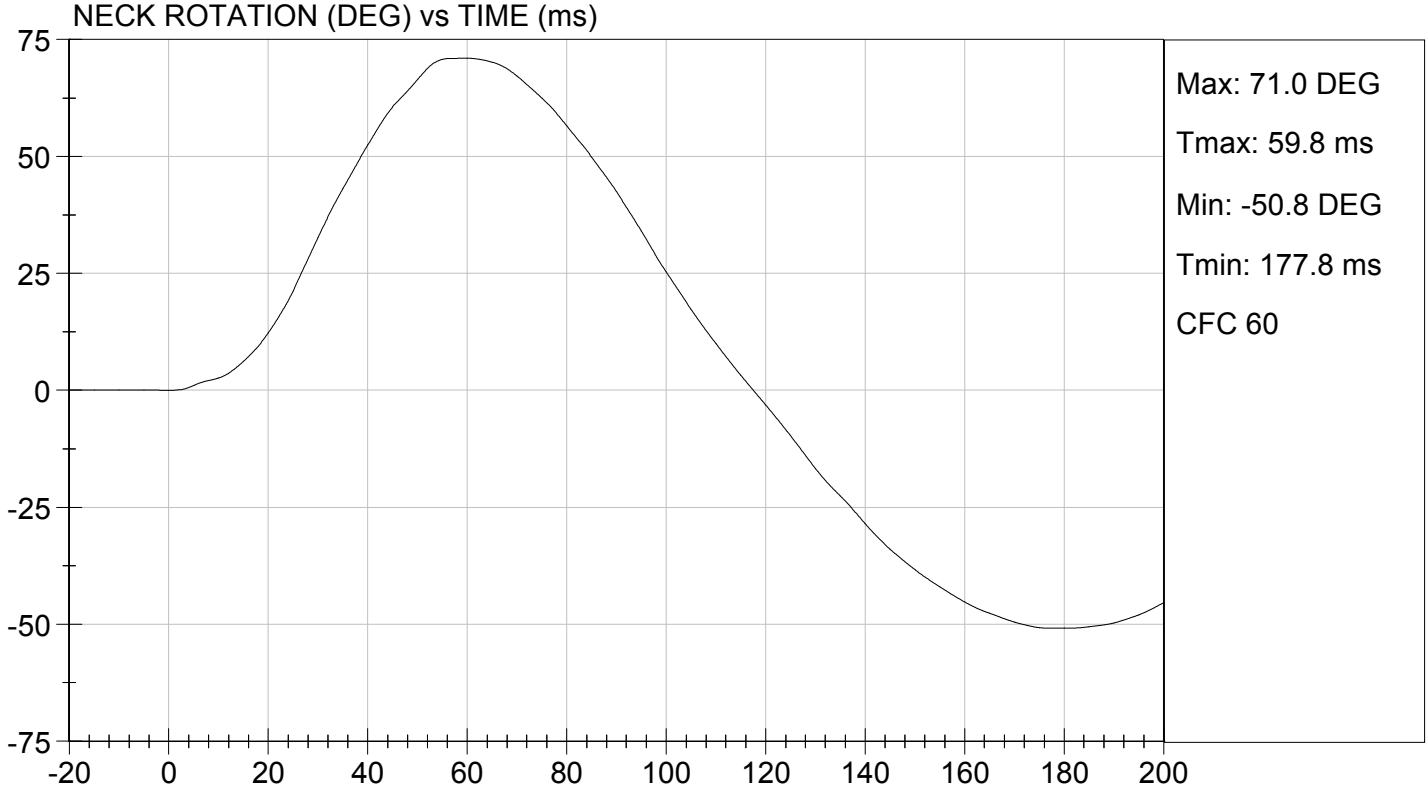
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 09/21/2015
TEST #: D152932

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



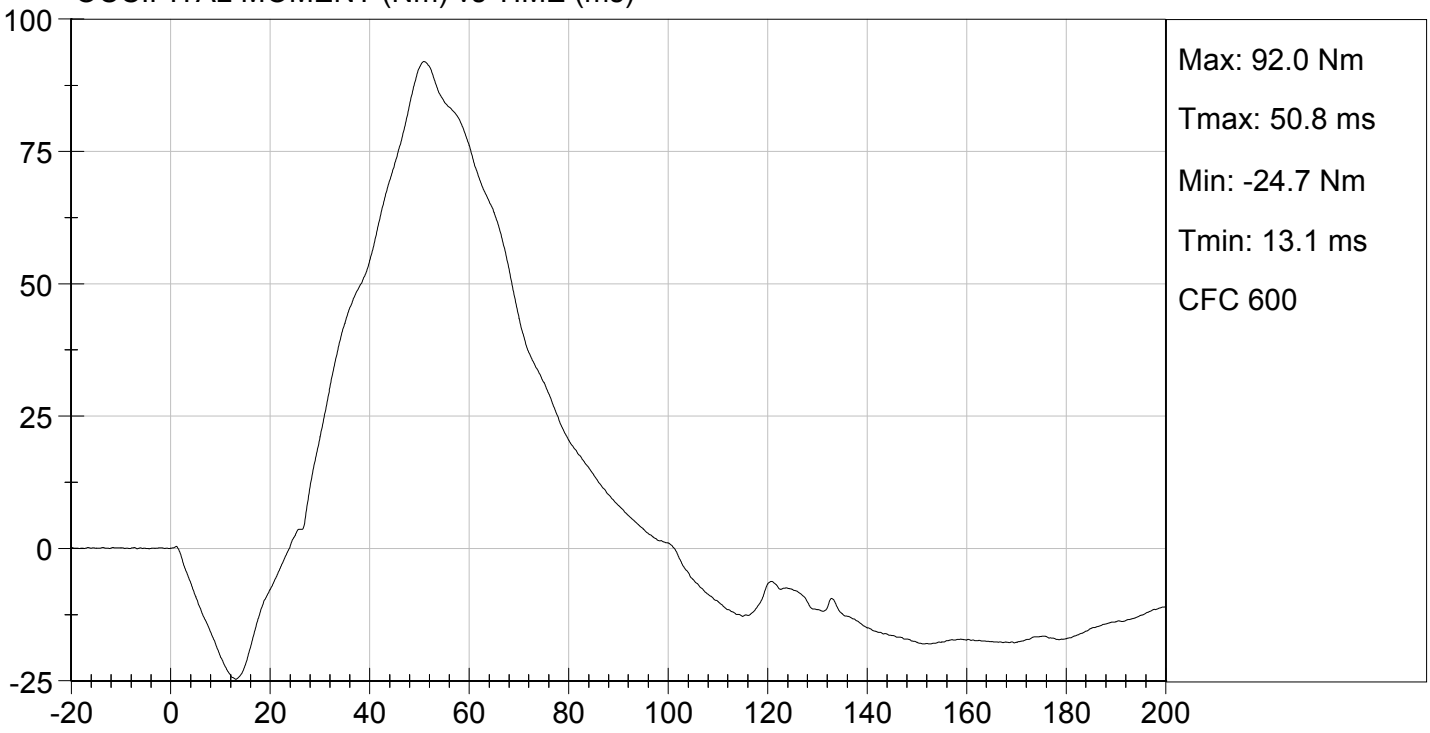
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 09/21/2015
TEST #: D152932

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last extension test. (572.36(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:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	20.08 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	20.30 g's
	@ 20 ms	14 ≤ g ≤ 19	17.58 g's
	@ 30 ms	11.0 ≤ g ≤ 16.0	12.74 g's
	Above 30 ms	22 g maximum	13.8 g's
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	38.3 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	101.2°
		72 ms ≤ time of max. rotation ≤ 82 ms	77.6 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	159.0 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-47.7 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	71.0 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	147.5 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

David Schoedel

Signature

09/21/2015

Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D152933

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.30	Pass
	20 ms	G's	14.00 to 19.00	17.58	Pass
	30 ms	G's	11.00 to 16.00	12.74	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	38.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	101.2	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	159.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-64.7	Pass
	Time	ms	65.0 to 79.0	71.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	147.5	Pass
			Overall Test Results		Pass

David Schoedel

Laboratory Technician

09/21/2015

Test Date

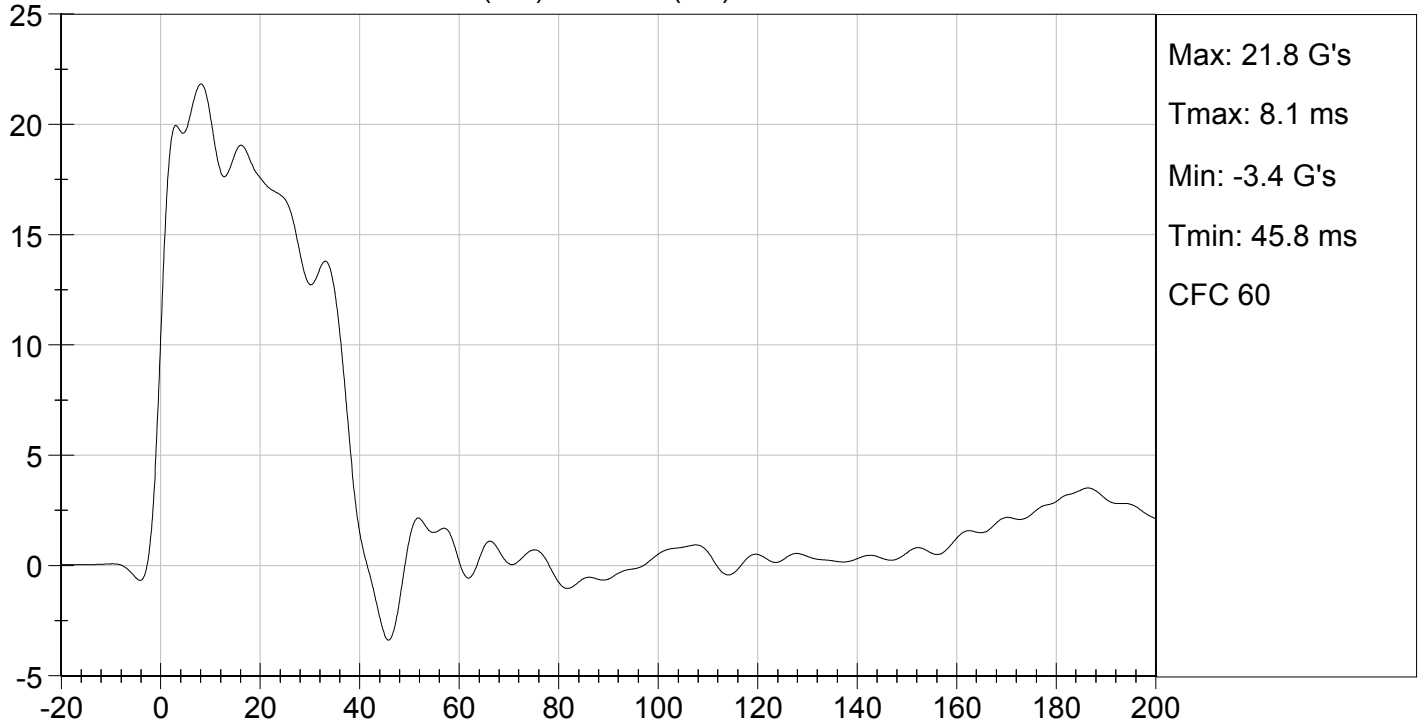
Jeff Leuenhorst

Approved By

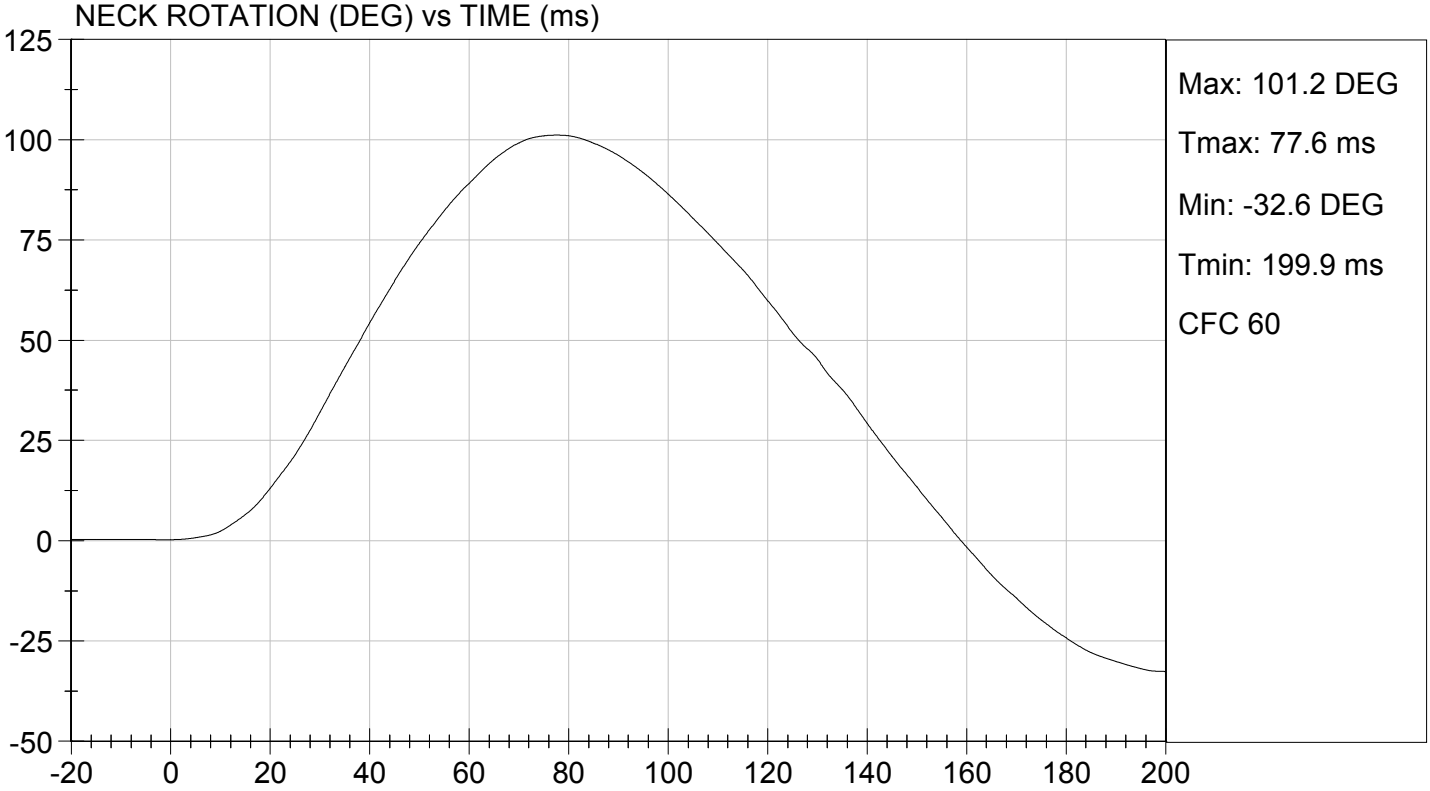
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 09/21/2015
TEST #: D152933

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

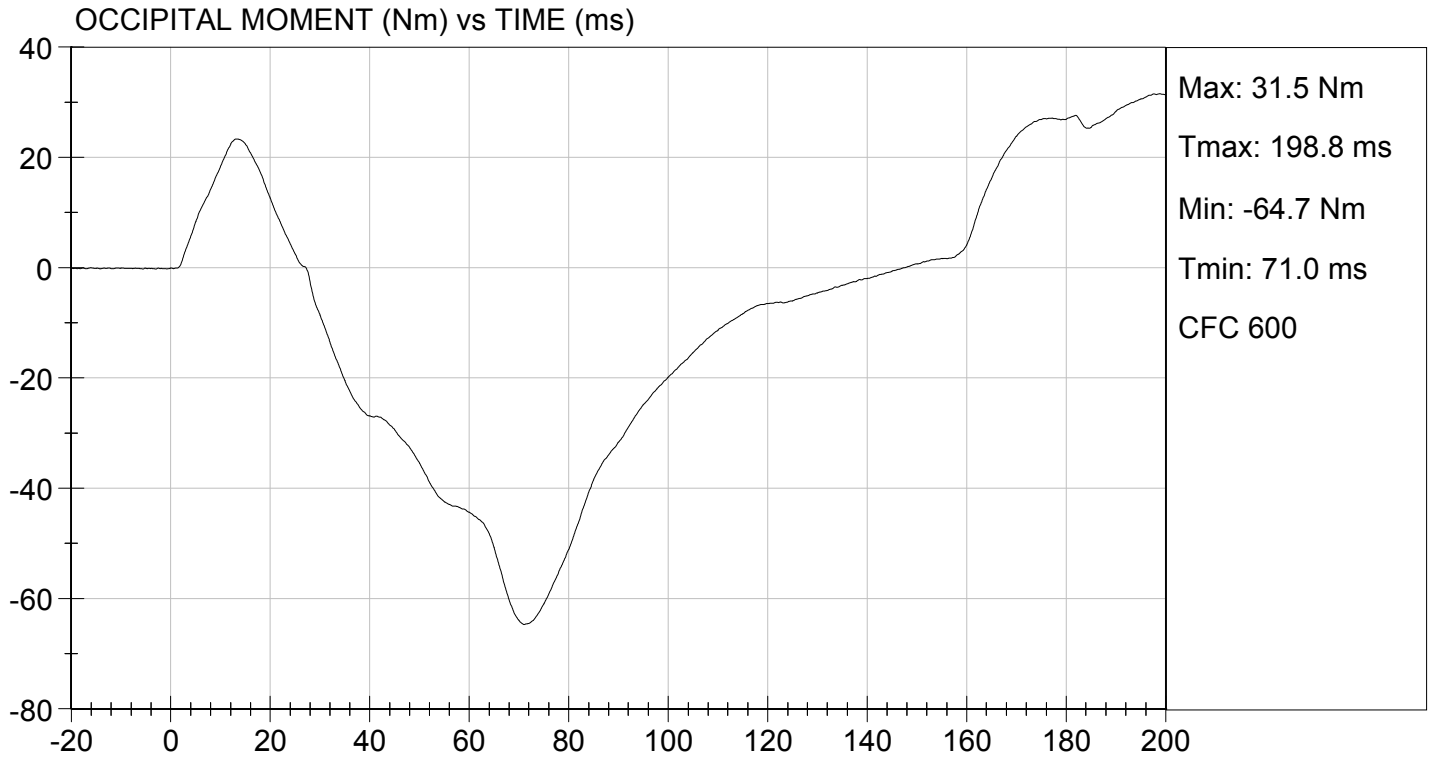


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 09/21/2015
TEST #: D152933



DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

X - No Damage

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

_____

___ - The following repairs or replacement was performed. Record:

_____

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))

X 7. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 13° ± 2°. The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2)

X 8. The midsagittal plane of the dummy is vertical within ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))

X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is 22 f/s ± 0.4 f/s. (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.93 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.75 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1261 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	71 %

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

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

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

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

David Schoedel

Signature

09/21/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D152934

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,611	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.98	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

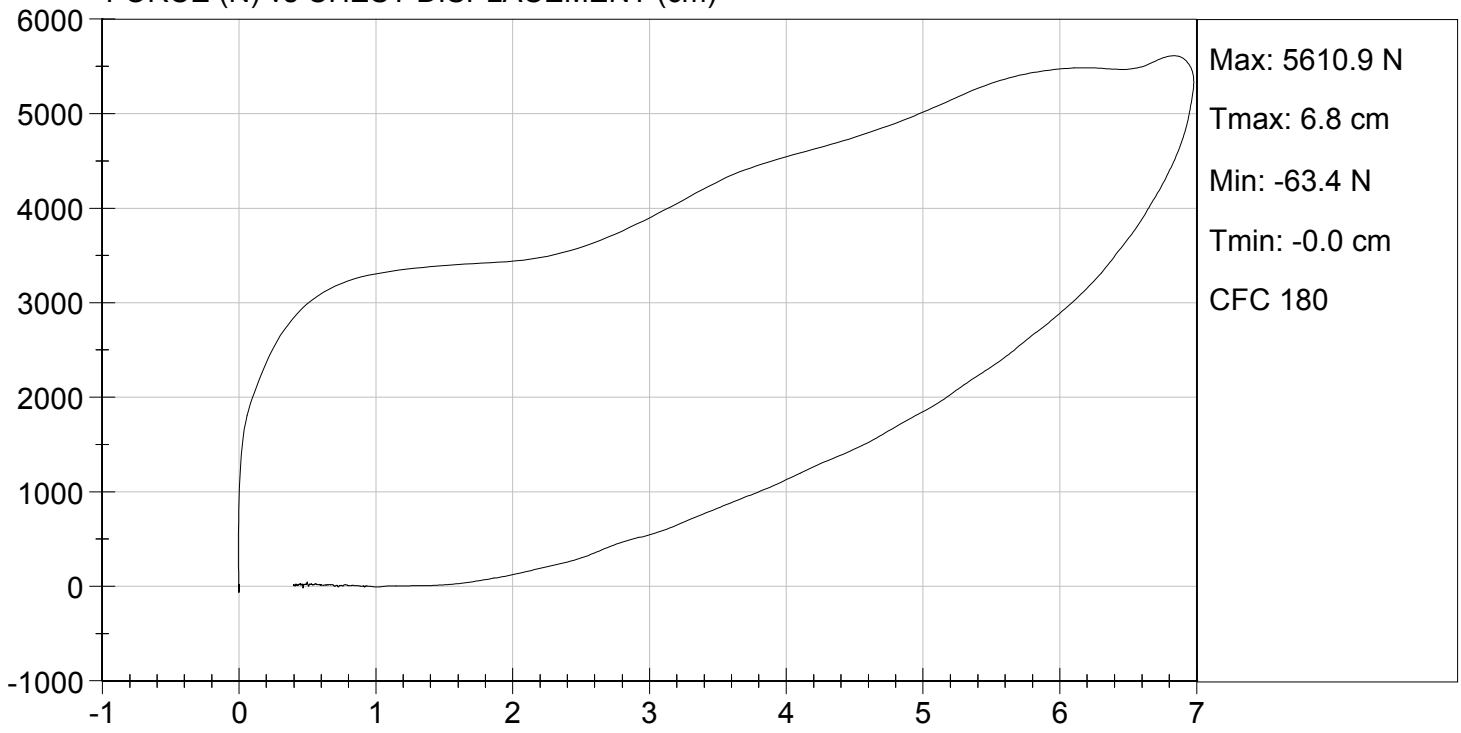
09/21/2015
Test Date

Jeff Leonardi
Approved By

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

TEST DATE: 09/21/2015
TEST #: D152934

FORCE (N) vs CHEST DISPLACEMENT (cm)



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

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.92 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1295 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

09/21/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D152936

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	45	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	5,761	Pass
		Overall Test Results		Pass

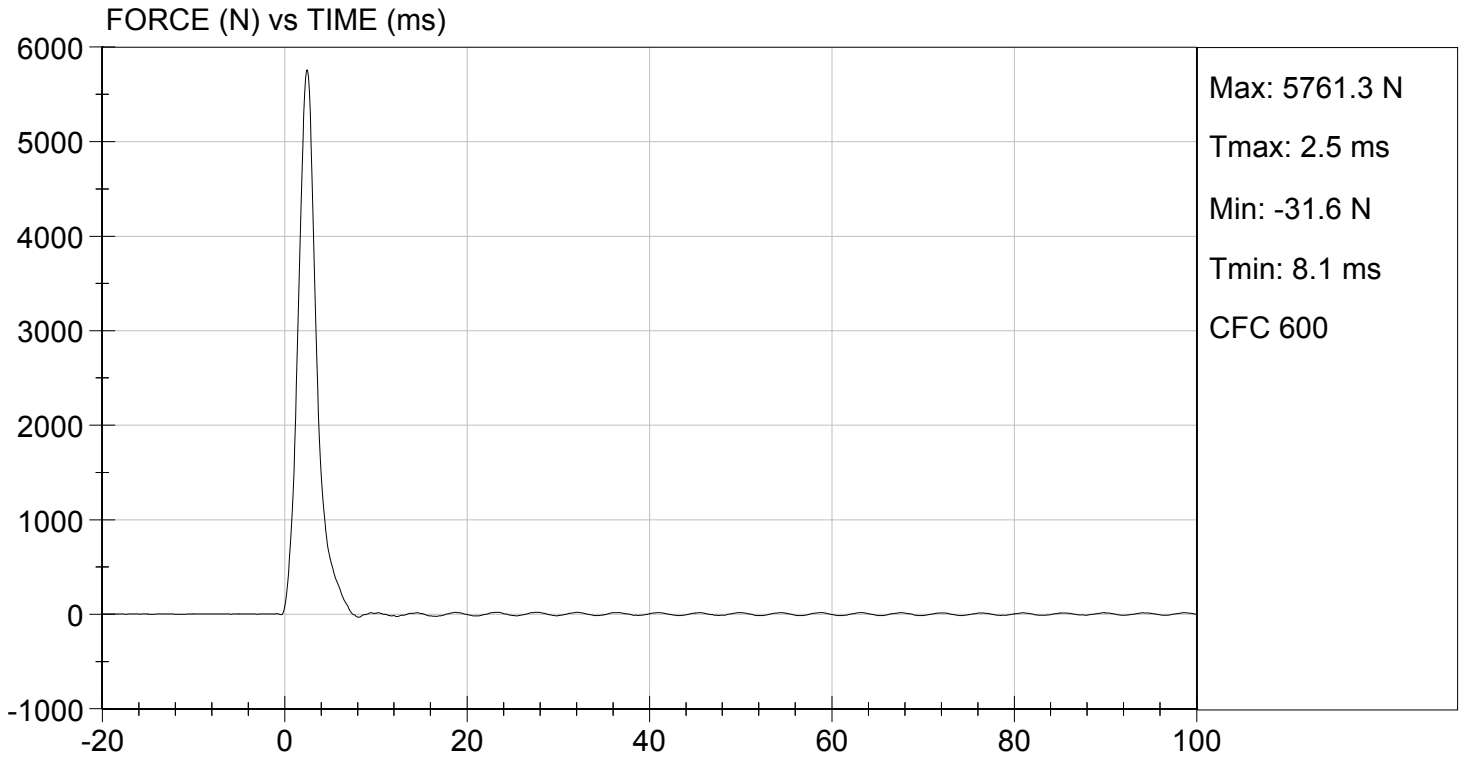
David Schoedel
Laboratory Technician

09/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/21/2015
TEST #: D152936



DATA SHEET A8

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

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.94 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1111 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

09/21/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D152935

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	45	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,944	Pass
		Overall Test Results		Pass

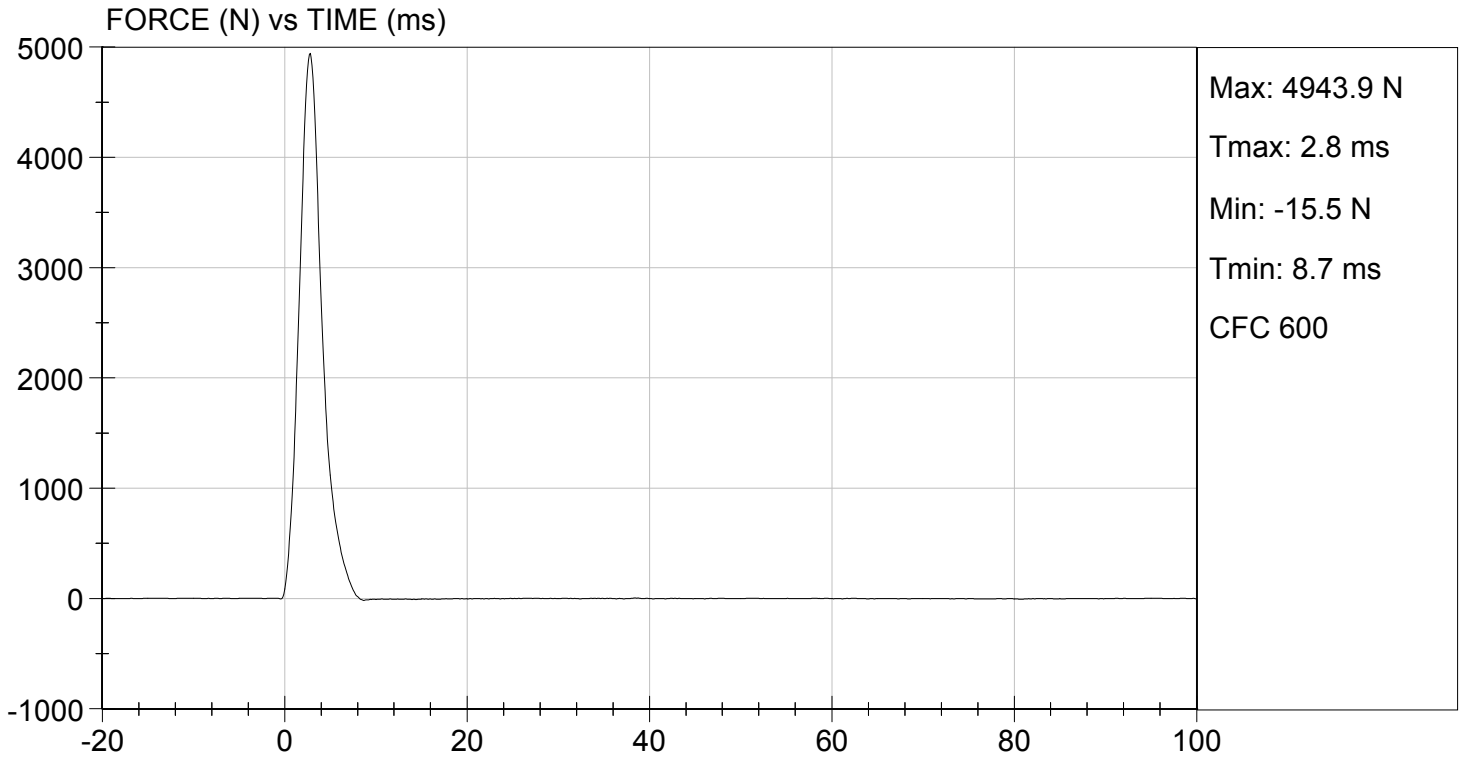
David Schoedel
Laboratory Technician

09/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/21/2015
TEST #: D152935



DATA SHEET A9

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

Dummy Serial Number: 403 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one hip joint-femur flexion test performed

X 2. The test fixture conforms to the specifications in Figure 17A.

X 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):

X 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)

X 3.2 remove the abdominal insert (78051-52)

X 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

X 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))

X 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))

X 7. Adjust the threaded rods until plane B is horizontal.

X 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.1°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	59.6 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	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°/s ≤ rotation rate ≤ 10°/s	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	53.4 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	44.5°

David Schoedel
Signature

09/21/2015
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

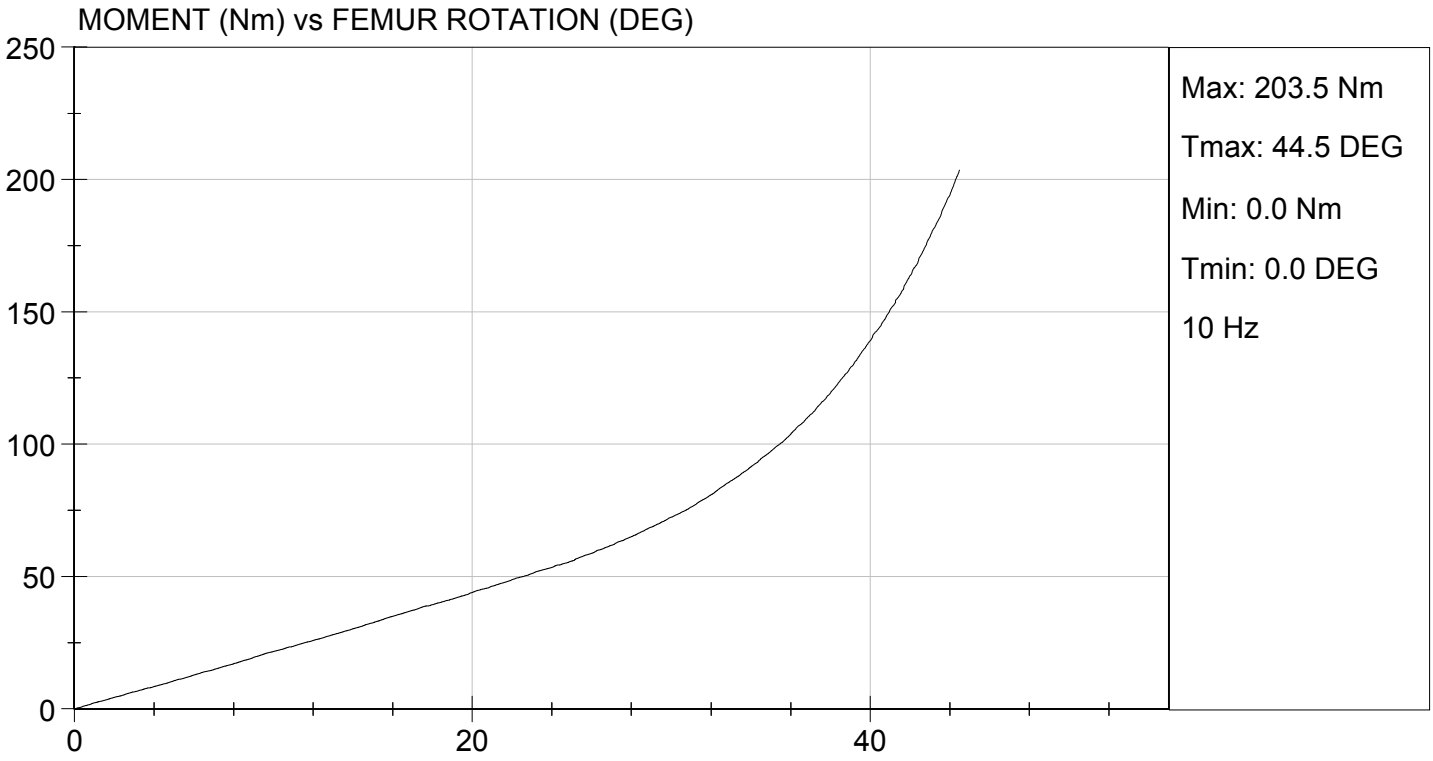
ATD Serial No: 403 **Test I.D:** D152930

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.4	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	45	45	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.1	Pass
30 Degrees	Nm	94.9 Nm Max	72.4	80.8	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

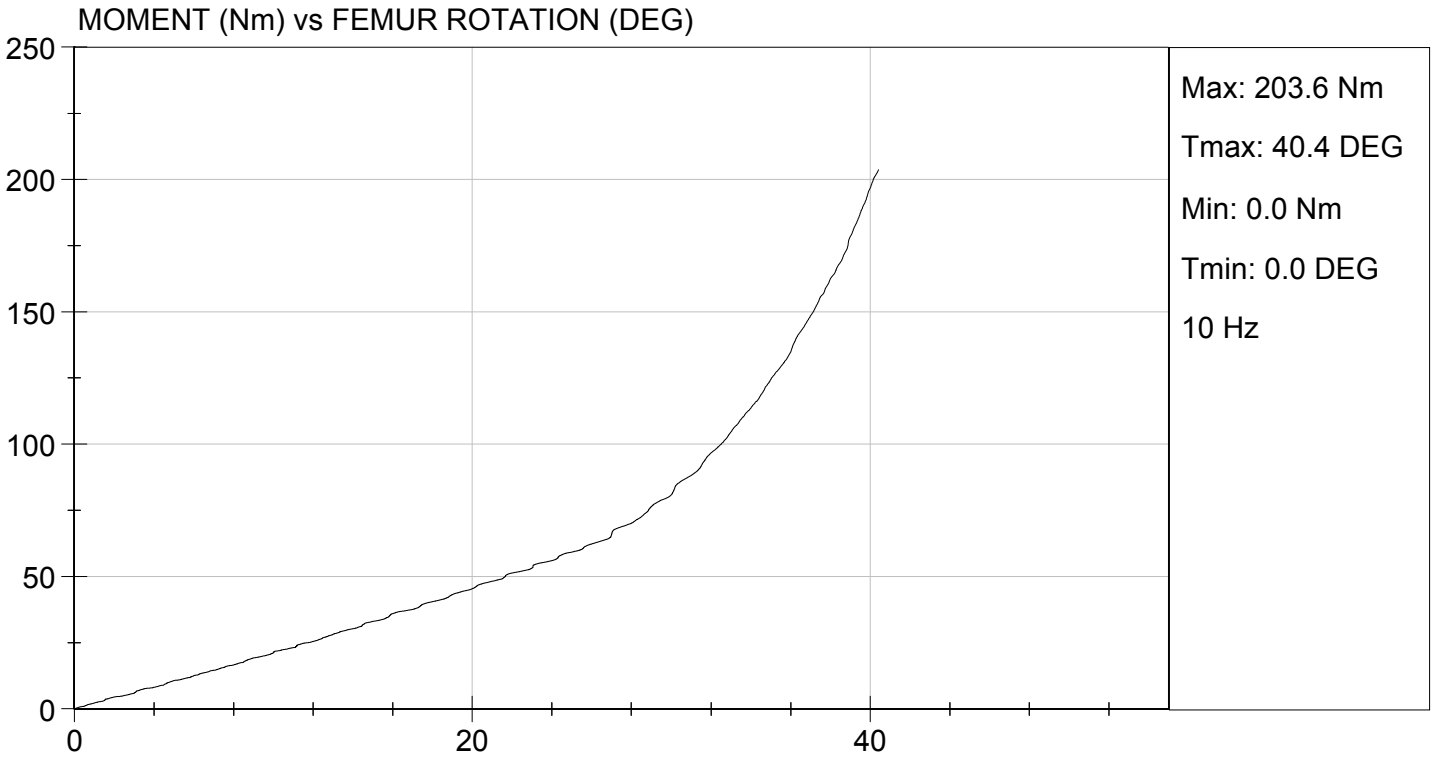
09/21/2015
Test Date

Jeff Leonardelli
Approved By


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 44.5 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 09/21/2015
TEST #: D152930



DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH70	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	AH5E5	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	C10591	09/11/2015	03/11/2016
NECK TRANSDUCER	Denton	1716	1157	10/21/2015	4/21/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH74	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	C10686	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	C13046	09/11/2015	03/11/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	403	09/10/2015	03/10/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8804	09/10/2015	03/10/2016
(2) LEFT FEMUR	Denton	2121	8805	09/10/2015	03/10/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH591	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	11/30/2015	05/30/2016
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	11/30/2015	05/30/2016
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 403 Test Date: 11/30/2015

Technician: Jack Coleman

____ 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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

__X__ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the 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 ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))

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

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	255 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	2.9 g

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

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test ID:** D153941

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	25	Pass
Peak Resultant Acceleration	G's	225 to 275	255	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

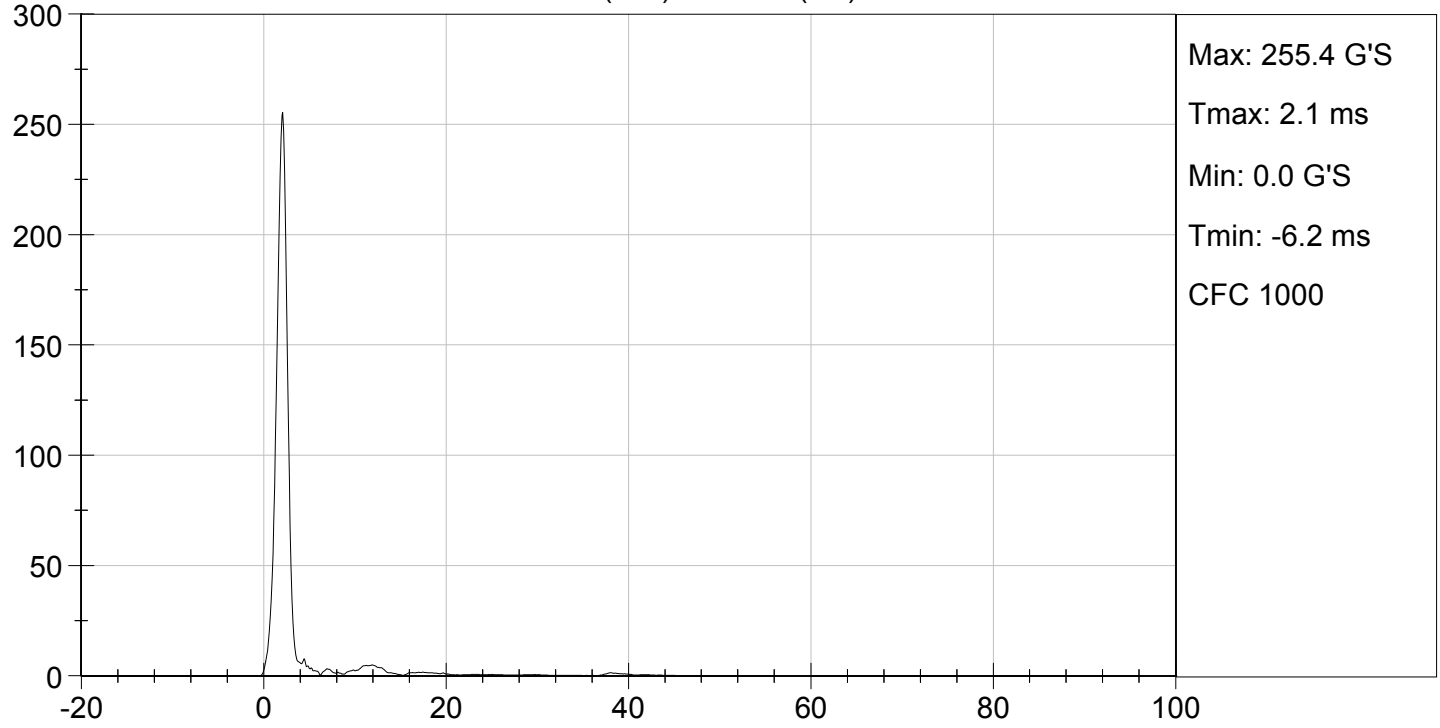
11/30/2015
Test Date

Jeff Leonardini
Approved By

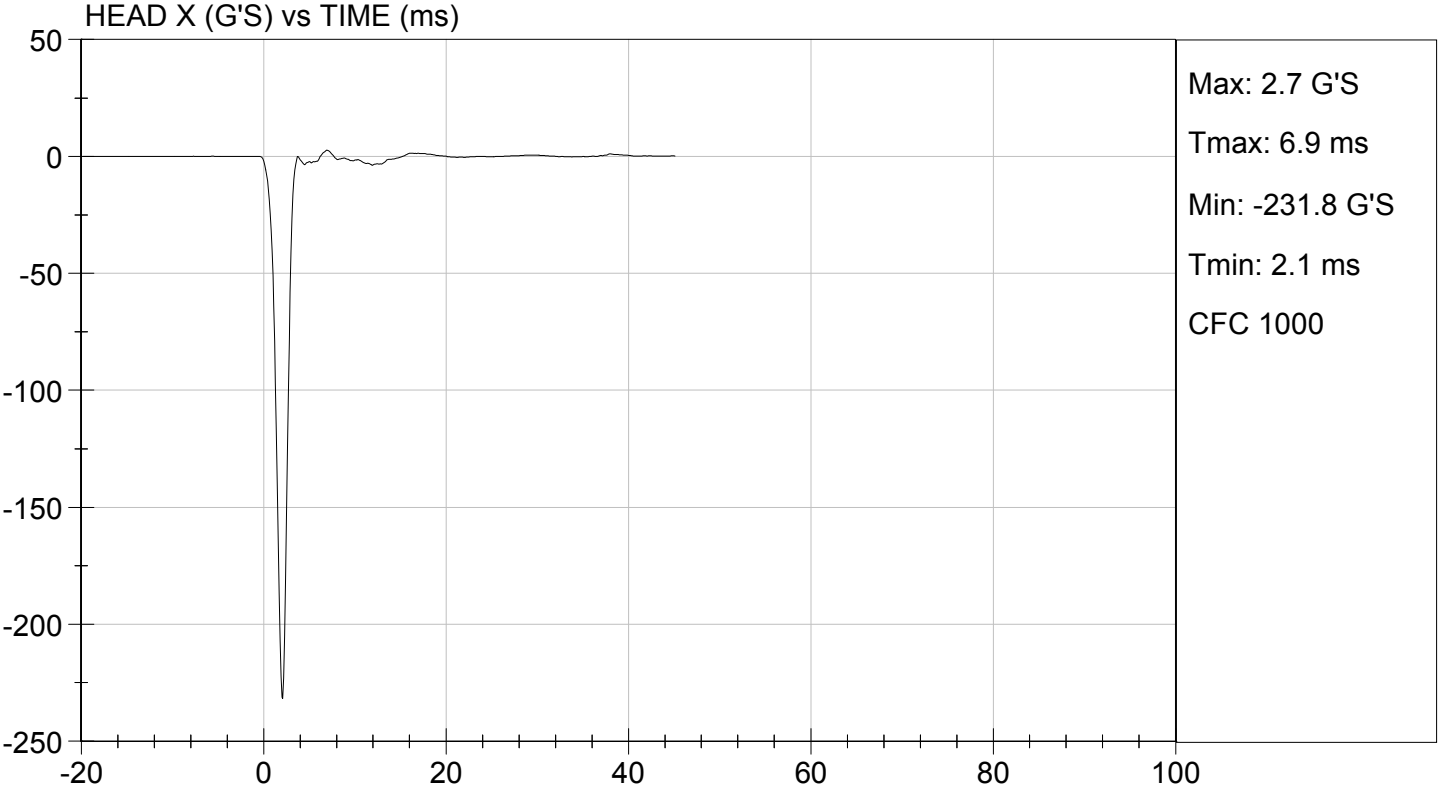
TEST DESC: HEAD DROP

TEST DATE: 11/30/2015
TEST #: D153941

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



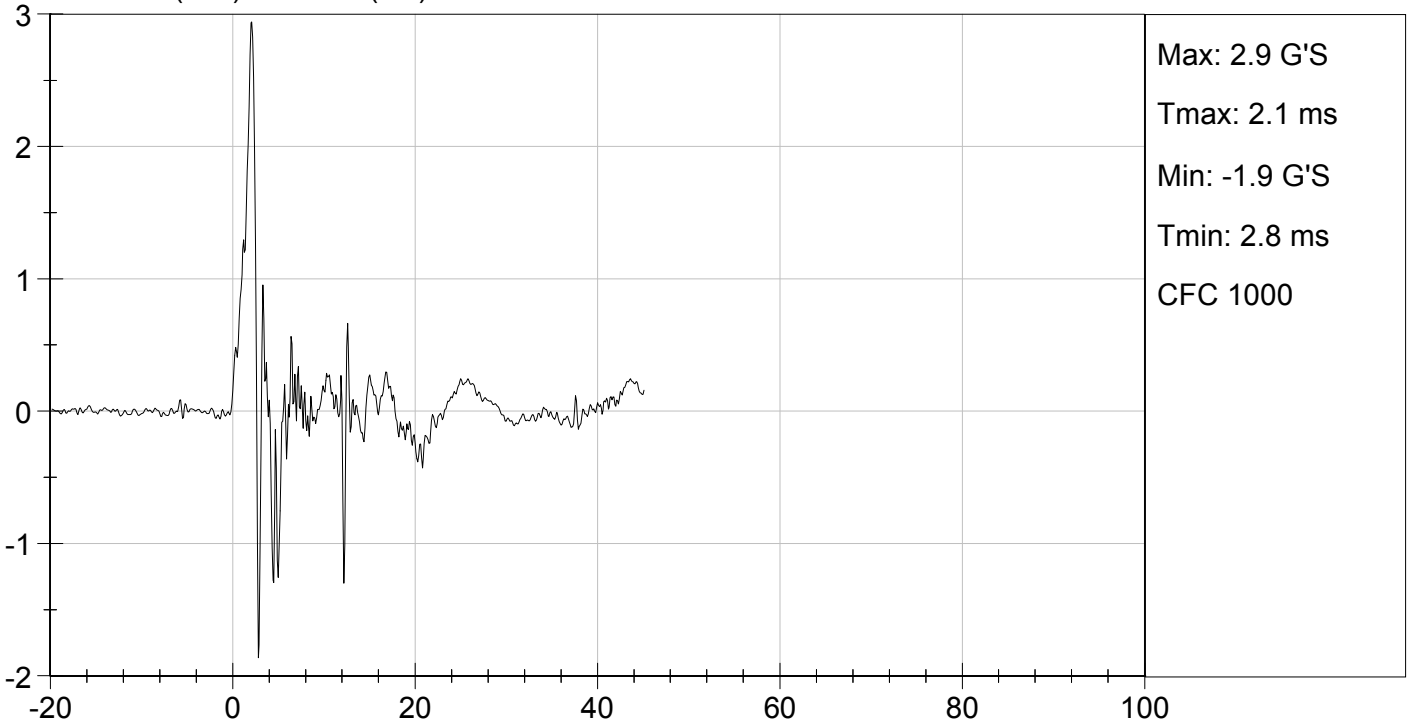
HEAD X (G'S) vs TIME (ms)



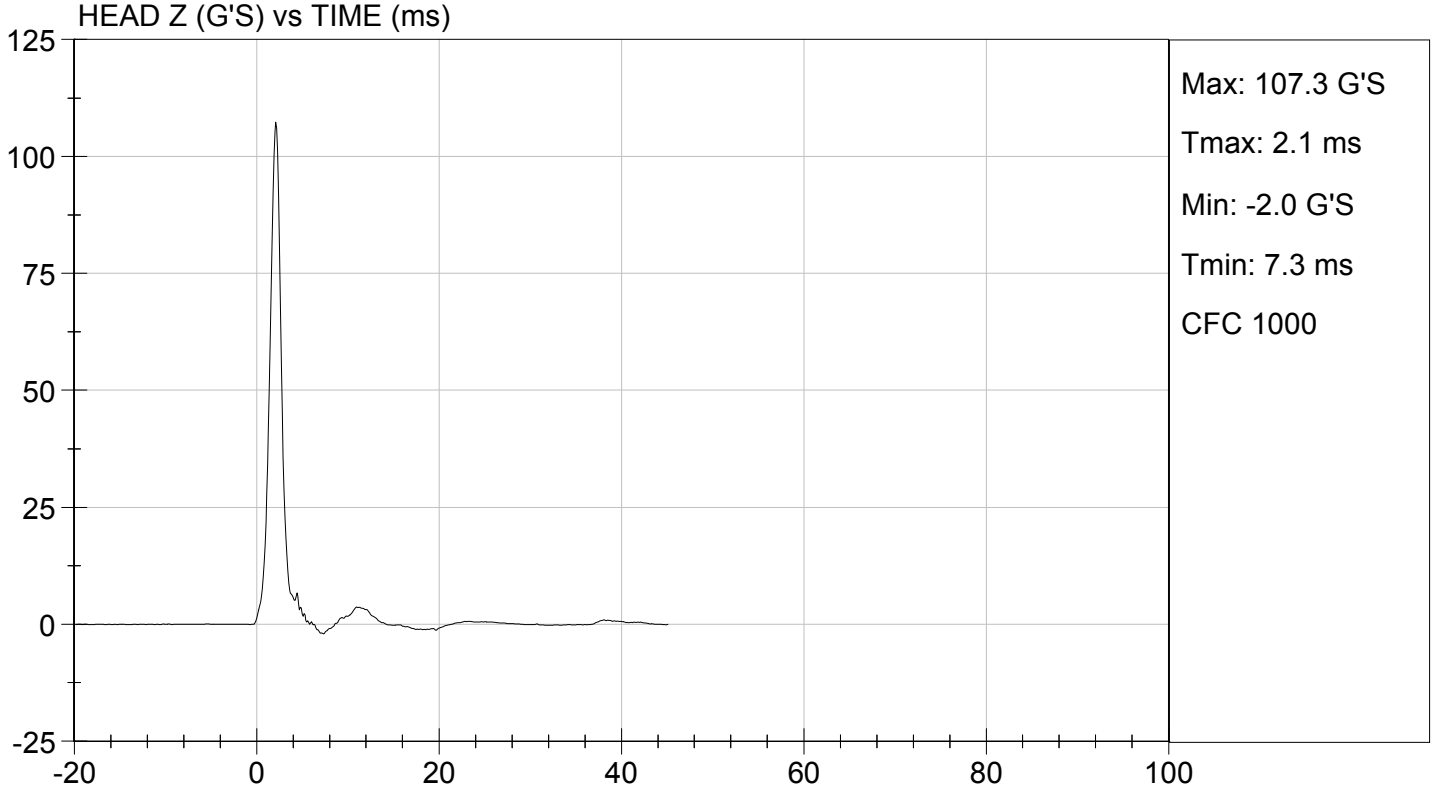
TEST DESC: HEAD DROP

TEST DATE: 11/30/2015
TEST #: D153941

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



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



DATA SHEET A4

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 11/30/2015

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. (572.36(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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	23.15 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	23.91 g's
	@ 20 ms	17.6 ≤ g ≤ 22.6	20.26 g's
	@ 30 ms	12.5 ≤ g ≤ 18.5	13.07 g's
	Above 30 ms	29 g maximum	13.0 g's
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	39.9 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	68.4°
		57 ms ≤ time of max. rotation ≤ 64 ms	58.7 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	113.1 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	67.2 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	52.4 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	101.2 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D153942

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	32	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.91	Pass
	20 ms	G's	17.60 to 22.60	20.26	Pass
	30 ms	G's	12.50 to 18.50	13.07	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	39.9	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	68.4	Pass
	Time	ms	57.0 to 64.0	58.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.1	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.1	Pass
	Time	ms	47.0 to 58.0	52.4	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	101.2	Pass
			Overall Test Results		Pass

Jack Coleman
Laboratory Technician

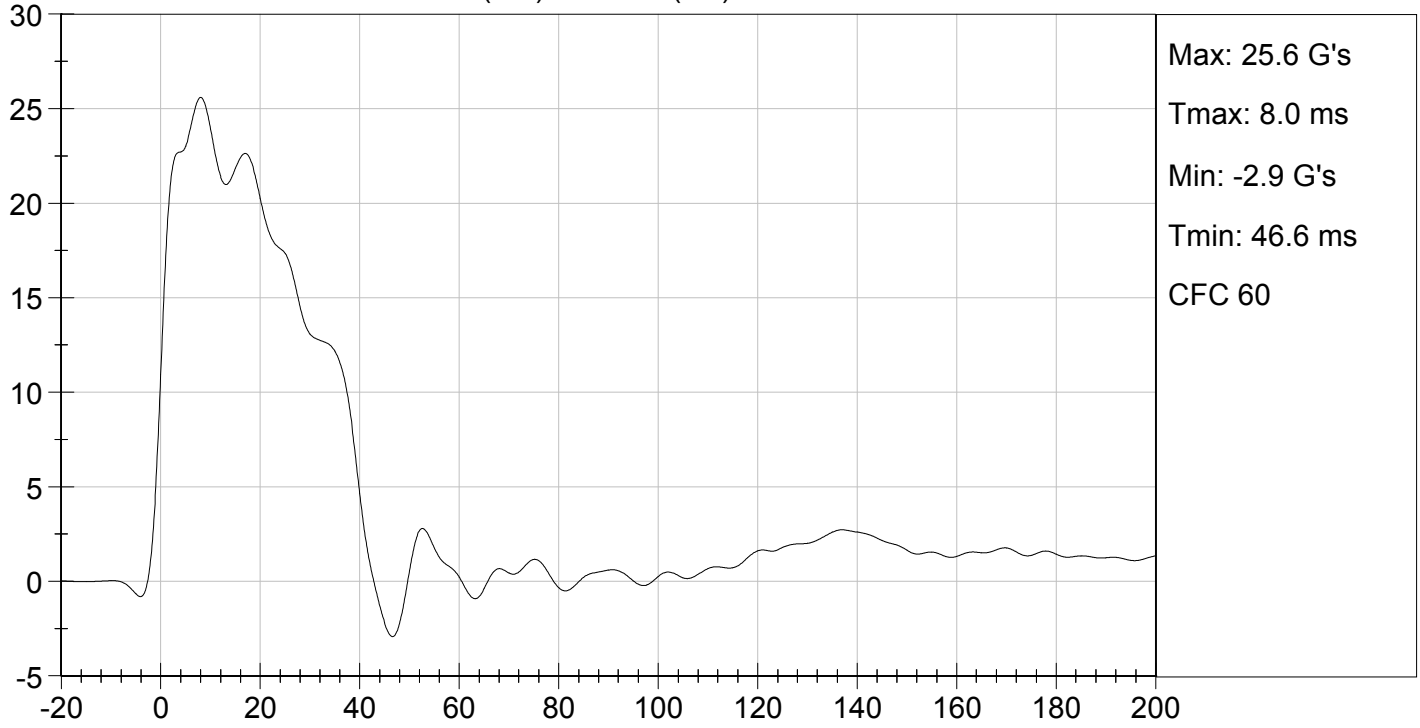
11/30/2015
Test Date

Jeff Leonardi
Approved By

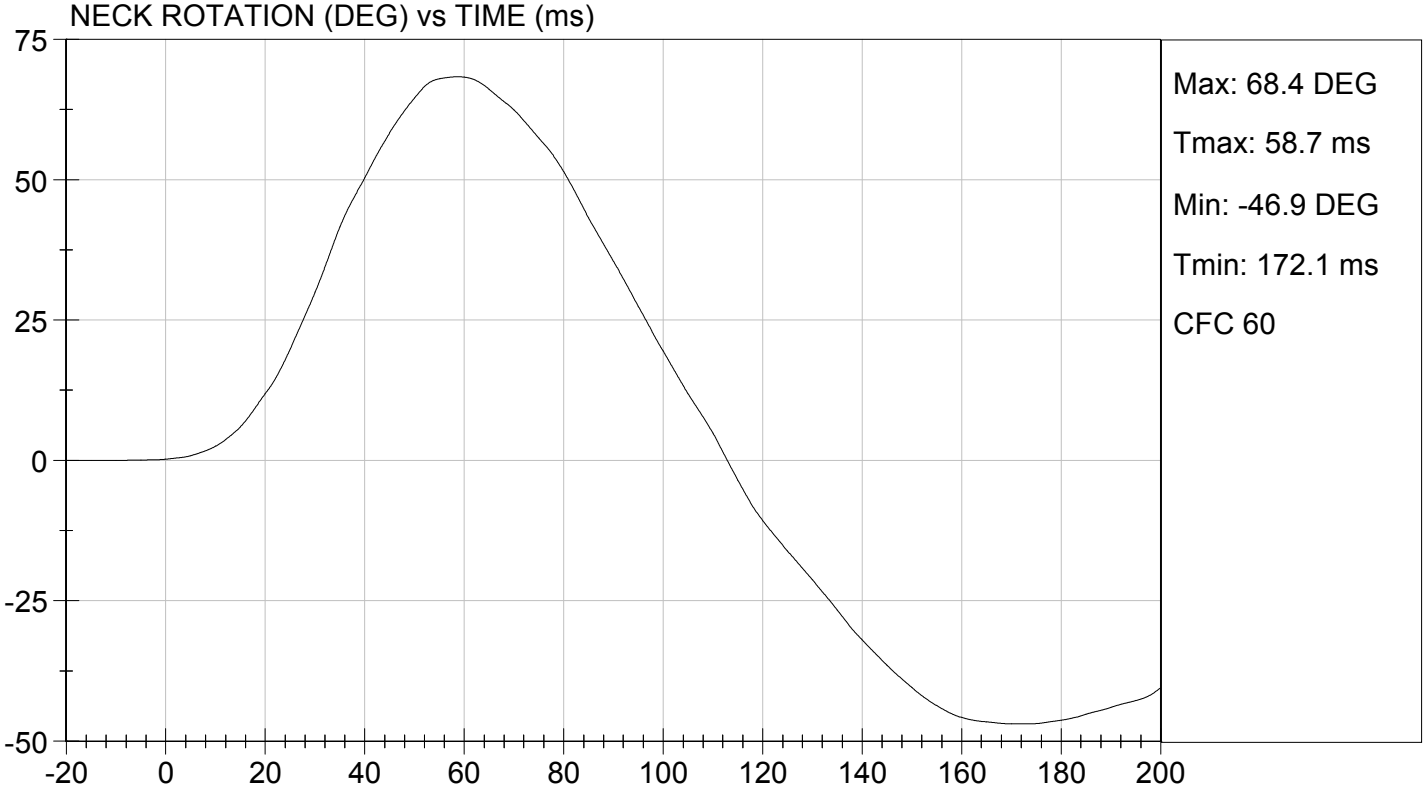
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 11/30/2015
TEST #: D153942

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



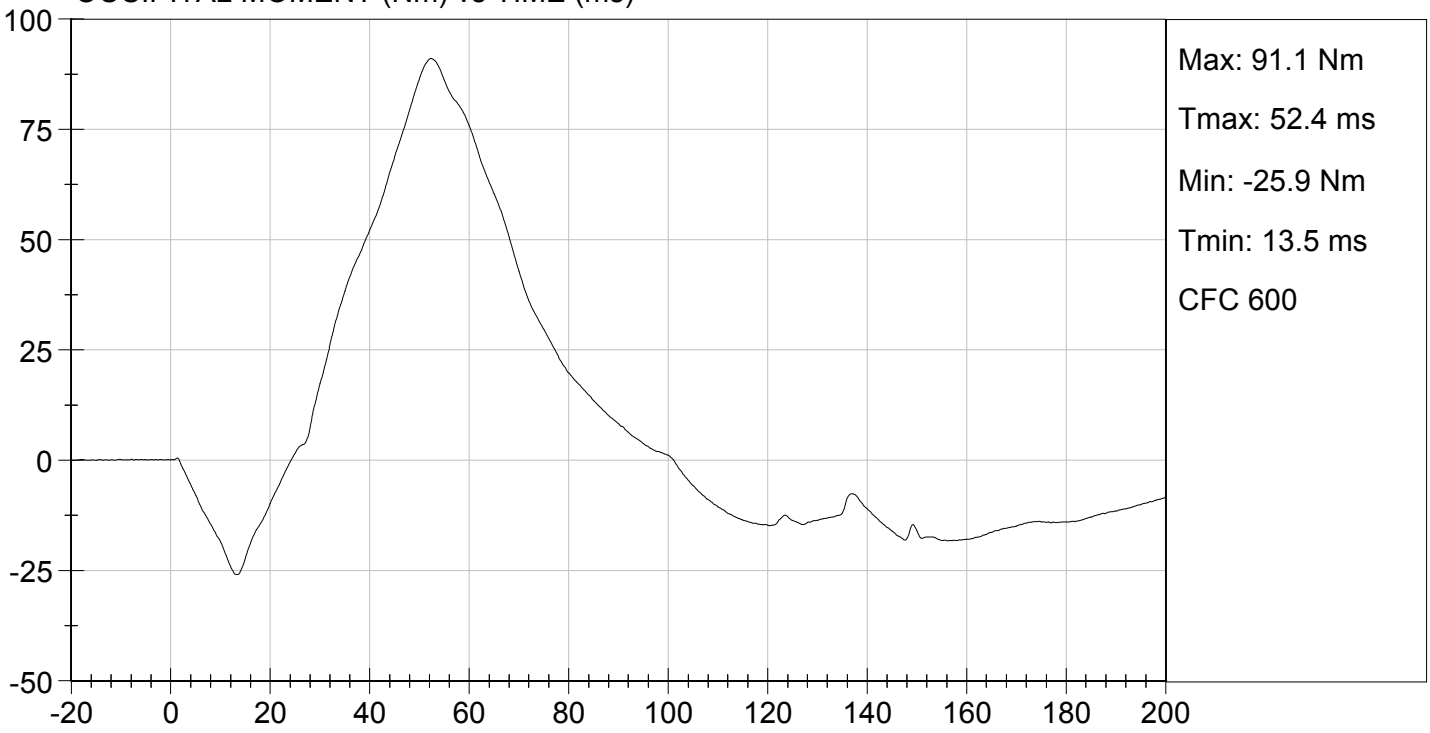
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/30/2015
TEST #: D153942

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 11/30/2015

Technician: Jack Coleman

____ 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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	20.08 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	19.73 g's
	@ 20 ms	14 ≤ g ≤ 19	17.48 g's
	@ 30 ms	11.0 ≤ g ≤ 16.0	11.41 g's
	Above 30 ms	22 g maximum	12.0 g's
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	40.8 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	97.5°
		72 ms ≤ time of max. rotation ≤ 82 ms	77.7 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	160.1 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-45.6 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	72.8 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	147.9 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

Jack Coleman — Signature

11/30/2015 — Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D153943

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	32	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.73	Pass
	20 ms	G's	14.00 to 19.00	17.48	Pass
	30 ms	G's	11.00 to 16.00	11.41	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	97.5	Pass
	Time	ms	72.0 to 82.0	77.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	160.1	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-61.8	Pass
	Time	ms	65.0 to 79.0	72.8	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	147.9	Pass
			Overall Test Results		Pass

Jack Coleman

Laboratory Technician

11/30/2015

Test Date

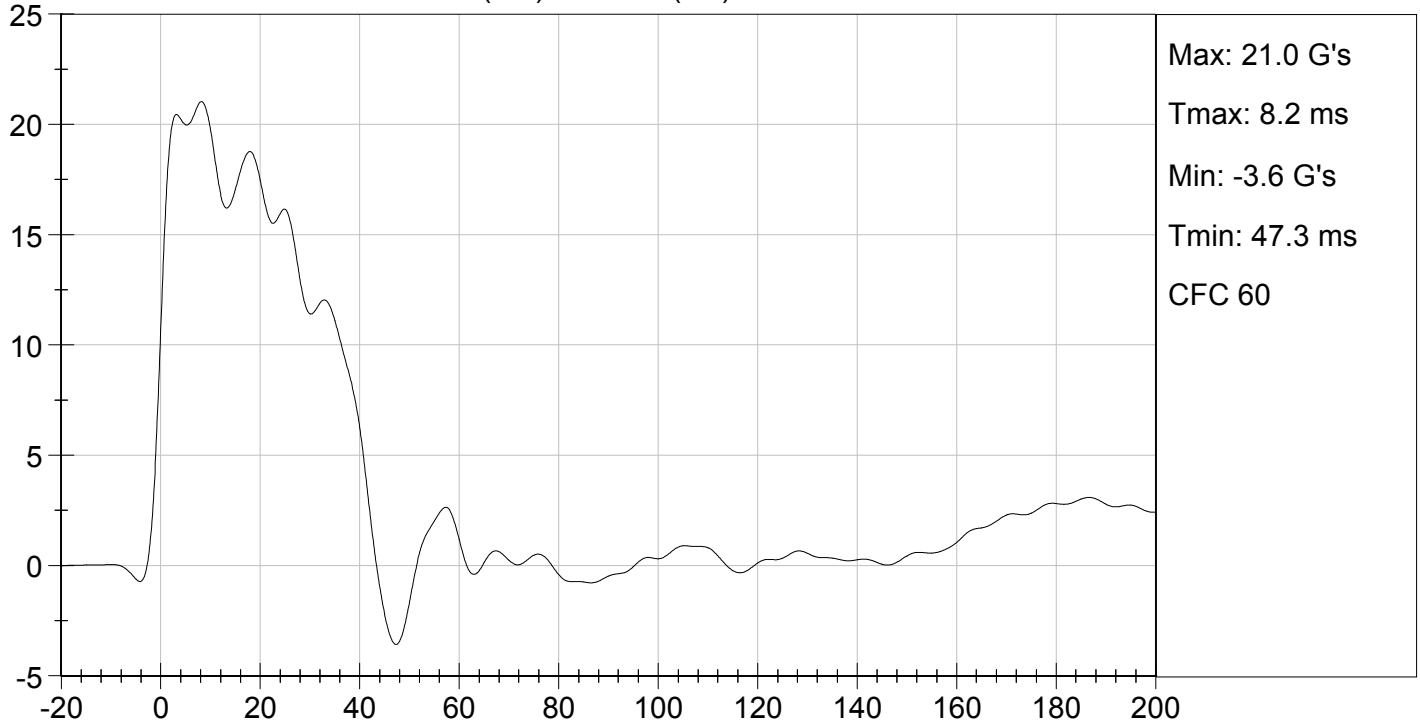
Jeff Leonardelli

Approved By

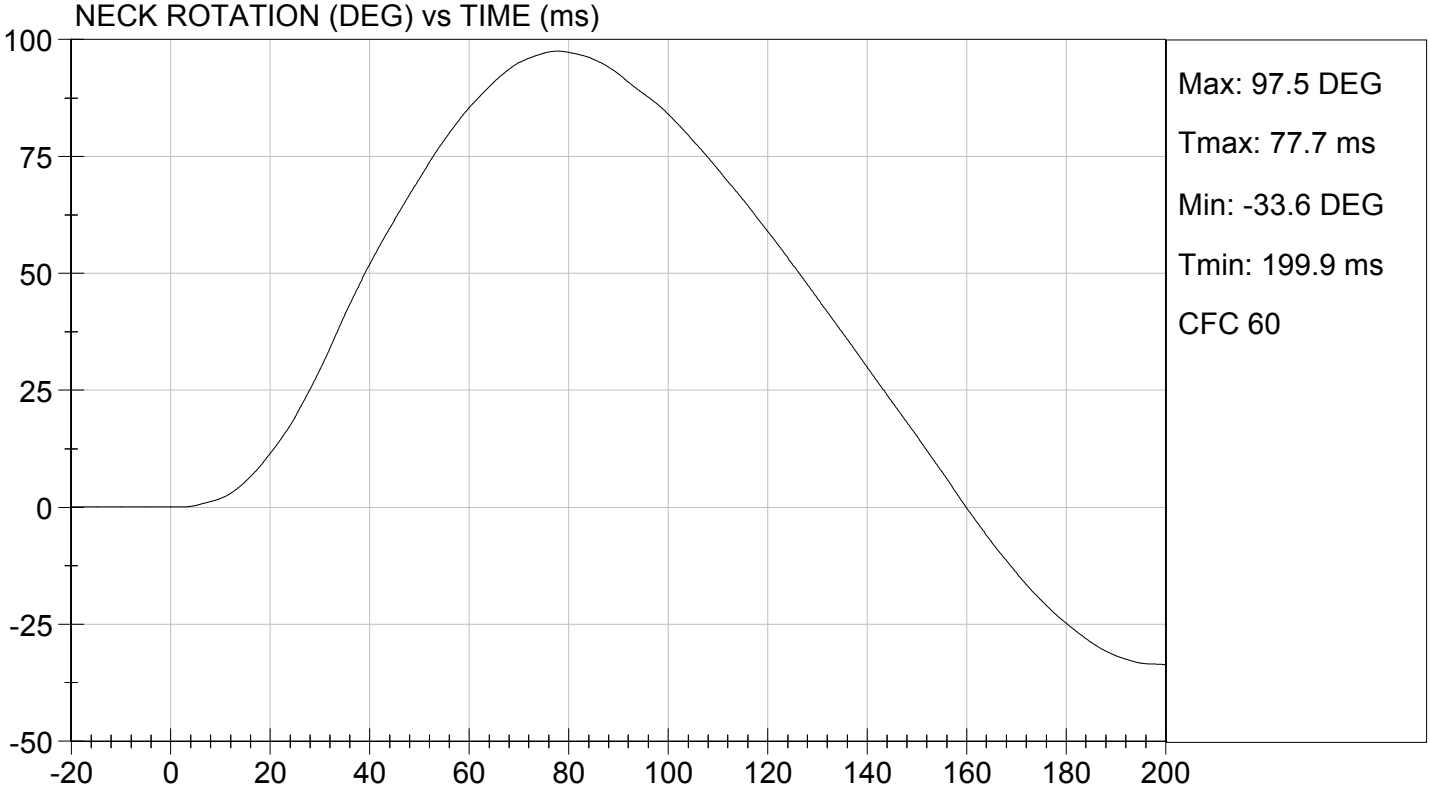
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/30/2015
TEST #: D153943

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

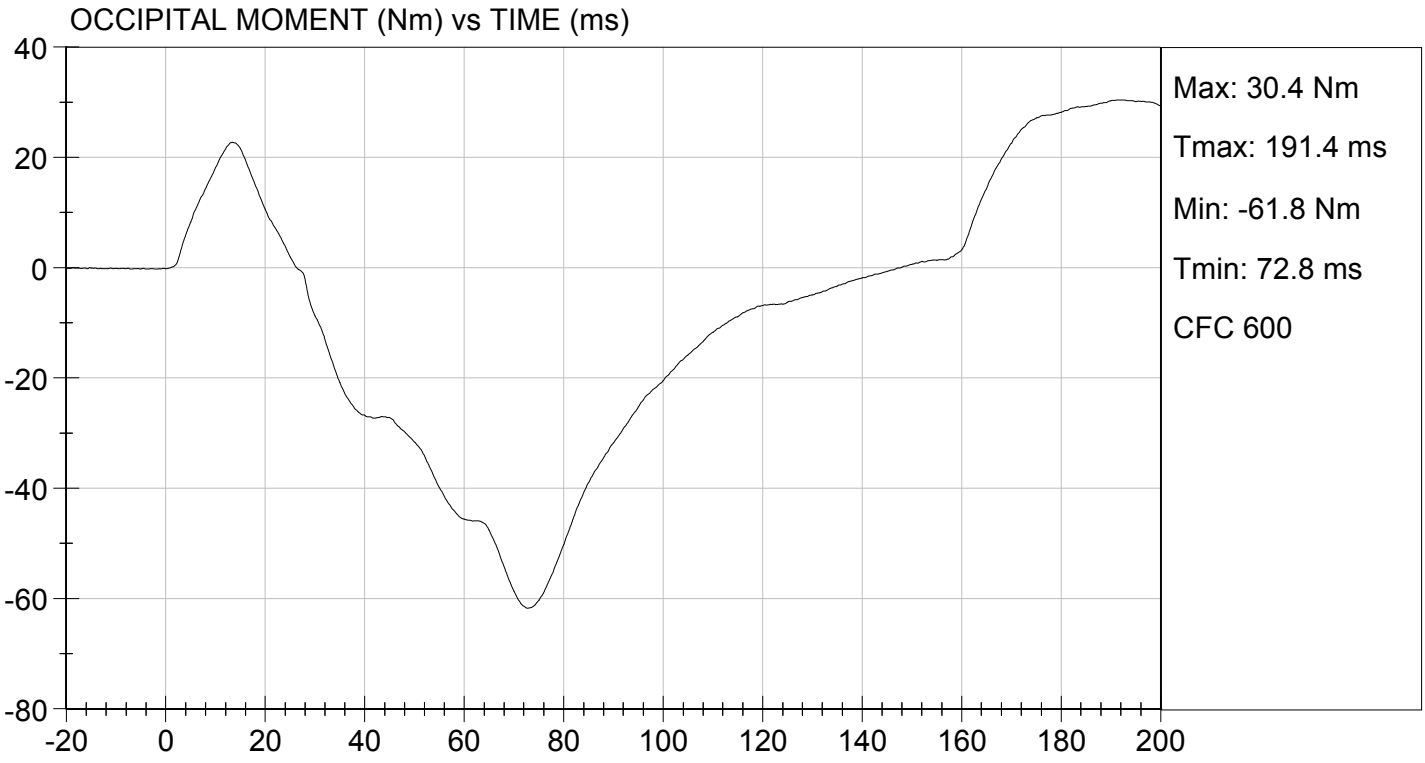


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/30/2015
TEST #: D153943



DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403 Test Date: 11/30/2015

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

_X_ - No Damage

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

_____

___ - The following repairs or replacement was performed. Record:

_____

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))

X 7. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 13° ± 2°. The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2)

X 8. The midsagittal plane of the dummy is vertical within ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))

X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is 22 f/s ± 0.4 f/s. (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.65 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.67 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1288 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	73 %

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

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

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

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

Jack Coleman

Signature

11/30/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D153944

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	33	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,731	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.77	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

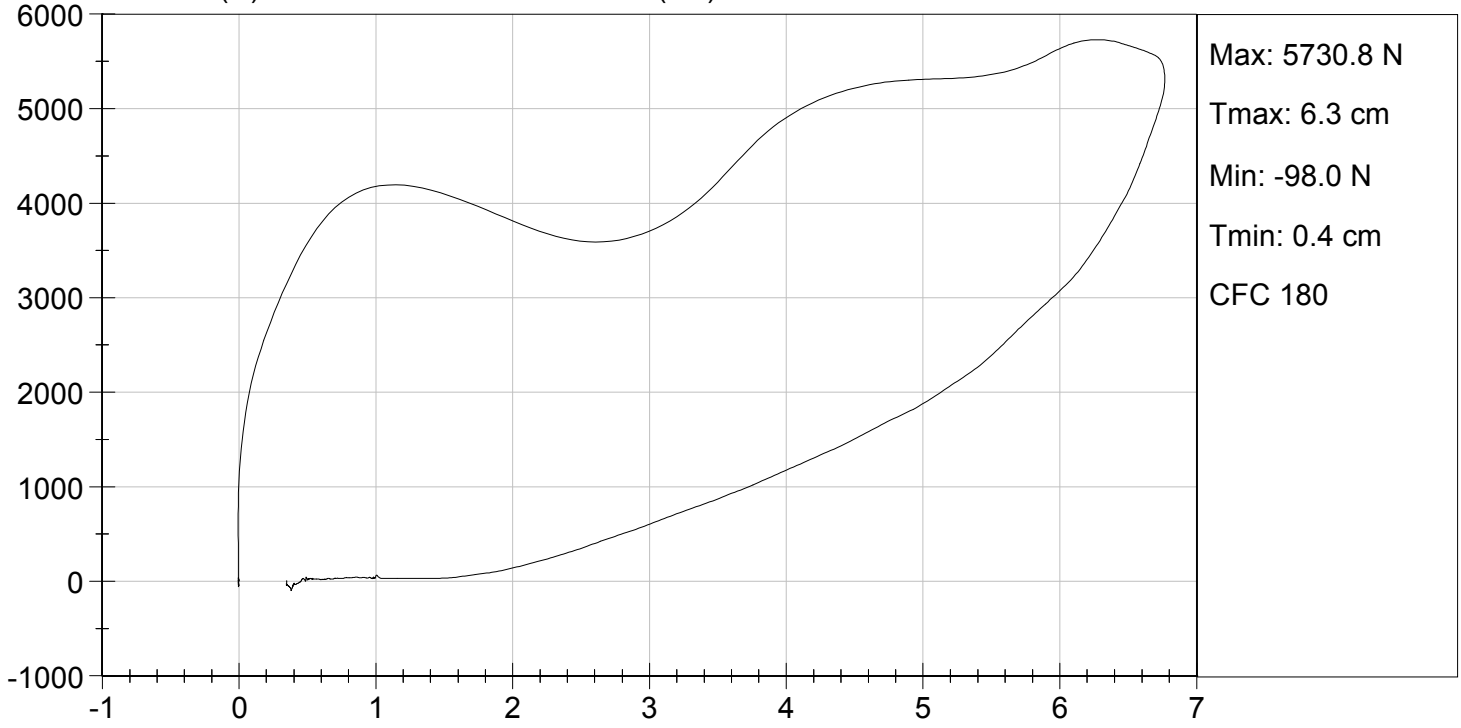
11/30/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 11/30/2015
TEST #: D153944

FORCE (N) vs CHEST DISPLACEMENT (cm)



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

Dummy Serial Number: 403 Test Date: 11/30/2015

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. (572.36(m))
_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.97 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1231 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))

Jack Coleman

Signature

11/30/2015

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D153946

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	32	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,474	Pass
		Overall Test Results		Pass

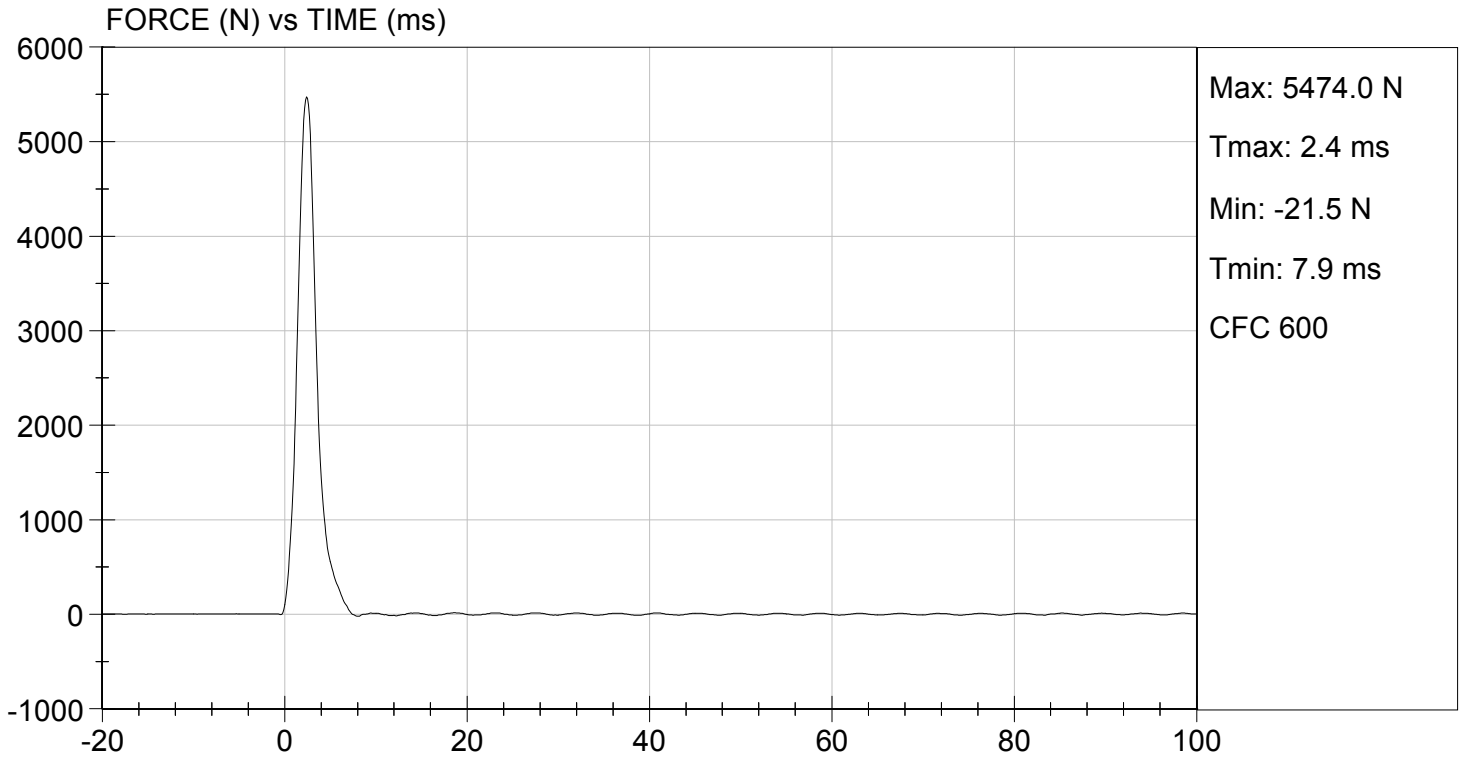
Jack Coleman
Laboratory Technician

11/30/2015
Test Date

Jeff LeVasseur
Approved By

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

TEST DATE: 11/30/2015
TEST #: D153946



DATA SHEET A8

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

Dummy Serial Number: 403 Test Date: 11/30/2015

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. (572.36(m))

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.97 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1084 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))

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D153945

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	32	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,824	Pass
		Overall Test Results		Pass

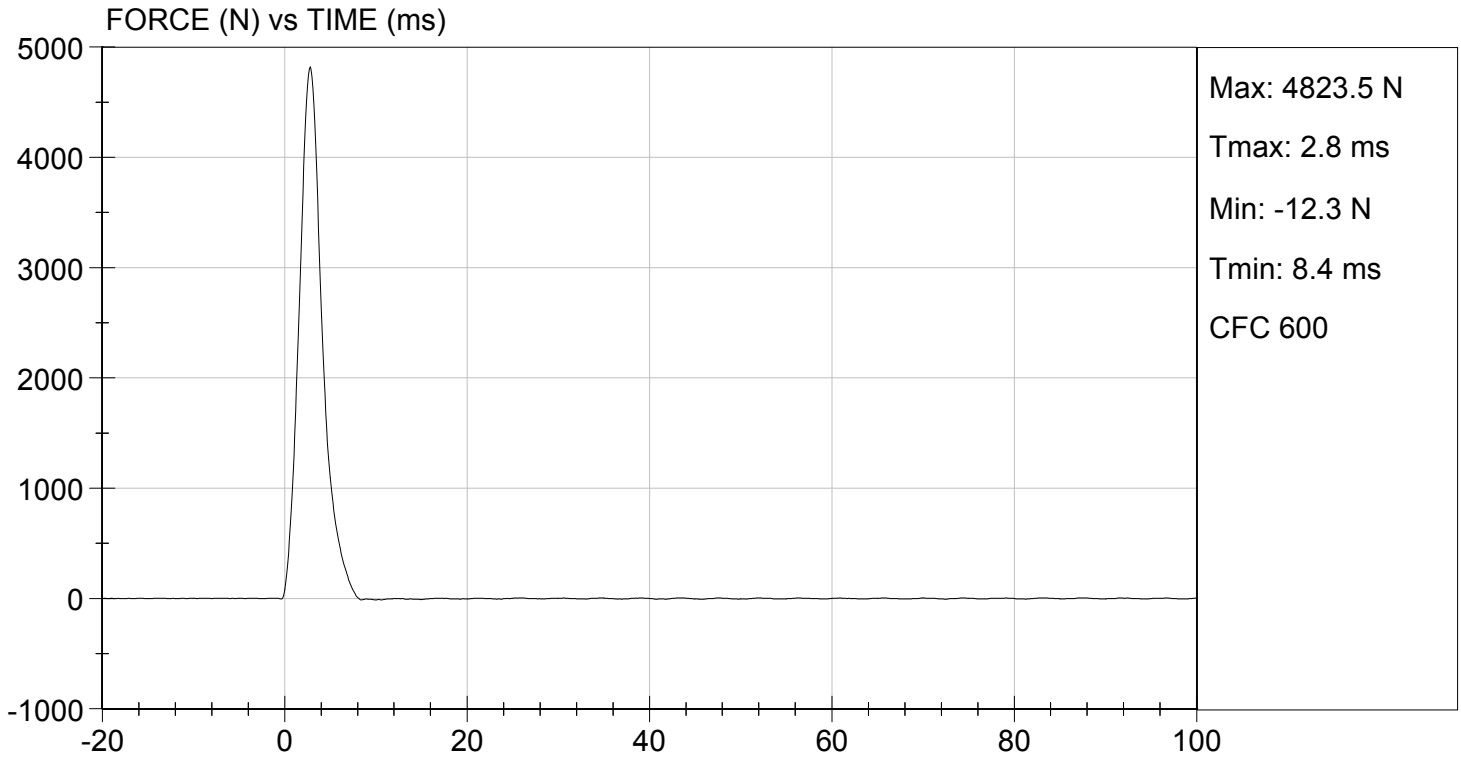
Jack Coleman
Laboratory Technician

11/30/2015
Test Date

Jeff Leonardini
Approved By

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

TEST DATE: 11/30/2015
TEST #: D153945



DATA SHEET A9

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

Dummy Serial Number: 403 Test Date: 11/30/2015

Technician: Jack Coleman

____ 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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

_X_ 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))

_X_ 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))

_X_ 7. Adjust the threaded rods until plane B is horizontal.

_X_ 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.3°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	53.5 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	45.5°

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

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

X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	61.8 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	43.2°

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D153940

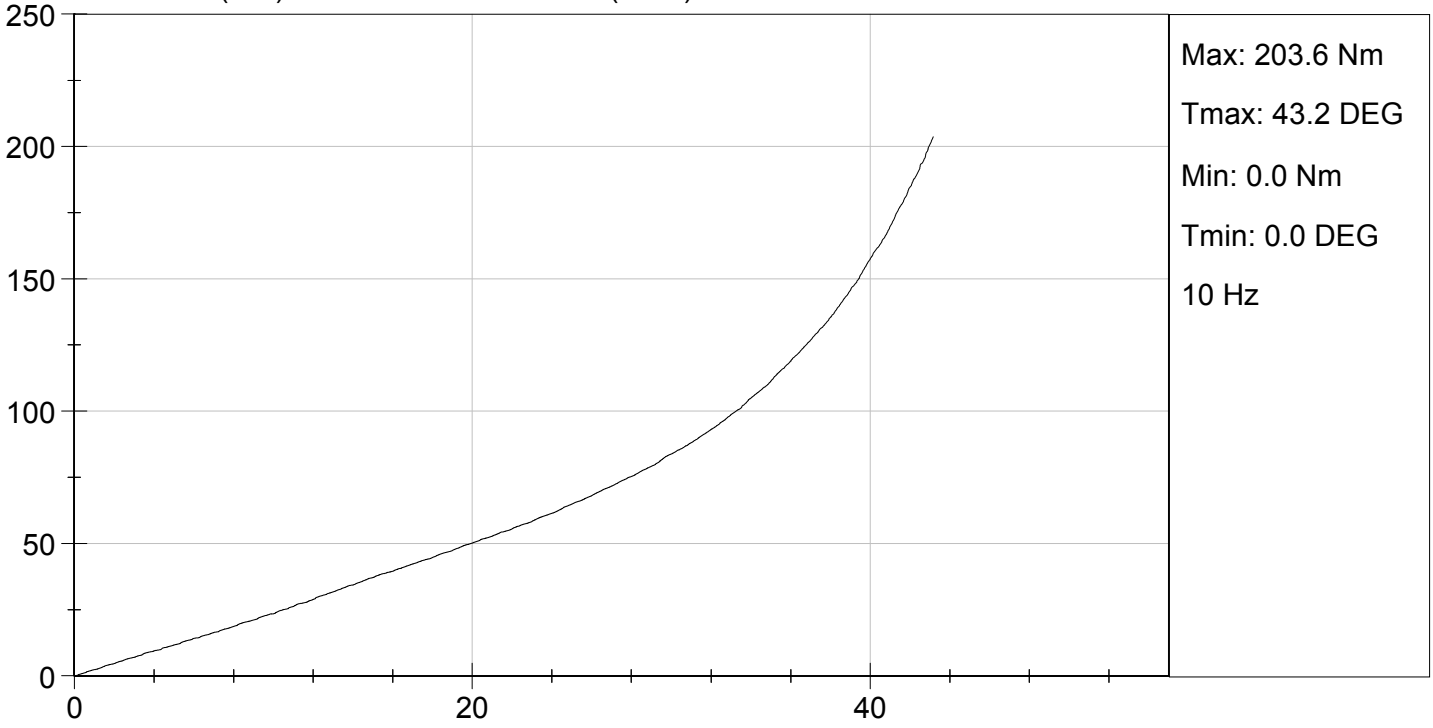
Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.1	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	83.8	72.6	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	43.2	45.5	Pass
		Overall Test Results			Pass

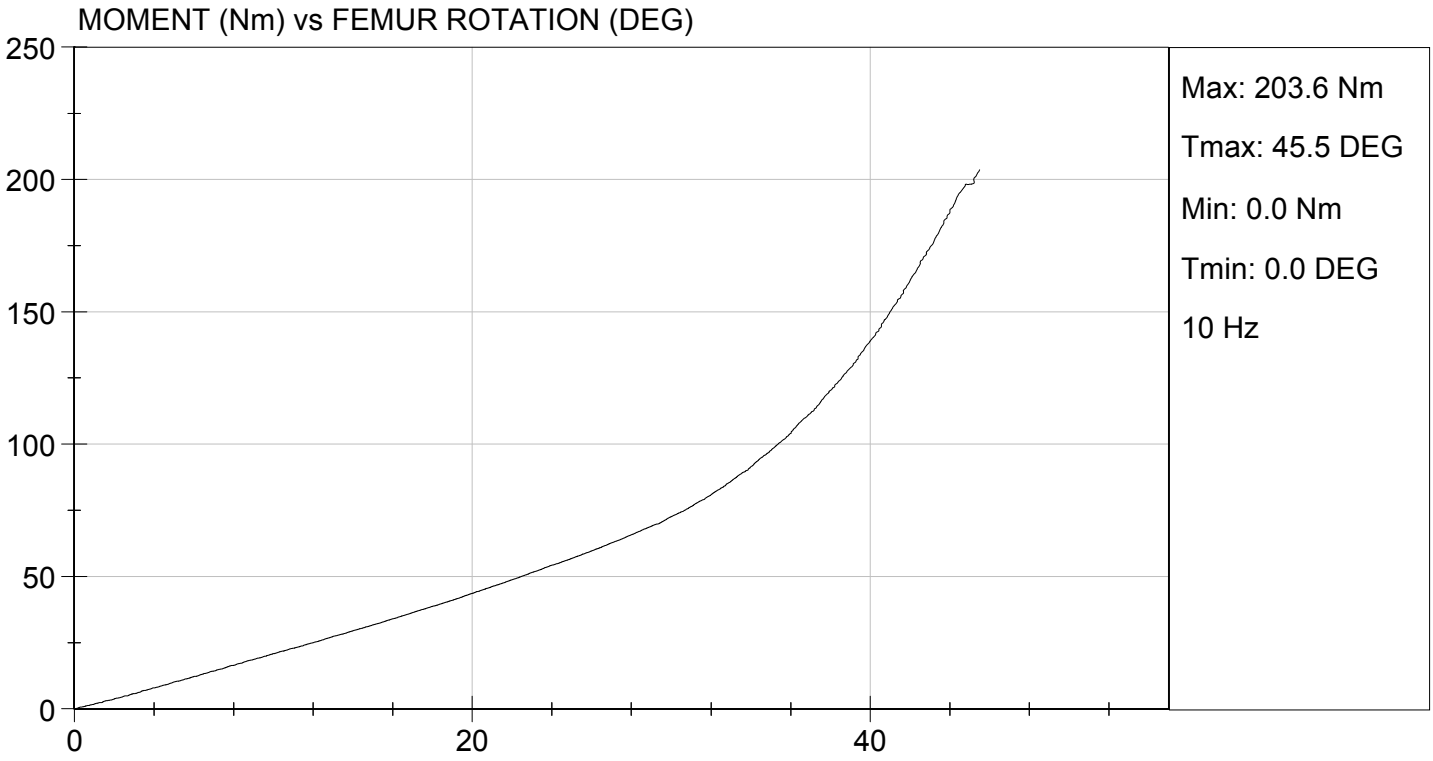
Jack Coleman
Laboratory Technician

11/30/2015
Test Date

Jeff Leonardelli
Approved By

MOMENT (Nm) vs FEMUR ROTATION (DEG)




MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.6 Nm
Tmax: 45.5 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH70	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	AH5E5	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	C10591	09/11/2015	03/11/2016
NECK TRANSDUCER	Denton	1716	1157	10/21/2015	4/21/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH74	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	C10686	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	C13046	09/11/2015	03/11/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	403	09/10/2015	03/10/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8804	09/10/2015	03/10/2016
(2) LEFT FEMUR	Denton	2121	8805	09/10/2015	03/10/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH591	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	11/30/2015	05/30/2016
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	11/30/2015	05/30/2016
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 403 Test Date: 11/30/2015

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 — 11/30/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonardini — 11/30/2015

Signature — Date

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

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

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

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.32(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:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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 ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))

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

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	262 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	6.7 g

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

Jack Coleman — Signature

09/21/2015 — Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test ID:** D152921

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	44	Pass
Peak Resultant Acceleration	G's	225 to 275	262	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	6.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

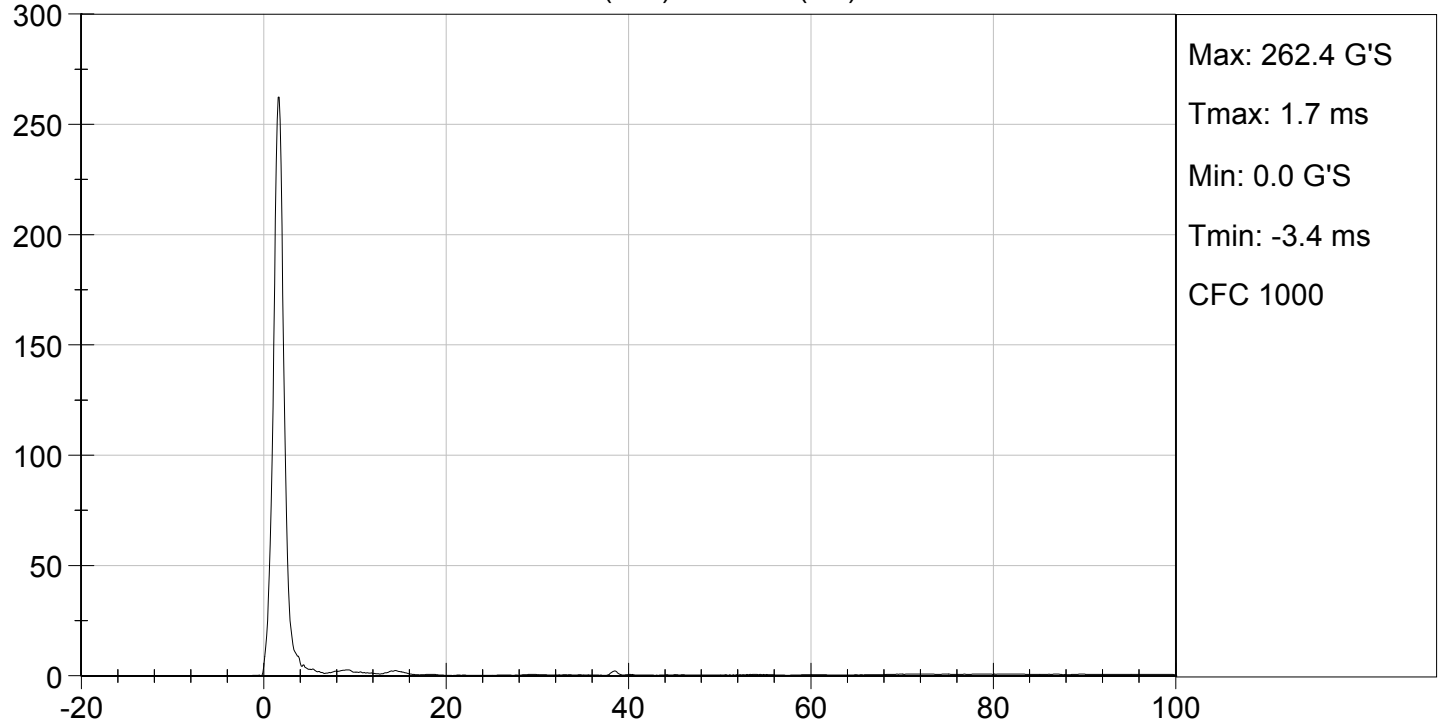
09/21/2015
Test Date

Jeff Leonardelli
Approved By

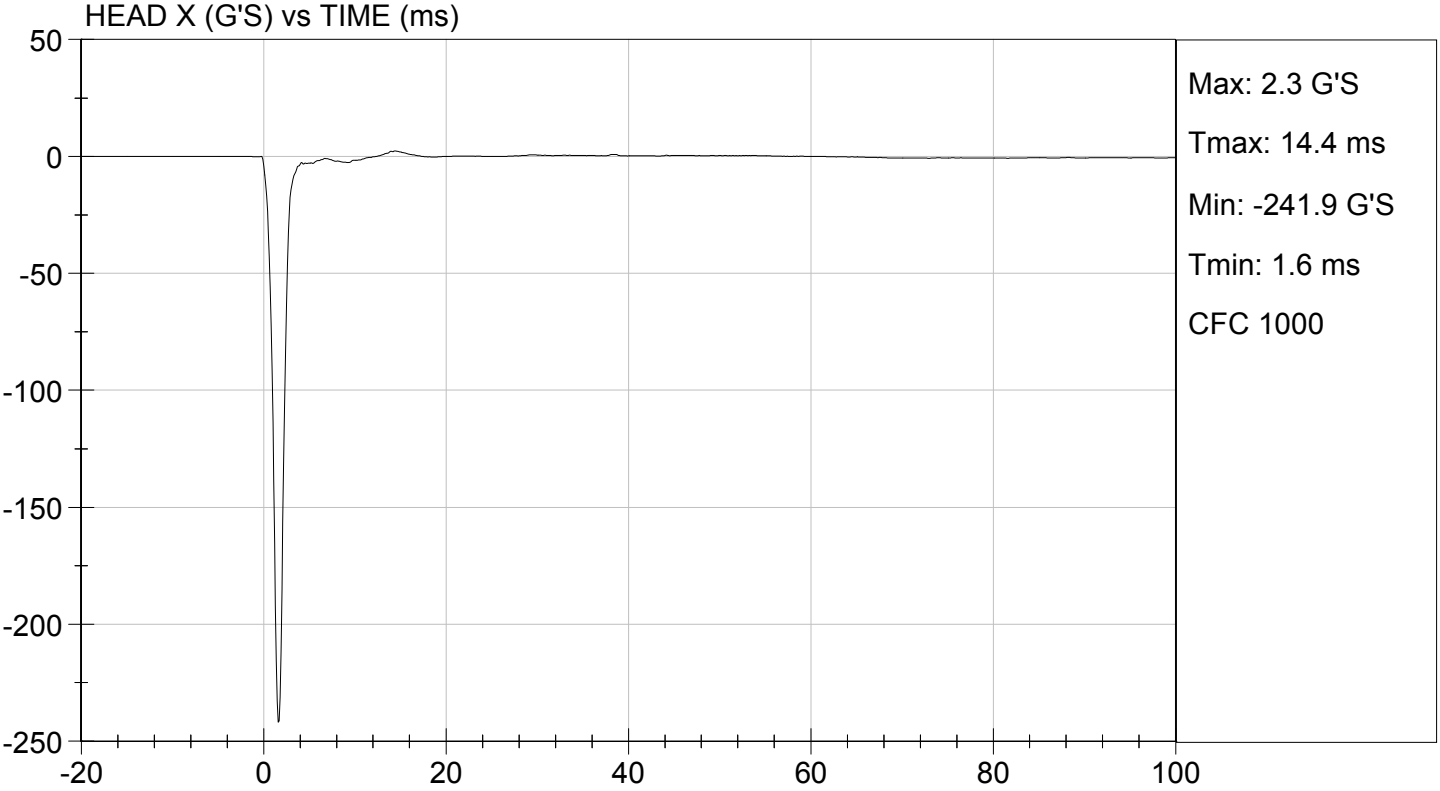
TEST DESC: HEAD DROP

TEST DATE: 09/21/2015
TEST #: D152921

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



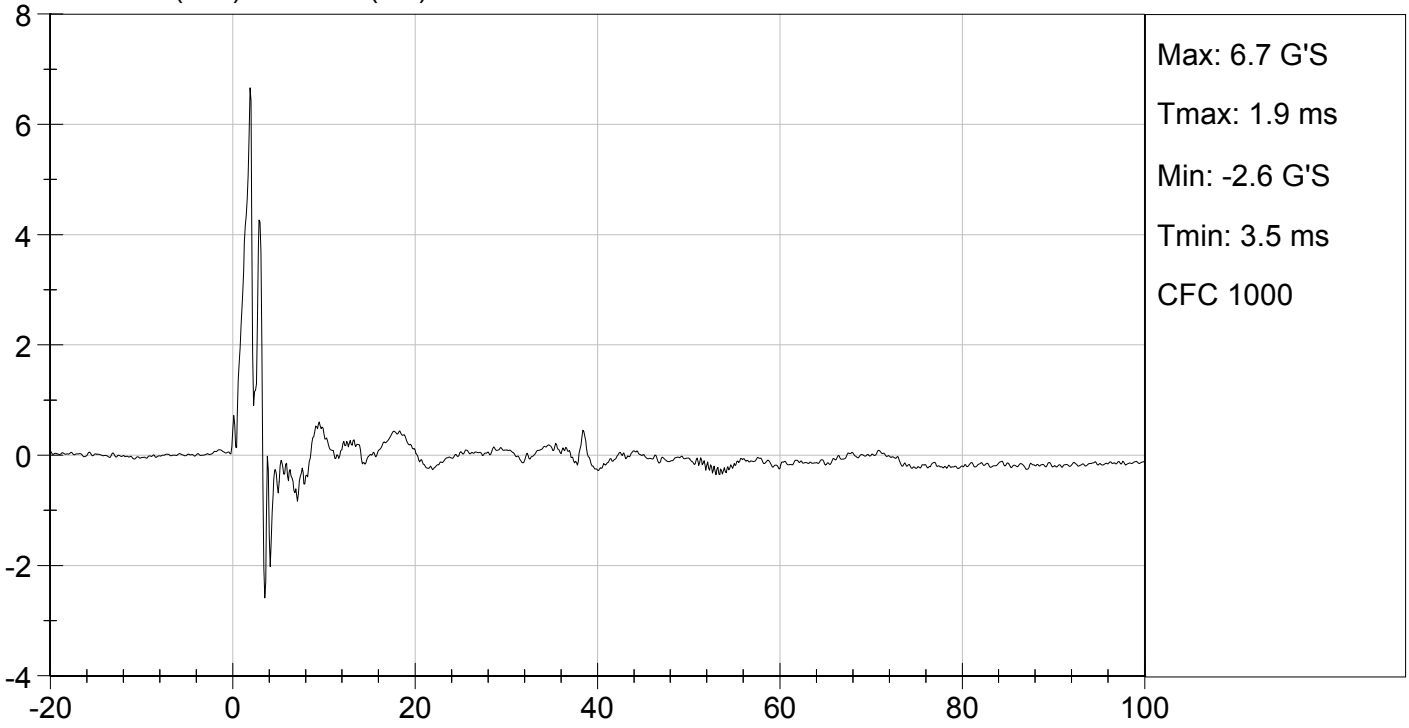
HEAD X (G'S) vs TIME (ms)



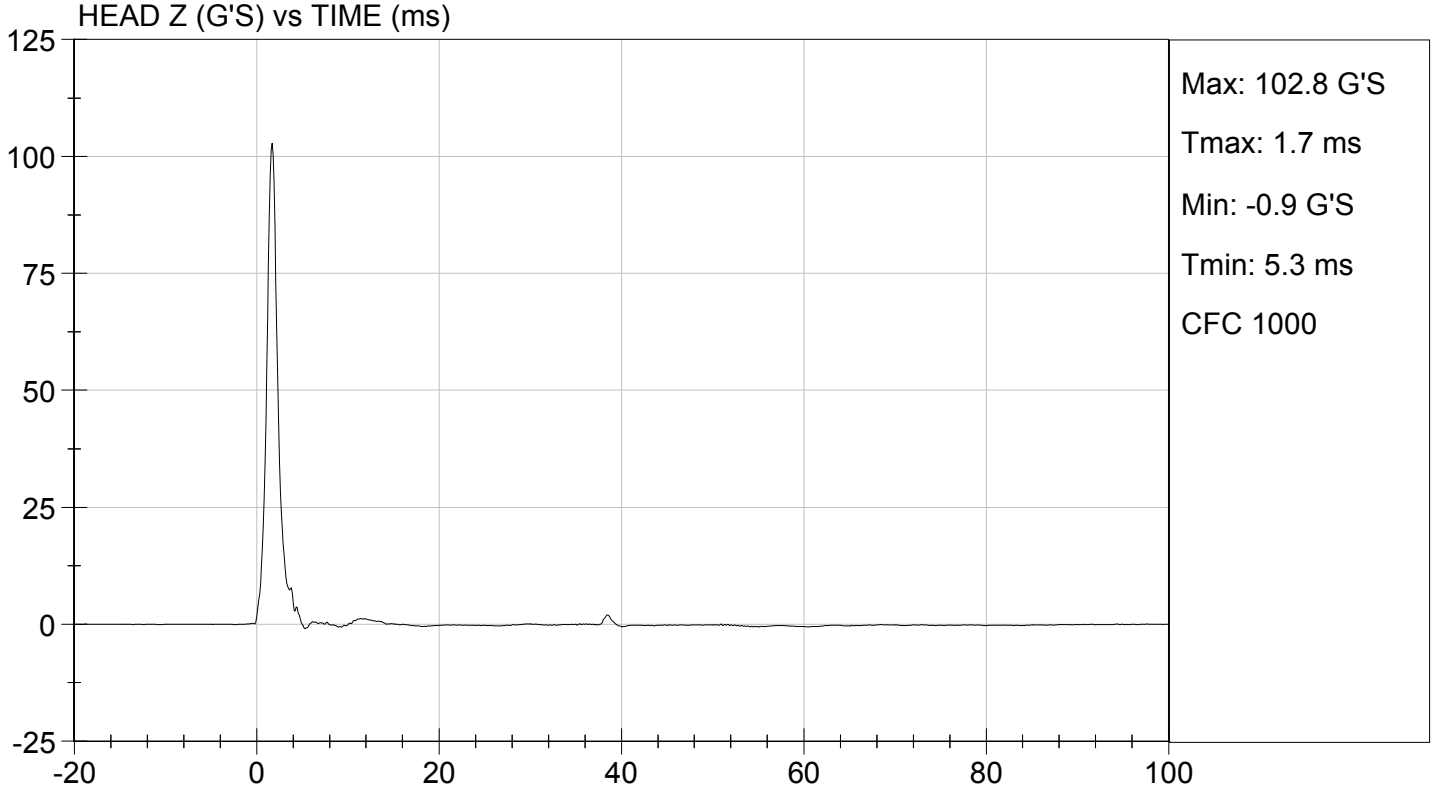
TEST DESC: HEAD DROP

TEST DATE: 09/21/2015
TEST #: D152921

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



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



DATA SHEET A4

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last flexion test. (572.36(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:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	23.15 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	24.30 g's
	@ 20 ms	17.6 ≤ g ≤ 22.6	18.63 g's
	@ 30 ms	12.5 ≤ g ≤ 18.5	13.70 g's
	Above 30 ms	29 g maximum	15.3 g's
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	41.1 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	69.7°
		57 ms ≤ time of max. rotation ≤ 64 ms	57.9 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	114.2 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	72.1 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	52.7 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	98.8 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

David Schoedel

Signature

09/21/2015

Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D152922

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.30	Pass
	20 ms	G's	17.60 to 22.60	18.63	Pass
	30 ms	G's	12.50 to 18.50	13.70	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	15.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	41.1	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	69.7	Pass
	Time	ms	57.0 to 64.0	57.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	97.7	Pass
	Time	ms	47.0 to 58.0	52.7	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.8	Pass
			Overall Test Results		Pass

David Schoedel
Laboratory Technician

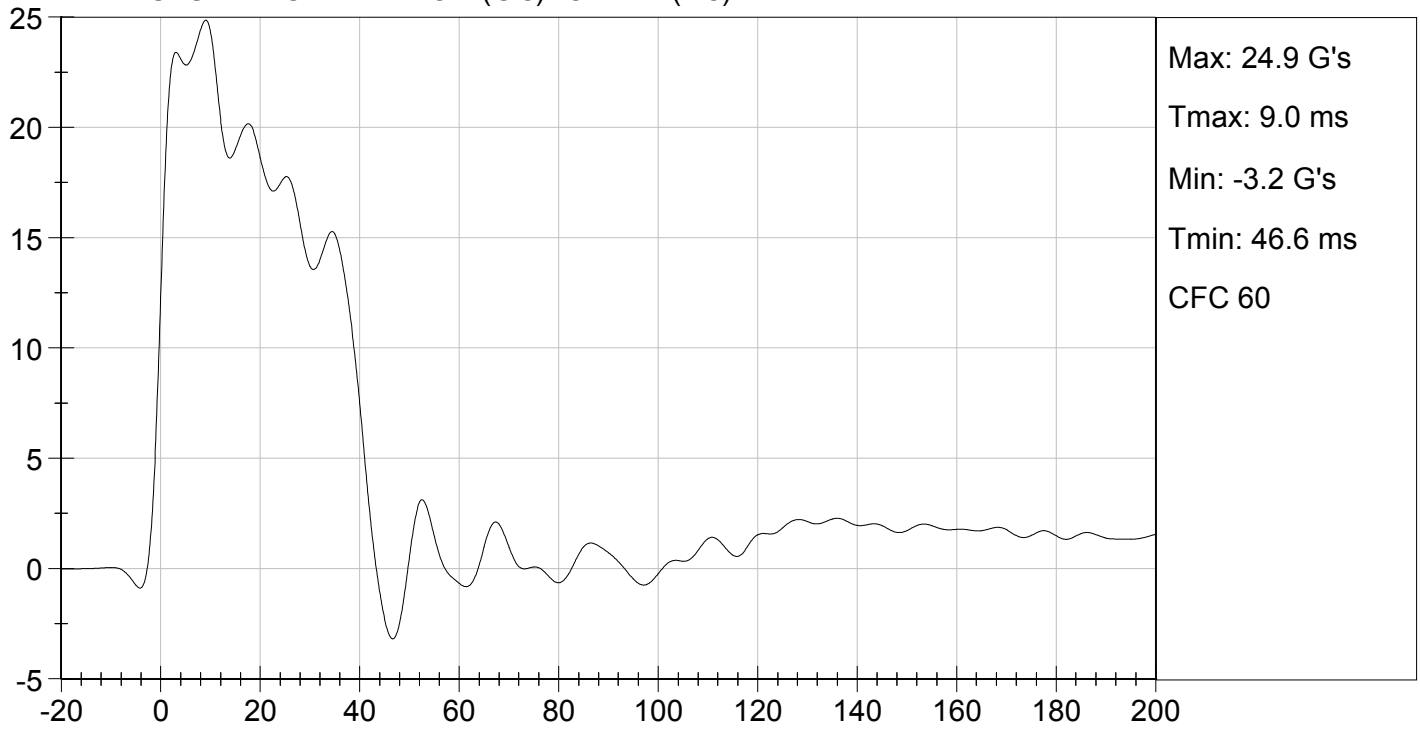
09/21/2015
Test Date

Jeff Leonardelli
Approved By

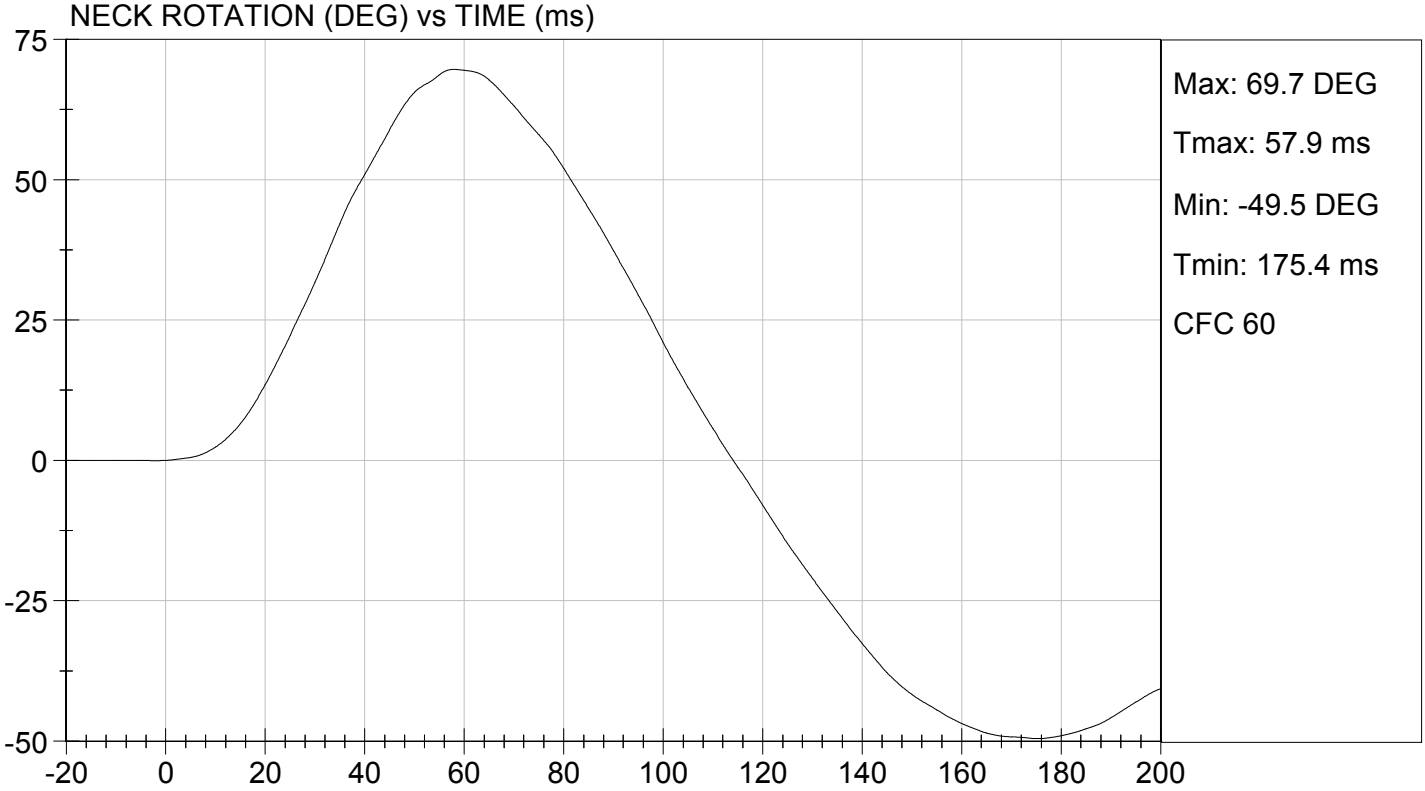
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 09/21/2015
TEST #: D152922

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



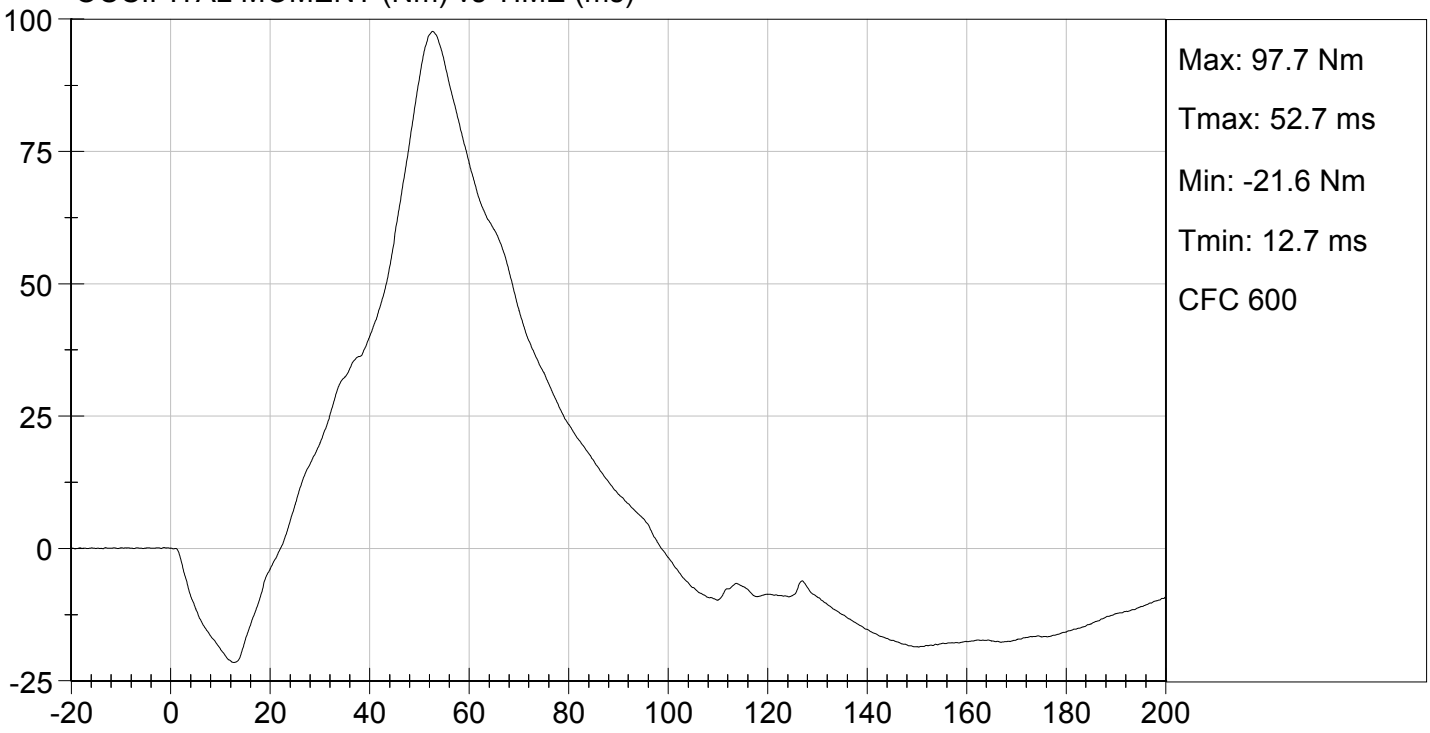
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 09/21/2015
TEST #: D152922

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last extension test. (572.36(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:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	20.08 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	19.79 g's
	@ 20 ms	14 ≤ g ≤ 19	15.42 g's
	@ 30 ms	11.0 ≤ g ≤ 16.0	12.46 g's
	Above 30 ms	22 g maximum	12.4 g's
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	44.0 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	96.2°
		72 ms ≤ time of max. rotation ≤ 82 ms	81.6 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	159.2 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-39.7 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	75.0 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	146.7 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

David Schoedel
Signature

09/21/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D152923

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	19.79	Pass
	20 ms	G's	14.00 to 19.00	15.42	Pass
	30 ms	G's	11.00 to 16.00	12.46	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	12.4	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	44.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.2	Pass
	Time	ms	72.0 to 82.0	81.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	159.2	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-53.8	Pass
	Time	ms	65.0 to 79.0	75.0	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	146.7	Pass
			Overall Test Results		Pass

David Schoedel
Laboratory Technician

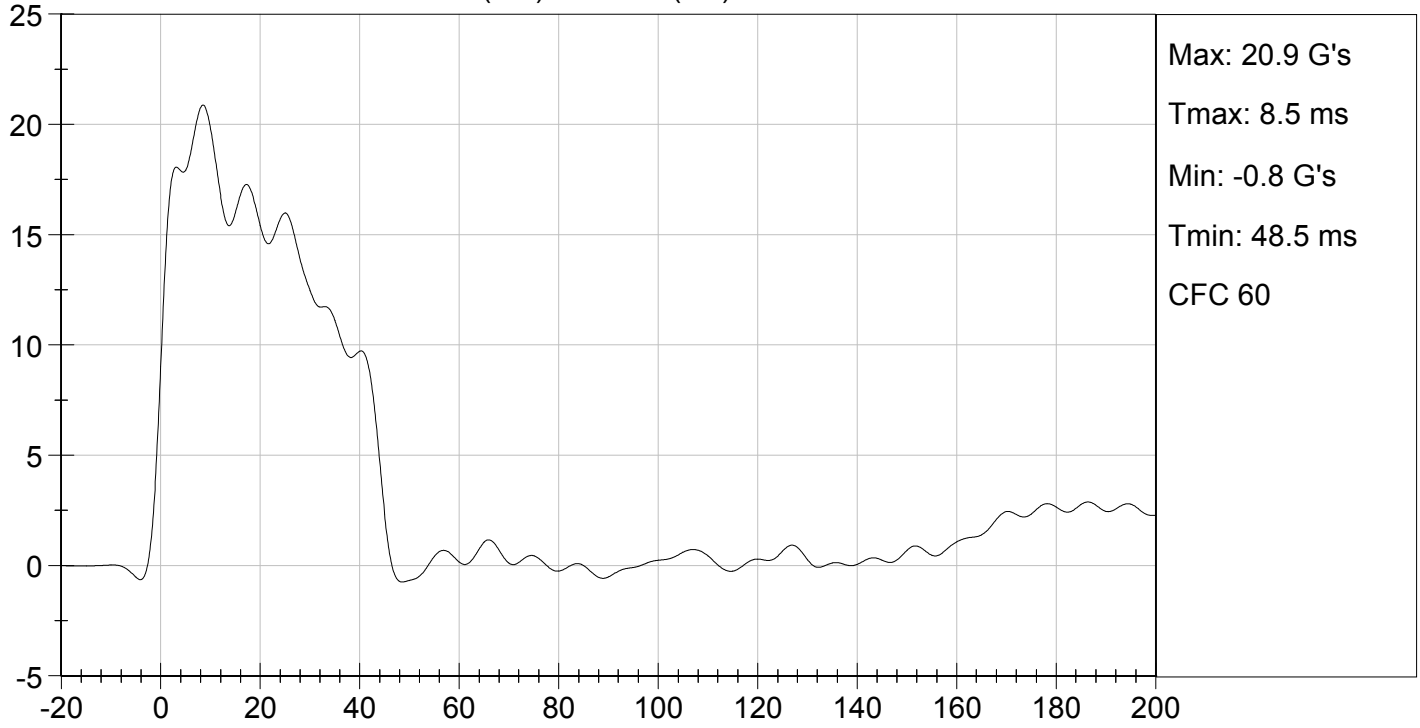
09/21/2015
Test Date

Jeff Leonardelli
Approved By

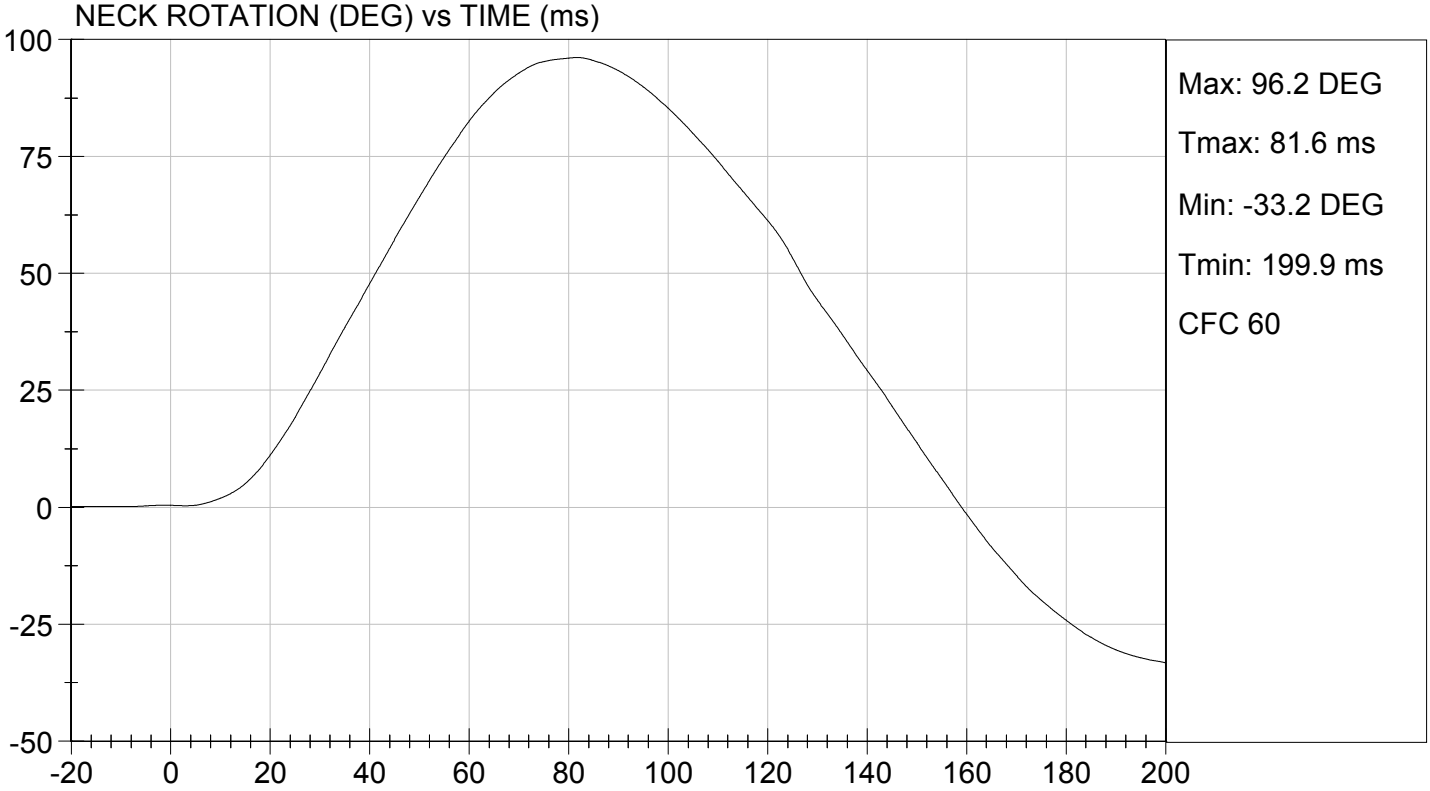
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

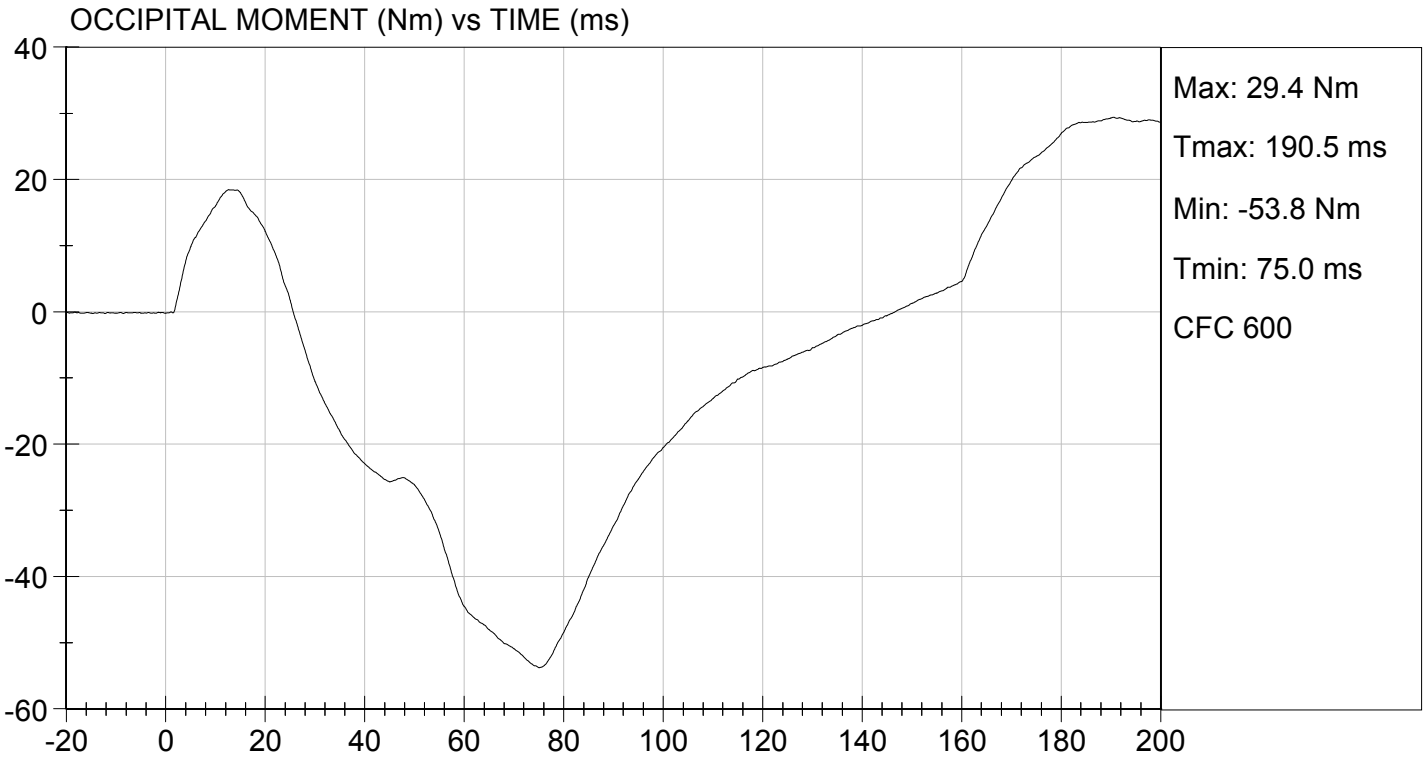
TEST DATE: 09/21/2015
TEST #: D152923

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



NECK ROTATION (DEG) vs TIME (ms)




OCCIPITAL MOMENT (Nm) vs TIME (ms)
40
20
0
-20
-40
-60
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 29.4 Nm
Tmax: 190.5 ms
Min: -53.8 Nm
Tmin: 75.0 ms
CFC 600

DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: Jack Coleman

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:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

X - No Damage

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

_____

___ - The following repairs or replacement was performed. Record:

_____

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))

X 7. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 13° ± 2°. The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2)

X 8. The midsagittal plane of the dummy is vertical within ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))

X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is 22 f/s ± 0.4 f/s. (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.93 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.69 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1318 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	74 %

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

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

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

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

Jack Coleman
Signature

09/21/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D152924

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,862	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.84	Pass
Internal Hysteresis	%	69 to 85	74	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

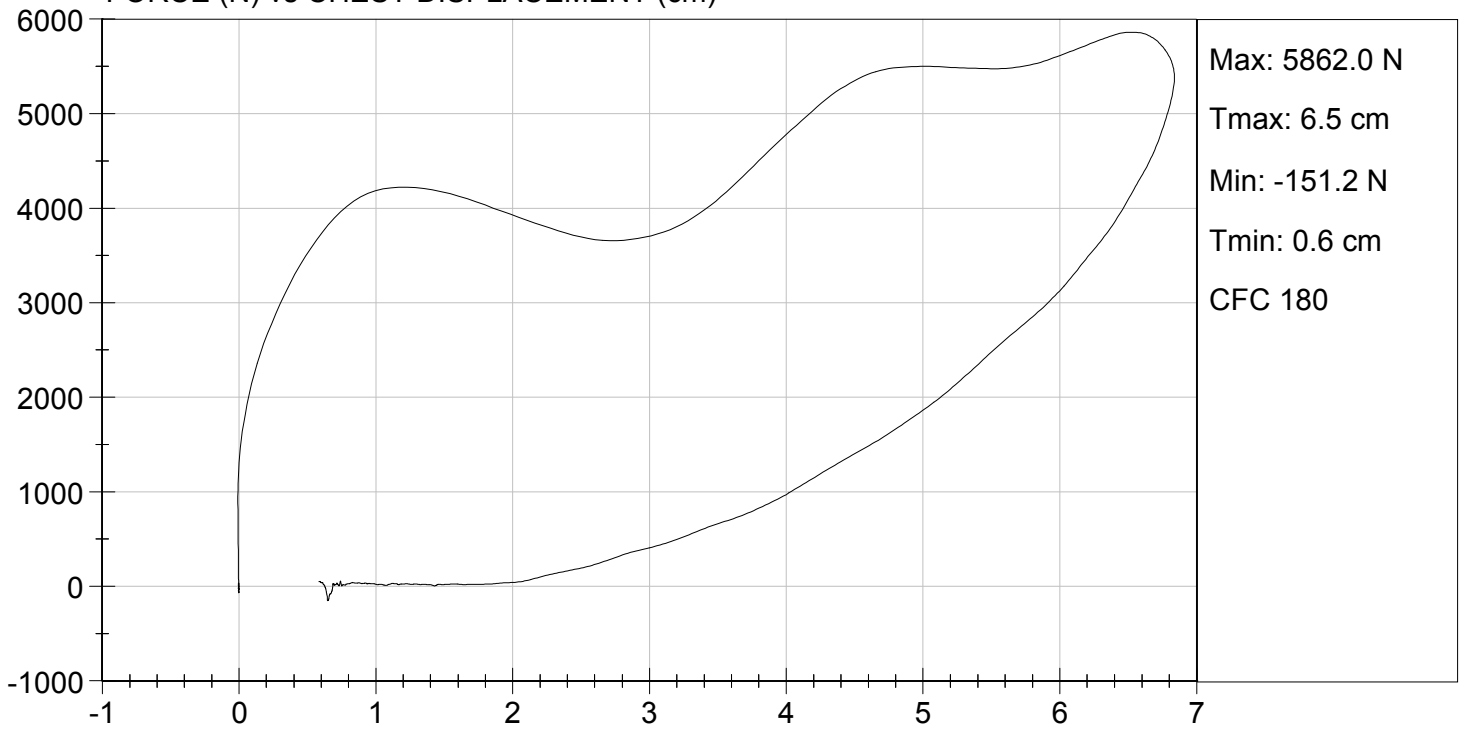
09/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/21/2015
TEST #: D152924

FORCE (N) vs CHEST DISPLACEMENT (cm)



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

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.97 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1205 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

09/21/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D152926

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	45	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,360	Pass
		Overall Test Results		Pass

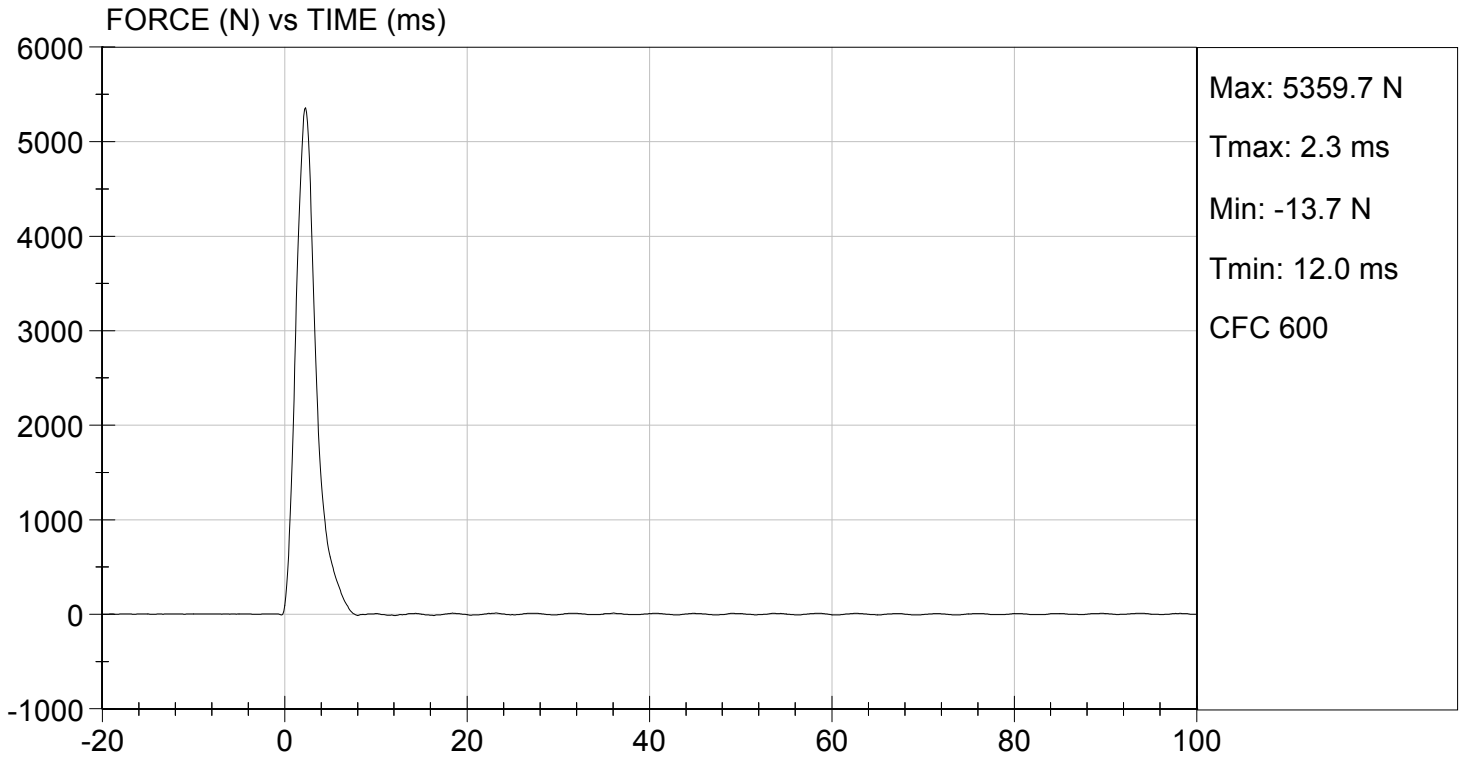
David Schoedel
Laboratory Technician

09/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/21/2015
TEST #: D152926



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

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.97 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1137 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

09/21/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D152925

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	45	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,056	Pass
		Overall Test Results		Pass

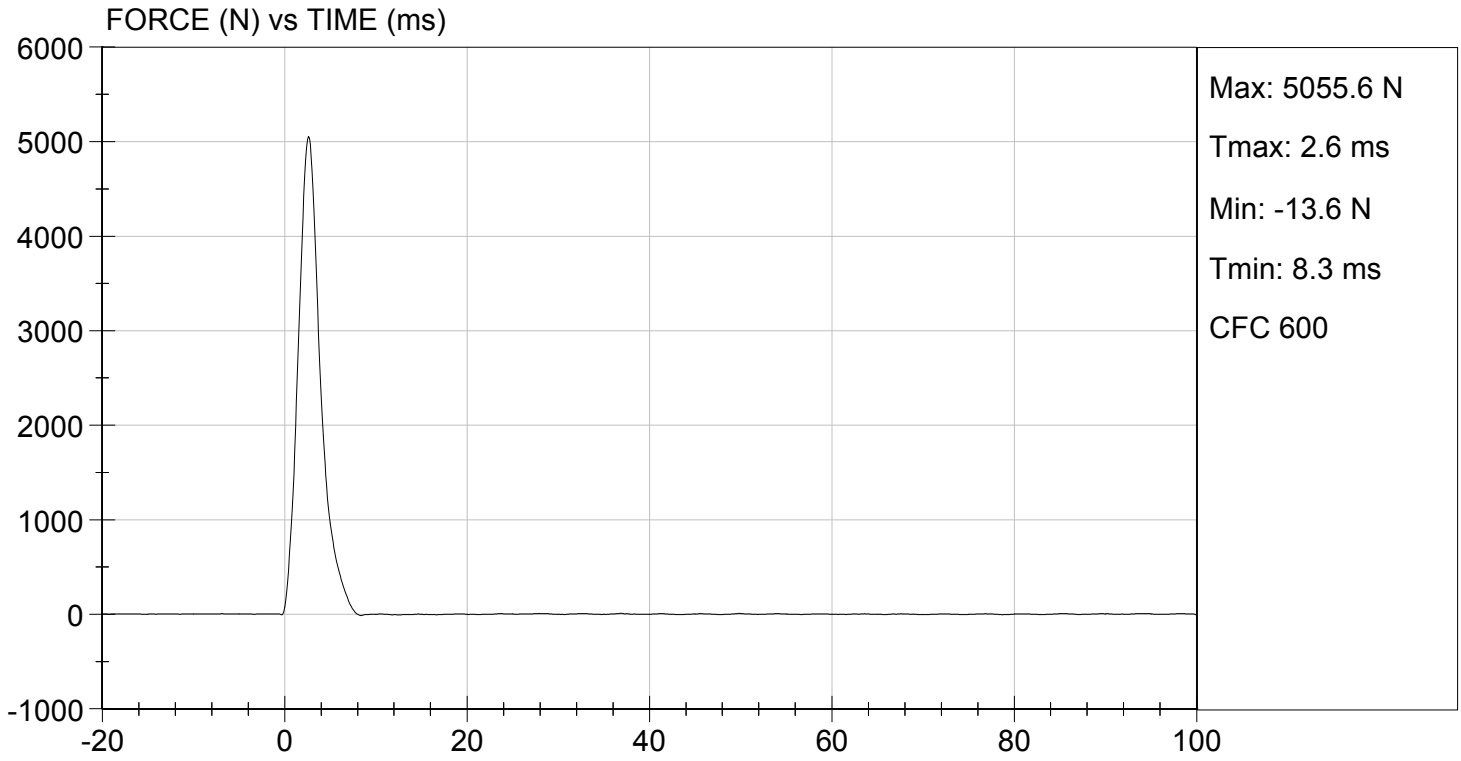
David Schoedel
Laboratory Technician

09/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/21/2015
TEST #: D152925



DATA SHEET A9

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

Dummy Serial Number: 401 Test Date: 09/21/2015

Technician: Jack Coleman

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one hip joint-femur flexion test performed

X 2. The test fixture conforms to the specifications in Figure 17A.

X 3. Use the assembled dummy (78051-218) except (572.35(c)(2)):

X 3.1 remove the leg assemblies (86-5001-001 & 002) by removing 3/8-16 Socket Head Cap Screw and retaining the structural assembly of the upper legs (78051-43 & 44)

X 3.2 remove the abdominal insert (78051-52)

X 3.3 replace the instrument cover plate (78051-13) in the pelvic bone with a rigid pelvic bone stabilizer insert (Figure 15A) and attach the pelvis upper support device (Figure 16A).

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	45%
Record the minimum humidity:	43%

X 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))

X 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))

X 7. Adjust the threaded rods until plane B is horizontal.

X 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.2°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	63.7 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	41.3°

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

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

X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	62.4 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	42.2°

Jack Coleman
Signature

09/21/2015
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D152920

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.8	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	43	43	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	84.6	86.3	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	42.2	41.3	Pass
		Overall Test Results			Pass

Jack Coleman

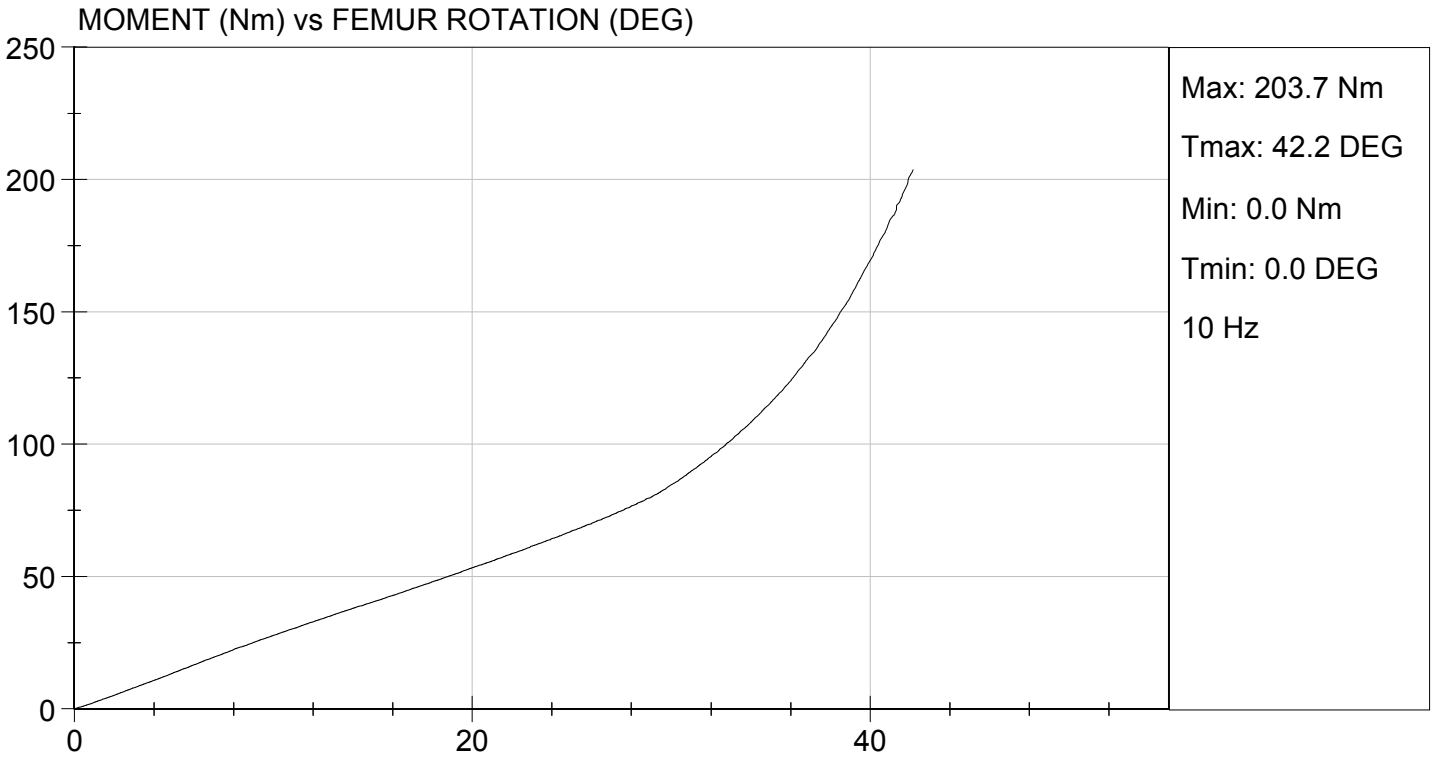
Laboratory Technician

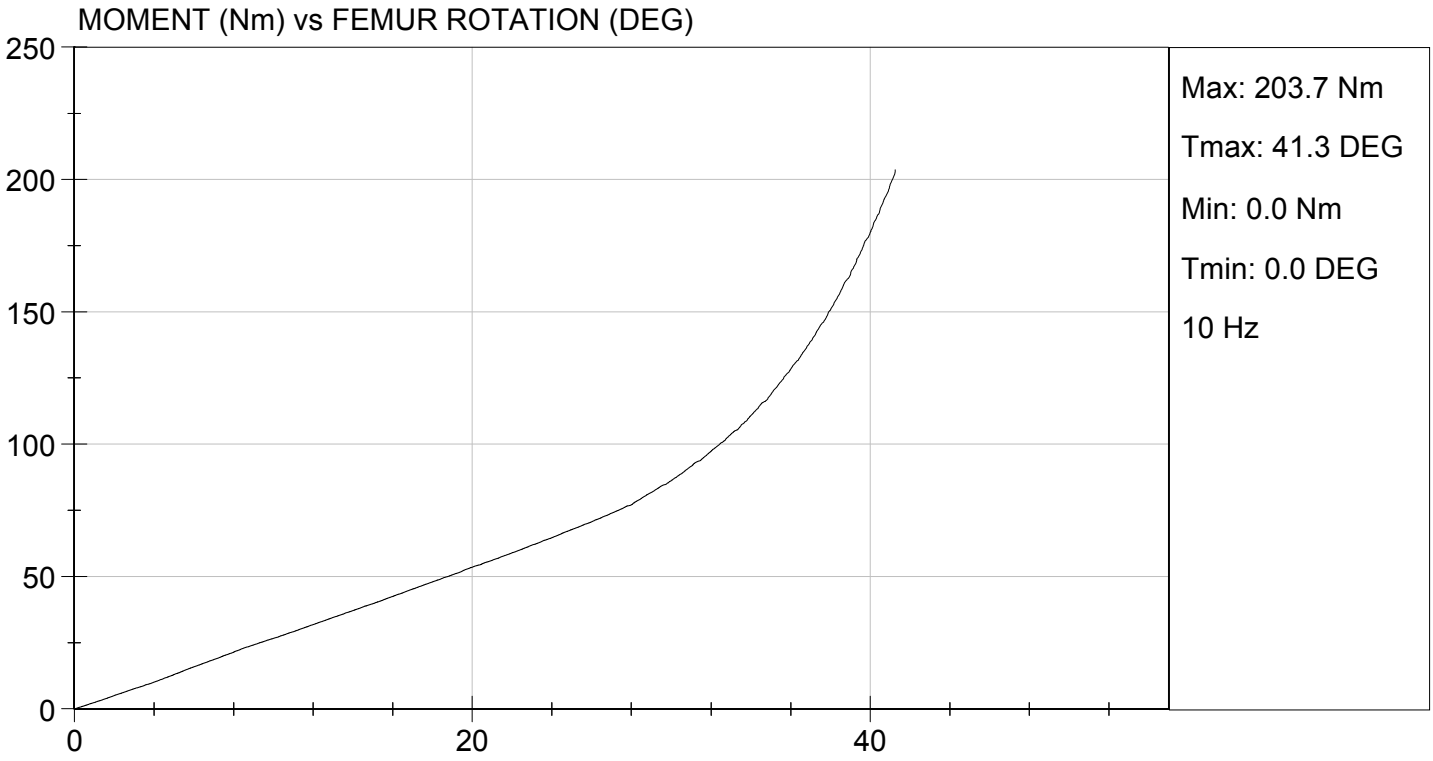
09/21/2015

Test Date

Jeff Leonardi

Approved By


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.7 Nm
Tmax: 42.2 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.7 Nm
Tmax: 41.3 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AH5D9	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	AH5L1	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	AH5N9	09/11/2015	03/11/2016
NECK TRANSDUCER	Denton	1716	1206	06/30/2015	12/30/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH79	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	AGH55	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	C12863	09/11/2015	03/11/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	401	09/10/2015	03/10/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8806	09/10/2015	03/10/2016
(2) LEFT FEMUR	Denton	2121	8807	09/10/2015	03/10/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH591	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	11/30/2015	05/30/2016
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	11/30/2015	05/30/2016
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET A3

HEAD DROP TEST (572.32) (50th Male)

Dummy Serial Number: 401 Test Date: 11/30/2015

Technician: Jack Coleman

____ 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: 21.4°C

Record the minimum temperature: 21.1°C

Record the maximum humidity: 33%

Record the minimum humidity: 25%

__X__ 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the 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 ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.32(b) & (572.32(c)(4))

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

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	257 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-8.1 g

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

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test ID:** D153931

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	25	Pass
Peak Resultant Acceleration	G's	225 to 275	257	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

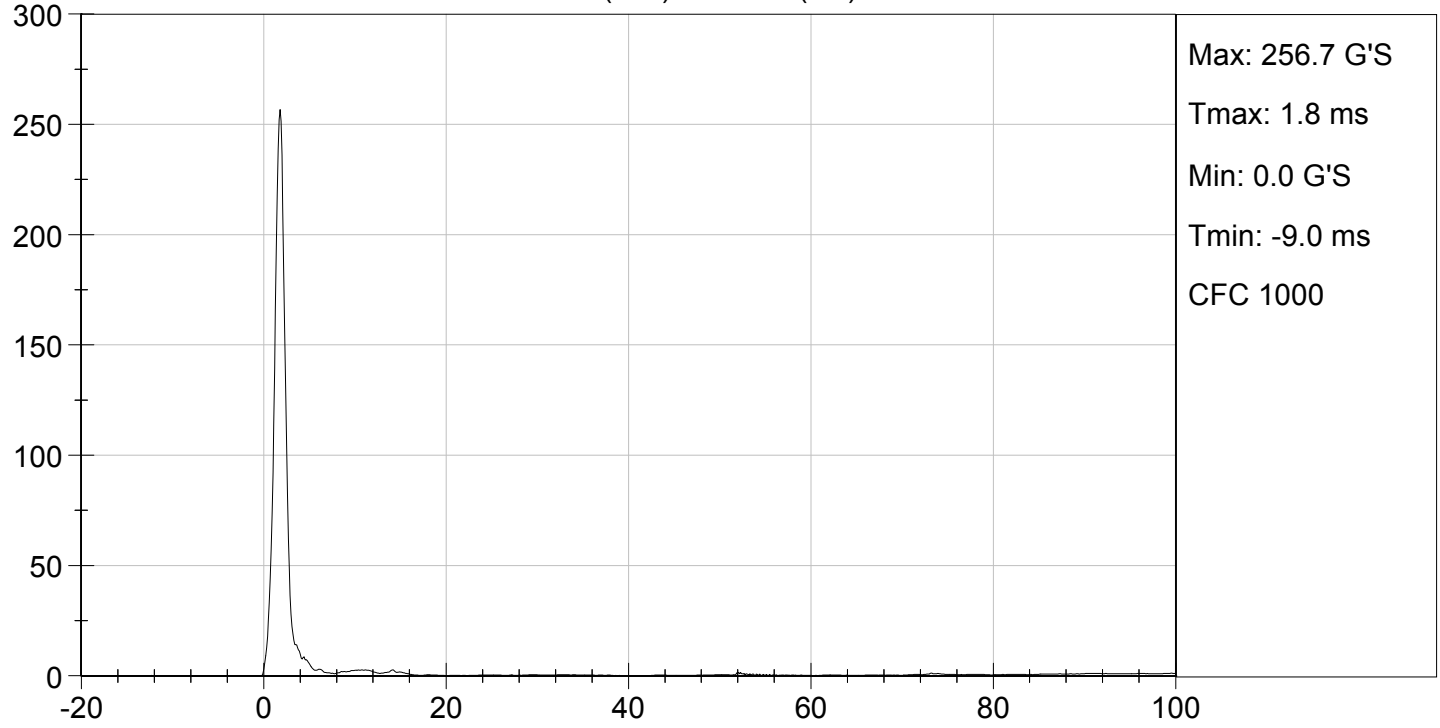
11/30/2015
Test Date

Jeff Leonardelli
Approved By

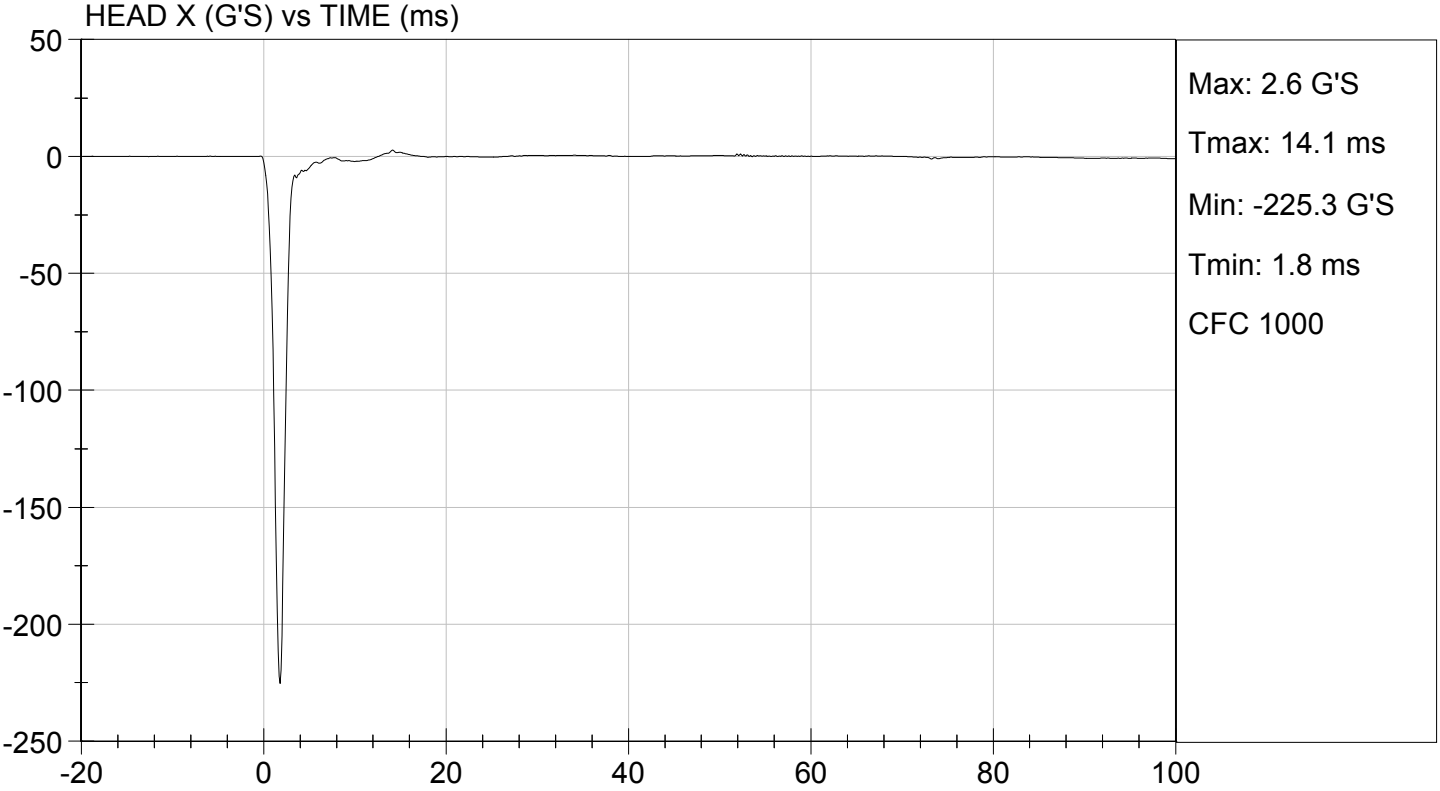
TEST DESC: HEAD DROP

TEST DATE: 11/30/2015
TEST #: D153931

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



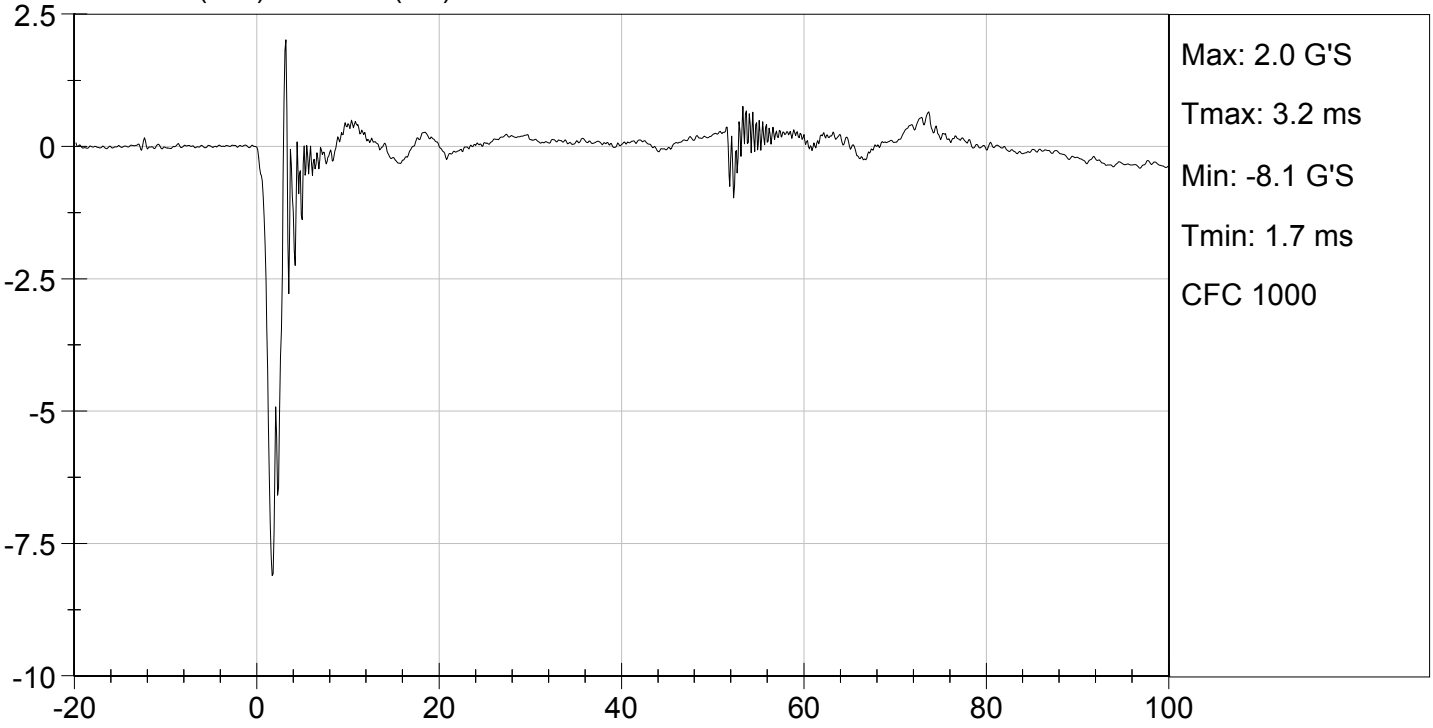
HEAD X (G'S) vs TIME (ms)



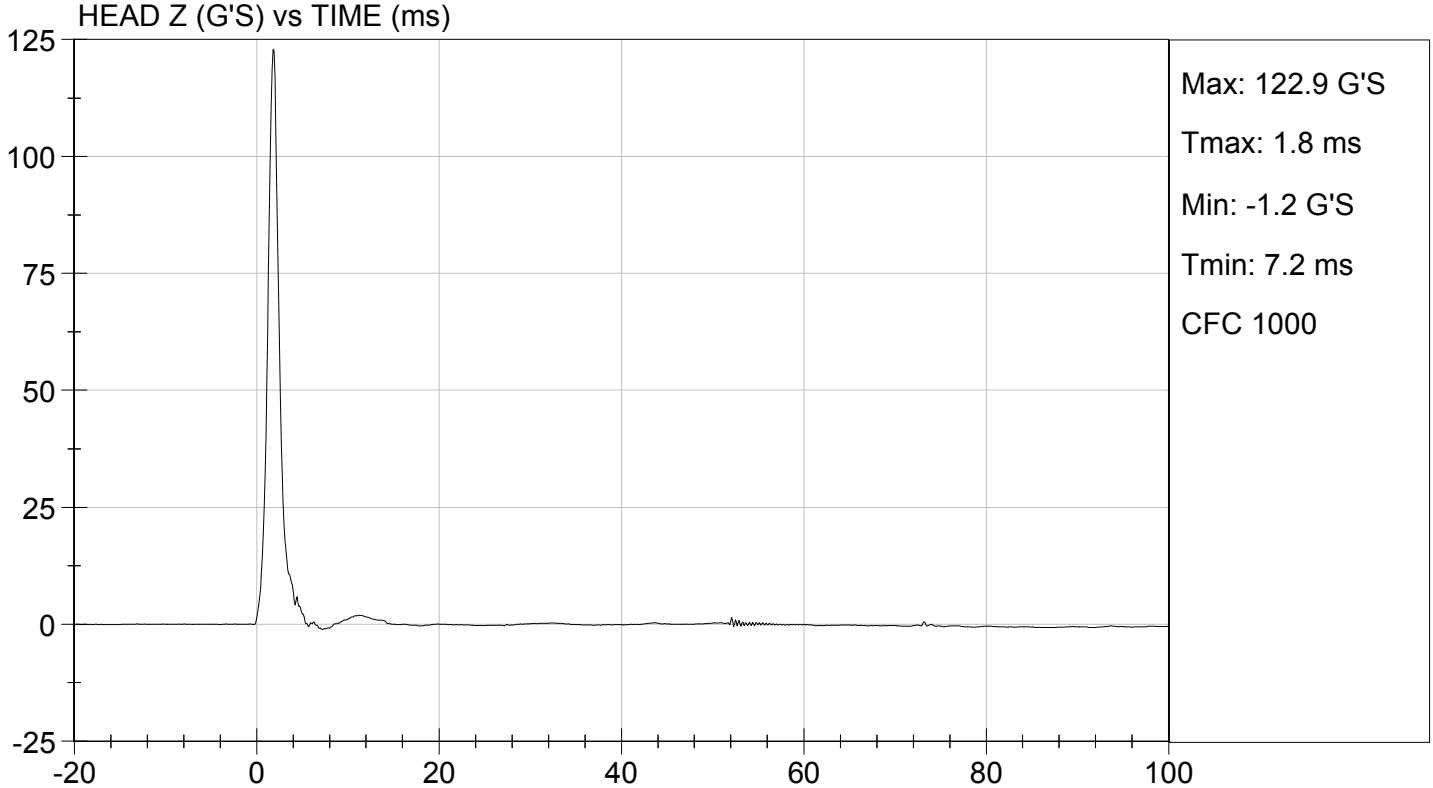
TEST DESC: HEAD DROP

TEST DATE: 11/30/2015
TEST #: D153931

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



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



DATA SHEET A4

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 11/30/2015

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last flexion test. (572.36(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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9A for the flexion test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 22.6 to 23.4 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

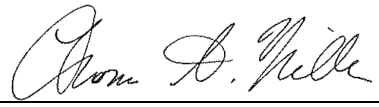
X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	23.15 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	23.94 g's
	@ 20 ms	17.6 ≤ g ≤ 22.6	19.12 g's
	@ 30 ms	12.5 ≤ g ≤ 18.5	13.17 g's
	Above 30 ms	29 g maximum	13.1 g's
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	41.5 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	66.2°
		57 ms ≤ time of max. rotation ≤ 64 ms	59.7 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	114.0 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	68.9 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	52.8 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	99.0 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(1)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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



Signature

11/30/2015

Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D153932

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	32	Pass
Pendulum Velocity		m/s	6.89 to 7.13	7.06	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.94	Pass
	20 ms	G's	17.60 to 22.60	19.12	Pass
	30 ms	G's	12.50 to 18.50	13.17	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	41.5	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	66.2	Pass
	Time	ms	57.0 to 64.0	59.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.0	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	93.4	Pass
	Time	ms	47.0 to 58.0	52.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.0	Pass
			Overall Test Results		Pass

Laboratory Technician

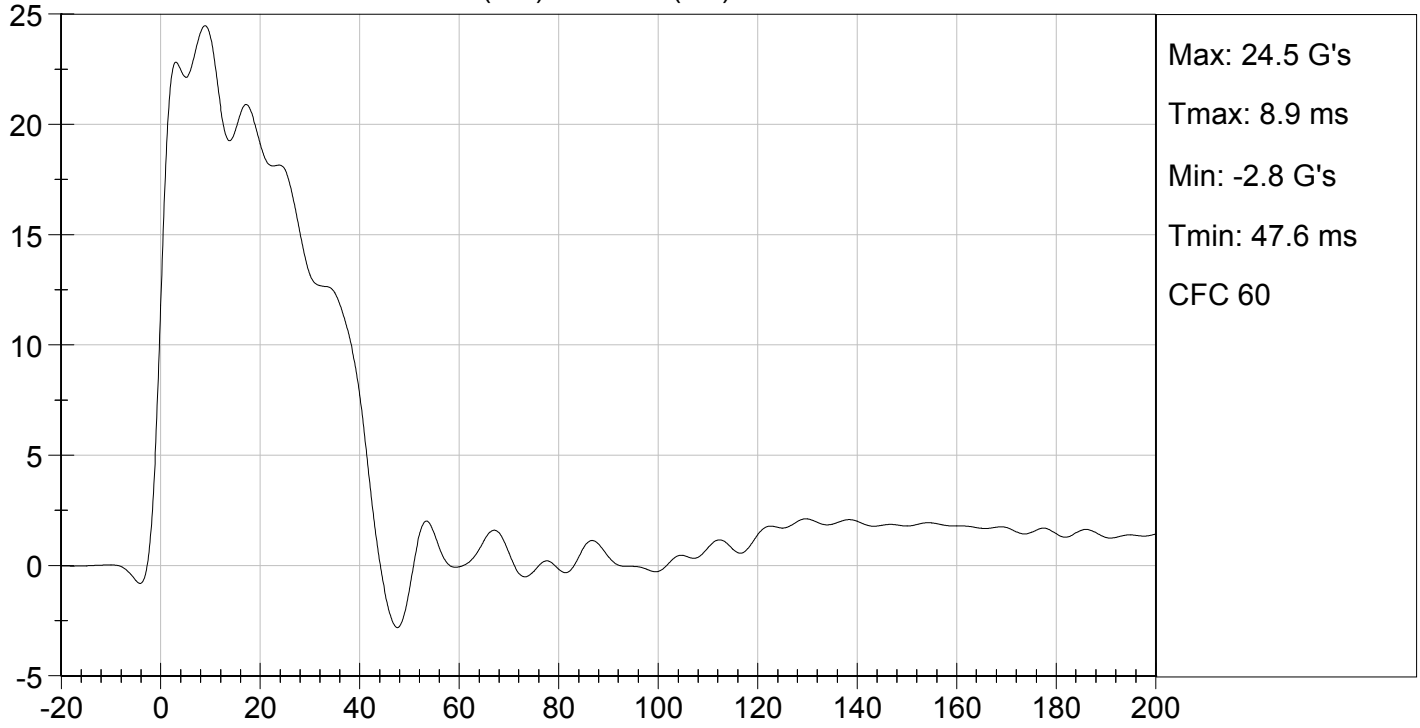
11/30/2015
Test Date

Approved By

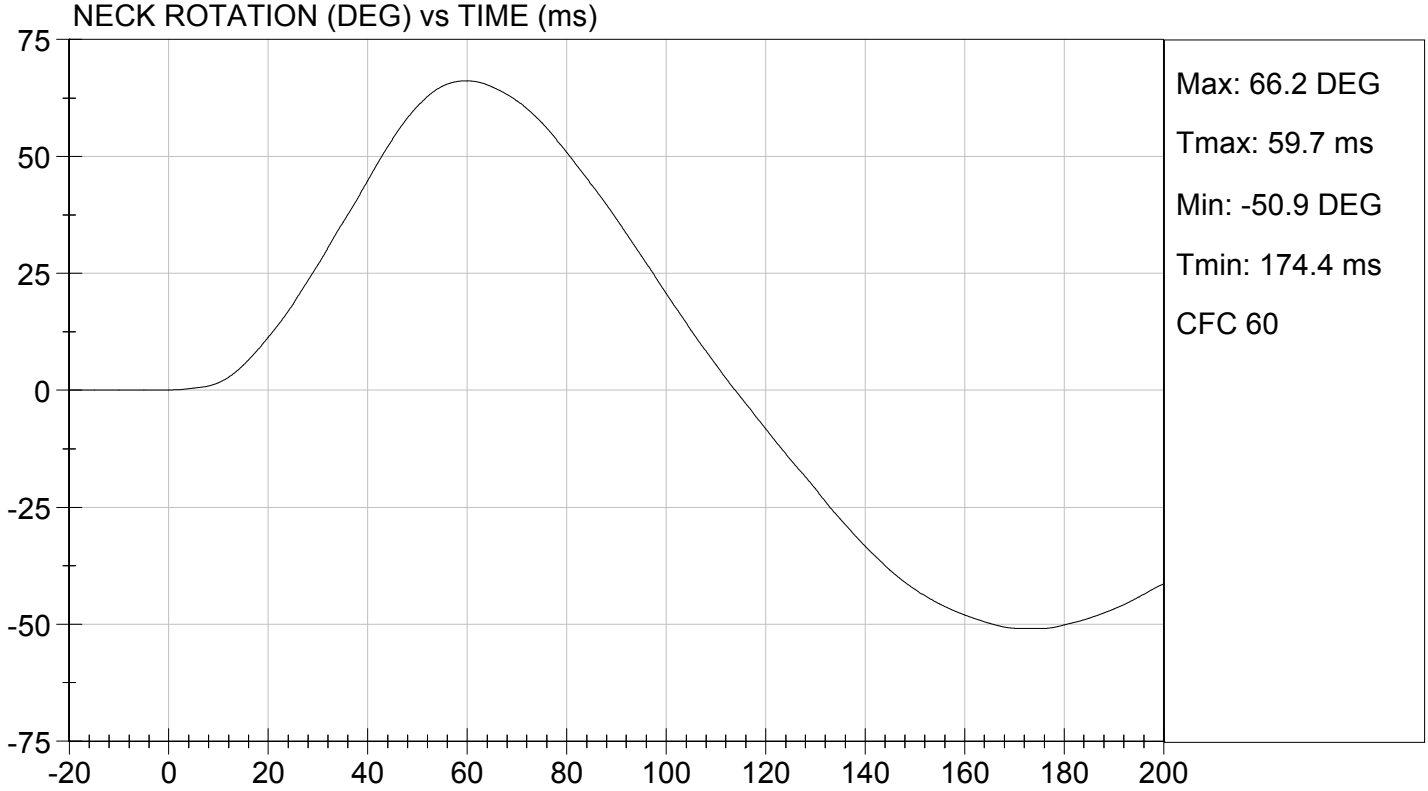
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 11/30/2015
TEST #: D153932

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



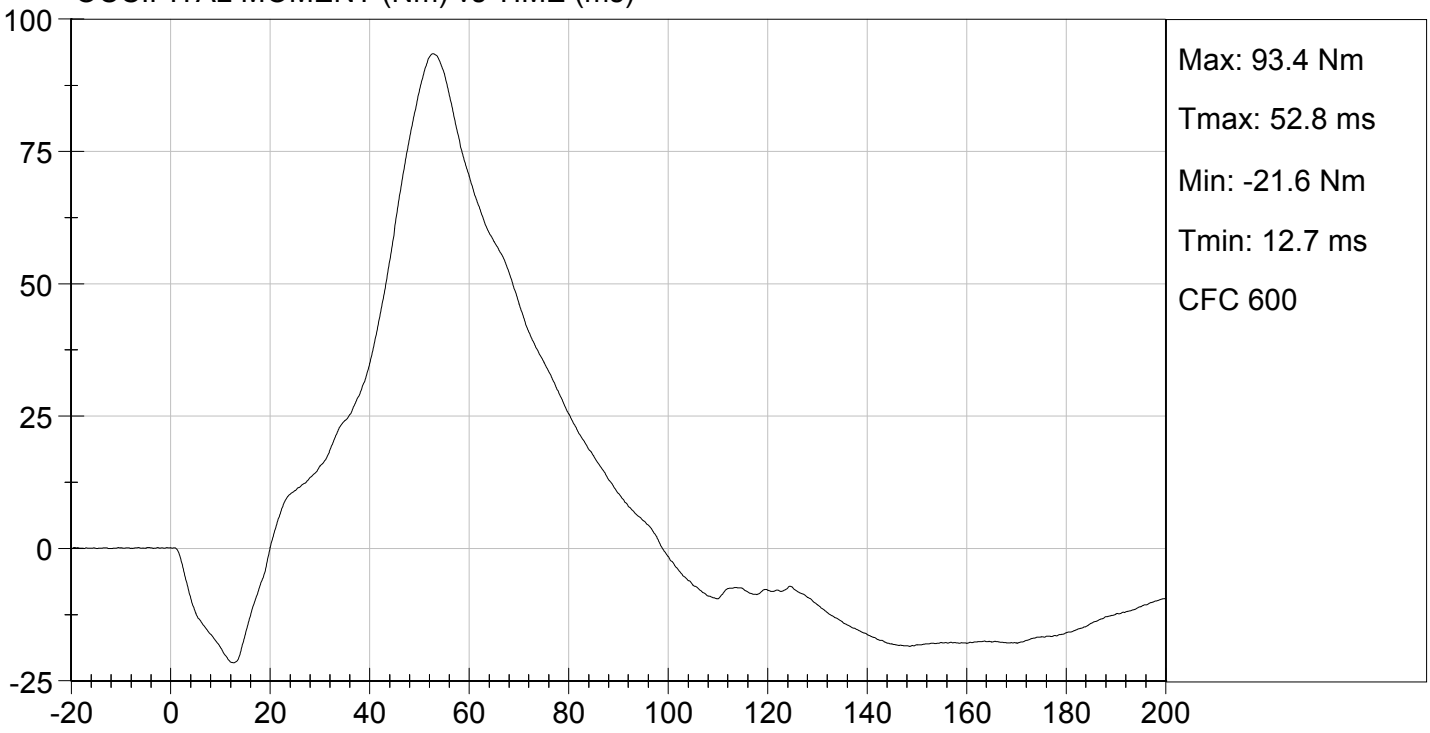
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/30/2015
TEST #: D153932

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 11/30/2015

Technician: Jack Coleman

____ 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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

Record findings and actions: No damage

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

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

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

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.36(i))

X 8. The test fixture pendulum conforms to the specifications in Figure 8A. (572.33(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 10A for the extension test. (572.33(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 11A.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 19.5 ft/s to 20.3 ft/sec as measured at the center of the pendulum accelerometer. (572.33(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	20.08 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	18.86 g's
	@ 20 ms	14 ≤ g ≤ 19	16.48 g's
	@ 30 ms	11.0 ≤ g ≤ 16.0	12.81 g's
	Above 30 ms	22 g maximum	13.1 g's
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	41.0 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	94.7°
		72 ms ≤ time of max. rotation ≤ 82 ms	79.0 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	157.3 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-40.5 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	71.9 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	145.4 ms

*Moment about the occipital condyle = My – (0.058 ft x Fx)(572.33(b)(2)(ii))
My = Moment in lbf-ft measured by the transducer
Fx = Force, in lbf measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.33(b)(3))

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

Jack Coleman

Signature

11/30/2015

Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D153933

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	32	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.86	Pass
	20 ms	G's	14.00 to 19.00	16.48	Pass
	30 ms	G's	11.00 to 16.00	12.81	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	41.0	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.7	Pass
	Time	ms	72.0 to 82.0	79.0	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	157.3	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-54.9	Pass
	Time	ms	65.0 to 79.0	71.9	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	145.4	Pass
			Overall Test Results		Pass

Jack Coleman
Laboratory Technician

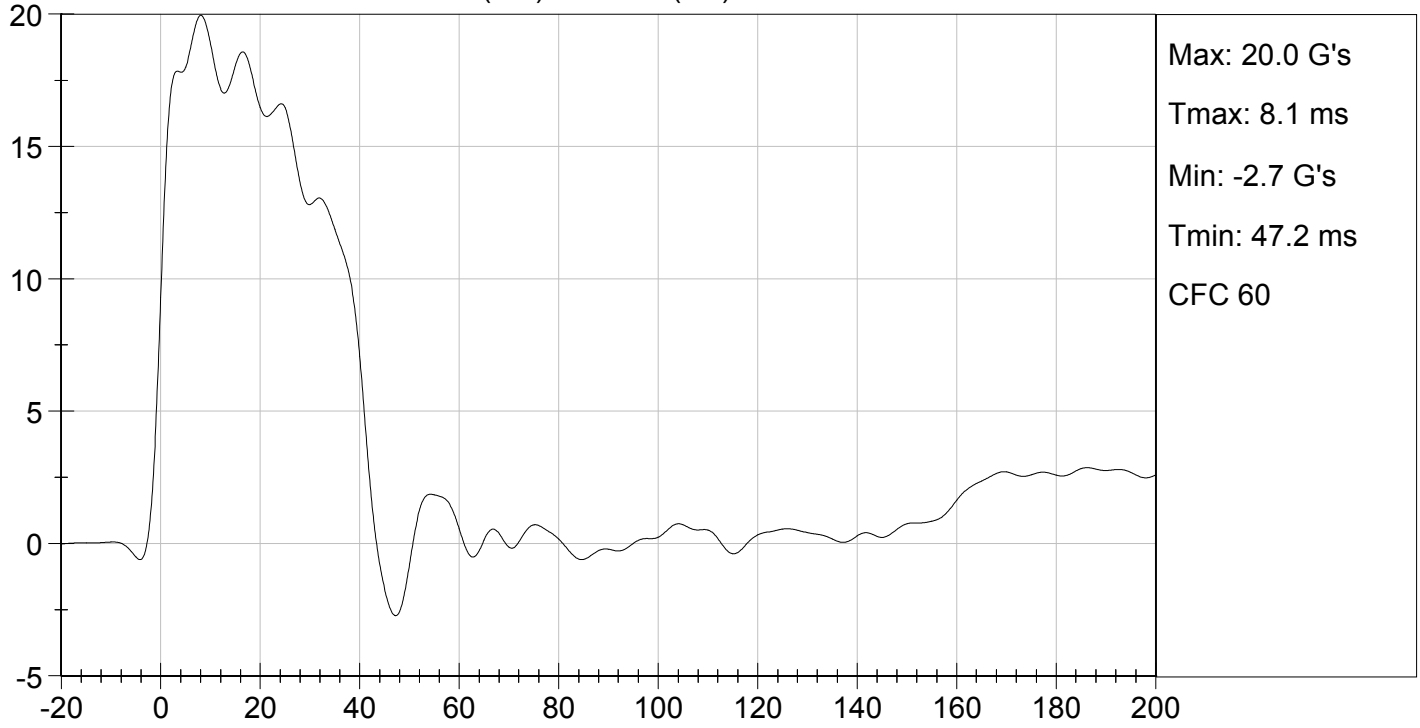
11/30/2015
Test Date

Jeff Leonardi
Approved By

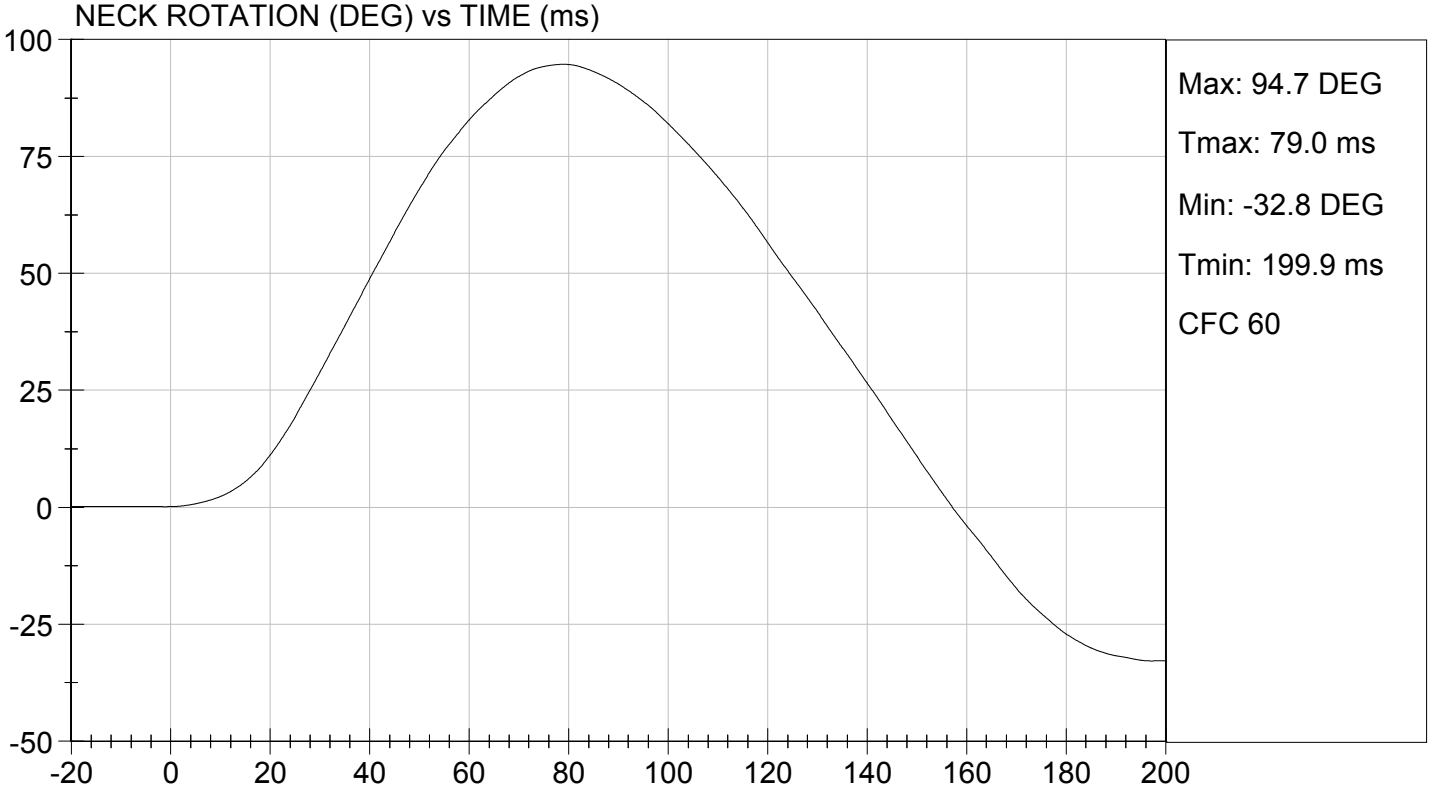
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/30/2015
TEST #: D153933

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

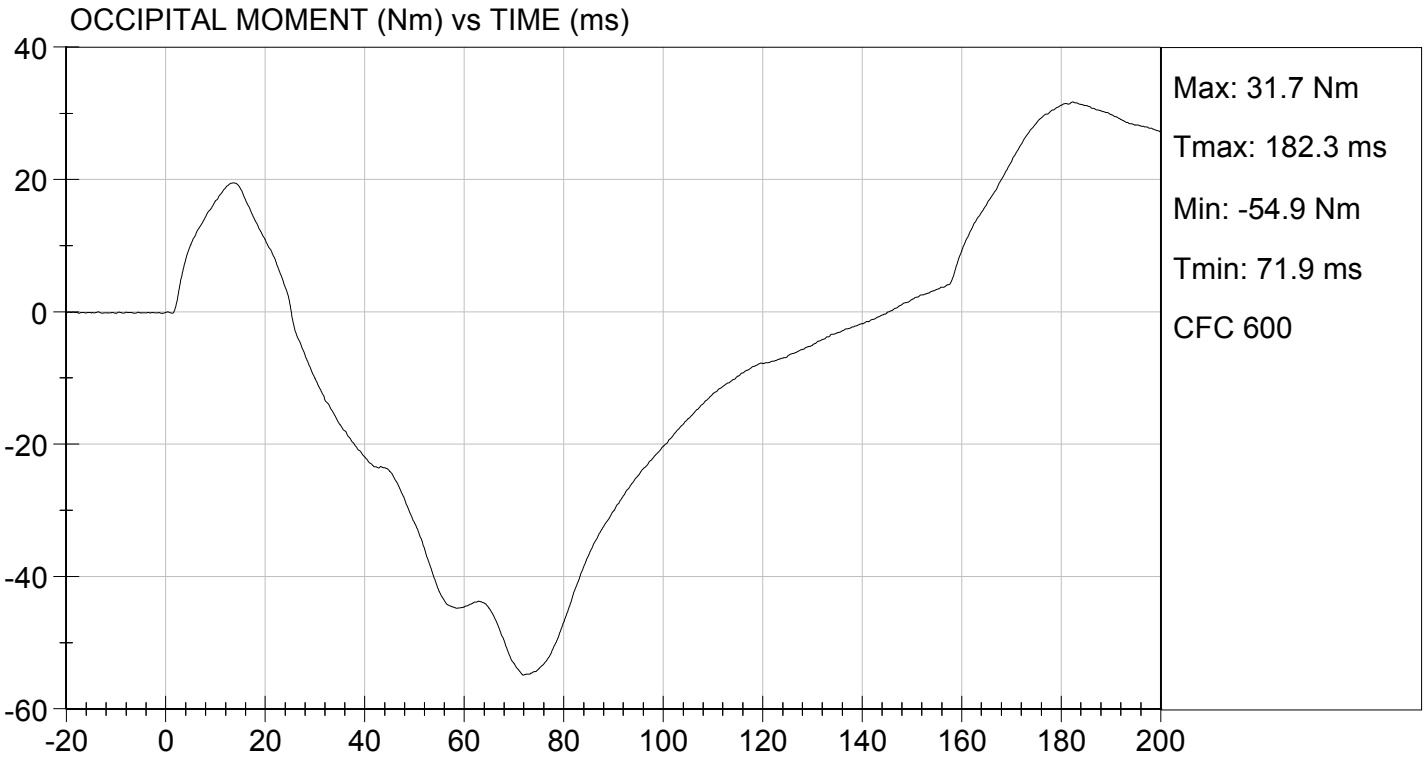


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/30/2015
TEST #: D153933



DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401 Test Date: 11/30/2015

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

_X_ - No Damage

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

___ - The following repairs or replacement was performed. Record:

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))

X 7. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 13° ± 2°. The angle may be measured using the special H-point tool (78051-532) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block. (572.34(c)(2)

X 8. The midsagittal plane of the dummy is vertical within ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.34(c)(4))

X 10. Align the adjustable neck bracket index marks to the "zero" position. (Figure 12A)

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 Class 180.

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.34(c)(5)) The velocity of the test probe at the time of impact is 22 f/s ± 0.4 f/s. (572.34(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.34(c)(6))

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

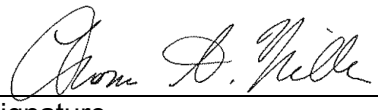
Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.65 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.59 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1313 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	73 %

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

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

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

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



Signature

11/30/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D153934

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	33	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,840	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.59	Pass
Internal Hysteresis	%	69 to 85	73	Pass
		Overall Test Results		Pass

Laboratory Technician

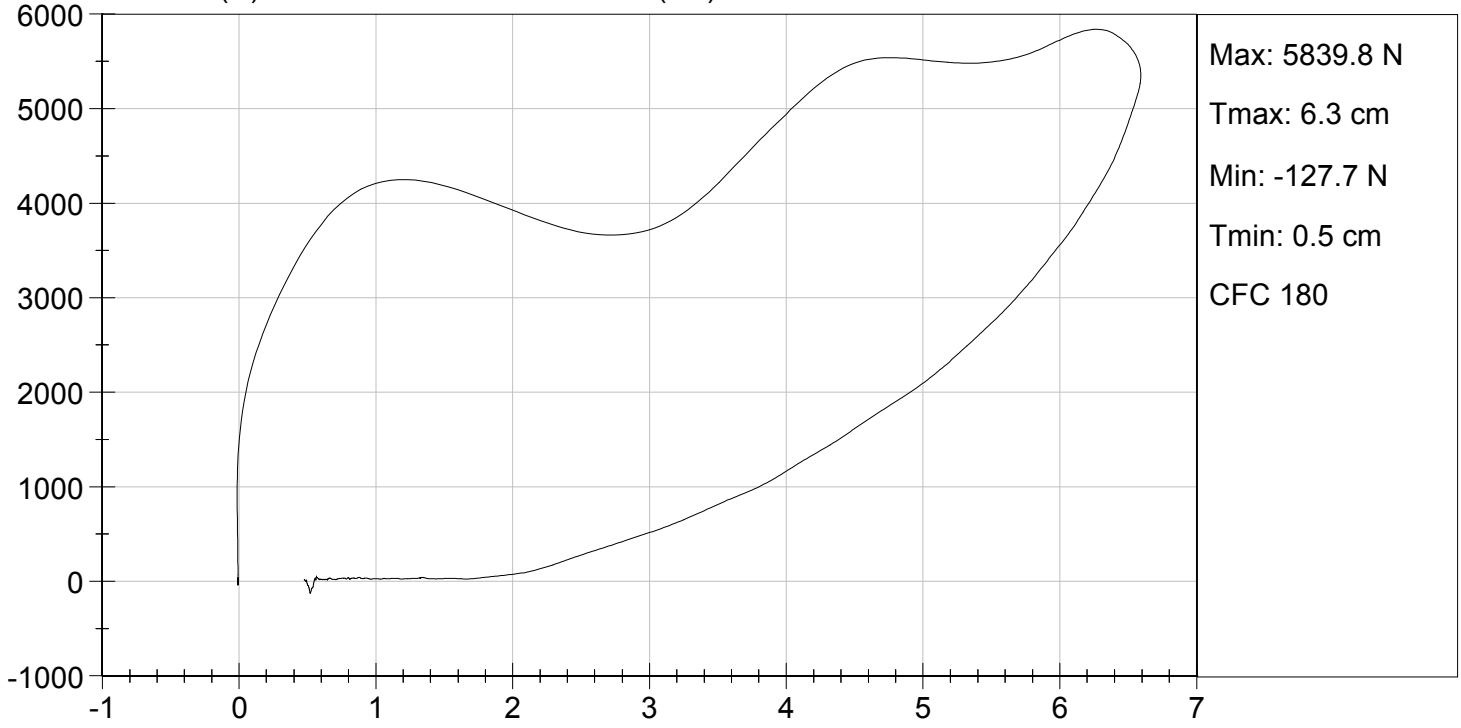
11/30/2015
Test Date

Approved By

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

TEST DATE: 11/30/2015
TEST #: D153934

FORCE (N) vs CHEST DISPLACEMENT (cm)



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

Dummy Serial Number: 401 Test Date: 11/30/2015

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. (572.36(m))
_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.97 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1230 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))

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D153936

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	32	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,471	Pass
		Overall Test Results		Pass

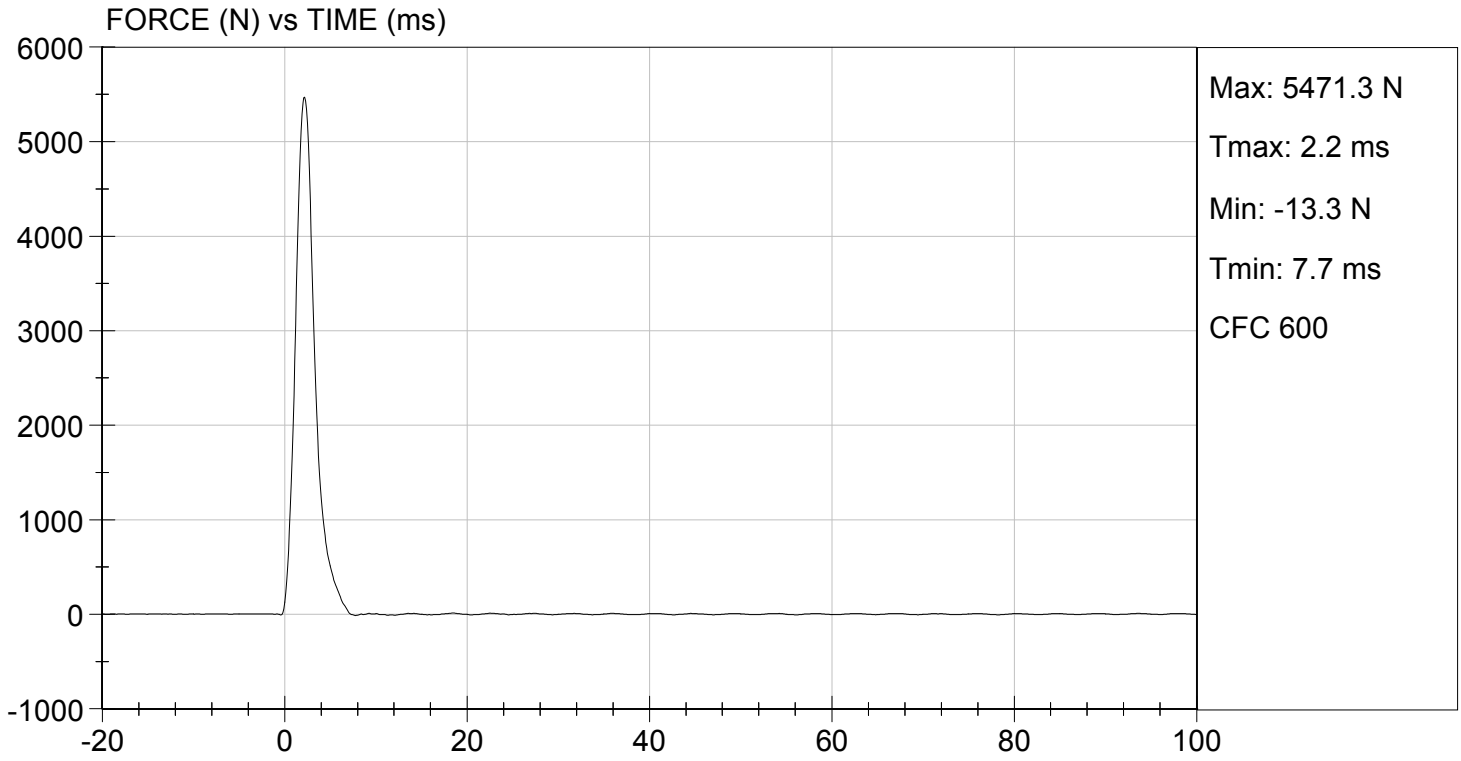
Jack Coleman
Laboratory Technician

11/30/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 11/30/2015
TEST #: D153936



DATA SHEET A8

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

Dummy Serial Number: 401 Test Date: 11/30/2015

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. (572.36(m))

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.92 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1082 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))

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D153935

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	32	Pass
Probe Velocity	m/s	2.07 to 2.13	2.11	Pass
Peak Probe Force	N	4715 to 5782	4,813	Pass
		Overall Test Results		Pass

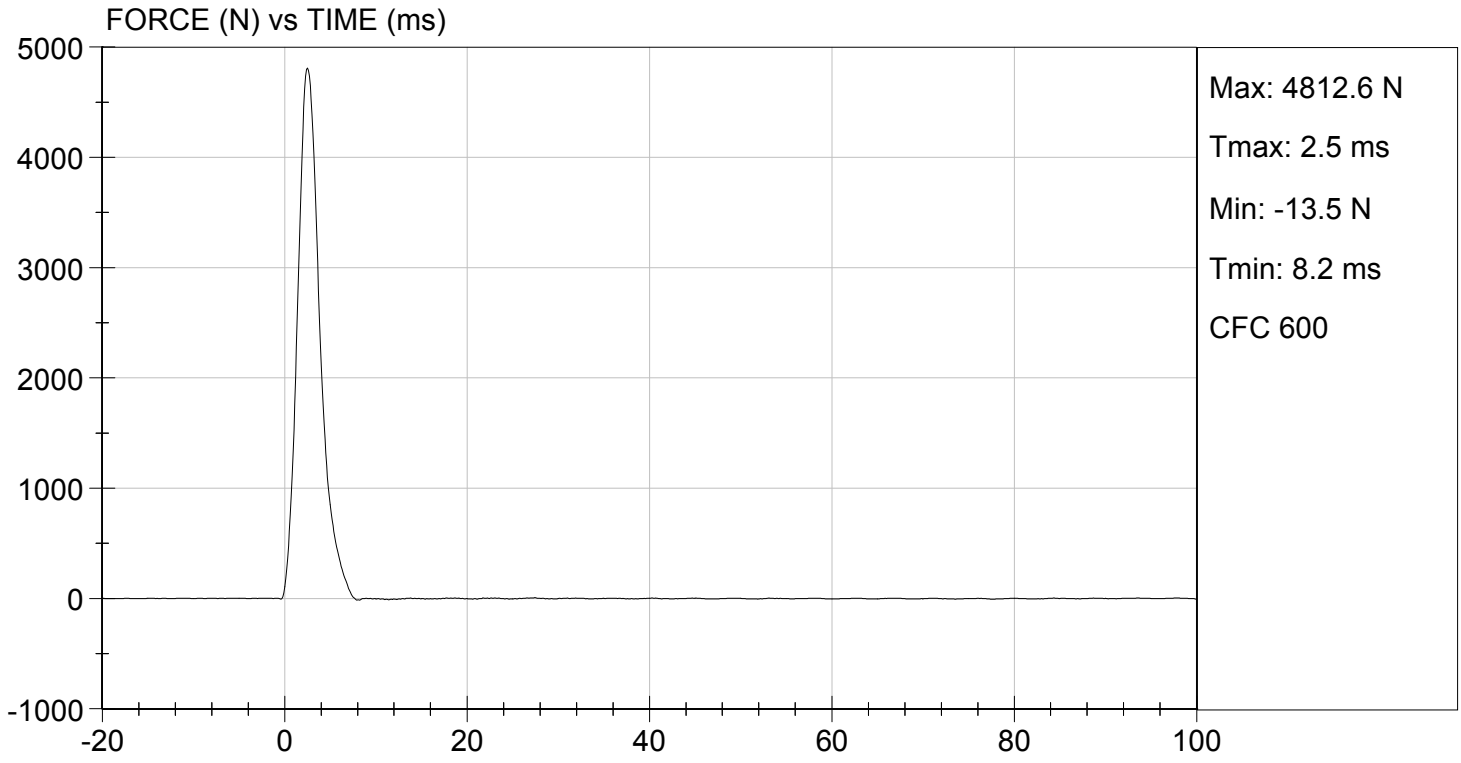
Jack Coleman
Laboratory Technician

11/30/2015
Test Date

Jeff Leonard
Approved By

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

TEST DATE: 11/30/2015
TEST #: D153935



DATA SHEET A9

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

Dummy Serial Number: 401 Test Date: 11/30/2015

Technician: Jack Coleman

____ 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:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	33%
Record the minimum humidity:	25%

_X_ 5. Seat the dummy on the rigid seat fixture. (572.35(c)(2)(ii))

_X_ 6. Secure the dummy by bolting the stabilizer insert and the pelvis upper support device to the seat back of the test fixture as shown in Figures 17A, 18A, and 19A. (572.35(c)(2)(ii))

_X_ 7. Adjust the threaded rods until plane B is horizontal.

_X_ 8. Secure the lever arm into the left femur shaft opening of the upper leg structure assembly (78051-43) and firmly secure it using the 3/8-16 socket head cap screws (Figure 19A). (572.35(c)(2)(iii))

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.2°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	64.8 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	41.0°

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

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

X 13. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6.2°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	66.5 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	41.1°

Jack Coleman
Signature

11/30/2015
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

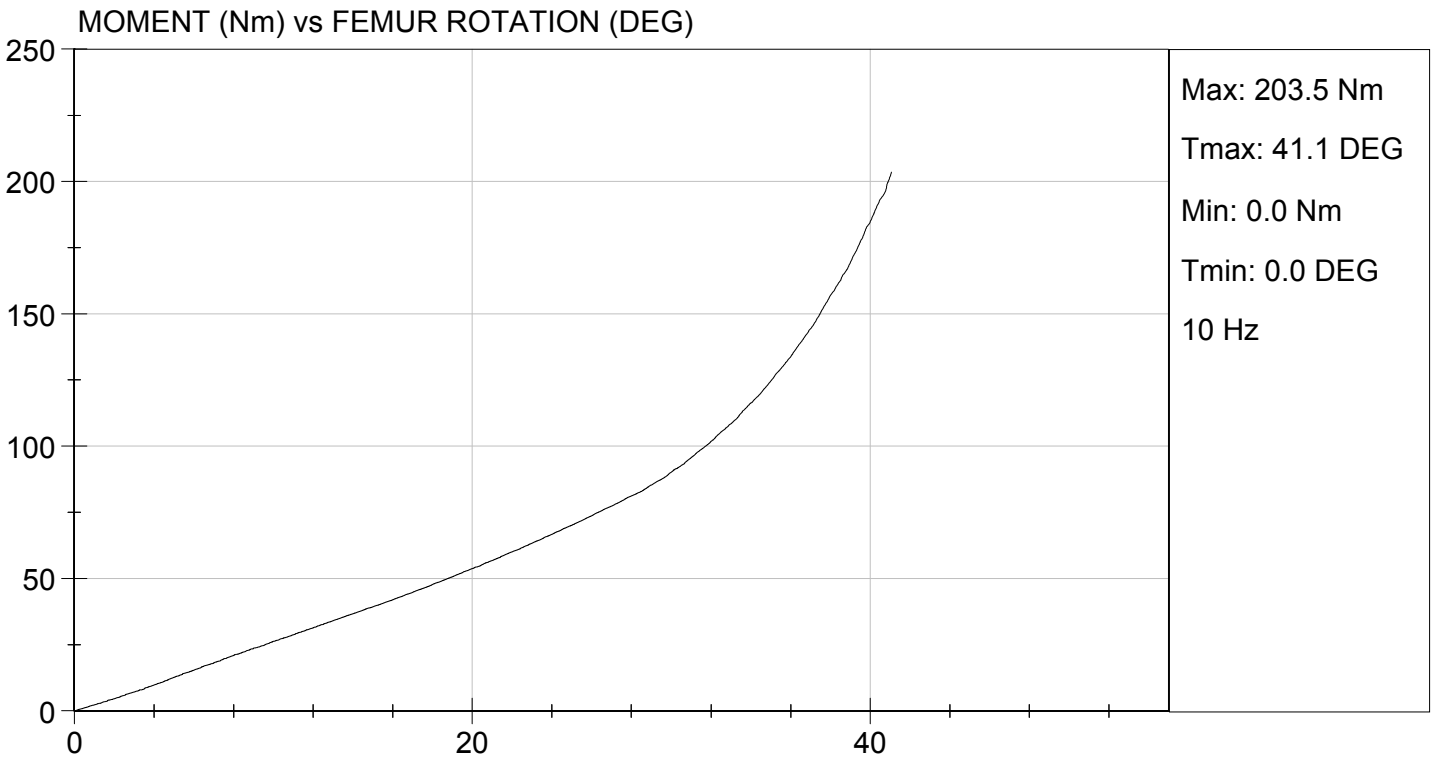
ATD Serial No: 401 **Test I.D:** D153930

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.1	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	25	25	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.2	Pass
30 Degrees	Nm	94.9 Nm Max	90.2	87.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	41.1	41.0	Pass
		Overall Test Results			Pass

Jack Coleman
Laboratory Technician

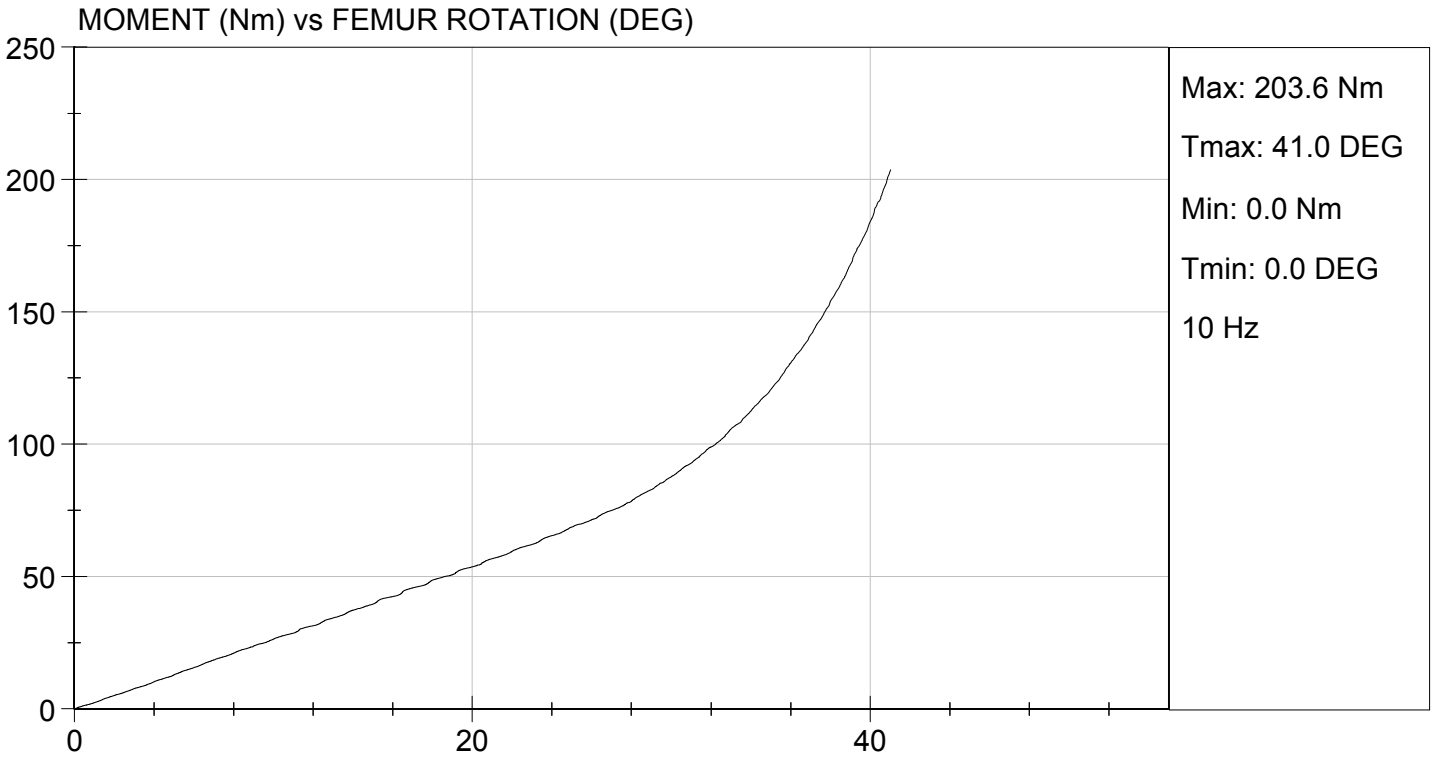
11/30/2015
Test Date

Jeff Leonardelli
Approved By


MOMENT (Nm) vs FEMUR ROTATION (DEG)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 41.1 DEG
Min: 0.0 Nm
Tmin: 0.0 DEG
10 Hz

TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 11/30/2015
TEST #: D153930



DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AH5D9	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	AH5L1	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	AH5N9	09/11/2015	03/11/2016
NECK TRANSDUCER	Denton	1716	1206	06/30/2015	12/30/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH79	09/11/2015	03/11/2016
(2) LATERAL	Endevco	7231C-750	AGH55	09/11/2015	03/11/2016
(3) VERTICAL	Endevco	7231C-750	C12863	09/11/2015	03/11/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	401	09/10/2015	03/10/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	8806	09/10/2015	03/10/2016
(2) LEFT FEMUR	Denton	2121	8807	09/10/2015	03/10/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH591	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	11/30/2015	05/30/2016
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	11/30/2015	05/30/2016
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 401 Test Date: 11/30/2015

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 Gall — 11/30/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonardini — 11/30/2015

Signature — Date

EXTERNAL DIMENSIONS

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

HYBRID III 5th SN #511, 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	186.4
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	222.3
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	476.3
S	HEAD BREADTH	The widest part of the head	137.1-147.3	142.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	179.5
U	HIP BREADTH	The widest part of the hip	299.7-314.9	299.9
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	361.2
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	83.7
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. “T”	528.3-548.7	539.4
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	851.9
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	762.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	340.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.0

DATA SHEET B3

HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number: 511 Test Date: 08/31/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one head drop performed

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

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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

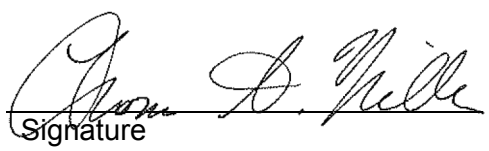
Record length: 595 mm

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 g ≤ x ≤ 300 g	282 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	7.8 g

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



Signature

08/31/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test ID:** D152681

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	52	Pass
Peak Resultant Acceleration	G's	250 to 300	282	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	7.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

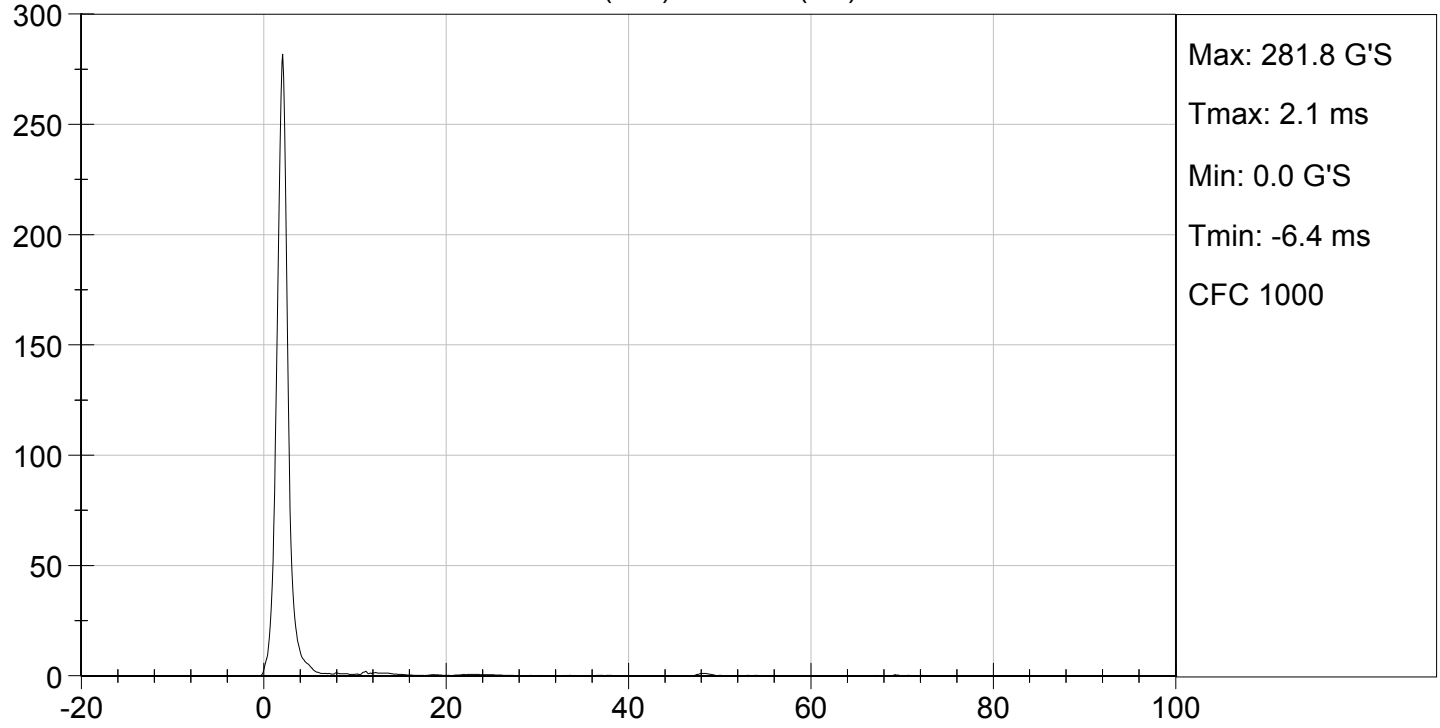
08/31/2015
Test Date

Approved By

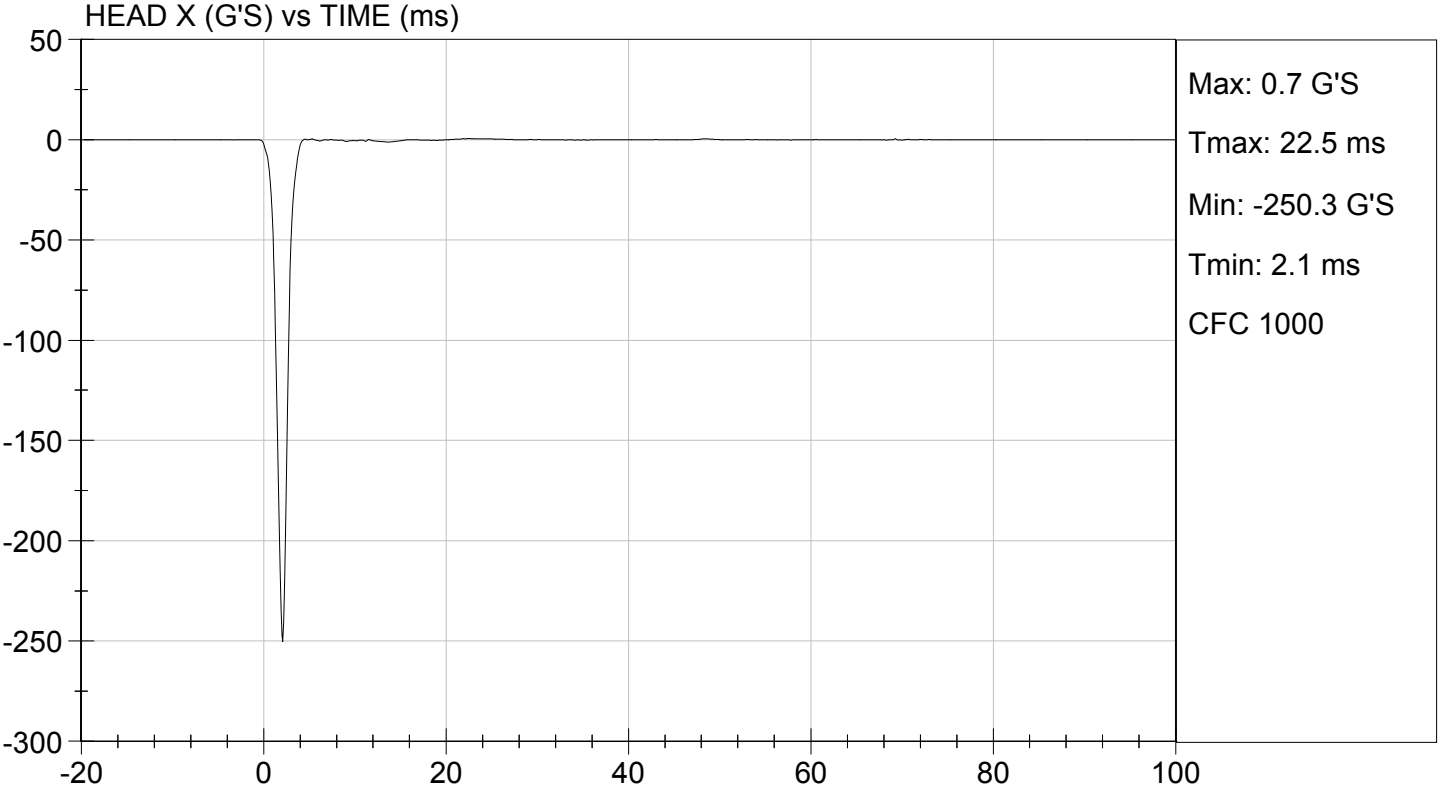
TEST DESC: HEAD DROP

TEST DATE: 08/31/2015
TEST #: D152681

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



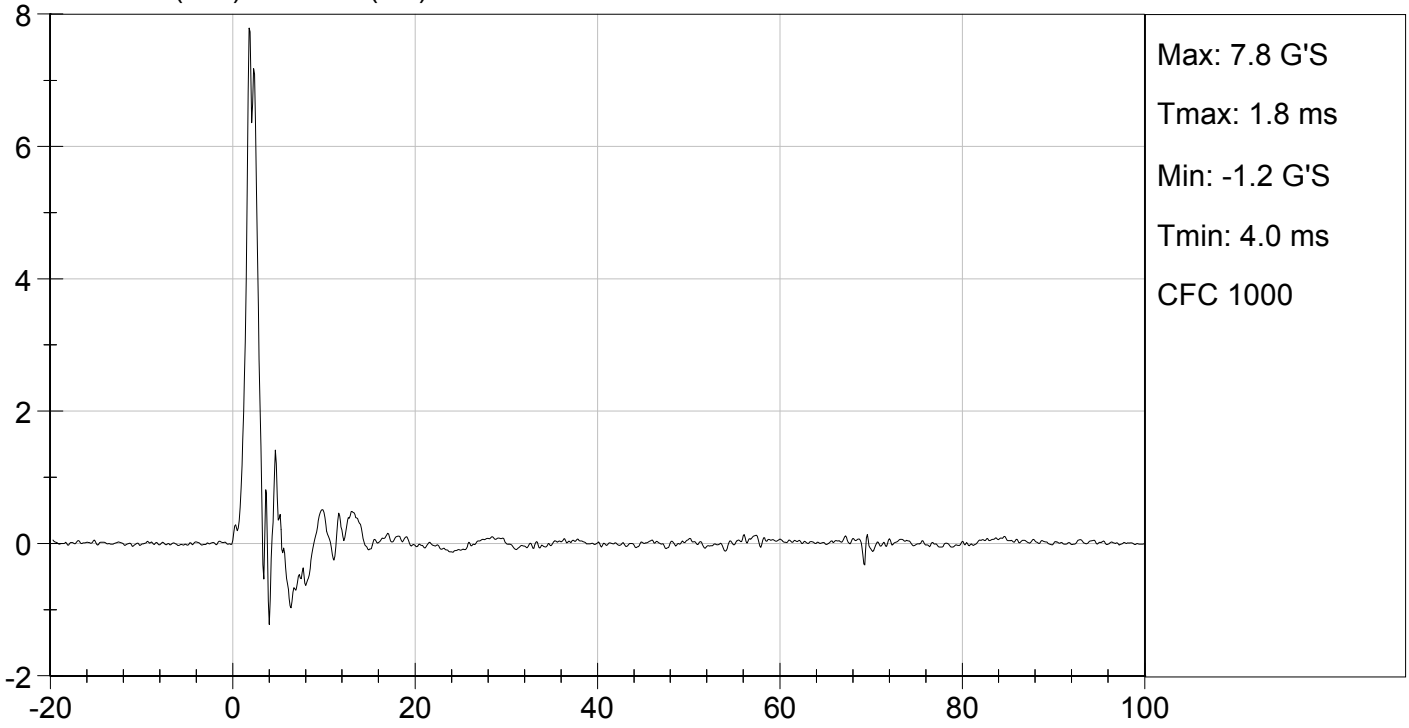
HEAD X (G'S) vs TIME (ms)



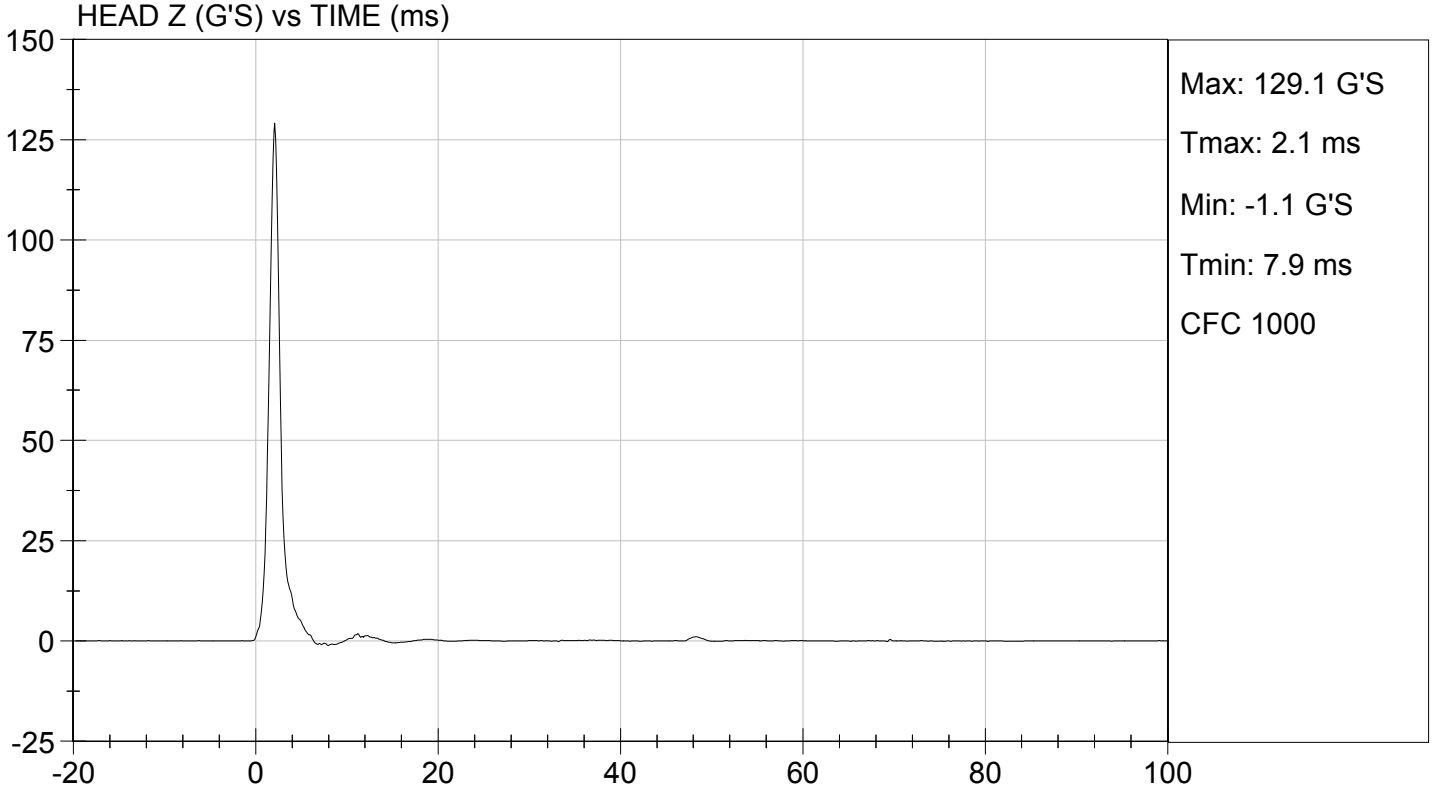
TEST DESC: HEAD DROP

TEST DATE: 08/31/2015
TEST #: D152681

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



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



DATA SHEET B4

NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 511 Test Date: 08/31/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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

Record findings and actions: No damage

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

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

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s ≤ speed ≤ 7.13 m/s	7.06 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.1 m/s ≤ ΔV ≤ 2.5 m/s	2.4 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.0 m/s	4.6 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	6.5 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 81 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	85 ms

*Moment about the occipital condyle = M_y – (0.01778 m x F_x)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

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

Signature

08/31/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D152682

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	52	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
			Overall Results		Pass

Laboratory Technician

08/31/2015

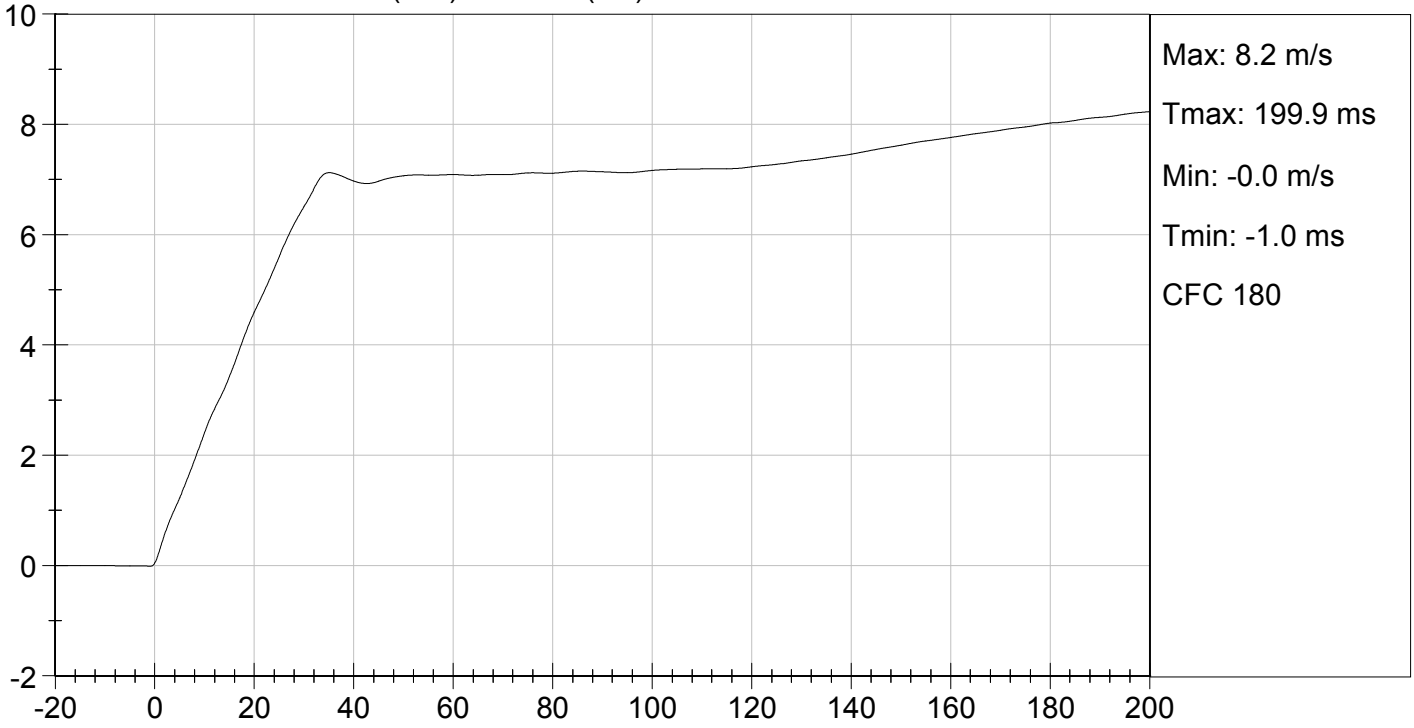
Test Date

Approved By

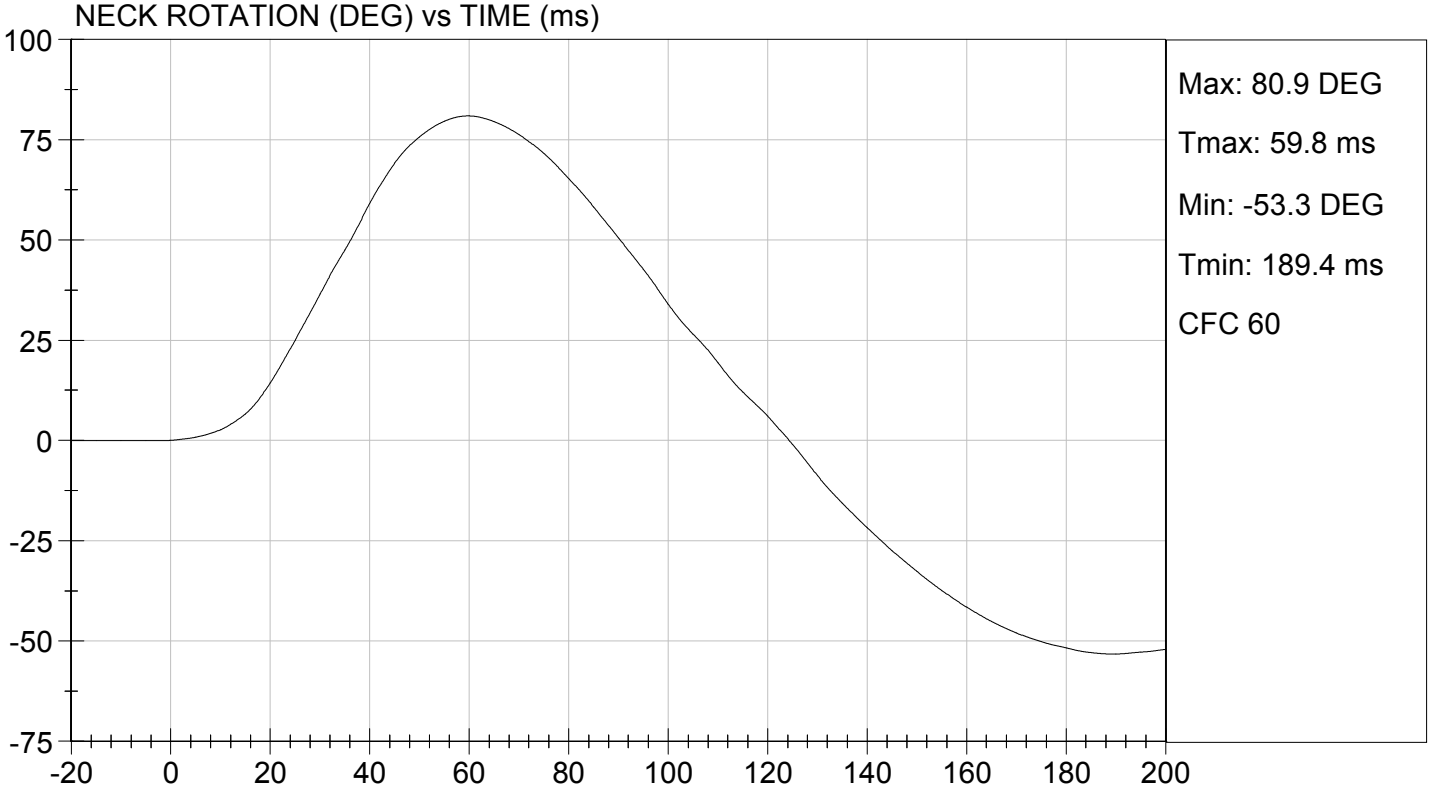
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 08/31/2015
TEST #: D152682

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

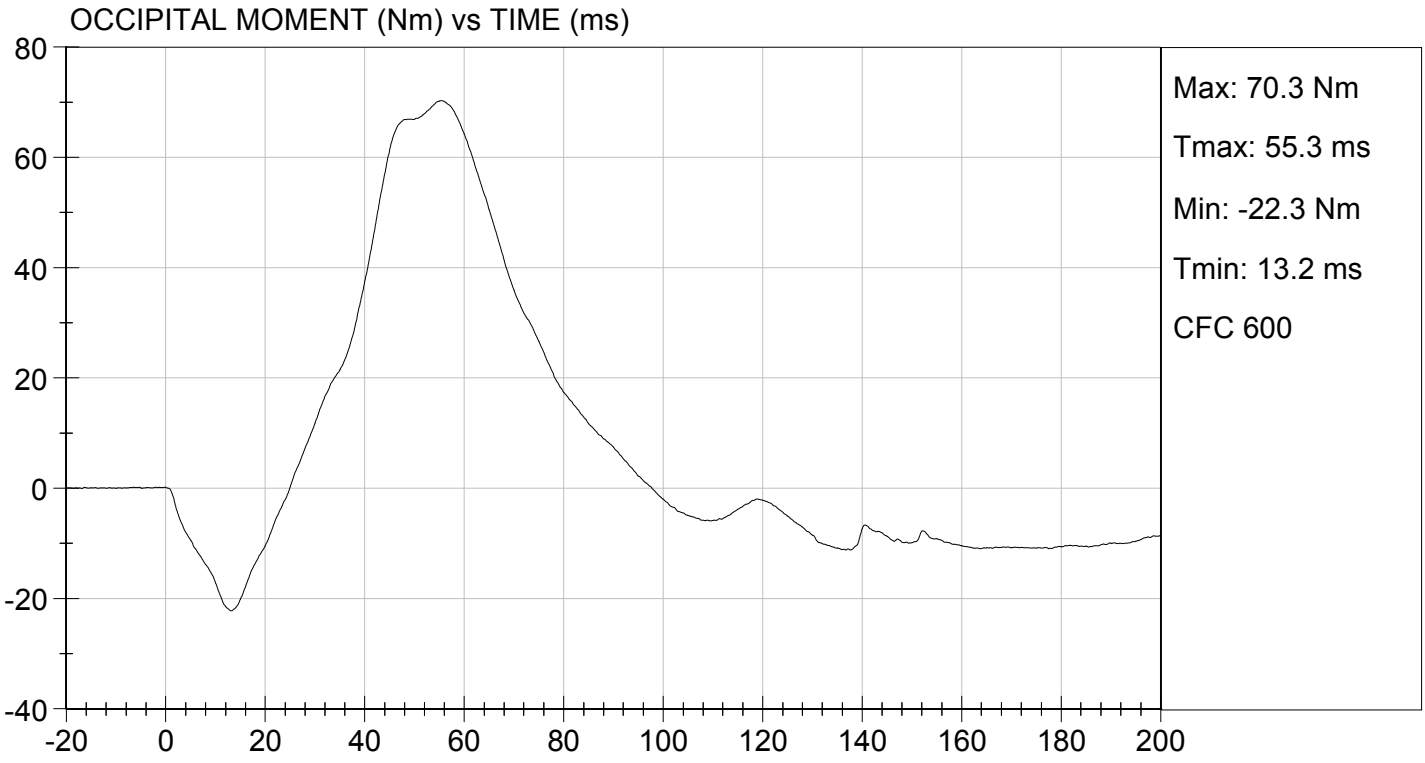


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 08/31/2015
TEST #: D152682



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 511 Test Date: 08/31/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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

Record findings and actions: No damage

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

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

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s ≤ speed ≤ 6.19 m/s	6.05 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.5 m/s ≤ ΔV ≤ 1.9 m/s	1.7 m/s
	@ 20 ms	3.1 m/s ≤ ΔV ≤ 3.9 m/s	3.6 m/s
	@ 30 ms	4.6 m/s ≤ ΔV ≤ 5.6 m/s	5.2 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-56 Nm @ 109 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	102 ms

*Moment about the occipital condyle = M_y – (0.01778 m x F_x)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

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

Signature

08/31/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D152683

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	52	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	109	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	102	Pass
			Overall Results		Pass

Laboratory Technician

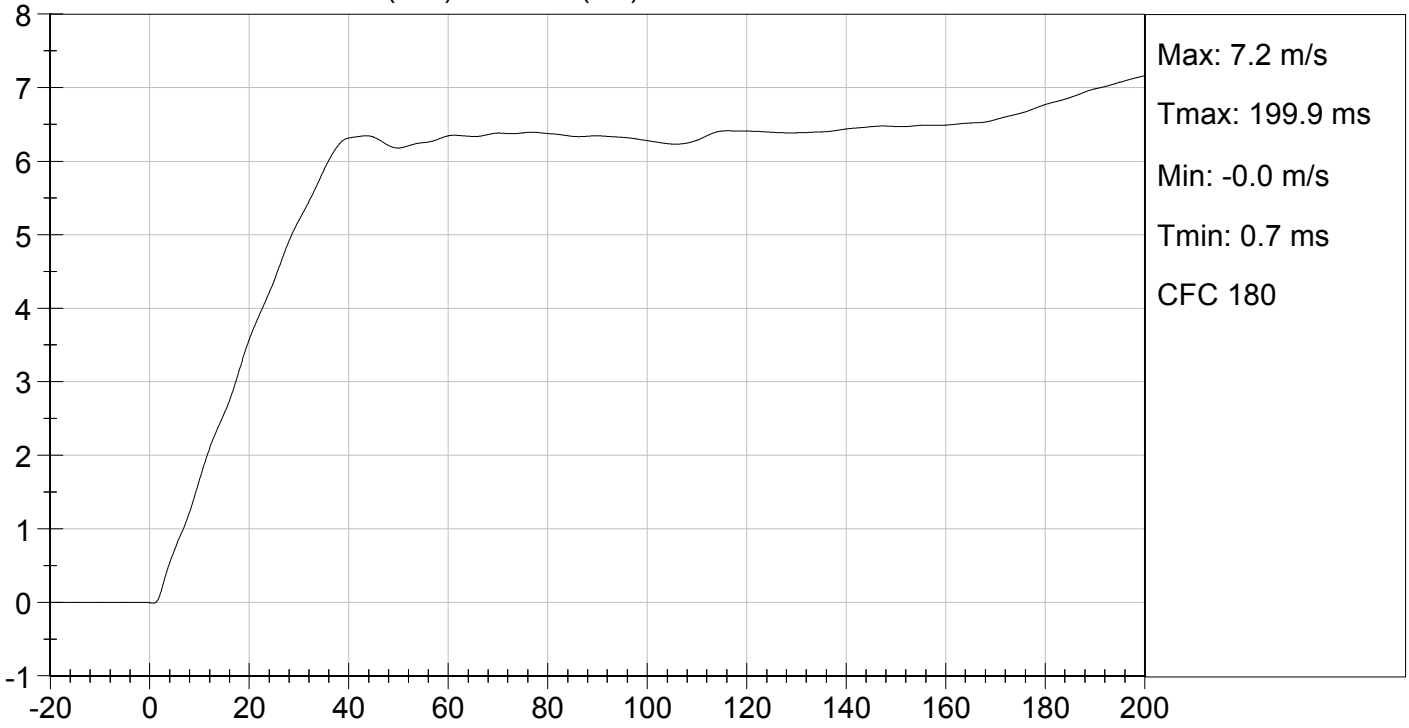
08/31/2015
Test Date

Approved By

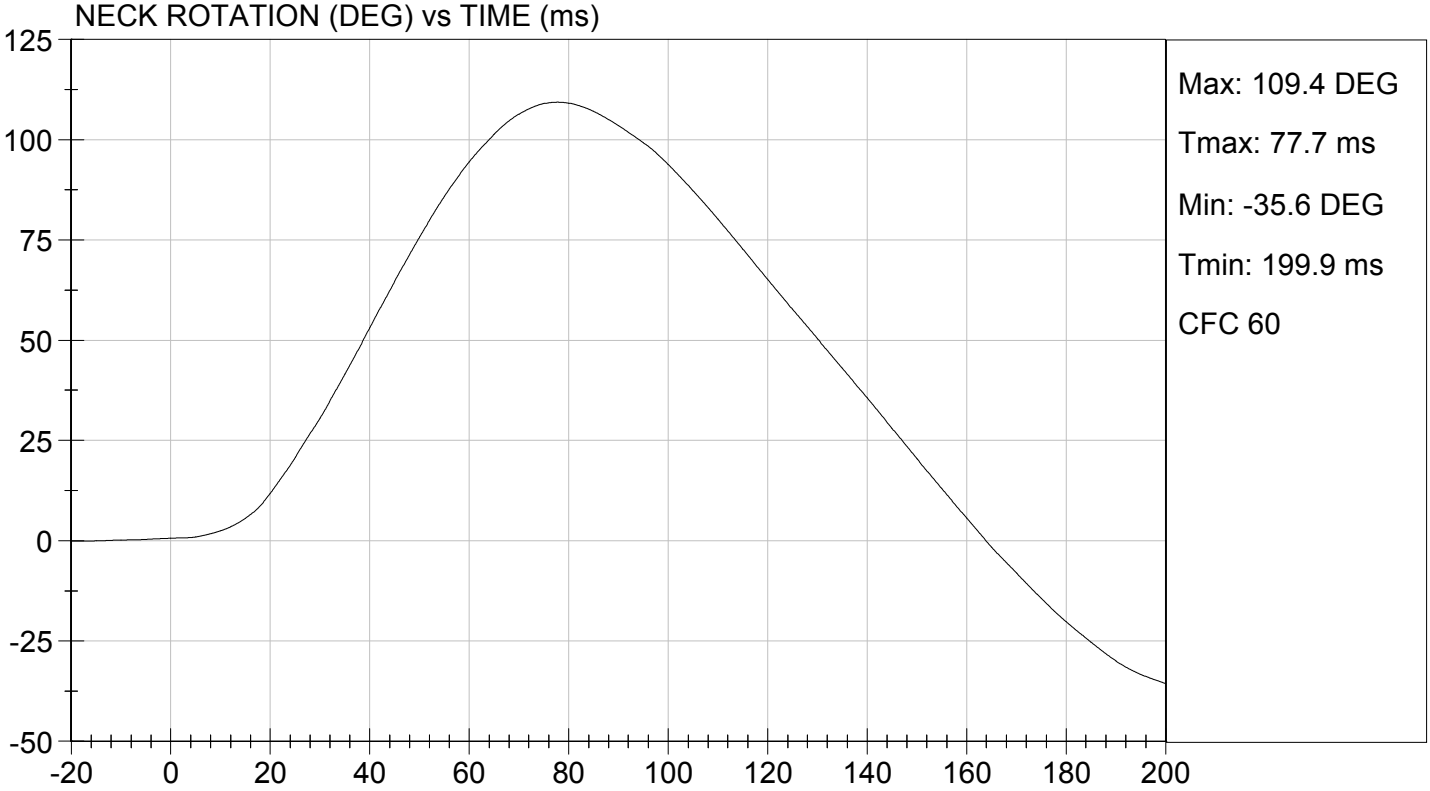
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 08/31/2015
TEST #: D152683

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

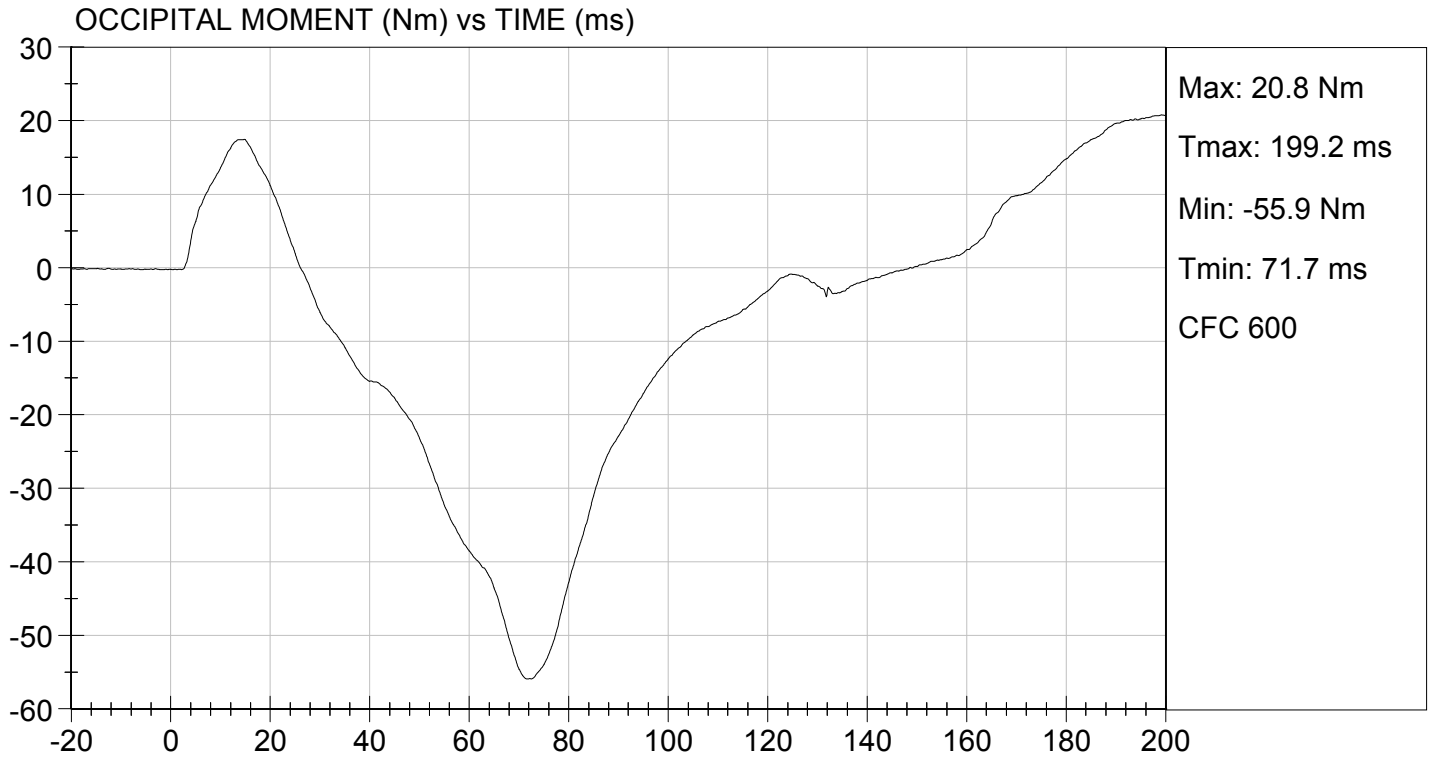


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 08/31/2015
TEST #: D152683



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 511 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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

X - No Damage

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

___ - The following repairs or replacement was performed. Record:

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

X 7. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 7° ± 2°. The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

X 8. The midsagittal plane of the dummy is vertical within ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))

X 10. Align the adjustable neck bracket index marks to the "zero" position.

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is 6.71 m/s ± 0.12m/s. (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.68 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4386 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4440 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	74%

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

**Force = impactor mass x acceleration (572.134(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

09/01/2015 — Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D152684

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4386	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4440	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

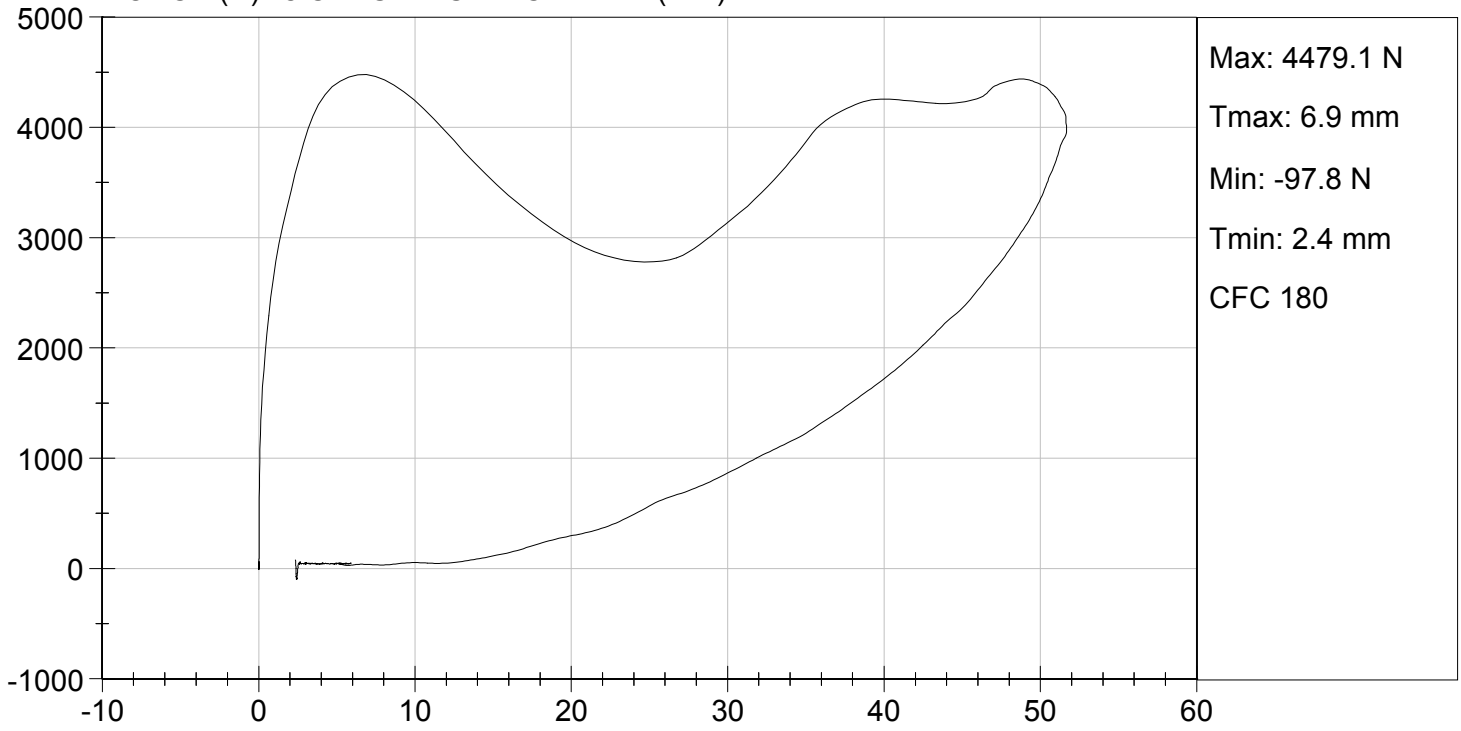
09/01/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/01/2015
TEST #: D152684

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

Dummy Serial Number: 511 Test Date: 09/01/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

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

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

X 3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).
___ With legs below femurs.
X Without legs below femurs.

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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°	18 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	1.0 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	342 N
Final ref. plane angle	Initial ref. plane angle ± 8°	20 deg

Jack Coleman
Signature

09/01/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D152687

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	52	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	20	Pass
Force at 45 deg	N	320 to 390	342	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.0	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

09/01/2015
Test Date

Jeff Leonardelli
Approved By

DATA SHEET B8

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

Dummy Serial Number: 511 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3924 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

09/01/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D152686

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	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3924	Pass
		Overall Test Results		Pass

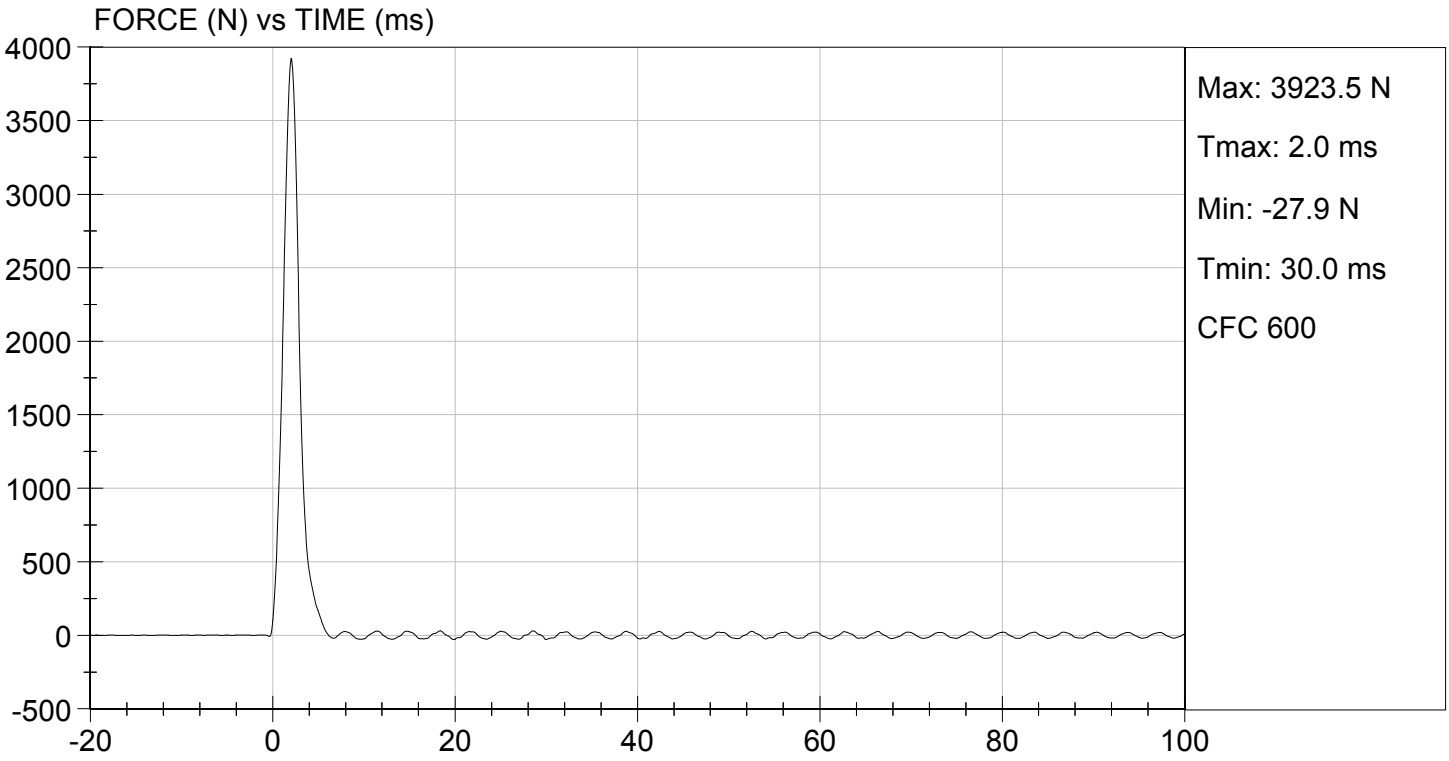
David Schoedel
Laboratory Technician

09/01/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/01/2015
TEST #: D152686



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

Dummy Serial Number: 511 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	52%
Record the minimum humidity:	49%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.11 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3649 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

09/01/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D152685

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	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3649	Pass
		Overall Test Results		Pass

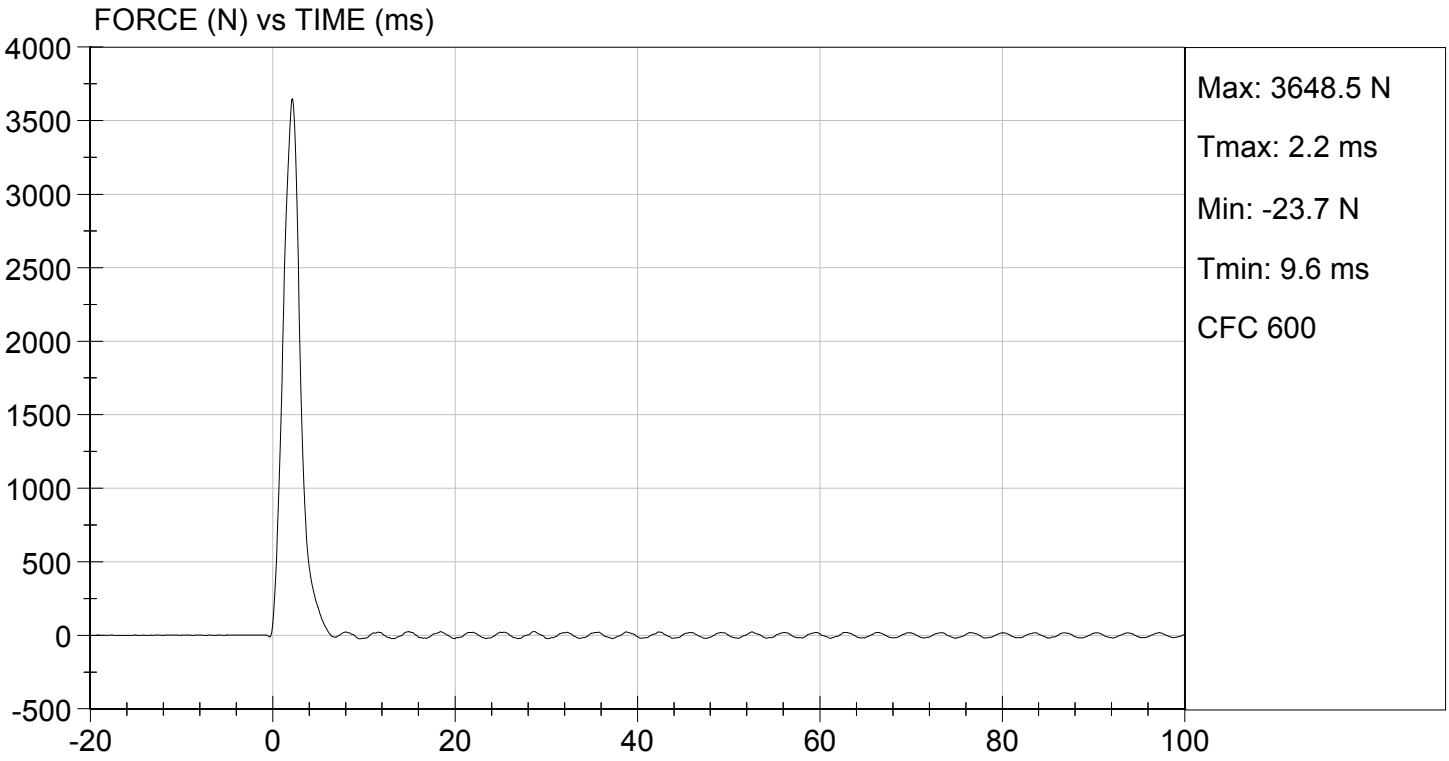
David Schoedel
Laboratory Technician

09/01/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/01/2015
TEST #: D152685



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	P82603	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82604	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82605	08/19/2015	02/19/2016
NECK TRANSDUCER	Denton	1716	2039	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P84432	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P84433	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P84435	08/19/2015	02/19/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	511	08/17/2015	02/17/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	9425	08/19/2015	02/19/2016
(2) LEFT FEMUR	Denton	2121	9426	08/19/2015	02/19/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 511 Test Date: 10/28/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

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

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

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

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

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	49%

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 g ≤ x ≤ 300 g	289 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-9.0 g

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

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test ID:** D153461

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	50	Pass
Peak Resultant Acceleration	G's	250 to 300	289	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

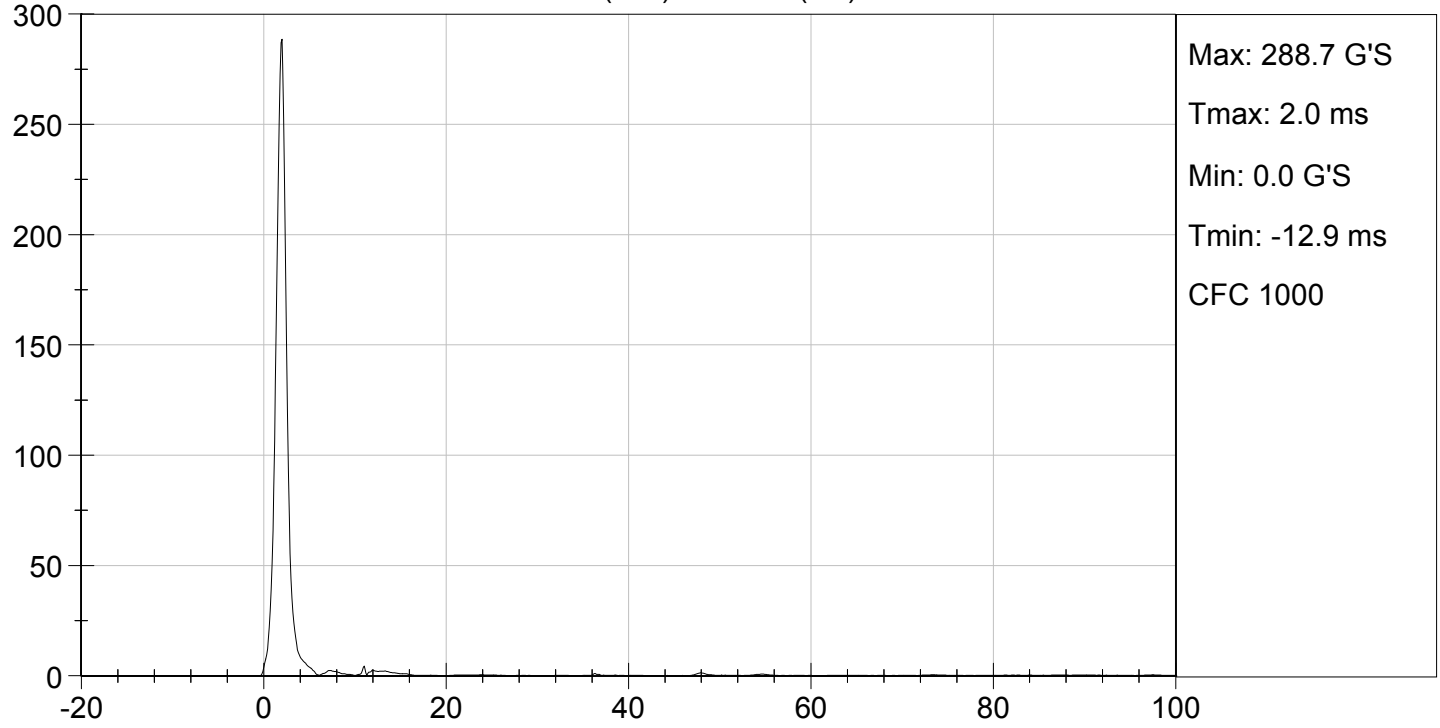
10/28/2015
Test Date

Jeff Leonard
Approved By

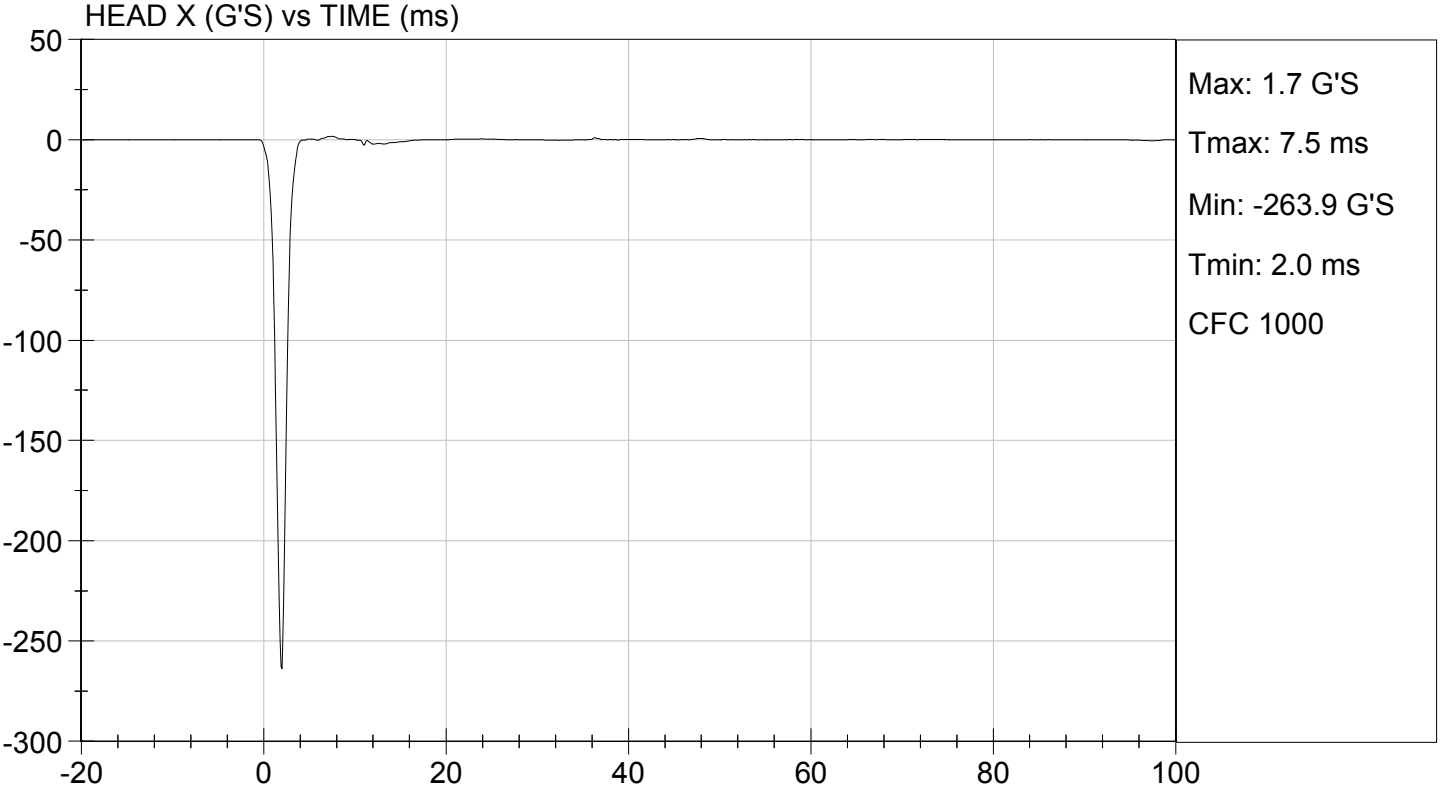
TEST DESC: HEAD DROP

TEST DATE: 10/28/2015
TEST #: D153461

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



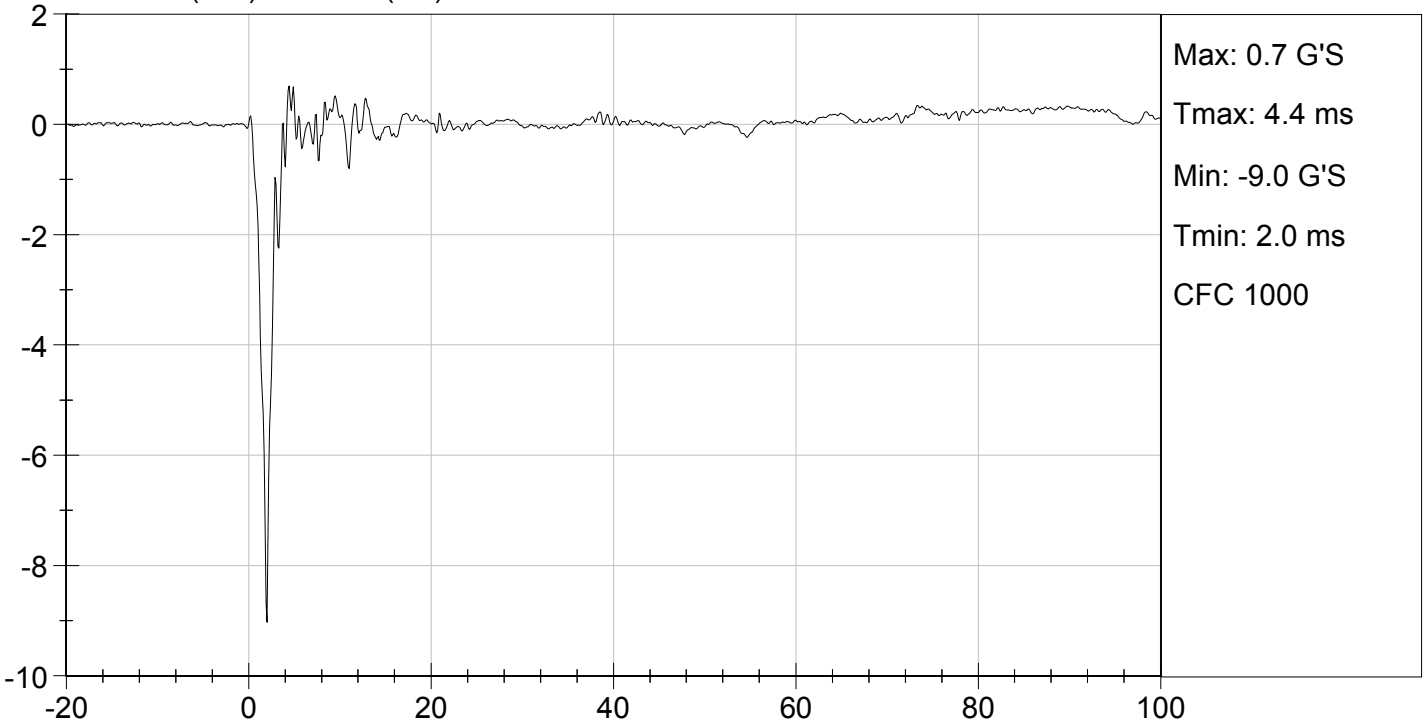
HEAD X (G'S) vs TIME (ms)



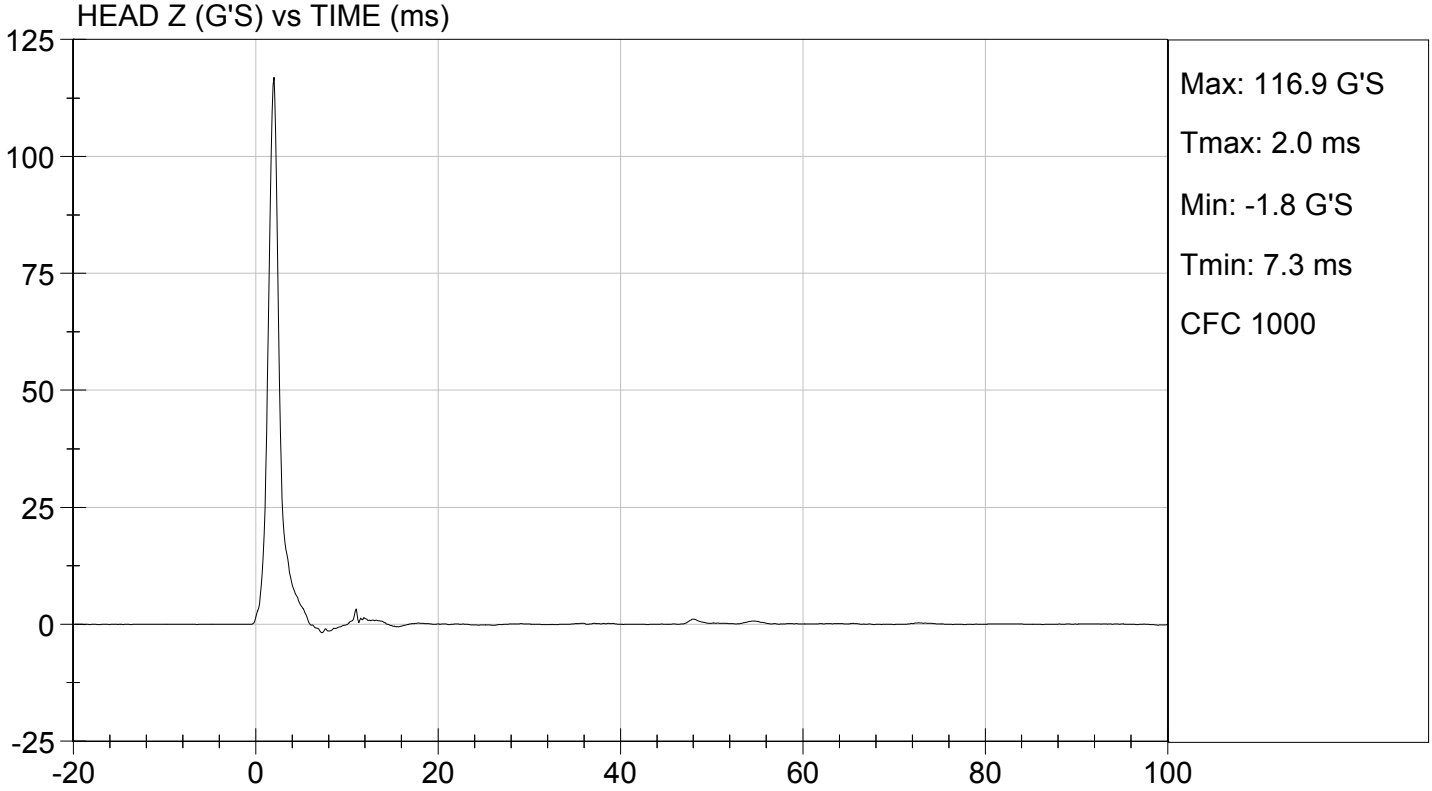
TEST DESC: HEAD DROP

TEST DATE: 10/28/2015
TEST #: D153461

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



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



DATA SHEET B4

NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 511 Test Date: 10/28/2015

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:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	49%

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

Record findings and actions: No damage

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

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

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s ≤ speed ≤ 7.13 m/s	7.06 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.1 m/s ≤ ΔV ≤ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.0 m/s	4.5 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	6.3 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	73 Nm @ 80 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	86 ms

*Moment about the occipital condyle = M_y – (0.01778 m x F_x)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

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

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153462

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	49	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	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

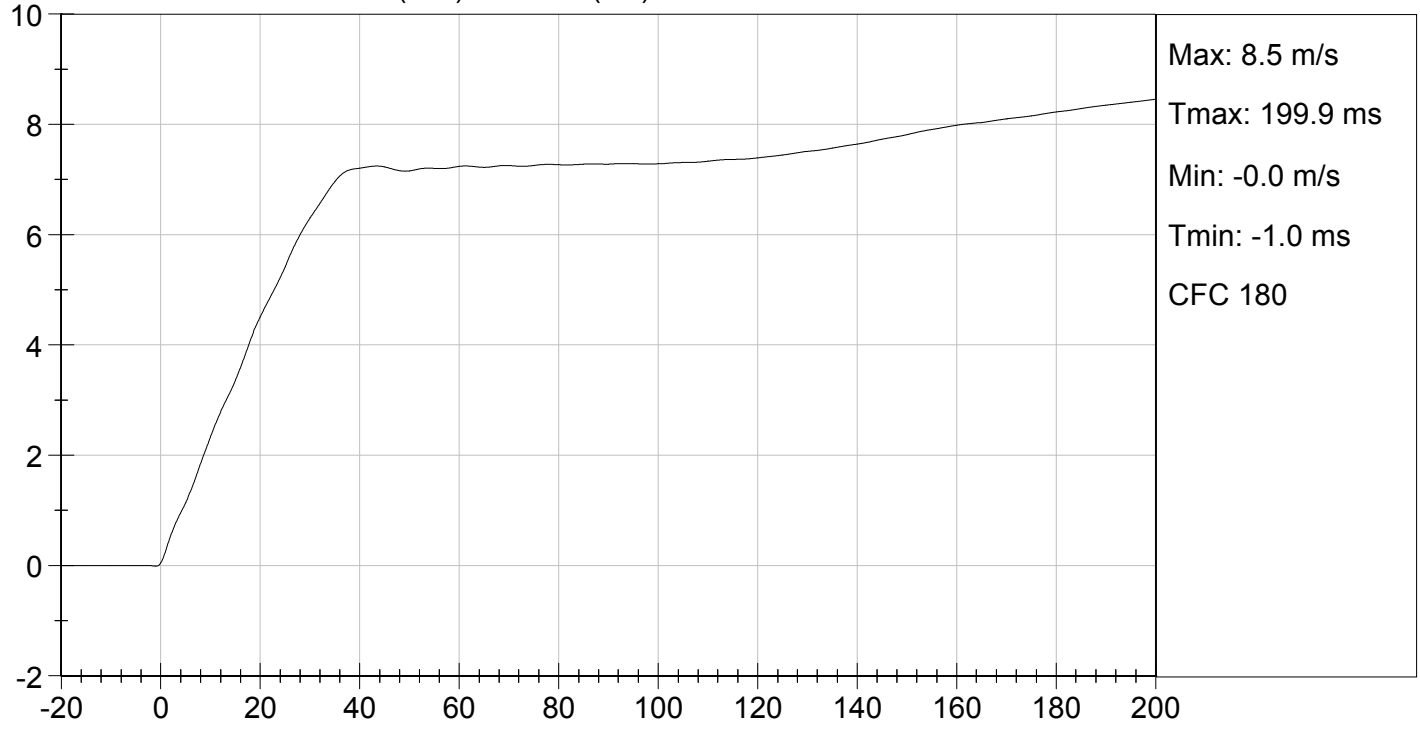
10/28/2015
Test Date

Jeff Leonardelli
Approved By

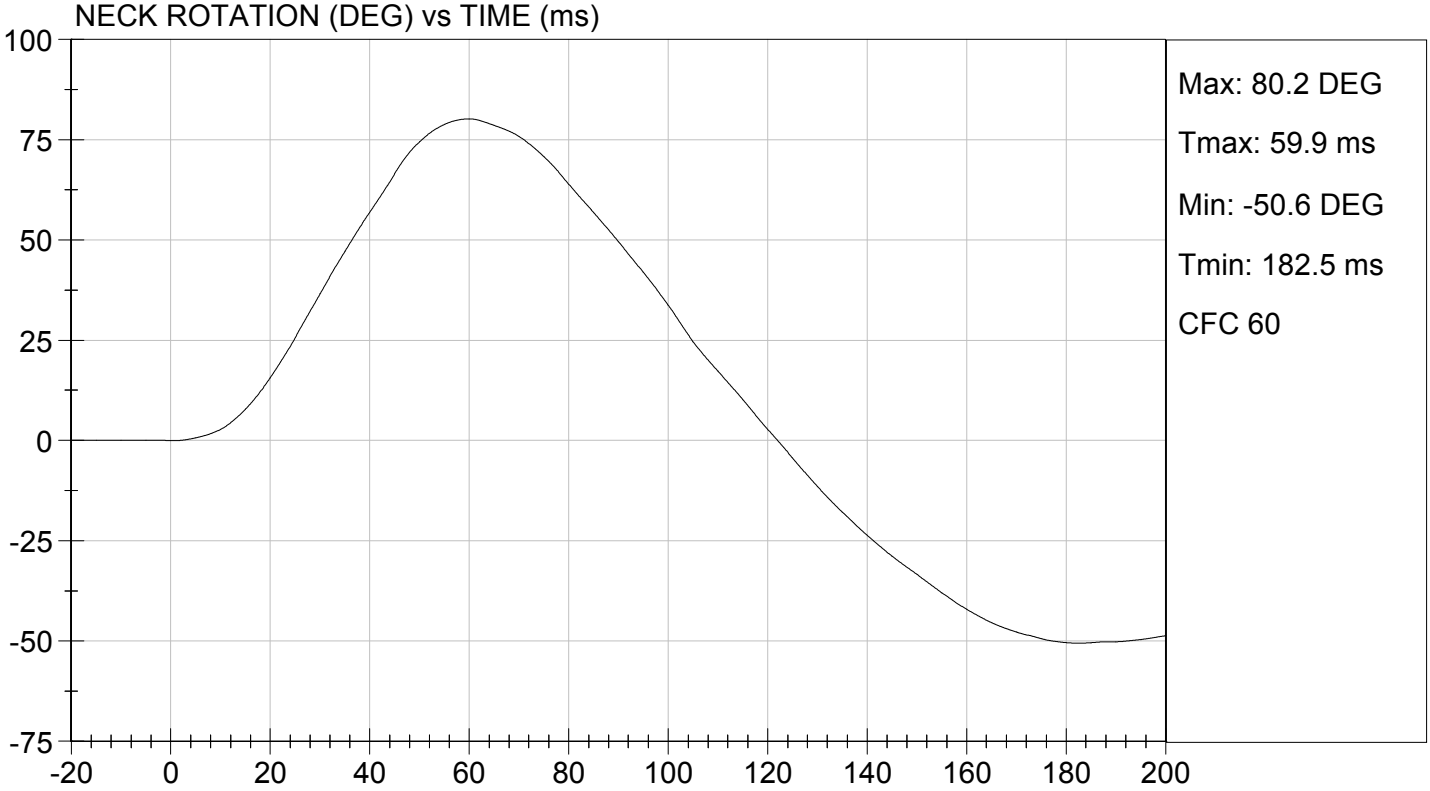
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 10/28/2015
TEST #: D153462

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



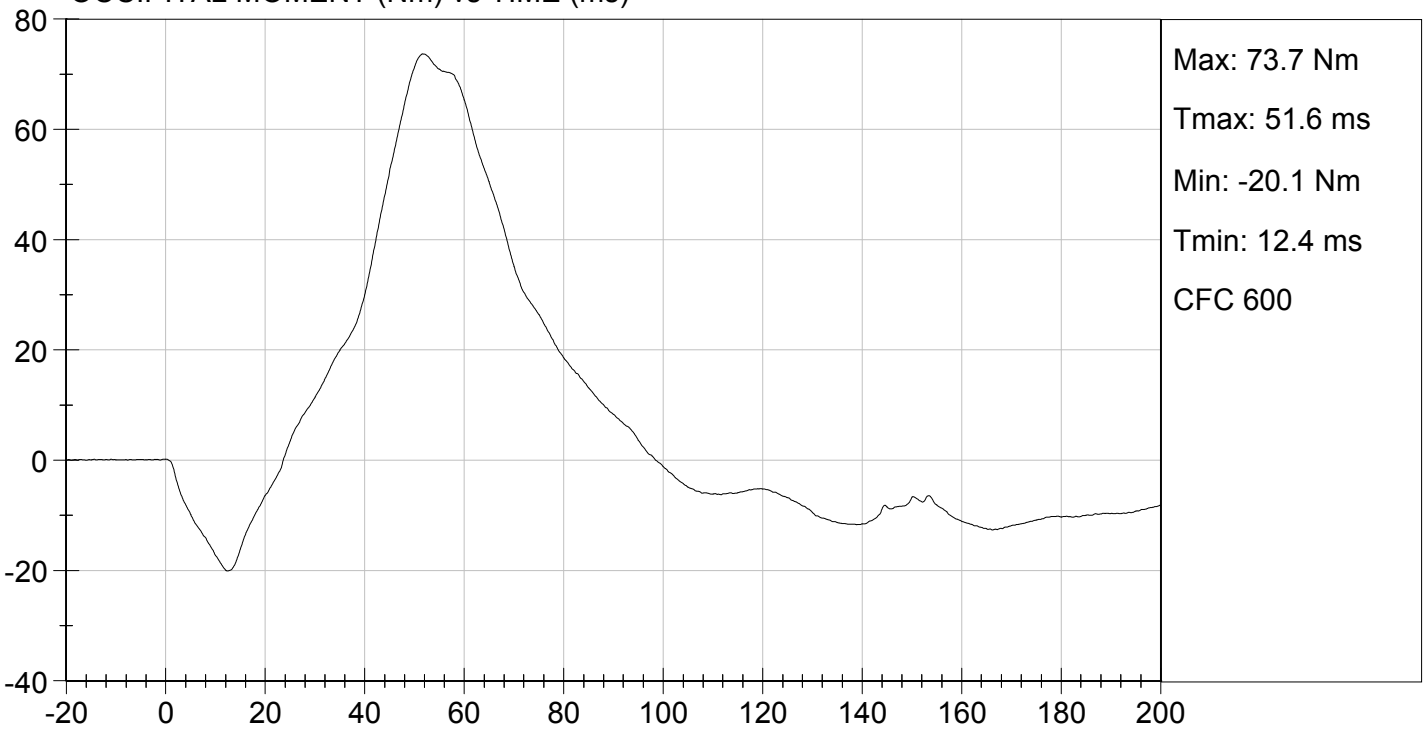
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/28/2015
TEST #: D153462

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 511 Test Date: 10/28/2015

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	49%

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

Record findings and actions: No damage

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

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

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 9B for the extension test. (572.133(c)(3))

X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.

X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.95 m/s to 6.19 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s ≤ speed ≤ 6.19 m/s	6.12 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.5 m/s ≤ ΔV ≤ 1.9 m/s	1.7 m/s
	@ 20 ms	3.1 m/s ≤ ΔV ≤ 3.9 m/s	3.7 m/s
	@ 30 ms	4.6 m/s ≤ ΔV ≤ 5.6 m/s	5.3 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-56 Nm @ 106 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	101 ms

*Moment about the occipital condyle = M_y – (0.01778 m x F_x)(572.133(b)(1)(ii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.133(b)(3))

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

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153463

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	49	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	106	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	101	Pass
			Overall Results		Pass

Jack Coleman

Laboratory Technician

10/28/2015

Test Date

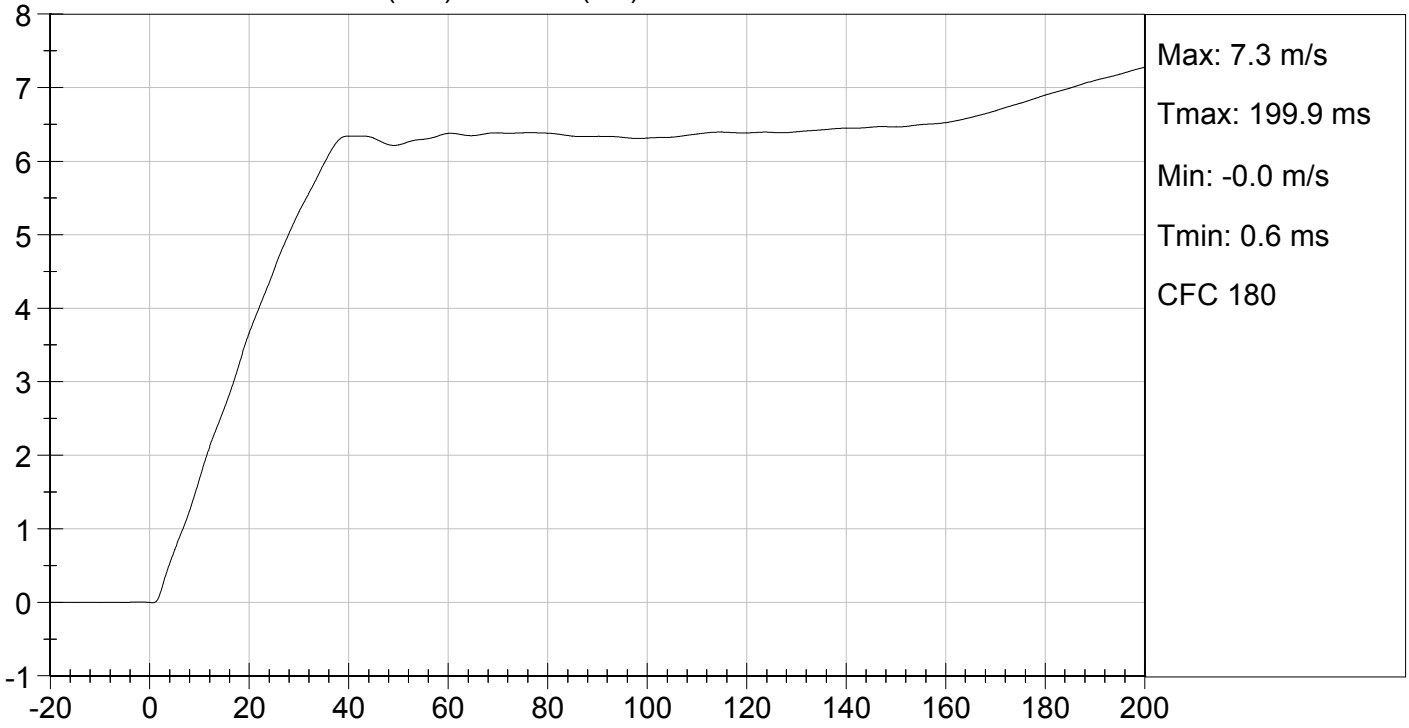
Jeff Leonardi

Approved By

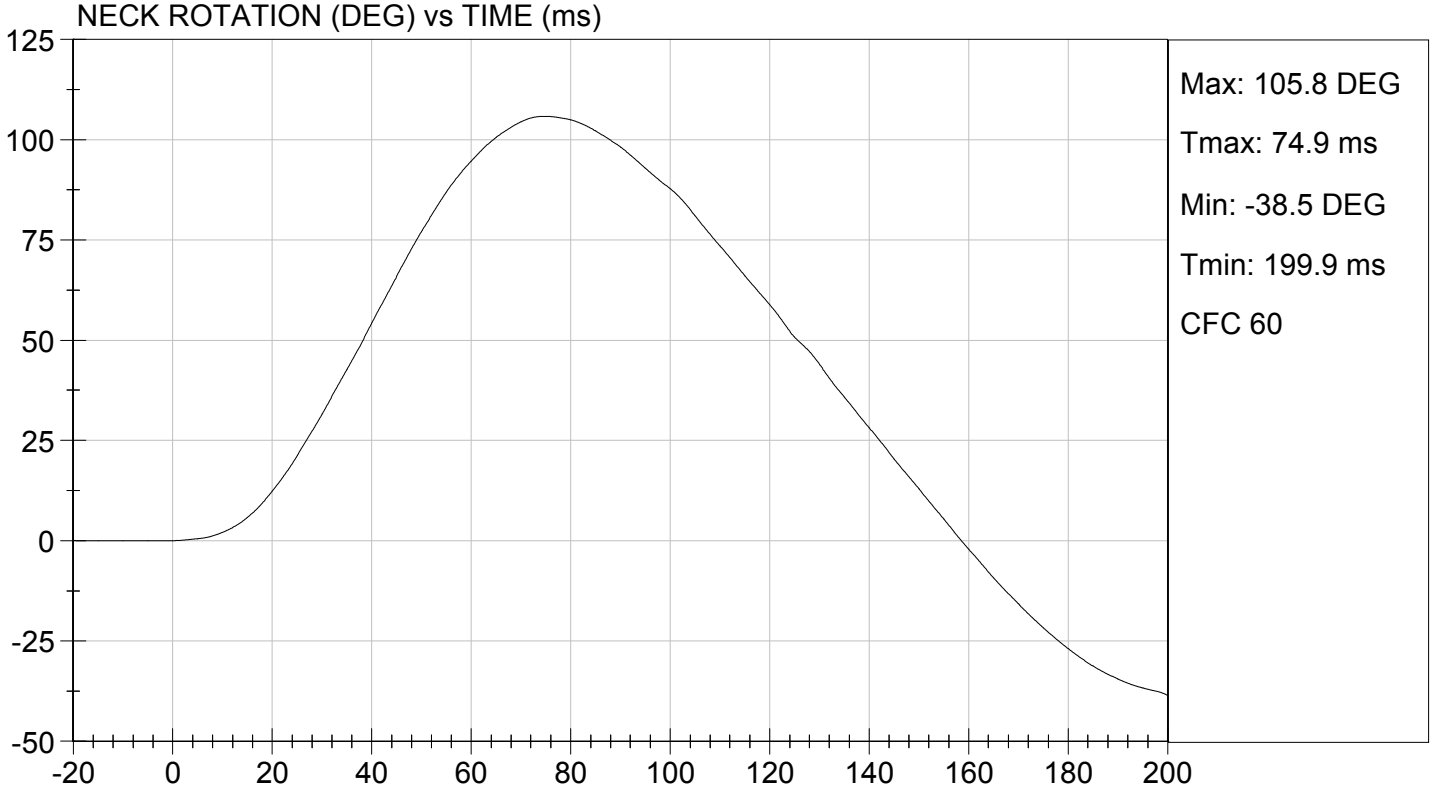
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 10/28/2015
TEST #: D153463

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

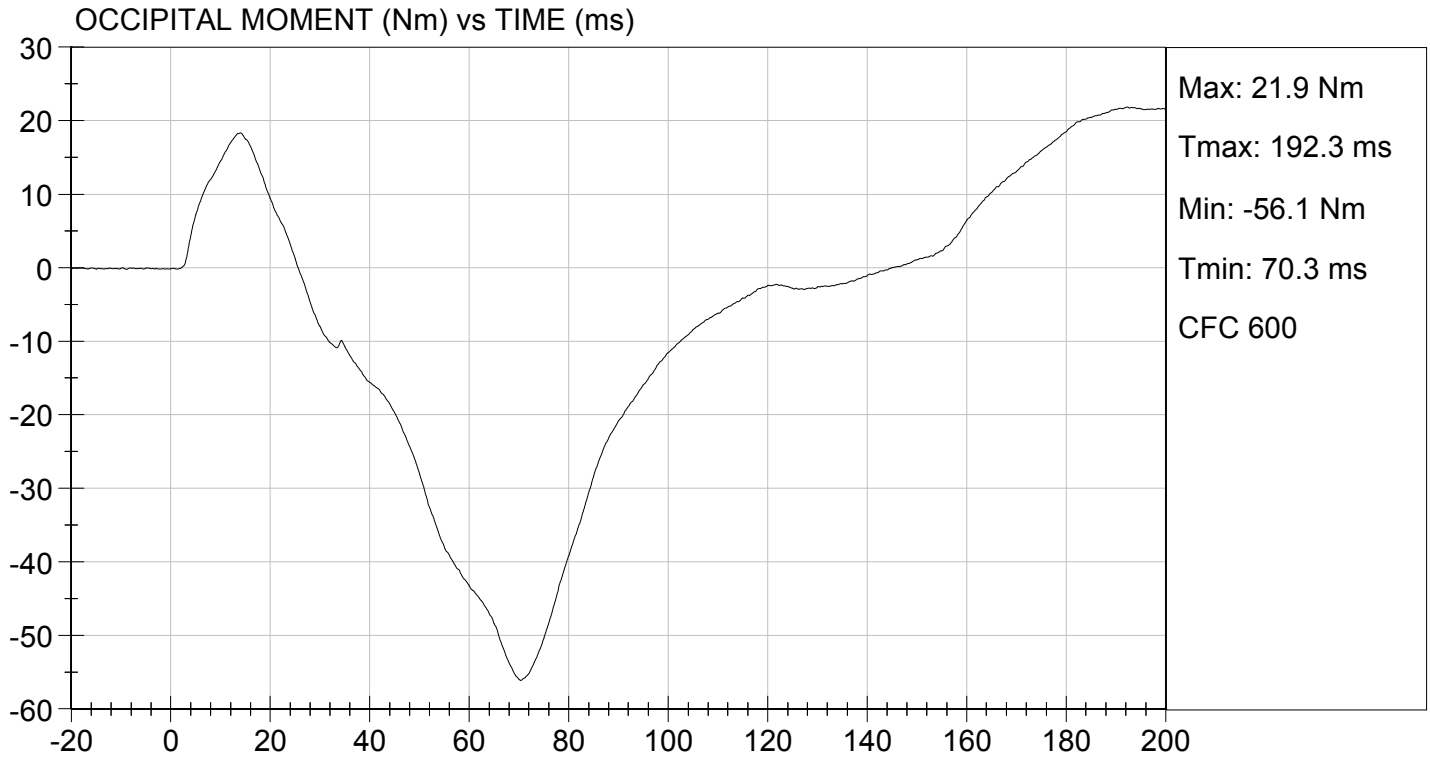


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/28/2015
TEST #: D153463



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 511 Test Date: 10/29/2015

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.1°C
Record the minimum temperature:	20.9°C
Record the maximum humidity:	42%
Record the minimum humidity:	39%

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

_X_ - No Damage

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

_____

___ - The following repairs or replacement was performed. Record:

_____

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

X 7. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 7° ± 2°. The angle may be measured using the special H-point tool (TE-2504) that inserts into the pelvic structure and extends outward beyond the pelvic skin surface or by using the surface of the pelvic adaptor block.

X 8. The midsagittal plane of the dummy is vertical within ± 1°. (572.134(c)(3))

X 9. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.134(c)(4))

X 10. Align the adjustable neck bracket index marks to the "zero" position.

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut that holds the arm yoke to the clavicle assembly.

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 180.

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.134(c)(5)) The velocity of the test probe at the time of impact is 6.71 m/s ± 0.12m/s. (572.134(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.134(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.134(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.77 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4379 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4439 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	73%

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

**Force = impactor mass x acceleration (572.134(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

10/29/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153464

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4379	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4439	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

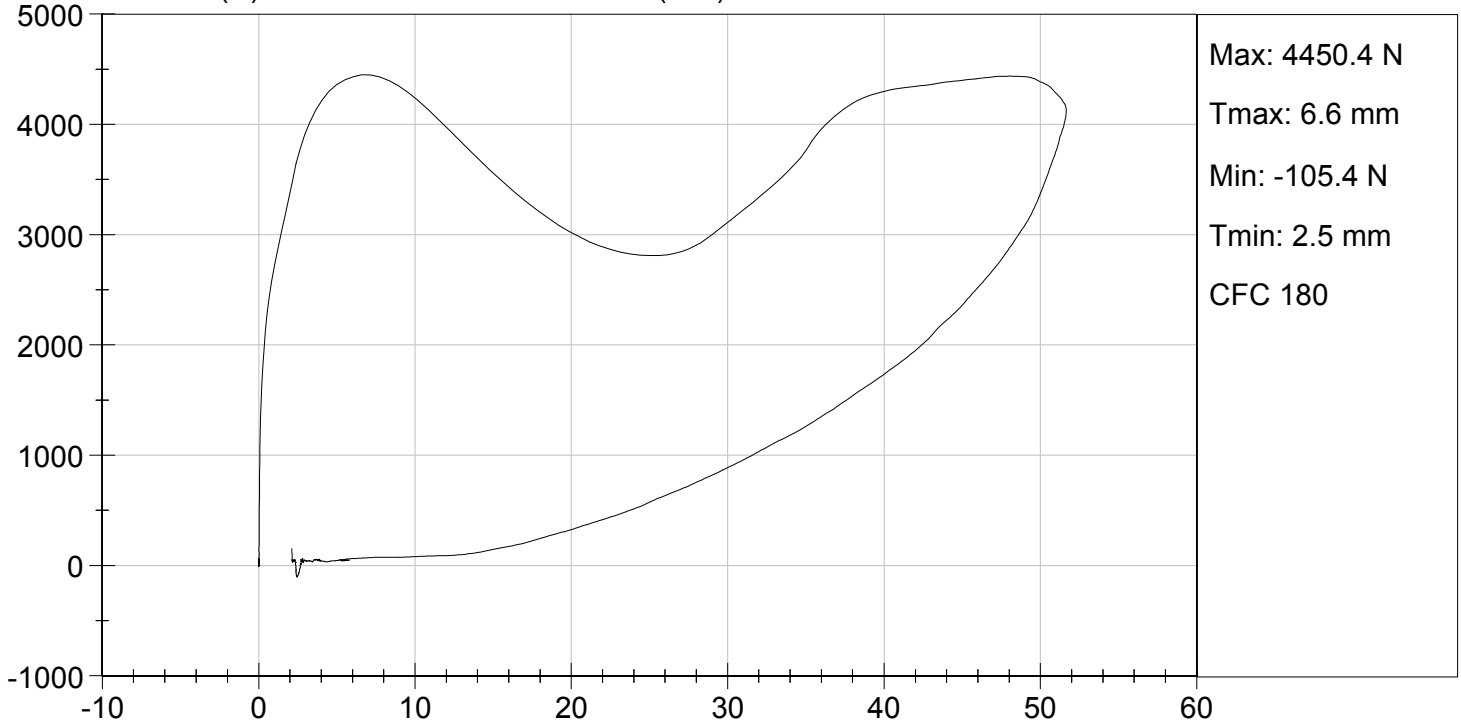
10/29/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/29/2015
TEST #: D153464

FORCE (N) vs CHEST DISPLACEMENT (mm)



DATA SHEET B7

TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 511 Test Date: 10/28/2015

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:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	49%

_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°	18 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	371 N
Final ref. plane angle	Initial ref. plane angle ± 8°	21 deg

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153467

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	49	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	371	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

10/28/2015
Test Date

Jeff Leonardelli
Approved By

DATA SHEET B8

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

Dummy Serial Number: 511 Test Date: 10/28/2015

Technician: Jessica Gall

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	49%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3791 N

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

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

Jessica Hall

Signature

10/28/2015

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153466

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	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3791	Pass
		Overall Test Results		Pass

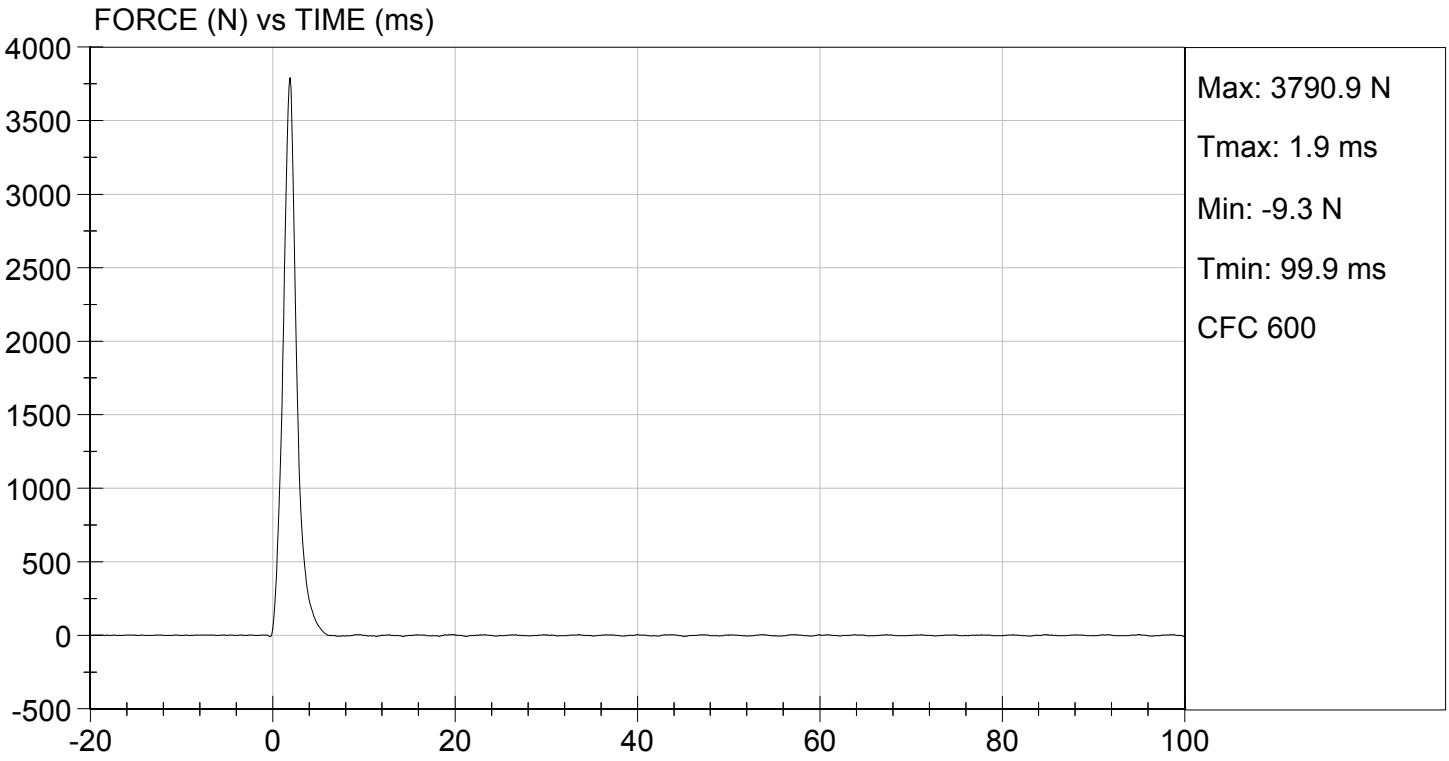
Jessica Hall
Laboratory Technician

10/28/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/28/2015
TEST #: D153466



DATA SHEET B9

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

Dummy Serial Number: 511 Test Date: 10/28/2015

Technician: Jessica Gall

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	49%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3763 N

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

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

Jessica Gall

Signature

10/28/2015

Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153465

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	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3763	Pass
		Overall Test Results		Pass

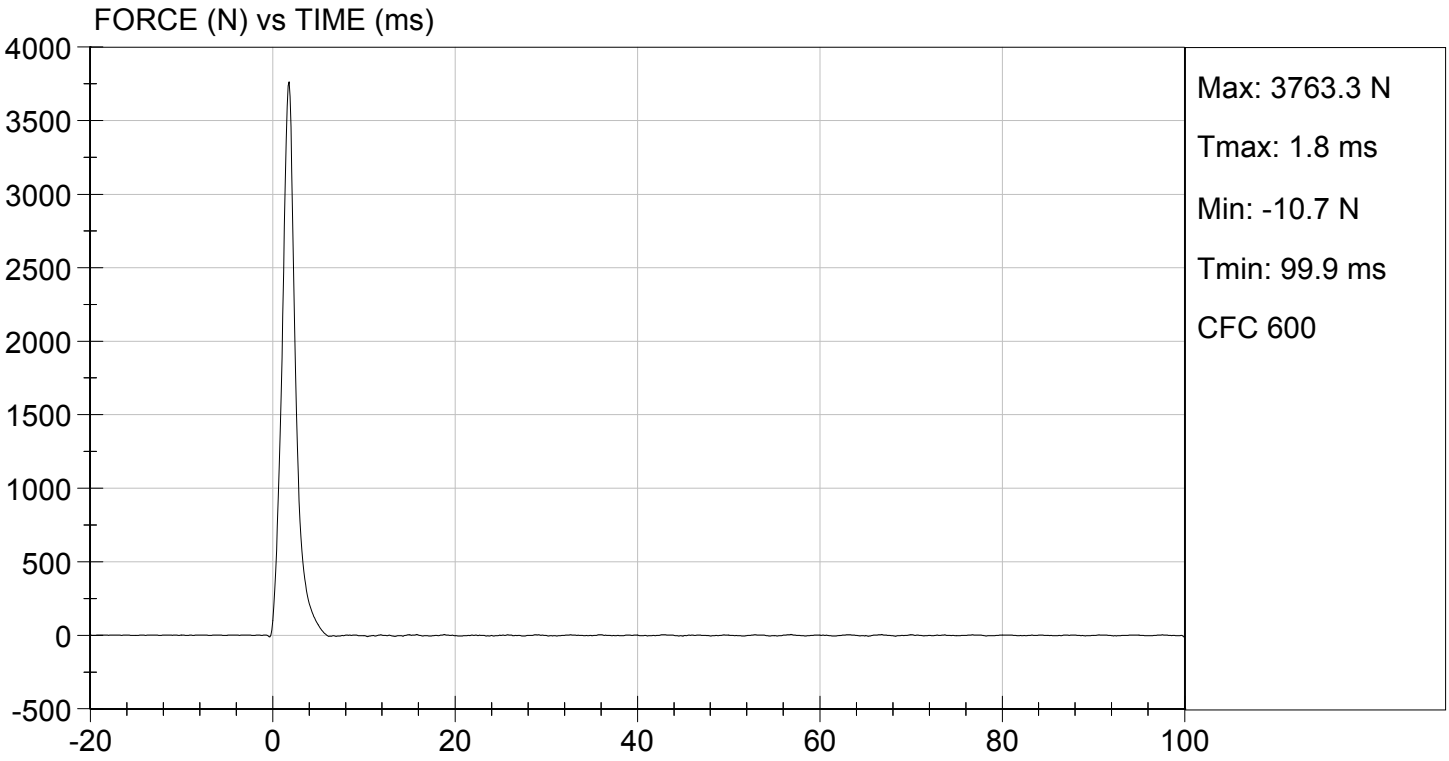
Jessica Hall
Laboratory Technician

10/28/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/28/2015
TEST #: D153465



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	P82603	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82604	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82605	08/19/2015	02/19/2016
NECK TRANSDUCER	Denton	1716	2039	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P84432	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P84433	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P84435	08/19/2015	02/19/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	511	08/17/2015	02/17/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	9425	08/19/2015	02/19/2016
(2) LEFT FEMUR	Denton	2121	9426	08/19/2015	02/19/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 511 Test Date: 10/26/2015

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 — 10/29/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 10/29/2015

Signature — Date

EXTERNAL DIMENSIONS

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

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

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

Dummy Serial Number: 155 Test Date: 10/20/2015

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	21.8°C
Record the minimum temperature	21.5°C
Record the maximum humidity	36%
Record the minimum humidity	32%

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 ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b)) & (572.122(c)(4))

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

Parameter	Specification	Result
Peak resultant acceleration	245 g ≤ x ≤ 300 g	280 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-7.5 g

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

David Schoedel

Signature

10/20/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test ID:** D153361

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	36	Pass
Peak Resultant Acceleration	G's	245 to 300	280	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/20/2015

Test Date

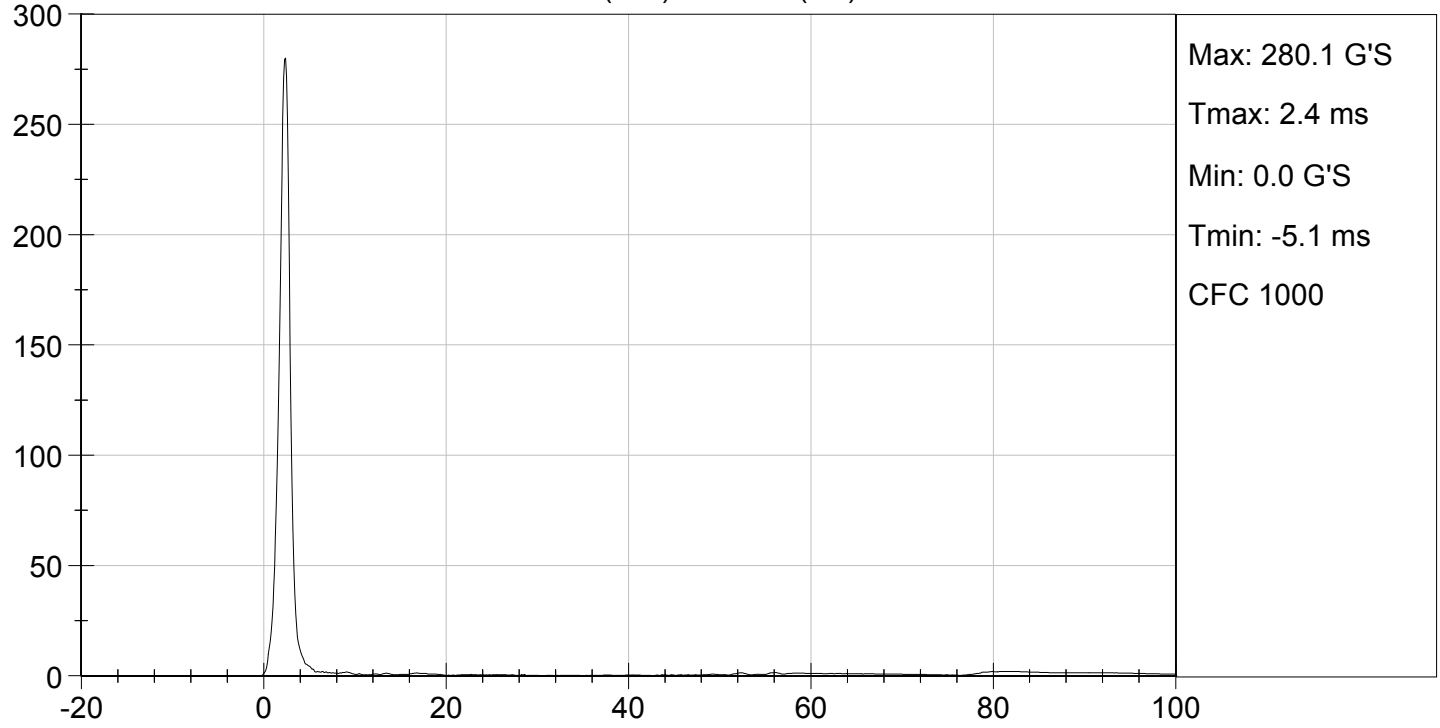
Jeff Leonardelli

Approved By

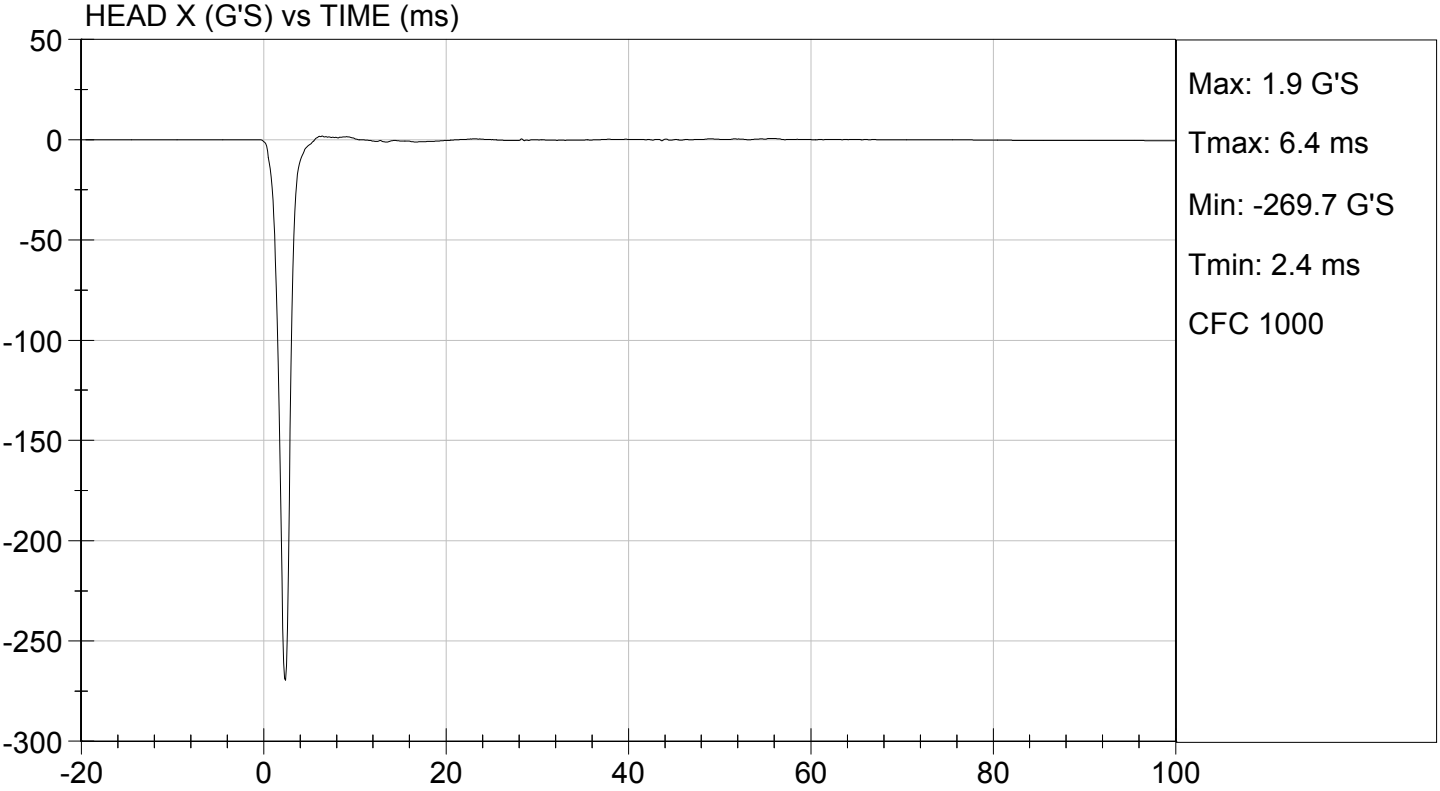
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153361

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

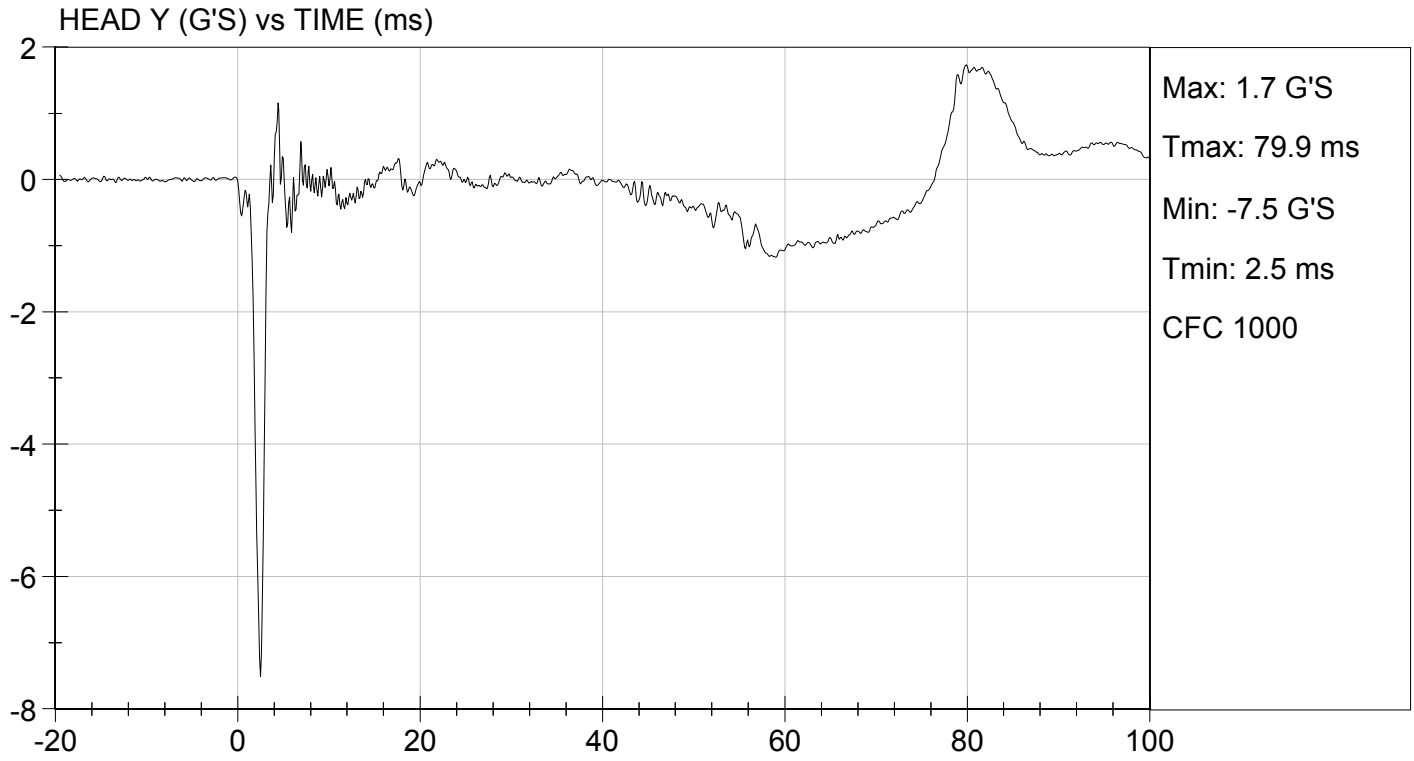


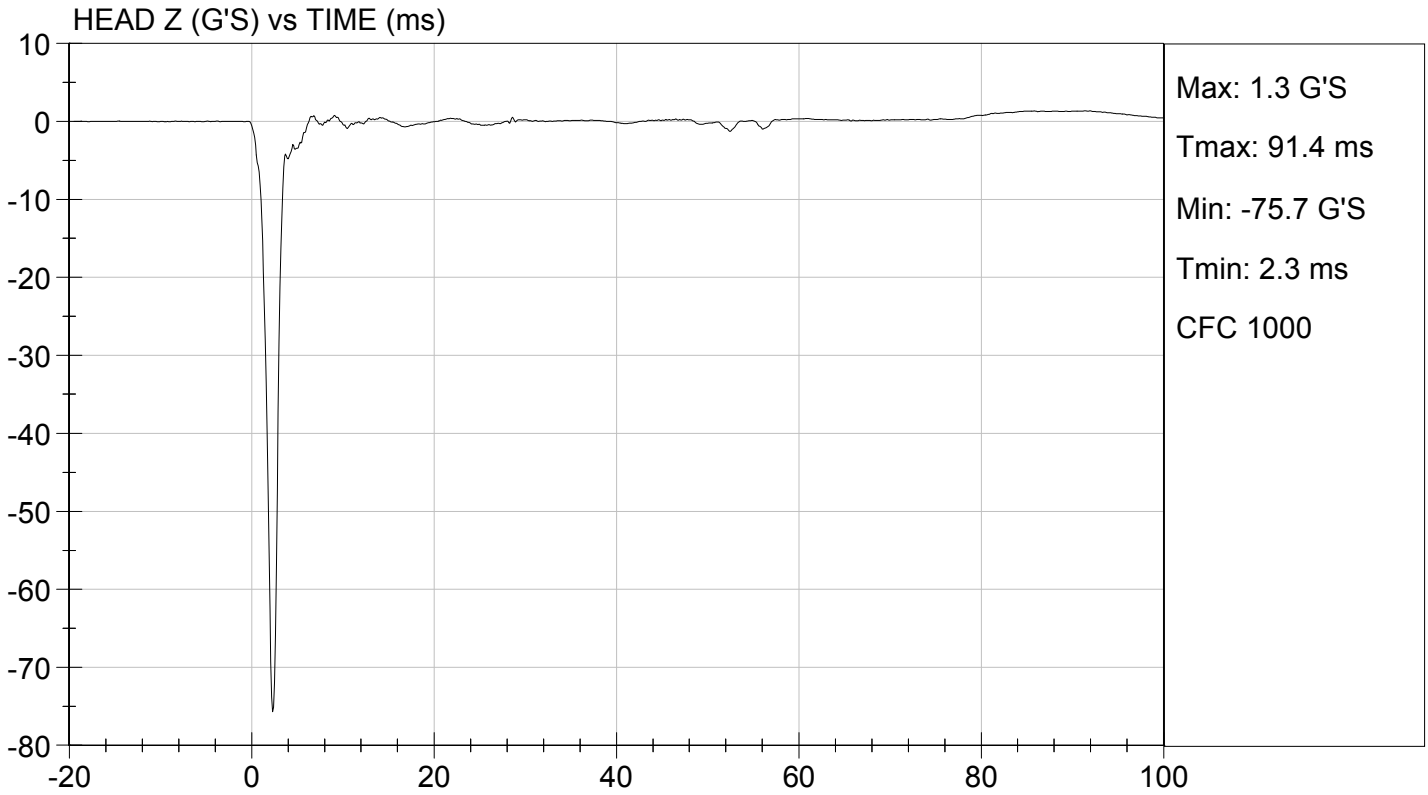
HEAD X (G'S) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153361





DATA SHEET C4

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

Dummy Serial Number: 155 Test Date: 10/20/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.5°C
Record the maximum humidity	36%
Record the minimum humidity	32%

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

Record findings and actions: No damage

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

Record findings and actions: No damage

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123l(3))

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

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

X 12. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.83 m/s ≤ speed ≤ 5.07 m/s	4.98 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.2 m/s ≤ ΔV ≤ 1.6 m/s	1.6 m/s
	@ 20 ms	2.4 m/s ≤ ΔV ≤ 3.4 m/s	3.1 m/s
	@ 30 ms	3.8 m/s ≤ ΔV ≤ 5.0 m/s	4.6 m/s
Plane D Rotation		Peak moment* 27 Nm ≤ moment ≤ 33 Nm during the following rotation range 74° ≤ angle ≤ 92°	29 Nm @ 82 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm 103 ms ≤ time ≤ 123 ms	109 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(1)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

David Schoedel
Signature

10/20/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153362

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	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	3.1	Pass
	30 ms	m/s	3.8 to 5.0	4.6	Pass
D Plane Rotation	Max	deg	74 to 92	82	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	27 to 33	29	Pass
Positive Moment Time Curve Decay to 5 Nm		ms	103 to 123	109	Pass
			Overall Results		Pass

David Schoedel
Laboratory Technician

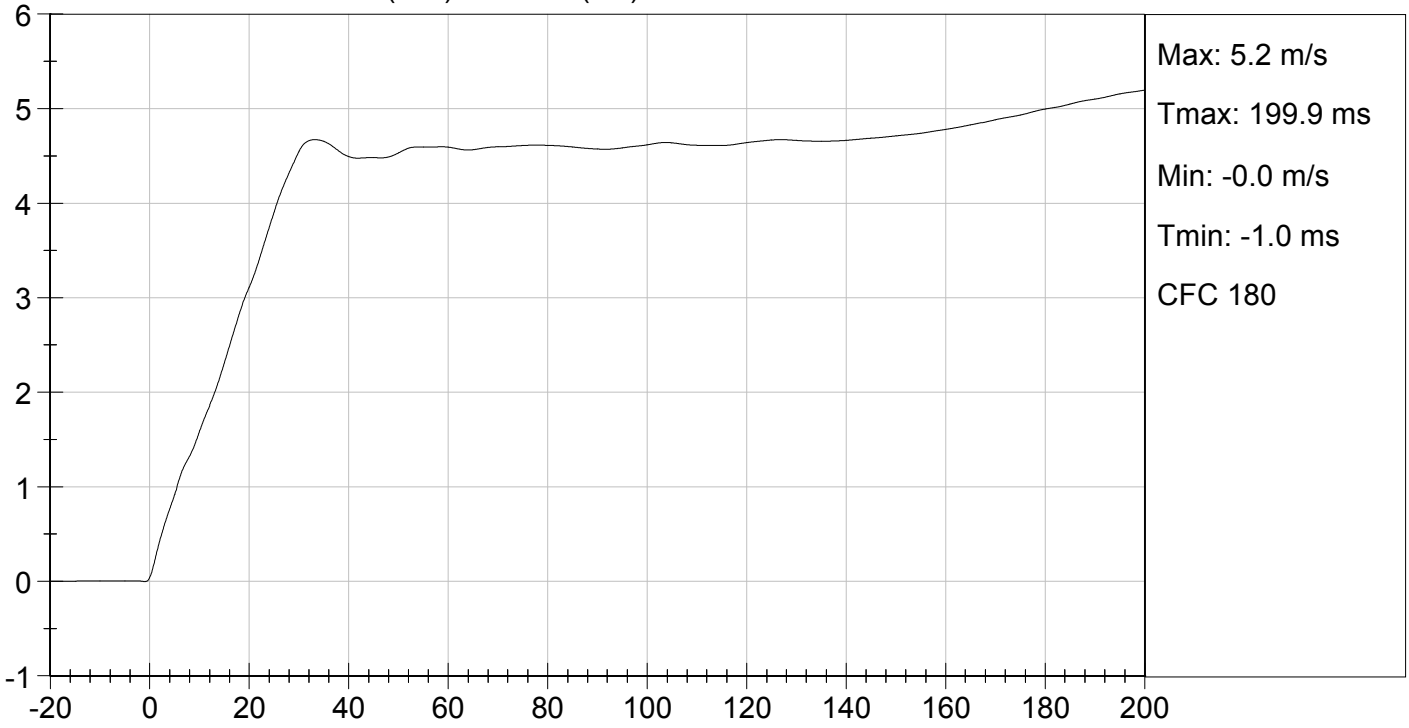
10/20/2015
Test Date

Jeff Leonardelli
Approved By

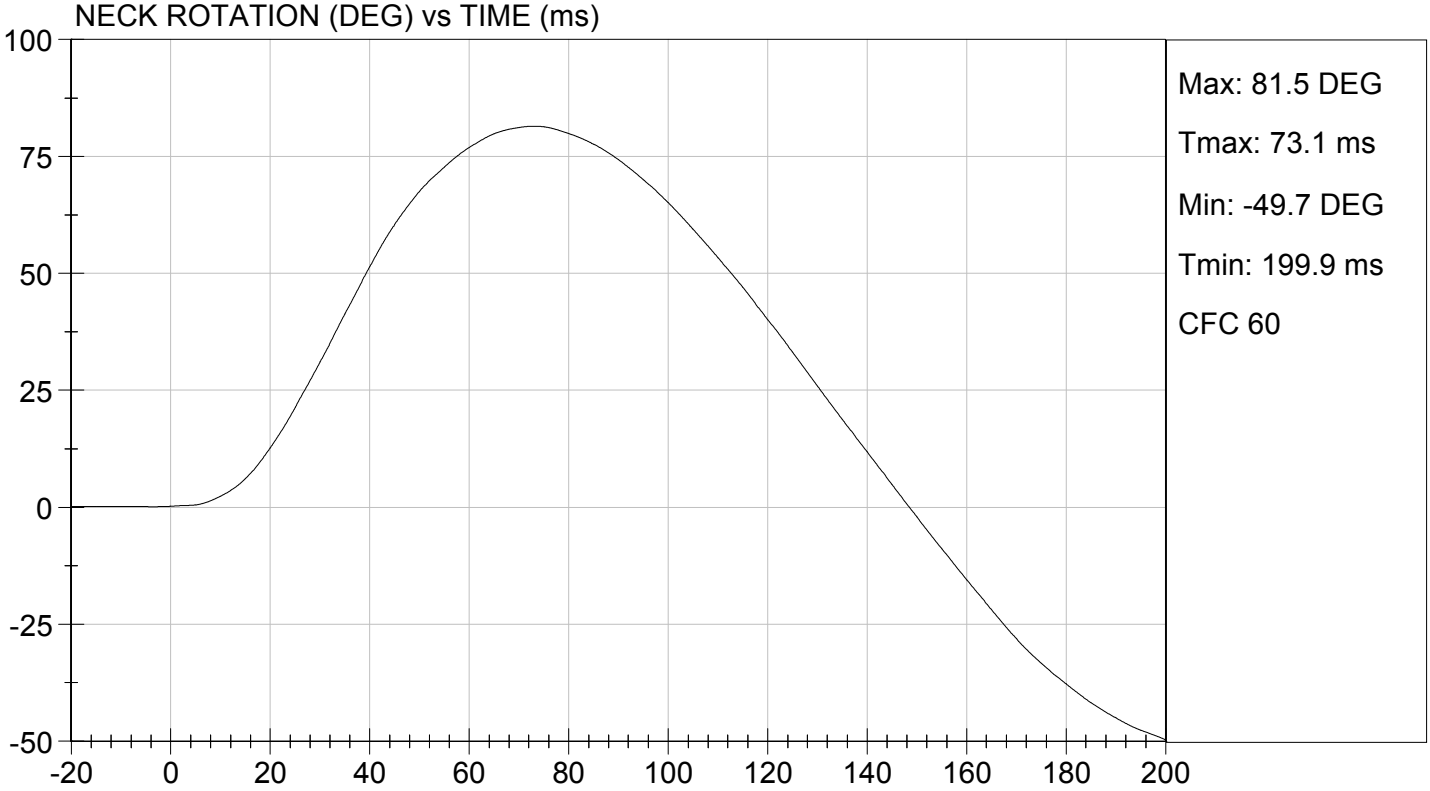
TEST DESC: NECK FLEXION
VELOCITY: 16.34 ft/s, 4.98 m/s

TEST DATE: 10/20/2015
TEST #: D153362

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

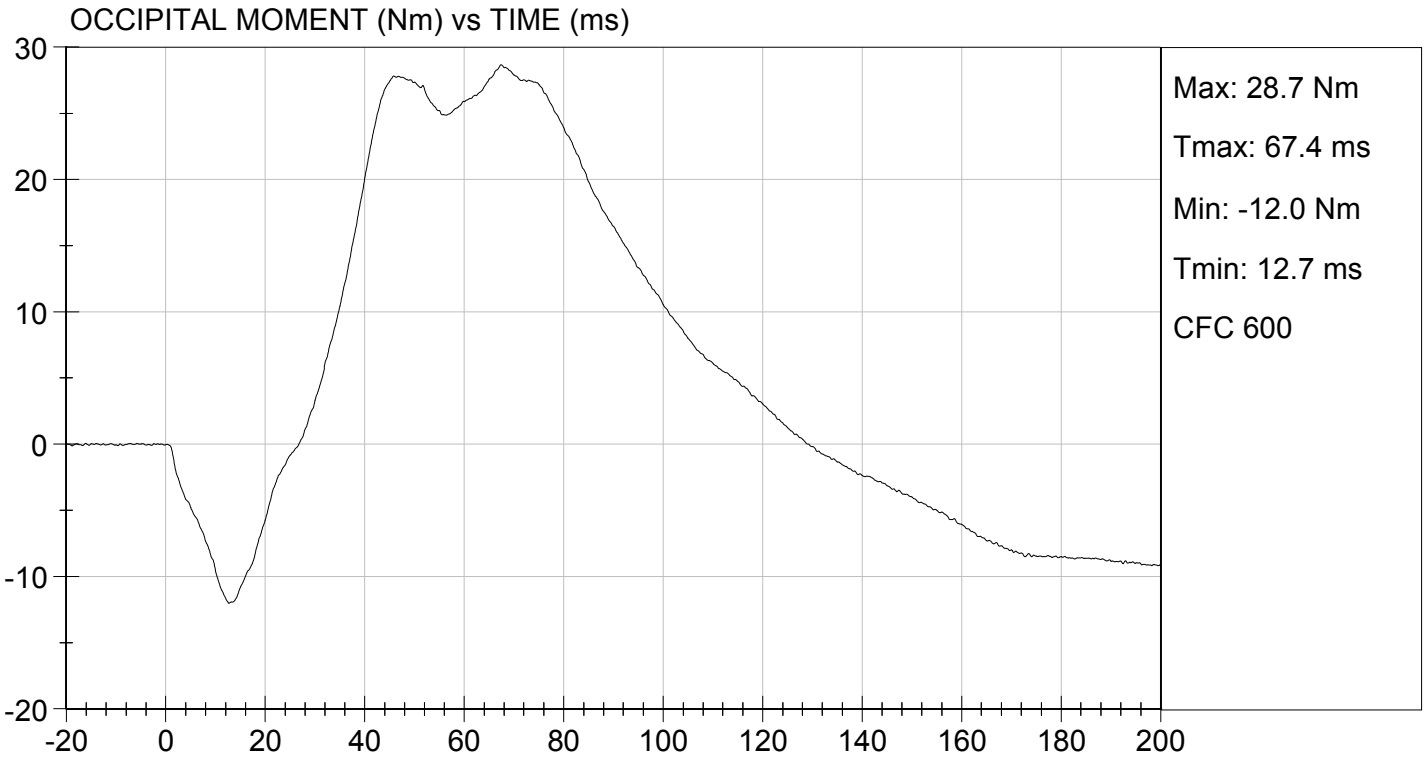


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/20/2015
TEST #: D153362



DATA SHEET C5

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

Dummy Serial Number: 155 Test Date: 10/20/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.5°C
Record the maximum humidity	36%
Record the minimum humidity	32%

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

Record findings and actions: No damage

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

Record findings and actions: No damage

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))

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

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

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.18 m/s ≤ speed ≤ 4.42 m/s	4.34 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.0 m/s ≤ ΔV ≤ 1.4 m/s	1.4 m/s
	@ 20 ms	2.2 m/s ≤ ΔV ≤ 3.0 m/s	2.7 m/s
	@ 30 ms	3.2 m/s ≤ ΔV ≤ 4.2 m/s	4.0 m/s
Plane D Rotation		Peak moment* -24 Nm ≤ moment ≤ -19 Nm during the following rotation range 85° ≤ angle ≤ 103°	-20 Nm @ 94 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm 123 ms ≤ time ≤ 147 ms	135 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(2)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

David Schoedel
Signature

10/20/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153363

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	32	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.34	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.4	Pass
	20 ms	m/s	2.2 to 3.0	2.7	Pass
	30 ms	m/s	3.2 to 4.2	4.0	Pass
D Plane Rotation	Max	deg	85 to 103	94	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-20	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	135	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

10/20/2015

Test Date

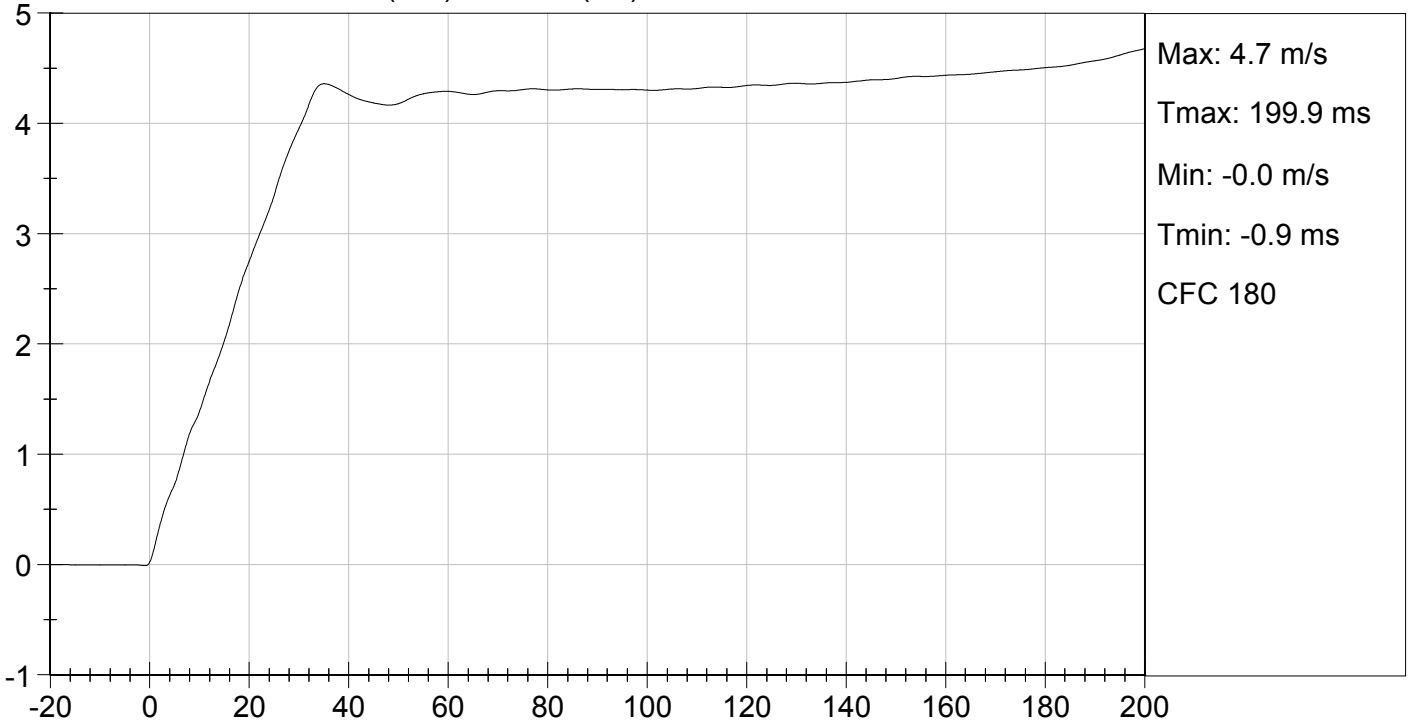
Jeff Levandoski

Approved By

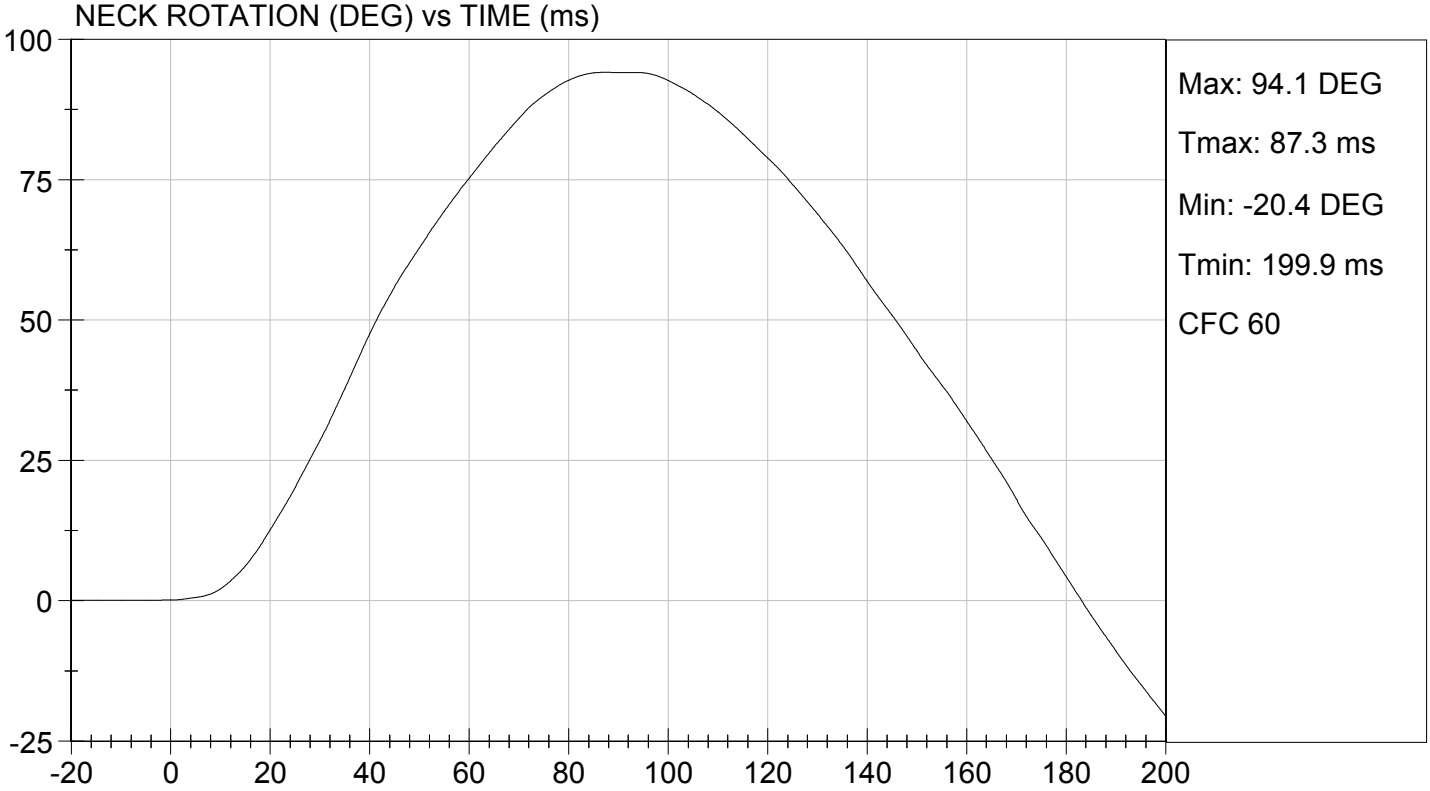
TEST DESC: NECK EXTENSION
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 10/20/2015
TEST #: D153363

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



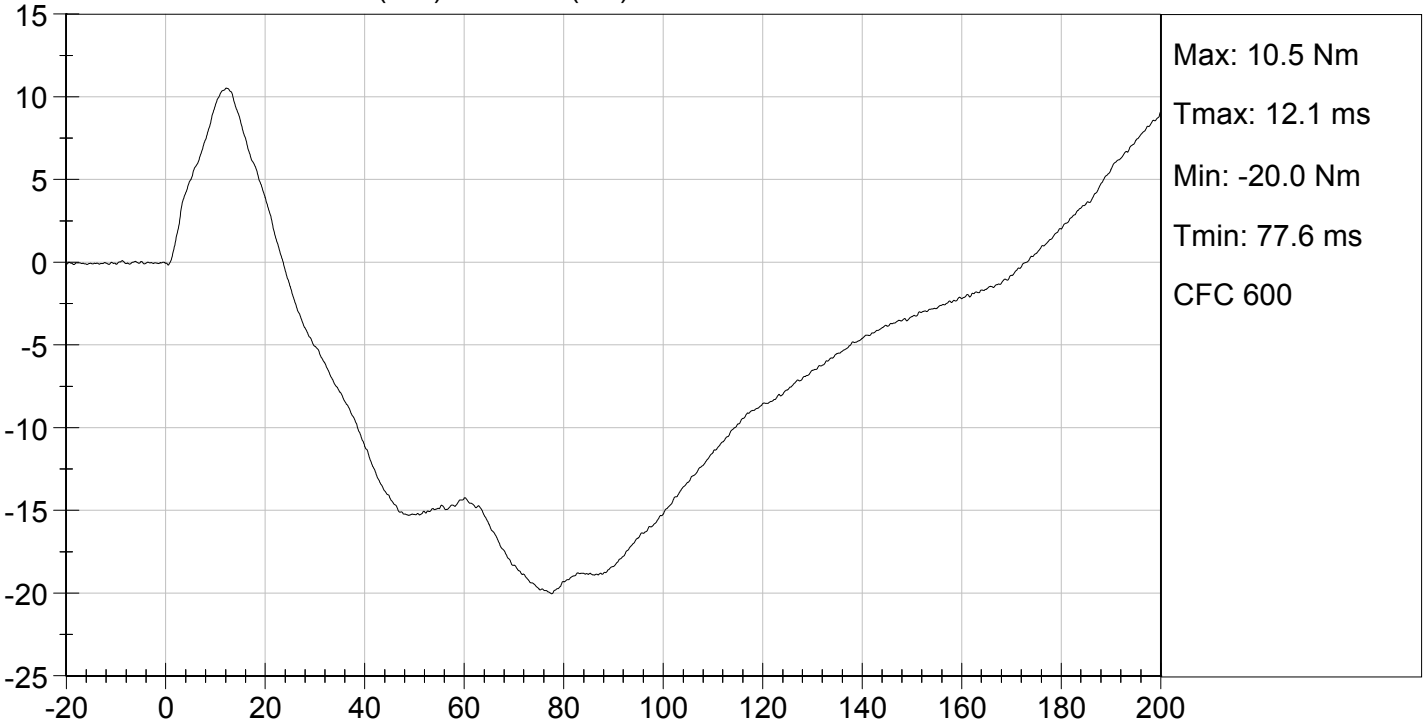
NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 10/20/2015
TEST #: D153363

OCCIPITAL MOMENT (Nm) vs TIME (ms)



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

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

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

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

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

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

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

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

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

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))

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

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

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

X 17. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.60 m/s
Chest Compression	38.0 mm ≤ compression ≤ 46.0 mm	39.1 mm
Peak force** between 38.0 and 46.0 mm chest compression	1150N ≤ peak force ≤ 1380N	1235 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force ≤ 1500 N	1306 N
Internal Hysteresis***	65% ≤ hysteresis ≤ 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
***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.

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153364

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.60	Pass
Peak Deflection	mm	38.0 to 46.0	39.1	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,235	Pass
Internal Hysteresis	%	65 to 85	72	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,306	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

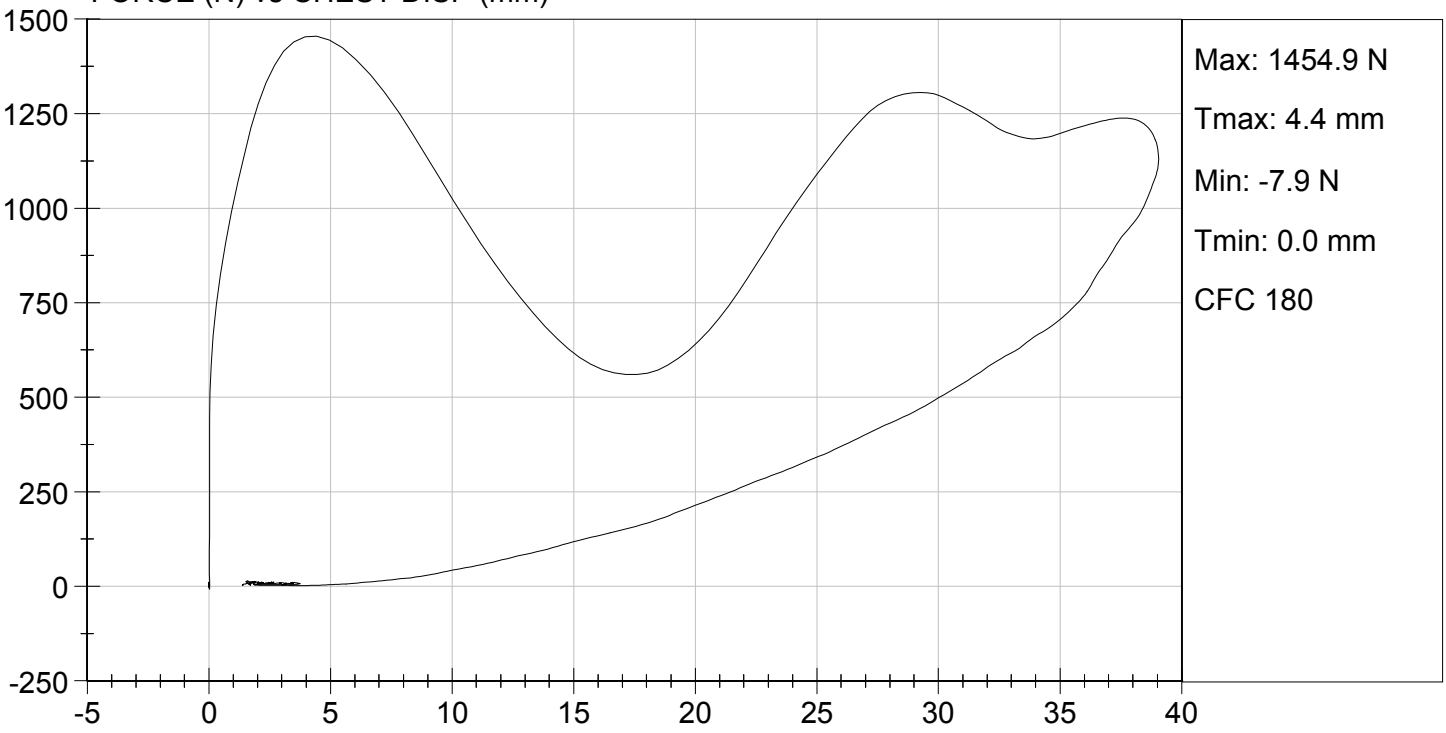
10/21/2015
Test Date

Jeff Leonardelli
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 10/21/2015
TEST #: D153364

FORCE (N) vs CHEST DISP (mm)



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

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

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

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

X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
X with legs below the femurs.
___ without legs below the femurs.

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

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

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°	14°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.6°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	164 N
Final ref. plane angle	Initial ref. plane angle ± 8°	19°

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153367

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	48	Pass
Initial Angle	deg	0 to 22	14	Pass
Return Angle	deg	+/- 8	19	Pass
Force at 45 deg	N	147 to 200	164	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.6	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardelli
Approved By

DATA SHEET C8

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

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

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

X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2450 N

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

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

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153366

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	2000 to 3000	2450	Pass
		Overall Test Results		Pass

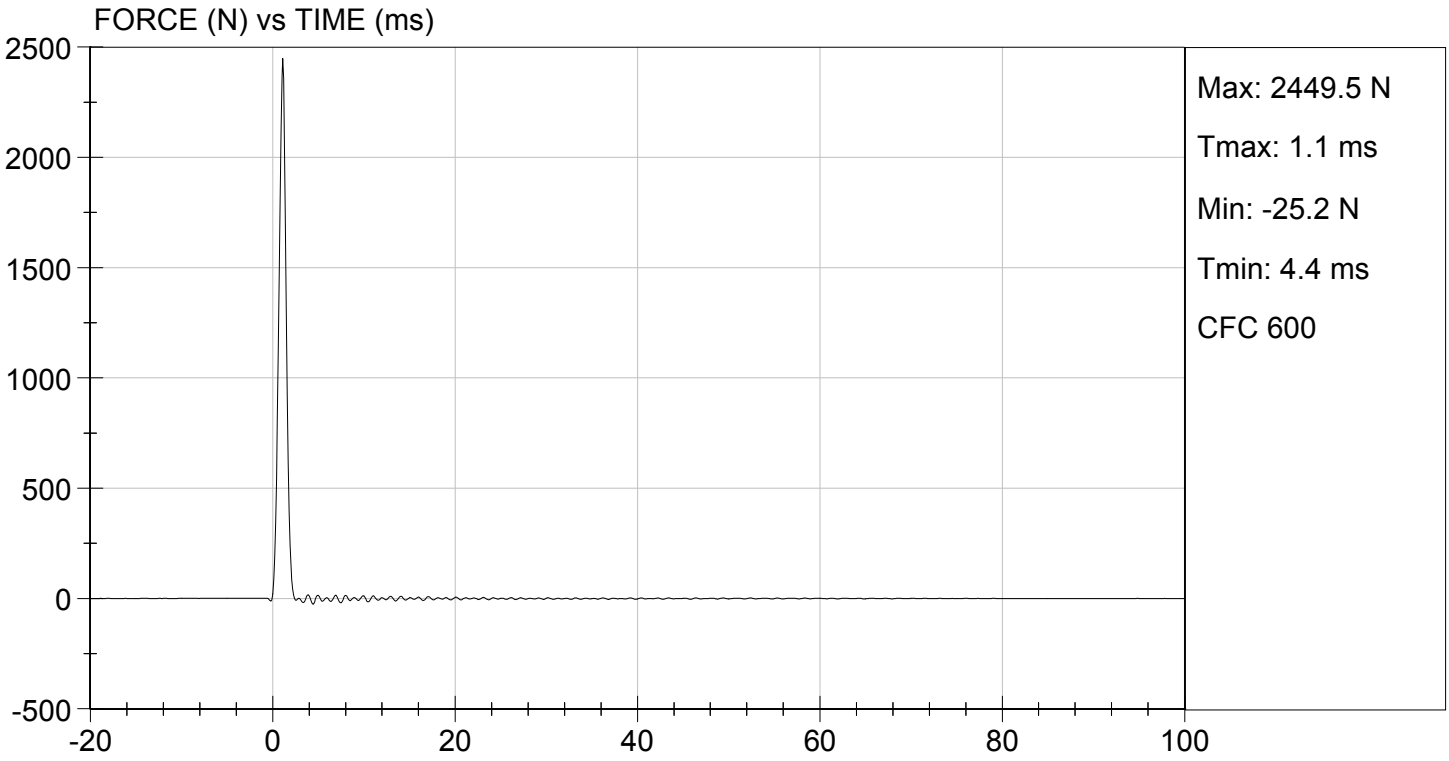
Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/21/2015
TEST #: D153366



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

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

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

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

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

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

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

X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 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.

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153365

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	44	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

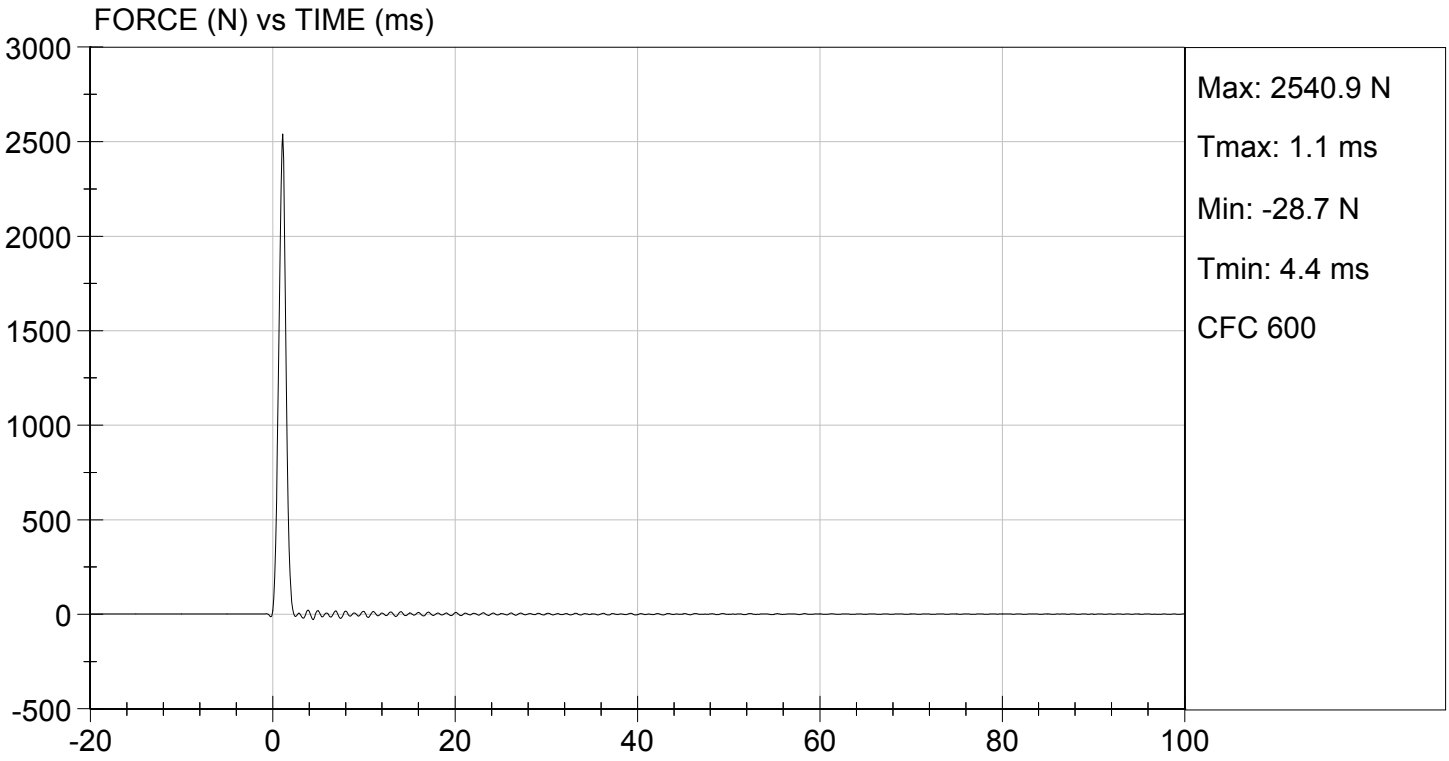
Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/21/2015
TEST #: D153365



DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79819	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79821	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79822	10/14/2015	04/14/2016
NECK TRANSDUCER	Denton	1716A	2038	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82128	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82129	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82130	10/14/2015	04/14/2016
CHEST POTENTIOMETER	Servo	08C1-3179	155	10/14/2015	04/14/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 155 Test Date: 10/28/2015

Technician: Jessica Gall

____ Pre test calibration
_X_ Post test calibration verification

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

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

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

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

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

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

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

_X_ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))

Record the maximum temperature	21.9°C
Record the minimum temperature	21.8°C
Record the maximum humidity	50%
Record the minimum humidity	49%

_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 ± 0.04 inches) by a means that ensures a smooth, instant release onto the impact surface. (572.122(b)) & (572.122(c)(4))

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

Parameter	Specification	Result
Peak resultant acceleration	245 g ≤ x ≤ 300 g	293 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	9.6 g

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

Jessica Gall

Signature

10/28/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test ID:** D153471

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	49	Pass
Peak Resultant Acceleration	G's	245 to 300	293	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	9.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

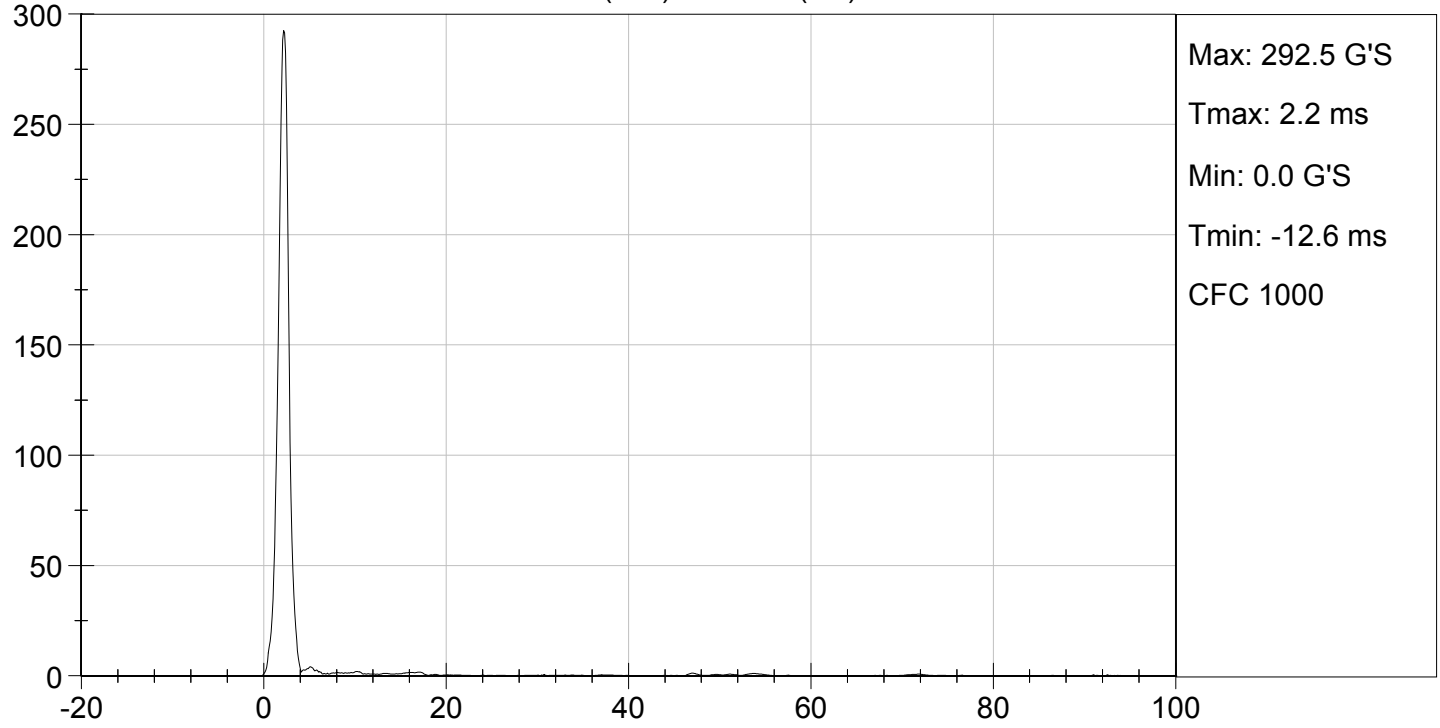
10/28/2015
Test Date

Jeff Leonardelli
Approved By

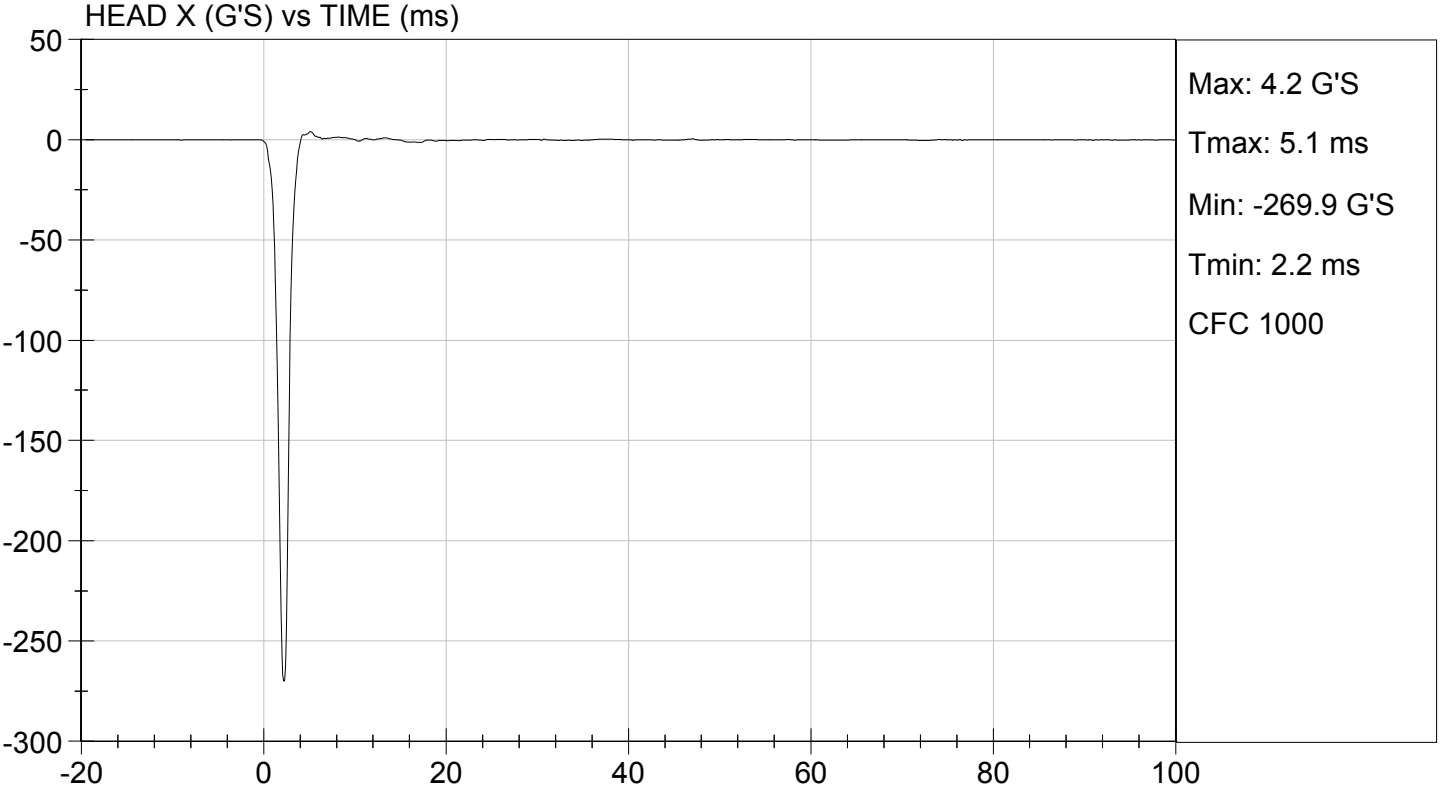
TEST DESC: HEAD DROP

TEST DATE: 10/28/2015
TEST #: D153471

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



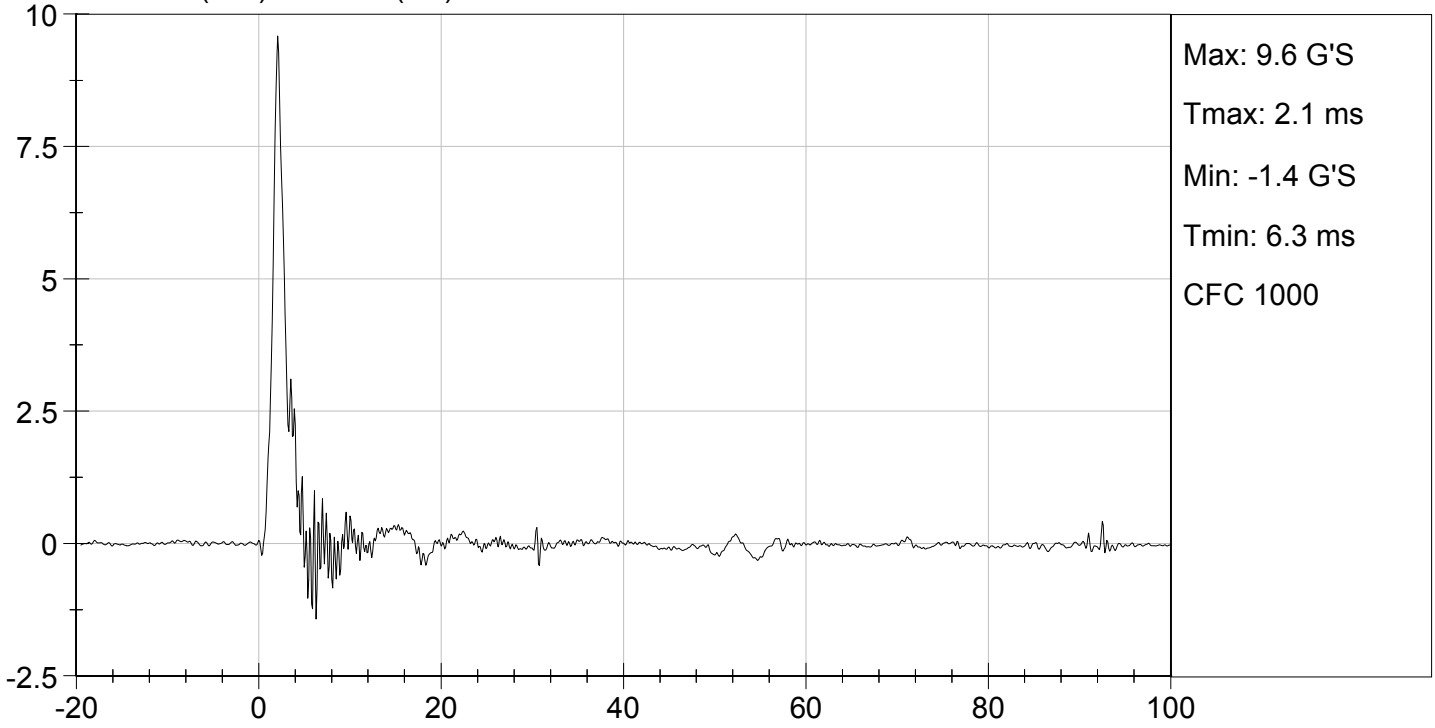
HEAD X (G'S) vs TIME (ms)



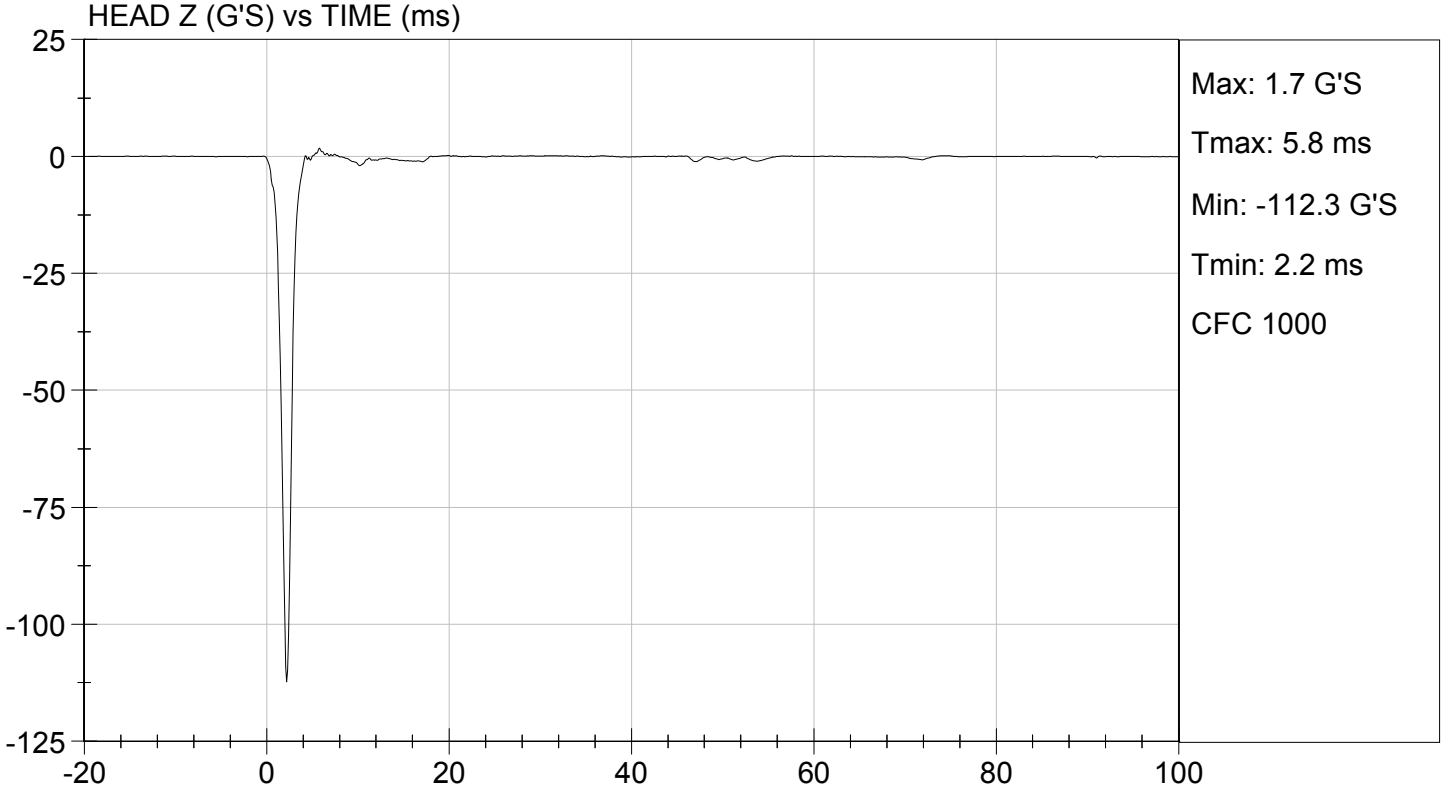
TEST DESC: HEAD DROP

TEST DATE: 10/28/2015
TEST #: D153471

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



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



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

Dummy Serial Number: 155 Test Date: 10/28/2015

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 S572.122. Data from the accelerometers are not required. (572.123(b))

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

Record the maximum temperature	21.9°C
Record the minimum temperature	21.8°C
Record the maximum humidity	50%
Record the minimum humidity	49%

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

X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
Record findings and actions: No damage

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123l(3))

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

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

X 12. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.83 m/s ≤ speed ≤ 5.07 m/s	5.03 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.2 m/s ≤ ΔV ≤ 1.6 m/s	1.6 m/s
	@ 20 ms	2.4 m/s ≤ ΔV ≤ 3.4 m/s	3.1 m/s
	@ 30 ms	3.8 m/s ≤ ΔV ≤ 5.0 m/s	4.4 m/s
Plane D Rotation		Peak moment* 27 Nm ≤ moment ≤ 33 Nm during the following rotation range 74° ≤ angle ≤ 92°	29 Nm @ 78 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm 103 ms ≤ time ≤ 123 ms	112 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(1)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

Jessica Hall
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153472

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	49	Pass
Pendulum Speed		m/s	4.83 to 5.07	5.03	Pass
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.6	Pass
	20 ms	m/s	2.4 to 3.4	3.1	Pass
	30 ms	m/s	3.8 to 5.0	4.4	Pass
D Plane Rotation	Max	deg	74 to 92	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	27 to 33	29	Pass
Positive Moment Time Curve Decay to 5 Nm		ms	103 to 123	112	Pass
			Overall Results		Pass

Jessica Hall

Laboratory Technician

10/28/2015

Test Date

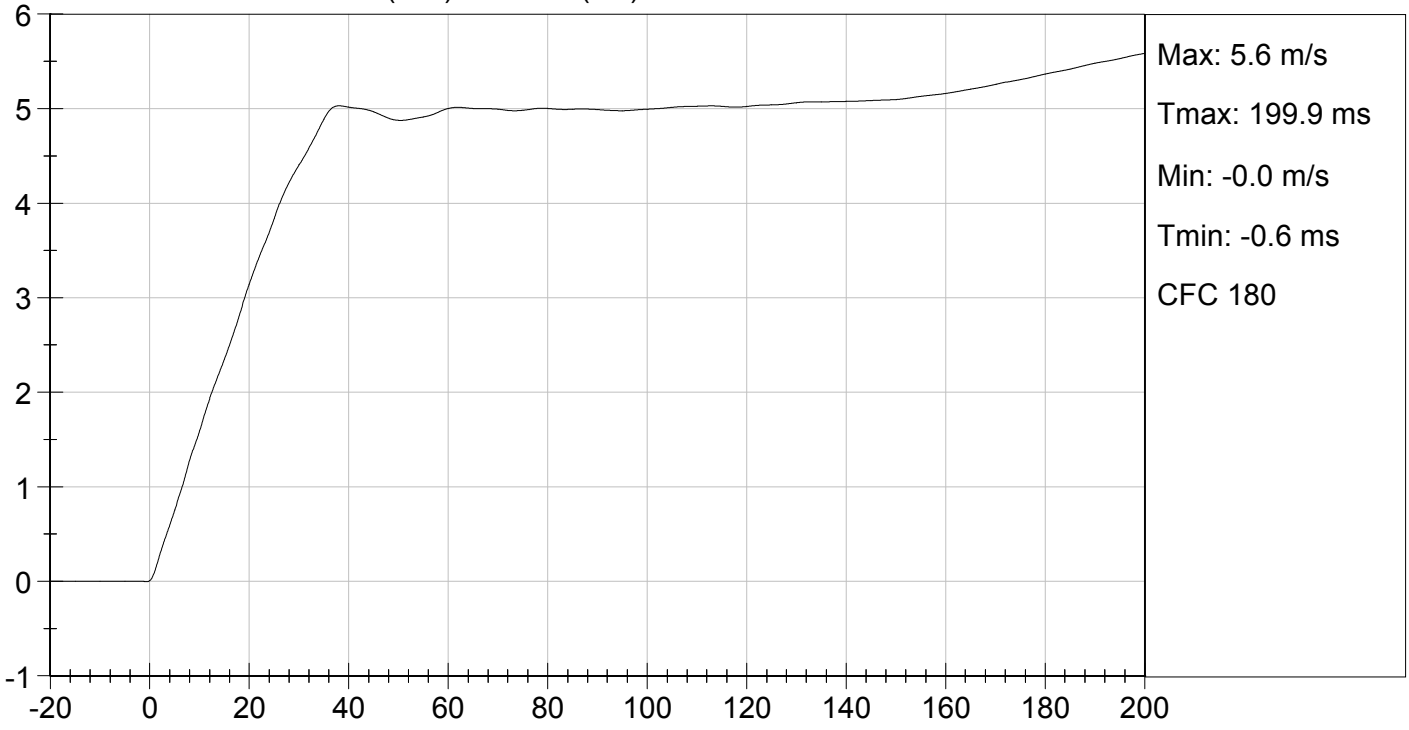
Jeff Leonardelli

Approved By

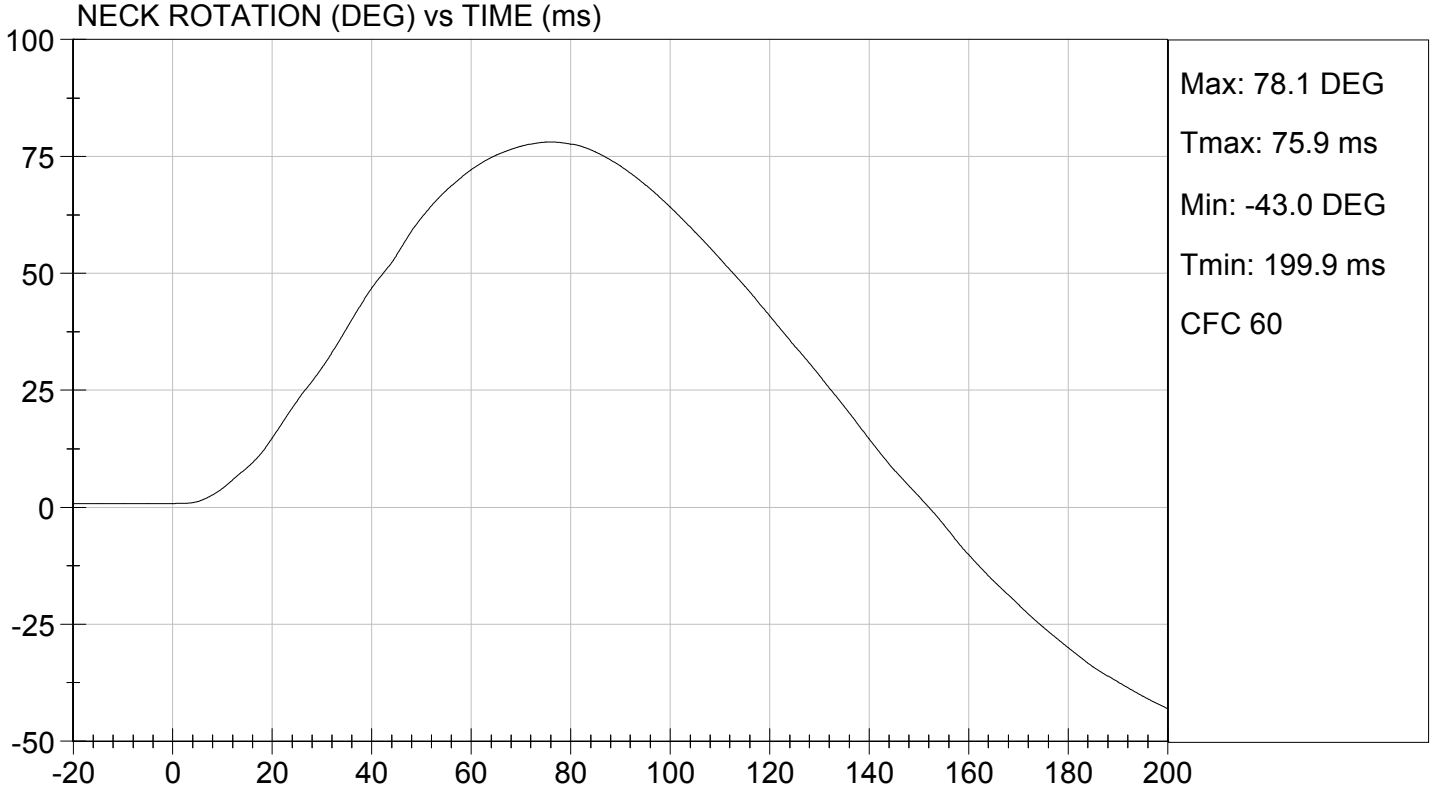
TEST DESC: NECK FLEXION
VELOCITY: 16.50 ft/s, 5.03 m/s

TEST DATE: 10/28/2015
TEST #: D153472

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



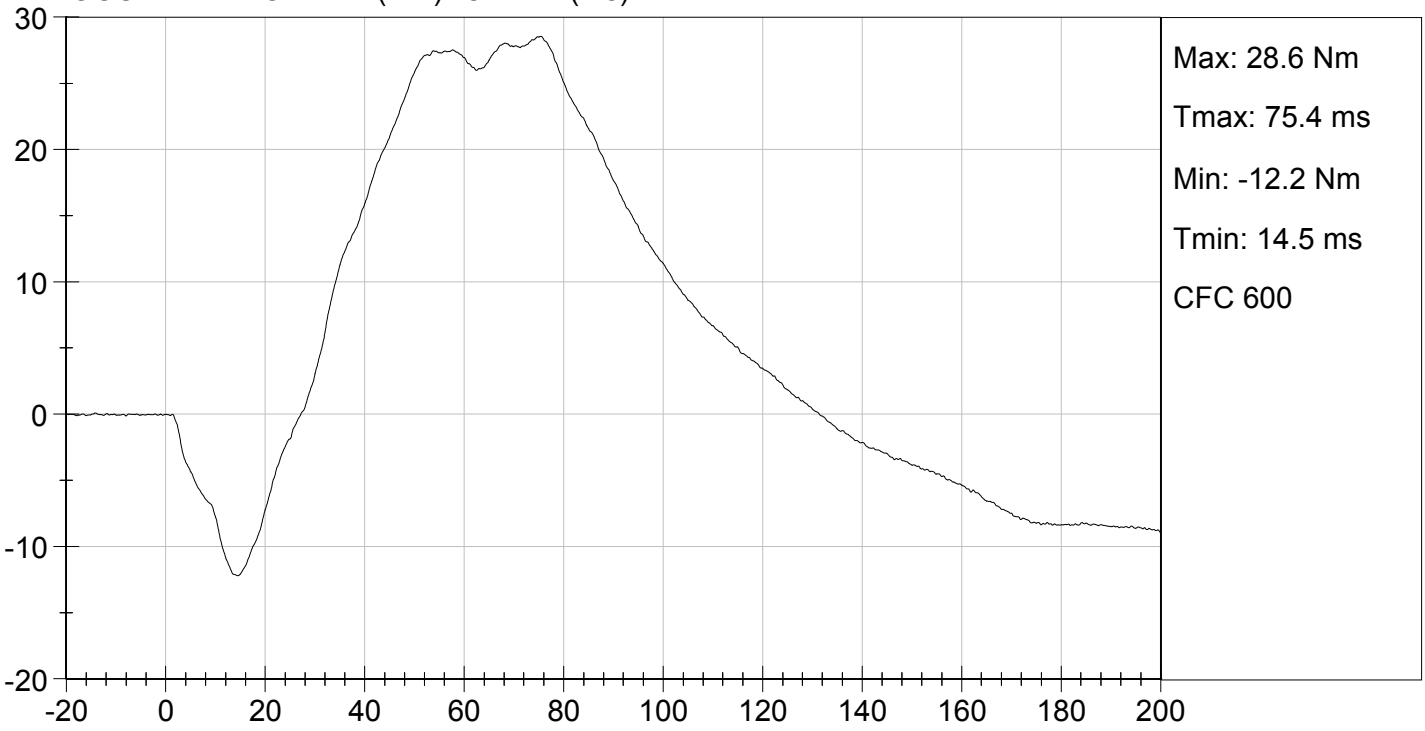
NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 16.50 ft/s, 5.03 m/s

TEST DATE: 10/28/2015
TEST #: D153472

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET C5

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

Dummy Serial Number: 155 Test Date: 10/28/2015

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	21.9°C
Record the minimum temperature	21.8°C
Record the maximum humidity	50%
Record the minimum humidity	49%

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

Record findings and actions: No damage

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

Record findings and actions: No damage

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

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

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

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))

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

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

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.18 m/s ≤ speed ≤ 4.42 m/s	4.42 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.0 m/s ≤ ΔV ≤ 1.4 m/s	1.4 m/s
	@ 20 ms	2.2 m/s ≤ ΔV ≤ 3.0 m/s	2.8 m/s
	@ 30 ms	3.2 m/s ≤ ΔV ≤ 4.2 m/s	4.0 m/s
Plane D Rotation		Peak moment* -24 Nm ≤ moment ≤ -19 Nm during the following rotation range 85° ≤ angle ≤ 103°	-21 Nm @ 93 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm 123 ms ≤ time ≤ 147 ms	134 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(2)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

Jessica Hall
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153473

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	49	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	4.0	Pass
D Plane Rotation	Max	deg	85 to 103	93	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-21	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	134	Pass
			Overall Results		Pass

Jessica Hall
Laboratory Technician

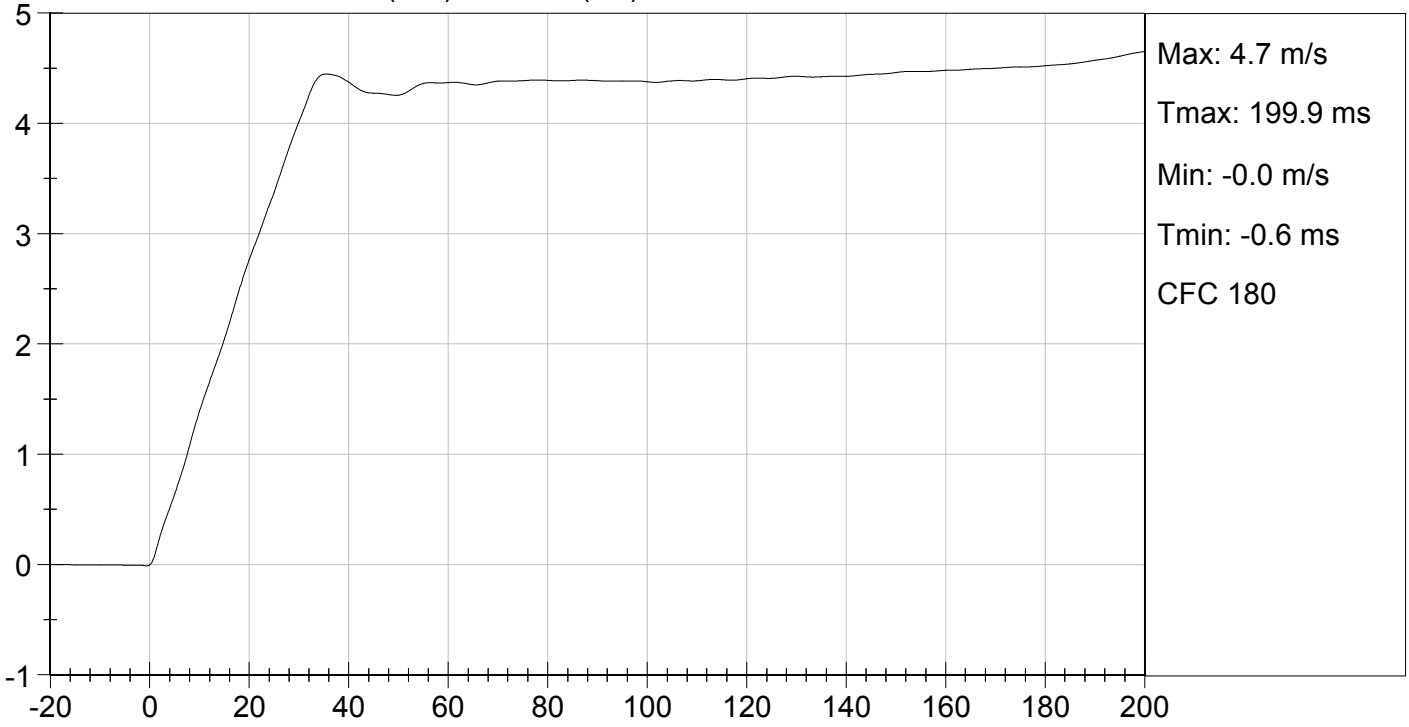
10/28/2015
Test Date

Jeff Leonardelli
Approved By

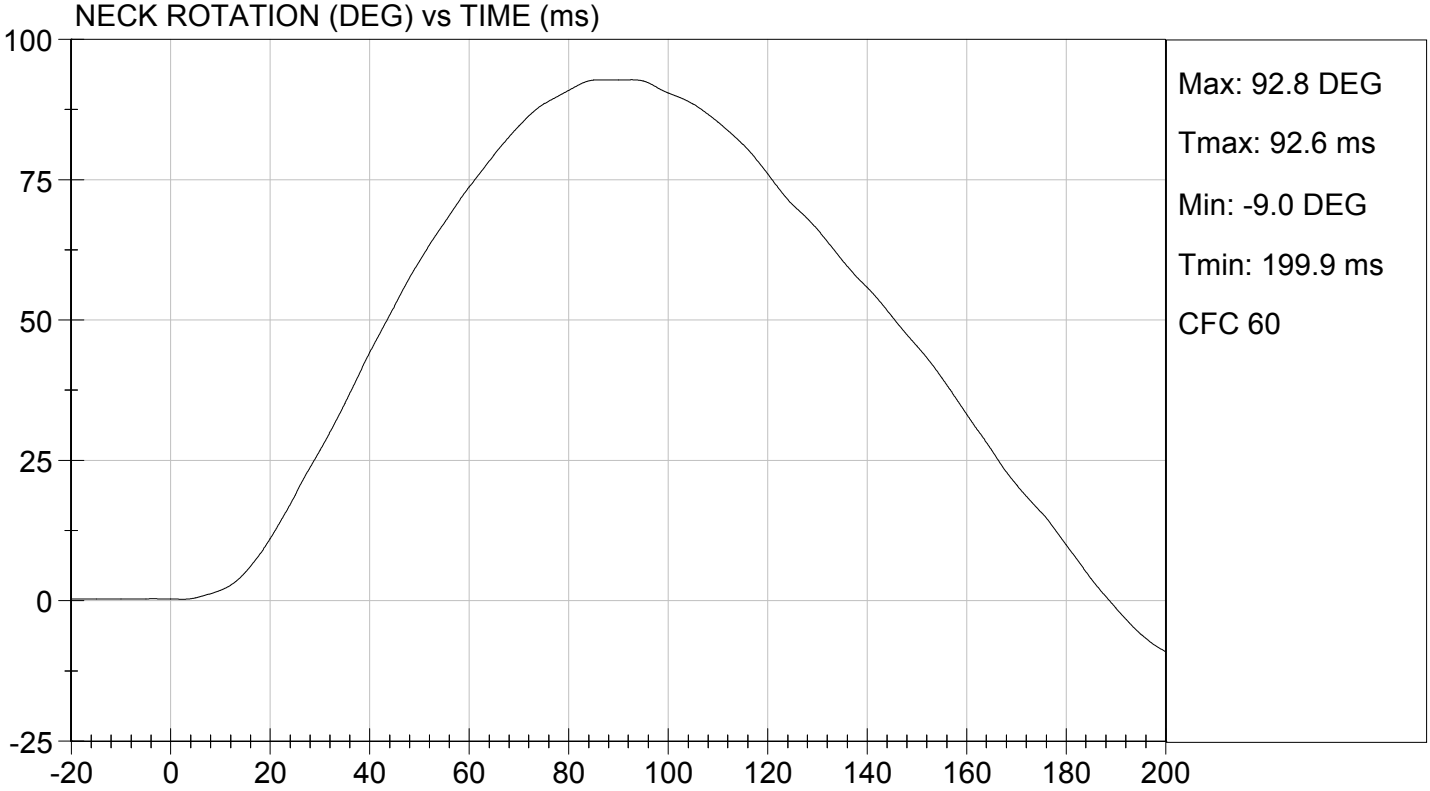
TEST DESC: NECK EXTENSION
VELOCITY: 14.49 ft/s, 4.42 m/s

TEST DATE: 10/28/2015
TEST #: D153473

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



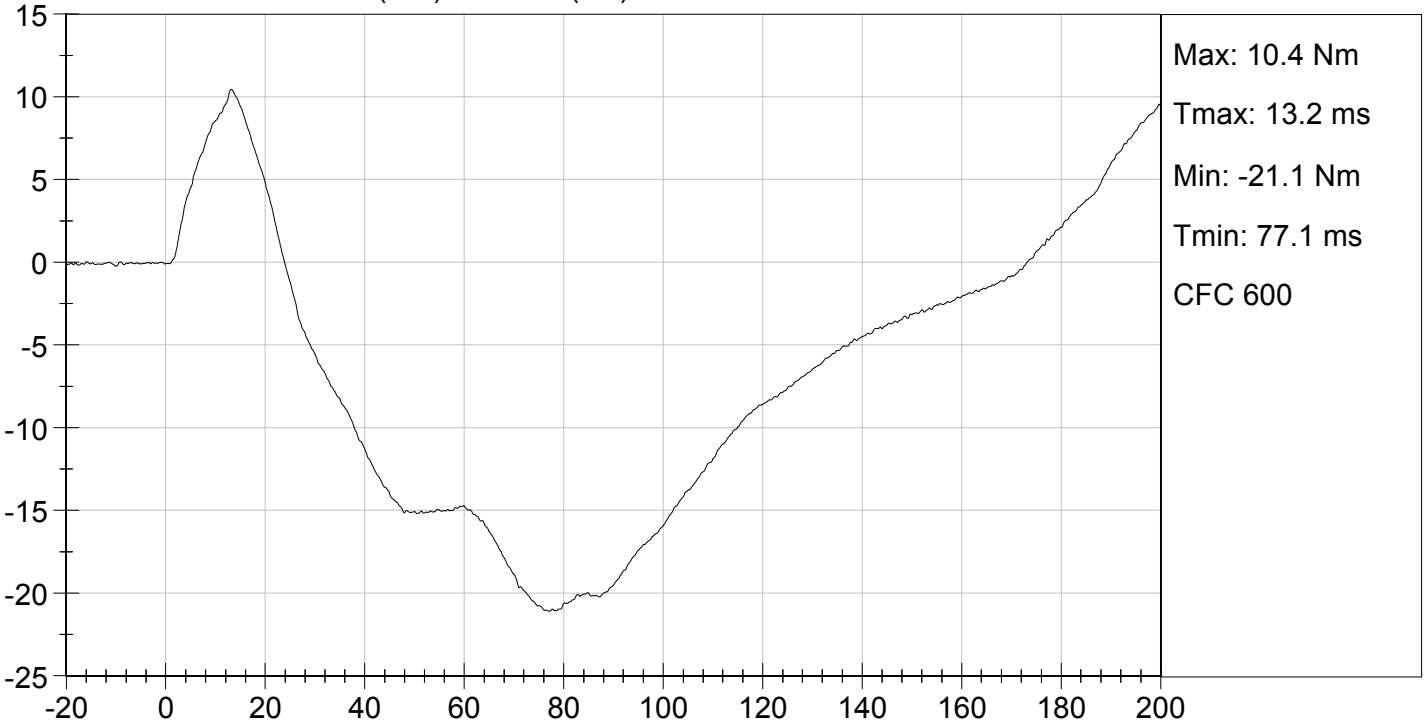
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/28/2015
TEST #: D153473

OCCIPITAL MOMENT (Nm) vs TIME (ms)



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

Dummy Serial Number: 155 Test Date: 10/29/2015

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 thorax impact test. (572.127(o))
X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature	21.7°C
Record the minimum temperature	20.9°C
Record the maximum humidity	41%
Record the minimum humidity	39%

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

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

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

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

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

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

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

X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.

X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.

X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))

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

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

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

X 17. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.77 m/s
Chest Compression	38.0 mm ≤ compression ≤ 46.0 mm	41.3 mm
Peak force** between 38.0 and 46.0 mm chest compression	1150N ≤ peak force ≤ 1380N	1329 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force ≤ 1500 N	1360 N
Internal Hysteresis***	65% ≤ hysteresis ≤ 85%	78%

*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

10/29/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153474

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	38.0 to 46.0	41.3	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,329	Pass
Internal Hysteresis	%	65 to 85	78	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,360	Pass
		Overall Test Results		Pass

Jessica Hall
Laboratory Technician

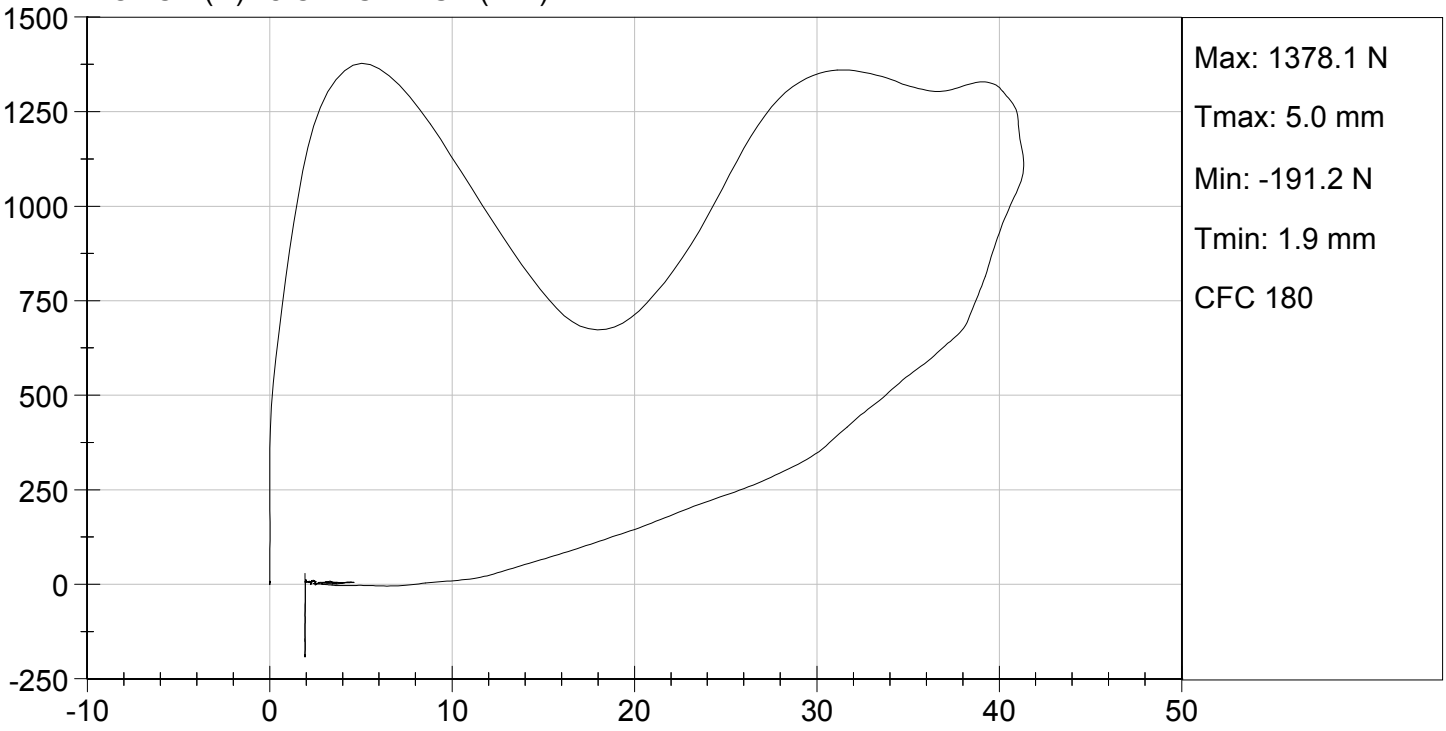
10/29/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/29/2015
TEST #: D153474

FORCE (N) vs CHEST DISP (mm)



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

Dummy Serial Number: 155 Test Date: 10/29/2015

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. (572.127(o))
X N/A, ONLY one torso flexion test performed

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

X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
X with legs below the femurs.
____ without legs below the femurs.

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

Record the maximum temperature	21.9°C
Record the minimum temperature	21.8°C
Record the maximum humidity	50%
Record the minimum humidity	49%

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°	14°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.7°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	163 N
Final ref. plane angle	Initial ref. plane angle ± 8°	19°

Jack Coleman
Signature

10/29/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153477

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.9	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Initial Angle	deg	0 to 22	14	Pass
Return Angle	deg	+/- 8	19	Pass
Force at 45 deg	N	147 to 200	163	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

10/29/2015
Test Date

Jeff Leonardi
Approved By

DATA SHEET C8

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

Dummy Serial Number: 155 Test Date: 10/28/2015

Technician: Jessica Gall

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one knee impact test performed

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

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

_X_ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.9°C
Record the minimum temperature	21.8°C
Record the maximum humidity	50%
Record the minimum humidity	49%

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

_X_ 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

_X_ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2178 N

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

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

Jessica Hall

Signature

10/28/2015

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153476

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	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	2000 to 3000	2178	Pass
		Overall Test Results		Pass

Jessica Hall

Laboratory Technician

10/28/2015

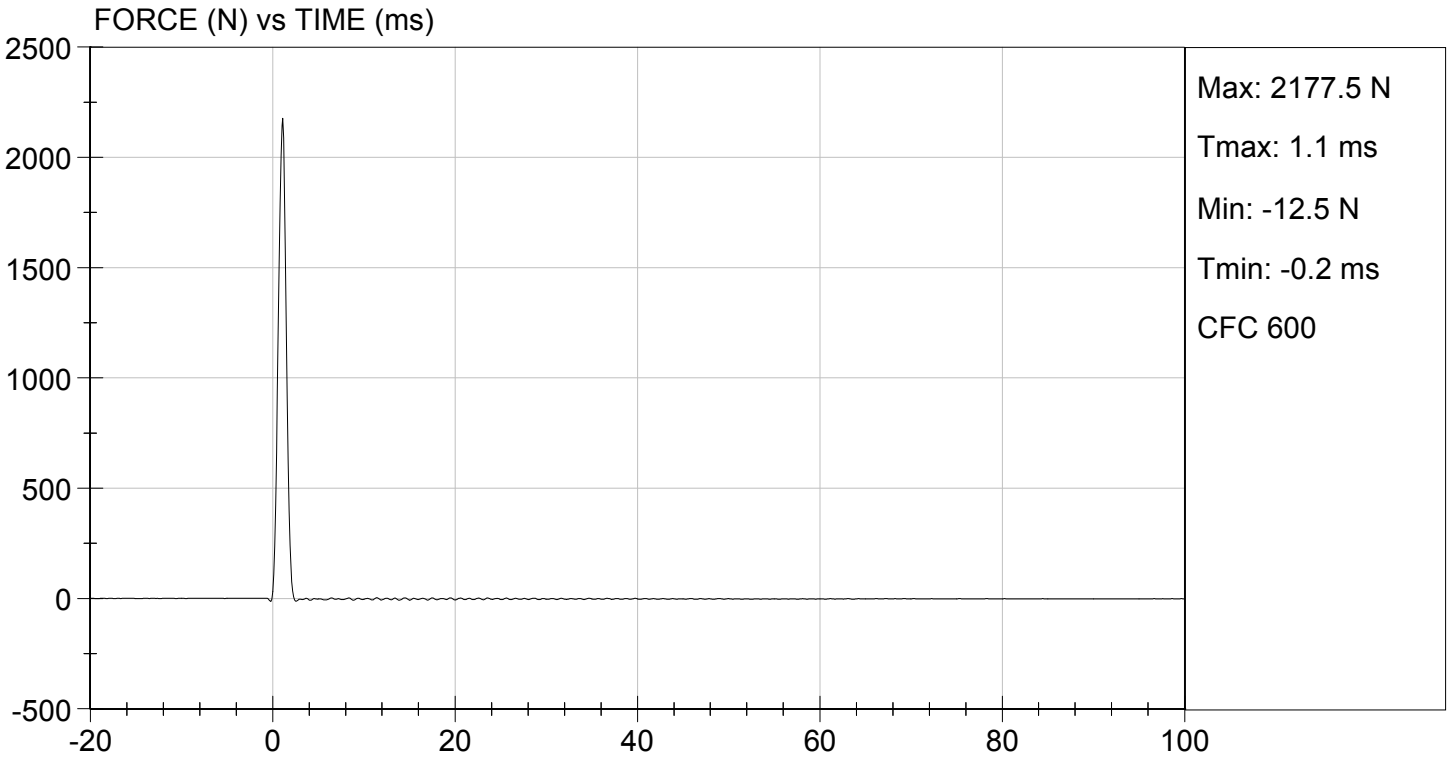
Test Date

Jeff Leonardelli

Approved By

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

TEST DATE: 10/28/2015
TEST #: D153476



DATA SHEET C9

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

Dummy Serial Number: 155 Test Date: 10/28/2015

Technician: Jessica Gall

____ Pre test calibration

__X__ Post test calibration verification

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

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

__X__ N/A, ONLY one knee impact test performed

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

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

__X__ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.9°C
Record the minimum temperature	21.8°C
Record the maximum humidity	50%
Record the minimum humidity	49%

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

__X__ 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

__X__ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2506 N

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

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

Jessica Gall
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153475

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	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	2000 to 3000	2506	Pass
		Overall Test Results		Pass

Jessica Hall

Laboratory Technician

10/28/2015

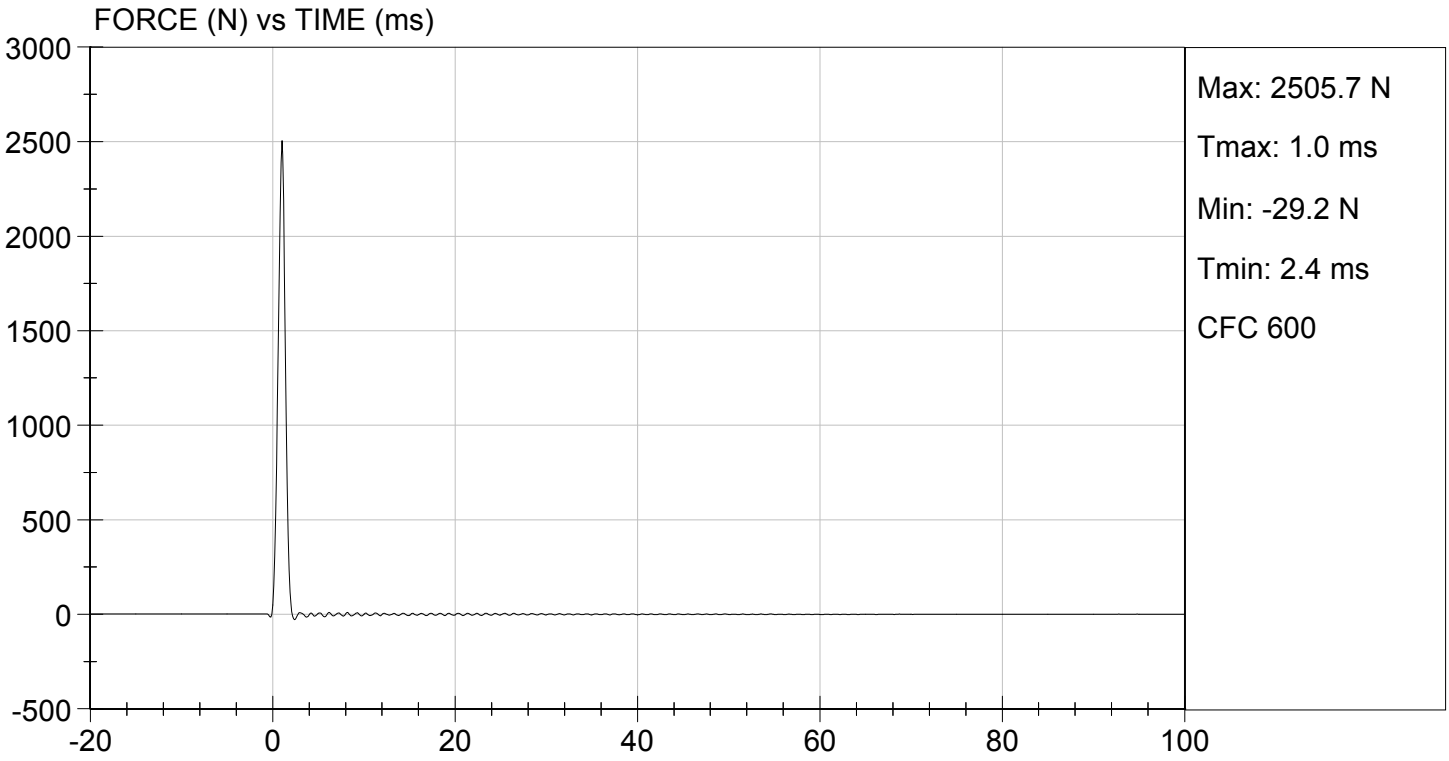
Test Date

Jeff Leonardelli

Approved By

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

TEST DATE: 10/28/2015
TEST #: D153475



DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79819	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79821	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79822	10/14/2015	04/14/2016
NECK TRANSDUCER	Denton	1716A	2038	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82128	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82129	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82130	10/14/2015	04/14/2016
CHEST POTENTIOMETER	Servo	08C1-3179	155	10/14/2015	04/14/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Gall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 155 Test Date: 10/26/2015

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 — 10/29/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 10/29/2015

Signature — Date