REPORT NO. 208-MGA-2014-DC019

DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208

FIAT GROUP AUTOS S.P.A.
2014 FIAT 500L MPV
NHTSA NO.: C20140306

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

TEST DATE: DECEMBER 16, 2014

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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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EXTERNAL DIMENSIONS

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

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

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

Dummy Serial Number: 510 Test Date: 11/18/2014

Technician: Maxime Chamberland

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:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

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	284 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	7.1 g

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

Maxime Chamberland
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test ID:** D144051

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

Maxime Chamberland
Laboratory Technician

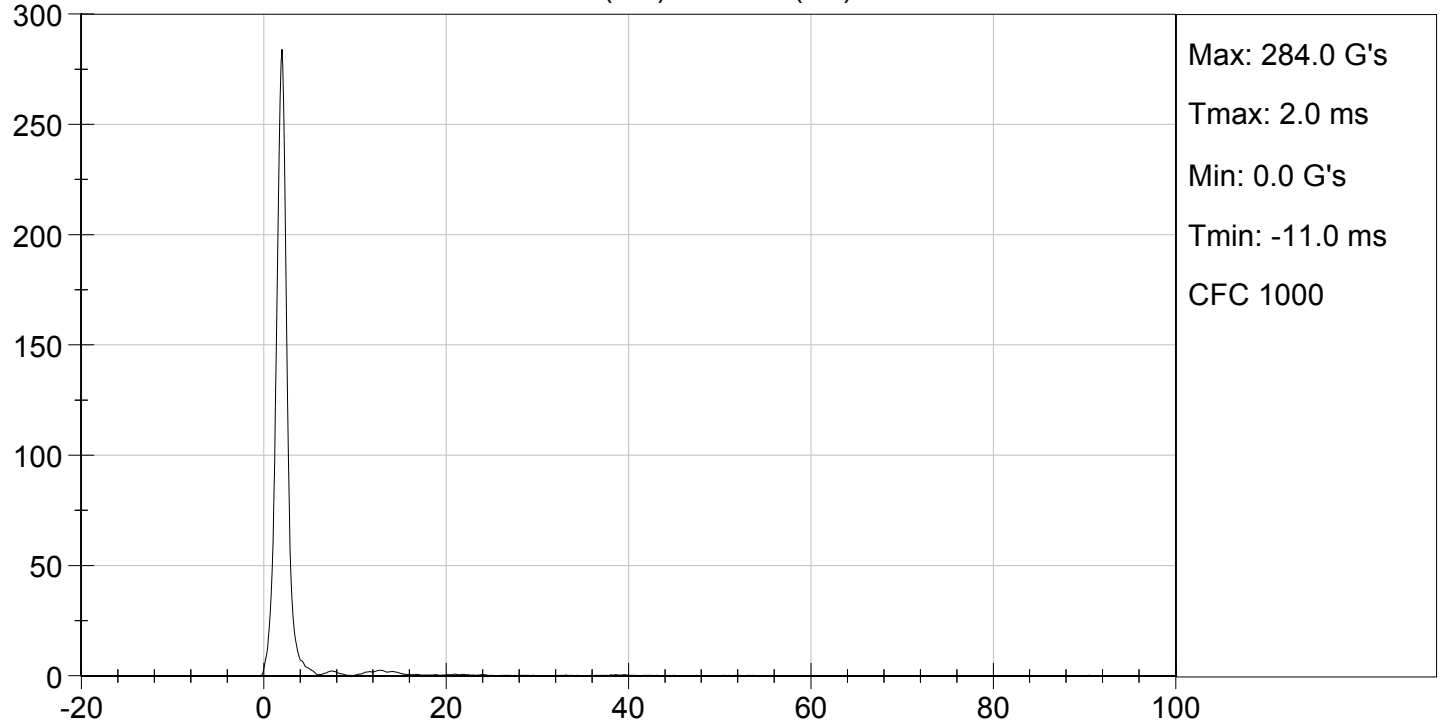
11/18/2014
Test Date

Jeff Leonardelli
Approved By

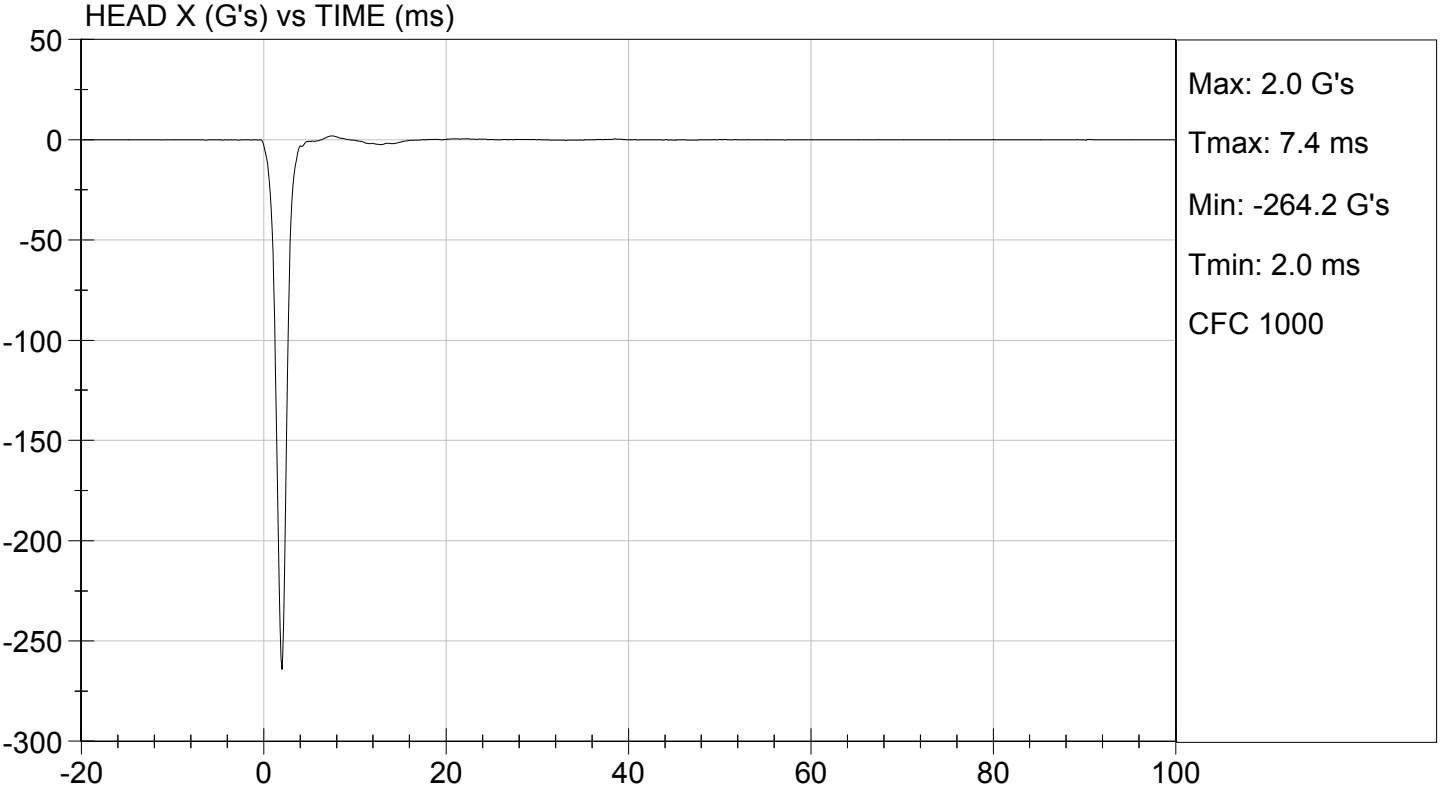
TEST DESC: HEAD DROP

TEST DATE: 11/18/2014
TEST #: D144051

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



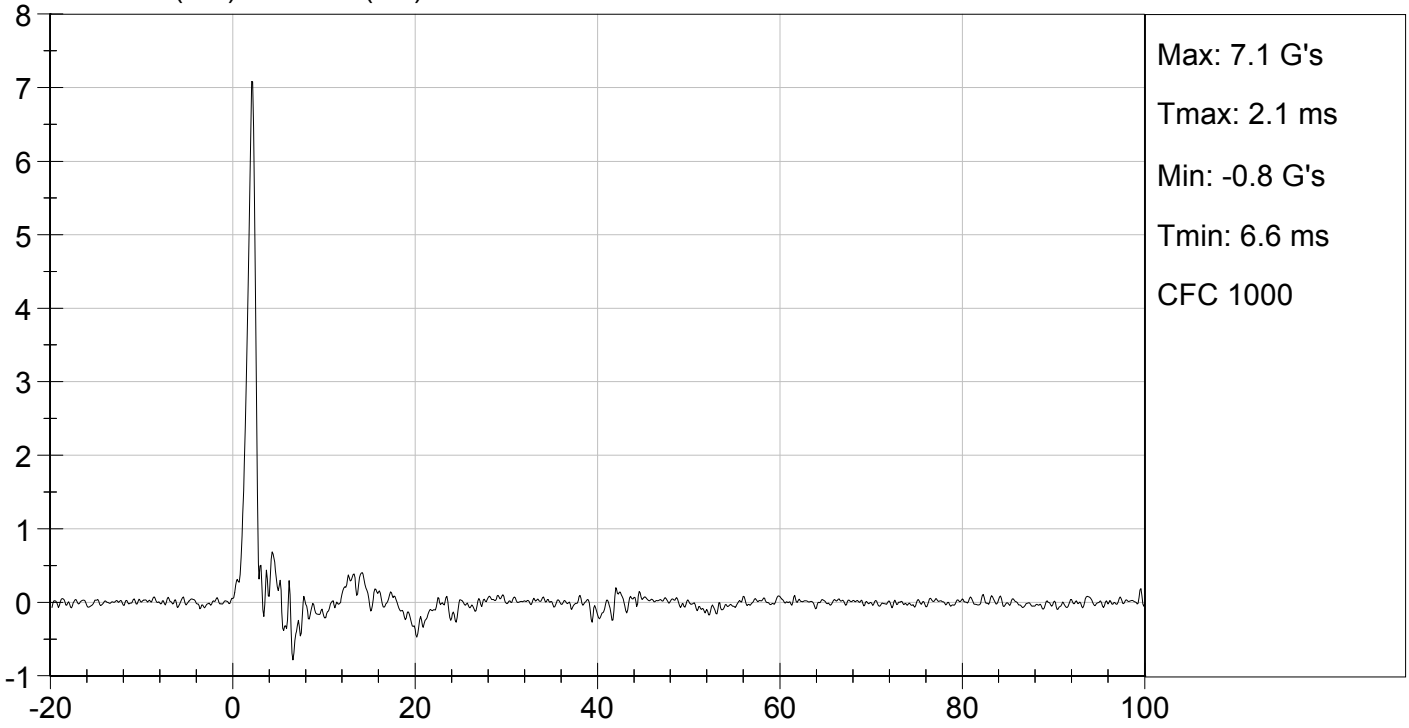
HEAD X (G's) vs TIME (ms)



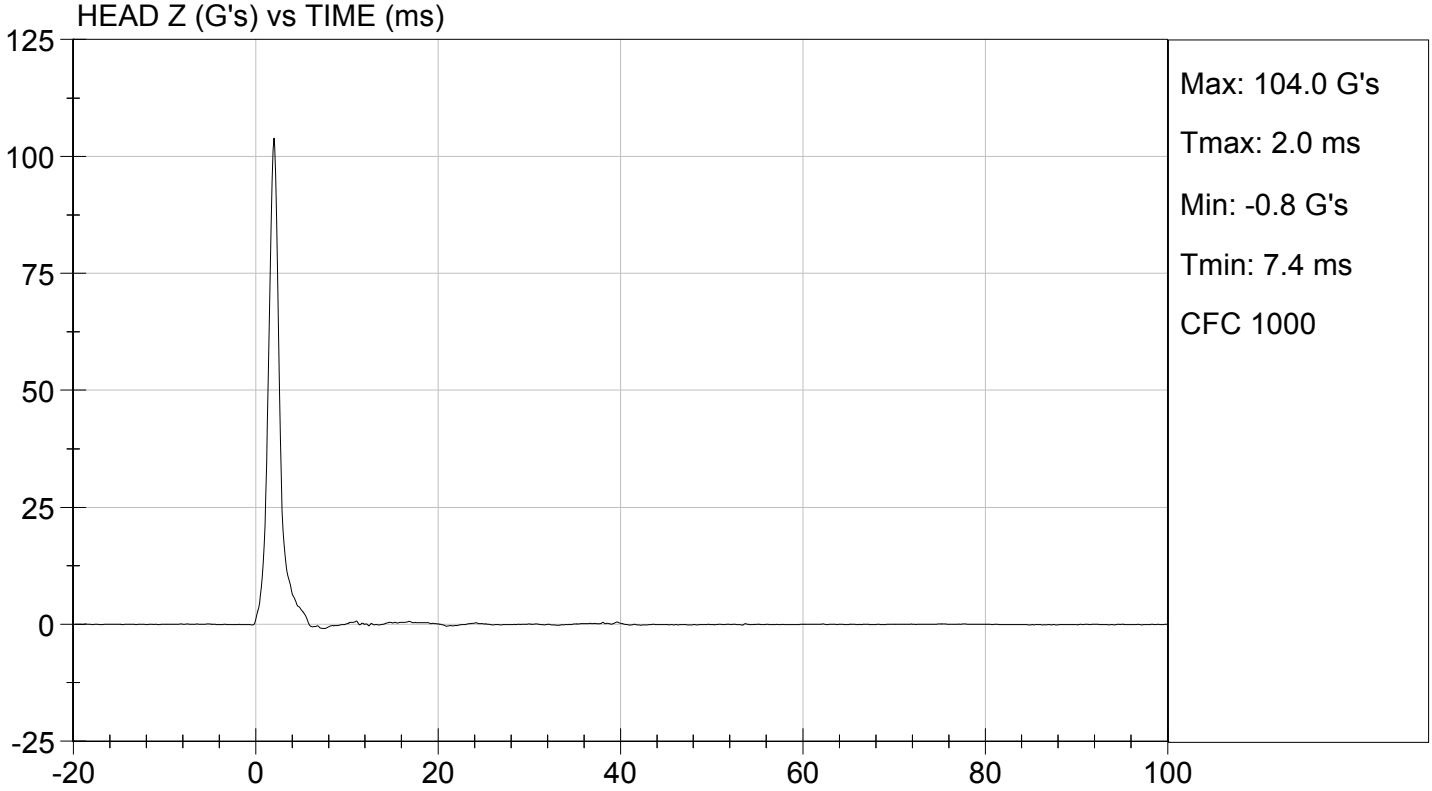
TEST DESC: HEAD DROP

TEST DATE: 11/18/2014
TEST #: D144051

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: 510 Test Date: 11/18/2014

Technician: Jack Coleman

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:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

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	4.3 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	5.8 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	69 Nm @ 81 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	89 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

11/18/2014
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144052

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

Jack Coleman
Laboratory Technician

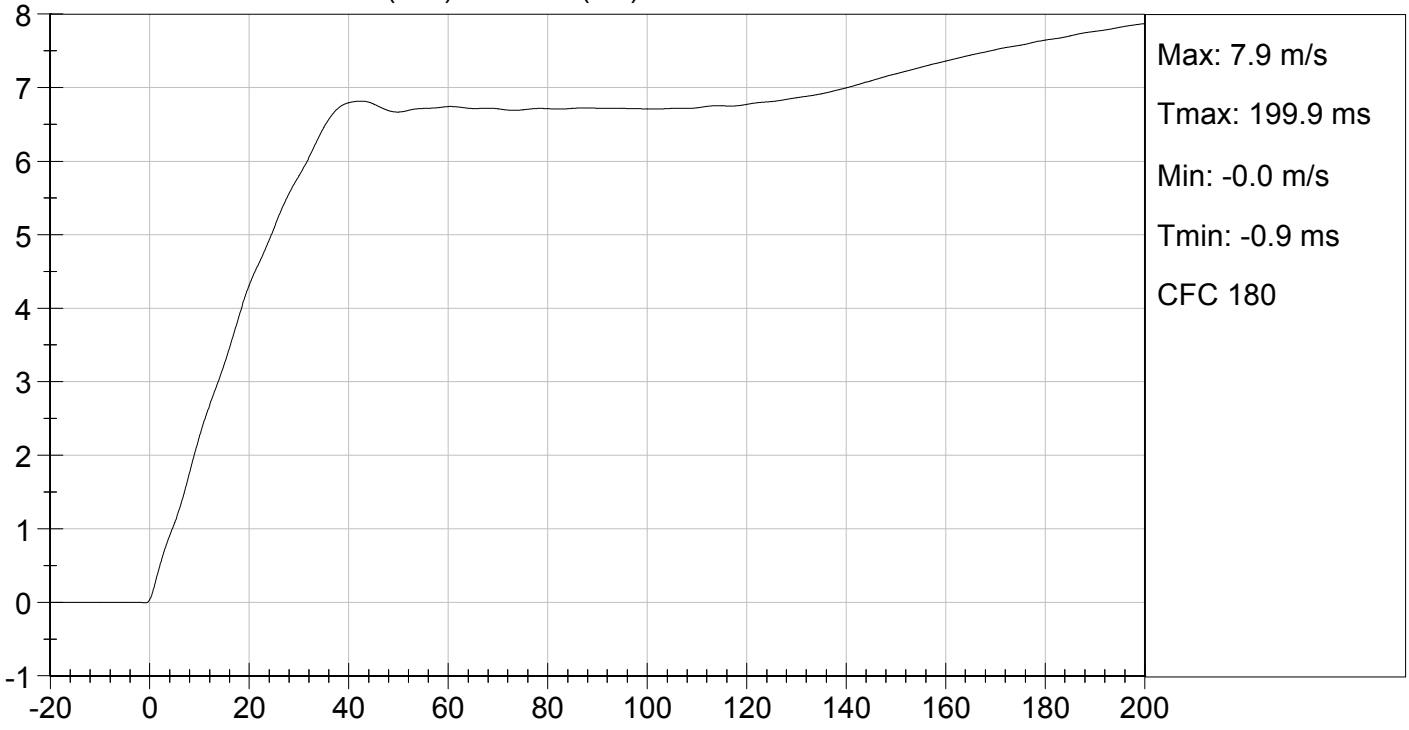
11/18/2014
Test Date

Jeff Leonardelli
Approved By

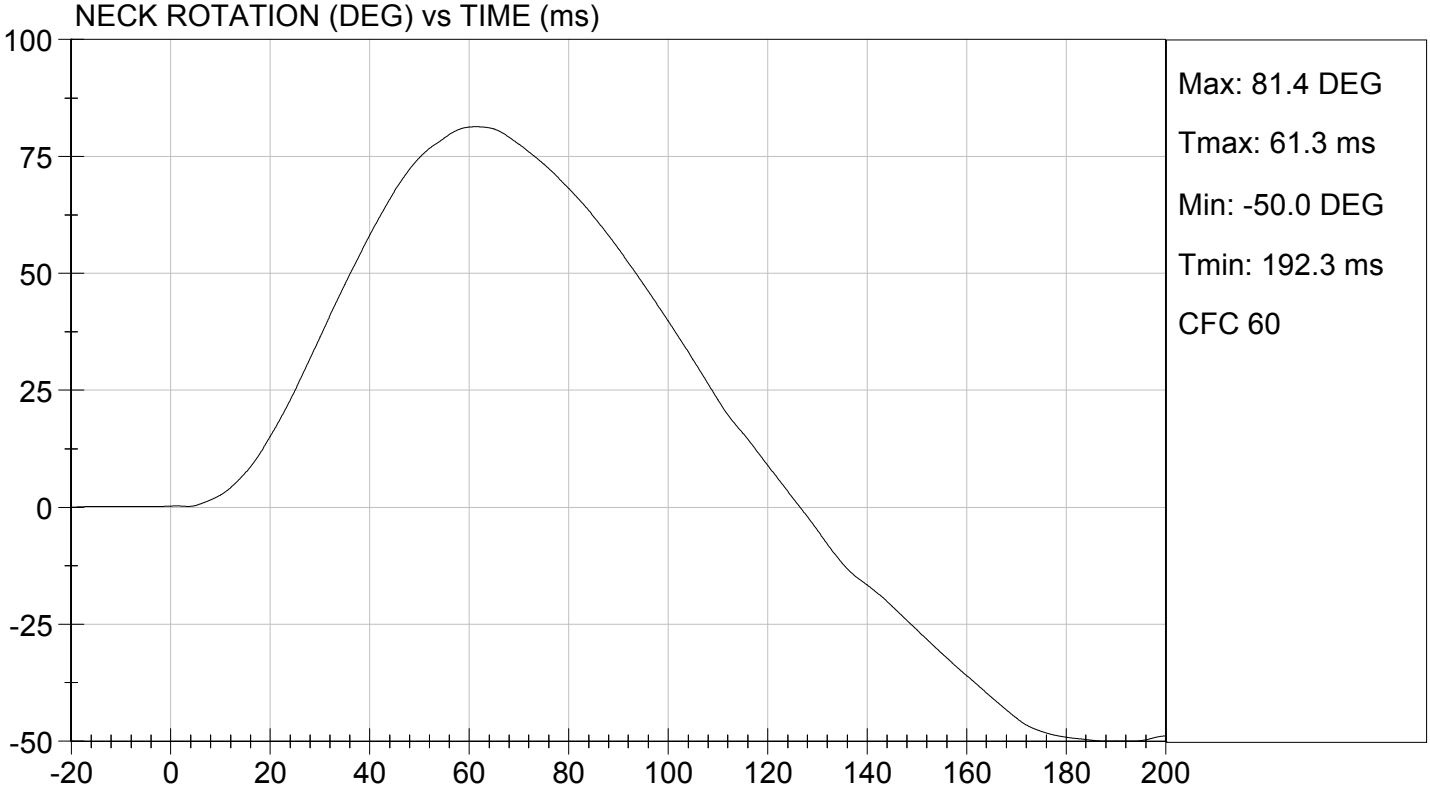
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

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

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



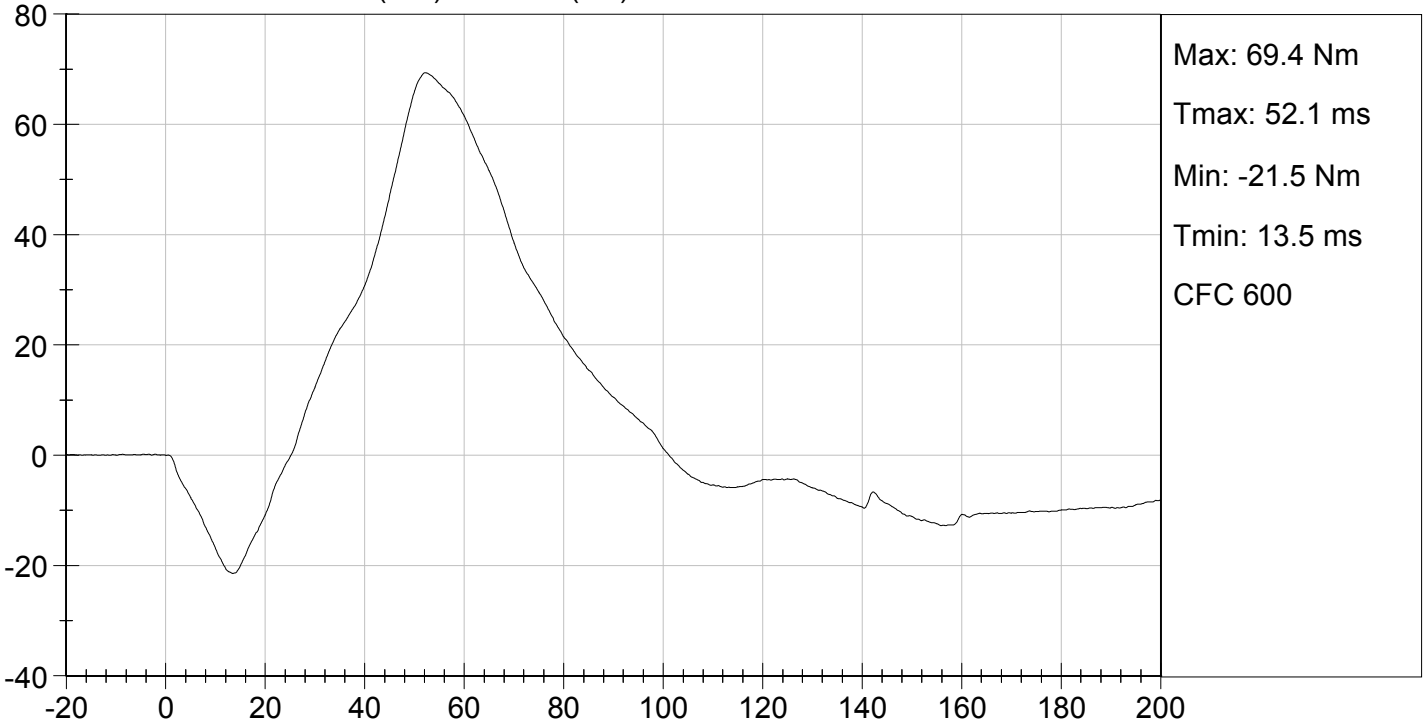
NECK ROTATION (DEG) vs TIME (ms)



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

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

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 11/18/2014

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last extension test. (572.137(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:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

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	1.6 m/s
	@ 20 ms	3.1 m/s ≤ ΔV ≤ 3.9 m/s	3.4 m/s
	@ 30 ms	4.6 m/s ≤ ΔV ≤ 5.6 m/s	4.9 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-57 Nm @ 99 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.

David Schoedel — Signature

11/18/2014 — Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144053

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

David Schoedel
Laboratory Technician

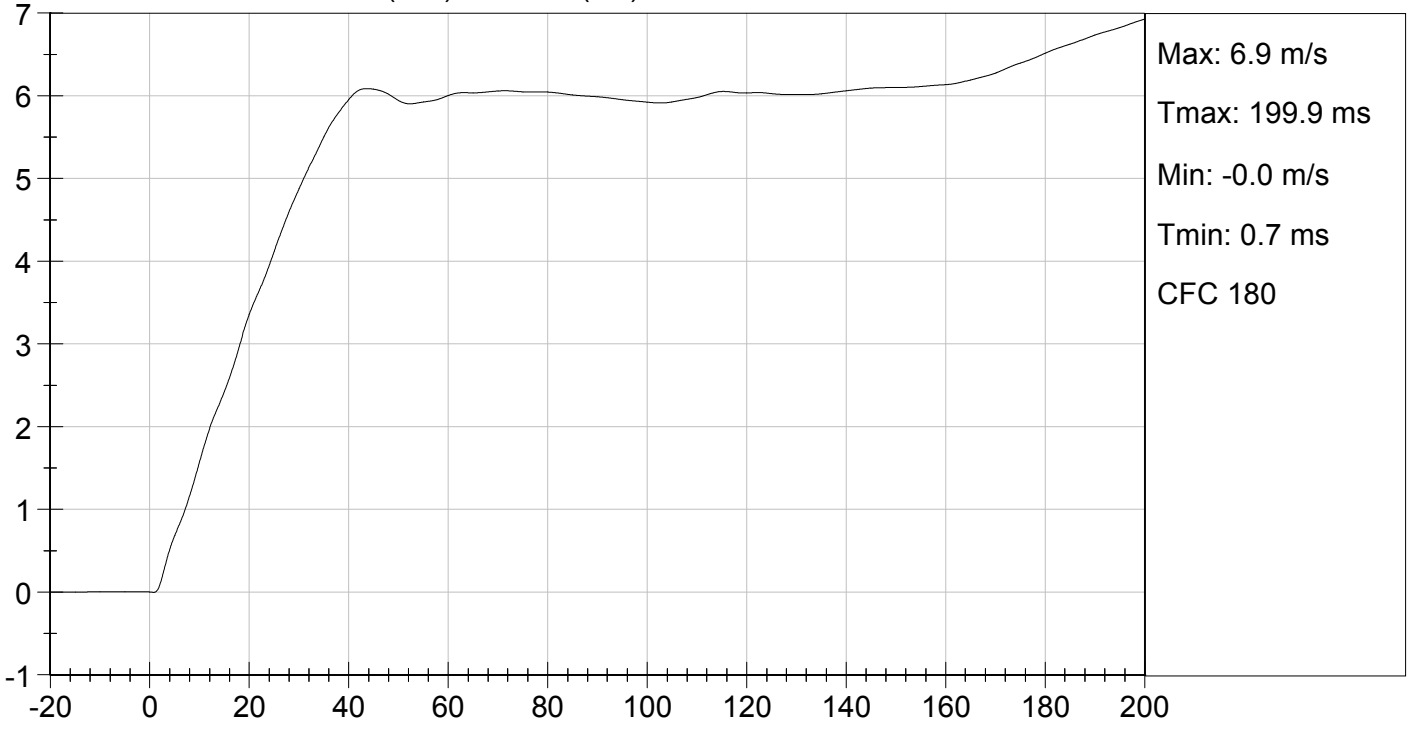
11/18/2014
Test Date

Jeff Leonardelli
Approved By

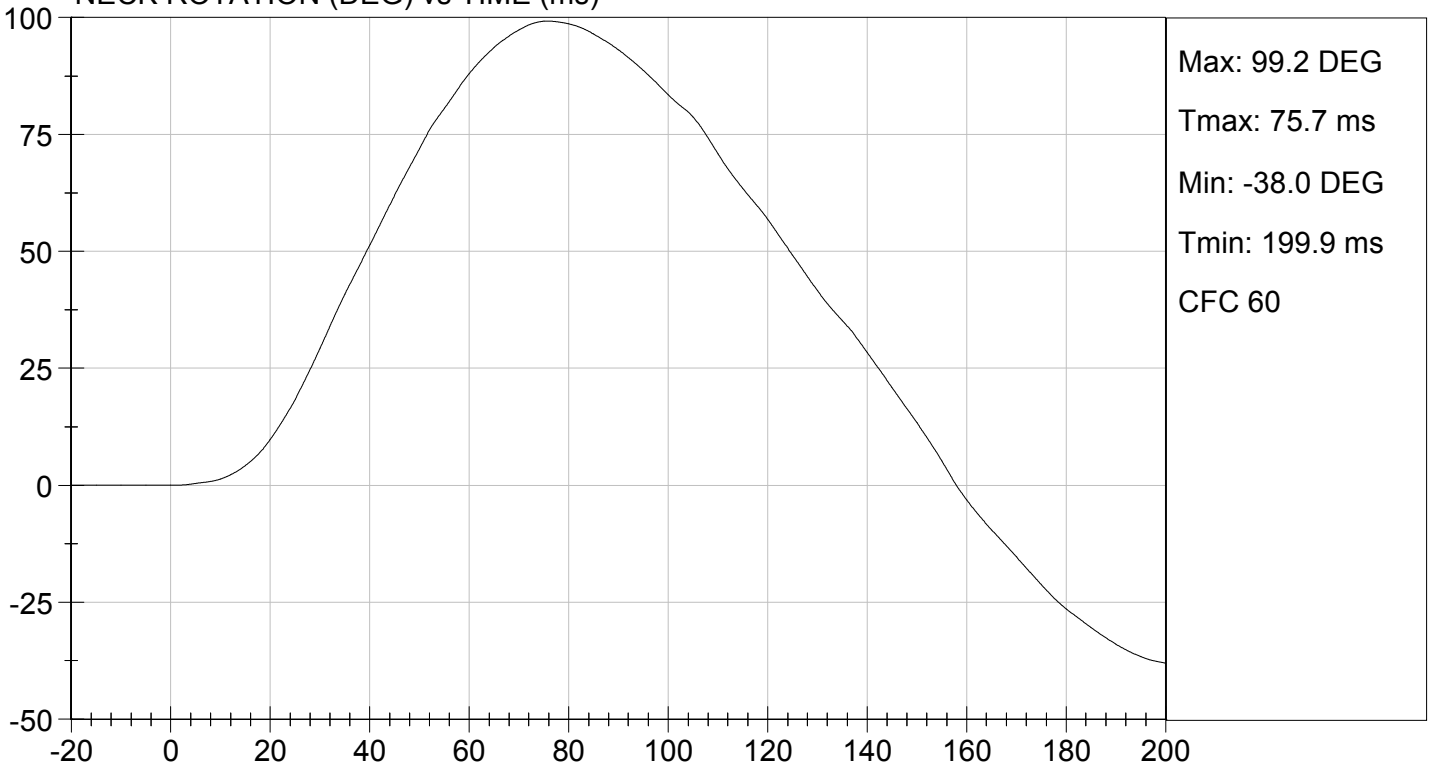
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

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

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

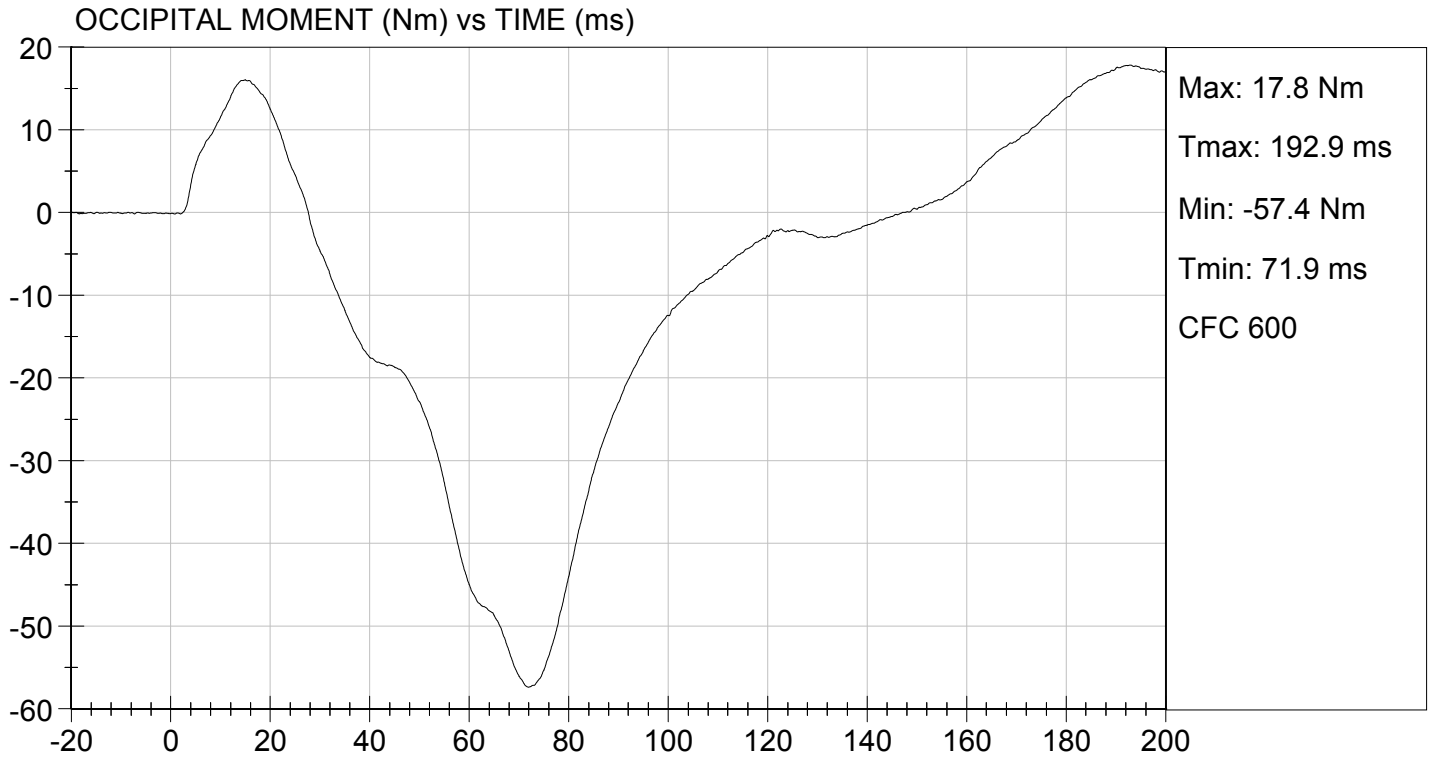


NECK ROTATION (DEG) vs TIME (ms)



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

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



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 11/18/2014

Technician: David Schoedel

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:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

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	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	3924 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4271 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	70%

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

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

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

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

David Schoedel — Signature

11/18/2014 — Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144054

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

David Schoedel
Laboratory Technician

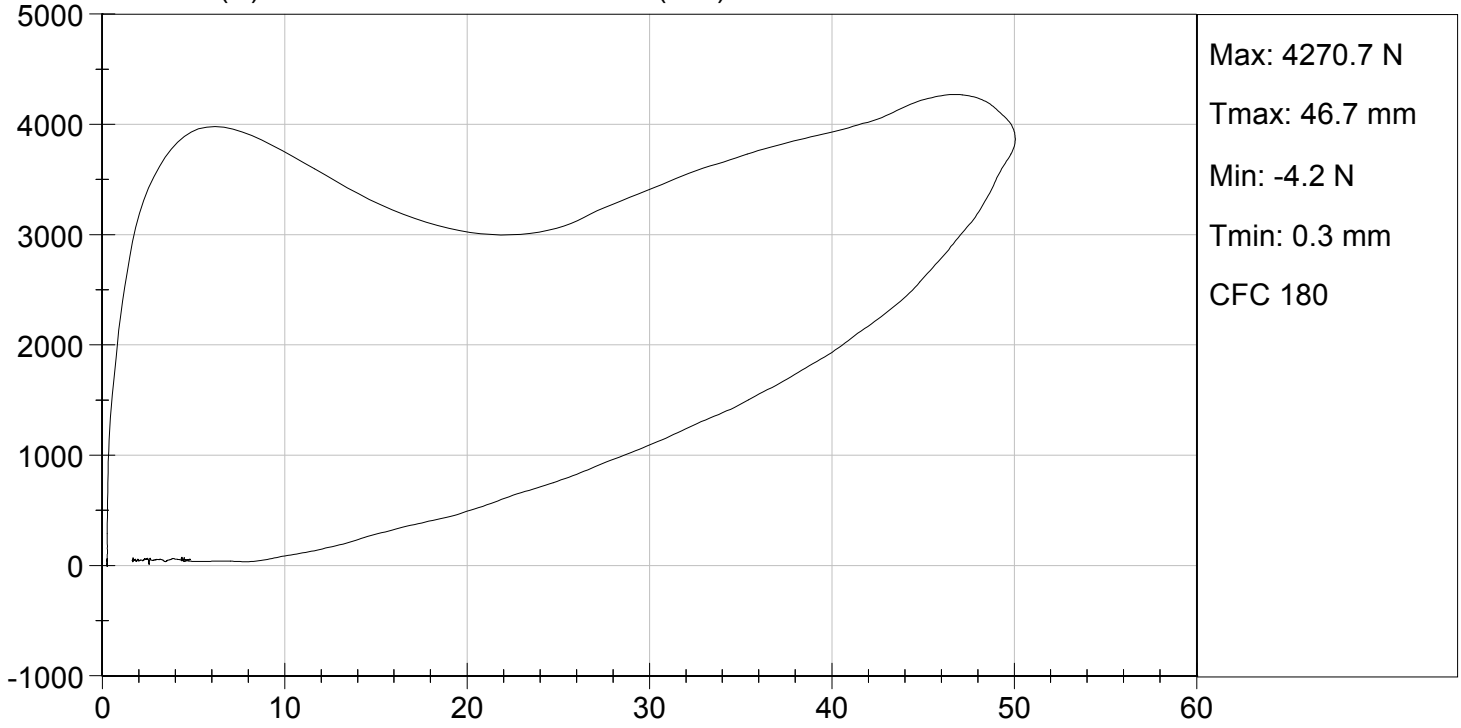
11/18/2014
Test Date

Jeff Leonardelli
Approved By

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

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

FORCE (N) vs CHEST DISPLACEMENT (mm)



DATA SHEET B7

TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 510 Test Date: 11/18/2014

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:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

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

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

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

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

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

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

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

Record reference plane angle (max. allowed 20°): See Result Table

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

X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))

X 14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))

X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))

X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))

X 17. Complete the following table:

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

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

Jack Coleman
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144057

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

Jack Coleman
Laboratory Technician

11/18/2014
Test Date

Jeff Leonardelli
Approved By

DATA SHEET B8

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

Dummy Serial Number: 510 Test Date: 11/18/2014

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

_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	3713 N

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

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

Jack Coleman
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144056

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

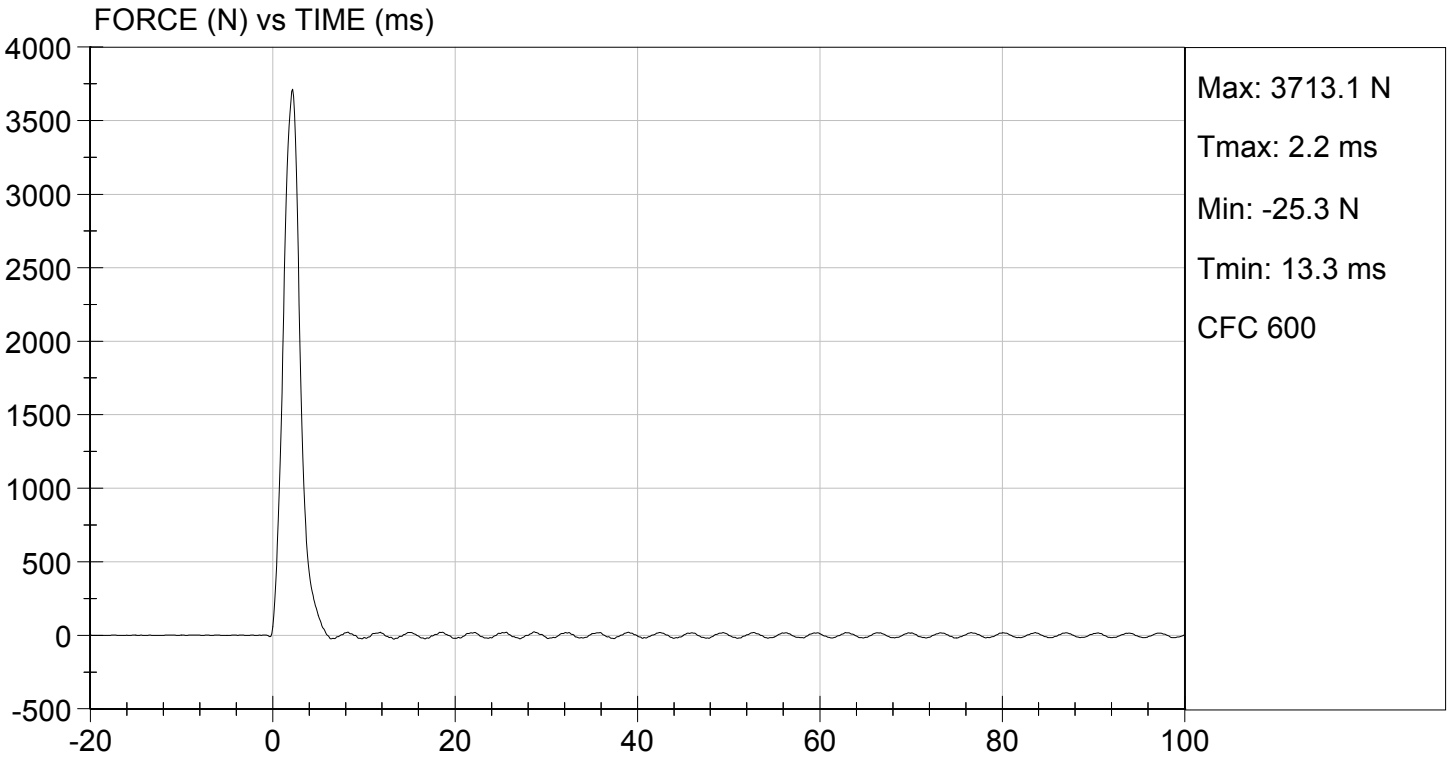
Jack Coleman
Laboratory Technician

11/18/2014
Test Date

Jeff Leonardi
Approved By

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

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



DATA SHEET B9

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

Dummy Serial Number: 510 Test Date: 11/18/2014

Technician: Jack Coleman

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:	22.0°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	16%
Record the minimum humidity:	13%

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	2.13 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3988 N

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

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

Jack Coleman
Signature

11/18/2014
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144055

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

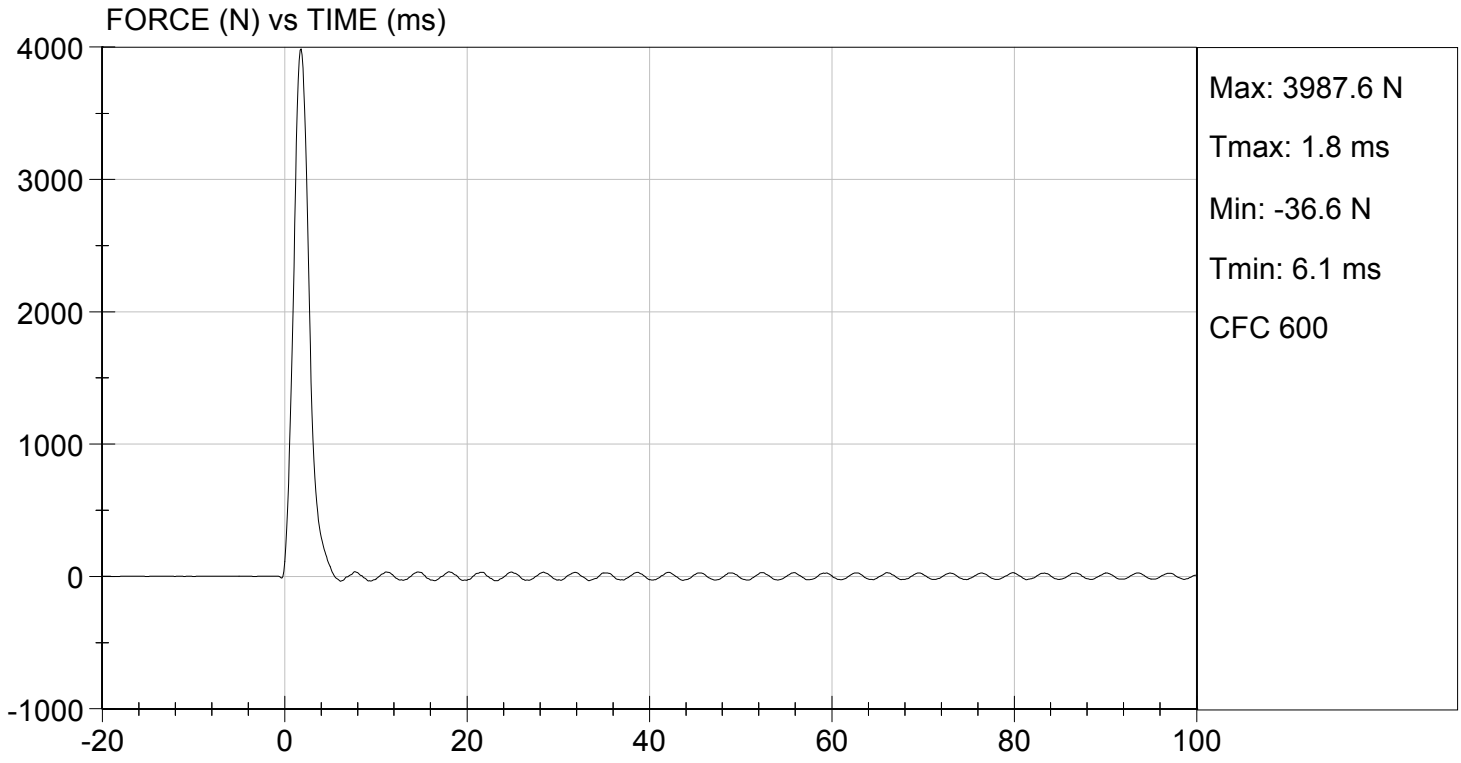
Jack Coleman
Laboratory Technician

11/18/2014
Test Date

Jeff Leonardelli
Approved By

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

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



DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

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

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B3

HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number: 510 Test Date: 12/16/2014

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:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

_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	270 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	-2.4 g

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

Jack Coleman — Signature

12/16/2014 — Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test ID:** D144441

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	36	Pass
Peak Resultant Acceleration	G's	250 to 300	270	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

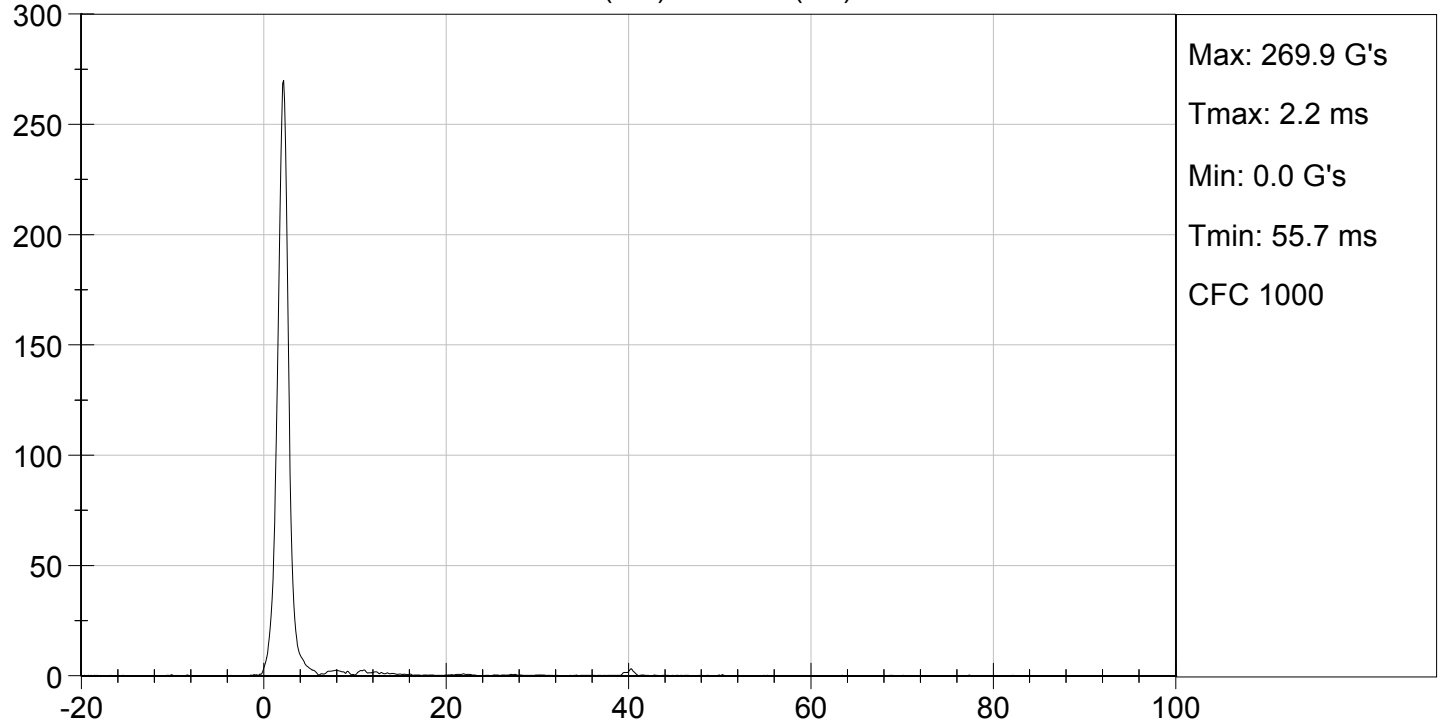
12/16/2014
Test Date

Jeff Leonardski
Approved By

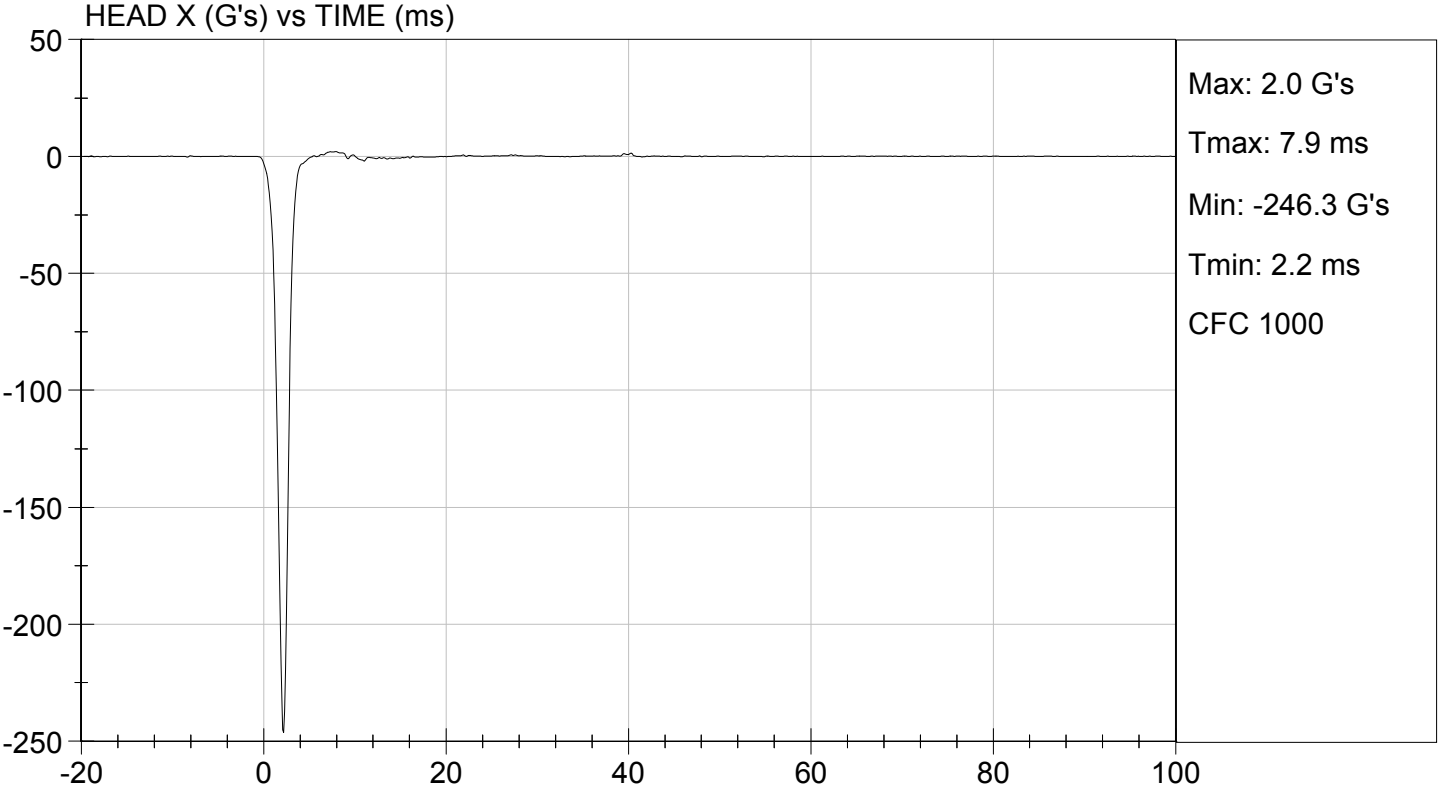
TEST DESC: HEAD DROP

TEST DATE: 12/16/2014
TEST #: D144441

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



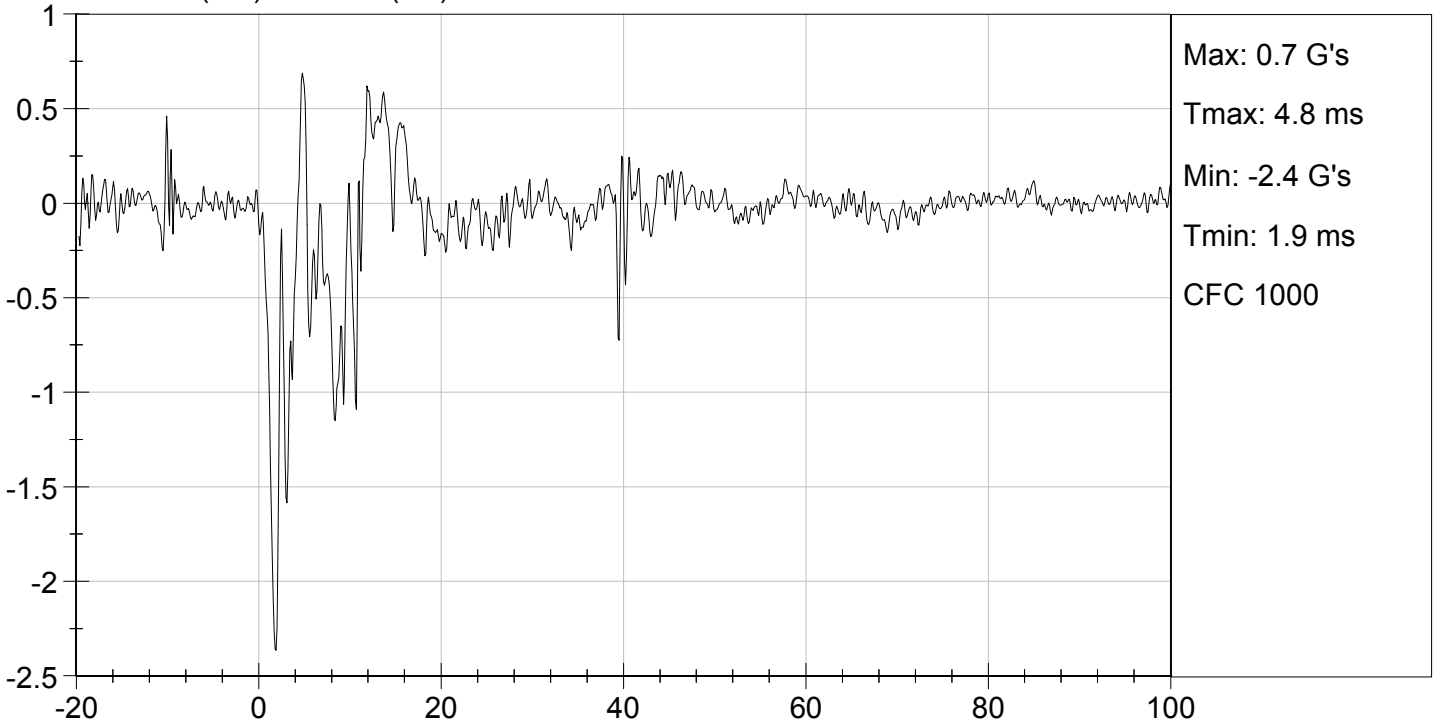
HEAD X (G's) vs TIME (ms)



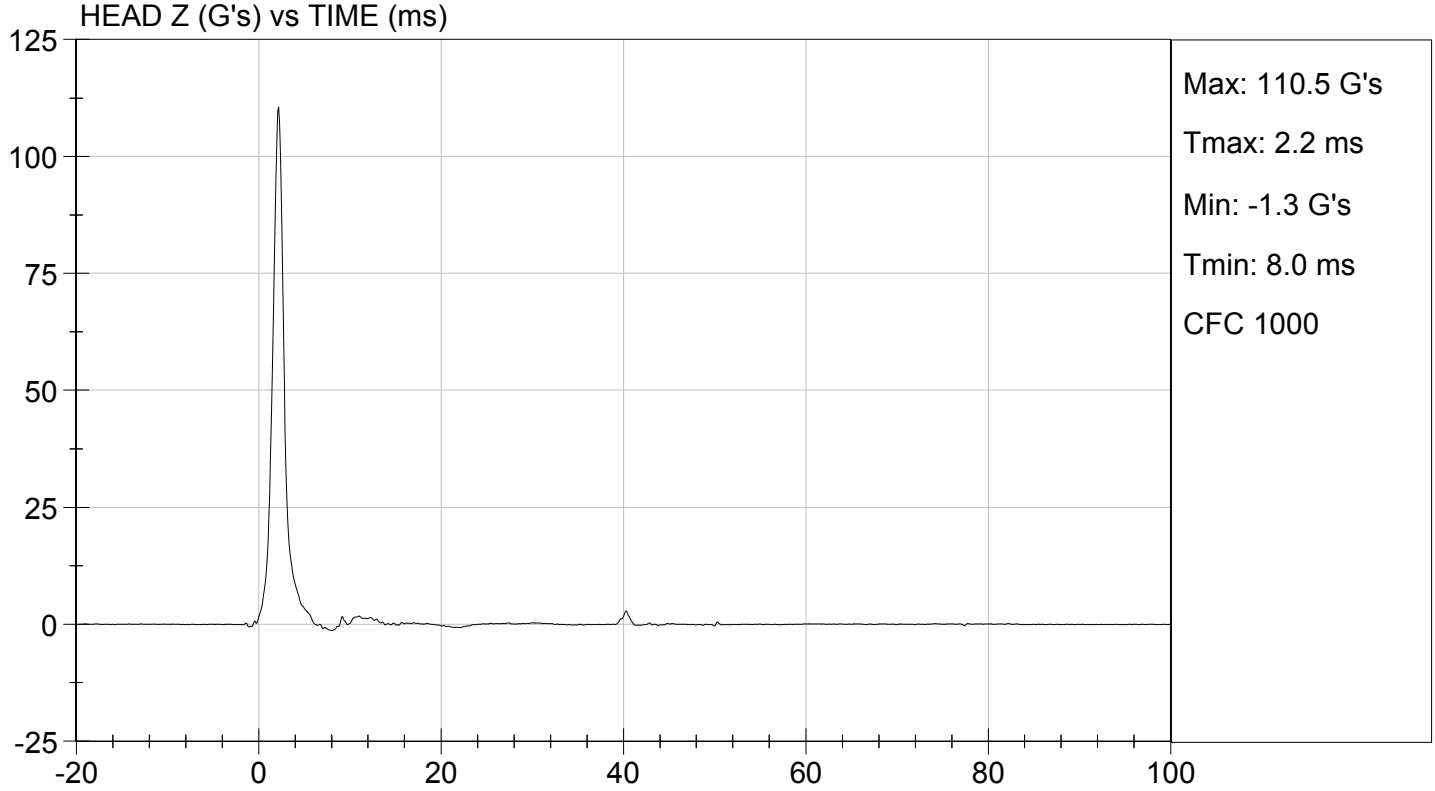
TEST DESC: HEAD DROP

TEST DATE: 12/16/2014
TEST #: D144441

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: 510 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last flexion test. (572.137(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:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

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	4.3 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	5.8 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 84 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	90 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.

David Schoedel
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144442

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	38	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	4.3	Pass
	30 ms	m/s	5.8 to 7.0	5.8	Pass
D Plane Rotation	Max	deg	77 to 91	84	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	90	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

12/16/2014

Test Date

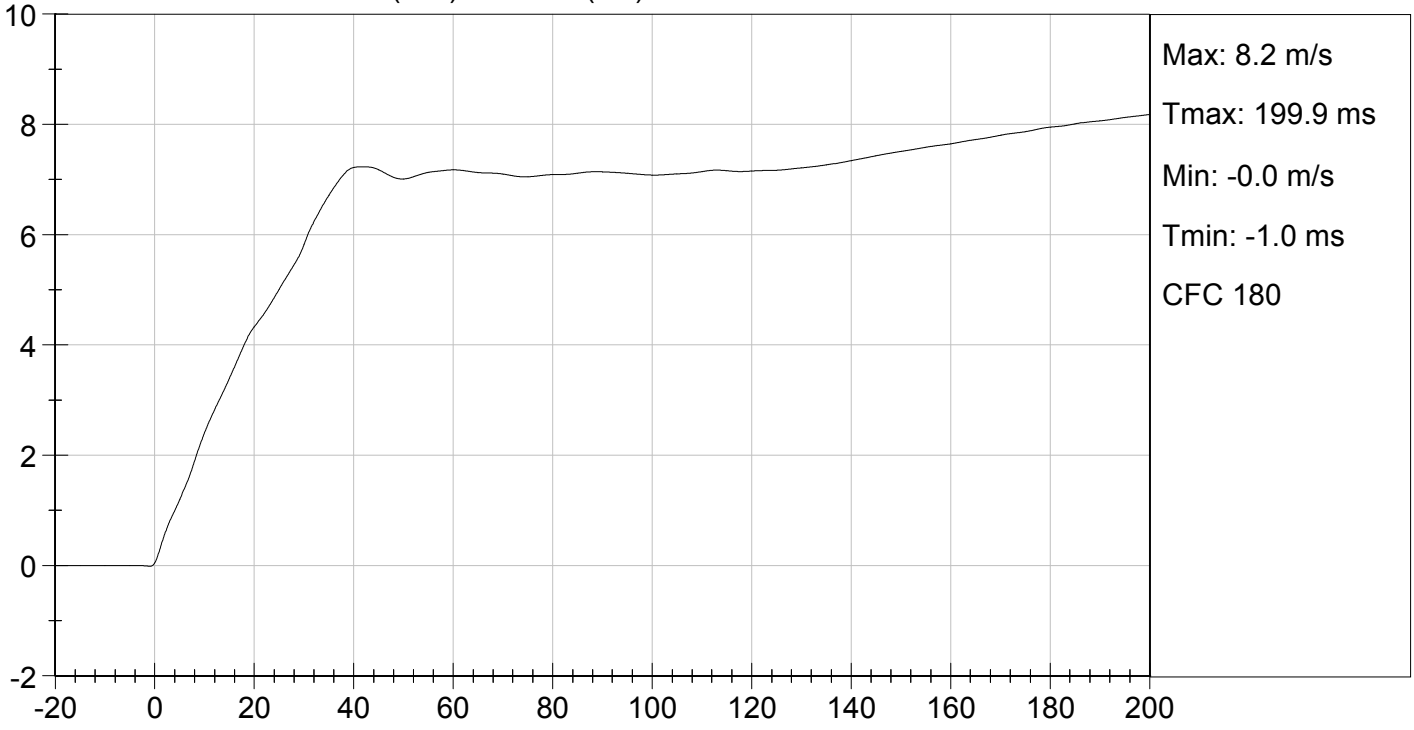
Jeff Levandoski

Approved By

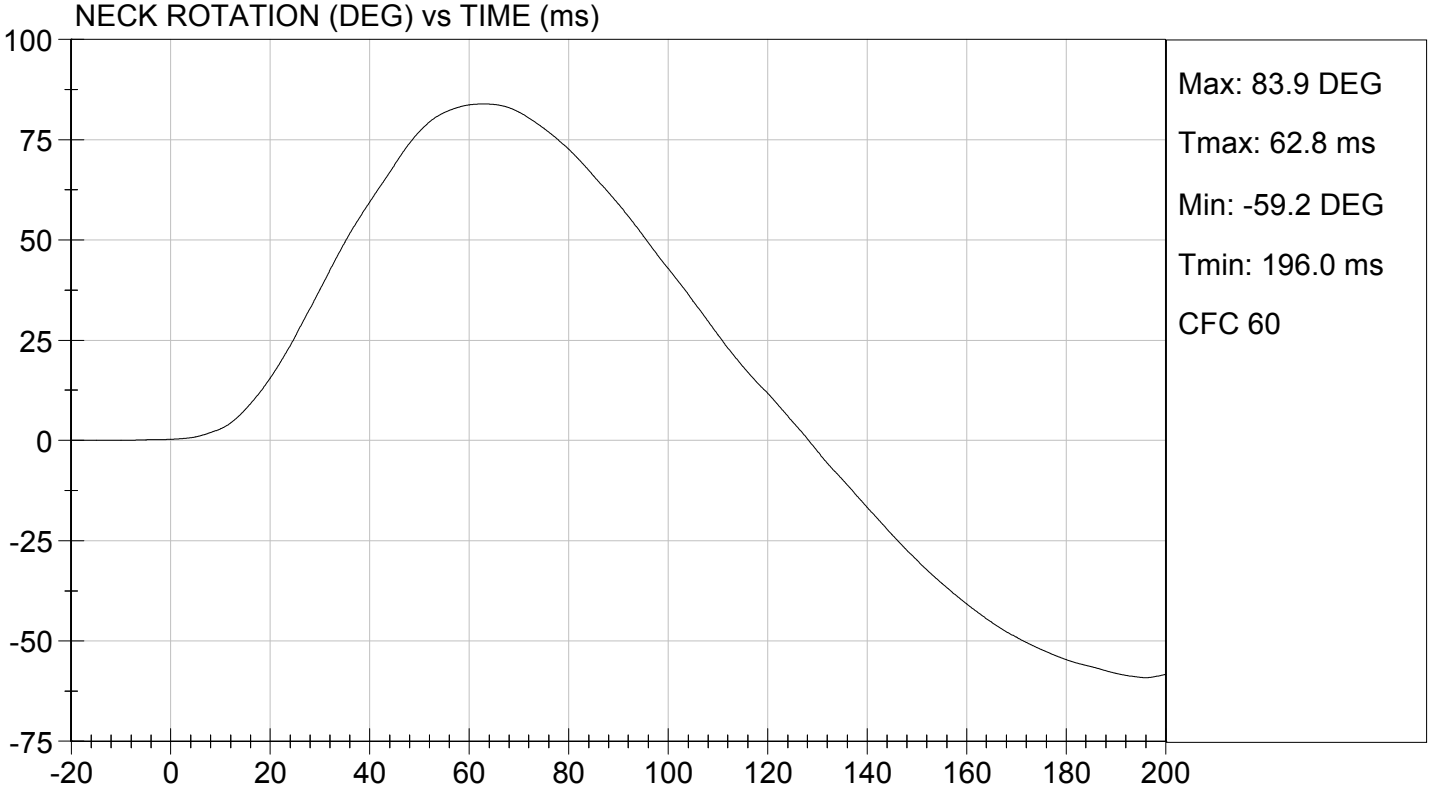
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 12/16/2014
TEST #: D144442

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

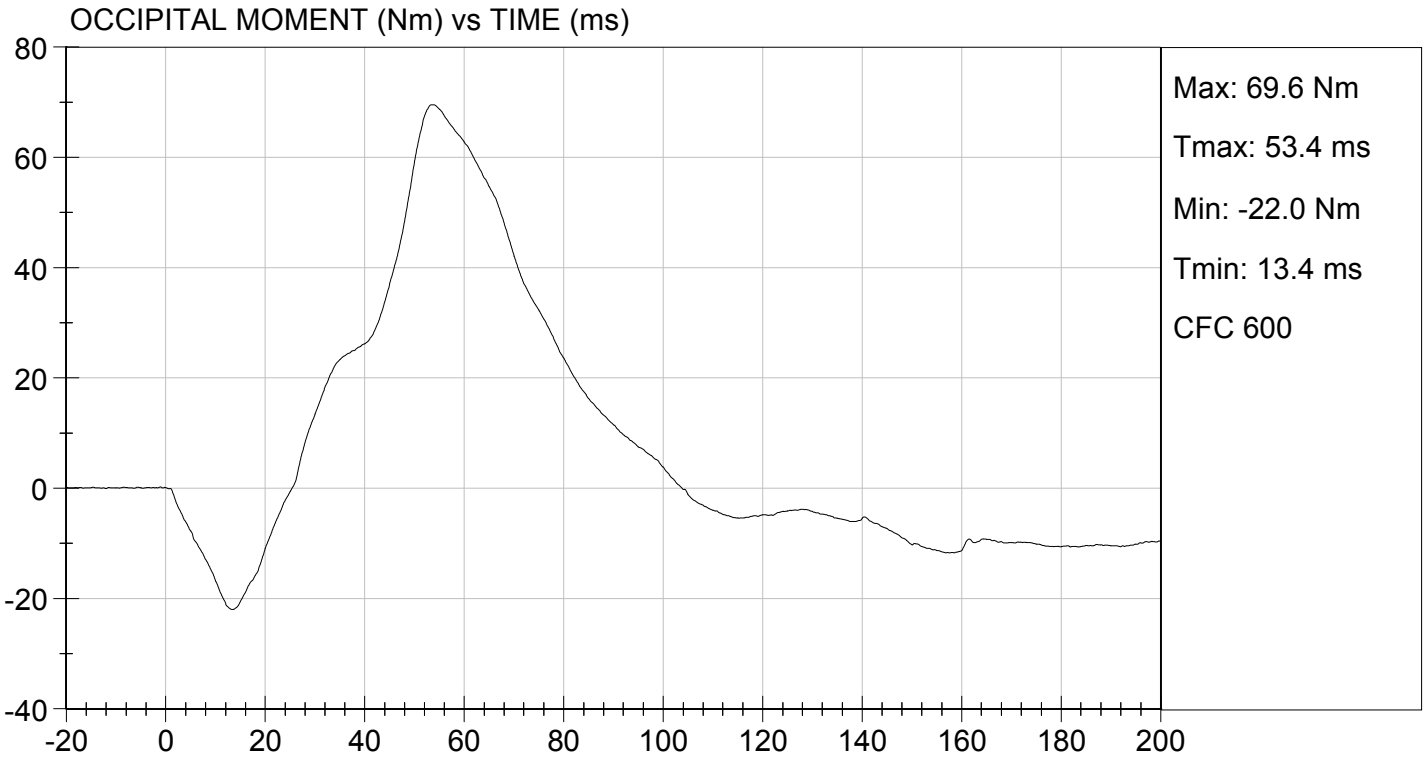


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/16/2014
TEST #: D144442



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

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	6.19 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.5 m/s ≤ ΔV ≤ 1.9 m/s	1.8 m/s
	@ 20 ms	3.1 m/s ≤ ΔV ≤ 3.9 m/s	3.8 m/s
	@ 30 ms	4.6 m/s ≤ ΔV ≤ 5.6 m/s	5.4 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-58 Nm @ 111 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	97 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.

David Schoedel
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144443

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	38	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	111	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-58	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	97	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

12/16/2014

Test Date

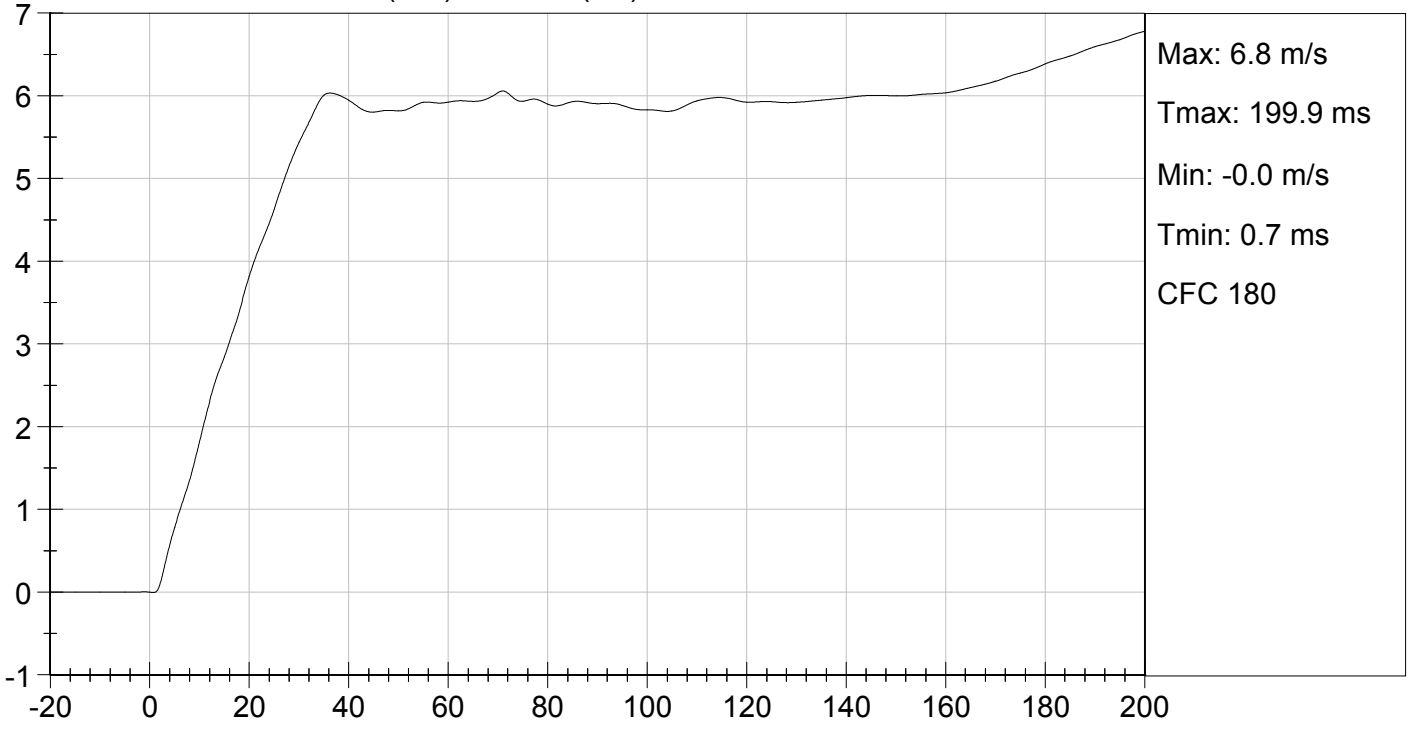
Jeff Levandoski

Approved By

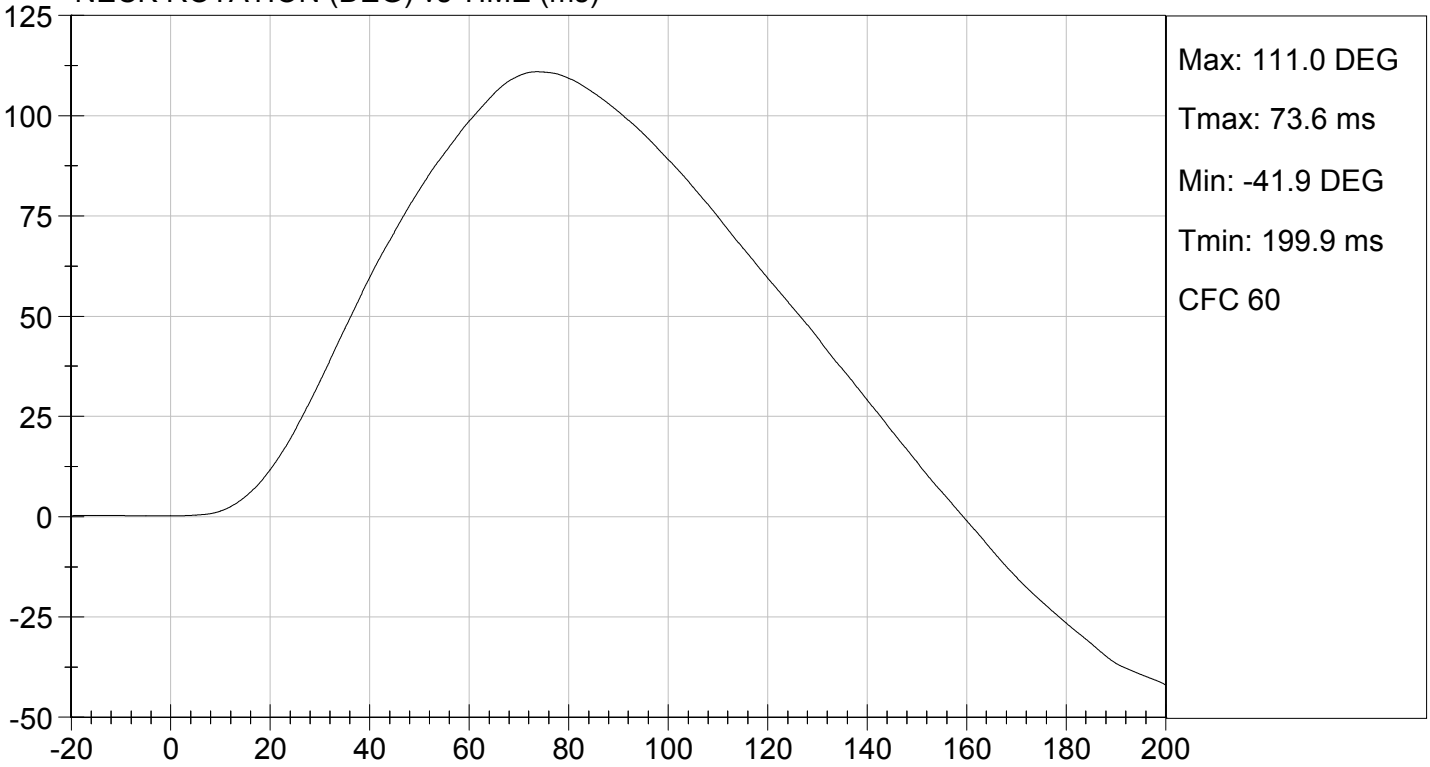
TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 12/16/2014
TEST #: D144443

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

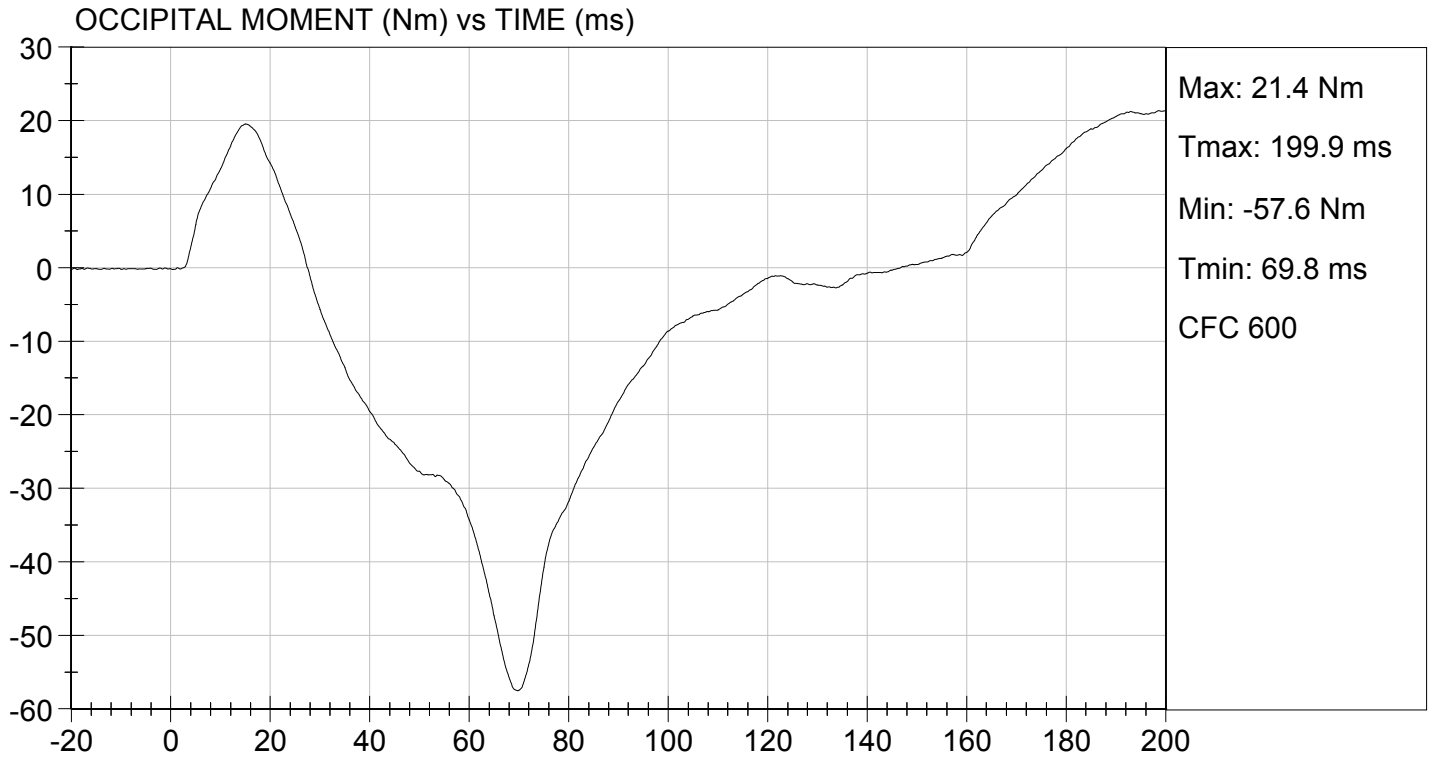


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/16/2014
TEST #: D144443



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

__X__ Post test calibration verification

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

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

__X__ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

__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	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	3979 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4138 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	71%

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

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

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

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

David Schoedel

Signature

12/16/2014

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144444

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	50	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	3979	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4138	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

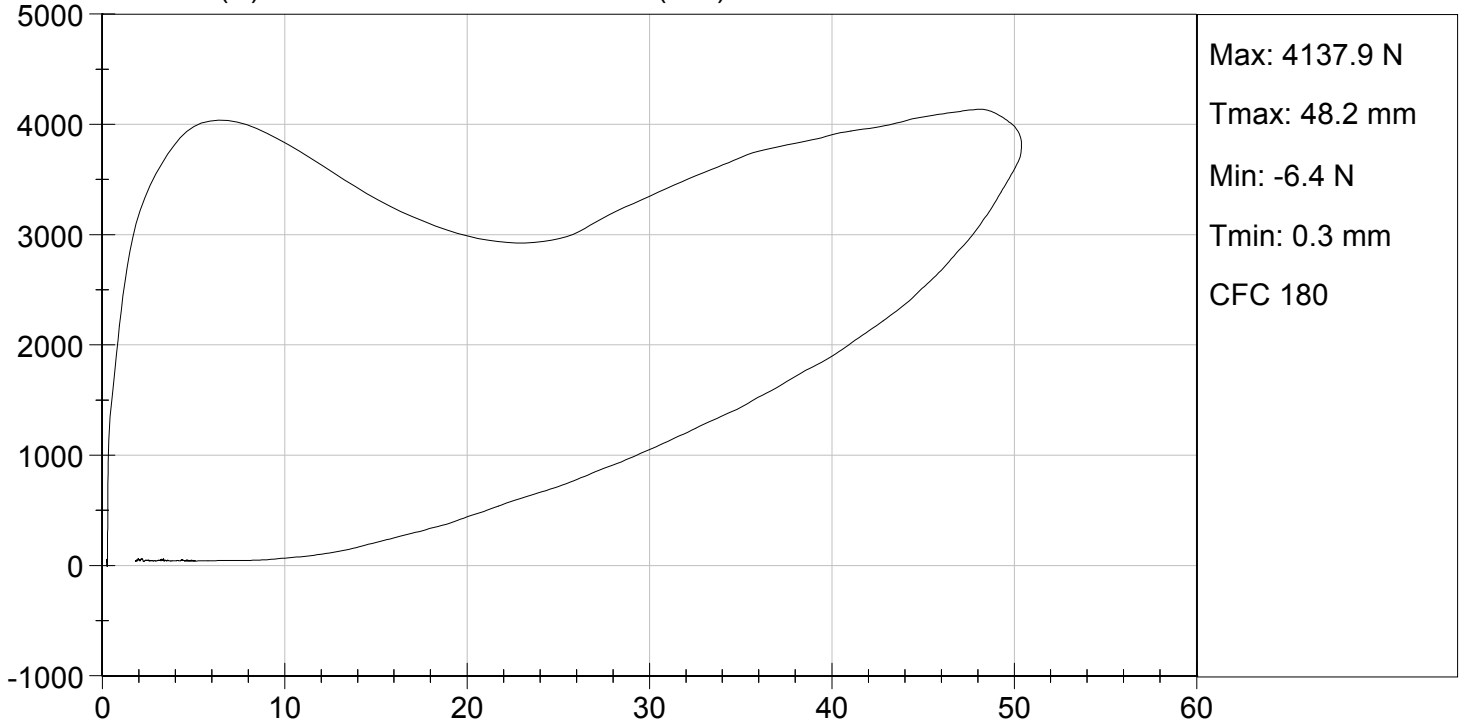
12/16/2014
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 12/16/2014
TEST #: D144444

FORCE (N) vs CHEST DISPLACEMENT (mm)



DATA SHEET B7

TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 510 Test Date: 12/16/2014

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one torso flexion test performed

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

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

____ With legs below femurs.

_X_ Without legs below femurs.

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

Record the maximum temperature:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

_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	0.8 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	385 N
Final ref. plane angle	Initial ref. plane angle ± 8°	21 deg

Jack Coleman
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144447

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	35	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	385	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

12/16/2014
Test Date

Jeff Leonardelli
Approved By

DATA SHEET B8

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

Dummy Serial Number: 510 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last knee impact test. (572.137(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:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

_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	2.13 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3607 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

12/16/2014 — Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144446

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3607	Pass
		Overall Test Results		Pass

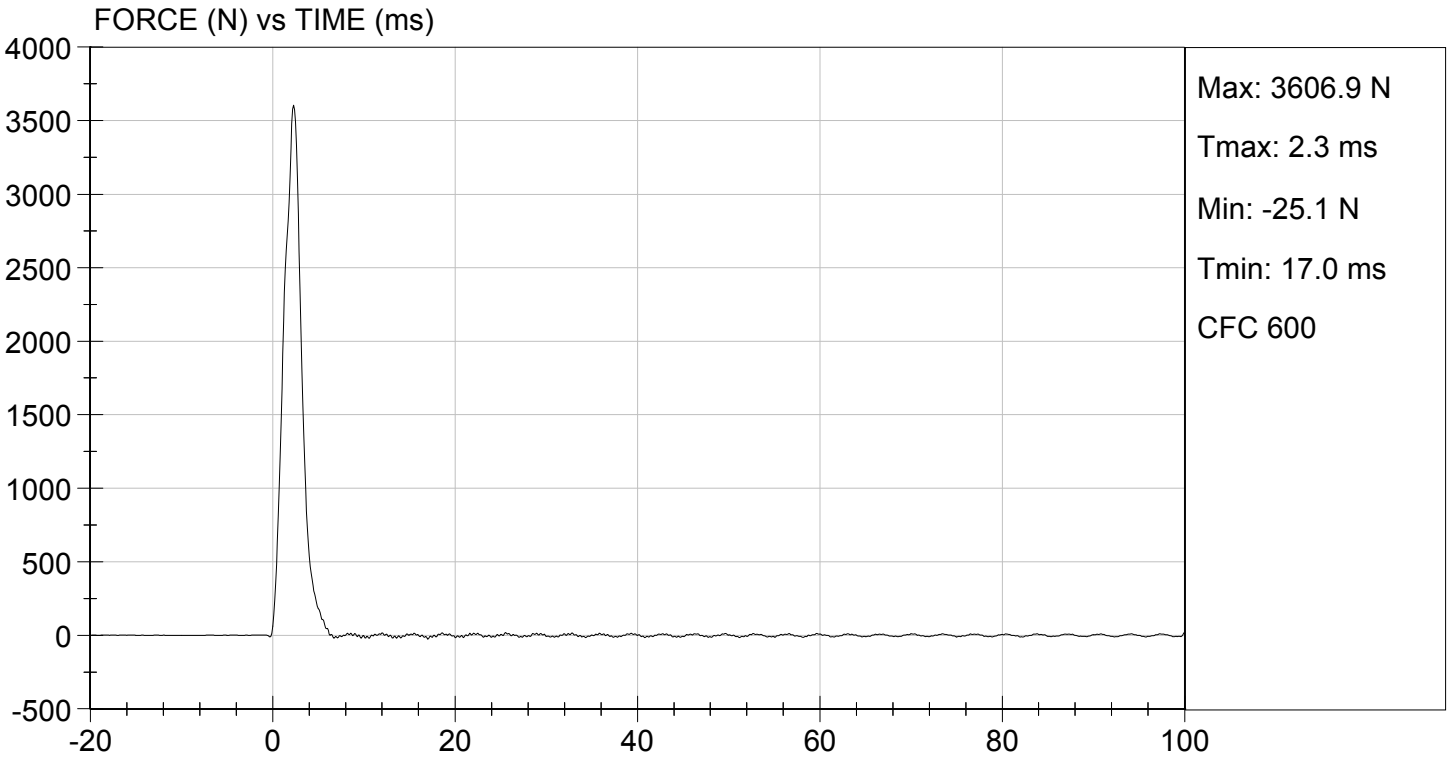
David Schoedel
Laboratory Technician

12/16/2014
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 12/16/2014
TEST #: D144446



DATA SHEET B9

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

Dummy Serial Number: 510 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last knee impact test. (572.137(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:	21.7°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	38%
Record the minimum humidity:	34%

_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	2.13 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3725 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

12/16/2014 — Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D144445

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3725	Pass
		Overall Test Results		Pass

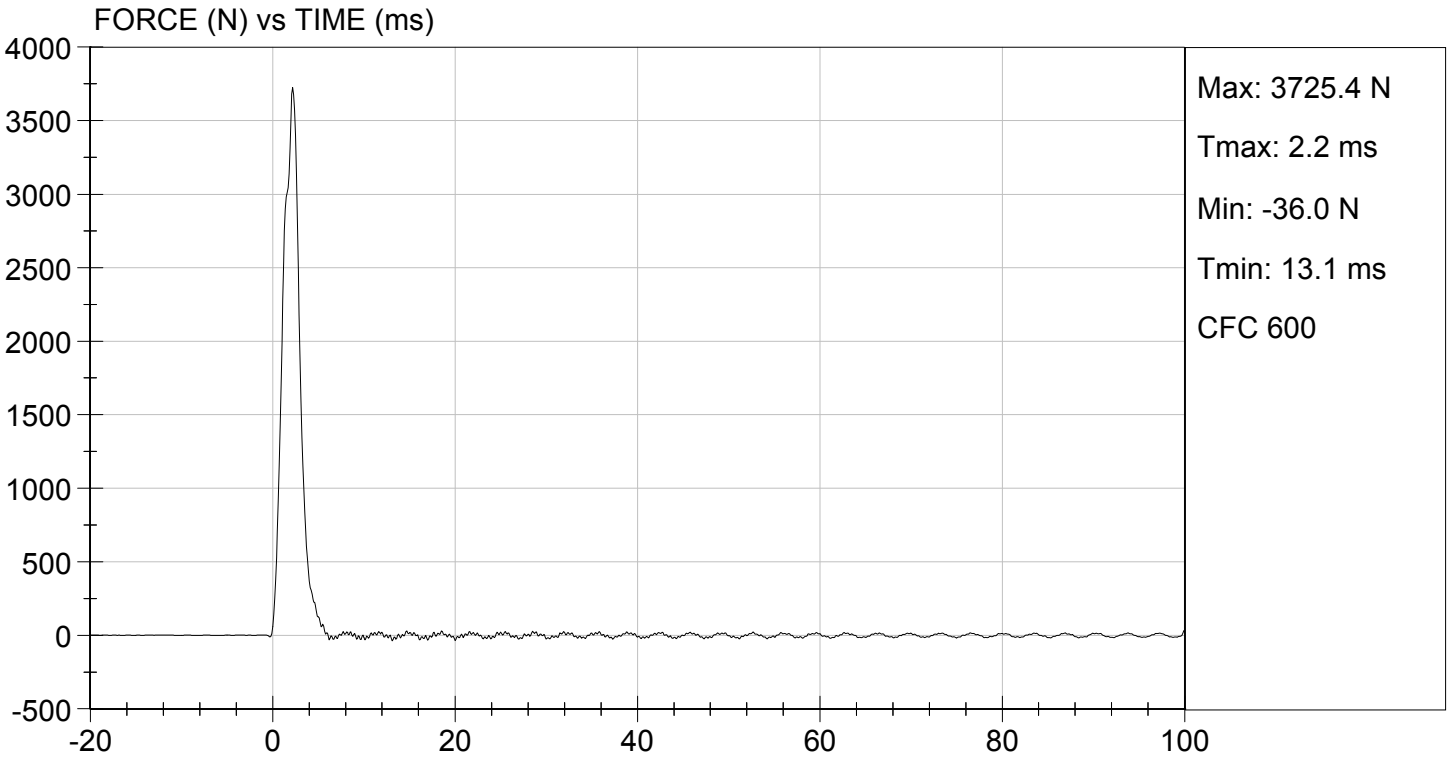
David Schoedel
Laboratory Technician

12/16/2014
Test Date

Jeff Leonardski
Approved By

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

TEST DATE: 12/16/2014
TEST #: D144445



DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

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

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 510 Test Date: 12/16/2014

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 12/16/2014

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 12/16/2014

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: 11/25/2014

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. (572.132(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:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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	284 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-4.0 g

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

Jack Coleman
Signature

11/25/2014
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test ID:** D144201

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	26	Pass
Peak Resultant Acceleration	G's	250 to 300	284	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-4.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

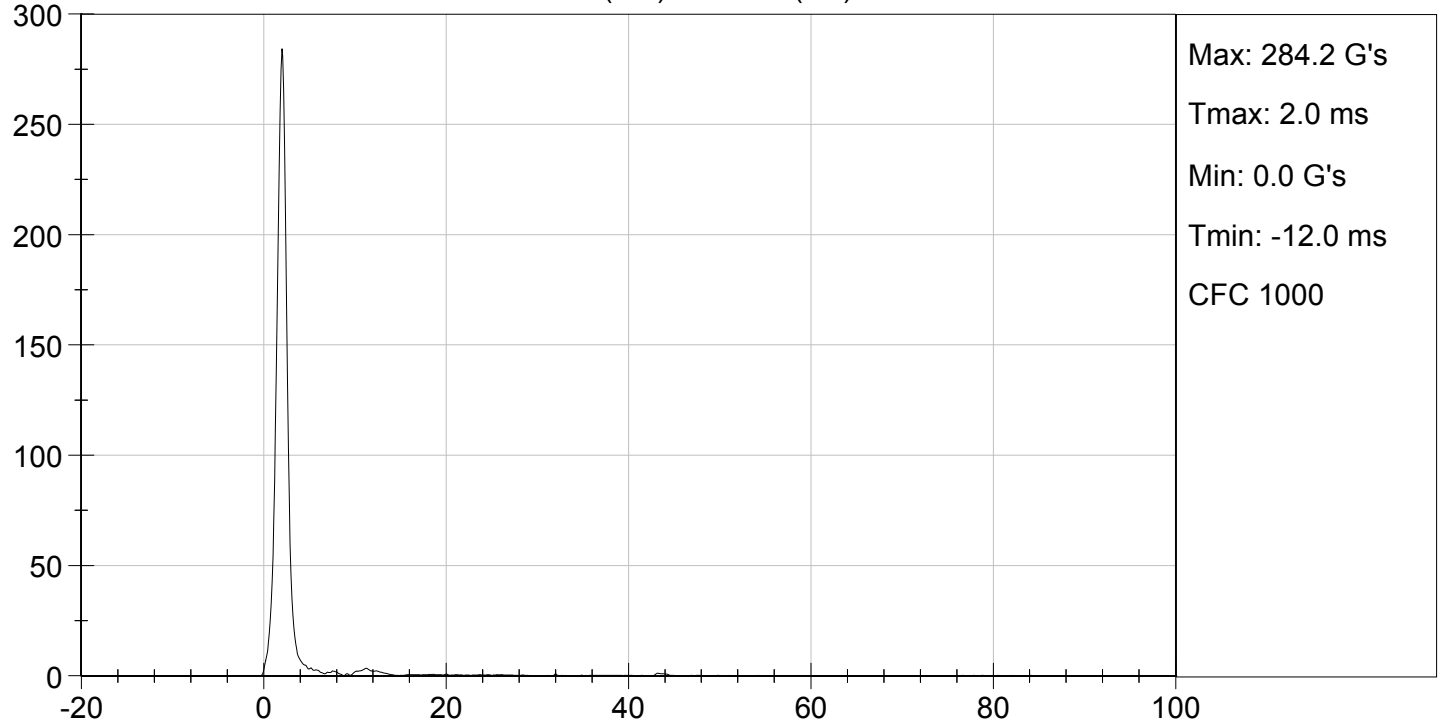
11/25/2014
Test Date

Jeff Leonardski
Approved By

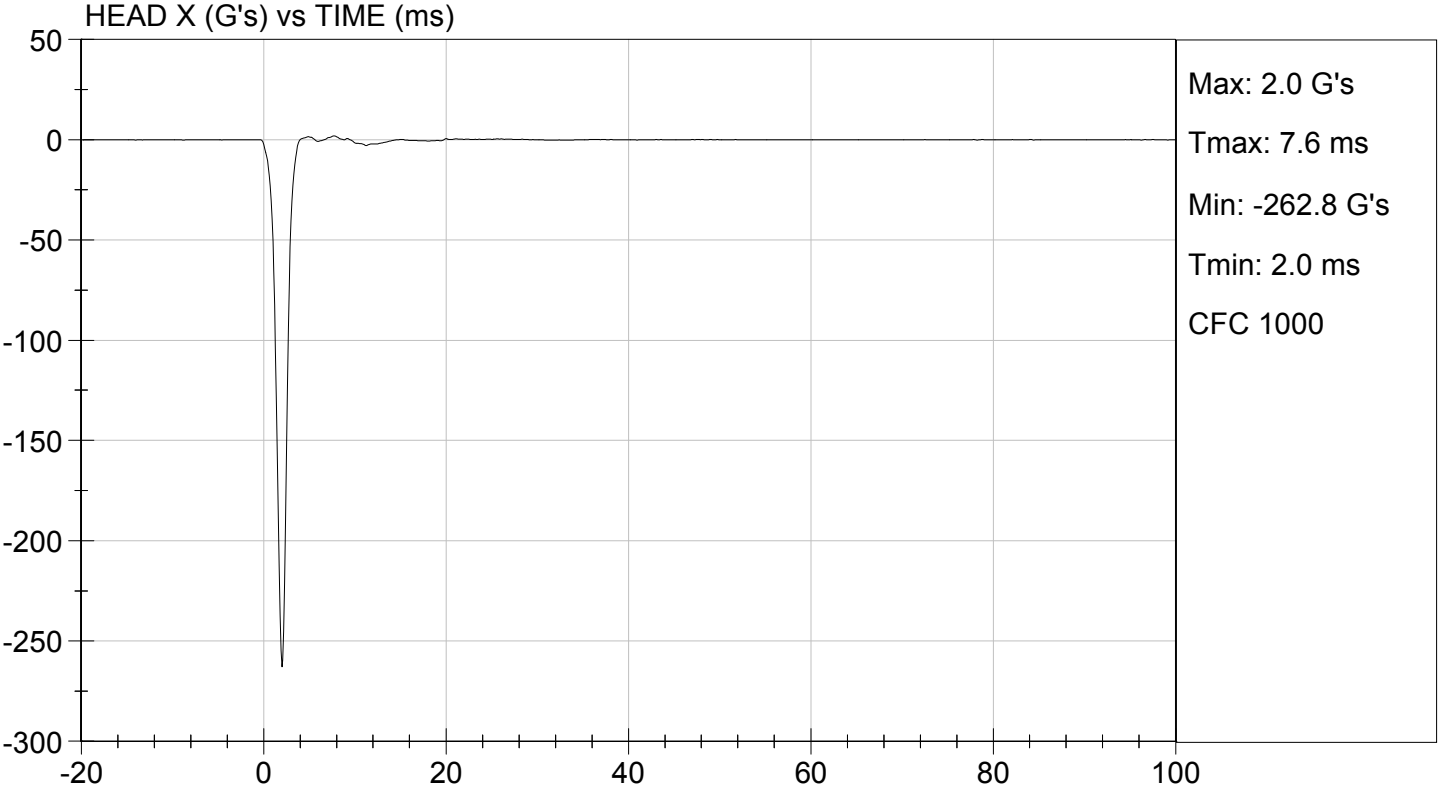
TEST DESC: HEAD DROP

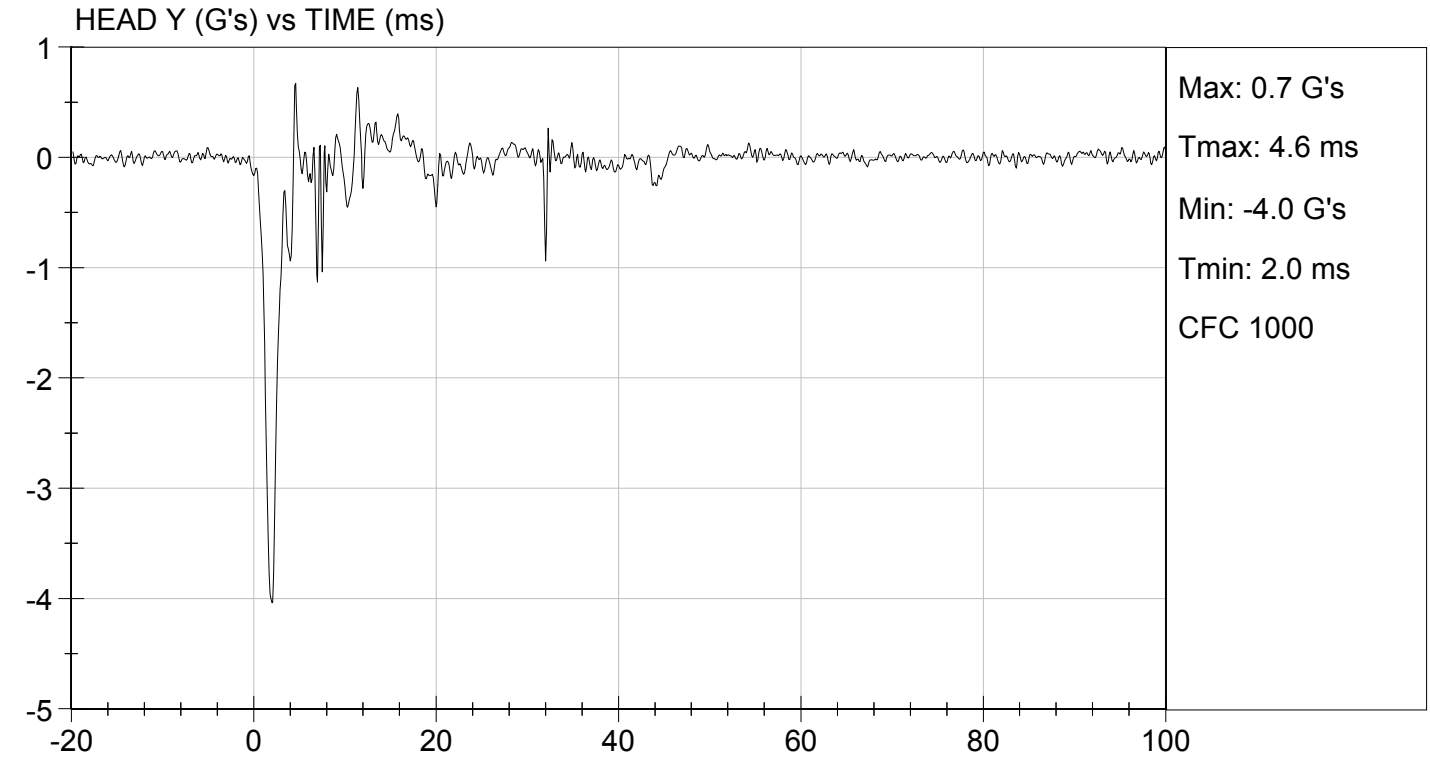
TEST DATE: 11/25/2014
TEST #: D144201

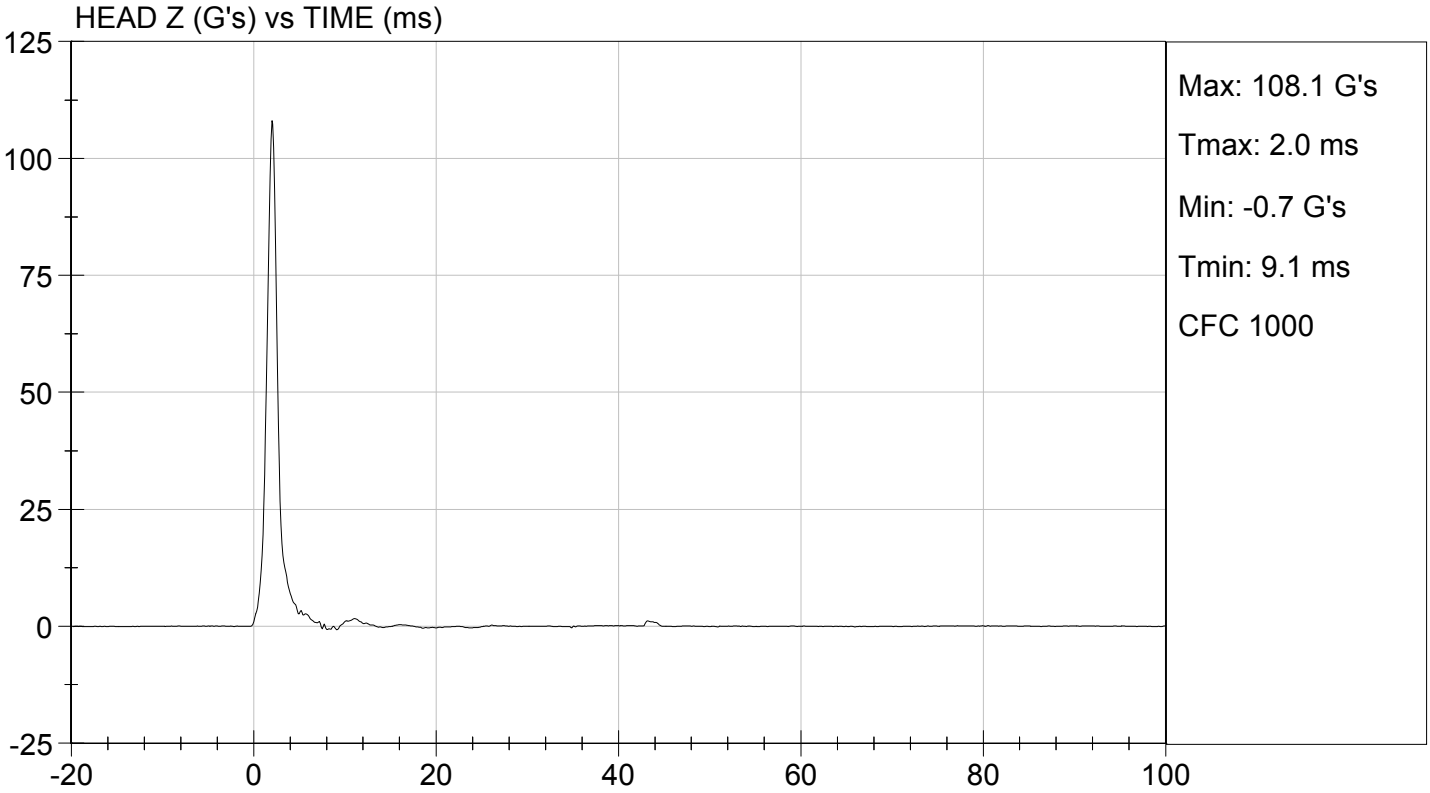
HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)



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




HEAD Y (G's) vs TIME (ms)
1
0
-1
-2
-3
-4
-5
-20
0
20
40
60
80
100
Max: 0.7 G's
Tmax: 4.6 ms
Min: -4.0 G's
Tmin: 2.0 ms
CFC 1000


HEAD Z (G's) vs TIME (ms)
125
100
75
50
25
0
-25
-20
0
20
40
60
80
100
Max: 108.1 G's
Tmax: 2.0 ms
Min: -0.7 G's
Tmin: 9.1 ms
CFC 1000

DATA SHEET B4

NECK FLEXION TEST (572.132) (5th Female)

Dummy Serial Number: 511 Test Date: 11/26/2014

Technician: Jack Coleman

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:	21.9°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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	6.96 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.1 m/s ≤ ΔV ≤ 2.5 m/s	2.5 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	6.3 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 78 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	83 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

11/26/2014
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144202

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Speed		m/s	6.89 to 7.13	6.96	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	78	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	83	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

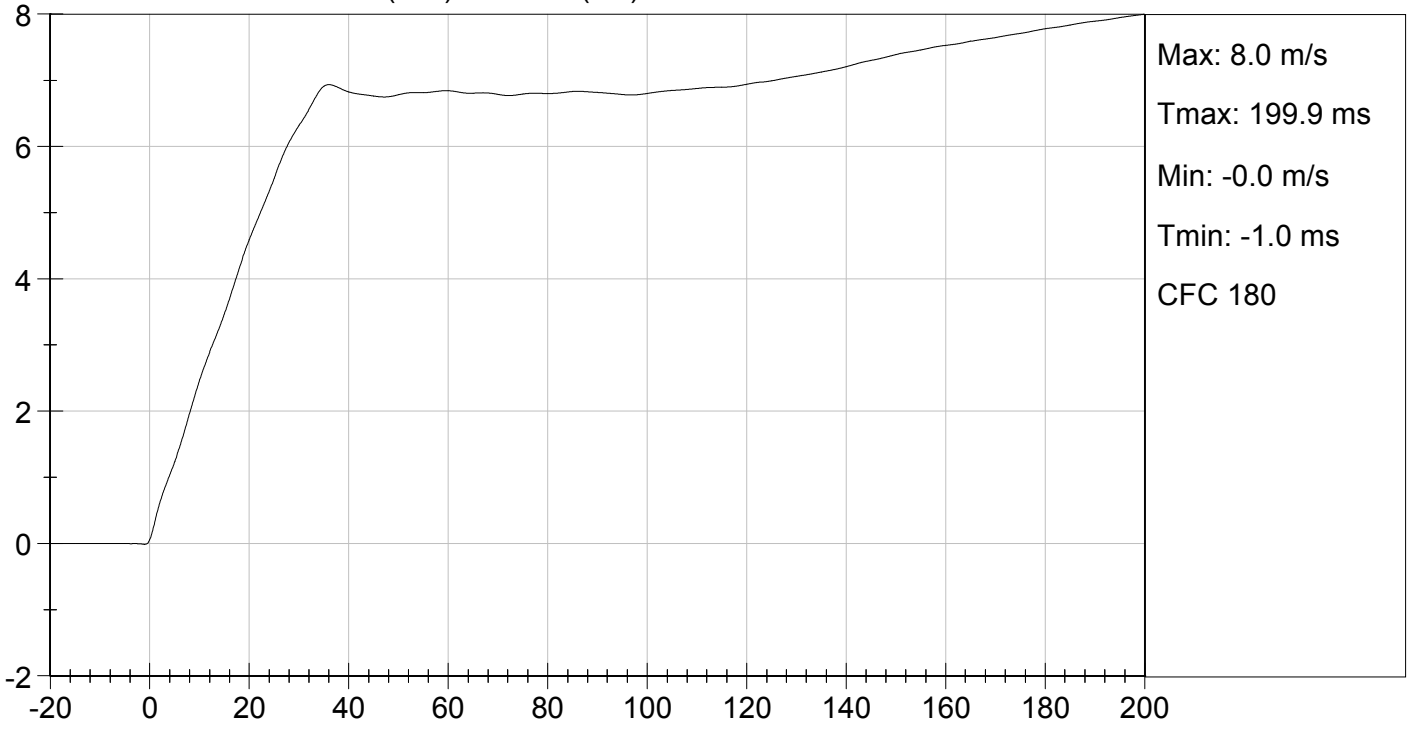
11/26/2014
Test Date

Jeff Leonardini
Approved By

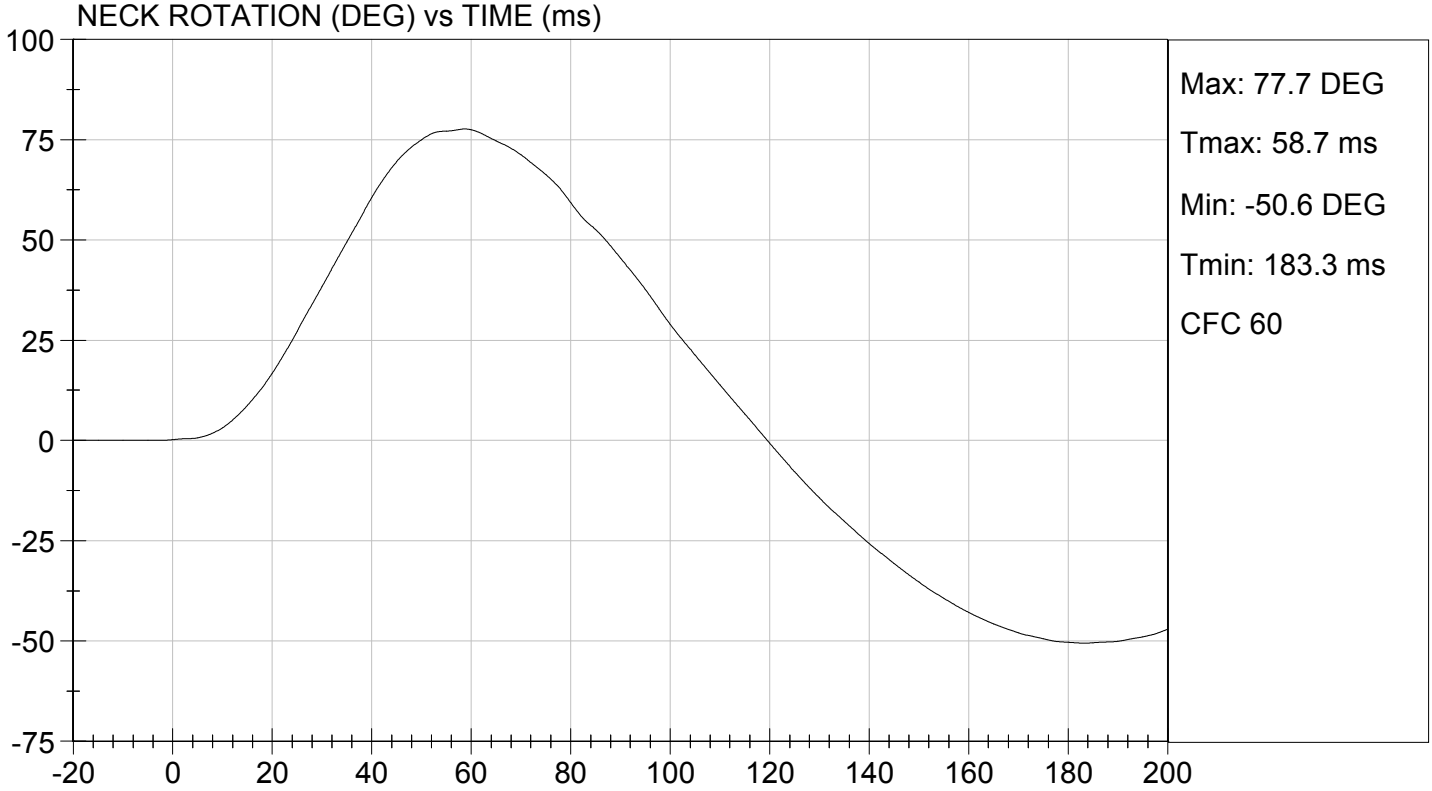
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 11/26/2014
TEST #: D144202

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

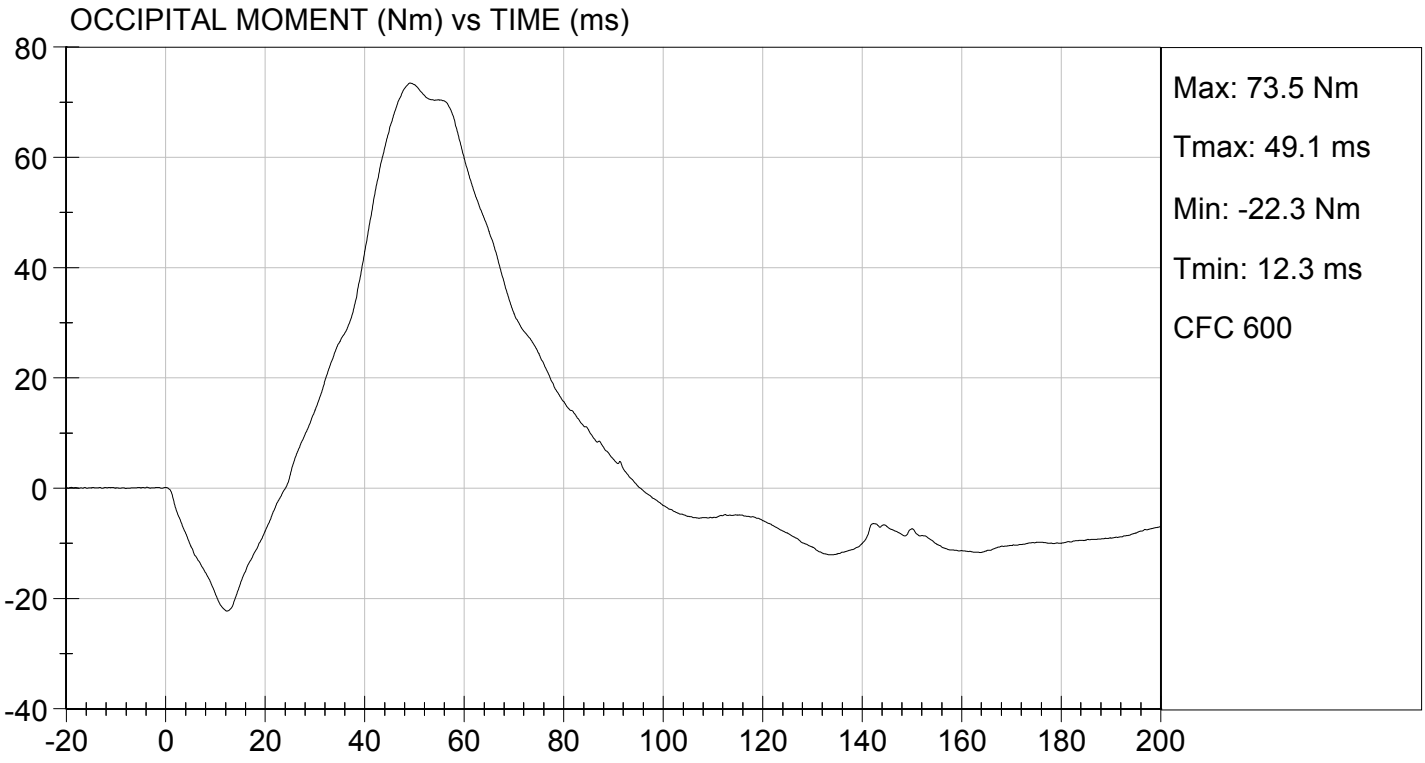


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/26/2014
TEST #: D144202



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 511 Test Date: 11/26/2014

Technician: Jack Coleman

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:	21.9°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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	3.6 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°	-63 Nm @ 104 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	100 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

11/26/2014
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144203

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.8	Pass
Laboratory Relative Humidity		%	10 to 70	20	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	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	104	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-63	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	100	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

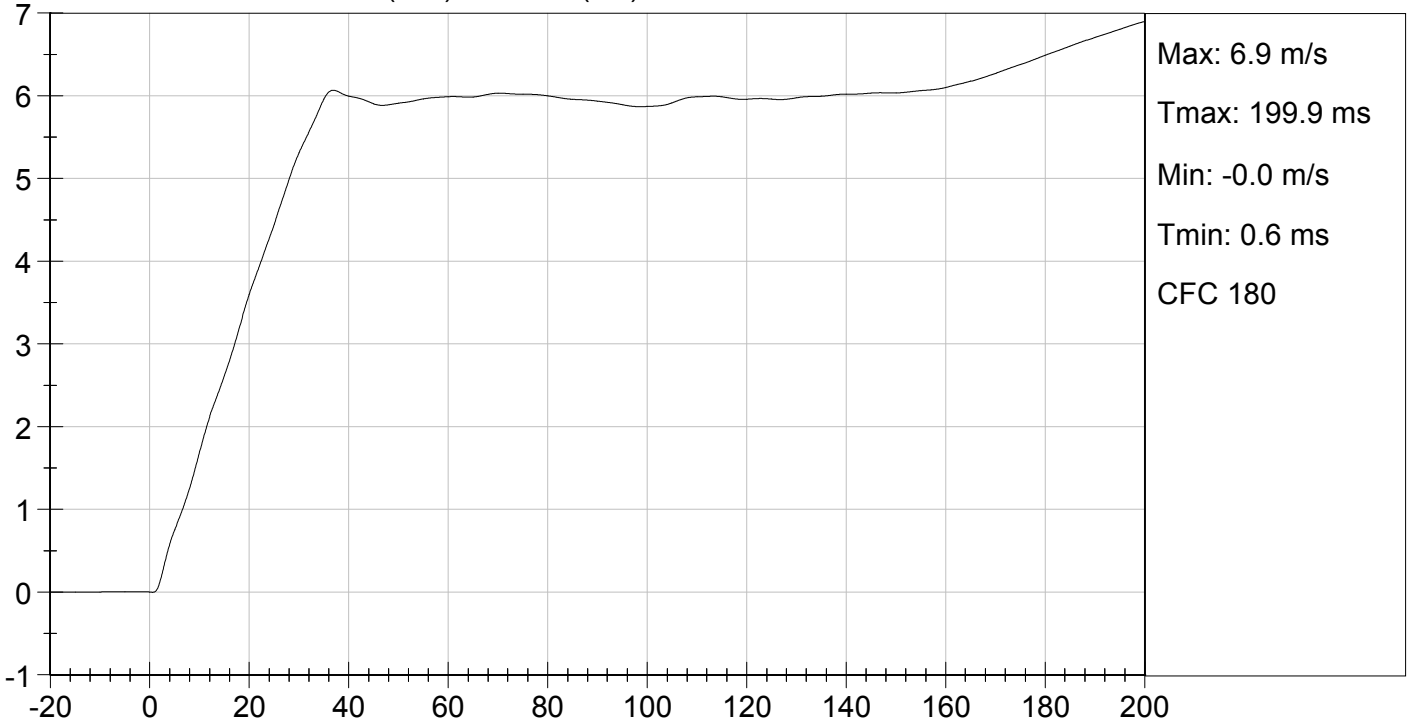
11/26/2014
Test Date

Jeff Leonardi
Approved By

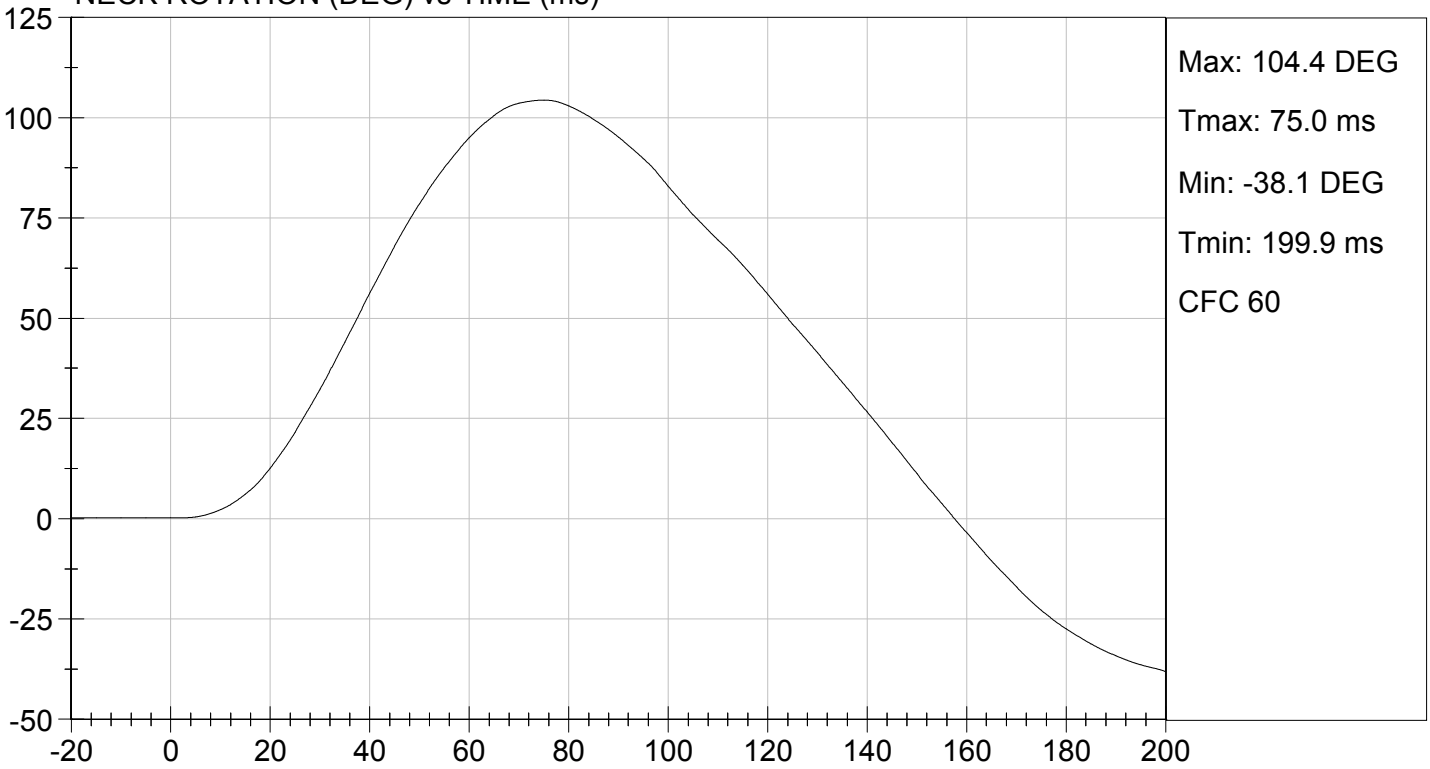
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/26/2014
TEST #: D144203

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

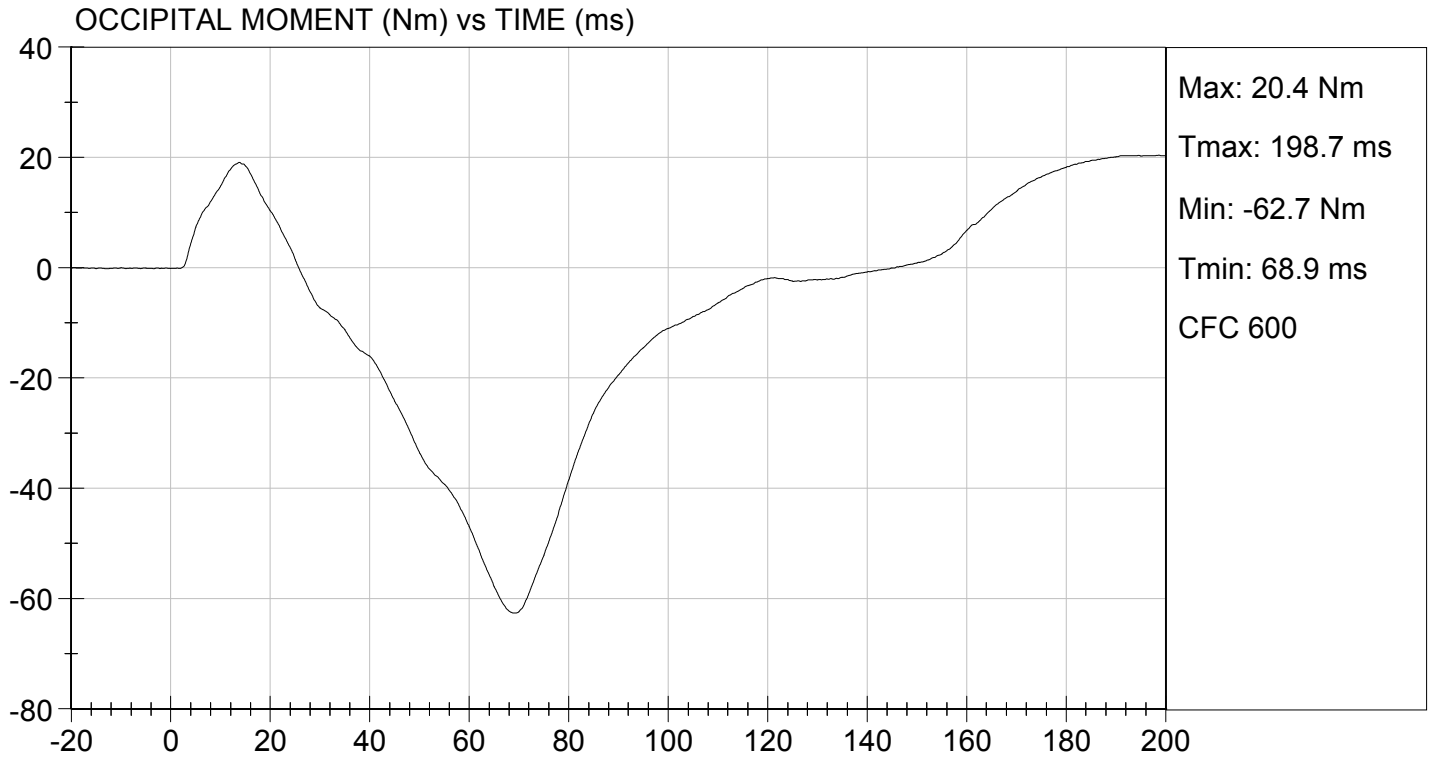


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/26/2014
TEST #: D144203



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 511 Test Date: 11/26/2014

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 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:	21.9°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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	4314 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4363 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	69%

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

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

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

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

Jack Coleman

Signature

11/26/2014

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144204

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	22	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	4314	Pass
Internal Hysteresis	%	69 to 85	69	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4363	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

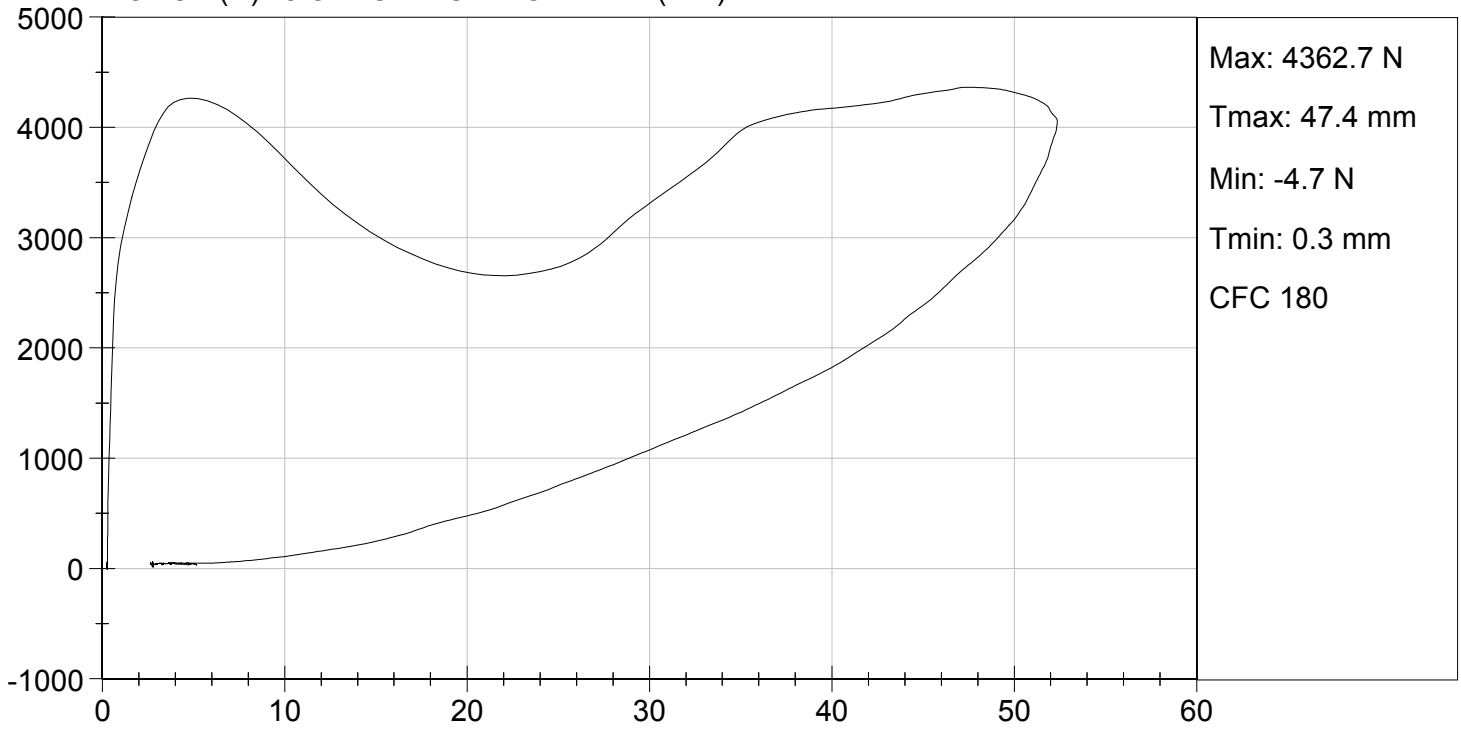
11/26/2014
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 11/26/2014
TEST #: D144204

FORCE (N) vs CHEST DISPLACEMENT (mm)



DATA SHEET B7

TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 511 Test Date: 11/26/2014

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:	21.9°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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

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

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

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

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

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

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

Record reference plane angle (max. allowed 20°): See Result Table

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

X 13. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.135(c)(9))

X 14. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.135(c)(10))

X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))

X 16. 3 minutes after the release of the force, measure the reference plane angle. (572.135(c)(11))

X 17. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	20 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.8 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	359 N
Final ref. plane angle	Initial ref. plane angle ± 8°	22 deg

Jack Coleman
Signature

11/26/2014
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144207

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	21	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	22	Pass
Force at 45 deg	N	320 to 390	359	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

11/26/2014
Test Date

Jeff Leonardelli
Approved By

DATA SHEET B8

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

Dummy Serial Number: 511 Test Date: 11/26/2014

Technician: Maxime Chamberland

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:	21.9°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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	3589 N

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

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

Maxime Chamberland
Signature

11/26/2014
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144206

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3589	Pass
		Overall Test Results		Pass

Maxime Chamberland

Laboratory Technician

11/26/2014

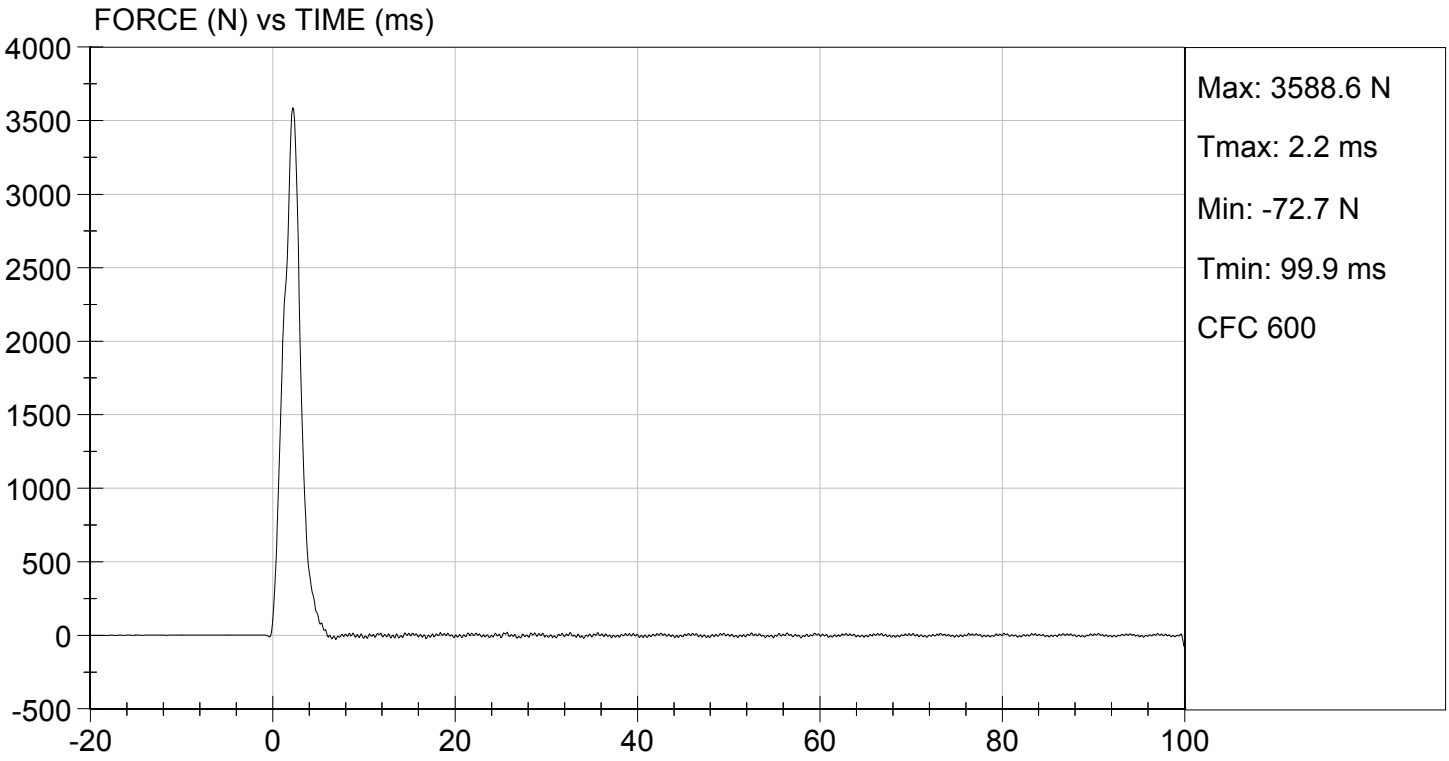
Test Date

Jeff Leonardelli

Approved By

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

TEST DATE: 11/26/2014
TEST #: D144206



DATA SHEET B9

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

Dummy Serial Number: 511 Test Date: 11/26/2014

Technician: Maxime Chamberland

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:	21.9°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	26%
Record the minimum humidity:	20%

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	3967 N

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

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

Maxime Chamberland
Signature

11/26/2014
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144205

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.8	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3967	Pass
		Overall Test Results		Pass

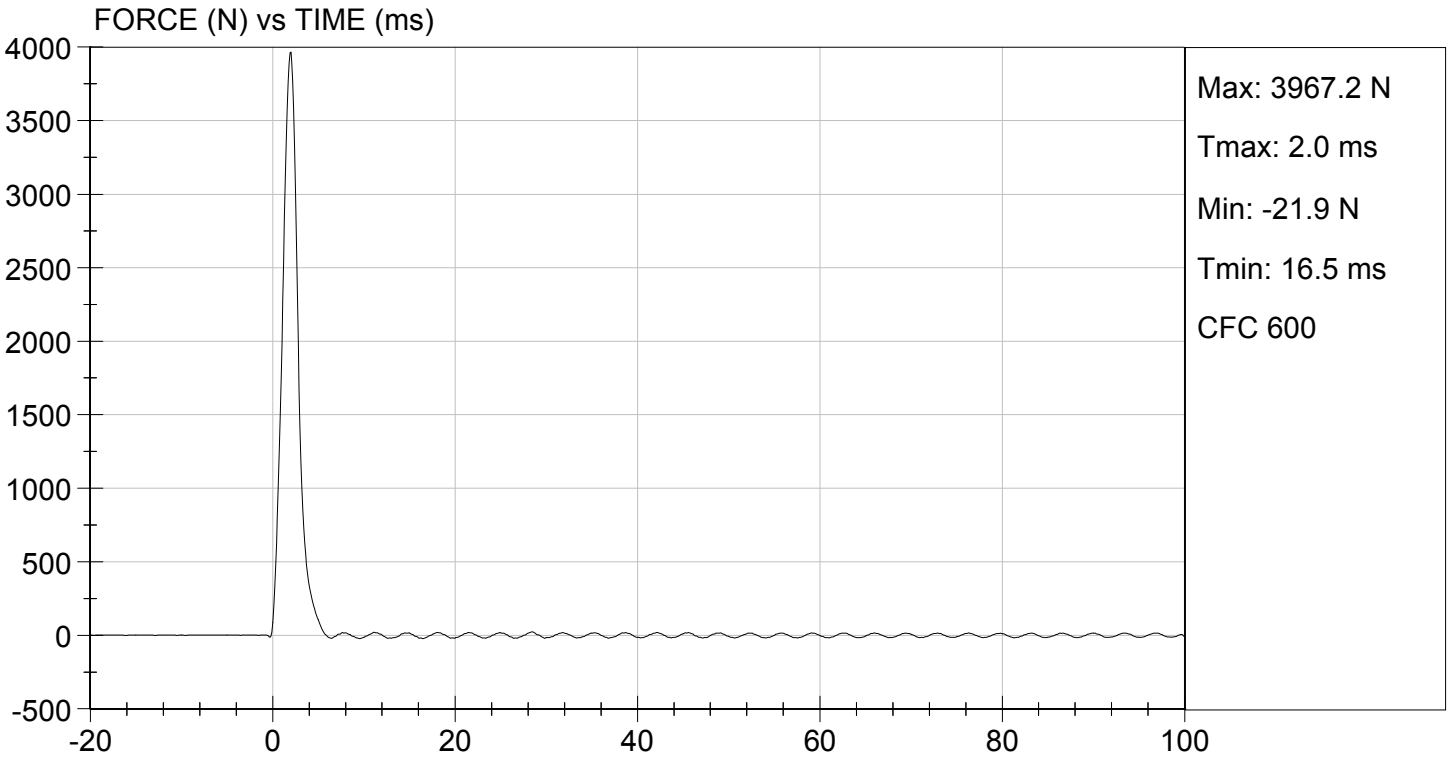
Maxime Chamberland
Laboratory Technician

11/26/2014
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 11/26/2014
TEST #: D144205



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	P82661	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82662	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82663	08/20/2014	02/20/2015
NECK TRANSDUCER	Denton	1716	1673	11/19/2014	05/19/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79704	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79705	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82657	08/20/2014	02/20/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	511	08/20/2014	02/20/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	639	07/11/2014	01/11/2015
(2) LEFT FEMUR	Denton	2121	643	07/11/2014	01/11/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B3

HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number: 511 Test Date: 12/16/2014

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:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

_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	283 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	-8.9 g

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

Jack Coleman
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test ID:** D144451

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Peak Resultant Acceleration	G's	250 to 300	283	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

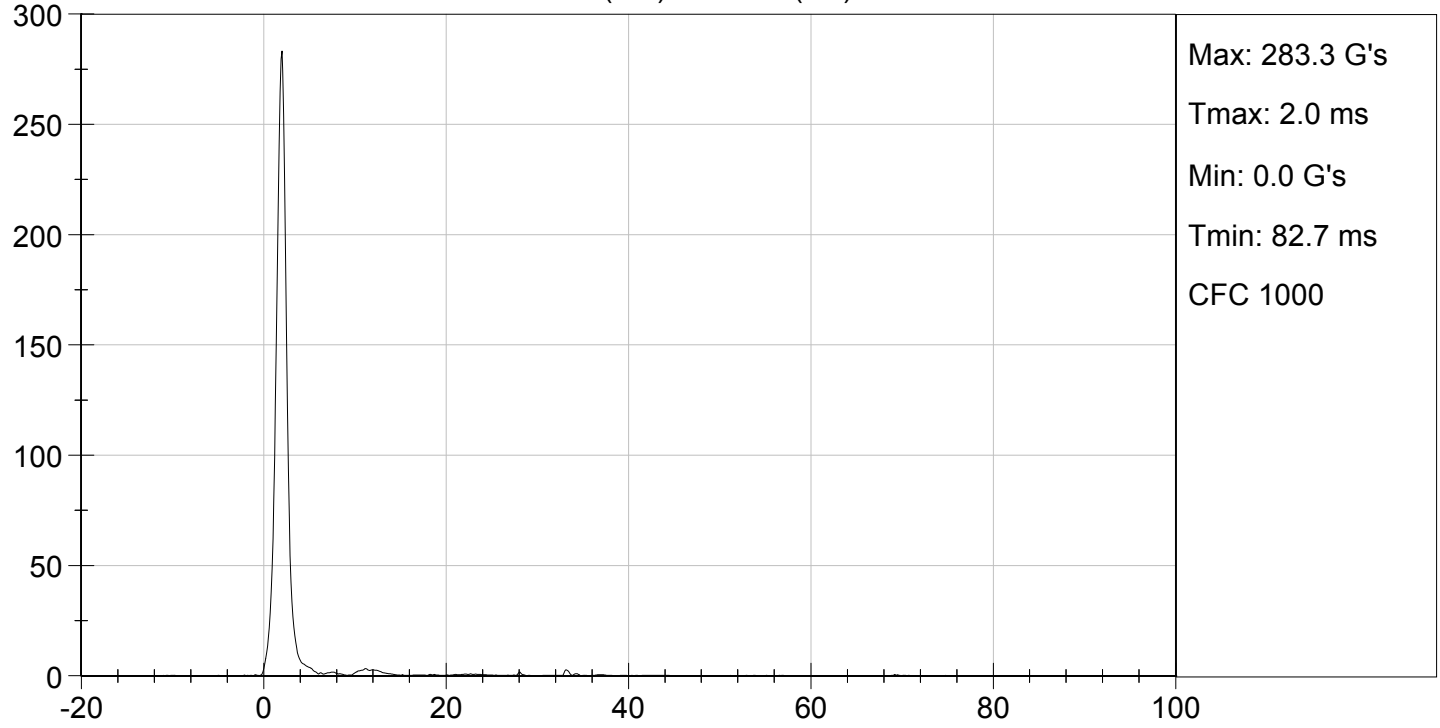
12/16/2014
Test Date

Jeff Leonardelli
Approved By

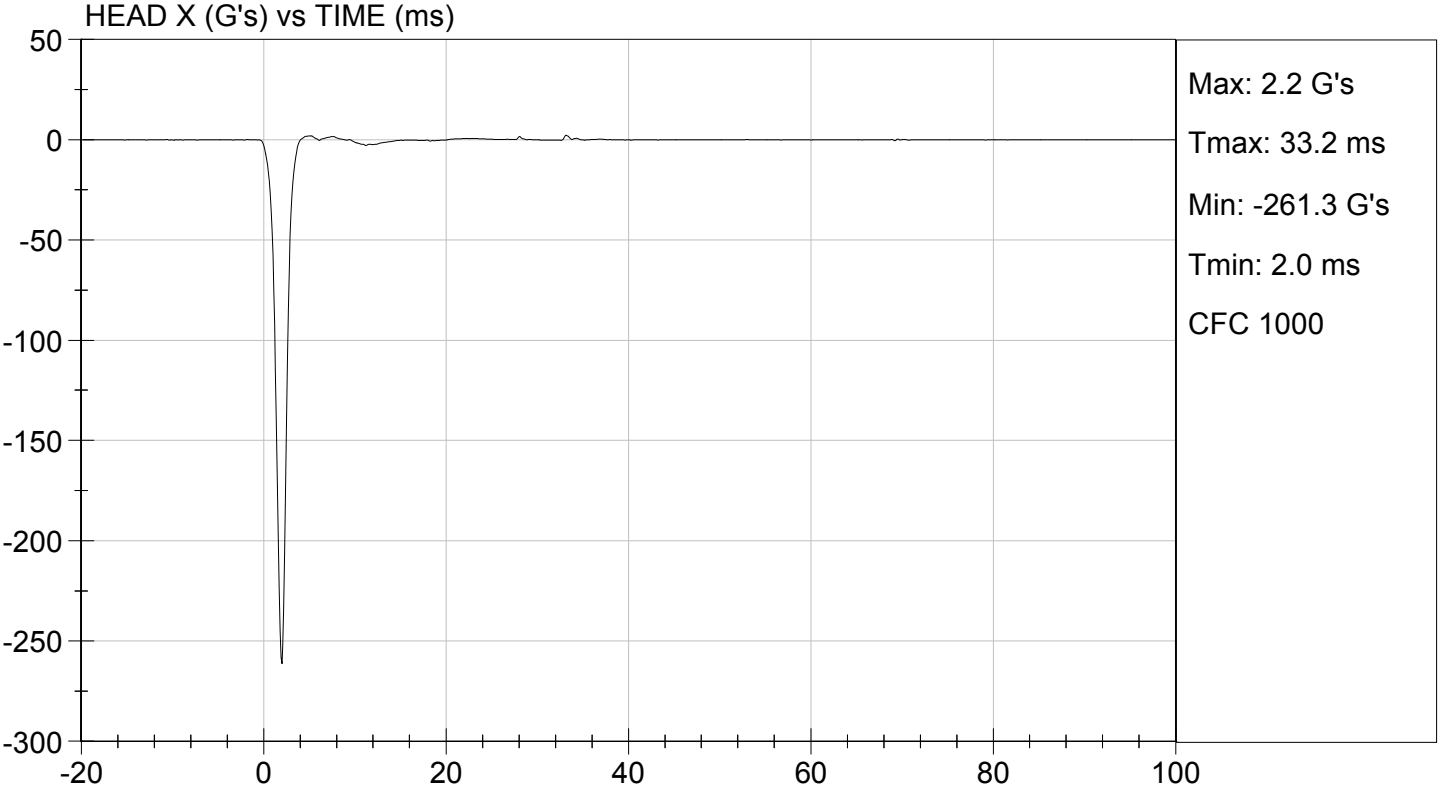
TEST DESC: HEAD DROP

TEST DATE: 12/16/2014
TEST #: D144451

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



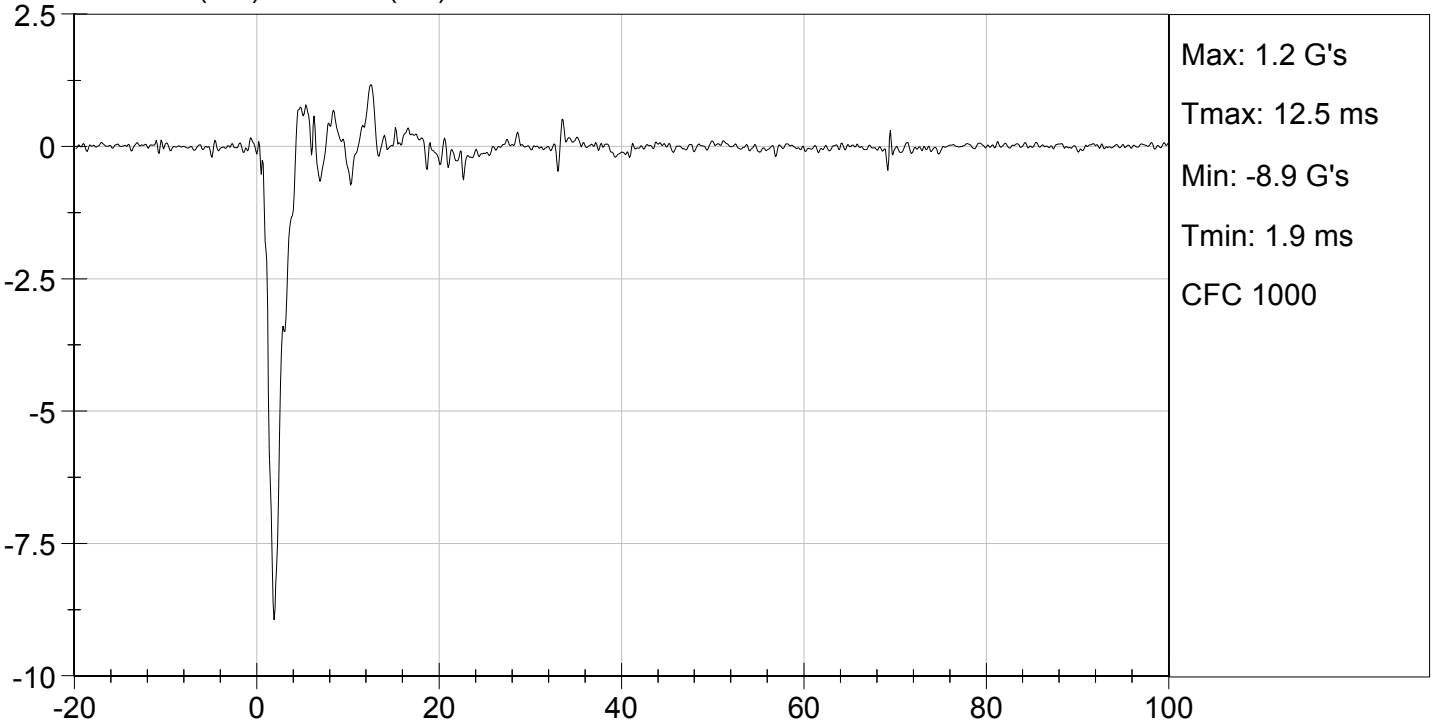
HEAD X (G's) vs TIME (ms)



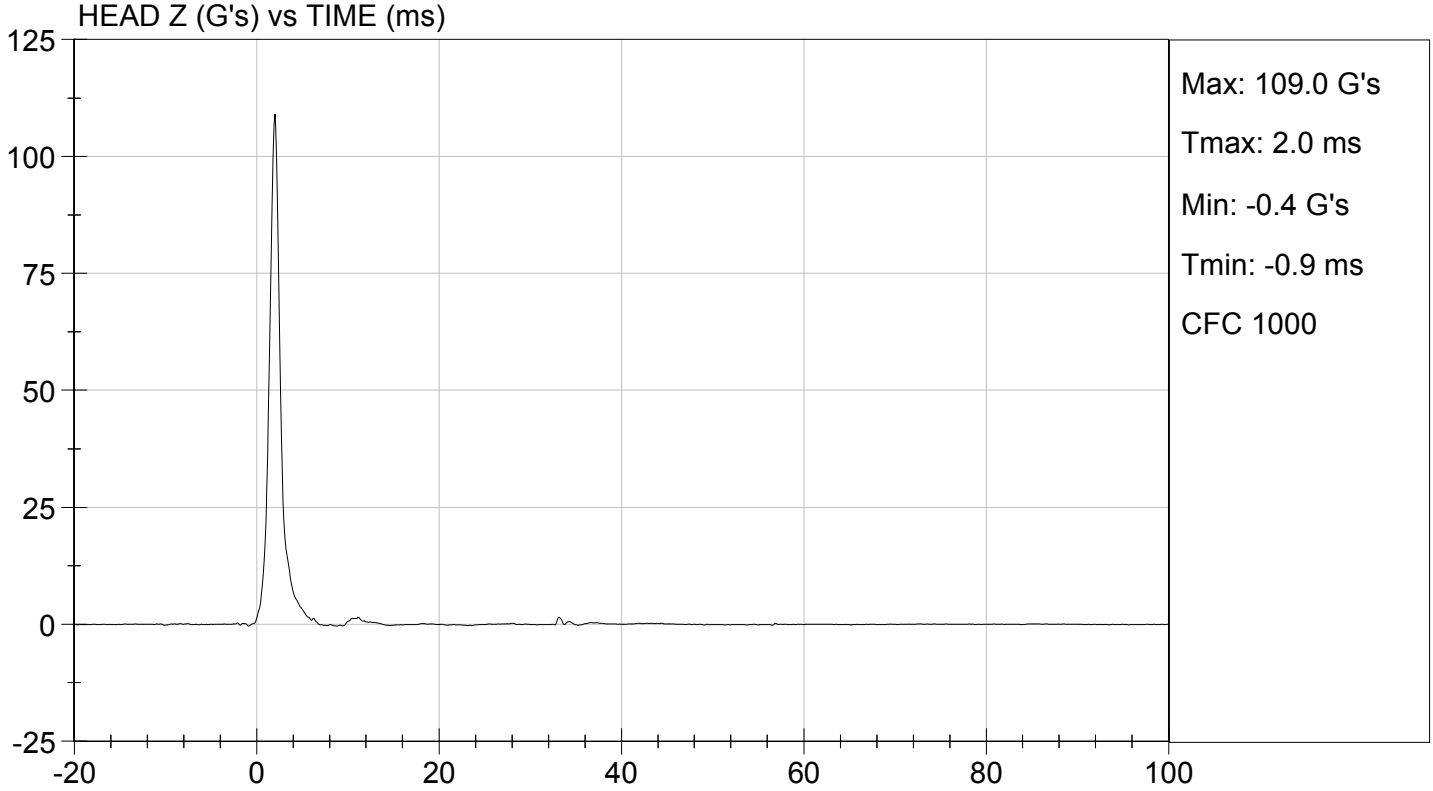
TEST DESC: HEAD DROP

TEST DATE: 12/16/2014
TEST #: D144451

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: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last flexion test. (572.137(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:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

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	2.5 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.0 m/s	4.4 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	5.9 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	74 Nm @ 85 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	81 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.

David Schoedel
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144452

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.4	Pass
	30 ms	m/s	5.8 to 7.0	5.9	Pass
D Plane Rotation	Max	deg	77 to 91	85	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	74	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	81	Pass
			Overall Results		Pass

David Schoedel
Laboratory Technician

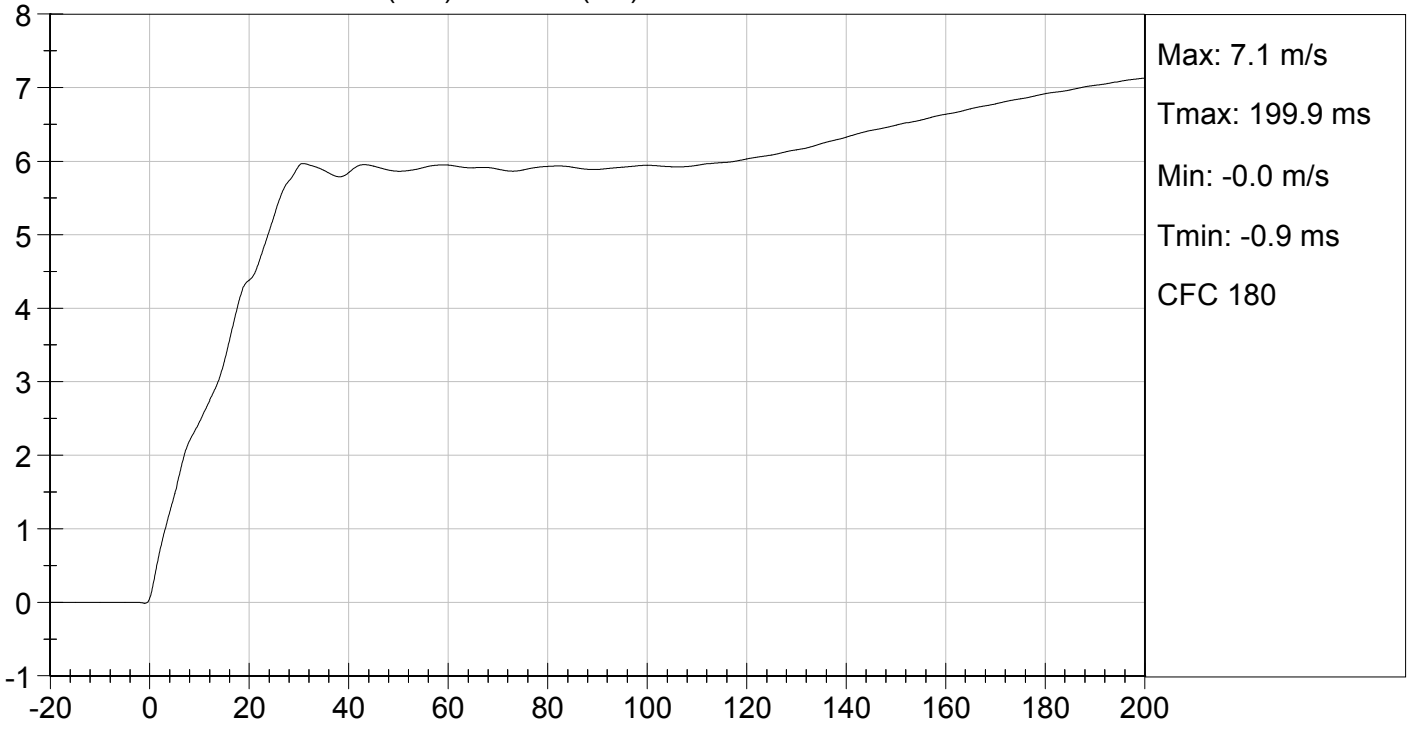
12/16/2014
Test Date

Jeff Leonardi
Approved By

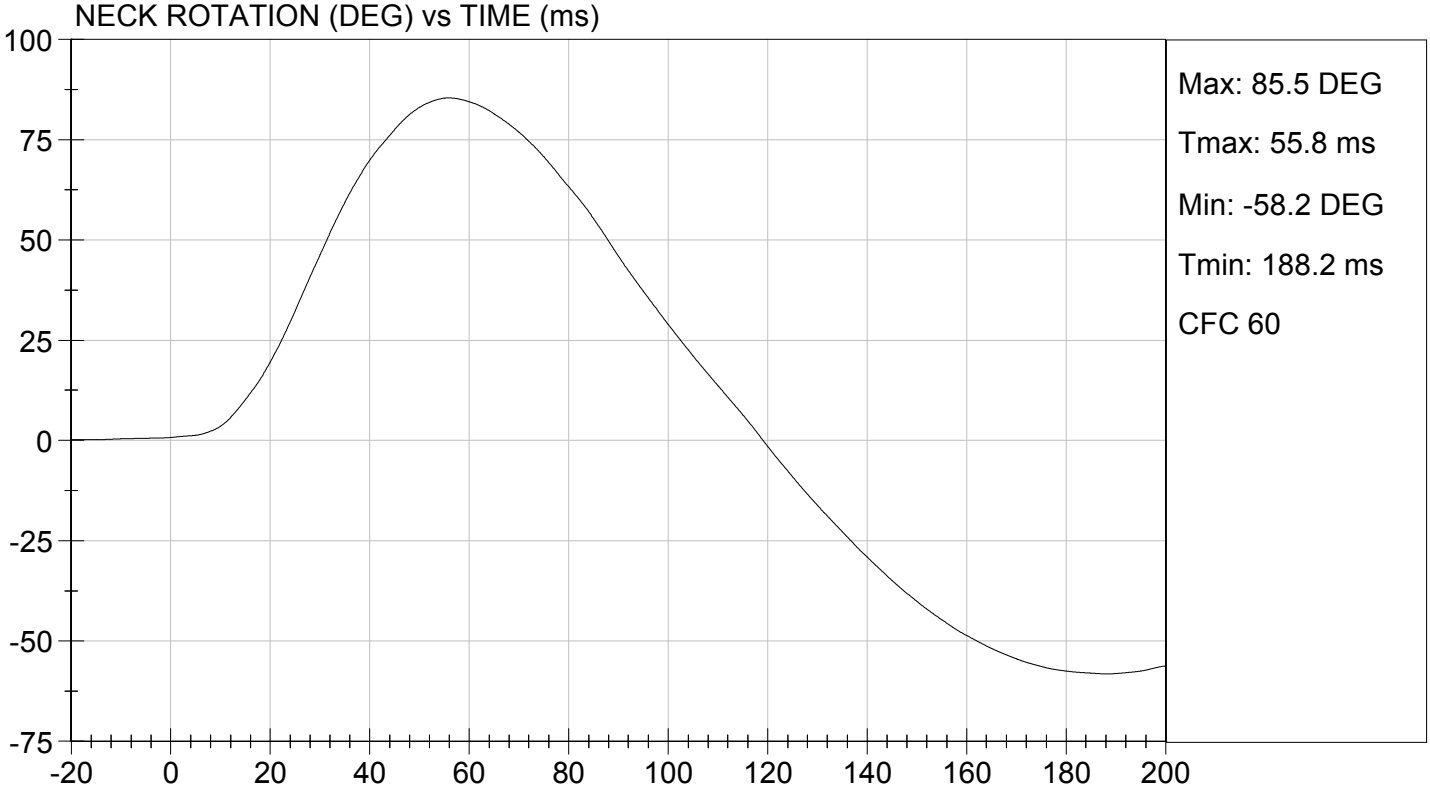
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 12/16/2014
TEST #: D144452

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

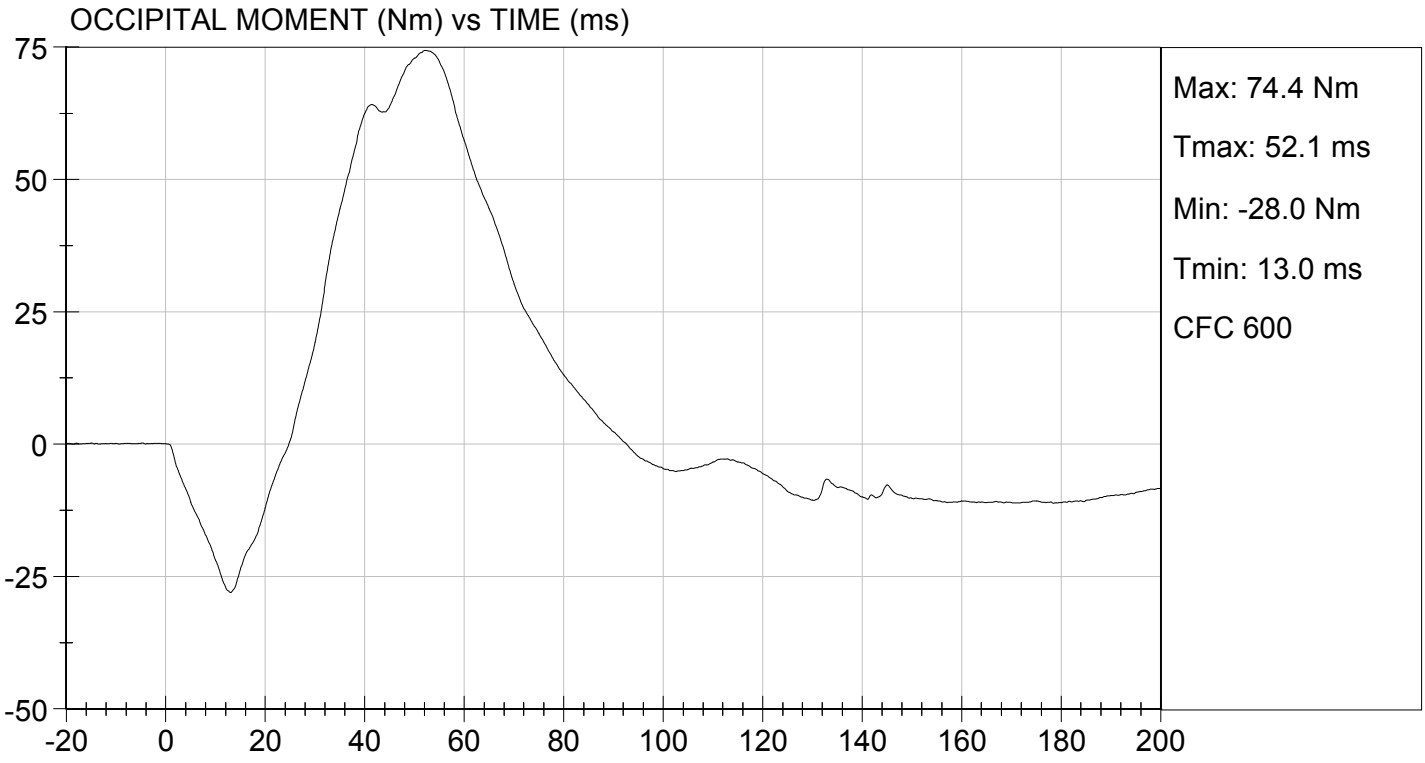


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/16/2014
TEST #: D144452



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 511 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

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	6.19 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	5.1 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-53 Nm @ 110 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.

David Schoedel
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144453

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.19	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	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	110	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	101	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

12/16/2014

Test Date

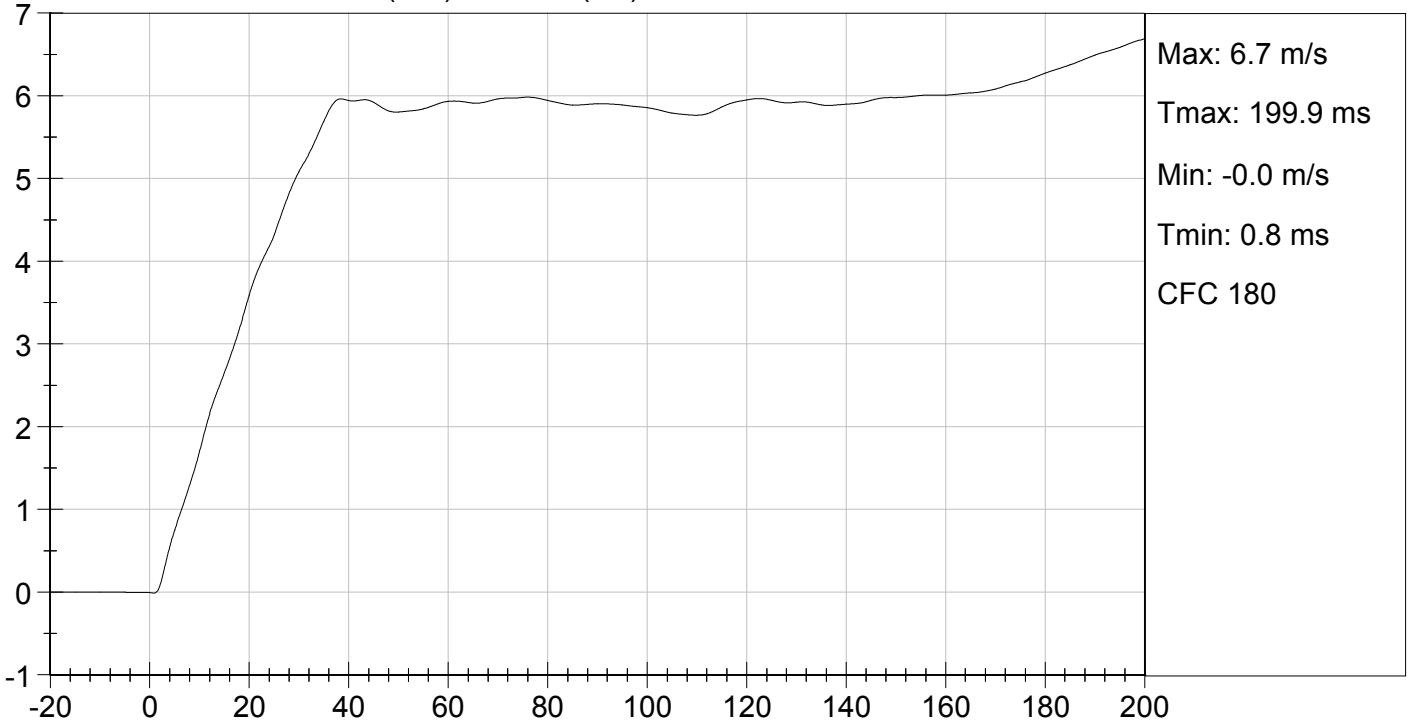
Jeff Leonardi

Approved By

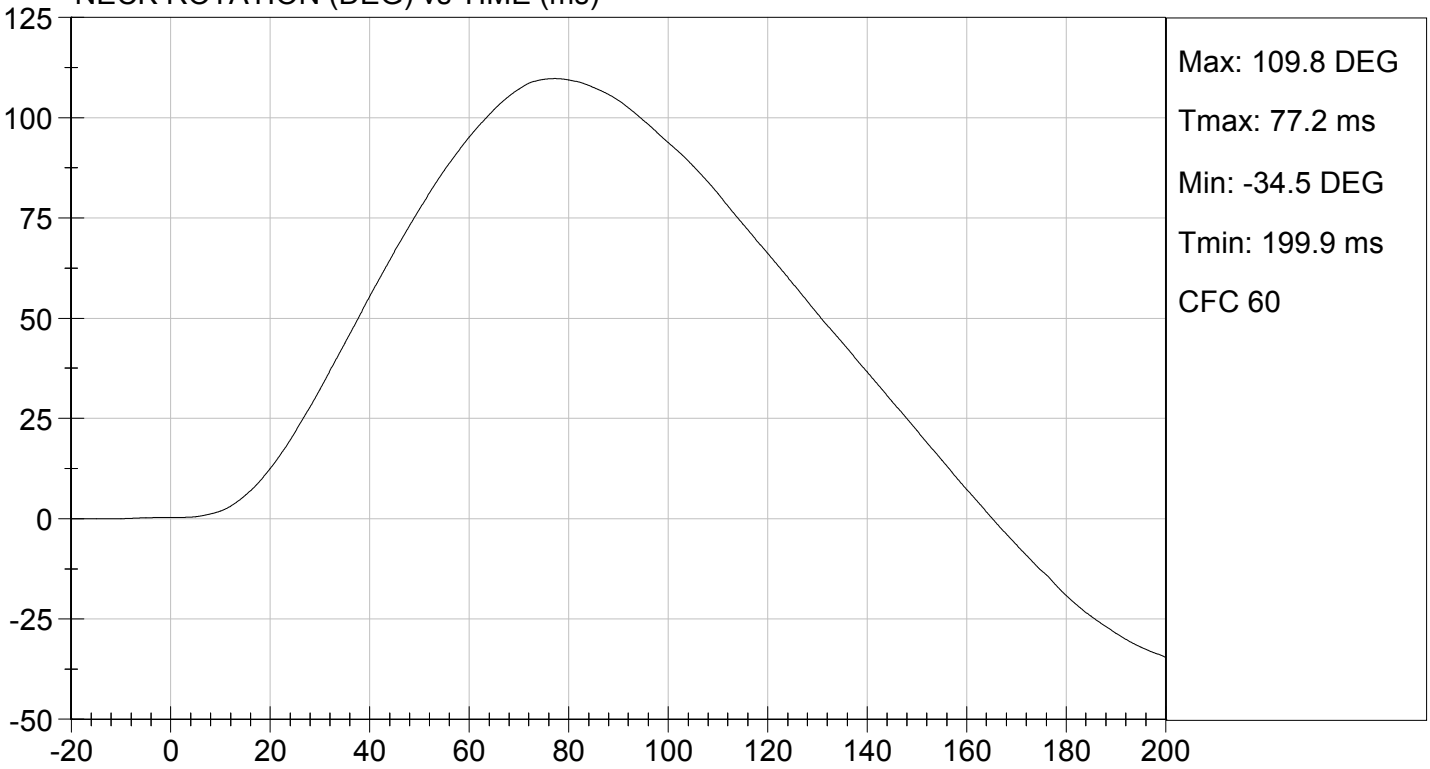
TEST DESC: NECK EXTENSION
VELOCITY: 20.30 ft/s, 6.19 m/s

TEST DATE: 12/16/2014
TEST #: D144453

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



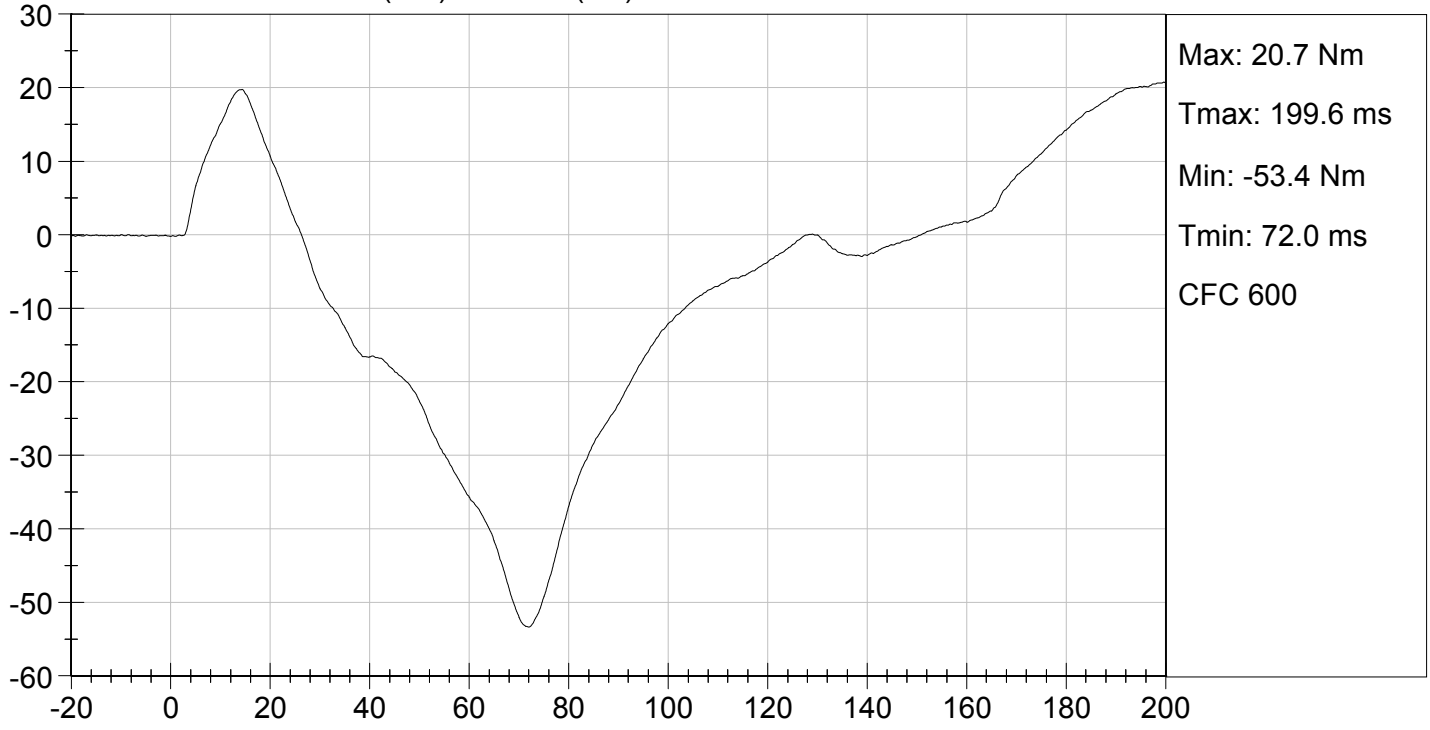
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 12/16/2014
TEST #: D144453

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 511 Test Date: 12/17/2014

Technician: David Schoedel

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

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	53 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4371 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4377 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	70%

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

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

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

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

David Schoedel

Signature

12/17/2014

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144454

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	26	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4371	Pass
Internal Hysteresis	%	69 to 85	70	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4377	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

12/17/2014

Test Date

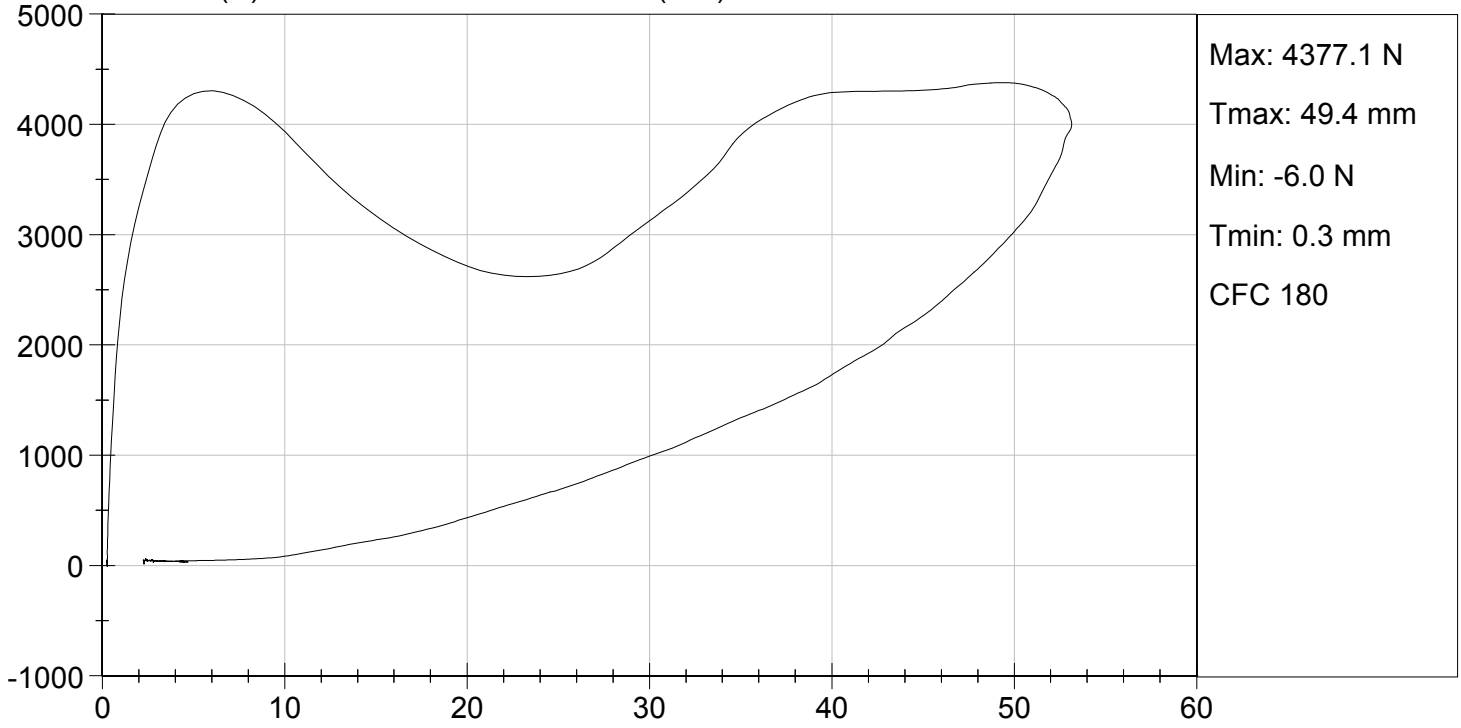
Jeff Leonardelli

Approved By

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

TEST DATE: 12/17/2014
TEST #: D144454

FORCE (N) vs CHEST DISPLACEMENT (mm)



DATA SHEET B7

TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 511 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last torso flexion test. (572.137(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:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

_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°	17 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.8 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	382 N
Final ref. plane angle	Initial ref. plane angle ± 8°	18 deg

David Schoedel
Signature

12/16/2014
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144457

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	33	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	18	Pass
Force at 45 deg	N	320 to 390	382	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

David Schoedel
Laboratory Technician

12/16/2014
Test Date

Jeff Leonardelli
Approved By

DATA SHEET B8

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

Dummy Serial Number: 511 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last knee impact test. (572.137(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:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

_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	2.13 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3998 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

12/16/2014 — Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144456

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3998	Pass
		Overall Test Results		Pass

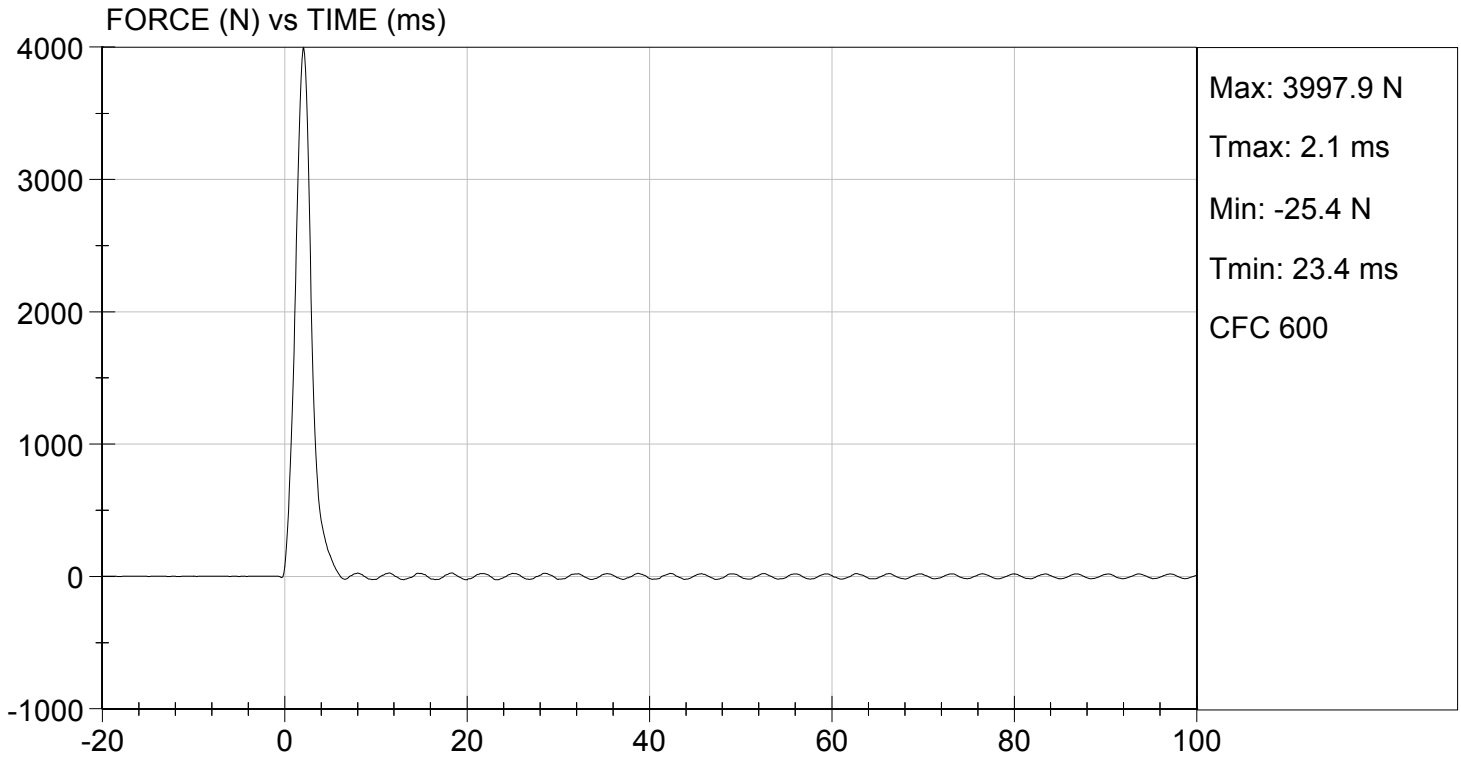
David Schoedel
Laboratory Technician

12/16/2014
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 12/16/2014
TEST #: D144456



DATA SHEET B9

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

Dummy Serial Number: 511 Test Date: 12/16/2014

Technician: David Schoedel

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last knee impact test. (572.137(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:	21.6°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	36%
Record the minimum humidity:	26%

_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	2.13 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3501 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

12/16/2014

Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D144455

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	3450 to 4060	3501	Pass
		Overall Test Results		Pass

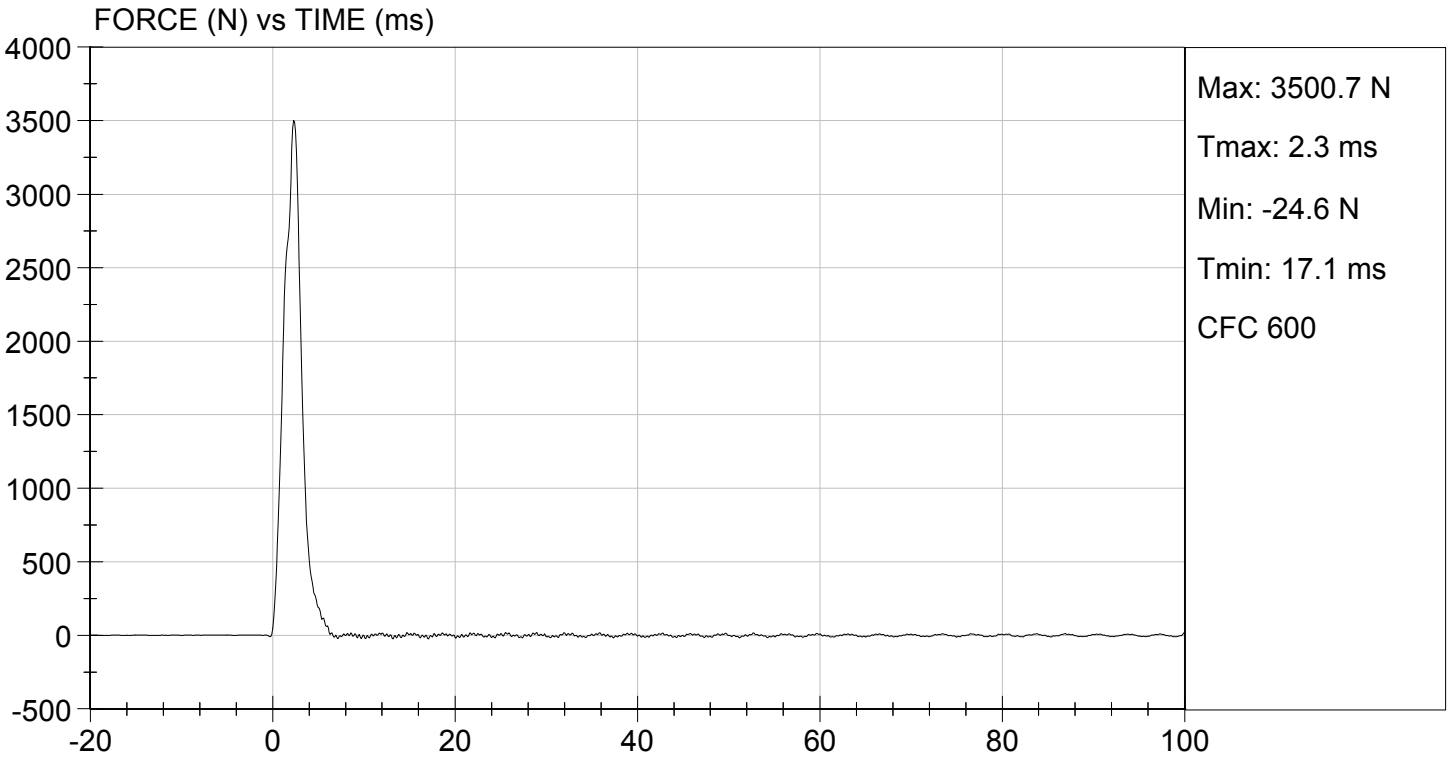
David Schoedel
Laboratory Technician

12/16/2014
Test Date

Jeff Leonardi
Approved By

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

TEST DATE: 12/16/2014
TEST #: D144455



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	P82661	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82662	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82663	08/20/2014	02/20/2015
NECK TRANSDUCER	Denton	1716	1673	11/19/2014	05/19/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79704	08/20/2014	02/20/2015
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79705	08/20/2014	02/20/2015
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82657	08/20/2014	02/20/2015
CHEST POTENTIOMETER	Servo	14CBI-2897	511	08/20/2014	02/20/2015
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	639	07/11/2014	01/11/2015
(2) LEFT FEMUR	Denton	2121	643	07/11/2014	01/11/2015
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AGH11	08/11/2014	02/11/2015
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P78815	07/15/2014	01/15/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P80111	07/02/2014	01/02/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	10/09/2014	04/09/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	10/09/2014	04/09/2015

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 511 Test Date: 12/16/2014

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 12/17/2014

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 12/17/2014

Signature — Date