REPORT NO. 208-MGA-2015-DC004

DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208

FUJI HEAVY INDUSTRIES INC.
2015 SUBARU OUTBACK MPV
NHTSA NO.: C20155502

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

TEST DATES: OCTOBER 12, 2015 – NOVEMBER 16, 2015

FINAL REPORT DATE: NOVEMBER 30, 2015

FINAL REPORT

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

TABLE OF CONTENTS

		Page No.
DUMMY S/N: 511	PRE-TEST CERTIFICATION DATA	1-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 511	POST-TEST CERTIFICATION DATA	2-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 510	PRE-TEST CERTIFICATION DATA	3-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 510	POST-TEST CERTIFICATION DATA	4-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 510	PRE-TEST CERTIFICATION DATA	5-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 510	POST-TEST CERTIFICATION DATA	6-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 155	PRE-TEST CERTIFICATION DATA	7-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 155	POST-TEST CERTIFICATION DATA	8-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 031	PRE-TEST CERTIFICATION DATA	9-1
	PASSED ALL CALIBRATION CHECKS	
DUMMY S/N: 031	POST-TEST CERTIFICATION DATA	10-1
	PASSED ALL CALIBRATION CHECKS	

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: 10/28/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	48%

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

Record findings and actions: No Damage

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

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

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

X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	250 g ≤ x ≤ 300 g	289 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-9.0 g

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

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

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

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	250 to 300	289	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

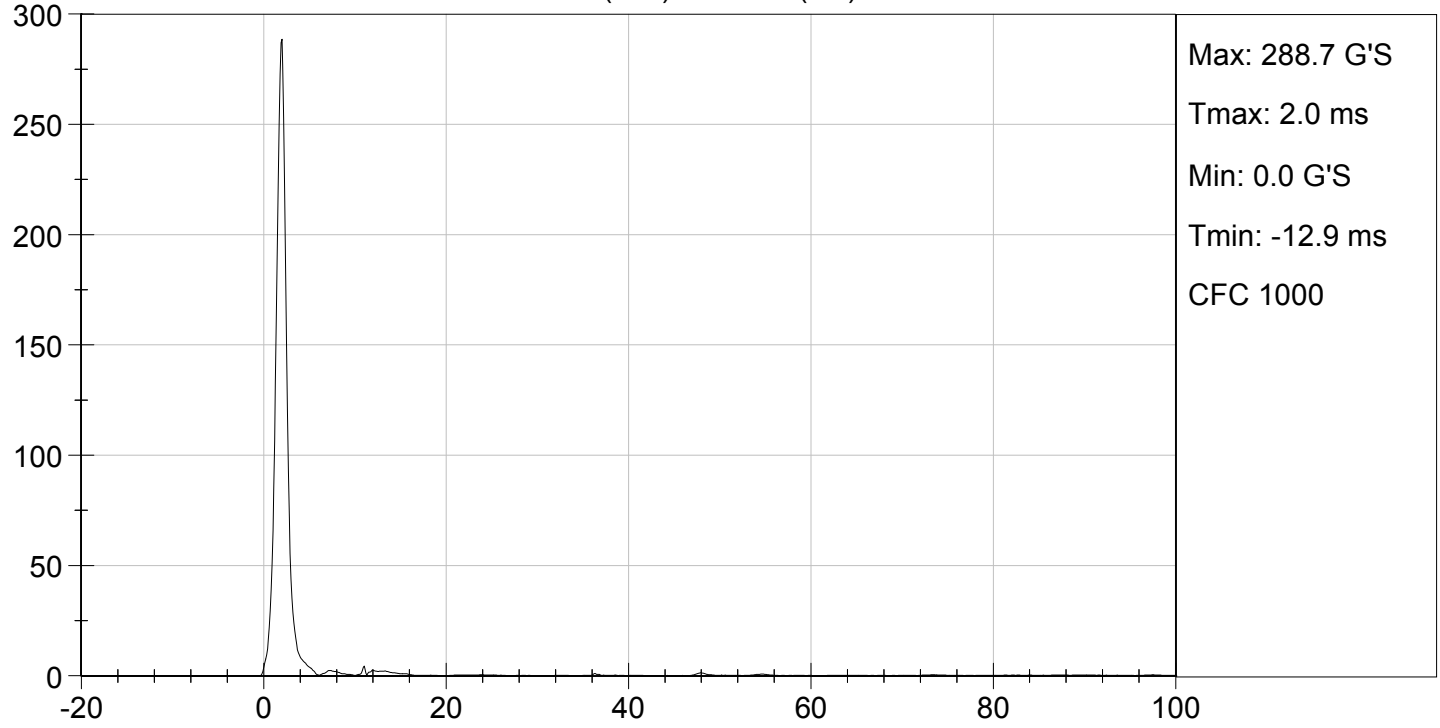
10/28/2015
Test Date

Jeff Leonardelli
Approved By

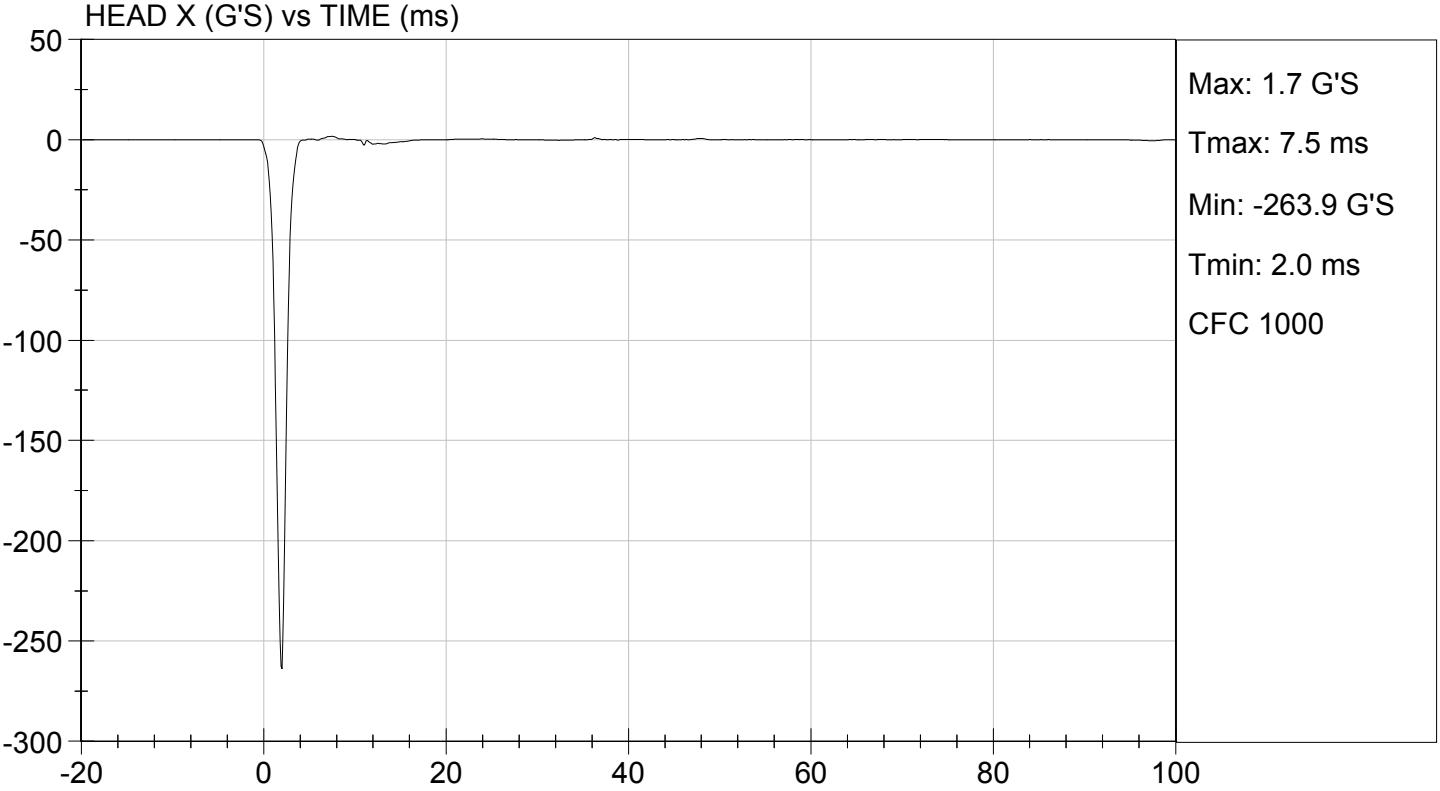
TEST DESC: HEAD DROP

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

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



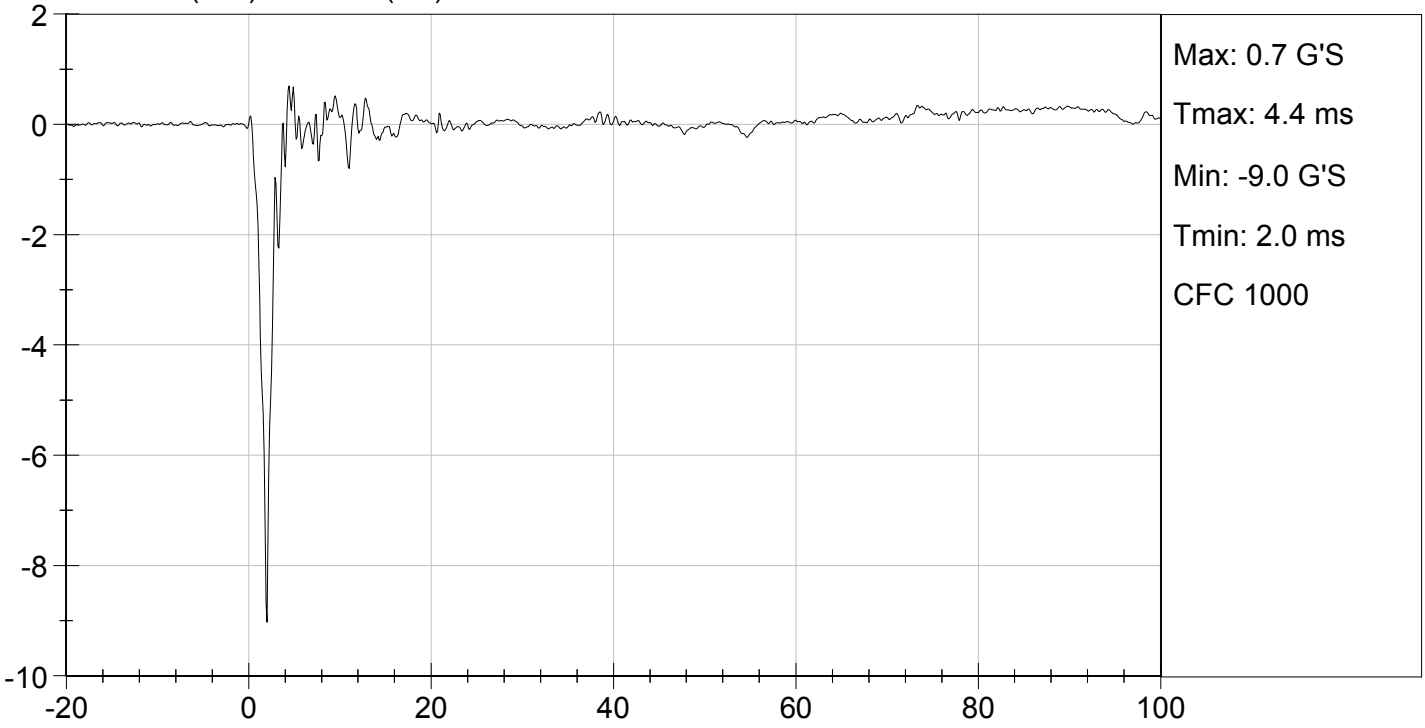
HEAD X (G'S) vs TIME (ms)



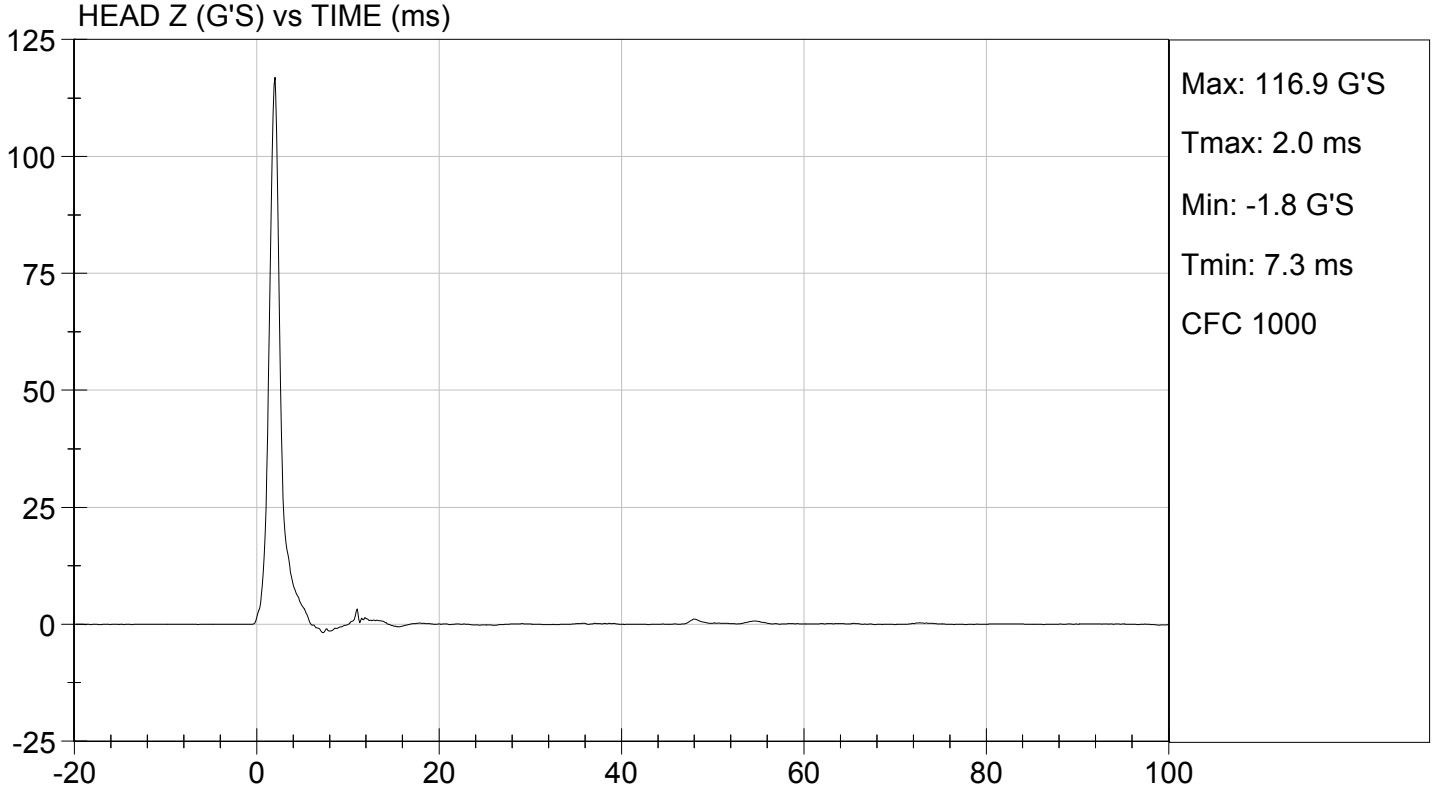
TEST DESC: HEAD DROP

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

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



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



DATA SHEET B4

NECK FLEXION TEST (572.132) (5th Female)

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

Technician: Jack Coleman

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:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	48%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s ≤ speed ≤ 7.13 m/s	7.06 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.1 m/s ≤ ΔV ≤ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.0 m/s	4.5 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	6.3 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	73 Nm @ 80 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	86 ms

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

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

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153462

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.3	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

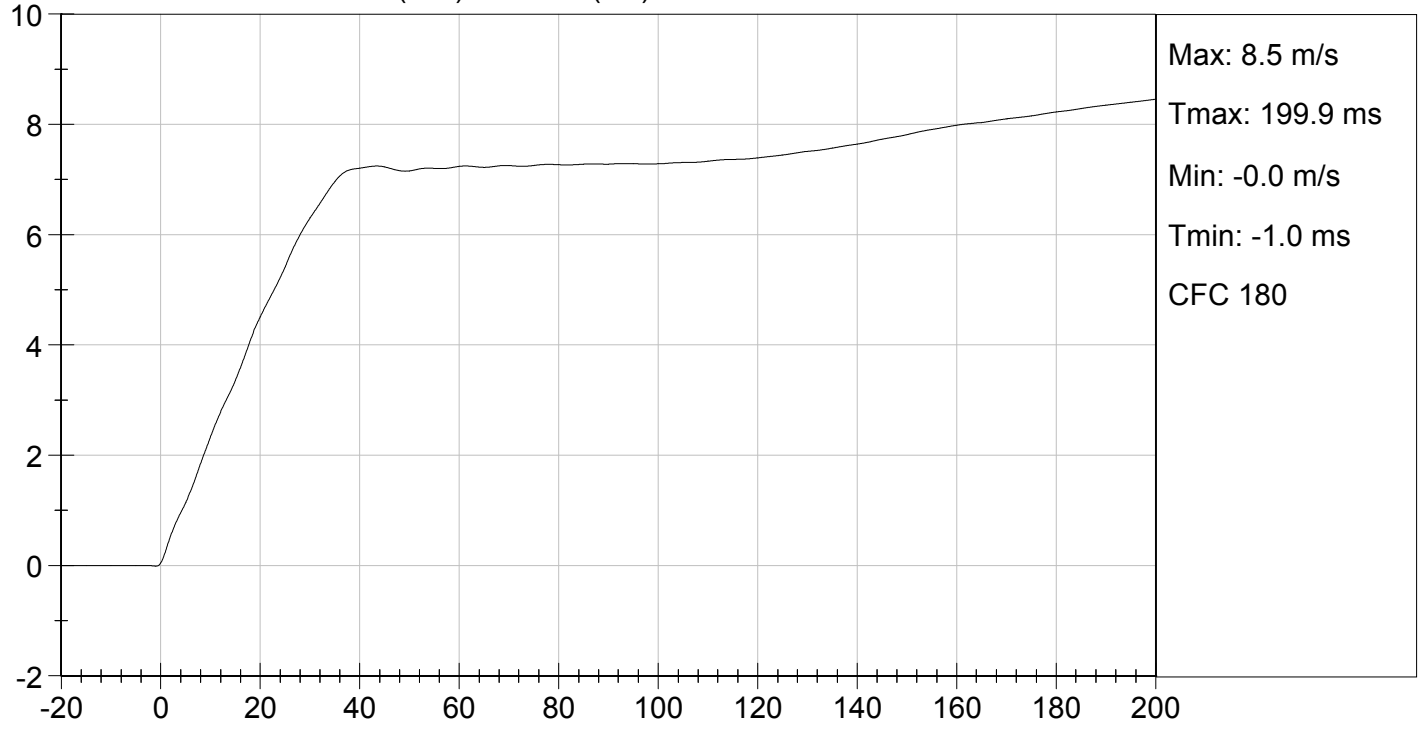
10/28/2015
Test Date

Jeff Leonardi
Approved By

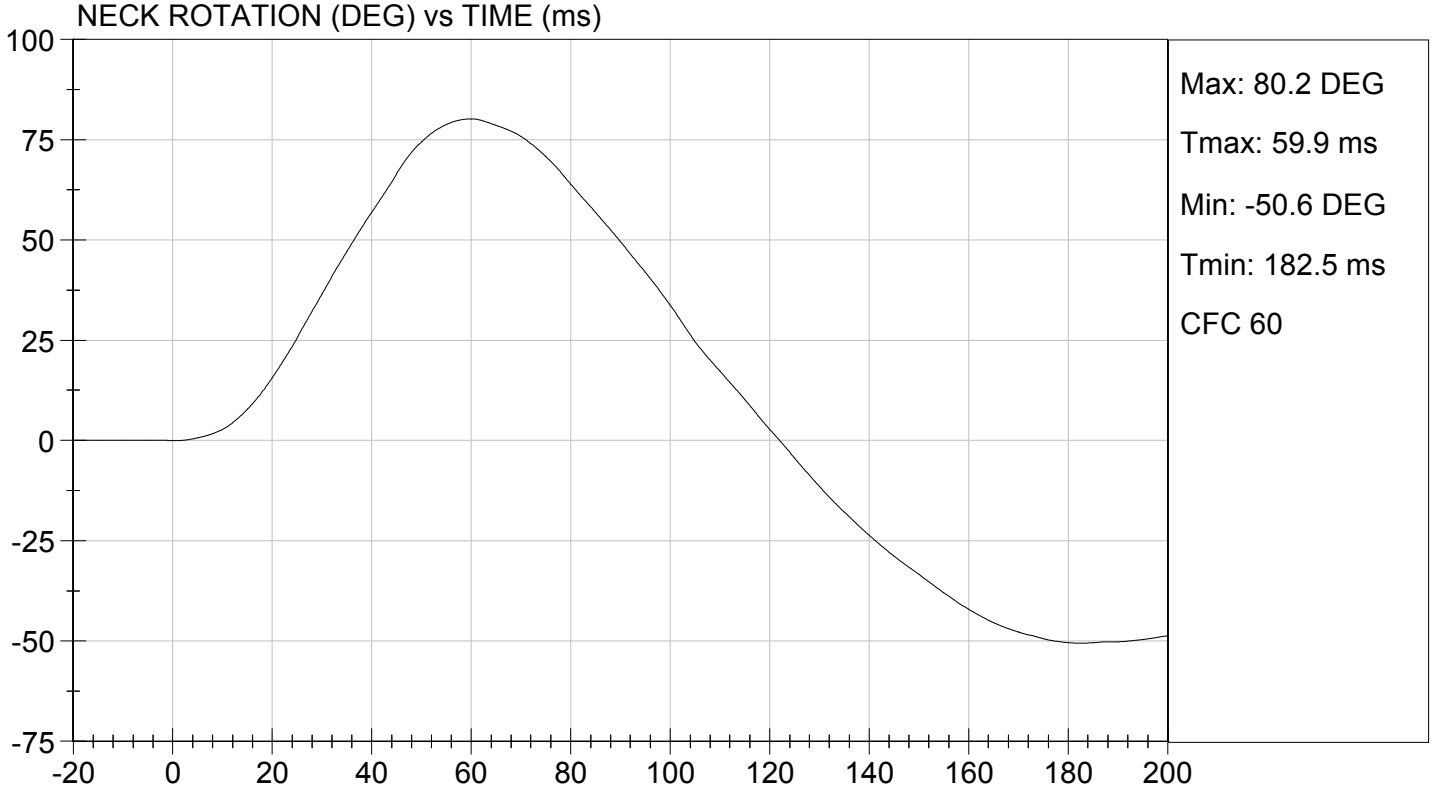
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 10/28/2015
TEST #: D153462

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

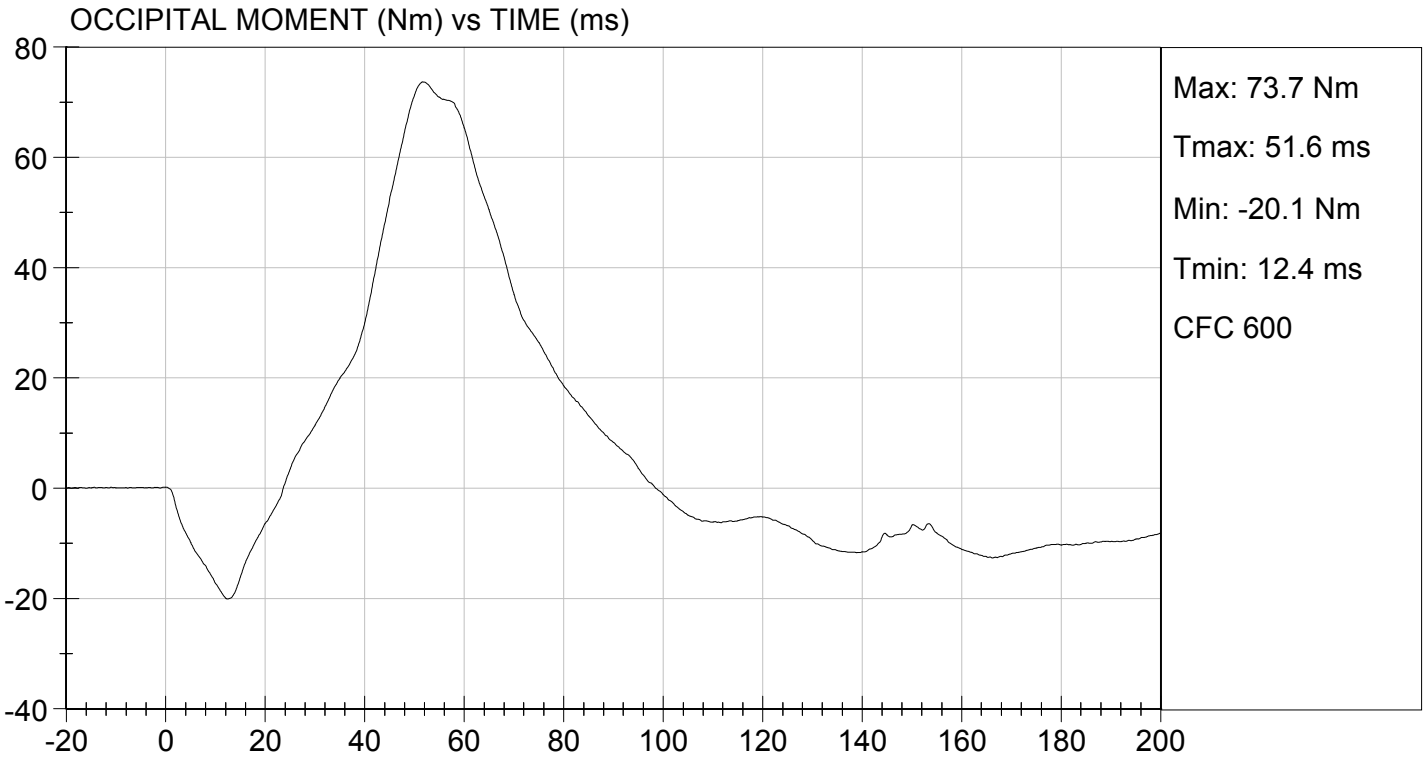


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/28/2015
TEST #: D153462



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

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

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:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	48%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s ≤ speed ≤ 6.19 m/s	6.12 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.5 m/s ≤ ΔV ≤ 1.9 m/s	1.7 m/s
	@ 20 ms	3.1 m/s ≤ ΔV ≤ 3.9 m/s	3.7 m/s
	@ 30 ms	4.6 m/s ≤ ΔV ≤ 5.6 m/s	5.3 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-56 Nm @ 106 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	101 ms

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

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

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153463

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.8	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	101	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

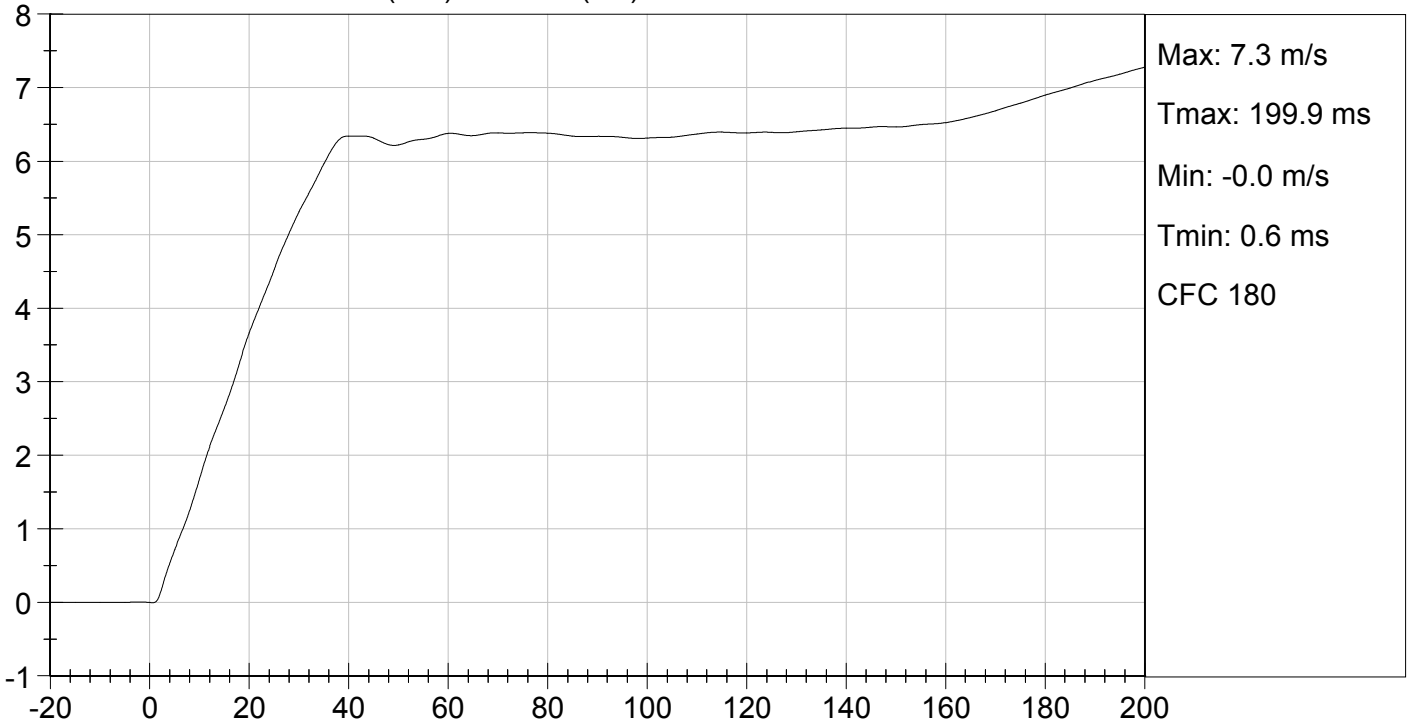
10/28/2015
Test Date

Jeff Leuenhorst
Approved By

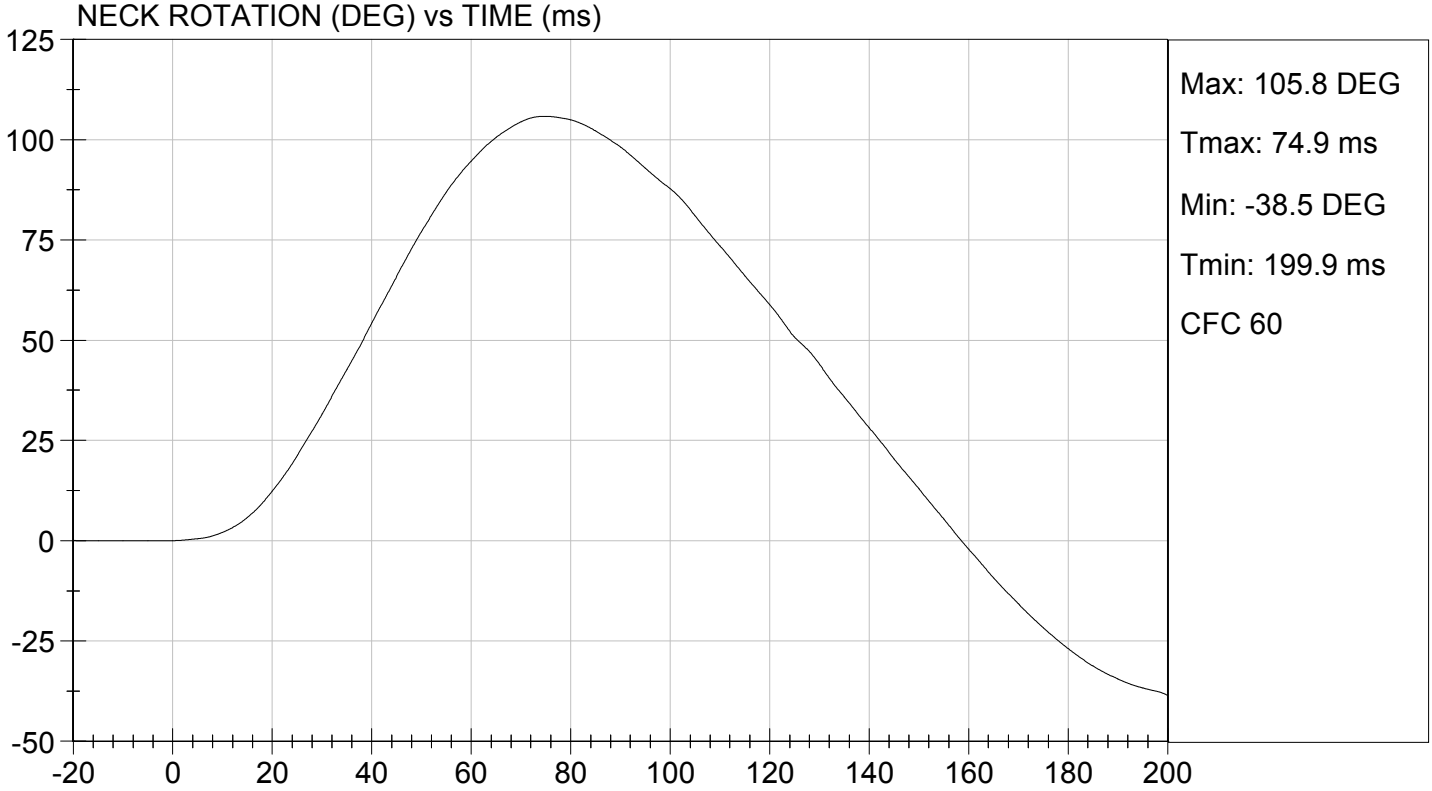
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 10/28/2015
TEST #: D153463

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

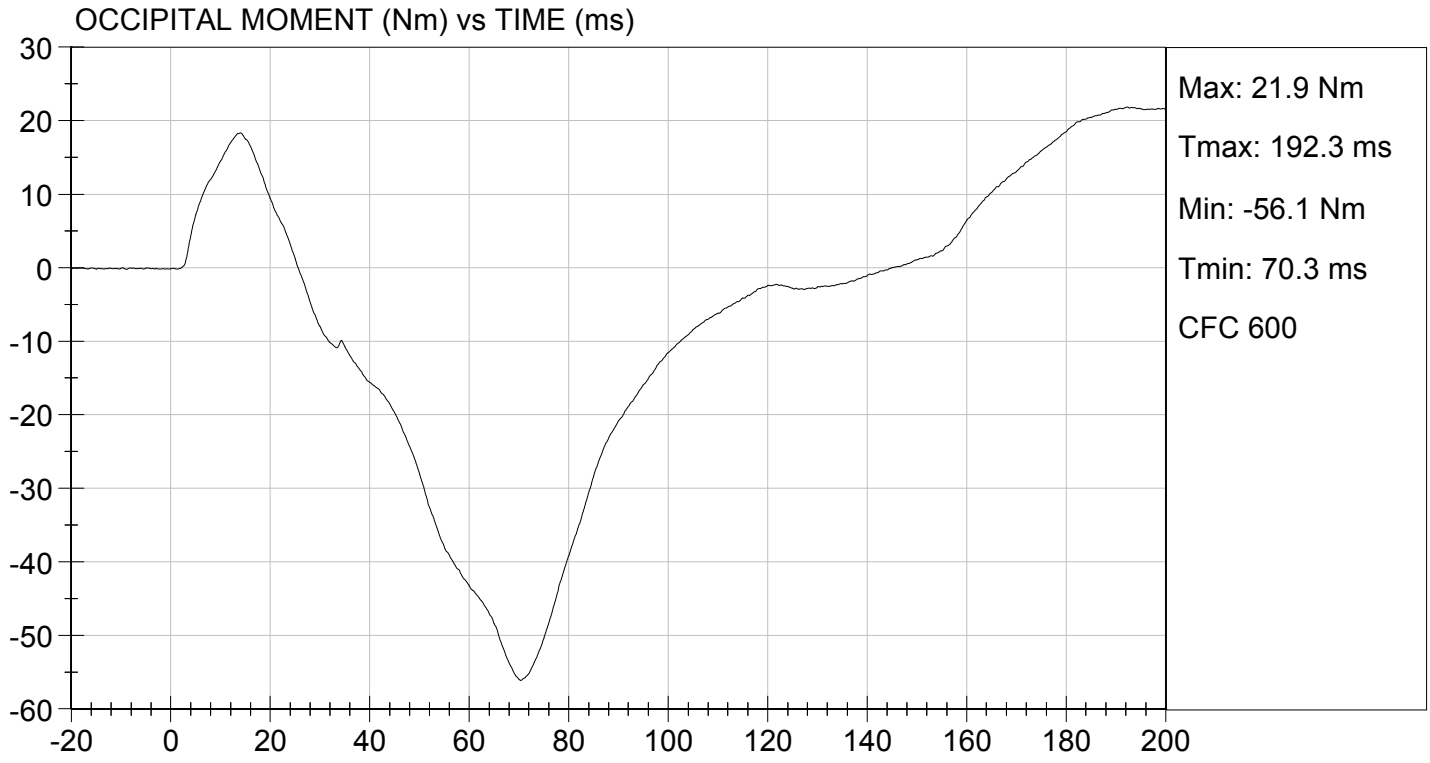


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/28/2015
TEST #: D153463



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 511 Test Date: 10/29/2015

Technician: Jack Coleman

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:	21.2°C
Record the minimum temperature:	20.9°C
Record the maximum humidity:	42%
Record the minimum humidity:	39%

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

X - No Damage

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

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

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

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

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

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

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

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

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

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

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

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

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.77 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4379 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4439 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	73%

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

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

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

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

Jack Coleman
Signature

10/29/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153464

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4379	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4439	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

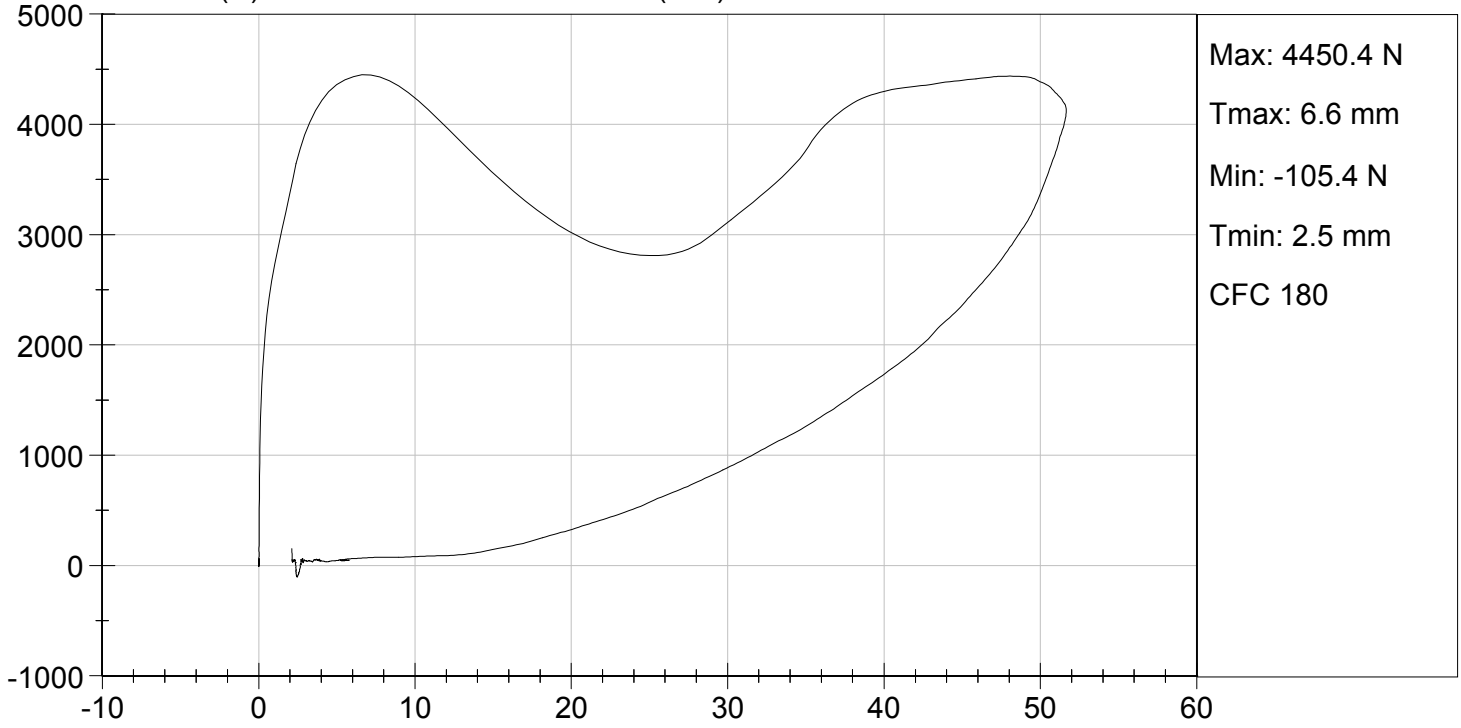
10/29/2015
Test Date

Jeff Leonardi
Approved By

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

TEST DATE: 10/29/2015
TEST #: D153464

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

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

Technician: Jack Coleman

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:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	48%

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

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

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

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

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

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

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

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

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

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

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

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

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

X 17. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	18 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.9 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	371 N
Final ref. plane angle	Initial ref. plane angle ± 8°	21 deg

Jack Coleman
Signature

10/28/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153467

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	371	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

10/28/2015
Test Date

Jeff Loranger
Approved By

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

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

Technician: Jessica Gall

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:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	48%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3971 N

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

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

Jessica Gall

Signature

10/28/2015

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153466

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3791	Pass
		Overall Test Results		Pass

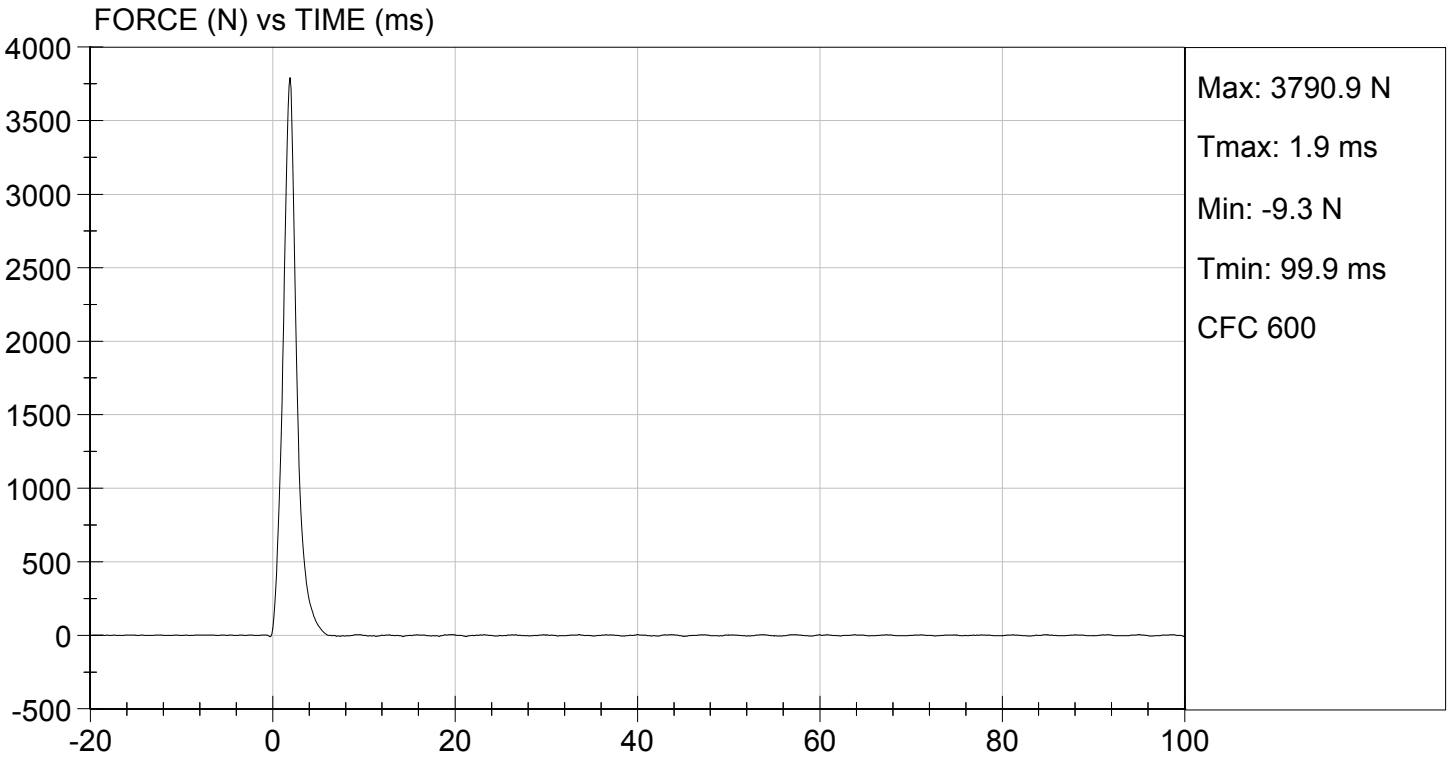
Jessica Hall
Laboratory Technician

10/28/2015
Test Date

Jeff Leonardi
Approved By

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

TEST DATE: 10/28/2015
TEST #: D153466



DATA SHEET B9

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

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

Technician: Jessica Gall

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:	21.1°C
Record the maximum humidity:	50%
Record the minimum humidity:	48%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3763 N

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

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

Jessica Gall — Signature

10/28/2015 — Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153465

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3763	Pass
		Overall Test Results		Pass

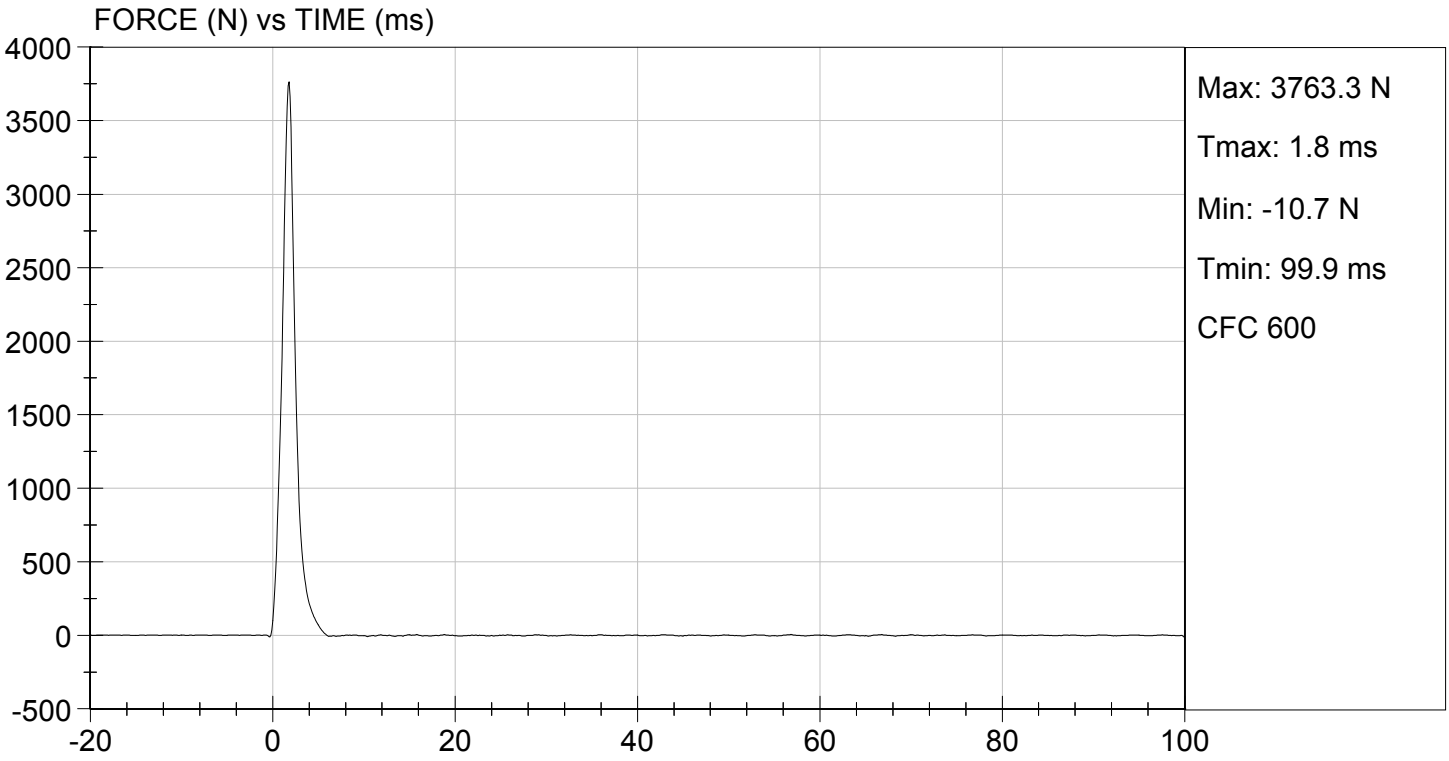
Jessica Hall
Laboratory Technician

10/28/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/28/2015
TEST #: D153465



DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82603	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82604	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82605	08/19/2015	02/19/2016
NECK TRANSDUCER	Denton	1716	2039	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P84432	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P84433	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P84435	08/19/2015	02/19/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	511	08/17/2015	02/17/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	9425	08/19/2015	02/19/2016
(2) LEFT FEMUR	Denton	2121	9426	08/19/2015	02/19/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 511 Test Date: 11/16/2015

Technician: Thomas Miller

____ 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:	21.4°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	32%
Record the minimum humidity:	29%

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

Record findings and actions: No Damage

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

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

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

X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

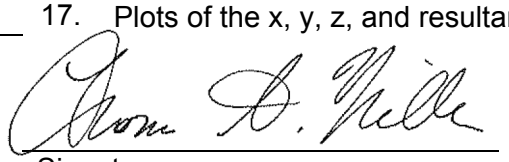
Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	250 g ≤ x ≤ 300 g	282 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	2.6 g

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



Signature

11/16/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test ID:** D153751

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	250 to 300	282	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

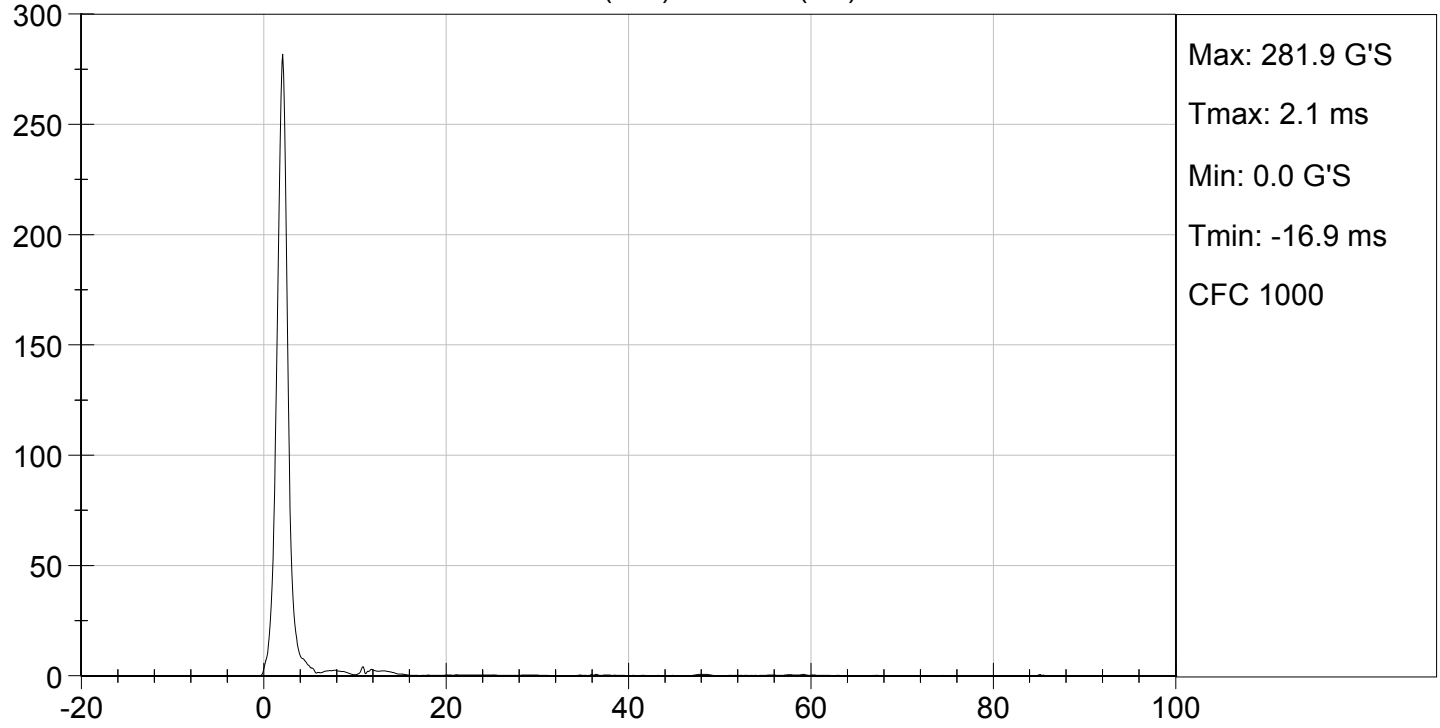
11/16/2015
Test Date

Approved By

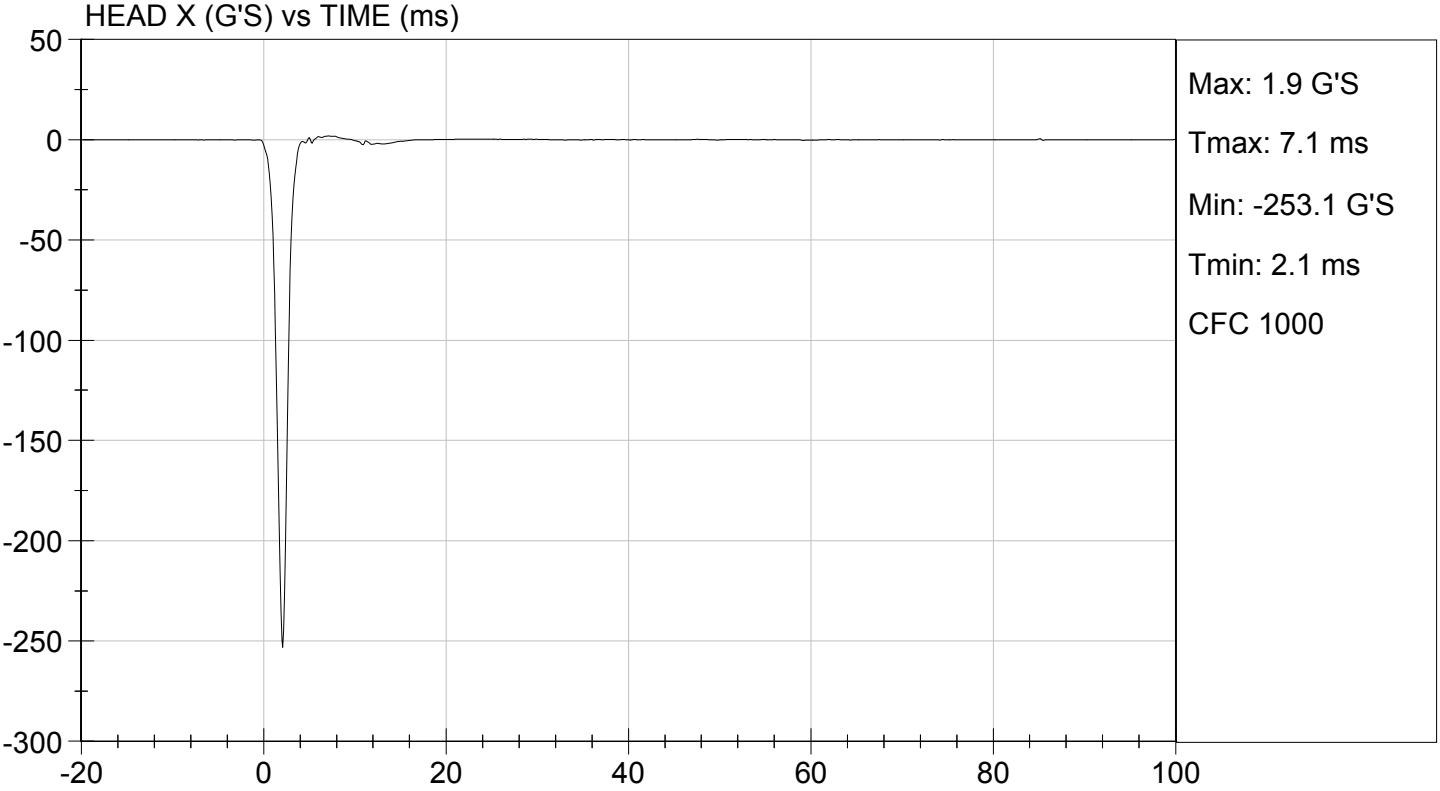
TEST DESC: HEAD DROP

TEST DATE: 11/16/2015
TEST #: D153751

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



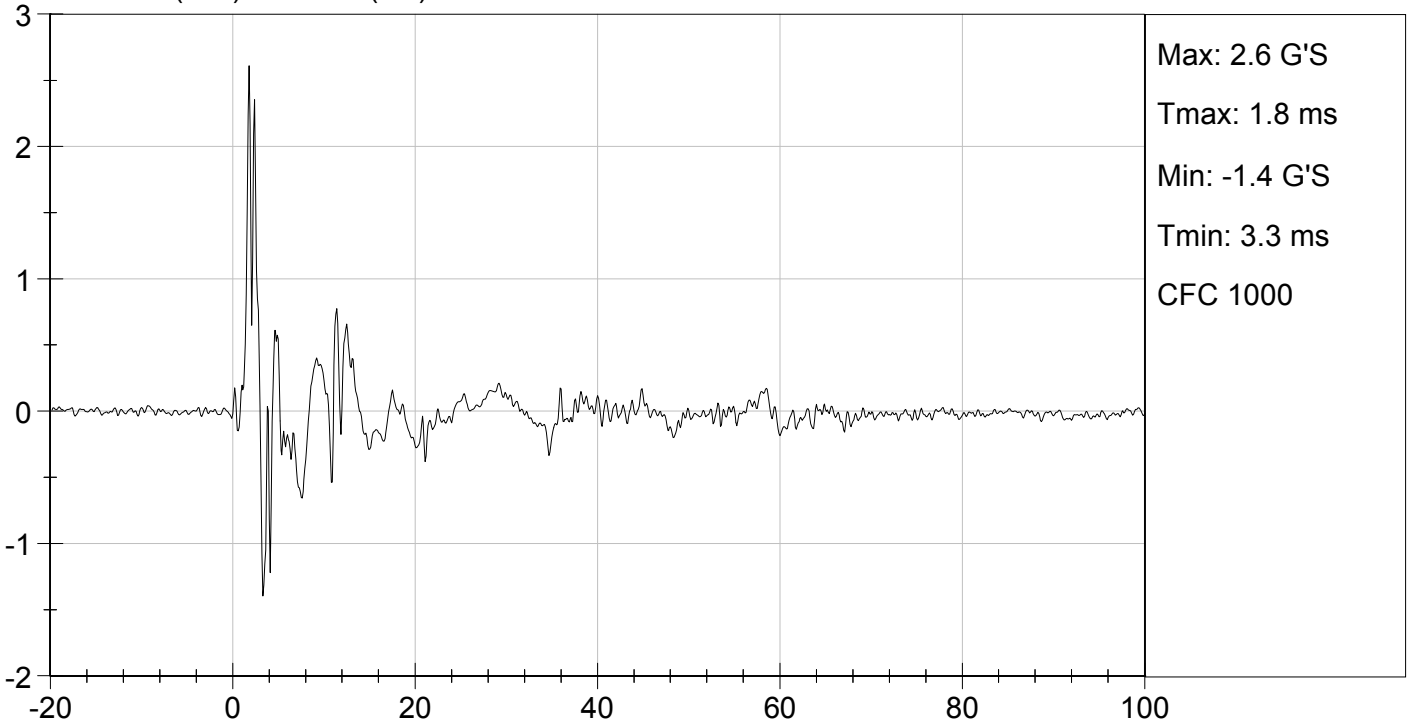
HEAD X (G'S) vs TIME (ms)



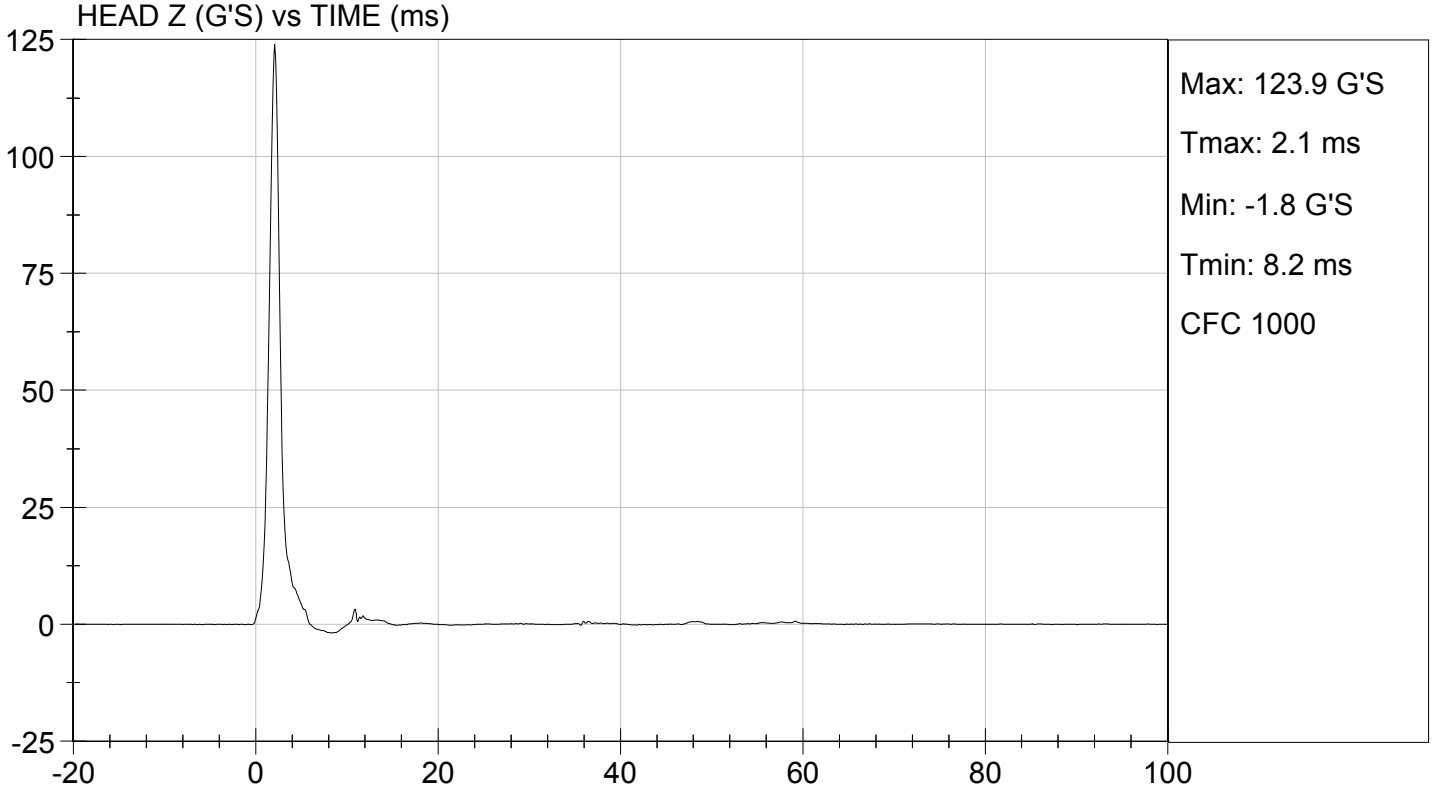
TEST DESC: HEAD DROP

TEST DATE: 11/16/2015
TEST #: D153751

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: 11/16/2015

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	32%
Record the minimum humidity:	29%

_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	4.5 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	6.2 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	73 Nm @ 81 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	84 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

11/16/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153752

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	29	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	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	81	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	84	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

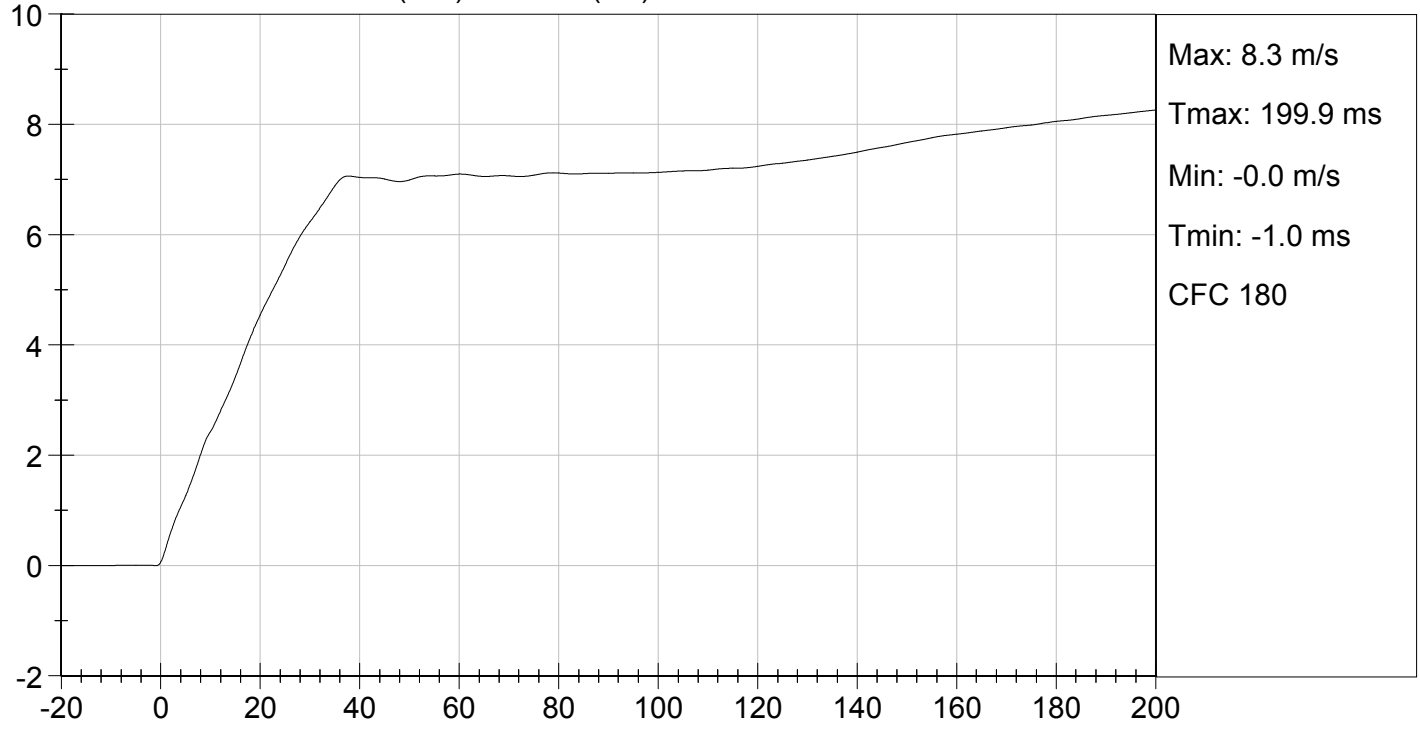
11/16/2015
Test Date

Jeff Leonardelli
Approved By

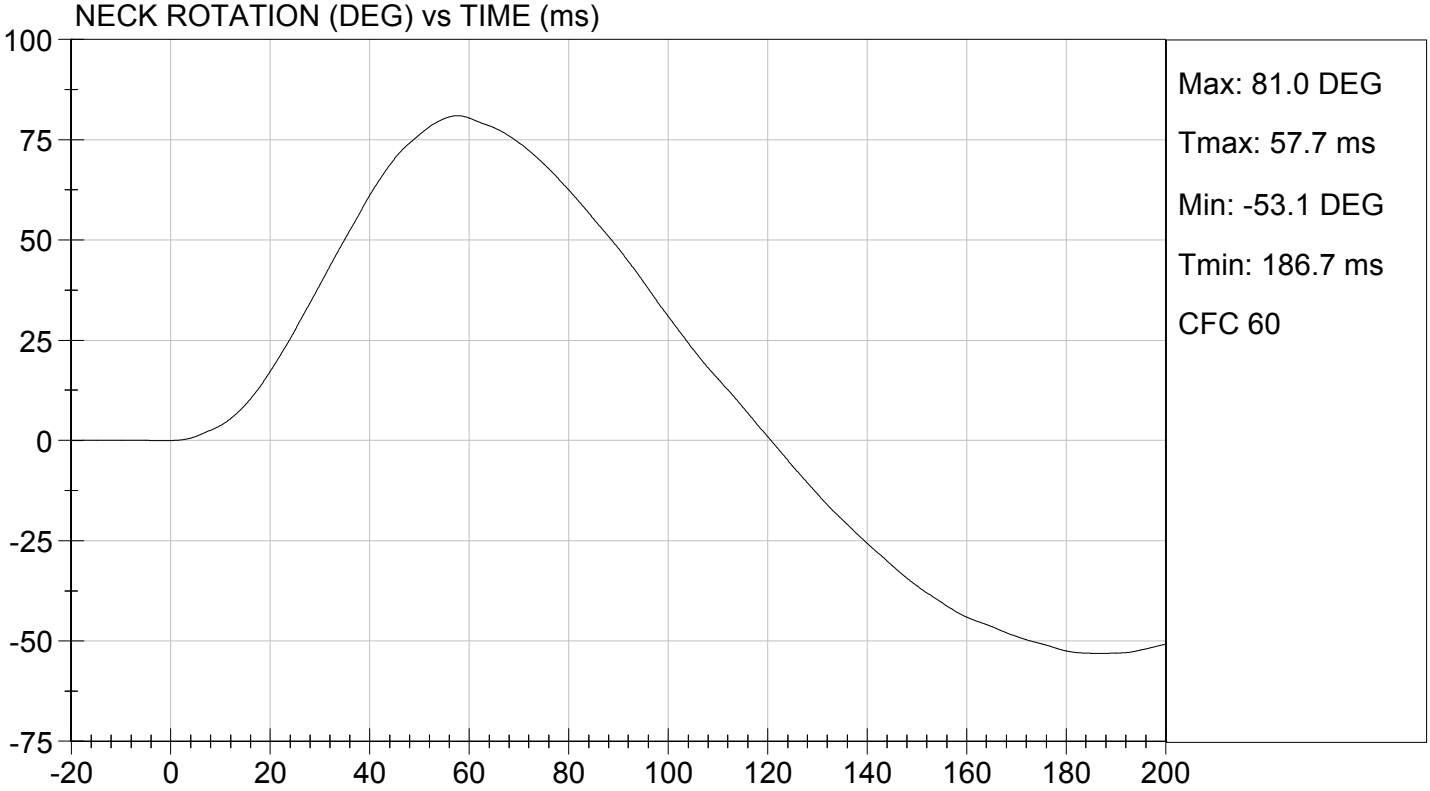
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 11/16/2015
TEST #: D153752

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



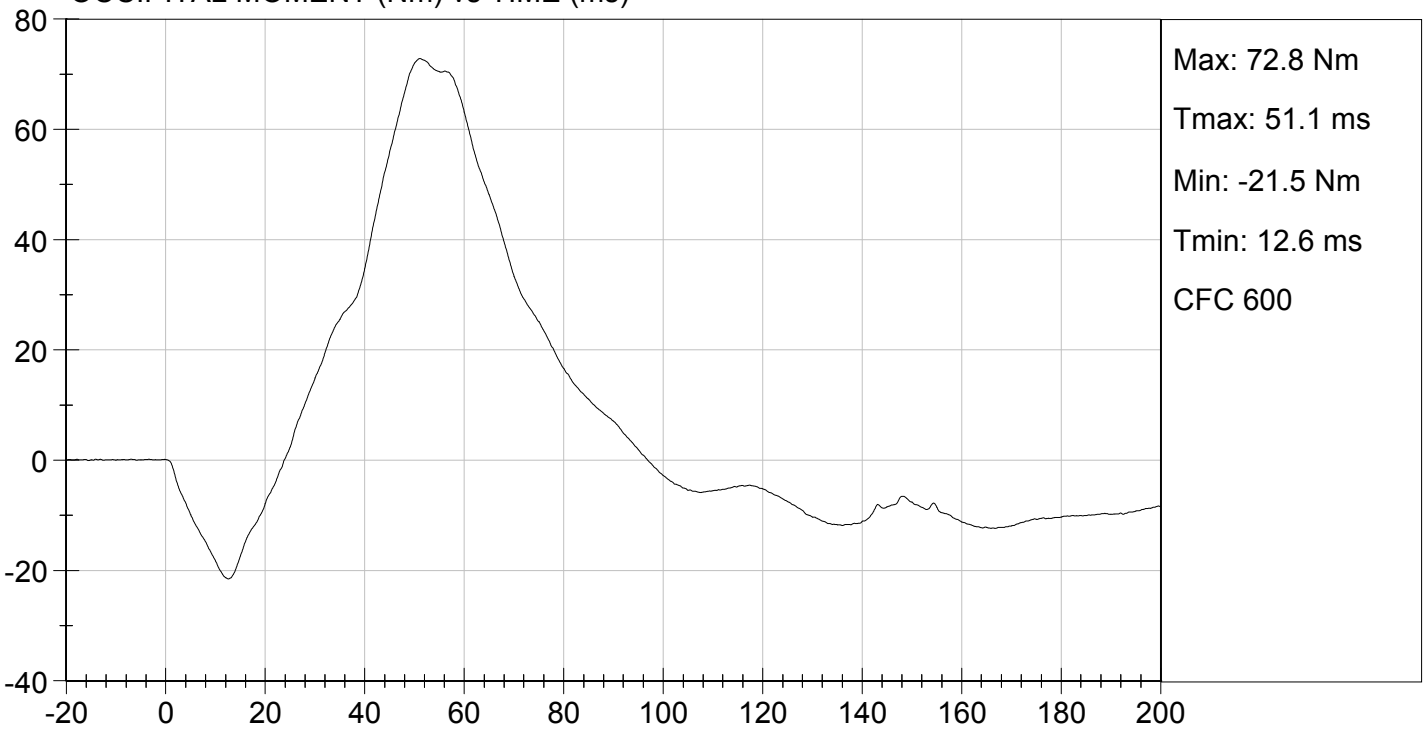
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/16/2015
TEST #: D153752

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 511 Test Date: 11/16/2015

Technician: Jack Coleman

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	32%
Record the minimum humidity:	29%

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	3.5 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°	-54 Nm @ 106 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	104 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

11/16/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153753

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	29	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	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	106	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	104	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

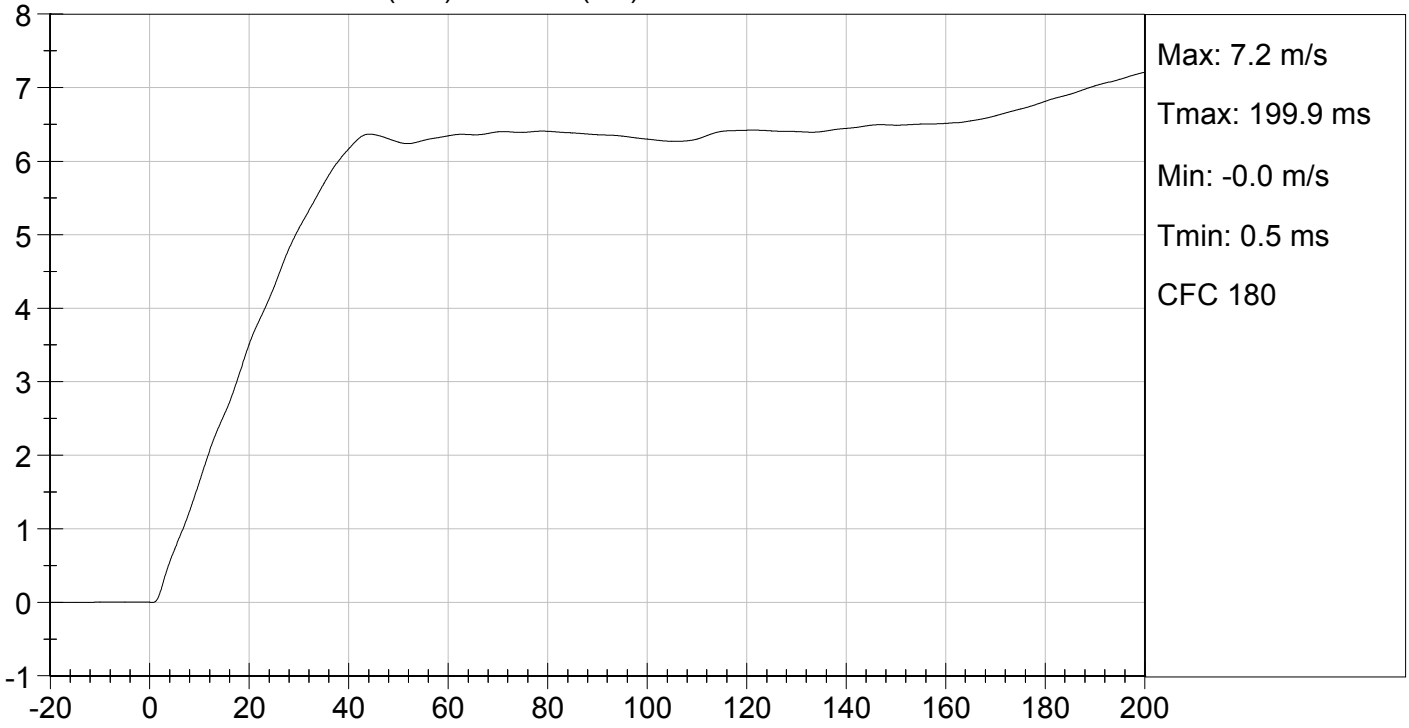
11/16/2015
Test Date

Jeff Leonard
Approved By

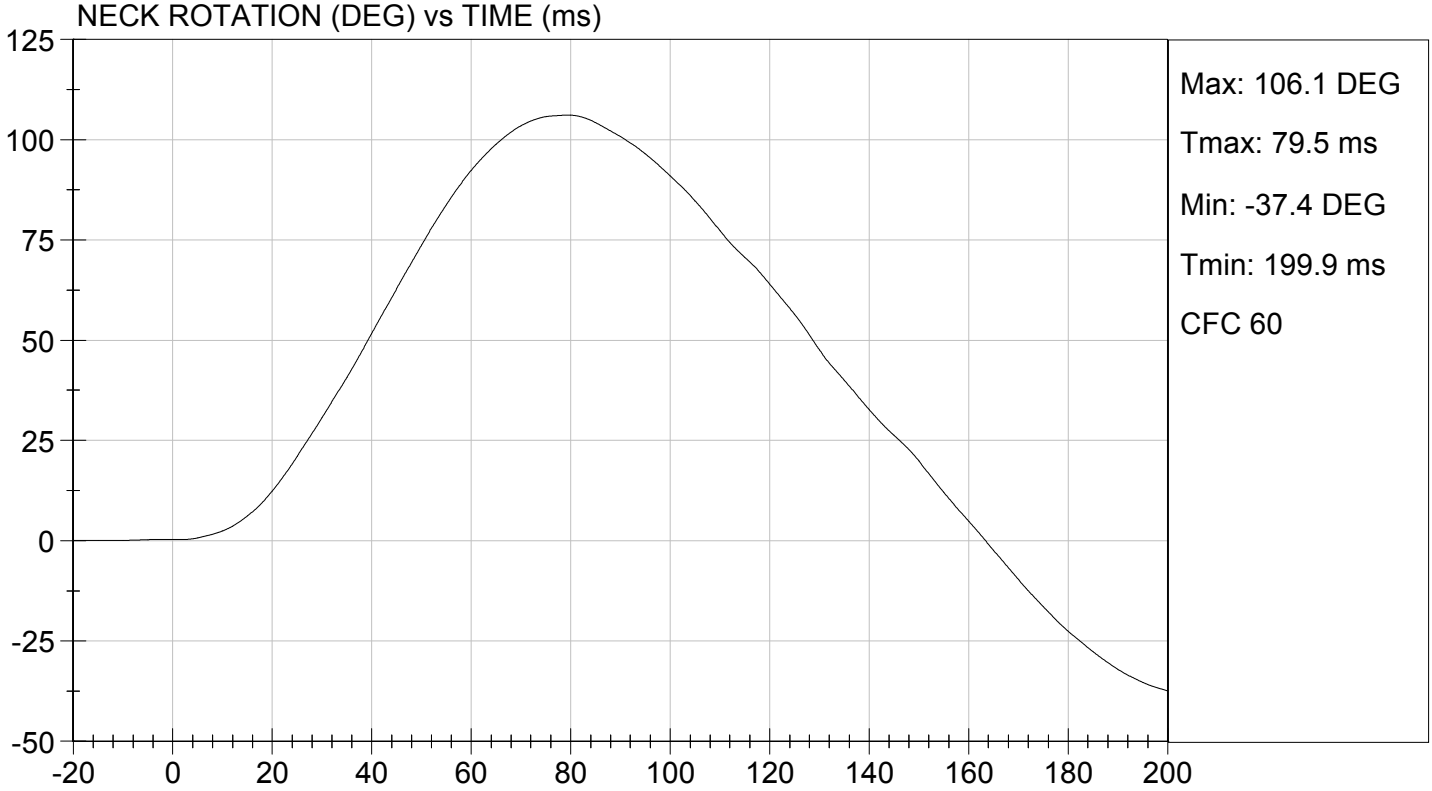
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/16/2015
TEST #: D153753

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

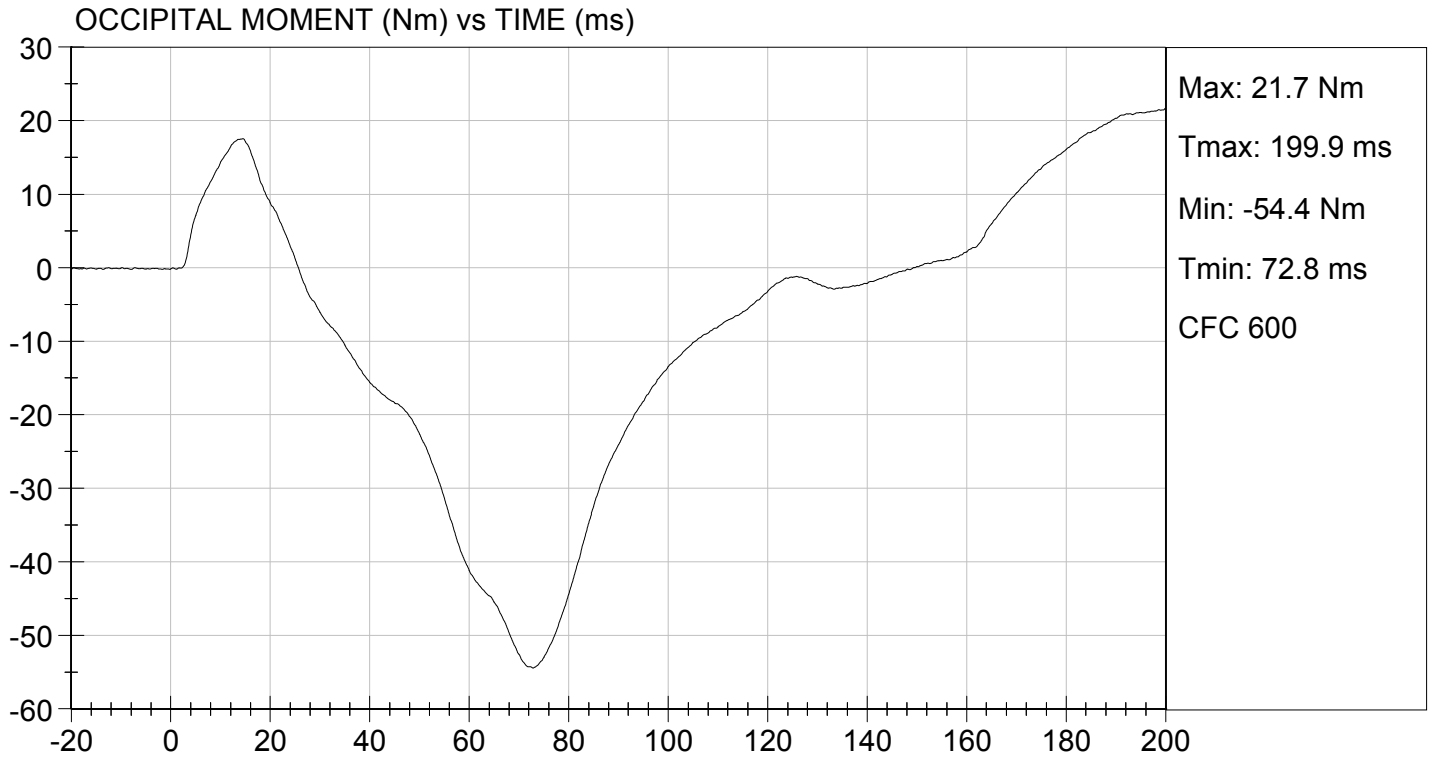


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/16/2015
TEST #: D153753



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 511 Test Date: 11/17/2015

Technician: Thomas Miller

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

X 2. The test fixture conforms to the specifications in Figure 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:	21.2°C
Record the minimum temperature:	20.6°C
Record the maximum humidity:	47%
Record the minimum humidity:	46%

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))

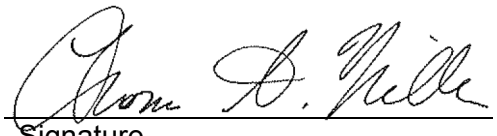
Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.77 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	51 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4360 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4439 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	74%

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

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

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

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



Signature

11/17/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153754

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	47	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4360	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4439	Pass
		Overall Test Results		Pass

Laboratory Technician

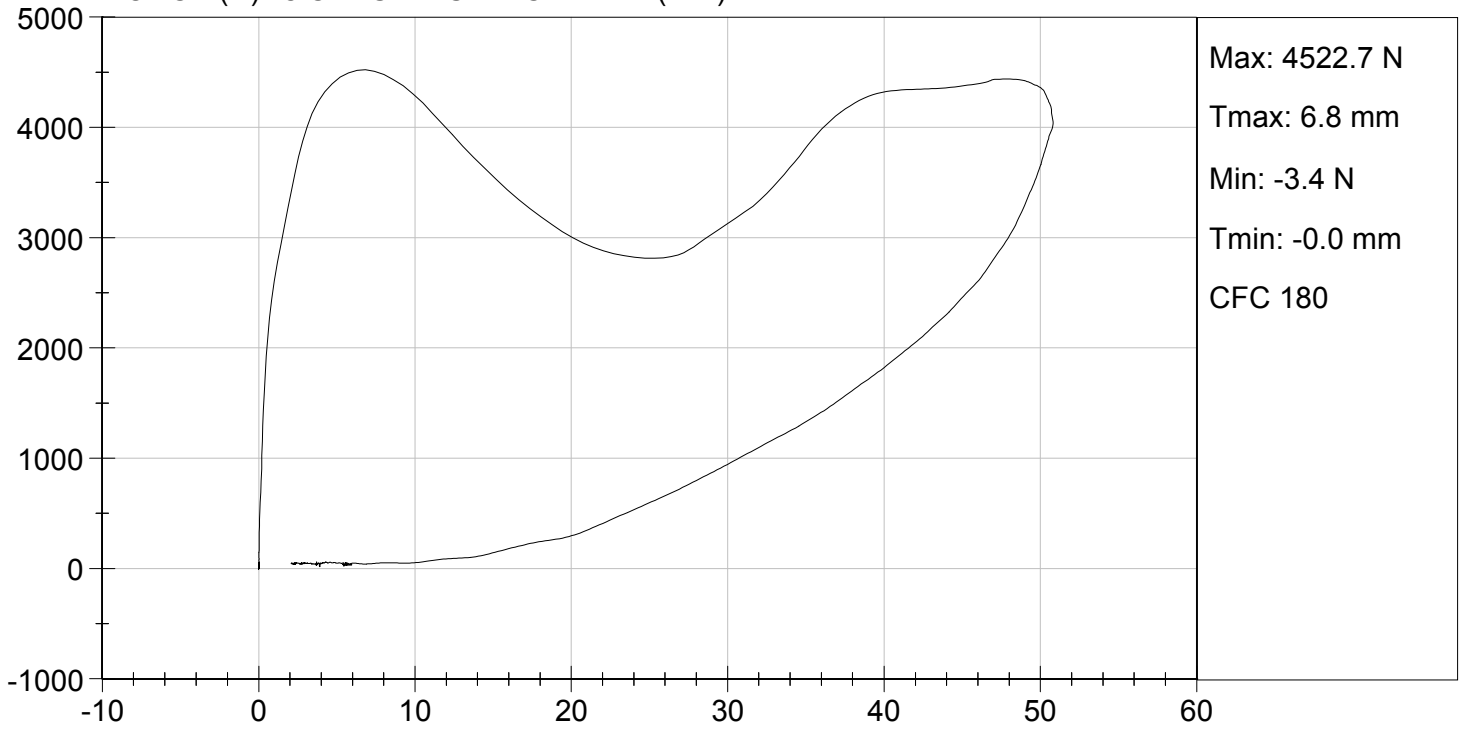
11/17/2015
Test Date

Approved By

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

TEST DATE: 11/17/2015
TEST #: D153754

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

Dummy Serial Number: 511 Test Date: 11/16/2015

Technician: Thomas Miller

____ 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:	21.4°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	32%
Record the minimum humidity:	29%

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

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

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

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

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

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

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

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

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

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

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

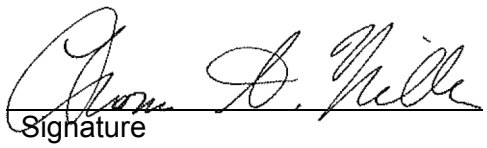
X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))

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

X 17. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	18 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.9 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	389 N
Final ref. plane angle	Initial ref. plane angle ± 8°	21 deg



Signature

11/16/2015

Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153757

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	32	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	21	Pass
Force at 45 deg	N	320 to 390	389	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Laboratory Technician

11/16/2015
Test Date

Approved By

DATA SHEET B8

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

Dummy Serial Number: 511 Test Date: 11/16/2015

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:	21.4°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	32%
Record the minimum humidity:	29%

_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	3641 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

11/16/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153756

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3641	Pass
		Overall Test Results		Pass

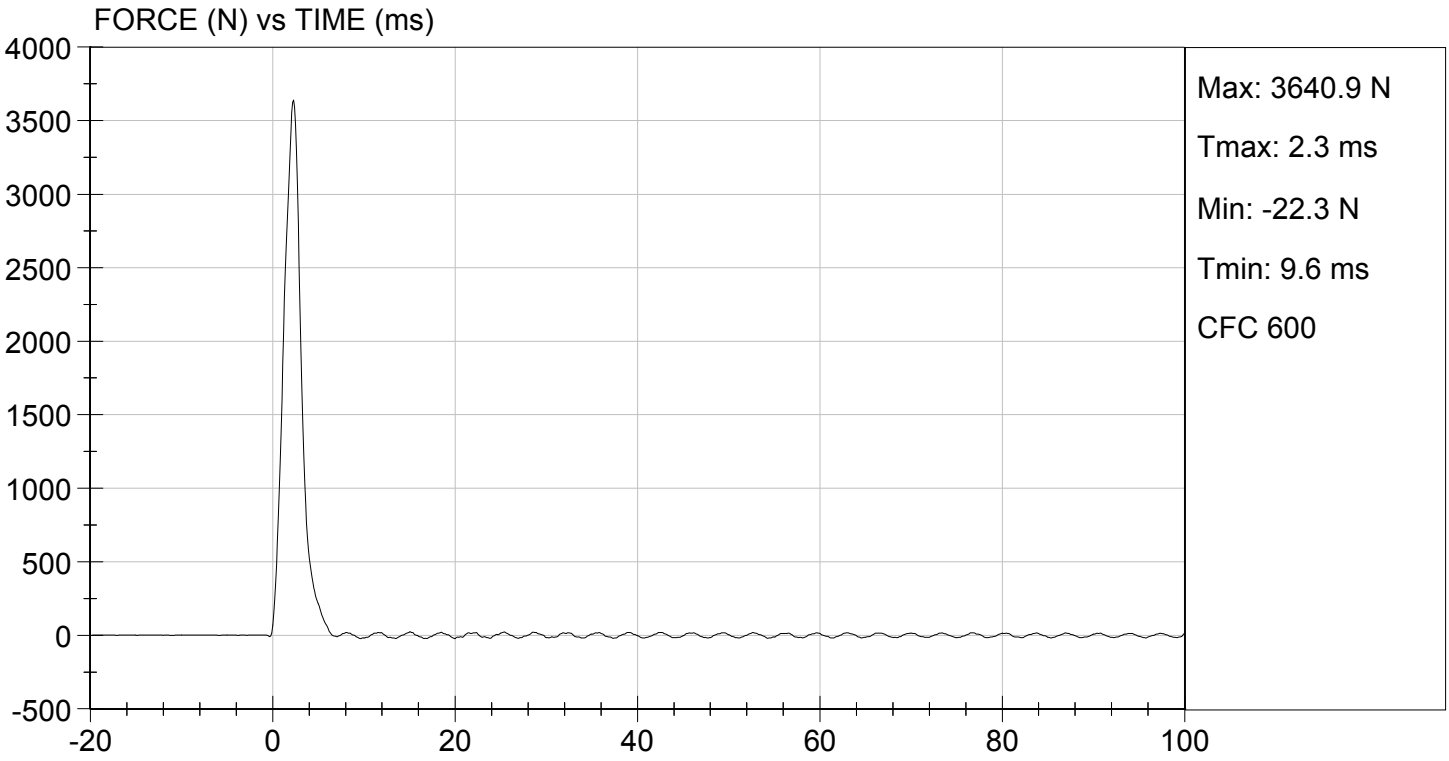
David Schoedel
Laboratory Technician

11/16/2015
Test Date

Jeff Leonardini
Approved By

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

TEST DATE: 11/16/2015
TEST #: D153756



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

Dummy Serial Number: 511 Test Date: 11/16/2015

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:	21.4°C
Record the minimum temperature:	21.4°C
Record the maximum humidity:	32%
Record the minimum humidity:	29%

_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	3754 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

11/16/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 511 **Test I.D:** D153755

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3754	Pass
		Overall Test Results		Pass

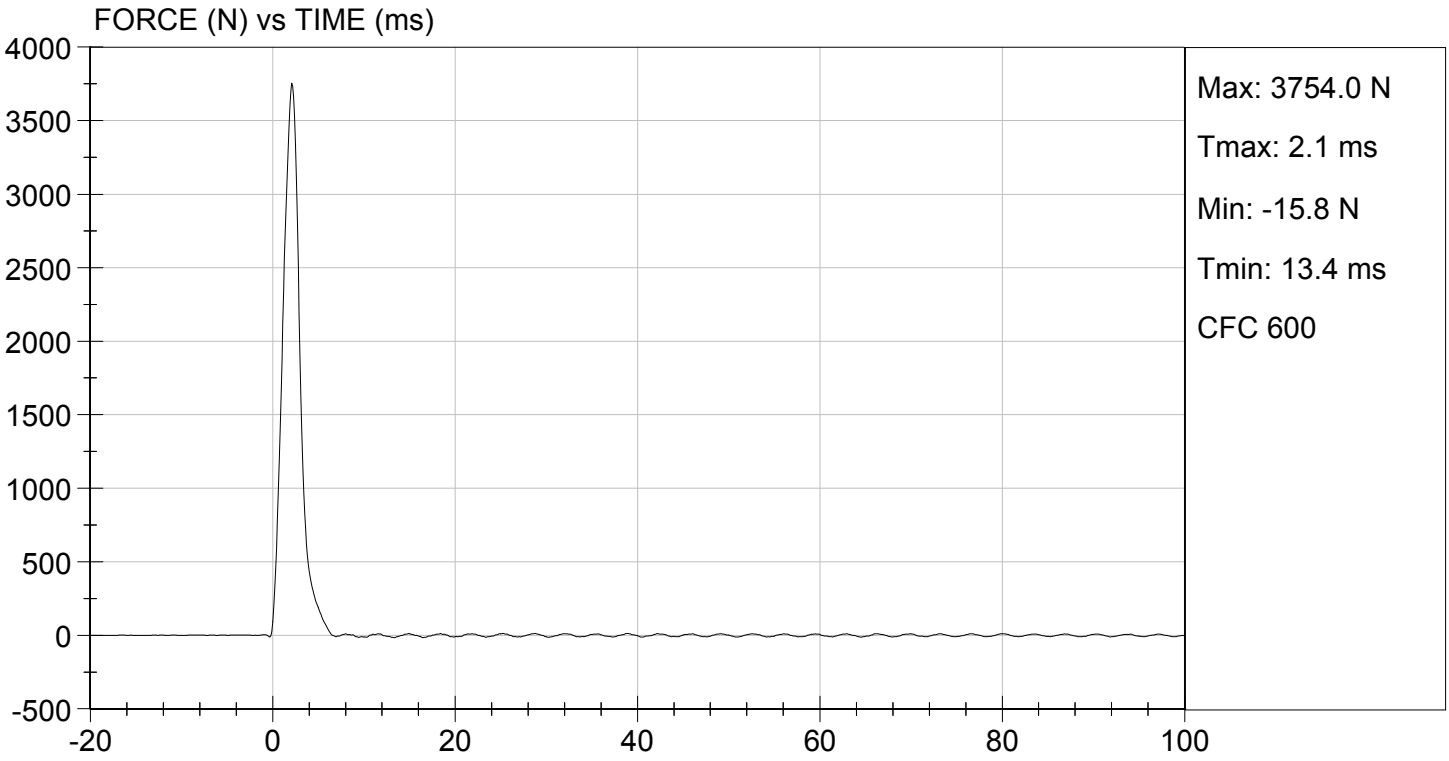
David Schoedel
Laboratory Technician

11/16/2015
Test Date

Jeff Leonardski
Approved By

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

TEST DATE: 11/16/2015
TEST #: D153755



DATA SHEET B10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82603	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82604	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82605	08/19/2015	02/19/2016
NECK TRANSDUCER	Denton	1716	2039	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P84432	08/19/2015	02/19/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P84433	08/19/2015	02/19/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P84435	08/19/2015	02/19/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	511	08/17/2015	02/17/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	9425	08/19/2015	02/19/2016
(2) LEFT FEMUR	Denton	2121	9426	08/19/2015	02/19/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 511 Test Date: 11/16/2015

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 11/17/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 11/17/2015

Signature — Date

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: 10/20/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one head drop performed

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

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

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

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

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

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

Record the maximum temperature:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	40%
Record the minimum humidity:	36%

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

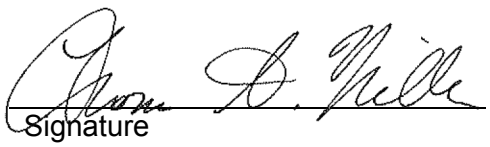
Record length: 595 mm

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	285 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	3.2 g

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



Signature

10/20/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test ID:** D153371

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Peak Resultant Acceleration	G's	250 to 300	285	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

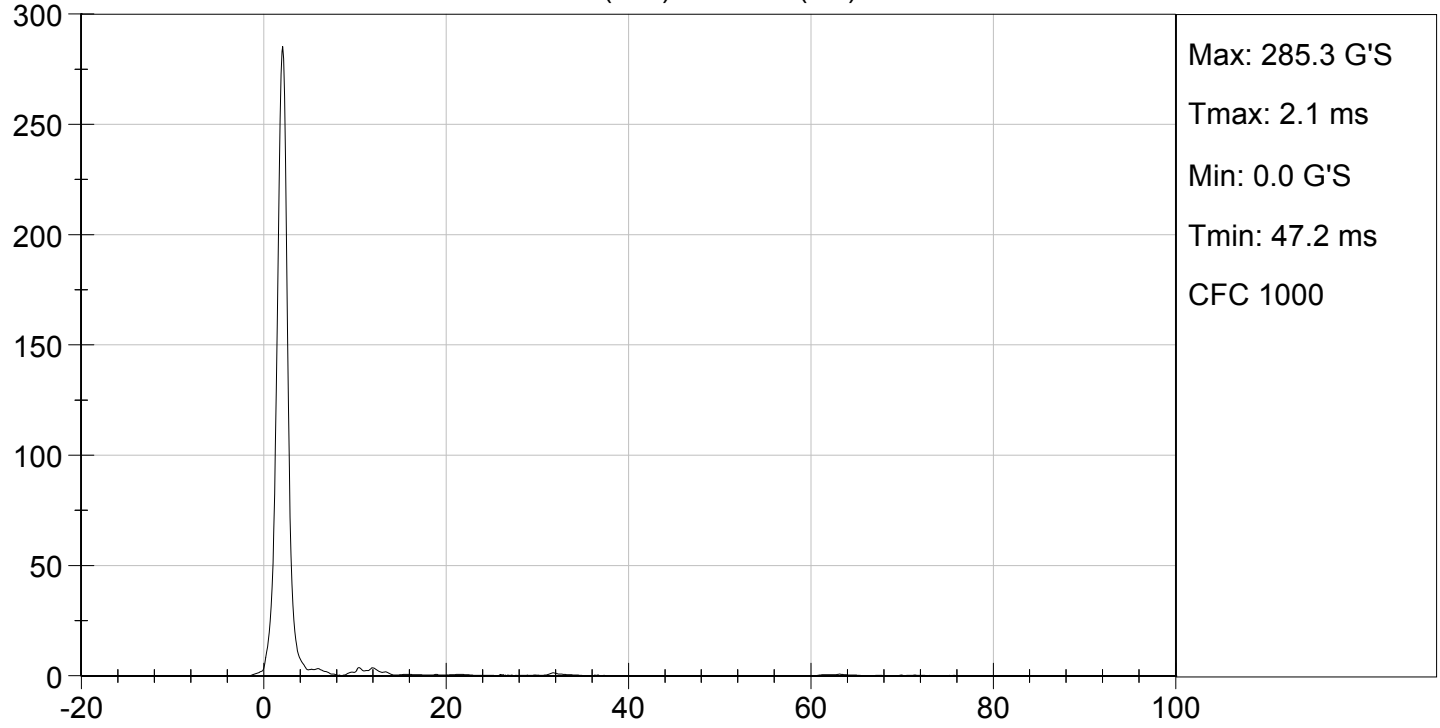
10/20/2015
Test Date

Approved By

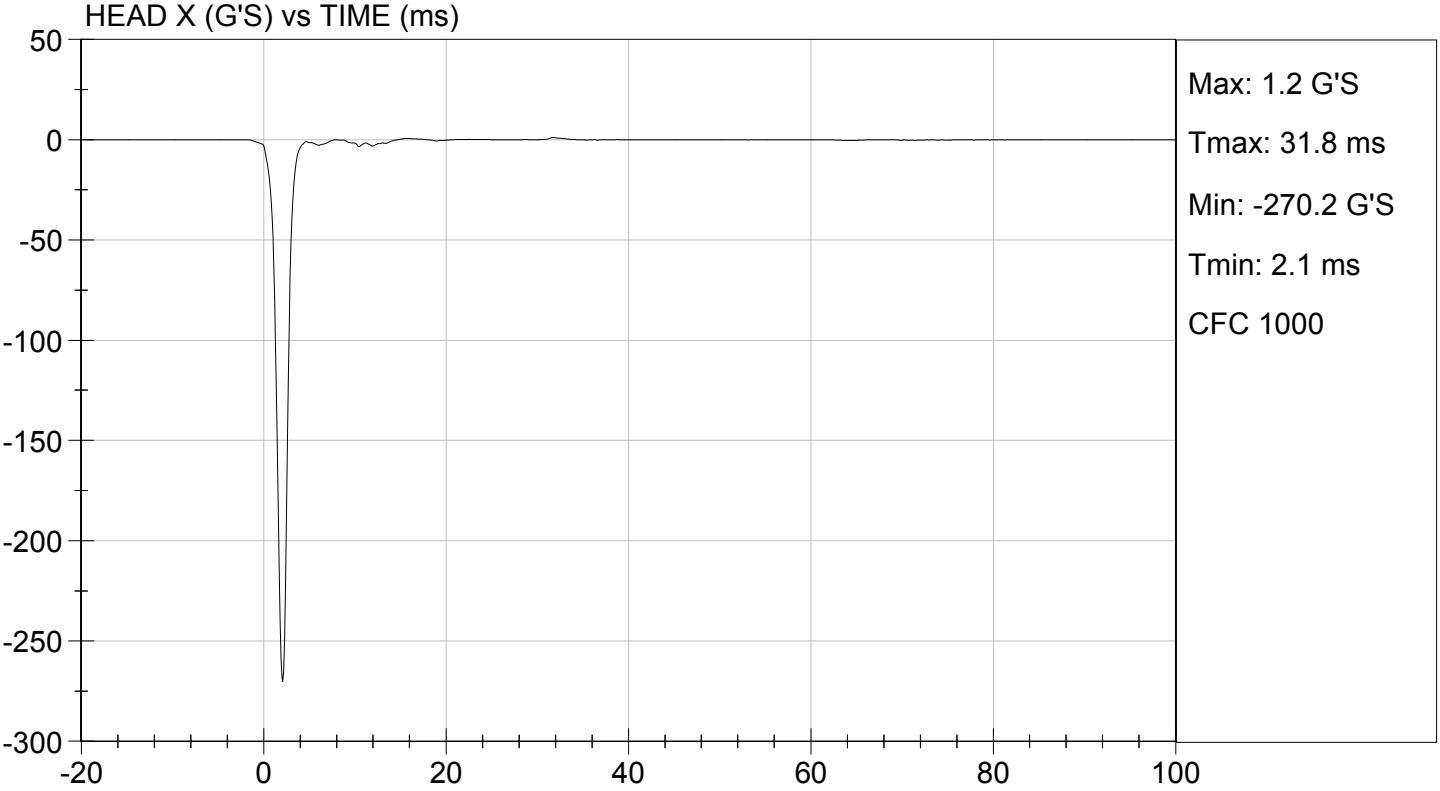
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153371

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



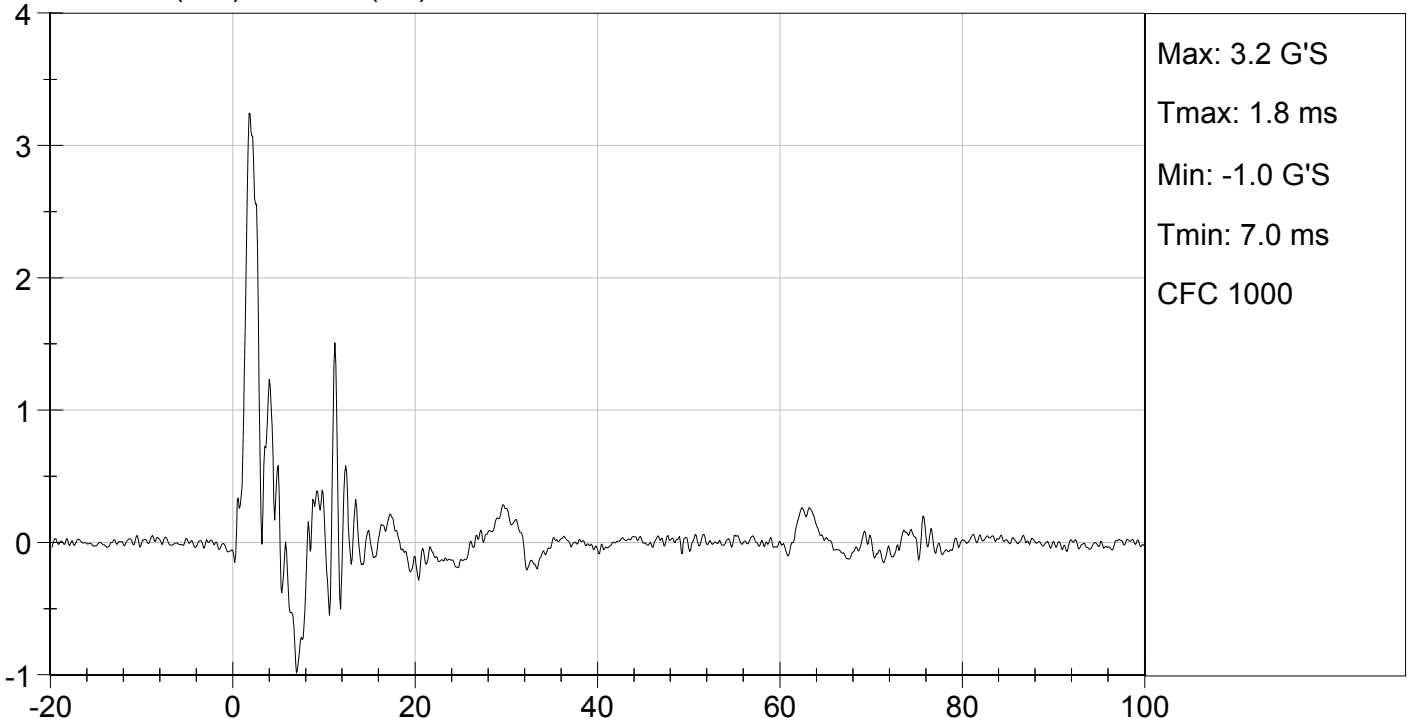
HEAD X (G'S) vs TIME (ms)



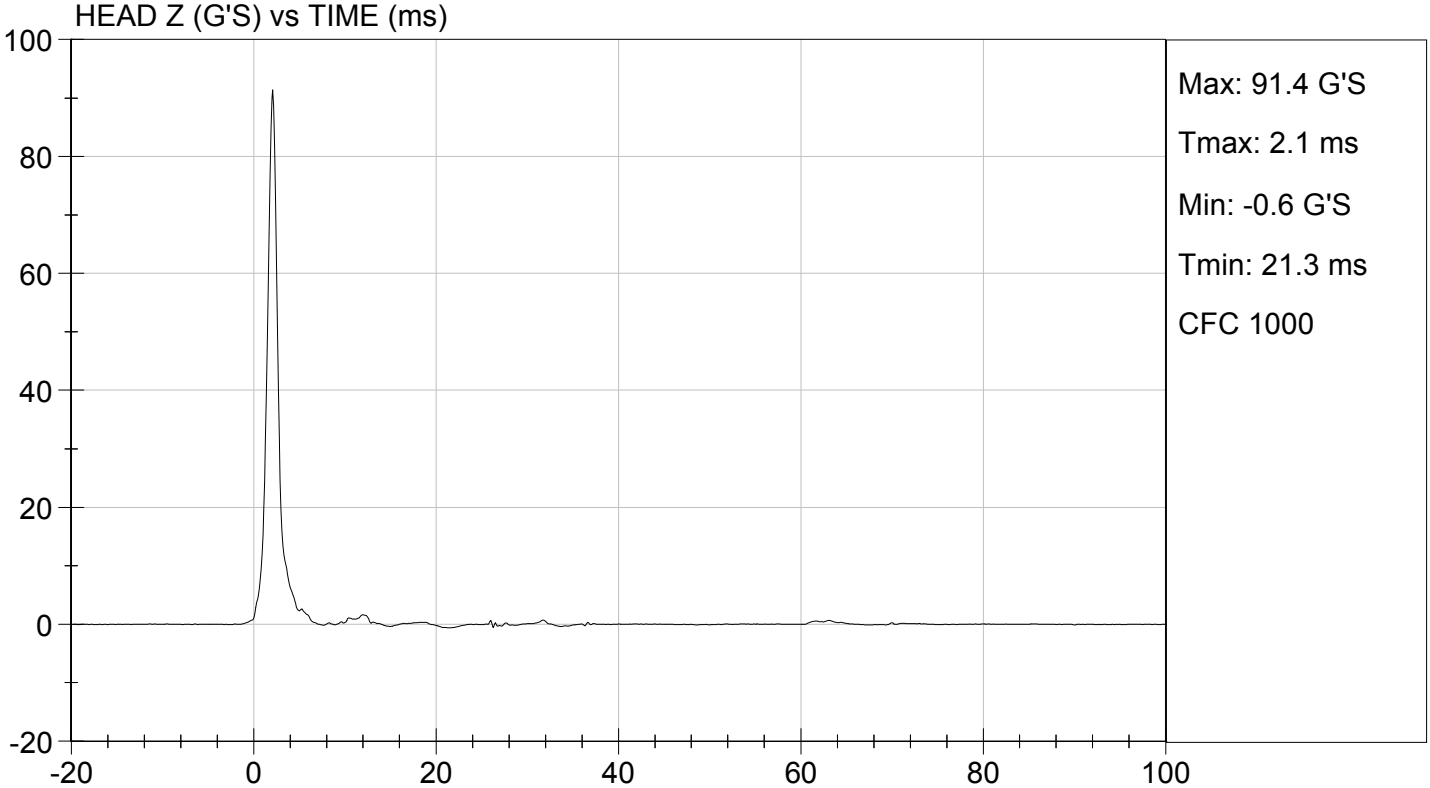
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153371

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: 10/21/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

X 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (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	6.1 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 82 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	87 ms

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

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

Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153372

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	43	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	6.1	Pass
D Plane Rotation	Max	deg	77 to 91	82	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	87	Pass
			Overall Results		Pass

Laboratory Technician

10/21/2015

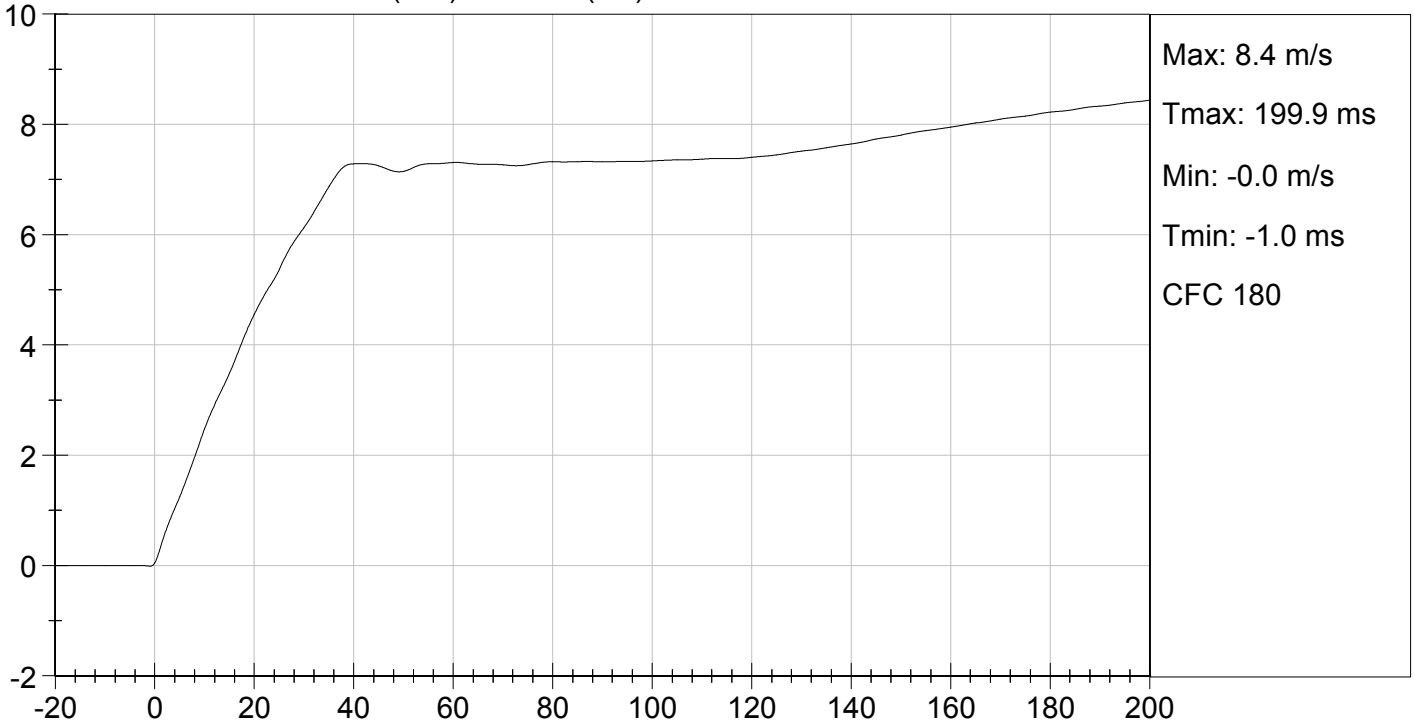
Test Date

Approved By

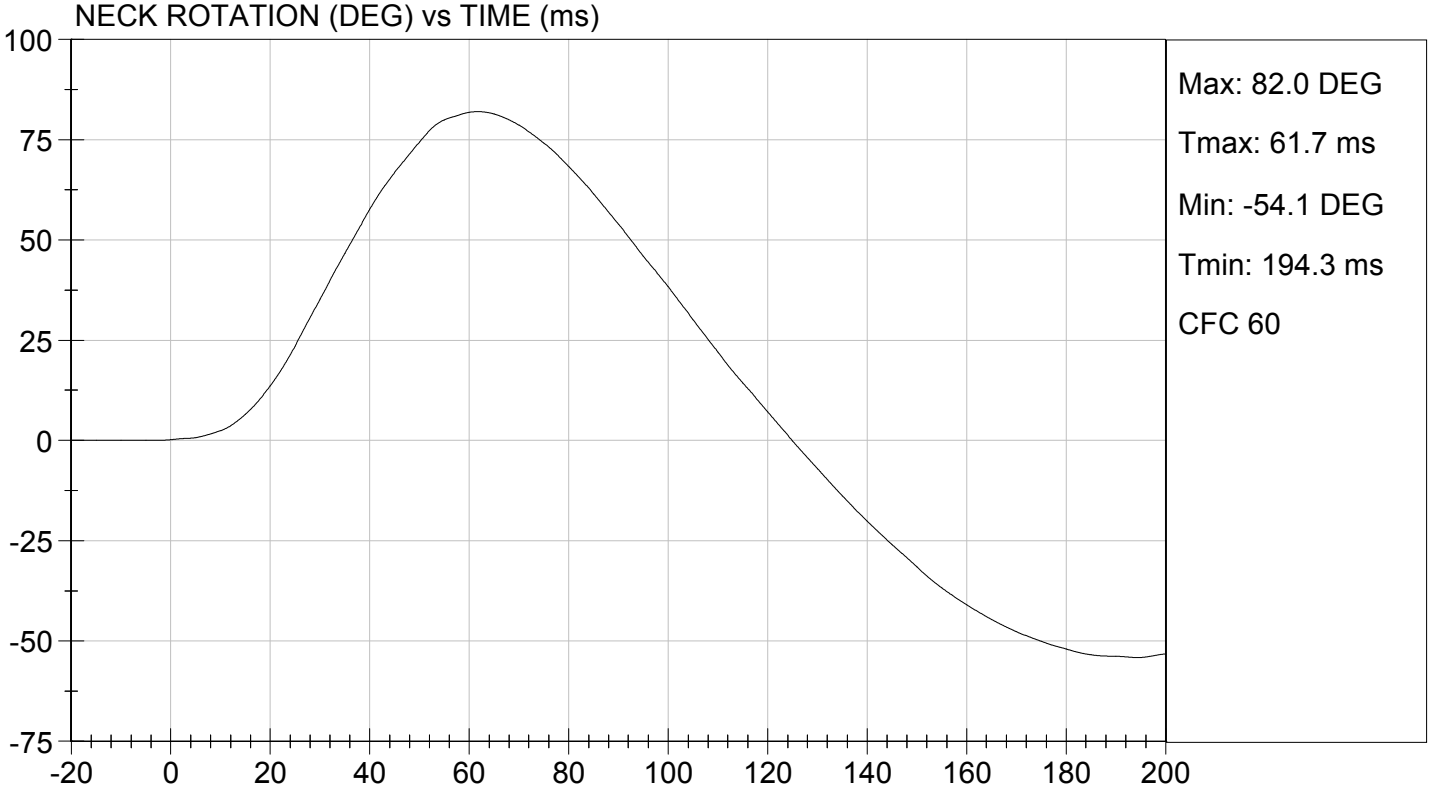
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 10/21/2015
TEST #: D153372

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

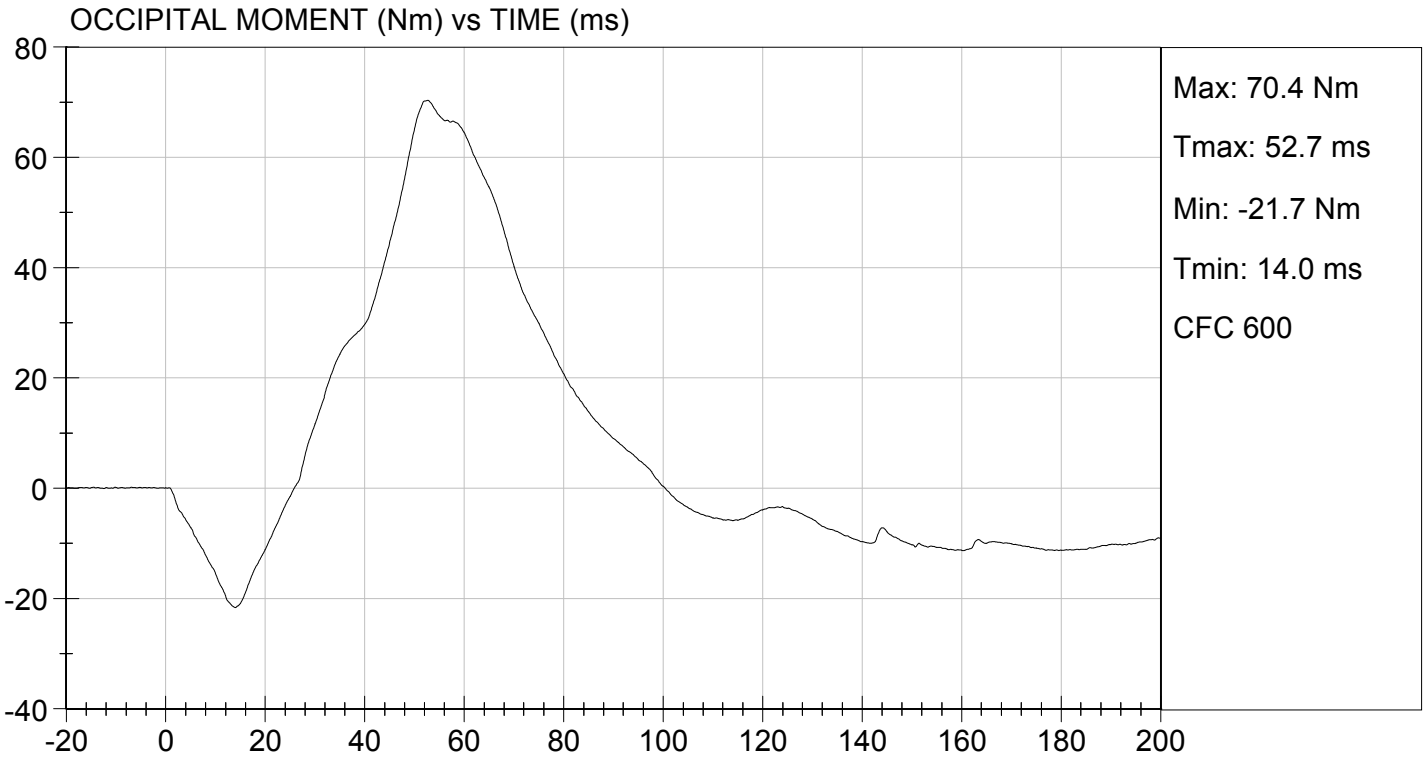


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/21/2015
TEST #: D153372



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s ≤ speed ≤ 6.19 m/s	6.05 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.5 m/s ≤ ΔV ≤ 1.9 m/s	1.8 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	5.5 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-61 Nm @ 109 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.

Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153373

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	43	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.5	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	97	Pass
			Overall Results		Pass

Laboratory Technician

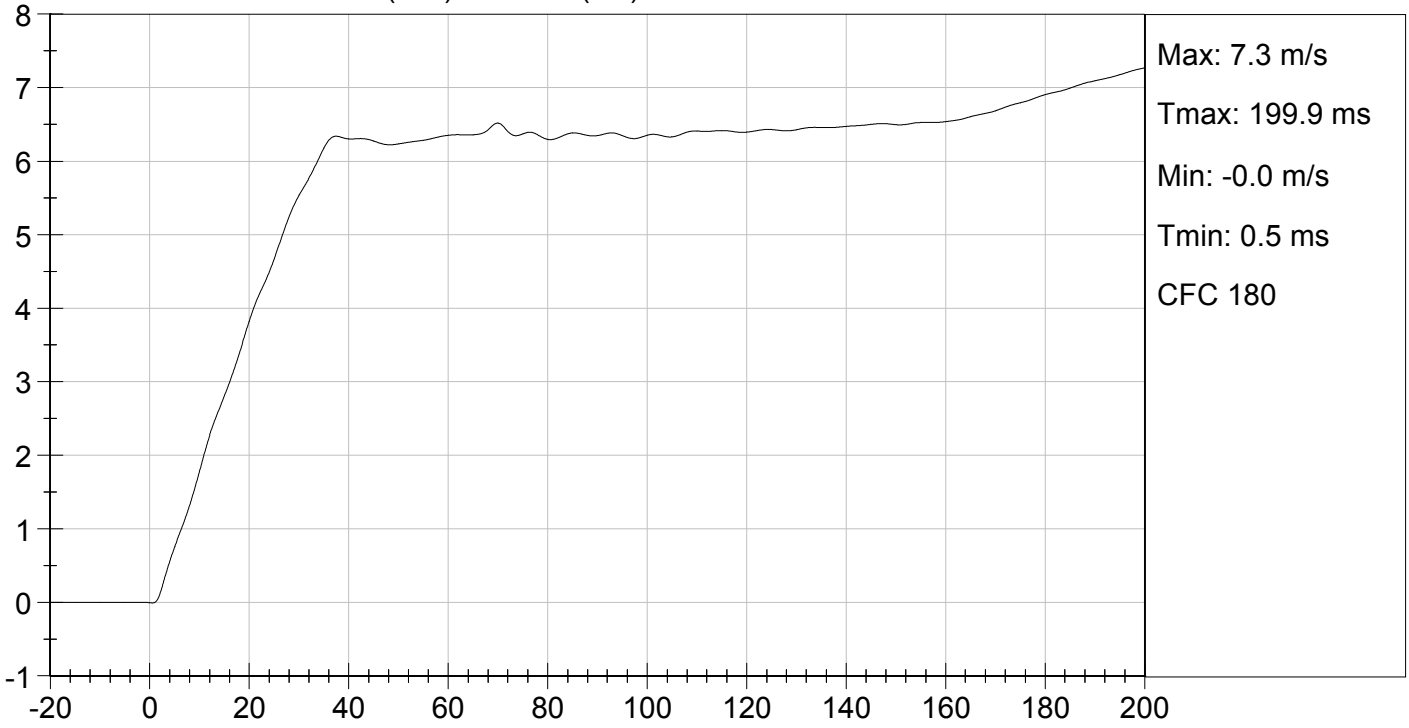
10/21/2015
Test Date

Approved By

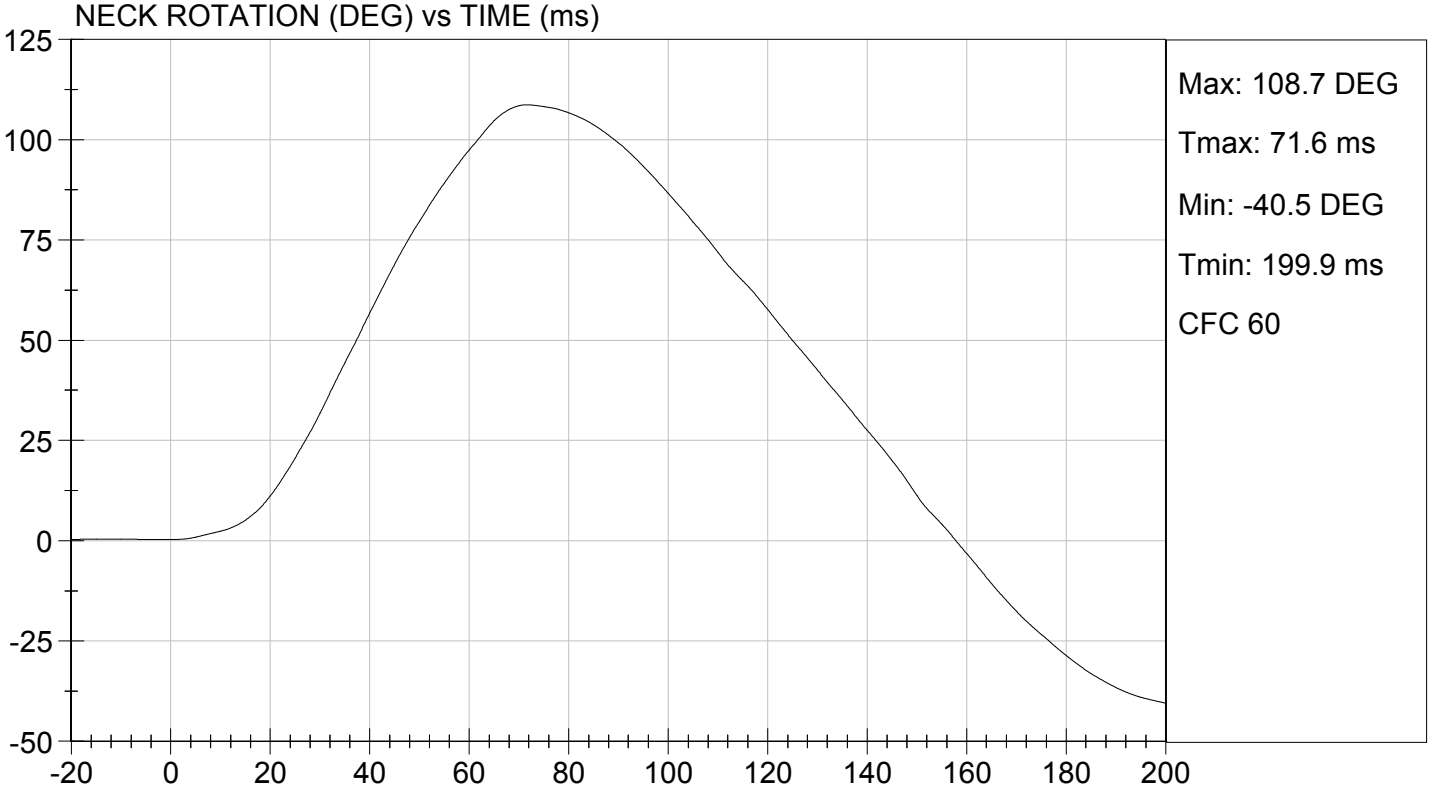
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 10/21/2015
TEST #: D153373

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

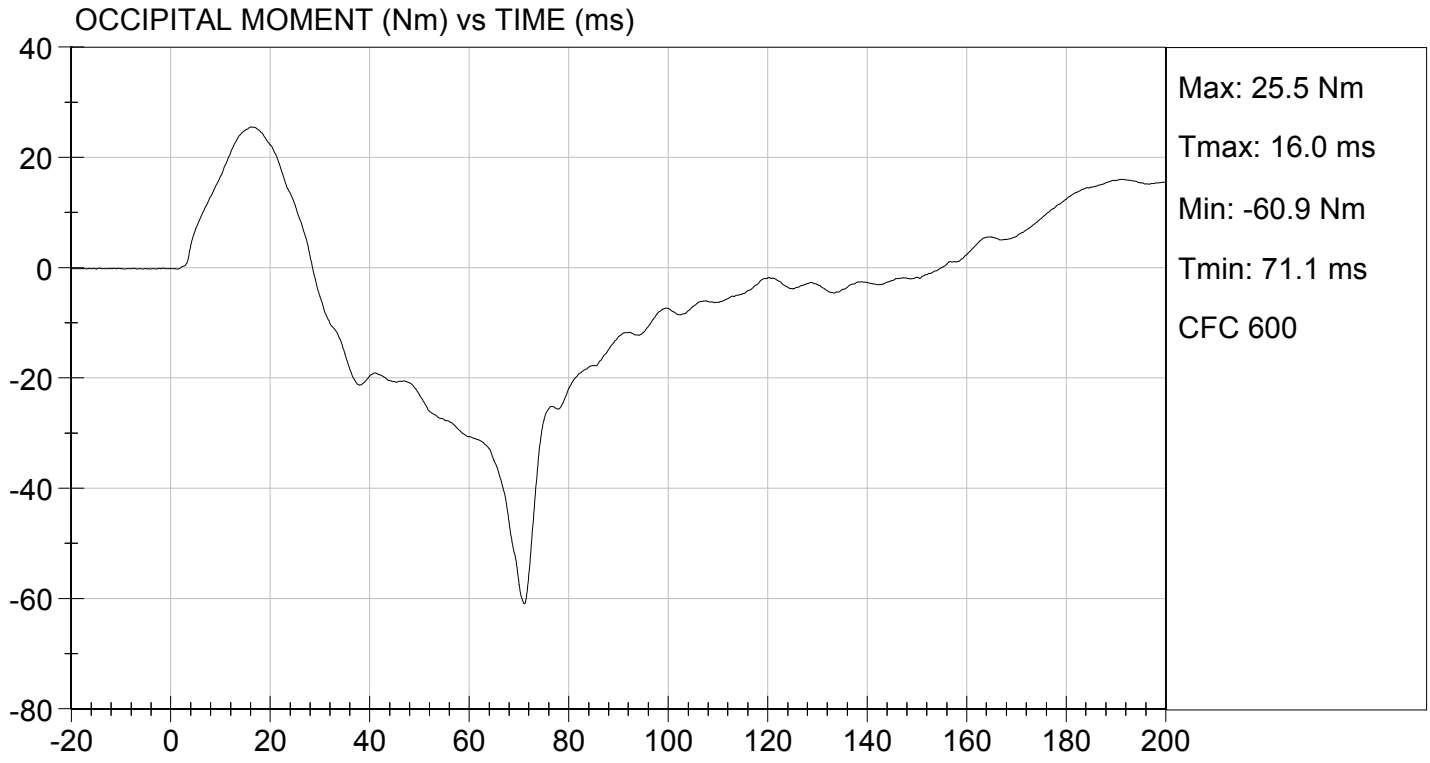


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/21/2015
TEST #: D153373



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

X 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, 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))

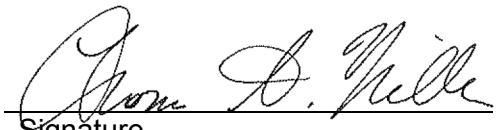
Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.68 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4020 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4167 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.



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153374

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Relative Humidity	%	10 to 70	49	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	4020	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4167	Pass
		Overall Test Results		Pass

Laboratory Technician

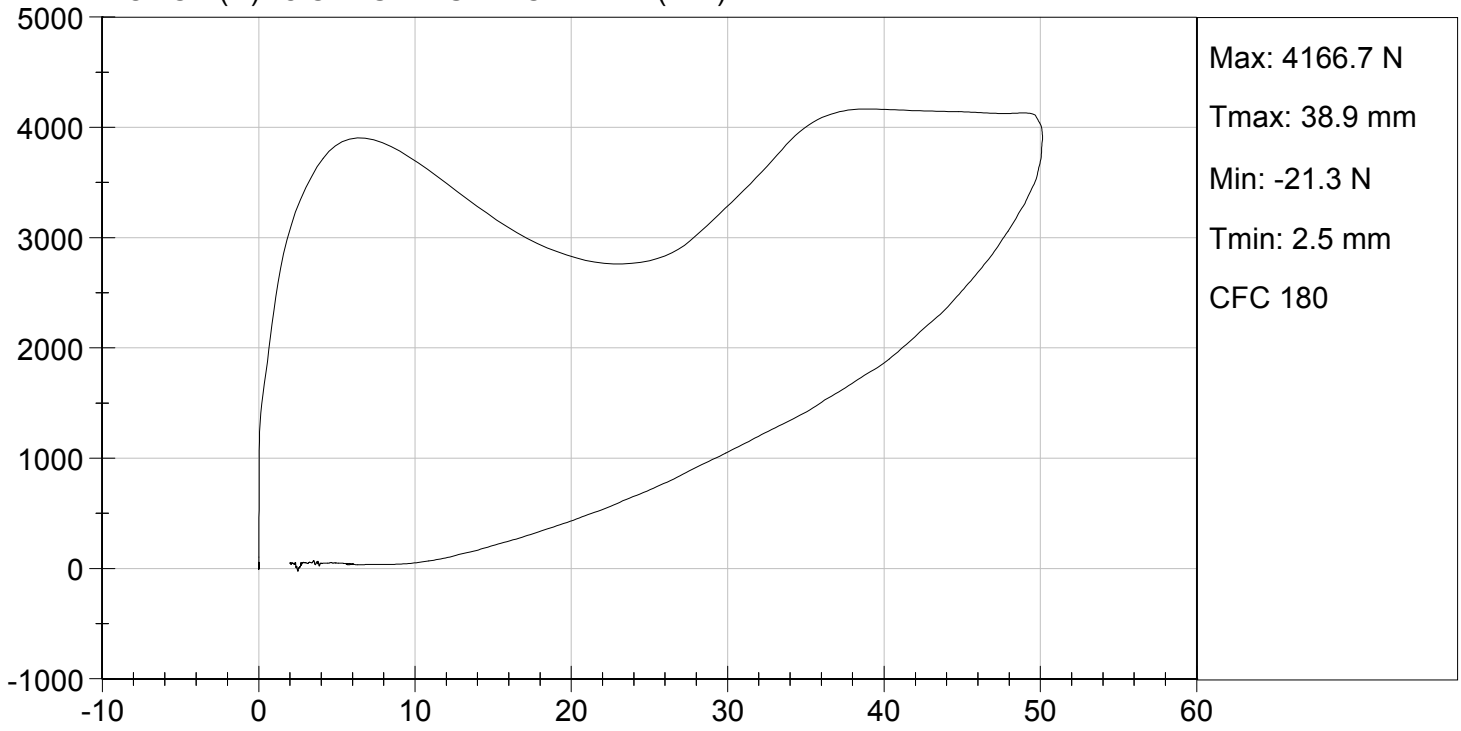
10/21/2015
Test Date

Approved By

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

TEST DATE: 10/21/2015
TEST #: D153374

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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	337 N
Final ref. plane angle	Initial ref. plane angle ± 8°	25 deg

Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153377

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	25	Pass
Force at 45 deg	N	320 to 390	337	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

Laboratory Technician

10/21/2015
Test Date

Approved By

DATA SHEET B8

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

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

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

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

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

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

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

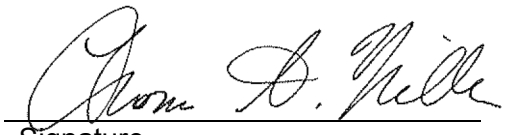
X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.11 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3904 N

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

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



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153376

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3904	Pass
		Overall Test Results		Pass

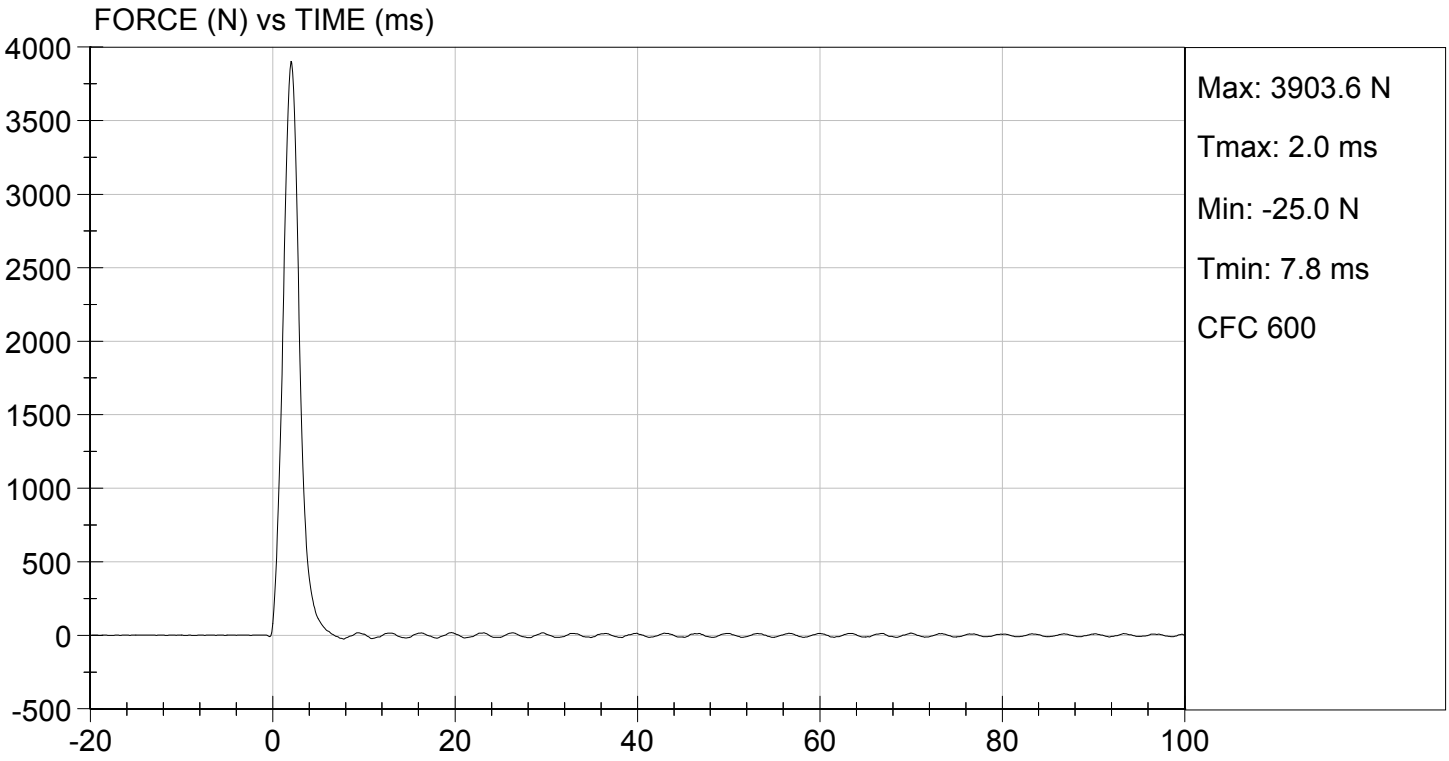
Laboratory Technician

10/21/2015
Test Date

Approved By

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

TEST DATE: 10/21/2015
TEST #: D153376



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

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

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

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

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

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

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

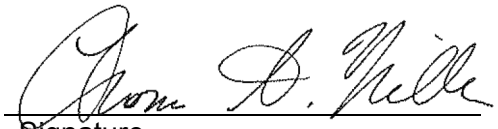
X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.10 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3831 N

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

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



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153375

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3831	Pass
		Overall Test Results		Pass

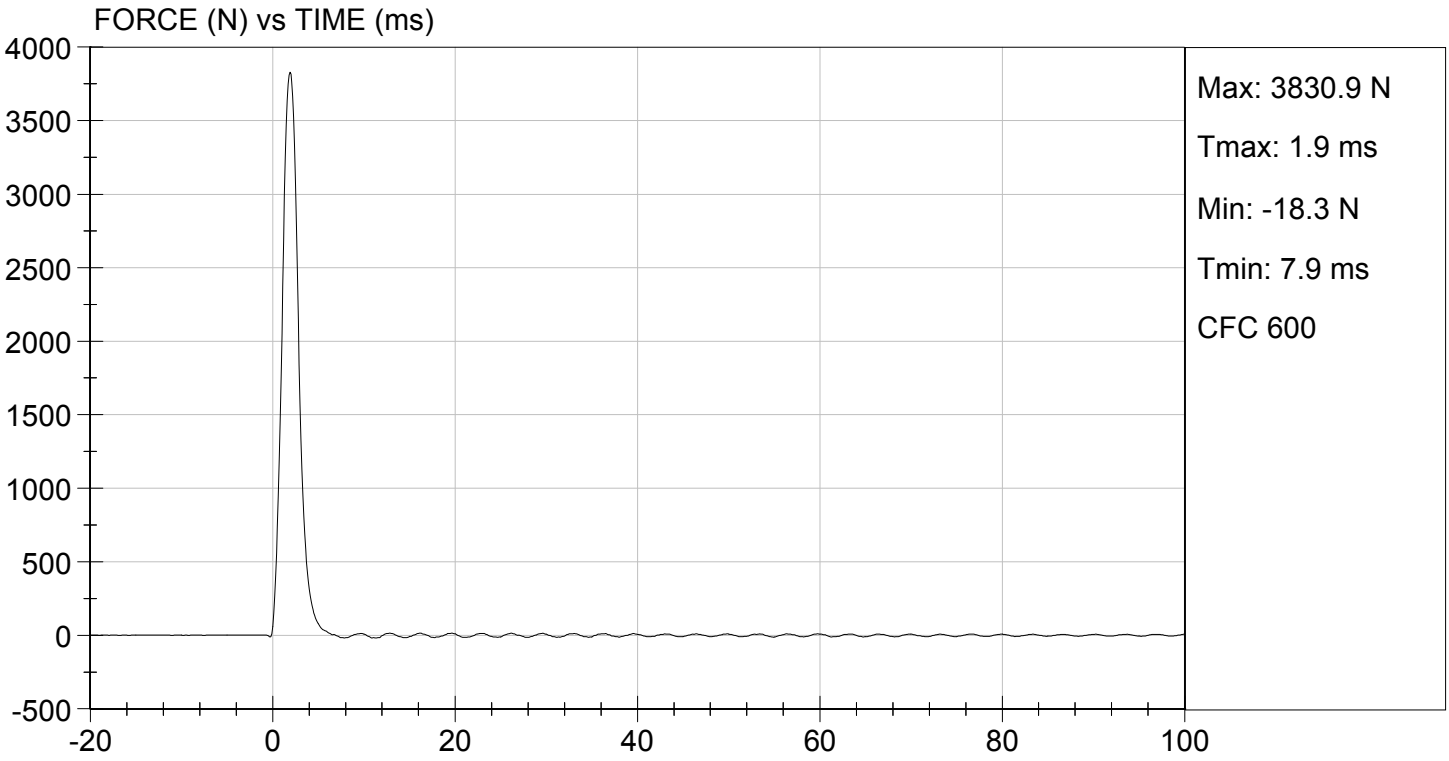
Laboratory Technician

10/21/2015
Test Date

Approved By

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

TEST DATE: 10/21/2015
TEST #: D153375



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	P83180	07/20/2015	01/20/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P83181	07/20/2015	01/20/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P83182	07/20/2015	01/20/2016
NECK TRANSDUCER	Denton	1716	7489	10/22/2015	04/22/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85174	07/22/2015	01/22/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P86736	07/01/2015	01/01/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P86737	07/01/2015	01/01/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	510	07/21/2015	01/21/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	979	07/30/2015	01/30/2016
(2) LEFT FEMUR	Denton	2121	1384	07/30/2015	01/30/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 510 Test Date: 11/16/2015

Technician: Thomas Miller

____ 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:	21.2°C
Record the maximum humidity:	34%
Record the minimum humidity:	29%

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	278 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	4.3 g

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

Signature

11/16/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test ID:** D153741

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Peak Resultant Acceleration	G's	250 to 300	278	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	4.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

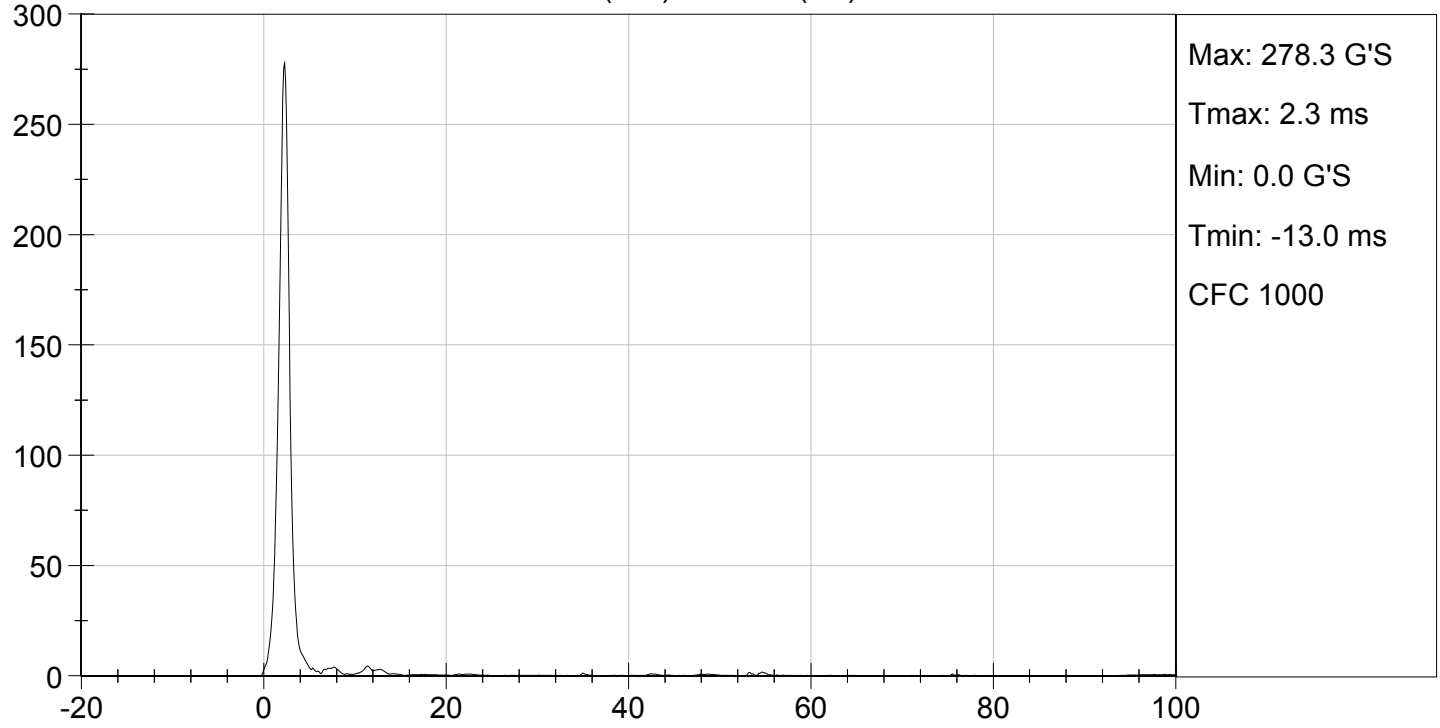
11/16/2015
Test Date

Approved By

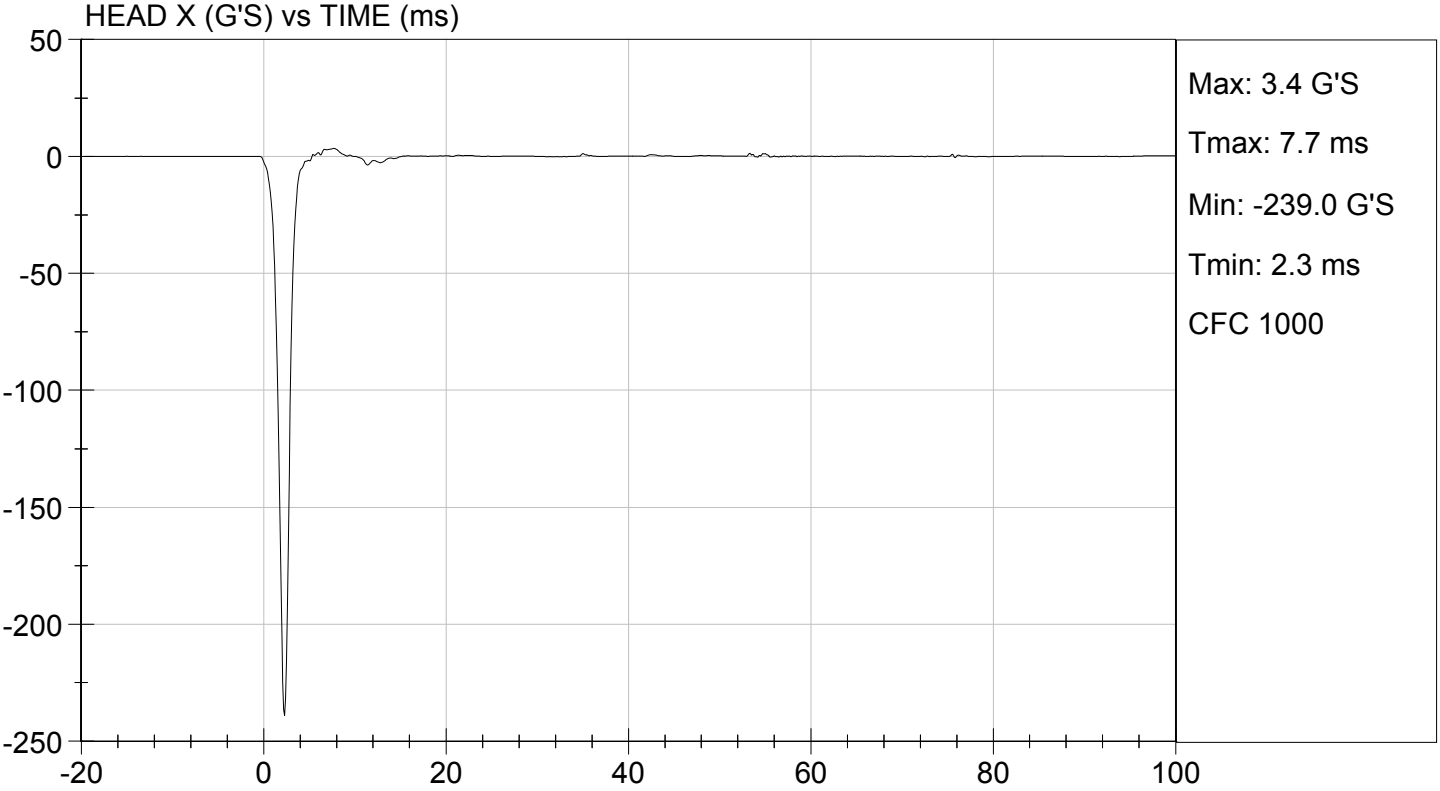
TEST DESC: HEAD DROP

TEST DATE: 11/16/2015
TEST #: D153741

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



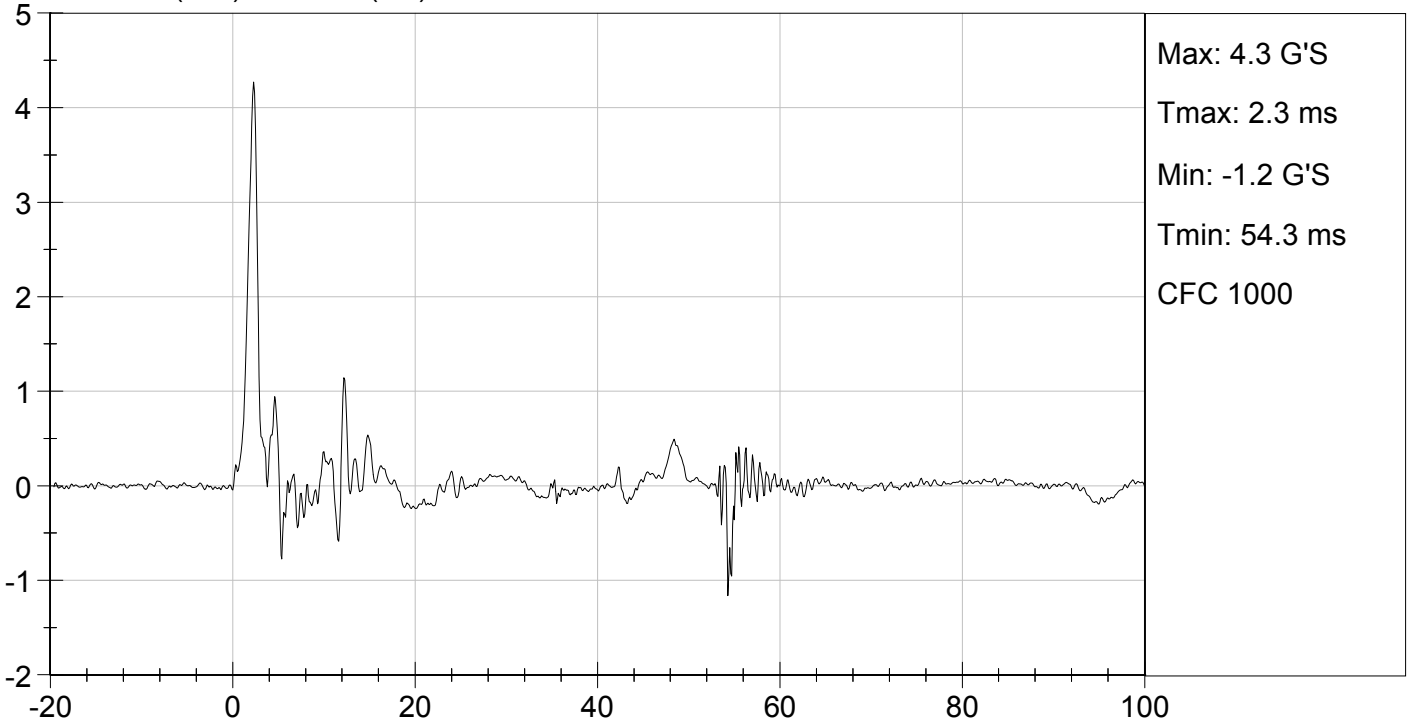
HEAD X (G'S) vs TIME (ms)



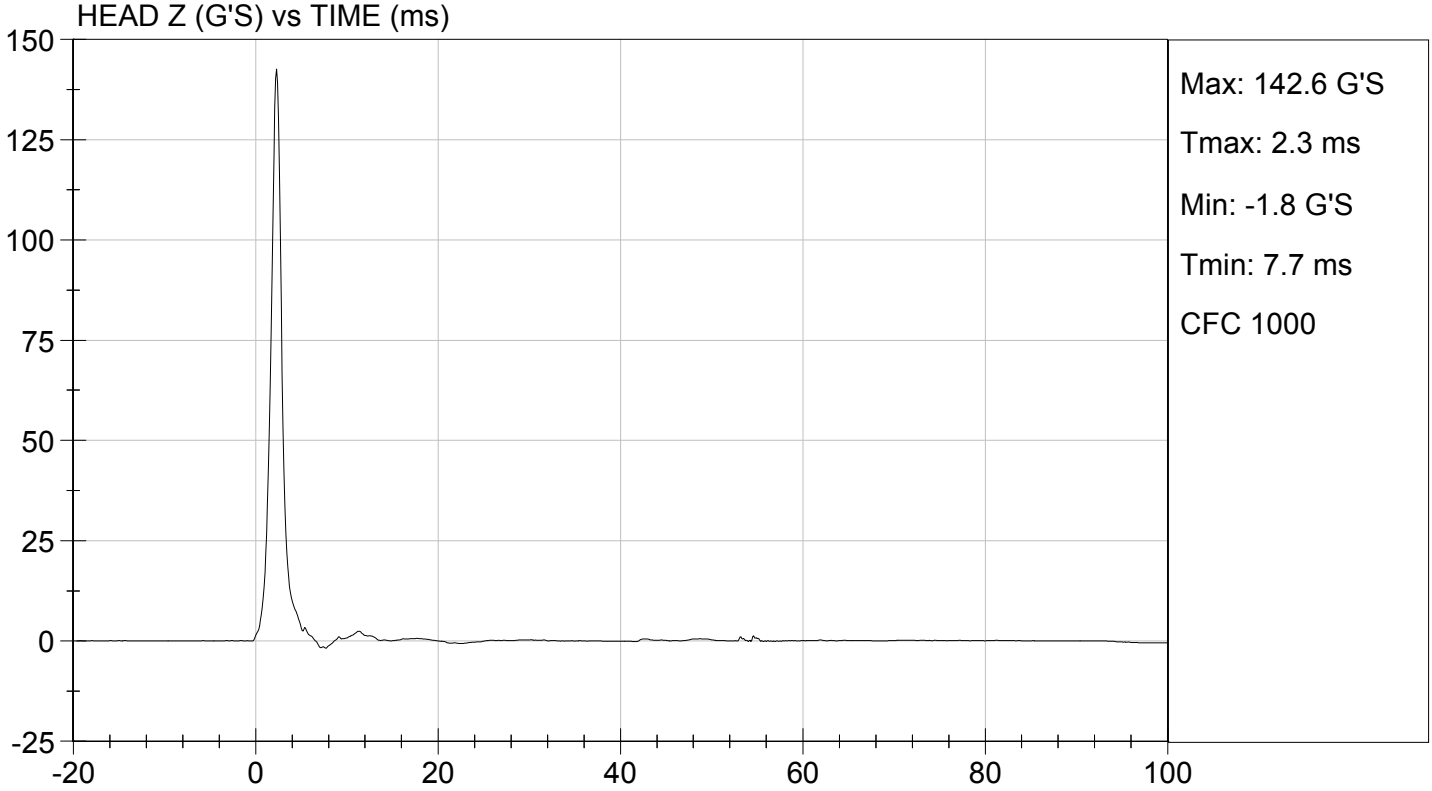
TEST DESC: HEAD DROP

TEST DATE: 11/16/2015
TEST #: D153741

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: 11/16/2015

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.7°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	34%
Record the minimum humidity:	29%

_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	4.6 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	6.2 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 86 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	87 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

11/16/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153742

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	29	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	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	86	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	87	Pass
			Overall Results		Pass

Jack Coleman
Laboratory Technician

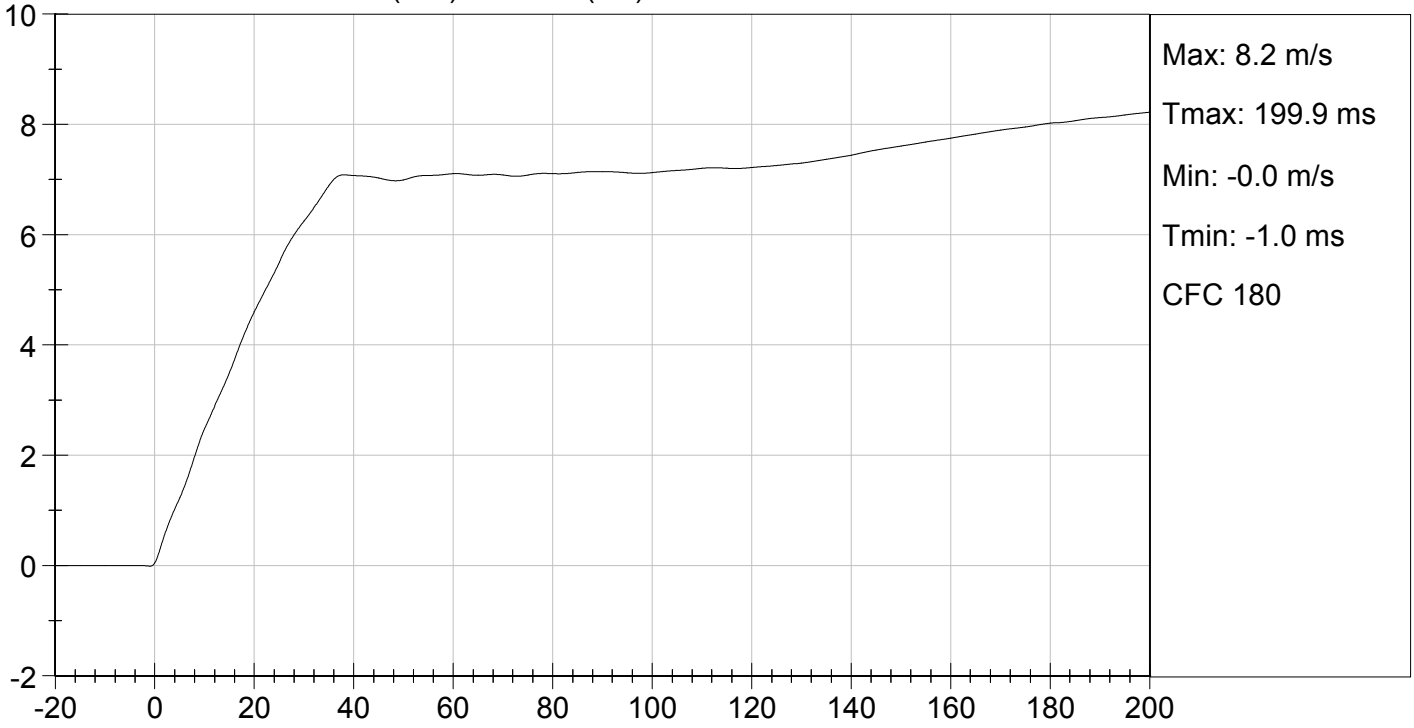
11/16/2015
Test Date

Jeff Leonardelli
Approved By

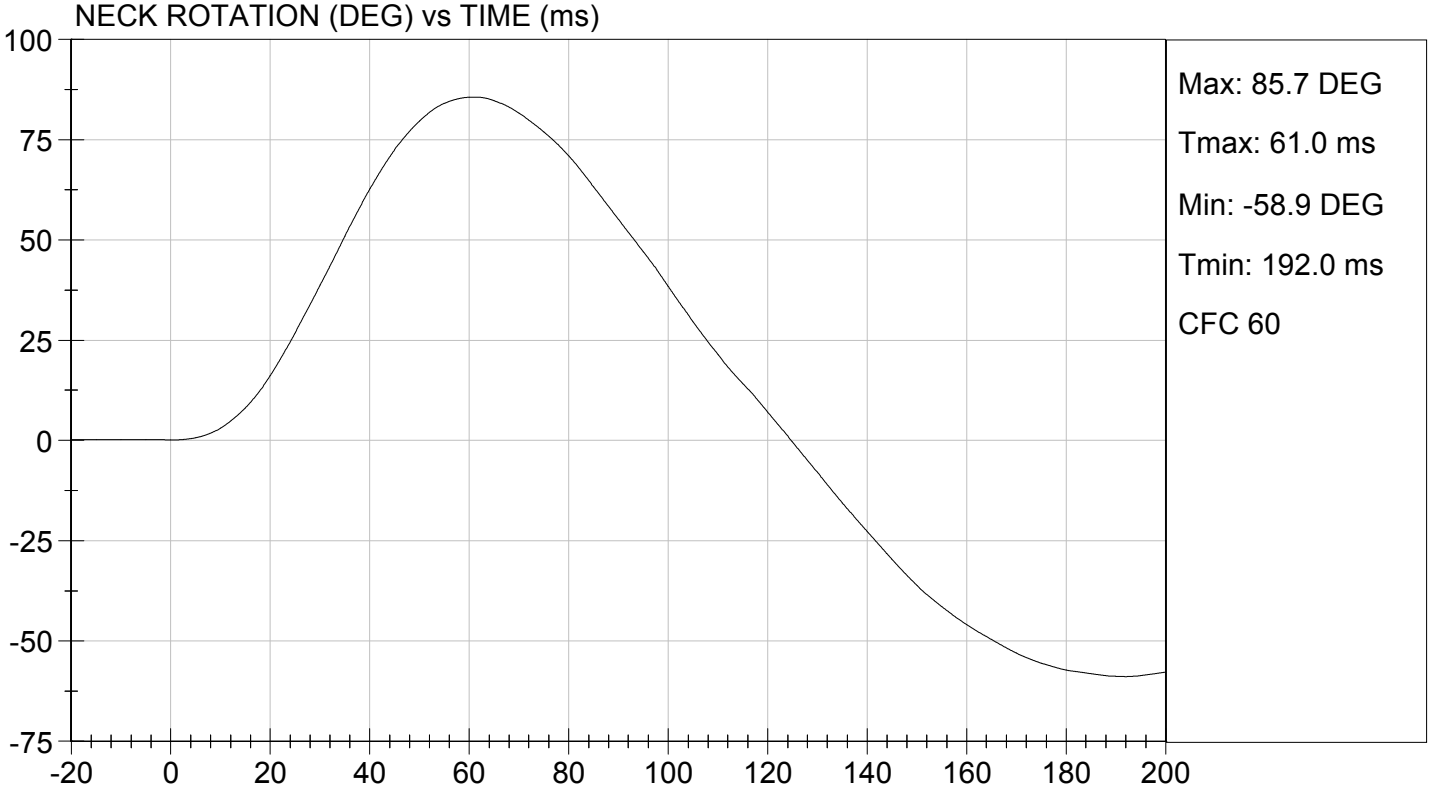
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 11/16/2015
TEST #: D153742

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

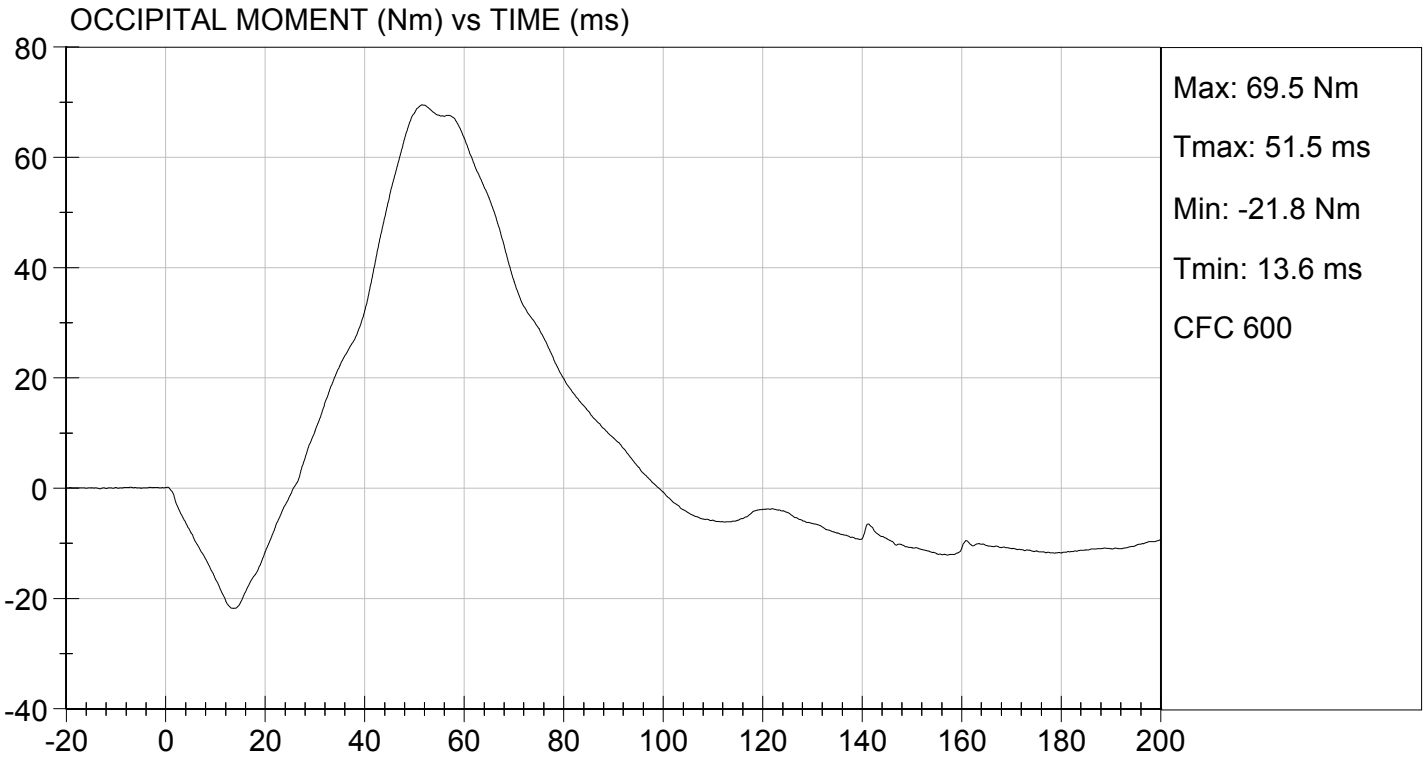


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/16/2015
TEST #: D153742



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 11/16/2015

Technician: Jack Coleman

____ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.7°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	34%
Record the minimum humidity:	29%

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	3.5 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°	-55 Nm @ 108 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

11/16/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153743

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	29	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	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.1	Pass
D Plane Rotation	Max	deg	99 to 114	108	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	100	Pass
			Overall Results		Pass

Jack Coleman

Laboratory Technician

11/16/2015

Test Date

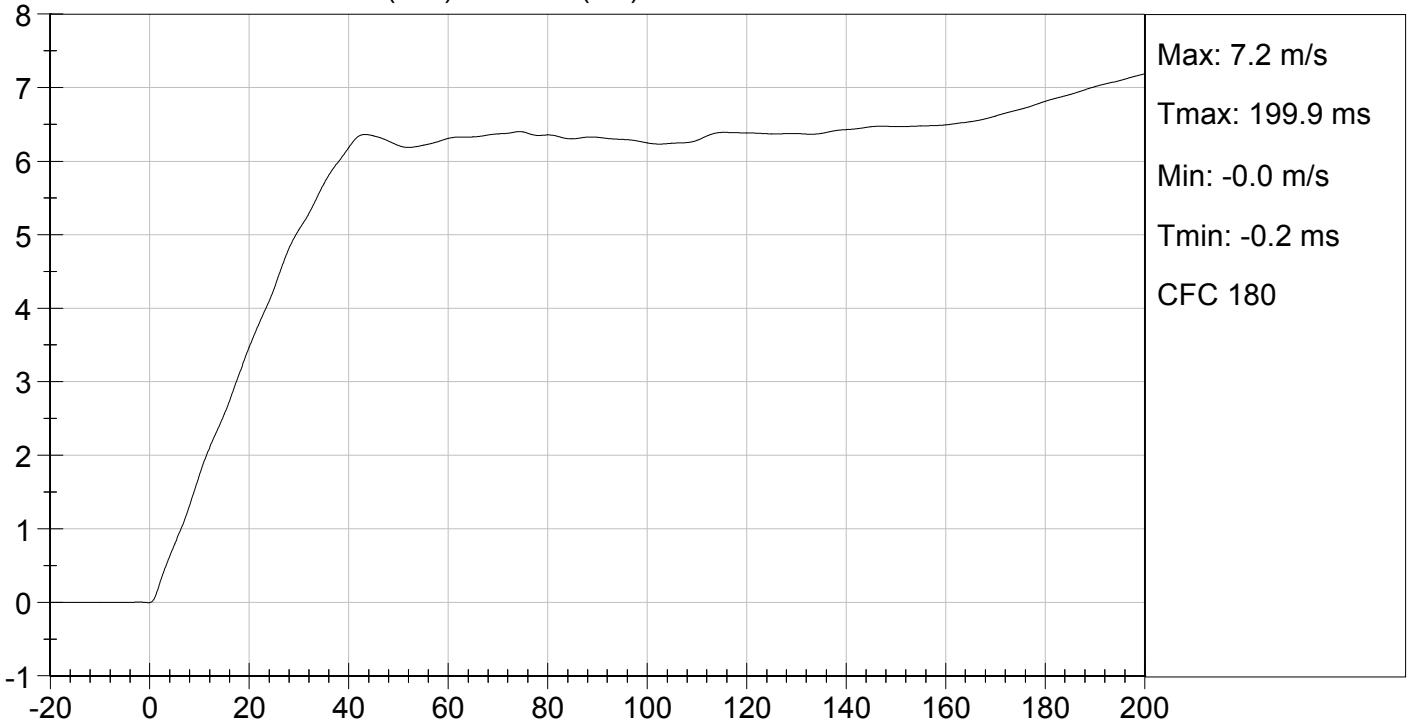
Jeff Leonardini

Approved By

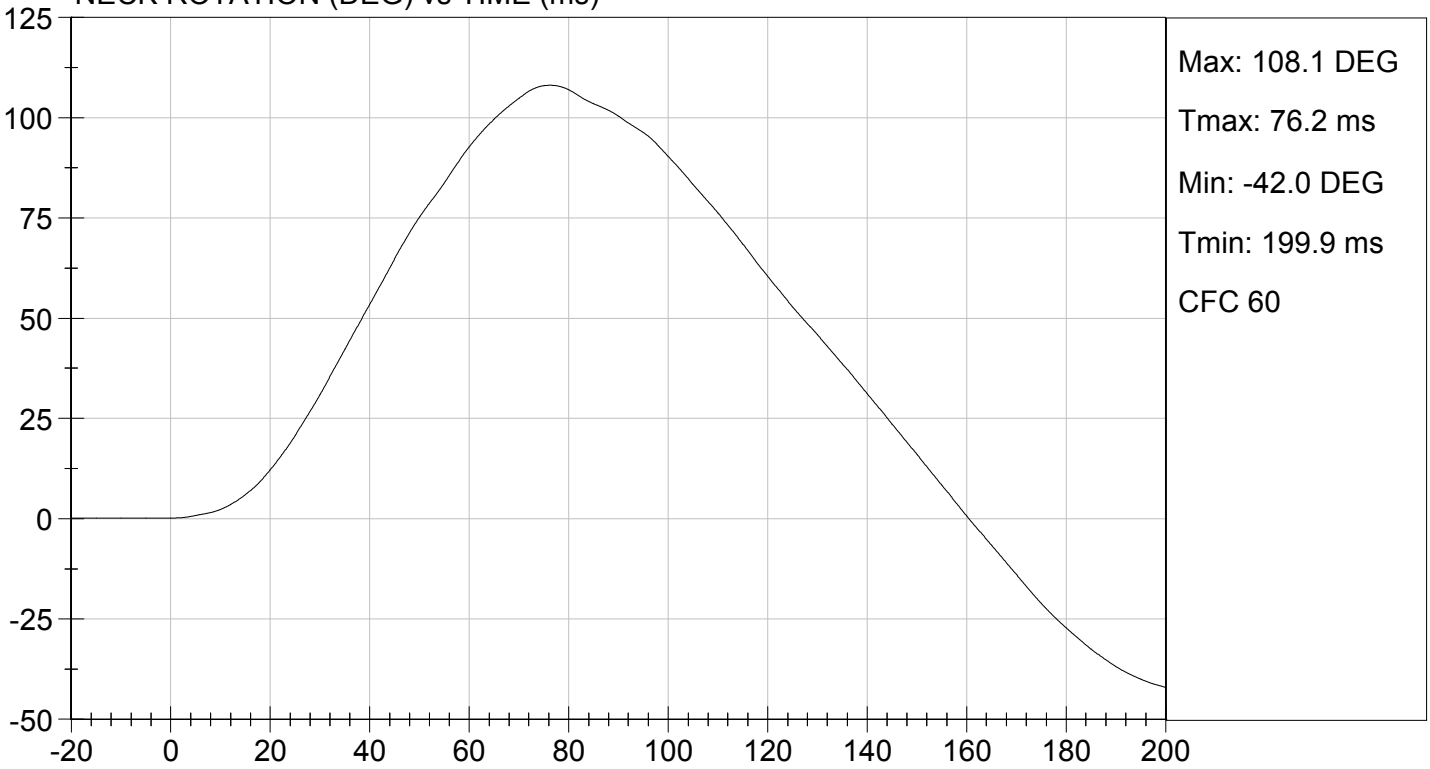
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 11/16/2015
TEST #: D153743

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

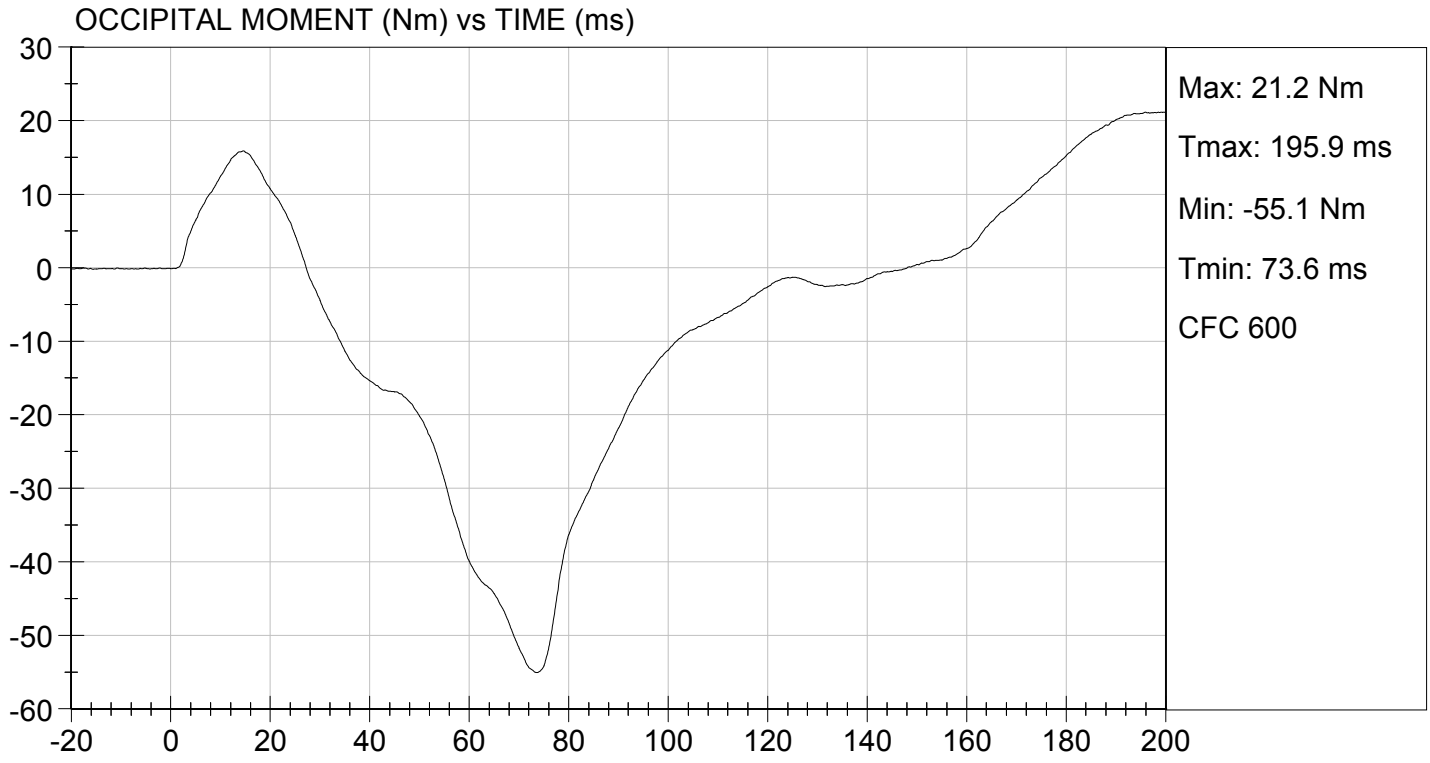


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 11/16/2015
TEST #: D153743



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 11/17/2015

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one thorax impact test performed

_X_ 2. The test fixture conforms to the specifications in Figure 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:	21.2°C
Record the minimum temperature:	20.6°C
Record the maximum humidity:	47%
Record the minimum humidity:	46%

_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))

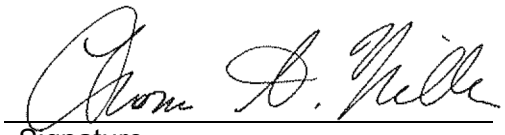
Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.68 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	51 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4166 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4183 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	72%

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

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

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

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



Signature

11/17/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153744

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	47	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4166	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4183	Pass
		Overall Test Results		Pass

Laboratory Technician

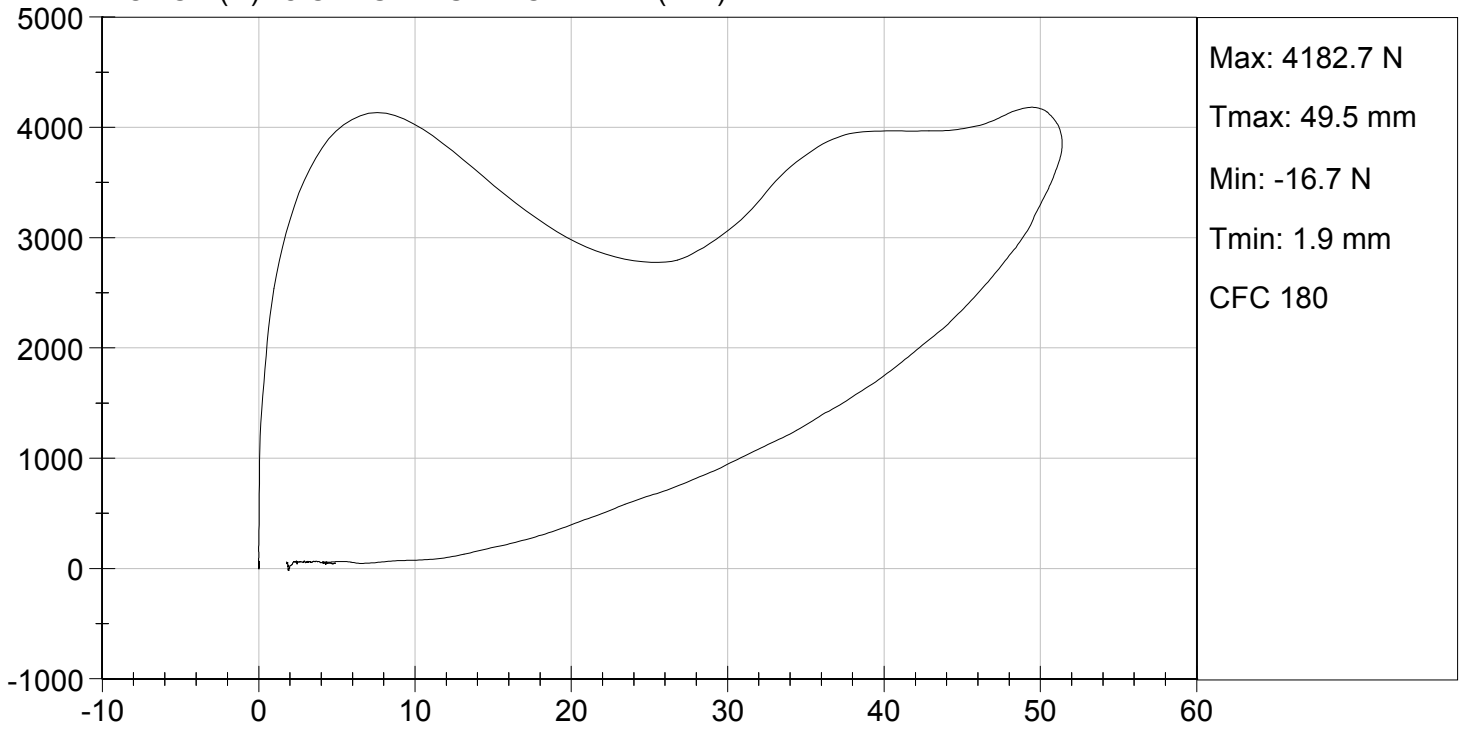
11/17/2015
Test Date

Approved By

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

TEST DATE: 11/17/2015
TEST #: D153744

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

Dummy Serial Number: 510 Test Date: 11/17/2015

Technician: Thomas Miller

____ 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:	21.2°C
Record the minimum temperature:	20.6°C
Record the maximum humidity:	47%
Record the minimum humidity:	46%

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

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

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

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

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

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

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

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

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

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

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

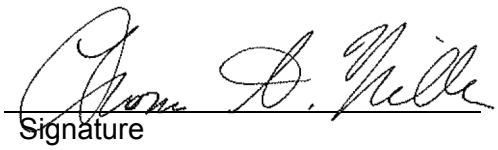
X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))

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

X 17. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	18 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.9 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	354 N
Final ref. plane angle	Initial ref. plane angle ± 8°	25 deg



Signature

11/17/2015

Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153747

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	20.6	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	25	Pass
Force at 45 deg	N	320 to 390	354	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Laboratory Technician

11/17/2015
Test Date

Approved By

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

Dummy Serial Number: 510 Test Date: 11/16/2015

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:	21.2°C
Record the maximum humidity:	34%
Record the minimum humidity:	29%

_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	3515 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

11/16/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153746

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3515	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

11/16/2015

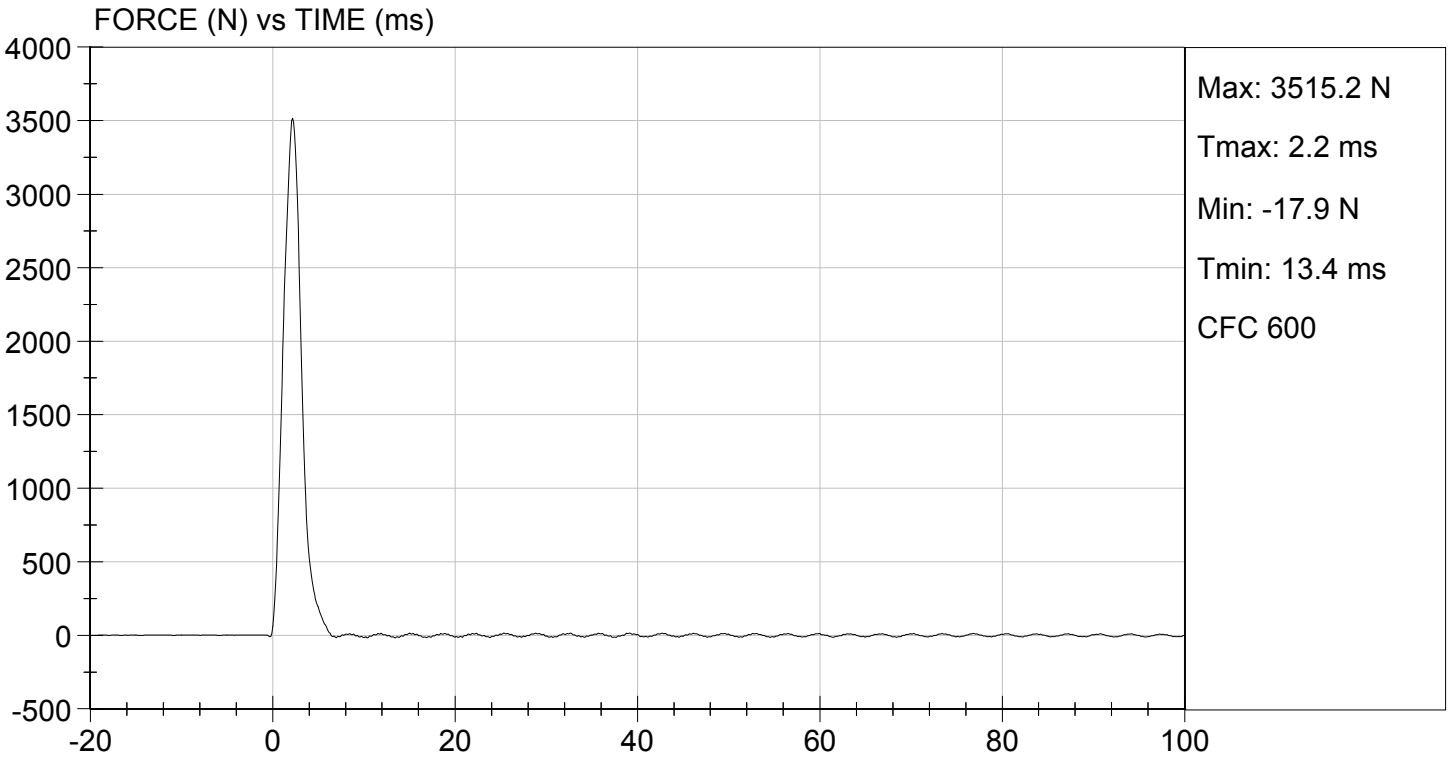
Test Date

Jeff Leonardelli

Approved By

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

TEST DATE: 11/16/2015
TEST #: D153746



DATA SHEET B9

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

Dummy Serial Number: 510 Test Date: 11/16/2015

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:	21.2°C
Record the maximum humidity:	34%
Record the minimum humidity:	29%

_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	3921 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

11/16/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153745

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	29	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3921	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

11/16/2015

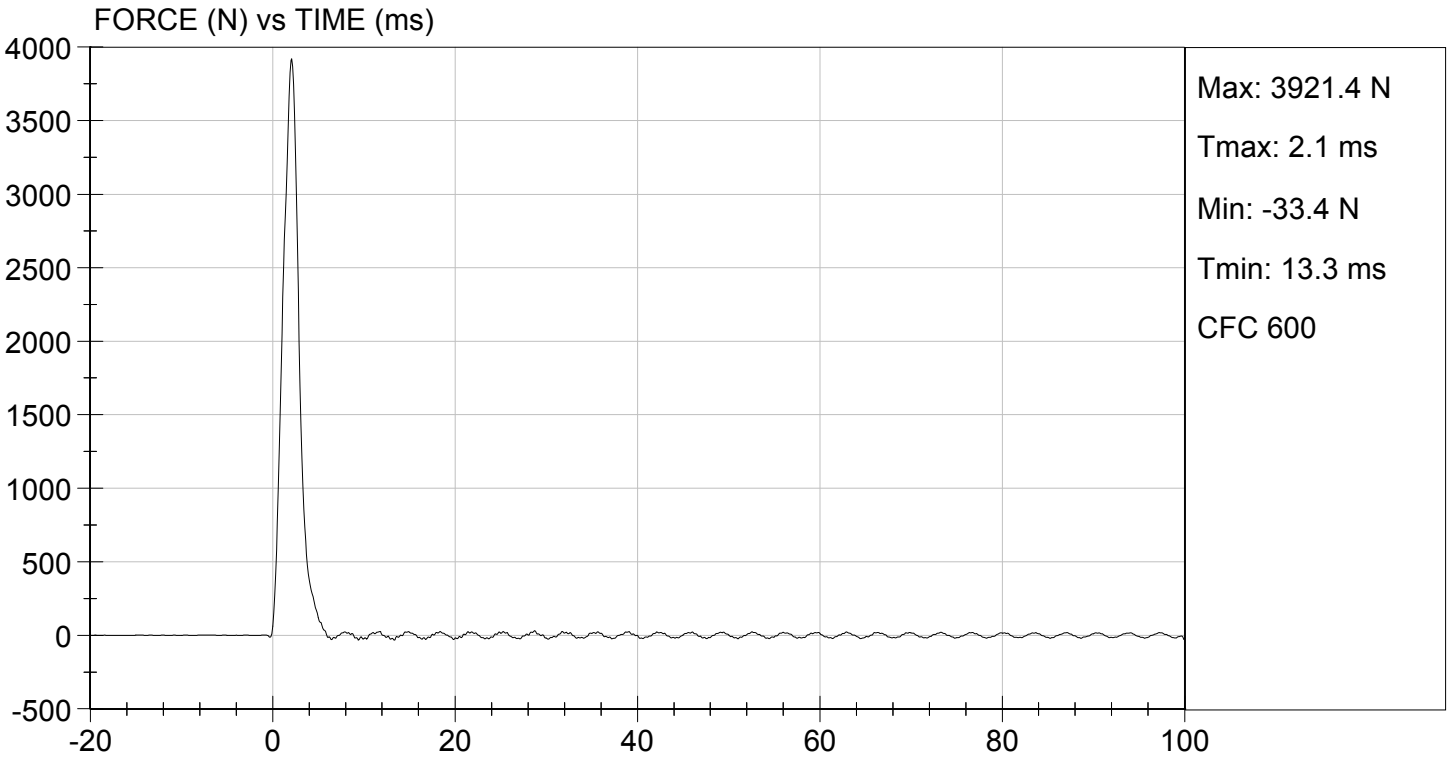
Test Date

Jeff Leonardson

Approved By

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

TEST DATE: 11/16/2015
TEST #: D153745



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	P83180	07/20/2015	01/20/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P83181	07/20/2015	01/20/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P83182	07/20/2015	01/20/2016
NECK TRANSDUCER	Denton	1716	7489	10/22/2015	04/22/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85174	07/22/2015	01/22/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P86736	07/01/2015	01/01/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P86737	07/01/2015	01/01/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	510	07/21/2015	01/21/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	979	07/30/2015	01/30/2016
(2) LEFT FEMUR	Denton	2121	1384	07/30/2015	01/30/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 510 Test Date: 11/16/2015

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 11/17/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 11/17/2015

Signature — Date

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: 08/31/2015

Technician: Thomas Miller

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one head drop performed

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

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

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

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

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

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

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

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

Record findings and actions: No Damage

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

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

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

X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.132(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

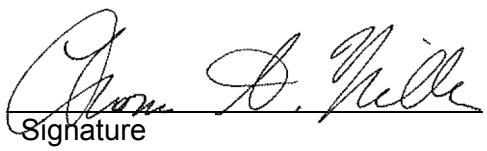
Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	250 g ≤ x ≤ 300 g	293 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	12.7 g

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



Signature

08/31/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test ID:** D152671

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Peak Resultant Acceleration	G's	250 to 300	293	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	12.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

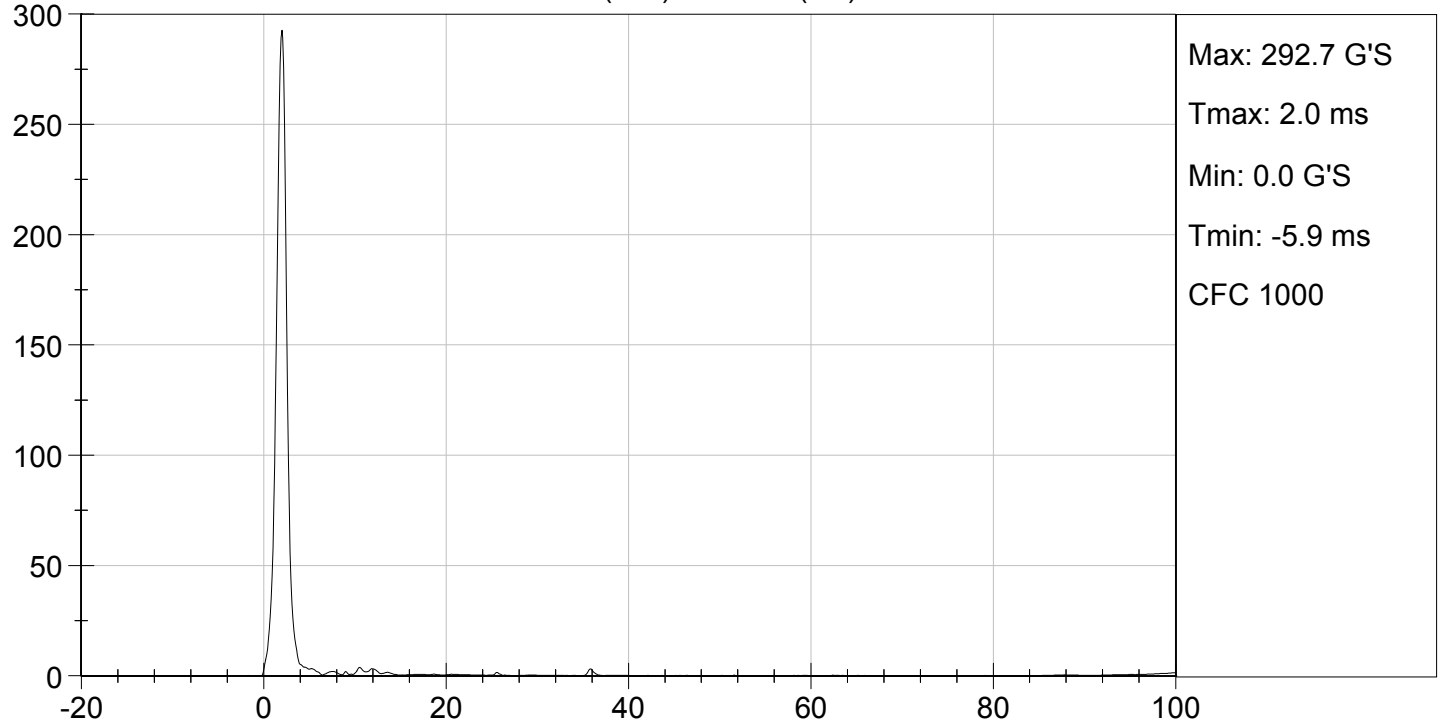
08/31/2015
Test Date

Approved By

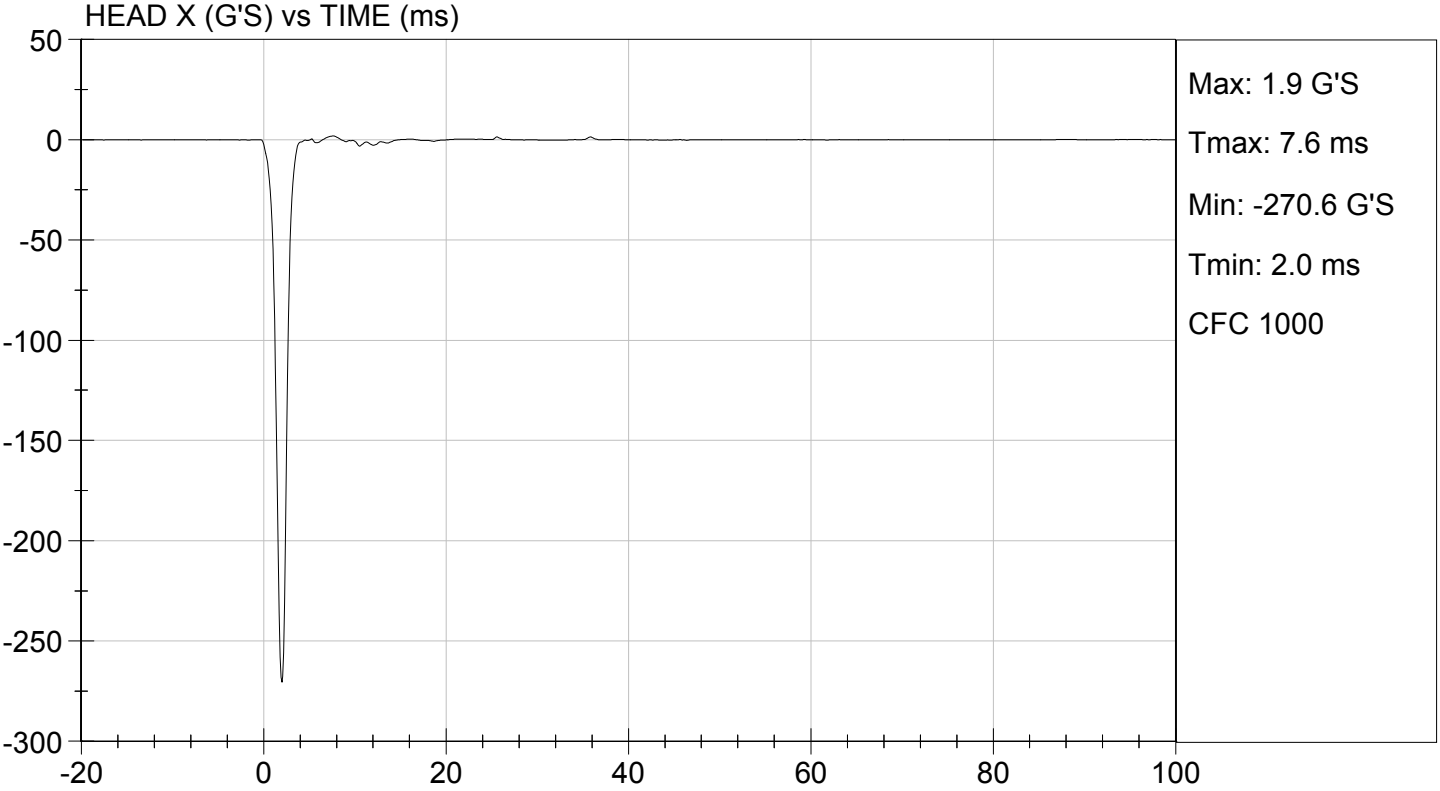
TEST DESC: HEAD DROP

TEST DATE: 08/31/2015
TEST #: D152671

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



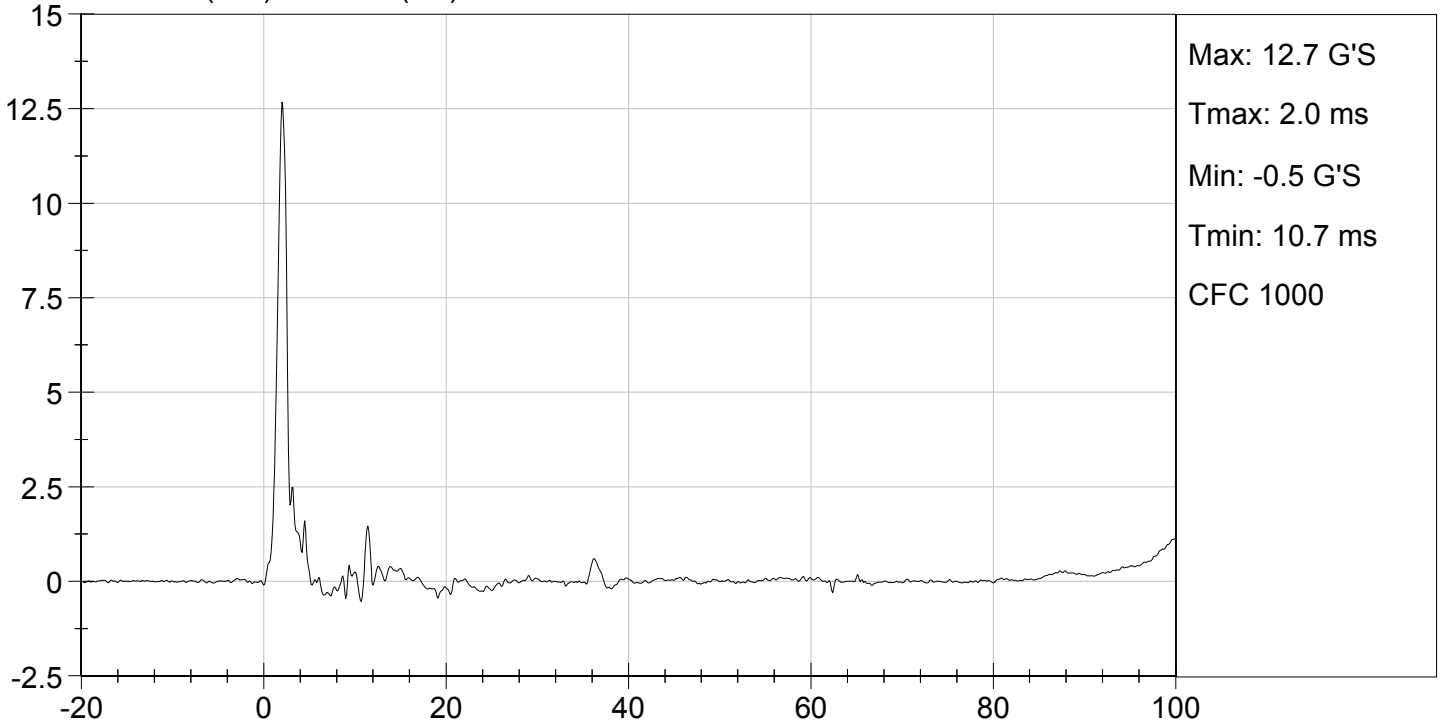
HEAD X (G'S) vs TIME (ms)



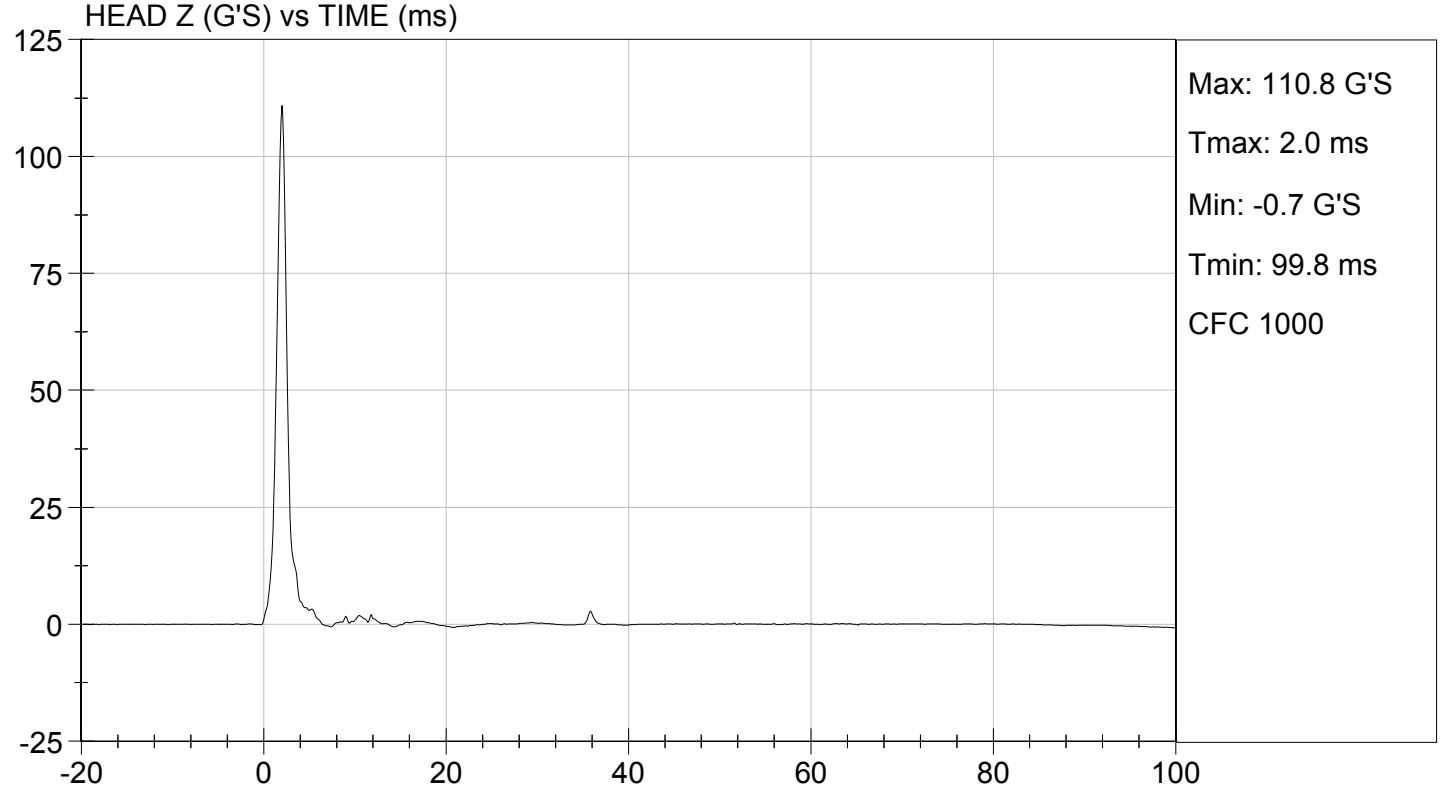
TEST DESC: HEAD DROP

TEST DATE: 08/31/2015
TEST #: D152671

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: 09/01/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

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

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s ≤ speed ≤ 7.13 m/s	7.06 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.1 m/s ≤ ΔV ≤ 2.5 m/s	2.4 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.0 m/s	4.5 m/s
	@ 30 ms	5.8 m/s ≤ ΔV ≤ 7.0 m/s	6.0 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 86 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

09/01/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D152672

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.0	Pass
D Plane Rotation	Max	deg	77 to 91	86	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

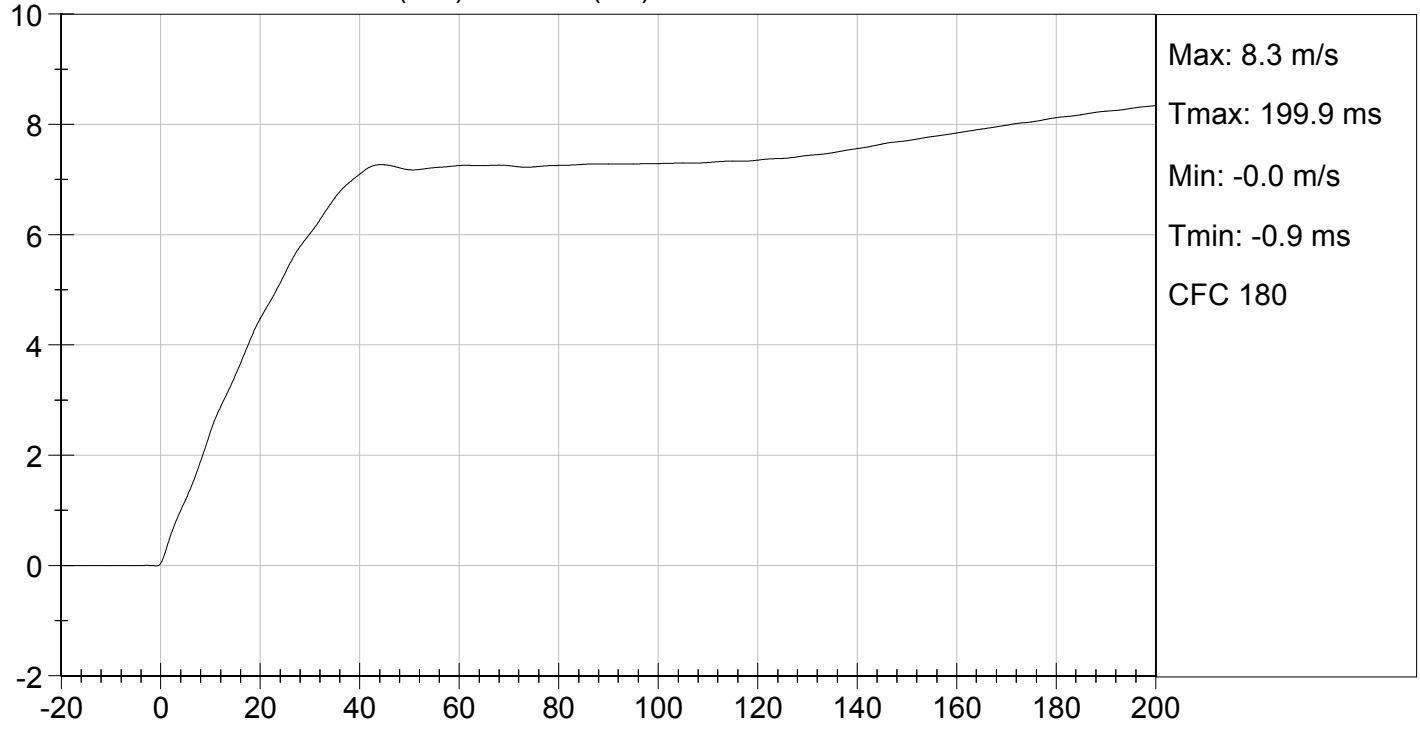
09/01/2015
Test Date

Jeff Leonardi
Approved By

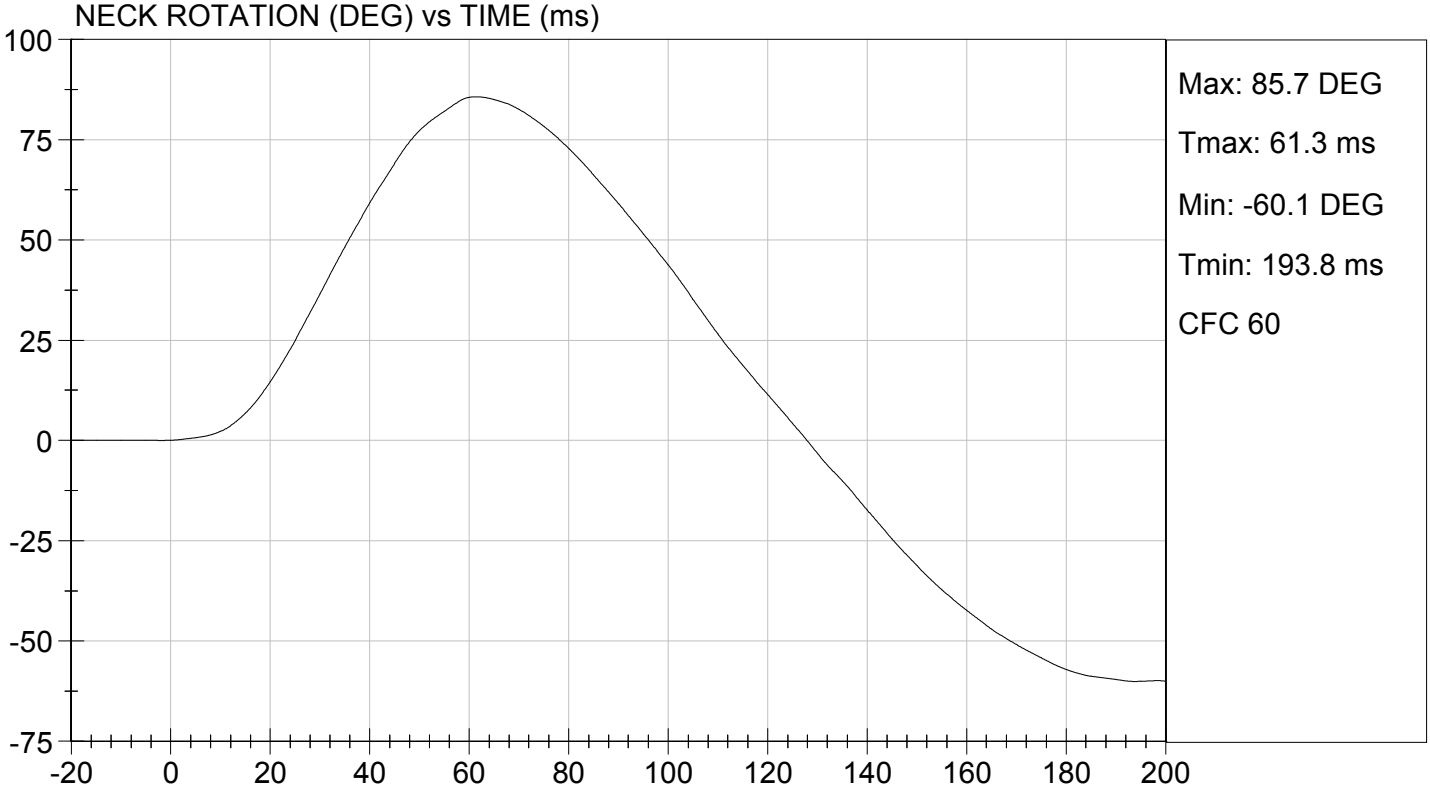
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 09/01/2015
TEST #: D152672

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

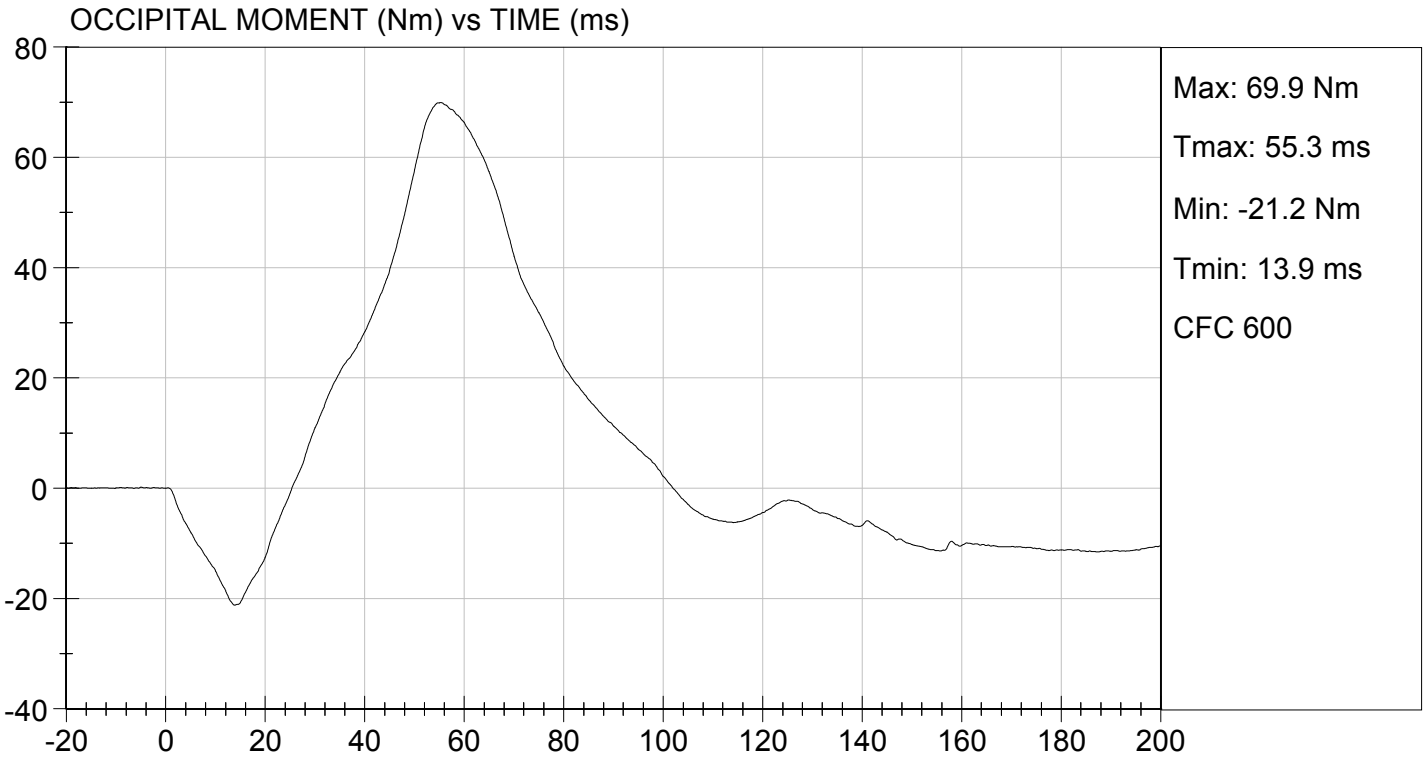


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 09/01/2015
TEST #: D152672



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

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

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s ≤ speed ≤ 6.19 m/s	6.12 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	3.8 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 @ 112 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms ≤ time ≤ 114 ms	98 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

09/01/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D152673

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	49	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	112	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	98	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

09/01/2015

Test Date

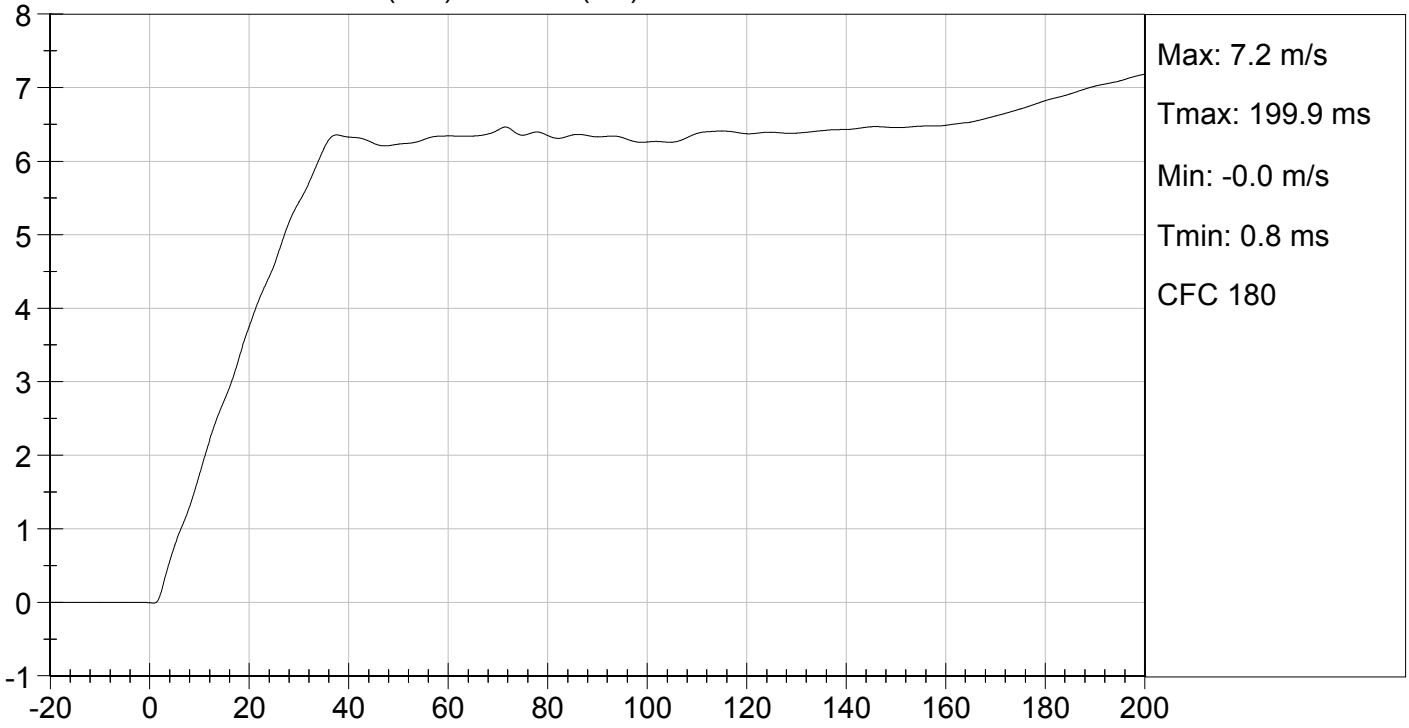
Jeff Leonardi

Approved By

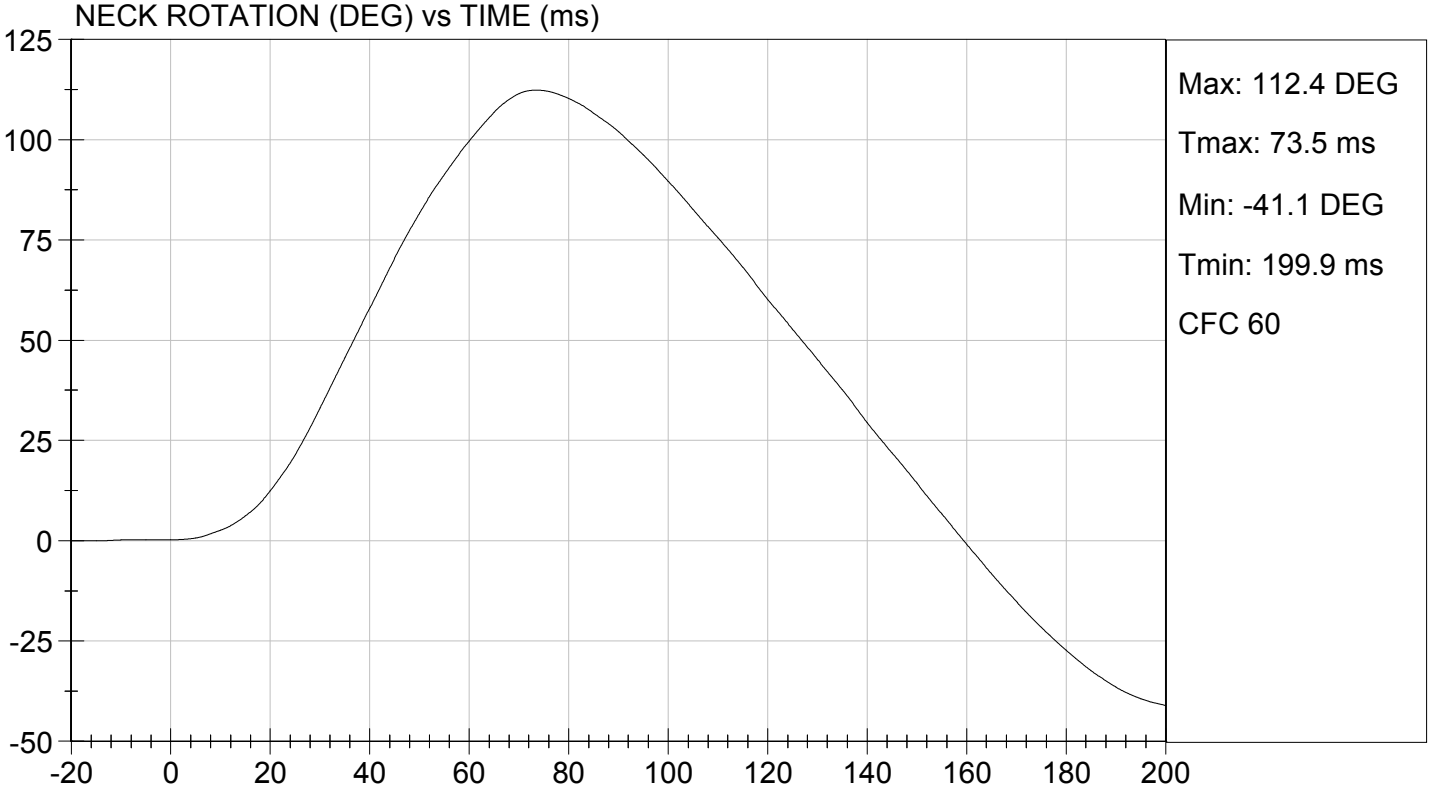
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 09/01/2015
TEST #: D152673

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

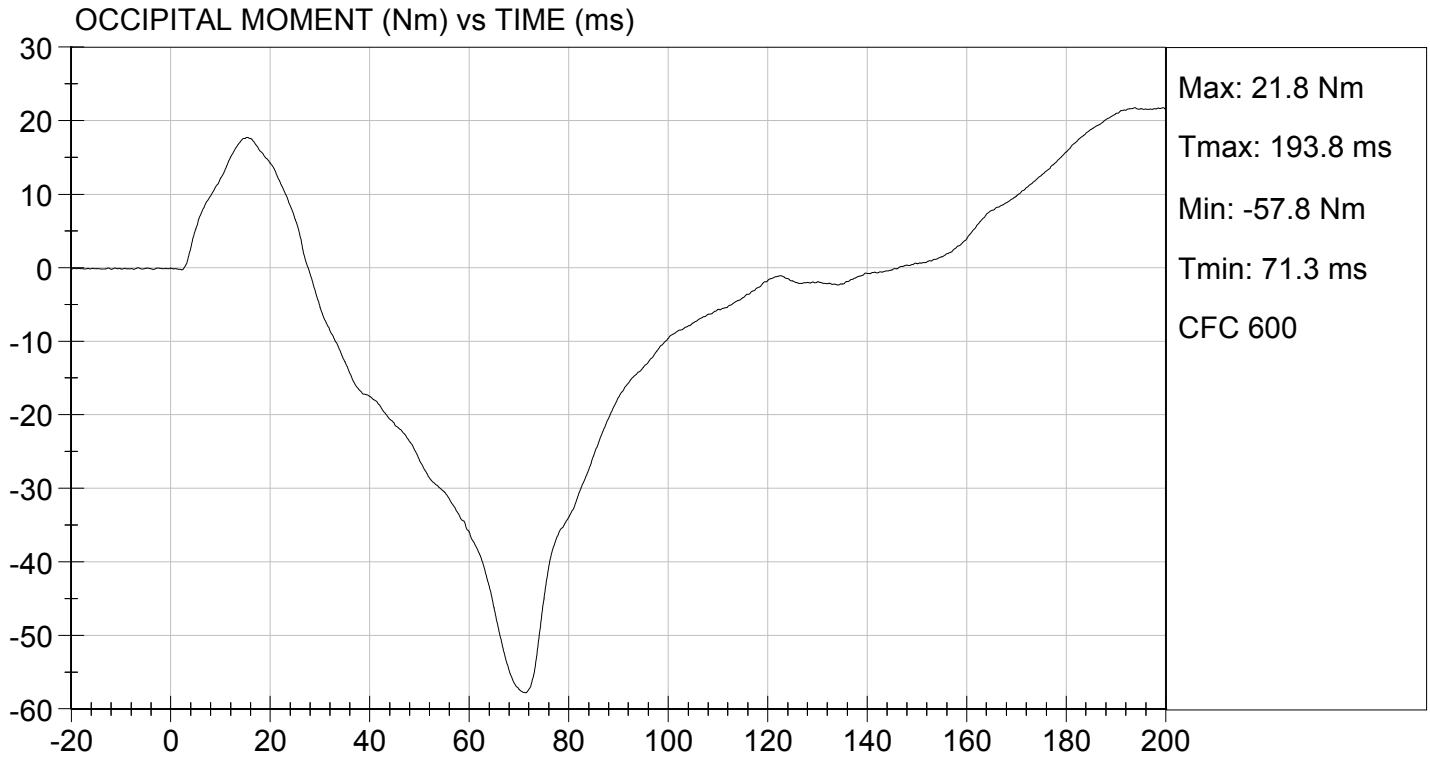


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 09/01/2015
TEST #: D152673



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration

___ Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

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

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

X - No Damage

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

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

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

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

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

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

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

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

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

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

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

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

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.77 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	4146 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4132 N
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	72%

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

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

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

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

David Schoedel

Signature

09/01/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D152674

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Relative Humidity	%	10 to 70	50	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4146	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4132	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

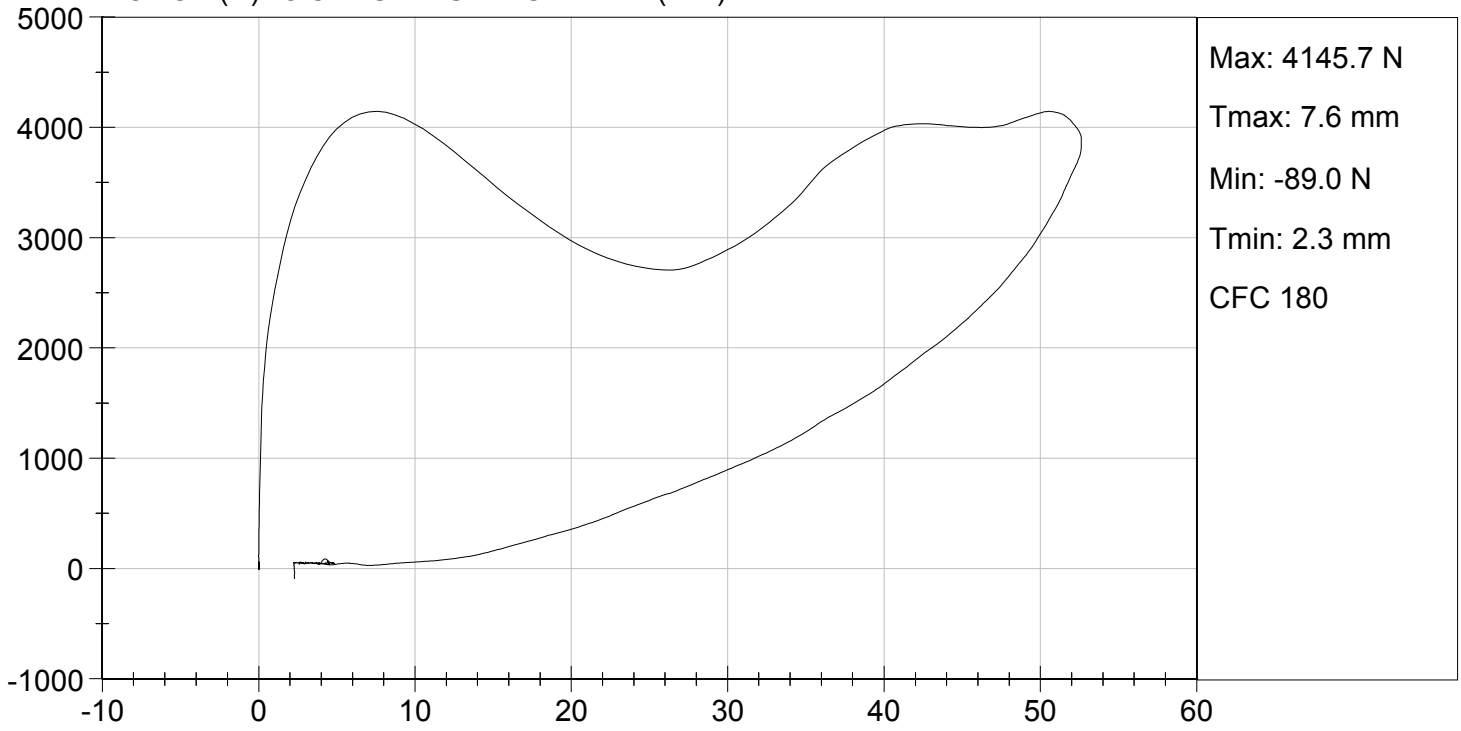
09/01/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/01/2015
TEST #: D152674

FORCE (N) vs CHEST DISPLACEMENT (mm)



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

Dummy Serial Number: 510 Test Date: 09/01/2015

Technician: Jack Coleman

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

X 17. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	18 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	1.1 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	344 N
Final ref. plane angle	Initial ref. plane angle ± 8°	23 deg

Jack Coleman
Signature

09/01/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D152677

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	23	Pass
Force at 45 deg	N	320 to 390	344	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.1	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

09/01/2015
Test Date

Jeff Leonardi
Approved By

DATA SHEET B8

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

Dummy Serial Number: 510 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

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

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3528 N

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

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

David Schoedel
Signature

09/01/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D152676

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3528	Pass
		Overall Test Results		Pass

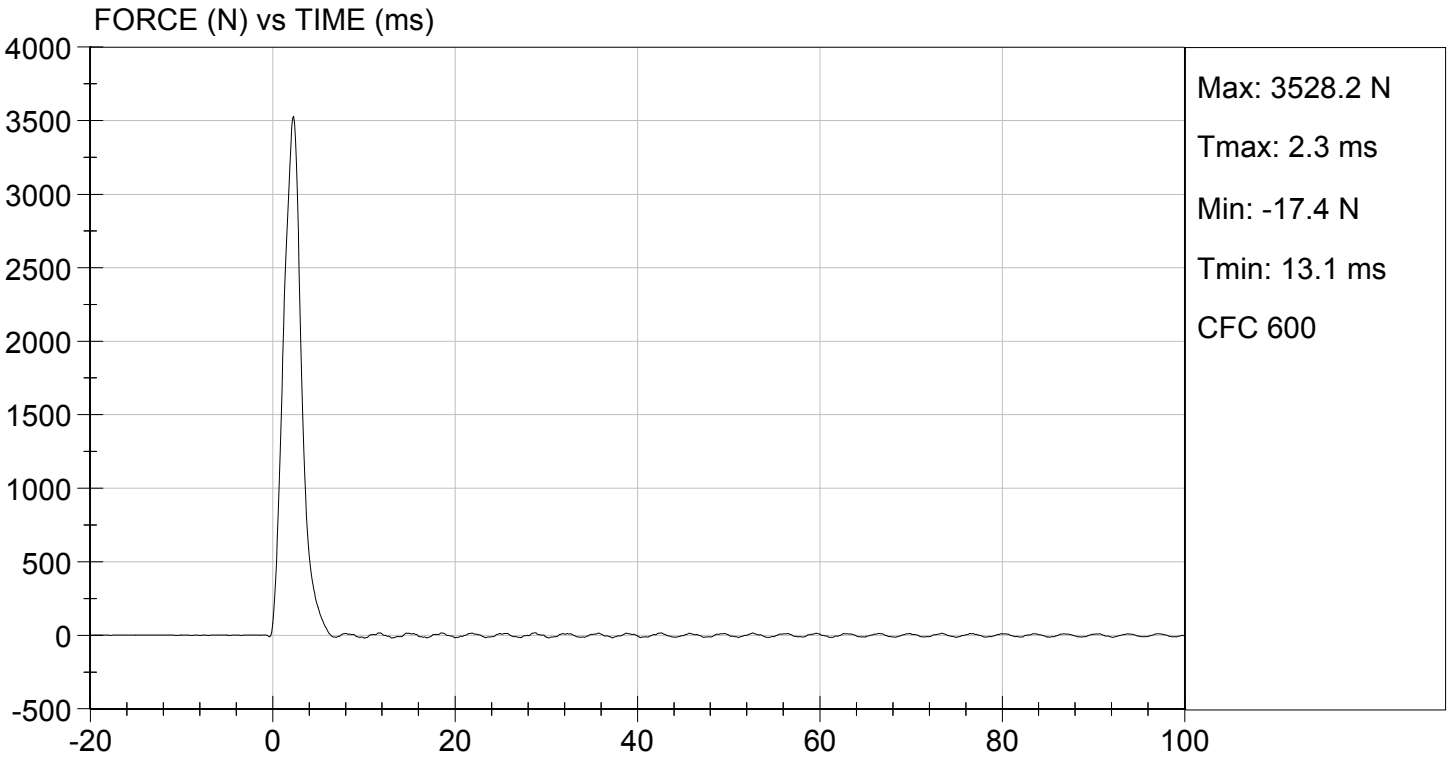
David Schoedel
Laboratory Technician

09/01/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/01/2015
TEST #: D152676



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

Dummy Serial Number: 510 Test Date: 09/01/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

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

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3610 N

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

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

David Schoedel
Signature

09/01/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D152675

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3610	Pass
		Overall Test Results		Pass

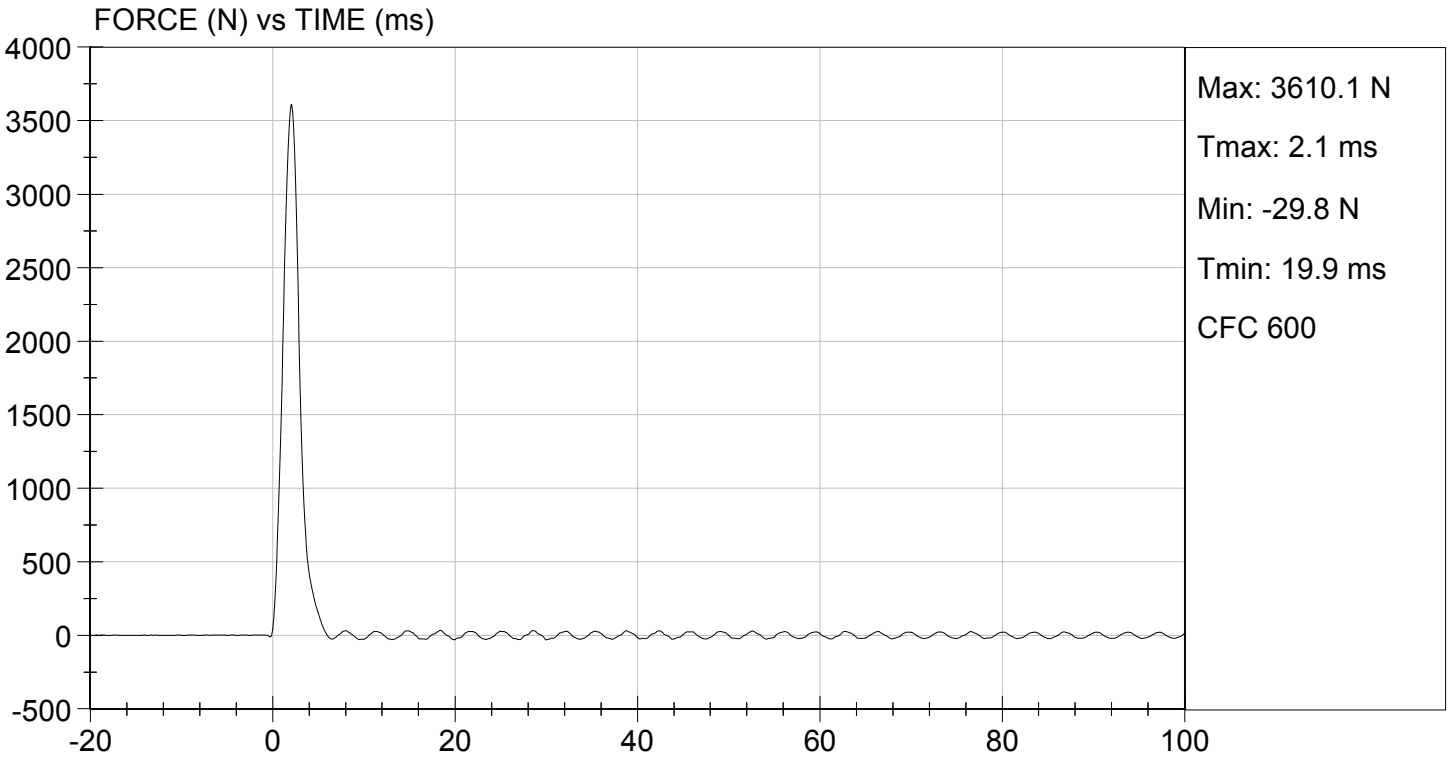
David Schoedel
Laboratory Technician

09/01/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 09/01/2015
TEST #: D152675



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	P83180	07/20/2015	01/20/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P83181	07/20/2015	01/20/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P83182	07/20/2015	01/20/2016
NECK TRANSDUCER	Denton	1716	2039	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85174	07/22/2015	01/22/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P86736	07/01/2015	01/01/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P86737	07/01/2015	01/01/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	510	07/21/2015	01/21/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	979	07/30/2015	01/30/2016
(2) LEFT FEMUR	Denton	2121	1384	07/30/2015	01/30/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	04/02/2015	10/02/2015
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	04/02/2015	10/02/2015

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B3

HEAD DROP TEST (572.132) (5th Female)

Dummy Serial Number: 510 Test Date: 10/20/2015

Technician: Thomas Miller

____ 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:	21.8°C
Record the minimum temperature:	21.5°C
Record the maximum humidity:	40%
Record the minimum humidity:	36%

_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

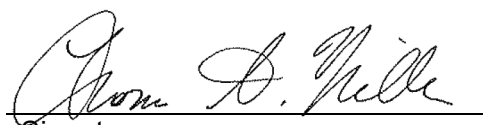
Record length: 595 mm

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	285 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	3.2 g

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



Signature

10/20/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test ID:** D153371

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Peak Resultant Acceleration	G's	250 to 300	285	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

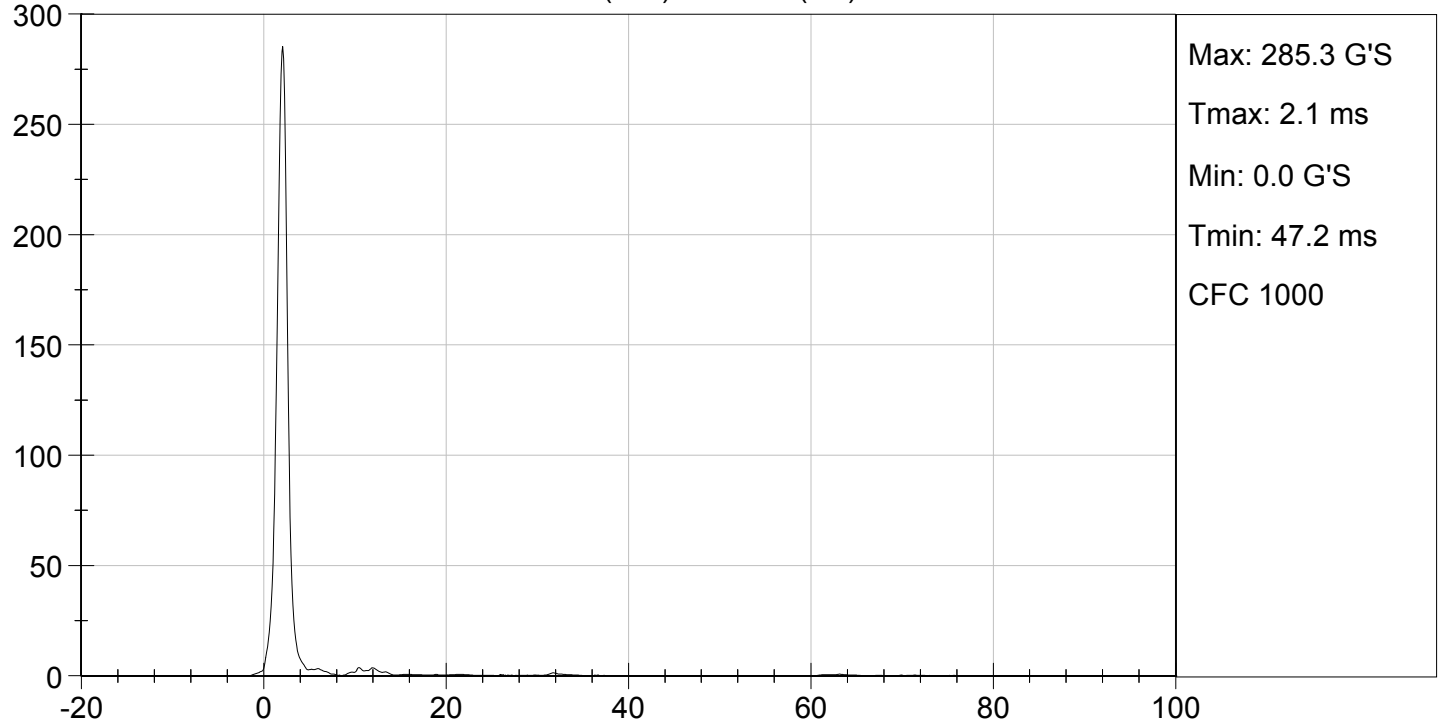
10/20/2015
Test Date

Approved By

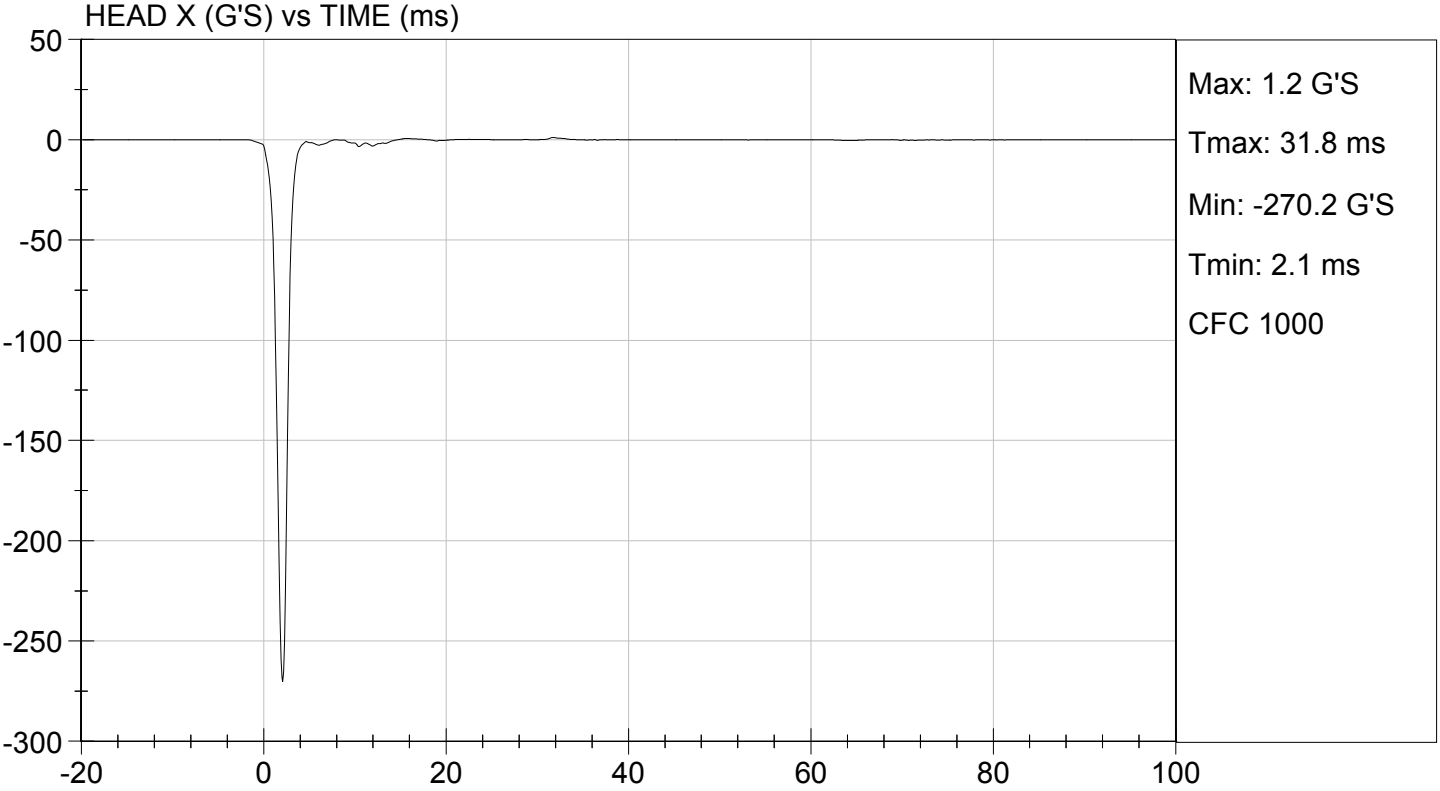
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153371

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



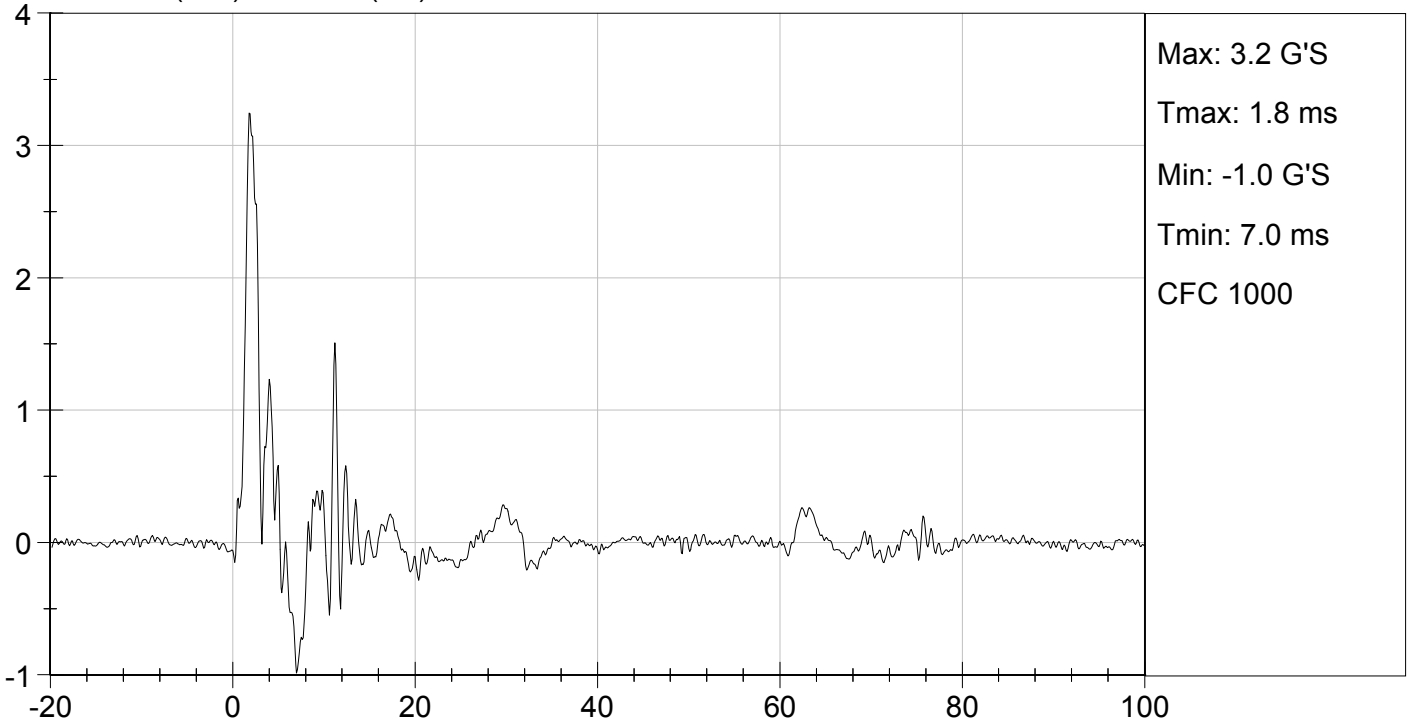
HEAD X (G'S) vs TIME (ms)



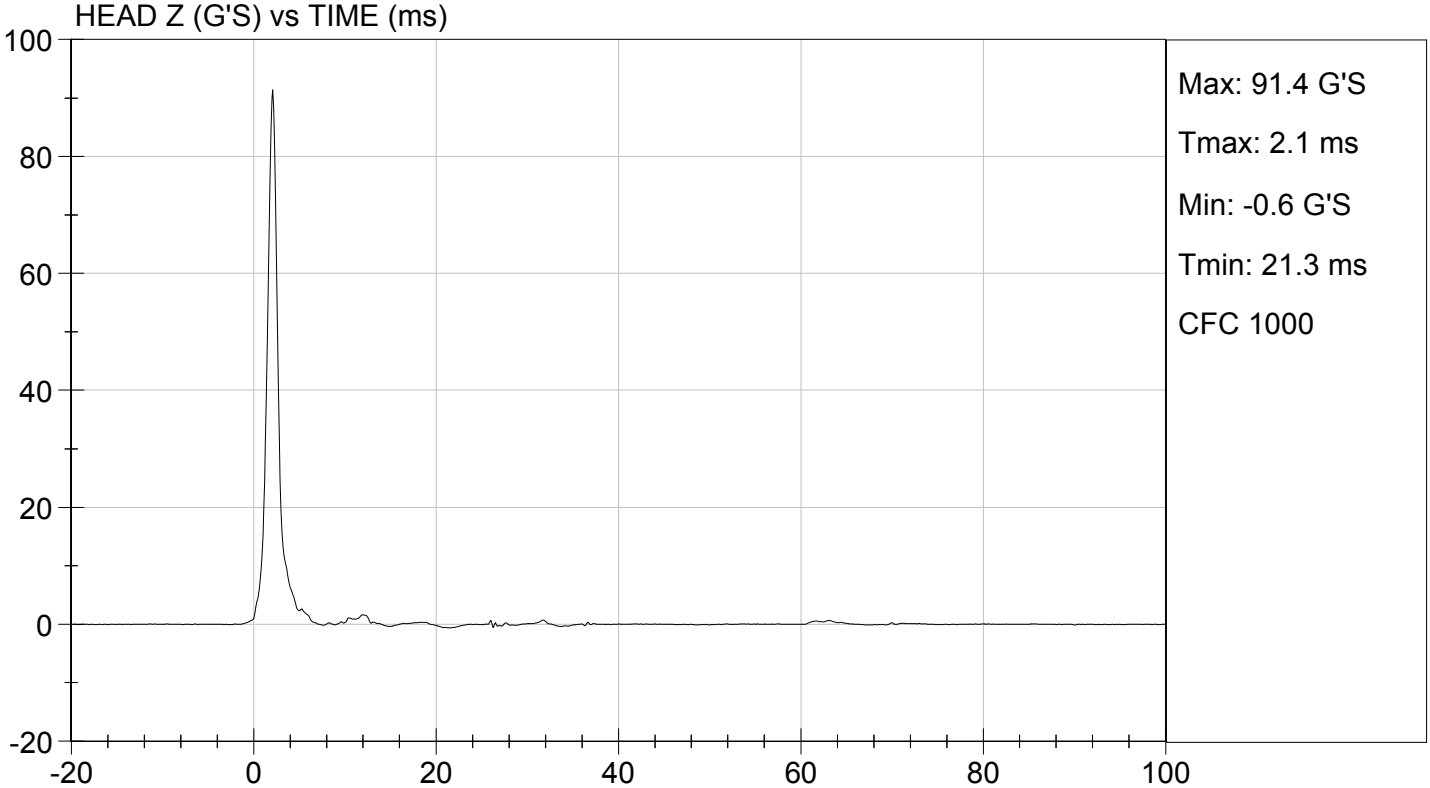
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153371

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: 10/21/2015

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last flexion test. (572.137(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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

_X_ 5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (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	6.1 m/s
Plane D Rotation		Peak moment* 69 Nm ≤ moment ≤ 83 Nm during the following rotation range 77° ≤ angle ≤ 91°	70 Nm @ 82 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms ≤ time ≤ 100 ms	87 ms

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

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

Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153372

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	43	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	6.1	Pass
D Plane Rotation	Max	deg	77 to 91	82	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	87	Pass
			Overall Results		Pass

Laboratory Technician

10/21/2015

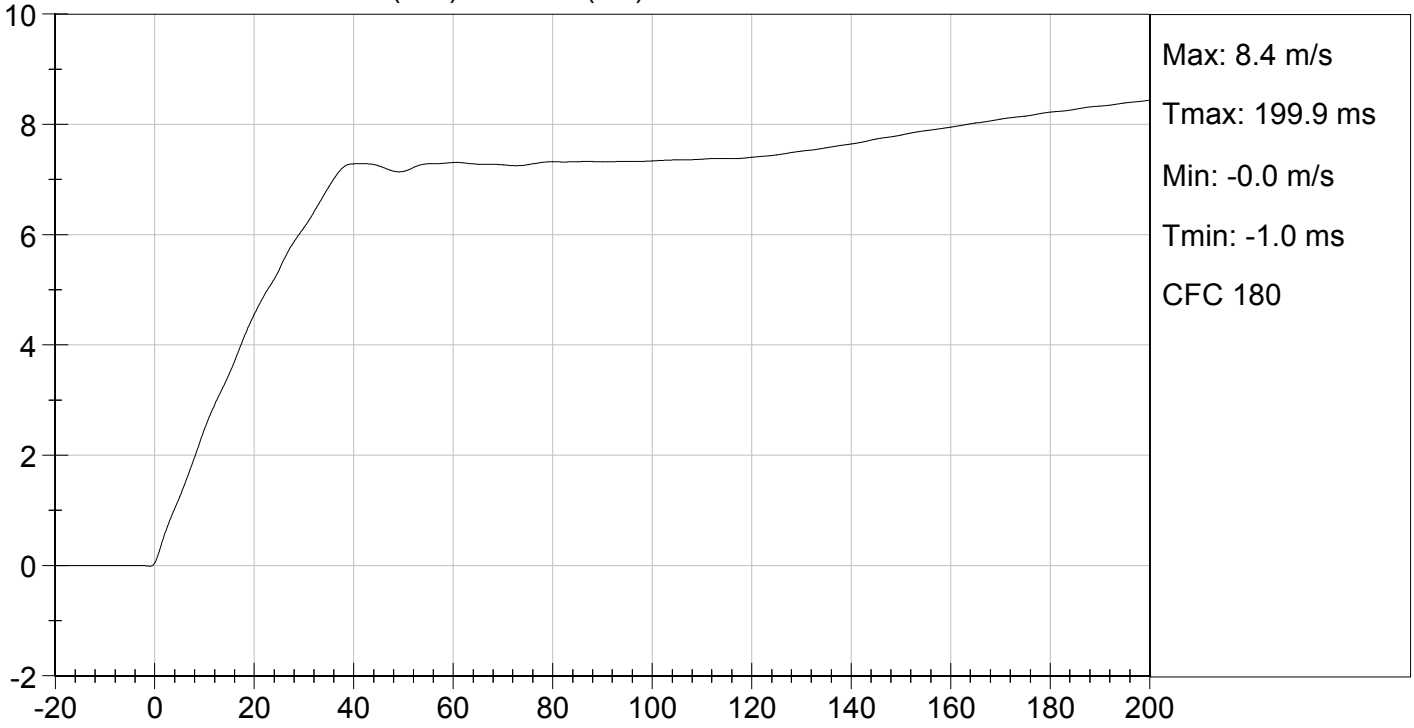
Test Date

Approved By

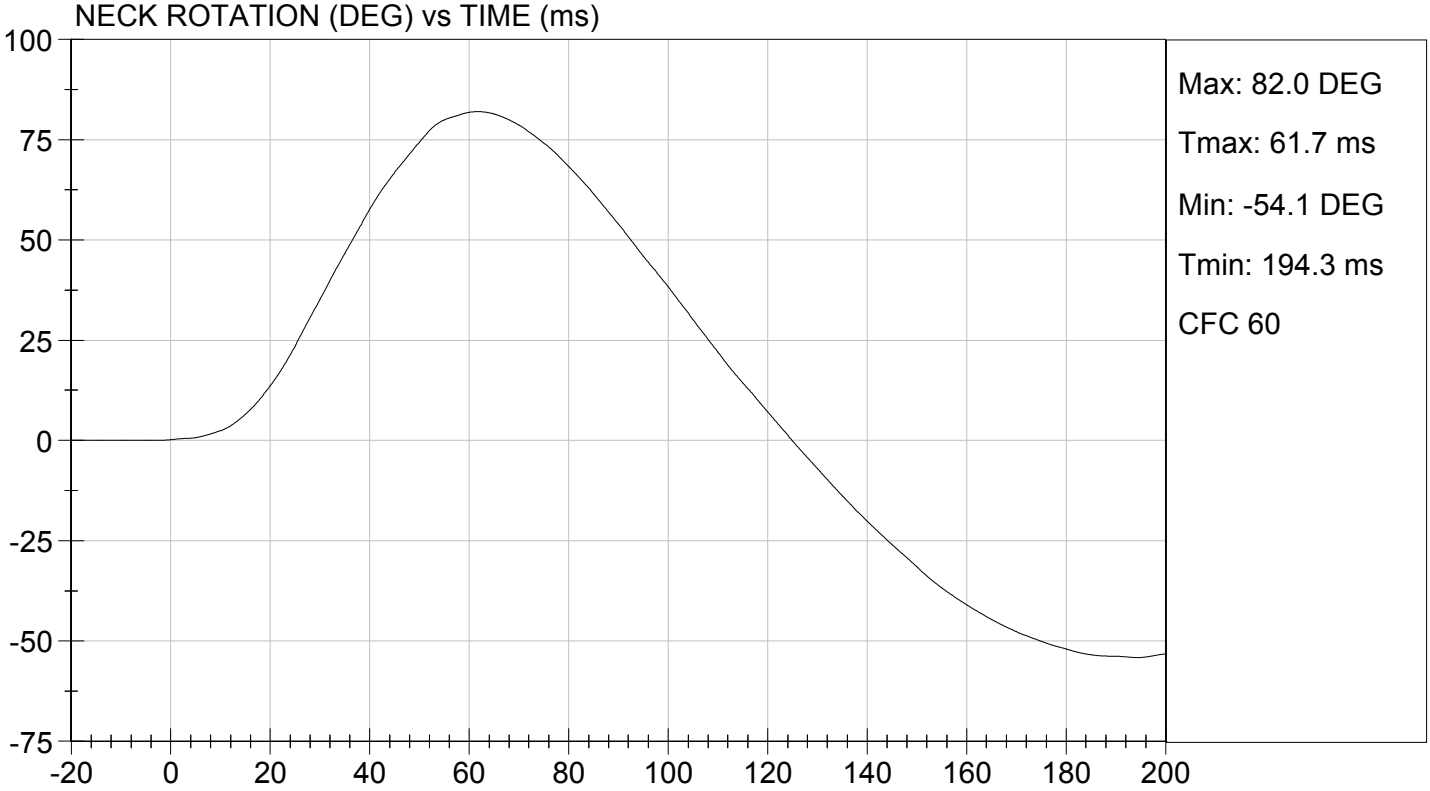
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 10/21/2015
TEST #: D153372

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



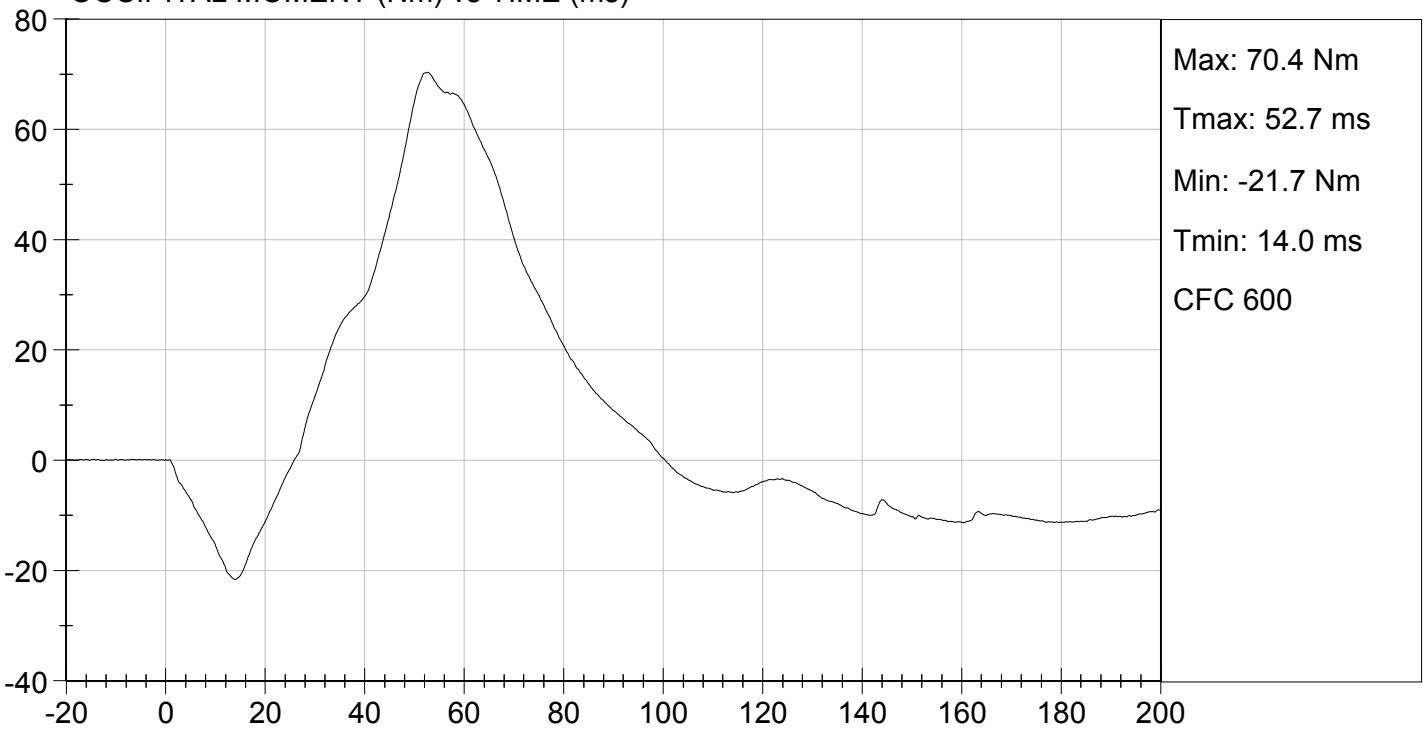
NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/21/2015
TEST #: D153372

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET B5

NECK EXTENSION TEST (572.133) (5th Female)

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

____ 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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s ≤ speed ≤ 6.19 m/s	6.05 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.5 m/s ≤ ΔV ≤ 1.9 m/s	1.8 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	5.5 m/s
Plane D Rotation		Peak moment* -65 Nm ≤ moment ≤ -53 Nm during the following rotation range 99° ≤ angle ≤ 114°	-61 Nm @ 109 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.

Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153373

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	43	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.8	Pass
	30 ms	m/s	4.6 to 5.6	5.5	Pass
D Plane Rotation	Max	deg	99 to 114	109	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-61	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	97	Pass
			Overall Results		Pass

Laboratory Technician

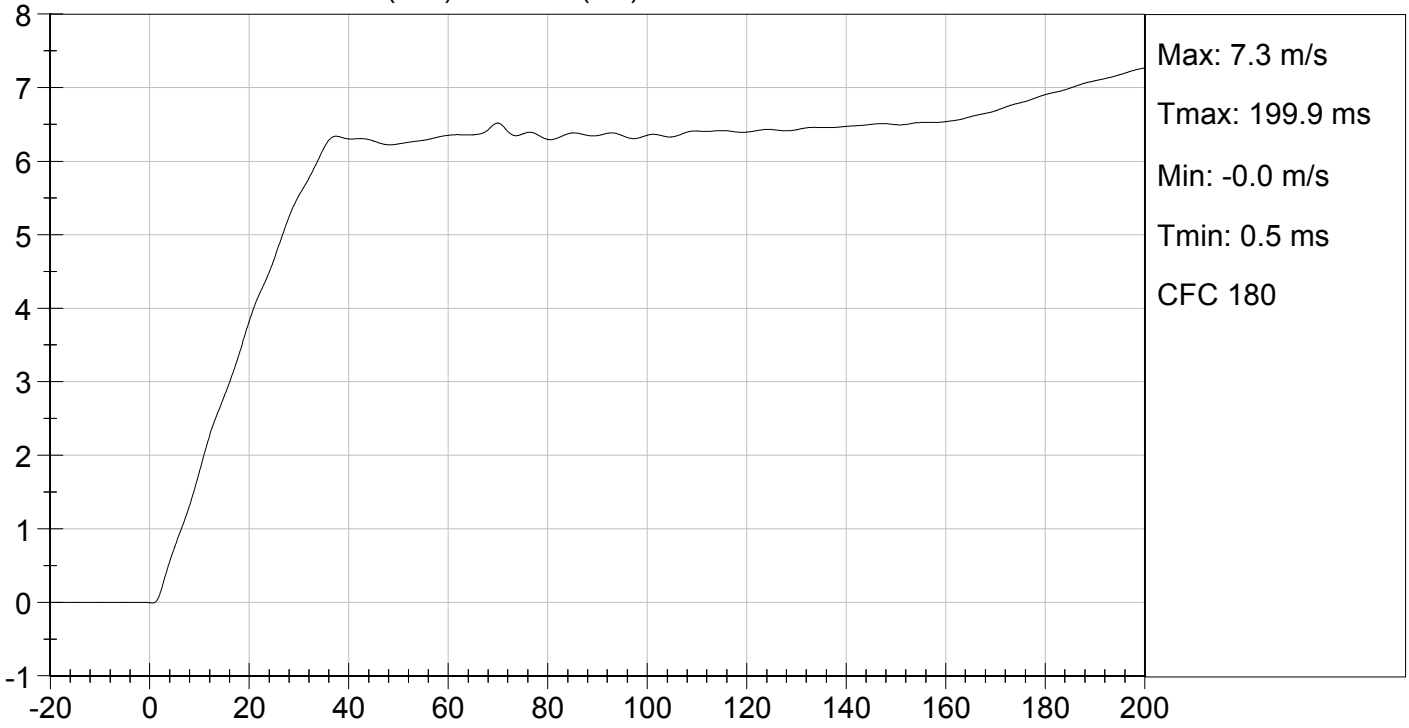
10/21/2015
Test Date

Approved By

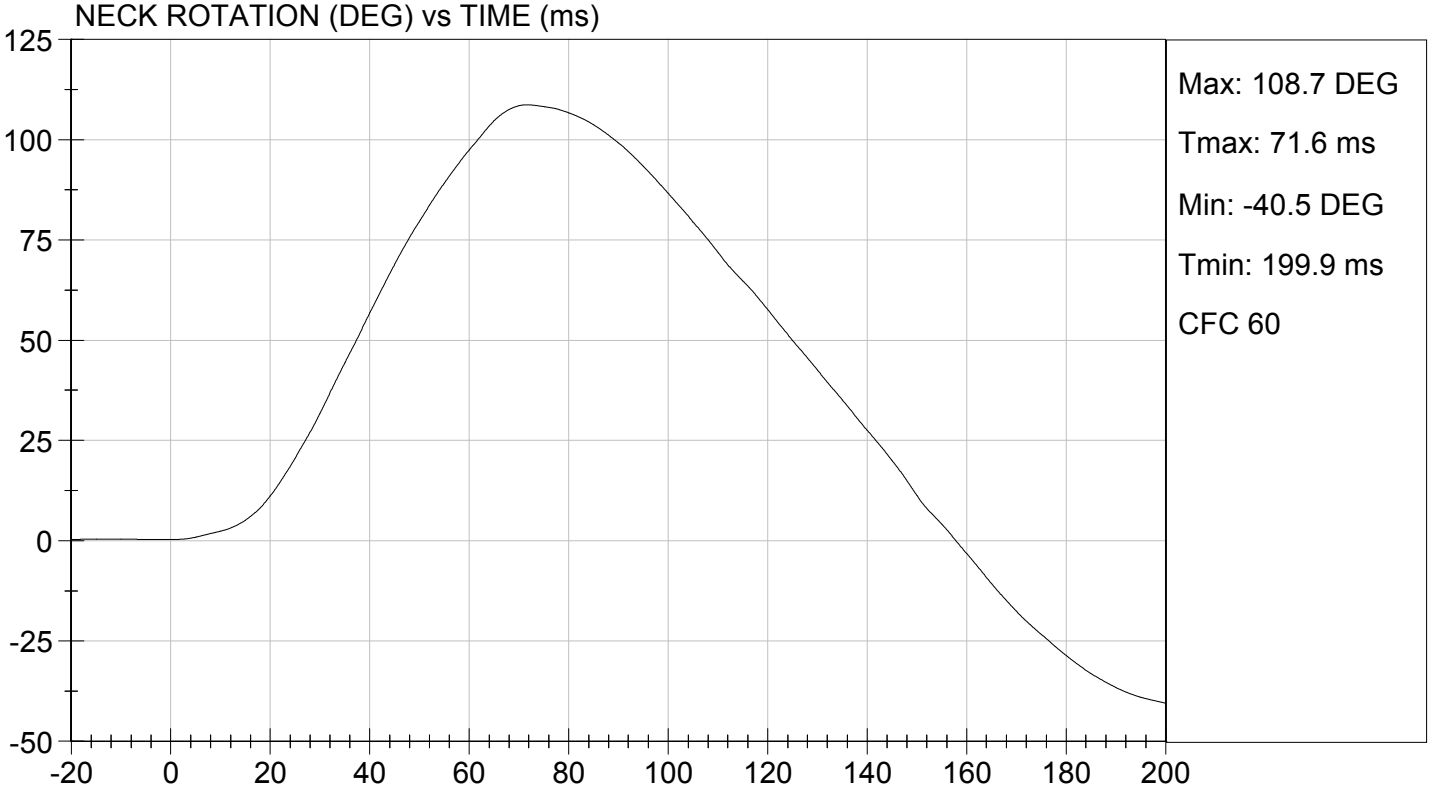
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 10/21/2015
TEST #: D153373

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

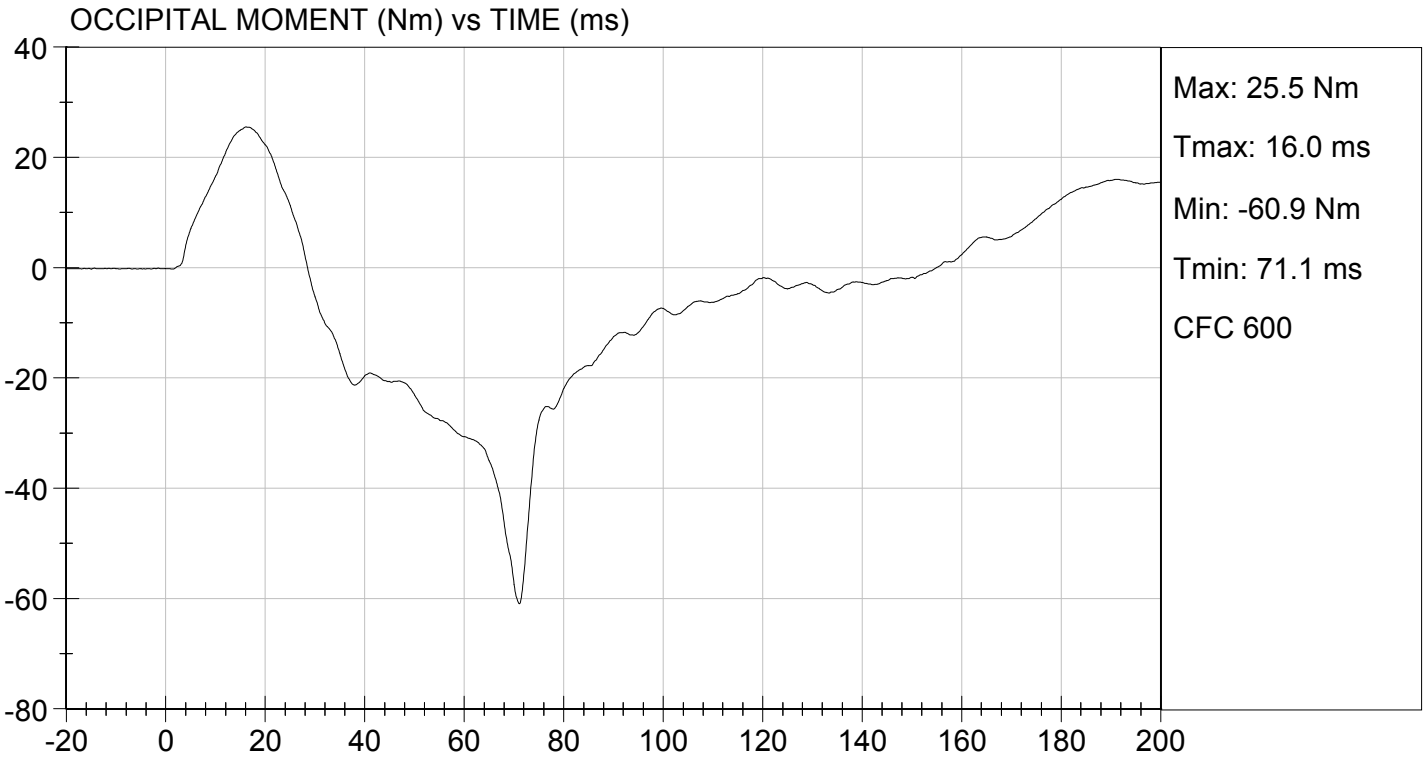


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/21/2015
TEST #: D153373



DATA SHEET B6

THORAX IMPACT TEST (572.134) (5th Female)

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one thorax impact test performed

_X_ 2. The test fixture conforms to the specifications in Figure 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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

_X_ 5. Remove the chest skin and visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, 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))

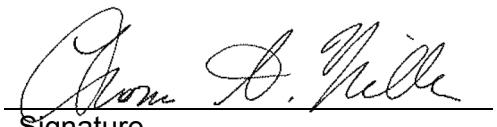
Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.68 m/s
Chest Compression	50.0 mm ≤ compression ≤ 58.0 mm	50 mm
Peak force** between 50.0 and 58.0 mm chest compression	3900N ≤ peak force ≤ 4400N	4020 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force ≤ 4600 N	4167 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.



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153374

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.8	Pass
Relative Humidity	%	10 to 70	49	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	4020	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4167	Pass
		Overall Test Results		Pass

Laboratory Technician

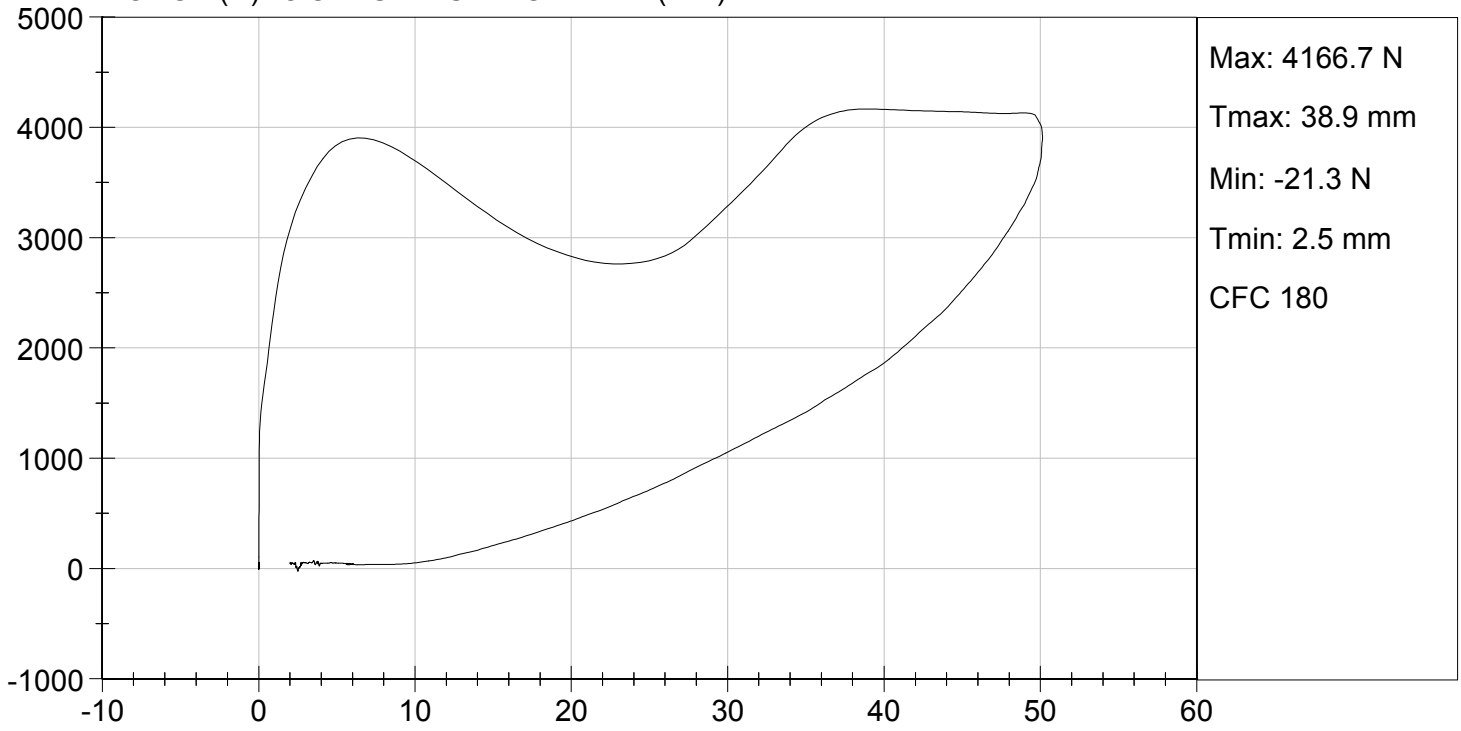
10/21/2015
Test Date

Approved By

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

TEST DATE: 10/21/2015
TEST #: D153374

FORCE (N) vs CHEST DISPLACEMENT (mm)



DATA SHEET B7

TORSO FLEXION TEST (572.135) (5th Female)

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

____ 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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

_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))

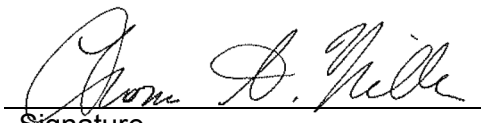
X 15. As quickly as possible release the force applied to the attachment bracket. (572.135(c)(11))

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	337 N
Final ref. plane angle	Initial ref. plane angle ± 8°	25 deg



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153377

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Initial Angle	deg	0 to 20	20	Pass
Return Angle	deg	+/- 8	25	Pass
Force at 45 deg	N	320 to 390	337	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Result		Pass

Laboratory Technician

10/21/2015
Test Date

Approved By

DATA SHEET B8

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

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

____ 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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

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

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

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

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

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

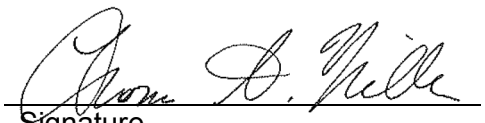
X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.11 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3904 N

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

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



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153376

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3904	Pass
		Overall Test Results		Pass

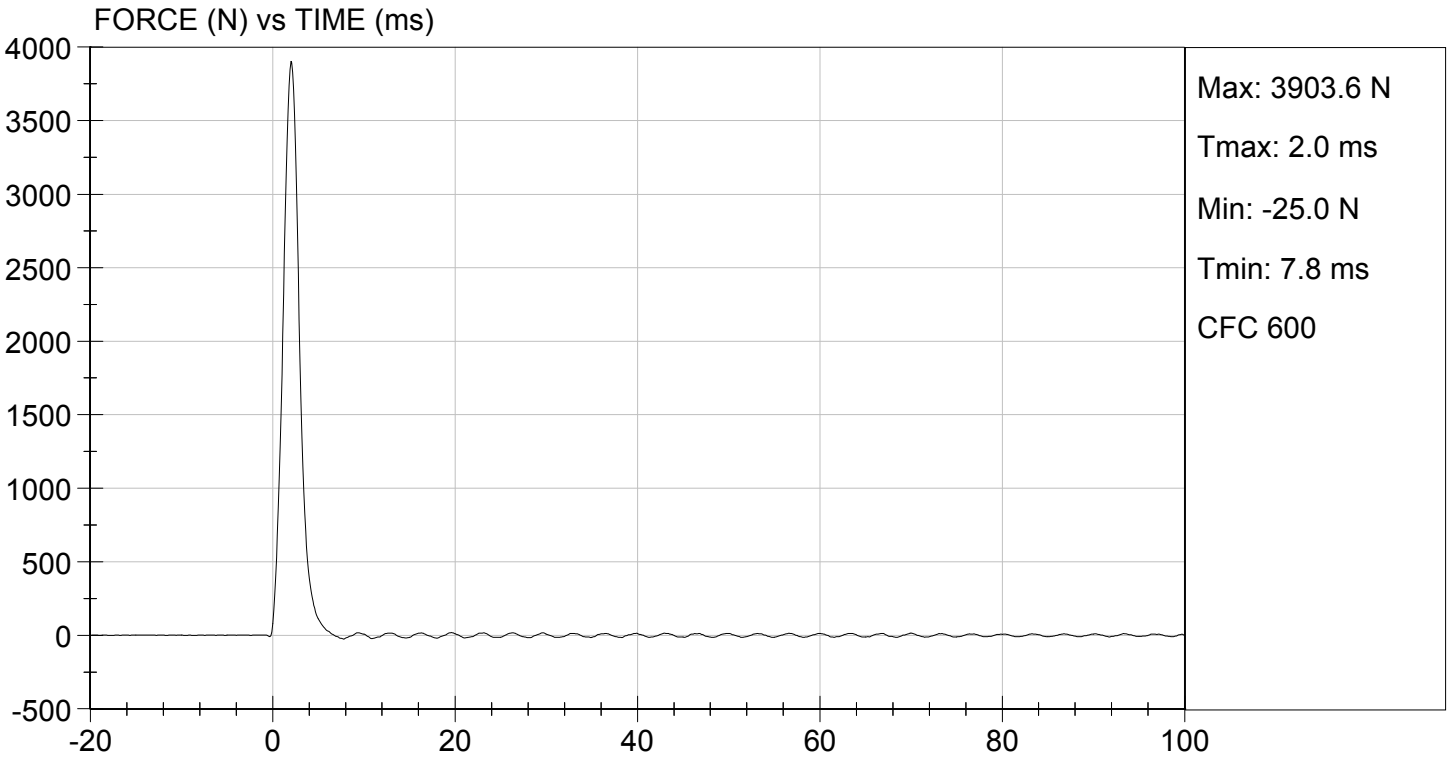
Laboratory Technician

10/21/2015
Test Date

Approved By

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

TEST DATE: 10/21/2015
TEST #: D153376



DATA SHEET B9

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

Dummy Serial Number: 510 Test Date: 10/21/2015

Technician: Thomas Miller

____ 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:	21.5°C
Record the minimum temperature:	20.8°C
Record the maximum humidity:	49%
Record the minimum humidity:	43%

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

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

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

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

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

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

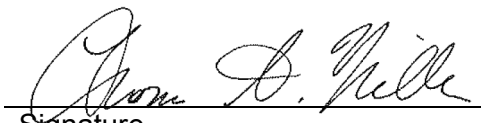
X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.10 m/s
Peak resistance force*	3450 N ≤ force ≤ 4060 N	3831 N

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

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



Signature

10/21/2015

Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 510 **Test I.D:** D153375

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3831	Pass
		Overall Test Results		Pass

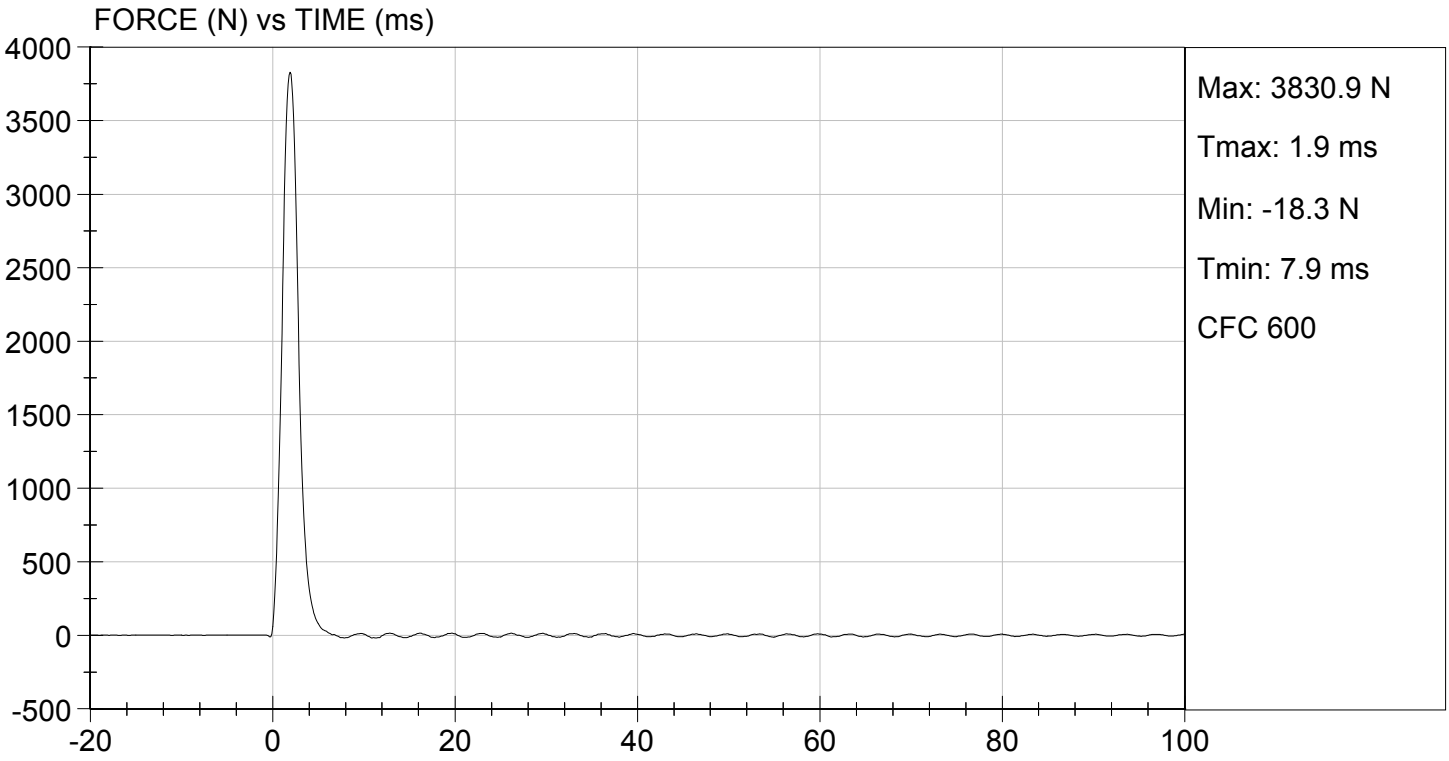
Laboratory Technician

10/21/2015
Test Date

Approved By

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

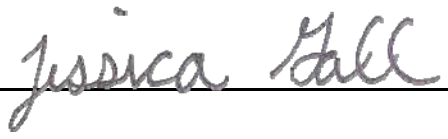
TEST DATE: 10/21/2015
TEST #: D153375



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	P83180	07/20/2015	01/20/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P83181	07/20/2015	01/20/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P83182	07/20/2015	01/20/2016
NECK TRANSDUCER	Denton	1716	2039	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85174	07/22/2015	01/22/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P86736	07/01/2015	01/01/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P86737	07/01/2015	01/01/2016
CHEST POTENTIOMETER	Servo	14CBI-2897	510	07/21/2015	01/21/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121	979	07/30/2015	01/30/2016
(2) LEFT FEMUR	Denton	2121	1384	07/30/2015	01/30/2016
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	23	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: 

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 510 Test Date: 10/19/2015

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 10/21/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 10/21/2015

Signature — Date

EXTERNAL DIMENSIONS

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

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

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

Dummy Serial Number: 155 Test Date: 10/13/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))
X N/A, ONLY one head drop performed

X 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))

X 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.

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

X 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))

X 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
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. (572.122(c)(2))

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	245 g ≤ x ≤ 300 g	269 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	6.0 g

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

David Schoedel
Signature

10/13/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test ID:** D153251

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Peak Resultant Acceleration	G's	245 to 300	269	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	6.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/13/2015

Test Date

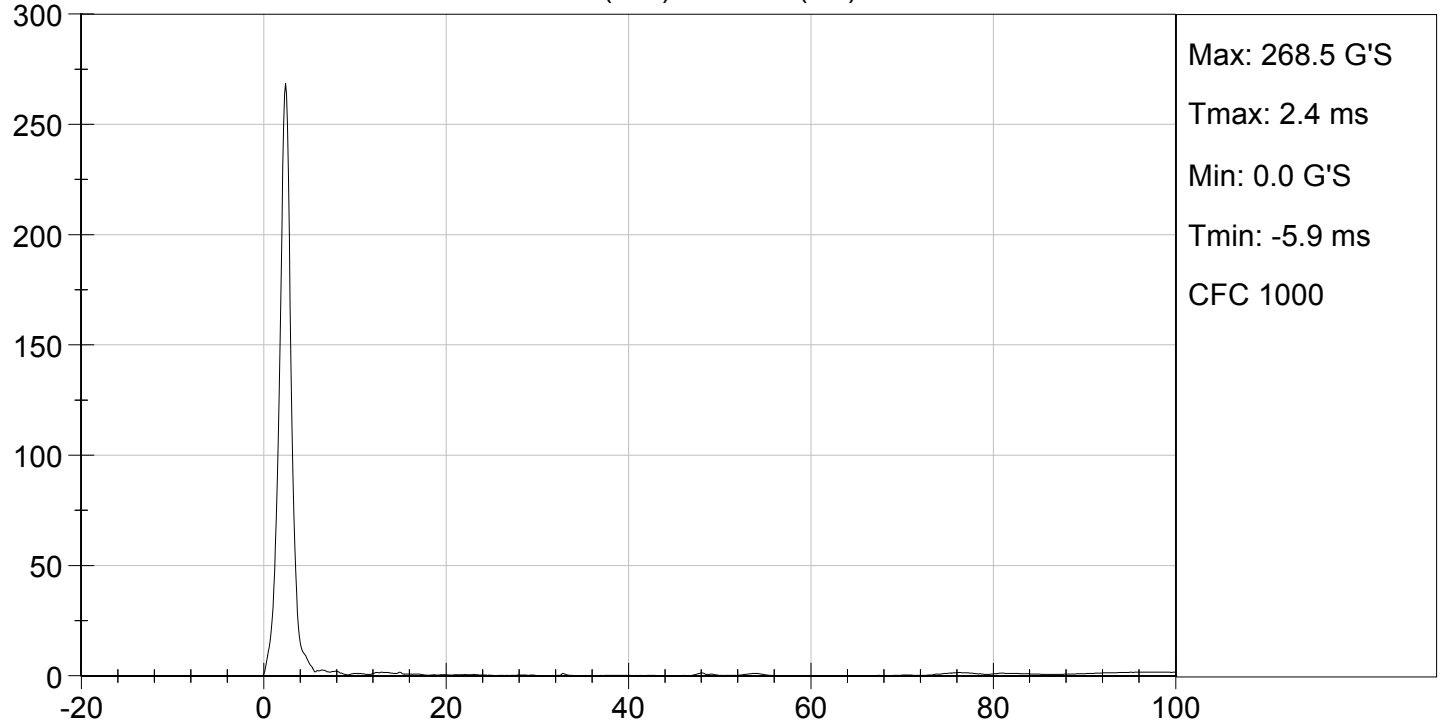
Jeff Leonardelli

Approved By

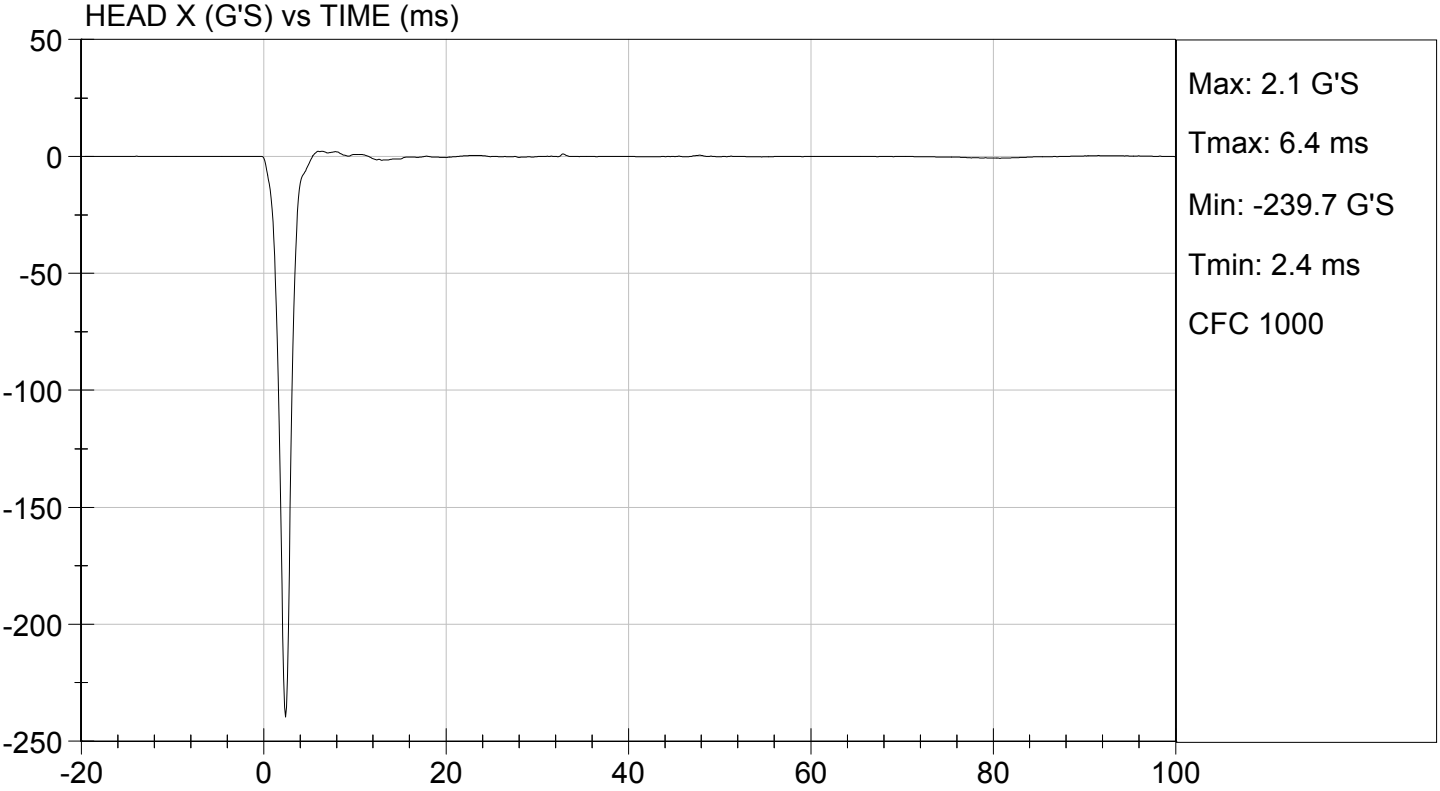
TEST DESC: HEAD DROP

TEST DATE: 10/13/2015
TEST #: D153251

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



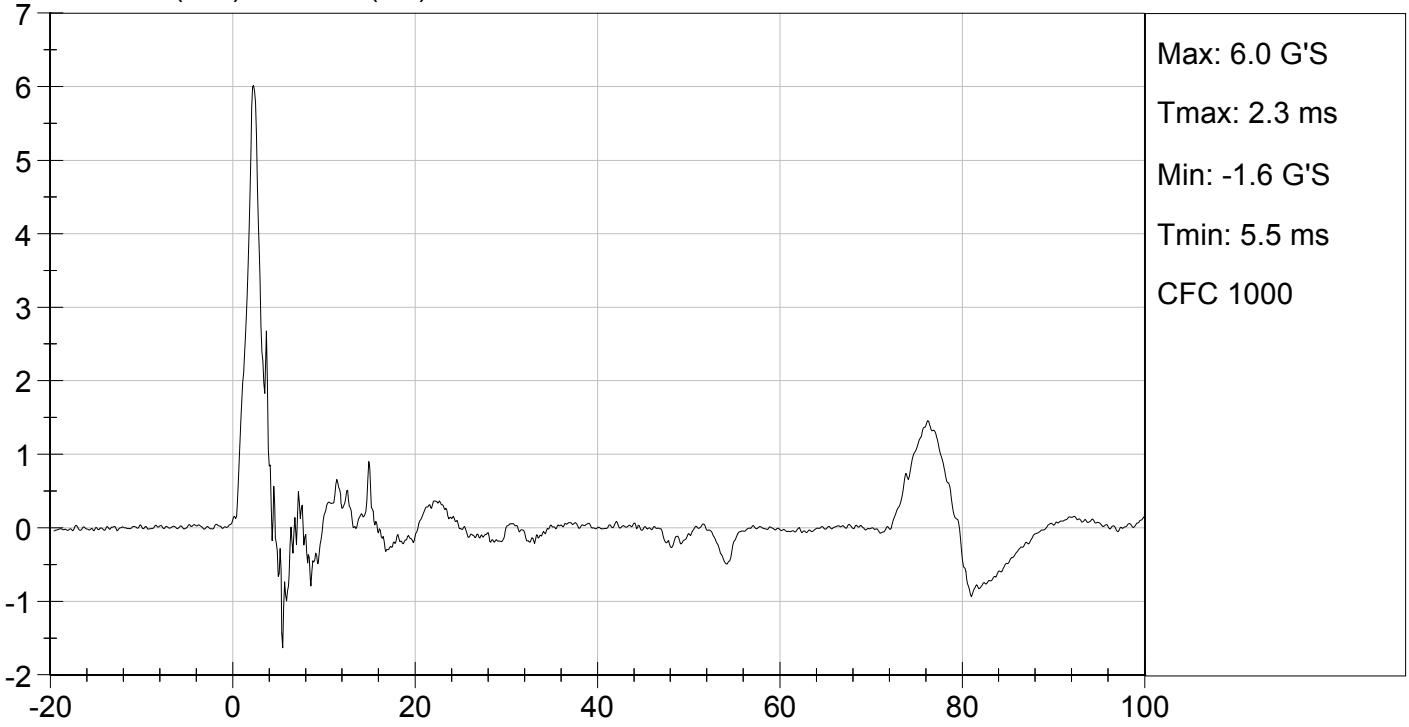
HEAD X (G'S) vs TIME (ms)



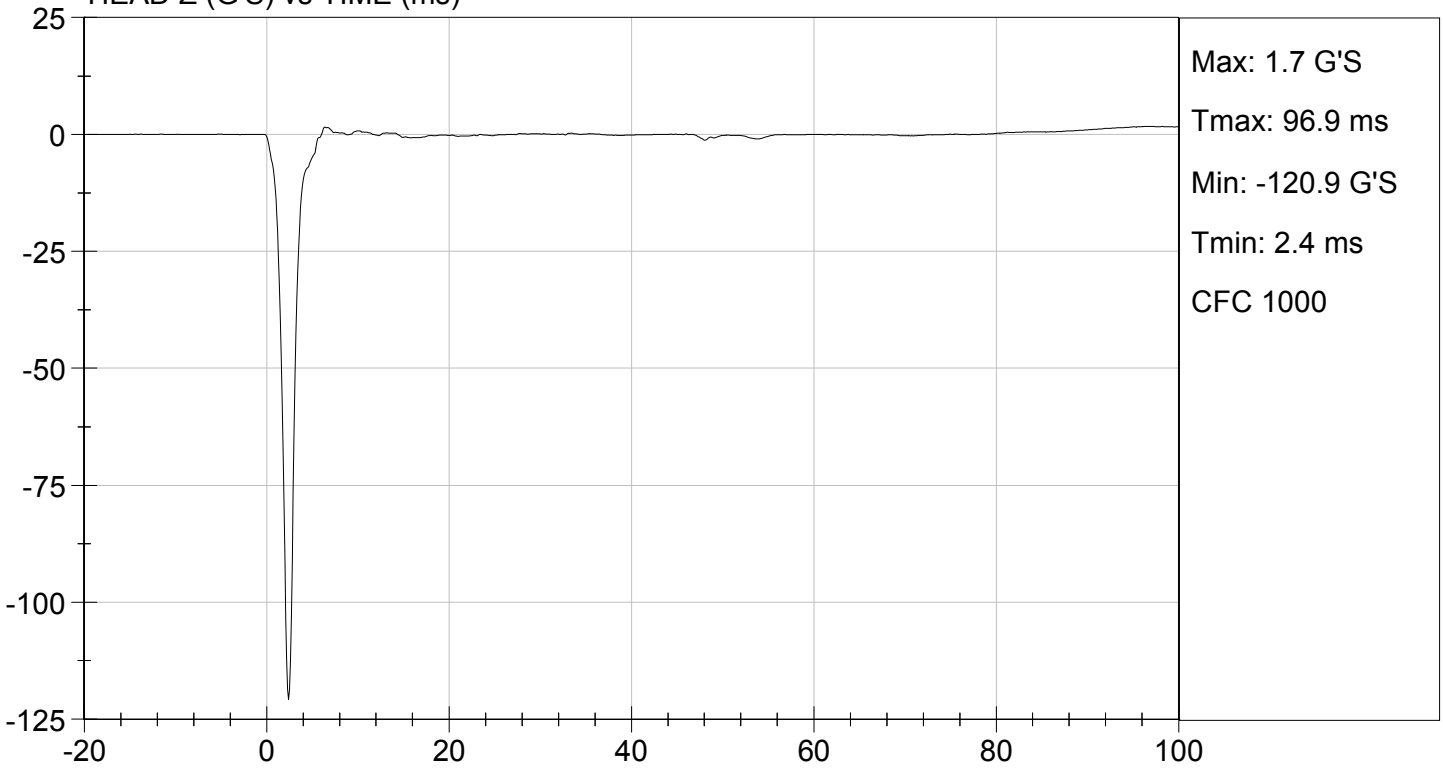
TEST DESC: HEAD DROP

TEST DATE: 10/13/2015
TEST #: D153251

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



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



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

Dummy Serial Number: 155 Test Date: 10/14/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
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 (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123l(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123l(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123l(4)(i))

X 12. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.83 m/s ≤ speed ≤ 5.07 m/s	4.89 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.2 m/s ≤ ΔV ≤ 1.6 m/s	1.6 m/s
	@ 20 ms	2.4 m/s ≤ ΔV ≤ 3.4 m/s	3.1 m/s
	@ 30 ms	3.8 m/s ≤ ΔV ≤ 5.0 m/s	4.4 m/s
Plane D Rotation		Peak moment* 27 Nm ≤ moment ≤ 33 Nm during the following rotation range 74° ≤ angle ≤ 92°	28 Nm @ 78 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm 103 ms ≤ time ≤ 123 ms	109 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(1)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

David Schoedel
Signature

10/14/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153252

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	34	Pass
Pendulum Speed		m/s	4.83 to 5.07	4.89	Pass
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.6	Pass
	20 ms	m/s	2.4 to 3.4	3.1	Pass
	30 ms	m/s	3.8 to 5.0	4.4	Pass
D Plane Rotation	Max	deg	74 to 92	78	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	27 to 33	28	Pass
Positive Moment Time Curve Decay to 5 Nm		ms	103 to 123	109	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

10/14/2015

Test Date

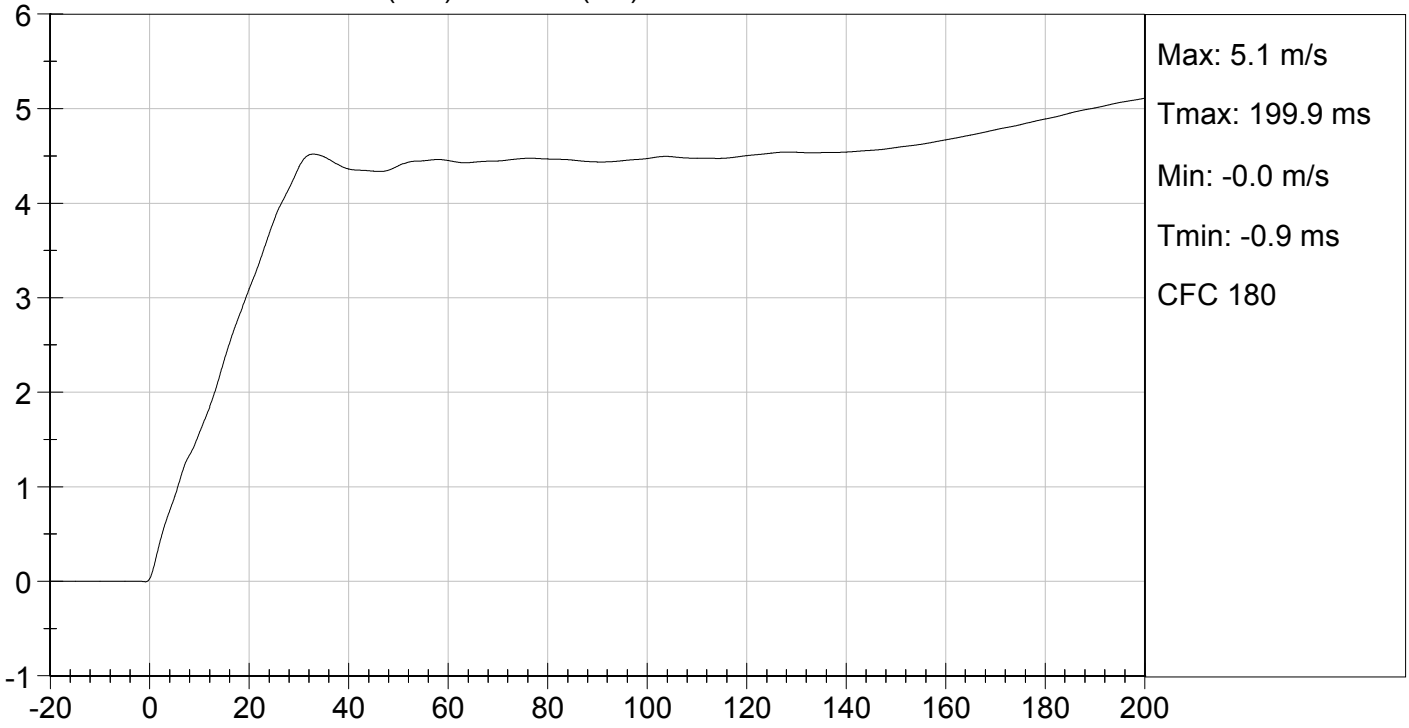
Jeff Leonardelli

Approved By

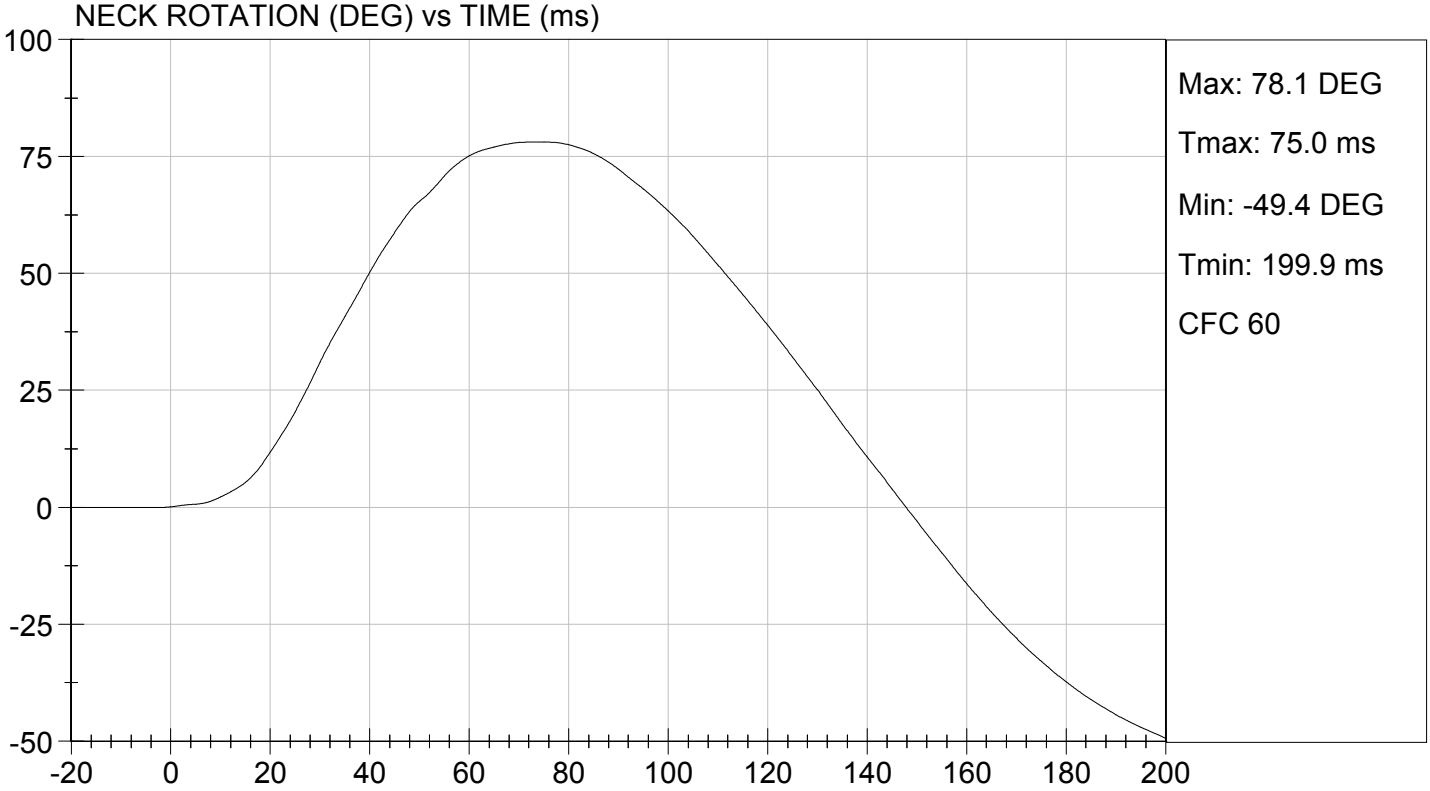
TEST DESC: NECK FLEXION
VELOCITY: 16.03 ft/s, 4.89 m/s

TEST DATE: 10/14/2015
TEST #: D153252

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



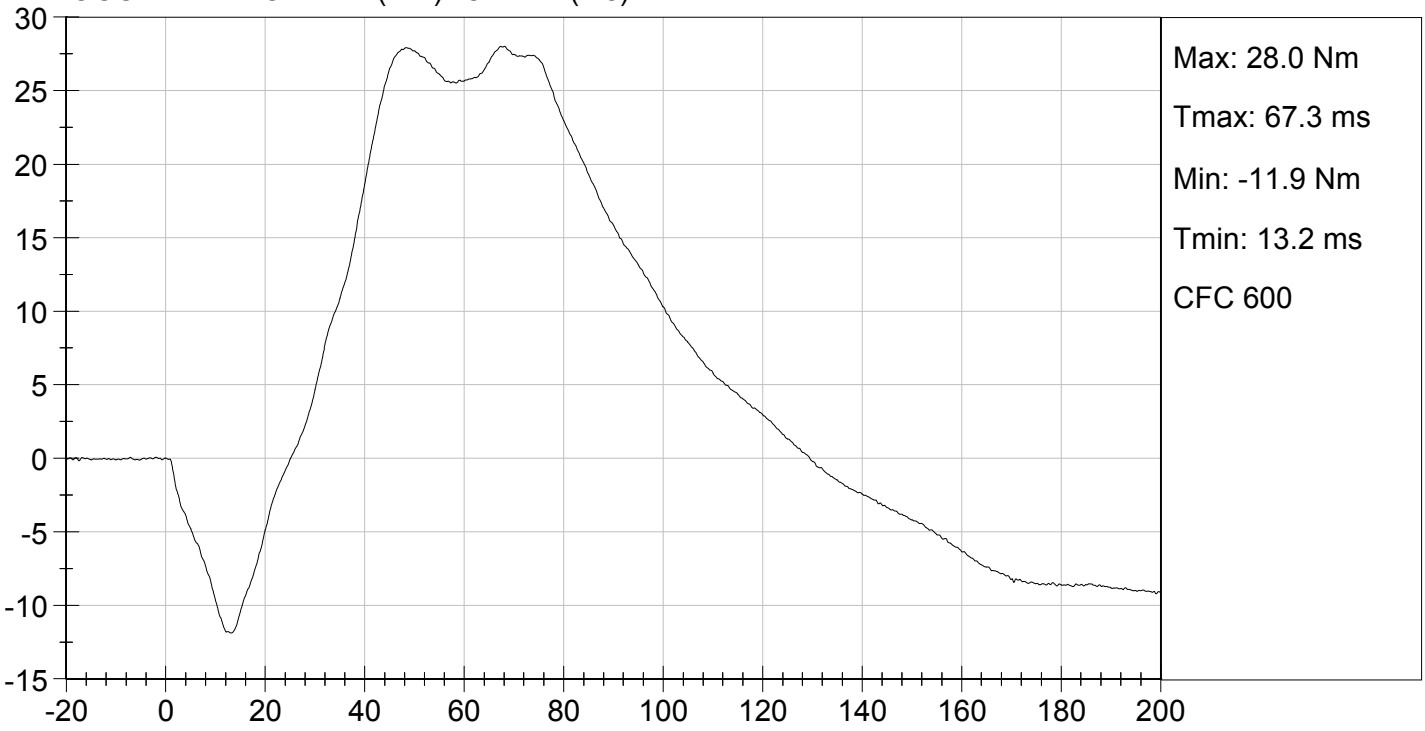
NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 16.03 ft/s, 4.89 m/s

TEST DATE: 10/14/2015
TEST #: D153252

OCCIPITAL MOMENT (Nm) vs TIME (ms)



DATA SHEET C5

NECK EXTENSION TEST (572.123) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 10/14/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.127(o))

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
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 (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.

Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.18 m/s ≤ speed ≤ 4.42 m/s	4.30 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.0 m/s ≤ ΔV ≤ 1.4 m/s	1.4 m/s
	@ 20 ms	2.2 m/s ≤ ΔV ≤ 3.0 m/s	2.6 m/s
	@ 30 ms	3.2 m/s ≤ ΔV ≤ 4.2 m/s	3.7 m/s
Plane D Rotation		Peak moment* -24 Nm ≤ moment ≤ -19 Nm during the following rotation range 85° ≤ angle ≤ 103°	-19 Nm @ 96 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm 123 ms ≤ time ≤ 147 ms	136 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(2)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

David Schoedel
Signature

10/14/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153253

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	34	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.30	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.4	Pass
	20 ms	m/s	2.2 to 3.0	2.6	Pass
	30 ms	m/s	3.2 to 4.2	3.7	Pass
D Plane Rotation	Max	deg	85 to 103	96	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-19	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	136	Pass
			Overall Results		Pass

David Schoedel
Laboratory Technician

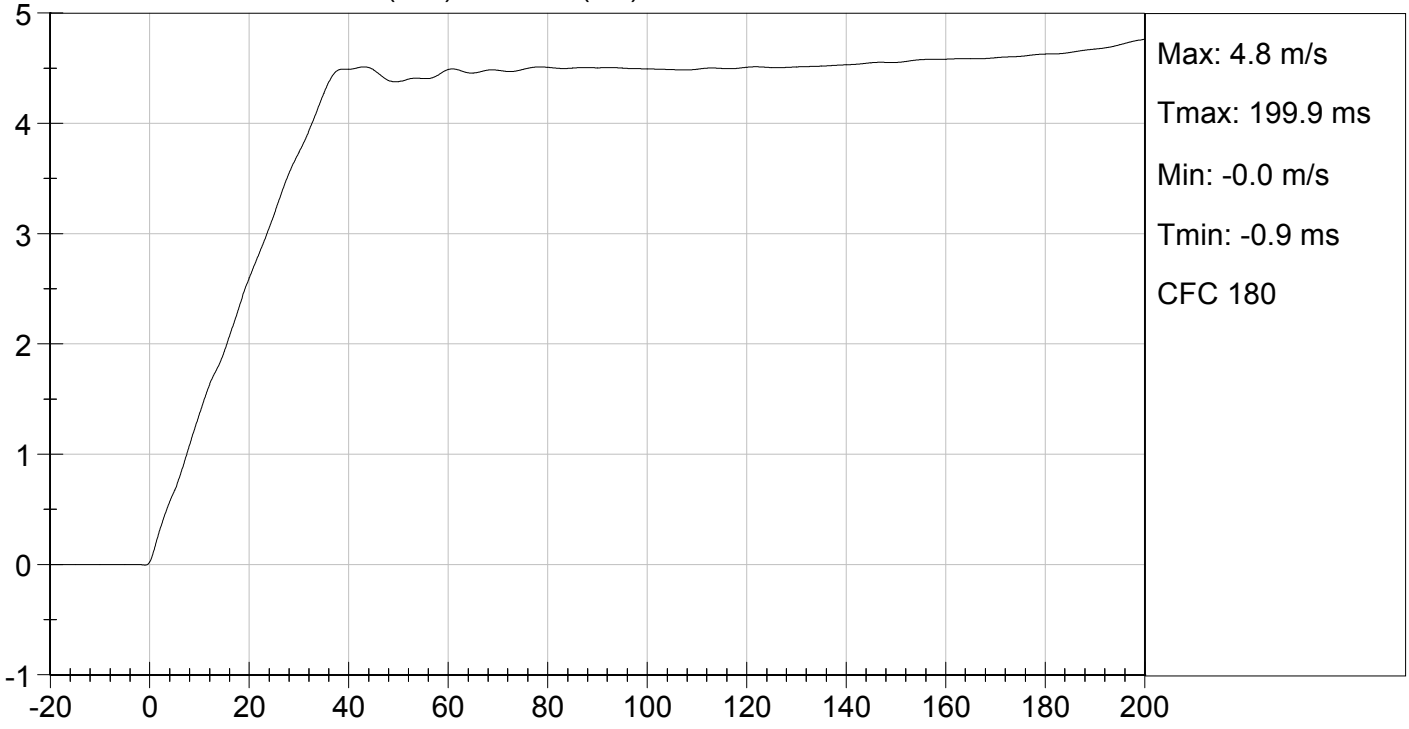
10/14/2015
Test Date

Jeff Levandoski
Approved By

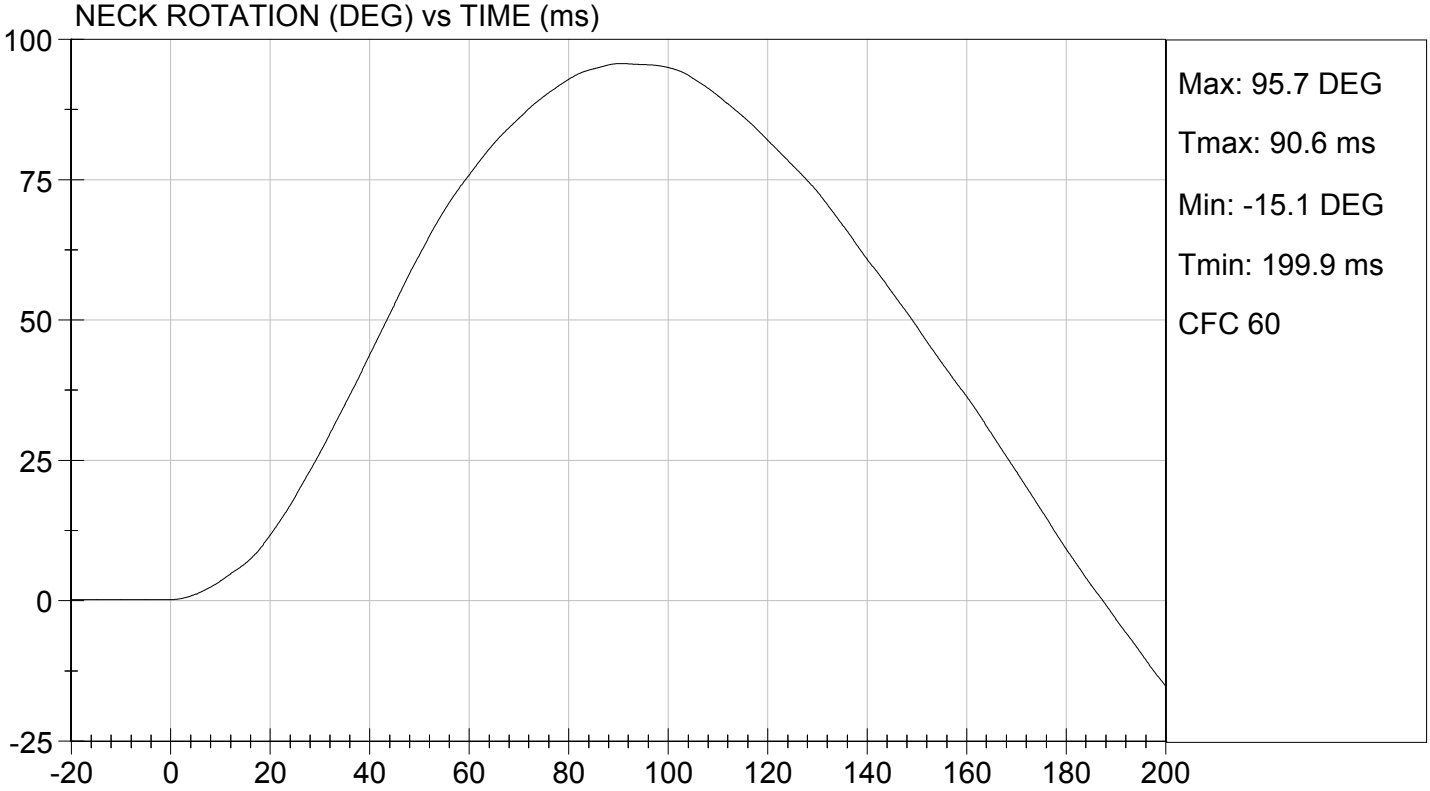
TEST DESC: NECK EXTENSION
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 10/14/2015
TEST #: D153253

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

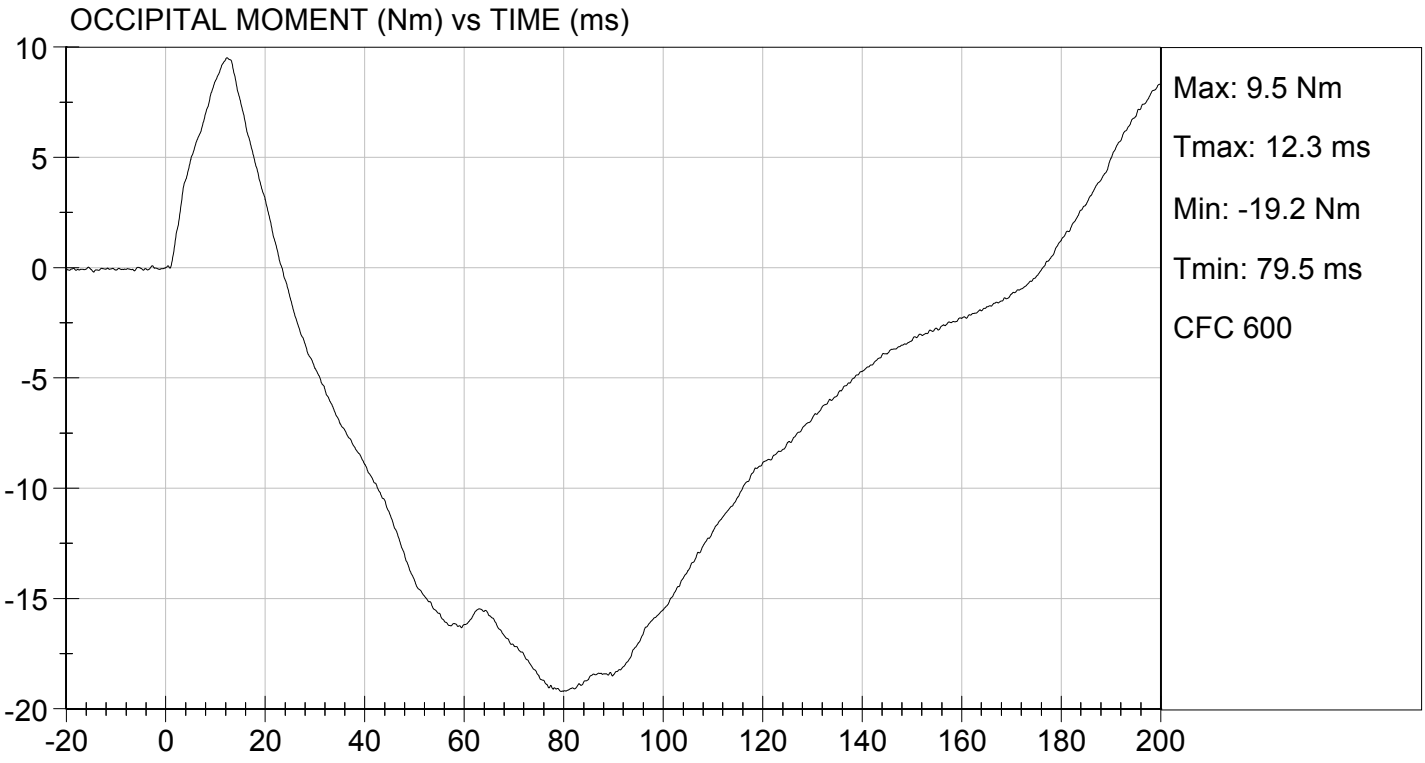


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 14.12 ft/s, 4.30 m/s

TEST DATE: 10/14/2015
TEST #: D153253



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

Dummy Serial Number: 155 Test Date: 10/14/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
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.
Record findings and actions:
X - No damage
___ - Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.

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

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

X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))

X 8. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 8° ± 2°. The angle may be measured at the pelvis lumbar joining surface.

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.124(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))

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

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

X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))

X 14. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.

X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))

X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is 6.71 m/s ± 0.12 m/s. (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2))

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.77 m/s
Chest Compression	38.0 mm ≤ compression ≤ 46.0 mm	41.3 mm
Peak force** between 38.0 and 46.0 mm chest compression	1150N ≤ peak force ≤ 1380N	1240 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force ≤ 1500 N	1312 N
Internal Hysteresis***	65% ≤ hysteresis ≤ 85%	73%

*Time zero is defined as the time of initial contact between the test probe and the chest skin.
**Force = impactor mass x acceleration
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

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

David Schoedel
Signature

10/14/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153254

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Relative Humidity	%	10 to 70	39	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	38.0 to 46.0	41.3	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,240	Pass
Internal Hysteresis	%	65 to 85	73	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,312	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/14/2015

Test Date

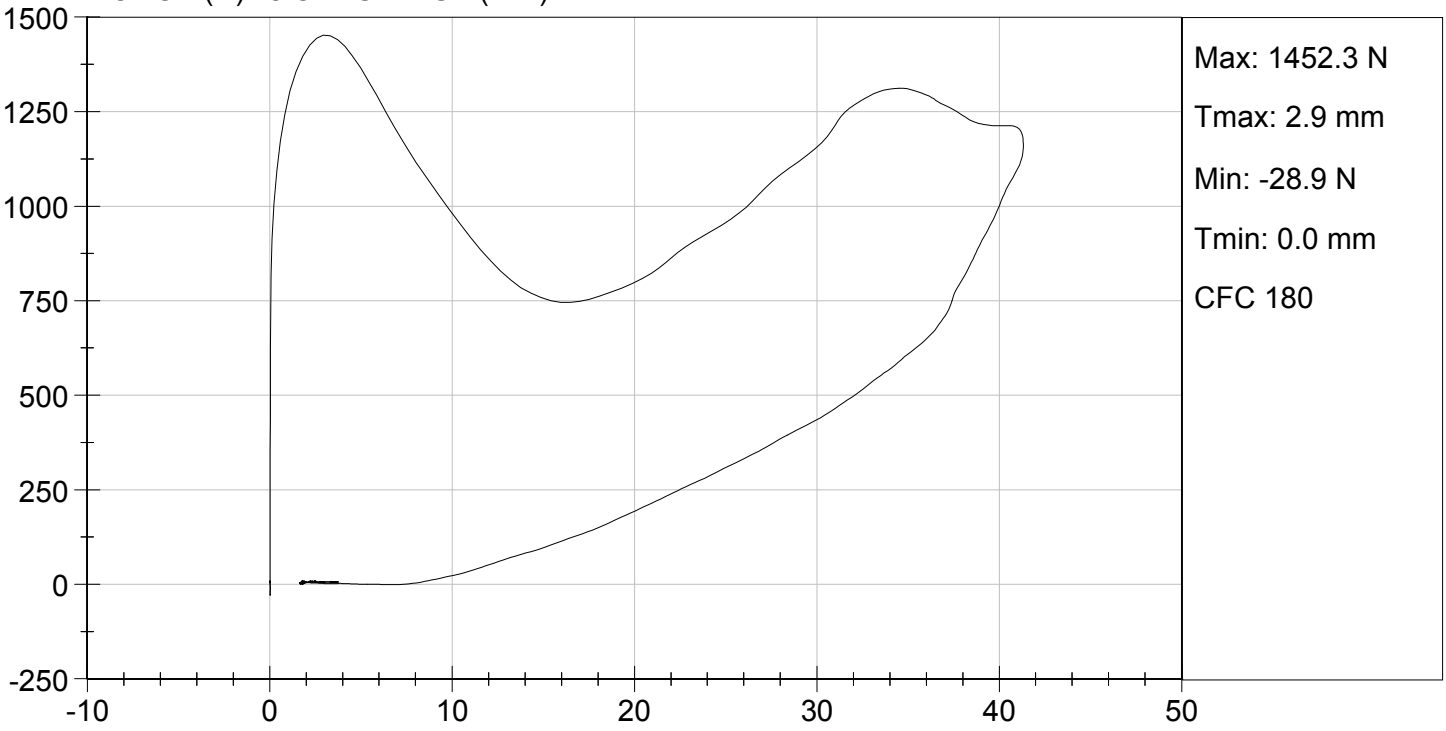
Jeff Leonardi

Approved By

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

TEST DATE: 10/14/2015
TEST #: D153254

FORCE (N) vs CHEST DISP (mm)



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

Dummy Serial Number: 155 Test Date: 10/14/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

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

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

X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
X with legs below the femurs.
___ without legs below the femurs.

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
Record the minimum humidity	34%

X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))

X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C**.** (572.125(c)(6))

X 7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))

X 8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))

X 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

X 10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))
Record reference plane angle (max. allowed 22°) See Result Table

X 11. Attach the pull cable and the load cell. (572.125(c)(6))

X 12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))

X 13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))

X 14. As quickly as possible release the force applied to the attachment bracket.(572.125(c)(9))

X 15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))

X 16. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 22°	21°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.6°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	147 N
Final ref. plane angle	Initial ref. plane angle ± 8°	20°

David Schoedel
Signature

10/14/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153257

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Initial Angle	deg	0 to 22	21	Pass
Return Angle	deg	+/- 8	20	Pass
Force at 45 deg	N	147 to 200	147	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.6	Pass
		Overall Result		Pass

David Schoedel
Laboratory Technician

10/14/2015
Test Date

Jeff Leonardi
Approved By

DATA SHEET C8

LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 10/14/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

X N/A, ONLY one knee impact test performed

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

X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
Record the minimum humidity	34%

X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.08 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2254 N

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

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

David Schoedel
Signature

10/14/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153256

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	2000 to 3000	2254	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/14/2015

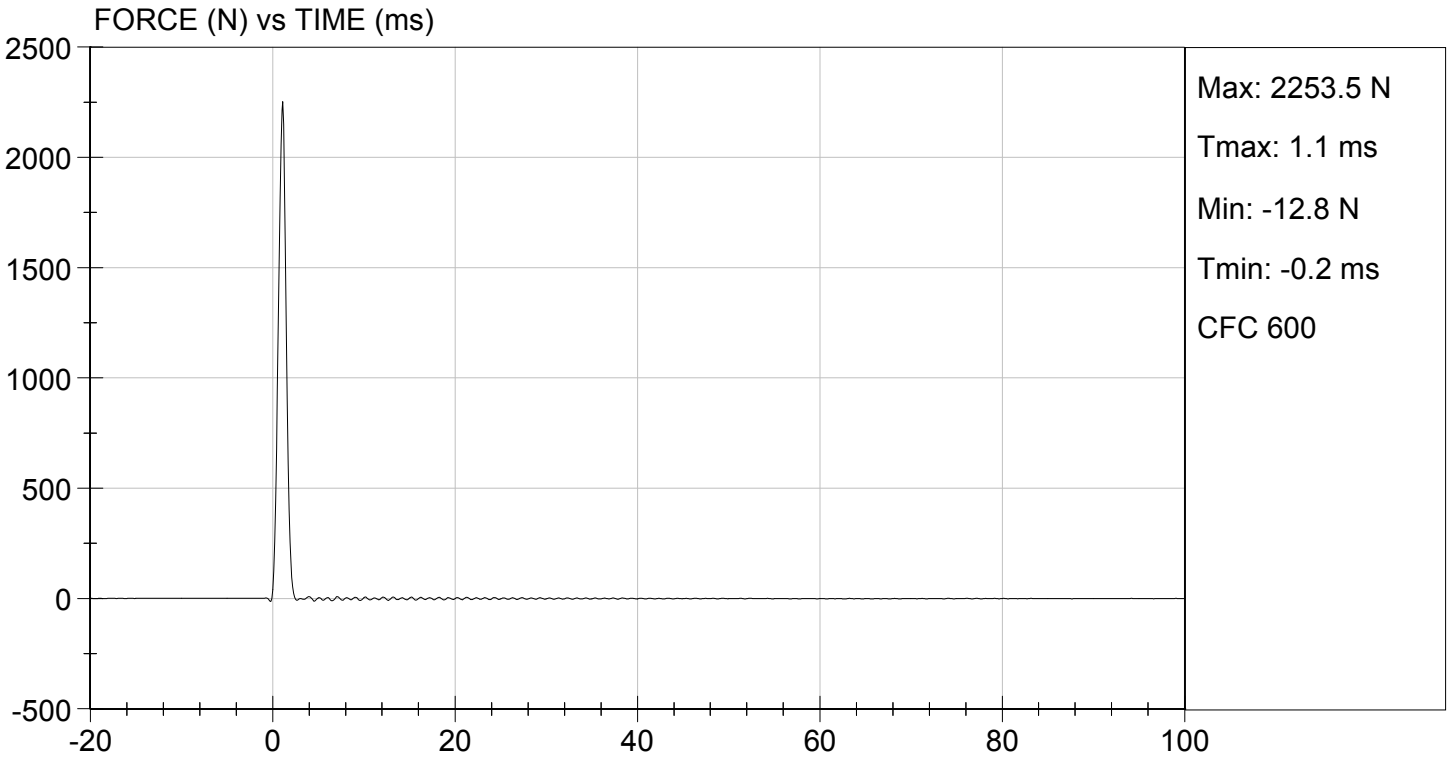
Test Date

Jeff Leonardelli

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 10/14/2015
TEST #: D153256



DATA SHEET C9

RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 10/14/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

X N/A, ONLY one knee impact test performed

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

X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.8°C
Record the minimum temperature	21.7°C
Record the maximum humidity	39%
Record the minimum humidity	34%

X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.10 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2075 N

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

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

David Schoedel
Signature

10/14/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153255

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	34	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	2000 to 3000	2075	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/14/2015

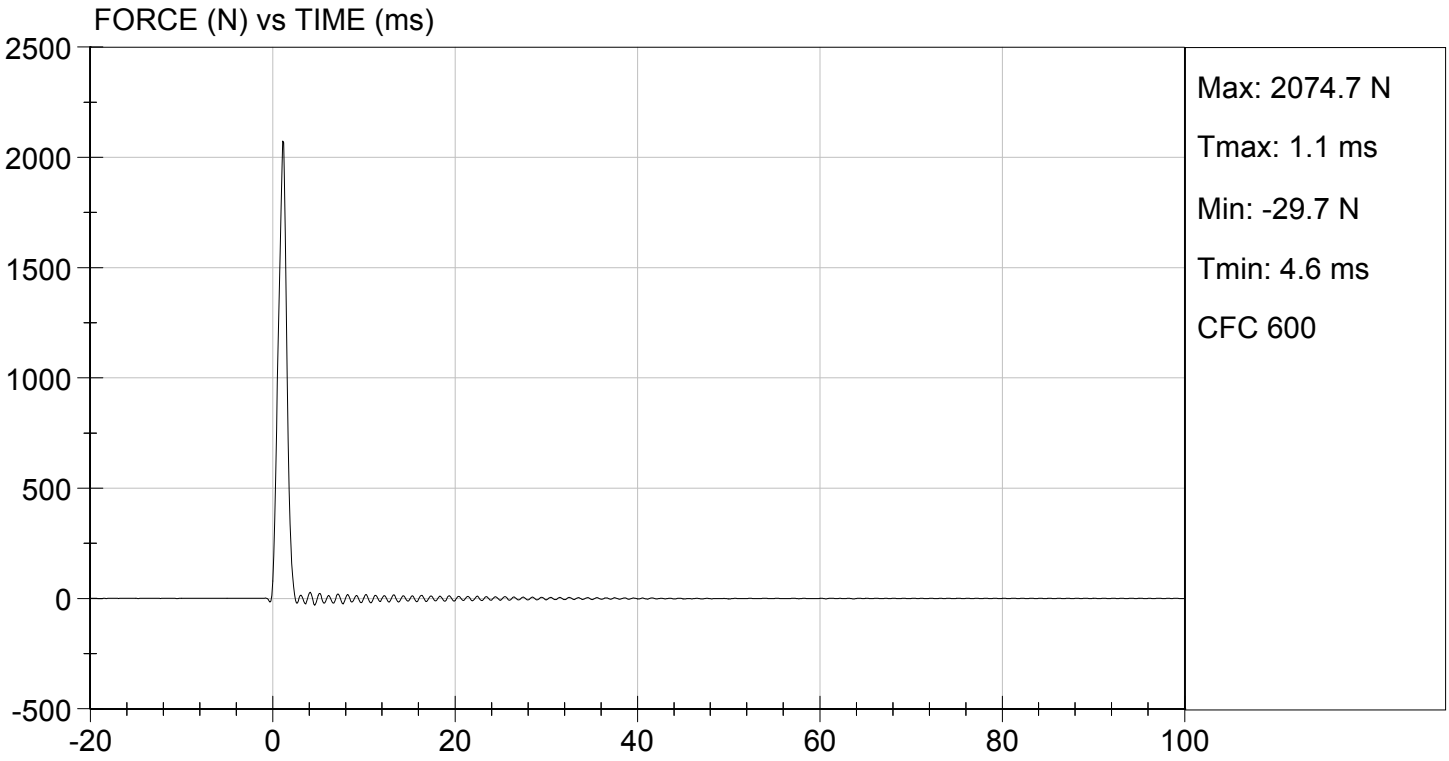
Test Date

Jeff Leonardelli

Approved By

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

TEST DATE: 10/14/2015
TEST #: D153255



DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79819	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79821	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79822	10/14/2015	04/14/2016
NECK TRANSDUCER	Denton	1716A	2038	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82128	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82129	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82130	10/14/2015	04/14/2016
CHEST POTENTIOMETER	Servo	08C1-3179	155	10/14/2015	04/14/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 155 Test Date: 10/20/2015

Technician: David Schoedel

____ Pre test calibration
_X_ Post test calibration verification

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

_X_ 1. It has been at least 2 hours since the last head drop. (572.122(c)(5))
_X_ N/A, ONLY one head drop performed

_X_ 2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))

_X_ 3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.

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

_X_ 5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.

_X_ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))

_X_ 7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))

Record the maximum temperature	21.8°C
Record the minimum temperature	21.5°C
Record the maximum humidity	36%
Record the minimum humidity	32%

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

Record findings and actions: No Damage

_X_ 9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	245 g ≤ x ≤ 300 g	280 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-7.5 g

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

David Schoedel

Signature

10/20/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test ID:** D153361

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	36	Pass
Peak Resultant Acceleration	G's	245 to 300	280	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-7.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/20/2015

Test Date

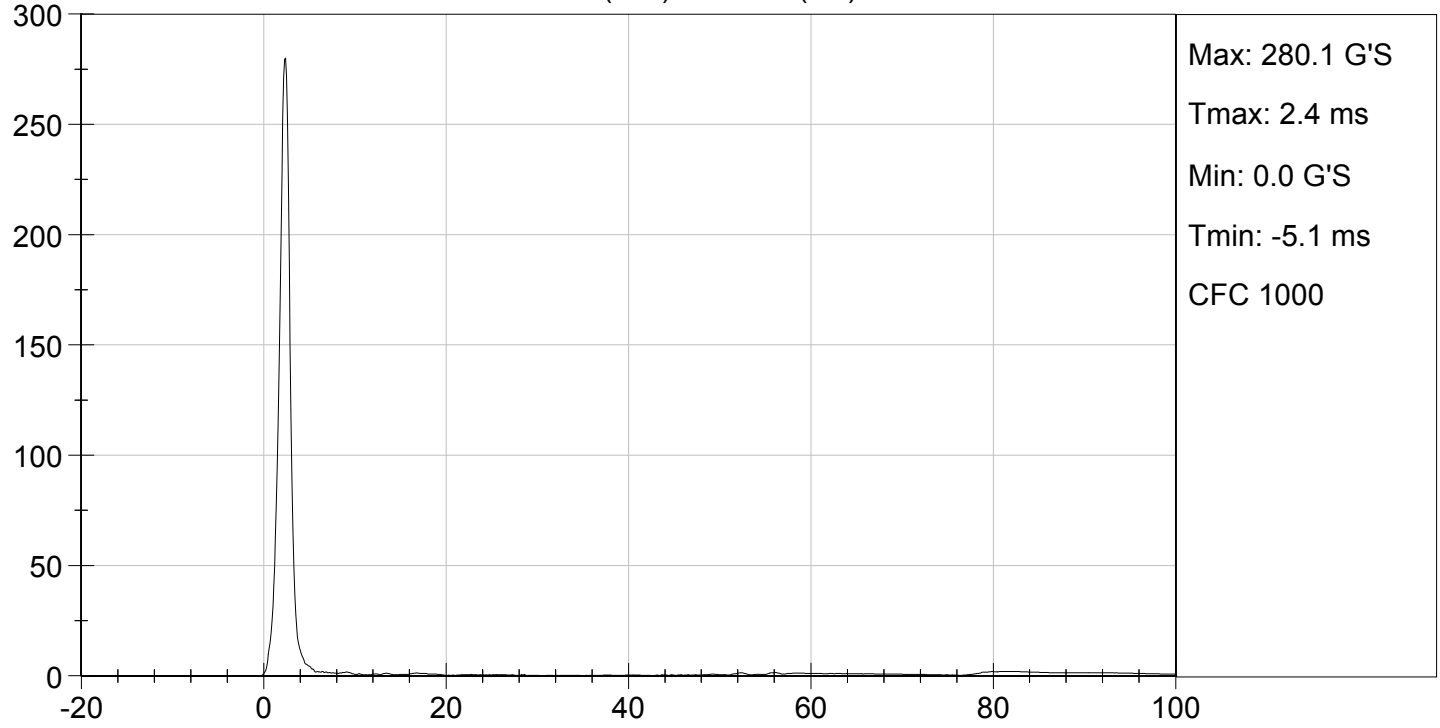
Jeff Leonardelli

Approved By

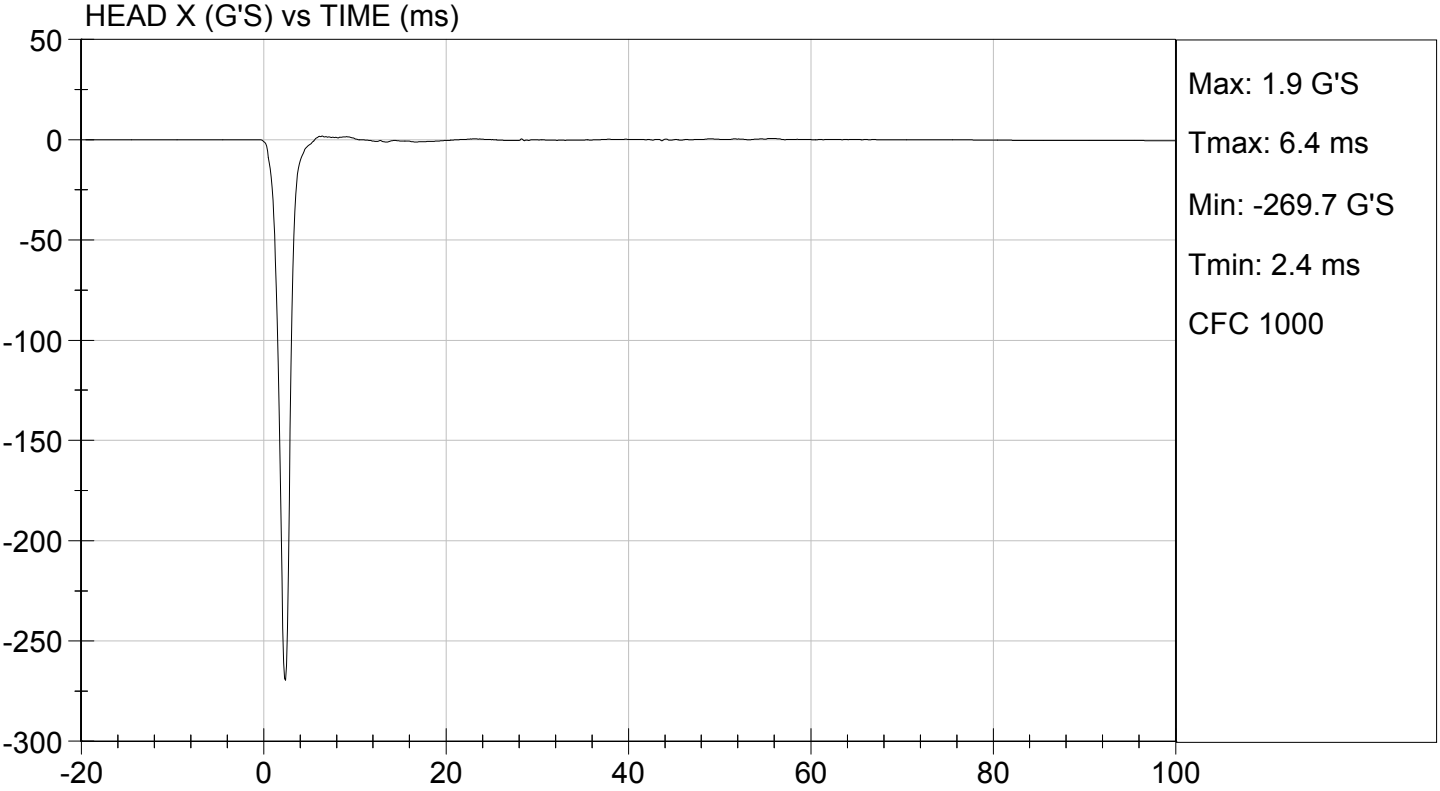
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153361

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



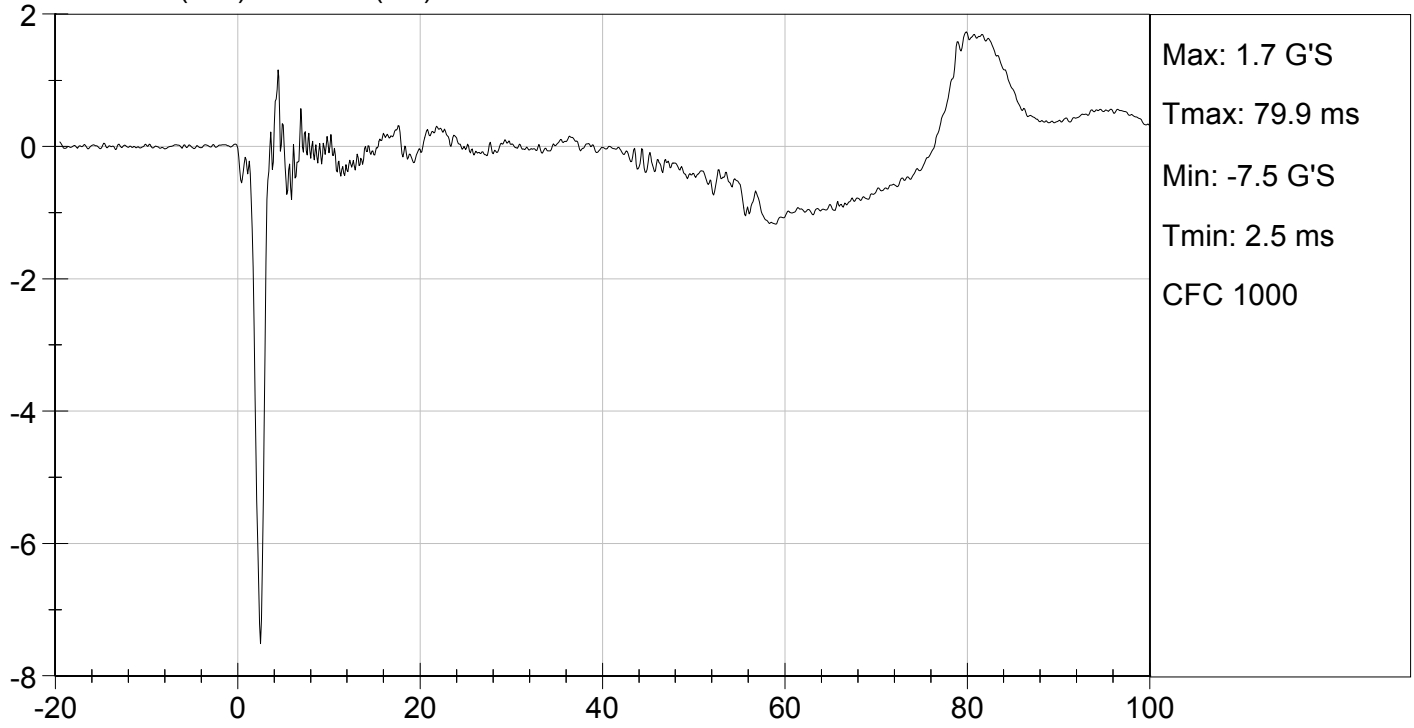
HEAD X (G'S) vs TIME (ms)



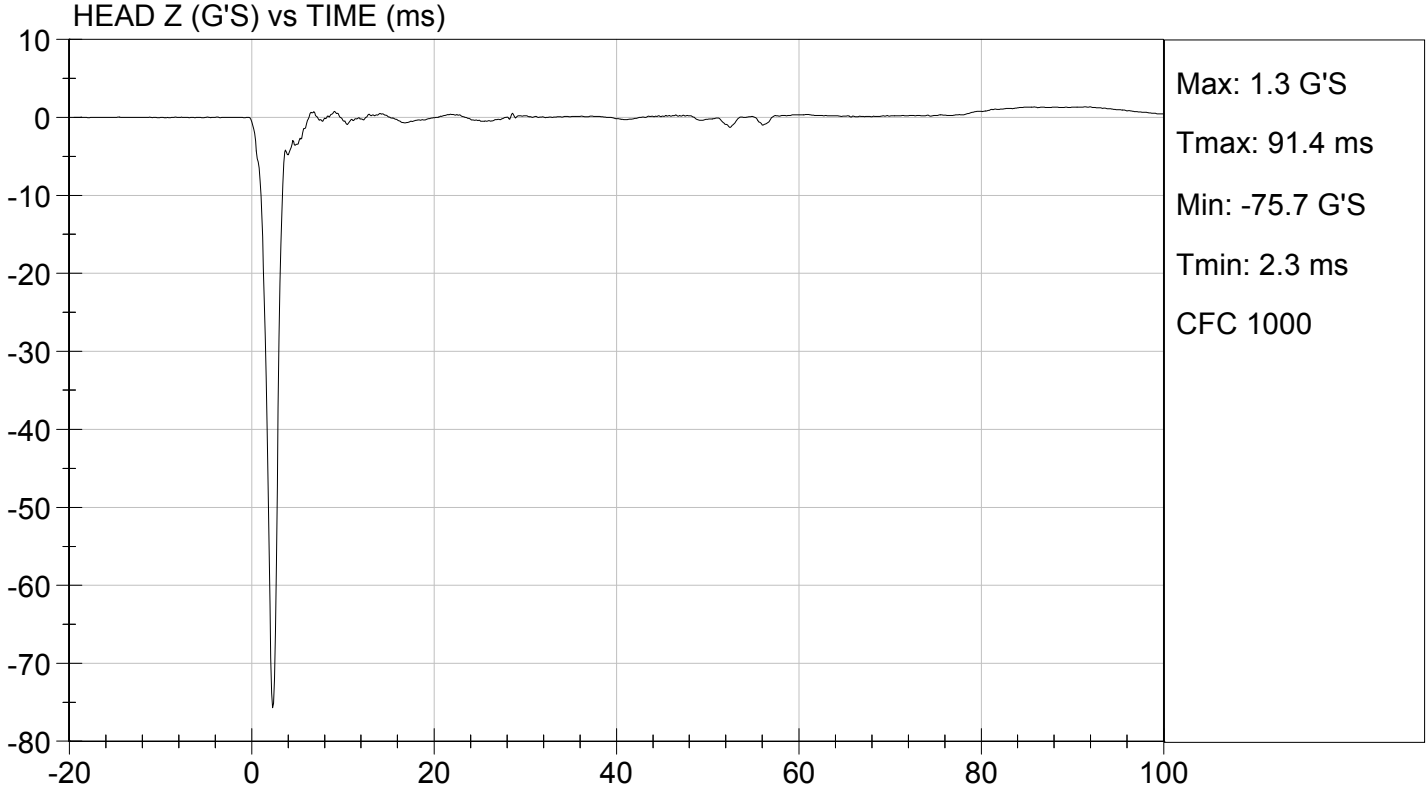
TEST DESC: HEAD DROP

TEST DATE: 10/20/2015
TEST #: D153361

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



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



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

Dummy Serial Number: 155 Test Date: 10/20/2015

Technician: David Schoedel

____ Pre test calibration
X Post test calibration verification

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

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

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.5°C
Record the maximum humidity	36%
Record the minimum humidity	32%

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

X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123l(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 7C for the flexion test. (572.123l(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.83 m/s to 5.07 m/s as measured at the center of the pendulum accelerometer. (572.123l(4)(i))

X 12. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.83 m/s ≤ speed ≤ 5.07 m/s	4.98 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.2 m/s ≤ ΔV ≤ 1.6 m/s	1.6 m/s
	@ 20 ms	2.4 m/s ≤ ΔV ≤ 3.4 m/s	3.1 m/s
	@ 30 ms	3.8 m/s ≤ ΔV ≤ 5.0 m/s	4.6 m/s
Plane D Rotation		Peak moment* 27 Nm ≤ moment ≤ 33 Nm during the following rotation range 74° ≤ angle ≤ 92°	29 Nm @ 82 degrees
Positive Moment Decay** (Flexion)		Time to decay to 5 Nm 103 ms ≤ time ≤ 123 ms	109 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(1)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

David Schoedel
Signature

10/20/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153362

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	32	Pass
Pendulum Speed		m/s	4.83 to 5.07	4.98	Pass
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.6	Pass
	20 ms	m/s	2.4 to 3.4	3.1	Pass
	30 ms	m/s	3.8 to 5.0	4.6	Pass
D Plane Rotation	Max	deg	74 to 92	82	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	27 to 33	29	Pass
Positive Moment Time Curve Decay to 5 Nm		ms	103 to 123	109	Pass
			Overall Results		Pass

David Schoedel
Laboratory Technician

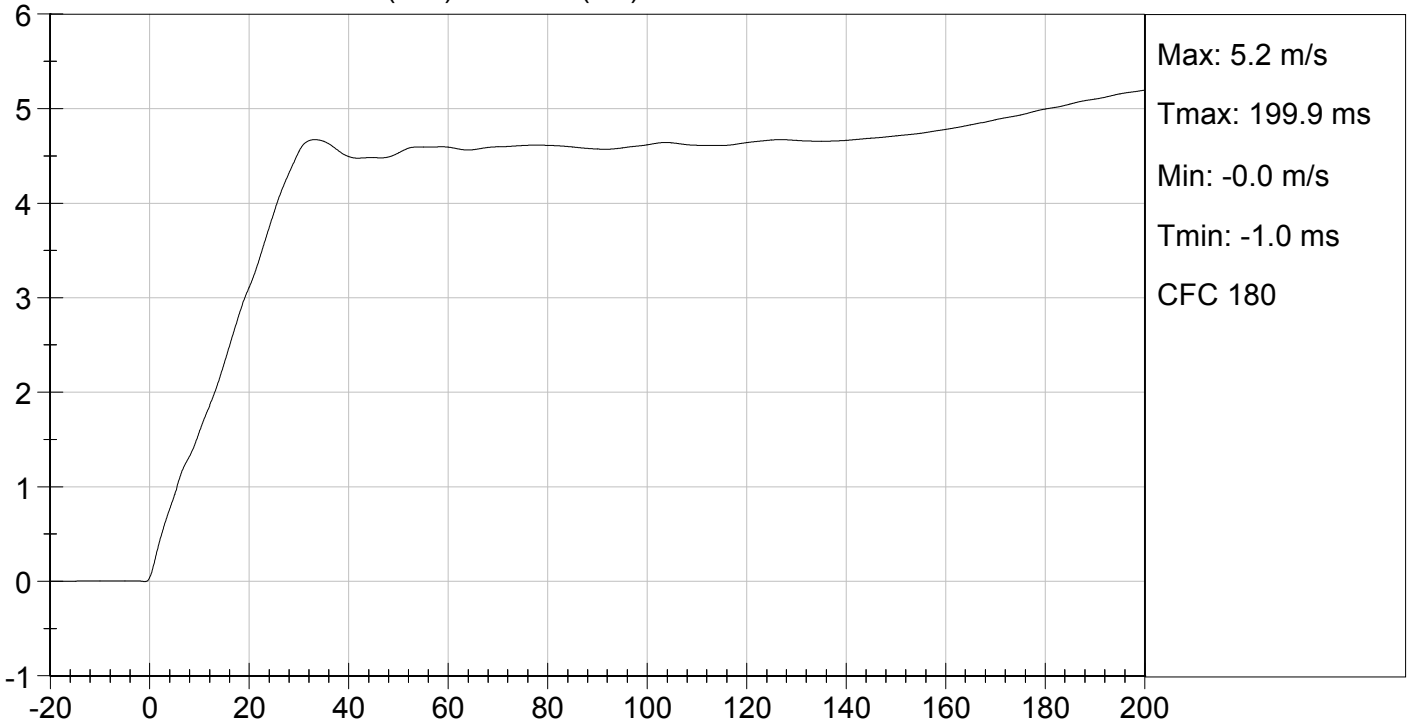
10/20/2015
Test Date

Jeff Leuenhagen
Approved By

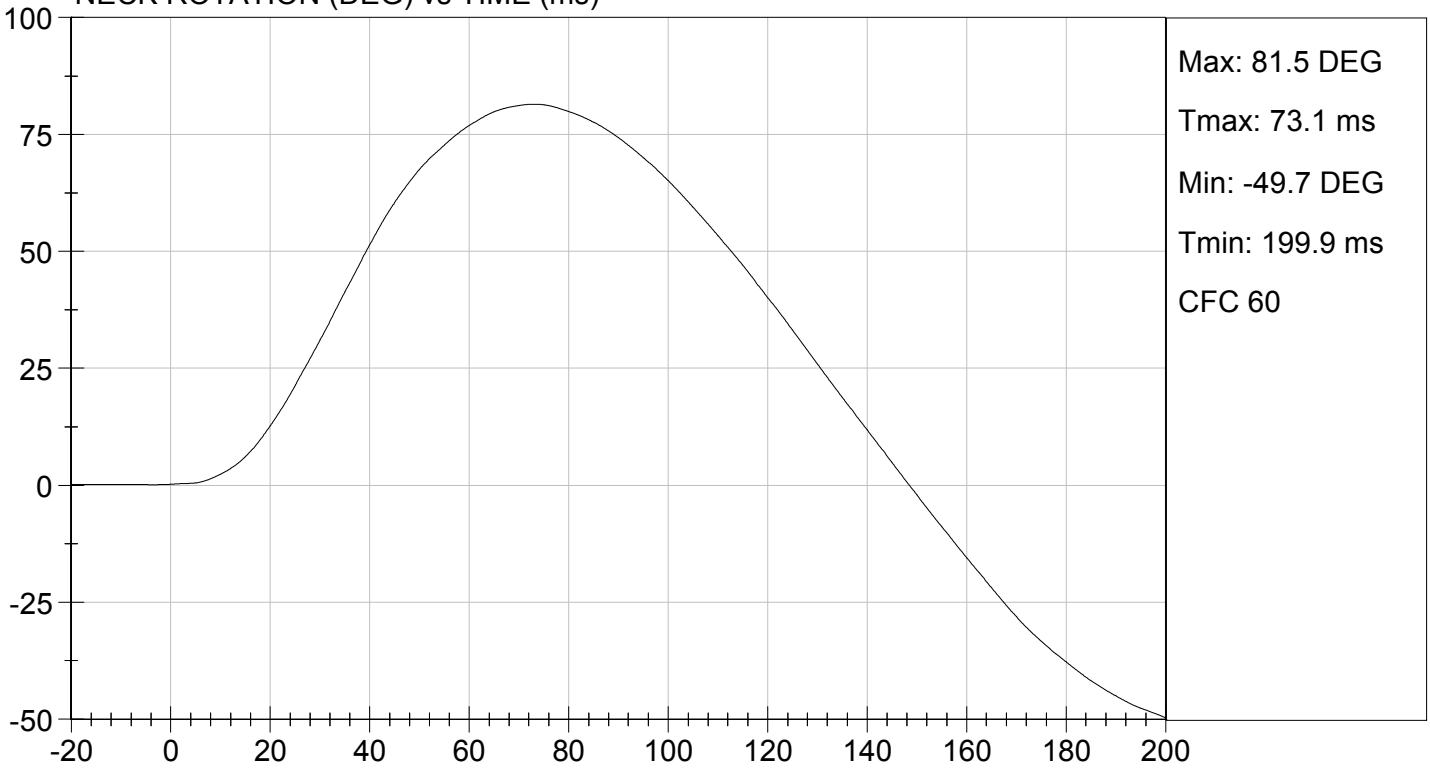
TEST DESC: NECK FLEXION
VELOCITY: 16.34 ft/s, 4.98 m/s

TEST DATE: 10/20/2015
TEST #: D153362

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

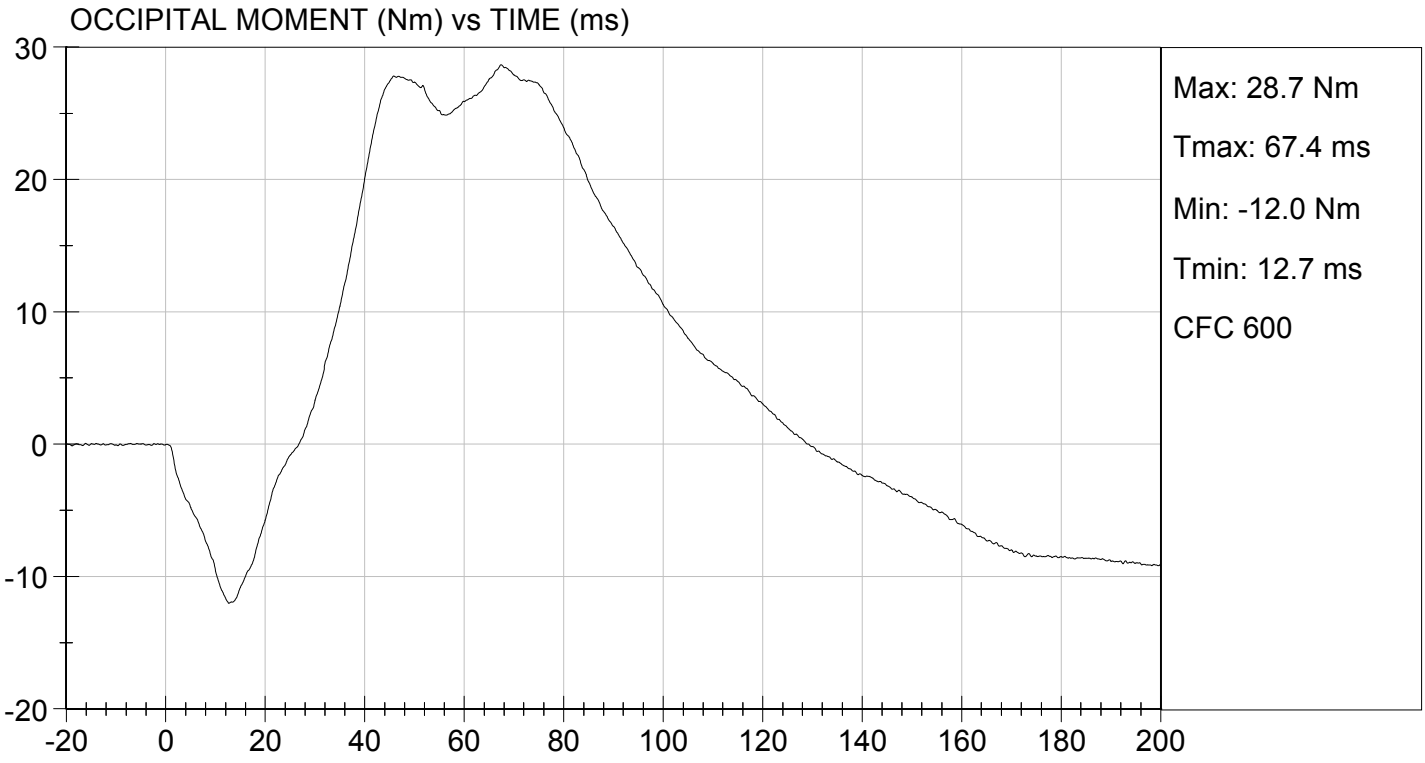


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/20/2015
TEST #: D153362



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

Dummy Serial Number: 155 Test Date: 10/20/2015

Technician: David Schoedel

____ Pre test calibration
X Post test calibration verification

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

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

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

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

Record the maximum temperature	21.8°C
Record the minimum temperature	21.5°C
Record the maximum humidity	36%
Record the minimum humidity	32%

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

X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
Record findings and actions: No damage

X 6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))

X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))

X 8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123(c)(3))

X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8C for the extension test. (572.123(c)(3))

X 10. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular ± 1 degree to plane "D" on the dummy's head.

X 11. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 4.18 m/s to 4.42 m/s as measured at the center of the pendulum accelerometer. (572.123(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		4.18 m/s ≤ speed ≤ 4.42 m/s	4.34 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	1.0 m/s ≤ ΔV ≤ 1.4 m/s	1.4 m/s
	@ 20 ms	2.2 m/s ≤ ΔV ≤ 3.0 m/s	2.7 m/s
	@ 30 ms	3.2 m/s ≤ ΔV ≤ 4.2 m/s	4.0 m/s
Plane D Rotation		Peak moment* -24 Nm ≤ moment ≤ -19 Nm during the following rotation range 85° ≤ angle ≤ 103°	-20 Nm @ 94 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm 123 ms ≤ time ≤ 147 ms	135 ms

*Moment about the occipital condyle = My – (0.01778 m x Fx) (572.123(b)(2)(iii))
My = Moment in Nm measured by the transducer
Fx = Force, in N measured by the transducer
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.123(b)(3))

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

David Schoedel
Signature

10/20/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153363

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	32	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.34	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.4	Pass
	20 ms	m/s	2.2 to 3.0	2.7	Pass
	30 ms	m/s	3.2 to 4.2	4.0	Pass
D Plane Rotation	Max	deg	85 to 103	94	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-20	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	135	Pass
			Overall Results		Pass

David Schoedel

Laboratory Technician

10/20/2015

Test Date

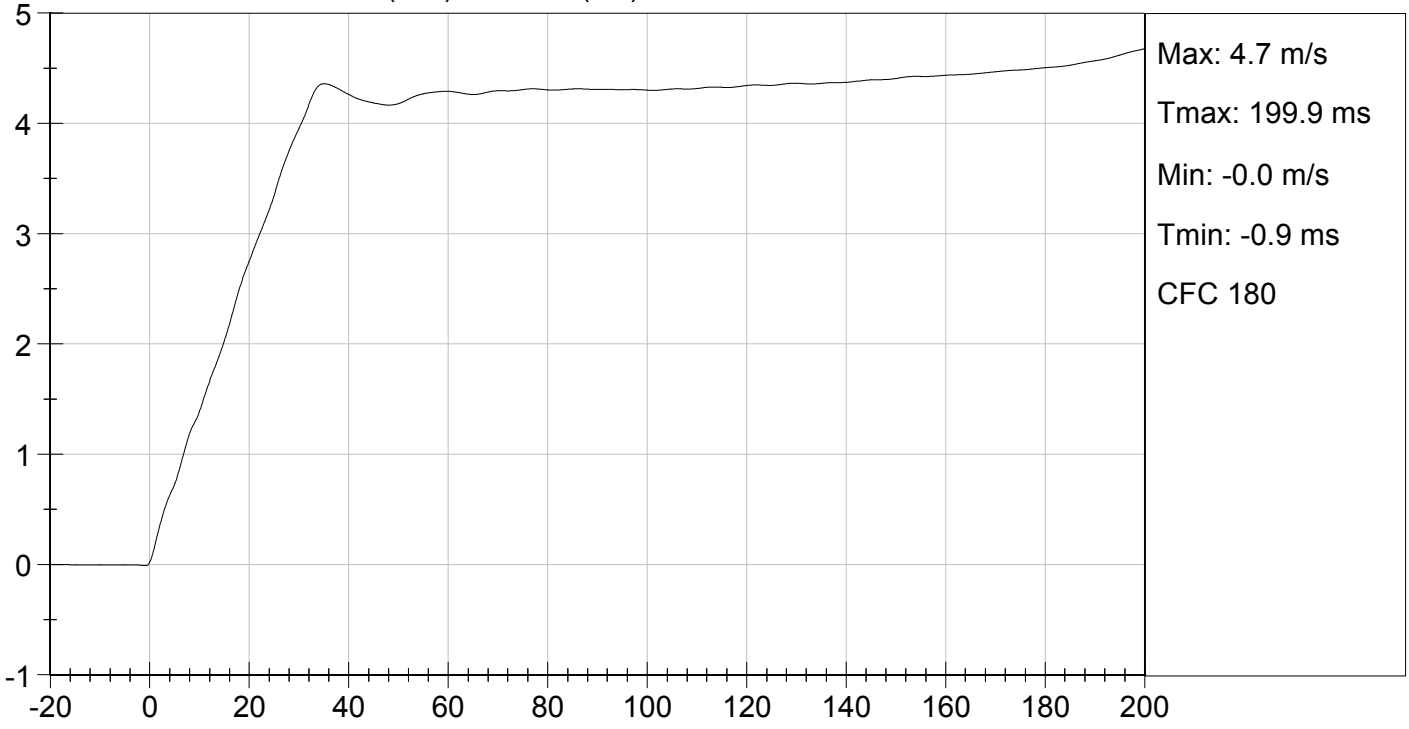
Jeff Leonardelli

Approved By

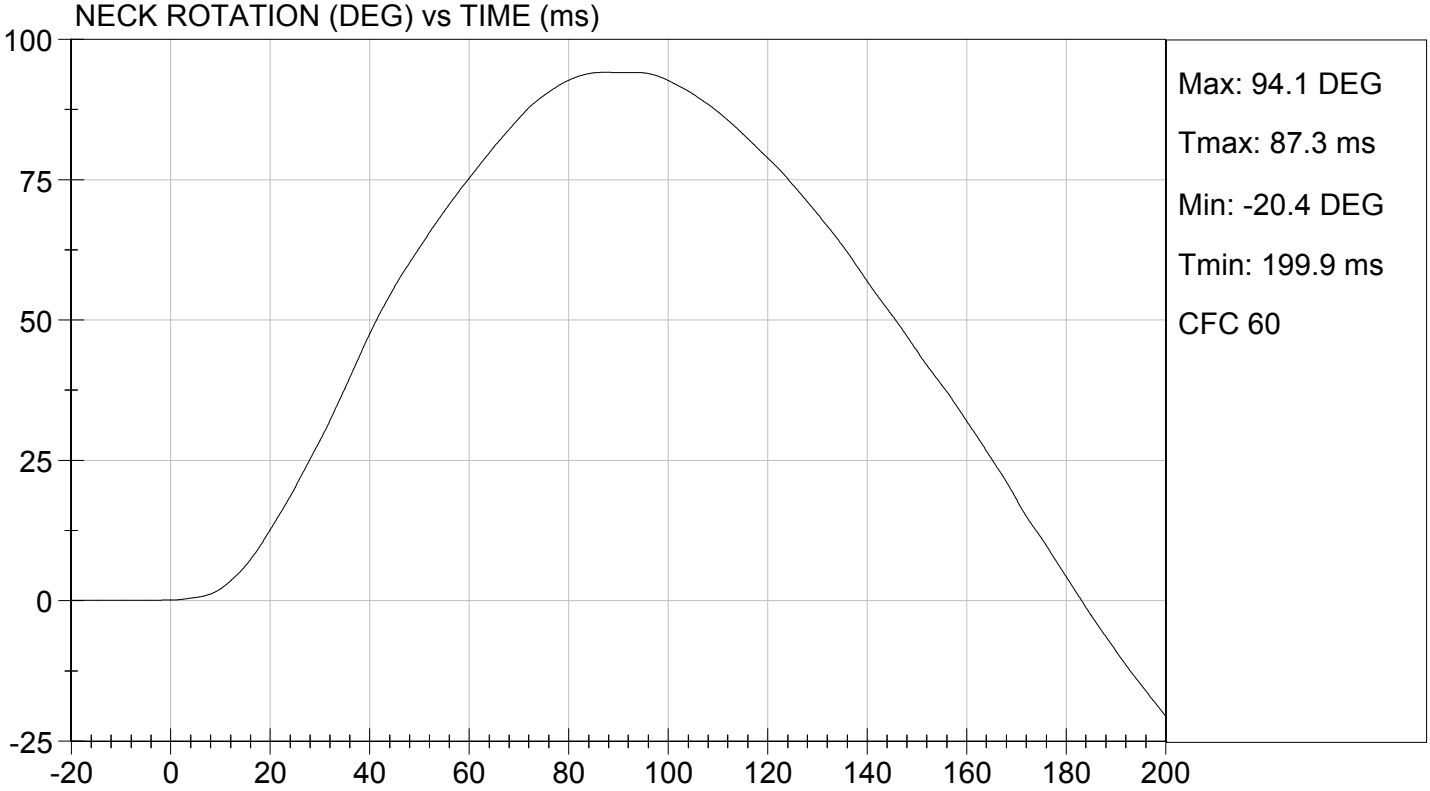
TEST DESC: NECK EXTENSION
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 10/20/2015
TEST #: D153363

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



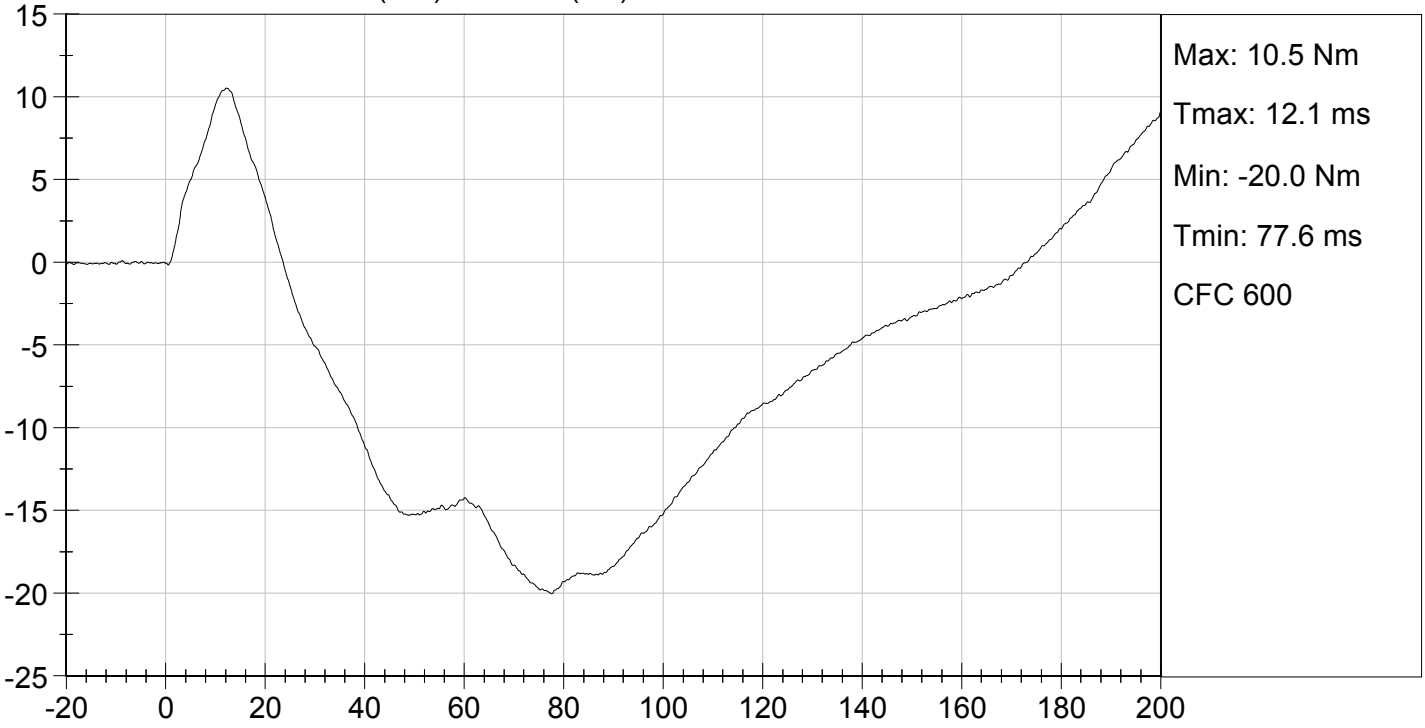
NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 14.24 ft/s, 4.34 m/s

TEST DATE: 10/20/2015
TEST #: D153363

OCCIPITAL MOMENT (Nm) vs TIME (ms)



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

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

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

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

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

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

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

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

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

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

X 7. Seat the dummy, (chest skin still removed) without back support on the test fixture surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))

X 8. Level the ribs both longitudinally and laterally ± 0.5° and adjust the pelvis angle to 8° ± 2°. The angle may be measured at the pelvis lumbar joining surface.

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.124(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is 12.7 mm ± 1 mm below the horizontal peripheral centerline of the No. 3 rib and is within 0.5° of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))

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

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

X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))

X 14. Place the arm assemblies horizontal ± 2° and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.

X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))

X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is 6.71 m/s ± 0.12 m/s. (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2))

Parameter*	Specification	Result
Test Probe Speed	6.59 m/s ≤ speed ≤ 6.83 m/s	6.60 m/s
Chest Compression	38.0 mm ≤ compression ≤ 46.0 mm	39.1 mm
Peak force** between 38.0 and 46.0 mm chest compression	1150N ≤ peak force ≤ 1380N	1235 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force ≤ 1500 N	1306 N
Internal Hysteresis***	65% ≤ hysteresis ≤ 85%	72%

*Time zero is defined as the time of initial contact between the test probe and the chest skin.
**Force = impactor mass x acceleration
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 10C)

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

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153364

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	20.9	Pass
Relative Humidity	%	10 to 70	49	Pass
Probe Speed	m/s	6.59 to 6.83	6.60	Pass
Peak Deflection	mm	38.0 to 46.0	39.1	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,235	Pass
Internal Hysteresis	%	65 to 85	72	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,306	Pass
		Overall Test Results		Pass

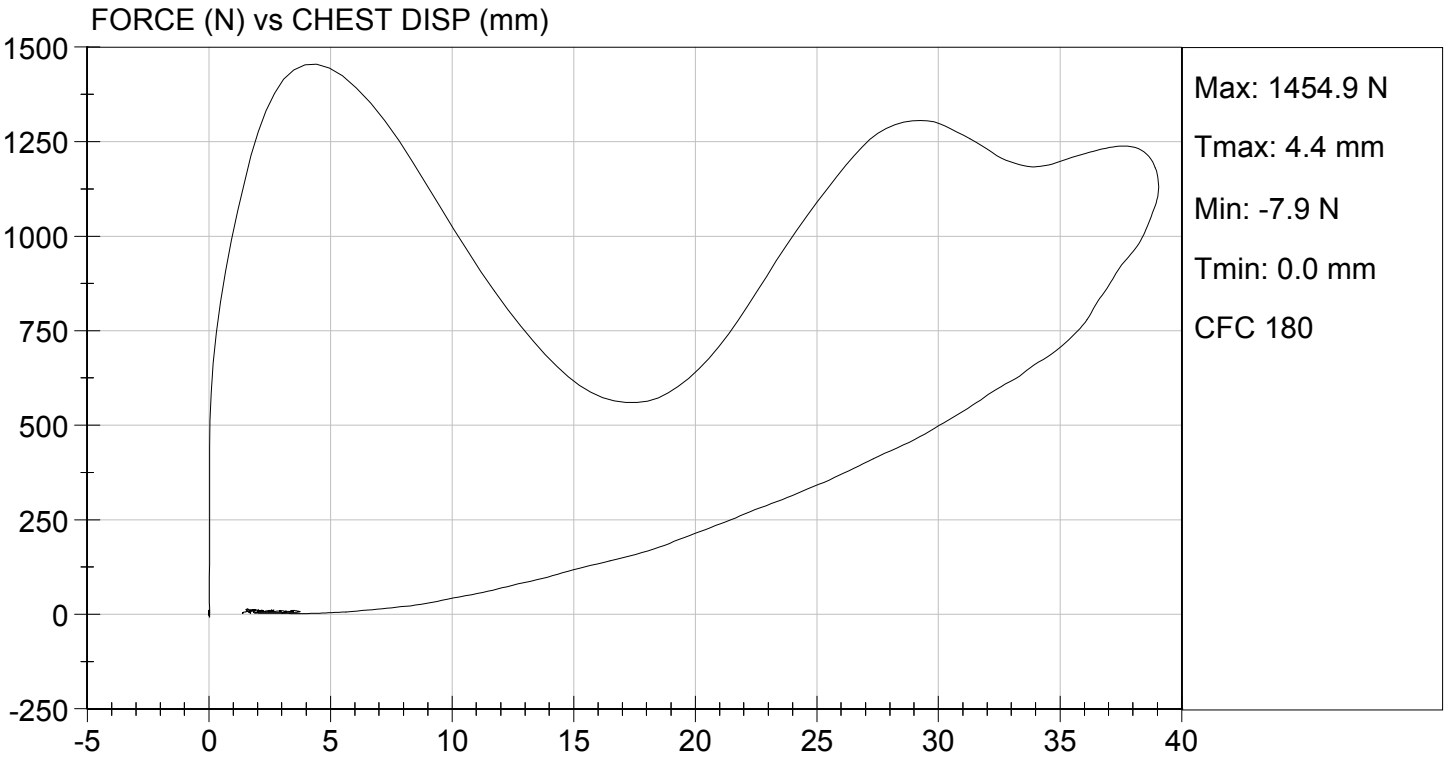
Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardelli
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 10/21/2015
TEST #: D153364



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

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

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

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

X 3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).
X with legs below the femurs.
____ without legs below the femurs.

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

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

X 5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))

X 6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C**.** (572.125(c)(6))

X 7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))

X 8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))

X 9. Remove all external support that was implemented in 9 above. (572.125(c)(5))

X 10. Measure the initial orientation angle of the torso reference plane of the seated, unsupported dummy. (572.135(c)(5))
Record reference plane angle (max. allowed 22°) See Result Table

X 11. Attach the pull cable and the load cell. (572.125(c)(6))

X 12. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the angle reference plane is at 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.125(c)(7))

X 13. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds. (572.125(c)(8))

X 14. As quickly as possible release the force applied to the attachment bracket.(572.125(c)(9))

X 15. 3 minutes after the release of the force, measure the reference plane angle. (572.125(c)(9))

X 16. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 22°	14°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.6°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	164 N
Final ref. plane angle	Initial ref. plane angle ± 8°	19°

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153367

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	48	Pass
Initial Angle	deg	0 to 22	14	Pass
Return Angle	deg	+/- 8	19	Pass
Force at 45 deg	N	147 to 200	164	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.6	Pass
		Overall Result		Pass

Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardelli
Approved By

DATA SHEET C8

LEFT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

____ Pre test calibration

__X__ Post test calibration verification

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

__X__ 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

__X__ N/A, ONLY one knee impact test performed

__X__ 2. The test fixture conforms to the specifications in Figure 12C.

__X__ 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

__X__ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

__X__ 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

__X__ 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

__X__ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.09 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2450 N

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

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

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153366

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	2000 to 3000	2450	Pass
		Overall Test Results		Pass

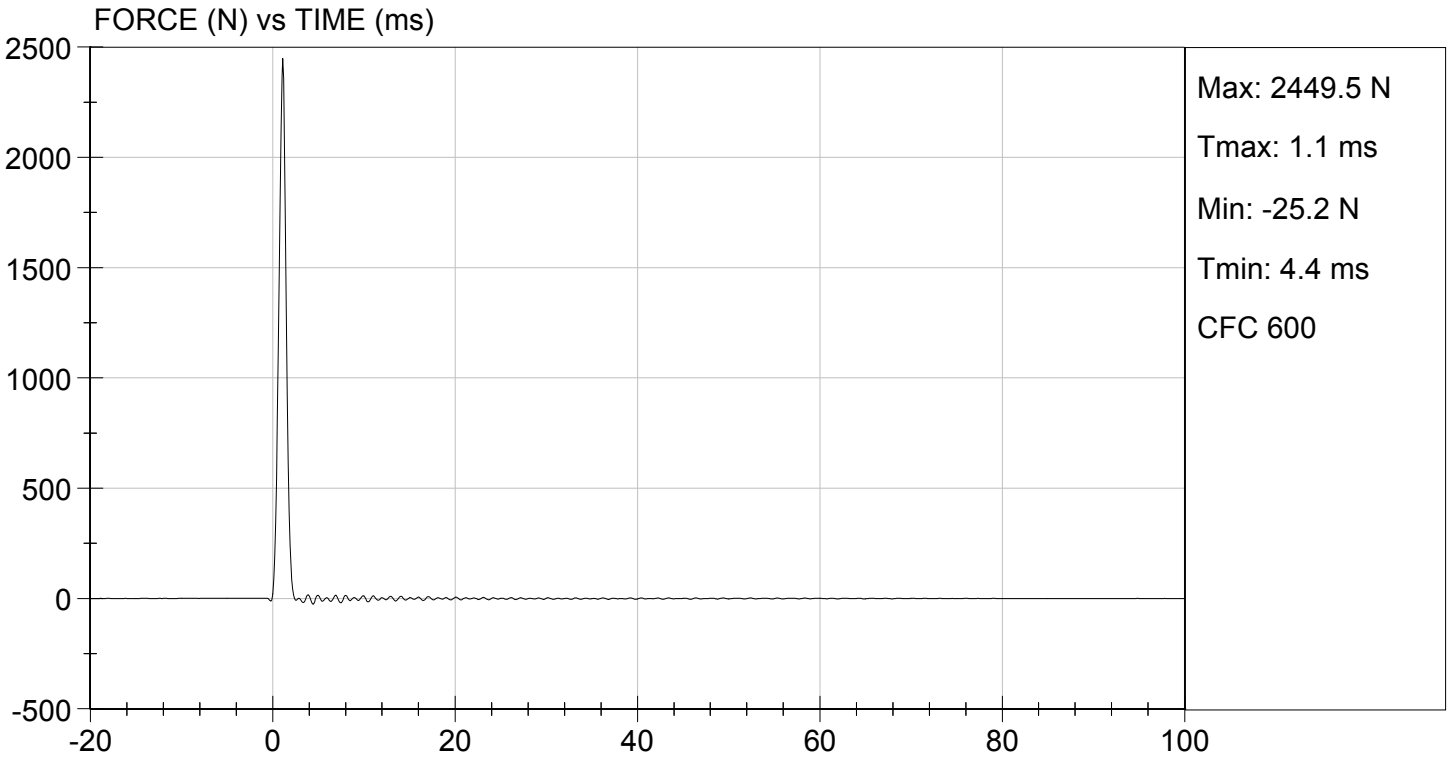
Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardelli
Approved By

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

TEST DATE: 10/21/2015
TEST #: D153366



DATA SHEET C9

RIGHT KNEE IMPACT TEST (572.126) (6 YEAR-OLD)

Dummy Serial Number: 155 Test Date: 10/21/2015

Technician: Jack Coleman

____ Pre test calibration

_X_ Post test calibration verification

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

_X_ 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))

_X_ N/A, ONLY one knee impact test performed

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

_X_ 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))

_X_ 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))

Record the maximum temperature	21.2°C
Record the minimum temperature	20.9°C
Record the maximum humidity	49%
Record the minimum humidity	44%

_X_ 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))

_X_ 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))

_X_ 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	2.07 m/s ≤ speed ≤ 2.13 m/s	2.12 m/s
Peak resistance force*	2000 N ≤ force ≤ 3000 N	2541 N

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

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

Jack Coleman
Signature

10/21/2015
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155 **Test I.D:** D153365

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	2000 to 3000	2541	Pass
		Overall Test Results		Pass

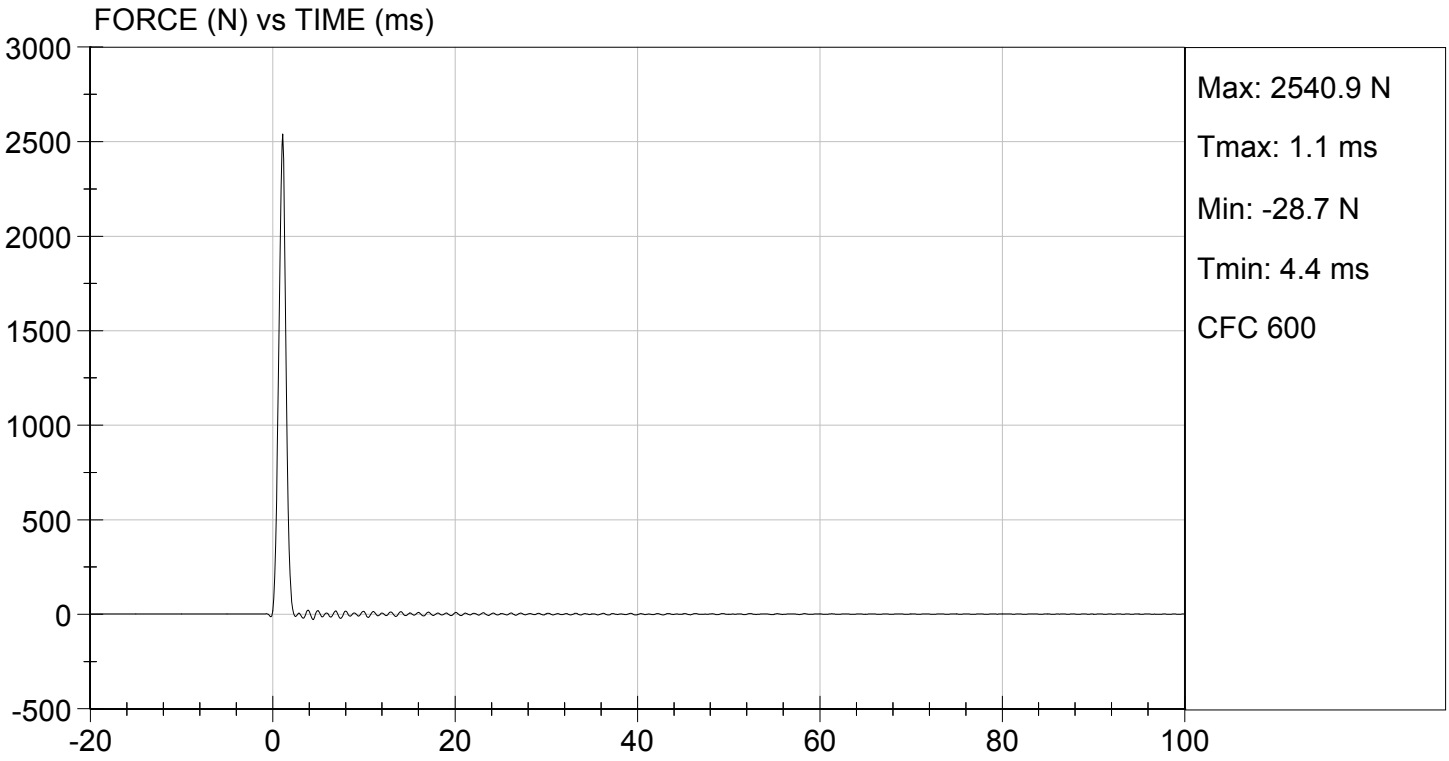
Jack Coleman
Laboratory Technician

10/21/2015
Test Date

Jeff Leonardi
Approved By

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

TEST DATE: 10/21/2015
TEST #: D153365



DATA SHEET C10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79819	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79821	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79822	10/14/2015	04/14/2016
NECK TRANSDUCER	Denton	1716A	2038	08/26/2015	02/26/2016
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P82128	10/14/2015	04/14/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P82129	10/14/2015	04/14/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P82130	10/14/2015	04/14/2016
CHEST POTENTIOMETER	Servo	08C1-3179	155	10/14/2015	04/14/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Gall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 155 Test Date: 10/20/2015

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 10/21/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 10/21/2015

Signature — Date

EXTERNAL DIMENSIONS

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

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

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

Dummy Serial Number: 031 Test Date: 10/13/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))
X N/A, ONLY one head drop performed

X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))

X 3. Accelerometers and their respective mounts are smooth and clean.

X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.

X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))

Record the maximum temperature	21.5°C
Record the minimum temperature	21.2°C
Record the maximum humidity	39%
Record the minimum humidity	38%

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

Record findings and actions: No Damage

X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	250 g ≤ x ≤ 280 g	260 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	9.5 g

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

David Schoedel
Signature

10/13/2015
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test ID:** D153241

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Peak Resultant Acceleration	G's	250 to 280	260	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	9.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/13/2015

Test Date

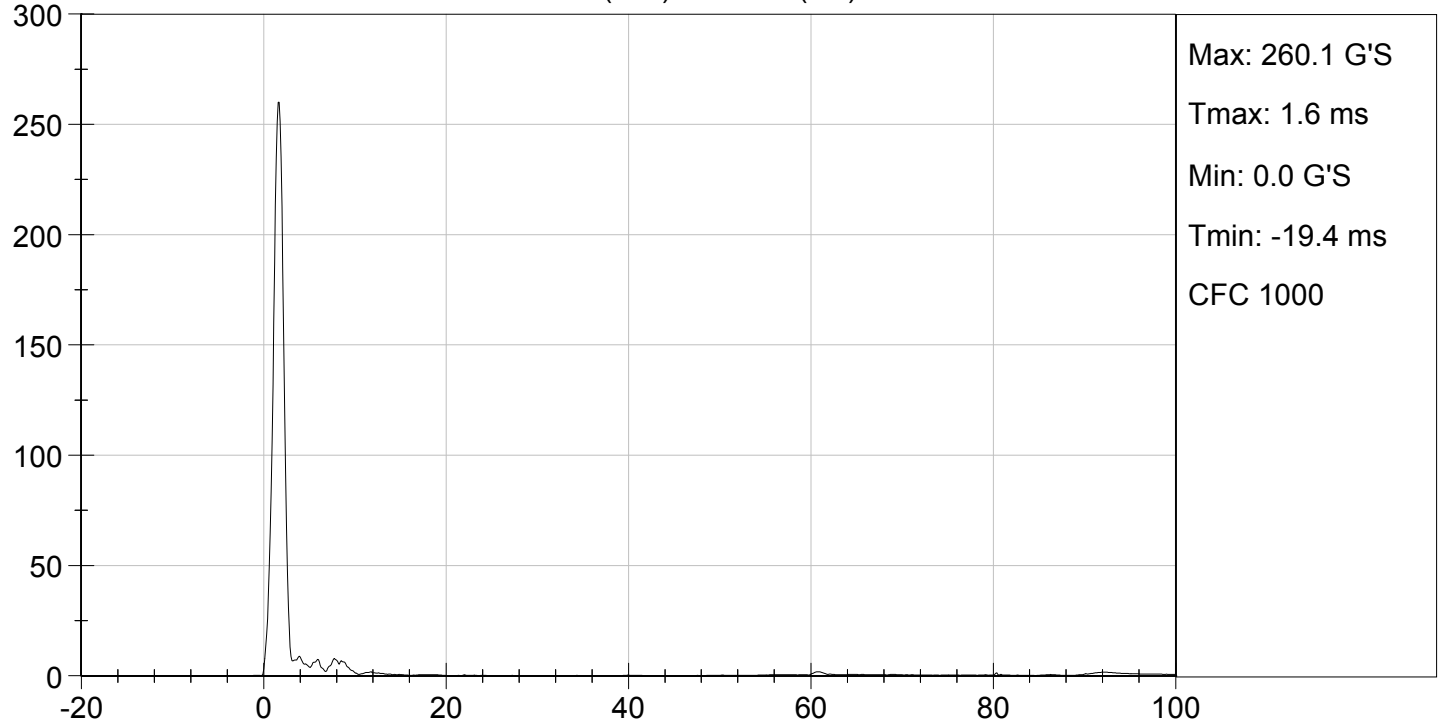
Jeff Leonardelli

Approved By

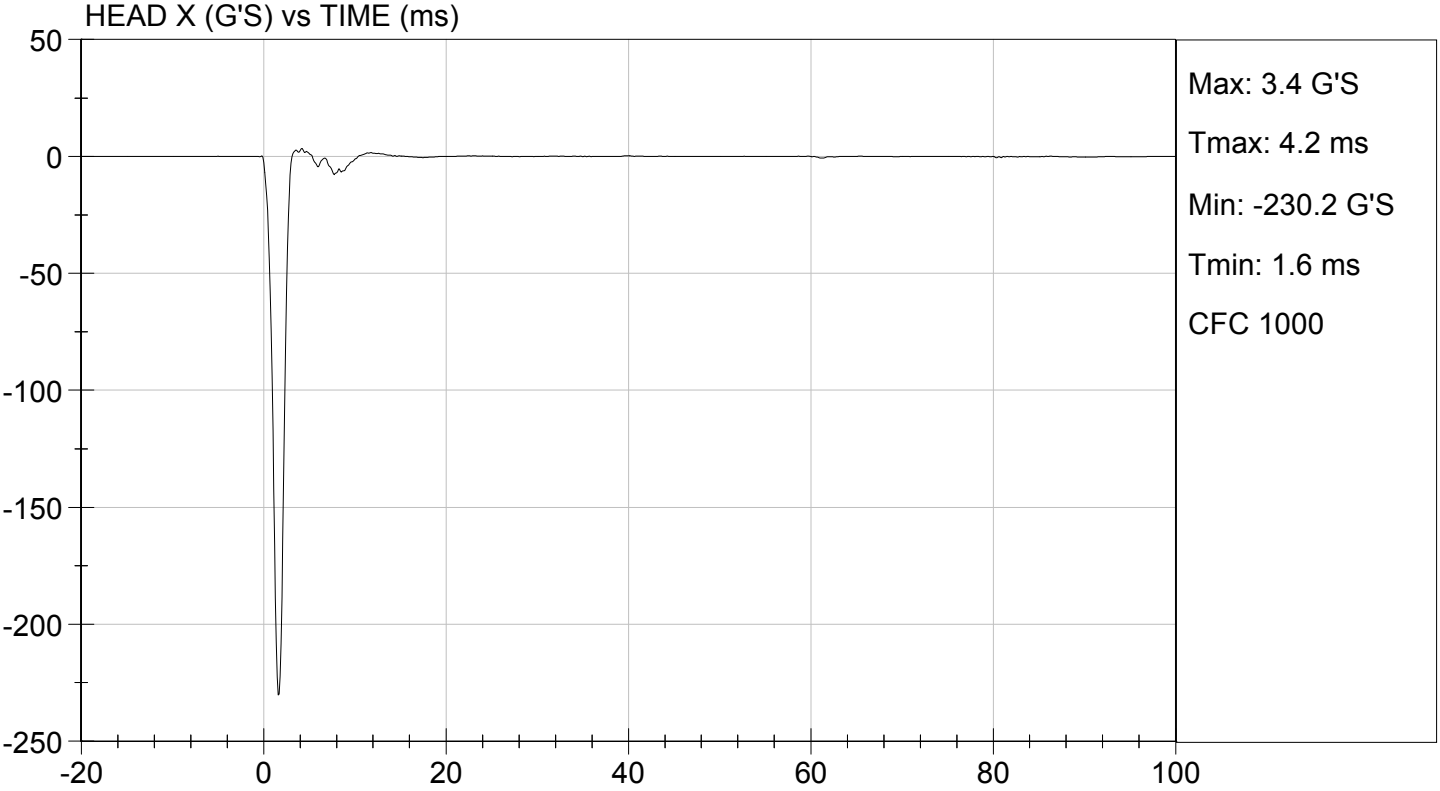
TEST DESC: HEAD DROP

TEST DATE: 10/13/2015
TEST #: D153241

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



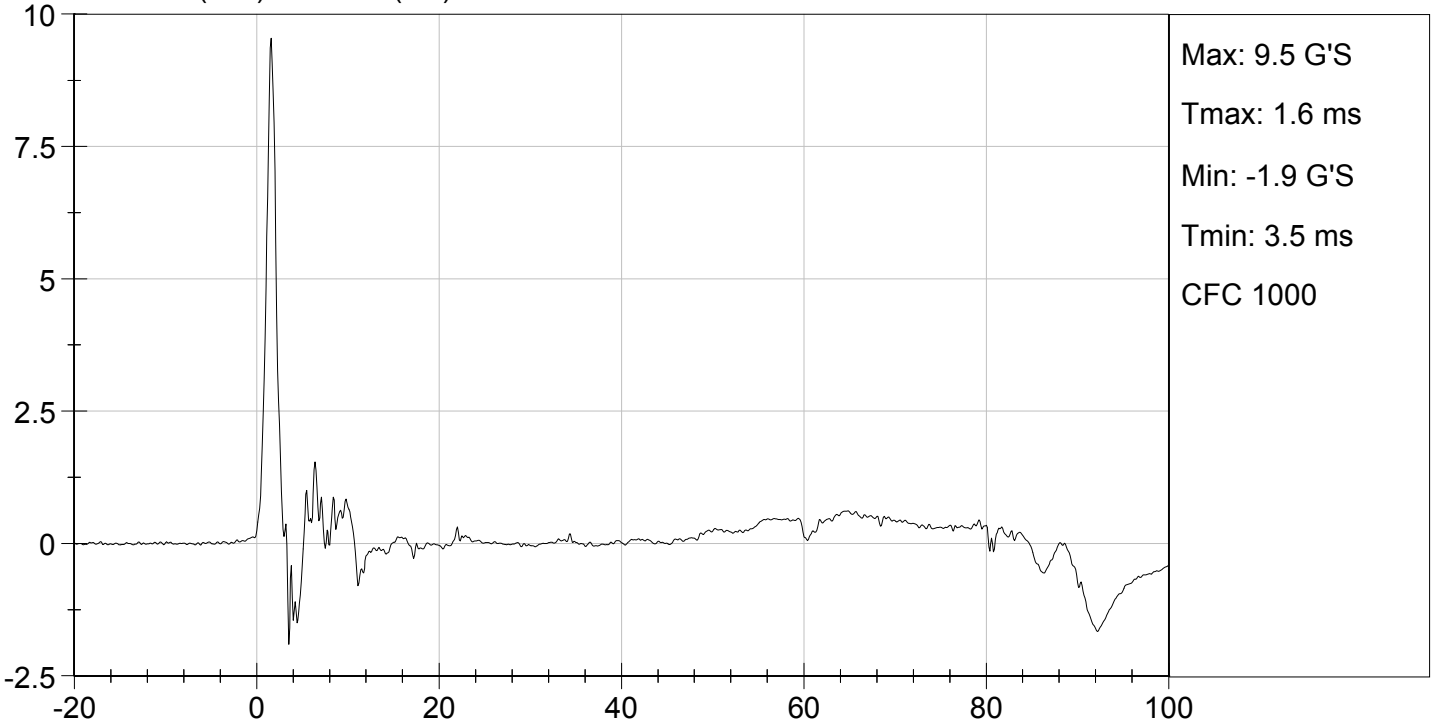
HEAD X (G'S) vs TIME (ms)



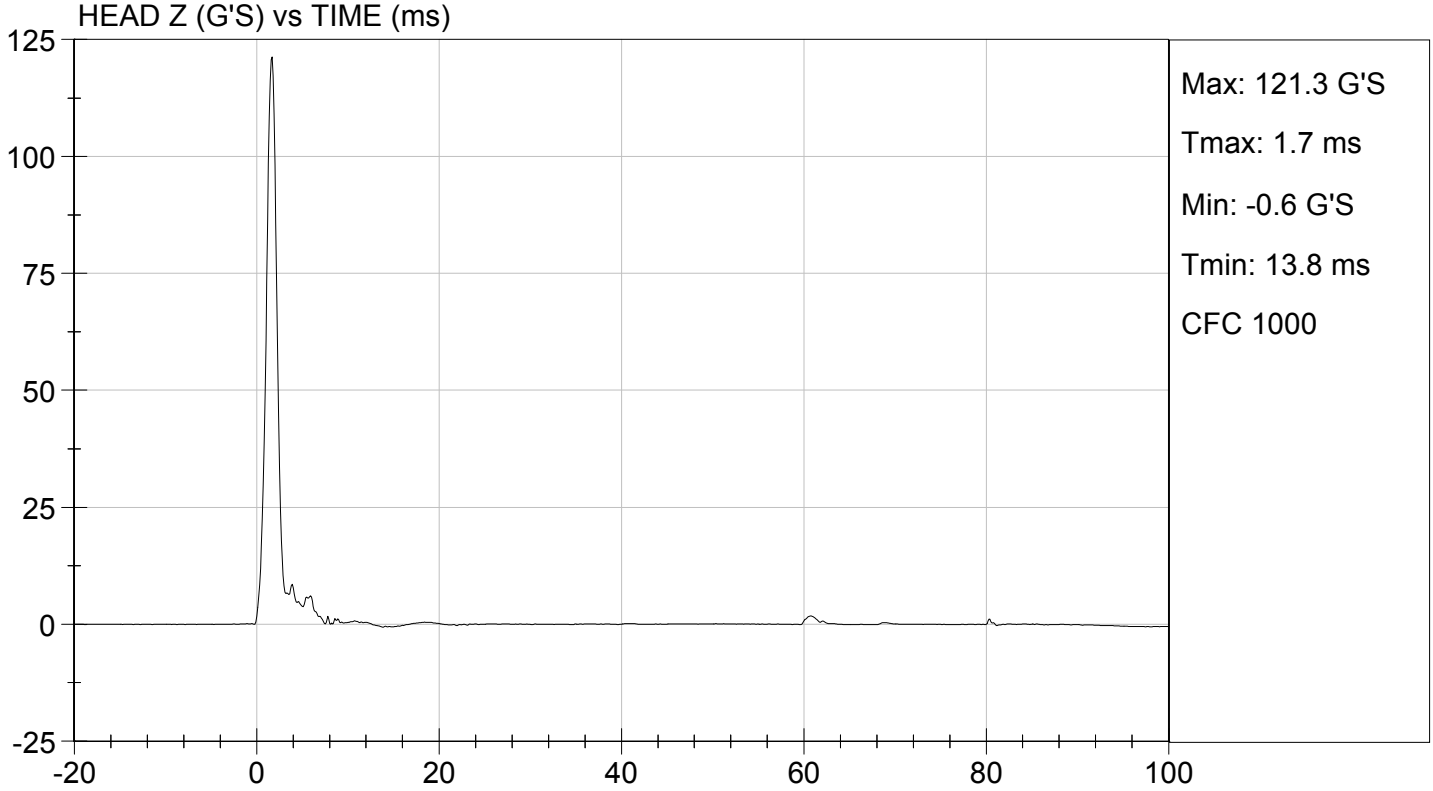
TEST DESC: HEAD DROP

TEST DATE: 10/13/2015
TEST #: D153241

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



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



DATA SHEET D4

NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 10/13/2015

Technician: David Schoedel

X Pre test calibration

____ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))

X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))

Record the maximum temperature	21.5°C
Record the minimum temperature	21.2°C
Record the maximum humidity	39%
Record the minimum humidity	38%

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

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		5.4 m/s ≤ speed ≤ 5.6 m/s	5.5 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.0 m/s ≤ ΔV ≤ 2.7 m/s	2.7 m/s
	@ 15 ms	3.0 m/s ≤ ΔV ≤ 4.0 m/s	3.7 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.1 m/s	5.0 m/s
Plane D Rotation		Peak moment* 42 Nm ≤ moment ≤ 53 Nm during the following rotation range 70° ≤ angle ≤ 82°	44.0 Nm @ 75 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 60 ms ≤ time ≤ 80 ms	69 ms

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

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

David Schoedel
Signature

10/13/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153242

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	39	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.5	Pass
Pendulum Velocity	10 ms	m/s	2.0 to 2.7	2.7	Pass
	15 ms	m/s	3.0 to 4.0	3.7	Pass
	20 ms	m/s	4.0 to 5.1	5.0	Pass
D Plane Rotation		deg	70 to 82	75	Pass
Peak Moment within Deflection Corridor		Nm	42.0 to 53.0	44.0	Pass
Positive Moment - Time Curve Decay to 10 Nm		ms	60.0 to 80.0	69.0	Pass
			Overall Test Results		Pass

David Schoedel
Laboratory Technician

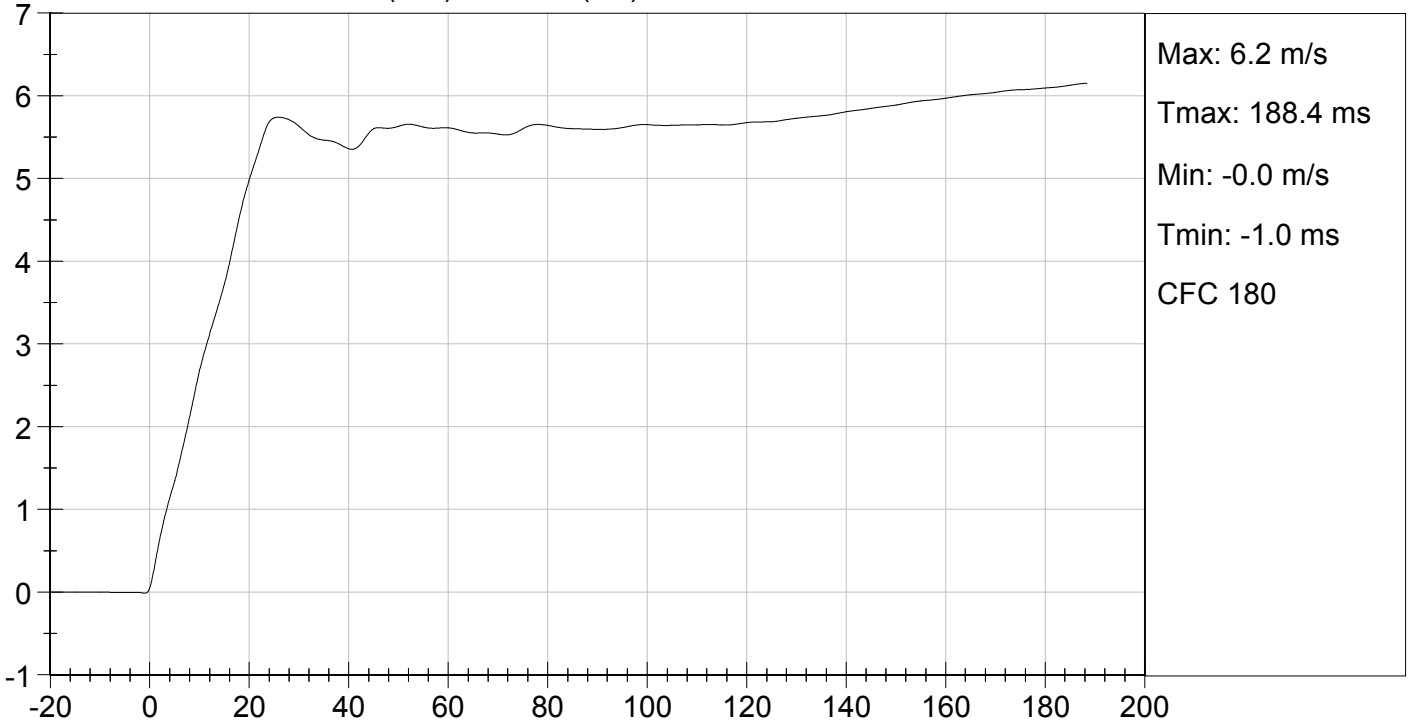
10/13/2015
Test Date

Jeff Leonardelli
Approved By

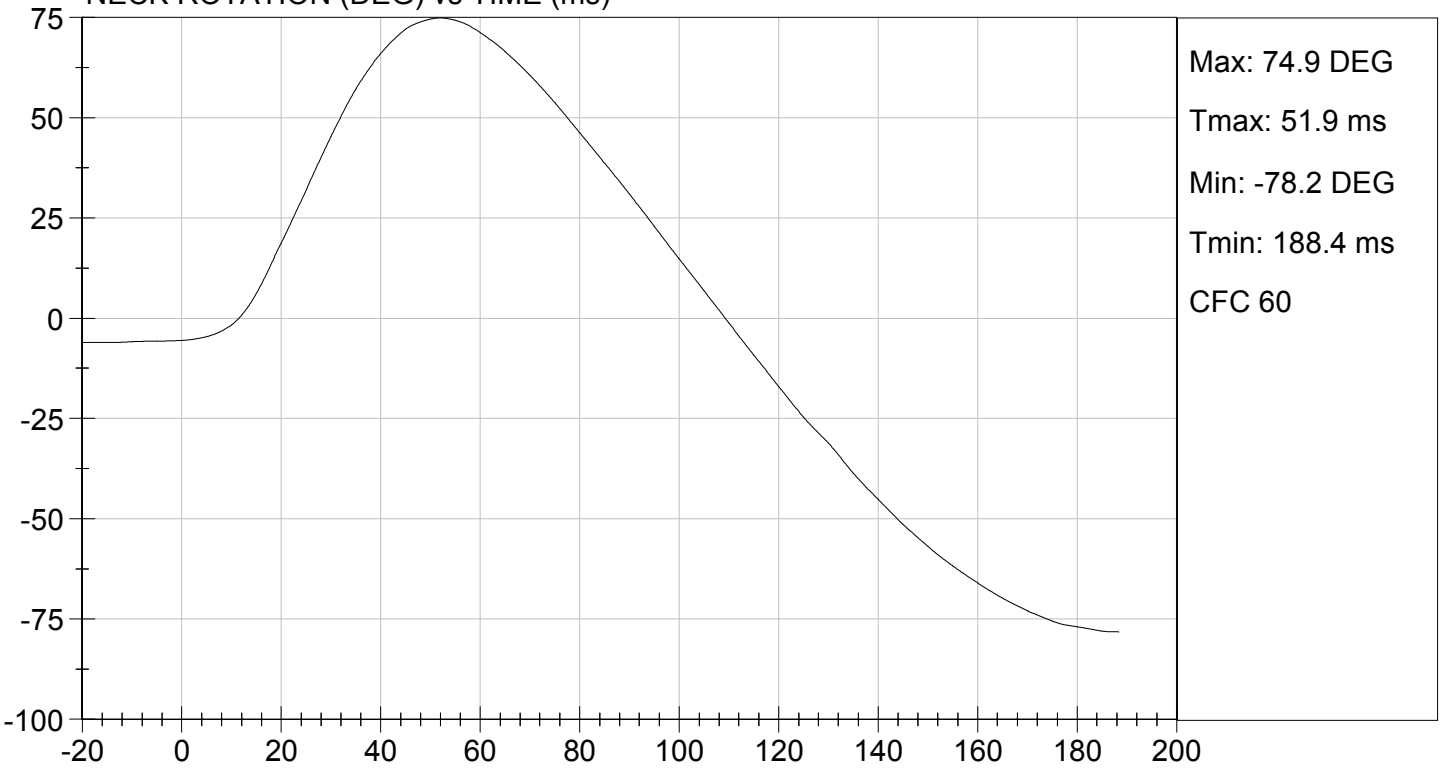
TEST DESC: NECK FLEXION
VELOCITY: 17.92 ft/s, 5.46 m/s

TEST DATE: 10/13/2015
TEST #: D153242

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

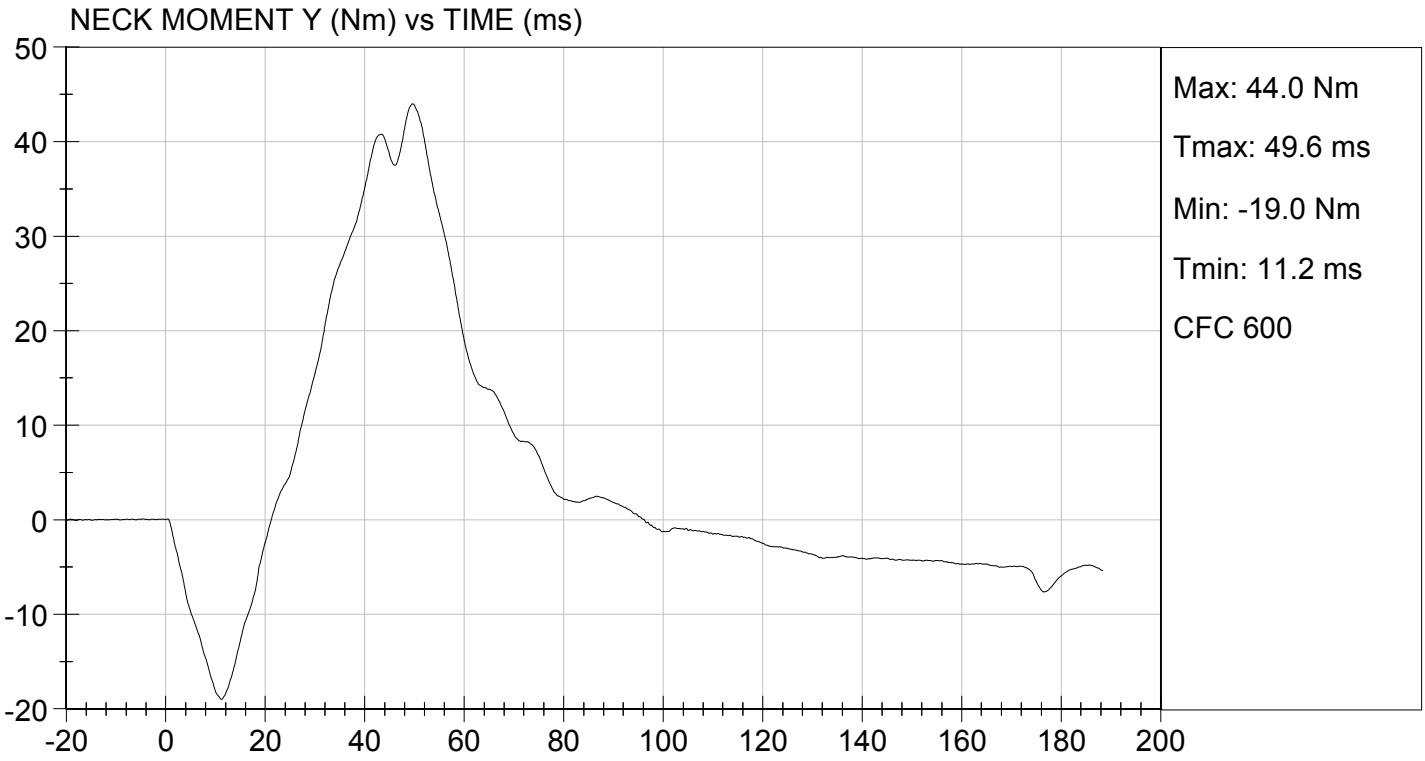


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/13/2015
TEST #: D153242



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

Dummy Serial Number: 031 Test Date: 10/13/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))

Record the maximum temperature	21.5°C
Record the minimum temperature	21.2°C
Record the maximum humidity	39%
Record the minimum humidity	38%

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

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		3.55 m/s ≤ speed ≤ 3.75 m/s	3.65 m/s
Pendulum ΔV with respect to impact speed	@ 6 ms	1.0 m/s ≤ ΔV ≤ 1.4 m/s	1.4 m/s
	@ 10 ms	1.9 m/s ≤ ΔV ≤ 2.5 m/s	2.5 m/s
	@ 14 ms	2.8 m/s ≤ ΔV ≤ 3.5 m/s	3.3 m/s
Plane D Rotation		Peak moment* -53.3 Nm ≤ moment ≤ -43.7 Nm during the following rotation range 83 ≤ angle ≤ 93	-46.1 Nm @ 89 degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm 60 ms ≤ time ≤ 80 ms	68 ms

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

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

David Schoedel — Signature

10/13/2015 — Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153243

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	39	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.65	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.4	Pass
	10 ms	m/s	1.9 to 2.5	2.5	Pass
	14 ms	m/s	2.8 to 3.5	3.3	Pass
D Plane Rotation		deg	83 to 93	89	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-46.1	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	68	Pass
			Overall Test Results		Pass

David Schoedel
Laboratory Technician

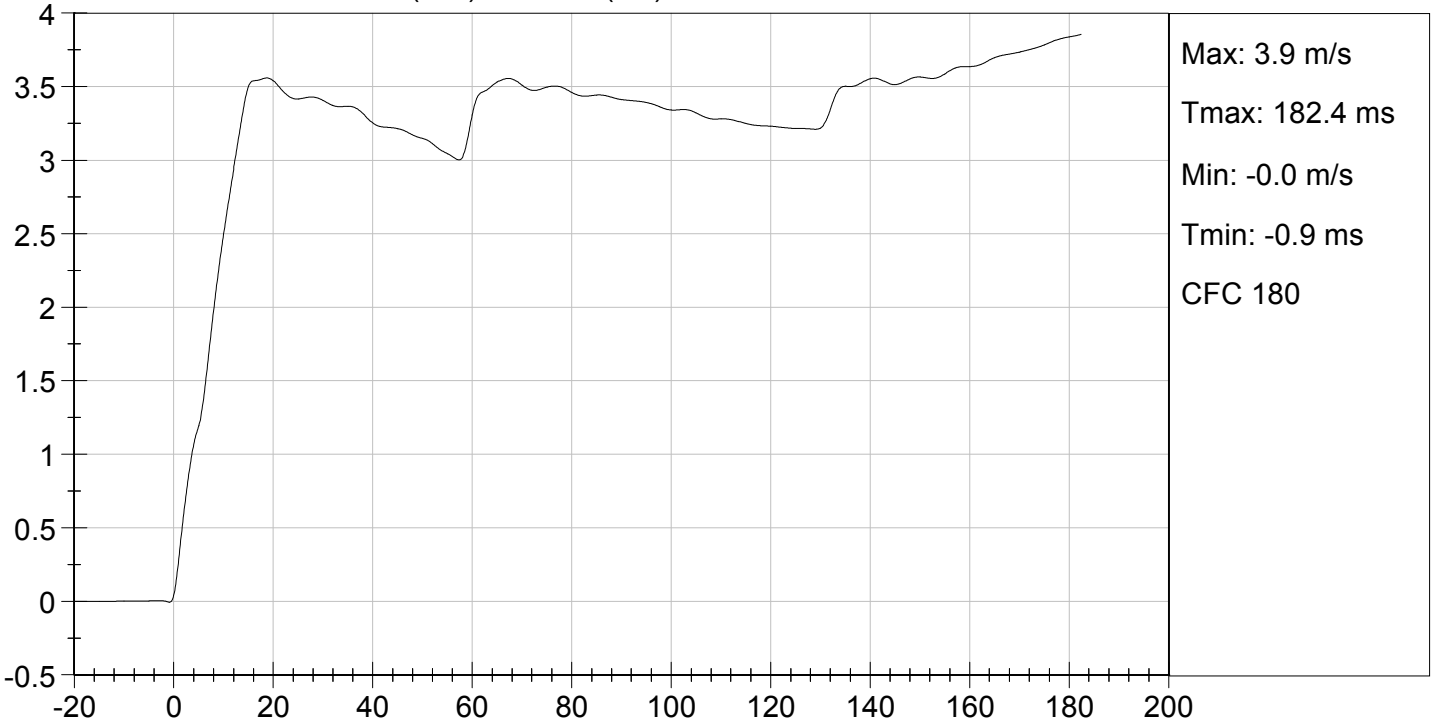
10/13/2015
Test Date

Jeff Leonardi
Approved By

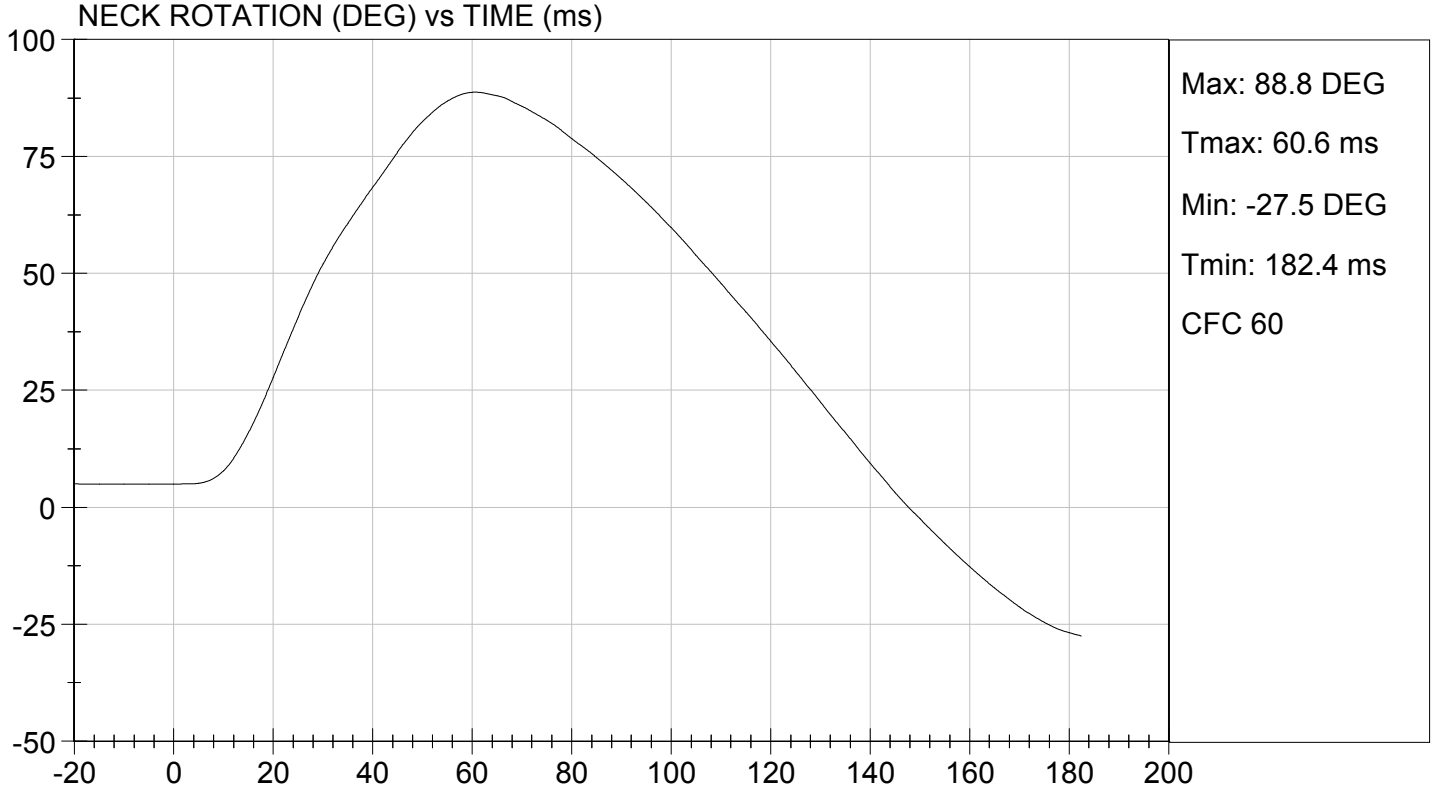
TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 10/13/2015
TEST #: D153243

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

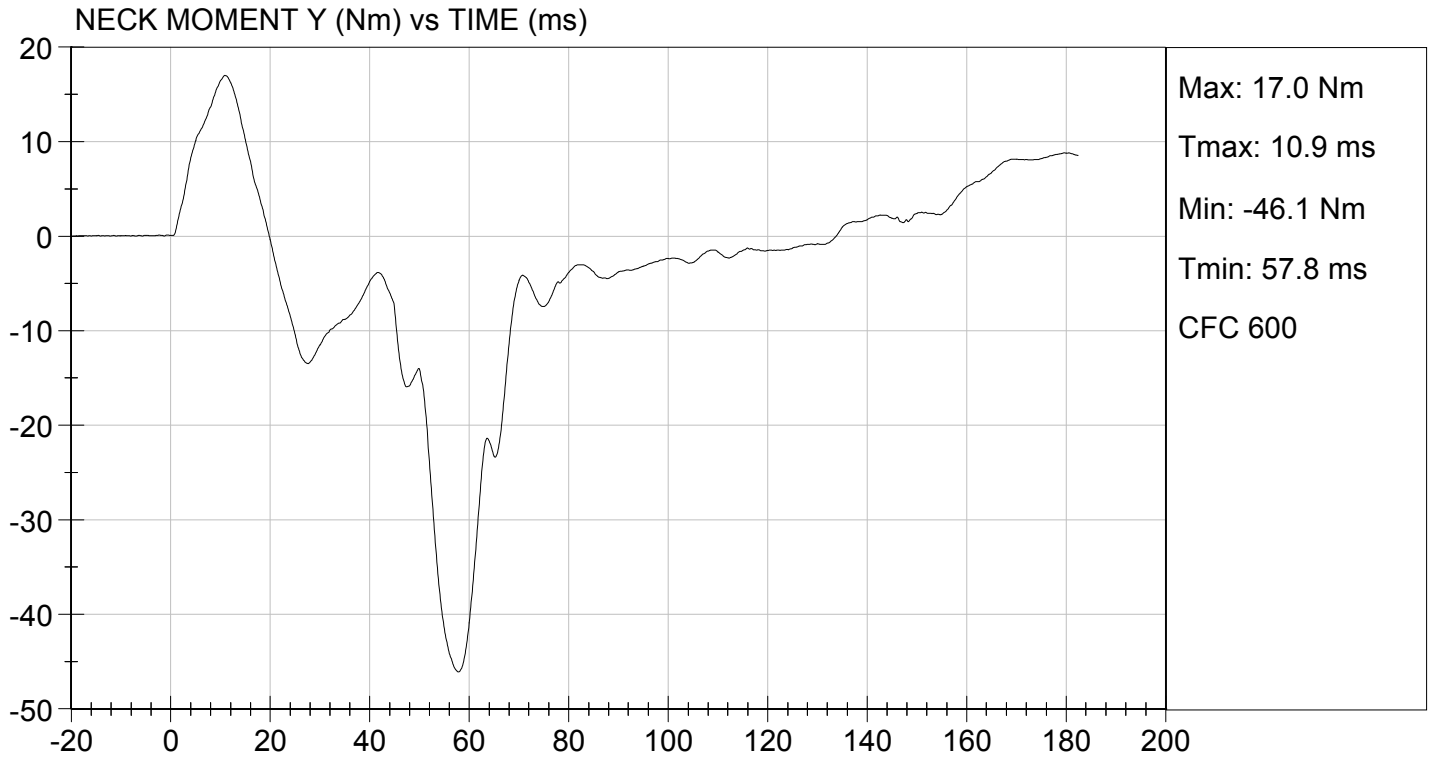


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 10/13/2015
TEST #: D153243



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

Dummy Serial Number: 031 Test Date: 10/13/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))
X N/A, ONLY one thorax impact test performed

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

X 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))

X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))

Record the maximum temperature	21.5°C
Record the minimum temperature	21.2°C
Record the maximum humidity	39%
Record the minimum humidity	38%

X 5. Remove the arms.

X 6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

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

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

X 7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))

X 8. Level the middle rib both longitudinally and laterally ± 0.5°. (572.144(c)(3))

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.144(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 2.5 mm within ± 0.5° of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))

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

X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.

X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	5.9 m/s ≤ speed ≤ 6.1 m/s	6.1 m/s
Chest Compression	32 mm ≤ compression ≤ 38 mm	36 mm
Peak force** between 32 and 38 mm chest compression	680 N ≤ peak force ≤ 810 N	753 N
Peak force** between 12.5 and 32.0 mm chest compression	Peak force ≤ 910 N	736 N
Internal Hysteresis***	65% ≤ 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 (572.144(b)(3))
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

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

David Schoedel
Signature

10/13/2015
Date

MGA RESEARCH CORPORATION

THORAX IMPACT TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153244

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
Probe Velocity	m/s	5.9 to 6.1	6.1	Pass
Peak Deflection	mm	32 to 38	36	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	753	Pass
Internal Hysteresis	%	65 to 85	70	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	736	Pass
		Overall Test Results		Pass

David Schoedel
Laboratory Technician

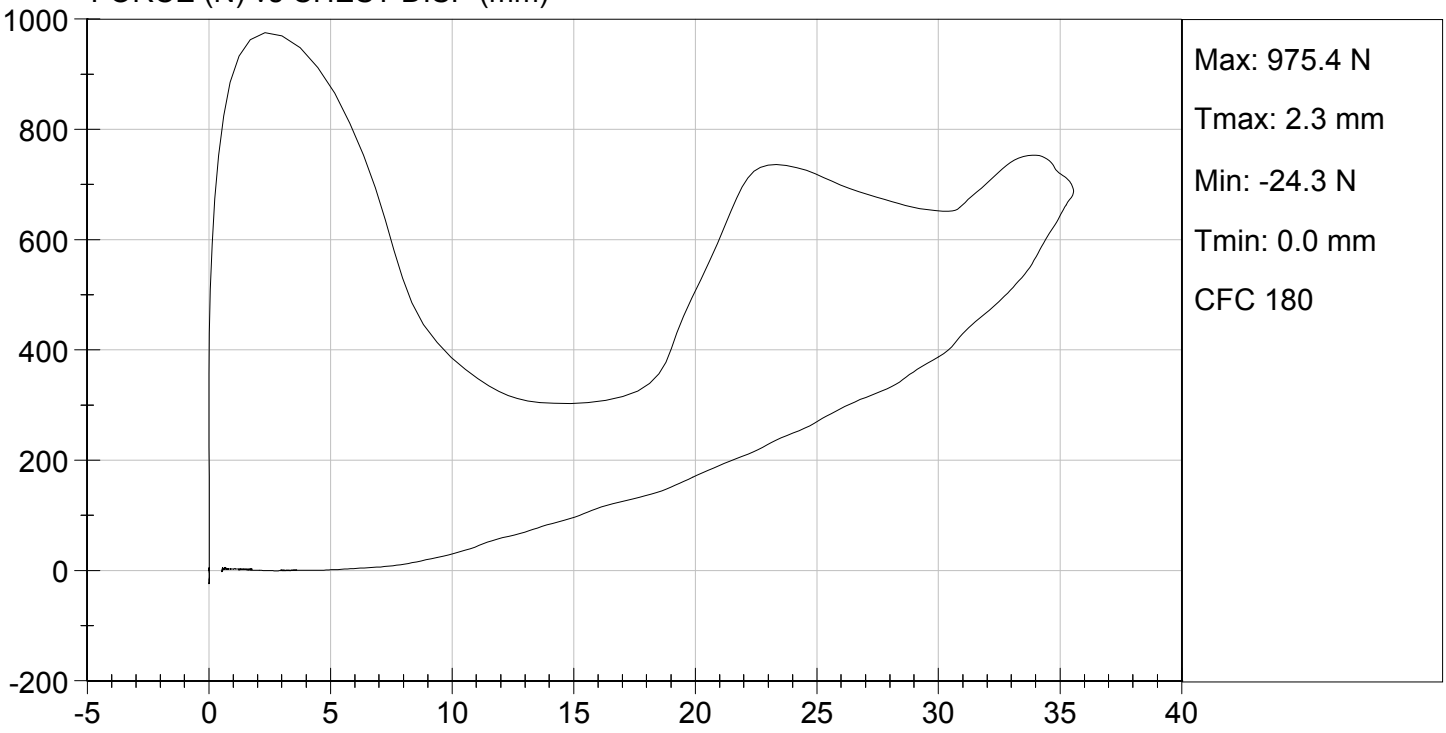
10/13/2015
Test Date

Jeff Leuenhagen
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 19.86 ft/s, 6.05 m/s

TEST DATE: 10/13/2015
TEST #: D153244

FORCE (N) vs CHEST DISP (mm)



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

Dummy Serial Number: 031 Test Date: 10/13/2015

Technician: David Schoedel

X Pre test calibration
___ Post test calibration verification

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

X 1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))
X N/A, ONLY torso flexion test performed

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

X 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).
X with legs below the femurs.
___ without legs below the femurs.

X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))

Record the maximum temperature	21.5°C
Record the minimum temperature	21.2°C
Record the maximum humidity	39%
Record the minimum humidity	38%

X 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))

X 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within ± 1° and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))

X 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket**.** (572.145(c)(2)(iv))

X 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

X 9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° and 30° ± 2°. The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))

X 10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0°. Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))

X 11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))

X 12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))
Record reference plane angle (max. allowed 15°) See Result Table

X 13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))

X 14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the torso reference plane reaches 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.145(c)(5))

X 15. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))

X 16. As quickly as possible release the force applied to the attachment bracket.(572.145(c)(8))

X 17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))

X 18. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 15°	5°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.8°/s
Force at 45° ± 0.5°	130 N ≤ force ≤ 180 N	134 N
Final ref. plane angle	Initial ref. plane angle ± 10°	6°

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

David Schoedel
Signature

10/13/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153247

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	38	Pass
Initial Angle	deg	0 to 15	5	Pass
Return Angle	deg	-10 to 10	6	Pass
Force at 45 deg	N	130 to 180	134	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
		Overall Test Results		Pass

David Schoedel

Laboratory Technician

10/13/2015

Test Date

Jeff Leonardelli

Approved By

DATA SHEET D8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P88702	10/12/2015	04/12/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P88703	10/08/2015	04/08/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P88704	10/12/2015	04/12/2016
NECK TRANSDUCER	Denton	3303	184	05/11/2015	11/11/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P88698	10/12/2015	04/12/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P88700	10/12/2015	04/12/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P88701	10/12/2015	04/12/2016
CHEST POTENTIOMETER	Servo	08C1-3179	031	10/13/2015	04/13/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

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

Dummy Serial Number: 031 Test Date: 10/22/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))
X N/A, ONLY one head drop performed

X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))

X 3. Accelerometers and their respective mounts are smooth and clean.

X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.

X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))

Record the maximum temperature	21.7°C
Record the minimum temperature	21.4°C
Record the maximum humidity	44%
Record the minimum humidity	43%

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

Record findings and actions: No Damage

X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

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

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 40.9 micro inches

X 12. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.142(c)(4))

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	250 g ≤ x ≤ 280 g	272 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration ≤ 15 g	-8.6 g

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

Jack Coleman

Signature

10/22/2015

Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test ID:** D153381

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	250 to 280	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-8.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

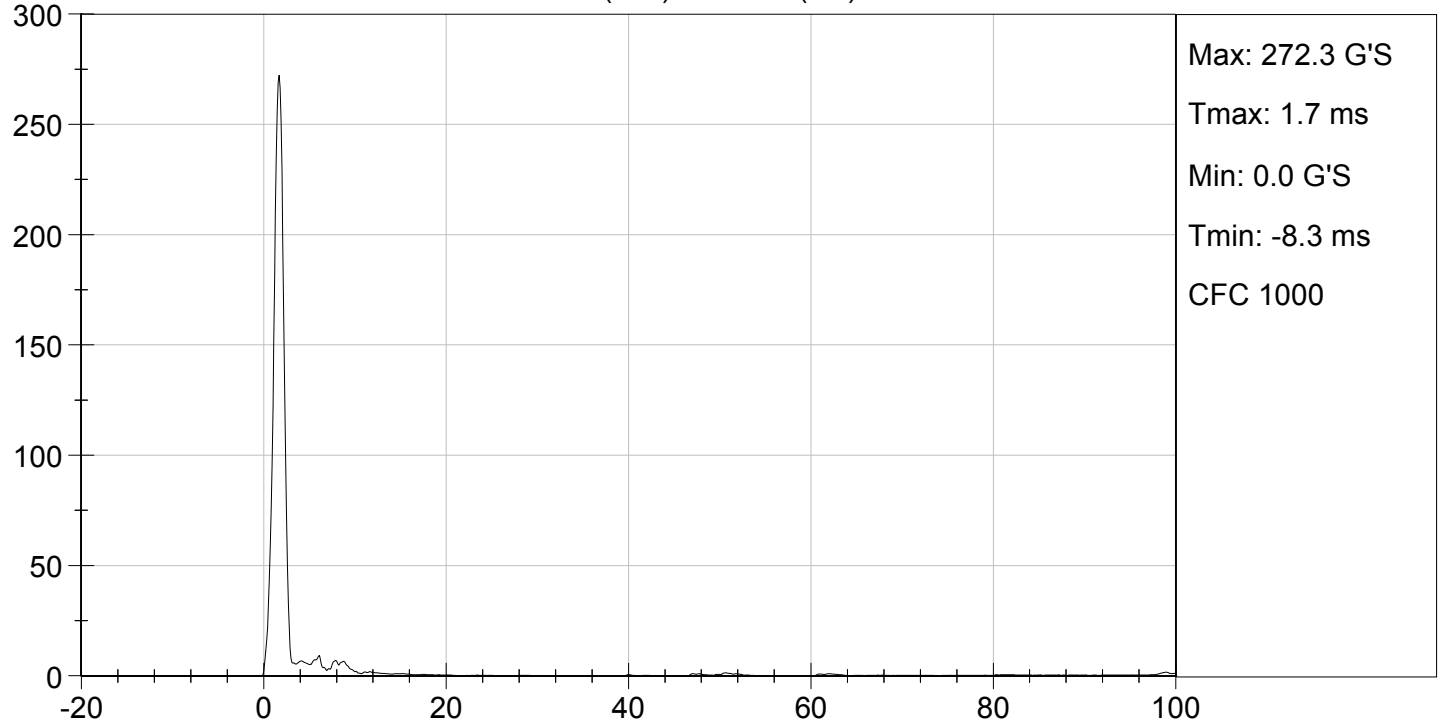
10/22/2015
Test Date

Jeff Leonardelli
Approved By

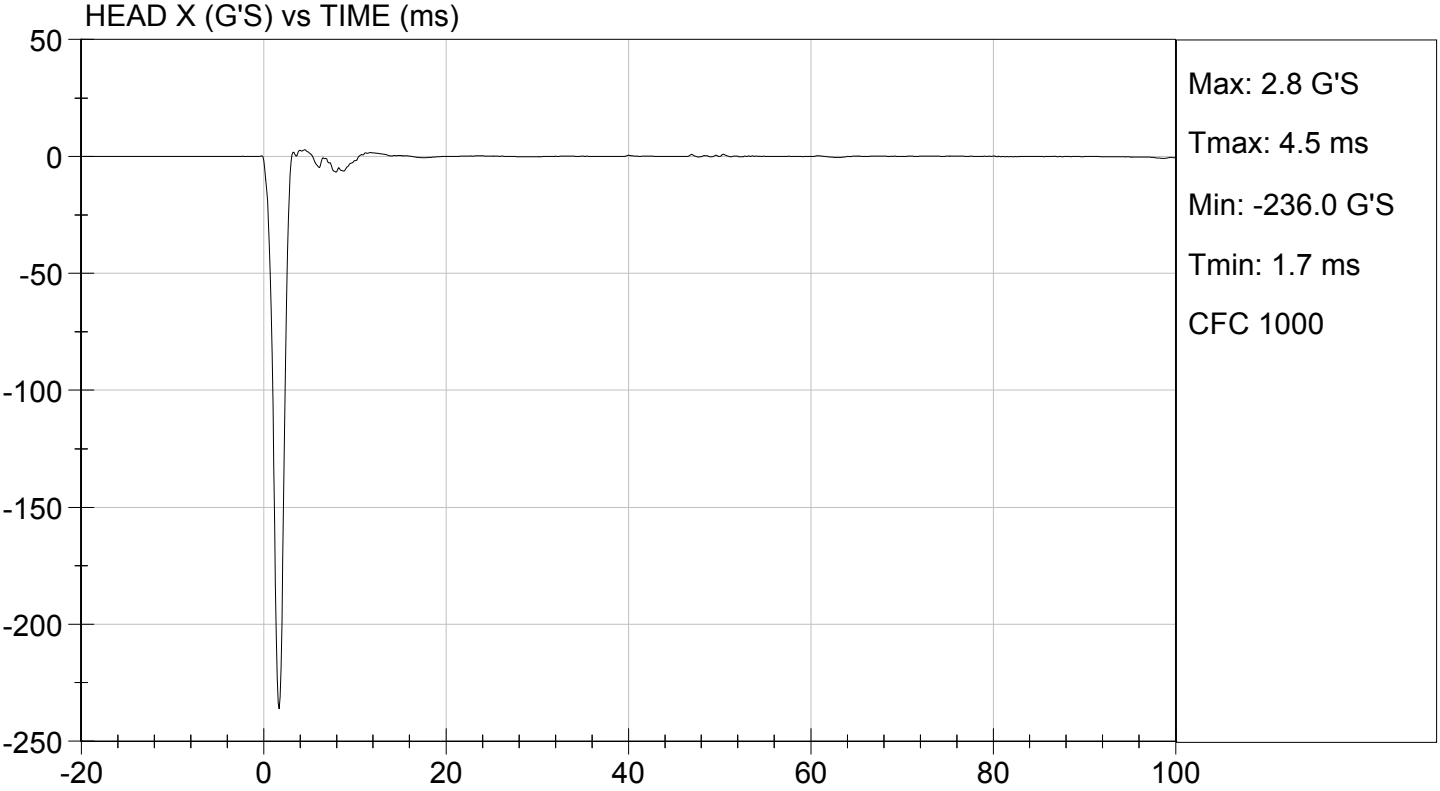
TEST DESC: HEAD DROP

TEST DATE: 10/22/2015
TEST #: D153381

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



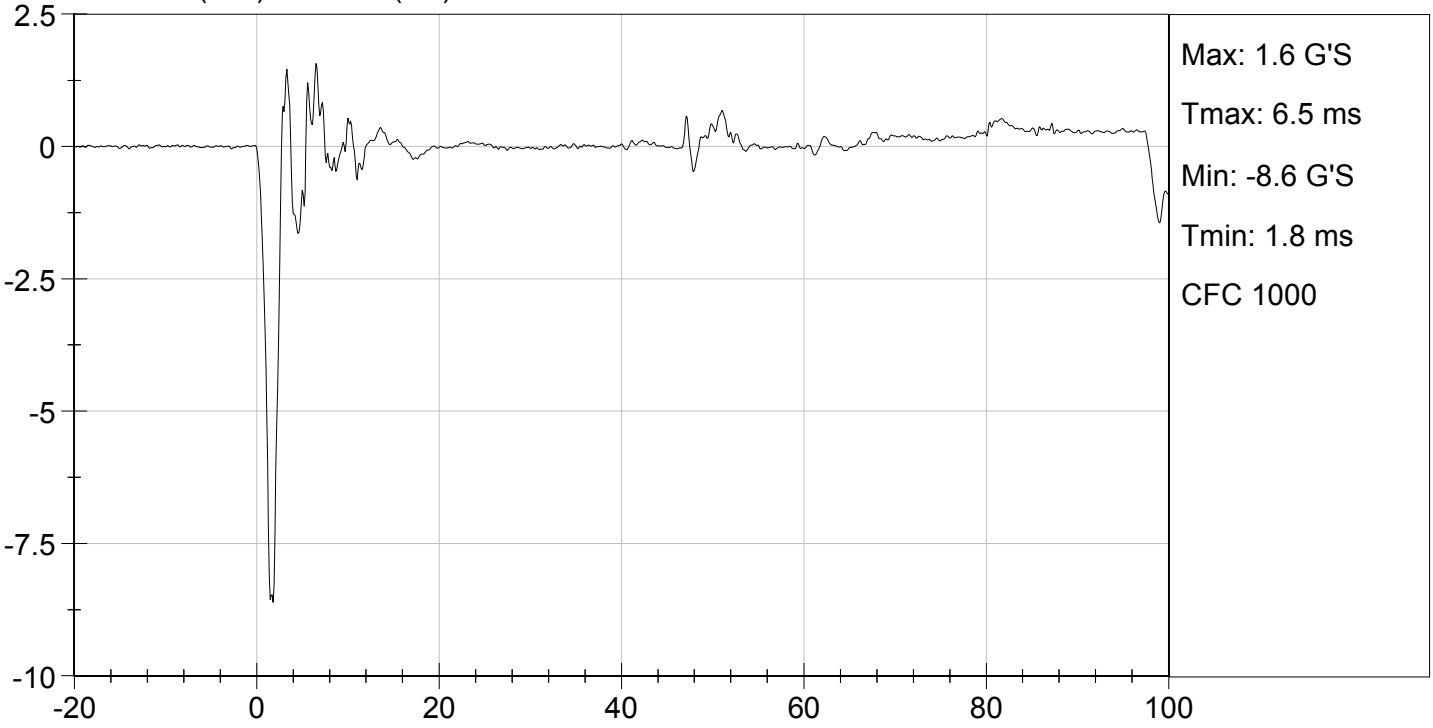
HEAD X (G'S) vs TIME (ms)



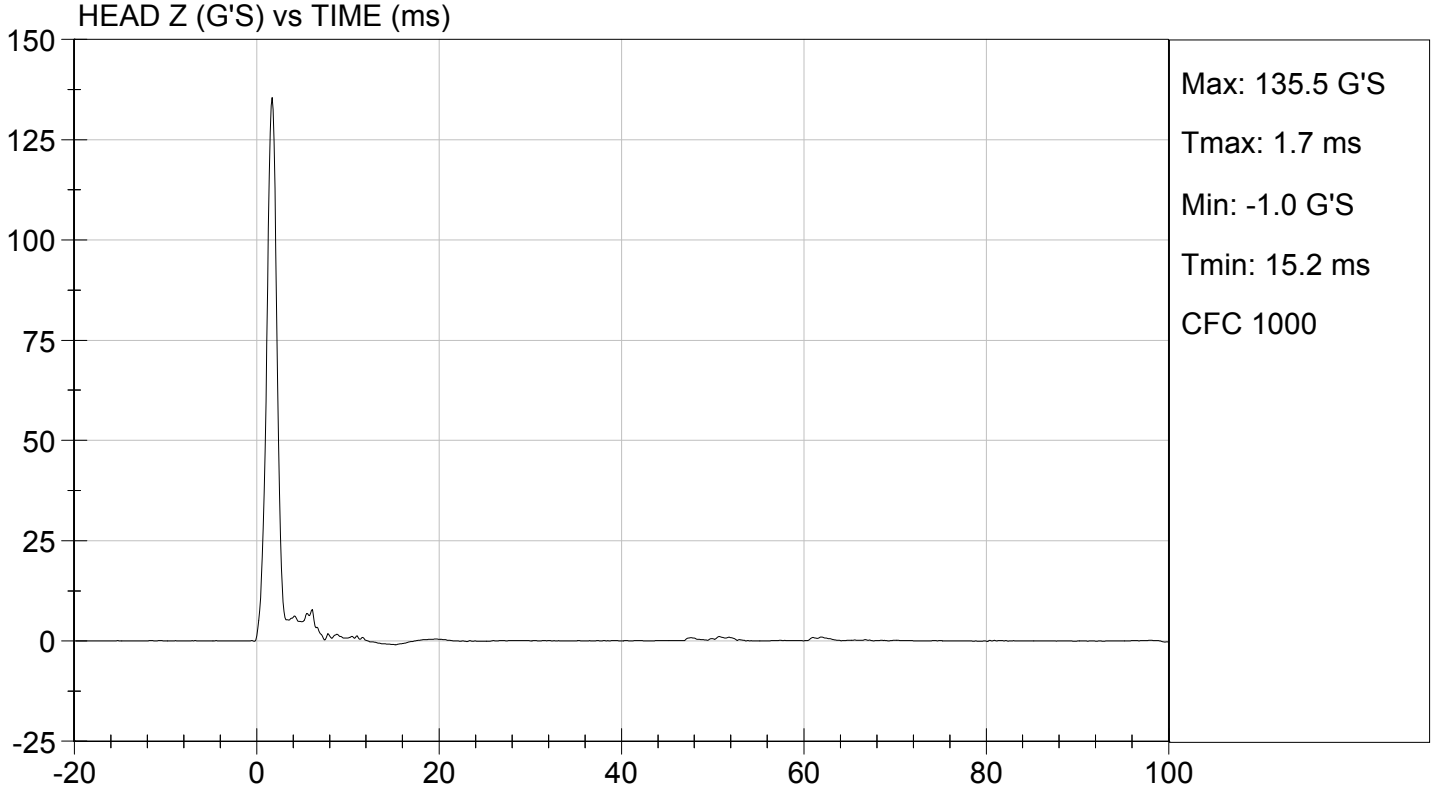
TEST DESC: HEAD DROP

TEST DATE: 10/22/2015
TEST #: D153381

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



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



DATA SHEET D4

NECK FLEXION TEST (572.143) (3 YEAR-OLD)

Dummy Serial Number: 031 Test Date: 10/22/2015

Technician: Jack Coleman

____ Pre test calibration

__X__ Post test calibration verification

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

__X__ 1. It has been at least 30 minutes since the last neck test. (572.146(p))

__X__ N/A, this is the first neck test performed

__X__ 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

__X__ 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))

Record the maximum temperature	21.7°C
Record the minimum temperature	21.4°C
Record the maximum humidity	44%
Record the minimum humidity	43%

__X__ 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.

Record findings and actions: No damage

__X__ 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

__X__ 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

__X__ 7. The test fixture pendulum conforms to the specifications in Figure 8D.

__X__ 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		5.4 m/s ≤ speed ≤ 5.6 m/s	5.5 m/s
Pendulum ΔV with respect to impact speed	@ 10 ms	2.0 m/s ≤ ΔV ≤ 2.7 m/s	2.6 m/s
	@ 15 ms	3.0 m/s ≤ ΔV ≤ 4.0 m/s	3.6 m/s
	@ 20 ms	4.0 m/s ≤ ΔV ≤ 5.1 m/s	4.9 m/s
Plane D Rotation		Peak moment* 42 Nm ≤ moment ≤ 53 Nm during the following rotation range 70° ≤ angle ≤ 82°	43.9 Nm @ 75 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 60 ms ≤ time ≤ 80 ms	69 ms

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

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

Jack Coleman
Signature

10/22/2015
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153382

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Speed		m/s	5.4 to 5.6	5.5	Pass
Pendulum Velocity	10 ms	m/s	2.0 to 2.7	2.6	Pass
	15 ms	m/s	3.0 to 4.0	3.6	Pass
	20 ms	m/s	4.0 to 5.1	4.9	Pass
D Plane Rotation		deg	70 to 82	75	Pass
Peak Moment within Deflection Corridor		Nm	42.0 to 53.0	43.9	Pass
Positive Moment - Time Curve Decay to 10 Nm		ms	60.0 to 80.0	69	Pass
			Overall Test Results		Pass

Jack Coleman
Laboratory Technician

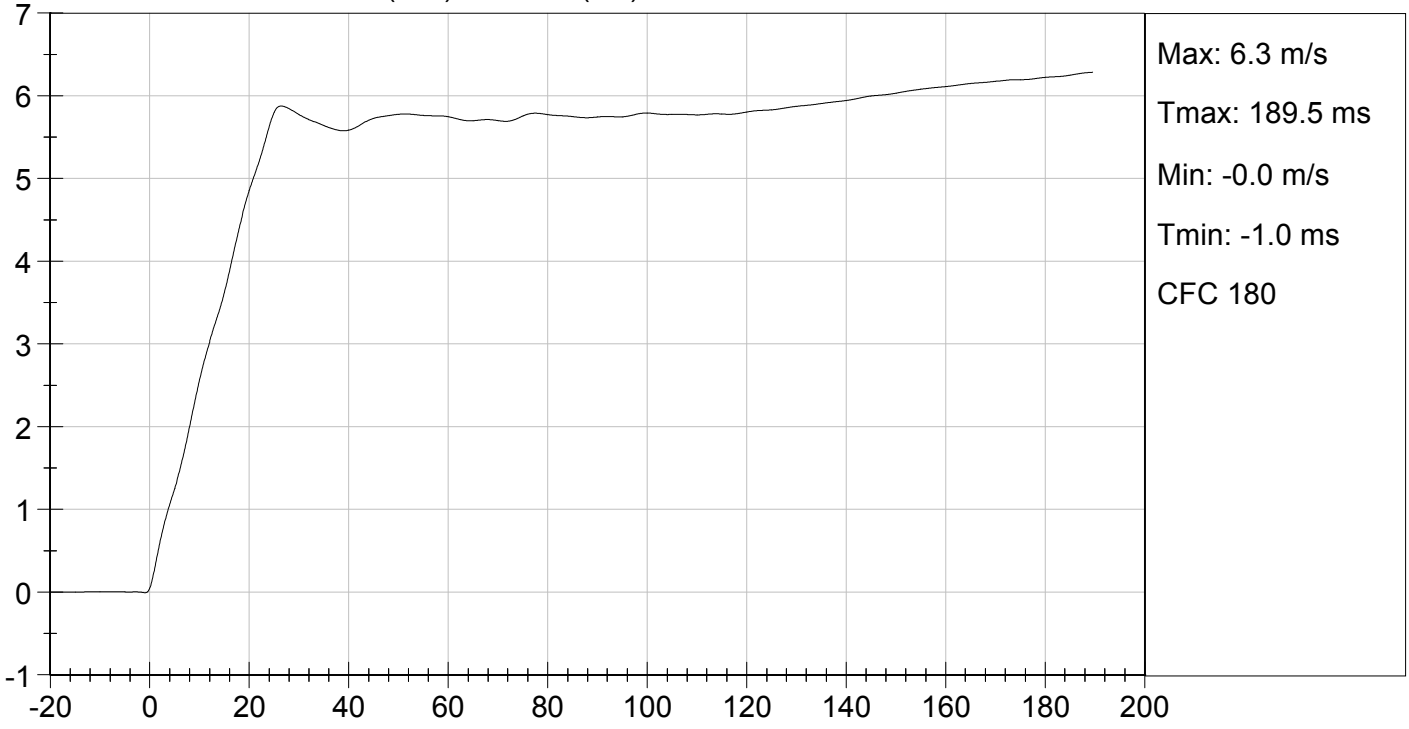
10/22/2015
Test Date

Jeff Leonardelli
Approved By

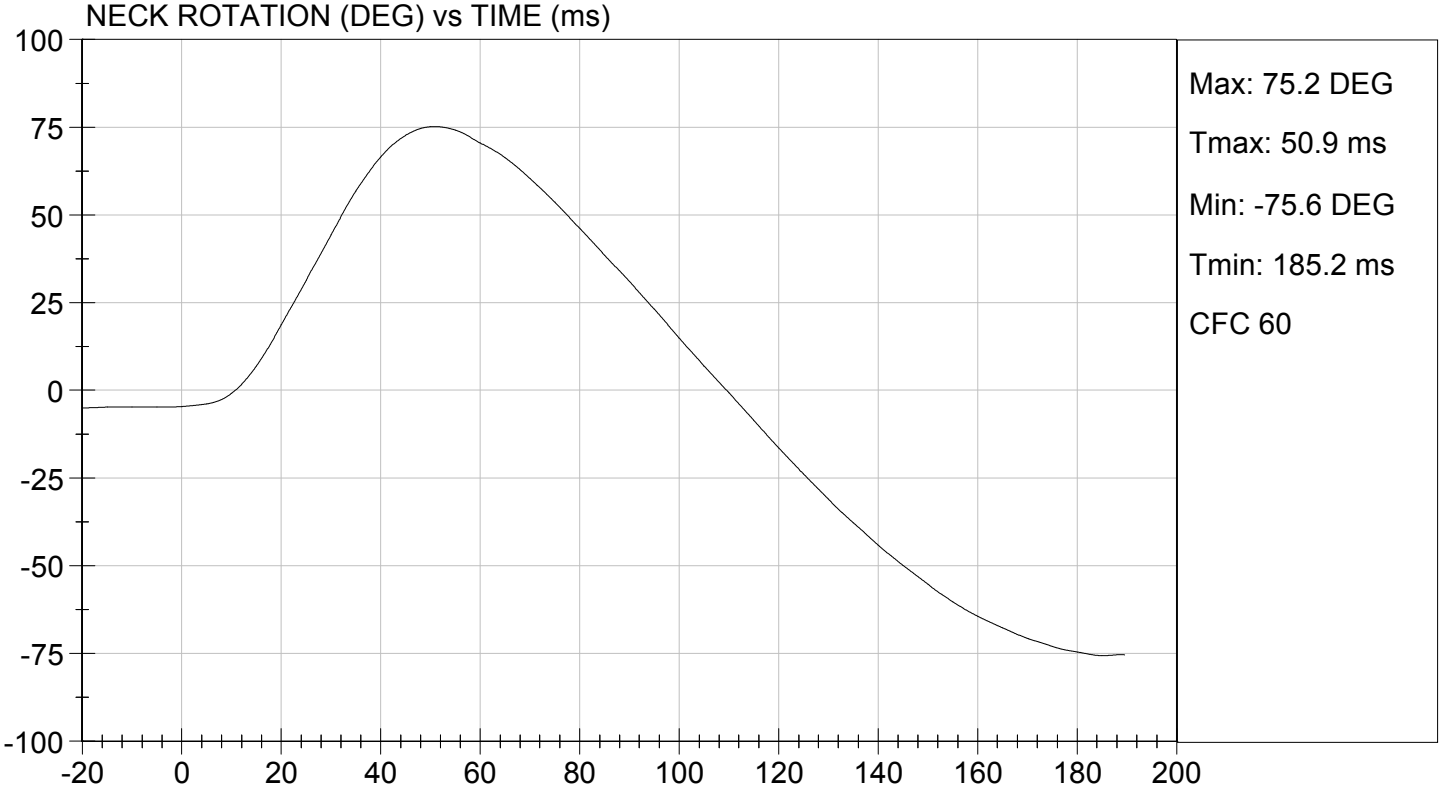
TEST DESC: NECK FLEXION
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 10/22/2015
TEST #: D153382

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

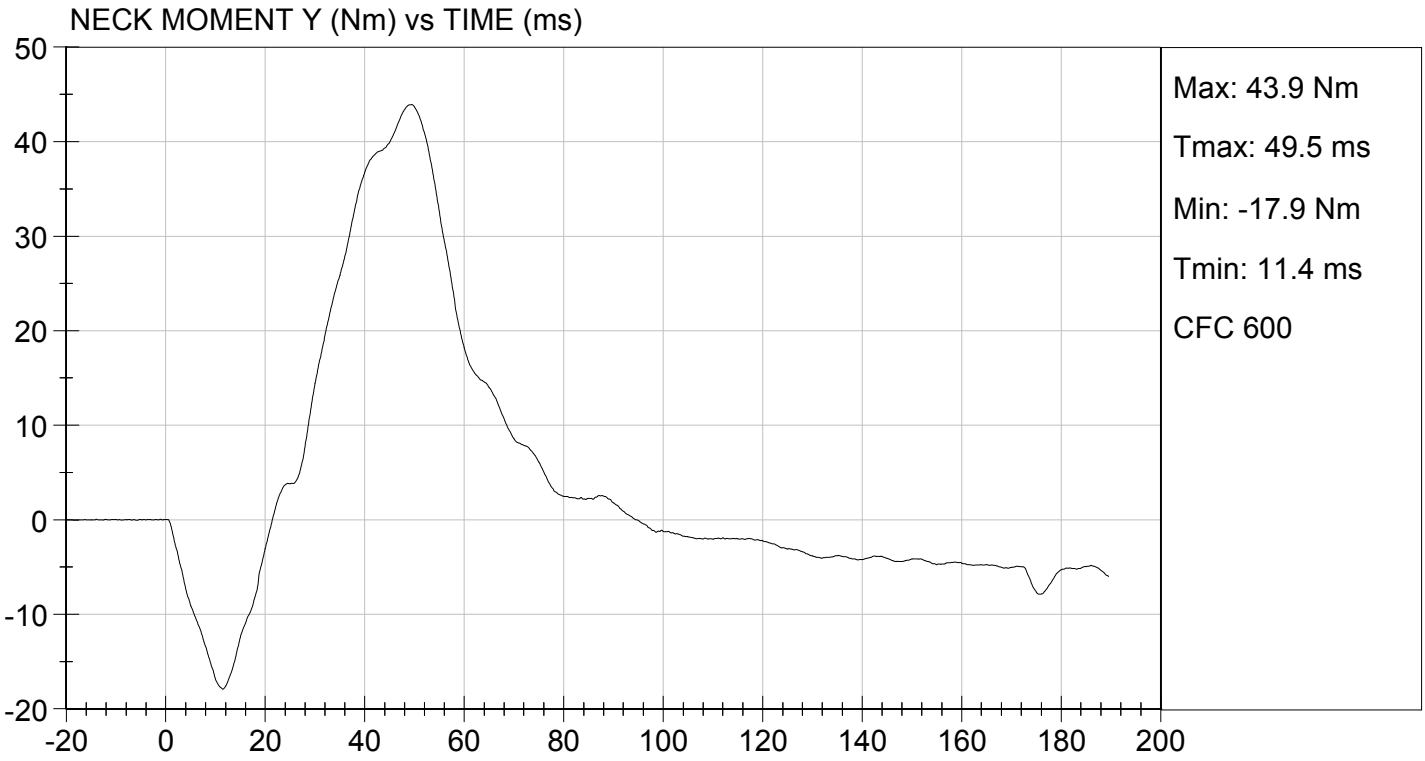


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK FLEXION
VELOCITY: 18.12 ft/s, 5.52 m/s

TEST DATE: 10/22/2015
TEST #: D153382



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

Dummy Serial Number: 031 Test Date: 10/22/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last neck test. (572.146(p))
X N/A, this is the first neck test performed

X 2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))

X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))

Record the maximum temperature	21.7°C
Record the minimum temperature	21.4°C
Record the maximum humidity	44%
Record the minimum humidity	43%

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

Record findings and actions: No damage

X 5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))

X 6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))

X 7. The test fixture pendulum conforms to the specifications in Figure 8D.

X 8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

X 9. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

X 10. Plane D is perpendicular ± 1 degree to the centerline of the pendulum.

X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(2)(iii))

X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 3.55 m/s to 3.75 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))

X 13. Complete the following table:

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

Parameter		Specification	Result
Pendulum impact speed		3.55 m/s ≤ speed ≤ 3.75 m/s	3.68 m/s
Pendulum ΔV with respect to impact speed	@ 6 ms	1.0 m/s ≤ ΔV ≤ 1.4 m/s	1.3 m/s
	@ 10 ms	1.9 m/s ≤ ΔV ≤ 2.5 m/s	2.3 m/s
	@ 14 ms	2.8 m/s ≤ ΔV ≤ 3.5 m/s	3.1 m/s
Plane D Rotation		Peak moment* -53.3 Nm ≤ moment ≤ -43.7 Nm during the following rotation range 83 ≤ angle ≤ 93	-45.9 Nm @ 89 degrees
Negative Moment Decay** (Extension)		Time to decay to -10 Nm 60 ms ≤ time ≤ 80 ms	70 ms

*The moment is a direct reading from the load cell
**Time zero is defined as the time of initial contact between the pendulum striker plate and the honeycomb material. (572.143(c)(4)(iii))

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

Jack Coleman
Signature

10/22/2015
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153383

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.68	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.3	Pass
	10 ms	m/s	1.9 to 2.5	2.3	Pass
	14 ms	m/s	2.8 to 3.5	3.1	Pass
D Plane Rotation		deg	83 to 93	89	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-45.9	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	70.0	Pass
			Overall Test Results		Pass

Jack Coleman
Laboratory Technician

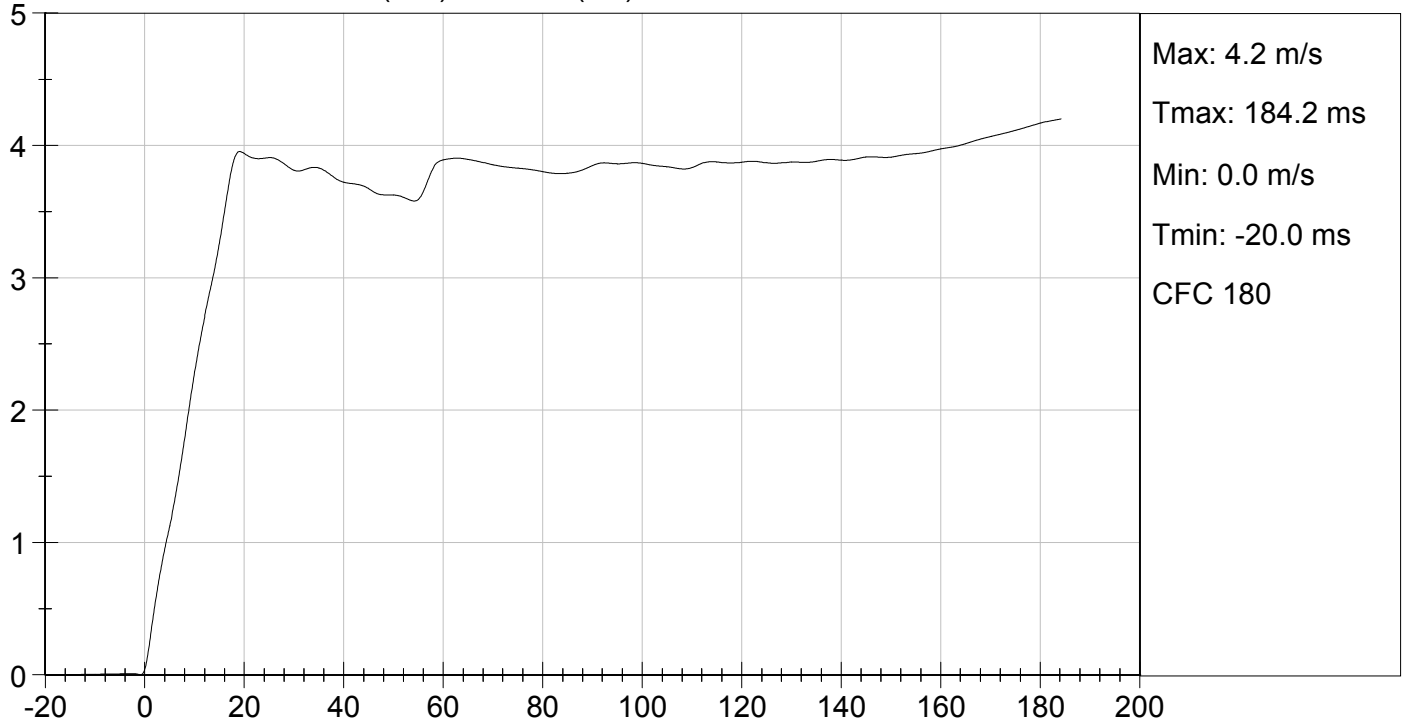
10/22/2015
Test Date

Jeff Leonardelli
Approved By

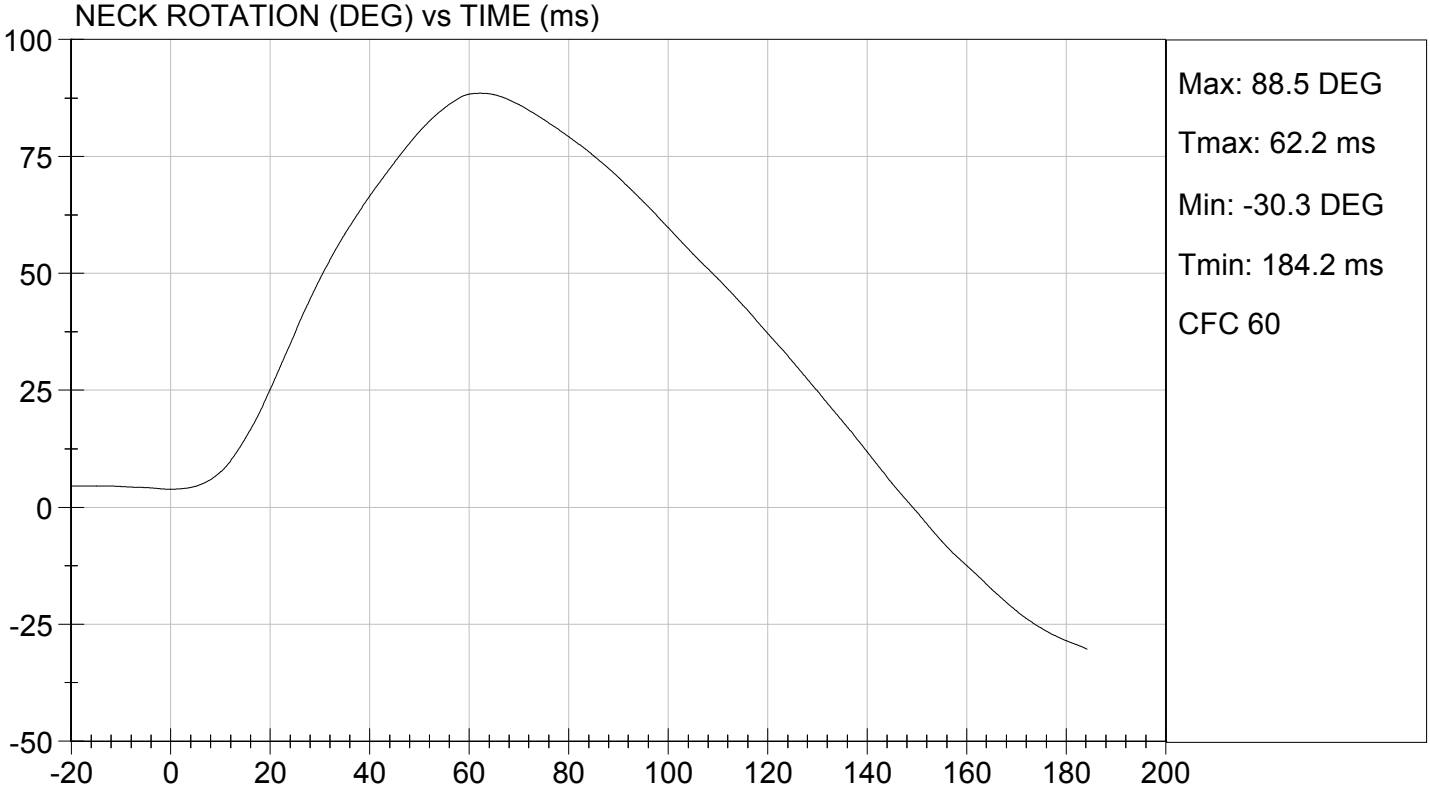
TEST DESC: NECK EXTENSION
VELOCITY: 12.08 ft/s, 3.68 m/s

TEST DATE: 10/22/2015
TEST #: D153383

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

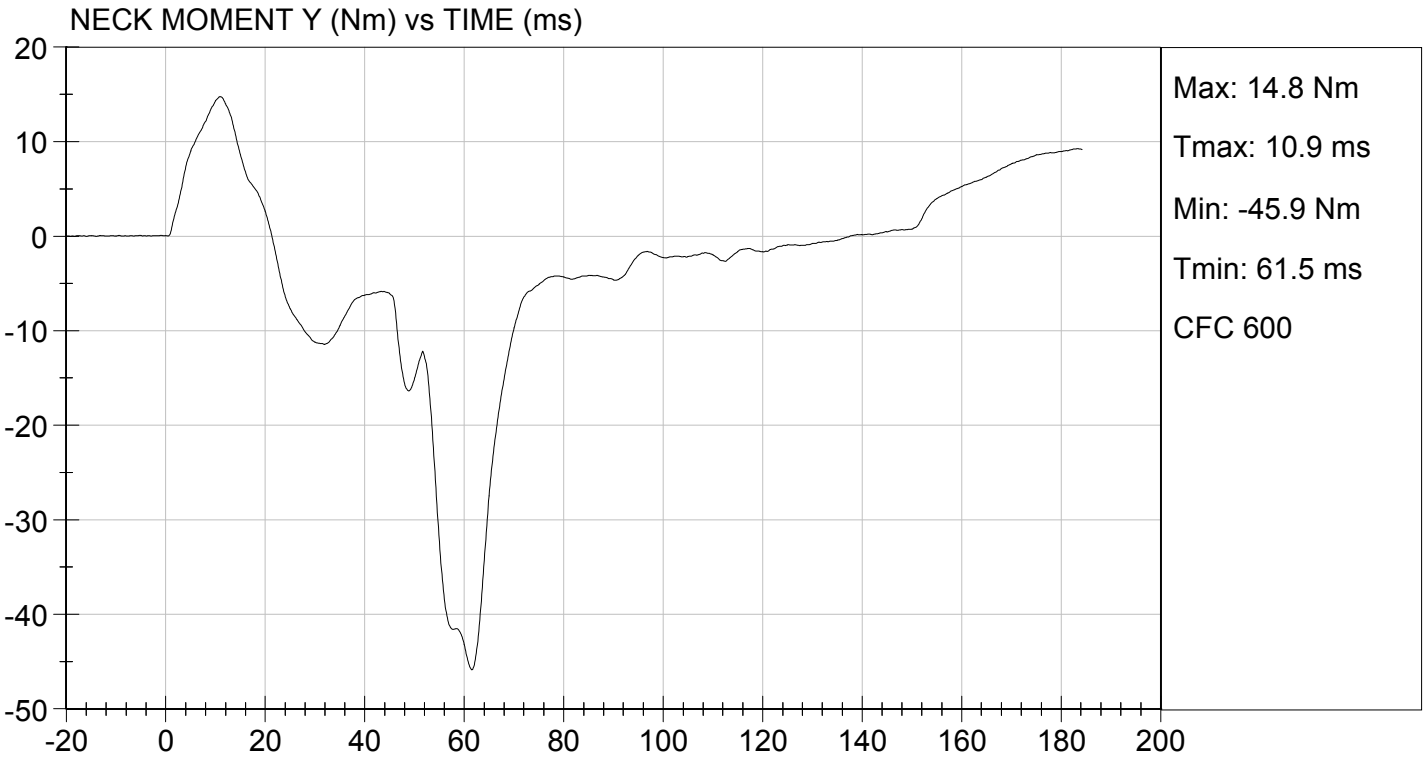


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 12.08 ft/s, 3.68 m/s

TEST DATE: 10/22/2015
TEST #: D153383



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

Dummy Serial Number: 031 Test Date: 10/22/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))
X N/A, ONLY one thorax impact test performed

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

X 3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))

X 4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))

Record the maximum temperature	21.7°C
Record the minimum temperature	21.4°C
Record the maximum humidity	44%
Record the minimum humidity	43%

X 5. Remove the arms.

X 6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.

X - No damage

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

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

X 7. Seat the dummy, without back and arm supports on the test fixture surface as shown in Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))

X 8. Level the middle rib both longitudinally and laterally ± 0.5°. (572.144(c)(3))

X 9. The midsagittal plane of the dummy is vertical within ± 1°. (572.144(c)(3))

X 10. The longitudinal centerline of the test probe is centered within ± 2.5 mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within ± 2.5 mm within ± 0.5° of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))

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

X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.

X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))

X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).

X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within 2° of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	5.9 m/s ≤ speed ≤ 6.1 m/s	6.1 m/s
Chest Compression	32 mm ≤ compression ≤ 38 mm	34 mm
Peak force** between 32 and 38 mm chest compression	680 N ≤ peak force ≤ 810 N	790 N
Peak force** between 12.5 and 32.0 mm chest compression	Peak force ≤ 910 N	790 N
Internal Hysteresis***	65% ≤ 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 (572.144(b)(3))
***Area under loading curve minus the area under the unloading curve divided by the area under the loading curve. (Figure 12D)

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

Jack Coleman — Signature

10/22/2015 — Date

MGA RESEARCH CORPORATION

THORAX IMPACT TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153384

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	44	Pass
Probe Velocity	m/s	5.9 to 6.1	6.1	Pass
Peak Deflection	mm	32 to 38	34	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	790	Pass
Internal Hysteresis	%	65 to 85	69	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	790	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

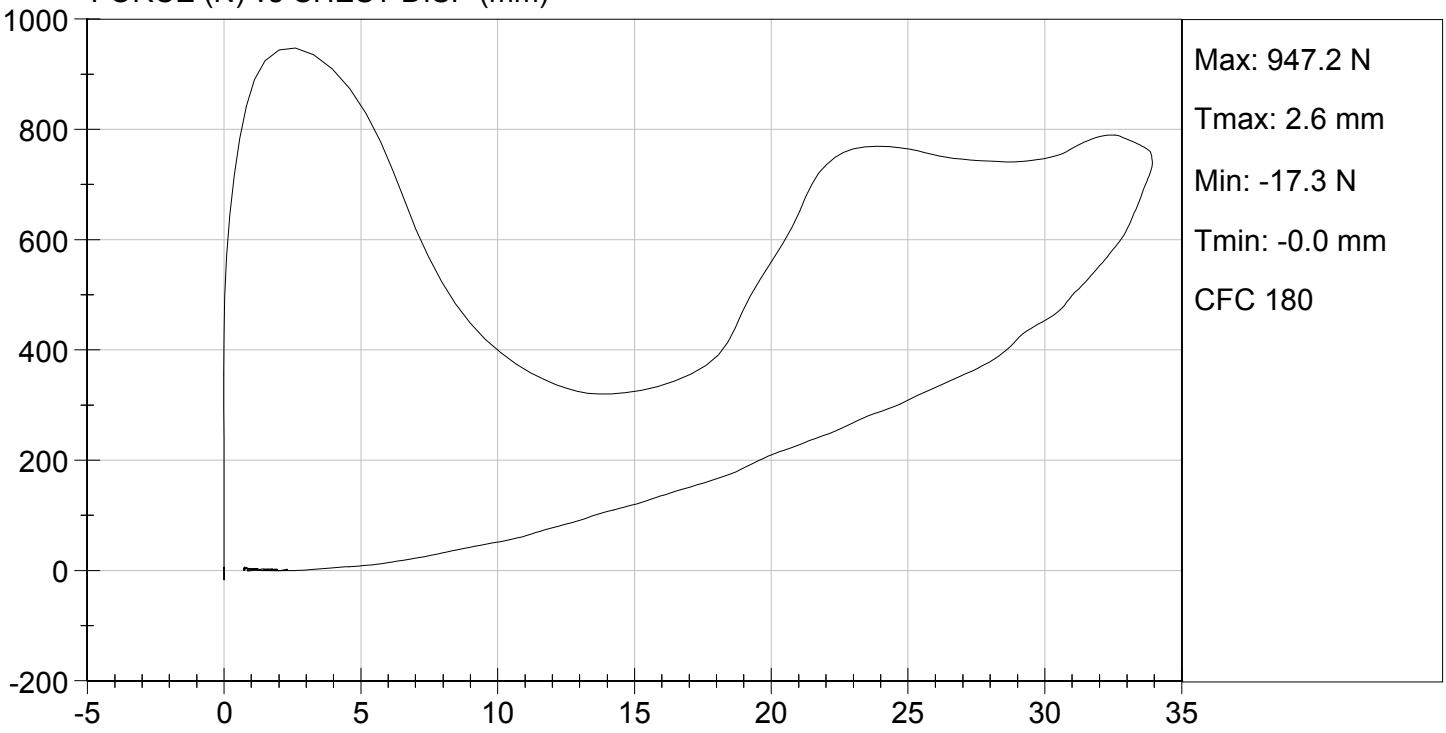
10/22/2015
Test Date

Jeff Leonardelli
Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 10/22/2015
TEST #: D153384

FORCE (N) vs CHEST DISP (mm)



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

Dummy Serial Number: 031 Test Date: 10/22/2015

Technician: Jack Coleman

____ Pre test calibration
X Post test calibration verification

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

X 1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))
X N/A, ONLY torso flexion test performed

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

X 3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).
X with legs below the femurs.
____ without legs below the femurs.

X 4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))

Record the maximum temperature	21.7°C
Record the minimum temperature	21.4°C
Record the maximum humidity	44%
Record the minimum humidity	43%

X 5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))

X 6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within ± 1° and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))

X 7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket**.** (572.145(c)(2)(iv))

X 8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))

X 9. Flex the dummy forward and back 3 times such that the angle of the torso reference plane moves between 0° and 30° ± 2°. The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))

X 10. Remove all externally applied flexion forces and support the dummy such that the torso reference plane is at or near 0°. Wait at least 30 minutes before continuing. (572.135(c)(3)(ii))

X 11. Remove all external support that was implemented in 10 above and wait 2 minutes. (572.145(c)(4))

X 12. Measure the initial orientation angle of the upper torso reference plane of the seated, unsupported dummy. (572.145(c)(4))
Record reference plane angle (max. allowed 15°) See Result Table

X 13. Attach the pull cable and the load cell while maintaining the initial torso orientation. (572.145(c)(5))

X 14. Apply a tension force in the midsagittal plane to the pull cable at any upper torso deflection rate between 0.5° and 1.5° per second, until the torso reference plane reaches 45° ± 0.5° of flexion relative to the vertical transverse plane. (572.145(c)(5))

X 15. Maintain angle reference plane at 45° ± 0.5° of flexion for 10 seconds and record the highest applied force during this period. (572.145(c)(6))

X 16. As quickly as possible release the force applied to the attachment bracket.(572.145(c)(8))

X 17. 3 to 4 minutes after the release of the force, measure the angle reference plane. (572.145(c)(8))

X 18. Complete the following table:

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 15°	11°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.7°/s
Force at 45° ± 0.5°	130 N ≤ force ≤ 180 N	171 N
Final ref. plane angle	Initial ref. plane angle ± 10°	12°

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

Jack Coleman
Signature

10/22/2015
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031 **Test I.D:** D153387

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Initial Angle	deg	0 to 15	11	Pass
Return Angle	deg	-10 to 10	12	Pass
Force at 45 deg	N	130 to 180	171	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
		Overall Test Results		Pass

Jack Coleman
Laboratory Technician

10/22/2015
Test Date

Jeff Leonardelli
Approved By

DATA SHEET D8

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P88702	10/12/2015	04/12/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P88703	10/08/2015	04/08/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P88704	10/12/2015	04/12/2016
NECK TRANSDUCER	Denton	3303	184	05/11/2015	11/11/2015
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P88698	10/12/2015	04/12/2016
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P88700	10/12/2015	04/12/2016
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P88701	10/12/2015	04/12/2016
CHEST POTENTIOMETER	Servo	08C1-3179	031	10/13/2015	04/13/2016
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	07/24/2015	01/24/2016
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P82097	06/16/2015	12/16/2015
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-240	P88169	06/03/2015	12/03/2015
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	18	09/28/2015	03/28/2016
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	29	09/28/2015	03/28/2016

LABORATORY TECHNICIAN: Jessica Hall

DATA SHEET B1
DUMMY DAMAGE CHECKLIST

Dummy Serial Number: 031 Test Date: 10/19 - 10/20/2015

Technician: Jessica Gall

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

X Perform general cleaning.

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

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

Repair or Replacement approved by:

Jessica Hall — 10/21/2015

Signature — Date

Describe the repair or replacement of parts:

Checked by:

Jeff Leonard — 10/21/2015

Signature — Date