REPORT NUMBER: 208-MGA-2022-005

DUMMY PERFORMANCE CALIBRATIONS
FMVSS 208

FORD MOTOR CO.
2022 FORD MUSTANG MACH-E MPV
NHTSA NO.: C20220204

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

TEST DATE: AUGUST 23, 2022

FINAL REPORT DATE: SEPTEMBER 27, 2022

FINAL REPORT

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

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

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

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

Dummy Serial Number: 403 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	45%
Record the minimum humidity:	34%

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

Record findings and actions: No Damage

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

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

Record the actual distance: 0.5 inches

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

X 16. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	245 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	-2.0 g

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

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test ID:** D221311

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	45	Pass
Peak Resultant Acceleration	G's	225 to 275	245	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

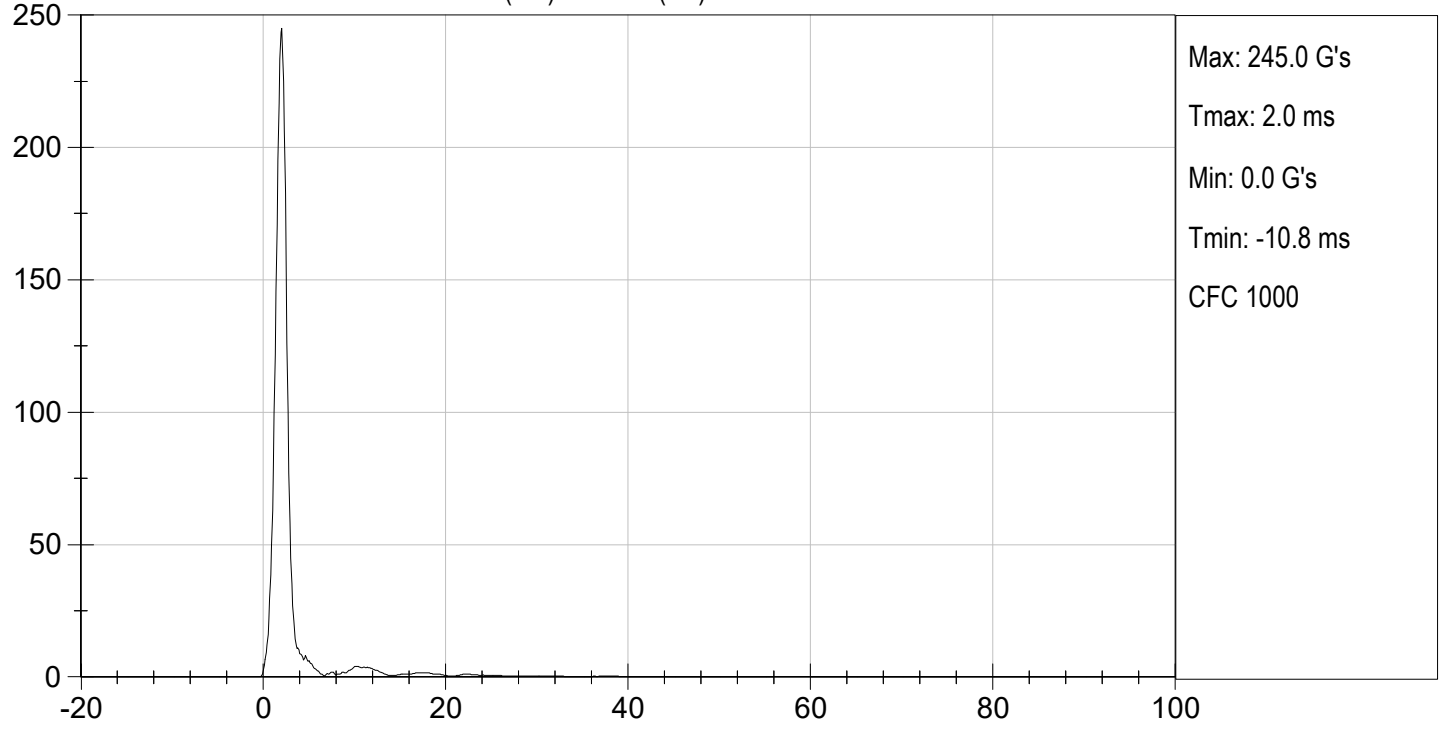
05/26/2022
Test Date

Approved By

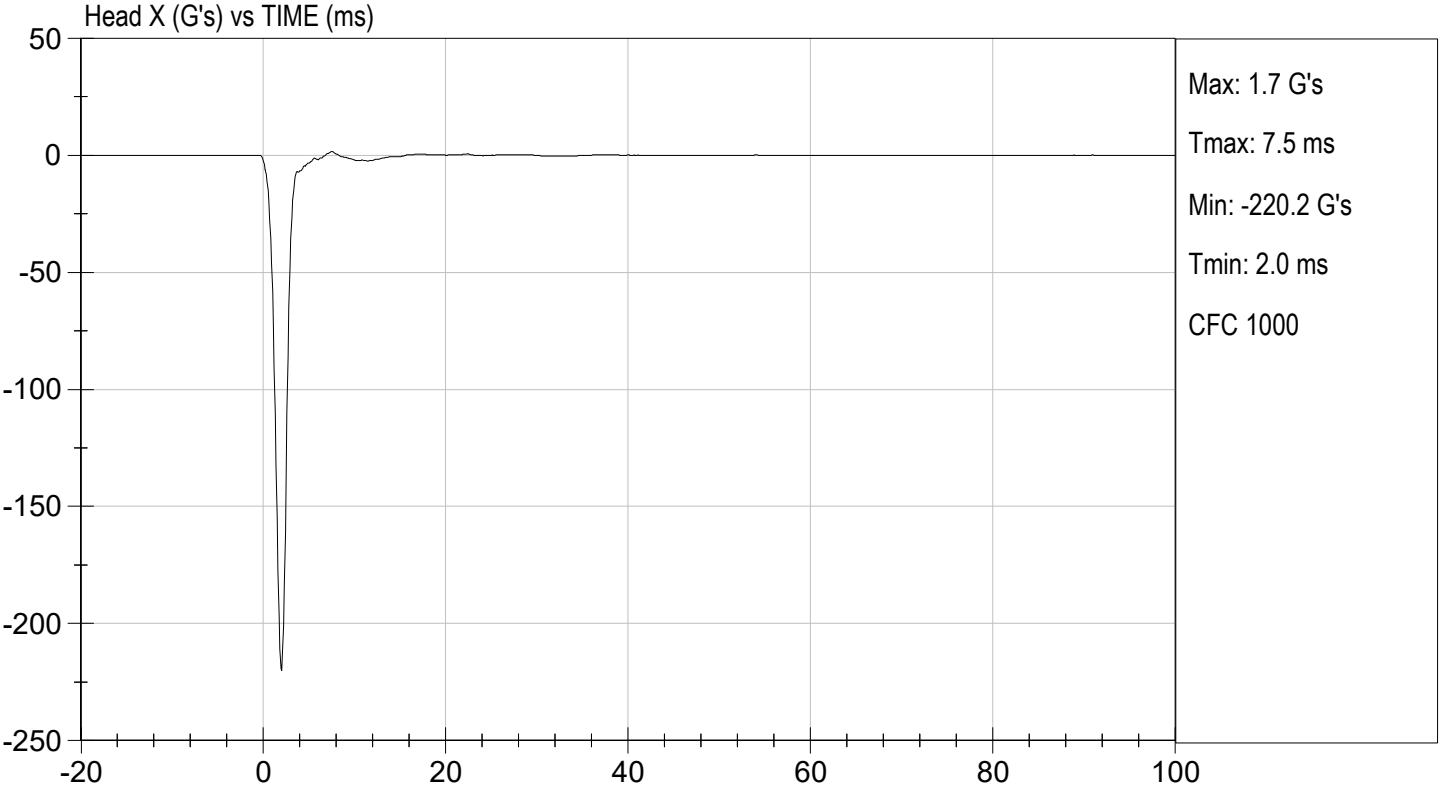
TEST DESC: HEAD DROP

TEST DATE: 05/26/2022
TEST #: D221311

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

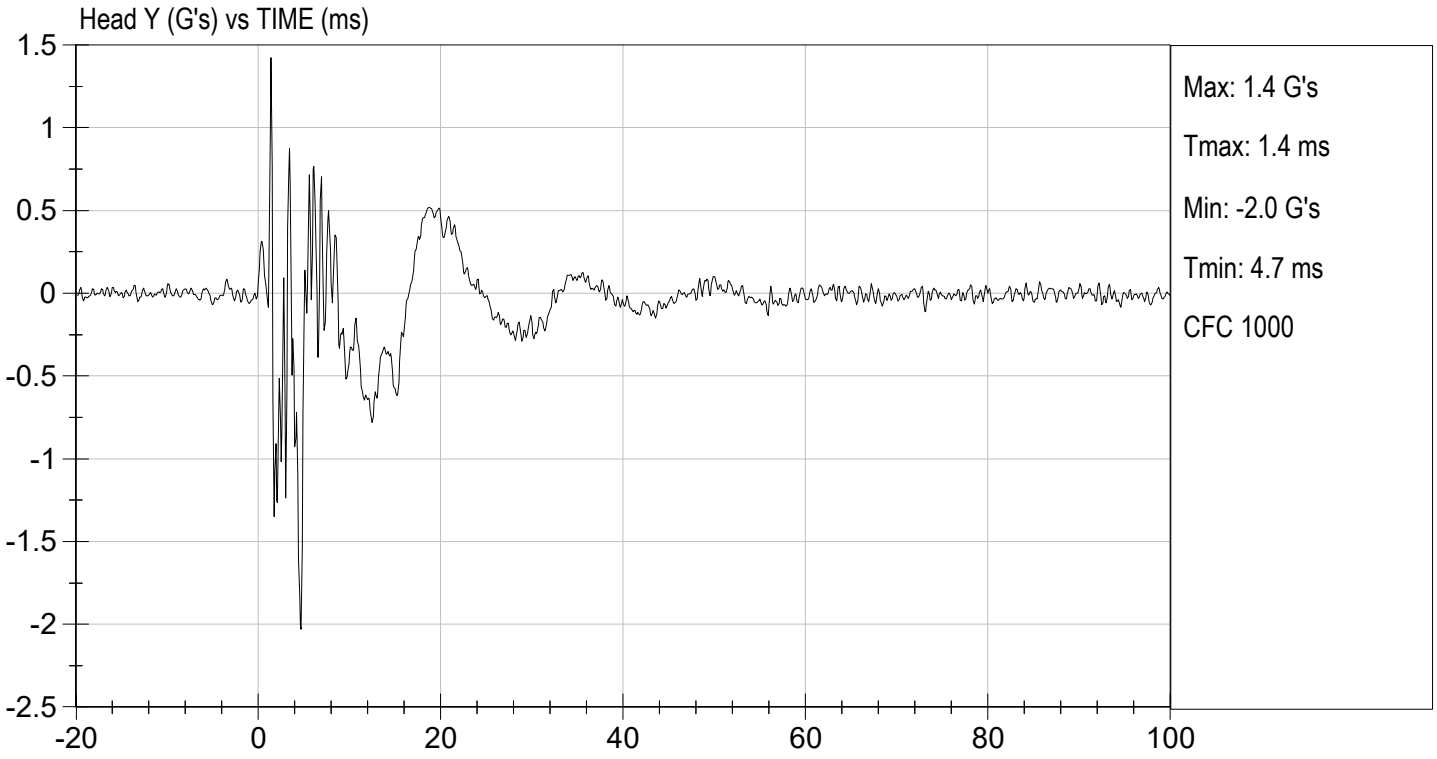


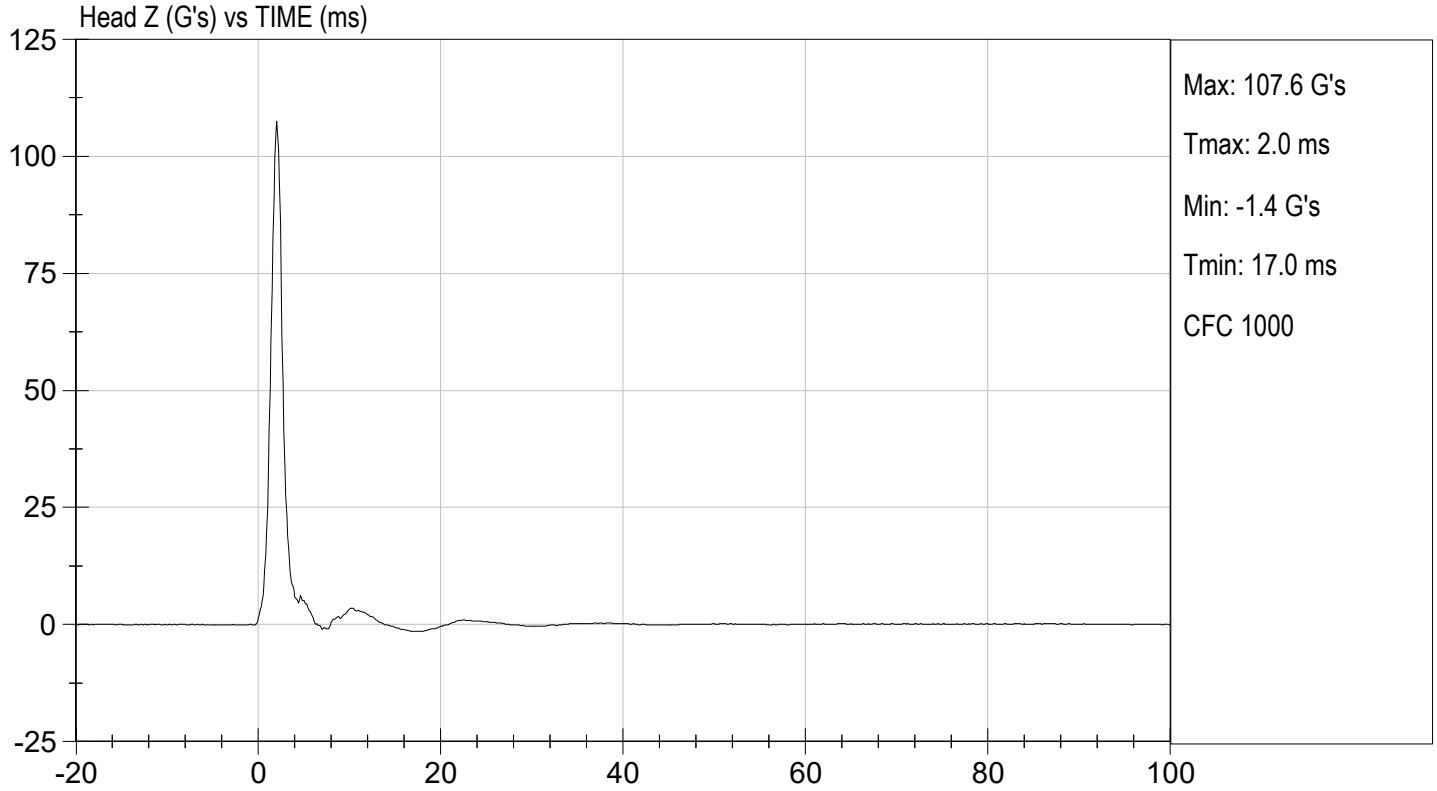
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 05/26/2022
TEST #: D221311





DATA SHEET A4

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 05/26/2022

Technician: Jon Love

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	34%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

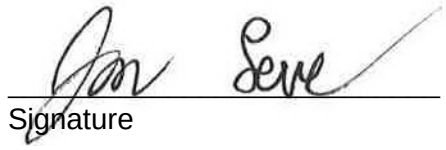
X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	22.83 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	23.36 g
	@ 20 ms	17.6 ≤ g ≤ 22.6	18.92 g
	@ 30 ms	12.5 ≤ g ≤ 18.5	16.72 g
	Above 30 ms	29 g maximum	16.70 g
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	37.6 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	73°
		57 ms ≤ time of max. rotation ≤ 64 ms	59.4 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	120.2 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	66.2 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	50.1 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	98.7 ms

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

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



Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221312

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.36	Pass
	20 ms	G's	17.60 to 22.60	18.92	Pass
	30 ms	G's	12.50 to 18.50	16.72	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	37.6	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	72.8	Pass
	Time	ms	57.0 to 64.0	59.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	120.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	89.7	Pass
	Time	ms	47.0 to 58.0	50.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.7	Pass
			Overall Test Results		Pass

Laboratory Technician

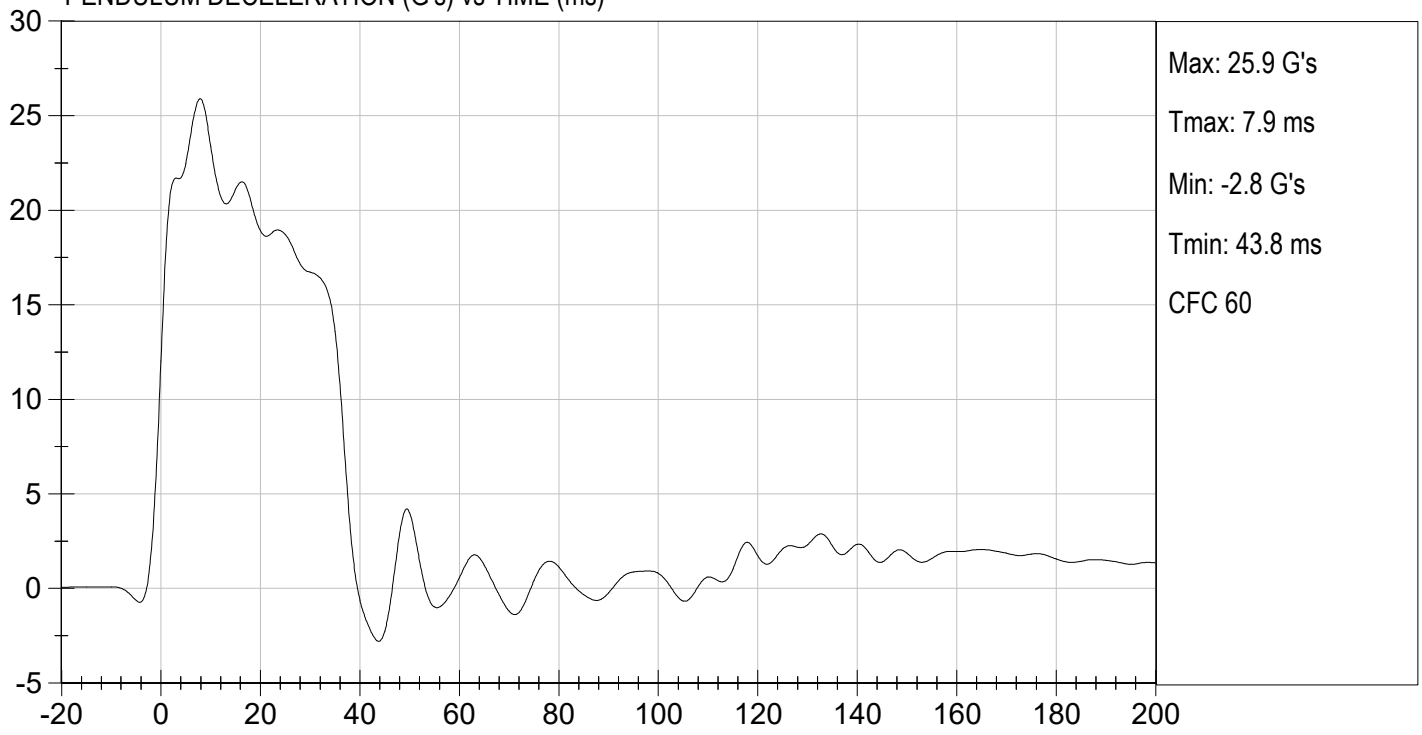
05/26/2022
Test Date

Approved By

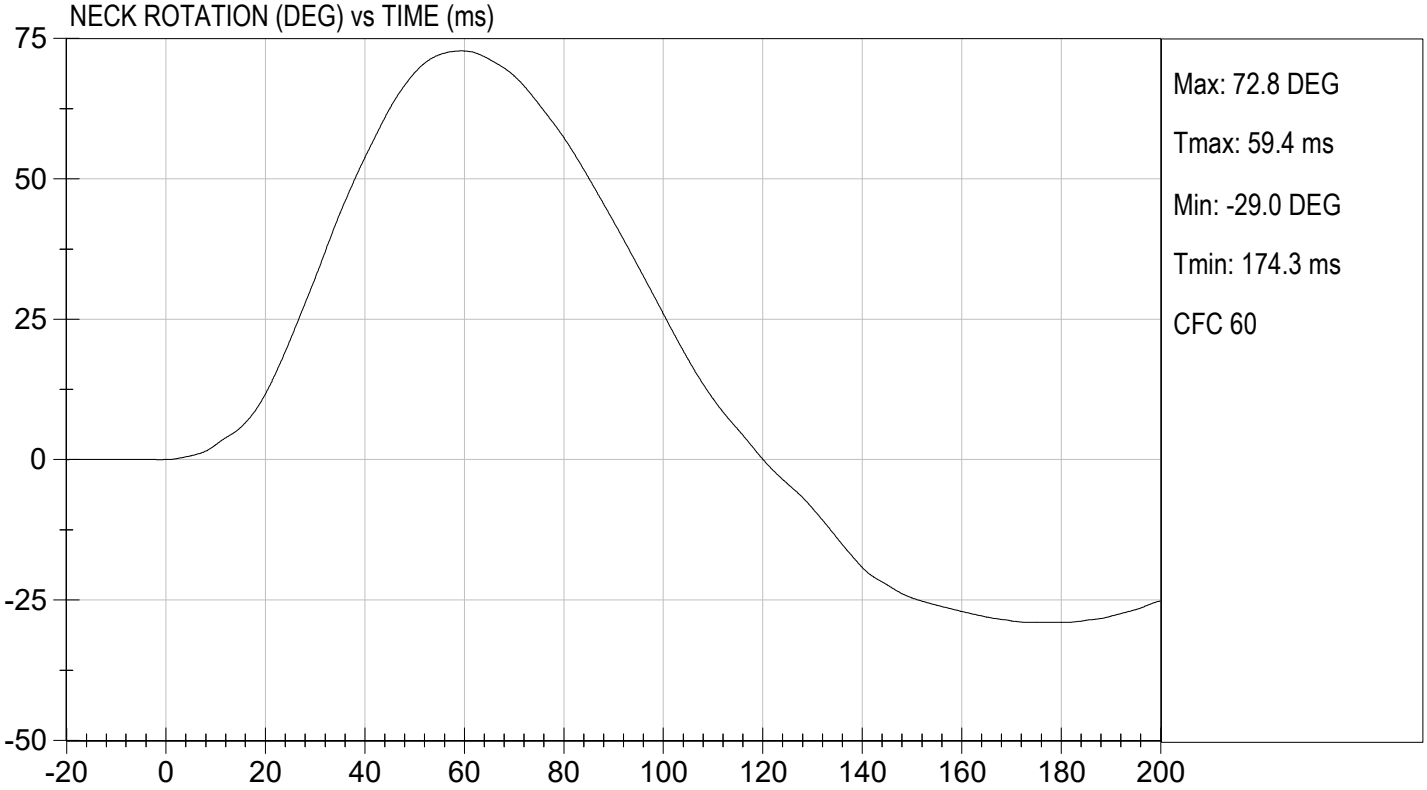
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 05/26/2022
TEST #: D221312

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

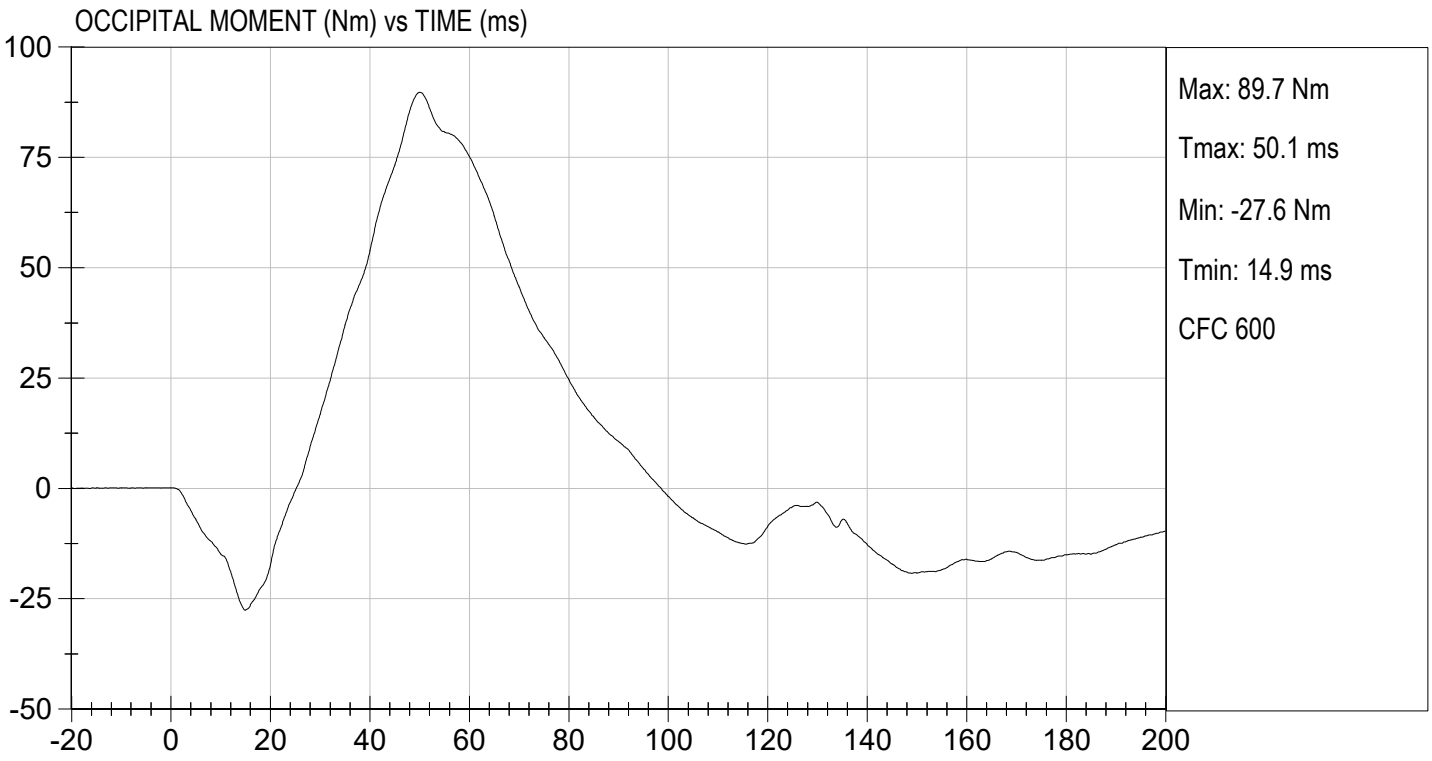


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 05/26/2022
TEST #: D221312



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 05/26/2022

Technician: Jon Love

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	34%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	19.85 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	20.16 g
	@ 20 ms	14 ≤ g ≤ 19	16.15 g
	@ 30 ms	11.0 ≤ g ≤ 16.0	13.33 g
	Above 30 ms	22 g maximum	13.70 g
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	40.9 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	99.8°
		72 ms ≤ time of max. rotation ≤ 82 ms	79.5 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	161.0 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-44.8 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	73.1 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	143.1 ms

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

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

X

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221313

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.16	Pass
	20 ms	G's	14.00 to 19.00	16.15	Pass
	30 ms	G's	11.00 to 16.00	13.33	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.7	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.9	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	99.8	Pass
	Time	ms	72.0 to 82.0	79.5	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	161.0	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.8	Pass
	Time	ms	65.0 to 79.0	73.1	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	143.1	Pass
			Overall Test Results		Pass

Laboratory Technician

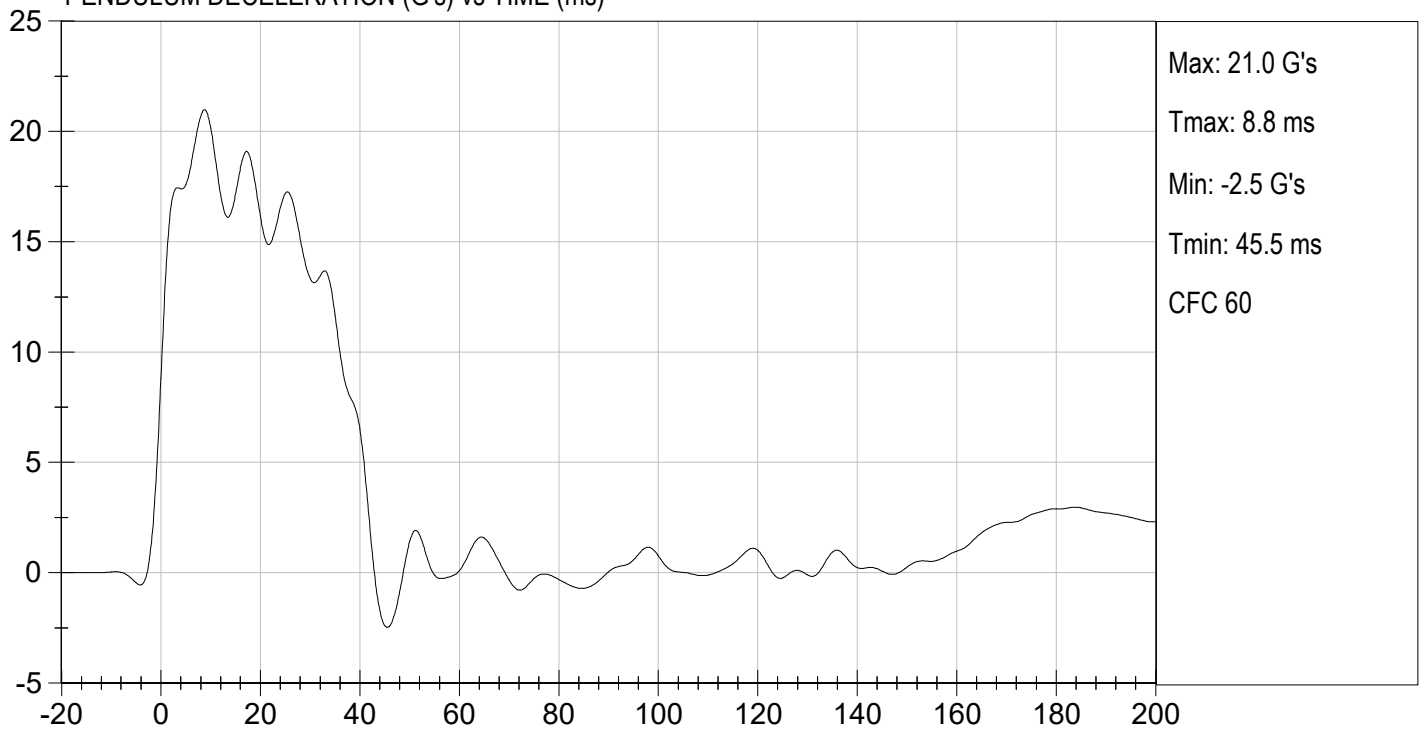
05/26/2022
Test Date

Approved By

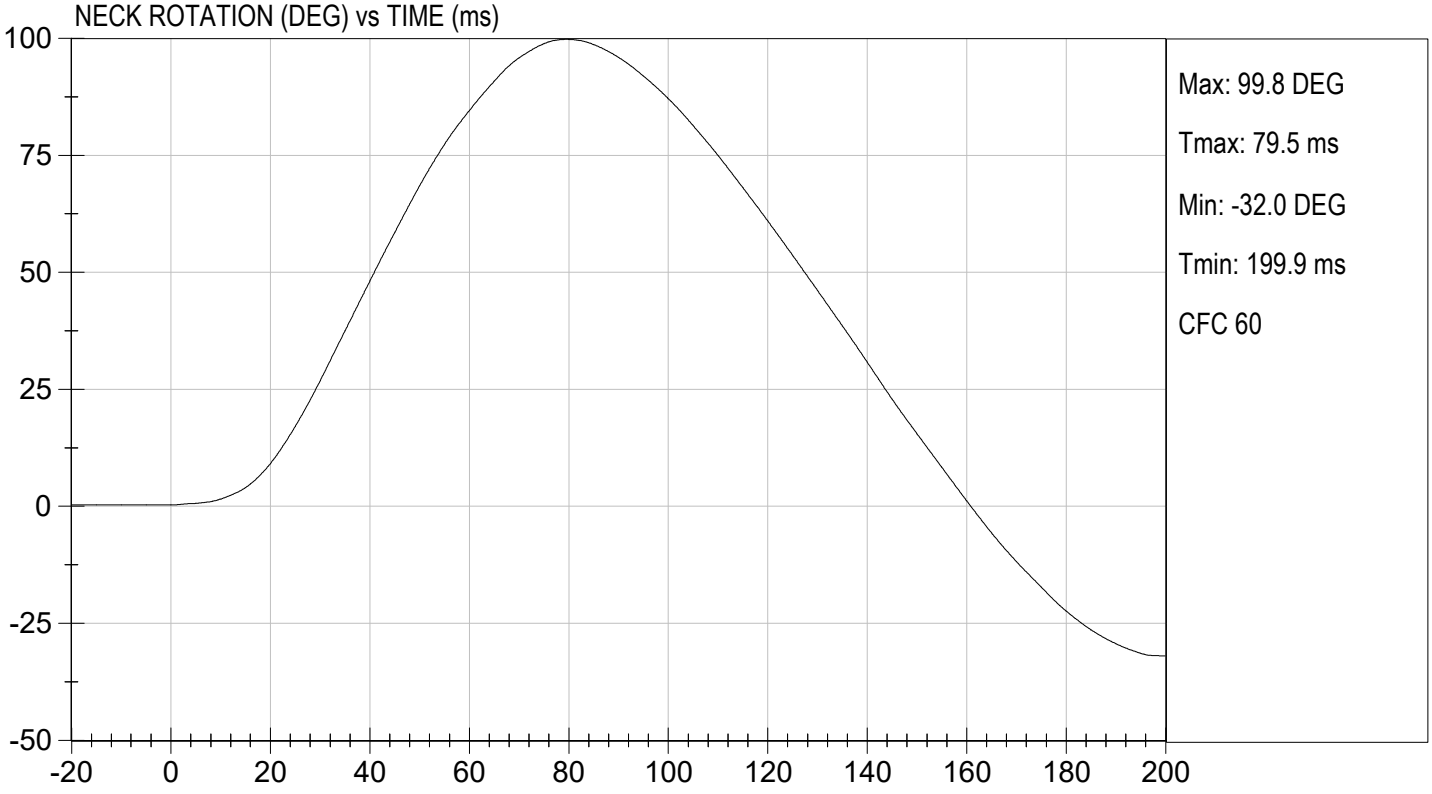
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 05/26/2022
TEST #: D221313

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

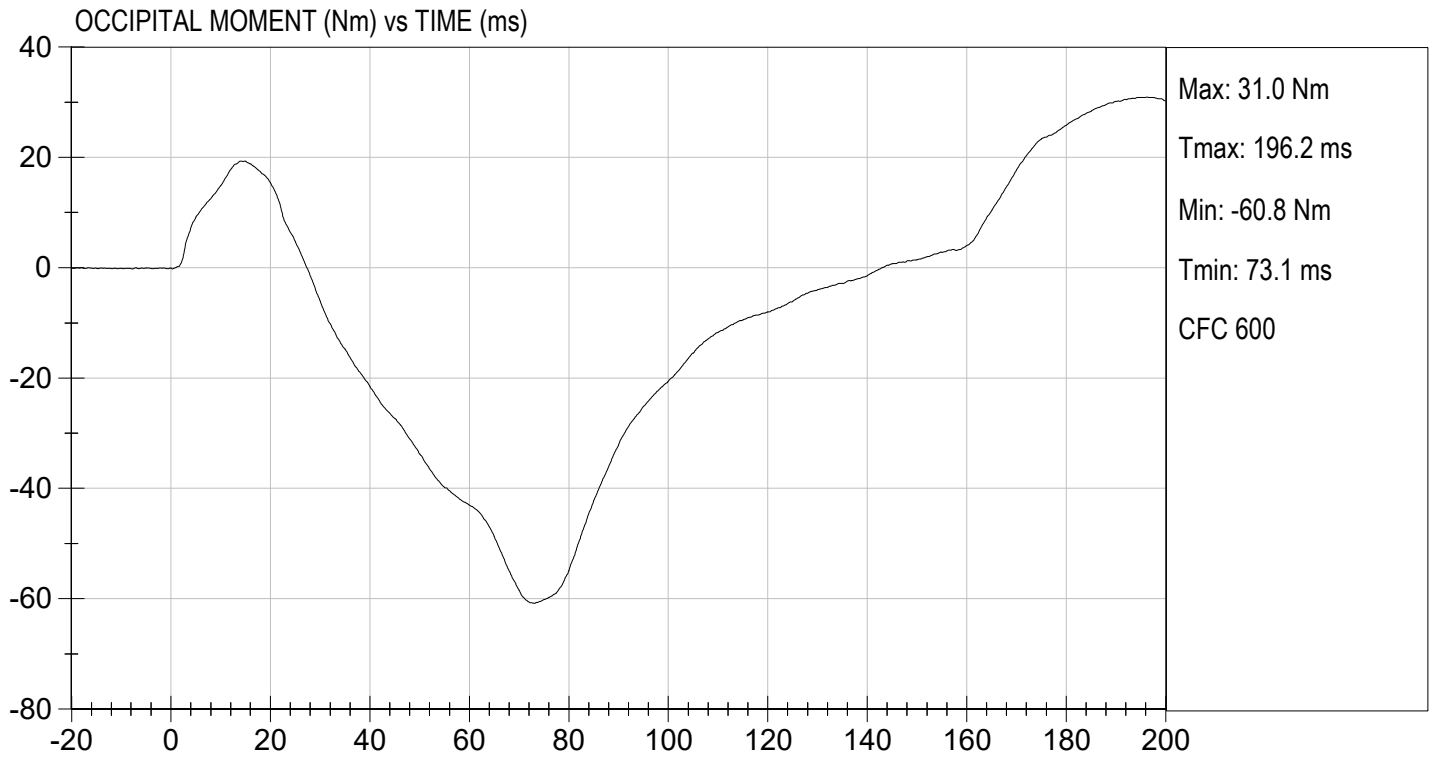


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 05/26/2022
TEST #: D221313



DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403 Test Date: 05/25/2022

Technician: Jon Love

X Pre test calibration

___ Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	43%
Record the minimum humidity:	32%

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

X - No Damage

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

___

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

___

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

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

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

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

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

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

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

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

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

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

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.92 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.56 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1275 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	71 %

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

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

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

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

Signature

05/25/2022
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221314

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,670	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.50	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

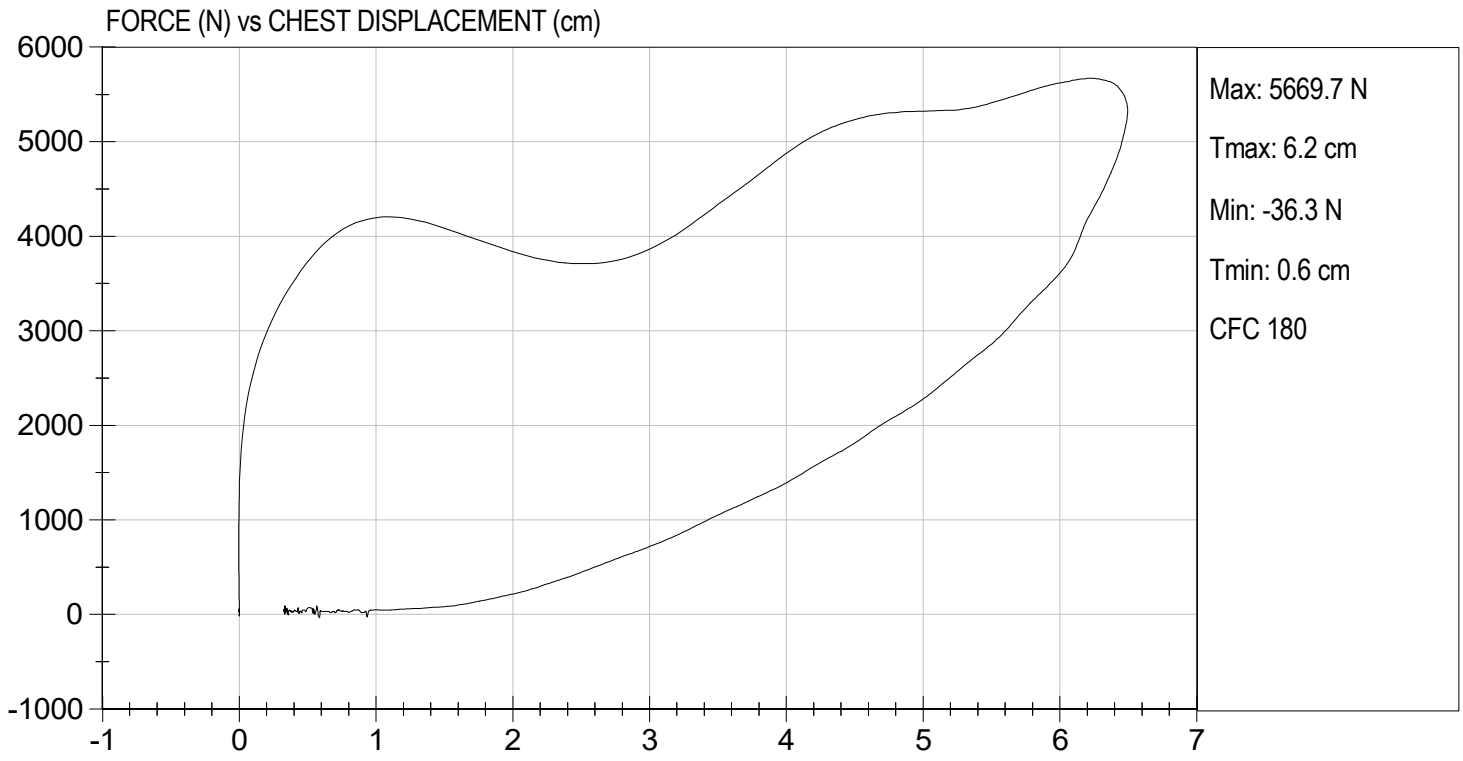
Laboratory Technician

05/25/2022
Test Date

Approved By

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

TEST DATE: 05/25/2022
TEST #: D221314



DATA SHEET A7

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

Dummy Serial Number: 403 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	35%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.86 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1110 lb

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

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

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221316

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	46	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	4,938	Pass
		Overall Test Results		Pass

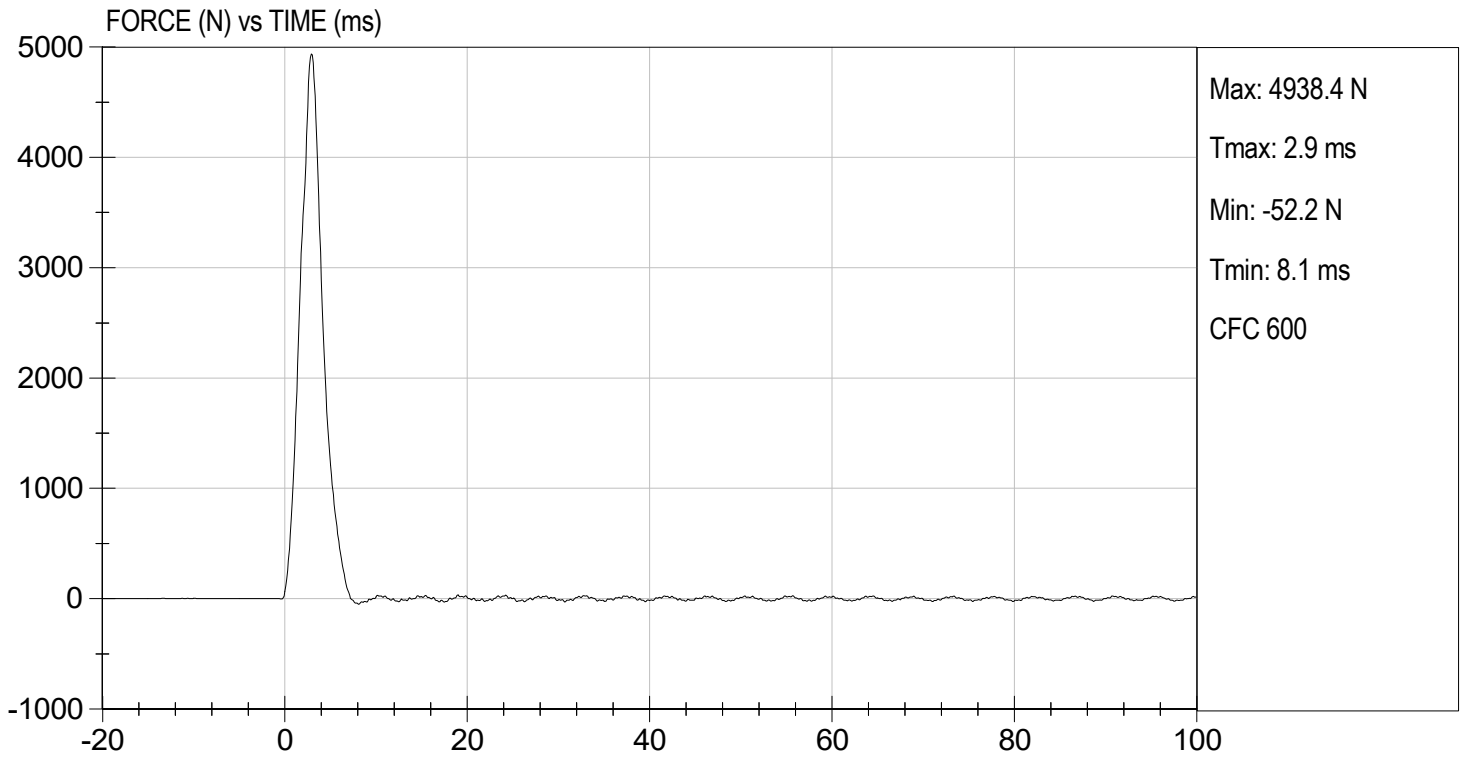
Laboratory Technician

05/26/2022
Test Date

Approved By

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

TEST DATE: 05/26/2022
TEST #: D221316



DATA SHEET A8

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

Dummy Serial Number: 403 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	35%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.89 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1140 lb

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

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

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221315

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	46	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,071	Pass
		Overall Test Results		Pass

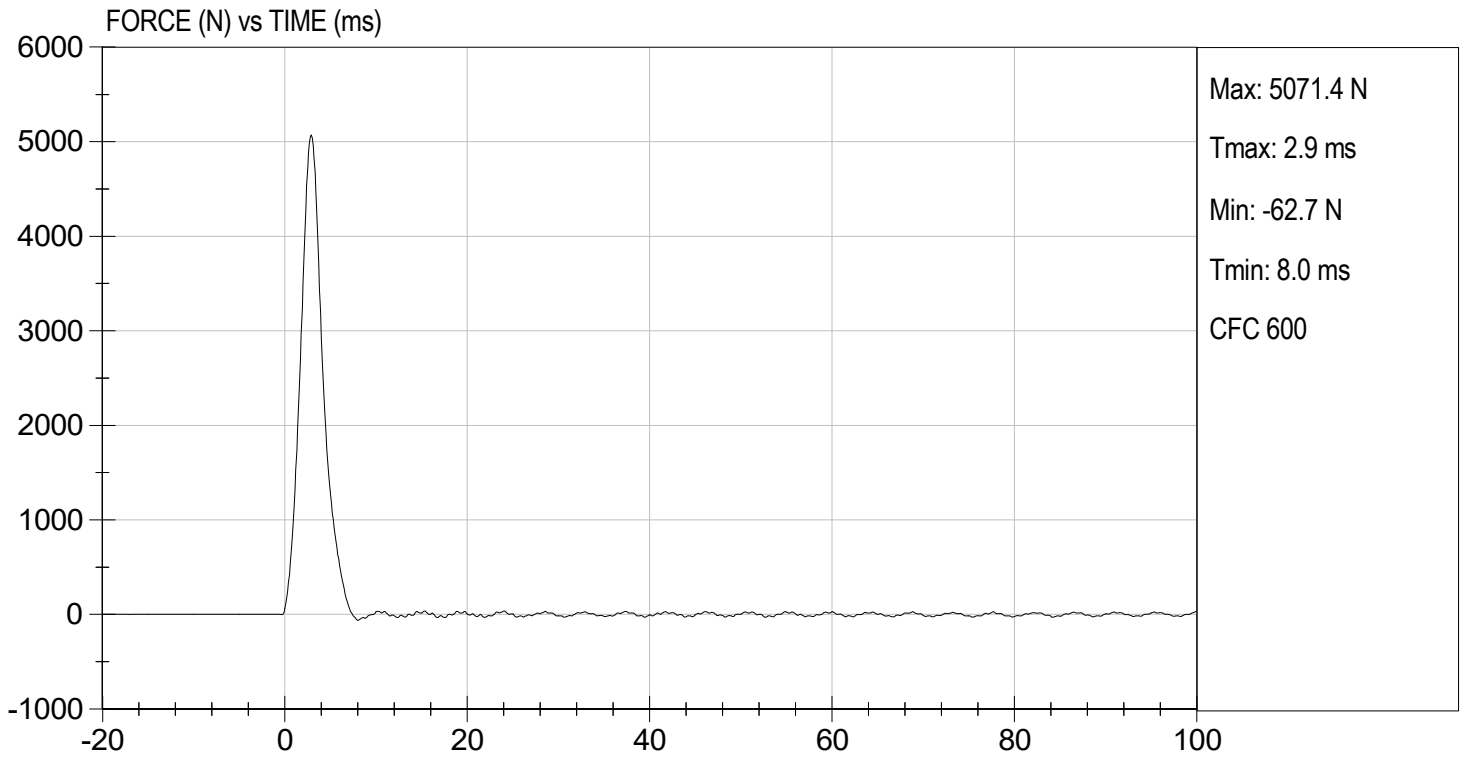
Laboratory Technician

05/26/2022
Test Date

Approved By

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

TEST DATE: 05/26/2022
TEST #: D221315



DATA SHEET A9

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

Dummy Serial Number: 403 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration

____ Post test calibration verification

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

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

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

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

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

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

X 3.2 remove the abdominal insert (78051-52)

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	45%
Record the minimum humidity:	34%

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

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

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

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

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	68.4 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	44°

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

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	66.4 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	43°

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221310

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	45	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	90.0	92.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	43.3	44.4	Pass
		Overall Test Results			Pass

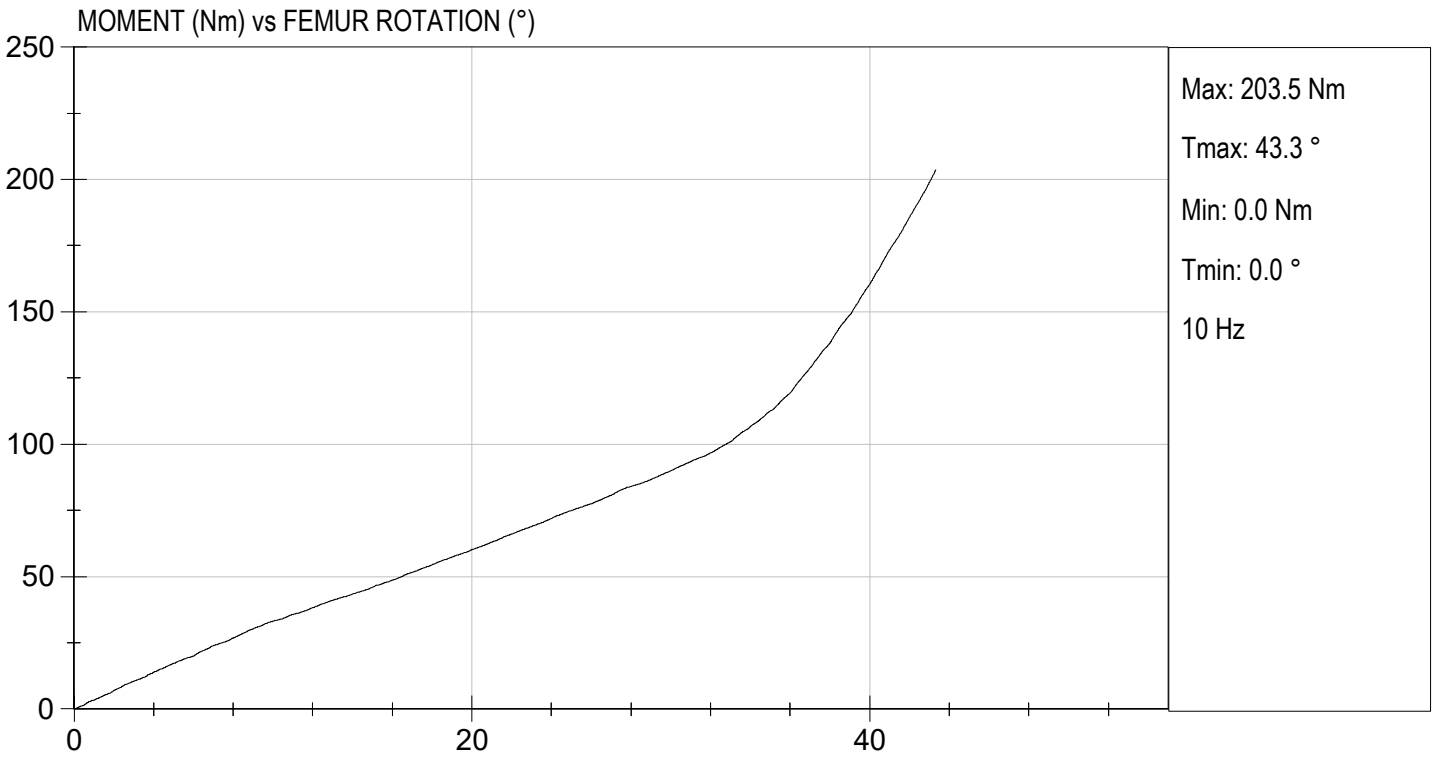
Laboratory Technician

05/26/2022
Test Date

Approved By

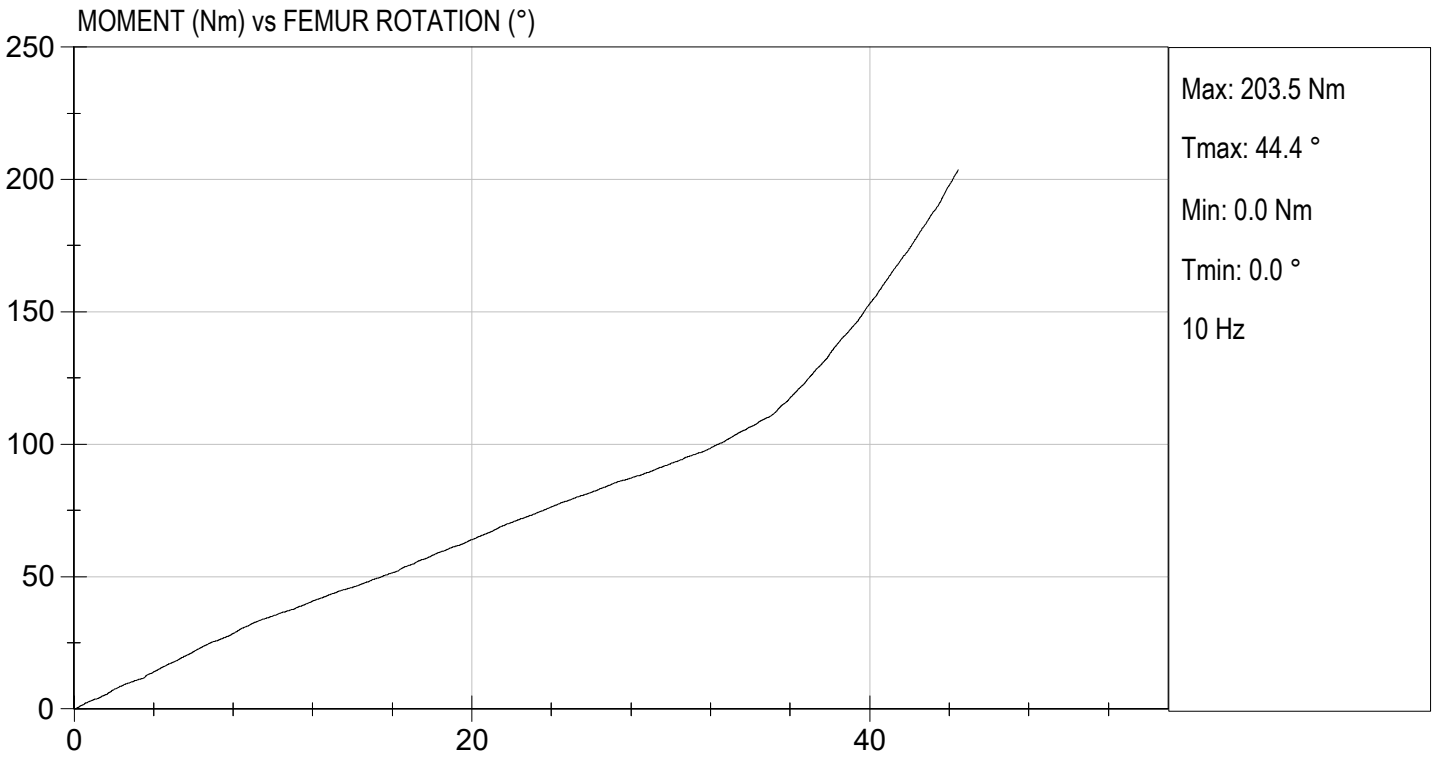
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 05/26/2022
TEST #: D221319



TEST DESC: LEFT HIP FEMUR FLEXION

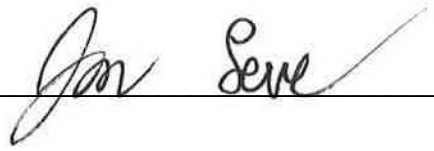
TEST DATE: 05/26/2022
TEST #: D221310



DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH90	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	AH5J3	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	C12885	04/05/2022	10/05/2022
NECK TRANSDUCER	Denton	1716A	N7489	05/09/2022	11/08/2022
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH74	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	AH5D9	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	AH5L1	04/05/2022	10/05/2022
CHEST POTENTIOMETER	Humanetics	78051-317	403	04/04/2022	10/04/2022
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Humanetics	221AJN2	F3137	04/04/2022	10/04/2022
(2) LEFT FEMUR	Humanetics	221AJN2	F3138	04/04/2022	10/04/2022
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	01/13/2022	07/15/2022
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	11/17/2021	05/19/2022
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	12/7/2021	06/08/2022
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	C3035	03/02/2022	09/01/2022
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	C3034	03/02/2022	09/01/2022

LABORATORY TECHNICIAN: 

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

Dummy Serial Number: 403 Test Date: 08/24/2022

Technician: Jonah Pulokas

____ Pre test calibration
_X_ Post test calibration verification

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

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

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

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

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

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

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

Record the maximum temperature:	21.5°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	43%
Record the minimum humidity:	32%

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

Record findings and actions: No Damage

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

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

Record the actual distance: 0.5 inches

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

X 16. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	249 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	4.6 g

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

Signature

08/24/2022
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test ID:** D221961

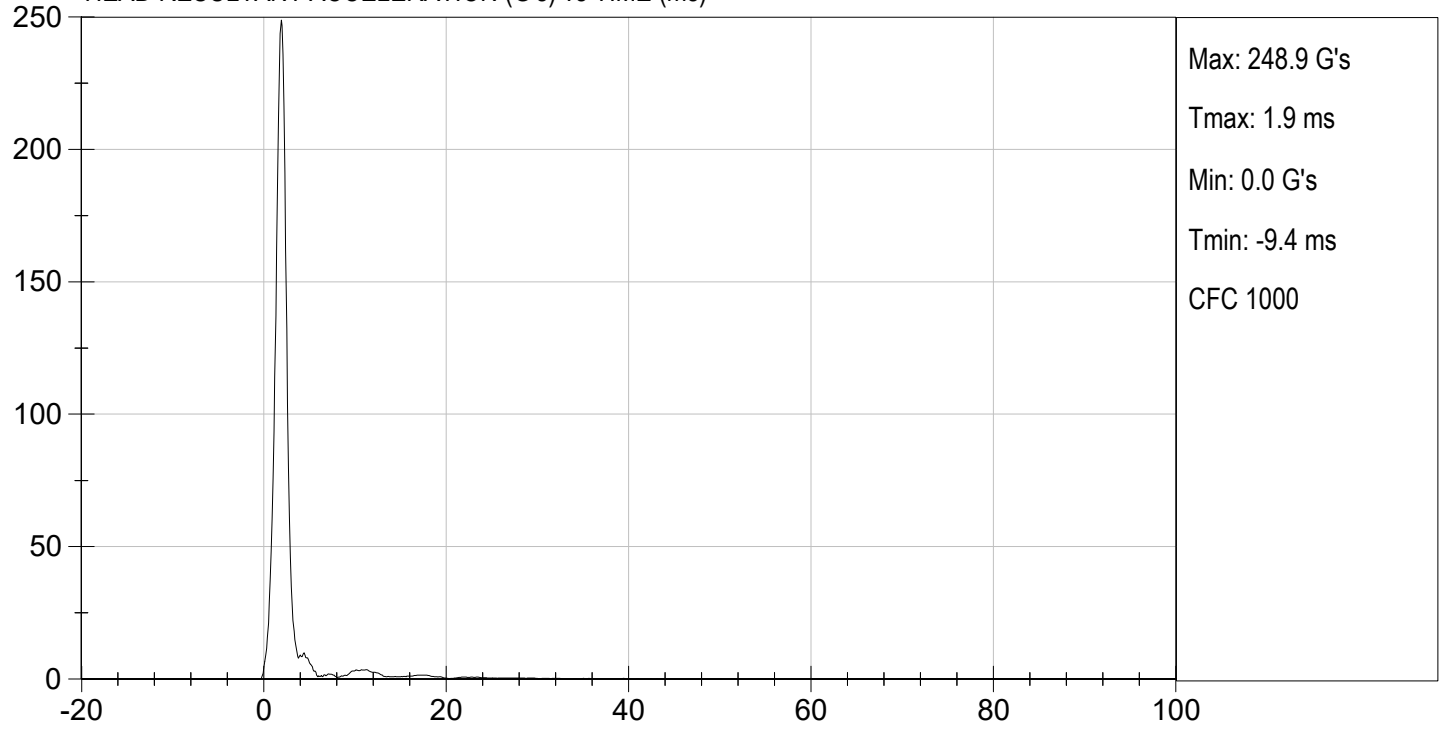
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	225 to 275	249	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	4.6	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

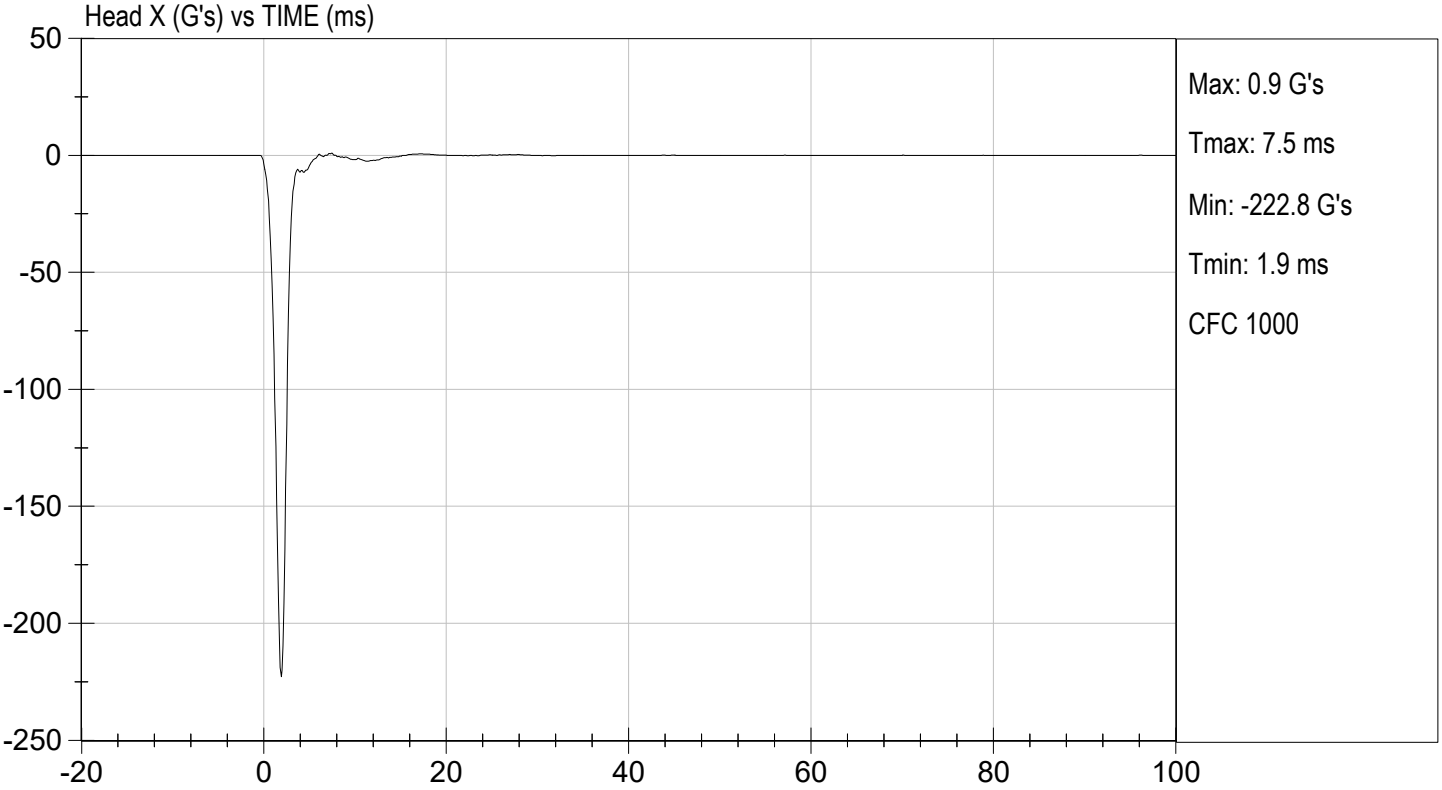
08/24/2022
Test Date

Approved By

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

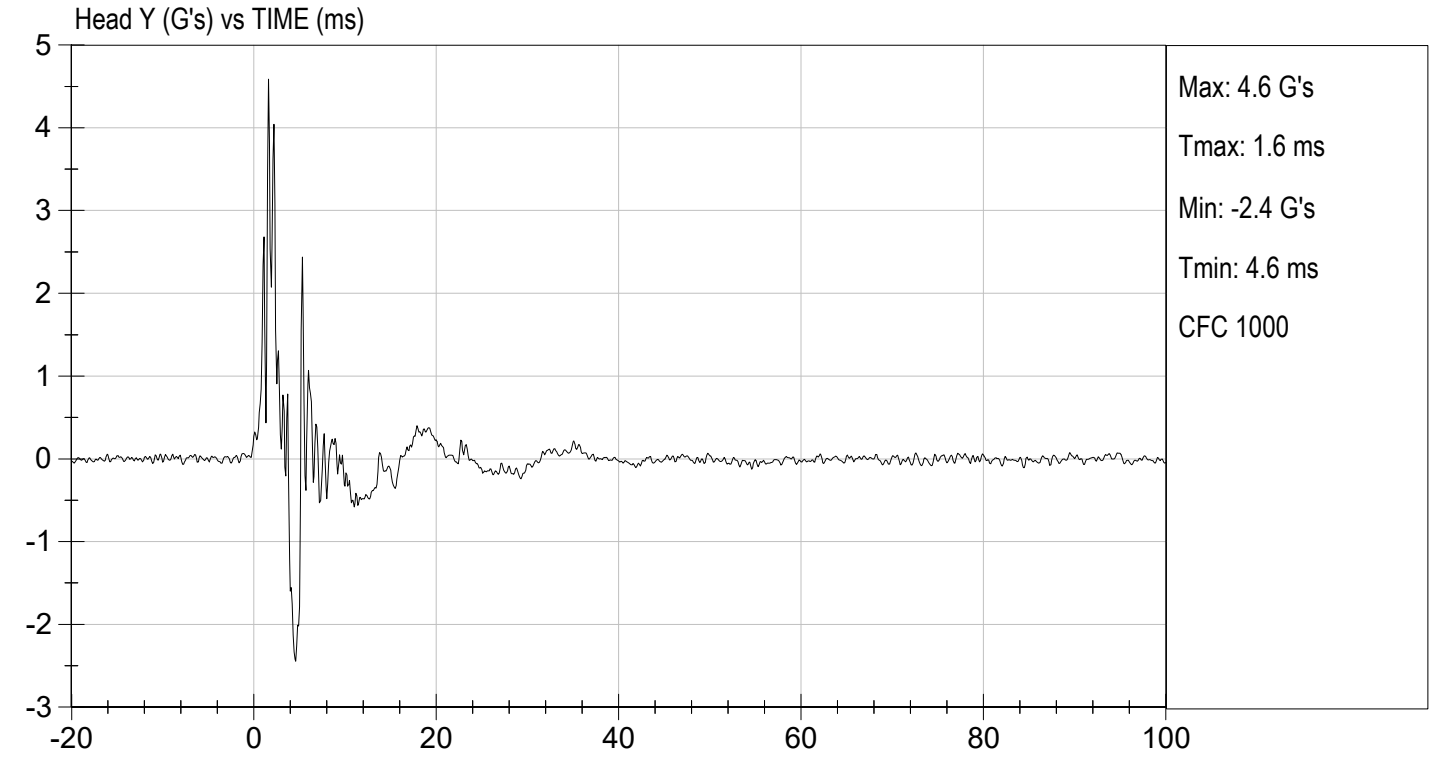


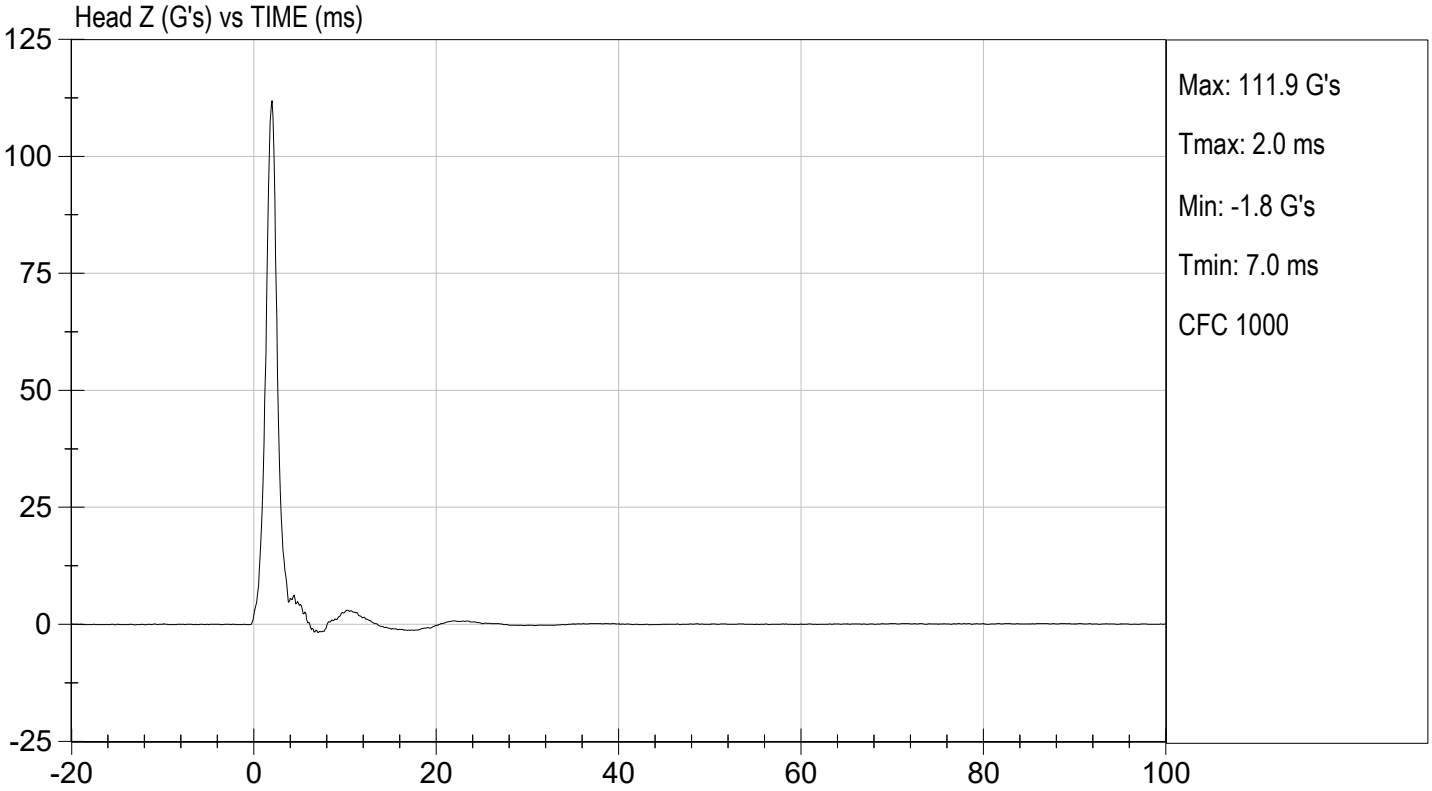
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 08/24/2022
TEST #: D221961





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

Dummy Serial Number: 403 Test Date: 08/24/2022

Technician: Jonah Pulokas

____ Pre test calibration
_X_ Post test calibration verification

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

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

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

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

Record the maximum temperature:	21.3°C
Record the minimum temperature:	21.0°C
Record the maximum humidity:	44%
Record the minimum humidity:	33%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	22.83 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	23.48 g
	@ 20 ms	17.6 ≤ g ≤ 22.6	21.20 g
	@ 30 ms	12.5 ≤ g ≤ 18.5	18.46 g
	Above 30 ms	29 g maximum	18.30 g
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	34.9 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	70°
		57 ms ≤ time of max. rotation ≤ 64 ms	58.7 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	114.6 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	70.6 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	48.0 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	97.1 ms

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

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

Signature

08/24/2022

Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221962

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.48	Pass
	20 ms	G's	17.60 to 22.60	21.20	Pass
	30 ms	G's	12.50 to 18.50	18.46	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	18.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	34.9	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	70.0	Pass
	Time	ms	57.0 to 64.0	58.7	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	114.6	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	95.7	Pass
	Time	ms	47.0 to 58.0	48.0	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.1	Pass
			Overall Test Results		Pass

Laboratory Technician

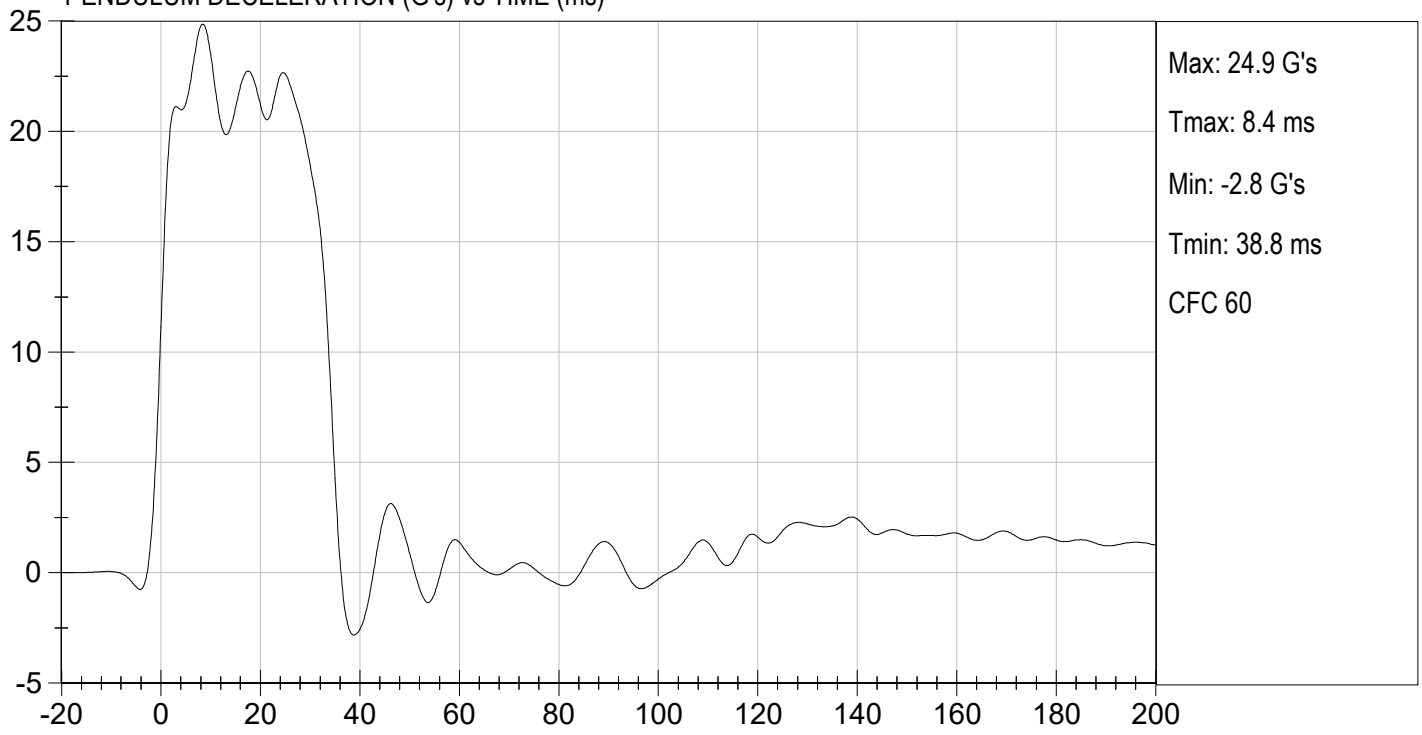
08/24/2022
Test Date

Approved By

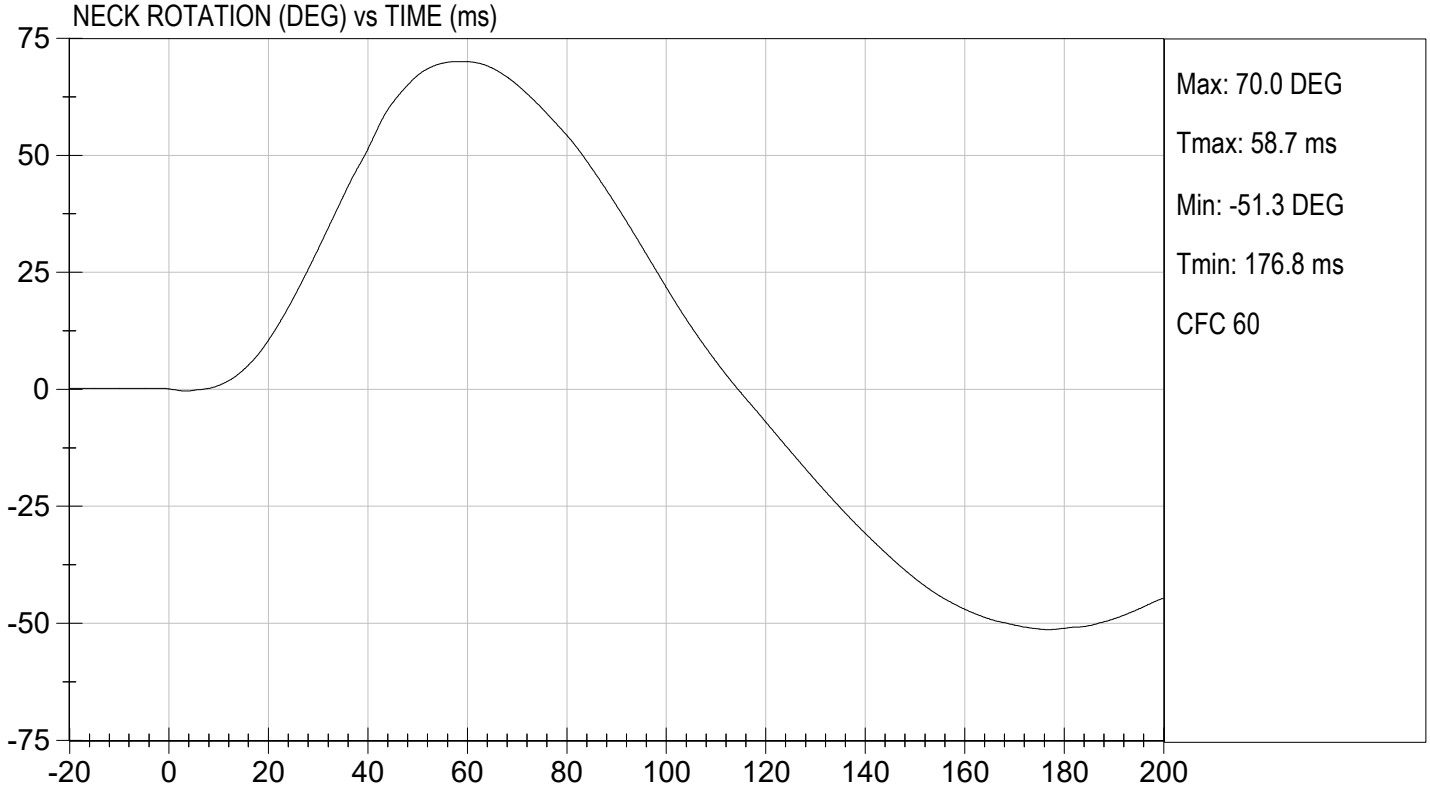
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 08/24/2022
TEST #: D221962

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

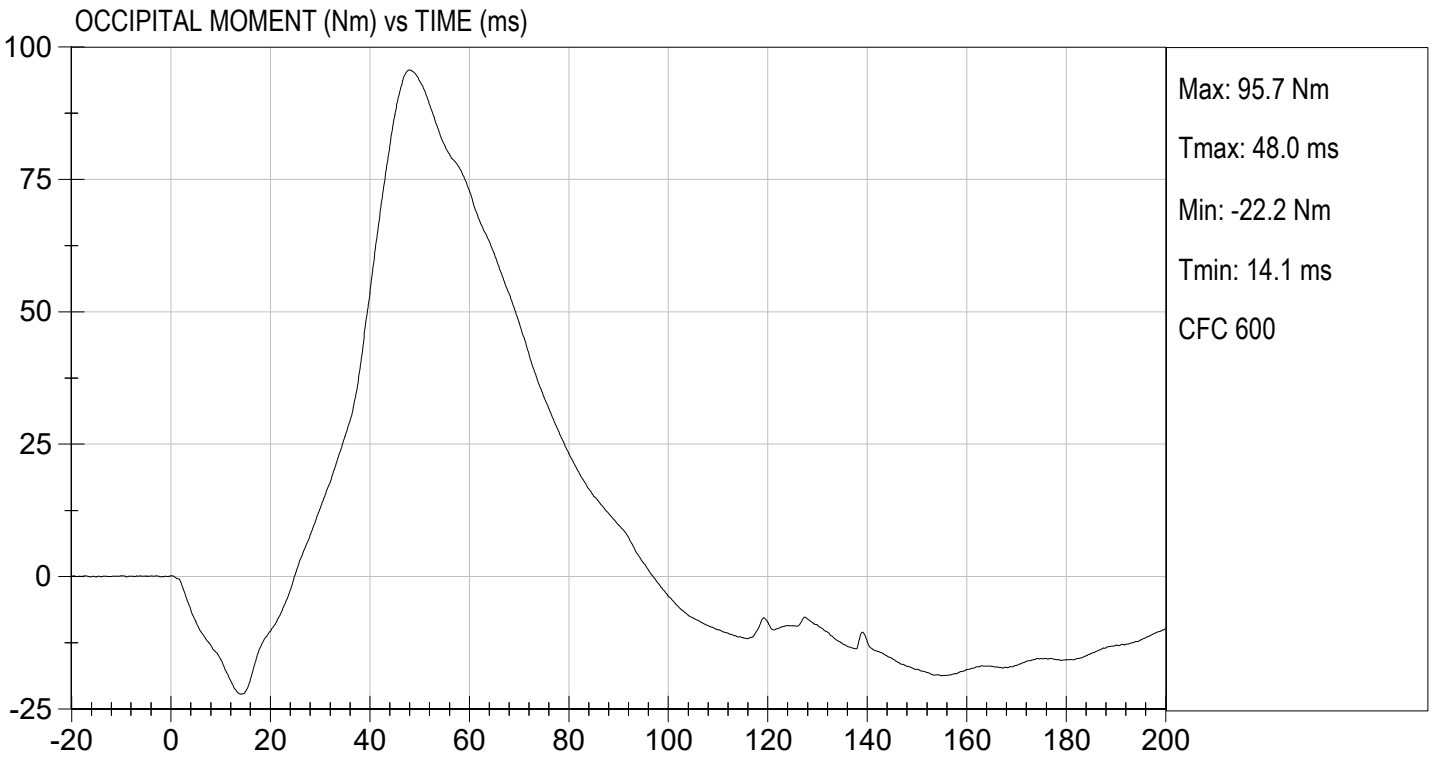


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 08/24/2022
TEST #: D221962



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 403 Test Date: 08/24/2022

Technician: Jonah Pulokas

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.3°C
Record the minimum temperature:	21.0°C
Record the maximum humidity:	44%
Record the minimum humidity:	33%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	19.85 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	18.77 g
	@ 20 ms	14 ≤ g ≤ 19	15.52 g
	@ 30 ms	11.0 ≤ g ≤ 16.0	11.82 g
	Above 30 ms	22 g maximum	13.10 g
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	42.7 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	100.1°
		72 ms ≤ time of max. rotation ≤ 82 ms	80.2 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	163.6 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-41.6 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	77.6 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	144.7 ms

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

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

X

Signature

08/24/2022
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221963

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.77	Pass
	20 ms	G's	14.00 to 19.00	15.52	Pass
	30 ms	G's	11.00 to 16.00	11.82	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.1	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	42.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	100.1	Pass
	Time	ms	72.0 to 82.0	80.2	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	163.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-56.4	Pass
	Time	ms	65.0 to 79.0	77.6	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.7	Pass
			Overall Test Results		Pass

Laboratory Technician

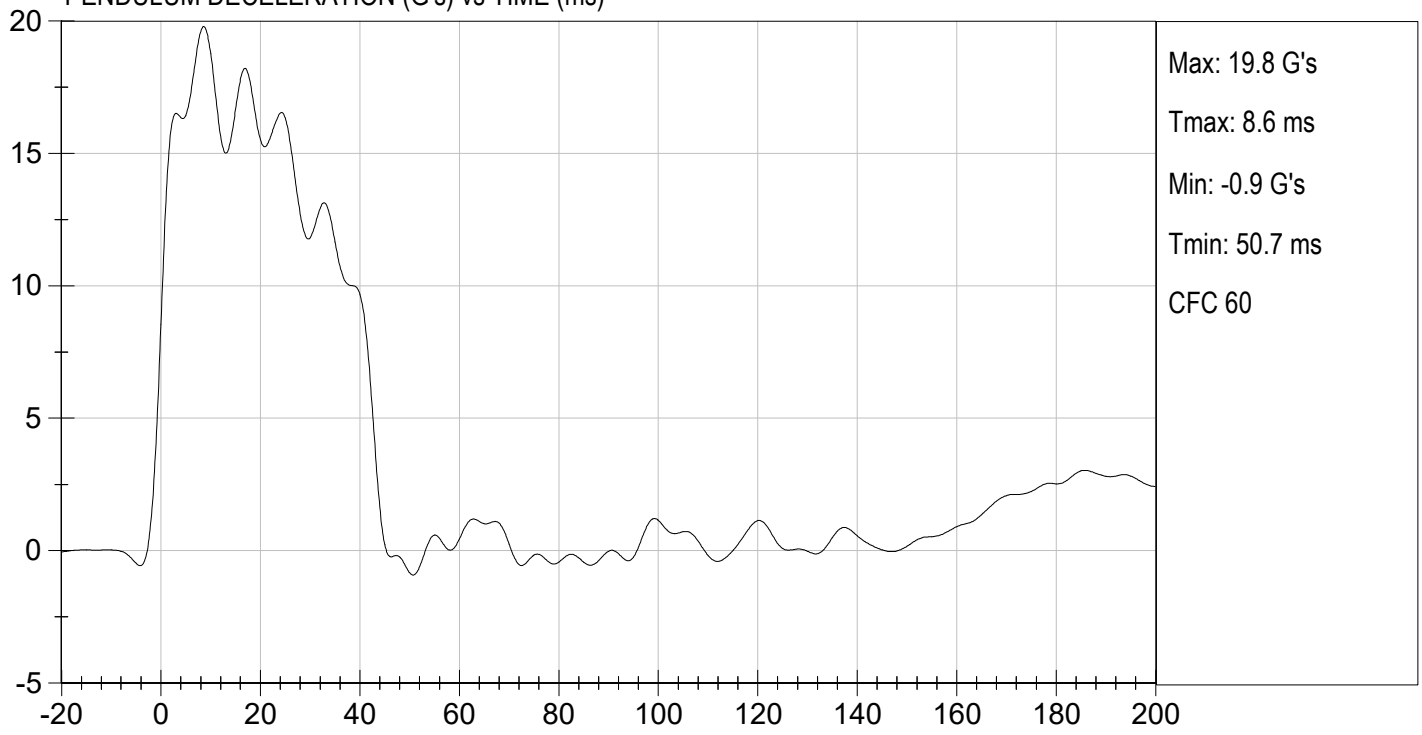
08/24/2022
Test Date

Approved By

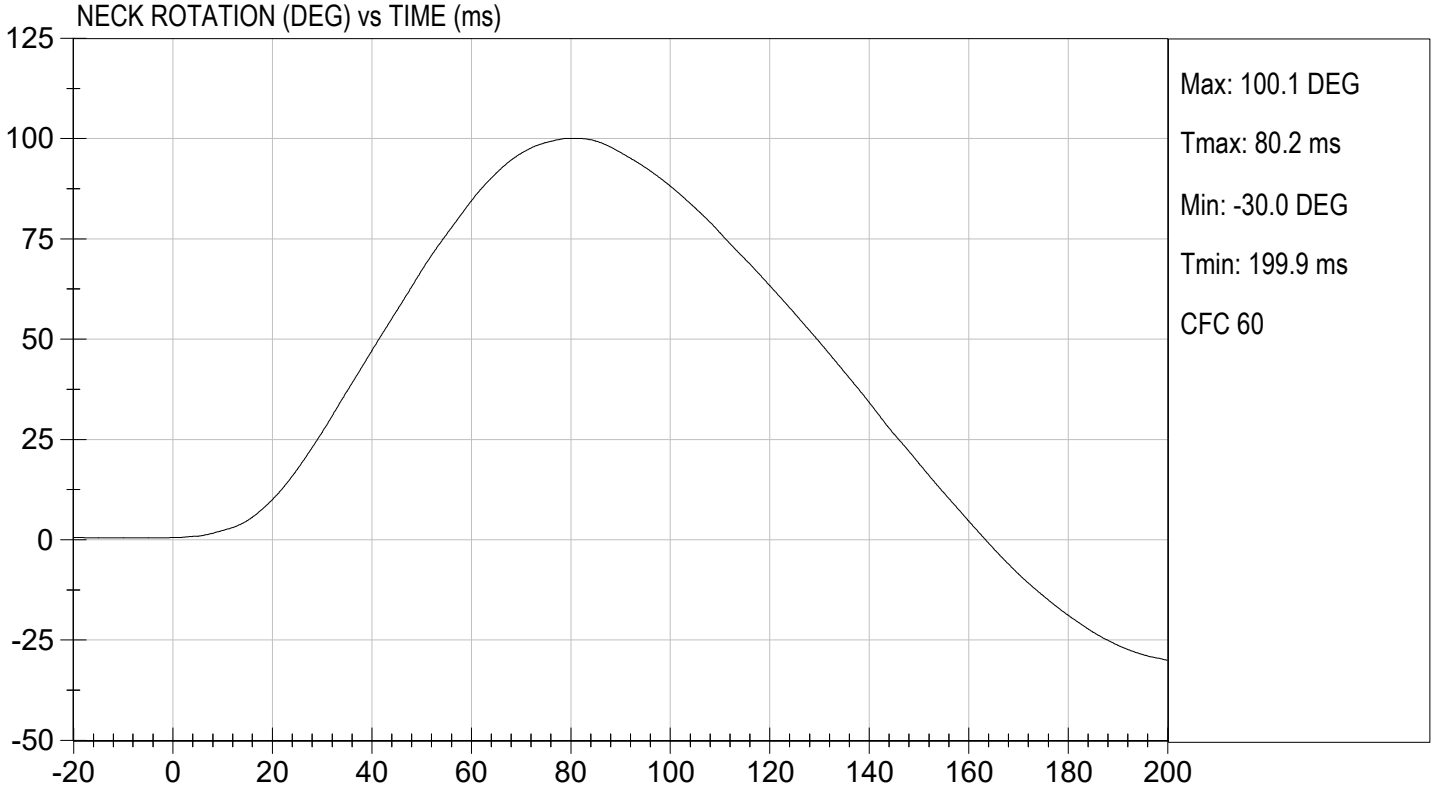
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

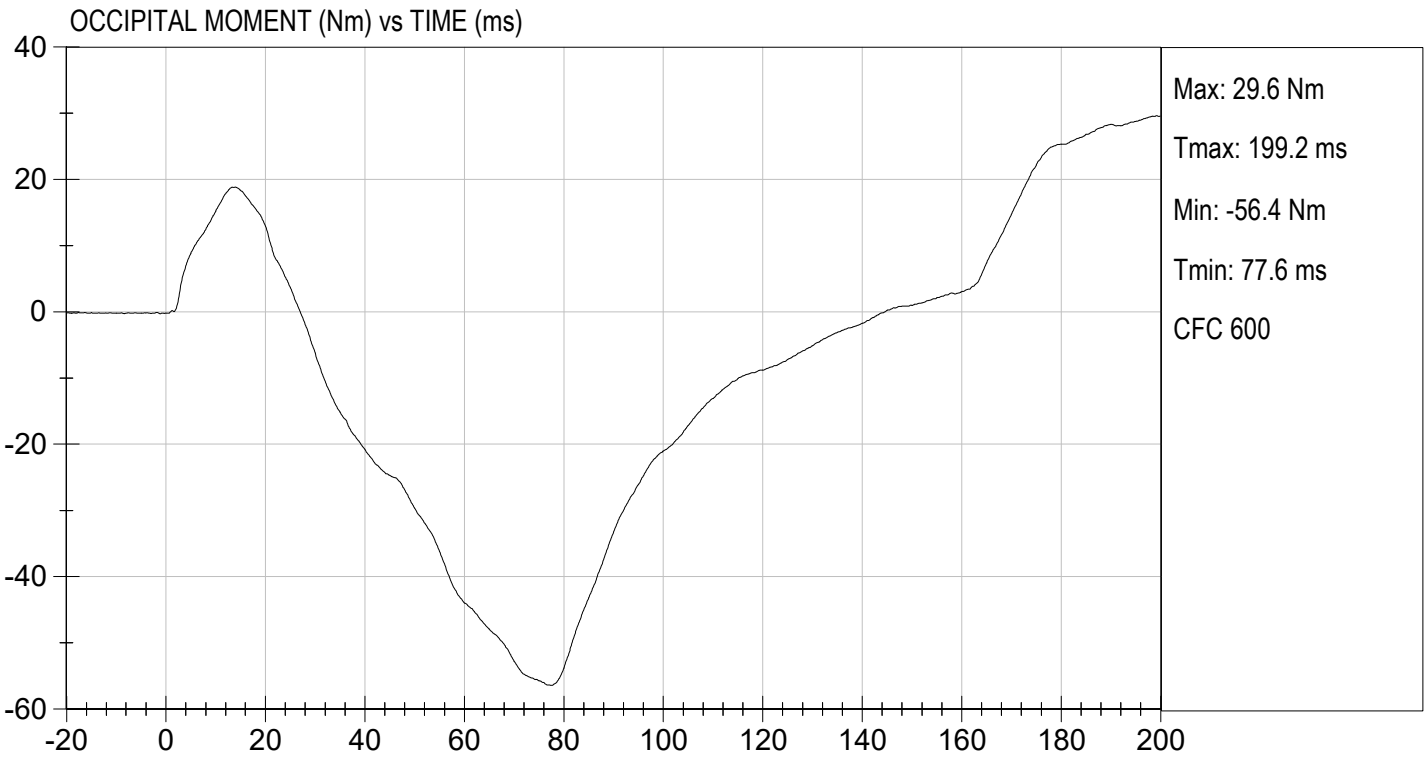
TEST DATE: 08/24/2022
TEST #: D221963

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



NECK ROTATION (DEG) vs TIME (ms)




OCCIPITAL MOMENT (Nm) vs TIME (ms)
40
20
0
-20
-40
-60
-20
0
20
40
60
80
100
120
140
160
180
200
Max: 29.6 Nm
Tmax: 199.2 ms
Min: -56.4 Nm
Tmin: 77.6 ms
CFC 600

DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 403 Test Date: 08/24/2022

Technician: Jonah Pulokas

___ Pre test calibration

X Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	44%
Record the minimum humidity:	33%

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

X - No Damage

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

___

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

___

X 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture

____ surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))

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

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

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

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

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

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

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

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

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

__X__ 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.65 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.63 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1269 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	70 %

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

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

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

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

Signature

08/24/2022
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221964

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
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,647	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.68	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

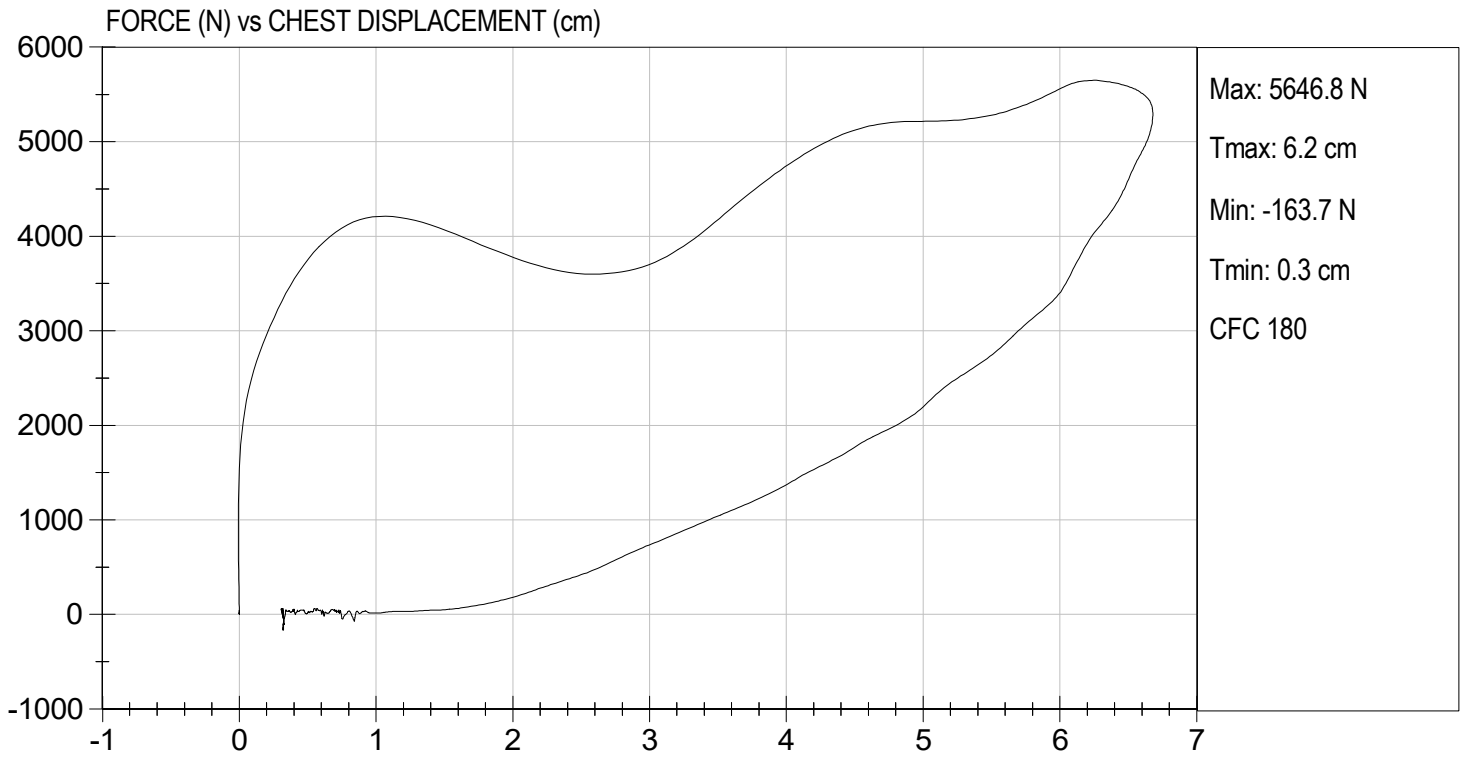
Laboratory Technician

08/24/2022
Test Date

Approved By

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

TEST DATE: 08/24/2022
TEST #: D221964



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

Dummy Serial Number: 403 Test Date: 08/25/2022

Technician: Jonah Pulokas

____ Pre test calibration
__X__ Post test calibration verification

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

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

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	47%
Record the minimum humidity:	36%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.82 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1162 lb

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

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

Signature

08/25/2022

Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221966

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	47	Pass
Probe Velocity	m/s	2.07 to 2.13	2.08	Pass
Peak Probe Force	N	4715 to 5782	5,168	Pass
		Overall Test Results		Pass

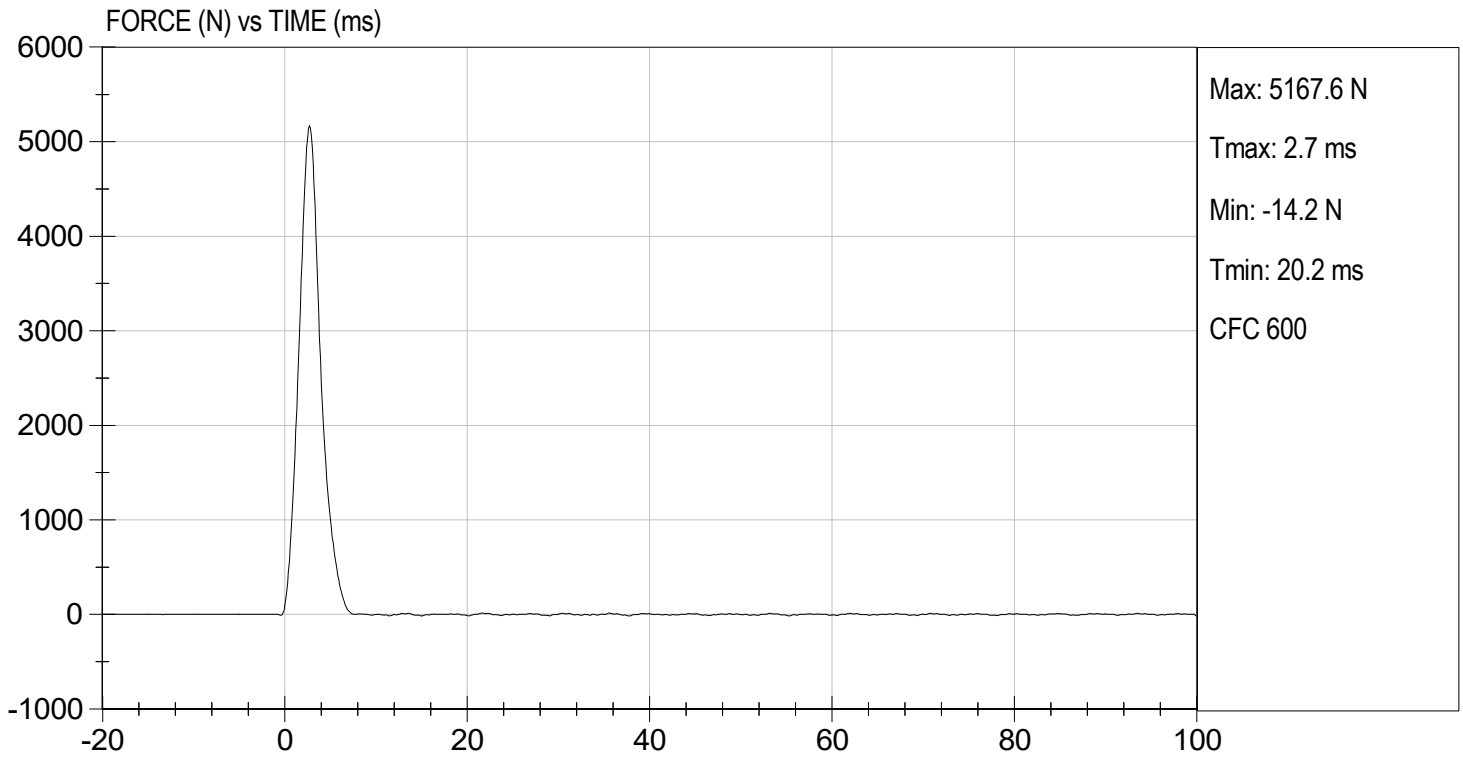
Laboratory Technician

08/25/2022
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.83 ft/s, 2.08 m/s

TEST DATE: 08/25/2022
TEST #: D221966



DATA SHEET A8

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

Dummy Serial Number: 403 Test Date: 08/25/2022

Technician: Jonah Pulokas

____ Pre test calibration

__X__ Post test calibration verification

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

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

__X__ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	47%
Record the minimum humidity:	36%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.89 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1142 lb

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

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

Signature

08/25/2022
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221965

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	47	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,082	Pass
		Overall Test Results		Pass

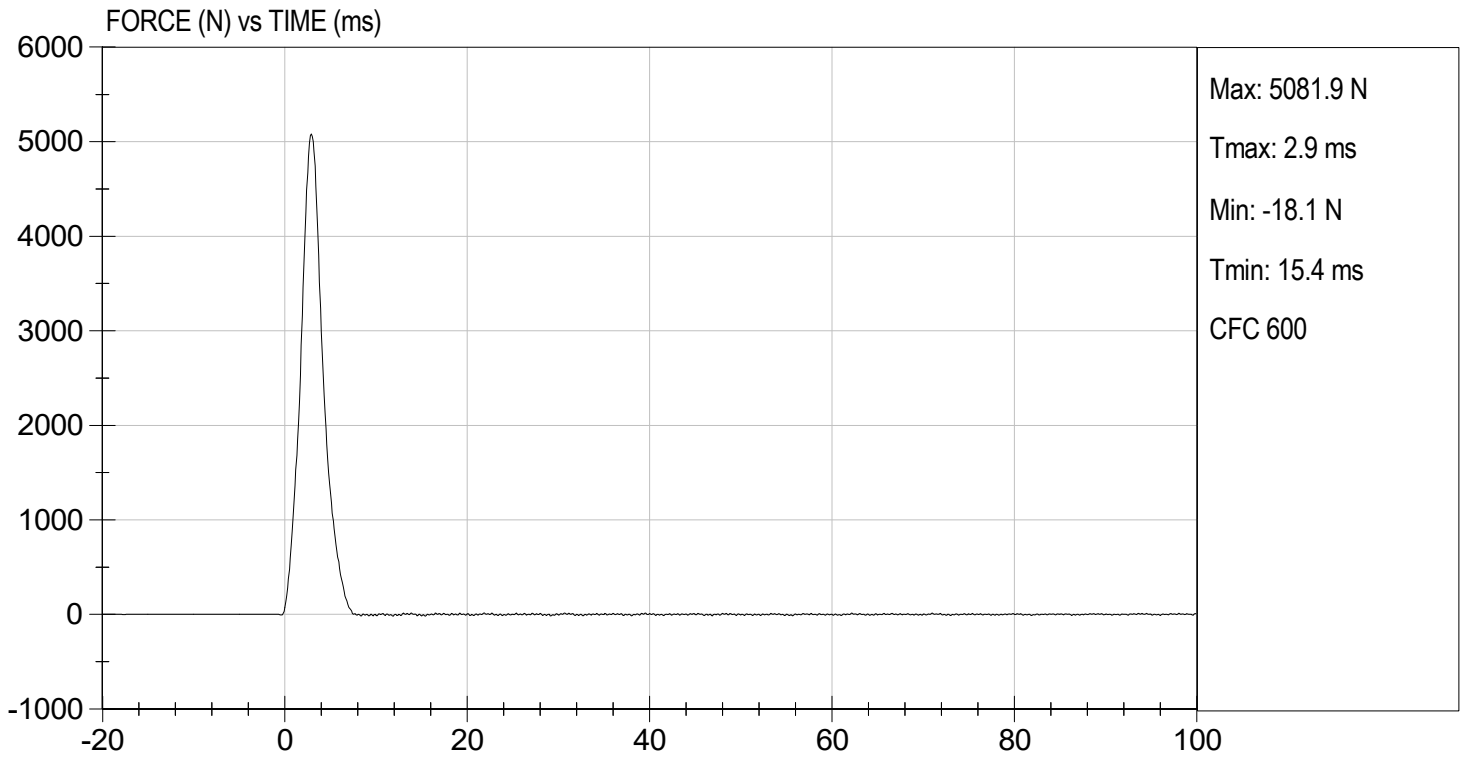
Laboratory Technician

08/25/2022
Test Date

Approved By

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

TEST DATE: 08/25/2022
TEST #: D221965



DATA SHEET A9

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

Dummy Serial Number: 403 Test Date: 08/25/2022

Technician: Jonah Pulokas

____ Pre test calibration

_X_ Post test calibration verification

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

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

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

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

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

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

_X_ 3.2 remove the abdominal insert (78051-52)

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	47%
Record the minimum humidity:	36%

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

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

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

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

_X_ 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline

horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	69.7 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	44°

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

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	68.8 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	43°

Signature

08/25/2022
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 403 **Test I.D:** D221960

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.4	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	47	47	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	93.3	94.5	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	42.6	44.4	Pass
		Overall Test Results			Pass

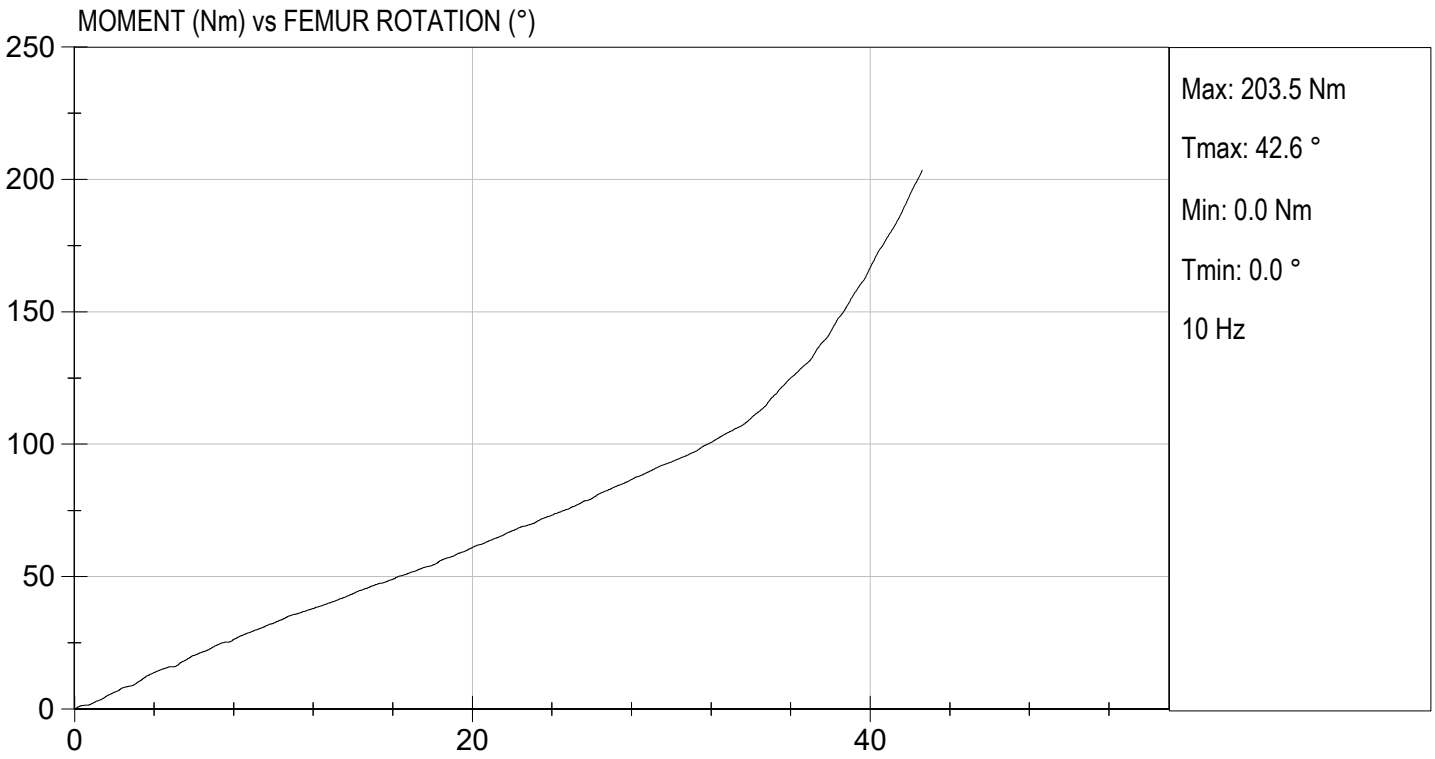
Laboratory Technician

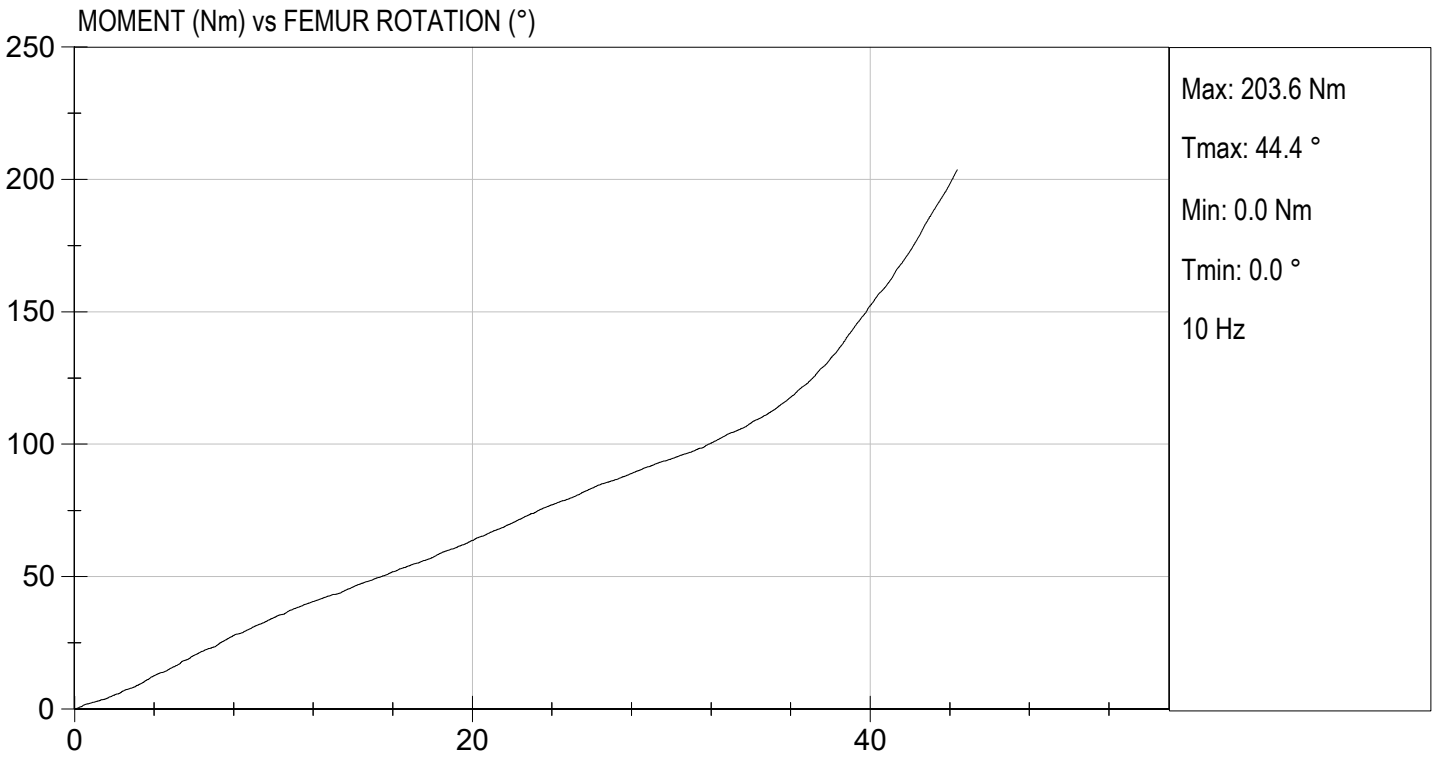
08/25/2022
Test Date

Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 08/25/2022
TEST #: D221969




MOMENT (Nm) vs FEMUR ROTATION (°)
250
200
150
100
50
0
0
20
40
Max: 203.6 Nm
Tmax: 44.4 °
Min: 0.0 Nm
Tmin: 0.0 °
10 Hz

DATA SHEET A1
DUMMY DAMAGE CHECKLIST (50th Male)

Dummy Serial Number: 403 Test Date: 08/24/2022

Technician: Jonah Pulokas

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:

Signature

08/24/2022

Date

Describe the repair or replacement of parts:

Checked by:

Signature

08/24/2022

Date

DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH90	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	AH5J3	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	C12885	04/05/2022	10/05/2022
NECK TRANSDUCER	Denton	1716JTF	N7489	05/09/2022	11/08/2022
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH74	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	AH5D9	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	AH5L1	04/05/2022	10/05/2022
CHEST POTENTIOMETER	Humanetics	78051-317	403	04/04/2022	10/04/2022
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Humanetics	2121AJLN2	F3137	04/04/2022	10/04/2022
(2) LEFT FEMUR	Humanetics	2121AJLN2	F3138	04/04/2022	10/04/2022
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/15/2022	01/14/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/19/2022	11/18/2022
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	05/31/2022	11/30/2022
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	C3035	03/02/2022	09/01/2022
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	C3034	03/02/2022	09/01/2022

LABORATORY TECHNICIAN: 

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

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

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

Dummy Serial Number: 401 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration
___ Post test calibration verification

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

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

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

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

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	45%
Record the minimum humidity:	34%

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

Record findings and actions: No Damage

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

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

Record the actual distance: 0.5 inches

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

X 16. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	251 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	5.3 g

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

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test ID:** D221301

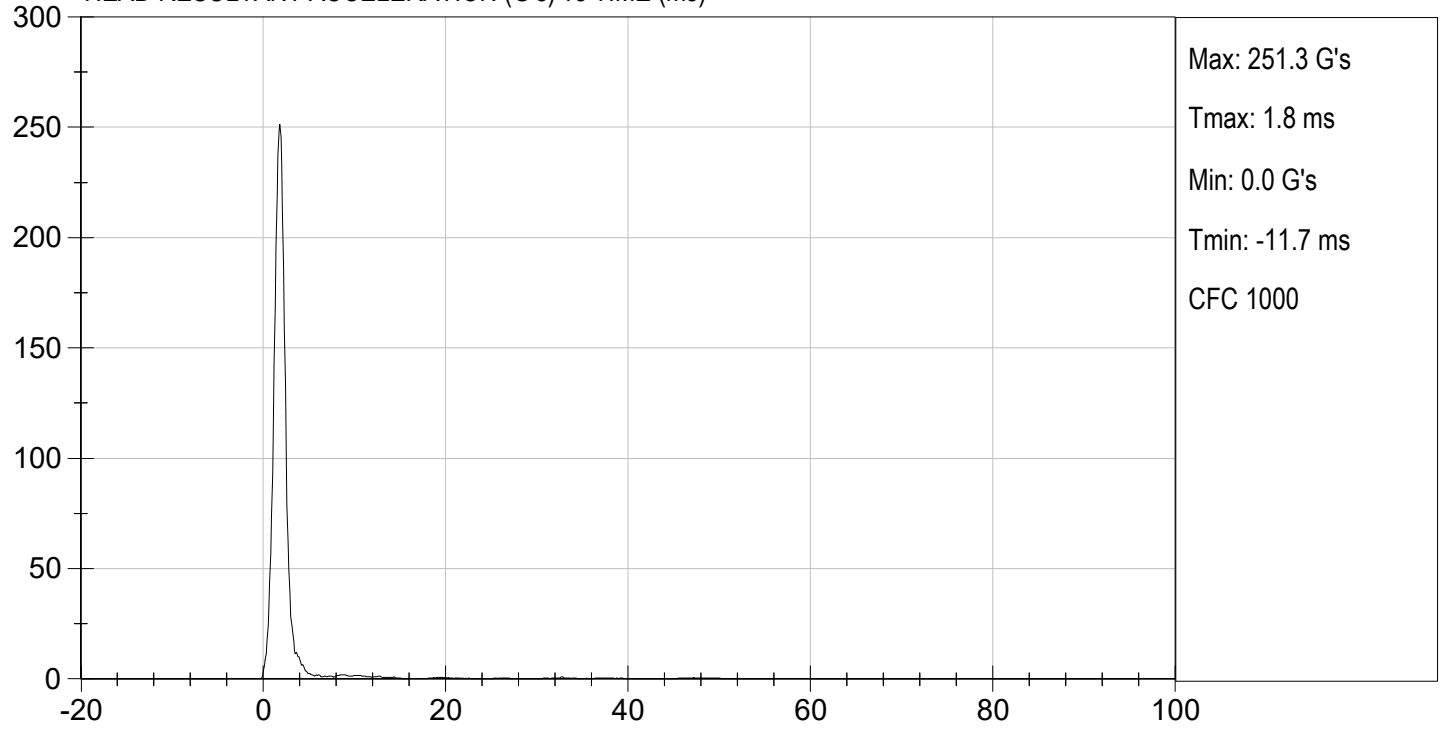
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	225 to 275	251	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	5.3	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

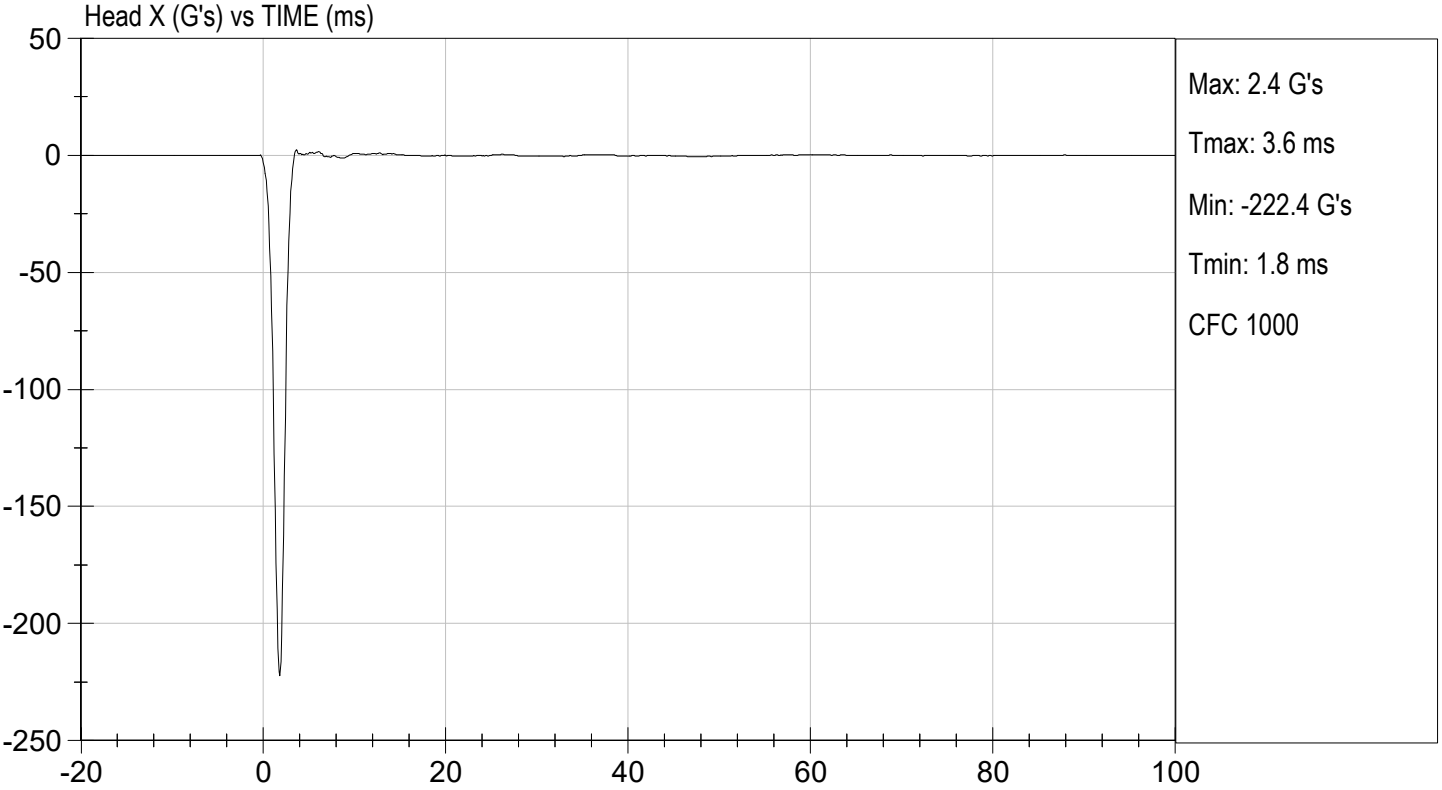
05/26/2022
Test Date

Approved By

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

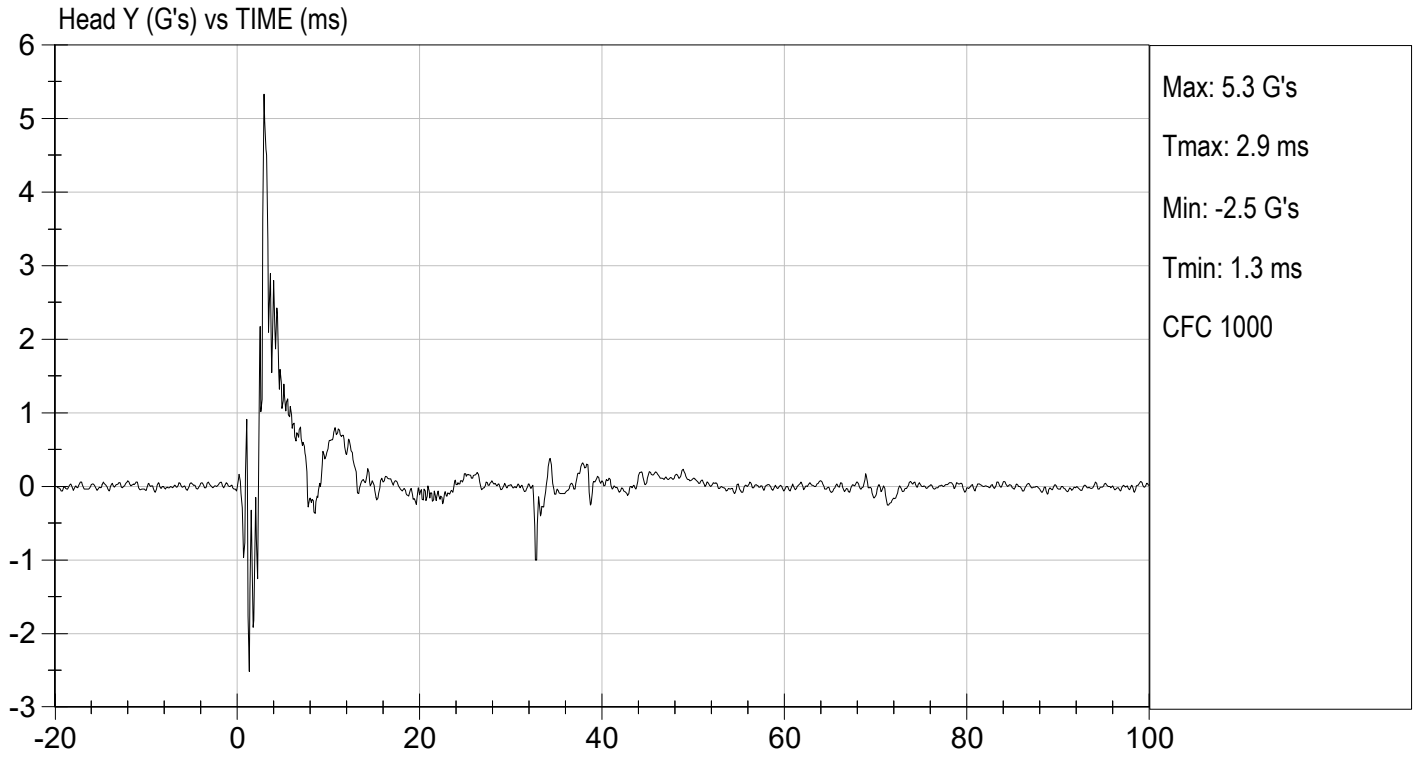


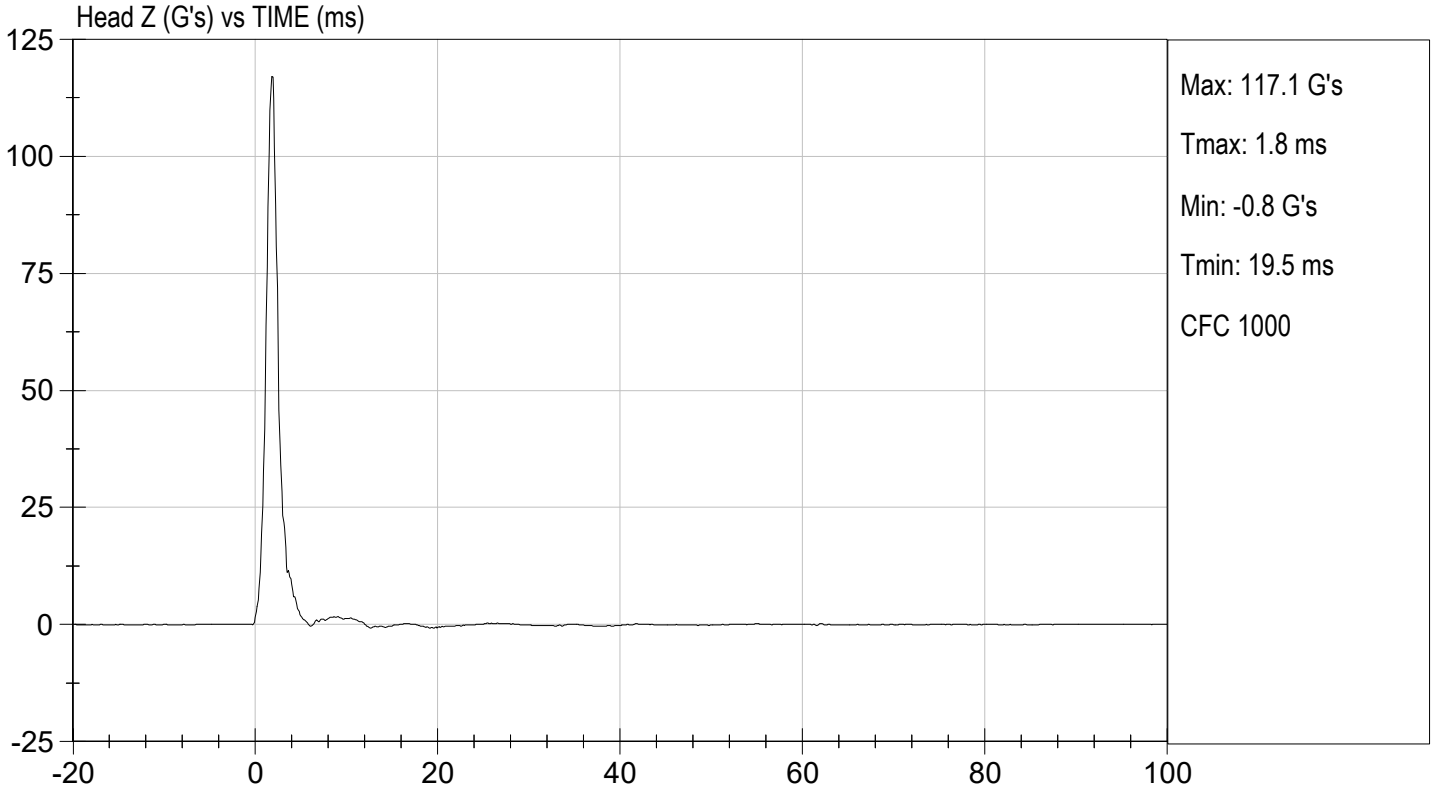
Head X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 05/26/2022
TEST #: D221301





DATA SHEET A4

NECK FLEXION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 05/26/2022

Technician: Jon Love

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	35%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

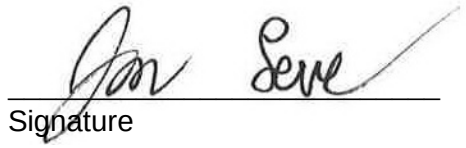
X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	22.83 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	24.09 g
	@ 20 ms	17.6 ≤ g ≤ 22.6	20.20 g
	@ 30 ms	12.5 ≤ g ≤ 18.5	16.32 g
	Above 30 ms	29 g maximum	16.30 g
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	37.8 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	68°
		57 ms ≤ time of max. rotation ≤ 64 ms	58.8 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	113.2 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	67.1 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	50.1 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	98.0 ms

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

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



Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221302

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	24.09	Pass
	20 ms	G's	17.60 to 22.60	20.20	Pass
	30 ms	G's	12.50 to 18.50	16.32	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	16.3	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	37.8	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	68.3	Pass
	Time	ms	57.0 to 64.0	58.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.2	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	91.0	Pass
	Time	ms	47.0 to 58.0	50.1	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	98.0	Pass
			Overall Test Results		Pass

Laboratory Technician

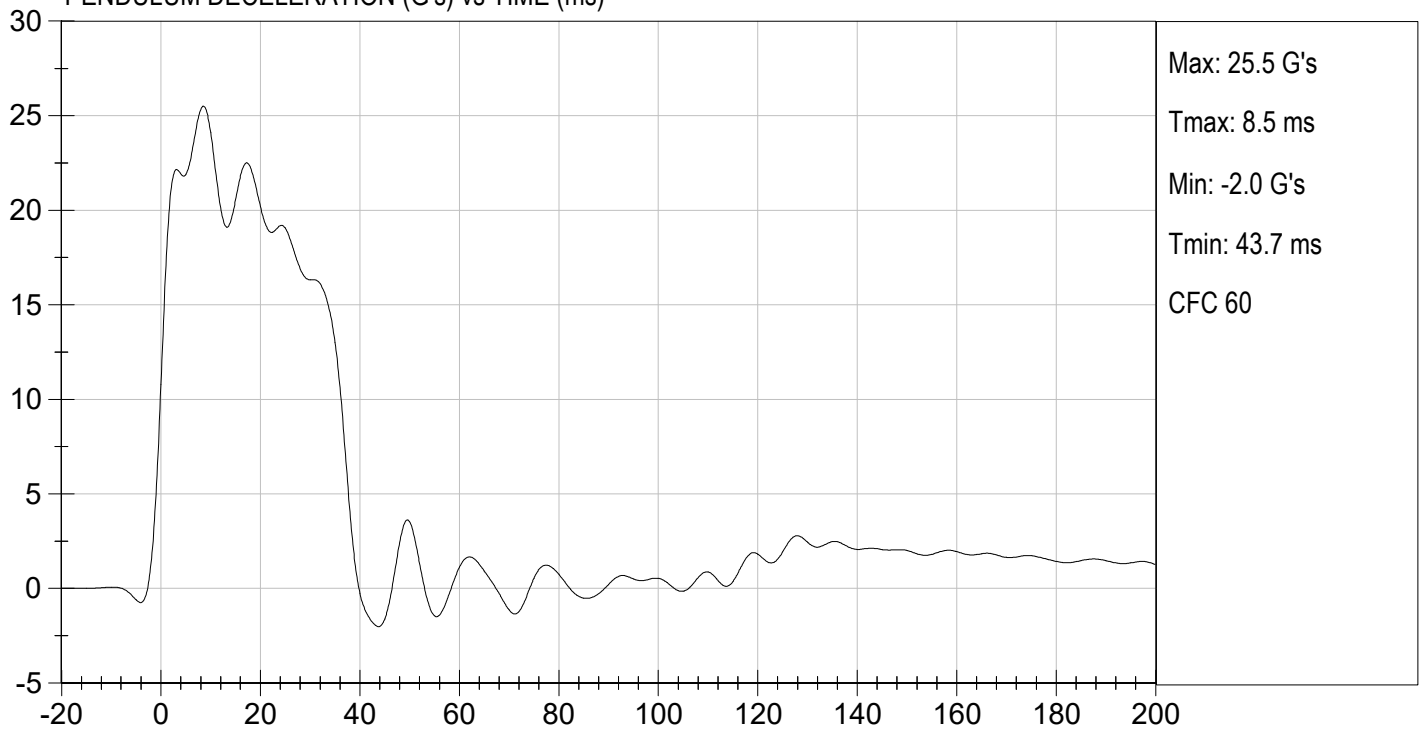
05/26/2022
Test Date

Approved By

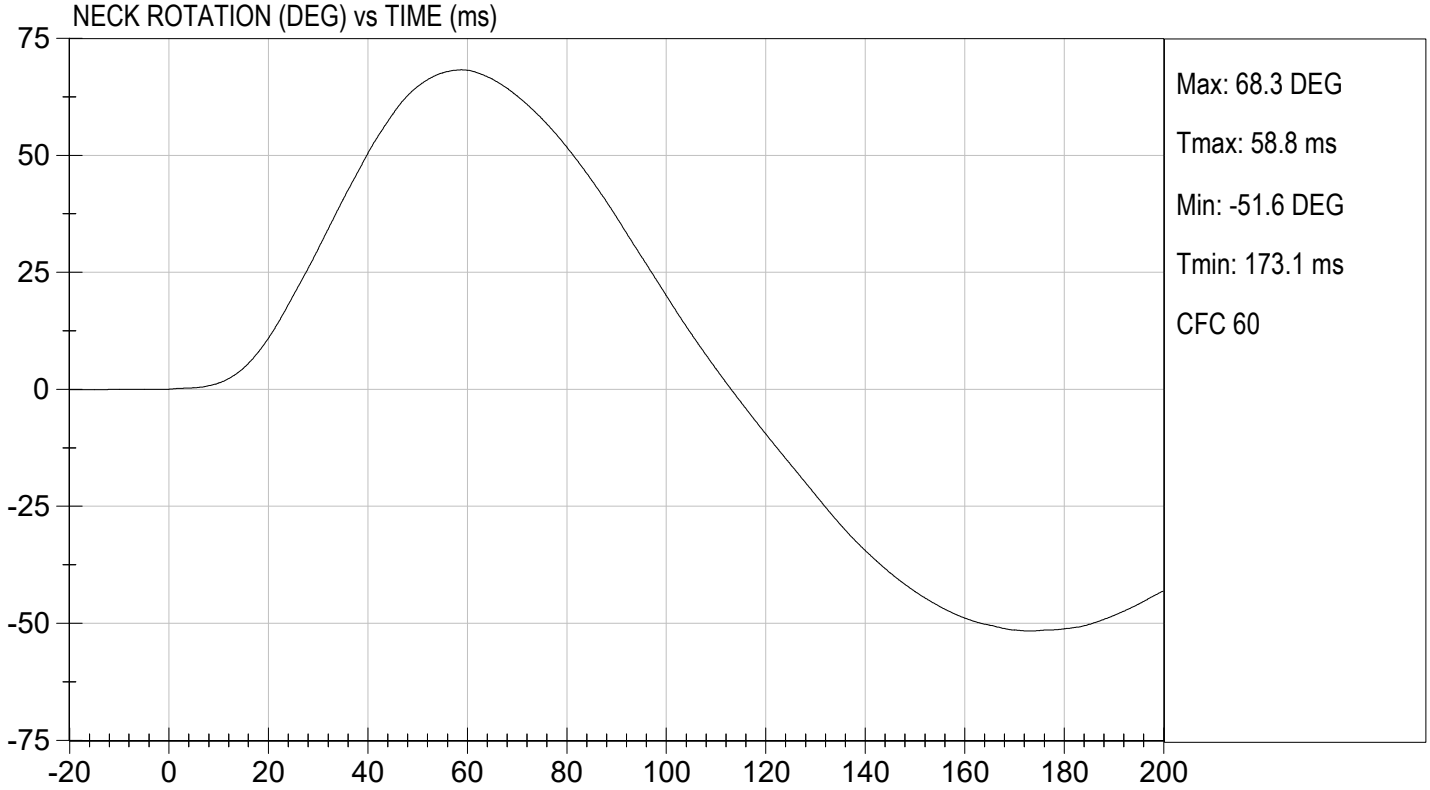
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 05/26/2022
TEST #: D221302

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

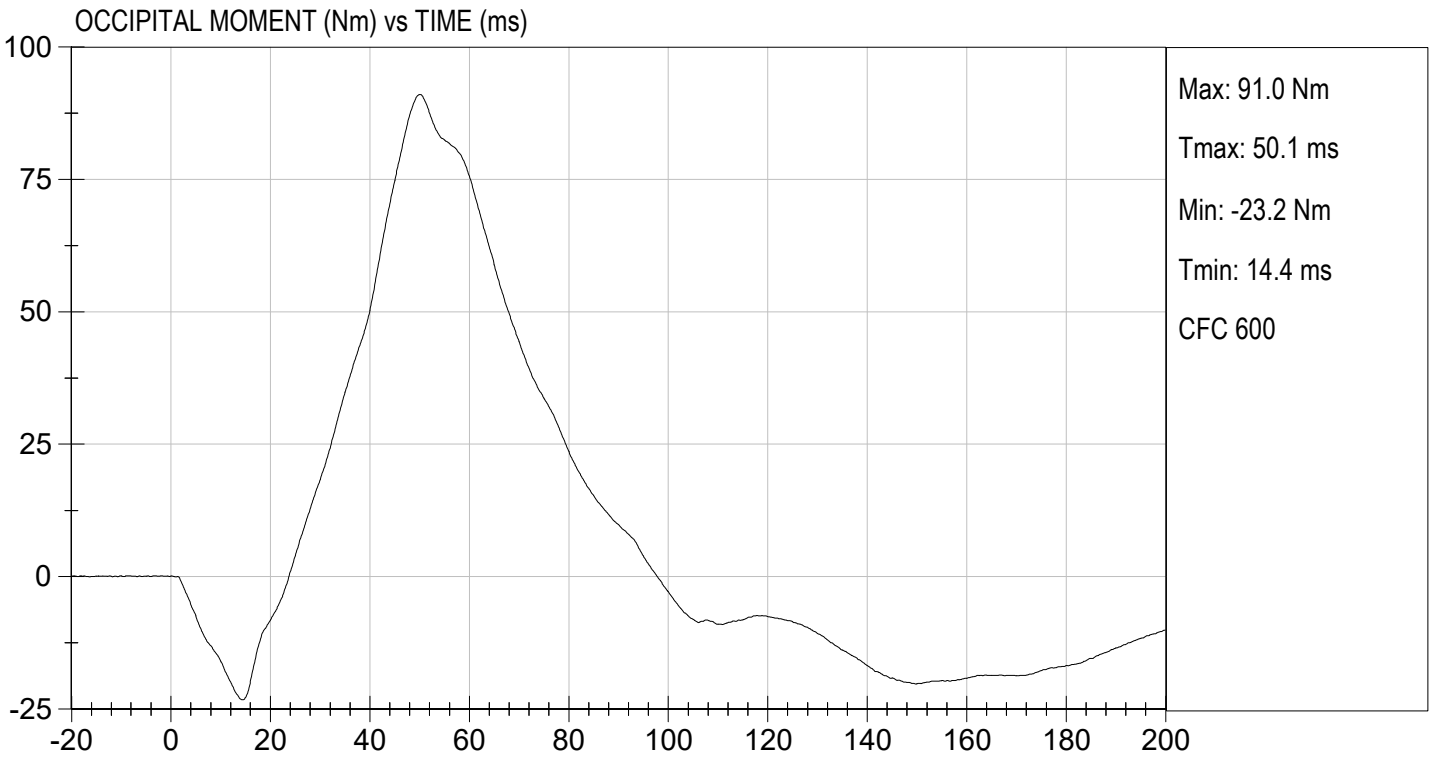


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 05/26/2022
TEST #: D221302



DATA SHEET A5

NECK EXTENSION TEST (572.33) (50th Male)

Dummy Serial Number: 401 Test Date: 05/26/2022

Technician: Jon Love

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one neck test performed

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	35%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	19.85 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	20.37 g
	@ 20 ms	14 ≤ g ≤ 19	16.91 g
	@ 30 ms	11.0 ≤ g ≤ 16.0	12.94 g
	Above 30 ms	22 g maximum	13.60 g
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	38.8 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	96.7°
		72 ms ≤ time of max. rotation ≤ 82 ms	78.8 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	157.8 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-42.5 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	73.7 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	140.6 ms

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

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

X

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221303

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity		%	10 to 70	46	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	20.37	Pass
	20 ms	G's	14.00 to 19.00	16.91	Pass
	30 ms	G's	11.00 to 16.00	12.94	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.6	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.8	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	96.7	Pass
	Time	ms	72.0 to 82.0	78.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	157.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-57.6	Pass
	Time	ms	65.0 to 79.0	73.7	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	140.6	Pass
			Overall Test Results		Pass

Jon Seve

Laboratory Technician

05/26/2022

Test Date

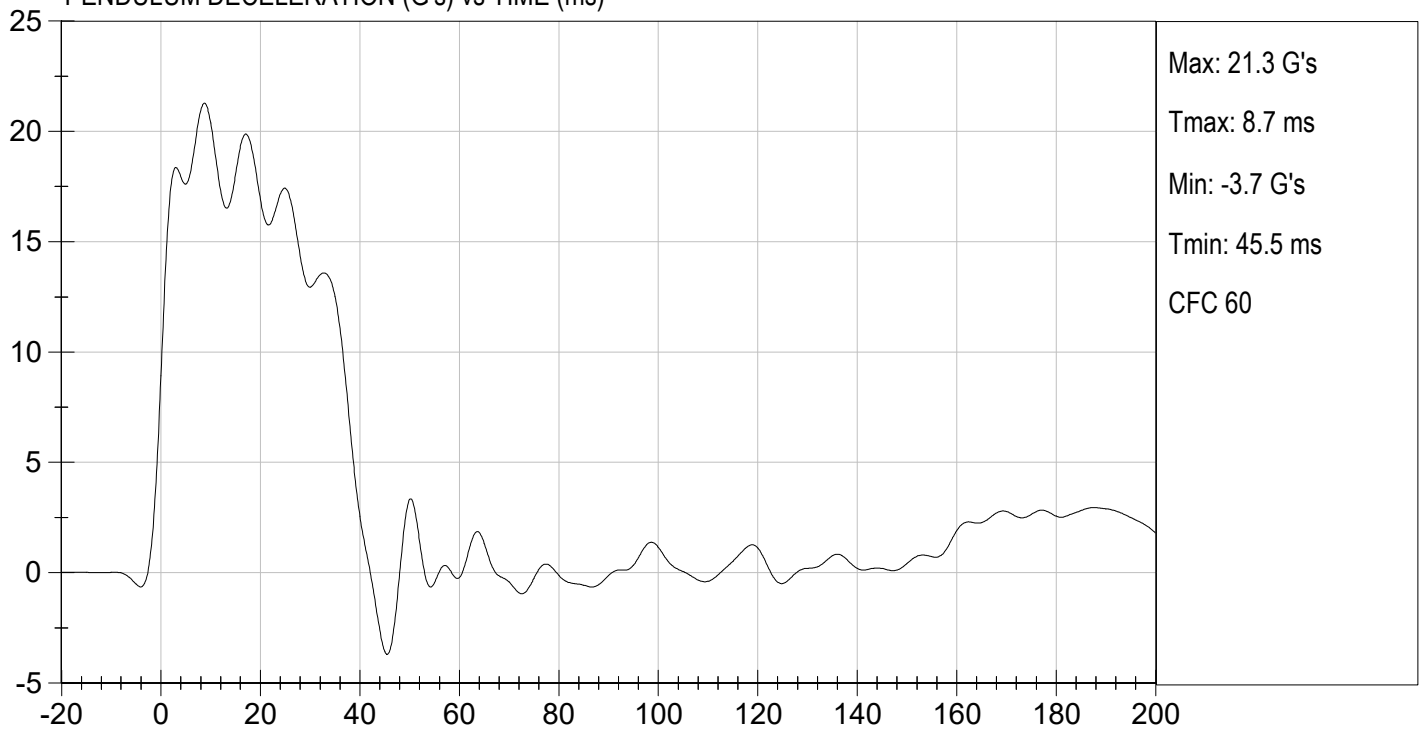
Jeff Leonardi

Approved By

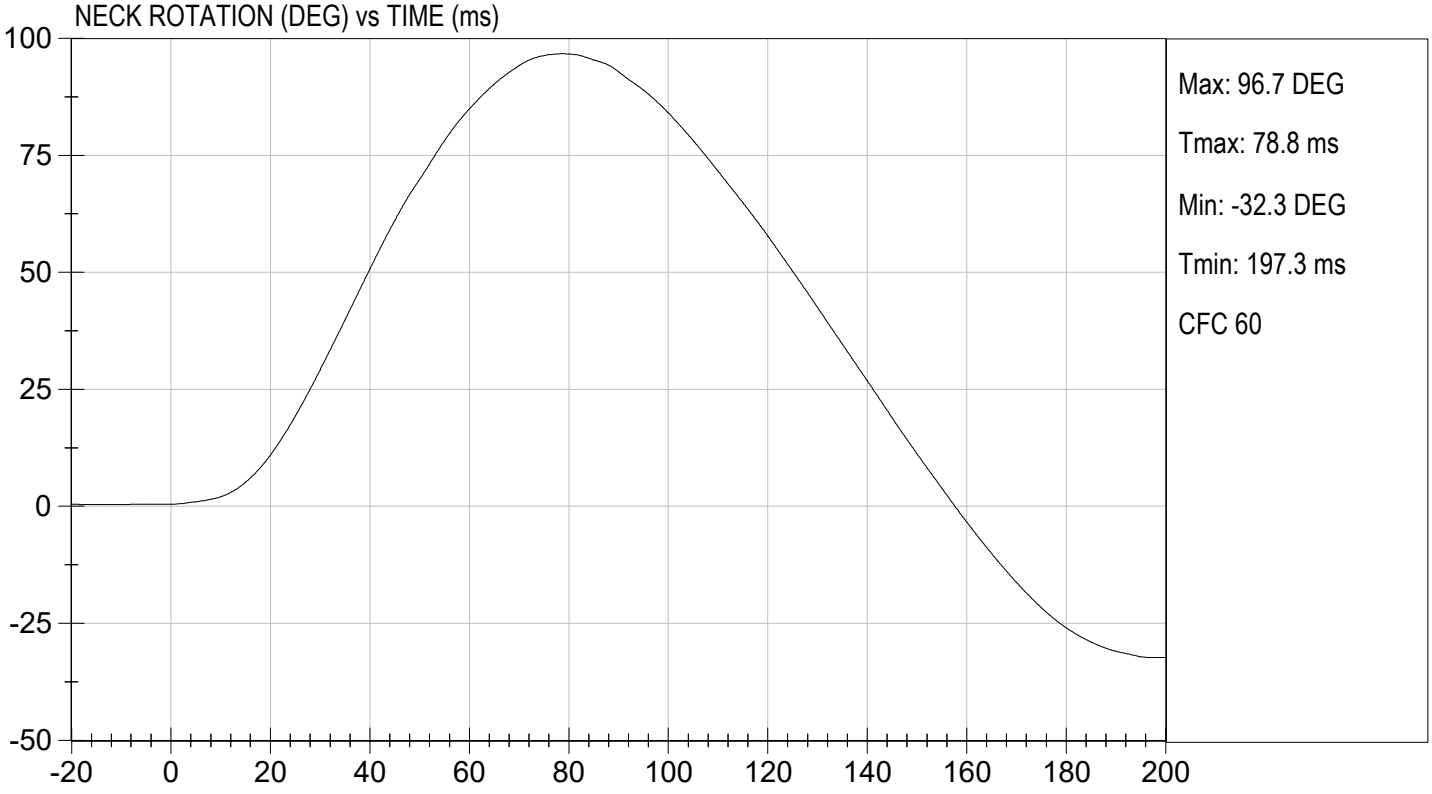
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 05/26/2022
TEST #: D221303

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

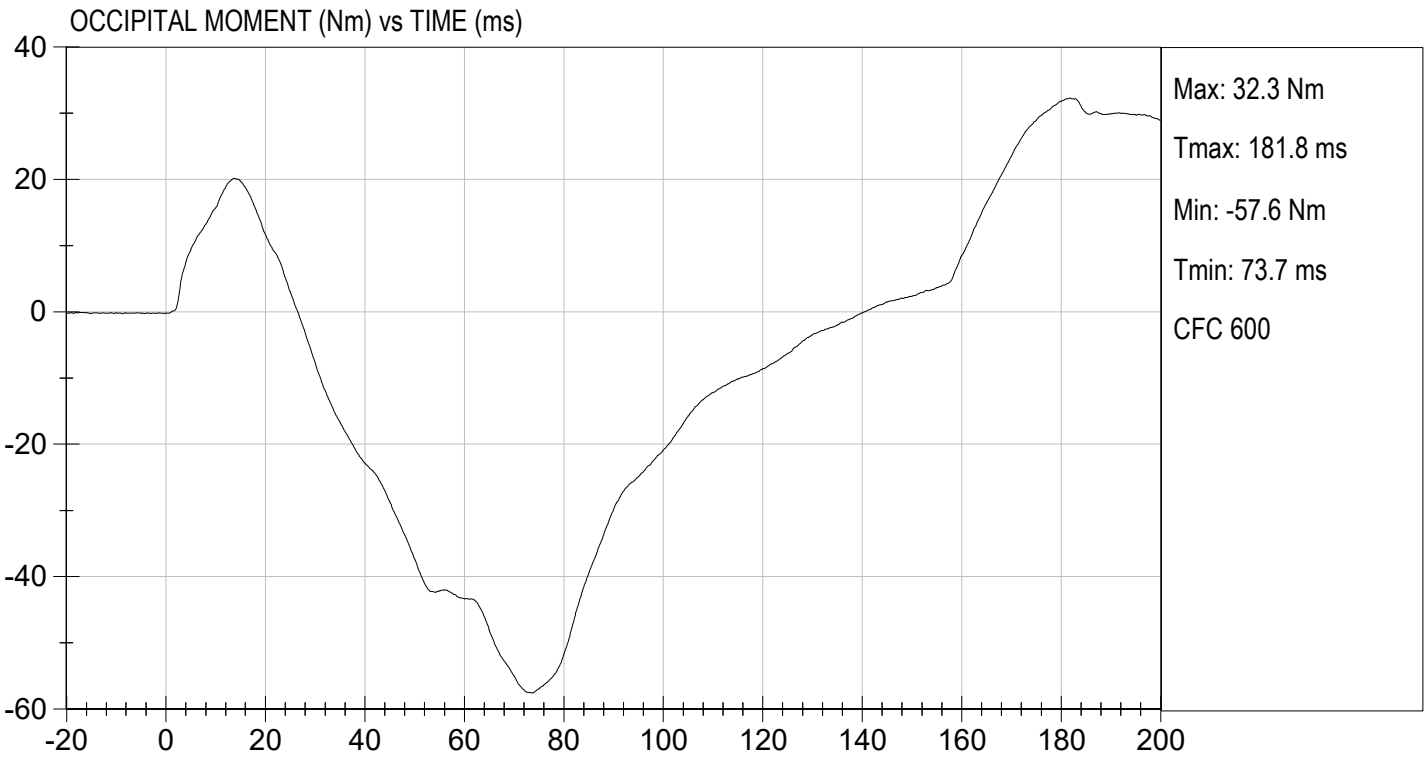


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 05/26/2022
TEST #: D221303



DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401 Test Date: 05/25/2022

Technician: Jon Love

X Pre test calibration

___ Post test calibration verification

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

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

X N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	43%
Record the minimum humidity:	32%

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

X - No Damage

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

___

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

___

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

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

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

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

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

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

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

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

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

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

X 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.92 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.79 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1285 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	70 %

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

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

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

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

Signature

05/25/2022
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221304

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,715	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.08	Pass
Internal Hysteresis	%	69 to 85	70	Pass
		Overall Test Results		Pass

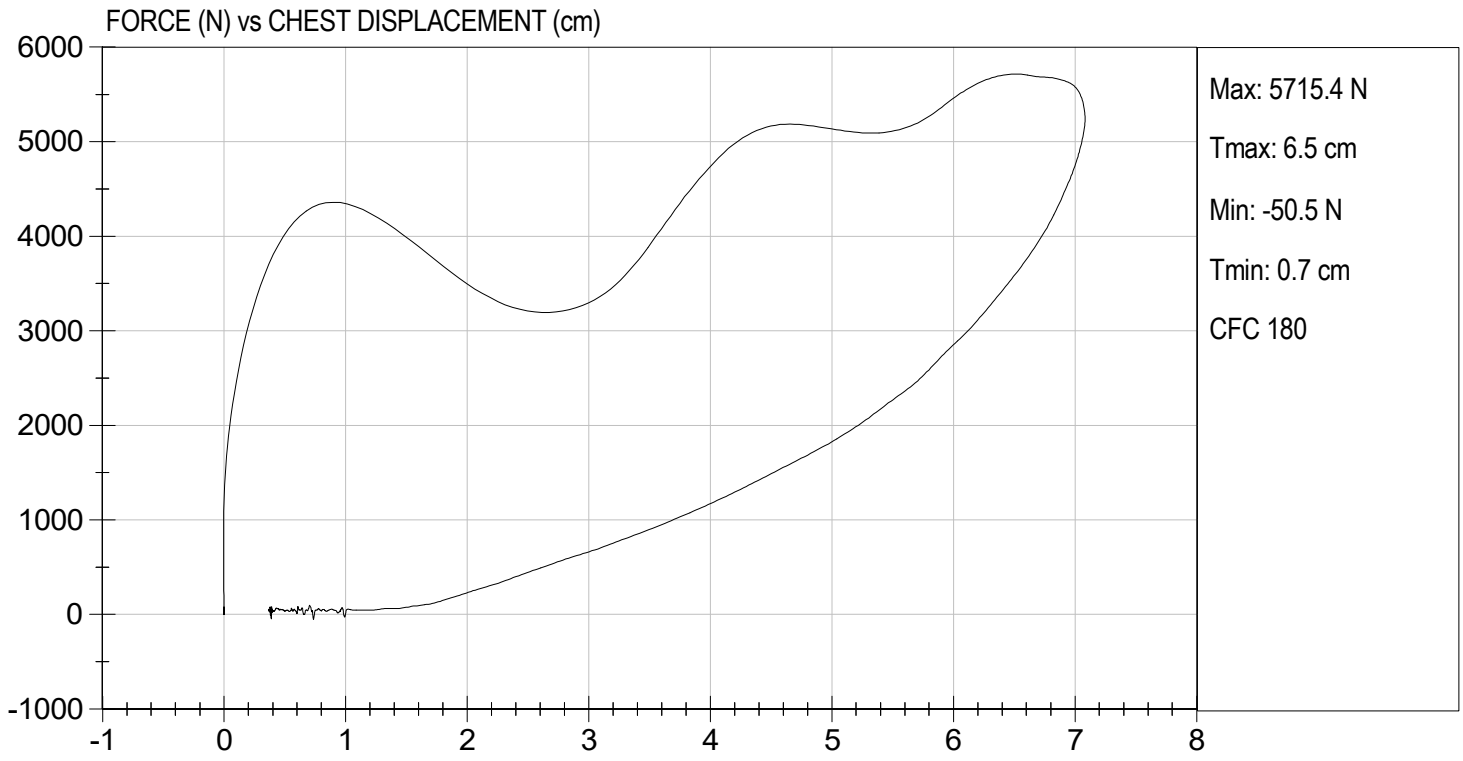
Laboratory Technician

05/25/2022
Test Date

Approved By

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

TEST DATE: 05/25/2022
TEST #: D221304



DATA SHEET A7

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

Dummy Serial Number: 401 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	35%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.89 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1200 lb

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

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

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221306

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	46	Pass
Probe Velocity	m/s	2.07 to 2.13	2.10	Pass
Peak Probe Force	N	4715 to 5782	5,336	Pass
		Overall Test Results		Pass

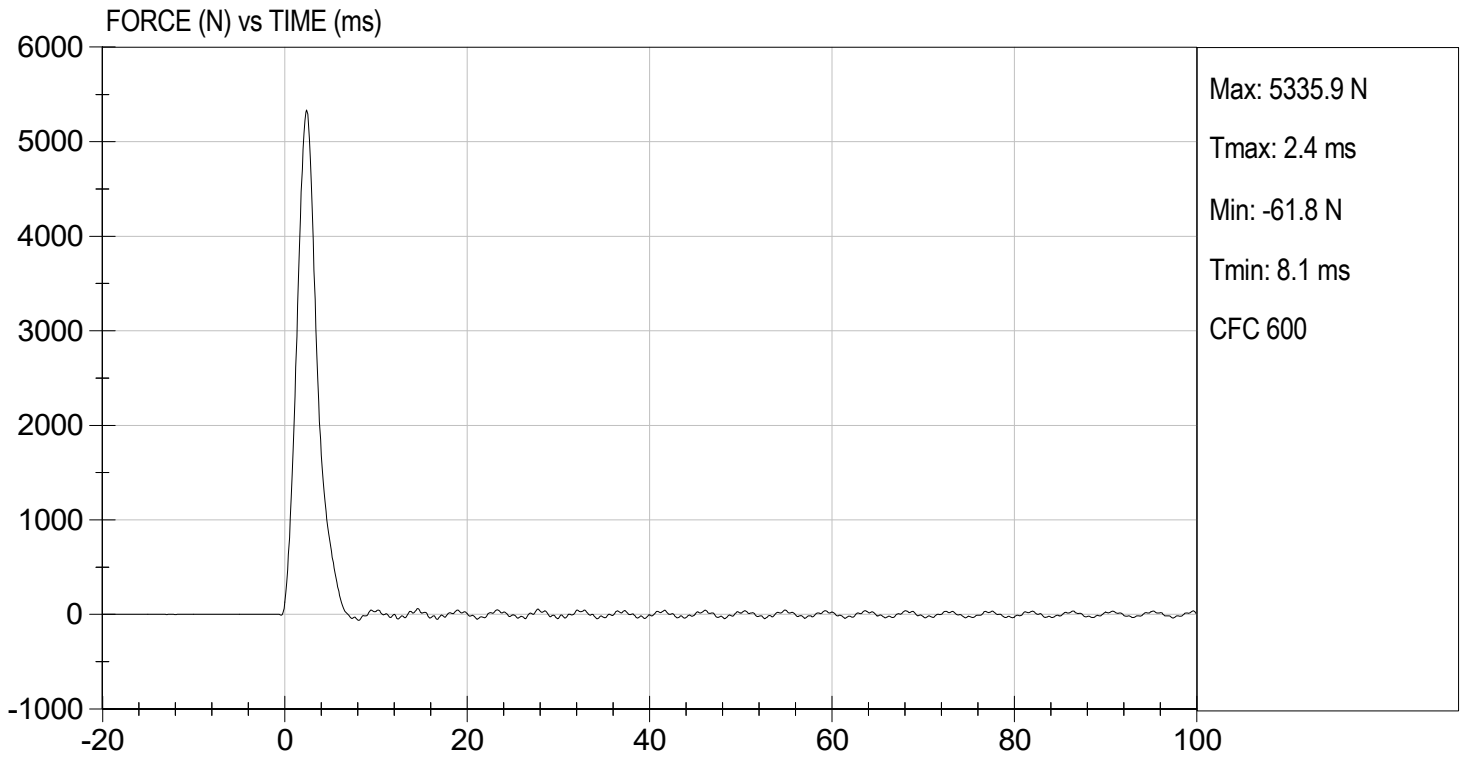
Laboratory Technician

05/26/2022
Test Date

Approved By

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

TEST DATE: 05/26/2022
TEST #: D221306



DATA SHEET A8

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

Dummy Serial Number: 401 Test Date:05/26/2022

Technician: Jonah Pulokas

X Pre test calibration

____ Post test calibration verification

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

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

X N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	46%
Record the minimum humidity:	35%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.96 t/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1075 lb

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

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

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221305

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	46	Pass
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	4,783	Pass
		Overall Test Results		Pass

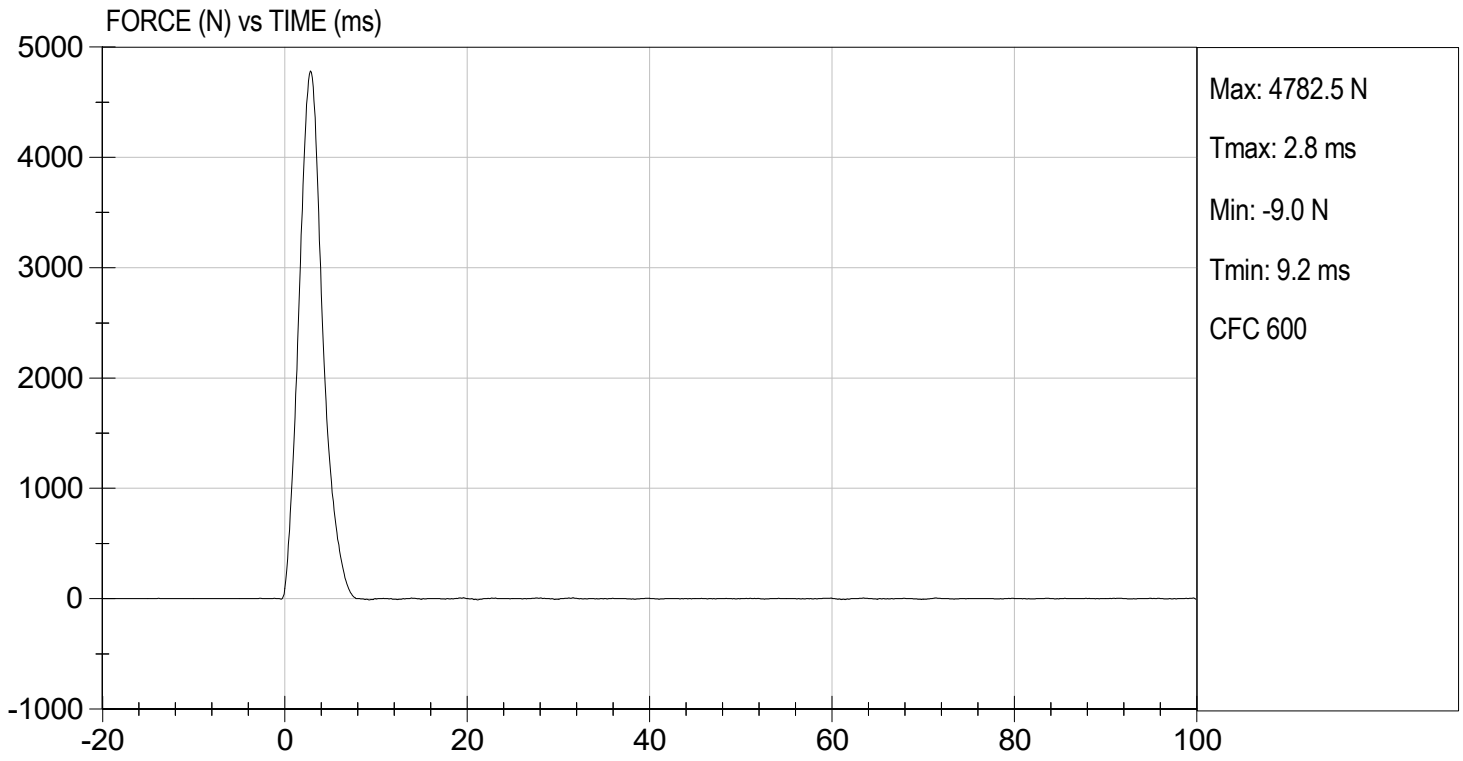
Laboratory Technician

05/26/2022
Test Date

Approved By

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

TEST DATE: 05/26/2022
TEST #: D221305



DATA SHEET A9

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

Dummy Serial Number: 401 Test Date: 05/26/2022

Technician: Jonah Pulokas

X Pre test calibration

____ Post test calibration verification

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

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

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

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

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

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

X 3.2 remove the abdominal insert (78051-52)

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

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

Record the maximum temperature:	21.9°C
Record the minimum temperature:	21.6°C
Record the maximum humidity:	45%
Record the minimum humidity:	34%

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

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

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

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

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	62.5 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	43°

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

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	62.7 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	42°

Signature

05/26/2022
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

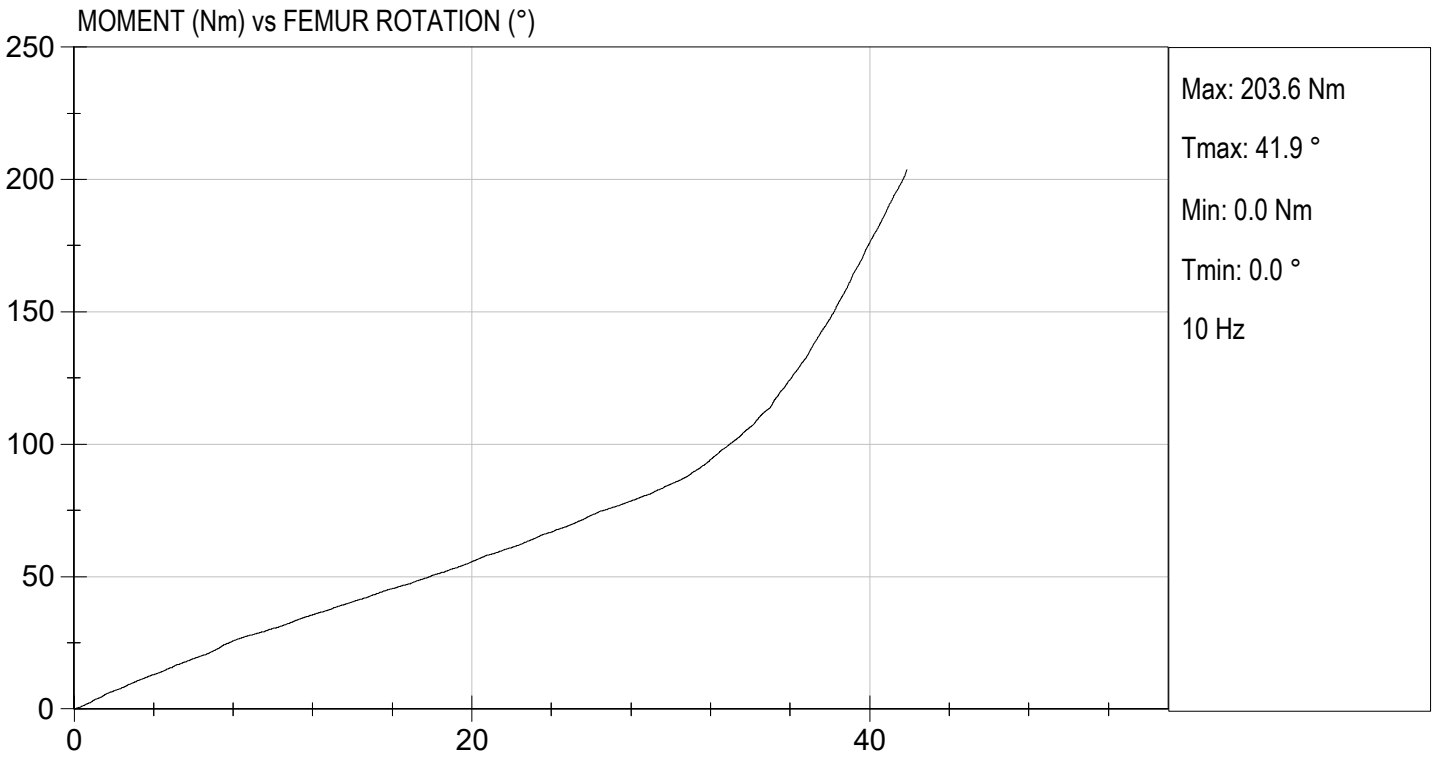
ATD Serial No: 401 **Test I.D:** D221300

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.9	21.9	Pass
Laboratory Relative Humidity	%	10 to 70	45	45	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.3	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	85.0	84.8	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	41.9	43.4	Pass
		Overall Test Results			Pass

Laboratory Technician

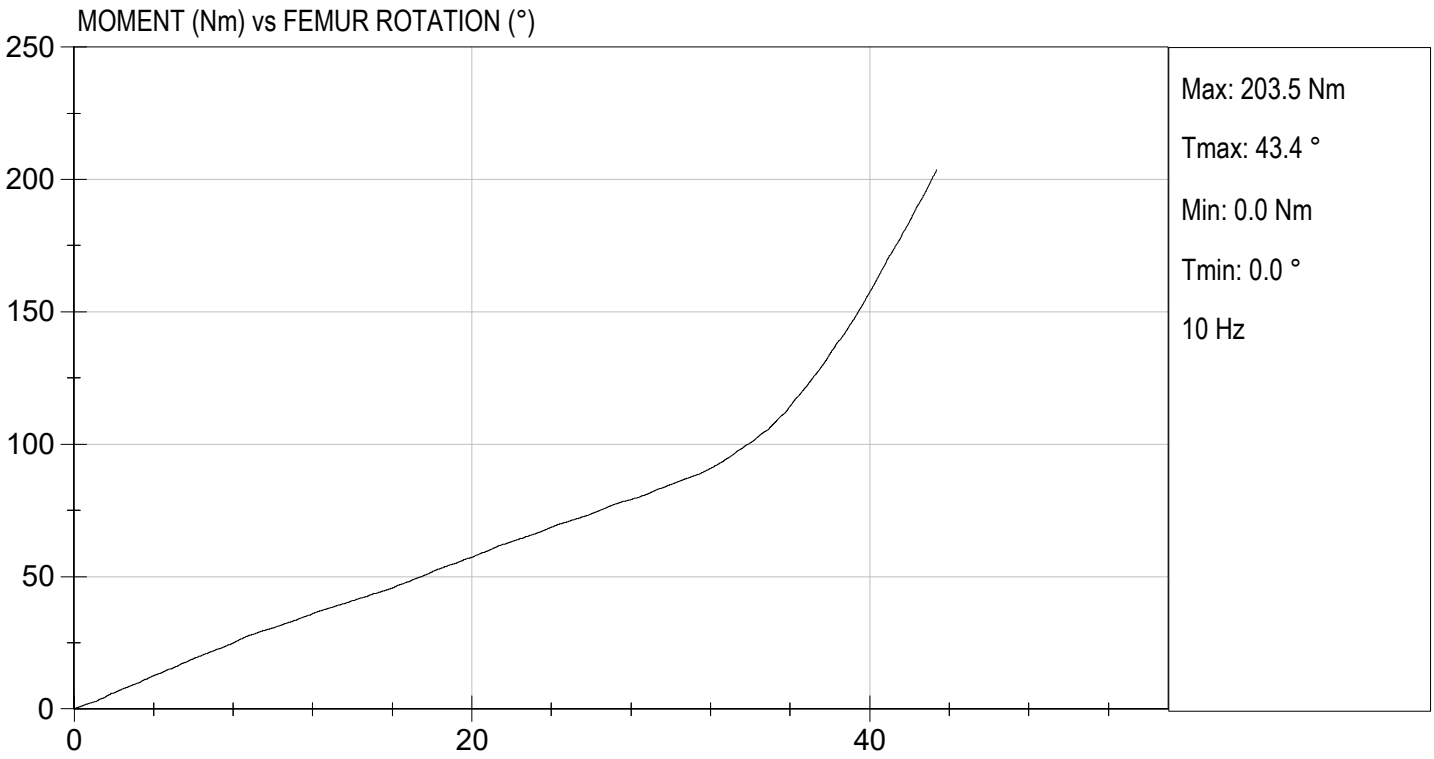
05/26/2022
Test Date

Approved By


MOMENT (Nm) vs FEMUR ROTATION (°)
250
200
150
100
50
0
0
20
40
Max: 203.6 Nm
Tmax: 41.9 °
Min: 0.0 Nm
Tmin: 0.0 °
10 Hz

TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 05/26/2022
TEST #: D221300



DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	C12811	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	C12853	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	AL6Y2	04/05/2022	10/05/2022
NECK TRANSDUCER	Denton	1716AJLN2	NET2183	02/17/2022	08/19/2022
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	AGH55	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	AGH70	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	AGH72	04/05/2022	10/05/2022
CHEST POTENTIOMETER	Humanetics	78051-317	401	04/04/2022	10/04/2022
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121AJTF	F2026	04/04/2022	10/04/2022
(2) LEFT FEMUR	Denton	2121AJTF	F2027	04/04/2022	10/04/2022
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	01/13/2022	07/15/2022
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	11/17/2021	05/19/2022
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P82128	12/07/2021	06/08/2022
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	C3035	03/02/2022	09/01/2022
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	C3034	03/02/2022	09/01/2022

LABORATORY TECHNICIAN: 

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

Dummy Serial Number: 401 Test Date: 08/24/2022

Technician: Jonah Pulokas

____ Pre test calibration
_X_ Post test calibration verification

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

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

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

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

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

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

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

Record the maximum temperature:	21.5°C
Record the minimum temperature:	21.2°C
Record the maximum humidity:	43%
Record the minimum humidity:	32%

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

Record findings and actions: No Damage

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

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

Record the actual distance: 0.5 inches

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

X 16. Complete the following table using channel class 1000 data. (572.36(i)):

Parameter	Specification	Result
Peak resultant acceleration	225 g ≤ x ≤ 275 g	253 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	-3.4 g

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

Signature

08/24/2022
Date

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test ID:** D221951

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	43	Pass
Peak Resultant Acceleration	G's	225 to 275	253	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-3.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Laboratory Technician

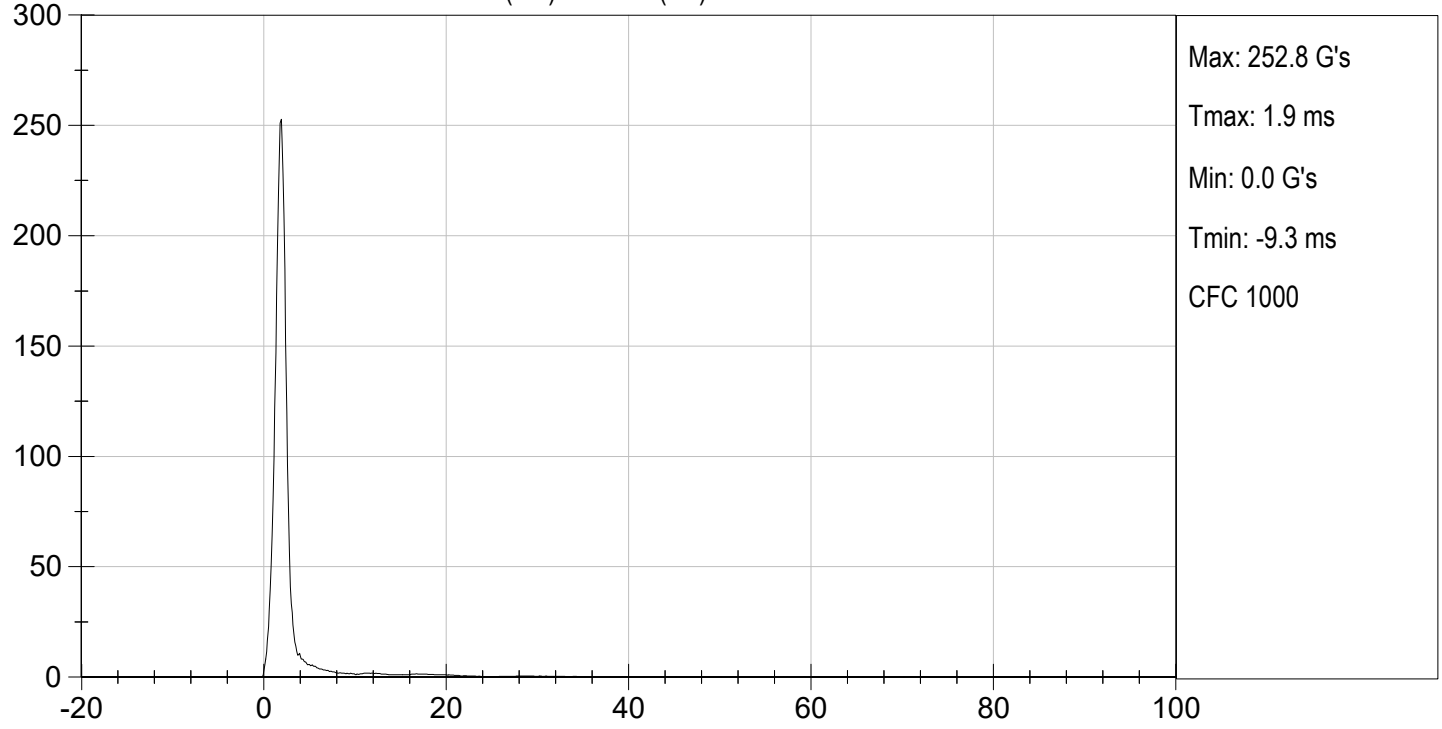
08/24/2022
Test Date

Approved By

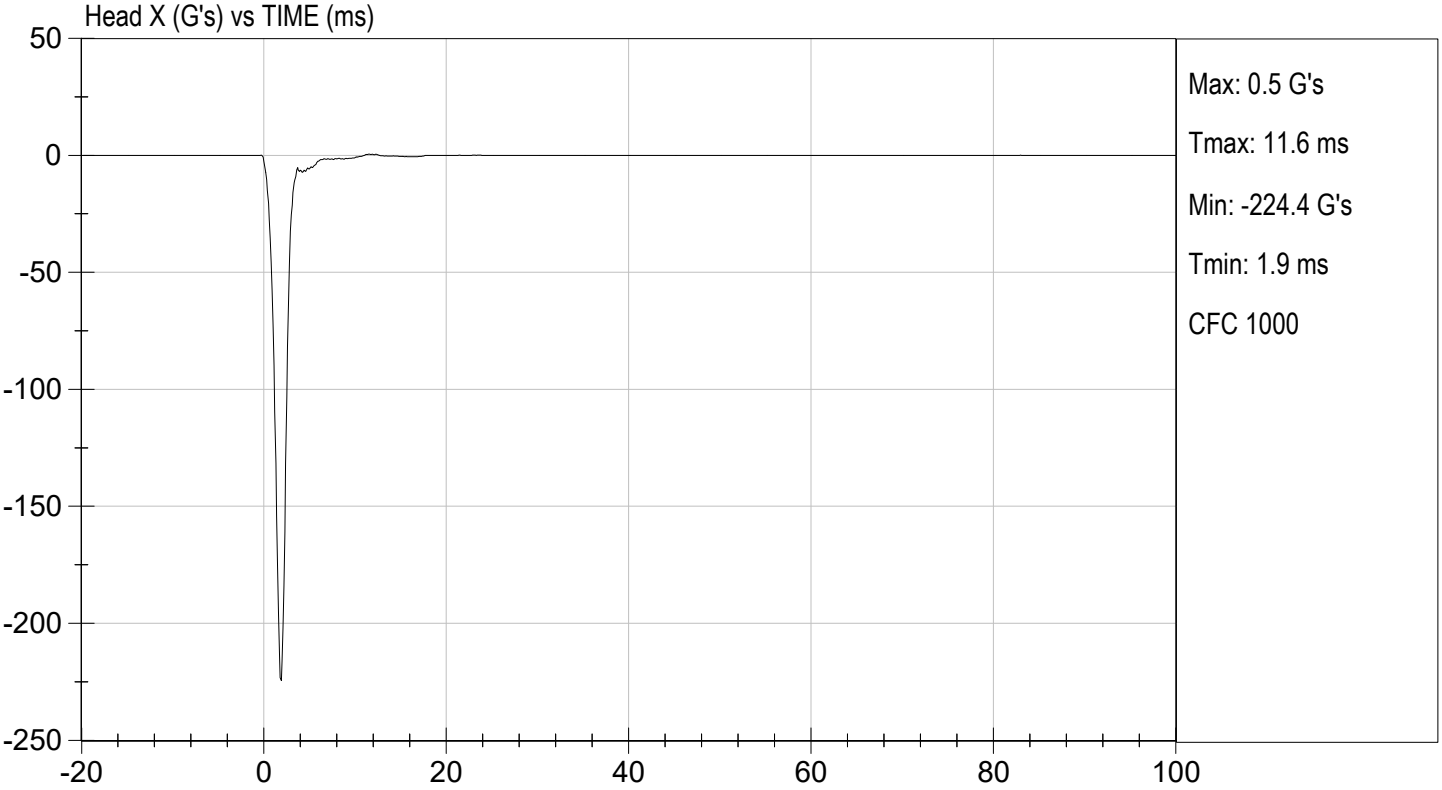
TEST DESC: HEAD DROP

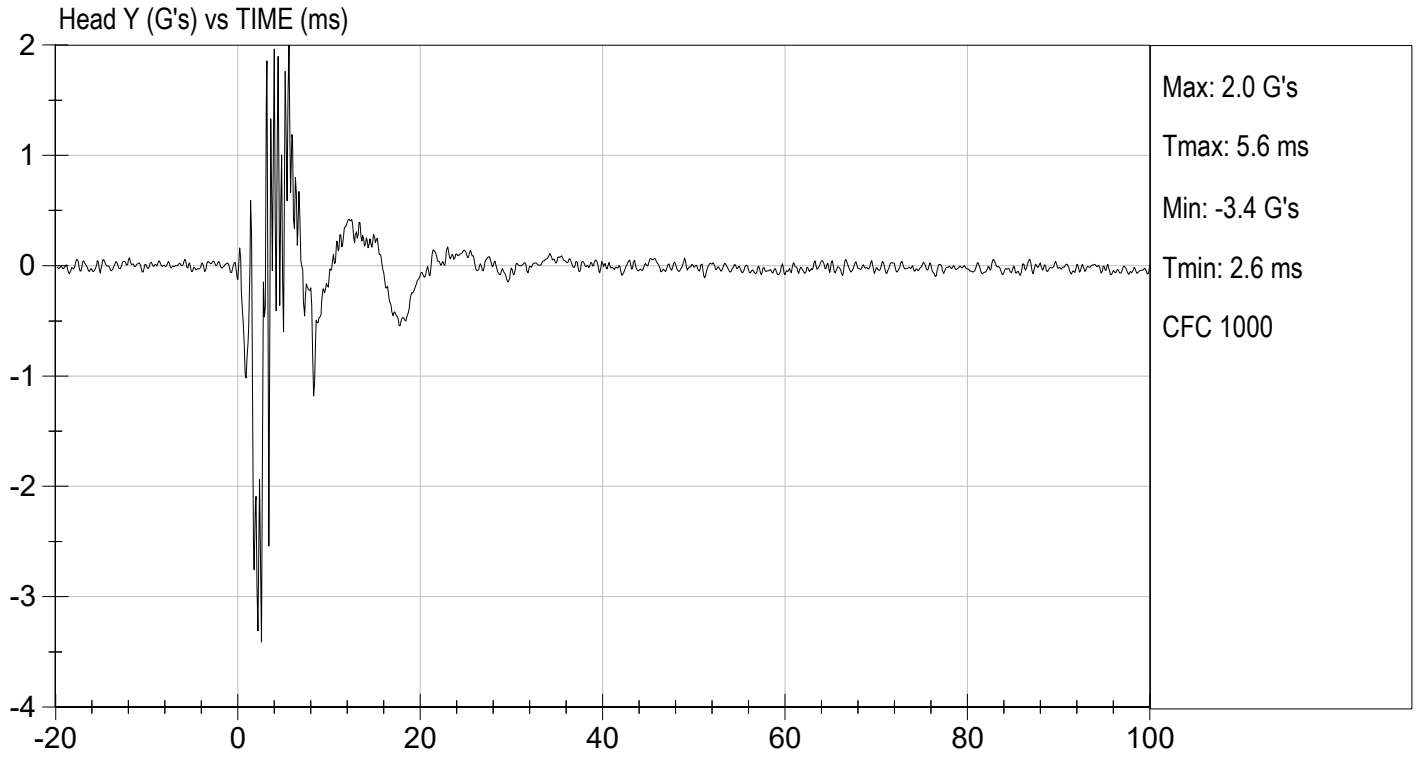
TEST DATE: 08/24/2022
TEST #: D221951

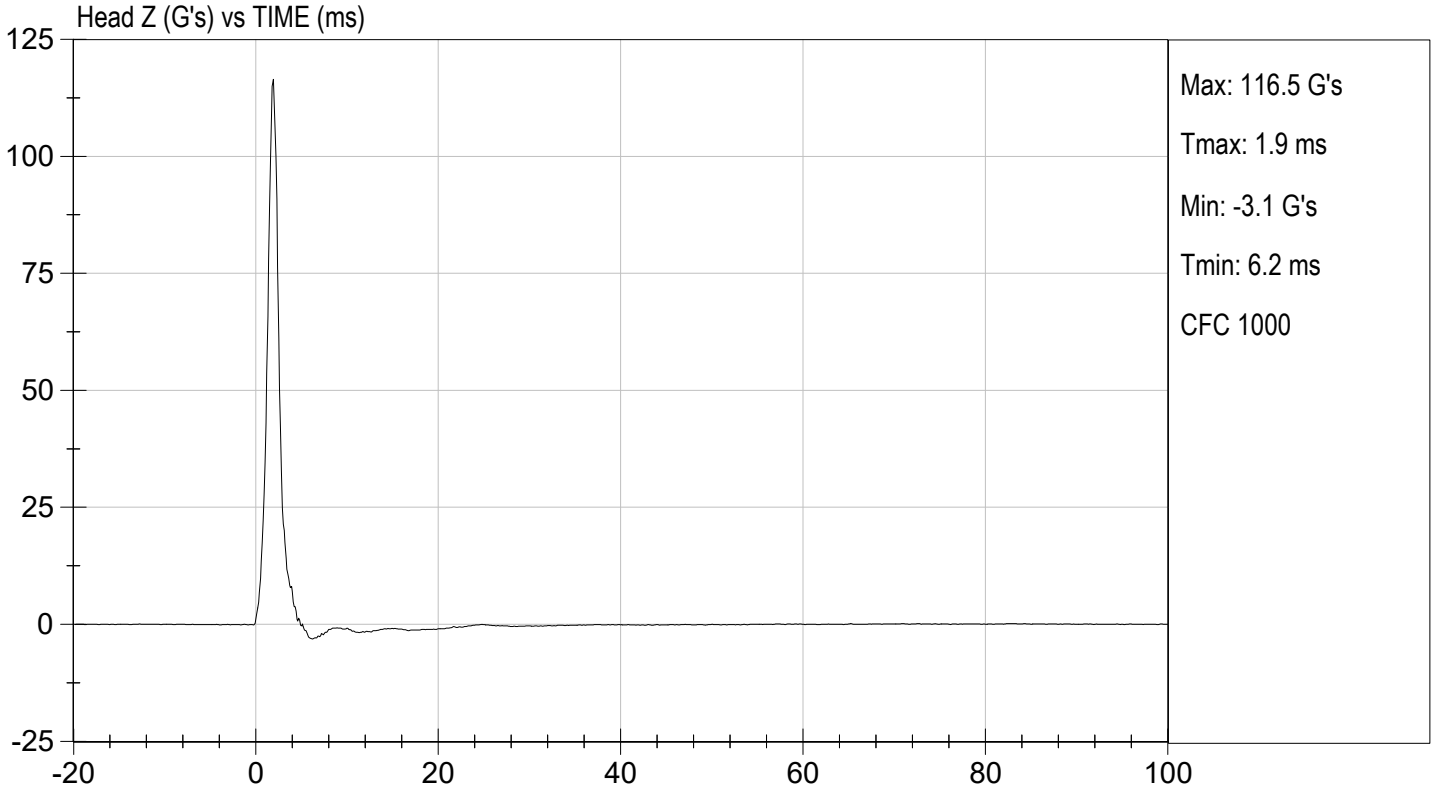
HEAD RESULTANT ACCELERATION (G's) vs TIME (ms)



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




Head Y (G's) vs TIME (ms)
2
1
0
-1
-2
-3
-4
-20
0
20
40
60
80
100
Max: 2.0 G's
Tmax: 5.6 ms
Min: -3.4 G's
Tmin: 2.6 ms
CFC 1000


Head Z (G's) vs TIME (ms)
125
100
75
50
25
0
-25
-20
0
20
40
60
80
100
Max: 116.5 G's
Tmax: 1.9 ms
Min: -3.1 G's
Tmin: 6.2 ms
CFC 1000

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

Dummy Serial Number: 401 Test Date: 08/24/2022

Technician: Jonah Pulokas

____ Pre test calibration
_X_ Post test calibration verification

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

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

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

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

Record the maximum temperature:	21.3°C
Record the minimum temperature:	21.0°C
Record the maximum humidity:	42%
Record the minimum humidity:	31%

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

Record findings and actions: No damage

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

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		22.6 ft/s ≤ speed ≤ 23.4 ft/s	22.83 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	22.5 ≤ g ≤ 27.5	23.46 g
	@ 20 ms	17.6 ≤ g ≤ 22.6	20.35 g
	@ 30 ms	12.5 ≤ g ≤ 18.5	18.27 g
	Above 30 ms	29 g maximum	18.20 g
First Pendulum Decay to 5g		34 ms ≤ time ≤ 42 ms	35.3 ms
Plane D Rotation		64° ≤ max. rotation ≤ 78°	70°
		57 ms ≤ time of max. rotation ≤ 64 ms	58.9 ms
Time for Plane D Rotation to Cross 0° During First Rebound		113 ms ≤ time ≤ 128 ms	113.4 ms
Maximum Moment		65 lbf-ft ≤ moment ≤ 80 lbf-ft	71.2 lbf-ft
		47 ms ≤ time of max. moment ≤ 58 ms	47.6 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Flexion)		97 ms ≤ time ≤ 107 ms	97.2 ms

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

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

Signature

08/24/2022

Date

MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221952

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	23.46	Pass
	20 ms	G's	17.60 to 22.60	20.35	Pass
	30 ms	G's	12.50 to 18.50	18.27	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	18.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	35.3	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	70.2	Pass
	Time	ms	57.0 to 64.0	58.9	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	113.4	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	96.5	Pass
	Time	ms	47.0 to 58.0	47.6	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	97.2	Pass
			Overall Test Results		Pass

Laboratory Technician

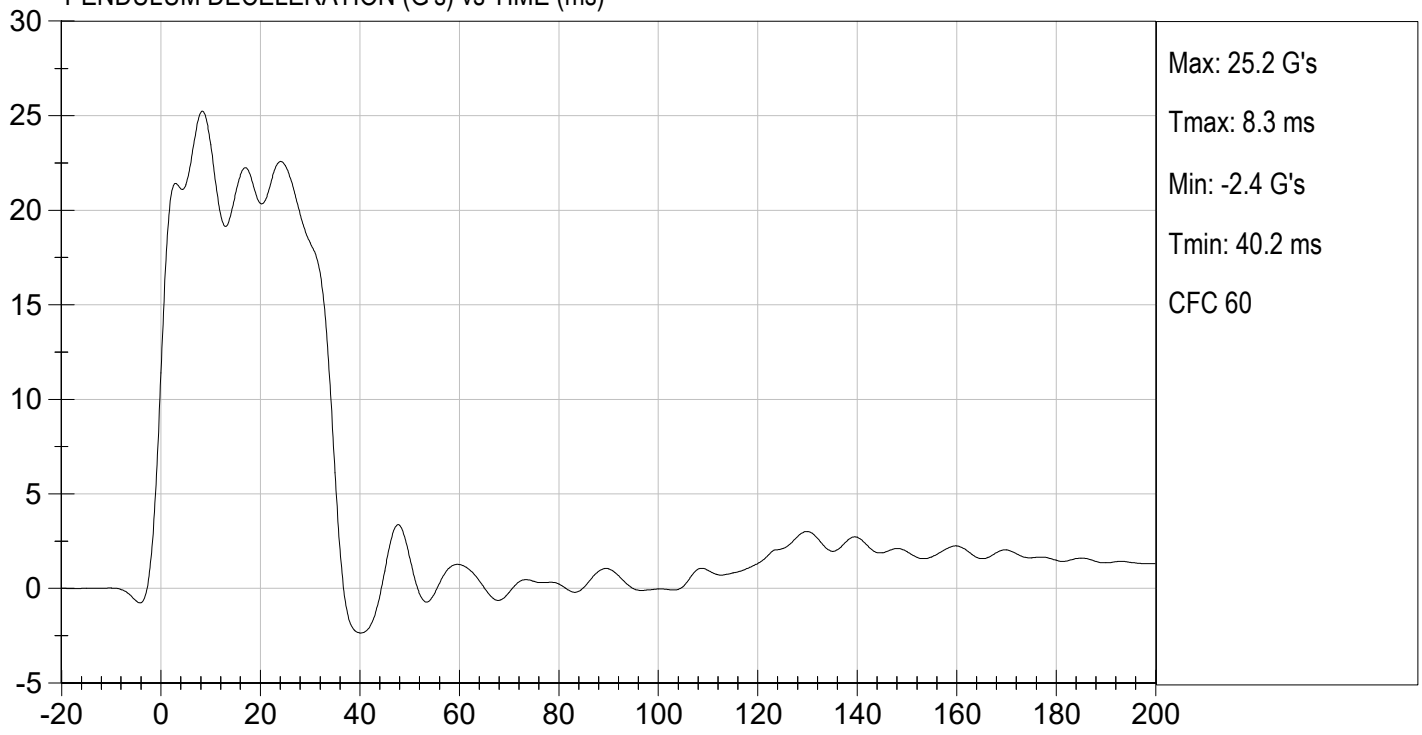
08/24/2022
Test Date

Approved By

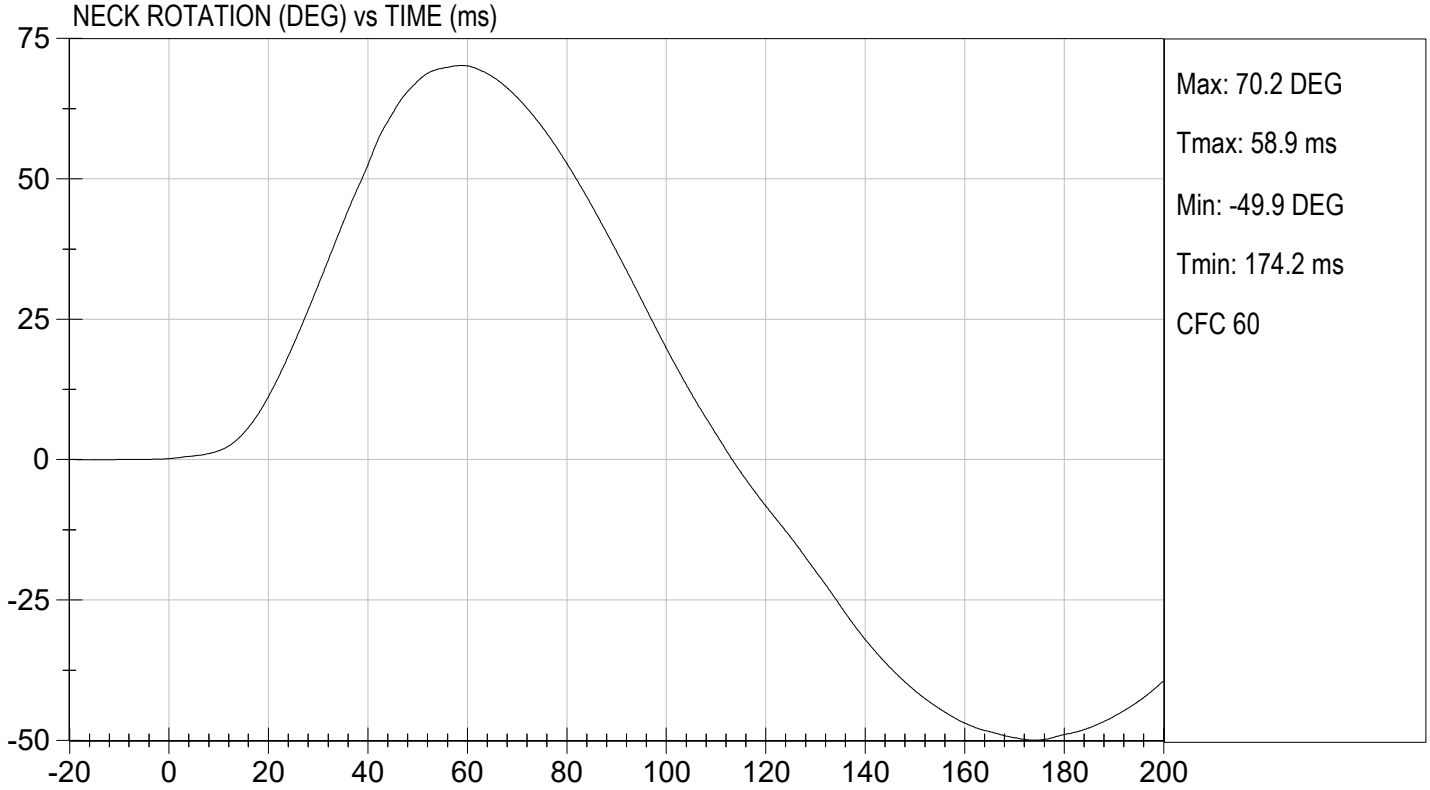
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 08/24/2022
TEST #: D221952

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

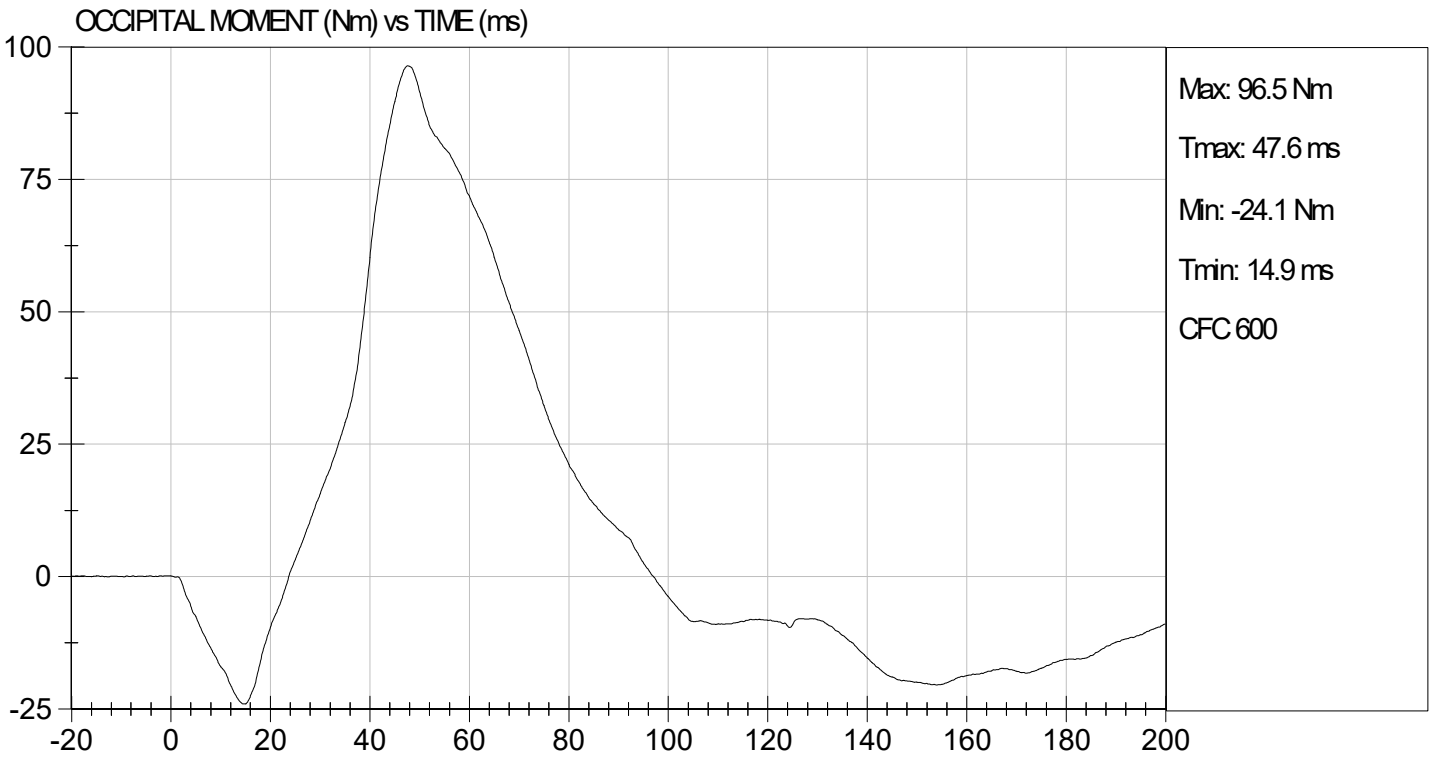


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 08/24/2022
TEST #: D221952



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

Dummy Serial Number: 401 Test Date: 08/24/2022

Technician: Jonah Pulokas

____ Pre test calibration
_X_ Post test calibration verification

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

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

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

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

Record the maximum temperature:	21.3°C
Record the minimum temperature:	21.0°C
Record the maximum humidity:	43%
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 (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (78051-90).

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

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

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

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

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

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

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

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

X 13. Complete the following table:

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

Parameter		Specification	Results
Pendulum impact speed		19.5 ft/s ≤ speed ≤ 20.3 ft/s	19.85 ft/s
Pendulum Deceleration Versus Time Pulse	@ 10 ms	17.2 ≤ g ≤ 21.2	18.39 g
	@ 20 ms	14 ≤ g ≤ 19	14.73 g
	@ 30 ms	11.0 ≤ g ≤ 16.0	12.54 g
	Above 30 ms	22 g maximum	13.0 g
First Pendulum Decay to 5g		38 ms ≤ time ≤ 46 ms	43.3 ms
Plane D Rotation		81° ≤ max. rotation ≤ 106°	94.0°
		72 ms ≤ time of max. rotation ≤ 82 ms	79.8 ms
Time for Plane D Rotation to Cross 0° During First Rebound		147 ms ≤ time ≤ 174 ms	160.6 ms
Maximum Moment		-59 lbf-ft ≤ moment ≤ -39 lbf-ft	-39.8 lbf-ft
		65 ms ≤ time of max. moment ≤ 79 ms	76.9 ms
Time of first decay to 0 lbf-ft Positive Moment Decay** (Extension)		120 ms ≤ time ≤ 148 ms	142.3 ms

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

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

X

Signature

08/24/2022

Date

MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221953

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.05	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.39	Pass
	20 ms	G's	14.00 to 19.00	14.73	Pass
	30 ms	G's	11.00 to 16.00	12.54	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.0	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	43.3	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	94.0	Pass
	Time	ms	72.0 to 82.0	79.8	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	160.6	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-54.0	Pass
	Time	ms	65.0 to 79.0	76.9	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	142.3	Pass
			Overall Test Results		Pass

Laboratory Technician

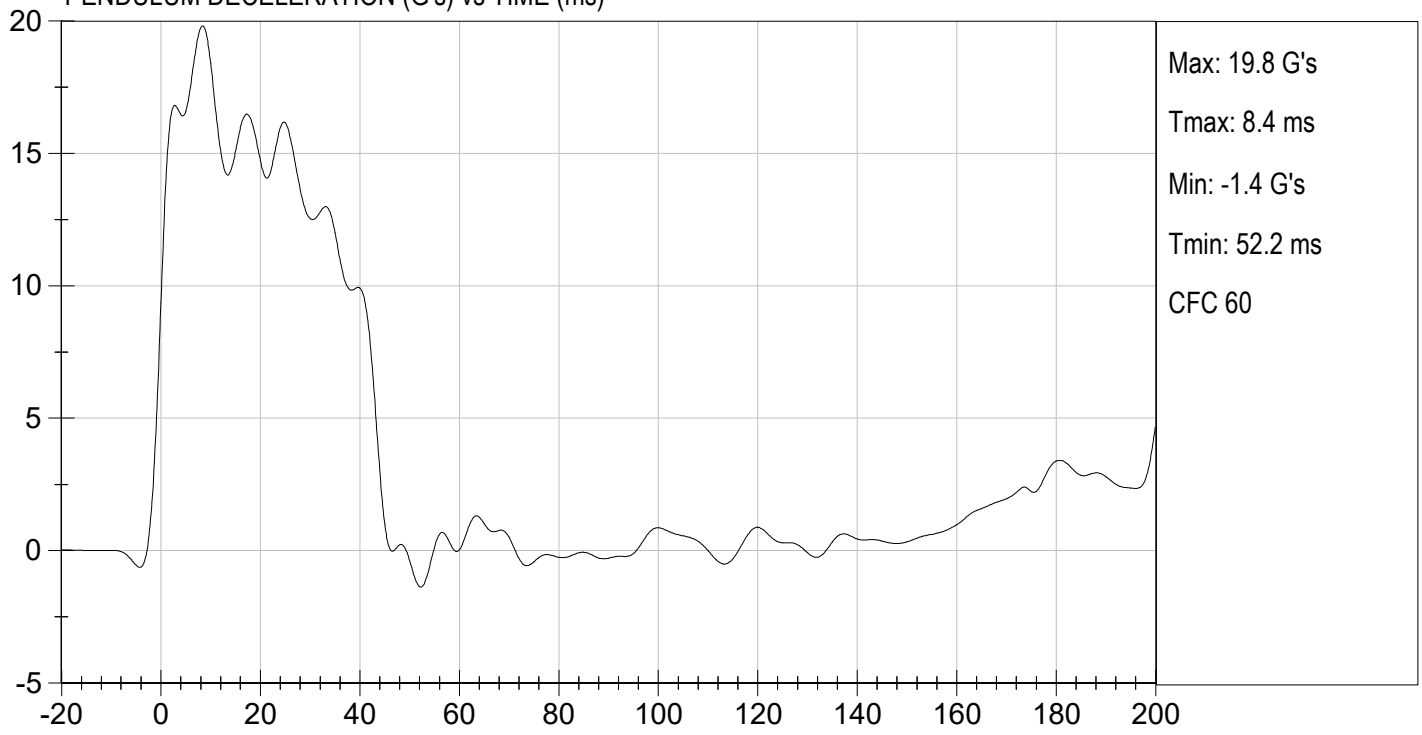
08/24/2022
Test Date

Approved By

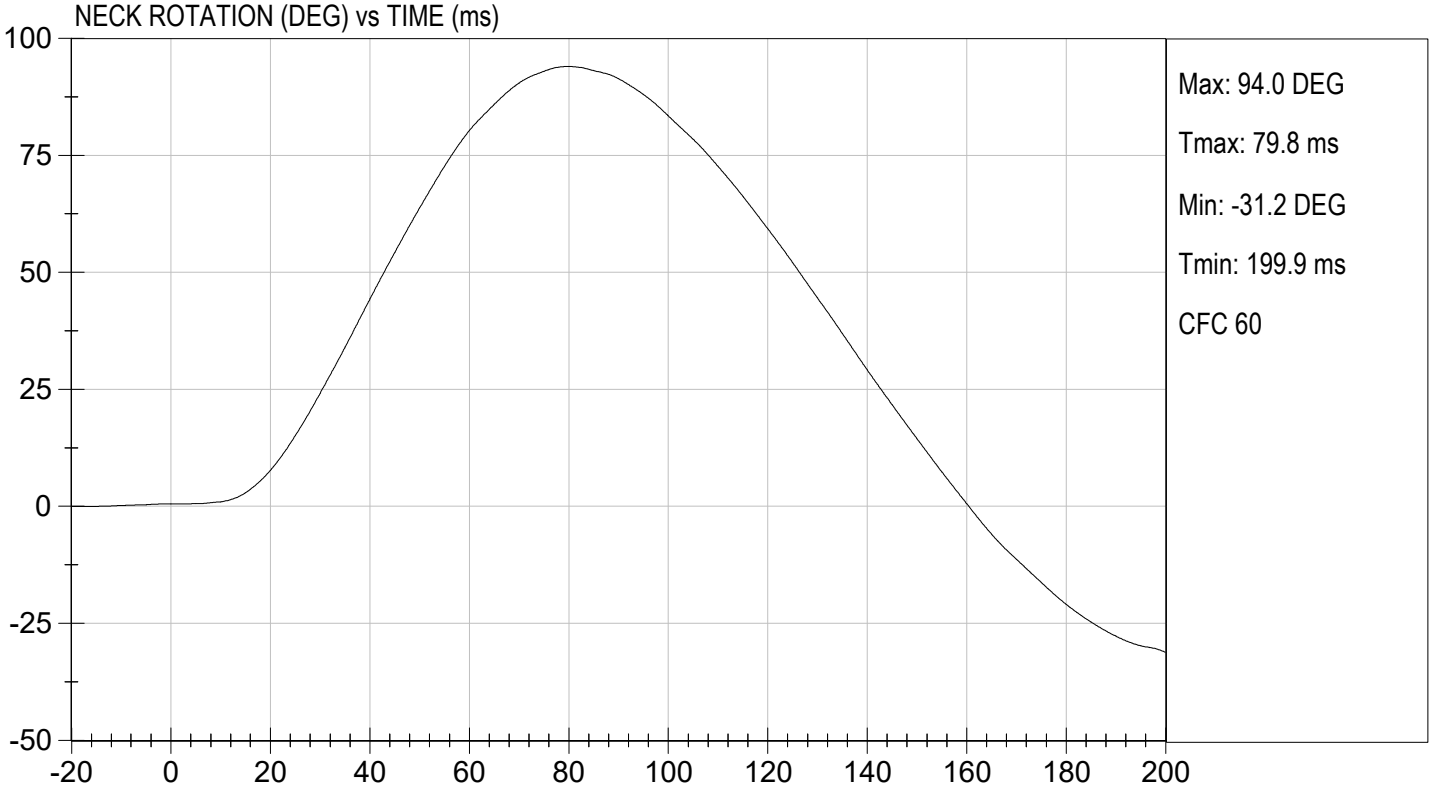
TEST DESC: NECK EXTENSION
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 08/24/2022
TEST #: D221953

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

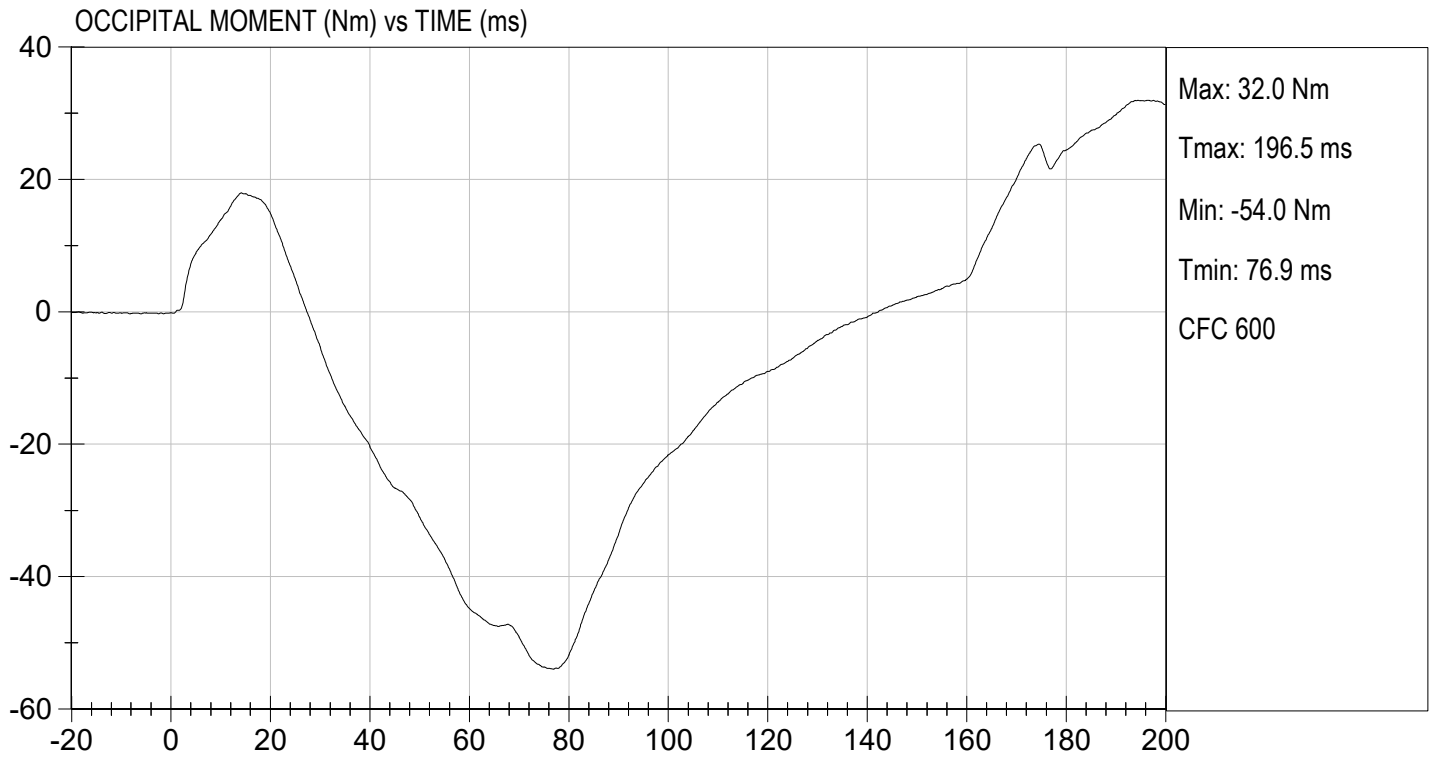


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 08/24/2022
TEST #: D221953



DATA SHEET A6

THORAX IMPACT TEST (572.34) (50th Male)

Dummy Serial Number: 401 Test Date: 08/24/2022

Technician: Jonah Pulokas

___ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one thorax impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	44%
Record the minimum humidity:	33%

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

_X_ - No Damage

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

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

_X_ 6. Seat the dummy, (chest skin still removed) without back and arm supports on the test fixture

____ surface as shown in Figure 12A. The surface must be long enough to support the pelvis and outstretched legs. (572. 34(c)(2))

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

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

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

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

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

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

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

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

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

__X__ 16. Complete the following table:

Thorax Impact Results (572.34(b))

Parameter*	Specification	Result
Test Probe Speed	21.6 ft/s ≤ speed ≤ 22.4 ft/s	21.92 ft/s
Chest Compression	2.5 in. ≤ compression ≤ 2.86 in.	2.84 in.
Peak resistance force**	1160 lb ≤ peak force ≤ 1325 lb	1248 lb
Internal Hysteresis***	69% ≤ hysteresis ≤ 85%	71 %

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

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

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

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

Signature

08/24/2022
Date

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221954

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
Probe Velocity	m/s	6.58 to 6.82	6.68	Pass
Peak Probe Force	N	5159 to 5893	5,551	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	7.21	Pass
Internal Hysteresis	%	69 to 85	71	Pass
		Overall Test Results		Pass

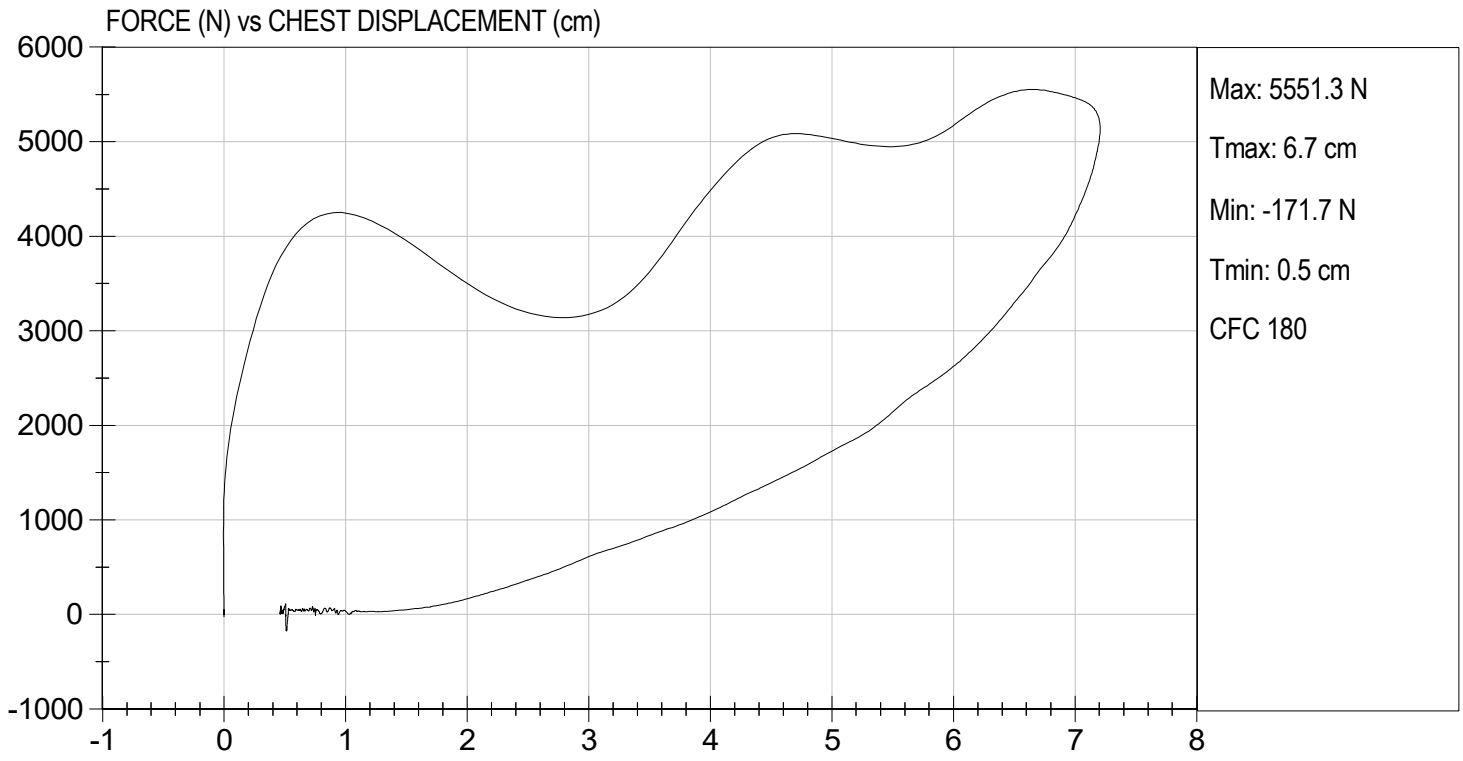
Laboratory Technician

08/24/2022
Test Date

Approved By

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

TEST DATE: 08/24/2022
TEST #: D221954



DATA SHEET A7

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

Dummy Serial Number: 401 Test Date: 08/25/2022

Technician: Jonah Pulokas

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	47%
Record the minimum humidity:	36%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.79 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1177 lb

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

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

Signature

08/25/2022
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221956

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	47	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	5,234	Pass
		Overall Test Results		Pass

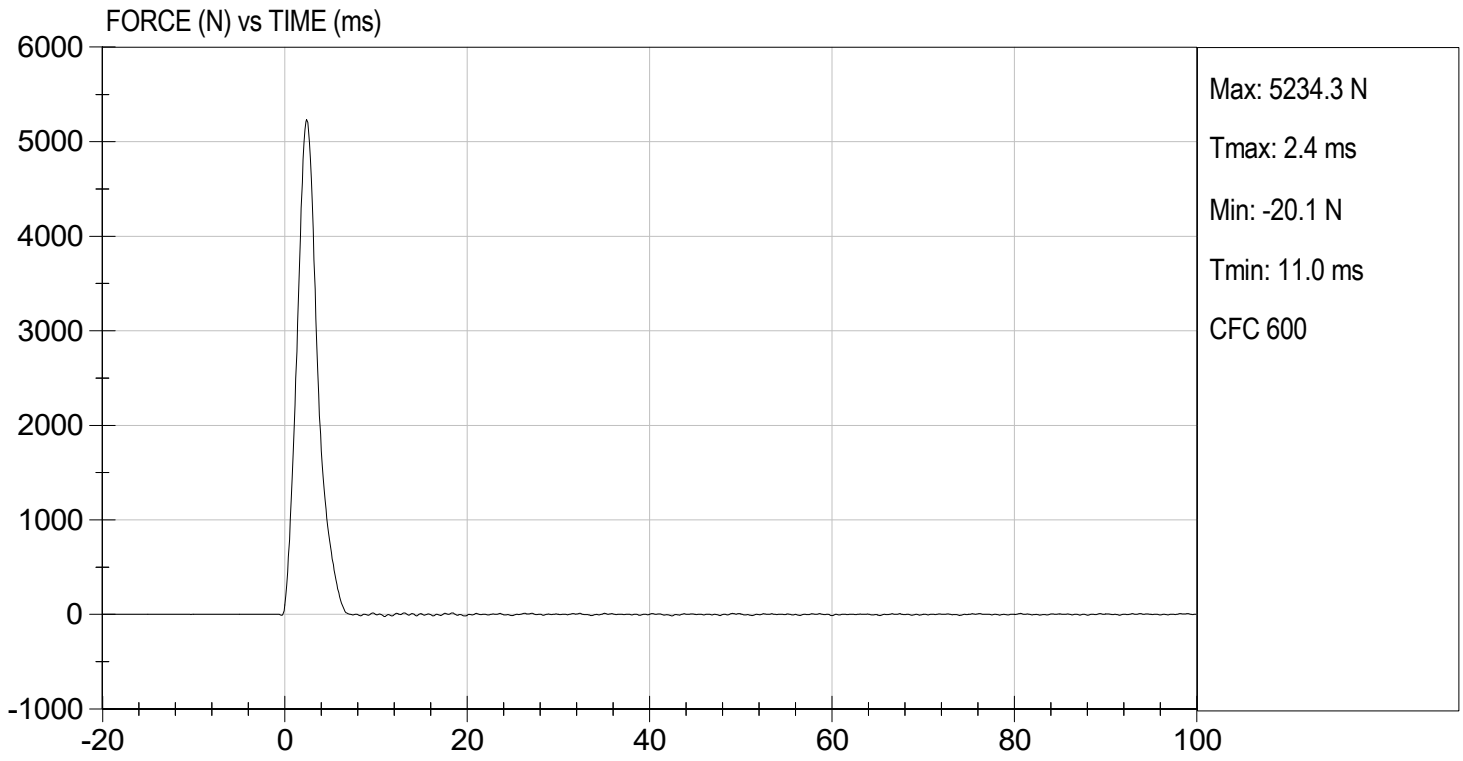
Laboratory Technician

08/25/2022
Test Date

Approved By

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

TEST DATE: 08/25/2022
TEST #: D221956



DATA SHEET A8

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

Dummy Serial Number: 401 Test Date: 08/25/2022

Technician: Jonah Pulokas

____ Pre test calibration

_X_ Post test calibration verification

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

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

_X_ N/A, ONLY one knee impact test performed

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

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	47%
Record the minimum humidity:	36%

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

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

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

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

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

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

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	6.8 ft/s ≤ speed ≤ 7.0 ft/s	6.79 ft/s
Peak resistance force*	1060 lb ≤ force ≤ 1300 lb	1107 lb

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

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

Signature

08/25/2022
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221955

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	47	Pass
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	4,924	Pass
		Overall Test Results		Pass

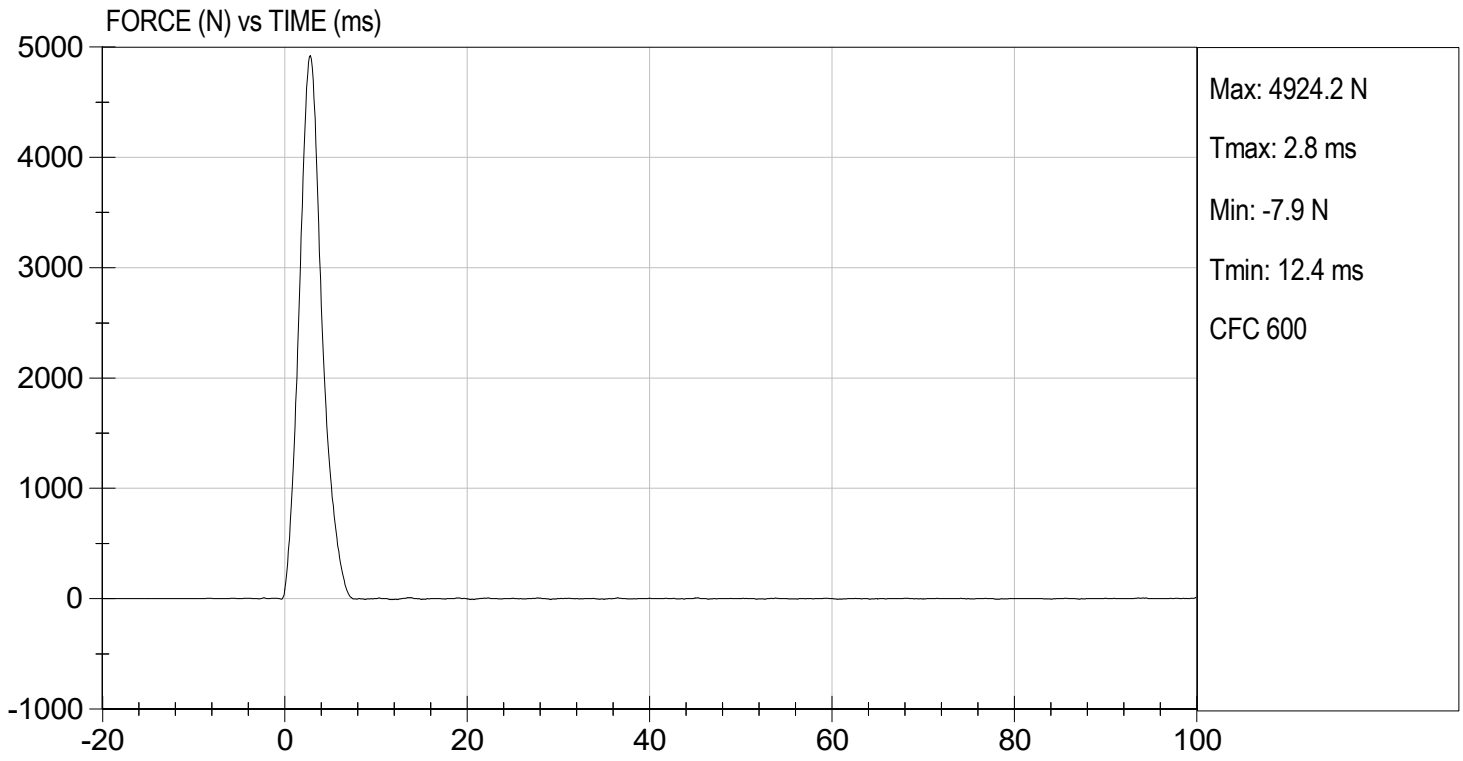
Laboratory Technician

08/25/2022
Test Date

Approved By

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

TEST DATE: 08/25/2022
TEST #: D221955



DATA SHEET A9

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

Dummy Serial Number: 401 Test Date: 08/25/2022

Technician: Jon Love

____ Pre test calibration

_X_ Post test calibration verification

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

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

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

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

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

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

_X_ 3.2 remove the abdominal insert (78051-52)

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

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

Record the maximum temperature:	21.4°C
Record the minimum temperature:	21.1°C
Record the maximum humidity:	47%
Record the minimum humidity:	36%

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

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

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

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

_X_ 9. Lift the lever arm parallel to the midsagittal plane at a rotation rate between 5 and 10 degrees per second while maintaining the ½ in. shoulder bolt longitudinal centerline

horizontal throughout the range of motion until the 150 ft-lbf torque level is reached (Figures 18A and 19A). (572.35(c)(2)(iv))

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	Torque ≤ 70 ft-lbf	68.7 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	41°

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

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

X 10. Complete the following table:

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

Parameter	Specification	Result
Rotation Rate	5°/s ≤ rotation rate ≤ 10°/s	6°/s
Femur Torque at 30°	torque ≤ 70 ft-lbf	67.0 ft-lbf
Rotation at 150 lbf-ft	40° ≤ rotation ≤ 50°	42°

Signature

08/25/2022
Date

MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 401 **Test I.D:** D221959

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.4	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	47	47	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.2	6.3	Pass
30 Degrees	Nm	94.9 Nm Max	90.9	93.087	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	41.7	40.6	Pass
		Overall Test Results			Pass

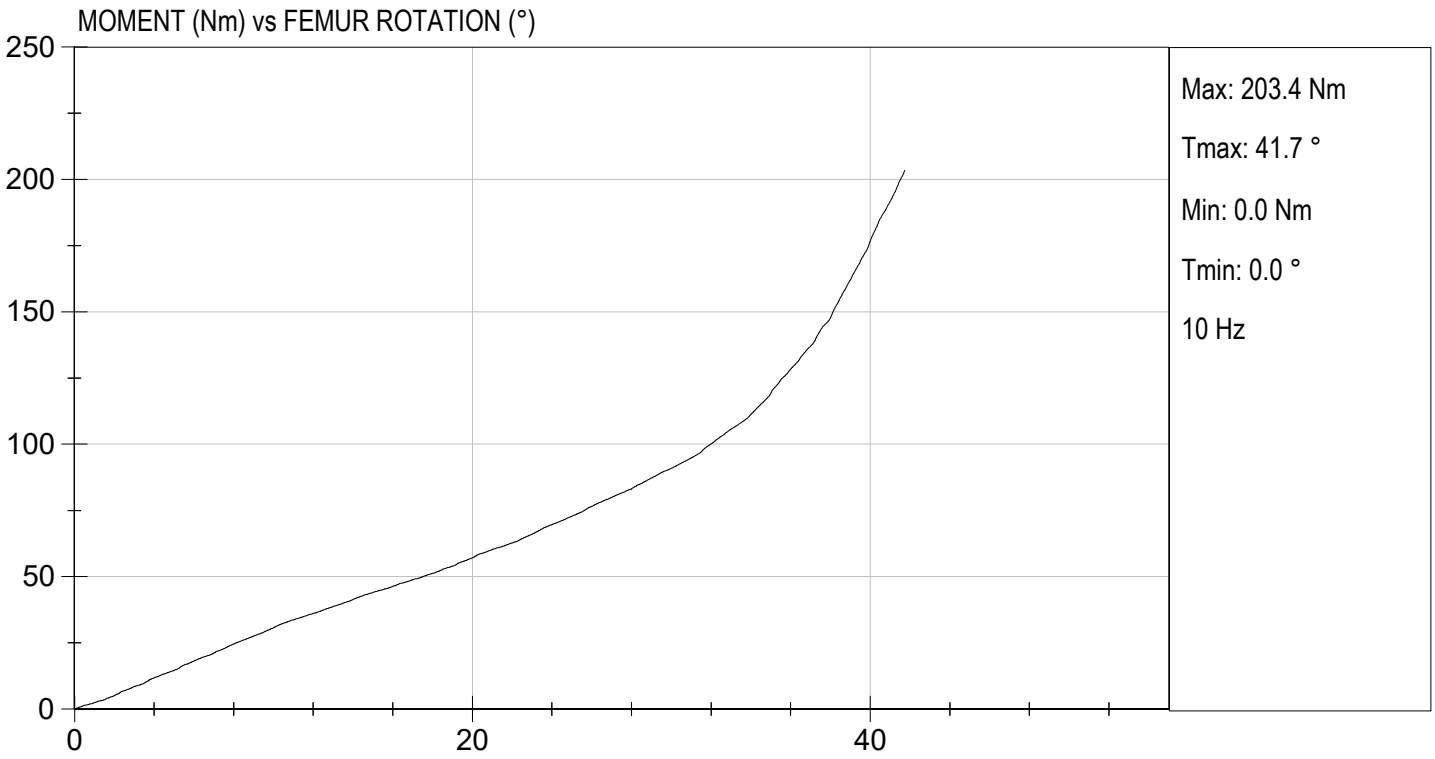
Laboratory Technician

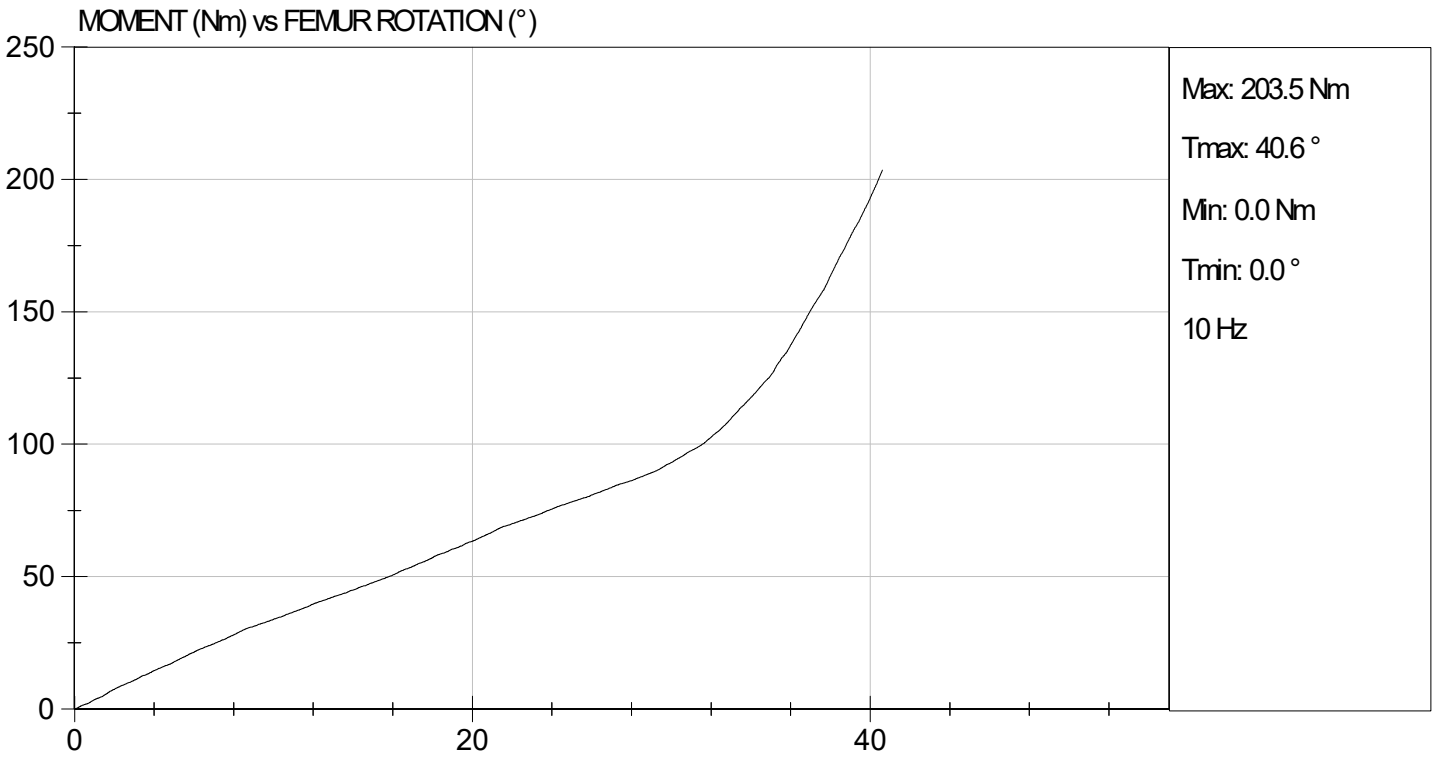
08/25/2022
Test Date

Approved By

TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 08/25/2022
TEST #: D221959




MOMENT (Nm) vs FEMUR ROTATION (°)
250
200
150
100
50
0
0
20
40
Max: 203.5 Nm
Tmax: 40.6 °
Min: 0.0 Nm
Tmin: 0.0 °
10 Hz

DATA SHEET A1
DUMMY DAMAGE CHECKLIST (50th Male)

Dummy Serial Number: 401 Test Date: 08/24/2022

Technician: Jonah Pulokas

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:

Signature

08/25/2022
Date

Describe the repair or replacement of parts:

Checked by:

Signature

08/25/2022
Date

DATA SHEET A10

PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7231C-750	C12811	04/05/2022	10/05/2022
(2) LATERAL	Endevco	7231C-750	C12853	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	7231C-750	AL6Y2	04/05/2022	10/05/2022
NECK TRANSDUCER	Denton	1716A	N1145	07/15/2022	01/14/2023
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	04/05/2022	AGH55	04/05/2022	10/05/2022
(2) LATERAL	Endevco	04/05/2022	AGH70	04/05/2022	10/05/2022
(3) VERTICAL	Endevco	04/05/2022	AGH72	04/05/2022	10/05/2022
CHEST POTENTIOMETER	Humanetics	78051-317	401	04/04/2022	10/04/2022
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121AJTF	F2026	04/04/2022	10/04/2022
(2) LEFT FEMUR	Denton	2121AJTF	F2027	04/04/2022	10/04/2022
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMTER	Endevco	7231C-750	AH5P1	07/15/2022	01/14/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/19/2022	11/18/2022
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	05/31/2022	11/30/2022
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	C3035	03/02/2022	09/01/2022
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	C3034	03/02/2022	09/01/2022

LABORATORY TECHNICIAN: