

**REPORT NUMBER: 208-MGA-2023-004**

**DUMMY PERFORMANCE CALIBRATIONS  
FMVSS 208**

**VOLVO CAR CORPORATION  
2023 VOLVO XC40  
NHTSA NO.: C20235900**

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



**TEST DATES: FEBRUARY 24, 2023 – SEPTEMBER 19, 2023**

**FINAL REPORT DATE: OCTOBER 27, 2023**

**FINAL REPORT**

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

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## EXTERNAL DIMENSIONS

HYBRID III 5 <sup>th</sup> SN #507, PART 572, SUBPART O EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	774.7-800.1	781.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	455.4
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	148.0
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	79.2
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	130.3
G	BACK OF ELBOW TO WRIST PIVOT	Back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	243.9-259.1	249
H	HEAD BACK TO BACKLINE	Back of skull cap skin to seat rear vertical surface (Reference)	43.2-48.2	44.8
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.	276.8-297.2	280.1
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.0
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	520.7-546.1	544.1
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	356.5
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	394.0
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. "K".	414.0-439.4	434.2

HYBRID III 5 <sup>th</sup> SN #507, PART 572, SUBPART O EXTERNAL DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (mm)	ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 304.8 ± 5.1 mm above seat surface	175.3-190.5	186.7
P	FOOT LENGTH	Tip of toe to rear of heel	218.5-233.7	222.0
Q	STANDING HEIGHT	(THEORETICAL)	1501.1	N/A
R	BUTTOCK TO KNEE PIVOT LENGTH	The rear surface of the buttocks to the knee pivot bolt	457.2-482.6	481.3
S	HEAD BREADTH	The widest part of the head	137.1-147.3	138.4
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	178.1
U	HIP BREADTH	The widest part of the hip	299.7-314.9	309.6
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	363.9
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	89.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. "T"	528.3-548.7	539.4
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	863.7
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	787.1
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	342.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	168.0

**DATA SHEET B3**  
HEAD DROP TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/16/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>41%</u>    |
| Record the minimum humidity:    | <u>34%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the

forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	266 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-2.4 g

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

Jon Seve  
Signature

08/16/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

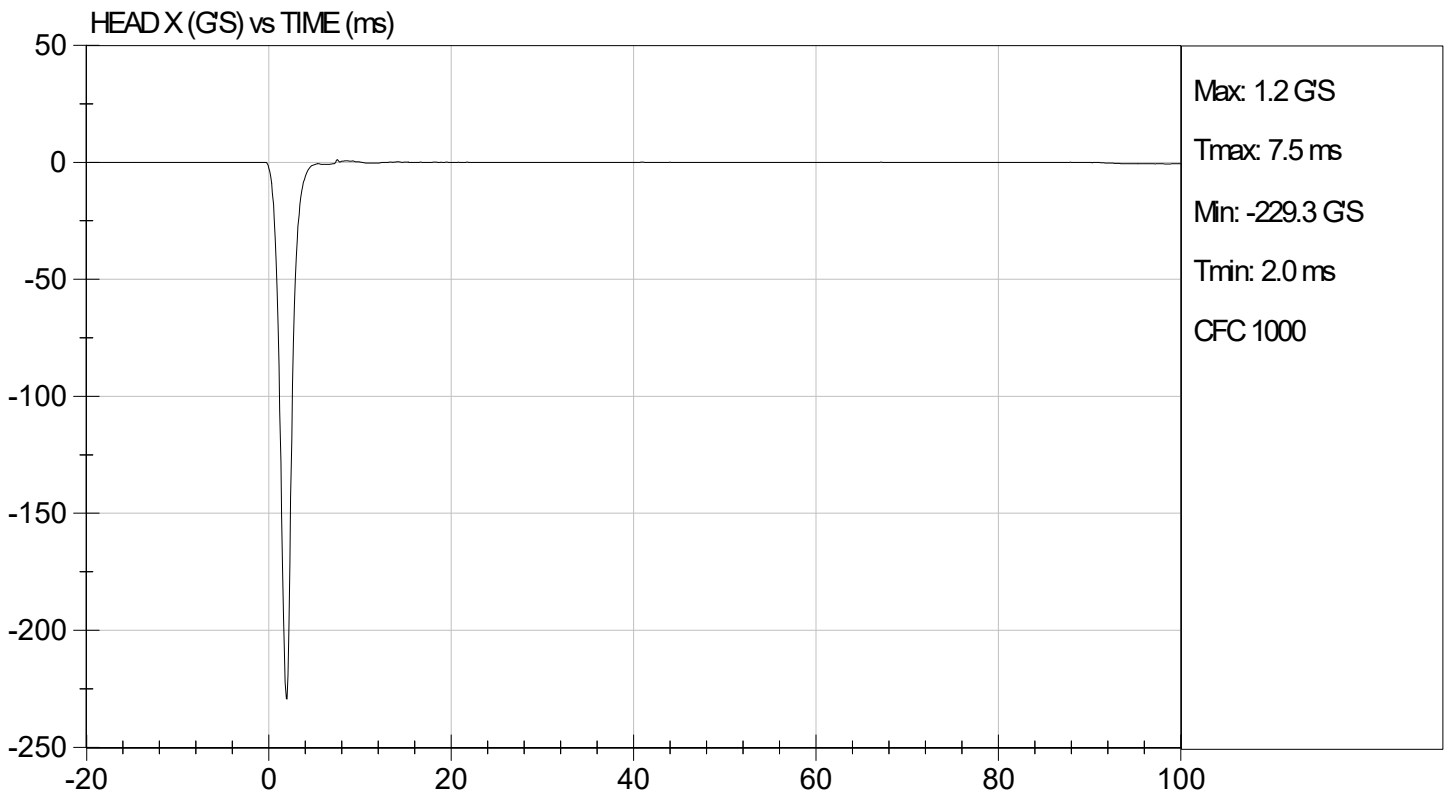
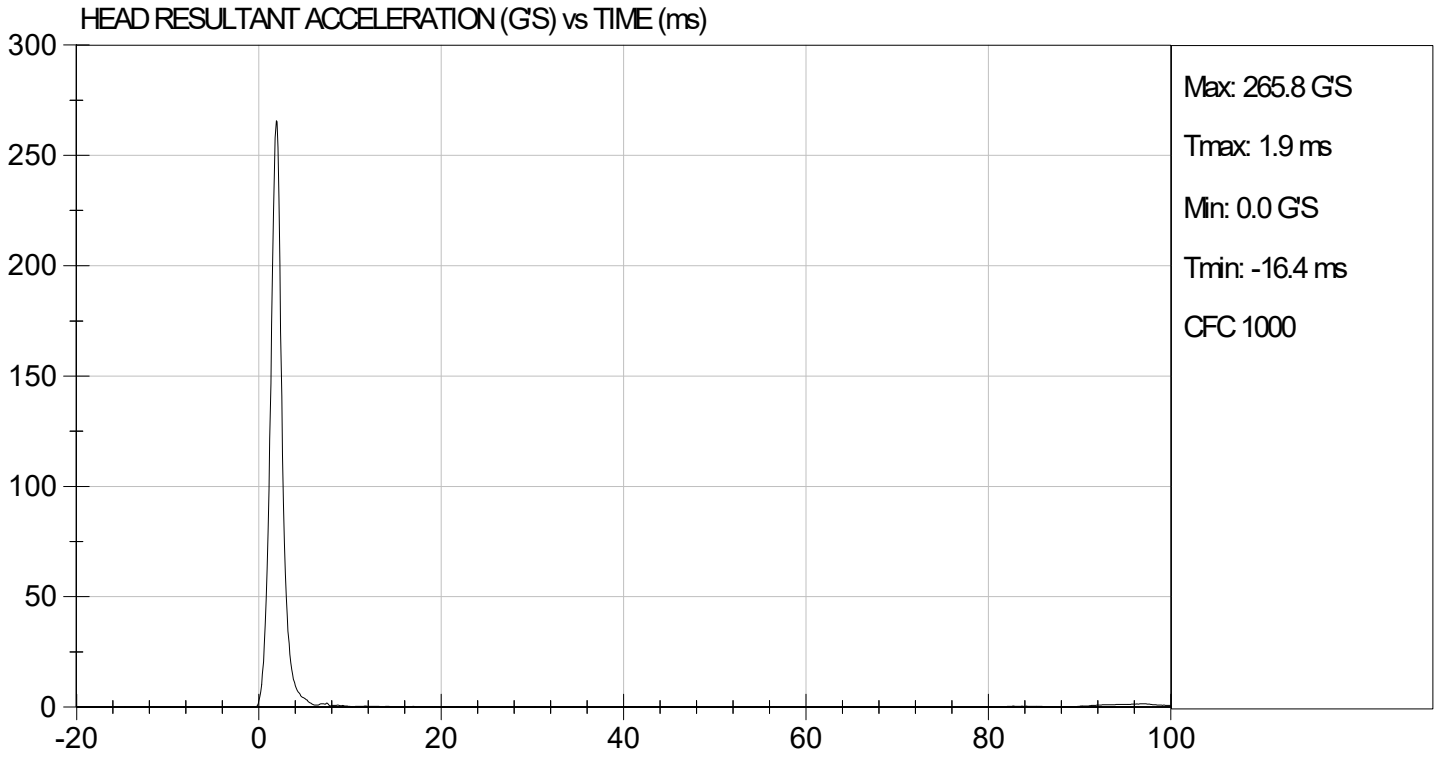
Test ID: D232231

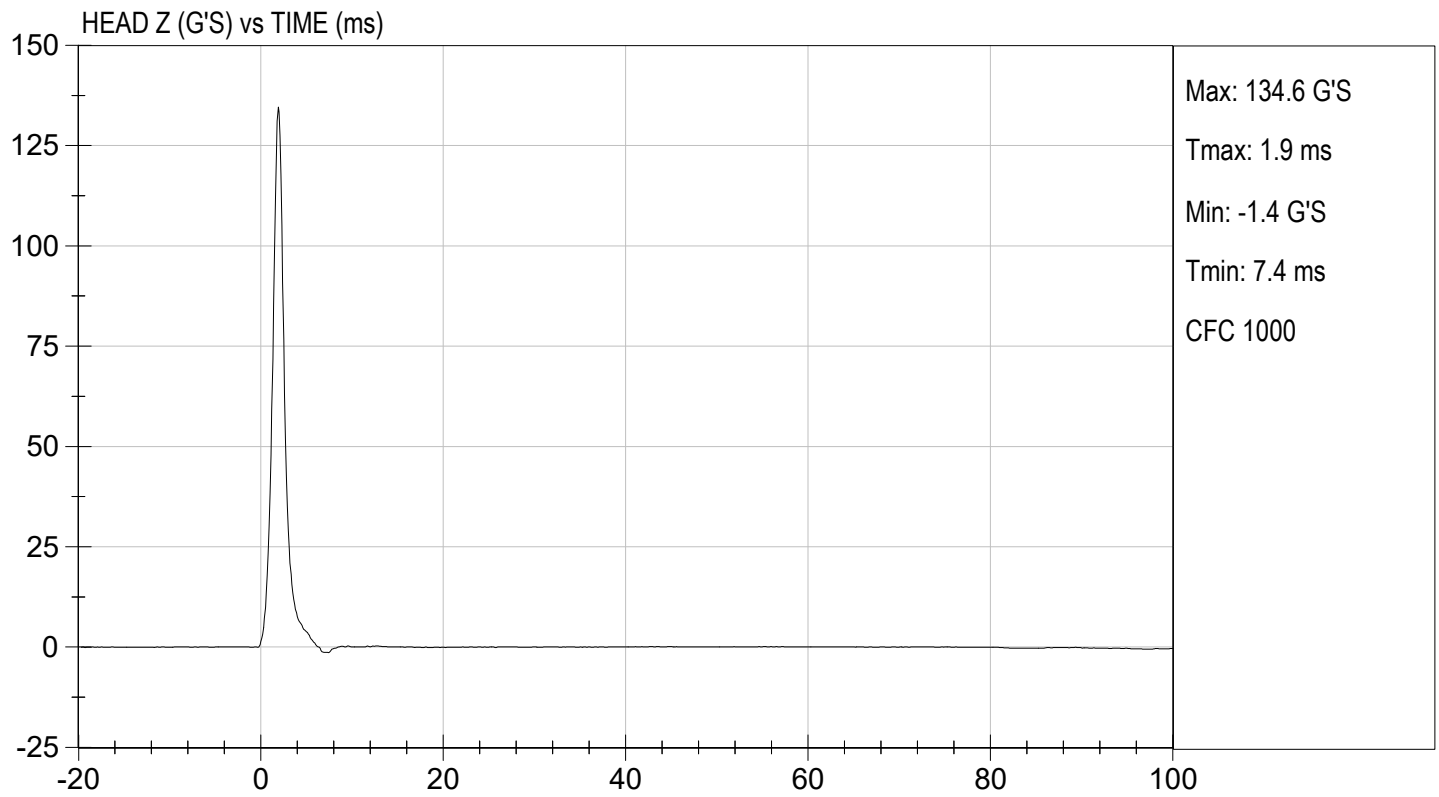
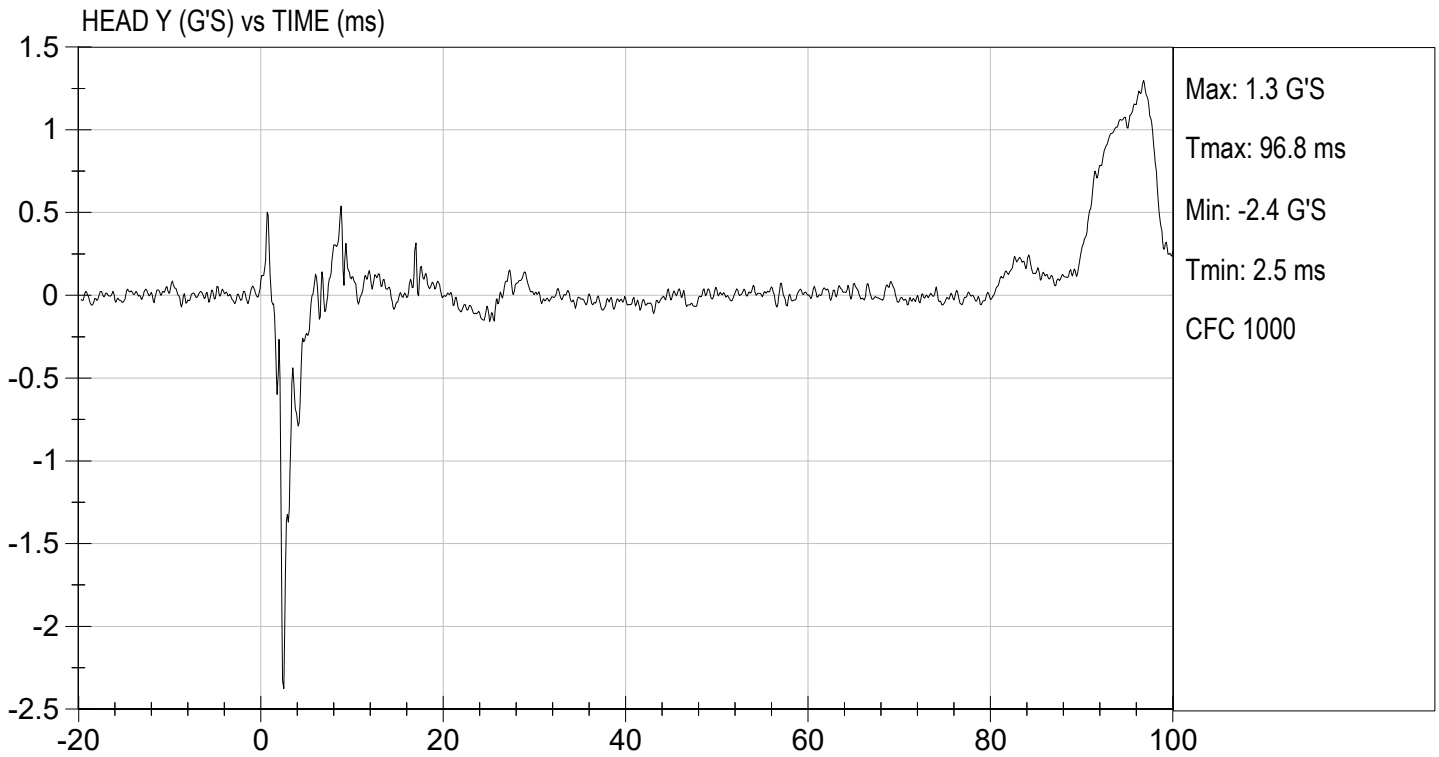
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	250 to 300	266	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 \_\_\_\_\_  
 Laboratory Technician

08/16/2023  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By





**DATA SHEET B4**  
NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/16/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>41%</u>    |
| Record the minimum humidity:    | <u>34%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J2111/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.6 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.5 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	70 Nm @ 84 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	86 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

08/16/2023  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

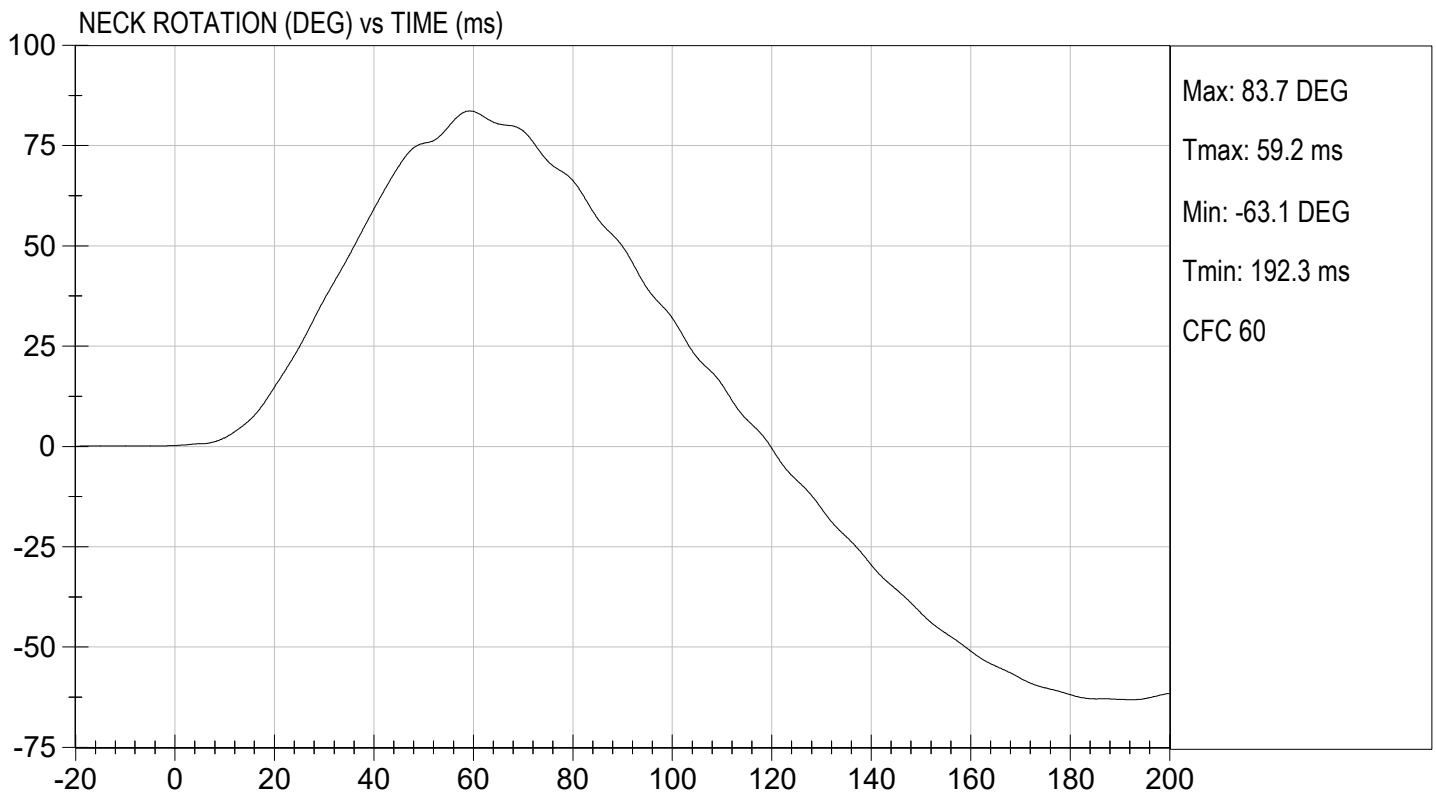
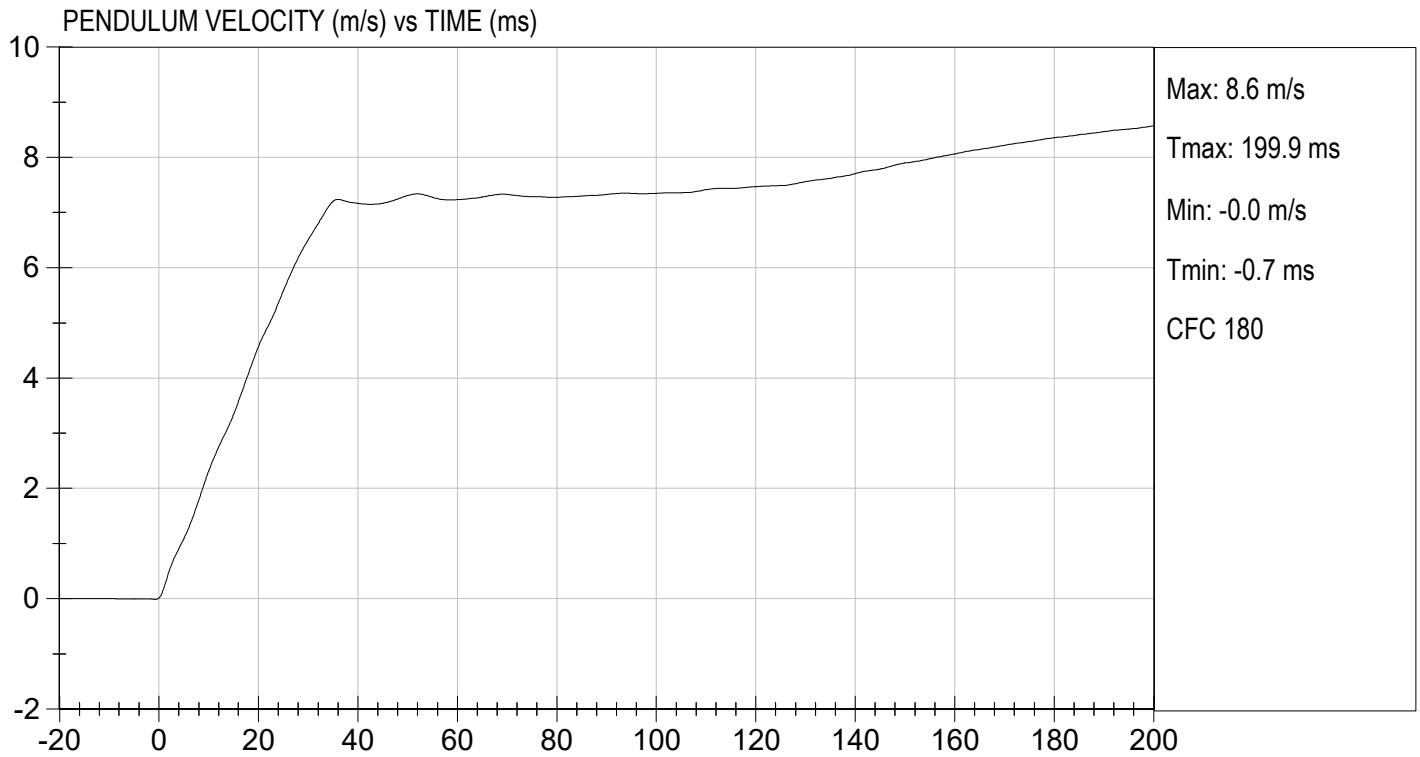
Test I.D.: D232232

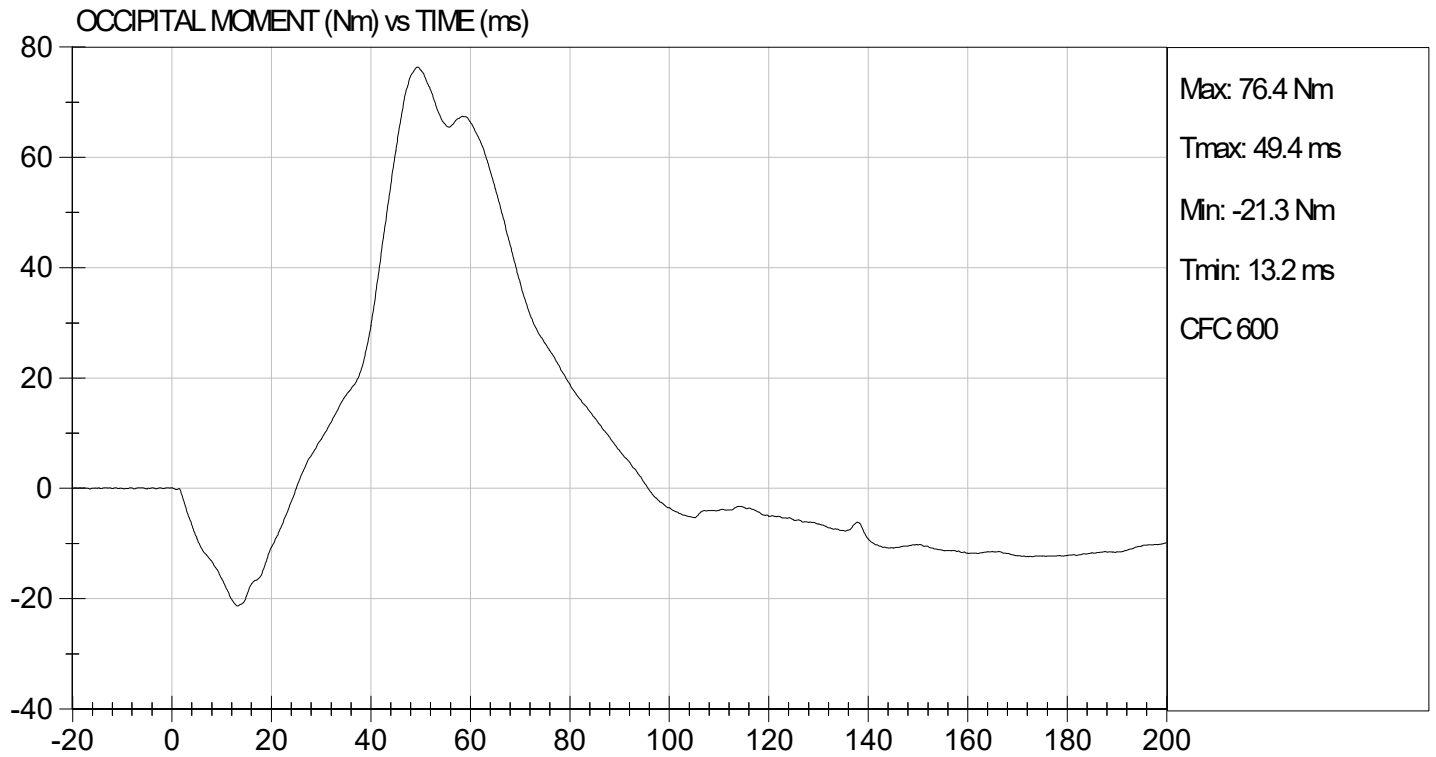
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	84	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
Overall Results					Pass

  
 \_\_\_\_\_  
 Laboratory Technician

08/16/2023  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By





**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/17/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>47%</u>    |
| Record the minimum humidity:    | <u>40%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

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

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.8 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.6 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.4 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-54 Nm @ 111 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	106 ms


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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

08/17/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

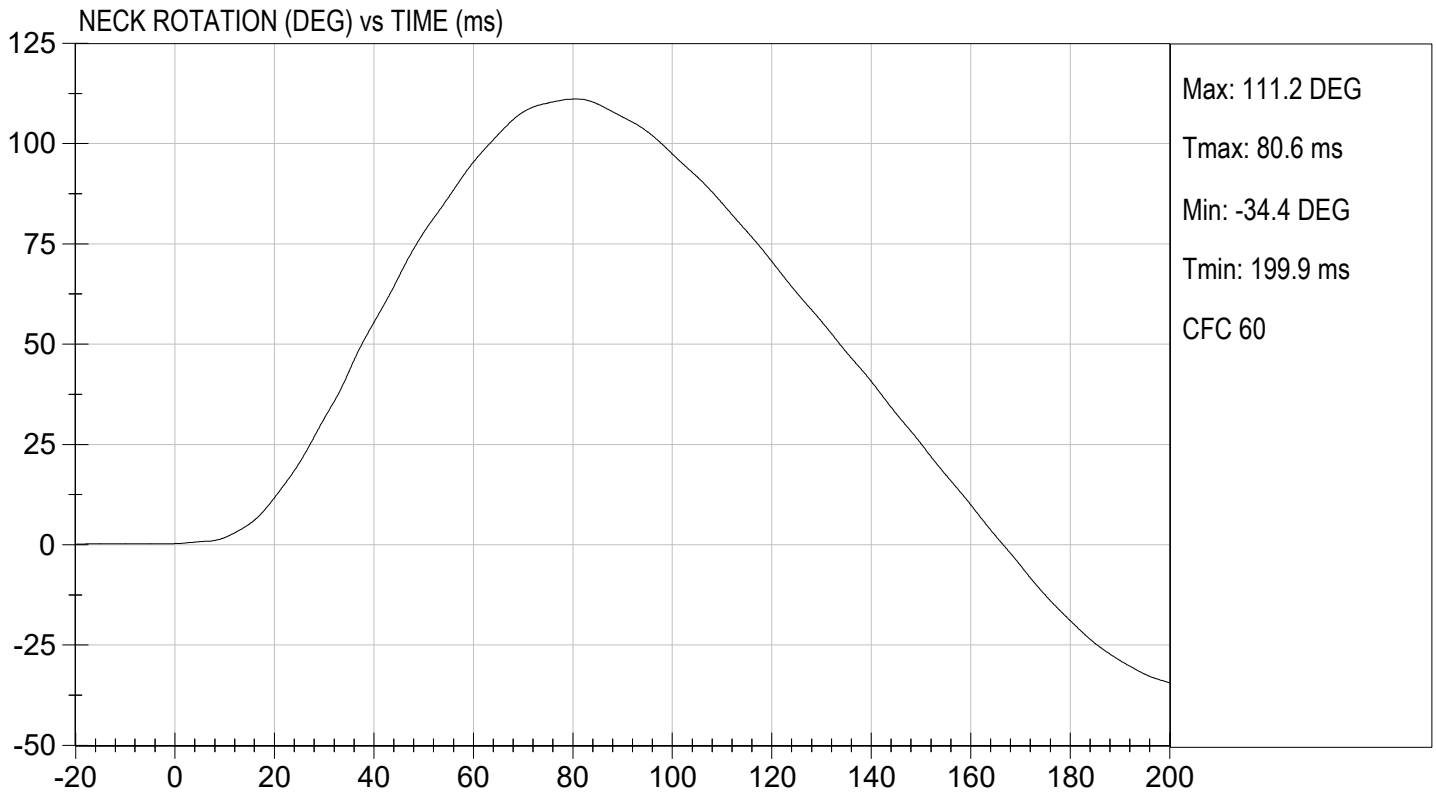
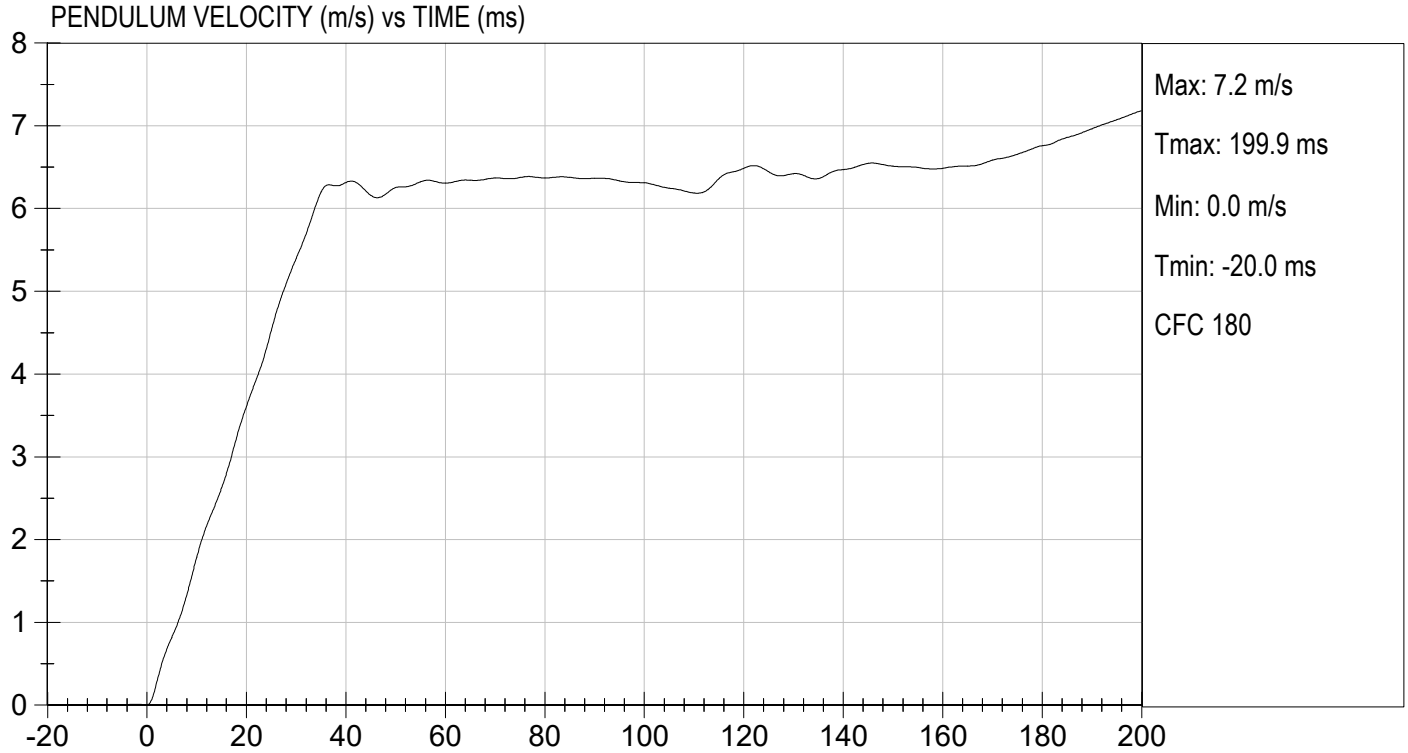
Test I.D: D232233

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	47	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.8	Pass
	20 ms	m/s	3.1 to 3.9	3.6	Pass
	30 ms	m/s	4.6 to 5.6	5.4	Pass
D Plane Rotation	Max	deg	99 to 114	111	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	106	Pass
<b>Overall Results</b>					<b>Pass</b>

  
 \_\_\_\_\_  
 Laboratory Technician

08/17/2023  
 \_\_\_\_\_  
 Test Date

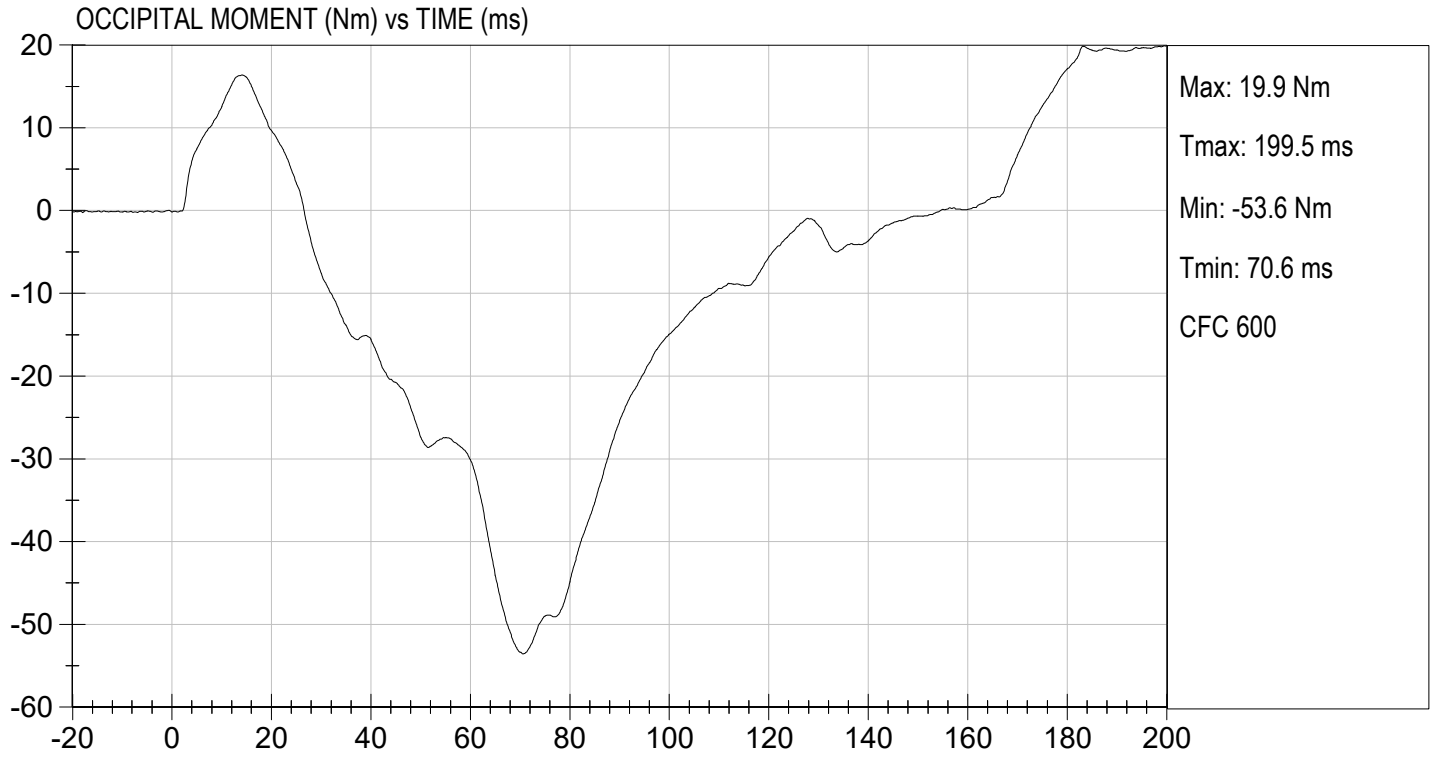
  
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 Approved By





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

TEST DATE: 08/17/2023  
TEST #: D232233



**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/18/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.3°C</u>
Record the minimum temperature:	<u>21.0°C</u>
Record the maximum humidity:	<u>41%</u>
Record the minimum humidity:	<u>34%</u>

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

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

- The following repairs or replacement was performed. Record:

---

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

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4376 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4375 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	72%

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

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

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

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

  
\_\_\_\_\_  
Signature

08/18/2023  
\_\_\_\_\_  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

Test I.D: D232234

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4376	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4375	Pass
Overall Test Results				Pass

  
 Laboratory Technician

08/18/2023

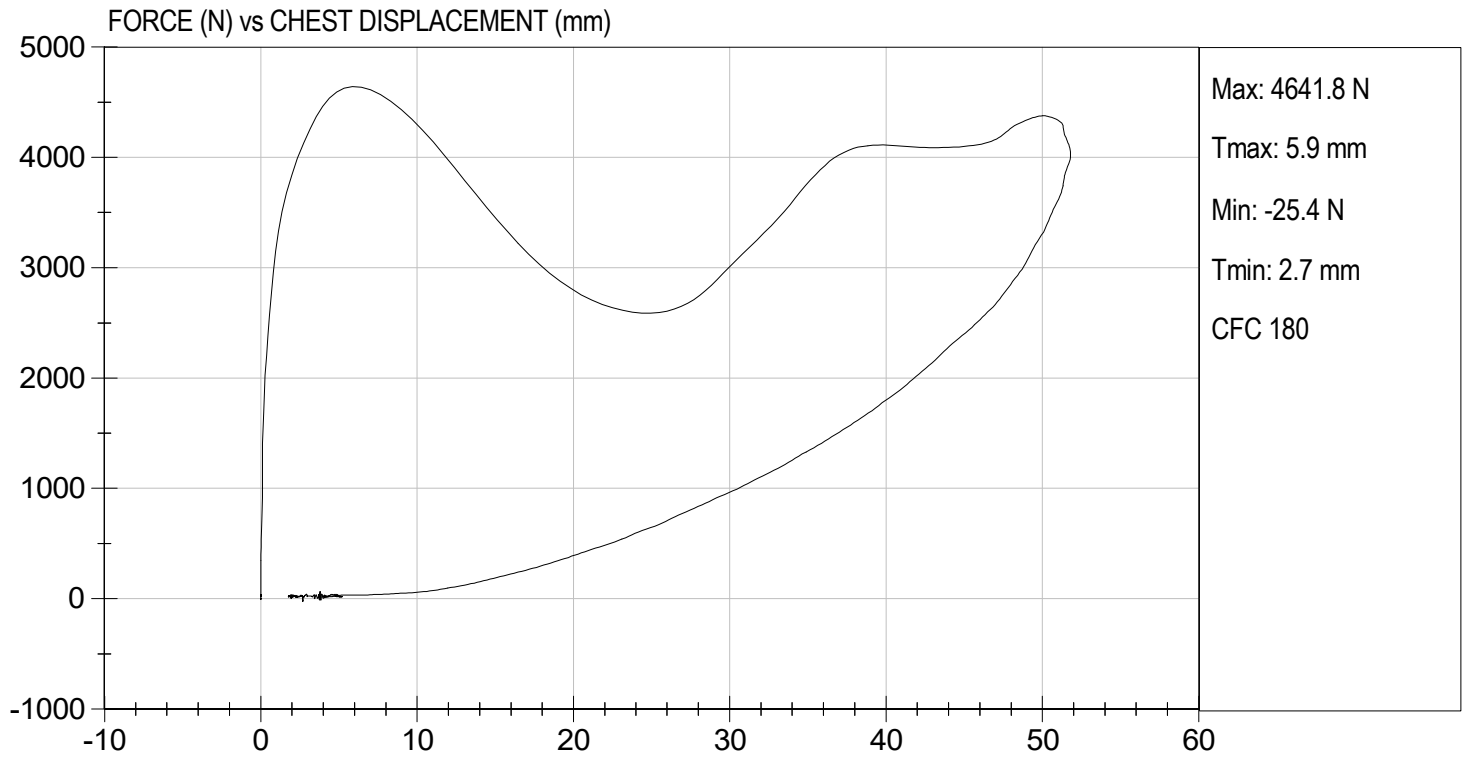
Test Date

  
 Approved By



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

TEST DATE: 08/18/2023  
TEST #: D232234



**DATA SHEET B7**  
TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/17/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 With legs below femurs.  
 Without legs below femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>44%</u>    |
| Record the minimum humidity:    | <u>37%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	16 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.6 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	341 N
Final ref. plane angle	Initial ref. plane angle ± 8°	4 deg

                    *Jon Seve*                      
 Signature

                    08/17/2023                      
 Date

**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

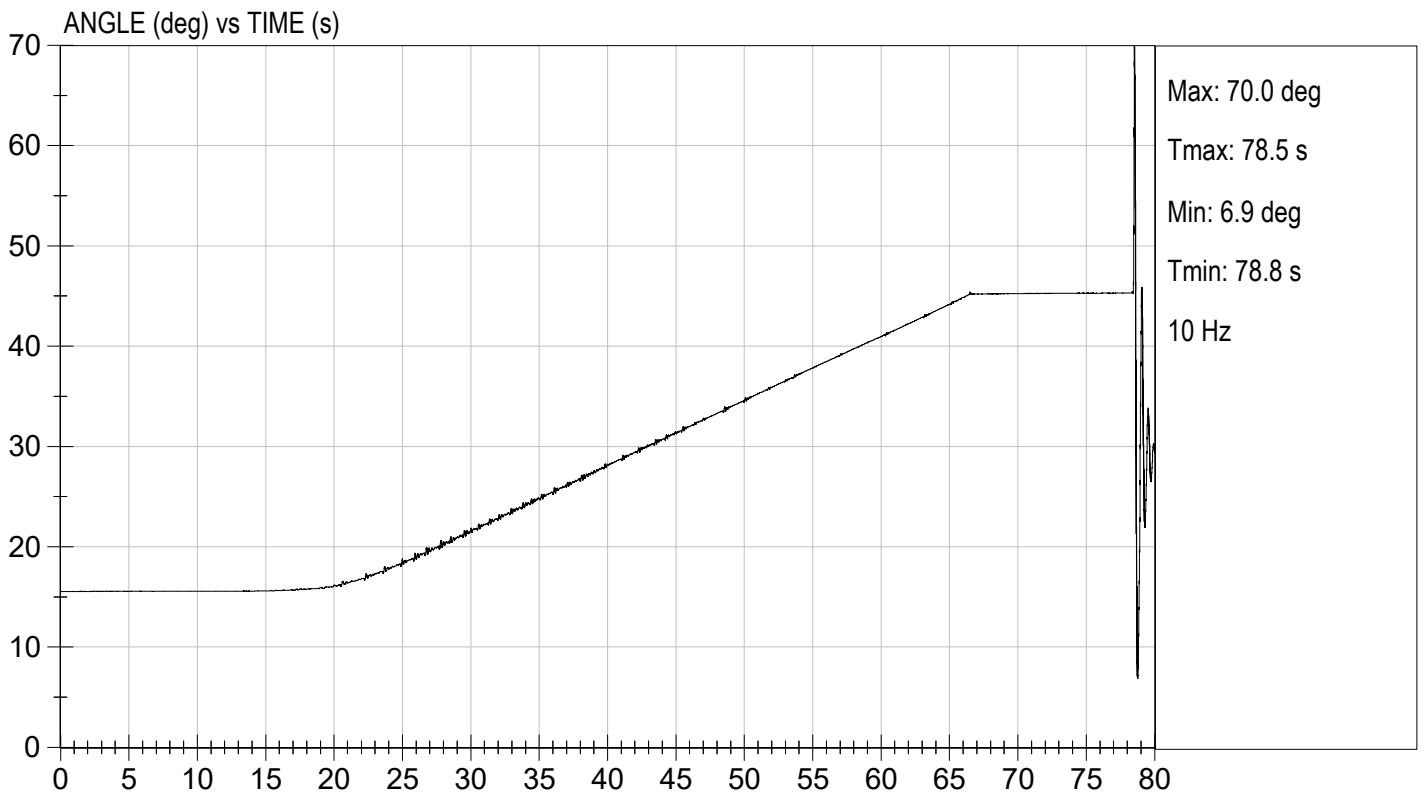
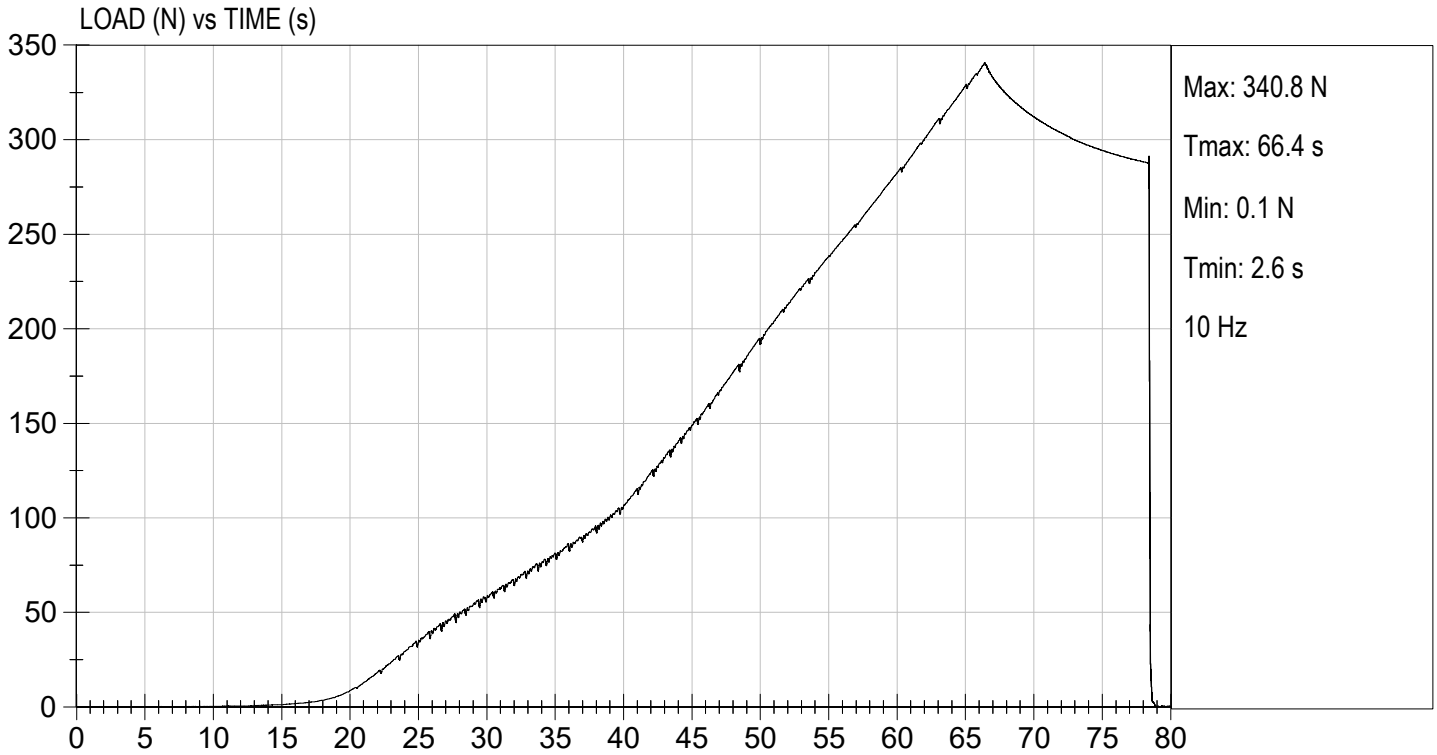
Test I.D: D232237

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	341	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.6	Pass
<b>Overall Result</b>				<b>Pass</b>

  
 \_\_\_\_\_  
 Laboratory Technician

08/17/2023  
 \_\_\_\_\_  
 Test Date

  
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 Approved By



**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/16/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14B.
3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>41%</u>    |
| Record the minimum humidity:    | <u>34%</u>    |
5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3794 N

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

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

  
\_\_\_\_\_  
Signature

08/16/2023  
\_\_\_\_\_  
Date

**MGA RESEARCH CORPORATION**

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

**ATD Serial No:** 507

**Test I.D.:** D232236

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3794	Pass
Overall Test Results				Pass



Laboratory Technician

08/16/2023

Test Date

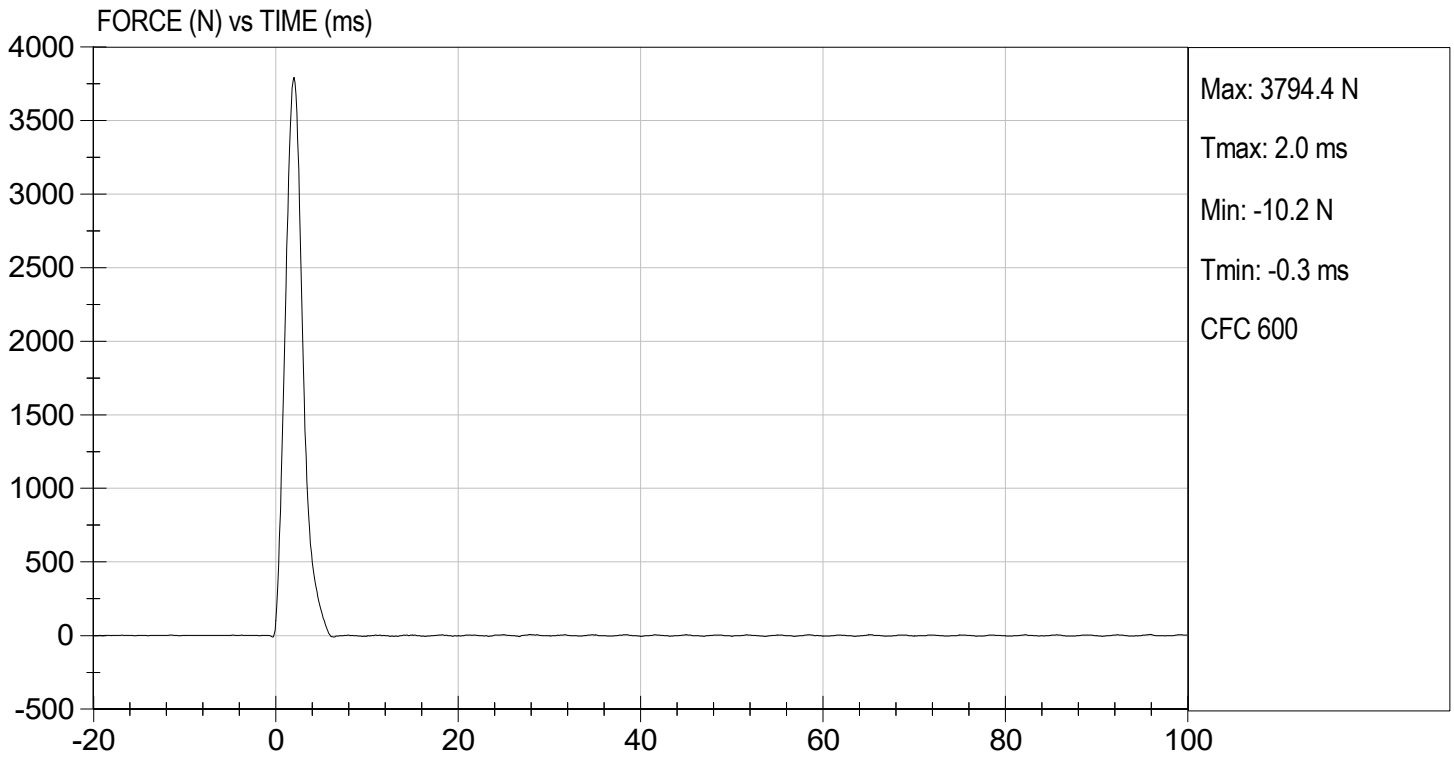


Approved By



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

TEST DATE: 08/16/2023  
TEST #: D232236



**DATA SHEET B9**  
RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 08/16/2023

Technician: Jon Love

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.3°C</u>
Record the minimum temperature:	<u>21.0°C</u>
Record the maximum humidity:	<u>41%</u>
Record the minimum humidity:	<u>34%</u>

5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))		
Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3825 N

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

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

  
\_\_\_\_\_  
Signature

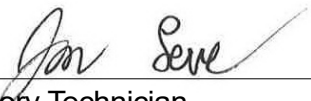
08/16/2023  
Date

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

**ATD Serial No:** 507

**Test I.D:** D232235

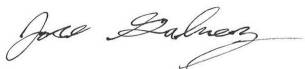
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3825	Pass
Overall Test Results				Pass



Laboratory Technician

08/16/2023

Test Date

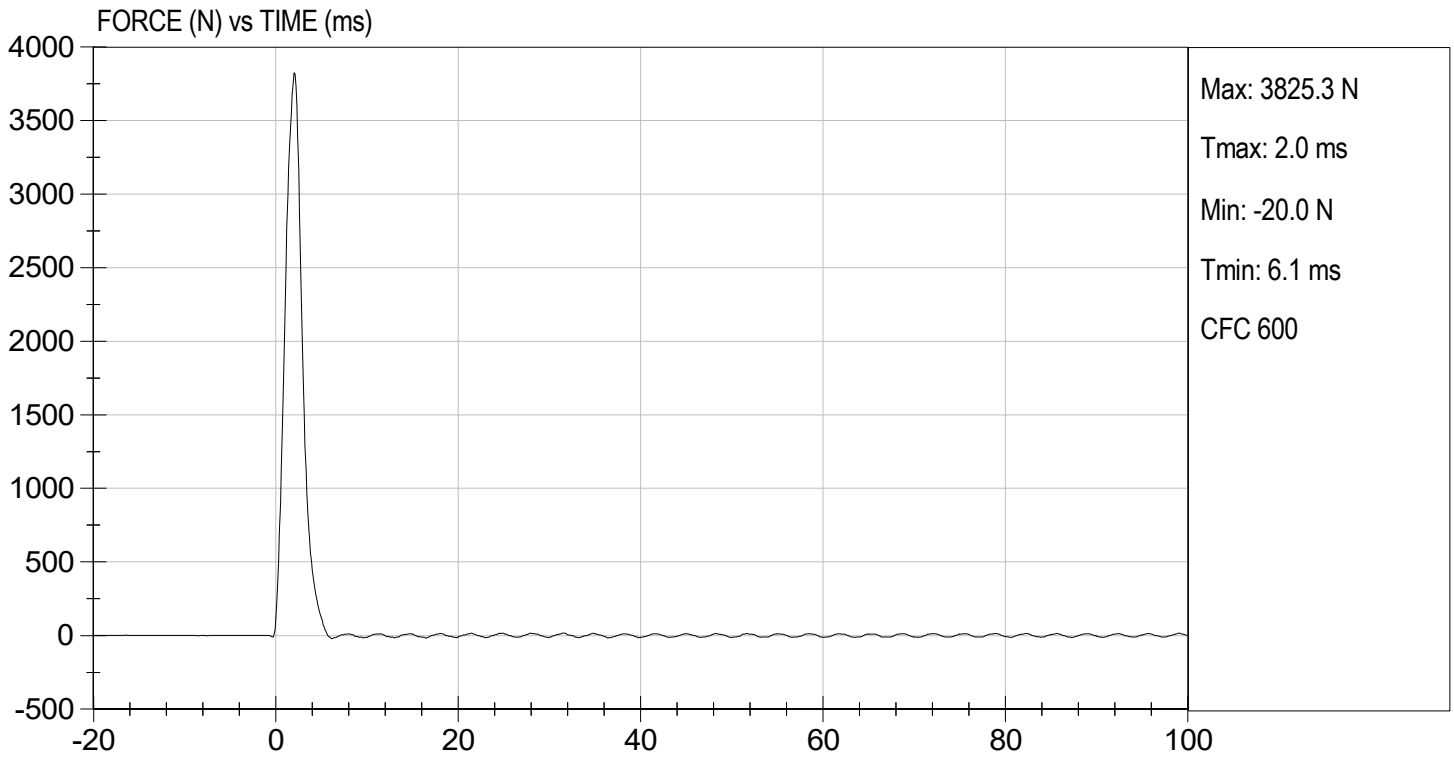


Approved By



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

TEST DATE: 08/16/2023  
TEST #: D232235



**DATA SHEET B10**  
**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
<b>DUMMY INSTRUMENTATION</b>					
<b>HEAD ACCELEROMETERS</b>					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85158	06/16/2023	02/15/2024
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P85159	06/16/2023	02/15/2024
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P85160	06/16/2023	02/15/2024
NECK TRANSDUCER	Denton	1716A	N937	05/10/2023	05/09/2024
<b>CHEST ACCELEROMETERS</b>					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79787	06/16/2023	02/15/2024
(2) LATERAL	Endevco	7264CM47-2KTZ-360	T30846	06/16/2023	02/15/2024
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P86735	06/16/2023	02/15/2024
CHEST POTENTIOMETER	Humanetics	880105-1080	507	06/16/2023	02/15/2024
<b>FEMUR LOAD CELLS</b>					
(1) RIGHT FEMUR	Denton	2121AJTF	F8151	06/16/2023	02/15/2024
(2) LEFT FEMUR	Denton	2121AJTF	F8152	06/16/2023	02/15/2024
<b>LABORATORY INSTRUMENTATION</b>					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	07/17/2023	01/06/2024
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	06/01/2023	12/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Servo	14CBI-2897	4707	08/11/2023	02/10/2024
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Servo	14CBI-2897	7297	08/11/2023	02/10/2024

LABORATORY TECHNICIAN: \_\_\_\_\_ *Jonah Pulokas*

**DATA SHEET B3**  
HEAD DROP TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>42%</u>    |
| Record the minimum humidity:    | <u>32%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

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

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

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

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

X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches

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

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

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	269 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	3.7 g

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 507

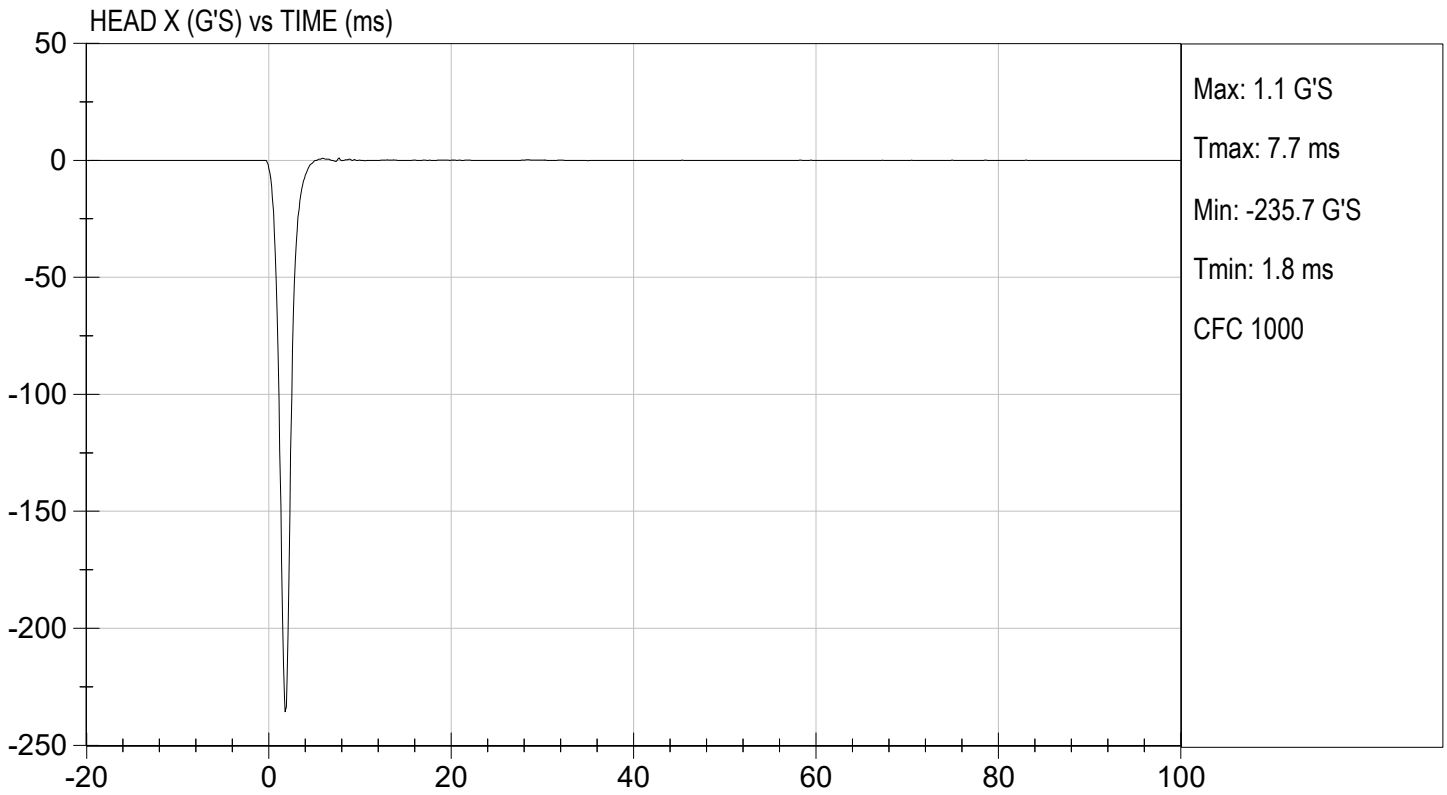
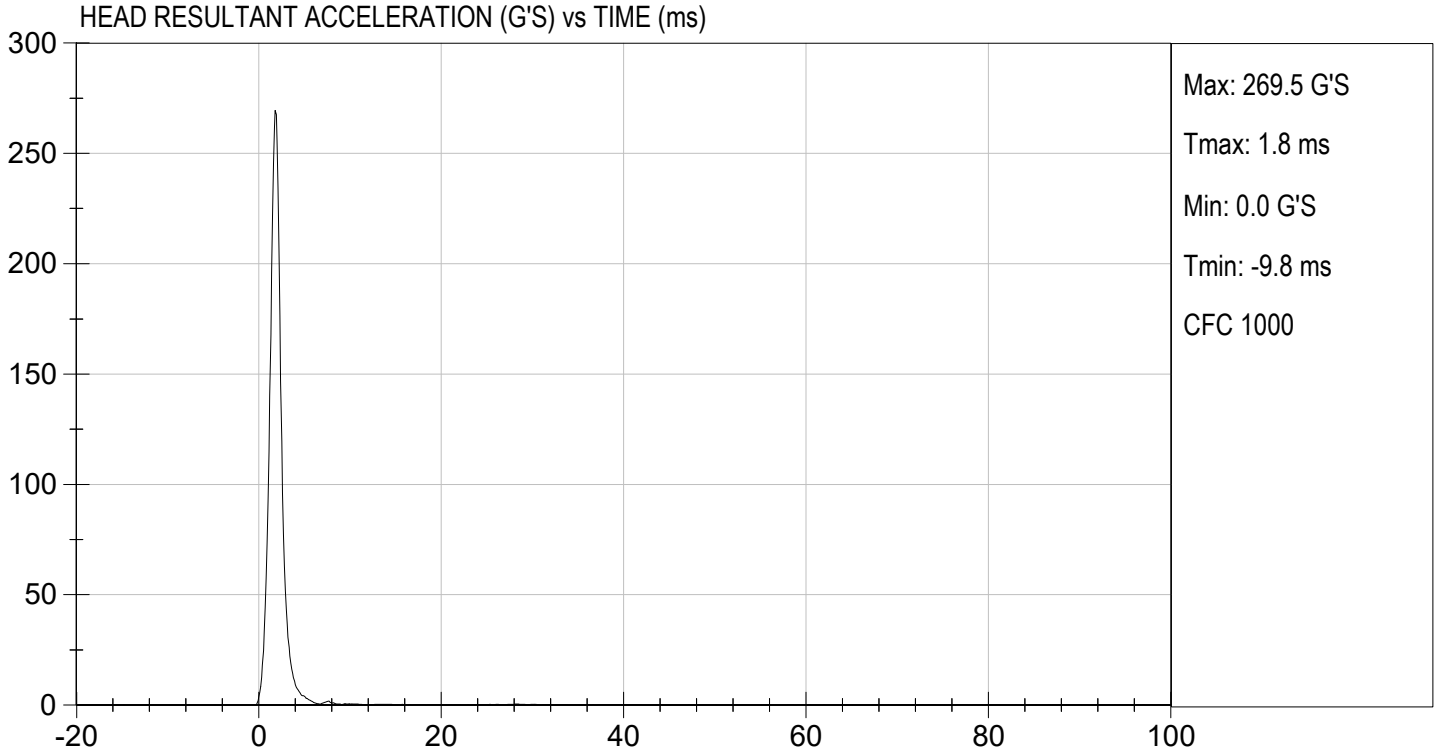
Test ID: D232601

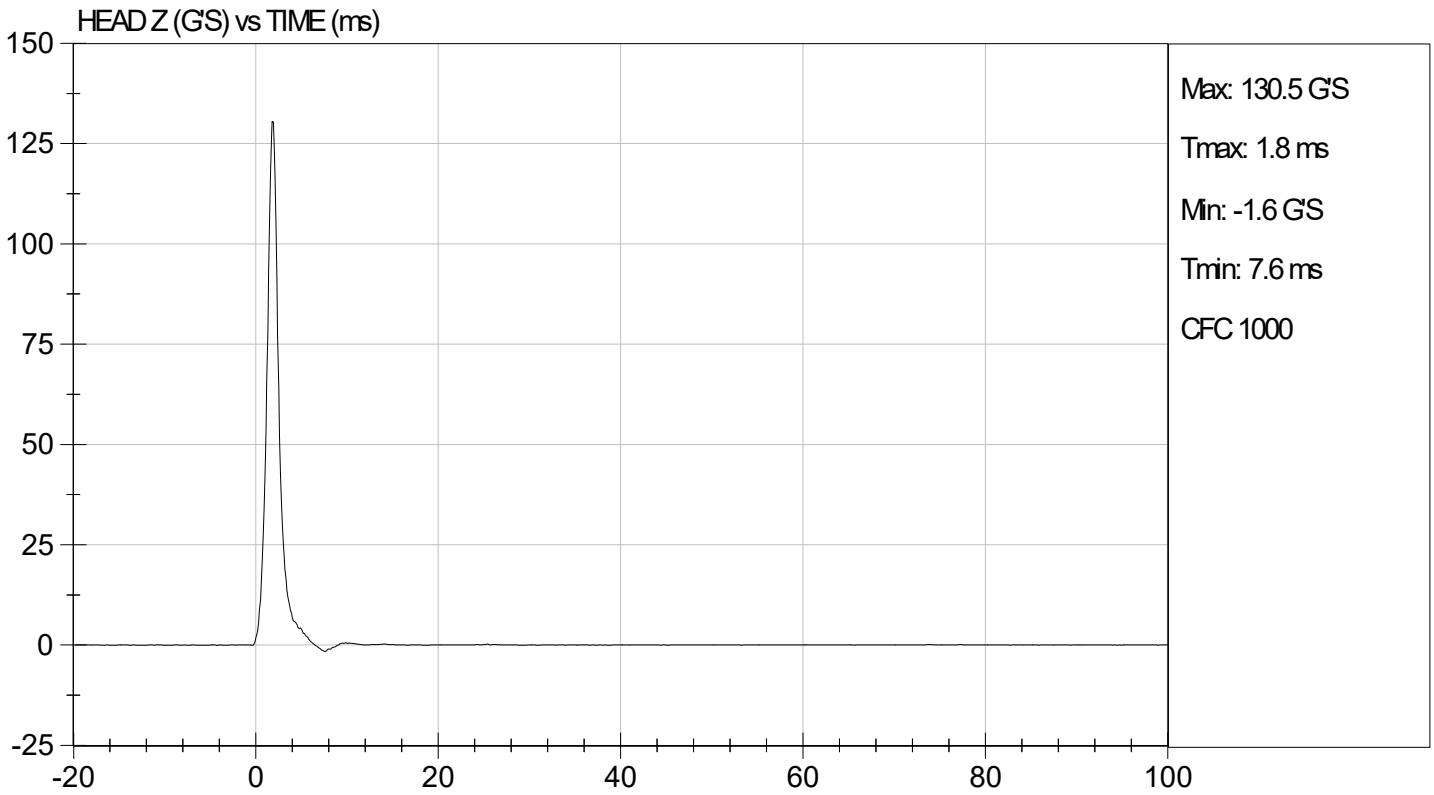
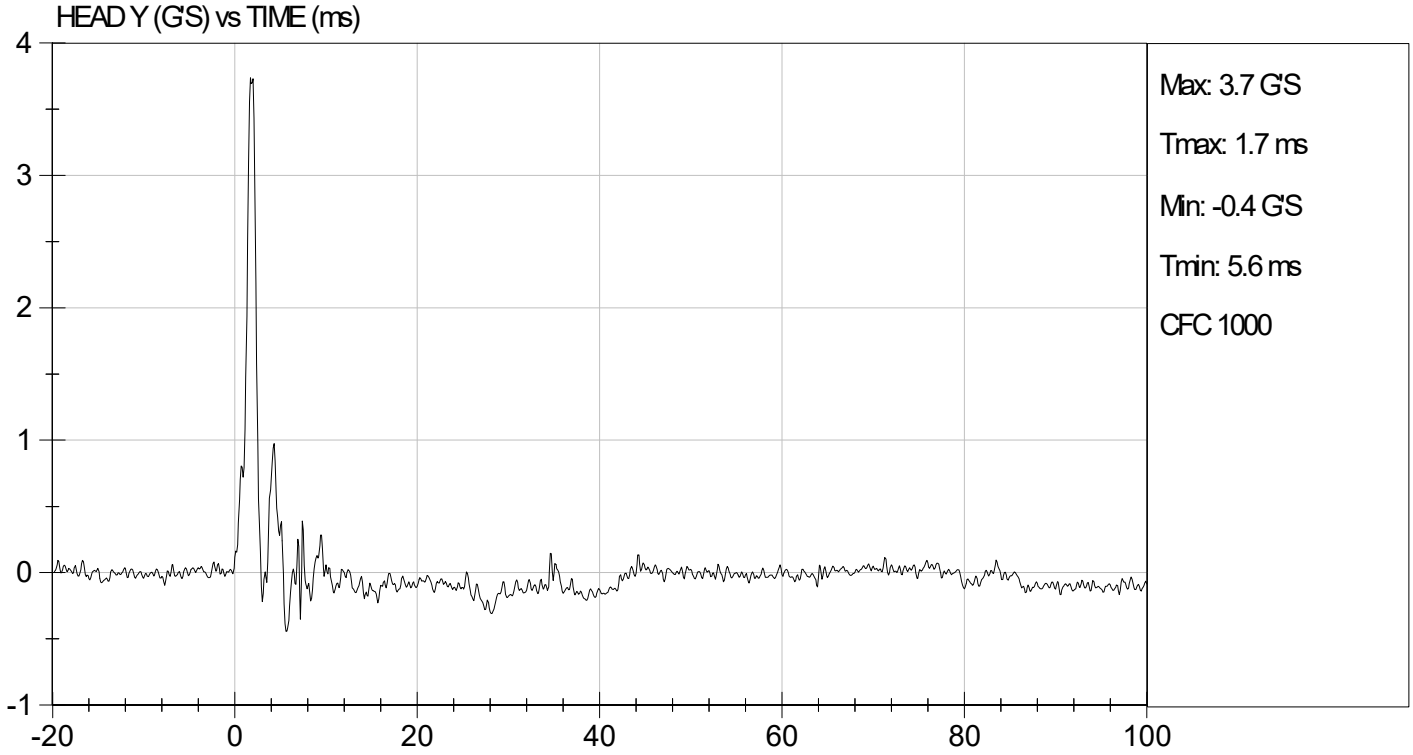
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	250 to 300	269	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	3.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 Laboratory Technician

09/20/2023  
 Test Date

  
 Approved By





**DATA SHEET B4**  
NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>42%</u>    |
| Record the minimum humidity:    | <u>32%</u>    |
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: | <u>No damage</u> |
|------------------------------|------------------|
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- |                              |   |
|------------------------------|---|
| Record findings and actions: | <u>No Deterioration; Hardness: Front 89; Back 90.</u> |
|------------------------------|---|
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J2111/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.2 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.3 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.2 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	76 Nm @ 80 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	87 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

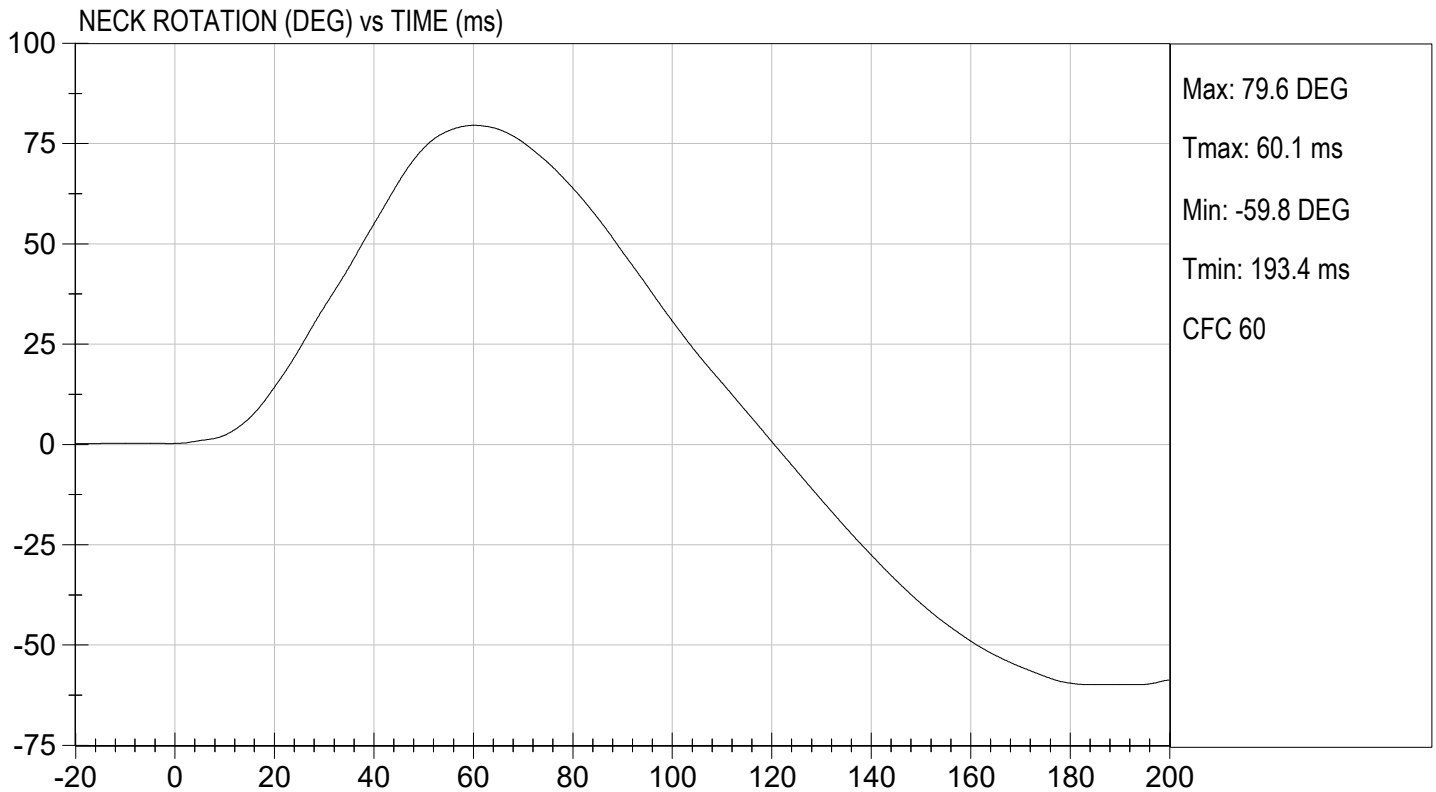
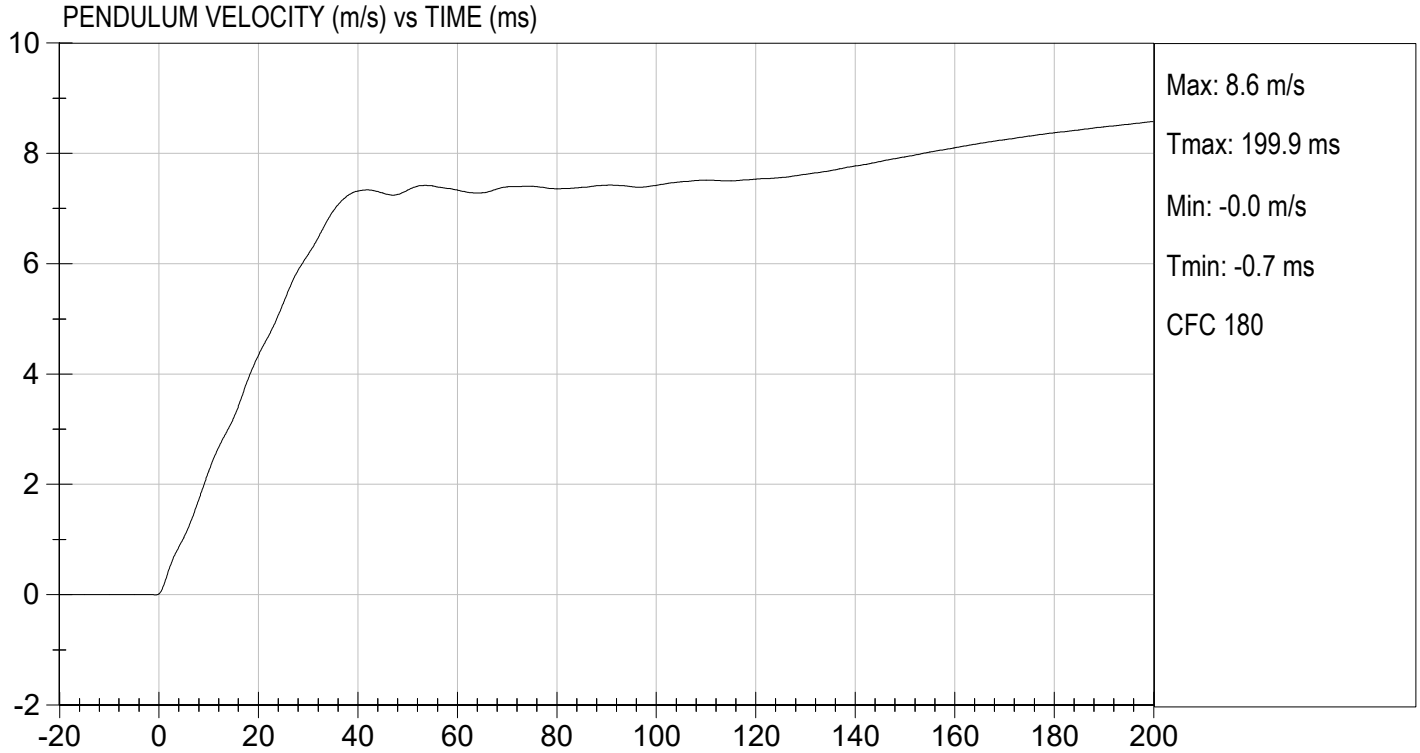
Test I.D: D232602

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	42	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.2	Pass
	20 ms	m/s	4.0 to 5.0	4.3	Pass
	30 ms	m/s	5.8 to 7.0	6.2	Pass
D Plane Rotation	Max	deg	77 to 91	80	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	76	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	87	Pass
Overall Results					Pass

  
 \_\_\_\_\_  
 Laboratory Technician

09/20/2023  
 \_\_\_\_\_  
 Test Date

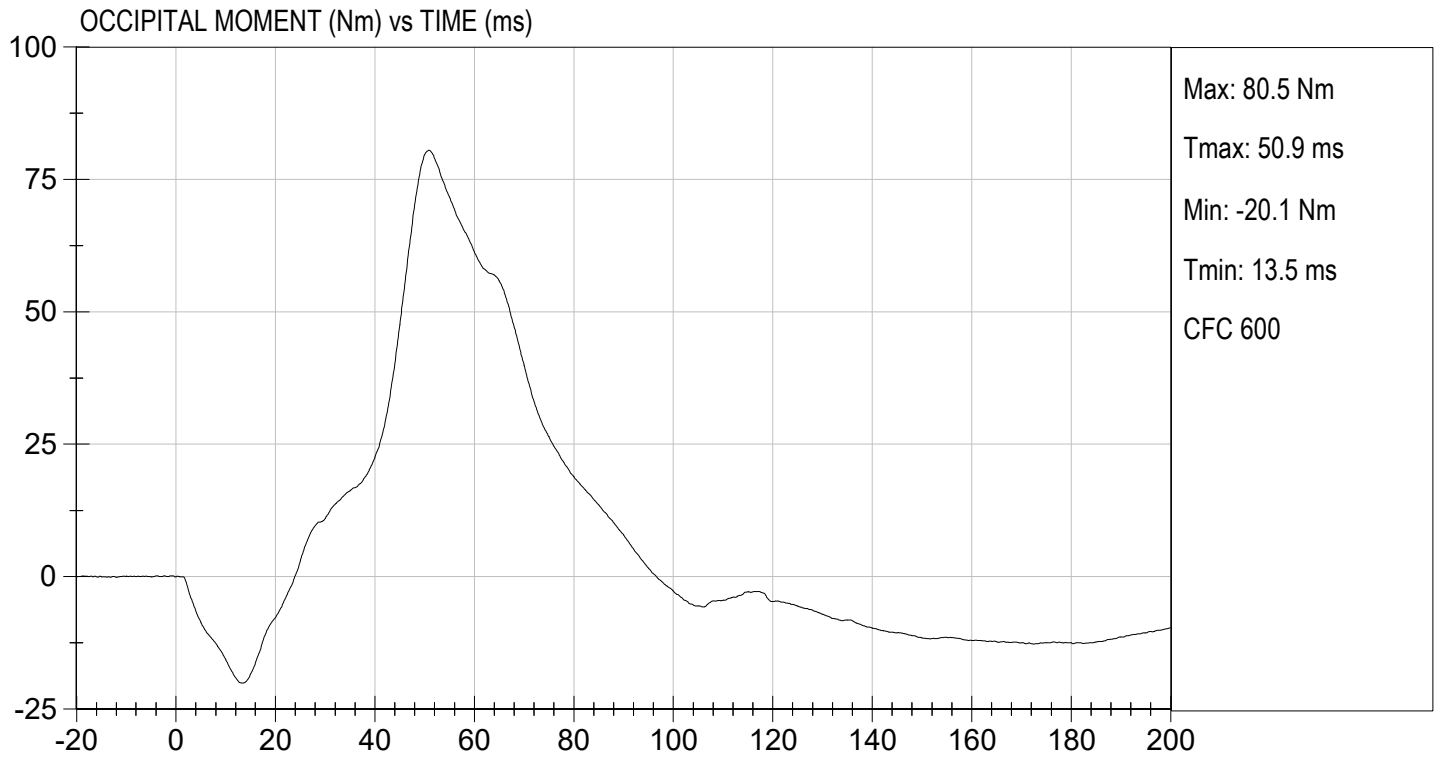
  
 \_\_\_\_\_  
 Approved By





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

TEST DATE: 09/20/2023  
TEST #: D232602



**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>43%</u>    |
| Record the minimum humidity:    | <u>33%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

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

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.7 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.5 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.3 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-56 Nm @ 111 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	105 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION  
NECK EXTENSION TEST  
HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

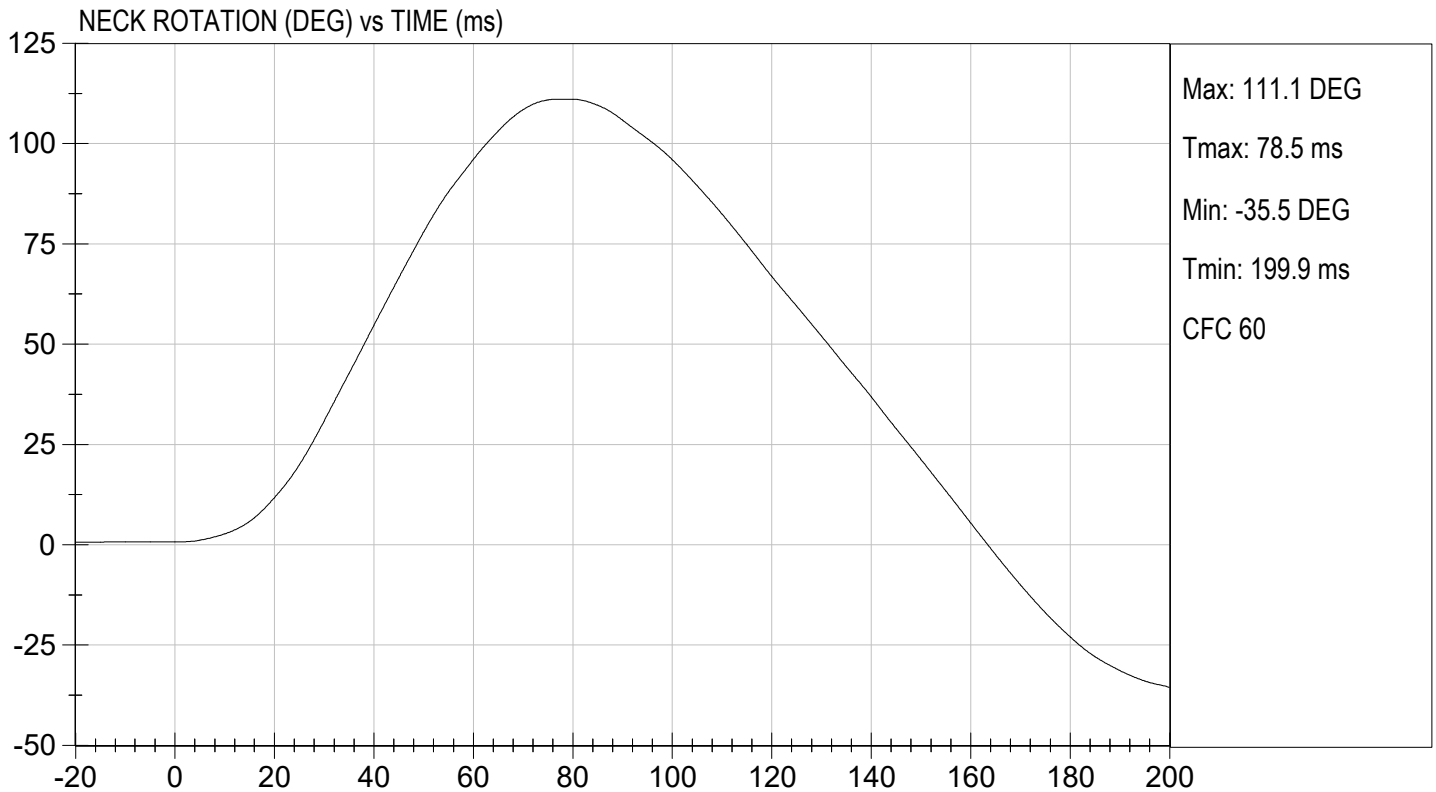
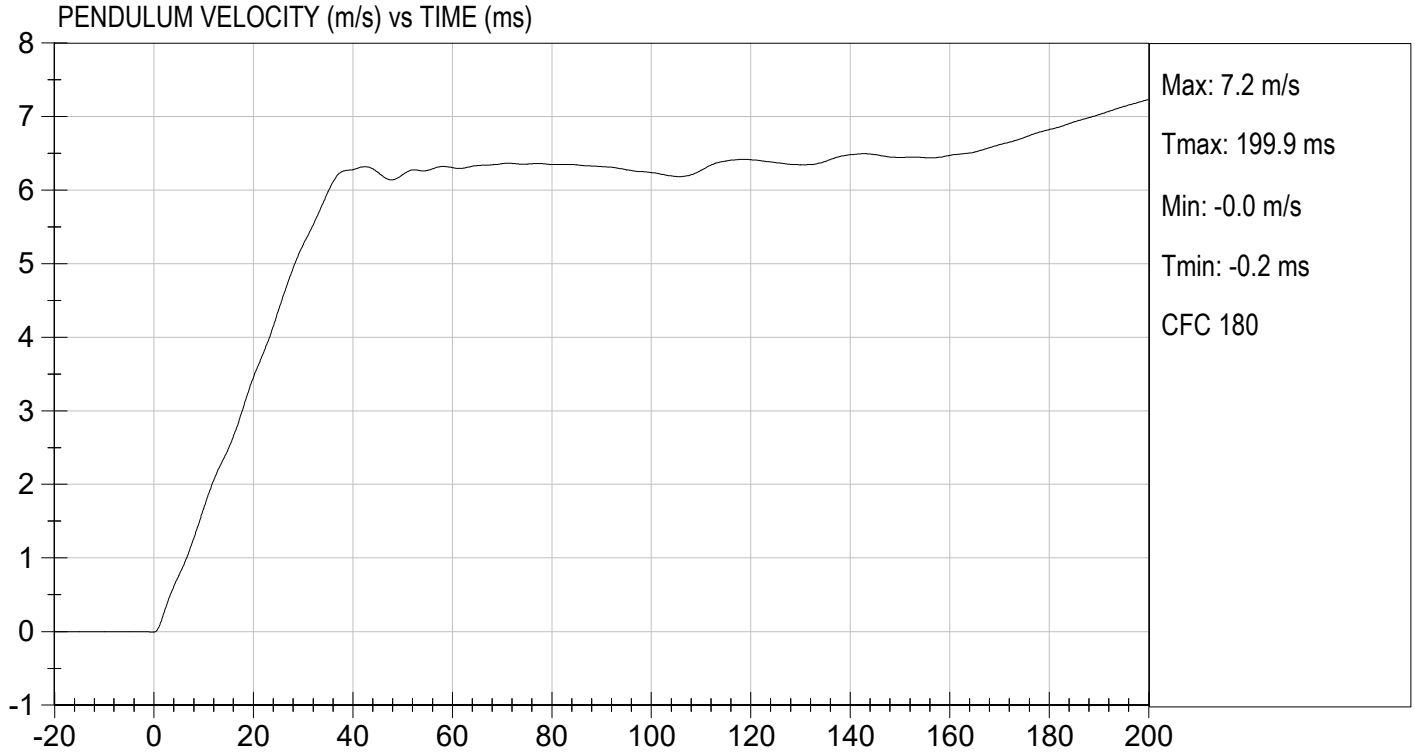
Test I.D.: D232603

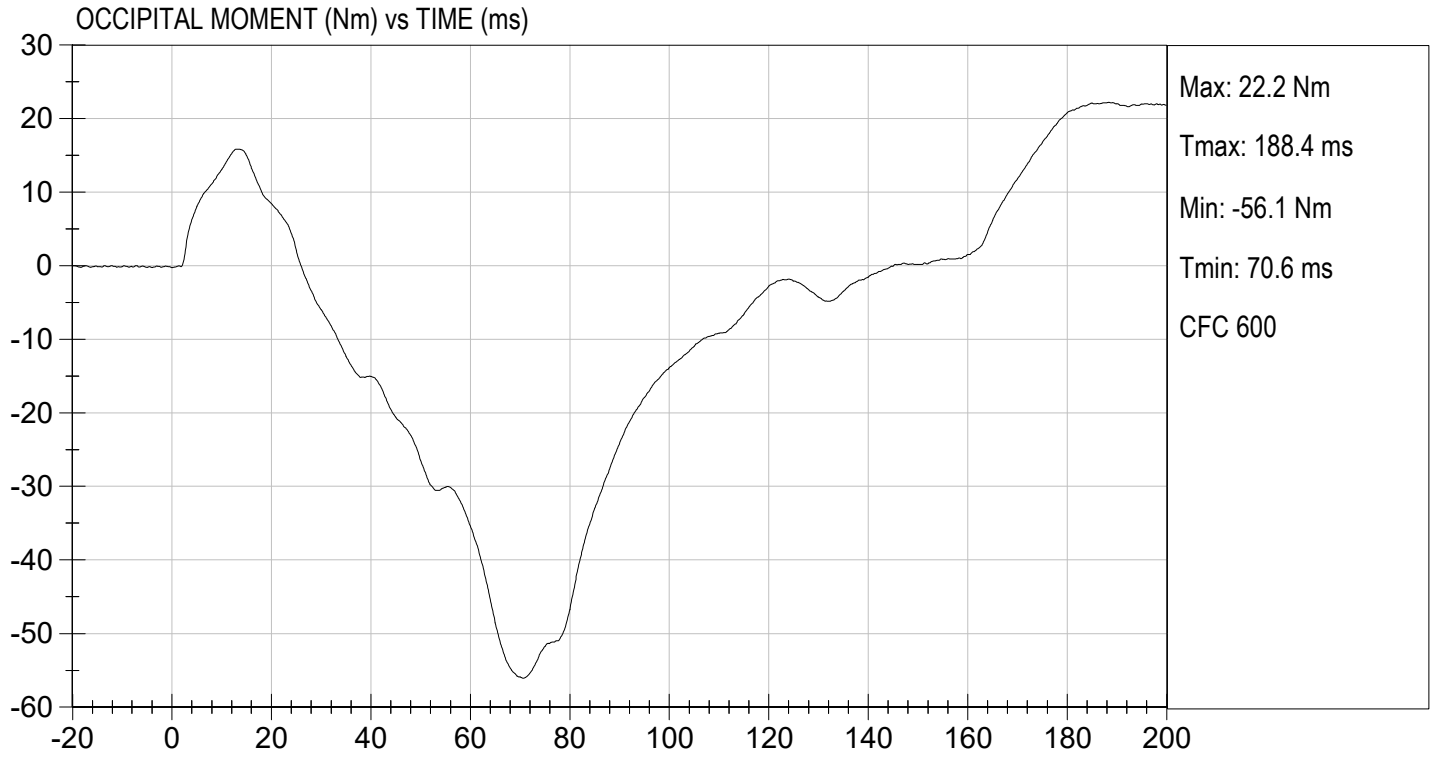
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	111	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-56	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	105	Pass
Overall Results					Pass

  
Laboratory Technician

09/20/2023  
Test Date

  
Approved By





**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.3°C</u>
Record the minimum temperature:	<u>20.0°C</u>
Record the maximum humidity:	<u>45%</u>
Record the minimum humidity:	<u>35%</u>

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

- No Damage

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

- The following repairs or replacement was performed. Record

---

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

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	53.0 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4375 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4373 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	72%

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

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

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

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

  
 Signature

09/20/2023  
 Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

Test I.D: D232604

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	53	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4375	Pass
Internal Hysteresis	%	69 to 85	72	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4373	Pass
Overall Test Results				Pass



Laboratory Technician

09/20/2023

Test Date

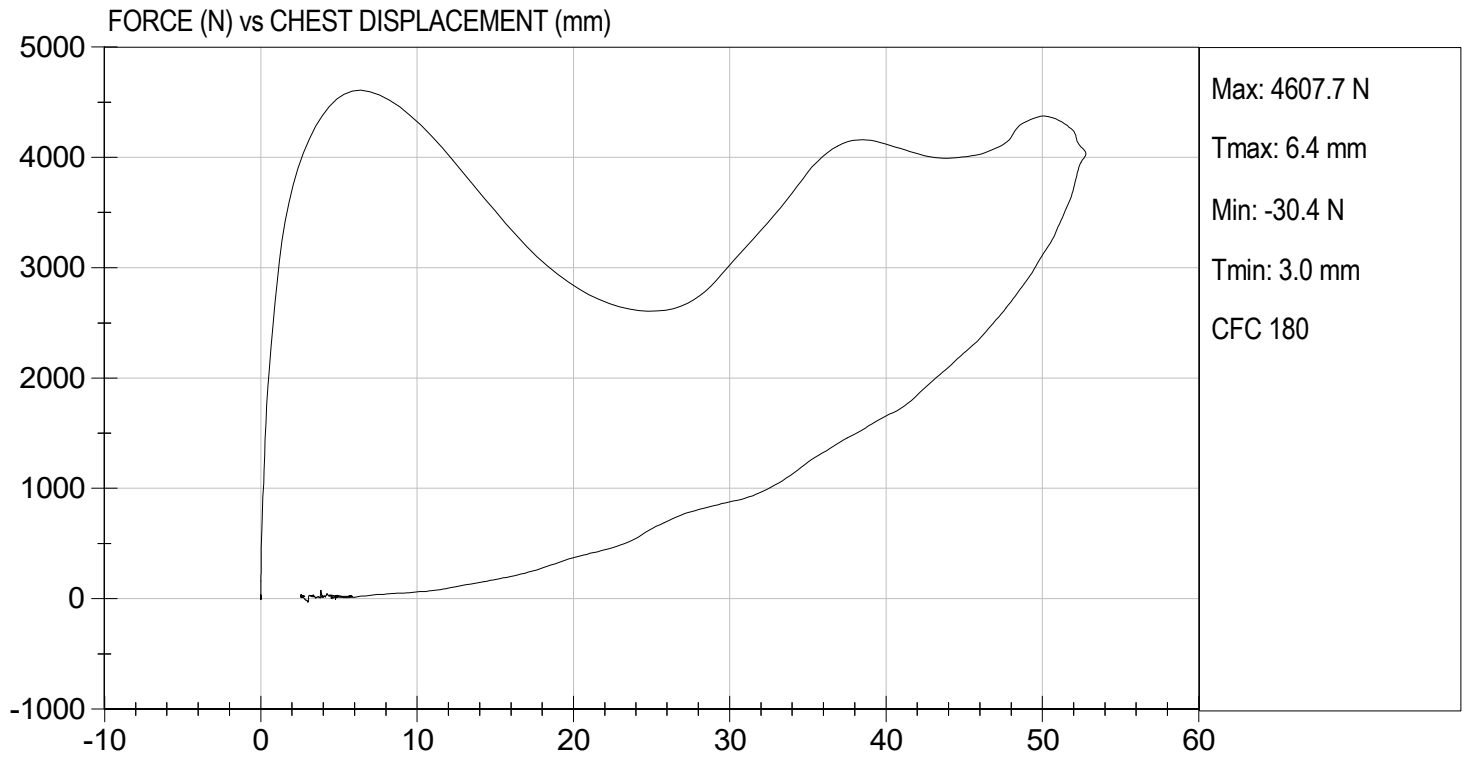


Approved By



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

TEST DATE: 09/20/2023  
TEST #: D232604



**DATA SHEET B7**  
TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 With legs below femurs.  
 Without legs below femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>20.0°C</u> |
| Record the maximum humidity:    | <u>42%</u>    |
| Record the minimum humidity:    | <u>32%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	19 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	1.1 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	343 N
Final ref. plane angle	Initial ref. plane angle ± 8°	6 deg

                    Jonah Pilokas                      
 Signature

                    09/20/2023                      
 Date

**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

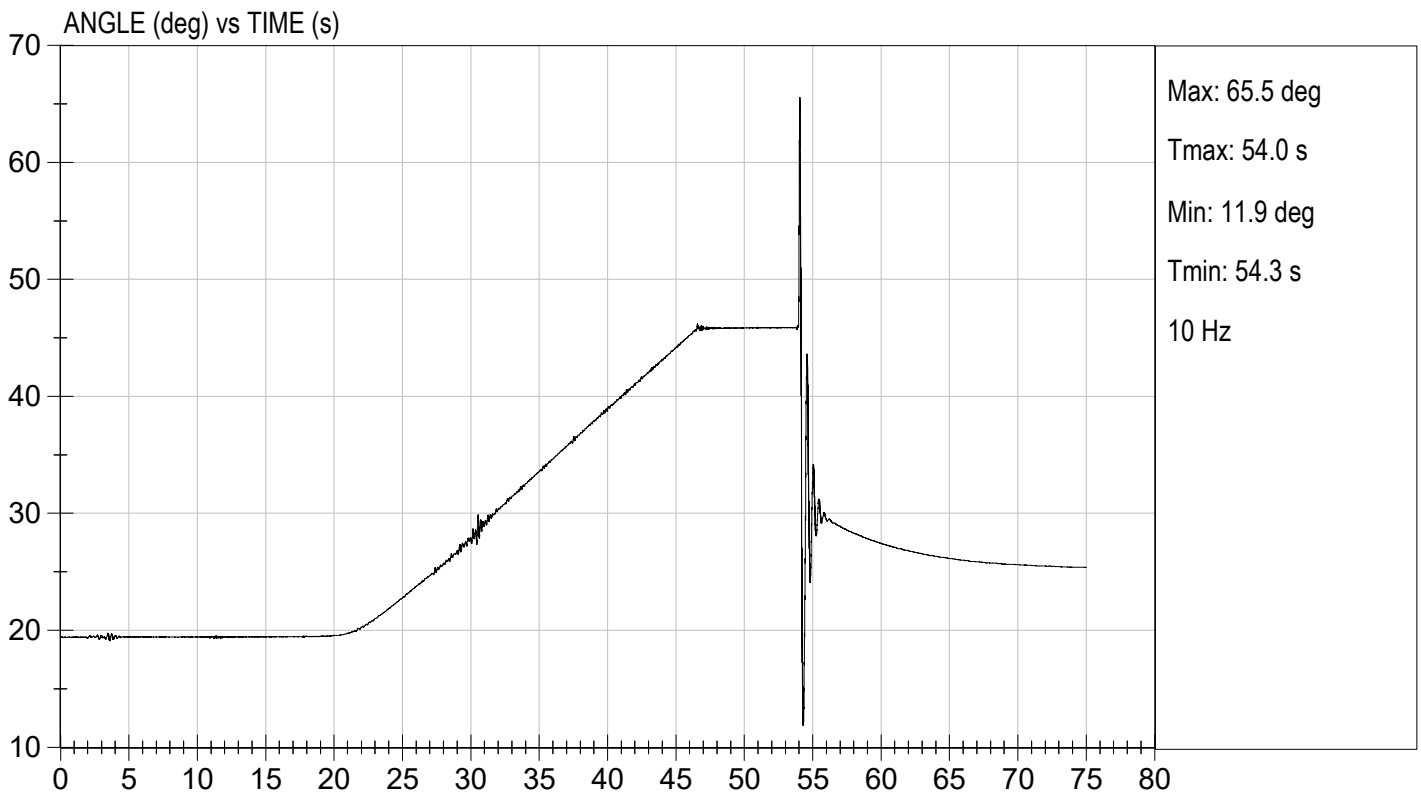
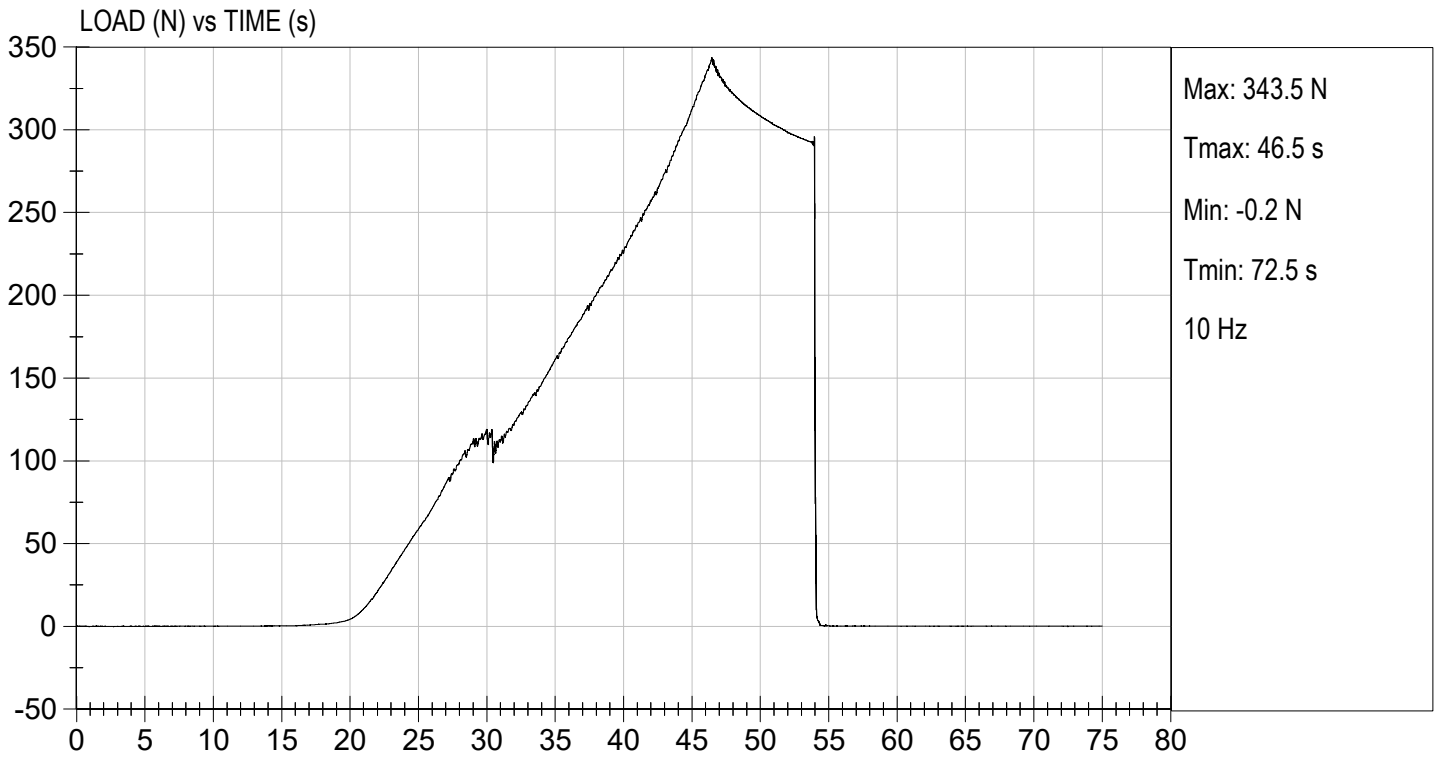
Test I.D: D232607

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Initial Angle	deg	0 to 20	19	Pass
Return Angle	deg	+/- 8	6	Pass
Force at 45 deg	N	320 to 390	343	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.1	Pass
<b>Overall Result</b>				<b>Pass</b>

  
 Laboratory Technician

09/20/2023  
 Test Date

  
 Approved By



**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.2°C</u>
Record the minimum temperature:	<u>19.9°C</u>
Record the maximum humidity:	<u>40%</u>
Record the minimum humidity:	<u>30%</u>

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

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.09 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3560 N

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**

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

**ATD Serial No:** 507

**Test I.D.:** D232606

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3560	Pass
Overall Test Results				Pass



Laboratory Technician

09/20/2023

Test Date

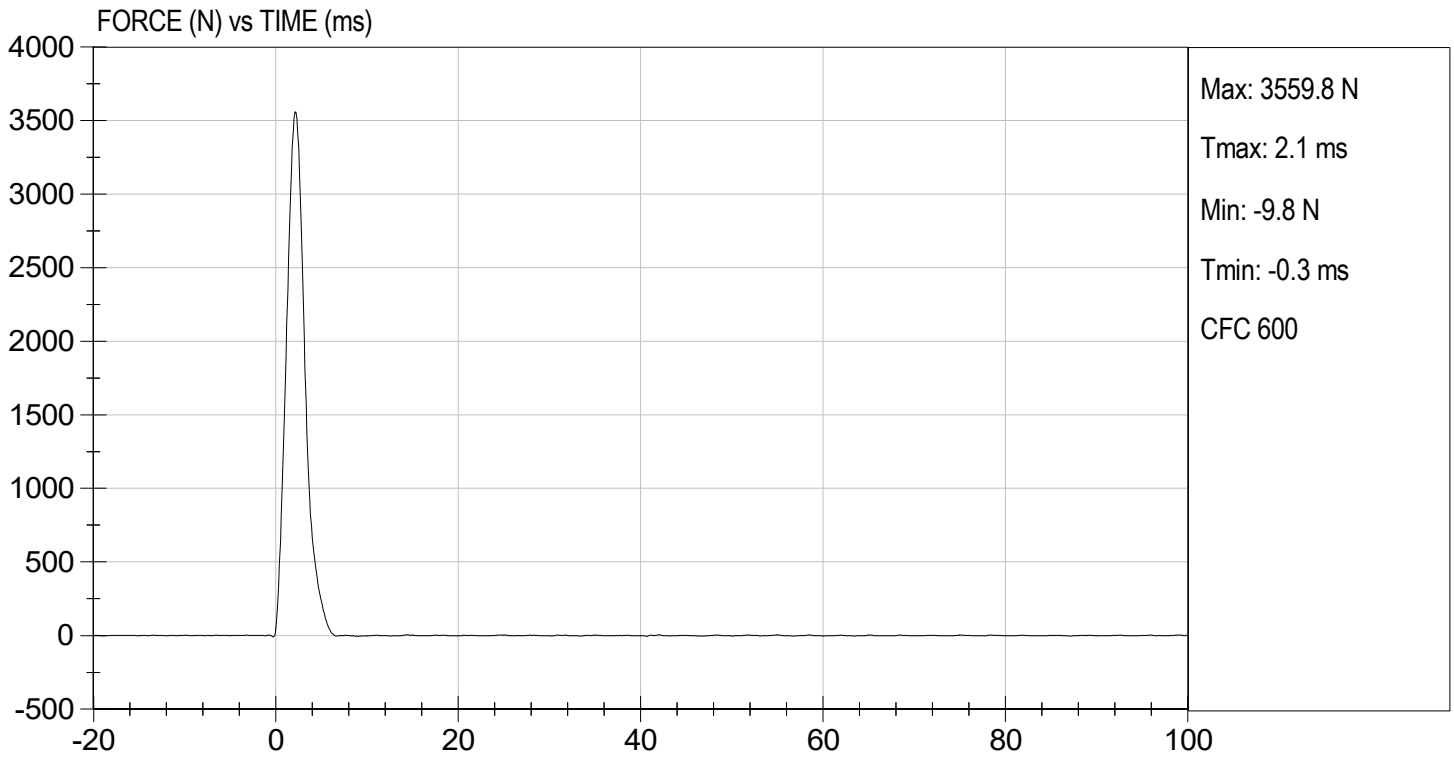


Approved By



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

TEST DATE: 09/20/2023  
TEST #: D232606



**DATA SHEET B9**  
RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 507

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.2°C</u>
Record the minimum temperature:	<u>19.9°C</u>
Record the maximum humidity:	<u>40%</u>
Record the minimum humidity:	<u>30%</u>

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

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.09 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3551 N

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 507

Test I.D: D232605

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Speed	m/s	2.07 to 2.13	2.09	Pass
Maximum Force	N	3450 to 4060	3551	Pass
Overall Test Results				Pass



Laboratory Technician

09/20/2023

Test Date

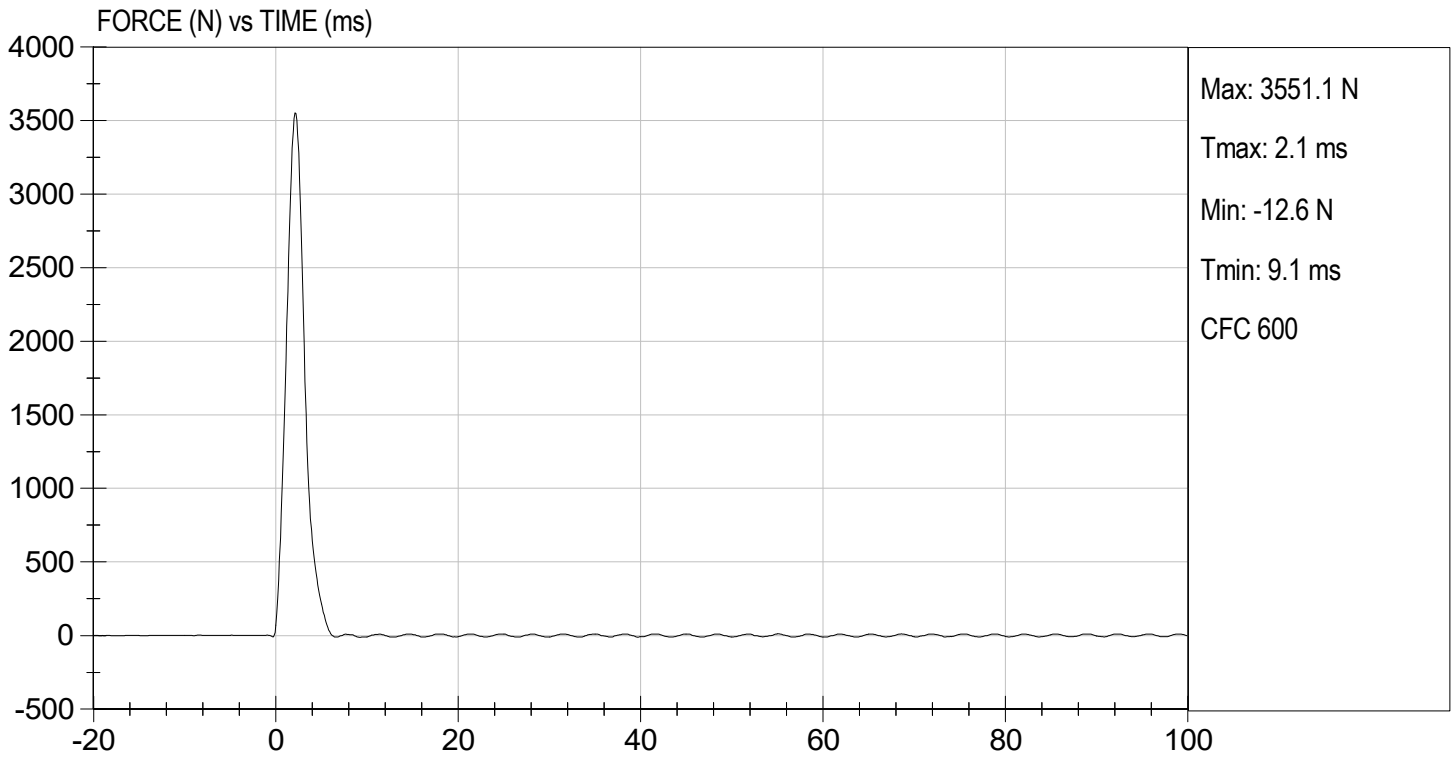


Approved By



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

TEST DATE: 09/20/2023  
TEST #: D232605



**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 507

Test Date: 09/20/2023

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

09/20/2023  
Date

Describe the repair or replacement of parts:

Checked by:

  
Signature

09/20/2023  
Date

**DATA SHEET B10**

**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
<b>DUMMY INSTRUMENTATION</b>					
<b>HEAD ACCELEROMETERS</b>					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85158	08/16/2023	02/15/2024
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P85159	08/16/2023	02/15/2024
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P85160	08/16/2023	02/15/2024
NECK TRANSDUCER	Denton	1716A	N937	05/10/2023	05/09/2024
<b>CHEST ACCELEROMETERS</b>					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79787	08/16/2023	02/15/2024
(2) LATERAL	Endevco	7264CM47-2KTZ-360	T30846	08/16/2023	02/15/2024
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P86735	08/16/2023	02/15/2024
CHEST POTENTIOMETER	Humanetics	880105-1080	507	08/16/2023	02/15/2024
<b>FEMUR LOAD CELLS</b>					
(1) RIGHT FEMUR	Denton	2121AJTF	F8151	08/16/2023	02/15/2024
(2) LEFT FEMUR	Denton	2121AJTF	F8152	08/16/2023	02/15/2024
<b>LABORATORY INSTRUMENTATION</b>					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	07/17/2023	01/06/2024
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	06/01/2023	12/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	C3035	09/06/2023	03/07/2024
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	C3034	09/06/2023	03/07/2024

LABORATORY TECHNICIAN: 

## EXTERNAL DIMENSIONS

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

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

**DATA SHEET B3**  
HEAD DROP TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.4°C</u> |
| Record the minimum temperature: | <u>21.1°C</u> |
| Record the maximum humidity:    | <u>46%</u>    |
| Record the minimum humidity:    | <u>39%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the

forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	266 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-1.2 g

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

Jonah Pulokas  
Signature

07/28/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

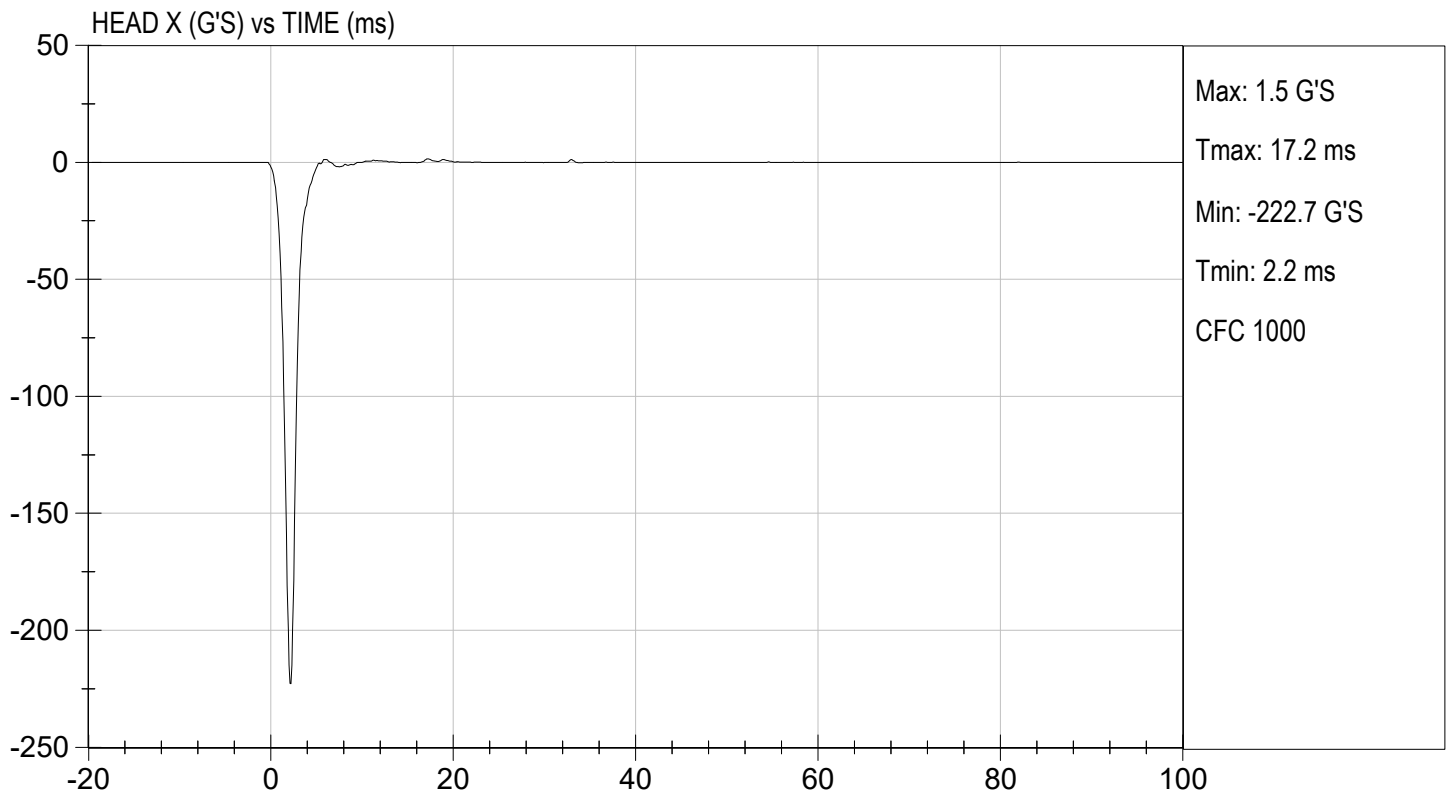
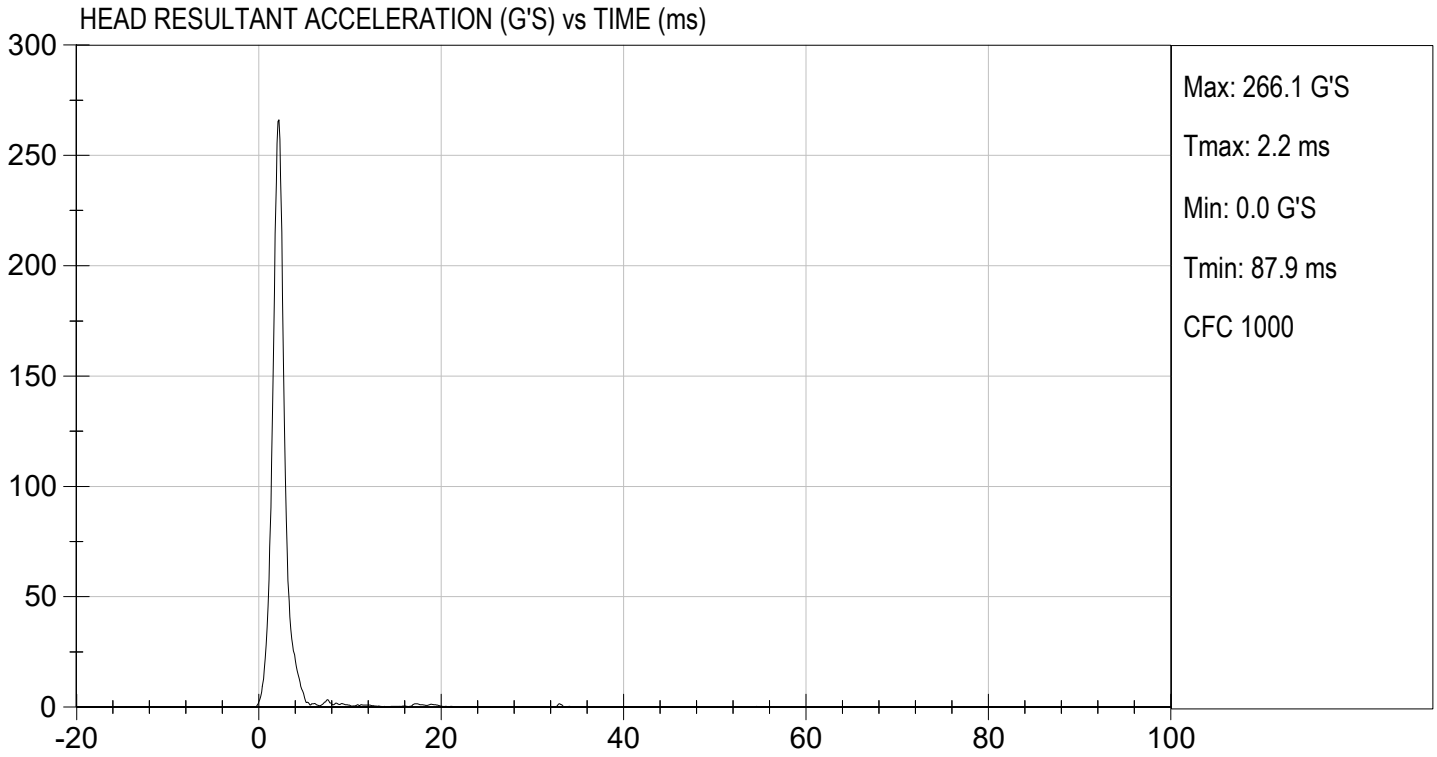
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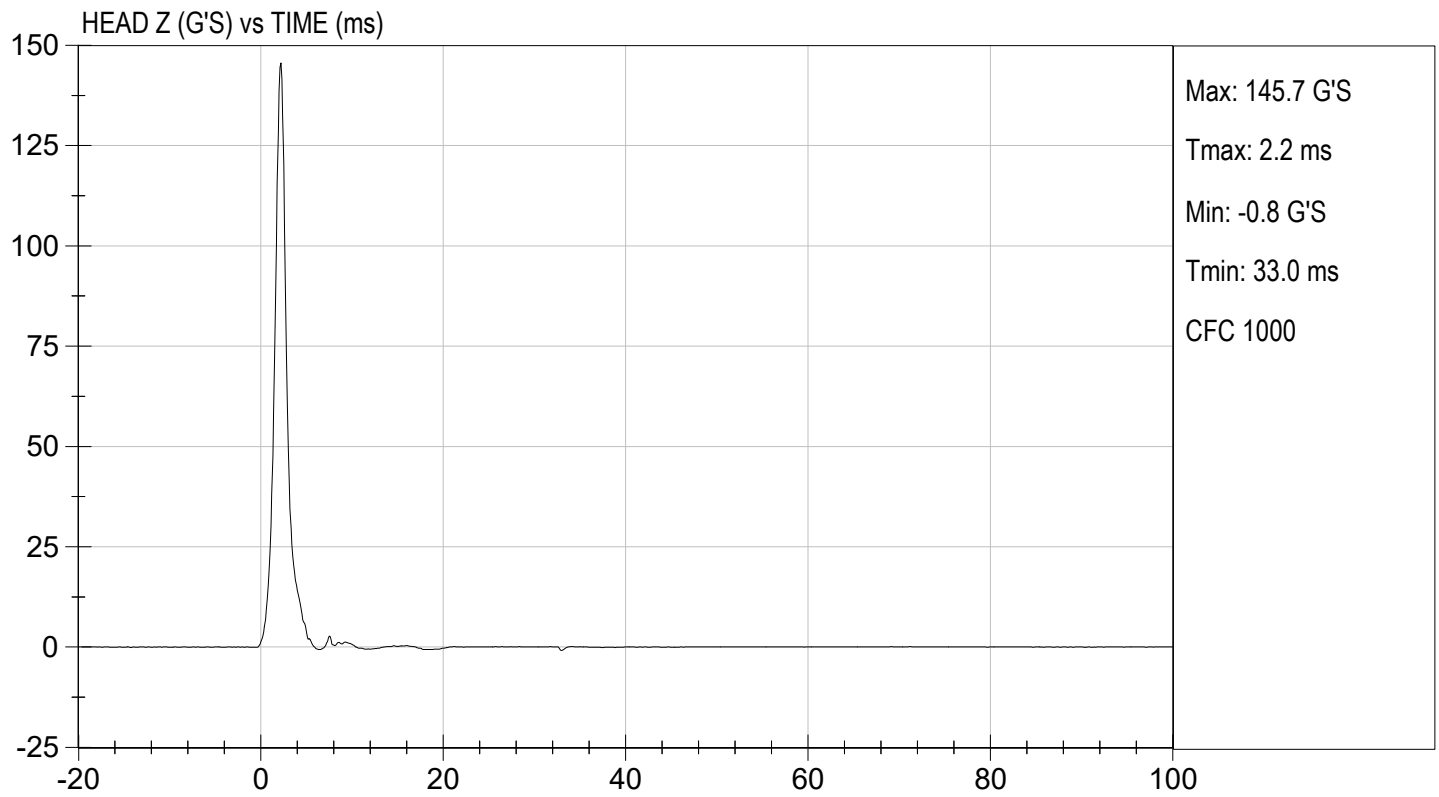
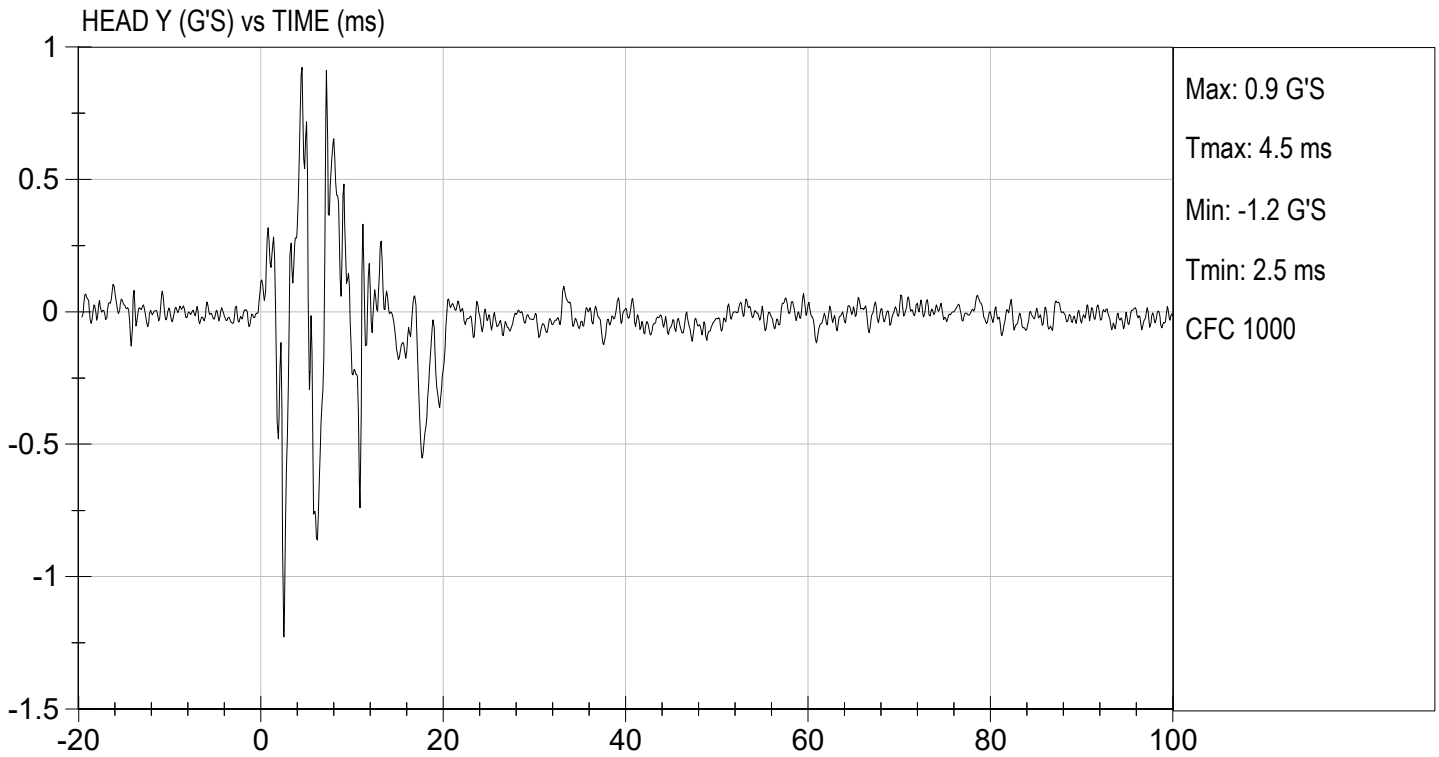
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.4	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Peak Resultant Acceleration	G's	250 to 300	266	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 Laboratory Technician

07/28/2023  
 Test Date

  
 Approved By





**DATA SHEET B4**  
NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>45%</u>    |
| Record the minimum humidity:    | <u>38%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J2111/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.5 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.4 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	76 Nm @ 83 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	85 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

07/28/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

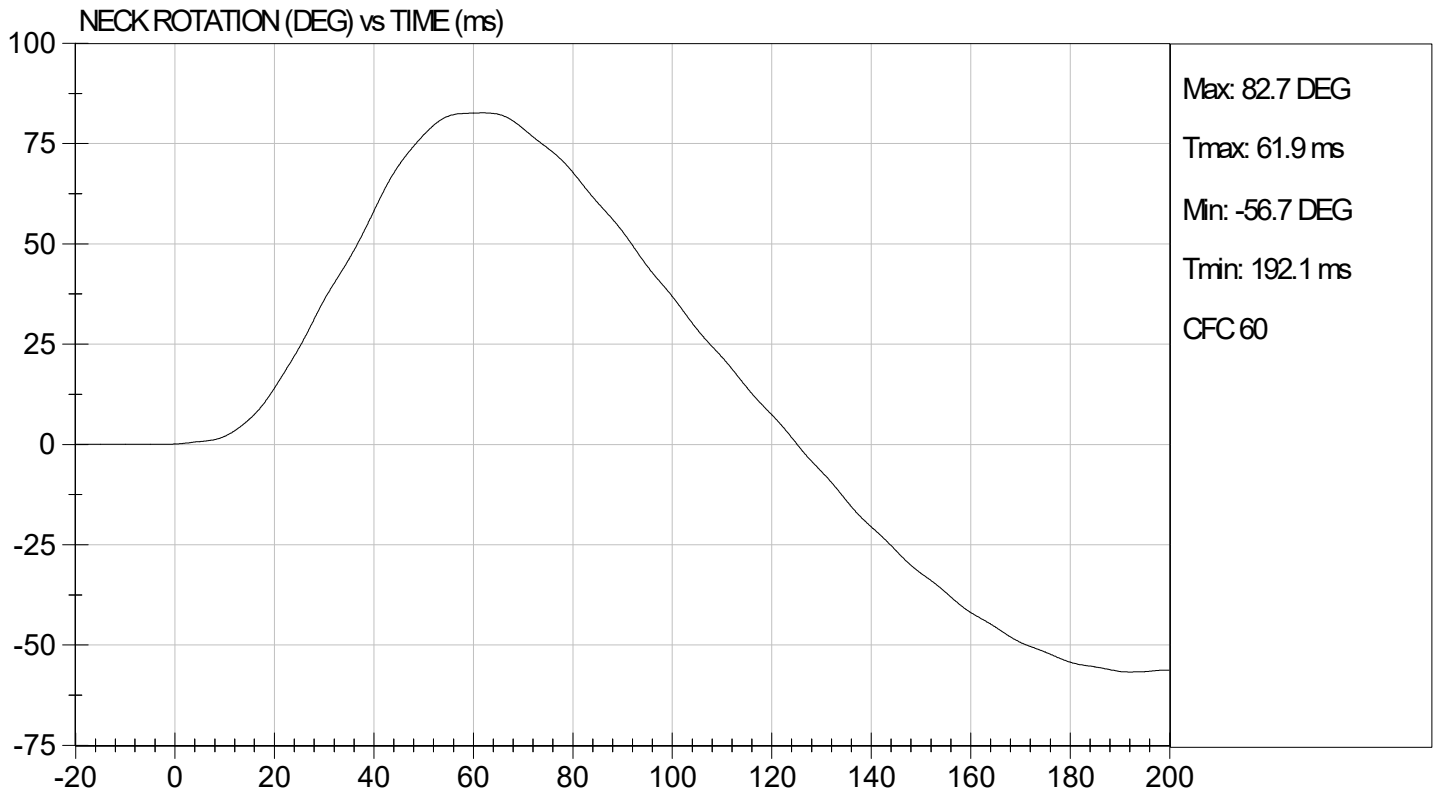
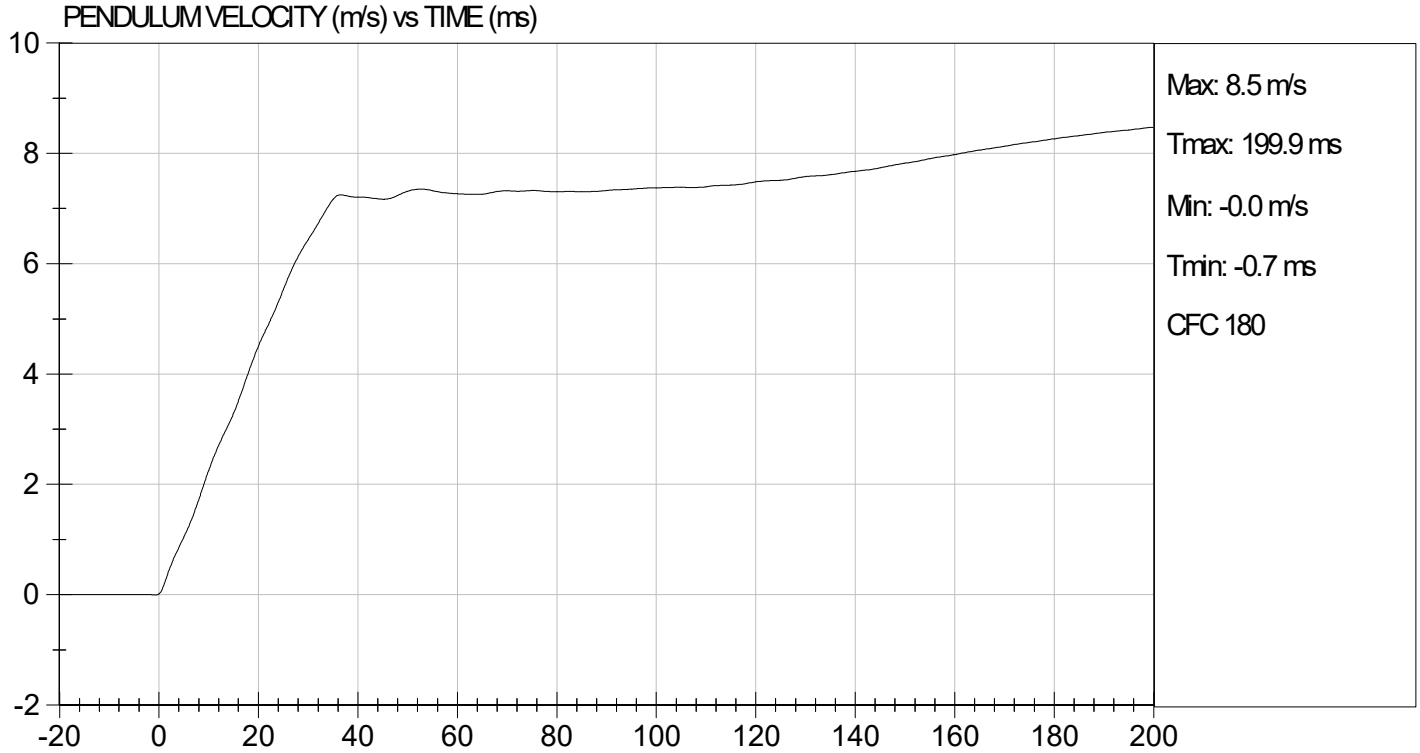
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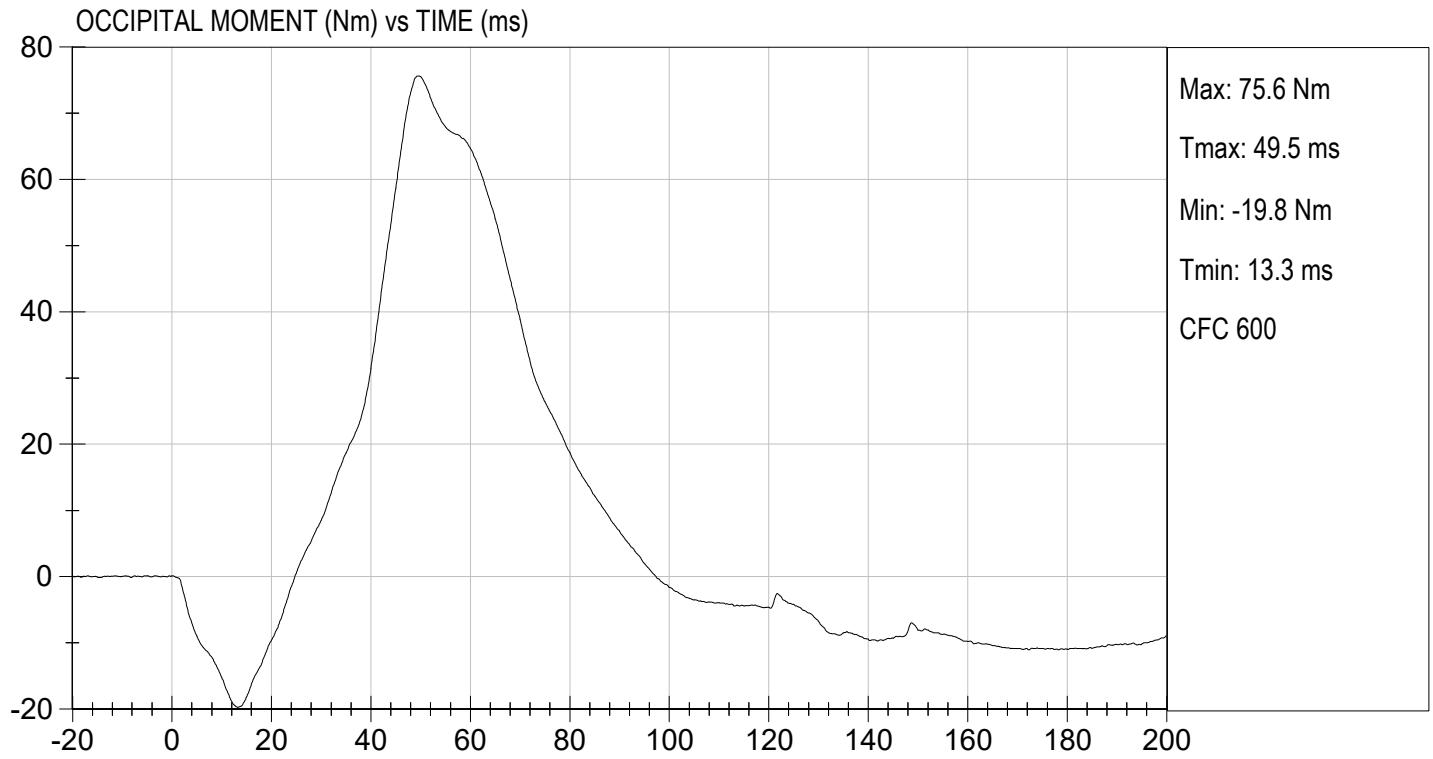
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.5	Pass
	30 ms	m/s	5.8 to 7.0	6.4	Pass
D Plane Rotation	Max	deg	77 to 91	83	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	76	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass

  
 Laboratory Technician

07/28/2023  
 Test Date

  
 Approved By





**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>45%</u>    |
| Record the minimum humidity:    | <u>38%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

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

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.05 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.7 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.4 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	4.9 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-53 Nm @ 112 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	105 ms


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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

07/28/2023  
Date

**MGA RESEARCH CORPORATION  
NECK EXTENSION TEST  
HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

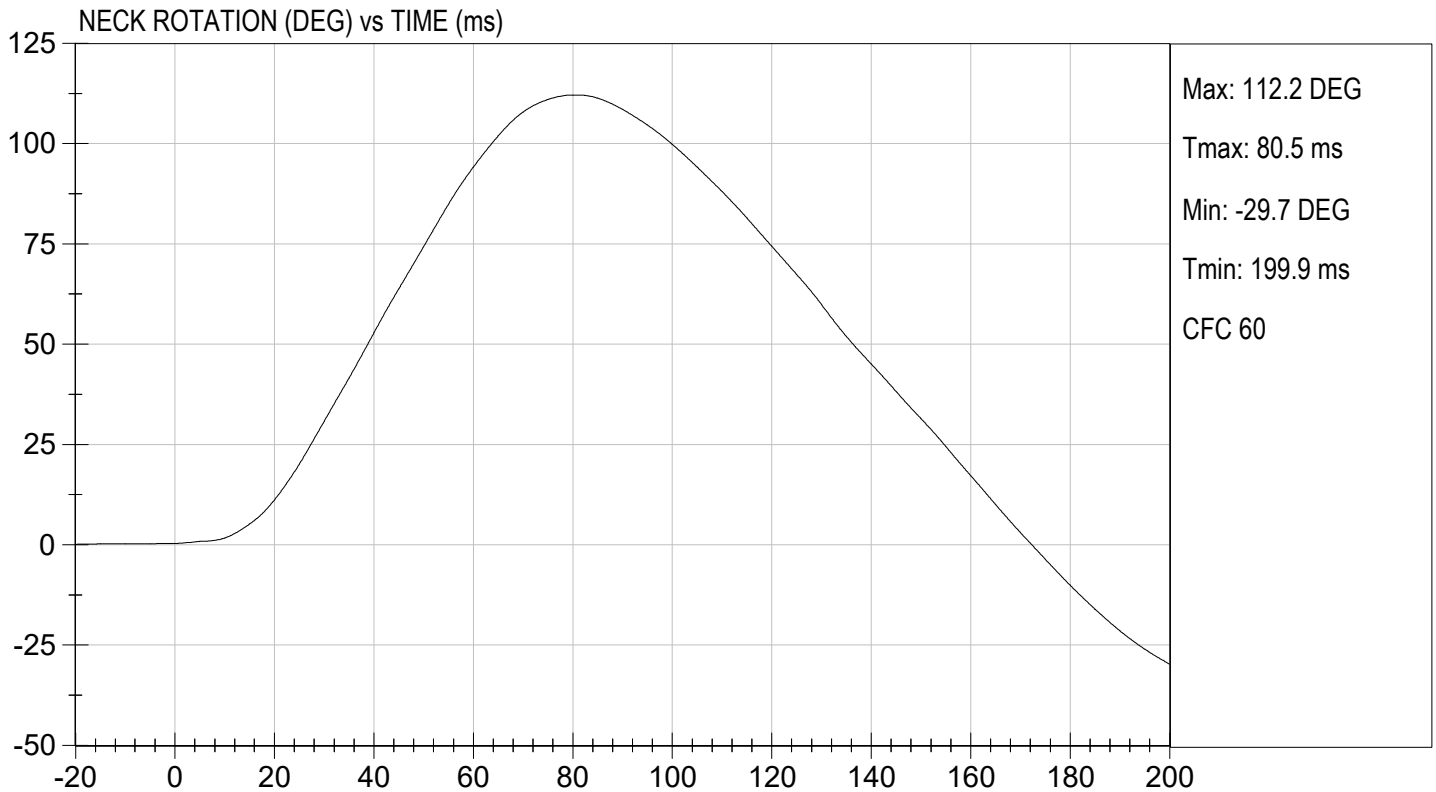
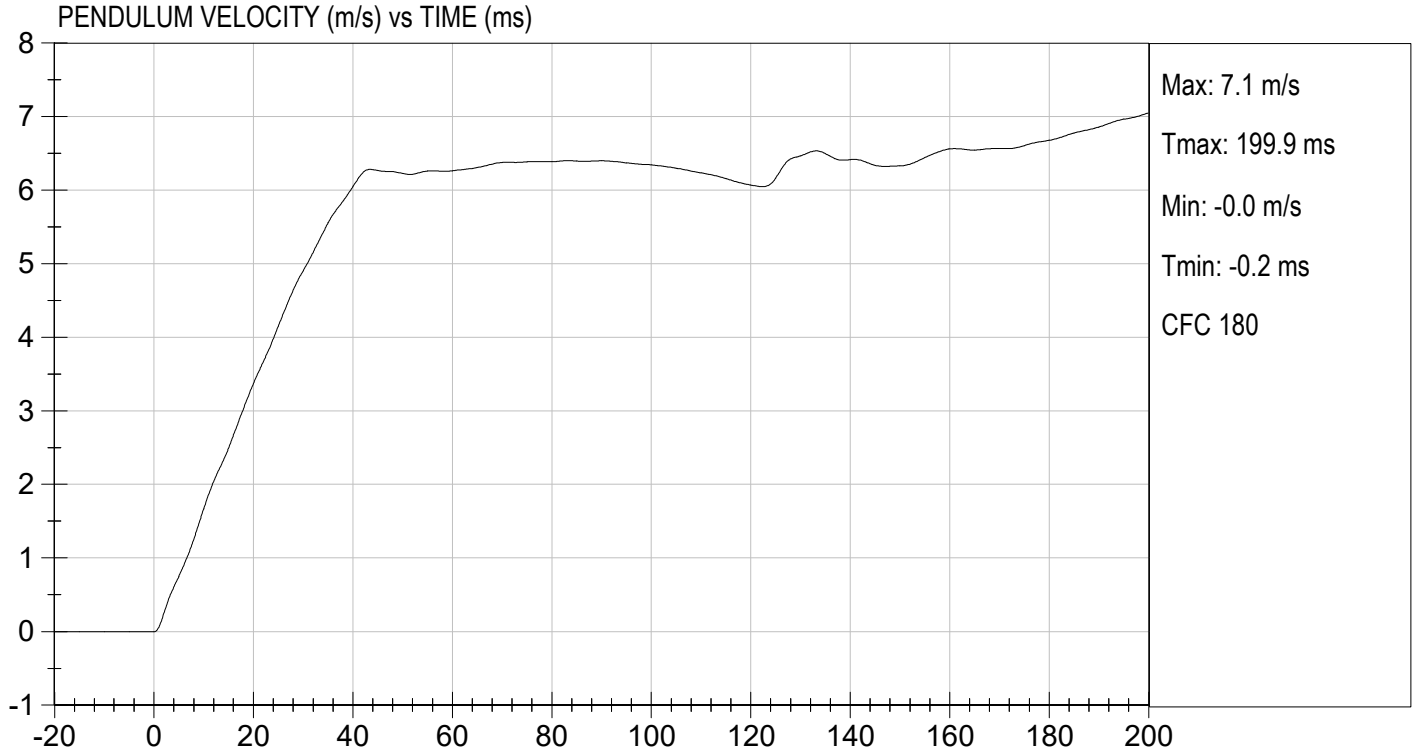
Test I.D: D231993

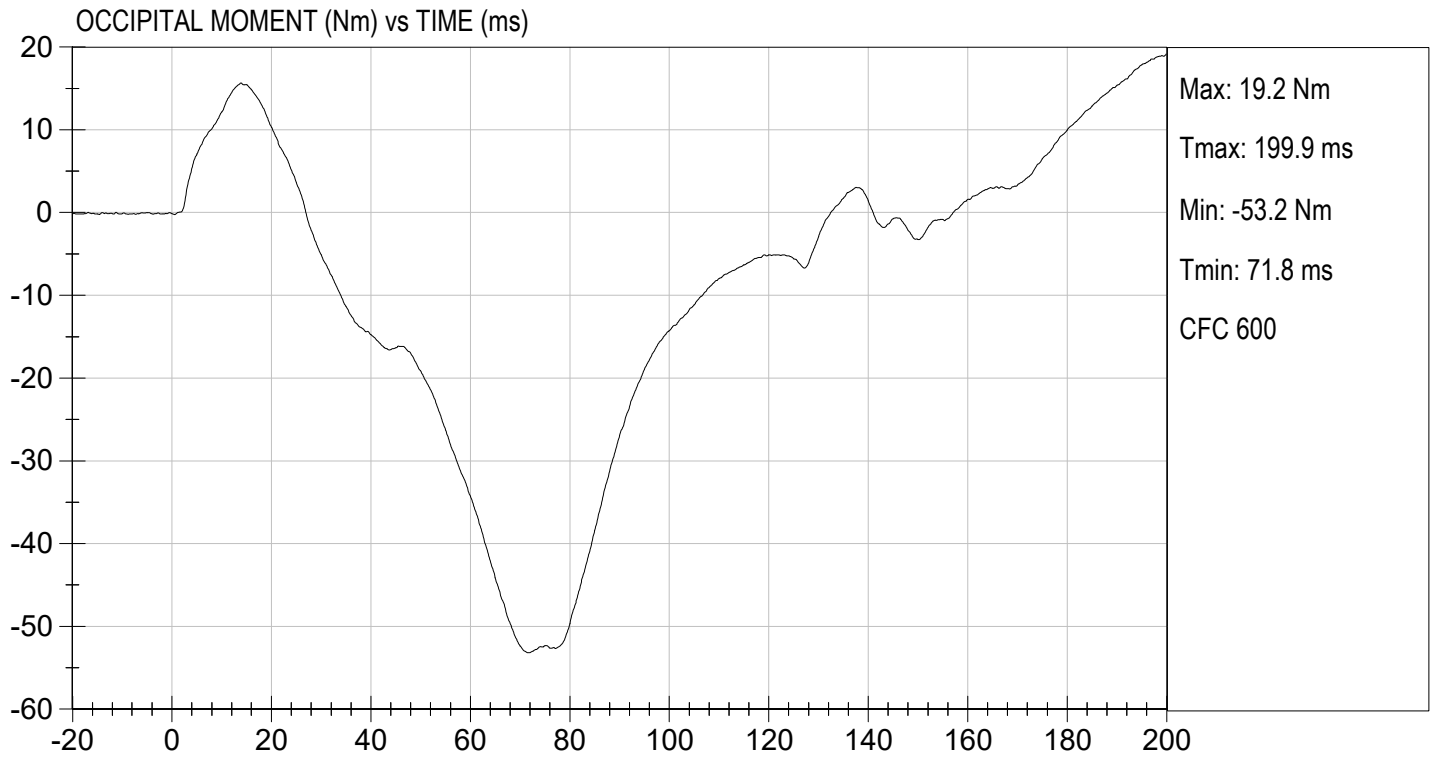
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity		%	10 to 70	45	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	112	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-53	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	105	Pass
Overall Results					Pass

  
Laboratory Technician

07/28/2023  
Test Date

  
Approved By





**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.4°C</u>
Record the minimum temperature:	<u>21.1°C</u>
Record the maximum humidity:	<u>46%</u>
Record the minimum humidity:	<u>39%</u>

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

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

- The following repairs or replacement was performed. Record:

---

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

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.77 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	52 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4335 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4361 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	73%

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

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

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

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

  
 \_\_\_\_\_  
 Signature

07/28/2023  
 \_\_\_\_\_  
 Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

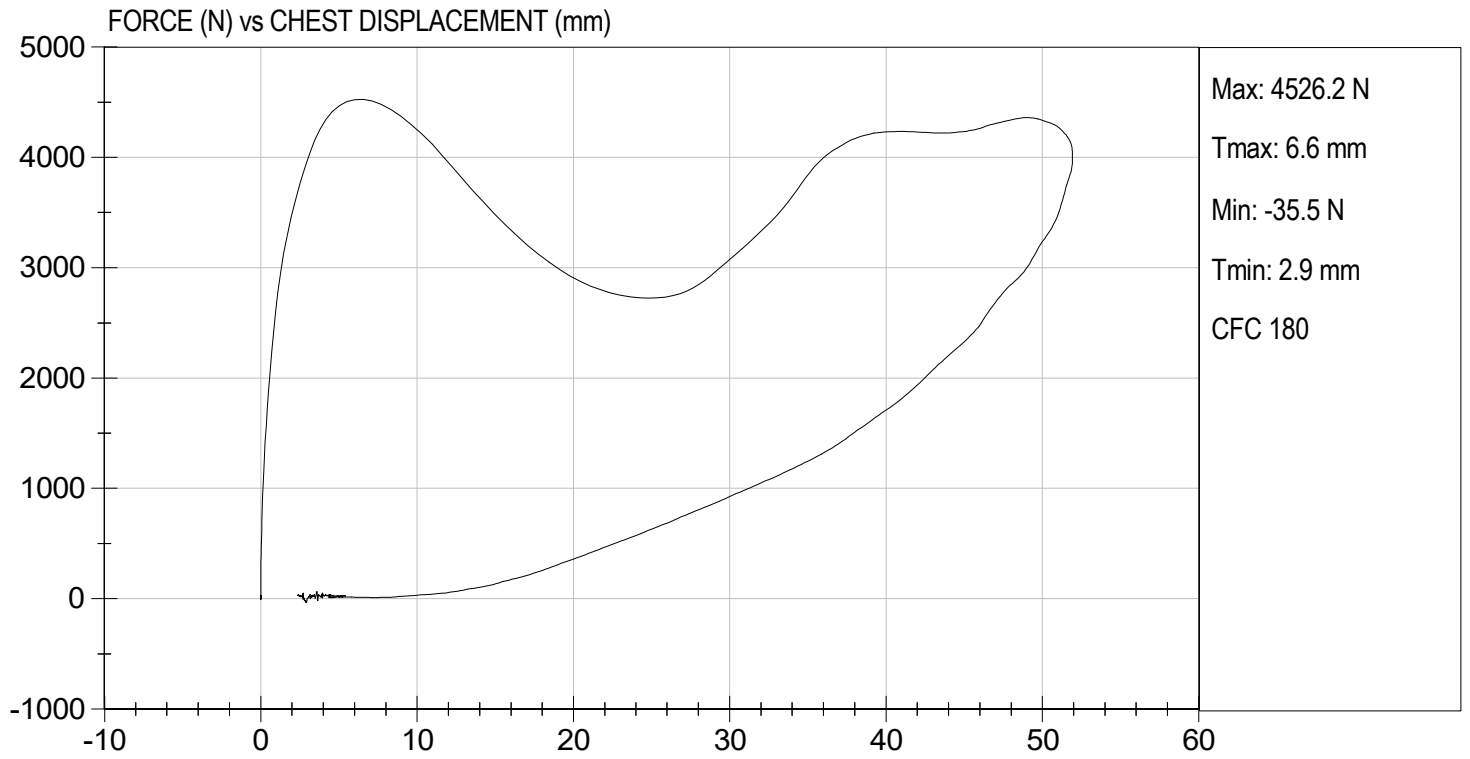
Test I.D: D231994

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	46	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4335	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4361	Pass
Overall Test Results				Pass

  
 Laboratory Technician

07/28/2023  
 Test Date

  
 Approved By



**DATA SHEET B7**  
TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 With legs below femurs.  
 Without legs below femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.6°C</u> |
| Record the minimum temperature: | <u>21.3°C</u> |
| Record the maximum humidity:    | <u>45%</u>    |
| Record the minimum humidity:    | <u>38%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	17 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.8 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	369 N
Final ref. plane angle	Initial ref. plane angle ± 8°	1 deg

*Jonah Pulokas*   
Signature

07/28/2023   
Date

**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D231997

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	1	Pass
Force at 45 deg	N	320 to 390	369	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
<b>Overall Result</b>				<b>Pass</b>



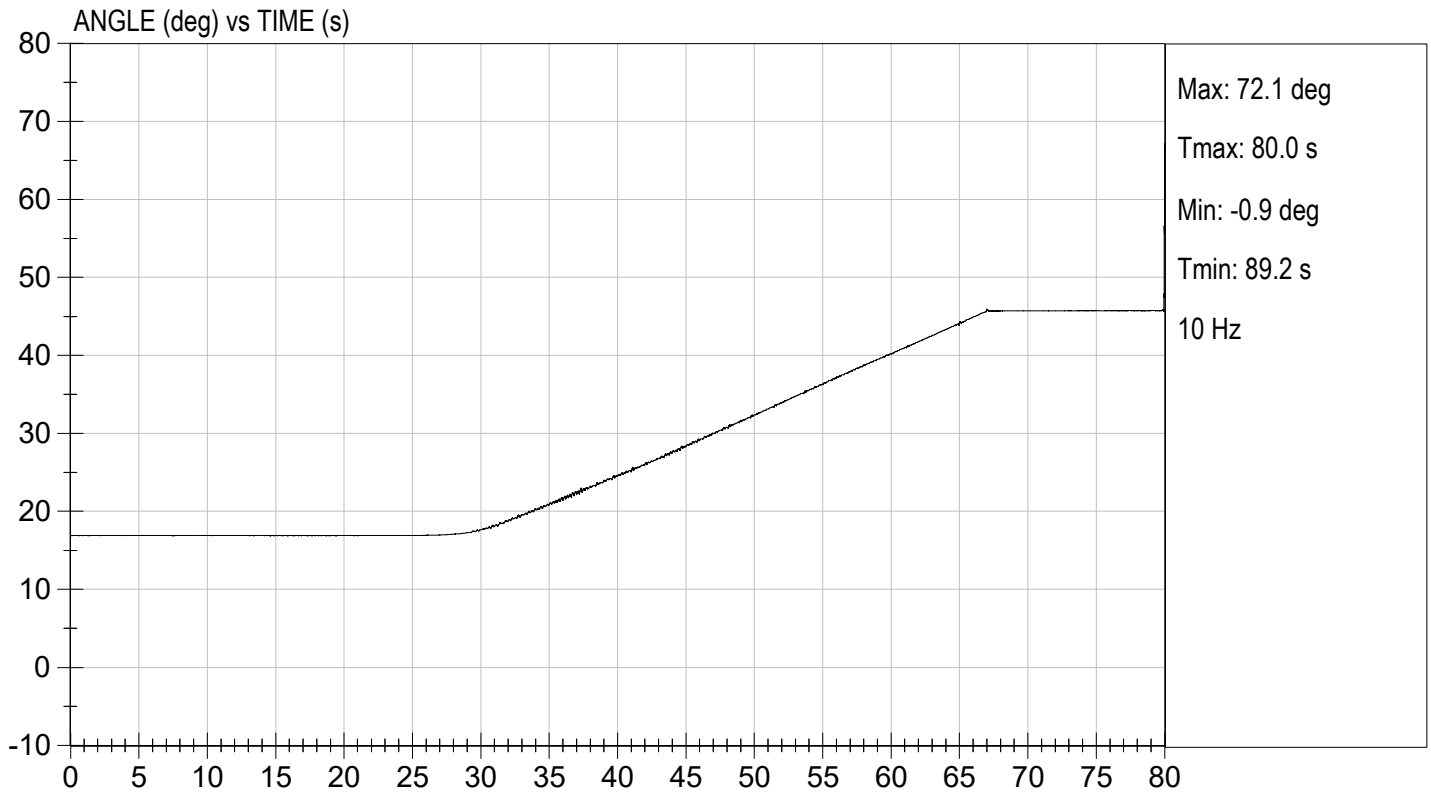
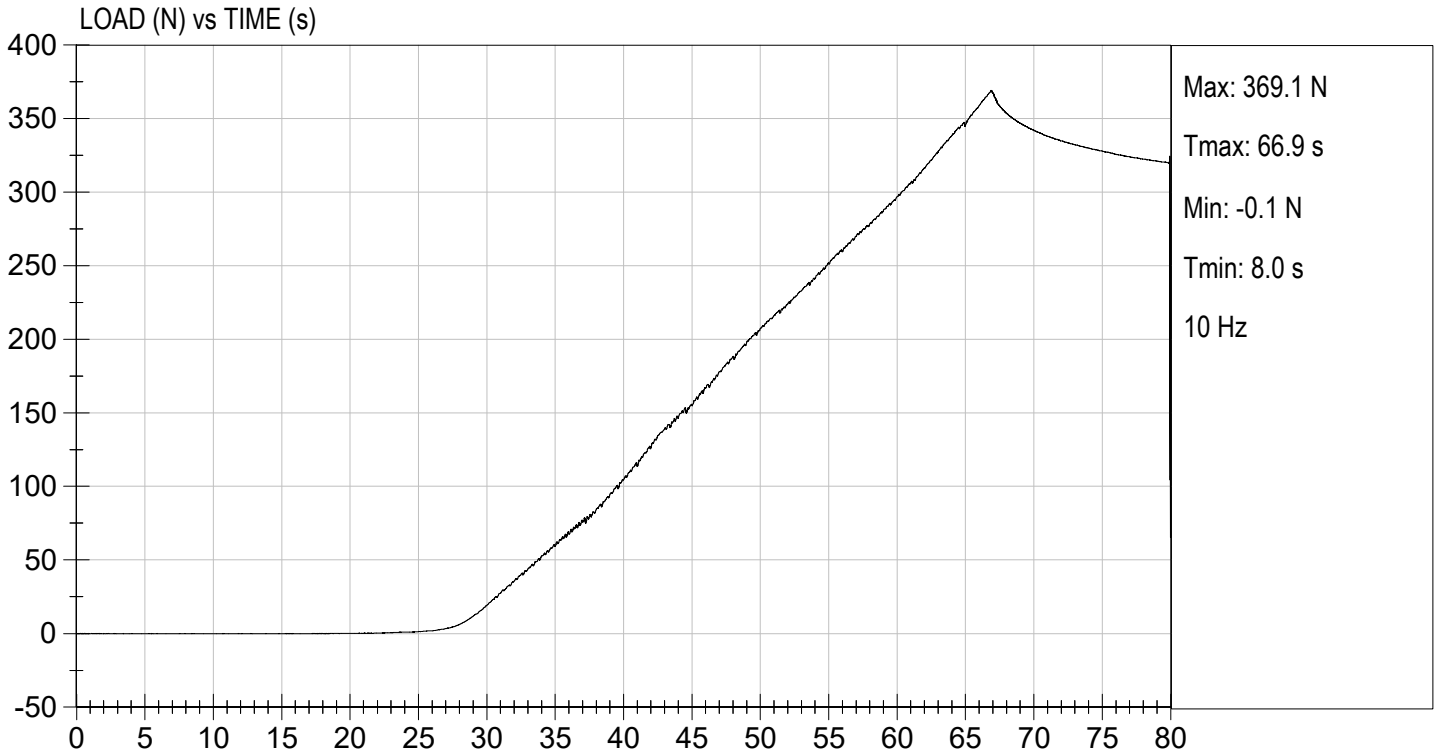
Laboratory Technician

07/28/2023

Test Date



Approved By



**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14B.
3. The knee assembly (880105-528L), lower leg structural replacement (880105- 603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>21.0°C</u> |
| Record the maximum humidity:    | <u>45%</u>    |
| Record the minimum humidity:    | <u>38%</u>    |
5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

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

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

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

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

  
Signature

07/28/2023  
Date

MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST  
HYBRID III 5TH PERCENTILE

ATD Serial No: 510

Test I.D: D231996

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3450	Pass
Overall Test Results				Pass



Laboratory Technician

07/28/2023

Test Date

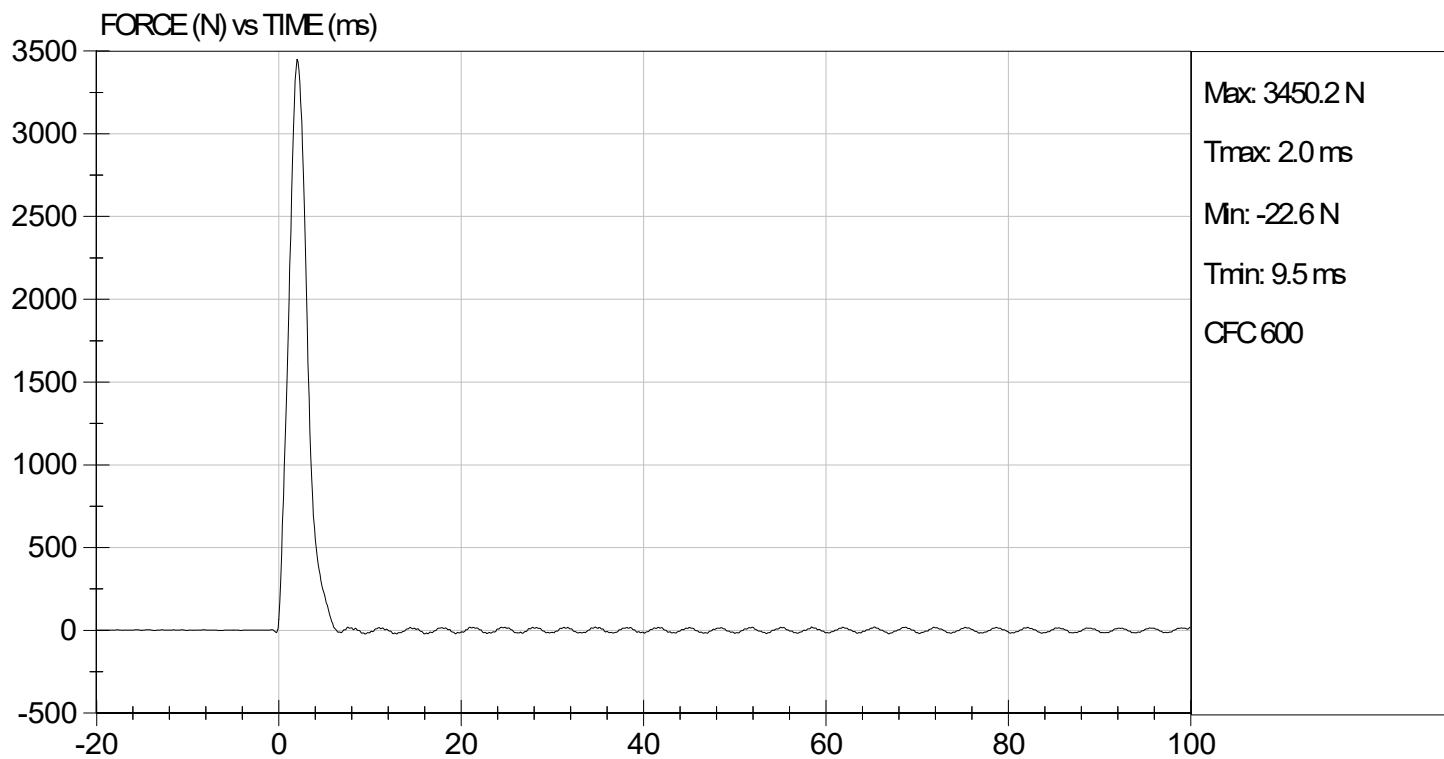


Approved By



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

TEST DATE: 07/28/2023  
TEST #: D231996



**DATA SHEET B9**  
RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 07/28/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.6°C</u>
Record the minimum temperature:	<u>21.3°C</u>
Record the maximum humidity:	<u>45%</u>
Record the minimum humidity:	<u>38%</u>

5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))		
Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3681 N

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

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

  
Signature

07/28/2023  
Date

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D231995

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3681	Pass
Overall Test Results				Pass

  
 \_\_\_\_\_  
 Laboratory Technician

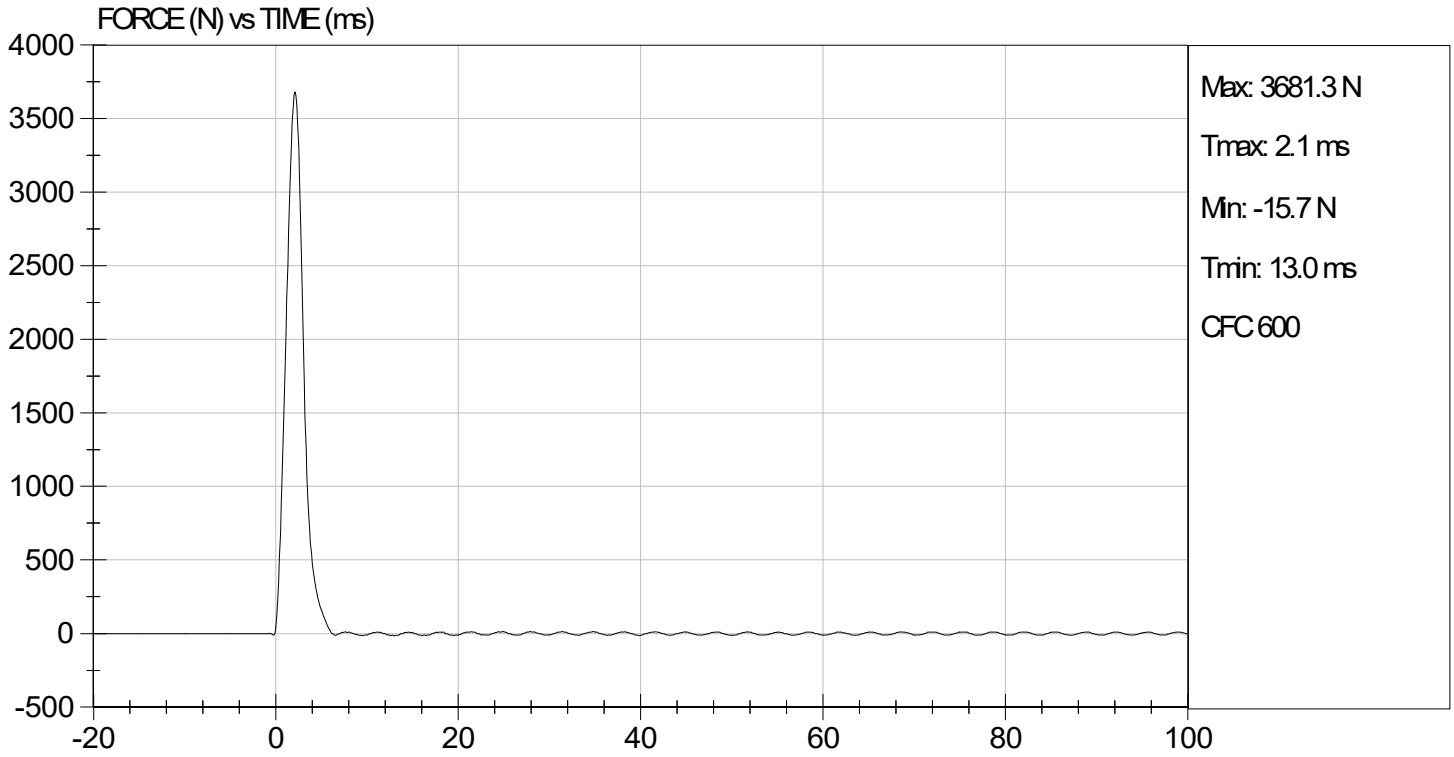
07/28/2023  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By



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

TEST DATE: 07/28/2023  
TEST #: D231995



**DATA SHEET B10**  
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360	T24763	08/03/2023	02/02/2024
(2) LATERAL	Endevco	7264C-2KTZ-360	T24813	08/03/2023	02/02/2024
(3) VERTICAL	Endevco	7264C-2KTZ-360	T24814	08/03/2023	02/02/2024
NECK TRANSDUCER	Denton	1716A	N742	08/09/2023	02/08/2024
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360M17	P88334	06/05/2023	12/05/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P88335	06/05/2023	12/05/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	P93609	06/05/2023	12/05/2023
CHEST POTENTIOMETER	Humanetics	880105-1080	510	06/05/2023	12/05/2023
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121AJFL	F1826	06/05/2023	12/05/2023
(2) LEFT FEMUR	Denton	2121AJFL	F1827	06/05/2023	12/05/2023
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	07/17/2023	01/16/2024
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	06/01/2023	12/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Servo	14CBI-2897	4707	08/11/2023	02/10/2024
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Servo	14CBI-2897	7297	08/11/2023	02/10/2024

LABORATORY TECHNICIAN: *Jondr Pulokas*

**DATA SHEET B3**  
HEAD DROP TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>20.3°C</u> |
| Record the maximum humidity:    | <u>42%</u>    |
| Record the minimum humidity:    | <u>32%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

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

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

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

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

X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches

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

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

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	274 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	2.2 g

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

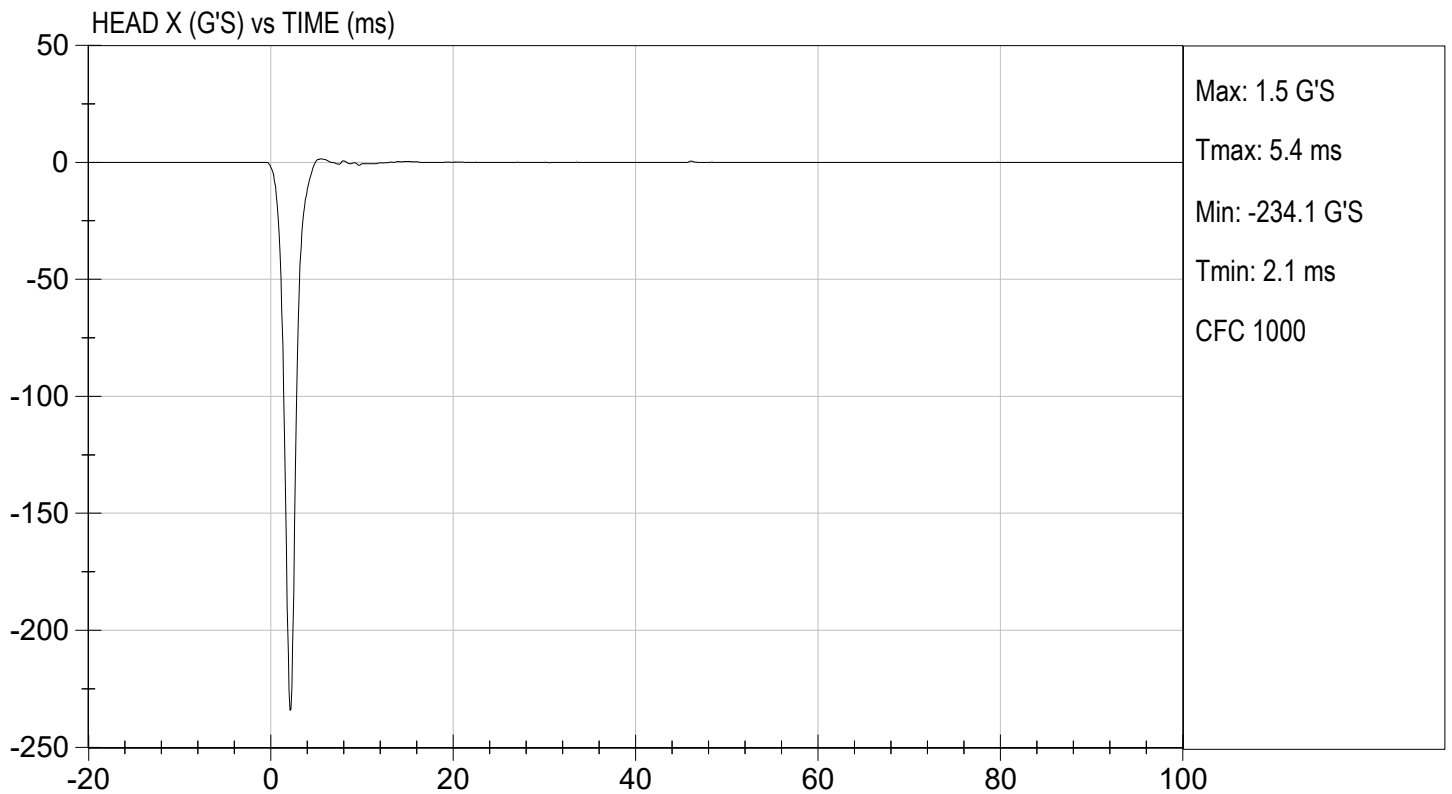
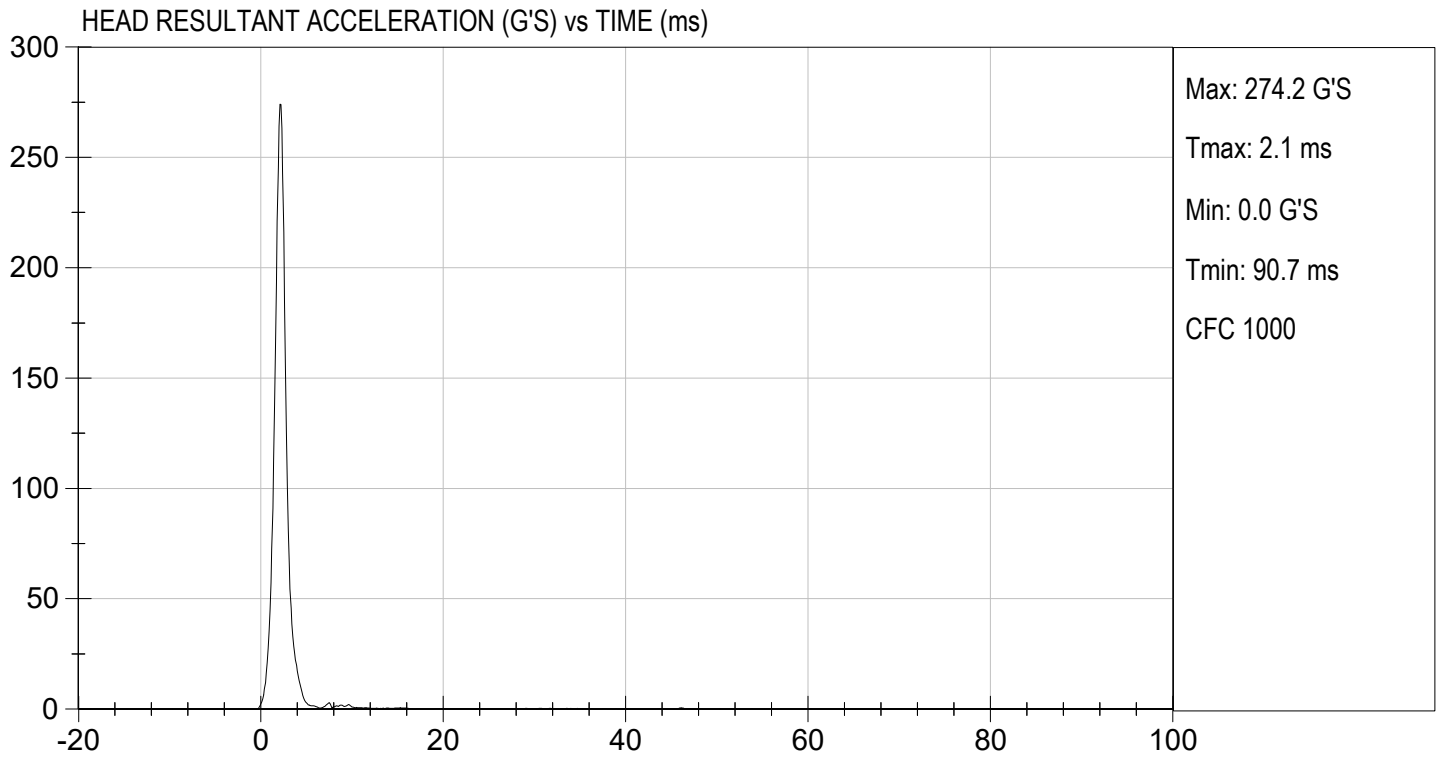
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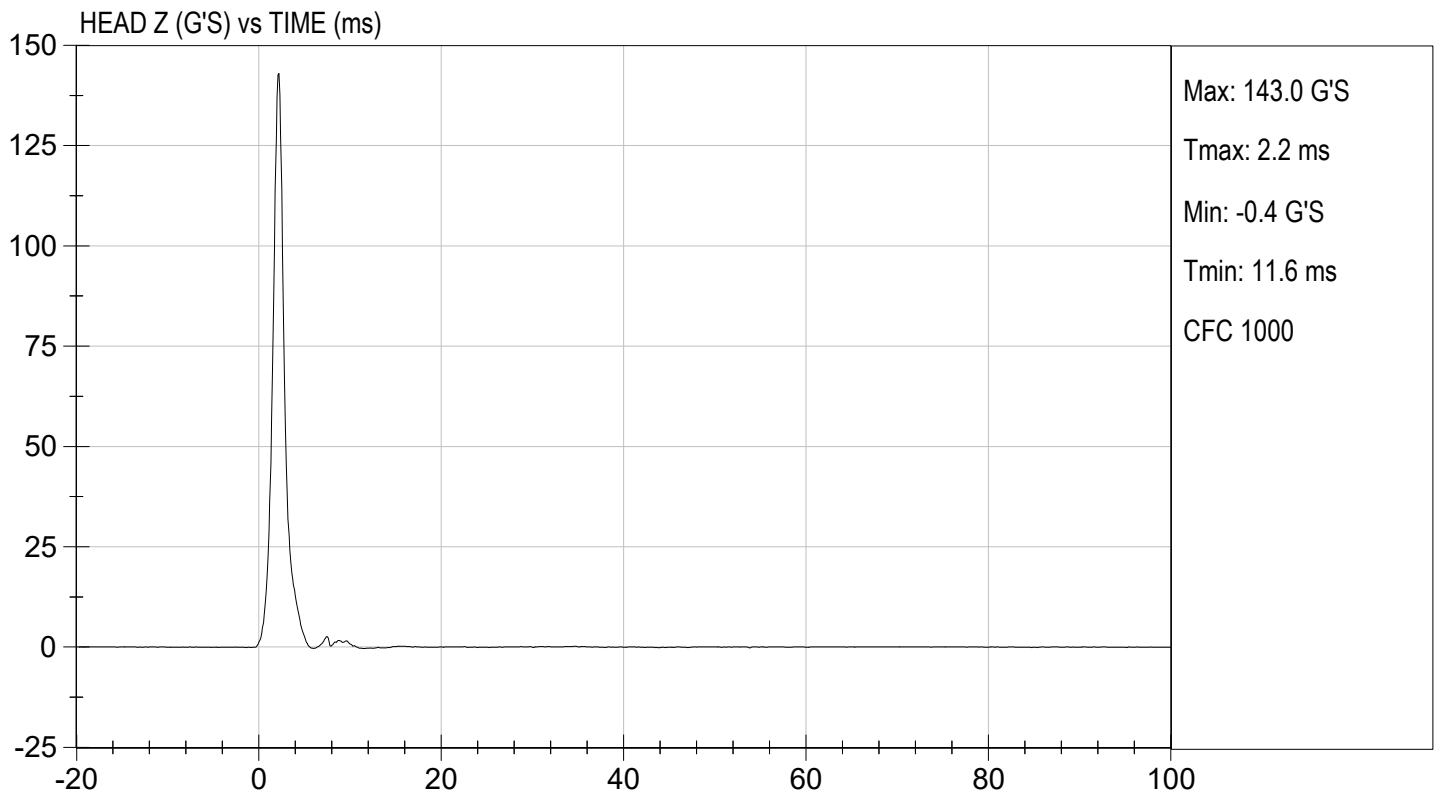
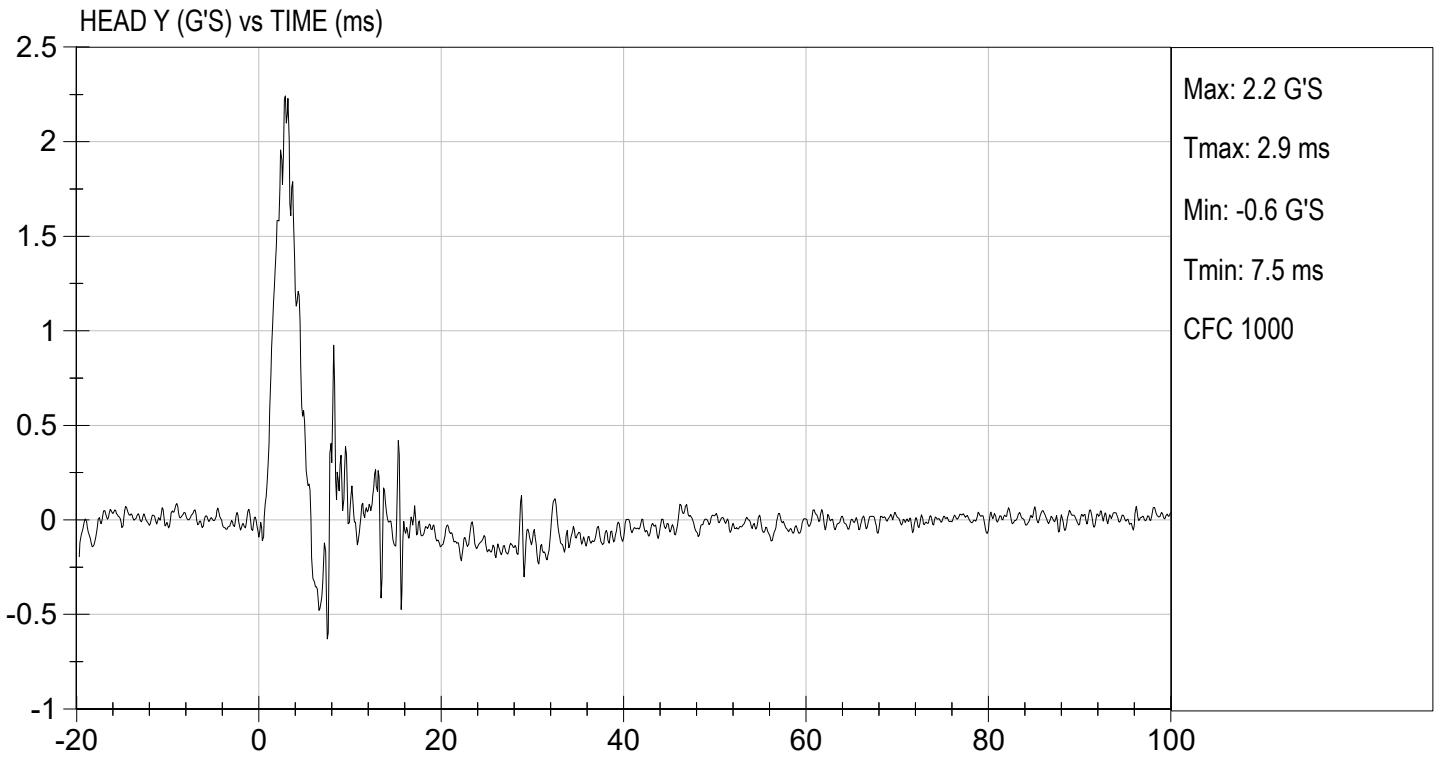
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Peak Resultant Acceleration	G's	250 to 300	274	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.2	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 Laboratory Technician

09/20/2023  
 Test Date

  
 Approved By





**DATA SHEET B4**  
NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

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. (572.137(q))  
            X   N/A, ONLY one neck test performed
- X   2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X   3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>43%</u>    |
| Record the minimum humidity:    | <u>33%</u>    |
- X   4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- |                              |                  |
|------------------------------|------------------|
| Record findings and actions: | <u>No damage</u> |
|------------------------------|------------------|
- X   5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- |                              |   |
|------------------------------|---|
| Record findings and actions: | <u>No Deterioration; Hardness: Front 89; Back 90.</u> |
|------------------------------|---|
- X   6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J2111/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.3 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.6 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.6 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	83 Nm @ 77 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	86 ms

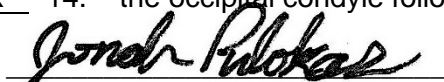
\*Moment about the occipital condyle =  $M_y - (0.01778 \text{ m} \times F_x)$ (572.133(b)(1)(ii))

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

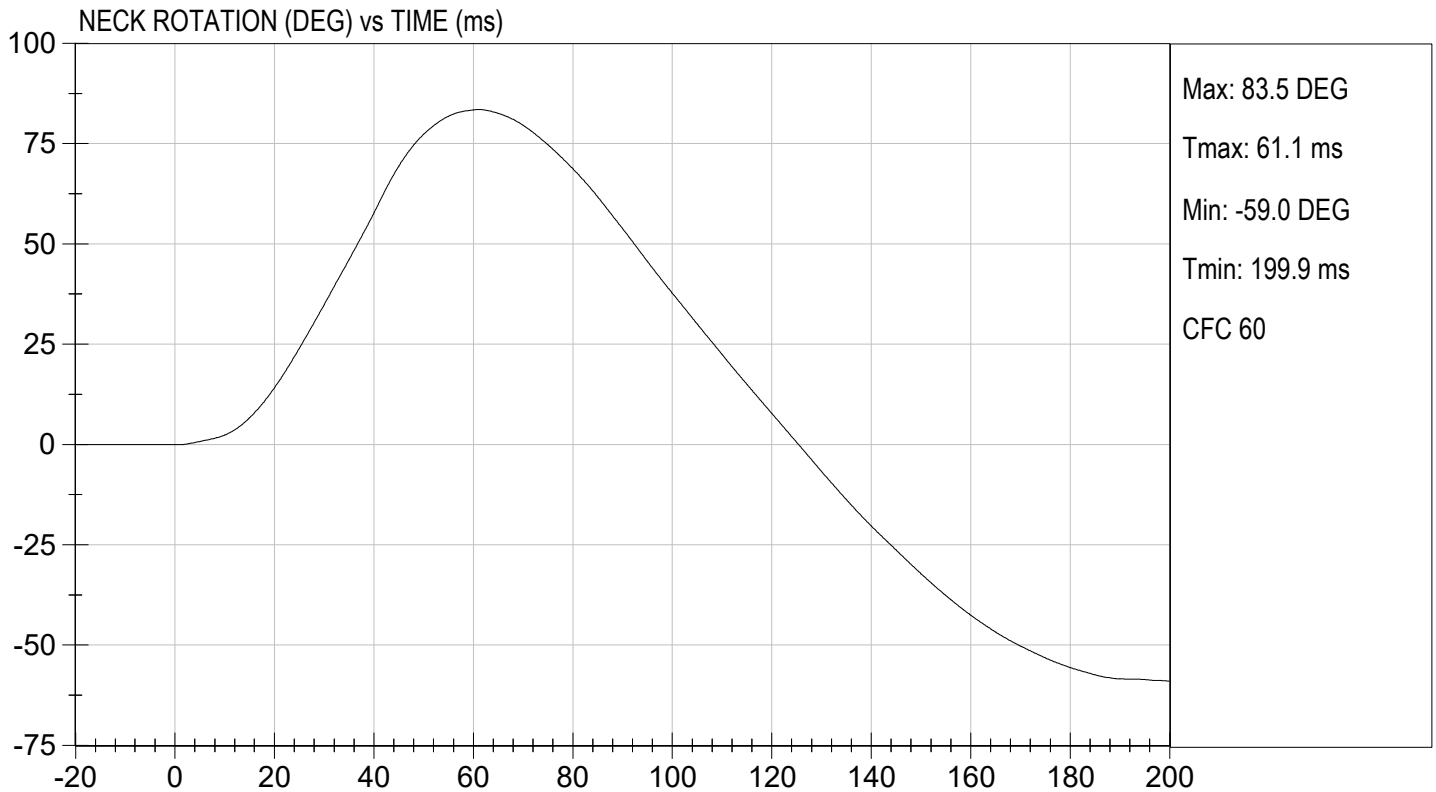
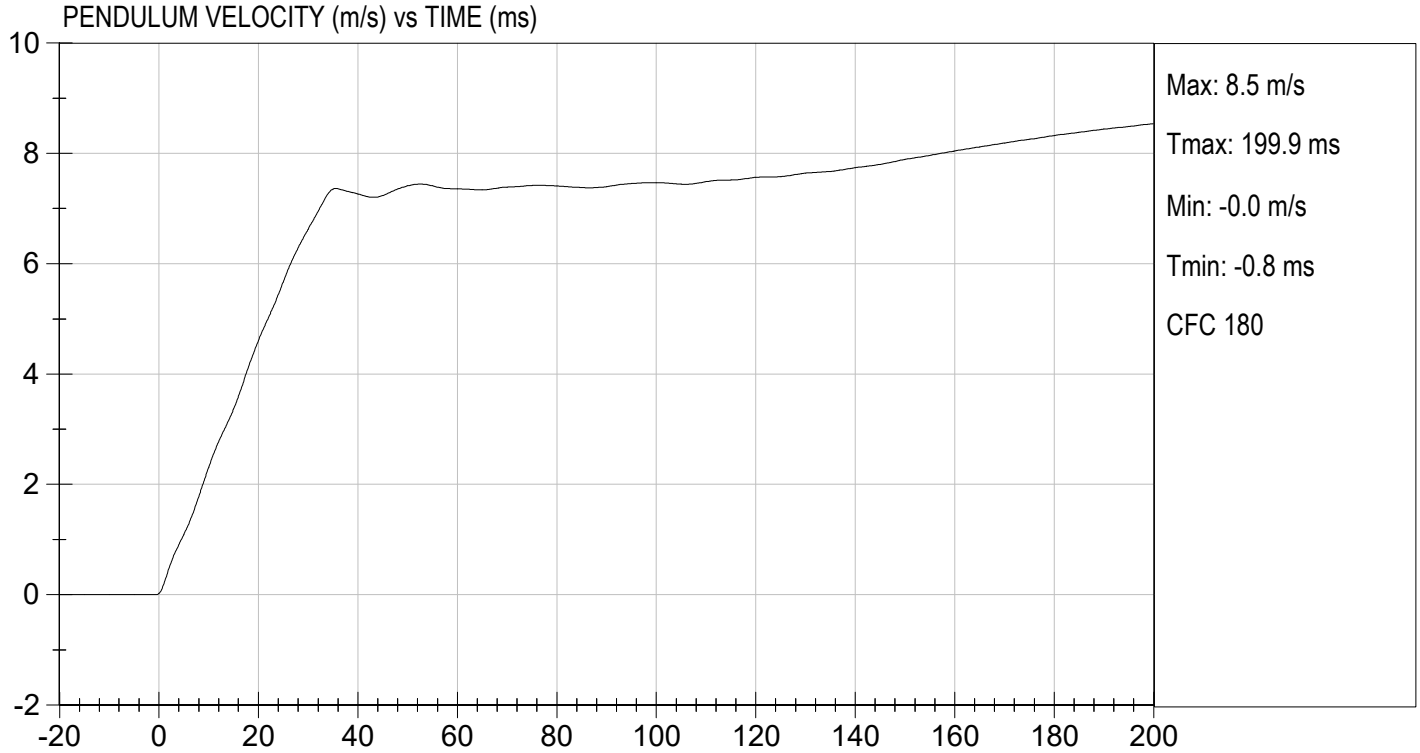
Test I.D: D232612

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.3	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.6	Pass
D Plane Rotation	Max	deg	77 to 91	83	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	73	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
Overall Results					Pass

  
 Laboratory Technician

09/20/2023  
 Test Date

  
 Approved By





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

TEST DATE: 09/20/2023  
TEST #: D232612



**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>43%</u>    |
| Record the minimum humidity:    | <u>33%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

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

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.6 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.3 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	4.9 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-55 Nm @ 113 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	106 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

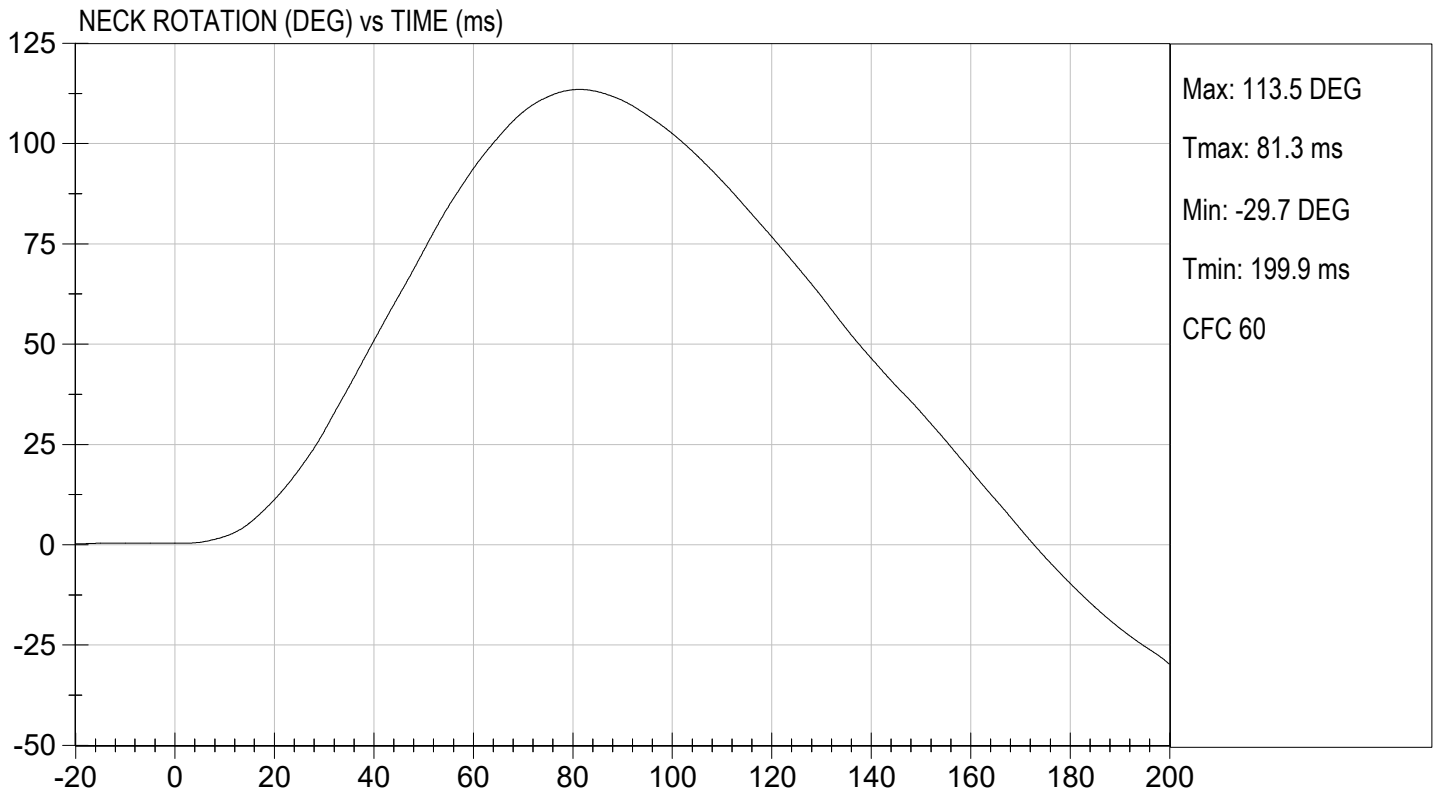
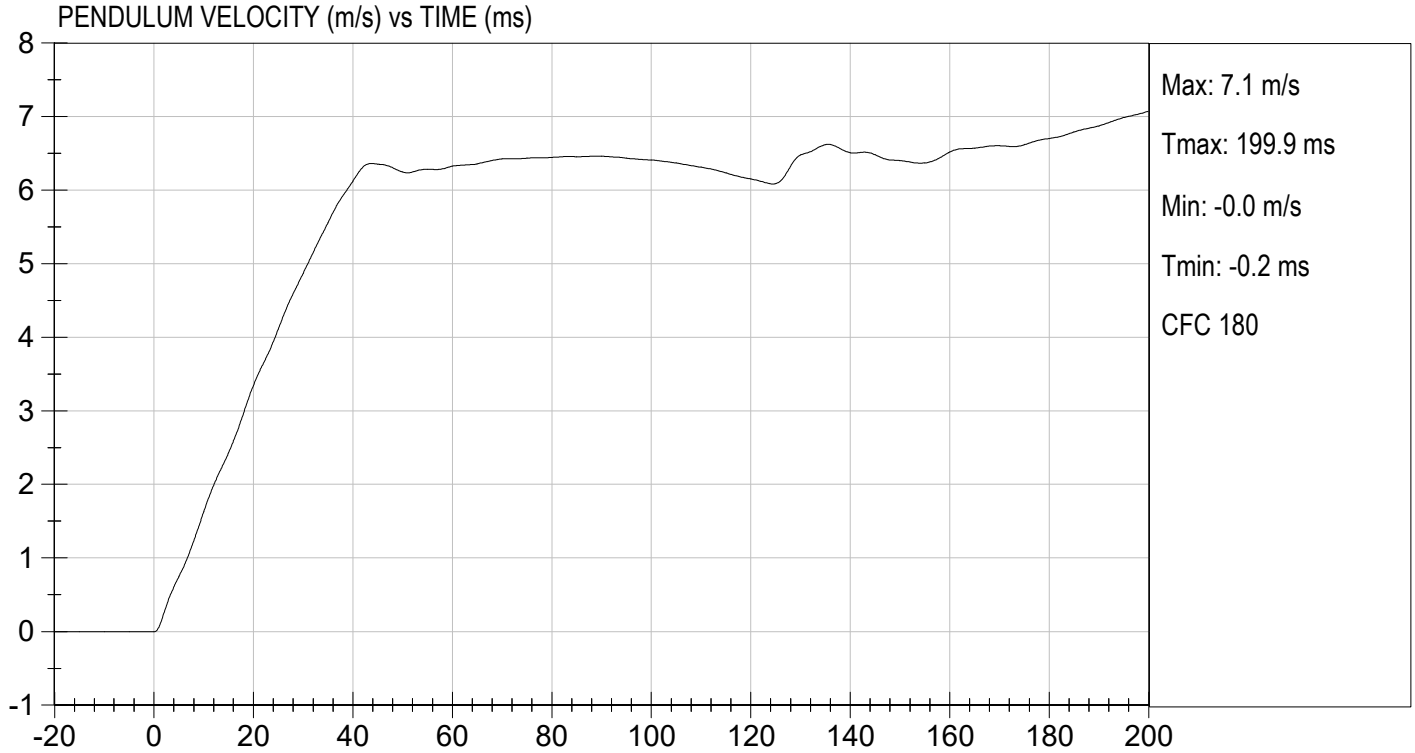
Test I.D.: D232613

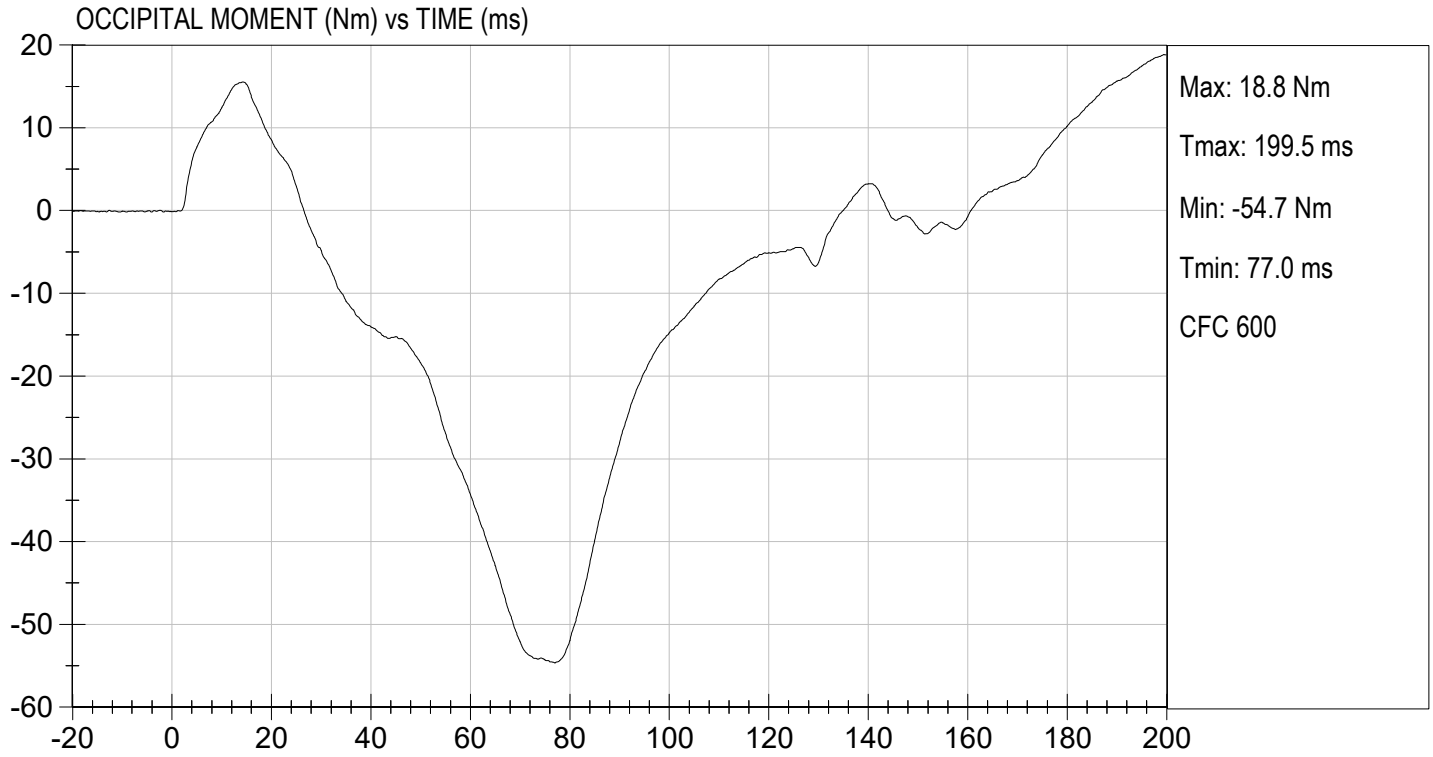
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.3	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	113	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-55	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	106	Pass
Overall Results					Pass

  
 Laboratory Technician

09/20/2023  
 Test Date

  
 Approved By





**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.2°C</u>
Record the minimum temperature:	<u>19.9°C</u>
Record the maximum humidity:	<u>45%</u>
Record the minimum humidity:	<u>35%</u>

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

- No Damage

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

---

- The following repairs or replacement was performed. Record

---

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

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	52.0 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4350 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4366 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	73%

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

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

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

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

  
 Signature

09/20/2023  
 Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D232614

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	52	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4350	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4366	Pass
Overall Test Results				Pass



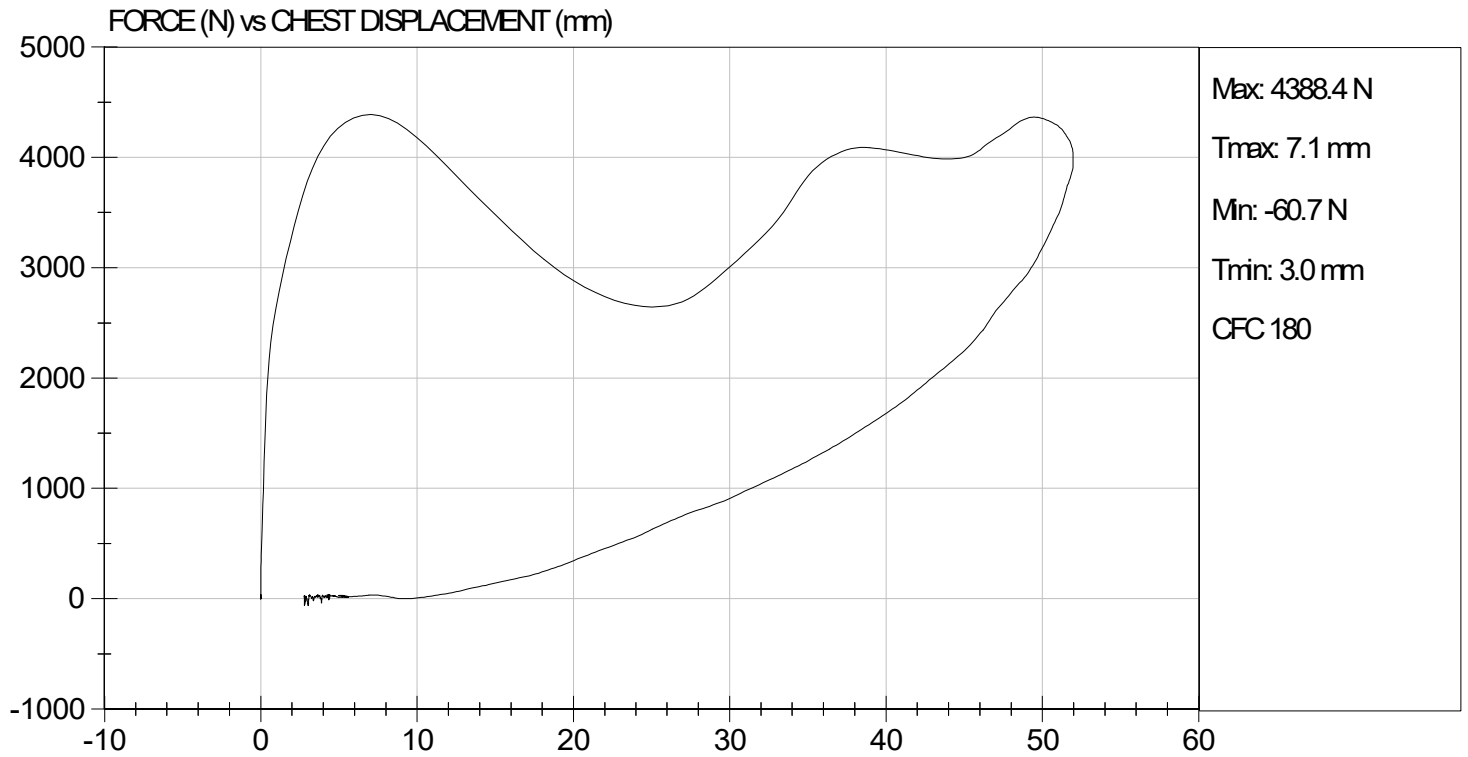
Laboratory Technician

09/20/2023

Test Date



Approved By



**DATA SHEET B7**  
TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 With legs below femurs.  
 Without legs below femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>43%</u>    |
| Record the minimum humidity:    | <u>33%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	17 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.7 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	326 N
Final ref. plane angle	Initial ref. plane angle ± 8°	4 deg

   
Signature

09/20/2023   
Date

**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

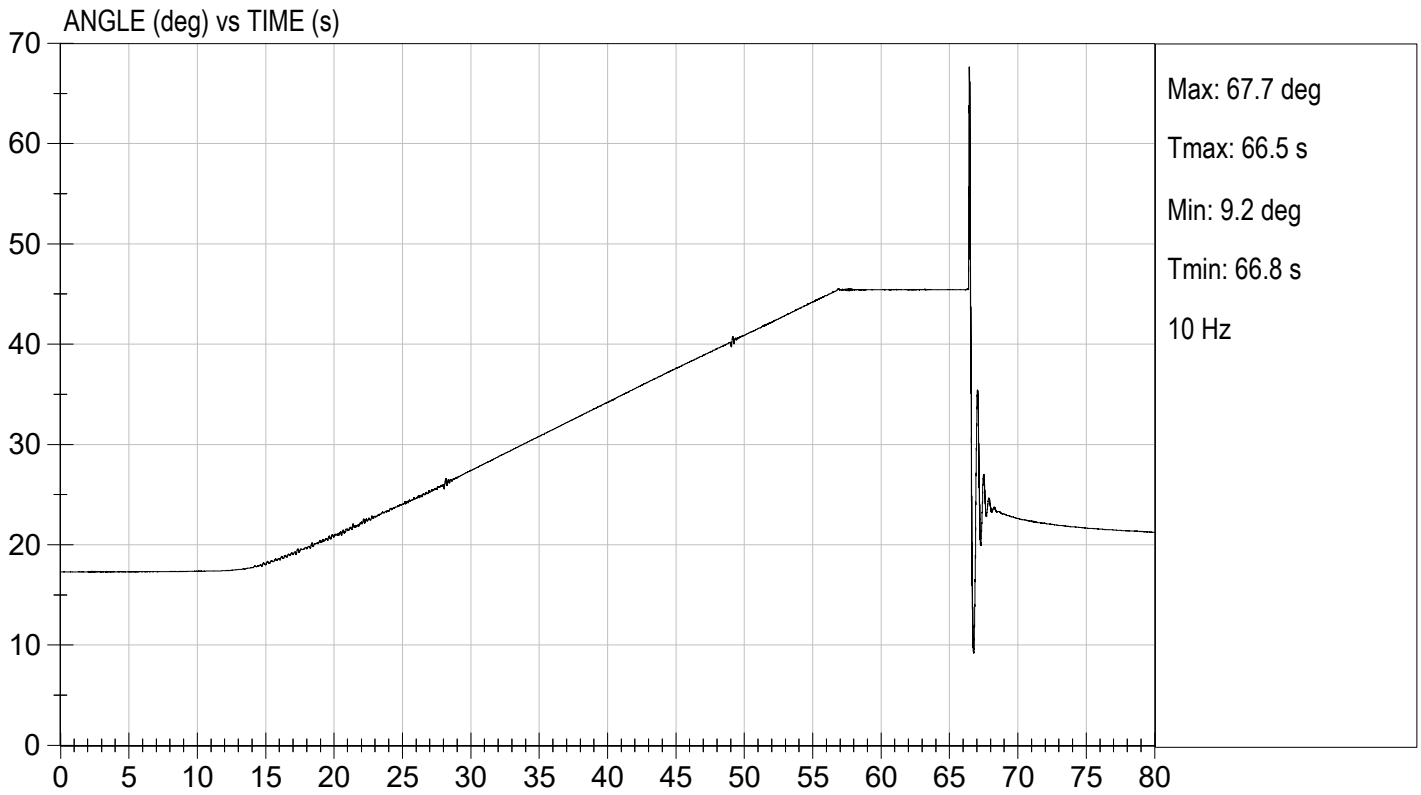
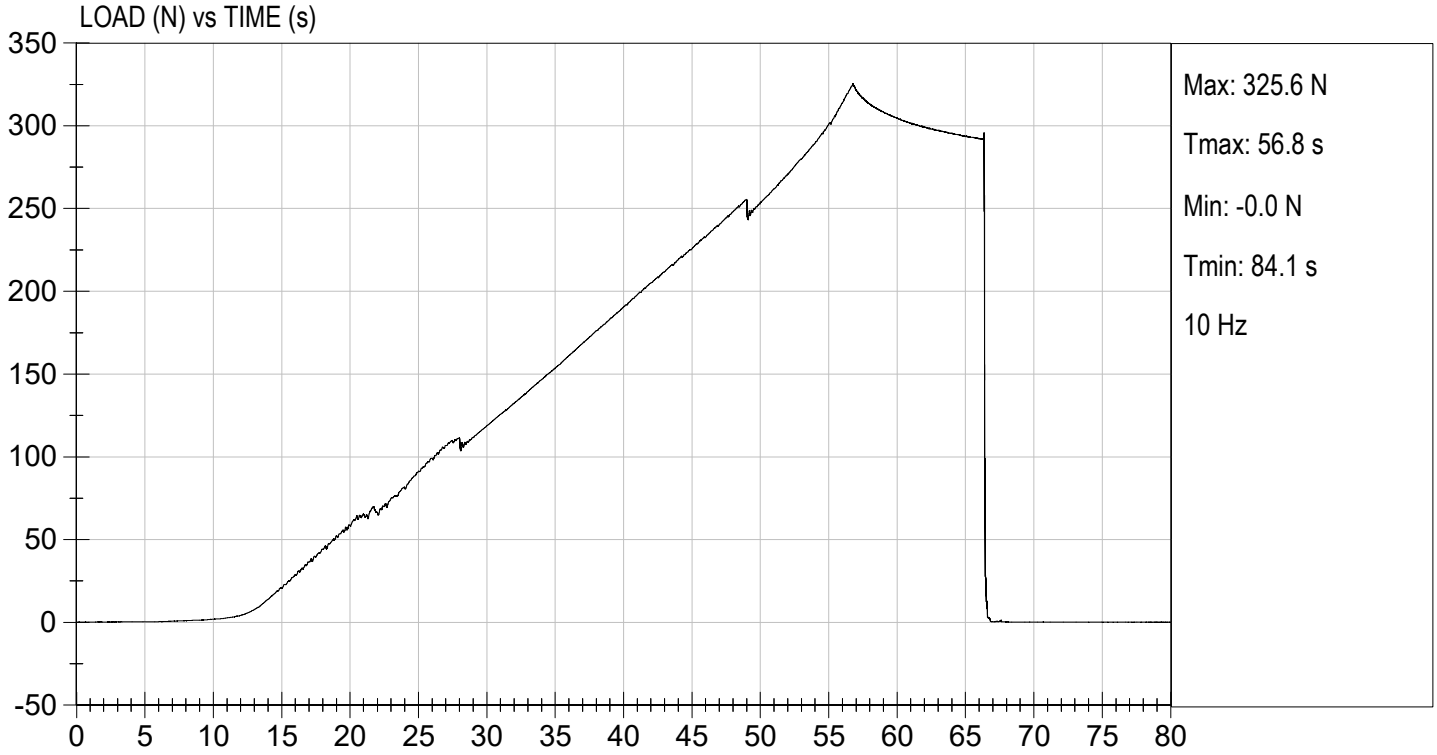
Test I.D: D232617

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	326	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
<b>Overall Result</b>				<b>Pass</b>

  
 Laboratory Technician

09/20/2023  
 Test Date

  
 Approved By



**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.2°C</u>
Record the minimum temperature:	<u>19.9°C</u>
Record the maximum humidity:	<u>40%</u>
Record the minimum humidity:	<u>30%</u>

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

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3702 N

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**

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

**ATD Serial No:** 510

**Test I.D.:** D232616

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3702	Pass
Overall Test Results				Pass



Laboratory Technician

09/20/2023

Test Date

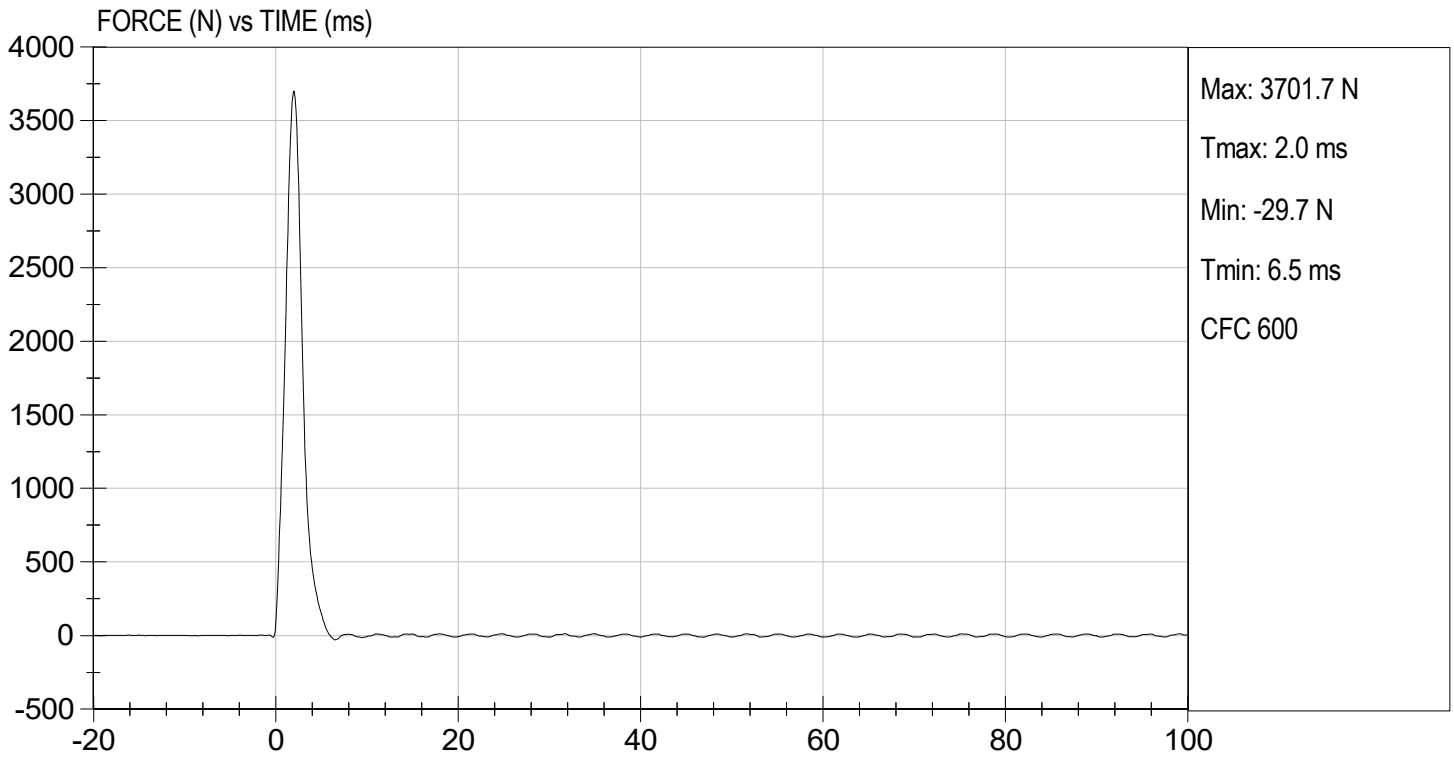


Approved By



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

TEST DATE: 09/20/2023  
TEST #: D232616



**DATA SHEET B9**  
RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 09/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.2°C</u>
Record the minimum temperature:	<u>19.9°C</u>
Record the maximum humidity:	<u>40%</u>
Record the minimum humidity:	<u>30%</u>

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

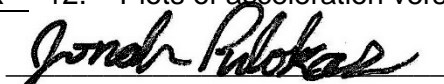
X 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.08 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3577 N

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

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

  
Signature

09/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D232615

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3577	Pass
Overall Test Results				Pass



Laboratory Technician

09/20/2023

Test Date

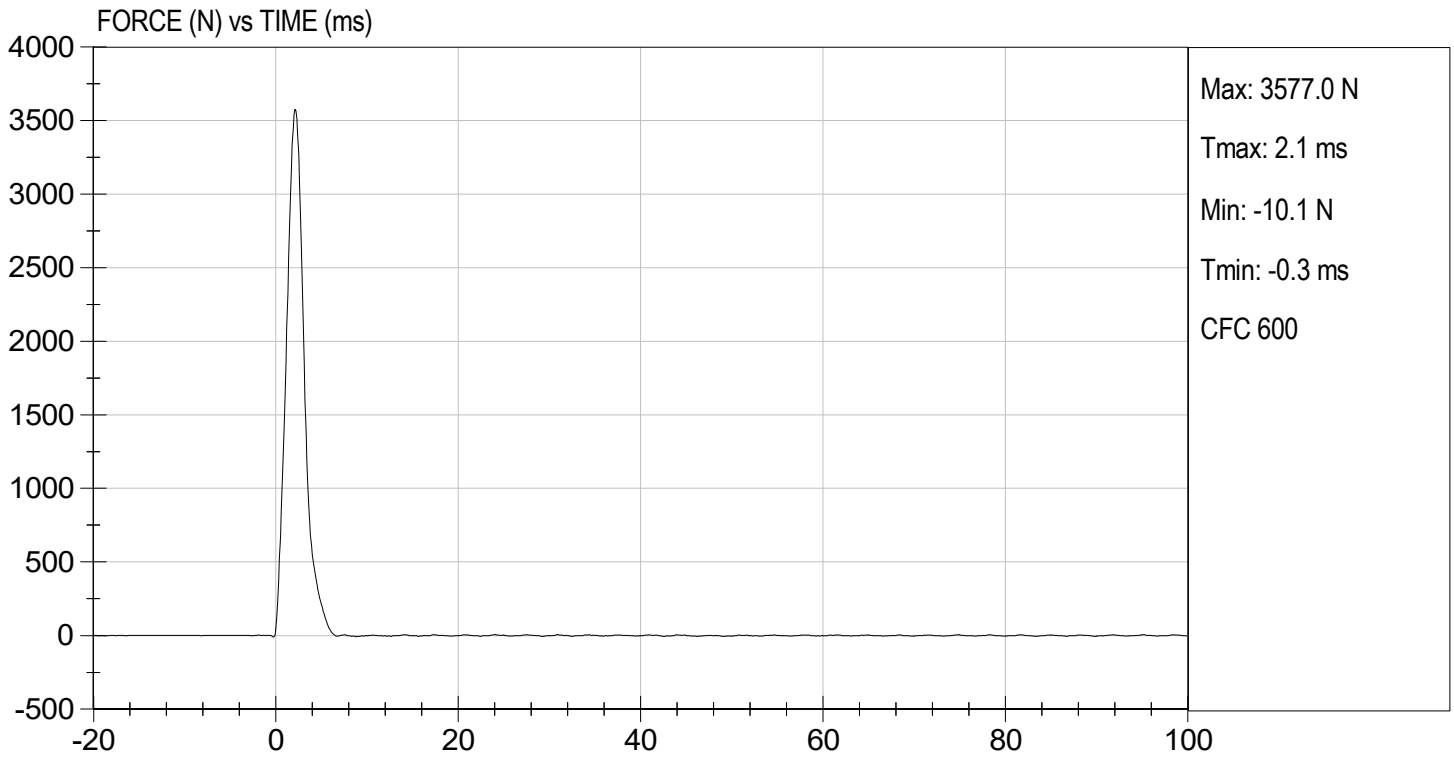


Approved By



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

TEST DATE: 09/20/2023  
TEST #: D232615



**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 510

Test Date: 09/20/2023

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.

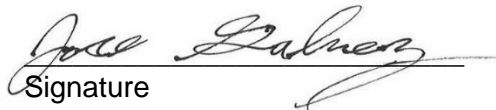
Repair or Replacement approved by:

  
Signature

09/20/2023  
Date

Describe the repair or replacement of parts:

Checked by:

  
Signature

09/20/2023  
Date



## EXTERNAL DIMENSIONS

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

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

**DATA SHEET B3**  
HEAD DROP TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/21/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity:    | <u>22%</u>    |
| Record the minimum humidity:    | <u>15%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.132(c)(2))
10. Suspend and orient the head assembly as shown in Figure 5B. The lowest point on the

forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface. (572.132(c)(3))

Record the actual distance: 376 mm

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

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

Record the right side distance: 501 mm

Record the left side distance: 501 mm

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

Record actual micro finish: 24.8 micro inches

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

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

Record thickness: 50.9 mm

Record width: 604 mm

Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	259 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-1.8 g

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

Jondr Pulokas  
Signature

03/21/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

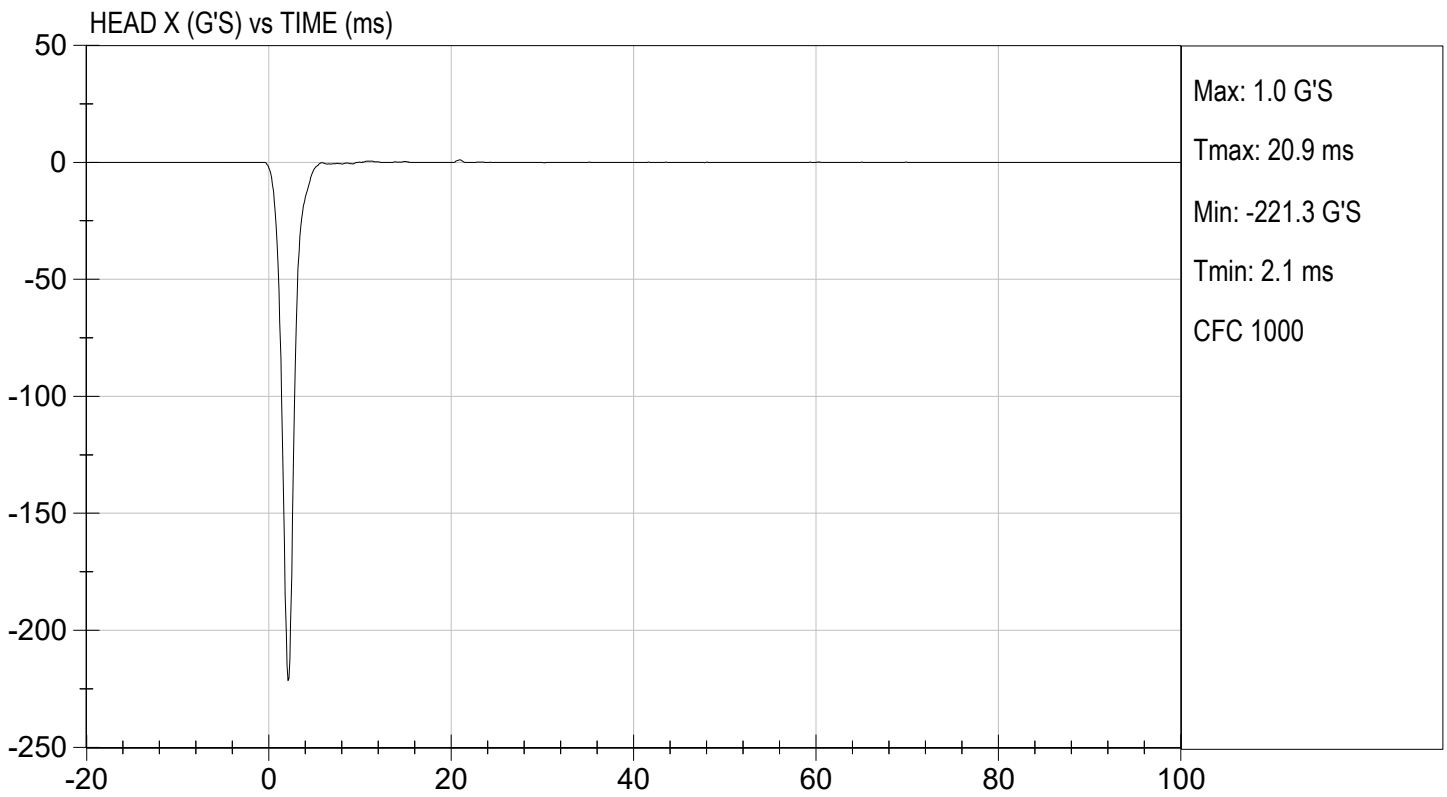
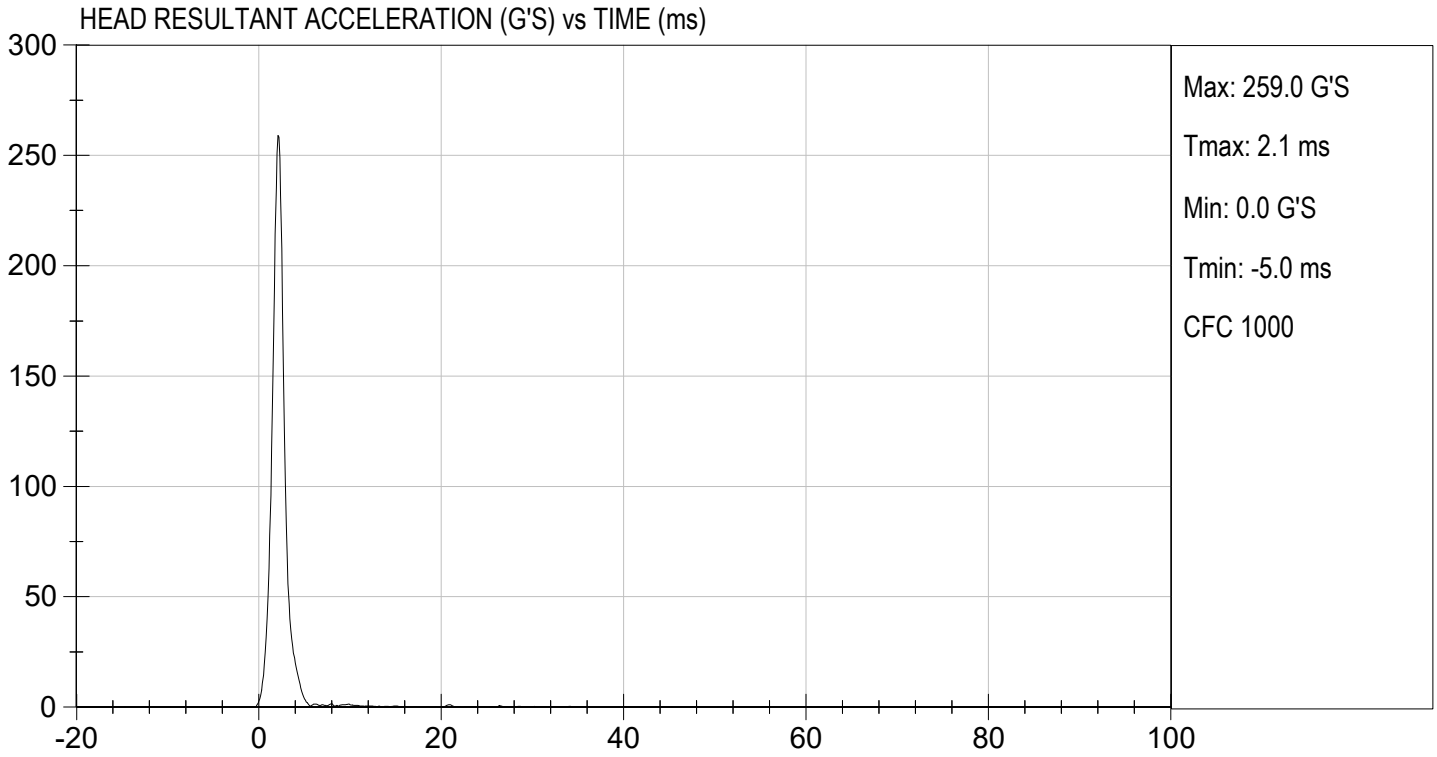
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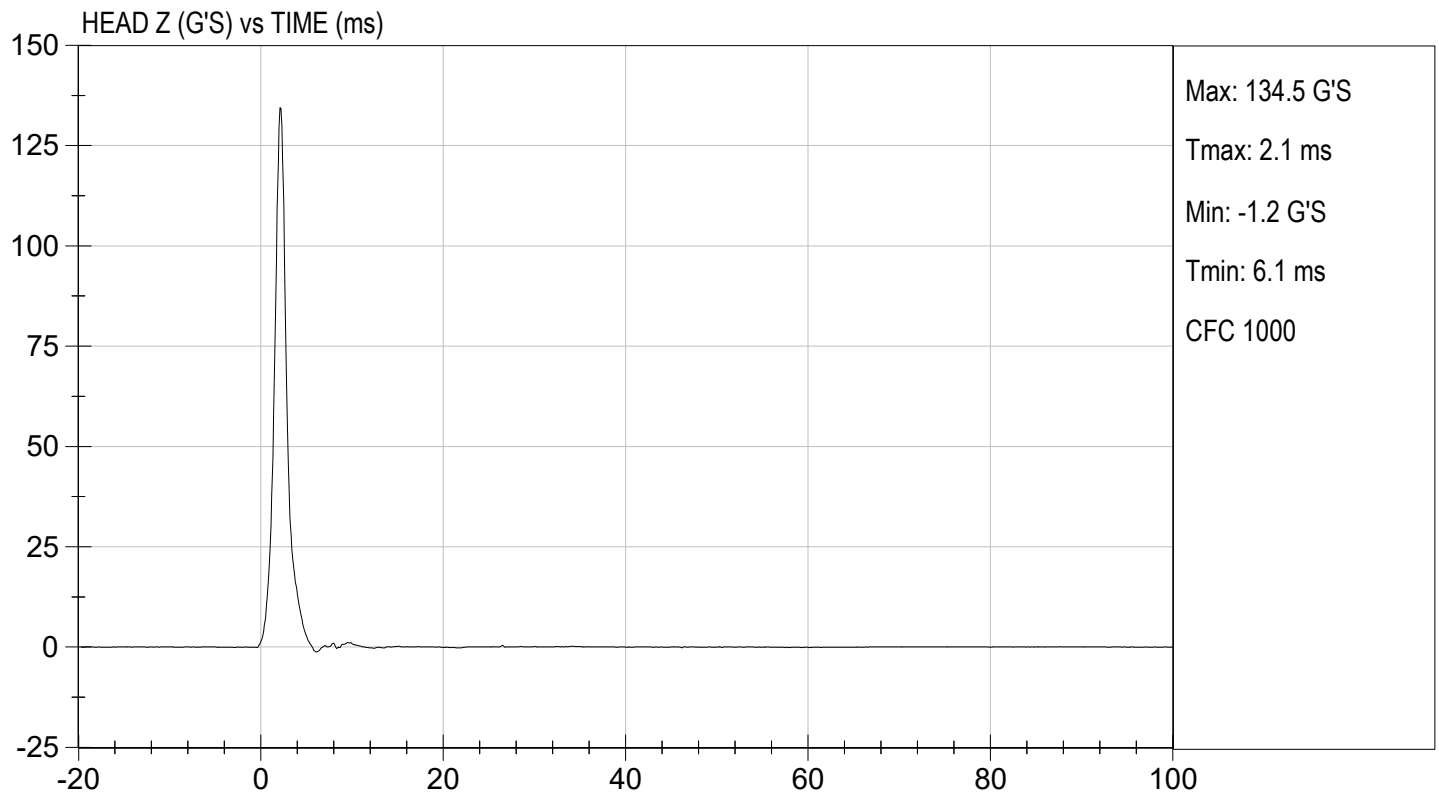
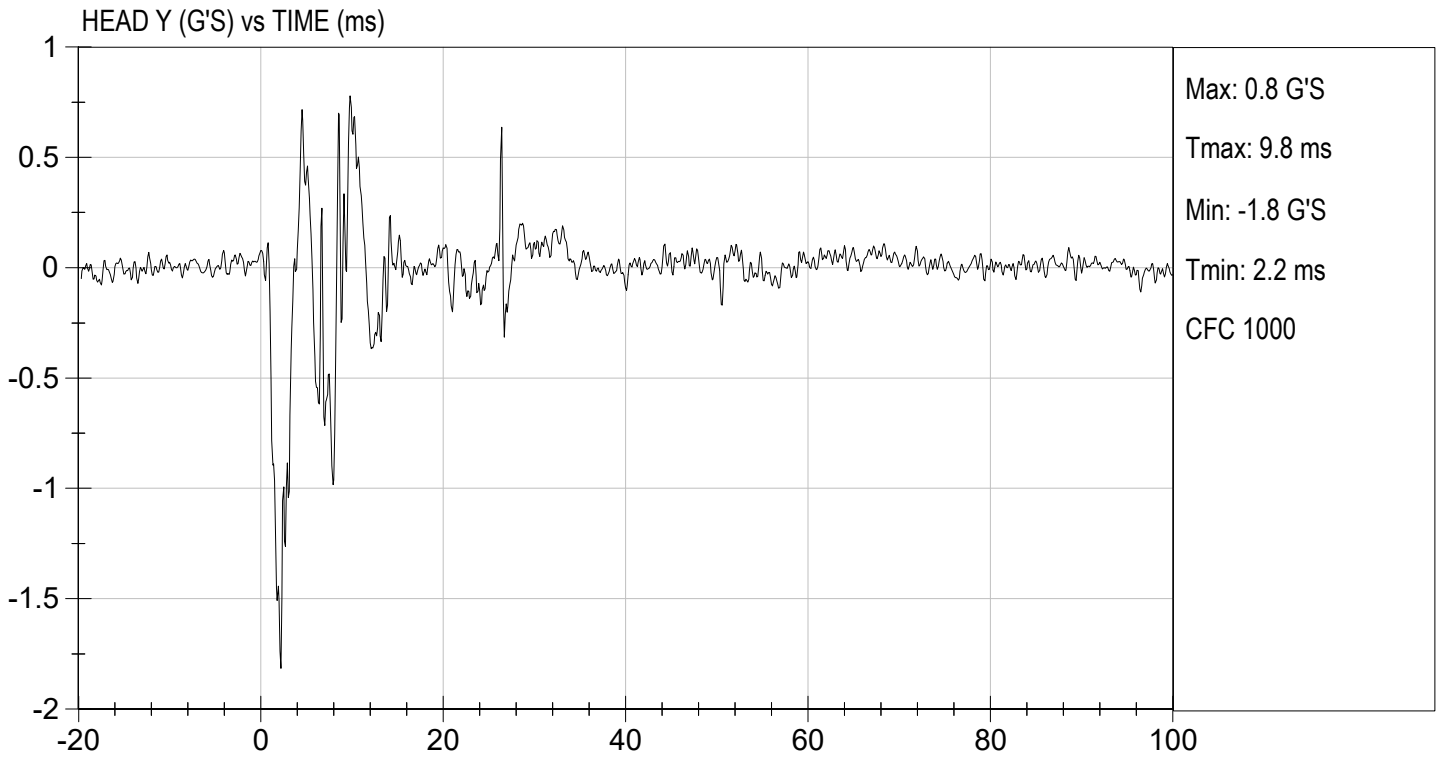
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	22	Pass
Peak Resultant Acceleration	G's	250 to 300	259	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-1.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

  
 Laboratory Technician

03/21/2023  
 Test Date

  
 Approved By





**DATA SHEET B4**  
NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/21/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last flexion test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.7°C</u> |
| Record the minimum temperature: | <u>21.4°C</u> |
| Record the maximum humidity:    | <u>20%</u>    |
| Record the minimum humidity:    | <u>13%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J2111/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.5 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.7 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.7 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	69 Nm @ 84 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	85 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

03/21/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

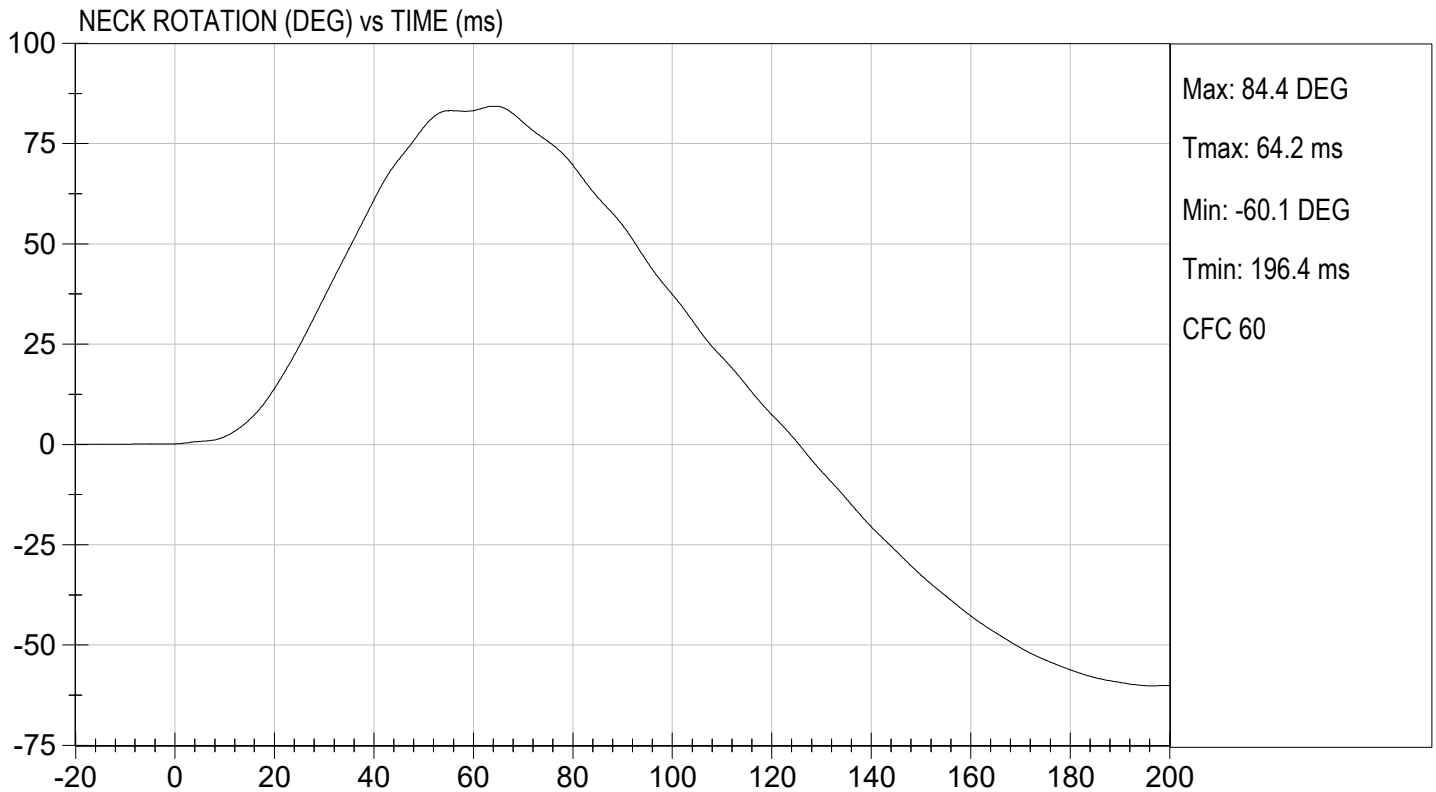
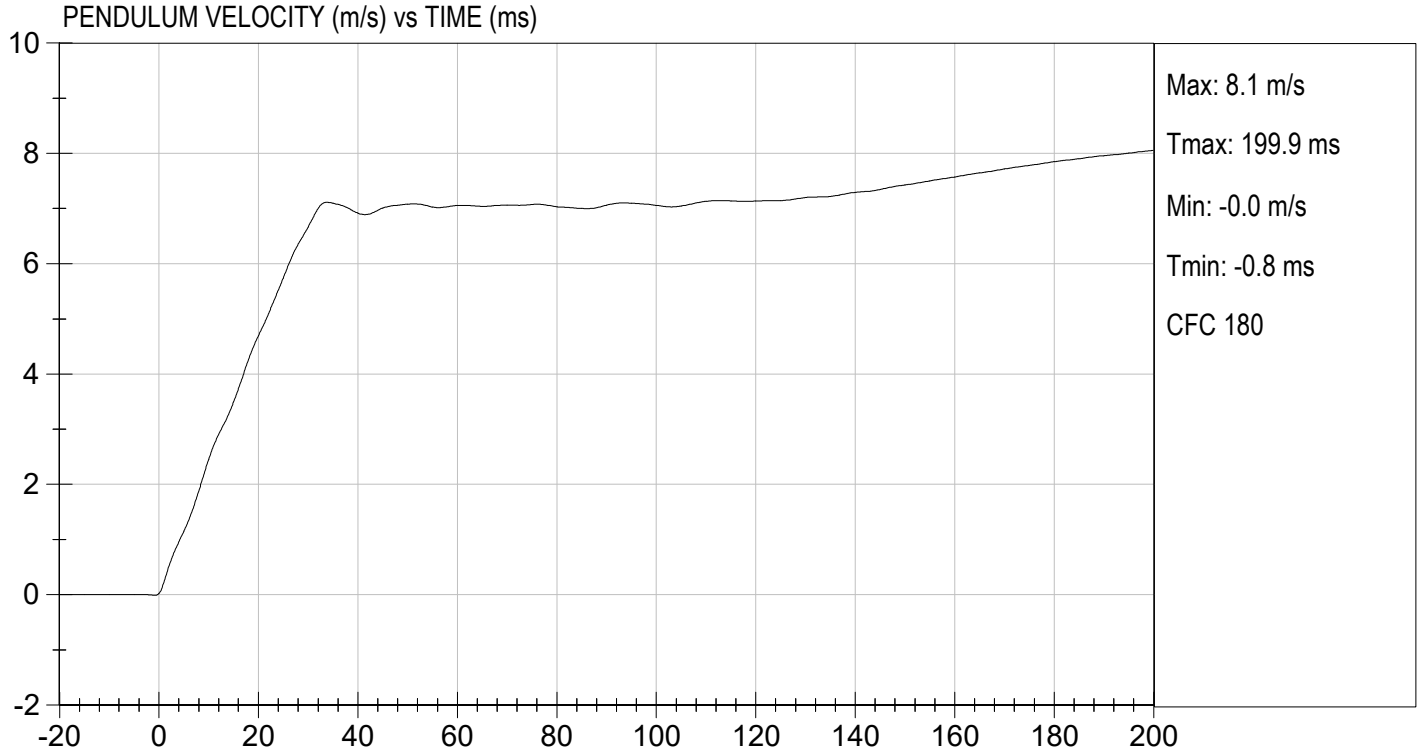
Test I.D: D230722

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	20	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.5	Pass
	20 ms	m/s	4.0 to 5.0	4.7	Pass
	30 ms	m/s	5.8 to 7.0	6.7	Pass
D Plane Rotation	Max	deg	77 to 91	84	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	69	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	85	Pass
Overall Results					Pass

  
 \_\_\_\_\_  
 Laboratory Technician

03/21/2023  
 \_\_\_\_\_  
 Test Date

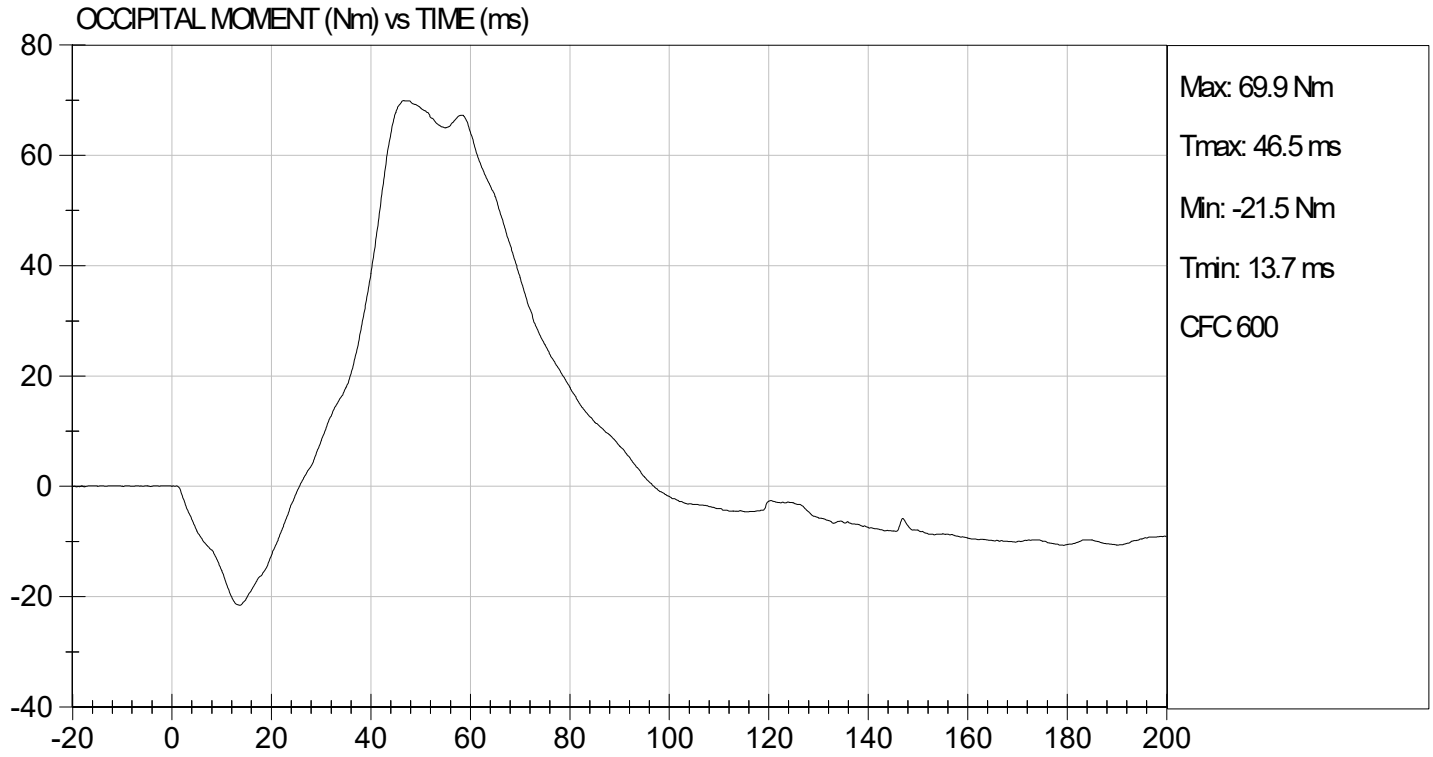
  
 \_\_\_\_\_  
 Approved By





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

TEST DATE: 03/21/2023  
TEST #: D230722



**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/21/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.7°C</u> |
| Record the minimum temperature: | <u>21.4°C</u> |
| Record the maximum humidity:    | <u>28%</u>    |
| Record the minimum humidity:    | <u>21%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

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

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

Parameter		Specification	Results
Pendulum impact speed		$5.95 \text{ m/s} \leq \text{speed} \leq 6.19 \text{ m/s}$	6.12 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.5 \text{ m/s} \leq \Delta V \leq 1.9 \text{ m/s}$	1.7 m/s
	@ 20 ms	$3.1 \text{ m/s} \leq \Delta V \leq 3.9 \text{ m/s}$	3.5 m/s
	@ 30 ms	$4.6 \text{ m/s} \leq \Delta V \leq 5.6 \text{ m/s}$	5.0 m/s
Plane D Rotation		Peak moment* $-65 \text{ Nm} \leq \text{moment} \leq -53 \text{ Nm}$ during the following rotation range $99^\circ \leq \text{angle} \leq 114^\circ$	-57 Nm @ 113 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm $94 \text{ ms} \leq \text{time} \leq 114 \text{ ms}$	103 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
 Signature

03/21/2023  
 Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

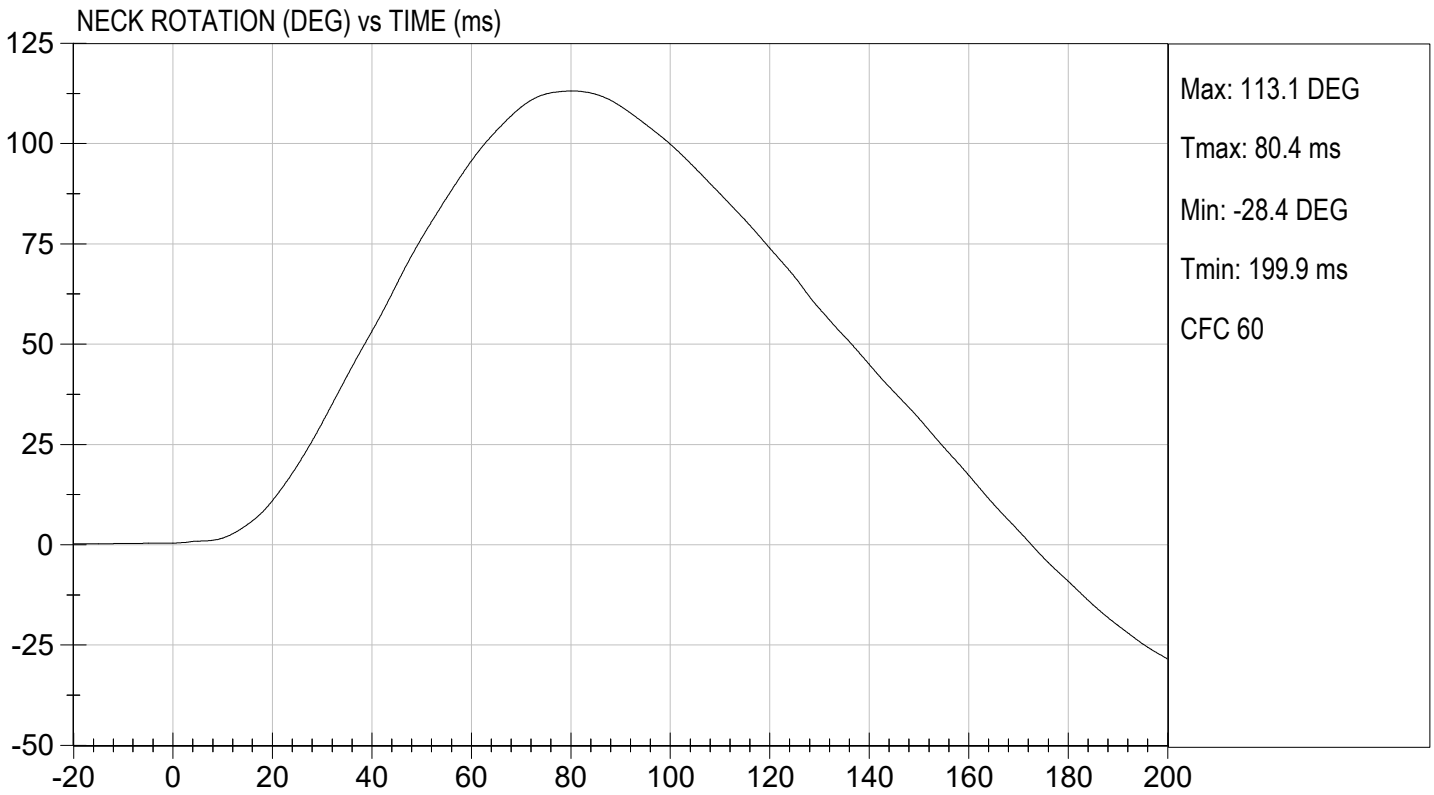
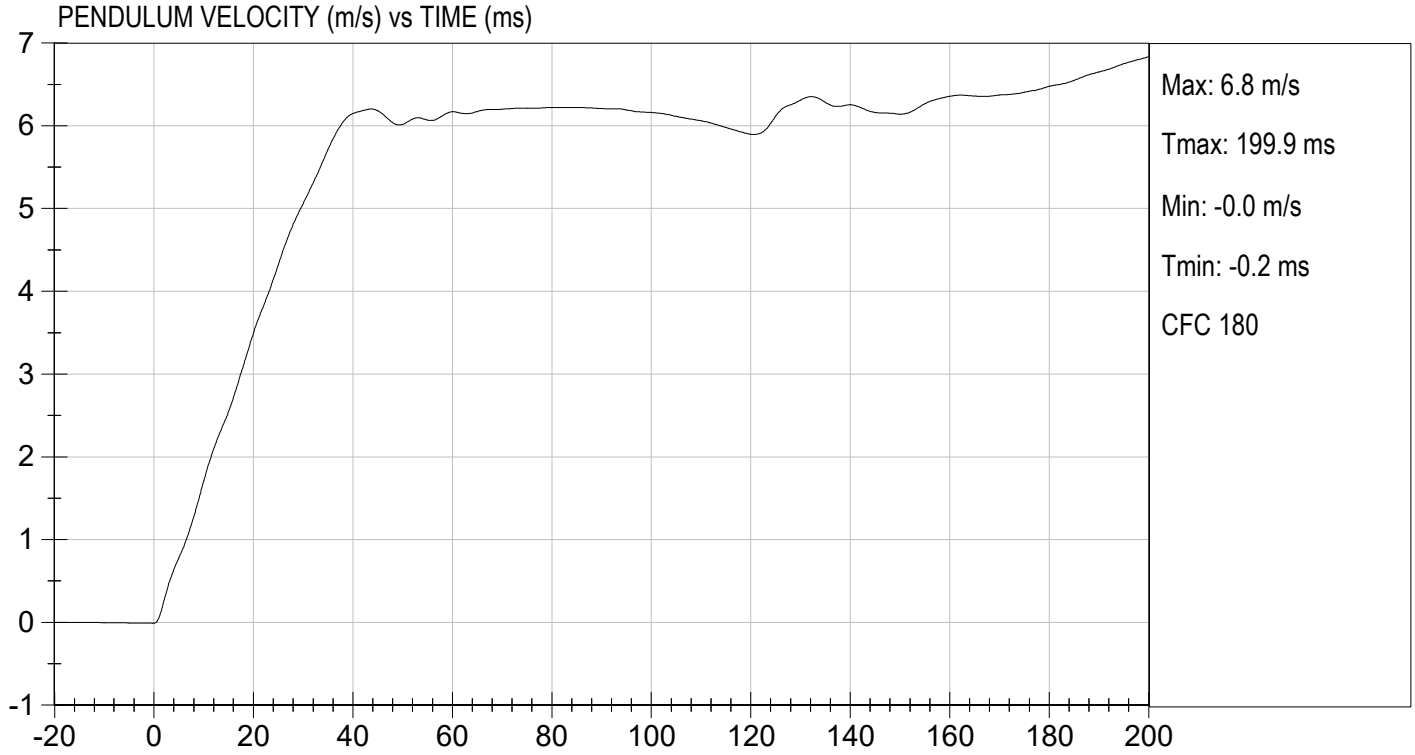
Test I.D.: D230723

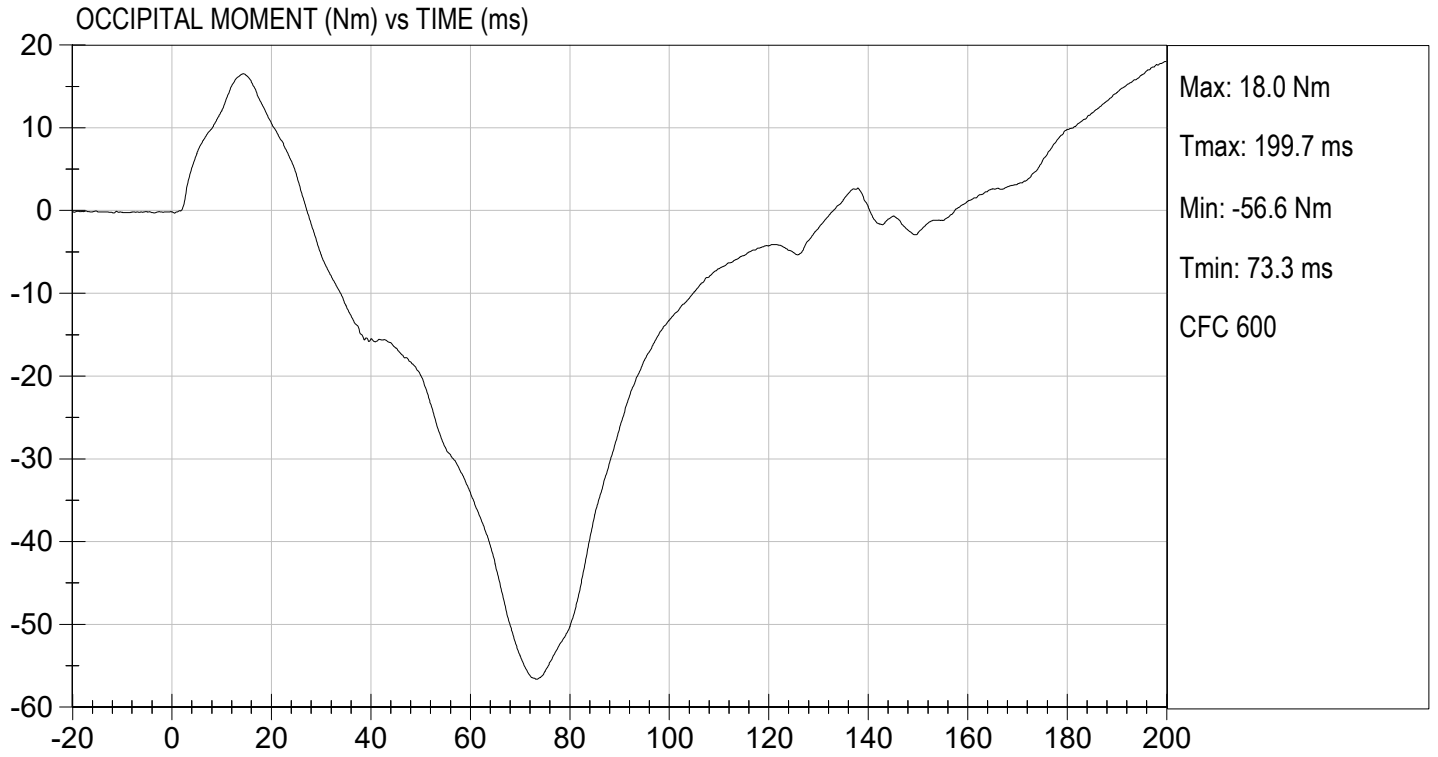
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.7	Pass
Laboratory Relative Humidity		%	10 to 70	22	Pass
Pendulum Speed		m/s	5.95 to 6.19	6.12	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.7	Pass
	20 ms	m/s	3.1 to 3.9	3.5	Pass
	30 ms	m/s	4.6 to 5.6	5	Pass
D Plane Rotation	Max	deg	99 to 114	113	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-57	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	103	Pass
Overall Results					Pass

  
 Laboratory Technician

03/21/2023  
 Test Date

  
 Approved By





**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.7°C</u>
Record the minimum temperature:	<u>21.4°C</u>
Record the maximum humidity:	<u>19%</u>
Record the minimum humidity:	<u>12%</u>

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

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

- The following repairs or replacement was performed. Record:

---

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

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	51 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4228 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4347 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	74%

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

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

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

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

  
 Signature

03/20/2023  
 Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

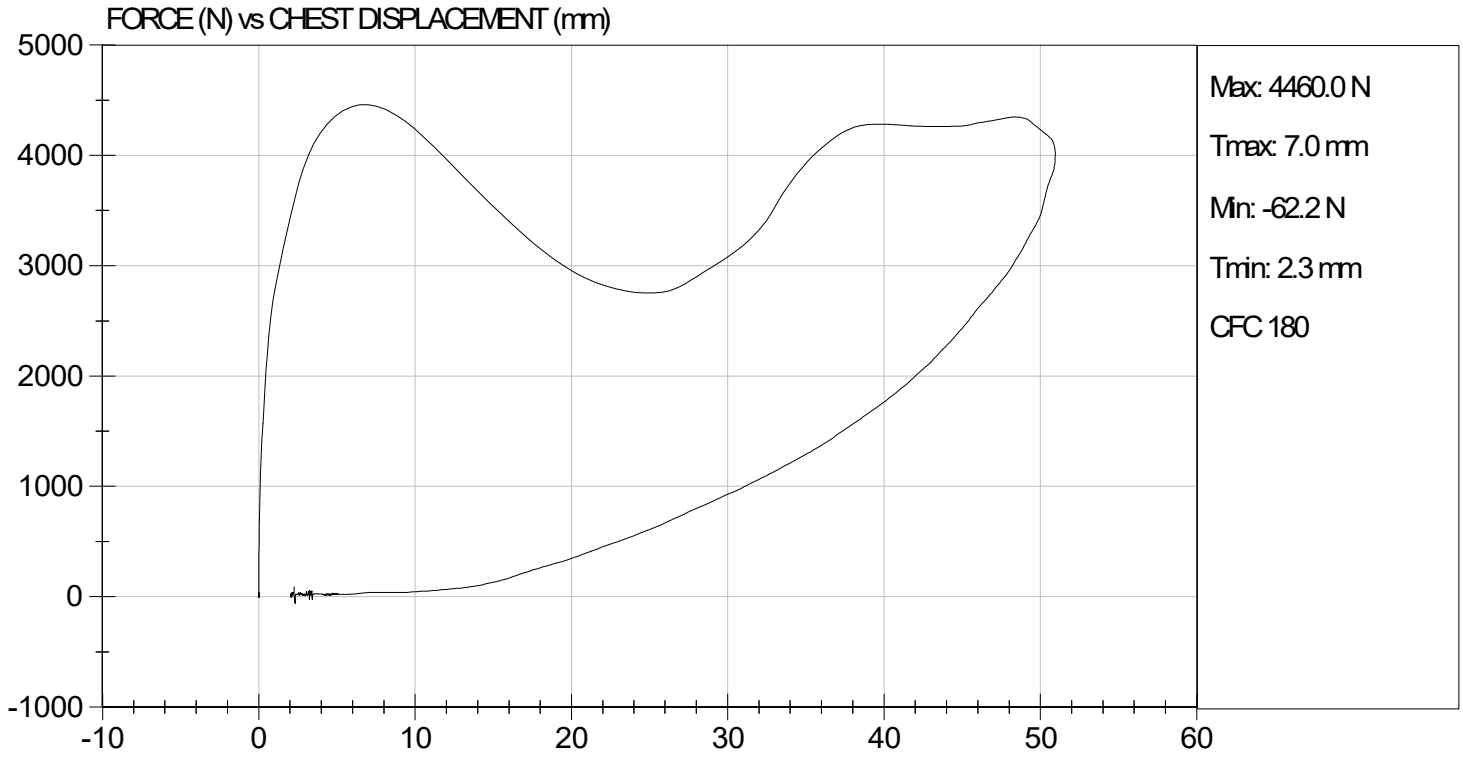
Test I.D: D230724

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	19	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4228	Pass
Internal Hysteresis	%	69 to 85	74	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4347	Pass
Overall Test Results				Pass

  
 Laboratory Technician

03/20/2023  
 Test Date

  
 Approved By



**DATA SHEET B7**  
TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/21/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 With legs below femurs.  
 Without legs below femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.8°C</u> |
| Record the minimum temperature: | <u>21.5°C</u> |
| Record the maximum humidity:    | <u>20%</u>    |
| Record the minimum humidity:    | <u>13%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	17 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.8 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	352 N
Final ref. plane angle	Initial ref. plane angle ± 8°	5 deg

*Jonah Pulokas*   
Signature

03/21/2023   
Date

**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

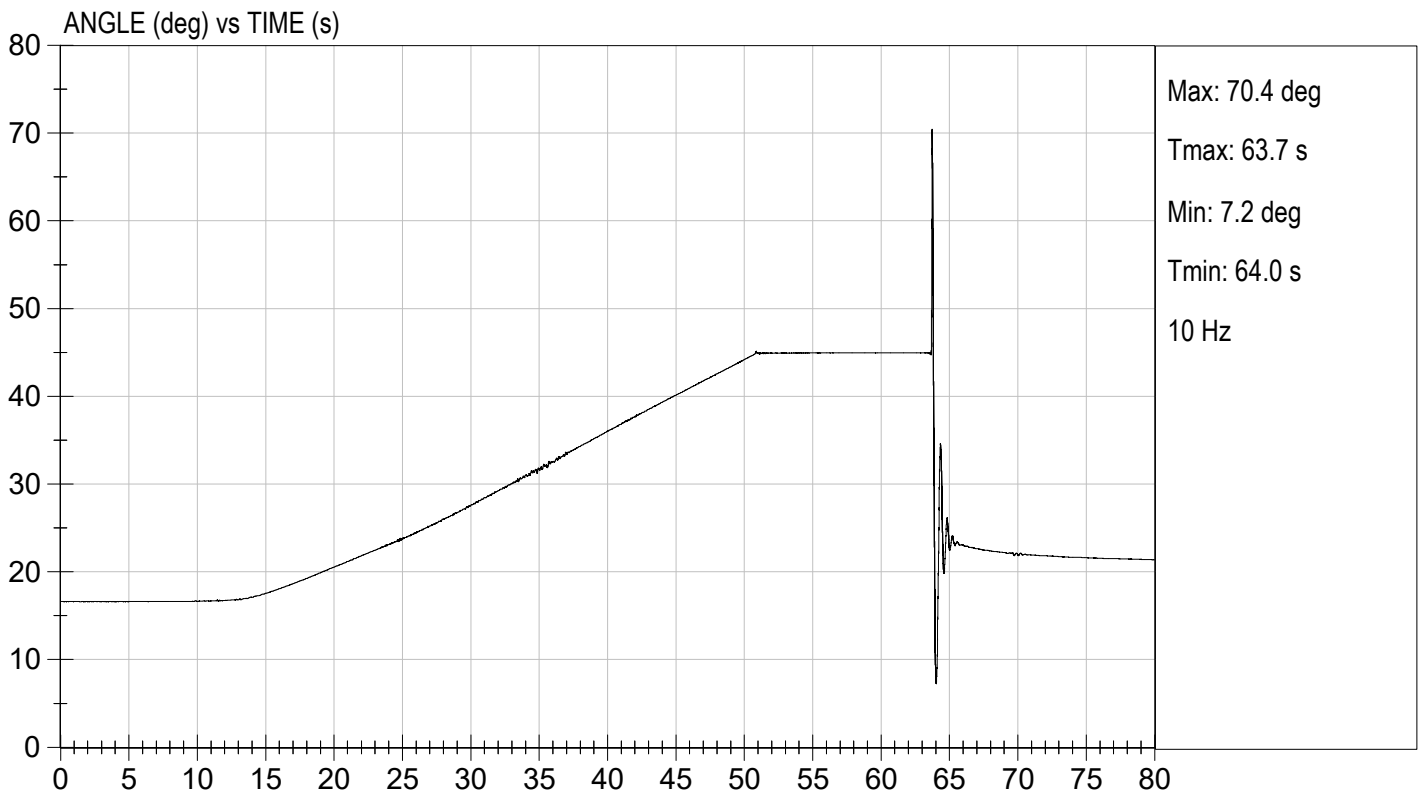
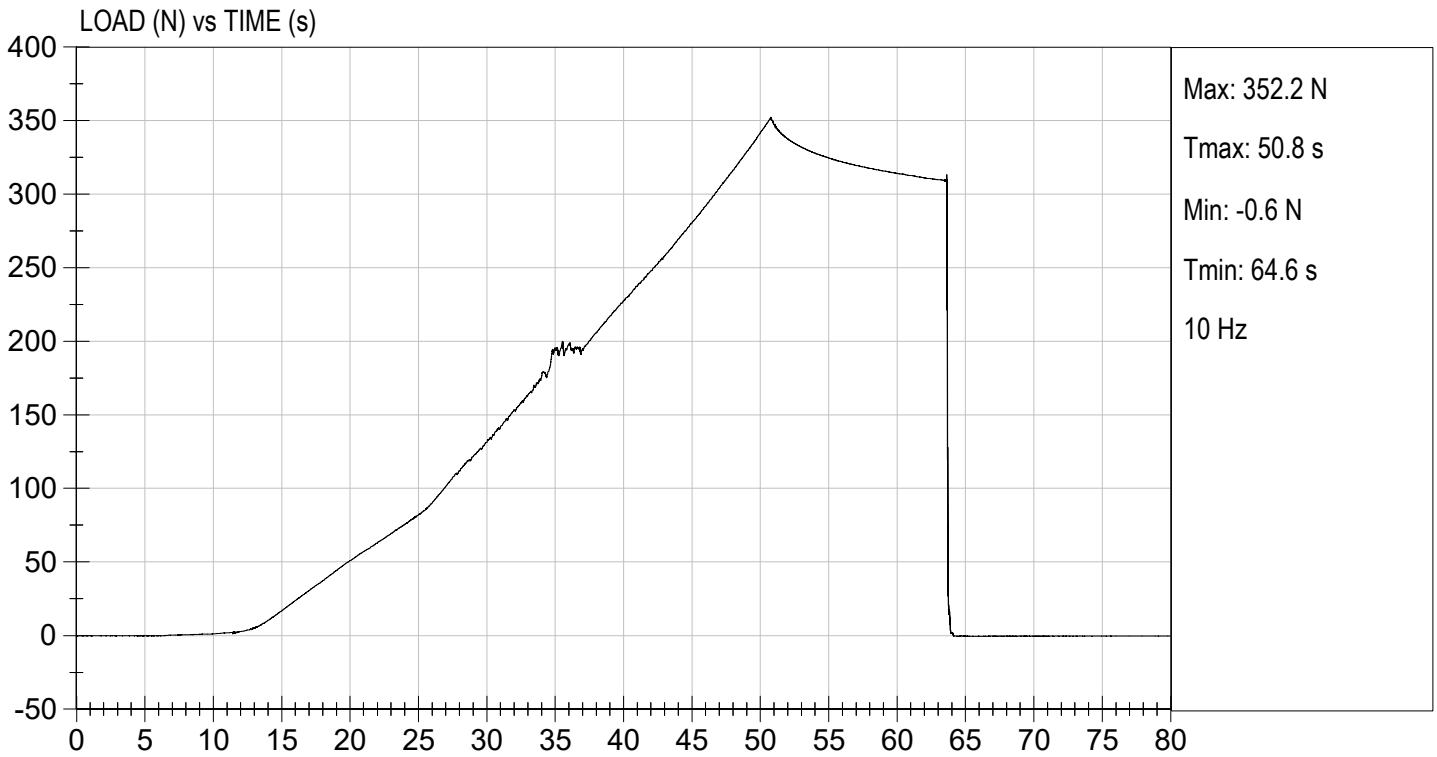
Test I.D: D230727

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.8	Pass
Laboratory Relative Humidity	%	10 to 70	20	Pass
Initial Angle	deg	0 to 20	17	Pass
Return Angle	deg	+/- 8	5	Pass
Force at 45 deg	N	320 to 390	352	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
<b>Overall Result</b>				<b>Pass</b>

  
 Laboratory Technician

03/21/2023  
 Test Date

  
 Approved By



**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last knee impact test. (572.137(q))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 14B.
3. The knee assembly (880105-528L), lower leg structural replacement (880105-603), lower leg flesh (880105-601), ankle assembly (880105-660), foot assembly (880105-650), and femur load transducer (SA572-S14) (may use the load cell structural replacement (78051-319)) were used. (572.136(b)(1))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.136(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.7°C</u> |
| Record the minimum temperature: | <u>21.4°C</u> |
| Record the maximum humidity:    | <u>19%</u>    |
| Record the minimum humidity:    | <u>12%</u>    |
5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3923 N

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

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

  
\_\_\_\_\_  
Signature

03/20/2023  
Date

**MGA RESEARCH CORPORATION**

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


**ATD Serial No:** 510

**Test I.D.:** D230726

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3923	Pass
Overall Test Results				Pass

  
\_\_\_\_\_  
Laboratory Technician

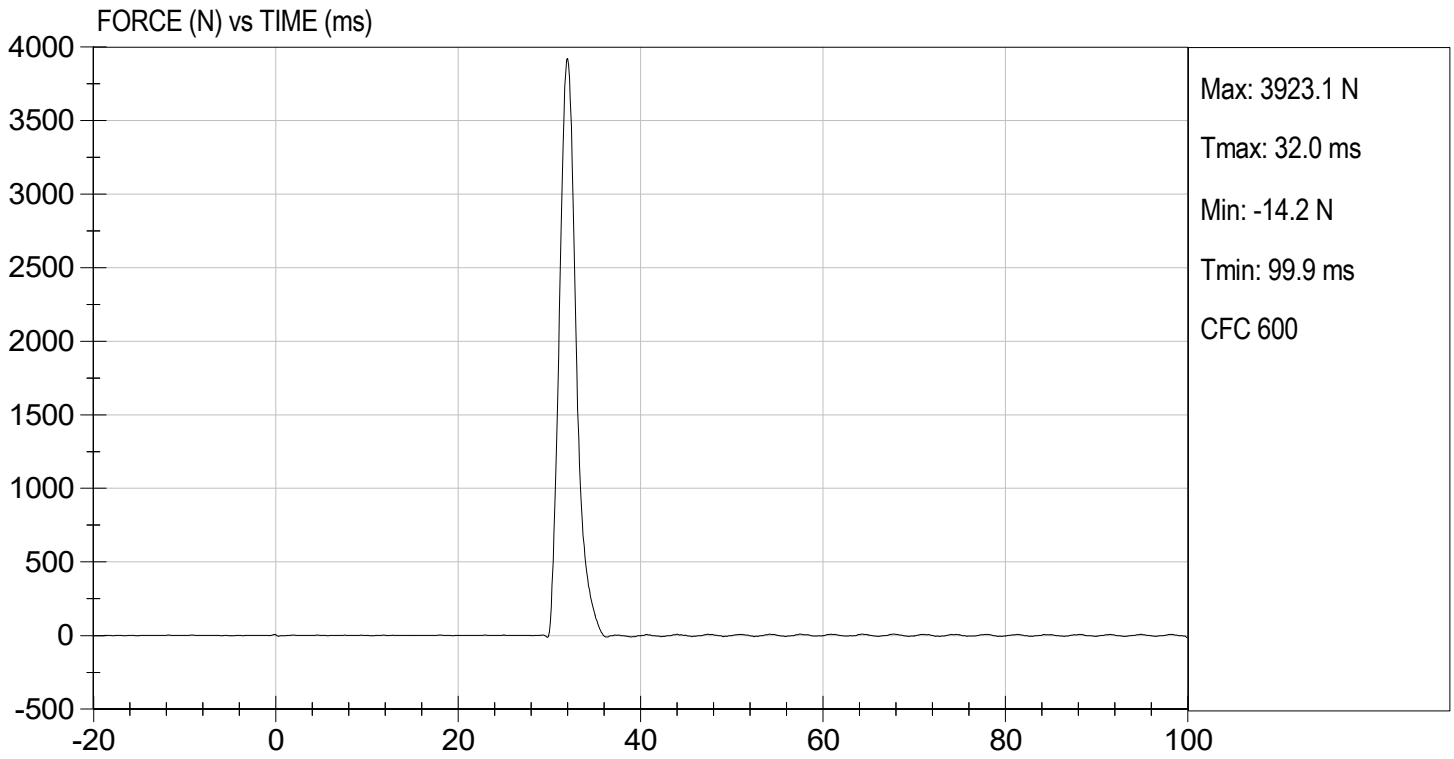
03/20/2023  
\_\_\_\_\_  
Test Date

  
\_\_\_\_\_  
Approved By



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

TEST DATE: 03/20/2023  
TEST #: D230726



**DATA SHEET B9**  
RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 03/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.7°C</u>
Record the minimum temperature:	<u>21.4°C</u>
Record the maximum humidity:	<u>19%</u>
Record the minimum humidity:	<u>12%</u>

5. Mount the test specimen and secure it to the rigid test fixture. (572.136(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.136(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.136(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s. (572.136(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.136(c)(6))

X 11. Complete the following table:

Knee Impact Results (572.136(b)(1) and 572.136(c)(5))		
Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.12 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3849 N

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

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

  
Signature

03/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D230725

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.7	Pass
Laboratory Relative Humidity	%	10 to 70	19	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3849	Pass
Overall Test Results				Pass

  
 \_\_\_\_\_  
 Laboratory Technician

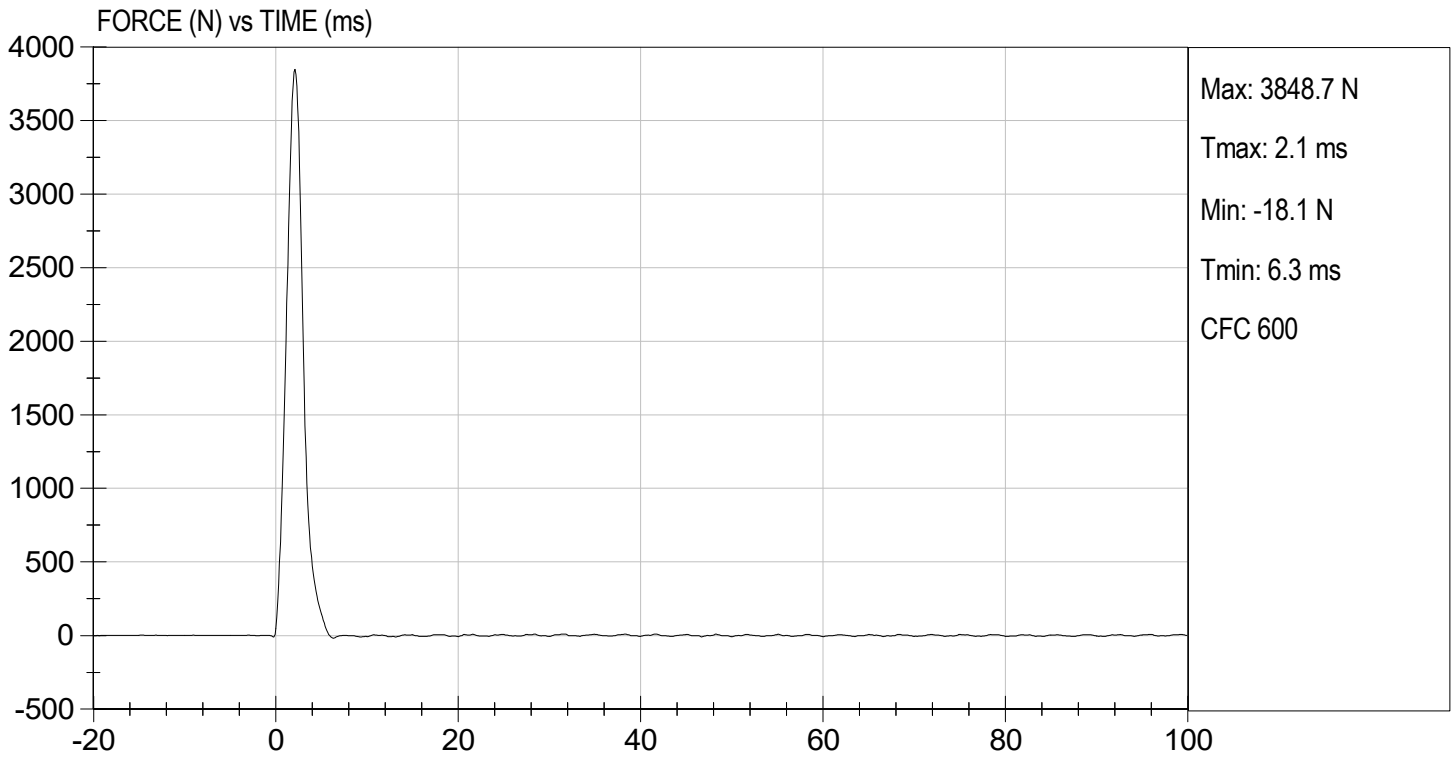
03/20/2023  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By



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

TEST DATE: 03/20/2023  
TEST #: D230725



**DATA SHEET B10**  
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79575	06/05/2023	12/05/2023
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79577	06/05/2023	12/05/2023
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79578	06/05/2023	12/05/2023
NECK TRANSDUCER	Denton	1716A	N2039	04/05/2023	10/05/2023
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P88334	06/05/2023	12/05/2023
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P88335	06/05/2023	12/05/2023
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P93609	06/05/2023	12/05/2023
CHEST POTENTIOMETER	Humanetics	880105-1080	510	06/05/2023	12/05/2023
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	Denton	2121AJFL	F1826	06/05/2023	12/05/2023
(2) LEFT FEMUR	Denton	2121AJFL	F1827	06/05/2023	12/05/2023
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	01/13/2023	07/15/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	11/30/2022	06/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Servo	14CBI-2897	4707	02/10/2023	08/12/2023
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Servo	14CBI-2897	7297	02/10/2023	08/12/2023

LABORATORY TECHNICIAN: 

**DATA SHEET B3**  
HEAD DROP TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.132(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (880105-100X), the six-axis neck transducer (SA572-S11) or neck transducer structural replacement (78051-383X), and three (3) accelerometers (SA572-S4). (572.132(a))
3. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. Torque the skull cap screws (10-24 x 1/2 SHCS) to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.136(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.132(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.2°C</u> |
| Record the minimum temperature: | <u>19.9°C</u> |
| Record the maximum humidity:    | <u>41%</u>    |
| Record the minimum humidity:    | <u>31%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage

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

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

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

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

X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.132(c)(4))  
Record actual micro finish: 24.8 micro inches

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

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

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 300 \text{ g}$	272 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	2.8 g

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

Jonah Pulokas  
Signature

06/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

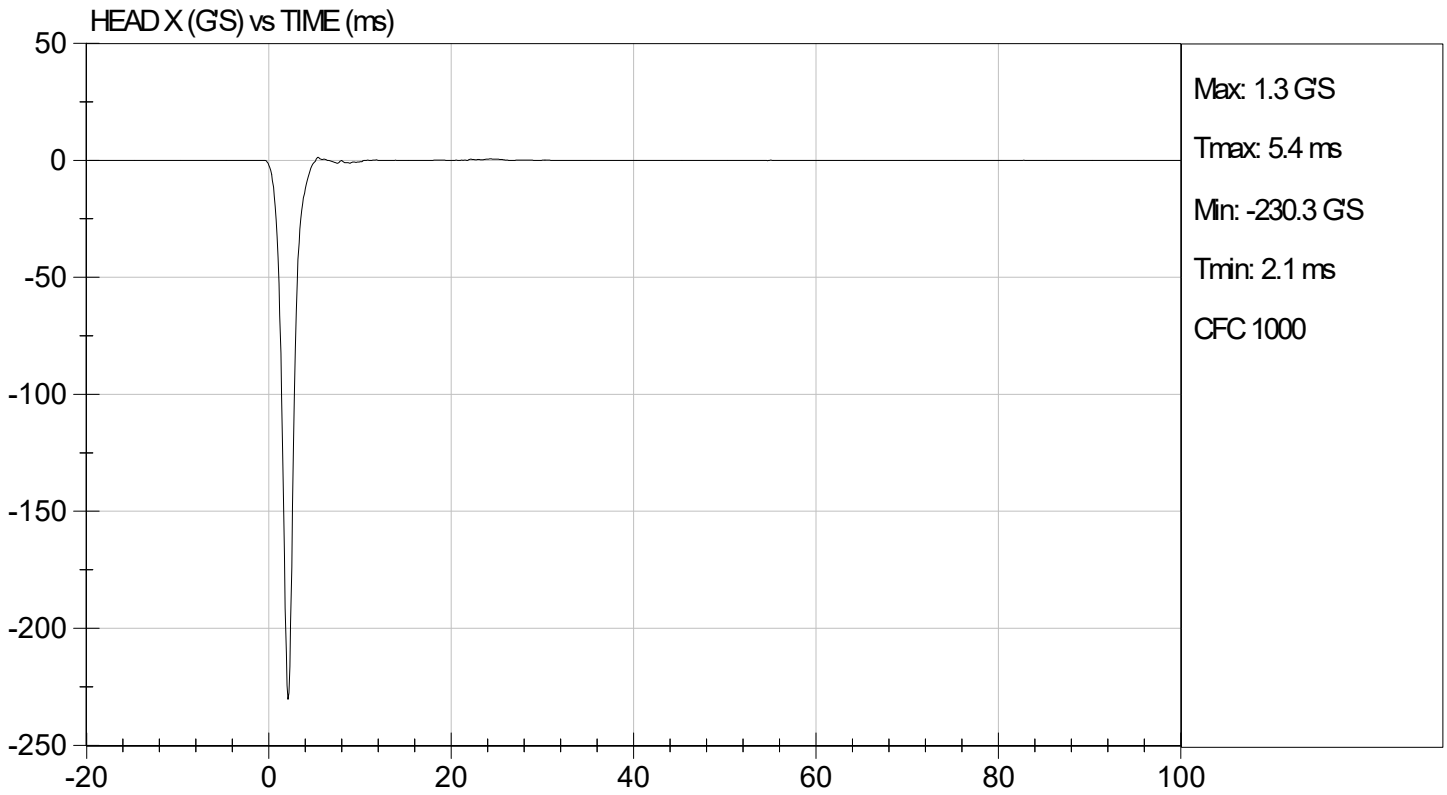
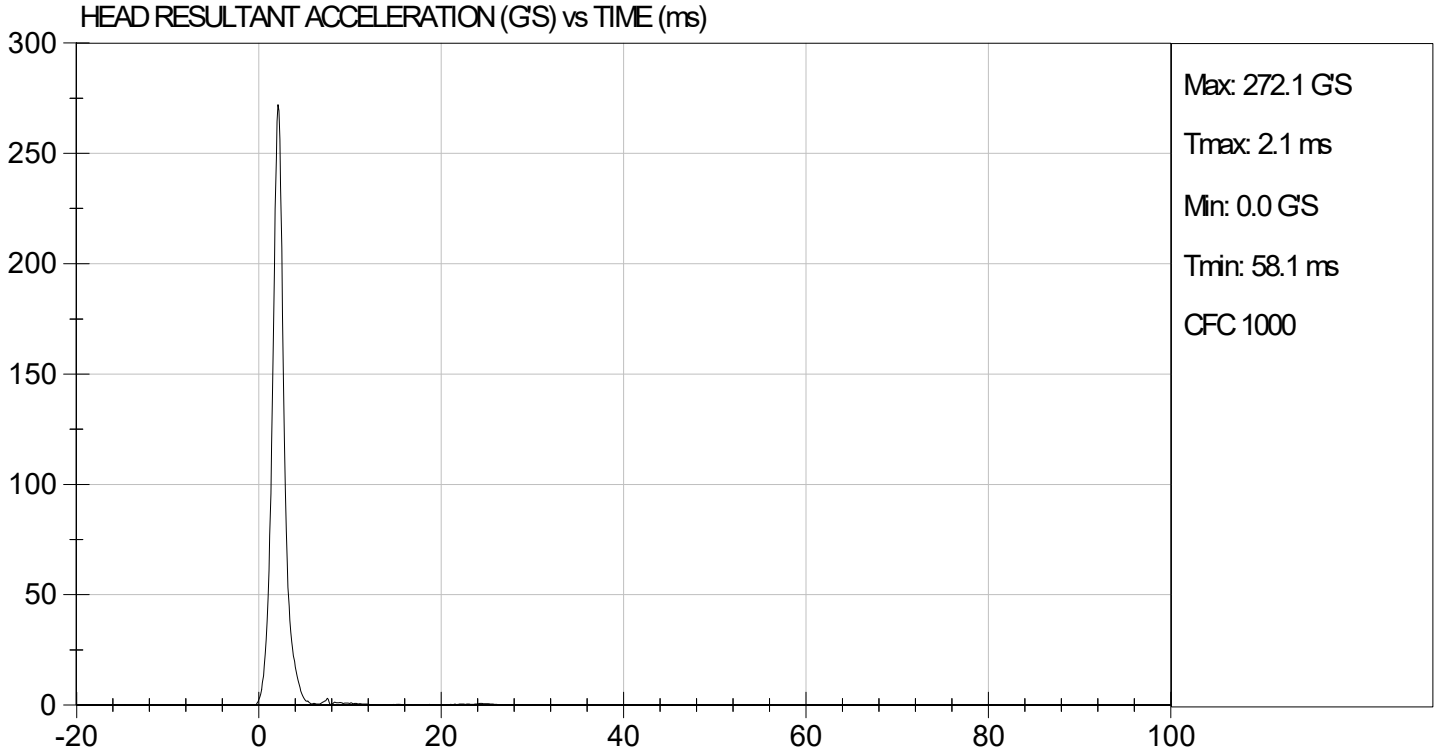
Test ID: D231591

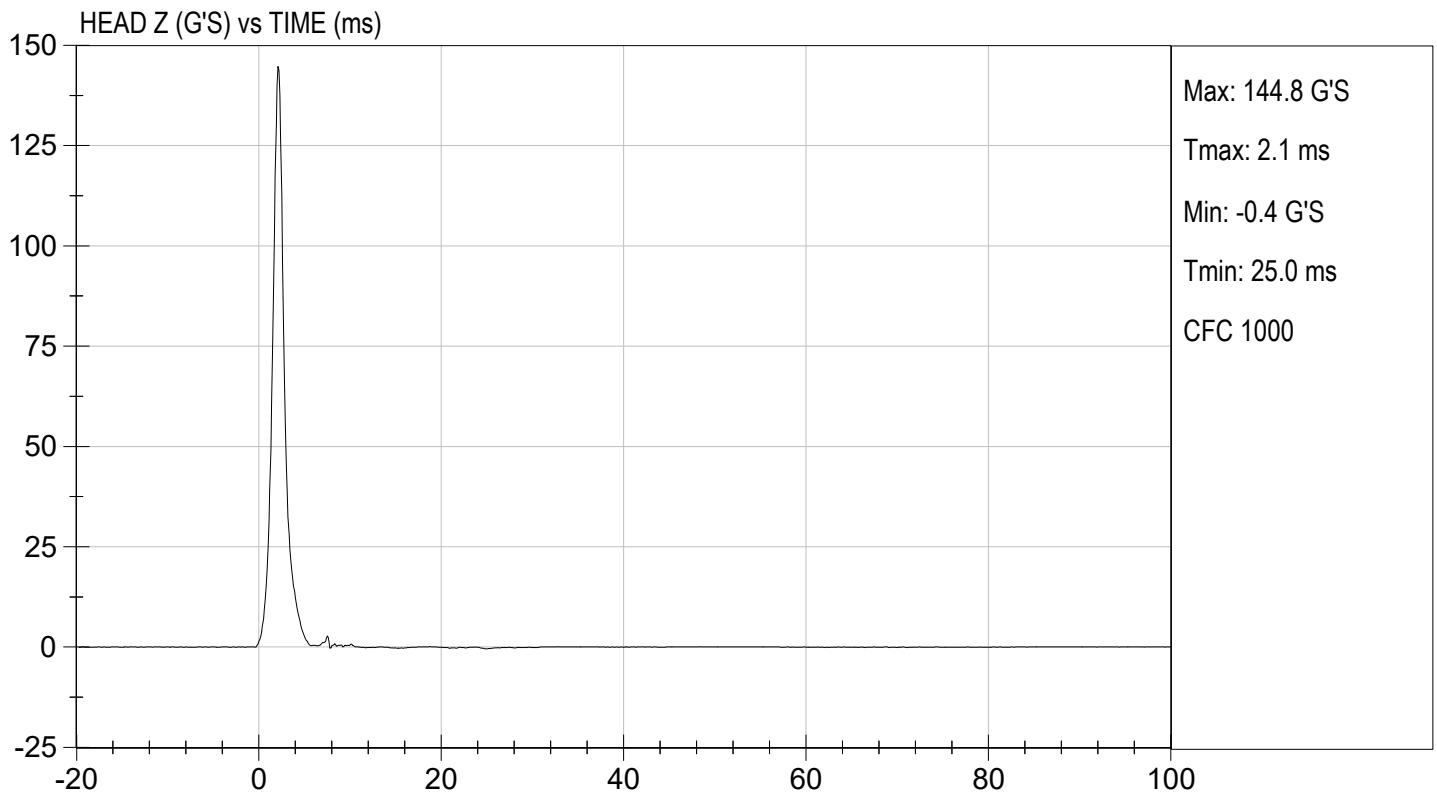
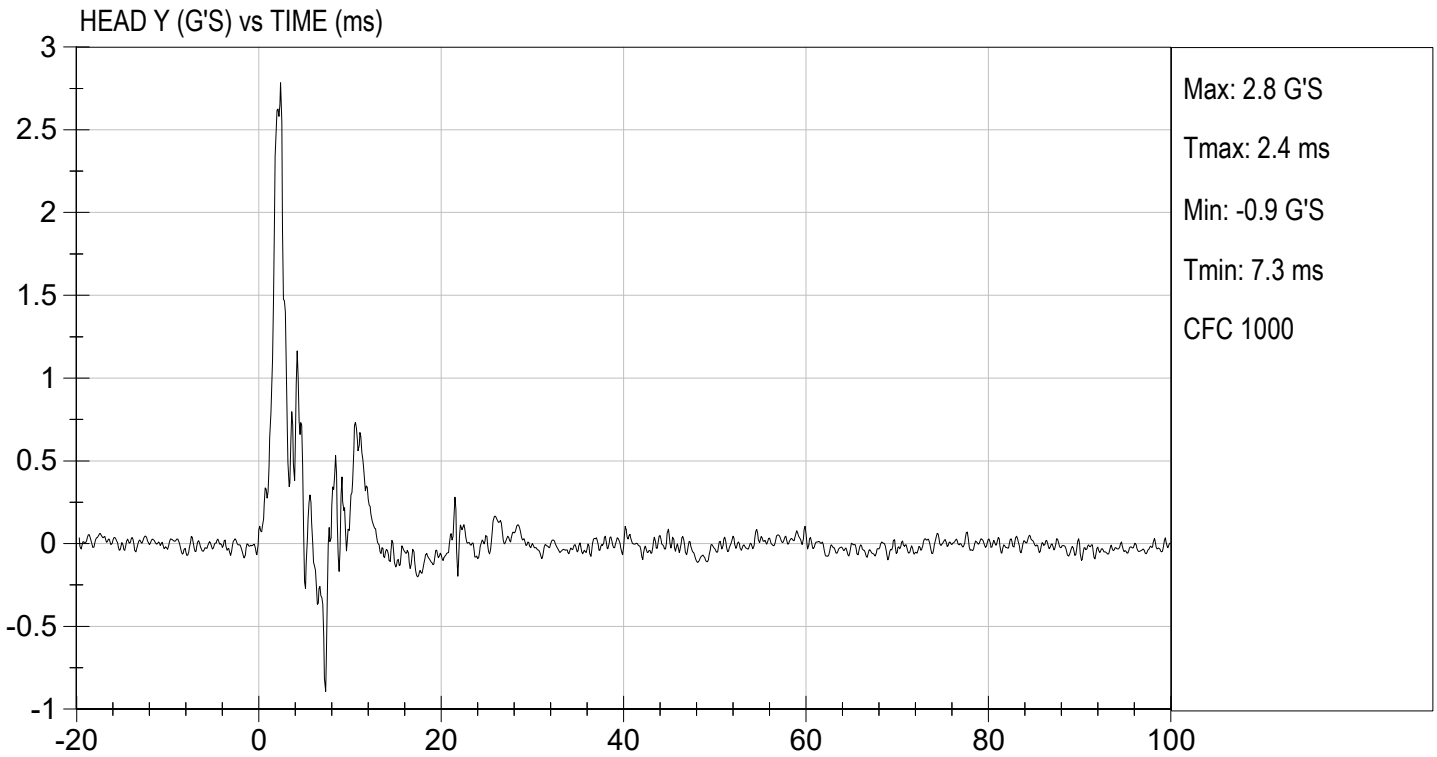
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Peak Resultant Acceleration	G's	250 to 300	272	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	2.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
			Overall Test Results	Pass

  
 Laboratory Technician

06/20/2023  
 Test Date

  
 Approved By





**DATA SHEET B4**  
NECK FLEXION TEST (572.132) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/20/2023

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. (572.137(q))  
         X   N/A, ONLY one neck test performed
- X   2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
- X   3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |                           |
|---------------------------------|---------------------------|
| Record the maximum temperature: | <u>      21.2°C      </u> |
| Record the minimum temperature: | <u>      19.9°C      </u> |
| Record the maximum humidity:    | <u>      41%      </u>    |
| Record the minimum humidity:    | <u>      31%      </u>    |
- X   4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions:       No damage
- X   5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions:       No Deterioration; Hardness: Front 89; Back 90.
- X   6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

- X 7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J2111/1 MAR95. (572.137(m))
- X 8. The test fixture pendulum conforms to the specifications in Figure 7B. (572.133(c)(3))
- X 9. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the head is vertical and coincides with the plane of motion of the pendulum longitudinal centerline as shown in Figure 8B for the flexion test. (572.133(c)(3))
- X 10. Install the transducers or other devices for measuring the "D" plane rotation with respect to the pendulum longitudinal centerline. Note: Plane "D" is the bottom horizontal surface of the skull. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly. An example of a measurement device is shown in Figure 10B.
- X 11. With the pendulum resting against the honeycomb material, the neck bracket was adjusted until the longitudinal centerline of the pendulum was perpendicular  $\pm 1$  degree to plane "D" on the dummy's head.
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 6.89 m/s to 7.13 m/s as measured at the center of the pendulum accelerometer. (572.133(c)(4)(i))
- X 13. Complete the following table:  
Neck Flexion Test Results (572.133(b)(1) & 572.133(c)(4)(I & ii))

Parameter		Specification	Results
Pendulum impact speed		6.89 m/s $\leq$ speed $\leq$ 7.13 m/s	7.06 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.1 m/s $\leq \Delta V \leq$ 2.5 m/s	2.4 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.0 m/s	4.6 m/s
	@ 30 ms	5.8 m/s $\leq \Delta V \leq$ 7.0 m/s	6.5 m/s
Plane D Rotation		Peak moment* 69 Nm $\leq$ moment $\leq$ 83 Nm during the following rotation range 77° $\leq$ angle $\leq$ 91°	71 Nm @ 83 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 80 ms $\leq$ time $\leq$ 100 ms	86 ms


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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

06/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

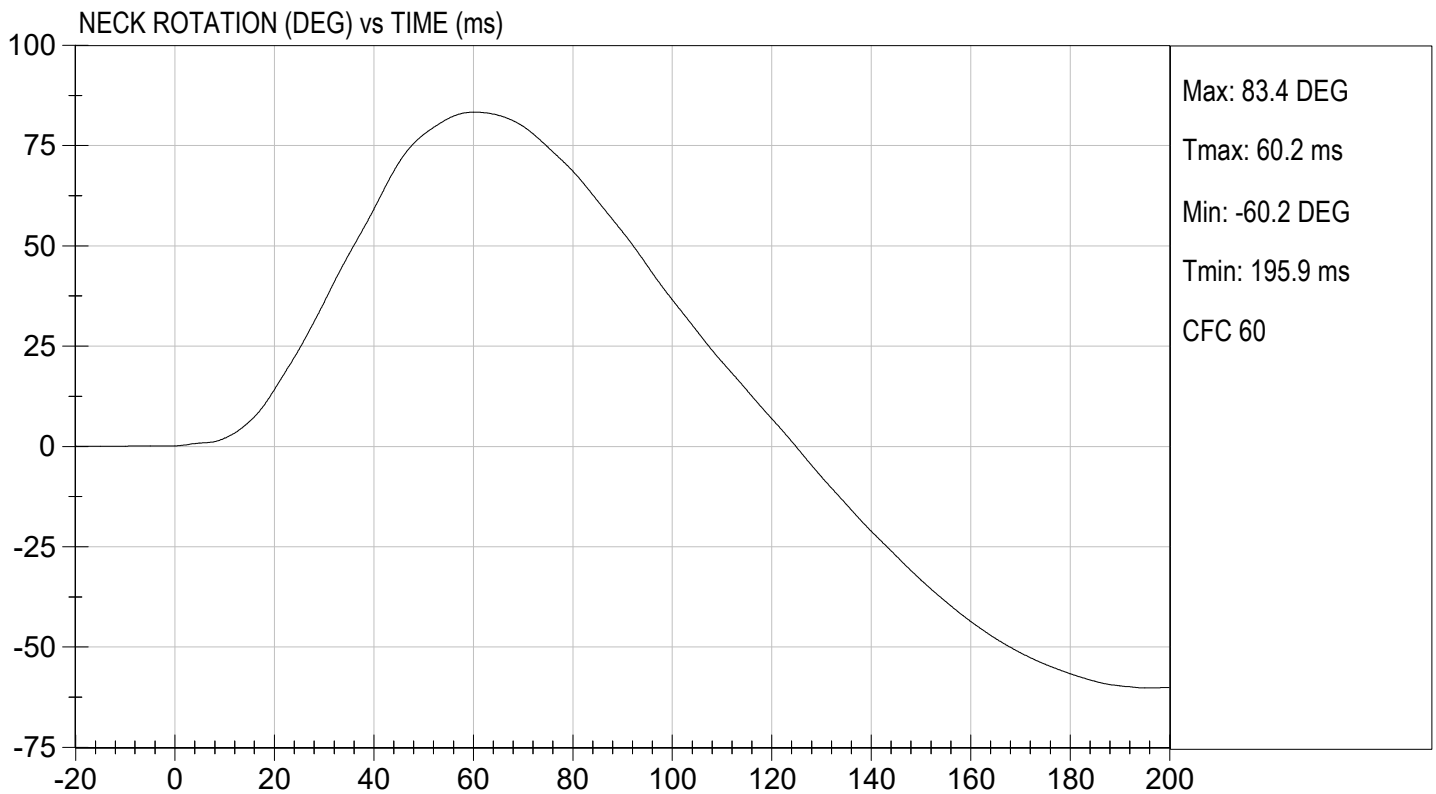
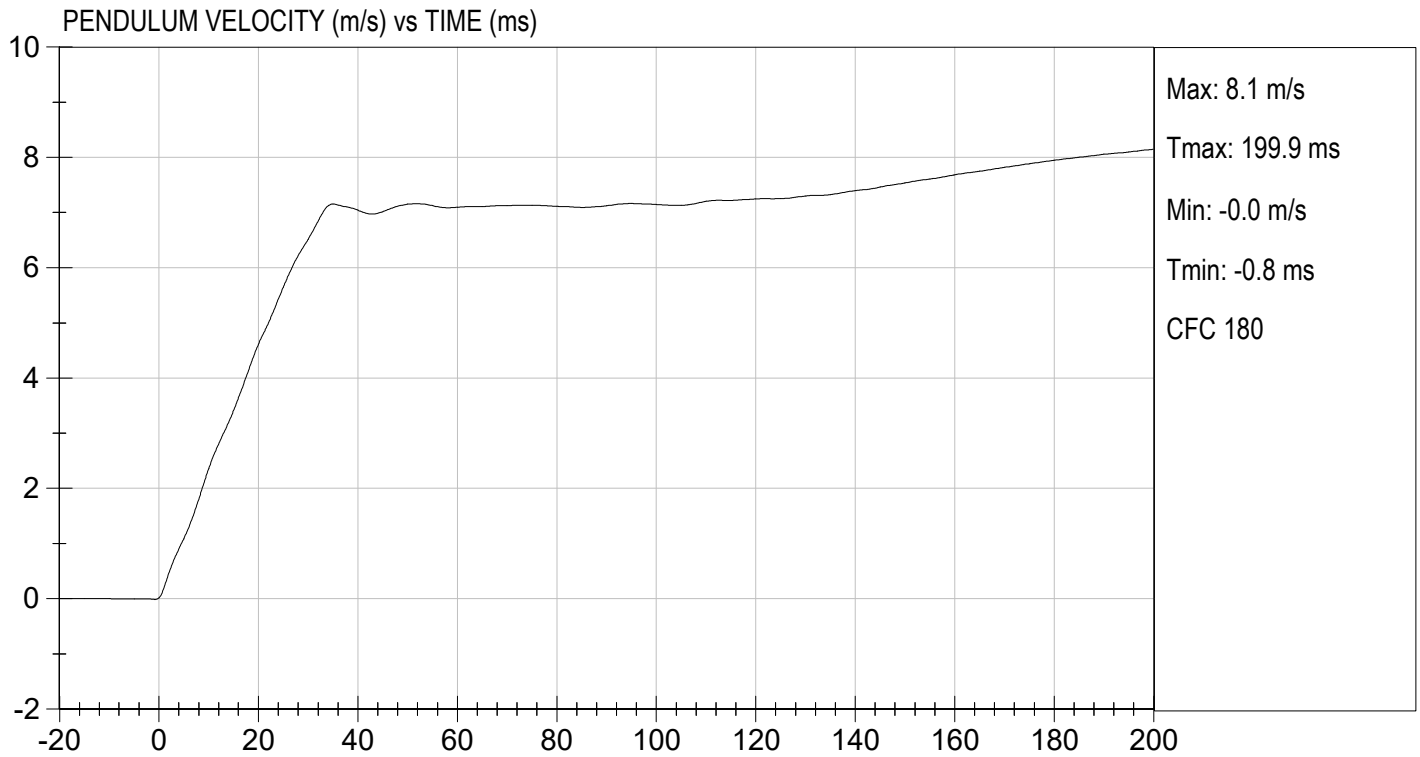
Test I.D: D231592

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	41	Pass
Pendulum Speed		m/s	6.89 to 7.13	7.06	Pass
Pendulum Velocity	10 ms	m/s	2.1 to 2.5	2.4	Pass
	20 ms	m/s	4.0 to 5.0	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.5	Pass
D Plane Rotation	Max	deg	77 to 91	83	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	71	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
Overall Results					Pass

  
 Laboratory Technician

06/20/2023  
 Test Date

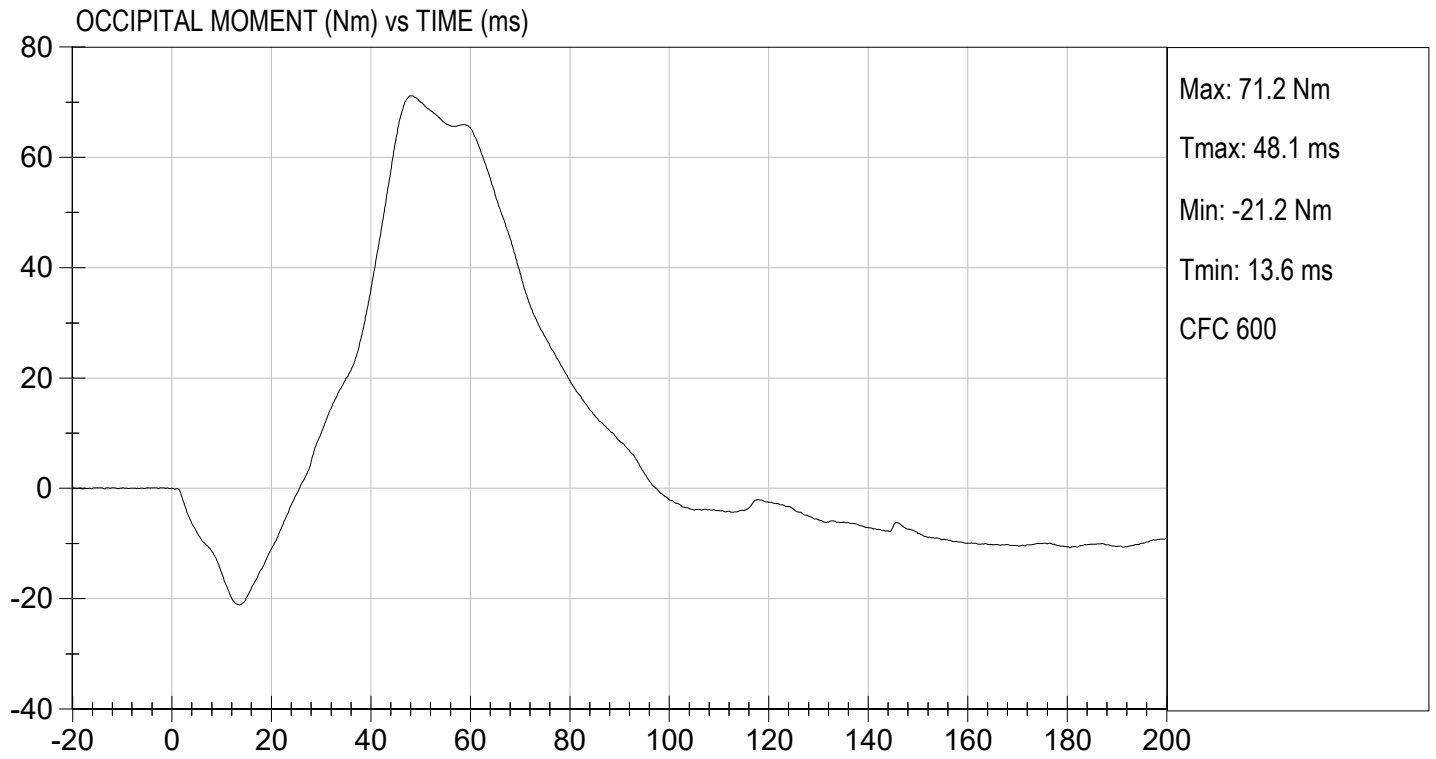
  
 Approved By





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

TEST DATE: 06/20/2023  
TEST #: D231592



**DATA SHEET B5**  
NECK EXTENSION TEST (572.133) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/21/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last extension test. (572.137(q))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (880105-100X), neck (880105-250), bib simulator (880105-371), upper neck adjusting bracket (880105-207), lower neck adjusting bracket (880105-208), six axis neck transducer (SA572-S11) and either three accelerometers (SA572-S4) or their mass equivalent installed in the head assembly as specified in drawing 880105-100X. Data from the accelerometers are not required. (572.133(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.133(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>20.0°C</u> |
| Record the maximum humidity:    | <u>43%</u>    |
| Record the minimum humidity:    | <u>33%</u>    |
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
5. Inspect the nodding blocks (78051-351) for any deterioration, but when replacement is necessary, ONLY replace during pre-test calibration. Using a Shore "A" type Durometer, verify the hardness of the nodding blocks is between 80 and 90. Ensure the nodding blocks are installed correctly. (880105-250 and PADI page17).
- Record findings and actions: No Deterioration; Hardness: Front 89; Back 90.
6. Torque the jam nut (9000018) on the neck cable (880105-206) to 1.4 ± 0.2 Nm (12.0 ± 2.0 in-lb). (572.133(c)(2))

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

Parameter		Specification	Results
Pendulum impact speed		5.95 m/s $\leq$ speed $\leq$ 6.19 m/s	6.05 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	1.5 m/s $\leq \Delta V \leq$ 1.9 m/s	1.6 m/s
	@ 20 ms	3.1 m/s $\leq \Delta V \leq$ 3.9 m/s	3.4 m/s
	@ 30 ms	4.6 m/s $\leq \Delta V \leq$ 5.6 m/s	4.9 m/s
Plane D Rotation		Peak moment* -65 Nm $\leq$ moment $\leq$ -53 Nm during the following rotation range 99° $\leq$ angle $\leq$ 114°	-54 Nm @ 113 degrees
Positive Moment Decay** (Extension)		Time to decay to -10 Nm 94 ms $\leq$ time $\leq$ 114 ms	104 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  
Signature

06/21/2023  
Date

**MGA RESEARCH CORPORATION  
NECK EXTENSION TEST  
HYBRID III 5TH PERCENTILE**


ATD Serial No: 510

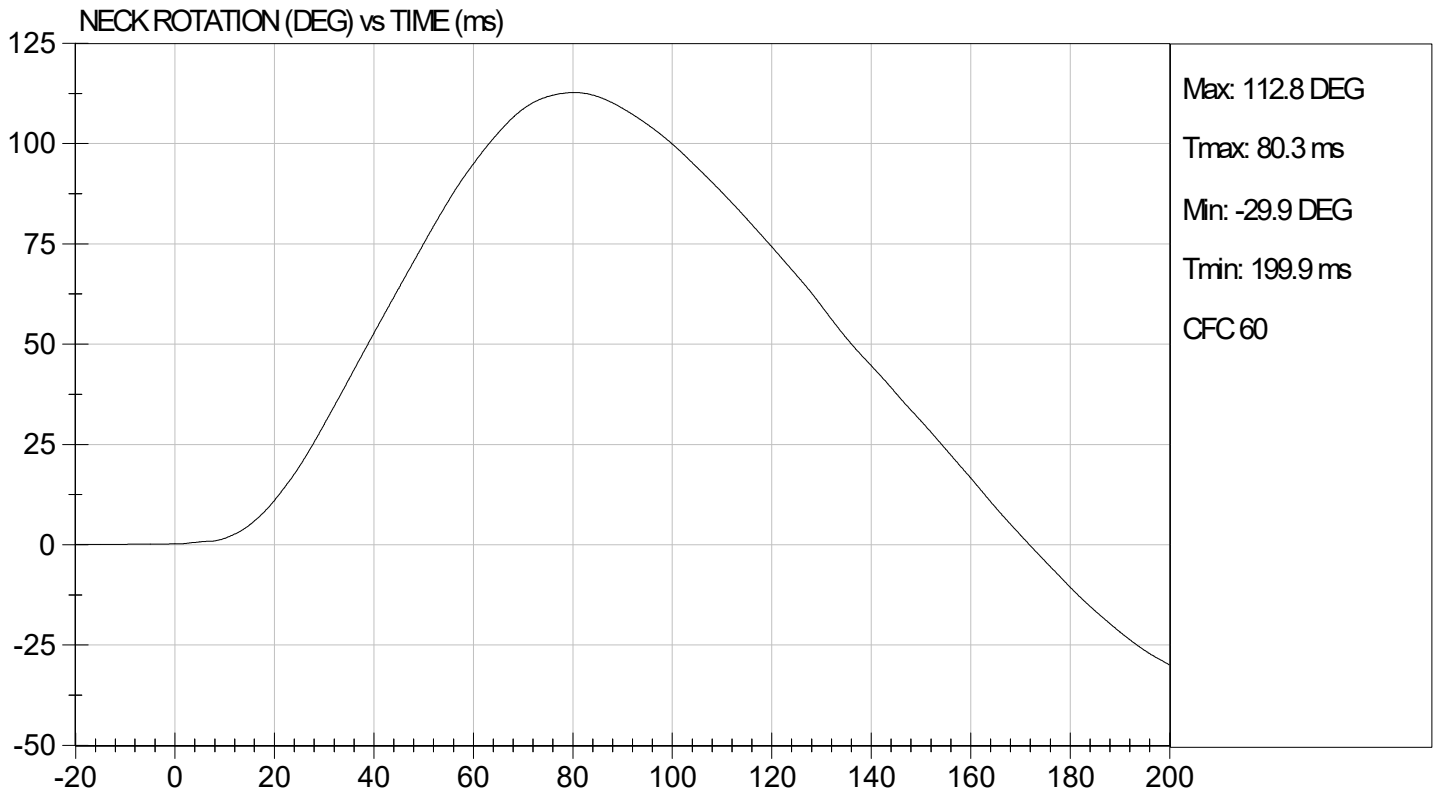
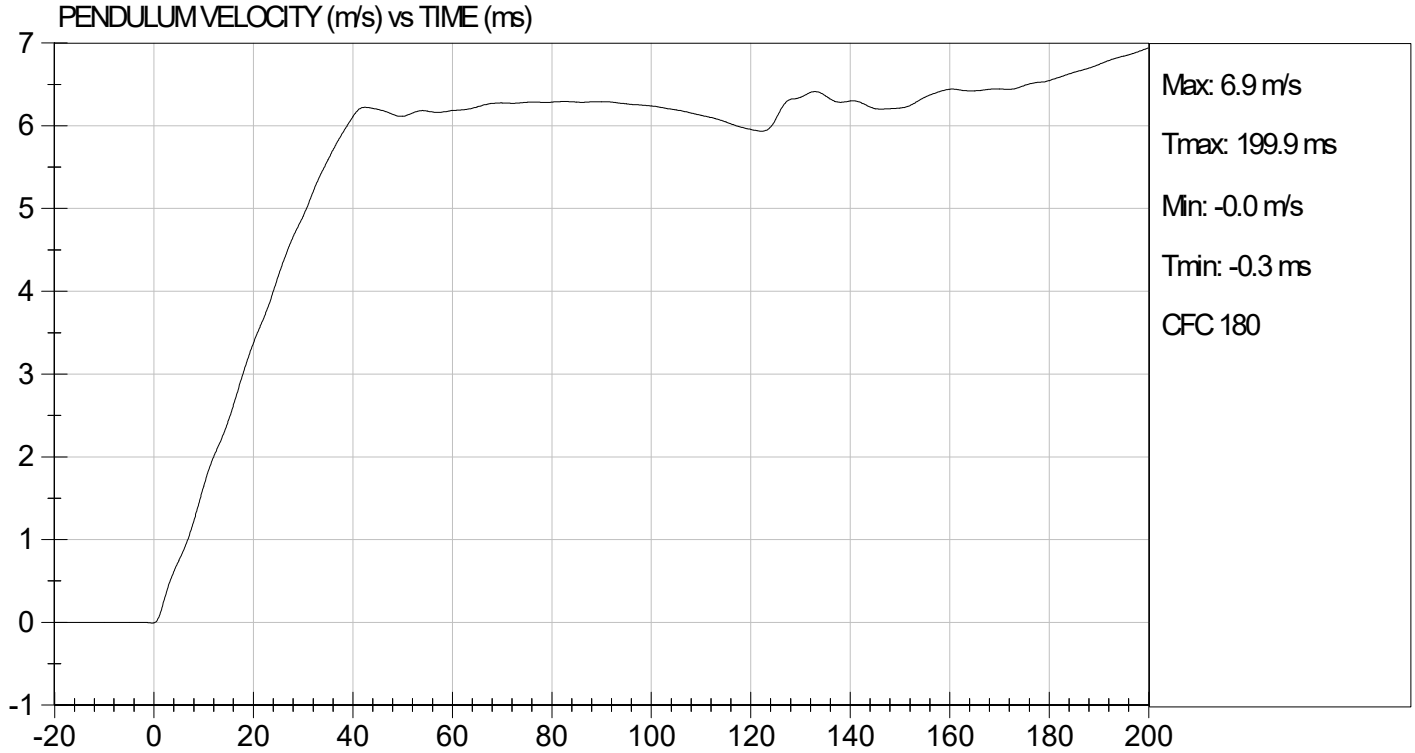
Test I.D.: D231593

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 Speed		m/s	5.95 to 6.19	6.05	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.6	Pass
	20 ms	m/s	3.1 to 3.9	3.4	Pass
	30 ms	m/s	4.6 to 5.6	4.9	Pass
D Plane Rotation	Max	deg	99 to 114	113	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	-65 to -53	-54	Pass
Negative Moment Time Curve Decay to -10 Nm		ms	94 to 114	104	Pass
Overall Results					Pass

  
Laboratory Technician

06/21/2023  
Test Date

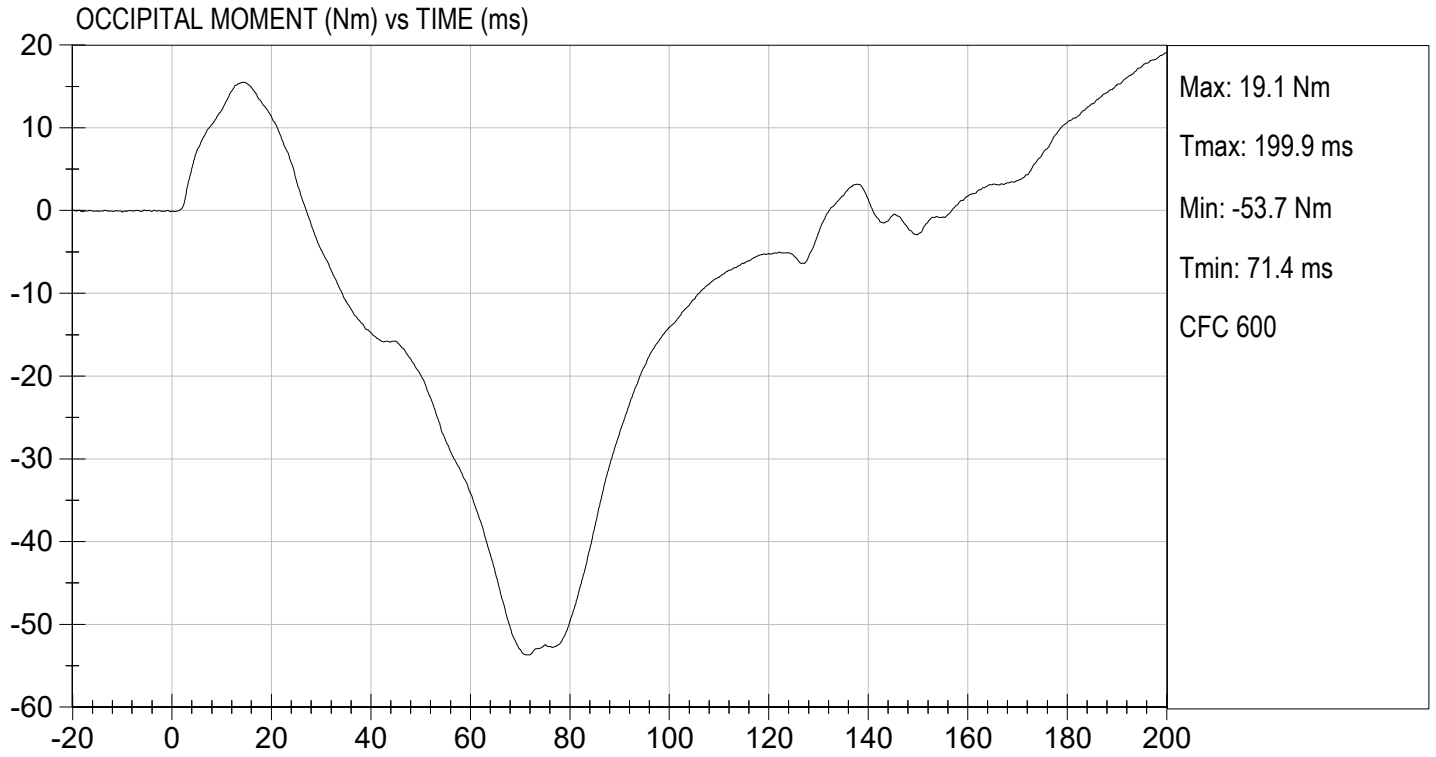
  
Approved By





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

TEST DATE: 06/21/2023  
TEST #: D231593



**DATA SHEET B6**  
THORAX IMPACT TEST (572.134) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/21/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.1°C</u>
Record the minimum temperature:	<u>19.8°C</u>
Record the maximum humidity:	<u>43%</u>
Record the minimum humidity:	<u>33%</u>

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

- No Damage

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

- The following repairs or replacement was performed. Record

---

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

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

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.68 m/s
Chest Compression	$50.0 \text{ mm} \leq \text{compression} \leq 58.0 \text{ mm}$	51.0 mm
Peak force** between 50.0 and 58.0 mm chest compression	$3900\text{N} \leq \text{peak force} \leq 4400\text{N}$	4288 N
Peak Force** between 18.0 and 50.0 mm chest compression	Peak Force $\leq 4600 \text{ N}$	4365 N
Internal Hysteresis***	$69\% \leq \text{hysteresis} \leq 85\%$	73%

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

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

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

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

  
 Signature

06/21/2023  
 Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 5TH PERCENTILE**

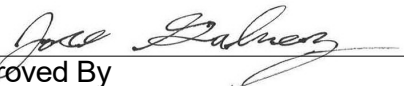
ATD Serial No: 510

Test I.D: D231594

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.1	Pass
Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/s	6.59 to 6.83	6.68	Pass
Peak Deflection	mm	50 to 58	51	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4288	Pass
Internal Hysteresis	%	69 to 85	73	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4365	Pass
Overall Test Results				Pass

  
 Laboratory Technician

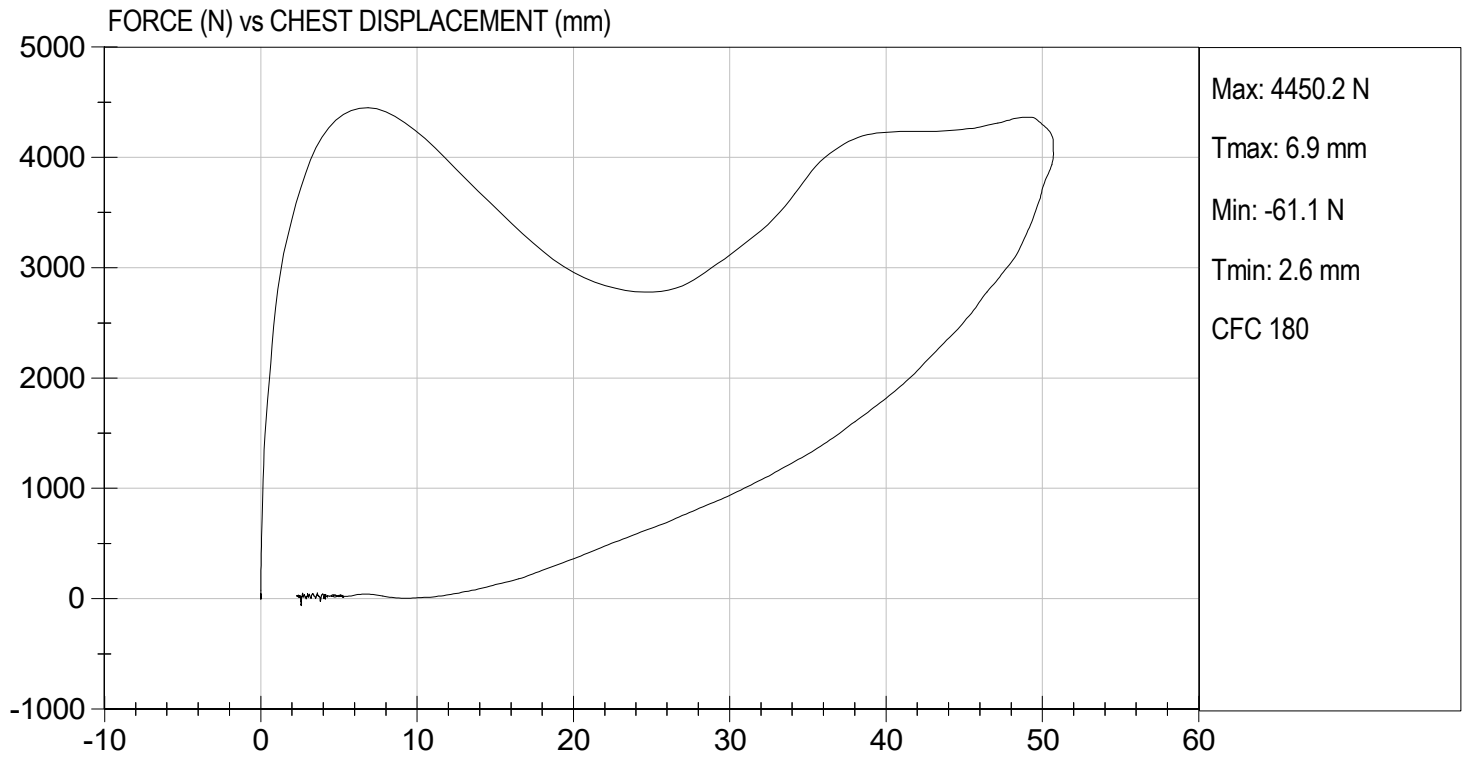
06/21/2023  
 Test Date

  
 Approved By



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

TEST DATE: 06/21/2023  
TEST #: D231594



**DATA SHEET B7**  
TORSO FLEXION TEST (572.135) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.137(q))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13B.
3. The complete assembled dummy (880105-000) is used (572.135(c)(2)).  
 With legs below femurs.  
 Without legs below femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                 |               |
|---------------------------------|---------------|
| Record the maximum temperature: | <u>21.3°C</u> |
| Record the minimum temperature: | <u>20.0°C</u> |
| Record the maximum humidity:    | <u>41%</u>    |
| Record the minimum humidity:    | <u>31%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼ cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.135(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 13B. (572.135(c)(4))
7. Inspect and adjust, if necessary, the seating of the abdominal insert within the pelvis cavity and with respect to the torso flesh, assuring that the torso flesh provides uniform fit and overlap with respect to the outside surface of the pelvis flesh. (572.135(c)(5))
8. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.135(c)(6))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 20°	16 deg
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.7 deg/sec
Force at 45° ± 0.5°	320 N ≤ force ≤ 390 N	356 N
Final ref. plane angle	Initial ref. plane angle ± 8°	2 deg

Jonah Pulokas   
Signature

06/20/2023   
Date

**MGA RESEARCH CORPORATION**  
**TORSO FLEXION TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D231597

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	41	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	2	Pass
Force at 45 deg	N	320 to 390	356	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
<b>Overall Result</b>				<b>Pass</b>



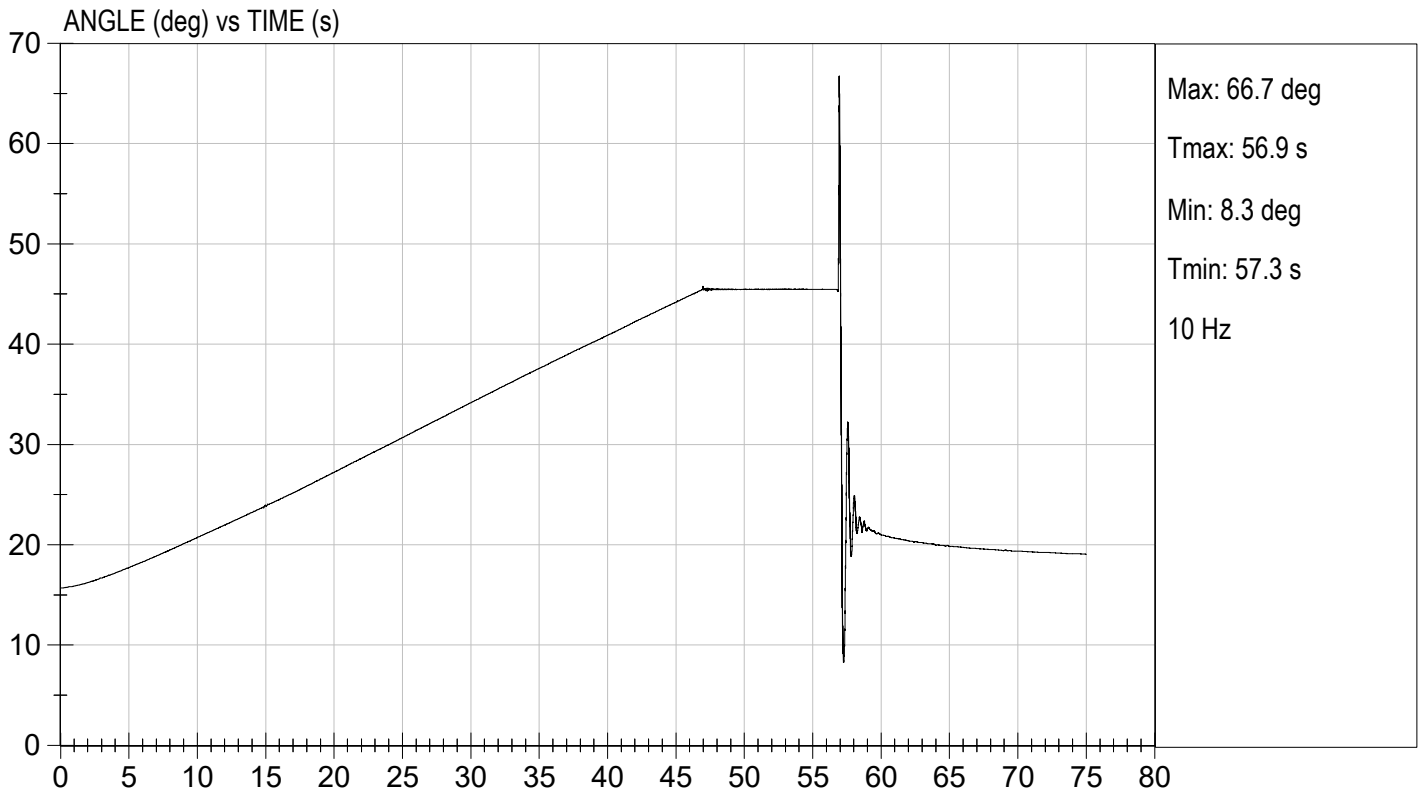
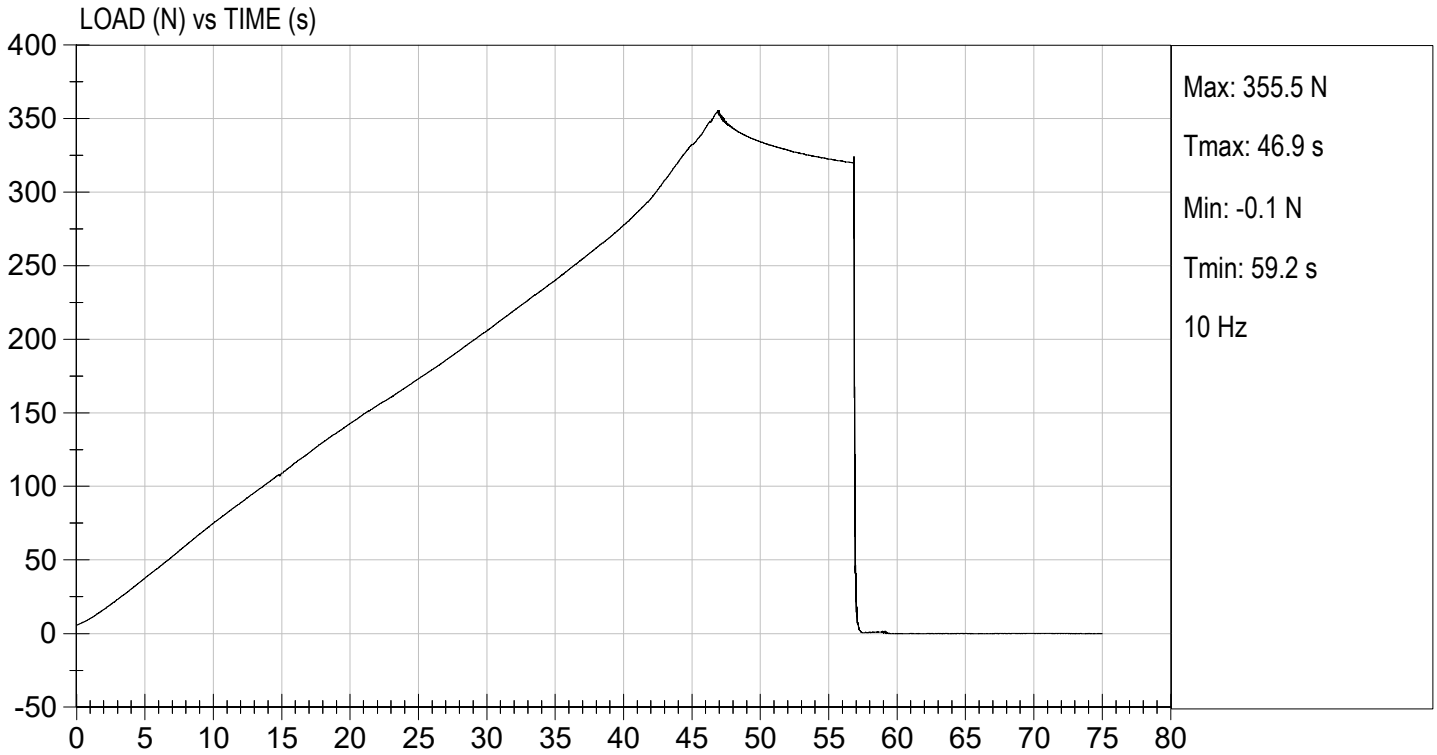
Laboratory Technician

06/20/2023

Test Date



Approved By



**DATA SHEET B8**  
LEFT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.2°C</u>
Record the minimum temperature:	<u>19.8°C</u>
Record the maximum humidity:	<u>42%</u>
Record the minimum humidity:	<u>32%</u>

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

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.11 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	3625 N

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

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

Jonah Pulokas  
Signature

06/20/2023  
Date

**MGA RESEARCH CORPORATION**

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


**ATD Serial No:** 510

**Test I.D.:** D231596

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	2.07 to 2.13	2.11	Pass
Maximum Force	N	3450 to 4060	3625	Pass
Overall Test Results				Pass

  
Laboratory Technician

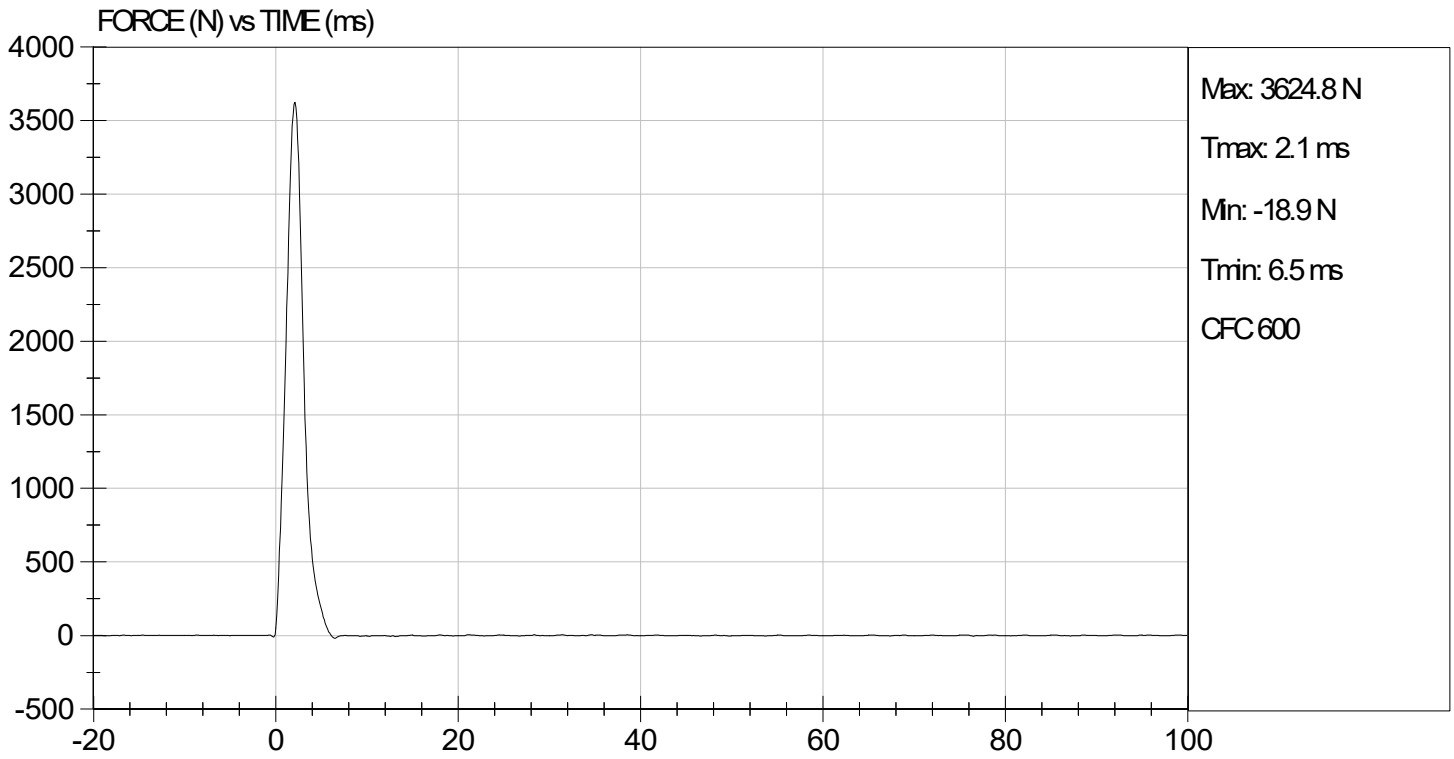
06/20/2023  
Test Date

  
Approved By



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

TEST DATE: 06/20/2023  
TEST #: D231596



**DATA SHEET B9**  
RIGHT KNEE IMPACT TEST (572.136) (5<sup>th</sup> Female)

Dummy Serial Number: 510

Test Date: 06/20/2023

Technician: Jonah Pulokas

- Pre test calibration  
 Post test calibration verification

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

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

Record the maximum temperature:	<u>21.1°C</u>
Record the minimum temperature:	<u>19.8°C</u>
Record the maximum humidity:	<u>42%</u>
Record the minimum humidity:	<u>32%</u>

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

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

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$3450 \text{ N} \leq \text{force} \leq 4060 \text{ N}$	4039 N

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

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

  
Signature

06/20/2023  
Date

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 5TH PERCENTILE**

ATD Serial No: 510

Test I.D: D231595

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	4039	Pass
Overall Test Results				Pass

  
\_\_\_\_\_  
Laboratory Technician

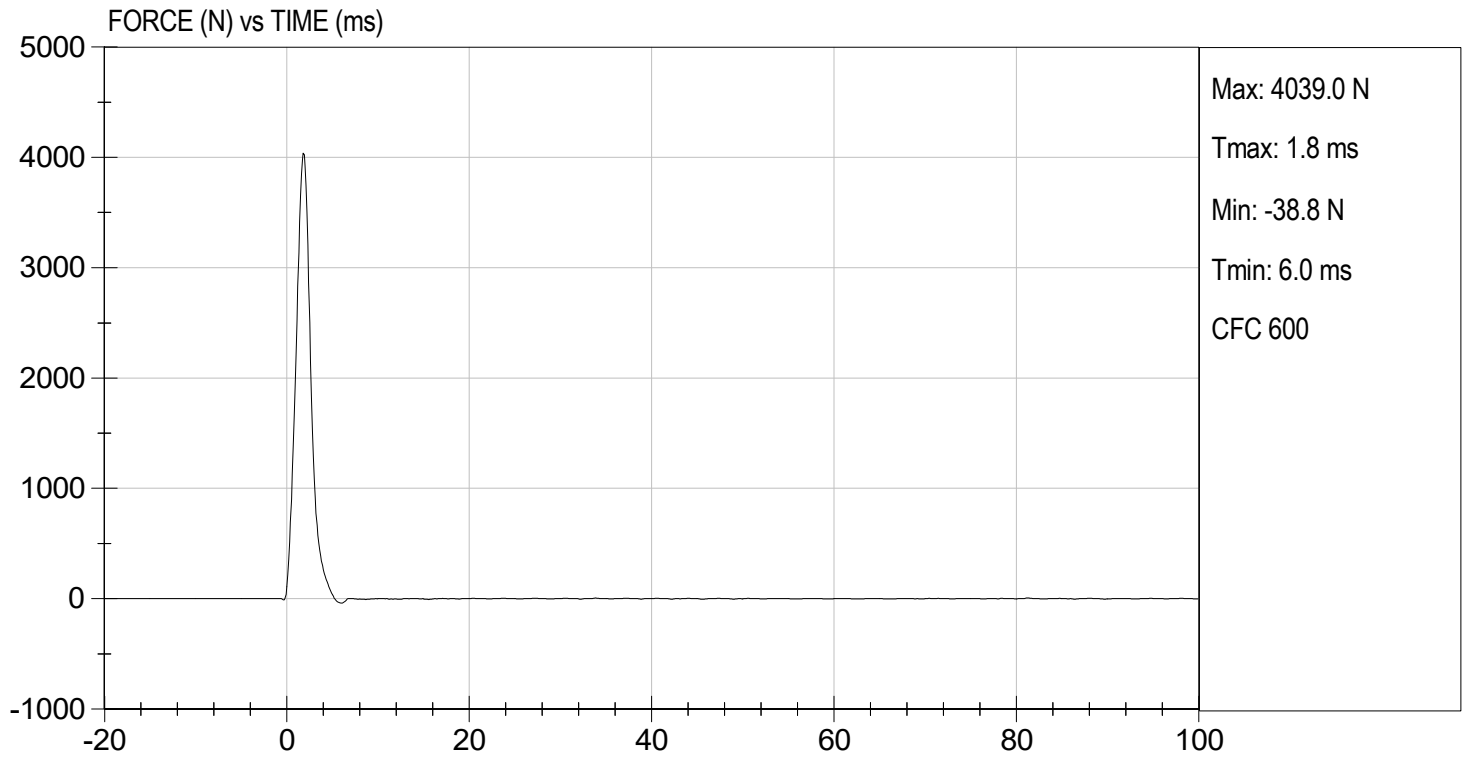
06/20/2023  
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Test Date

  
\_\_\_\_\_  
Approved By



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

TEST DATE: 06/20/2023  
TEST #: D231595



**DATA SHEET B1**  
**DUMMY DAMAGE CHECKLIST**

Dummy Serial Number: 510

Test Date: 06/20/2023

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

06/20/2023  
Date

Describe the repair or replacement of parts:

Checked by:

  
\_\_\_\_\_  
Signature

06/20/2023  
Date

**DATA SHEET B10**

**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
<b>DUMMY INSTRUMENTATION</b>					
<b>HEAD ACCELEROMETERS</b>					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79575	06/05/2023	12/08/2023
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P79577	06/05/2023	12/08/2023
(3) VERTICAL	Endevco	7264C-2KTZ-2-360M17	P79578	06/05/2023	12/08/2023
NECK TRANSDUCER	Denton	1716a	N2039	04/05/2023	10/05/2023
<b>CHEST ACCELEROMETERS</b>					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360M17	P88334	06/05/2023	12/08/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P88335	06/05/2023	12/08/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	P93609	06/05/2023	12/08/2023
CHEST POTENTIOMETER	Humanetics	880105-1080	510	06/05/2023	12/08/2023
<b>FEMUR LOAD CELLS</b>					
(1) RIGHT FEMUR	Denton	2121AJFL	F1826	06/05/2023	12/08/2023
(2) LEFT FEMUR	Denton	2121AJFL	F1827	06/05/2023	12/08/2023
<b>LABORATORY INSTRUMENTATION</b>					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	AH5P1	01/13/2023	07/15/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	06/01/2023	12/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Servo	14CBI-2897	4707	02/10/2023	08/12/2023
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Servo	14CBI-2897	7297	02/10/2023	08/12/2023

LABORATORY TECHNICIAN: 

## EXTERNAL DIMENSIONS

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

HYBRID III 3 year SN #031, PART 572, SUBPART P EXTERNAL DIMENSIONS, continued

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

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

Dummy Serial Number: 031

Test Date: 05/30/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.142(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
3. Accelerometers and their respective mounts are smooth and clean.
4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>35%</u>    |
| Record the minimum humidity    | <u>32%</u>    |
7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

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

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

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

X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.142(c)(4))  
 Record actual micro finish: 24.8 micro inches

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

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 280 \text{ g}$	268 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-14.1 g

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

Brian Roach  
 Signature

05/30/2023  
 Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 3 YEAR OLD**

ATD Serial No: 031

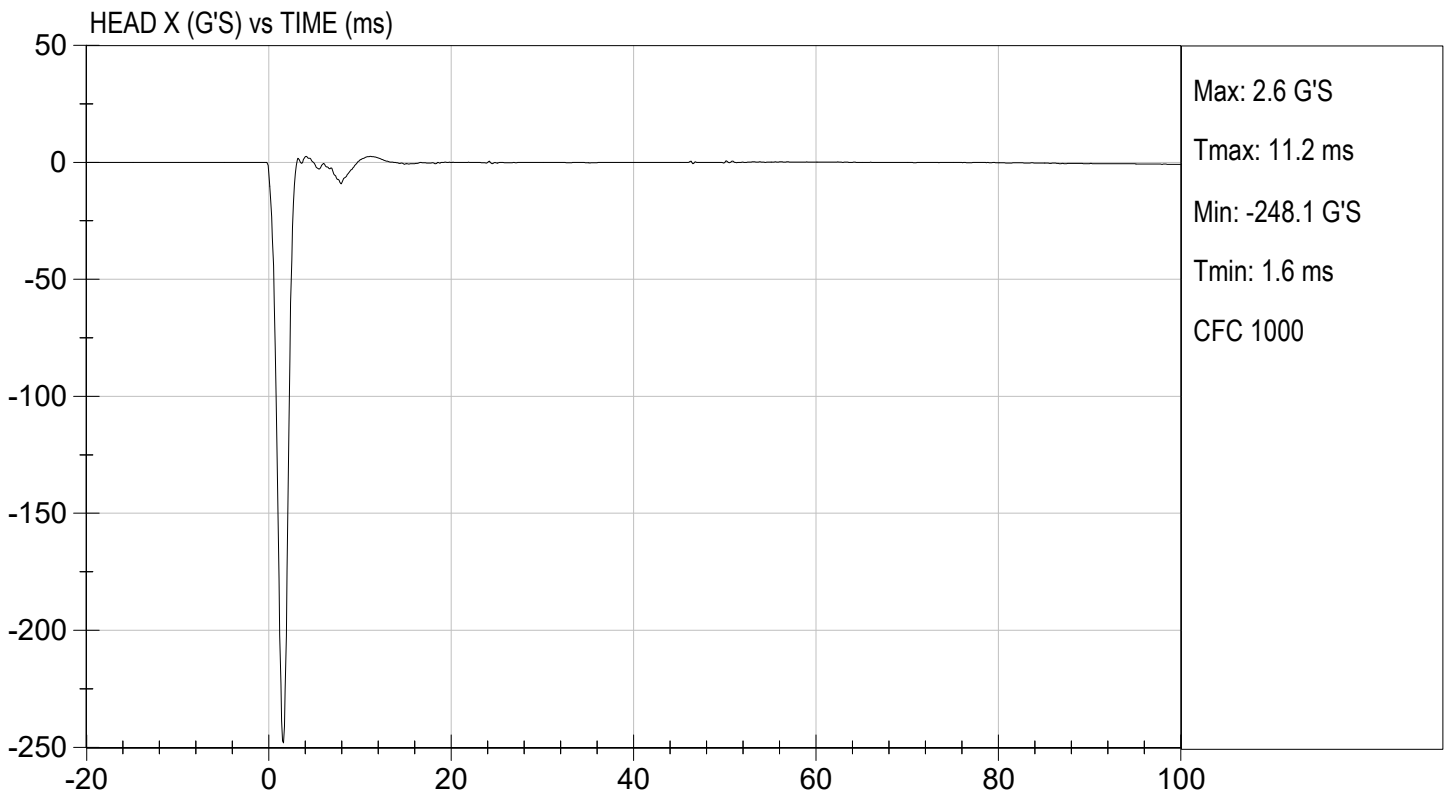
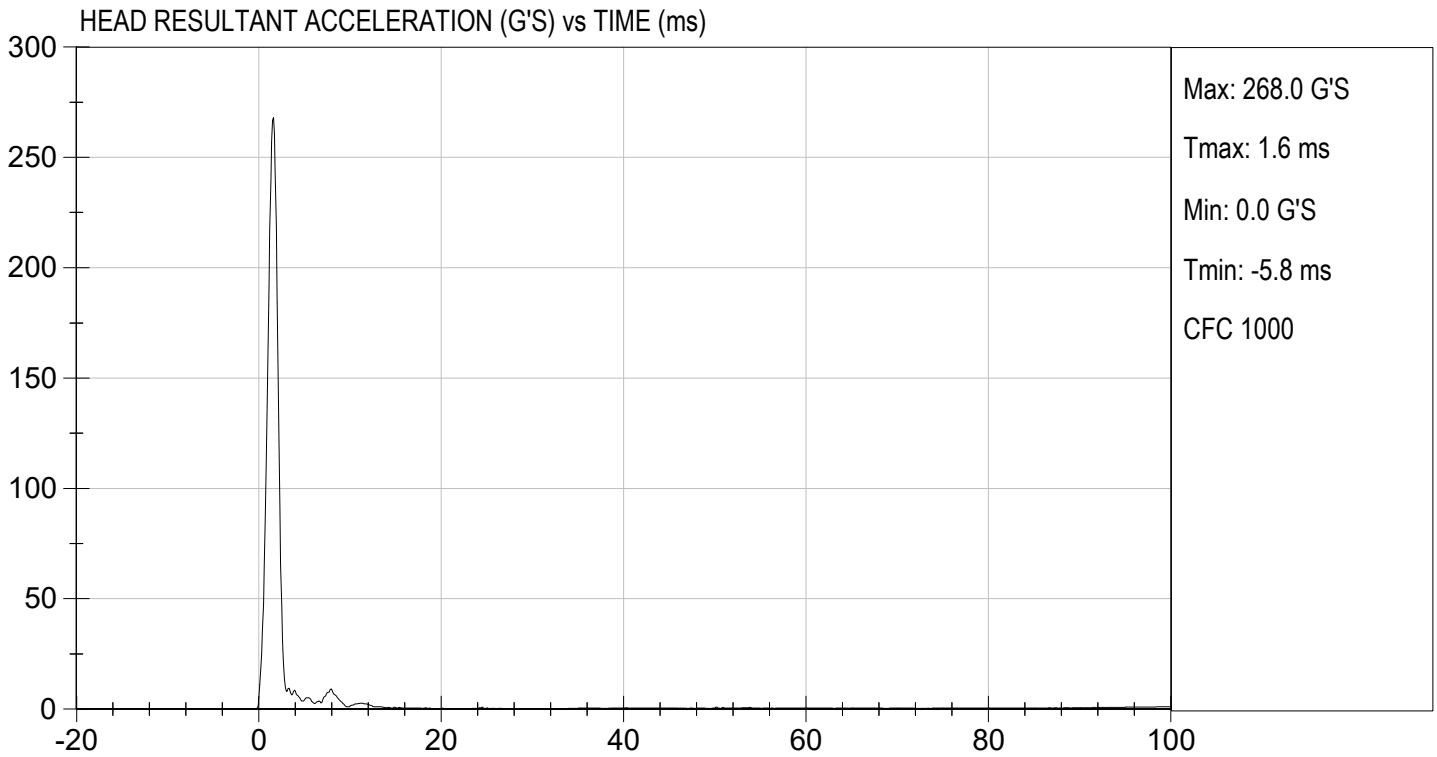
Test ID: D231371

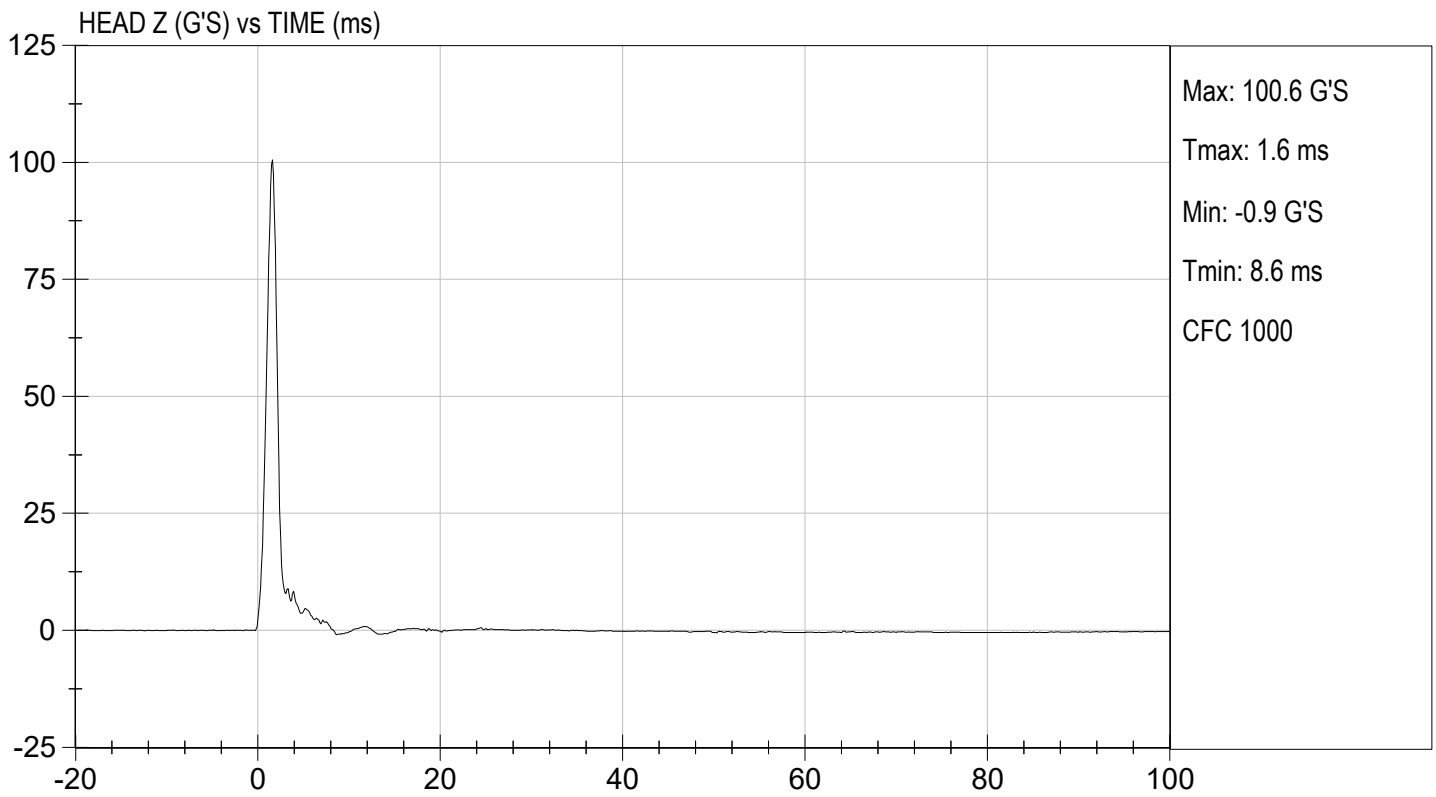
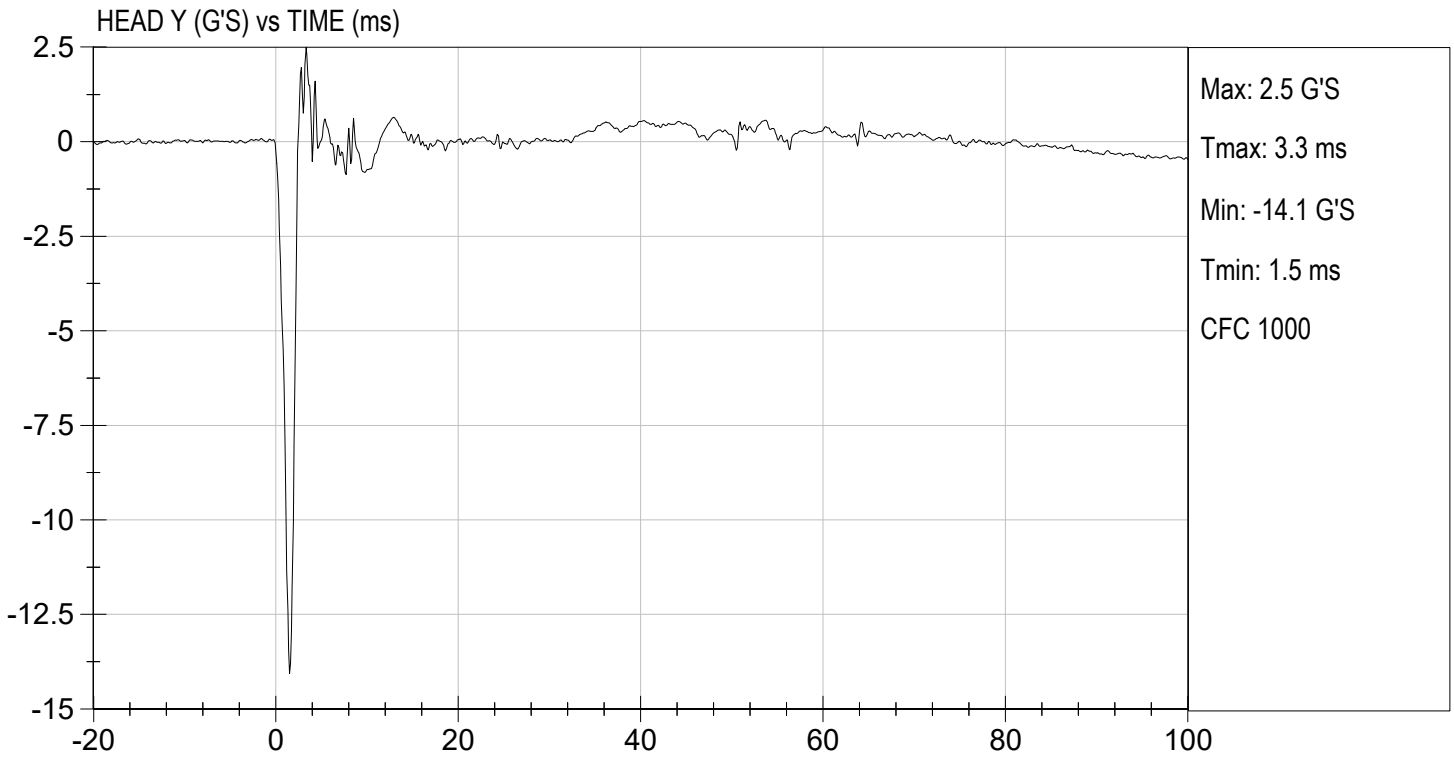
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Peak Resultant Acceleration	G's	250 to 280	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-14.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Brian Roach  
 Laboratory Technician

05/30/2023  
 Test Date

Joe Galvez  
 Approved By





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

Dummy Serial Number: 031

Test Date: 05/30/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last neck test. (572.146(p))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>35%</u>    |
| Record the minimum humidity    | <u>32%</u>    |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
7. The test fixture pendulum conforms to the specifications in Figure 8D.
8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))
9. Install the transducers or other devices for measuring the "D" plane rotation with respect

to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

- X 10. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))

Parameter		Specification	Result
Pendulum impact speed		5.4 m/s $\leq$ speed $\leq$ 5.6 m/s	5.46 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.0 m/s $\leq \Delta V \leq$ 2.7 m/s	2.5 m/s
	@ 15 ms	3.0 m/s $\leq \Delta V \leq$ 4.0 m/s	3.7 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.1 m/s	5.0 m/s
Plane D Rotation		Peak moment* 42 Nm $\leq$ moment $\leq$ 53 Nm during the following rotation range 70° $\leq$ angle $\leq$ 82°	42.5 Nm @ 76 degrees
Positive Moment Decay** (Flexion)		Time to decay to 10 Nm 60 ms $\leq$ time $\leq$ 80 ms	71 ms

\*The moment is a direct reading from the load cell

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

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

Brian Roach  
Signature

05/30/2023  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

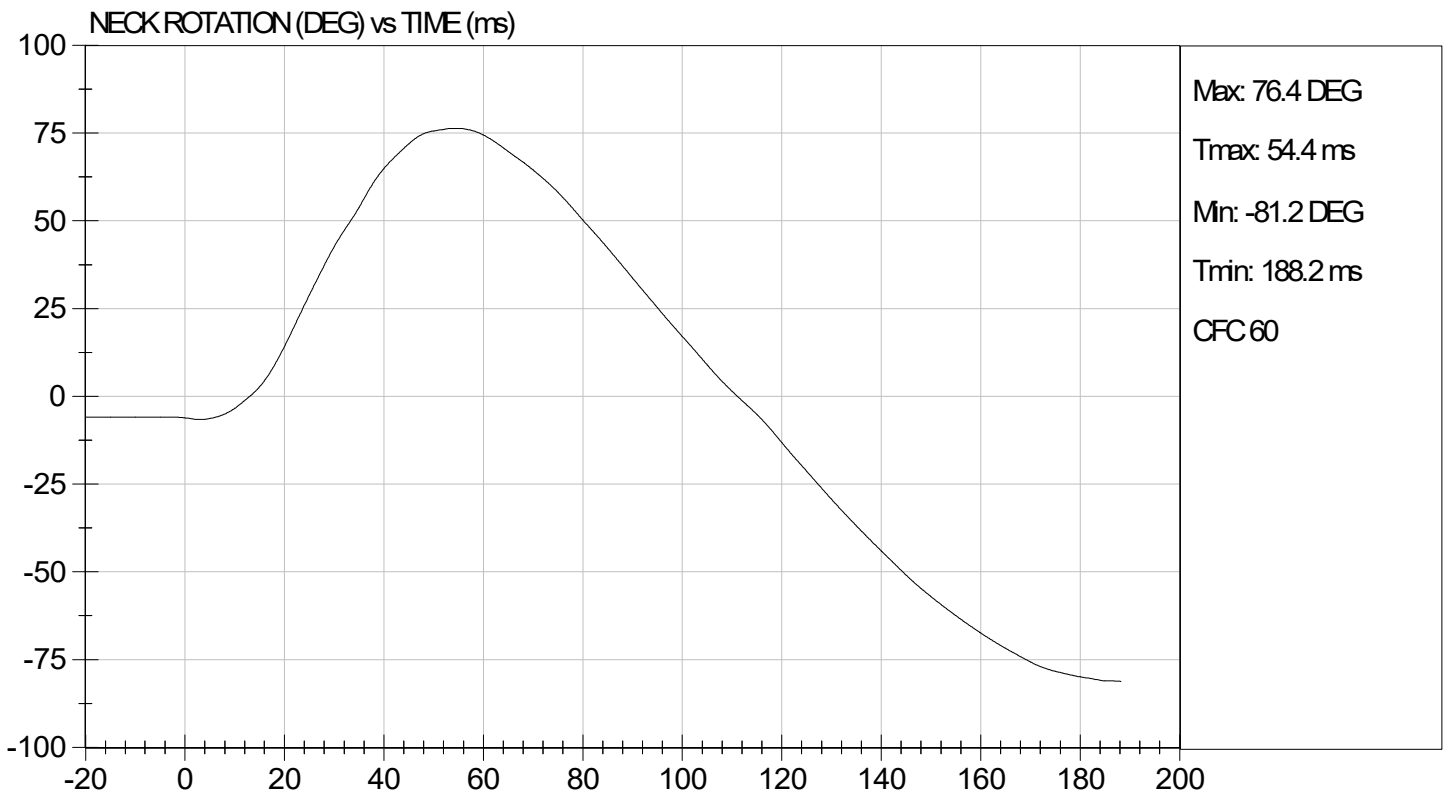
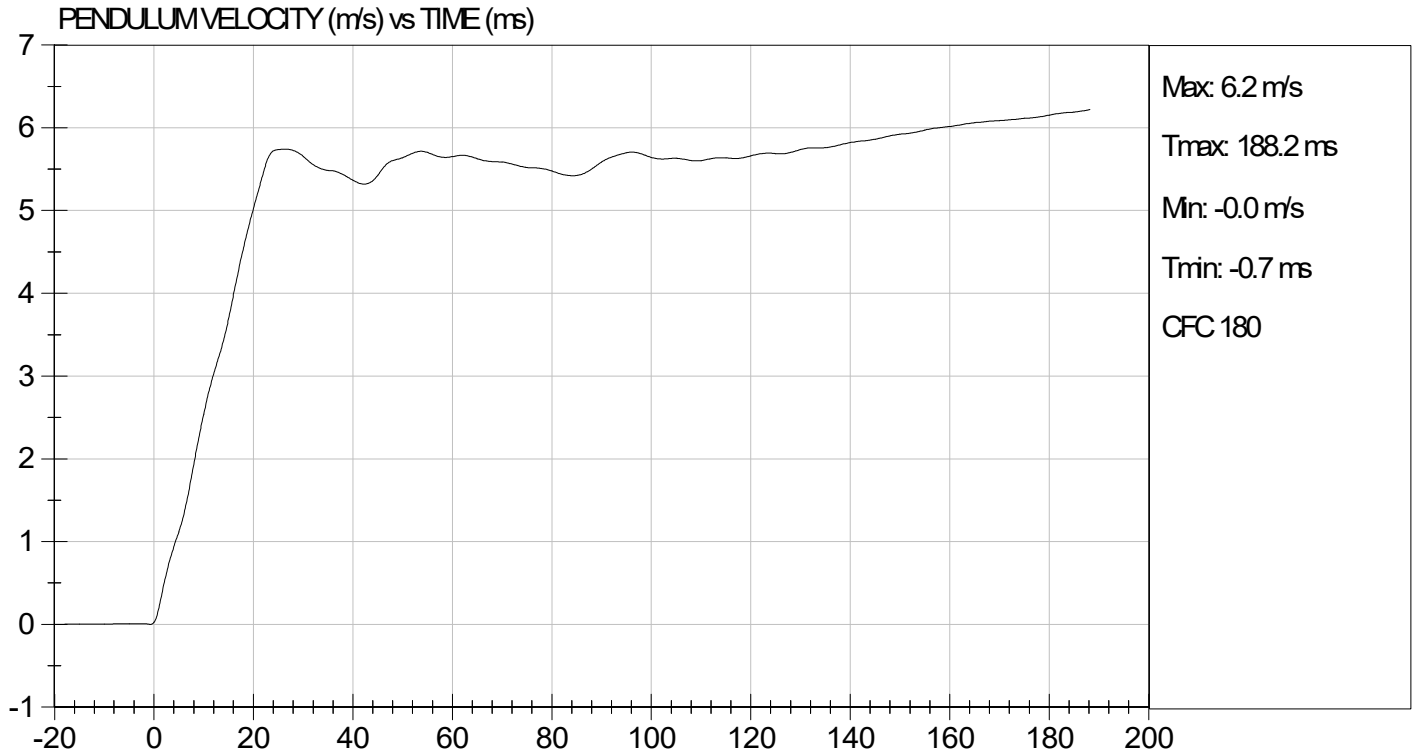
**Test I.D.:** D231372

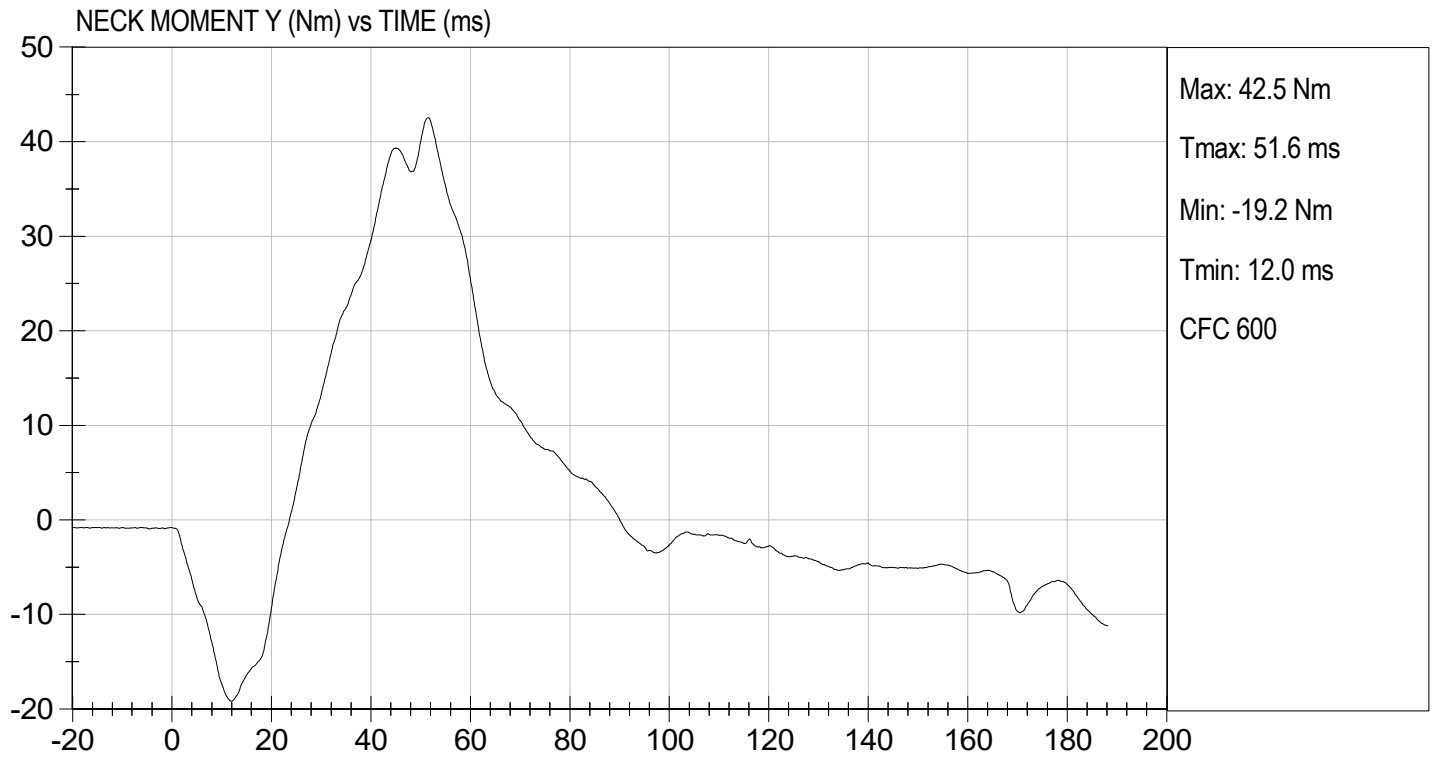
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Speed		m/s	5.40 to 5.60	5.46	Pass
Pendulum Velocity	10 msec	m/s	2.0 to 2.7	2.5	Pass
	15 msec	m/s	3.0 to 4.0	3.7	Pass
	20 msec	m/s	4.0 to 5.1	5.0	Pass
D Plane Rotation		deg	70 to 82	76	Pass
Peak Moment within Deflection Corridor		Nm	42.0 to 53.0	42.5	Pass
Positive Moment - Time Curve Decay to 10 Nm		msec	60.0 to 80.0	71	Pass
				Overall Test Results	Pass

  
 \_\_\_\_\_  
 Laboratory Technician

05/30/2023  
 \_\_\_\_\_  
 Test Date

  
 \_\_\_\_\_  
 Approved By





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

Dummy Serial Number: 031

Test Date: 05/30/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last neck test. (572.146(p))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>35%</u>    |
| Record the minimum humidity    | <u>32%</u>    |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
7. The test fixture pendulum conforms to the specifications in Figure 8D.
8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	$3.55 \text{ m/s} \leq \text{speed} \leq 3.75 \text{ m/s}$	3.65 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 6 ms	$1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$
	@ 10 ms	$1.9 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$
	@ 14 ms	$2.8 \text{ m/s} \leq \Delta V \leq 3.5 \text{ m/s}$
Plane D Rotation	Peak moment* $-53.3 \text{ Nm} \leq \text{moment} \leq -43.7 \text{ Nm}$ during the following rotation range $83 \leq \text{angle} \leq 93$	-44.6 Nm @ 87 degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$	71 ms

\*The moment is a direct reading from the load cell

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

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

Brian Roach  
Signature

05/30/2023  
Date

**MGA RESEARCH CORPORATION**  
**NECK EXTENSION TEST**  
**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D.:** D231373

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	35	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.65	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.4	Pass
	10 ms	m/s	1.9 to 2.5	2.5	Pass
	14 ms	m/s	2.8 to 3.5	3.4	Pass
D Plane Rotation		deg	83 to 93	87	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-44.6	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	71	Pass
<b>Overall Test Results</b>					<b>Pass</b>

*Brian Roach*

Laboratory Technician

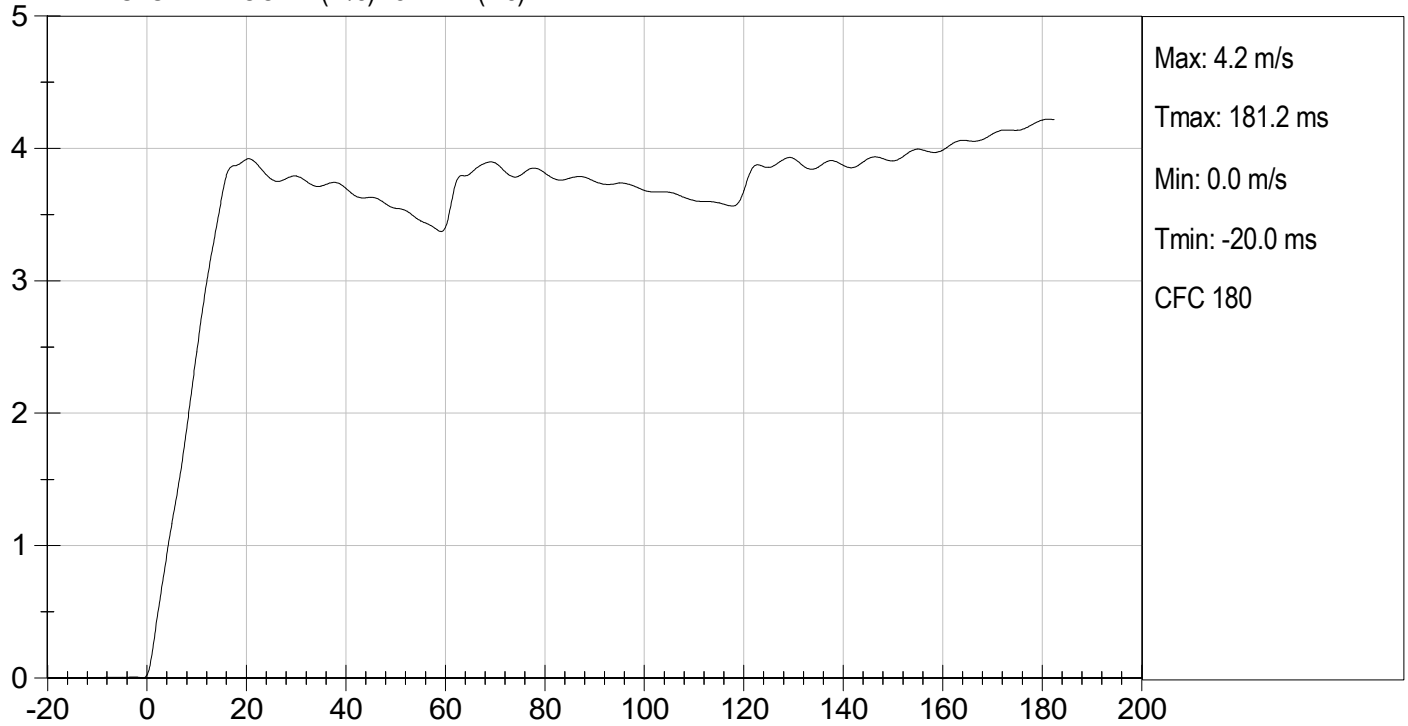
05/30/2023

Test Date

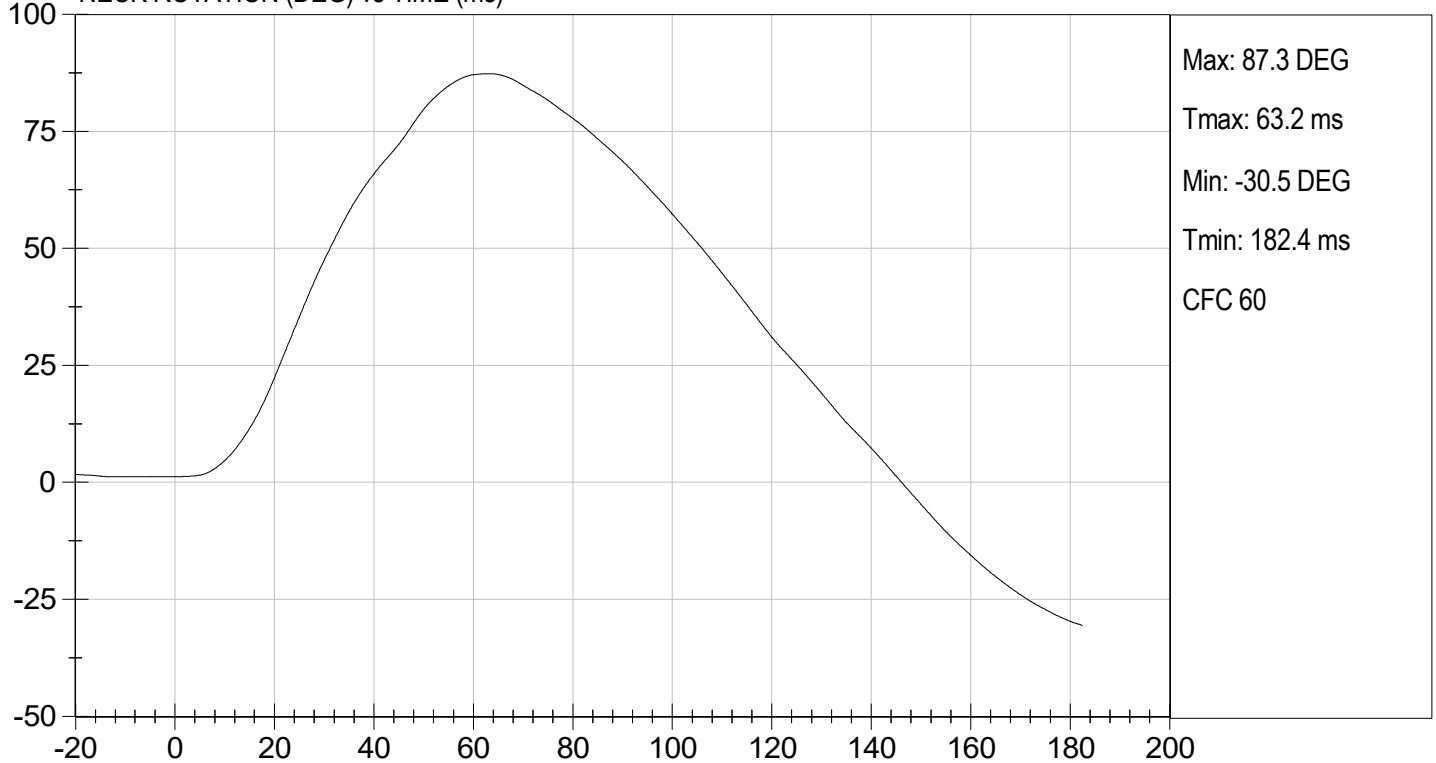
*Jose Galvez*  
 Approved By



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



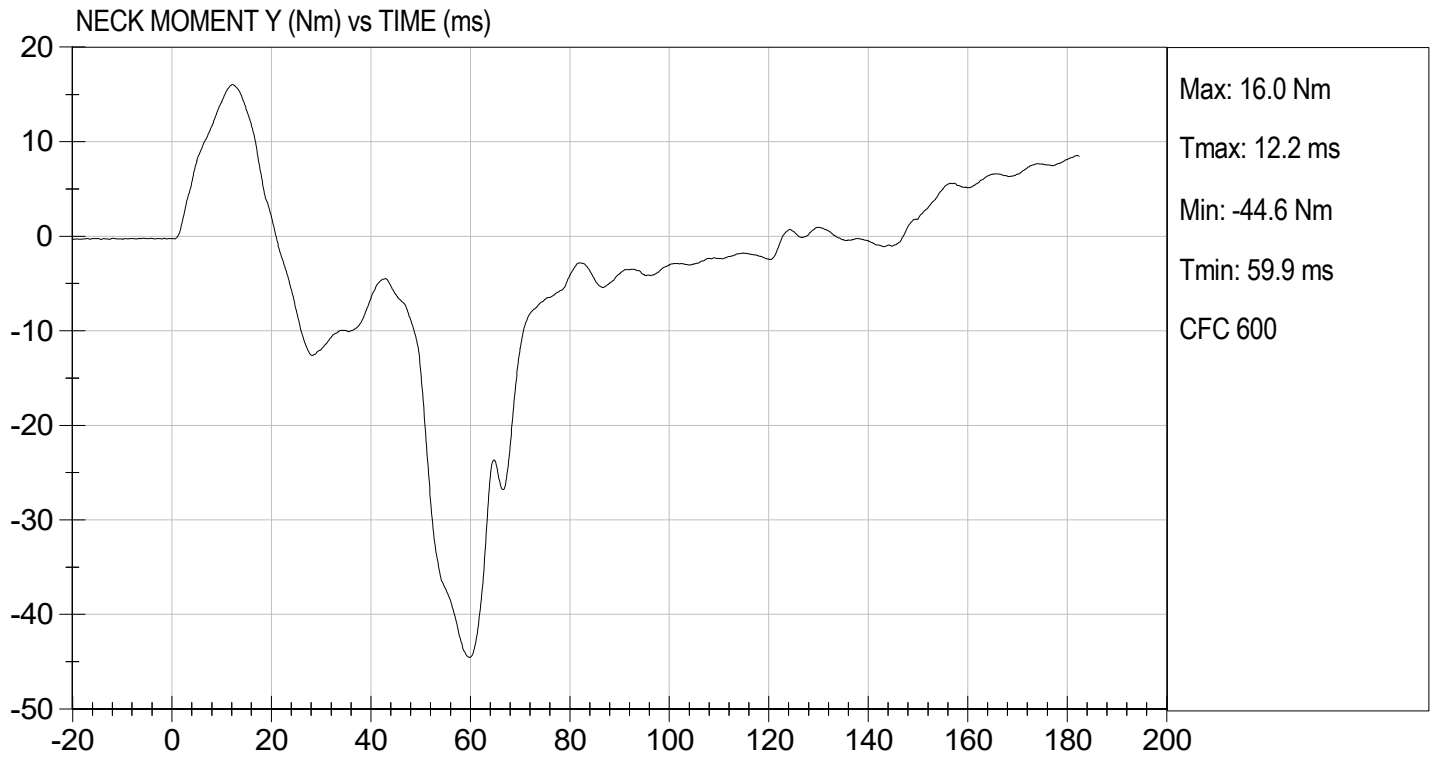
NECK ROTATION (DEG) vs TIME (ms)





TEST DESC: NECK EXTENSION  
VELOCITY: 11.99 ft/s, 3.65 m/s

TEST DATE: 05/30/2023  
TEST #: D231373



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

Dummy Serial Number: 031

Test Date: 05/31/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 11D.
3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))
4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.3°C</u> |
| Record the maximum humidity    | <u>43%</u>    |
| Record the minimum humidity    | <u>40%</u>    |
5. Remove the arms.
6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
- Record findings and actions:
- No damage
- Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.
- The following repairs or replacement was performed. Record damage.
7. Seat the dummy, without back and arm supports on the test fixture surface as shown in

Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))

- X 8. Level the middle rib both longitudinally and laterally  $\pm 0.5^\circ$ . (572.144(c)(3))
- X 9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.144(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within  $\pm 2.5$  mm within  $\pm 0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	5.9 m/s ≤ speed ≤ 6.1 m/s	6.05 m/s
Chest Compression	32 mm ≤ compression ≤ 38 mm	37.7 mm
Peak force** between 32 and 38 mm chest compression	680 N ≤ peak force ≤ 810 N	733 N
Peak force** between 12.5 and 32.0 mm chest compression	Peak force ≤ 910 N	687 N
Internal Hysteresis***	65% ≤ hysteresis ≤ 85%	66.4%

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

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

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

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

Brian Roach  
Signature

05/31/2023  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT TEST**  
**HYBRID III 3 YEAR OLD**

ATD Serial No: 031

Test I.D: D231374

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Probe Velocity	m/s	5.9 to 6.1	6.05	Pass
Peak Deflection	mm	32 to 38	37.7	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	733	Pass
Internal Hysteresis	%	65 to 85	66.4	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	687	Pass
Overall Test Results				Pass

Brian Road  
 Laboratory Technician

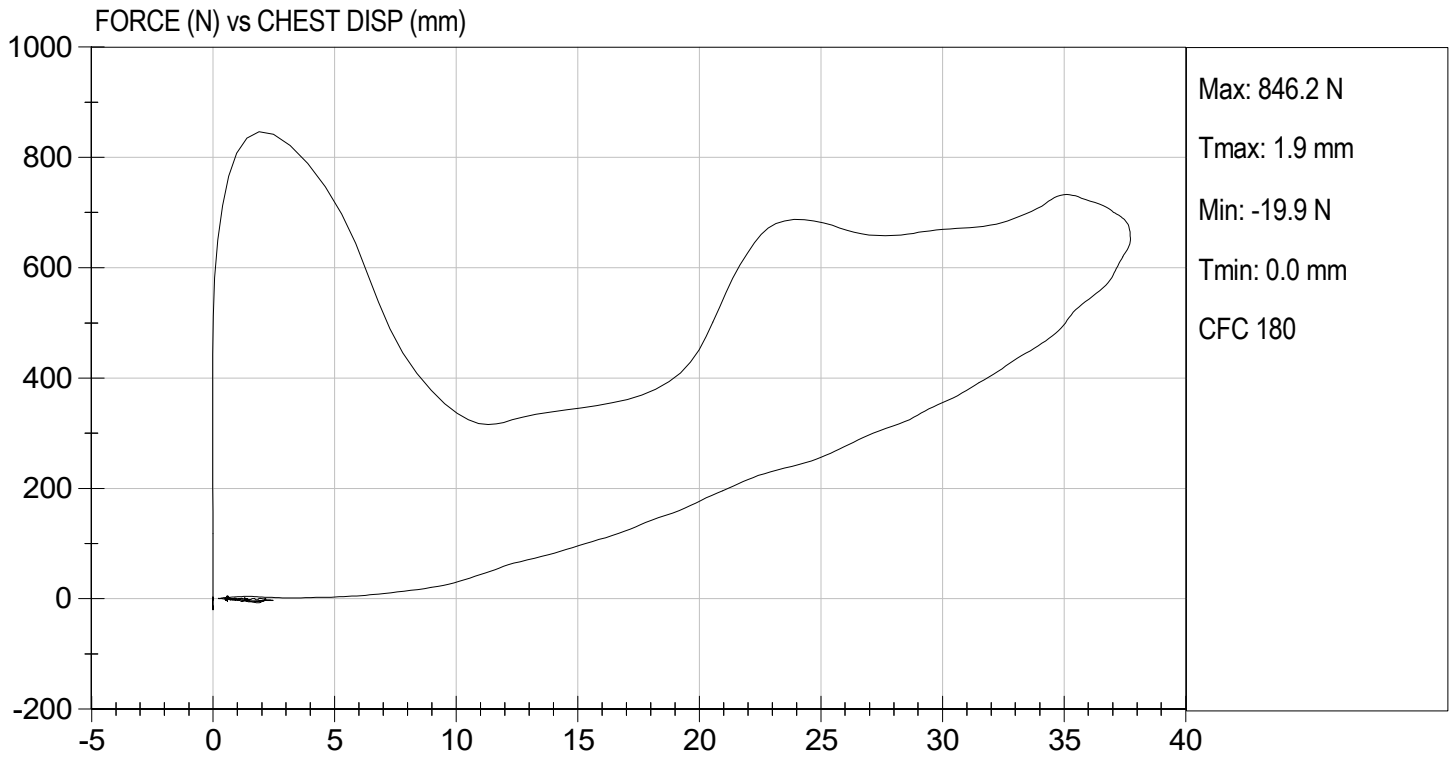
05/31/2023  
 Test Date

Jose Galvez  
 Approved By



TEST DESC: THORAX IMPACT  
VELOCITY: 19.84 ft/s, 6.05 m/s

TEST DATE: 05/31/2023  
TEST #: D231374



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

Dummy Serial Number: 031

Test Date: 05/31/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))  
 N/A, ONLY torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13D.
3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>21.4°C</u> |
| Record the maximum humidity    | <u>43%</u>    |
| Record the minimum humidity    | <u>40%</u>    |
5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))
6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within  $\pm 1^\circ$  and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))
7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))
8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))
9. Flex the dummy forward and back 3 times such that the angle of the torso reference

plane moves between  $0^\circ$  and  $30^\circ \pm 2^\circ$ . The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 15^\circ$	$7^\circ$
Torso rotation rate	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	$0.9^\circ/s$
Force at $45^\circ \pm 0.5^\circ$	$130 \text{ N} \leq \text{force} \leq 180 \text{ N}$	165 N
Final ref. plane angle	Initial ref. plane angle $\pm 10^\circ$	$3^\circ$

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

Brian Road  
Signature

05/31/2023  
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 031

Test I.D: D231377

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 15	7	Pass
Return Angle	deg	-10 to 10	3	Pass
Force at 45 deg	N	130 to 180	165	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Test Results				Pass



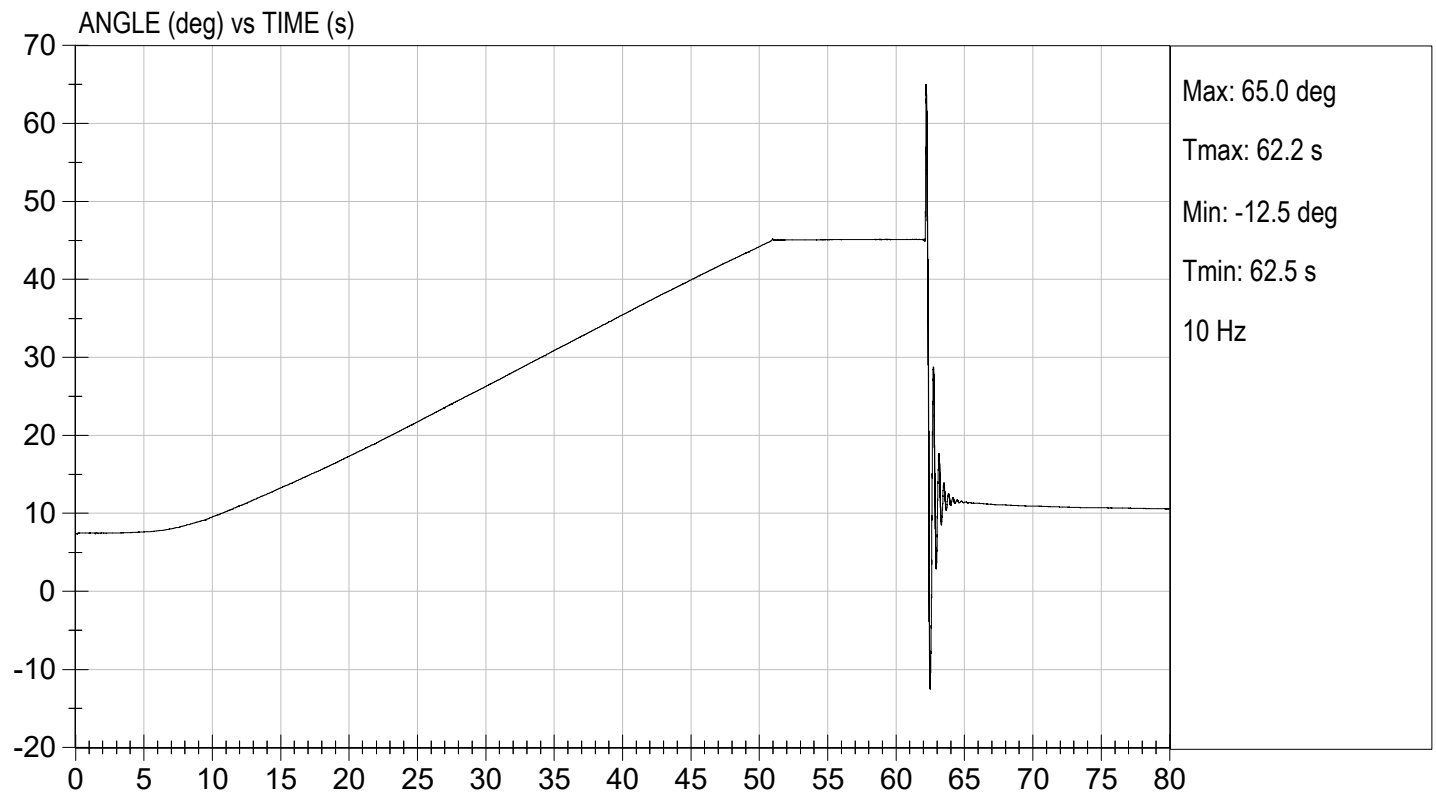
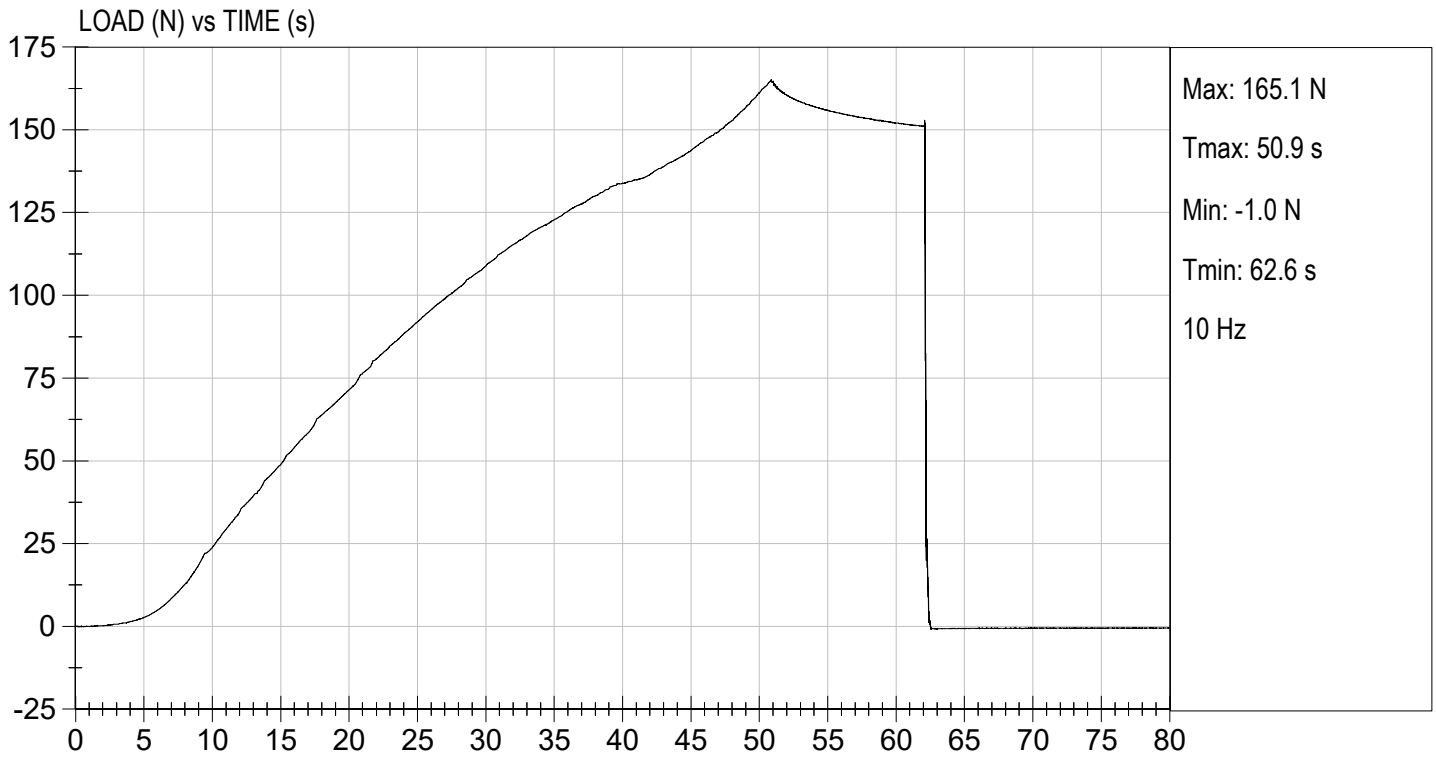
Laboratory Technician

05/31/2023

Test Date



Approved By



**DATA SHEET D8**  
**PART 572 INSTRUMENTATION CALIBRATION INFORMATION**

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360M17	P85701	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P88338	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264CM47-2KTZ-360	T26458	05/24/2023	11/23/2023
NECK TRANSDUCER	Denton	3303LN2	N233	10/28/2023	10/28/2023
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264CM47-2KTZ-360	T18417	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264CM47-2KTZ-360	T22265	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264CM47-2KTZ-360	T24803	05/24/2023	11/23/2023
CHEST POTENTIOMETER	Humanetics	210-8150	031	05/31/2023	11/30/2023
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	C13081	05/02/2023	11/01/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	N/A	N/A	N/A	N/A	N/A
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	018	01/19/2023	07/21/2023
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	023	01/19/2023	07/21/2023

LABORATORY TECHNICIAN:                     Brian Road

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

Dummy Serial Number: 031

Test Date: 07/17/2023

Technician: Brian Roach

- Pre test calibration  
X Post test calibration verification

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

- X 1. It has been at least 2 hours since the last head drop. (572.142(c)(5))  
    X N/A, ONLY one head drop performed
- X 2. The head assembly consists of the head (210-1000), adaptor plate (ATD 6259), accelerometer mounting block (SA572-S80) structural replacement of ½ mass of the neck load transducer (TE-107-001), head mounting washer (ATD 6262) one ½-20x1" flat head cap screw (9000150), and three (3) accelerometers (SA572-S4). (572.142(a))
- X 3. Accelerometers and their respective mounts are smooth and clean.
- X 4. The head accelerometer mounting plate screws (10-32 x 5/8 SHCS) are torqued to 10.2 Nm.
- X 5. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
- X 6. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.142(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>20.1°C</u> |
| Record the maximum humidity    | <u>43%</u>    |
| Record the minimum humidity    | <u>40%</u>    |
- X 7. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the low risk deployment test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
- X 8. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.142(c)(2))

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

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

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

X 11. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2032.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.142(c)(4))  
 Record actual micro finish: 24.8 micro inches

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

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

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

Parameter	Specification	Result
Peak resultant acceleration	$250 \text{ g} \leq x \leq 280 \text{ g}$	262 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-9.7 g

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

Brian Road  
 Signature

Date: 07/17/2023

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 3 YEAR OLD**

ATD Serial No: 031

Test ID: D231691

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Peak Resultant Acceleration	G's	250 to 280	262	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.7	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

*Brian Roach*

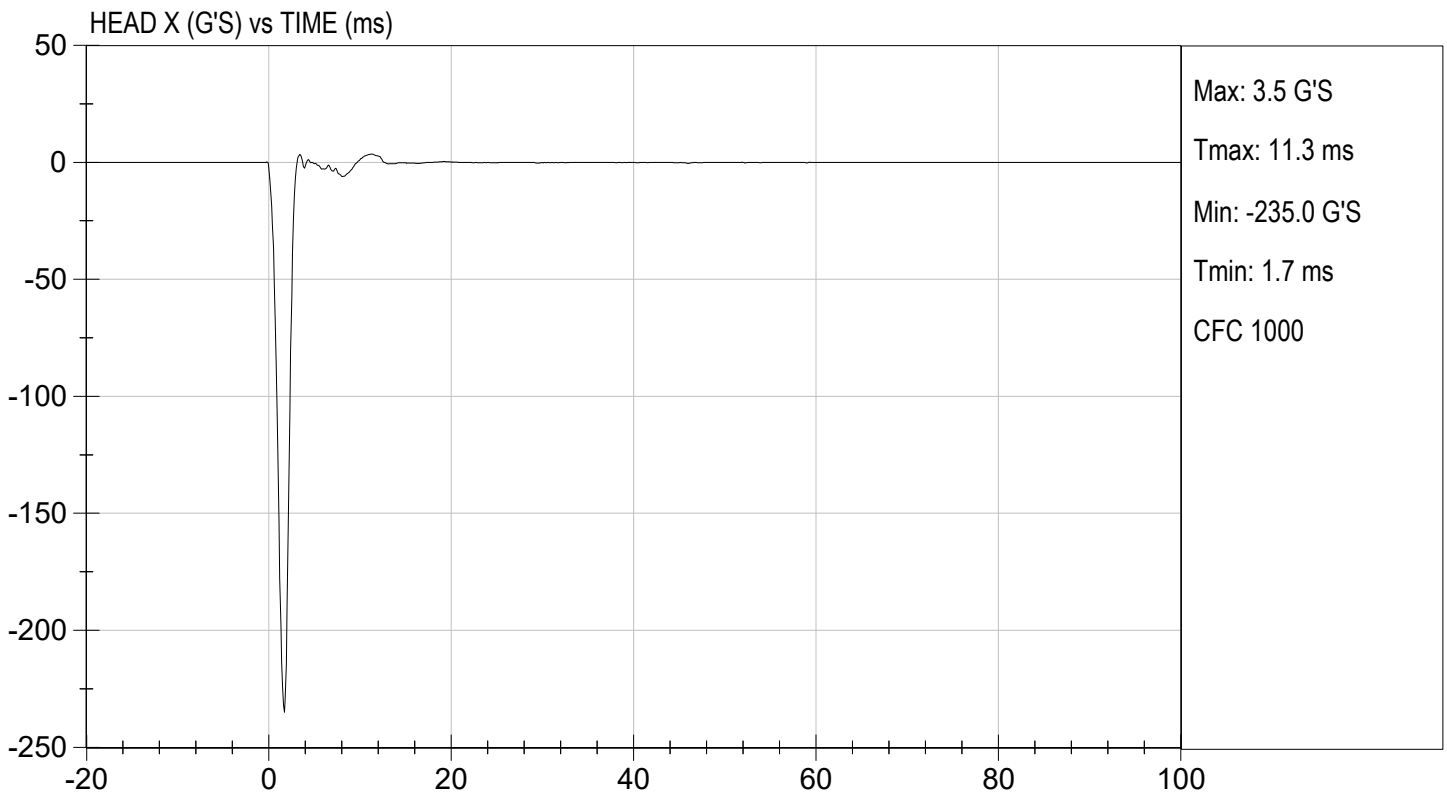
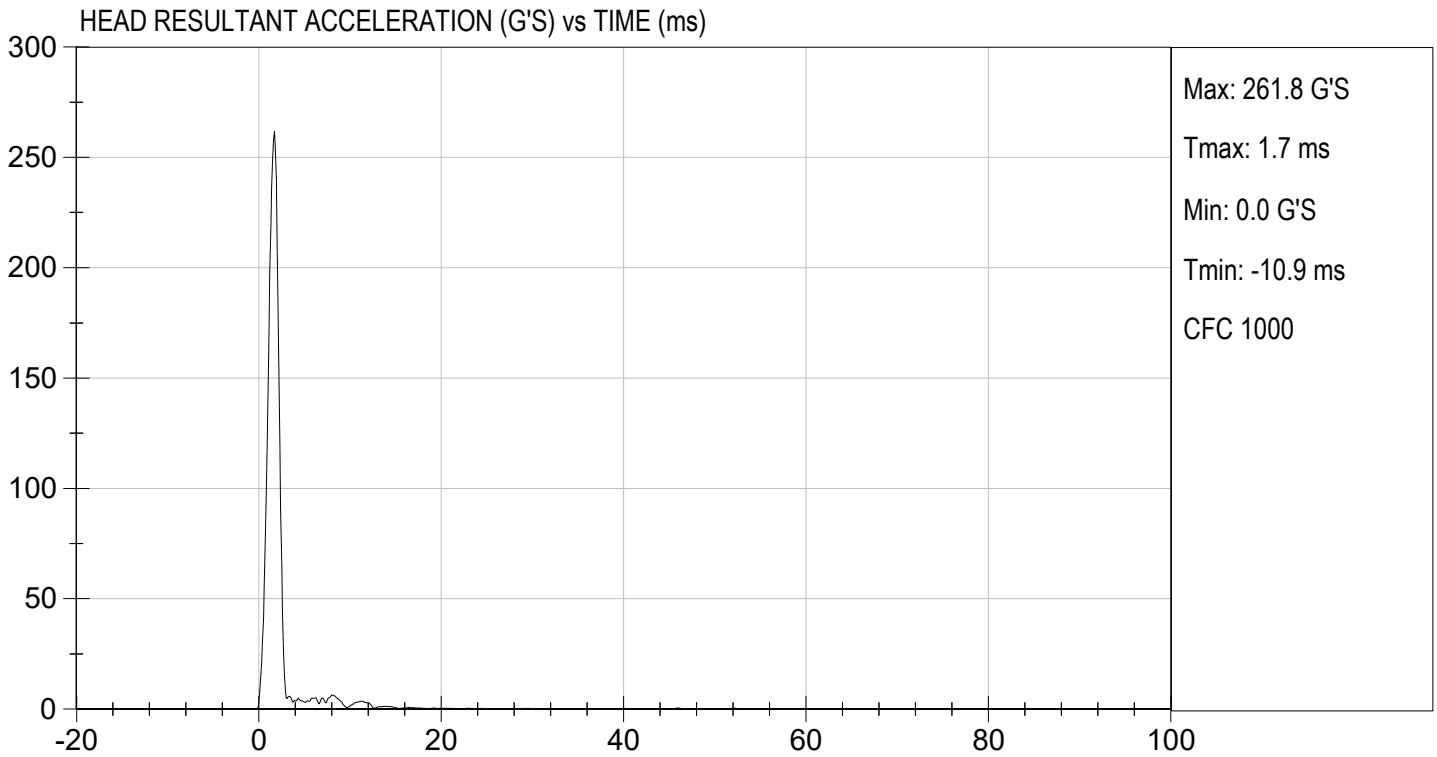
Laboratory Technician

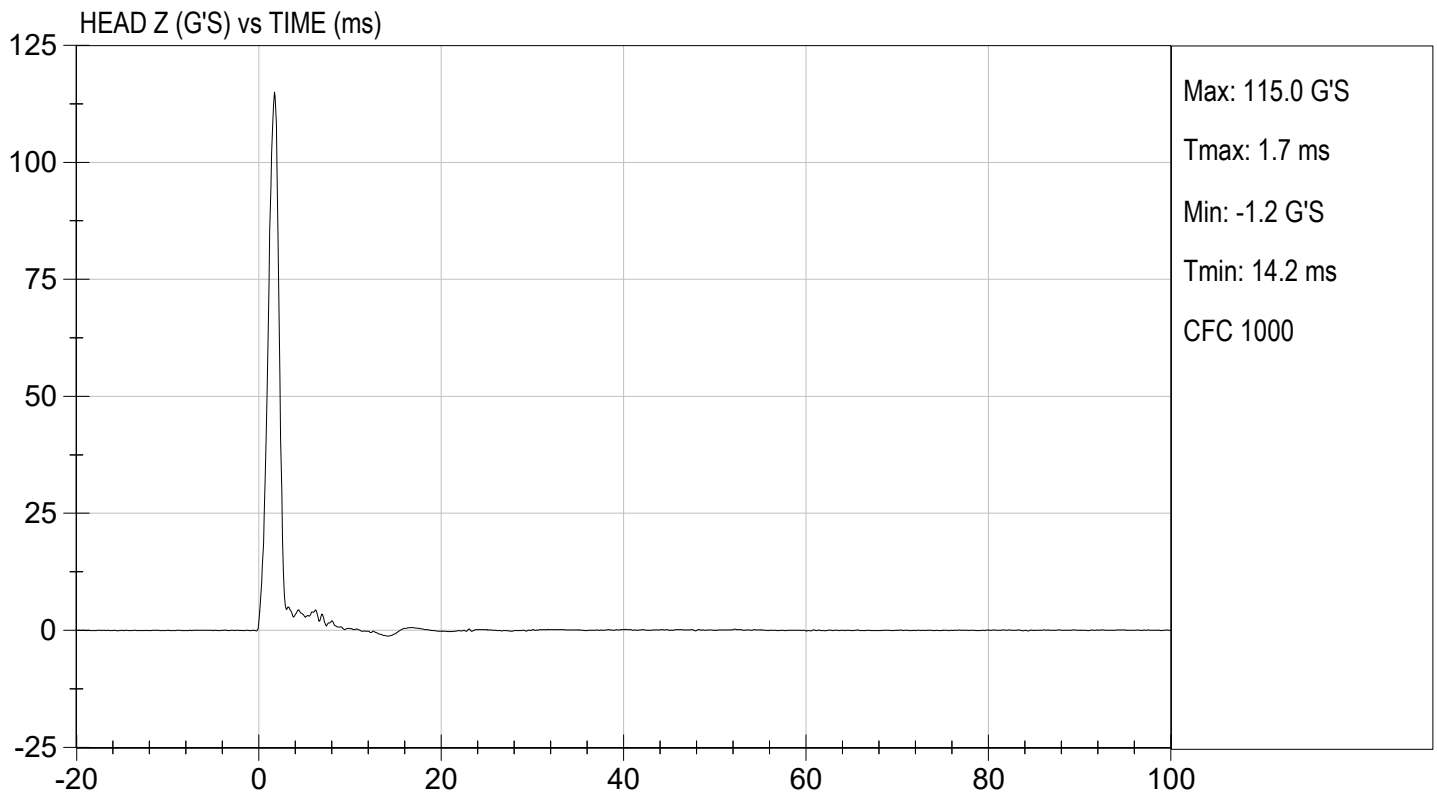
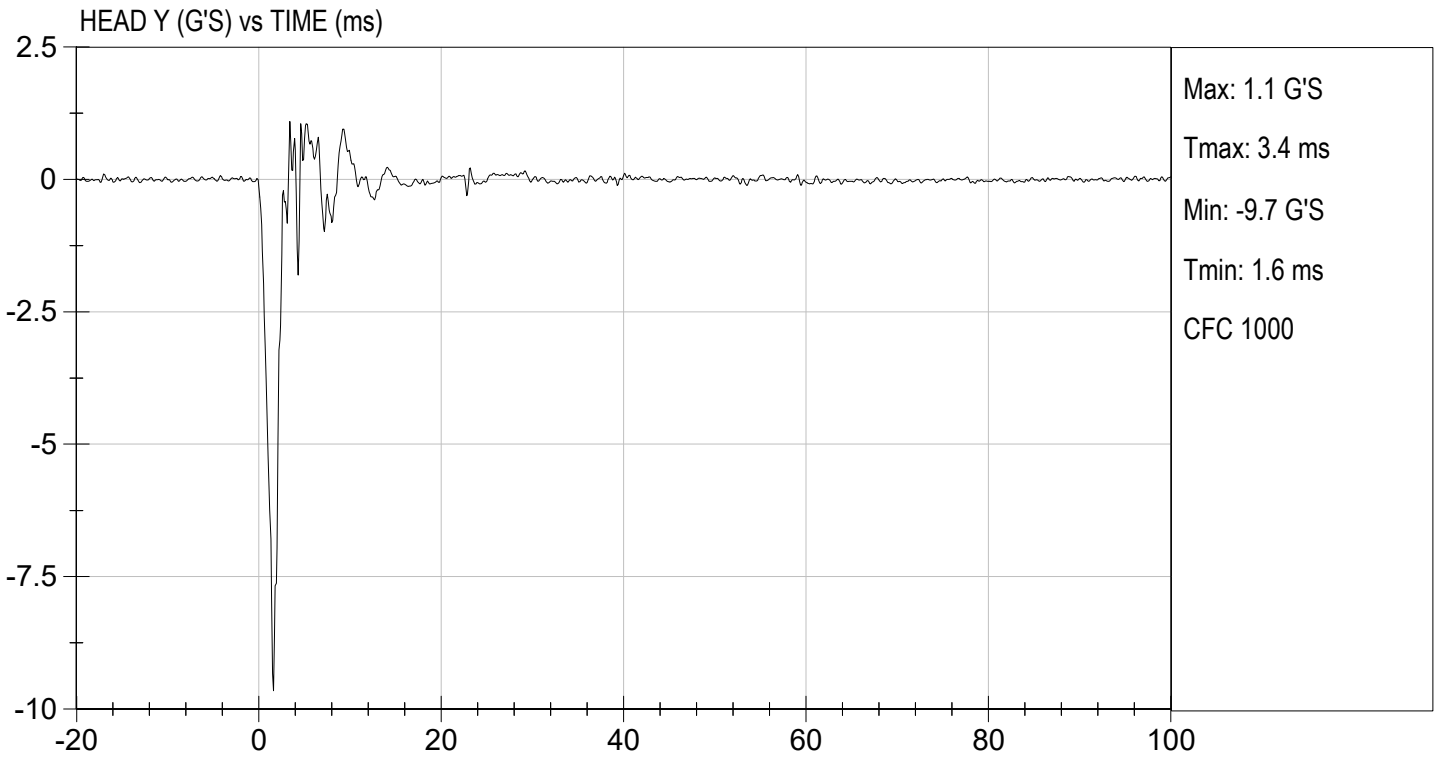
07/17/2023

Test Date

*Jose Salmeron*

Approved By





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

Dummy Serial Number: 031

Test Date: 07/14/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last neck test. (572.146(p))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.2°C</u> |
| Record the minimum temperature | <u>20.0°C</u> |
| Record the maximum humidity    | <u>47%</u>    |
| Record the minimum humidity    | <u>44%</u>    |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
7. The test fixture pendulum conforms to the specifications in Figure 8D.
8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 9D for the flexion test. (572.143(c)(3))
9. Install the transducers or other devices for measuring the "D" plane rotation with respect

to the pendulum longitudinal centerline. Note: Plane "D" is the top horizontal surface of the neck load cell. These measurement devices should be designed to minimize their influence upon the performance of the head-neck assembly.

- X 10. Plane D is perpendicular  $\pm 1$  degree to the centerline of the pendulum.
- X 11. Set the instrumentation so that the moment and rotation are defined to be zero when the longitudinal centerline of the neck and pendulum are parallel. (572.143(b)(1)(iii))
- X 12. Release the pendulum and allow it to fall freely from a height to achieve an impact speed of 5.4 m/s to 5.6 m/s as measured at the center of the pendulum accelerometer. (572.143(c)(4))
- X 13. Complete the following table:

Neck Flexion Test Results (572.143(b)(1)) & (572.143(c)(4)(ii))

Parameter	Specification	Result
Pendulum impact speed	5.4 m/s $\leq$ speed $\leq$ 5.6 m/s	5.40 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	2.0 m/s $\leq \Delta V \leq$ 2.7 m/s
	@ 15 ms	3.0 m/s $\leq \Delta V \leq$ 4.0 m/s
	@ 20 ms	4.0 m/s $\leq \Delta V \leq$ 5.1 m/s
Plane D Rotation	Peak moment* 42 Nm $\leq$ moment $\leq$ 53 Nm during the following rotation range 70° $\leq$ angle $\leq$ 82°	42.5 Nm @ 78 degrees
Positive Moment Decay** (Flexion)	Time to decay to 10 Nm 60 ms $\leq$ time $\leq$ 80 ms	70 ms

\*The moment is a direct reading from the load cell

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

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

Brian Roach  
Signature

07/14/2023  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

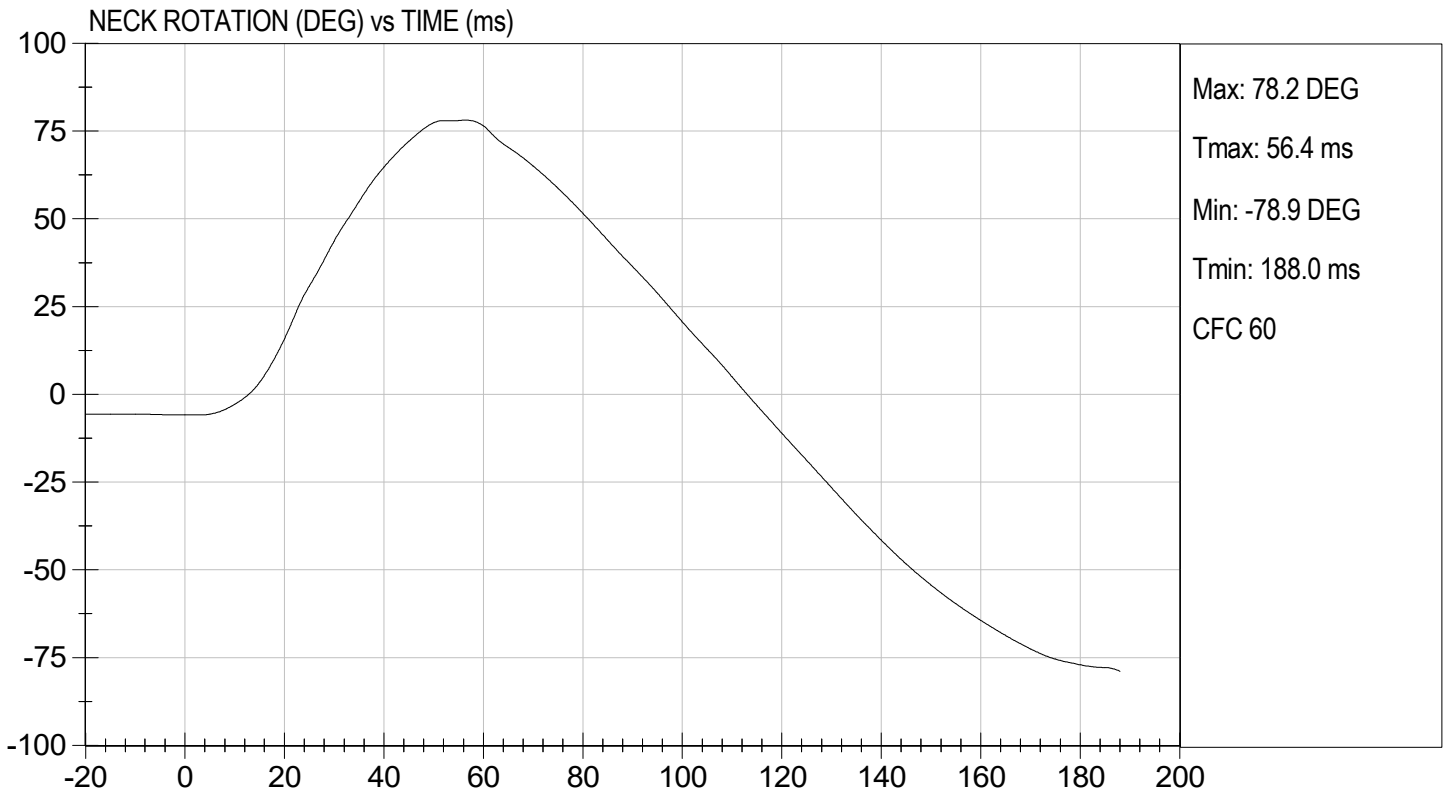
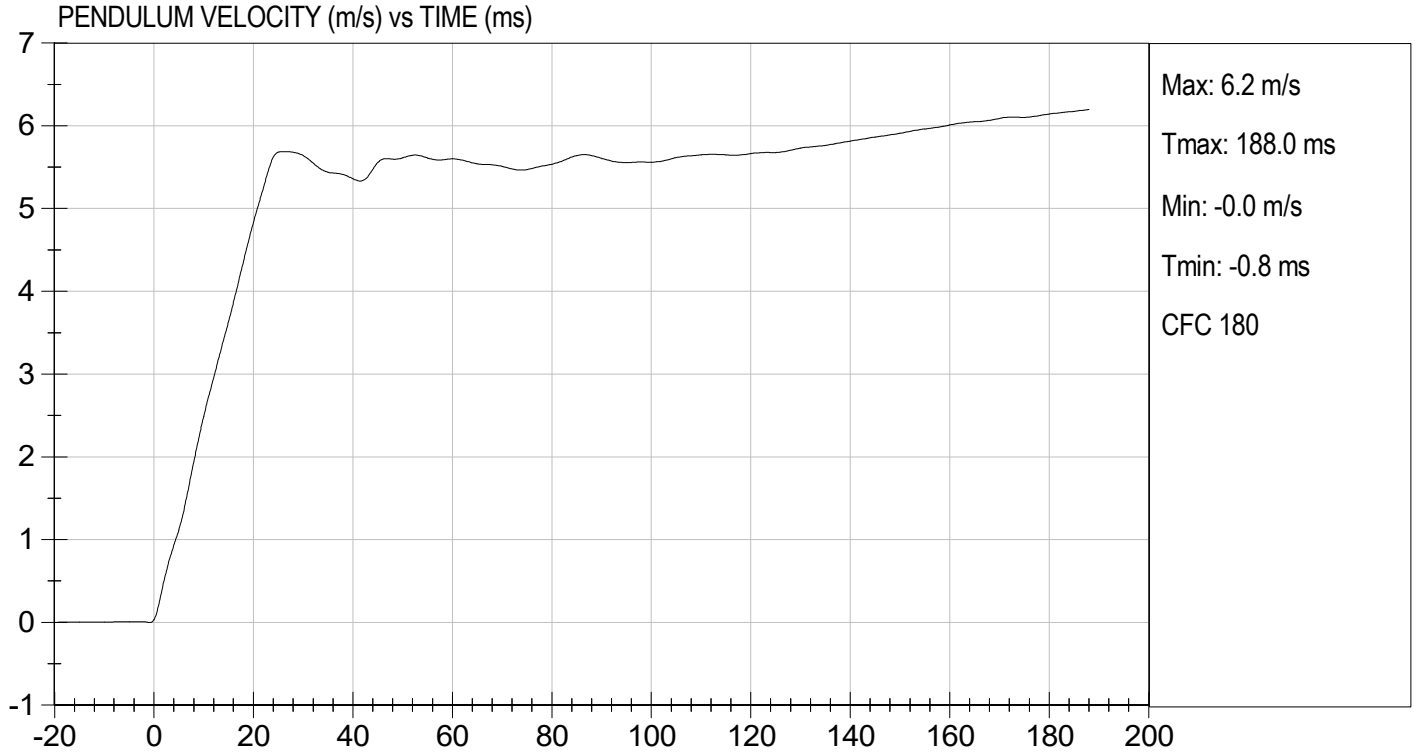
**Test I.D.:** D231692

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	47	Pass
Pendulum Speed		m/s	5.40 to 5.60	5.40	Pass
Pendulum Velocity	10 msec	m/s	2.0 to 2.7	2.5	Pass
	15 msec	m/s	3.0 to 4.0	3.6	Pass
	20 msec	m/s	4.0 to 5.1	4.8	Pass
D Plane Rotation		deg	70 to 82	78	Pass
Peak Moment within Deflection Corridor		Nm	42.0 to 53.0	42.5	Pass
Positive Moment - Time Curve Decay to 10 Nm		msec	60.0 to 80.0	70	Pass
Overall Test Results					Pass

Brian Roach  
Laboratory Technician

07/14/2023  
Test Date

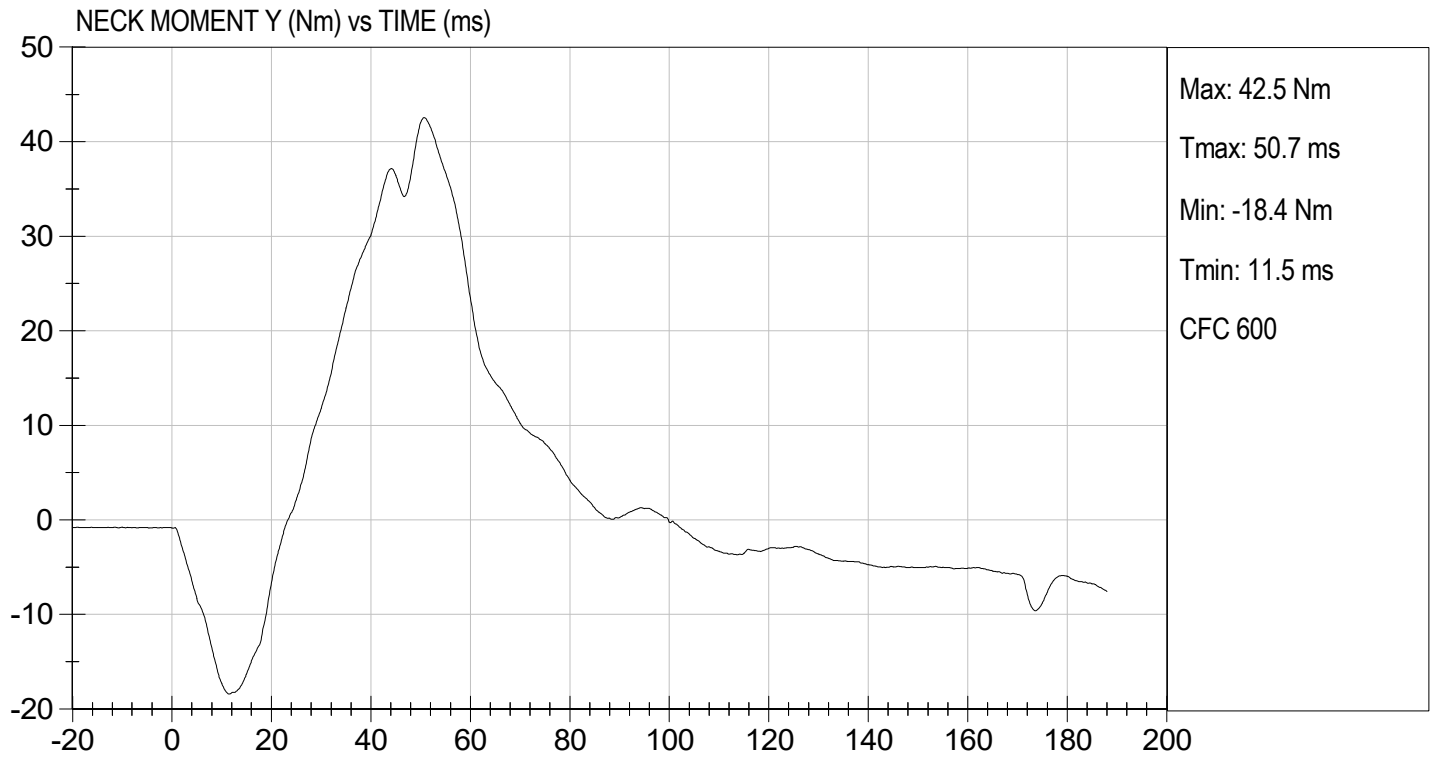
Jose Salmeron  
Approved By





TEST DESC: NECK FLEXION  
VELOCITY: 17.73 ft/s, 5.40 m/s

TEST DATE: 07/14/2023  
TEST #: D231692



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

Dummy Serial Number: 031

Test Date: 07/17/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last neck test. (572.146(p))  
 N/A, this is the first neck test performed
2. The components required for the neck tests include the neck molding assembly (210-2015), neck cable (210-2040), nylon shoulder bushing (9001373), upper mount plate insert (910420-048), bib simulator (TE-208-050), urethane washer (210-2050), neck mounting plate (TE-250-021), two jam nuts (9001336), load moment transducer (SA572-S19) and headform (TE-208-000). (572.143(a))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.143(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.2°C</u> |
| Record the minimum temperature | <u>20.0°C</u> |
| Record the maximum humidity    | <u>43%</u>    |
| Record the minimum humidity    | <u>40%</u>    |
4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the low risk deployment test, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
5. Torque the jam nut (9001336) on the neck cable (210-2040) between 0.2 Nm and 0.3 Nm. (572.143(c)(2))
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.146(l))
7. The test fixture pendulum conforms to the specifications in Figure 8D.
8. The head-neck assembly is mounted on the pendulum so the midsagittal plane of the headform is vertical and coincides with the plane of motion of the pendulum as shown in Figure 10D for the extension test. (572.143(c)(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	$3.55 \text{ m/s} \leq \text{speed} \leq 3.75 \text{ m/s}$	3.60 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 6 ms	$1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$
	@ 10 ms	$1.9 \text{ m/s} \leq \Delta V \leq 2.5 \text{ m/s}$
	@ 14 ms	$2.8 \text{ m/s} \leq \Delta V \leq 3.5 \text{ m/s}$
Plane D Rotation	Peak moment* $-53.3 \text{ Nm} \leq \text{moment} \leq -43.7 \text{ Nm}$ during the following rotation range $83 \leq \text{angle} \leq 93$	-43.8 Nm @ 89 degrees
Negative Moment Decay** (Extension)	Time to decay to -10 Nm $60 \text{ ms} \leq \text{time} \leq 80 \text{ ms}$	71 ms

\*The moment is a direct reading from the load cell

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

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

Brian Roach  
Signature

07/17/2023  
Date

**MGA RESEARCH CORPORATION  
NECK EXTENSION TEST  
HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D.:** D231693

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity		%	10 to 70	43	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.60	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.4	Pass
	10 ms	m/s	1.9 to 2.5	2.5	Pass
	14 ms	m/s	2.8 to 3.5	3.4	Pass
D Plane Rotation		deg	83 to 93	89	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-43.8	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	71	Pass
<b>Overall Test Results</b>					<b>Pass</b>

*Brian Roach*

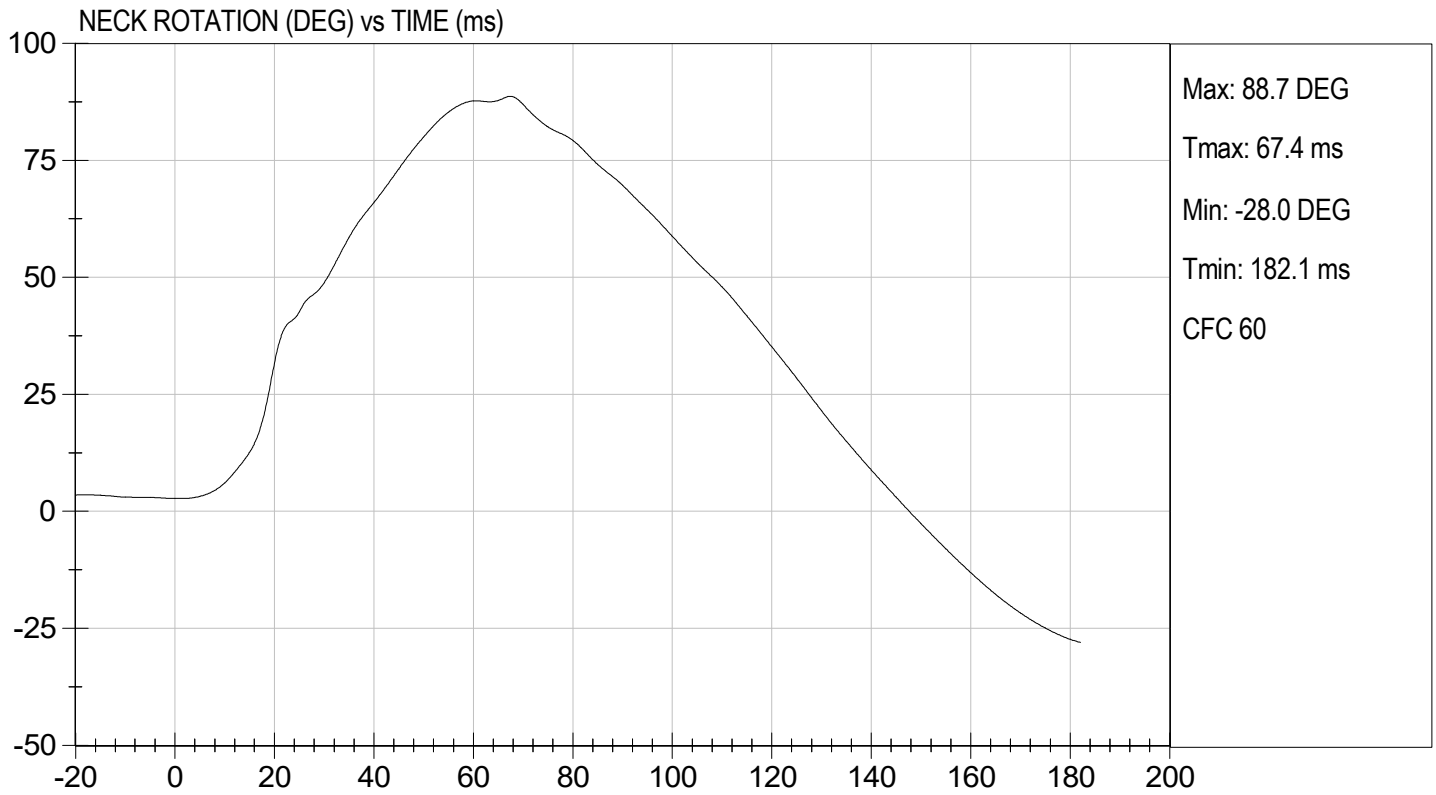
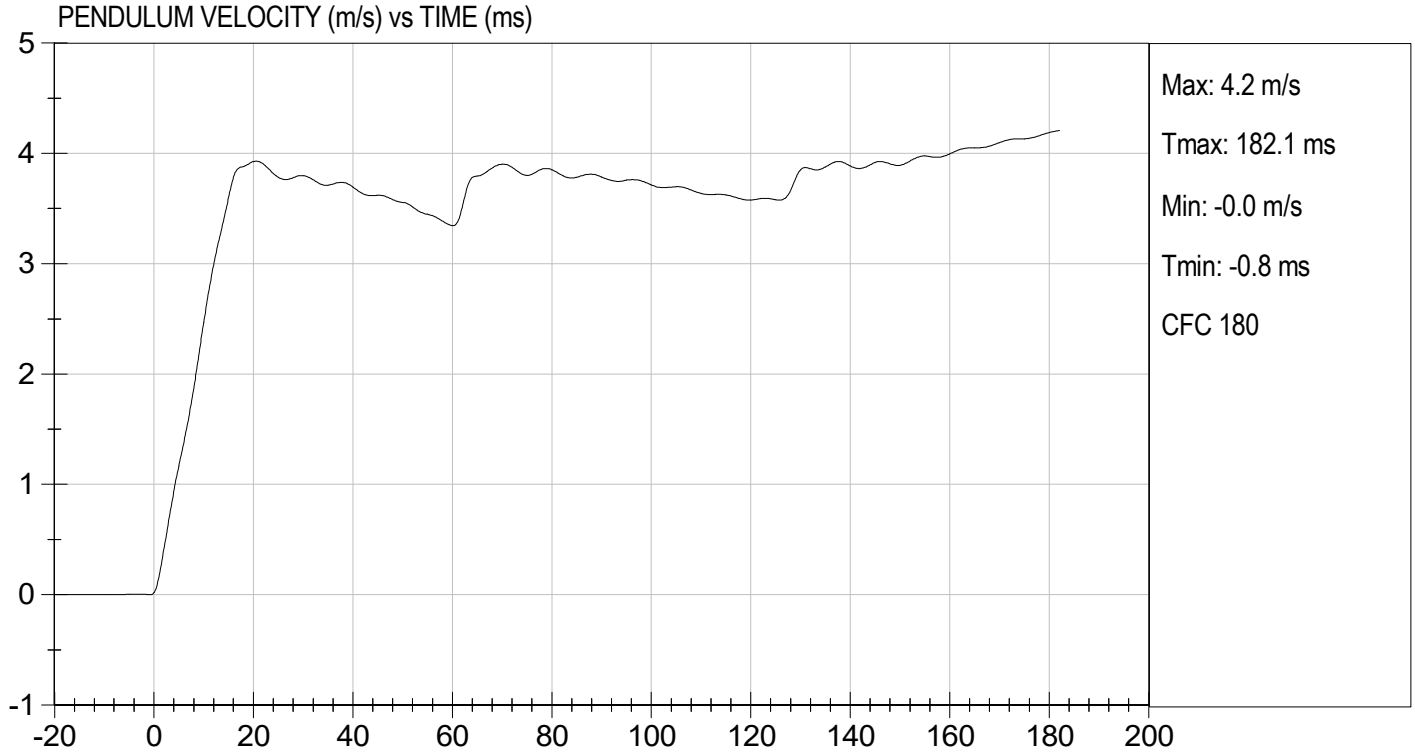
Laboratory Technician

07/17/2023

Test Date

*Jose Galvez*

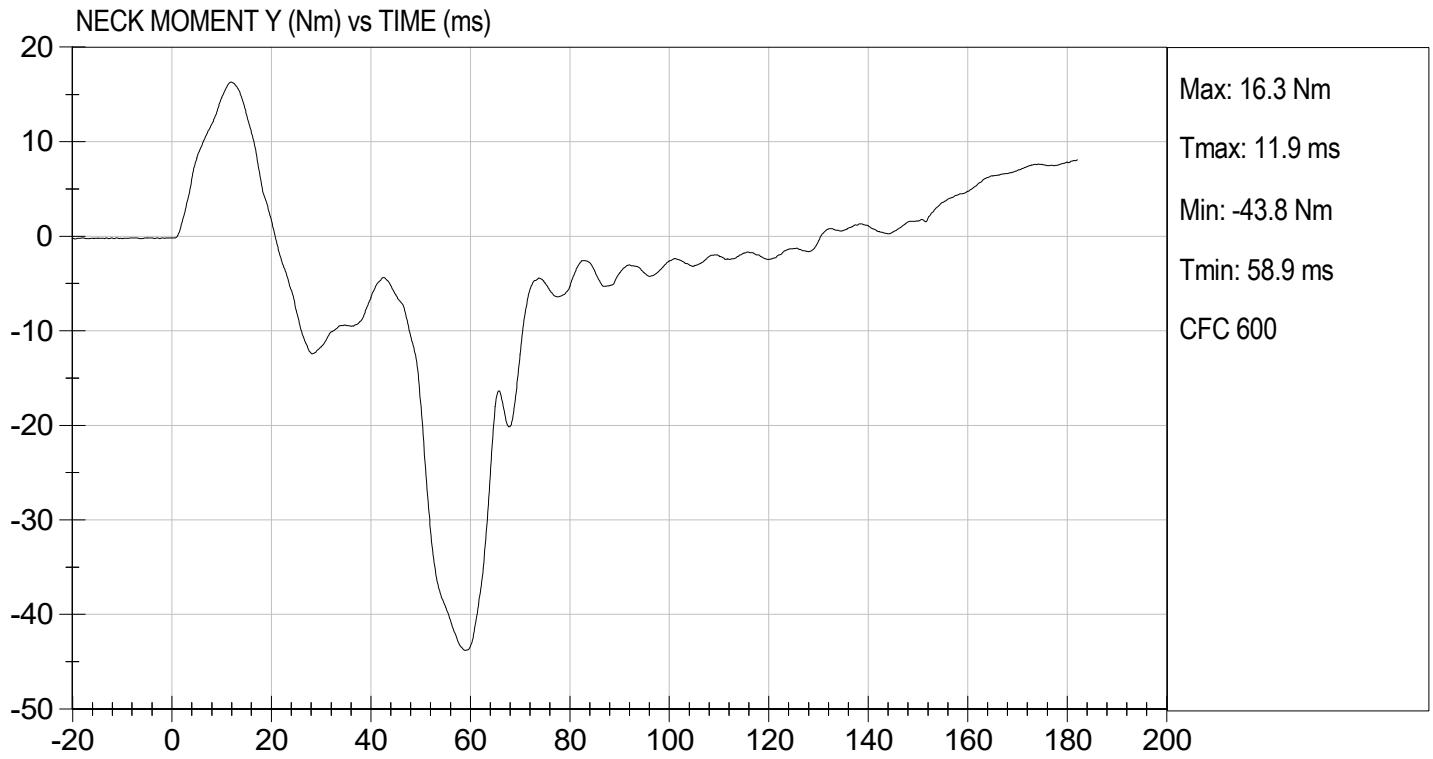
Approved By





TEST DESC: NECK EXTENSION  
VELOCITY: 11.82 ft/s, 3.60 m/s

TEST DATE: 07/17/2023  
TEST #: D231693



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

Dummy Serial Number: 031

Test Date: 07/17/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last thorax impact test. (572.146(p))  
 N/A, ONLY one thorax impact test performed
2. The test fixture conforms to the specifications in Figure 11D.
3. The complete assembled dummy (210-0000) is used (572.144(b)) and is dressed in cotton-polyester-based tight-fitting long sleeved shirt and ankle length pants. The weight of the shirt and pants shall not exceed 0.25 kg. (572.144(c)(1))
4. The dummy assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.144(c)(2))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>22.2°C</u> |
| Record the minimum temperature | <u>20.0°C</u> |
| Record the maximum humidity    | <u>42%</u>    |
| Record the minimum humidity    | <u>39%</u>    |
5. Remove the arms.
6. Unzip the 3 zippers and fold down the chest jacket. Visually inspect the thorax assembly for cracks, cuts, abrasions, etc. Particular attention should be given to the rib damping material, chest displacement transducer assembly and the rear rib supports. Inspect for rib deformation using the chest depth gage. If any damage is noted repair and/or replace the damaged components unless the damage resulted from the vehicle crash test in which the dummy was an occupant in which case the damage must be documented and post test calibration verification testing completed before any repairs or replacements are made.
- Record findings and actions:
- No damage
- Damage from crash test, no repairs or replacement because this is a post test calibration verification. Record damage.
- 
- The following repairs or replacement was performed. Record damage.
- 

7. Seat the dummy, without back and arm supports on the test fixture surface as shown in

Figure 11D. The surface must be long enough to support the pelvis and outstretched legs. (572.144(c)(3))

- X 8. Level the middle rib both longitudinally and laterally  $\pm 0.5^\circ$ . (572.144(c)(3))
- X 9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.144(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is centered on the center of the No. 2 rib within  $\pm 2.5$  mm within  $\pm 0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.144(c)(4))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to the laboratory coordinate system. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is rolled up and zipped, and the arms installed. The reference locations must be accessible after the chest skin is rolled up and the arms installed. It will be necessary to leave the chest skin zipper unfastened until the references are checked and then fasten it just prior to the test.
- X 12. Install the chest skin and arms, and reposition the dummy using the reference measurements recorded.
- X 13. Place the upper arms parallel to the torso. Place the lower arms horizontal and forward and parallel to the midsagittal plane. (572.144(c)(3))
- X 14. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.146(l)).
- X 15. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.144(c)(5)) The velocity of the test probe at the time of impact is between 5.9 m/s and 6.1 m/s. (572.144(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.144(c)(6)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.144(c)(7))

X 16. Complete the following table:

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

Parameter*	Specification	Result
Test Probe Speed	$5.9 \text{ m/s} \leq \text{speed} \leq 6.1 \text{ m/s}$	5.98 m/s
Chest Compression	$32 \text{ mm} \leq \text{compression} \leq 38 \text{ mm}$	33.4 mm
Peak force** between 32 and 38 mm chest compression	$680 \text{ N} \leq \text{peak force} \leq 810 \text{ N}$	742 N
Peak force** between 12.5 and 32.0 mm chest compression	Peak force $\leq 910 \text{ N}$	756 N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	70.0%

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

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

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

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

Brian Roach  
Signature

07/17/2023  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT TEST**  
**HYBRID III 3 YEAR OLD**

ATD Serial No: 031

Test I.D: D231694

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	42	Pass
Probe Velocity	m/s	5.9 to 6.1	5.98	Pass
Peak Deflection	mm	32 to 38	33.4	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	742	Pass
Internal Hysteresis	%	65 to 85	70.0	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	756	Pass
Overall Test Results				Pass

*Brian Rood*

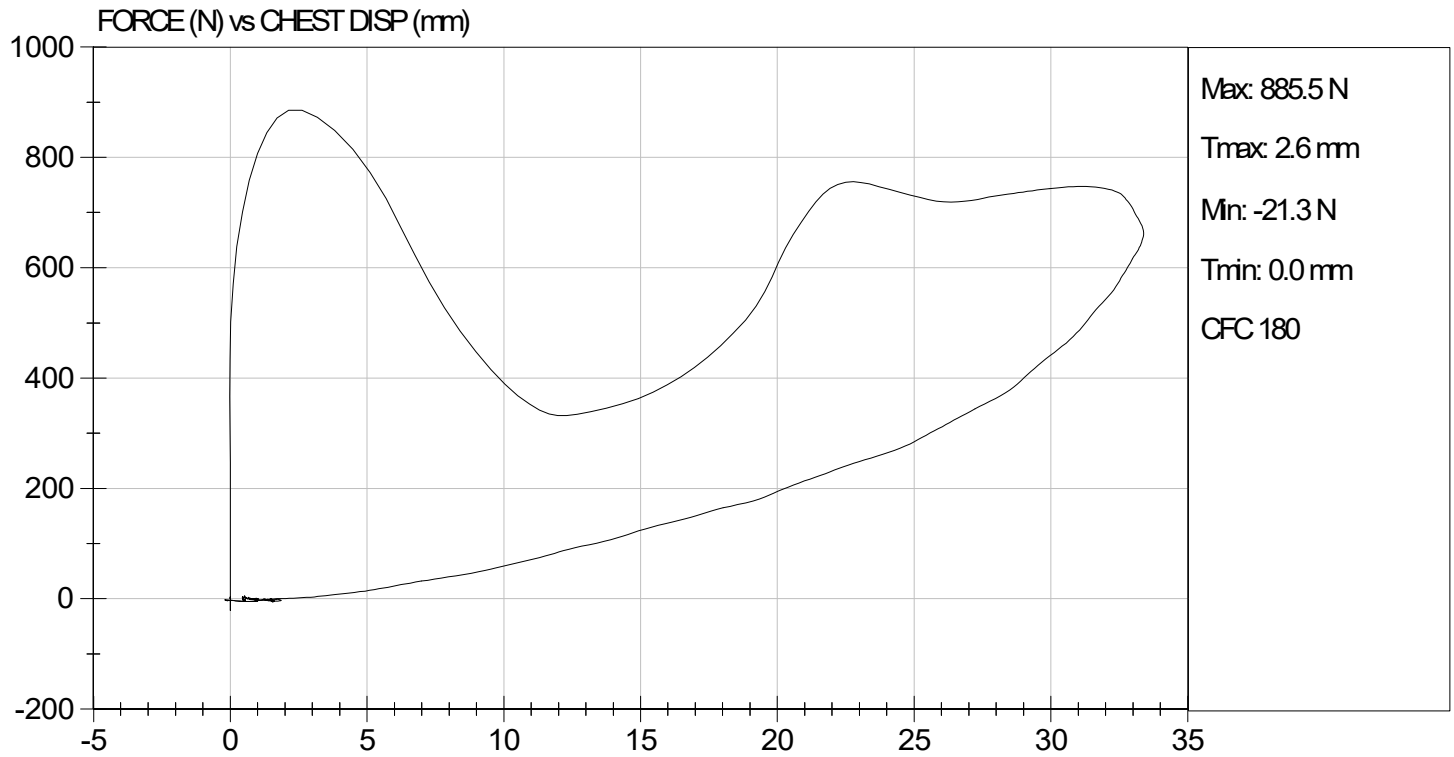
Laboratory Technician

07/17/2023

Test Date

*Jose Galvez*

Approved By



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

Dummy Serial Number: 031

Test Date: 07/17/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.146(p))  
 N/A, ONLY torso flexion test performed
2. The test fixture conforms to the specifications in Figure 13D.
3. The complete assembled dummy (210-0000) is used with or without the lower legs. (572.145(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.145(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>20.1°C</u> |
| Record the maximum humidity    | <u>43%</u>    |
| Record the minimum humidity    | <u>40%</u>    |
5. Unzip the torso jacket and remove the lumbar load transducer or its structural replacement from the dummy. Attach the rigid pelvis attachment fixture to the lumbar spine. (572.145(c)(2)(i)&(ii))
6. Secure the fixture to the table so that the pelvis-lumbar joining surface is horizontal within  $\pm 1^\circ$  and the buttocks and upper legs of the seated dummy are in contact with the test surface. (572.145(c)(2)(iii))
7. Attach the loading adapter bracket to the upper part of the torso as shown in Figure 13D and zip up the torso jacket. (572.145(c)(2)(iv))
8. Place the upper arms parallel to the torso and the lower arms extended horizontally and forward, parallel to the midsagittal plane. (572.145(c)(2)(v))
9. Flex the dummy forward and back 3 times such that the angle of the torso reference

plane moves between  $0^\circ$  and  $30^\circ \pm 2^\circ$ . The torso reference plane is defined by the transverse plane tangent to the posterior surface of the upper backplate of the spine box weldment (210-8020). (572.145(c)(3)(i))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle $\leq 15^\circ$	$9^\circ$
Torso rotation rate	$0.5^\circ/s \leq \text{rate} \leq 1.5^\circ/s$	$0.8^\circ/s$
Force at $45^\circ \pm 0.5^\circ$	$130 \text{ N} \leq \text{force} \leq 180 \text{ N}$	170 N
Final ref. plane angle	Initial ref. plane angle $\pm 10^\circ$	$4^\circ$

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

Brian Road  
Signature

07/17/2023  
Date

**MGA RESEARCH CORPORATION**

**TORSO FLEXION TEST**

**HYBRID III 3 YEAR OLD**

**ATD Serial No:** 031

**Test I.D:** D231697

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	43	Pass
Initial Angle	deg	0 to 15	9	Pass
Return Angle	deg	-10 to 10	4	Pass
Force at 45 deg	N	130 to 180	170	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.8	Pass
<b>Overall Test Results</b>				<b>Pass</b>

*Brian Roach*

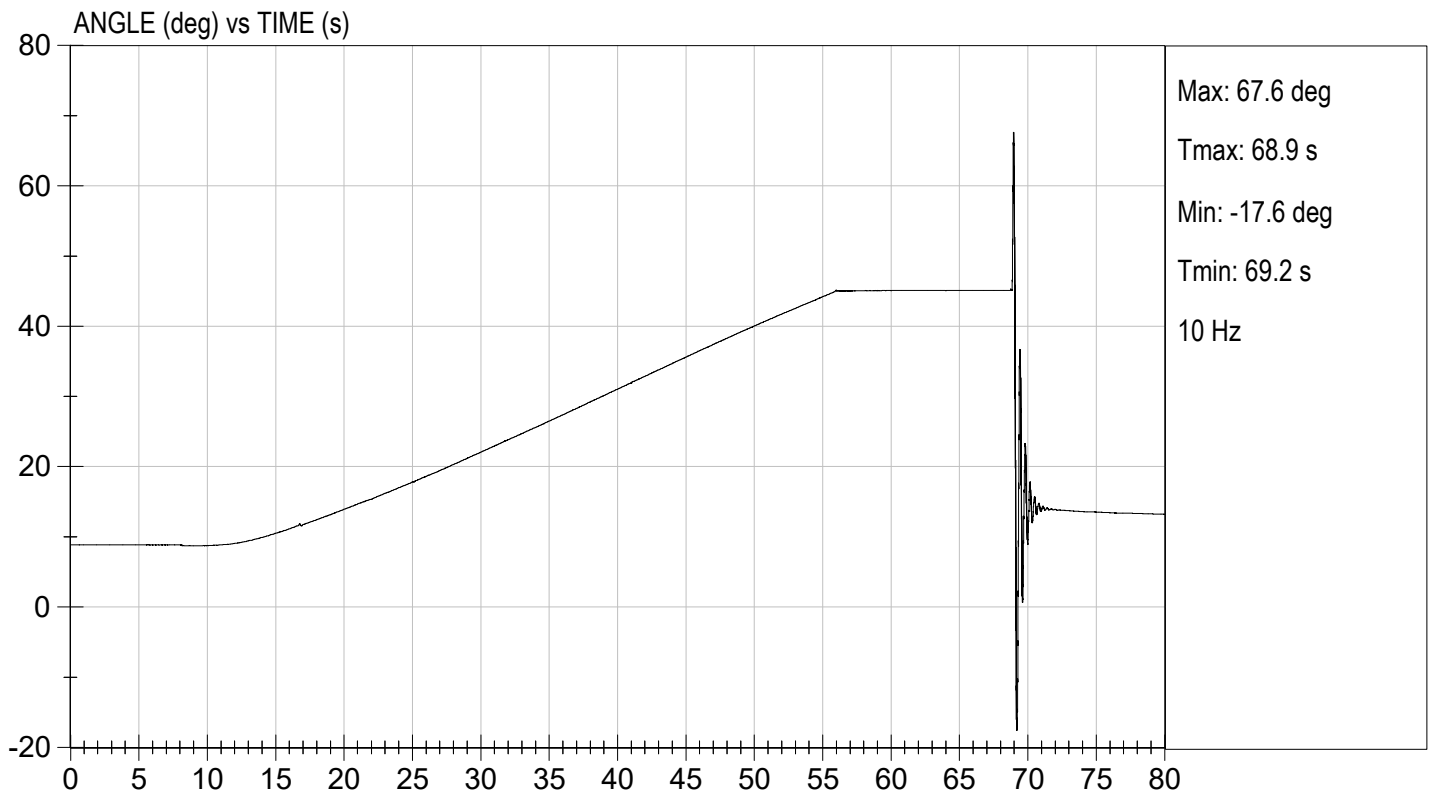
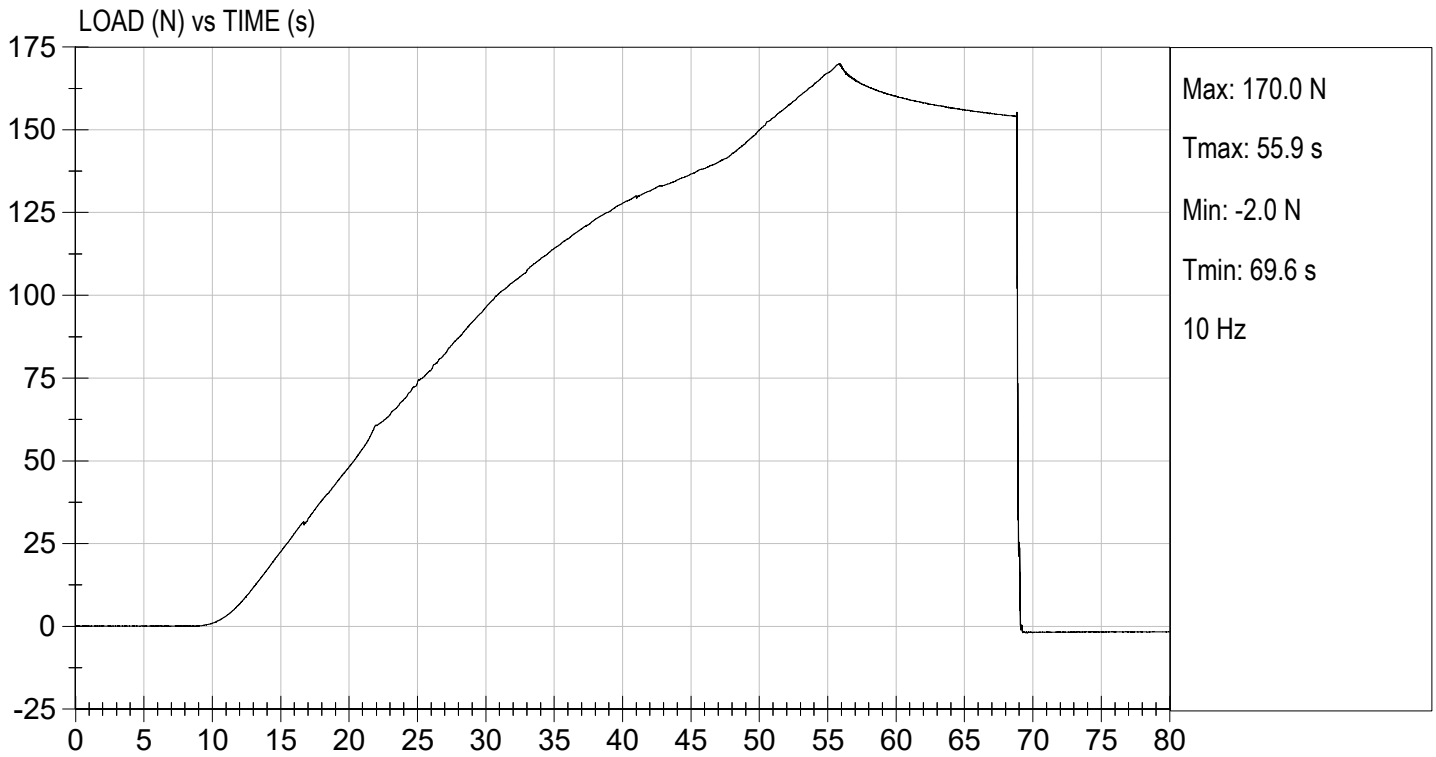
Laboratory Technician

07/17/2023

Test Date

*Jose Galvez*

Approved By



**DATA SHEET D8**  
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P85701	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-2-360M17	P88338	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264CM47-2KTZ-360	T26458	05/24/2023	11/23/2023
NECK TRANSDUCER	Denton	3303	N184	05/05/2023	11/04/2023
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264CM47-2KTZ-360	T18417	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	T22265	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	T24803	05/24/2023	11/23/2023
CHEST POTENTIOMETER	Humanetics	210-80150	031	05/31/2023	11/30/2023
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	C13081	05/02/2023	11/01/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	N/A	N/A	N/A	N/A	N/A
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Servo	14CBI-2897	4707	02/10/2023	08/12/2023
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Servo	14CBI-2897	7297	02/10/2023	08/12/2023

LABORATORY TECHNICIAN: Brian Road

**DATA SHEET D1**  
**DUMMY DAMAGE CHECKLIST (3 YEAR-OLD)**

Dummy Serial Number: 031

Test Date: 07/17/2023

Technician: Brian Roach

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

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:

Brian Road  
Signature

07/17/2023  
Date

Describe the repair or replacement of parts:

Checked by:

Joe Galvez  
Signature

07/17/2023  
Date

## EXTERNAL DIMENSIONS

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

HYBRID III 6 year-old SN #155, PART 572, SUBPART N EXTERNAL DIMENSIONS, continued

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

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

Dummy Serial Number: 155

Test Date: 05/30/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 2 hours since the last head drop. (572.122(c)(5))  
 N/A, ONLY one head drop performed
2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
4. Accelerometers and their respective mounts are smooth and clean.
5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>35%</u>    |
| Record the minimum humidity    | <u>28%</u>    |
8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No Damage
9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

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

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

X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))  
 Record the right side distance: 501 mm  
 Record the left side distance: 501 mm

X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2155.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.122(c)(4))  
 Record actual micro finish: 24.8 micro inches

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

X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))  
 Record thickness: 50.9 mm  
 Record width: 604 mm  
 Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$245 \text{ g} \leq x \leq 300 \text{ g}$	262 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-2.9 g

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

Brian Road  
 Signature

05/30/2023  
 Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 6 YEAR OLD**

ATD Serial No: 155

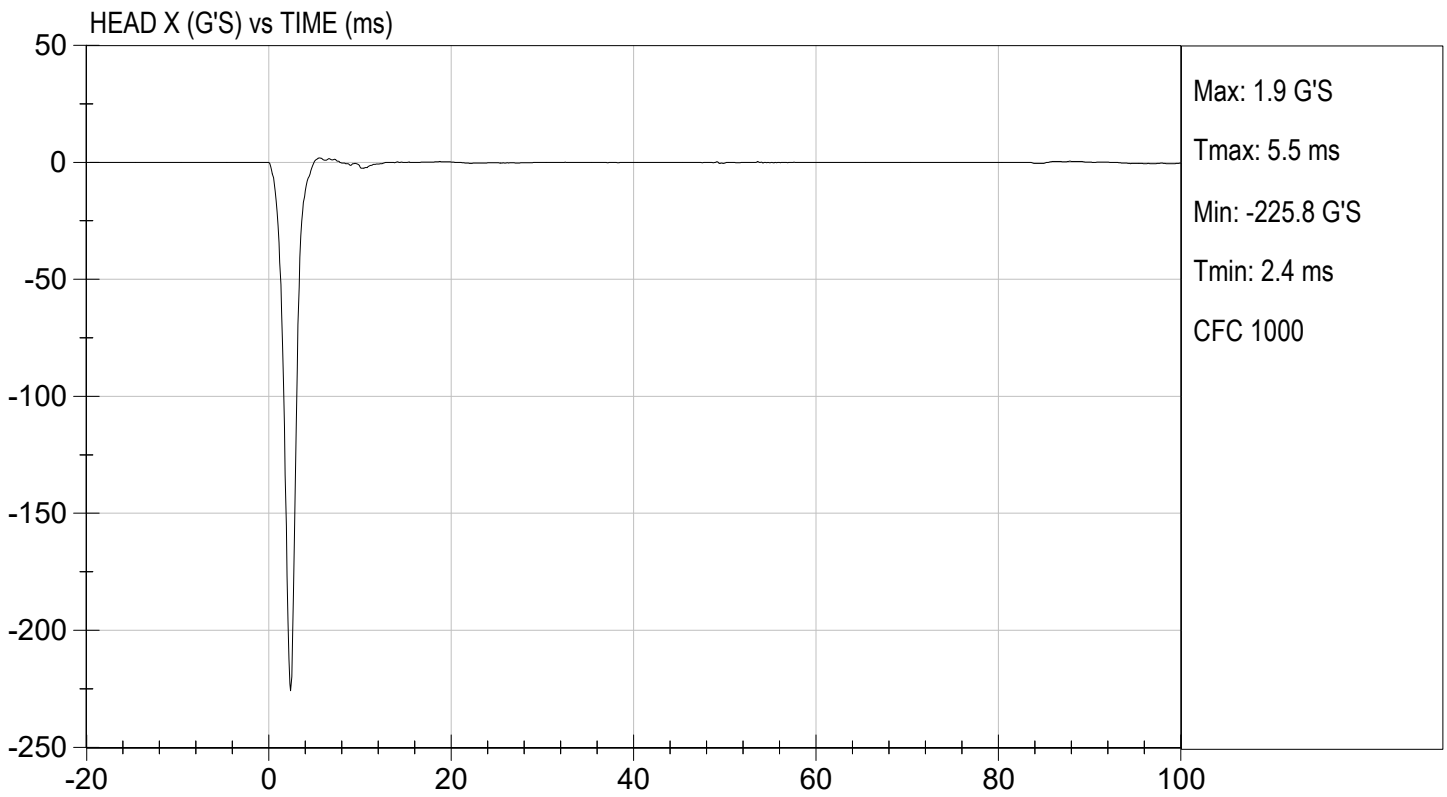
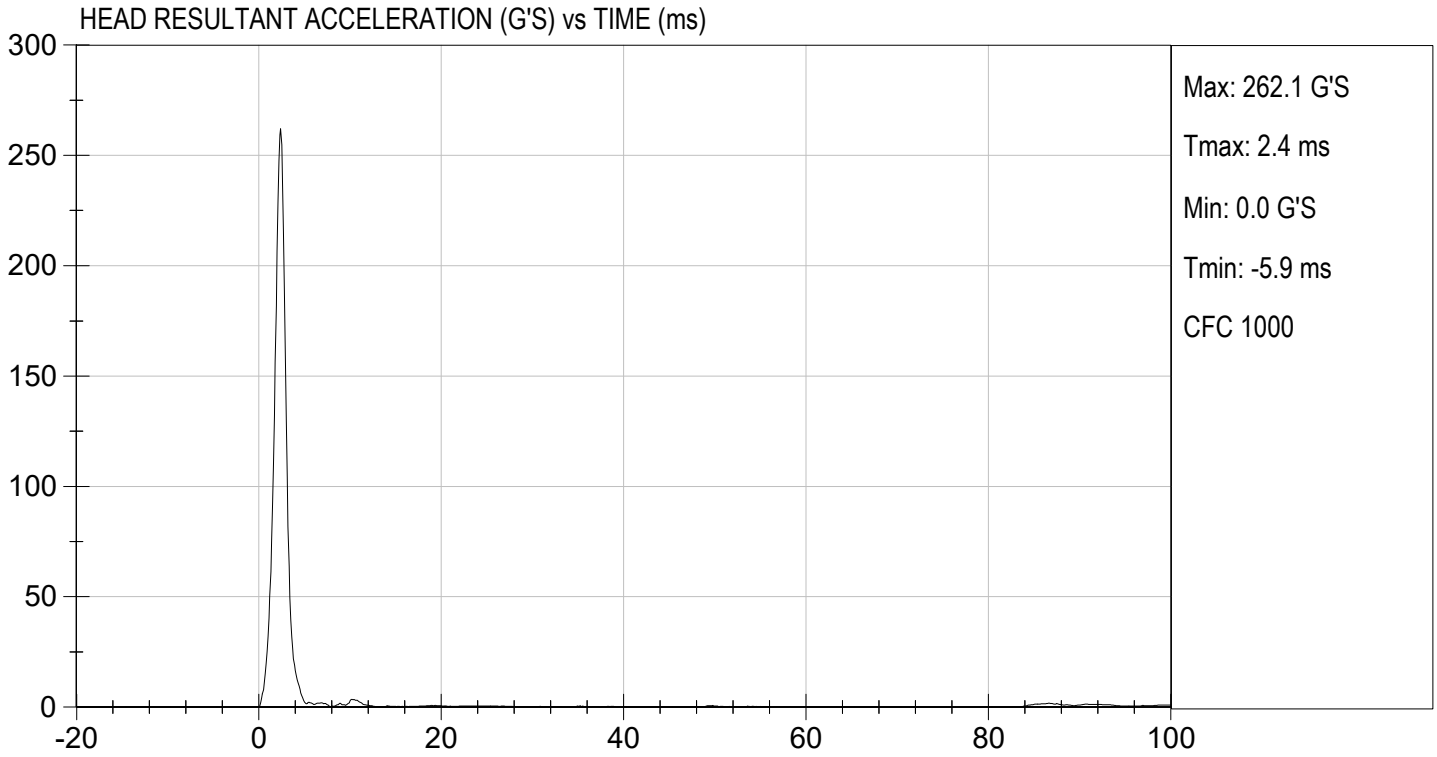
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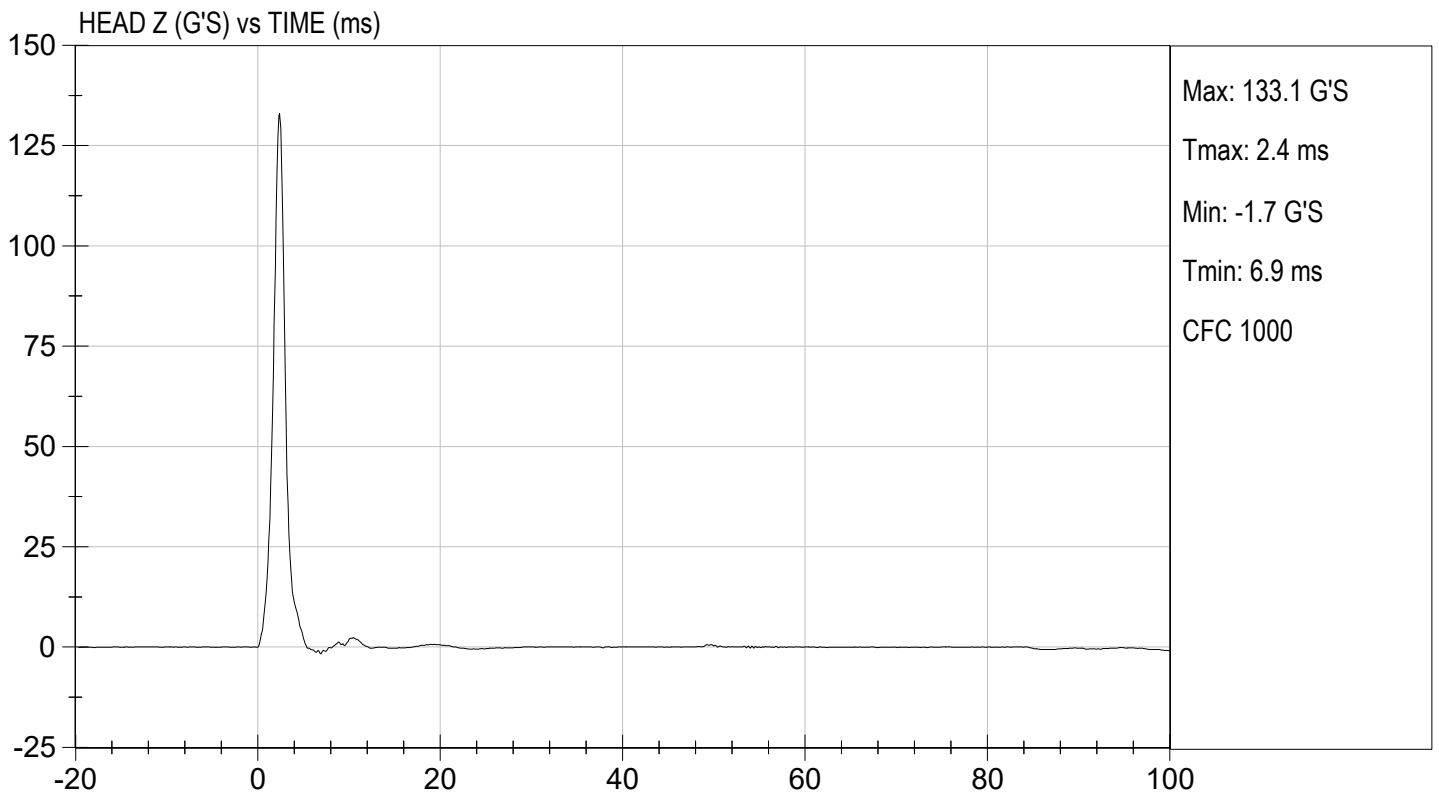
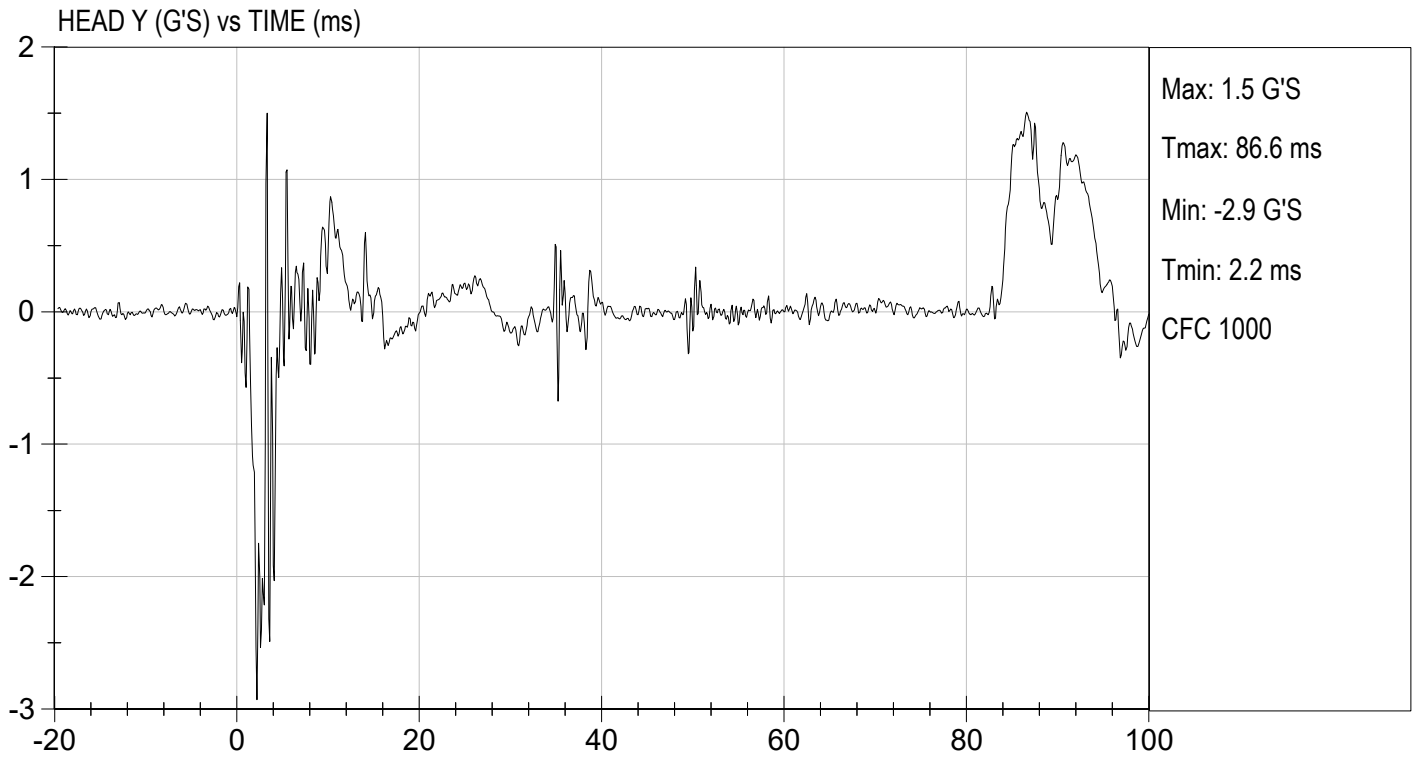
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	35	Pass
Peak Resultant Acceleration	G's	245 to 300	262	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.9	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Brian Roach  
 Laboratory Technician

05/30/2023  
 Test Date

Jose Galvez  
 Approved By





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

Dummy Serial Number: 155

Test Date: 05/30/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last neck test. (572.127(o))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>35%</u>    |
| Record the minimum humidity    | <u>28%</u>    |
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
5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage
6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123I(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	4.83 m/s $\leq$ speed $\leq$ 5.07 m/s	4.84 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	1.2 m/s $\leq \Delta V \leq$ 1.6 m/s
	@ 20 ms	2.4 m/s $\leq \Delta V \leq$ 3.4 m/s
	@ 30 ms	3.8 m/s $\leq \Delta V \leq$ 5.0 m/s
Plane D Rotation	Peak moment* 27 Nm $\leq$ moment $\leq$ 33 Nm during the following rotation range 74° $\leq$ angle $\leq$ 92°	30 Nm @ 79 degrees
Positive Moment Decay** (Flexion)	Time to decay to 5 Nm 103 ms $\leq$ time $\leq$ 123 ms	111 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  Brian Road    
Signature

  05/30/2023    
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

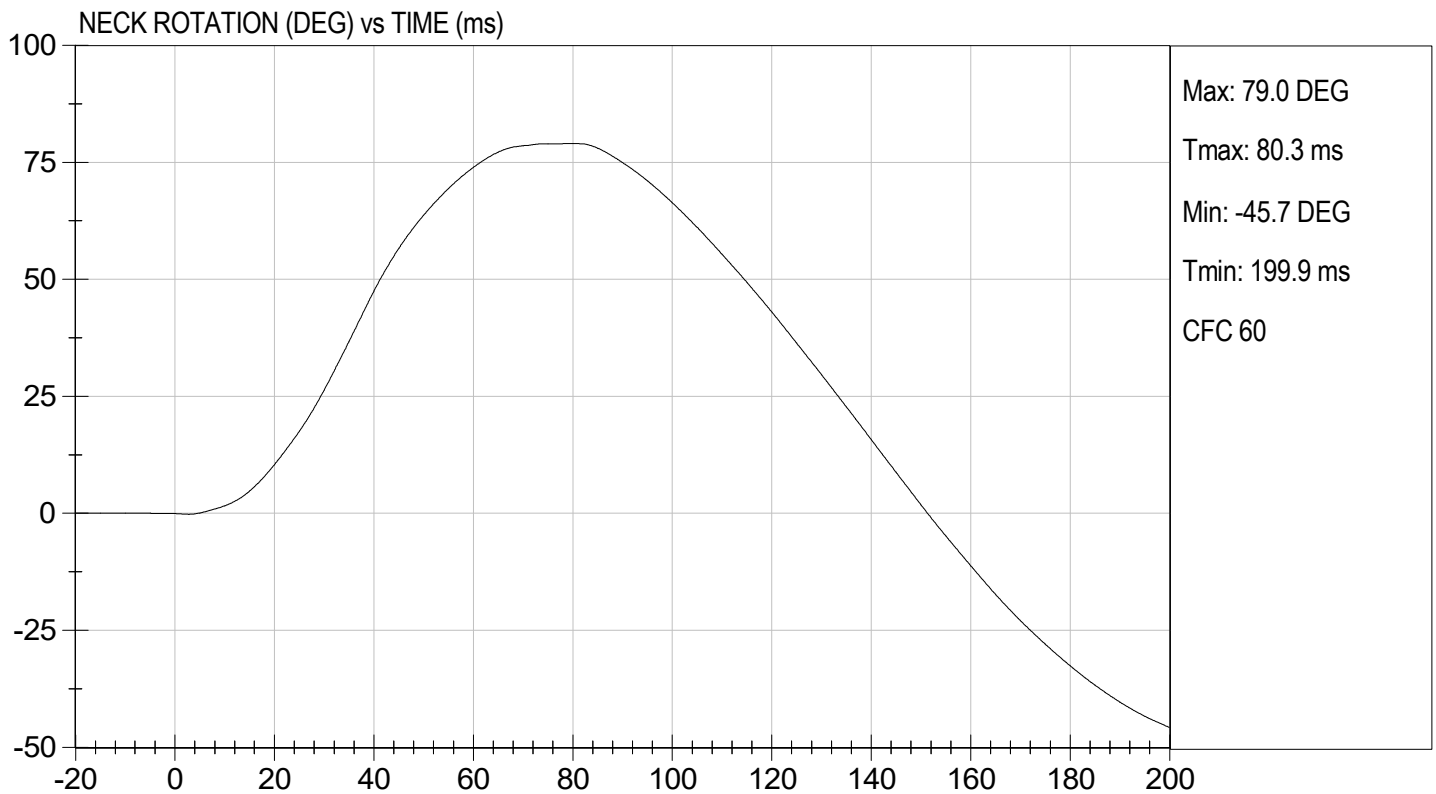
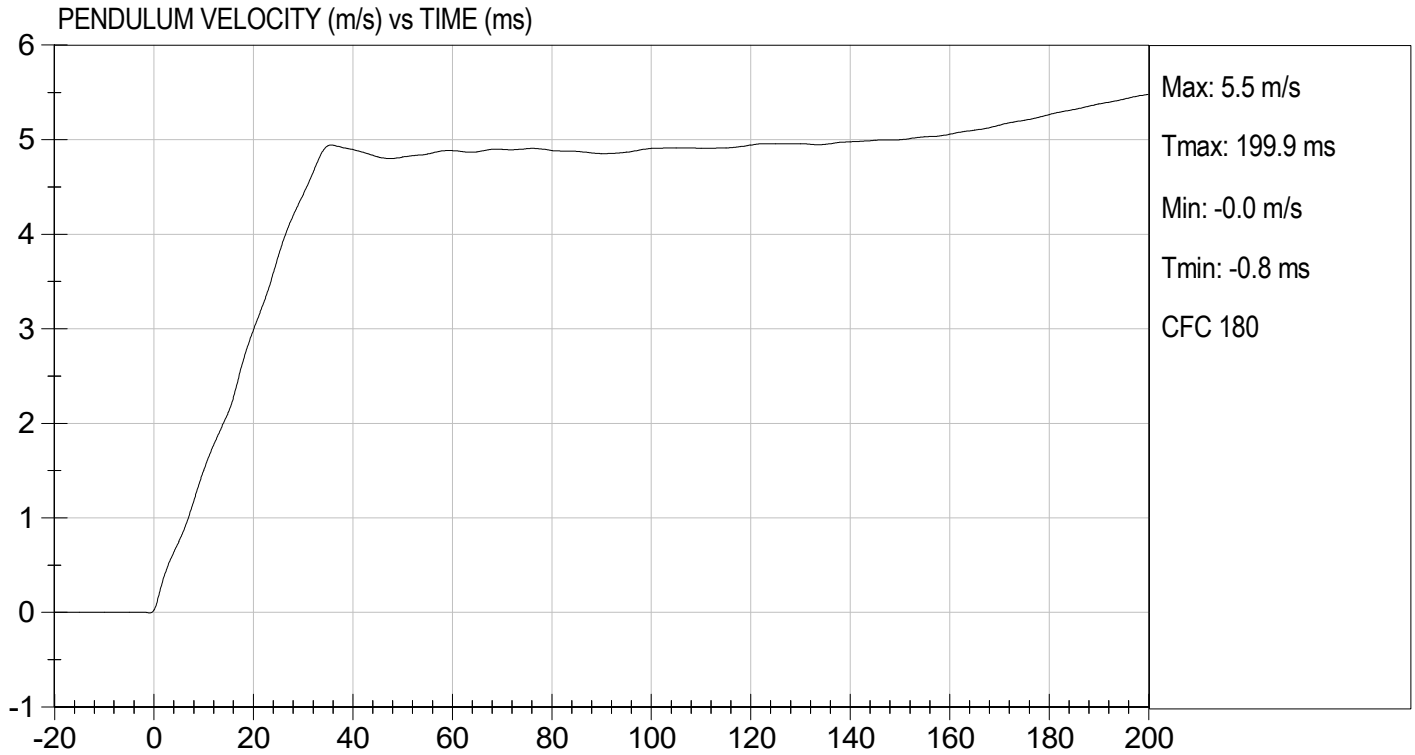
**Test I.D:** D231382

Tested Parameter	Units	Specification	Result	Pass/Fail	
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass	
Laboratory Relative Humidity	%	10 to 70	35	Pass	
Pendulum Speed	m/s	4.83 to 5.07	4.84	Pass	
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.5	Pass
	20 ms	m/s	2.4 to 3.4	3.0	Pass
	30 ms	m/s	3.8 to 5.0	4.4	Pass
D Plane Rotation	Max	deg	74 to 92	79	Pass
Occipital Condyle Moment within Deflection Corridor	Nm	27 to 33	30.2	Pass	
Positive Moment Time Curve Decay to 5 Nm	ms	103 to 123	111	Pass	
<b>Overall Results</b>				<b>Pass</b>	

Brian Roach  
Laboratory Technician

05/30/2023  
Test Date

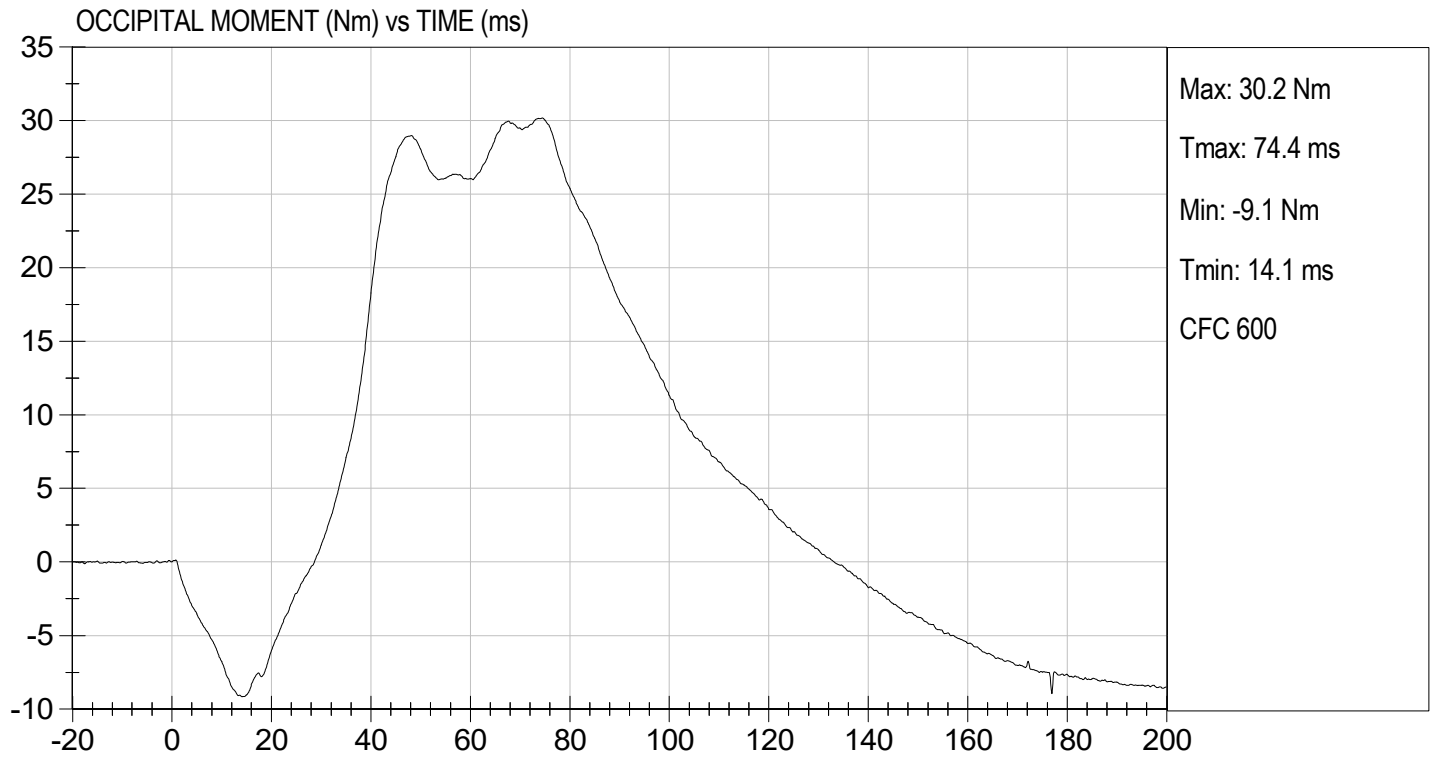
Jose Galvez  
Approved By





TEST DESC: NECK FLEXION  
VELOCITY: 15.87 ft/s, 4.84 m/s

TEST DATE: 05/30/2023  
TEST #: D231382



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

Dummy Serial Number: 155

Test Date: 05/31/2023

Technician: Brian Roach

- X Pre test calibration  
       Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last neck test. (572.127(o))  
      X N/A, ONLY one neck test performed
- X 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
- X 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.5°C</u> |
| Record the minimum temperature | <u>21.0°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>37%</u>    |
- X 4. Visually inspect neck assembly for cracks, cuts and separation of the rubber from the metal segments. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions: No damage
- X 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage

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

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

Parameter	Specification	Result
Pendulum impact speed	$4.18 \text{ m/s} \leq \text{speed} \leq 4.42 \text{ m/s}$	4.27 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$
	@ 20 ms	$2.2 \text{ m/s} \leq \Delta V \leq 3.0 \text{ m/s}$
	@ 30 ms	$3.2 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$
Plane D Rotation	Peak moment* $-24 \text{ Nm} \leq \text{moment} \leq -19 \text{ Nm}$ during the following rotation range $85^\circ \leq$ $\text{angle} \leq 103^\circ$	-20 Nm @ 97 degrees
Negative Moment Decay** (Extension)	Time to decay to -5 Nm $123 \text{ ms} \leq$ time $\leq 147 \text{ ms}$	138 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

Brian Roach  
Signature

05/31/2023  
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D231383

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.27	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.4	Pass
	20 ms	m/s	2.2 to 3.0	2.5	Pass
	30 ms	m/s	3.2 to 4.2	3.7	Pass
D Plane Rotation	Max	deg	85 to 103	97	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-20	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	138	Pass
<b>Overall Results</b>					<b>Pass</b>

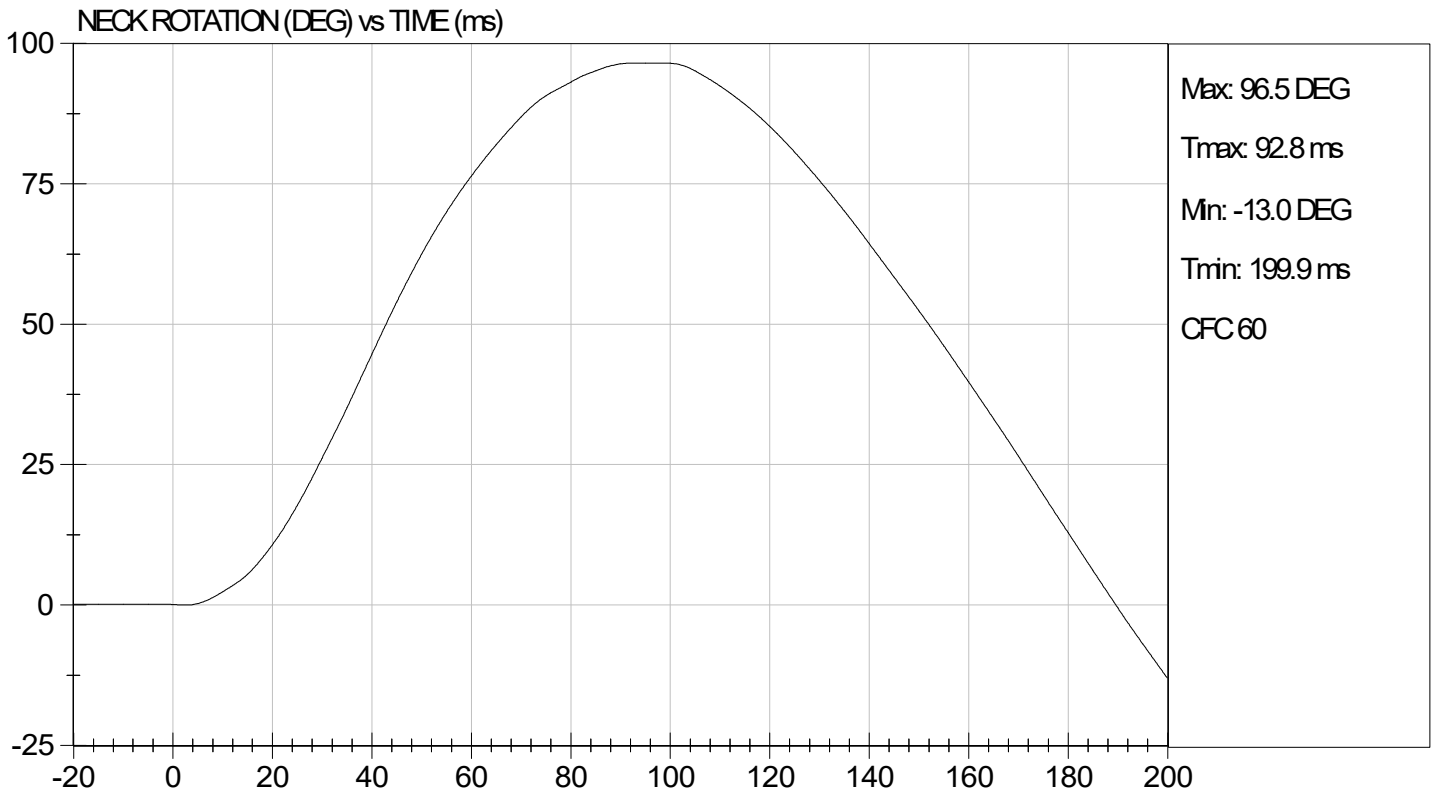
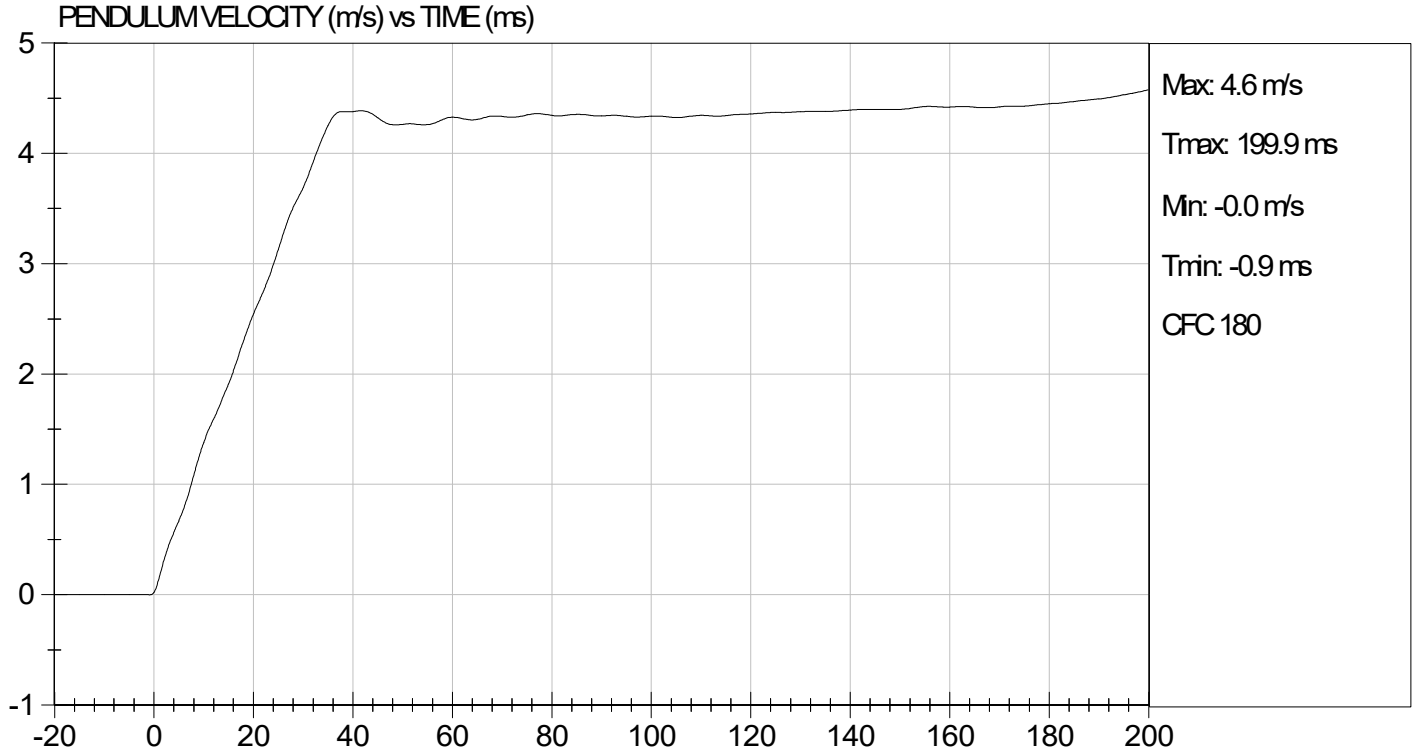
*Brian Roach*

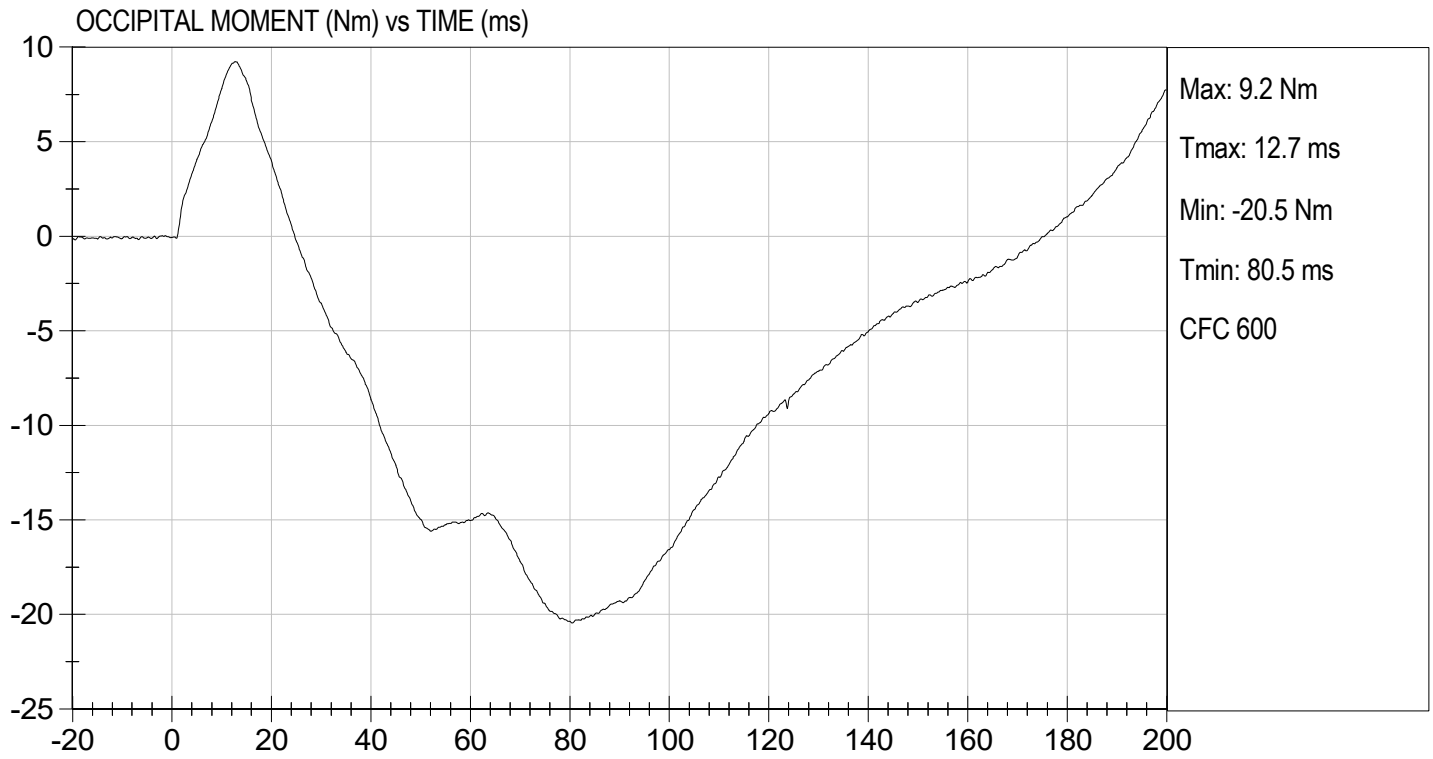
Laboratory Technician

05/31/2023

Test Date

*Joe Galvez*  
Approved By





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

Dummy Serial Number: 155

Test Date: 06/01/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

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

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

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

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

Record the maximum temperature	<u>21.5°C</u>
Record the minimum temperature	<u>20.4°C</u>
Record the maximum humidity	<u>43%</u>
Record the minimum humidity	<u>41%</u>

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

Record findings and actions:

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

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

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

7. Seat the dummy, (chest skin still removed) without back support on the test fixture

surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))

- X 8. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $8^\circ \pm 2^\circ$ . The angle may be measured at the pelvis lumbar joining surface.
- X 9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.124(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- X 14. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2)

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.77 m/s
Chest Compression	$38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$	40.8 mm
Peak force** between 38.0 and 46.0 mm chest compression	$1150\text{N} \leq \text{peak force} \leq 1380\text{N}$	1313 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force $\leq 1500 \text{ N}$	1407 N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	72%

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

\*\*Force = impactor mass x acceleration

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

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

Brian Roach  
Signature

06/01/2023  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 6 YEAR OLD**

ATD Serial No: 155

Test I.D.: D231384

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.5	Pass
Relative Humidity	%	10 to 70	43	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	38.0 to 46.0	40.8	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,313	Pass
Internal Hysteresis	%	65 to 85	72	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,407	Pass
Overall Test Results				Pass

Brian Roach  
Laboratory Technician

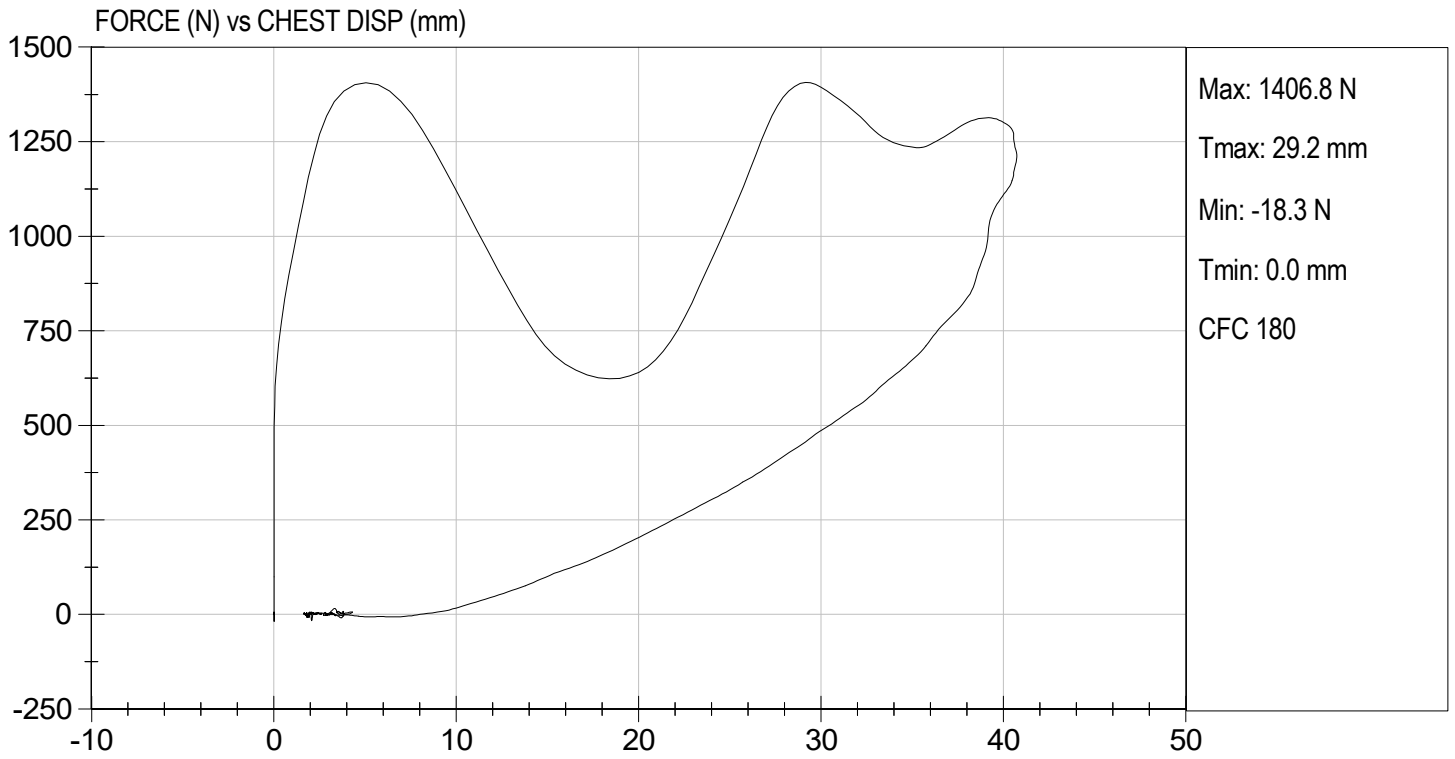
06/01/2023  
Test Date

Jose Galvez  
Approved By



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

TEST DATE: 06/01/2023  
TEST #: D231384



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

Dummy Serial Number: 155

Test Date: 06/01/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 11C.
3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.4°C</u> |
| Record the minimum temperature | <u>20.3°C</u> |
| Record the maximum humidity    | <u>40%</u>    |
| Record the minimum humidity    | <u>38%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
9. Remove all external support that was implemented in 8 above. (572.125(c)(5))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 22°	20°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.7°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	186 N
Final ref. plane angle	Initial ref. plane angle ± 8°	4°

Brian Road  
Signature

06/01/2023  
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D231387

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	40	Pass
Initial Angle	deg	0 to 22	20	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	147 to 200	186	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
Overall Result				Pass

*Brian Roach*

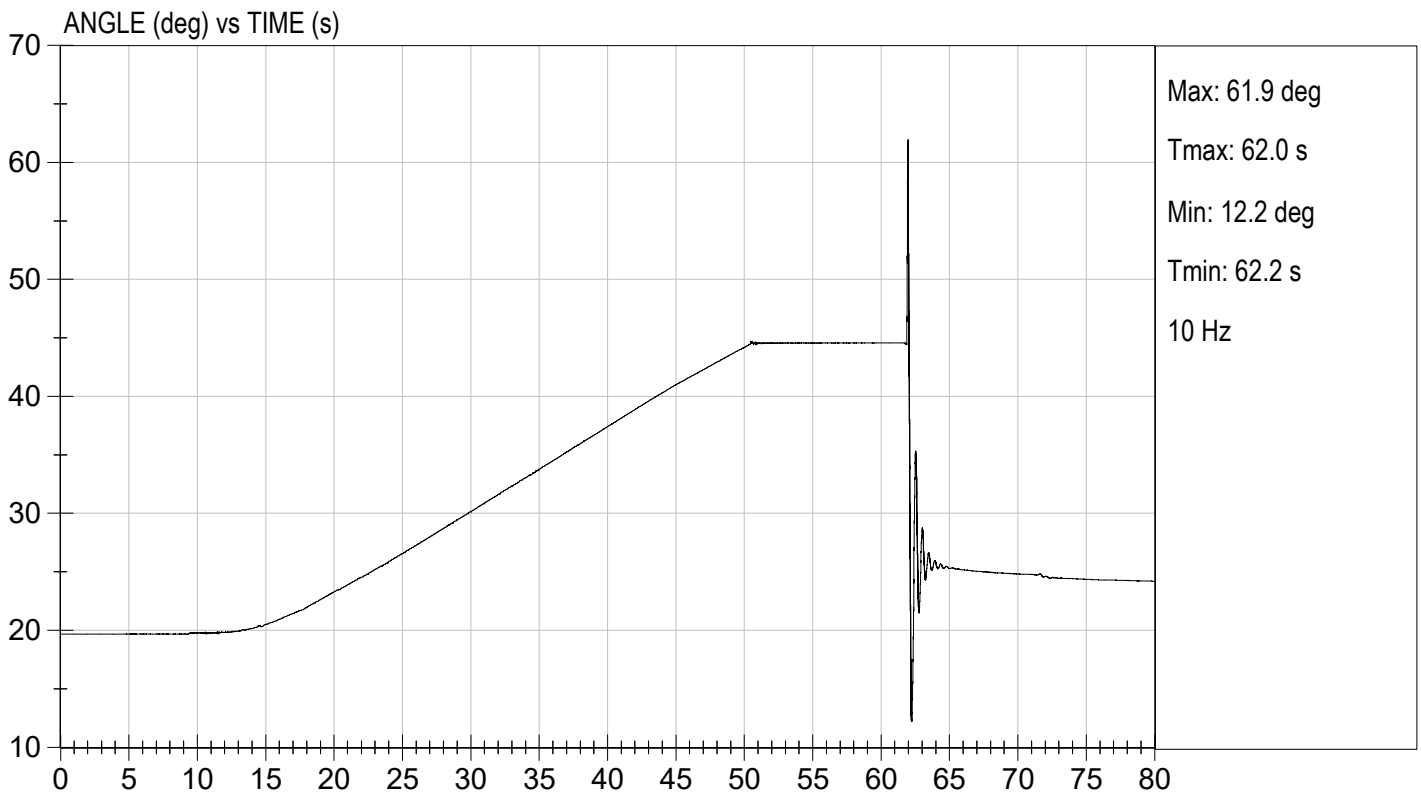
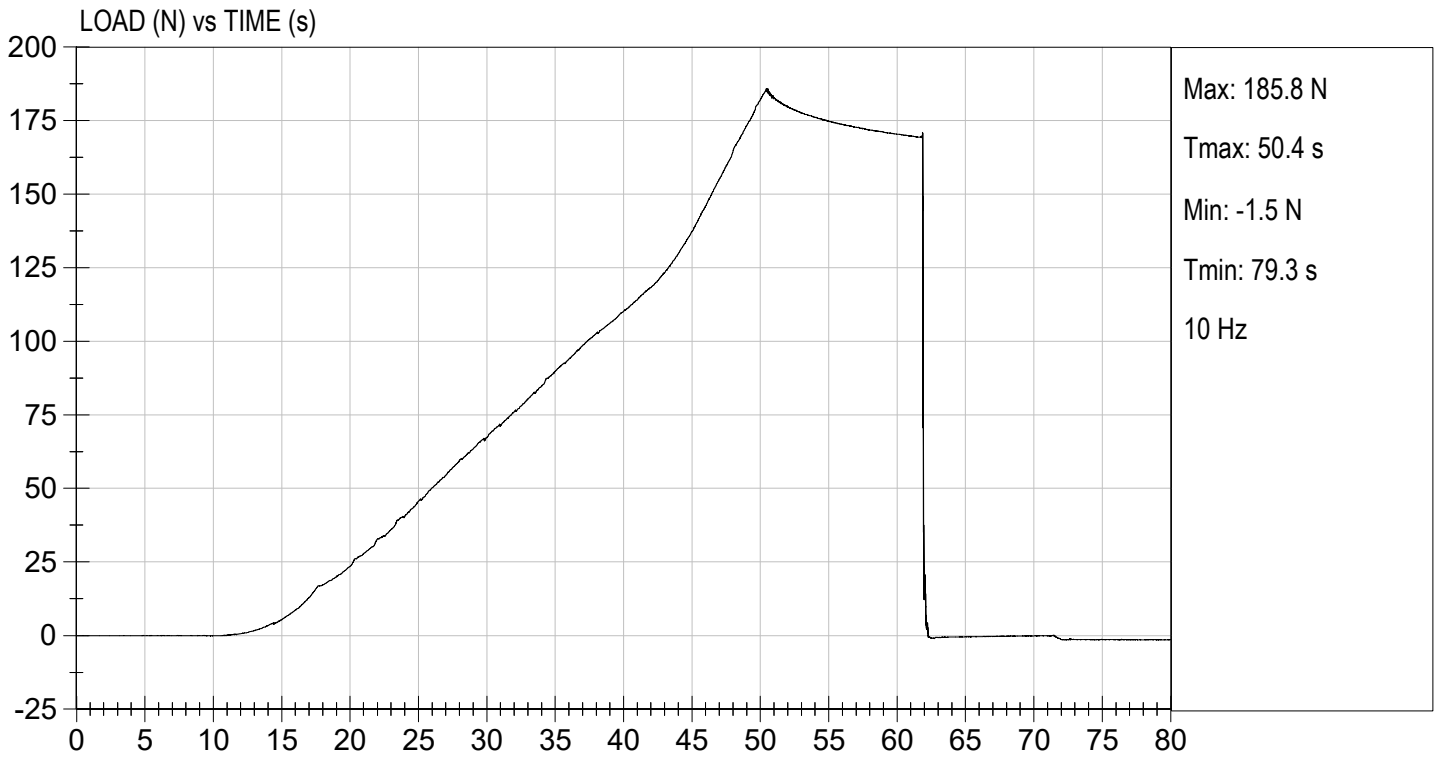
Laboratory Technician

06/01/2023

Test Date

*Joe Palmer*

Approved By



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

Dummy Serial Number: 155

Test Date: 05/31/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 12C.
3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>20.5°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>42%</u>    |
5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.

\_\_\_\_\_  
(572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.13 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2562 N

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

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

Brian Road  
Signature

05/31/2023  
Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D231386

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.13	Pass
Maximum Force	N	2000 to 3000	2562	Pass
Overall Test Results				Pass

*Brian Roud*

Laboratory Technician

05/31/2023

Test Date

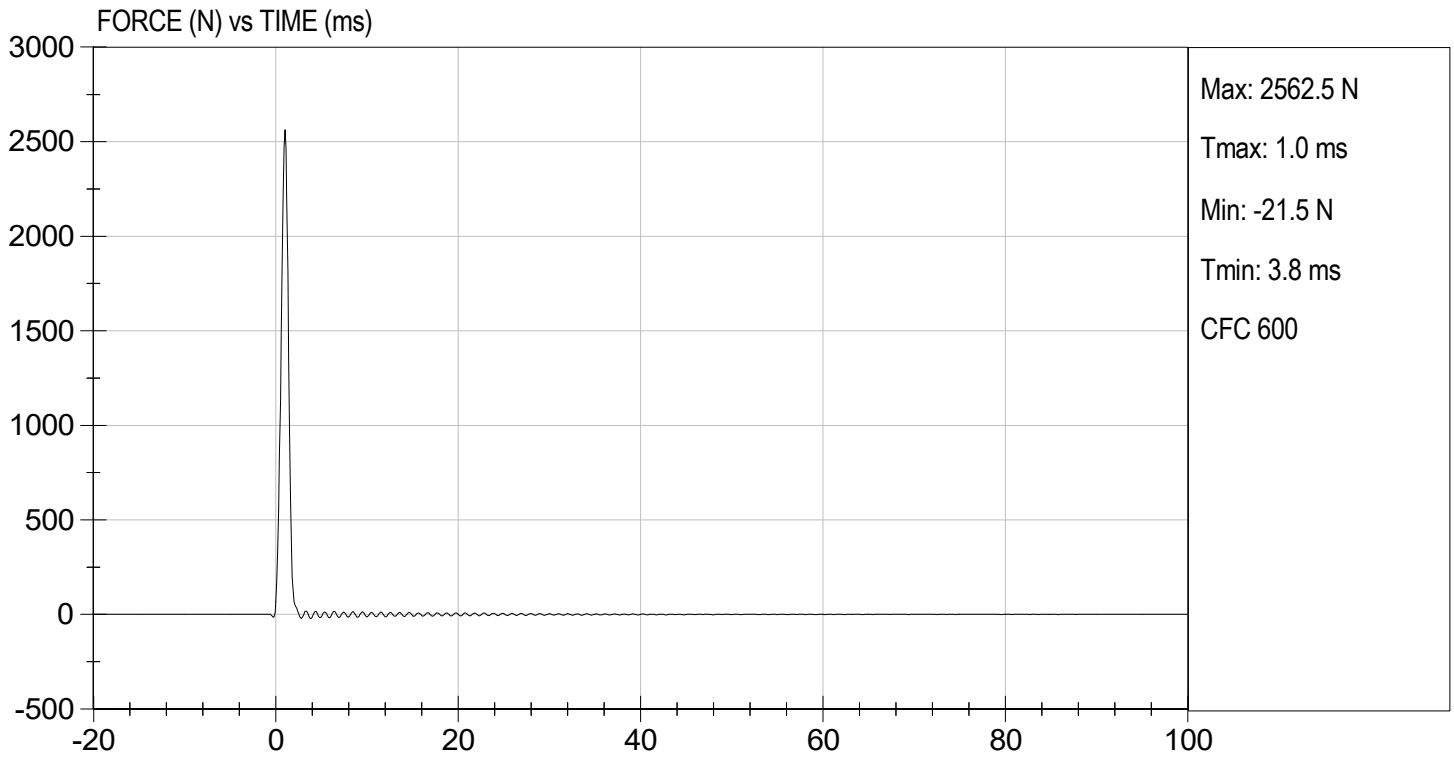
*Joe Galvez*

Approved By



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

TEST DATE: 05/31/2023  
TEST #: D231386



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

Dummy Serial Number: 155

Test Date: 05/31/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
 N/A, ONLY one knee impact test performed
2. The test fixture conforms to the specifications in Figure 12C.
3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.6°C</u> |
| Record the minimum temperature | <u>20.5°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>42%</u>    |
5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.

(572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2633 N

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

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

Brian Roach  
Signature

Date: 05/31/2023

**MGA RESEARCH CORPORATION**  
**RIGHT KNEE IMPACT TEST**  
**HYBRID III 6 YEAR OLD**

ATD Serial No: 155

Test I.D: D231385

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	2000 to 3000	2633	Pass
Overall Test Results				Pass

Brian Roach  
 Laboratory Technician

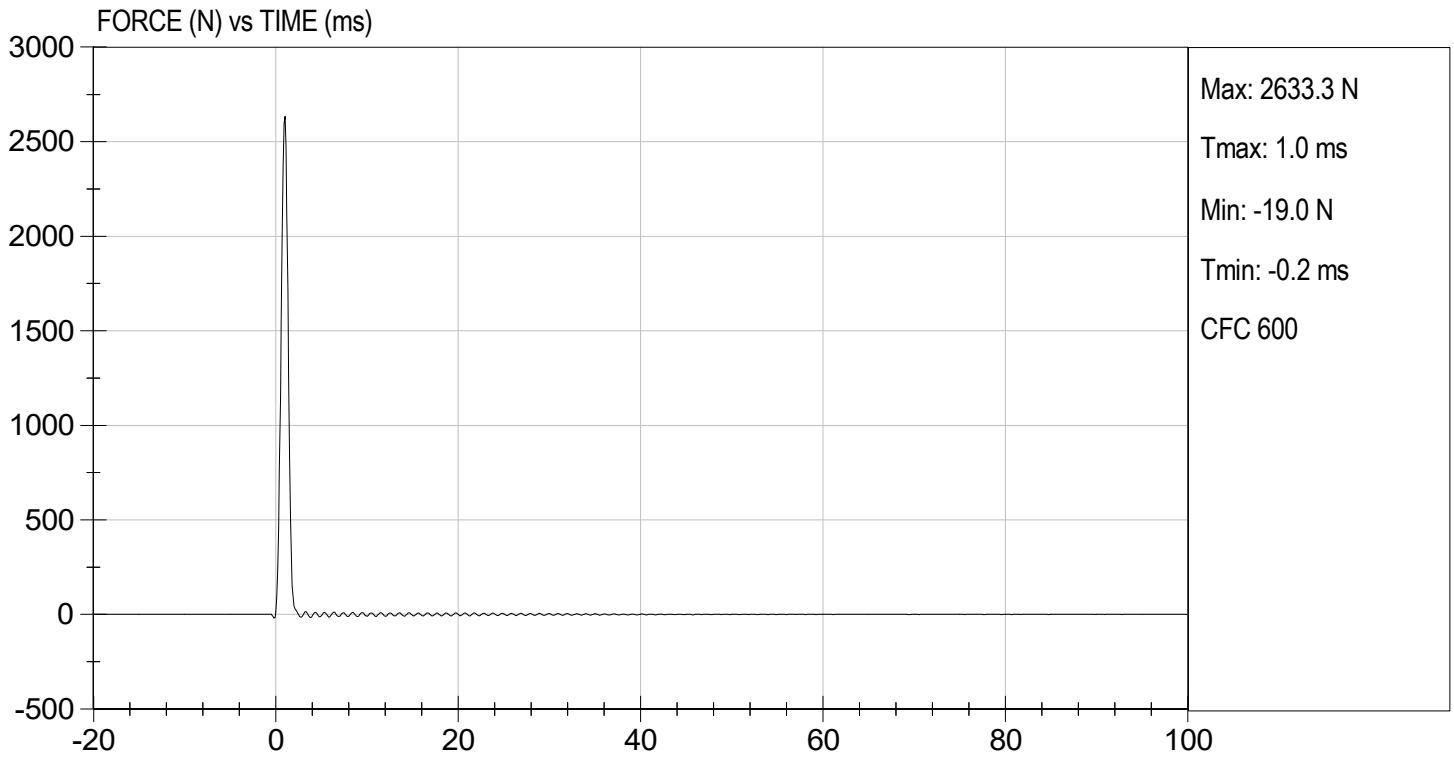
05/31/2023  
 Test Date

Joe Galvez  
 Approved By



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

TEST DATE: 05/31/2023  
TEST #: D231385



**DATA SHEET C10**  
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360M17	P79723	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P84426	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	P84428	05/24/2023	11/23/2023
NECK TRANSDUCER	Denton	1716-06-6N	N253	05/05/2023	11/04/2023
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360M17	P88330	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P88331	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	P88332	05/24/2023	11/23/2023
CHEST POTENTIOMETER	Humanetics	127-8050	155	05/31/2023	11/30/2023
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	C13081	05/02/2023	11/01/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P82128	06/01/2023	12/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	132-0-0-102	018	01/19/2023	07/21/2023
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	023	01/19/2023	07/21/2023

LABORATORY TECHNICIAN:         Brian Roach

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

Dummy Serial Number: 155

Test Date: 07/06/2023

Technician: Brian Roach

- Pre test calibration  
 X  Post test calibration verification

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

- X  1. It has been at least 2 hours since the last head drop. (572.122(c)(5))  
      X  N/A, ONLY one head drop performed
- X  2. The head assembly consists of the complete head (127-1000), a six-axis neck transducer (SA572-S11) or its structural replacement (78051-383X), a head to neck pivot pin (78051-339), and three (3) accelerometers (SA572-S4). (572.122(a))
- X  3. Torque the skull cap screws (10-32 x 1/2 SHCS) to 10.2 Nm.
- X  4. Accelerometers and their respective mounts are smooth and clean.
- X  5. The head accelerometer mounting plate screws (10-24 x 3/8 SHCS) are torqued to 9.0 Nm.
- X  6. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.126(m))
- X  7. The head assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.122(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>37%</u>    |
- X  8. Visually inspect the head skin for cracks, cuts, abrasions, etc. Repair or replace the head skin if the damaged area is more than superficial. Note: If the damage resulted from the vehicle crash test in which the dummy was an occupant, the damaged area is to be documented with photography and the post test calibration verification testing completed before any replacement or repairs are made.
- Record findings and actions:     No Damage
- X  9. Clean the impact surface of the skin and the impact surface of the fixture with isopropyl alcohol, trichloroethane or equivalent prior to the test. (572.122(c)(2))

- X 10. Suspend and orient the head assembly as shown in Figure 5C. The lowest point on the forehead is  $376.0 \pm 1.0$  mm ( $14.8 \pm 0.04$  inch) from the impact surface.  
Record the actual distance: 376 mm

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

- X 11. The 1.57 mm (0.062 inch) diameter holes located on either side of the dummy's head are equidistance within 2 mm from the impact surface. A typical test setup is shown in Figure 5C. (572.122(c)(3))  
Record the right side distance: 501 mm  
Record the left side distance: 501 mm

- X 12. The impact surface is clean and dry and has a micro finish in the range of  $203.2 \times 10^{-6}$  mm (8 micro inches) to  $2155.0 \times 10^{-6}$  mm (80 micro inches) (RMS). (572.122(c)(4))  
Record actual micro finish: 24.8 micro inches

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

- X 14. The impact surface is a flat horizontal steel plate 50.8 mm (2 inches) thick and 610 mm (24 inches) square. (572.122(c)(4))  
Record thickness: 50.9 mm  
Record width: 604 mm  
Record length: 595 mm

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

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

Parameter	Specification	Result
Peak resultant acceleration	$245 \text{ g} \leq x \leq 300 \text{ g}$	289 g
Resultant versus time history curve	Unimodal	Yes
Oscillations after the main pulse	Less than 10% of the peak resultant acceleration	Yes
Lateral acceleration	y-axis acceleration $\leq 15 \text{ g}$	-9 g

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

Brian Road  
Signature

07/06/2023  
Date

**MGA RESEARCH CORPORATION**  
**HEAD DROP TEST**  
**HYBRID III 6 YEAR OLD**

ATD Serial No: 155

Test ID: D231641

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Peak Resultant Acceleration	G's	245 to 300	289	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-9.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

*Brian Road*

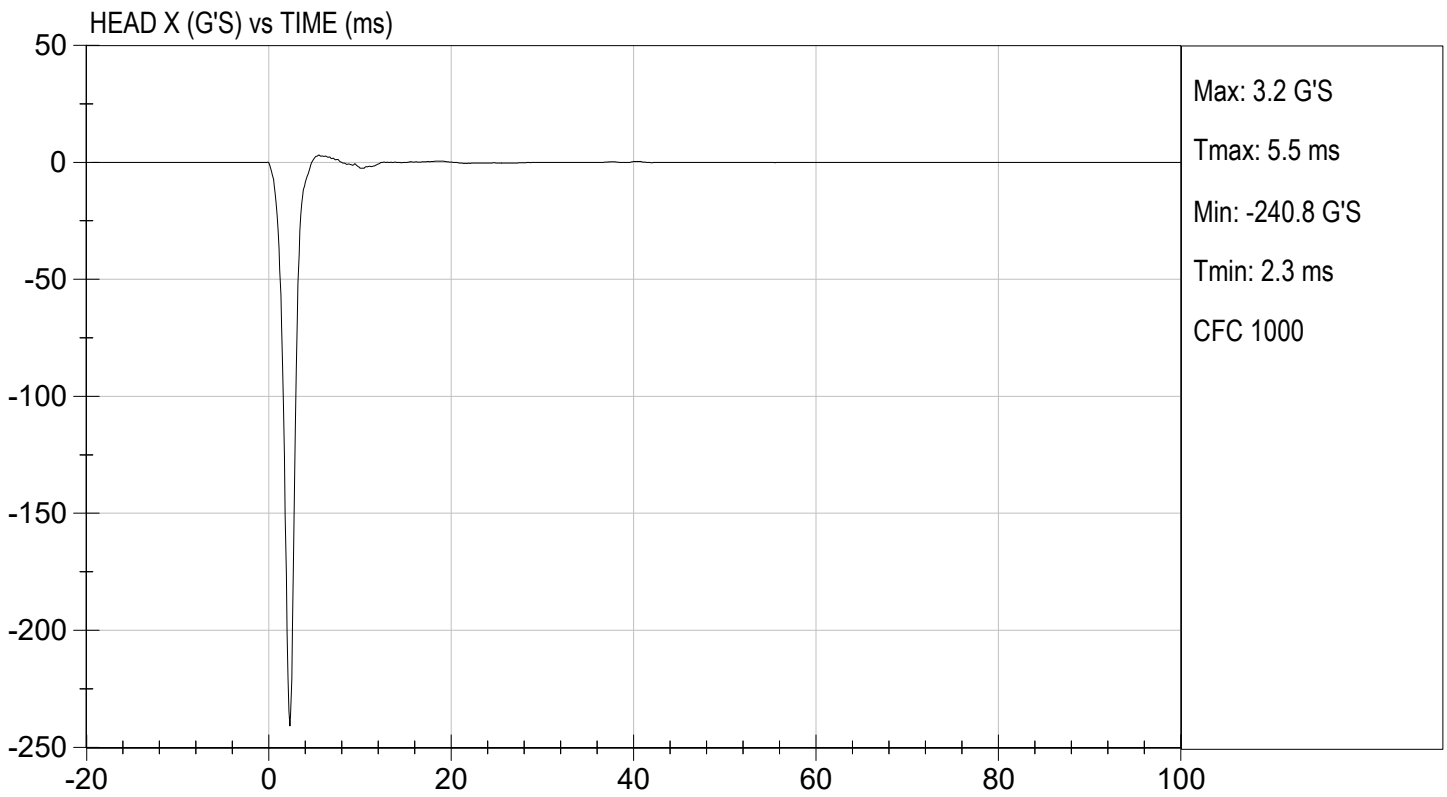
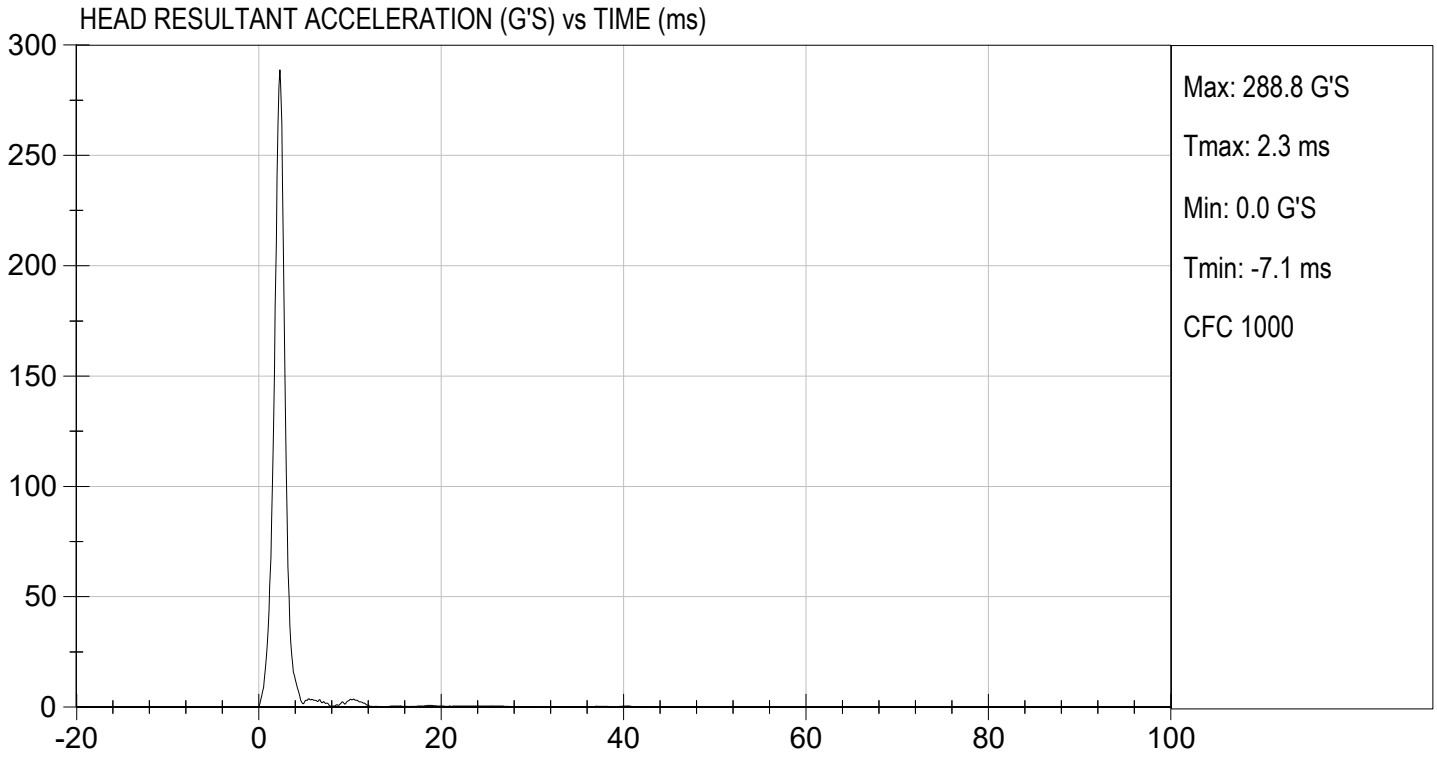
Laboratory Technician

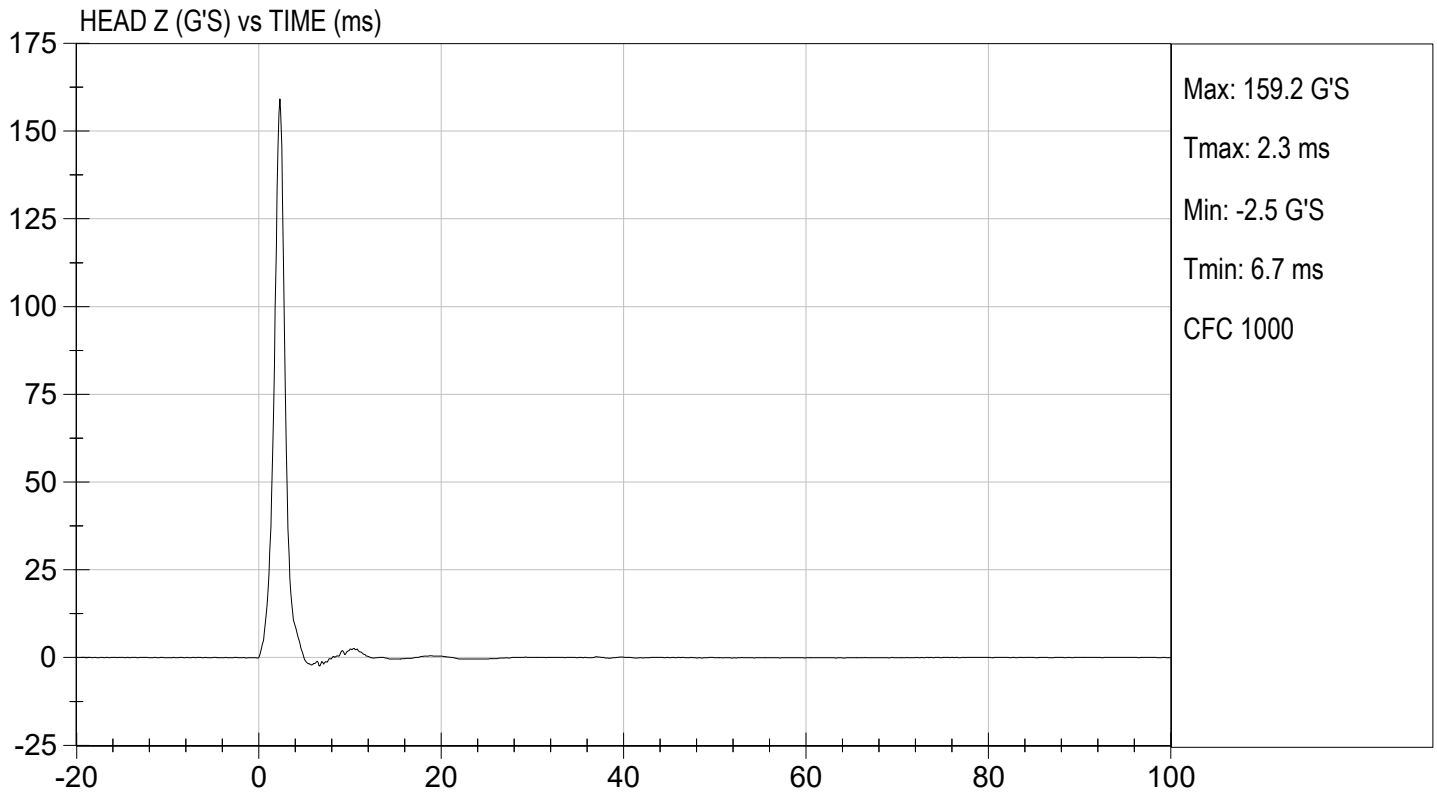
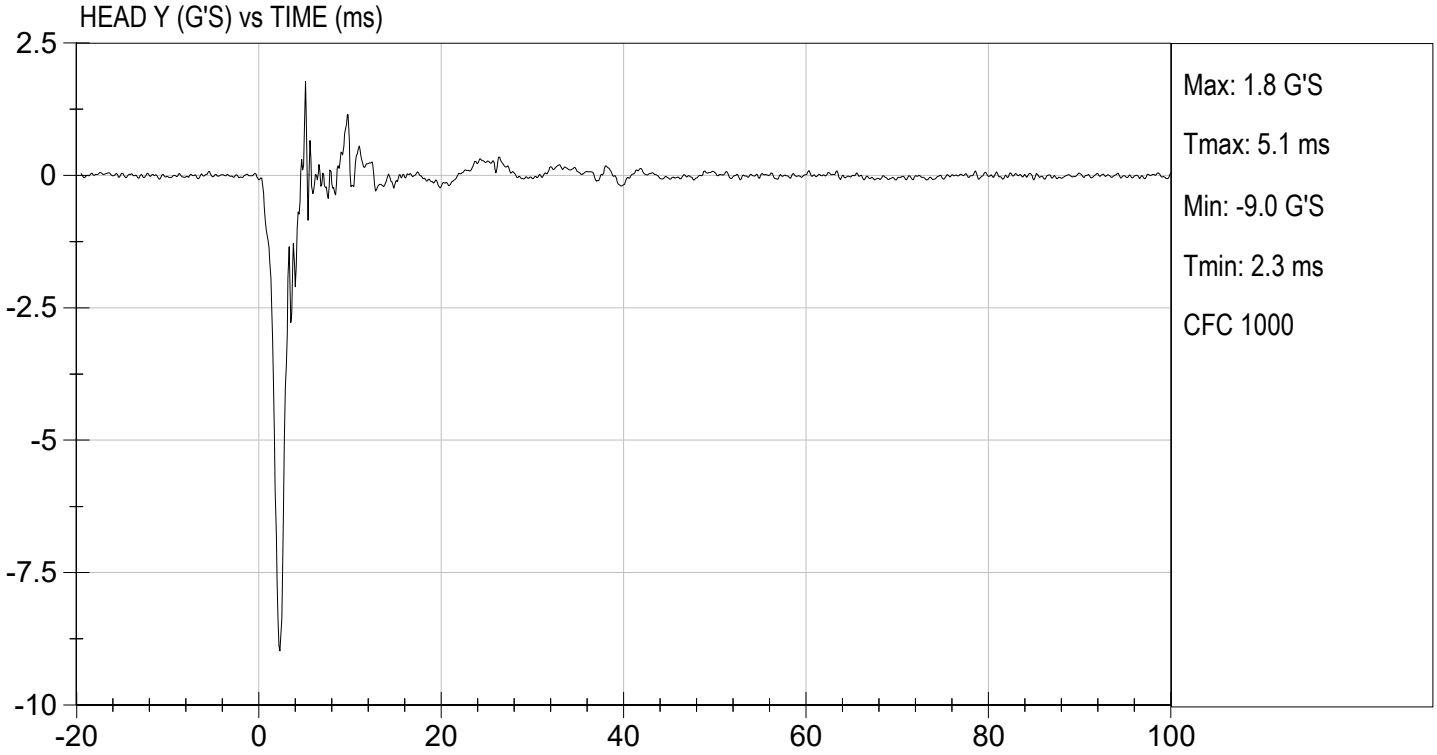
07/06/2023

Test Date

*Joe Galvez*

Approved By





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

Dummy Serial Number: 155

Test Date: 07/07/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last neck test. (572.127(o))  
 N/A, ONLY one neck test performed
2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>37%</u>    |
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
5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.
- Record findings and actions: No damage
6. Torque the jam nut (9000341) on the neck cable (127-1016) to 0.23 ± 0.02 Nm (2.0 ± 0.2 in-lb). (572.123(c)(2))
7. The data acquisition system, including transducers, conforms to the requirements of SAE Recommended Practice J211/1 MAR95. (572.127(k))
8. The test fixture pendulum conforms to the specifications in Figure 6C. (572.123I(3))

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

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

Parameter	Specification	Result
Pendulum impact speed	4.83 m/s $\leq$ speed $\leq$ 5.07 m/s	4.84 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	1.2 m/s $\leq \Delta V \leq$ 1.6 m/s
	@ 20 ms	2.4 m/s $\leq \Delta V \leq$ 3.4 m/s
	@ 30 ms	3.8 m/s $\leq \Delta V \leq$ 5.0 m/s
Plane D Rotation	Peak moment* 27 Nm $\leq$ moment $\leq$ 33 Nm during the following rotation range 74° $\leq$ angle $\leq$ 92°	29 Nm @ 80 degrees
Positive Moment Decay** (Flexion)	Time to decay to 5 Nm 103 ms $\leq$ time $\leq$ 123 ms	114 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

   Brian Roach  
Signature

   07/07/2023  
Date

**MGA RESEARCH CORPORATION**

**NECK FLEXION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D231642

Tested Parameter	Units	Specification	Result	Pass/Fail	
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass	
Laboratory Relative Humidity	%	10 to 70	44	Pass	
Pendulum Speed	m/s	4.83 to 5.07	4.84	Pass	
Pendulum Velocity	10 ms	m/s	1.2 to 1.6	1.4	Pass
	20 ms	m/s	2.4 to 3.4	2.7	Pass
	30 ms	m/s	3.8 to 5.0	4.0	Pass
D Plane Rotation	Max	deg	74 to 92	80	Pass
Occipital Condyle Moment within Deflection Corridor	Nm	27 to 33	28.9	Pass	
Positive Moment Time Curve Decay to 5 Nm	ms	103 to 123	114	Pass	
<b>Overall Results</b>				<b>Pass</b>	

*Brian Roach*

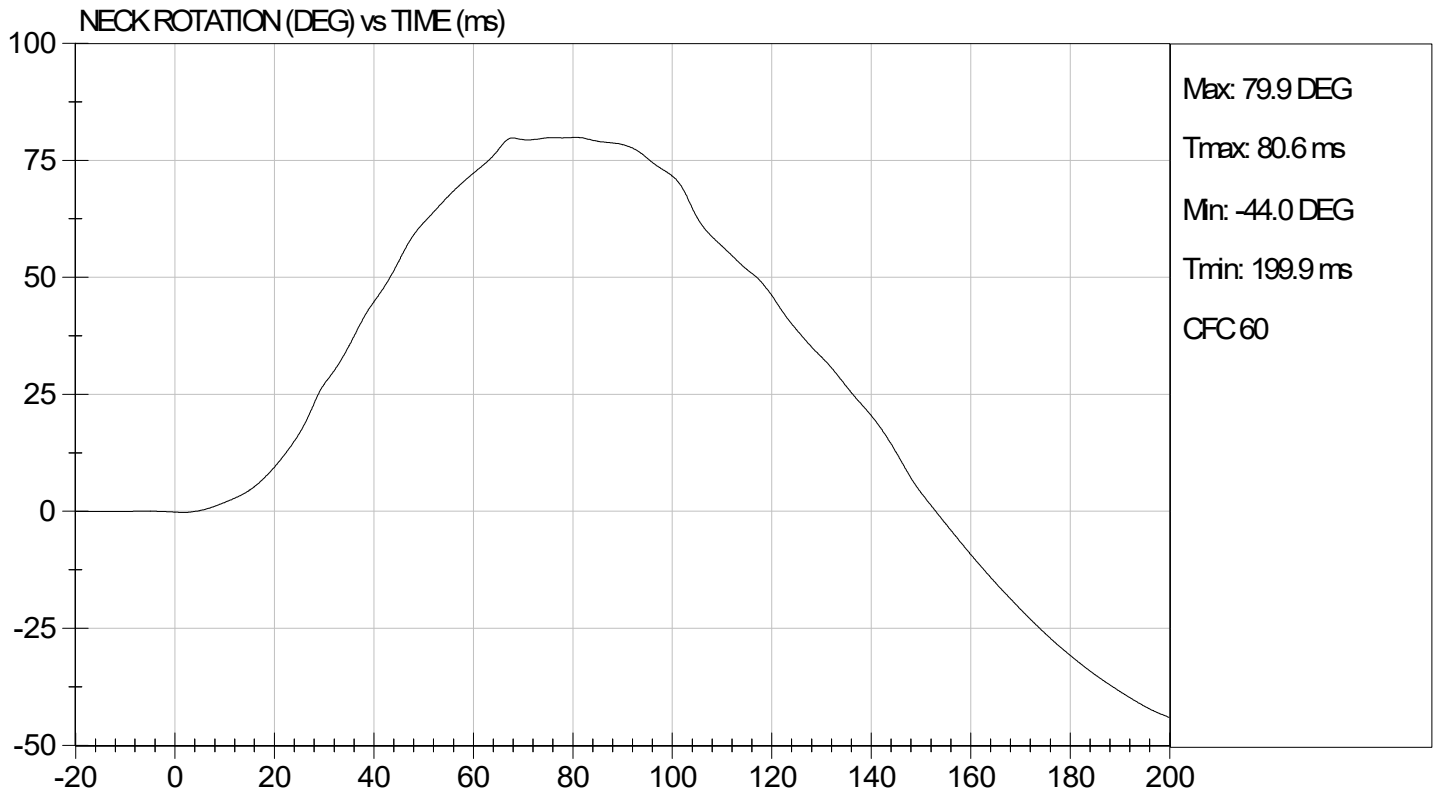
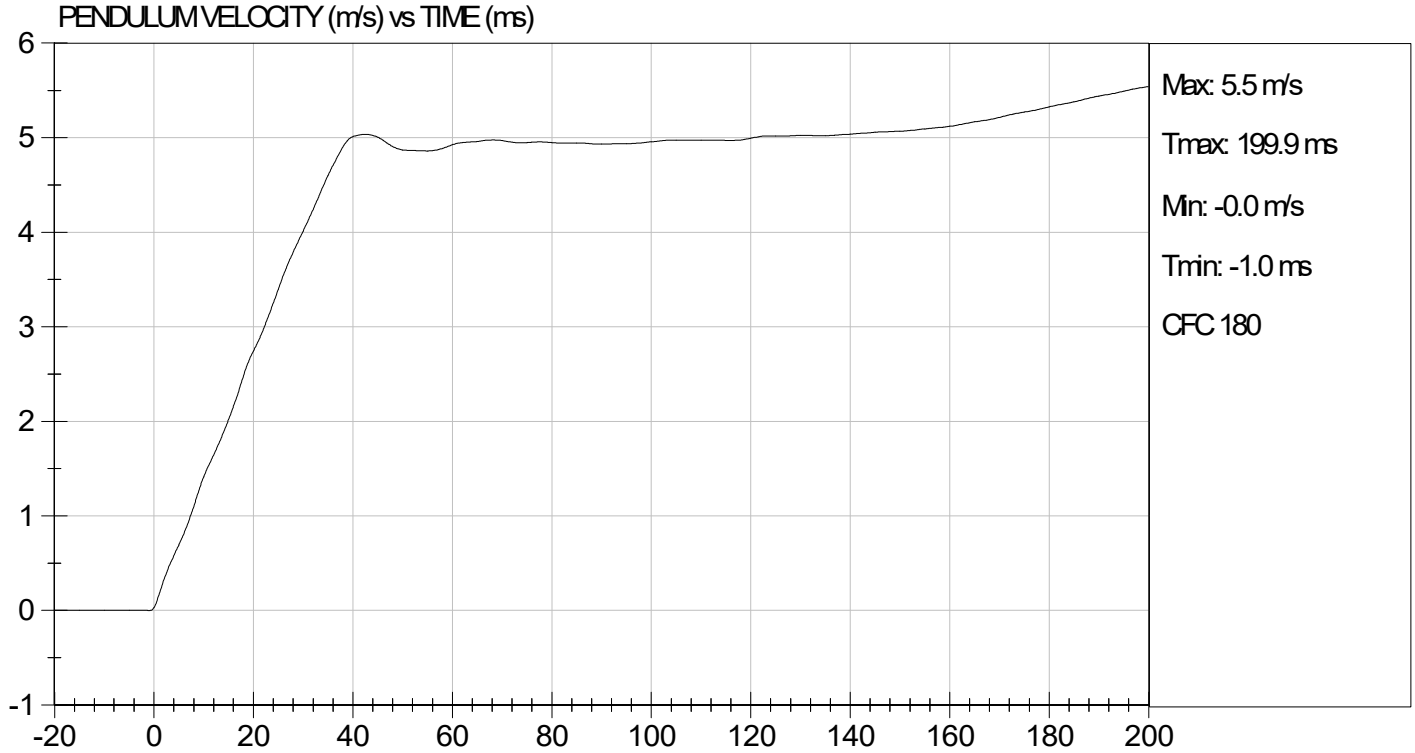
Laboratory Technician

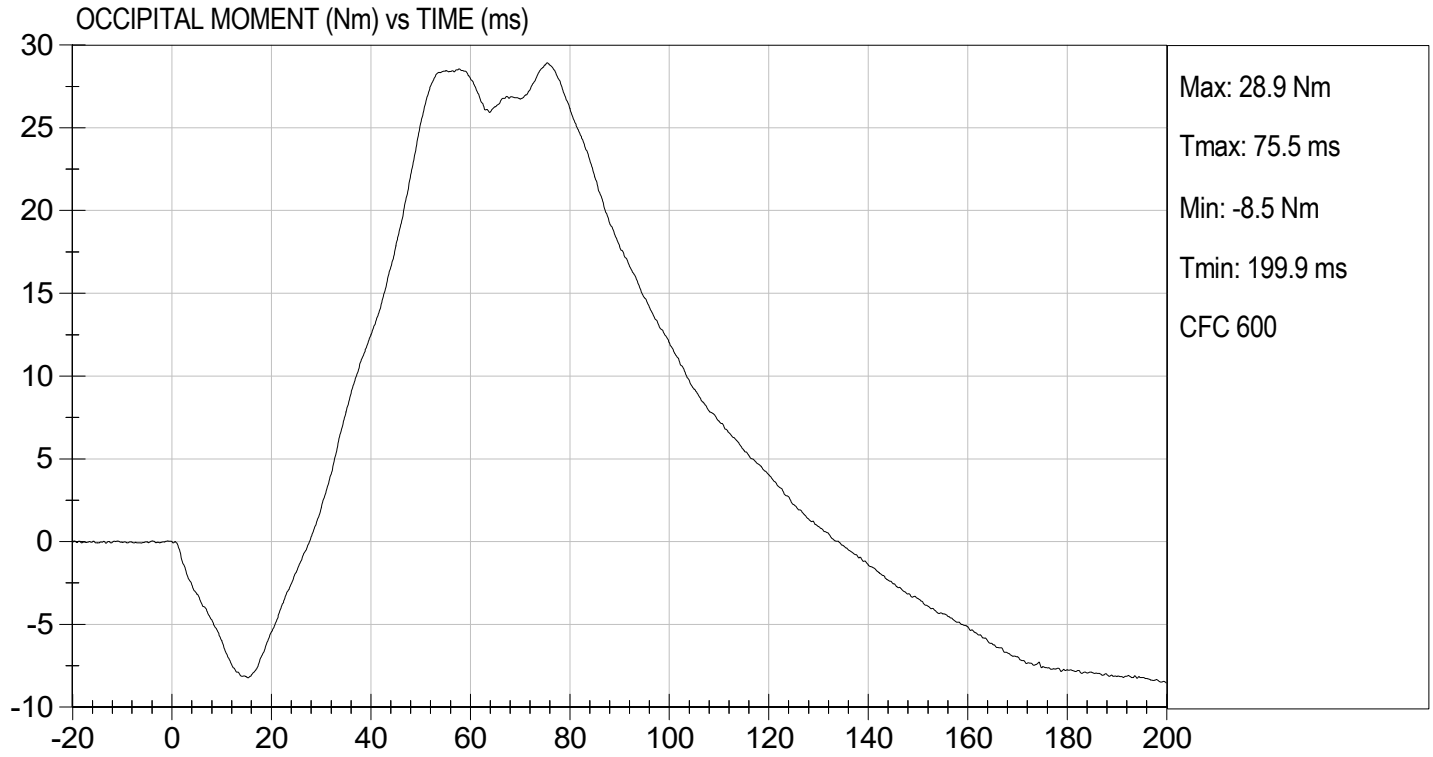
07/07/2023

Test Date

*Joe Lubner*

Approved By





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

Dummy Serial Number: 155

Test Date: 07/07/2023

Technician: Brian Roach

- Pre test calibration
- Post test calibration verification

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

- 1. It has been at least 30 minutes since the last neck test. (572.127(o))  
 N/A, ONLY one neck test performed
  
- 2. The components required for the neck tests include the head assembly (127-1000), neck (127-1015), pivot pin (78051-339), bib simulator (TE127-1025), neck bracket assembly (127-8221), six axis neck transducer (SA572-S11), neck mounting adaptor (TE-2208-001) and three accelerometers (SA572-S4) installed in the head assembly as specified in S572.122. Data from the accelerometers are not required. (572.123(b))
  
- 3. The assembly soaked at a temperature between 20.6°C (69°F) and 22.2°C (72°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to a test. (572.123(c)(1))  

Record the maximum temperature	<u>21.1°C</u>
Record the minimum temperature	<u>20.8°C</u>
Record the maximum humidity	<u>44%</u>
Record the minimum humidity	<u>37%</u>
  
- 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
  
- 5. Inspect the nodding blocks (127-1020, 127-1021) for splits or deformation. Inspect the Neck Cable (127-1016) for deformation. Inspect the mounting plate insert (910420-048) and the nylon shoulder bushing (9001373) and replace if they are torn or worn. When replacement is necessary, ONLY replace during pretest calibration.  
Record findings and actions: No damage

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

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

Parameter		Specification	Result
Pendulum impact speed		$4.18 \text{ m/s} \leq \text{speed} \leq 4.42 \text{ m/s}$	4.23 m/s
Pendulum $\Delta V$ with respect to impact speed	@ 10 ms	$1.0 \text{ m/s} \leq \Delta V \leq 1.4 \text{ m/s}$	1.4 m/s
	@ 20 ms	$2.2 \text{ m/s} \leq \Delta V \leq 3.0 \text{ m/s}$	2.6 m/s
	@ 30 ms	$3.2 \text{ m/s} \leq \Delta V \leq 4.2 \text{ m/s}$	3.7 m/s
Plane D Rotation		Peak moment* $-24 \text{ Nm} \leq \text{moment} \leq -19 \text{ Nm}$ during the following rotation range $85^\circ \leq$ $\text{angle} \leq 103^\circ$	-21 Nm @ 98 degrees
Negative Moment Decay** (Extension)		Time to decay to -5 Nm $123 \text{ ms} \leq$ time $\leq 147 \text{ ms}$	136 ms

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

$M_y$  = Moment in Nm measured by the transducer

$F_x$  = Force, in N measured by the transducer

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

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

  Brian Roach    
Signature

  07/07/2023    
Date

**MGA RESEARCH CORPORATION**

**NECK EXTENSION TEST**

**HYBRID III 6 YEAR OLD**

**ATD Serial No:** 155

**Test I.D:** D231643

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	44	Pass
Pendulum Speed		m/s	4.18 to 4.42	4.23	Pass
Pendulum Velocity	10 ms	m/s	1.0 to 1.4	1.4	Pass
	20 ms	m/s	2.2 to 3.0	2.6	Pass
	30 ms	m/s	3.2 to 4.2	3.7	Pass
D Plane Rotation	Max	deg	85 to 103	98	Pass
Occipital Condyle Moment within Deflection Corridor		Nm	-19 to -24	-21	Pass
Positive Moment Time Curve Decay to 5 Nm		msec	123 to 147	136	Pass
<b>Overall Results</b>					<b>Pass</b>

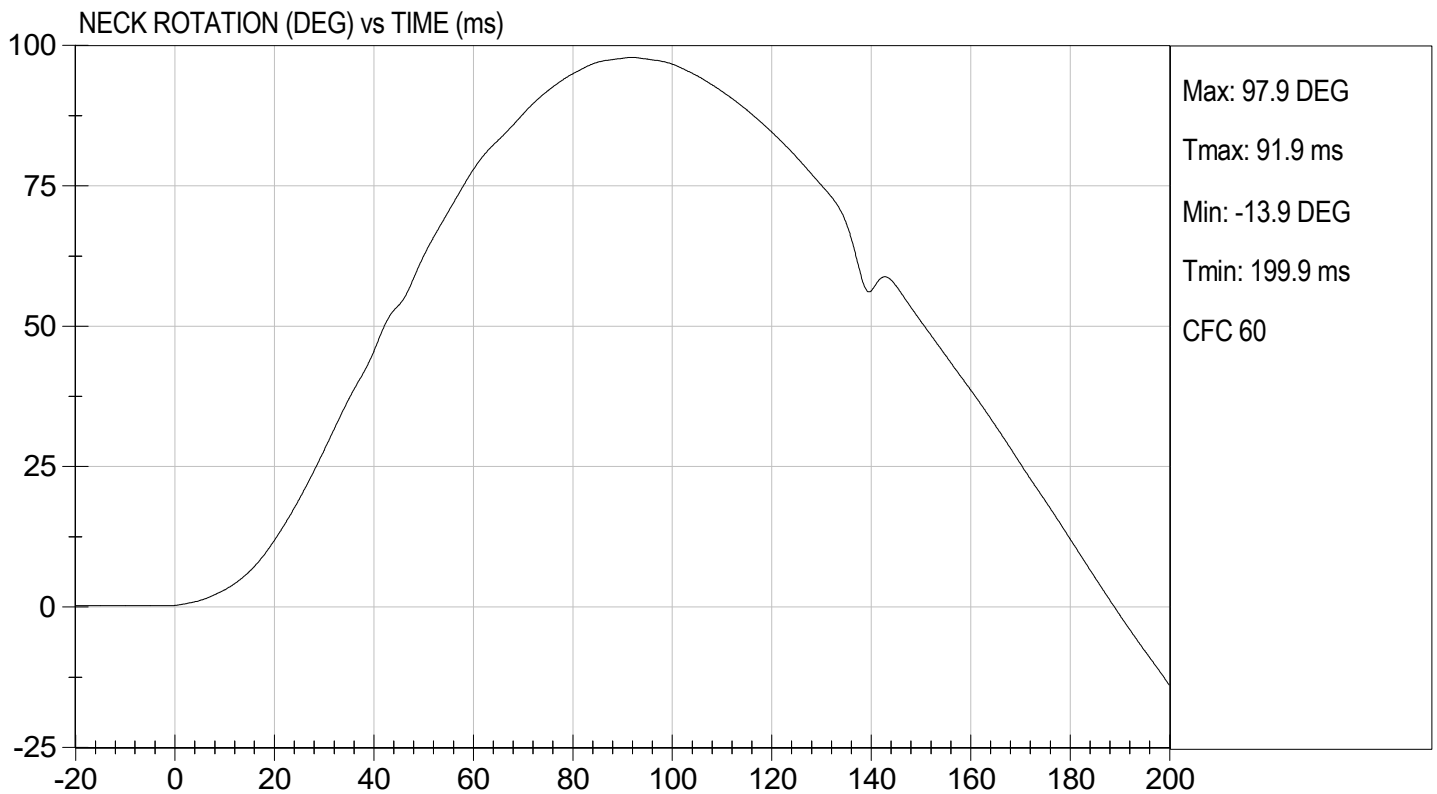
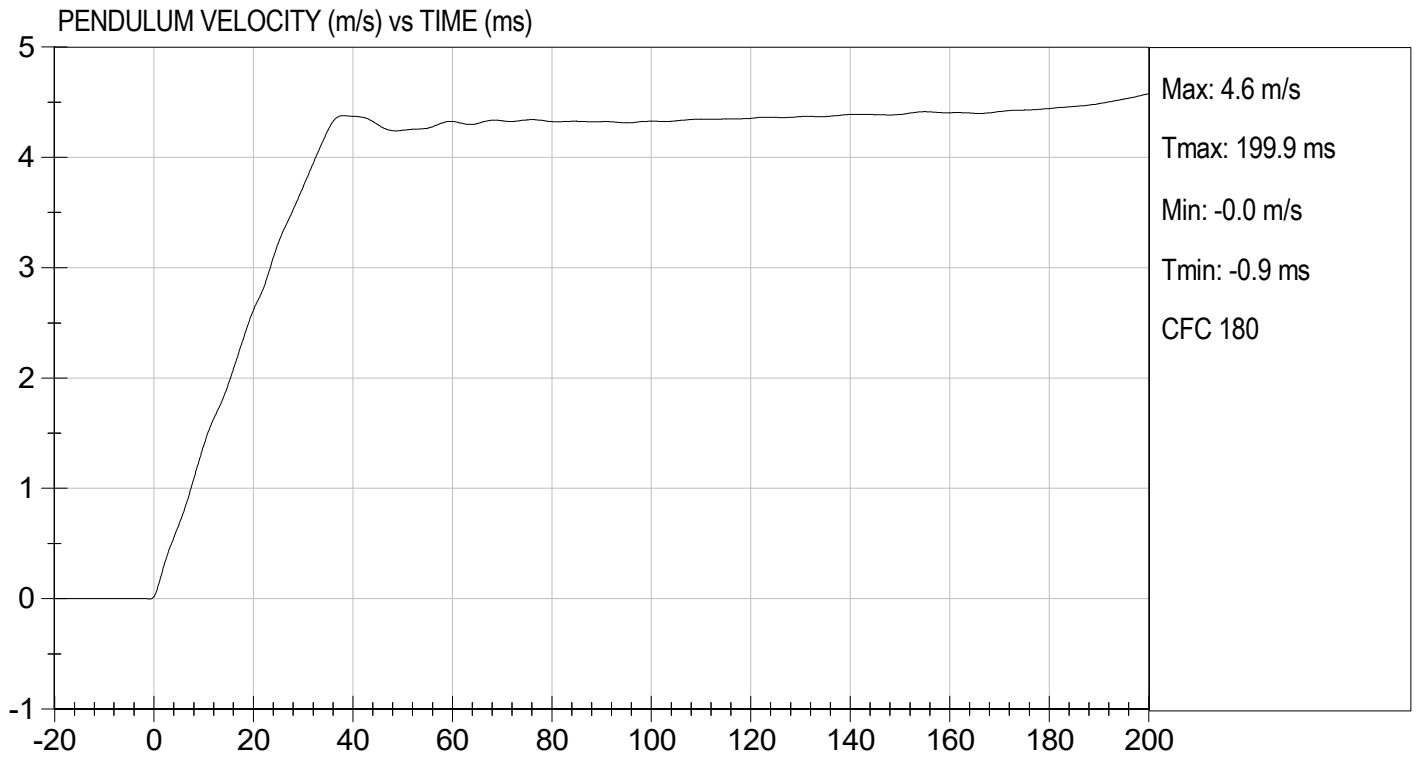
*Brian Roach*

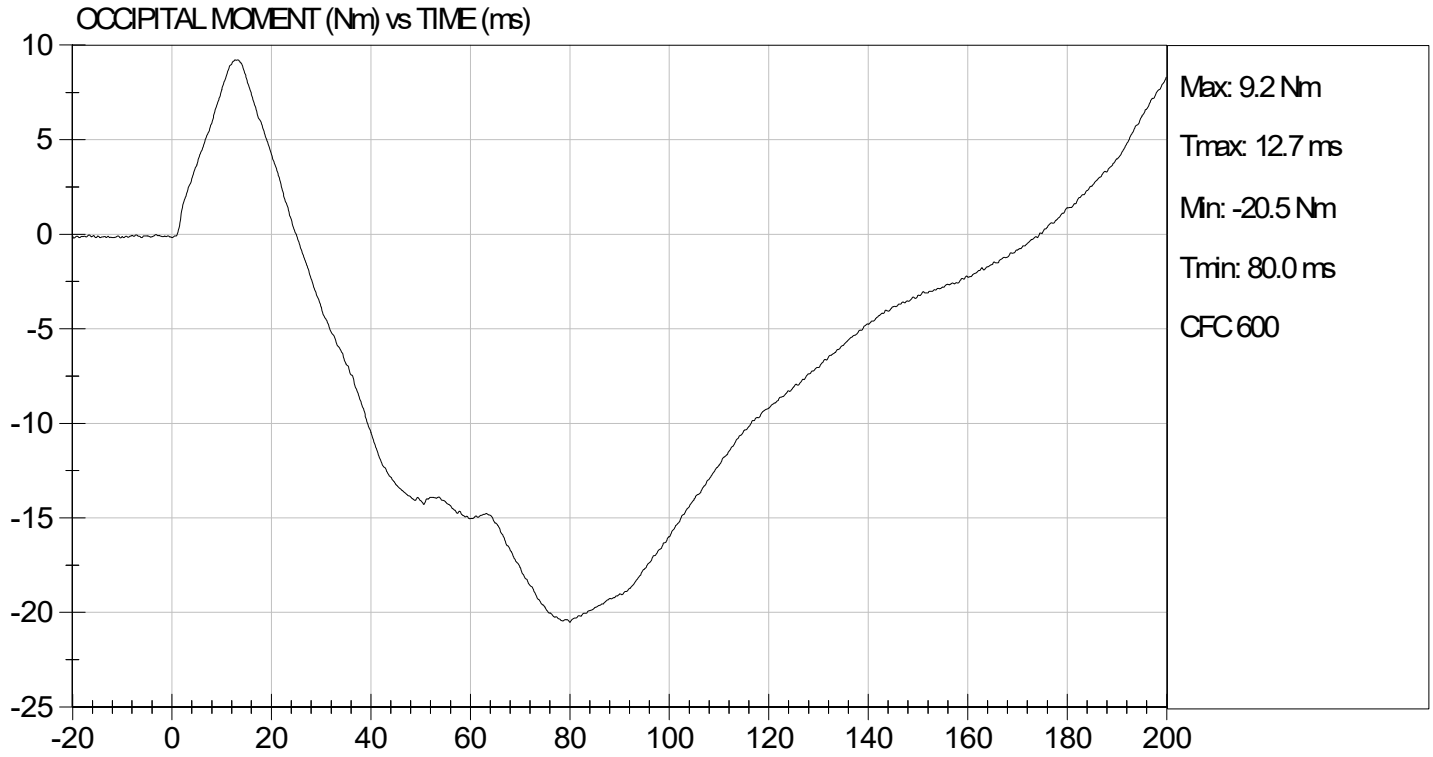
Laboratory Technician

07/07/2023

Test Date

*Joe Palmer*  
Approved By





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

Dummy Serial Number: 155

Test Date: 06/30/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

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

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

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

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

Record the maximum temperature	<u>21.4°C</u>
Record the minimum temperature	<u>20.9°C</u>
Record the maximum humidity	<u>45%</u>
Record the minimum humidity	<u>43%</u>

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

Record findings and actions:

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

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

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

7. Seat the dummy, (chest skin still removed) without back support on the test fixture

surface as shown in Figure 9C. The surface must be long enough to support the pelvis and outstretched legs. (572.124(c)(2))

- X 8. Level the ribs both longitudinally and laterally  $\pm 0.5^\circ$  and adjust the pelvis angle to  $8^\circ \pm 2^\circ$ . The angle may be measured at the pelvis lumbar joining surface.
- X 9. The midsagittal plane of the dummy is vertical within  $\pm 1^\circ$ . (572.124(c)(3))
- X 10. The longitudinal centerline of the test probe is centered within  $\pm 2.5$  mm of the midsagittal plane of the dummy and is  $12.7 \text{ mm} \pm 1 \text{ mm}$  below the horizontal peripheral centerline of the No. 3 rib and is within  $0.5^\circ$  of a horizontal line in the dummy's midsagittal plane. (572.124(c)(3))
- X 11. Record locations such as the rear surfaces of the thoracic spine and the lower neck bracket reference with respect to locations such as the rear surfaces of the thoracic spine and the lower neck bracket. These reference measurements are necessary to ensure the dummy is in the same position after the chest skin is installed. The reference locations must be accessible after installation of the chest skin. It may be necessary to leave the chest skin zipper unfastened until the references are checked and fasten it just prior to the test.
- X 12. Install the chest skin and reposition the dummy as described in the preceding paragraph using the reference measurements recorded.
- X 13. The dummy is dressed in a tight-fitting size 5 short sleeve shirt. (572.124(c)(2))
- X 14. Place the arm assemblies horizontal  $\pm 2^\circ$  and parallel to the midsagittal plane. The arms are held in place by tightening the adjustment nut which holds the arm yoke to the clavicle assembly.
- X 15. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.127(k))
- X 16. Impact the anterior surface of the thorax with the test probe so the longitudinal centerline of the probe is within  $2^\circ$  of a horizontal line in the dummy's midsagittal plane at the moment of impact. (572.124(c)(4)) The velocity of the test probe at the time of impact is  $6.71 \text{ m/s} \pm 0.12 \text{ m/s}$ . (572.124(b)) The probe is guided so there is no significant lateral, vertical or rotational movement during the impact. (572.124(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy. (572.124(c)(6))

X 17. Complete the following table:

Thorax Impact Results (572.124(b)) and 572.124(b)(1)&(2)

Parameter*	Specification	Result
Test Probe Speed	$6.59 \text{ m/s} \leq \text{speed} \leq 6.83 \text{ m/s}$	6.77 m/s
Chest Compression	$38.0 \text{ mm} \leq \text{compression} \leq 46.0 \text{ mm}$	41 mm
Peak force** between 38.0 and 46.0 mm chest compression	$1150\text{N} \leq \text{peak force} \leq 1380\text{N}$	1271 N
Peak force** between 12.5 and 38.0 mm chest compression	Peak force $\leq 1500 \text{ N}$	1435 N
Internal Hysteresis***	$65\% \leq \text{hysteresis} \leq 85\%$	73%

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

\*\*Force = impactor mass x acceleration

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

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

Brian Roach  
Signature

06/30/2023  
Date

**MGA RESEARCH CORPORATION**  
**THORAX IMPACT**  
**HYBRID III 6 YEAR OLD**


ATD Serial No: 155

Test I.D.: D231644

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.4	Pass
Relative Humidity	%	10 to 70	45	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	38.0 to 46.0	40.8	Pass
Peak Resistive Force w/in Deflection Corridor	N	1150 to 1380	1,271	Pass
Internal Hysteresis	%	65 to 85	73	Pass
Peak Force 12.5 mm - 38.0 mm	N	<= 1,500	1,435	Pass
Overall Test Results				Pass

  
 Laboratory Technician

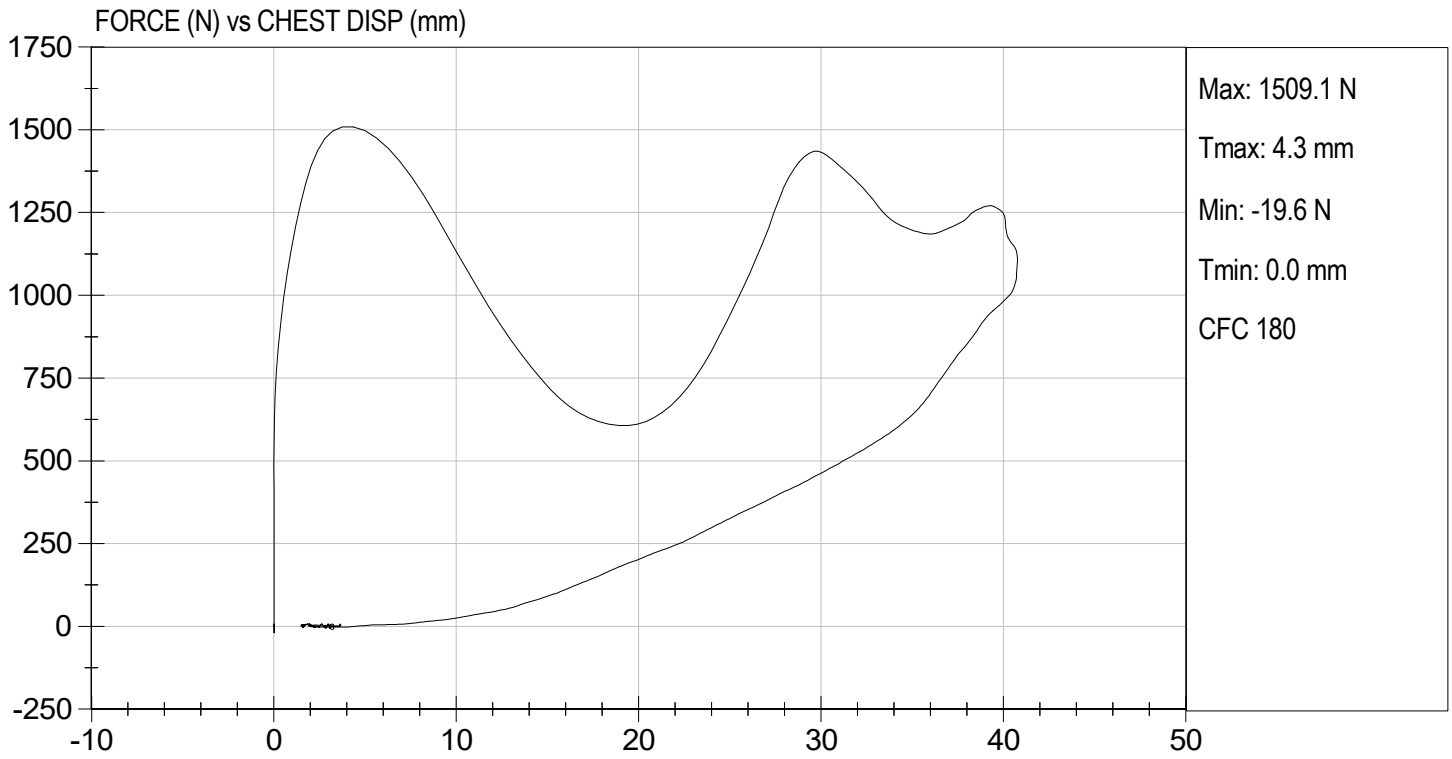
06/30/2023  
 Test Date

  
 Approved By



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

TEST DATE: 06/30/2023  
TEST #: D231644



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

Dummy Serial Number: 155

Test Date: 07/10/2023

Technician: Brian Roach

- Pre test calibration  
 Post test calibration verification

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

1. It has been at least 30 minutes since the last torso flexion test. (572.127(o))  
 N/A, ONLY one torso flexion test performed
2. The test fixture conforms to the specifications in Figure 11C.
3. The complete assembled dummy (127-0000) is used (572.125(c)(2)).  
 with legs below the femurs.  
 without legs below the femurs.
4. The dummy assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.135(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.3°C</u> |
| Record the minimum temperature | <u>20.8°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>42%</u>    |
5. Secure the pelvis to the fixture at the pelvis instrument cavity rear face by threading four ¼x20x½ inch cap screws into the available threaded attachment holes. Tighten the mountings so that the test material is rigidly affixed to the test fixture and the pelvic lumbar joining surface is horizontal. (572.125(c)(3))
6. Attach the loading adapter bracket to the spine of the dummy as shown in Figure 11C. (572.125(c)(6))
7. Flex the dummy forward and back 3 times such that the angle reference plane moves between 0° and 30° with respect to the vertical transverse plane. (572.125(c)(4))
8. Support the dummy such that the angle reference plane is at or near 0° (vertical with respect to the vertical transverse plane). Wait at least 30 minutes before continuing. (572.125(c)(4))
9. Remove all external support that was implemented in 8 above. (572.125(c)(5))

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

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

Parameter	Specification	Result
Initial ref. plane angle	Angle ≤ 22°	20°
Torso rotation rate	0.5°/s ≤ rate ≤ 1.5°/s	0.7°/s
Force at 45° ± 0.5°	147 N ≤ force ≤ 200 N	179 N
Final ref. plane angle	Initial ref. plane angle ± 8°	5°

Brian Road  
Signature

07/10/2023  
Date

MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

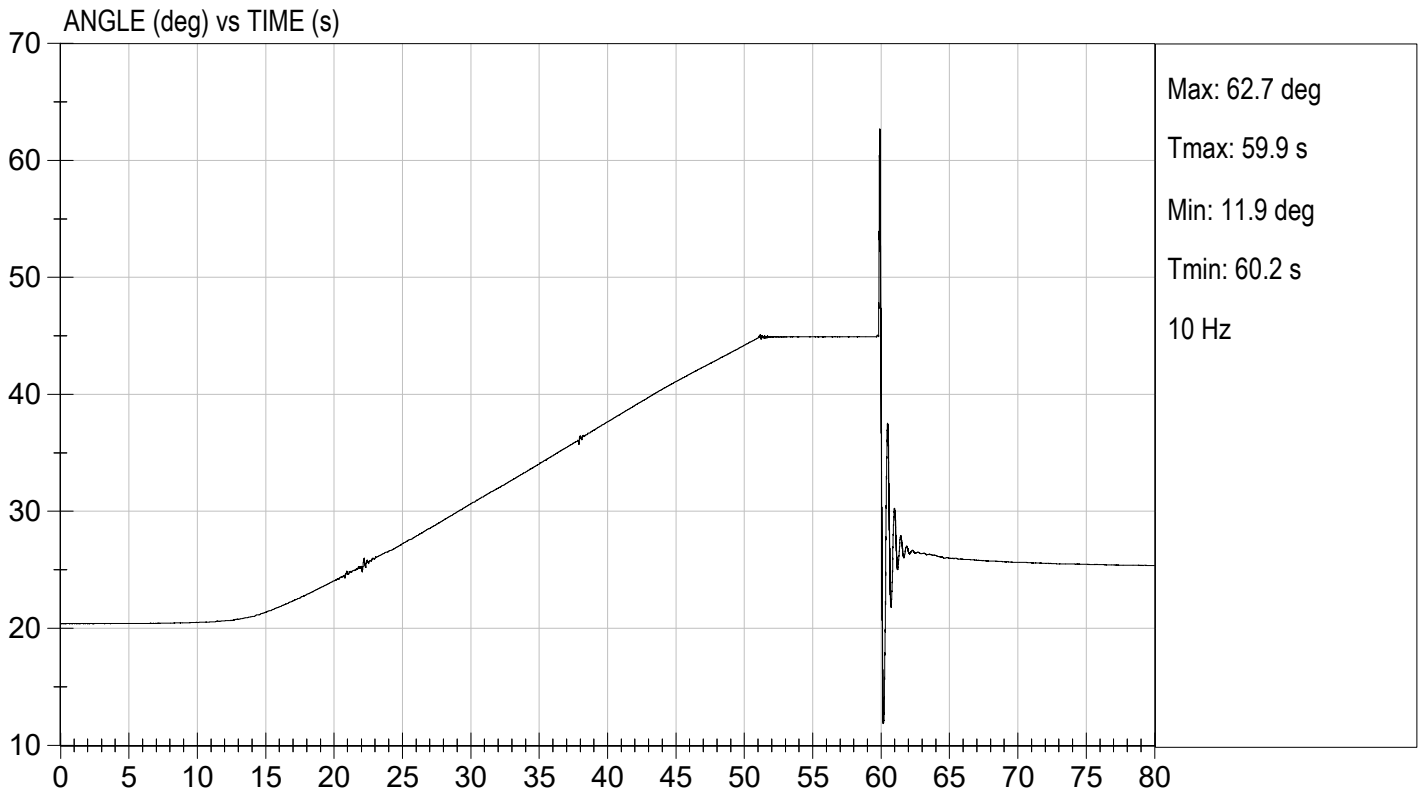
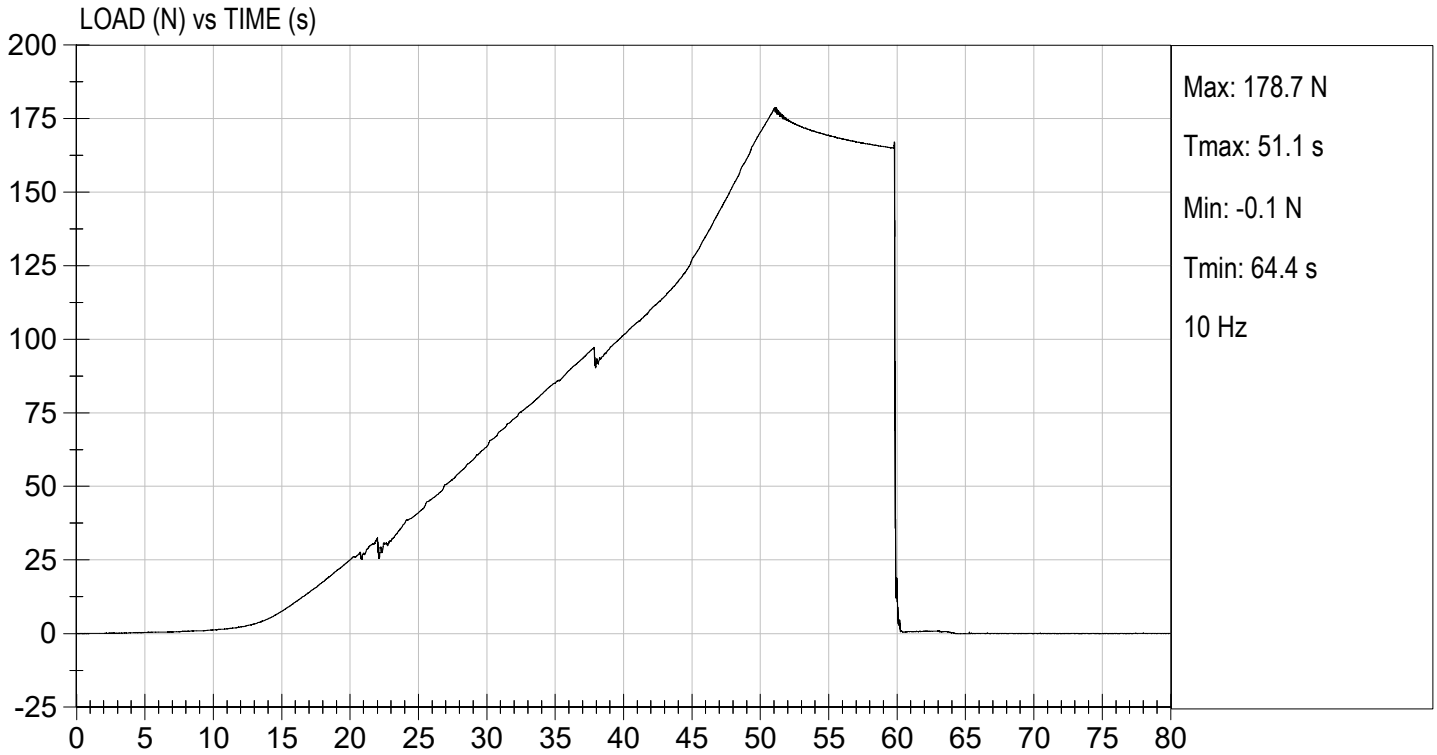
Test I.D: D231647

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Initial Angle	deg	0 to 22	20	Pass
Return Angle	deg	+/- 8	5	Pass
Force at 45 deg	N	147 to 200	179	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.7	Pass
Overall Result				Pass

Brian Road  
Laboratory Technician

07/10/2023  
Test Date

Joe Galvez  
Approved By



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

Dummy Serial Number: 155

Test Date: 07/07/2023

Technician: Brian Roach

- Pre test calibration  
X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
     X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 12C.
- X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-1), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>42%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.

\_\_\_\_\_ (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.07 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2262 N

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

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

Brian Roach  
Signature

07/07/2023  
Date

**MGA RESEARCH CORPORATION**

**LEFT KNEE IMPACT TEST**

**HYBRID III 6 YEAR OLD**


**ATD Serial No:** 155

**Test I.D.:** D231646

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.07	Pass
Maximum Force	N	2000 to 3000	2262	Pass
Overall Test Results				Pass

  
Laboratory Technician

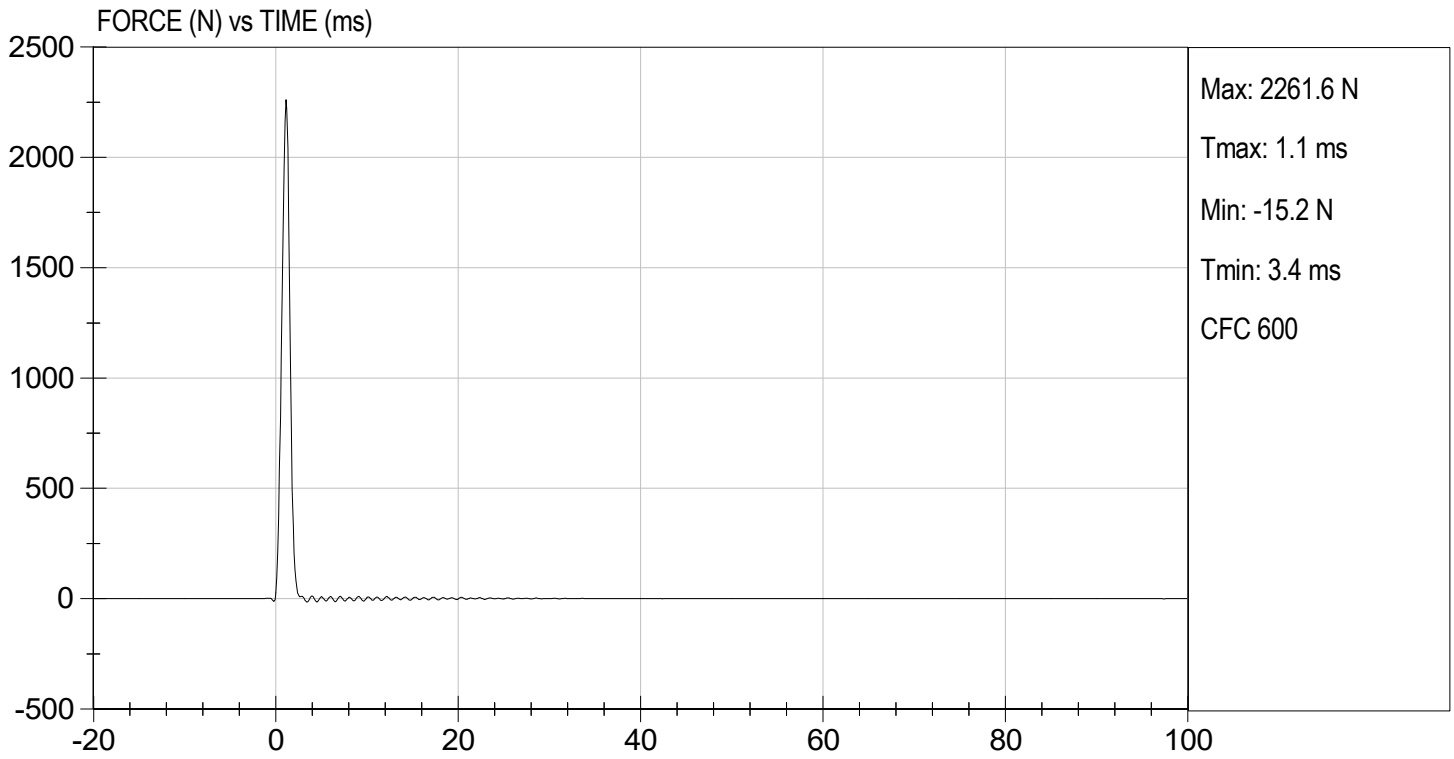
07/07/2023  
Test Date

  
Approved By



TEST DESC: LEFT KNEE  
VELOCITY: 6.78 ft/s, 2.07 m/s

TEST DATE: 07/07/2023  
TEST #: D231646



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

Dummy Serial Number: 155

Test Date: 07/07/2023

Technician: Brian Roach

- Pre test calibration  
X Post test calibration verification

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

- X 1. It has been at least 30 minutes since the last knee impact test. (572.127(o))  
     X N/A, ONLY one knee impact test performed
- X 2. The test fixture conforms to the specifications in Figure 12C.
- X 3. The knee assembly consisting of the knee machined (127-4013), knee flesh (127-4011), lower leg (127-4014), foot assembly (127-4030-2), and femur load transducer (SA572-S10) (may use the load cell structural replacement (127-4007)) were used. (572.126(b))
- X 4. The knee assembly soaked at a temperature between 18.9°C (66°F) and 25.6°C (78°F) and at a relative humidity from 10% to 70% for a period of at least four (4) hours prior to this test. (572.126(c)(1))
- |                                |               |
|--------------------------------|---------------|
| Record the maximum temperature | <u>21.1°C</u> |
| Record the minimum temperature | <u>20.6°C</u> |
| Record the maximum humidity    | <u>44%</u>    |
| Record the minimum humidity    | <u>42%</u>    |
- X 5. Mount the test specimen and secure it to the rigid test fixture. (572.126(c)(2))
- X 6. No parts of the foot or tibia contact any exterior surface. (572.126(c)(2))
- X 7. Align the test probe so that throughout its stroke and at contact with the knee it is within 2 degrees of horizontal and collinear with the longitudinal centerline of the femur. (572.126(c)(3))
- X 8. The probe is guided so there is no significant lateral, vertical or rotational movement during the impact with the knee. (572.136(c)(4))
- X 9. The data acquisition system, including transducers, must conform to the requirements of SAE Recommended Practice J211/1 MAR95 (572.136(m)) Class 600.
- X 10. Contact the knee with the test probe at a speed between 2.07 m/s and 2.13 m/s.

\_\_\_\_\_ (572.126(c)(5)) Neither the suspension hardware, suspension cables, nor other attachments to the probe, including the velocity vane, make contact with the dummy.  
(572.126(c)(6))

X 11. Complete the following table:

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

Parameter	Specification	Result
Probe speed	$2.07 \text{ m/s} \leq \text{speed} \leq 2.13 \text{ m/s}$	2.10 m/s
Peak resistance force*	$2000 \text{ N} \leq \text{force} \leq 3000 \text{ N}$	2451 N

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

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

Brian Roach  
Signature

07/07/2023  
Date

MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 6 YEAR OLD

ATD Serial No: 155

Test I.D: D231645

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.5	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	44	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	2000 to 3000	2451	Pass
Overall Test Results				Pass

*Brian Roud*

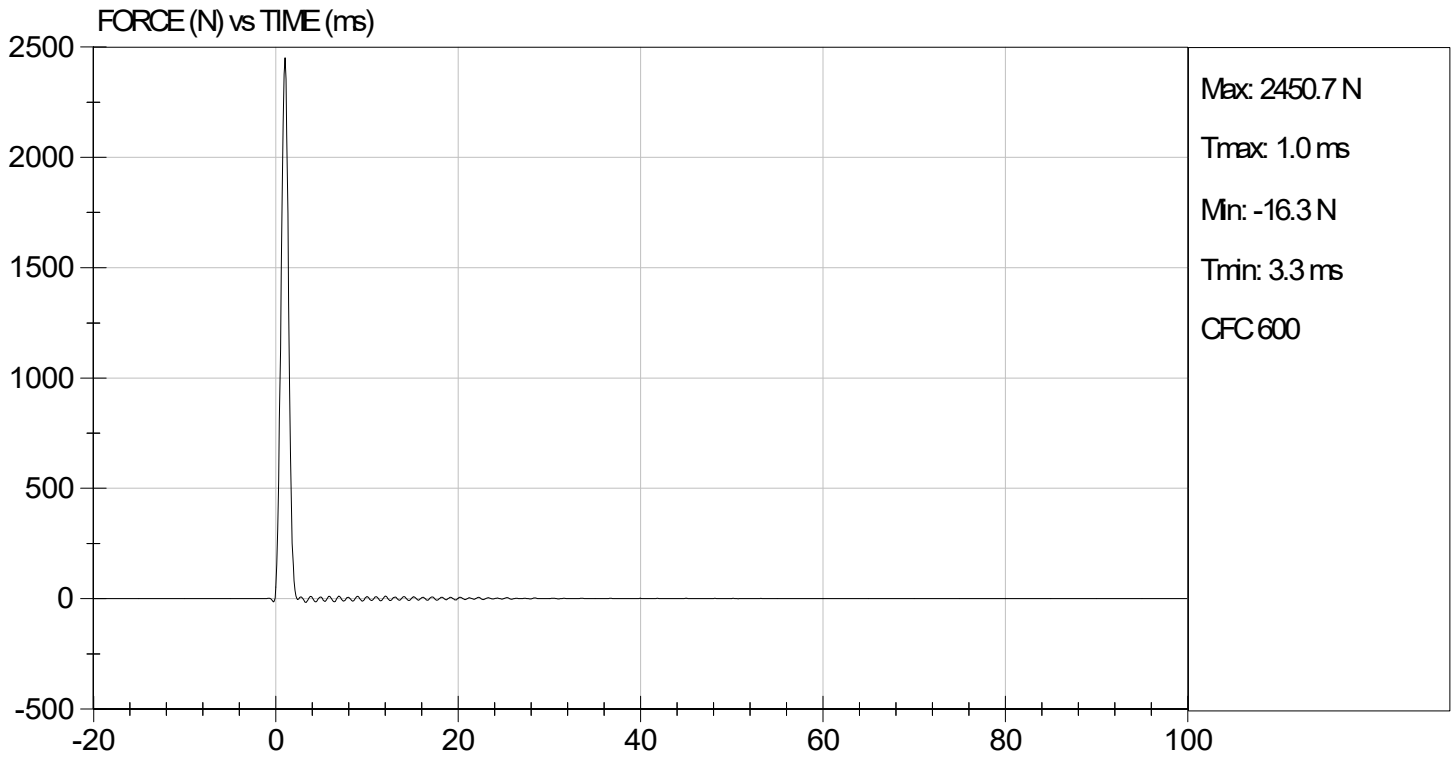
Laboratory Technician

07/07/2023

Test Date

*Joe Galvez*

Approved By



**DATA SHEET C10**  
PART 572 INSTRUMENTATION CALIBRATION INFORMATION

I.D. NO.	MANUFACTURER	MODEL NO.	SERIAL NO.	DATE OF LAST CALIBRATION	DATE OF NEXT CALIBRATION
DUMMY INSTRUMENTATION					
HEAD ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-2-360M17	P79723	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P84426	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	P84428	05/24/2023	11/23/2023
NECK TRANSDUCER	Denton	1716-03-06N	N253	05/05/2023	11/04/2023
CHEST ACCELEROMETERS					
(1) LONGITUDINAL	Endevco	7264C-2KTZ-360M17	P88330	05/24/2023	11/23/2023
(2) LATERAL	Endevco	7264C-2KTZ-360M17	P88331	05/24/2023	11/23/2023
(3) VERTICAL	Endevco	7264C-2KTZ-360M17	P88332	05/24/2023	11/23/2023
CHEST POTENTIOMETER	Humanetics	127-8050	155	05/31/2023	11/30/2023
FEMUR LOAD CELLS					
(1) RIGHT FEMUR	N/A	N/A	N/A	N/A	N/A
(2) LEFT FEMUR	N/A	N/A	N/A	N/A	N/A
LABORATORY INSTRUMENTATION					
NECK PENDULUM ACCELEROMETER	Endevco	7231C-750	C13081	05/02/2023	11/01/2023
THORAX PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-360M17	P97372	05/22/2023	11/21/2023
KNEE PENDULUM ACCELEROMETER	Endevco	7264C-2KTZ-2-360M17	P82128	06/01/2023	12/01/2023
NECK ROTATION TRANSDUCER 1 (OPTIONAL)	Spectrol	1320-0-0102	018	01/19/2023	07/21/2023
NECK ROTATION TRANSDUCER 2 (OPTIONAL)	Spectrol	132-0-0-102	023	01/19/2023	07/21/2023

LABORATORY TECHNICIAN:       Brian Roach

**DATA SHEET C1**  
**DUMMY DAMAGE CHECKLIST (6 YEAR-OLD)**

Dummy Serial Number: 155

Test Date: 07/07/2023

Technician: Brian Roach

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:

Brian Road  
Signature

07/07/2023  
Date

Describe the repair or replacement of parts:

Checked by:

Joe Galvez  
Signature

07/07/2023  
Date