



REPORT NUMBER: TWG-MGA-2018-004

**SIDE AIRBAG OUT-OF-POSITION INJURY
TECHNICAL WORKING GROUP**

**TOYOTA MOTOR MANUFACTURING TURKEY INC.
2018 Toyota C-HR XLE 5-Door Hatchback
NHTSA No.: M20185105TWG3**

Test Date: September 26, 2018

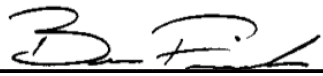
Final Report Date: April 17, 2019

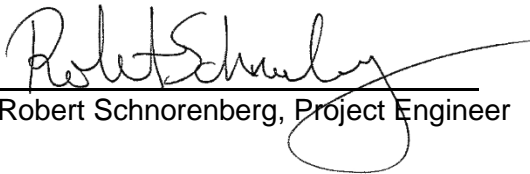
FINAL REPORT

**PREPARED BY:
MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105**

**PREPARED FOR:
ALPHA TECHNOLOGY ASSOCIATE, INC.
2810 Old Lee Highway, Suite 120
Fairfax, VA 22031**

SIGNATURE APPROVAL PAGE

Prepared by: 
Ben Fischer, Project Engineer

Approved by: 
Robert Schnorenberg, Project Engineer

Approval Date: April 17, 2019

FINAL REPORT ACCEPTANCE BY:

Date: _____

The results presented in this report relate only to the specified test items.

TECHNICAL REPORT DOCUMENTATION PAGE

1. Report No. TWG-MGA-2018-004		2. Government Accession No.		3. Recipient's Catalog No.																
4. Title and Subtitle Final Report of Side Airbag Out-of-Position Injury Technical Working Group evaluation of a 2018 Toyota C-HR XLE 5-Door Hatchback, NHTSA No.: M20185105TWG3				5. Report Date April 17, 2019																
				6. Performing Organization Code MGA																
7. Author(s) Ben Fischer, Project Engineer				8. Performing Organization Report No. TWG-MGA-2018-004																
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105				10. Work Unit No.																
				11. Contract or Grant No. DTNH22-13-D-00311L																
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, DC 20590				13. Type of Report and Period Covered: Final Test Report September 26, 2018 to April 17, 2019																
				14. Sponsoring Agency Code NRM-110																
15. Supplementary Notes																				
16. Abstract A Side Airbag Out-of-Position Injury evaluation was conducted on the subject 2018 Toyota C-HR XLE 5-Door Hatchback in accordance with the specifications of the Side Airbag Out-of-Position Injury Technical Working Group Laboratory Test Procedure for the generation of consumer information. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on September 26, 2018.																				
Injury Summary (3-Year-Old Out-Of-Position)																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 12.5%;">HIC15</th> <th style="width: 12.5%;">Maximum Chest Displacement (mm)</th> <th style="width: 12.5%;">Maximum Chest Displacement Rate m/s)</th> <th style="width: 12.5%;">Nij (NTF)</th> <th style="width: 12.5%;">Nij (NTE)</th> <th style="width: 12.5%;">Nij (NCF)</th> <th style="width: 12.5%;">Nij (NCE)</th> </tr> </thead> <tbody> <tr> <td align="center">10.615</td> <td align="center">-3.1</td> <td align="center">-0.4</td> <td align="center">0.14</td> <td align="center">0.35</td> <td align="center">0.10</td> <td align="center">0.23</td> </tr> </tbody> </table>							HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate m/s)	Nij (NTF)	Nij (NTE)	Nij (NCF)	Nij (NCE)	10.615	-3.1	-0.4	0.14	0.35	0.10	0.23
HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate m/s)	Nij (NTF)	Nij (NTE)	Nij (NCF)	Nij (NCE)														
10.615	-3.1	-0.4	0.14	0.35	0.10	0.23														
17. Key Words Side Airbag Out-of-Position Technical Working Group OOP TWG HIII 3YO				18. Distribution Statement Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE Washington, DC 20590 e-mail: tis@nhtsa.dot.gov FAX: 202-493-2833																
19. Security Classification of Report Unclassified		20. Security Classification of Page Unclassified		21. No. of Pages 69		22. Price														

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	Purpose and Summary of Test	1
2	Occupant and Vehicle Information / Data Sheets	3

<u>Data Sheet No.</u>		<u>Page No.</u>
1	Test Summary	3
2	Test Vehicle Information	4
3	Dummy Positioning in Vehicle	5
4	Dummy Injury Criteria Values	6

<u>Appendix</u>		
A	Photographs	A
B	Dummy Response Data Traces	B
C	Dummy Configuration and Performance Verification Data	C
D	Test Equipment and Instrumentation Calibration Data	D

SECTION 1 PURPOSE AND SUMMARY OF TEST

PURPOSE

The purpose of this test was to obtain data in a static out-of-position side air bag deployment. These data constitute part of the general consumer information collected by Alpha Technology Associate, Inc.

SUMMARY

The effects of both a curtain and torso airbag deployment in a 2018 Toyota C-HR XLE 5-Door Hatchback with an out-of-position Hybrid III 3-Year-Old child dummy were evaluated. The curtain and seat airbags were fired remotely. The test was performed by MGA Research Corporation on September 26, 2018. Pre- and post-test photographs of the vehicle and dummy can be found in Appendix A.

Two high-speed cameras (1000 fps) were used to document the side airbag deployment event. The following camera locations were used:

- Left Side Through Removed Left Rear Passenger Door
- Left Side $\frac{3}{4}$ View Through Windshield

One Hybrid III 3-Year-Old child dummy (Serial Number 082) was placed in the right rear passenger seat situated in the rear-facing position along the outboard edge of the seat per Section 3.3.3.2 according to dummy placement instructions specified in the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG).

The dummy was instrumented with the following instrumentation:

- Head Accelerometers
- Upper Neck Load Cell
- Lower Neck Load Cell
- Chest Accelerometers
- Upper Spine Accelerometers
- Lower Spine Accelerometers
- Upper Sternum Accelerometers
- Lower Sternum Accelerometers
- Chest Potentiometer

The 27 channels of data were recorded using an off board data acquisition system. Appendix B contains the dummy data traces.

The Hybrid III 3-Year-Old child dummy's visible contact points were as follows:

- Side curtain airbag to back of head and shoulder
- Side torso/pelvis airbag to left side of torso

The Hybrid III 3-Year-Old child dummy was placed in the right rear passenger seat along the outboard edge of the seat cushion, kneeling and facing rearward. The vertical centerline of the dummy's sternum was aligned as close as possible with the leading edge of the seatback bolster. The sternum contacted with seat. The dummy's head was placed in between the seat bolster and pillar/side trim to maximize contact between the sternum and seatback. The head remained in its neutral orientation. The outboard leg was positioned at the outboard edge of the seat cushion and parallel to the seat centerline and remained on the cushion. The outboard knee and lower leg was slid toward the seatback/seat cushion junction until the top edge of the upper rib was aligned horizontally with the top edge of the airbag module. The inboard leg was aligned parallel to the centerline of the seat cushion. The inboard knee and lower leg was slid toward the seat bight until a line drawn through both shoulder bolts was perpendicular to the vehicle centerline. The inboard arm was rotated towards the seatback until the thumb contacts the seatback. The outboard arm and hand was rotated to hang down as close to vertical as possible.

The dummy's skullcap seam was taped with 4mm electrical tape to prevent the airbag from getting caught in the seam. The dummy's head skin was cleaned with alcohol and dusted with baby powder to achieve acceptable frictional characteristics.

This orientation complies with Section 3.3.3.2 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

Test Note: The test vehicle's right rear door was replaced prior to testing due to excessive damage cause by prior vehicle evaluations.

**SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS**

**DATA SHEET NO. 1
TEST SUMMARY**

	Test Data	Description
Seating Position	P3	Right Rear Seating Position
Test	3.3.3.2*	Rear-Facing Child Dummy
Curtain Airbag	Roof-Rail Mounted	Side Curtain Airbag
Torso Airbag	Seat Mounted	Side Torso Airbag
ATD Type/Serial No.	Hybrid III 3-Year-Old / 082	Child Dummy

*Procedure as defined by Lund, et al and the Technical Working Group dated July, 2003

Number of Data Channels	27
Number of Airbag Channels	4
Number of High-Speed Video	2

Visible Dummy Contact Points	
Head Contact	Side curtain airbag to back of head
Left Shoulder Contact	Side curtain airbag to left shoulder
Left Torso Contact	Side torso airbag to torso
Left Pelvis Contact	None

DATA SHEET NO. 2

TEST VEHICLE INFORMATION

Please note that this vehicle had previously been tested in an
NCAP Side Impact on October 20, 2017.

TEST VEHICLE INFORMATION

Manufacturer	Toyota
Model	C-HR XLE
Body Style	5-Door Hatchback
NHTSA No.	M20185105
VIN	NMTKHMBX4JR007159
Color	Ruby Flare Pearl
Delivery Date	9/21/2017
Odometer Reading	65 miles
Dealer	Toyota of Brookfield
Transmission	Automatic
Final Drive	FWD
Number of Cylinders	4
Engine Displacement	2.0 L
Engine Placement	Lateral
Automatic Door Lock (ADL)	No
Owner's Manual Details Instructions on Disabling ADLs	-
Bucket Seats	Yes

TEST VEHICLE OPTIONS

Driver Front Airbag	Yes
Driver Side Curtain Airbag	Yes
Driver Side Torso Airbag	No
Driver Side Torso/Pelvis Airbag	Yes
Rear Pass. Side Curtain Airbag	Yes
Rear Pass. Side Torso Airbag	Yes
Rear Pass. Side Torso/Pelvis Airbag	No
Force Limiter	Yes
Pretensioner	Yes
Power Steering	Yes
Power Door Locks	Yes
Tilt Wheel	Yes
Air Conditioning	Yes
Anti-lock Brakes	Yes
Traction Control	Yes
All-Wheel Drive	No
Power Seats	No

DATA FROM CERTIFICATION LABEL

Manufactured By	TOYOTA MOTOR MANUFACTURING TURKEY INC.
Date of Manufacture	03/17

GVWR (kg)	1964
GAWR Front (kg)	1050
GAWR Rear (kg)	1080

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Contoured Bench		
Number of Occupants	2	3		5
Capacity Wt. (VCW) (kg)				375
Cargo Wt. (RCLW) (kg)				28

DATA SHEET NO. 3
DUMMY POSITIONING IN VEHICLE

Measurement		Value
Seat Position (from forward-most)		Fixed
Seat Height Position		Fixed
Placed in Position No. 3		-
Seat Back Angle (at outboard headrest post)	SA (°)	10.0
Top of Curtain Airbag Module to Head/Neck Junction	AN (mm)	250
Top of Seat Airbag Module to Head/Neck Junction	AN (mm)	40
Head CG to Door Panel	HD (mm)	65
Head to Seat Back Centerline	HSC (mm)	138
ATD Back to Seatback	CD (mm)	235
Chest to Seatback	CS (mm)	32
Right Arm to Seat Back Centerline	RACL (mm)	40
Left Arm to Seat Back Centerline	LACL (mm)	310
Right Arm to Door Panel	RA (mm)	300
Left Arm to Door Panel	LA (mm)	25
Knee to Knee	KK (mm)	110
Toe to Toe	TT (mm)	90
Right Knee to Seat Cushion Centerline	KSCR (mm)	130
Left Knee to Seat Cushion Centerline	KSCL (mm)	185
Right Toe to Seat Cushion Centerline	TSCR (mm)	147
Left Toe to Seat Cushion Centerline	TSCL (mm)	237
Nose to Dash	ND (mm)	-
Nose to Seatback	NS (mm)	0
Top of Head to Headliner	HH (mm)	85

DATA SHEET NO. 4
DUMMY INJURY CRITERIA VALUES

NHTSA No. M20185105TWG3

DESCRIPTION	UNIT	Position No. 3			
		MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Head X	g	27.5	19.0	-8.0	19.6
Head Y	g	17.2	31.2	-5.8	9.7
Head Z	g	12.8	9.4	-10.6	19.9
Head Resultant	g	28.4	19.0		
Upper Neck Fx	N	25.8	6.4	-208.9	28.1
Upper Neck Fy	N	84.3	8.3	-133.6	11.4
Upper Neck Fz	N	342.6	9.4	-127.4	25.2
Upper Neck F Resultant	N	349.8	9.5		
Upper Neck Mx	Nm	8.9	71.2	-10.6	16.0
Upper Neck My	Nm	6.7	50.8	-6.7	11.7
Upper Neck Mz	Nm	8.7	84.8	-8.9	22.9
Upper Neck M Resultant	Nm	14.1	15.8		
Lower Neck Fx	N	26.6	5.7	-197.5	14.0
Lower Neck Fy	N	142.2	7.4	267.3	10.6
Lower Neck Fz	N	411.9	9.1	140.2	35.8
Lower Neck F Resultant	N	477.3	9.1		
Lower Neck Mx	Nm	12.6	76.5	-16.9	11.6
Lower Neck My	Nm	19.1	37.6	-1.0	5.7
Lower Neck Mz	Nm	9.9	82.4	-12.8	14.5
Lower Neck M Resultant	Nm	22.6	11.9		
Chest X	g	5.9	29.7	-20.1	7.4
Chest Y	g	37.8	7.0	-4.4	8.8
Chest Z	g	7.9	8.6	-3.1	15.9
Chest Resultant	g	42.4	7.1		

DATA SHEET NO. 4 (continued)
DUMMY INJURY CRITERIA VALUES

NHTSA No. M20185105TWG3

DESCRIPTION	UNIT	Position No. 3			
		MAXIMUM	TIME (ms)	MINIMUM	TIME (ms)
Upper Spine X	g	9.0	29.3	-12.6	7.4
Upper Spine Y	g	55.4	7.0	-6.8	8.9
Upper Spine Z	g	10.4	8.0	-5.9	29.5
Upper Spine Resultant	g	57.5	7.0		
Lower Spine X	g	27.7	7.5	-5.1	22.5
Lower Spine Y	g	39.5	7.4	-2.3	30.9
Lower Spine Z	g	18.9	8.4	-3.9	15.4
Lower Spine Resultant	g	49.8	7.5		
Upper Sternum X	g	43.8	5.1	-55.1	7.7
Lower Sternum X	g	92.9	4.8	-58.0	5.2
Chest Displacement	mm	0.3	51.1	-3.1	13.7
Chest Displacement Rate	m/s	0.4	18.5	-0.4	8.8

DATA SHEET NO. 4 (continued)
DUMMY INJURY CRITERIA VALUES

NHTSA No. M20185105TWG3

Head Injury Summary (Hybrid III 3-Year-Old Child Out-Of-Position)

ATD position	HEAD INJURY CRITERIA (HIC)					
	HIC15			HIC36		
	HIC	T ¹ (msec)	T ² (msec)	HIC	T ¹ (msec)	T ² (msec)
No. 082 Right Front	10.615	18.8	33.8	11.607	7.1	43.1

Neck Injury Summary (Hybrid III 3-Year-Old Child Out-Of-Position)

	Nij	Time (msec)	Z Force (N) (CFC 600)	X Force (N) (CFC 600)	Y Moment (N-m) (CFC 600)
Ntf	0.14	51.5	91.5	-72.1	6.7
Nte	0.35	11.6	224.3	-115.7	6.7
Ncf	0.10	43.7	-29.3	-120.5	5.8
Nce	0.23	19.5	-119.6	-166.5	-4.7
Peak Tension (CFC1000)		342.6 N	Peak Compression (CFC 1000)		-127.4 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2120 N	Extension (mCVe)	27 N-m	Tension	1130 N
Compression (CVc)	2120 N	Flexion (mCVf)	68 N-m	Compression	1380 N

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

		<u>Page No.</u>
Photo No. 001	Right Three-Quarter Front View of Vehicle, As Received	A-1
Photo No. 002	Vehicle Certification Placard	A-1
Photo No. 003	Pre-Test Vehicle Left Side View	A-2
Photo No. 004	Post-Test Vehicle Left Side View	A-2
Photo No. 005	Pre-Test 3-Year-Old Child Dummy Left Side View	A-3
Photo No. 006	Post-Test 3-Year-Old Child Dummy Left Side View	A-3
Photo No. 007	Pre-Test 3-Year-Old Child Dummy Left Side Close-Up View	A-4
Photo No. 008	Post-Test 3-Year-Old Child Dummy Left Side Close-Up View	A-4
Photo No. 009	Pre-Test 3-Year-Old Child Dummy Left Three-Quarter Front View	A-5
Photo No. 010	Post-Test 3-Year-Old Child Dummy Left Three-Quarter Front View	A-5
Photo No. 011	Pre-Test 3-Year-Old Child Dummy Left Three-Quarter Front Close-Up View	A-6
Photo No. 012	Post-Test 3-Year-Old Child Dummy Left Three-Quarter Front Close-Up View	A-6
Photo No. 013	Pre-Test 3-Year-Old Child Dummy Front View	A-7
Photo No. 014	Post-Test 3-Year-Old Child Dummy Front View	A-7
Photo No. 015	Pre-Test 3-Year-Old Child Dummy Front Close-Up View	A-8
Photo No. 016	Post-Test 3-Year-Old Child Dummy Front Close-Up View	A-8
Photo No. 017	Pre-Test 3-Year-Old Child Dummy Right Three-Quarter Front View	A-9
Photo No. 018	Post-Test 3-Year-Old Child Dummy Right Three-Quarter Front View	A-9
Photo No. 019	Pre-Test 3-Year-Old Child Dummy Right Side View	A-10
Photo No. 020	Post-Test 3-Year-Old Child Dummy Right Side View	A-10
Photo No. 021	Post-Test 3-Year-Old Child Dummy Right Side View (Door Open)	A-11
Photo No. 022	Post-Test Curtain Airbag Left Side View	A-11
Photo No. 023	Post-Test Curtain Airbag Left Three-Quarter Front View	A-12
Photo No. 024	Post-Test Curtain Airbag Front View	A-12
Photo No. 025	Post-Test Curtain Airbag Right Side View (Door Open)	A-13



Photo No. 001 - Right Three-Quarter Front View of Vehicle, As Received



Photo No. 002 - Vehicle Certification Placard



Photo No. 003 - Pre-Test Vehicle Left Side View



Photo No. 004 - Post-Test Vehicle Left Side View



Photo No. 005 - Pre-Test 3-Year-Old Child Dummy Left Side View



Photo No. 006 - Post-Test 3-Year-Old Child Dummy Left Side View



Photo No. 007 - Pre-Test 3-Year-Old Child Dummy Left Side Close-Up View



Photo No. 008 - Post-Test 3-Year-Old Child Dummy Left Side Close-Up View



Photo No. 009 - Pre-Test 3-Year-Old Child Dummy Left Three-Quarter Front View



Photo No. 010 - Post-Test 3-Year-Old Child Dummy Left Three-Quarter Front View



Photo No. 011 - Pre-Test 3-Year-Old Child Dummy Left Three-Quarter Front Close-Up View

PHOTOGRAPH NOT AVAILABLE

Photo No. 012 - Post-Test 3-Year-Old Child Dummy Left Three-Quarter Front Close-Up View

PHOTOGRAPH NOT AVAILABLE

Photo No. 013 - Pre-Test 3-Year-Old Child Dummy Front View

PHOTOGRAPH NOT AVAILABLE

Photo No. 014 - Post-Test 3-Year-Old Child Dummy Front View

PHOTOGRAPH NOT AVAILABLE

Photo No. 015 - Pre-Test 3-Year-Old Child Dummy Front Close-Up View

PHOTOGRAPH NOT AVAILABLE

Photo No. 016 - Post-Test 3-Year-Old Child Dummy Front Close-Up View



Photo No. 017 - Pre-Test 3-Year-Old Child Dummy Right Three-Quarter Front View



Photo No. 018 - Post-Test 3-Year-Old Child Dummy Right Three-Quarter Front View



Photo No. 019 - Pre-Test 3-Year-Old Child Dummy Right Side View



Photo No. 020 - Post-Test 3-Year-Old Child Dummy Right Side View



Photo No. 021 - Post-Test 3-Year-Old Child Dummy Right Side View (Door Open)



Photo No. 022 - Post-Test Curtain Airbag Left Side View



Photo No. 023 - Post-Test Curtain Airbag Left Three-Quarter Front View

PHOTOGRAPH NOT AVAILABLE

Photo No. 024 - Post-Test Curtain Airbag Front View



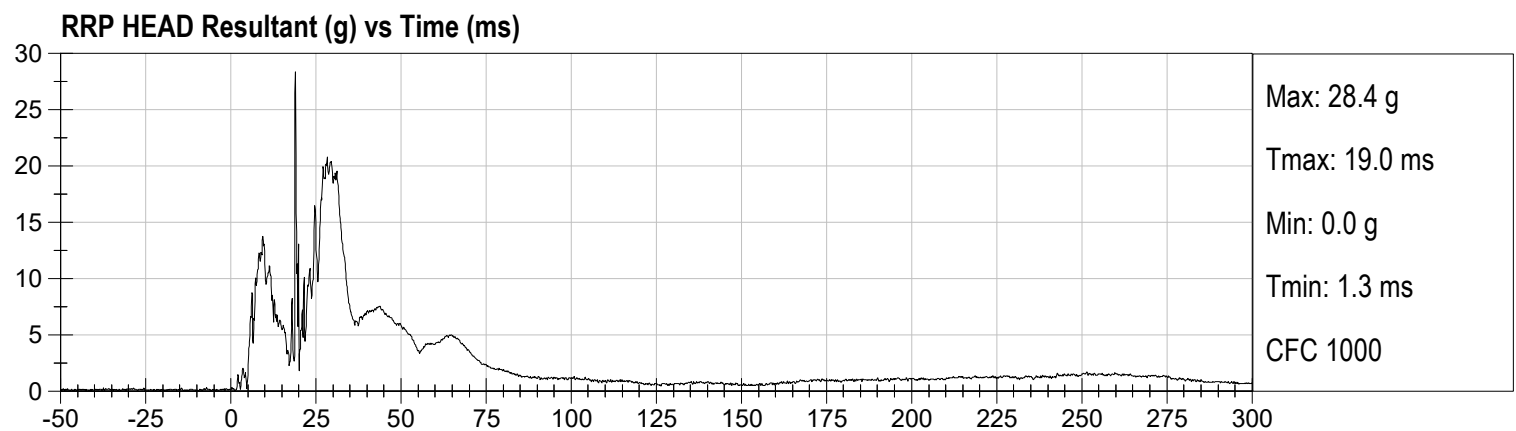
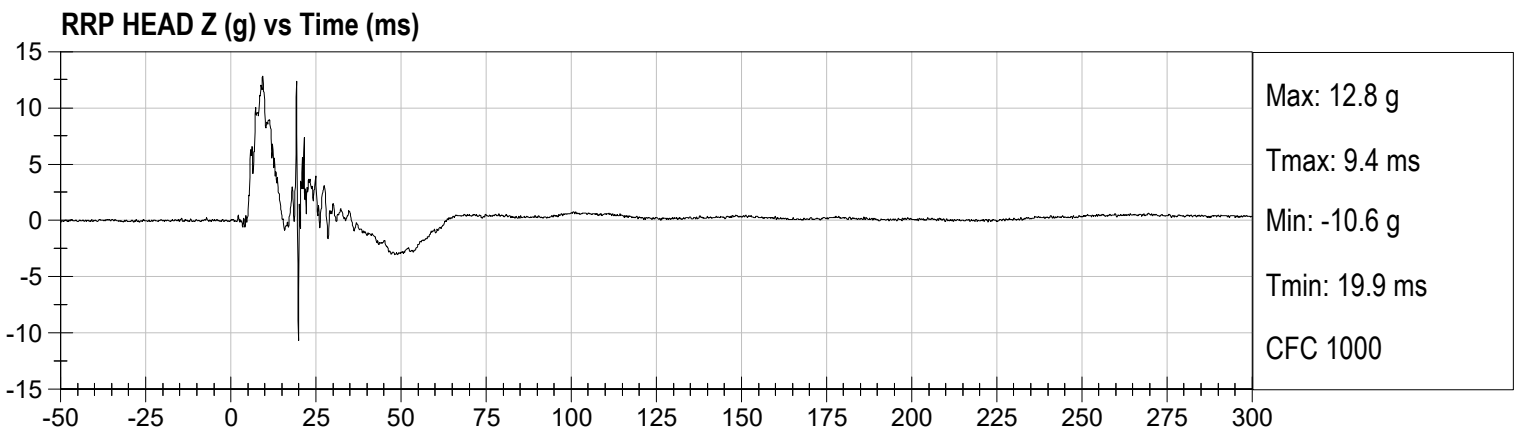
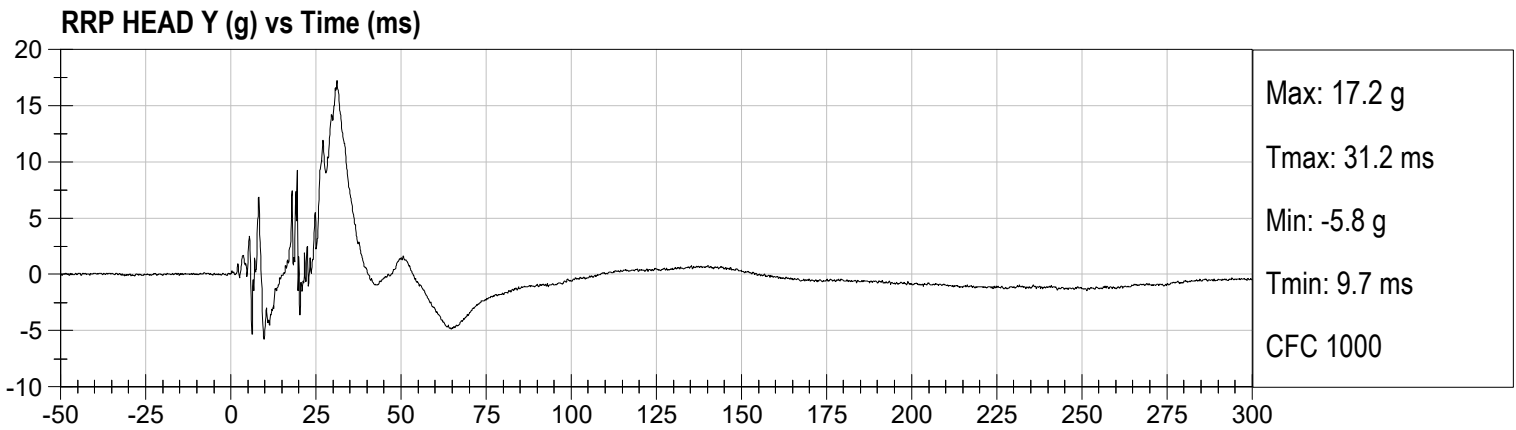
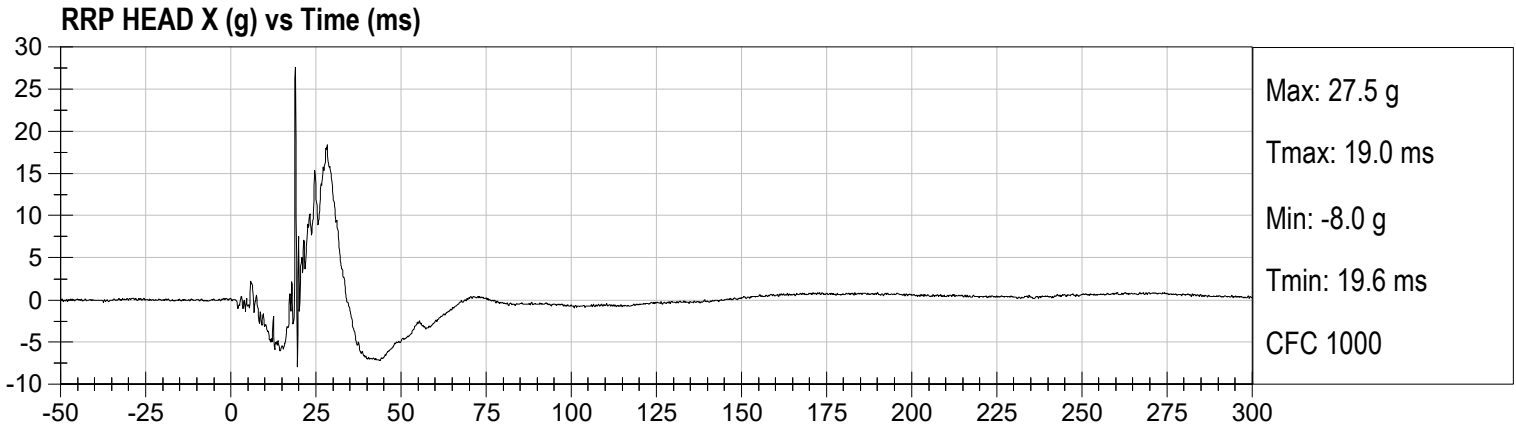
Photo No. 025 - Post-Test Curtain Airbag Right Side View (Door Open)

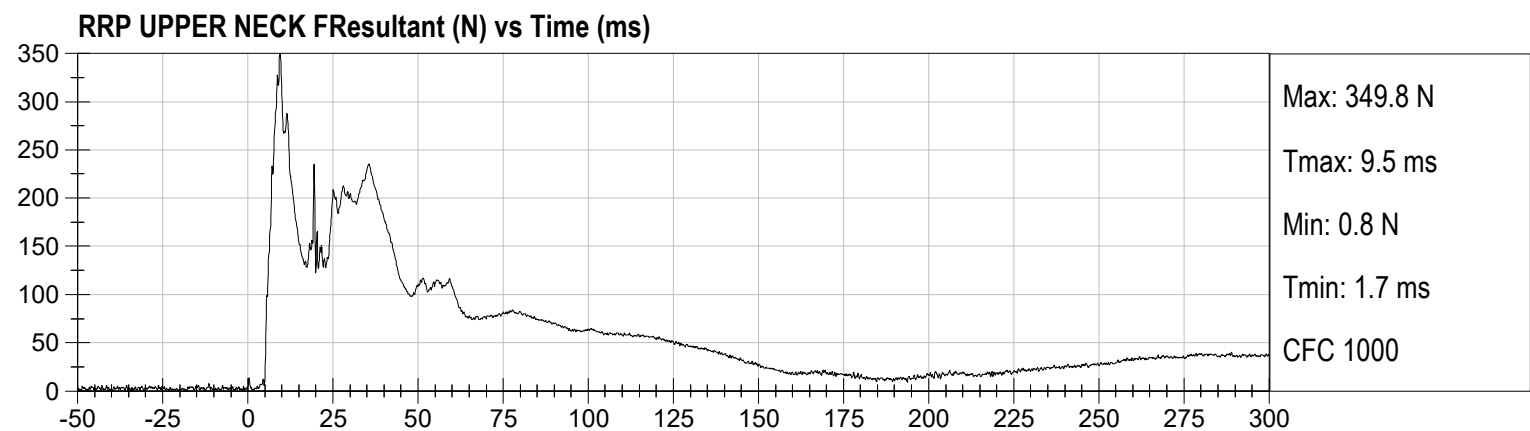
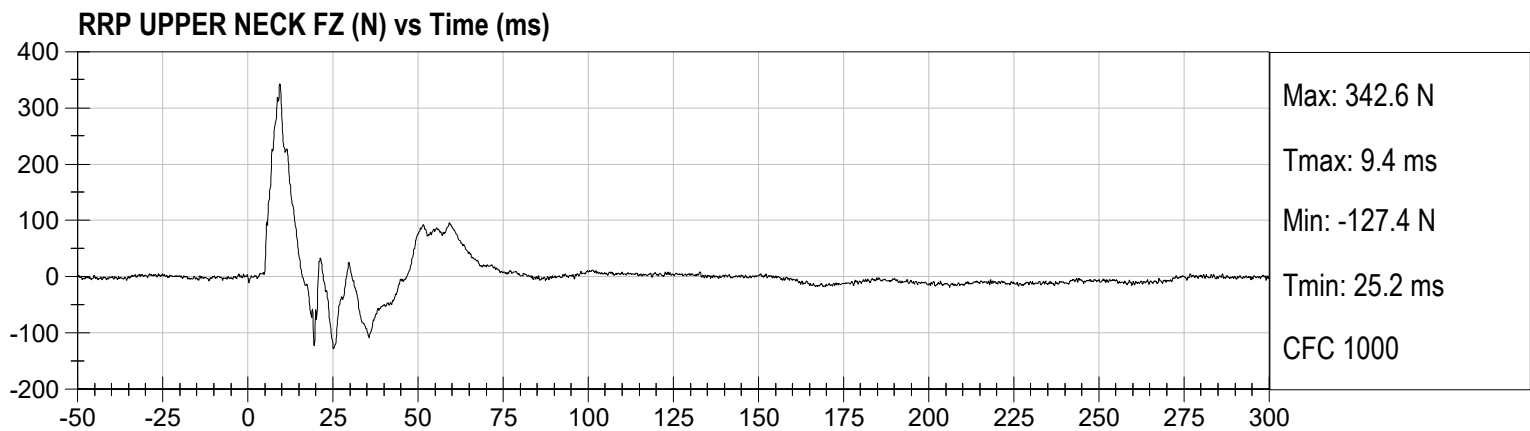
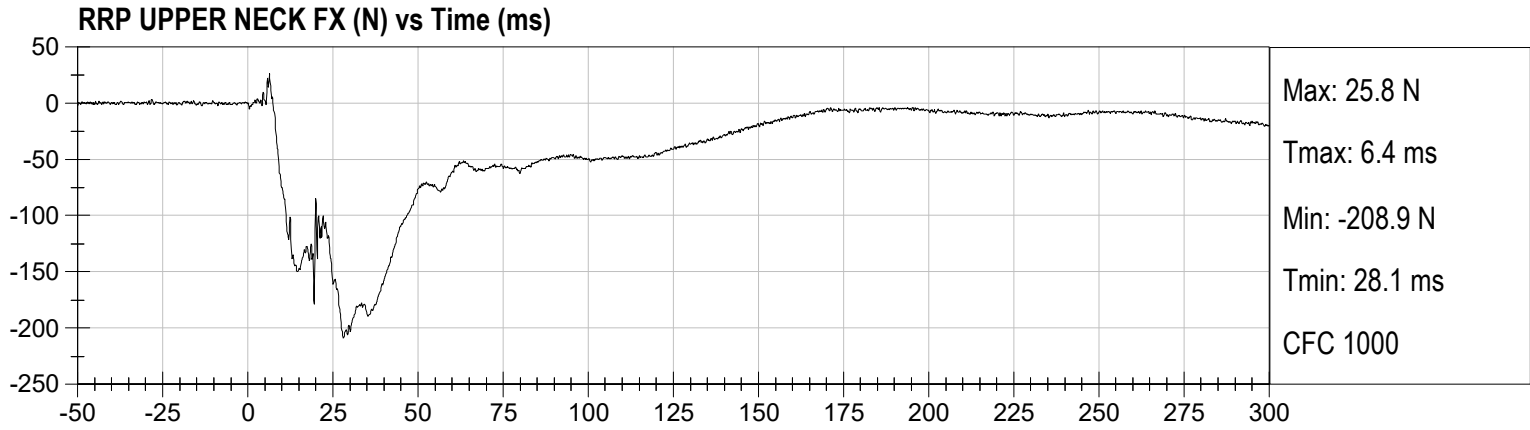
APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

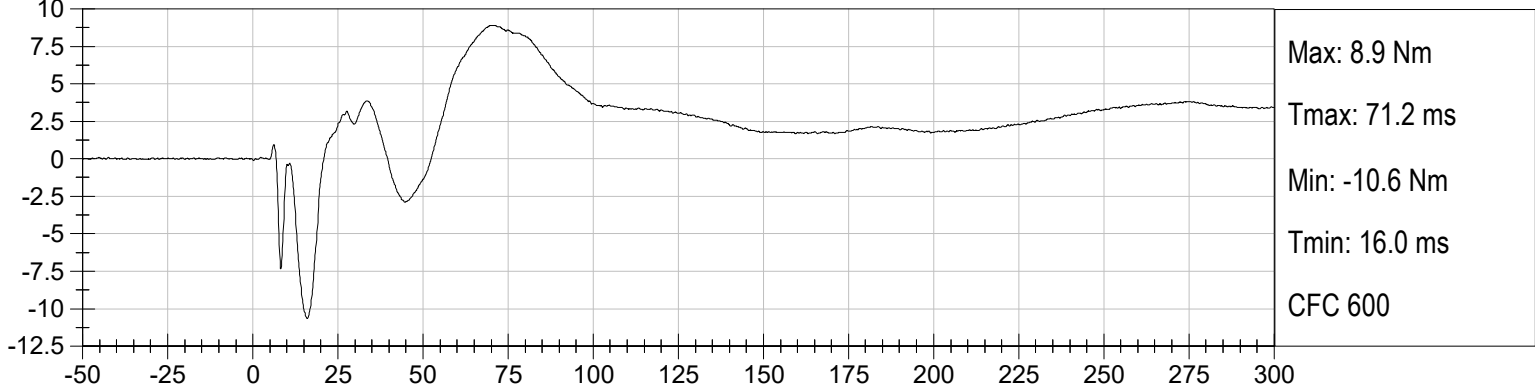
	<u>Page No.</u>
RRP Head X Acceleration vs. Time	B-1
RRP Head Y Acceleration vs. Time	B-1
RRP Head Z Acceleration vs. Time	B-1
RRP Head Resultant Acceleration vs. Time	B-1
RRP Upper Neck X Force vs. Time	B-2
RRP Upper Neck Y Force vs. Time	B-2
RRP Upper Neck Z Force vs. Time	B-2
RRP Upper Neck Resultant Force vs. Time	B-2
RRP Upper Neck X Moment vs. Time	B-3
RRP Upper Neck Y Moment vs. Time	B-3
RRP Upper Neck Z Moment vs. Time	B-3
RRP Upper Neck Resultant Moment vs. Time	B-3
RRP Lower Neck X Force vs. Time	B-4
RRP Lower Neck Y Force vs. Time	B-4
RRP Lower Neck Z Force vs. Time	B-4
RRP Lower Neck Resultant Force vs. Time	B-4
RRP Lower Neck X Moment vs. Time	B-5
RRP Lower Neck Y Moment vs. Time	B-5
RRP Lower Neck Z Moment vs. Time	B-5
RRP Lower Neck Resultant Moment vs. Time	B-5
RRP Nij (NTF)	B-6
RRP Nij (NTE)	B-6
RRP Nij (NCF)	B-6
RRP Nij (NCE)	B-6
RRP Chest X Acceleration vs. Time	B-7
RRP Chest Y Acceleration vs. Time	B-7
RRP Chest Z Acceleration vs. Time	B-7
RRP Chest Resultant Acceleration vs. Time	B-7

	<u>Page No.</u>
RRP Upper Spine X Acceleration vs. Time	B-8
RRP Upper Spine Y Acceleration vs. Time	B-8
RRP Upper Spine Z Acceleration vs. Time	B-8
RRP Upper Spine Resultant Acceleration vs. Time	B-8
RRP Lower Spine X Acceleration vs. Time	B-9
RRP Lower Spine Y Acceleration vs. Time	B-9
RRP Lower Spine Z Acceleration vs. Time	B-9
RRP Lower Spine Resultant Acceleration vs. Time	B-9
RRP Upper Sternum X Acceleration vs. Time	B-10
RRP Lower Sternum X Acceleration vs. Time	B-10
RRP Chest Displacement vs. Time	B-10
Passenger Curtain Airbag – Fire Voltage vs. Time	B-11
Passenger Curtain Airbag – Fire Current vs. Time	B-11
RRP Seat Airbag – Fire Voltage vs. Time	B-11
RRP Seat Airbag – Fire Current vs. Time	B-11

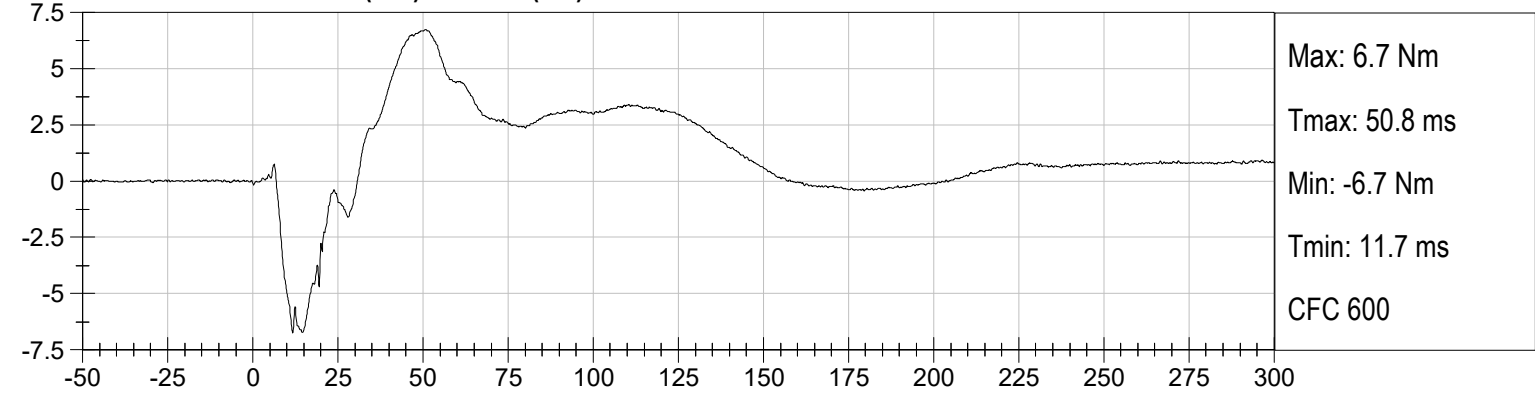




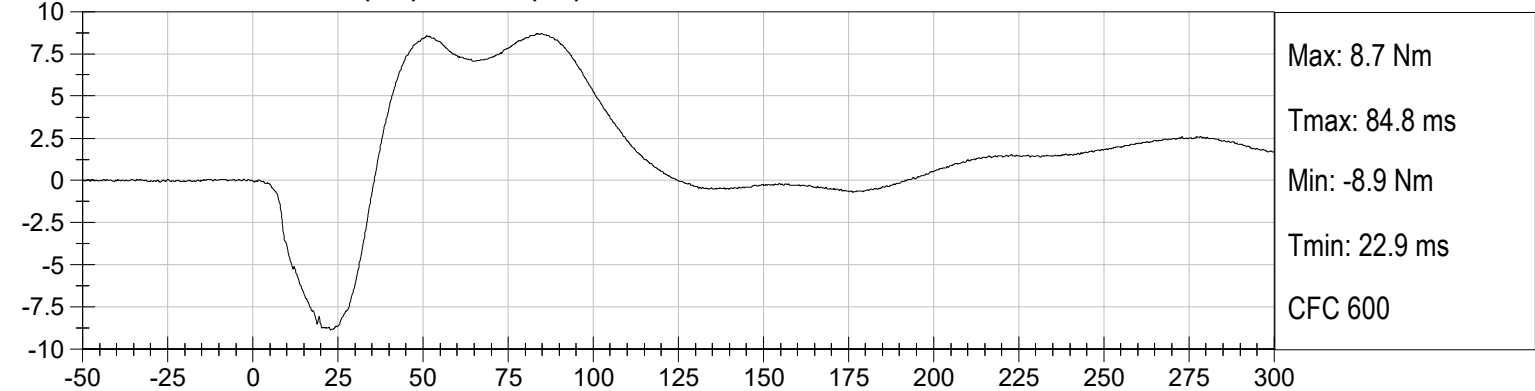
RRP UPPER NECK MX (Nm) vs Time (ms)



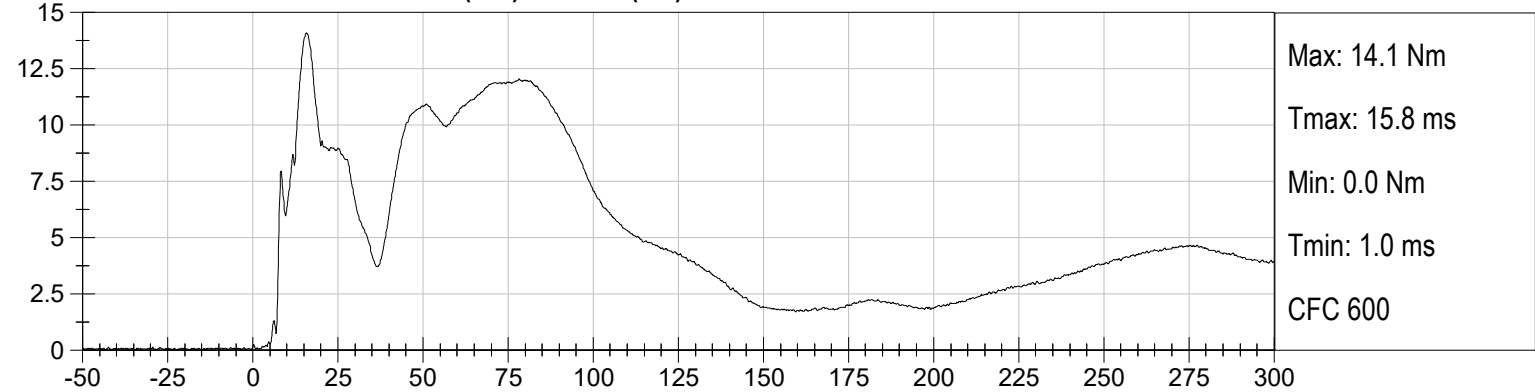
RRP UPPER NECK MY (Nm) vs Time (ms)

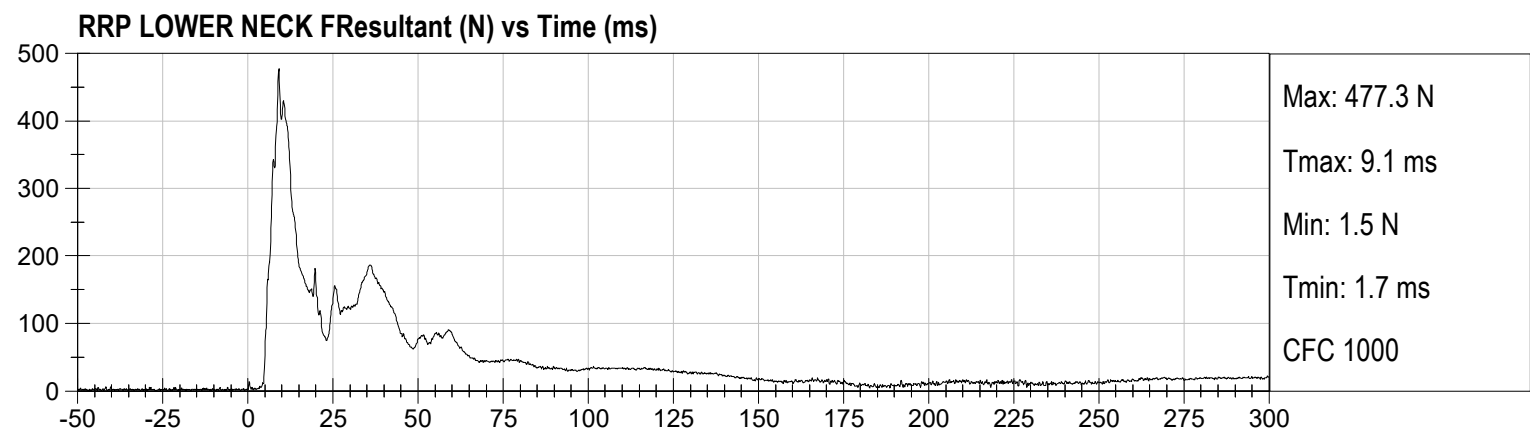
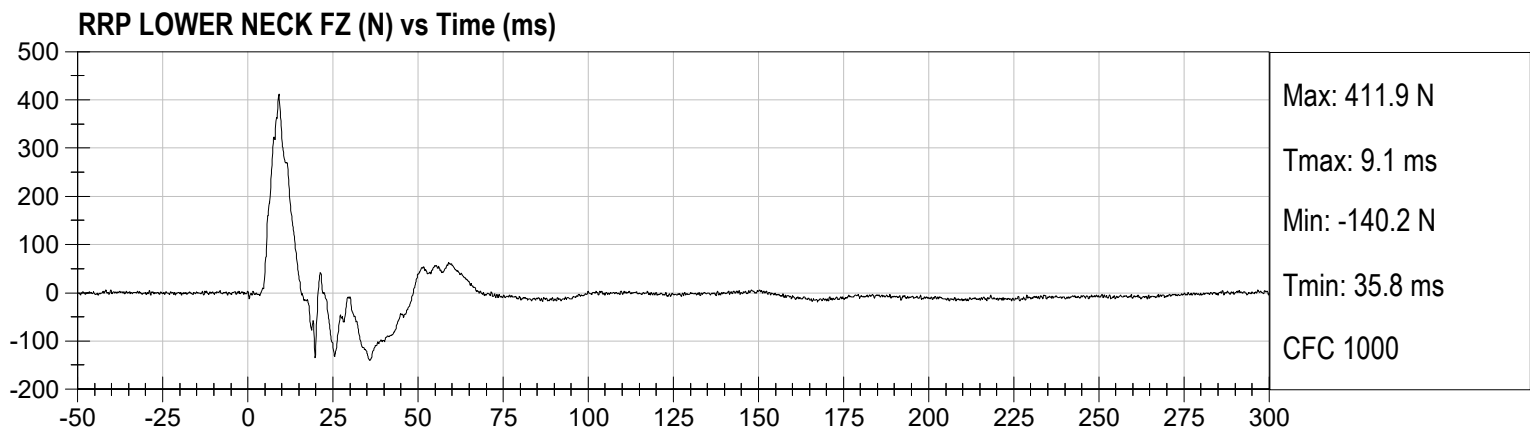
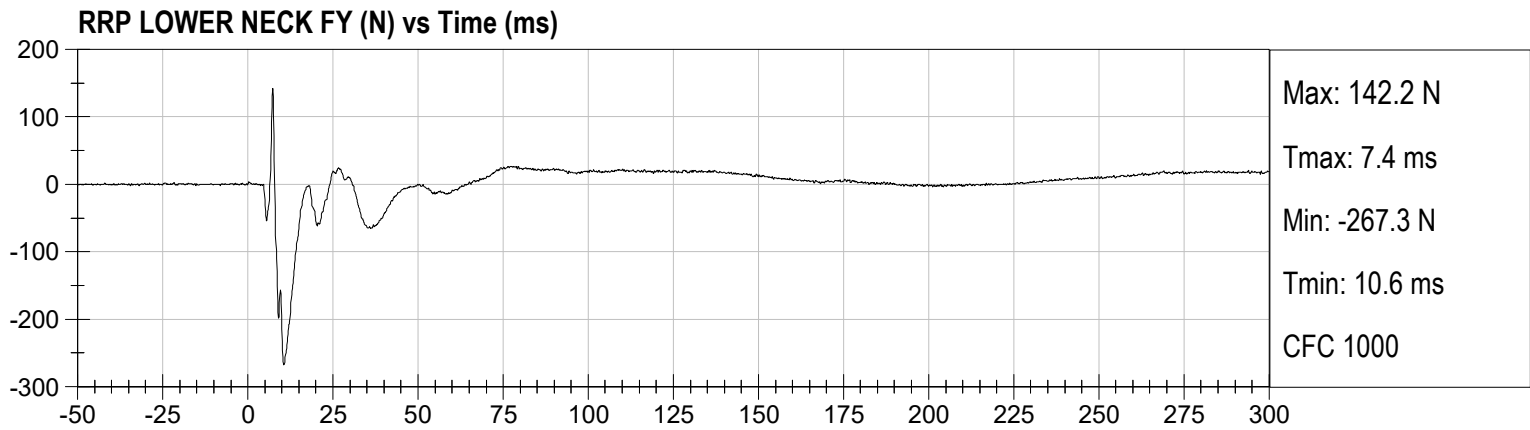
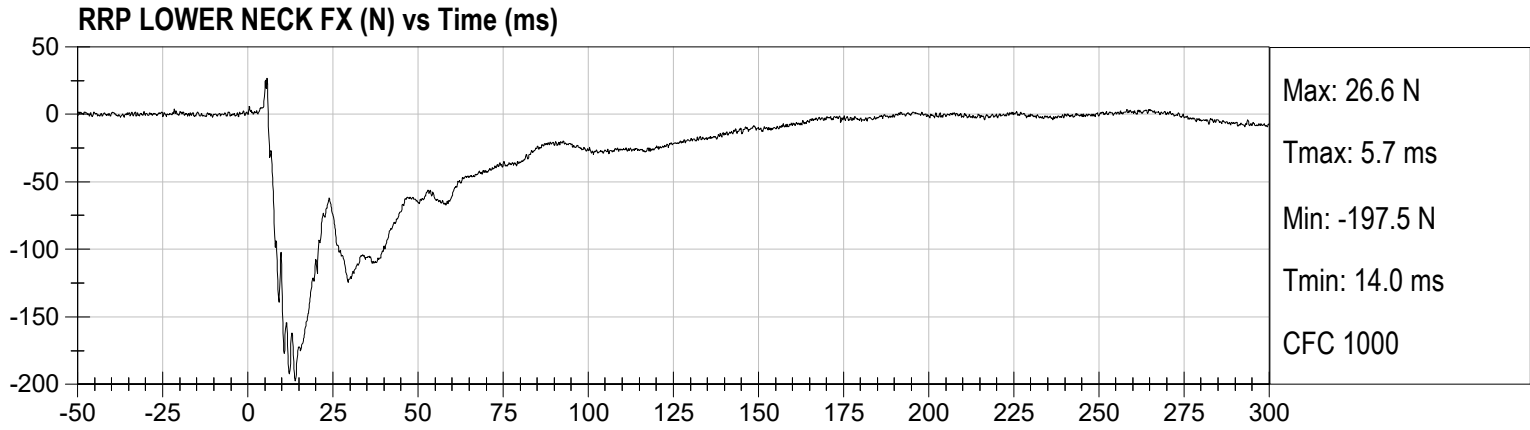


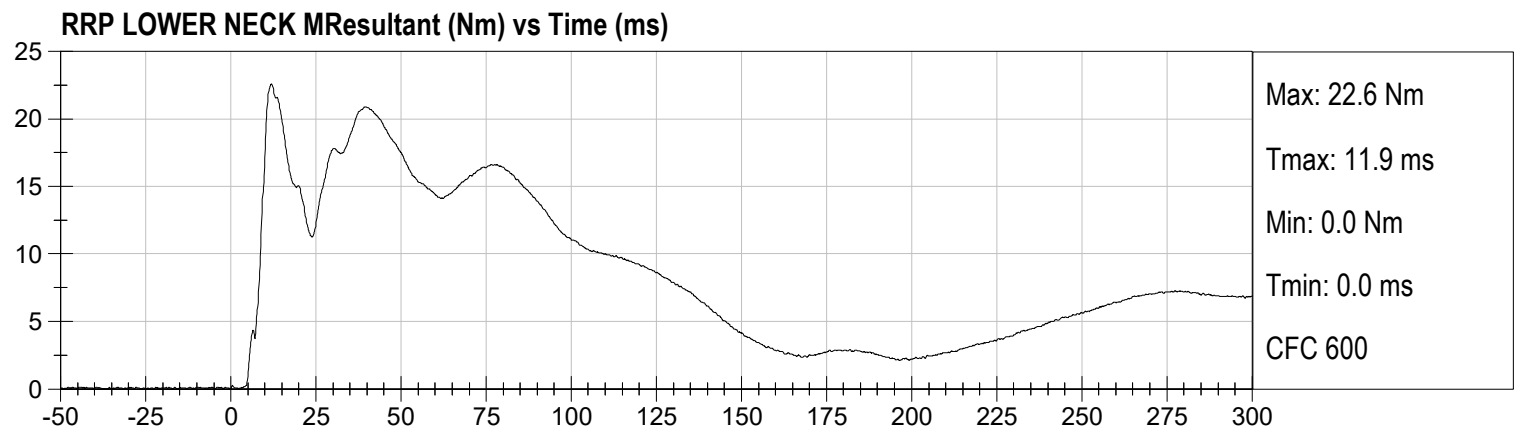
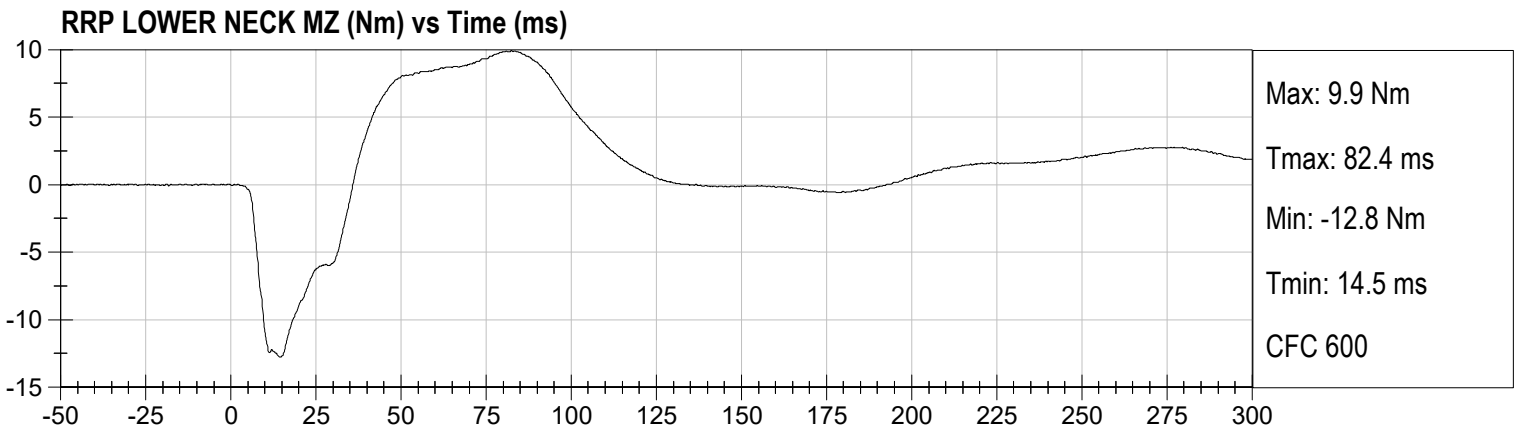
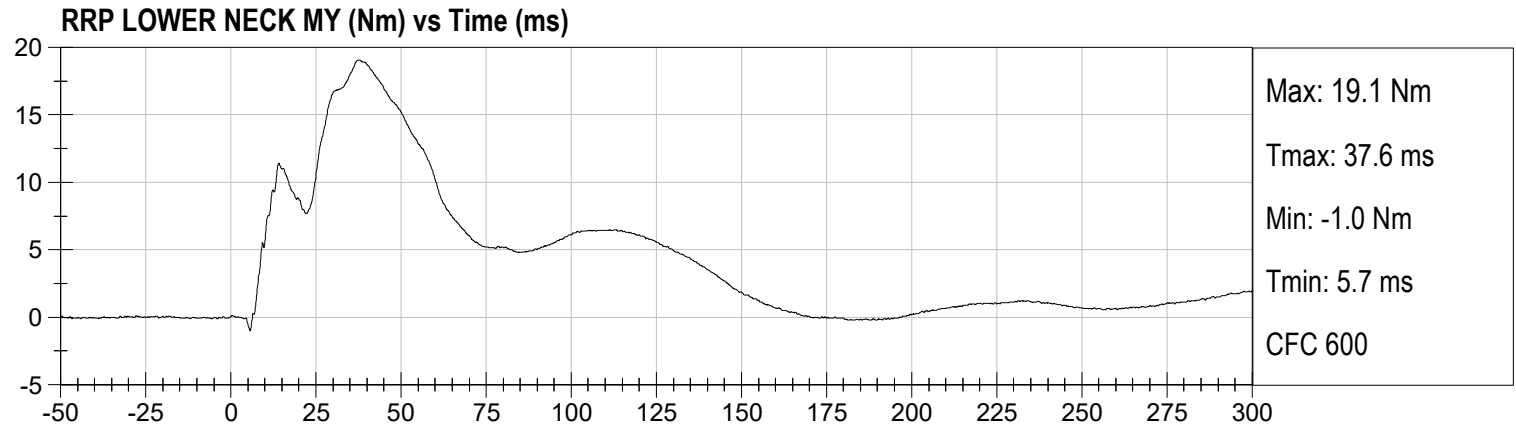
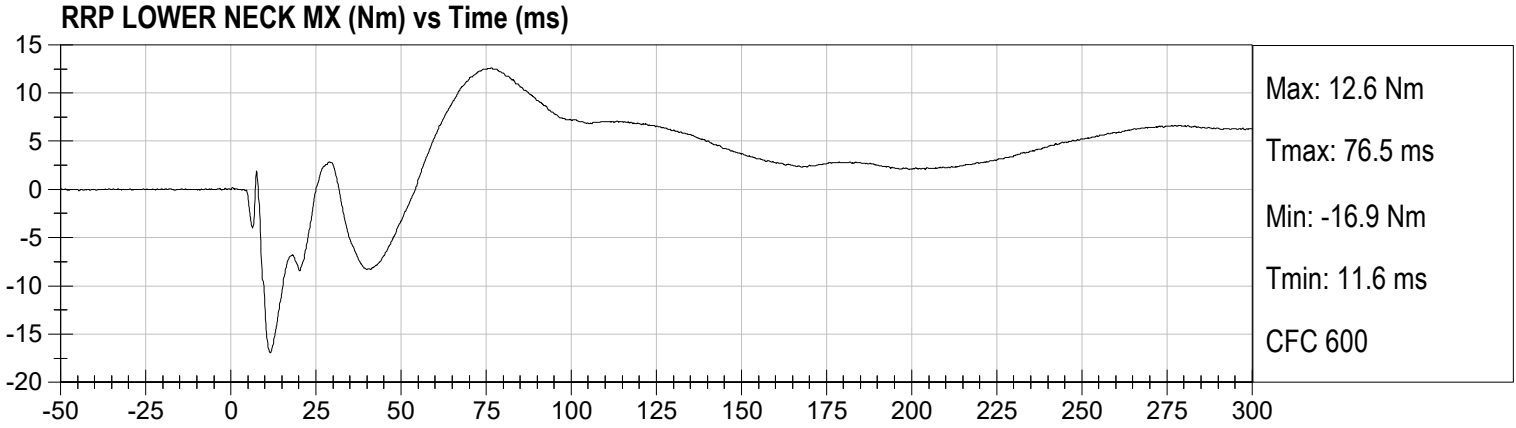
RRP UPPER NECK MZ (Nm) vs Time (ms)

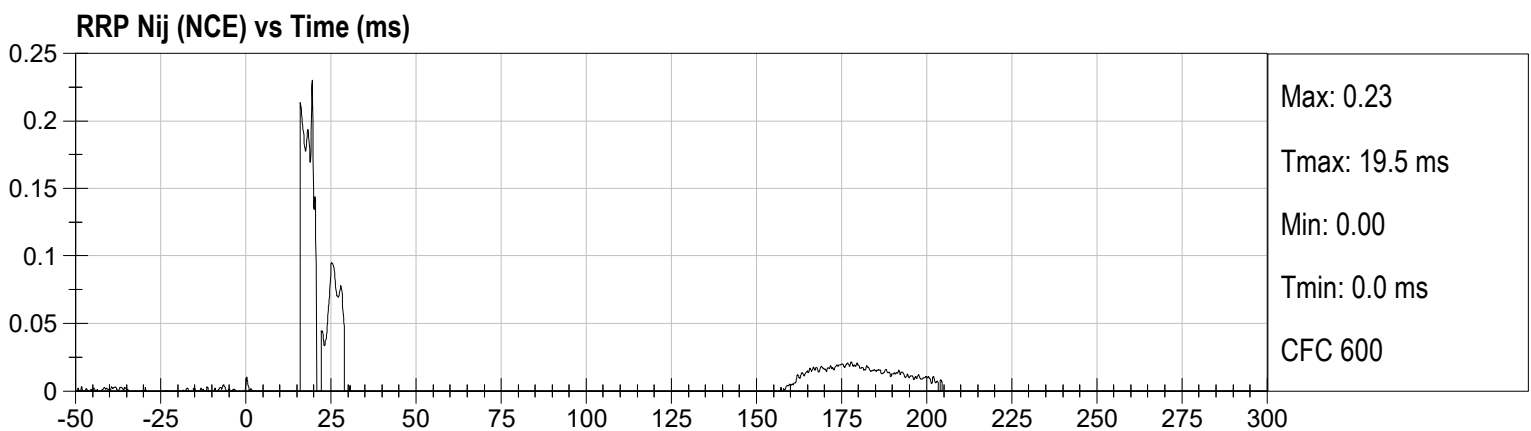
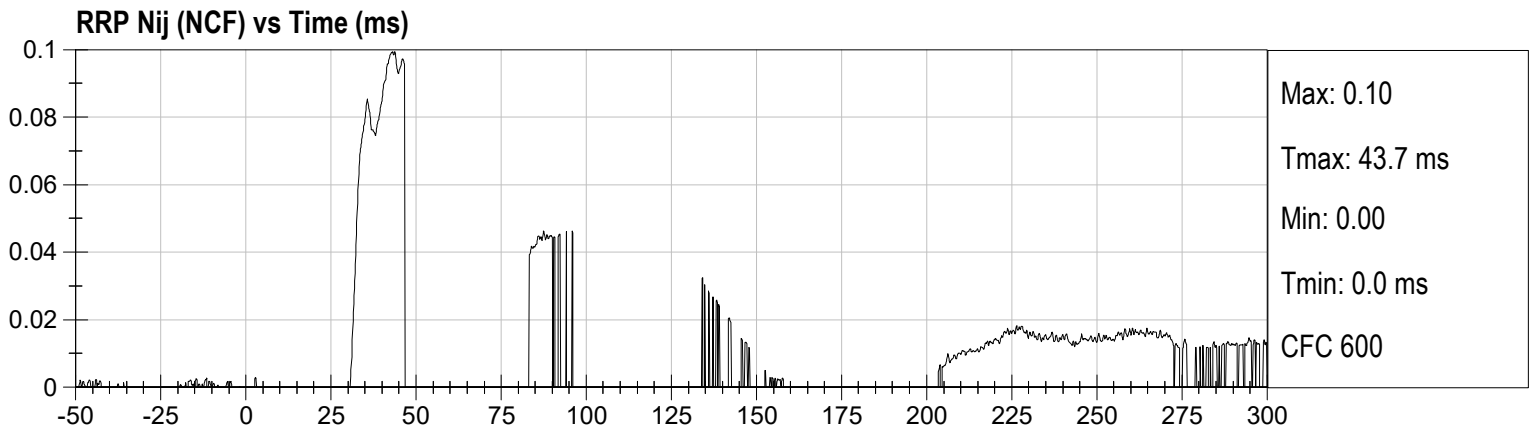
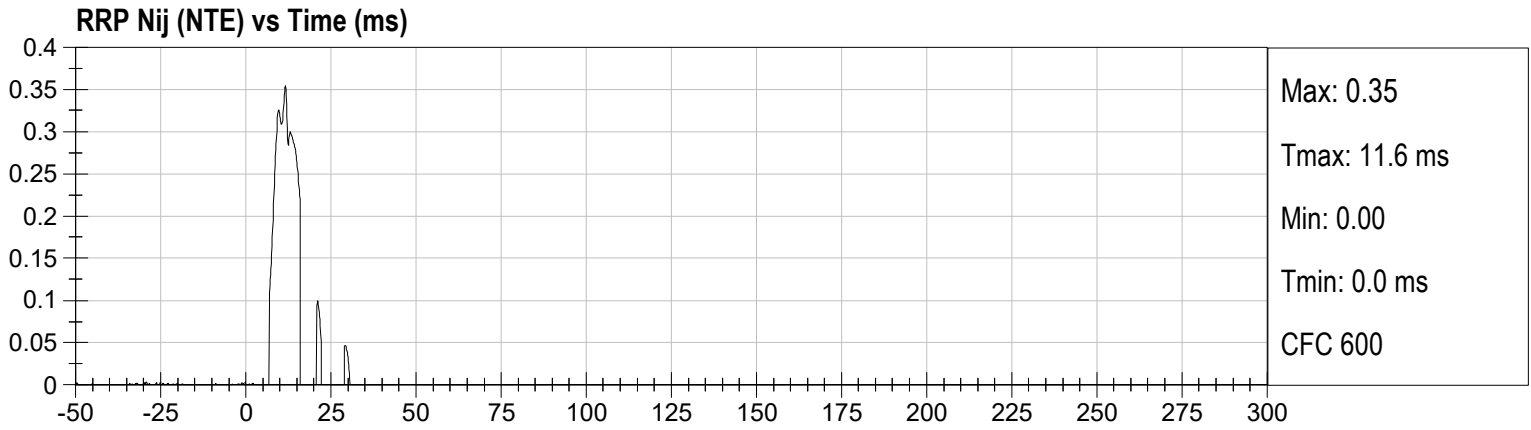
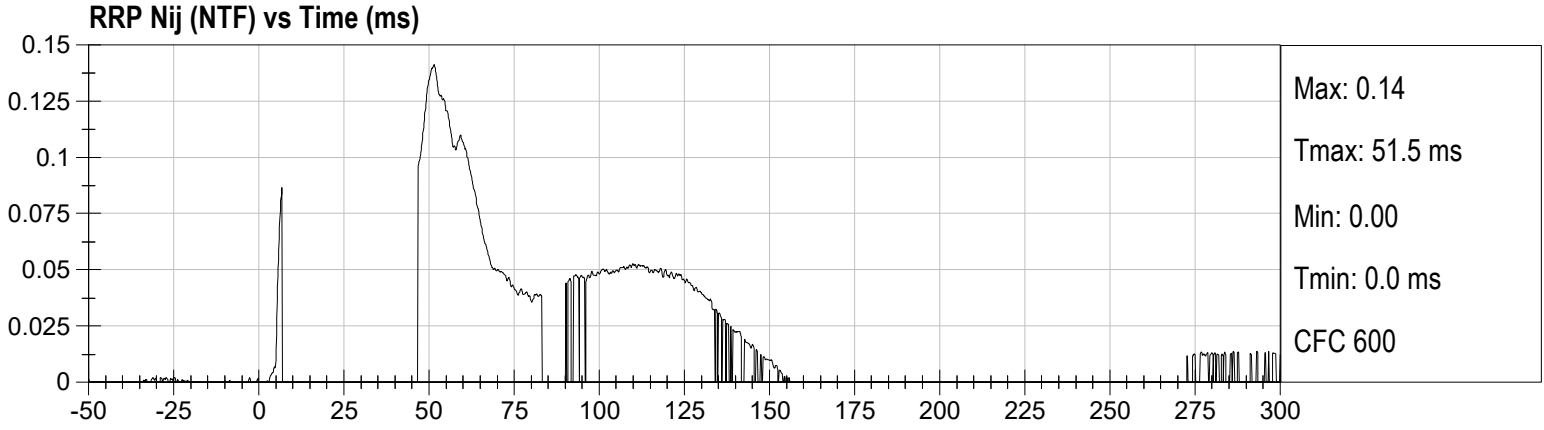


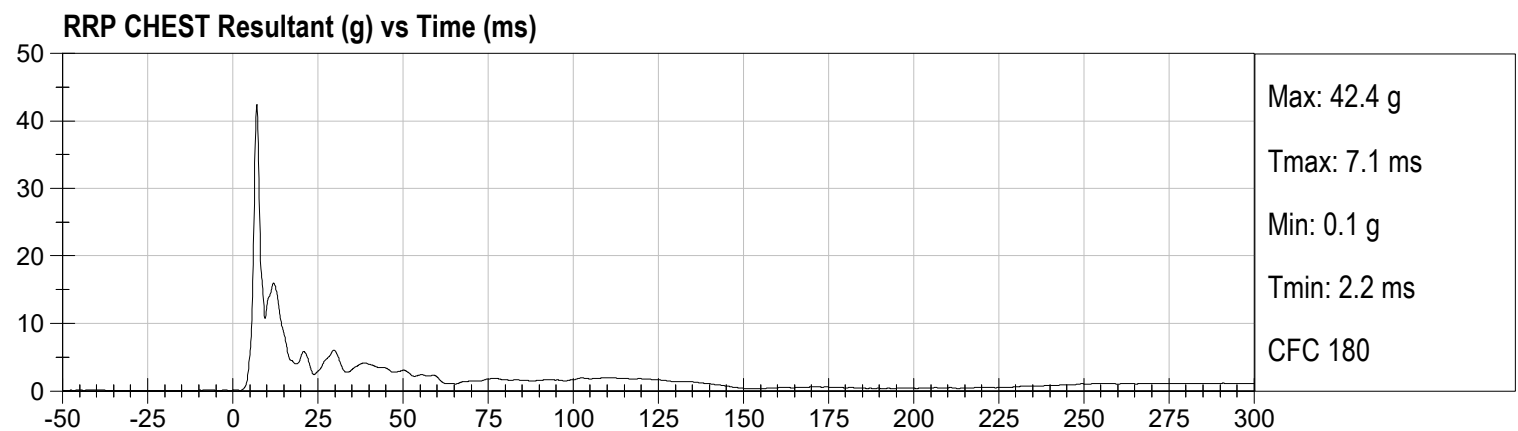
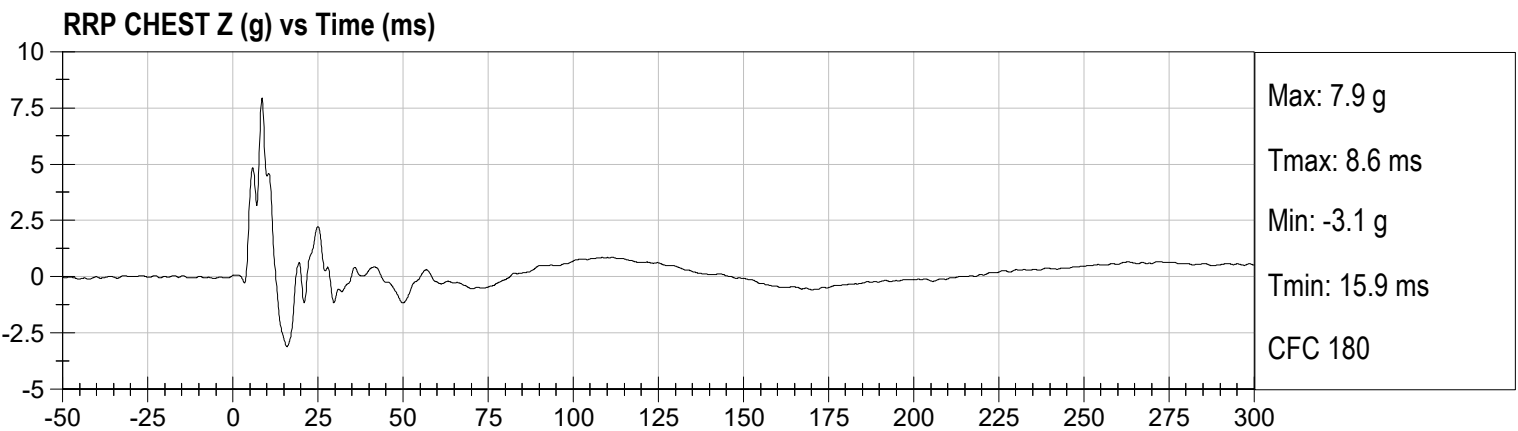
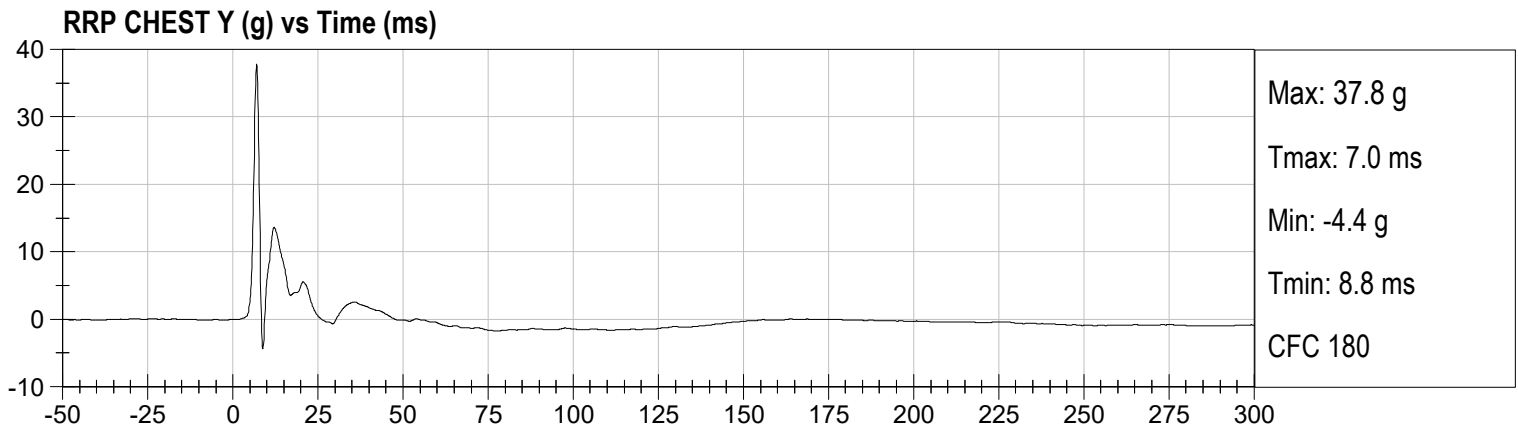
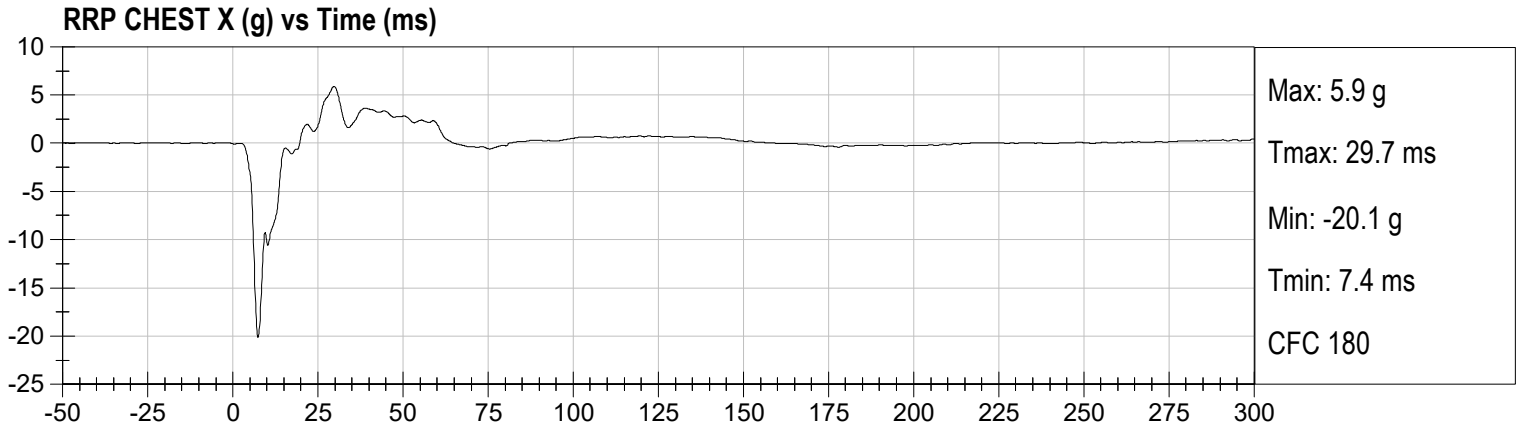
RRP UPPER NECK MResultant (Nm) vs Time (ms)

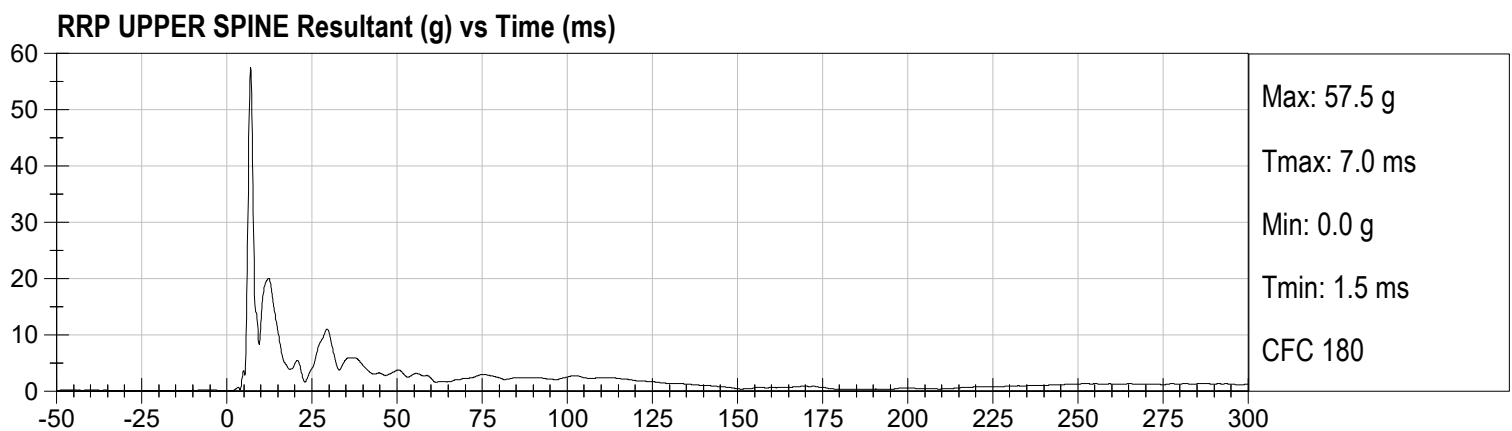
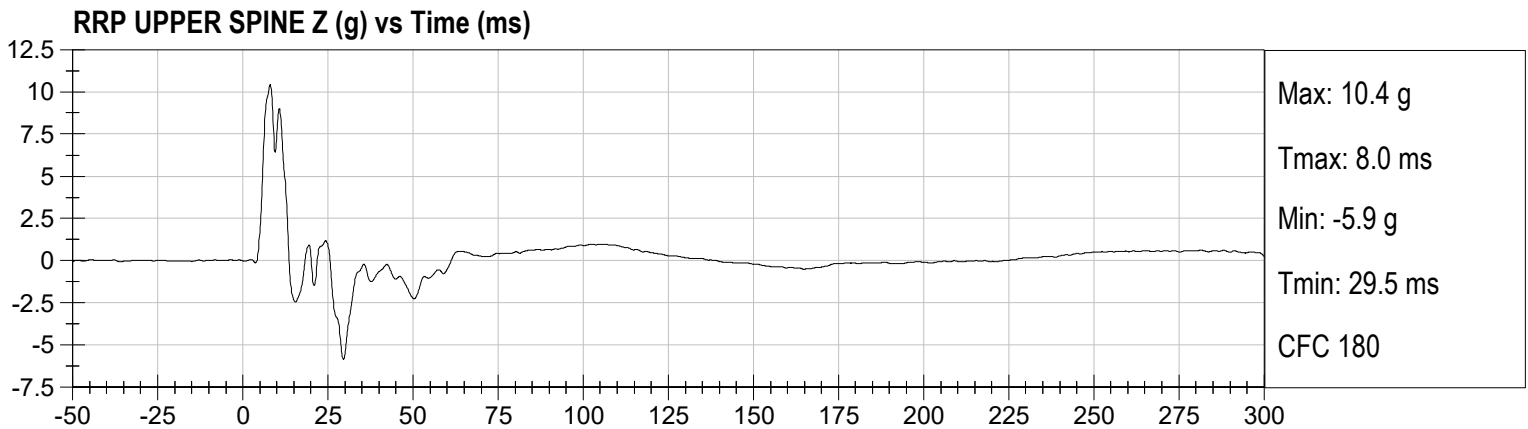
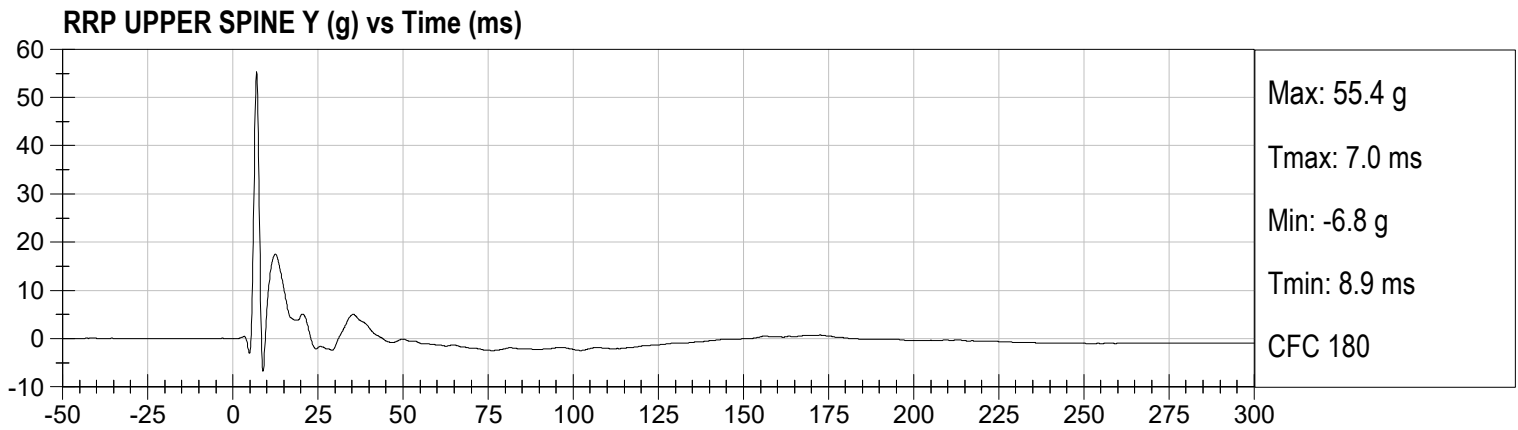
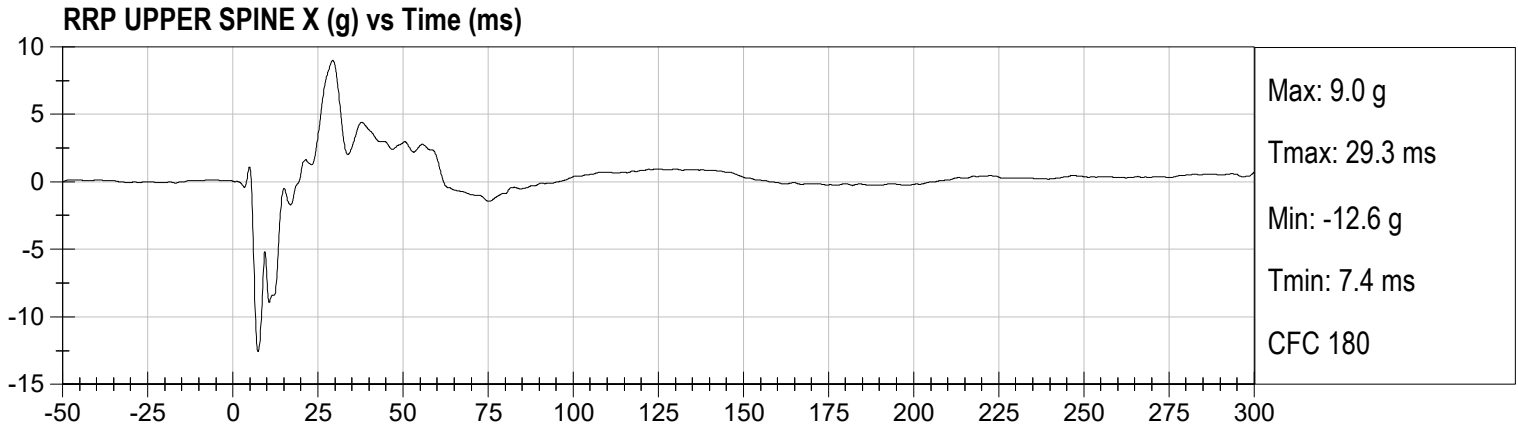


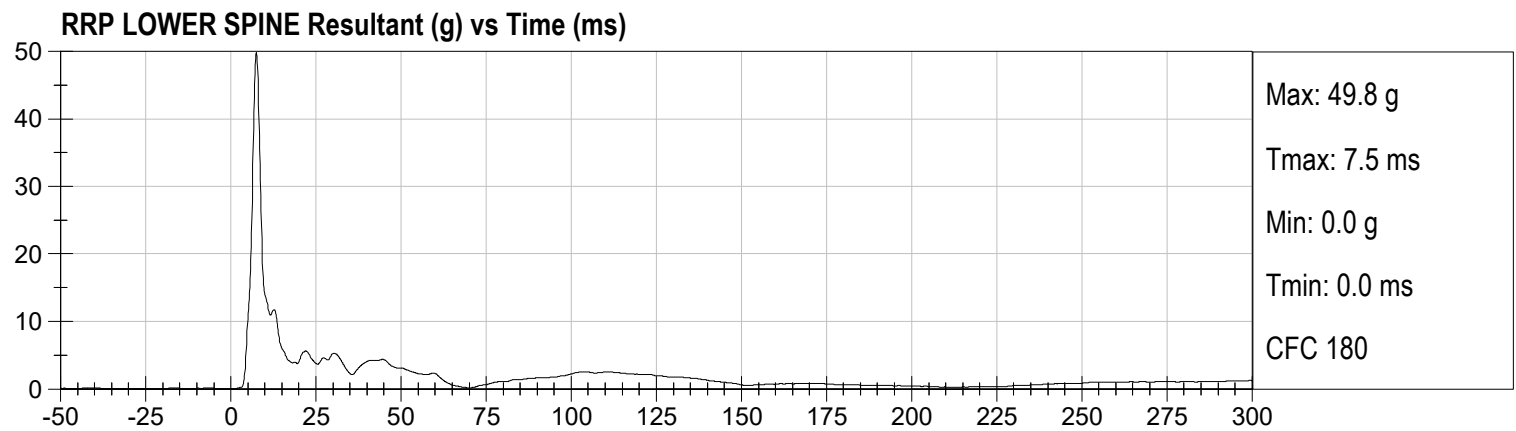
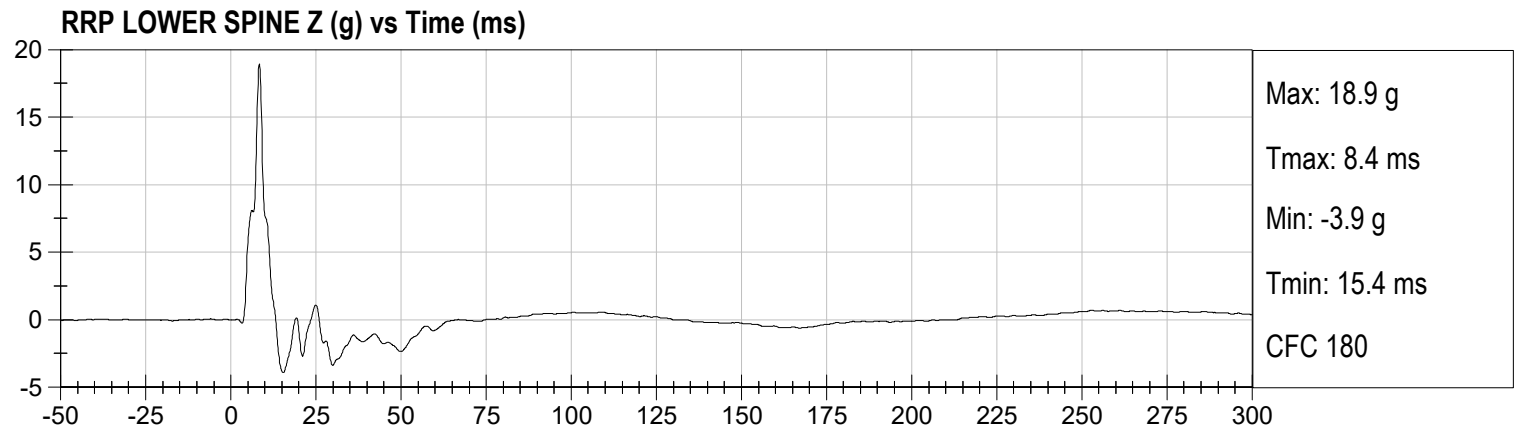
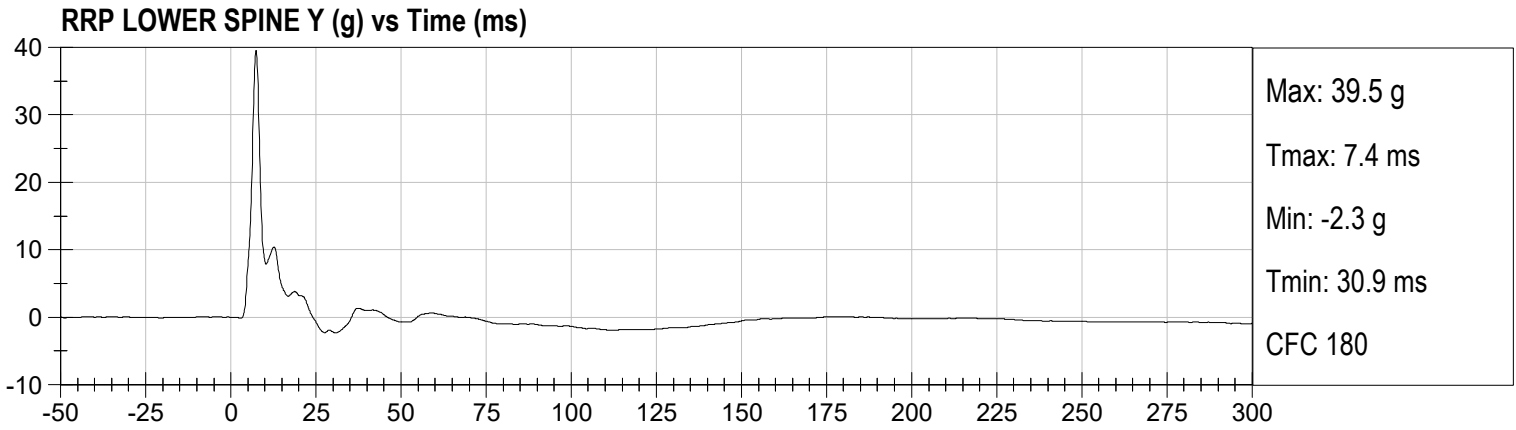
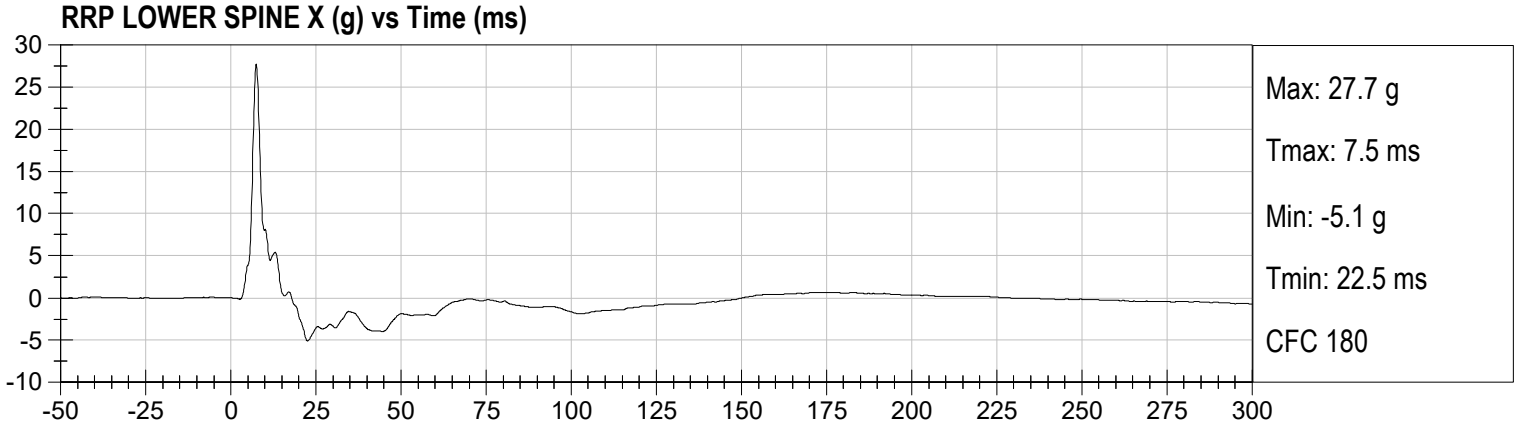




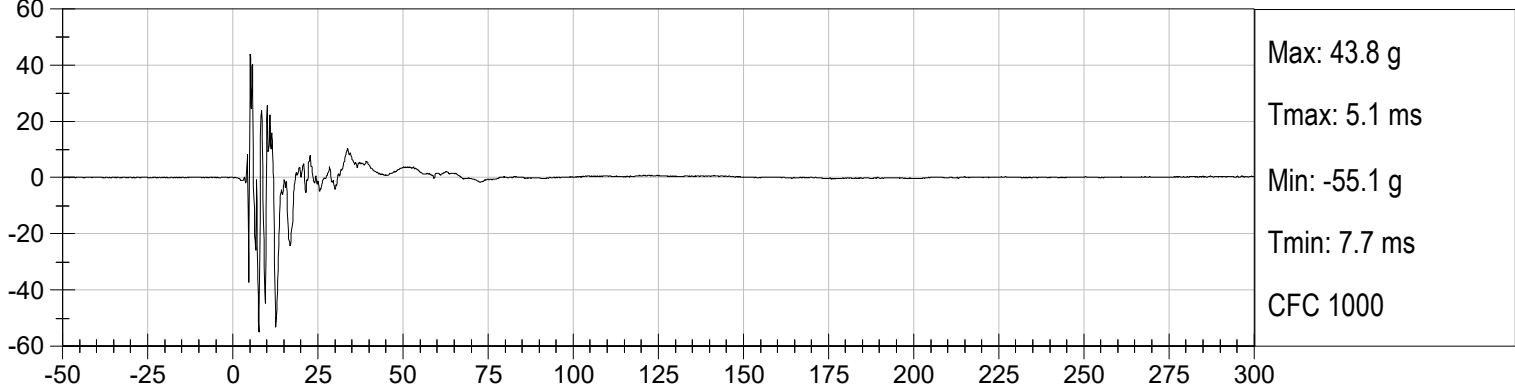




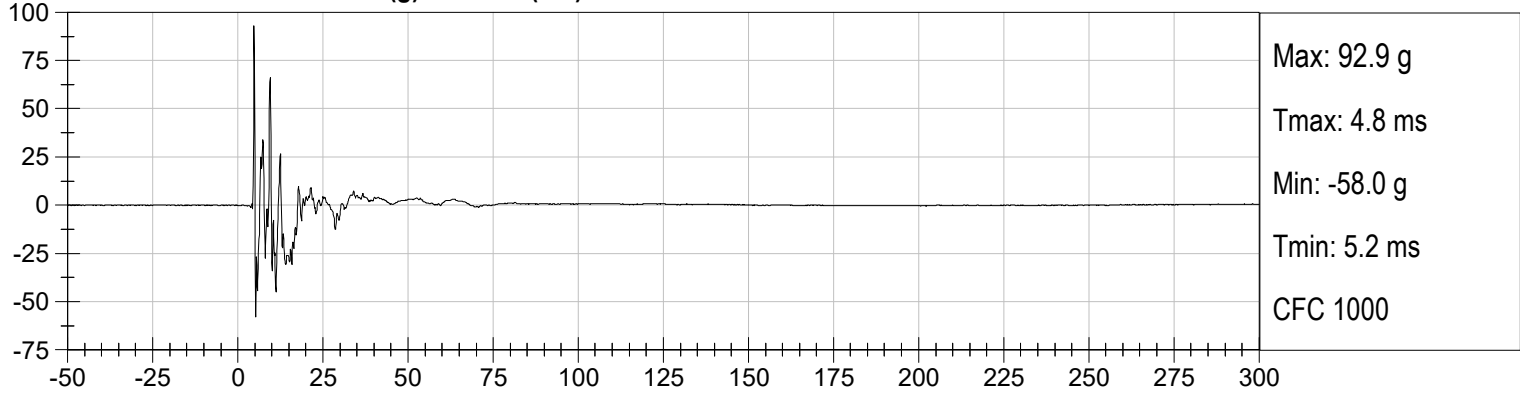




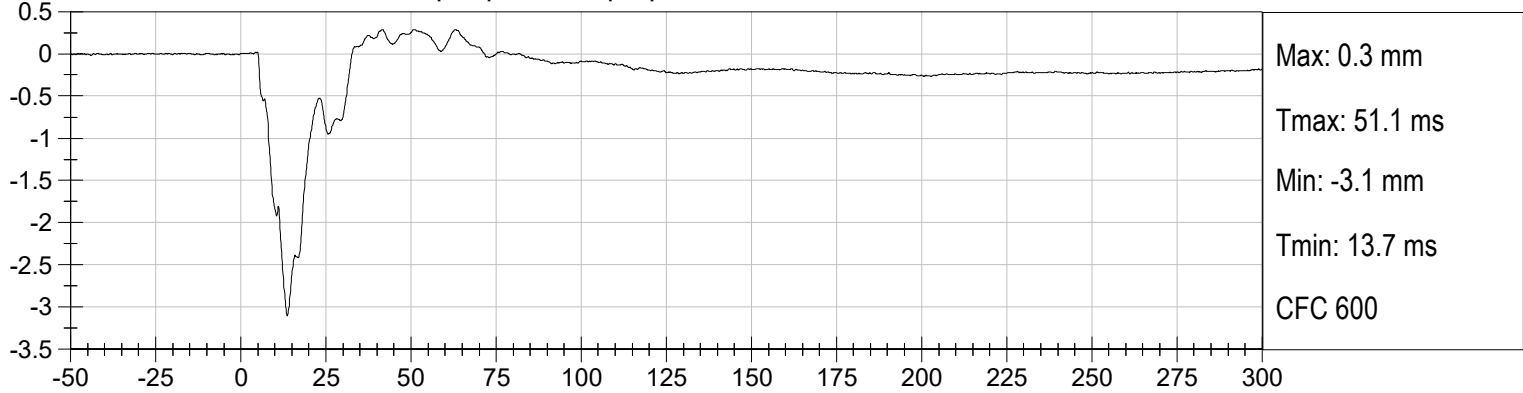
RRP UPPER STERNUM X (g) vs Time (ms)



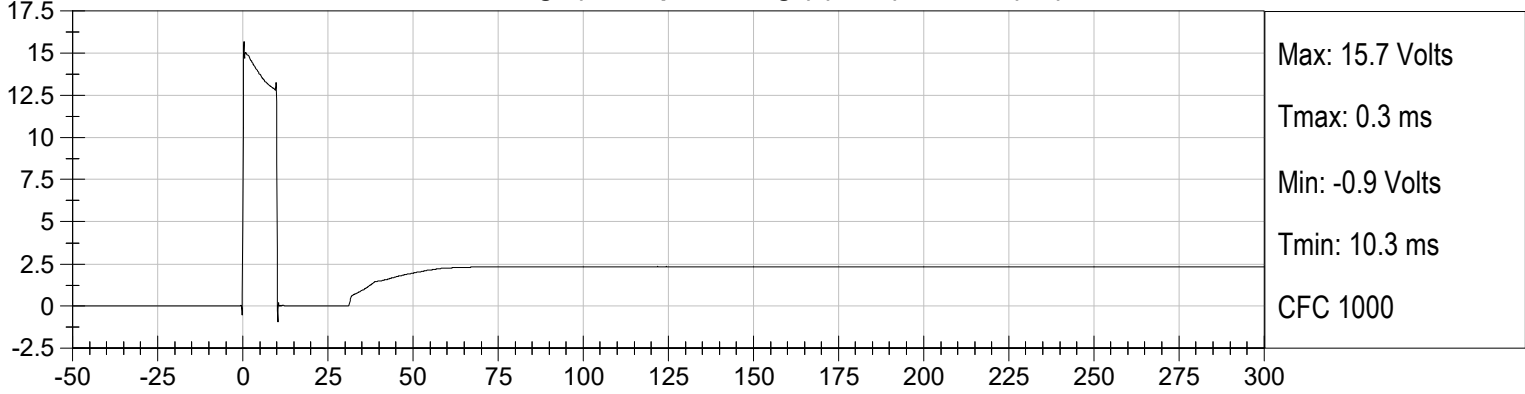
RRP LOWER STERNUM X (g) vs Time (ms)



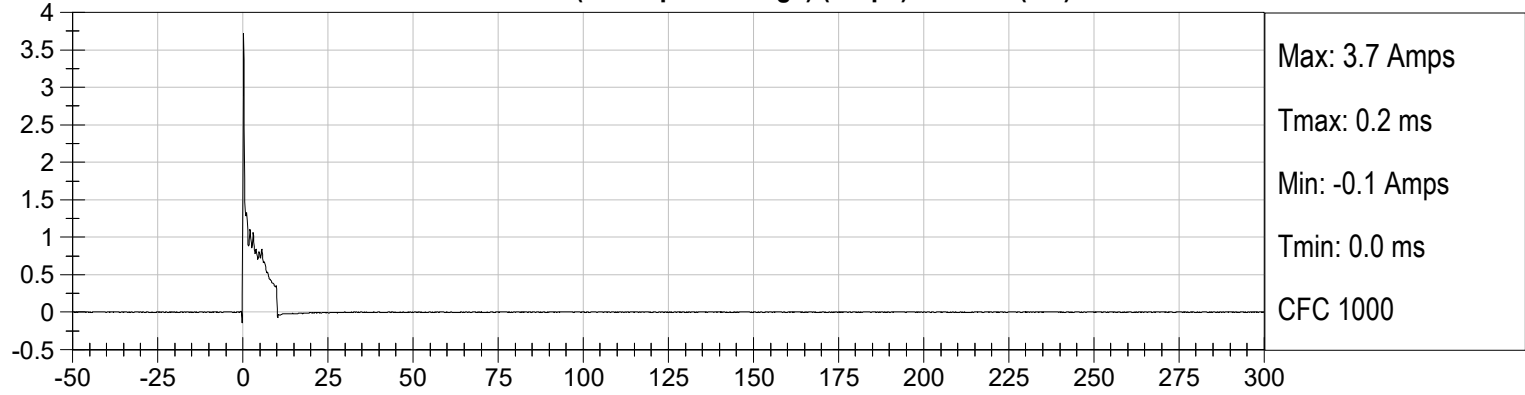
RRP CHEST DISPLACEMENT (mm) vs Time (ms)



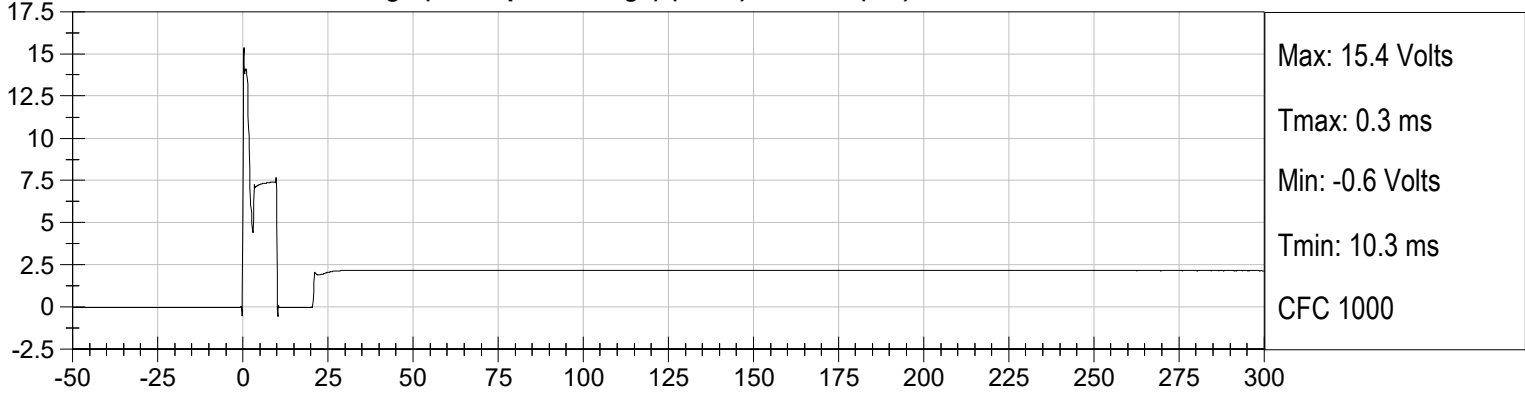
PASSENGER CURTAIN AB - Fire Voltage (DC Cap Discharge) (Volts) vs Time (ms)



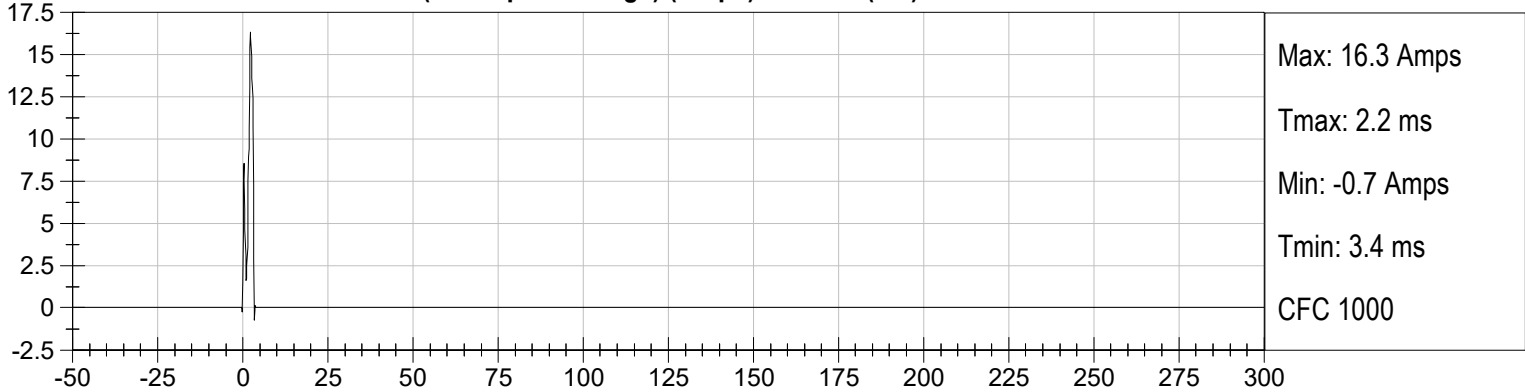
PASSENGER CURTAIN AB - Fire Current (DC Cap Discharge) (Amps) vs Time (ms)



RRP SEAT AB - Fire Voltage (DC Cap Discharge) (Volts) vs Time (ms)



RRP SEAT AB - Fire Current (DC Cap Discharge) (Amps) vs Time (ms)



APPENDIX C
DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

Hybrid III 3-Year-Old ATD

MGA RESEARCH CORPORATION
HEAD DROP TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 082

Test ID: D182481

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	46	Pass
Peak Resultant Acceleration	G's	250 to 280	254	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-14.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Brian Roach

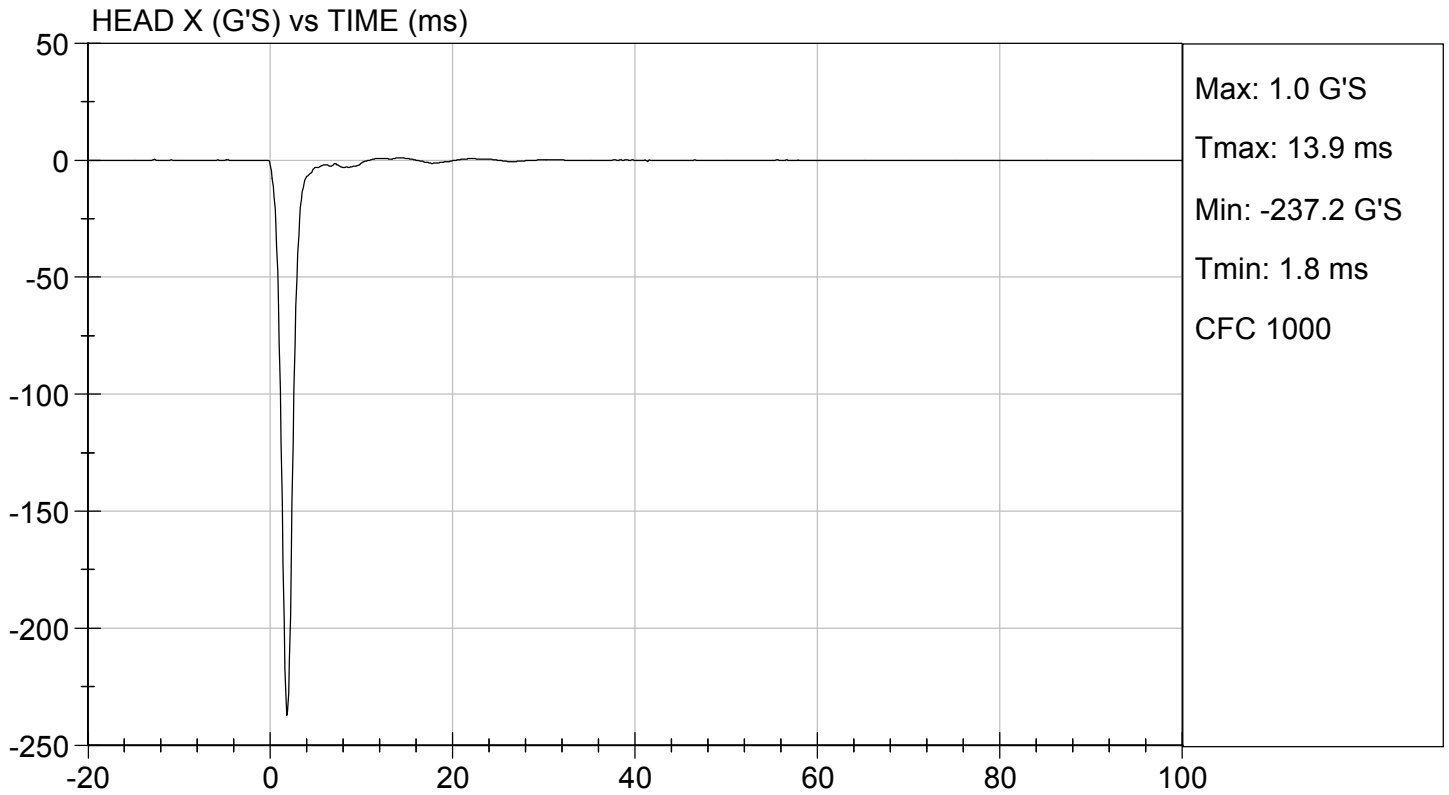
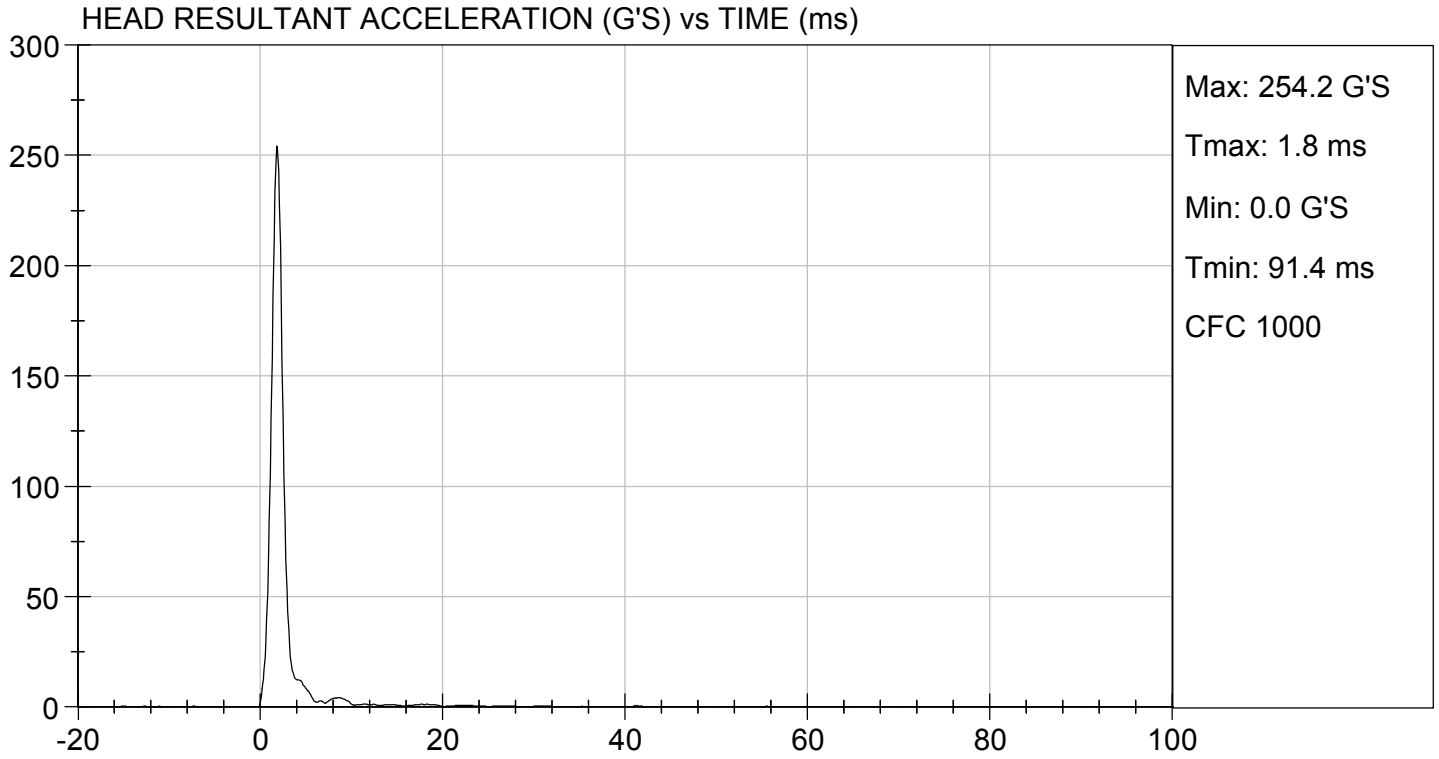
Laboratory Technician

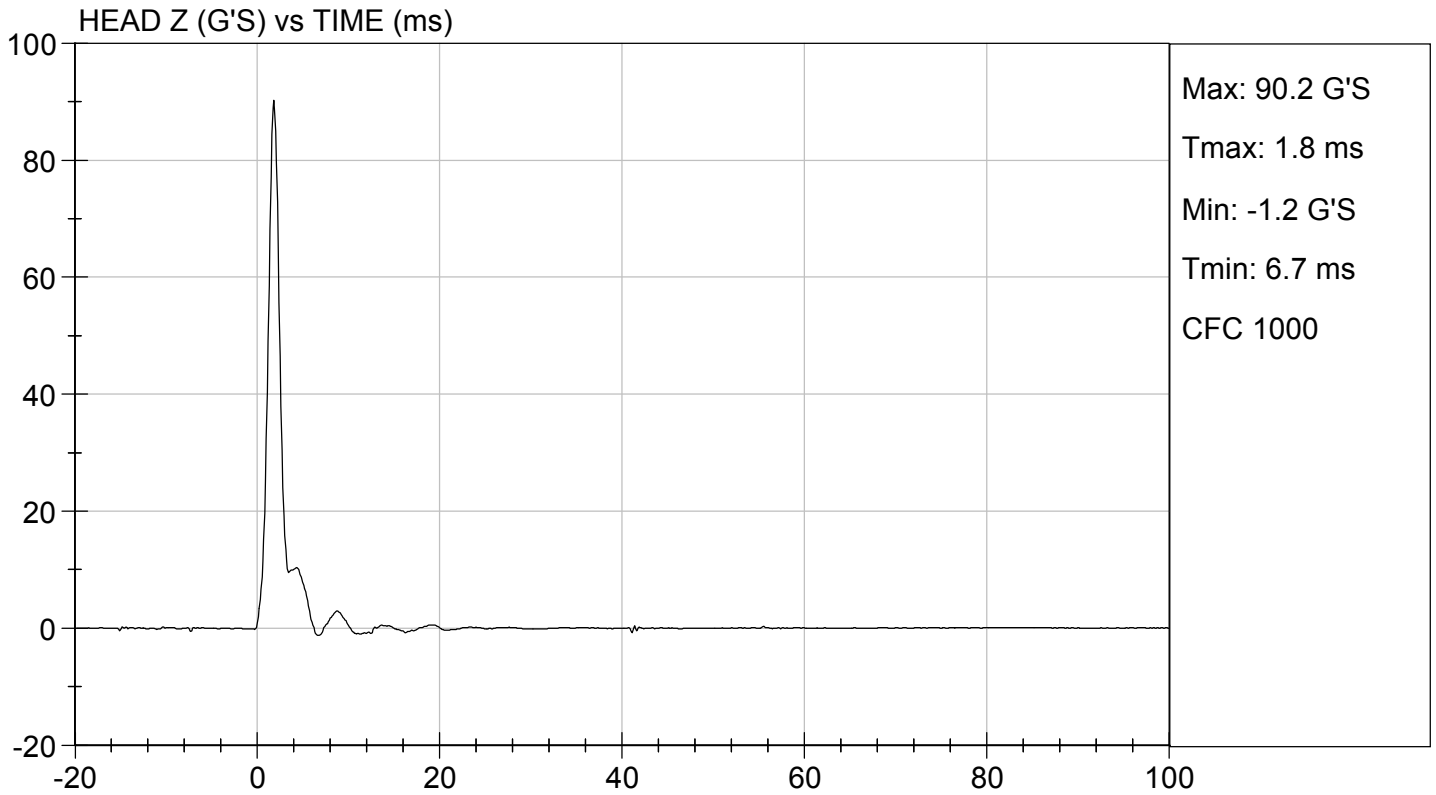
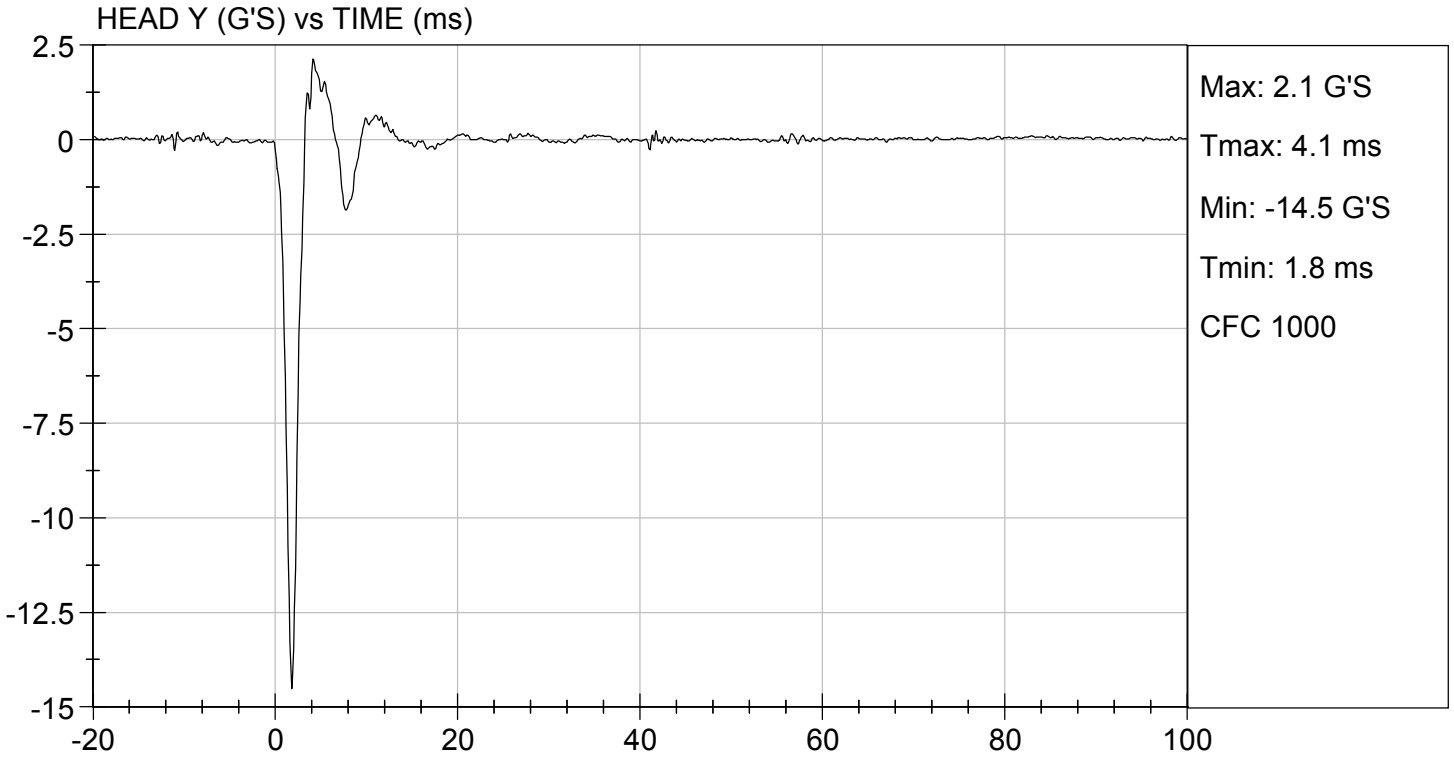
08/15/2018

Test Date

B. F. K.

Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 082

Test I.D.: D182482

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	50	Pass	
Pendulum Speed	m/s	5.40 to 5.60	5.52	Pass	
Pendulum Velocity	10 msec	m/s	2.0 to 2.7	2.6	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	73	Pass	
Peak Moment within Deflection Corridor	Nm	42.0 to 53.0	46.2	Pass	
Positive Moment - Time Curve Decay to 10 Nm	msec	60.0 to 80.0	69	Pass	
Overall Test Results				Pass	

Brian Roach

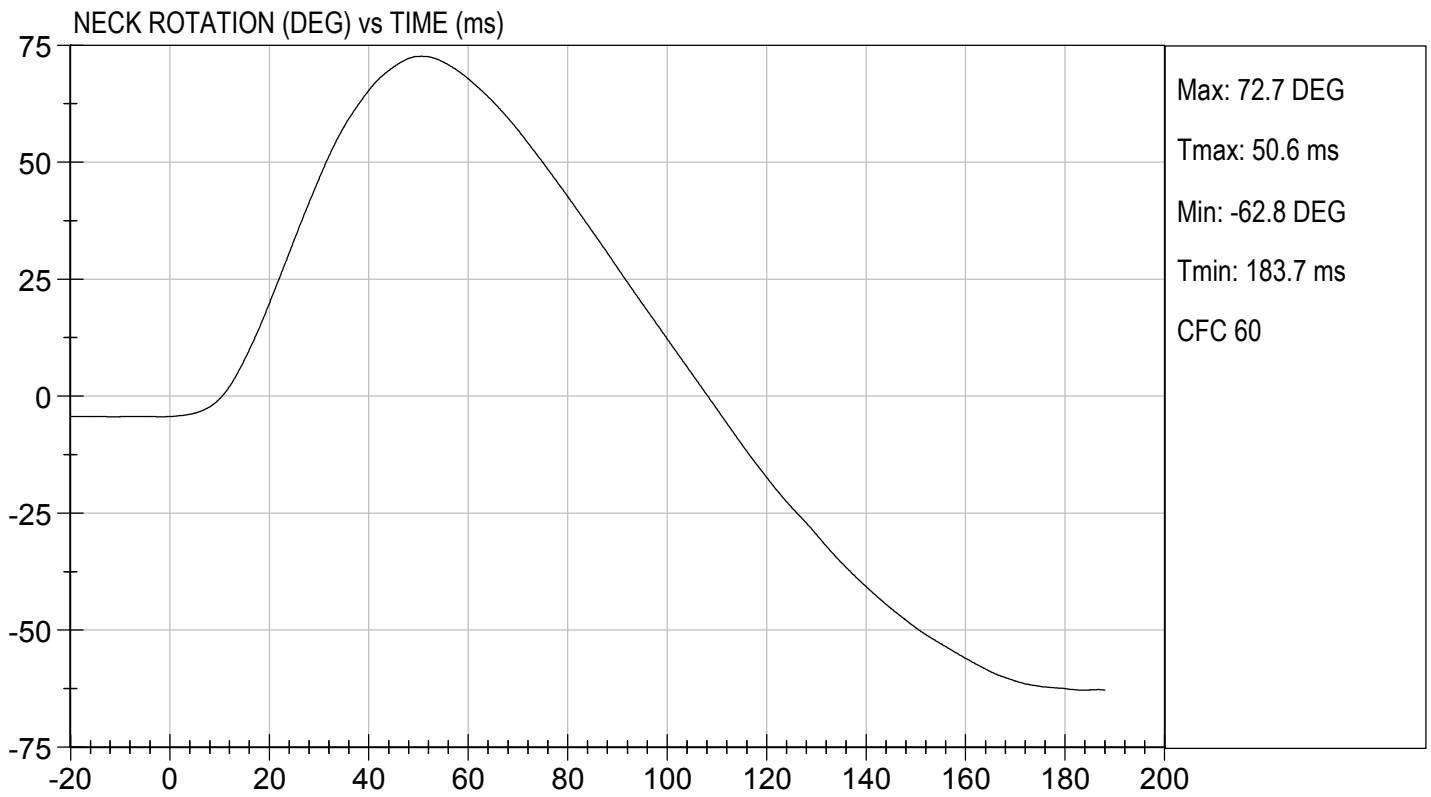
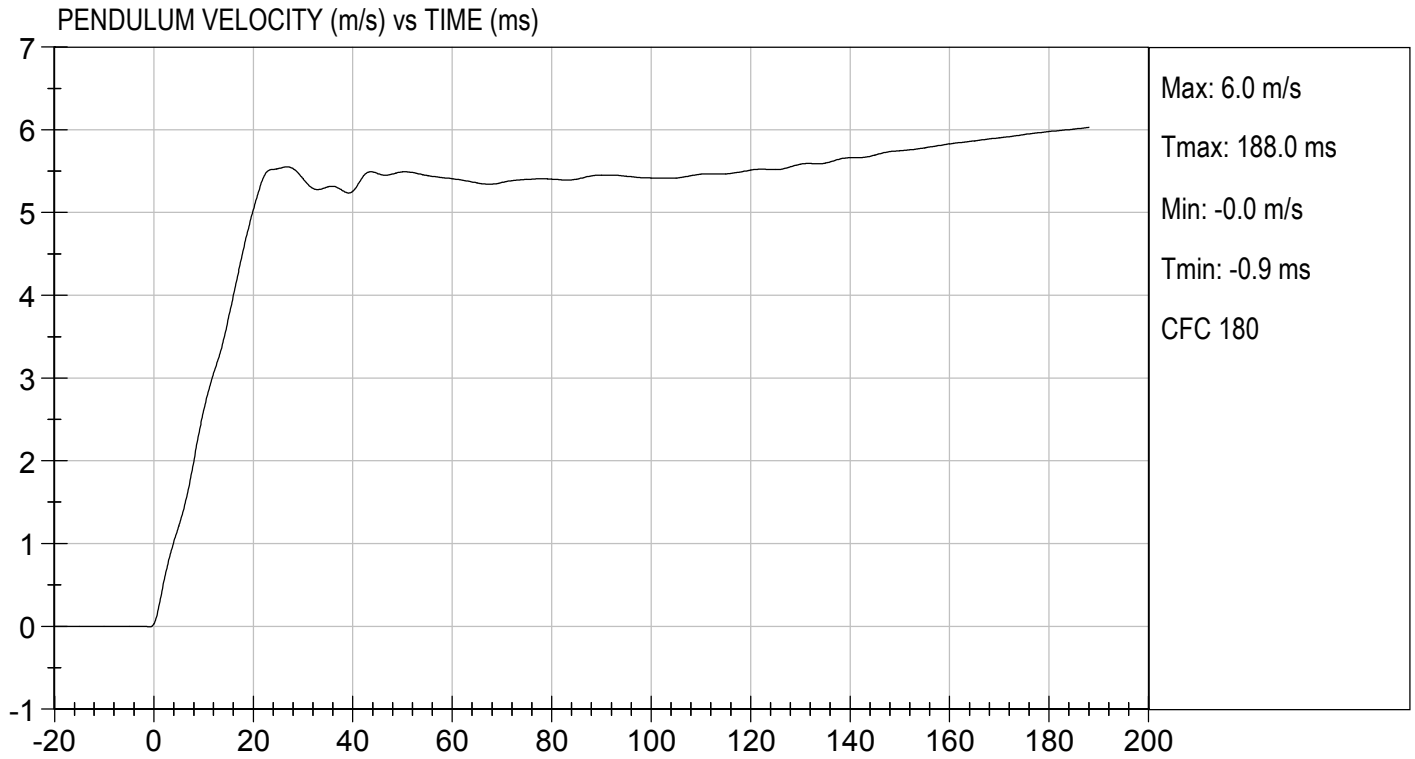
Laboratory Technician

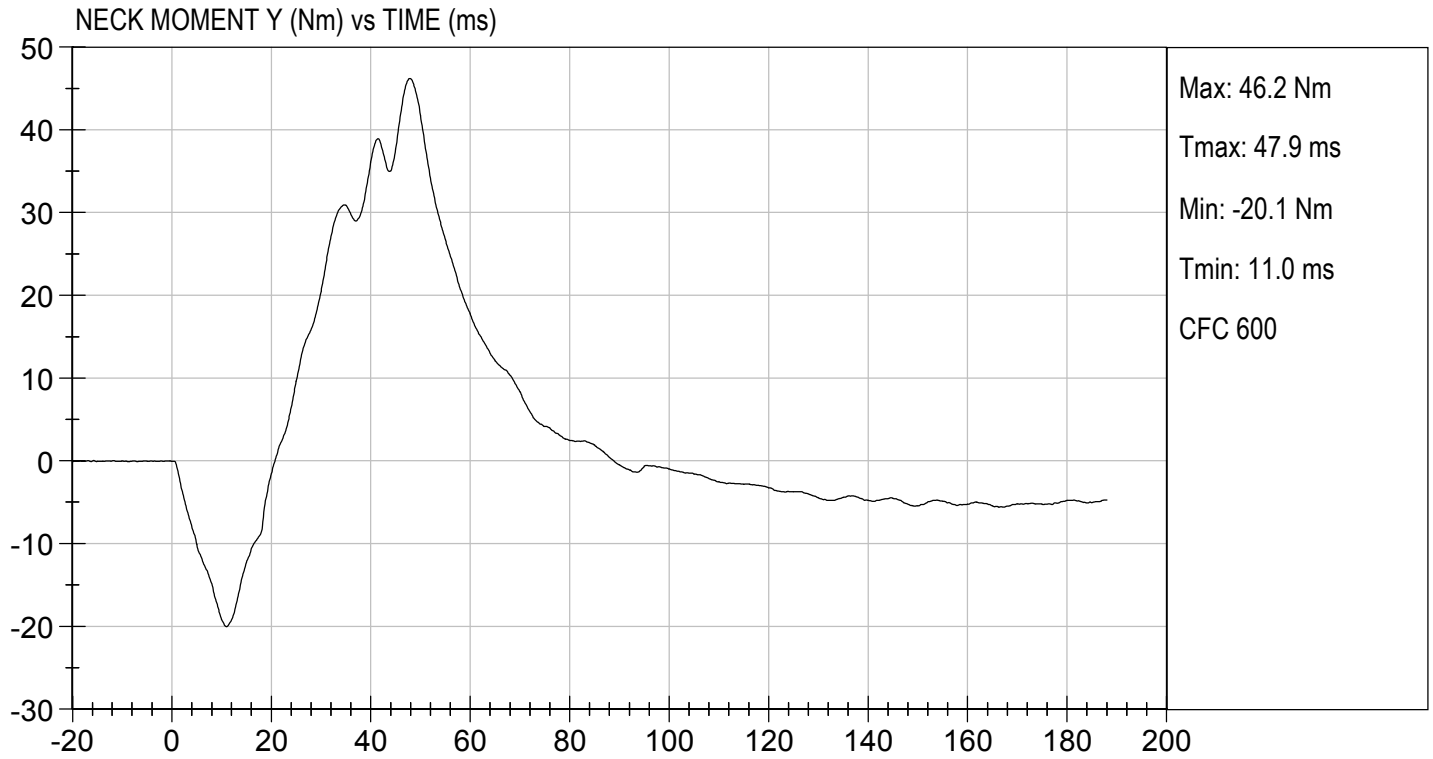
08/16/2018

Test Date

B. F. H.

Approved By





MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 082

Test I.D: D182483

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	50	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.71	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.3	Pass
	10 ms	m/s	1.9 to 2.5	2.4	Pass
	14 ms	m/s	2.8 to 3.5	3.3	Pass
D Plane Rotation		deg	83 to 93	88	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-44.4	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	68	Pass
Overall Test Results					Pass

Brian Roach

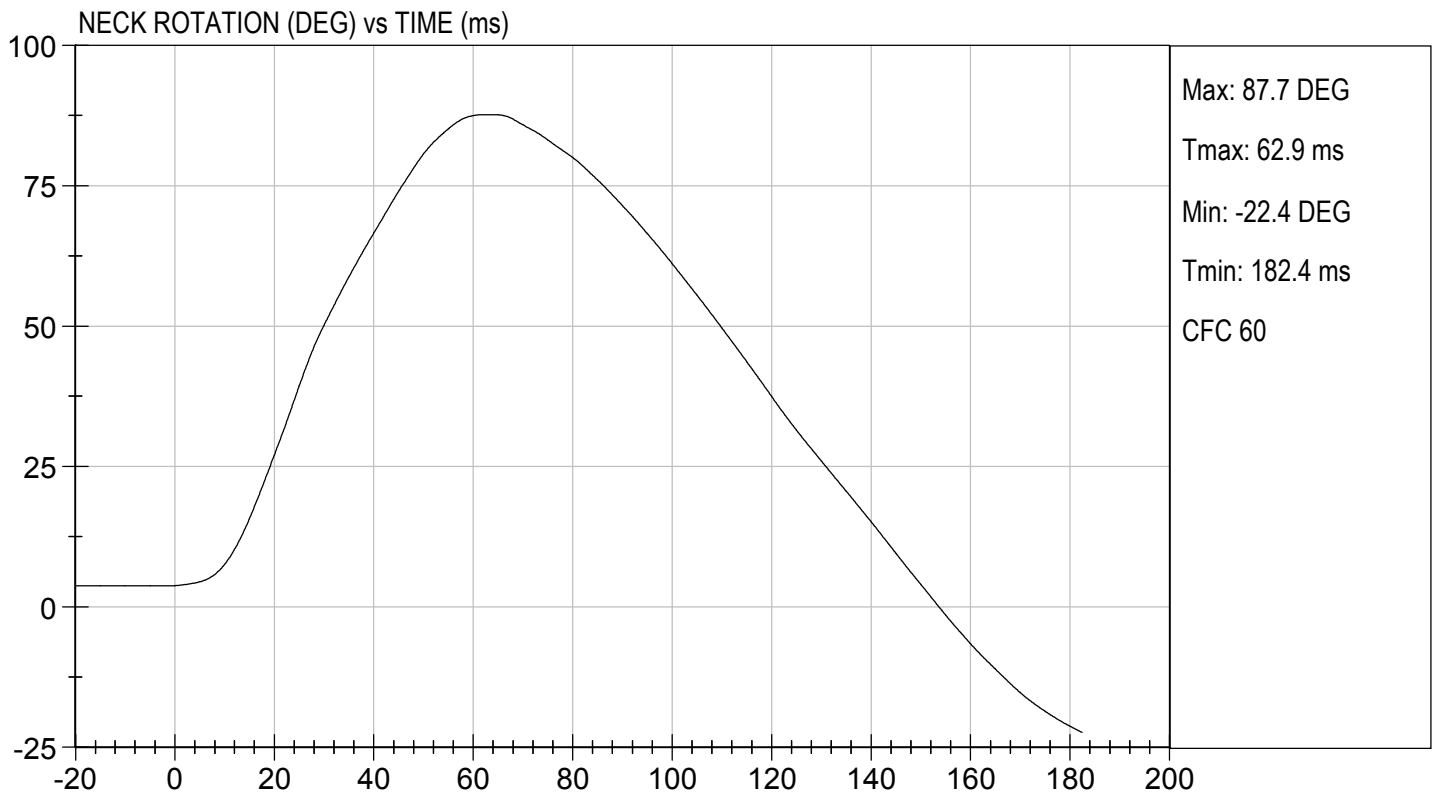
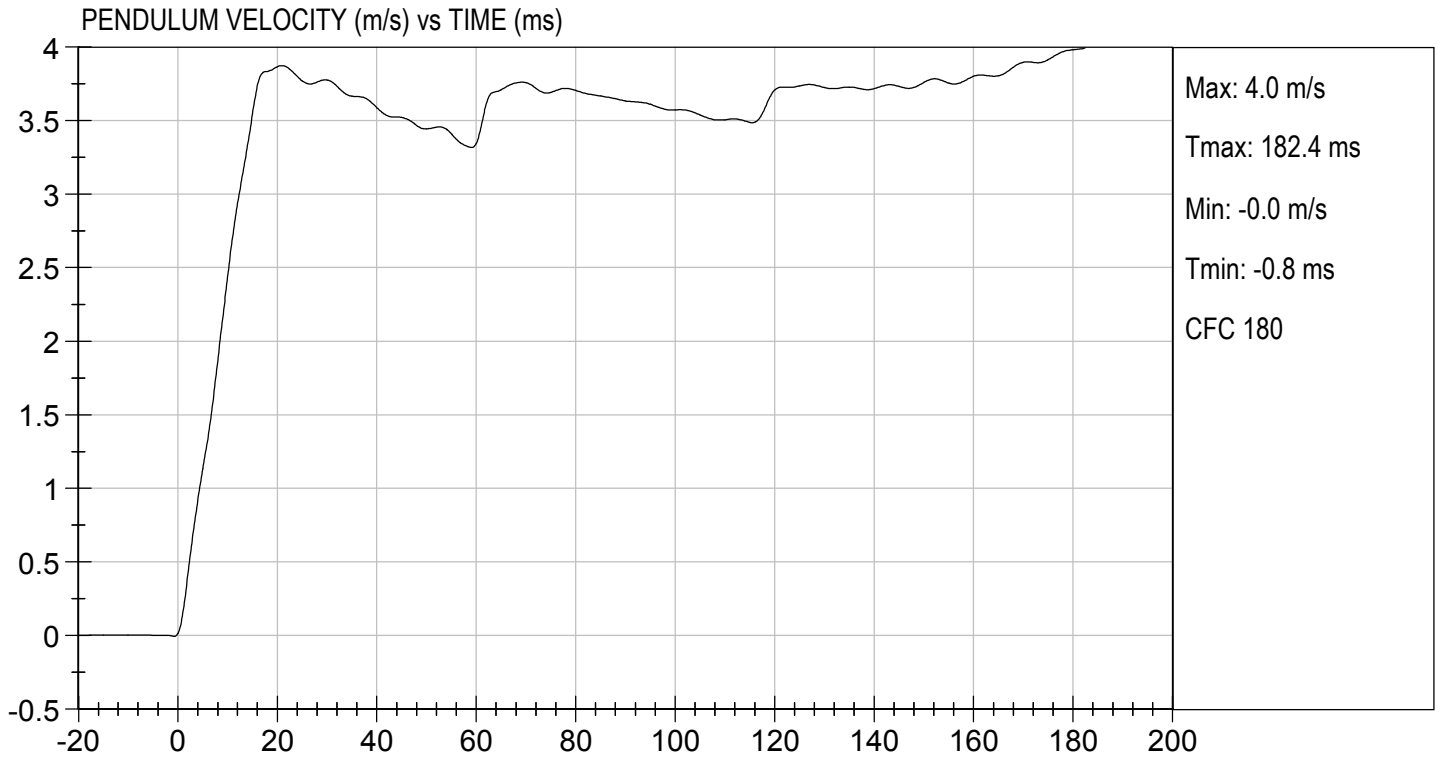
Laboratory Technician

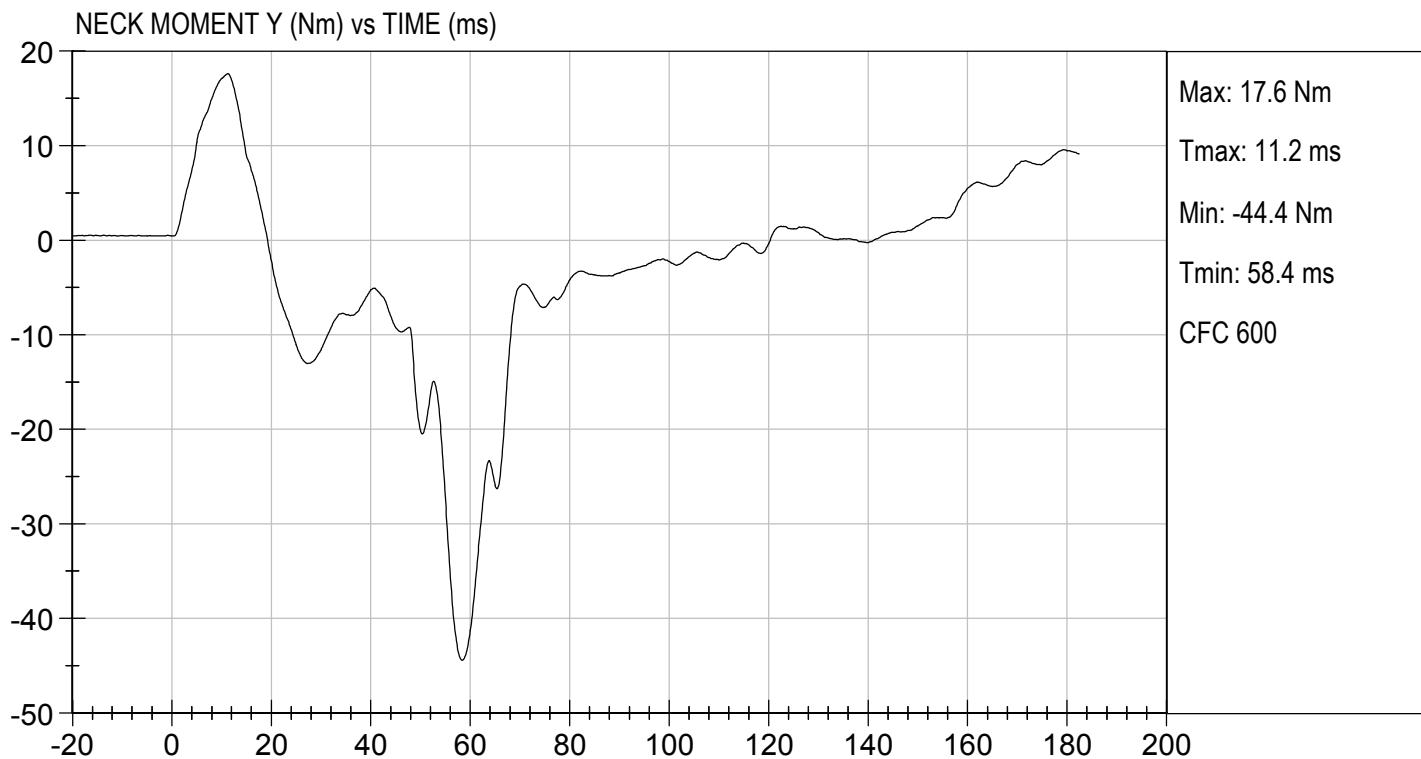
08/16/2018

Test Date

B. F.

Approved By





MGA RESEARCH CORPORATION
THORAX IMPACT TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 082

Test I.D: D182484

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	46	Pass
Probe Velocity	m/s	5.9 to 6.1	6.05	Pass
Peak Deflection	mm	32 to 38	34.1	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	693	Pass
Internal Hysteresis	%	65 to 85	72.9	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	746	Pass
Overall Test Results				Pass

Brian Roach

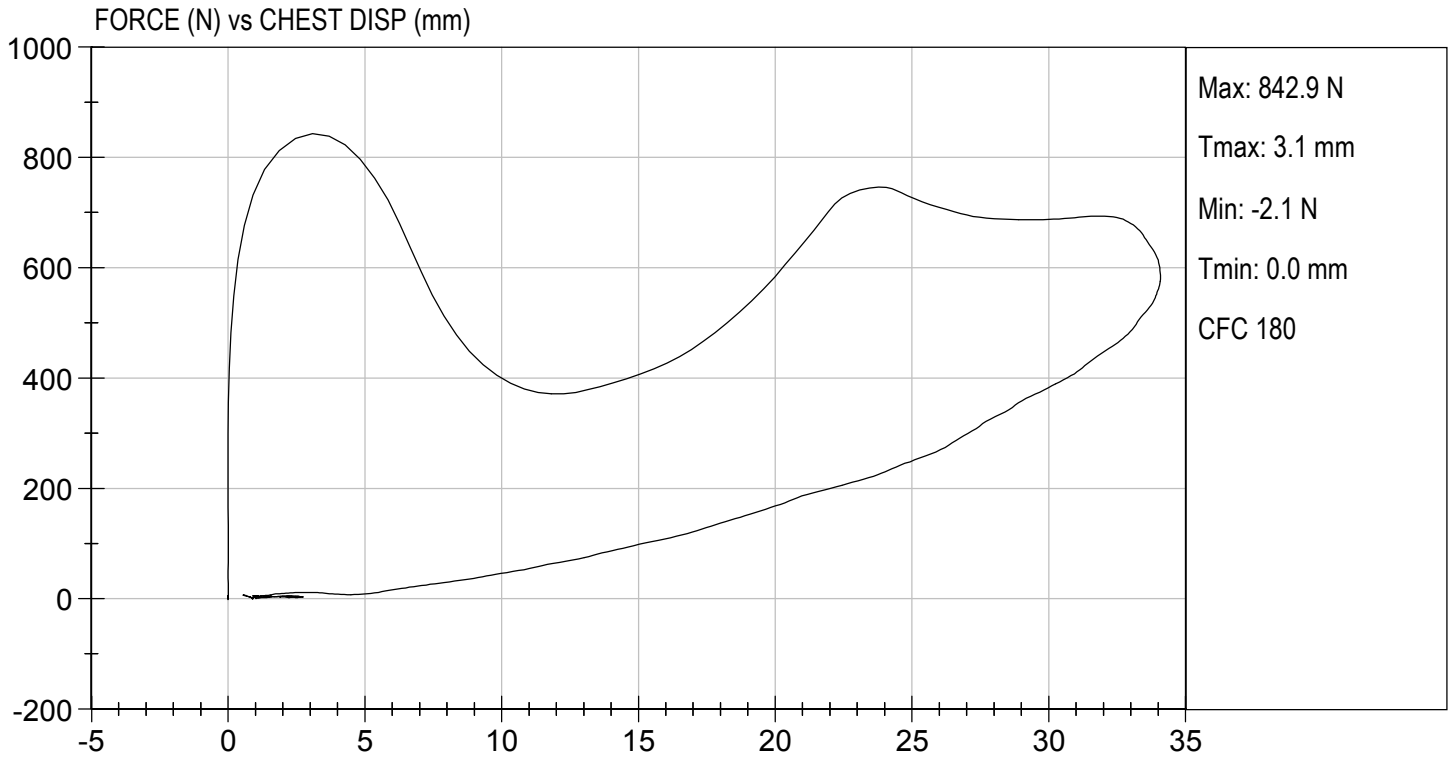
Laboratory Technician

08/14/2018

Test Date

B. F.

Approved By



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 082

Test I.D: D182487

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	49	Pass
Initial Angle	deg	0 to 15	5	Pass
Return Angle	deg	-10 to 10	5	Pass
Force at 45 deg	N	130 to 180	171	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
Overall Test Results				Pass

Brian Roach

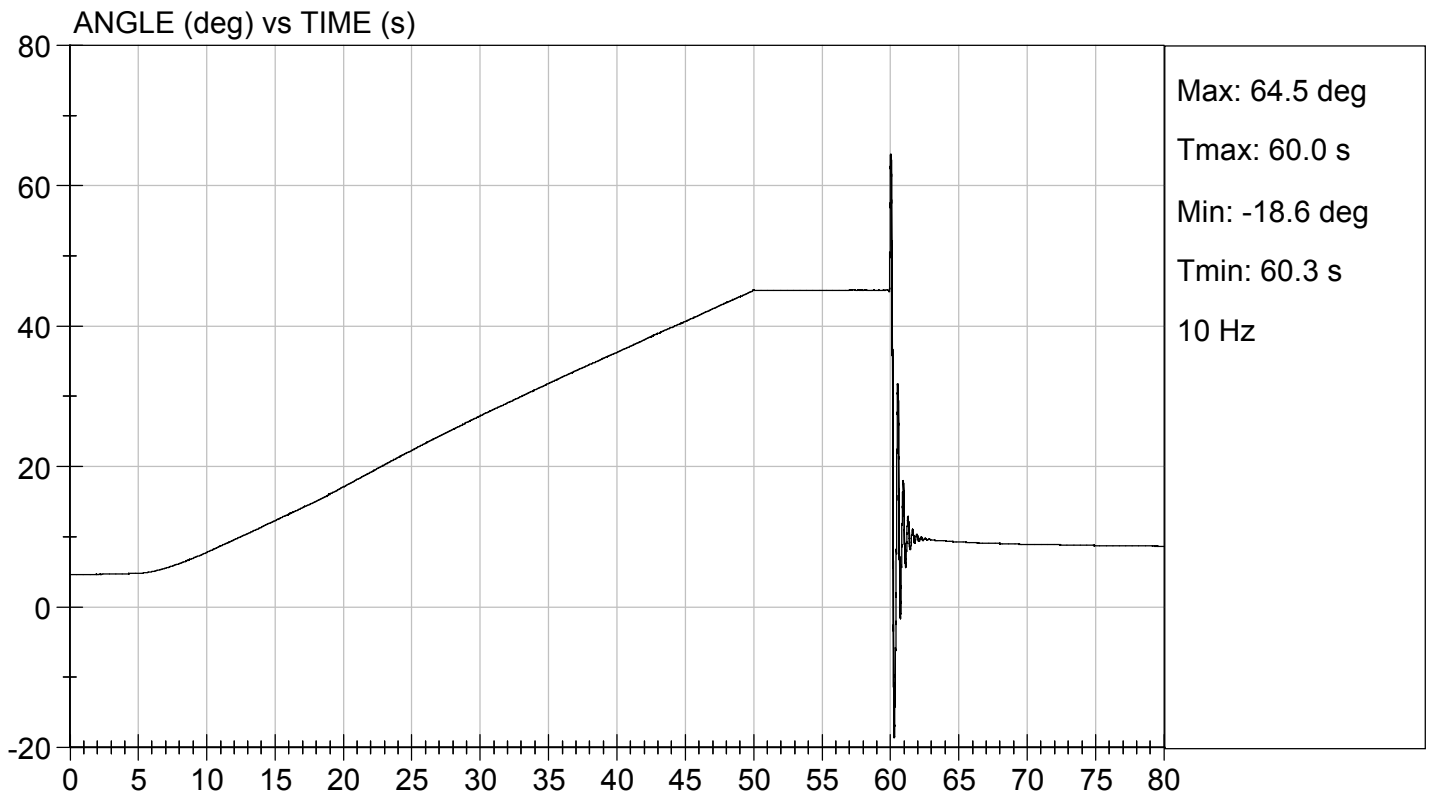
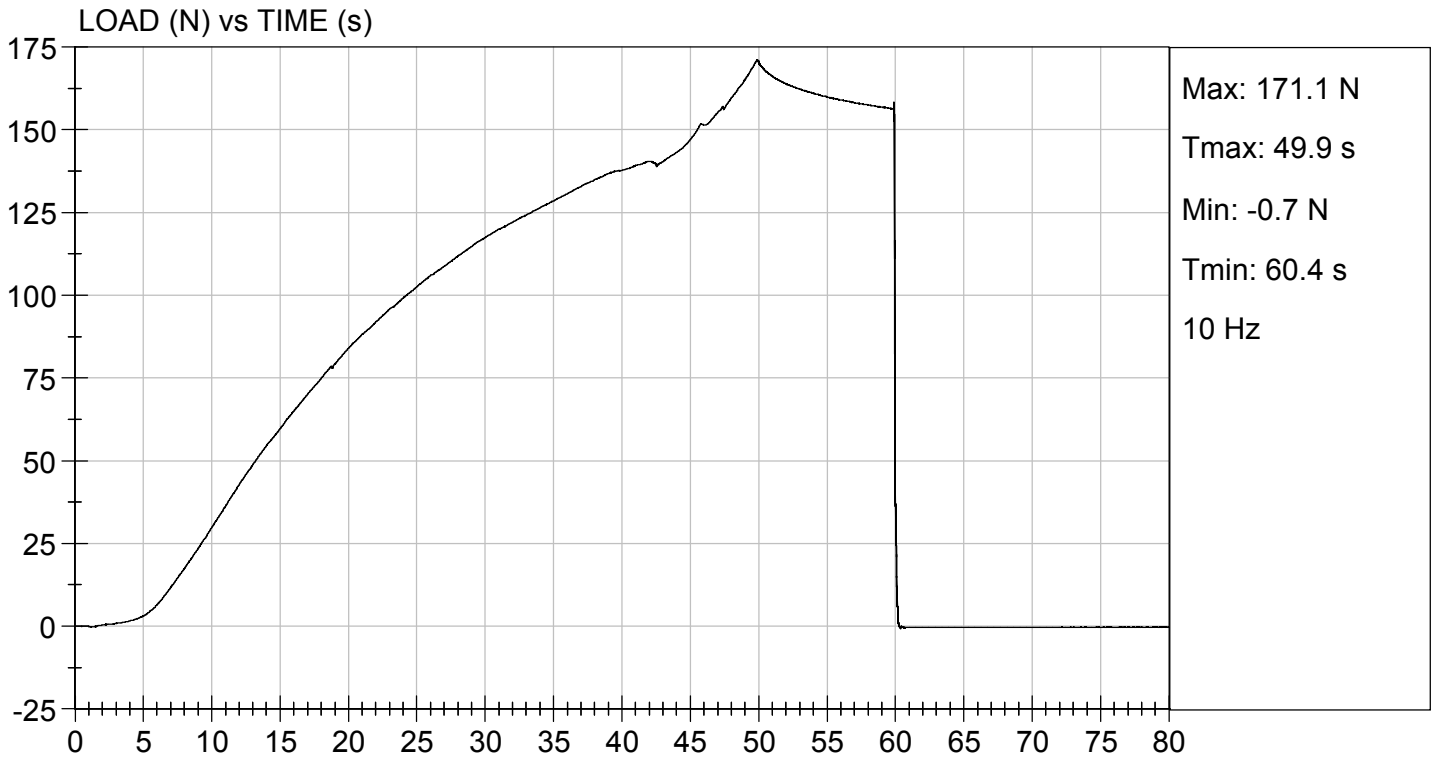
Laboratory Technician

08/16/2018

Test Date

B. F. K.

Approved By



CALIBRATION TEST RESULTS

POST-TEST

Hybrid III 3-Year-Old ATD

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

ATD Serial No: 082

Test ID: D183041

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	45	Pass
Peak Resultant Acceleration	G's	250 to 280	251	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-4.0	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
Overall Test Results				Pass

Brian Roach

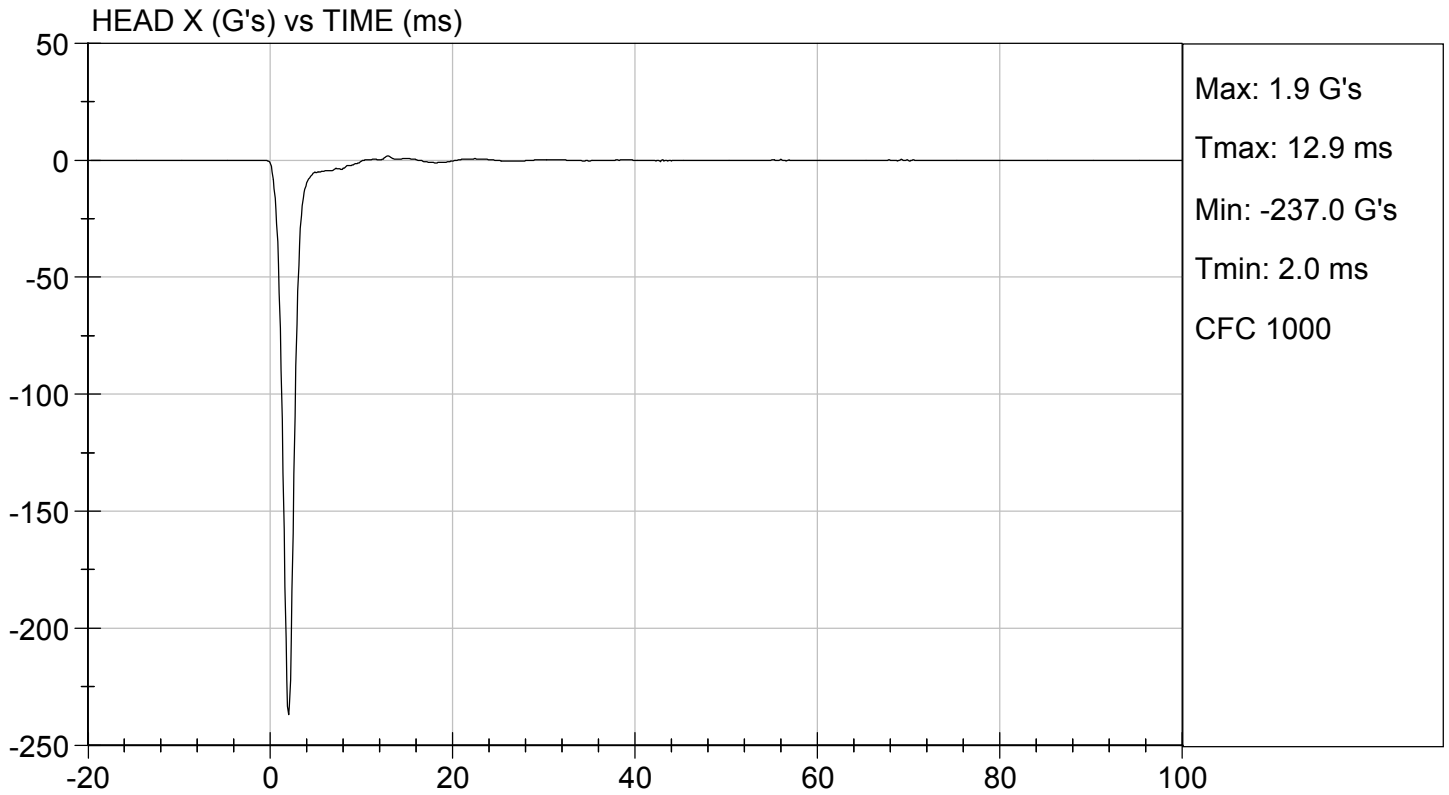
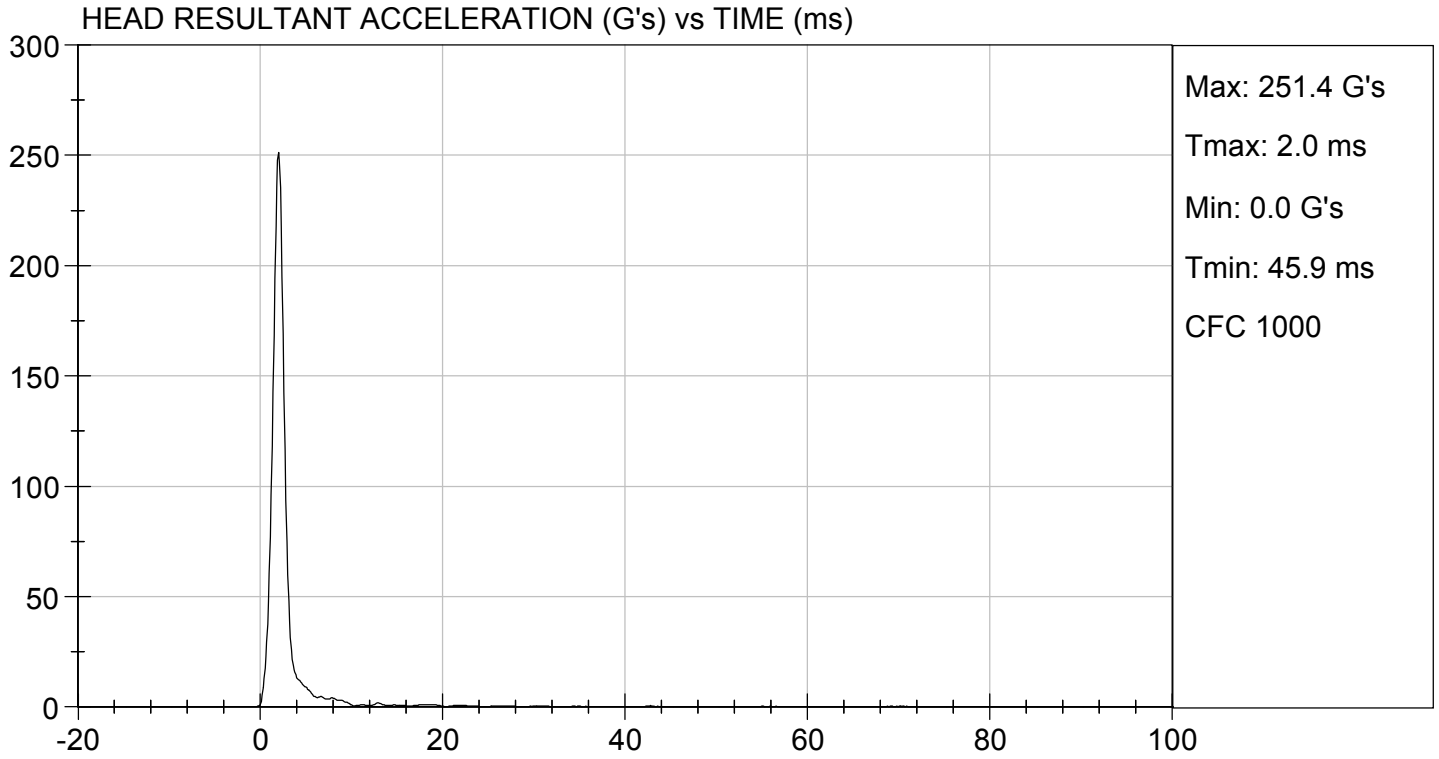
Laboratory Technician

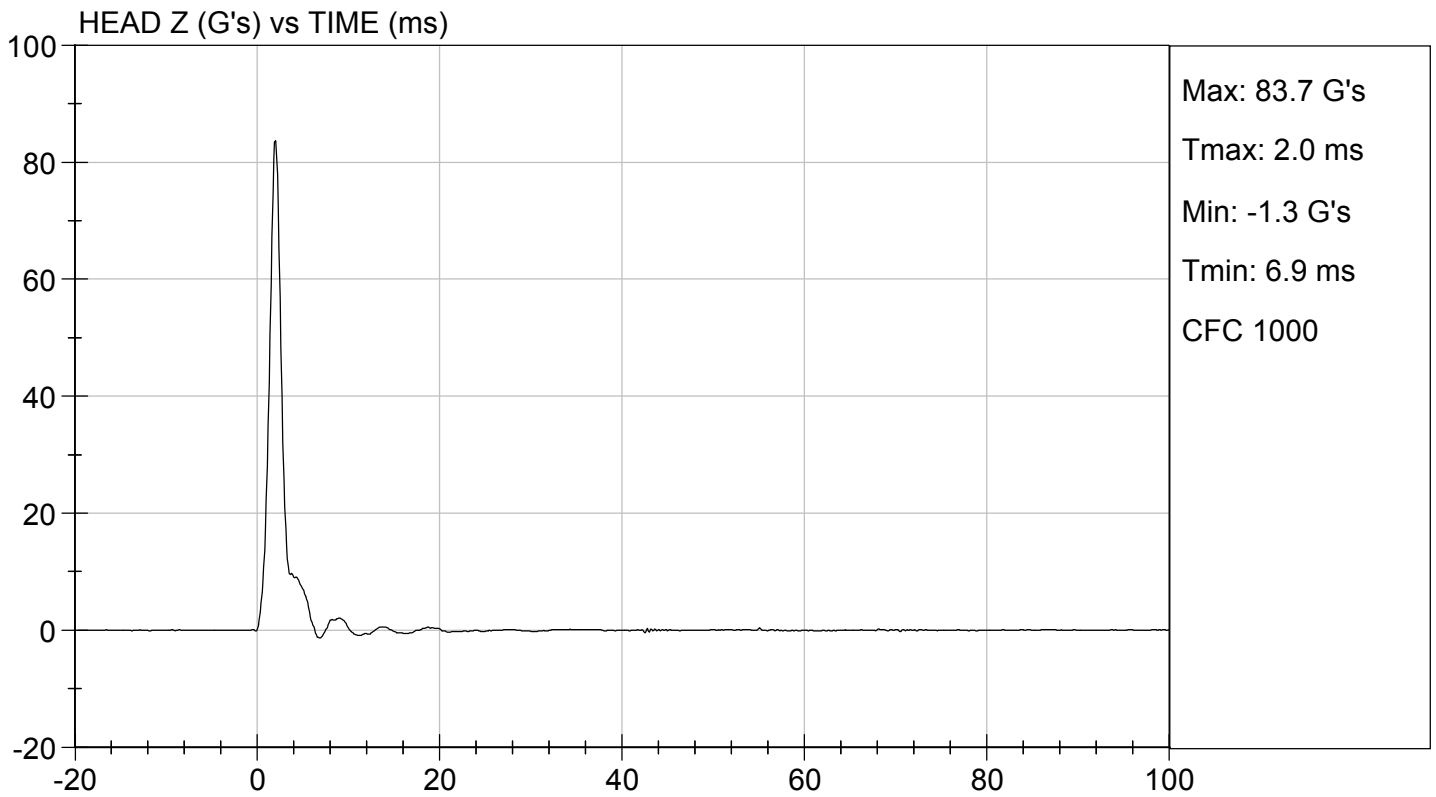
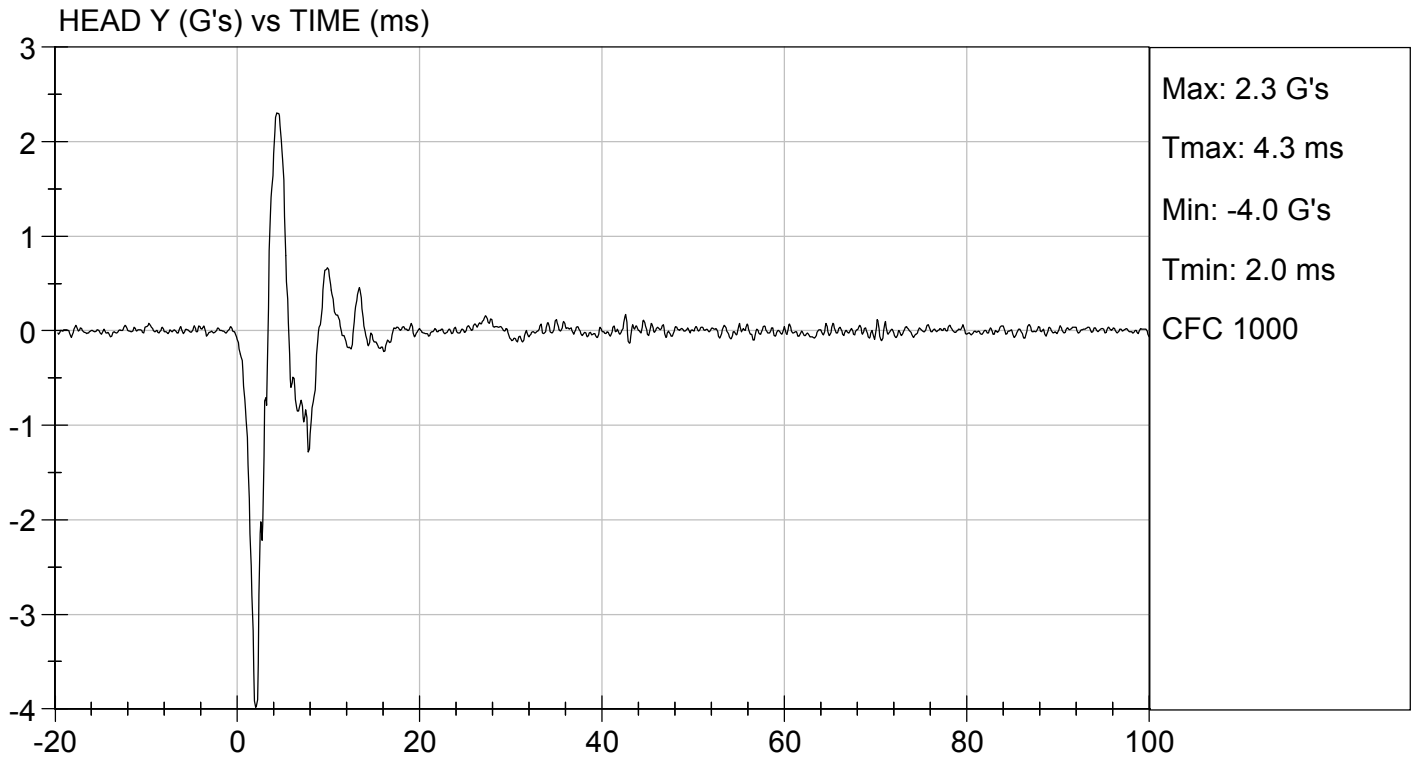
10/09/2018

Test Date

B. F. H.

Approved By





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 3 YEAR OLD

ATD Serial No: 082

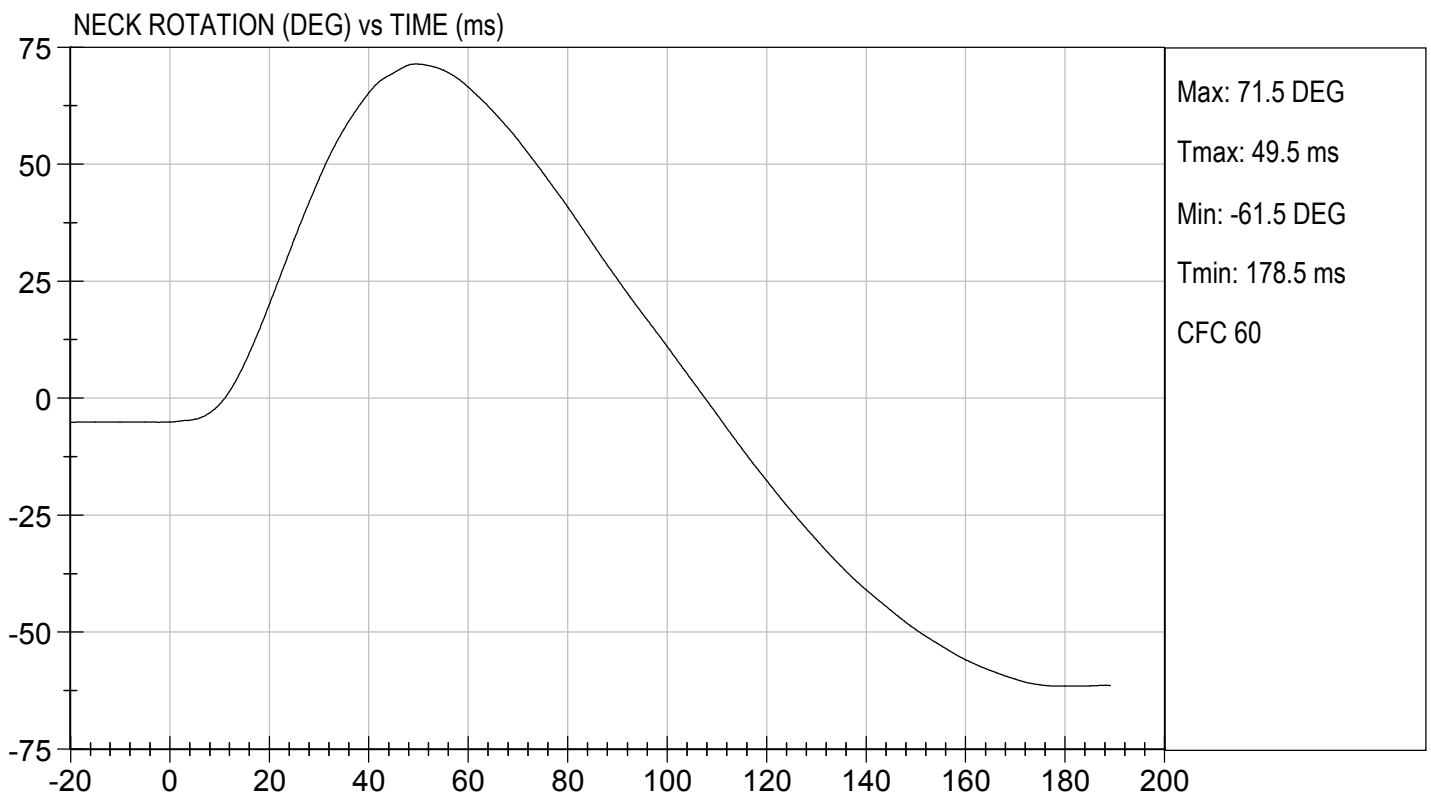
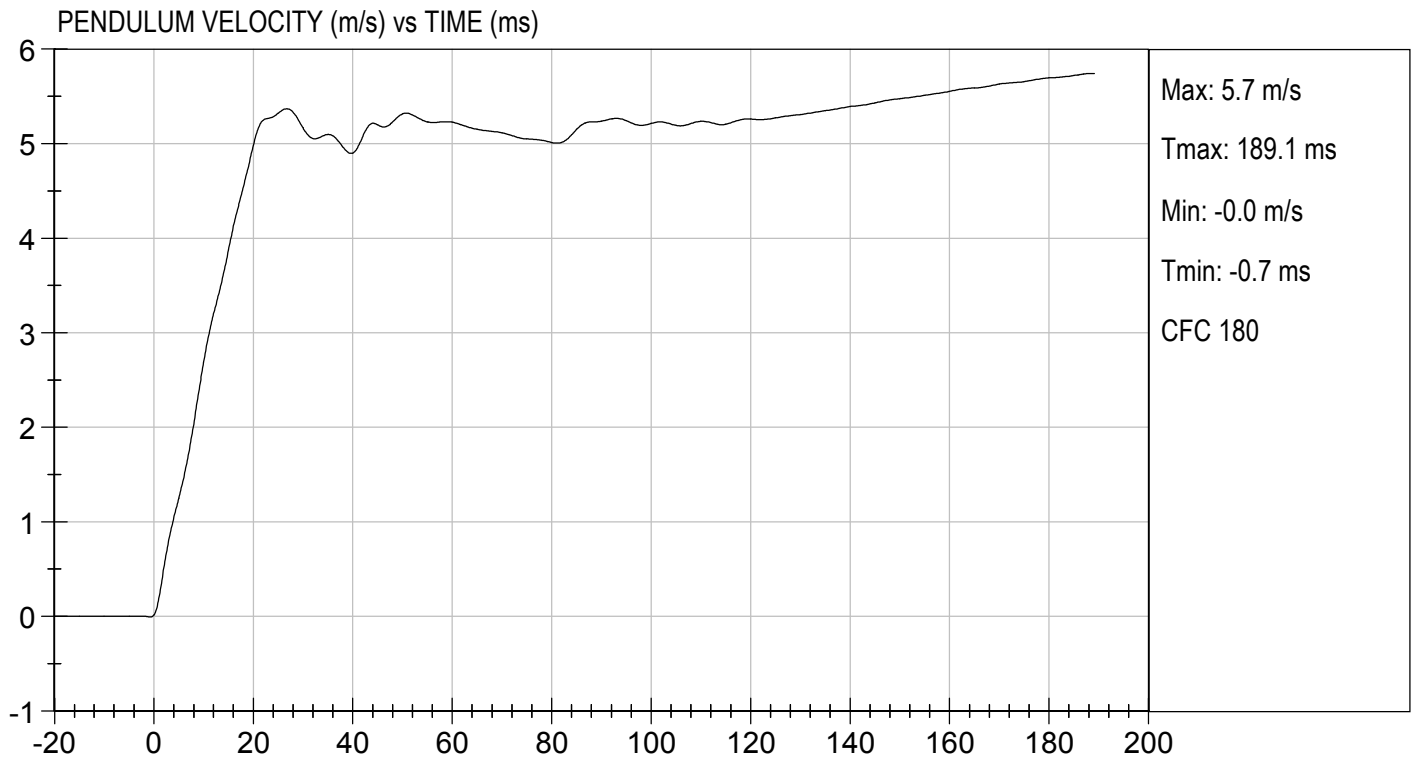
Test I.D: D183042

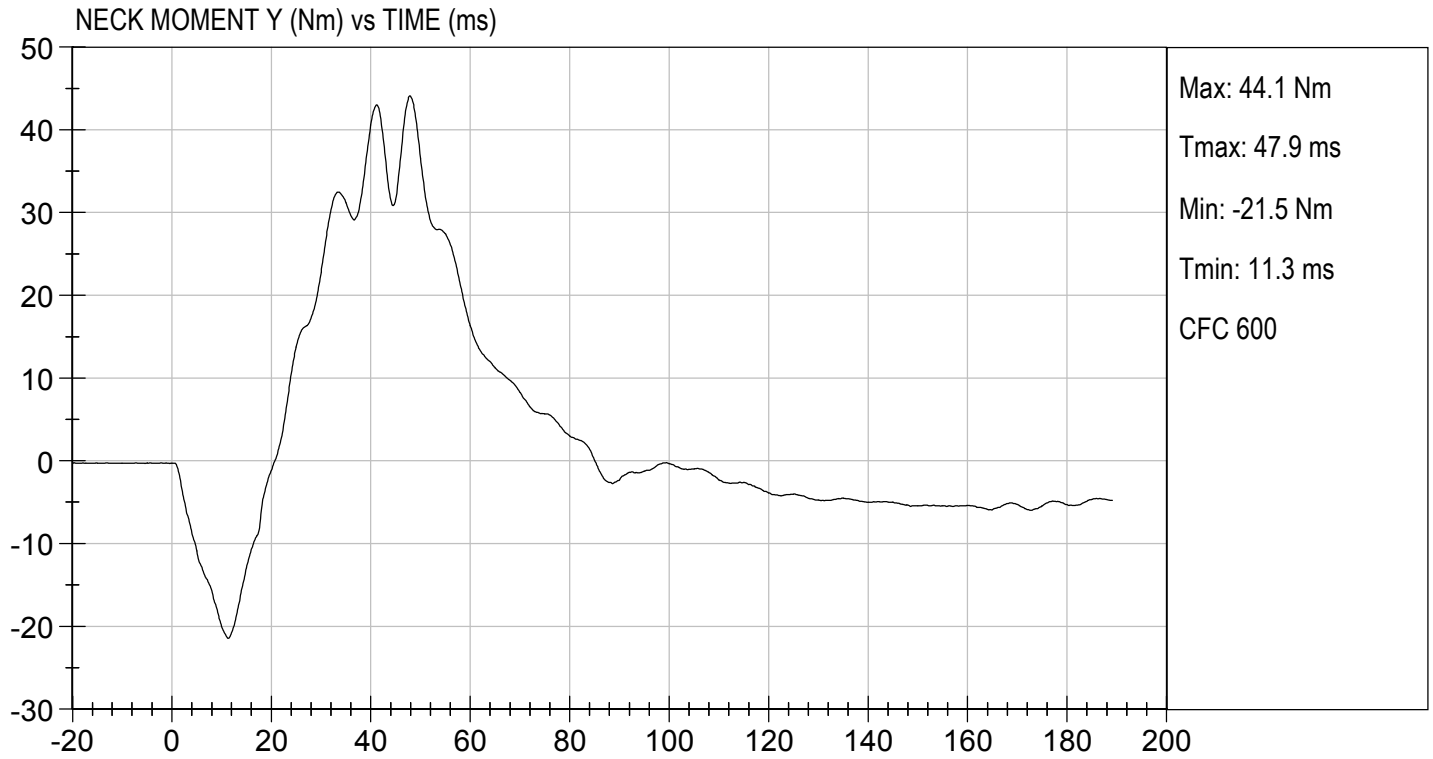
Tested Parameter	Units	Specification	Result	Pass/Fail	
Laboratory Temperature	deg C	20.6 to 22.2	21.1	Pass	
Laboratory Relative Humidity	%	10 to 70	51	Pass	
Pendulum Speed	m/s	5.40 to 5.60	5.52	Pass	
Pendulum Velocity	10 msec	m/s	2.0 to 2.7	2.7	Pass
	15 msec	m/s	3.0 to 4.0	3.9	Pass
	20 msec	m/s	4.0 to 5.1	5.0	Pass
D Plane Rotation	deg	70 to 82	71	Pass	
Peak Moment within Deflection Corridor	Nm	42.0 to 53.0	44.1	Pass	
Positive Moment - Time Curve Decay to 10 Nm	msec	60.0 to 80.0	67	Pass	
Overall Test Results				Pass	

Brian Roach
Laboratory Technician

10/10/2018
Test Date

B. F. H.
Approved By





MGA RESEARCH CORPORATION
NECK EXTENSION TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 082

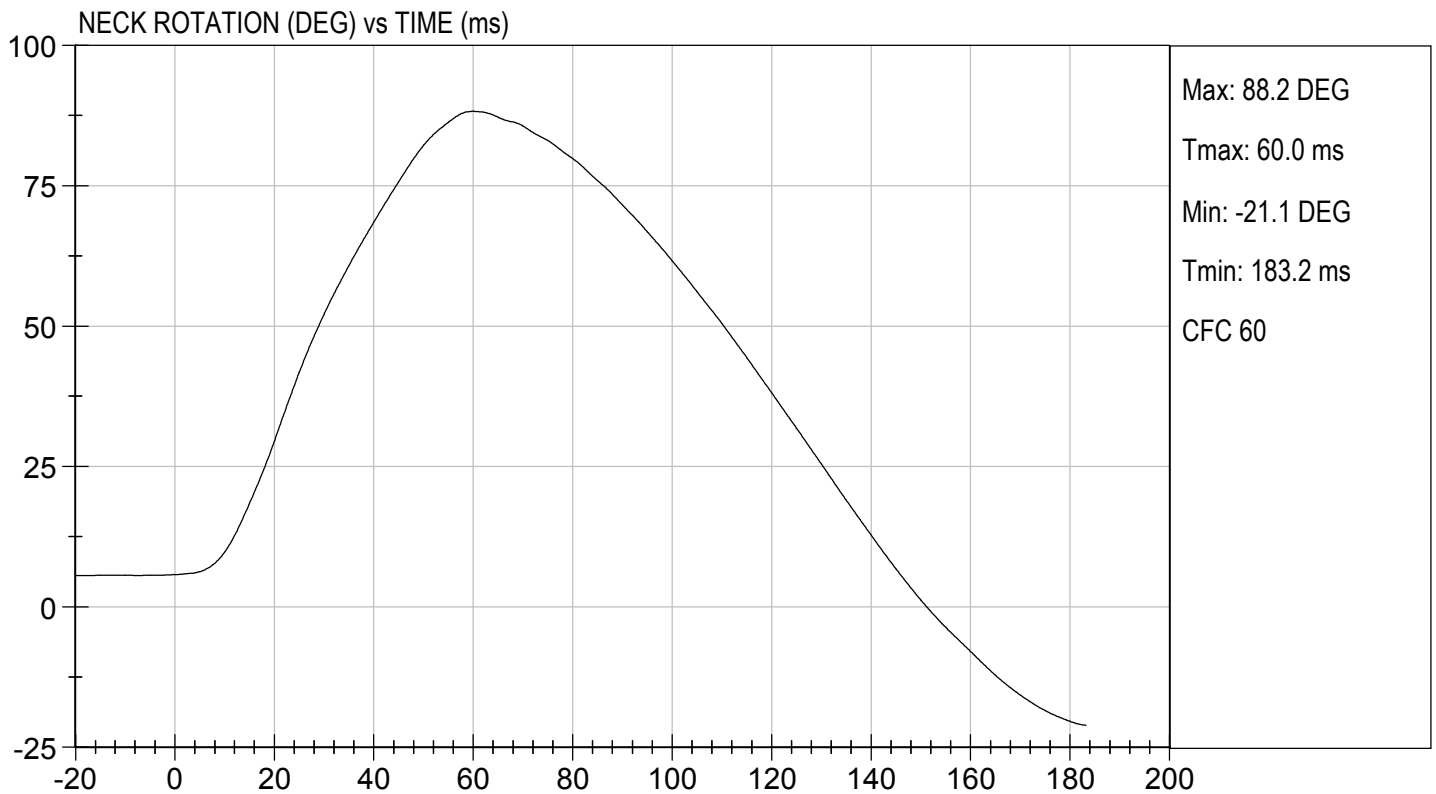
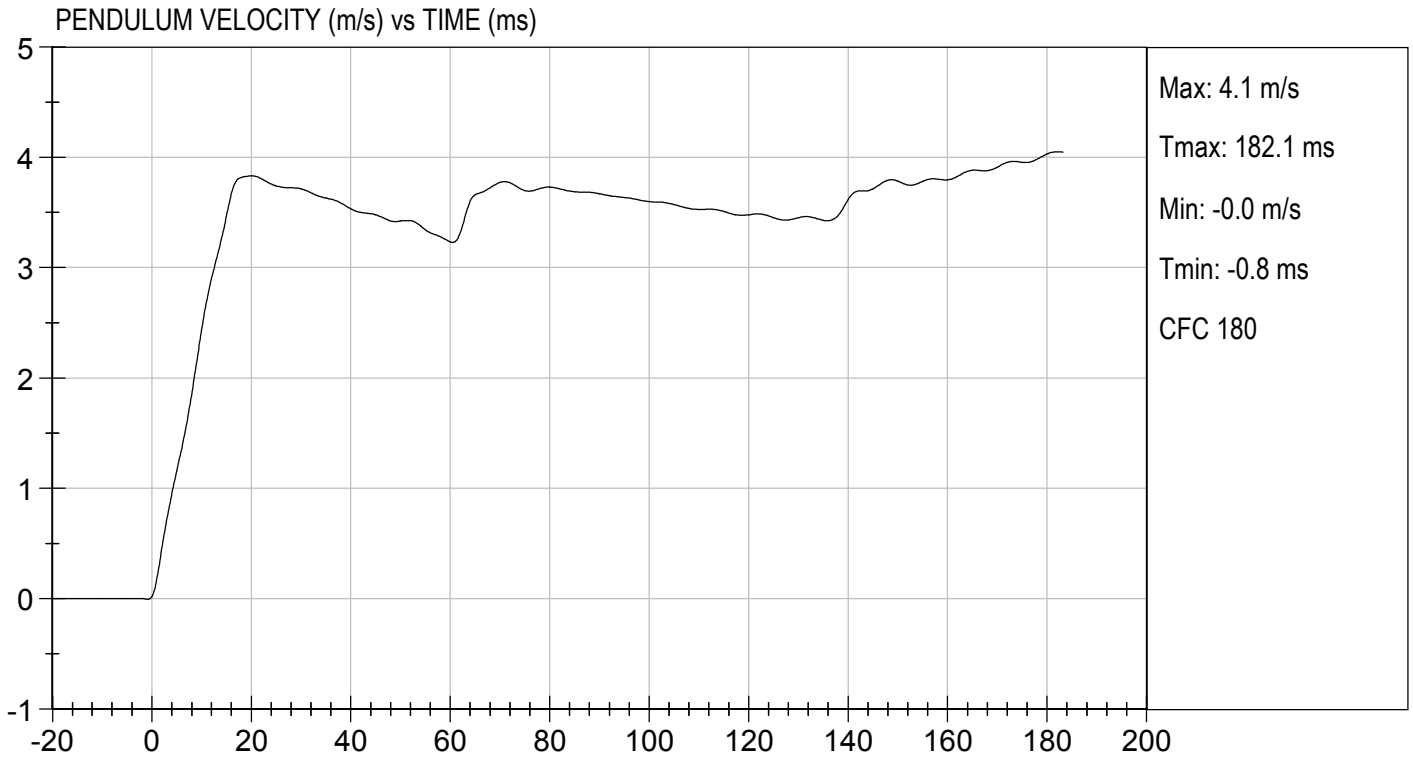
Test I.D: D183043

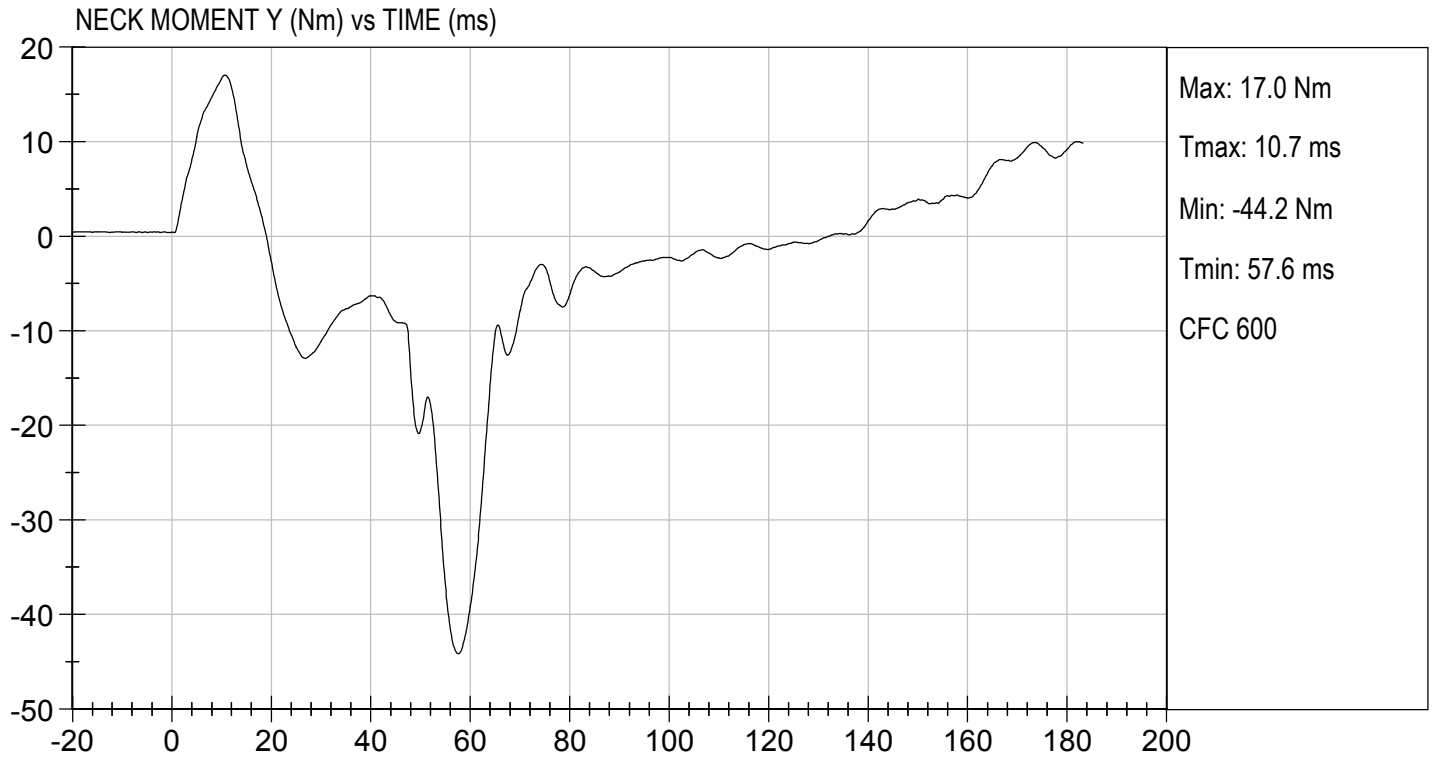
Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.1	Pass
Laboratory Relative Humidity		%	10 to 70	51	Pass
Pendulum Speed		m/s	3.55 to 3.75	3.63	Pass
Pendulum Velocity	6 ms	m/s	1.0 to 1.4	1.4	Pass
	10 ms	m/s	1.9 to 2.5	2.4	Pass
	14 ms	m/s	2.8 to 3.5	3.3	Pass
D Plane Rotation		deg	83 to 93	88	Pass
Peak Moment within Deflection Corridor		Nm	-53.3 to -43.7	-44.2	Pass
Negative Moment - Time Curve Decay to -10 Nm		ms	60.0 to 80.0	65	Pass
Overall Test Results					Pass

Brian Roach
Laboratory Technician

10/10/2018
Test Date

B. F. K.
Approved By





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

ATD Serial No: 082

Test I.D: D183044

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	51	Pass
Probe Velocity	m/s	5.9 to 6.1	5.98	Pass
Peak Deflection	mm	32 to 38	34.4	Pass
Peak Resistive Force w/in Deflection Corridor	N	680 to 810	724	Pass
Internal Hysteresis	%	65 to 85	72.2	Pass
Max Force 12.5 mm - 32 mm Deflection	N	<= 910	752	Pass
Overall Test Results				Pass

Brian Roach

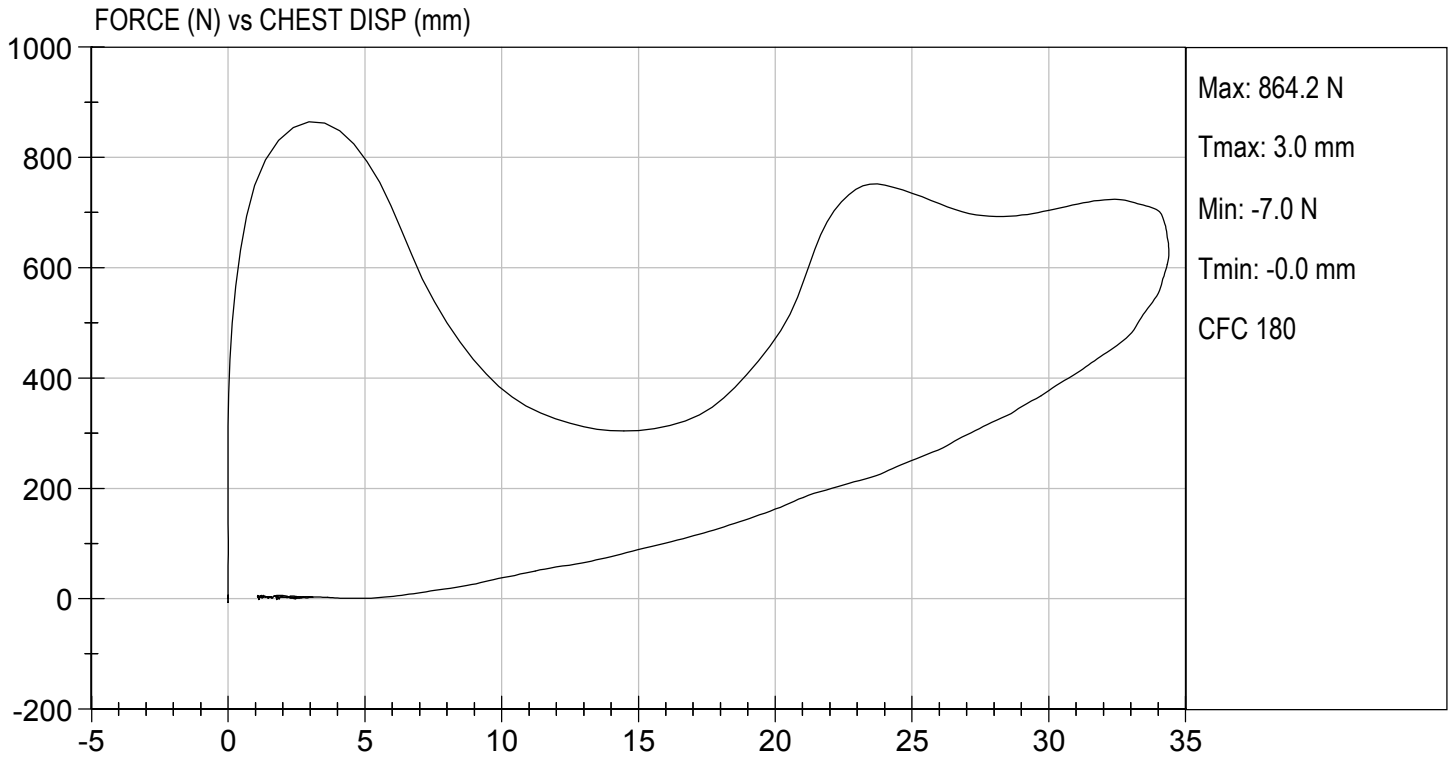
Laboratory Technician

10/10/2018

Test Date

B. Fick

Approved By



MGA RESEARCH CORPORATION
TORSO FLEXION TEST
HYBRID III 3 YEAR OLD

ATD Serial No: 082

Test I.D: D183047

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	52	Pass
Initial Angle	deg	0 to 15	3	Pass
Return Angle	deg	-10 to 10	3	Pass
Force at 45 deg	N	130 to 180	176	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	1.0	Pass
Overall Test Results				Pass

Brian Roach

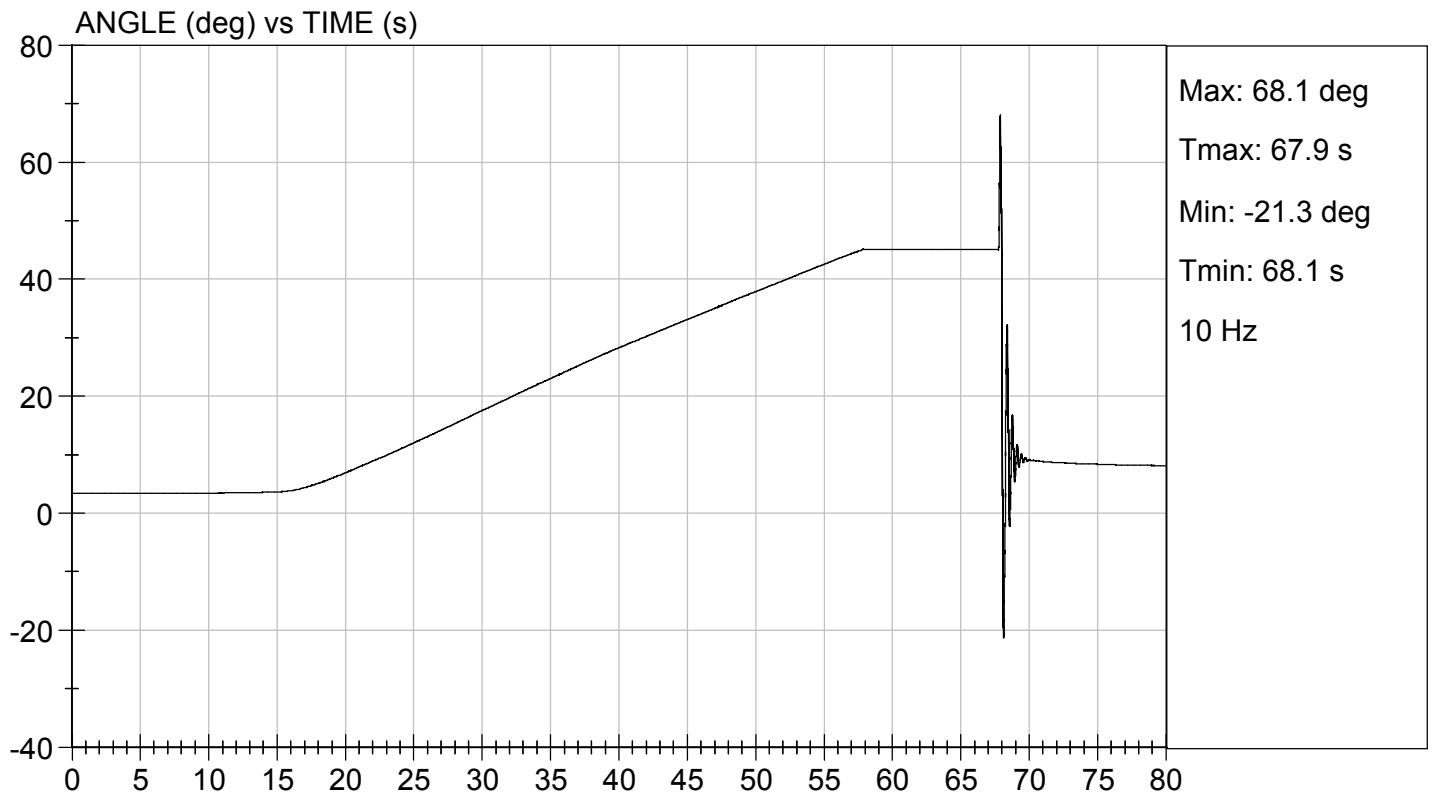
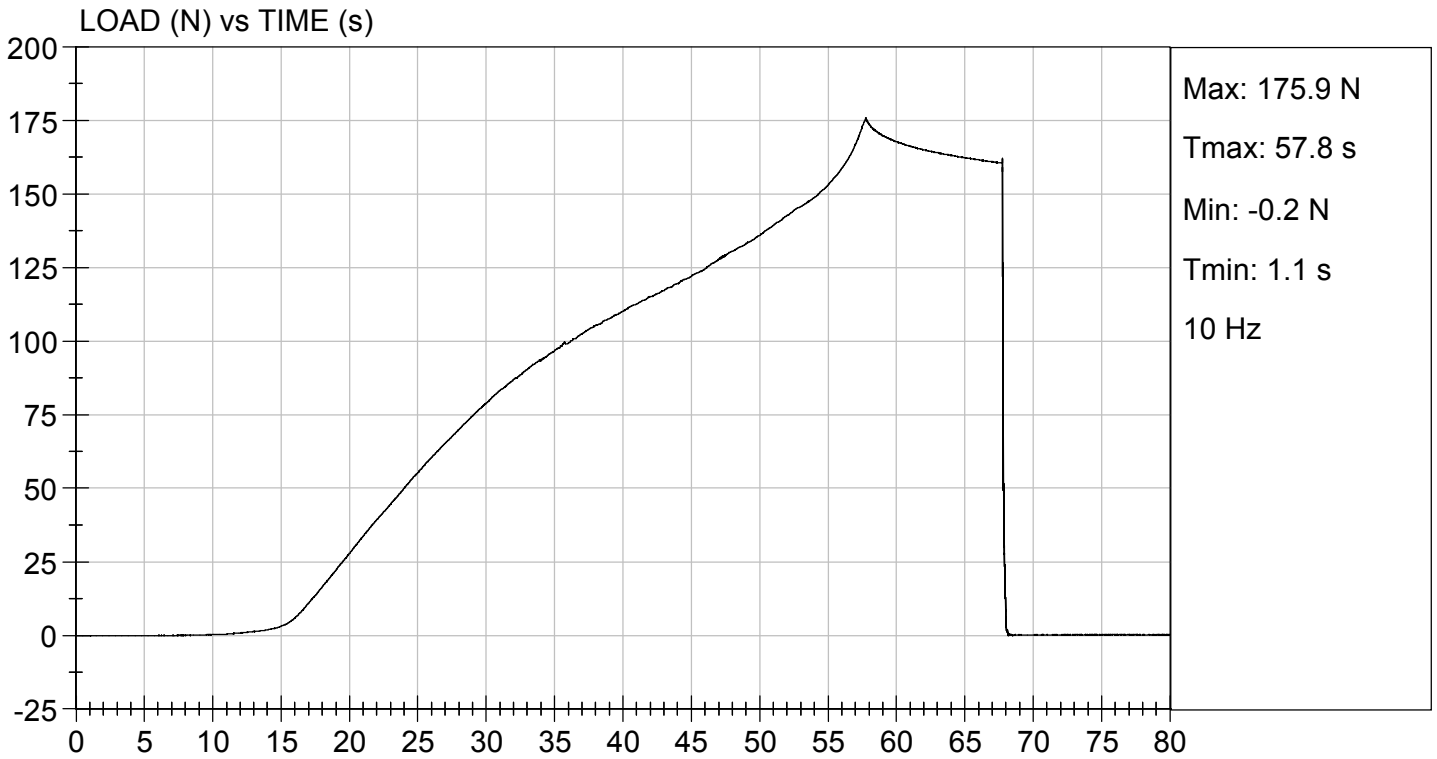
Laboratory Technician

10/10/2018

Test Date

B. F. K.

Approved By



**APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA**

Table 1 – Dummy Instrumentation

		HIII 3-Year-Old S/N 082		
		Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers	X	P88333	Endevco	09/18/18
	Y	P88334	Endevco	09/18/18
	Z	P88335	Endevco	09/18/18
Upper Neck Load Cell		NG124	FTSS	08/02/18
Lower Neck Load Cell		NG249	Denton	08/02/18
Chest Accelerometers	X	P86724	Endevco	07/30/18
	Y	P86725	Endevco	07/30/18
	Z	P86726	Endevco	07/30/18
Chest Potentiometer		082	Servo	08/02/18
Upper Sternum Accelerometer	X	P88302	Endevco	05/24/18
Lower Sternum Accelerometer	X	P88303	Endevco	09/20/18
Upper Spine Accelerometers	X	P79639	Endevco	09/19/18
	Y	P79640	Endevco	09/19/18
	Z	P79641	Endevco	09/19/18
Lower Spine Accelerometers	X	P84445	Endevco	09/19/18
	Y	P84449	Endevco	09/19/18
	Z	P88720	Endevco	09/19/18