REPORT NUMBER: NCAP-MGA-2018-037

NEW CAR ASSESSMENT PROGRAM (NCAP)
Frontal Barrier Impact Test

GENERAL MOTORS OF CANADA COMPANY
2018 Nissan Titan S 4x4 Crew Cab Truck
NHTSA No.: O20185201

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: October 5, 2018

Final Report Date: December 11, 2018

FINAL REPORT

U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Standards
Mail Code: NRM-110
1200 New Jersey Ave, SE
Room W43-410
Washington, DC 20590

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Approval Date: December 11, 2018

FINAL REPORT ACCEPTANCE BY OCWS:

_____
Division Chief, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

_____
COTR, New Car Assessment Program
NHTSA, Office of Crashworthiness Standards

Date: _____

Technical Report Documentation Page

1. Report No. NCAP-MGA-2018-037	*2. Government Accession No.*	*3. Recipient's Catalog No.*
4. Title and Subtitle Final Report of New Car Assessment Program Frontal Impact Testing of a 2018 Nissan Titan S 4x4 Crew Cab Truck, NHTSA No.: O20185201		*5. Report Date* December 11, 2018 *6. Performing Organization Code* MGA
7. Author(s) Ben Fischer, Project Engineer		*8. Performing Organization Report No.* NCAP-MGA-2018-037
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-12-D-00258
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, D.C. 20590		*13. Type of Report and Period Covered* Final Test Report October 5, 2018 to December 11, 2018 *14. Sponsoring Agency Code* NRM-110
15. Supplementary Notes		

16. Abstract

A 56.3 km/h NCAP Frontal Impact Test was conducted on a 2018 Nissan Titan S 4x4 Crew Cab Truck in accordance with the specifications of the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure. This test was conducted to obtain data indicant of FMVSS 208, 212, 219 (partial), and 301 performance. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on October 5, 2018.

The impact velocity of the vehicle was 56.97 km/h and the ambient temperature at the barrier face at the time of impact was 21.4°C. The target vehicle post-test maximum crush was 604mm located at the vehicle centerline. The test vehicle's performance was as follows:

Measurement Description	Units	Driver ATD		Passenger ATD	
		Threshold	Result	Threshold	Result
Head Injury Criteria (HIC_{15})	N/A	700	233	700	418
Maximum Chest	mm	63	31	52	14
Nij	N/A	1	0.33	1	0.39
Neck Tension	N	4170	1287	2620	1006
Neck Compression	N	4000	436	2520	439
Left Femur Force	N	10008	3425	6805	1255
Right Femur Force	N	10008	624	6805	1161

17. Key Words 35 mph Frontal Barrier Impact Test New Car Assessment Program (NCAP)		*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 Email: tis@nhtsa.dot.gov FAX: 202-493-2833	
19. Security Classification of Report Unclassified	*20. Security Classification of Page* Unclassified	*21. No. of Pages* 172	22. Price

TABLE OF CONTENTS

SECTION 1
PURPOSE AND SUMMARY OF TEST

PURPOSE

This 56.3 km/h frontal barrier impact test is part of the Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract number DTNH22-12-D-00258. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for consumer information purposes.

The 56.3 km/h frontal barrier impact was conducted in accordance with the Office of Crashworthiness Standards Frontal NCAP Laboratory Test Procedure.

SUMMARY

A load cell barrier consisting of 176 load cells was impacted by a 2018 Nissan Titan S 4x4 Crew Cab Truck at a velocity of 56.97 km/h. The test was performed at MGA Research Corporation on October 5, 2018. Pre-test and post-test photographs of the vehicle and dummies can be found in Appendix A.

Two (2) real-time cameras and fourteen (14) high-speed cameras were used to document the frontal barrier impact event. Camera locations and other pertinent camera information can be found in this report.

One Part 572E 50th percentile male anthropomorphic test device (ATD), was placed in the driver seating position and one Part 572O 5th percentile female test device (ATD) was placed in the right-front passenger seating position according to dummy placement instructions specified in the Frontal NCAP Laboratory Test Procedure.

Both ATDs were fully instrumented with head, chest and pelvis tri-axial accelerometers, chest displacement potentiometers, upper neck transducers, right/left femur load cells, and lower leg instrumentation.

The driver (position 1) ATD (Serial No. 351) and the right-front passenger (position 2) ATD (Serial No. 138) were calibrated previous to this test. Certification details, along with instrumentation calibration data, are found in Appendix C of this report.

The 634 channels of data were recorded on a data acquisition system. Appendix B contains the dummy response data traces.

There was 100 percent windshield retention and no intrusion into the protected zone of the windshield during the event. There was no Stoddard Solvent leakage after the event or during any phase of the static rollover.

The maximum static crush of the vehicle was 604mm at the vehicle centerline and both the driver and passenger side doors remained closed during the impact event and were operable after the impact.

The driver's visible contact points were as follows: The driver's head contacted the airbag. The driver's head also contacted the headrest. The driver's knees contacted the knee bolster. The passenger's visible contact points were as follows: The passenger's head contacted the airbag. The passenger's head also contacted the headrest. The passenger's knees contacted the glove box.

The occupant data is summarized below:

ATD position	HIC_{15}	Nij	Neck Tension (N)	Neck Comp. (N)	3ms Chest Clip (Gs)	Chest Disp. (mm)	Left Femur (N)	Right Femur (N)
Driver (50^{th})	233	0.33	1287	436	37	31	3425	624
Passenger (5^{th})	418	0.39	1006	439	41	14	1255	1161

The test data can be found on the NHTSA website at www.nhtsa.dot.gov.

TEST NOTES

Barrier C-04 Fx recorded no valid data.
Barrier C-04 My recorded no valid data.
Barrier C-04 Mz recorded no valid data.
Barrier C-06 Fx recorded questionable data.
Barrier I-05 My recorded no valid data.

SECTION 2
OCCUPANT AND VEHICLE INFORMATION / DATA SHEETS

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20185201	Traction Control System (TCS)	Yes
Model Year	2018	Power Steering	Yes
Make	Nissan	Power Window Auto-Reverse	Yes
Model	Titan S 4x4 Crew Cab	Driver Frontal Airbag	Yes
Body Style	Truck	Driver Curtain Airbag	Yes
VIN	1N6AA1EJ9JN542949	Driver Head/Torso Airbag	No
Body Color	Gun Metallic	Driver Torso Airbag	No
Odometer (km/mi)	217km / 135mi	Driver Torso/Pelvis Airbag	Yes
Engine Displacement (L)	5.6 L	Driver Pelvis Airbag	No
Type/No. Cylinders	V8	Driver Knee Airbag	No
Engine Placement	Logitudinal	Front Pass. Frontal Airbag	Yes
Transmission Type	Automatic	Front Pass. Curtain Airbag	Yes
Transmission Speeds	7	Front Pass. Head/Torso Airbag	No
Overdrive	Yes	Front Pass. Torso Airbag	No
Final Drive	RWD	Front Pass. Torso/Pelvis Airbag	Yes
Roof Rack	No	Front Pass. Pelvis Airbag	No
Sunroof/T-Top	No	Front Pass. Knee Airbag	No
Running Boards	No	Driver Pretensioner	Yes
Tilt Steering Wheel	Yes	Driver Load Limiter	Yes
Power Seats	No	Front Pass. Pretensioner	Yes
Anti-Lock Brakes (ABS)	Yes	Front Pass. Load Limiter	Yes
Automatic Door Locks (ADLs)	Yes	Other	N/A

Does owner's manual provide instructions to turn off automatic door locks?	No

DATA FROM CERTIFICATION LABEL

Manufactured By	NISSAN MOTOR CO., LTD.
Date of Manufacture	06/18

GVWR (kg)	3311
GAWR Front (kg)	1724
GAWR Rear (kg)	1820

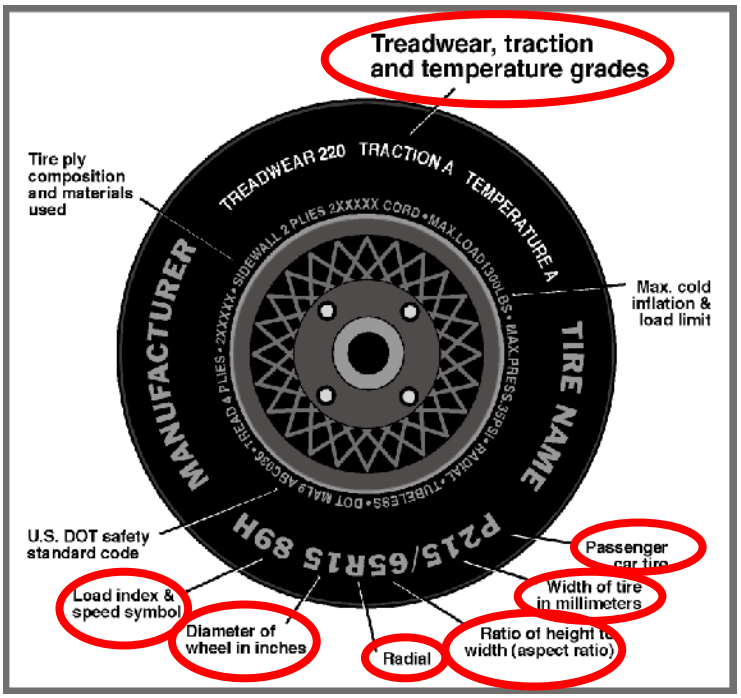
VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total
Type of Seats	Bucket	Bench		
Designated Seating Capacity (DSC)	3	3		6
Capacity Weight (VCW) (kg)				675
Cargo Weight (RCLW) (kg)				267

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

VEHICLE TIRE INFORMATION



Measured Parameter	Front	Rear
Max. Tire Pressure (kPa)	300	300
Cold Pressure (kPa)	250	250
Recommended Tire Size	265/70R18	265/70R18
Tire Size on Vehicle	265/70R18	265/70R18
Tire Manufacturer	Toyo	Toyo
Tire Model	Open Country	Open Country
Treadwear	400	400
Traction	A	A
Temperature Grade	B	B
Tire Plies Sidewall	2 Polyester	2 Polyester
Tire Plies Body	2 Steel, 2 Polyester, 1 Nylon	2 Steel, 2 Polyester, 1 Nylon
Load Index/Speed Symbol	114S	114S
Tire Material	Rubber	Rubber
DOT Safety Code Left	73D6 3KD 4417	73D6 3KD 4417
DOT Safety Code Right	73D6 3KD 4417	73D6 3KD 4417

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)		
		Front	Rear	Total	Front	Rear	Total
Left	kg	750.5	570.5		790.0	675.0	
Right	kg	737.5	553.0		762.5	654.0	
Ratio	%	57.0%	43.0%		53.9%	46.1%	
Totals	kg	1488.0	1123.5	2611.5	1552.5	1329.0	2881.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value
Total Delivered Weight (UVW)	kg	2611.5
Weight of 1 P572E ATD & 1 P572O ATD	kg	141
Rated Cargo/Luggage Weight (RCLW)	kg	136
Calculated Test Vehicle Target Weight (TVTW)	kg	2888.5

TEST VEHICLE ATTITUDES AND CG

	Units	LF	RF	LR	RR	CG (aft of front axle)
As Delivered	mm	925	926	972	961	1531
As Tested	mm	919	916	941	940	1641
Post Test	mm	884	844	948	930	

GENERAL TEST VEHICLE DATA

Measurement Description	Units	Value
Total Vehicle Wheel Base	mm	3558
Total Vehicle Length at Left Side	mm	5238
Total Vehicle Length at Centerline	mm	5793
Total Vehicle Length at Right Side	mm	5238
Weight of Ballast in Cargo Area	kg	49
Weight of Vehicle Components Removed	kg	4
Amount of Stoddard Solvent in Fuel Tank	L	90.1

List of components removed to meet test weight: None.

List of components removed for instrumentation, data box, and equipment installation: LR and RR Floormats, LF and RF Underbody Plastic

DATA SHEET NO. 1 (CONTINUED)
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

TARGET VEHICLE STRUCTURAL MEASUREMENT

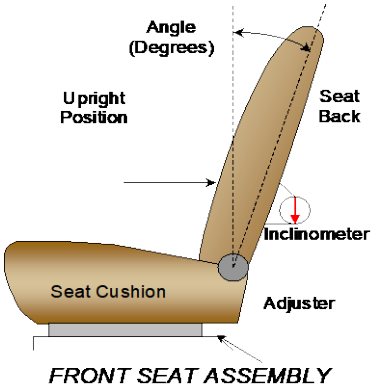
	Elements	Pre-Test (mm)
1	Total Length	5793
2	Total Width	2005
3	Bumper Top Height	645
4	Bumper Bottom Height	320
5	Longitudinal Member Top Height	592
6	Distance between Longitudinal Members	773
7	Longitudinal Member Width	98
8	Engine Top Height	1133
9	Engine Bottom Height	265
10	Engine and Gearbox Width	1223
11	Front Bumper-Engine Distance	621
12	Front Shock Absorber Fixing Height	725
13	Bonnet Leading Edge Height	1177
14	Front Shock Absorber Fixing Width	969
15	Front Bumper – Front Axle Distance	982
16	Front Axle – A-Pillar Distance	563
17	A-Pillar – B-Pillar Distance	1202
18	B-Pillar – Rear Axle Distance	1780
19	B-Pillar – C-Pillar Distance	1254
20	Roof Sill Bottom Height	1753
21	Roof Sill Top Height	1854
22	Floor Sill Bottom Height	364
23	Floor Sill Top Height	528

DATA SHEET NO. 2
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

NOMINAL DESIGN RIDING POSITION

The driver seat back is positioned as close as possible to the manufacturer's design angle. For the passenger seat back, seat back is adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated October 2015.



	Degrees
Driver Seat Back Angle	5.1° on seat back frame
Passenger Seat Back Angle	4.5° on seat back frame

SEAT FORE/AFT POSITIONS

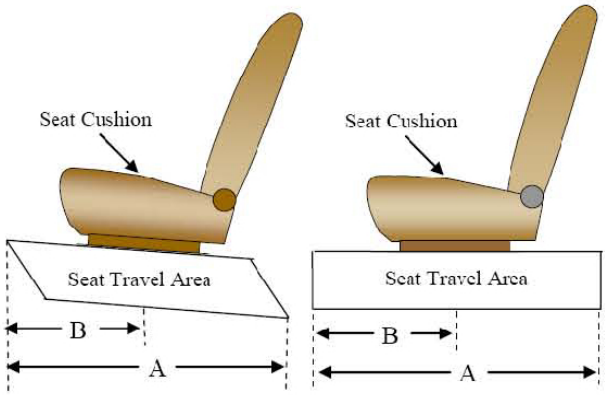
The driver and passenger seat fore/aft positions are adjusted following Appendix F, "Driver & Passenger Dummy Seating & Positioning Procedures" in the NCAP Test Procedure dated October 2015.

	Total Fore/Aft Travel	Placed in Position #
Driver Seat	240 mm / 25 detents (1st as 1)	120 mm / 12th detent (1st as 0)
Passenger Seat	240 mm / 25 detents (1st as 1)	0 mm / 0th detent (1st as 0)

SEAT BELT UPPER ANCHORAGES

The seat belt upper anchorages are positioning following the manufacturer's specified position as listed in Form 1.

	Total # of Positions	Placed in Position #
Driver Seat	4 (1st as 1)	0 (1st as 0)
Passenger Seat	4 (1st as 1)	0 (1st as 0)



DATA SHEET NO. 2 (CONTINUED)
SEAT ADJUSTMENT, FUEL SYSTEM, AND STEERING WHEEL DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

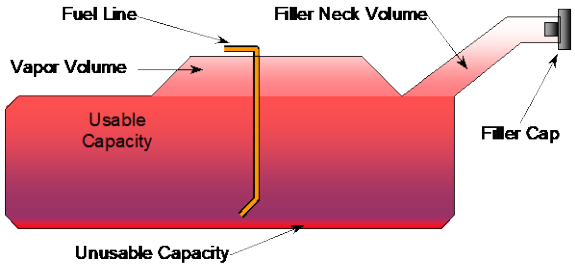
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank"	96.9
Usable Capacity of "Optional Tank"	
92-94% of Usable Capacity	89.1 to 91.1
Actual Amount of Solvent used	90.1
1/3 of Usable Capacity	32.3

FUEL PUMP

Describe the fuel pump type, its behavior, and the location of the fuel filler pipe.

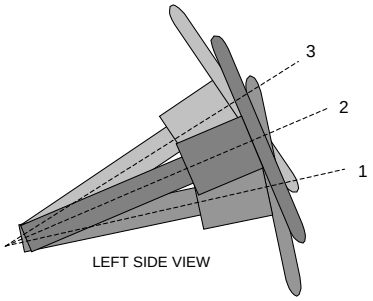
The vehicle is equipped with an electronic fuel pump. The fuel pump will run for appoximately 1 second after turning the ingnition switch ON. The pump turn off immediately after turning ingnition switch OFF. The filler neck is located on the driver's side..



VEHICLE FUEL TANK ASSEMBLY

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when moved through its full range of motion. An aluminum plate is placed across the rim of the steering wheel, an inclinometer is placed on the plate and the angle is measured.



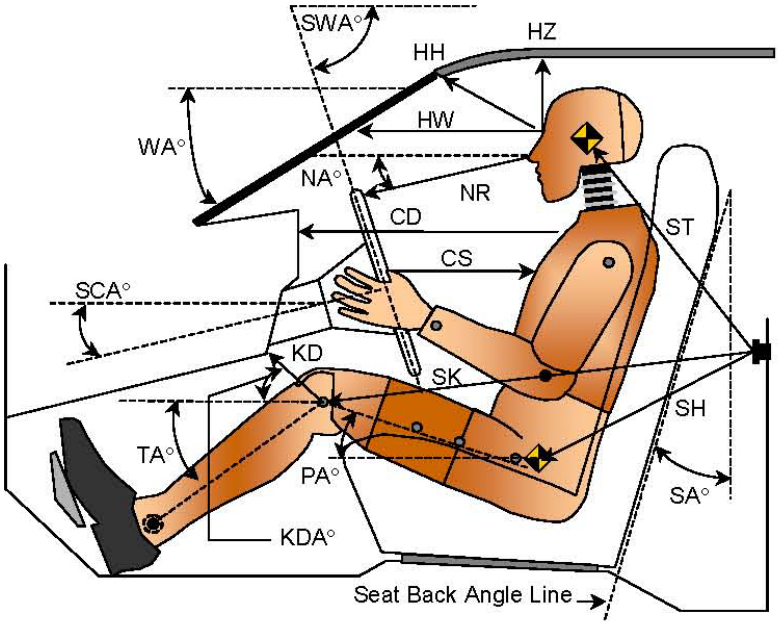
STEERING COLUMN ASSEMBLY

STEERING COLUMN POSITION

	Degrees	Fore/Aft Position (mm)
Lowermost Position 1	67.2	217
Geometric Center Position 2	64.4	235
Uppermost Position 3	61.5	253
Telescoping Steering Wheel Travel		36
Test Position	64.4	235

DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

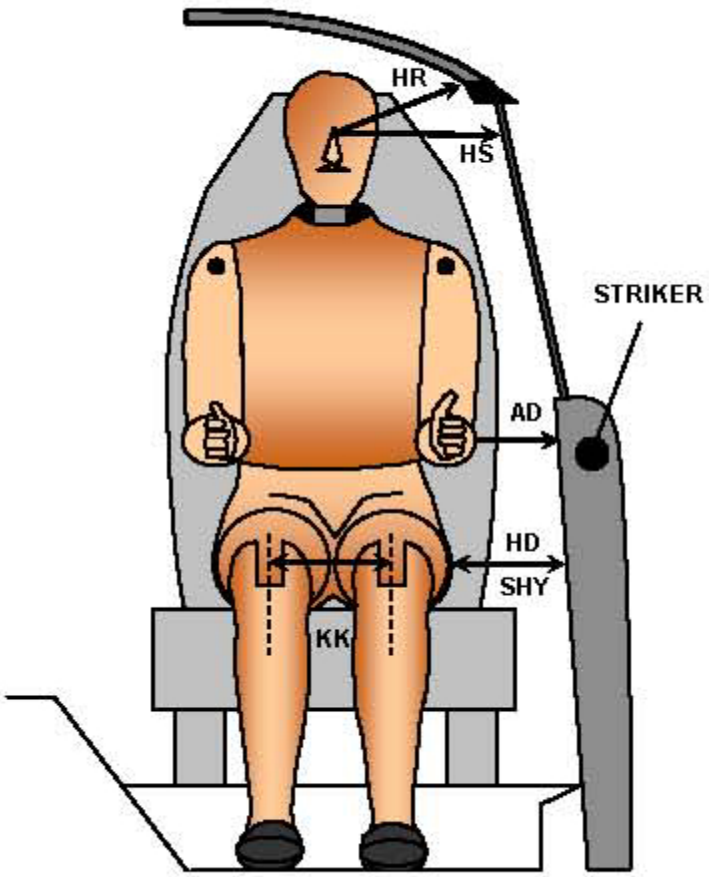


LEFT SIDE VIEW

Code	Measurement Description	Driver		Passenger	
		Length (mm)	Angle (°)	Length (mm)	Angle (°)
WA°	Windshield Angle		24.8		
SWA°	Steering Wheel Angle		64.4		
SCA°	Steering Column Angle		25.6		
SA°	Seat Back Angle		5.1		4.5
HZ	Head to Roof (Z)	218	90	305	90
HH	Head to Header	428	23.7	416	37.5
HW	Head to Windshield	690	0	711	0
NR	Nose to Rim	389	9.5		
CD	Chest to Dash	540		435	
CS	Chest to Steering Hub	302	1.3		
RA	Rim to Abdomen	176	0		
KDL	Left Knee to Dash	181	24.7	123	29.0
KDR	Right Knee to Dash	149	31.8	130	27.9
PA°	Pelvic Angle		24.5		21.4
TA°	Tibia Angle		54.3		64.0
SK	Striker to Knee	667	97.1	673	91.5
ST	Striker to Head	672	16.8	588	31.2
SH	Striker to H-Point	272	100.0	363	93.8

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

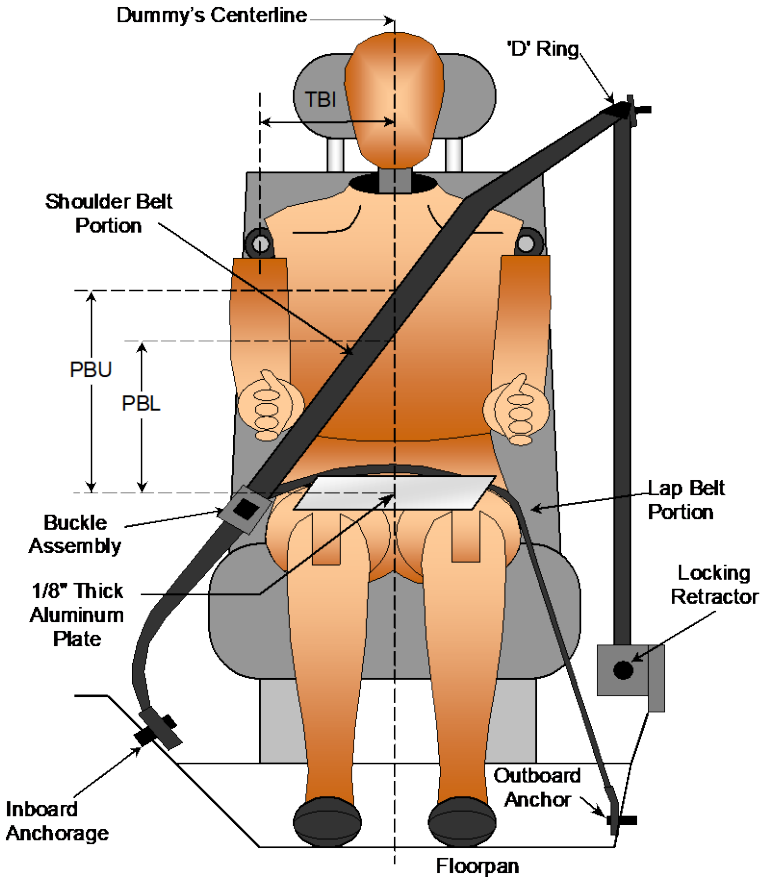


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver	Passenger
		Length (mm)	
AD	Arm to Door	133	90
HD	H-Point to Door	133	187
HR	Head to Side Header	232	294
HS	Head to Side Window	338	379
KK	Knee to Knee	368	227
SHY	Striker to H-Point (Y Direction)	300	305
AA	Ankle to Ankle	360	174

DATA SHEET NO. 5
SEAT BELT POSITIONING DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018



FRONT VIEW OF DUMMY

SEAT BELT POSITIONING MEASUREMENTS

Measurement Description	Units	Driver	Passenger
PBU - Top surface of reference to belt upper edge	mm	390	325
PBL - Top surface of reference to belt lower edge	mm	300	230

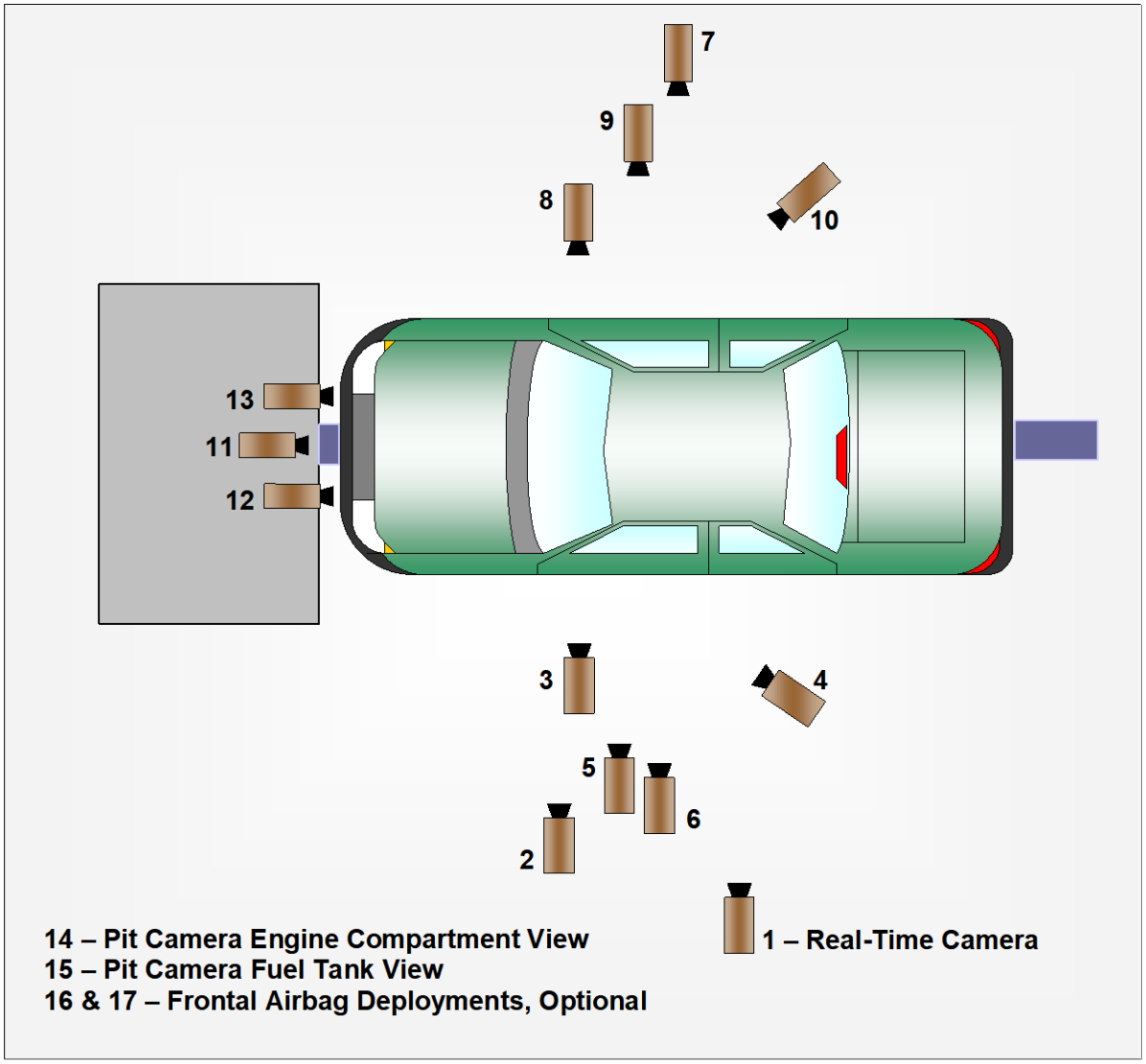
BELT LENGTH DATA

Measurement Description	Units	Driver	Passenger
Shoulder Belt Length as measured on ATD	mm	905	960
Lap Belt Length as measured on ATD	mm	880	920
Remainder of belt on reel	mm	745	650
Total Belt Length for Continuous Webbing Systems	mm	3330	3330

DATA SHEET NO. 6
HIGH-SPEED CAMERA LOCATIONS AND DATA

Test Vehicle:	2018 Nissan Titan S Crew Cab 4x4 Truck	NHTSA No.:	O20185201
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	10/5/2018

CAMERA POSITIONS FOR FRONTAL IMPACTS



DATA SHEET NO. 6 (CONTINUED)
CAMERA LOCATIONS AND DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018

CAMERA LOCATIONS

No.	Camera View	Coordinates (mm)			Lens (mm)	Speed (fps)
		X*	Y*	Z*		
1	Real-Time Left Overall					30
2	Driver Close-Up	-1670	-6660	-2100	50	1000
3	Left Front Half	-1510	-6000	-1460	24	1000
4	Left Angle	-7020	-5790	-2100	75	1000
5	Steering Column - Top					
6	Steering Column - Bottom					
7	Right Overall	-2710	6170	-1360	14	1000
8	Passenger Close-Up	-1770	6840	-2130	50	1000
9	Right Front Half	-1290	6040	-1440	24	1000
10	Right Angle	-6940	5780	-2100	75	1000
11	Windshield	0	0	-2310	16	1000
12	Driver Windshield	110	-370	-2230	25	1000
13	Passenger Windshield	110	370	-2230	25	1000
14	Pit Front	-1070	0	3340	24	1000
15	Pit Rear	-3340	0	3340	24	1000
16	Onboard Driver Side				12	1000
17	Onboard Passenger Side				12	1000
18	Real-Time Pan View					30

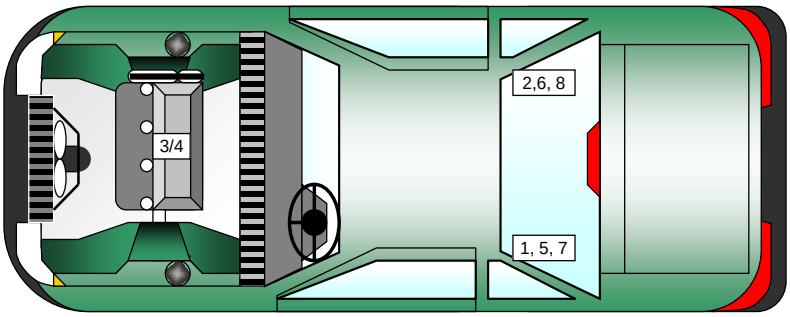
*COORDINATES:

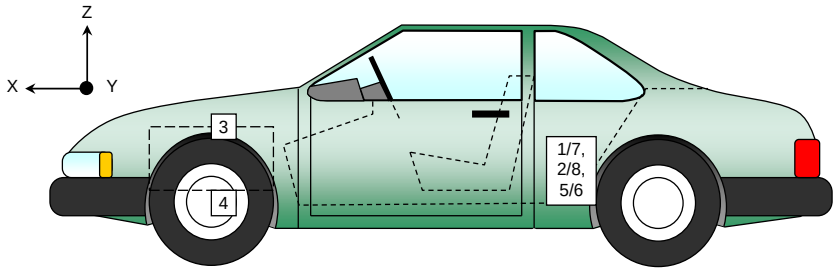
+X = forward of impact plane
+Y = right of monorail centerline
+Z = below ground level

Cameras 5 & 6 were not used for this test.

DATA SHEET NO. 7
VEHICLE ACCELEROMETER LOCATIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018





VEHICLE ACCELEROMETER PRE-TEST LOCATIONS

No.	Accelerometer Location	Measurements (mm)		
		X	Y	Z
1	Left Rear Crossmember Accelerometer – X Direction	2380	-424	-587
2	Right Rear Crossmember Accelerometer – X Direction	2380	440	-585
3	Engine Top X	4957	0	-1147
4	Engine Bottom X	4661	0	-257
5	Left Rear Crossmember Accelerometer – Z Direction	2380	-424	-587
6	Right Rear Crossmember Accelerometer – Z Direction	2380	440	-585
7	Left Rear Crossmember Accelerometer Redundant – X Direction	2412	-424	-587
8	Right Rear Crossmember Accelerometer Redundant – X Direction	2412	440	-585

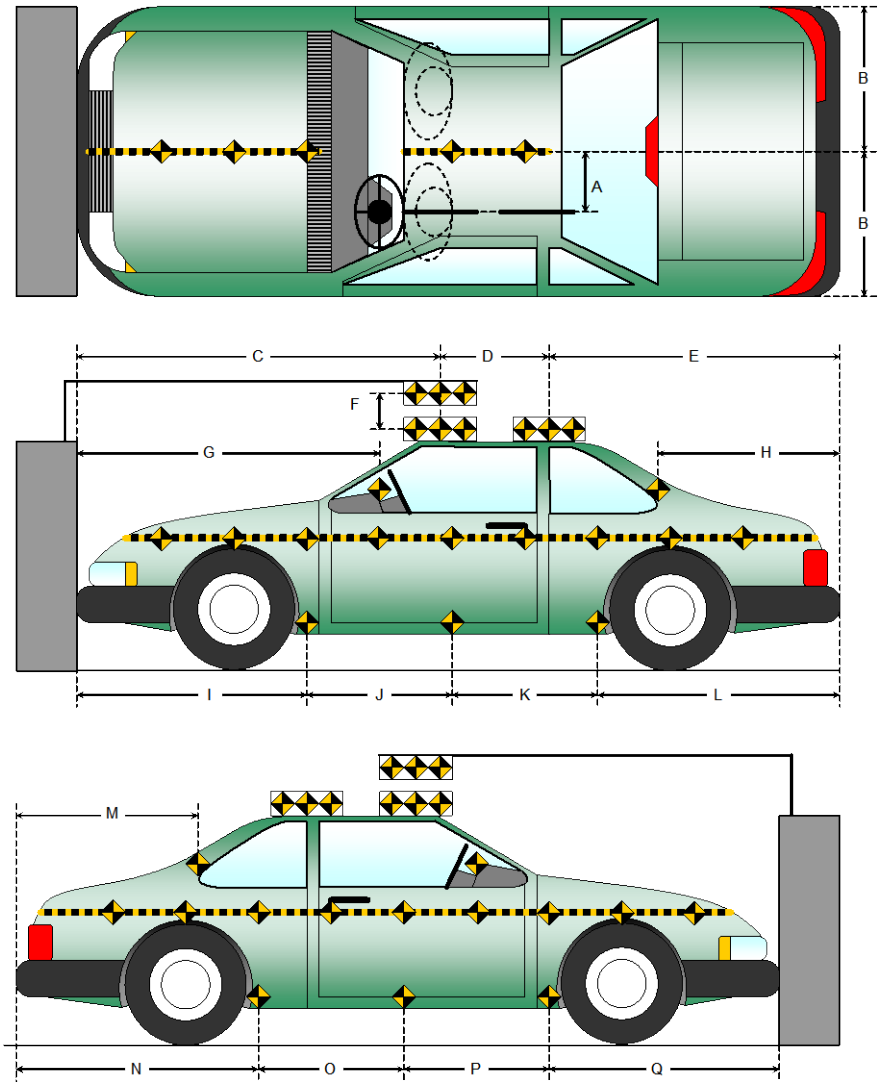
Reference Points: X - Rear Surface of Vehicle (+ forward)
Y - Vehicle Centerline (+ to right)
Z - Ground Plane (+ down)

DATA SHEET NO. 8

PHOTOGRAPHIC REFERENCE TARGET LOCATIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

Item	Value (mm)
A	452
B	1003
C	2470
D	616
E	2707
F	160
G	
H	2095
I	1558
J	1230
K	1230
L	1775
M	2095
N	1775
O	1230
P	1230
Q	1558



DATA SHEET NO. 9
LOAD CELL LOCATIONS ON FIXED BARRIER

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

Advanced Research Load Cell Barrier

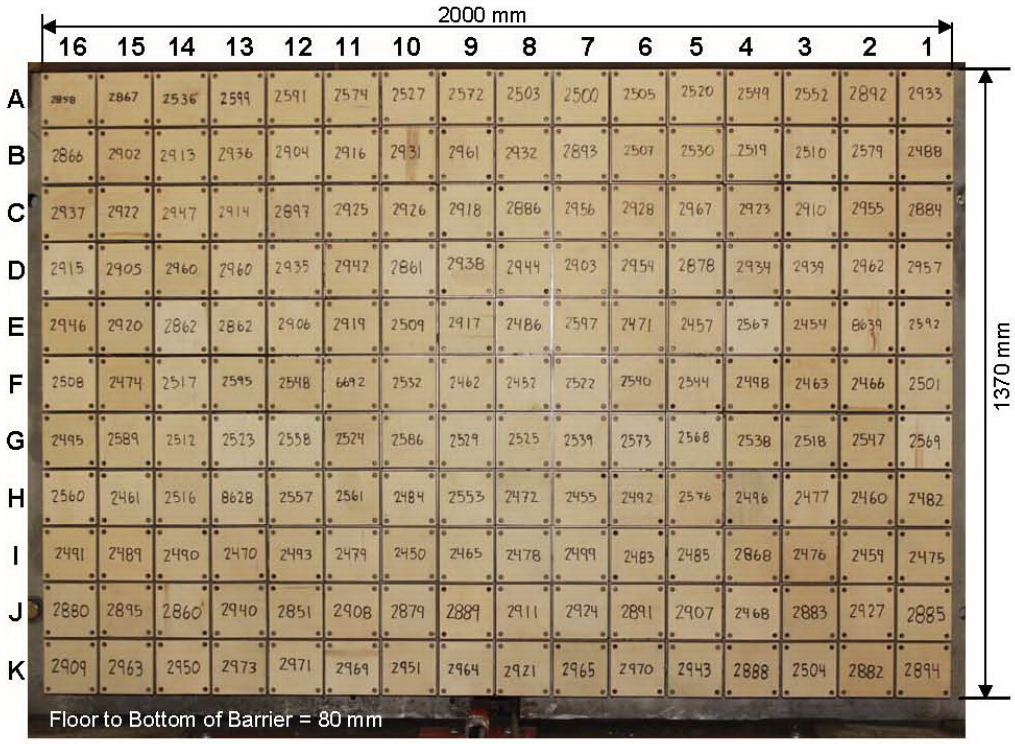


Photo for Reference Only

Centerline

A-16	A-15	A-14	A-13	A-12	A-11	A-10	A-09	A-08	A-07	A-06	A-05	A-04	A-03	A-02	A-01
B-16	B-15	B-14	B-13	B-12	B-11	B-10	B-09	B-08	B-07	B-06	B-05	B-04	B-03	B-02	B-01
C-16	C-15	C-14	C-13	C-12	C-11	C-10	C-09	C-08	C-07	C-06	C-05	C-04	C-03	C-02	C-01
D-16	D-15	D-14	D-13	D-12	D-11	D-10	D-09	D-08	D-07	D-06	D-05	D-04	D-03	D-02	D-01
E-16	E-15	E-14	E-13	E-12	E-11	E-10	E-09	E-08	E-07	E-06	E-05	E-04	E-03	E-02	E-01
F-16	F-15	F-14	F-13	F-12	F-11	F-10	F-09	F-08	F-07	F-06	F-05	F-04	F-03	F-02	F-01
G-16	G-15	G-14	G-13	G-12	G-11	G-10	G-09	G-08	G-07	G-06	G-05	G-04	G-03	G-02	G-01
H-16	H-15	H-14	H-13	H-12	H-11	H-10	H-09	H-08	H-07	H-06	H-05	H-04	H-03	H-02	H-01
I-16	I-15	I-14	I-13	I-12	I-11	I-10	I-09	I-08	I-07	I-06	I-05	I-04	I-03	I-02	I-01
J-16	J-15	J-14	J-13	J-12	J-11	J-10	J-09	J-08	J-07	J-06	J-05	J-04	J-03	J-02	J-01
K-16	K-15	K-14	K-13	K-12	K-11	K-10	K-09	K-08	K-07	K-06	K-05	K-04	K-03	K-02	K-01

Load Cells are 121 mm x 121 mm with a 7 mm gap in between each load cell.

DATA SHEET NO. 10
TEST VEHICLE SUMMARY OF RESULTS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

INSTRUMENTATION

Driver Dummy Data Channels	49
Passenger Dummy Data Channels	49
Vehicle Structure Accelerometers	8
Barrier Channels	528
Total	634

CAMERA COVERAGE

High-Speed Vehicle Onboard	2
High-Speed Offboard	12
Real-Time	2
Total	16

DATA SHEET NO. 11
POST-TEST OBSERVATIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018

TEST DUMMY INFORMATION AND CONTACT LOCATIONS

Description	Driver	Passenger
Dummy Type / Serial No.	HIII 50% / 351	HIII 5% / 138
Head Contact	Airbag, Headrest	Airbag, Headrest
Upper Torso Contact	Airbag	Airbag
Lower Torso Contact	None	None
Left Knee Contact	Knee Bolster	Glove Box
Right Knee Contact	Knee Bolster	Glove Box

DOOR OPENING AND SEAT TRACK INFORMATION

Description	Driver	Passenger
Locked/Unlocked Doors	Doors were locked	Doors were locked
Front Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Rear Door Opening	Door remained closed and latched; Door opened without tools	Door remained closed and latched; Door opened without tools
Seat Track Shift (mm)	0	0
Seat Back Failure	None	None

POST TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Windshield Damage	None
Window Damage	None
Other Notable Effects	None

VEHICLE REBOUND FROM BARRIER

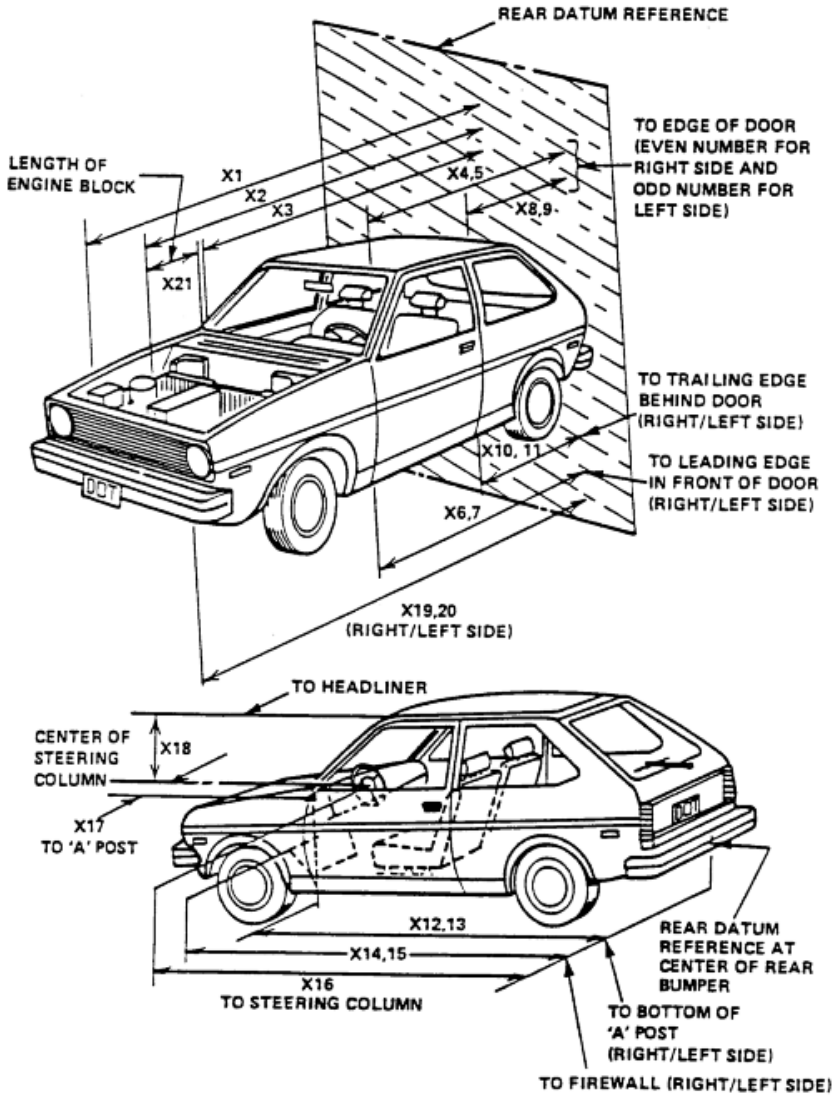
Measured Parameter	Units	Value
Left Side	mm	425
Center	mm	425
Right Side	mm	430
Average	mm	427

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Driver (Occupant 1)		Passenger (Occupant 2)	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	Yes	Yes	Yes
Curtain Side Airbag	Yes	Yes	Yes	No
Torso/Pelvis Side Airbag	Yes	No	Yes	No
Knee Airbag	No		No	
Seat Belt Pretensioner	Yes	Yes	Yes	Yes
Seat Belt Load Limiter	Yes		Yes	

DATA SHEET NO. 12
VEHICLE PROFILE MEASUREMENTS

Test Vehicle:	2018 Nissan Titan S Crew Cab 4x4 Truck	NHTSA No.:	O20185201
Test Program:	NCAP Frontal Barrier Impact Test	Test Date:	10/5/2018



DATA SHEET NO. 12 (CONTINUED)
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

RSOV (Rear Surface of Vehicle)

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
1	Total Length of Vehicle at Centerline	mm	5793	5189	604
2	RSOV to Front of Engine	mm	5157	4983	174
3	RSOV to Firewall	mm	4755	4644	111
4	RSOV to Upper Leading Edge of Right Door	mm	4226	4259	-33
5	RSOV to Upper Leading Edge of Left Door	mm	4226	4261	-35
6	RSOV to Lower Leading Edge of Right Door	mm	4195	4197	-2
7	RSOV to Lower Leading Edge of Left Door	mm	4195	4186	9
8	RSOV to Upper Trailing Edge of Right Door	mm	3022	3056	-34
9	RSOV to Upper Trailing Edge of Left Door	mm	3022	3050	-28
10	RSOV to Lower Trailing Edge of Right Door	mm	3035	3052	-17
11	RSOV to Lower Trailing Edge of Left Door	mm	3035	3037	-2
12	RSOV to Bottom of “A” Post of Right Side	mm	4170	4159	11
13	RSOV to Bottom of “A” Post of Left Side	mm	4152	4117	35
14	RSOV to Firewall, Right Side	mm	4614	4649	-35
15	RSOV to Firewall, Left Side	mm	4613	4631	-18
16	RSOV to Steering Column	mm	3725	3733	-8
17	Center of Steering Column to “A” Post	mm	412	400	12
18	Center of Steering Column to Headliner	mm	434	427	7
19	RSOV to Right Side of Front Bumper	mm	5238	4959	279
20	RSOV to Left Side of Front Bumper	mm	5238	4950	288
21	Length of Engine Block	mm	484	484	0
RD	RSOV to Right Side of Dash Panel	mm	4010	4052	-42
CD	RSOV to Center of Dash Panel	mm	3976	4028	-52
LD	RSOV to Left Side of Dash Panel	mm	4010	4047	-37

DATA SHEET NO. 13
ACCIDENT INVESTIGATION DIVISION DATA

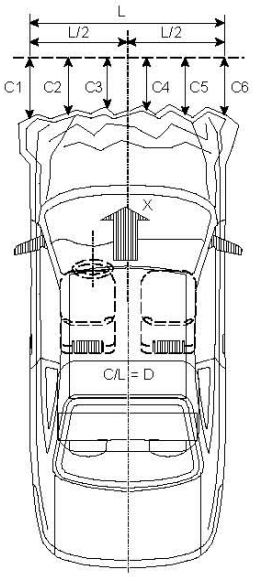
Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

VEHICLE INFORMATION

VIN: 1N6AA1EJ9JN542949 Wheelbase (mm): 3558
Vehicle Size Category: Truck Test Weight (kg): 2881.5

ACCELEROMETER DATA

Accelerometer Locations: As per measurements on Page 15
Cal. Procedure/Interval: MGA procedure / 6 month
Integration Algorithm: Trapezoidal
Linearity: > 99%
Impact Velocity (km/h): 56.97
Velocity Change (km/h): 62.8
Time of Separation (msec): 103



CRUSH PROFILE

Collision Deformation Classification: 12FDEW2
Midpoint of Damage: Centerline
Damage Region Length (mm): 2570
Impact Mode: Frontal

No.	Measurement Description	Units	Pre-Test	Post-Test	Difference
C1	Crush zone 1 at left side	mm	5238	4950	288
C2	Crush zone 2 at left side	mm	5651	5183	468
C3	Crush zone 3 at left side	mm	5782	5183	599
C4	Crush zone 4 at right side	mm	5782	5191	591
C5	Crush zone 5 at right side	mm	5651	5204	447
C6	Crush zone 6 at right side	mm	5238	4959	279
L	C1 TO C6	mm	2570	2548	22

DATA SHEET NO. 14
VEHICLE INTRUSION MEASUREMENTS

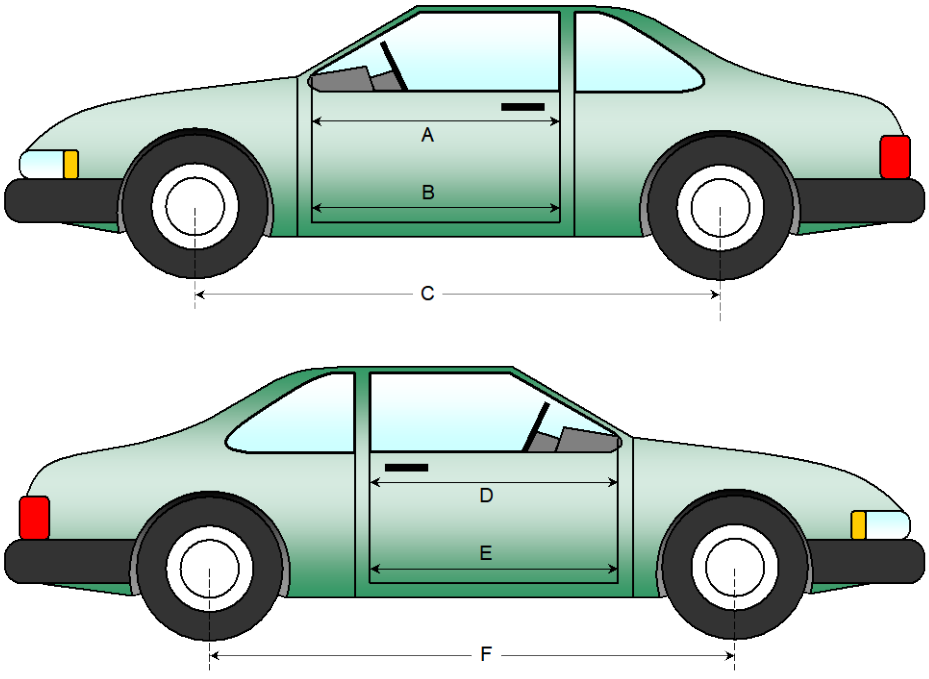
Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018

DOOR OPENING WIDTH

Item	Description	Units	Pre-Test	Post-Test	Difference
A	Left Side Upper	mm	1064	1064	0
B	Left Side Lower	mm	1058	1058	0
D	Right Side Upper	mm	1064	1064	0
E	Right Side Lower	mm	1058	1058	0

WHEELBASE MEASUREMENTS

Item	Description	Units	Pre-Test	Post-Test	Difference
C	Left Side Wheelbase	mm	3558	3477	81
F	Right Side Wheelbase	mm	3558	3452	106



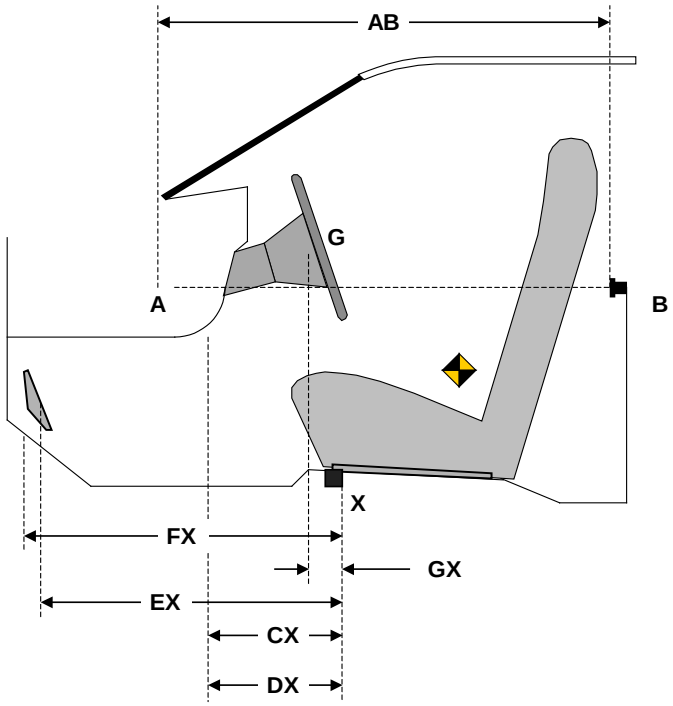
DATA SHEET NO. 14 (CONTINUED)
VEHICLE INTRUSION MEASUREMENTS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

DRIVER COMPARTMENT INTRUSION

Item	Description	Units	Pre-Test	Post-Test	Difference
AB	Door Opening (Inside Window Jam)	mm	882	882	0
CX	Left Knee Bolster to X	mm	296	314	-18
DX	Right Knee Bolster to X	mm	275	290	-15
EX	Brake Pedal to X	mm	546	522	24
FX	Foot Rest to X	mm	626	625	1
GX	Center of Steering Column Wheel Hub to X	mm	62	88	-26

X = Front of Seat Track (stationary)



DRIVER COMPARTMENT

DATA SHEET NO. 15
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL) DATA, AND 301 DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018

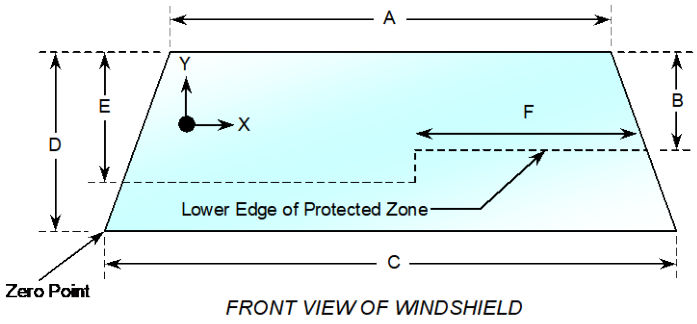
Windshield Mounting Details:
Windshield glass is secured to the vehicle frame with a rubber trim and glue.

The standard requires that the post-test retention measurement be a minimum of 75 percent of the pre-test total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles which are equipped with occupant passive restraints.

Temperature of windshield molding during test: 21.5° C.

WINDSHIELD PERIPHERY MEASUREMENTS

Measurement	Pre-Test (mm)	Post-Test (mm)	% of Retention
Left Side	2225	2225	100.0
Right Side	2225	2225	100.0
Total	4450	4450	100.0



FRONT VIEW OF WINDSHIELD

Item	Units	Value
A	mm	1360
B	mm	475
C	mm	1540
D	mm	775
E	mm	433
F	mm	554

AREA OF PROTECTED ZONE FAILURES - NONE

A. Provide coordinates of the area that the protected zone was penetrated more than 0.25 inches by a vehicle component other than one that is normally in contact with the windshield. **None**

X	Y

B. Provide coordinates of the area beneath the protected zone that the inner surface of the windshield was penetrated by a vehicle component. **None**

X	Y

DATA SHEET NO. 15 (CONTINUED)
SUMMARY OF FMVSS 212, FMVSS 219 (PARTIAL), AND 301 DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck NHTSA No.: O20185201
Test Program: NCAP Frontal Barrier Impact Test Test Date: 10/5/2018

FMVSS 301 FUEL SYSTEM INTEGRITY POST IMPACT DATA

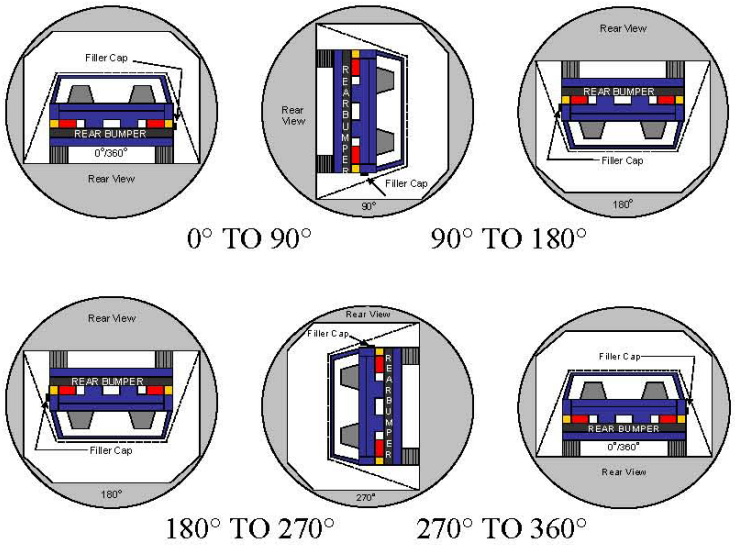
Temperature at Time of Impact: 21.4°C Test Time: 10:30 a.m.

A. From impact until vehicle motion ceases: 0 oz.
(Maximum allowable = 1 oz.)
B. For the 5 minute period after motion ceases: 0 oz.
(Maximum allowable = 5 oz.)
C. For the following 25 minutes: 0 oz.
(Maximum allowable = 1 oz./minute)
D. Spillage: None

DATA SHEET NO. 16
FMVSS 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018

1. The specified fixture rollover rate for each 90° of rotation is 60 to 180 seconds.
2. The position hold time at each position is 300 seconds (minimum).
3. Details of Stoddard Solvent spillage: **None**



SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	91	300	391
90° to 180°	92	300	392
180° to 270°	90	300	390
270° to 360°	88	300	388

FMVSS 301 SPILLAGE TABLE (units in ounces)

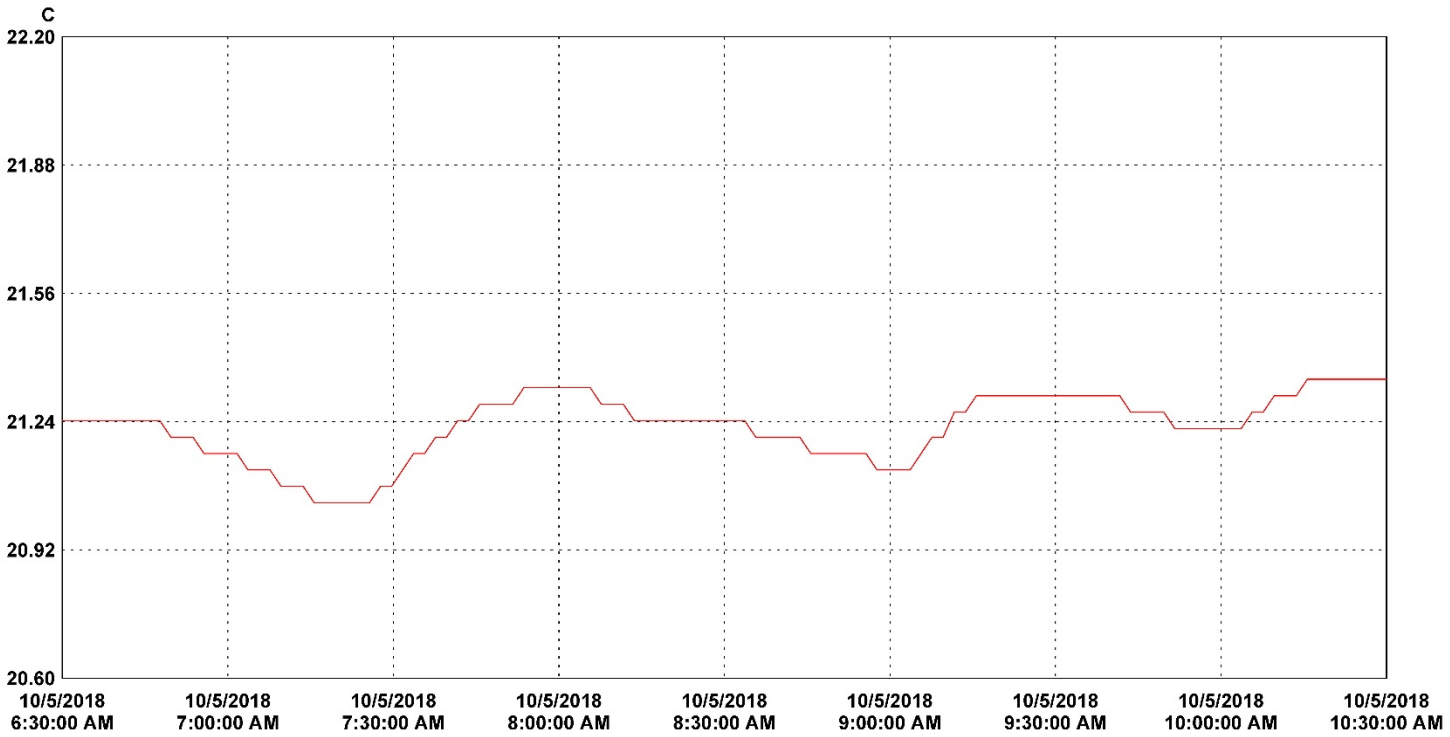
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

SOLVENT SPILLAGE LOCATION TABLE

Test Phase	Spillage Location
0° to 90°	
90° to 180°	
180° to 270°	
270° to 360°	

DATA SHEET NO. 17
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab 4x4 Truck
Test Program: NCAP Frontal Barrier Impact Test
NHTSA No.: O20185201
Test Date: 10/5/2018



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	12032257	VSC_Prep_Room	1		21.35	21.23	21.04	C	Temperature	12032257_VSC_Prep_Room.spl

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Photo No. 001 - Load Cell Location

Photo No. 002 - Pre-Test Load Cell Wall

Photo No. 003 - Post-Test Load Cell Wall

Photo No. 004 - Manufacturer Label

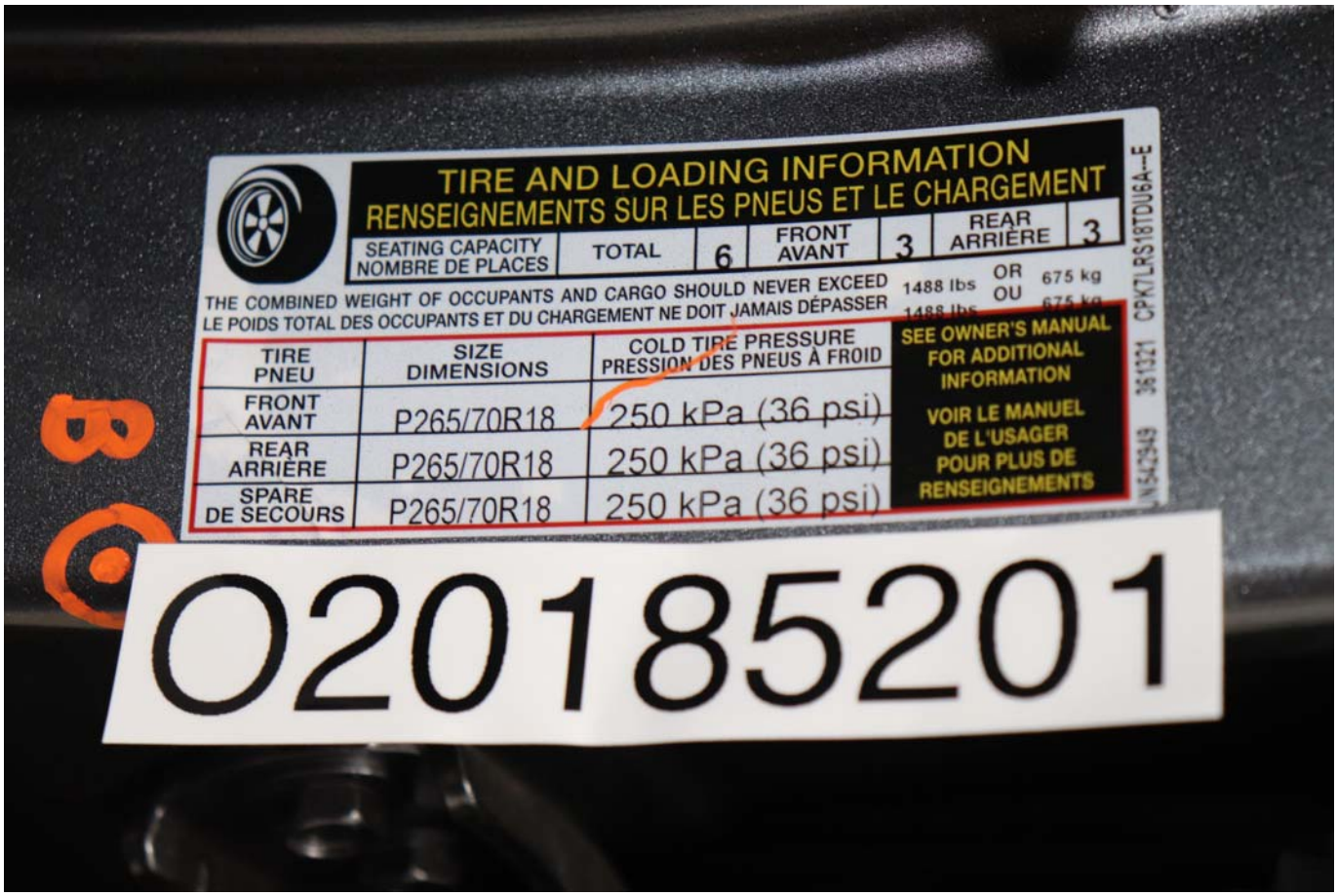


Photo No. 005 - Tire Placard

Photo No. 006 - 2018 Nissan Titan S 4x4 Crew Cab Truck Frontal As Delivered

Photo No. 007 - Left Rear 3-4 View, As Received

Photo No. 008 - Pre-Test Front View of Test Vehicle

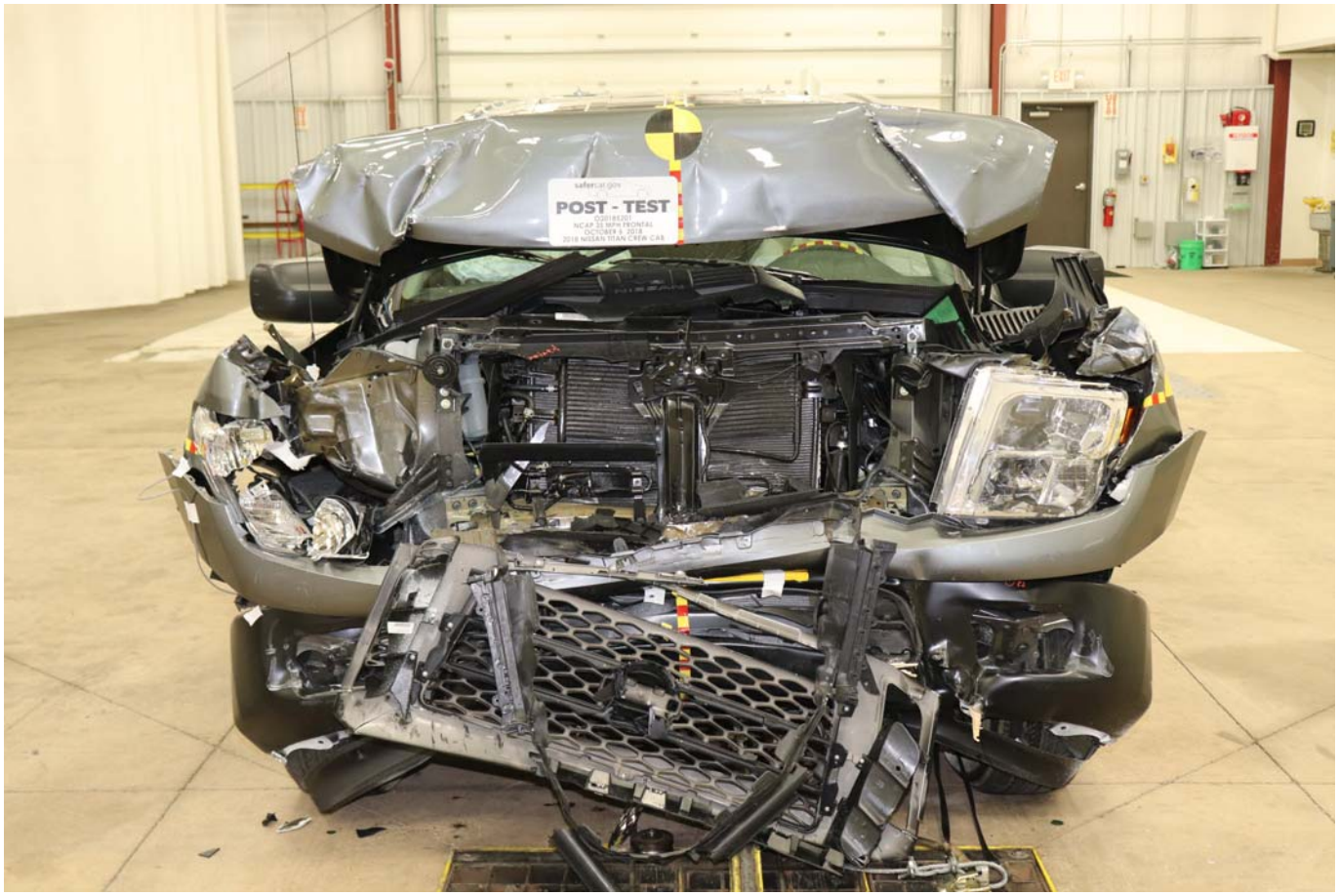


Photo No. 009 - Post-Test Front View of Test Vehicle

Photo No. 010 - Pre-Test Left View of Test Vehicle

Photo No. 011 - Post-Test Left View of Test Vehicle

Photo No. 012 - Pre-Test Right View of Test Vehicle

Photo No. 013 - Post-Test Right View of Test Vehicle

Photo No. 014 - Pre-Test Right Front 3-4 View

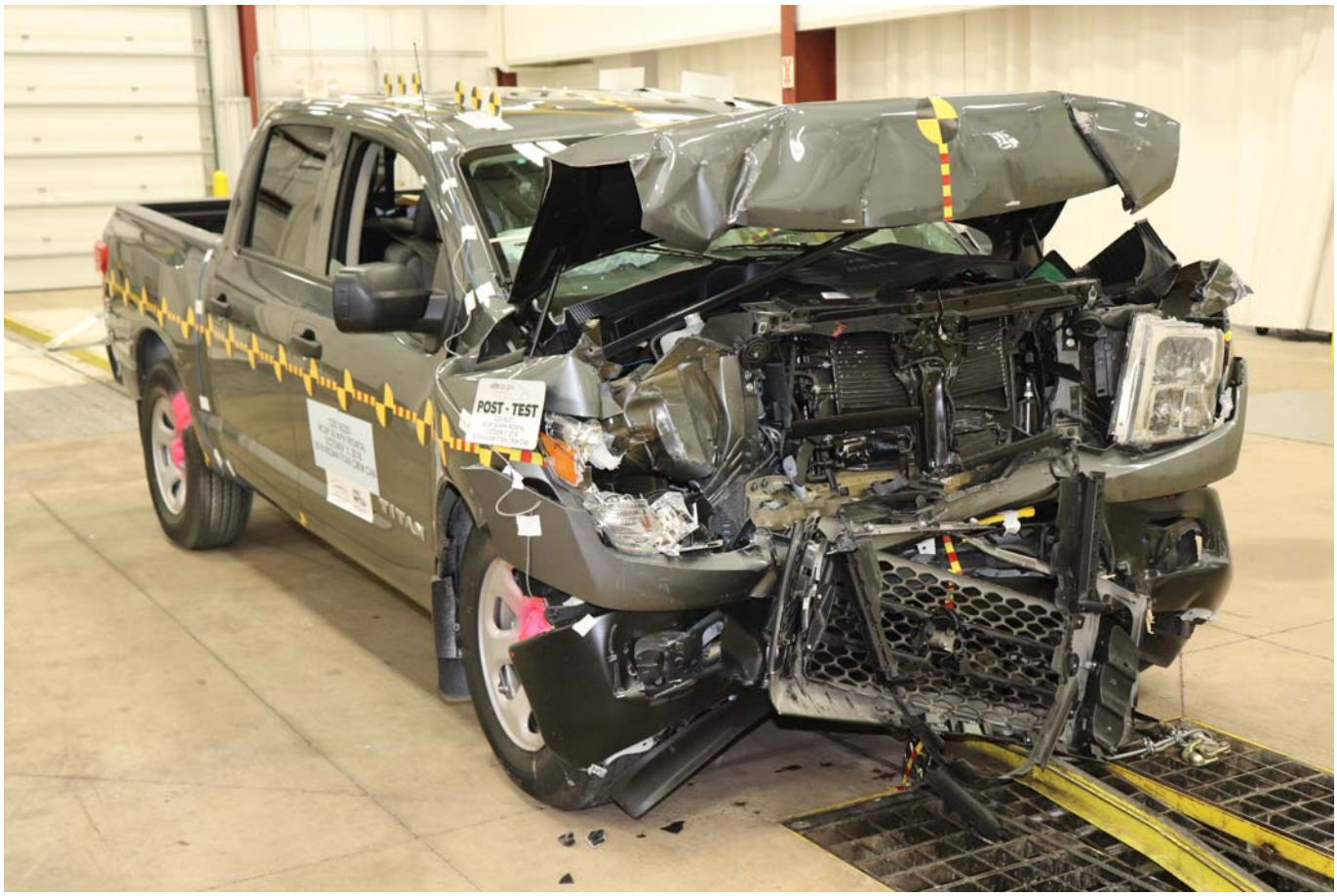


Photo No. 015 - Post-Test Right Front 3-4 View

Photo No. 016 - Pre-Test Left Rear 3-4 View

Photo No. 017 - Post-Test Left Rear 3-4 View

Photo No. 018 - Pre-Test Windshield View

Photo No. 019 - Post-Test Windshield View

Photo No. 020 - Pre-Test Engine Compartment View

Photo No. 021 - Post-Test Engine Compartment View

Photo No. 022 - Pre-Test Fuel Filler Cap View

Photo No. 023 - Post-Test Fuel Filler Cap View

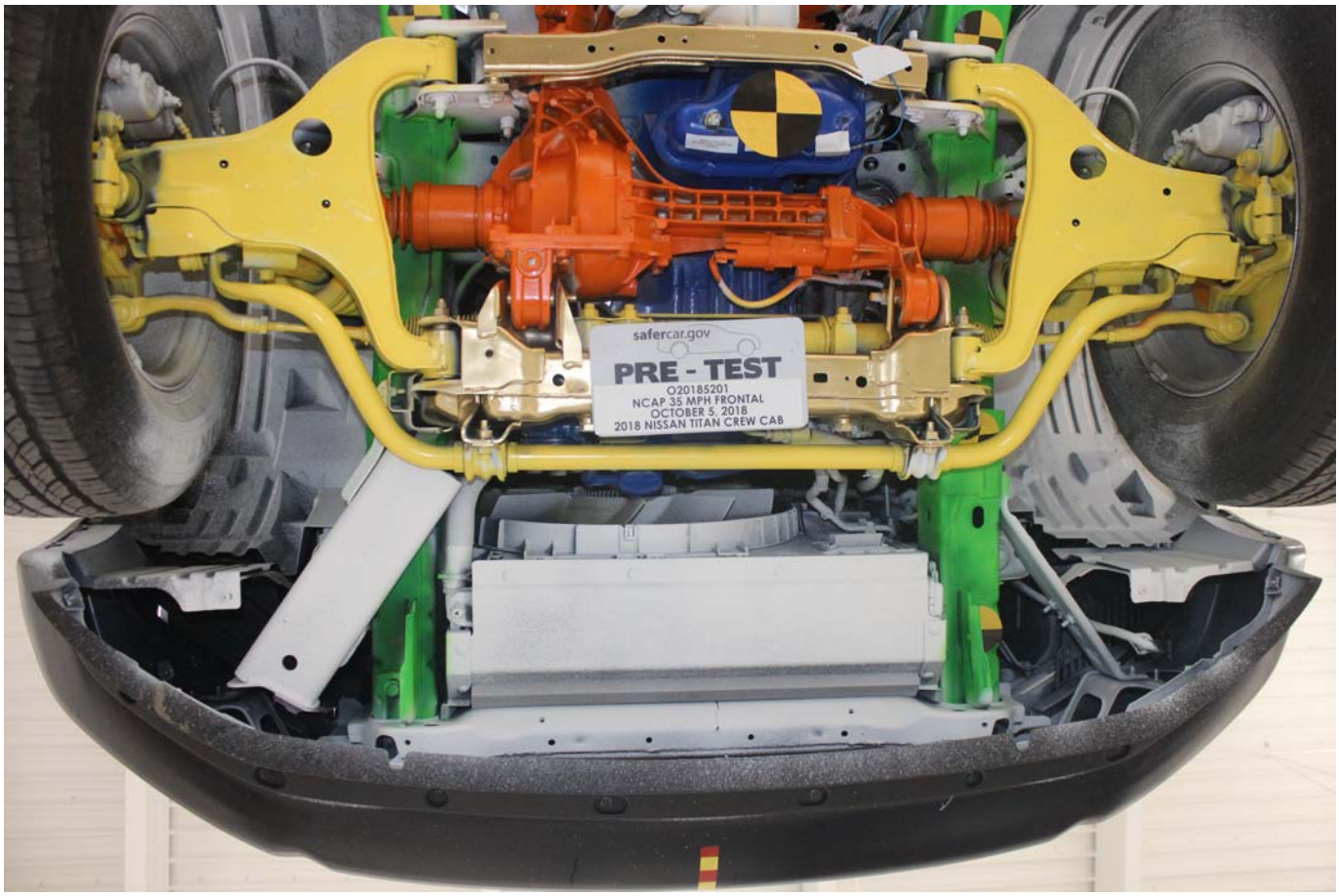


Photo No. 024 - Pre-Test Front Underbody View

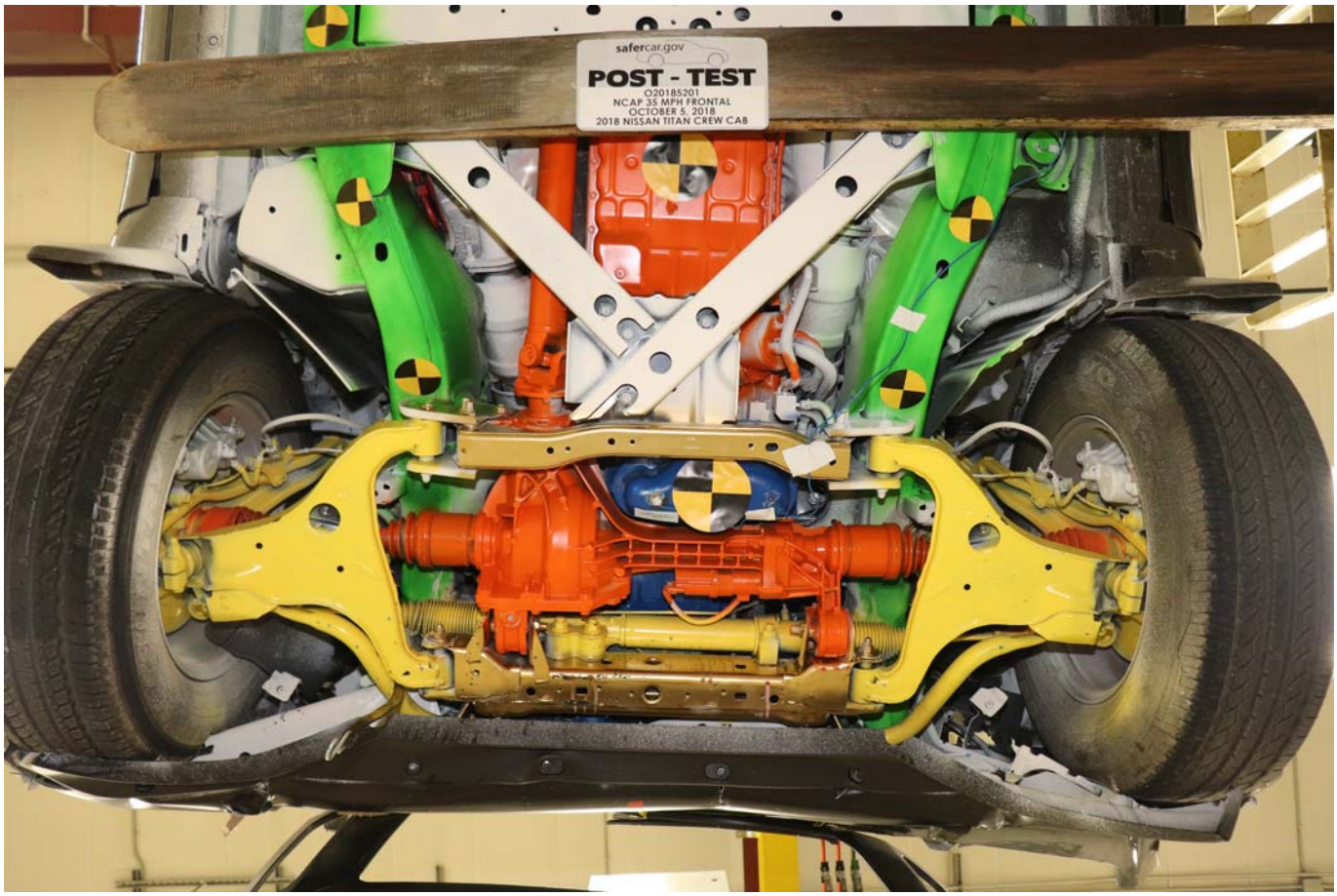


Photo No. 025 - Post-Test Front Underbody View

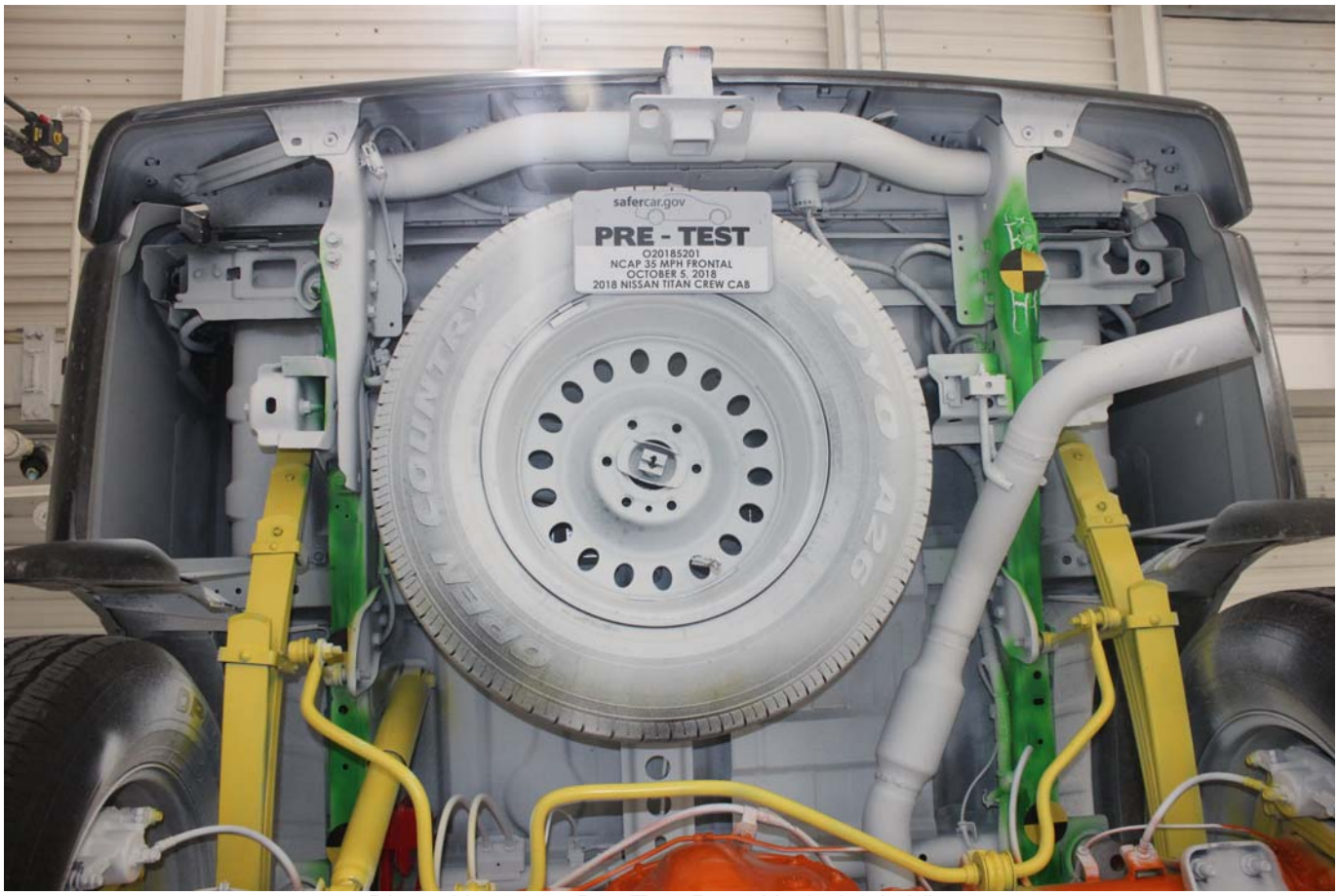


Photo No. 026 - Pre-Test Rear Underbody View

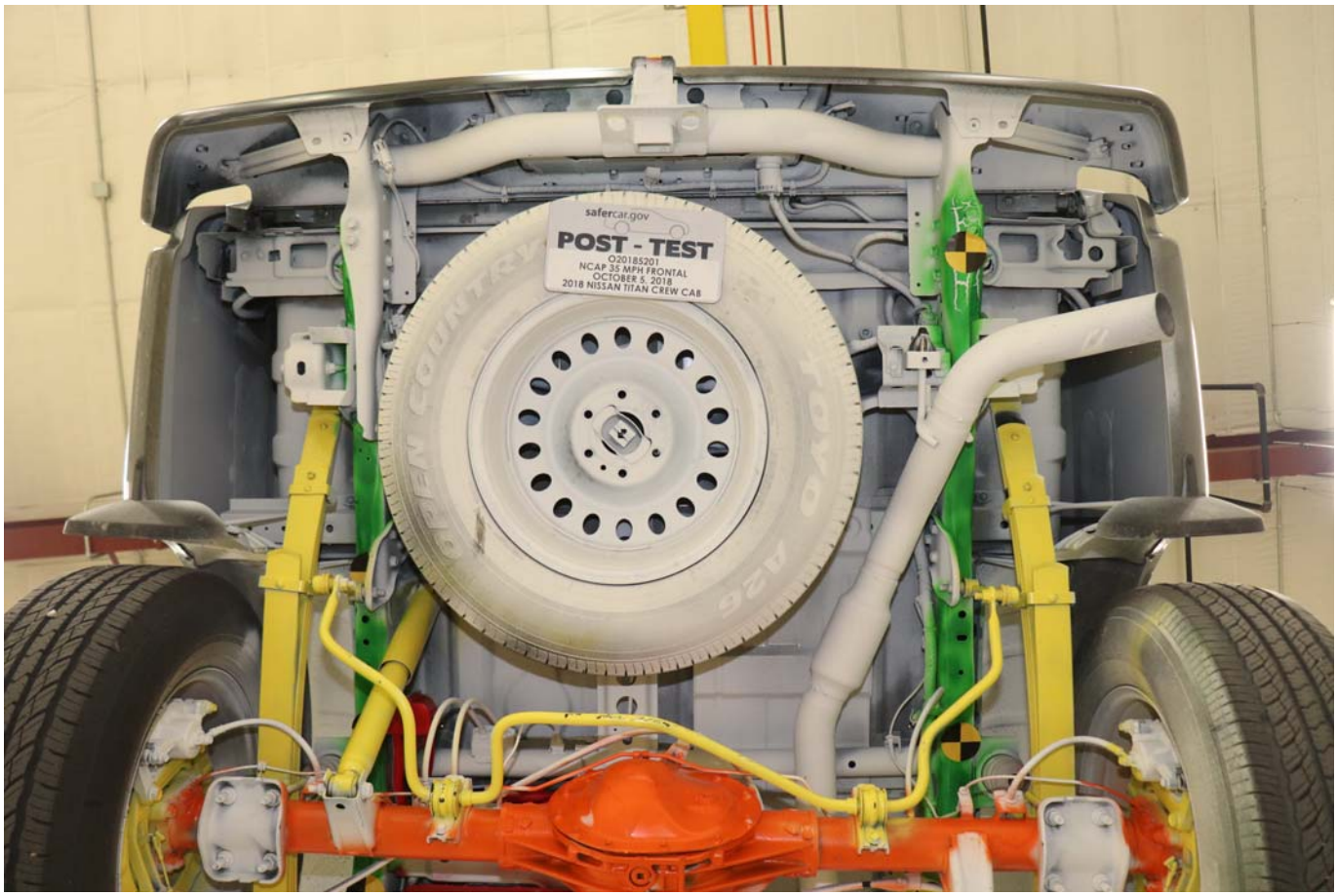


Photo No. 027 - Post-Test Rear Underbody View

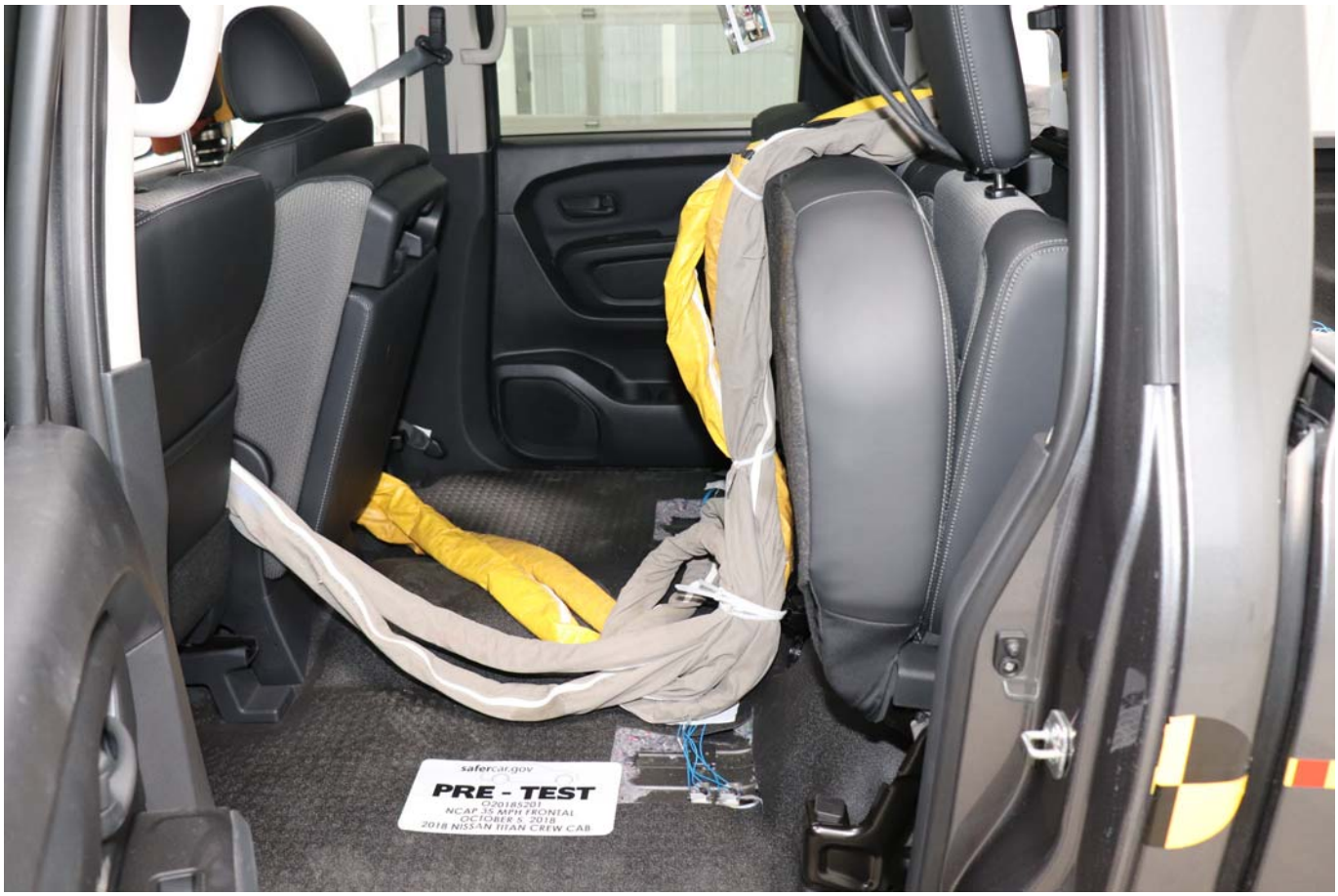


Photo No. 028 - Pre-Test Dummy Cable Routing

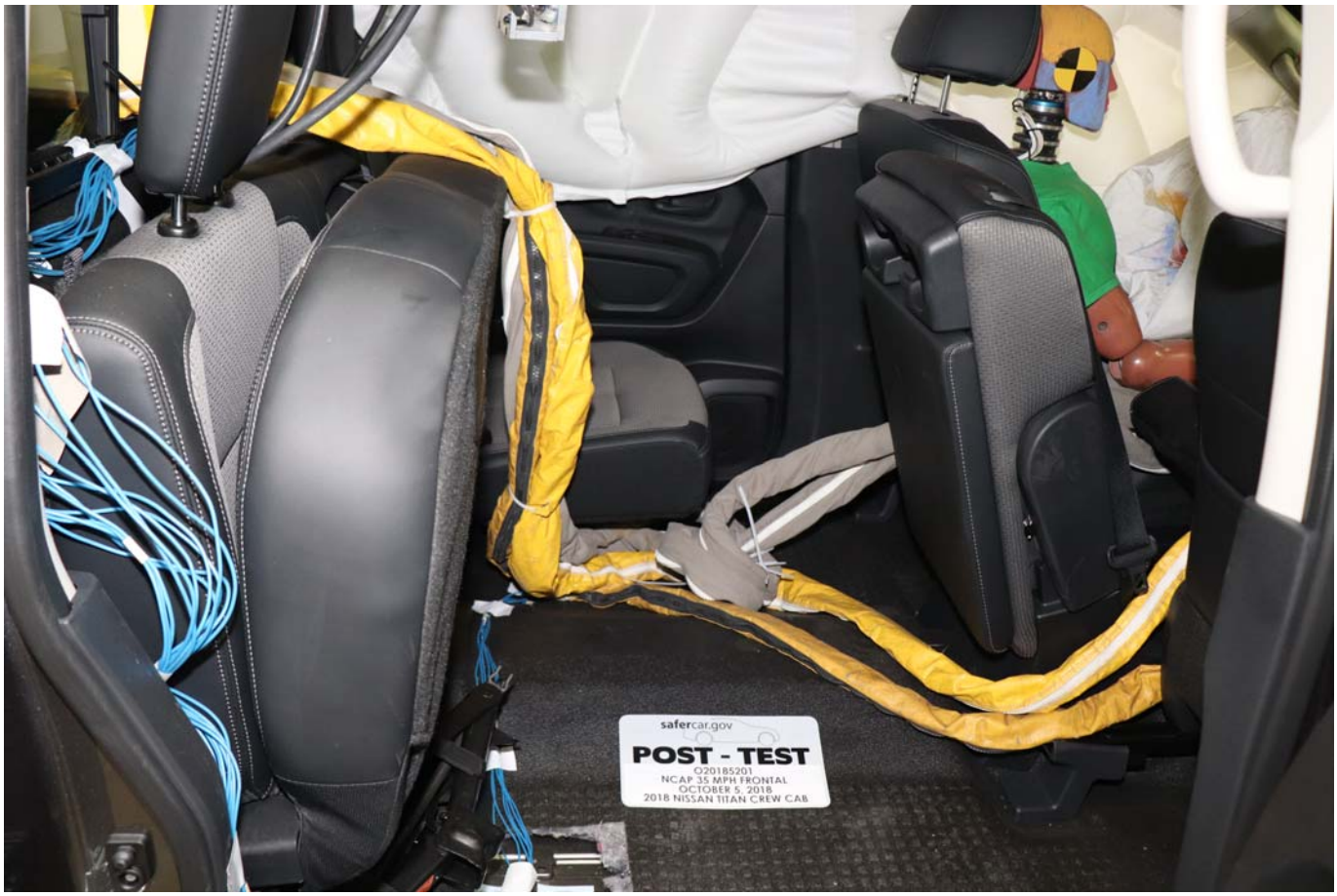


Photo No. 029 - Post-Test Dummy Cable Routing

Photo No. 030 - Pre-Test Driver Dummy Front View

Photo No. 031 - Post-Test Driver Dummy Front View

Photo No. 032 - Pre-Test Driver Dummy Window View

Photo No. 033 - Post-Test Driver Dummy Window View

Photo No. 034 - Pre-Test Driver Dummy and Vehicle Interior

Photo No. 035 - Post-Test Driver Dummy and Vehicle Interior

Photo No. 036 - Pre-Test Driver Seat Fore-Aft Markings

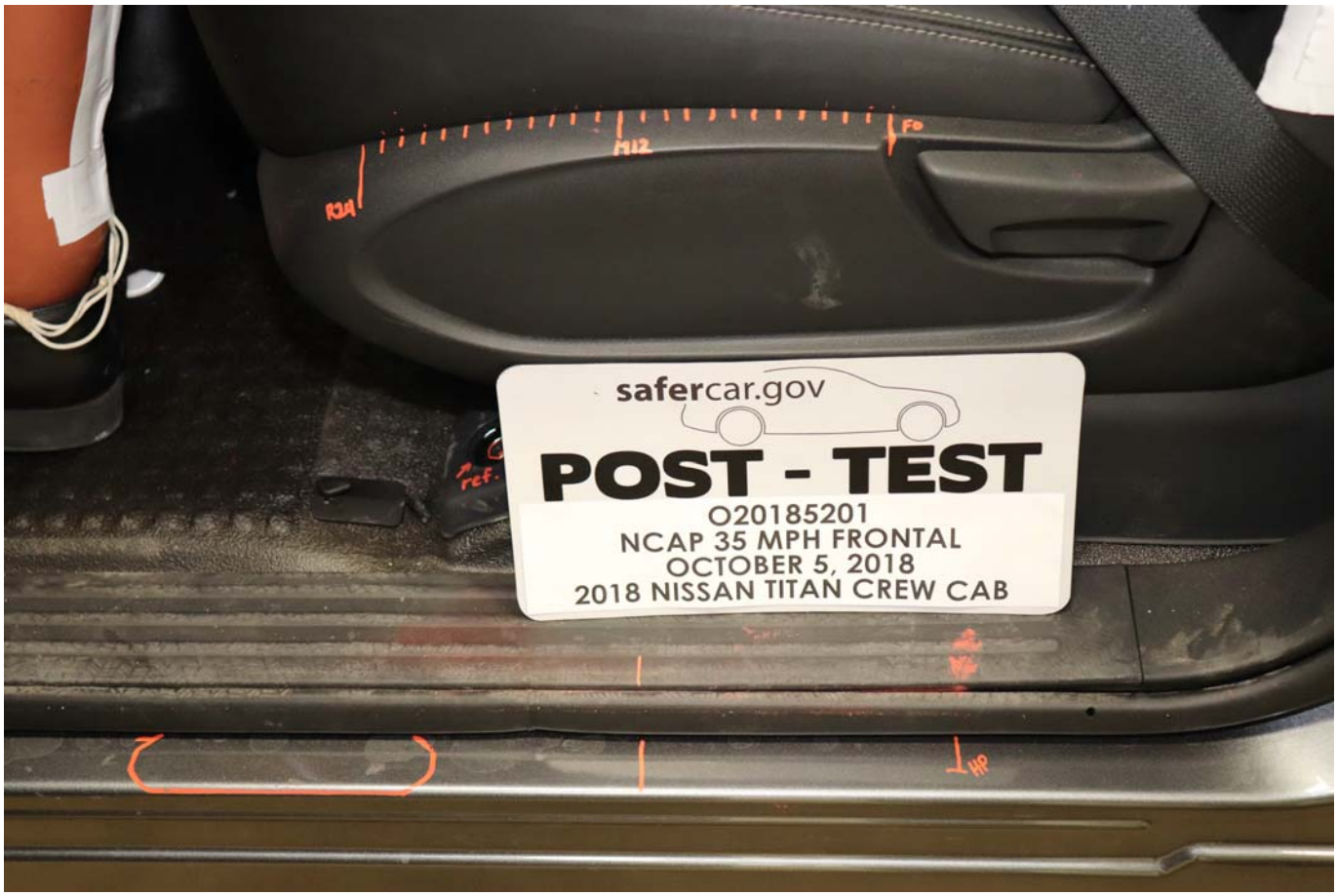


Photo No. 037 - Post-Test Driver Seat Fore-Aft Markings

Photo No. 038 - Pre-Test View of Belt Anchorage for Driver Dummy

Photo No. 039 - Post-Test View of Belt Anchorage for Driver Dummy

Photo No. 040 - Pre-Test Driver Dummy Feet

Photo No. 041 - Post-Test Driver Dummy Feet

Photo No. 042 - Pre-Test Driver Side Knee Bolster

Photo No. 043 - Post-Test Driver Side Knee Bolster

Photo No. 044 - Pre-Test Driver Side Floorpan

Photo No. 045 - Post-Test Driver Side Floorpan

Photo No. 046 - Post-Test Driver Dummy Face

Photo No. 047 - Post-Test Driver Dummy Contact with Airbag

Photo No. 048 - Post-Test Driver Dummy Contact with Headrest

Photo No. 049 - Pre-Test View of the Steering Wheel

Photo No. 050 - Post-Test View of the Steering Wheel

Photo No. 051 - Pre-Test Passenger Dummy Front View

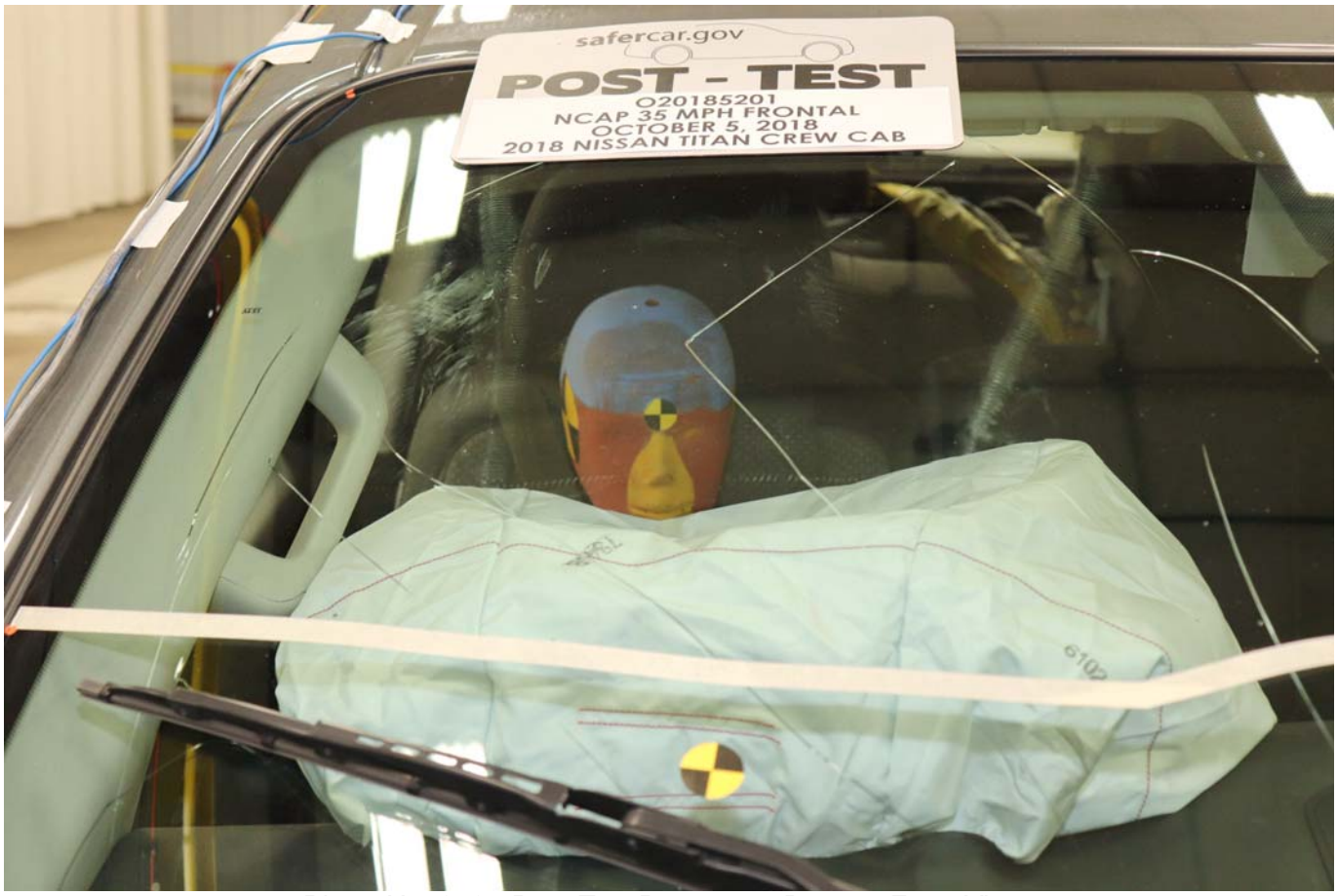


Photo No. 052 - Post-Test Passenger Dummy Front View

Photo No. 053 - Pre-Test Passenger Dummy Window View

Photo No. 054 - Post-Test Passenger Dummy Window View

Photo No. 055 - Pre-Test Passenger Dummy and Vehicle Interior

Photo No. 056 - Post-Test Passenger Dummy and Vehicle Interior

Photo No. 057 - Pre-Test Passenger Seat Fore-Aft Markings

Photo No. 058 - Post-Test Passenger Seat Fore-Aft Markings

Photo No. 059 - Pre-Test View of Belt Anchorage for Passenger Dummy

Photo No. 060 - Post-Test View of Belt Anchorage for Passenger Dummy

Photo No. 061 - Pre-Test Passenger Dummy Feet

Photo No. 062 - Post-Test Passenger Dummy Feet

Photo No. 063 - Pre-Test Passenger Side Knee Bolster

Photo No. 064 - Post-Test Passenger Side Knee Bolster

Photo No. 065 - Pre-Test Passenger Side Floorpan

Photo No. 066 - Post-Test Passenger Side Floorpan

Photo No. 067 - Post-Test Passenger Dummy Face

Photo No. 068 - Post-Test Passenger Dummy Contact with Airbag

Photo No. 069 - Post-Test Passenger Dummy Contact with Headrest

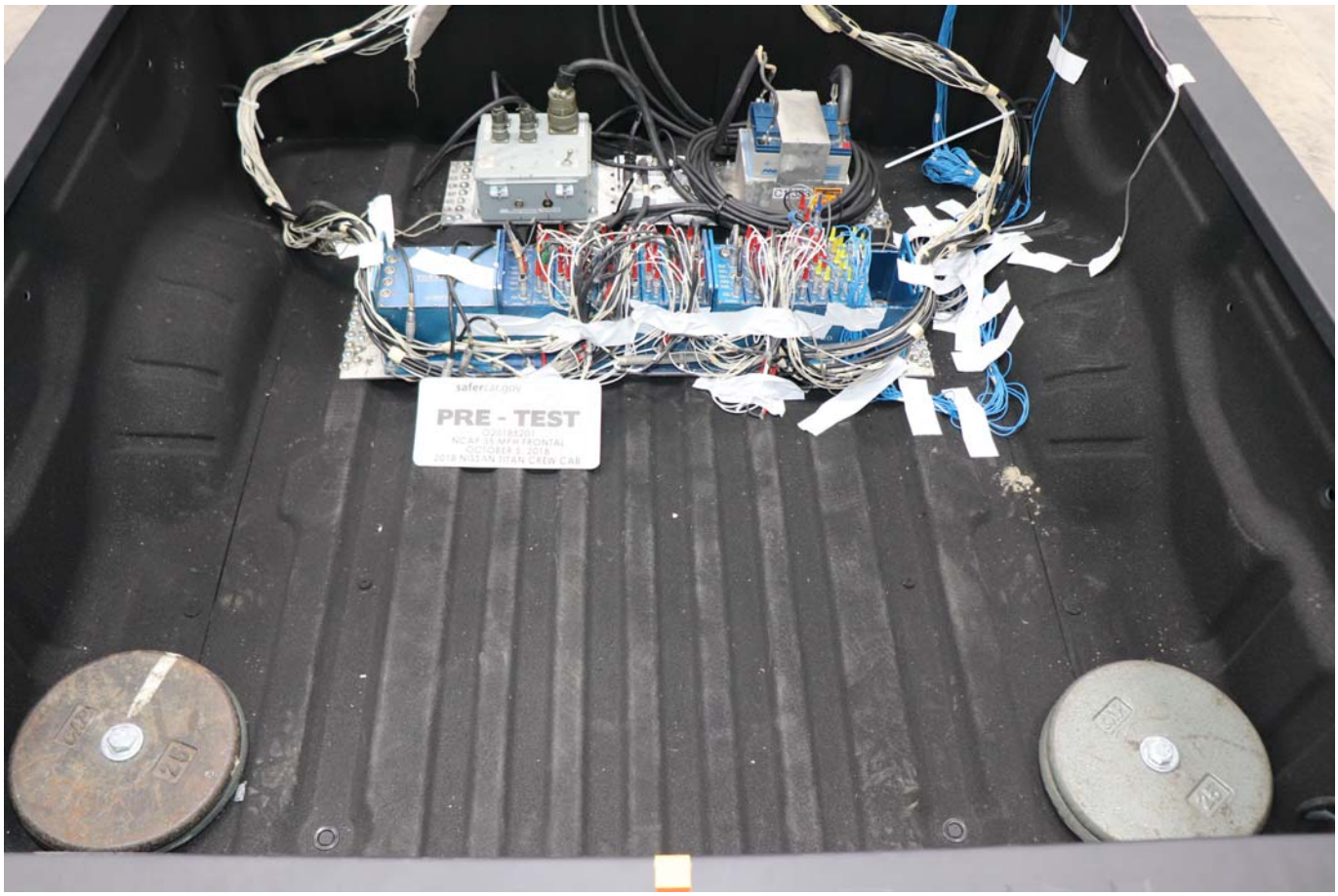


Photo No. 070 - Ballast Installed in Vehicle

PHOTOGRAPH NOT APPLICABLE

Photo No. 071 - Post-Test Stoddard Solvent Spillage Location View

Photo No. 072 - Post-Test Speed Trap Read-Out

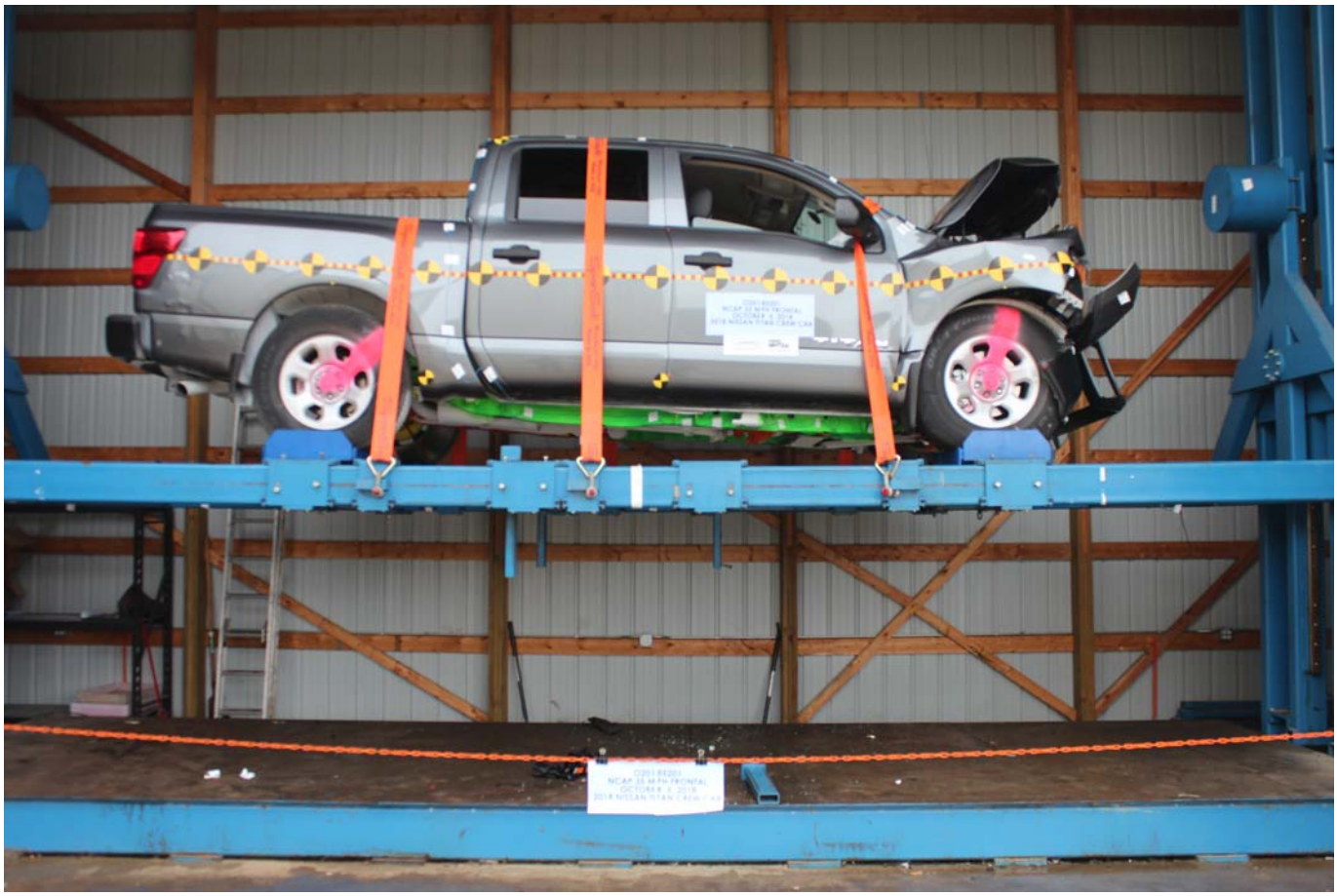


Photo No. 073 - Vehicle at 0 Degree on Static Rollover Device

Photo No. 074 - Vehicle at 90 Degrees on Static Rollover Device

Photo No. 075 - Vehicle at 180 Degrees on Static Rollover Device

Photo No. 076 - Vehicle at 270 Degrees on Static Rollover Device

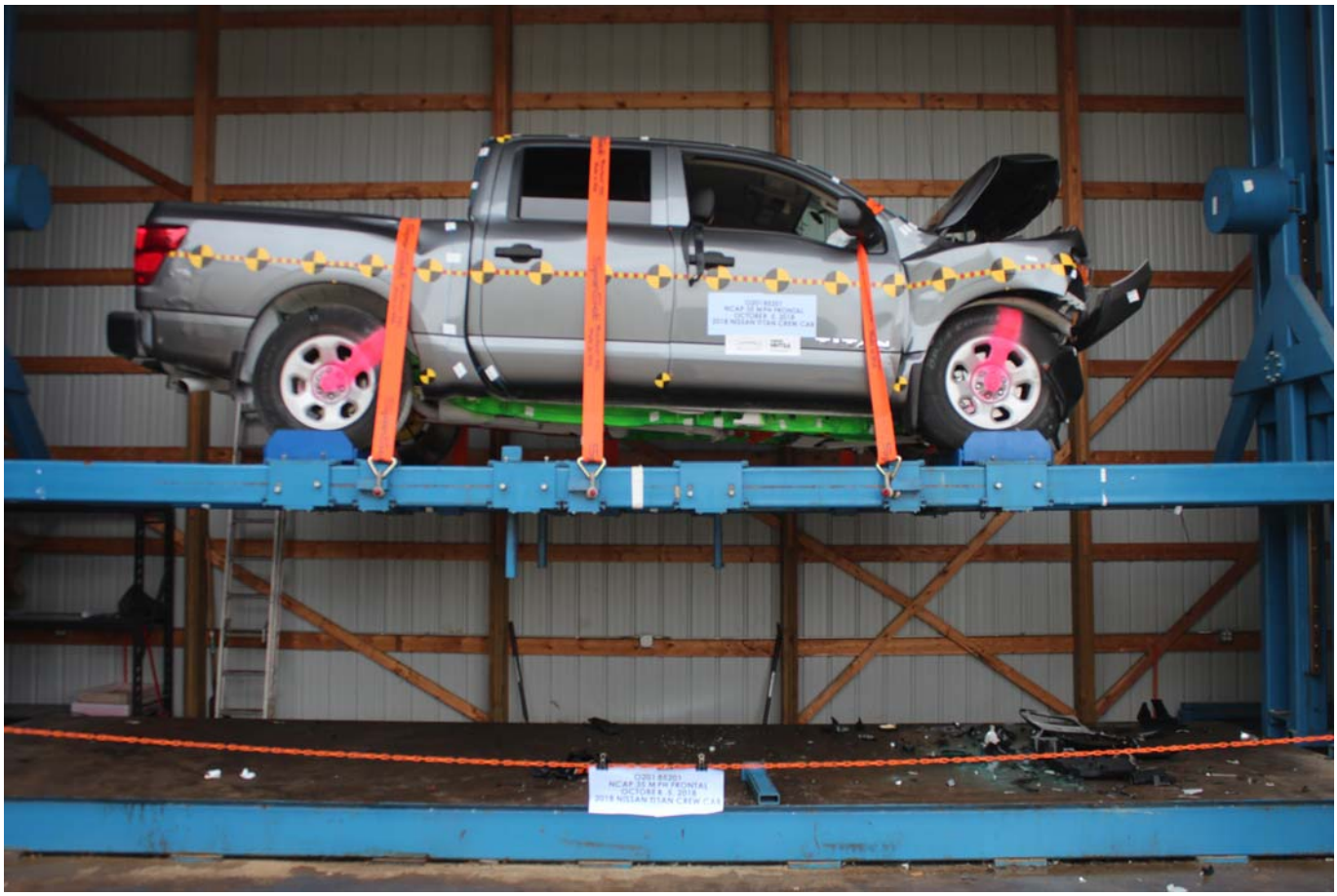
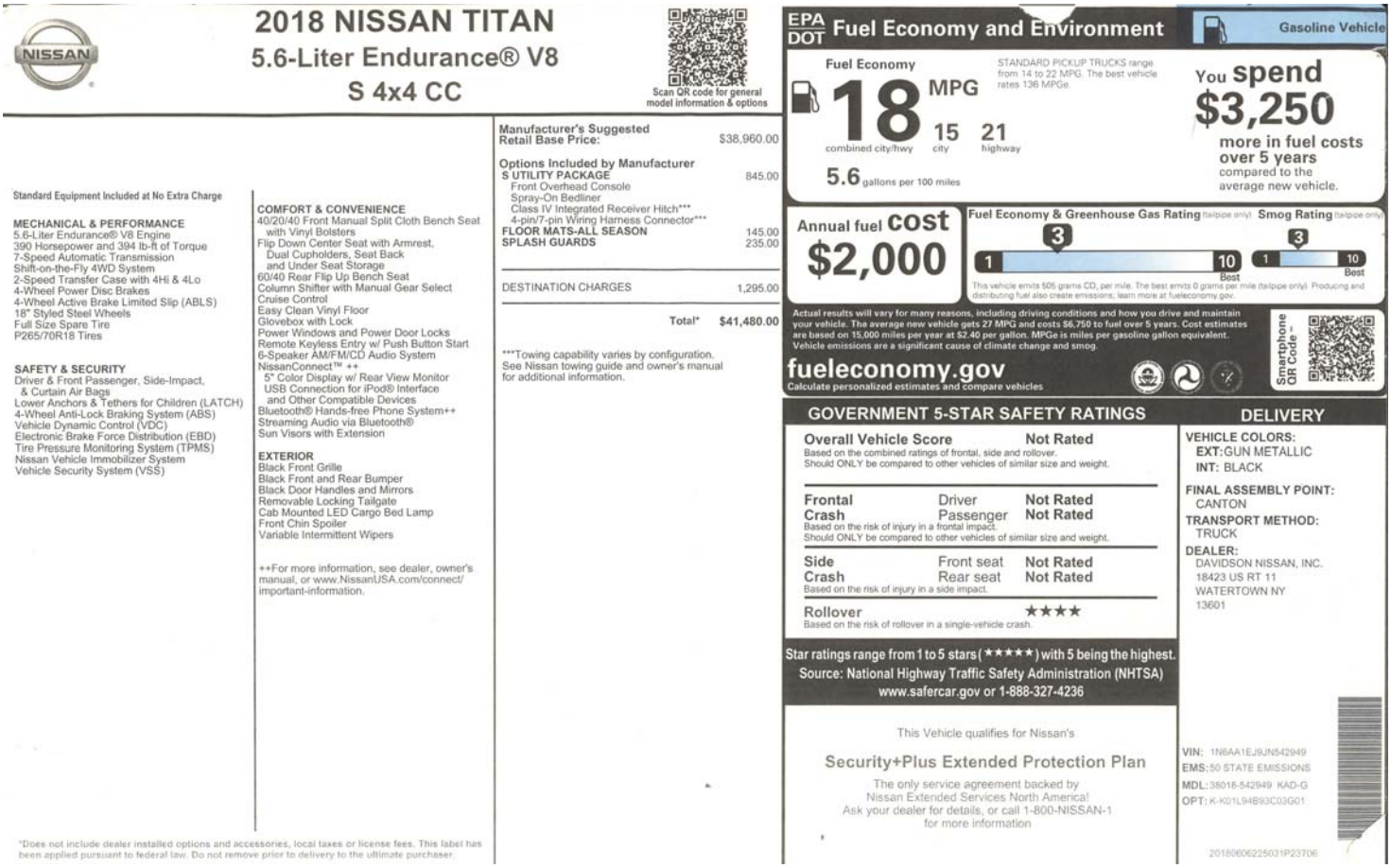


Photo No. 077 - Vehicle at 360 Degrees on Static Rollover Device

Photo No. 078 - 2018 Nissan Titan S 4x4 Crew Cab Truck Frontal Impact Event



2018 NISSAN TITAN
5.6-Liter Endurance® V8
S 4x4 CC

Scan QR code for general model information & options

Standard Equipment Included at No Extra Charge

MECHANICAL & PERFORMANCE
5.6-Liter Endurance® V8 Engine
390 Horsepower and 394 lb-ft of Torque
7-Speed Automatic Transmission
Shift-on-the-Fly 4WD System
2-Speed Transfer Case with 4Hi & 4Lo
4-Wheel Power Disc Brakes
4-Wheel Active Brake Limited Slip (ABLS)
18" Styled Steel Wheels
Full Size Spare Tire
P265/70R18 Tires

SAFETY & SECURITY
Driver & Front Passenger, Side-Impact, & Curtain Air Bags
Lower Anchors & Tethers for Children (LATCH)
4-Wheel Anti-Lock Braking System (ABS)
Vehicle Dynamic Control (VDC)
Electronic Brake Force Distribution (EBD)
Tire Pressure Monitoring System (TPMS)
Nissan Vehicle Immobilizer System
Vehicle Security System (VSS)

COMFORT & CONVENIENCE
40/20/40 Front Manual Split Cloth Bench Seat with Vinyl Bolsters
Flip Down Center Seat with Armrest, Dual Cupholders, Seat Back and Under Seat Storage
60/40 Rear Flip Up Bench Seat
Column Shifter with Manual Gear Select
Cruise Control
Easy Clean Vinyl Floor
Glovebox with Lock
Power Windows and Power Door Locks
Remote Keyless Entry w/ Push Button Start
6-Speaker AM/FM/CD Audio System
NissanConnect™ ++
5" Color Display w/ Rear View Monitor
USB Connection for iPod® Interface and Other Compatible Devices
Bluetooth® Hands-free Phone System++
Streaming Audio via Bluetooth®
Sun Visors with Extension

EXTERIOR
Black Front Grille
Black Front and Rear Bumper
Black Door Handles and Mirrors
Removable Locking Tailgate
Cab Mounted LED Cargo Bed Lamp
Front Chin Spoiler
Variable Intermittent Wipers

++For more information, see dealer, owner's manual, or www.NissanUSA.com/connect/important-information.

*Does not include dealer installed options and accessories, local taxes or license fees. This label has been applied pursuant to federal law. Do not remove prior to delivery to the ultimate purchaser.

Manufacturer's Suggested Retail Base Price:	$38,960.00
Options Included by Manufacturer	
S UTILITY PACKAGE	845.00
Front Overhead Console	
Spray-On Bedliner	
Class IV Integrated Receiver Hitch***	
4-pin/7-pin Wiring Harness Connector***	
FLOOR MATS-ALL SEASON	145.00
SPLASH GUARDS	235.00
DESTINATION CHARGES	1,295.00
Total*	**$41,480.00**

***Towing capability varies by configuration. See Nissan towing guide and owner's manual for additional information.

EPA DOT Fuel Economy and Environment — Gasoline Vehicle

Fuel Economy: **18** MPG combined city/hwy — 15 city — 21 highway

STANDARD PICKUP TRUCKS range from 14 to 22 MPG. The best vehicle rates 136 MPGe.

5.6 gallons per 100 miles

You spend **$3,250** more in fuel costs over 5 years compared to the average new vehicle.

Annual fuel cost **$2,000**

Fuel Economy & Greenhouse Gas Rating (tailpipe only) 3 (1–10, Best) — Smog Rating (tailpipe only) 3 (1–10, Best)

This vehicle emits 505 grams CO2 per mile. The best emits 0 grams per mile (tailpipe only). Producing and distributing fuel also create emissions; learn more at fueleconomy.gov.

Actual results will vary for many reasons, including driving conditions and how you drive and maintain your vehicle. The average new vehicle gets 27 MPG and costs $6,750 to fuel over 5 years. Cost estimates are based on 15,000 miles per year at $2.40 per gallon. MPGe is miles per gasoline gallon equivalent. Vehicle emissions are a significant cause of climate change and smog.

fueleconomy.gov
Calculate personalized estimates and compare vehicles

Smartphone QR Code

GOVERNMENT 5-STAR SAFETY RATINGS

Overall Vehicle Score		**Not Rated**
Based on the combined ratings of frontal, side and rollover. Should ONLY be compared to other vehicles of similar size and weight.		
Frontal Crash	Driver	**Not Rated**
	Passenger	**Not Rated**
Based on the risk of injury in a frontal impact. Should ONLY be compared to other vehicles of similar size and weight.		
Side Crash	Front seat	**Not Rated**
	Rear seat	**Not Rated**
Based on the risk of injury in a side impact.		
Rollover		★★★★
Based on the risk of rollover in a single-vehicle crash.		

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.
Source: National Highway Traffic Safety Administration (NHTSA)
www.safercar.gov or 1-888-327-4236

This Vehicle qualifies for Nissan's

Security+Plus Extended Protection Plan

The only service agreement backed by Nissan Extended Services North America!
Ask your dealer for details, or call 1-800-NISSAN-1 for more information

DELIVERY

VEHICLE COLORS:
EXT: GUN METALLIC
INT: BLACK

FINAL ASSEMBLY POINT:
CANTON

TRANSPORT METHOD:
TRUCK

DEALER:
DAVIDSON NISSAN, INC.
18423 US RT 11
WATERTOWN NY
13601

VIN: 1N6AA1EJ9JN542949
EMS: 50 STATE EMISSIONS
MDL: 38016-542949 KAD-G
OPT: K-K01L94B93C03G01

20180606225031P23706

Photo No. 079 - Monroney Label Photograph

APPENDIX B
DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

The following additional dummy and vehicle response data can be found in the R&D section of the NHTSA website at www.nhtsa.dot.gov

Driver Head X Redundant

Driver Head Y Redundant

Driver Head Z Redundant

Driver Head Angular Velocity X

Driver Head Angular Velocity Y

Driver Head Angular Velocity Z

Driver Upper Neck Force Y

Driver Upper Neck Moment X

Driver Upper Neck Moment Z

Driver Chest X Redundant

Driver Chest Y Redundant

Driver Chest Z Redundant

Driver Pelvis X

Driver Pelvis Y

Driver Pelvis Z

Driver Left Femur Redundant

Driver Right Femur Redundant

Driver Left Upper Tibia Moment X

Driver Left Upper Tibia Moment Y

Driver Left Upper Tibia Force Z

Driver Left Lower Tibia Moment X

Driver Left Lower Tibia Moment Y

Driver Left Lower Tibia Force Z

Driver Right Upper Tibia Moment X

Driver Right Upper Tibia Moment Y

Driver Right Upper Tibia Force Z

Driver Right Lower Tibia Moment X

Driver Right Lower Tibia Moment Y

Driver Right Lower Tibia Force Z

Driver Left Foot Fore Z

Driver Left Foot Aft X

Driver Left Foot Aft Z

Driver Right Foot Fore Z

Driver Right Foot Aft X

Driver Right Foot Aft Z

Driver Lap Belt Force

Driver Shoulder Belt Force

Passenger Head X Redundant

Passenger Head Y Redundant

Passenger Head Z Redundant

Passenger Head Angular Velocity X

Passenger Head Angular Velocity Y

Passenger Head Angular Velocity Z

Passenger Upper Neck Force Y

Passenger Upper Neck Moment X

Passenger Upper Neck Moment Z

Passenger Chest X Redundant

Passenger Chest Y Redundant

Passenger Chest Z Redundant

Passenger Pelvis X

Passenger Pelvis Y

Passenger Pelvis Z

Passenger Left Femur Redundant

Passenger Right Femur Redundant

Passenger Left Upper Tibia Moment X

Passenger Left Upper Tibia Moment Y

Passenger Left Upper Tibia Force Z

Passenger Left Lower Tibia Moment X

Passenger Left Lower Tibia Moment Y

Passenger Left Lower Tibia Force Z

Passenger Right Upper Tibia Moment X

Passenger Right Upper Tibia Moment Y

Passenger Right Upper Tibia Force Z

Passenger Right Lower Tibia Moment X

Passenger Right Lower Tibia Moment Y

Passenger Right Lower Tibia Force Z

Passenger Left Foot Fore Z

Passenger Left Foot Aft X

Passenger Left Foot Aft Z

Passenger Right Foot Fore Z

Passenger Right Foot Aft X

Passenger Right Foot Aft Z

Passenger Lap Belt Force

Passenger Shoulder Belt Force

Left Rear Seat Crossmember X

Right Rear Seat Crossmember X

Vehicle Engine Top X

Vehicle Engine Bottom X

Left Rear Seat Crossmember Z

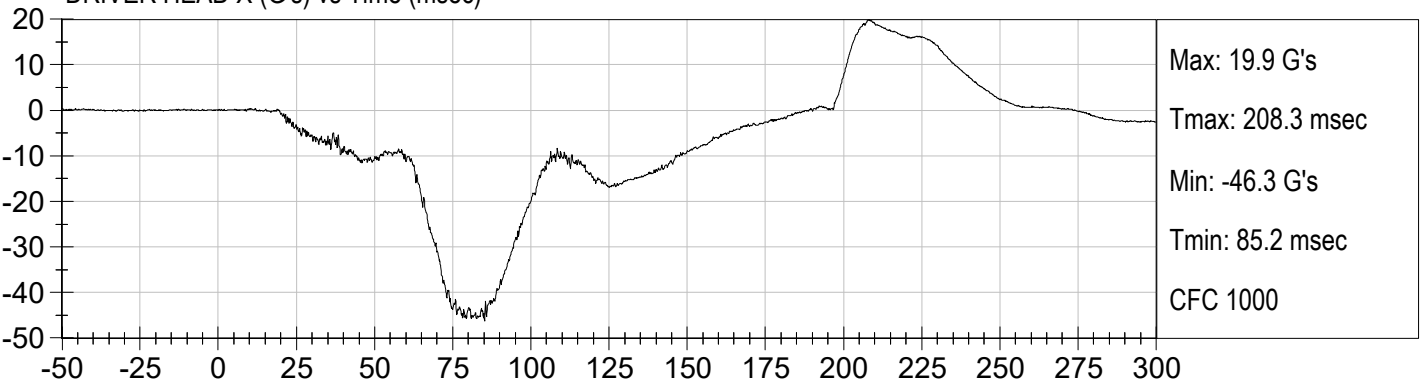
Right Rear Seat Crossmember Z

Left Rear Seat Crossmember Xr

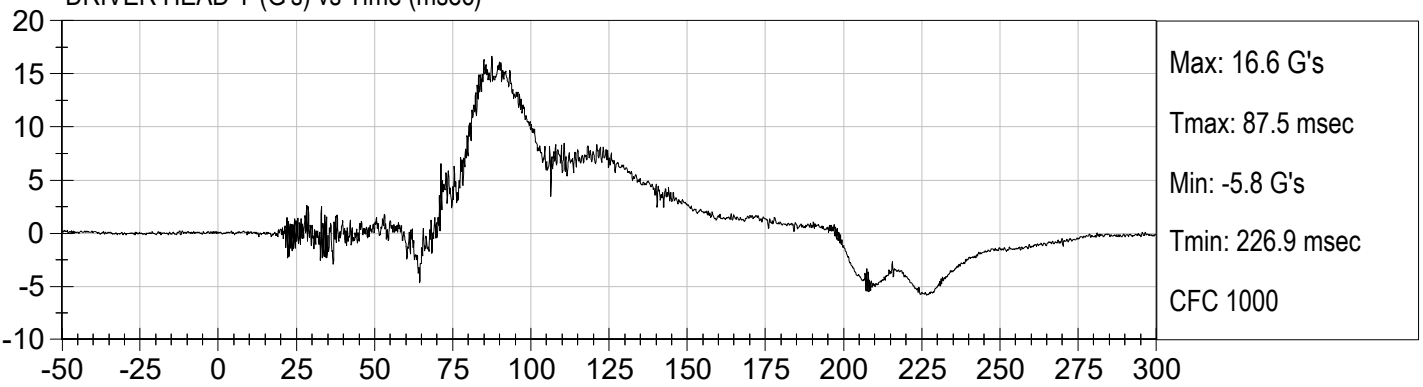
Right Rear Seat Crossmember Xr

Advanced Research Load Cell Barrier – 528 channels

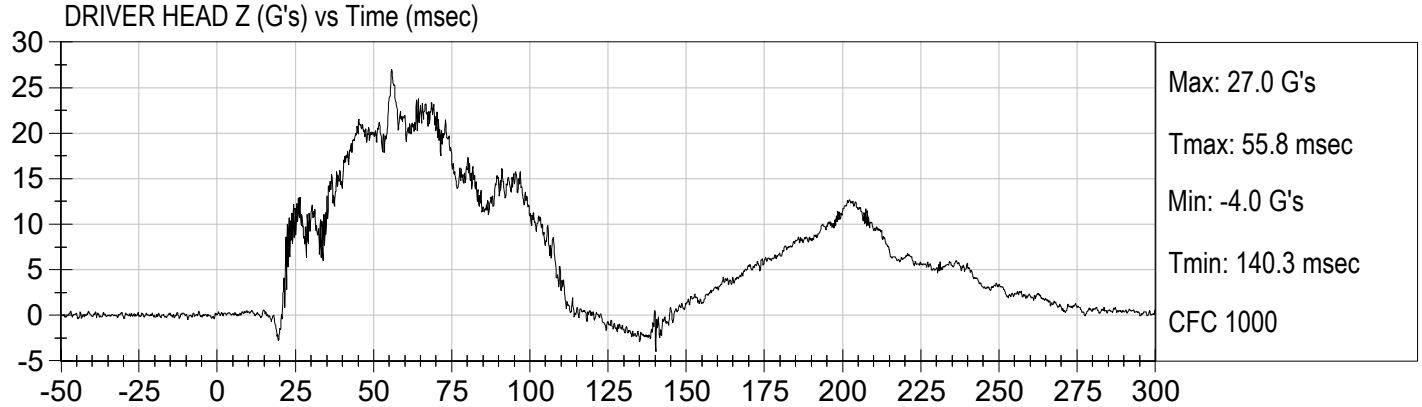
DRIVER HEAD X (G's) vs Time (msec)



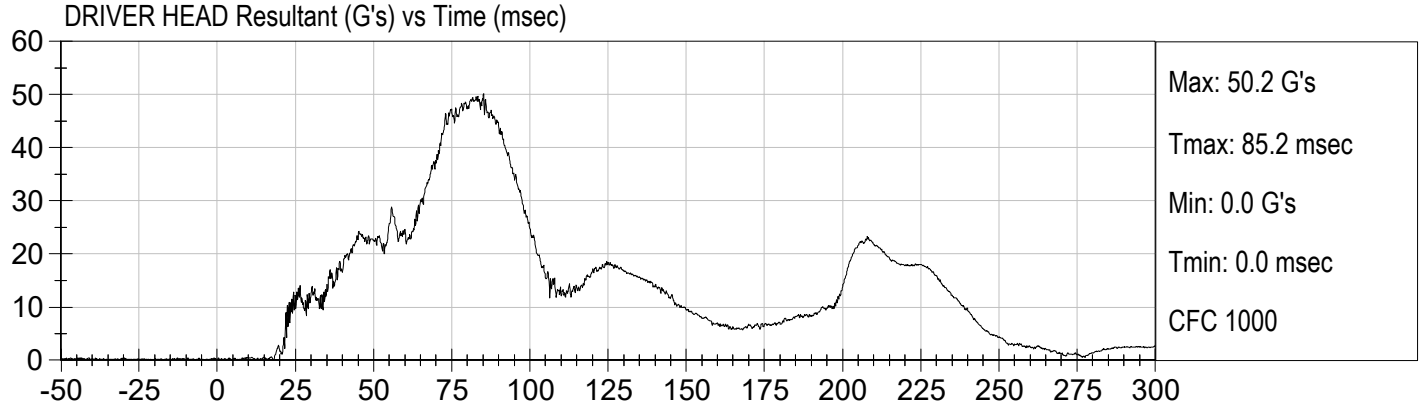
DRIVER HEAD Y (G's) vs Time (msec)



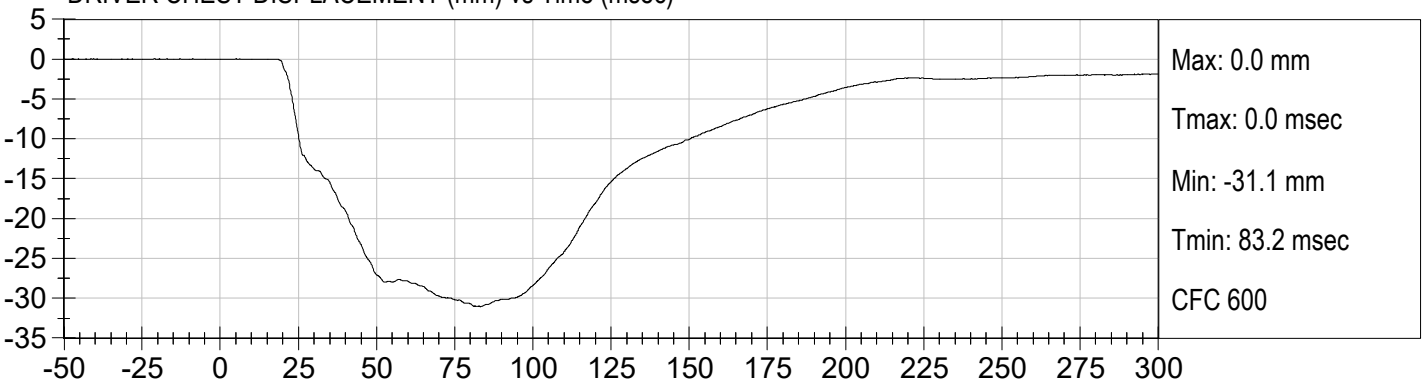
DRIVER HEAD Z (G's) vs Time (msec)



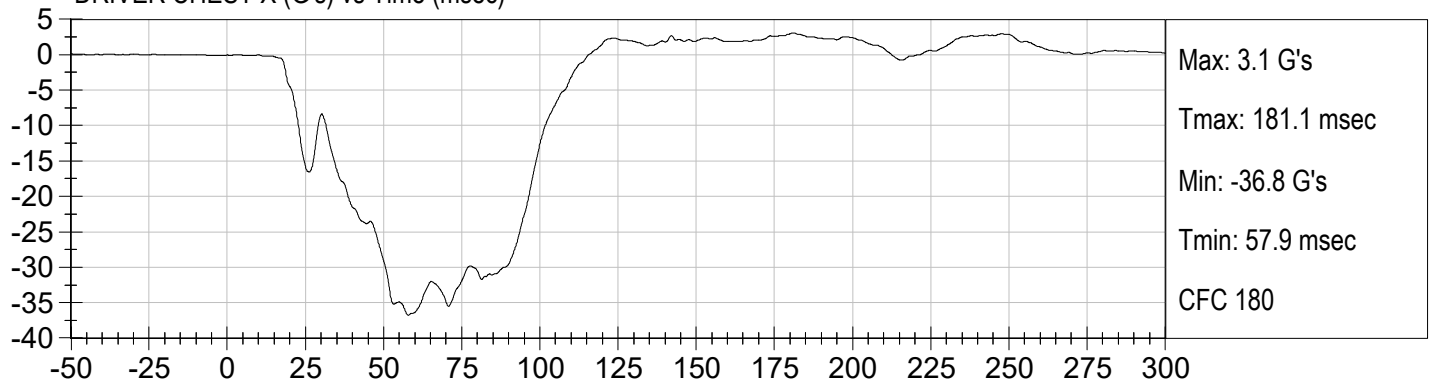
DRIVER HEAD Resultant (G's) vs Time (msec)



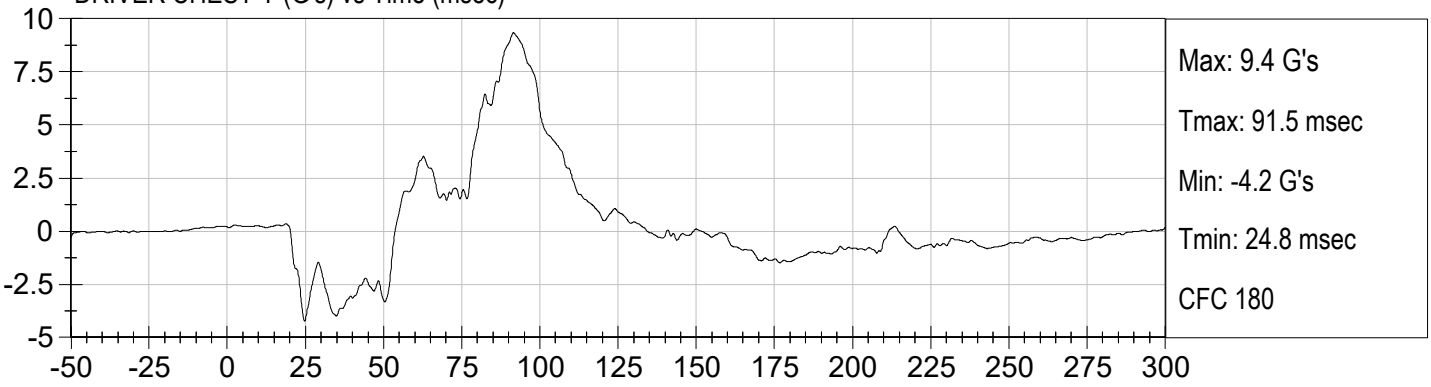
DRIVER CHEST DISPLACEMENT (mm) vs Time (msec)



DRIVER CHEST X (G's) vs Time (msec)

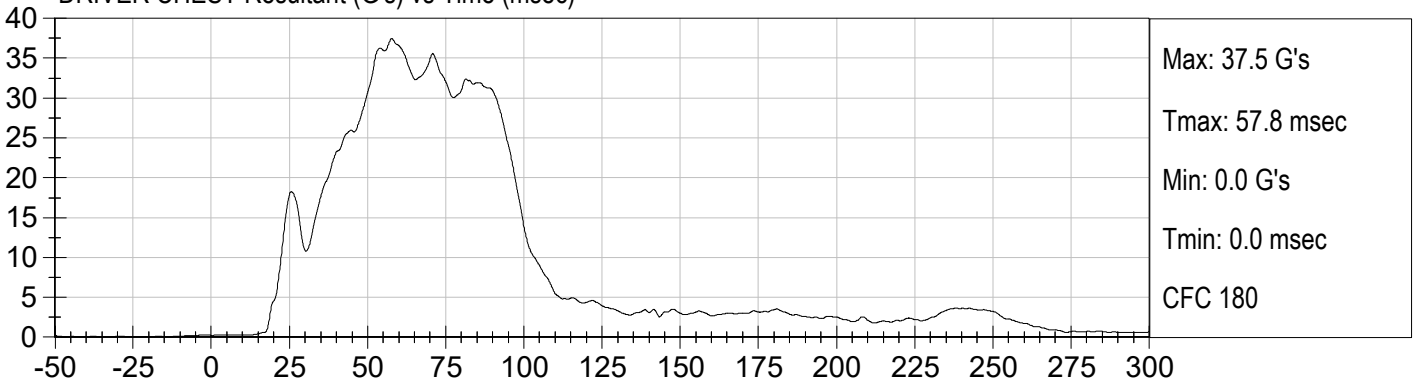


DRIVER CHEST Y (G's) vs Time (msec)

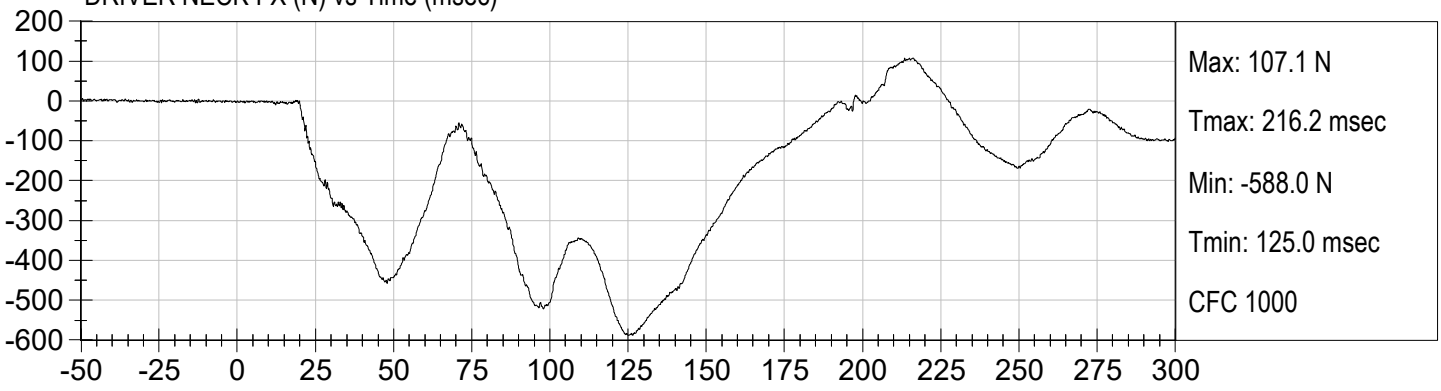


DRIVER CHEST Z (G's) vs Time (msec)

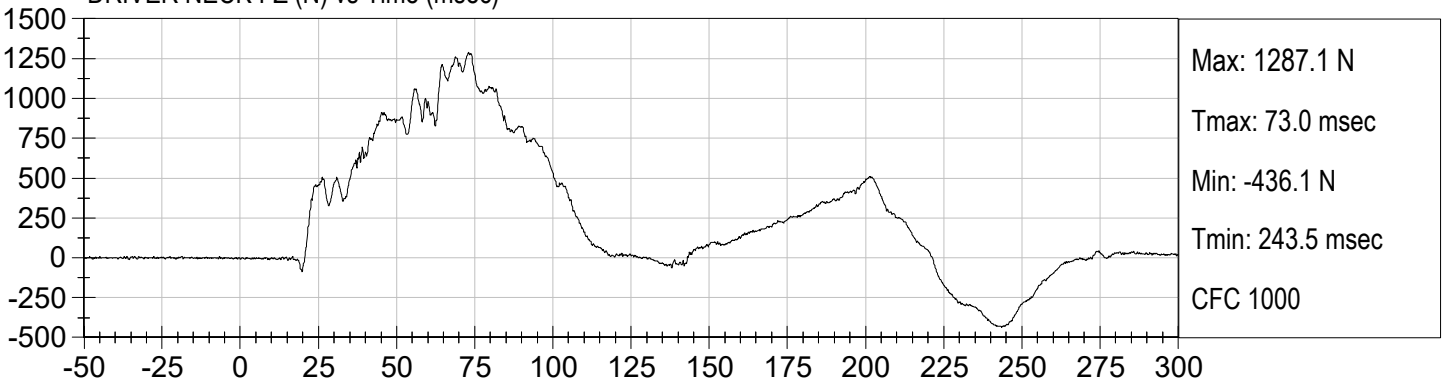
DRIVER CHEST Resultant (G's) vs Time (msec)



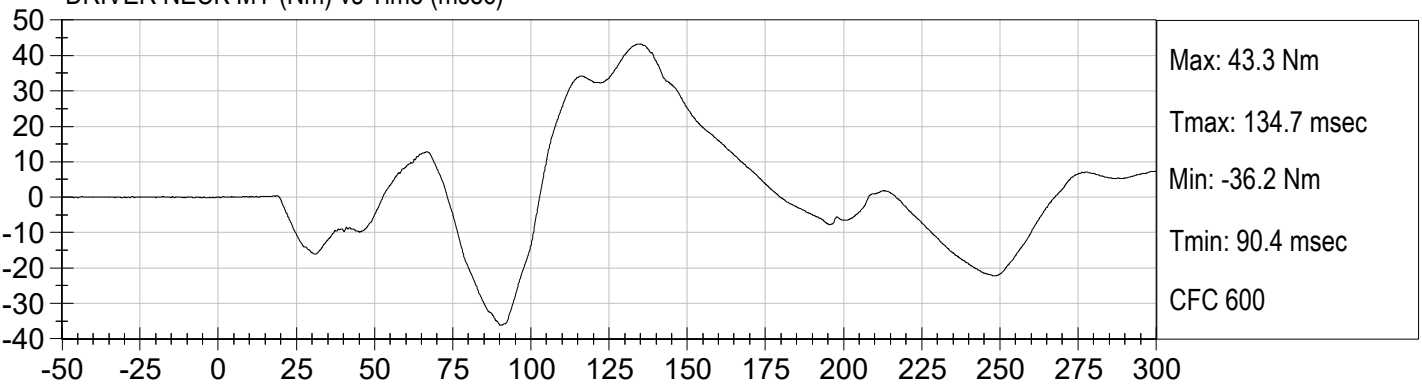
DRIVER NECK FX (N) vs Time (msec)

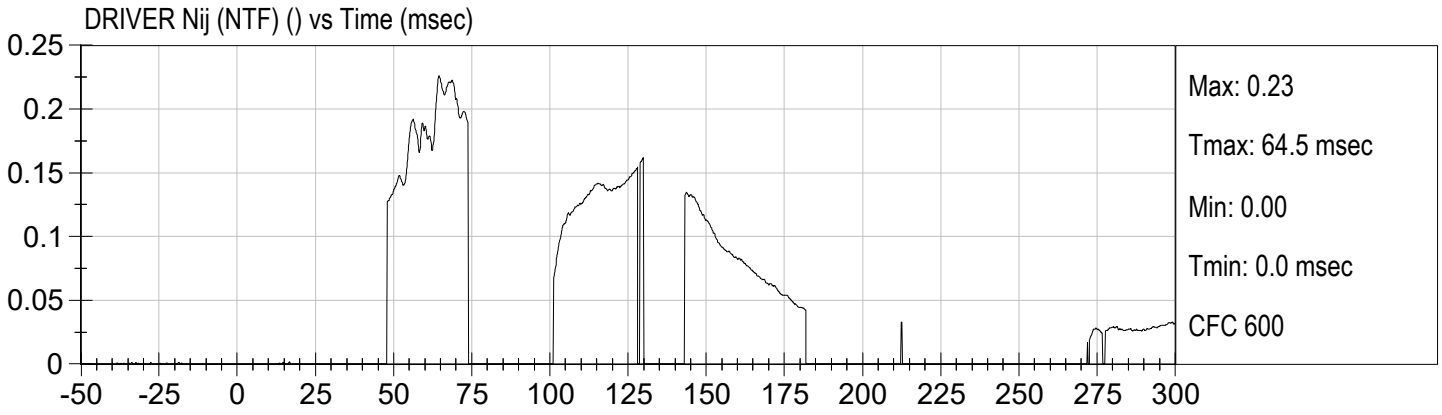


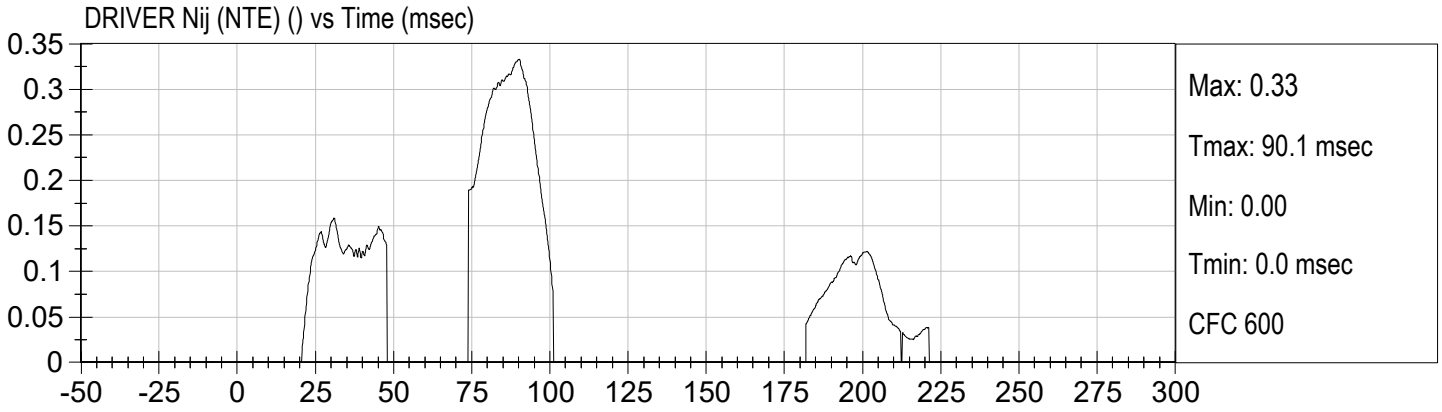
DRIVER NECK FZ (N) vs Time (msec)

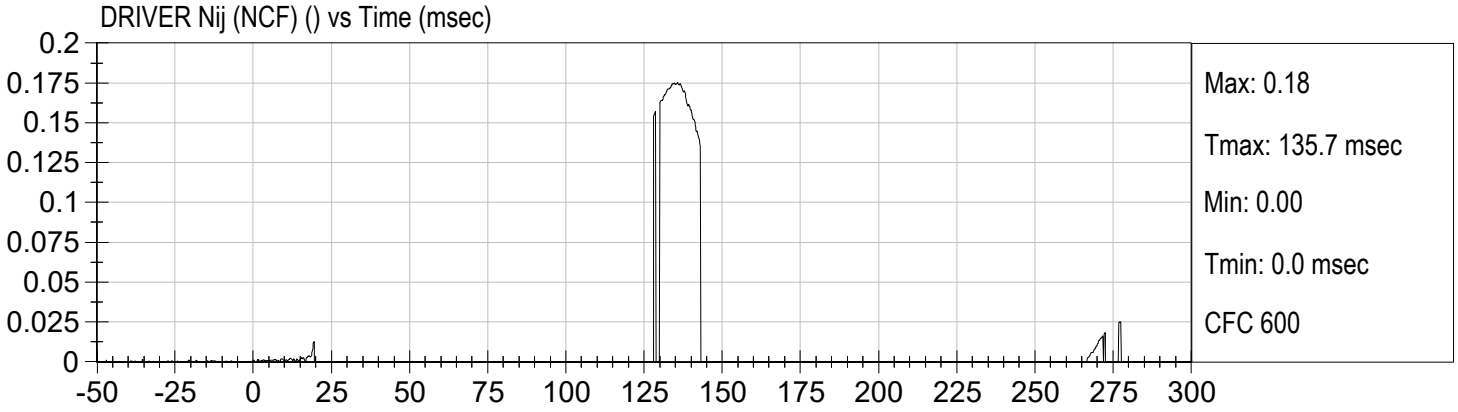


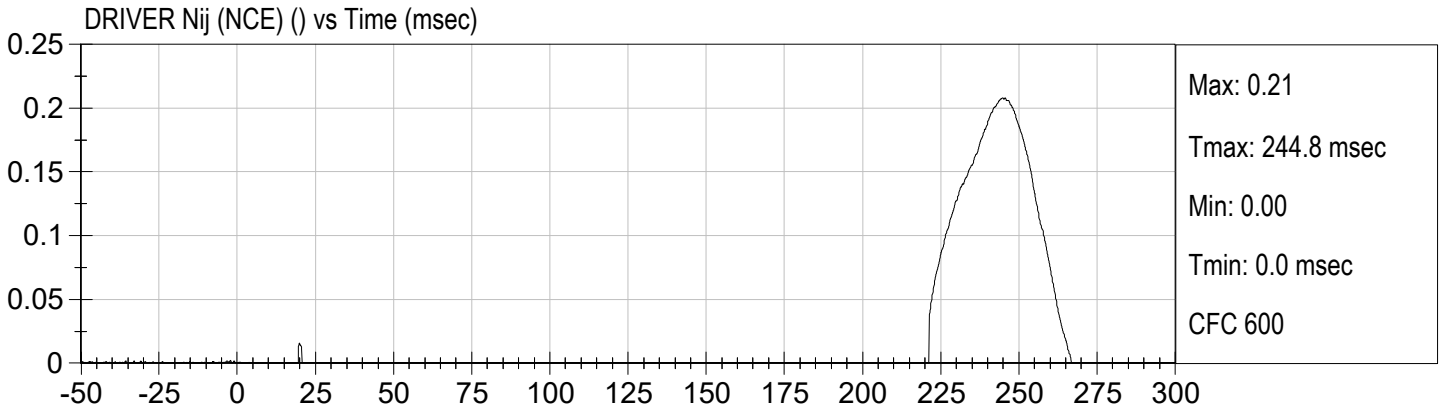
DRIVER NECK MY (Nm) vs Time (msec)



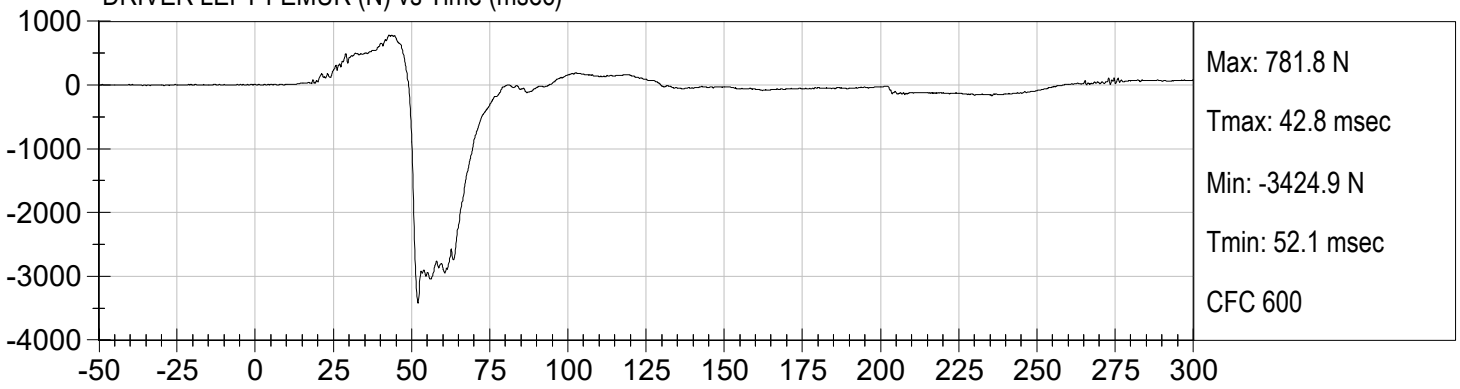

DRIVER Nij (NTF) () vs Time (msec)
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.23
Tmax: 64.5 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600


DRIVER Nij (NTE) () vs Time (msec)
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.33
Tmax: 90.1 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600

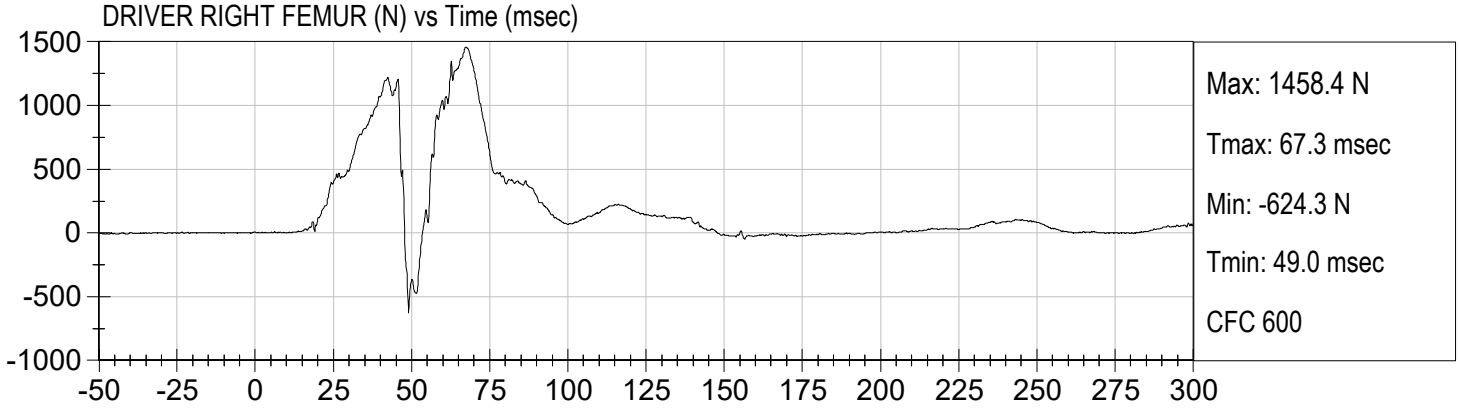

DRIVER Nij (NCF) () vs Time (msec)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.18
Tmax: 135.7 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600


DRIVER Nij (NCE) () vs Time (msec)
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.21
Tmax: 244.8 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600

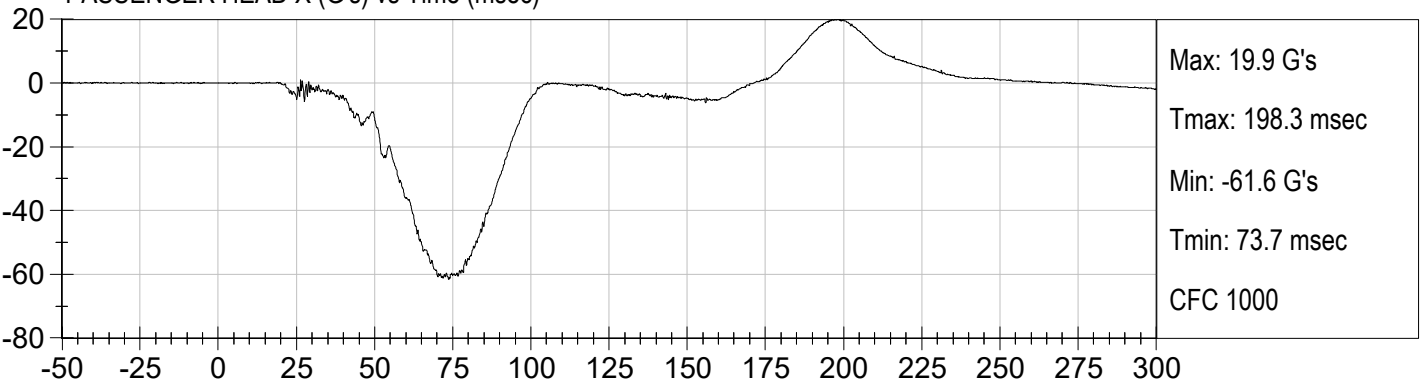
DRIVER LEFT FEMUR (N) vs Time (msec)



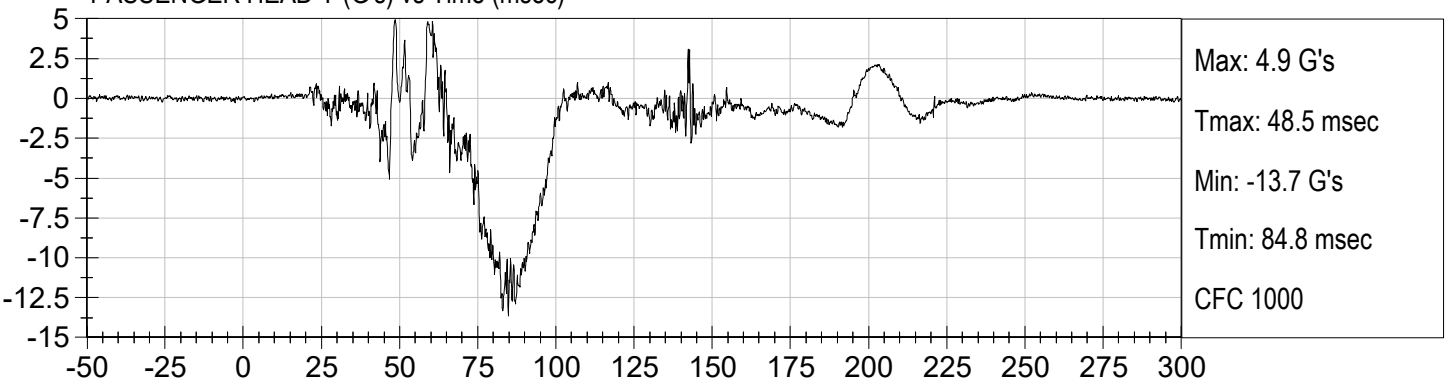
DRIVER RIGHT FEMUR (N) vs Time (msec)



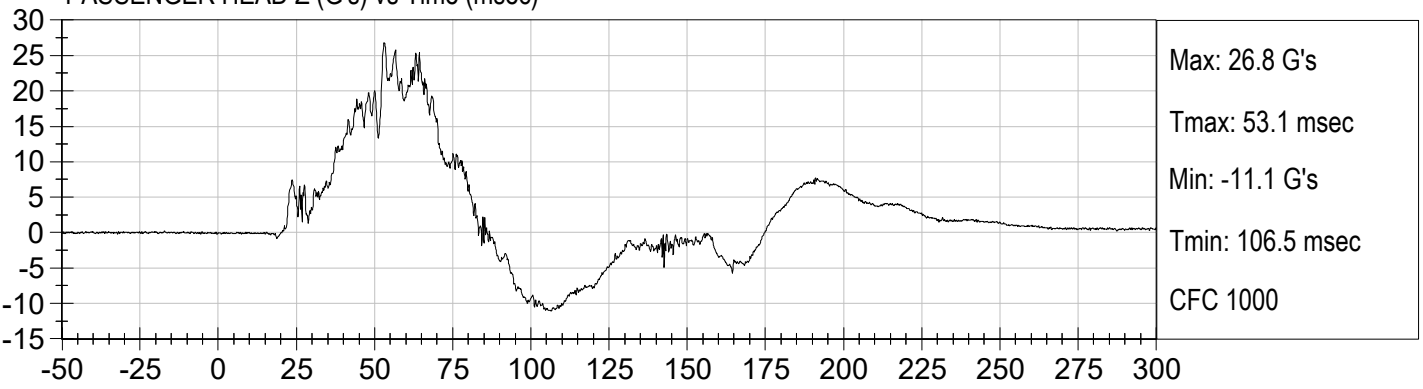
PASSENGER HEAD X (G's) vs Time (msec)



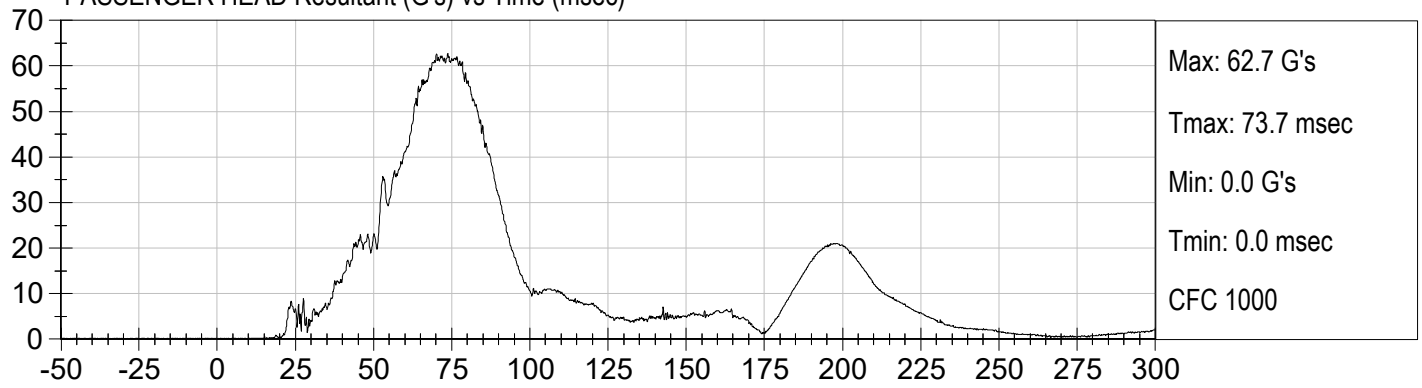
PASSENGER HEAD Y (G's) vs Time (msec)



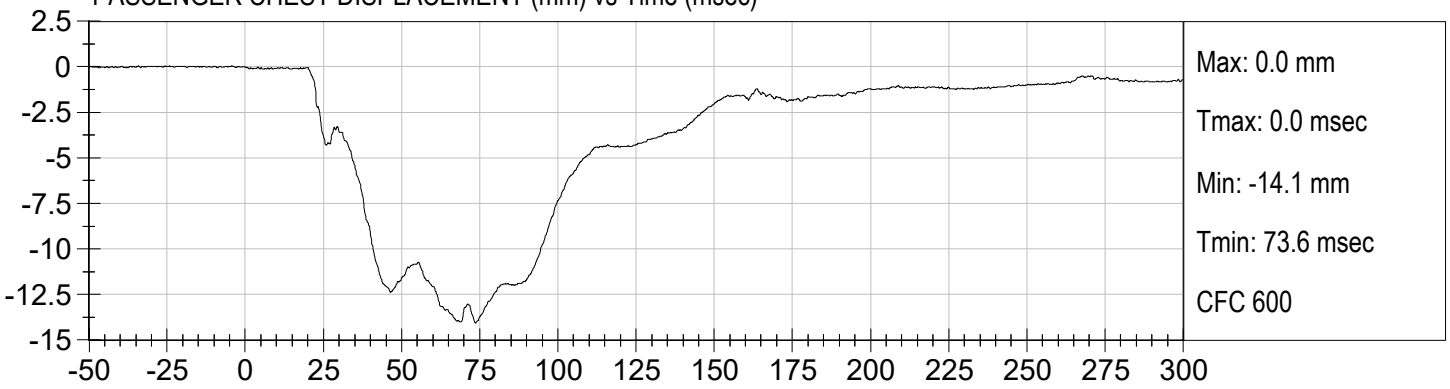
PASSENGER HEAD Z (G's) vs Time (msec)



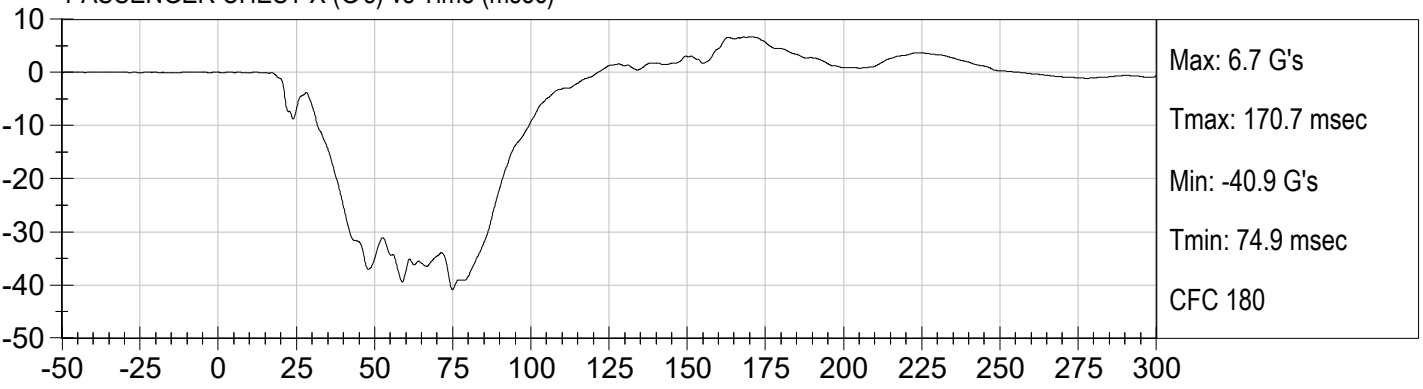
PASSENGER HEAD Resultant (G's) vs Time (msec)



PASSENGER CHEST DISPLACEMENT (mm) vs Time (msec)

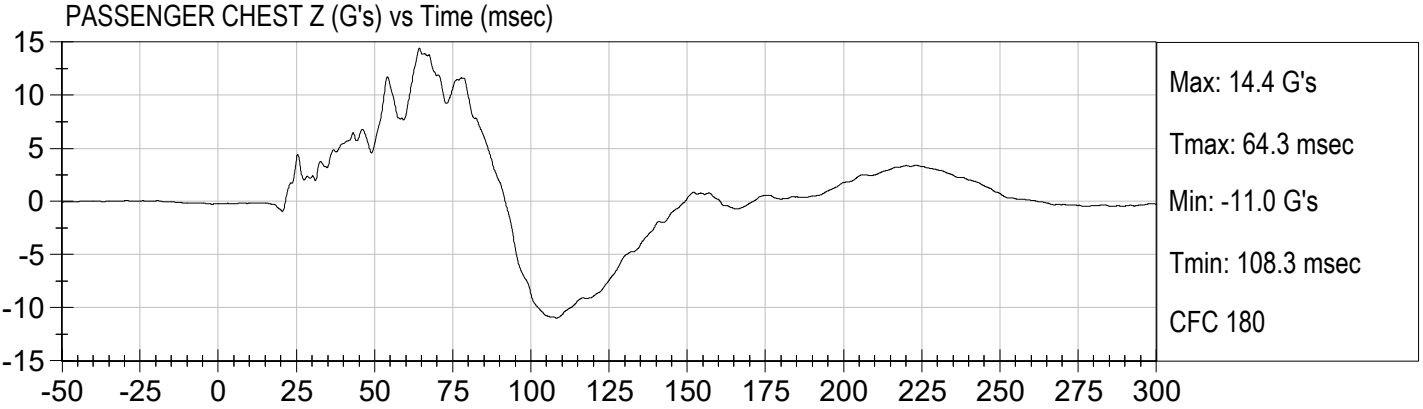


PASSENGER CHEST X (G's) vs Time (msec)

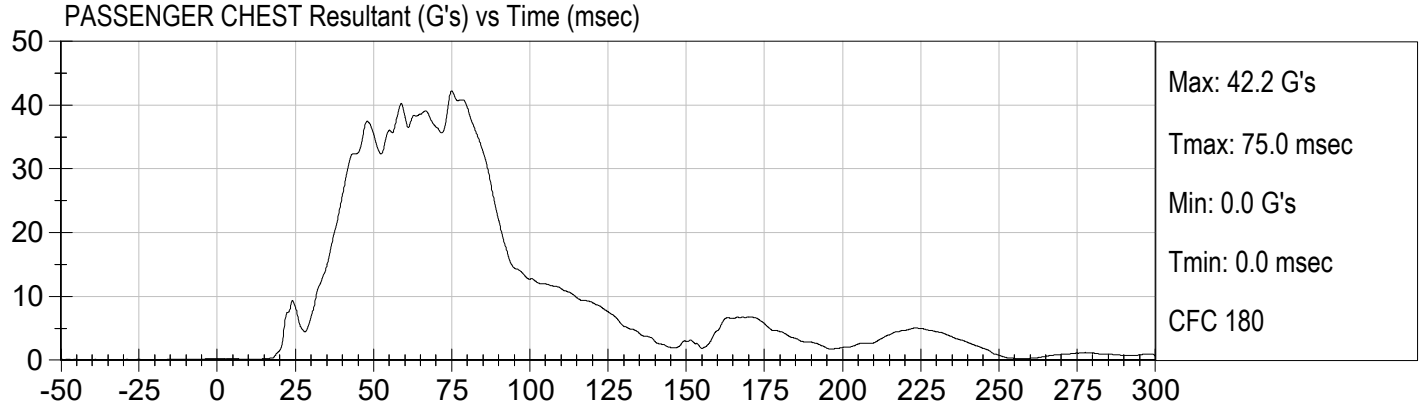


PASSENGER CHEST Y (G's) vs Time (msec)

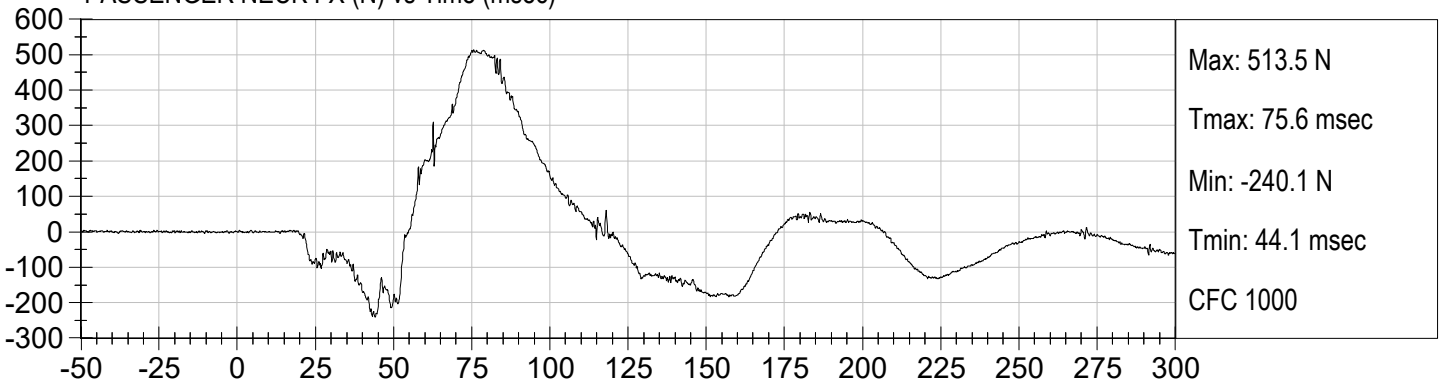
PASSENGER CHEST Z (G's) vs Time (msec)



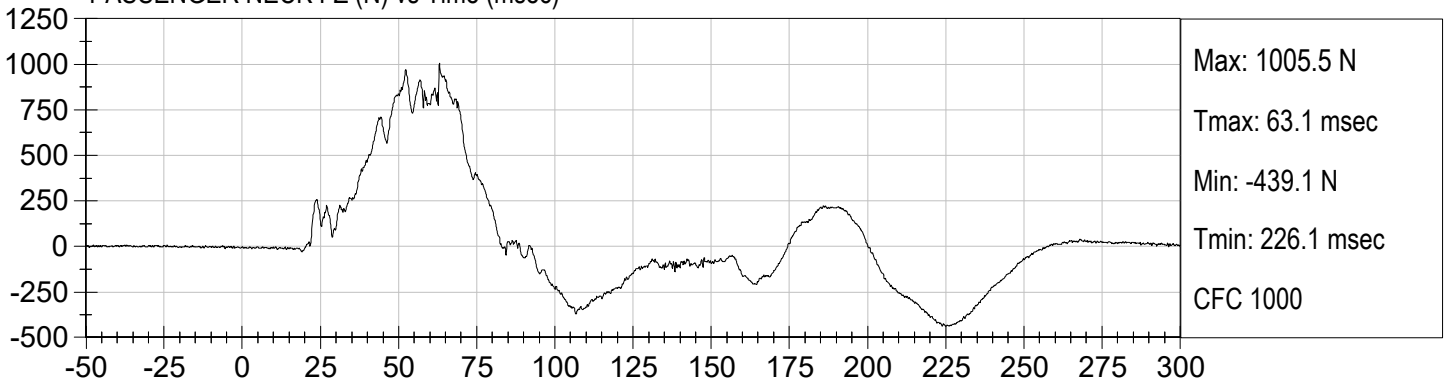
PASSENGER CHEST Resultant (G's) vs Time (msec)



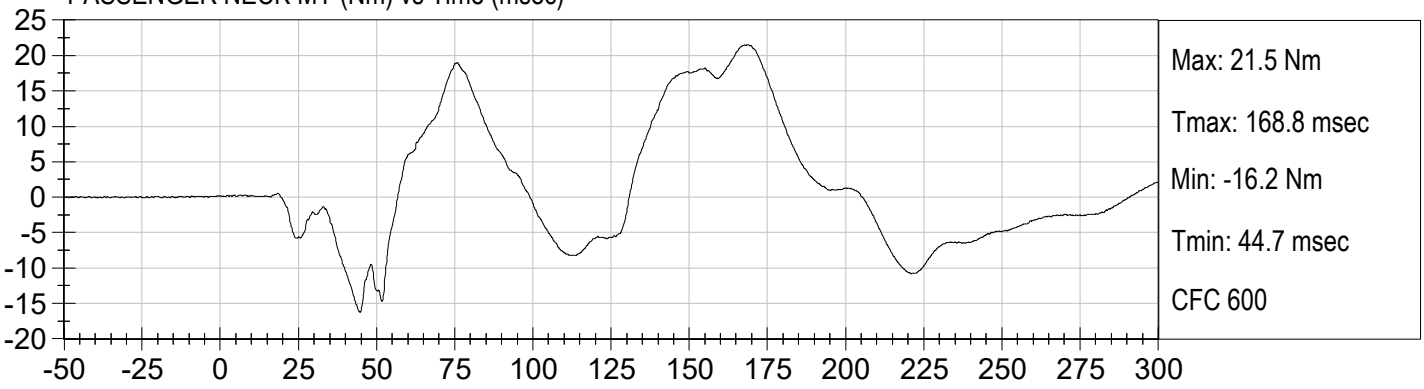
PASSENGER NECK FX (N) vs Time (msec)

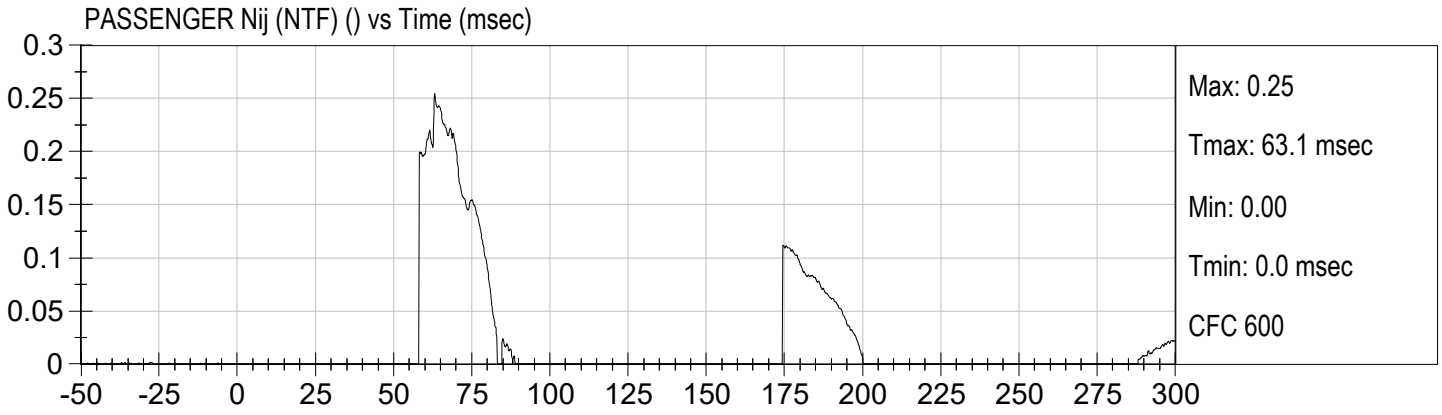


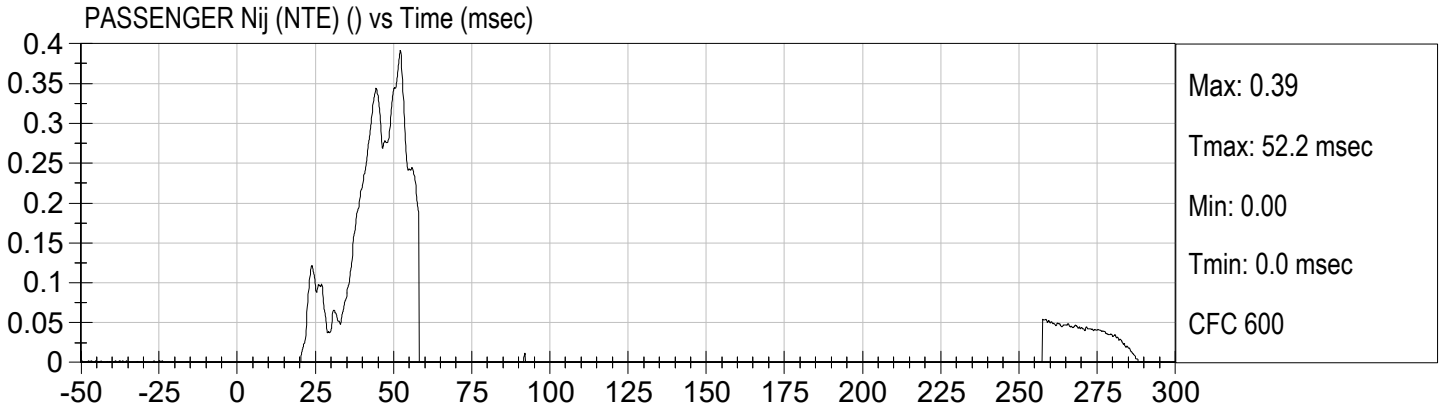
PASSENGER NECK FZ (N) vs Time (msec)

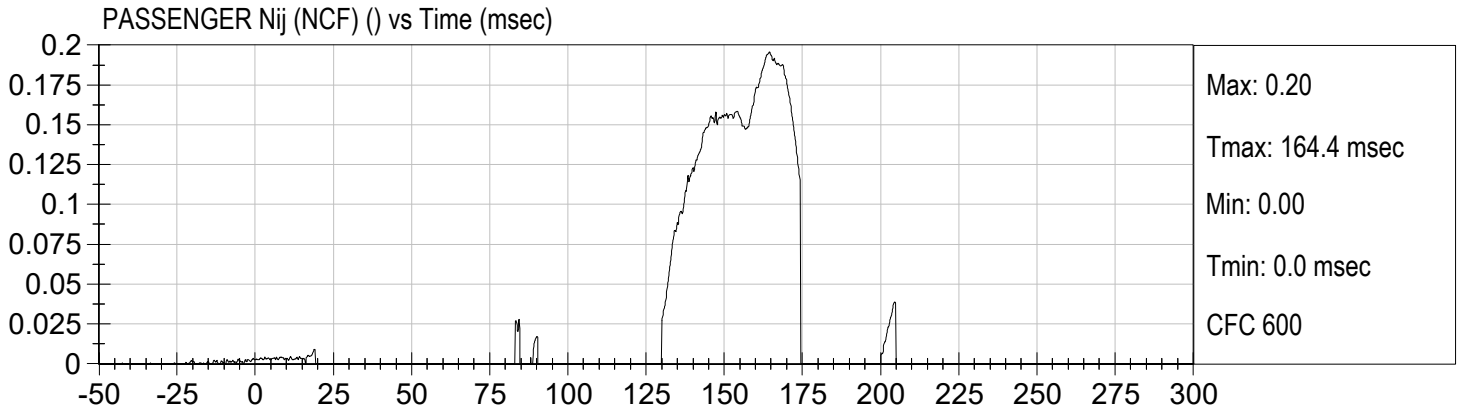


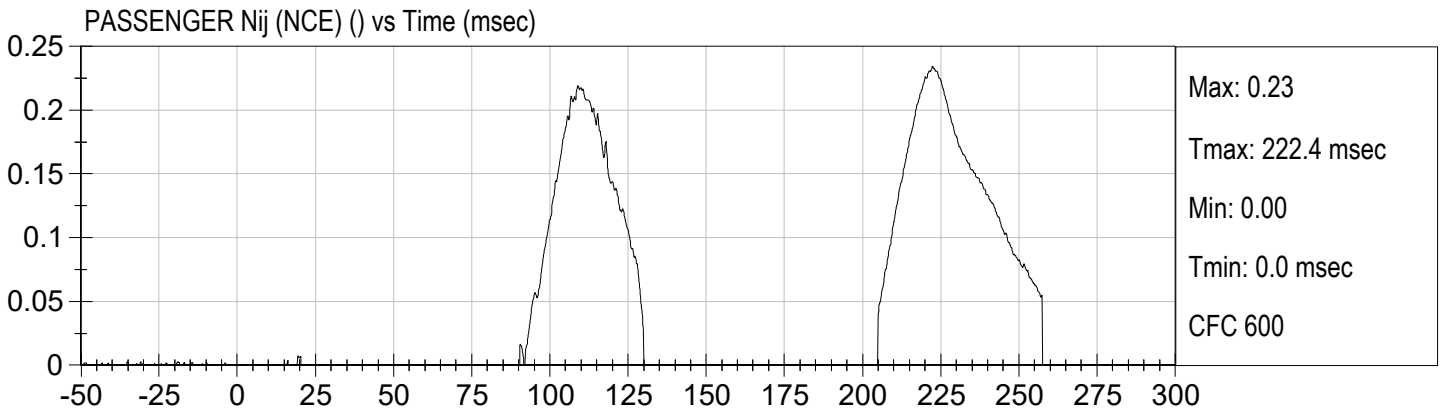
PASSENGER NECK MY (Nm) vs Time (msec)



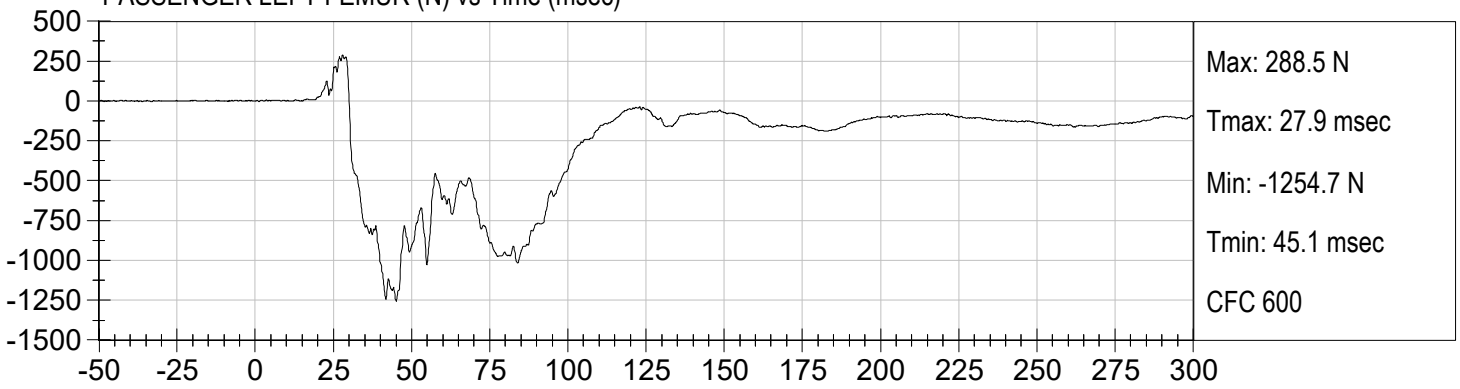

PASSENGER Nij (NTF) () vs Time (msec)
0.3
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.25
Tmax: 63.1 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600


PASSENGER Nij (NTE) () vs Time (msec)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.39
Tmax: 52.2 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600

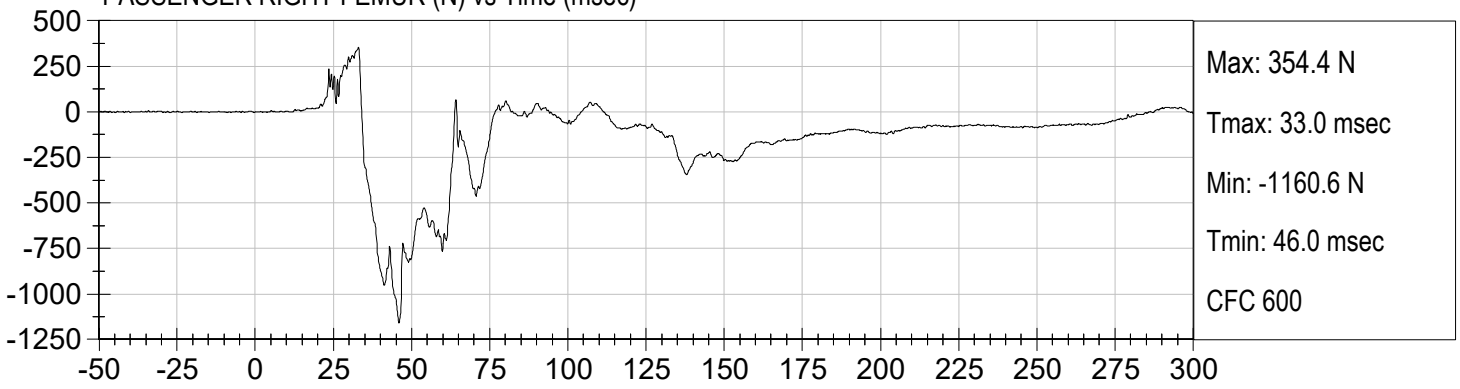

PASSENGER Nij (NCF) () vs Time (msec)
0.2
0.175
0.15
0.125
0.1
0.075
0.05
0.025
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.20
Tmax: 164.4 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600


PASSENGER Nij (NCE) () vs Time (msec)
0.25
0.2
0.15
0.1
0.05
0
-50 -25 0 25 50 75 100 125 150 175 200 225 250 275 300
Max: 0.23
Tmax: 222.4 msec
Min: 0.00
Tmin: 0.0 msec
CFC 600

PASSENGER LEFT FEMUR (N) vs Time (msec)



PASSENGER RIGHT FEMUR (N) vs Time (msec)



APPENDIX C
DUMMY CALIBRATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

Hybrid III, 50th External Measurements
SN: 351

HYBRID III, PART 572, SUBPART E EXTERNAL DIMENSIONS				
DIMENSION	DESCRIPTION	DETAILS	ASSEMBLY DIMENSION (inches)	ACTUAL MEASUREMENT
A	TOTAL SITTING HEIGHT	Seat surface to highest point on top of the head.	34.6–35.0	34.8
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	19.9-20.5	20.0
C	H-POINT HEIGHT	Reference	3.3-3.5	3.4
D	H-POINT LOCATION FROM BACKLINE	Reference	5.3-5.5	5.5
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	3.3-3.7	3.5
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	5.5-6.1	6.0
G	BACK OF ELBOW TO WRIST PIVOT	back of the elbow flesh to the wrist pivot in line with the elbow and wrist pivots	11.4-12.0	11.8
H	HEAD BACK TO BACKLINE	Back of Skull cap skin to seat rear vertical surface (Reference)	1.6-1.8	1.7
I	SHOULDER TO- ELBOW LENGTH	Measure from the highest point on top of the shoulder clevis to the lowest part of the flesh on the elbow in line with the elbow pivot bolt.	13.0-13.6	13.3
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	7.5-8.3	7.8
K	BUTTOCK TO KNEE LENGTH	The forward most part of the knee flesh to the rear vertical surface of the fixture.	22.8-23.8	23.8
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	16.9-17.9	17.0
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	19.1-19.7	19.5
N	BUTTOCK POPLITEAL LENGTH	The rearmost surface of the lower leg to the same point on the rear surface of the buttocks used for dim. “K”.	17.8-18.8	18.8

HYBRID III, SUBPART E EXTERIOR DIMENSIONS, continued				
DIMENSION	DESCRIPTION	DETAILS		ACTUAL MEASUREMENT
O	CHEST DEPTH WITHOUT JACKET	Measured 16.9-17.1 in. above seat surface	8.4-9.0	8.5
P	FOOT LENGTH	Tip of toe to rear of heel	9.9-10.5	10.3
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	16.3-17.2	16.5
W	FOOT BREADTH	The widest part of the foot	3.6-4.2	4.0
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 16.9-17.1 in. above seat surface	38.2-39.4	39.2
Z	WAIST CIRCUMFERENCE	Measured 8.9-9.1 in. above seat surface	32.9-34.1	33.7
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	16.9-17.1	17.0
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	8.9-9.1	9.0

NOTE: THE H-POINT IS LOCATED 1.83 INCHES FORWARD AND 2.57 INCHES DOWN FROM THE CENTER OF THE PELVIS ANGLE REFERENCE HOLE.

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D182981

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	225 to 275	274	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

Jacob D Taylor
Laboratory Technician

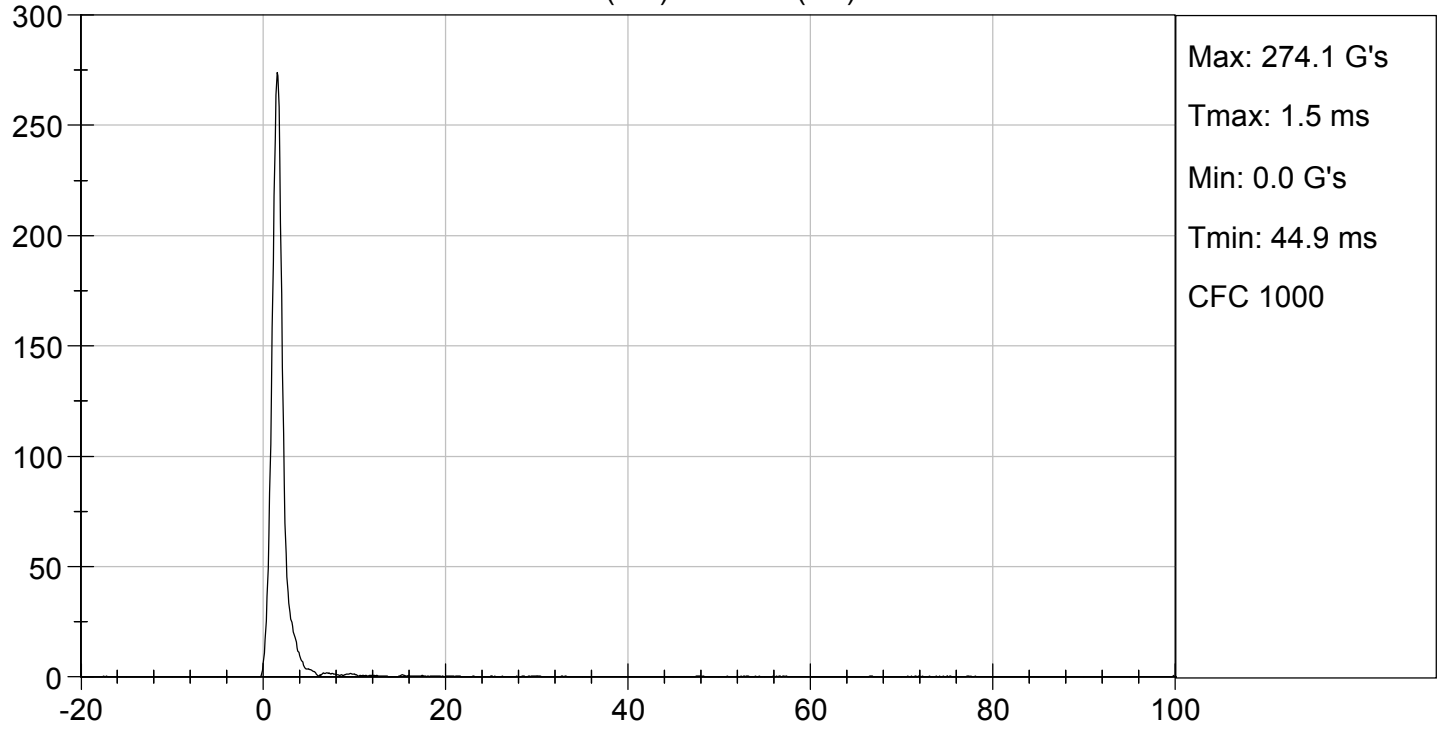
10/02/2018
Test Date

Approved By

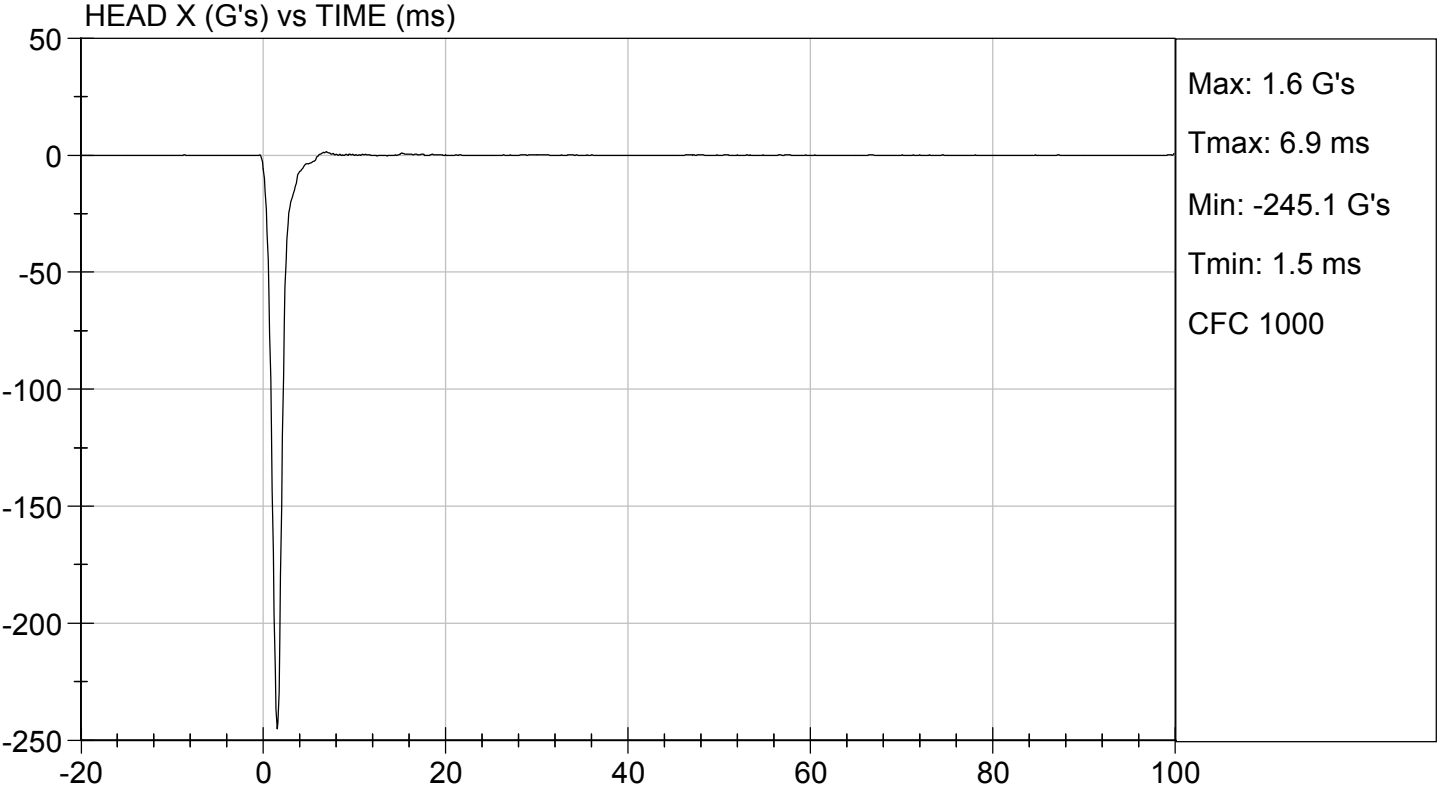
TEST DESC: HEAD DROP

TEST DATE: 10/02/2018
TEST #: D182981

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

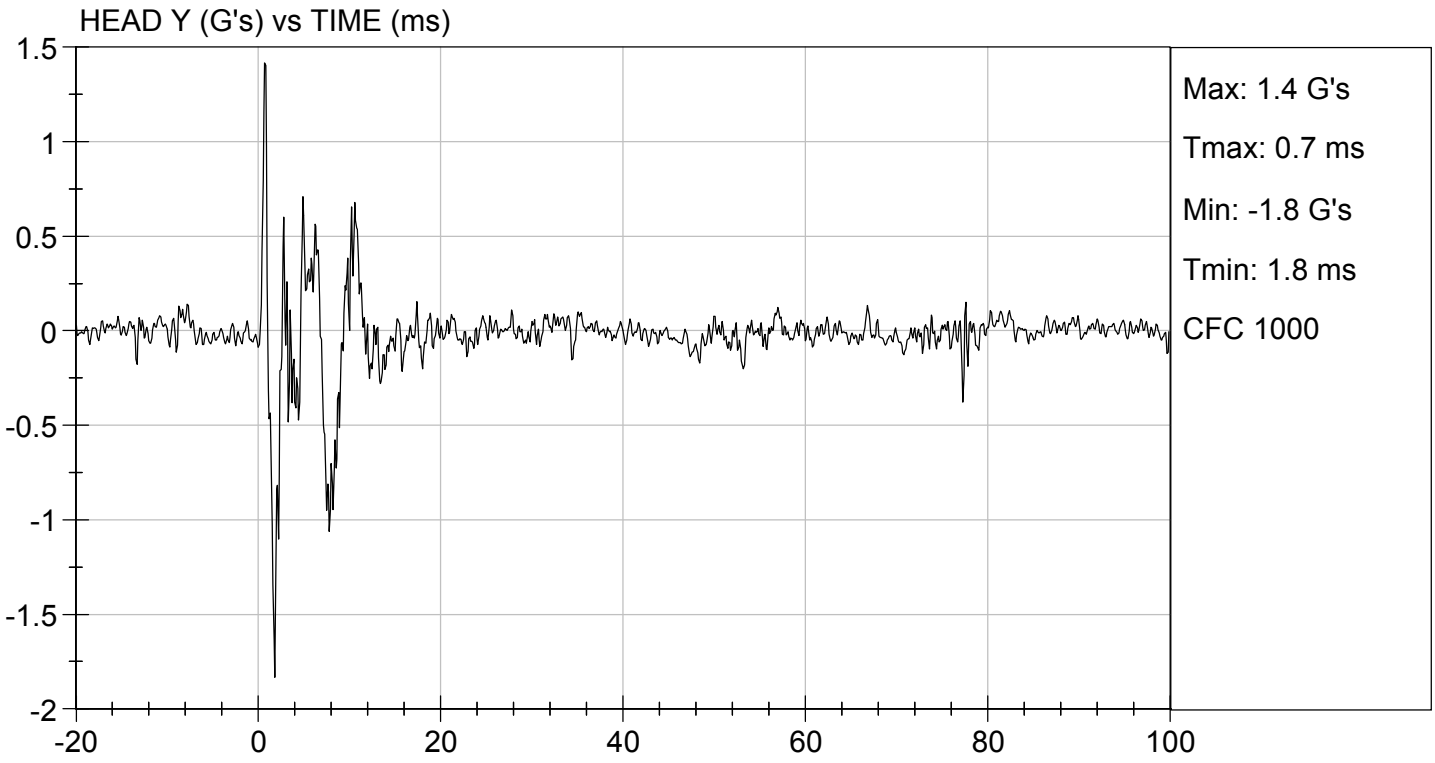


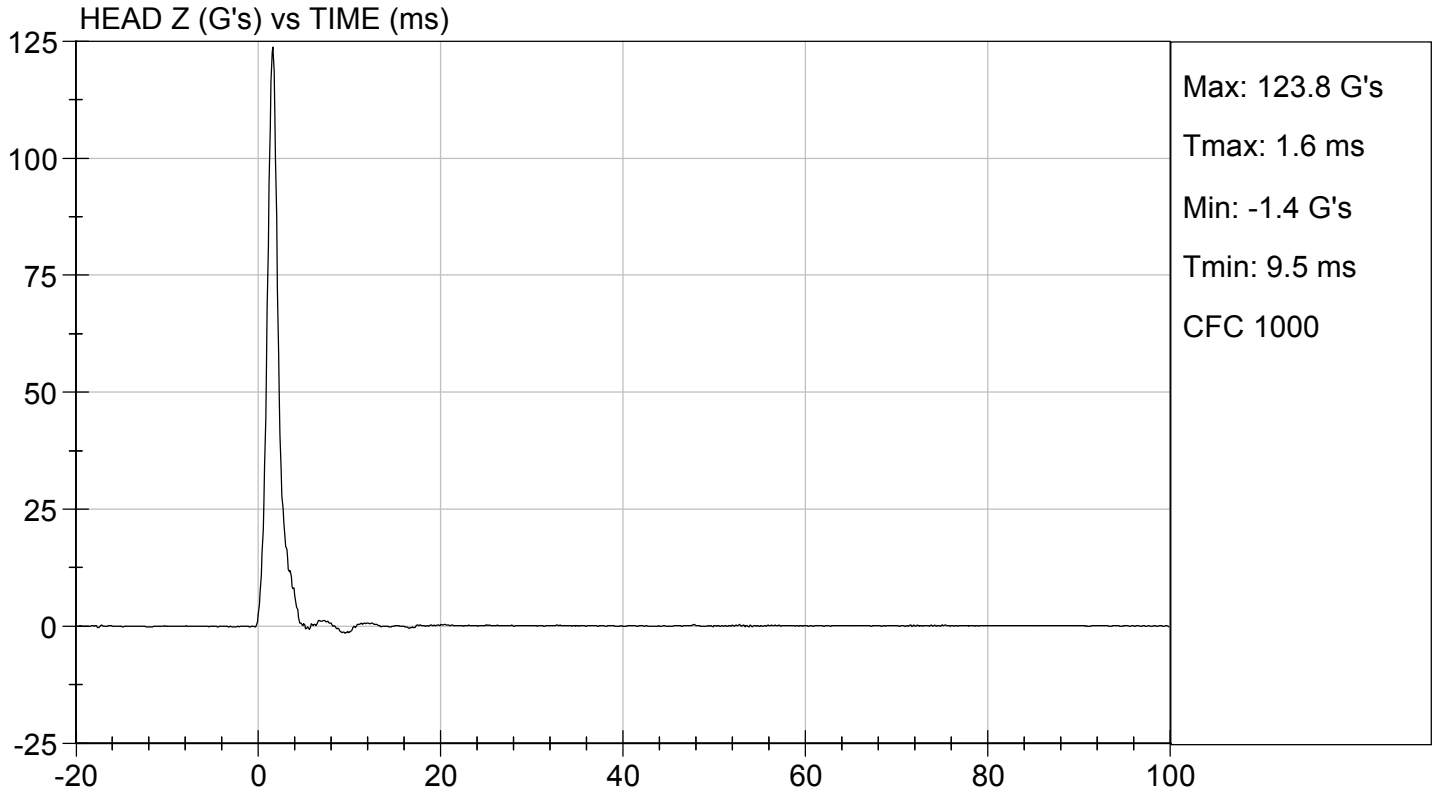
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 10/02/2018
TEST #: D182981





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D182982

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.98	Pass
	20 ms	G's	17.60 to 22.60	21.05	Pass
	30 ms	G's	12.50 to 18.50	13.54	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	13.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	38.0	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	76.5	Pass
	Time	ms	57.0 to 64.0	60.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	122.0	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	89.7	Pass
	Time	ms	47.0 to 58.0	51.8	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.6	Pass
			Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

10/03/2018

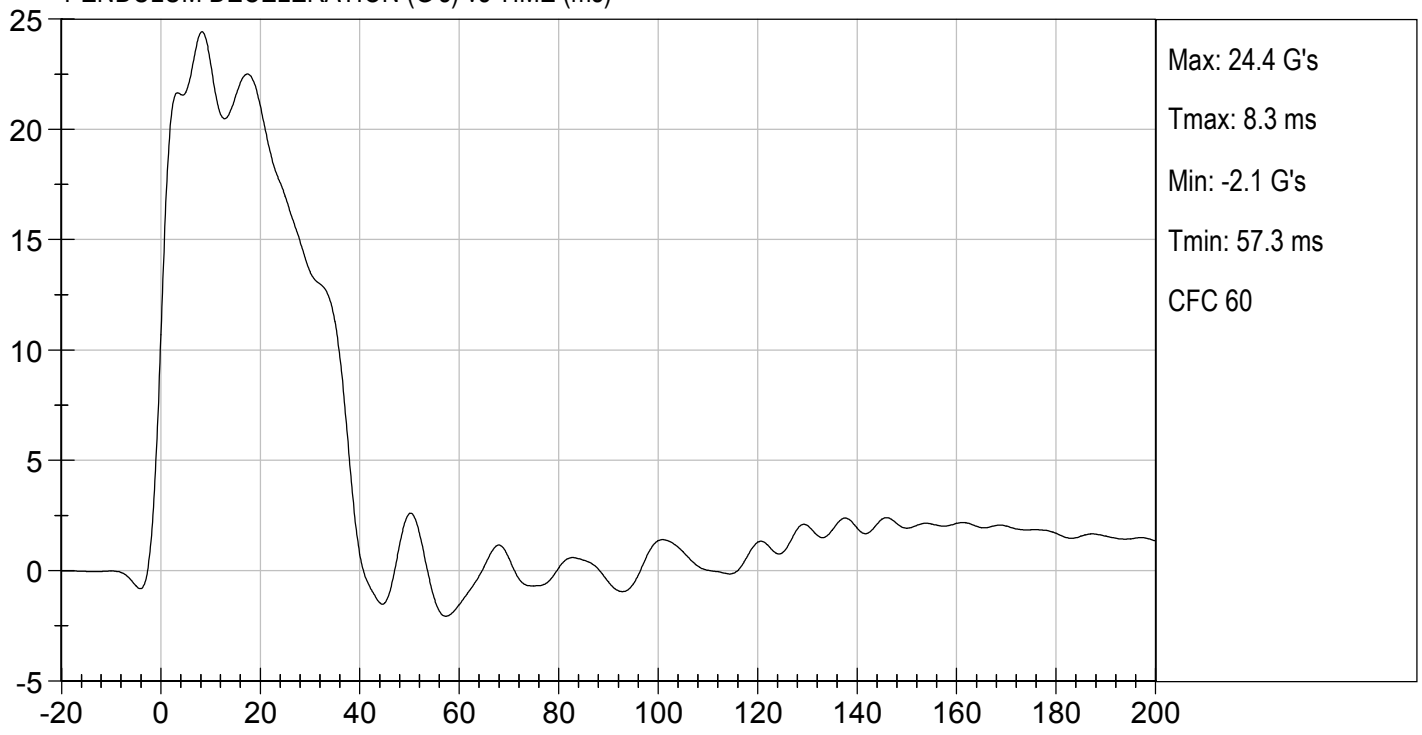
Test Date

Approved By

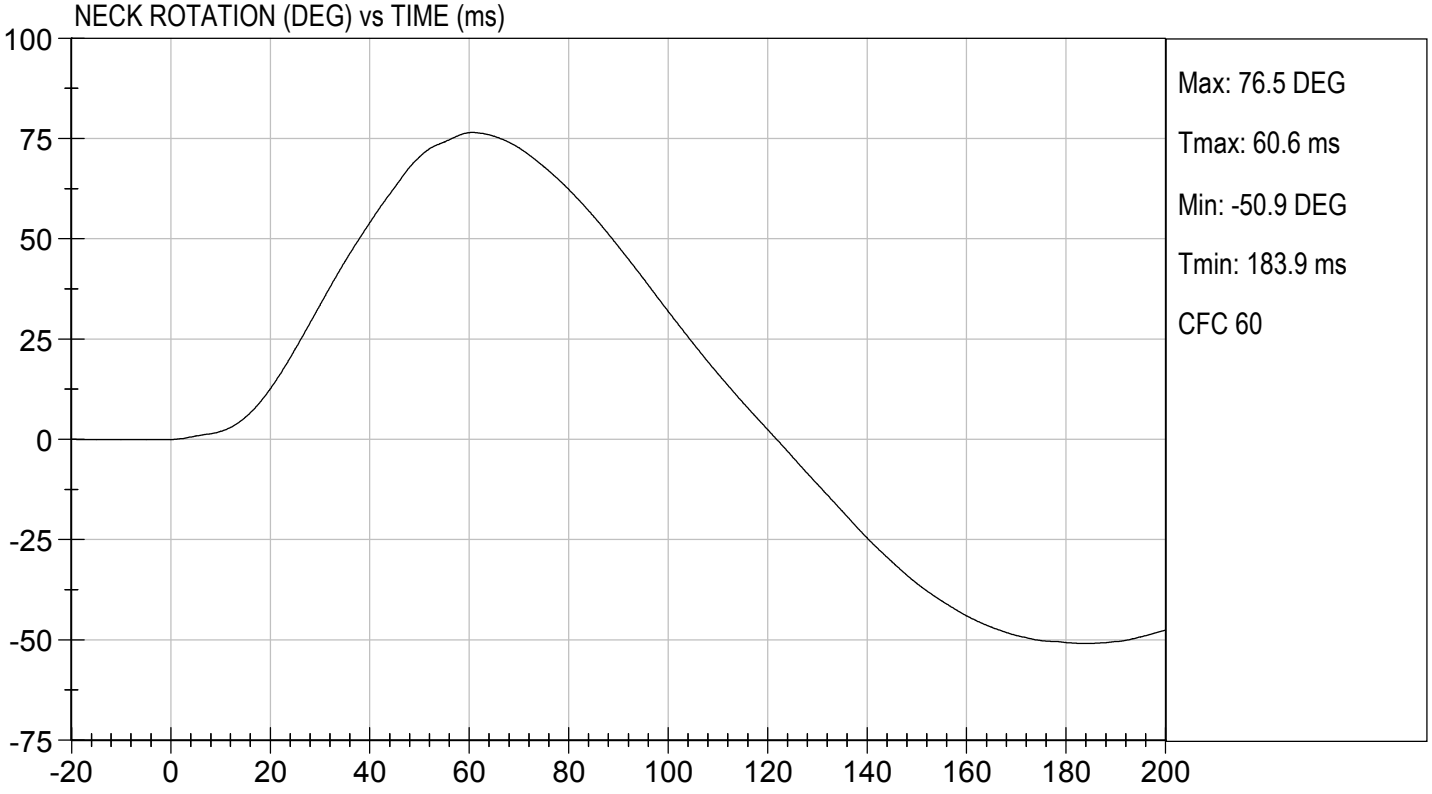
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 10/03/2018
TEST #: D182982

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

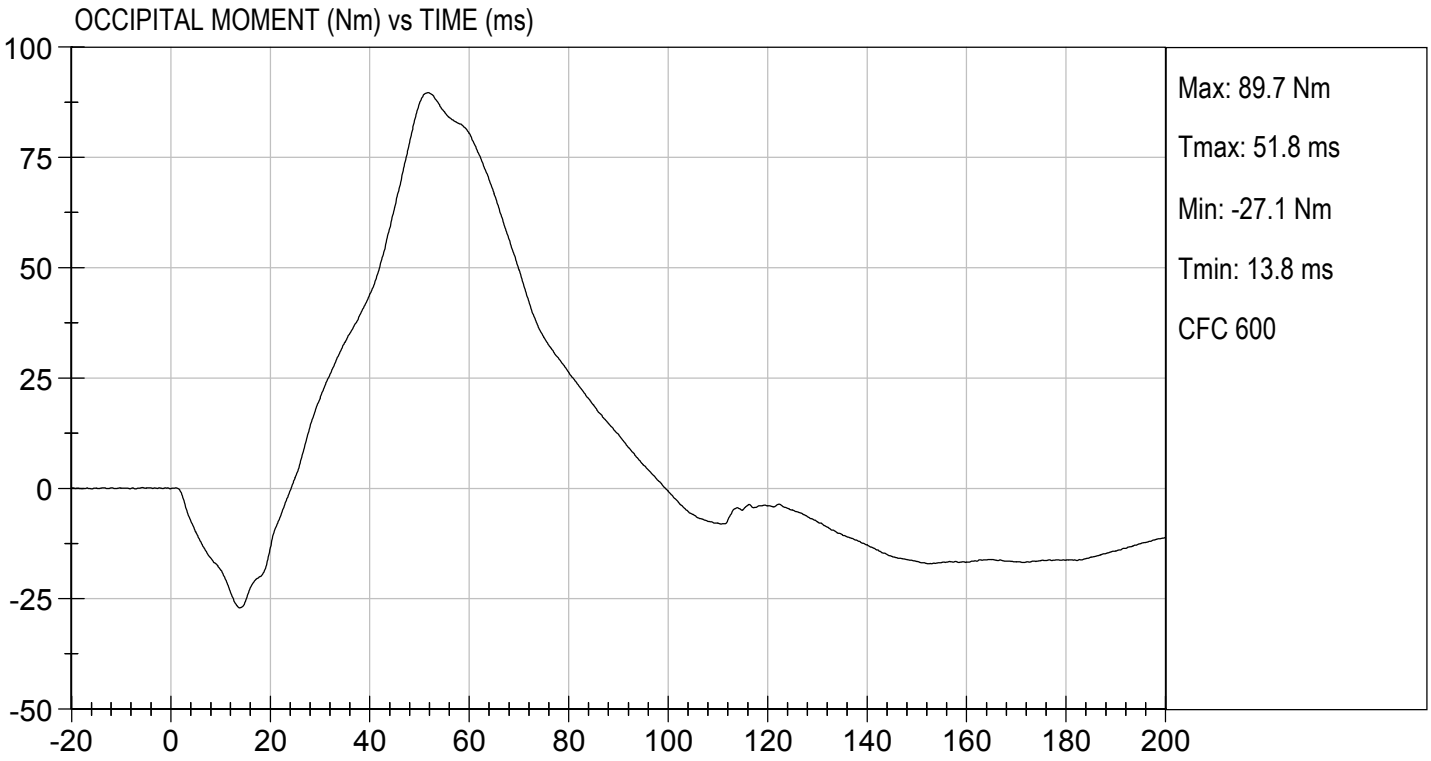


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/03/2018
TEST #: D182982



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D182983

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	20.9	Pass
Laboratory Relative Humidity		%	10 to 70	48	Pass
Pendulum Velocity		m/s	5.95 to 6.19	5.98	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.25	Pass
	20 ms	G's	14.00 to 19.00	16.92	Pass
	30 ms	G's	11.00 to 16.00	12.77	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	14.2	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	38.7	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	103.2	Pass
	Time	ms	72.0 to 82.0	80.6	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	167.8	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-60.7	Pass
	Time	ms	65.0 to 79.0	73.8	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	148.0	Pass
			Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

10/03/2018

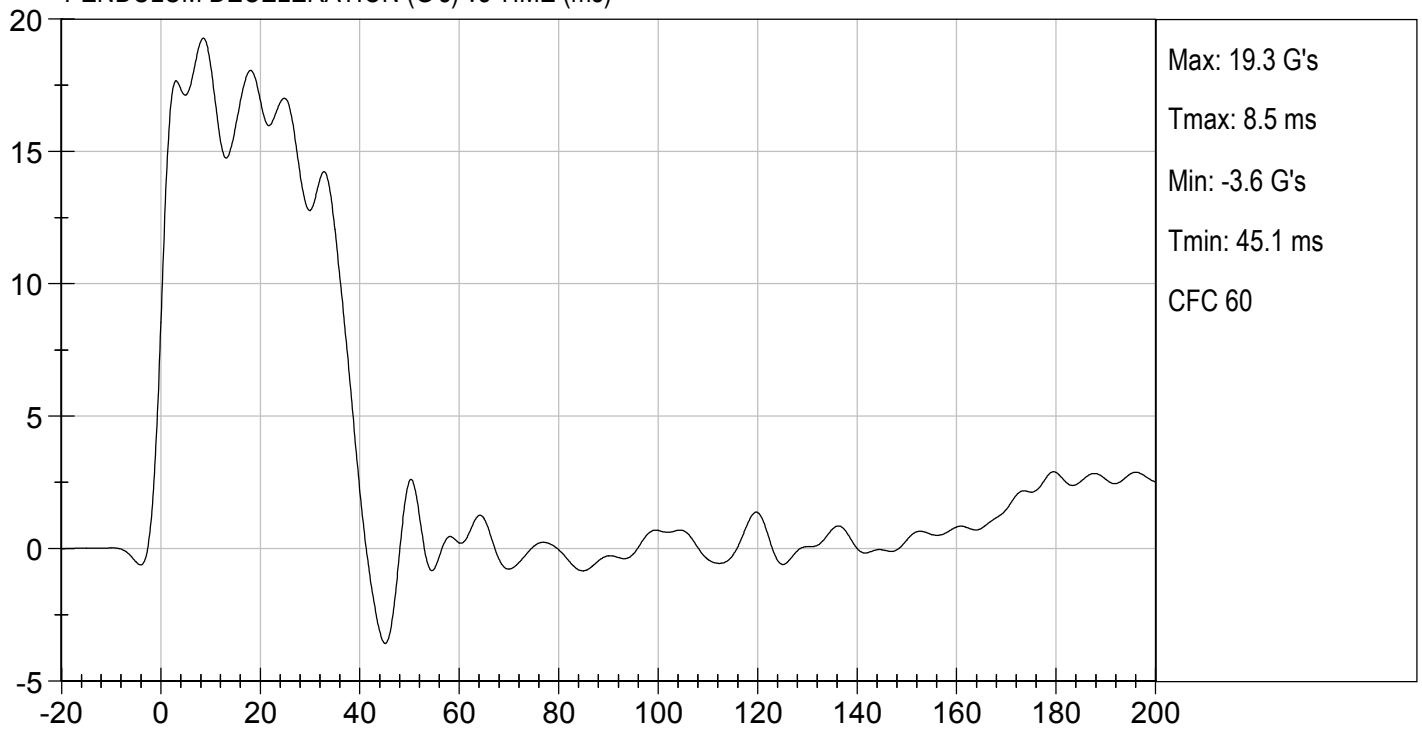
Test Date

Approved By

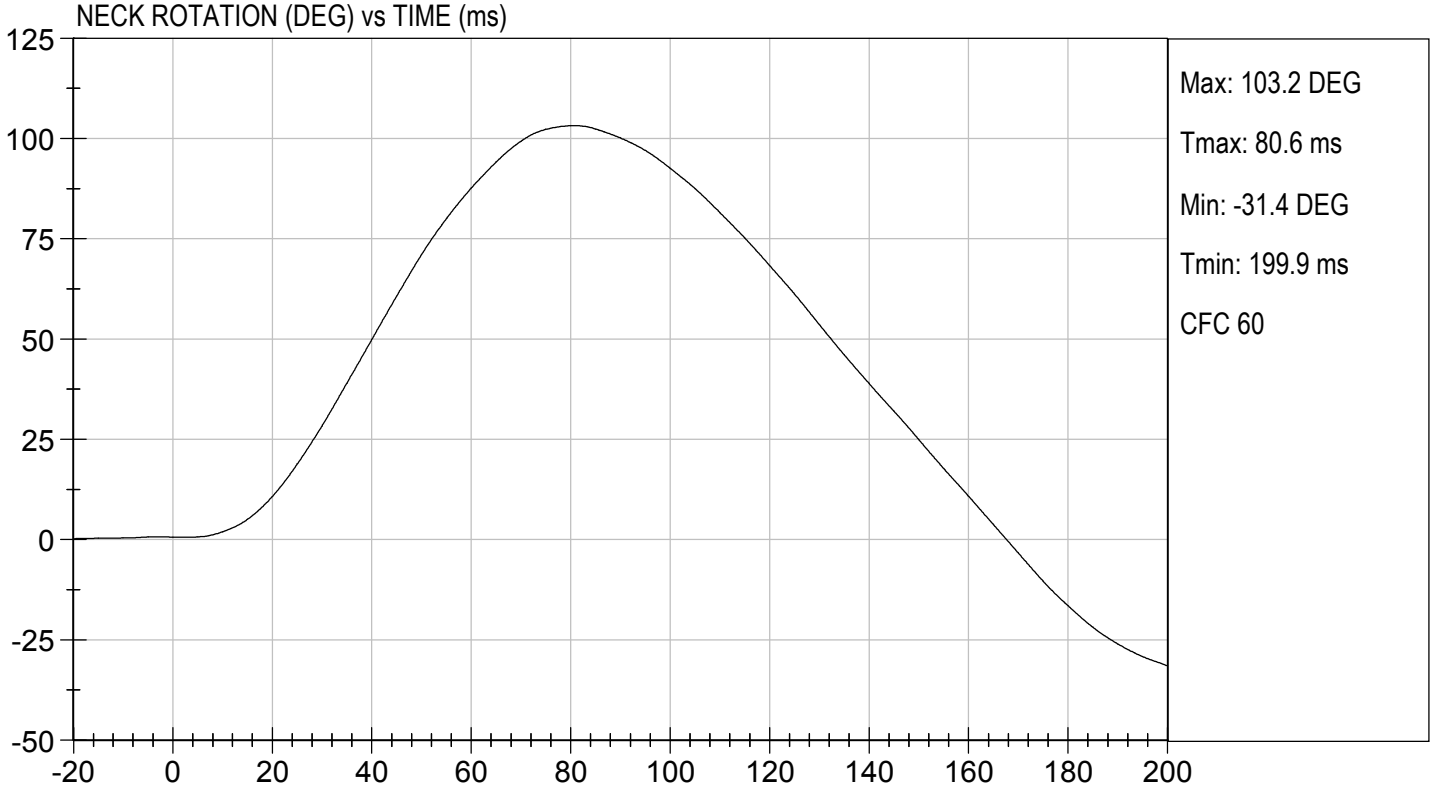
TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 10/03/2018
TEST #: D182983

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



NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 10/03/2018
TEST #: D182983

MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D182984

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22.0	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,475	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.81	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

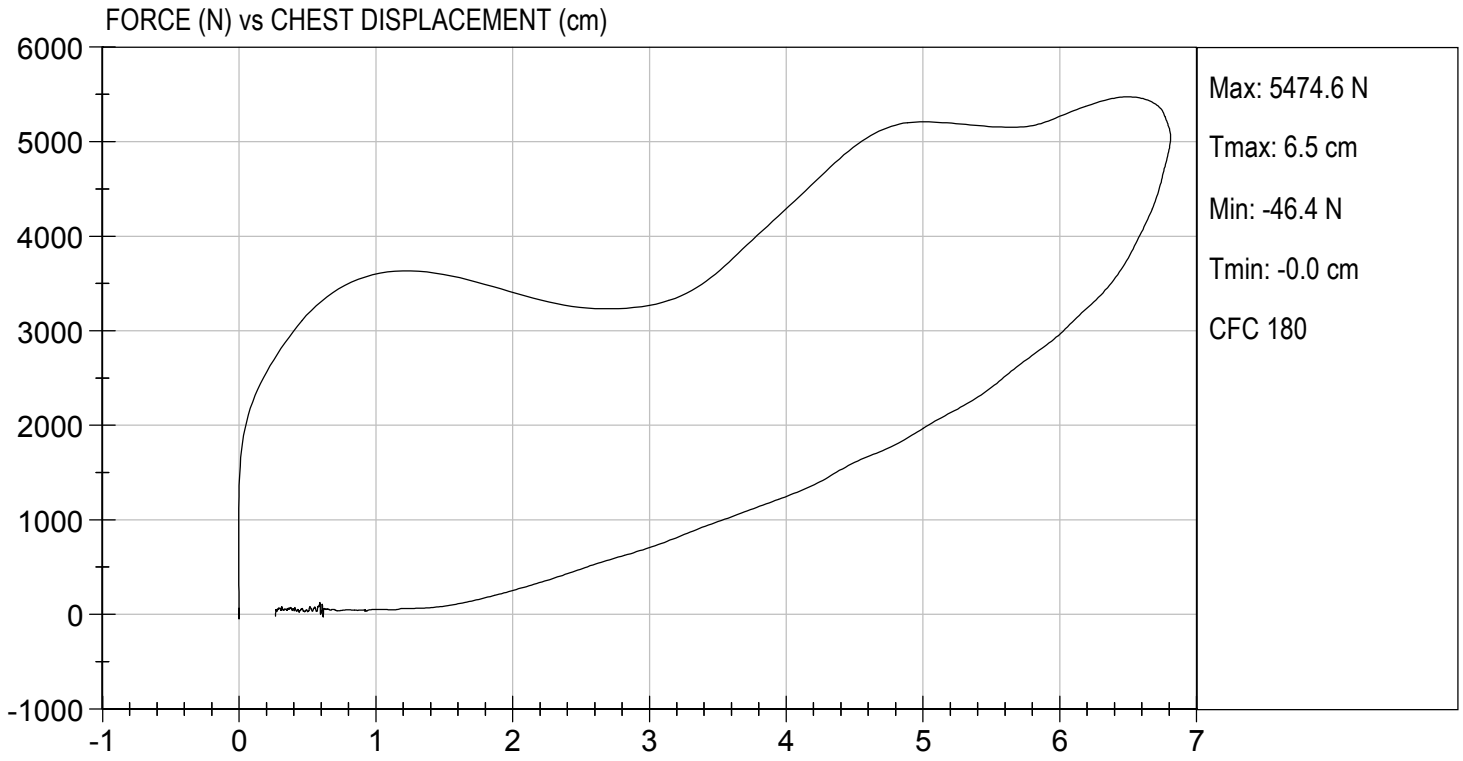
Jacob D Taylor
Laboratory Technician

10/02/2018
Test Date

Approved By

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

TEST DATE: 10/02/2018
TEST #: D182984



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D182985

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	4,750	Pass
		Overall Test Results		Pass

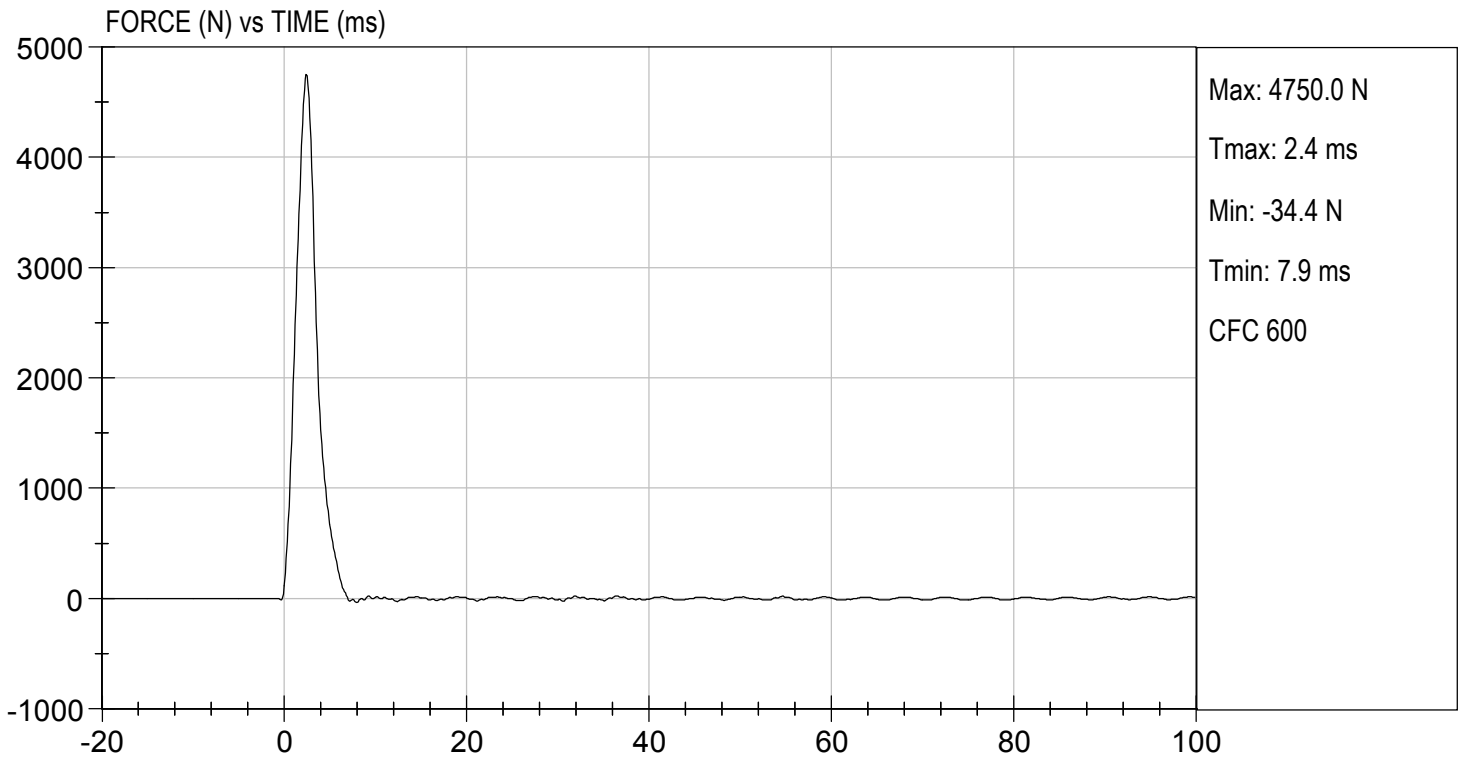
Danielle Redinbaugh
Laboratory Technician

10/03/2018
Test Date

Approved By

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

TEST DATE: 10/03/2018
TEST #: D182985



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D182986

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Probe Velocity	m/s	2.07 to 2.13	2.09	Pass
Peak Probe Force	N	4715 to 5782	4,968	Pass
		Overall Test Results		Pass

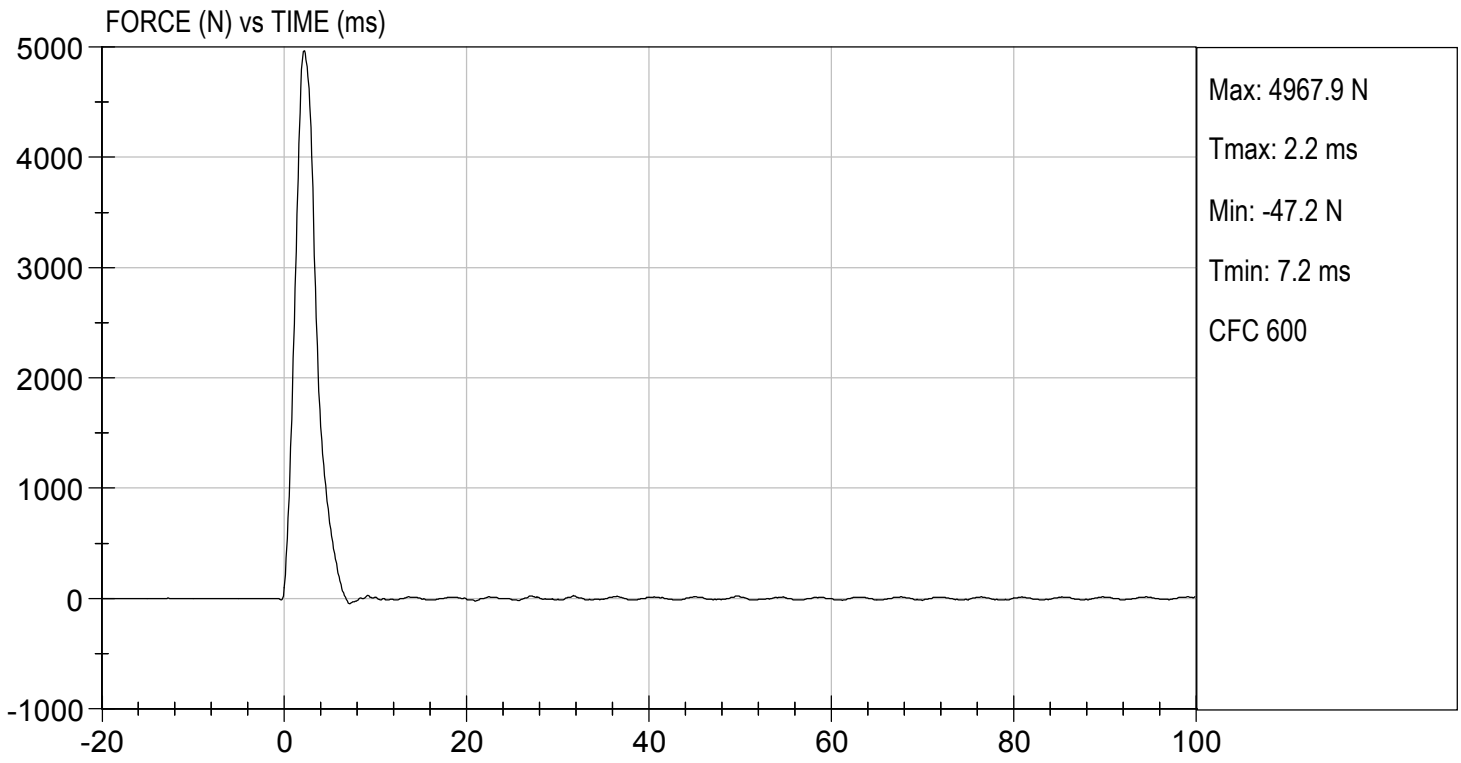
Danielle Redinbaugh
Laboratory Technician

10/03/2018
Test Date

Approved By

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

TEST DATE: 10/03/2018
TEST #: D182986



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D182980

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	22	22	Pass
Laboratory Relative Humidity	%	10 to 70	50	50	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.5	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	92.3	88.1	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	46.7	44.5	Pass
		Overall Test Results			Pass

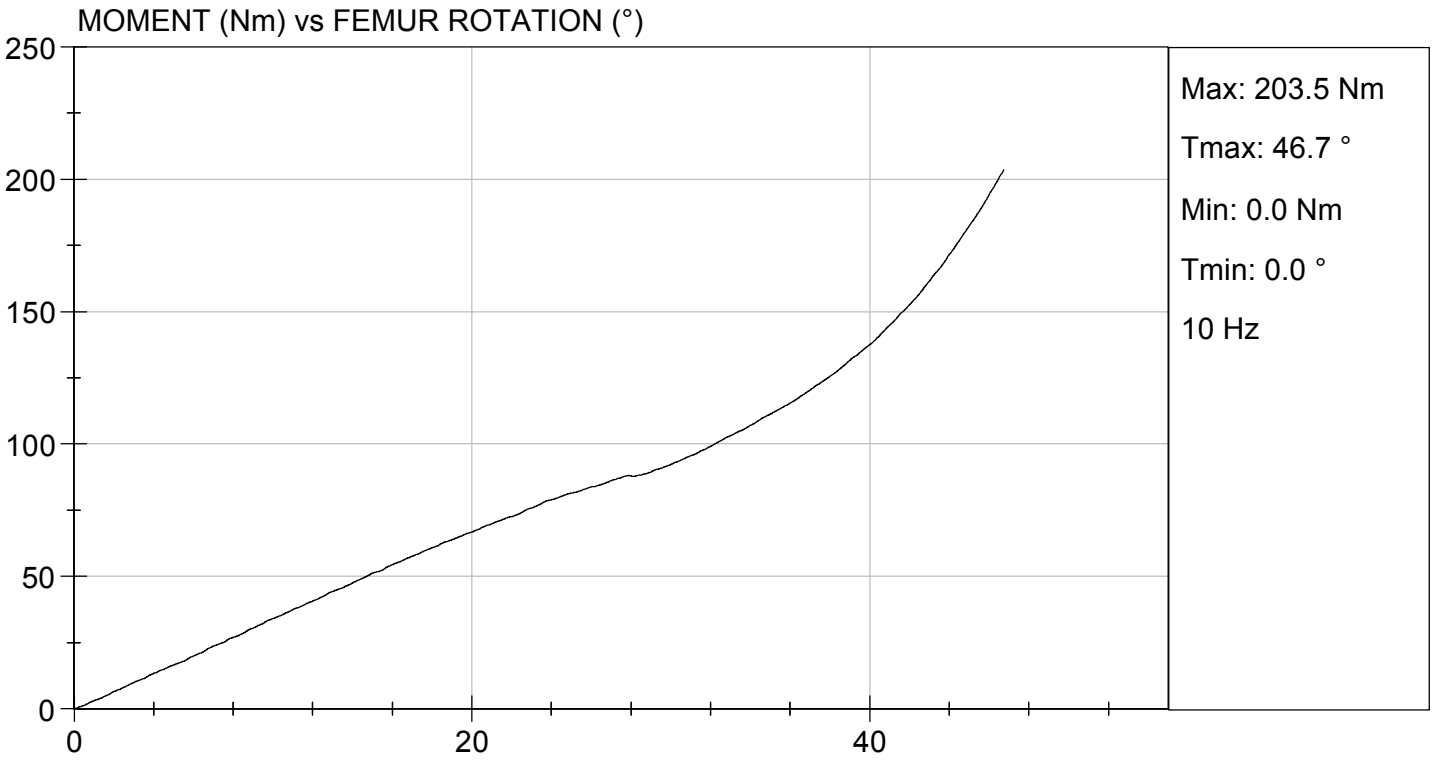
Danielle Redinbaugh
Laboratory Technician

10/03/2018
Test Date

Approved By

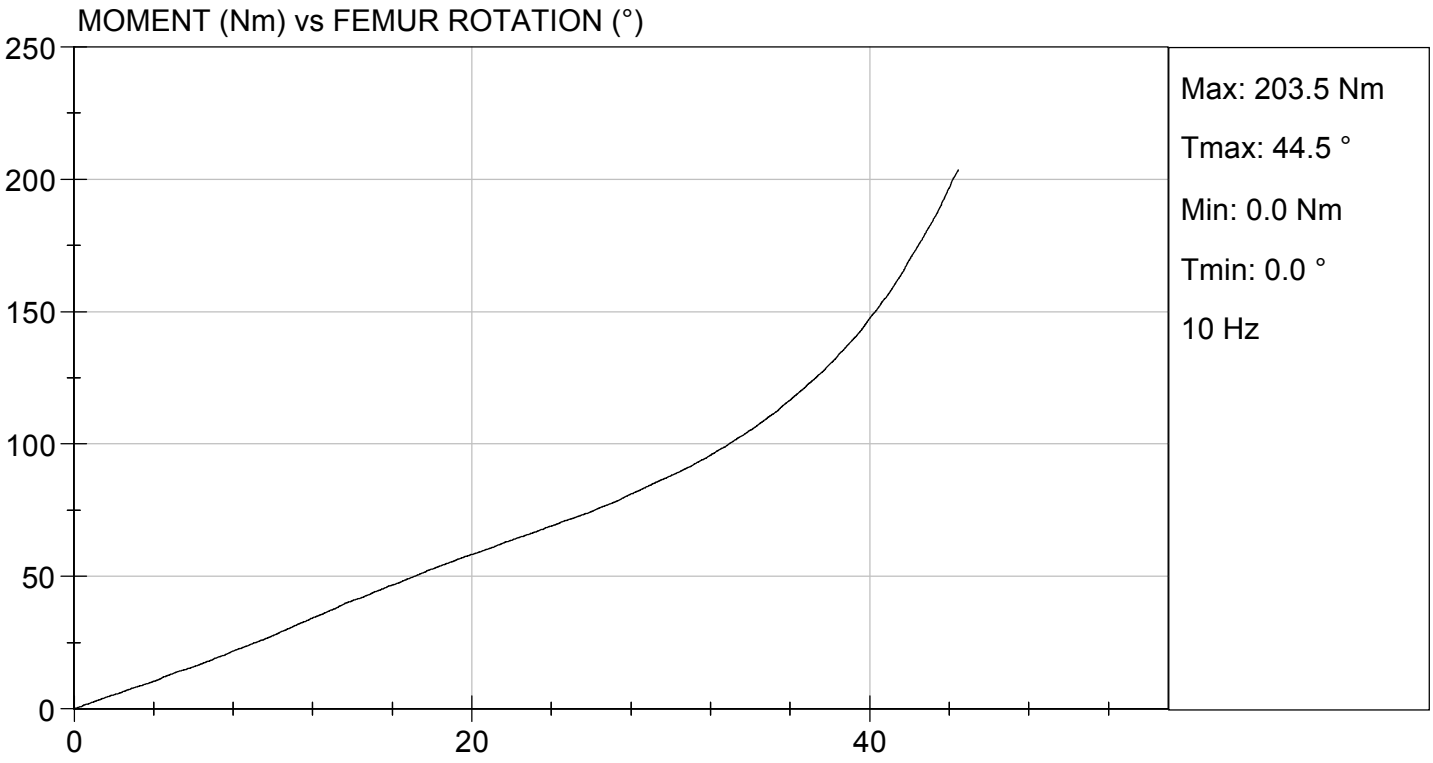
TEST DESC: RIGHT HIP FEMUR FLEXION

TEST DATE: 10/03/2018
TEST #: D182989



TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 10/03/2018
TEST #: D182980



CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 50TH PERCENTILE MALE - DRIVER ATD

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test ID:** D183021

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	225 to 275	273	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

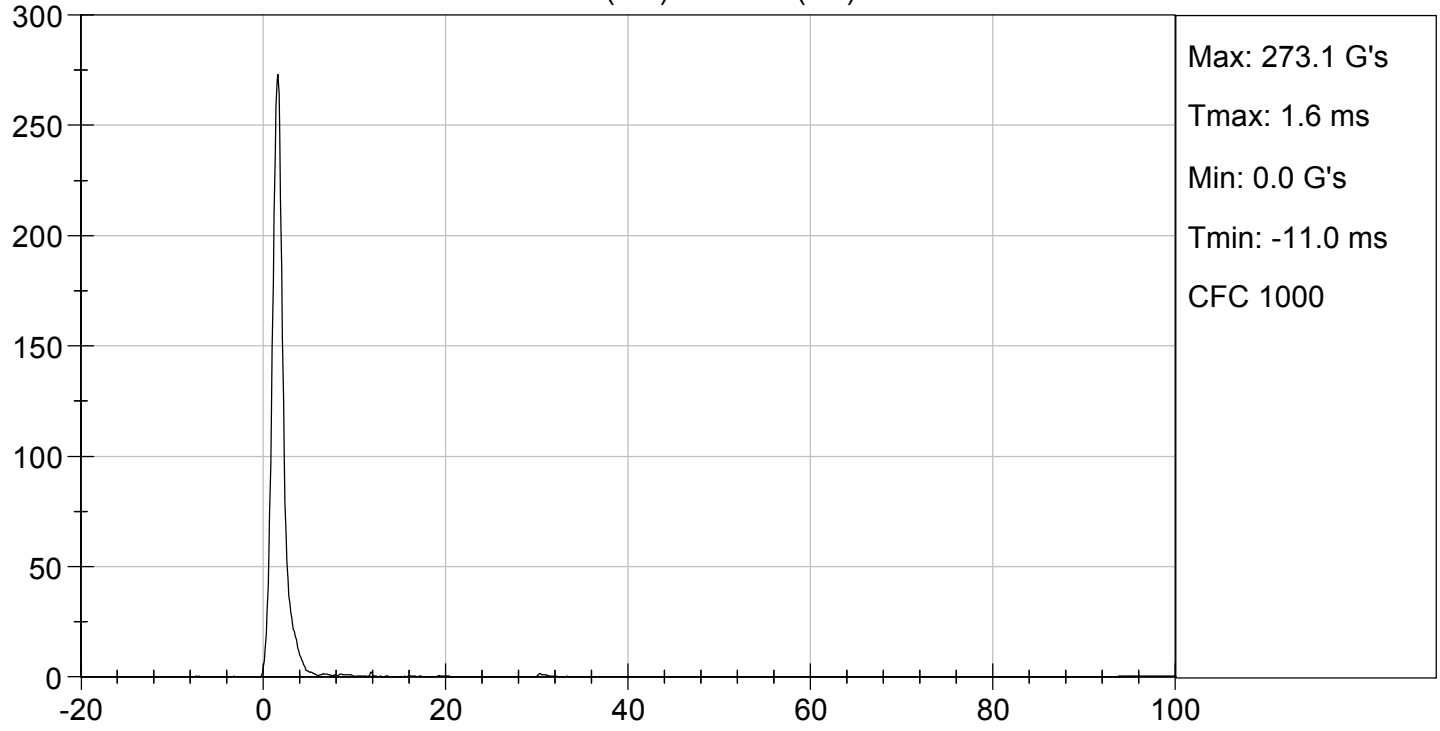
10/08/2018
Test Date

Approved By

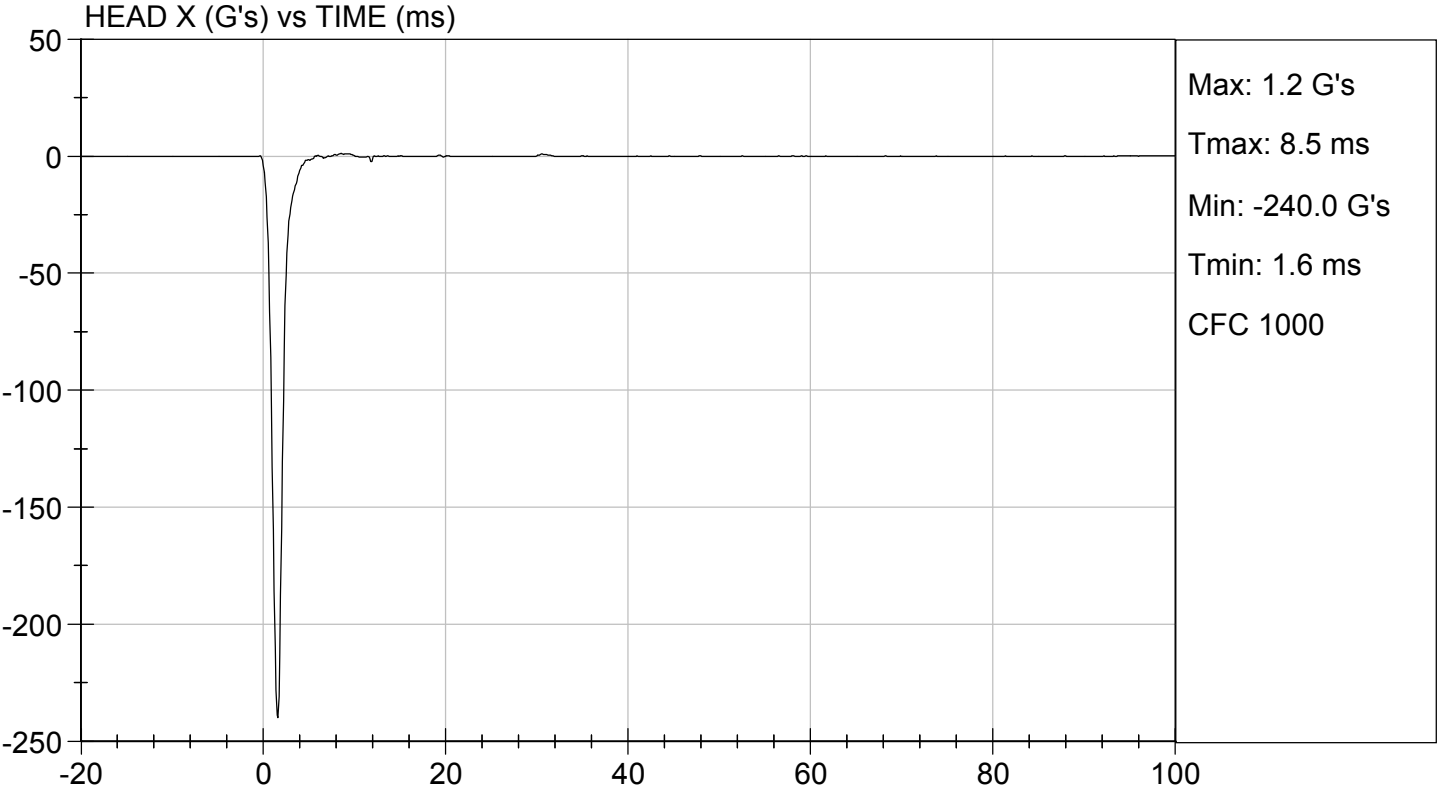
TEST DESC: HEAD DROP

TEST DATE: 10/08/2018
TEST #: D183021

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

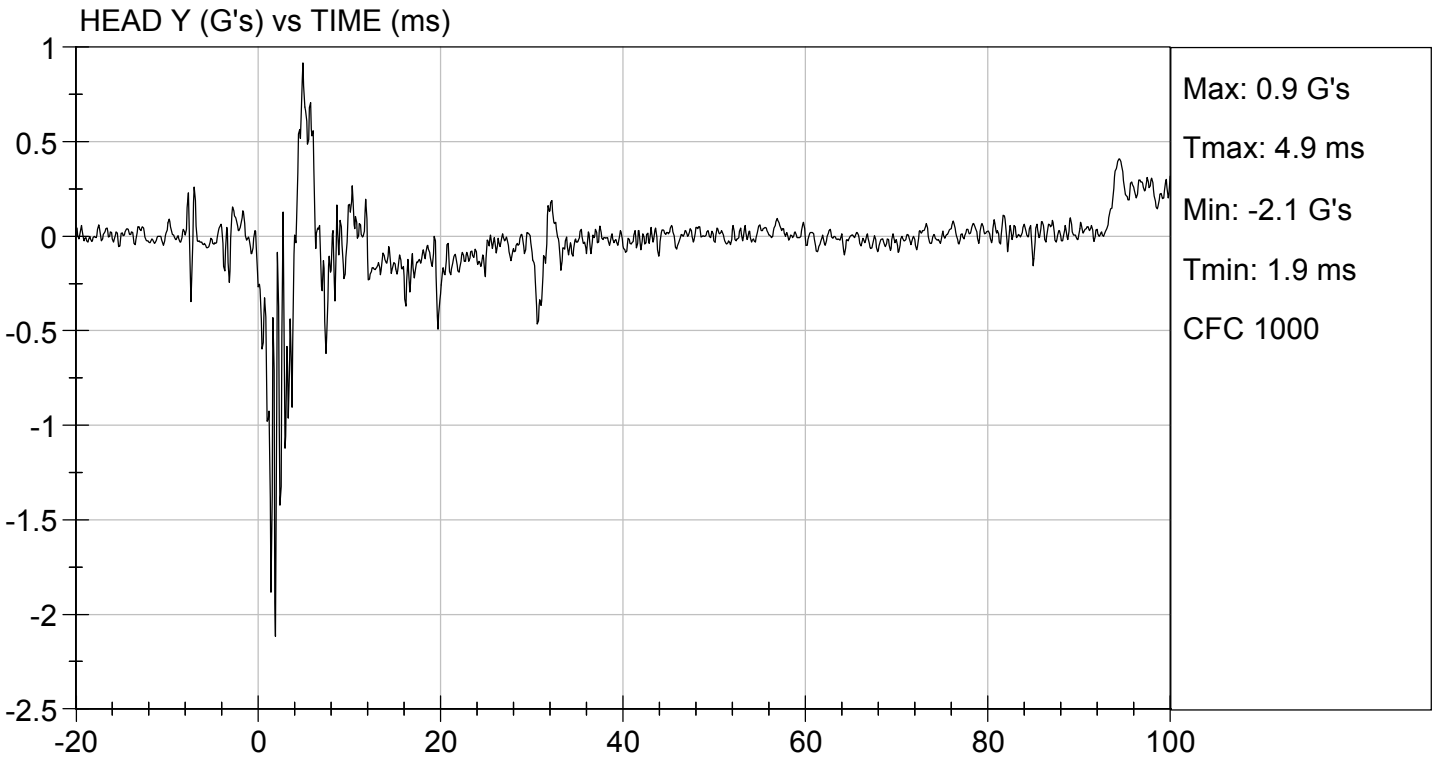


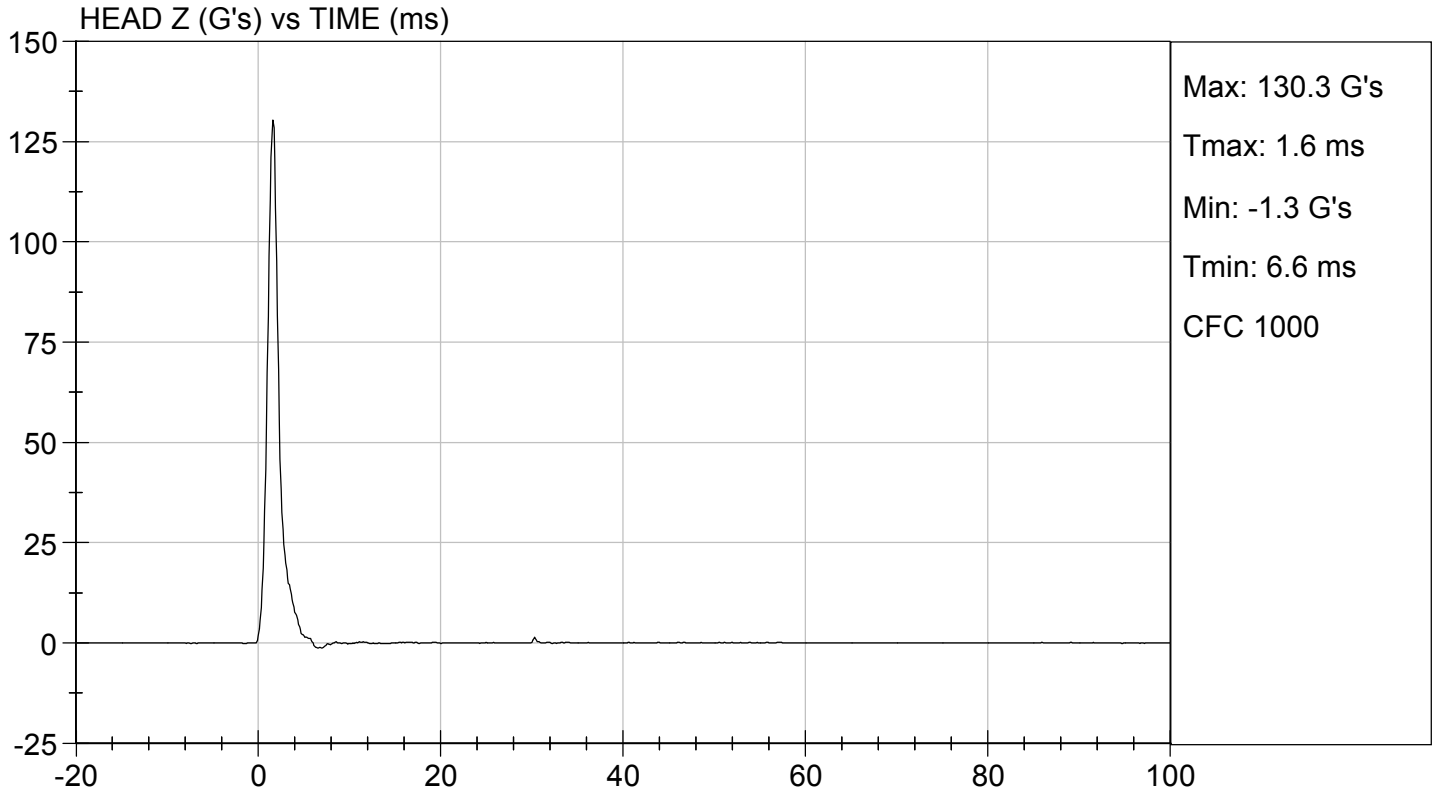
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 10/08/2018
TEST #: D183021





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D183022

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	45	Pass
Pendulum Velocity		m/s	6.89 to 7.13	6.96	Pass
Pendulum Deceleration	10 ms	G's	22.50 to 27.50	22.95	Pass
	20 ms	G's	17.60 to 22.60	20.97	Pass
	30 ms	G's	12.50 to 18.50	14.75	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 29.0	14.8	Pass
Deceleration Decay Time to Cross 5 G's		ms	34.0 to 42.0	36.5	Pass
Maximum "D" Plane Rotation	Maximum	Deg	64.0 to 78.0	74.3	Pass
	Time	ms	57.0 to 64.0	59.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	113.0 to 128.0	120.8	Pass
Moment About Occipital Condyle	Maximum	Nm	88.1 to 108.5	94.5	Pass
	Time	ms	47.0 to 58.0	49.9	Pass
Positive Moment Decay Time To Zero Crossing		ms	97.0 to 107.0	99.1	Pass
			Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

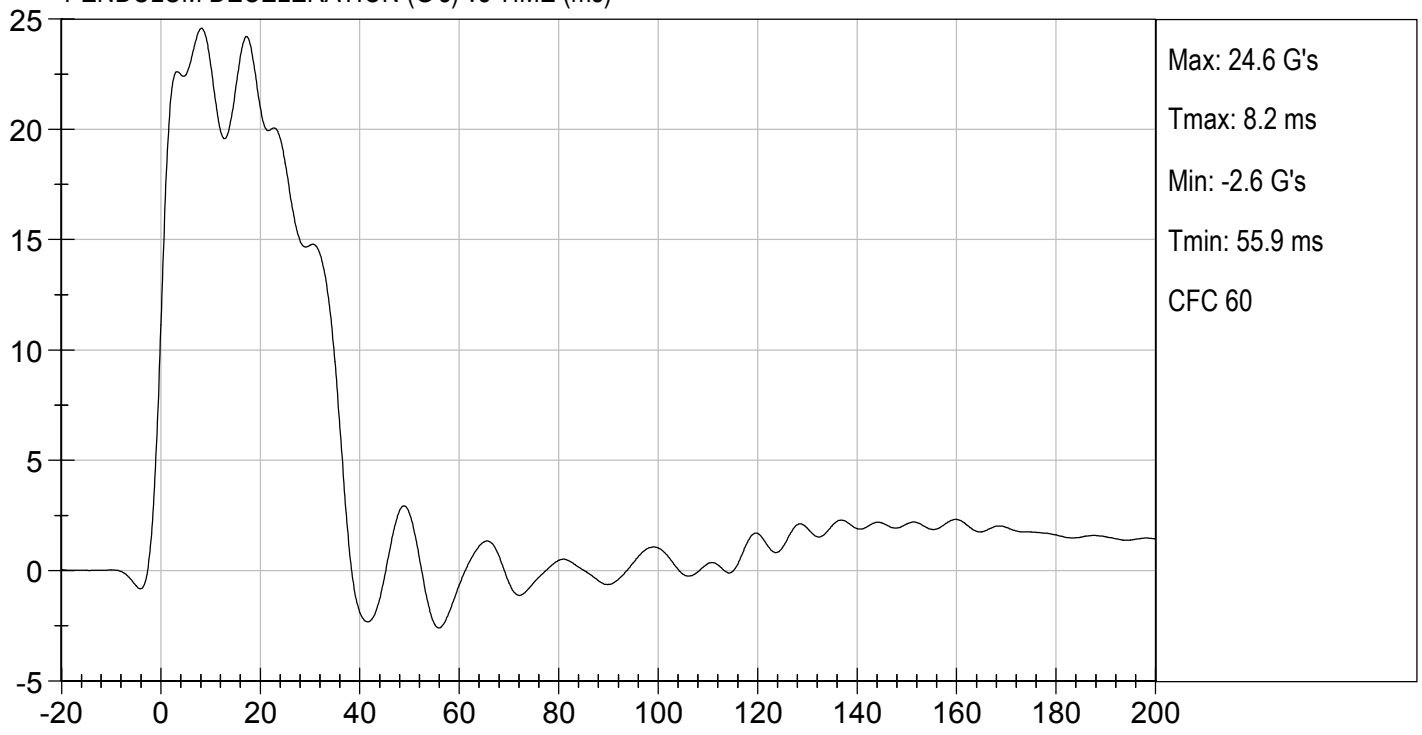
10/08/2018
Test Date

Approved By

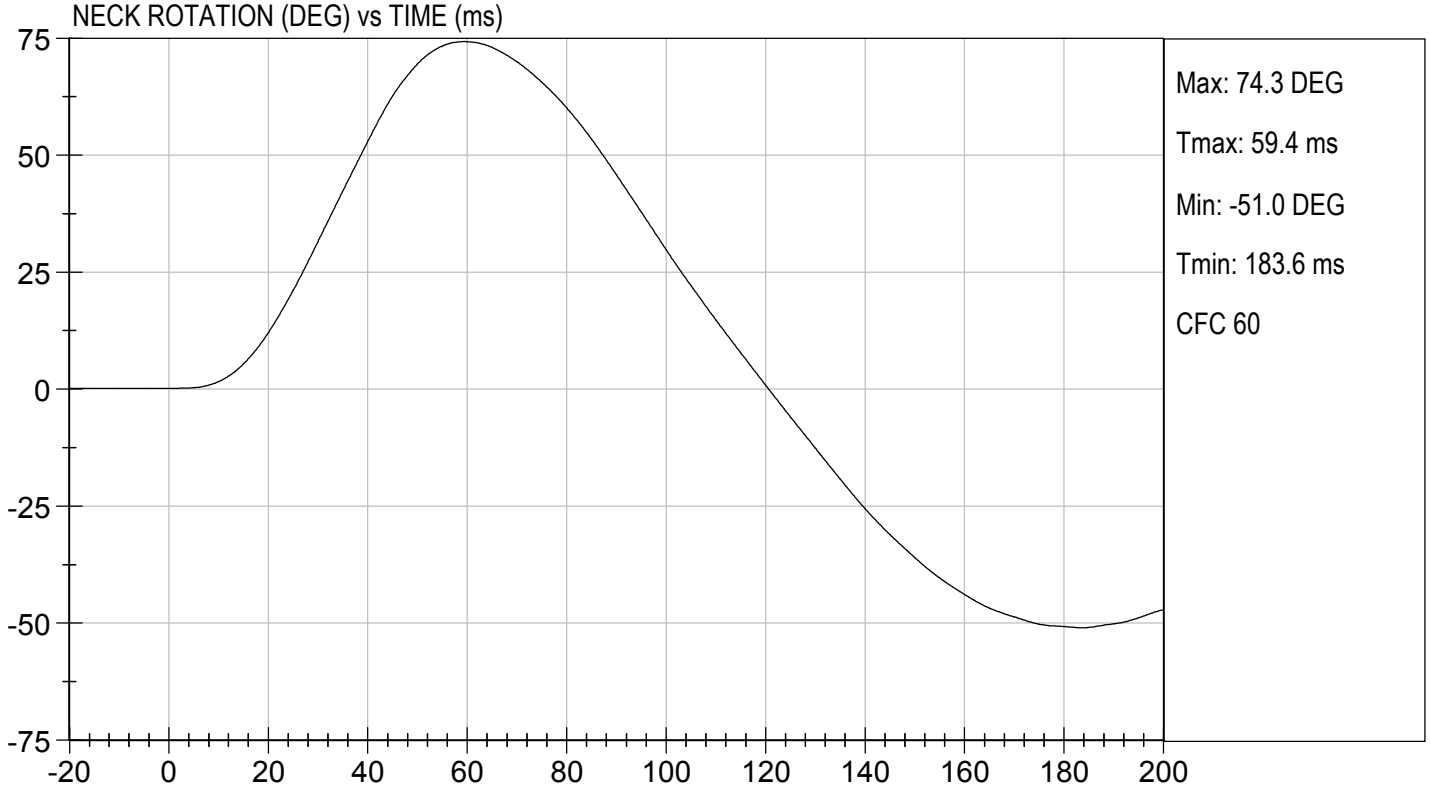
TEST DESC: NECK FLEXION
VELOCITY: 22.83 ft/s, 6.96 m/s

TEST DATE: 10/08/2018
TEST #: D183022

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

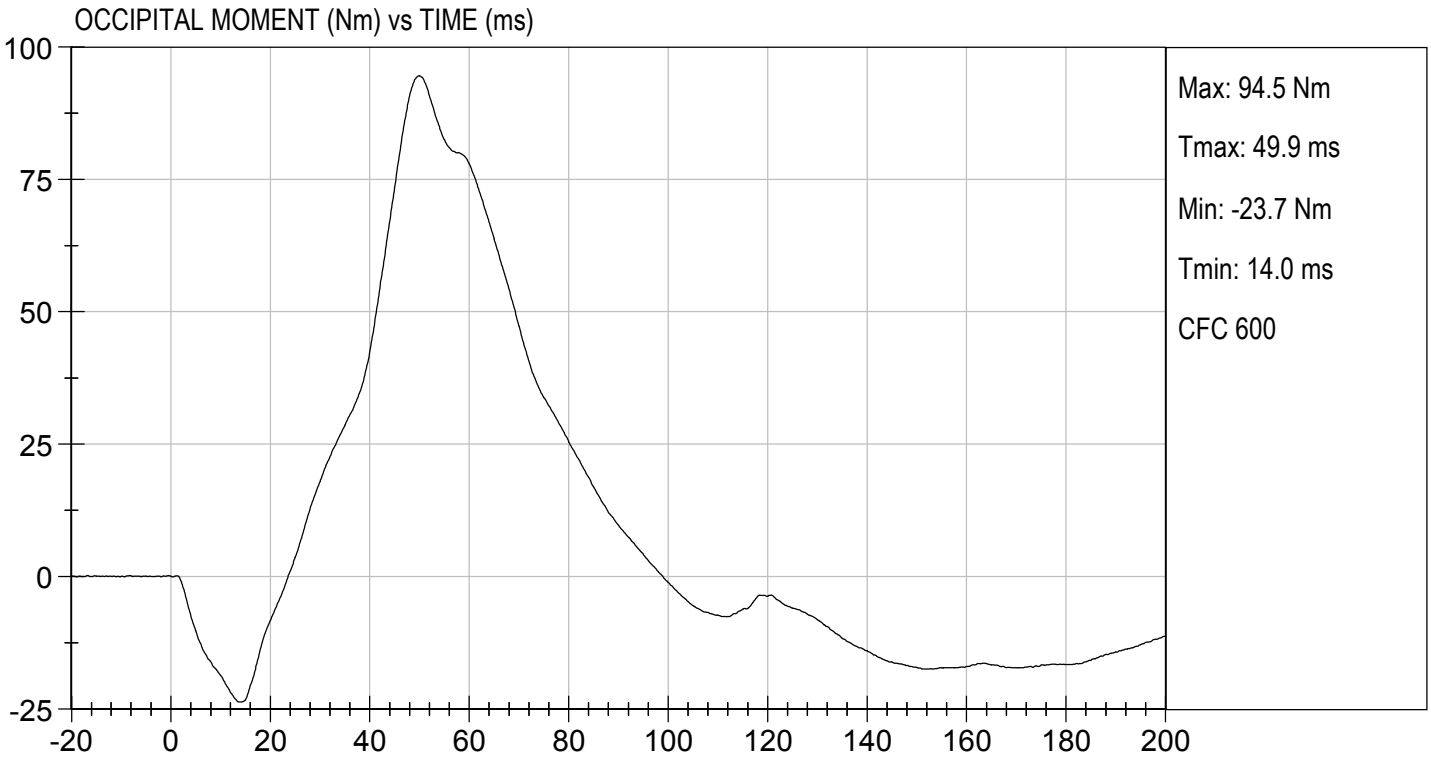


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/08/2018
TEST #: D183022



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D183023

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	45	Pass
Pendulum Velocity		m/s	5.95 to 6.19	6.12	Pass
Pendulum Deceleration	10 ms	G's	17.20 to 21.20	18.89	Pass
	20 ms	G's	14.00 to 19.00	16.58	Pass
	30 ms	G's	11.00 to 16.00	11.69	Pass
Peak Pendulum Deceleration After 30 ms		G's	<= 22.0	13.5	Pass
Deceleration Decay Time to Cross 5 G's		ms	38.0 to 46.0	40.5	Pass
Maximum "D" Plane Rotation	Maximum	Degrees	81.0 to 106.0	102.9	Pass
	Time	ms	72.0 to 82.0	79.4	Pass
"D" Plane Rotation Decay Time To Zero Crossing		ms	147.0 to 174.0	165.3	Pass
Moment About Occipital Condyle	Maximum	Nm	-52.9 to -79.9	-63.6	Pass
	Time	ms	65.0 to 79.0	72.6	Pass
Negative Moment Decay Time To Zero Crossing		ms	120.0 to 148.0	144.9	Pass
			Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

10/08/2018

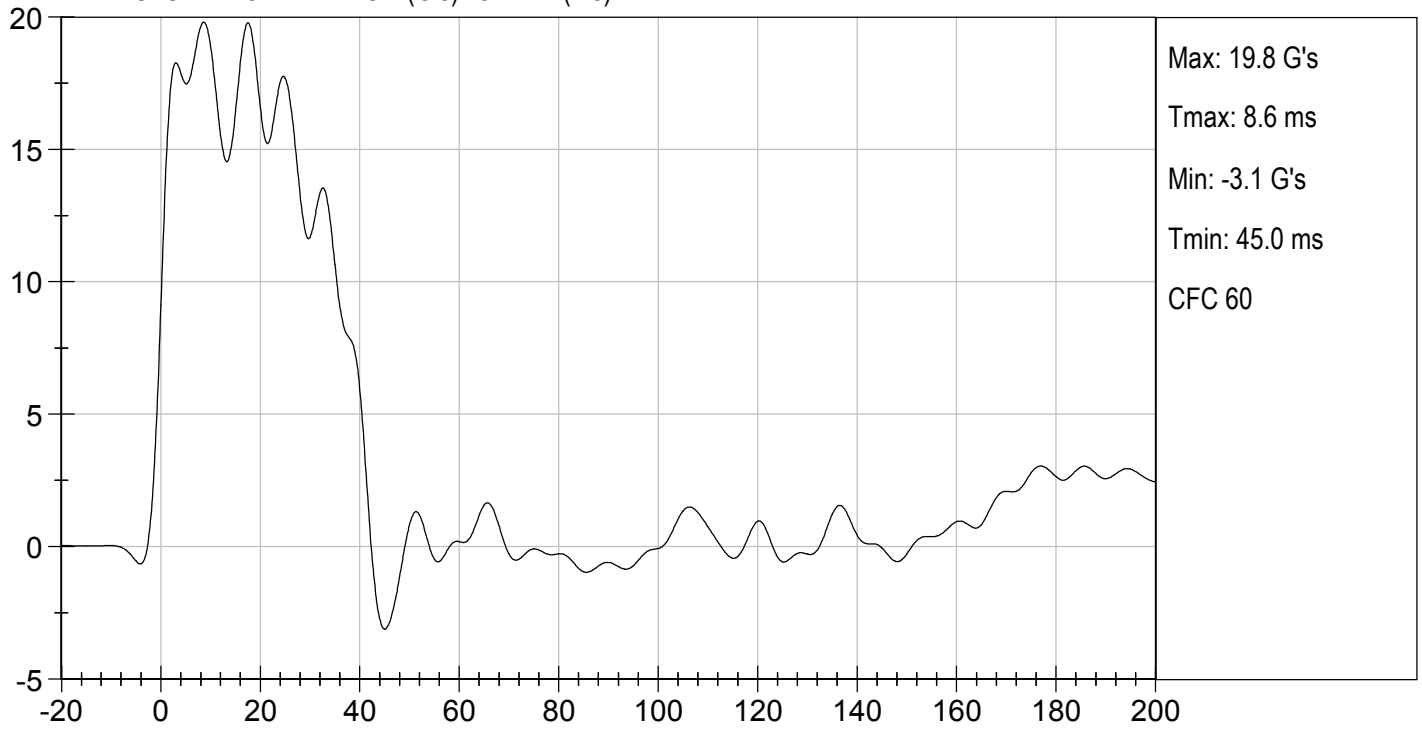
Test Date

Approved By

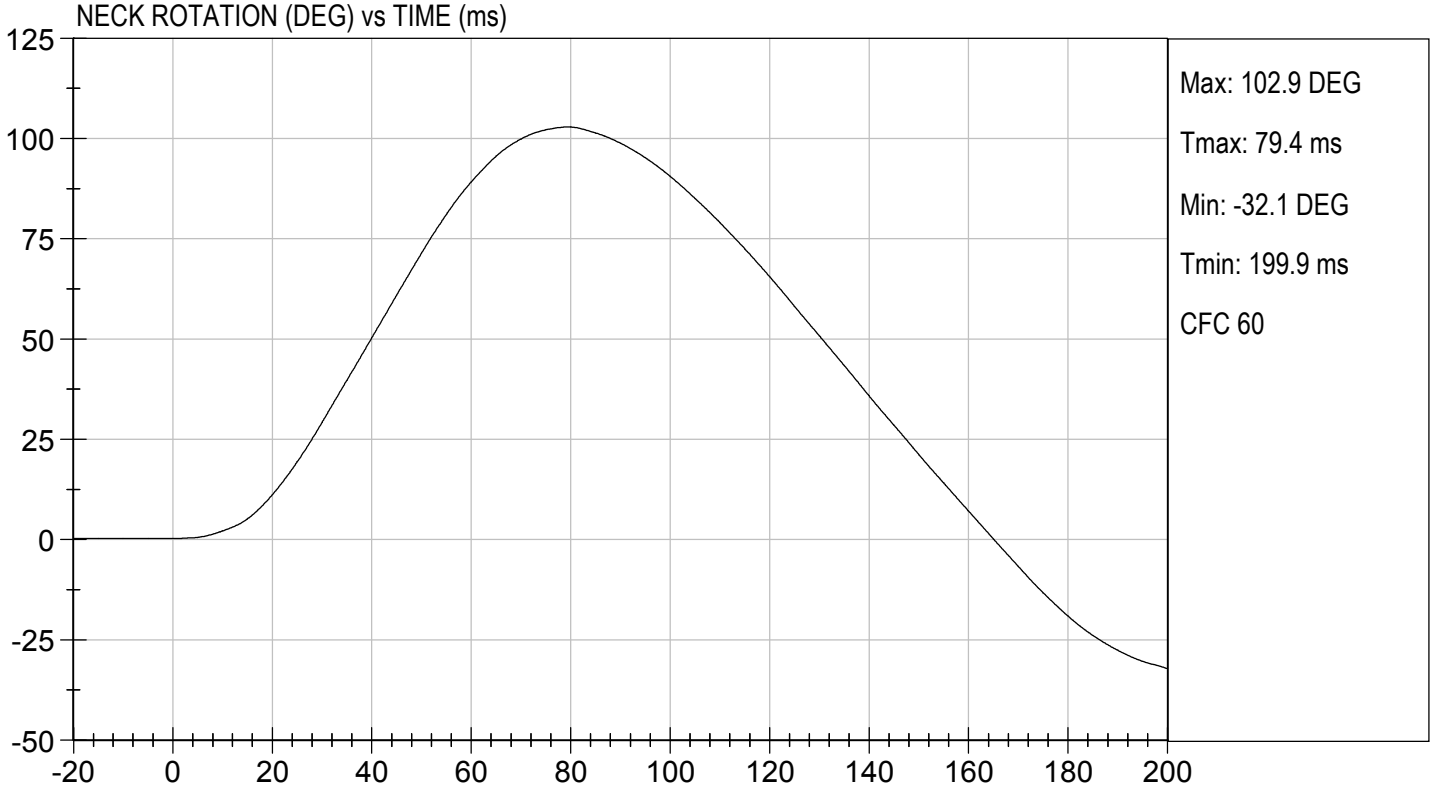
TEST DESC: NECK EXTENSION
VELOCITY: 20.08 ft/s, 6.12 m/s

TEST DATE: 10/08/2018
TEST #: D183023

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

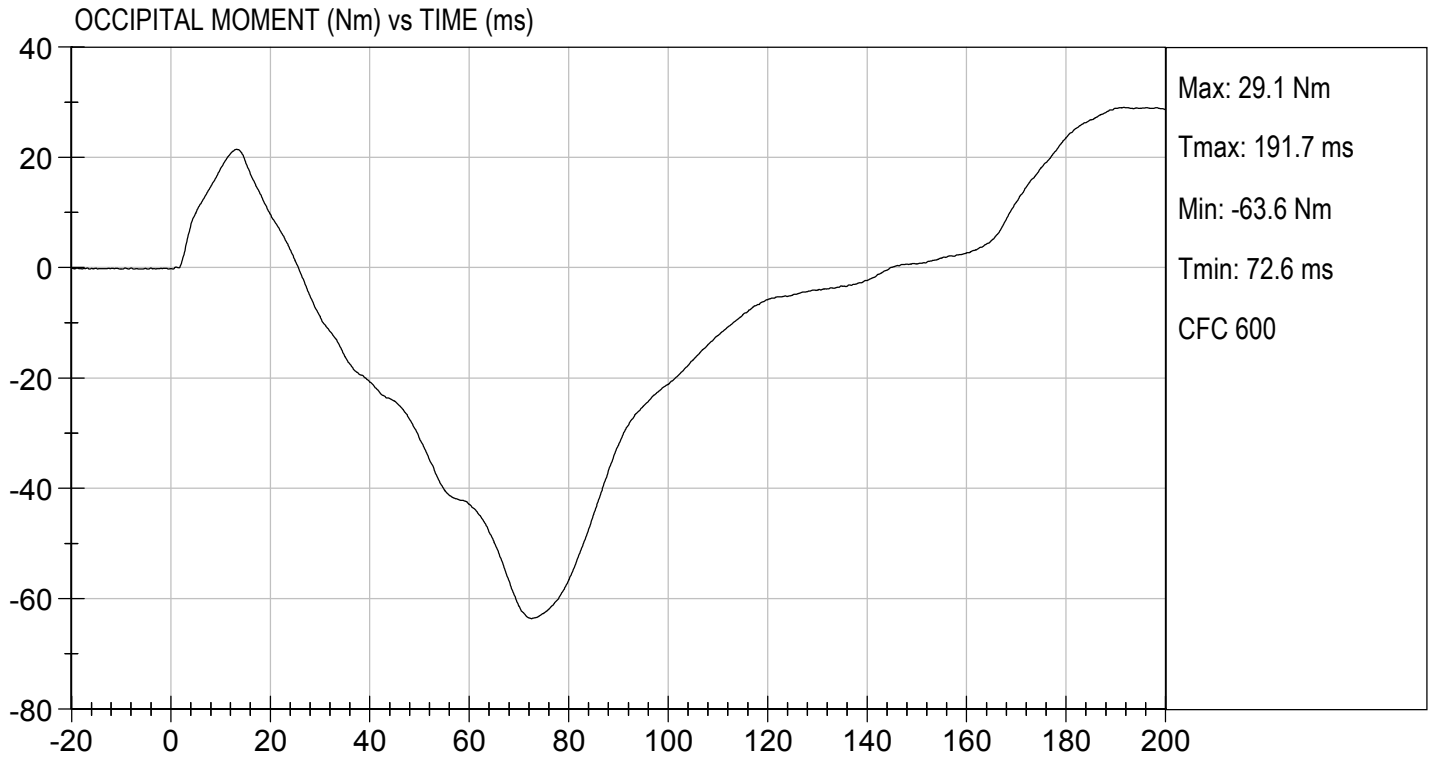


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 10/08/2018
TEST #: D183023



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D183024

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	45	Pass
Probe Velocity	m/s	6.58 to 6.82	6.60	Pass
Peak Probe Force	N	5159 to 5893	5,365	Pass
Peak Sternum Displacement	cm	6.35 to 7.26	6.89	Pass
Internal Hysteresis	%	69 to 85	69	Pass
		Overall Test Results		Pass

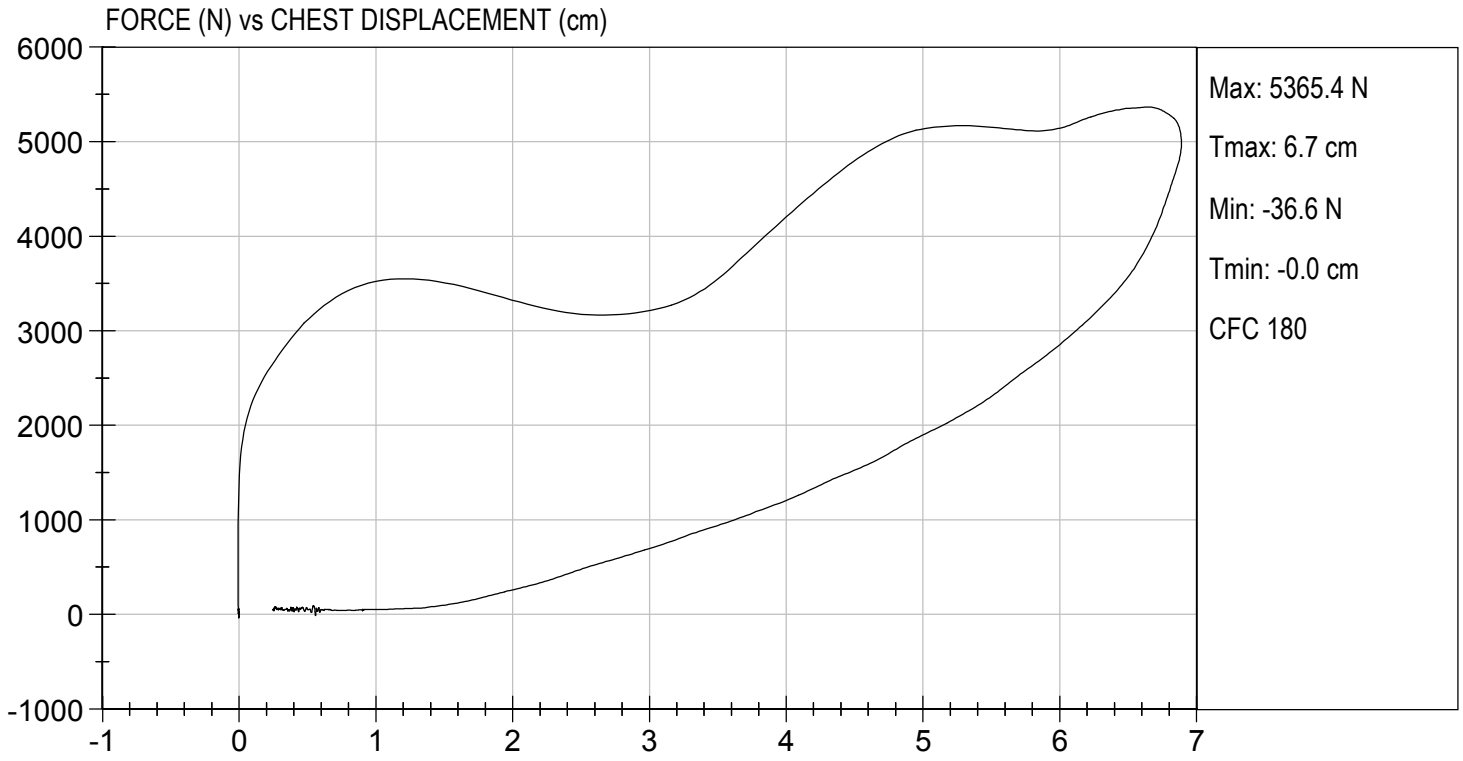
Jacob D Taylor
Laboratory Technician

10/08/2018
Test Date

Approved By

TEST DESC: THORAX IMPACT
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 10/08/2018
TEST #: D183024



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D183025

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
Probe Velocity	m/s	2.07 to 2.13	2.12	Pass
Peak Probe Force	N	4715 to 5782	5,045	Pass
		Overall Test Results		Pass

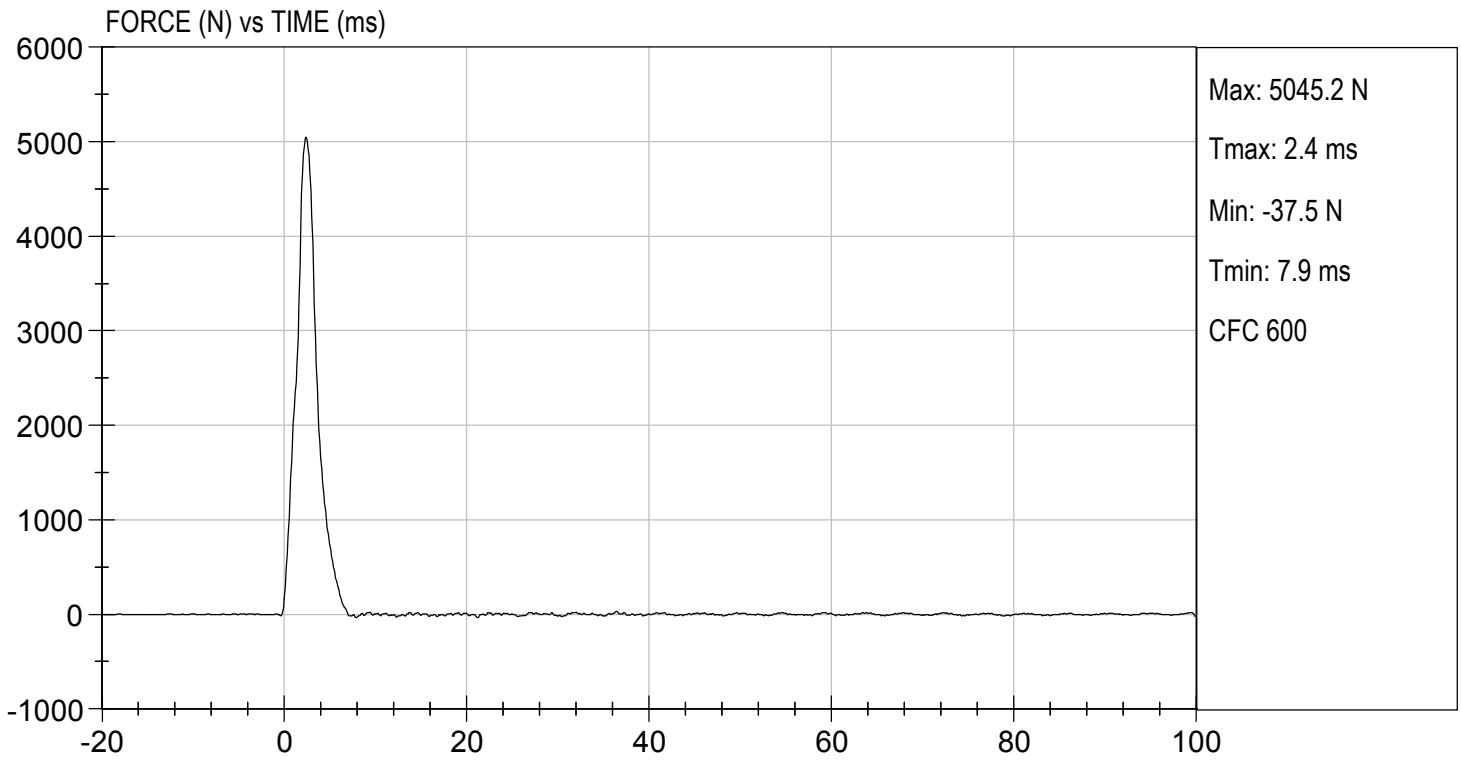
Jacob D Taylor
Laboratory Technician

10/08/2018
Test Date

Approved By

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

TEST DATE: 10/08/2018
TEST #: D183025



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 50TH PERCENTILE MALE

ATD Serial No: 351 **Test I.D:** D183026

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
Probe Velocity	m/s	2.07 to 2.13	2.07	Pass
Peak Probe Force	N	4715 to 5782	5,080	Pass
		Overall Test Results		Pass

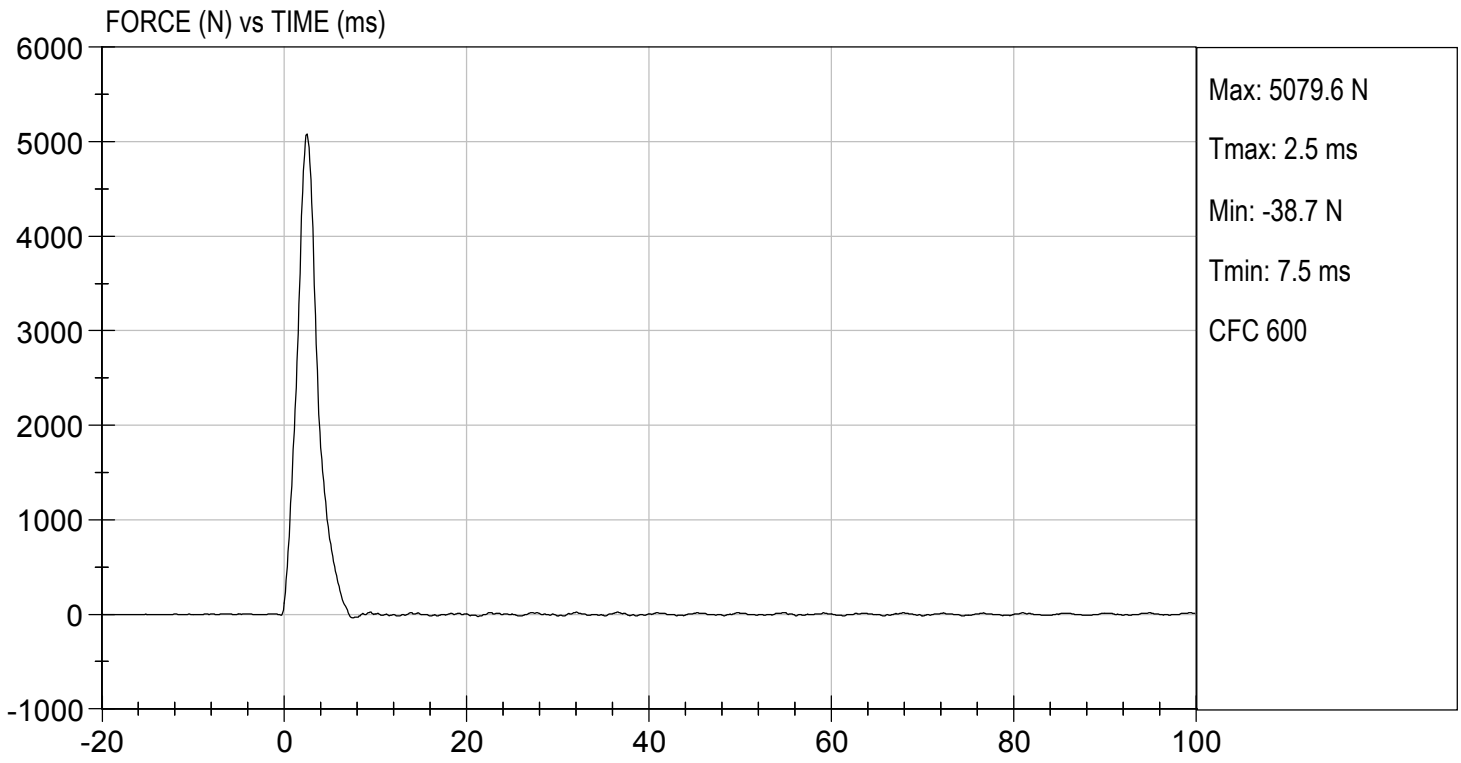
Jacob D Taylor
Laboratory Technician

10/08/2018
Test Date

Approved By

TEST DESC: LEFT KNEE
VELOCITY: 6.78 ft/s, 2.07 m/s

TEST DATE: 10/08/2018
TEST #: D183026



MGA RESEARCH CORPORATION

HIP-FEMUR FLEXION TEST

HYBRID III 50TH PERCENTILE MALE

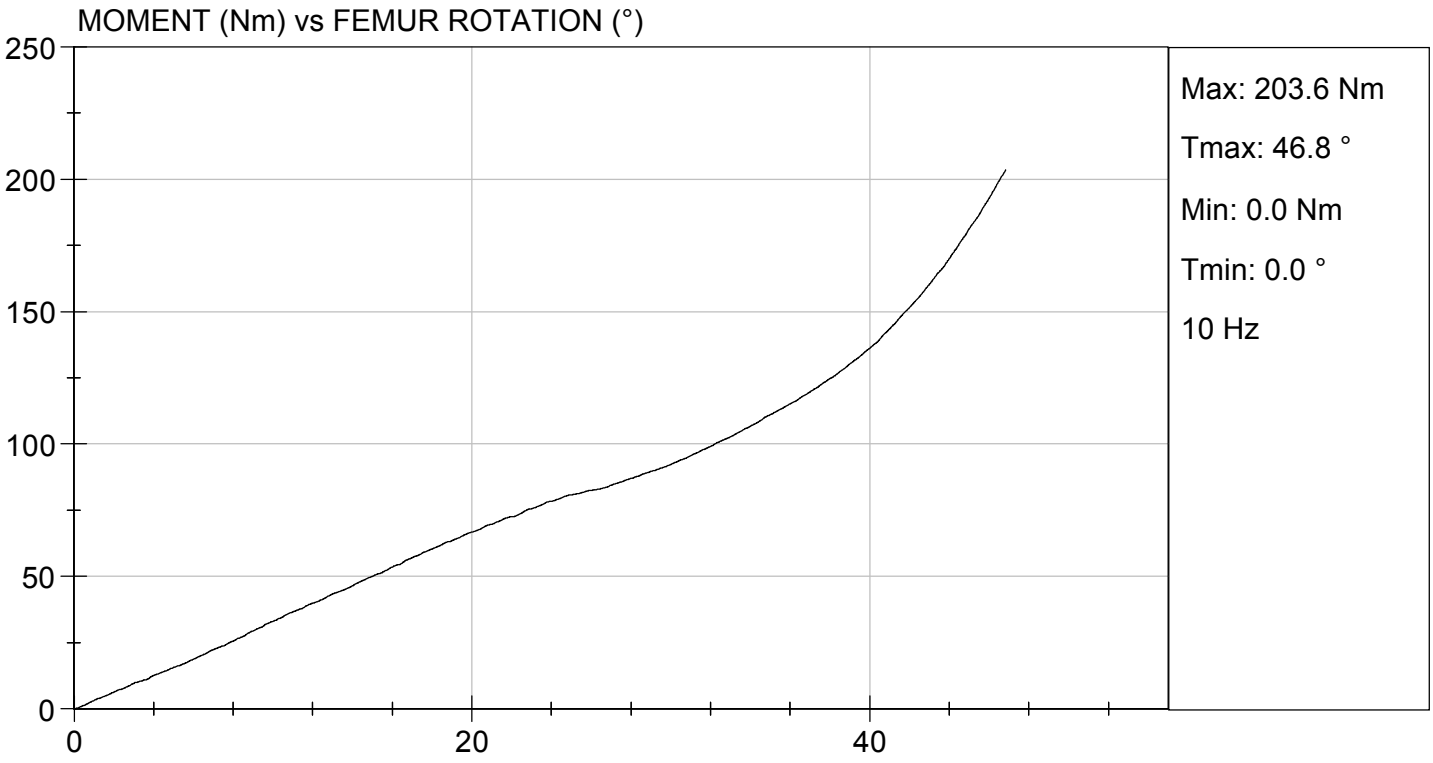
ATD Serial No: 351 **Test I.D:** D183020

Tested Parameter	Units	Specification	Result		Pass/Fail
			Right	Left	
Laboratory Temperature	deg C	18.9 to 25.6	21.2	21.2	Pass
Laboratory Relative Humidity	%	10 to 70	45	45	Pass
Rotation Rate	deg/s	5.0 to 10.0	6.5	6.4	Pass
30 Degrees	Nm	94.9 Nm Max	92.3	82.7	Pass
150 ft-lbf / 203.4 Nm	Deg	40.0 to 50.0 Degree Max Rotation	46.8	44.6	Pass
		Overall Test Results			Pass

Jacob D Taylor
Laboratory Technician

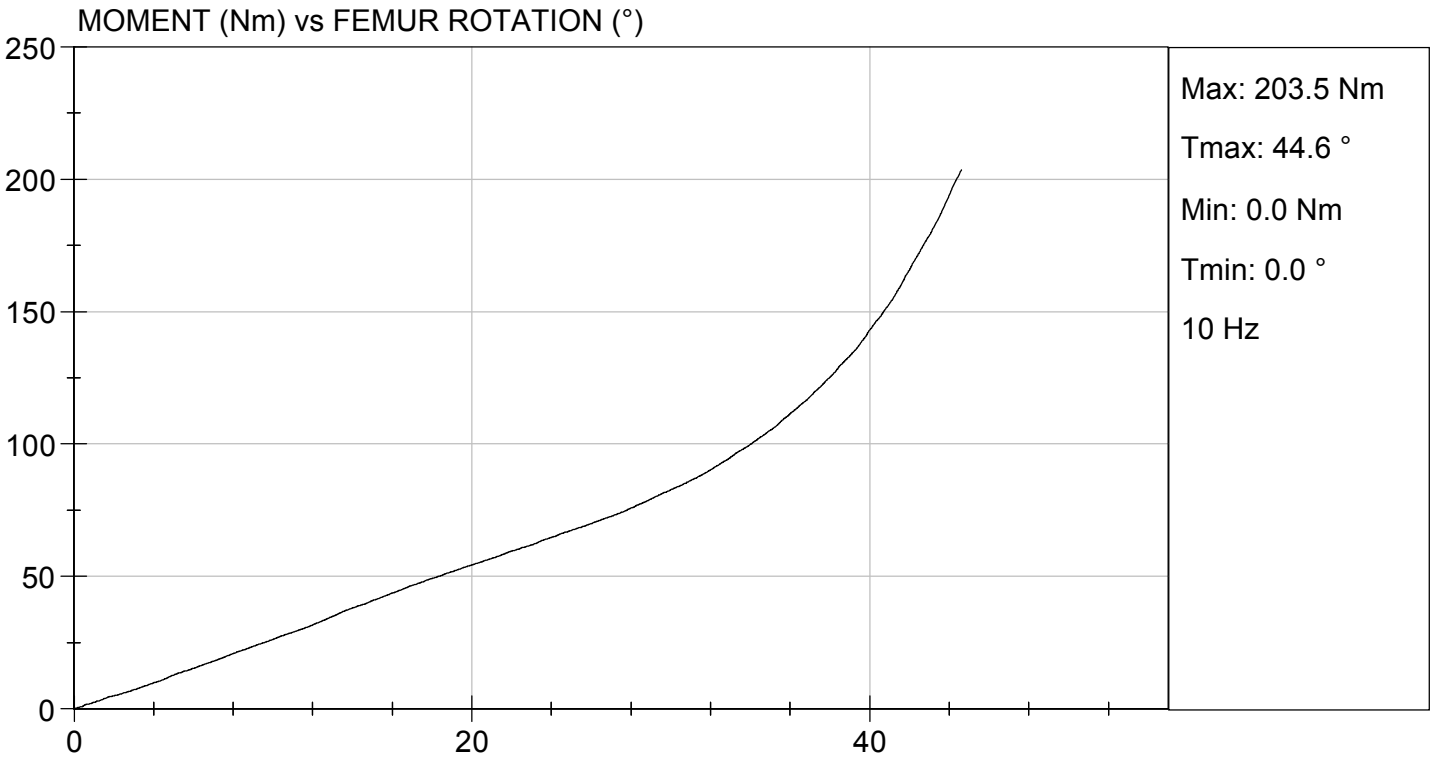
10/08/2018
Test Date

Approved By


MOMENT (Nm) vs FEMUR ROTATION (°)
250
200
150
100
50
0
0
20
40
Max: 203.6 Nm
Tmax: 46.8 °
Min: 0.0 Nm
Tmin: 0.0 °
10 Hz

TEST DESC: LEFT HIP FEMUR FLEXION

TEST DATE: 10/08/2018
TEST #: D183020



CALIBRATION TEST RESULTS

PRE-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

Hybrid III, 5th External Measurements
SN: 138

HYBRID III, 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	785.1
B	SHOULDER PIVOT HEIGHT	Centerline of shoulder pivot bolt to the seat surface.	431.8-457.2	456.8
C	H-POINT HEIGHT	Reference	81.3-86.3	84.0
D	H-POINT LOCATION FROM BACKLINE	Reference	144.8-149.8	146.2
E	SHOULDER PIVOT FROM BACKLINE	Center of the shoulder clevis to the rear vertical surface of the fixture.	68.6-83.8	78.0
F	THIGH CLEARANCE	Measured at the highest point on the upper femur segment.	119.4-134.6	127.5
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	45.0
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	280.2
J	ELBOW REST HEIGHT	Measure from the flesh below the elbow pivot bolt to the seat surface.	182.8-203.2	201.9
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	526.7
L	POPLITEAL HEIGHT	Seat surface to the plane of the horizontal plane of the bottom of the feet.	355.6-376.0	362.3
M	KNEE PIVOT HEIGHT	Centerline of knee pivot bolt to the horizontal plane of the bottom of the feet.	393.7-419.1	398.0

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”.	414-439.4	430.5
HYBRID III, 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	184.6
P	FOOT LENGTH	Tip of toe to rear of heal	218.5-233.7	221.0
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	472.6
S	HEAD BREADTH	The widest part of the head	137.1-147.3	141.9
T	HEAD DEPTH	Back of the head to the forehead	177.8-188.0	184.2
U	HIP BREADTH	The widest part of the hip	299.7-314.9	307.4
V	SHOULDER BREADTH	Outside edges of right and left shoulder clevises	350.5-365.7	360.5
W	FOOT BREADTH	The widest part of the foot	78.8-94.0	85.0
X	HEAD CIRCUMFERENCE	Measured at the point as in dim. “T”	528.3-548.7	546.2
Y	CHEST CIRCUMFERENCE (WITH CHEST JACKET)	Measured 345.4 ± 12.7 mm above seat surface	850.9-881.3	875.1
Z	WAIST CIRCUMFERENCE	Measured 165.1 ± 5.1 mm above seat surface	759.5-789.9	785.4
AA	REFERENCE LOCATION FOR MEASUREMENT OF CHEST CIRCUMFERENCE	Reference	332.7-358.1	345.4
BB	REFERENCE LOCATION FOR MEASUREMENT OF WAIST CIRCUMFERENCE	Reference	160.1-170.2	165.1

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test ID:** D182911

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	48	Pass
Peak Resultant Acceleration	G's	250 to 300	284	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-2.5	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

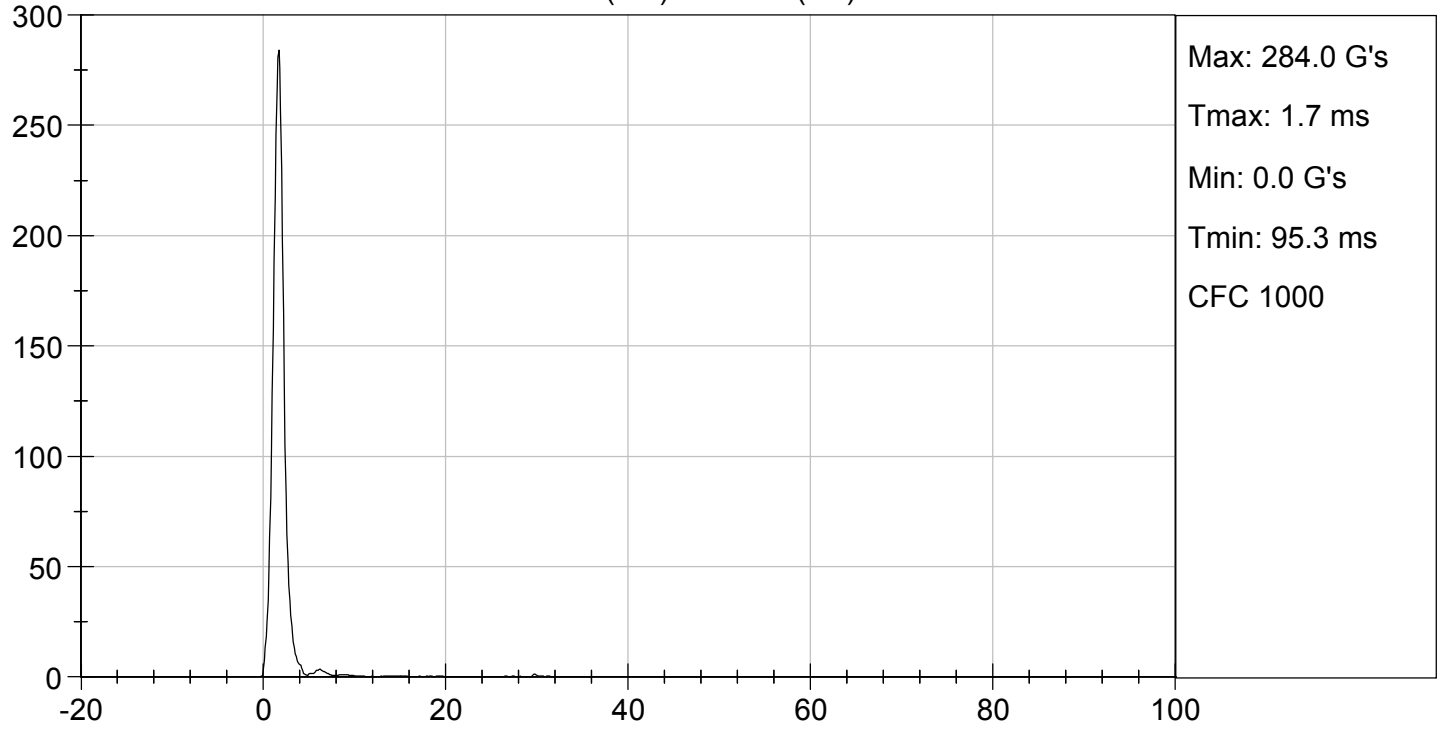
09/25/2018
Test Date

Approved By

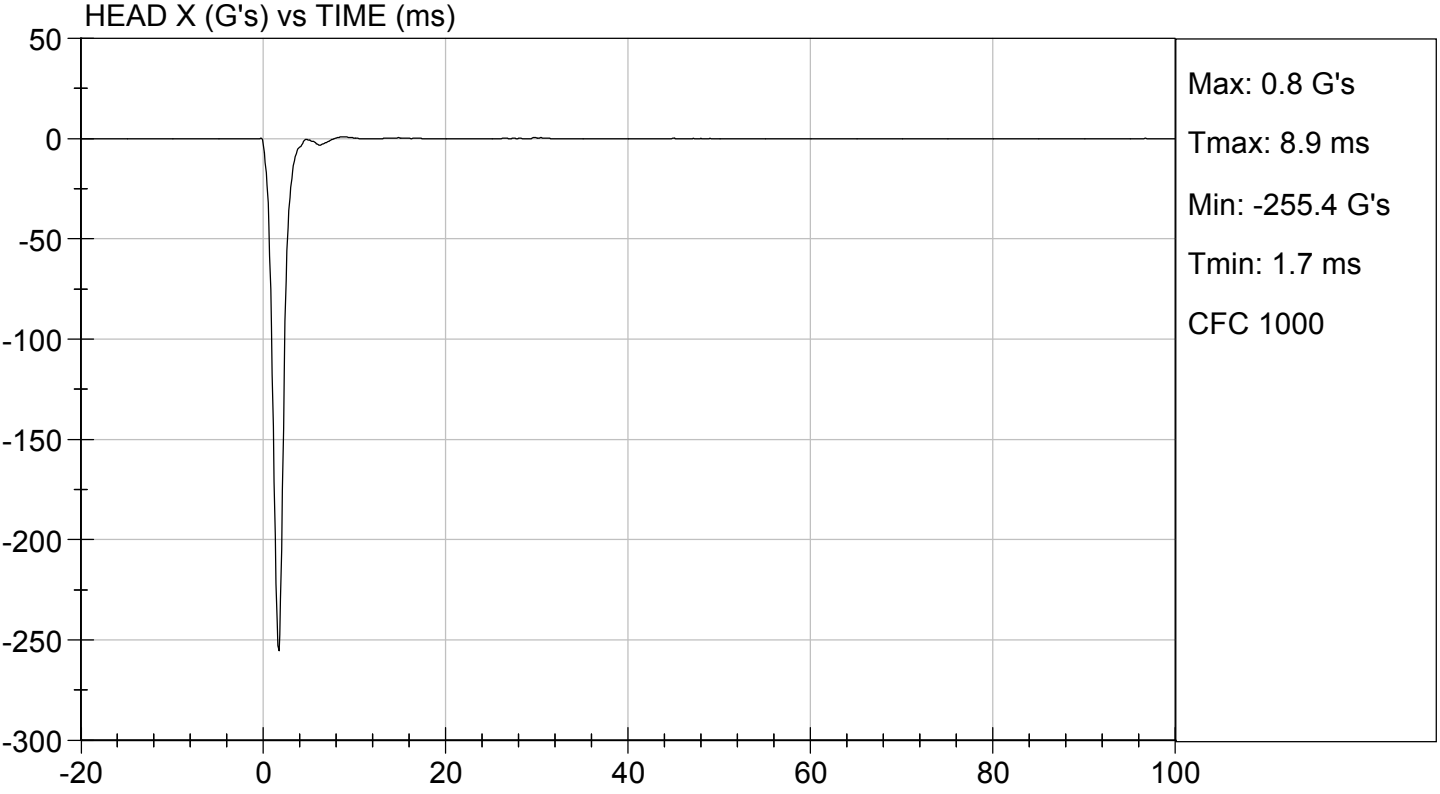
TEST DESC: HEAD DROP

TEST DATE: 09/25/2018
TEST #: D182911

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

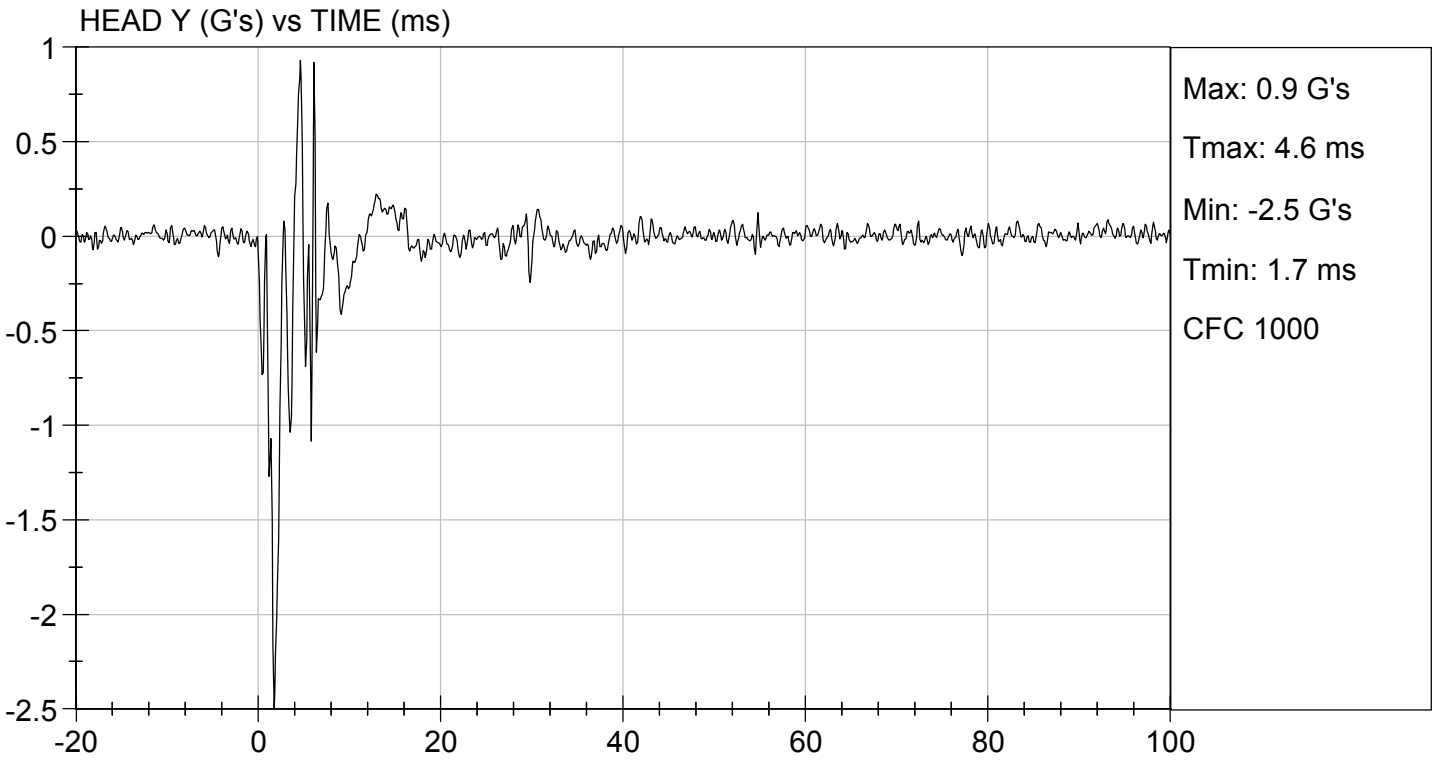


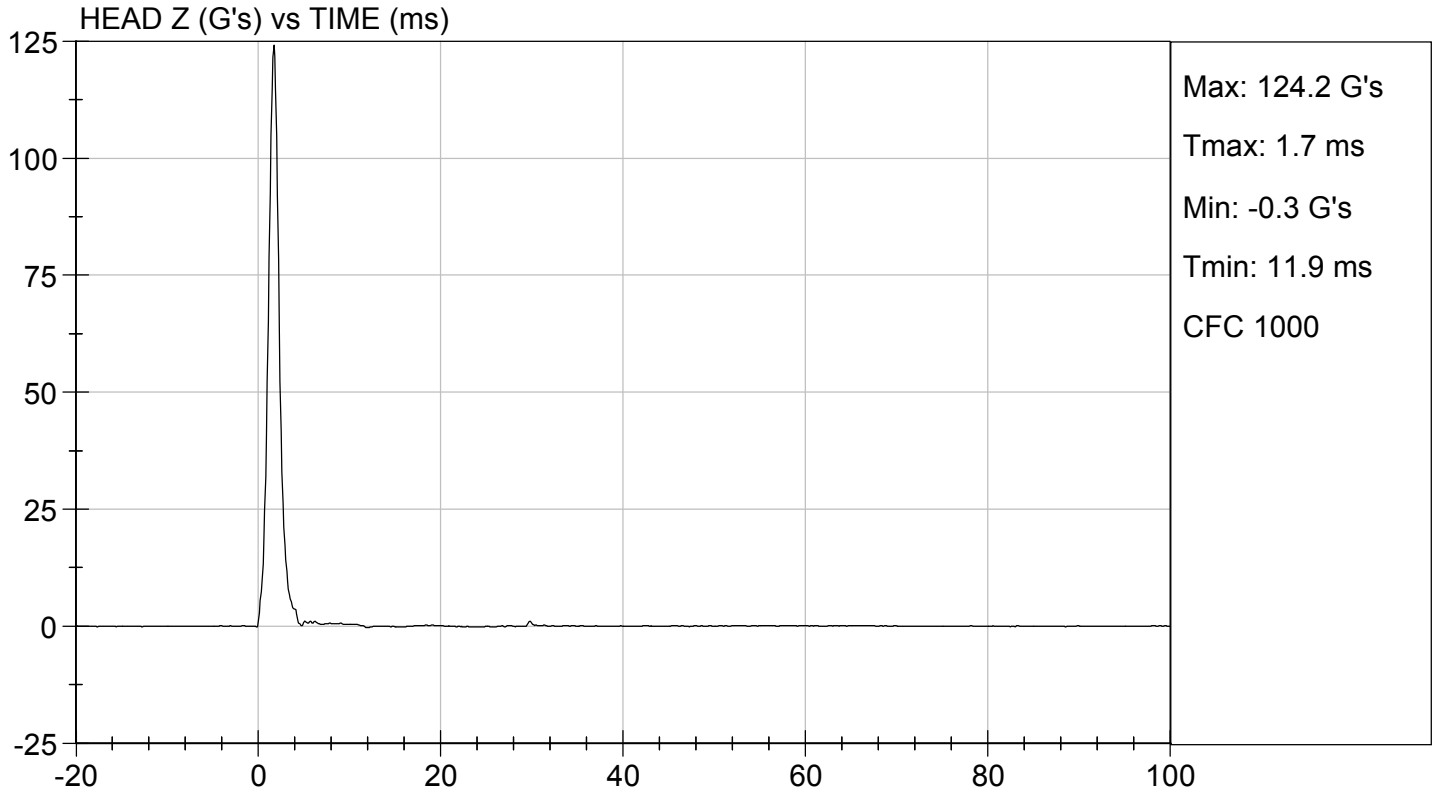
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 09/25/2018
TEST #: D182911





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D182912

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	48	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	4.6	Pass
	30 ms	m/s	5.8 to 7.0	6.9	Pass
D Plane Rotation	Max	deg	77 to 91	84	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	82	Pass
			Overall Results		Pass

Danielle Redinbaugh
Laboratory Technician

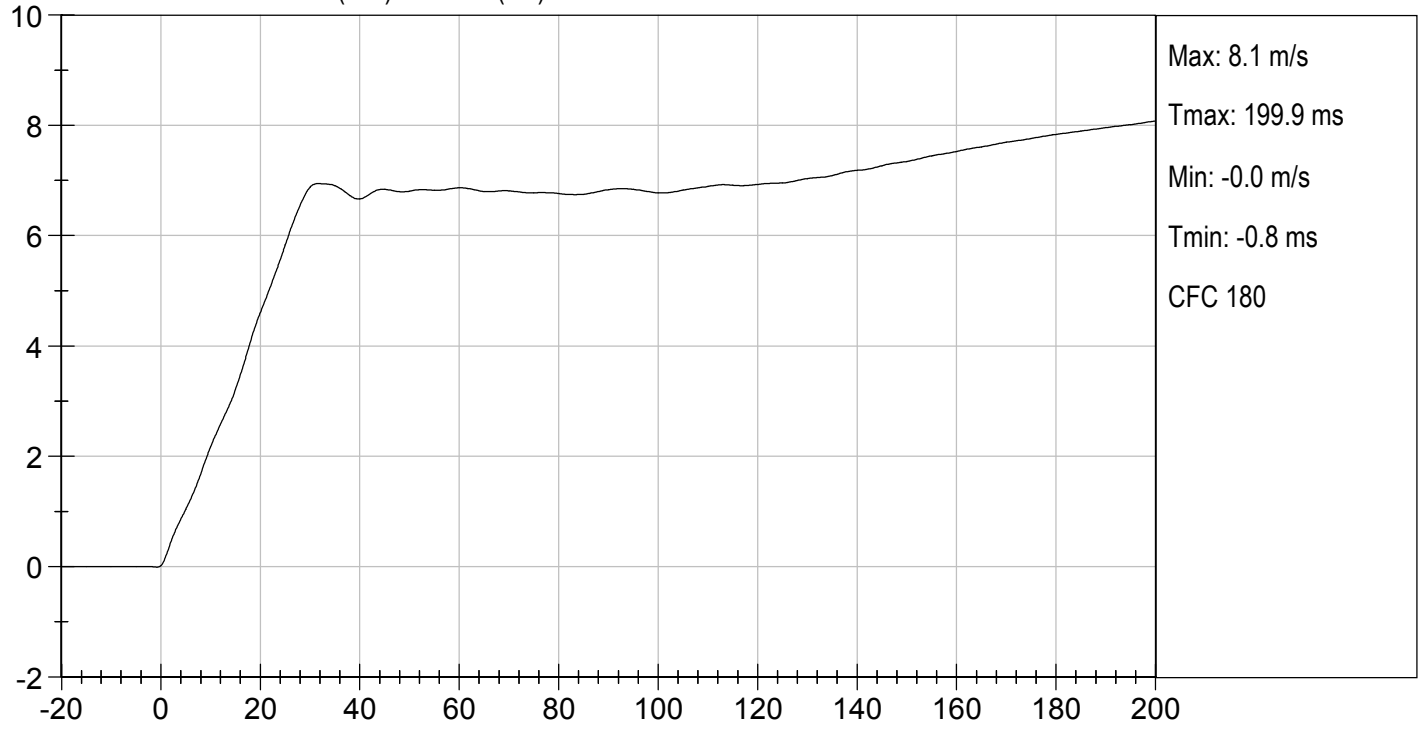
09/26/2018
Test Date

Approved By

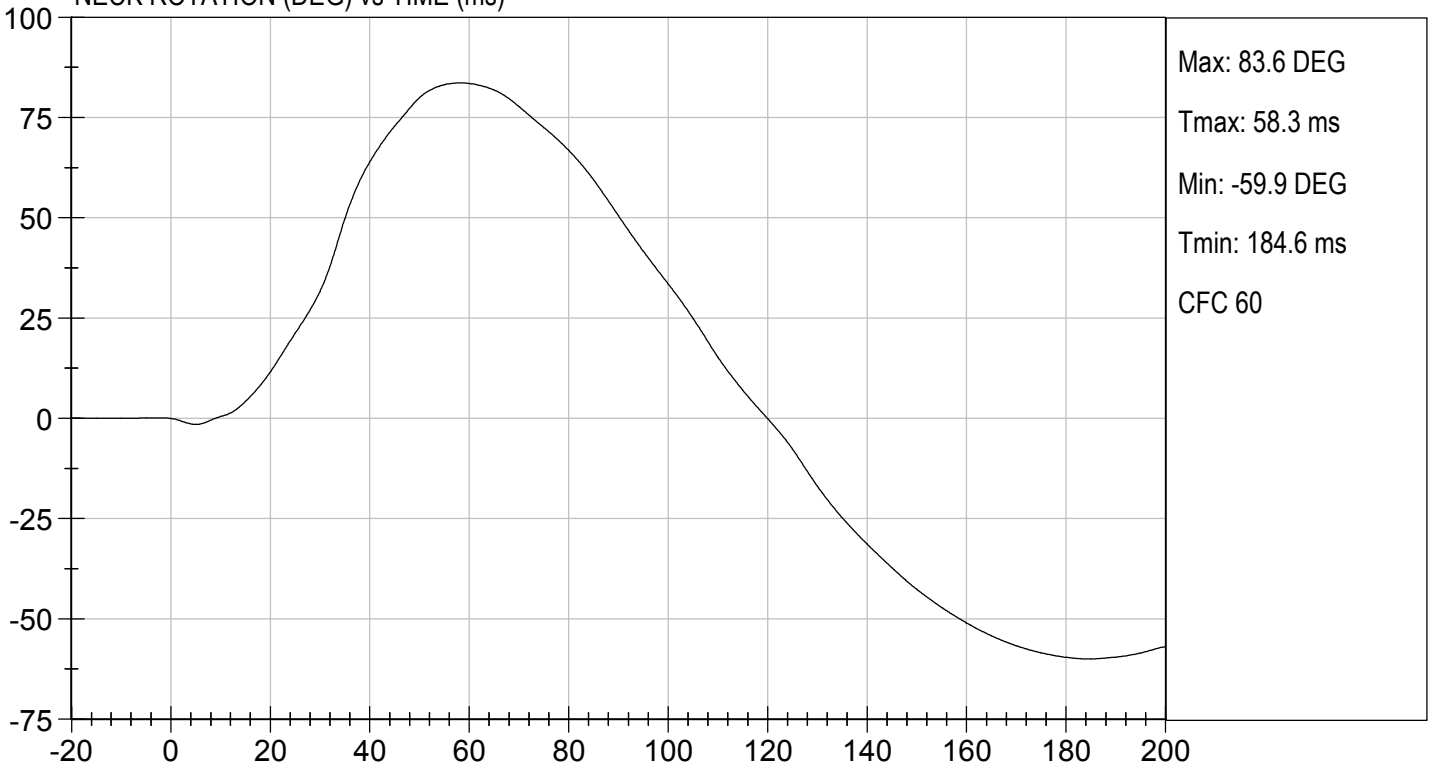
TEST DESC: NECK FLEXION
VELOCITY: 23.15 ft/s, 7.06 m/s

TEST DATE: 09/26/2018
TEST #: D182912

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

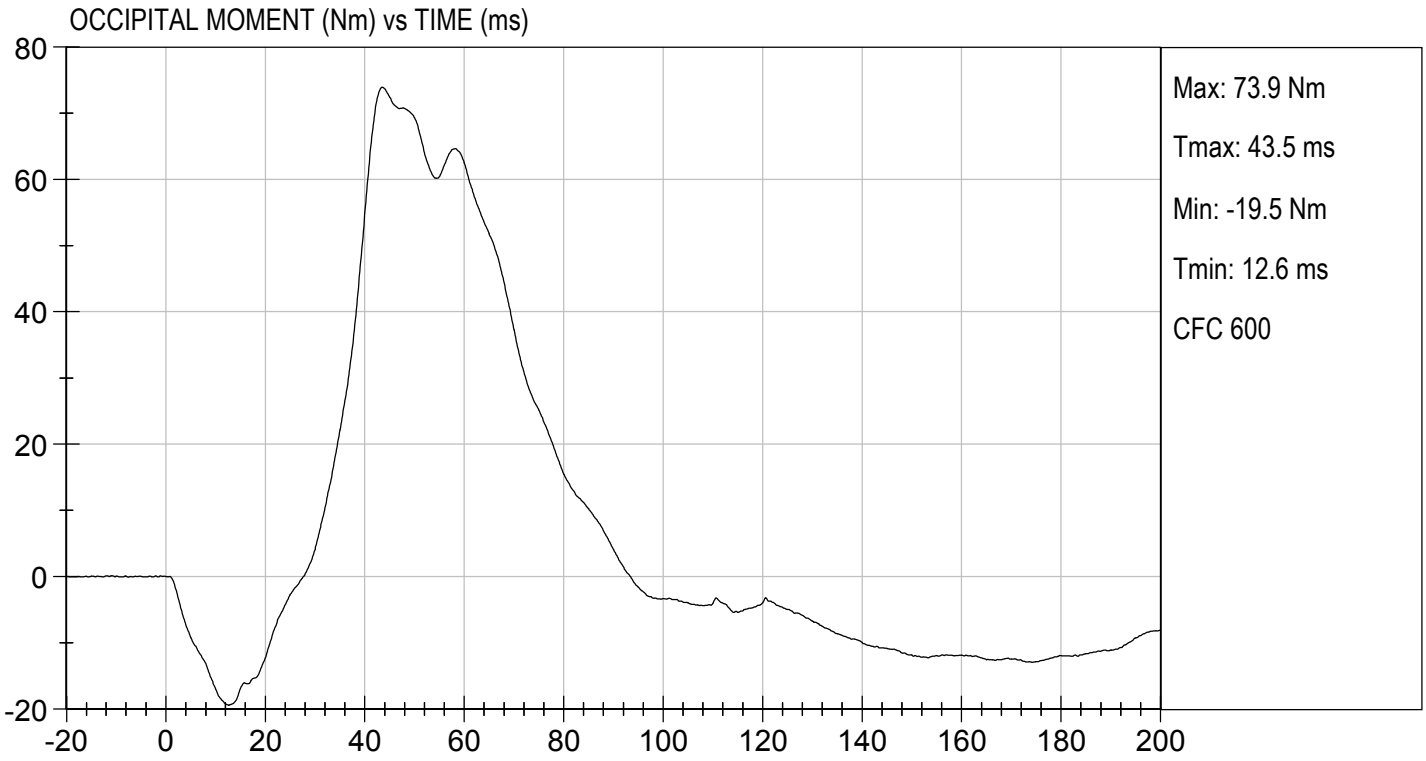


NECK ROTATION (DEG) vs TIME (ms)



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

TEST DATE: 09/26/2018
TEST #: D182912



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D182913

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	48	Pass
Pendulum Speed		m/s	5.95 to 6.19	5.98	Pass
Pendulum Velocity	10 ms	m/s	1.5 to 1.9	1.9	Pass
	20 ms	m/s	3.1 to 3.9	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.2	Pass
D Plane Rotation	Max	deg	99 to 114	110	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	104	Pass
			Overall Results		Pass

Danielle Redinbaugh
Laboratory Technician

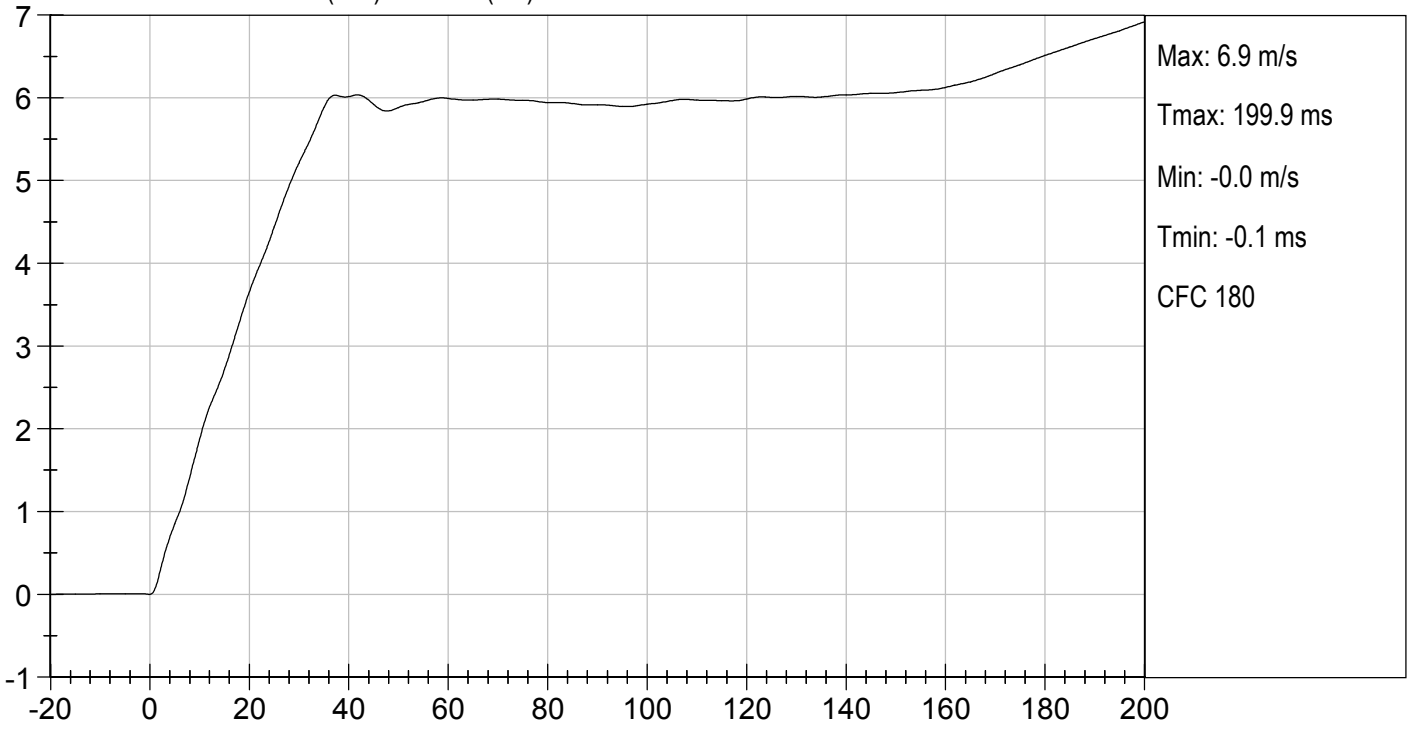
09/26/2018
Test Date

Approved By

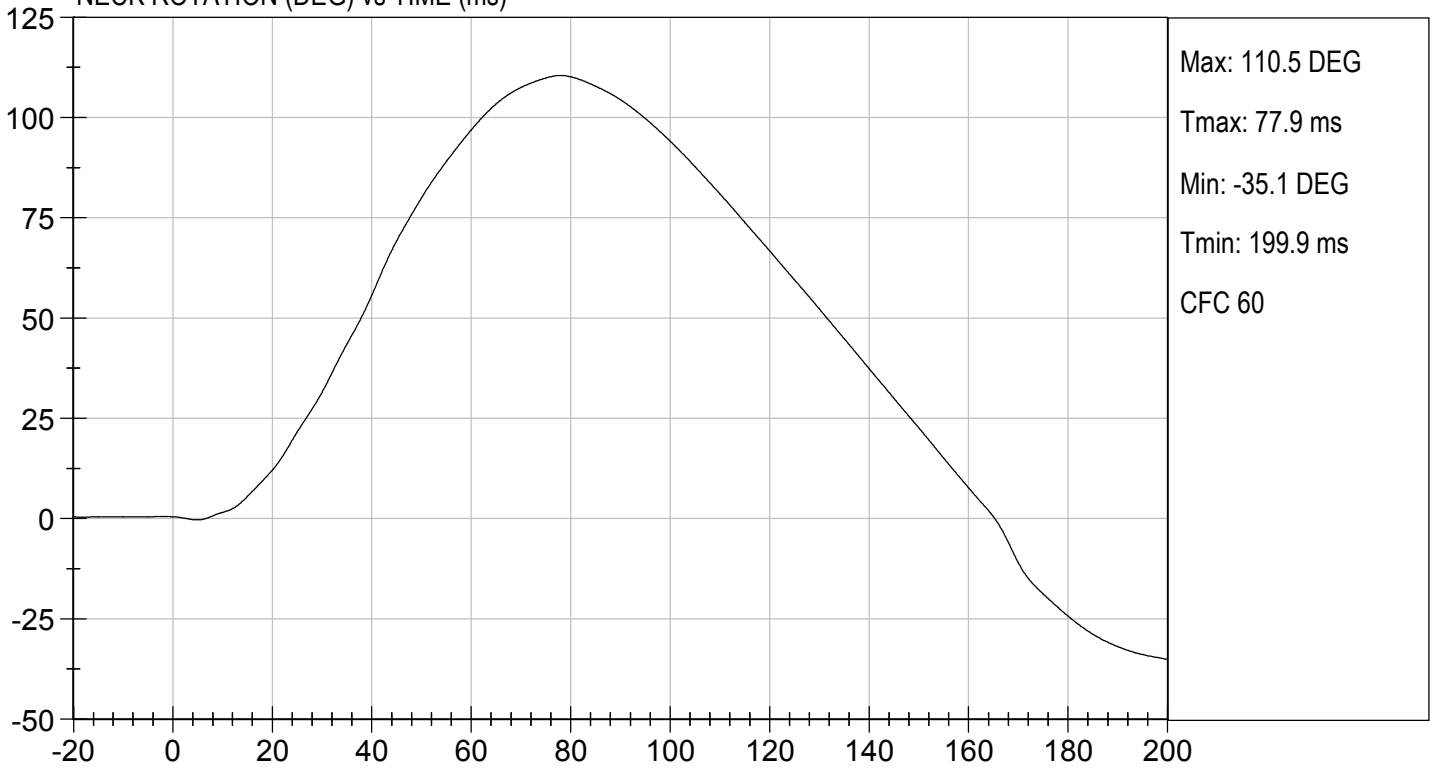
TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 09/26/2018
TEST #: D182913

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

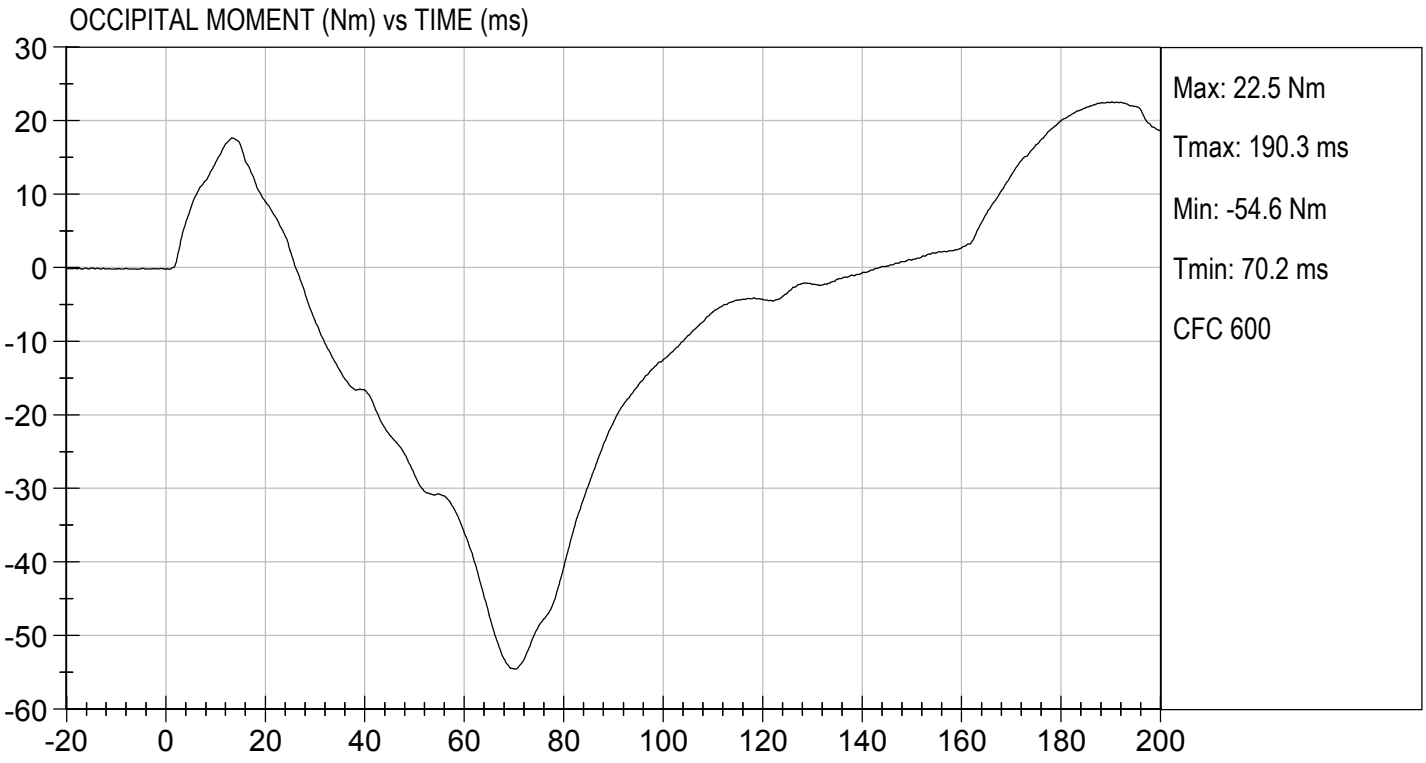


NECK ROTATION (DEG) vs TIME (ms)



TEST DESC: NECK EXTENSION
VELOCITY: 19.61 ft/s, 5.98 m/s

TEST DATE: 09/26/2018
TEST #: D182913



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D182914

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.7	Pass
Relative Humidity	%	10 to 70	48	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	56	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4253	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4160	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

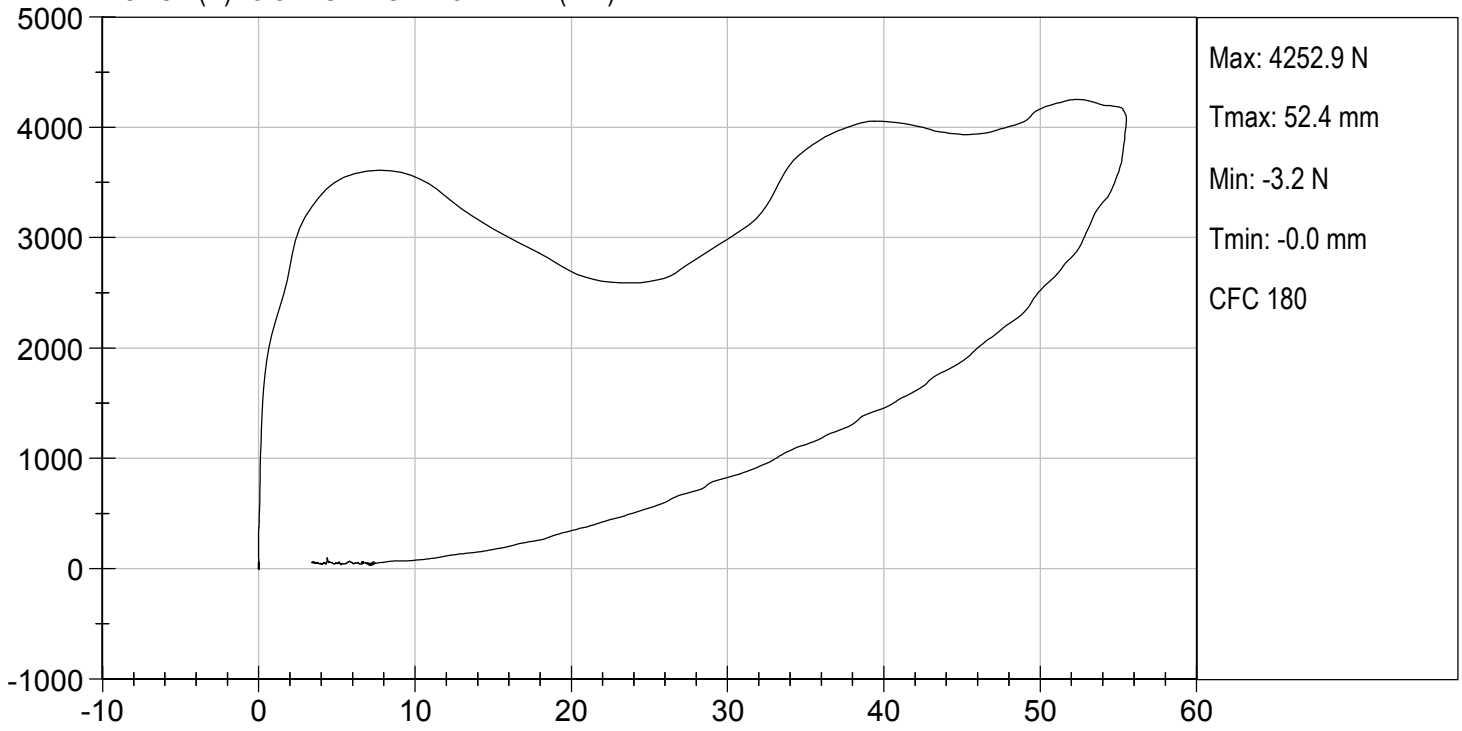
09/26/2018
Test Date

Approved By

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

TEST DATE: 09/26/2018
TEST #: D182914

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D182915

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	Pass
Laboratory Relative Humidity	%	10 to 70	40	Pass
Probe Speed	m/s	2.07 to 2.13	2.12	Pass
Maximum Force	N	3450 to 4060	3661	Pass
		Overall Test Results		Pass

Danielle Redinbaugh

Laboratory Technician

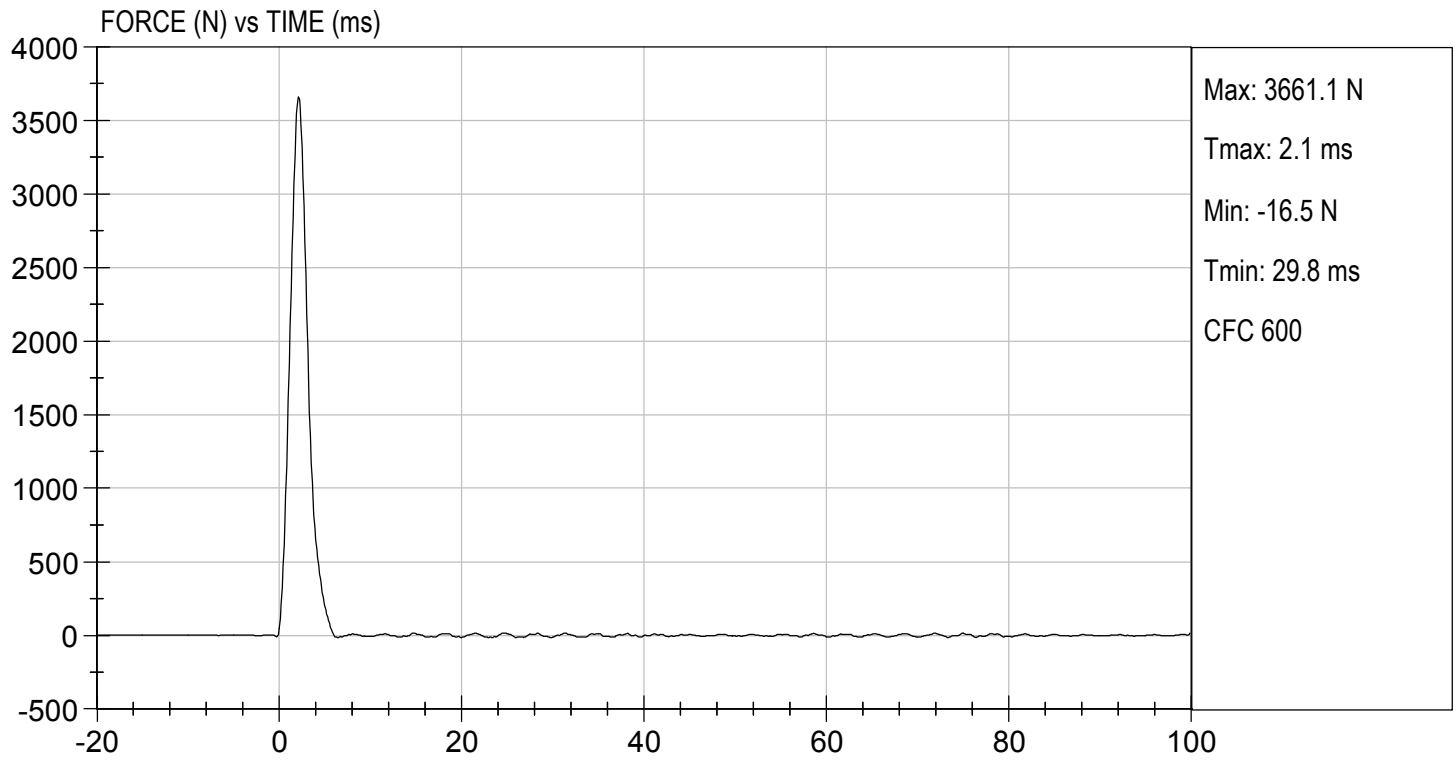
09/26/2018

Test Date

Approved By

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

TEST DATE: 09/26/2018
TEST #: D182915



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D182916

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	22	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	3635	Pass
		Overall Test Results		Pass

Danielle Redinbaugh

Laboratory Technician

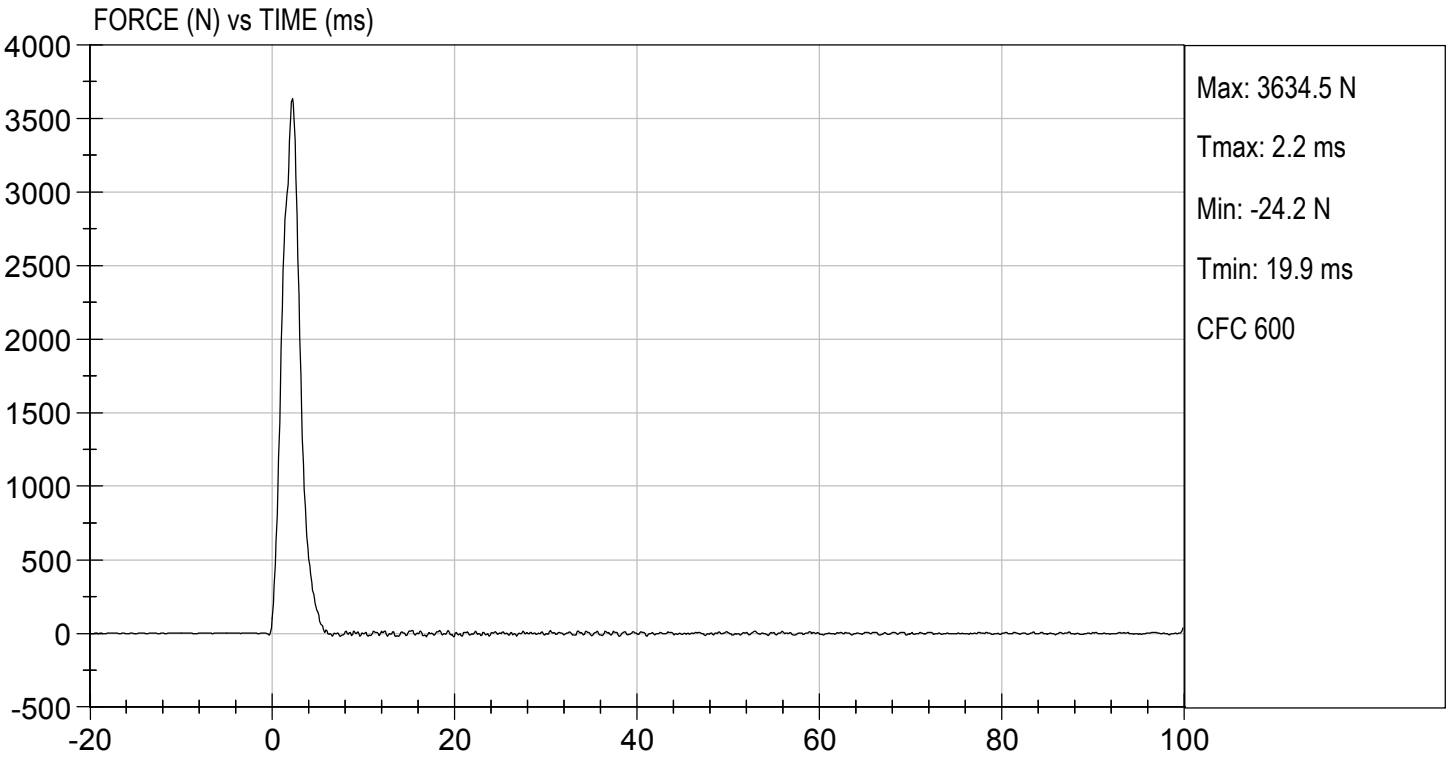
09/26/2018

Test Date

Approved By

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

TEST DATE: 09/26/2018
TEST #: D182916



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D182917

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
Initial Angle	deg	0 to 20	18	Pass
Return Angle	deg	+/- 8	3	Pass
Force at 45 deg	N	320 to 390	366	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.6	Pass
		Overall Result		Pass

Danielle Redinbaugh

Laboratory Technician

09/26/2018

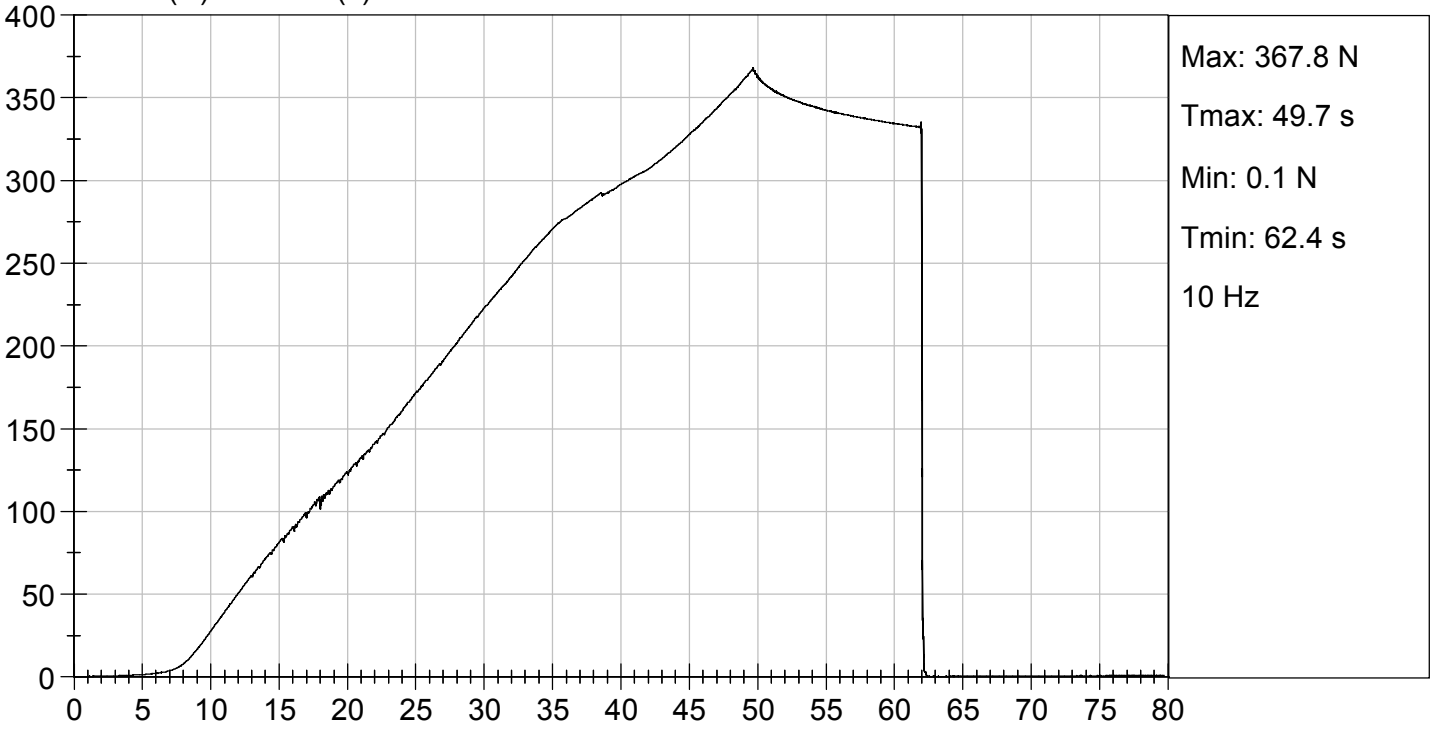
Test Date

Approved By

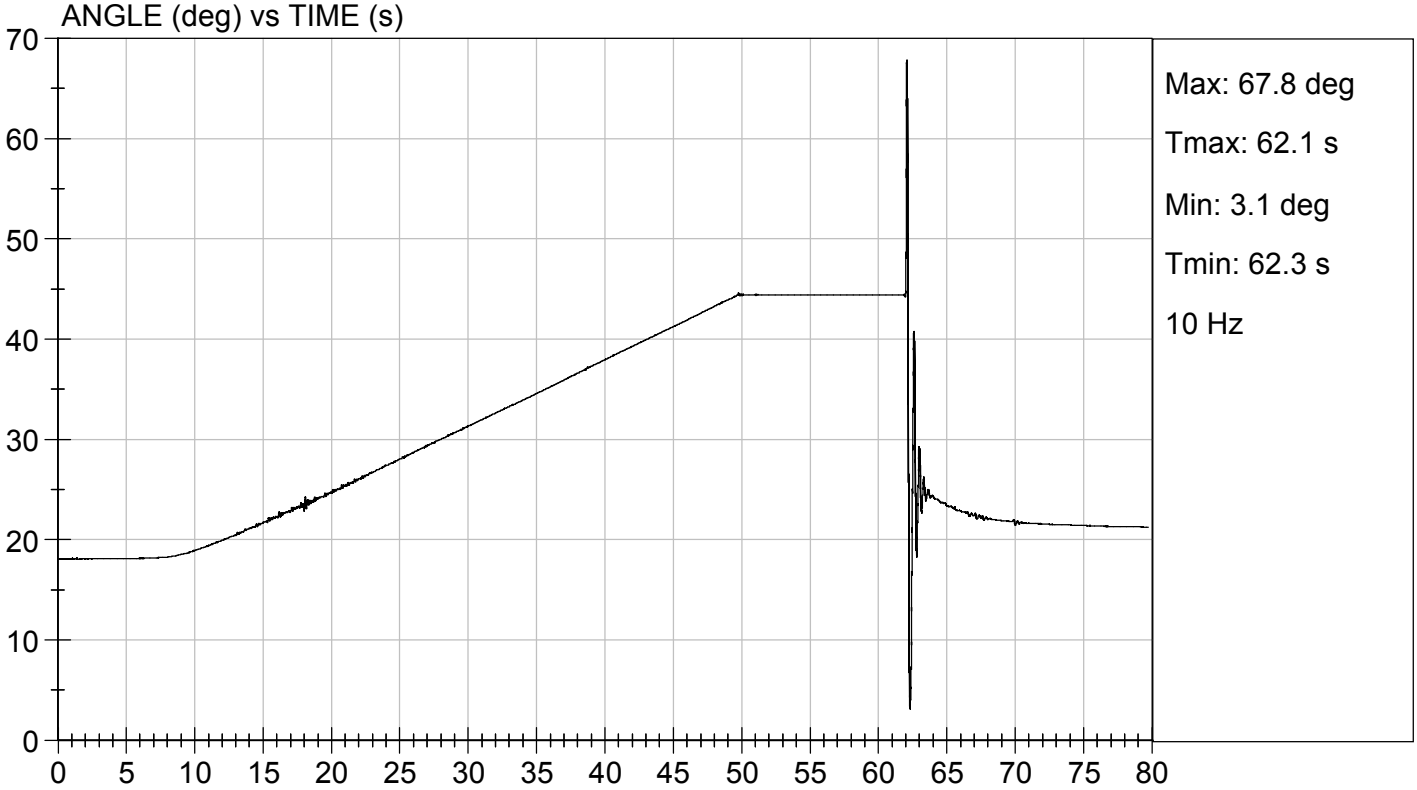
TEST DESC: LUMBAR FLEXION

TEST DATE: 09/26/2018
TEST #: D182917

LOAD (N) vs TIME (s)



ANGLE (deg) vs TIME (s)



CALIBRATION TEST RESULTS

POST-TEST

HYBRID III 5TH PERCENTILE FEMALE - PASSENGER ATD

MGA RESEARCH CORPORATION

HEAD DROP TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test ID:** D183051

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	52	Pass
Peak Resultant Acceleration	G's	250 to 300	268	Pass
Peak Lateral Acceleration	G's	<= +/- 15.0	-5.4	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	within 10% of peak	Yes	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

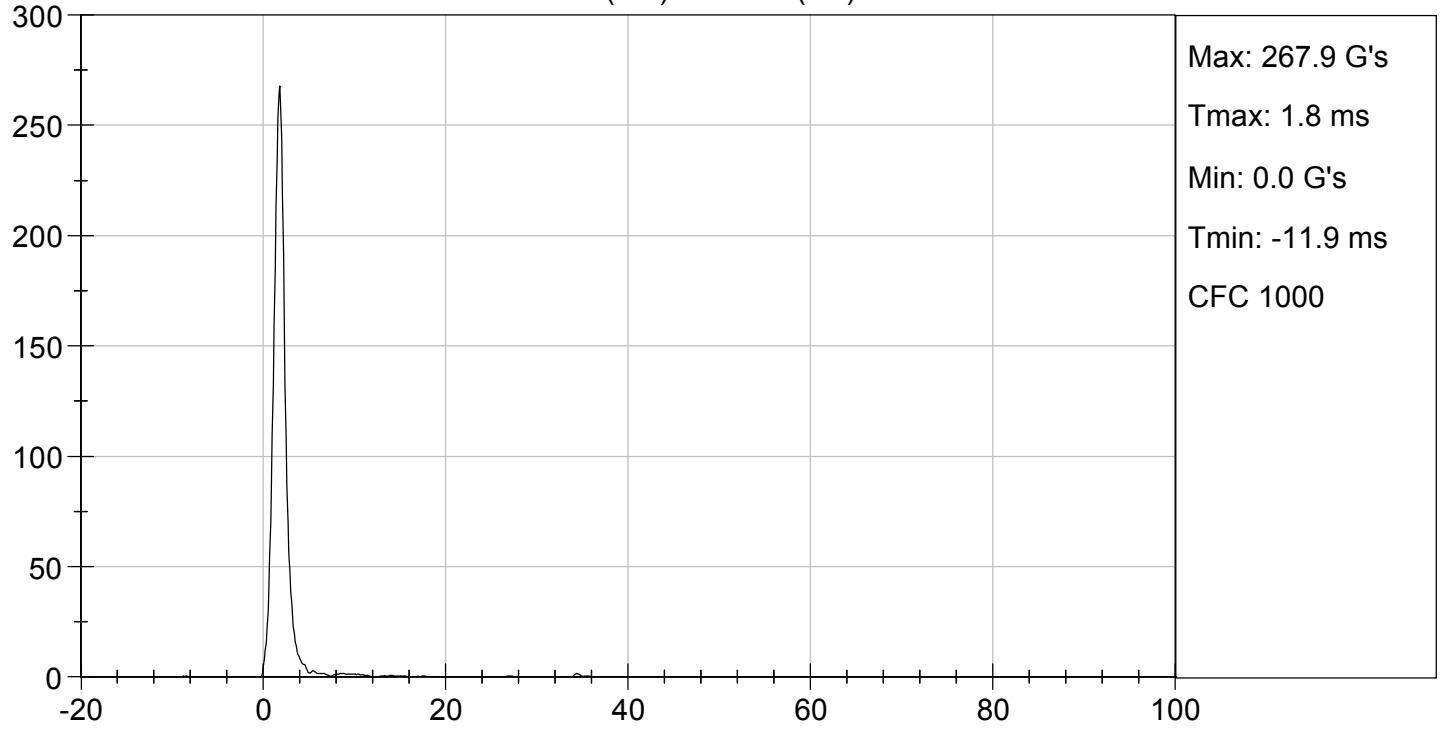
10/10/2018
Test Date

Approved By

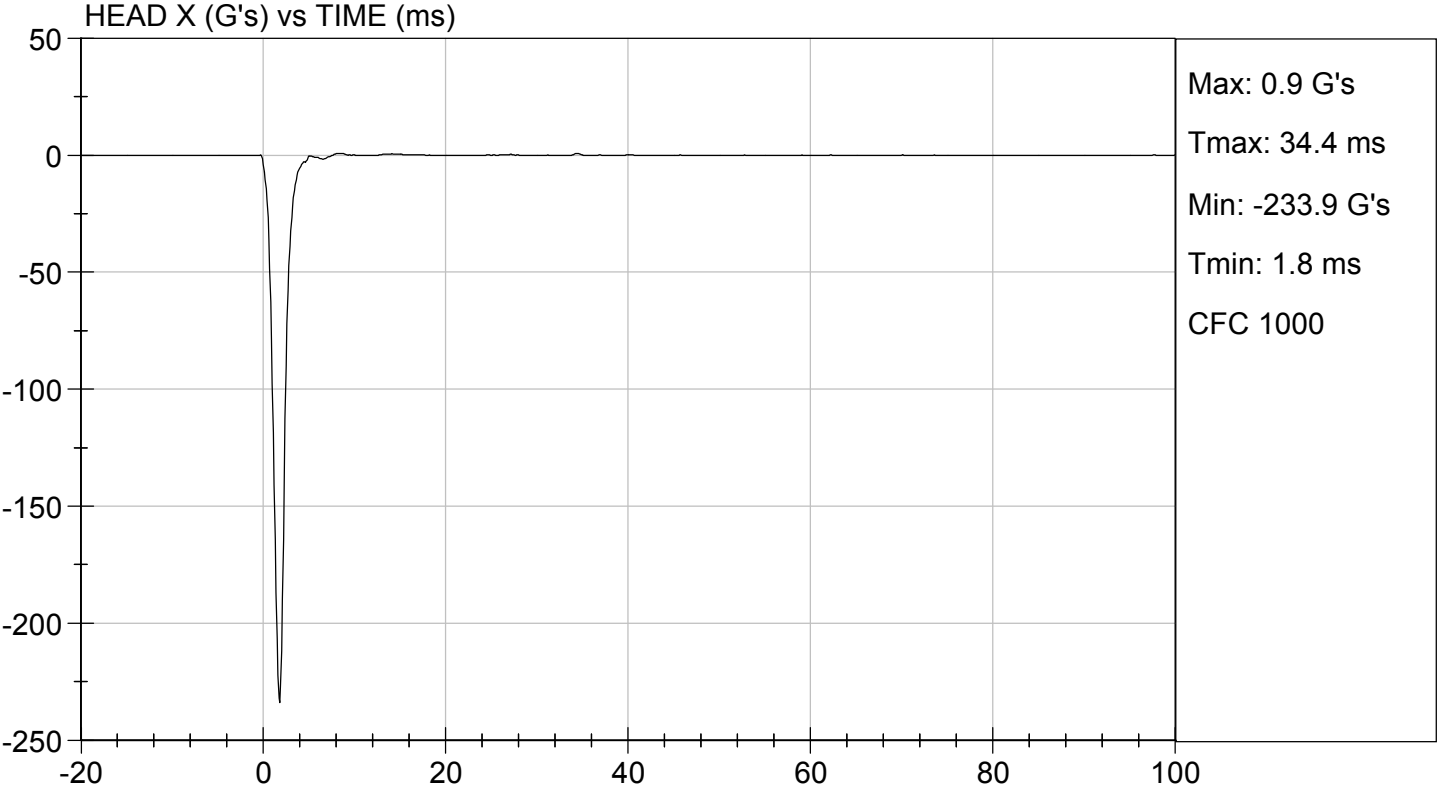
TEST DESC: HEAD DROP

TEST DATE: 10/10/2018
TEST #: D183051

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

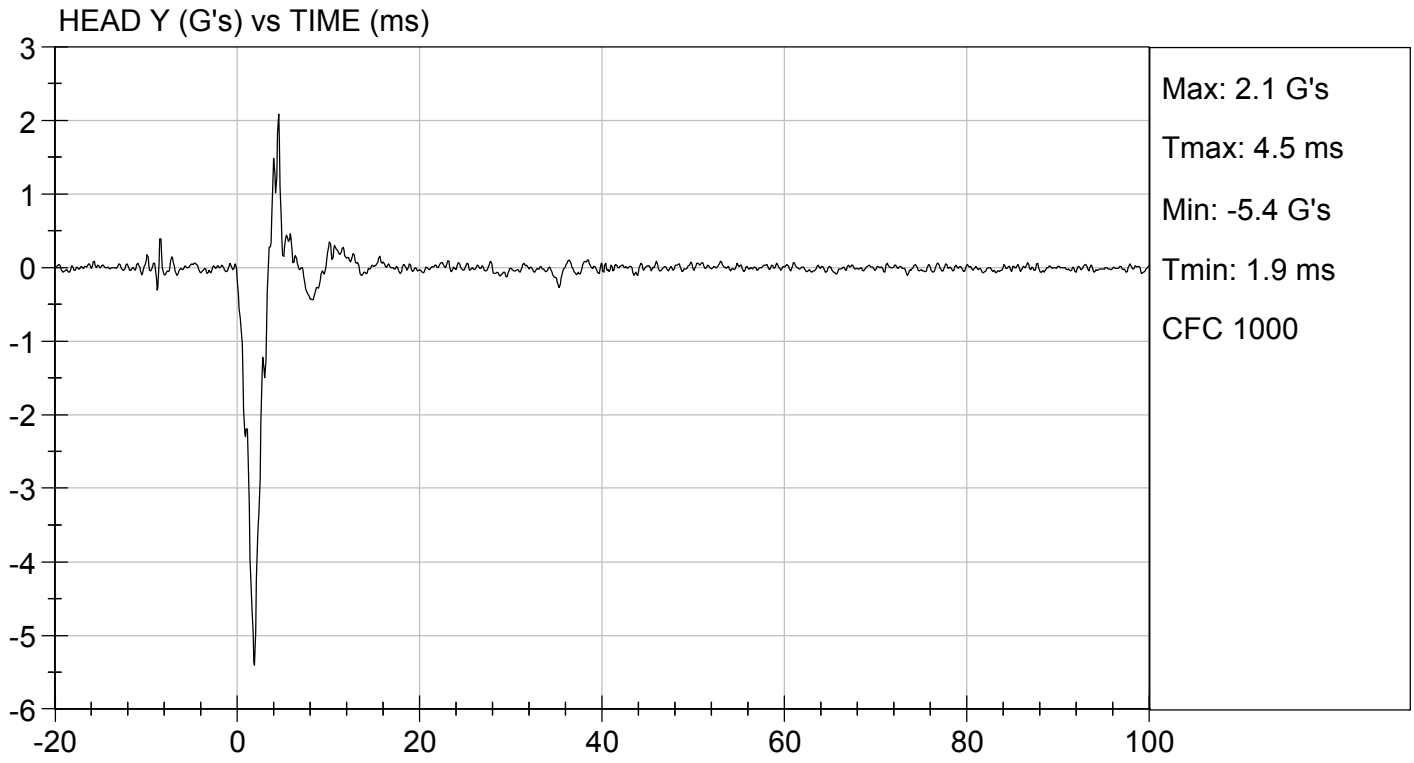


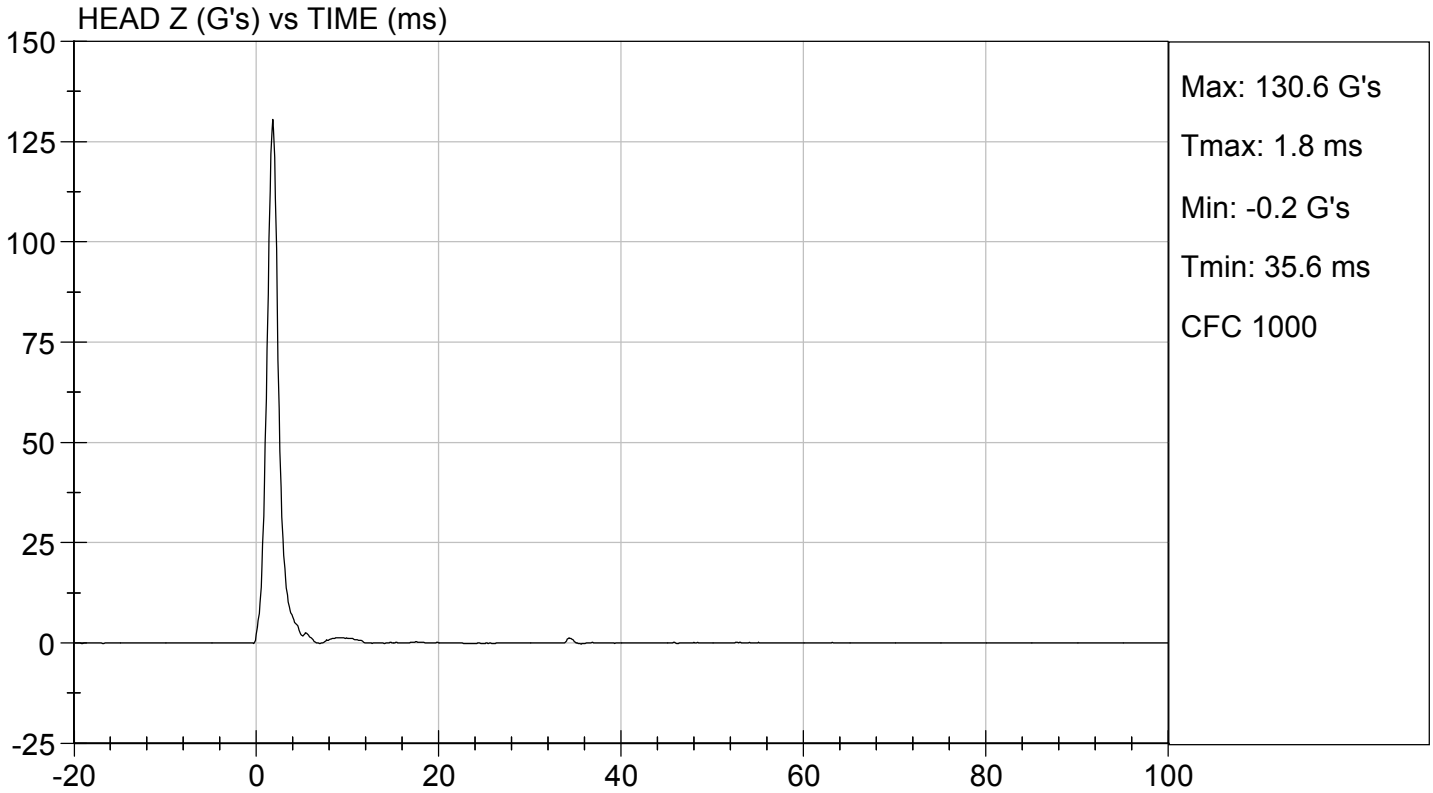
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 10/10/2018
TEST #: D183051





MGA RESEARCH CORPORATION

NECK FLEXION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D183052

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	52	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	6.6	Pass
D Plane Rotation	Max	deg	77 to 91	86	Pass
Occipital Condyle Moment within Rotation Corridor		Nm	69 to 83	70	Pass
Positive Moment Time Curve Decay to 10 Nm		ms	80 to 100	86	Pass
			Overall Results		Pass

Jacob D Taylor

Laboratory Technician

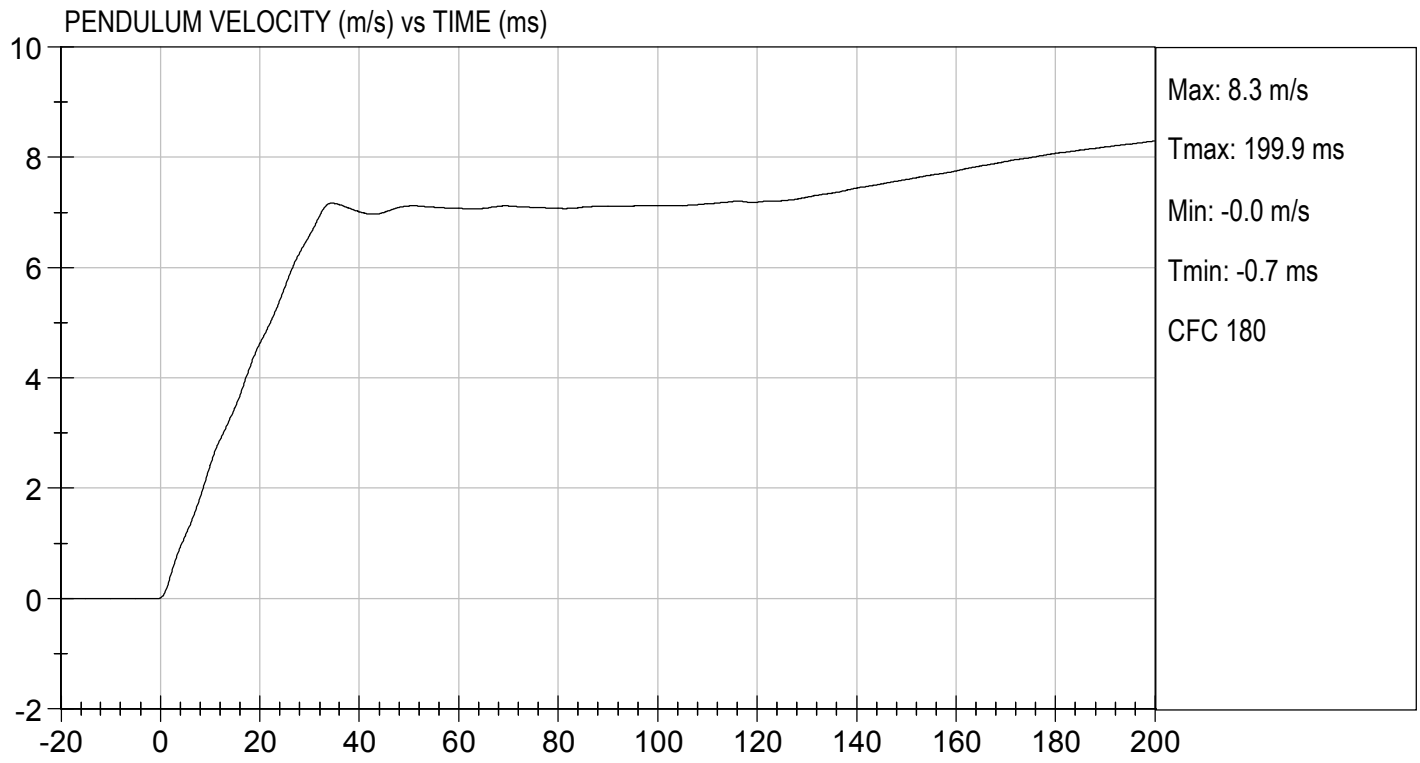
10/10/2018

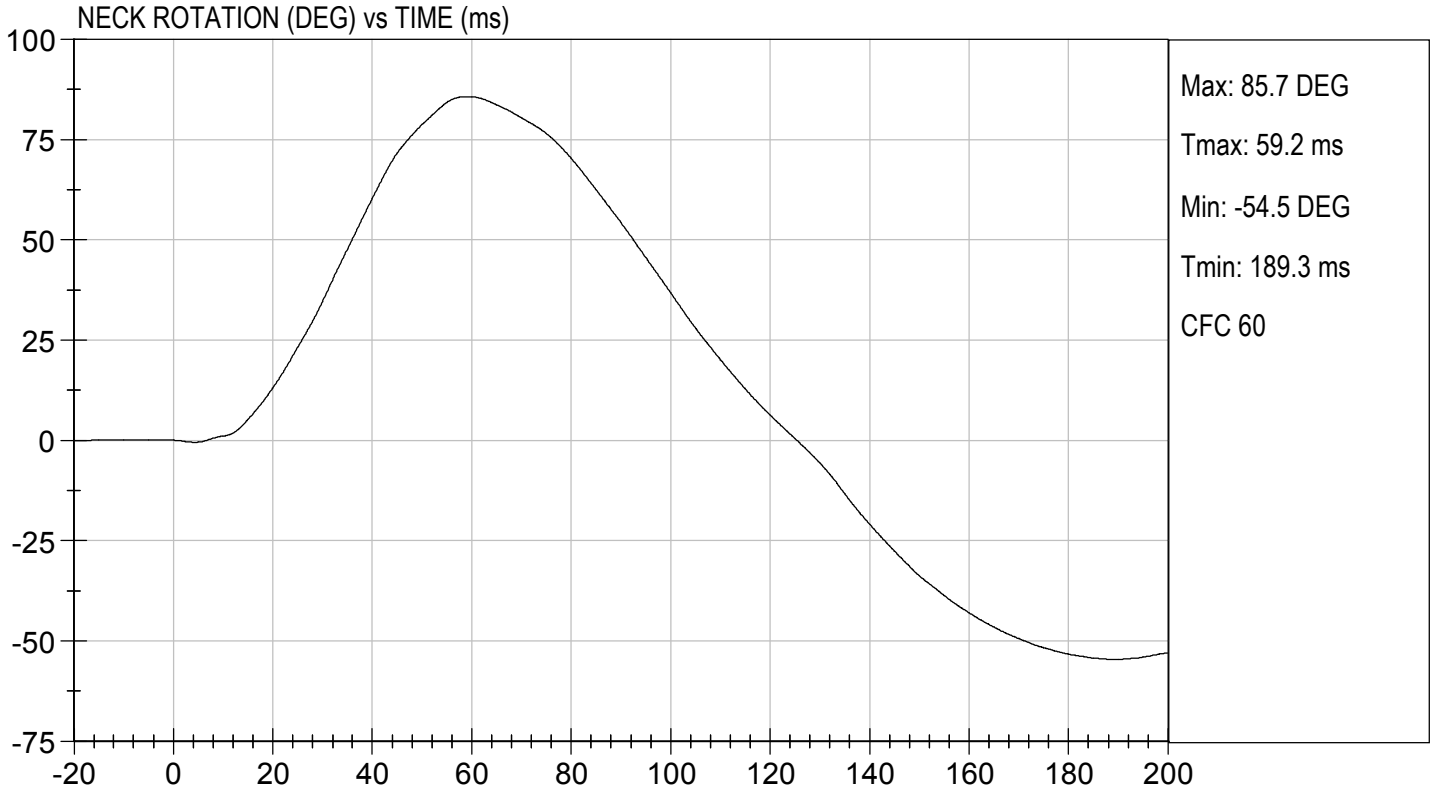
Test Date

Approved By

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

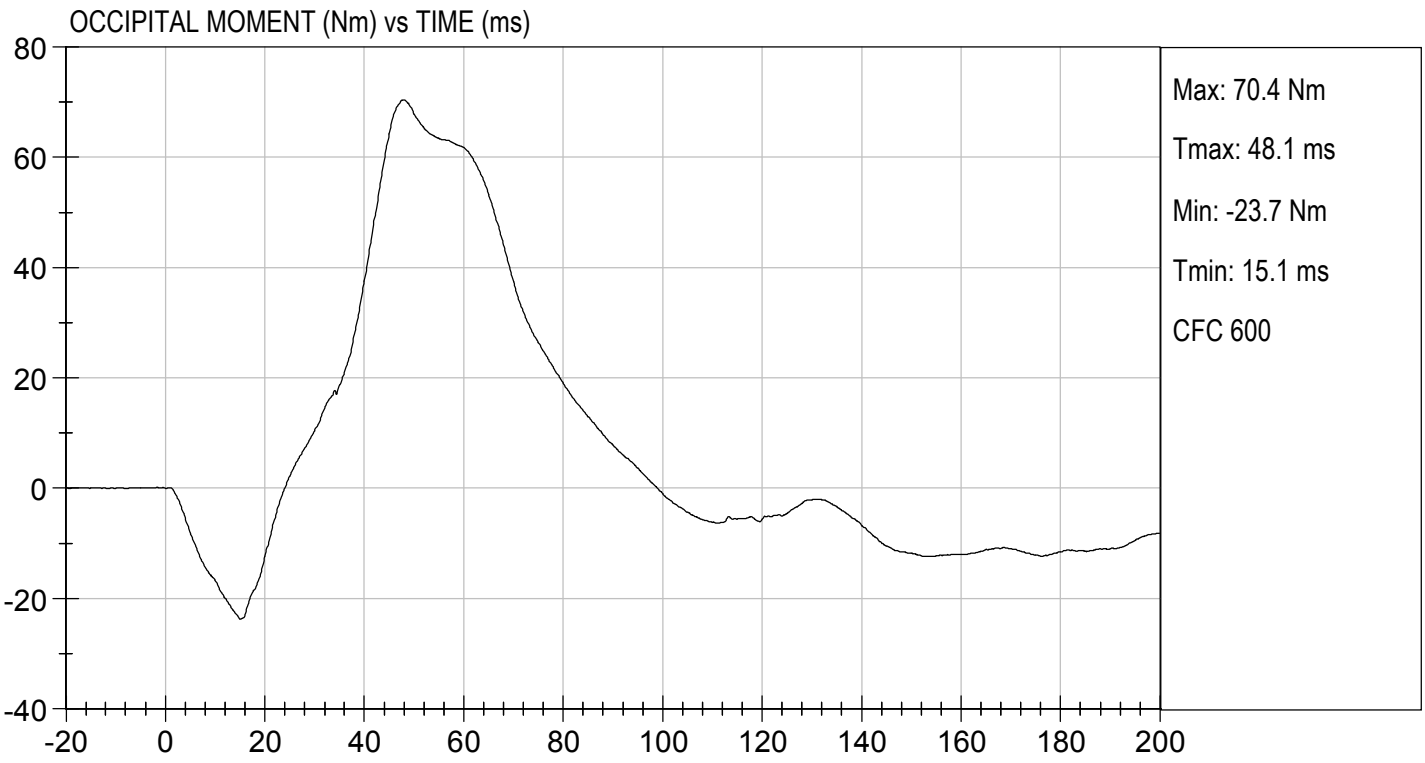
TEST DATE: 10/10/2018
TEST #: D183052





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

TEST DATE: 10/10/2018
TEST #: D183052



MGA RESEARCH CORPORATION

NECK EXTENSION TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D183053

Tested Parameter		Units	Specification	Result	Pass/Fail
Laboratory Temperature		deg C	20.6 to 22.2	21.4	Pass
Laboratory Relative Humidity		%	10 to 70	52	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	3.7	Pass
	30 ms	m/s	4.6 to 5.6	5.3	Pass
D Plane Rotation	Max	deg	99 to 114	108	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	103	Pass
			Overall Results		Pass

Jacob D Taylor

Laboratory Technician

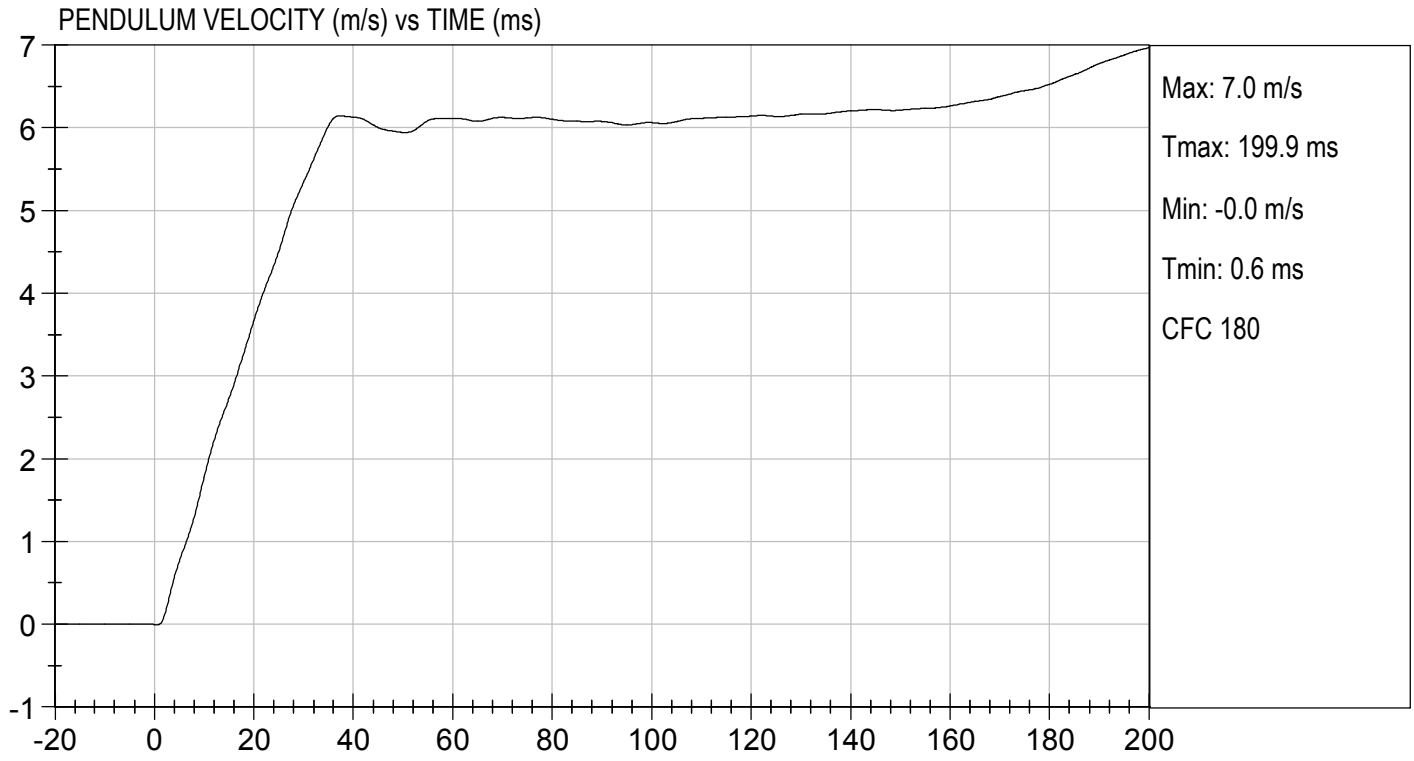
10/10/2018

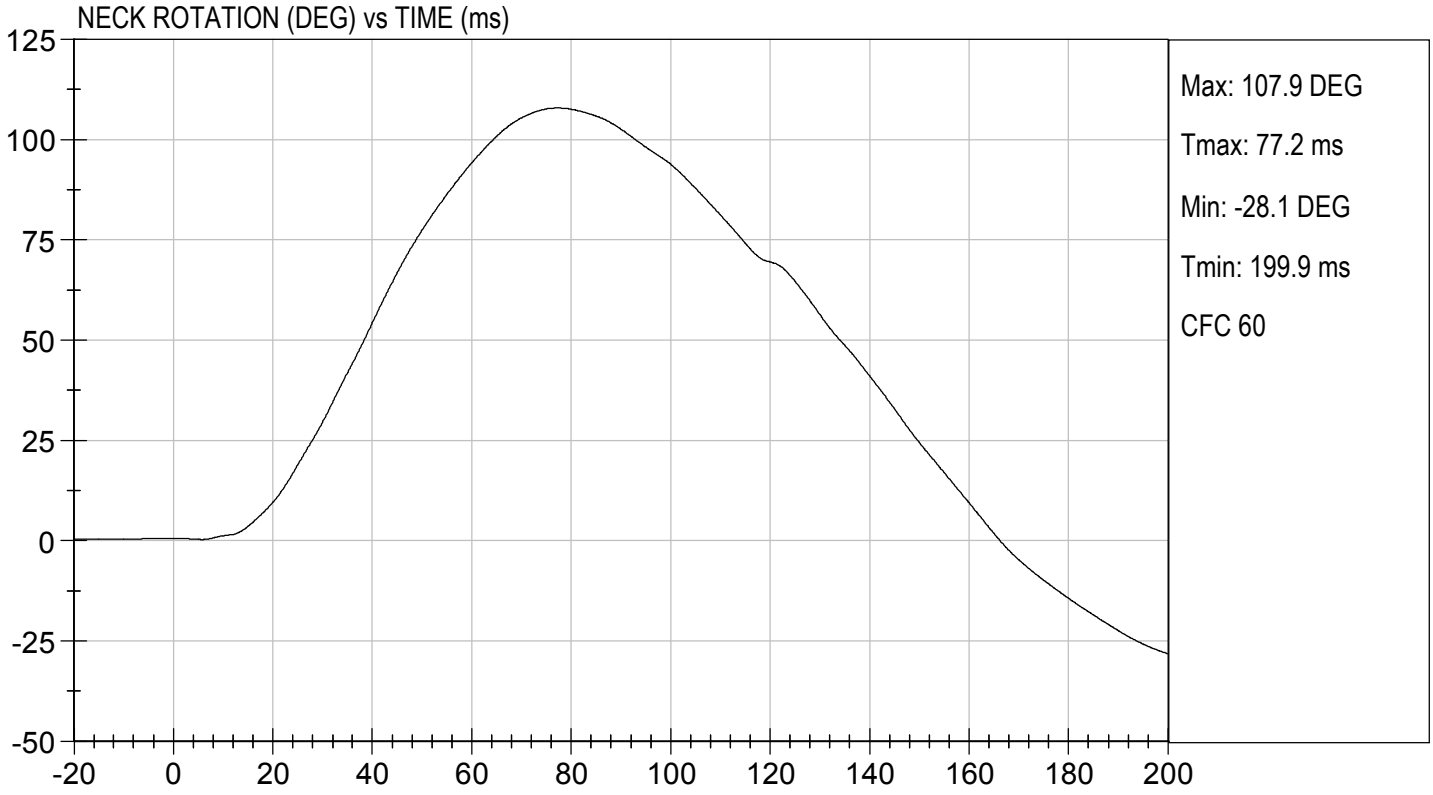
Test Date

Approved By

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

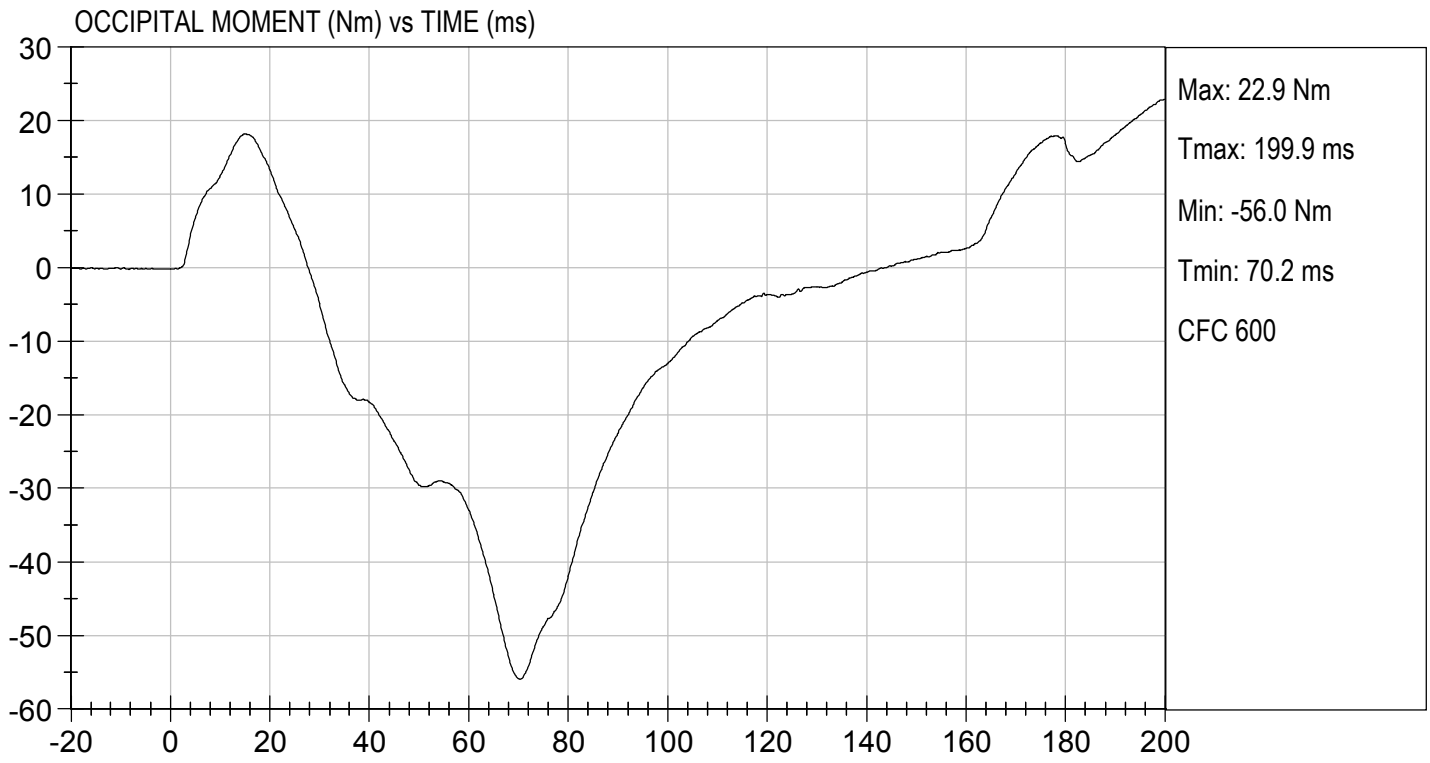
TEST DATE: 10/10/2018
TEST #: D183053





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

TEST DATE: 10/10/2018
TEST #: D183053



MGA RESEARCH CORPORATION

THORAX IMPACT

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D183054

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.2	Pass
Relative Humidity	%	10 to 70	51	Pass
Probe Speed	m/s	6.59 to 6.83	6.77	Pass
Peak Deflection	mm	50 to 58	55	Pass
Peak Resistive Force w/in Deflection Corridor	N	3900 to 4400	4266	Pass
Internal Hysteresis	%	69 to 85	71	Pass
Peak Force 18 mm - 50 mm	N	<= 4600	4199	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

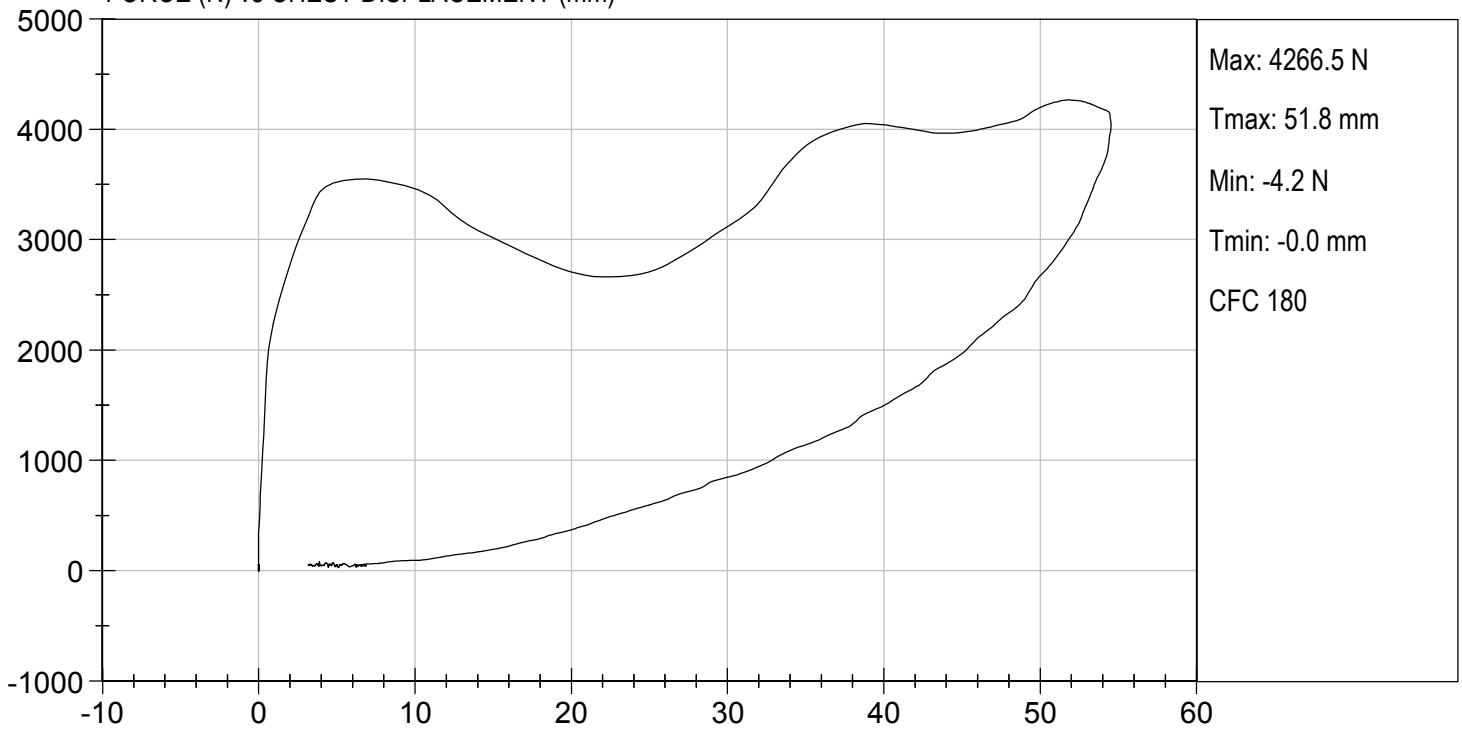
10/10/2018
Test Date

Approved By

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

TEST DATE: 10/10/2018
TEST #: D183054

FORCE (N) vs CHEST DISPLACEMENT (mm)



MGA RESEARCH CORPORATION

RIGHT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D183055

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	52	Pass
Probe Speed	m/s	2.07 to 2.13	2.08	Pass
Maximum Force	N	3450 to 4060	3603	Pass
		Overall Test Results		Pass

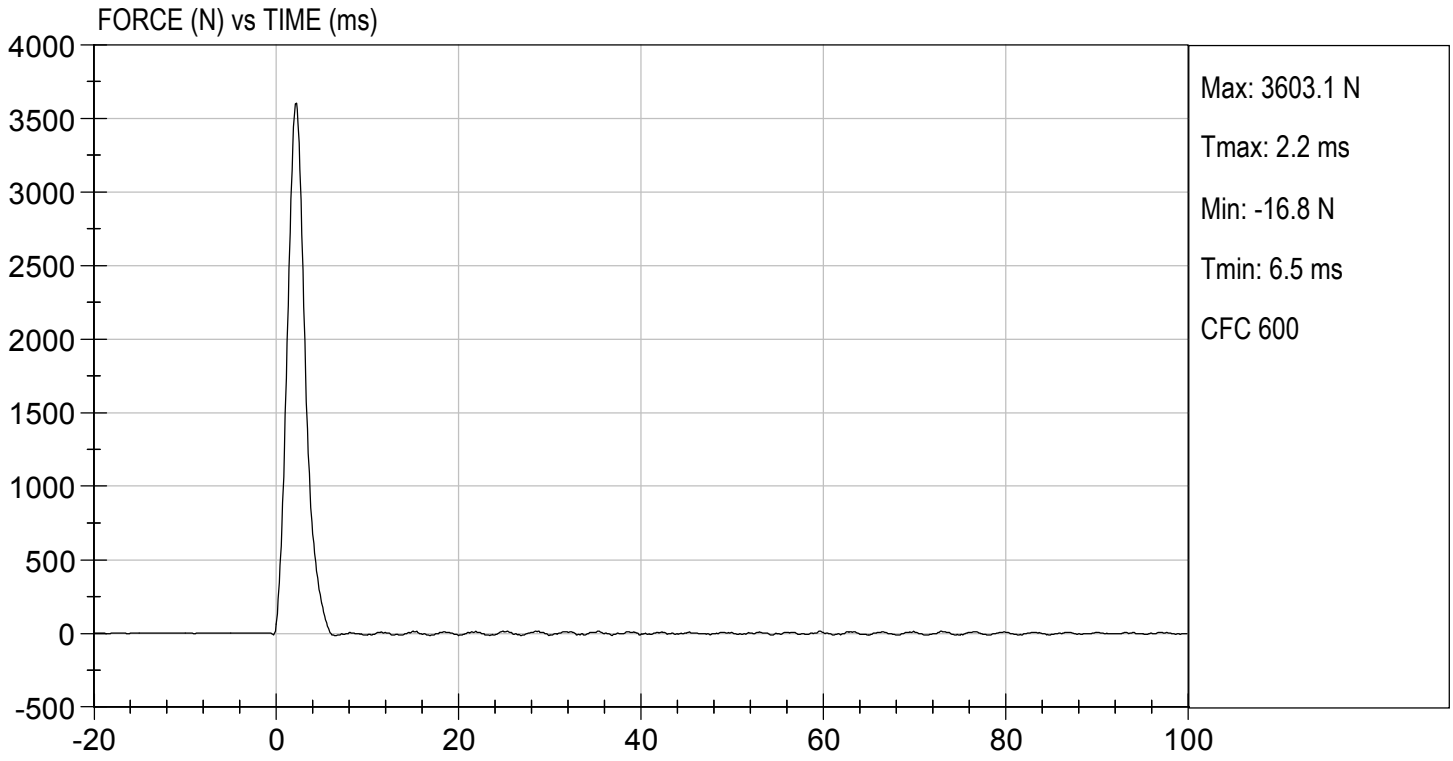
Jacob D Taylor
Laboratory Technician

10/10/2018
Test Date

Approved By

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

TEST DATE: 10/10/2018
TEST #: D183055



MGA RESEARCH CORPORATION

LEFT KNEE IMPACT TEST

HYBRID III 5TH PERCENTILE

ATD Serial No: 138 **Test I.D:** D183056

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	52	Pass
Probe Speed	m/s	2.07 to 2.13	2.10	Pass
Maximum Force	N	3450 to 4060	3829	Pass
		Overall Test Results		Pass

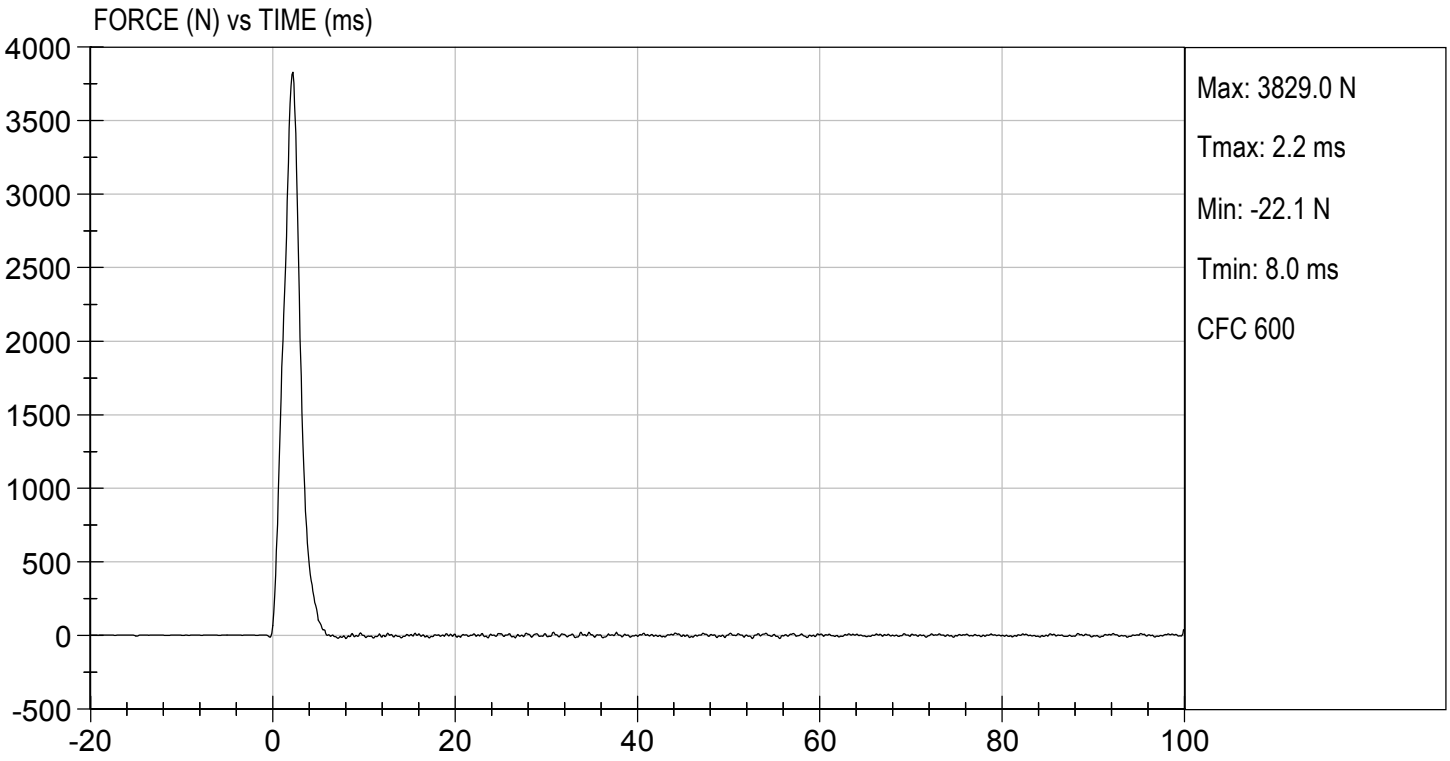
Jacob D Taylor
Laboratory Technician

10/10/2018
Test Date

Approved By

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

TEST DATE: 10/10/2018
TEST #: D183056



MGA RESEARCH CORPORATION

TORSO FLEXION TEST

HYBRID III 5TH PERCENTILE

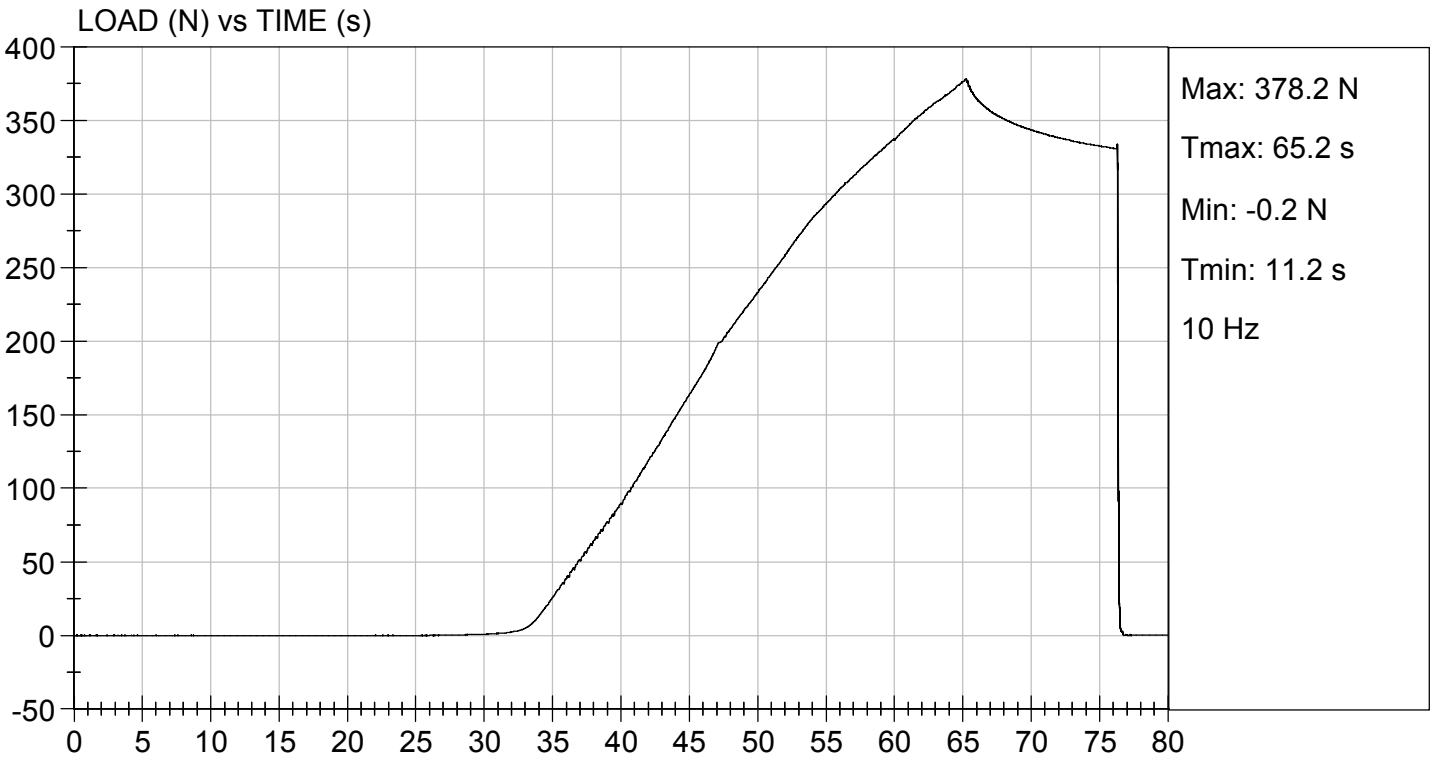
ATD Serial No: 138 **Test I.D:** D183057

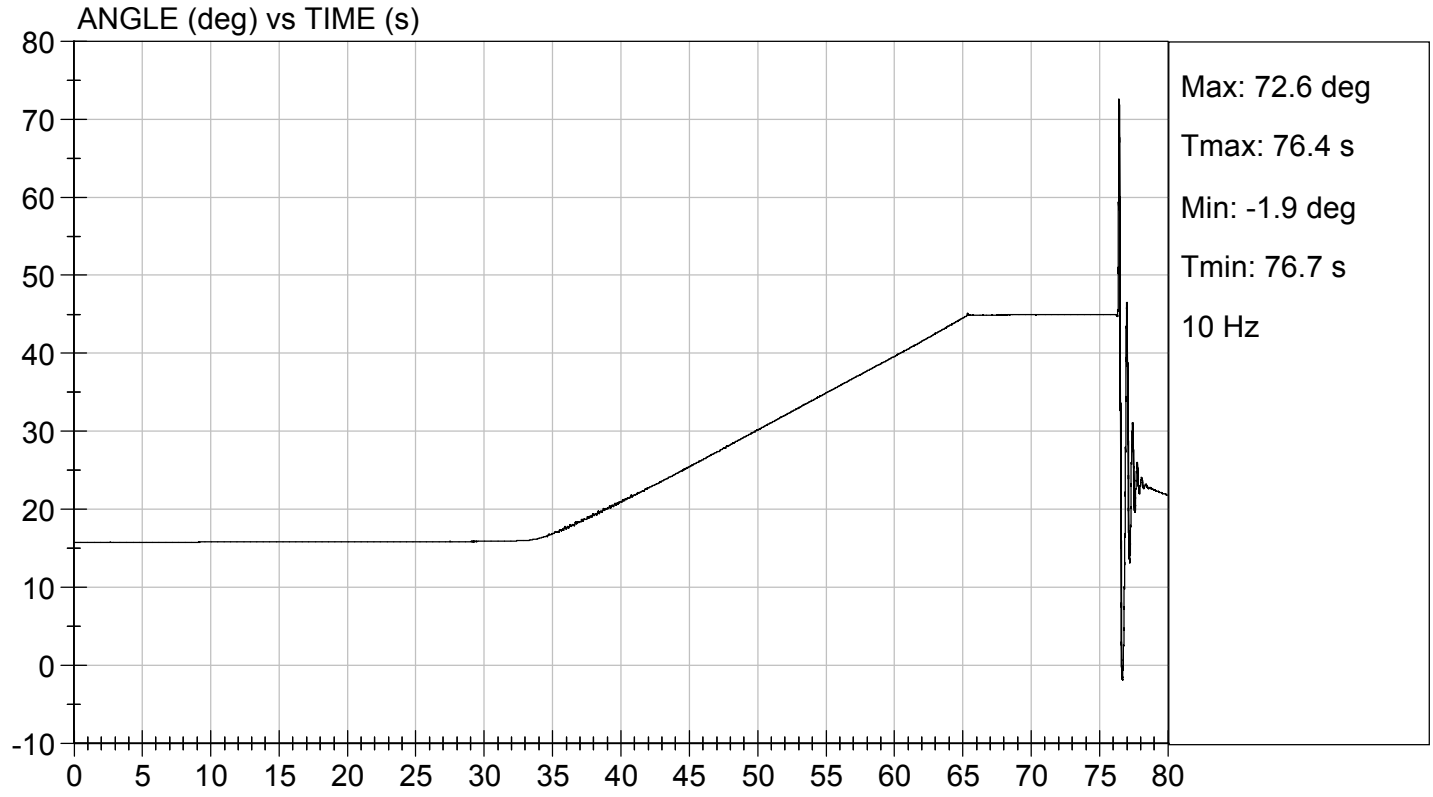
Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	18.9 to 25.6	21.1	Pass
Laboratory Relative Humidity	%	10 to 70	52	Pass
Initial Angle	deg	0 to 20	16	Pass
Return Angle	deg	+/- 8	4	Pass
Force at 45 deg	N	320 to 390	378	Pass
Upper Torso Deflection Rate	deg/s	0.5 to 1.5	0.9	Pass
		Overall Result		Pass

Jacob D Taylor
Laboratory Technician

10/10/2018
Test Date

Approved By


LOAD (N) vs TIME (s)
400
350
300
250
200
150
100
50
0
-50
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
Max: 378.2 N
Tmax: 65.2 s
Min: -0.2 N
Tmin: 11.2 s
10 Hz


ANGLE (deg) vs TIME (s)
80
70
60
50
40
30
20
10
0
-10
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80
Max: 72.6 deg
Tmax: 76.4 s
Min: -1.9 deg
Tmin: 76.7 s
10 Hz