REPORT NUMBER: SPNCAP-MGA-2018-035

NEW CAR ASSESSMENT PROGRAM (NCAP)
Side Impact Pole Test

MAZDA MOTOR CORPORATION
2018 Nissan Titan S Crew Cab Truck
NHTSA No.: O20185202

MGA RESEARCH CORPORATION
5000 Warren Road
Burlington, WI 53105

Test Date: October 4, 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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Prepared by: _____
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Approved by: _____
Ben Fischer, Project Engineer

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. SPNCAP-MGA-2018-035	*2. Government Accession No.*	*3. Recipient's Catalog No.*
4. Title and Subtitle Final Report of New Car Assessment Program Side Impact Pole Testing of a 2018 Nissan Titan S Crew Cab Truck, NHTSA No.: O20185202		*5. Report Date* December 11, 2018 *6. Performing Organization Code* MGA
7. Author(s) Robert Schnorenberg, Project Engineer		*8. Performing Organization Report No.* SPNCAP-MGA-2018-035
9. Performing Organization Name and Address MGA Research Corporation 5000 Warren Road Burlington, WI 53105		*10. Work Unit No.* *11. Contract or Grant No.* DTNH22-14-D-00353
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards (NRM-110) 1200 New Jersey Ave, SE, Room W43-410 Washington, DC 20590		*13. Type of Report and Period Covered:* Final Test Report October 4, 2018 to December 11, 2018 *14. Sponsoring Agency Code* NRM-110
15. Supplementary Notes		

16. Abstract

A 32.20 km/h, 75° oblique impact Side NCAP Test was conducted on the subject 2018 Nissan Titan S Crew Cab Truck in accordance with the specifications of the Office of Crashworthiness Standards Side NCAP Pole Laboratory Test Procedure for the generation of consumer information on vehicle side pole crash protection. The test was conducted at MGA Research Corporation in Burlington, Wisconsin on October 4, 2018.

The impact velocity was 32.28 km/h, and the ambient temperature at the struck (driver's) side of the target vehicle at the time of impact was 21.8°C. The test vehicle post-test maximum crush was 423 mm at level 3. The test vehicle's performance was as follows:

	Driver ATD (SID-IIs)		
Measurement Description	**Units**	**Threshold**	**Result**
Head Injury Criteria (HIC_{36})	N/A	1000	221
Resultant Lower Spine Acceleration	Gs	82	34
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2506
Maximum Thoracic Rib Deflection	mm	38*	26
Maximum Abdomen Rib Deflection	mm	45*	21

*Proposed IARV

The doors on the struck side of the vehicle did not separate from the body at the hinges or latches and the opposite doors did not open during the side impact event.

17. Key Words New Car Assessment Program (NCAP) Side Impact Pole Part 572V SID-IIs		*18. Distribution Statement* Copies of this report are available from: National Highway Traffic Safety Administration Technical Information Services Division, NPO-411 1200 New Jersey Ave, SE Washington, DC 20590 e-mail: tis@nhtsa.dot.gov FAX: 202-493-2833	
19. Security Classification of Report Unclassified	*20. Security Classification of Page* Unclassified	*21. No. of Pages* 138	22. Price

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SECTION 1
TEST PURPOSE AND PROCEDURE

This side impact test is part of the MY 2018 New Car Assessment Program Side Impact Test Program, sponsored by the National Highway Traffic Safety Administration (NHTSA), under Contract No. DTNH22-14-D-00353. The purpose of this test is to generate comparative side impact performance in a 2018 Nissan Titan S Crew Cab Truck. The side impact test was conducted in accordance with the Office of Crashworthiness Standard's Side NCAP Pole Laboratory Test Procedure, dated October 2015.

SECTION 2
SUMMARY OF TEST RESULTS

A rigid pole side impact test was conducted on a 2018 Nissan Titan S Crew Cab Truck. The subject vehicle was towed into the rigid pole at an angle of 75° and a velocity of 32.28 km/h. The test was conducted by MGA Research Corporation in Burlington, Wisconsin on October 4, 2018. Pre-test and post-test photographs of the test vehicle and side impact dummy (SID-IIs) are included in Appendix A of this report.

One Part 572V (SID-IIs) dummy was placed in the driver designated seating position according to instructions specified in the OCWS Side NCAP Pole Laboratory Test Procedure dated October 2015. Camera locations and other pertinent camera information are included in this report.

The Part 572V (SID-IIs) dummy was instrumented accordingly:

Primary and Redundant Head CG Triaxial Accelerometers
Thorax Upper, Middle, and Lower Rib Displacement Potentiometers
Abdomen Upper Rib and Lower Rib Displacement Potentiometers
Lower Spine (T12) Triaxial Accelerometers
Iliac Load Cell
Acetabulum Load Cell

Appendix B contains the vehicle and dummy response data. Dummy configuration and performance verification data can be found in Appendix C of this report. Appendix D contains the test equipment and instrumentation calibration data.

Injury readings for the SID-IIs dummy were recorded as follows:

Measurement Description	Driver ATD (SID-IIs)		
	Units	Threshold	Result
Head Injury Criteria (HIC_{36})	N/A	1000	221
Resultant Lower Spine Acceleration	Gs	82	34
Total Pelvic Force (sum of acetabular and iliac forces)	N	5525	2506
Maximum Thoracic Rib Deflection	mm	38*	26
Maximum Abdominal Rib Deflection	mm	45*	21

*Proposed IARV

Supplemental restraint information is given below:

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	No			
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other				

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

GENERAL COMMENTS

Load Cell Pole #8 FY recorded no valid data.

MGA does not endorse or certify products. The manufacturer's name appears solely for identification purposes.

SECTION 3
OCCUPANT AND VEHICLE INFORMATION

DATA SHEET NO. 1
GENERAL TEST AND VEHICLE PARAMETER DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck
Test Program: NCAP Side Pole Impact Test
NHTSA No. O20185202
Test Date: 10/4/2018

TEST VEHICLE INFORMATION AND OPTIONS

NHTSA No.	O20185202
Model Year	2018
Make	Nissan
Model	Titan S Crew Cab
Body Style	Truck
VIN	1N6AA1EK0JN544159
Body Color	Brilliant Silver
Odometer Reading (km/mi)	18km / 11mi
Engine Displacement (L)	5.6 L
Type/No. Cylinders	V8
Engine Placement	Longitudinal
Transmission Type	Automatic
Transmission Speeds	7
Overdrive	Yes
Final Drive	RWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	No
Anti-Lock Brakes (ABS)	Yes

Traction Control System (TCS)	Yes
Auto-Leveling System	No
Automatic Door Locks (ADL)	Yes
Power Window Auto-Reverse	Yes
Other Optional Feature	N/A
Driver Front Airbag	Yes
Driver Curtain Airbag	Yes
Driver Head/Torso Airbag	No
Driver Torso Airbag	No
Driver Torso/Pelvis Airbag	Yes
Driver Pelvis Airbag	No
Driver Knee Airbag	No
Rear Pass. Curtain Airbag	Yes
Rear Pass. Head/Torso Airbag	No
Rear Pass. Torso Airbag	No
Rear Pass. Torso/Pelvis Airbag	No
Rear Pass. Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	No
Driver Load Limiter	Yes
Rear Pass. Load Limiter	No
Other Restraint Feature	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
Vehicle Type	Truck

GVWR (kg)	3221
GAWR Front (kg)	1724
GAWR Rear (kg)	1820

VEHICLE SEATING AND WEIGHT CAPACITY DATA

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	3	3		6	
Capacity Weight (VCW) (kg)				650	(A)
DSC x 68.04 kg				408	(B)
Rated Cargo and Luggage Weight (RCLW) (kg)				242	(A-B)

VEHICLE SEAT TYPE

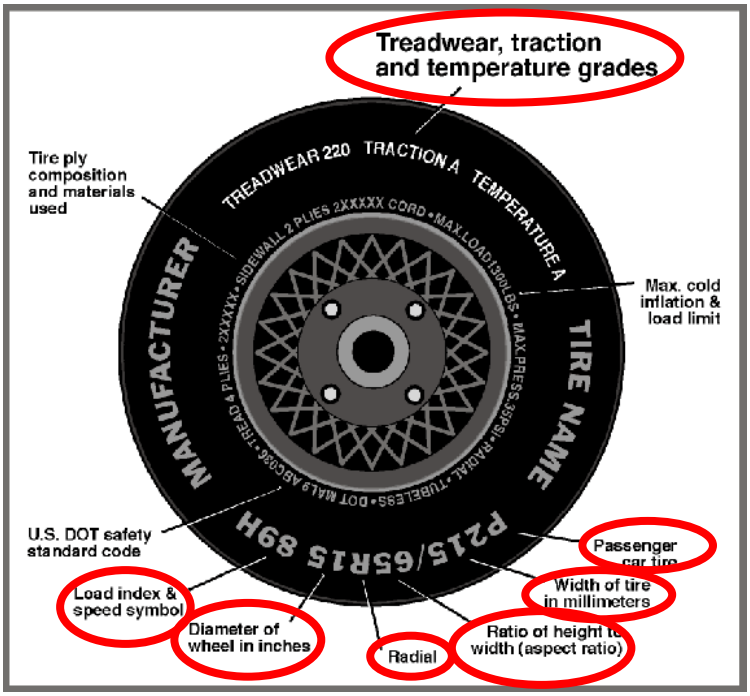
Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						Manual	Power
Front Seat	X					w/ Lever	
Rear or Second Row			X		X		
Third Row Seat							

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

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20185202
Test Date: 10/4/2018

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 Polyester, 2 Steel, 1 Nylon	2 Polyester, 2 Steel, 1 Nylon
Load Index/Speed Symbol	114S	114S
Tire Material	Rubber	Rubber
DOT Safety Code Left	73D6 3KD 4317	73D6 3KD 4417
DOT Safety Code Right	73D6 3KD 4417	73D6 3KD 4317

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

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

TEST PRESSURES

	Units	LF	RF	LR	RR
As Delivered	kpa	276	283	262	241
Tire Placard	kpa	250	250	250	250
Owner's Manual	kpa	250	250	250	250
As Tested	kpa	250	250	250	250

TEST VEHICLE WEIGHTS

	Units	As Delivered (UVW)			As Tested (ATW)			Fully Loaded		
		Front	Rear	Total	Front	Rear	Total	Front	Rear	Total
Left	kg	707.0	565.5		724.5	639.5		714.0	661.0	
Right	kg	713.5	538.5		728.0	612.5		706.5	631.0	
Ratio	%	56.3%	43.7%		53.7%	46.3%		52.4%	47.6%	
Totals	kg	1420.5	1104.0	2524.5	1452.5	1252.0	2704.5	1420.5	1292.0	2712.5

TARGET TEST WEIGHT CALCULATION

Measured Parameter	Units	Value	
Total Delivered Weight (UVW)	kg	2524.5	(A)
Actual Weight of 1 P572V ATD (SID-IIs) ATD Used	kg	52	(B)
Rated Cargo/Luggage Weight (RCLW)	kg	136	(C)
Calculated Vehicle Target Weight (TVTW)	kg	2712.5	(A+B+C)

Does the measured As Tested Vehicle Weight lie within the required weight range (i.e. Calculated Test Vehicle Target Weight – 4.5 kg to 9 kg)? **YES**

TEST VEHICLE ATTITUDES AND CG

	Units	As Delivered	As Tested	Fully Loaded	Meets Requirement***
Driver Door Sill Angle (front-to-rear)*	deg	-0.5	-0.4	-0.3	Yes
Front Pass. Sill Angle (front-to-rear)*	deg	-1.1	-0.8	-0.8	Yes
Front Bumper Angle (left-to-right)**	deg	-0.1	0.0	0.0	Yes
Rear Bumper Angle (left-to-right)**	deg	-0.3	0.1	0.4	Yes
Vehicle CG (Aft of Front Axle)	mm	1556	1647	1695	
Vehicle CG (Left (+) / Right (-) from Longitudinal Centerline)	mm	7	7	12	

*ND=Nose Down (-), NU=Nose Up (+) ** LD=Left Down (-), LU=Left Up (+)
*** The "As Tested" vehicle attitude measurements must be equal to or between the "As Delivered" and "Fully Loaded" vehicle attitude measurements.

WEIGHT OF BALLAST AND VEHICLE COMPONENTS REMOVED TO MEET TVTW

Component Description	Weight (kg)
Ballast (if any)	78
None	

Test height adjustable suspension setting, if applicable:	Not Applicable

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

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

SEAT POSITIONING

The driver's seat, front center seat (if applicable), and right front passenger's seat should be set to the forward-most, mid-height, mid-angle position. The struck-side rear passenger's seat, rear center seat, and non-struck side rear passenger's seats should be set to the rear-most, lowest, mid-angle position.

SCRL ANGLE RANGE

Seat	SCRL (°)		
	Max	Min	Mid
Driver Seat	Fixed	Fixed	Fixed
Front Passenger Seat	Fixed	Fixed	Fixed
Front Center Seat			
Struck Side Rear Seat	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed

SEAT HEIGHT AND ANGLE

Seat	As Tested SCRL Angle (Mid) (°)	As Tested SCRP Height (mm)	SCRP Height Position	SCRP Height (mm)		
				Rear-most	Mid-Fore/Aft	Forward-Most
Driver Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Passenger Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Front Center Seat			Max			
			Mid			
			Min			
Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Max	Fixed	Fixed	Fixed
			Mid	Fixed	Fixed	Fixed
			Min	Fixed	Fixed	Fixed

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

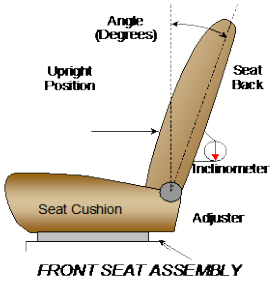
Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

SEAT FORE/AFT POSITIONS

Seat	Total Fore/Aft Travel		Test Position from Forward-most Position	
	mm	Detents	mm	Detent
Driver Seat	240	25 (1st as 1)	0	0th (1st as 0)
Front Passenger Seat	240	25 (1st as 1)	0	0th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

SEAT BACK ANGLE ADJUSTMENT

The driver's seat back is positioned such that the dummy's head is level. The front center and front passenger's seat backs are positioned in a similar manner as the driver's seat back. The struck-side rear passenger seat back is positioned in accordance with the information provided by the manufacturer on Form No. 1 for the 5th percentile female dummy in a Side NCAP MDB test. The rear center and non-struck side rear passenger's seat back is set to match the struck-side rear seat back.



Seat	Total Seat Back Angle Range		Test Position from Vertical	
	Degrees	Detents	Degree	Detent
Driver Seat w/Seated Dummy	76.1	39 (1st as 1)	-10.6	4th (1st as 0)
Front Passenger Seat	76.1	39 (1st as 1)	-9.9	4th (1st as 0)
Front Center Seat				
Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Non-Struck Side Rear Seat	Fixed	Fixed	Fixed	Fixed
Rear Center Seat	Fixed	Fixed	Fixed	Fixed

Seat back angles measured on outboard headrest post.

SEAT BELT ANCHORAGE ADJUSTMENT

Seat belt anchorages are adjusted in accordance with the information provided by the manufacturer on Form No. 1.

	Total # of Positions	**Placed in Position #**
Driver Seat	4 detents (1st as 1)	0th (Uppermost as 0)

HEAD RESTRAINT ADJUSTMENT

Head restraints are adjusted to the lowest and most full forward in-use position.

	Total # of Positions	**Placed in Position #**
Driver Seat	5 detents (1st as 1)	0 (Lowermost as 0)

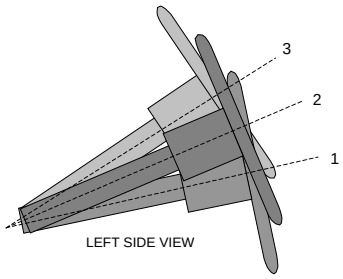
DATA SHEET NO. 2 (CONTINUED)
SEAT, SEAT BELT, STEERING WHEEL ADJUSTMENT, AND FUEL SYSTEM DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck
Test Program: NCAP Side Pole Impact Test
NHTSA No. O20185202
Test Date: 10/4/2018

STEERING COLUMN ADJUSTMENT

Steering wheel and column adjustments are made so that the steering wheel geometric locus is described when it moves through its full range of motion.

	Degrees	Fore/Aft Position (mm)
Lowermost, Position 1	66.2	252
Geometric Center, Position 2	63.5	234
Uppermost, Position 3	60.8	215
Telescoping Steering Wheel Travel		37
Test Position	63.5	234

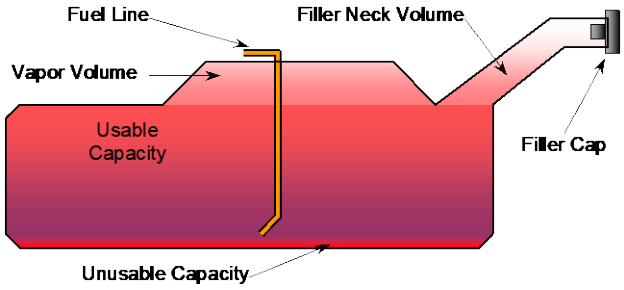


STEERING COLUMN ASSEMBLY

FUEL PUMP

Describe the fuel pump type, details about how it operates 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 will turn off immediately after turning ingnition switch OFF. The filler neck is located on the driver's side.



VEHICLE FUEL TANK ASSEMBLY

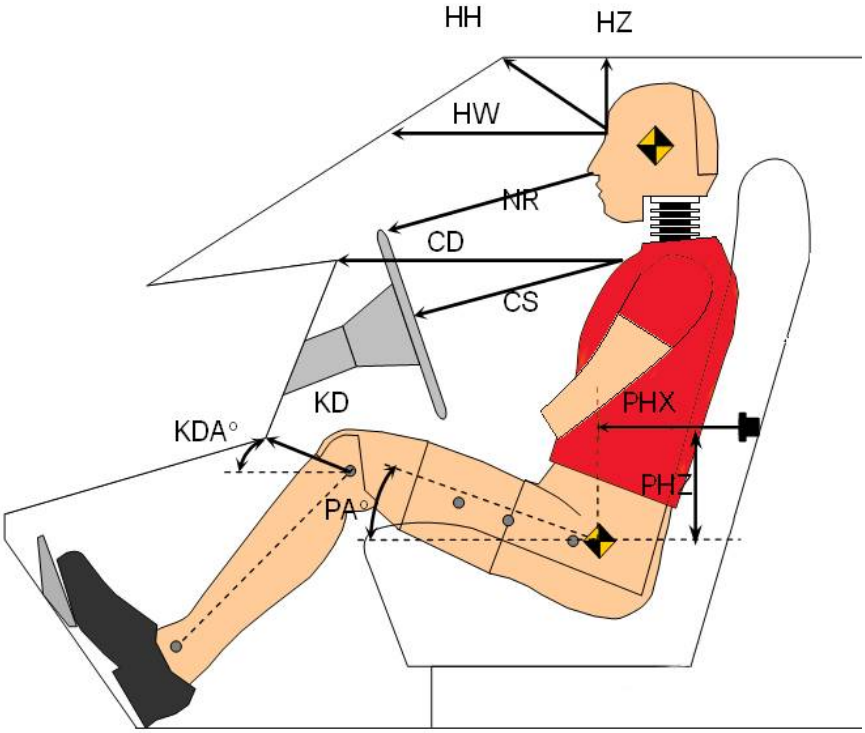
FUEL TANK CAPACITY DATA

	Liters
Usable Capacity of "Standard Tank" (see Form No. 1)	96.9
Usable Capacity of "Optional Tank" (see Form No. 1)	
Usable Capacity of Standard Tank as Specified in Owner's Manual	96.9
Usable Capacity of Optional Tank as Specified in Owner's Manual	
93% of Usable Capacity	90.1
Actual Amount of Solvent Used	90.1
1/3 of Usable Capacity	32.3

Is the actual amount of solvent used in the test equal to 93% ± 1% of the Usable Capacity stated in Form No. 1? **YES**

.DATA SHEET NO. 3
DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

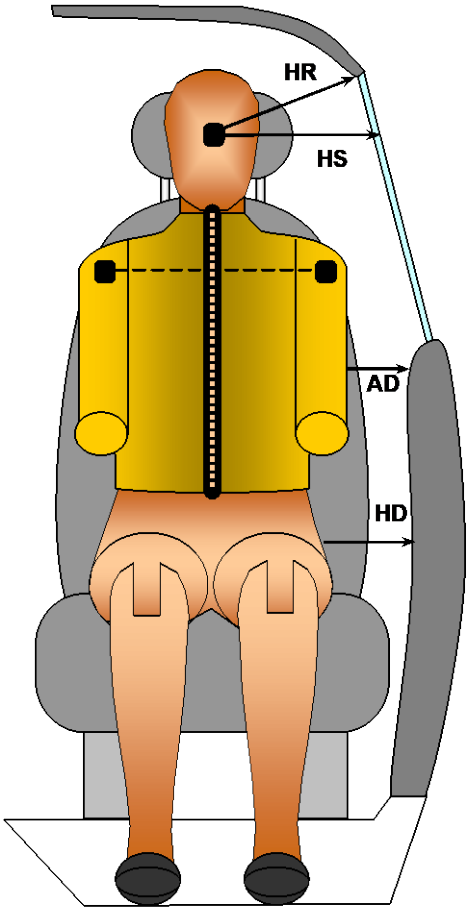


LEFT SIDE VIEW

Code	Measurement Description	Driver	
		Length (mm)	Angle (°)
HH	Head to Header	344	
HW	Head to Windshield	705	
HZ	Head to Roof Liner	228	
NR	Nose to Rim	214	
CD	Chest to Dashboard	414	
CS	Chest to Steering Wheel	150	
KDL/KDAL°	Left Knee to Dash	107	34.6
KDR/KDAR°	Right Knee to Dash	105	43.5
PAX°	Pelvic Tilt Angle (X-Axis)		19.6
PAY°	Pelvic Tilt Angle (Y-Axis)		-1.0
PHX	Hip Point to Striker (X-Axis)	419	
PHZ	Hip Point to Striker (Z-Axis)	26	

DATA SHEET NO. 4
DUMMY LATERAL CLEARANCE DIMENSIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

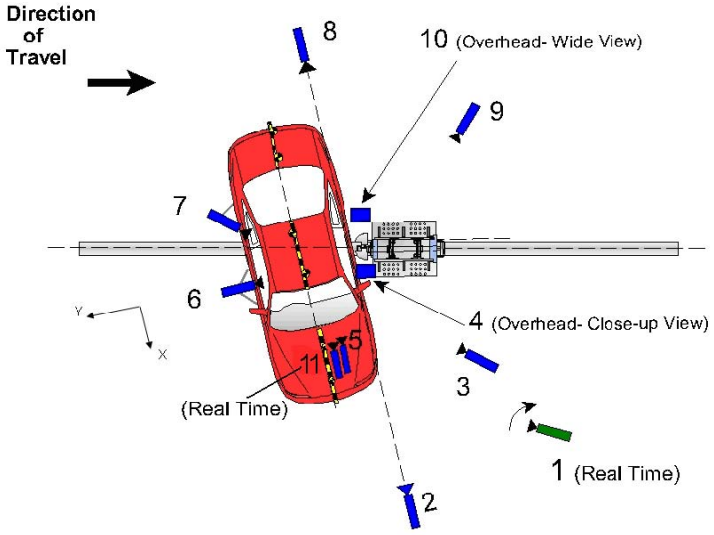


FRONT VIEW OF DUMMY

Code	Measurement Description	Driver Length (mm)
HR	Head to Side Header	267
HS	Head to Side Window	371
AD	Arm to Door	160
HD	Hip Point to Door	167

DATA SHEET NO. 5
CAMERA AND INSTRUMENTATION DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018



Reference: (from Point of Impact for X and Y; from Ground for Z):
+X = Forward of Impact, + Y = Right of Impact, +Z = Down

Camera No.	View	Coordinates (mm)			Lens (mm)	Film Speed (fps)
		X*	Y*	Z*		
1	Real-Time Pan View					30
2	Front Ground Level	6760	60	-2040	24	1000
3	Impact Side 45° Forward	4480	-2200	-2090	20	1000
4	Overhead Closeup	0	0	-6670	70	1000
5	Onboard – Driver Front				16	1000
6	Onboard – Driver Side				8	1000
7	Onboard – Driver Rear				8	1000
8	Rear Ground Level	-7980	-50	-1990	24	1000
9	Impact Side 45° Rearward	-3760	-3910	-1960	20	1000
10	Overhead Wide View	0	600	-6650	14	1000
11	Real-Time Dummy Front View					30

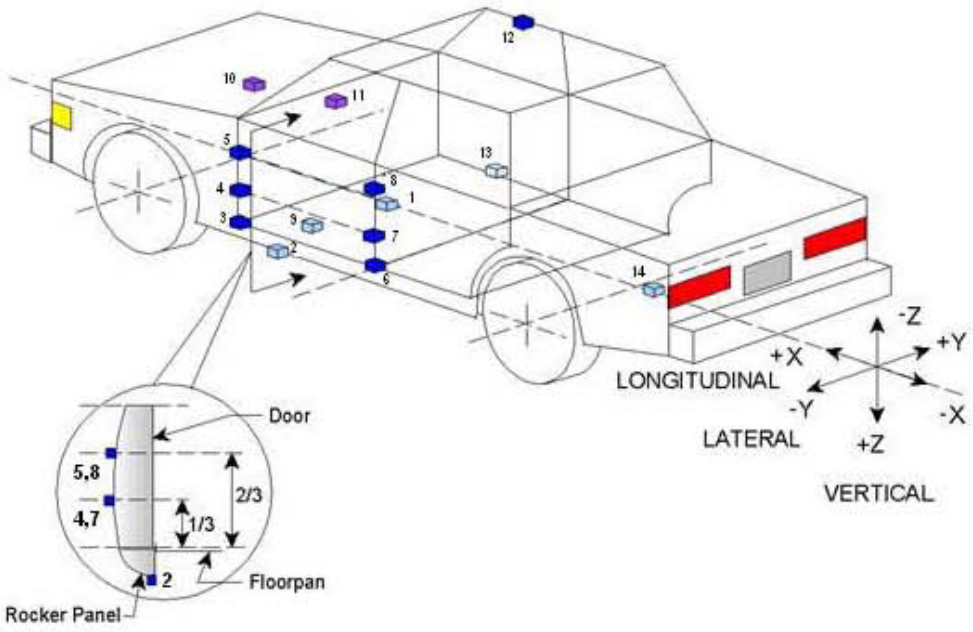
*All measurements accurate to ± 6 mm
Note: Vehicle was at a 75° angle to the rigid pole.

Explain why camera(s) did not operate as intended: None

INSTRUMENTATION	Number of Channels
Driver Dummy	19
Vehicle Structure	18
Pole Load Cells	8
TOTAL	45

DATA SHEET NO. 6
VEHICLE ACCELEROMETER DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018



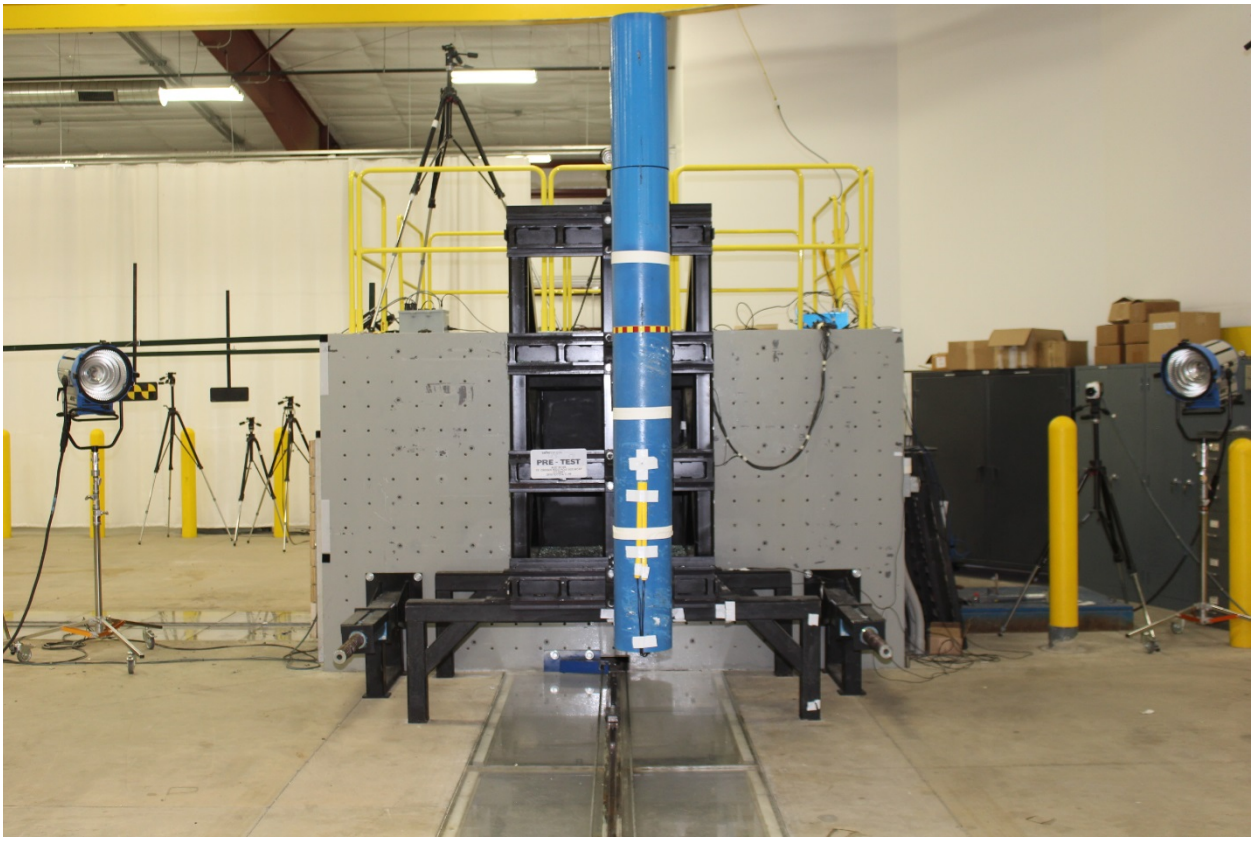
	Accelerometer Location			
	ID	Coordinates (mm)		
		X	Y	Z
1	Vehicle CG	3100	0	-310
2	Left Floor Sill	3920	-744	-374
3	A Pillar Sill	4142	-744	-368
4	A Pillar Low	4200	-910	-740
5	A Pillar Mid	4200	-910	-795
6	B Pillar Sill	3030	-744	-383
7	B Pillar Low	3015	-810	-750
8	B Pillar Mid	3055	-820	-1005
9	Driver Seat Track	3245	-460	-545
10	Engine Top	4920	0	-1149
11	Firewall	4714	0	-1273
12	Right Roof	3109	642	-1861
13	Right Floor Sill	3918	744	-374
14	Rear Floorpan	1338	0	-849

Reference:
X – Test Vehicle Rear Bumper (+forward)
Y – Test Vehicle Centerline (+ to right)
Z – Ground Plane (+ down)

DATA SHEET NO. 7
RIGID POLE LOAD CELL DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20185202
Test Date: 10/4/2018



254 mm Diameter Rigid Pole

Load Cell Locations	
ID	Height From Impact Surface (mm)
1	182
2	470
3	698
4	986
5	1212
6	1641
7	1854
8	2053

DATA SHEET NO. 8
POST-TEST OBSERVATIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

TEST DUMMY INFORMATION AND CONTACT POINTS

Description	Driver SID-IIs Dummy
Face	Curtain Airbag
Top of Head	Curtain Airbag
Left Side of Head	Curtain Airbag
Back of Head	Curtain Airbag, Headrest
Left Shoulder	Side Torso/Pelvis Airbag, Seatback
Upper Torso	Seatback
Lower Torso	Seatback
Left Hip	Side Torso/Pelvis Airbag
Left Knee	Door Panel

POST-TEST DOOR PERFORMANCE

Description	Struck Side		Non-Struck Side		Rear Hatch/ Other Door
	Front	Rear	Front	Rear	
Remained Closed and Operational	No	No	Yes	Yes	Yes
Total Separation from Vehicle at Hinges or Latches	No	No	No	No	No
Latch or Hinge Systems Pulled Out of Their Anchorages	No	No	No	No	No
Disengaged from Latched Position	No	No	No	No	No
Latch Separated from Striker	No	No	No	No	No
Jammed Shut	Yes	Yes	No	No	No
If Door Opened at Striker, Record Width of Opening at Striker (mm)	N/A	N/A	N/A	N/A	N/A

POST-TEST SEAT PERFORMANCE

	Struck Side		Non-Struck Side	
Description	Front	Rear	Front	Rear
Seat Movement Along Seat Track	No	No	No	No
Seat Disengagement from Floor Pan	No	No	No	No
Seat Back Movement from Initial Position	No	No	No	No
Seat Back Collapse	No	No	No	No

POST-TEST STRUCTURAL OBSERVATIONS

Critical Areas of Performance	Observations and Conclusions
Pillar Performance	No Separation
Sill Separation	None
Windshield Damage	Cracked
Side Window Damage	Left Front Window Broken
Other Notable Effects	None

DATA SHEET NO. 8 (CONTINUED)
POST-TEST OBSERVATIONS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

SUPPLEMENTAL RESTRAINT SYSTEM INFORMATION

Restraint Type	Struck Side Driver		Struck Side Rear Passenger	
	Mounted	Deployed	Mounted	Deployed
Frontal Airbag	Yes	No		
Knee Airbag	No			
Side Curtain Airbag	Yes	Yes	Yes	Yes
Side Torso/Pelvis Airbag	Yes	Yes	No	
Seat Belt Pretensioner	Yes	Yes	No	
Seat Belt Load Limiter	Yes		No	
Other				

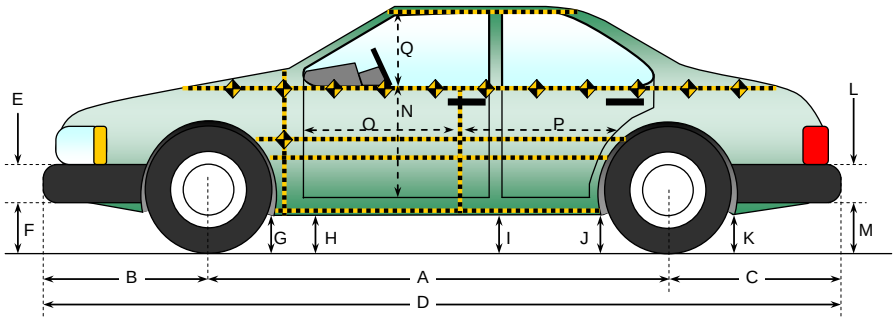
VEHICLE SPEED, VEHICLE ANGLE AT IMPACT, AND IMPACT POINT LOCATION DATA

Measured Parameter	Units	Tolerance	Value
Vertical Impact Reference Line (Aft of Front Axle) (Intended Impact Point)	mm		1186
Actual Impact Point (Aft of Front Axle)	mm		1183
Horizontal Offset (+forward / -rearward)	mm	+/- 38 of Intended Impact Point	3
Angle Between Vehicle's Longitudinal Centerline and Line of Forward Motion	deg	75 +/- 3	75.0
Trap No. 1 Velocity (Primary)	km/h	31.4 to 33.0	32.28
Trap No. 2 Velocity (Redundant)	km/h	31.4 to 33.0	32.33

DATA SHEET NO. 9
VEHICLE PROFILE MEASUREMENTS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20185202
Test Date: 10/4/2018



All measurements in (mm) with tolerance of ± 3 mm

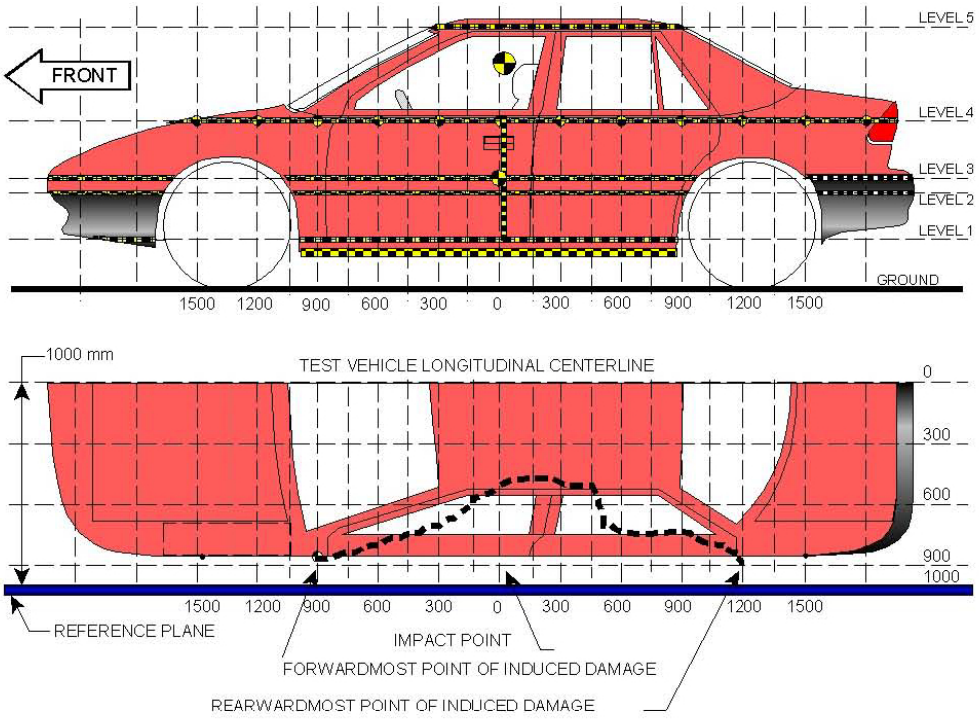
LEFT SIDE VIEW

VEHICLE PRE- AND POST-TEST MEASUREMENT INFORMATION

Code	Measurement Description	Pre-Test	Post-Test	Difference
A	Wheelbase	3558	3497	61
B	Front Axle to FSOV	991	1022	-31
C	Rear Axle to RSOV	1250	1231	19
D	Total Vehicle Length at Centerline	5799	5750	49
E	Front Bumper Thickness	330	330	0
F	Front Bumper Bottom to Ground	322	350	-28
G	Sill Height at Front Wheel Well	335	305	30
H	Sill Height at Front Door Leading Edge	350	305	45
I	Sill Height at B-Pillar	357	296	61
J1	Sill Height at Rear Wheel Well	370	374	-4
J2	Pinch Weld Height at Rear Wheel Well	365	350	15
K	Sill Height Aft of Rear Wheel Well	403	457	-54
L	Rear Bumper Thickness	216	216	0
M	Rear Bumper Bottom to Ground	386	408	-22
N	Sill Height to Bottom of Front Window Sill	943	928	15
O	Front Door Leading Edge to Impact CL	628	429	199
P	Rear Door Trailing Edge to Impact CL	1554	1438	116
Q	Front Window Opening	437	423	14
R	Right Side Length	5044	5099	-55
S	Left Side Length	5044	4831	213
T	Vehicle Width at B-Pillars	2005	1894	111

DATA SHEET NO. 10
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018



NOTE: The measurements are taken along the vertical impact reference line.
Vehicle measurements forward of the vertical impact reference line are negative.

MAXIMUM EXTERIOR CRUSH MEAUREMENTS

Level	Measurement Description	Height Above Ground (mm)	Maximum Exterior Static Crush	Distance from Impact
1	Sill Top	480	364	0
2	Mid Door	830	418	75
3	Occupant Hip Point	1090	423	75
4	Window Sill	1170	406	0
5	Window Top	1780	214	0

DATA SHEET NO. 10 (CONTINUED)
VEHICLE EXTERIOR CRUSH MEASUREMENTS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

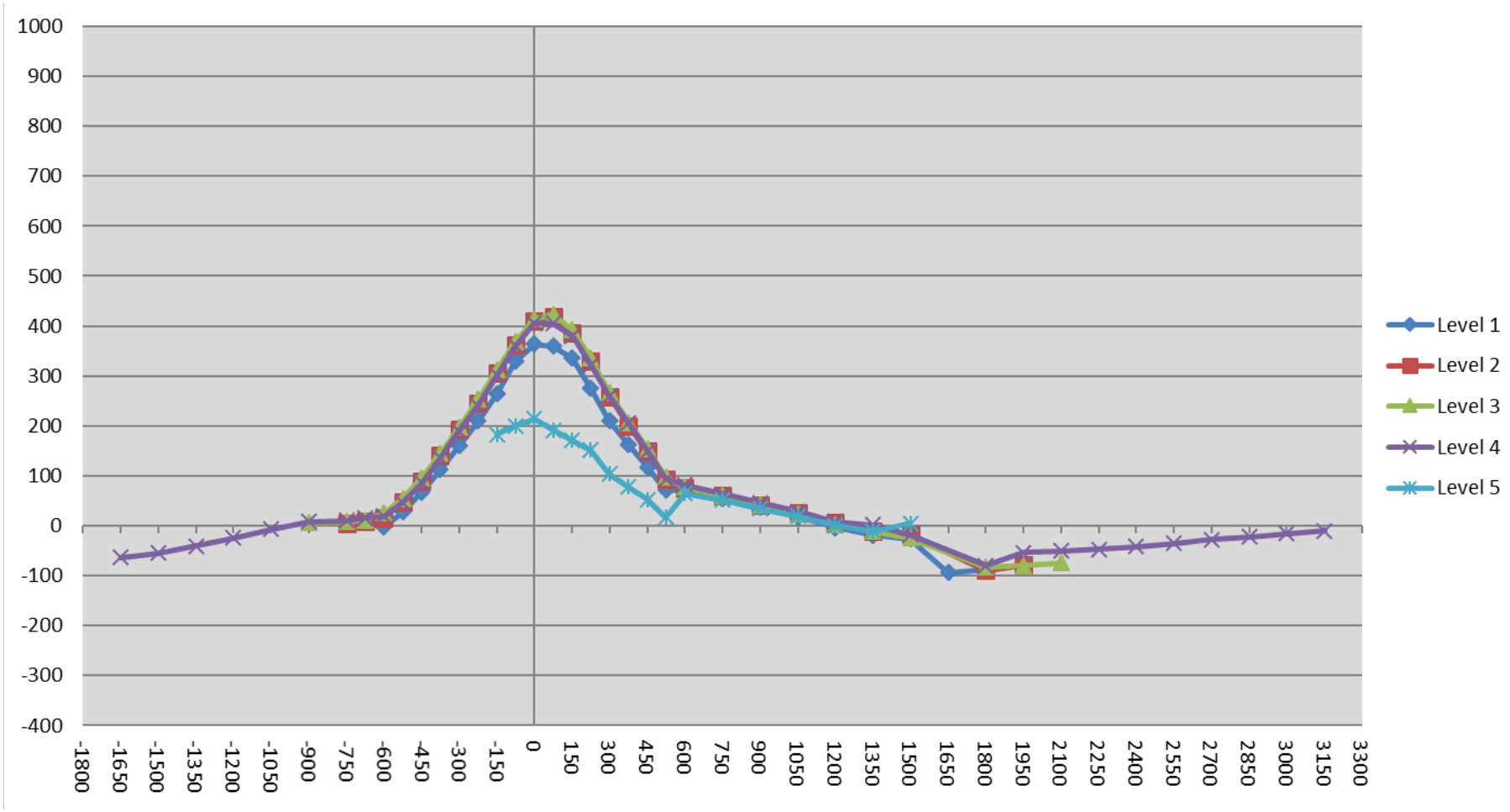
	Pre-Test					Post-Test					Difference				
	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
-2700															
-2550															
-2400															
-2250															
-2100															
-1950															
-1800															
-1650				209					145					-64	
-1500				170					115					-55	
-1350				150					109					-41	
-1200				139					115					-24	
-1050				133					126					-7	
-900			94	135				100	143				6	8	
-825															
-750		94	95	152			98	103	162			4	8	10	
-675		97	98	159			105	109	175			8	11	16	
-600	130	100	101	160		127	116	126	179		-3	16	25	19	
-525	134	105	106	160		162	153	161	206		28	48	55	46	
-450	139	109	110	158		207	198	206	244		68	89	96	86	
-375	141	113	114	154		253	254	259	290		112	141	145	136	
-300	141	115	114	149		301	307	311	338		160	192	197	189	
-225	140	115	113	145		350	361	366	386		210	246	253	241	
-150	139	114	111	140	427	403	420	423	441	610	264	306	312	301	183
-75	139	112	110	137	408	468	475	478	497	608	329	363	368	360	200
0	140	111	108	134	397	504	520	522	540	611	364	409	414	406	214
75	139	110	107	131	388	498	528	530	536	579	359	418	423	405	191
150	139	110	106	128	382	475	496	498	508	553	336	386	392	380	171
225	138	109	105	125	379	413	439	441	447	530	275	330	336	322	151
300	138	109	105	124	375	348	368	371	384	479	210	259	266	260	104
375	139	109	104	123	375	301	309	311	329	453	162	200	207	206	78
450	139	108	104	122	373	257	257	258	272	425	118	149	154	150	52
525	138	108	104	119	371	209	202	201	213	388	71	94	97	94	17
600	138	108	105	118	371	211	184	183	200	435	73	76	78	82	64
675															
750	138	108	105	117	368	193	168	165	180	419	55	60	60	63	51
825															
900	140	109	106	117	368	176	150	148	163	402	36	41	42	46	34
1050	141	109	108	118	368	159	134	132	147	387	18	25	24	29	19
1200	146	111	111	122	369	142	117	114	130	369	-4	6	3	8	0
1350	149	116	115	128	371	130	106	104	130	360	-19	-10	-11	2	-11
1500	157	116	119	130	385	130	98	95	112	390	-27	-18	-24	-18	5
1650	157					63					-94				
1800	146	122	115	139		58	32	32	59		-88	-90	-83	-80	
1950		102	101	129			23	21	75			-79	-80	-54	
2100			100	116				26	65				-74	-51	
2250				113					66					-47	
2400				111					69					-42	
2550				112					77					-35	
2700				113					85					-28	
2850				117					95					-22	
3000				122					106					-16	
3150				128					118					-10	

Pre-test measurements are taken when the vehicle is in the “As Tested” weight condition. Vehicle measurements forward of the vertical impact reference line are negative. The crush pile grid is established prior to the test based on an estimated impact point. The final distance from impact is determined after the final dummy positioning and the pole is aligned with the center of gravity of the dummy’s head.

DATA SHEET NO. 10 (CONTINUED)
VEHICLE EXTERIOR CRUSH MEASUREMENTS

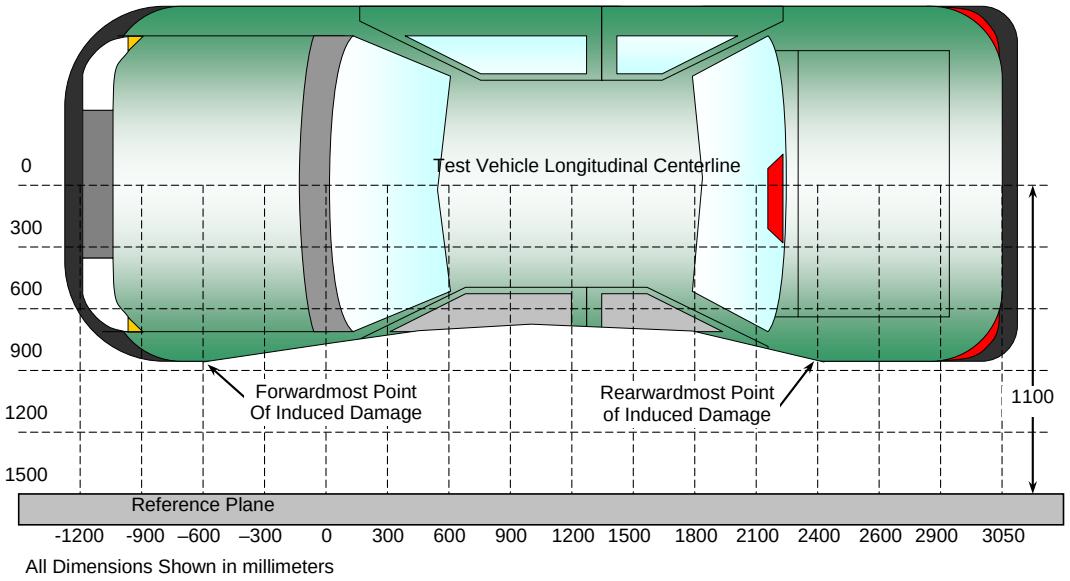
Test Vehicle: 2018 Nissan Titan S Crew Cab Truck
Test Program: NCAP Side Pole Impact Test

NHTSA No. O20185202
Test Date: 10/4/2018



DATA SHEET NO. 11
VEHICLE DAMAGE PROFILE DISTANCES

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018



TOP VIEW

DAMAGE PROFILE DISTANCES

DPD	Distance from Impact Point (mm)	Level	Pre-Test (mm)	Post-Test (mm)	Crush (mm)
1	555	3	104	182	78
2	319	3	105	356	251
3	83	3	107	519	412
4	-153	3	111	419	308
5	-389	3	114	239	125
6	-625	3	100	113	13

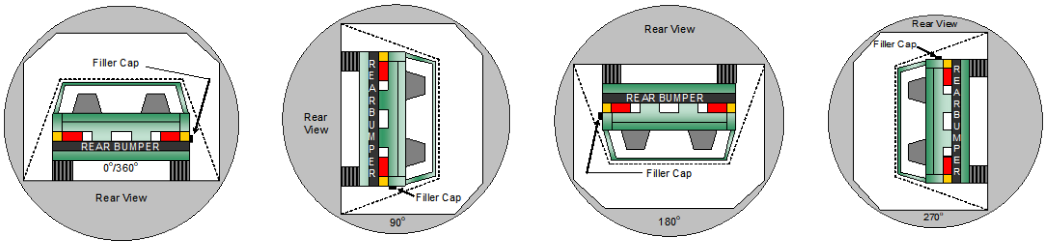
DATA SHEET NO. 12
FMVSS NO. 301 STATIC ROLLOVER RESULTS

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018

Test Time: 10:50 a.m. Temperature: 21.8°C

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

FMVSS 301 STATIC ROLLOVER DATA



0°/360° 90° 180° 270°

ROLLOVER SOLVENT COLLECTION TIME TABLE IN SECONDS

Test Phase	Rotation Time	Hold Time	Total Time
0° to 90°	92	300	392
90° to 180°	93	300	393
180° to 270°	94	300	394
270° to 360°	86	300	386

FMVSS 301 ROLLOVER SPILLAGE TABLE (units in ounces)

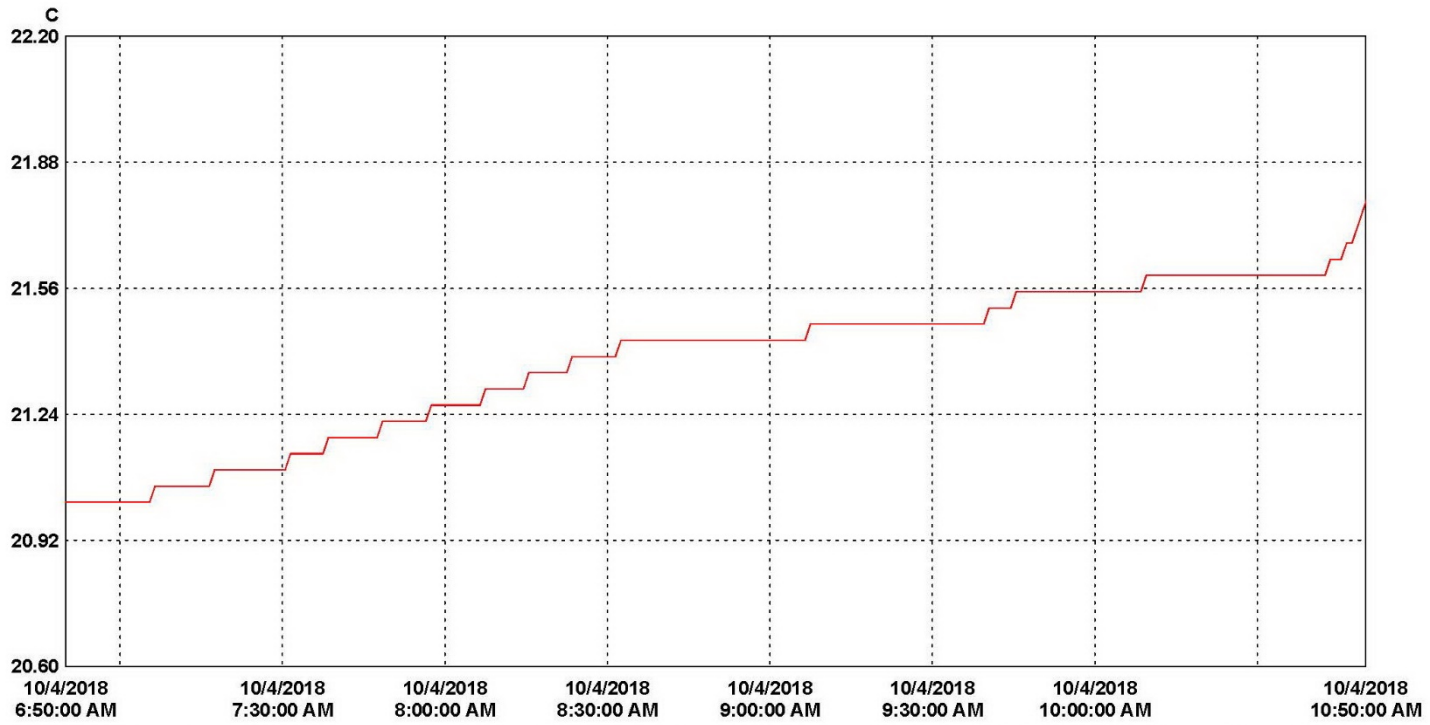
Test Phase	First 5 Minutes	Sixth Minute	Seventh Minute	Eight Minute
0° to 90°	0	0	0	0
90° to 180°	0	0	0	0
180° to 270°	0	0	0	0
270° to 360°	0	0	0	0

ROLLOVER SOLVENT SPILLAGE LOCATION TABLE

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

DATA SHEET NO. 13
DUMMY/VEHICLE TEMPERATURE STABILIZATION DATA

Test Vehicle: 2018 Nissan Titan S Crew Cab Truck NHTSA No. O20185202
Test Program: NCAP Side Pole Impact Test Test Date: 10/4/2018



LN	Serial #	Description	CH	Value	Maximum	Average	Minimum	Units	CH description	Logger file
1	14312013	VSC_South_Hall	1		21.76	21.37	21.02	C	Temperature	14312013_VSC_South_Hall.spl

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

Photo No. 001 - As Delivered Right Front Three-Quarter View of Test Vehicle

Photo No. 002 - As Delivered Left Rear Three-Quarter View of Test Vehicle

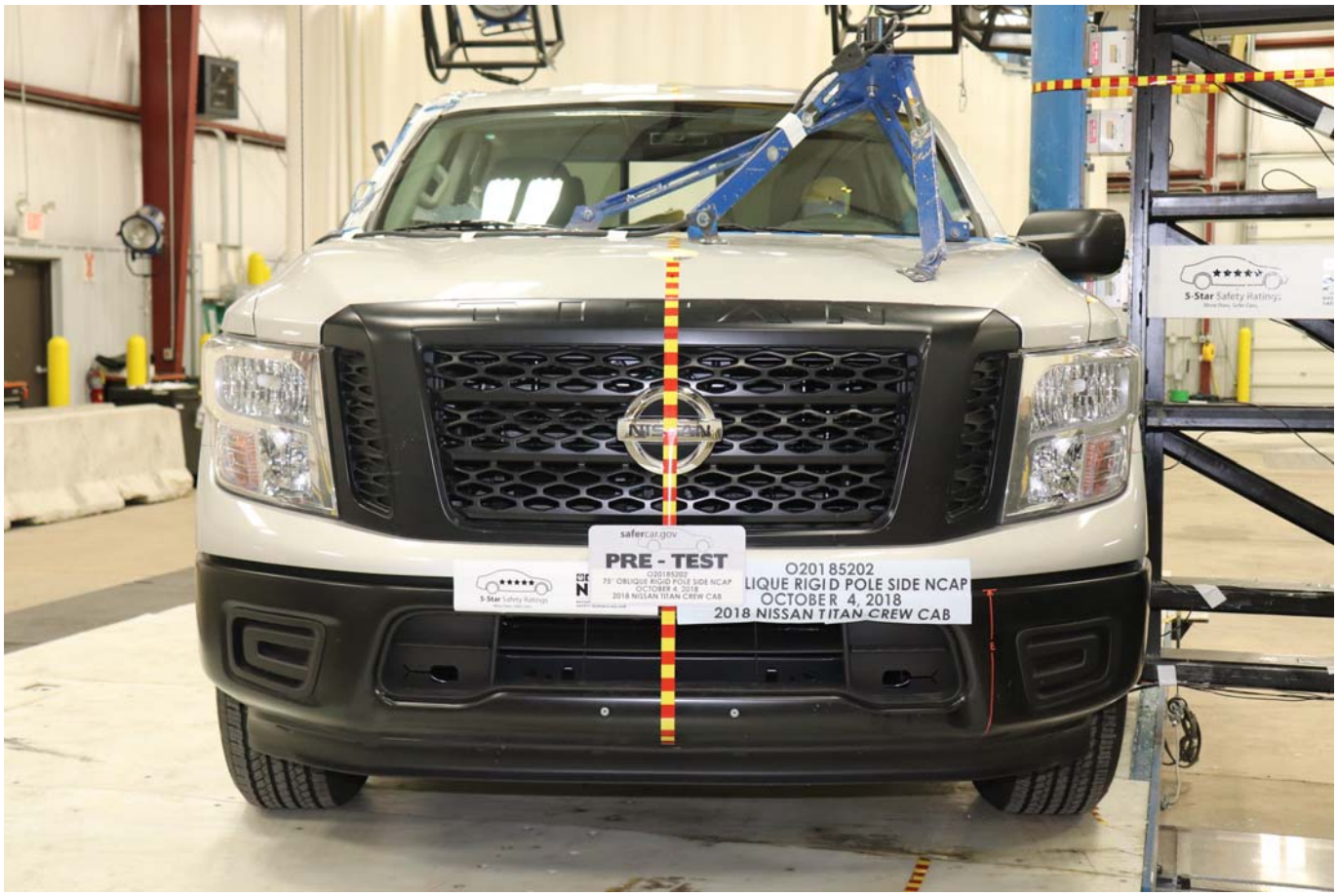


Photo No. 003 - Pre-Test Frontal View of Test Vehicle

Photo No. 004 - Post-Test Frontal View of Test Vehicle

Photo No. 005 - Pre-Test Left Front Three-Quarter View of Test Vehicle

Photo No. 006 - Post-Test Left Front Three-Quarter View of Test Vehicle

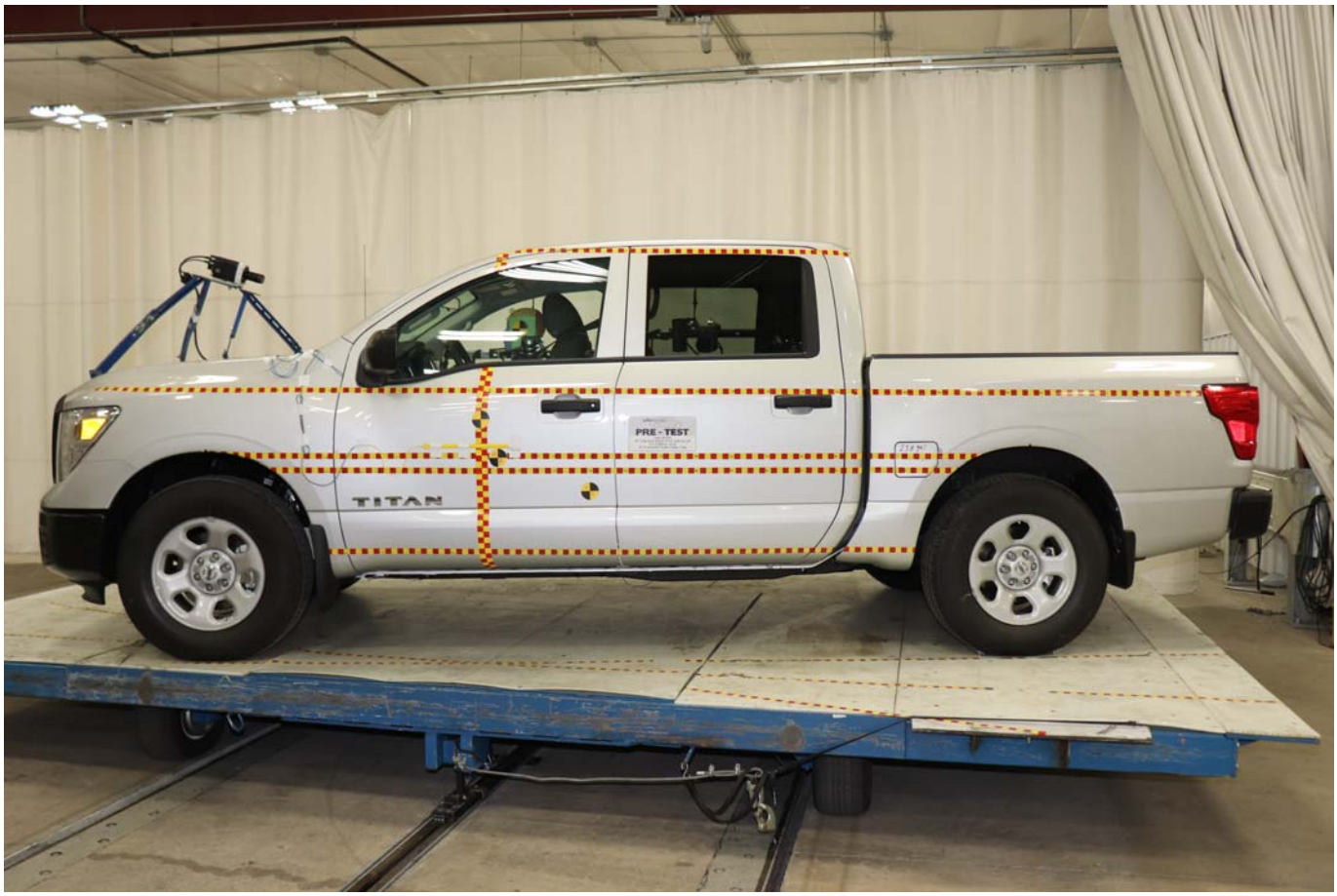


Photo No. 007 - Pre-Test Left Side View of Test Vehicle

Photo No. 008 - Post-Test Left Side View of Test Vehicle

Photo No. 009 - Pre-Test Left Rear Three-Quarter View of Test Vehicle

Photo No. 010 - Post-Test Left Rear Three-Quarter View of Test Vehicle

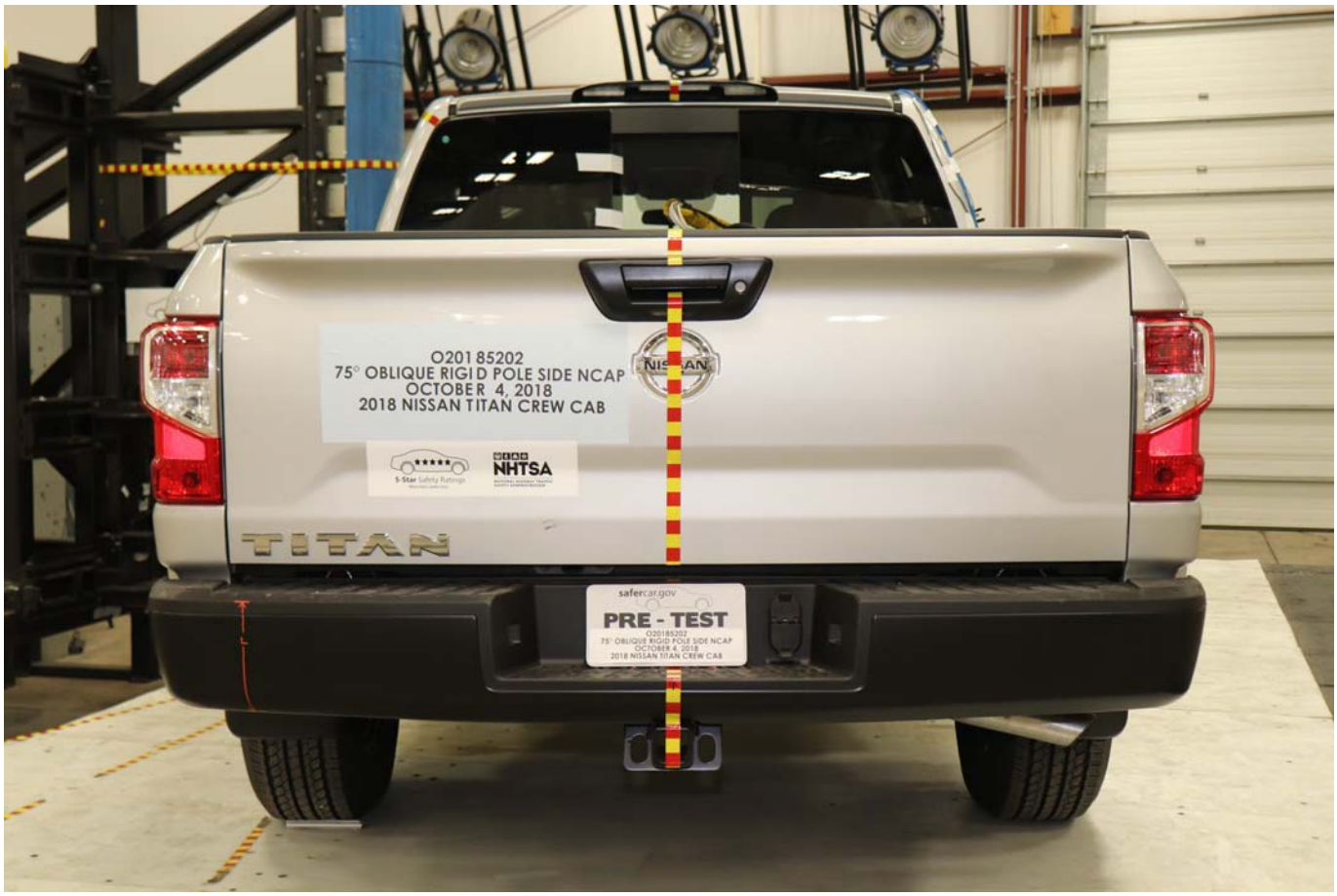


Photo No. 011 - Pre-Test Rear View of Test Vehicle

Photo No. 012 - Post-Test Rear View of Test Vehicle

Photo No. 013 - Pre-Test Right Side View of Test Vehicle

Photo No. 014 - Post-Test Right Side View of Test Vehicle

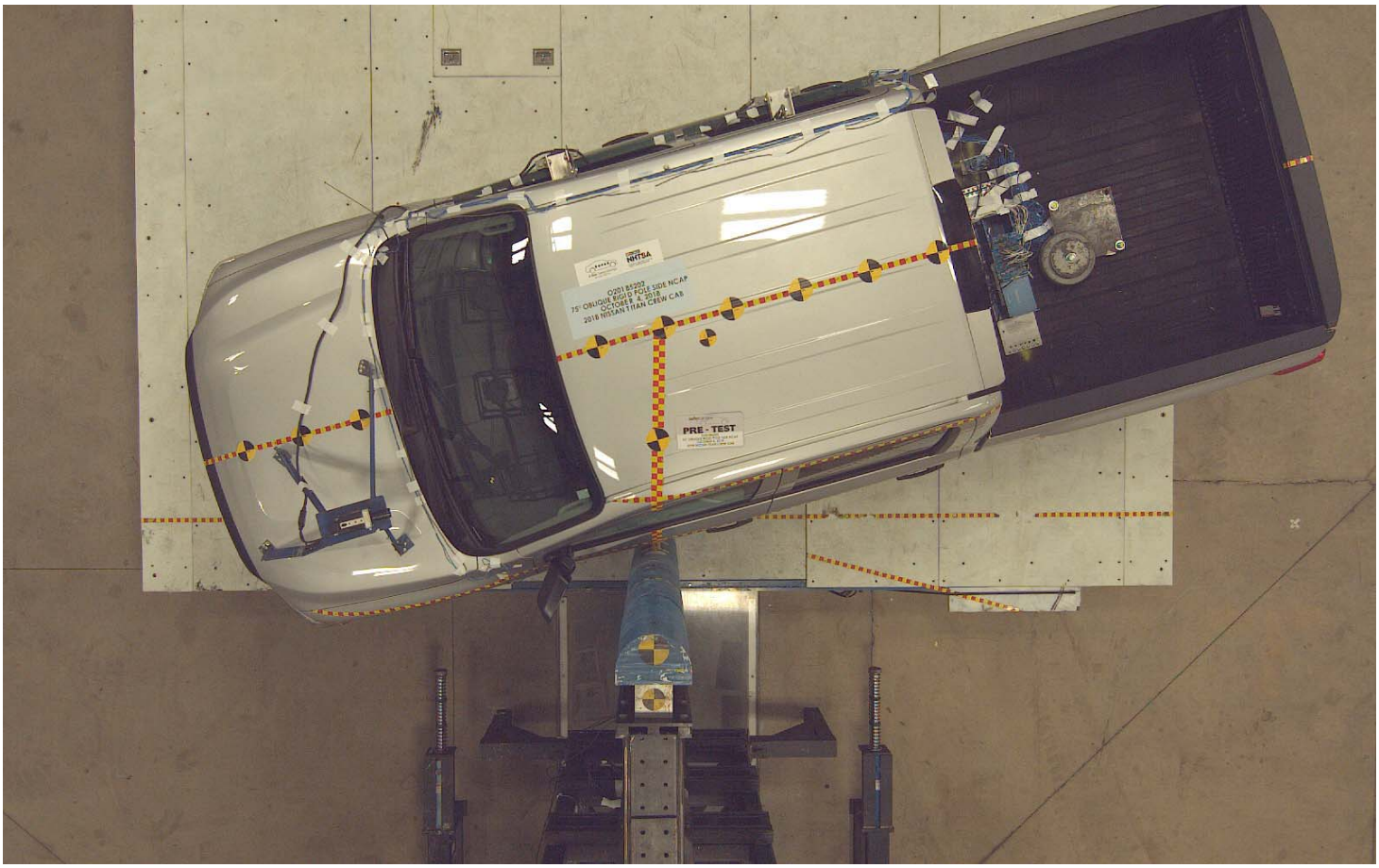


Photo No. 015 - Pre-Test Overhead View of Test Area

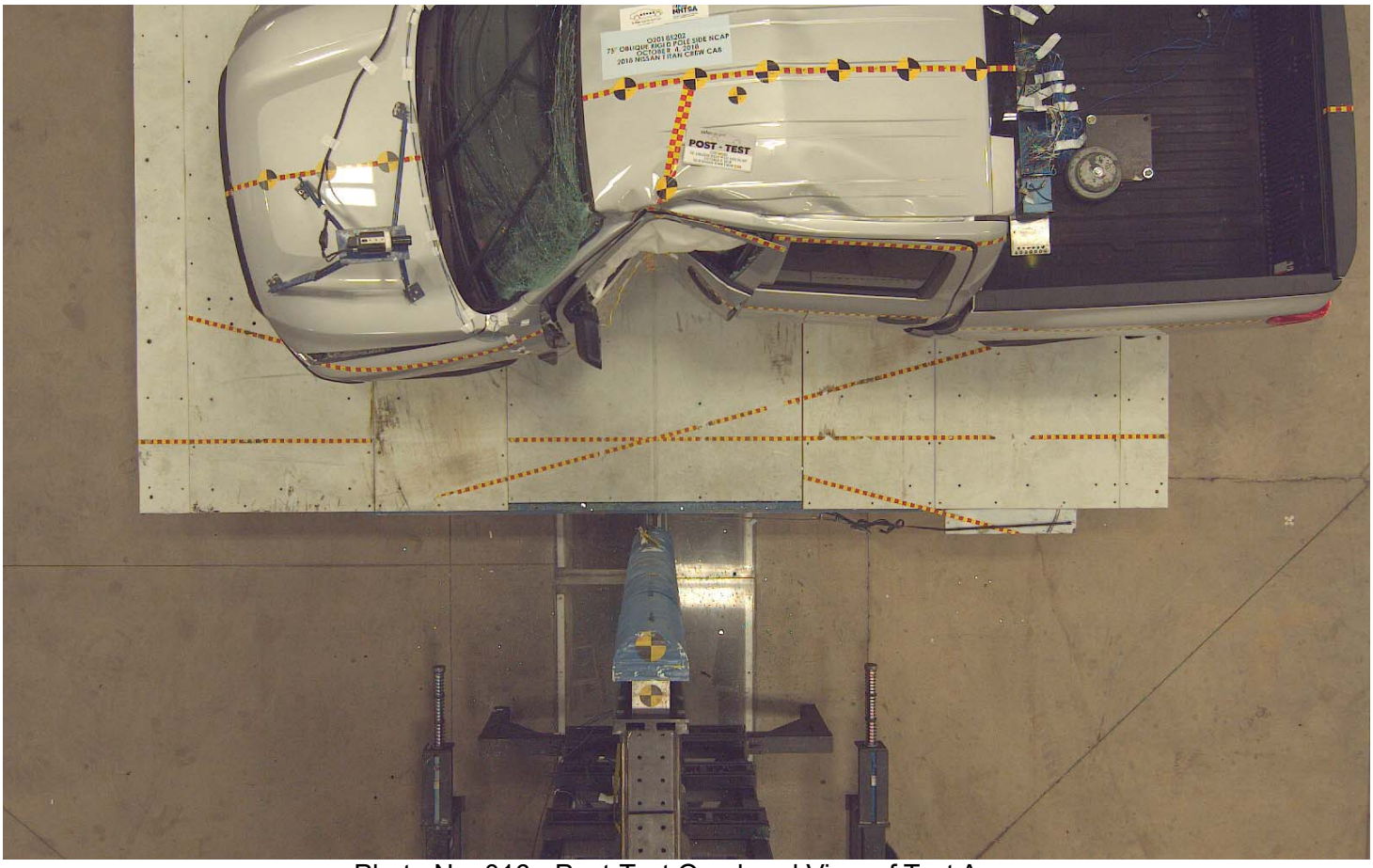


Photo No. 016 - Post-Test Overhead View of Test Area

Photo No. 017 - Pre-Test Left Side View of Pole Positioned Against Side of Vehicle

Photo No. 018 - Pre-Test Right Side View of Pole Positioned Against Side of Vehicle

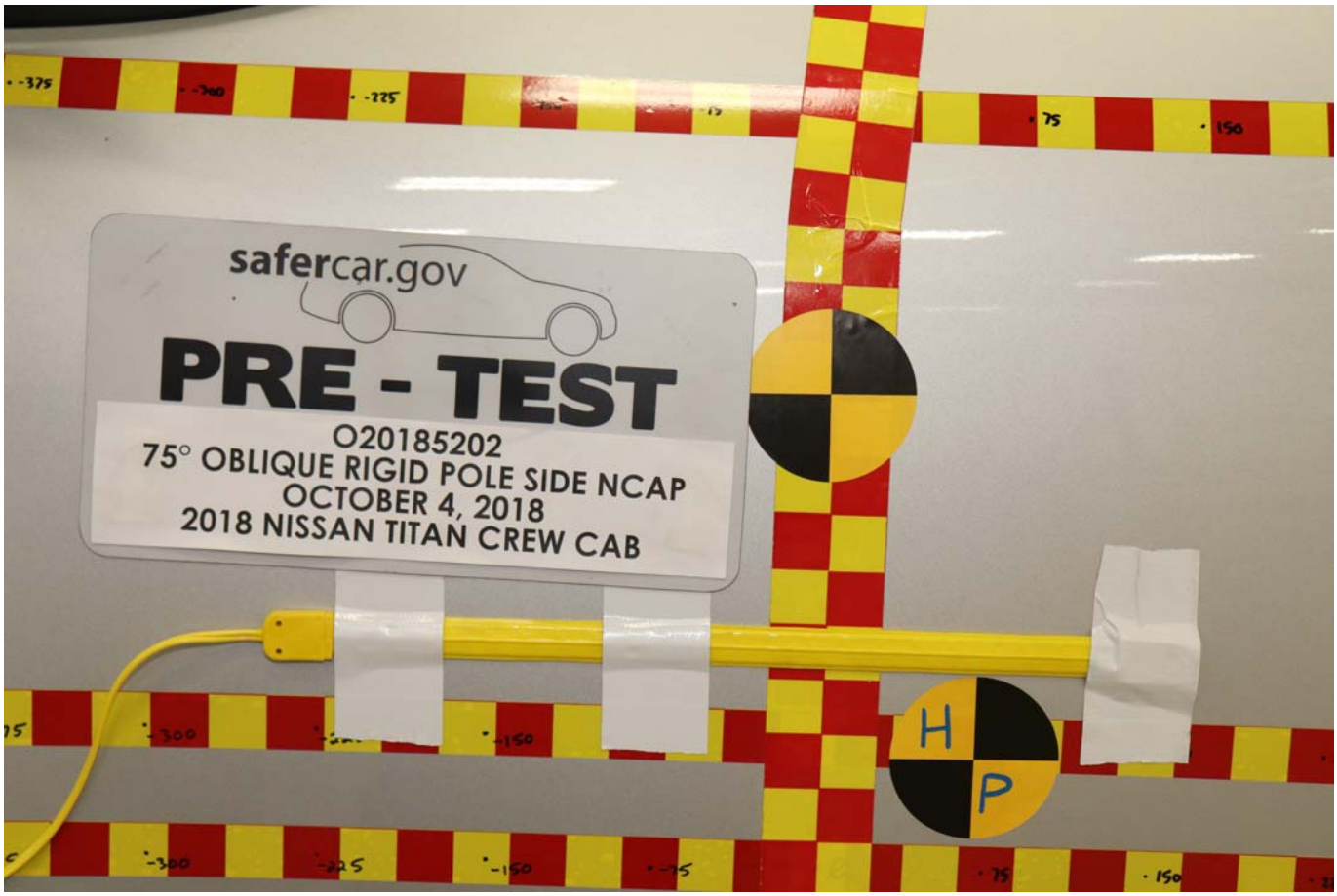


Photo No. 019 - Pre-Test Close-Up View of Impact Point Target

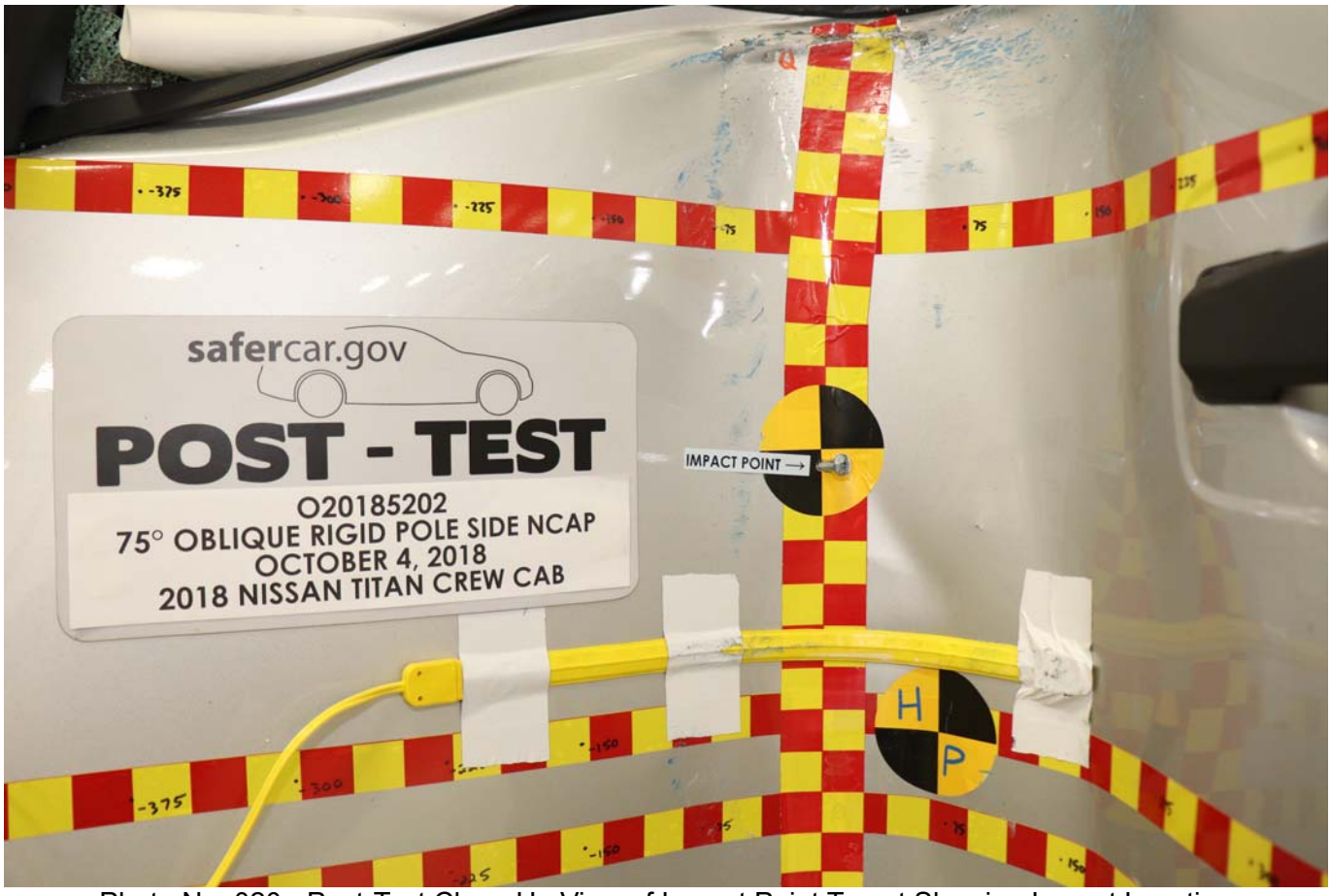


Photo No. 020 - Post-Test Close-Up View of Impact Point Target Showing Impact Location

Photo No. 021 - Pre-Test Front Close-Up View of Dummy Head and Chest

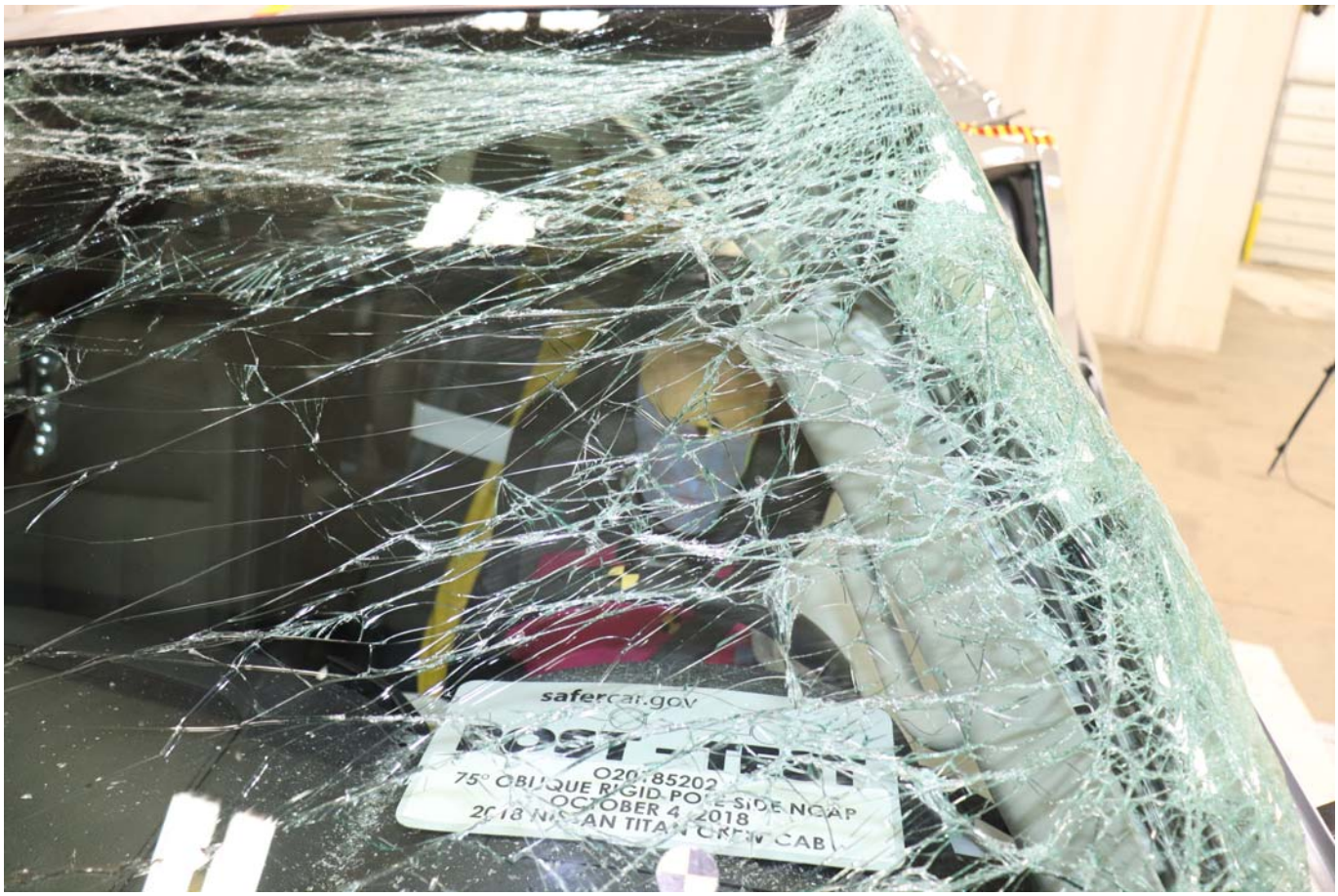


Photo No. 022 - Post-Test Front Close-Up View of Dummy

Photo No. 023 - Pre-Test Left Side View of Dummy Showing Belt and Chalking

Photo No. 024 - Pre-Test Left Side View of Dummy Shoulder and Door Top View

Photo No. 025 - Post-Test Left Side View of Dummy Shoulder and Door Top View

Photo No. 026 - Pre-Test Front View of Seat Back Prior to Dummy Positioning

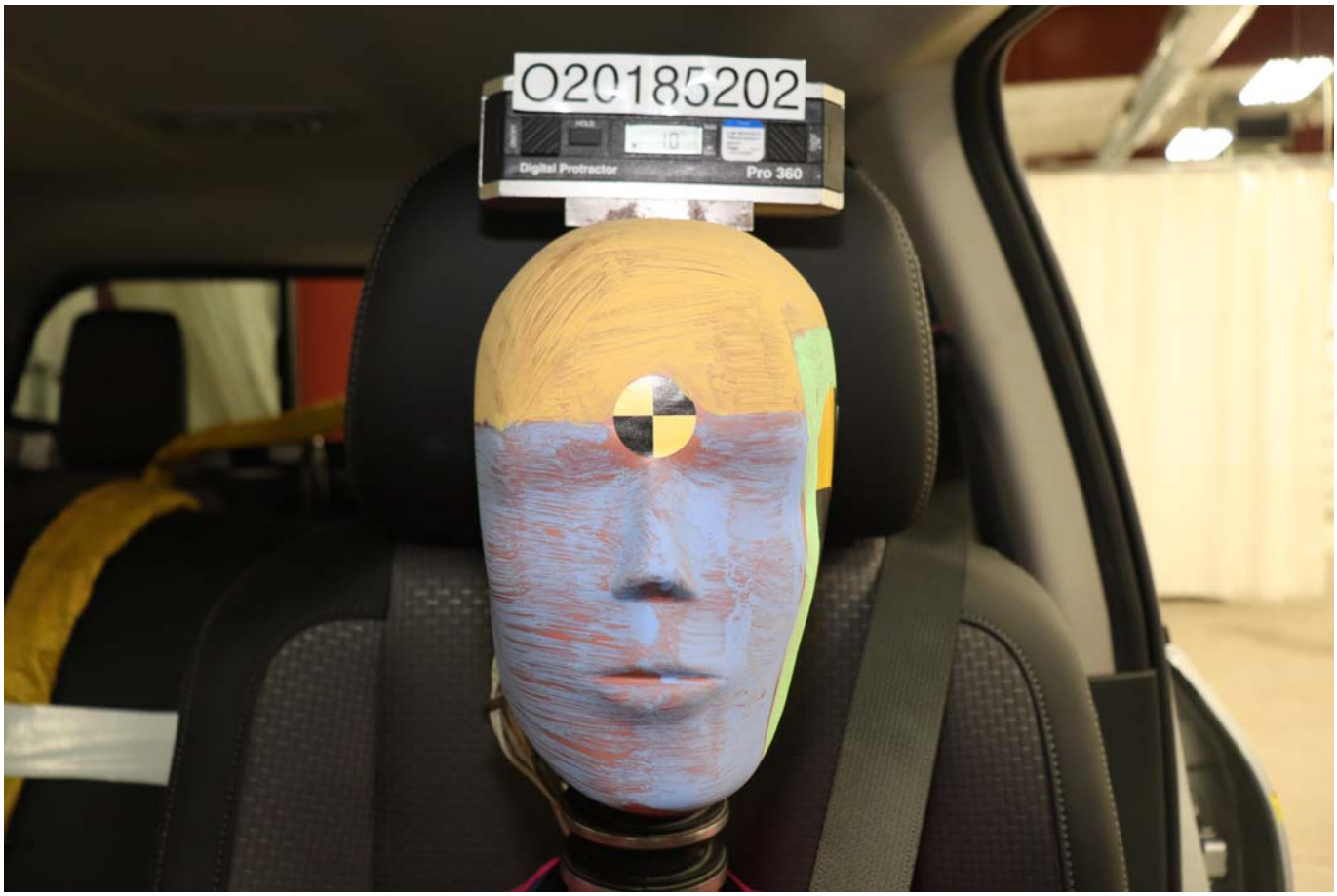


Photo No. 027 - Pre-Test Front Close-Up View of Dummy Head and Shoulders in Relation to Head Restraint

Photo No. 028 - Pre-Test Front View of Seat Pan Prior to Dummy Positioning

Photo No. 029 - Pre-Test Overhead View of Dummy Thighs on Seat Pan

Photo No. 030 - Pre-Test Left Side View of Dummy Neck Showing Position of Adjustable Neck Bracket

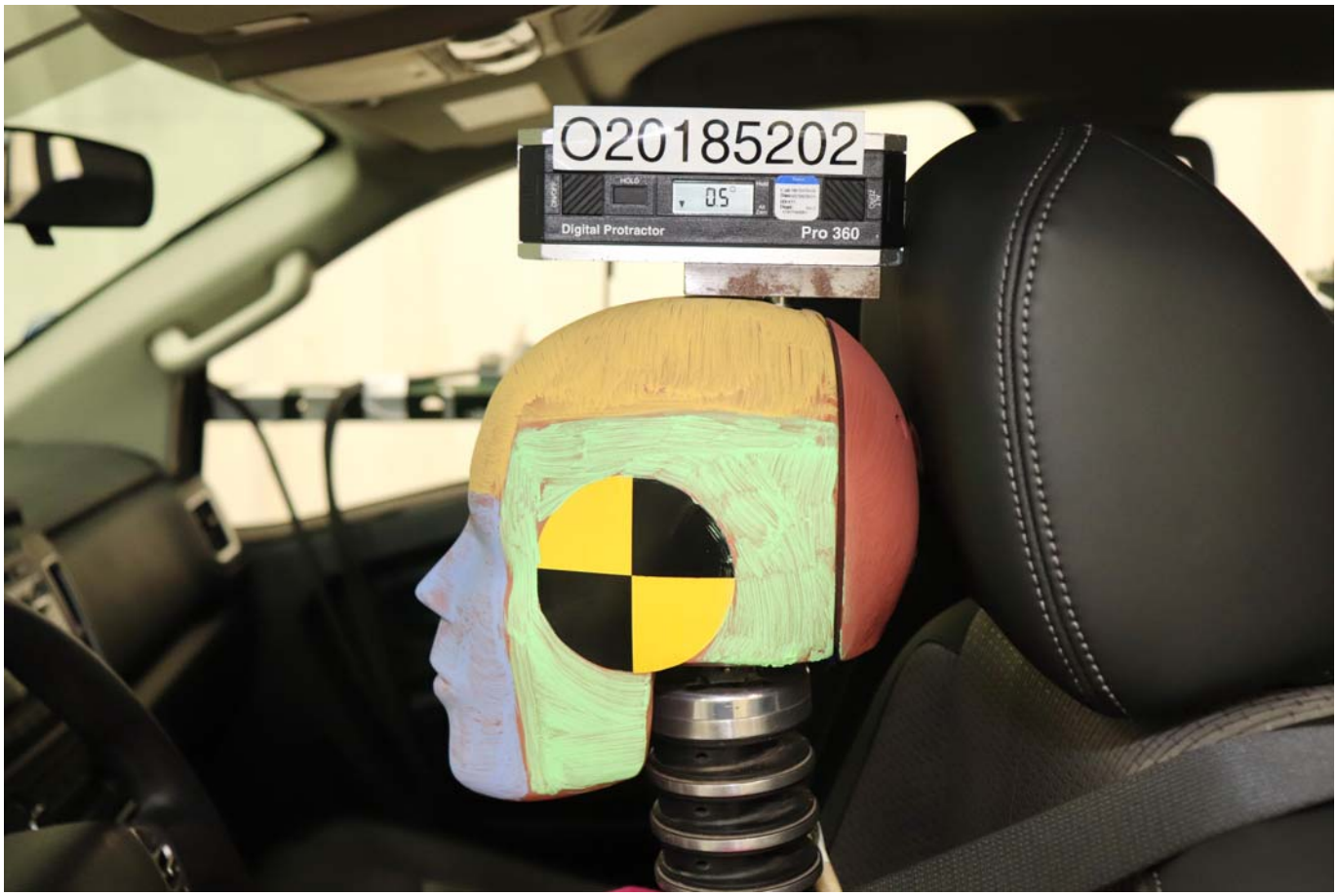


Photo No. 031 - Pre-Test Left Side View of Dummy Head Showing Dummy Head is Level

Photo No. 032 - Pre-Test Placement of Dummy Feet

Photo No. 033 - Pre-Test View of Belt Anchorage for Dummy

Photo No. 034 - Pre-Test Left Side View of Steering Wheel

Photo No. 035 - Pre-Test View of Disengaged Parking Brake

Photo No. 036 - Pre-Test View of Parking Brake

Photo No. 037 - Pre-Test Close-Up Left Side View of Driver Seat Track

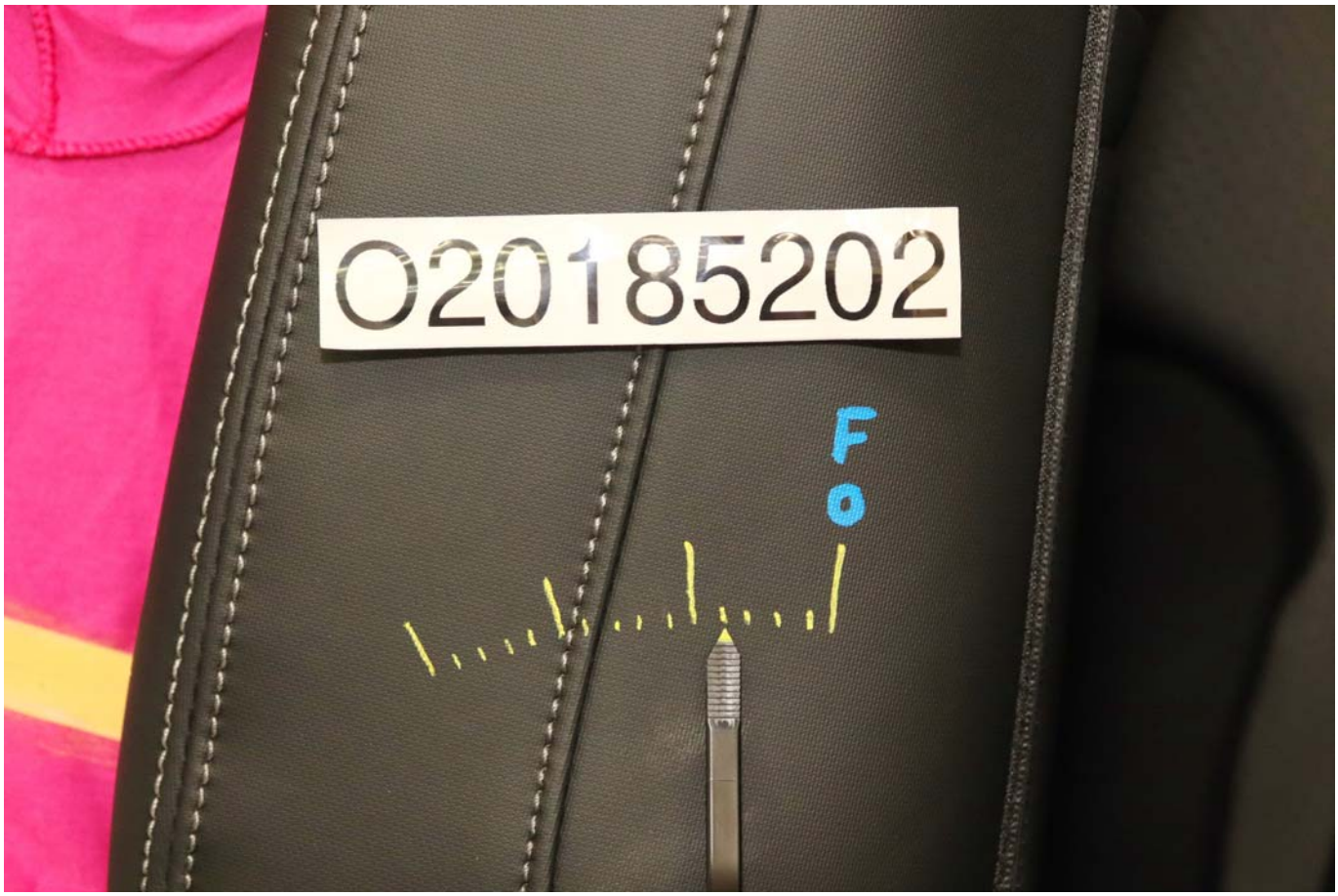


Photo No. 038 - Pre-Test Close-Up Left Side View of Driver Seat Back

Photo No. 039 - Pre-Test Close-Up View of Driver Seat Back or Head Restraint

Photo No. 040 - Pre-Test Dummy and Door Clearance View

Photo No. 041 - Post-Test Dummy and Door Clearance View

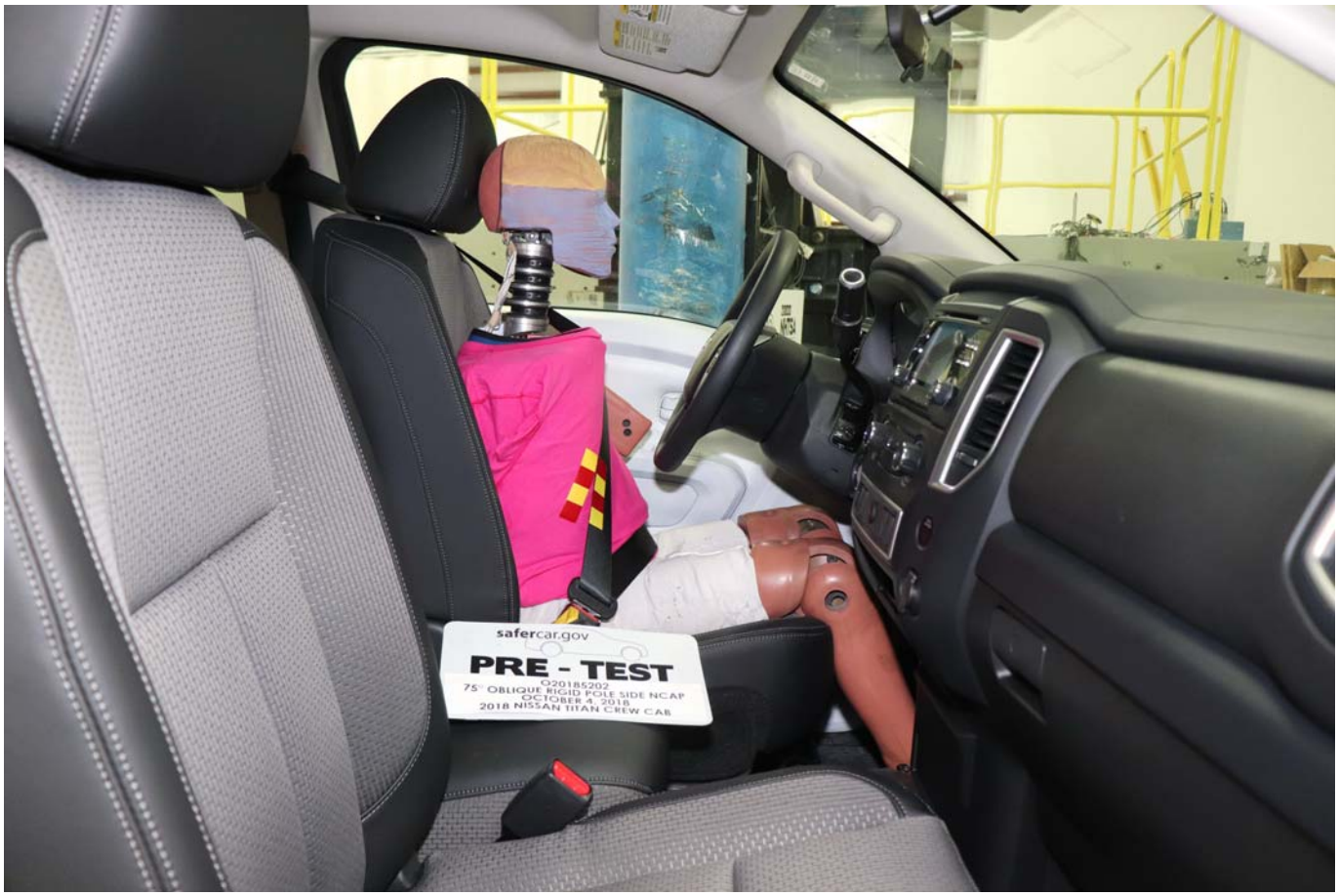


Photo No. 042 - Pre-Test Right Side View of Dummy and Front Seat of Occupant Compartment

Photo No. 043 - Post-Test Right Side View of Dummy and Front Seat of Occupant Compartment

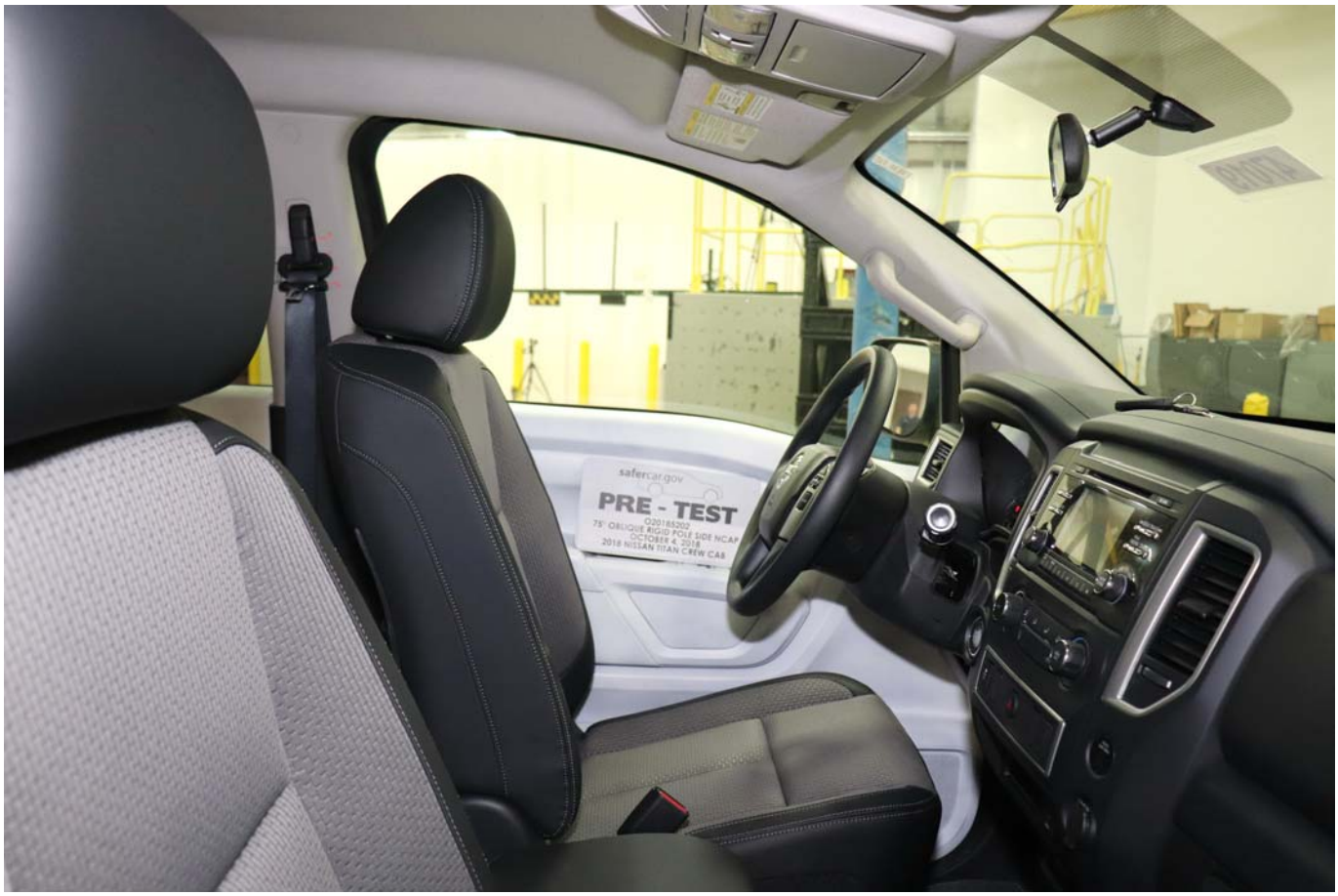


Photo No. 044 - Pre-Test Inner Door Panel View

Photo No. 045 - Post-Test Inner Door Panel View Showing Dummy Contact Location

Photo No. 046 - Post-Test Dummy Close-Up Head Contact with Vehicle Interior View

Photo No. 047 - Post-Test Dummy Close-Up Head Contact with Side Air Bag View

Photo No. 048 - Post-Test Dummy Close-Up Torso Contact with Vehicle Interior View

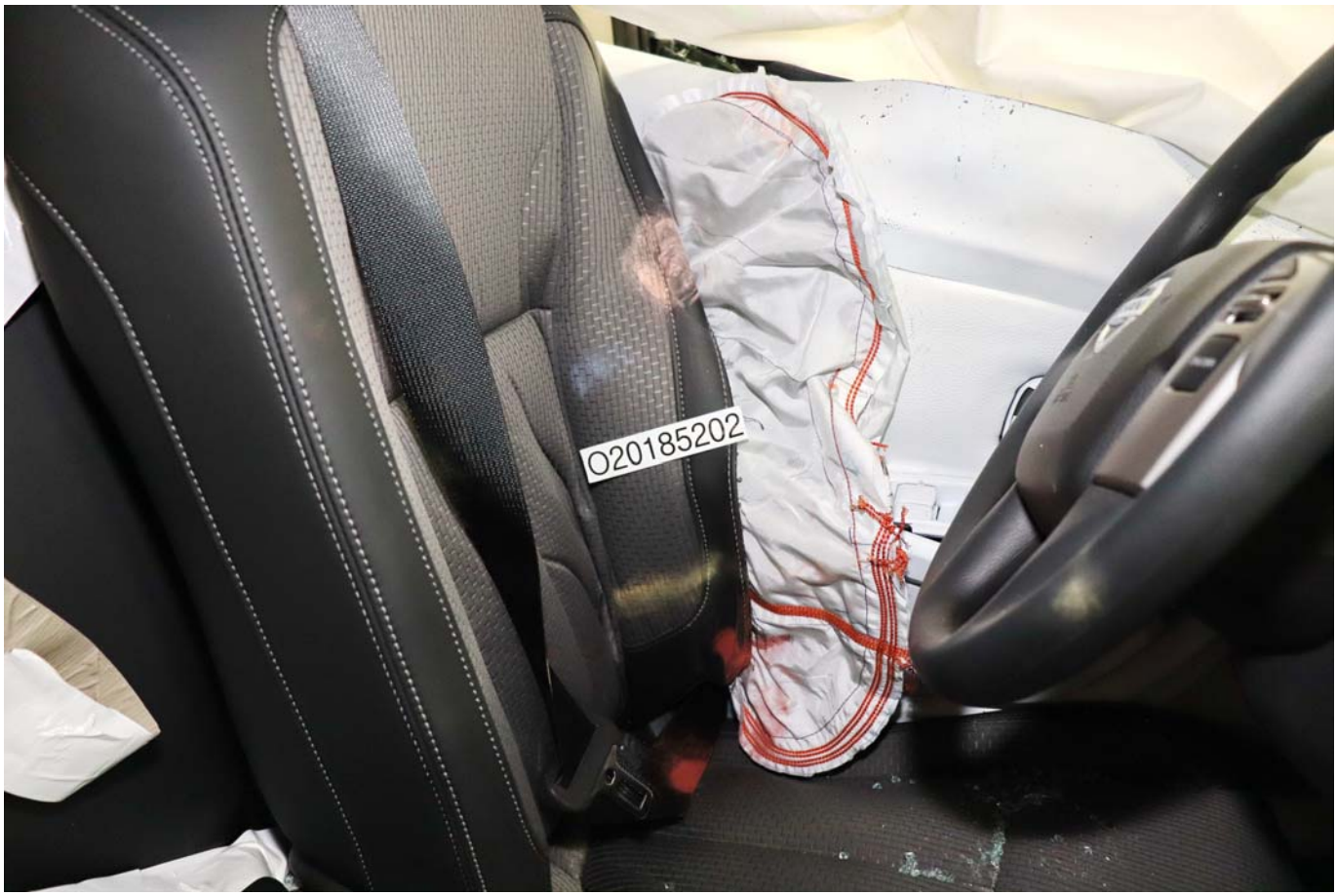


Photo No. 049 - Post-Test Dummy Close-Up Torso Contact with Side Air Bag View

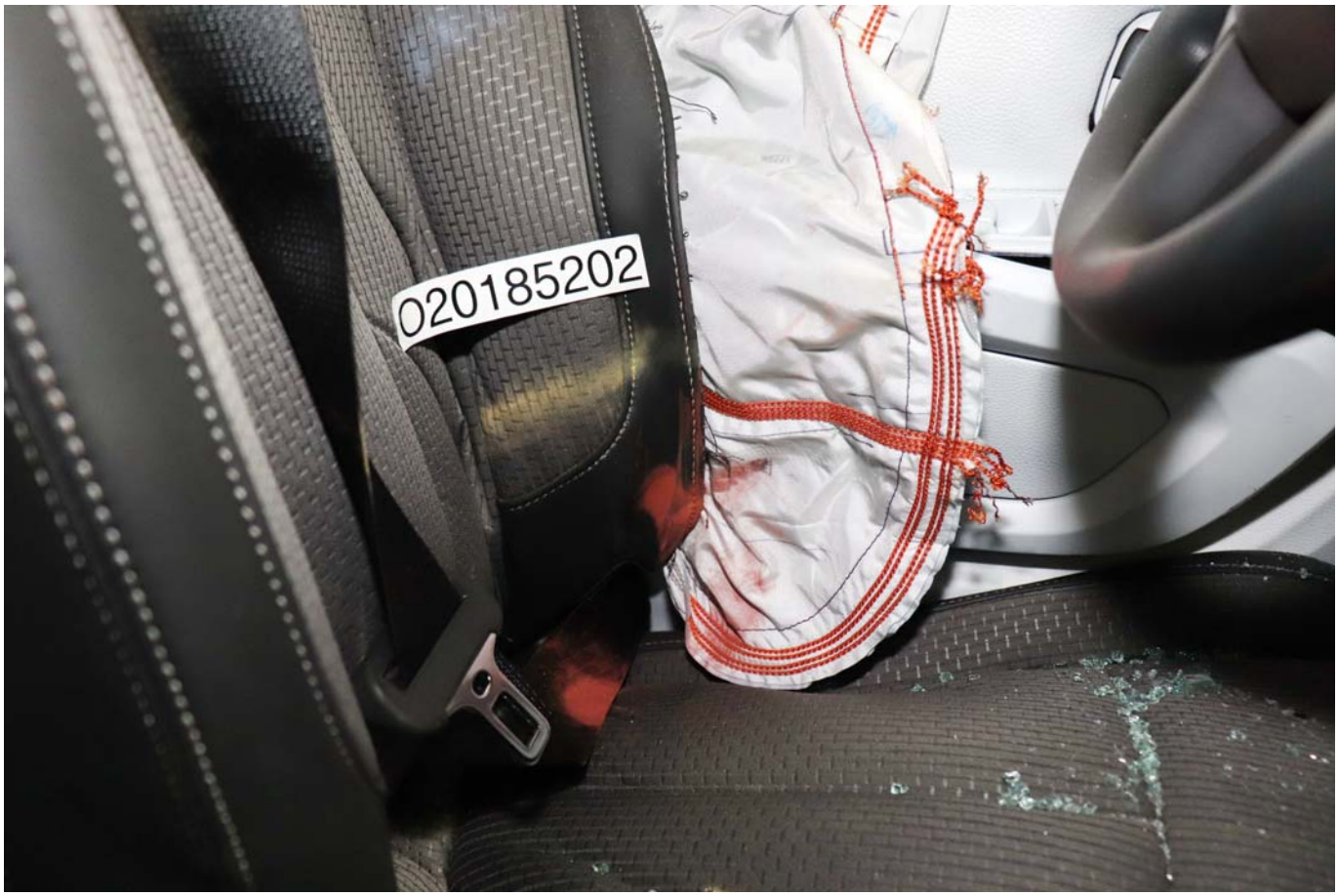


Photo No. 050 - Post-Test Dummy Close-Up Pelvis Contact with Vehicle Interior View

Photo No. 051 - Post-Test Dummy Close-Up Pelvis Contact with Side Air Bag View

Photo No. 052 - Post-Test Dummy Close-Up Knee Contact with Vehicle Interior View

Photo No. 053 - Pre-Test View of Fuel Filler Cap or Fuel Filler Neck

Photo No. 054 - Post-Test View of Fuel Filler Cap or Fuel Filler Neck

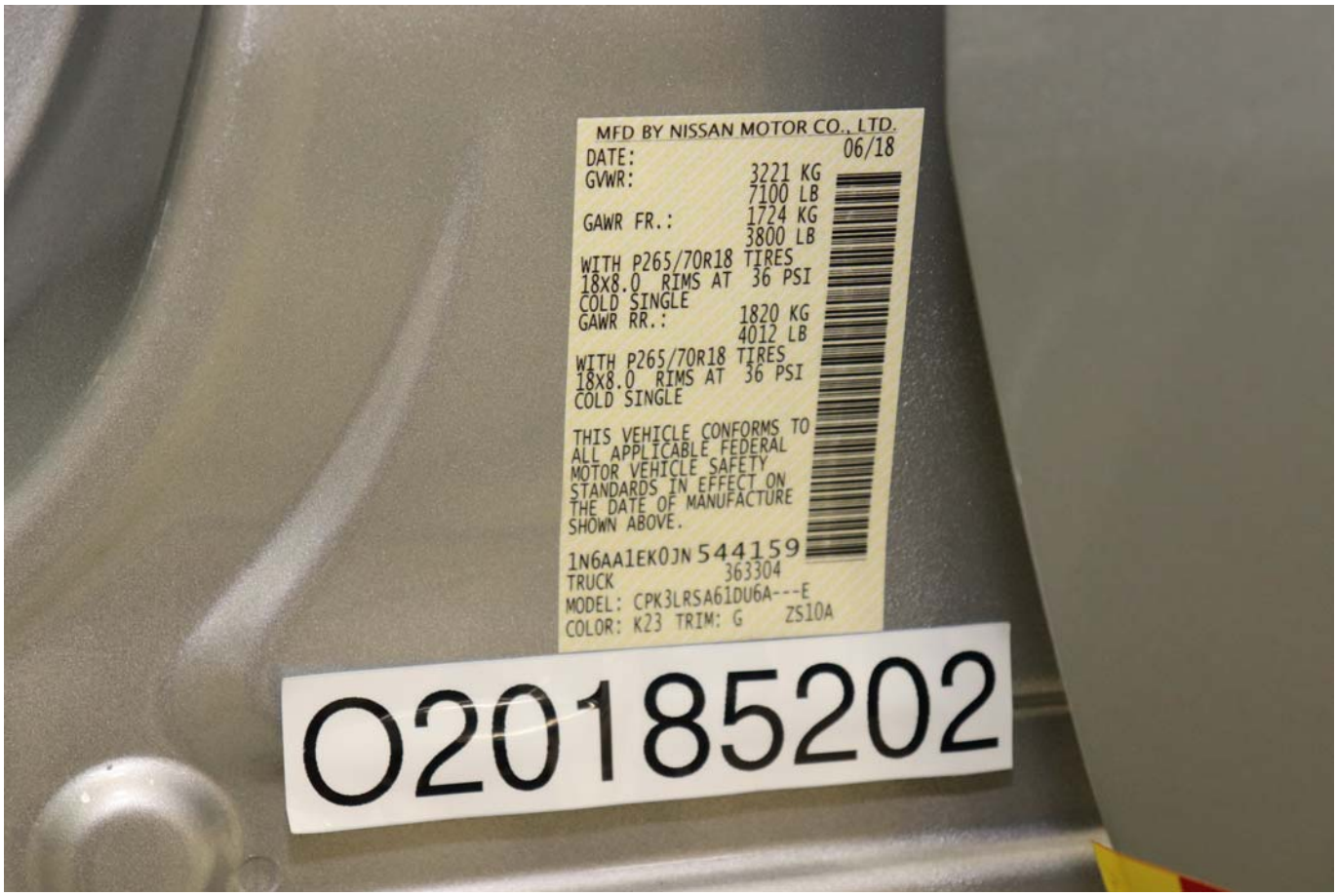


Photo No. 055 - Close-Up View of Vehicle Certification Label

Photo No. 056 - Close-Up View of Vehicle Tire Information Placard or Label

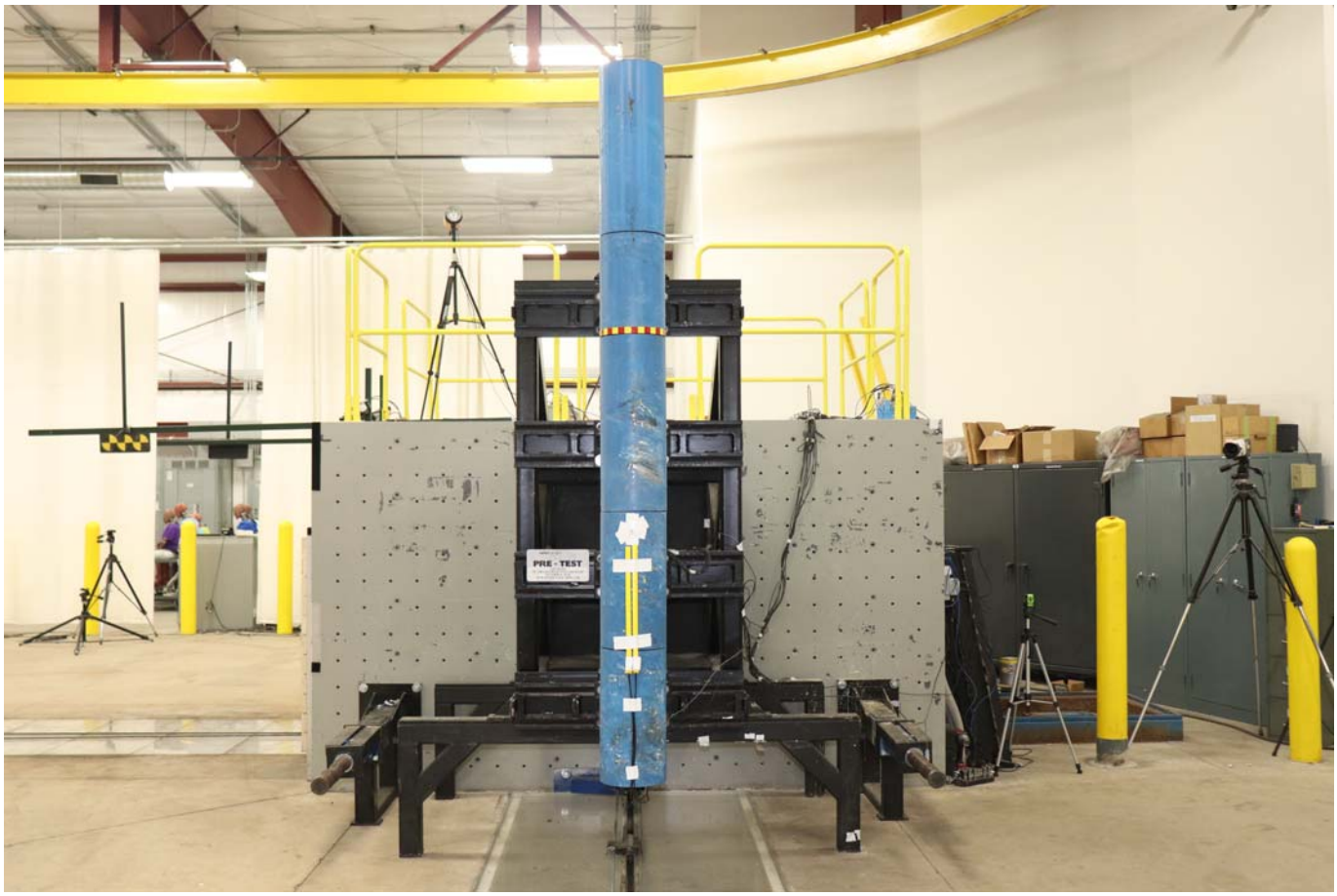


Photo No. 057 - Pre-Test Pole Barrier Front View

Photo No. 058 - Post-Test Pole Barrier Front View

Photo No. 059 - Pre-Test Pole Barrier Side View

Photo No. 060 - Post-Test Pole Barrier Side View

Photo No. 061 - Pre-Test Ballast View

Photo No. 062 - Post-Test Primary and Redundant Speed Trap Read-Out

Photo No. 063 - FMVSS Photo No. 301 Static Rollover 0 Degrees

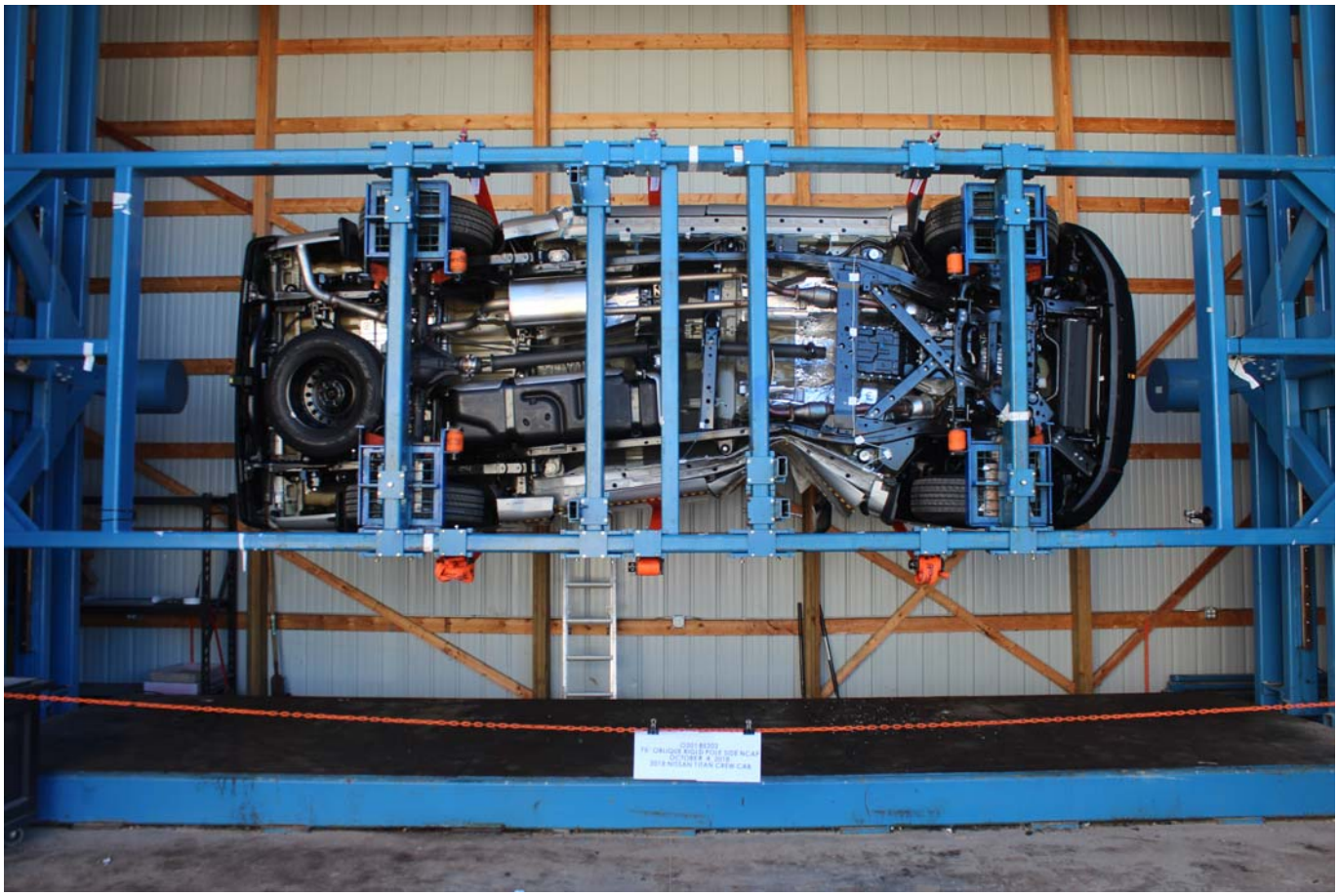


Photo No. 064 - FMVSS Photo No. 301 Static Rollover 90 Degrees

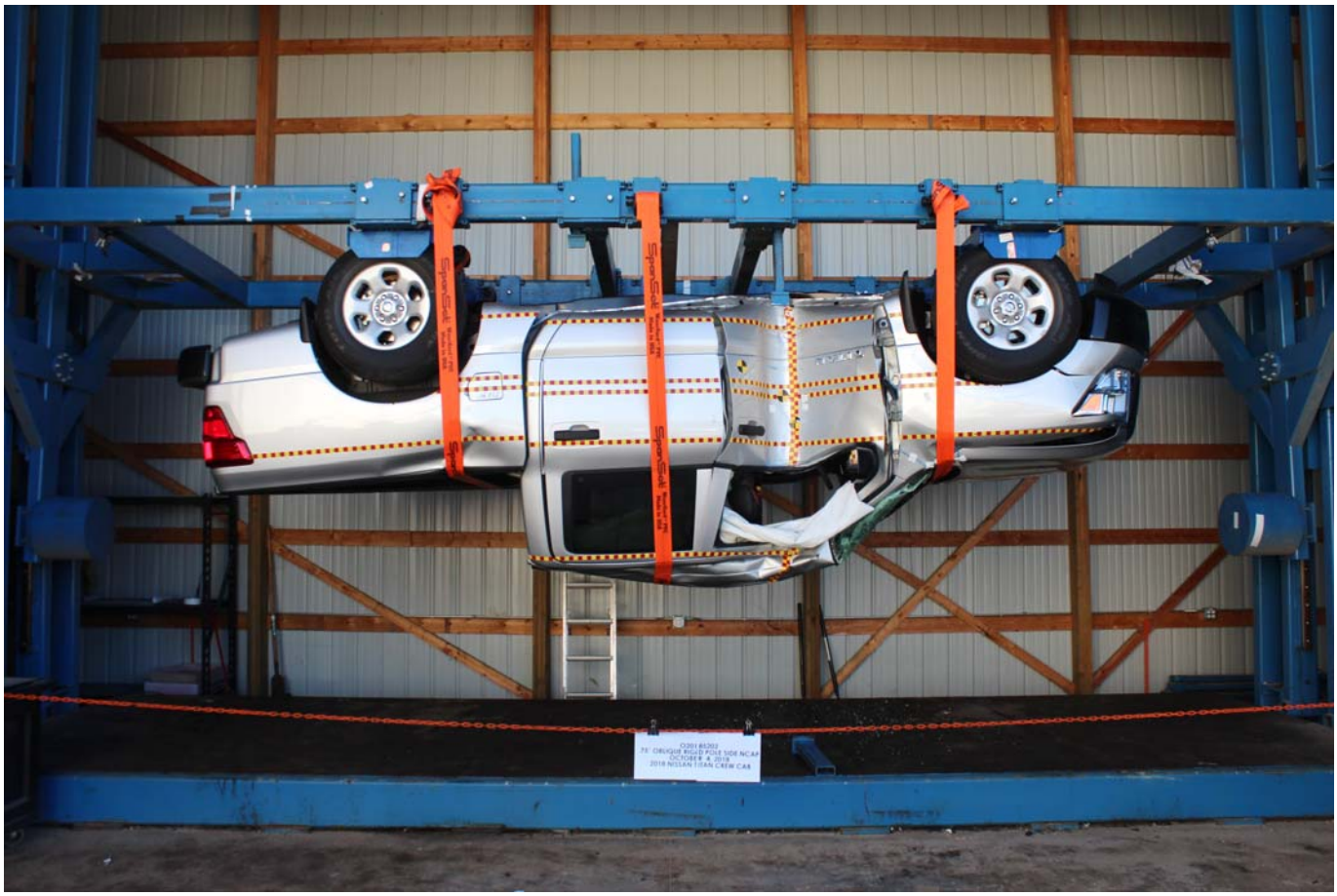


Photo No. 065 - FMVSS Photo No. 301 Static Rollover 180 Degrees

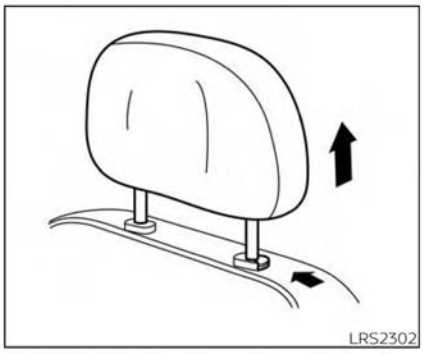
Photo No. 066 - FMVSS Photo No. 301 Static Rollover 270 Degrees

Photo No. 067 - FMVSS Photo No. 301 Static Rollover 360 Degrees

Photo No. 068 - Impact Event

PHOTOGRAPH NOT AVAILABLE

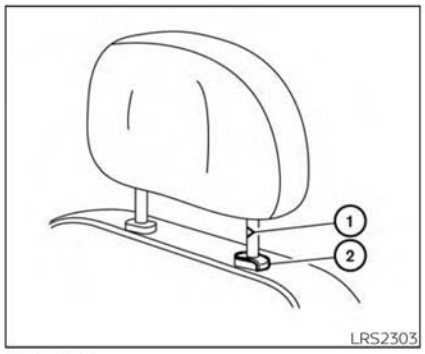
Photo No. 069 - Monroney Label



REMOVABLE (without Dual Head Restraint/Headrest DVD System only)

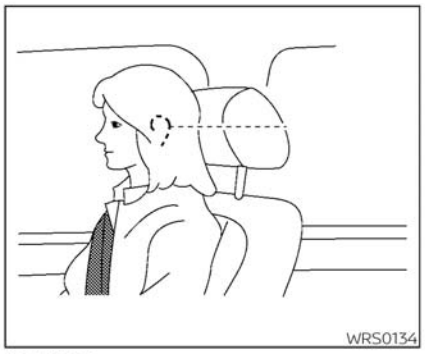
⚠ CAUTION

Do not remove head restraint/headrest from vehicles equipped with Dual Head Restraint/Headrest DVD System. Removal may damage the system wiring.



INSTALL

1. Align the head restraint/headrest stalks with the holes in the seat. Make sure that the head restraint/headrest is facing the correct direction. The stalk with the notch (notches) ① must be installed in the hole with the lock knob ②.
2. Push and hold the lock knob and push the head restraint/headrest down.
3. Properly adjust the head restraint/headrest before an occupant uses the seating position.



ADJUST

For adjustable head restraint/headrest

Adjust the head restraint/headrest so the center is level with the center of your ears. If your ear position is still higher than the recommended alignment, place the head restraint/headrest at the highest position.

Photo No. 070 - Head Restraint Use and Adjustment Information from Vehicle Owners Manual

Photo No. 071 - Post-Test View of Shattered Vehicle Inner Door Panel

APPENDIX B
DUMMY RESPONSE DATA PLOTS

TABLE OF DATA PLOTS
Driver Dummy Instrumentation Plots

The following additional data for this test can be obtained from the Research and Development section of the NHTSA website. The website can be found at www.NHTSA.dot.gov

Additional Driver Dummy Instrumentation Data

Driver Head CG Redundant Acceleration (X) vs. Time

Driver Head CG Redundant Acceleration (Y) vs. Time

Driver Head CG Redundant Acceleration (Z) vs. Time

Driver Head Angular Velocity X (Deg/Sec) vs. Time

Driver Head Angular Velocity Y (Deg/Sec) vs. Time

Driver Head Angular Velocity Z (Deg/Sec) vs. Time

Driver Upper Thorax Rib Deflection (Y)

Driver Middle Thorax Rib Deflection (Y)

Driver Lower Thorax Rib Deflection (Y)

Driver Upper Abdomen Rib Deflection (Y)

Driver Lower Abdomen Rib Deflection (Y)

Vehicle Instrumentation Data

Vehicle Center of Gravity Acceleration (X)

Vehicle Center of Gravity Acceleration (Y)

Vehicle Center of Gravity Acceleration (Z)

Left Floor Sill Acceleration (Y)

Left A-Pillar Sill Acceleration (Y)

Left Lower A-Pillar Acceleration (Y)

Left Mid A-Pillar Acceleration (Y)

Left B-Pillar Sill Acceleration (Y)

Left Lower B-Pillar Acceleration (Y)

Left Mid B-Pillar Acceleration (Y)

Driver Seat Track at Dummy Hip Point Acceleration (Y)

Engine Top Acceleration (X)

Engine Top Acceleration (Y)

Firewall Center Acceleration (Y)

Right Roof at Vertical Impact Reference Line Acceleration (Y)

Right Sill at Vertical Impact Reference Line Acceleration (Y)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (X)

Rear Floorpan Behind Rear Axle at Centerline Acceleration (Y)

Pole Instrumentation Data

Load Cell Pole Barrier #1 Force (Y)

Load Cell Pole Barrier #2 Force (Y)

Load Cell Pole Barrier #3 Force (Y)

Load Cell Pole Barrier #4 Force (Y)

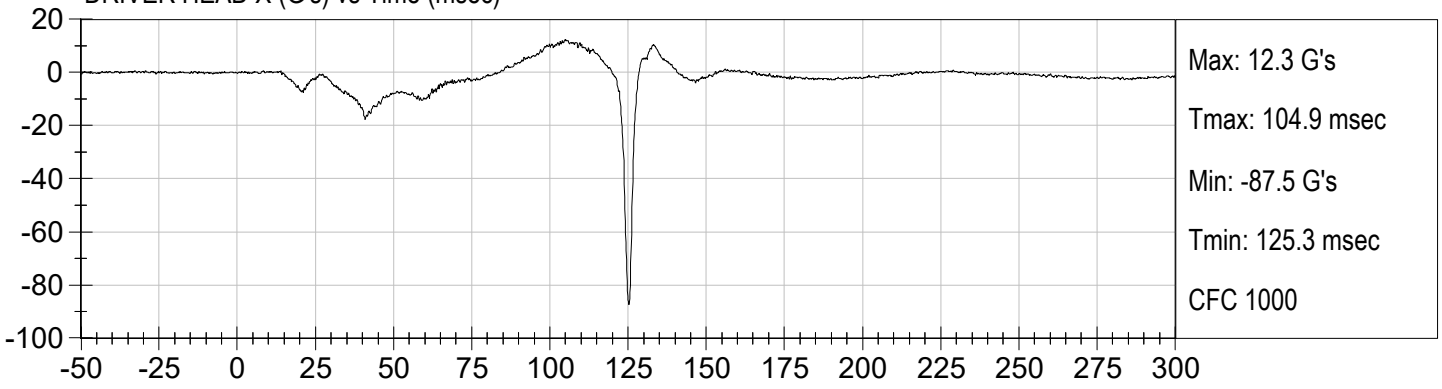
Load Cell Pole Barrier #5 Force (Y)

Load Cell Pole Barrier #6 Force (Y)

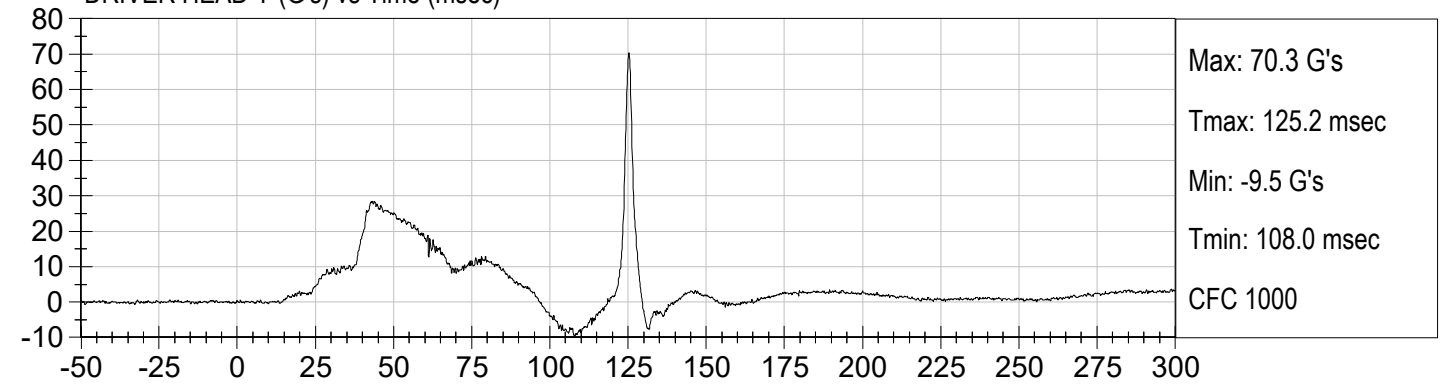
Load Cell Pole Barrier #7 Force (Y)

Load Cell Pole Barrier #8 Force (Y)

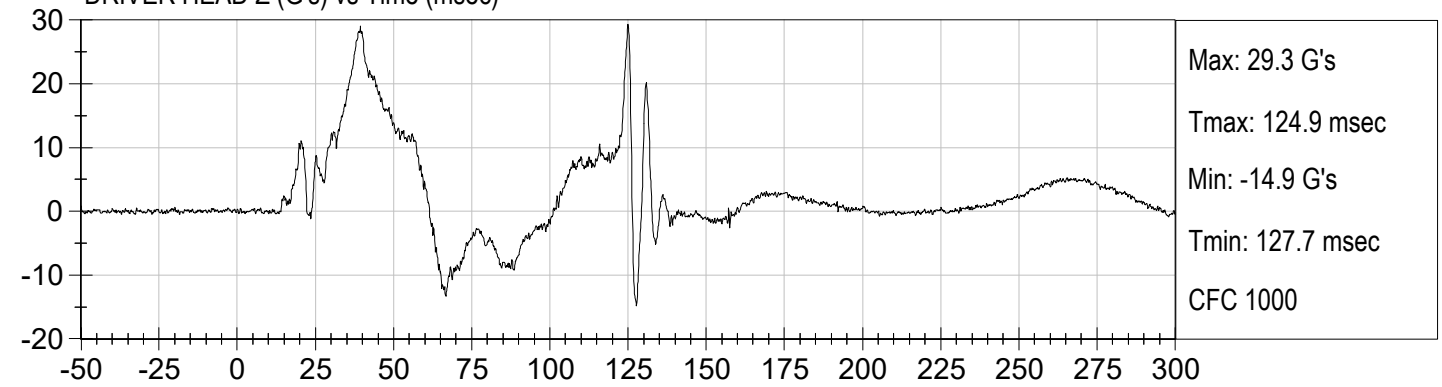
DRIVER HEAD X (G's) vs Time (msec)



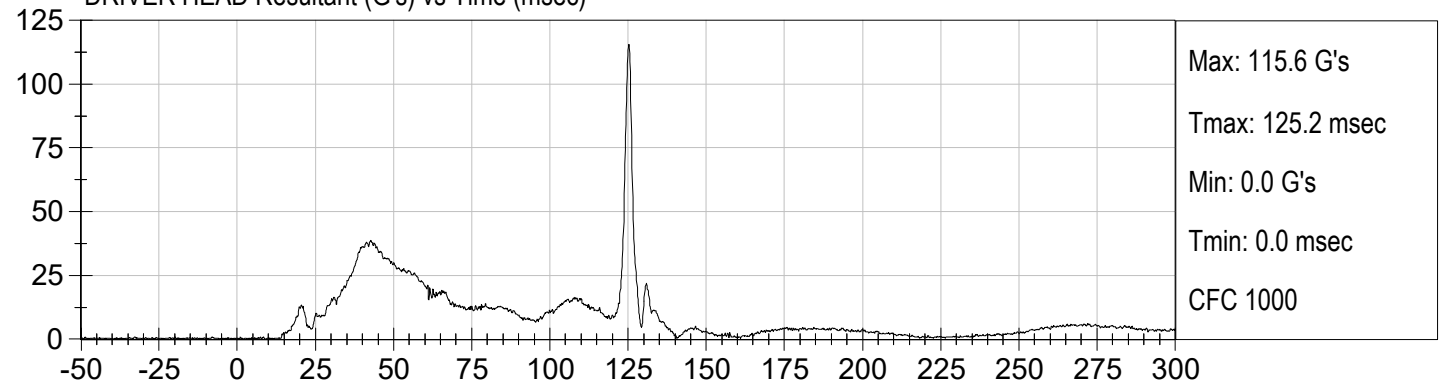
DRIVER HEAD Y (G's) vs Time (msec)



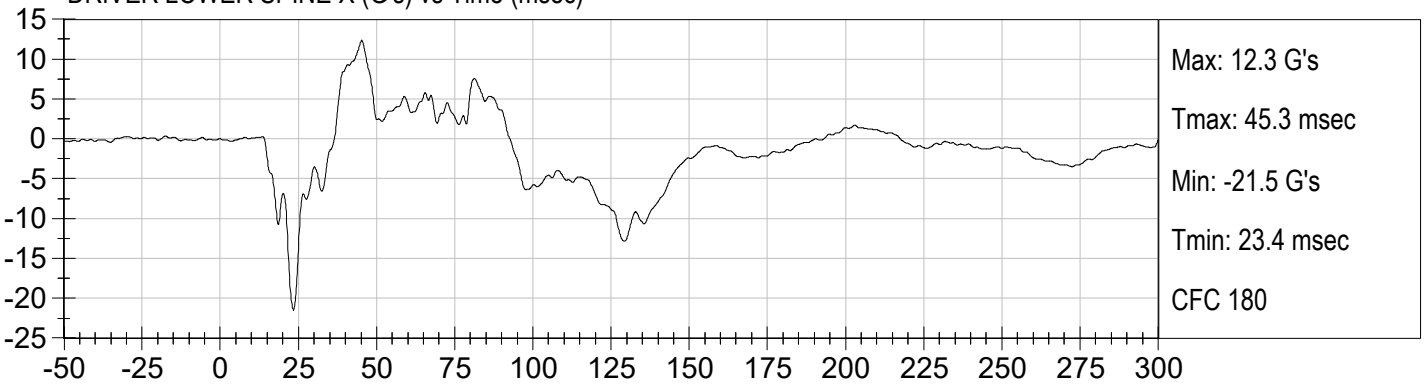
DRIVER HEAD Z (G's) vs Time (msec)



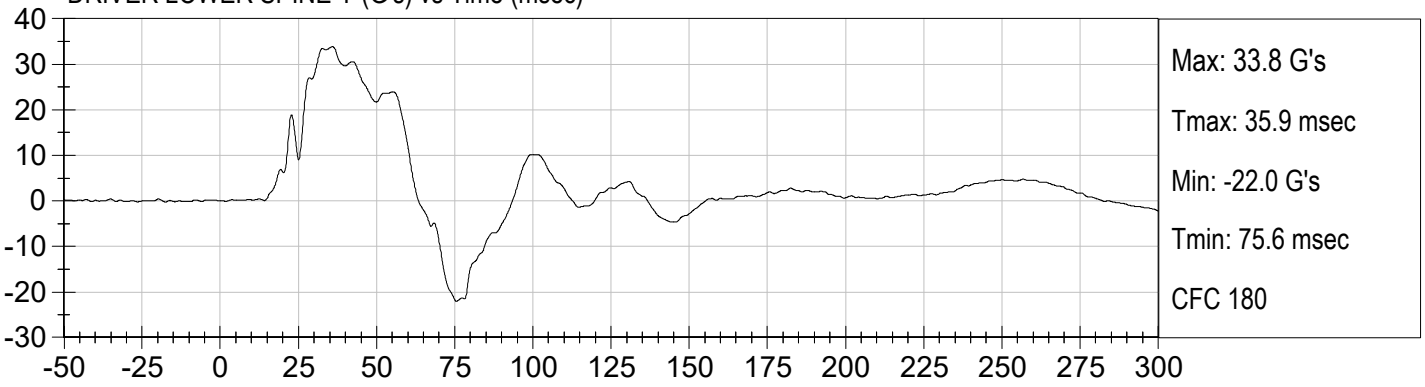
DRIVER HEAD Resultant (G's) vs Time (msec)



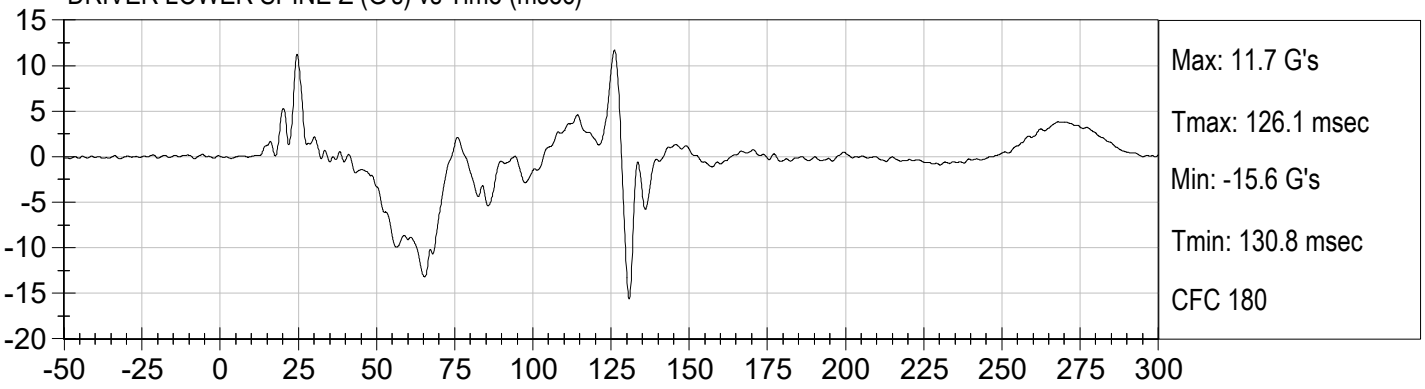
DRIVER LOWER SPINE X (G's) vs Time (msec)



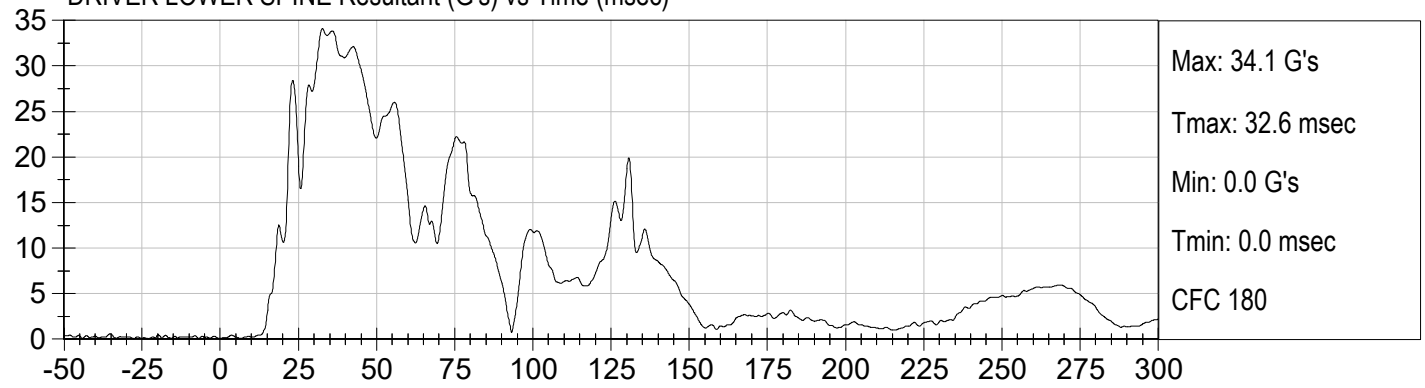
DRIVER LOWER SPINE Y (G's) vs Time (msec)



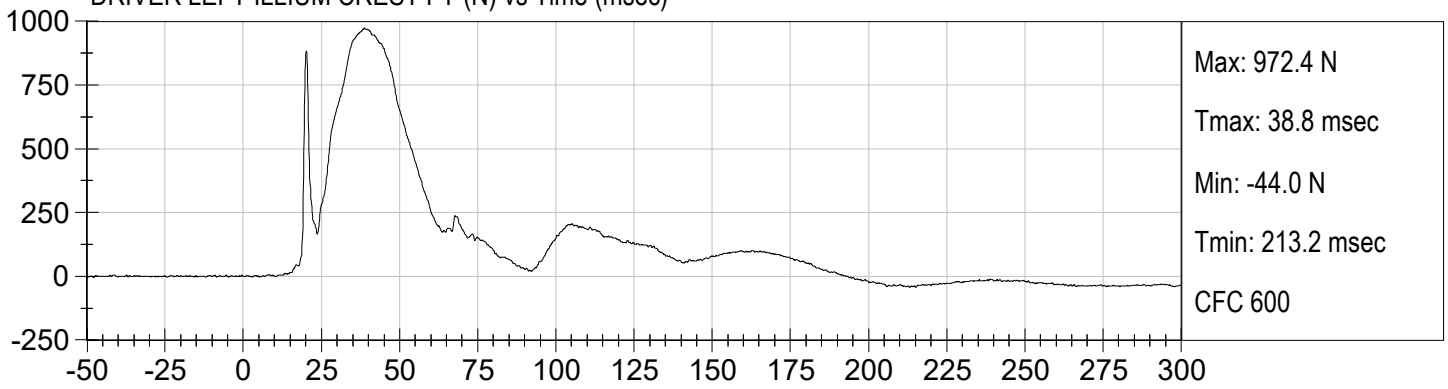
DRIVER LOWER SPINE Z (G's) vs Time (msec)



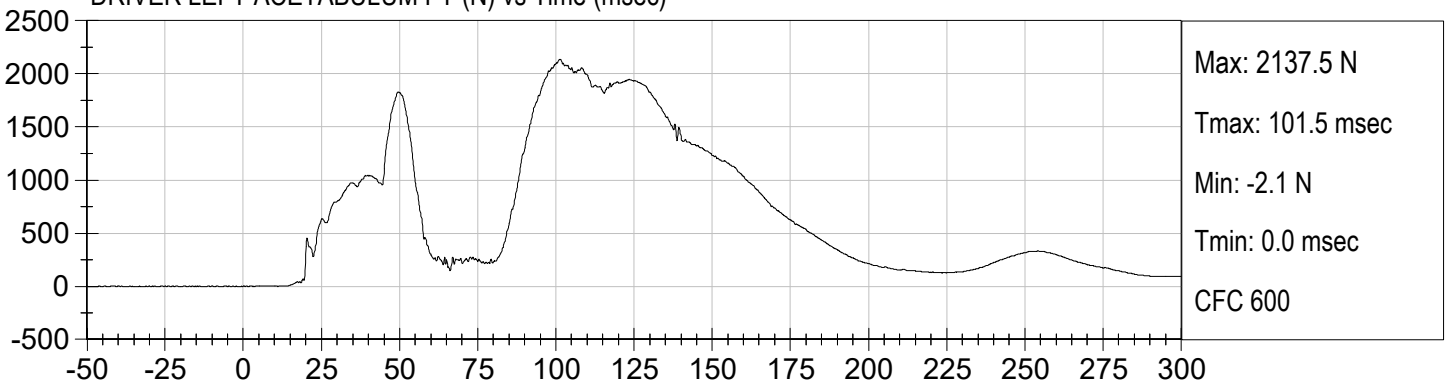
DRIVER LOWER SPINE Resultant (G's) vs Time (msec)



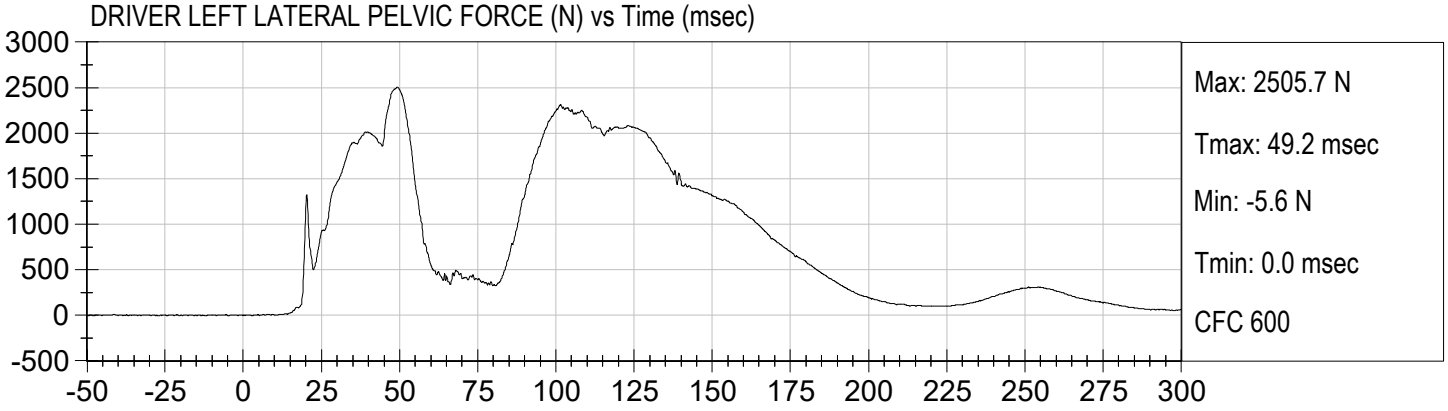
DRIVER LEFT ILLIUM CREST FY (N) vs Time (msec)



DRIVER LEFT ACETABULUM FY (N) vs Time (msec)



DRIVER LEFT LATERAL PELVIC FORCE (N) vs Time (msec)



APPENDIX C
DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

CALIBRATION TEST RESULTS

PRE-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SID-IIsD External Measurements
SN: 296

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	784	Pass
B	Shoulder Pivot Height	437 - 453	442	Pass
C	H-point Height	79 - 89	83	Pass
D	H-point from Seatback	141 - 151	145	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	121	Pass
G	Head Breadth	140 - 148	142	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	180	Pass
J	Head Circumference	541 - 551	548	Pass
K	Buttock to Knee Length	514 - 540	535	Pass
L	Popliteal Height	343 - 369	358	Pass
M	Knee Pivot to Floor Height	392 - 409	404	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	206	Pass
P	Foot Length	216 - 232	219	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	316	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	481	Pass
V	Shoulder Width	341 - 357	346	Pass
W	Foot Width	78 - 94	85	Pass
Y	Chest Circumference w/ jacket	851 - 881	870	Pass
Z	Waist Circumference	761 - 791	772	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D182651

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.5	Pass
Laboratory Relative Humidity	%	10 to 70	45	Pass
Peak Resultant Acceleration	G's	115 to 137	135	Pass
Peak Longitudinal Acceleration	G's	+/- 15	-2.8	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

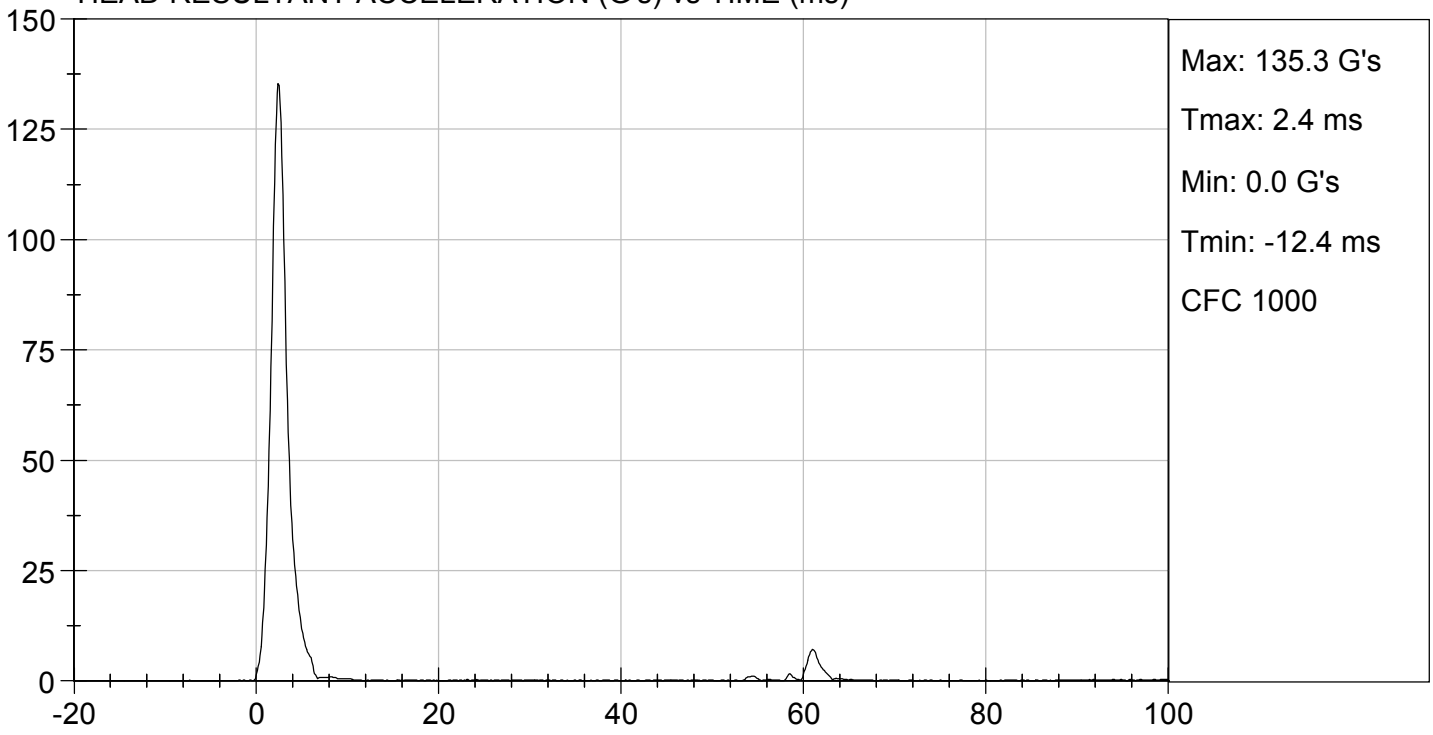
08/28/2018
Test Date

Robert Schwabe
Approved By

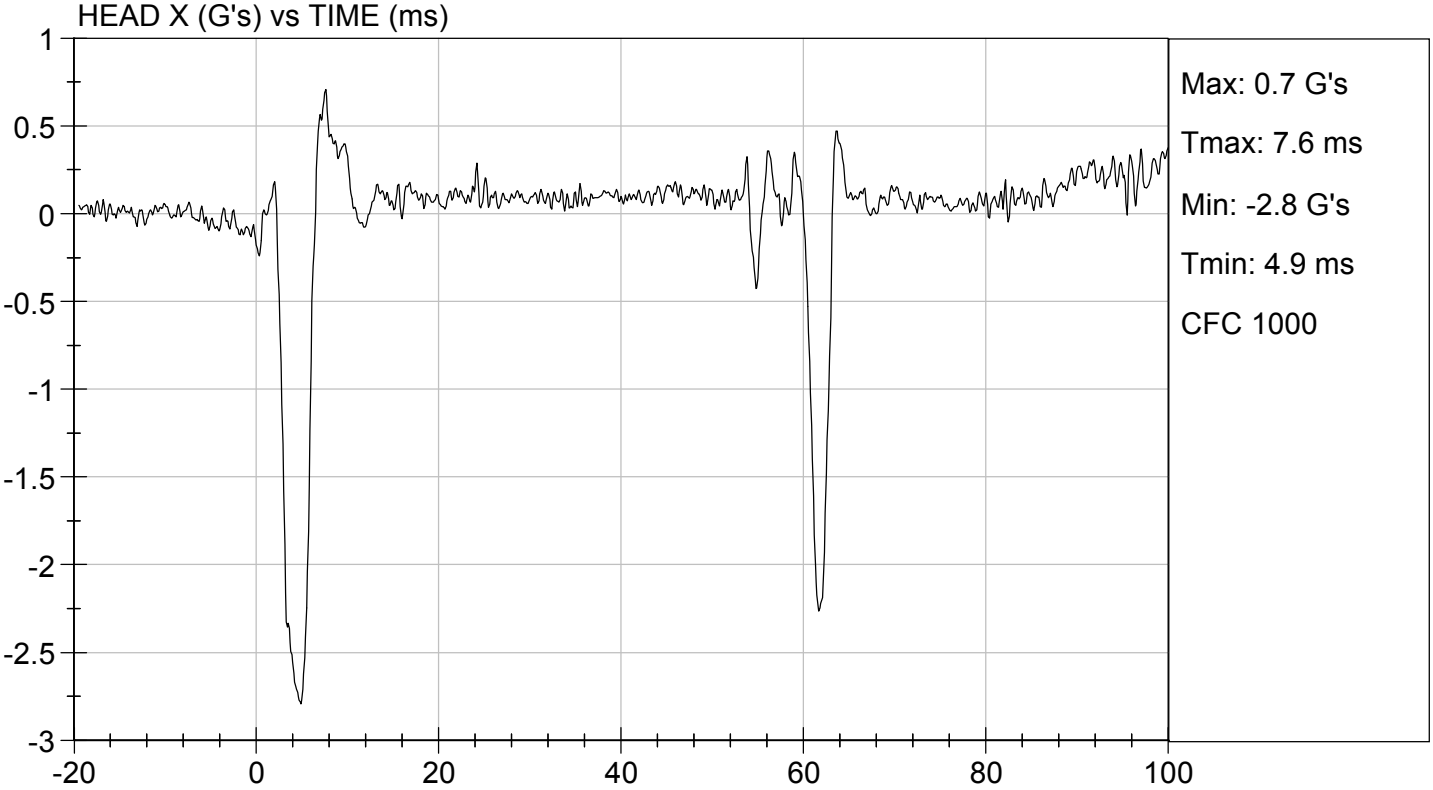
TEST DESC: HEAD DROP

TEST DATE: 08/28/2018
TEST #: D182651

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

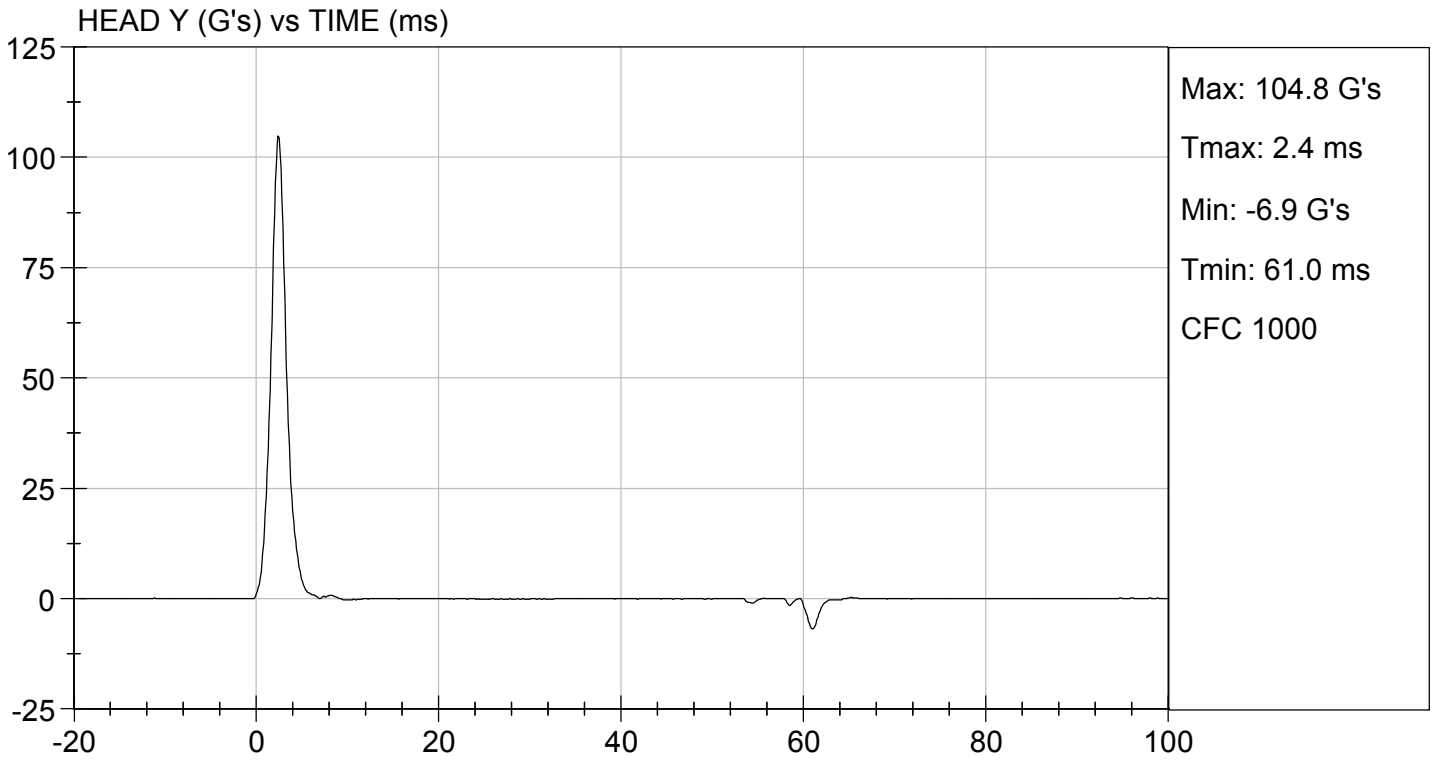


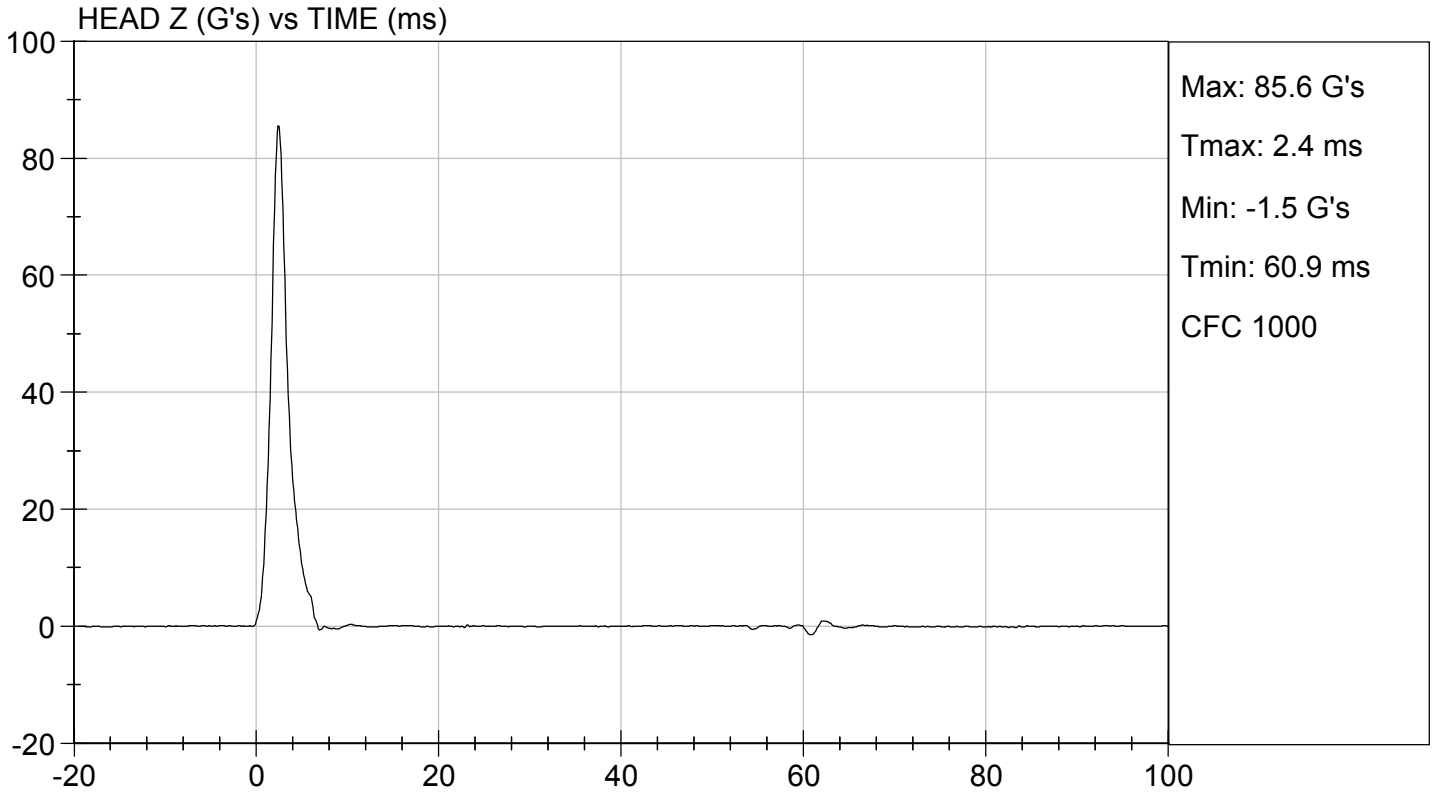
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 08/28/2018
TEST #: D182651





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D182652

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	21.5	Pass
Humidity		%	10 to 70	44	Pass
Impact Velocity		m/s	5.51 to 5.63	5.61	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.57	Pass
	15 ms	m/s	3.30 to 4.10	3.74	Pass
	20 ms	m/s	4.40 to 5.40	5.19	Pass
	25 ms	m/s	5.40 to 6.10	5.62	Pass
	25-100 ms	m/s	5.50 to 6.20	5.67	Pass
Maximum D-Plane Rotation		deg	71 to 81	71	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	61	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-41	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	111	Pass
			Overall Test Results		Pass

Danielle Redinbaugh

Laboratory Technician

08/28/2018

Test Date

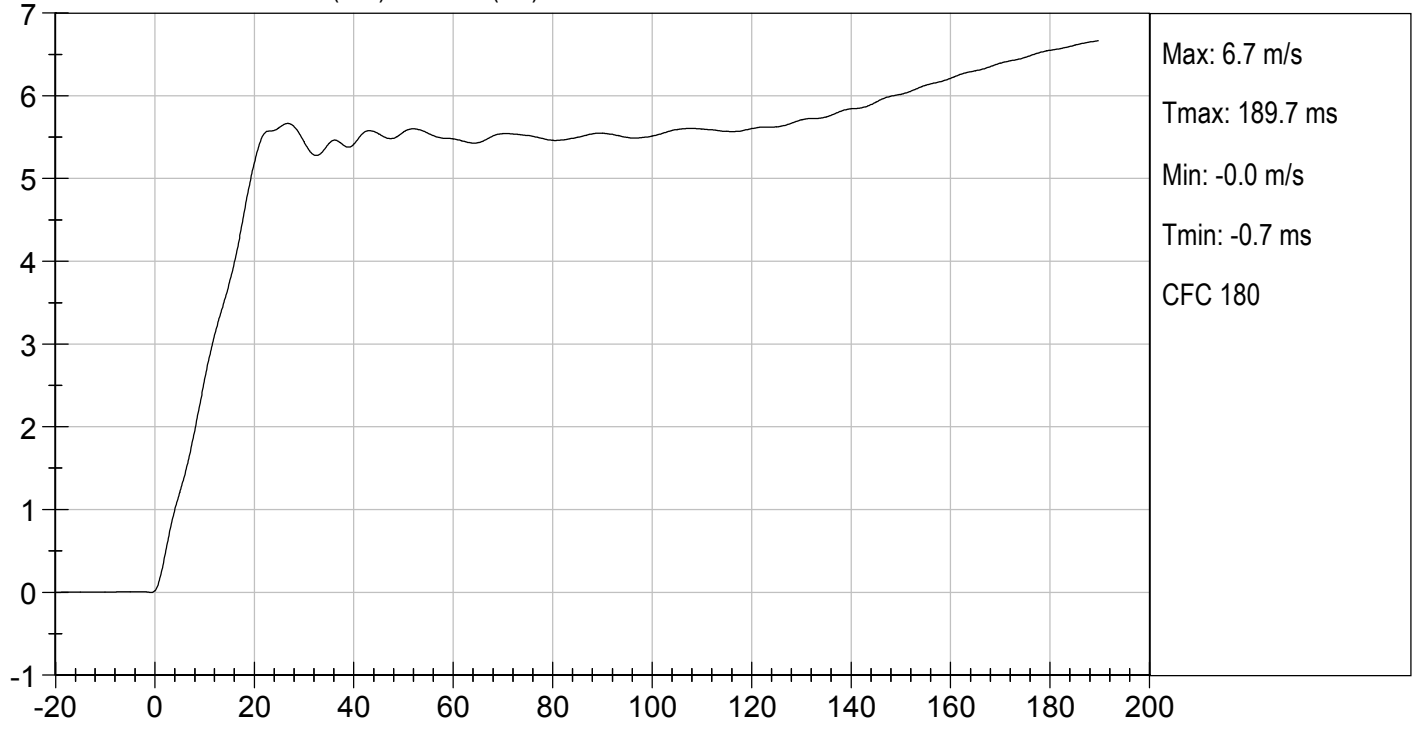
Robert Schmidt

Approved By

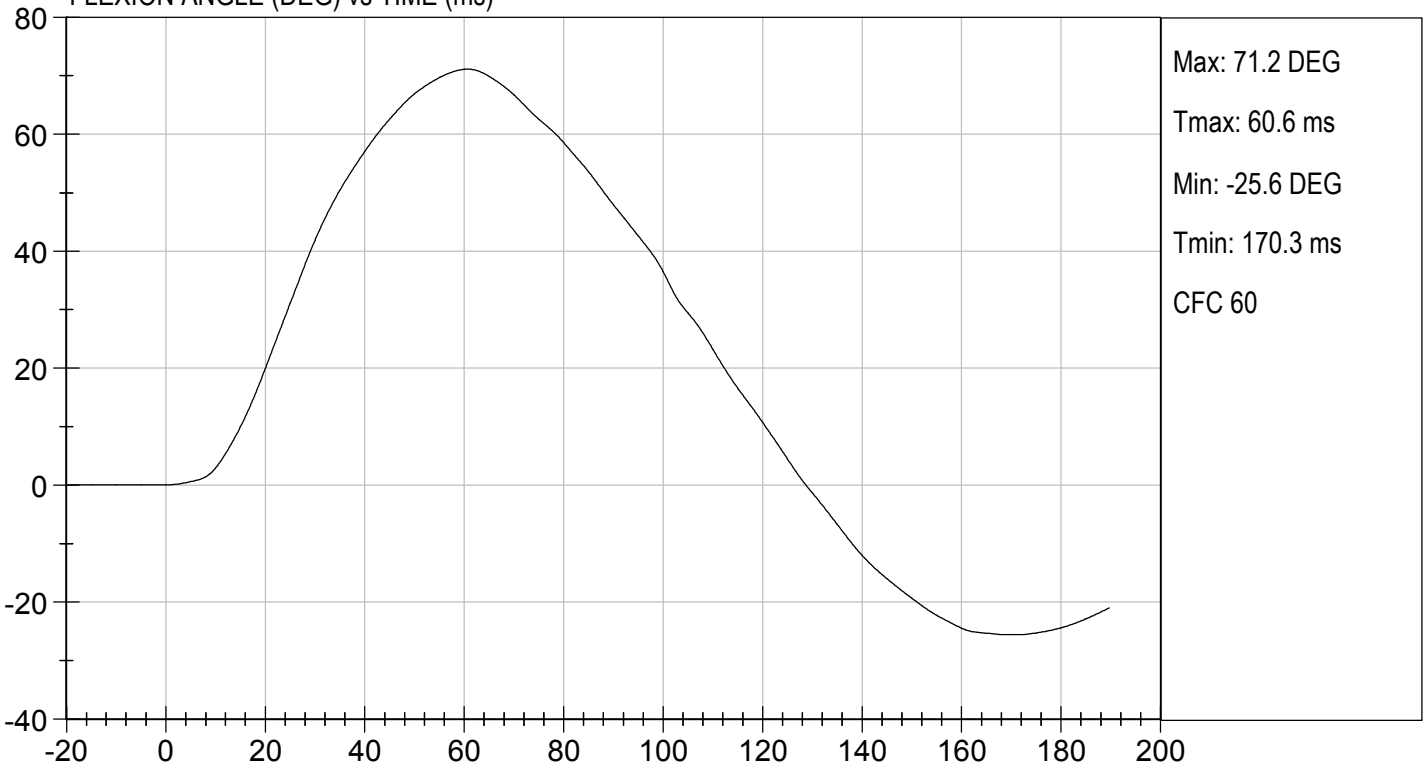
TEST DESC: NECK BENDING
VELOCITY: 18.40 ft/s, 5.61 m/s

TEST DATE: 08/28/2018
TEST #: D182652

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

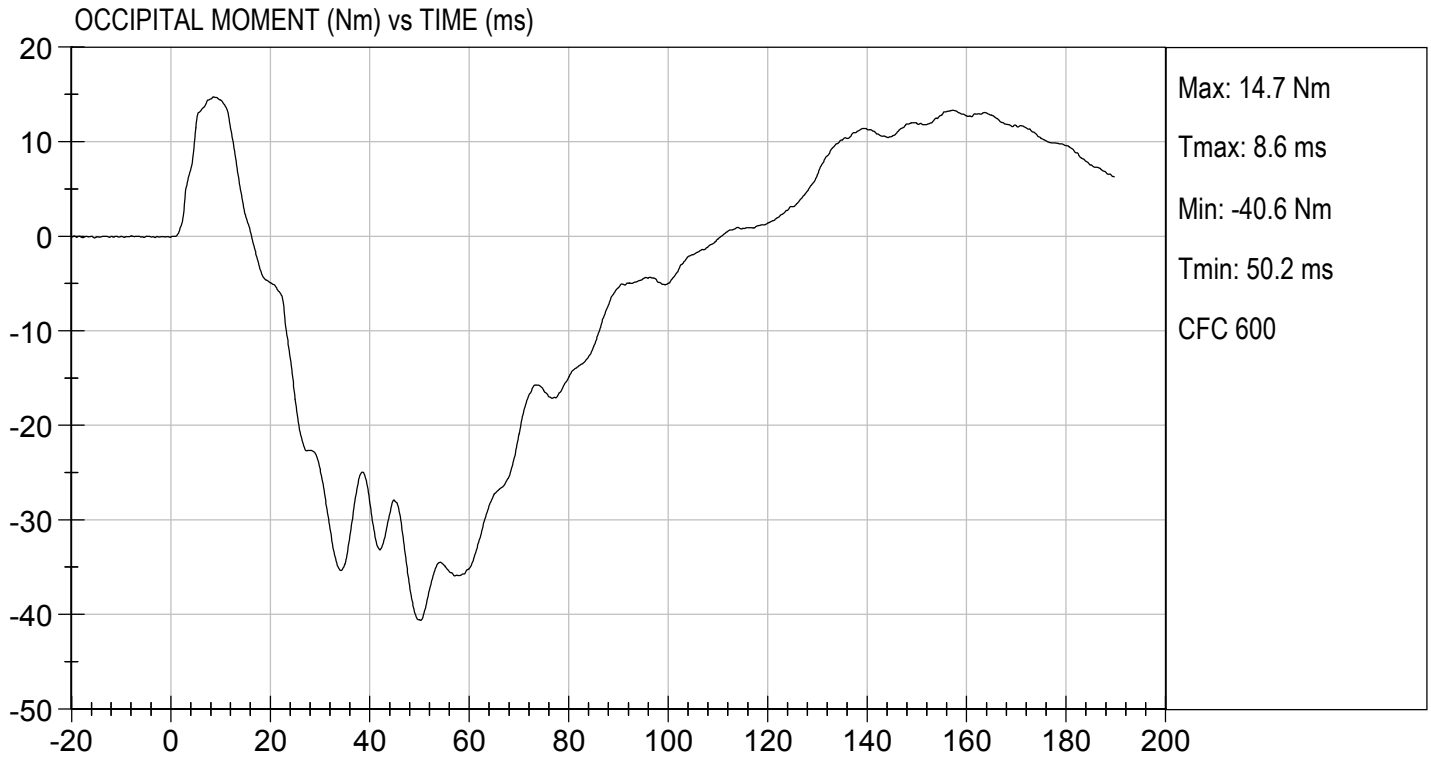


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.40 ft/s, 5.61 m/s

TEST DATE: 08/28/2018
TEST #: D182652



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D182653

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.6	Pass
Laboratory Relative Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	30	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	20	Pass
		Overall Test Results		Pass

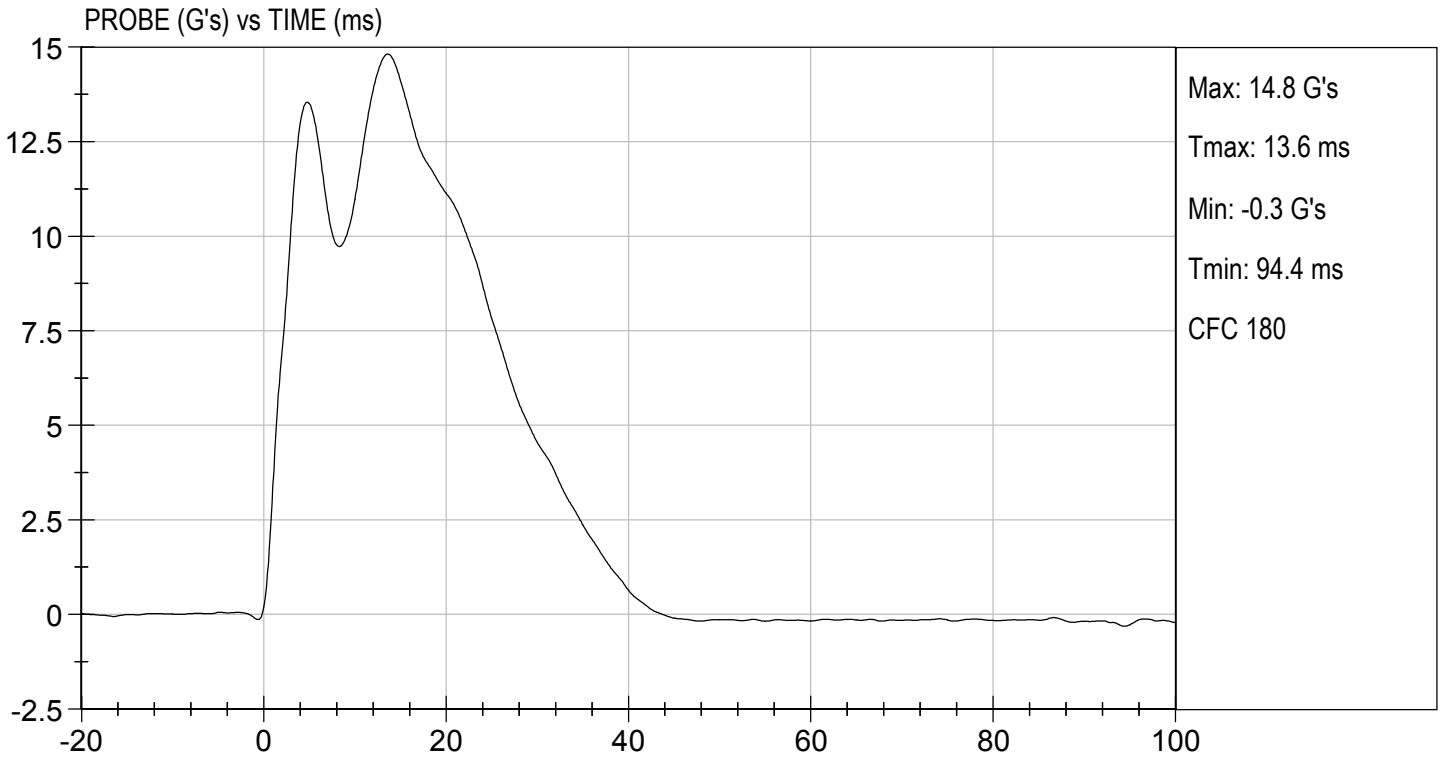
Danielle Redinbaugh
Laboratory Technician

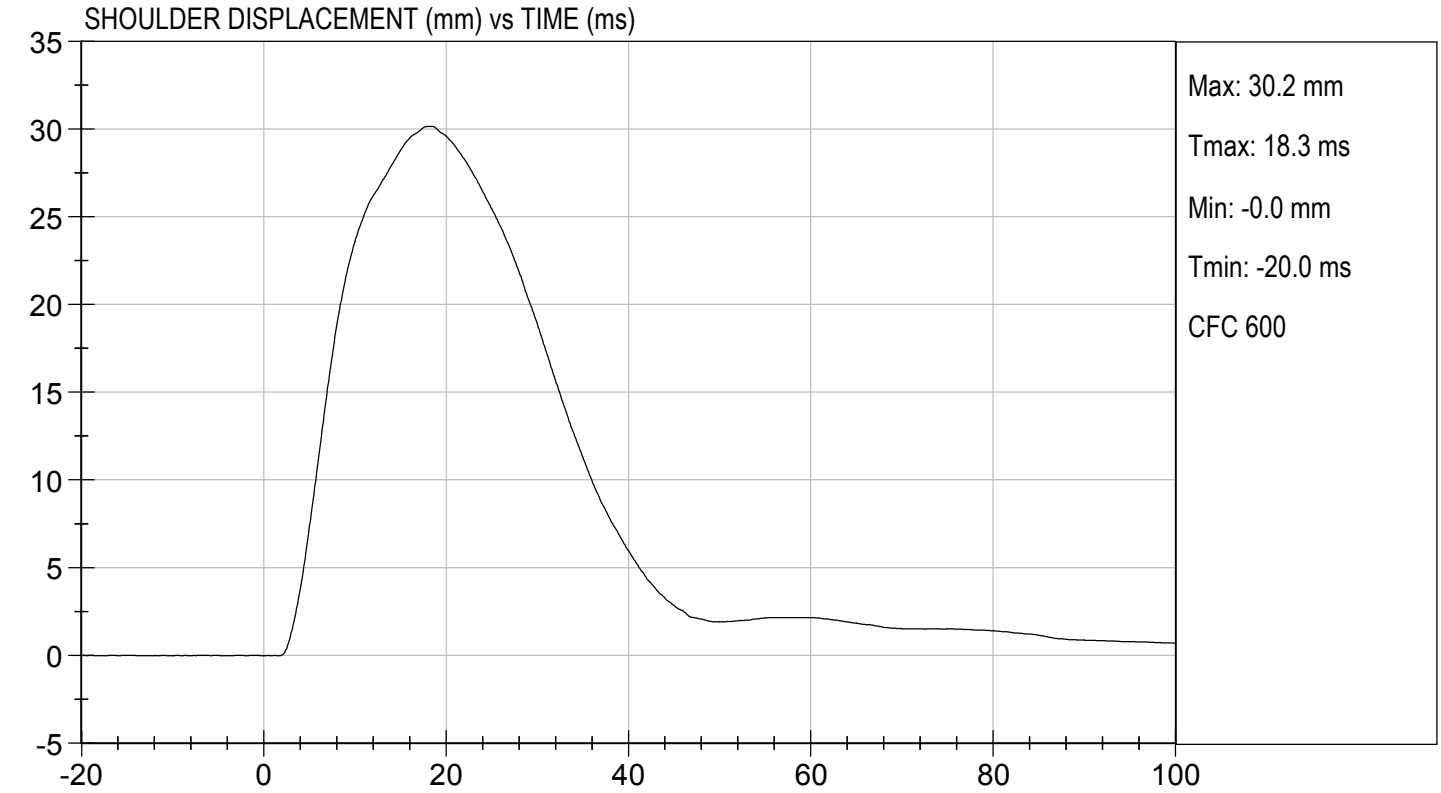
08/27/2018
Test Date

Robert Schmidt
Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 08/27/2018
TEST #: D182653

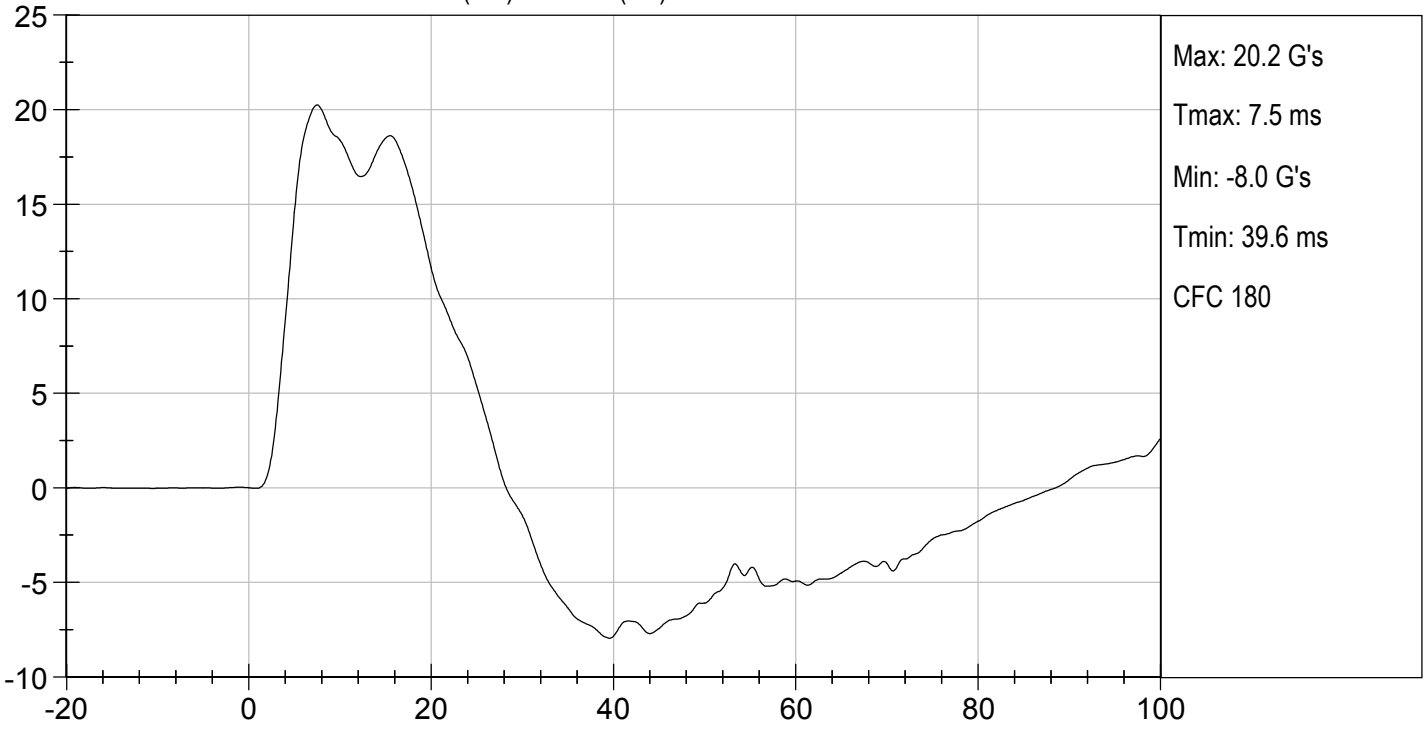




TEST DESC: SHOULDER IMPACT
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 08/27/2018
TEST #: D182653

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D182654

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	6.60 to 6.80	6.77	Pass
Maximum Probe Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	34	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	31	Pass
Lower Rib Displacement	mm	32 to 38	35	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	38	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	33	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

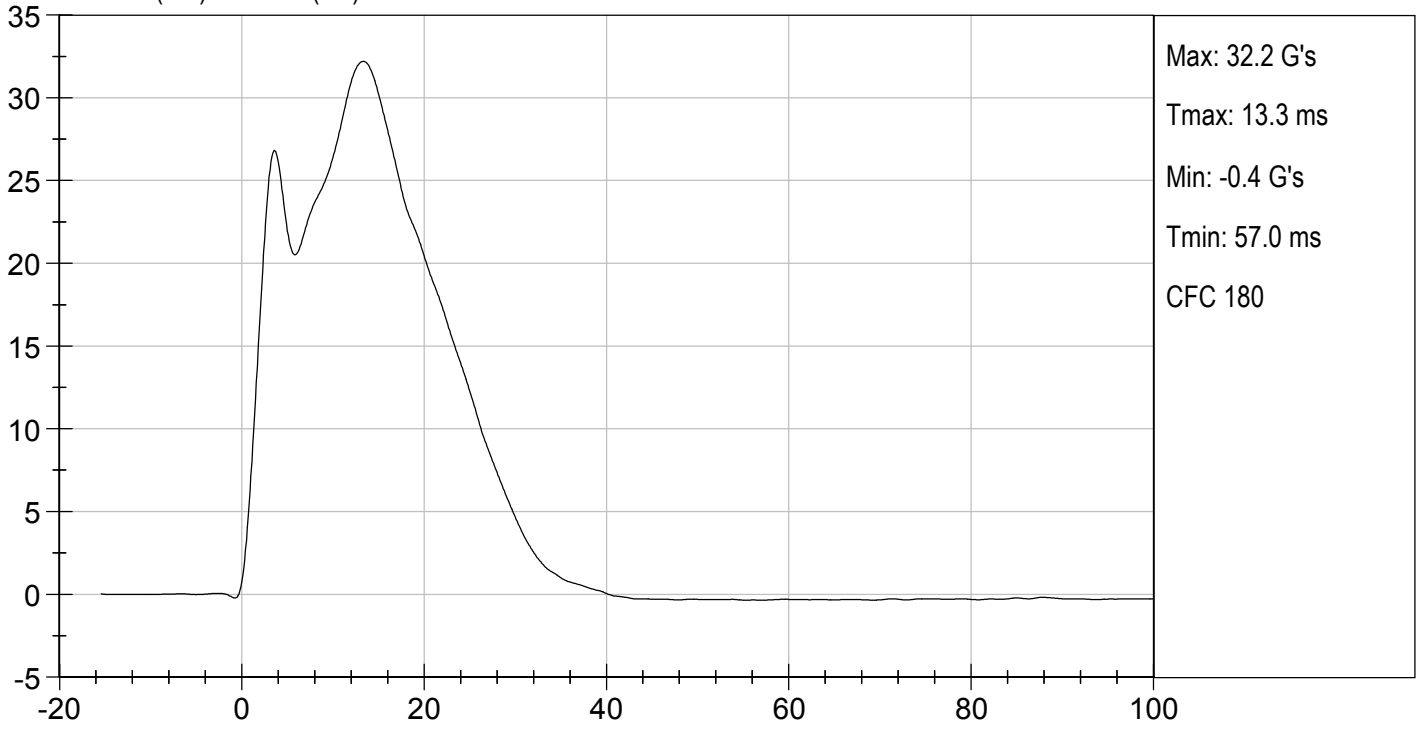
08/27/2018
Test Date

Robert Schmidt
Approved By

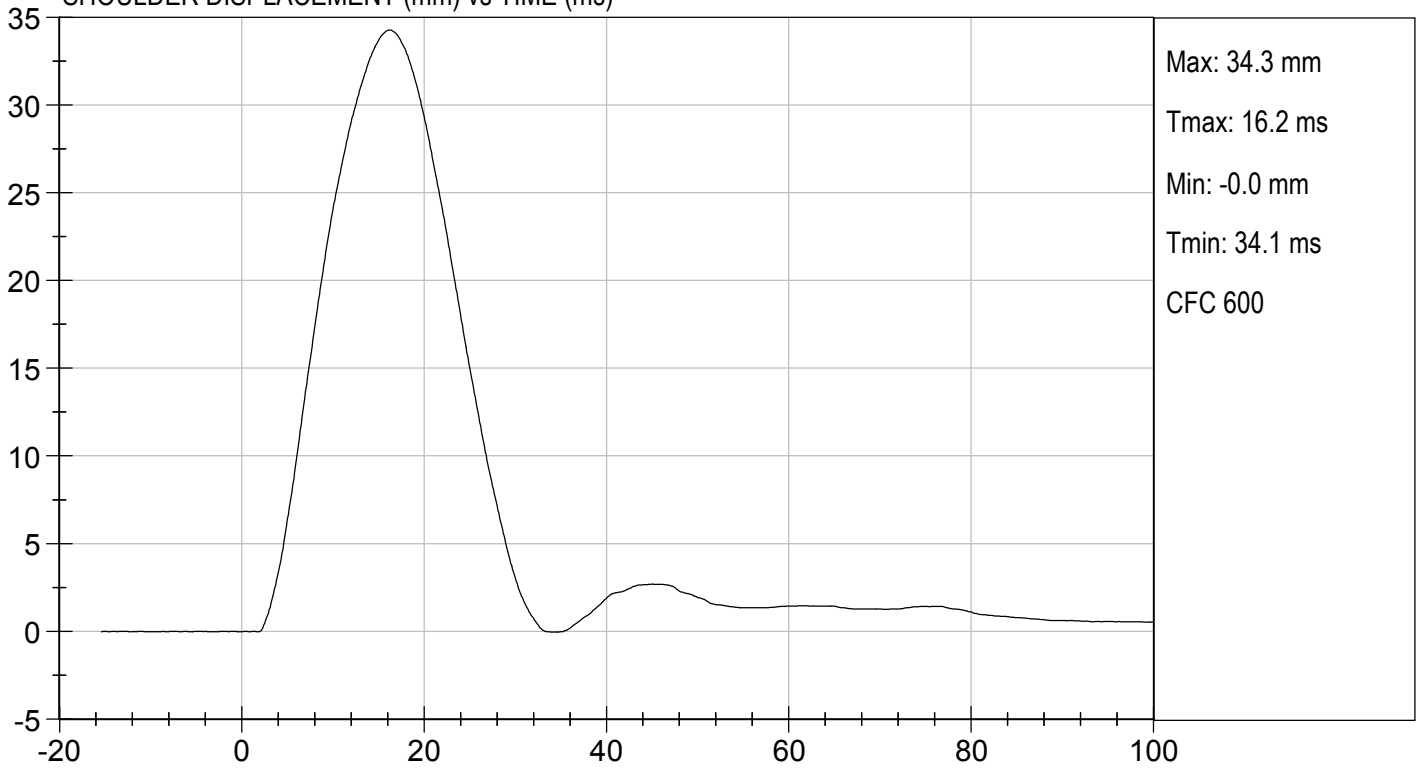
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 08/27/2018
TEST #: D182654

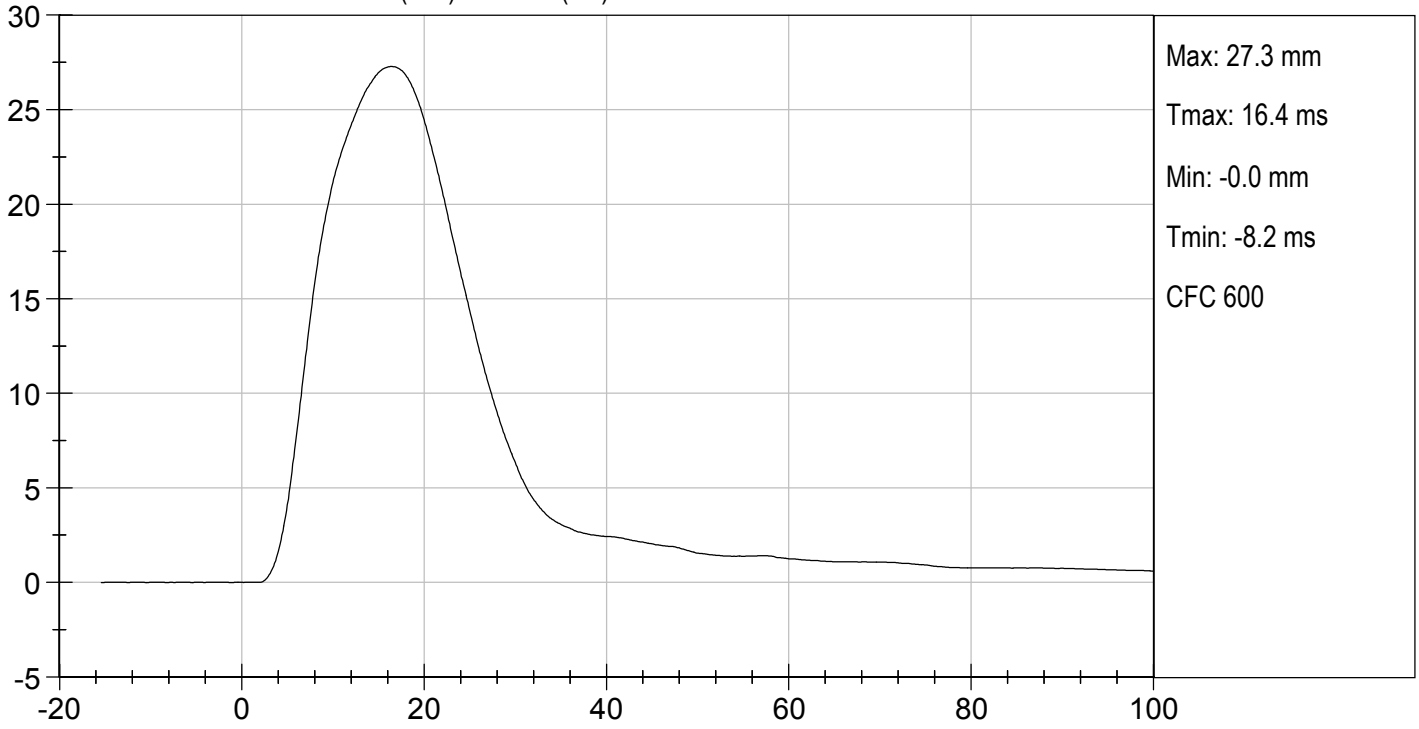
PROBE (G's) vs TIME (ms)



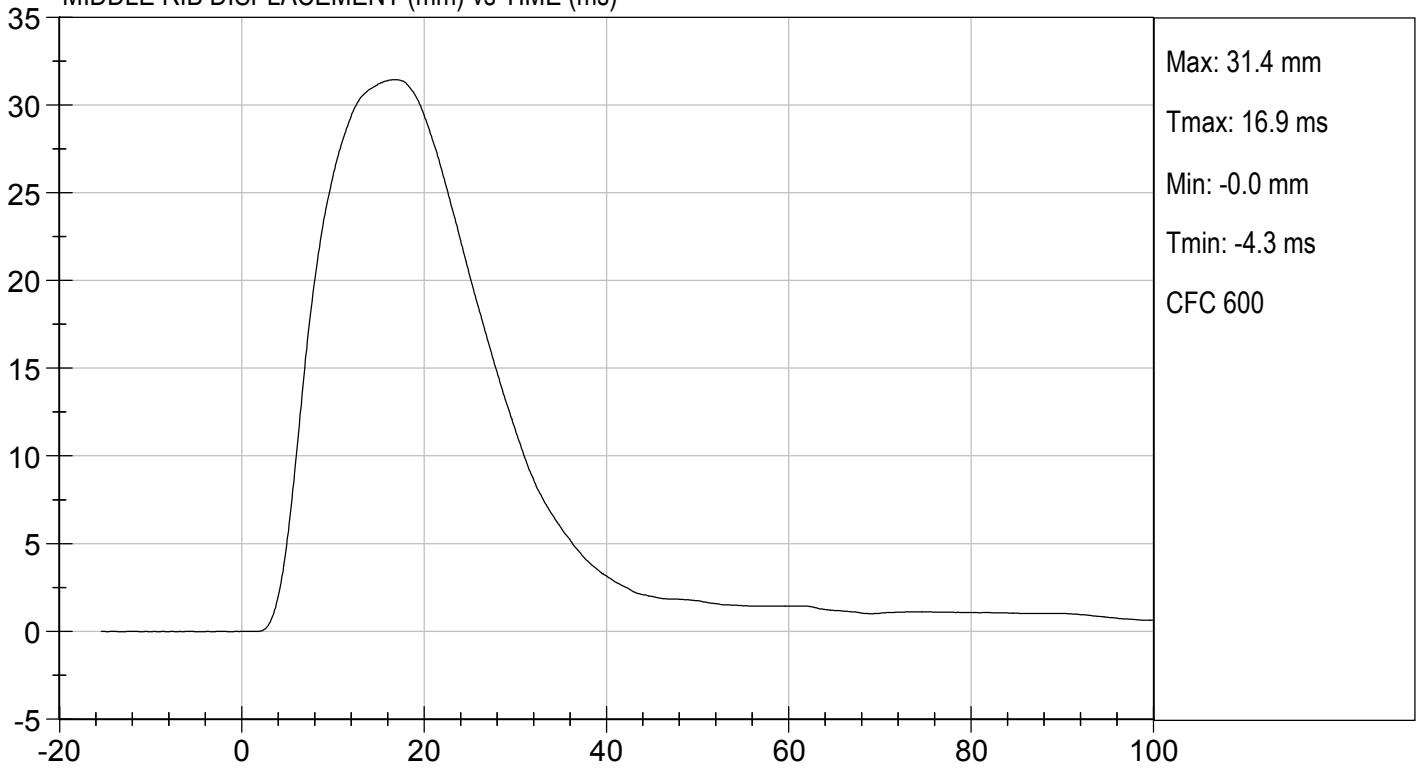
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



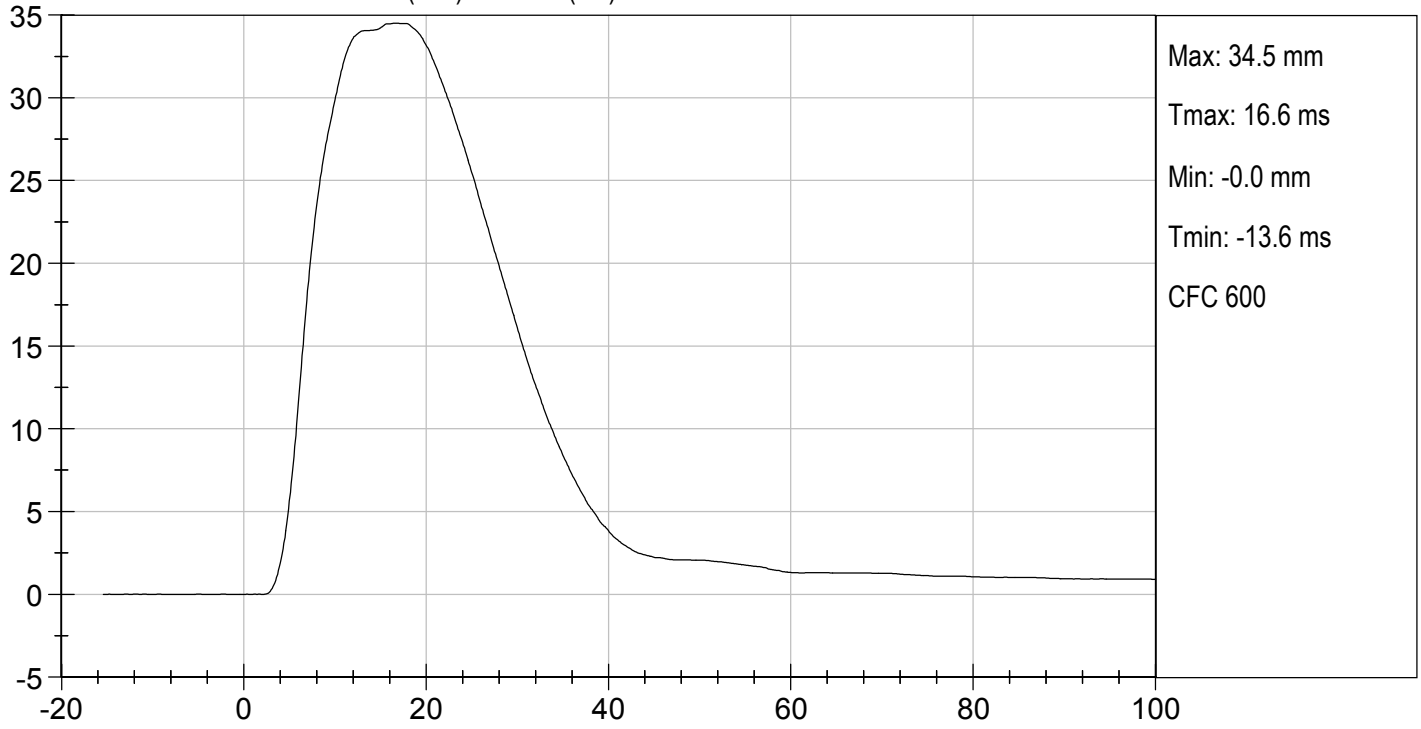
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



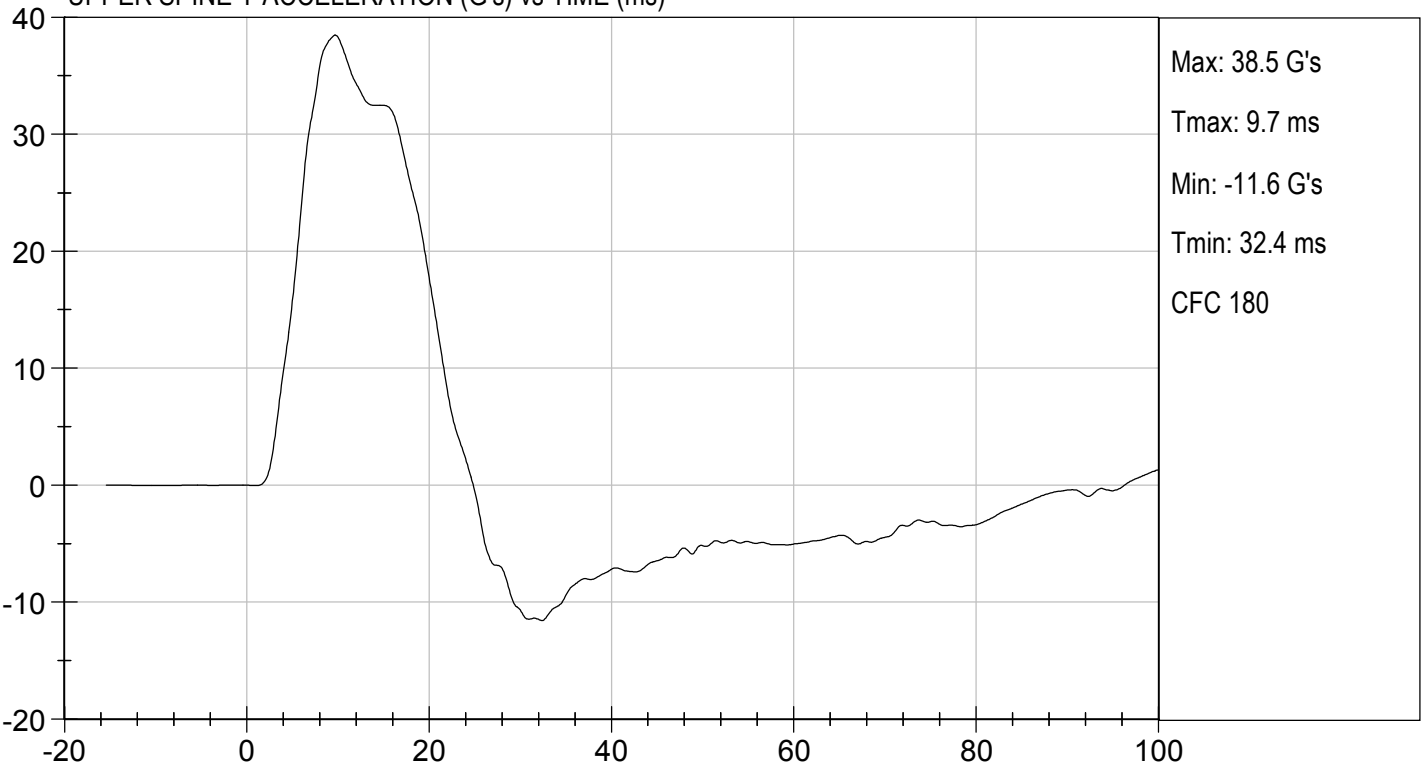
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 22.22 ft/s, 6.77 m/s

TEST DATE: 08/27/2018
TEST #: D182654

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



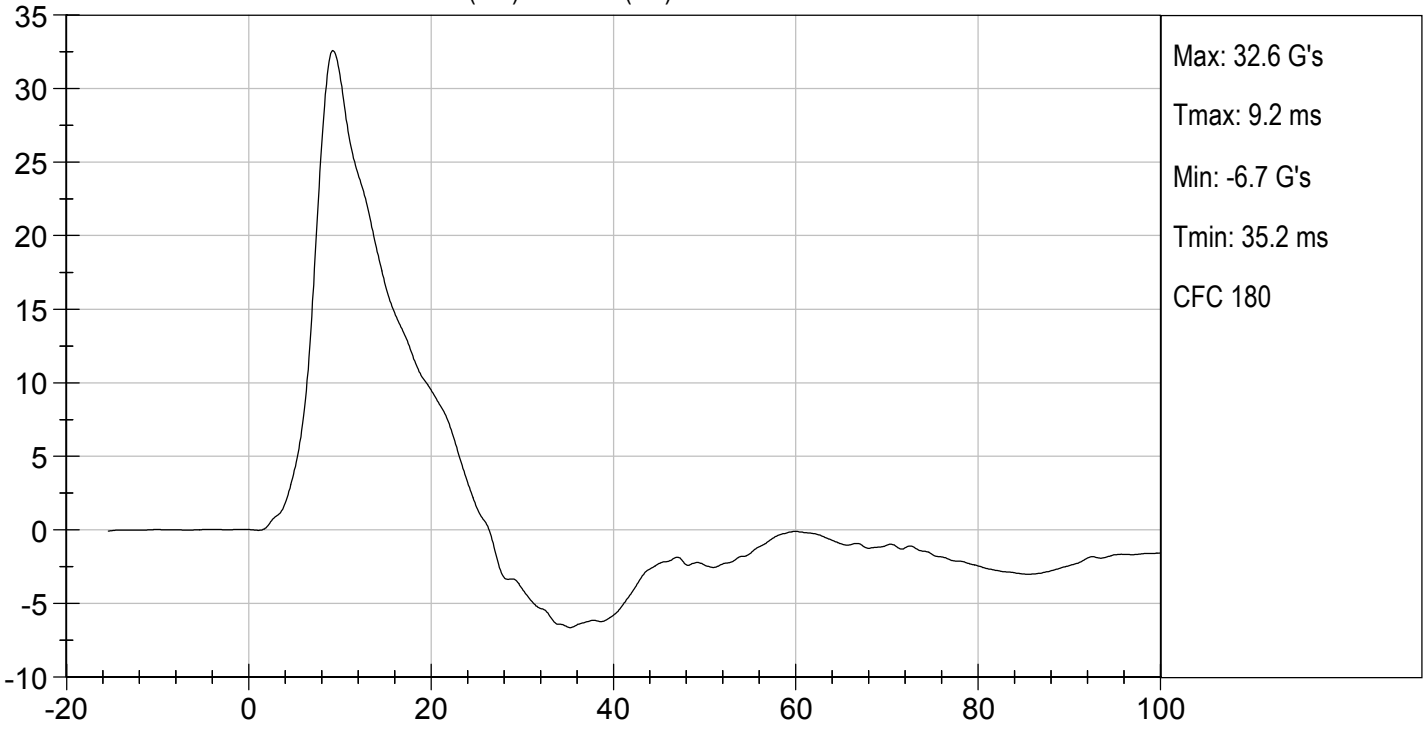
UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 08/27/2018
TEST #: D182654

LOWER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D182655

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	39	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	15	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
		Overall Test Results		Pass

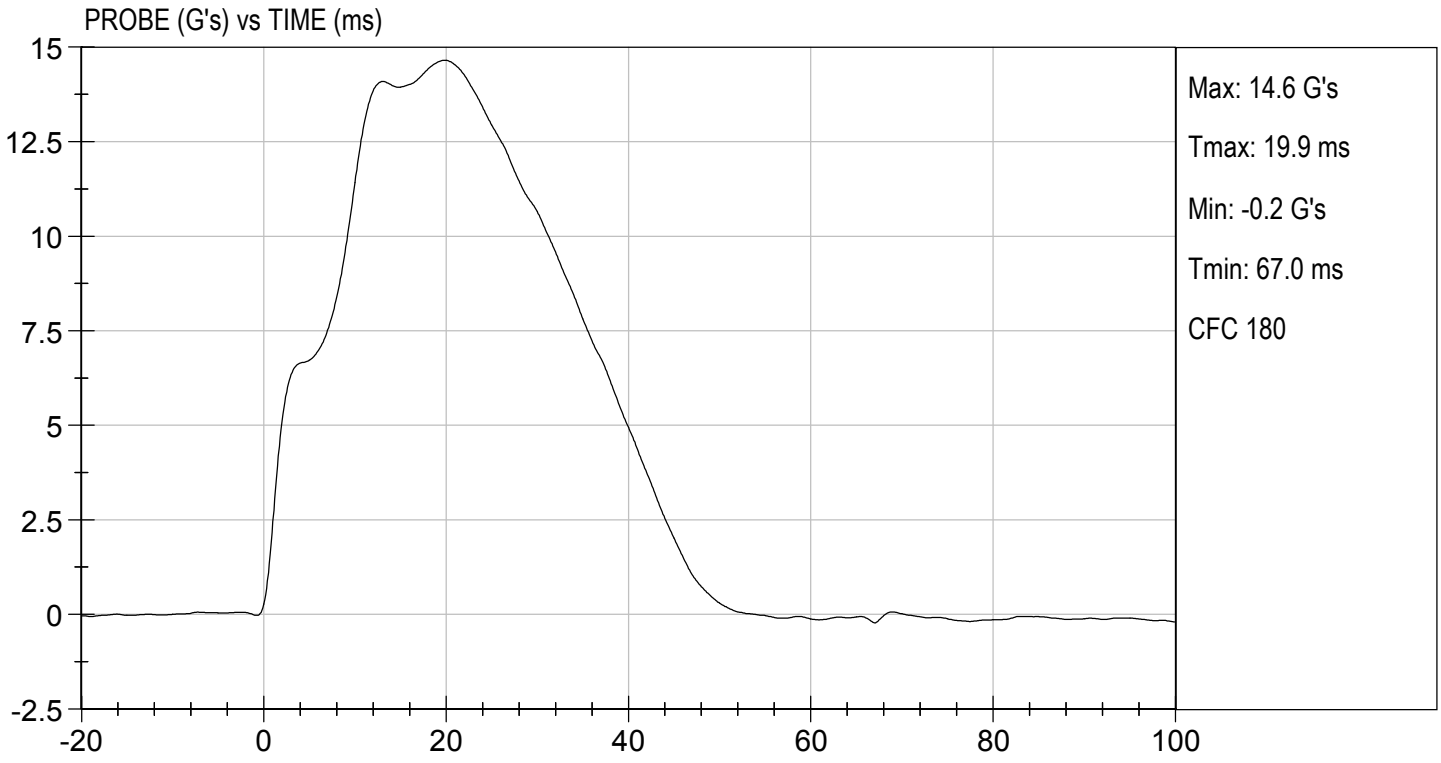
Danielle Redinbaugh
Laboratory Technician

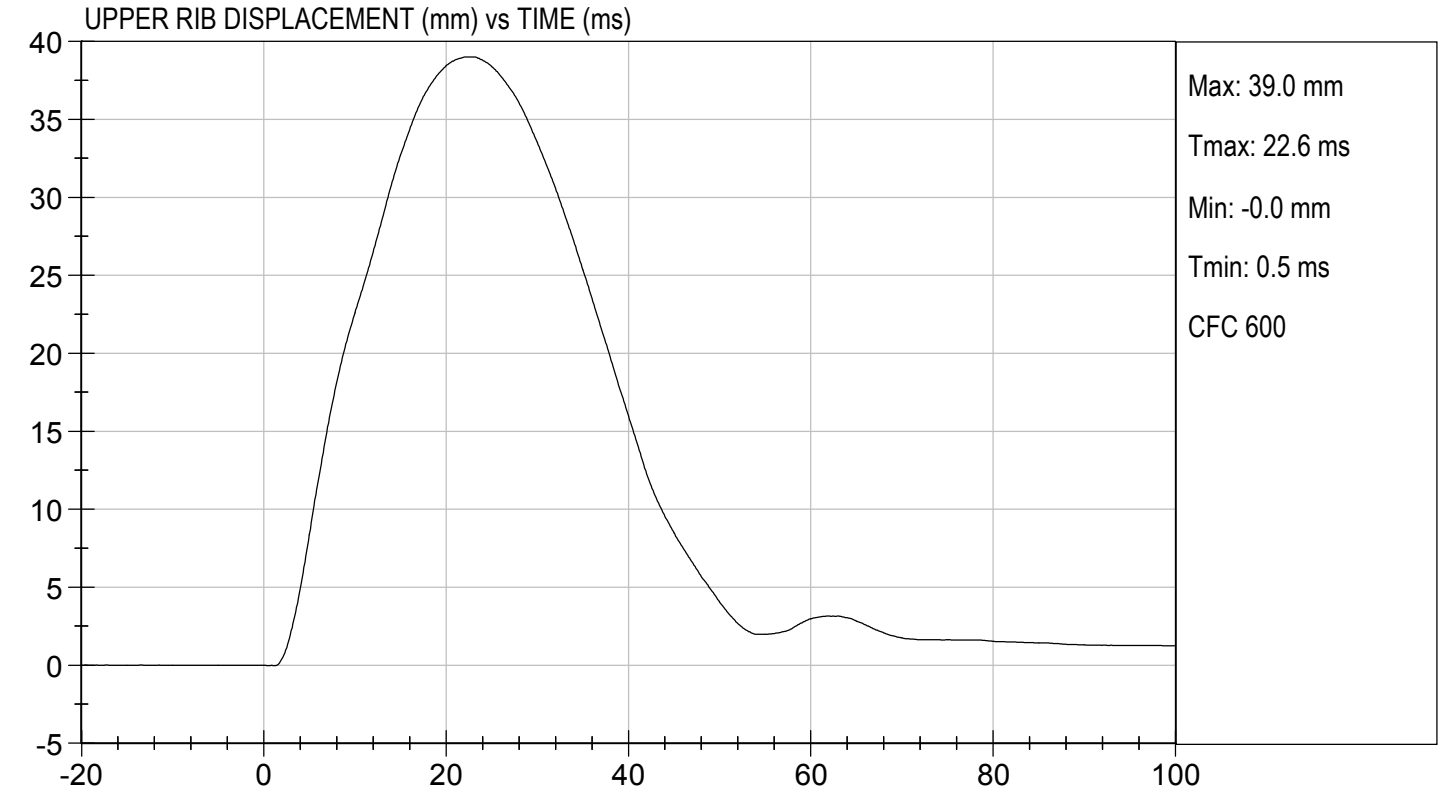
08/27/2018
Test Date

Robert Schmidt
Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/27/2018
TEST #: D182655

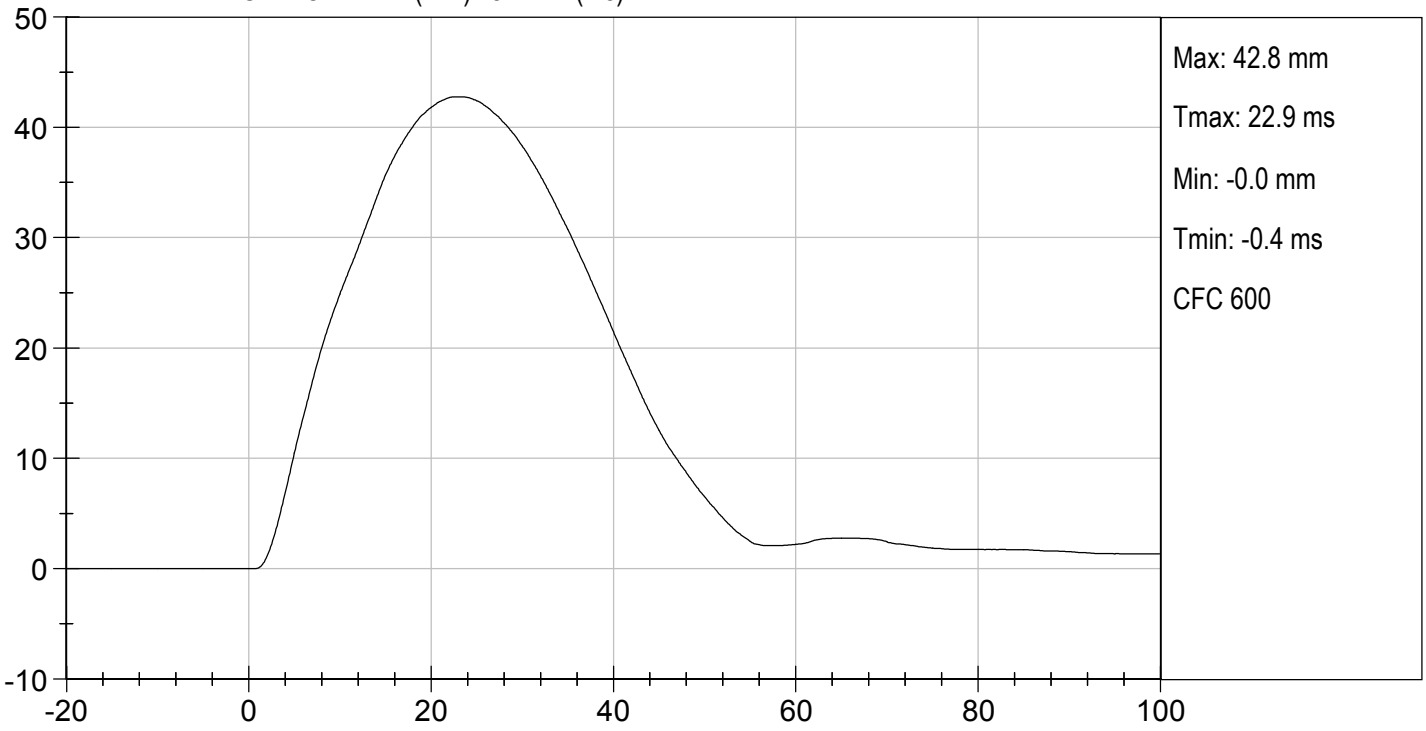




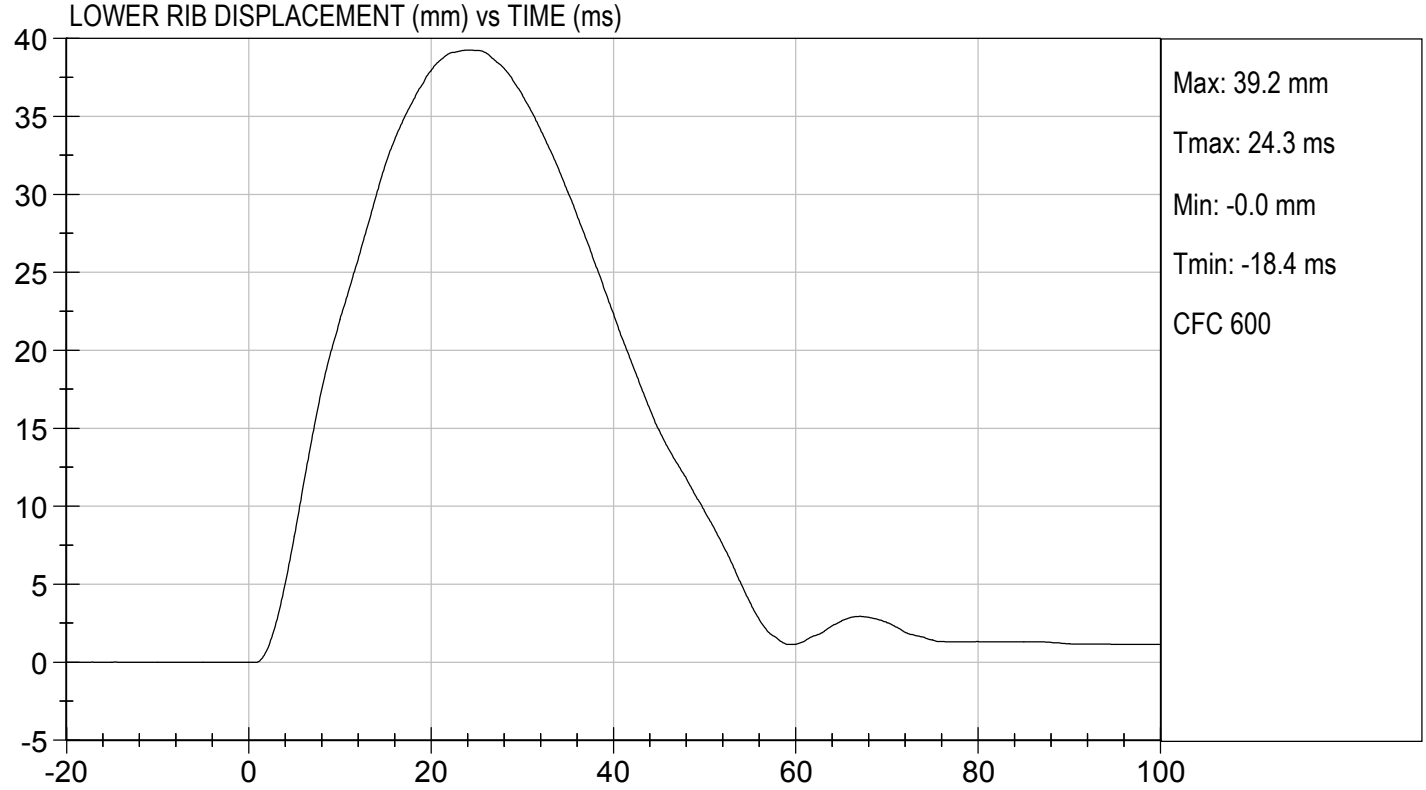
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/27/2018
TEST #: D182655

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



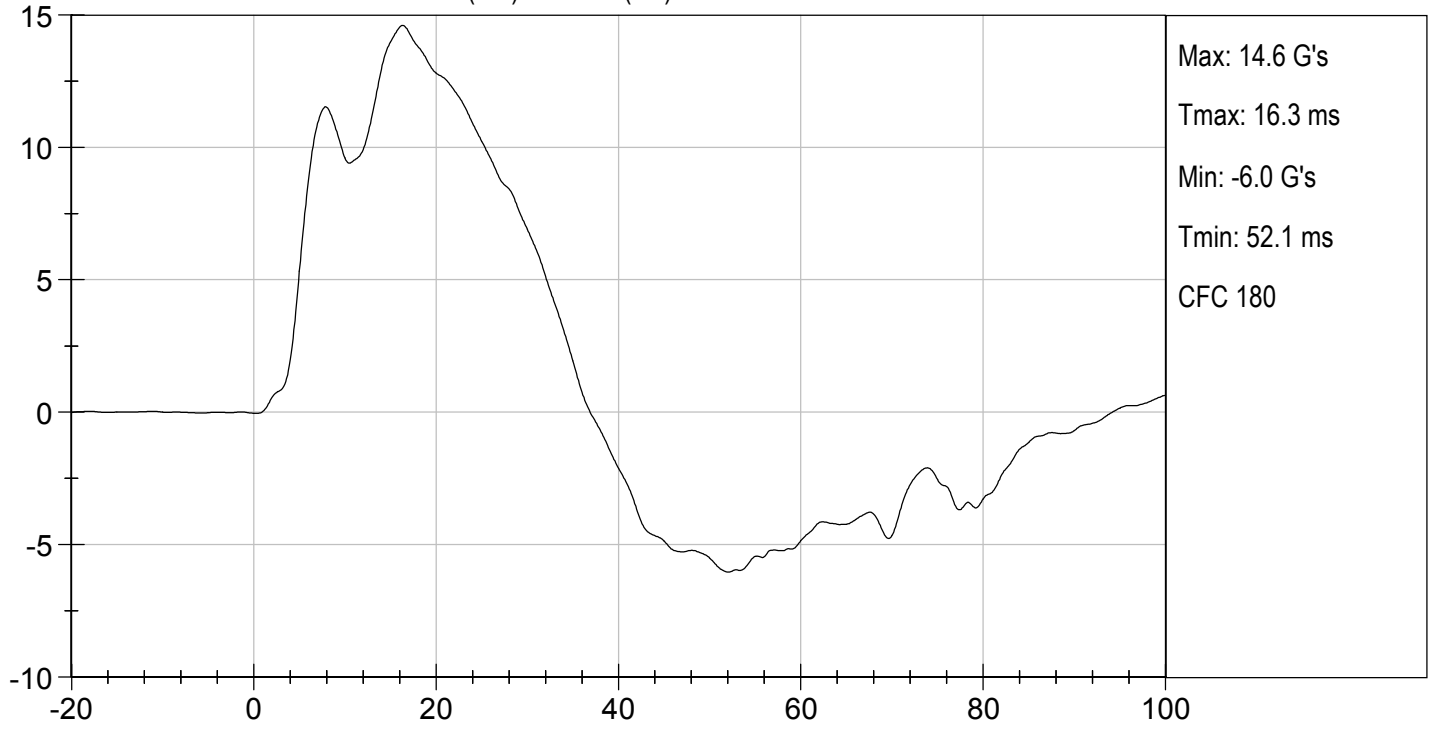
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



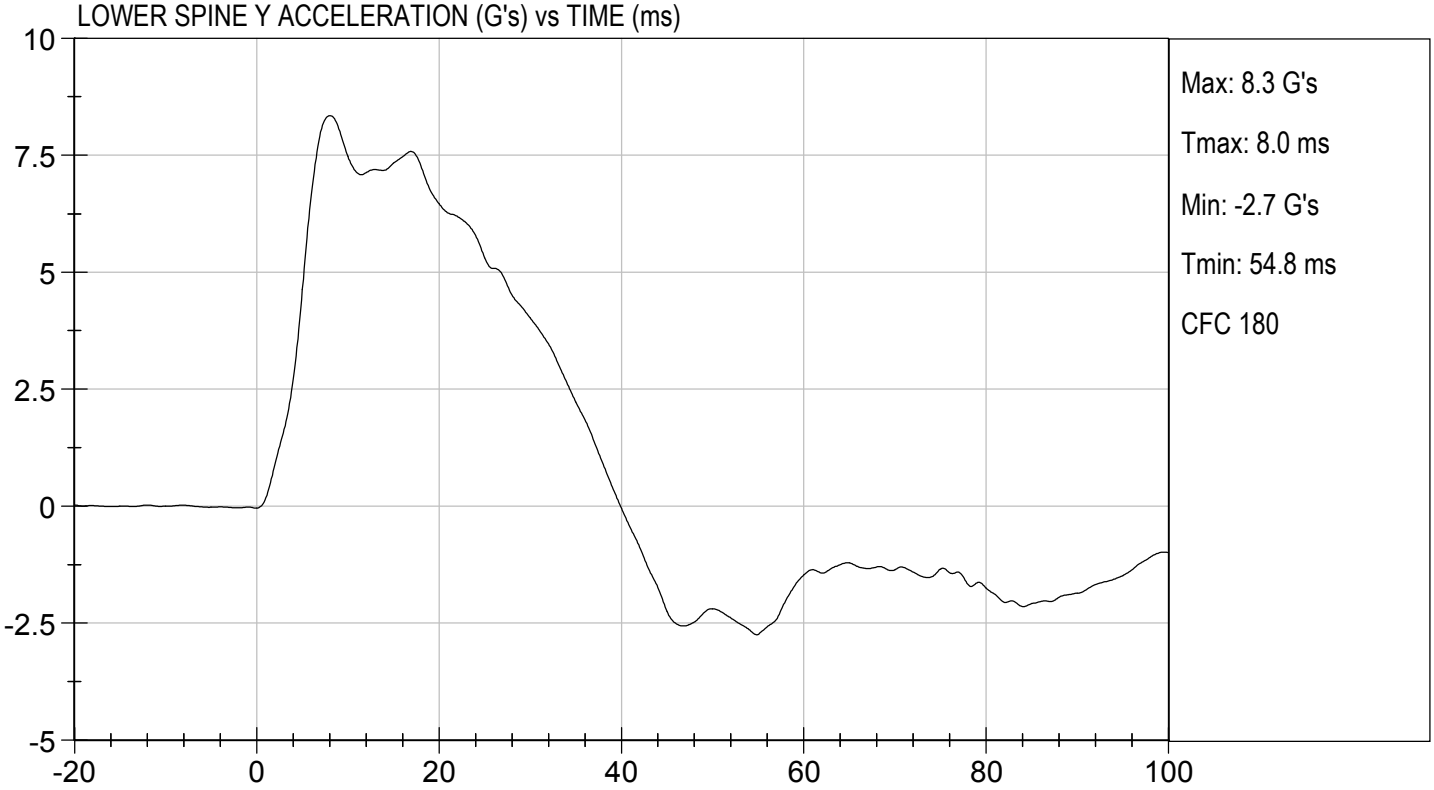
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/27/2018
TEST #: D182655

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



LOWER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D182656

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.34	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	44	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	40	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

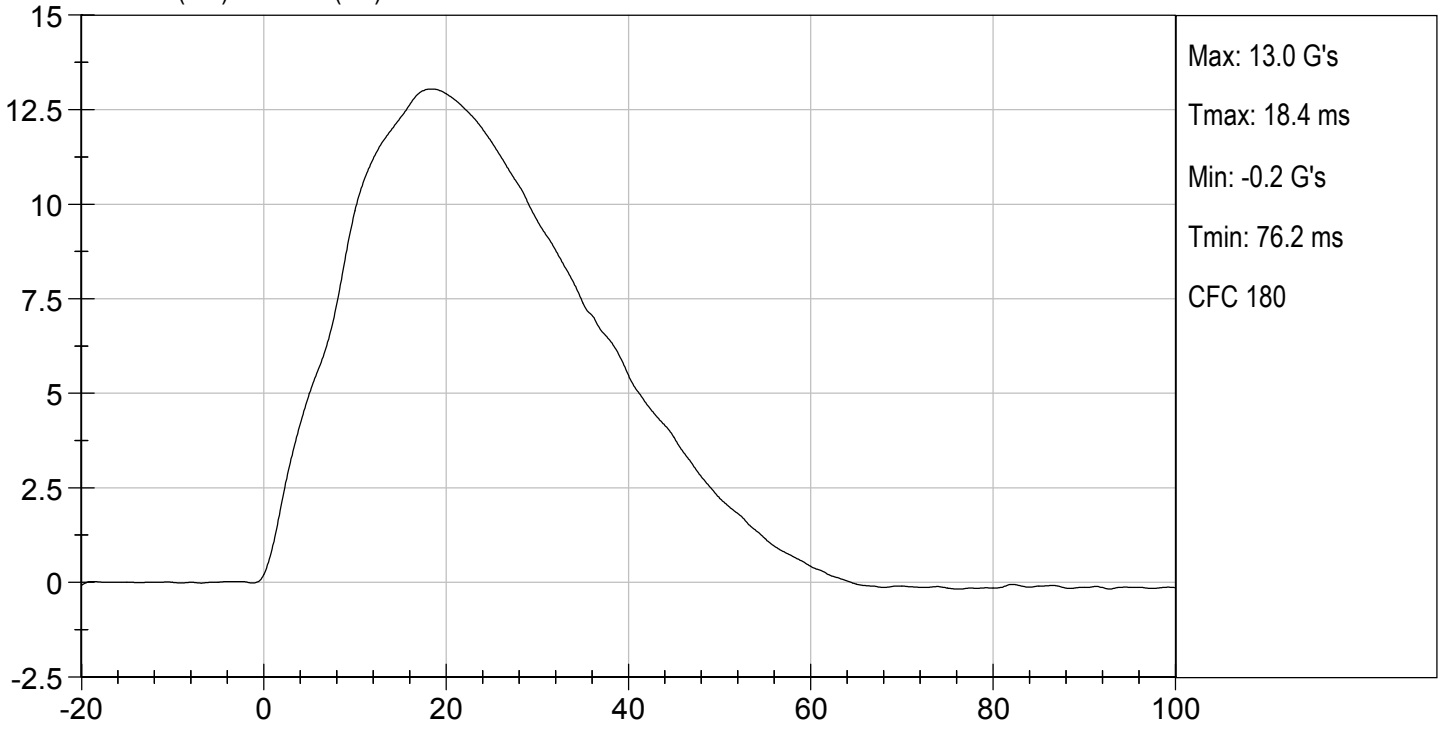
08/27/2018
Test Date

Robert Schmidt
Approved By

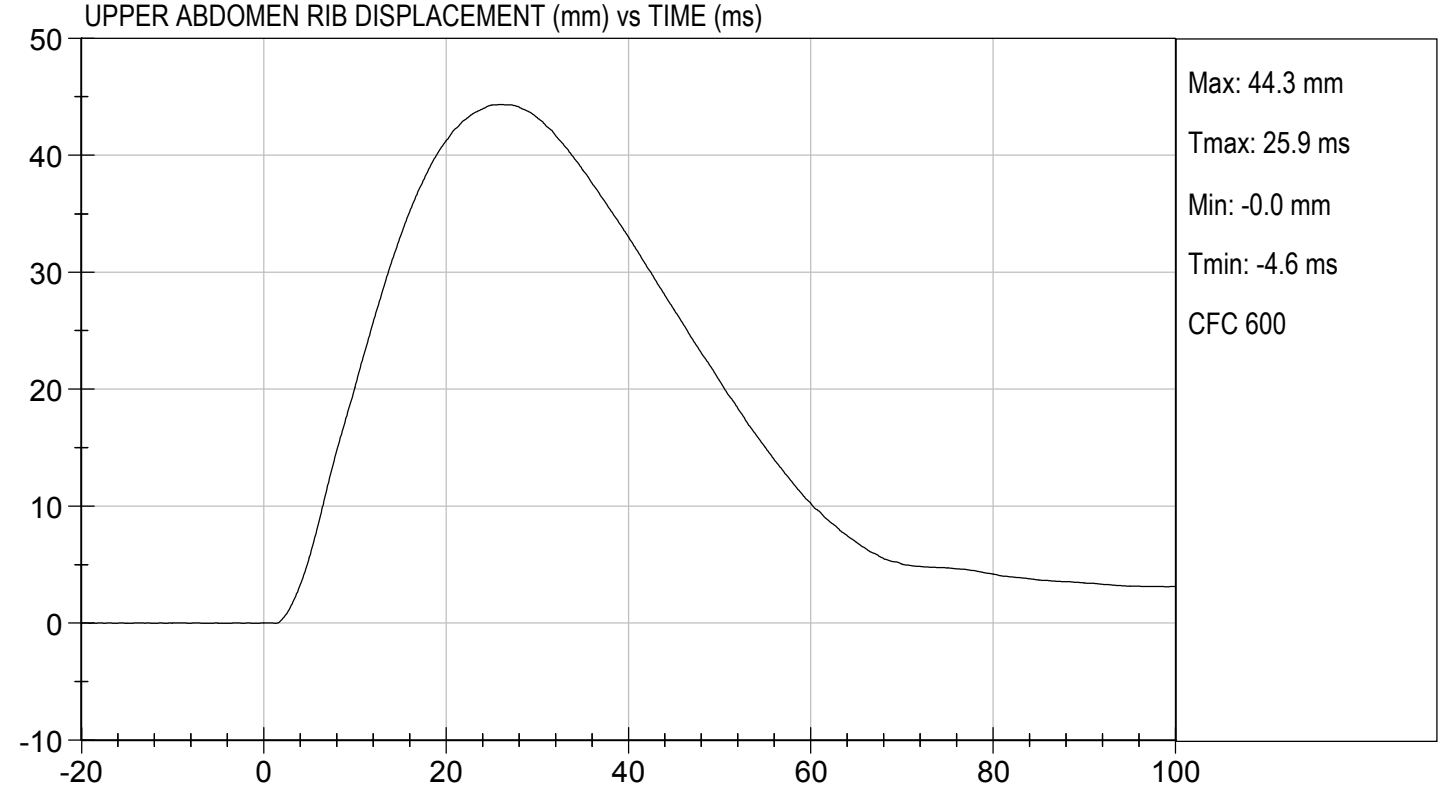
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/27/2018
TEST #: D182656

PROBE (G's) vs TIME (ms)



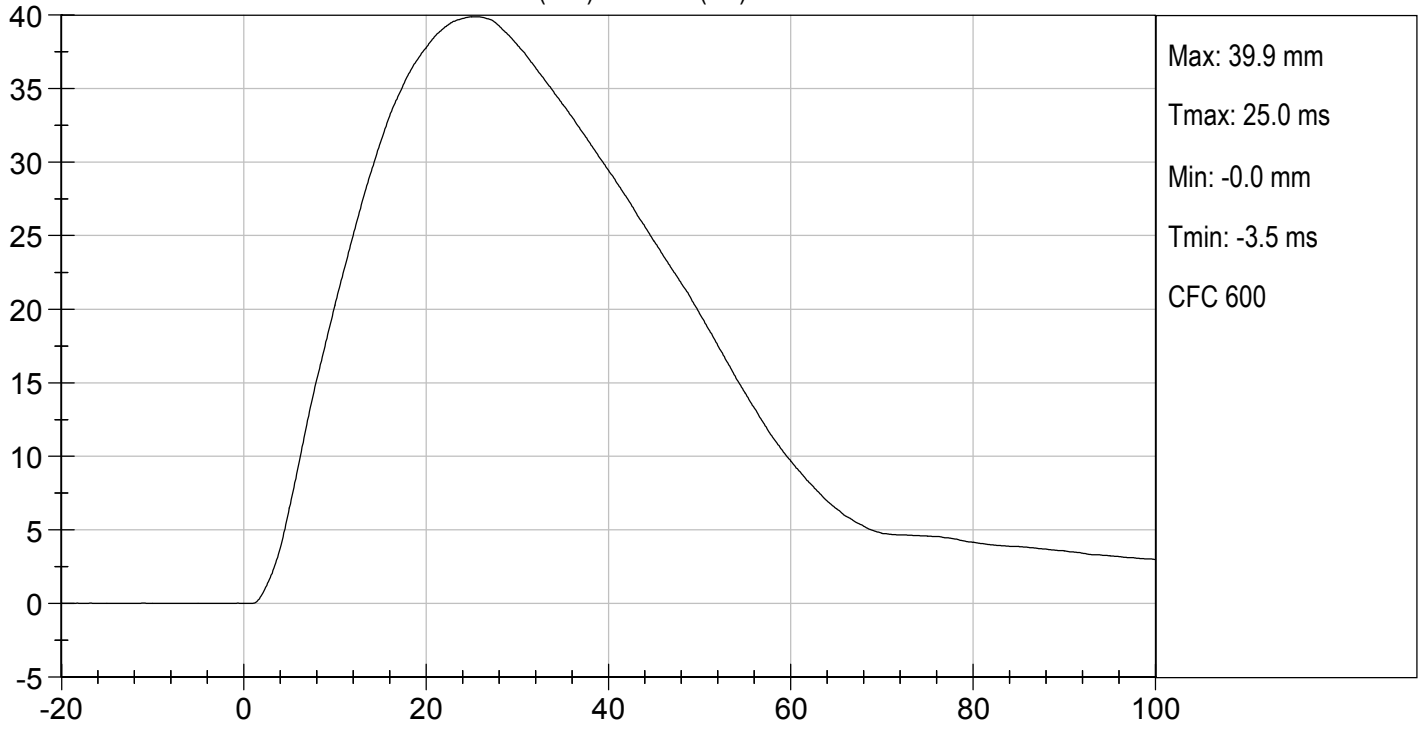
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



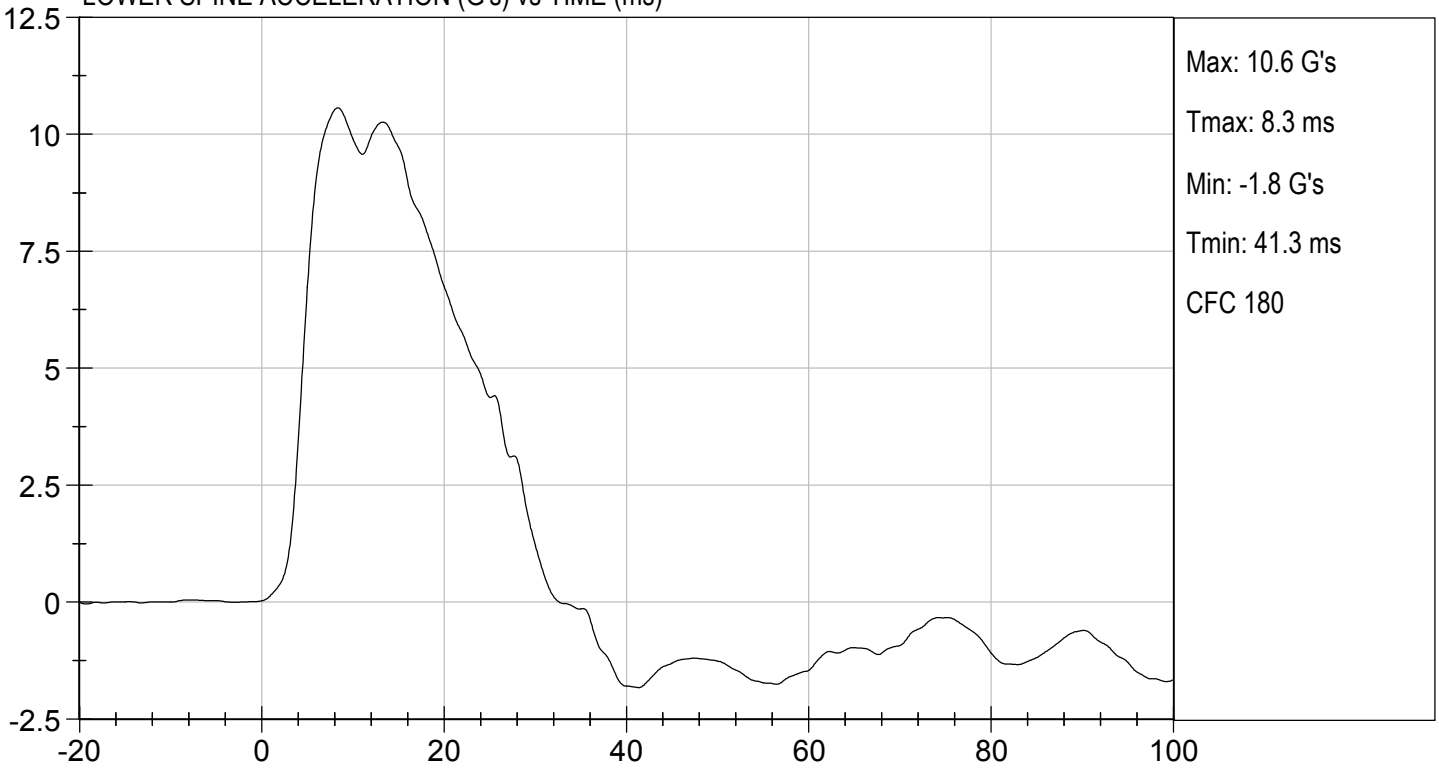
TEST DESC: ABDOMEN IMPACT
VELOCITY: 14.25 ft/s, 4.34 m/s

TEST DATE: 08/27/2018
TEST #: D182656

LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D182657

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	6.60 to 6.80	6.61	Pass
Maximum Probe Acceleration	G's	38 to 47	44	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	41	Pass
Peak Acetabulum Force	N	3600 to 4300	4,093	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

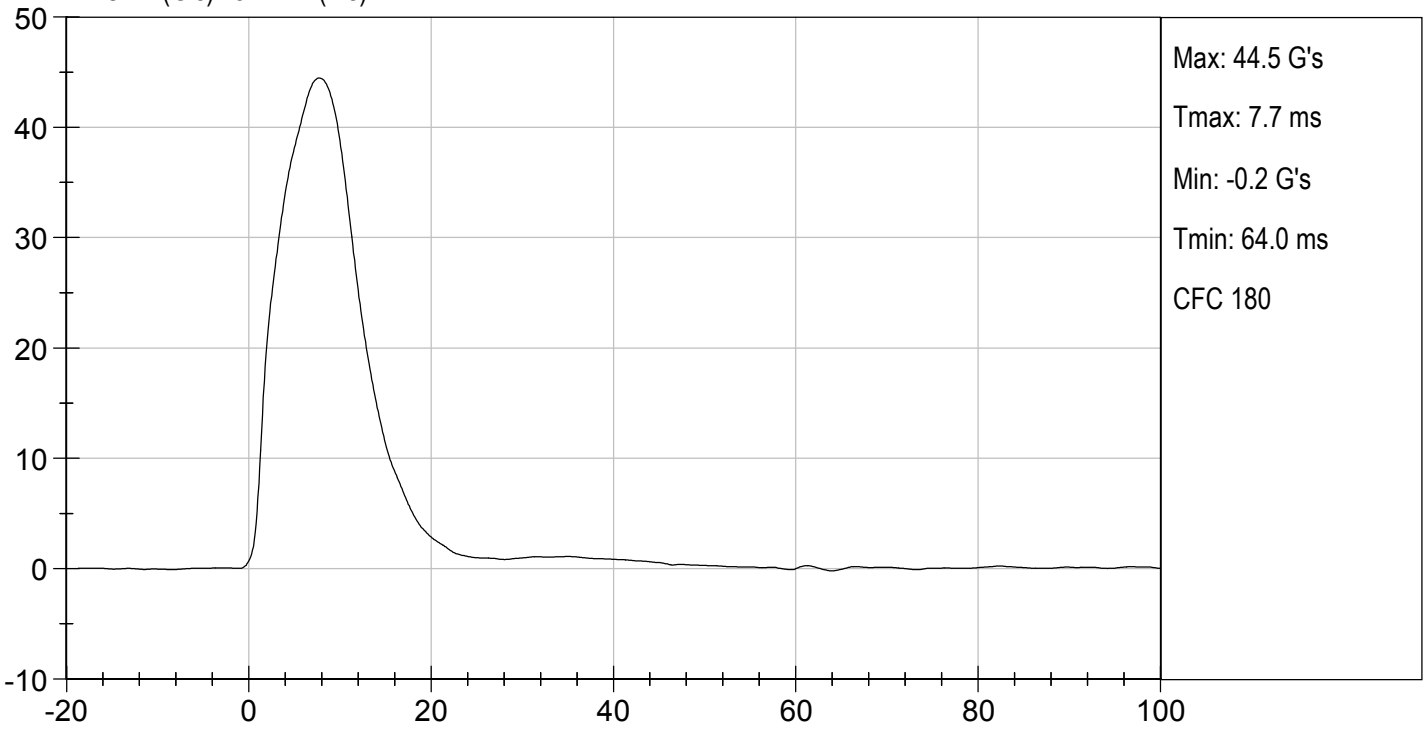
08/27/2018
Test Date

Robert Schmulen
Approved By

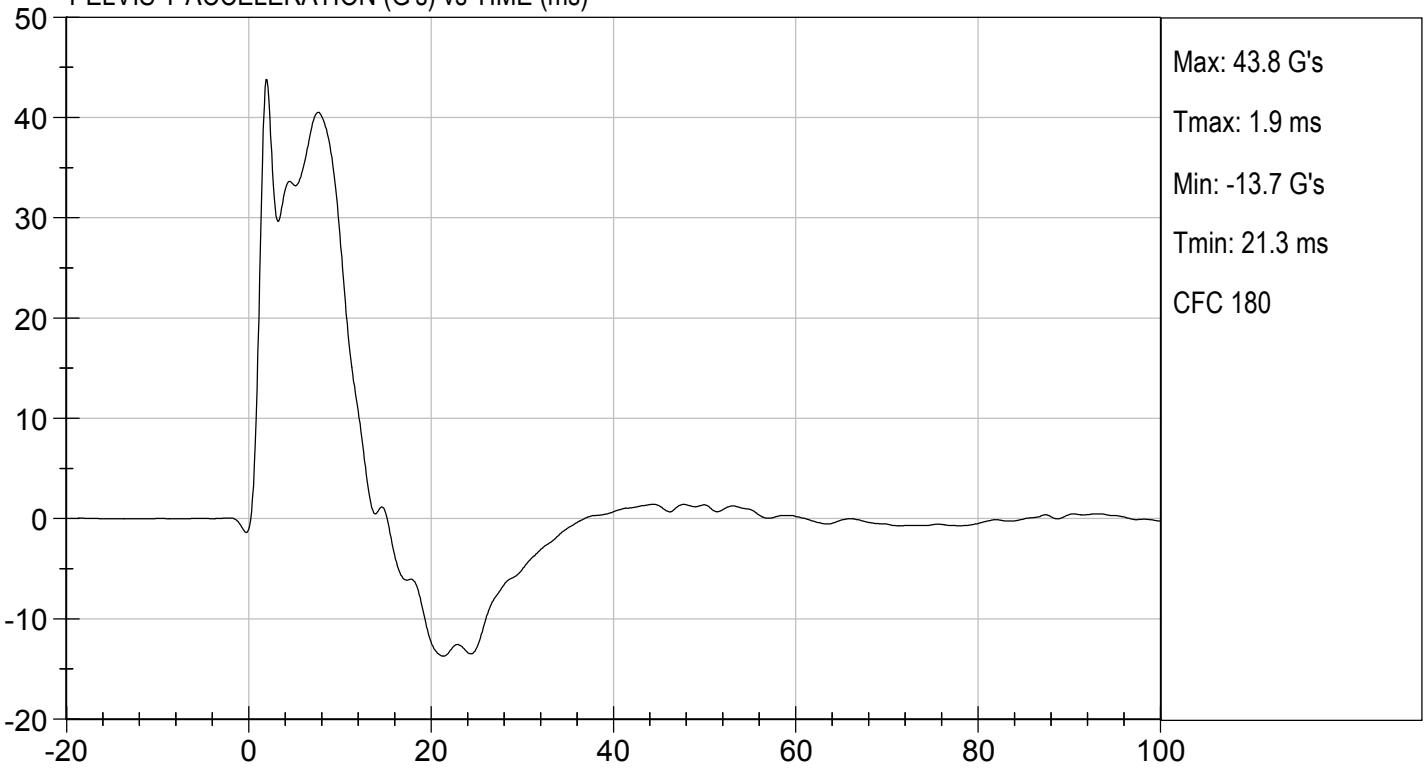
TEST DESC: PELVIS IMPACT
VELOCITY: 21.70 ft/s, 6.61 m/s

TEST DATE: 08/27/2018
TEST #: D182657

PROBE (G's) vs TIME (ms)

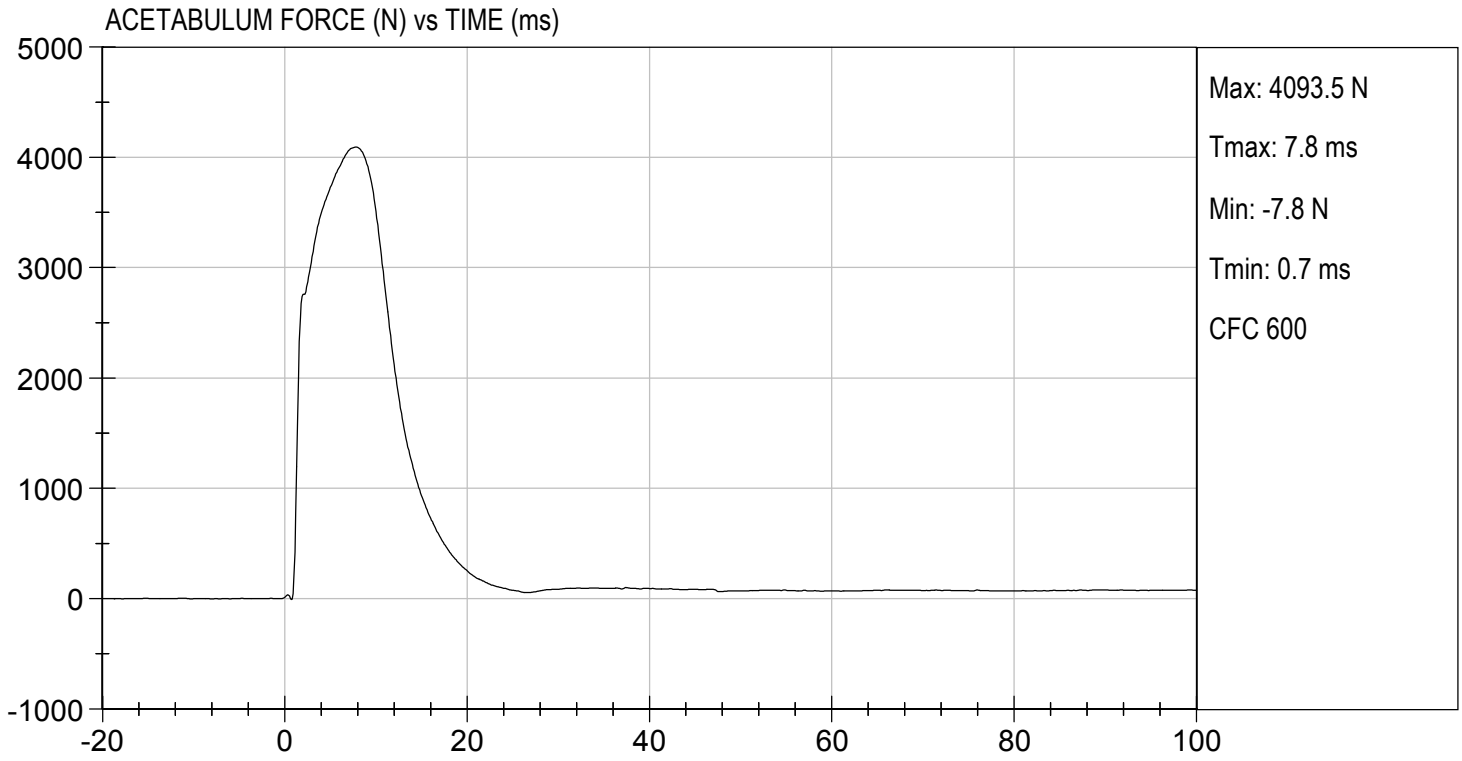


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: PELVIS IMPACT
VELOCITY: 21.70 ft/s, 6.61 m/s

TEST DATE: 08/27/2018
TEST #: D182657



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D182658

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.6	Pass
Humidity	%	10 to 70	51	Pass
Impact Velocity	m/s	4.20 to 4.40	4.36	Pass
Maximum Probe Acceleration	G's	36 to 45	37	Pass
Pelvis Y Acceleration	G's	28 to 39	29	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,215	Pass
		Overall Test Results		Pass

Danielle Redinbaugh
Laboratory Technician

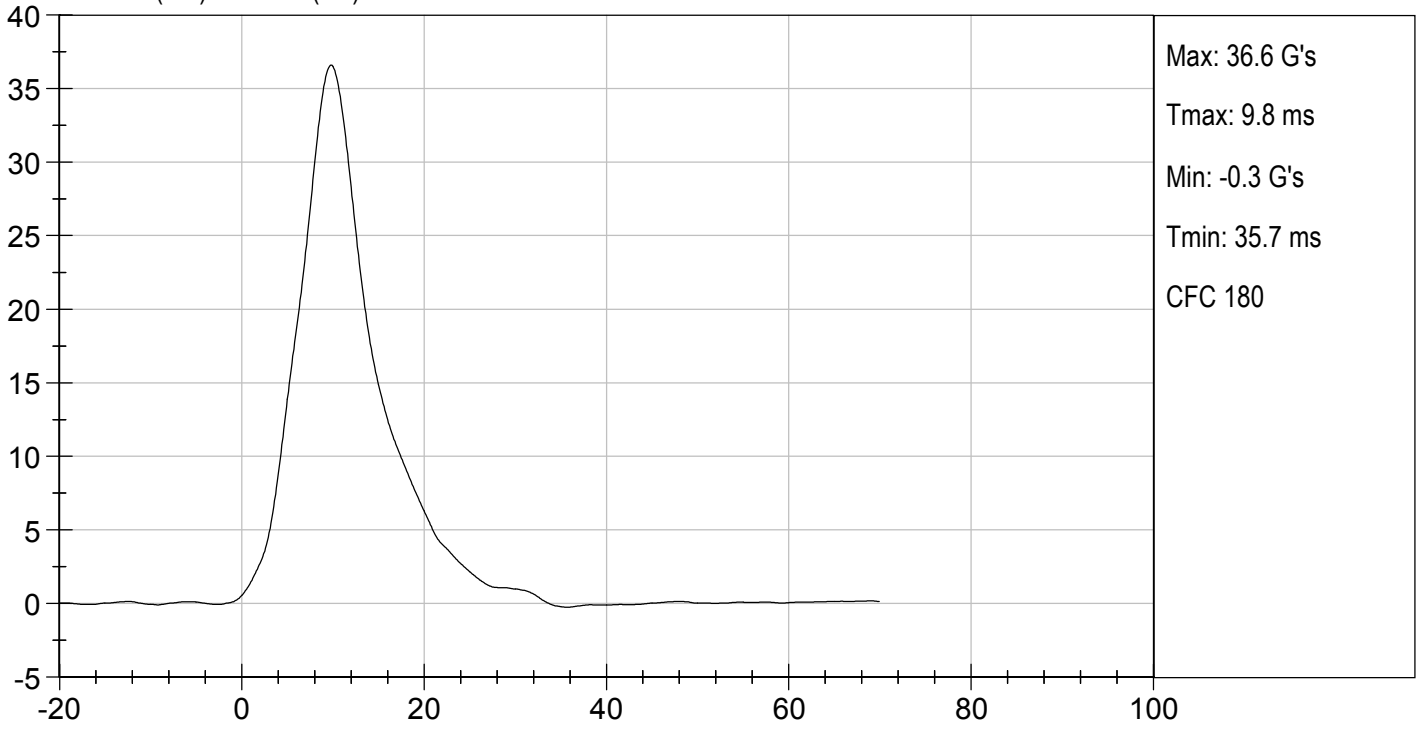
08/28/2018
Test Date

Robert Schmidt
Approved By

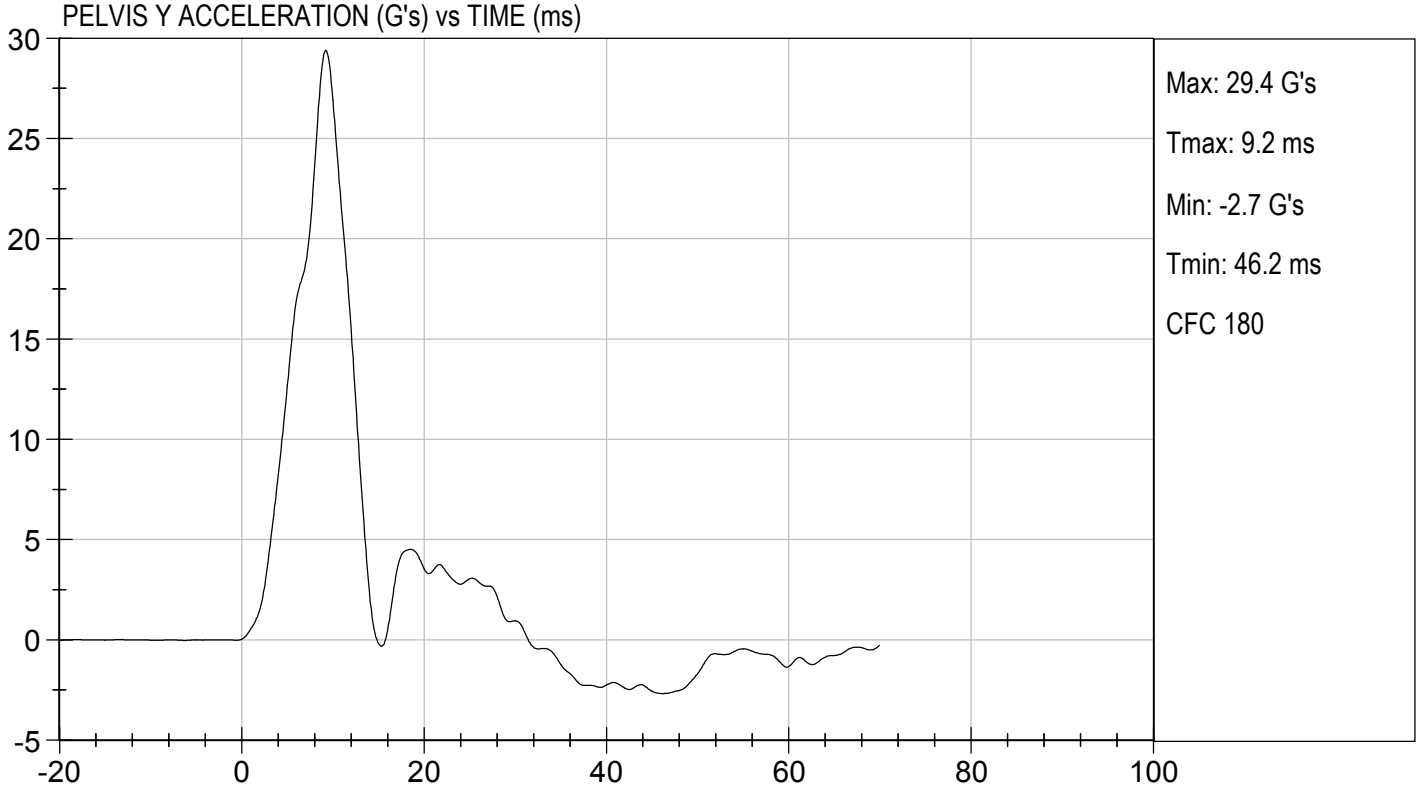
TEST DESC: ILLIAC
VELOCITY: 14.30 ft/s, 4.36 m/s

TEST DATE: 08/28/2018
TEST #: D182658

PROBE (G's) vs TIME (ms)

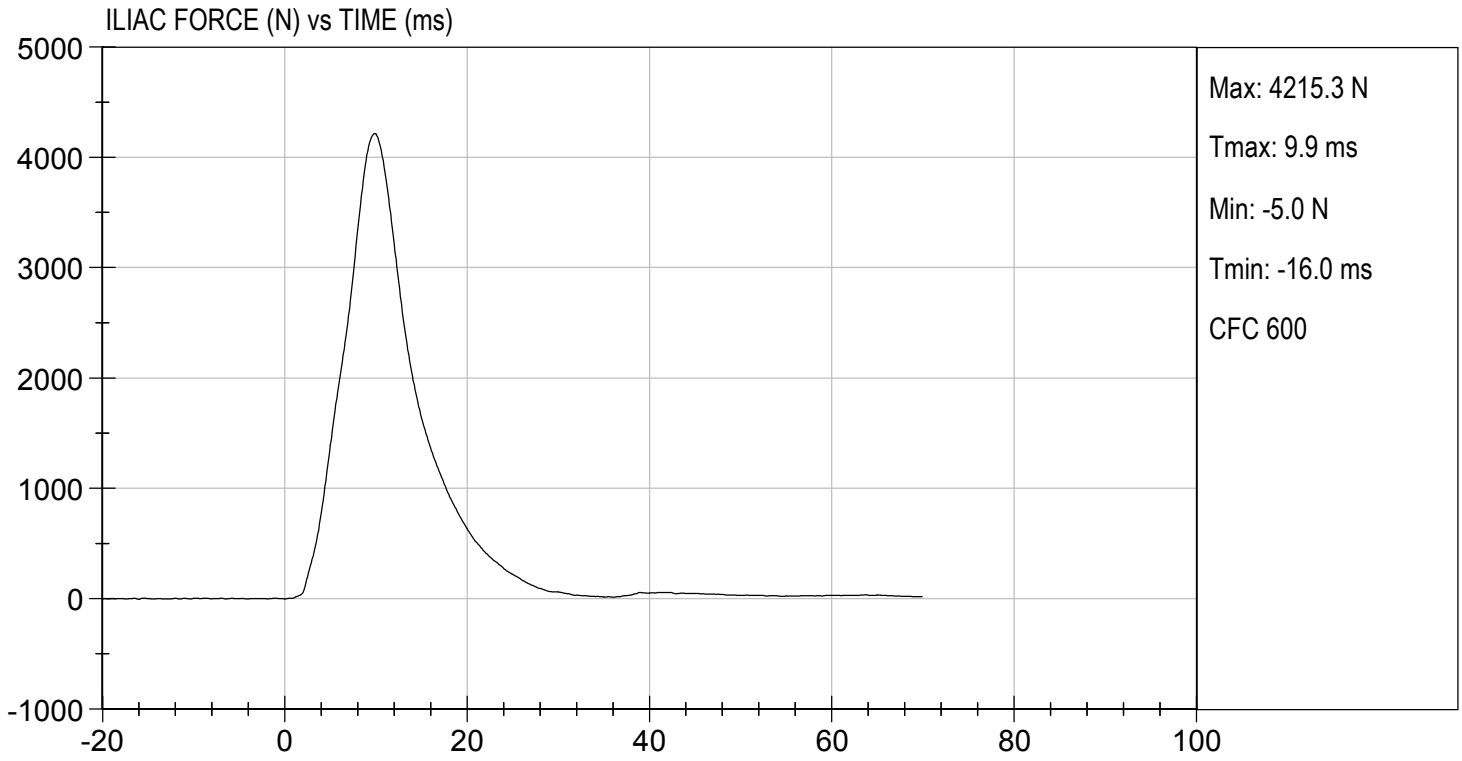


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.30 ft/s, 4.36 m/s

TEST DATE: 08/28/2018
TEST #: D182658



CALIBRATION TEST RESULTS

POST-TEST

SID-IIS 5TH PERCENTILE FEMALE - DRIVER ATD

SID-IIsD External Measurements
SN: 296

No.	Name	Spec. (mm)	Result	Pass/Fail
A	Sitting Height	772 - 788	784	Pass
B	Shoulder Pivot Height	437 - 453	442	Pass
C	H-point Height	79 - 89	83	Pass
D	H-point from Seatback	141 - 151	145	Pass
E	Shoulder Pivot from Backline	97 - 107	99	Pass
F	Thigh Clearance	119 -135	121	Pass
G	Head Breadth	140 - 148	142	Pass
H	Head Back from Backline	40 - 46	45	Pass
I	Head Depth	178 - 188	180	Pass
J	Head Circumference	541 - 551	548	Pass
K	Buttock to Knee Length	514 - 540	535	Pass
L	Popliteal Height	343 - 369	358	Pass
M	Knee Pivot to Floor Height	392 - 409	404	Pass
N	Buttock Popliteal Length	416 - 442	435	Pass
O	Chest Depth w/o Jacket	195 - 211	206	Pass
P	Foot Length	216 - 232	219	Pass
Q	Hip Breadth (w/ pelvic plugs)	313 - 323	316	Pass
R	Arm Length	249 - 259	250	Pass
S	Knee Joint to Seatback	477 - 493	481	Pass
V	Shoulder Width	341 - 357	346	Pass
W	Foot Width	78 - 94	85	Pass
Y	Chest Circumference w/ jacket	851 - 881	870	Pass
Z	Waist Circumference	761 - 791	772	Pass

MGA RESEARCH CORPORATION

HEAD DROP TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D183001

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	22	Pass
Laboratory Relative Humidity	%	10 to 70	50	Pass
Peak Resultant Acceleration	G's	115 to 137	130	Pass
Peak Longitudinal Acceleration	G's	+/- 15	3.1	Pass
Unimodal	N/A	Yes	Yes	Pass
Oscillations	N/A	<15%	Yes	Pass
		Overall Test Results		Pass

Danielle Redenbaugh
Laboratory Technician

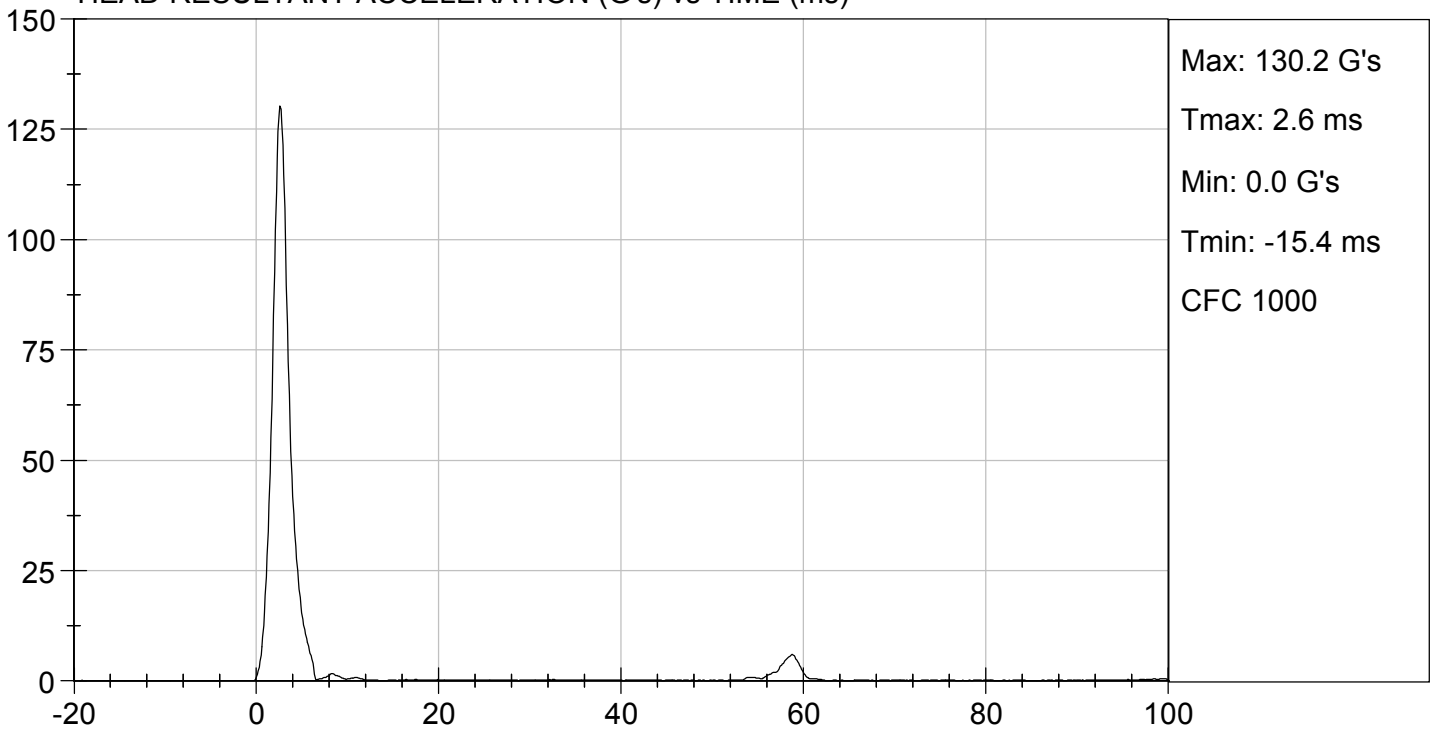
10/04/2018
Test Date

Robert Schmidt
Approved By

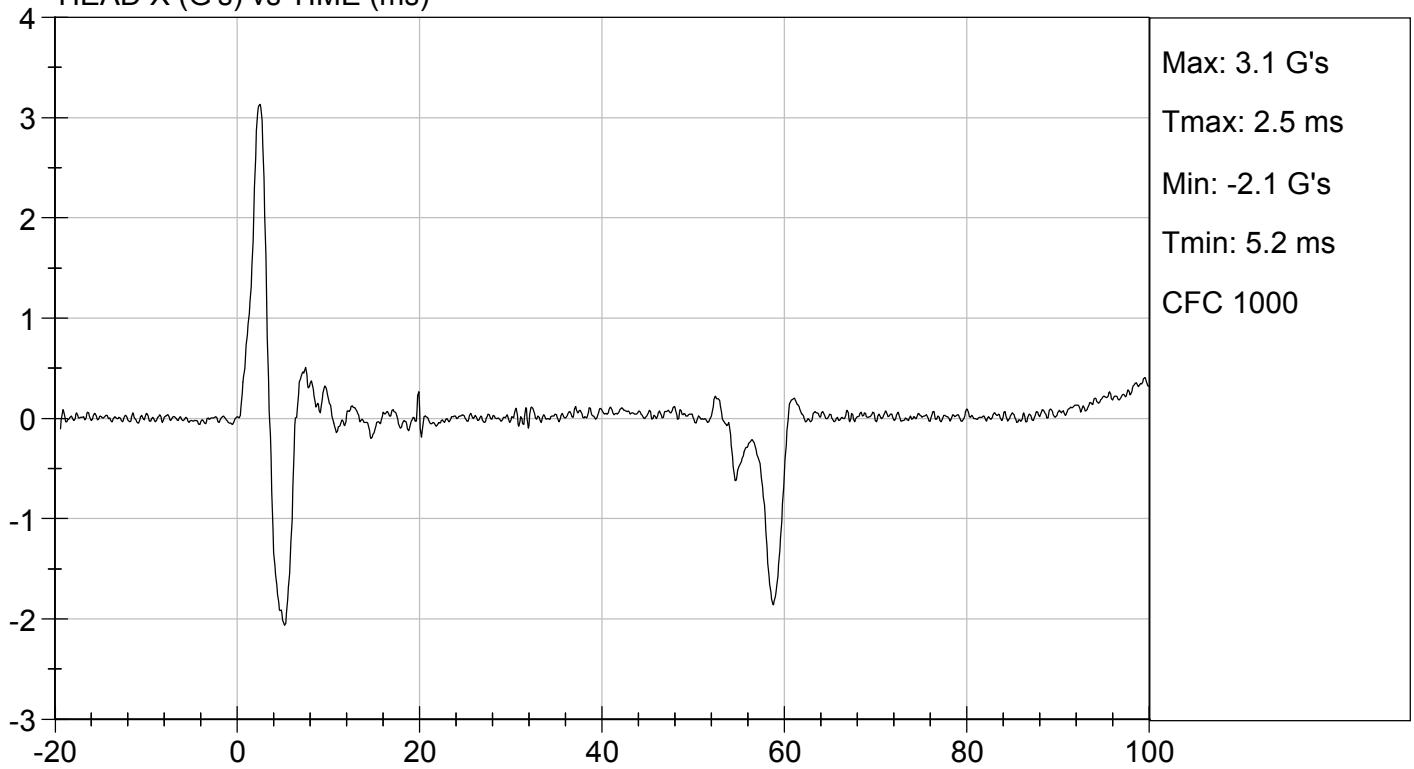
TEST DESC: HEAD DROP

TEST DATE: 10/04/2018
TEST #: D183001

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

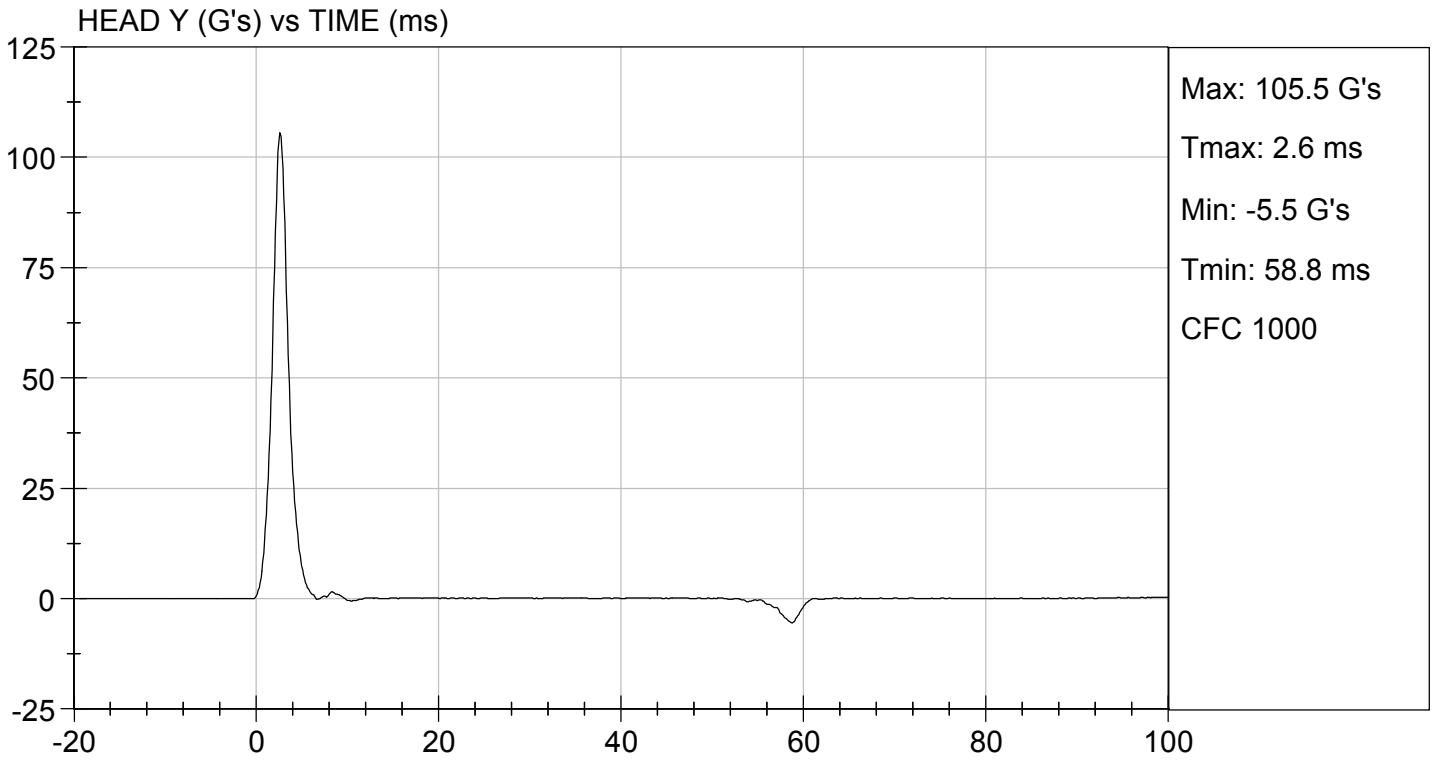


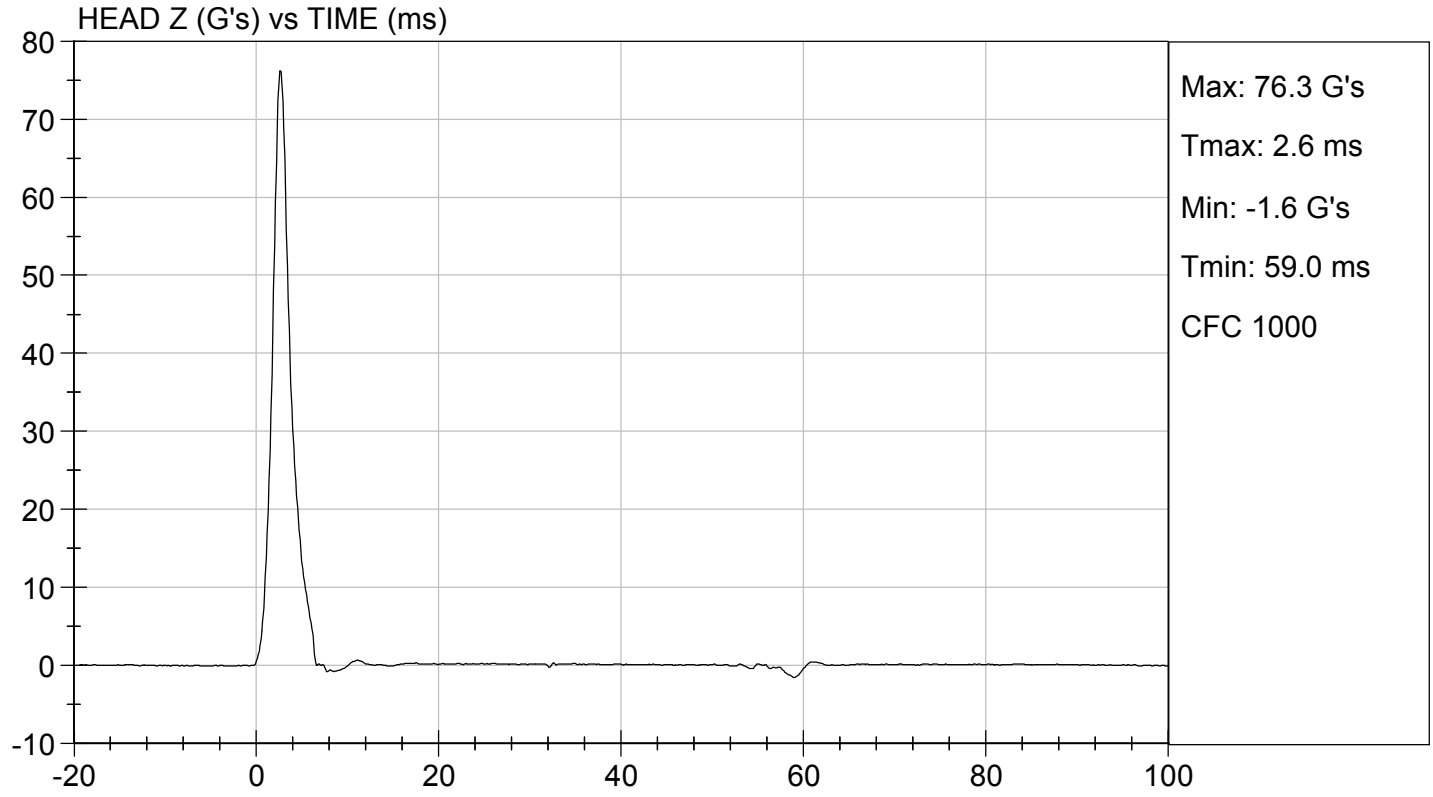
HEAD X (G's) vs TIME (ms)



TEST DESC: HEAD DROP

TEST DATE: 10/04/2018
TEST #: D183001





MGA RESEARCH CORPORATION

LATERAL NECK PENDULUM TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D183002

Tested Parameter		Units	Specification	Result	Pass/Fail
Temperature		deg C	20.6 to 22.2	20.9	Pass
Humidity		%	10 to 70	48	Pass
Impact Velocity		m/s	5.51 to 5.63	5.58	Pass
Pendulum Velocity	10 ms	m/s	2.20 to 2.80	2.60	Pass
	15 ms	m/s	3.30 to 4.10	3.84	Pass
	20 ms	m/s	4.40 to 5.40	5.33	Pass
	25 ms	m/s	5.40 to 6.10	5.70	Pass
	25-100 ms	m/s	5.50 to 6.20	5.73	Pass
Maximum D-Plane Rotation		deg	71 to 81	72	Pass
Time of Maximum D-Plane Rotation		ms	50 to 70	62	Pass
Maximum Occipital Condyle Moment		Nm	-44 to -36	-42	Pass
Time of Moment Decay to 0 Nm		ms	102 to 126	110	Pass
			Overall Test Results		Pass

Danielle Redenbaugh

Laboratory Technician

10/04/2018

Test Date

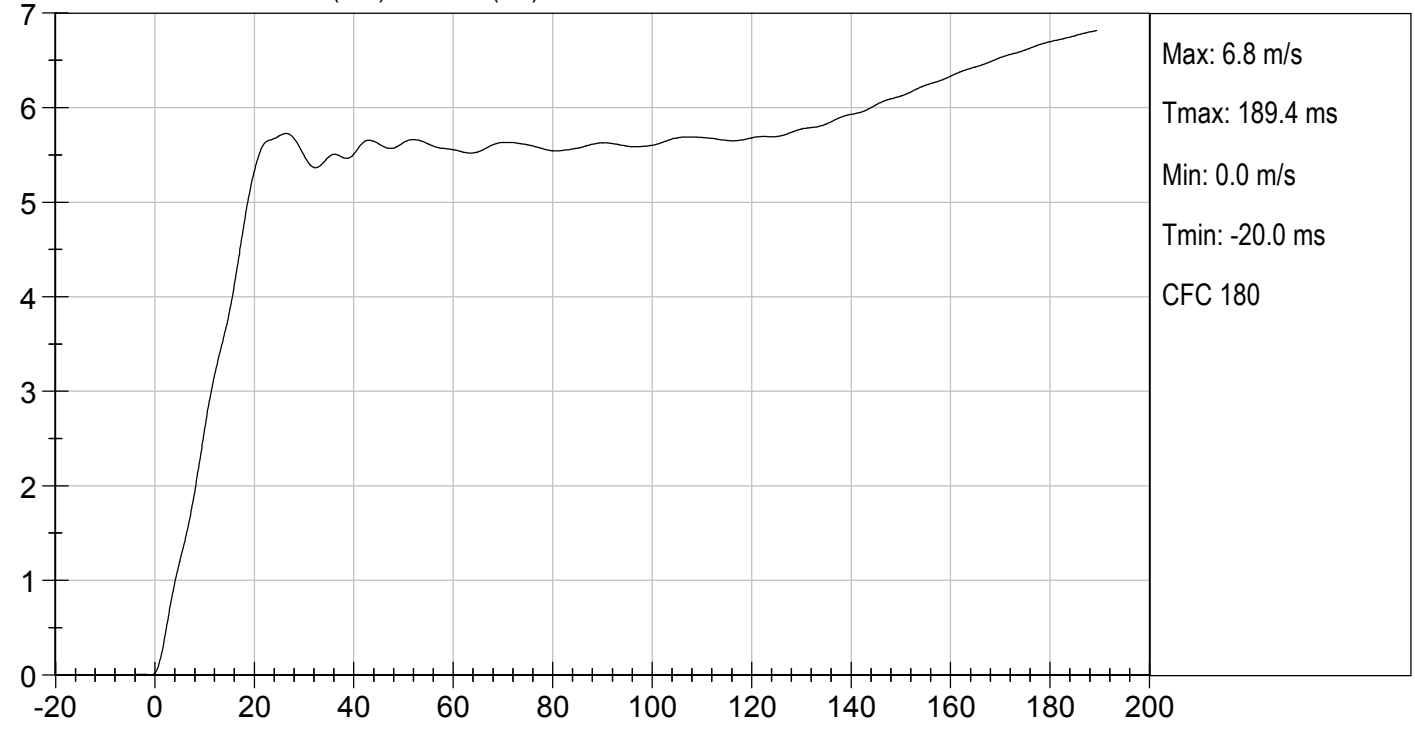
Robert Schmidt

Approved By

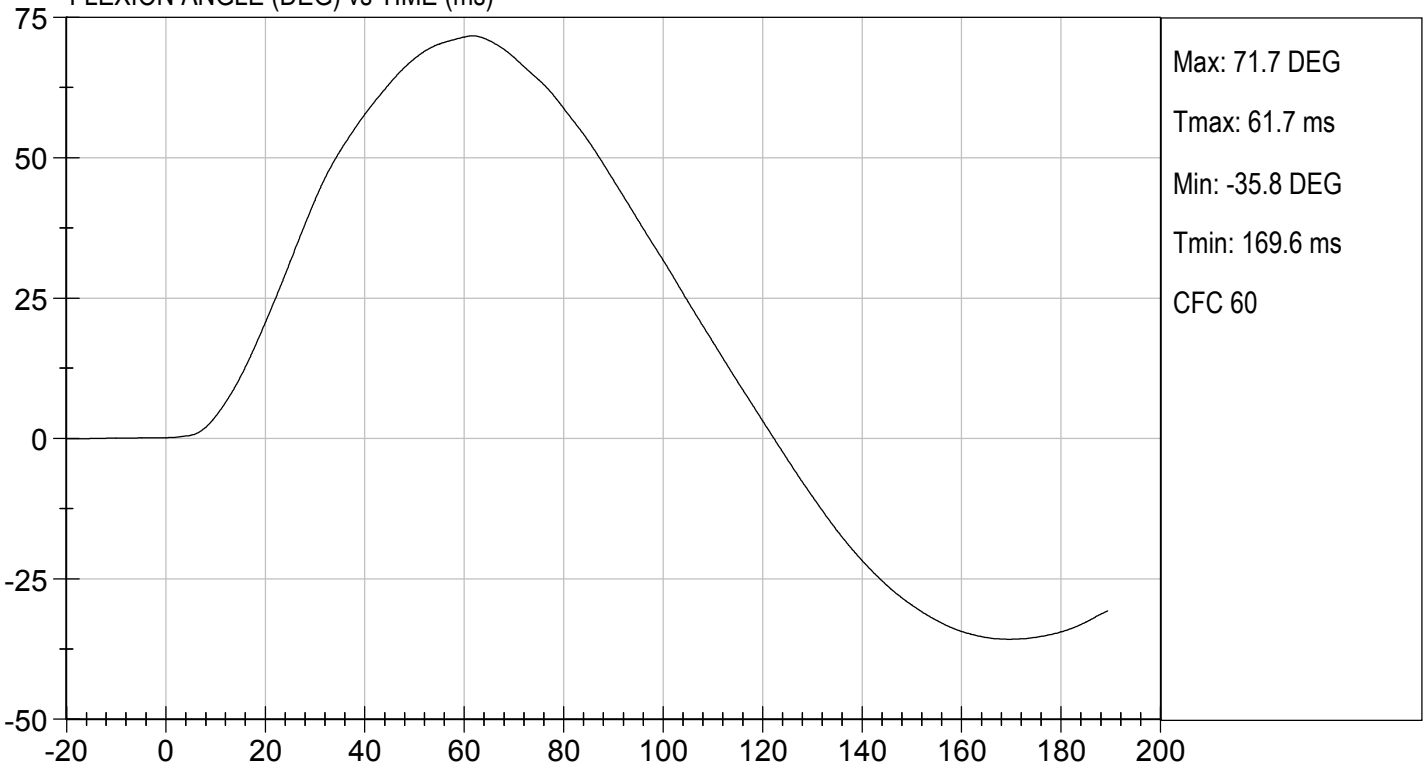
TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 10/04/2018
TEST #: D183002

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

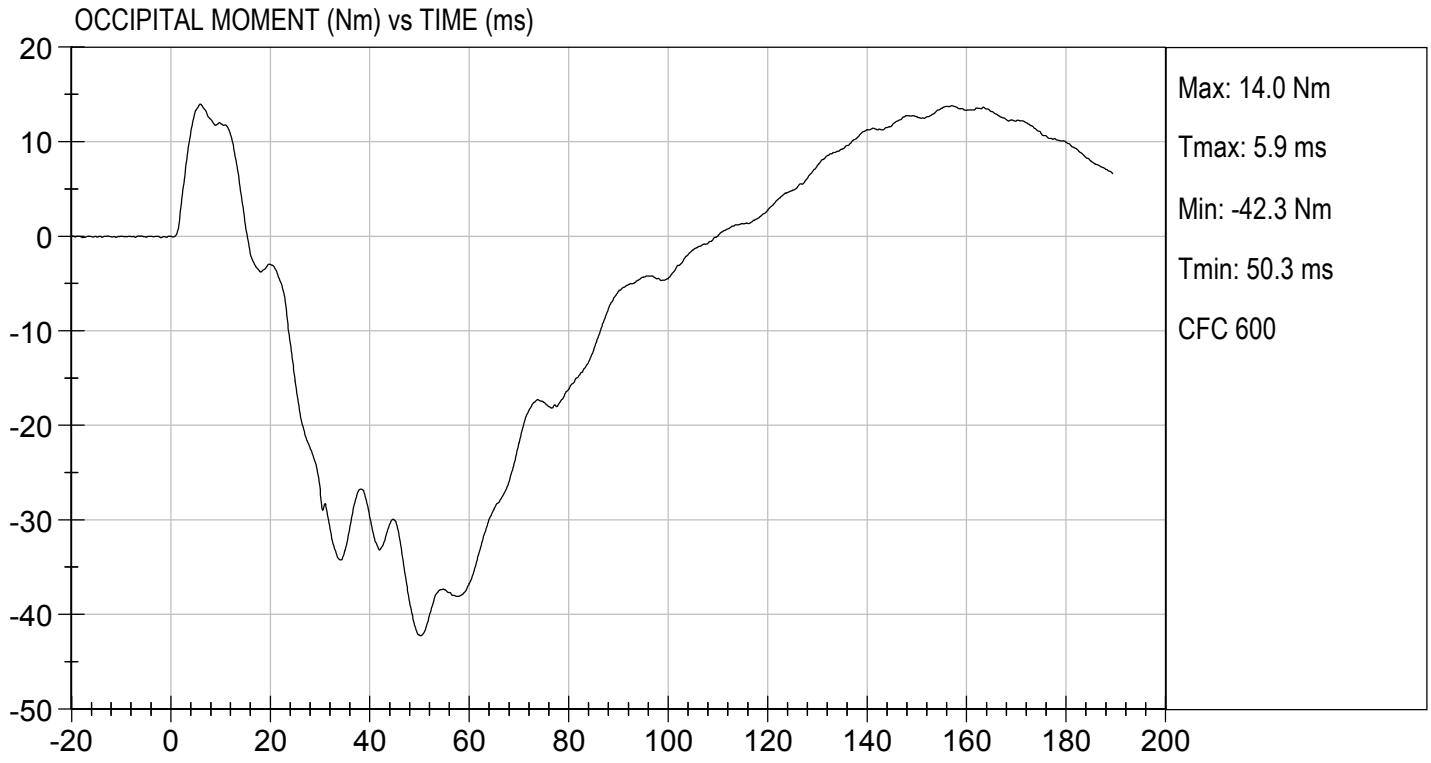


FLEXION ANGLE (DEG) vs TIME (ms)



TEST DESC: NECK BENDING
VELOCITY: 18.32 ft/s, 5.58 m/s

TEST DATE: 10/04/2018
TEST #: D183002



MGA RESEARCH CORPORATION

SHOULDER IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test ID:** D183003

Tested Parameter	Units	Specification	Result	Pass/Fail
Laboratory Temperature	deg C	20.6 to 22.2	21.3	Pass
Laboratory Relative Humidity	%	10 to 70	39	Pass
Impact Velocity	m/s	4.20 to 4.40	4.27	Pass
Maximum Probe Acceleration	G's	13 to 18	15	Pass
Shoulder Displacement	mm	28 to 37	29	Pass
Upper Spine (T1) Y Acceleration	G's	17 to 22	20	Pass
		Overall Test Results		Pass

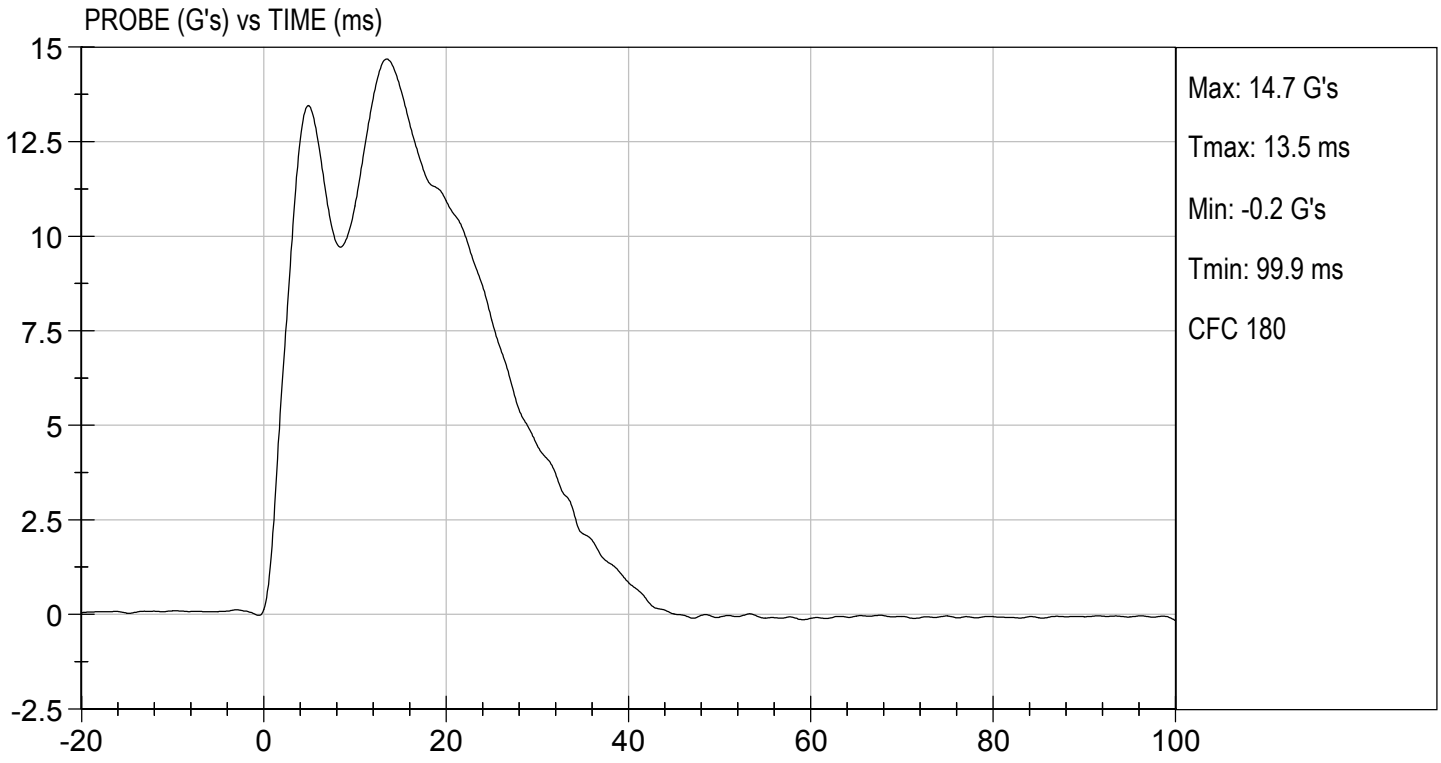
Jacob D Taylor
Laboratory Technician

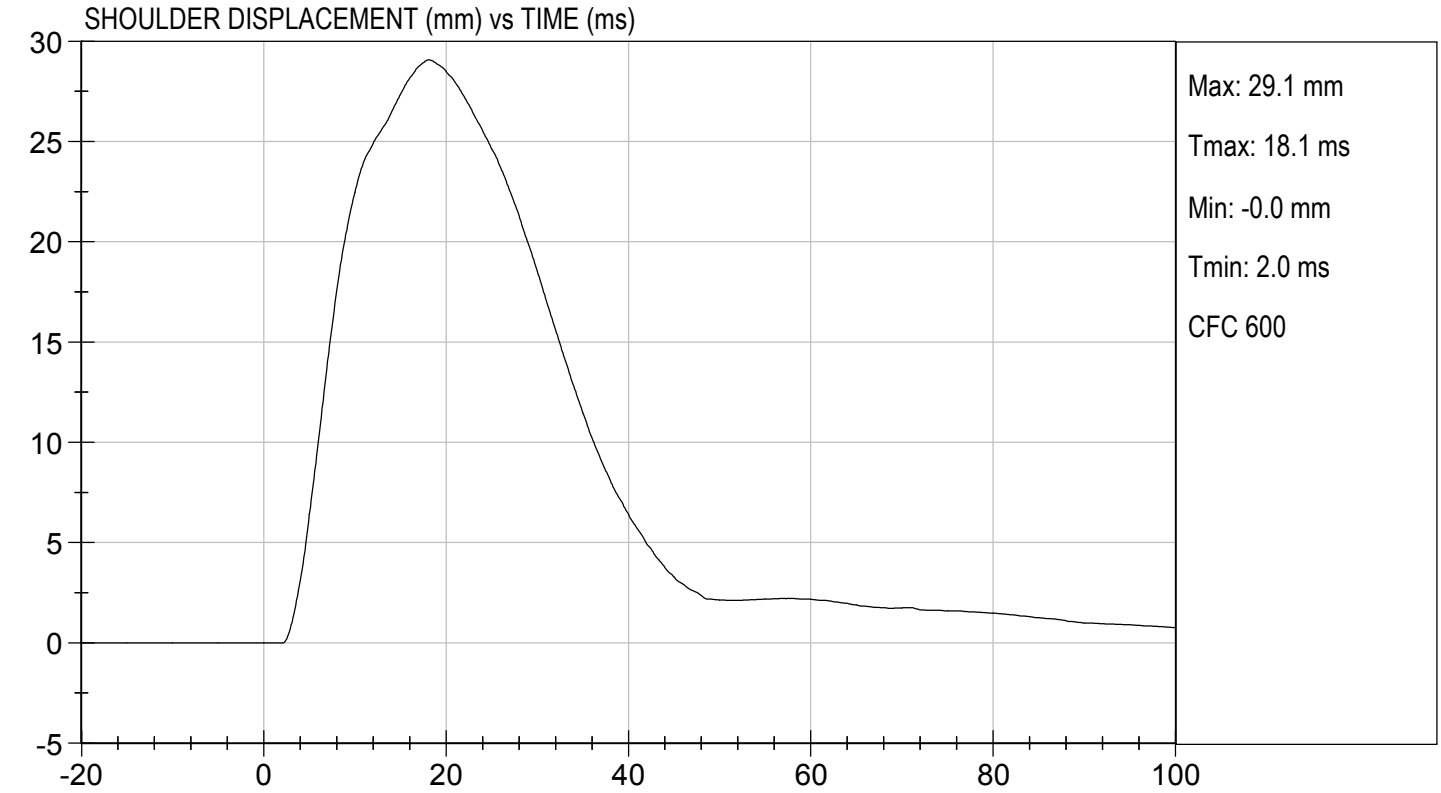
10/04/2018
Test Date

Robert Schmidt
Approved By

TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 10/04/2018
TEST #: D183003

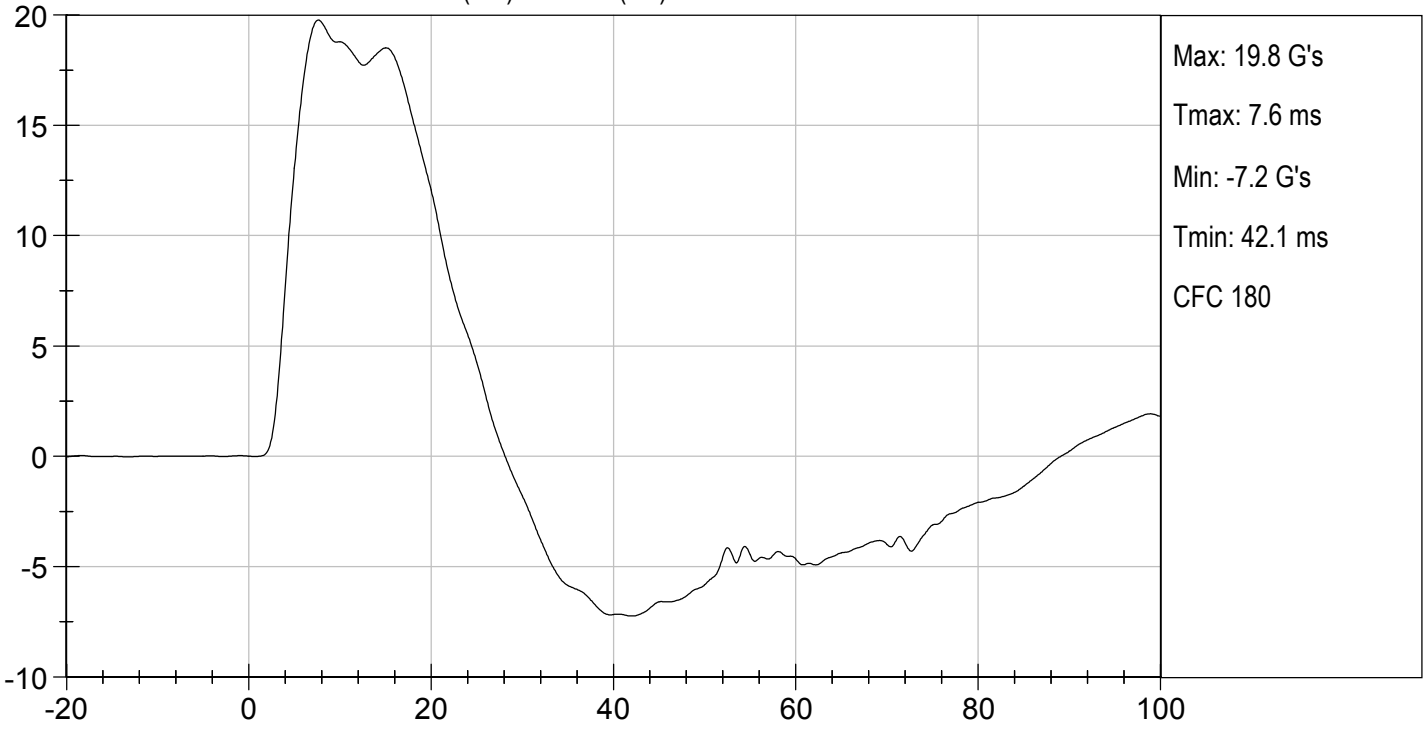




TEST DESC: SHOULDER IMPACT
VELOCITY: 14.01 ft/s, 4.27 m/s

TEST DATE: 10/04/2018
TEST #: D183003

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

THORAX (WITH ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D183004

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	39	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	30 to 36	32	Pass
Shoulder Displacement	mm	31 to 40	36	Pass
Upper Rib Displacement	mm	25 to 32	27	Pass
Middle Rib Displacement	mm	30 to 36	30	Pass
Lower Rib Displacement	mm	32 to 38	32	Pass
Upper Spine (T1) Y Acceleration	G's	34 to 43	39	Pass
Lower Spine (T12) Y Acceleration	G's	29 to 37	35	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

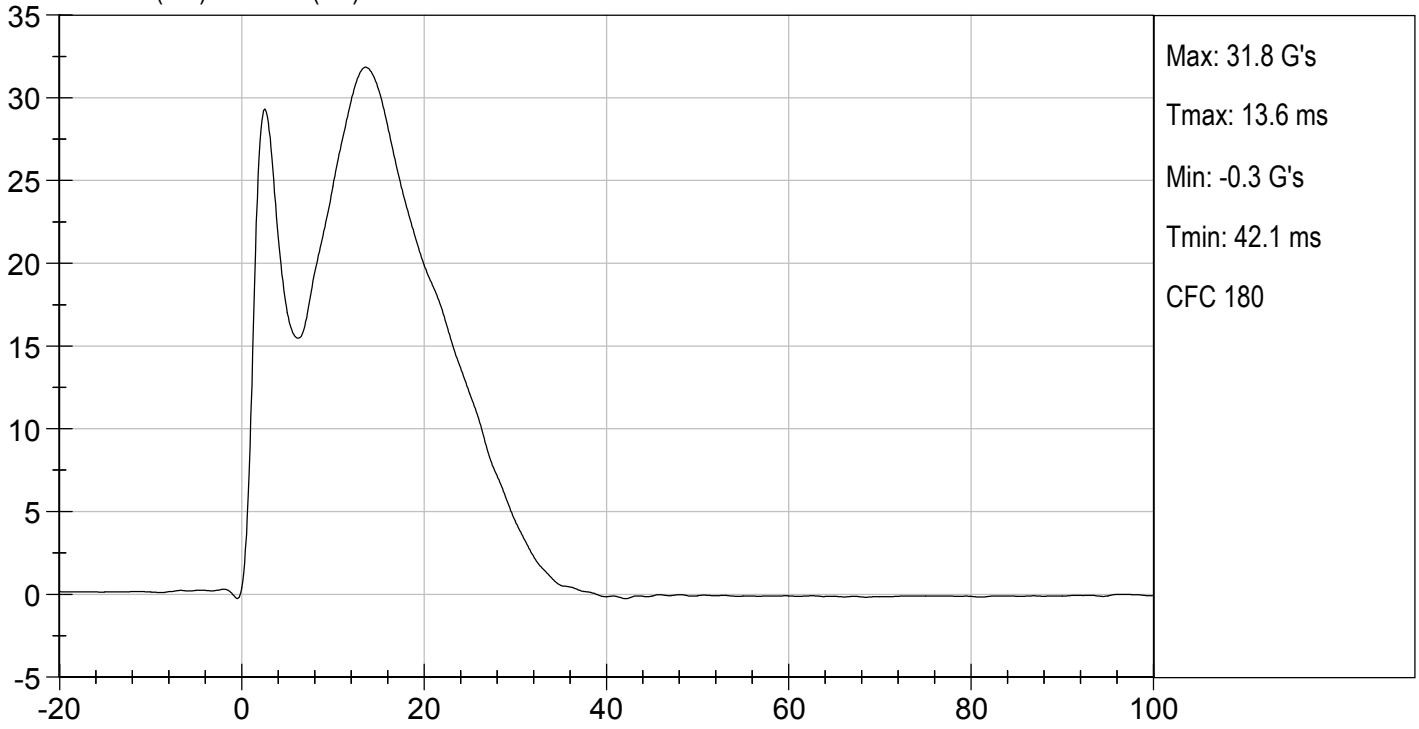
10/04/2018
Test Date

Robert Schmidt
Approved By

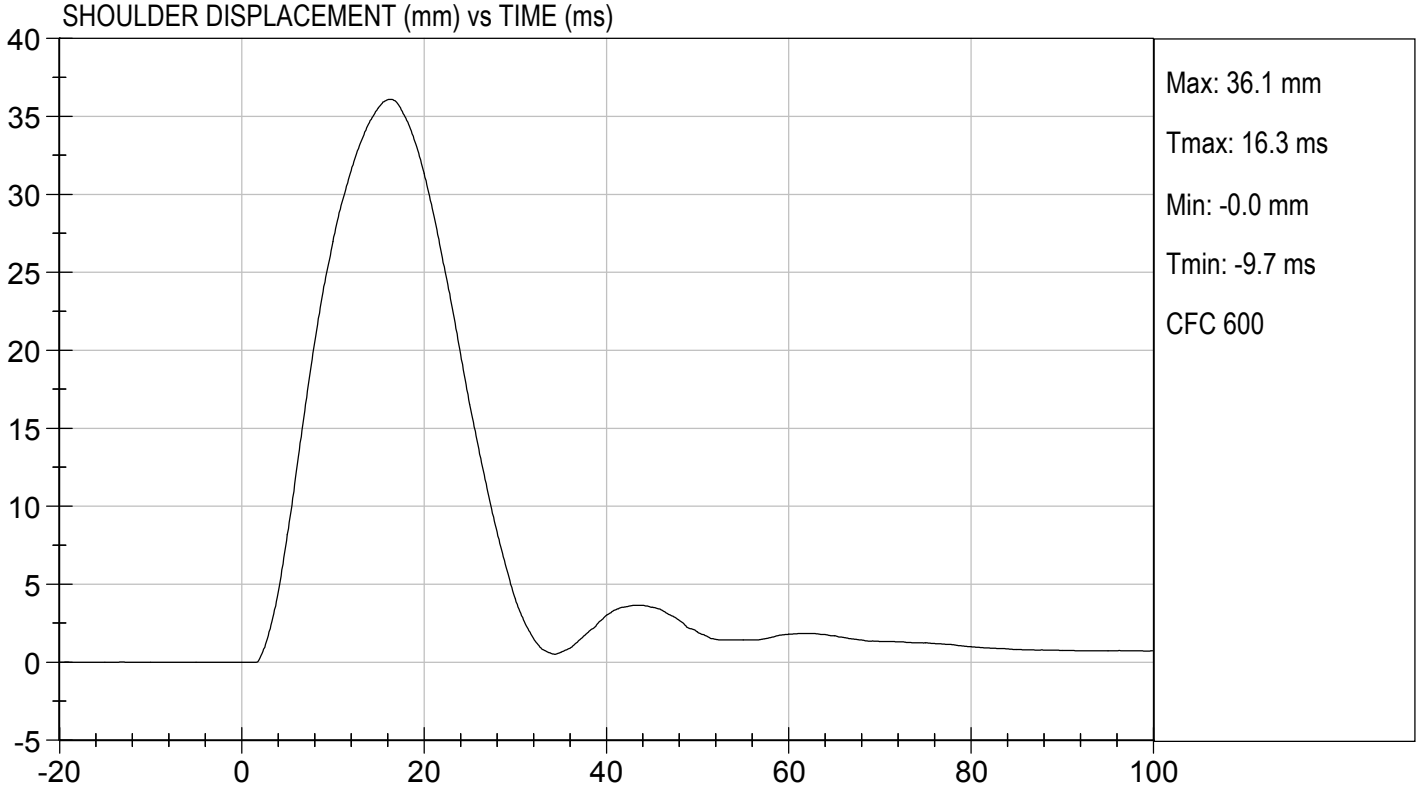
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 10/04/2018
TEST #: D183004

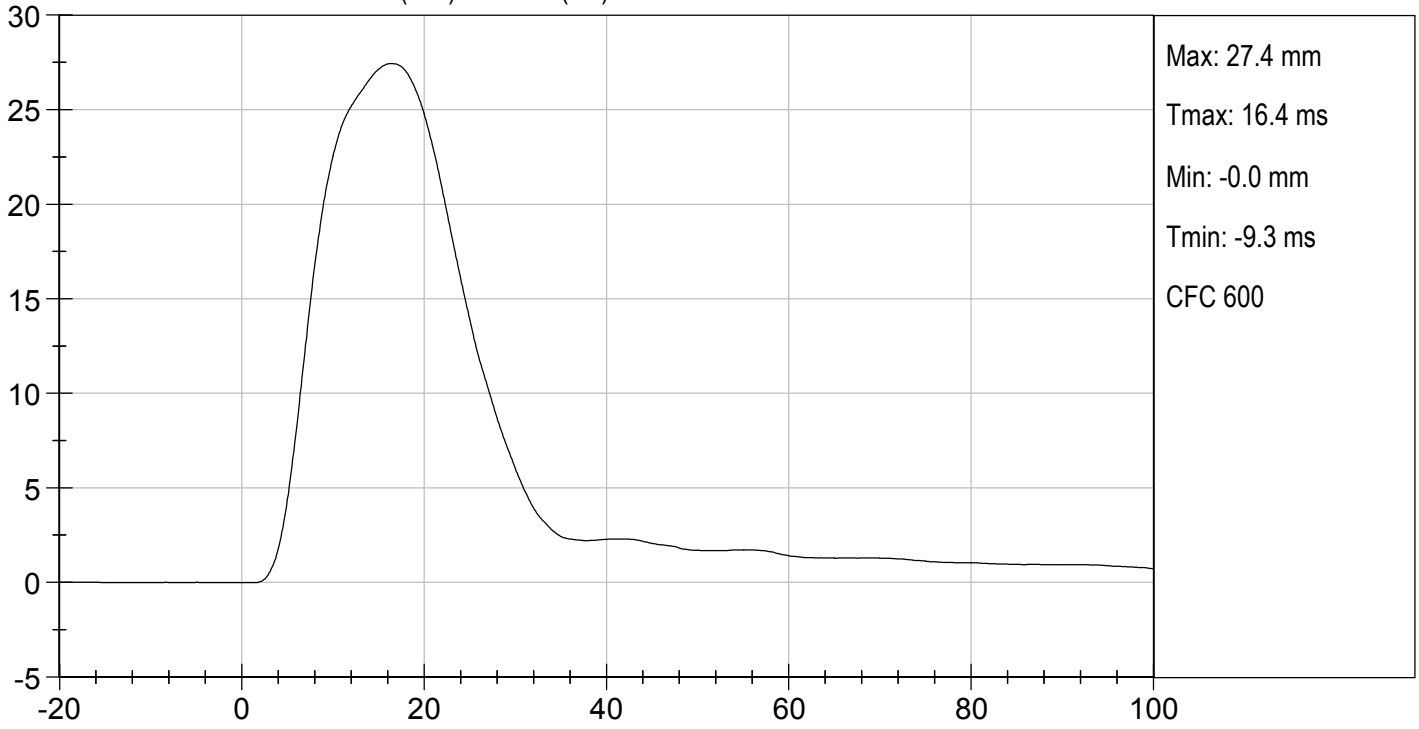
PROBE (G's) vs TIME (ms)



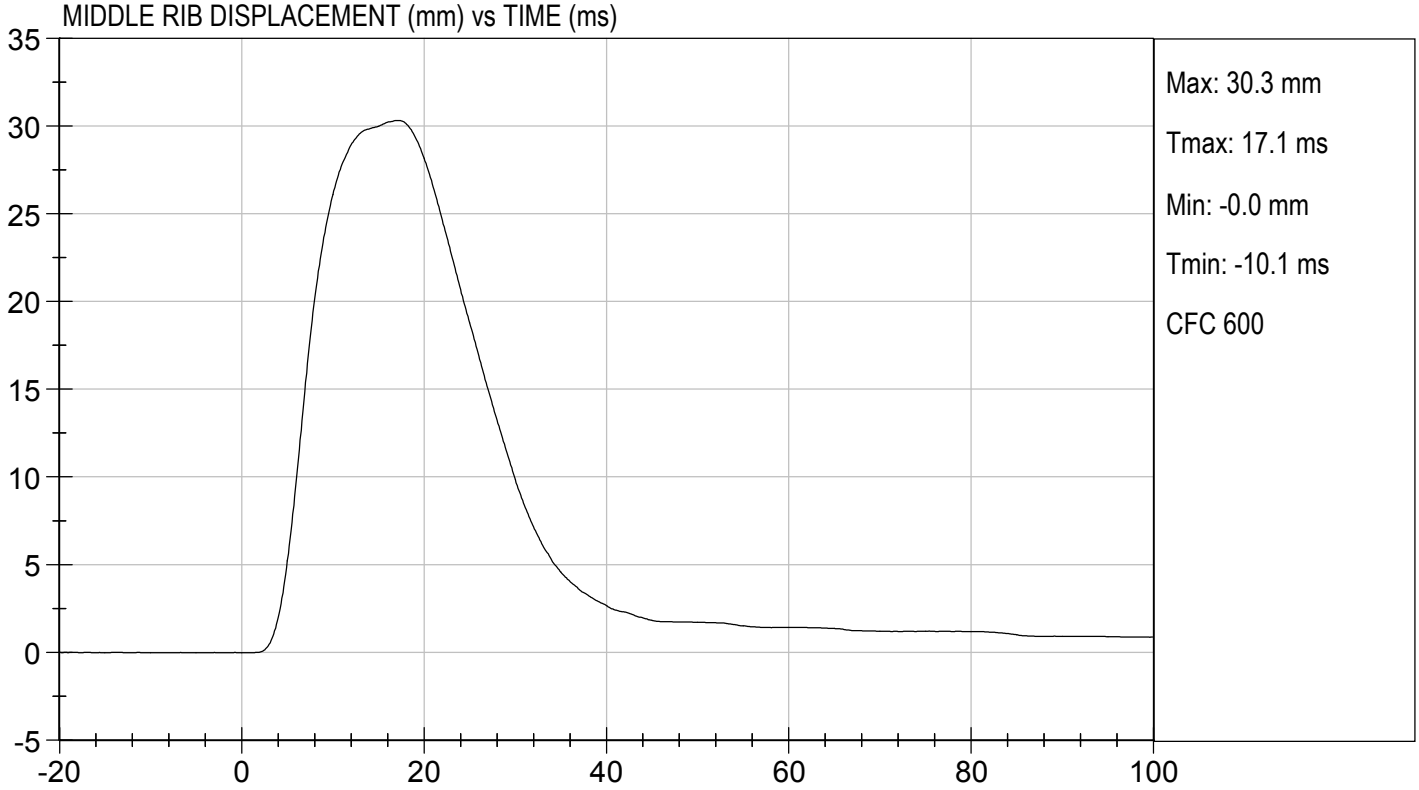
SHOULDER DISPLACEMENT (mm) vs TIME (ms)



UPPER RIB DISPLACEMENT (mm) vs TIME (ms)



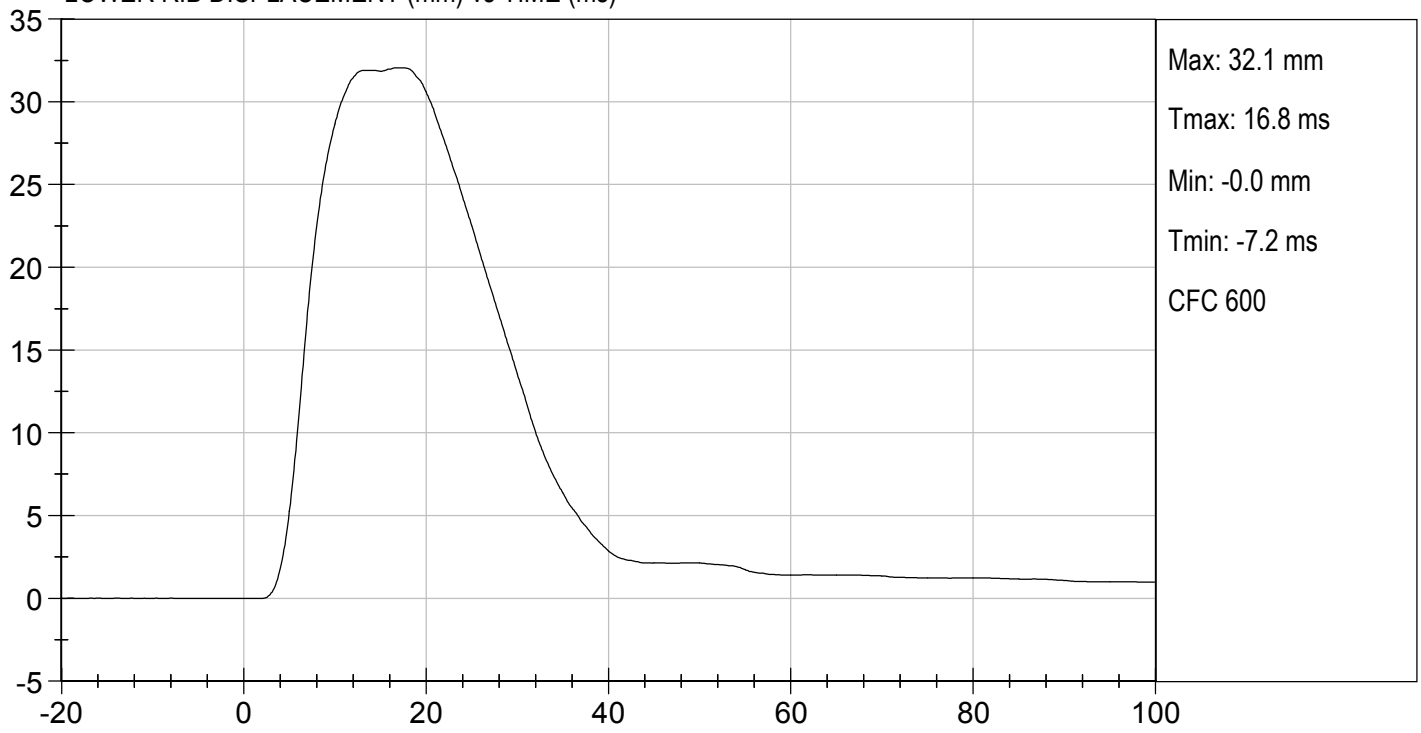
MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



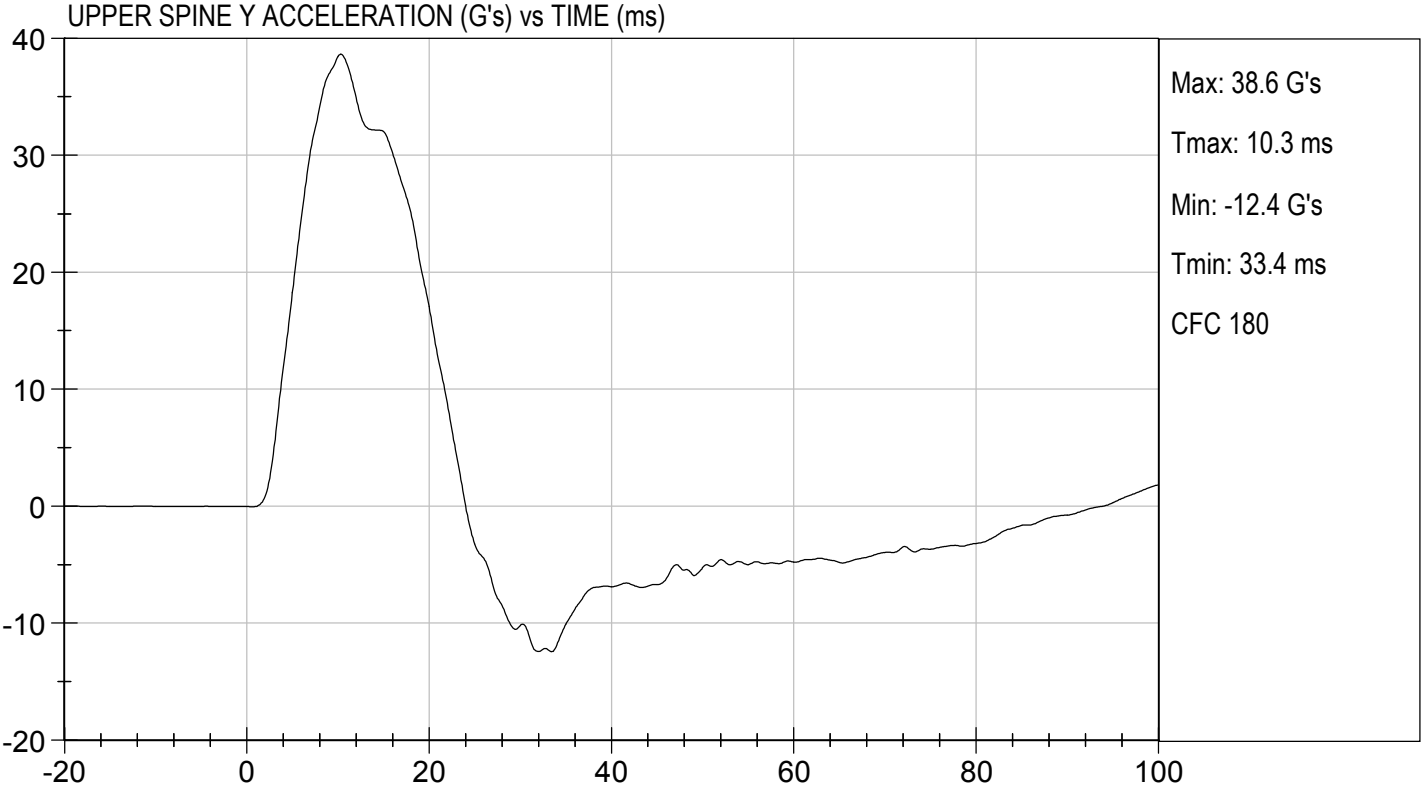
TEST DESC: THORAX IMPACT WITH ARM
VELOCITY: 21.64 ft/s, 6.60 m/s

TEST DATE: 10/04/2018
TEST #: D183004

LOWER RIB DISPLACEMENT (mm) vs TIME (ms)

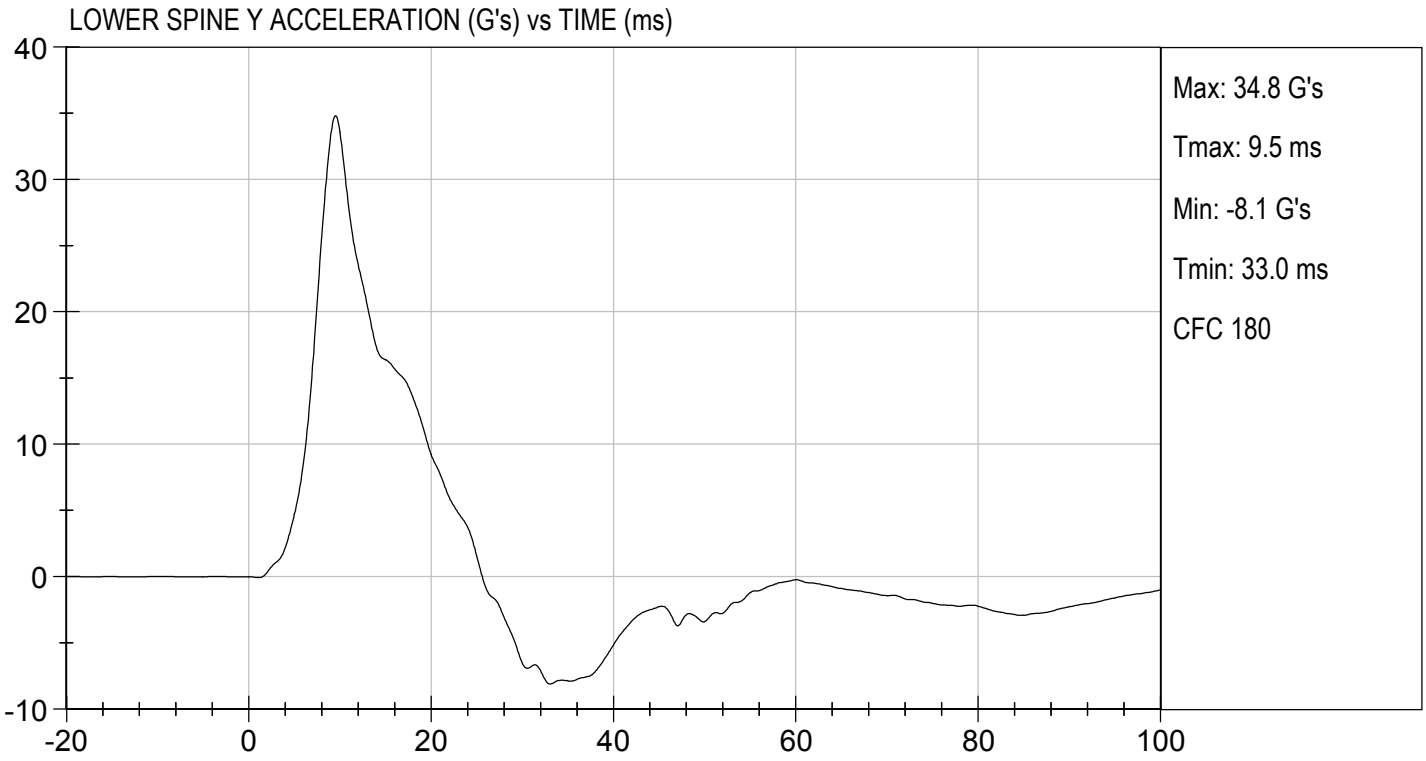


UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 10/04/2018
TEST #: D183004



MGA RESEARCH CORPORATION

THORAX (WITHOUT ARM) IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D183005

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	39	Pass
Impact Velocity	m/s	4.20 to 4.40	4.20	Pass
Maximum Probe Acceleration	G's	14 to 18	15	Pass
Upper Rib Displacement	mm	32 to 40	39	Pass
Middle Rib Displacement	mm	39 to 45	43	Pass
Lower Rib Displacement	mm	35 to 43	40	Pass
Upper Spine (T1) Y Acceleration	G's	13 to 17	14	Pass
Lower Spine (T12) Y Acceleration	G's	7 to 11	8	Pass
		Overall Test Results		Pass

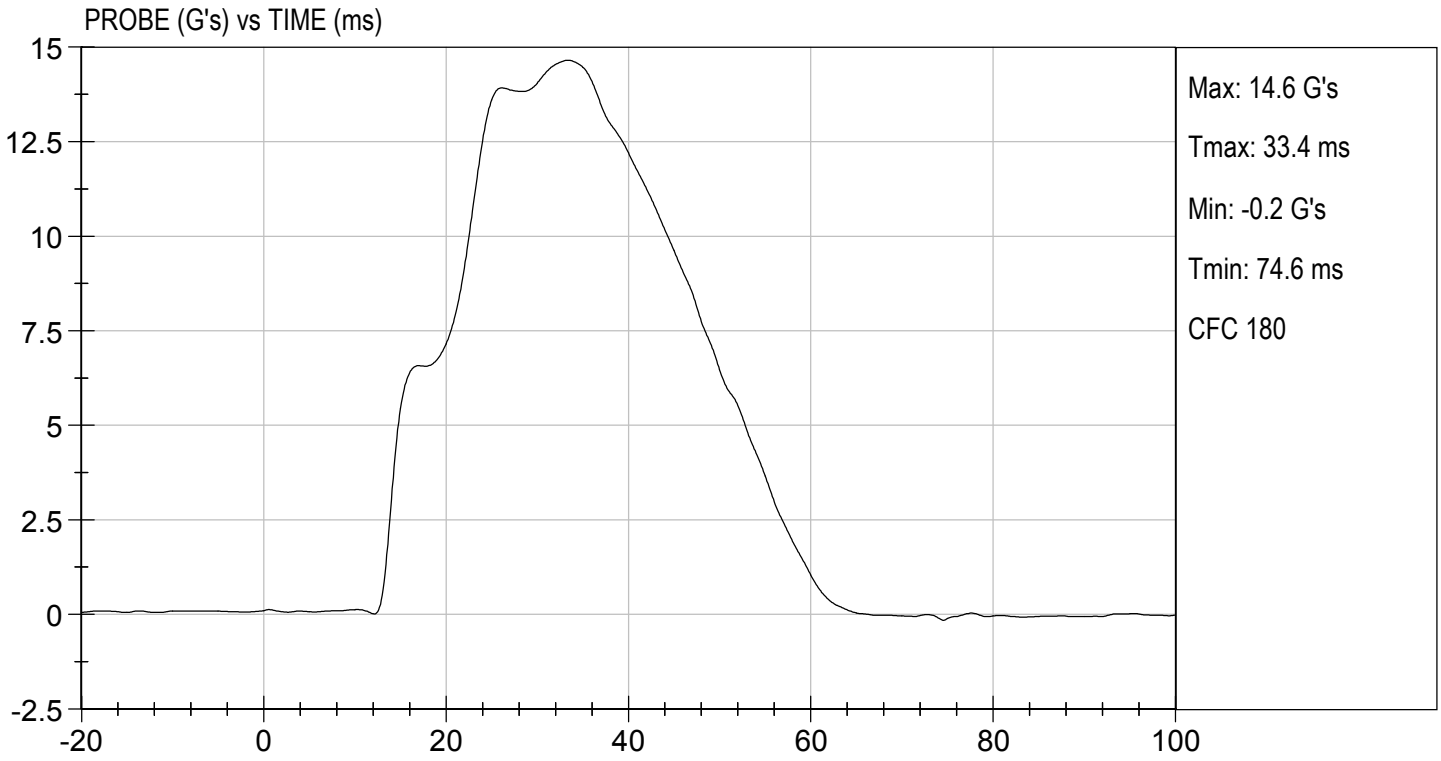
Jacob D Taylor
Laboratory Technician

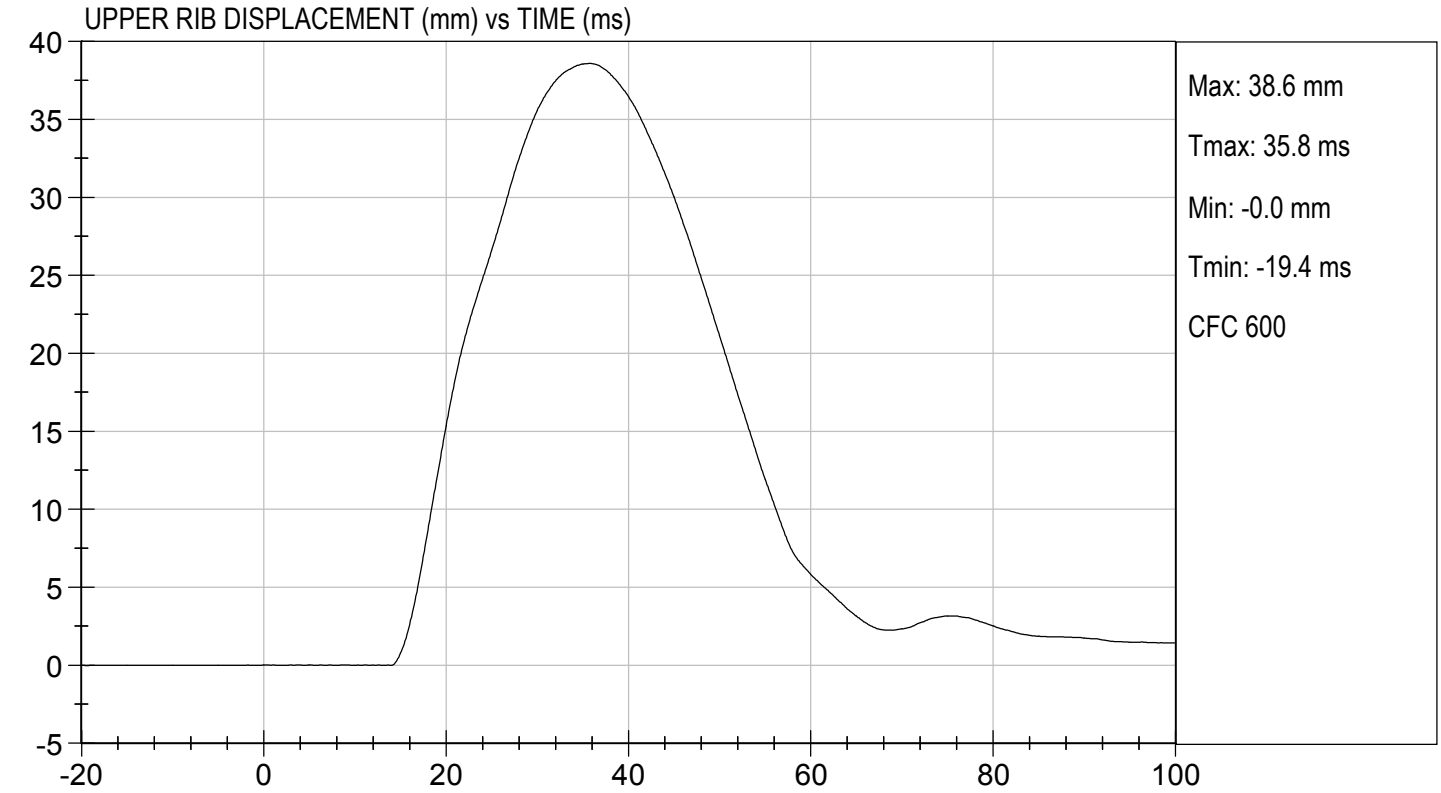
10/04/2018
Test Date

Robert Schmidt
Approved By

TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.77 ft/s, 4.20 m/s

TEST DATE: 10/04/2018
TEST #: D183005

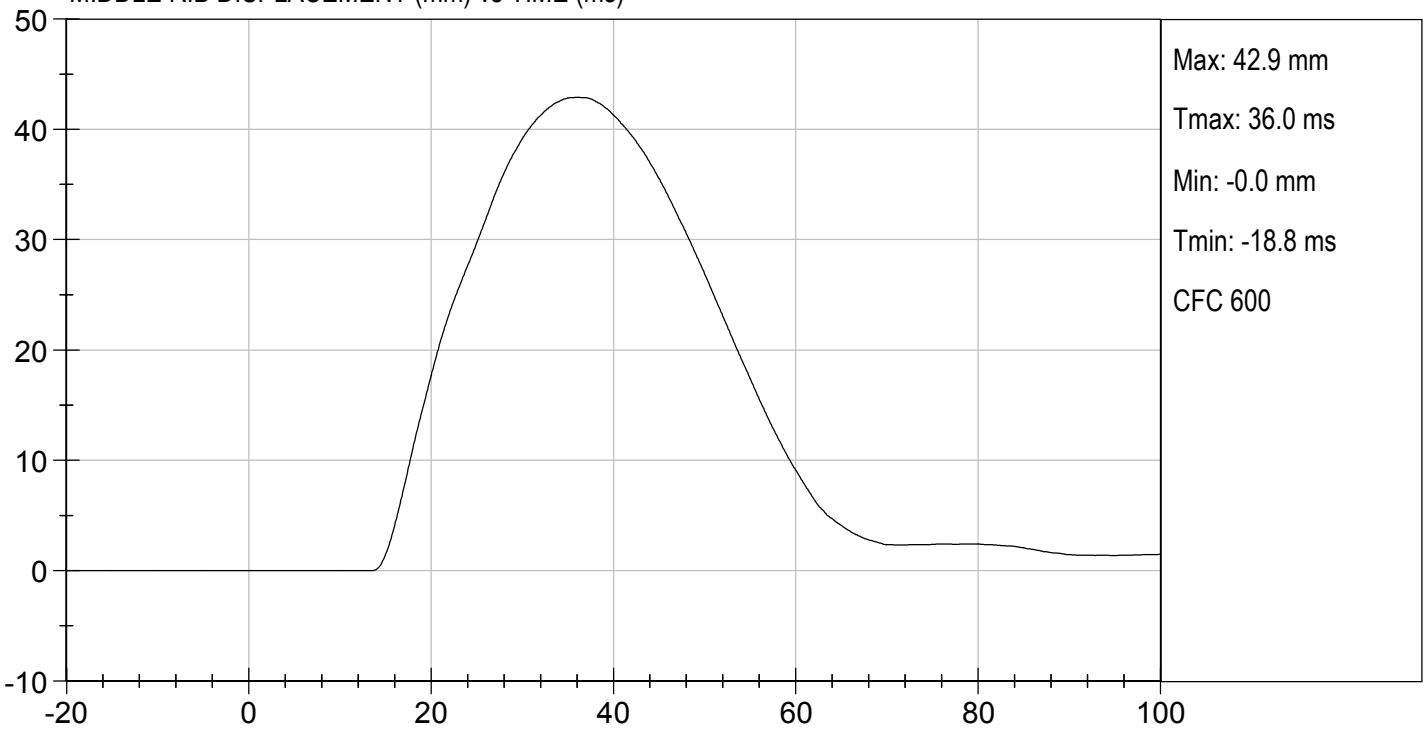




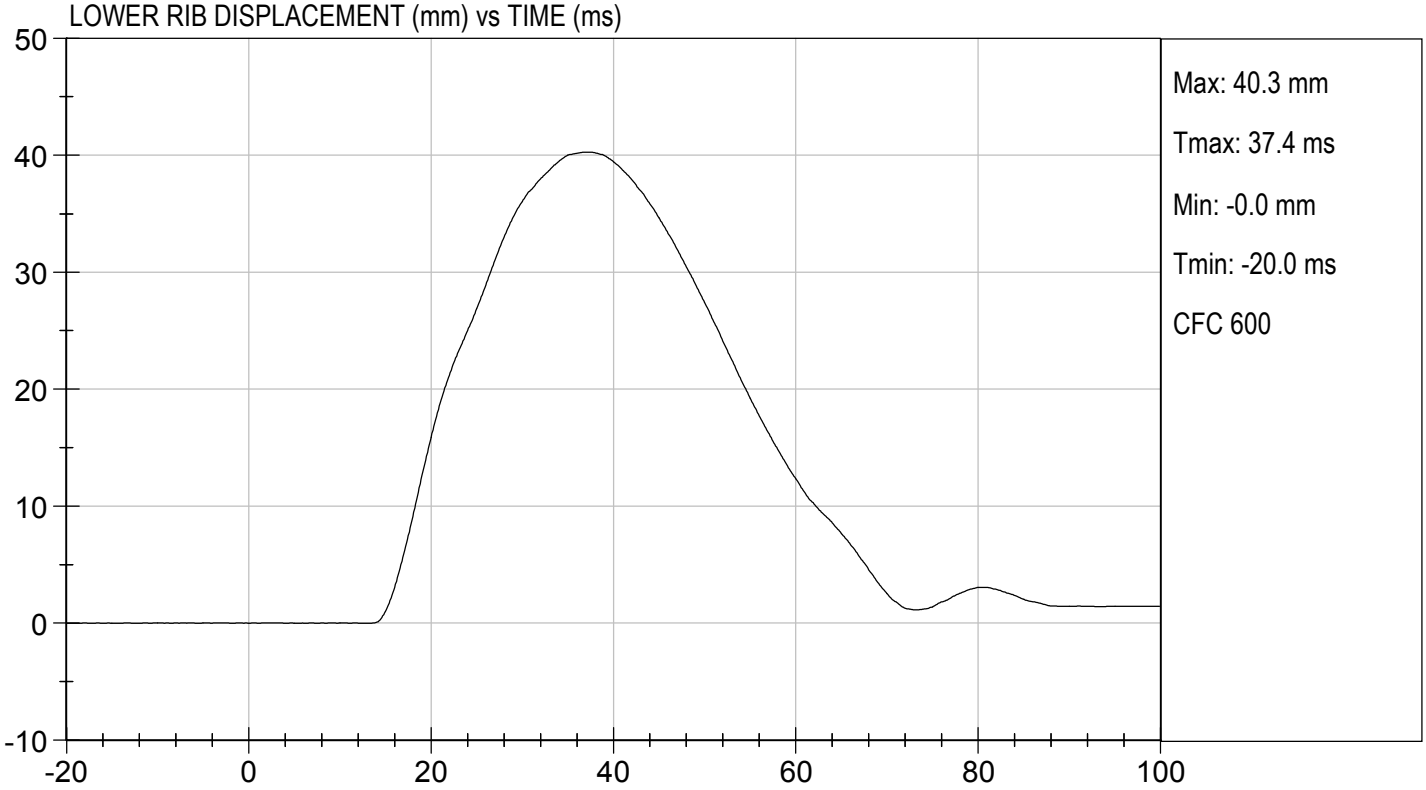
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.77 ft/s, 4.20 m/s

TEST DATE: 10/04/2018
TEST #: D183005

MIDDLE RIB DISPLACEMENT (mm) vs TIME (ms)



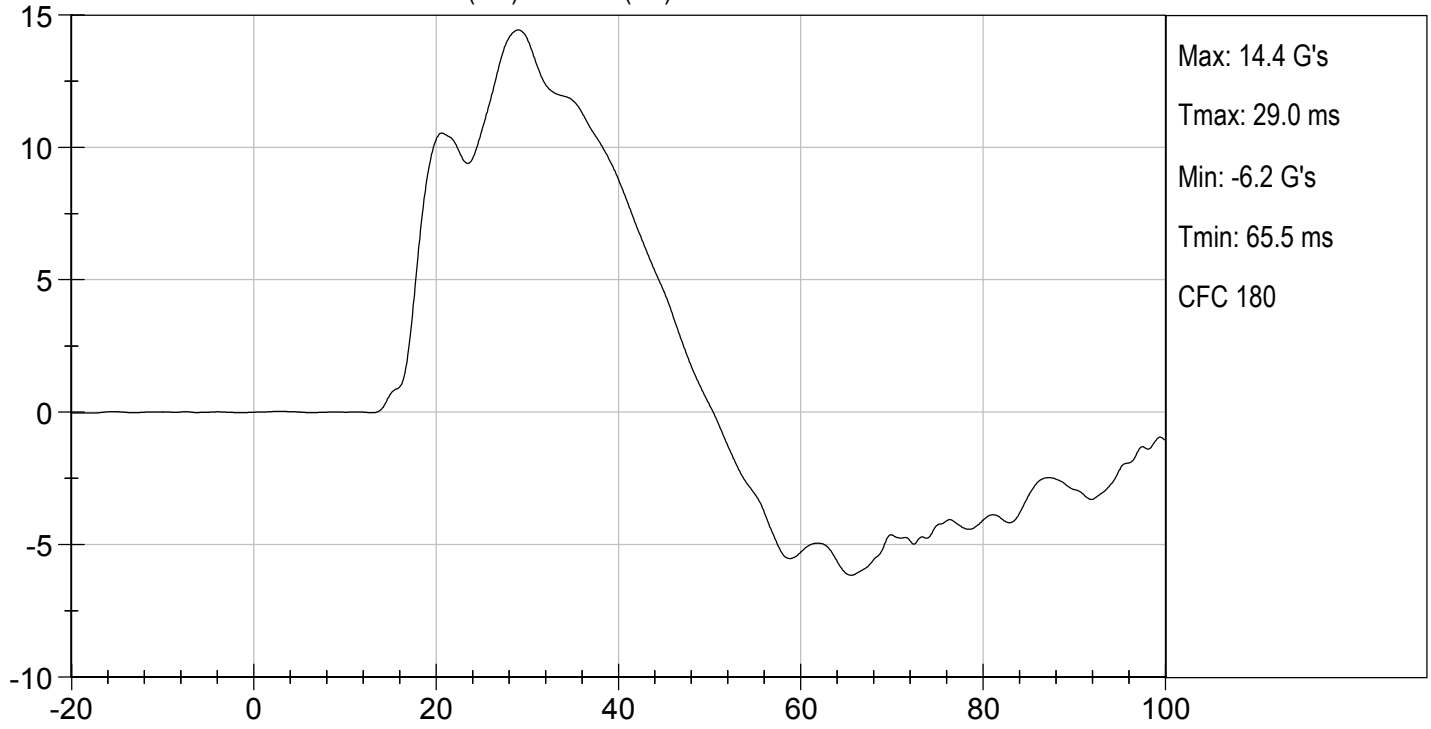
LOWER RIB DISPLACEMENT (mm) vs TIME (ms)



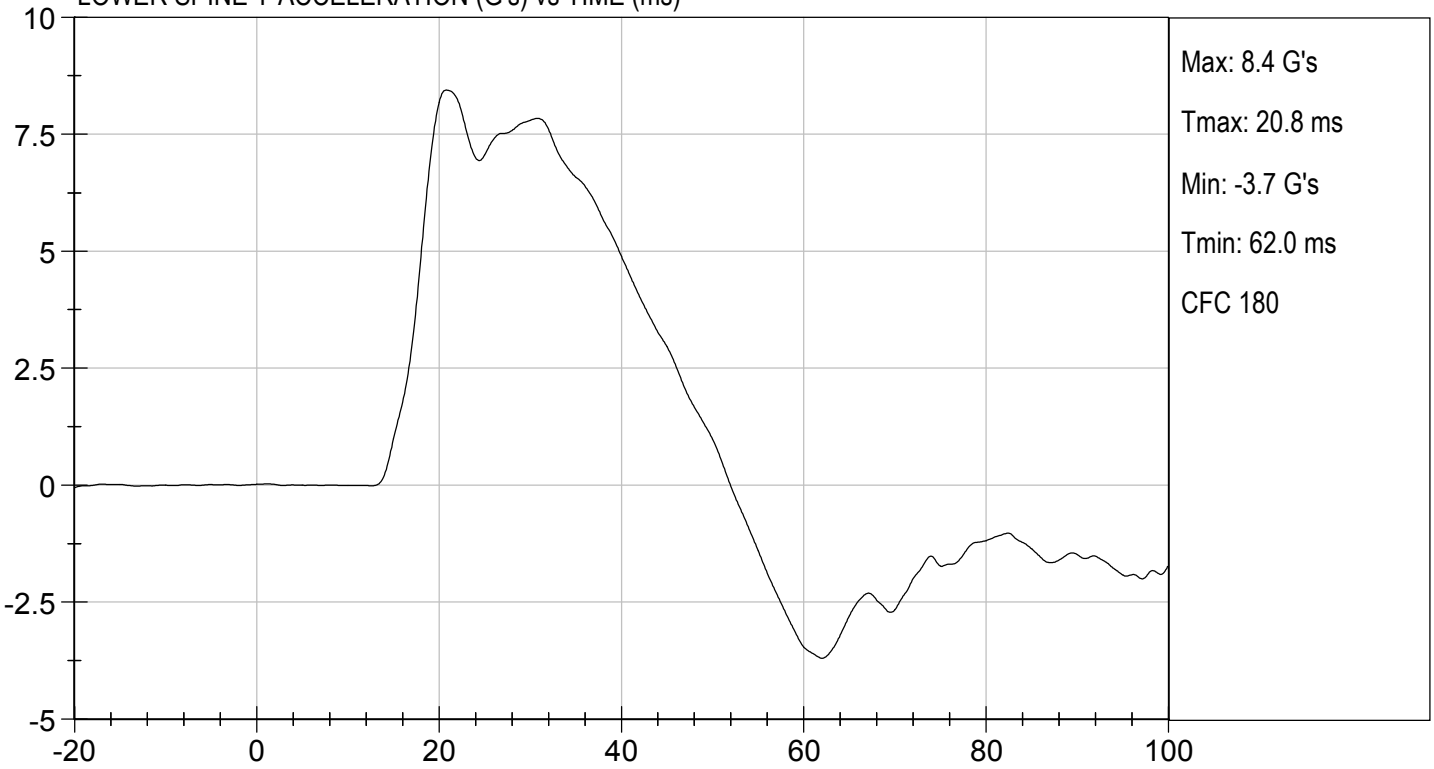
TEST DESC: THORAX IMPACT WITHOUT ARM
VELOCITY: 13.77 ft/s, 4.20 m/s

TEST DATE: 10/04/2018
TEST #: D183005

UPPER SPINE Y ACCELERATION (G's) vs TIME (ms)



LOWER SPINE Y ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

ABDOMINAL IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D183006

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.3	Pass
Humidity	%	10 to 70	39	Pass
Impact Velocity	m/s	4.20 to 4.40	4.20	Pass
Maximum Probe Acceleration	G's	12 to 16	13	Pass
Upper Abdomen Rib Displacement	mm	36 to 47	43	Pass
Lower Abdomen Rib Displacement	mm	33 to 44	38	Pass
Lower Spine (T12) Y Acceleration	G's	9 to 14	11	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

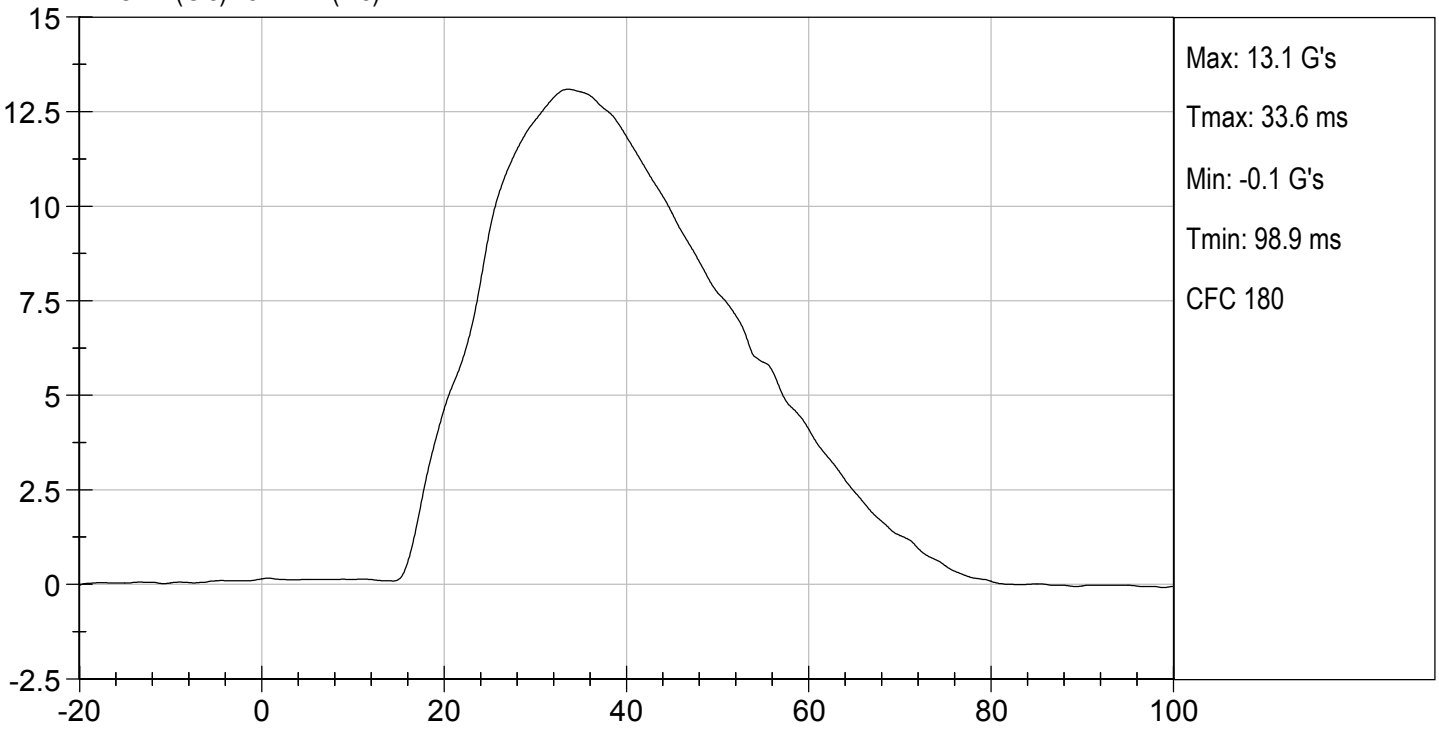
10/04/2018
Test Date

Robert Schmulsky
Approved By

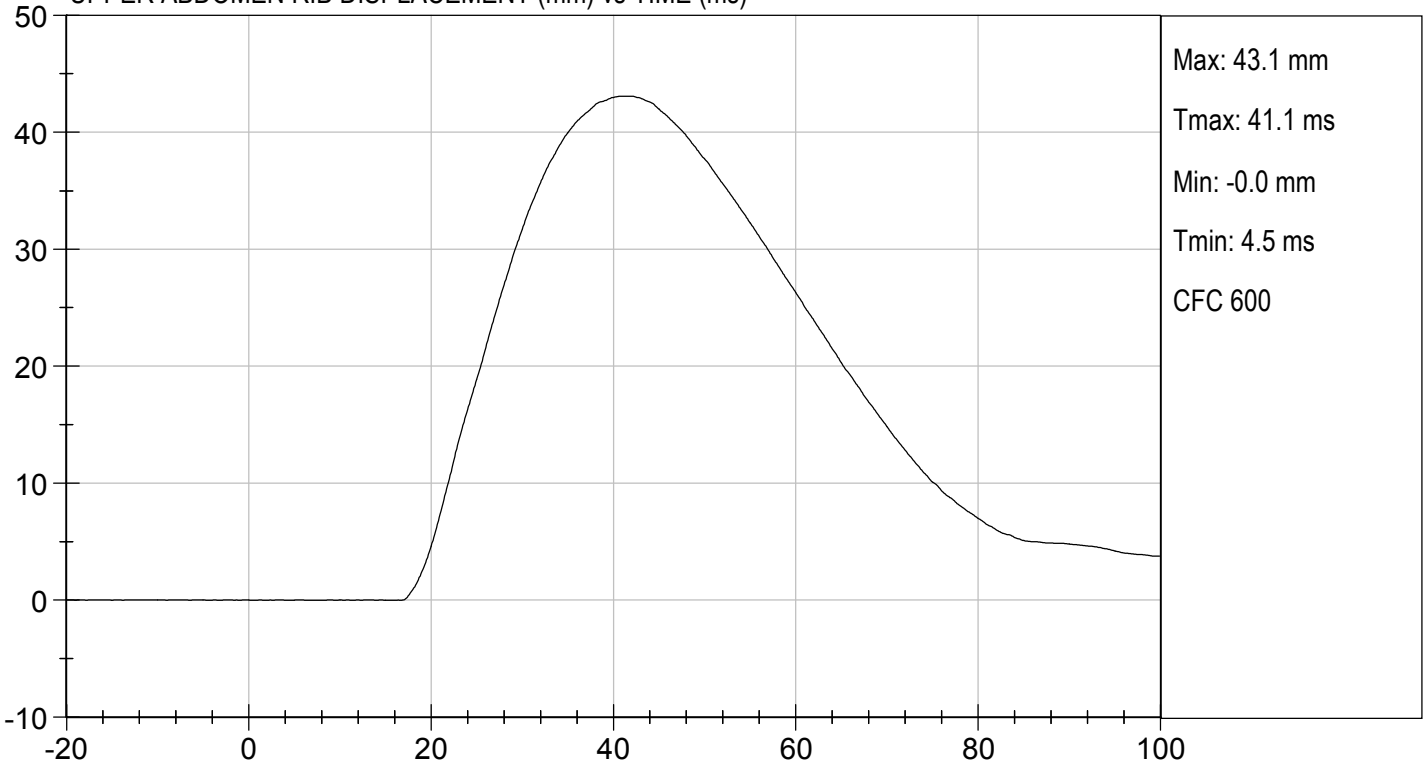
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.78 ft/s, 4.20 m/s

TEST DATE: 10/04/2018
TEST #: D183006

PROBE (G's) vs TIME (ms)



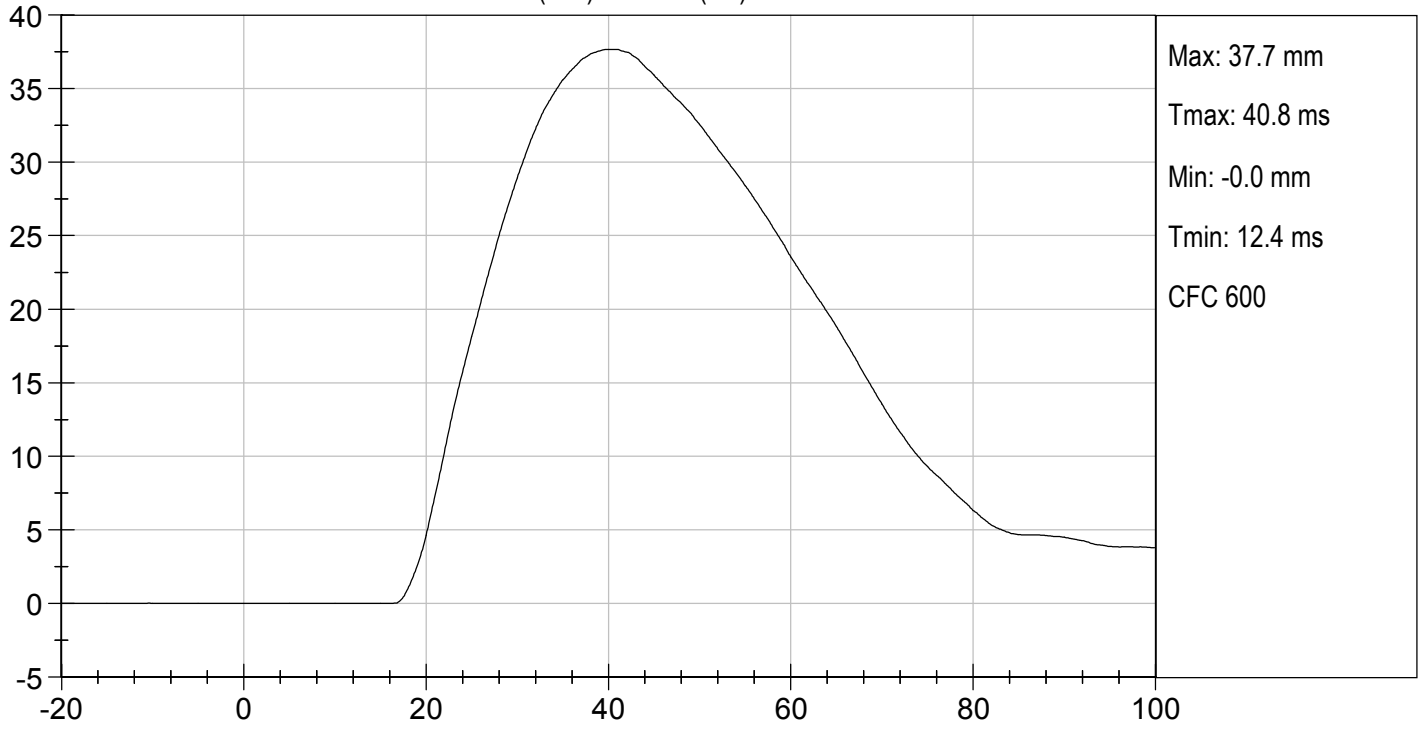
UPPER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



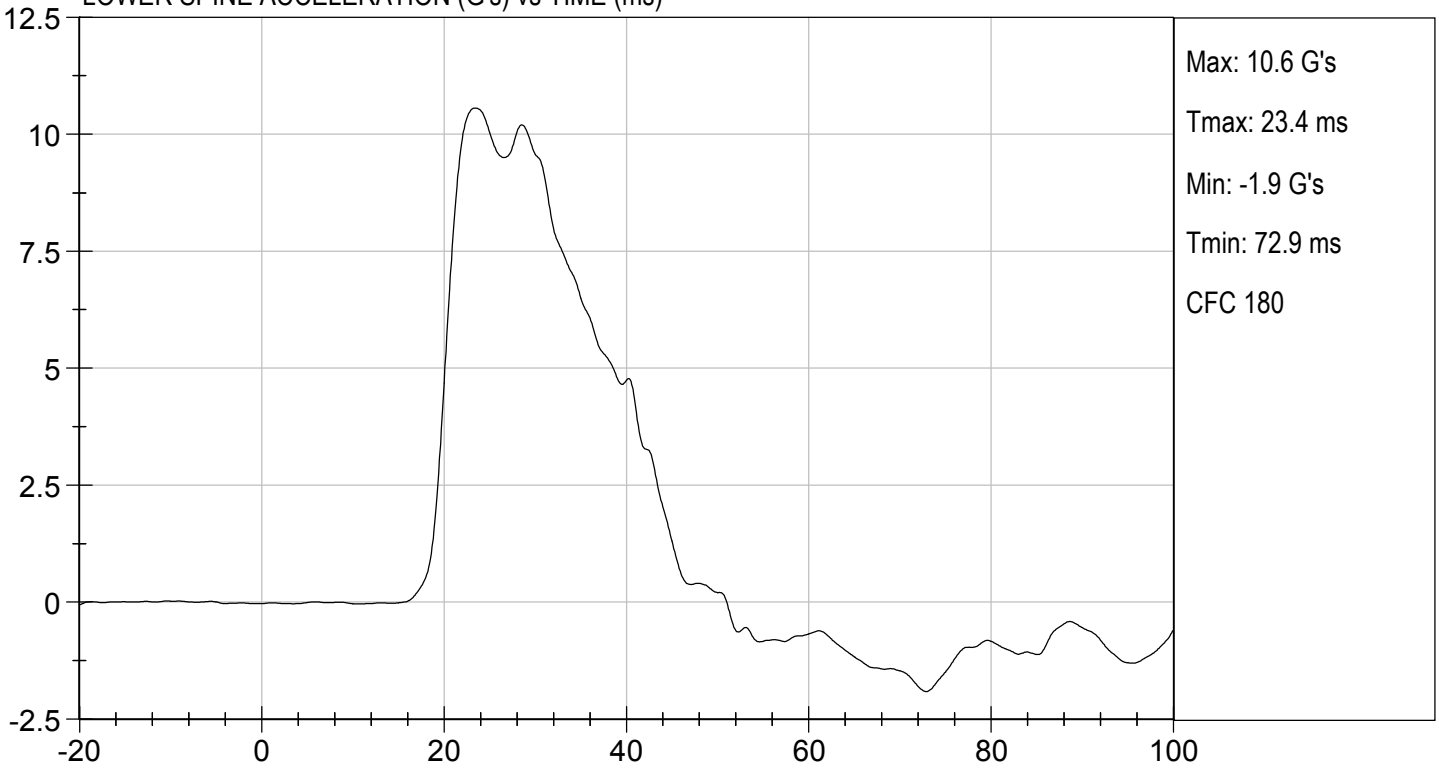
TEST DESC: ABDOMEN IMPACT
VELOCITY: 13.78 ft/s, 4.20 m/s

TEST DATE: 10/04/2018
TEST #: D183006

LOWER ABDOMEN RIB DISPLACEMENT (mm) vs TIME (ms)



LOWER SPINE ACCELERATION (G's) vs TIME (ms)



MGA RESEARCH CORPORATION

PELVIS IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D183007

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	6.60 to 6.80	6.60	Pass
Maximum Probe Acceleration	G's	38 to 47	42	Pass
Pelvis Y Acceleration After 6 ms	G's	34 to 42	40	Pass
Peak Acetabulum Force	N	3600 to 4300	4,055	Pass
		Overall Test Results		Pass

Jacob D Taylor
Laboratory Technician

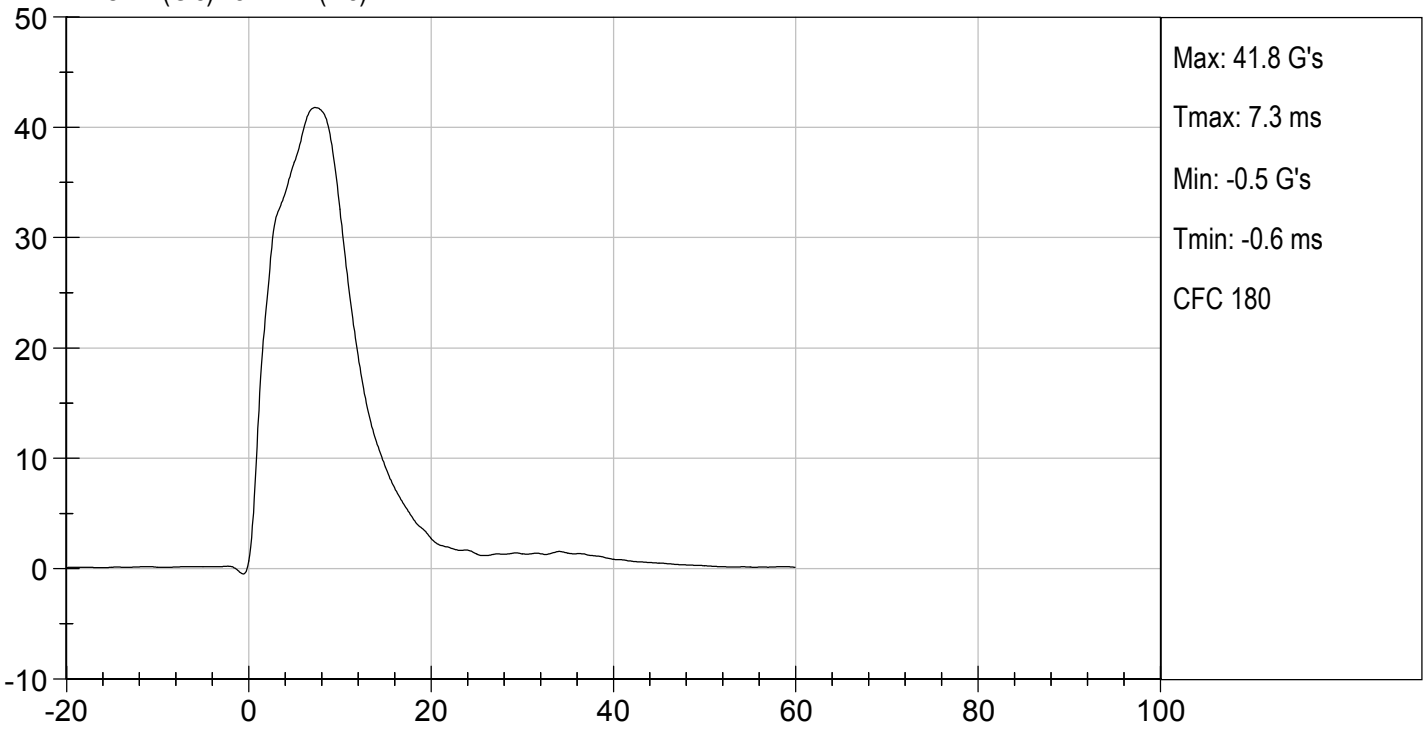
10/05/2018
Test Date

Robert Schmulen
Approved By

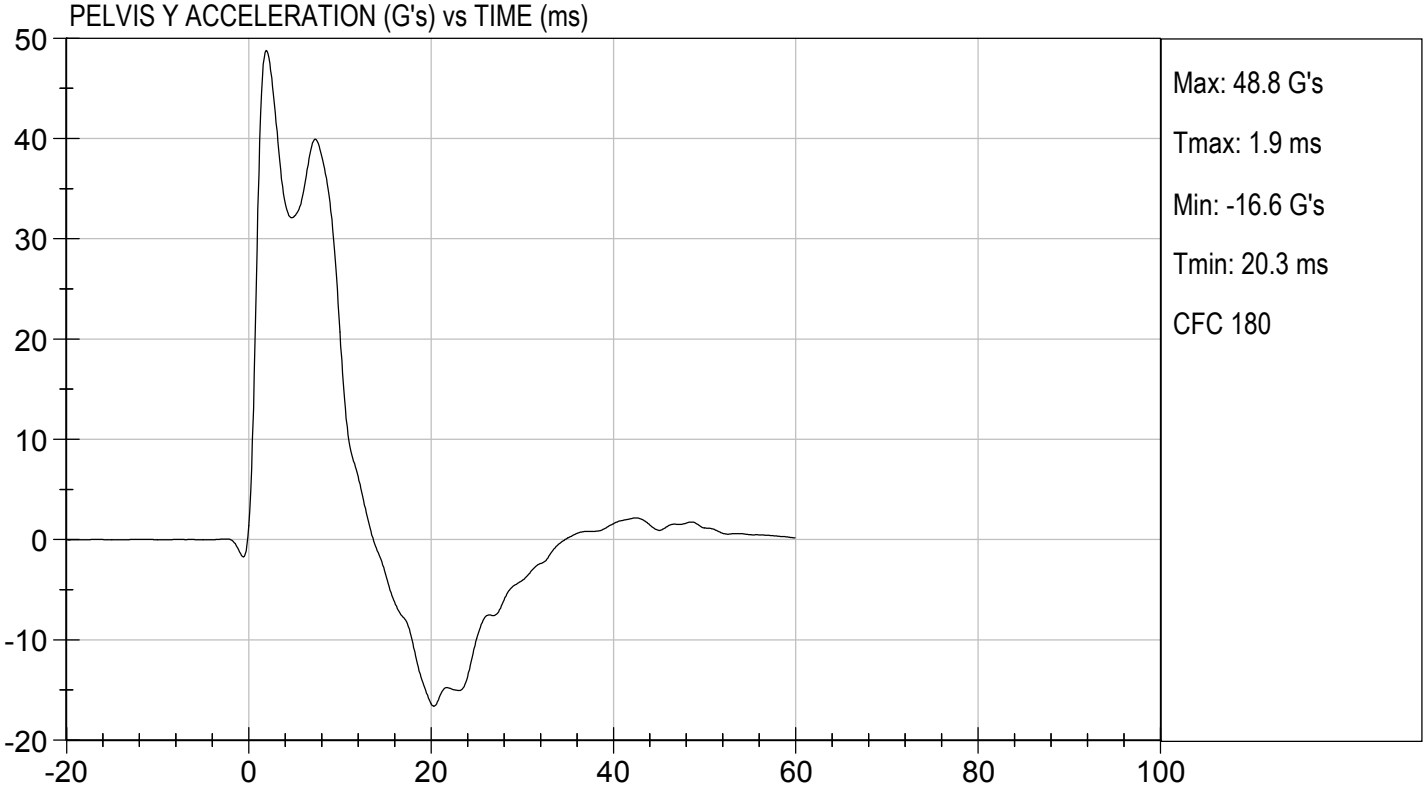
TEST DESC: PELVIS IMPACT
VELOCITY: 21.65 ft/s, 6.60 m/s

TEST DATE: 10/05/2018
TEST #: D183007

PROBE (G's) vs TIME (ms)

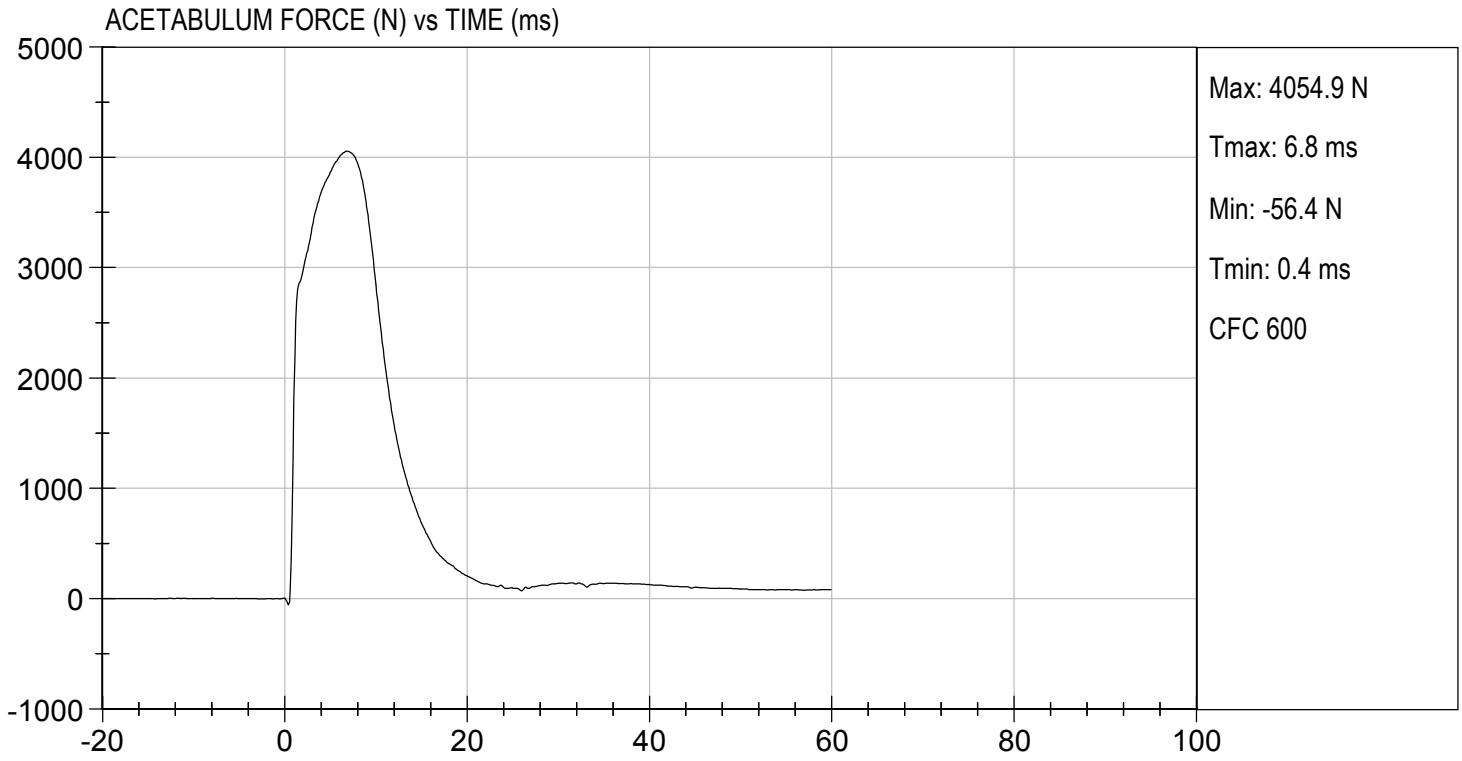


PELVIS Y ACCELERATION (G's) vs TIME (ms)



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

TEST DATE: 10/05/2018
TEST #: D183007



MGA RESEARCH CORPORATION

ILIAC IMPACT TEST

SID-IIs BUILD LEVEL D DUMMY

ATD Serial No: 296 **Test I.D:** D183008

Tested Parameter	Units	Specification	Result	Pass/Fail
Temperature	deg C	20.6 to 22.2	21.8	Pass
Humidity	%	10 to 70	41	Pass
Impact Velocity	m/s	4.20 to 4.40	4.38	Pass
Maximum Probe Acceleration	G's	36 to 45	36	Pass
Pelvis Y Acceleration	G's	28 to 39	28	Pass
Peak Pelvis Iliac Force	N	4100 to 5100	4,155	Pass
		Overall Test Results		Pass

Jacob D Taylor

Laboratory Technician

10/05/2018

Test Date

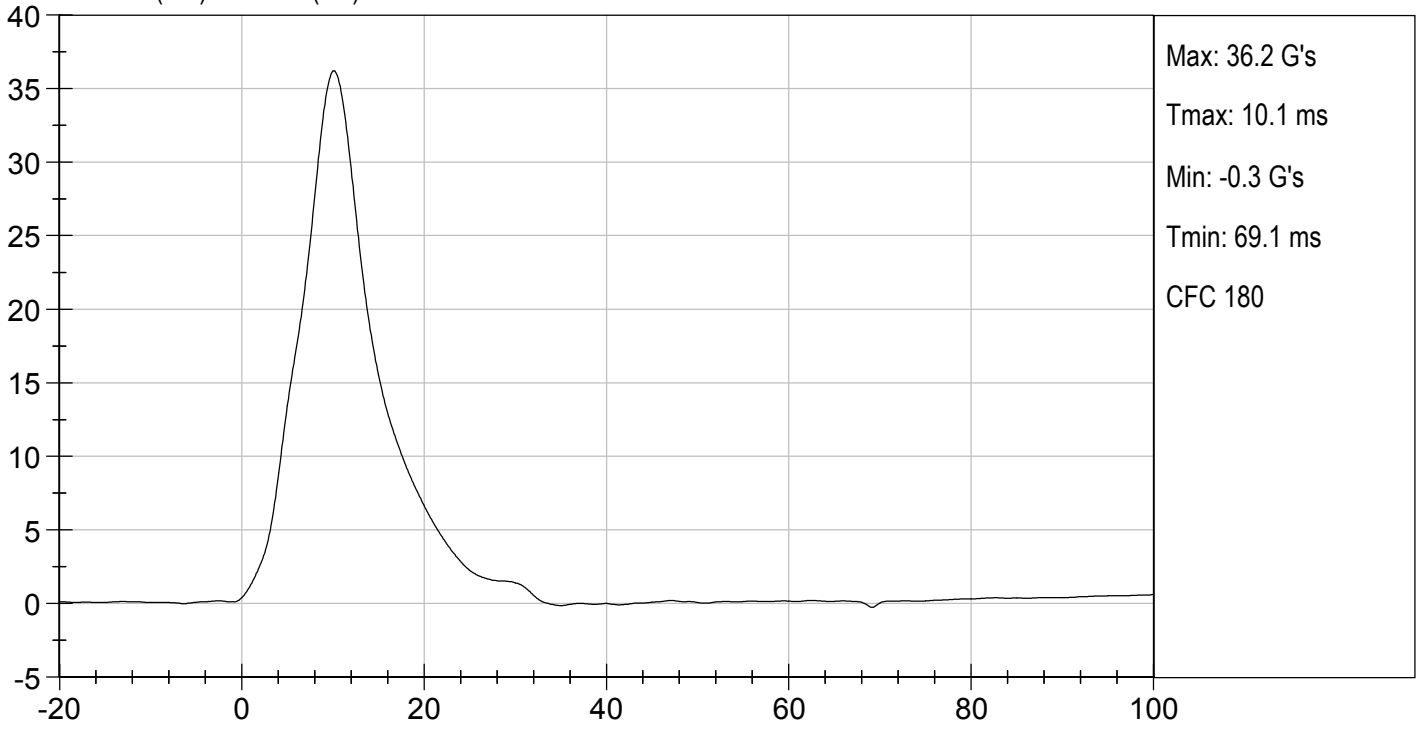
Robert Schmulen

Approved By

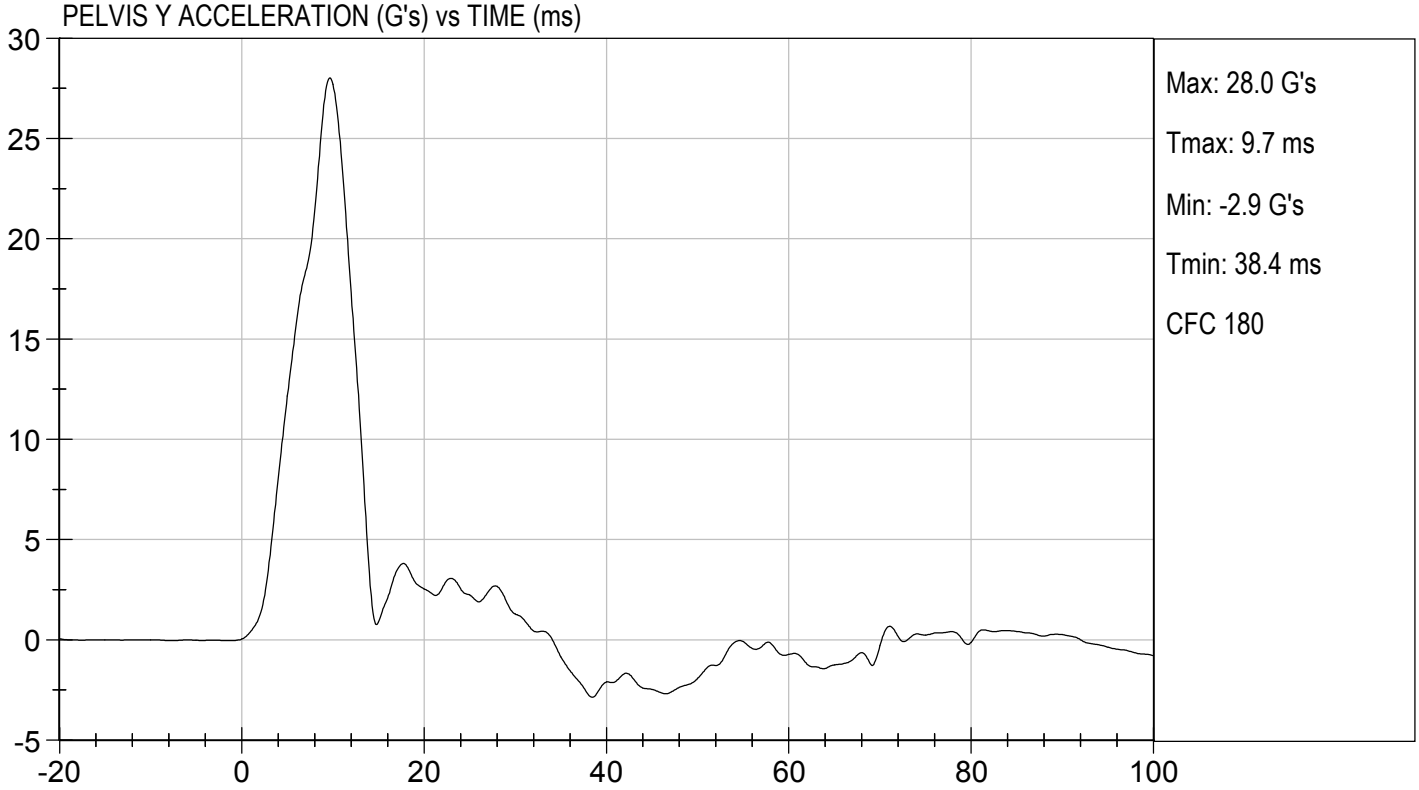
TEST DESC: ILLIAC
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 10/05/2018
TEST #: D183008

PROBE (G's) vs TIME (ms)

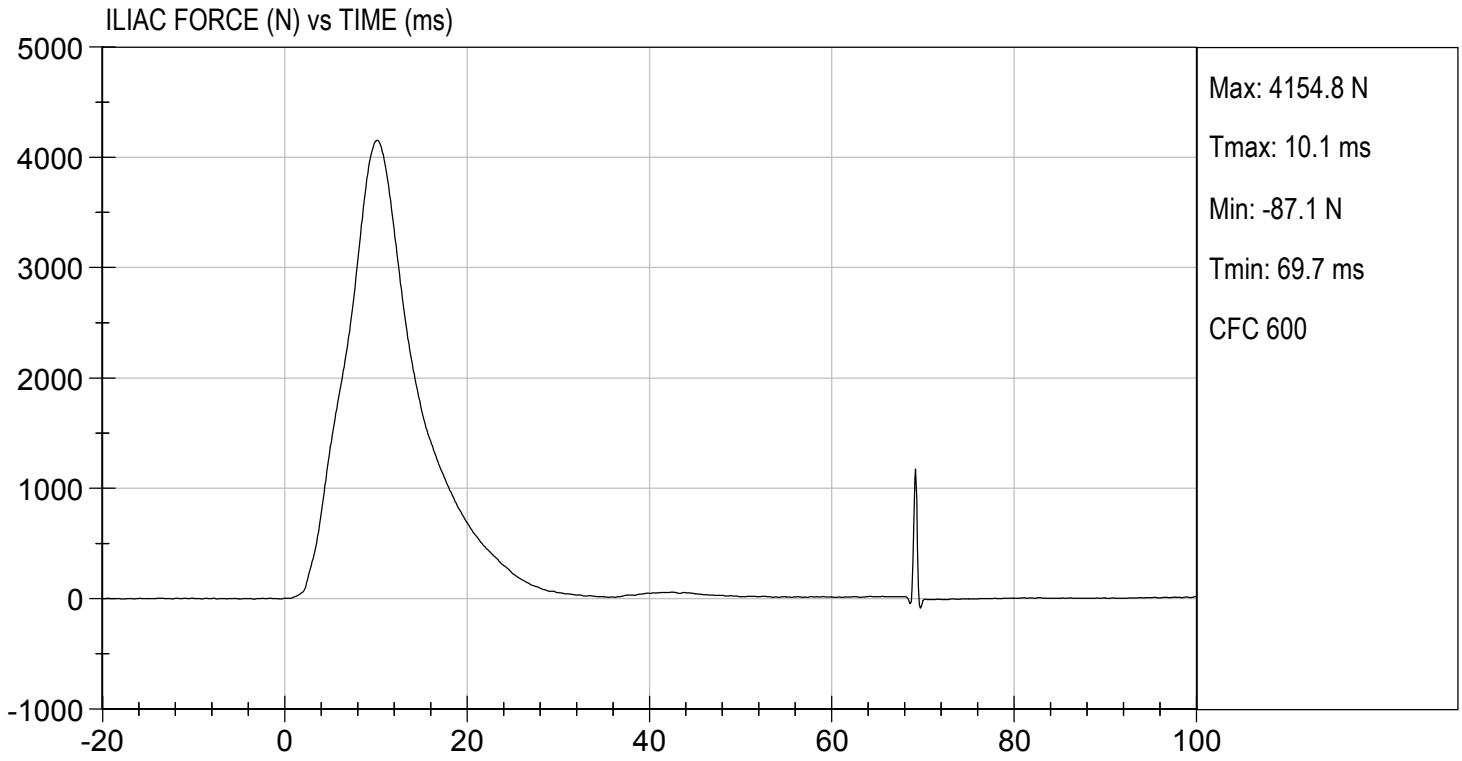


PELVIS Y ACCELERATION (G's) vs TIME (ms)



TEST DESC: ILLIAC
VELOCITY: 14.37 ft/s, 4.38 m/s

TEST DATE: 10/05/2018
TEST #: D183008



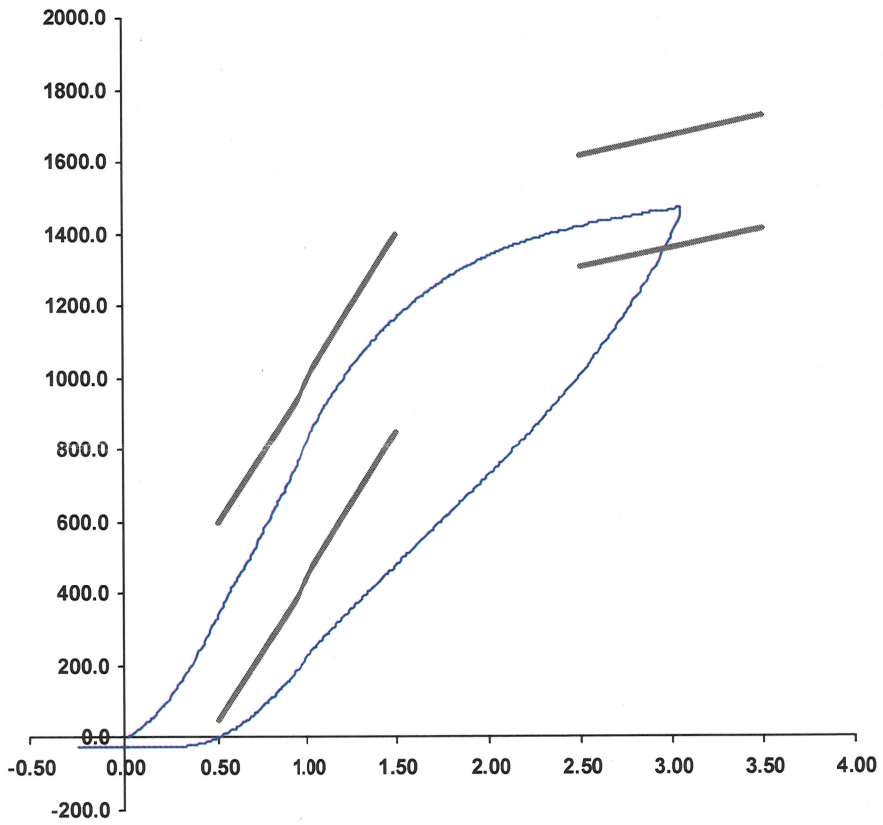
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12167
Test Number 6527
Report Number 6542
Test Date 2/28/2018 10:40:45 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	342.63	50.00	600.00
Force @ 1.5 mm (N)	1,167.85	850.00	1,400.00
Force @ 2.5 mm (N)	1,419.91	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,468.39	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 **28-Feb-18**
SACO Research

By : DC Date : 2/28/18

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

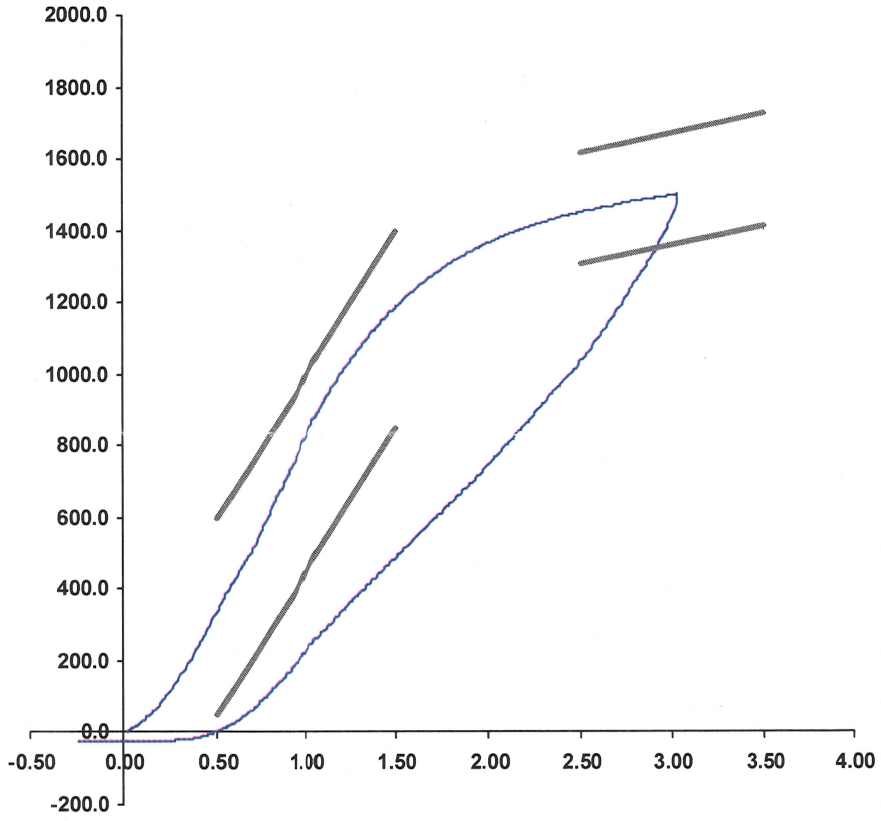
SACO RESEARCH

SID-IIs Pelvis Plug Certification Test

Plug S/N 12282
Test Number 6667
Report Number 6682
Test Date 3/15/2018 11:23:24 AM

	Test Results	Spec Min	Spec Max
Force @ 0.5 mm (N)	337.25	50.00	600.00
Force @ 1.5 mm (N)	1,187.88	850.00	1,400.00
Force @ 2.5 mm (N)	1,451.32	1,306.00	1,618.00
Force @ 3.0 mm (N)	1,500.26	1,361.00	1,673.00

Force (-N) vs Extension (-mm)



Testing Machine STM-20 5965542
Load Cell S/N (FI360947), Units (LBS) 1000

Crosshead Speed (mm / min) or Rate 12.7
Extension or Position Measured by XHD_100 (XHD100)

Notes:

Operator

Part Number 180-4450

Template No 107 **15-Mar-18**
SACO Research

By : DC Date : 3/15/18

SACO Research 41735 Elm St, #401 Murrieta, CA 92562 Tel 310-694-2082 FAX

APPENDIX D
TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION DATA

Table 1 – Dummy Instrumentation

				SID-IIs S/N 296		
				Serial Number	Manufacturer	Calibration Date
Head CG Accelerometers			X	P85003	Endevco	07/17/18
			Y	P94783	Endevco	07/17/18
			Z	P94786	Endevco	07/17/18
			Xr	P94938	Endevco	07/17/18
			Yr	P96854	Endevco	07/17/18
			Zr	P97386	Endevco	07/17/18
Head Angular Rate Sensors			X	ARS7413	DTS	07/15/14
			Y	ARS7421	DTS	07/15/14
			Z	ARS7423	DTS	07/15/14
Displacement Potentiometers	Thoracic Rib	Upper	Y	G012	FTSS	07/31/18
		Middle	Y	G1163	FTSS	07/31/18
		Lower	Y	G1158	FTSS	07/31/18
	Abdominal Rib	Upper	Y	G1146	FTSS	07/31/18
		Lower	Y	G1126	FTSS	07/31/18
Lower Spine Accelerometers (T12)			X	P79418	Endevco	07/17/18
			Y	P79439	Endevco	07/17/18
			Z	P79614	Endevco	07/17/18
Acetabulum Load Cell			Y	ACG111	FTSS	04/04/18
Iliac Wing Load Cell			Y	IWG226	FTSS	04/04/18
Pelvis Plug (struck side)				12167	SACO	02/28/18
Pelvis Plug (non-struck side)				12282	SACO	03/15/18

Table 2 – Vehicle Instrumentation

		Serial Number	Manufacturer	Calibration Date
Vehicle Center of Gravity	X	PCB1258	PCB	06/26/18
Vehicle Center of Gravity	Y	PCB1300	PCB	06/26/18
Vehicle Center of Gravity	Z	PCB1255	PCB	06/26/18
Left Floor Sill	Y	PCB1253	PCB	06/15/18
A-Pillar Sill	Y	T16834	Endevco	08/15/18
A-Pillar Low	Y	PCB1072	PCB	09/24/18
A-Pillar Mid	Y	PCB1298	PCB	06/15/18
B-Pillar Sill	Y	PCB1306	PCB	06/15/18
B-Pillar Low	Y	PCB1020	PCB	09/25/18
B-Pillar Mid	Y	PCB1046	PCB	09/25/18
Driver Seat	Y	PCB1187	PCB	05/03/18
Engine Top	X	PCB1127	PCB	05/23/18
Engine Top	Y	PCB1186	PCB	04/11/18
Firewall	Y	PCB1353	PCB	10/01/18
Right Roof	Y	PCB1367	PCB	08/20/18
Right Floor Sill	Y	PCB1063	PCB	09/24/18
Rear Floorpan	X	PCB639	PCB	05/23/18
Rear Floorpan	Y	PCB946	PCB	05/14/18

Table 3 – Pole Instrumentation

	Serial Number	Manufacturer	Calibration Date
Load Cell 1	DG6277	FTSS	07/30/18
Load Cell 2	DG6278	FTSS	07/30/18
Load Cell 3	DG6279	FTSS	07/30/18
Load Cell 4	DG6280	FTSS	07/30/18
Load Cell 5	DG6281	FTSS	07/30/18
Load Cell 6	DG6283	FTSS	07/30/18
Load Cell 7	DG6284	FTSS	07/30/18
Load Cell 8	DG6582	FTSS	07/30/18