

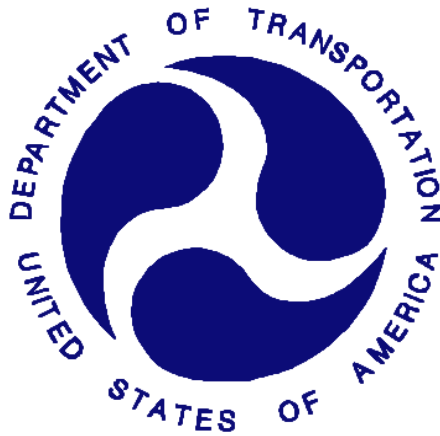
REPORT NUMBER: TWG-TRC-19-03

NEW CAR ASSESSMENT PROGRAM (NCAP)  
Side Airbag Out-of-Position Test

GENERAL MOTORS LLC  
2019 Cadillac XT4 SUV

NHTSA NUMBER: M20190102TWG2  
TRC TEST NUMBER: 190710-2

PREPARED BY:  
TRANSPORTATION RESEARCH CENTER INC.  
10820 State Route 347  
P.O. BOX B-67  
East Liberty, OH 43319



Test Date: July 10, 2019

FINAL REPORT

Alpha Technology Associate, Inc.  
2810 Old Lee Highway, Suite 120  
Fairfax, VA 22031

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-13-D-00311L, Alpha Technology PO 15GT153. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Prepared By: ILO Projects Operations Group

Approved By:   
John Shultz  
Project Manager

Approval Date: June 26, 2020

FINAL REPORT ACCEPTANCE BY:

Accepted By: \_\_\_\_\_

Acceptance Date: \_\_\_\_\_

**TECHNICAL REPORT DOCUMENTATION PAGE**

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4. <u>TITLE AND SUBTITLE</u> Final Report of New Car Assessment Program Side Air Bag Out-of-Position Testing of 2019 Cadillac XT4 SUV NHTSA No. M20190102TWG2		5. Report Date June 26, 2020	
		6. <u>PERFORMING ORGANIZATION CODE</u> TRC	
7. <u>AUTHOR(S)</u> John Shultz, Project Manager		8. <u>PERFORMING ORGANIZATION REPORT NO.</u> 190710-2	
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15. <u>SUPPLEMENTARY NOTES</u>			
16. <u>ABSTRACT</u> <p>A side air bag out of position test was conducted on the subject 2019 Cadillac XT4 SUV in accordance with the specifications of the Office of Crashworthiness Standards SAB OOP NCAP Laboratory Test Procedure for the generation of consumer information on vehicle side air bag protection. The test was conducted at the by Transportation Research Center Inc. in East Liberty, Ohio, on July 10, 2019.</p> <p>The curtain and torso side air bags were deployed and responses were measured on a SID-IIs. One real-time camera and three high speed cameras recorded the event. The ambient temperature at the time of air bag deployment was 21.5°C.</p>			
<b>Section 3.3.5.3 – SID-IIs – Position 2</b>			
<b>Measurement Description</b>	<b>Units</b>	<b>IARV</b>	<b>Result</b>
Head Injury Criteria (HIC15)	N/A	779	35
Nij	N/A	1	0.30
Upper Neck Tension	Newton	2070	105.1
Upper Neck Compression	Newton	2520	-875.9
Maximum Chest Compression	mm	34	
Maximum Chest Compression rate	m/sec	8.2	
17. <u>KEY WORDS</u> New Car Assessment Program Side Air Bag Out-of-position (OOP) Technical Working Group (TWG)		18. <u>DISTRIBUTION STATEMENT</u> Copies of this report are available from the following: Alpha Technology Associate, Inc. 2810 Old Lee Hwy, Suite 120 Fairfax, VA 22031 Phone: (703) 876-0010 FAX: (703) 876-0120 Attn: Steven Kim	
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## **SECTION 1 – TEST PURPOSE AND PROCEDURE**

This side air bag out-of-position test is part of the MY19 New Car Assessment Program (NCAP), sponsored by the National Highway Traffic Safety Administration (NHTSA), under contract number DTNH22-13-D-00311L. The purpose of this test is to obtain data on the performance of side air bags with an out-of-position occupant in a 2019 Cadillac XT4 SUV. The air bag test was conducted in accordance with the Office of Crashworthiness Standard's Laboratory Test Procedure, dated April 2018.

## SECTION 2 – SUMMARY OF TEST RESULTS

The effects of both a seat-mounted side air bag and a curtain air bag deployment in a 2019 Cadillac XT4 SUV on an out-of-position SID-IIs were evaluated. The test was performed by TRC on July 10, 2019. Pre and post-test photographs of the vehicle and ATD can be found in Appendix A.

The vehicle had previously undergone crash testing as part of the NCAP. After conducting the crash test and before conducting the air bag deployment test, the vehicle was inspected for damage. The vehicle was found to be in good condition to undergo the air bag deployment test.

One real-time camera and three high-speed cameras were used to record the air bag deployment event. High speed images were recorded at rates of 1,000 frames per second. Cameras were placed relative to the position 2 and were positioned to capture the deployment event from the side, the front, and the oblique views.

The SID-IIs was placed in the right front (passenger) seat situated inboard facing. This placement followed the ATD placement instructions in the NCAP Laboratory Test Procedure as well as the Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as prepared by the Side Airbag Out-of-Position Injury Technical Working Group (TWG). The specific test section was section 3.3.5.3.

The SID-IIs was instrumented with head X, Y, and Z accelerometers, a six-axis upper neck load cell, and a six-axis lower neck load cell. During the air bag deployment, a total of twenty-two channels of data were recorded using an on-board data acquisition system. Appendix B contains the ATD response data traces and Appendix C contains the instrumentation list and calibration information. Appendix D contains the dummy's pre-test qualification performance verification data.

No Injury Reference Values were exceeded during the test. The occupant data is summarized below:

Measurement Description	Units	Passenger ATD SID-IIs	
		IARV	Result
Head Injury Criteria (HIC15)	N/A	779	35
Nij	N/A	1	0.30
Upper Neck Tension	N	2070	105.1
Upper Neck Compression	N	2520	-875.9
Thorax Compression	mm	34	
Thorax Compression rate	m/sec	8.2	

### SECTION 3 DATA SHEET

#### DATA SHEET NO. 1 TEST SUMMARY

Test Vehicle: 2019 Cadillac XT4 SUV  
Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
Test Date: 7/10/2019

#### TEST SUMMARY

##### TEST CONFIGURATION INFORMATION

Seating Position:	P2	Right Front Seating Position
Test Section:	3.3.5.3	Roof-Rail-Mounted, Inboard Facing
Airbag 1:	Seat	Seat mounted – outside seam
Airbag 2:	Side Rail	Side curtain airbag
Booster Block:	N/A	N/A
ATD Type/Serial No.:	SID-IIs	DI8818
Vehicle	Cadillac	XT4
Previous Crash Test	MDB	2/21/2019 and M20190102

##### EQUIPMENT INFORMATION

Number of Data Channels	22
Number of High Speed Video Cameras	3
Number of Real Time Video Cameras	1

##### VISIBLE DUMMY CONTACT POINTS

Head	None Visible
Upper Torso	None Visible
Lower Torso	None Visible
Knee	None Visible

**DATA SHEET NO. 2  
GENERAL TEST AND VEHICLE PARAMETER DATA**

Test Vehicle: 2019 Cadillac XT4 SUV  
Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
Test Date: 7/10/2019

**TEST CONFIGURATION INFORMATION**

NHTSA No.	M20190102
Model Year	2019
Make	Cadillac
Model	XT4
Body Style	MPV
VIN	1GYAZAR45KF122319
Body Color	Radiant Silver Metallic
Odometer Reading (km/mi)	128 mi
Engine Displacement (L)	2.0
Type/No. Cylinders	Gas/4
Engine Placement	Front Transverse
Transmission Type	Automatic
Transmission Speeds	9
Overdrive	Yes
Final Drive	FWD
Roof Rack	No
Sunroof/T-Top	No
Running Boards	No
Tilt Steering Wheel	Yes
Power Seats	Yes
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	No
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	Yes
Rear Pass. Curtain Airbag	Yes
Rear Pass. Head/Torso Airbag	No
Rear Pass. Torso Airbag	No
Rear Pass. Torso/Pelvis Airbag	No
Rear Passenger Pelvis Airbag	No
Driver Seat Belt Pretensioner	Yes
Rear Pass. Seat Belt Pretensioner	No
Driver Load Limiter	Yes
Rear Passenger Load Limiter	No
Other Safety Restraint	No

**DATA FROM CERTIFICATION LABEL**

Manufactured By	GENERAL MOTORS LLC
Date of Manufacture	10/18
Vehicle Type	MPV

GVWR (kg)	2250
GAWR Front (kg)	1220
GAWR Rear (kg)	1200

**VEHICLE SEATING AND CAPACITY WEIGHT INFORMATION**

Measured Parameter	Front	Rear	Third	Total	
Designated Seating Capacity (DSC)	2	3	N/A	5	
Capacity Weight (VCW) (kg)				511.0	(A)
DSC x 68.04 (kg)				340.2	(B)
Cargo Weight (RCLW) (kg)				170.8	(A-B)

**VEHICLE SEAT TYPE**

Seating Location	Type of Seat Pan				Type of Seat Back		
	Bucket	Bench	Split Bench	Contoured	Fixed	Adjustable	
						w/ Lever	w/ Knob
Front Seat	Yes	N/A	N/A		N/A	N/A	Yes
Rear or Second Row Seat	N/A	N/A	Yes	Yes	Yes	N/A	N/A
Third Row Seat	N/A	N/A	N/A	N/A	N/A	N/A	N/A



**DATA SHEET NO. 3**  
**SEAT ADJUSTMENT DATA**

Test Vehicle: 2019 Cadillac XT4 SUV  
Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
Test Date: 7/10/2019

**VEHICLE SEAT FORE/AFT POSITION**

Seat Location	Total Fore/Aft Travel		Test Position from Forwardmost Position	
	mm	# Detents	mm	# Detents
Front Right	240	N/A	0	N/A
Rear Right	N/A	N/A	N/A	N/A

Seat Fore/Aft Position Per TWG Guidelines	Full forward
Reason for Deviation from TWG Guidelines	No deviations

**VEHICLE SEAT BACK ANGLE ADJUSTMENT**

Seat Location	Total Seat Back Angle Range		Test Position from Most Upright (Vertical)	
	Degrees	# Detents	Degrees	# Detents
Front Right	65.4	N/A	-8.9	N/A
Rear Right	N/A	N/A	N/A	N/A

OEM Back Angle Design Position	-8.9 degrees on headrest upper rod
Method of Measuring Back Angle Position	Inclineometer at headrest post
Seat Back Angle Position Per TWG Guidelines	Manufacturer's design angle
Reason for Deviation from TWG Guidelines	No deviations

**VEHICLE SEAT HEIGHT ADJUSTMENT**

Seat Location	Total Height Adjustment Range		Test Position from Lowest Position	
	mm	# Detents	mm	# Detents
Front Right	51	N/A	51	N/A
Rear Right	Fixed	N/A	N/A	N/A

Seat Height Adjustment Per TWG Guidelines	Highest position
Reason for Deviation from TWG Guidelines	No deviations

**DATA SHEET NO. 4  
DUMMY SETUP AND POSITIONING DATA**

Test Vehicle: 2019 Cadillac XT4 SUV  
 Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
 Test Date: 7/10/2019

**DUMMY INFORMATION**

ATD Type	SID-IIs
Serial Number	DI8818
Qualification Date	June 26, 2019
Qualification Type	Partial
Clothing	Cotton shirt and shoes
Other ATD Prep	Electrical tape on skull cap seam, baby power on head

**DUMMY POSITIONING INFORMATION**

TWG Setup Instructions	As specified in the 3.3.5.3 Test Procedure; Seat is adjusted to its highest position; ATD positioned to 3.3.5.3.1
Actual Setup	<p>The vehicle seat height adjustment is set to full up. The seat track is set to the full forward position in order to minimize the vertical distance between the dummy head and the roof rail airbag. The seat back angle set as close as possible to the design position as called out in the Form 1.</p> <p>The dummy's skull cap is powdered and the seam is taped. The dummy is facing toward the center of the vehicle with its back in contact with the vehicle's arm rest. The head CG is directly under the projected deployment trajectory of the side curtain airbag. The head is neither in flexion or extension in this position.</p>

**DATA SHEET NO. 5**  
**DUMMY INJURY CRITERIA DATA**

Test Vehicle: 2019 Cadillac XT4 SUV  
Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
Test Date: 7/10/2019

**RECORDED DATA - MINIMUMS AND MAXIMUMS**

Channel	Unit	CFC	Maximum	Time (ms)	Minimum	Time (ms)
Head X	G	1000	30.26	26.80	-2.96	292.96
Head Y	G	1000	14.16	32.88	-20.87	8.72
Head Z	G	1000	18.07	7.44	-6.72	13.68
Head Resultant	G	1000	33.35	26.88		
Head Red X	G	1000	31.15	26.80	-3.18	295.04
Head Red Y	G	1000	14.73	32.80	-21.28	8.64
Head Red Z	G	1000	17.92	7.44	-7.68	13.68
Head Red Resultant	G	1000	34.27	27.04		
Upper Neck X	N	1000	53.62	25.28	-179.65	16.48
Upper Neck Y	N	1000	430.87	22.40	-73.46	145.28
Upper Neck Z	N	1000	105.13	96.24	-875.85	11.20
Upper Neck Resultant	N	1000	888.13	11.20		
Upper Neck X	Nm	600	26.53	17.20	-11.79	52.72
Upper Neck Y	Nm	600	8.48	23.52	-13.60	39.52
Upper Neck Z	Nm	600	5.08	158.56	-6.27	84.40
Upper Neck Resultant	Nm	600	28.86	17.04		
Lower Neck X	N	1000	138.92	12.88	-242.13	21.44
Lower Neck Y	N	1000	424.93	15.76	-91.89	282.96
Lower Neck Z	N	1000	94.61	238.72	-752.92	13.04
Lower Neck Resultant	N	1000	811.16	13.04		
Lower Neck X	Nm	600	17.84	146.32	-49.12	37.44
Lower Neck Y	Nm	600	41.67	13.04	-8.72	51.52
Lower Neck Z	Nm	600	20.42	15.84	-7.06	79.60
Lower Neck Resultant	Nm	600	54.35	33.92		

**HEAD INJURY SUMMARY**

HIC15	T1 (ms)	T2 (ms)	HIC36	T1 (ms)	T2 (ms)
35	19.04	34.08	38	18.24	39.52

**DATA SHEET NO. 5  
DUMMY INJURY CRITERIA DATA (CONTINUED)**

Test Vehicle: 2019 Cadillac XT4 SUV  
 Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
 Test Date: 7/10/2019

**NECK INJURY SUMMARY**

Injury Criteria	Value	Time (ms)
Upper Neck NTF	0.05	115.92
Upper Neck NTE	0.19	49.60
Upper Neck NCF	0.21	22.96
Upper Neck NCE	0.30	34.08
Peak Tension <sup>1</sup>	105.13	96.24
Peak Compression	-875.85	11.20

**CHEST INJURY SUMMARY**

Injury Criteria	Value	Time (ms)
[Chest/Rib] Deflection		
Deflection Rate <sup>1</sup>		

<sup>1</sup>[Describe deflection rate calculation method]

**RESEARCH INJURY SUMMARY**

Research Injury Criteria <sup>2</sup>	Value	Time (ms)
Upper Neck Lateral Moment		
Upper Neck Twist Moment		
Lower Neck Flexion Moment		
Lower Neck Extension Moment		
Lower Neck Lateral Moment		
Lower Neck Twist Moment		
Lower Neck Tension		
Lower Neck Compression		
Spine Acceleration		

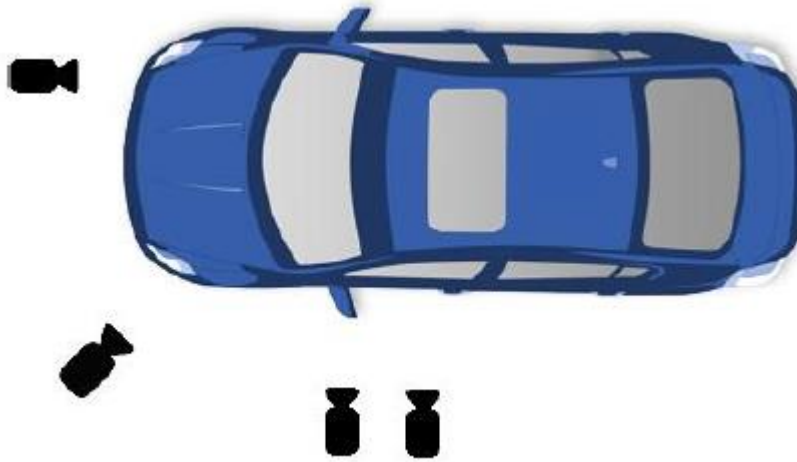
<sup>2</sup>These injury criteria are only monitored and not considered pass/fail

**DATA SHEET NO. 6  
CAMERA SETUP AND DESCRIPTION**

Test Vehicle: 2019 Cadillac XT4 SUV  
 Test Program: Side Air Bag Out-of-Position Test

NHTSA No.: M20190102TWG2  
 Test Date: 7/10/2019

**CAMERA SETUP DIAGRAM FOR SAB OOP TESTS**



No.	Camera View	Location (mm) <sup>1</sup>			Lens (mm)	Speed (fps)
		X	Y	Z		
1	Left View	0	-2589	-1236	20	1000
2	Oblique View	2311	-1723	-1500	28	1000
3	Front View	2247	271	-1623	50	1000
4	Real Time	-172	-2713	-1159	Zoom	30

<sup>1</sup> +X forward of vehicle, +Y right of vehicle, +Z into ground

**APPENDIX A**  
**PHOTOGRAPHS**

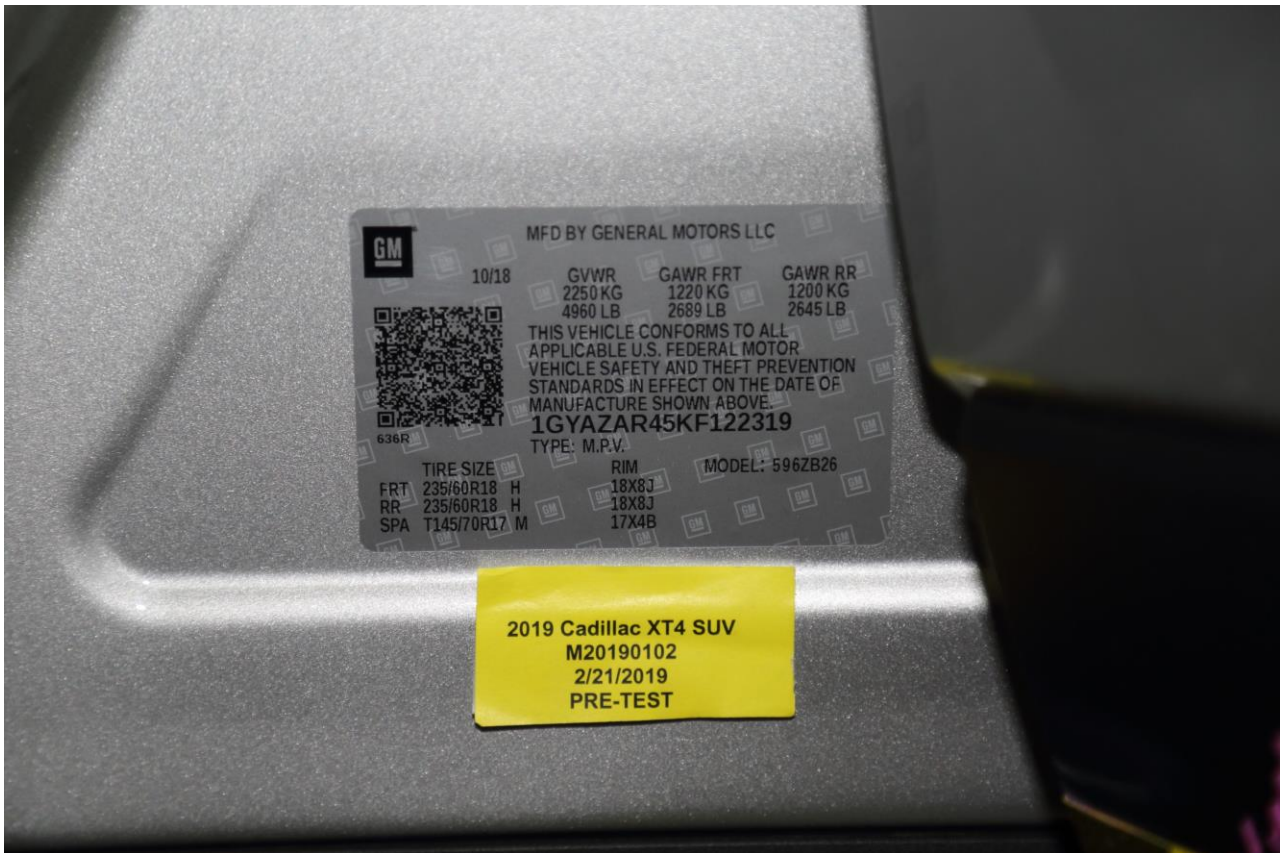
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**Figure A-1 Right Front 3/4 View of Test Vehicle as Delivered**

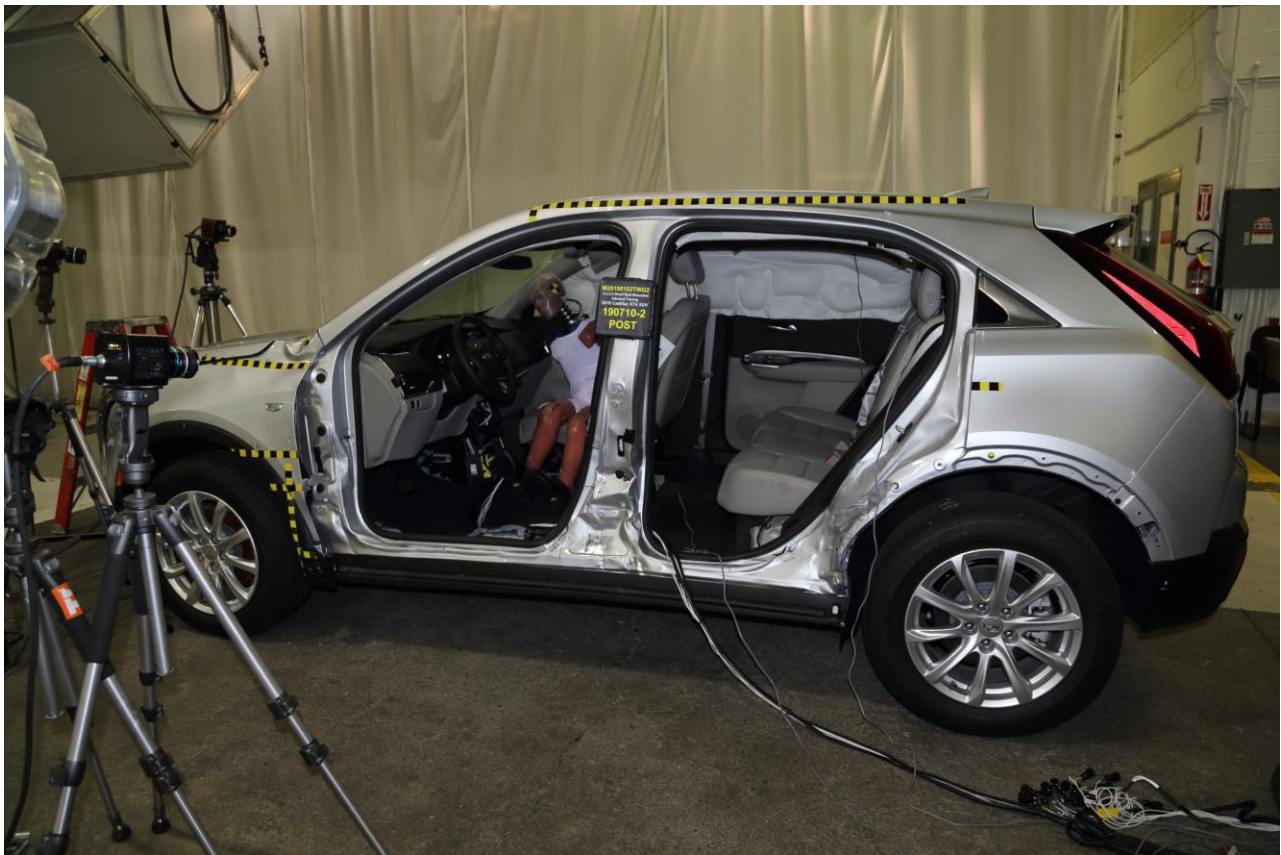


**Figure A-2 Vehicle Certification Label**





**Figure A-3 Pre-Test Vehicle Left Side View**



**Figure A-4 Post-Test Vehicle Left Side View**



**Figure A-5 Pre-Test Vehicle Location of Air Bag 1**



**Figure A-6 Pre-Test Vehicle Location of Air Bag 2**





Figure A-7 Pre-Test Vehicle Location of Air Bag 3



Figure A-8 Pre-Test Vehicle Seat Back Angle



Figure A-9 Pre-Test Dummy Left Side View



Figure A-10 Post-Test Dummy Left Side View





Figure A-11 Pre-Test Dummy Left Side Close-up View



Figure A-12 Post-Test Dummy Left Side Close-up View



Figure A-13 Pre-Test Dummy Left  $\frac{3}{4}$  Front View



Figure A-14 Post-Test Dummy Left  $\frac{3}{4}$  Front View





Figure A-15 Pre-Test Dummy Left  $\frac{3}{4}$  Front Close-up View



Figure A-16 Post-Test Dummy Left  $\frac{3}{4}$  Front Close-up View



**Figure A-17 Pre-Test Dummy Front View**



**Figure A-18 Post-Test Dummy Front View**





Figure A-19 Pre-Test Dummy Front Close-up View



Figure A-20 Post-Test Dummy Front Close-up View



**Figure A-21 Pre-Test Dummy Right ¾ Front View**



**Figure A-22 Post-Test Dummy Right ¾ Front View**





Figure A-23 Pre-Test Dummy Right Side Front View



Figure A-24 Post-Test Dummy Right Side Front View



Figure A-25 Post-Test Dummy Right Side Front View



Figure A-26 Post-Test Curtain Air Bag Left Side View





Figure A-27 Post-Test Curtain Air Bag Left ¾ Front View



Figure A-28 Post-Test Curtain Air Bag Front View



**Figure A-29 Post-Test Curtain Air Bag Right Side View**

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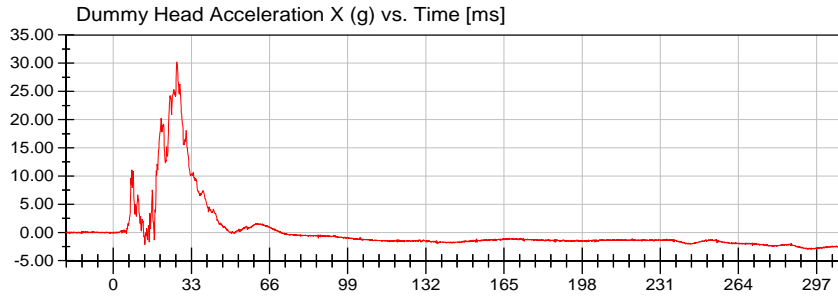
# Alpha Technology

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)



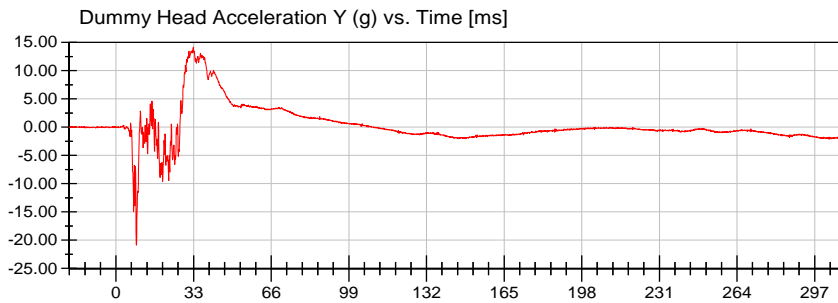
**<Max>**

30.26 g at 26.80 ms

**<Min>**

-2.96 g at 292.96 ms

CFC\_1000



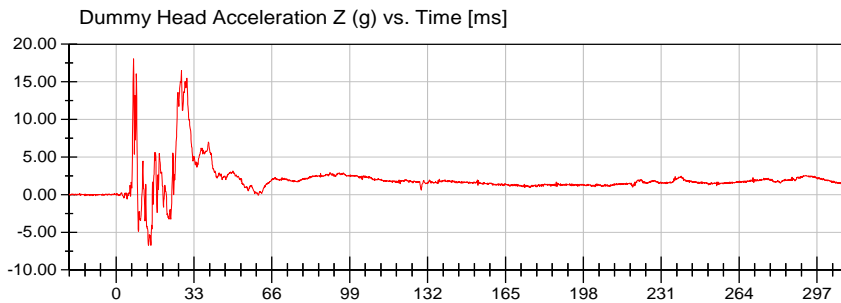
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14.16 g at 32.88 ms

**<Min>**

-20.87 g at 8.72 ms

CFC\_1000



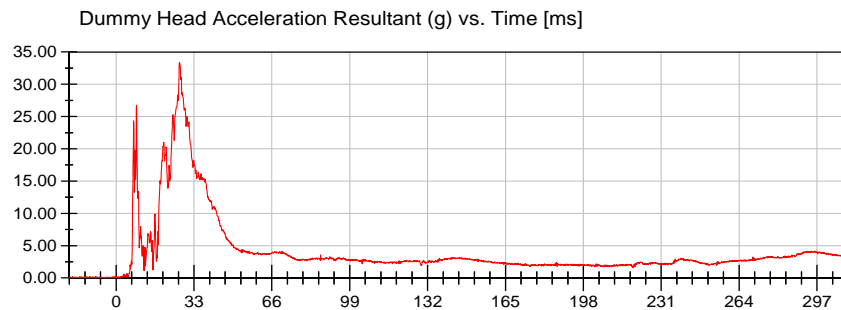
**<Max>**

18.07 g at 7.44 ms

**<Min>**

-6.72 g at 13.68 ms

CFC\_1000



**<Max>**

33.35 g at 26.88 ms

**<Min>**

0.04 g at -19.52 ms

CFC\_1000



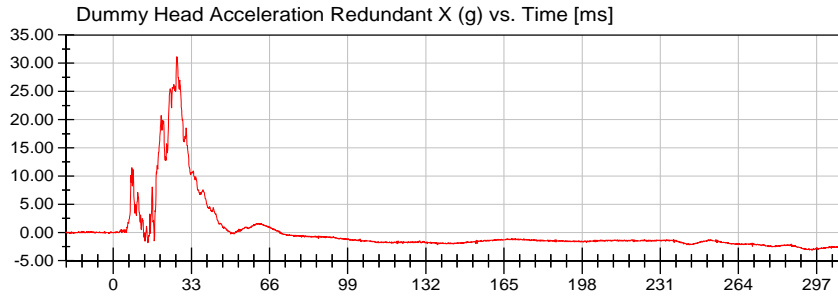
# Alpha Technology

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)



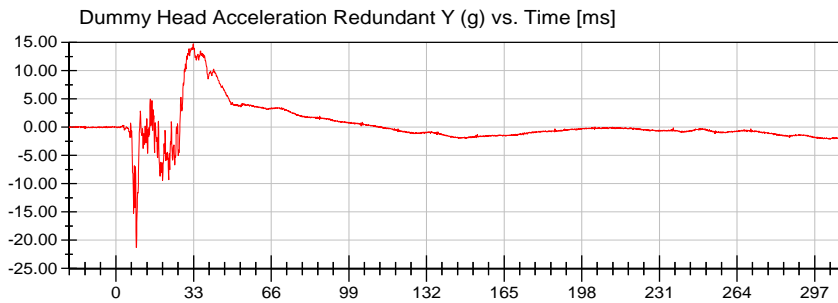
**<Max>**

31.14 g at 26.80 ms

**<Min>**

-3.18 g at 295.04 ms

CFC\_1000



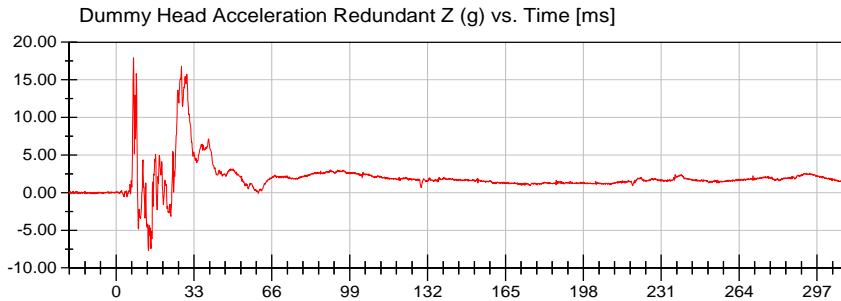
**<Max>**

14.73 g at 32.80 ms

**<Min>**

-21.28 g at 8.64 ms

CFC\_1000



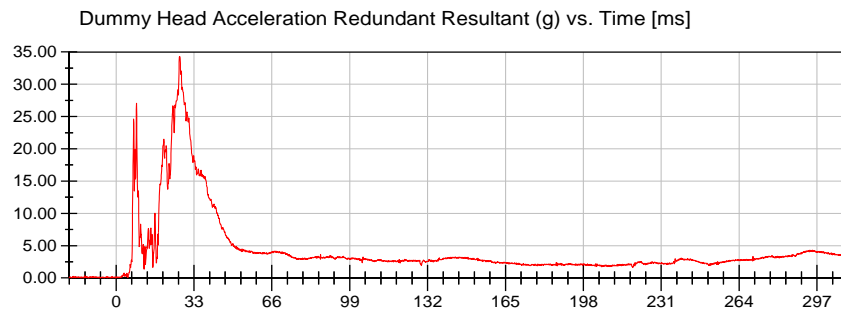
**<Max>**

17.92 g at 7.44 ms

**<Min>**

-7.68 g at 13.68 ms

CFC\_1000



**<Max>**

34.27 g at 27.04 ms

**<Min>**

0.02 g at -18.96 ms

CFC\_1000



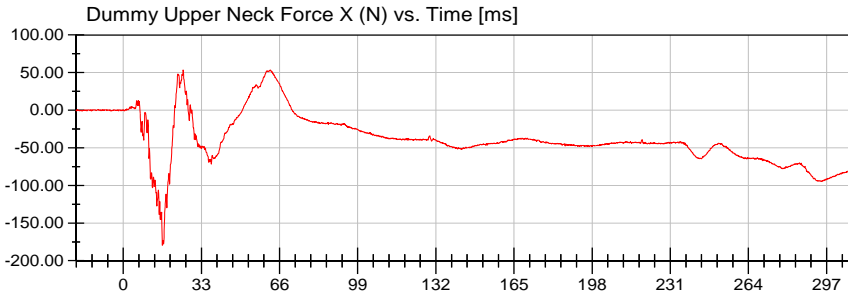
# Alpha Technology

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019



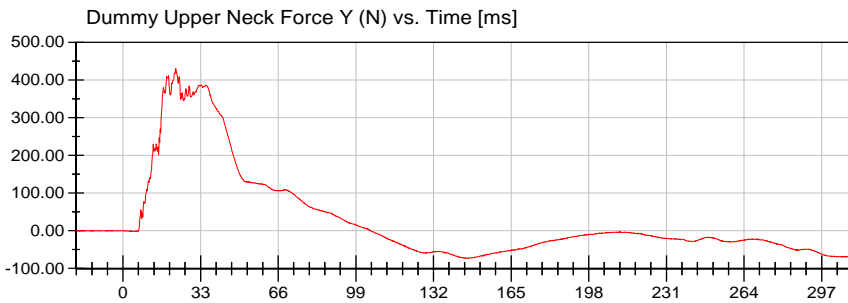
**<Max>**

53.62 N at 25.28 ms

**<Min>**

-179.65 N at 16.48 ms

CFC\_1000



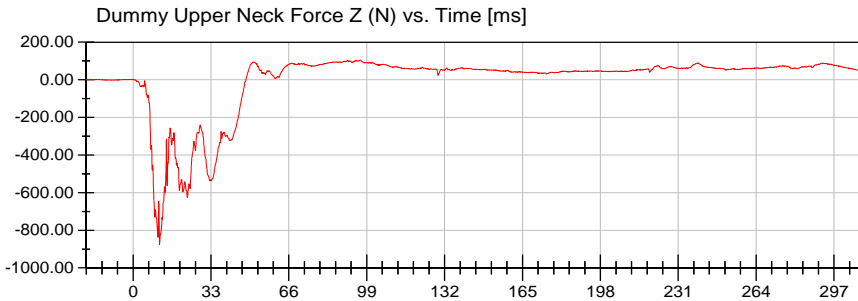
**<Max>**

430.87 N at 22.40 ms

**<Min>**

-73.46 N at 145.28 ms

CFC\_1000



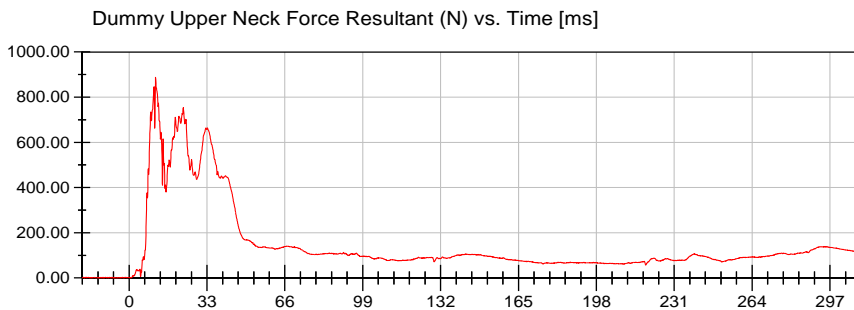
**<Max>**

105.13 N at 96.24 ms

**<Min>**

-875.85 N at 11.20 ms

CFC\_1000



**<Max>**

888.13 N at 11.20 ms

**<Min>**

0.15 N at -14.08 ms

CFC\_1000



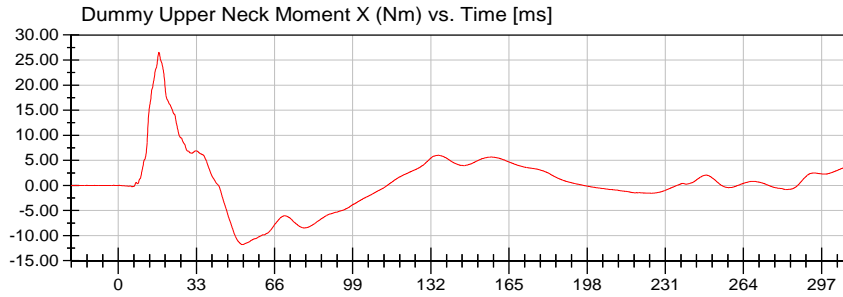
# Alpha Technology

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019



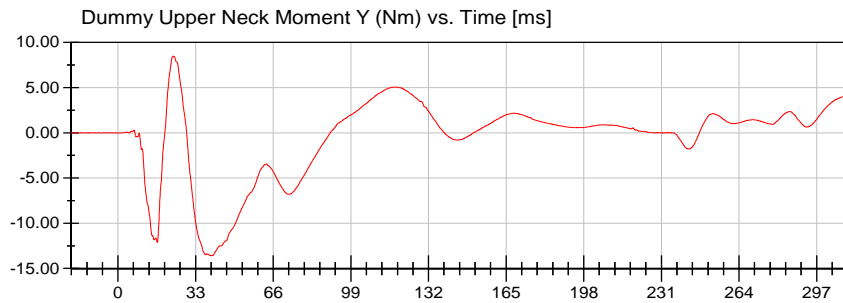
**<Max>**

26.53 Nm at 17.20 ms

**<Min>**

-11.79 Nm at 52.72 ms

CFC\_600



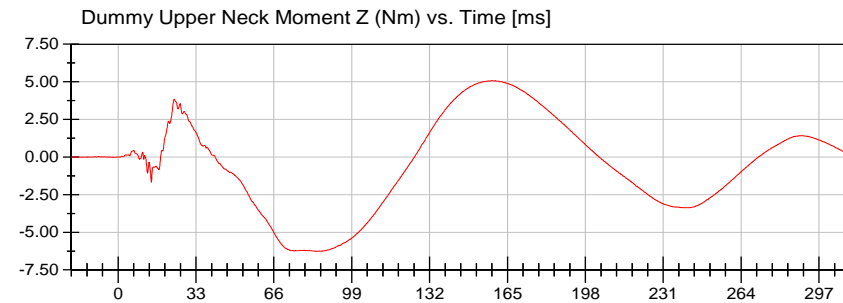
**<Max>**

8.48 Nm at 23.52 ms

**<Min>**

-13.60 Nm at 39.52 ms

CFC\_600



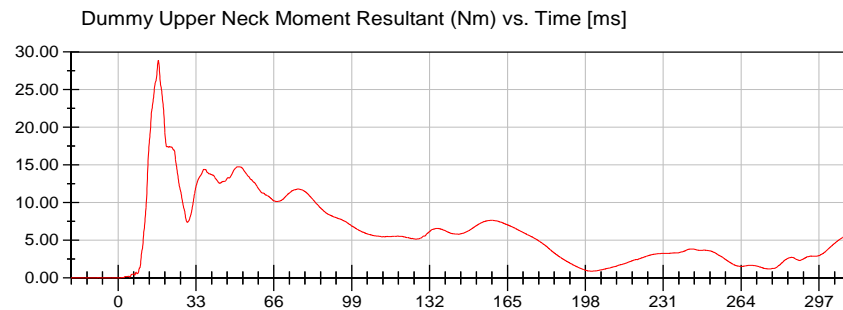
**<Max>**

5.08 Nm at 158.56 ms

**<Min>**

-6.27 Nm at 84.40 ms

CFC\_600



**<Max>**

28.85 Nm at 17.04 ms

**<Min>**

0.00 Nm at -3.44 ms

CFC\_600



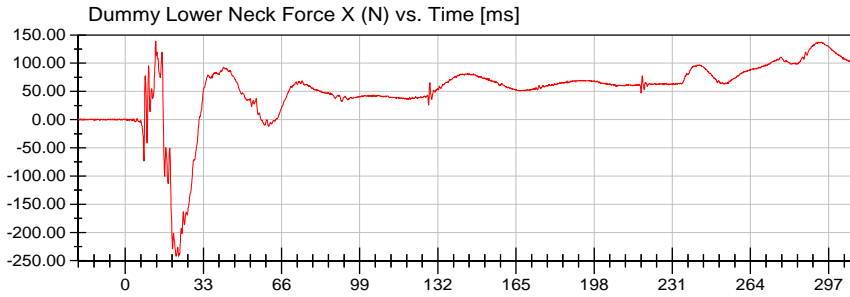
# Alpha Technology

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019



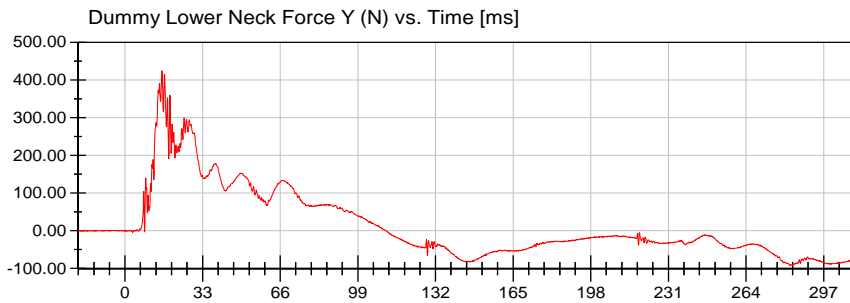
**<Max>**

138.92 N at 12.88 ms

**<Min>**

-242.13 N at 21.44 ms

CFC\_1000



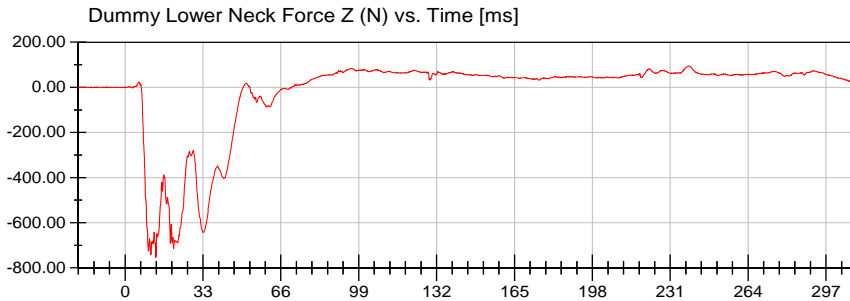
**<Max>**

424.93 N at 15.76 ms

**<Min>**

-91.89 N at 282.96 ms

CFC\_1000



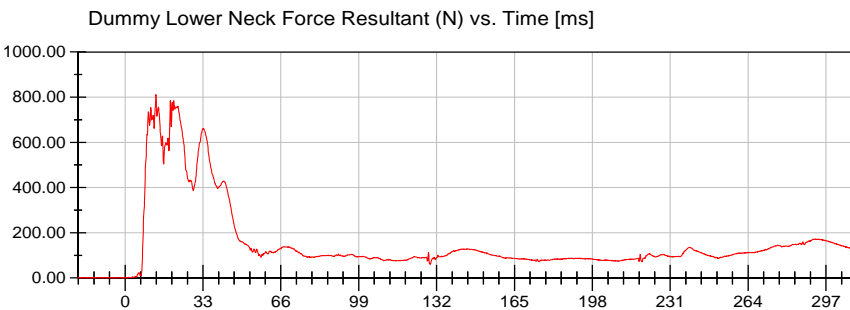
**<Max>**

94.61 N at 238.72 ms

**<Min>**

-752.92 N at 13.04 ms

CFC\_1000



**<Max>**

811.15 N at 13.04 ms

**<Min>**

0.12 N at -13.52 ms

CFC\_1000



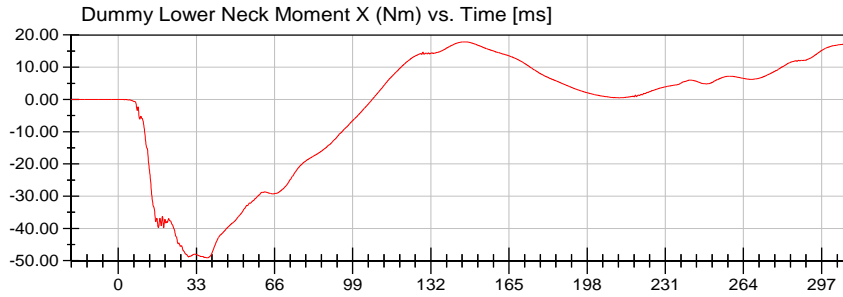
# Alpha Technology

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)



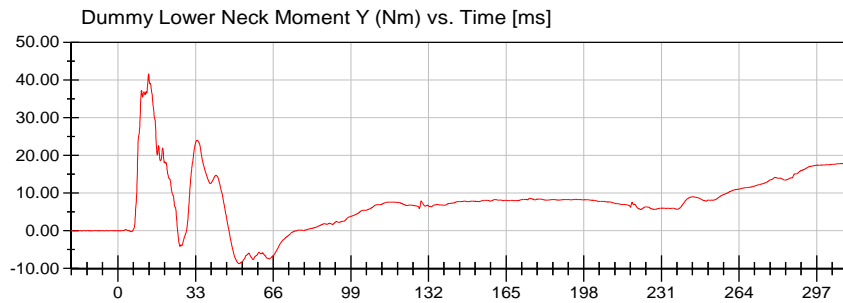
**<Max>**

17.84 Nm at 146.32 ms

**<Min>**

-49.12 Nm at 37.44 ms

CFC\_600



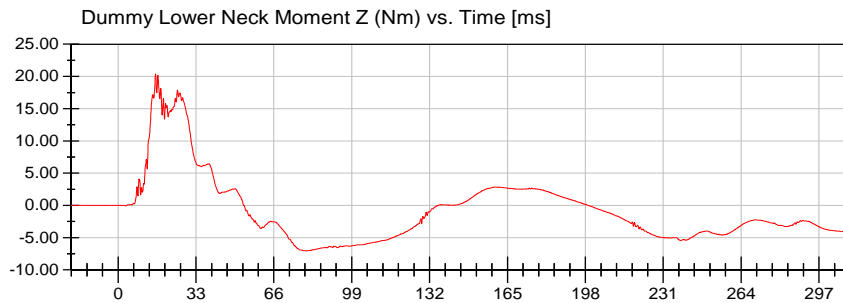
**<Max>**

41.67 Nm at 13.04 ms

**<Min>**

-8.72 Nm at 51.52 ms

CFC\_600



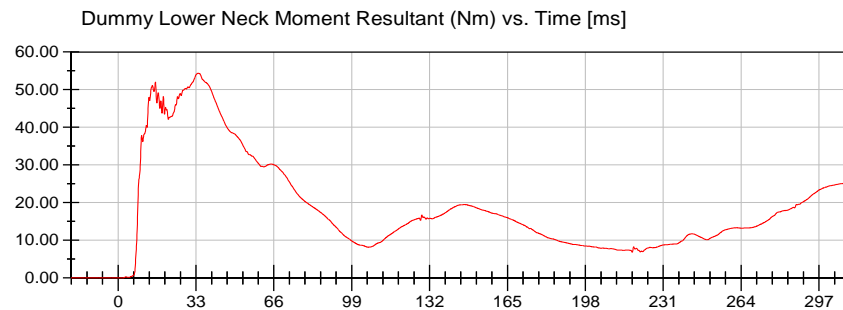
**<Max>**

20.41 Nm at 15.84 ms

**<Min>**

-7.06 Nm at 79.60 ms

CFC\_600



**<Max>**

54.35 Nm at 33.92 ms

**<Min>**

0.00 Nm at -1.20 ms

CFC\_600





# 2019 Cadillac XT4 SUV TWG OOP Test 3.3.5.3

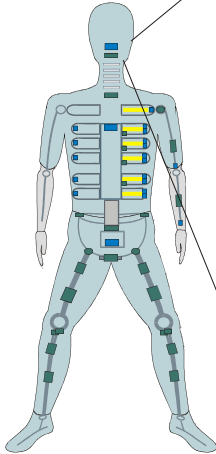
Date: 07/10/2019  
Time: 13:23

## Neck Injury Predictor (NIJ)

**Customer: Alpha Technology**  
**Test Number: M20190102TWG2**

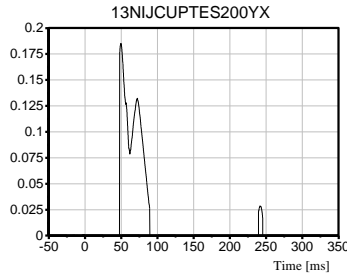
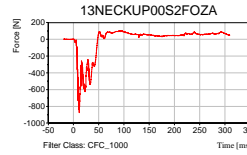
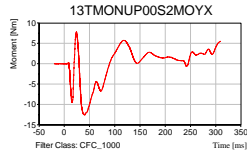
Test Orientation = Frontal  
Fzc(Tension) = 3880  
Fzc(Compression) = 3880  
Myc(Extension) = 61  
Myc(Flexion) = 155

**TRC Inc. Test Lab: CTF**  
**Test Number: 190710-2**

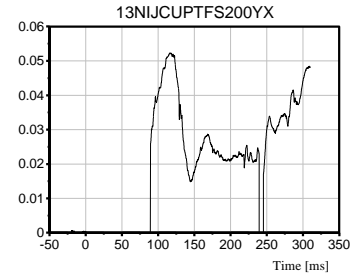


Dummy: SID IIs  
Seating Position:  
Right Front Passenger

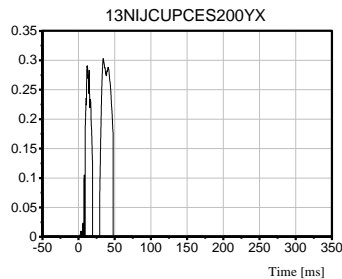
NIJ Source Code: (Fz/Fzc)+(Myc/Myc)



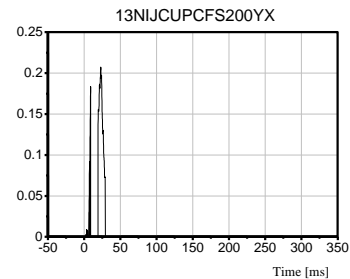
**Max [NTE] 0.1853 at 49.60 ms**



**Max [NTF] 0.0523 at 115.92 ms**



**Max [NCE] 0.3031 at 34.08 ms**



**Max [NCF] 0.2075 at 22.96 ms**

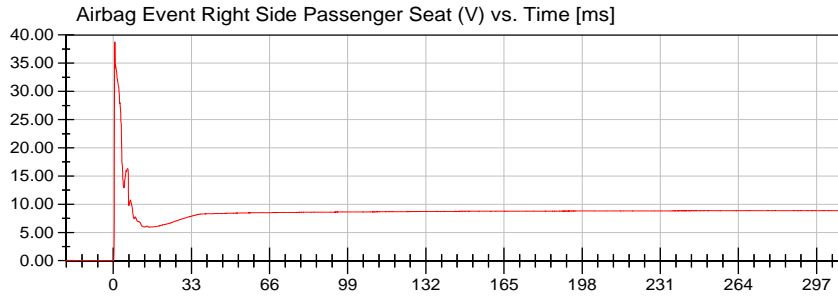
# Alpha Technology

Test Lab: CTF

Test Number: 190710-2 (M20190102TWG2)

Position #2 SID IIs Dummy (13S2)

Test Date: 07/10/2019



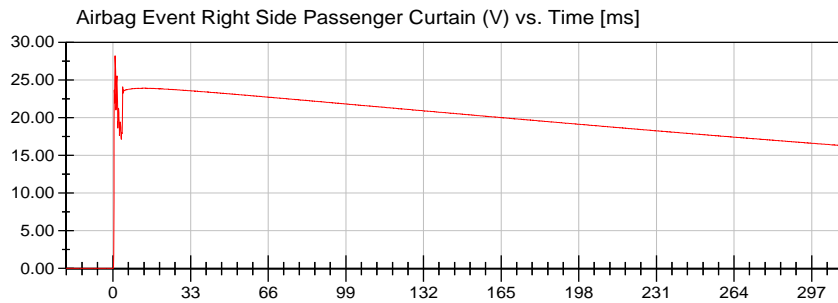
**<Max>**

38.77 V at 0.64 ms

**<Min>**

0.00 V at -20.00 ms

Unfiltered



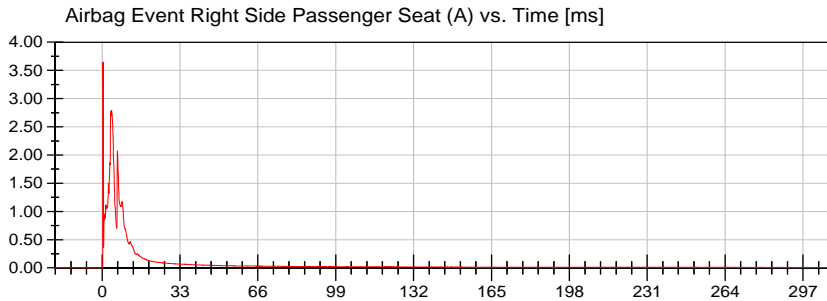
**<Max>**

28.23 V at 0.88 ms

**<Min>**

0.00 V at -20.00 ms

Unfiltered



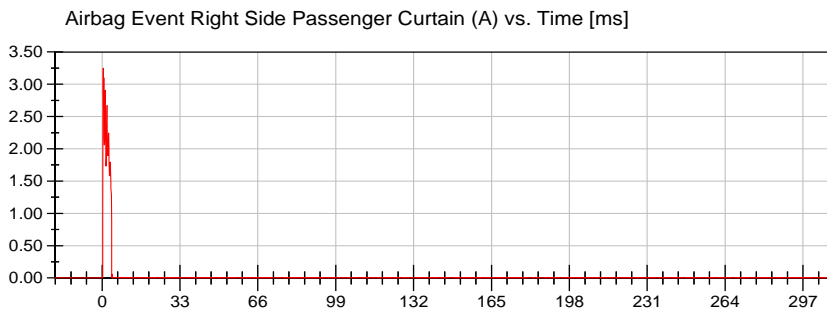
**<Max>**

3.65 A at 0.40 ms

**<Min>**

0.00 A at -20.00 ms

Unfiltered



**<Max>**

3.25 A at 0.48 ms

**<Min>**

0.00 A at -20.00 ms

Unfiltered





**APPENDIX C**  
**DUMMY QUALIFICATION DATA**

**Pre-Test Calibration Sheets**  
**Passenger S/N DI8818**

## Transportation Research Center Inc.

Right Lateral Head Drop  
SID IIs Serial No. DI8818 Certification No. 27-1  
Test Date: 6/26/2019

Test Parameter	Specification	Test Results	Pass
Temperature	18.9 - 25.6 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	58 %	Yes
Peak Head Resultant Acceleration	115 - 137 g	129.5 g	Yes
Peak Head Longitudinal Acceleration	(-15) - 15 g	-5.0 g	Yes
Is Head Resultant Acceleration Curve Unimodal within 15% of Peak?	< 15 %	1.40 %	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

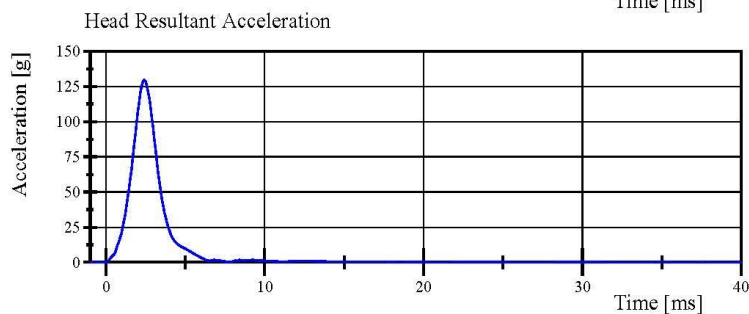
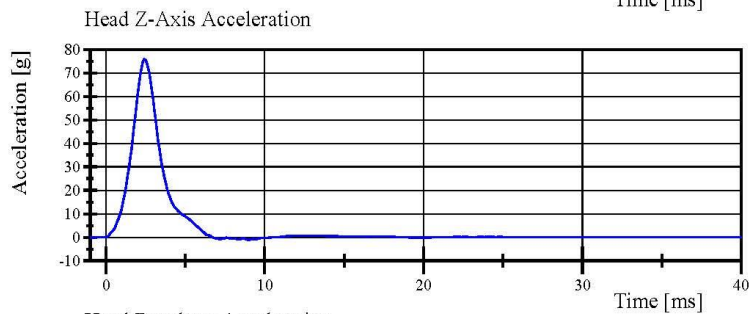
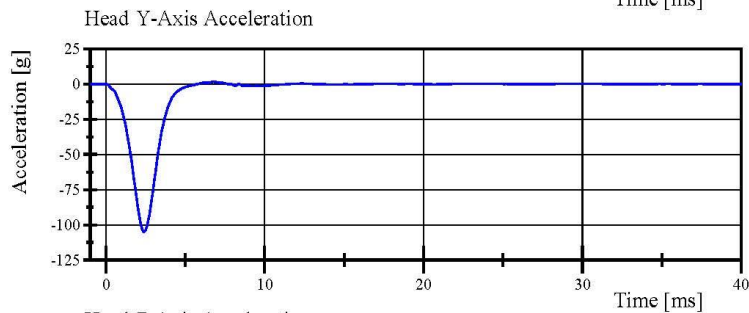
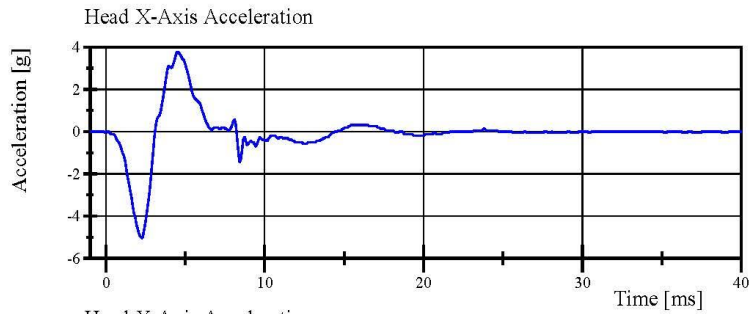
**Head Skin S/N: DI6457**

# Transportation Research Center Inc.

Right Lateral Head Drop

SID IIs Serial No. DI8818 Certification No. 27-1

Test Date: 6/26/2019



Specification Source: CFR49 Part 572 Subpart V  
with Polarity in accordance with J211

06.26.2019 09:23:06 199



## Transportation Research Center Inc.

Right Lateral Neck  
SID IIs Serial No. DI8818 Certification No. 27-1  
Test Date: 6/26/2019

Test Parameter	Specification	Test Results	Pass
Temperature	20.6 - 22.2 °C	20.8 °C	Yes
Relative Humidity	10 - 70 %	59 %	Yes
Pendulum Velocity	5.51 - 5.63 m/s	5.581 m/s	Yes
Pendulum Integrated Velocity			
Change at 10 ms	(-2.20) - (-2.80) m/s	-2.447 m/s	Yes
Change at 15 ms	(-3.30) - (-4.10) m/s	-3.626 m/s	Yes
Change at 20 ms	(-4.40) - (-5.40) m/s	-4.902 m/s	Yes
Change at 25 ms	(-5.40) - (-6.10) m/s	-5.905 m/s	Yes
Change at 25 to 100 ms	(-5.50) - (-6.20) m/s	-6.078 m/s	Yes
Maximum Headform Flexion occurring between 50ms and 70ms.			
Peak	71 - 81 deg	71.3 deg	Yes
Time of Peak	50 - 70 ms	62.2 ms	Yes
Total Neck Occipital Condyles Moment	(-36) - (-44) N·m	-39.0 N·m	Yes
Total Neck Occipital Condyles Moment Decay Time to 0 N·m	102 - 126 ms	121.6 ms	Yes

**Test meets specifications.**

**Condition: Used**

**Comments:**

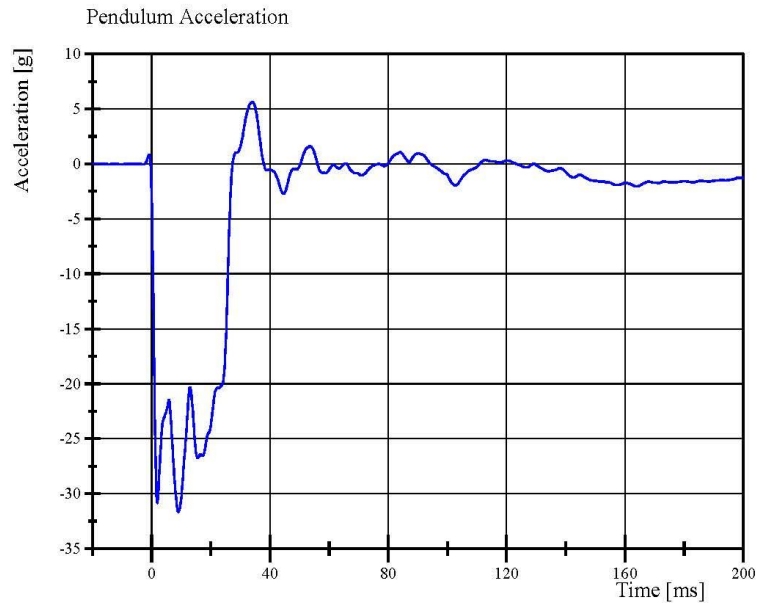
**Neck S/N: DJ1259**

# Transportation Research Center Inc.

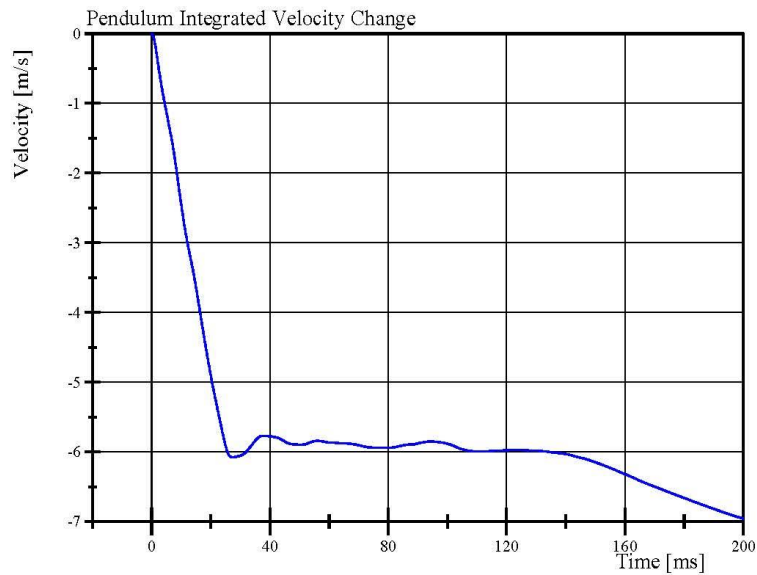
Right Lateral Neck

SID IIs Serial No. DI8818 Certification No. 27-1

Test Date: 6/26/2019



Filter Class: CFC\_180  
Max: 5.6 g at 34.0 ms  
Min: -31.6 g at 9.0 ms



Filter Class: CFC\_180  
Max: 0.0 m/s at 0.0 ms  
Min: -7.0 m/s at 200.0 ms

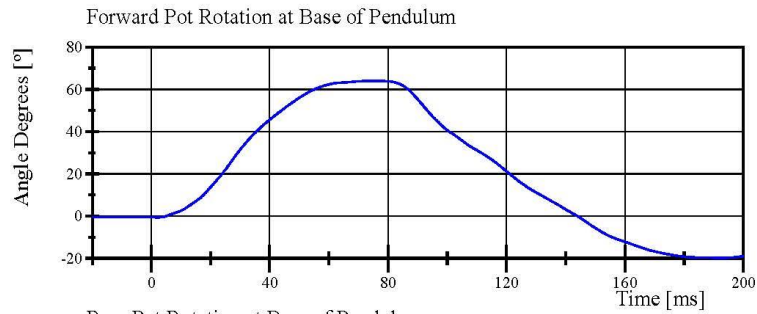
Specification Source: CFR49 Part 572 Subpart V  
with Polarity in accordance with J211

06.26.2019 10:30:42 719

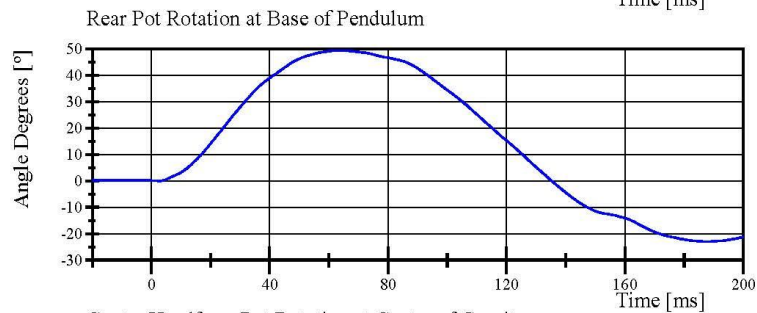


# Transportation Research Center Inc.

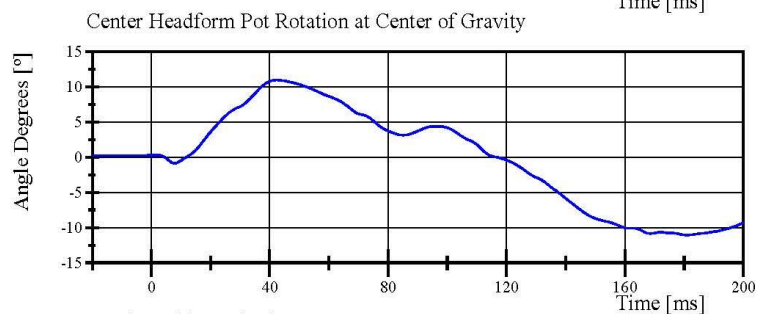
Right Lateral Neck  
SID IIs Serial No. DI8818 Certification No. 27-1  
Test Date: 6/26/2019



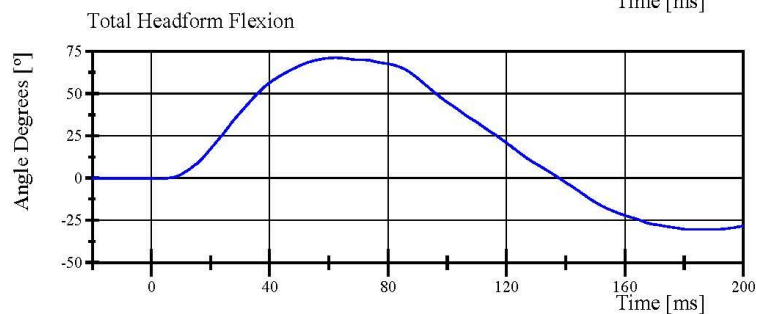
Filter Class: CFC\_60  
Max: 64.1 ° at 73.4 ms  
Min: -19.8 ° at 192.3 ms



Filter Class: CFC\_60  
Max: 49.3 ° at 63.6 ms  
Min: -23.0 ° at 187.6 ms



Filter Class: CFC\_60  
Max: 11.0 ° at 42.4 ms  
Min: -11.1 ° at 180.9 ms



Filter Class: CFC\_60  
Max: 71.3 ° at 62.2 ms  
Min: -30.4 ° at 182.2 ms

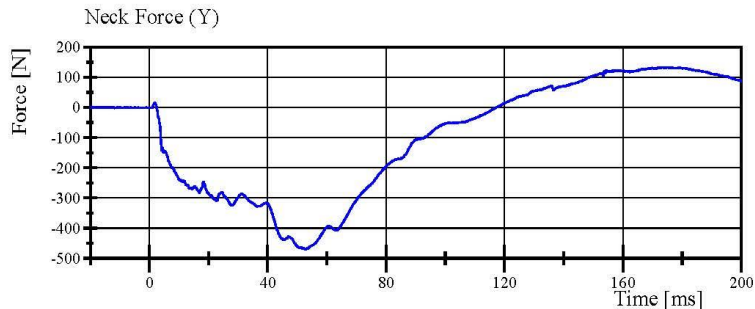
Specification Source: CFR49 Part 572 Subpart V  
with Polarity in accordance with J211

06.26.2019 10:30:43 719

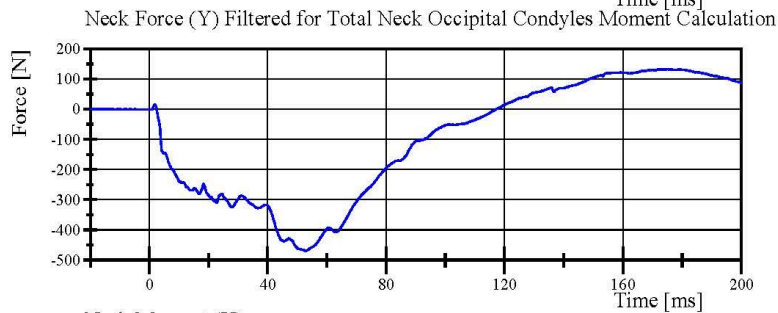


# Transportation Research Center Inc.

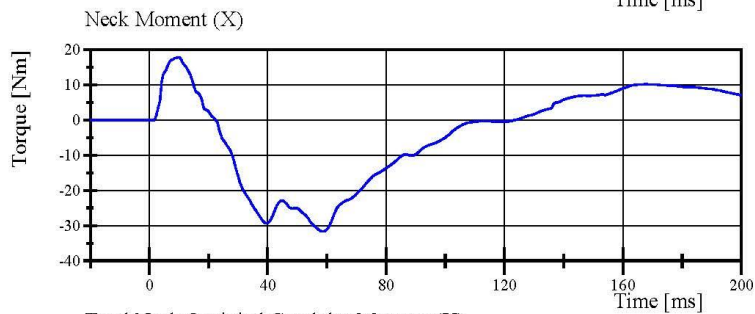
Right Lateral Neck  
SID IIs Serial No. DI8818 Certification No. 27-1  
Test Date: 6/26/2019



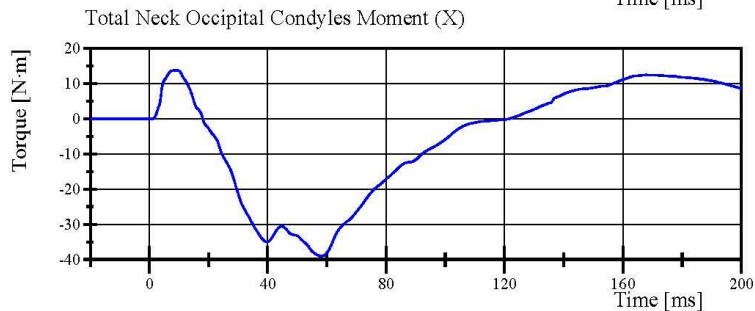
Filter Class: CFC\_1000  
Max: 134.4 N at 175.0 ms  
Min: -469.4 N at 52.9 ms



Filter Class: CFC\_600  
Max: 133.9 N at 175.0 ms  
Min: -468.8 N at 52.9 ms



Filter Class: CFC\_600  
Max: 17.9 Nm at 10.0 ms  
Min: -31.6 Nm at 58.6 ms



Filter Class: Without\_(Consta  
Max: 13.8 N·m at 8.6 ms  
Min: -39.0 N·m at 58.1 ms

Specification Source: CFR49 Part 572 Subpart V  
with Polarity in accordance with J211

06.26.2019 10:30:44 719





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

			<b>Serial Number</b>	<b>Manufacturer and Model #</b>	<b>Calibration Date</b>	<b>Date Due</b>
ATD		N/A	DI8818	FTSS	26-Jun-2019	
Head Accelerometers	Primary	X	P97682	Endevco	26-Jun-2019	26-Dec-2019
		Y	P97834	Endevco	27-Jun-2019	27-Dec-2019
		Z	P97883	Endevco	27-Jun-2019	27-Dec-2019
	Redundant	X	P97692	Endevco	27-Jun-2019	28-Dec-2019
		Y	P97543	Endevco	27-Jun-2019	27-Dec-2019
		Z	P97848	Endevco	27-Jun-2019	27-Dec-2019
Upper Neck Load Cell		Fx, Fy, Fz, Mx, My, Mz	DK7373S	FTSS	27-Jun-2019	26-Jun-2020
Lower Neck Load Cell		Fx, Fy, Fz, Mx, My, Mz	151	Denton	2-Apr-2019	1-Apr-2020
Chest Potentiometer		Dx				
Sternum Accelerometer		X				
Spine Accelerometer		X				
Data System		N/A	223	Kayser-Threde	10-Jul-2019	
Inclinometer		N/A	DP-7	Mitutoyo Pro 360	19-Oct-2018	19-Oct-2019