

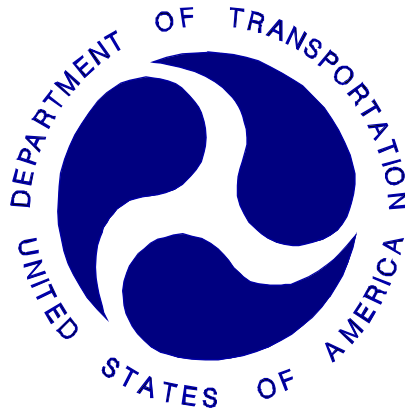
REPORT NUMBER: TWG-CAL-13-06

NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

Ford Motor Co
2013 Ford Focus
Four Door Sedan

NHTSA NUMBER: MD0213TWG2
CALSPAN TEST NUMBER: CT2013-06

PREPARED BY:
CALSPAN CORPORATION
P.O. BOX 400
BUFFALO, NEW YORK 14225

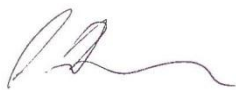


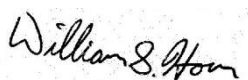
April 4, 2013

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. DTNH22-12-D-00260, Alpha Technology PO 3GC171. 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.

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Accepted By: _____

Acceptance Date: _____

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7. Author(s) William Horn, Project Manager Adam Hardbattle, Project Engineer				8. Performing Organization Report No. CT2013-06		
9. Performing Organization Name and Address Calspan Corporation Transportation Sciences Center P.O. Box 400 Buffalo, New York 14225				10. Work Unit No.		
				11. Contract or Grant No. DTNH22-12-D-00260		
12. Sponsoring Agency Name and Address Alpha Technology Associate, Inc 2810 Old Lee Hwy, Suite 120 Fairfax,VA 22031				13. Type of Report and Period Covered Draft Report, 4 April 2013		
				14. Sponsoring Agency Code NVS-111		
15. Supplementary Notes						
16. Abstract This side impact Out-Of-Position test was performed in conjunction with a New Car Assessment Program (NCAP). This test was conducted at the Calspan Test Facility in Buffalo, New York, on April 4, 2013.						
Injury Summary						
HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
48.497	N/A	N/A	0.000	0.040	0.844	0.494
17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position			18. Distribution Statement <u>Copies of this report are available from:</u> Alpha Technology Associate, Inc 2810 Old Lee Hwy, Suite 120 Fairfax,VA 22031 Phone: (703) 876-0010 Fax: (703) 876-0120 Attn: Mai Lan Aram			
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TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	PURPOSE AND SUMMARY OF TEST	1-1
2	DATA SHEETS	2-1
	Data Sheet 1 – Test Summary	2-1
	Data Sheet 2 – Vehicle Parameter Data	2-2
	Data Sheet 3 – Dummy Positioning in Vehicle	2-3
	Data Sheet 4 – Dummy Injury Criteria Values	2-4
A	PHOTOGRAPHS	A-1
B	DUMMY RESPONSE DATA TRACES	B-1
C	TEST EQUIPMENT LIST AND CALIBRATION INFORMATION	C-1

SECTION 1

PURPOSE AND SUMMARY OF TEST:

1.1 PURPOSE

The purpose of this test was to obtain data from a static out-of-position side impact using a vehicle that had undergone a New Car Assessment Program (NCAP) sponsored test requested by the National Highway Traffic Safety Administration (NHTSA). This test was performed under NHTSA contract No. DTNH22-12-D-00260 and through Alpha Technology Associate, Inc. PO 3GC171.

1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2013 Ford Focus four door sedan on an out-of-position SIDIIIs (Hybrid III 5th female anthropomorphic test device (ATD)) were evaluated. The test was performed by Calspan on April 4, 2013. Pre-and post-test photographs of the vehicle and ATD can be found in Appendix A.

Three high-speed digital cameras were used to document the side airbag deployment event. Images were recorded at rates of 1000 frames per second. One camera was placed perpendicular to the right-front seat centerline to capture the deployment event from the side. The second camera was placed parallel to the right-front seat centerline to capture the deployment event from the front. The third camera was placed ¾ to the front to also capture the deployment event.

The SID-IIIs 5th female anthropomorphic test device (ATD) was placed in the right front (passenger) seat situated perpendicular to the centerline of the seat, facing towards left front seat according to the ATD placement instructions specified Alpha Technology Associate, Inc. who referenced 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 was section 3.3.5.3.

The female ATD was instrumented with head x, y and z accelerometers (primary). In addition, upper six axial neck forces, and moment load cell sensors and lower six axial neck force and moment load cell sensors were utilized.

Seventeen channels of data were recorded using an on-board data acquisition system. Appendix A contains photographs. Appendix B contains ATD response data traces. Appendix C contains the Instrumentation Data Channel assignments.

The 5th female ATD was placed with its left arm outstretched against the back of the right front (passenger) seat facing inboard cross car with its legs extended. After consultation with the program sponsor, the seat track was adjusted to locate the head c.g. under the expected deployment location of a head curtain chamber to maximize the airbag to head interaction. The location was determined by observing test data from the previous left side impact test on this vehicle. While keeping the head in neutral orientation, the ATD's pelvis was moved outboard until the dummy's back contacted the door trim panel armrest. The center of gravity of the head was centered in the deployment trajectory of the airbag. The dummy was then moved to maintain the vertical plane through the centerline of the ATD's shoulder bolts parallel to the vehicle centerline. The ATD's arm was bent straight across the back seat cushion. This orientation complies with section 3.3.5.3 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

SECTION 2

DATA SHEET NO. 1 TEST SUMMARY

TEST CONFIGURATION INFORMATION:

Seating Position:	P2	Right Front Seating Position
Test:	3.3.5.3	Inboard Facing SID-IIs on Raised Seat (Driver and Passenger Positions with Roof-Rail-Mounted Airbags)
Airbag: 1	Curtain	Roof Rail Mounted – Passenger Side
Airbag: 2	Seat/Torso	Passenger Seat Mounted – Outside Seam
Booster Block:	N/A	N/A
ATD Type/Serial No.:	8012	5 th Female SID-IIs

Number of Data Channels:	17	
Number of Cameras:	0	<u>Real Time</u>
	3	<u>High Speed Digital</u>
	0	<u>High Speed Film</u>

PRE-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	None
Upper Torso Contact:	Back against door armrest / arm against seat
Lower Torso Contact:	Butt on edge of seat
Knee Contact:	Console
Foot Contact:	None

POST-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Curtain Airbag & Side Head Liner
Upper Torso Contact:	Seat/Torso Airbag
Lower Torso Contact:	Seat/Torso Airbag
Knee Contact:	Console
Foot Contact:	None

DATA SHEET NO. 2
VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2013 Ford Focus Four Door Sedan

NHTSA No. : MD0213TWG2 ; VIN: 1FADP3E27DL103760 Color: Light Grey/Silver

Engine Data: 4 cylinders; - CID; 2.0 Liters; - cc

Placement: - Longitudinal or In-Line; Lateral Transverse or Lateral

Transmission Data: 5 speeds; X Manual; - Automatic; - Overdrive

Final Drive: - Rear Wheel Drive; X Front Wheel Drive; - Four Wheel Drive

Safety Belt Features – Driver X Pretensioner (Shoulder); X Load Limiter; X Adj. Anchorage

Safety Belt Features - Passenger X Pretensioner (Shoulder); X Load Limiter; X Adj. Anchorage

Major Options: X A/C; X Pwr.Strg.; X Pwr. Brakes

X Pwr. Windows; X Pwr. Door Locks; X Tilt Wheel

Date Received: 9/26/2012 ; Odometer Reading 60 Km

Selling Dealer: Lake Ford-Lincoln

& Address: 2472 Corning Road, Elmira, NY 14903

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Ford Motor Co

Date of Manufacture 07/12

GVWR: 1810 kg; GAWR: 940 kg FRONT; 883 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P195/65R15

*Recommended Cold Tire Pressure: 240 Kpa Front 240 kpa Rear

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P215/55R16 ; Manufacturer: Continental

Tire Pressure with Maximum Capacity Vehicle Load: Front 350 kPa Rear: 350 kPa

Treadwear: 500 ; Traction: AA ; Temperature: A

VEHICLE CAPACITY DATA:

Type of Front Seats: - Bench; X Bucket; - Split Bench

Number of Occupants: 2 Front; 3 Rear; 5 Total

Vehicle Capacity Weight (VCW) = 375 Kg

No. of Occupants x 68.04 kg = 340.2 Kg

Rated Cargo/Luggage Weight (RCLW) = 34.8 Kg

*Tire pressure used for test

‡Vehicle had previously undergone a New Car Assessment Program Side NCAP MDB Test.

DATA SHEET NO. 3
SID-IIs DUMMY POSITIONING IN VEHICLE

NHTSA No. MD0213-TWG2

Measurement	Value
Total Fore/Aft Travel (mm)	245
Test Distance Rearward of Full-Forward (mm)	118
Total Fore/Aft Travel (Detents)	25
Placed in Position #	11

Seat Back Angle	SA (°)	Value
Airbag Module Width	AMW (mm)	-
Airbag Width	ABW (mm)	-
Airbag Module Length	AML (mm)	-
Airbag Length	ABL (mm)	-
Top of Airbag Module to Head/Neck Junction	AN (mm)	-
Head CG to Door Panel/Side Window	HD (mm)	165
Head to Seat Back Centerline	HSC (mm)	-
Head to B-Pillar (cg)	HB (mm)	200
Head to Roof, Z (top of the head)	HZ (mm)	42
Head to Header	HHH (mm)	-
Chest to Dash	CD (mm)	270 (side)
Chest to Seatback	CS (mm)	0
Right Arm to Seat Back Centerline	RACL (mm)	-
Right Arm to Seat Back Centerline	RACL (°)	-
Left Arm to Seat Back Centerline	LACL (mm)	-
Left Arm to Seat Back Centerline	LACL (°)	-
Right Arm to Door Panel	RA (mm)	N/A
Left Arm to Door Panel	LA (mm)	N/A
Knee to Knee	KK (mm)	-
Toe to Toe	TT (mm)	-
Right Knee to Seat Cushion Centerline	KSCR (mm)	-
Left Knee to Seat Cushion Centerline	KSCL (mm)	-
Right Toe to Seat Cushion Centerline	TSCR (mm)	-
Left Toe to Seat Cushion Centerline	TSCL (mm)	-
Nose to Dash	ND (mm)	-
Nose to Seatback	NS (mm)	-
Nose to Header	NR (mm)	-
Foam Block Depth	(mm)	-
Foam Block Width	(mm)	-
Foam Block Thickness	(mm)	-
HD36 foam density	(g/L)	-

DATA SHEET 4

SID-IIs DUMMY INJURY CRITERIA VALUES

NHTSA No.: MD0213TWG2

Channel	Max	Time (ms)	Min	Time (ms)
V1P2 Head x [g , CFC_1000]	16.890	8.600	-35.603	1.450
V1P2 Head y [g , CFC_1000]	45.867	1.050	-28.583	1.900
V1P2 Head z [g , CFC_1000]	110.430	1.500	-11.541	4.500
V1P2 Headform Resultant [g, CFC_1000]	115.764	1.500	0.000	-0.000
V1P2 Upper Neck MocY [N-m, CFC_600]	59.044	11.000	-24.808	46.950
V1P2 Upper Neck Ntf [N-m, CFC_600]	0.000	0.000	0	0
V1P2 Upper Neck Nte [N-m, CFC_600]	0.040	0.200	0	0
V1P2 Upper Neck Ncf [N-m, CFC_600]	0.844	10.800	0	0
V1P2 Upper Neck Nce [N-m, CFC_600]	0.494	47.150	0	0
V1P2 Upper Neck Nij [Nij, CFC_600]	0.840	10.800	0	0
V1P2 Upper Neck Fx [N , CFC_1000]	589.869	10.000	-103.503	41.600
V1P2 Upper neck Fy [N , CFC_1000]	306.364	1.600	-163.477	13.950
V1P2 Upper neck Fz [N , CFC_1000]	178.112	0.150	-1813.990	10.750
V1P2 Neck F Res	1909.937	10.750	0	0
V1P2 Upper Neck Mx [N-m , CFC_600]	28.355	35.100	-10.100	14.450
V1P2 Upper Neck My [N-m , CFC_600]	69.118	10.950	-26.305	41.900
V1P2 Upper Neck Mz [N-m , CFC_600]	10.273	30.350	-3.593	144.500
V1P2 Neck M Res	69.478	10.950	0	0
V1P2 Lower Neck Fx F [N , CFC_1000]	607.053	9.450	-359.882	49.800
V1P2 Lower Neck Fy F [N , CFC_1000]	228.074	30.750	-215.790	1.800
V1P2 Lower Neck Fz F [N , CFC_1000]	14.044	0.150	-2054.063	4.750
V1P2 Lower Neck Res	2100.194	4.750	0	0
V1P2 Lower Neck Mx F [N-m , CFC_600]	19.851	63.600	-1.774	29.550
V1P2 Lower Neck My F [N-m , CFC_600]	67.125	4.250	-19.923	93.750
V1P2 Lower Neck Mz F [N-m , CFC_600]	9.212	1.800	-11.271	81.450
V1P2 Lower Neck Res	67.154	4.300	0	0
Curtain Airbag Volts	26.10	0.65	-0.01	0.05
Curtain Airbag Current	3.39	0.4	0	93.8
Seat/Torso Airbag Volts	21.62	2.75	0	0
Seat/Torso Airbag Current	3.41	0.4	0	10.5

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2013 Ford Focus Four Door Sedan

NHTSA No.: MD0213TWG2

HEAD INJURY CRITERIA (HIC)

	HIC15			
	HIC(15)	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position #2 - Right	48.497	0.950	1.750	80.283

THORAX CRITERIA

	Critical Values	Actual	Time(ms)
Maximum Deflection (mm)	N/A	N/A	N/A
Maximum Deflection Rate (m/s)	N/A	N/A	N/A

Position 2 Neck Injury Summary (SID-IIs – In Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.000	0.000	0.000	-0.000	0.000
Nte	0.040	0.200	46.173	-35.346	-1.989
Ncf	0.844	10.800	-1801.065	571.841	58.843
Nce	0.494	47.150	-480.840	-20.524	-24.799

Peak Tension (CFC1000) 178.112 N

Peak Compression (CFC1000) -1813.99 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	4287 N	Extension (mCVe)	67 N-m	Tension	2070 N
Compression (CVc)	3880 N	Flexion (mCVf)	155 N-m	Compression	2520 N

APPENDIX A
PHOTOGRAPHS

TABLE OF PHOTOGRAPHS

<u>Figure</u>	<u>Photograph Title</u>	<u>Page</u>
Figure A- 1	Right ¾ Front View of Vehicle, As Received	A- 3
Figure A- 2	Vehicle Certification Placard	A- 3
Figure A- 3	Pre-Test Vehicle Left Side View	A- 4
Figure A- 4	Post-Test Vehicle Left Side View	A- 4
Figure A- 5	Pre-Test 5th female SID-IIs Dummy Left Side View	A- 5
Figure A- 6	Post-Test 5th female SID-IIs Dummy Left Side View	A- 5
Figure A- 7	Pre-Test 5th female SID-IIs Dummy Left Side Closeup View	A- 6
Figure A- 8	Post-Test 5th female SID-IIs Dummy Left Side Closeup View	A- 6
Figure A- 9	Pre-Test 5th female SID-IIs Dummy Left ¾ Front View	A- 7
Figure A- 10	Post-Test 5th female SID-IIs Dummy Left ¾ Front View	A- 7
Figure A- 11	Pre-Test 5th female SID-IIs Dummy Left ¾ Front Closeup View	A- 8
Figure A- 12	Post-Test 5th female SID-IIs Dummy Left ¾ Front Closeup View	A- 8
Figure A- 13	Pre-Test 5th female SID-IIs Dummy Front View	A- 9
Figure A- 14	Post-Test 5th female SID-IIs Dummy Front View	A- 9
Figure A- 15	Pre-Test 5th female SID-IIs Dummy Front Closeup View	A- 10
Figure A- 16	Pre-Test 5th female SID-IIs Dummy Right Side View	A- 10
Figure A- 17	Pre-Test 5th female SID-IIs Dummy Right Side Clearance View	A- 11
Figure A- 18	Pre-Test 5th female SID-IIs Dummy Rear Right Side Clearance View	A- 11
Figure A- 19	Post-Test Curtain Airbag Left Side View	A- 12
Figure A- 20	Post-Test Curtain Airbag Left ¾ Front View	A- 12
Figure A- 21	Post-Test Curtain Airbag Front View	A- 13
Figure A- 22	Post-Test Curtain Airbag Right Side View	A- 13
Figure A- 23	Post-Test Curtain Airbag Rear Right View	A- 14
Figure A- 24	Post-Test Curtain Airbag Right Front View	A- 14
Figure A- 25	Post NCAP Left Side View	A- 15



Figure A-1: Right ¾ Front View of Vehicle, As Received

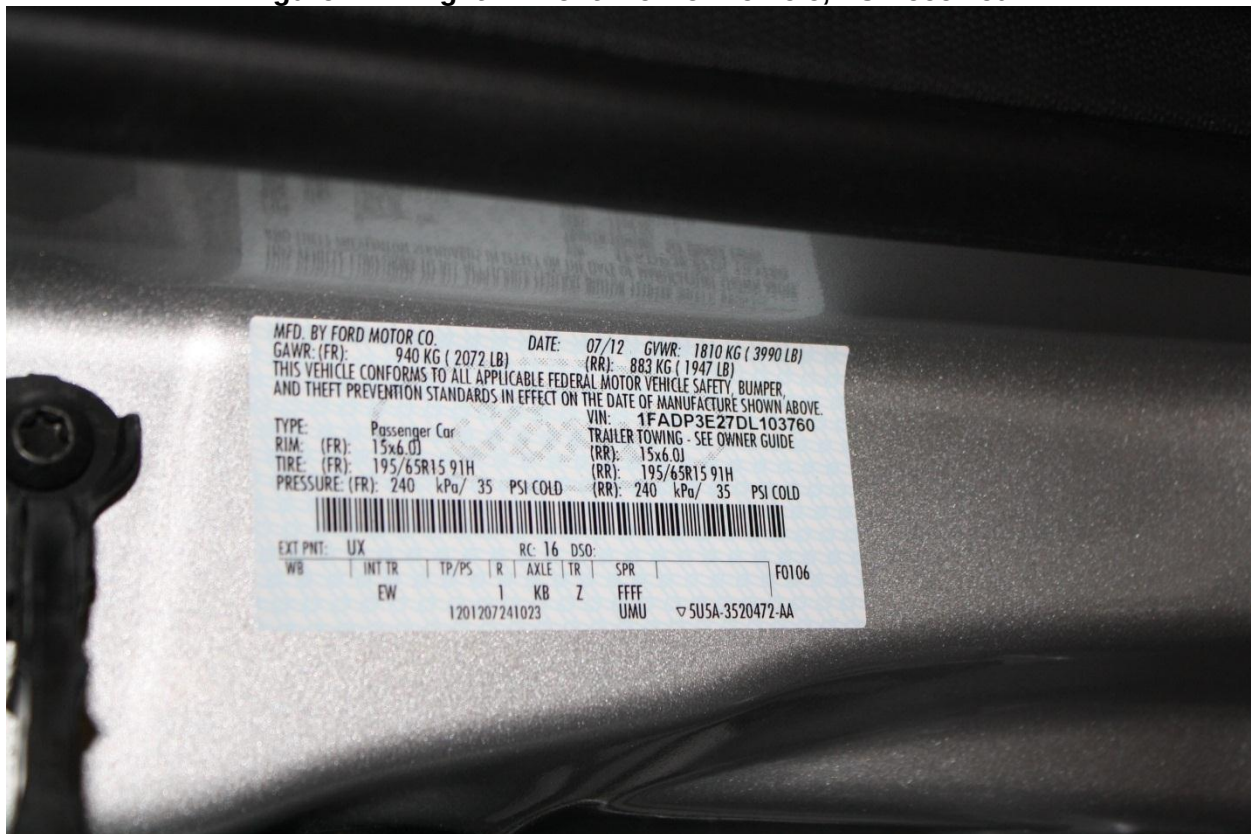


Figure A-2: Vehicle Certification Placard



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



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



Figure A-5: Pre-Test 5th female SID-11s Dummy Left Side View



Figure A-6: Post-Test 5th female SID-11s Dummy Left Side View



Figure A-7: Pre-Test 5th female SID-II's Dummy Left Side Close-up View



Figure A-8: Post-Test 5th female SID-II's Dummy Left Side Close-up View



Figure A-9: Pre-Test 5th female SID-II's Dummy Left $\frac{3}{4}$ Front View

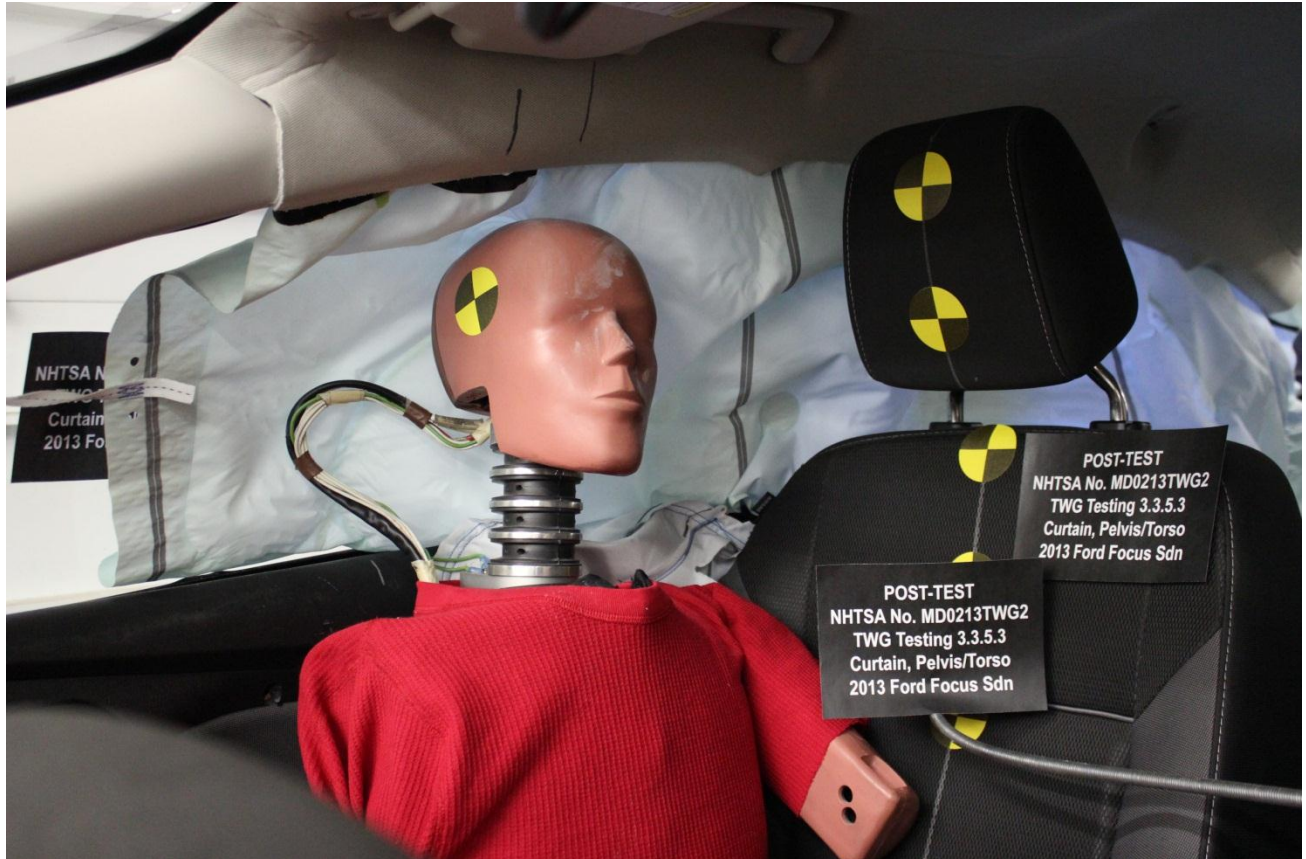


Figure A-10: Post-Test 5th female SID-II's Dummy Left $\frac{3}{4}$ Front View



Figure A-11: Pre-Test 5th female SID-II's Dummy Left $\frac{3}{4}$ Front Close-up View

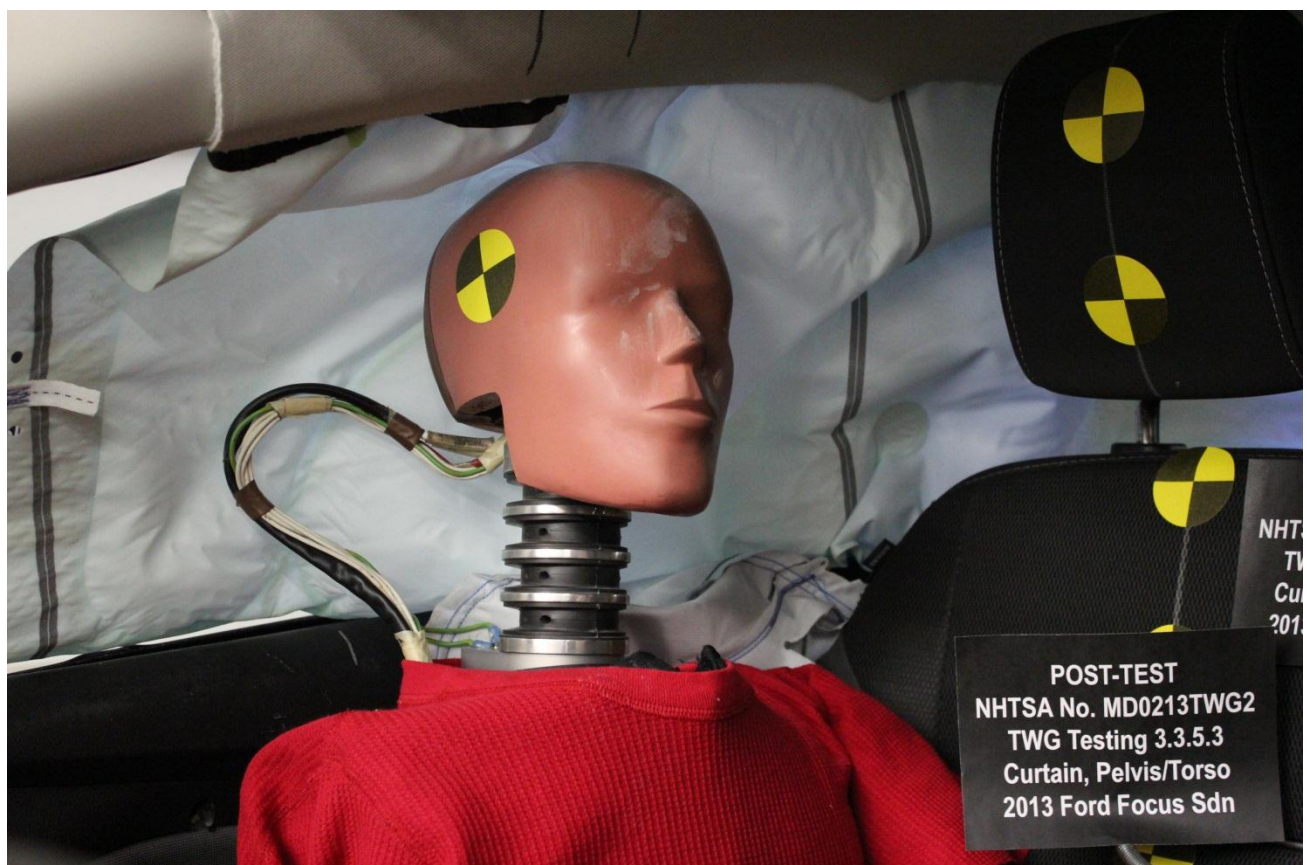


Figure A-12: Post-Test 5th female SID-II's Dummy Left $\frac{3}{4}$ Front Close-up View



Figure A-13: Pre-Test 5th female SID-II's Dummy Front View

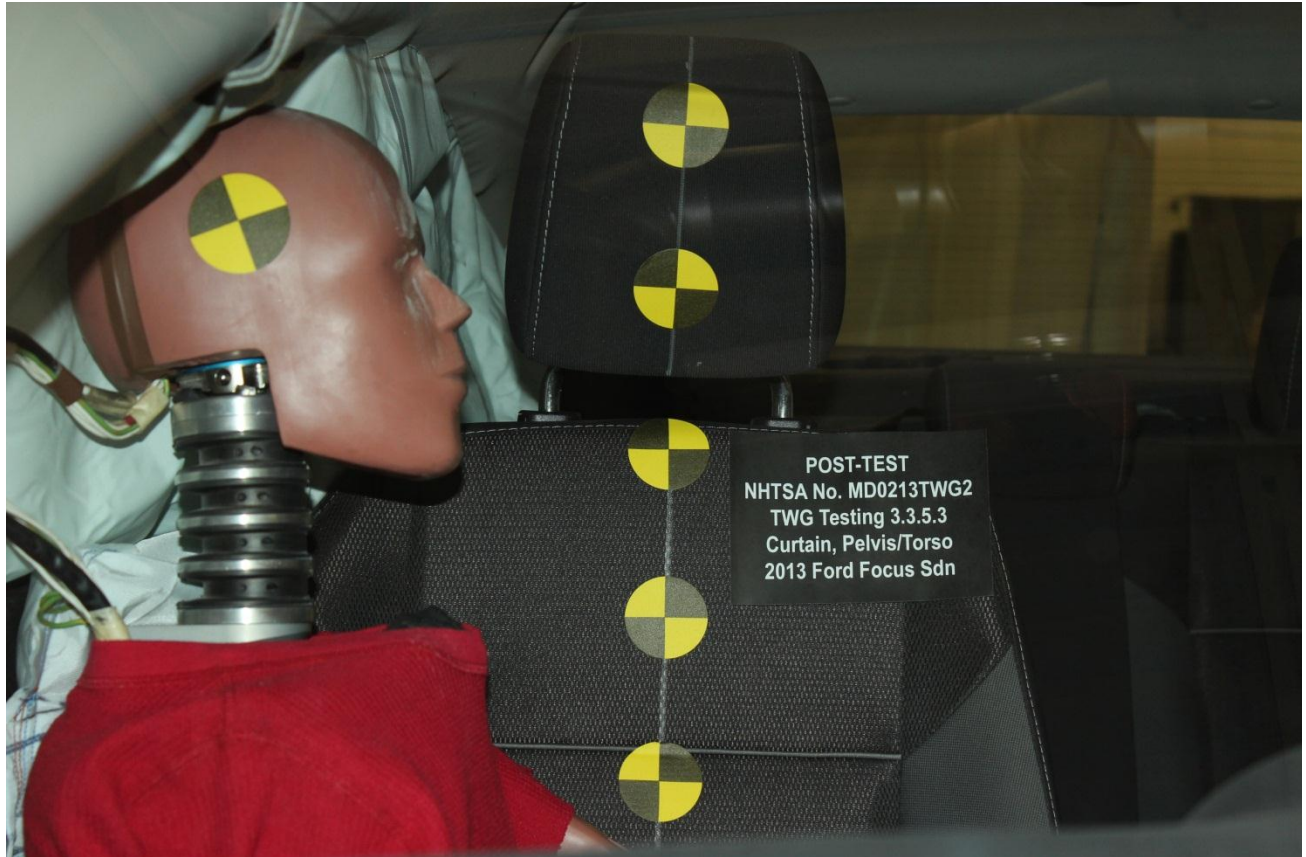


Figure A-14: Post-Test 5th female SID-II's Dummy Front View

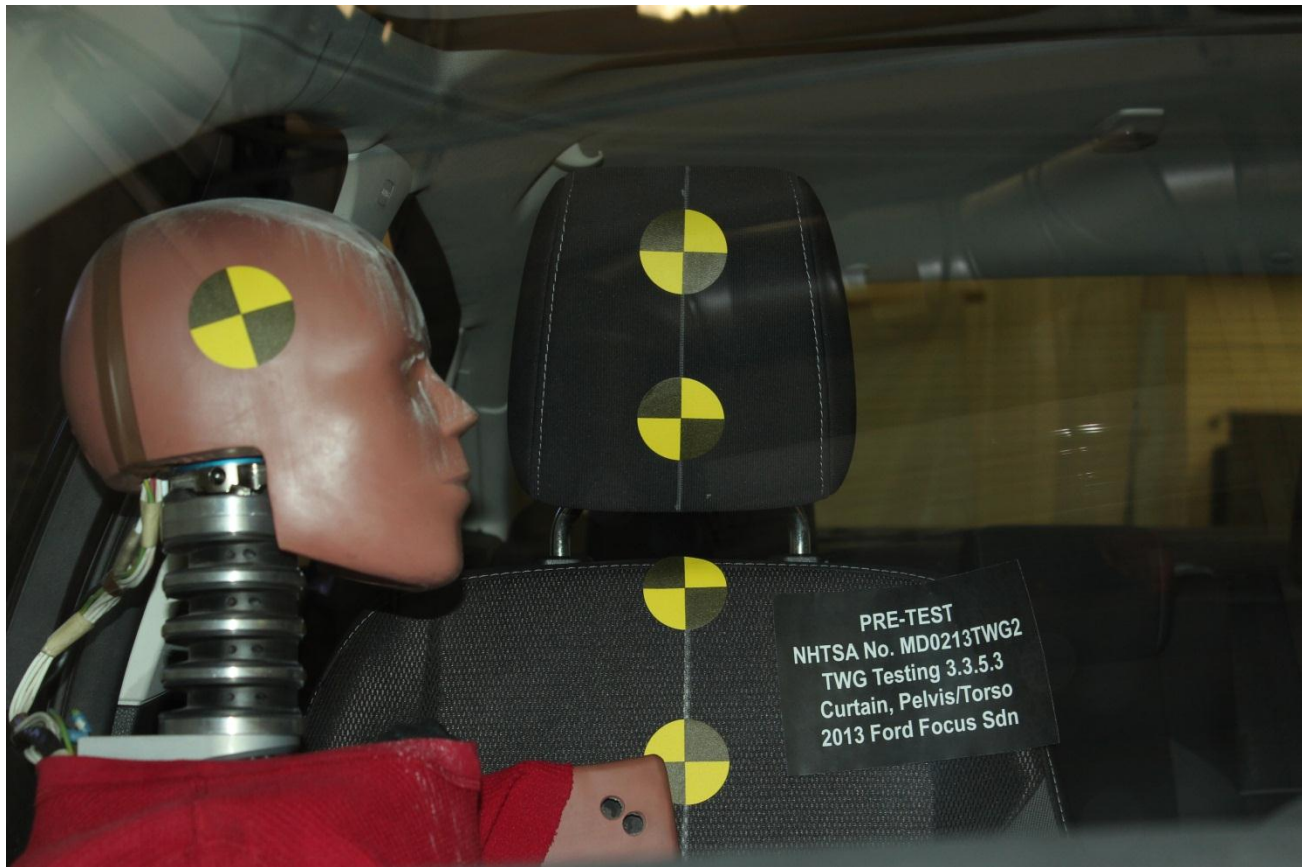


Figure A-15: Pre-Test 5th female SID-IIs Dummy Front Close-up View



Figure A-16: Pre-Test 5th female SID-IIs Dummy Right Side View



Figure A-17: Pre-Test 5th female SID-IIs Dummy Right Side Clearance View



Figure A-18: Pre-Test 5th female SID-IIs Dummy Rear Right Side Clearance View

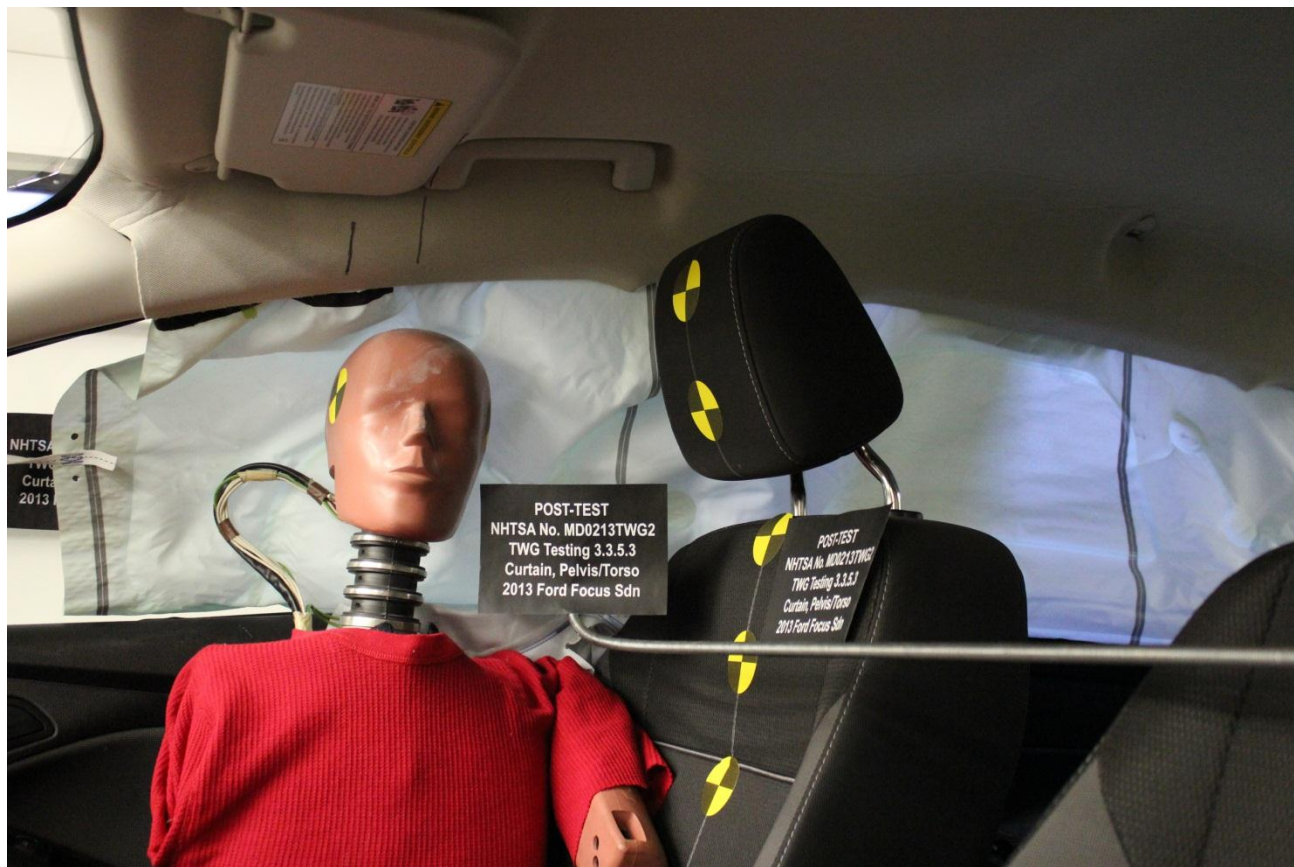


Figure A-19: Post-Test Curtain Airbag Left Side View

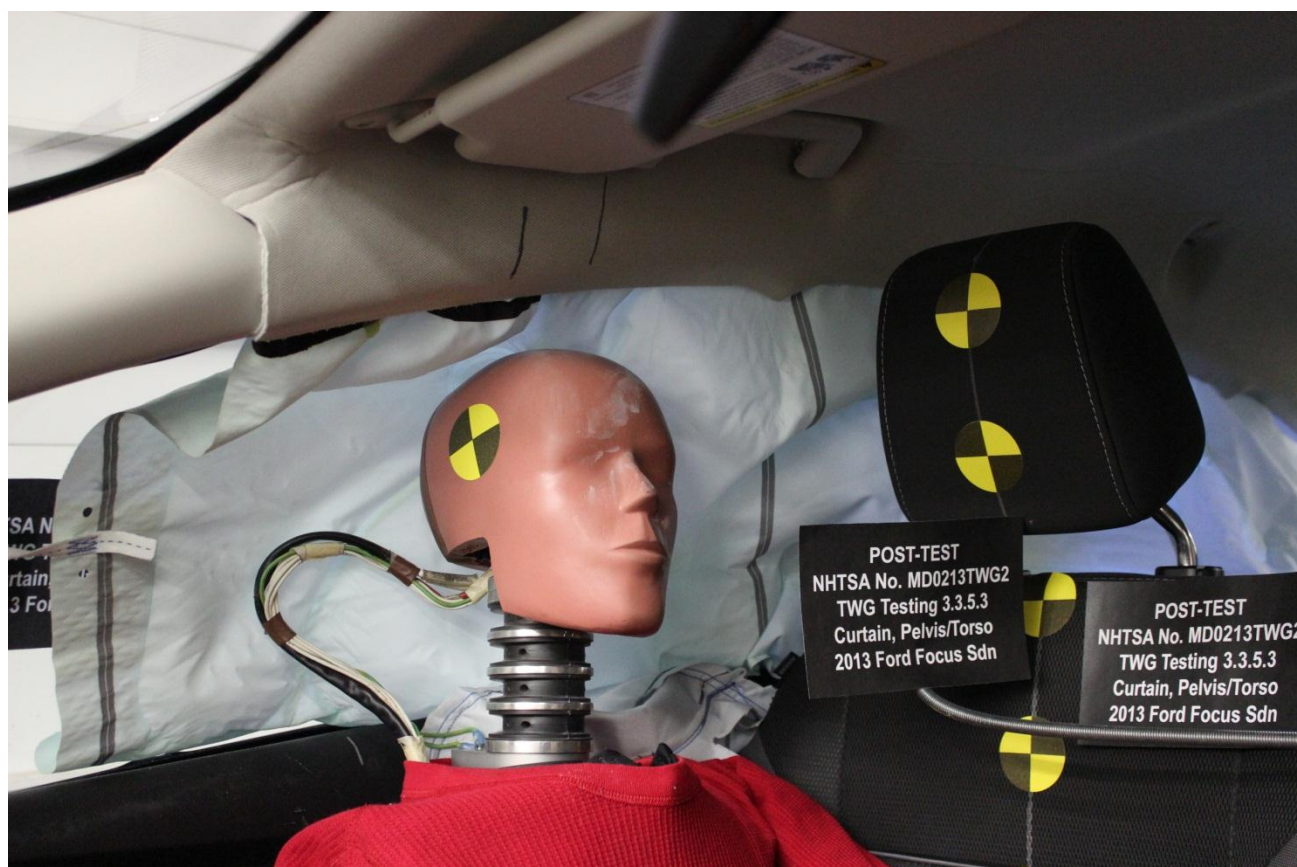


Figure A-20: Post-Test Curtain Airbag Left $\frac{3}{4}$ Front View

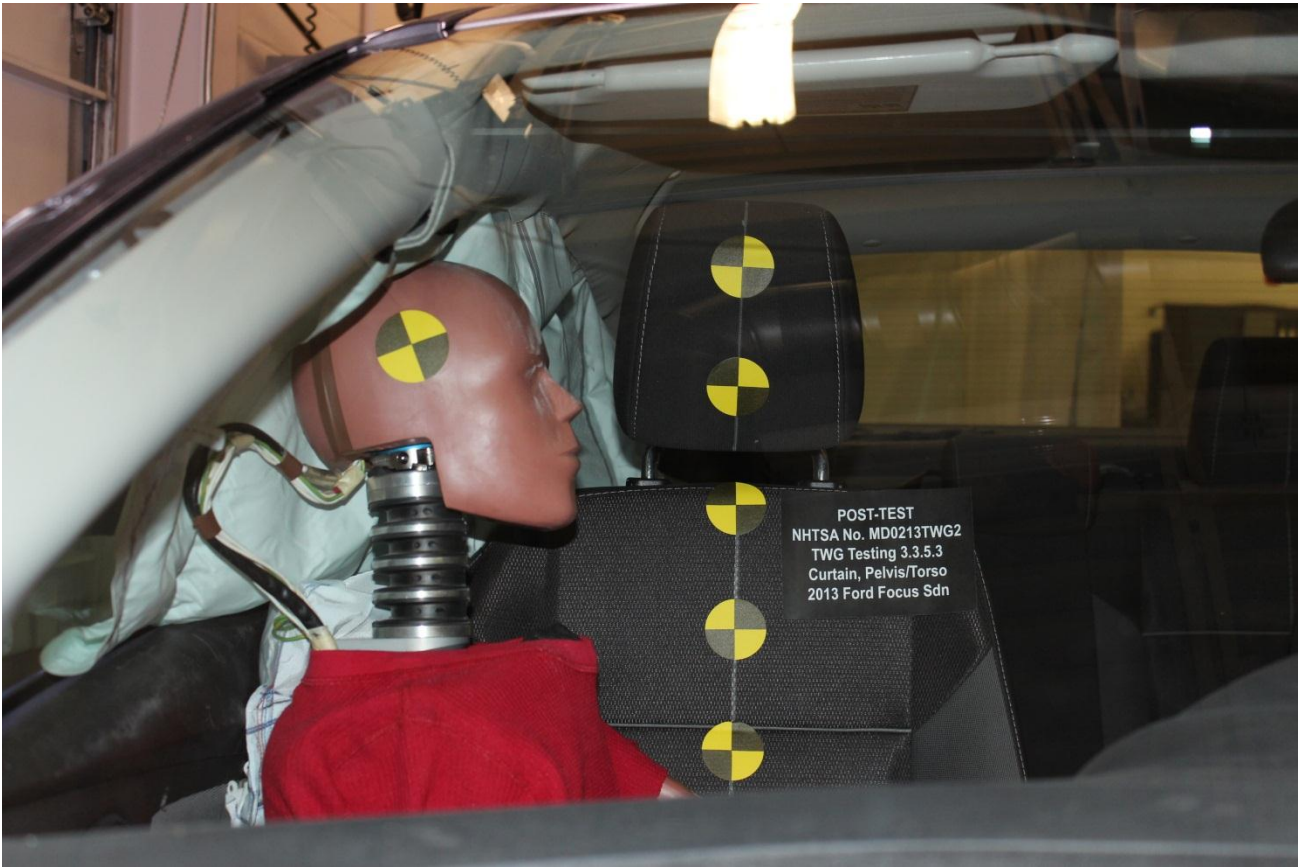


Figure A-21: Post-Test Curtain Airbag Front View



Figure A-22: Post-Test Curtain Airbag Right Side View



Figure A-23: Post-Test Curtain Airbag Rear Right Side View

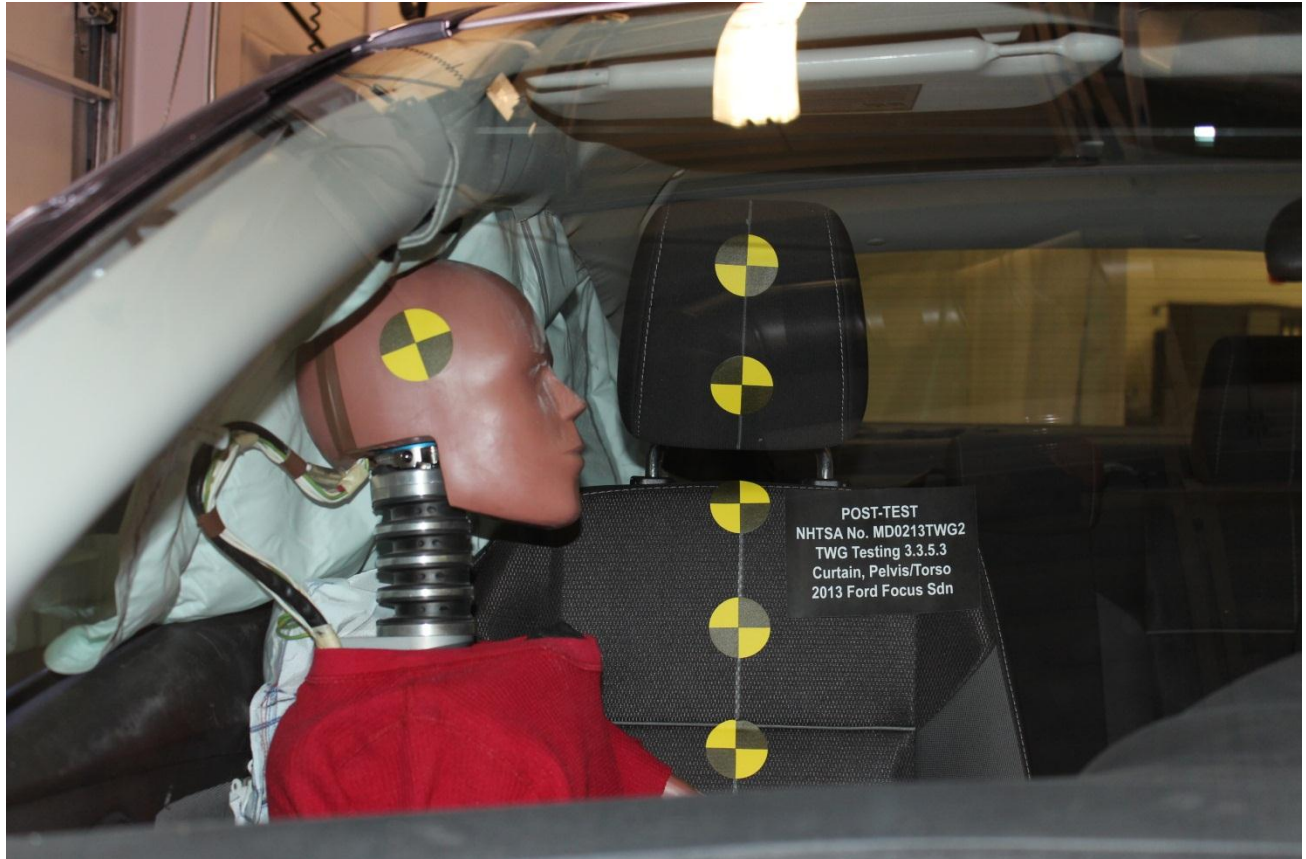


Figure A-24: Post-Test Curtain Airbag Right Front Side View

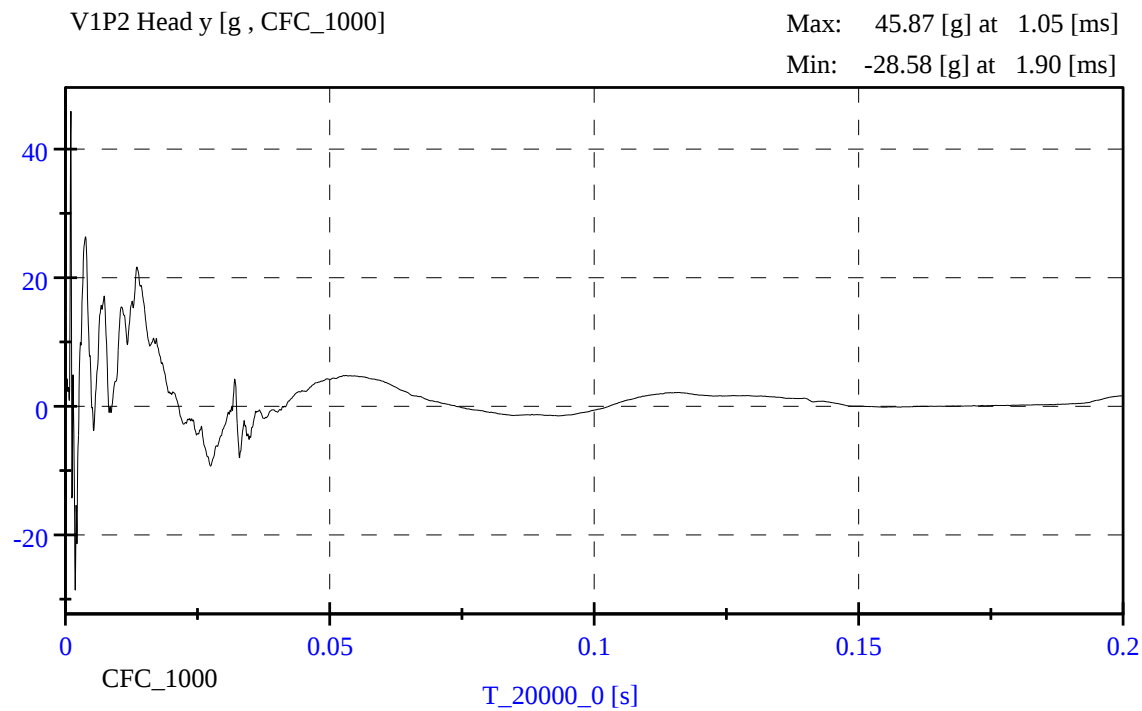
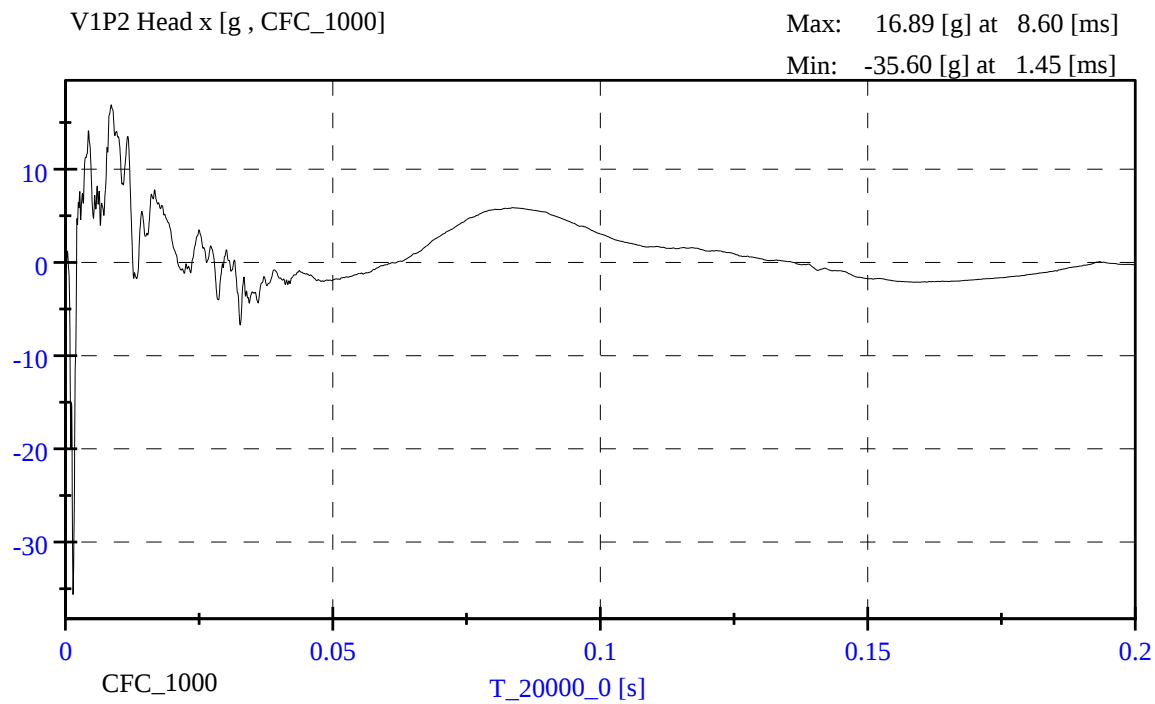


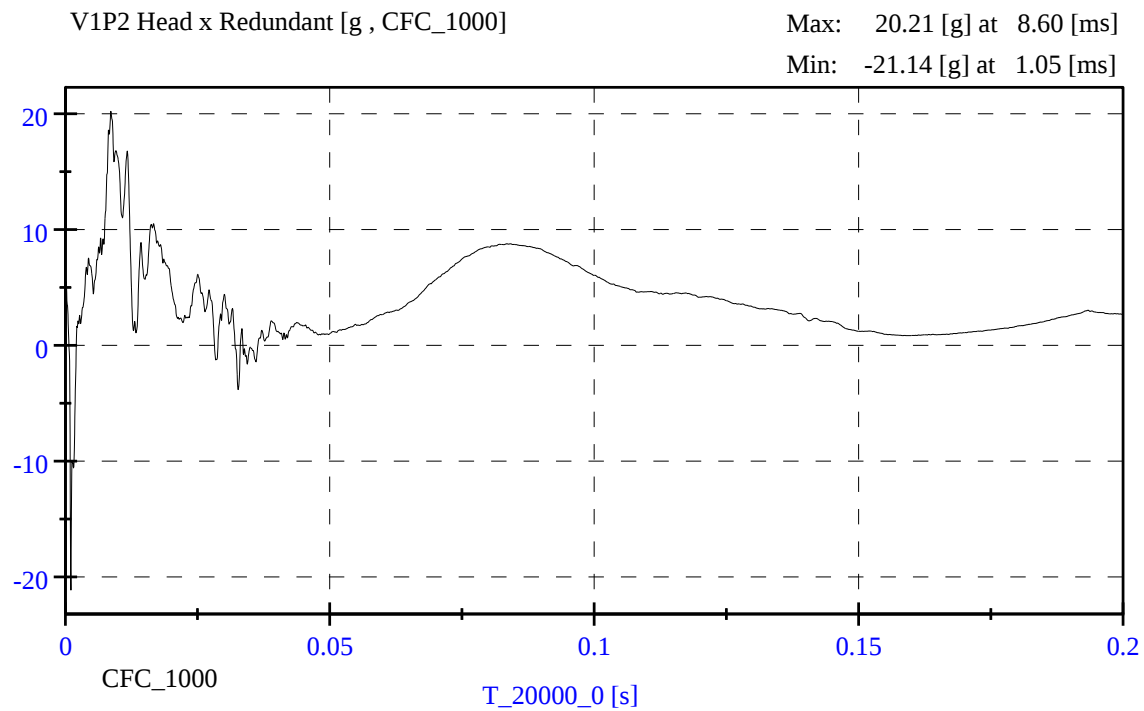
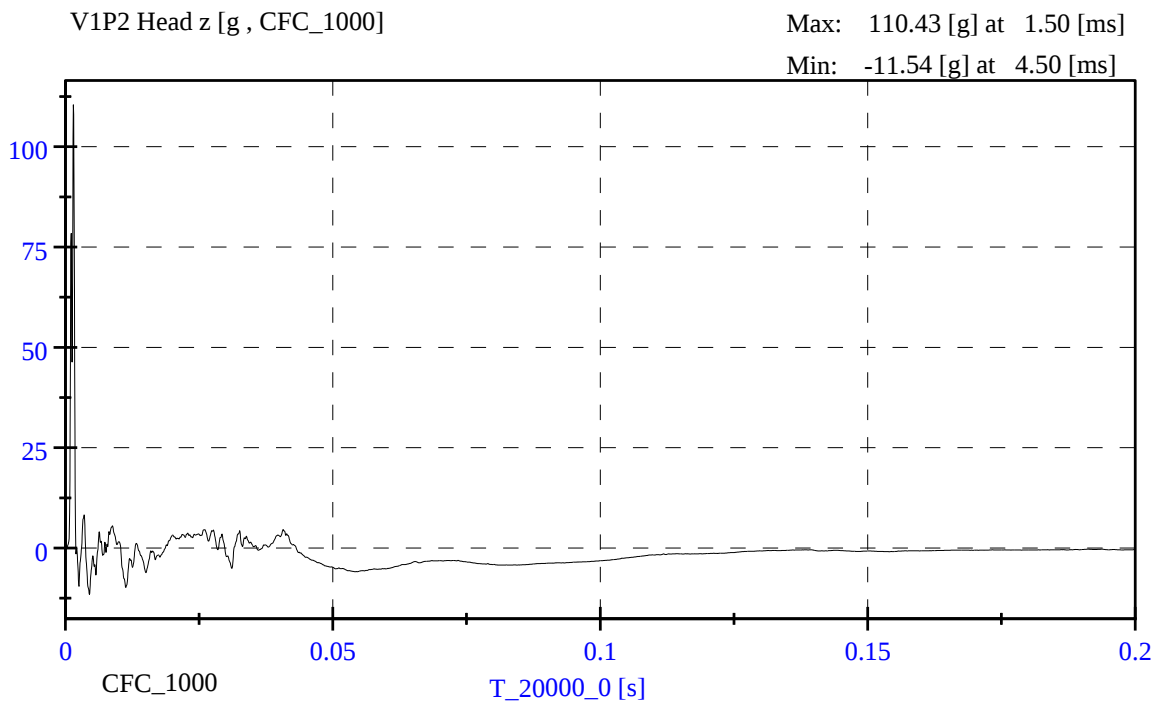
Figure A-25: Post NCAP Left Side View

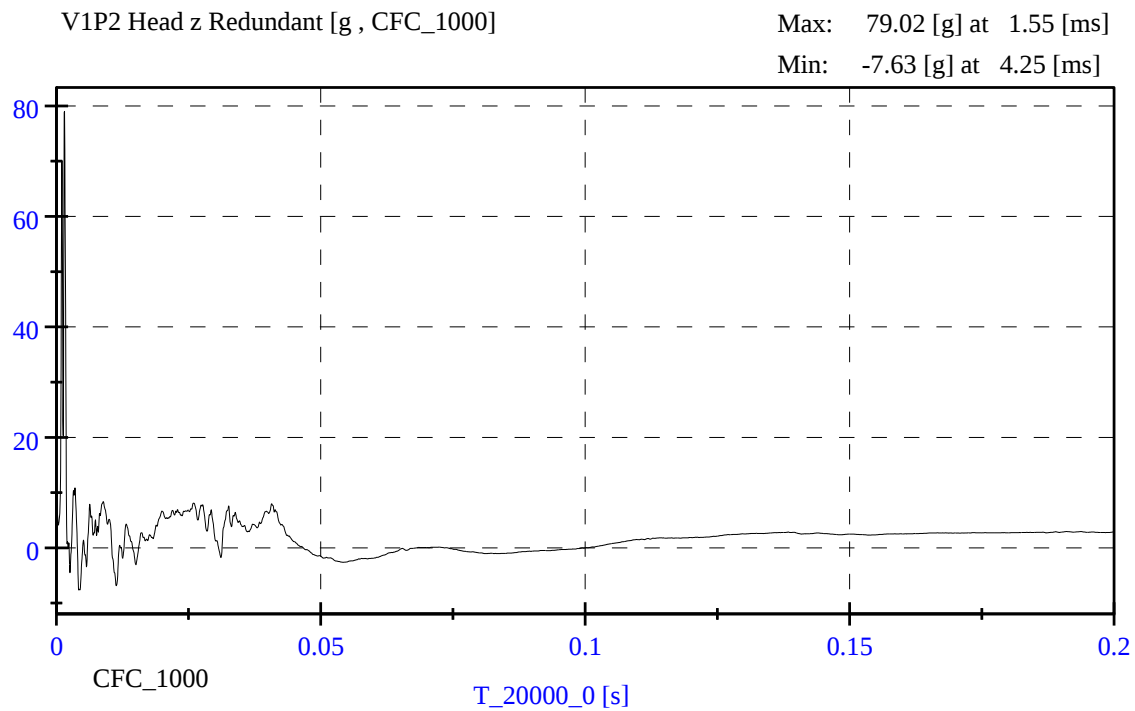
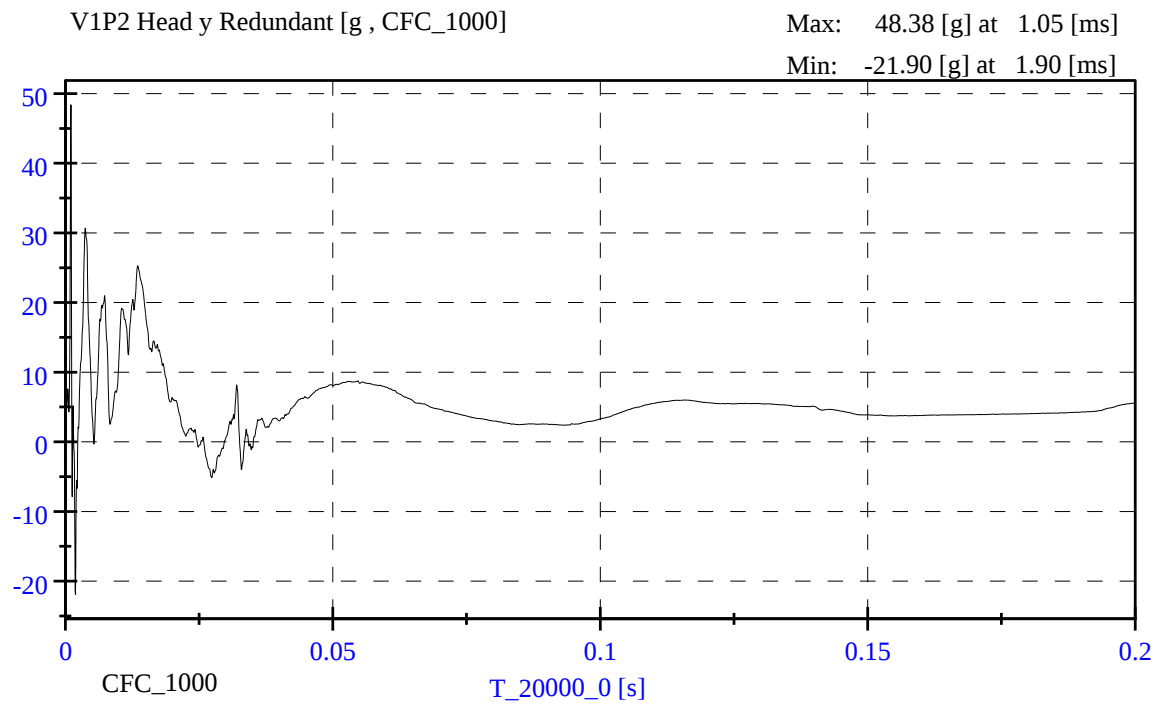
APPENDIX B
VEHICLE AND DUMMY PLOTS

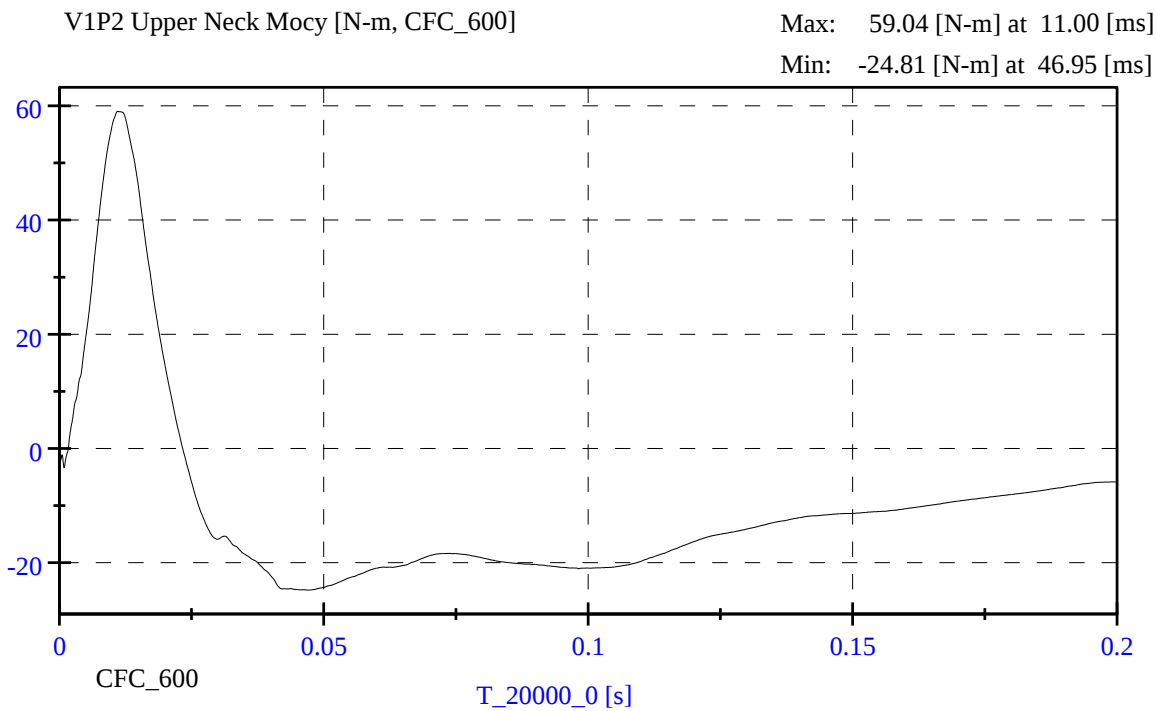
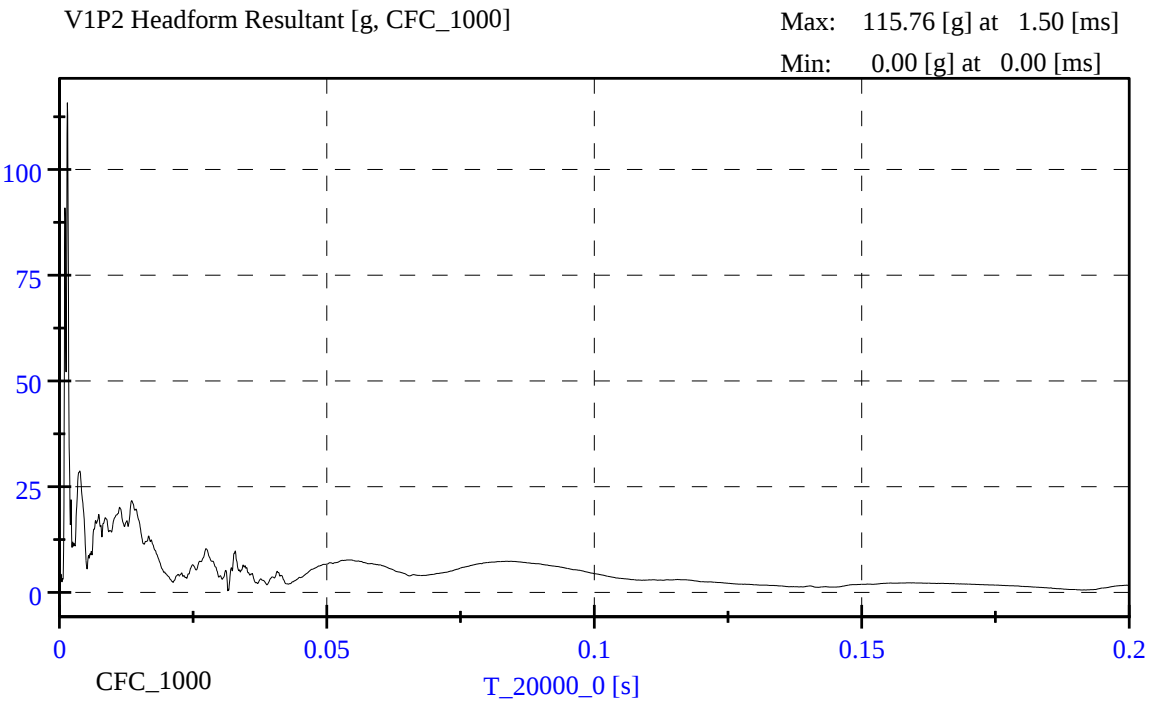
Table of Data Plots

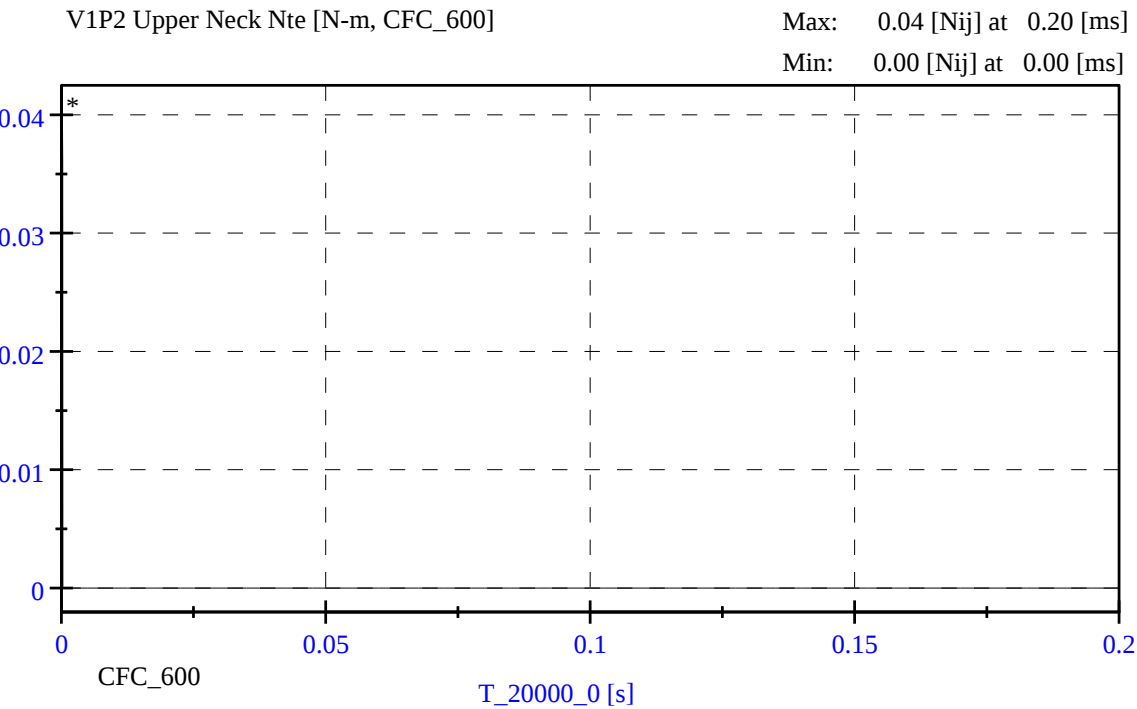
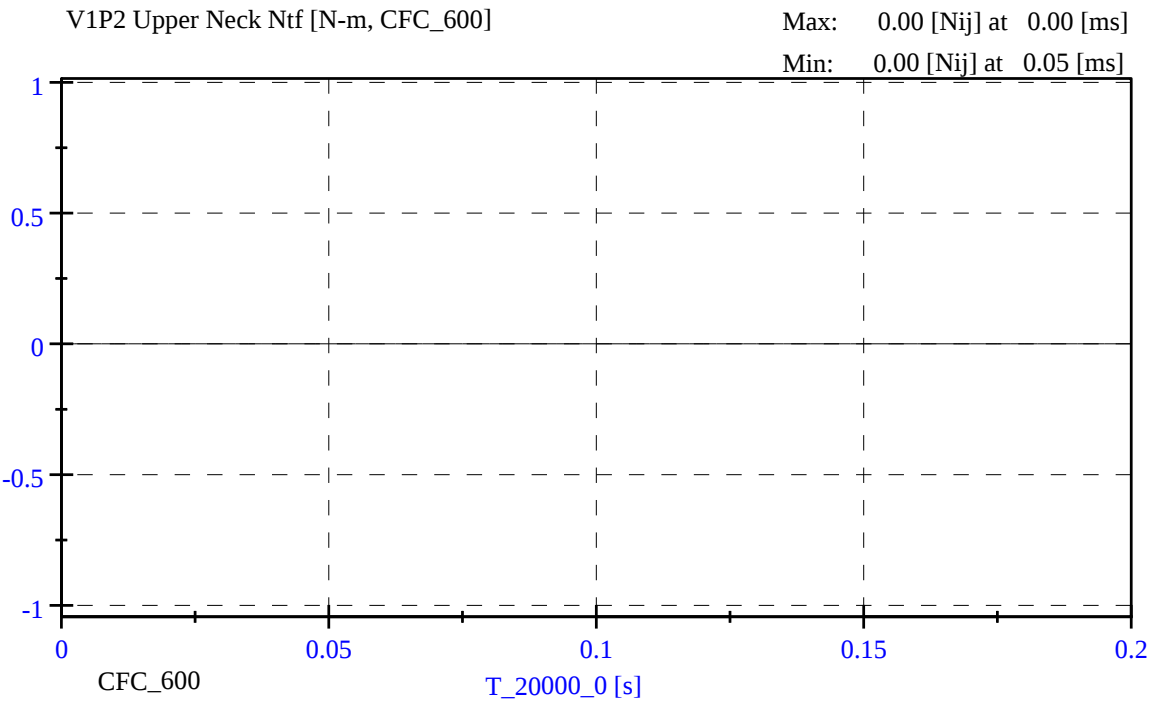
No.	Description	Page
1	V1P2 Head x [g , CFC_1000]	B-2
2	V1P2 Head y [g , CFC_1000]	B-2
3	V1P2 Head z [g , CFC_1000]	B-3
4	V1P2 Head x Redundant [g , CFC_1000]	B-3
5	V1P2 Head y Redundant [g , CFC_1000]	B-4
6	V1P2 Head z Redundant [g , CFC_1000]	B-4
7	V1P2 Headform Resultant [g , CFC_1000]	B-5
8	V1P2 Upper Neck Mocyc [N-m, CFC_600]	B-5
9	V1P2 Upper Neck Ntf [N-m, CFC_600]	B-6
10	V1P2 Upper Neck Nte [N-m, CFC_600]	B-6
11	V1P2 Upper Neck Ncf [N-m, CFC_600]	B-7
12	V1P2 Upper Neck Nce [N-m, CFC_600]	B-7
13	V1P2 Upper Neck Nij [Nij, CFC_600]	B-8
14	V1P2 Upper Neck Load Cell Fx [N , CFC_1000]	B-8
15	V1P2 Upper Neck Load Cell Fy [N , CFC_1000]	B-9
16	V1P2 Upper Neck Load Cell Fz [N , CFC_1000]	B-9
17	Input: V1P2 NEKU Fx F (35), V1P2 NEKU Fy F (36)...	B-10
18	V1P2 Upper Neck Load Cell Mx [N-m , CFC_600]	B-10
19	V1P2 Upper Neck Load Cell My [N-m , CFC_600]	B-11
20	V1P2 Upper Neck Load Cell Mz [N-m , CFC_600]	B-11
21	Input: V1P2 NEKU Mx F (38), V1P2 NEKU My F (39)...	B-12
22	V1P2 Lower Neck Load Cell Fx [N , CFC_1000]	B-12
23	V1P2 Lower Neck Load Cell Fy [N , CFC_1000]	B-13
24	V1P2 Lower Neck Load Cell Fz [N , CFC_1000]	B-13
25	Input: V1P2 NEKL Fx F (42), V1P2 NEKL Fy F (43)...	B-14
26	V1P2 Lower Neck Load Cell Mx [N-m , CFC_600]	B-14
27	V1P2 Lower Neck Load Cell My [N-m , CFC_600]	B-15
28	V1P2 Lower Neck Load Cell Mz [N-m , CFC_600]	B-15
29	Input: V1P2 NEKL Mx F (46), V1P2 NEKL My F (47)...	B-16
30	V1P2 Curtain Airbag Voltage	B-16
31	V1P2 Seat Airbag Voltage	B-17
32	V1P2 Curtain Airbag Current	B-17
33	V1P2 Seat Airbag Current	B-18

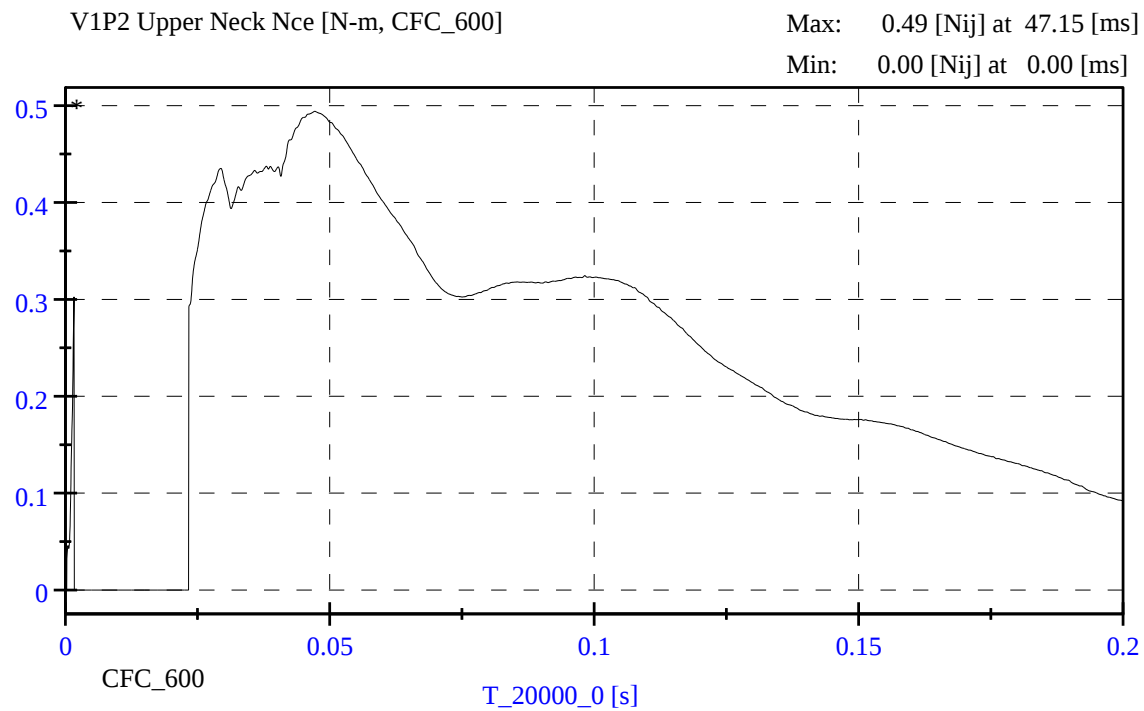
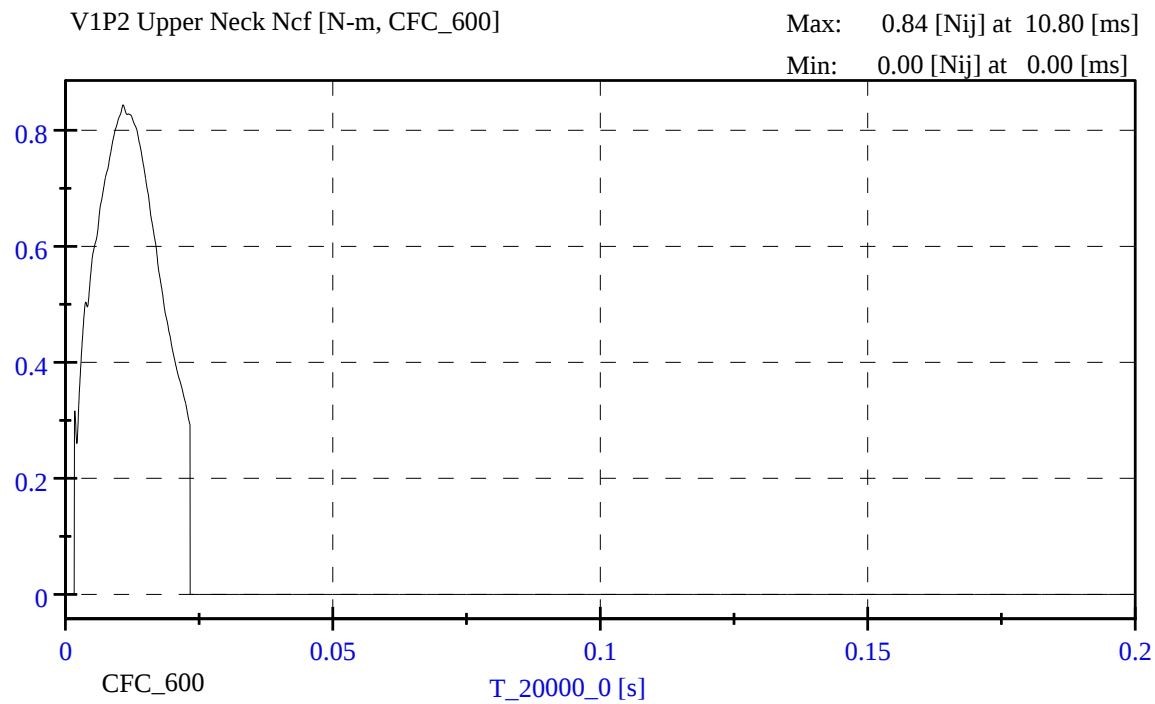


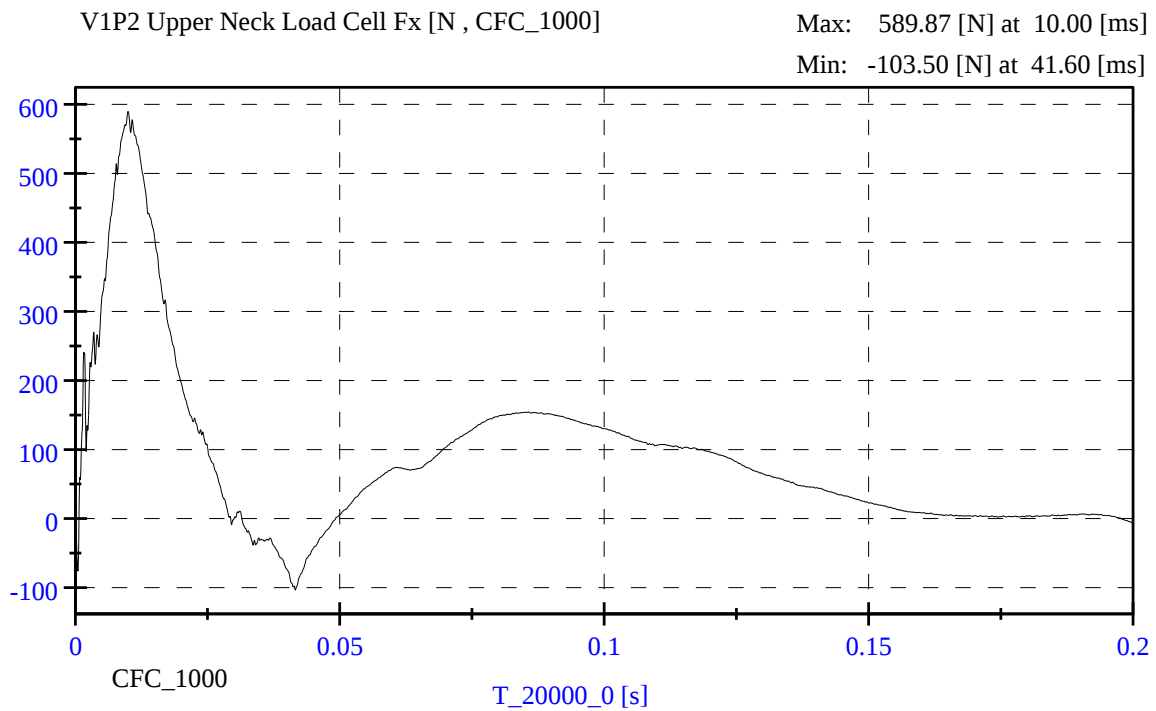
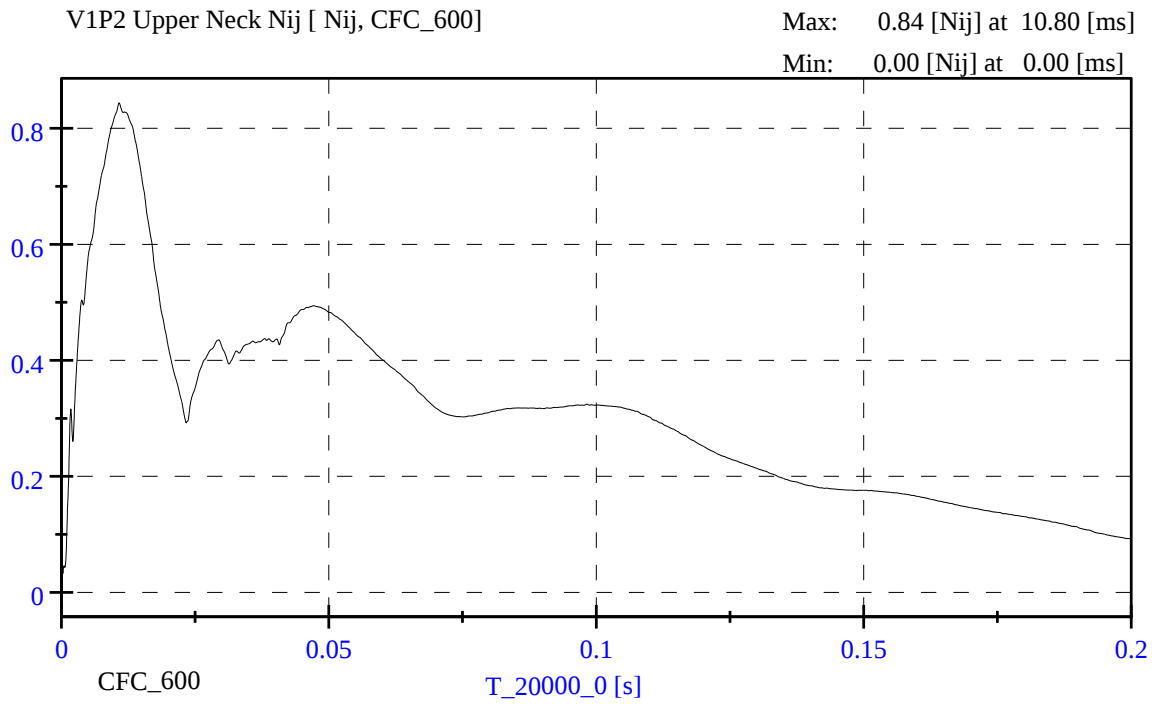


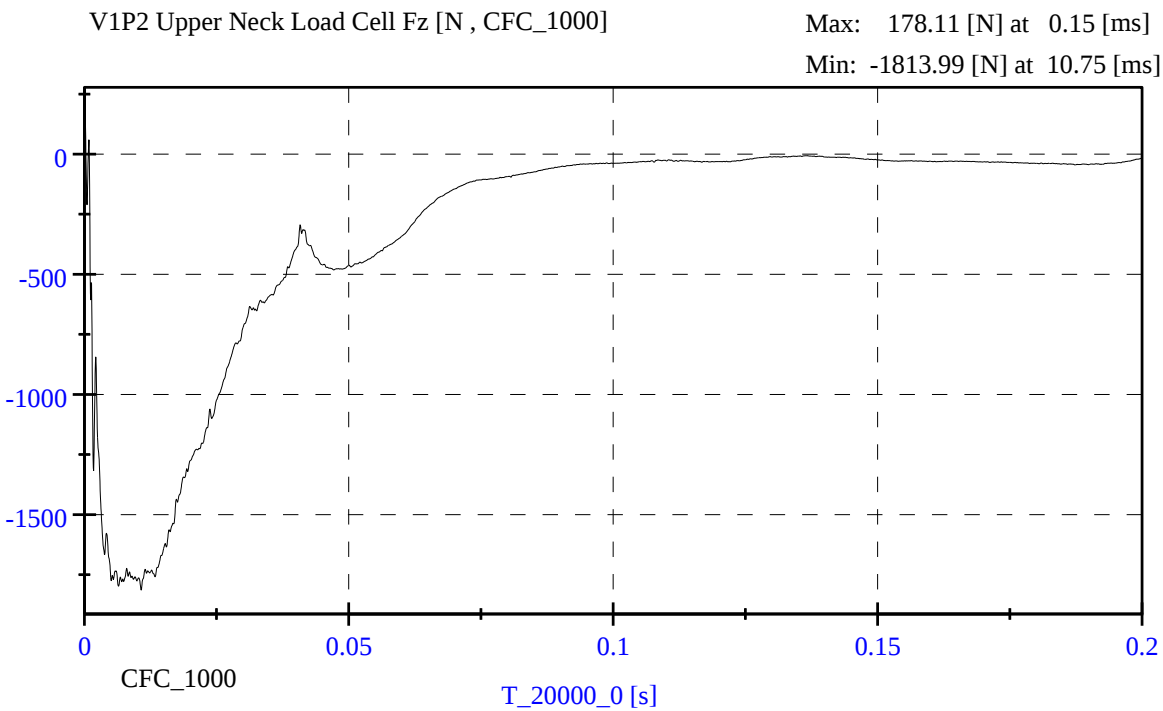
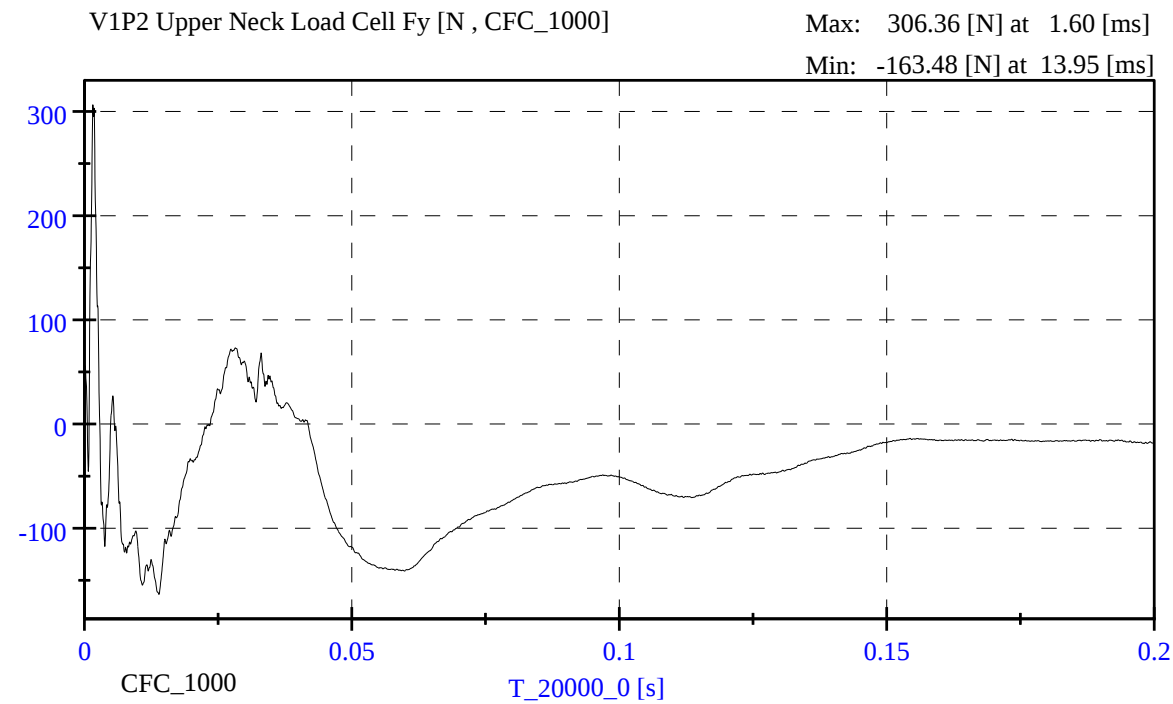


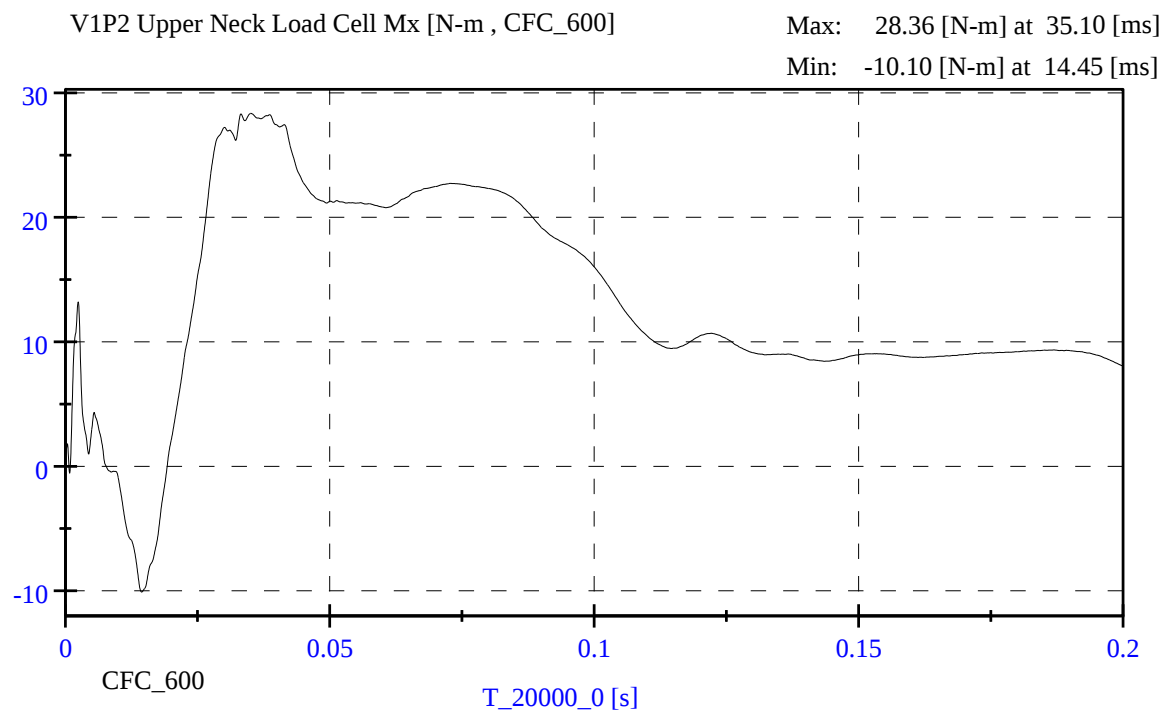
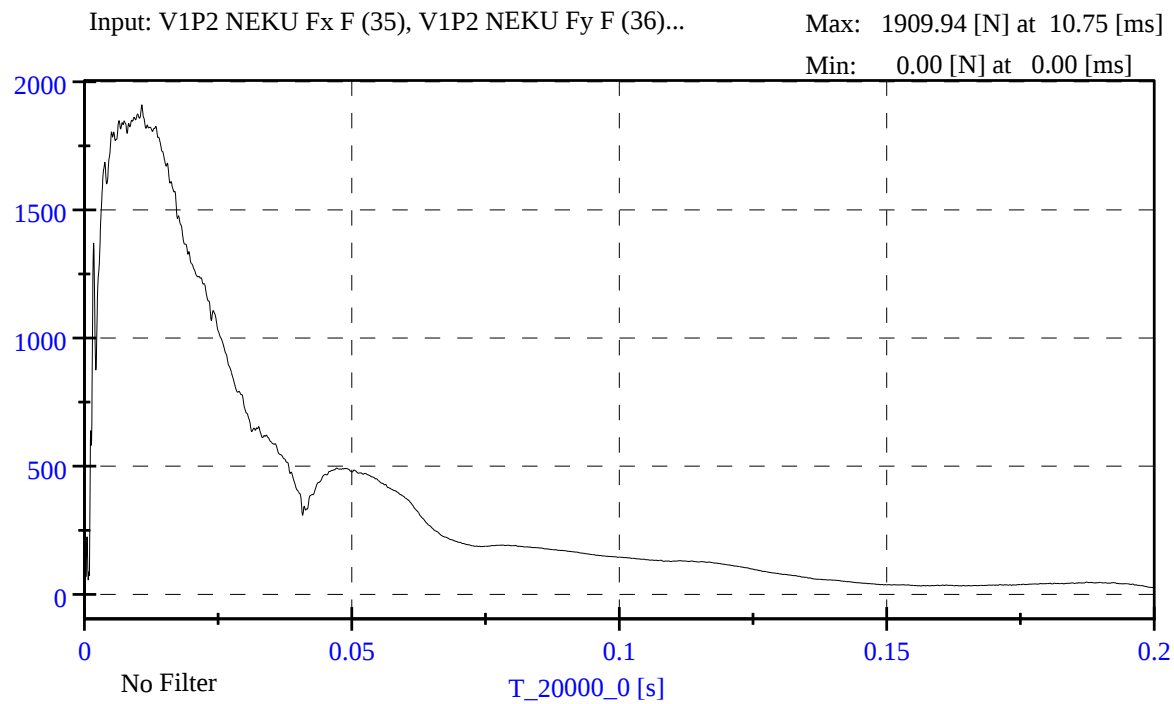


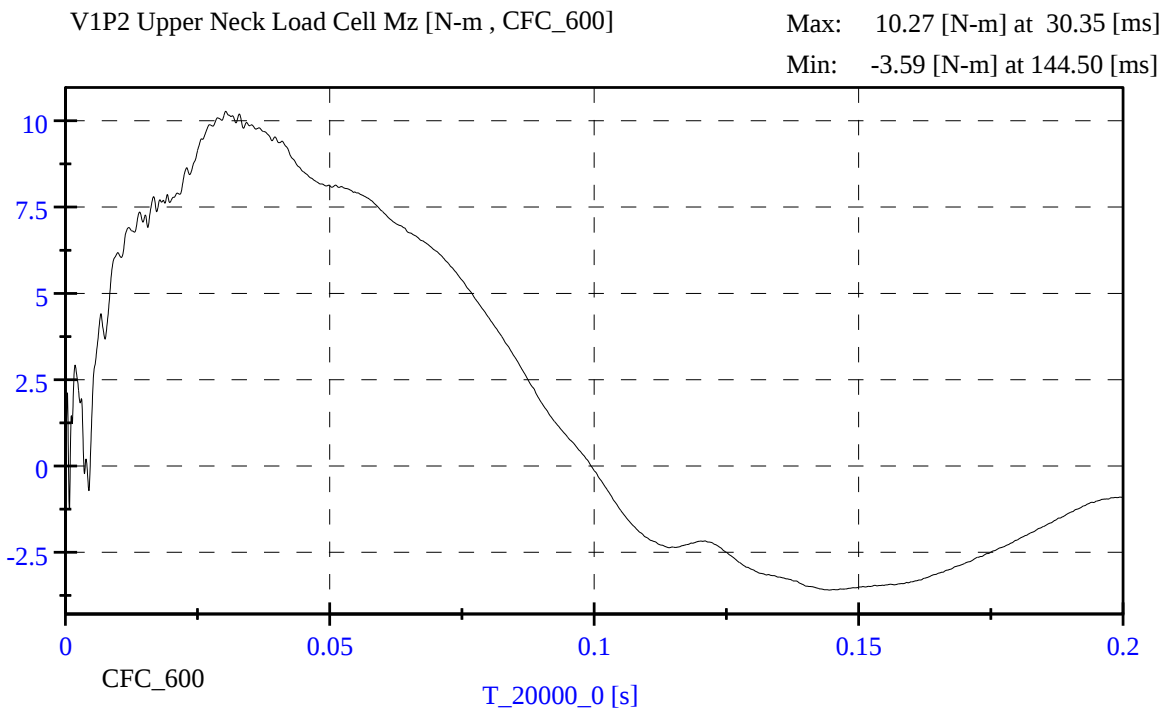
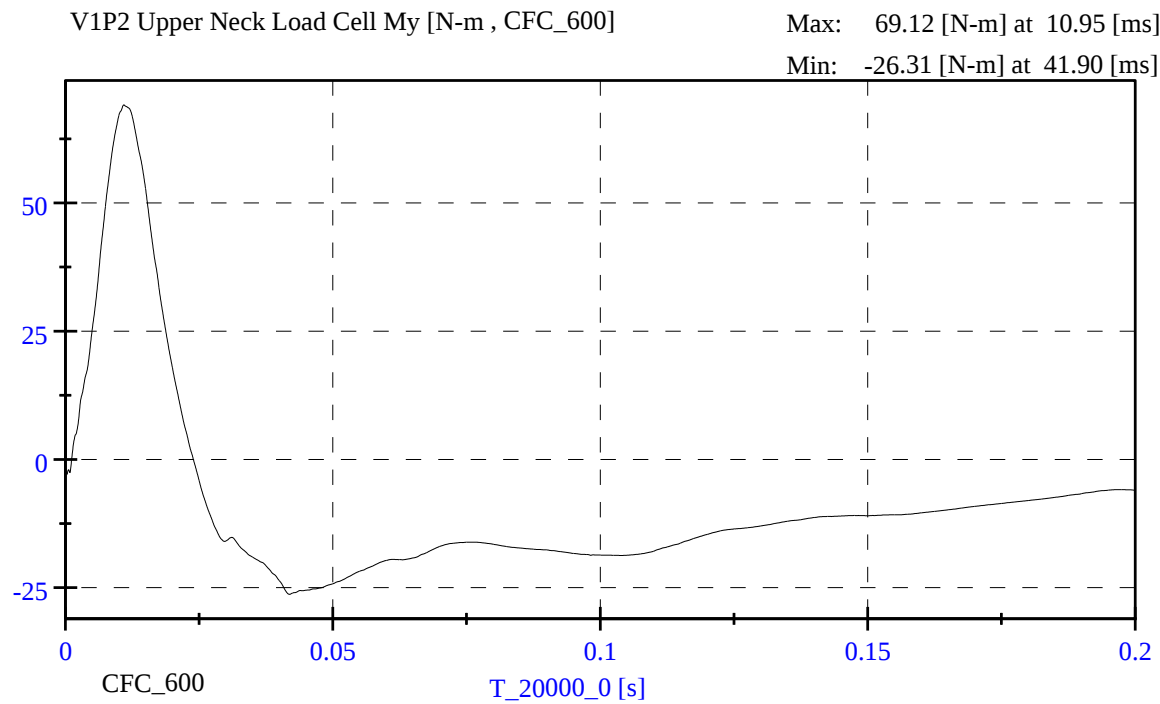


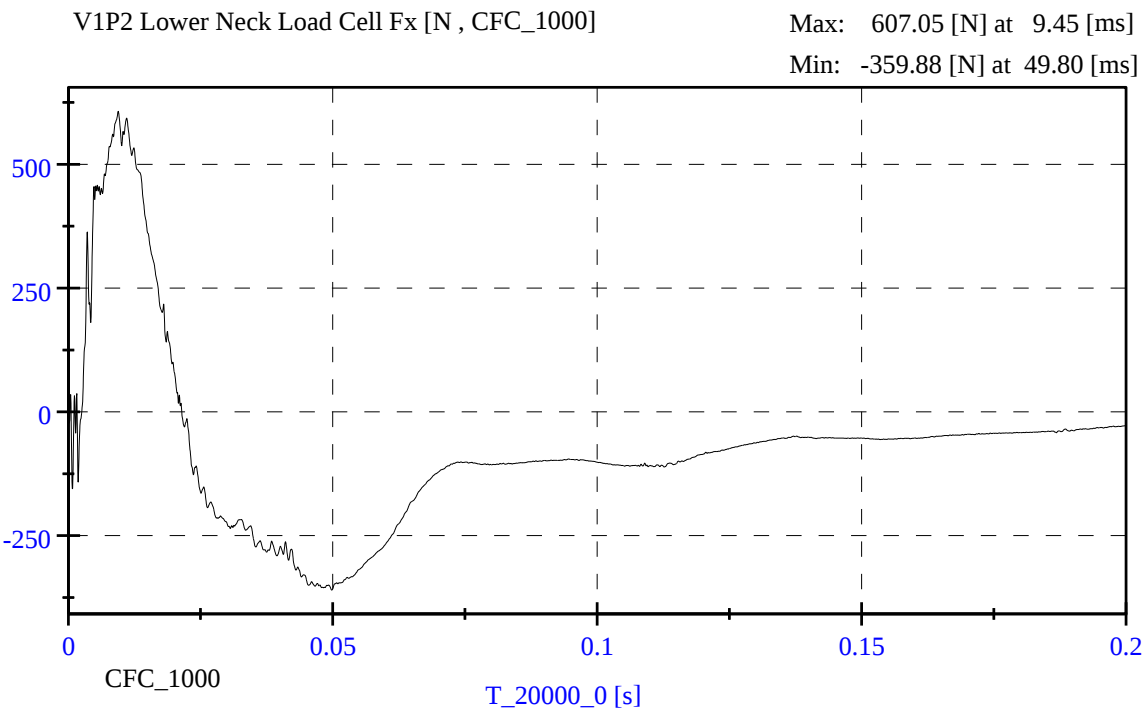
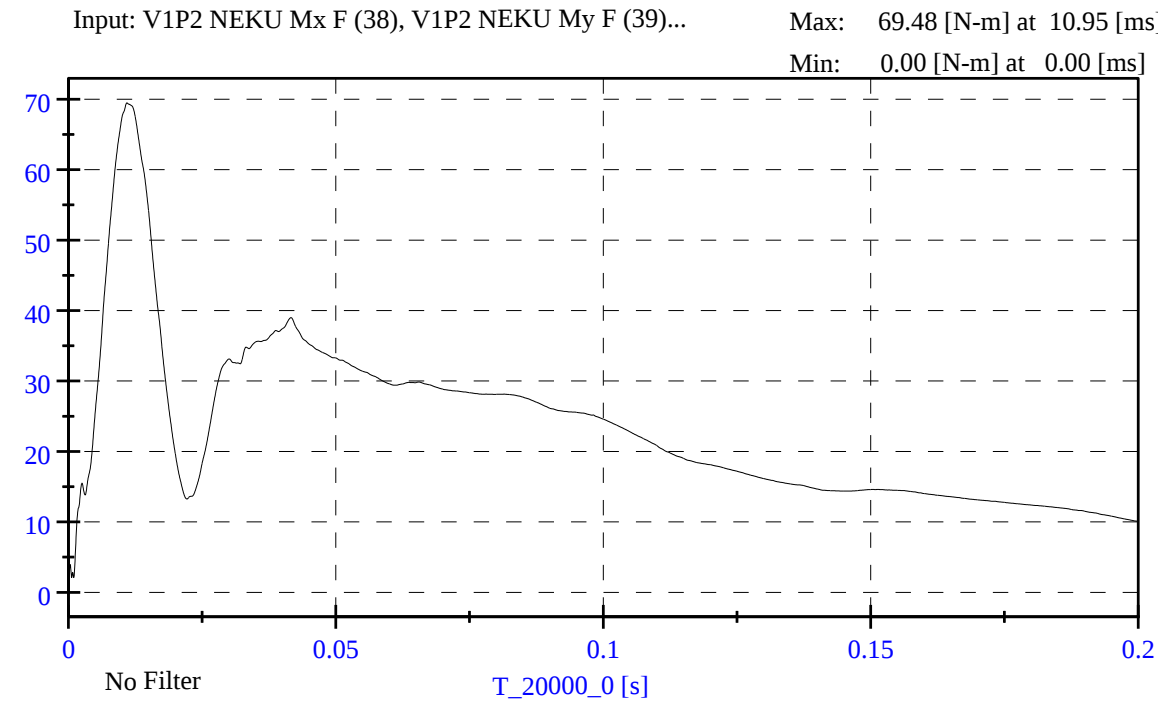


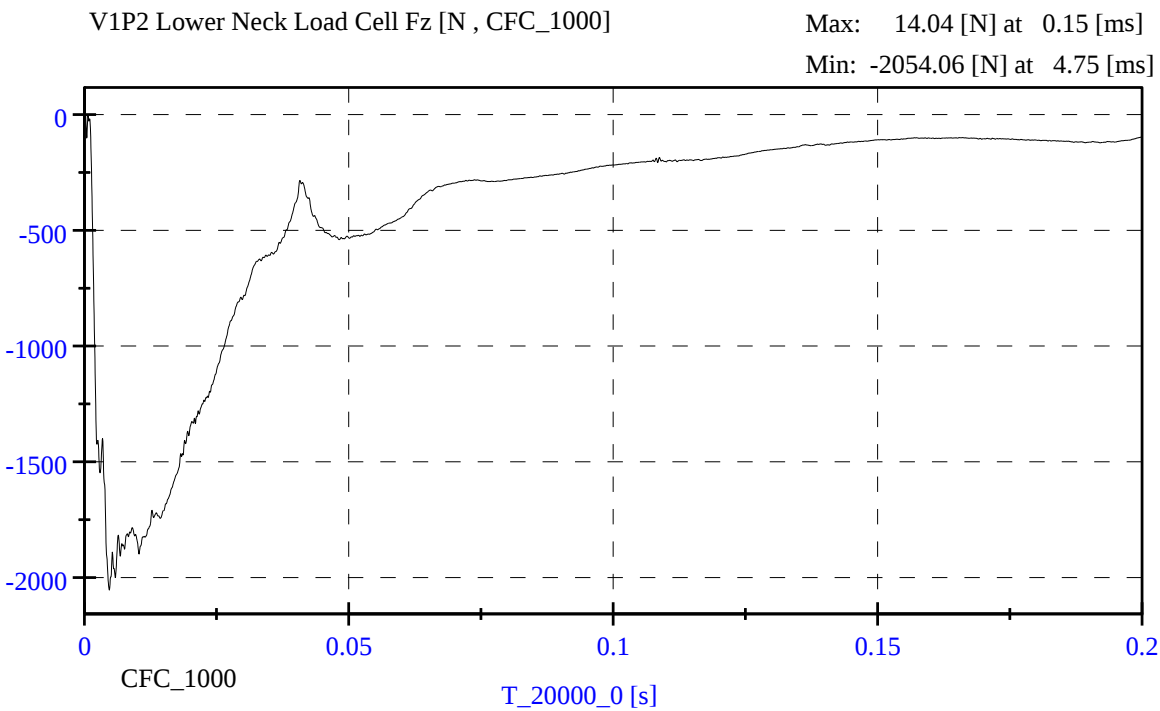
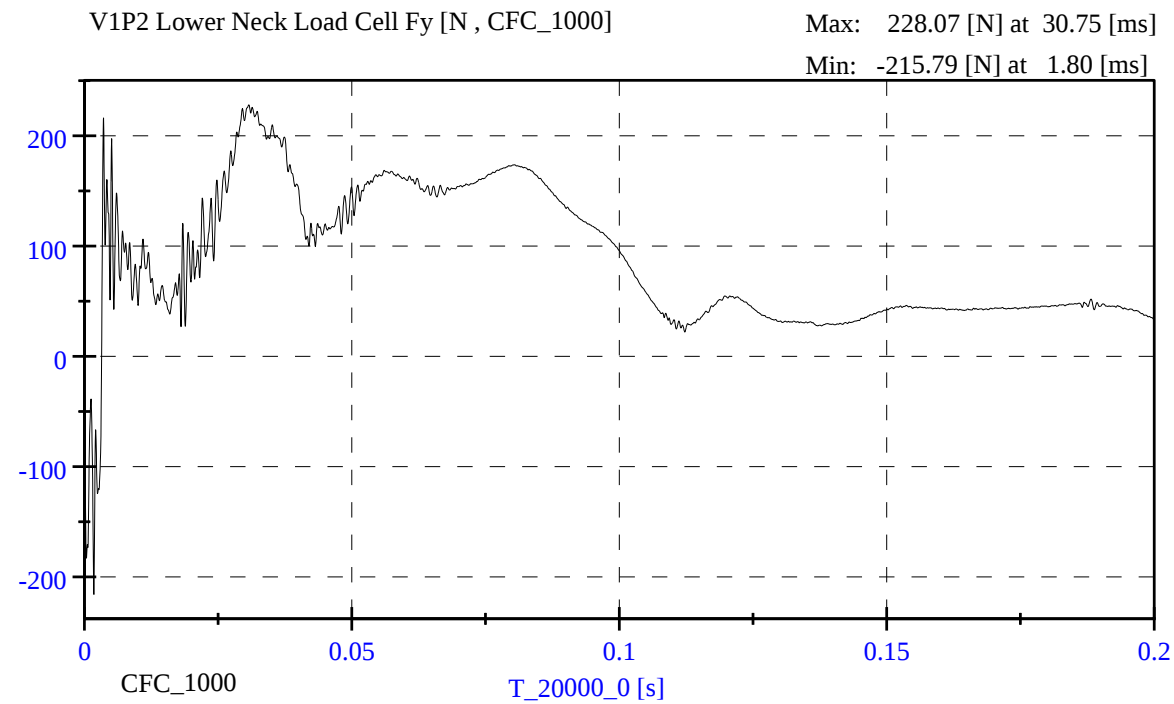


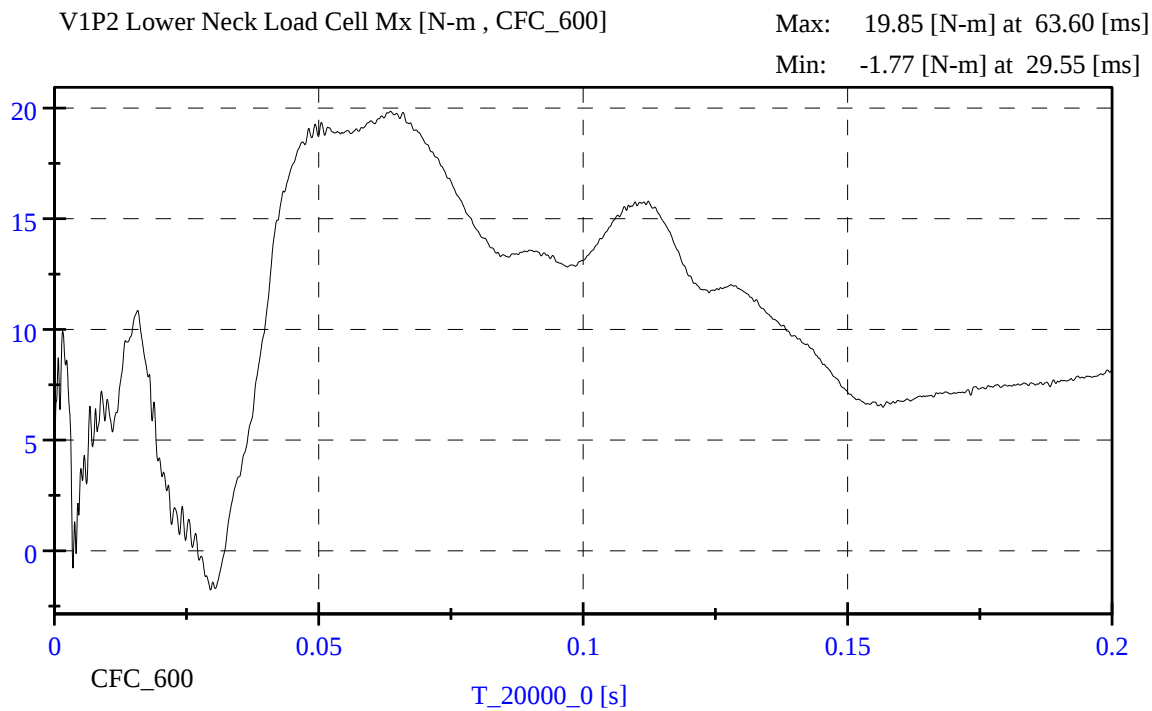
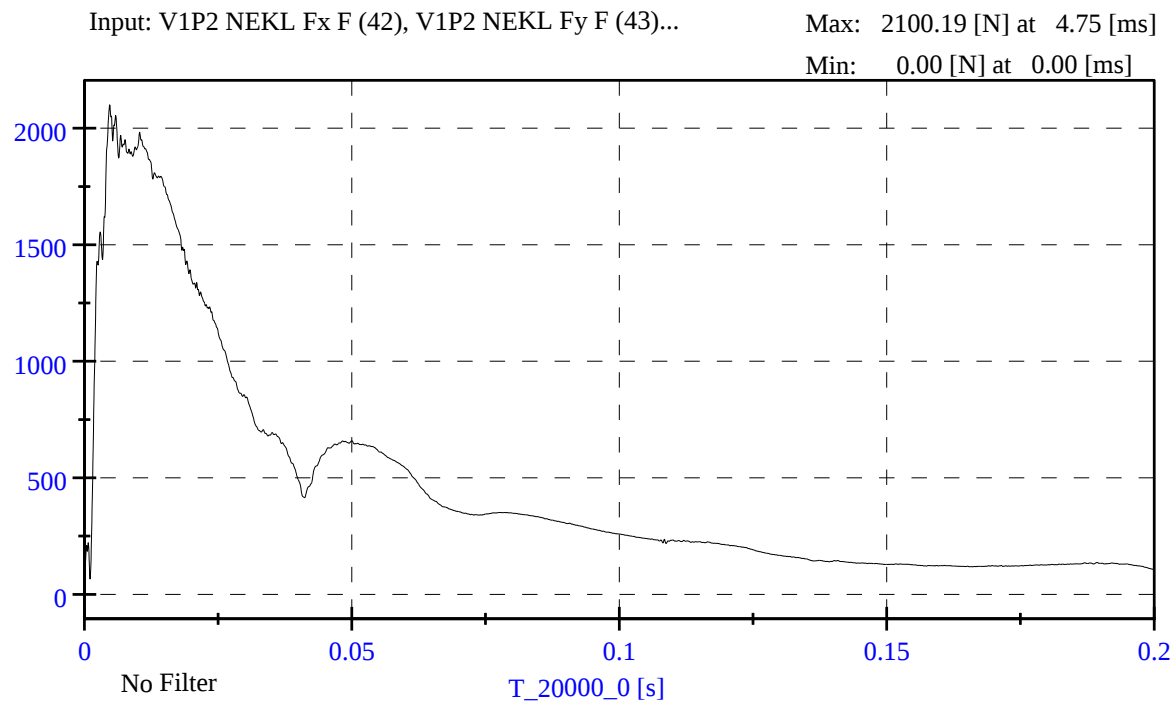


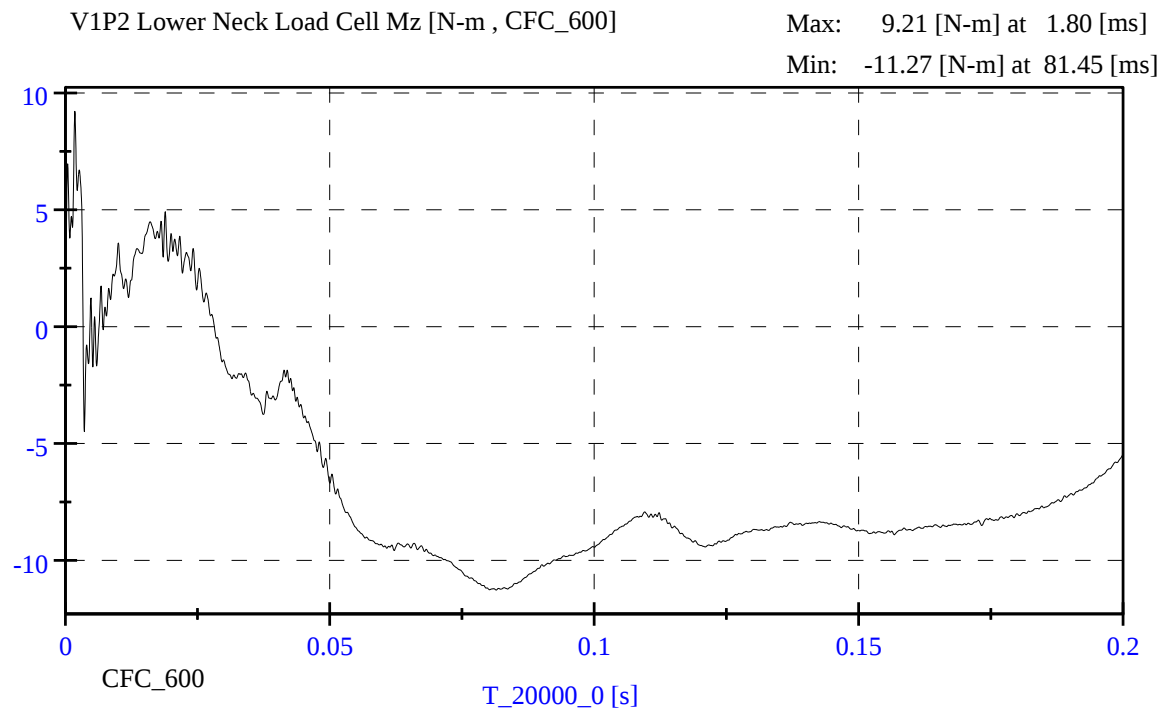
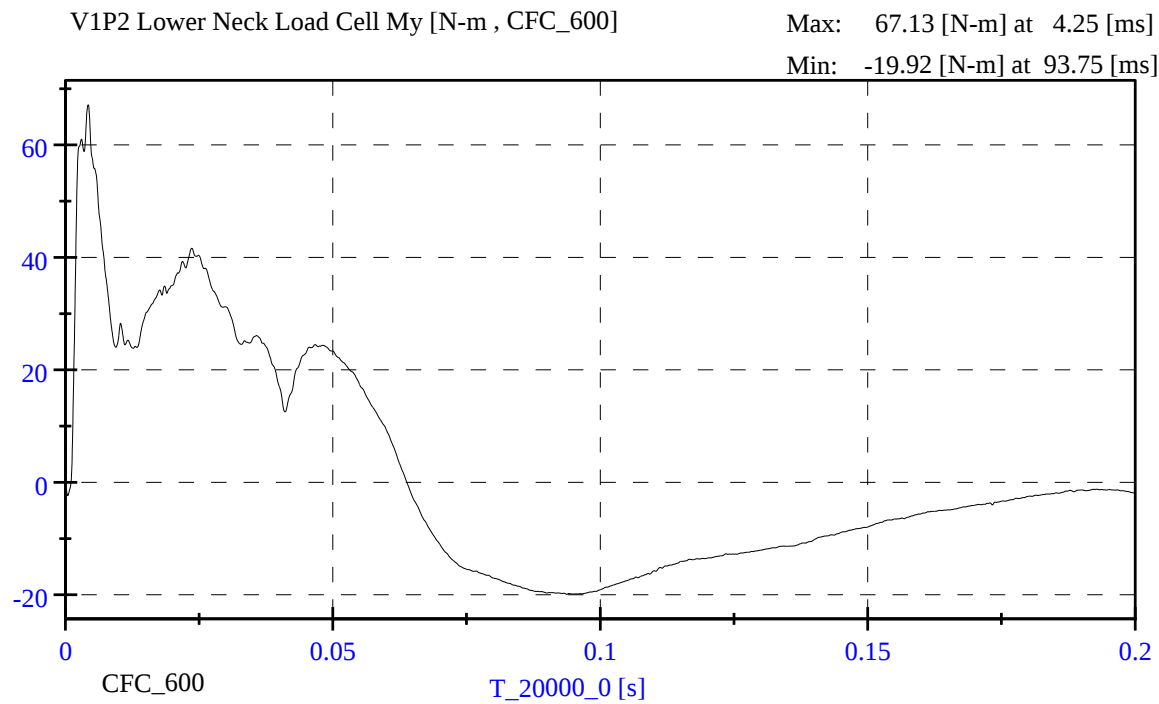


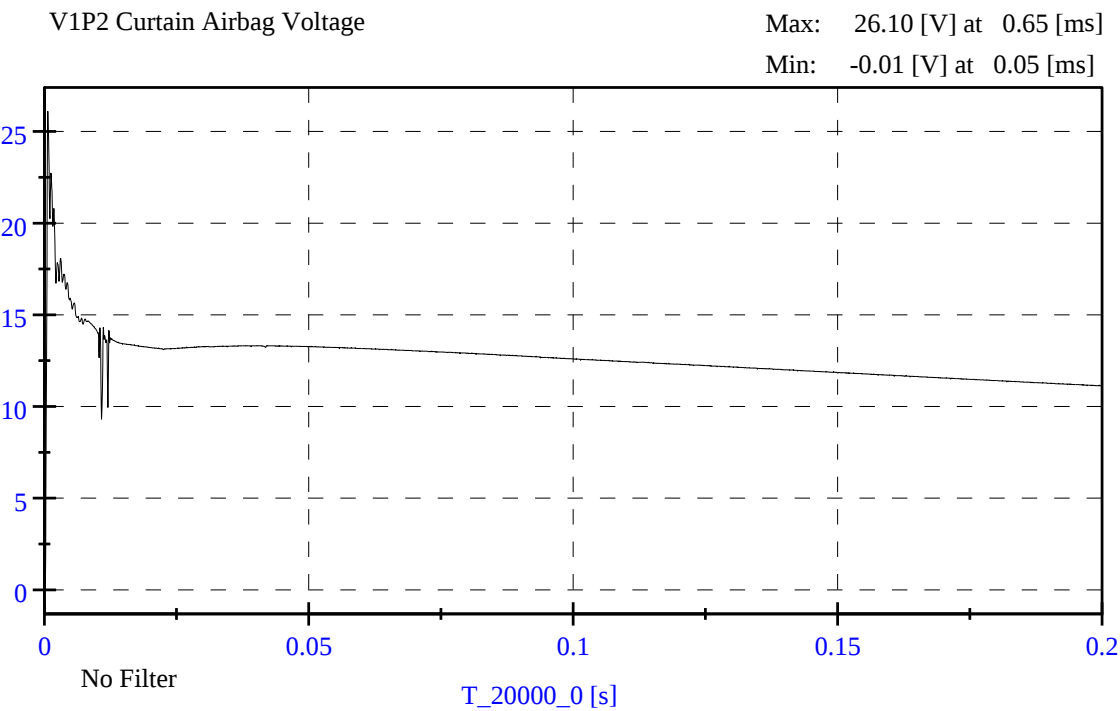
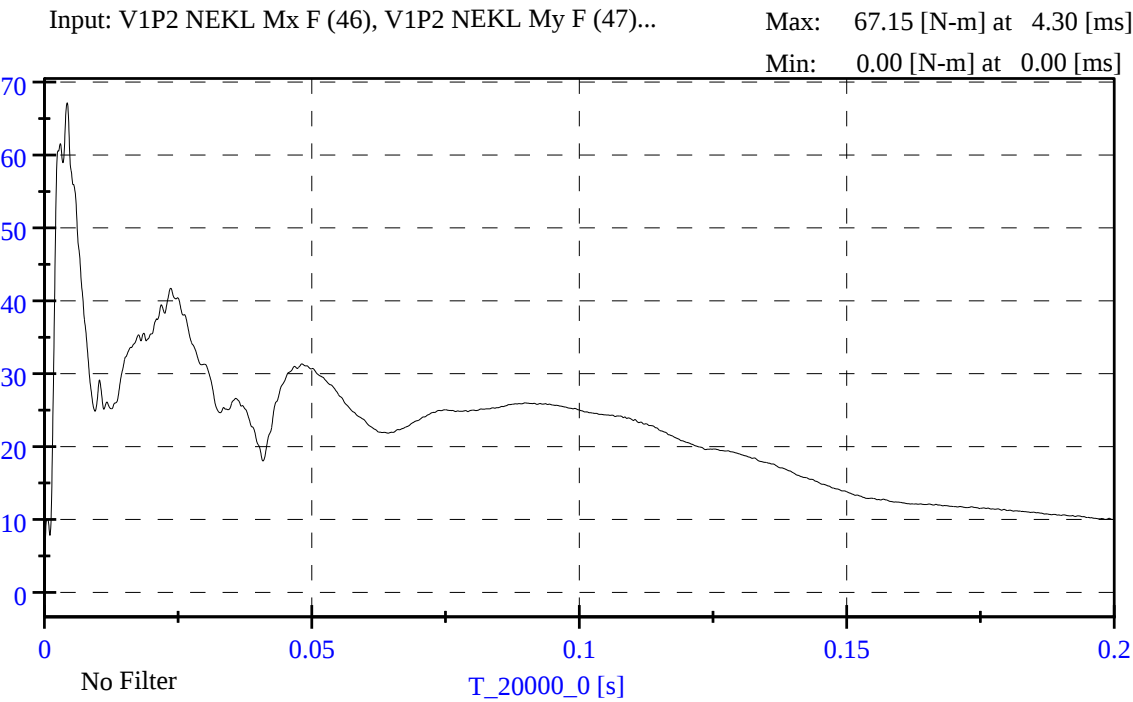


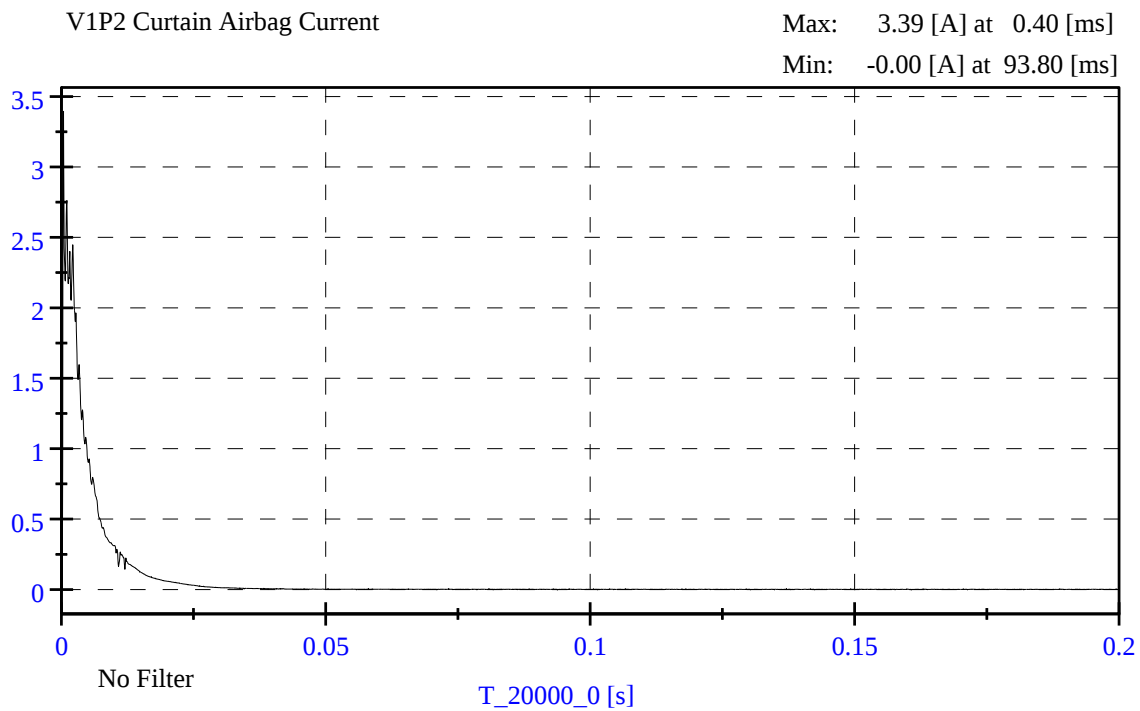
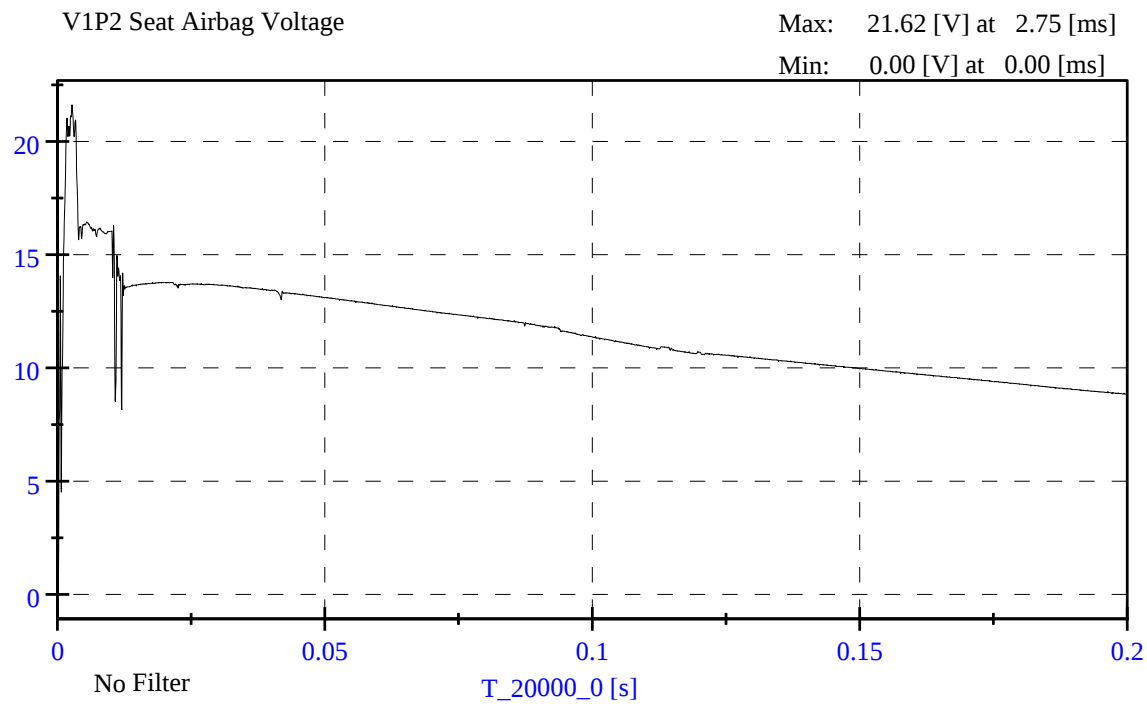


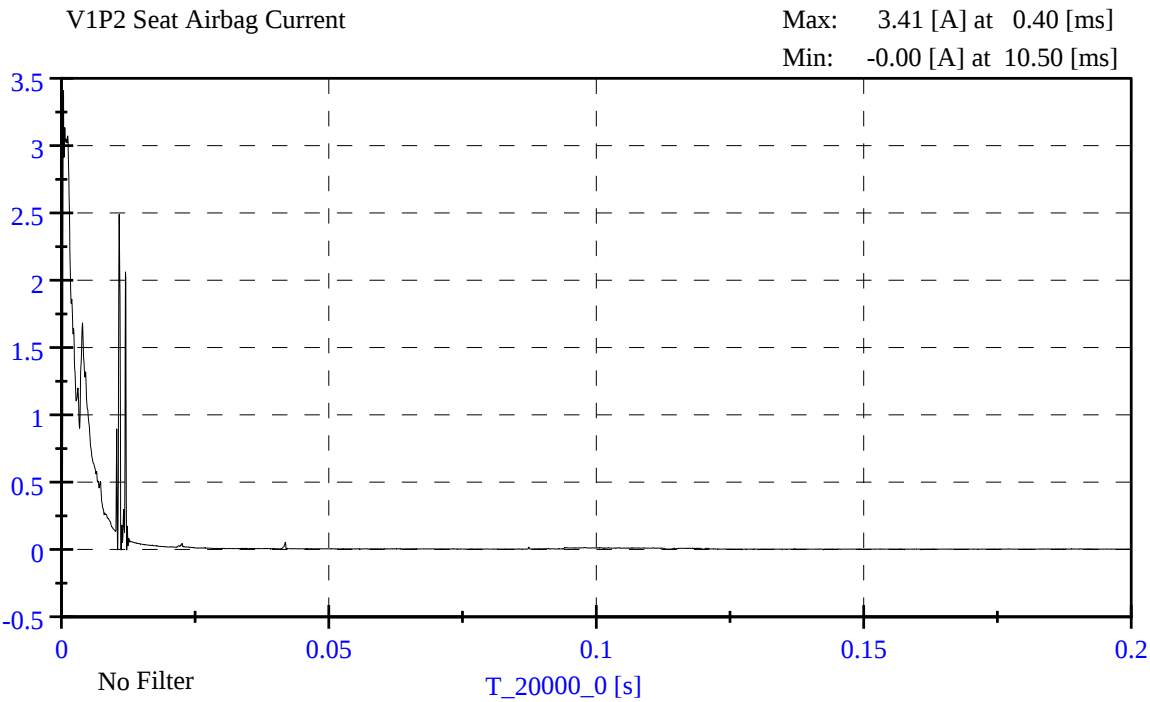












APPENDIX C
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

P572C INSTRUMENTATION

	POSITION #2 (RIGHT) SERIAL NO.: MD0213TWG2		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
HEAD AX	AC-P59021	ENDEVCO	01/25/2013
HEAD AY	AC-P52088	ENDEVCO	01/25/2013
HEAD AZ	AC-P58794	ENDEVCO	01/25/2013
HEAD RedAX	AC-P52095	ENDEVCO	01/25/2013
HEAD RedAY	AC-P58908	ENDEVCO	01/25/2013
HEAD RedAZ	AC-P58986	ENDEVCO	01/25/2013
UPPER NECK FX	LC-2192	DENTON	5/21/2012
UPPER NECK FY	LC-2192	DENTON	5/21/2012
UPPER NECK FZ	LC-2192	DENTON	5/21/2012
UPPER NECK MX	LC-2192	DENTON	5/21/2012
UPPER NECK MY	LC-2192	DENTON	5/21/2012
UPPER NECK MZ	LC-2192	DENTON	5/21/2012
LOWER NECK FX	LC-DJ2031	DENTON	3/14/2013
LOWER NECK FY	LC-DJ2031	DENTON	3/14/2013
LOWER NECK FZ	LC-DJ2031	DENTON	3/14/2013
LOWER NECK MX	LC-DJ2031	DENTON	3/14/2013
LOWER NECK MY	LC-DJ2031	DENTON	3/14/2013
LOWER NECK MZ	LC-DJ2031	DENTON	3/14/2013
Torso Bag Voltage	KT Minidau timer	N/A	-
Curtain Bag Voltage	KT Minidau timer	N/A	-
Torso Bag Current	KT Minidau timer	N/A	-
Curtain Bag Current	KT Minidau timer	N/A	-