

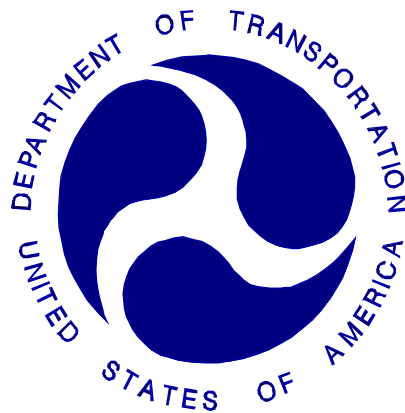
REPORT NUMBER: TWG-CAL-13-05

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

Chrysler Group LLC
2013 Dodge Dart
Four Door Sedan

NHTSA NUMBER: MD0305TWG2
CALSPAN TEST NUMBER: CT2013-05

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



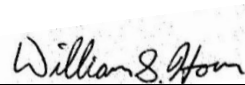
April 3, 2013

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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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 3, 2013.						
Injury Summary						
HIC15	Maximum Chest Displacement (mm)	Maximum Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
12.365	N/A	N/A	0.099	0.109	0.033	0.394
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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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 Dodge Dart four door sedan on an out-of-position SIDIIIs (Hybrid III 5th female anthropomorphic test device (ATD)) was evaluated. The test was performed by Calspan on April 03, 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 parallel to the centerline of the seat, facing forwards 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 3.3.5.2.

The female ATD was instrumented with head x, y and z accelerometers (primary). In addition, six upper axial neck forces, and moment load cell sensors and six lower 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 right arm outstretched against the front (passenger) door facing forward in the car sitting with its legs placed on floor. 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 was tilted outboard until the dummy's head was positioned under the airbag. The center of gravity of the head was centered in the deployment trajectory of the airbag. This orientation complies with section 3.3.5.2 of the TWG Recommended Procedures for Evaluating Occupant Injury Risk from Deploying Side Airbags as defined by Lund, et al and the Technical Working Group First Revision dated July, 2003.

SECTION 2

DATA SHEET NO. 1 TEST SUMMARY

TEST CONFIGURATION INFORMATION:

Seating Position:	P2	Right Front Seating Position
Test:	3.3.5.2	Foreword 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 edge of seat/arm against door
Lower Torso Contact:	Butt on side of seat
Knee Contact:	None
Foot Contact:	Floor

POST-TEST VISIBLE DUMMY CONTACT POINTS

Head Contact:	Curtain Airbag
Upper Torso Contact:	Seat/Torso Airbag
Lower Torso Contact:	Seat/Torso Airbag
Knee Contact:	None
Foot Contact:	Floor

DATA SHEET NO. 2
VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2013 Dodge Dart Four Door Sedan

NHTSA No. : MD0305TWG2 VIN: 1C3CDFBA7DD708016 Color: Charcoal gray

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

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

Transmission Data: 6 speeds; - Manual; X Automatic; X 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: 9/6/2012; Odometer Reading 39 Km

Selling Dealer: Transitown Dodge Chrysler Jeep

& Address: Amherst, NY 14226

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Chrysler Group LLC

Date of Manufacture 07/12

GVWR: 1944 kg; GAWR: 1076 kg FRONT; 870 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P225/45R17

*Recommended Cold Tire Pressure: 235 Kpa Front 235 kpa Rear

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P225/45R17; 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) = 374 Kg

No. of Occupants x 68.04 kg = 340.2 Kg

Rated Cargo/Luggage Weight (RCLW) = 33.8 Kg

*Tire pressure used for test

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

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

Measurement	Value
Total Fore/Aft Travel (mm)	220
Test Distance Rearward of Full-Forward (mm)	110
Total Fore/Aft Travel (Detents)	22
Placed in Position #	11

Seat Back Angle	SA (°)	Value
Head CG to Door Panel/Side Window	HD (mm)	95
Head to Seat Back Centerline	HSC (mm)	-
Head to B-Pillar (cg)	HB (mm)	238
Head to Roof, Z (top of the head)	HZ (mm)	46
Head to Header	HHD (mm)	-
Chest to Dash	CD (mm)	505
Chest to Seatback	CS (mm)	-

DATA SHEET 4

SID-IIs DUMMY INJURY CRITERIA VALUES

NHTSA No.: MD0305TWG2

Channel	Max	Time (ms)	Min	Time (ms)
V1P2 Head x [g , CFC_1000]	6.956	0.400	-14.199	1.350
V1P2 Head y [g , CFC_1000]	15.224	1.550	-8.849	0.450
V1P2 Head z [g , CFC_1000]	29.933	0.500	-20.249	6.550
V1P2 Headform Resultant [g, CFC_1000]	31.313	0.500	0	0
V1P2 Upper Neck Moc [N-m, CFC_600]	6.382	128.450	-9.848	27.250
V1P2 Upper Neck Ntf [N-m, CFC_600]	0.099	130.850	0	0
V1P2 Upper Neck Nte [N-m, CFC_600]	0.109	198.100	0	0
V1P2 Upper Neck Ncf [N-m, CFC_600]	0.033	0.250	0	0
V1P2 Upper Neck Nce [N-m, CFC_600]	0.394	4.700	0	0
V1P2 Upper Neck Nij [Nij, CFC_600]	0.39	4.70	0	0
V1P2 Upper Neck Fx [N , CFC_1000]	122.343	34.250	-70.083	122.050
V1P2 Upper neck Fy [N , CFC_1000]	109.368	64.800	-132.360	154.150
V1P2 Upper neck Fz [N , CFC_1000]	266.114	113.500	-1184.160	4.650
V1P2 Neck F Res	1185.164	4.650	0	0
V1P2 Upper Neck Mx [N-m , CFC_600]	12.050	9.850	-17.522	52.550
V1P2 Upper Neck My [N-m , CFC_600]	5.234	130.150	-9.104	11.300
V1P2 Upper Neck Mz [N-m , CFC_600]	1.349	198.100	-7.712	33.400
V1P2 Neck M Res	19.513	53.050	0	0
V1P2 Lower Neck Fx F [N , CFC_1000]	138.822	17.750	-158.697	55.850
V1P2 Lower Neck Fy F [N , CFC_1000]	257.099	10.300	-115.427	19.350
V1P2 Lower Neck Fz F [N , CFC_1000]	186.434	187.700	-1329.214	5.100
V1P2 Lower Neck Res	1334.190	5.100	0	0
V1P2 Lower Neck Mx F [N-m , CFC_600]	19.302	155.200	-29.452	65.750
V1P2 Lower Neck My F [N-m , CFC_600]	66.104	5.550	-15.952	18.750
V1P2 Lower Neck Mz F [N-m , CFC_600]	4.534	72.550	-12.271	10.250
V1P2 Lower Neck Res	66.282	5.550	0	0
Curtain Airbag Volts	14.65	1.25	0	0
Curtain Airbag Current	3.41	0.4	0	66.200
Seat/Torso Airbag Volts	26.05	0.5	0	0
Seat/Torso Airbag Current	3.17	0.35	0	0

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2013 Dodge Dart Four Door Sedan

NHTSA No.: MD0305TWG2

HEAD INJURY CRITERIA (HIC)

	HIC15			
	HIC(15)	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position #2 - Right	12.365	0.300	15.300	14.662

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	0.099	130.850	247.513	-62.324	6.319
Nte	0.109	198.100	250.963	10.789	-3.401
Ncf	0.033	0.250	-128.781	-14.752	0.019
Nce	0.394	4.700	-1180.062	37.780	-6.023

Peak Tension (CFC1000) 266.114 N

Peak Compression (CFC1000) -1184.16 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

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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-II's Dummy Left Side View



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

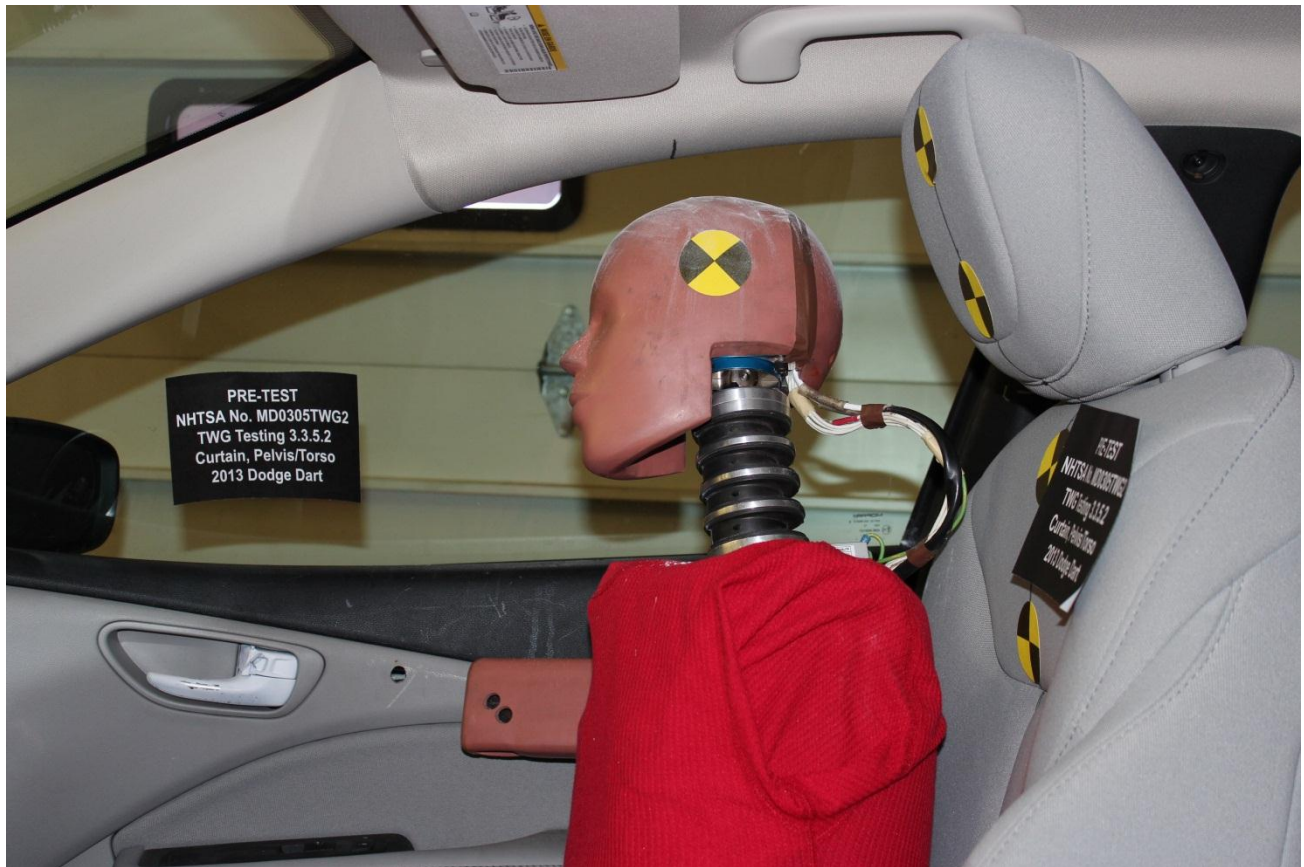


Figure A-7: Pre-Test 5th female SID-IIs Dummy Left Side Close-up View



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



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

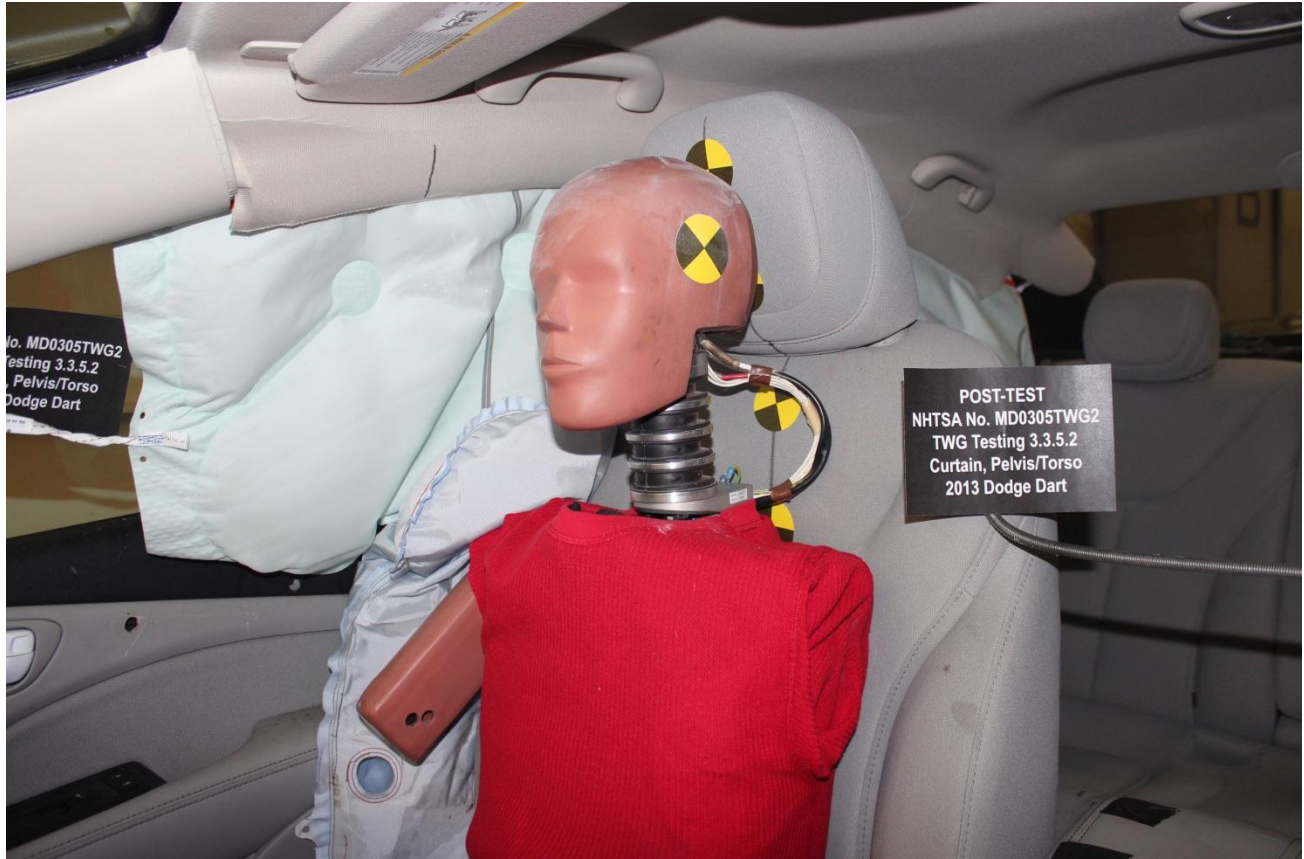


Figure A-10: Post-Test 5th female SID-II's Dummy Left $\frac{3}{4}$ Front View

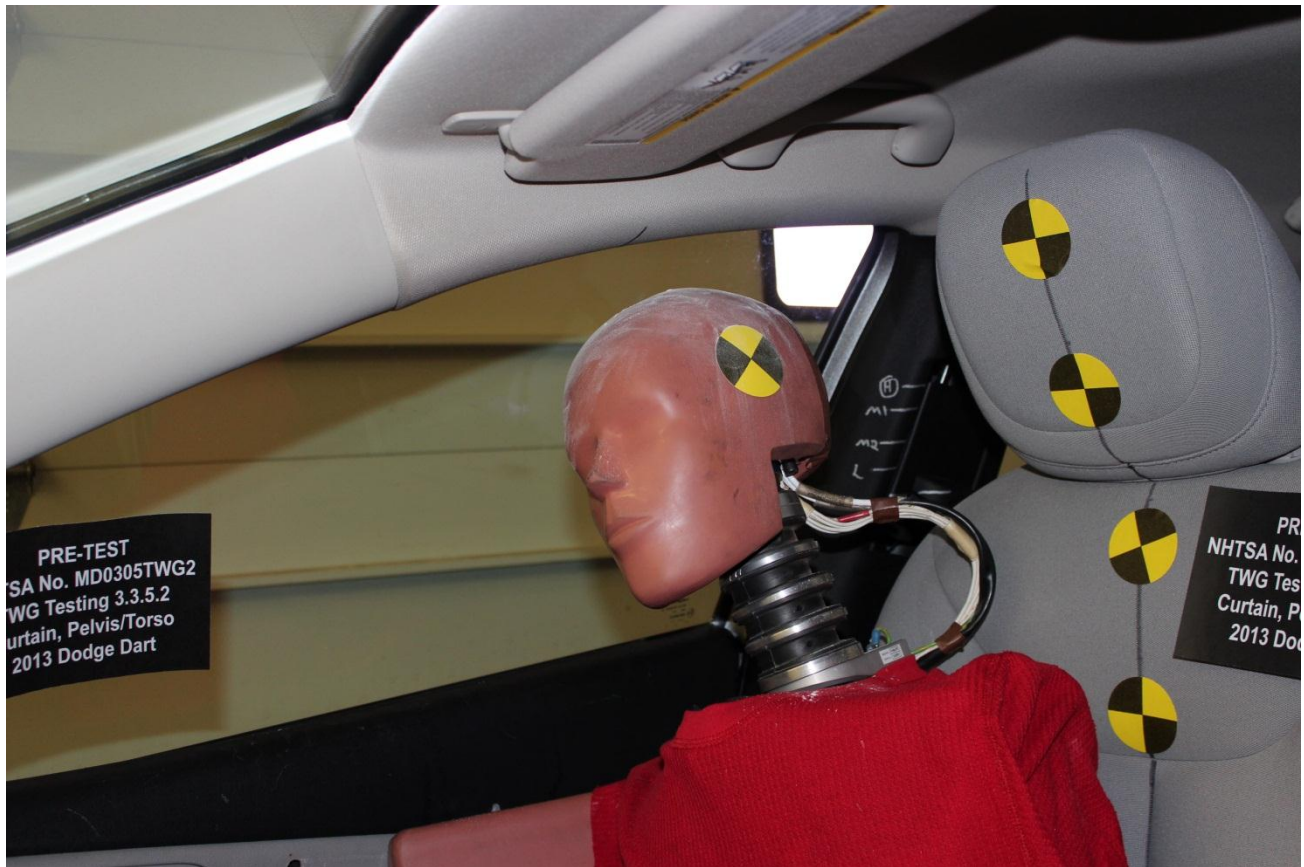


Figure A-11: Pre-Test 5th female SID-IIs Dummy Left $\frac{3}{4}$ Front Close-up View

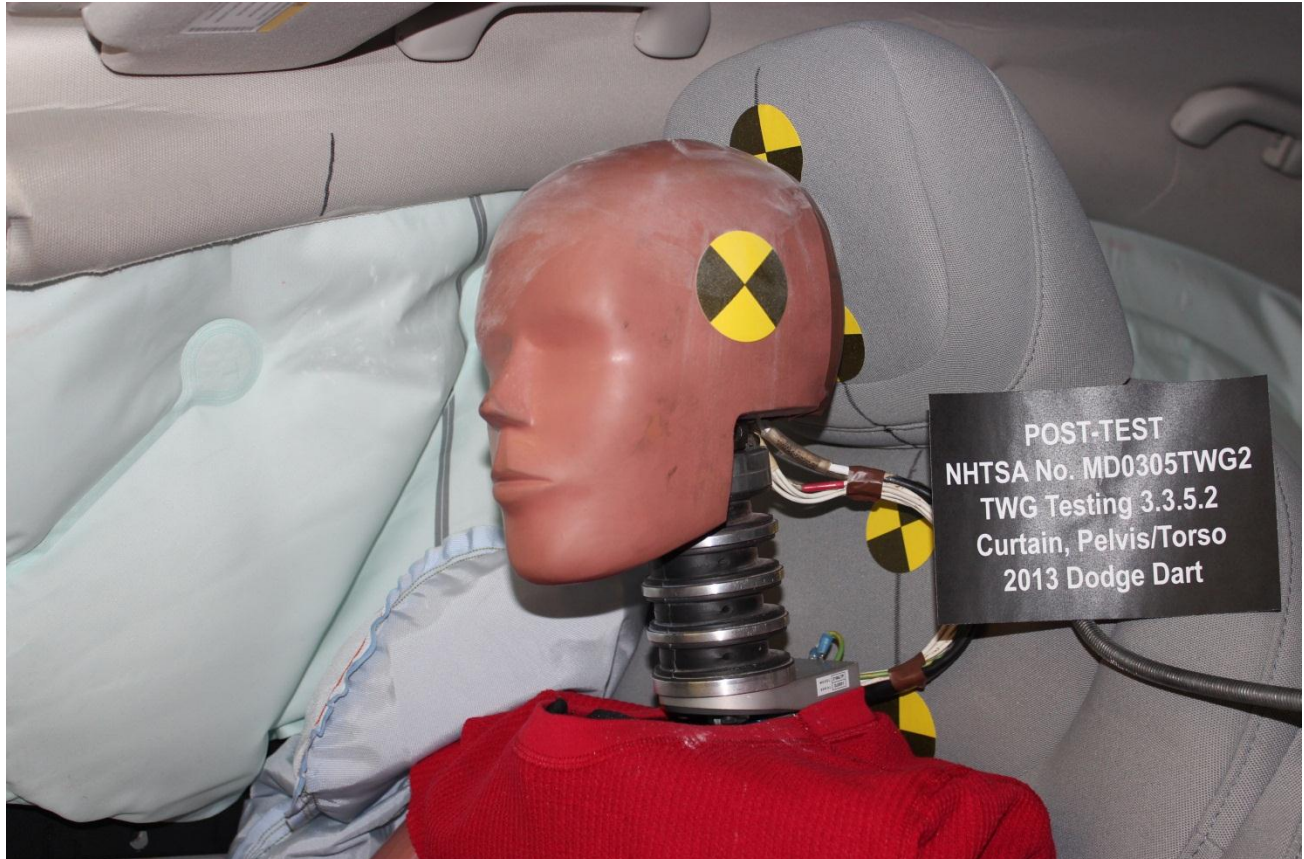


Figure A-12: Post-Test 5th female SID-IIs Dummy Left $\frac{3}{4}$ Front Close-up View



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

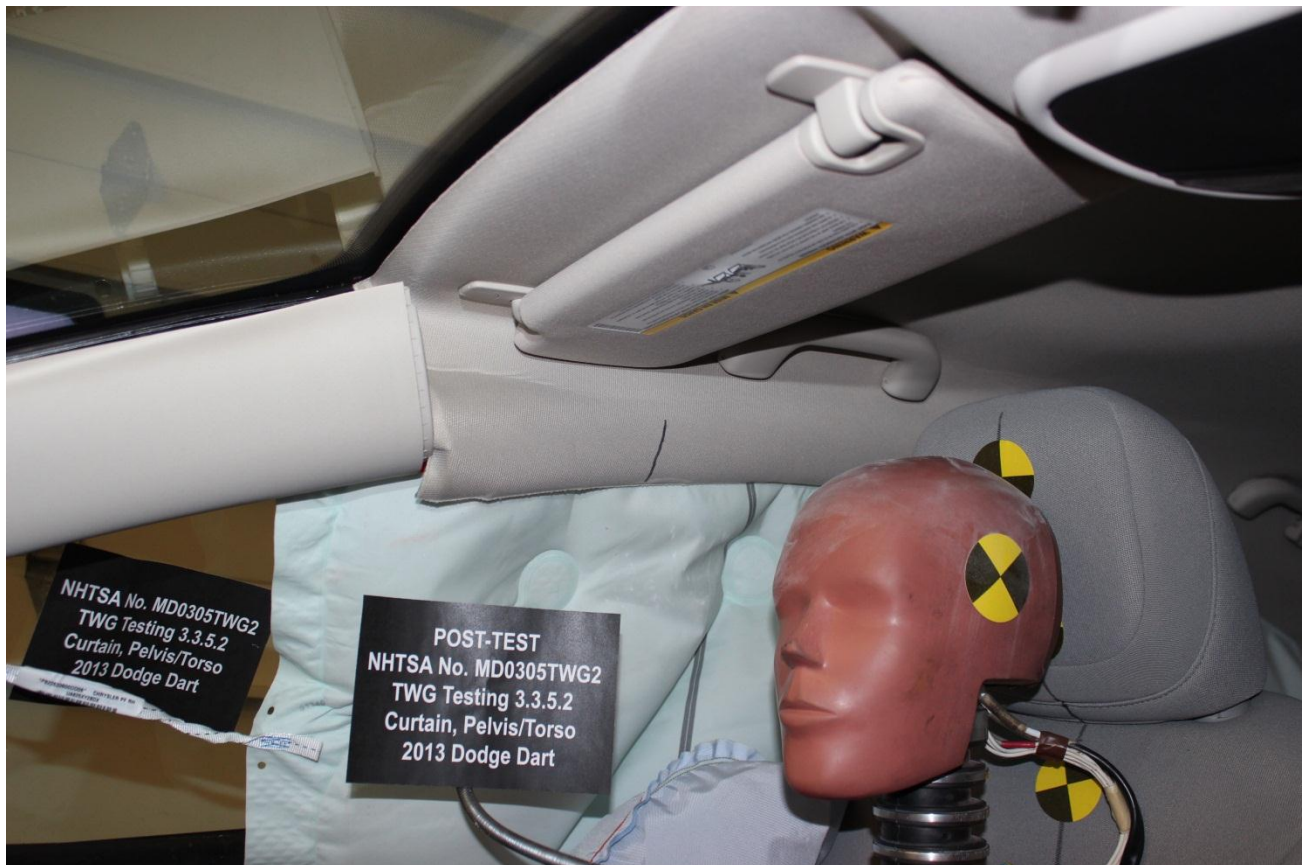


Figure A-20: Post-Test Curtain Airbag Left $\frac{3}{4}$ Front View



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

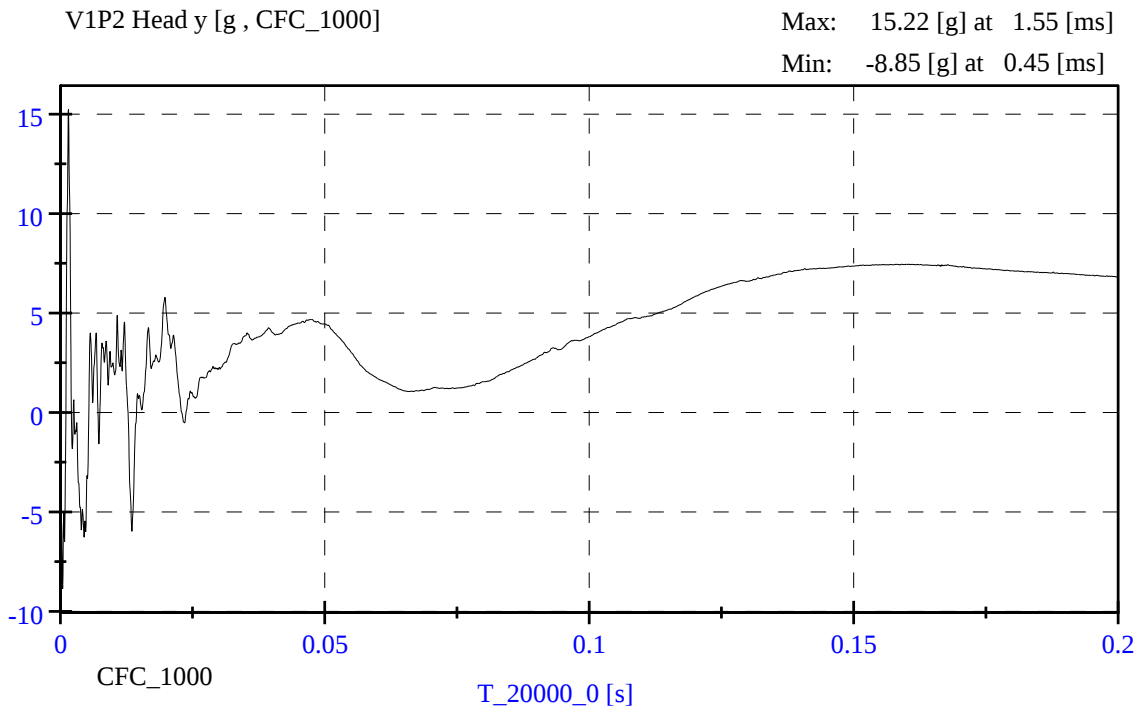
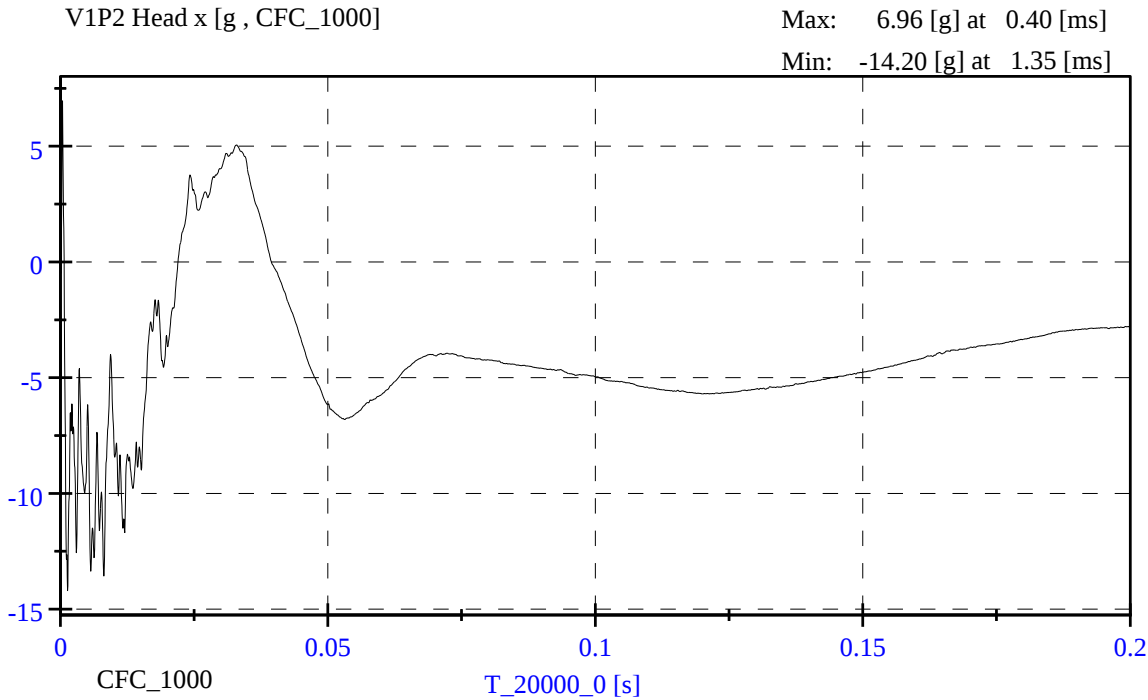


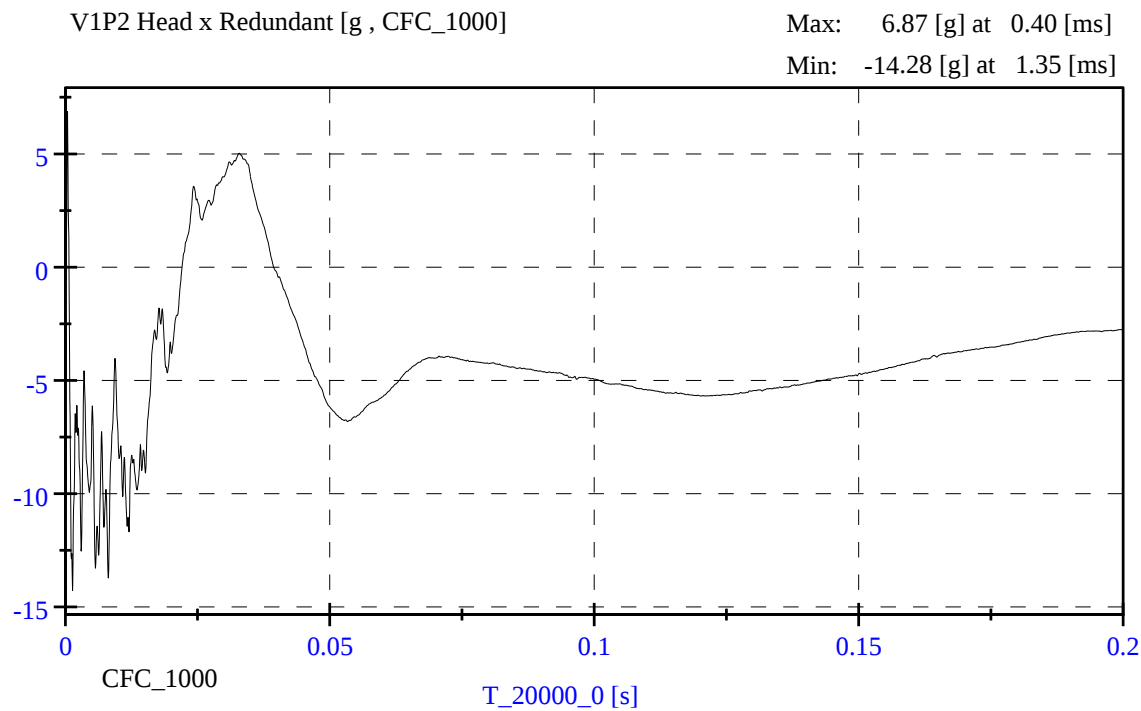
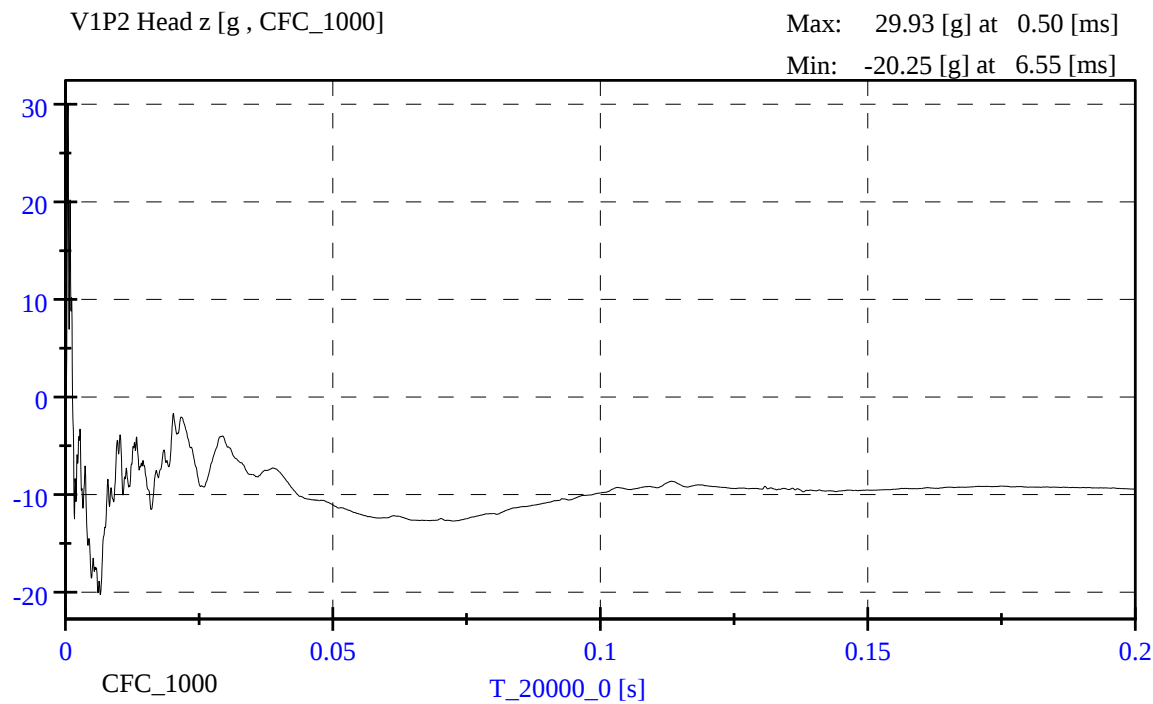
Figure A-25: Post NCAP Left Side View

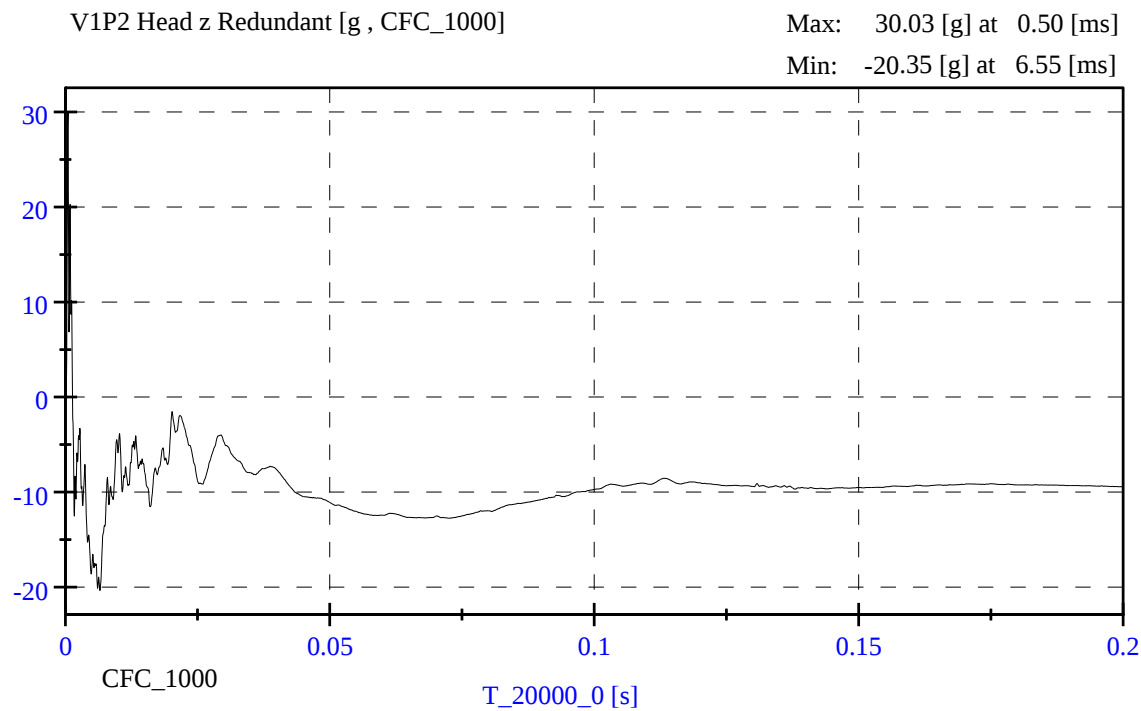
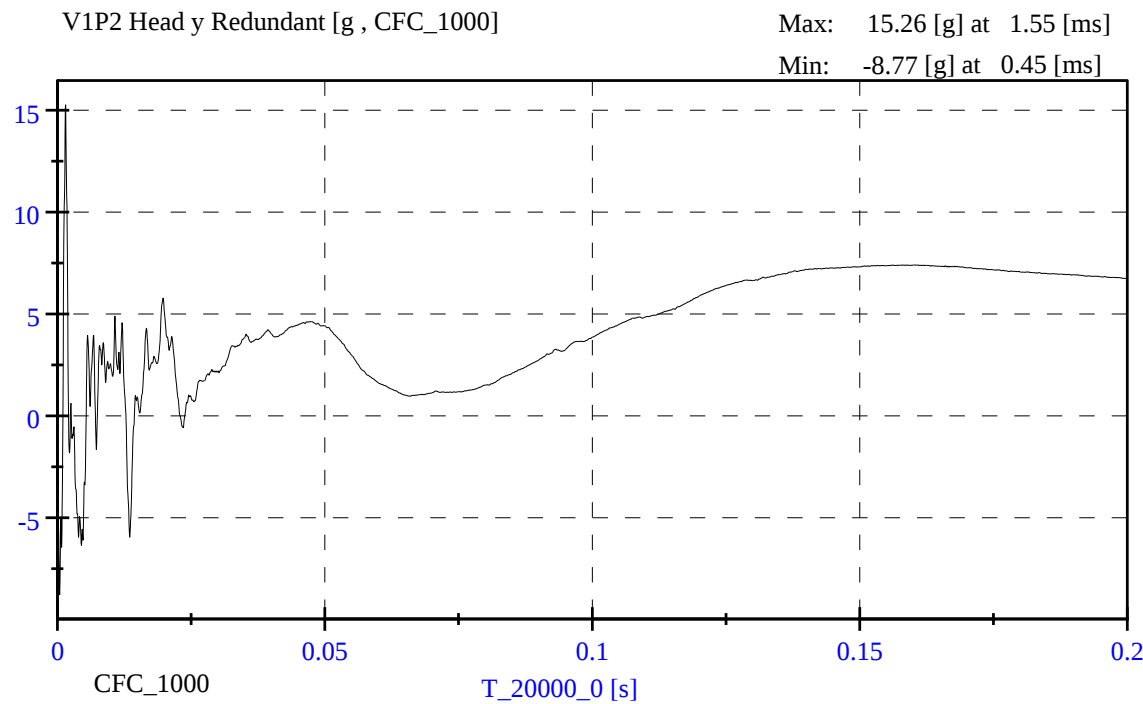
APPENDIX B
VEHICLE AND DUMMY PLOTS

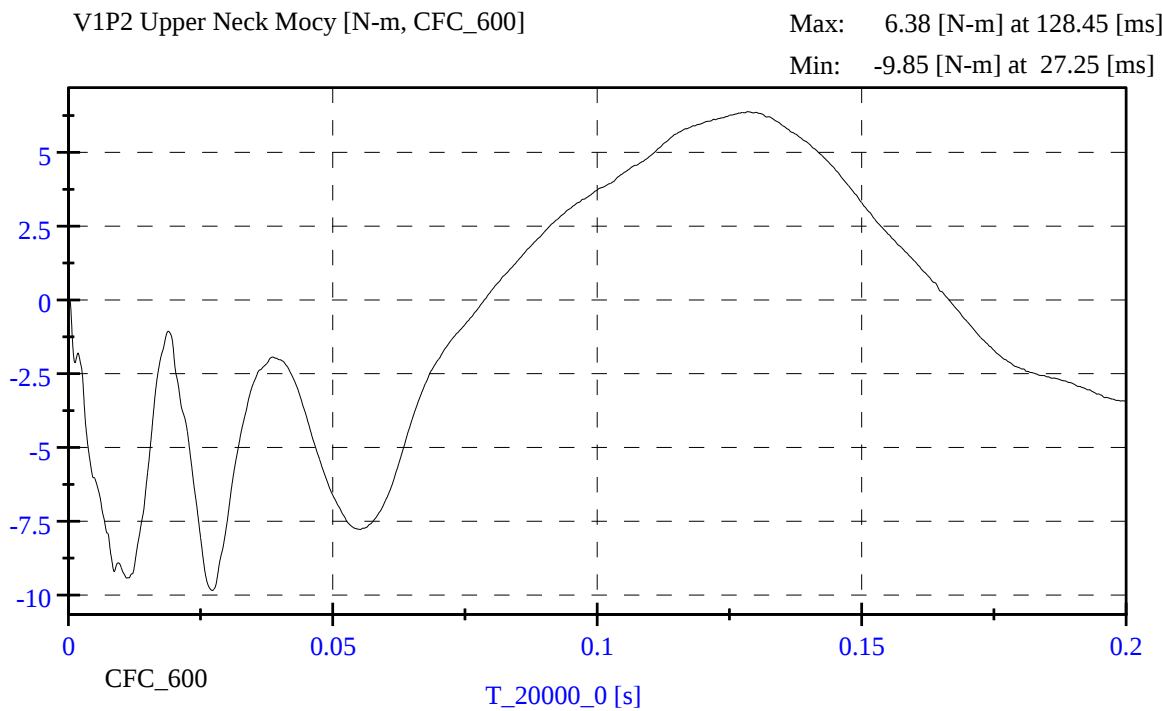
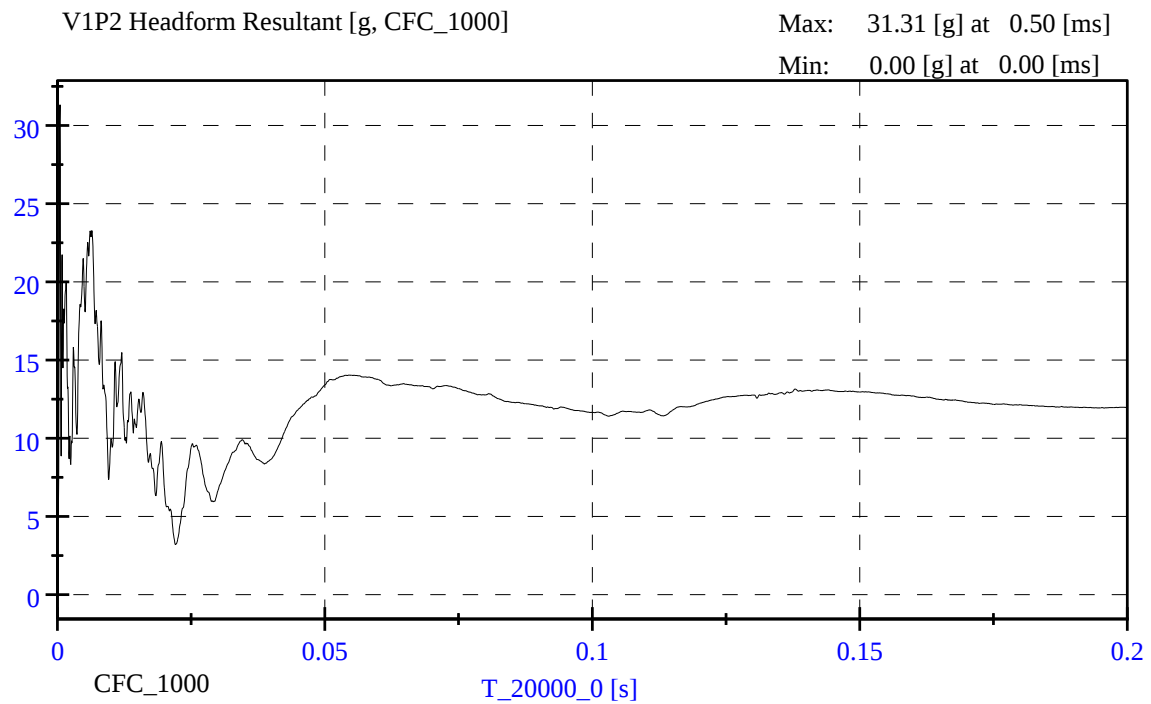
Table of Data Plots

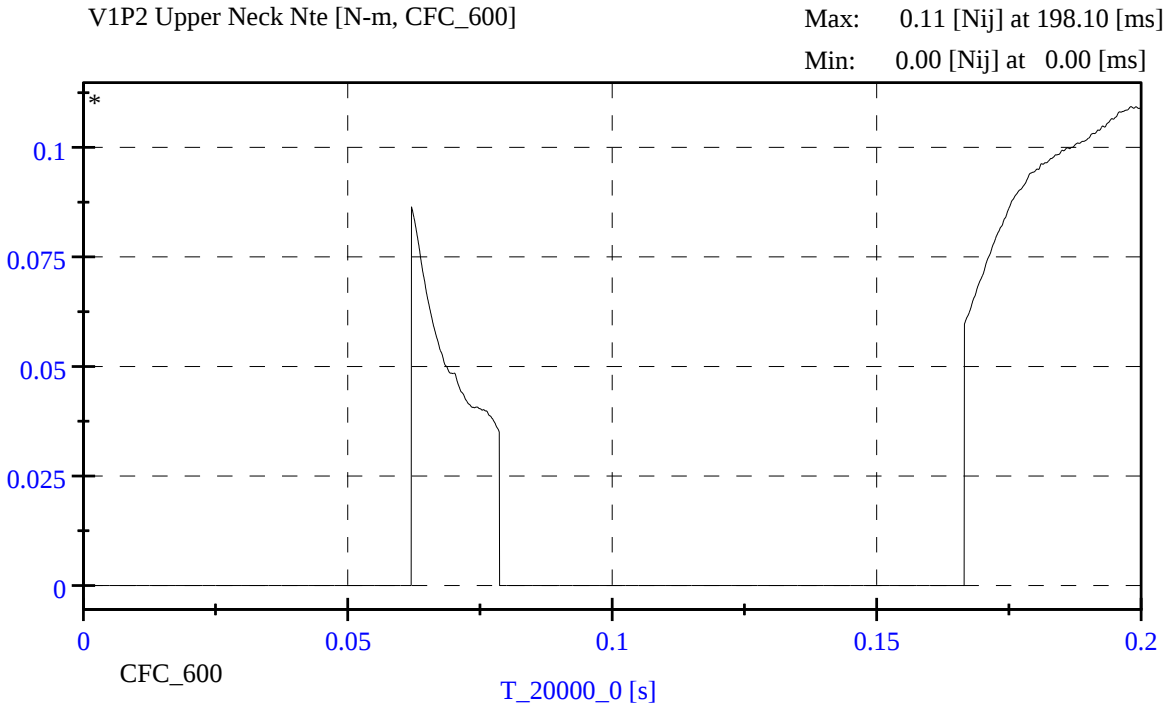
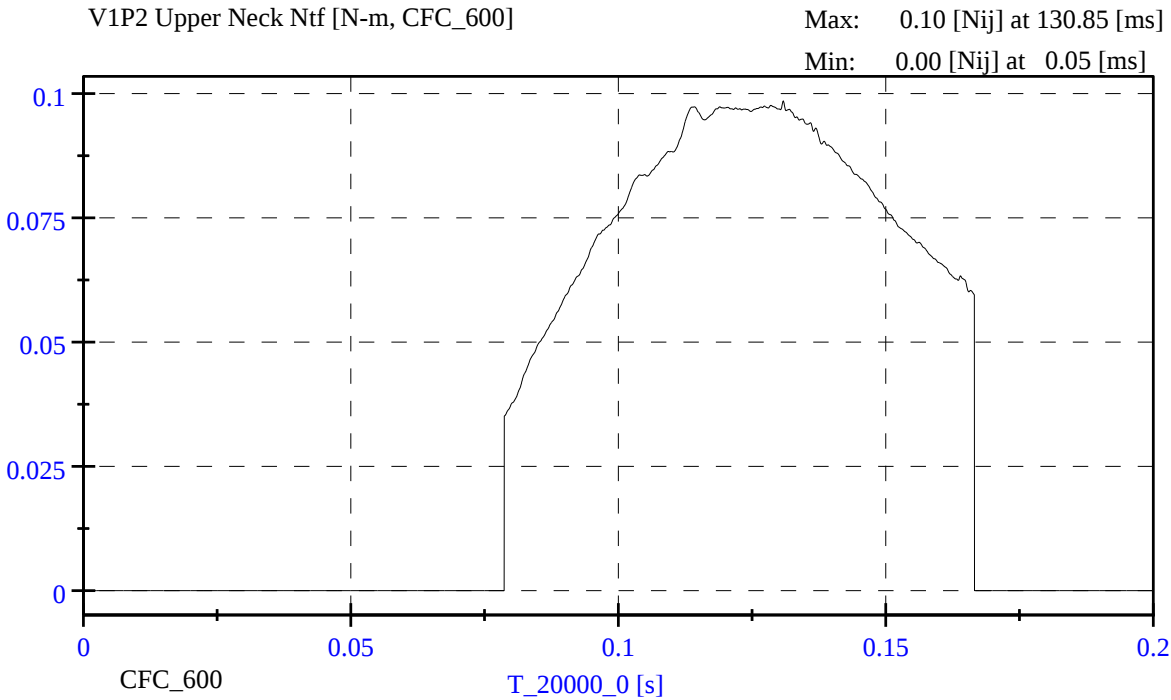
No.	Description	Page
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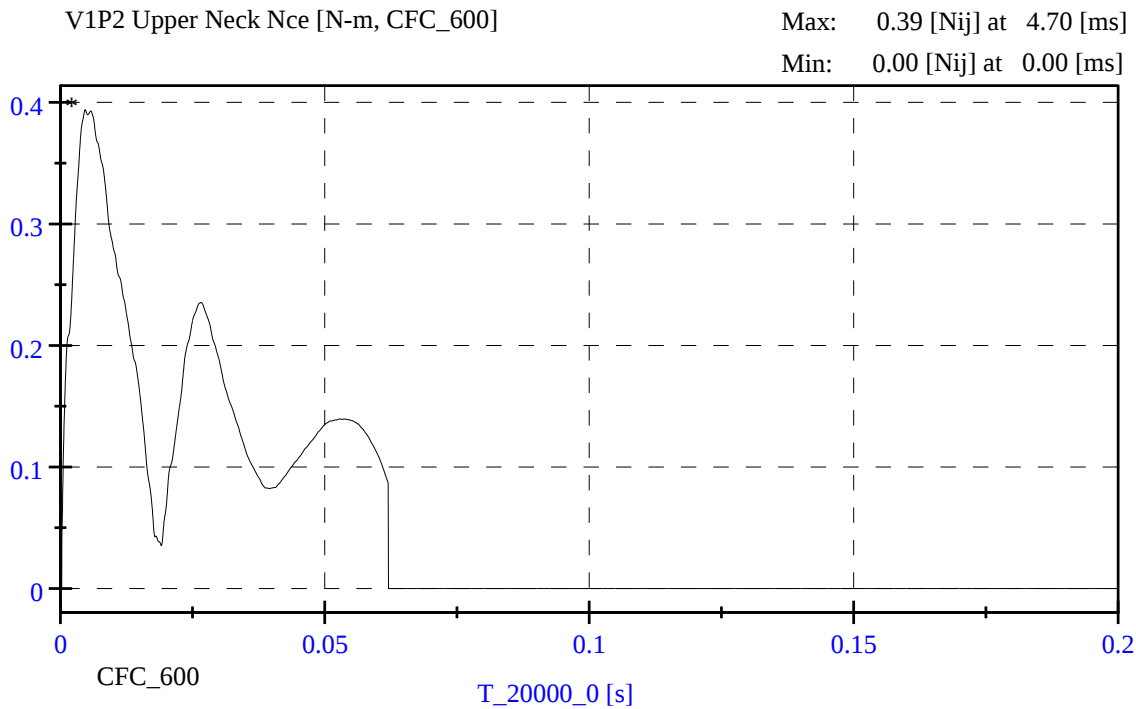
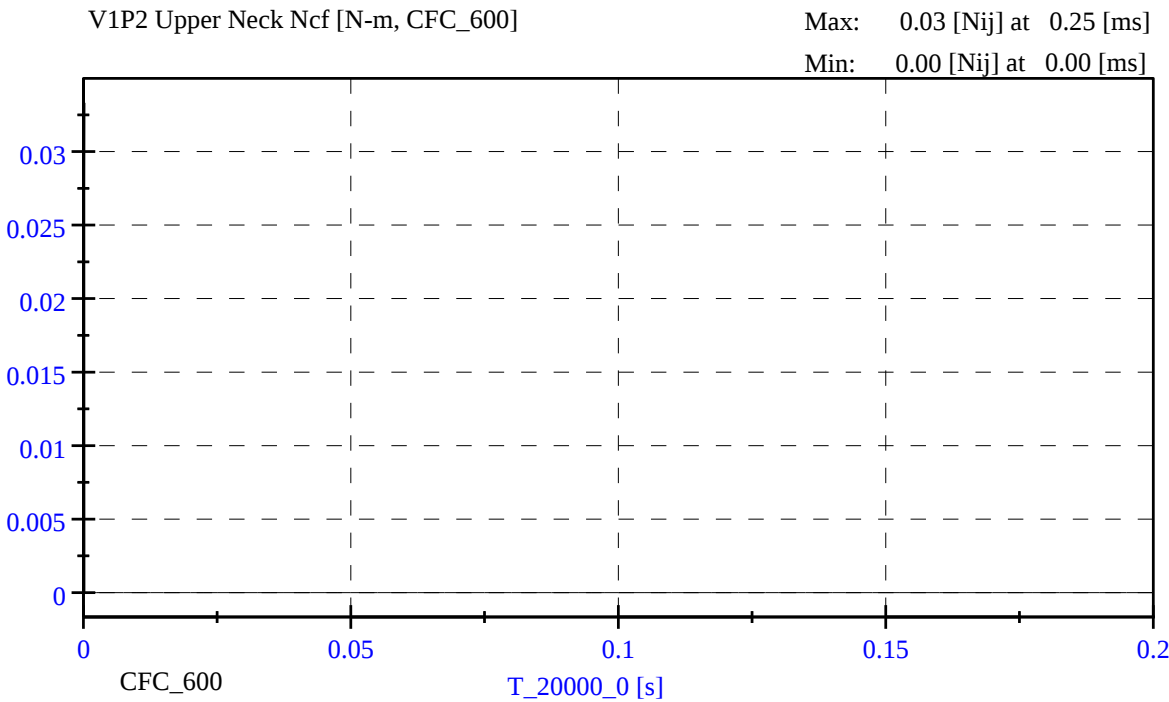


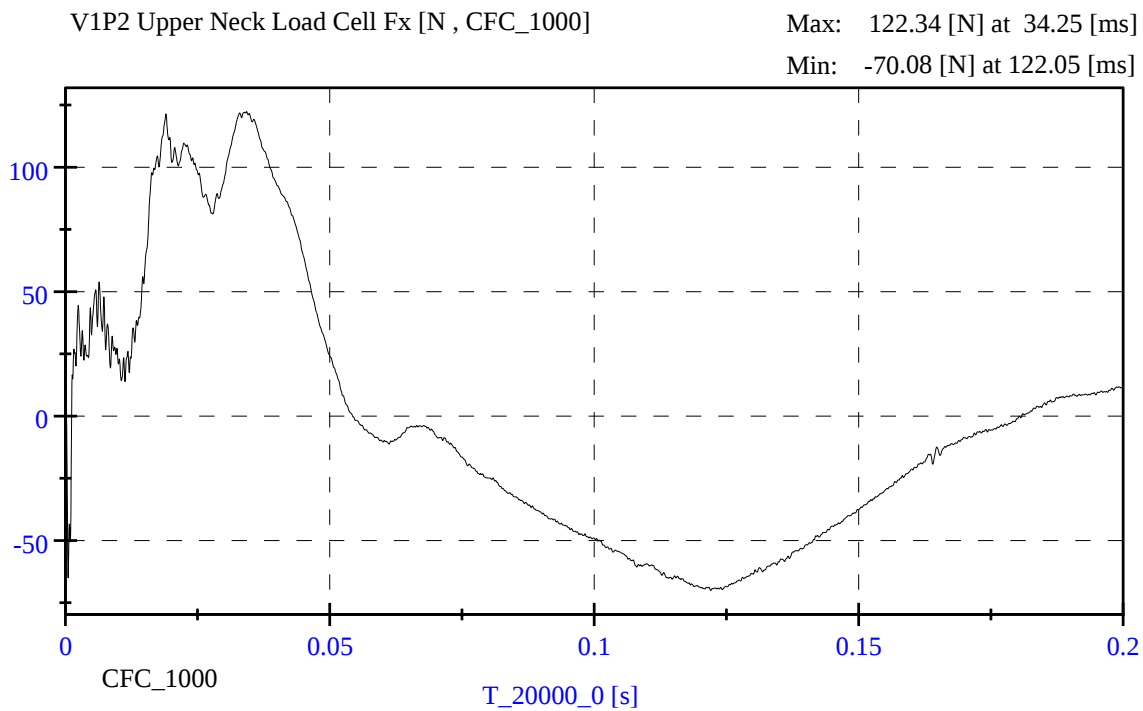
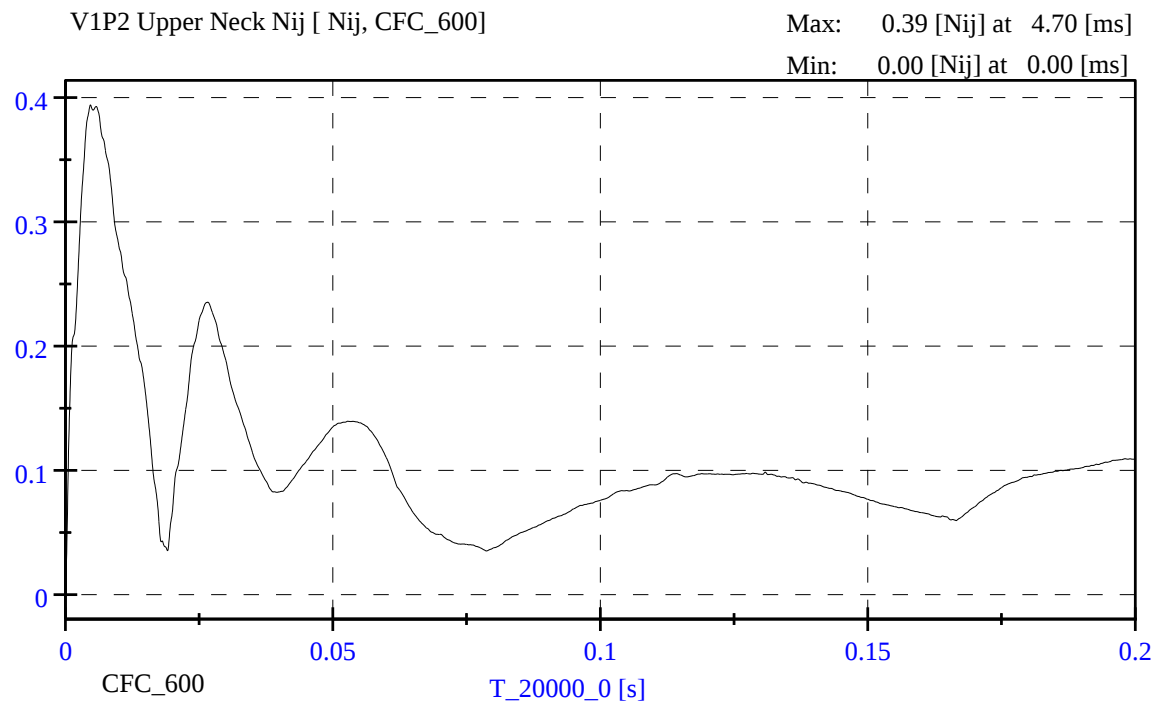


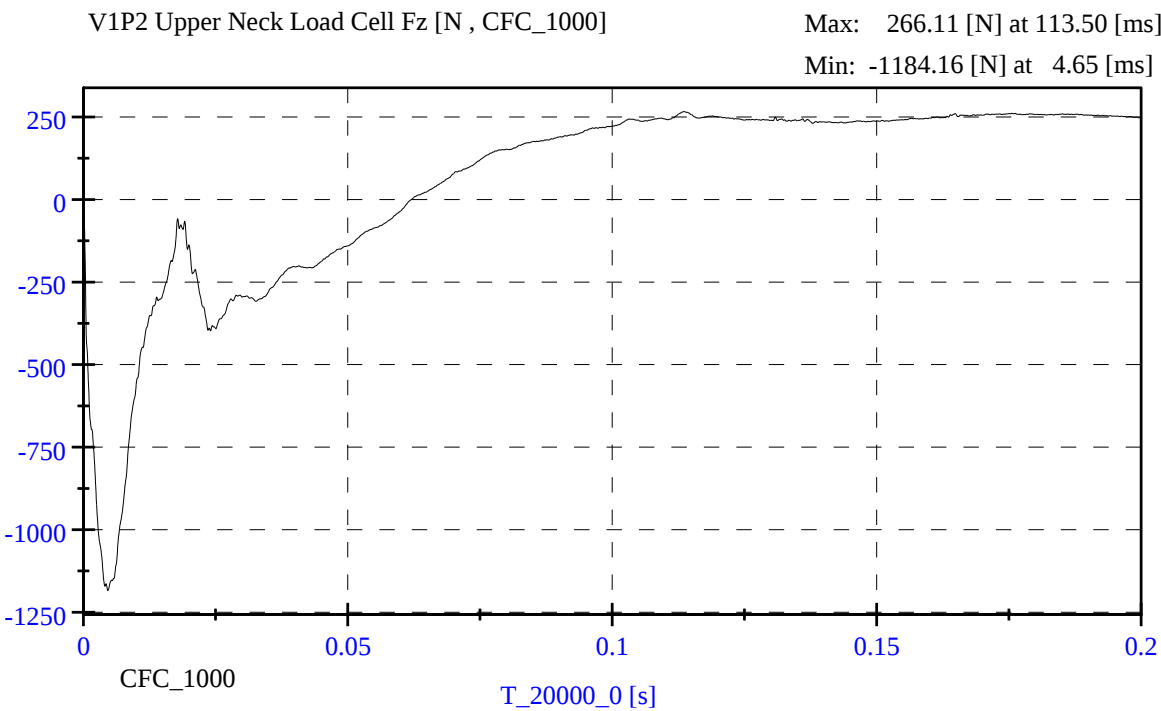
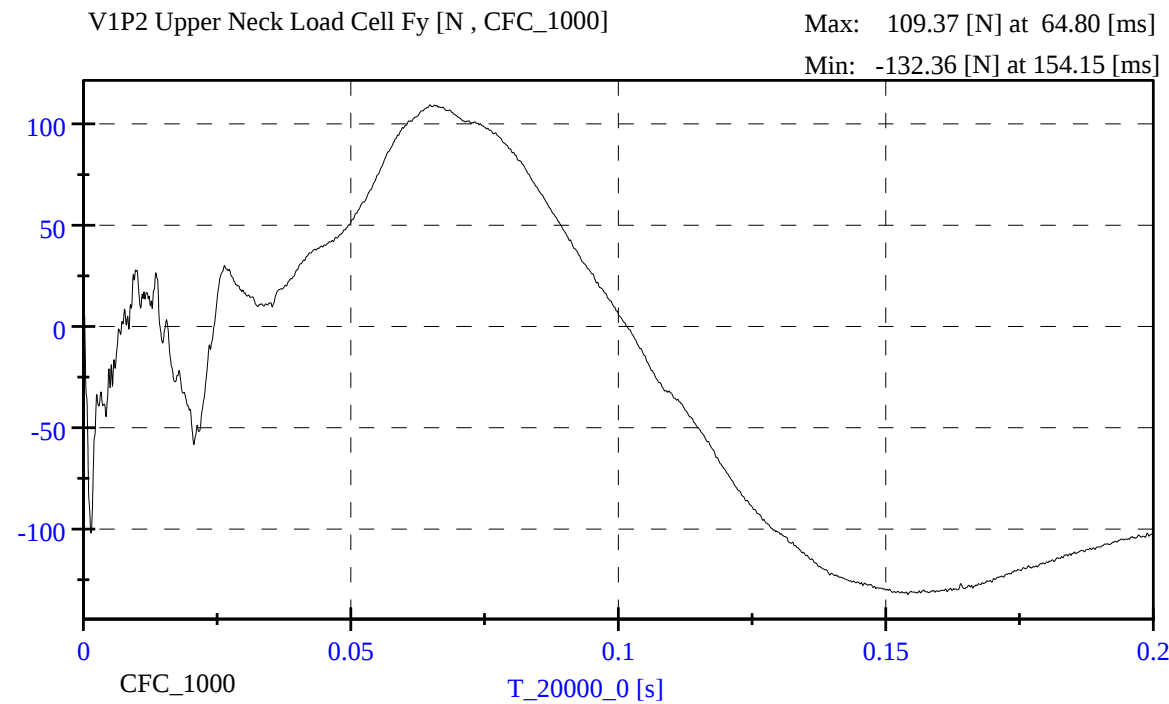


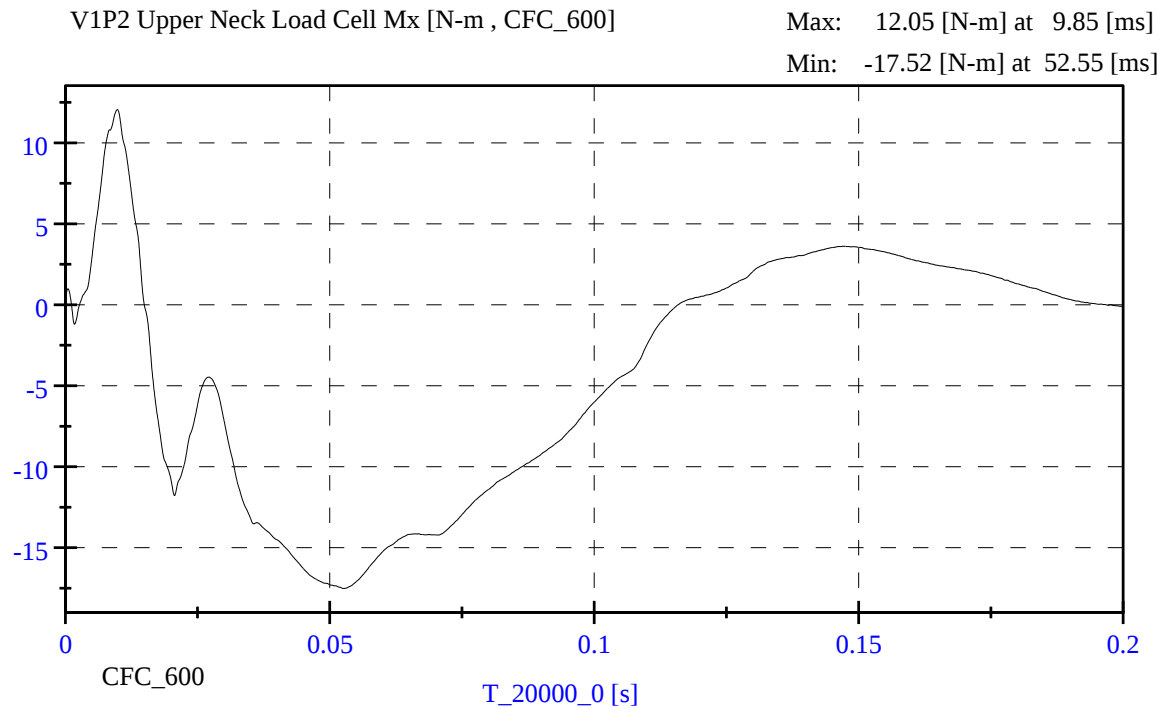
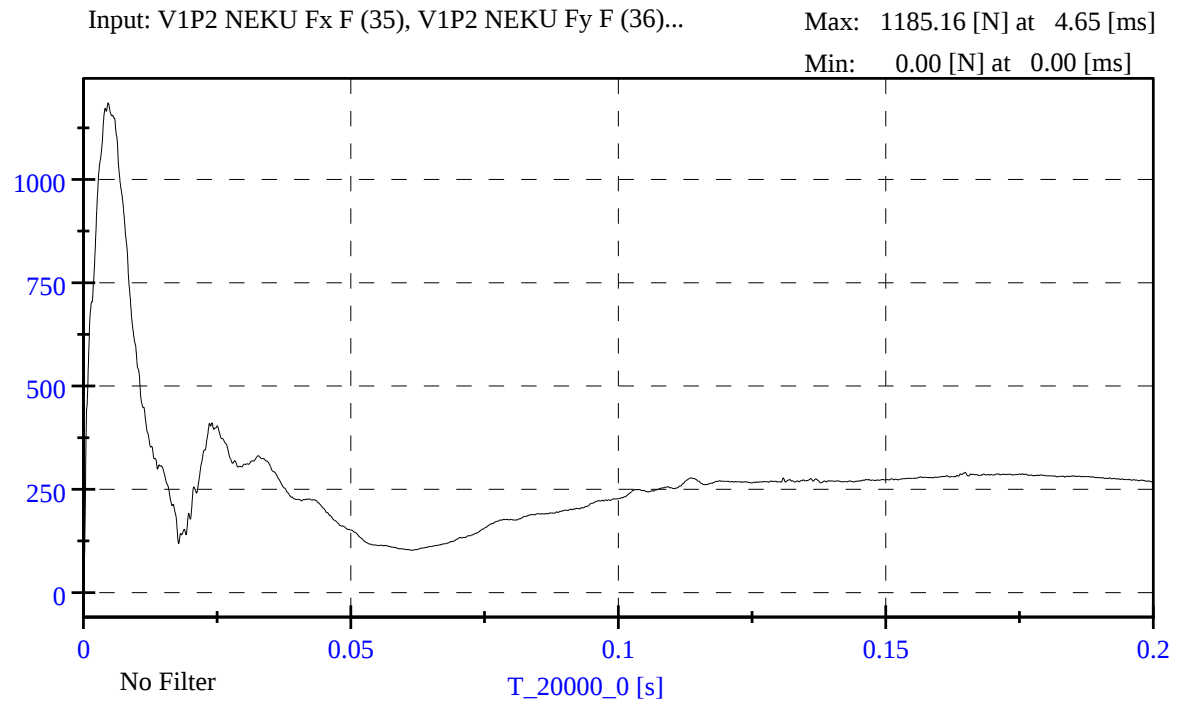


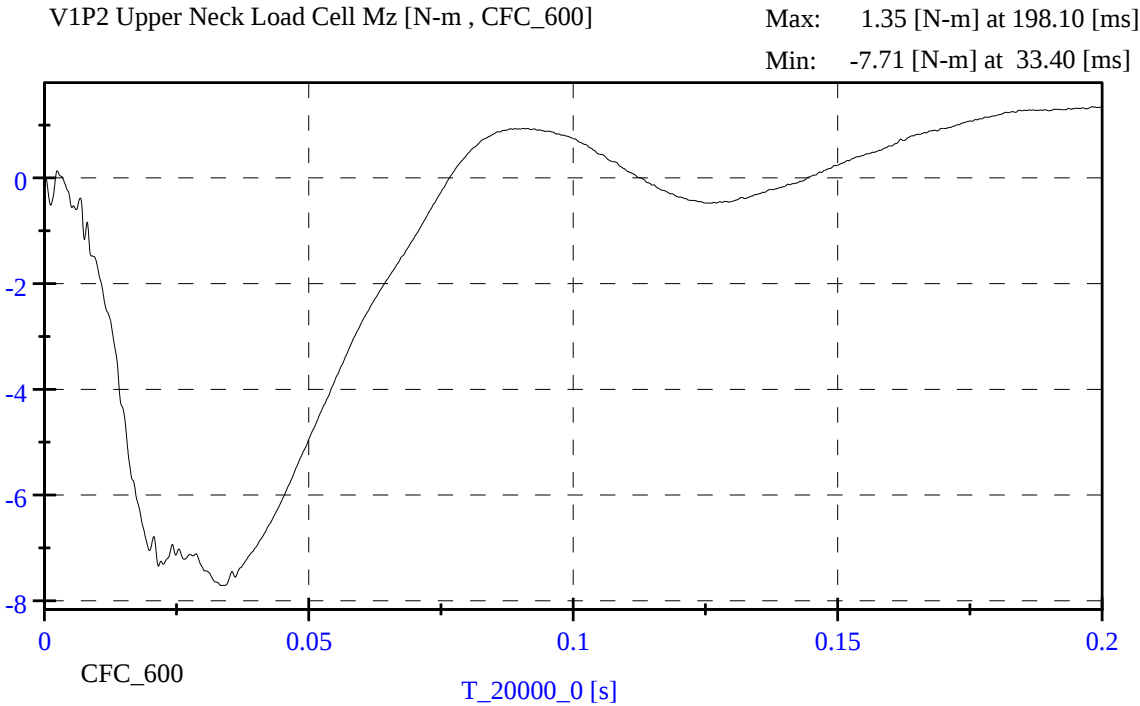
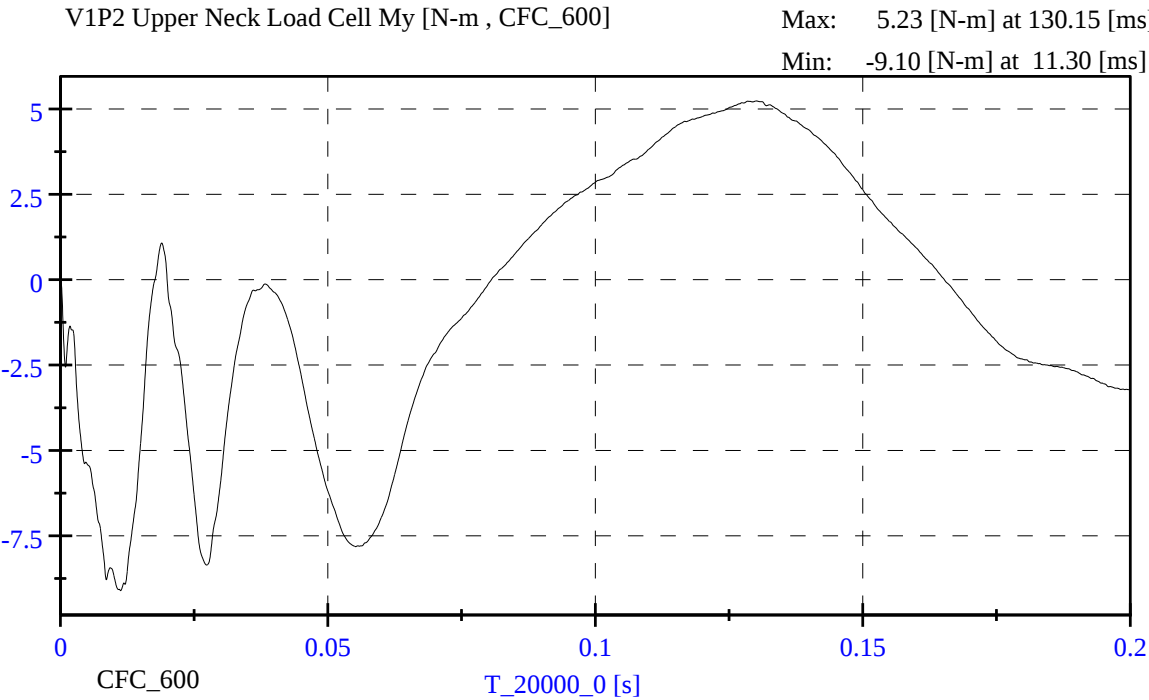


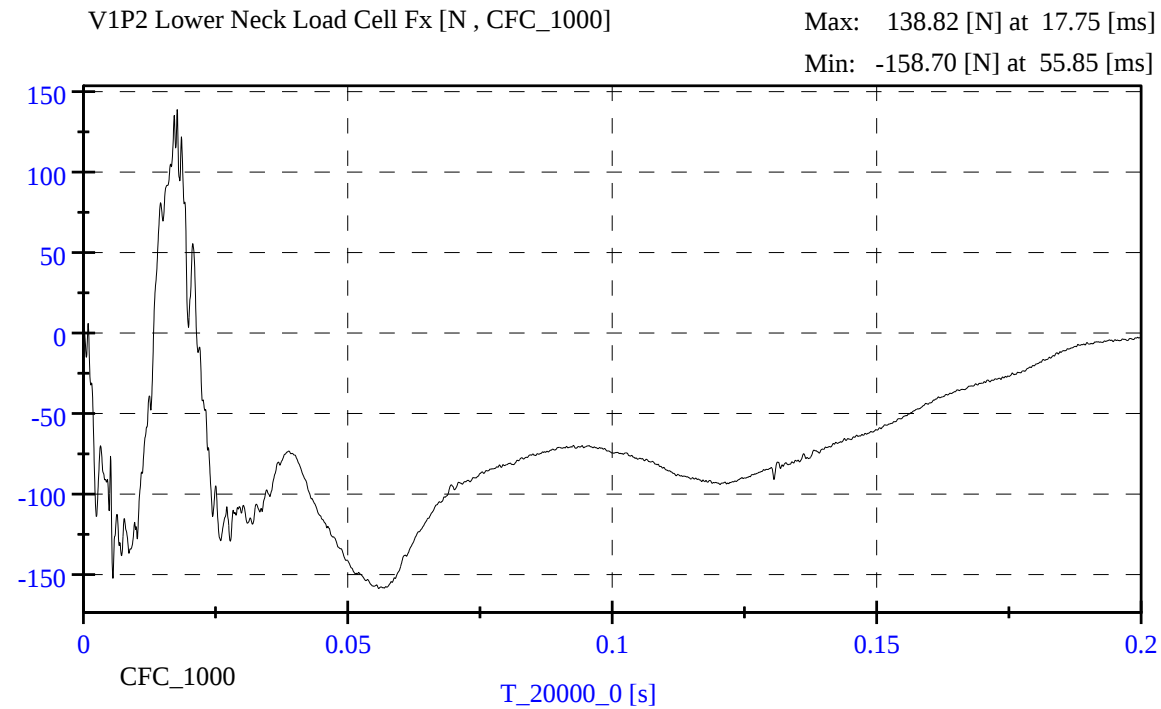
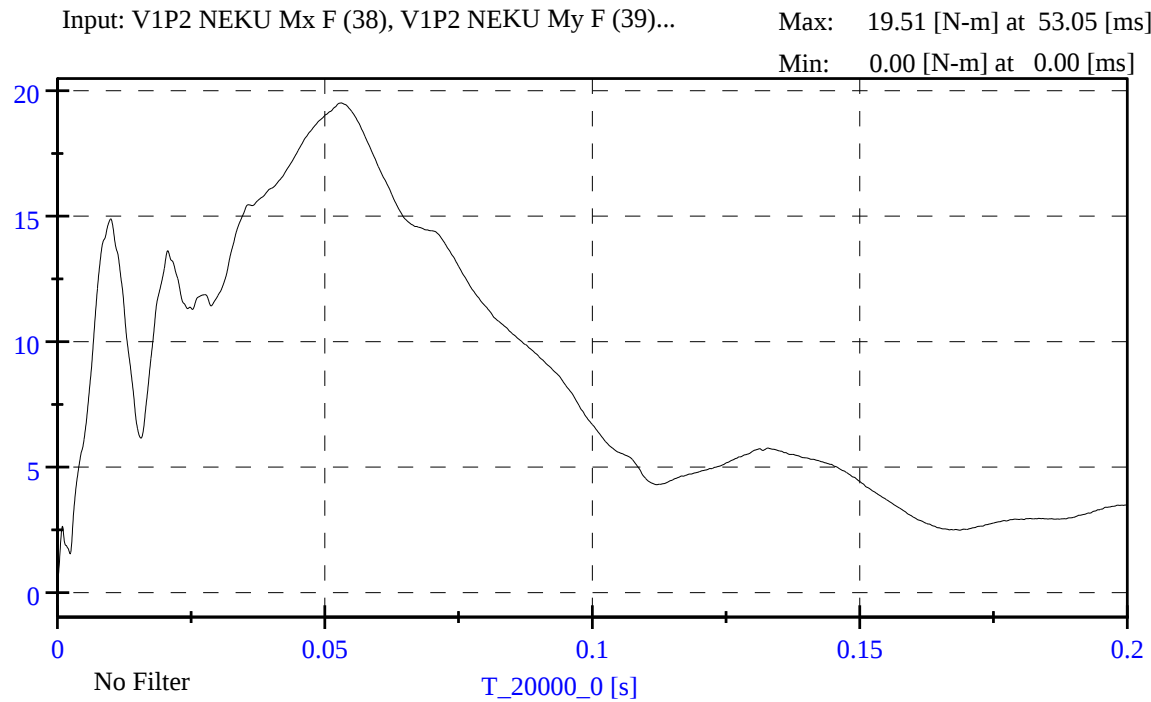


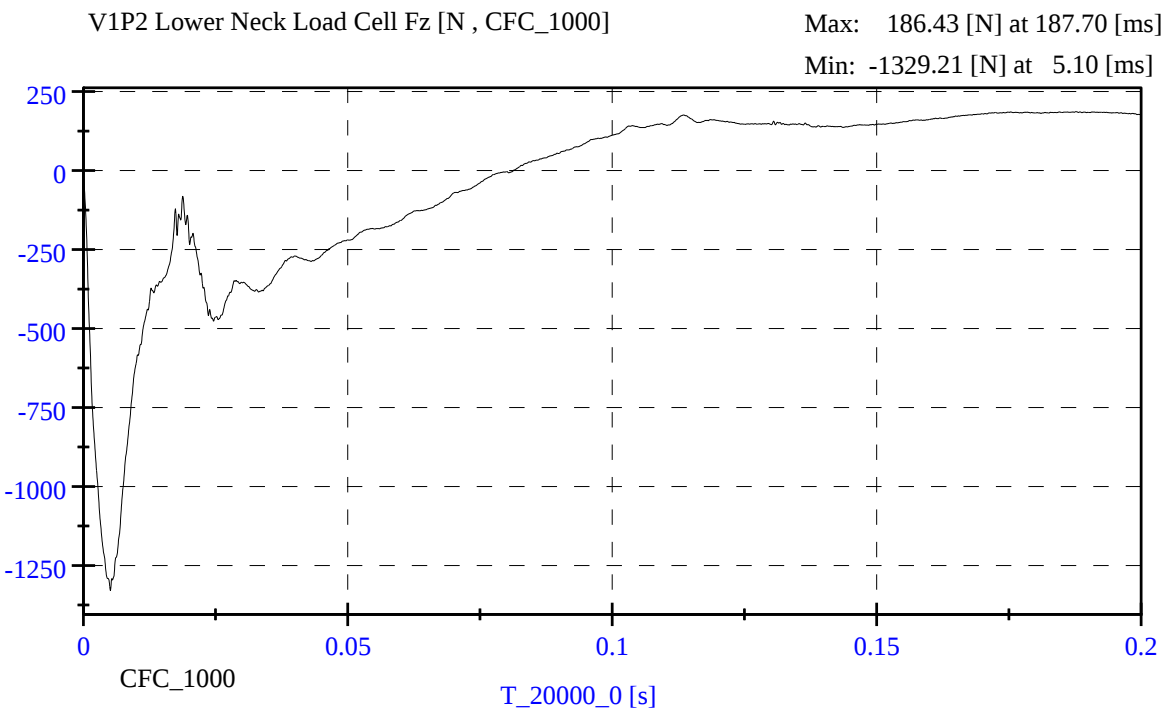
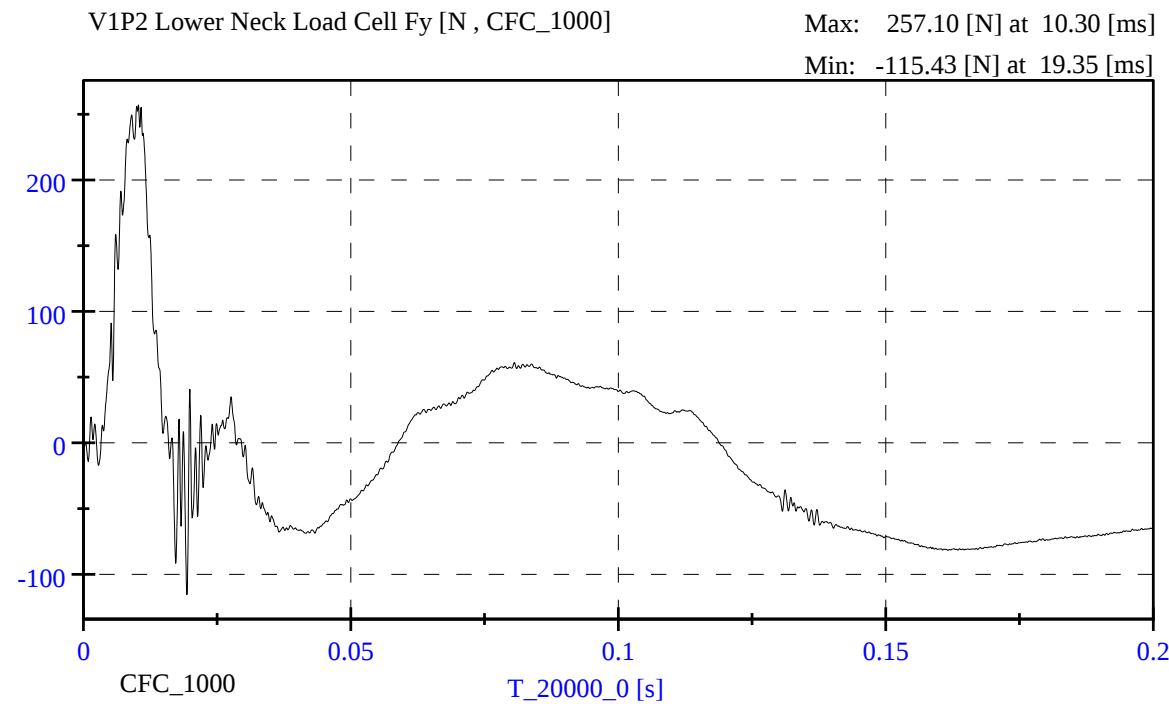


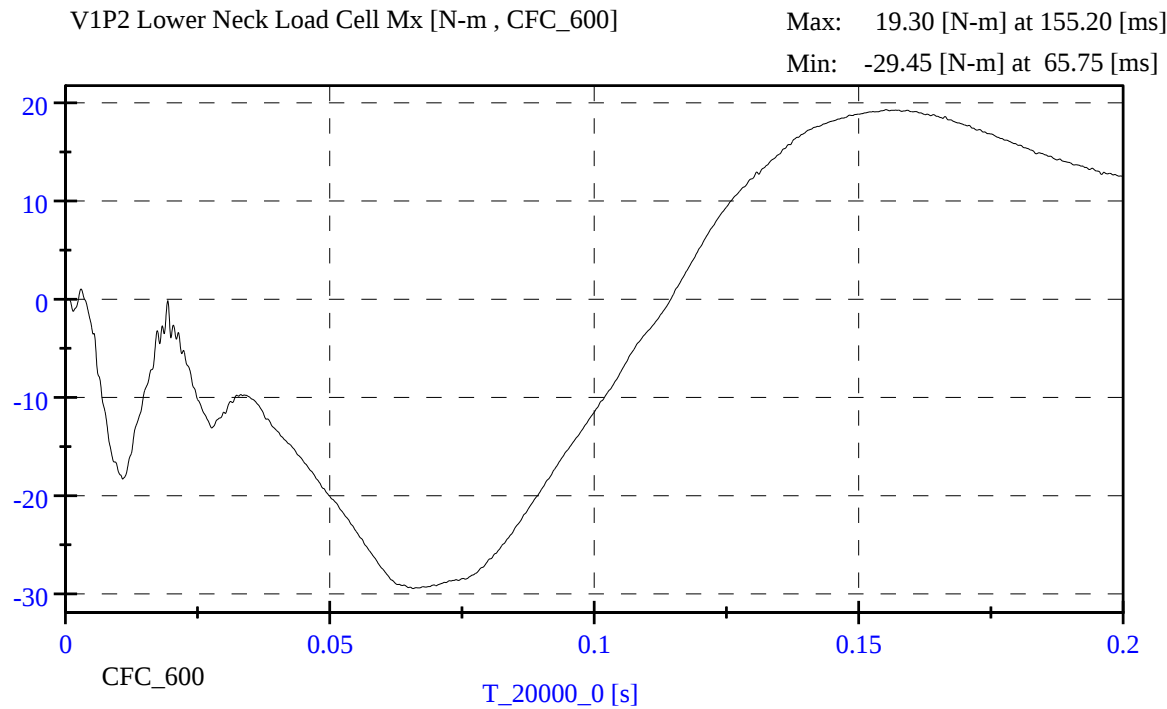
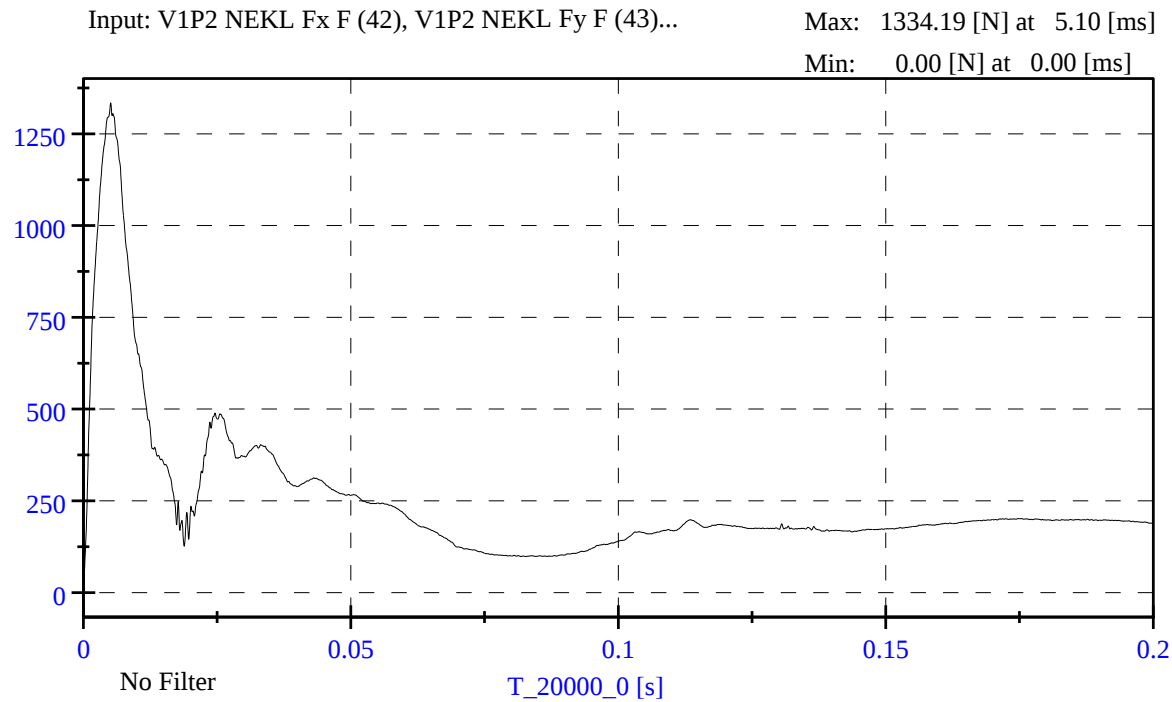


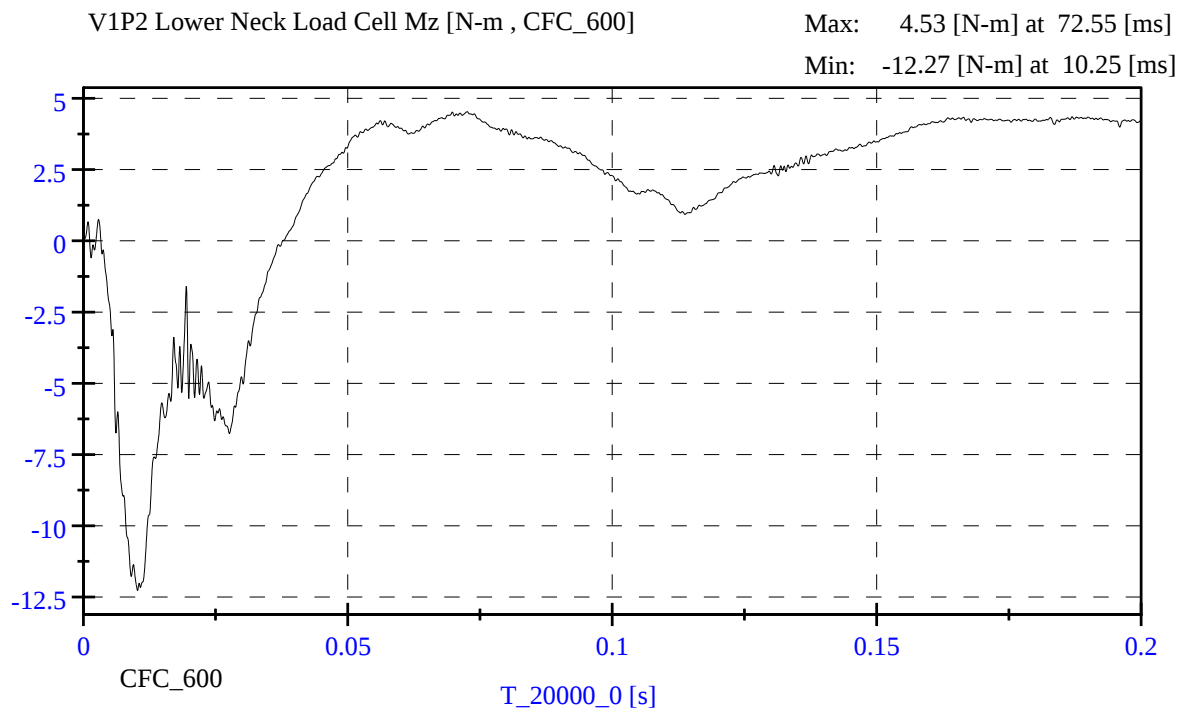
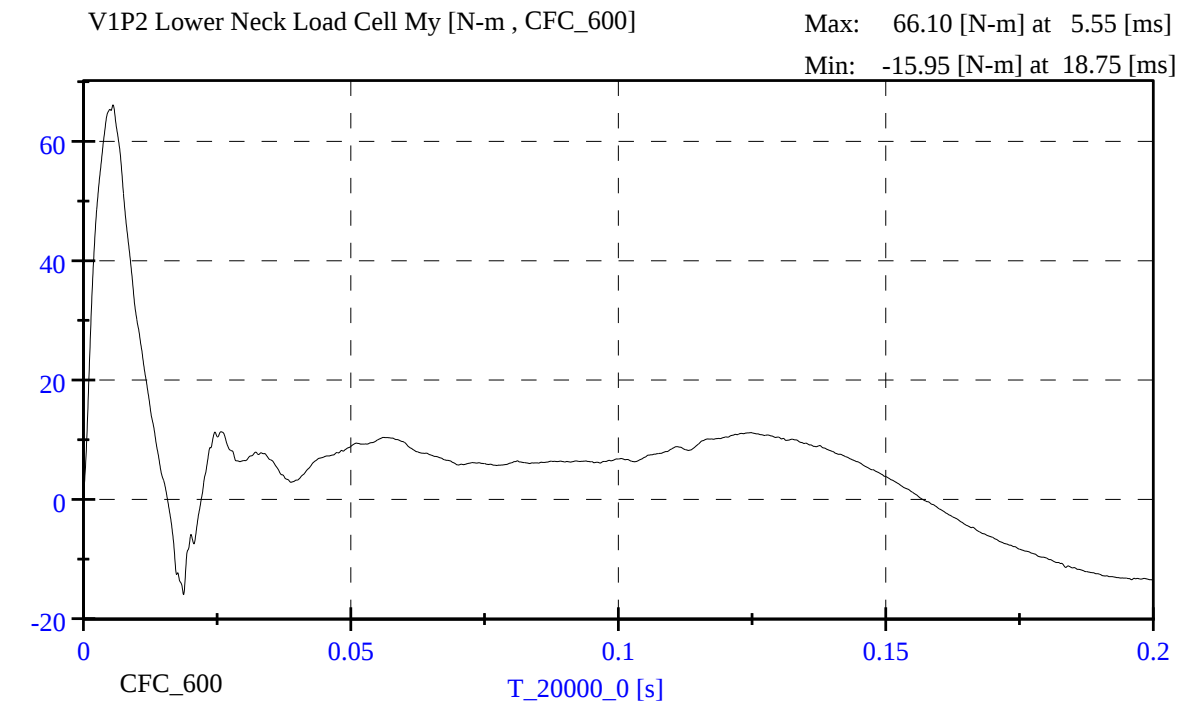


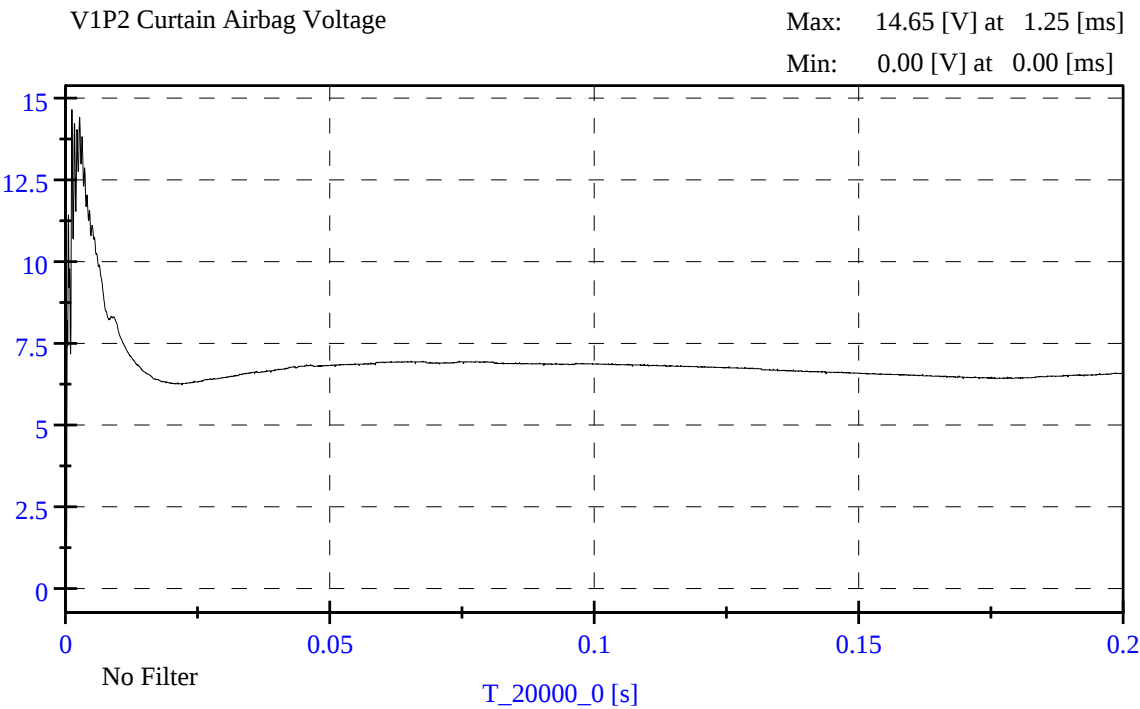
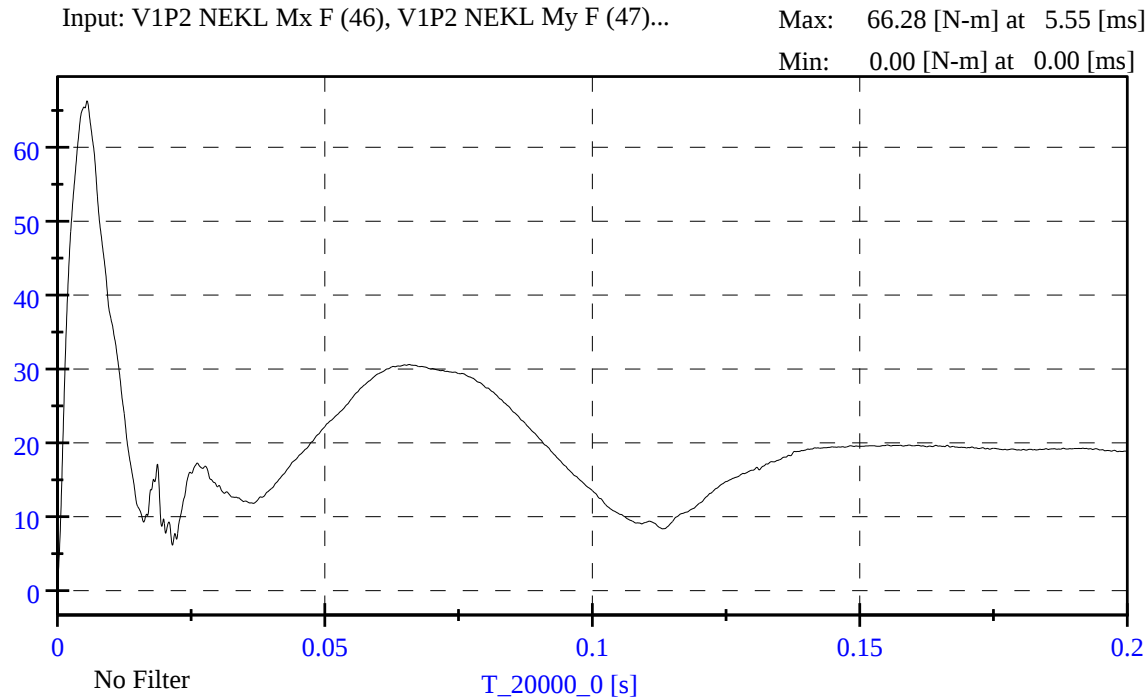


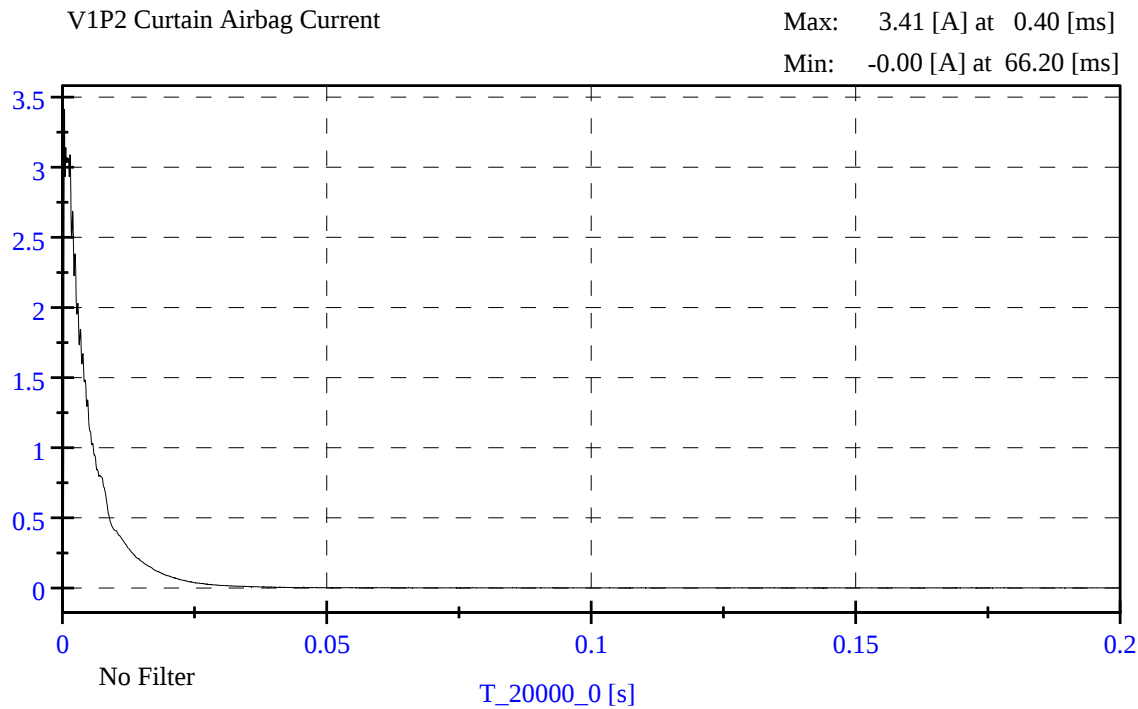
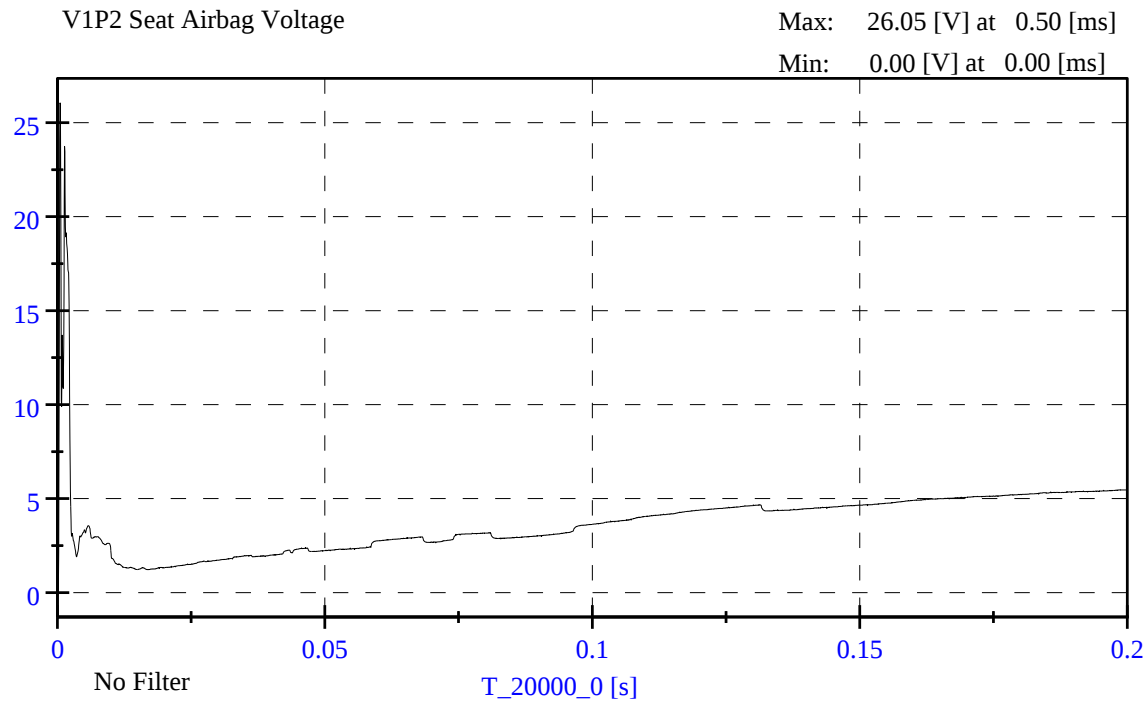


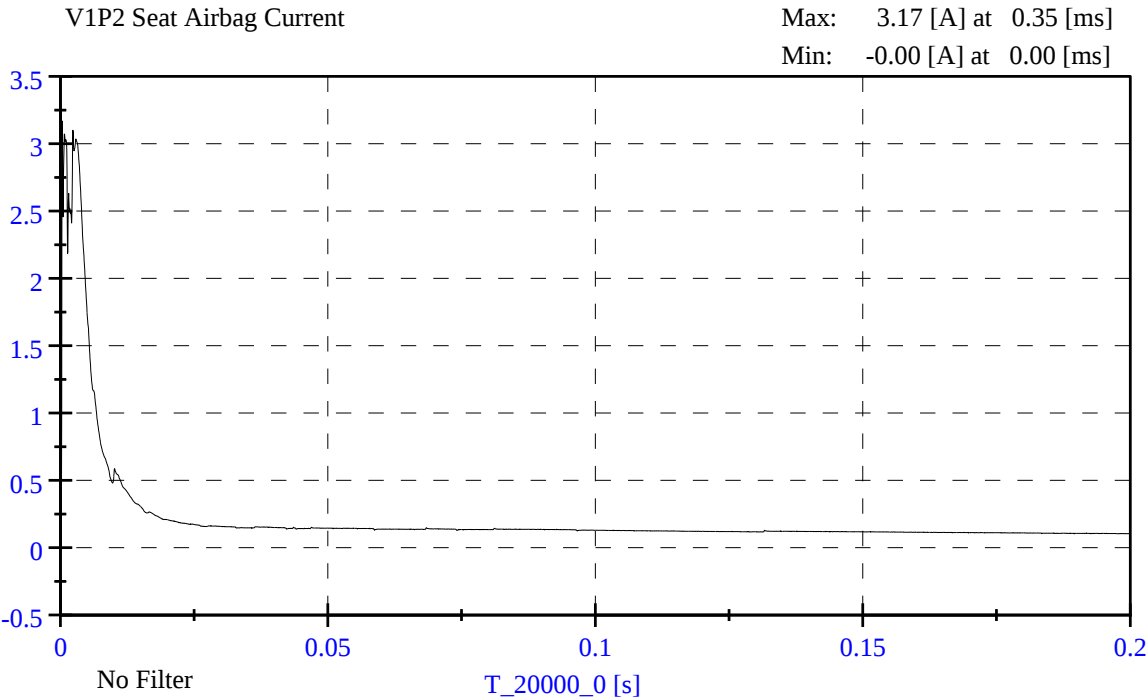












APPENDIX C
TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

P572C INSTRUMENTATION

	POSITION #2 (RIGHT) SERIAL NO.: MD0305TWG2		
	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 Redundant AX	AC-P52095	ENDEVCO	01/25/2013
HEAD Redundant AY	AC-P58908	ENDEVCO	01/25/2013
HEAD Redundant AZ	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
Curtain Bag Voltage	KT Minidau timer	N/A	N/A
Curtain Bag Current	KT Minidau timer	N/A	N/A
Seat/Torso Bag Voltage	KT Minidau timer	N/A	N/A
Seat/Torso Bag Current	KT Minidau timer	N/A	N/A