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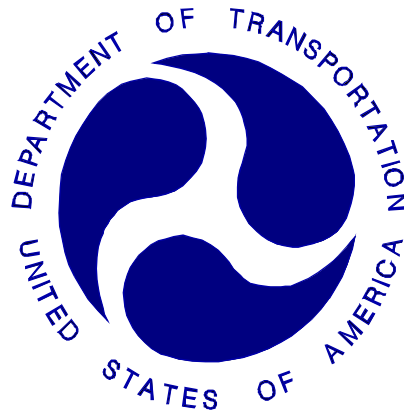
NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

MAZDA MOTOR CORPORATION
2010 MAZDA 3
4-DOOR SEDAN

NHTSA NUMBER: MA5400TWG

CALSPAN TEST NUMBER: 8883-TWG-4

CALSPAN
ADVANCED INFORMATION ENGINEERING SERVICES
TRANSPORTATION SCIENCES CENTER
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June 10, 2009

FINAL REPORT

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Rulemaking
Office of Crashworthiness Standards
Mail Code: NVS-111
1200 New Jersey Ave SE, Room W43-410
Washington, DC 20590

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12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Crashworthiness Standards Mail Code: NVS-111 1200 New Jersey Ave SE, Room W43-410 Washington, D.C. 20590				13. Type of Report and Period Covered Final Report, June 2009		
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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 Advanced Information Engineering Services Crash Test Facility in Buffalo, New York, on June 10, 2009.						
Injury Summary						
HIC15	Chest Displacement (mm)	Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
2.7	-0.9	0.86	0.01	0.24	0.36	0.36
17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position				18. Distribution Statement		
				Copies of this report are available from: National Highway Traffic Safety Administration Technical Reference Division Room 5111 (NAD-52) 1200 New Jersey Ave SE, Room W43-410. Washington, D.C. 20590 Telephone No. (202) 366-4946 ATTN: Robert Hornicle		
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SECTION 1

PURPOSE AND SUMMARY OF TEST M95304TWG

1.1 PURPOSE

The purpose of this test was to obtain data in a static out-of-position side impact. These data constitute part of the general consumer information collected by the New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under contract No. DTNH22-06-D-00024.

1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2010 Mazda 3 4-Door Sedan with an out-of-position six-year-old child were evaluated. The test was performed by Calspan Corporation on June 10, 2009. Pre-and post-test photographs of the vehicle and dummy can be found in Appendix A.

One high-speed digital camera was used to document the side airbag deployment event. The camera was placed perpendicular to the right-front seat centerline as to capture the deployment event. The recorded image rate is 1000 frames per second.

One part 572, Hybrid III six-year-old child anthropomorphic test device (ATD), was placed in the right front seat situated in the forward facing position according to dummy placement instructions specified in 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 child dummy was instrumented with head triaxial accelerometers. In addition, chest displacement and upper and lower six axial neck force and moment load cell sensors were utilized.

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

The six-year old child dummy was placed on the outboard edge of foam block, aligning the upper spine with the deployment trajectory of the airbag. The dummy's head was placed in between the seat bolster and pillar trim to minimize the fore-aft clearance between the neck and the seatback. The head remained in its neutral orientation. The legs were aligned such that they crossed the heel placement points but the feet did overhang the seat cushion. The dummy was then positioned so the dummy's neck/torso junction was aligned vertically with the top edge of the airbag module. While maintaining the neck/torso top of the airbag module alignment, the vehicle door was closed and the pelvis was moved outboard until it made contact the door trim/armrest. The outboard forearm was placed on the armrest. The inboard arm was positioned such that the upper arm contacted the seat back and the fingertips contacted the booster seat. The dummy's arms were then bent at the elbow until the fingers contacted the booster seat. This orientation complies with section 3.3.3.5 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:	3.3.3.5	Forward facing Hybrid-III six-year-old child dummy on booster block
Airbag:	Seat	Seat mounted – outside seam
Airbag:	Side Rail	Side curtain airbag.
Booster Block:	300mm x 450mm x 75mm	Block consisted of HD36 foam with a density of 44.8 g/L
ATD Type/Serial No.:	144	Hybrid III six-year-old child dummy

<u>Number of Data Channels</u>	10	
<u>Number of Cameras:</u>	0	<u>Real Time</u>
	1	<u>High Speed Digital</u>
	0	<u>High Speed Film</u>

VISIBLE DUMMY CONTACT POINTS

Head Contact:	Side Curtain airbag
Upper Torso Contact:	Seat side torso airbag
Lower Torso Contact:	Seat side torso airbag
Left Knee Contact:	No Contact
Right Knee Contact:	No Contact

DATA SHEET NO. 2

VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION

Year/Make/Model/Body Style: 2010 Mazda 3 4-door Sedan

NHTSA No. : MA5400TWG ; VIN: JM1BL1SF8A1124021 ; Color: Silver

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

Placement: - Longitudinal or In-Line; X 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: 4/15/09 ; Odometer Reading 6 km

Selling Dealer: Ricart Mazda

& Address: 4255 S. Hamilton Rd. Groveport, OH. 43125

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Mazda Motor Corporation

Date of Manufacture 02/09

GVWR: 1768 kg; GAWR: 933 kg FRONT; 835 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P205/55R16

* Recommended Cold Tire Pressure: 240 kPa FRONT; 240 kPa REAR

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P205/55R16 ; Manufacturer: Bridgestone

Tire Pressure with Maximum Capacity Vehicle Load: Front: 300 kPa; Rear: 300 kPa

Treadwear: 300 ; Traction: A ; 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) = 385.0 kg

No. of Occupants x 68.04 kg = 340.0 kg

Rated Cargo/Luggage Weight (RCLW) = 45.0 kg

*Tire pressure used for test

‡Vehicle had previously undergone a New Car Assessment Program Barrier Impact Test on April 29, 2009.

DATA SHEET NO. 3

CHILD DUMMY POSITIONING IN VEHICLE

NHTSA No. MA5400TWG

Measurement		Value
Total Fore/Aft Travel (mm)		259
Test Distance Rearward of Full-Forward (mm)		259
Total Fore/Aft Travel (Detents)		27
Placed in Position #		27
Seat Back Angle	SA (°)	17.2
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/Window	HD (mm)	205
Head to Seat Back Centerline	HSC (mm)	175
Head to B-Pillar (cg)	HB (mm)	215
Head to Roof, Z (top of the head)	HZ (mm)	225
Head to Header	HHH (mm)	406
Chest to Dash	CD (mm)	559
Chest to Seatback	CS (mm)	230
Right Arm to Seat Back Centerline	RACL (mm)	315
Right Arm to Seat Back Centerline	RACL (°)	-
Left Arm to Seat Back Centerline	LACL (mm)	85
Left Arm to Seat Back Centerline	LACL (°)	-
Right Arm to Door Panel	RA (mm)	20
Left Arm to Door Panel	LA (mm)	285
Knee to Knee	KK (mm)	115
Toe to Toe	TT (mm)	125
Right Knee to Seat Cushion Centerline	KSCR (mm)	175
Left Knee to Seat Cushion Centerline	KSCL (mm)	65
Right Toe to Seat Cushion Centerline	TSCR (mm)	5
Left Toe to Seat Cushion Centerline	TSCL (mm)	110
Nose to Dash	ND (mm)	596
Nose to Seatback	NS (mm)	295
Nose to Header	NR (mm)	486
Foam Block Depth	(mm)	300
Foam Block Width	(mm)	450
Foam Block Thickness	(mm)	75
HD36 foam density	(g/L)	44.8

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES

NHTSA No. MA5400TWG

		MAXIMUM VALUE			
		Position #2			
DESCRIPTION	Unit	Pos	msec	Neg	msec
Head X	g	16.0	42.4	-12.3	57.1
Head Y	g	0.4	176.5	-11.6	42.8
Head Z	g	7.8	42.8	-5.7	35.8
Head Resultant	g	18.1	42.4	0.0	-15.4
Upper Neck Fx	N	231.5	46.7	-10.1	34.2
Upper Neck Fy	N	27.8	42.8	-65.4	39.0
Upper Neck Fz	N	37.9	196.9	-518.0	44.9
Upper Neck F Resultant	N	561.1	45.5	0.0	-3.8
Upper Neck Mx	N-m	4.3	38.6	-16.5	53.4
Upper Neck My	N-m	21.7	46.7	-11.4	63.6
Upper Neck Mz	N-m	2.4	143.3	-10.3	76.4
Upper Neck M Resultant	N-m	22.4	46.9	0.0	3.3
Lower Neck Fx	N	92.9	63.4	-176.0	40.2
Lower Neck Fy	N	123.4	42.5	-117.9	38.3
Lower Neck Fz	N	41.3	196.6	-397.1	46.0
Lower Neck F Resultant	N	420.7	46.1	0.0	3.8
Lower Neck Mx	N-m	3.8	177.0	-22.8	58.7
Lower Neck My	N-m	4.5	34.8	-11.6	75.4
Lower Neck Mz	N-m	2.3	147.2	-14.7	42.7
Lower Neck M Resultant	N-m	23.5	58.7	0.0	20.5
Chest Displacement	g	0.3	84.2	-0.9	48.0

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2010 Mazda 3 4-Door Sedan

NHTSA No. MA5400TWG

HEAD INJURY CRITERIA (HIC)				
HIC15				
	HIC	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position #2 - Right	2.7	45.0	60.0	8.0

THORAX CRITERIA			
	Critical Values	Actual	Time(ms)
Deflection (mm)	40	-0.9	48.0
Deflection Rate (m/s)	8.5	0.86	35.6

Position 4 Neck Injury Summary (HIII 6 year old – In Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.01	148.0	12.1	-0.8	0.9
Nte	0.24	59.2	0.9	22.6	-8.8
Ncf	0.36	45.9	-504.7	226.7	17.2
Nce	0.36	64.6	-117.2	31.8	-11.8

Peak Tension (CFC1000) 37.9 N Peak Compression (CFC1000) -518.0 N

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	3096 N	Extension (mCVe)	42 N-m	Tension	1890 N
Compression (CVc)	2800 N	Flexion (mCVf)	93 N-m	Compression	-1820 N

Condyle Offset -0.01778

APPENDIX A

PHOTOGRAPHS

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Figure A-1: Pre-Test Vehicle Left Side View



Figure A-2: Post-Test Vehicle Left Side View



Figure A-3: Vehicle Certification Placard

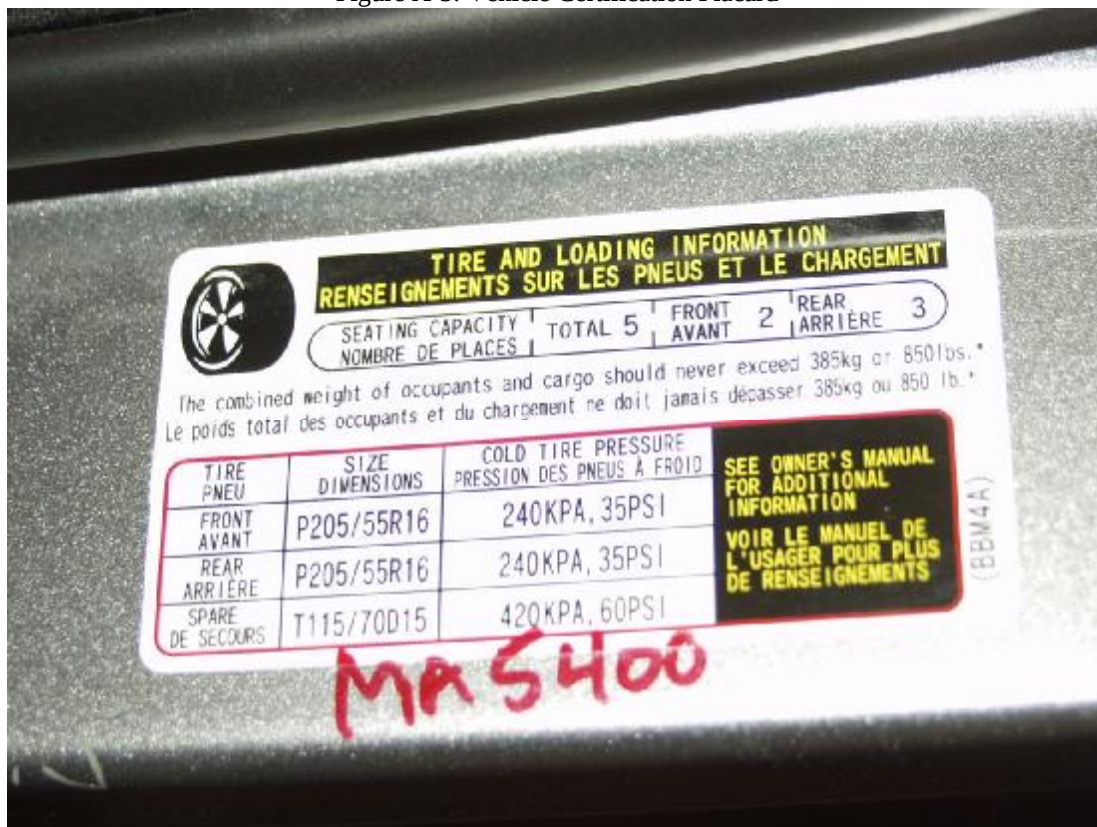


Figure A-4: Vehicle Tire Placard



Figure A-5: Pre-Test Frontal View of Dummy



Figure A-6: Post-Test Frontal View of Dummy



Figure A-7: Pre-Test Left Side View of Dummy



Figure A-8: Post-Test Left Side View of Dummy



Figure A-9: Pre-Test Right Side View of Dummy



Figure A-10: Post-Test Right Side View of Dummy

APPENDIX B

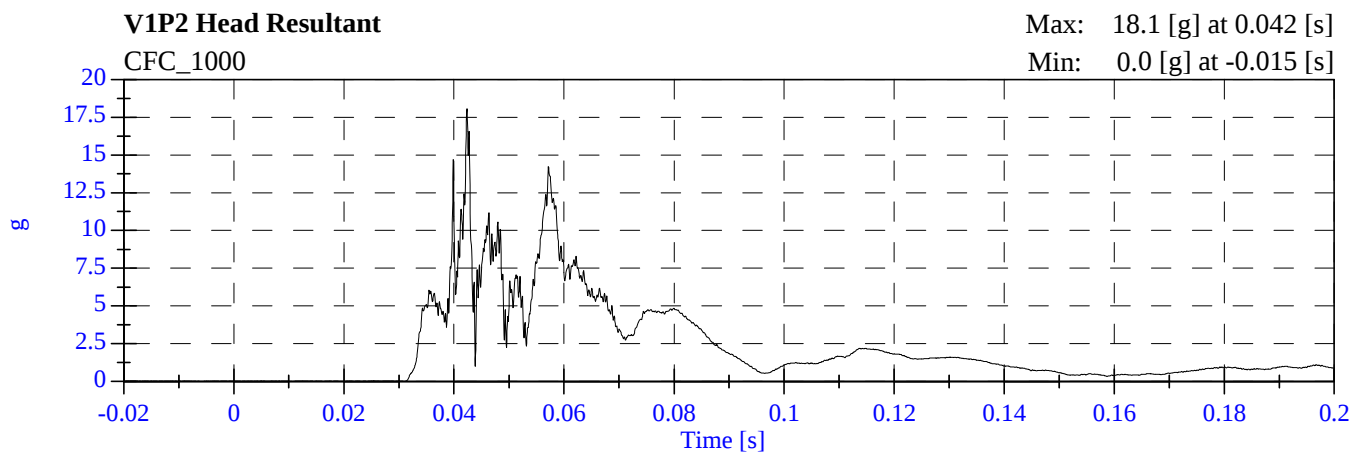
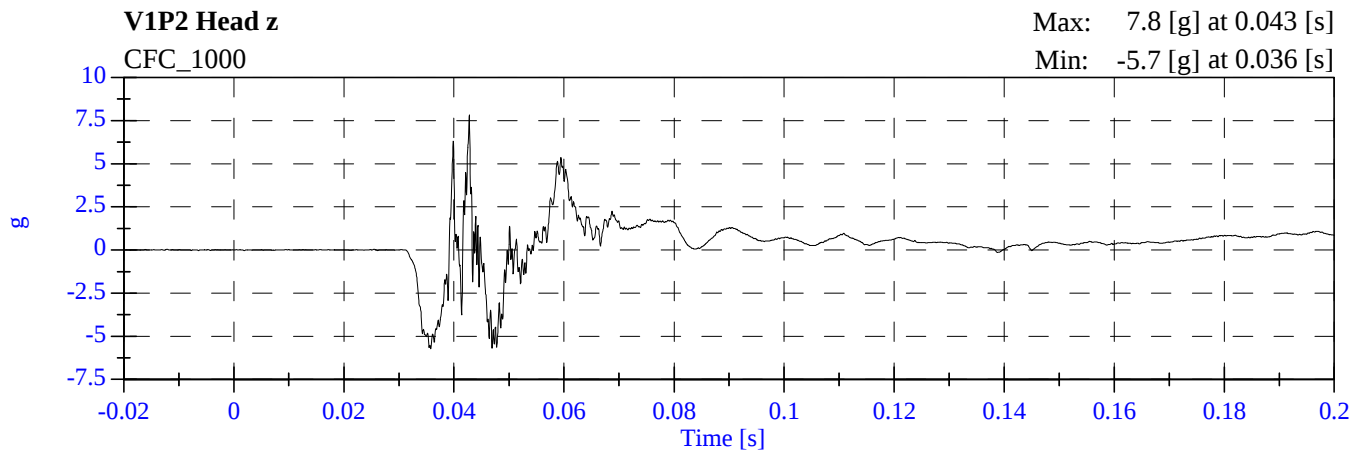
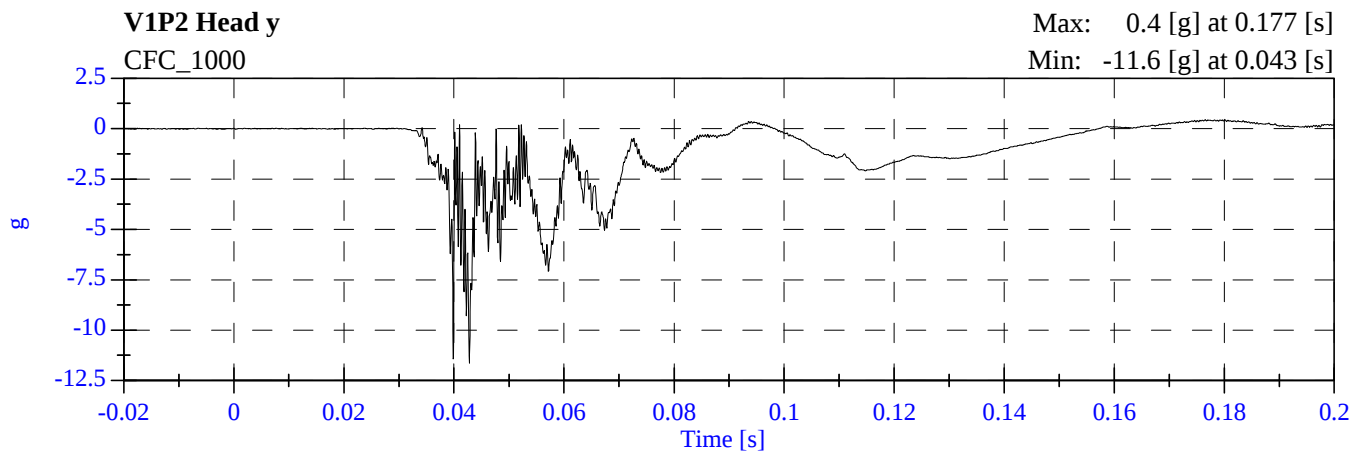
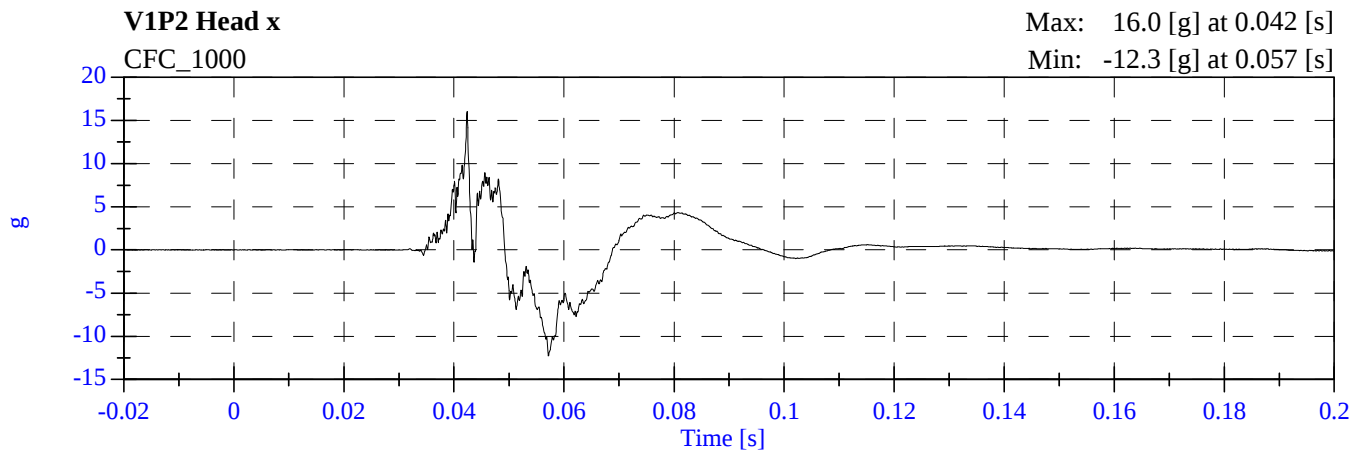
CHILD DUMMY RESPONSE DATA TRACES

TABLE OF DATA PLOTS

PLOT	PLOT NAME[UNITS, CHANNEL FILTER CLASS]	PAGE
1	P2 Head x [g, CFC_1000]	B-3
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7	P2 Upper Neck Fz [N, CFC_1000]	B-4
8	P2 Upper Neck F Resultant [N, CFC_1000]	B-4
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18	P2 Lower Neck My [N-m, CFC_600]	B-7
19	P2 Lower Neck Mz [N-m, CFC_600]	B-7
20	P2 Lower Neck M Resultant [N-m, CFC_600]	B-7
25	P2 Chest Compression [mm, CFC_600]	B-8

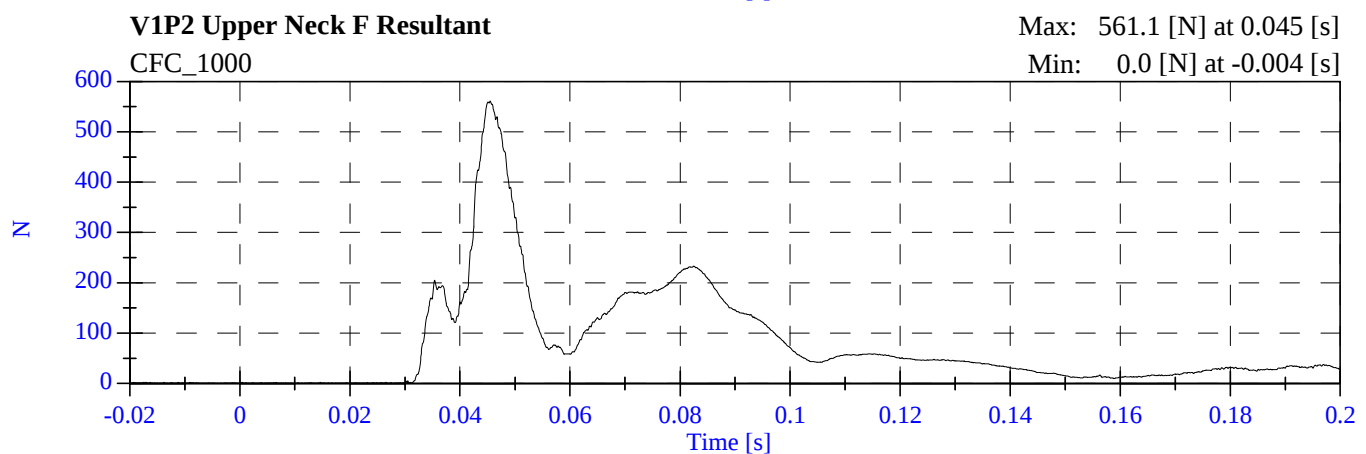
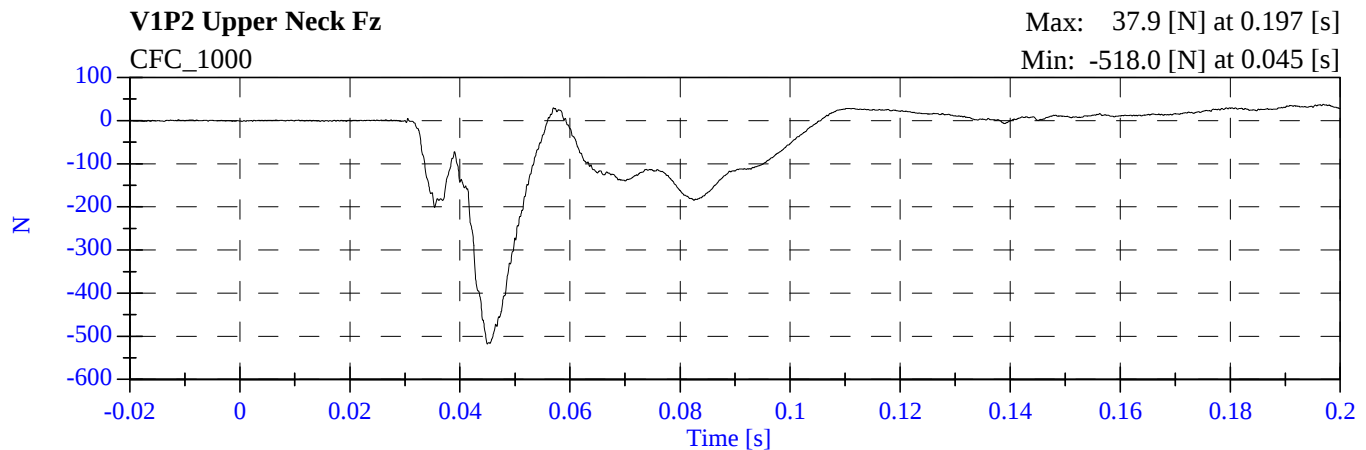
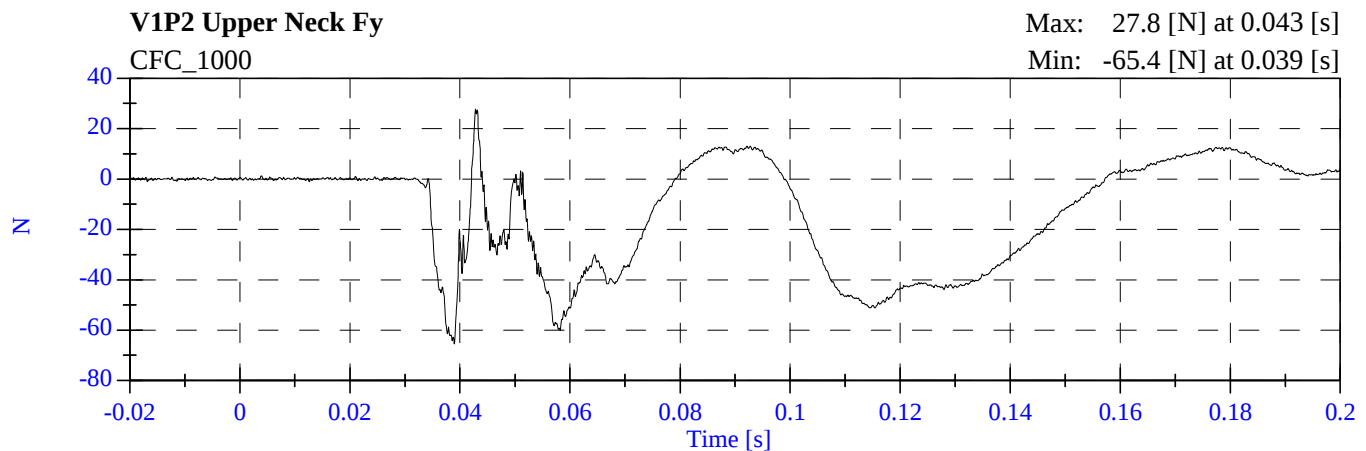
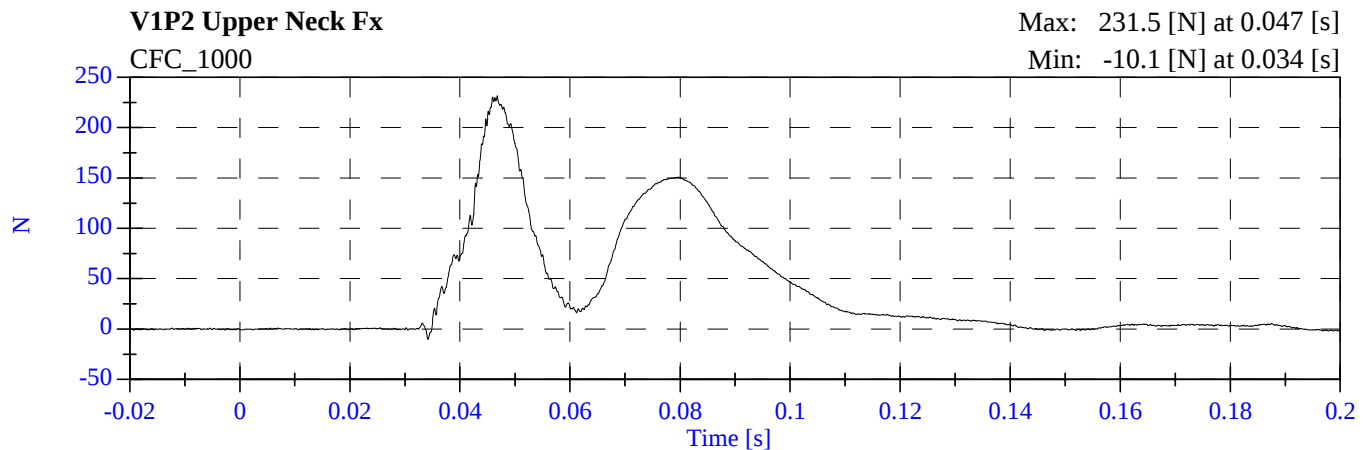
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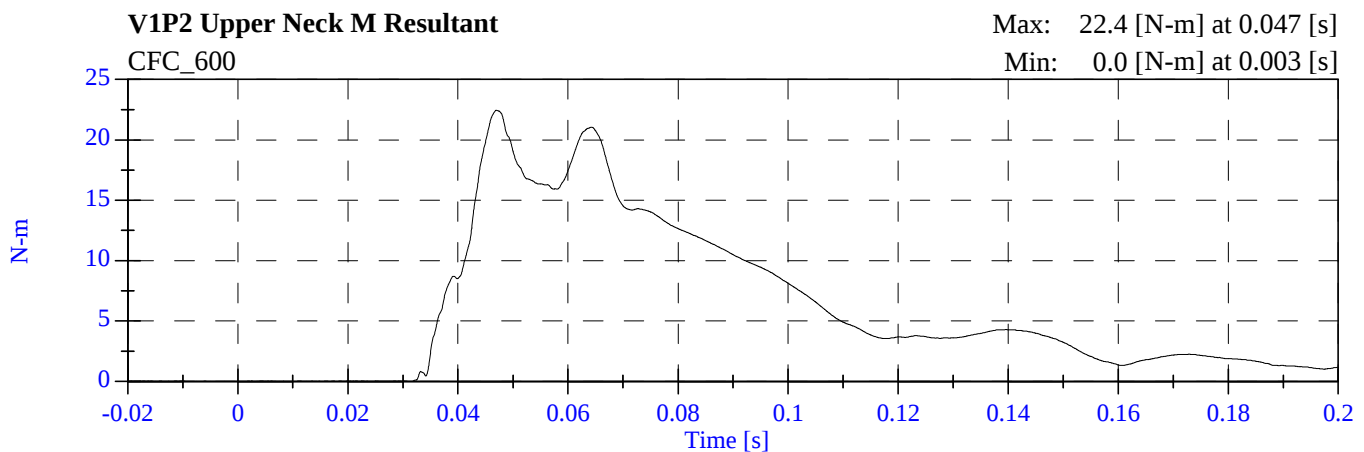
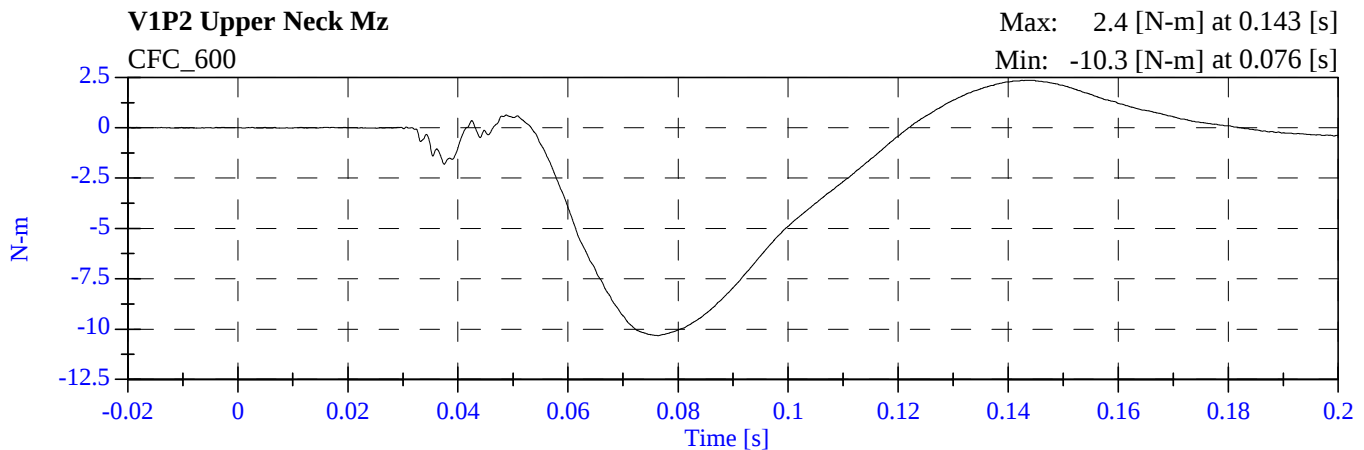
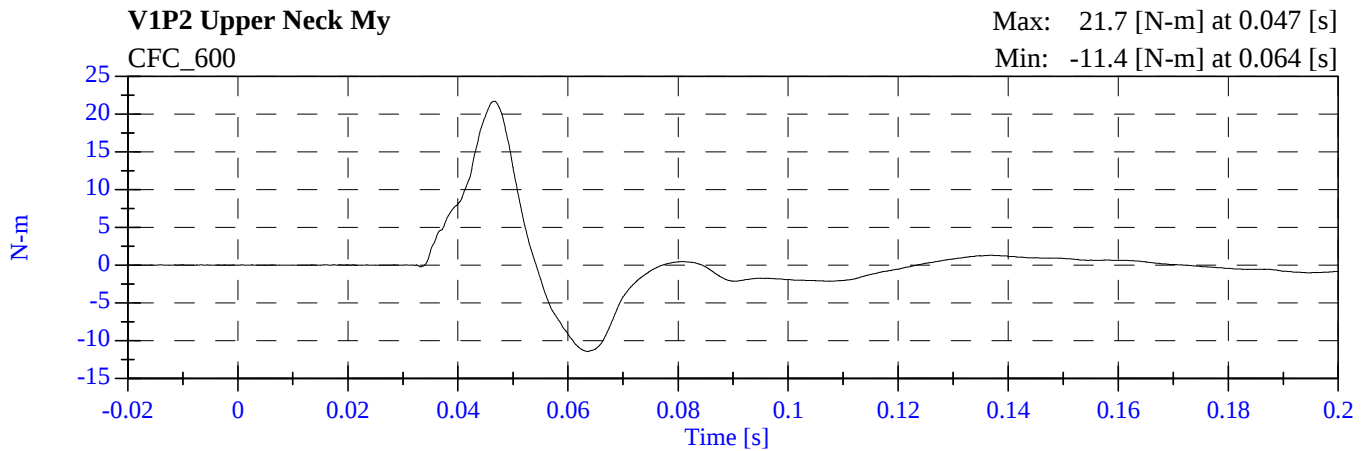
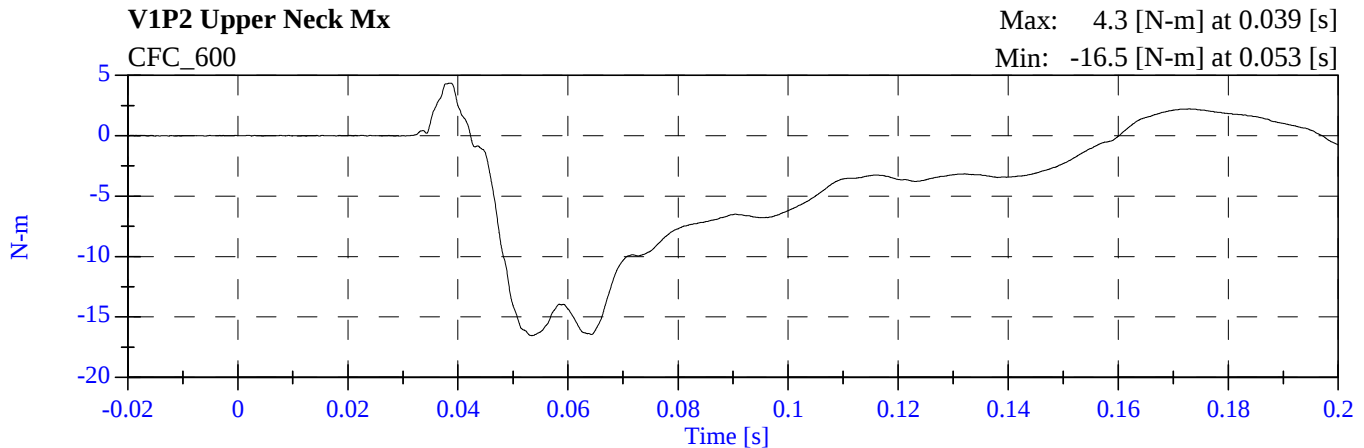
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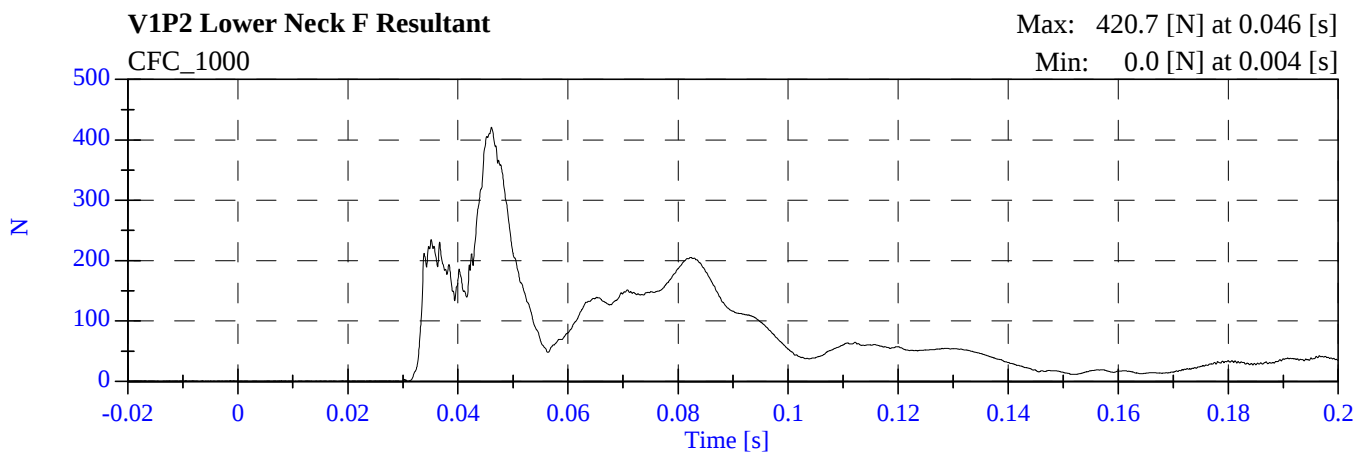
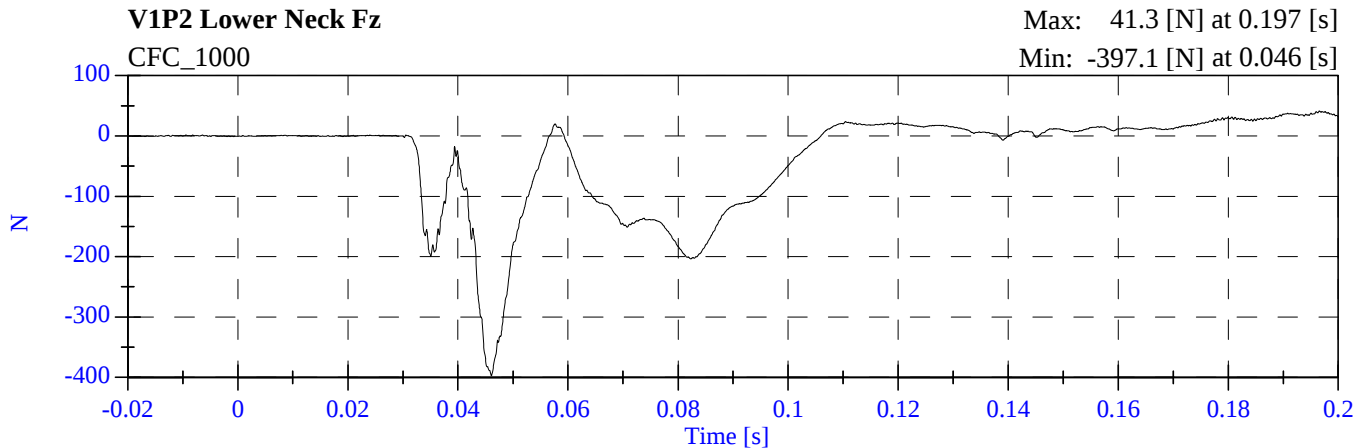
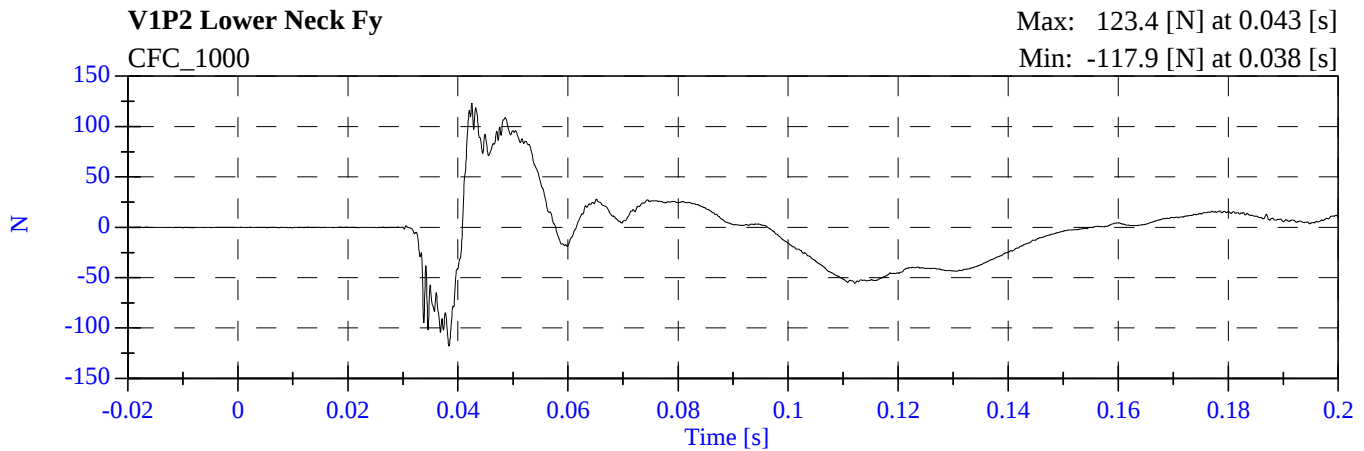
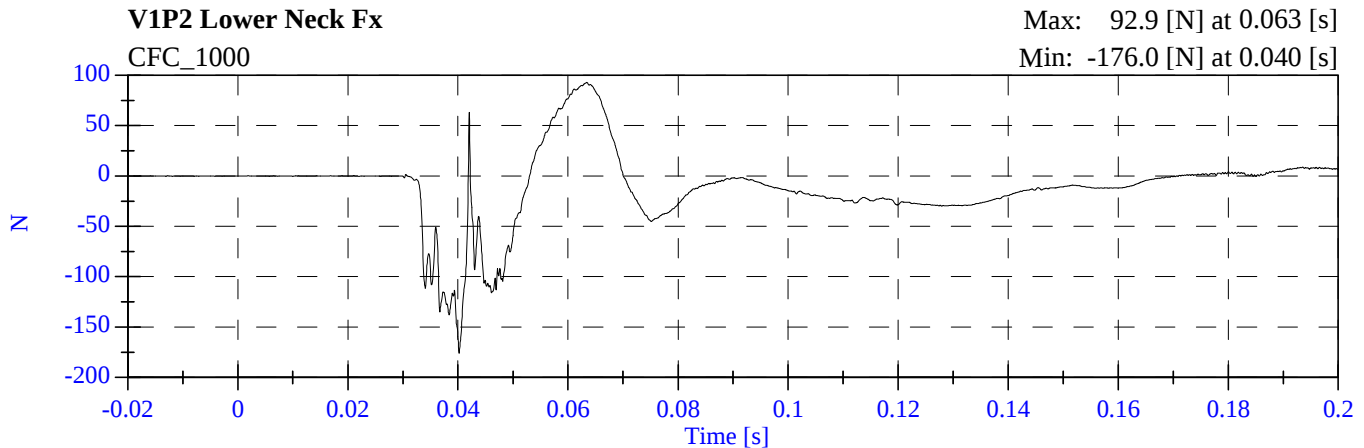
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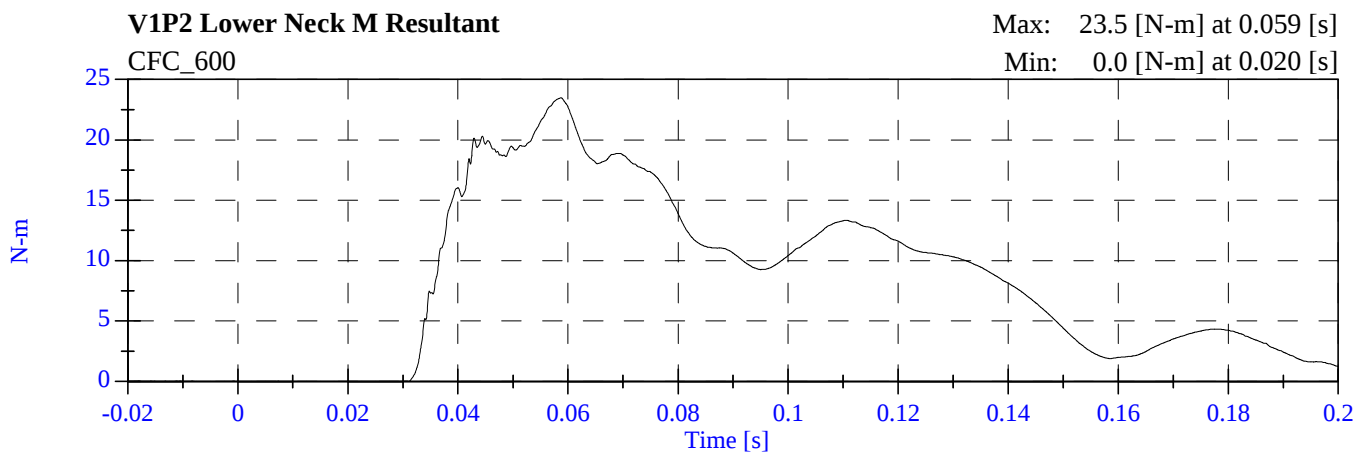
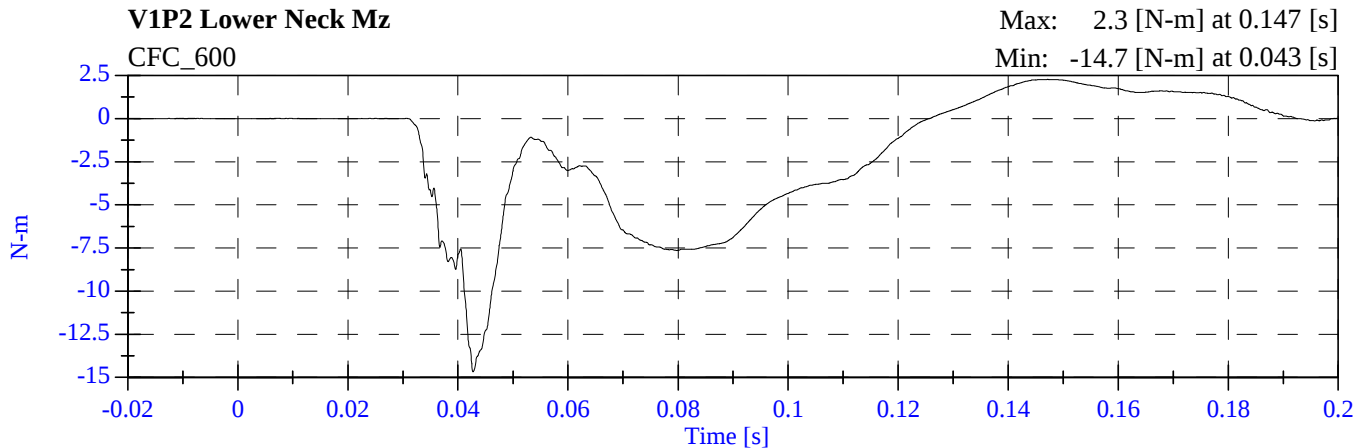
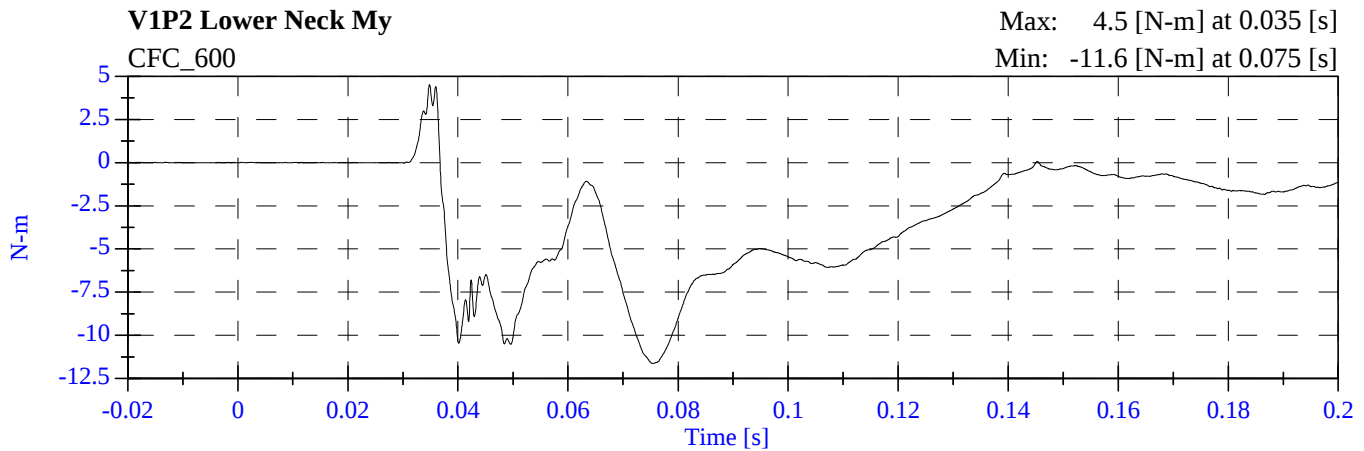
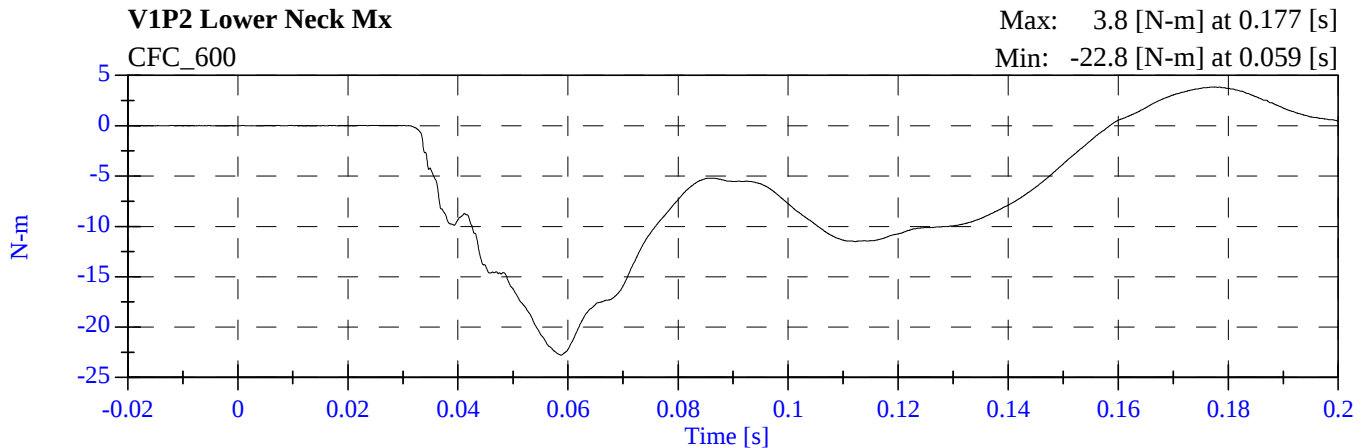
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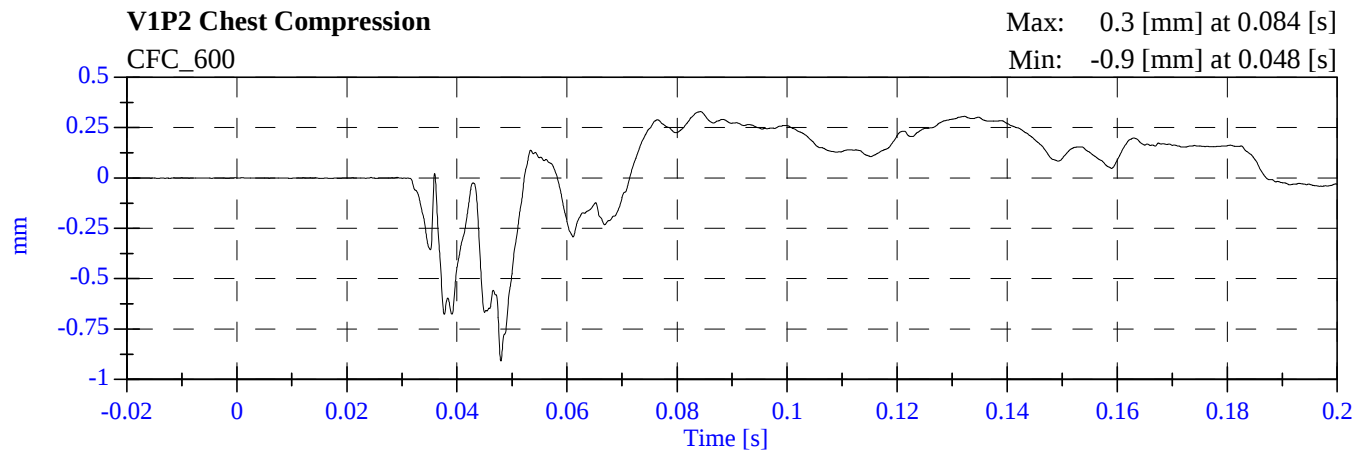
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APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

P572C INSTRUMENTATION

	POSITION #2 (RIGHT) SERIAL NO.: M95304TWG		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
HEAD AX	AC-P51280	ENDEVCO	4/14/09
HEAD AY	AC-P49194	ENDEVCO	4/13/09
HEAD AZ	AC-P58799	ENDEVCO	4/15/09
UPPER NECK FX	LC-1647Fx	DENTON	4/14/09
UPPER NECK FY	LC-1647Fy	DENTON	4/14/09
UPPER NECK FZ	LC-1647Fz	DENTON	4/14/09
UPPER NECK MX	LC-1647Mx	DENTON	4/14/09
UPPER NECK MY	LC-1647My	DENTON	4/14/09
UPPER NECK MZ	LC-1647Mz	DENTON	4/14/09
LOWER NECK FX	LC-146Fx	DENTON	4/20/09
LOWER NECK FY	LC-146Fy	DENTON	4/20/09
LOWER NECK FZ	LC-146Fz	DENTON	4/20/09
LOWER NECK MX	LC-146Mx	DENTON	4/20/09
LOWER NECK MY	LC-146My	DENTON	4/20/09
LOWER NECK MZ	LC-146Mz	DENTON	4/20/09
CHEST DISPLACEMENT X	DS-144	DENTON	4/20/09