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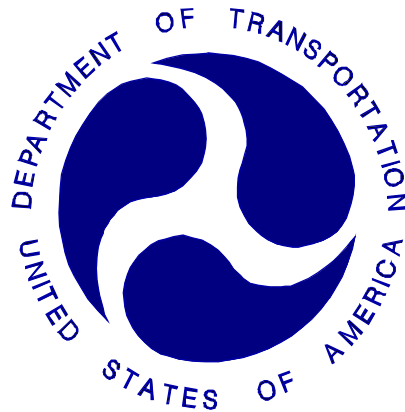
NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

MITSUBISHI MOTORS NORTH AMERICA
2009 MITSUBISHI GALANT
4-DOOR SEDAN

NHTSA NUMBER: M95600TWG

CALSPAN TEST NUMBER: 8883-TWG-2

CALSPAN
ADVANCED INFORMATION ENGINEERING SERVICES
TRANSPORTATION SCIENCES CENTER
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June 4, 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 4, 2009.						
Injury Summary						
HIC15	Chest Displacement (mm)	Chest Displacement Rate (m/s)	NIJ(NTF)	NIJ(NTE)	NIJ(NCF)	NIJ(NCE)
2.5	3.5	2.2	0.07	0.28	0.22	0.12
17. Key Words New Car Assessment Program (NCAP) Side Airbag Out-Of-Position				18. Distribution Statement		
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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 2009 Mitsubishi Galant 4-Door Sedan with an out-of-position HYIII six year old child were evaluated. The test was performed by Calspan on June 4, 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 with its arms hanging at its sides on the foam block facing inboard with its legs extended. The seat track was adjusted to 40 mm rearward of full forward to minimize the vertical distance between the dummy's head and the roof-rail module and to maximize the cushion to head interaction. While keeping the head in neutral orientation, the dummy's pelvis was moved outboard until the dummy's back contacted the door trim panel armrest and 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 dummy's shoulder bolts parallel to the vehicle centerline. The dummy's arms were then bent at the elbow until the fingers contacted the booster seat. This orientation complies with section 3.3.5.1 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:	3.3.5.1	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: 2009 Mitsubishi Galant 4-Door Sedan

NHTSA No. : M95600TWG; VIN: 4A3AB36FX9E003190 ; Color: Blue

Engine Data: 4 cylinders; - CID; 2.4 Liters; - cc

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

Transmission Data: 4 speeds; - Manual; X 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: 8/18/08 ; Odometer Reading 42 km

Selling Dealer: Ray Laks Mitsubishi

& Address: 120 Orchard Park Rd, West Seneca, NY 14224

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Mitsubishi Motors North America

Date of Manufacture 01/08

GVWR: 1985 kg; GAWR: 1060 kg FRONT; 940 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P215/55R17

* Recommended Cold Tire Pressure: 220 kPa FRONT; 220 kPa REAR

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P215/55R17 ; Manufacturer: Goodyear

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

Treadwear: 260 ; 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) = 375.0 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 Barrier Impact Test on August 27, 2008.

DATA SHEET NO. 3

CHILD DUMMY POSITIONING IN VEHICLE

NHTSA No. M95600TWG

Measurement		Value
Total Fore/Aft Travel (mm)		220
Test Distance Rearward of Full-Forward (mm)		40
Total Fore/Aft Travel (Detents)		23
Placed in Position #		5
Seat Back Angle	SA (°)	22.4 degrees from head restraint post
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)	215
Head to Seat Back Centerline	HSC (mm)	-
Head to B-Pillar (cg)	HB (mm)	325
Head to Roof, Z (top of the head)	HZ (mm)	175
Head to Header	HHH (mm)	270
Chest to Dash	CD (mm)	460
Chest to Seatback	CS (mm)	220
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)	0
Left Arm to Door Panel	LA (mm)	0
Knee to Knee	KK (mm)	90
Toe to Toe	TT (mm)	80
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)	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. M95600TWG

		MAXIMUM VALUE			
		Position #2			
DESCRIPTION	Unit	Pos	msec	Neg	msec
Head X	g	16.9	43.8	-3.4	34.5
Head Y	g	9.7	44.5	-6.4	44.9
Head Z	g	21.7	43.9	-10.1	46.0
Head Resultant	g	24.8	43.9	0.0	-14.2
Upper Neck Fx	N	103.9	43.6	-67.8	35.0
Upper Neck Fy	N	184.5	35.7	-26.6	177.4
Upper Neck Fz	N	112.1	57.0	-380.9	45.3
Upper Neck F Resultant	N	384.4	45.3	0.1	-9.9
Upper Neck Mx	N-m	20.0	48.6	-14.8	35.7
Upper Neck My	N-m	13.2	43.0	-9.2	85.1
Upper Neck Mz	N-m	6.3	39.9	-5.4	87.8
Upper Neck M Resultant	N-m	21.4	48.3	0.0	9.3
Lower Neck Fx	N	121.8	32.6	-241.9	44.3
Lower Neck Fy	N	88.8	32.3	-242.1	34.8
Lower Neck Fz	N	336.4	46.2	-102.7	128.1
Lower Neck F Resultant	N	379.6	46.1	0.0	16.5
Lower Neck Mx	N-m	22.4	52.1	-5.4	178.7
Lower Neck My	N-m	16.1	33.0	-16.5	79.0
Lower Neck Mz	N-m	11.2	38.4	-3.9	96.1
Lower Neck M Resultant	N-m	26.9	52.1	0.0	21.8
Chest Displacement	g	3.5	36.0	-0.6	31.7

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

VEHICLE: 2009 Mitsubishi Galant 4-Door Sedan

NHTSA No. M95600TWG

HEAD INJURY CRITERIA (HIC)				
HIC15				
	HIC	t ₁ (msec)	t ₂ (msec)	Average Acceleration t ₁ to t ₂
Position #2 - Right	2.5	32.0	47.0	7.7

THORAX CRITERIA			
	Critical Values	Actual	Time(ms)
Deflection (mm)	40	3.5	36.0
Deflection Rate (m/s)	8.5	2.2	33.6

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	0.07	160.6	20.4	-41.9	6.2
Nte	0.28	85.6	31.6	47.8	-10.1
Ncf	0.22	45.3	-354.0	20.4	9.1
Nce	0.12	33.3	-226.1	-38.1	-1.4

Peak Tension (CFC1000) 112.1 N Peak Compression (CFC1000) -380.9 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

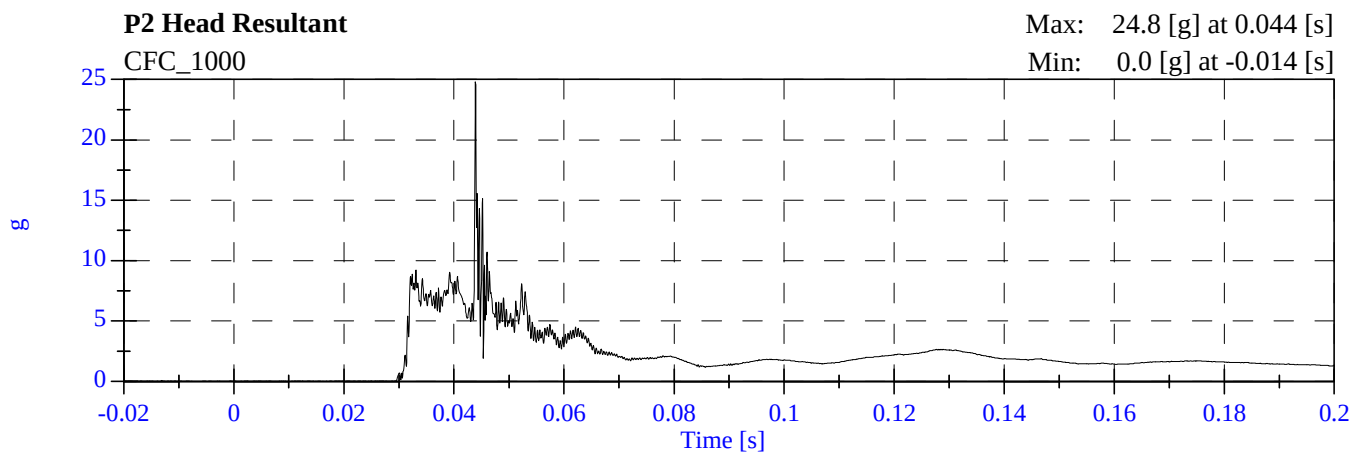
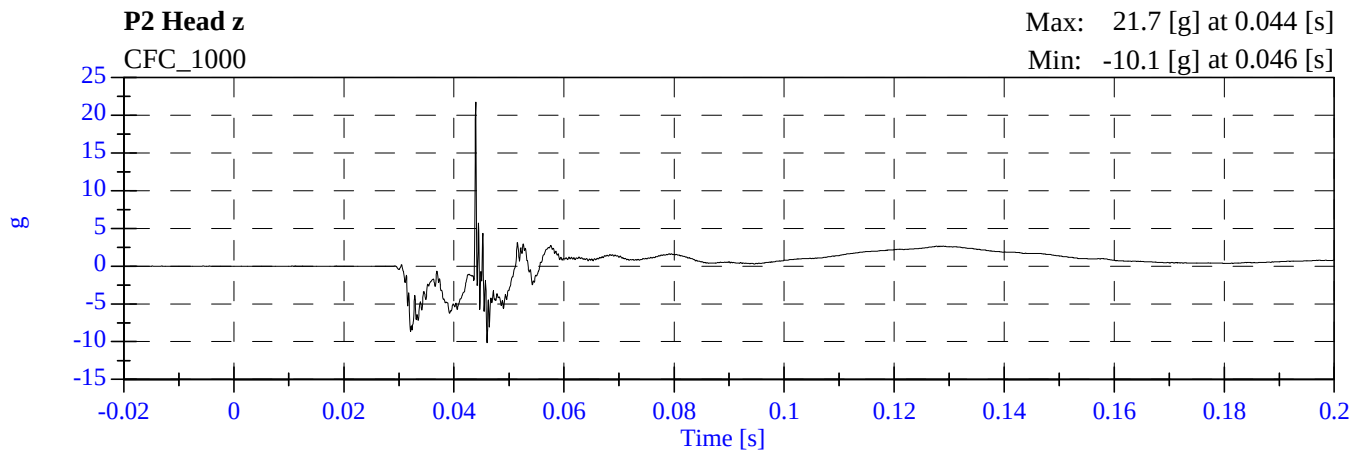
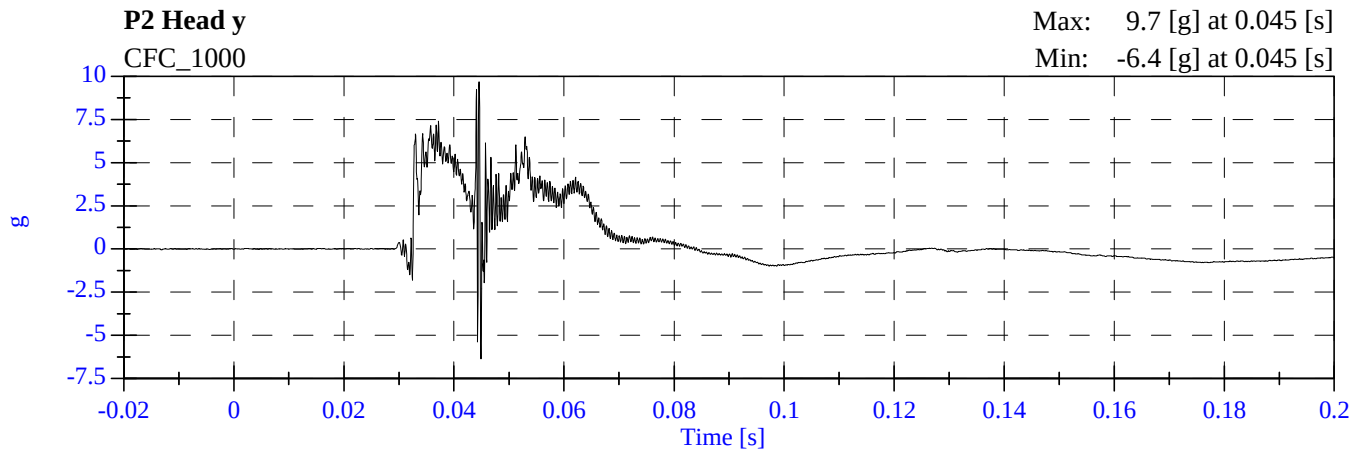
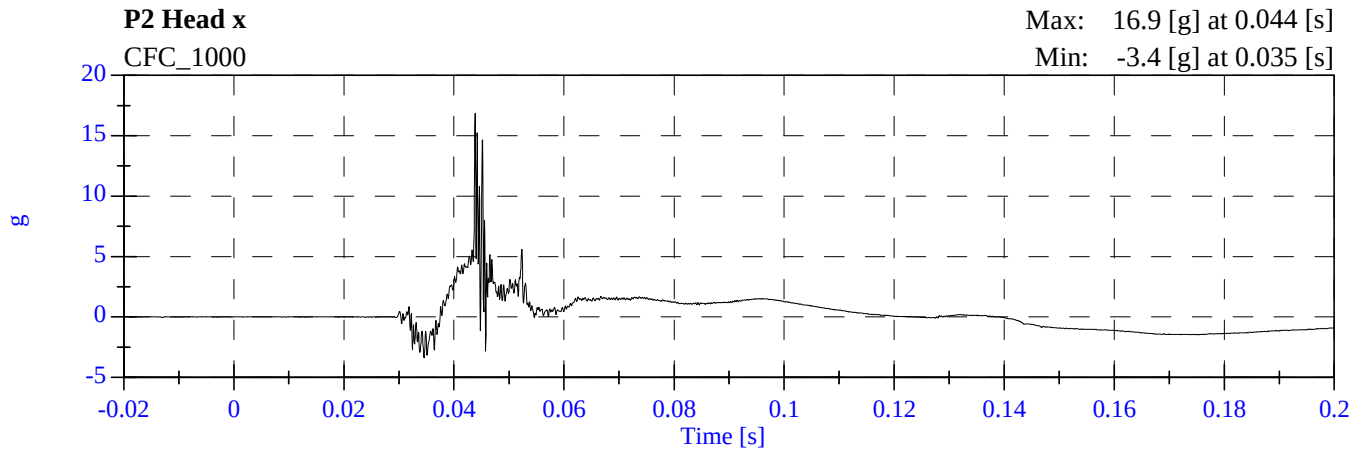
CHILD DUMMY RESPONSE DATA TRACES

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PLOT	PLOT NAME[UNITS, CHANNEL FILTER CLASS]	PAGE
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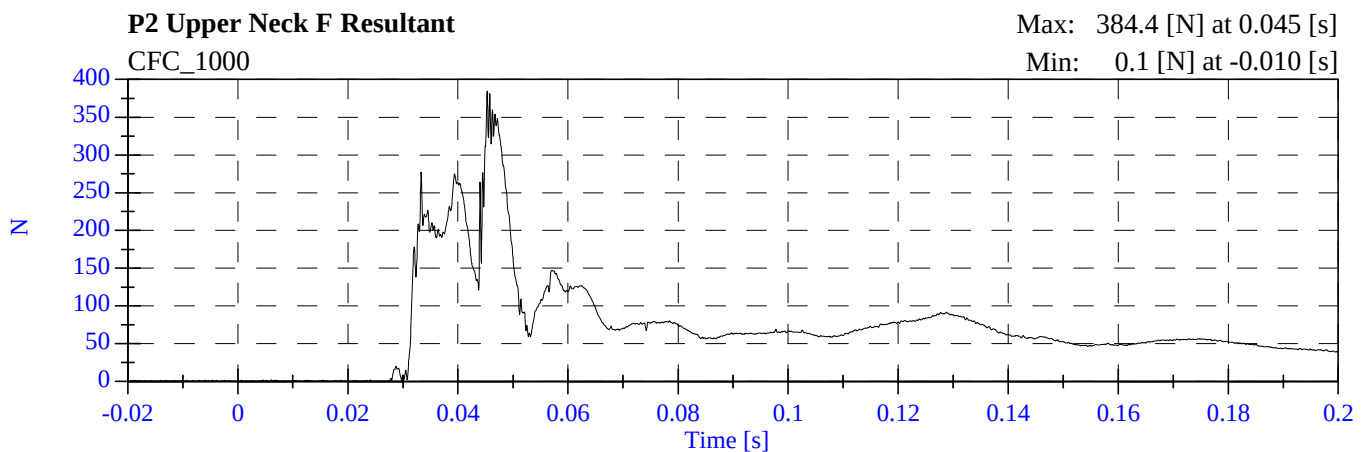
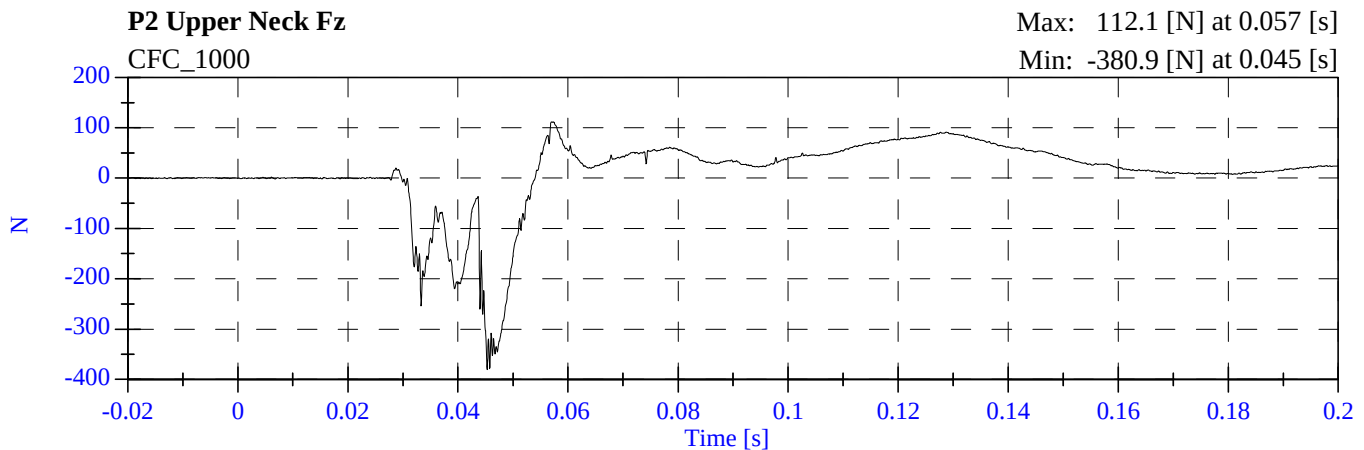
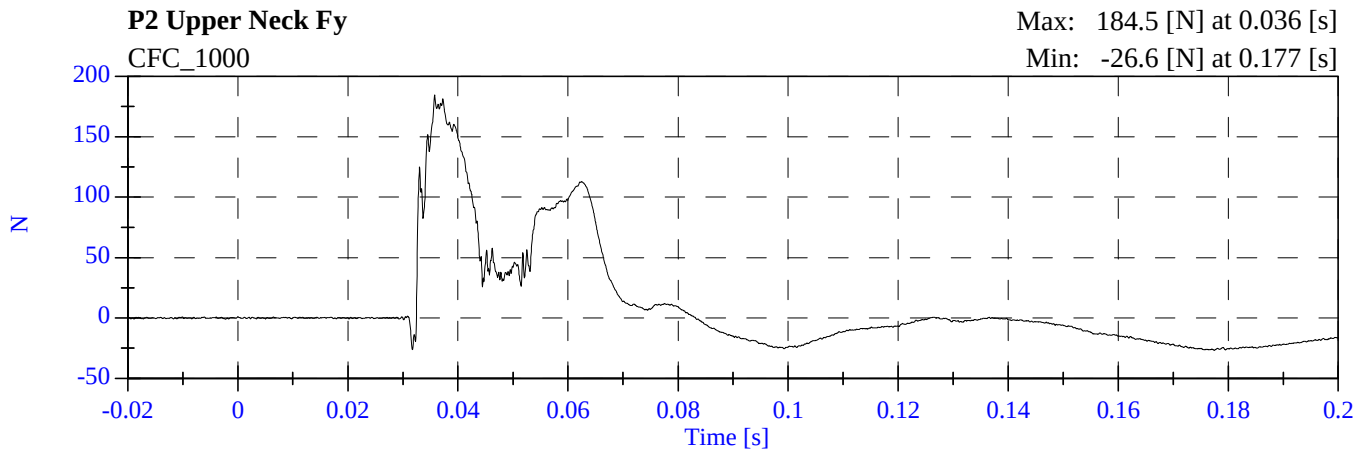
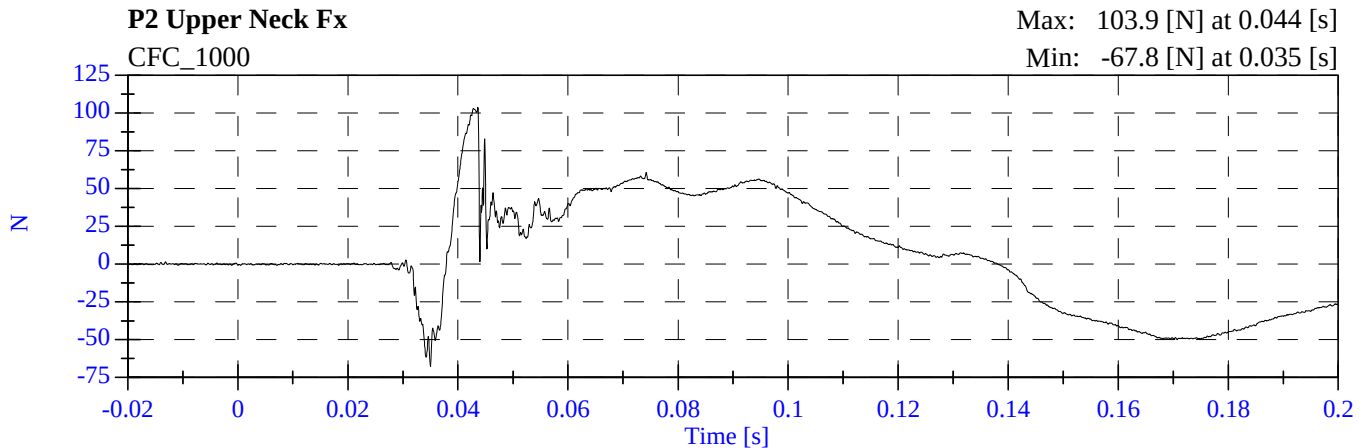
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M95600 - June 04, 2009



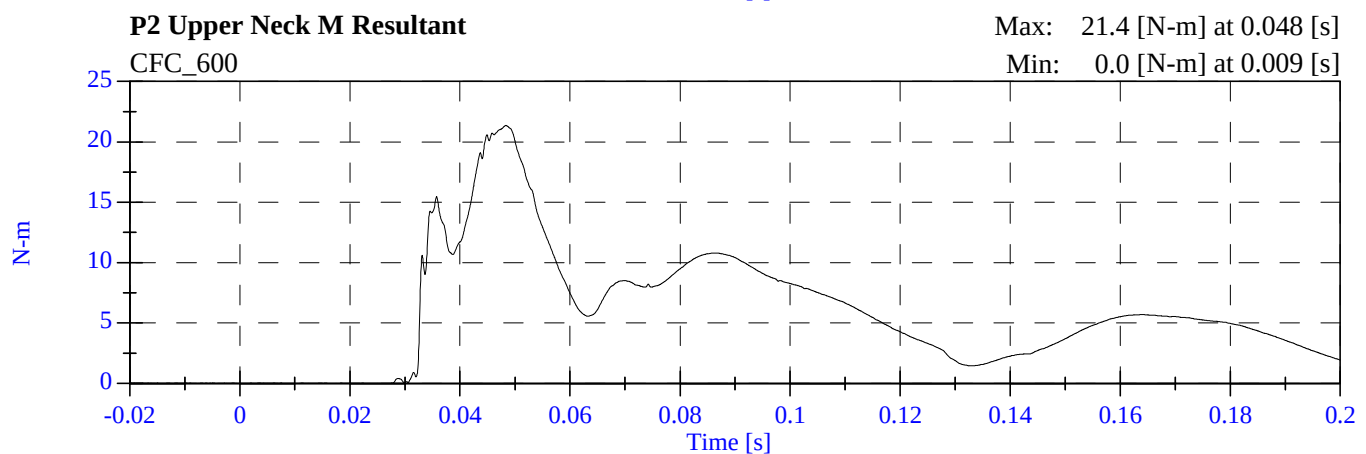
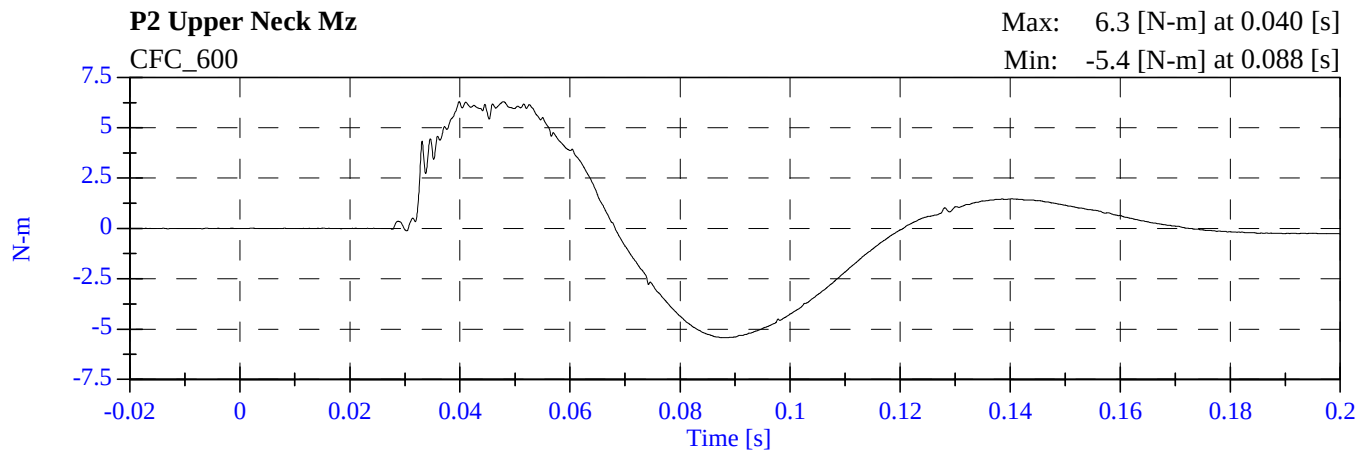
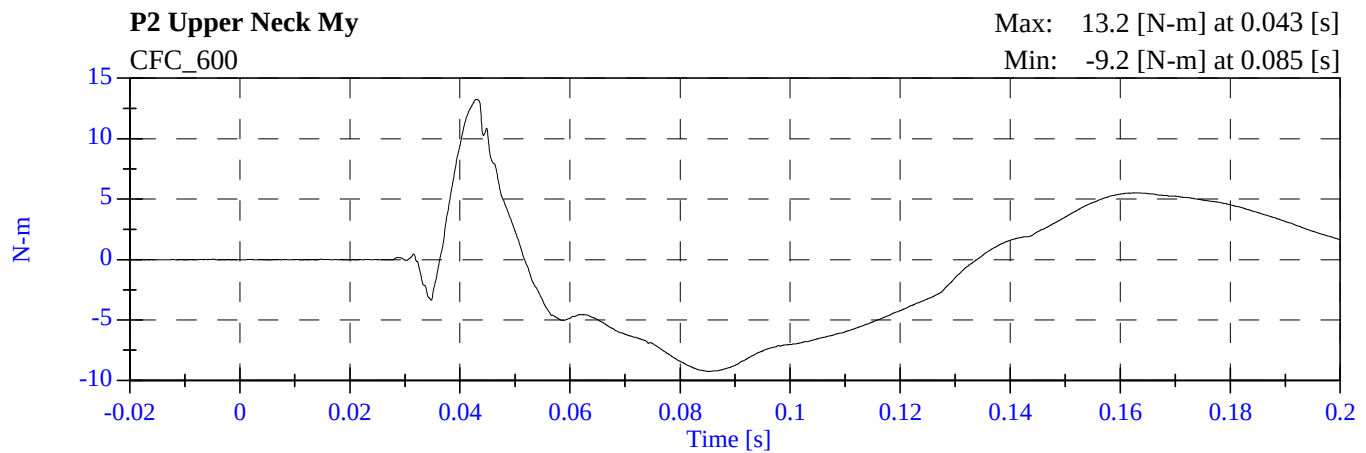
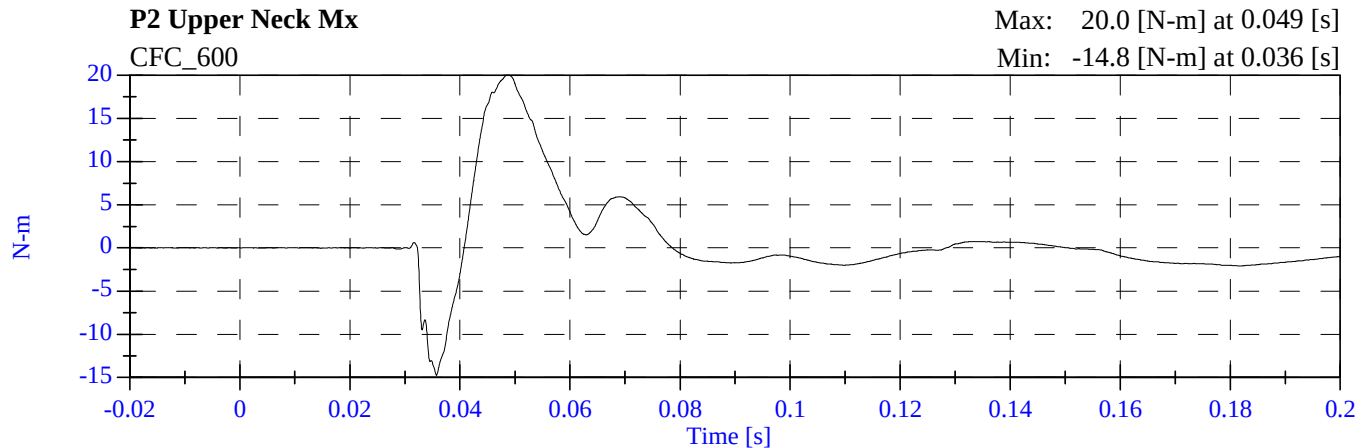
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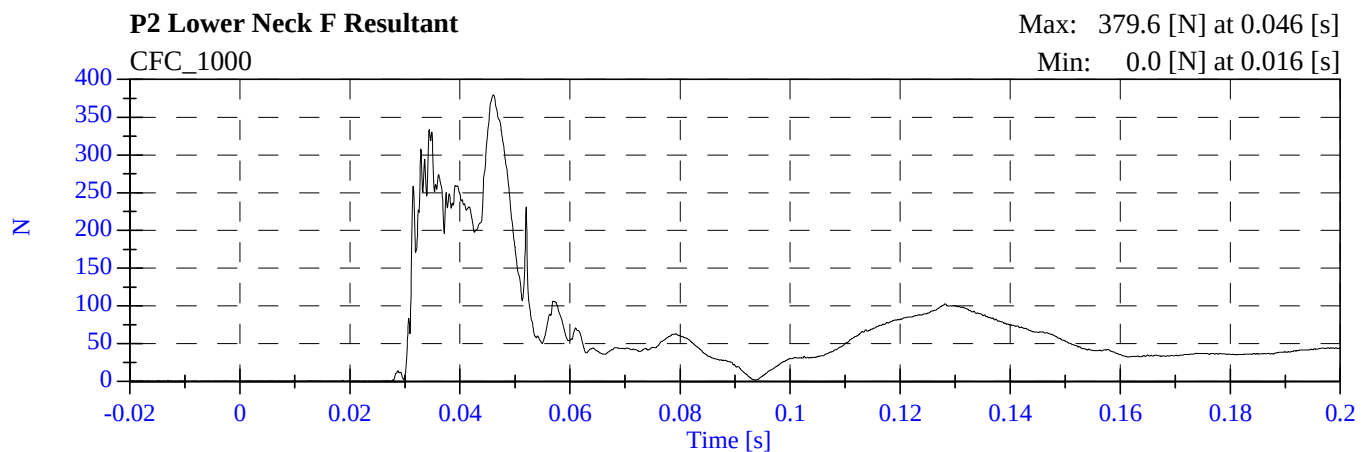
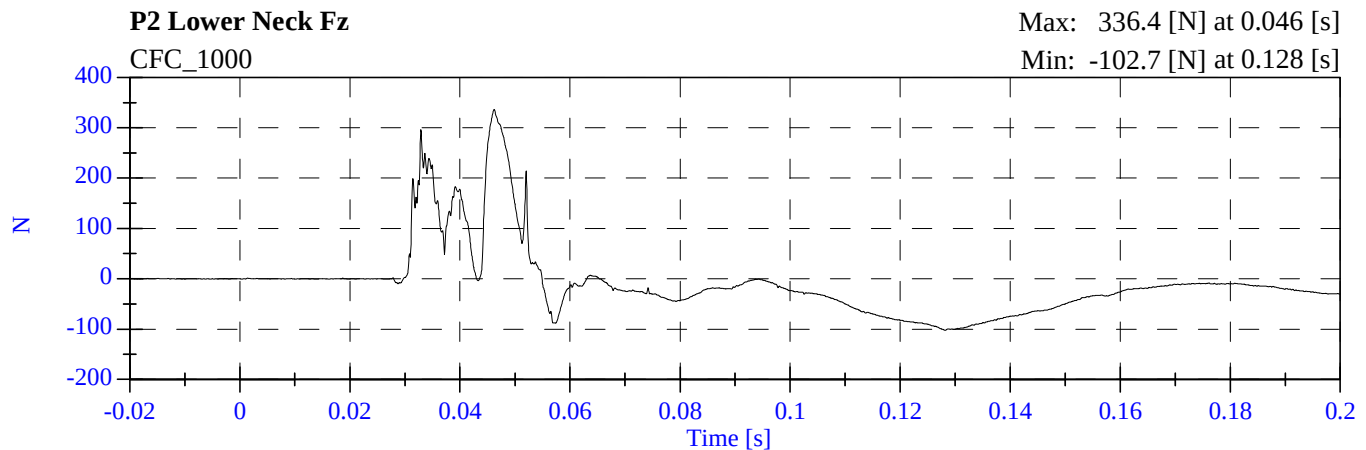
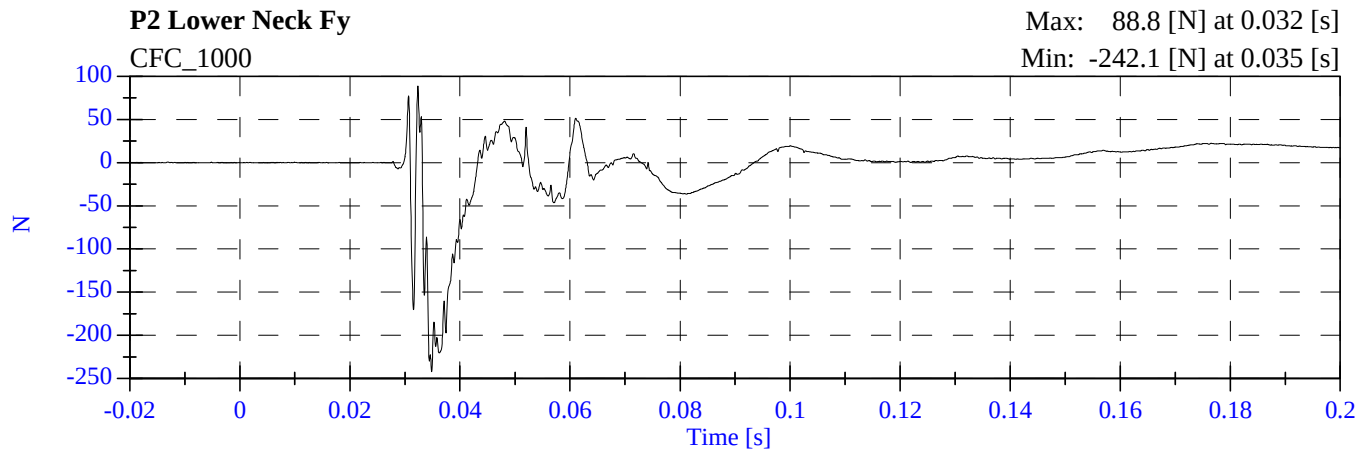
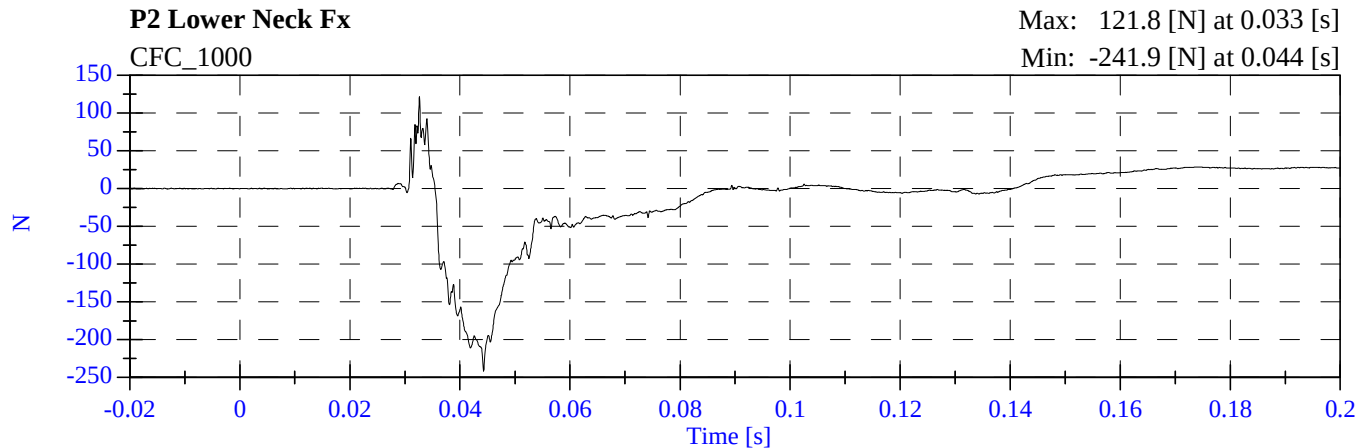
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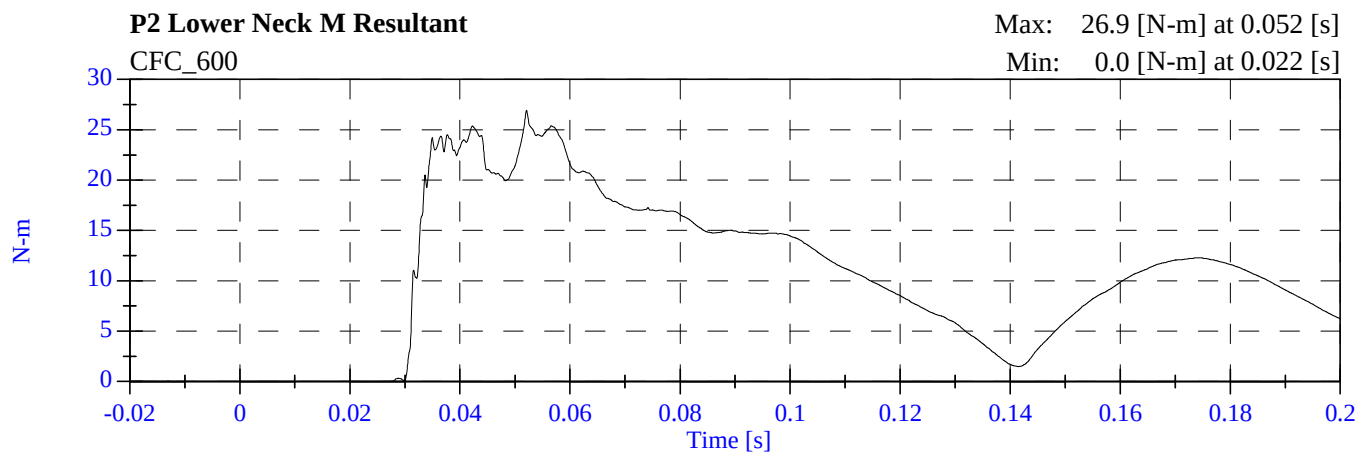
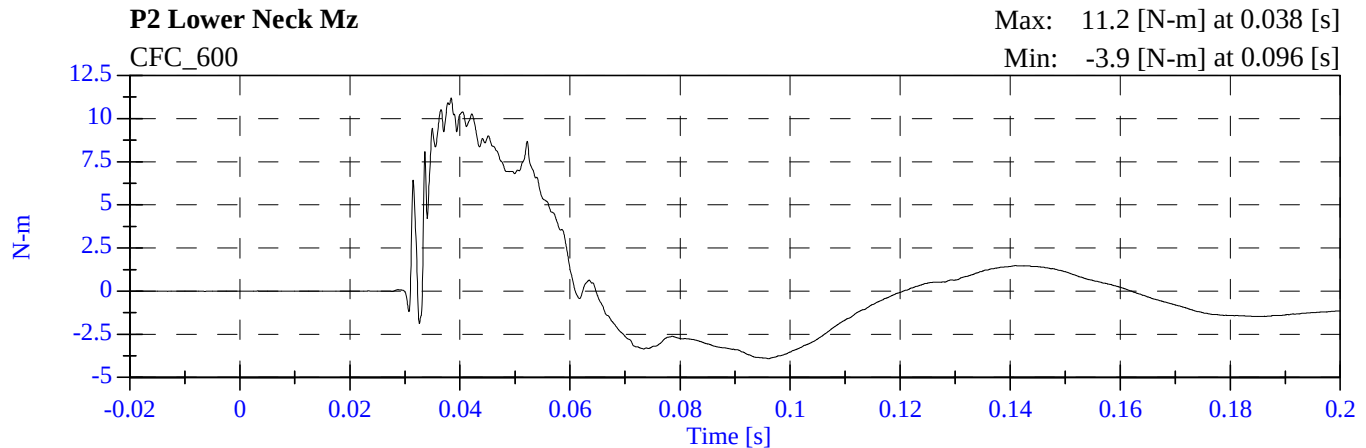
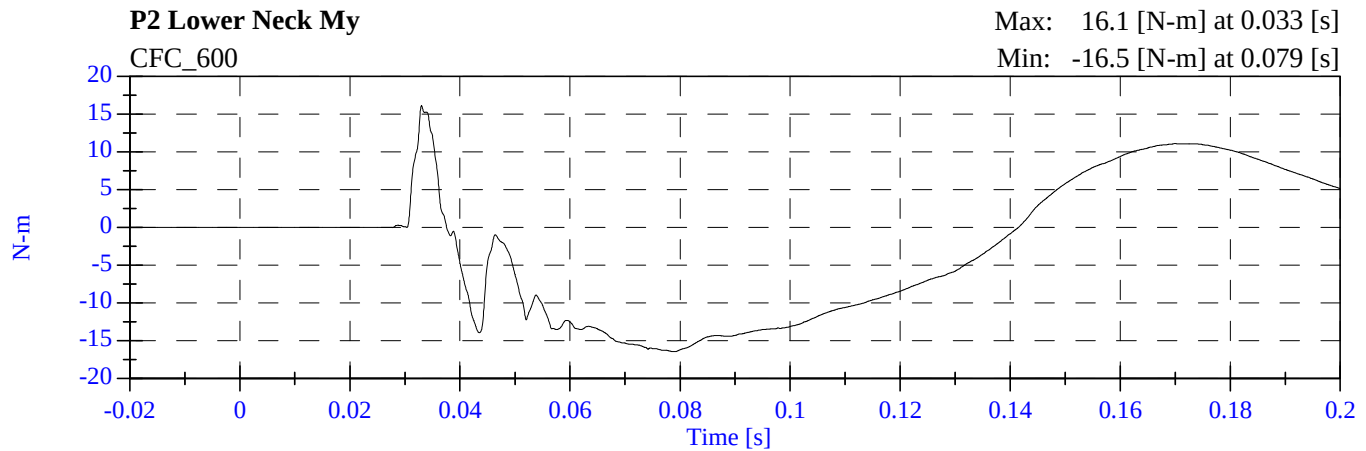
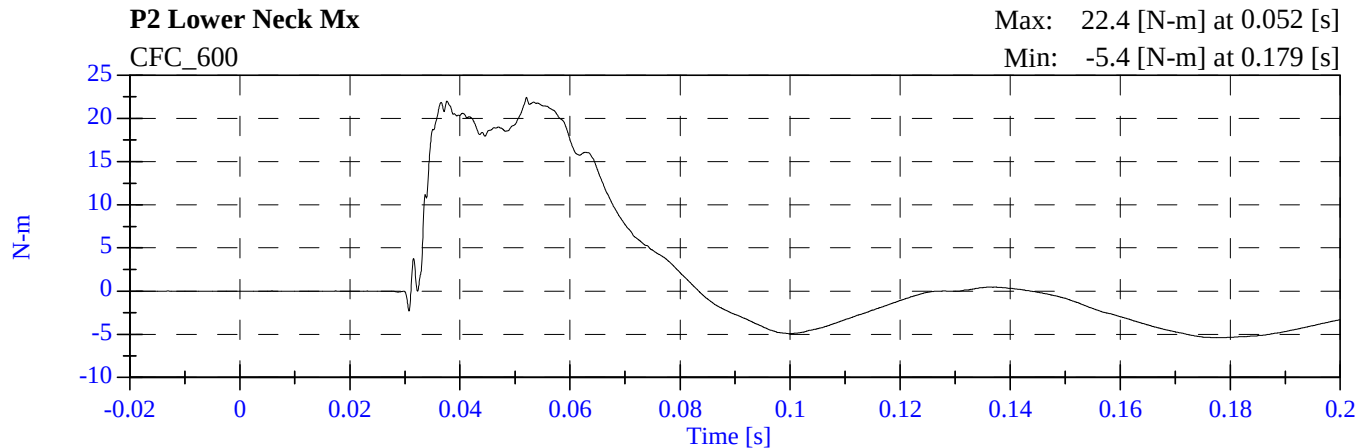
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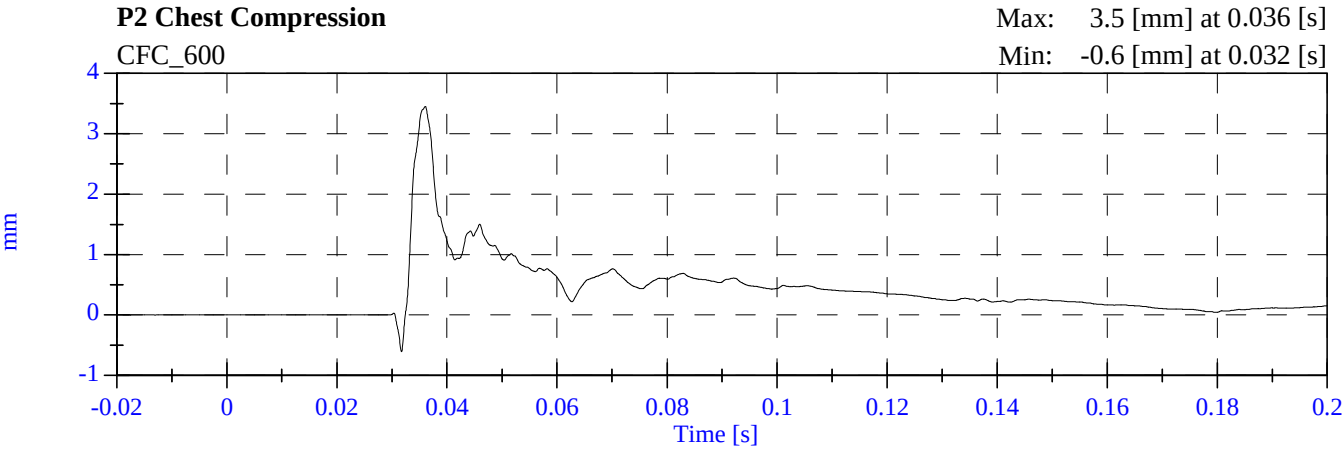


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2009 Mitsubishi Galant - TWG/OOP
M95600 - June 04, 2009



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