REPORT NUMBER: TWG-CAL05-07

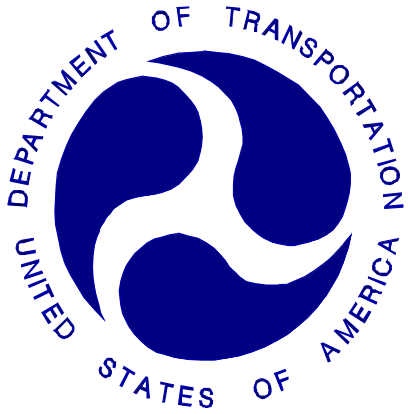
NEW CAR ASSESSMENT PROGRAM (NCAP)
SIDE AIRBAG OUT-OF-POSITION INJURY TESTING

2005 PONTIAC G6
FOUR DOOR SEDAN

NHTSA NUMBER: M50114TWG2

CALSPAN CORPORATION TEST NUMBER: 8642-TWG-15

CALSPAN CORPORATION
TRANSPORTATION SCIENCES CENTER
P.O. BOX 400
BUFFALO, NEW YORK 14225



June 13, 2005

FINAL REPORT

U. S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Rulemaking
Office of Crashworthiness Standards
Mail Code: NVS-111
400 Seventh Street, SW, Room No. 5313
Washington, DC 20590

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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 Corporation Crash Test Facility in Buffalo, New York, on June 13, 2005.

Injury Summary

HIC15	HIC36	Clip (g's)	Chest Displacement (mm)	NIJ NTF	NIJ NTE	NIJ NCF	NIJ NCE
10.8	11.8	19.1	-0.7	0.10	0.23	0.42	0.54

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) 400 Seventh St., S.W. Washington, D.C. 20590 Telephone No. (202) 366-4946 ATTN: Robert Hornicle

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PURPOSE AND SUMMARY OF TEST M50114TWG2

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. DTNH22-01-D-32005.

1.2 SUMMARY

The effects of both a seat-mounted side airbag and a curtain airbag deployment in a 2005 Pontiac G6 with an out-of-position six-year-old child were evaluated. The test was performed by Calspan Corporation on June 13, 2005. 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 in perpendicular 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, chest, and pelvic triaxial accelerometers. In addition upper and lower six axial neck force and moment load cell sensors were utilized.

Twenty-three 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 Hybrid IIII six-year-old child dummy's visible contact points were as follows: The seat airbag to the right scapula and right side of the posterior thorax and pelvis and the curtain airbag to the top and the back of the head.

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:

	TEST DATA	DESCRIPTION
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; Side Rail	Bolster mounted thorax side airbag and side curtain airbag.
Booster Block	300mm x 450 mm x 75 mm	Block consisted of HD36 foam with a density of 44.8 g/L
ATD Type/Serial No.:	P572N/186	Hybrid III six-year-old child dummy

*- Procedure as defined by Lund, et al and the Technical Working Group dated July, 2003

Number of Data Channels	23	
Number of Cameras:	0	Real Time
	1	High Speed Digital
	0	High Speed Film

VISIBLE DUMMY CONTACT POINTS

Head Contact:	The back (occipital) and the top (parietal) of the head by the side curtain.
Upper Torso Contact:	Side airbag to the right scapula and right side of the posterior thorax
Lower Torso Contact:	Side airbag to the right side of the pelvis (ilium)
Left Knee Contact:	None
Right Knee Contact:	None

DATA SHEET 2

VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 2005 Pontiac G6 Four-Door Sedan

NHTSA No. : M50114 ; VIN: 1G2ZG548254124632‡ ; Color: Silver

Engine Data: 6 cylinders; - CID; 3.5 Liters; - cc

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

Transmission Data: 4 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 ADLs; X A/C; X Pwr.Strg.; X Pwr. Brakes

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

Date Received: 11/10/2004 ; Odometer Reading 89 km

Selling Dealer: Jim Culligan, Inc.

& Address: 8129 Main Street Williamsville, NY 14221-6032

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: General Motors Corp

Date of Manufacture 10/04

GVWR: 2004 kg; GAWR: 1091 kg FRONT; 913 kg REAR

DATA FROM TIRE PLACARD:

Recommended Tire Size: P215/60R16

* Recommended Cold Tire Pressure: 210 kpa FRONT; 210 kpa REAR

DATA FROM TIRE SIDEWALL:

Size of Tires on Test Vehicle: P215/60R16 94S ; Manufacturer: Uniroyal

Tire Pressure with Maximum Capacity Vehicle Load: Front: 240 kPa; Rear: 240 kPa

Treadwear: 540 ; 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) = 404.0 kg

No. of Occupants x 68.04 kg = 340.2 kg

Rated Cargo/Luggage Weight (RCLW) = 63.8 kg

*Tire pressure used for test

‡ This vehicle had previously been tested in an NCAP frontal impact on November 19, 2004.

DATA SHEET NO. 3

CHILD DUMMY POSITIONING IN VEHICLE

NHTSA No. M50114TWG2

Measurement		Value
Total Fore/Aft Travel (mm)		240
Test Distance Rearward of Full-Forward (mm)		160
Total Fore/Aft Travel (Detents)		24
Placed in Position #		16
Seat Back Angle	SA (^{o})	11.4
Airbag Module Width	AMW (mm)	130
Airbag Width	ABW (mm)	320
Airbag Module Length	AML (mm)	250
Airbag Length	ABL (mm)	280
Top of Airbag Module to Head/Neck Junction	AN (mm)	-125
Head CG to Door Panel/Window	HD (mm)	175
Head to Seat Back Centerline	HSC (mm)	190
Head to B-Pillar (cg)	HB (mm)	200
Head to Roof, Z (top of the head)	HZ (mm)	160
Head to Header	HHD (mm)	464
Chest to Dash	CD (mm)	535
Chest to Seatback	CS (mm)	-
Right Arm to Seat Back Centerline	RACL (mm)	-
Right Arm to Seat Back Centerline	RACL (^{o})	-
Left Arm to Seat Back Centerline	LACL (mm)	65
Left Arm to Seat Back Centerline	LACL (^{o})	-
Right Arm to Door Panel	RA (mm)	-
Left Arm to Door Panel	LA (mm)	0
Knee to Knee	KK (mm)	-
Toe to Toe	TT (mm)	190
Right Knee to Seat Cushion Centerline	KSCR (mm)	190
Left Knee to Seat Cushion Centerline	KSCL (mm)	190
Right Toe to Seat Cushion Centerline	TSCR (mm)	0
Left Toe to Seat Cushion Centerline	TSCL (mm)	-
Nose to Dash	ND (mm)	544
Nose to Seatback	NS (mm)	-
Nose to Header	NR (mm)	473
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. M50114TWG2

		MAXIMUM VALUE			
		Position #2			
DESCRIPTION	**Unit**	**Maximum**	**Time (ms)**	**Minimum**	**Time (ms)**
Head X	**g**	20.7	16.8	-1.9	174.0
Head Y	**g**	5.1	23.2	-19.8	14.3
Head Z	**g**	11.0	16.4	-6.3	10.4
Head Resultant	**g**	23.6	16.4	0.0	-19.6
Upper Neck Fx	**N**	252.1	18.2	-63.1	173.5
Upper Neck Fy	**N**	40.7	154.0	-177.7	15.0
Upper Neck Fz	**N**	211.2	123.0	-604.2	16.5
Upper Neck F Resultant	**N**	654.5	16.5	0.0	-43.6
Upper Neck Mx	**N-m**	14.7	15.3	-22.9	26.9
Upper Neck My	**N-m**	24.1	16.0	-16.1	42.4
Upper Neck Mz	**N-m**	3.8	63.6	-5.9	16.1
Upper Neck M Resultant	**N-m**	28.6	15.6	0.0	-25.7
Lower Neck Fx	**N**	350.0	15.1	-237.3	8.7
Lower Neck Fy	**N**	207.4	26.3	-287.5	12.9
Lower Neck Fz	**N**	199.7	125.4	-433.7	18.4
Lower Neck F Resultant	**N**	489.1	17.6	0.0	-37.5
Lower Neck Mx	**N-m**	8.1	153.1	-27.1	15.5
Lower Neck My	**N-m**	13.1	172.8	-28.0	13.9
Lower Neck Mz	**N-m**	17.1	58.7	-20.0	15.4
Lower Neck M Resultant	**N-m**	42.3	15.1	0.0	-4.7
Chest X	**g**	50.0	9.1	-6.7	35.7
Chest Y	**g**	2.6	42.6	-14.6	9.1
Chest Z	**g**	5.7	9.0	-2.2	122.6
Chest Resultant	**g**	52.4	9.1	0.0	-44.6
Chest Displacement	**mm**	2.6	69.5	-0.7	13.2
Pelvic X	**g**	4.0	28.5	-4.1	19.3
Pelvic Y	**g**	2.8	109.6	-2.6	16.4
Pelvic Z	**g**	6.3	9.4	-6.0	16.5
Pelvic Resultant	**g**	6.6	16.4	0.0	-17.9

DATA SHEET 4

CHILD DUMMY INJURY CRITERIA VALUES (CONTINUED)

NHTSA No. M50114TWG2

	HEAD INJURY CRITERIA (HIC)							
	HIC15				HIC36			
	HIC	t_1 (msec)	t_2 (msec)	Average Acceleration t_1 to t_2	HIC	t_1 (msec)	t_2 (msec)	Average Acceleration t_1 to t_2
Position #2 – Right Front	10.8	13.3	28.3	13.9	11.8	11.3	31.7	12.7

	CLIP SUMMARY*			
	CLIP (g's)	t_1 (msec)	t_2 (msec)	CSI
Position #2 – Right Front	19.1	8.3	11.3	33.7

* The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

Position 2 Neck Injury Summary (HIII 6 year old – Out of Position)

Nij V10	Nij	Time (ms)	Z Force (N)	X Force (N)	Y Moment (N-m)
Ntf	0.10	164.0	46.3	-57.4	7.8
Nte	0.23	91.3	0.5	71.9	-8.6
Ncf	0.42	16.3	-570.5	220.0	20.1
Nce	0.54	44.6	-184.6	110.6	-17.6

Peak Tension (CFC1000) 211.2 N **Peak Compression (CFC1000) -604.2 N**

Critical Values

Nij Intercepts				Peak Limits	
Tension (CVt)	2880 N	Extension (mCVe)	37 N-m	Tension	1890 N
Compression (CVc)	2880 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 Dummy Frontal View

Figure A-6: Post-Test Dummy Frontal View

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

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

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

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

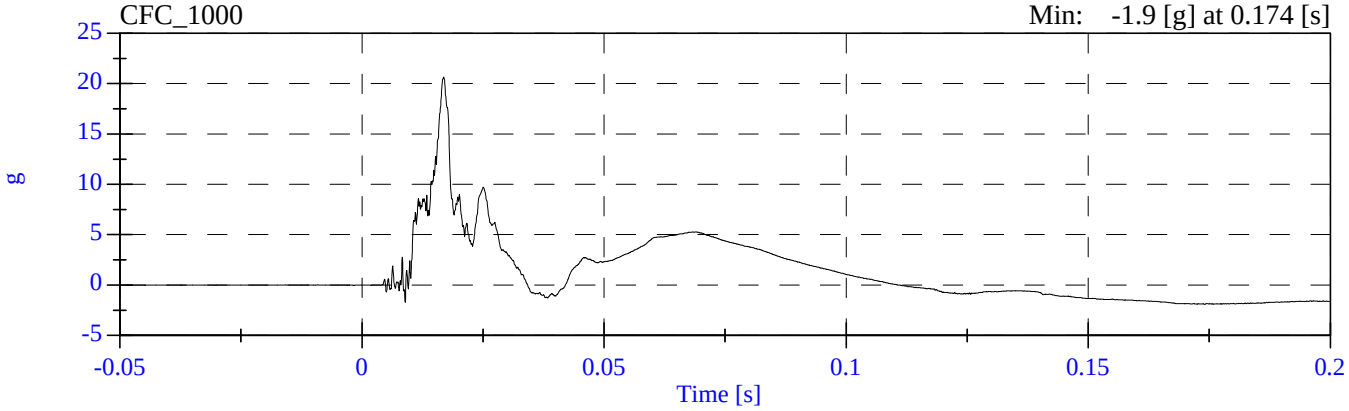
APPENDIX B

CHILD DUMMY RESPONSE DATA TRACES

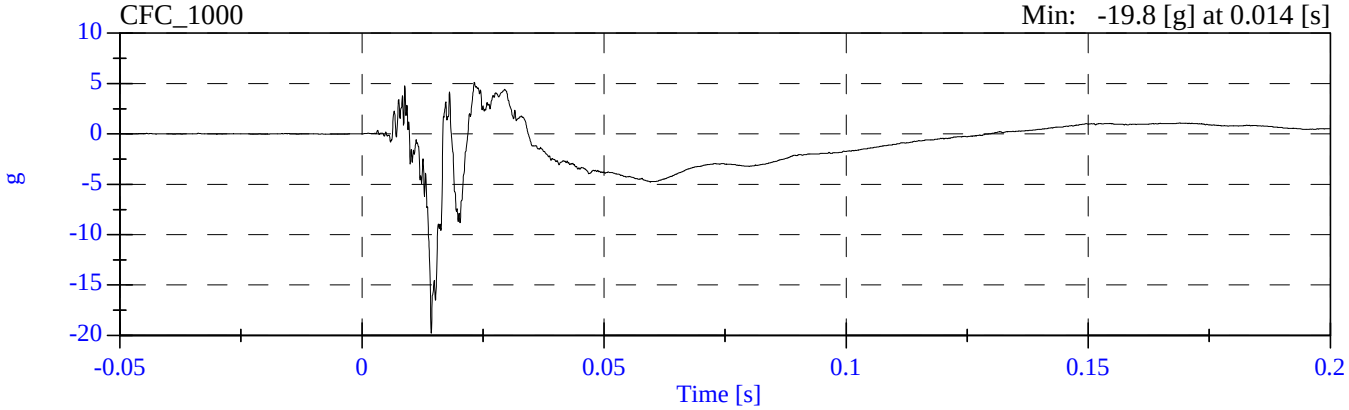
TABLE OF DATA PLOTS

M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

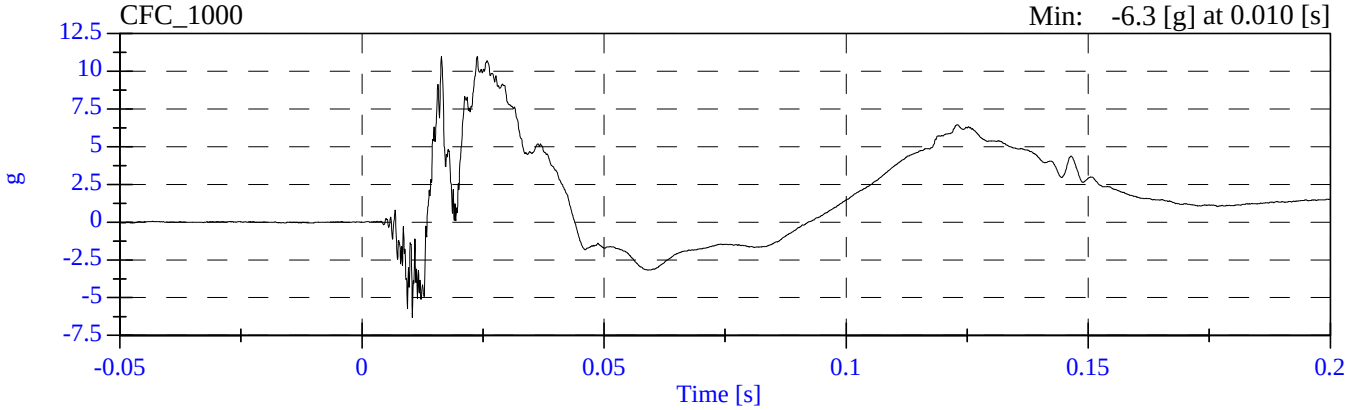
P2 Head x
CFC_1000
Max: 20.7 [g] at 0.017 [s]
Min: -1.9 [g] at 0.174 [s]



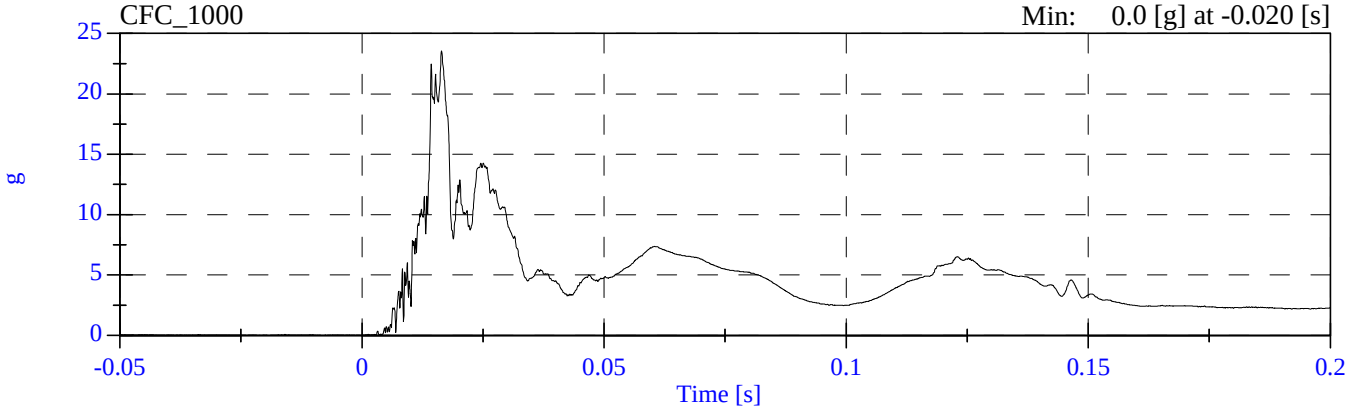
P2 Head y
CFC_1000
Max: 5.1 [g] at 0.023 [s]
Min: -19.8 [g] at 0.014 [s]



P2 Head z
CFC_1000
Max: 11.0 [g] at 0.016 [s]
Min: -6.3 [g] at 0.010 [s]

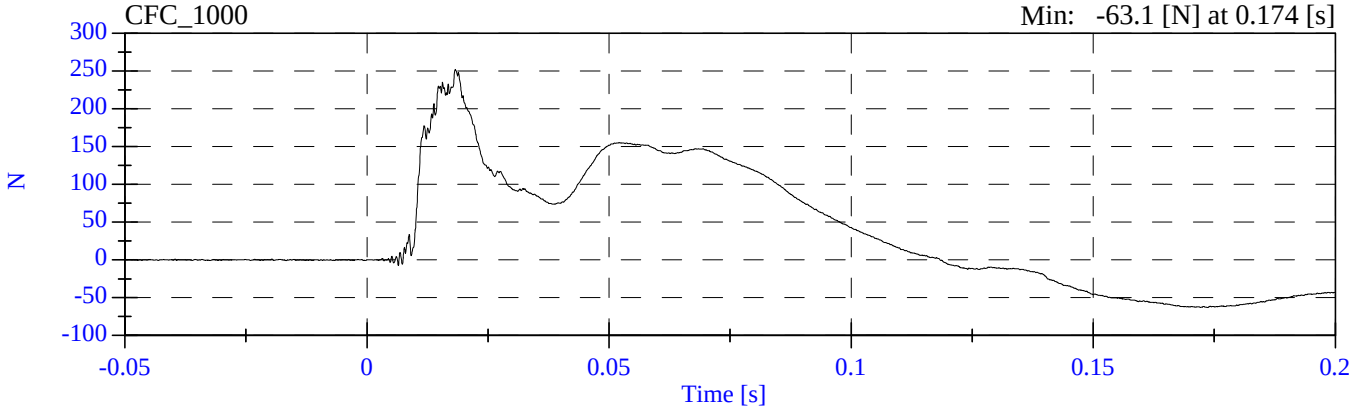


P2 Head Resultant
CFC_1000
Max: 23.6 [g] at 0.016 [s]
Min: 0.0 [g] at -0.020 [s]

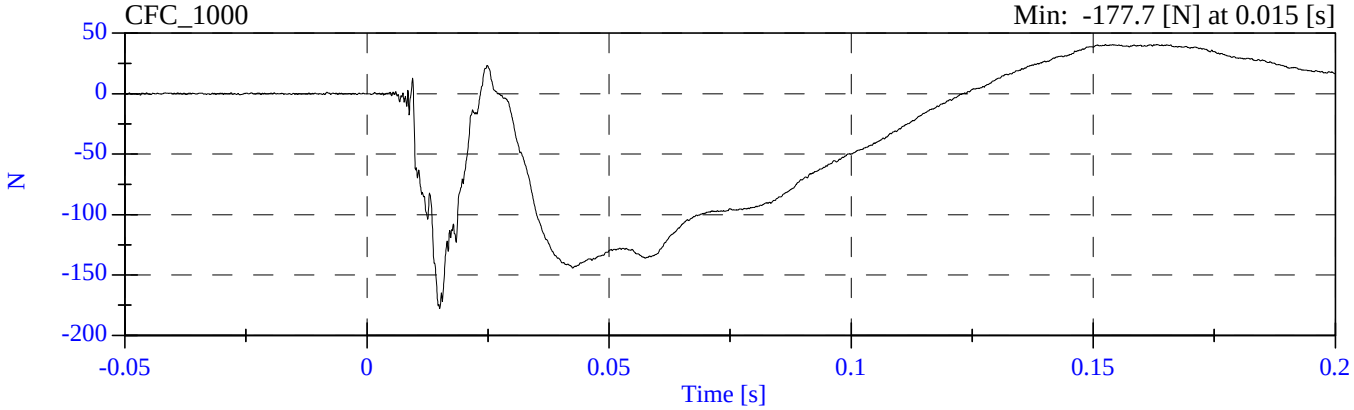


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

P2 Upper Neck Fx
CFC_1000
Max: 252.1 [N] at 0.018 [s]
Min: -63.1 [N] at 0.174 [s]



P2 Upper Neck Fy
CFC_1000
Max: 40.7 [N] at 0.154 [s]
Min: -177.7 [N] at 0.015 [s]



P2 Upper Neck Fz
CFC_1000
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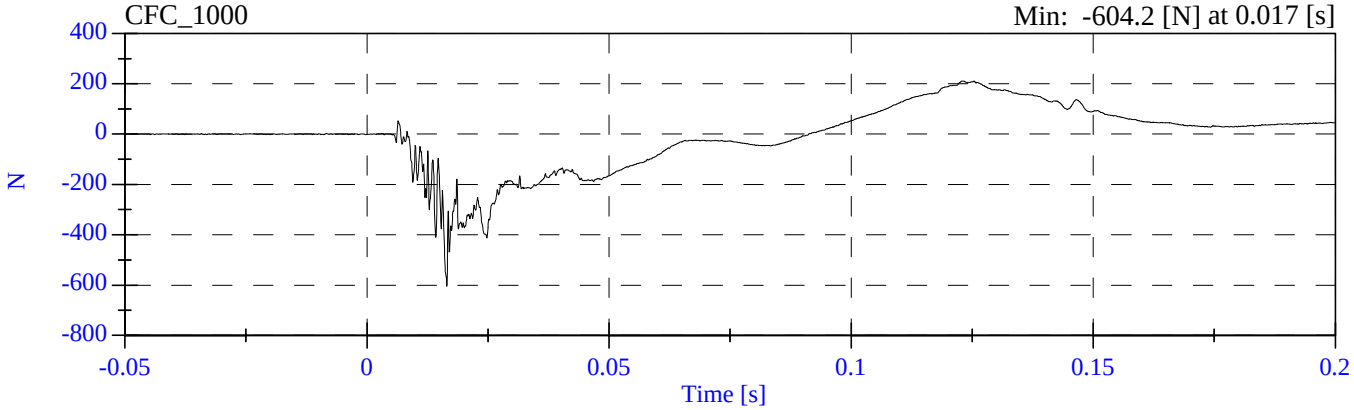
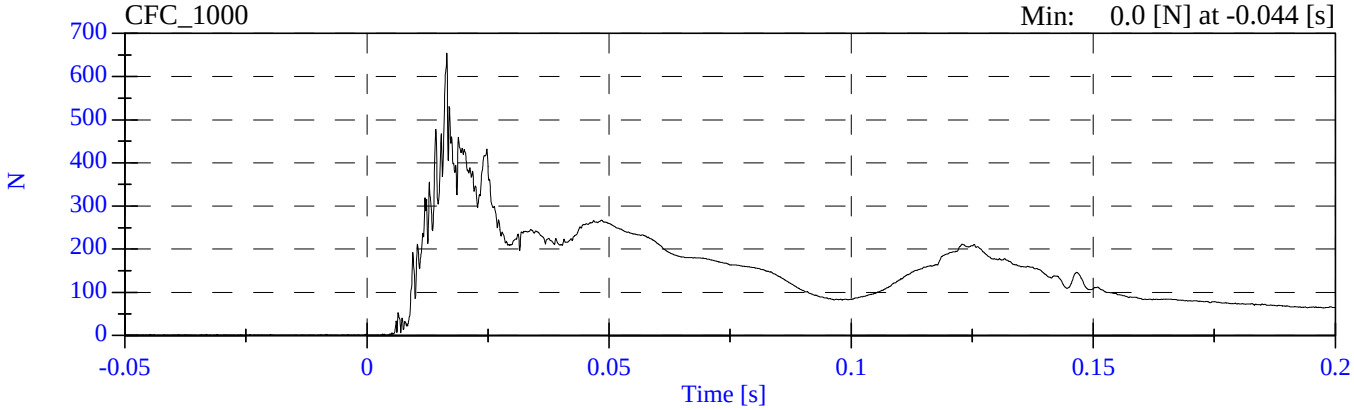
Min: -604.2 [N] at 0.017 [s]

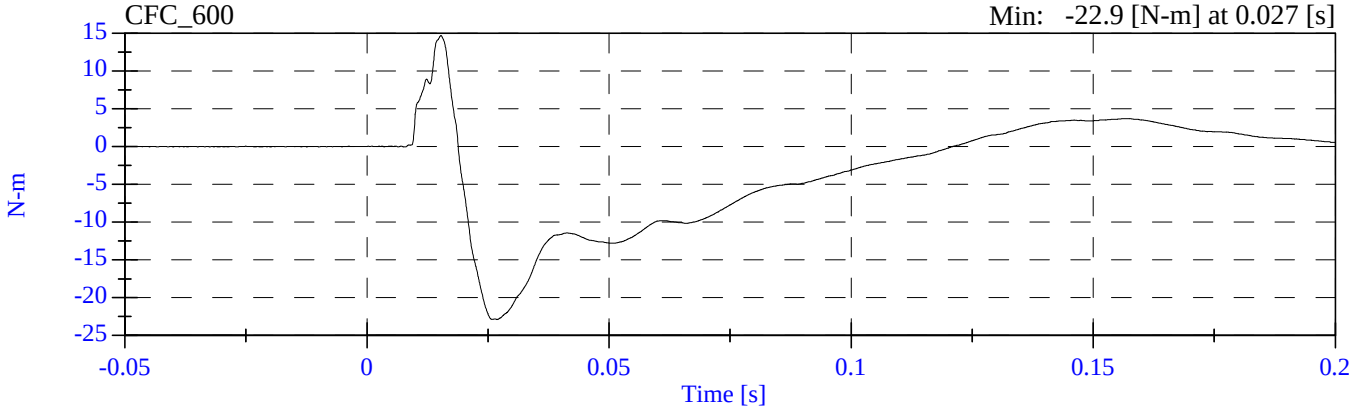


P2 Upper Neck F Resultant
CFC_1000
Max: 654.5 [N] at 0.017 [s]
Min: 0.0 [N] at -0.044 [s]

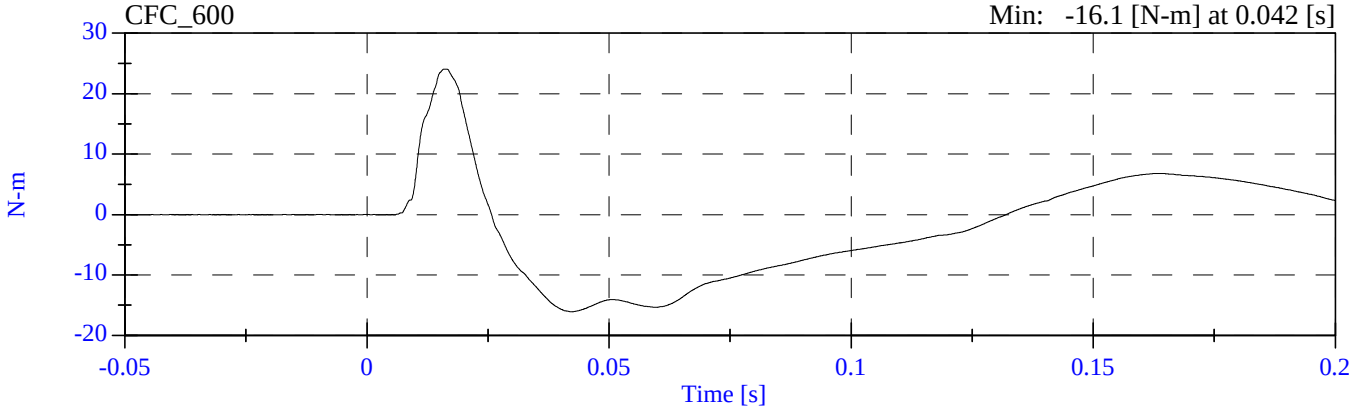


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

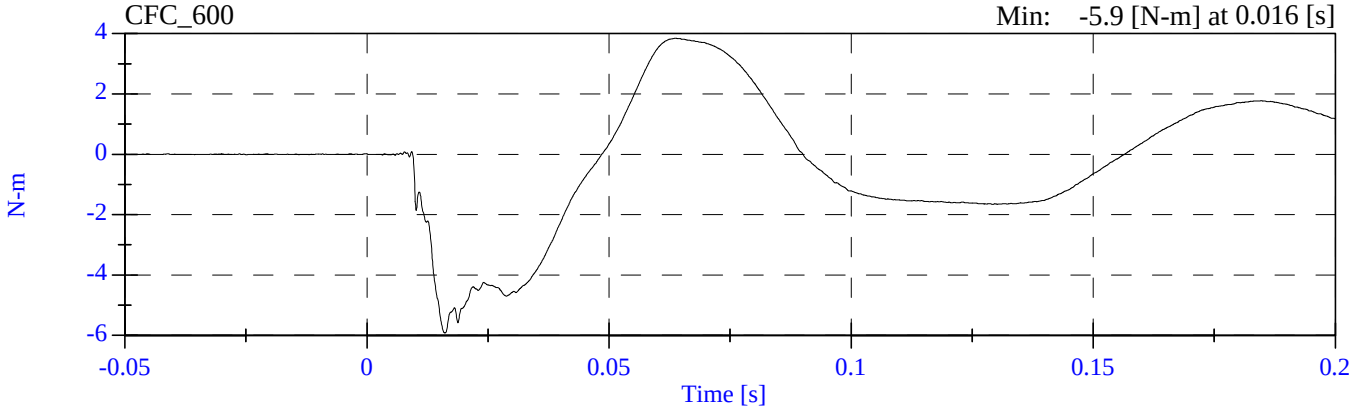
P2 Upper Neck Mx
CFC_600
Max: 14.7 [N-m] at 0.015 [s]
Min: -22.9 [N-m] at 0.027 [s]



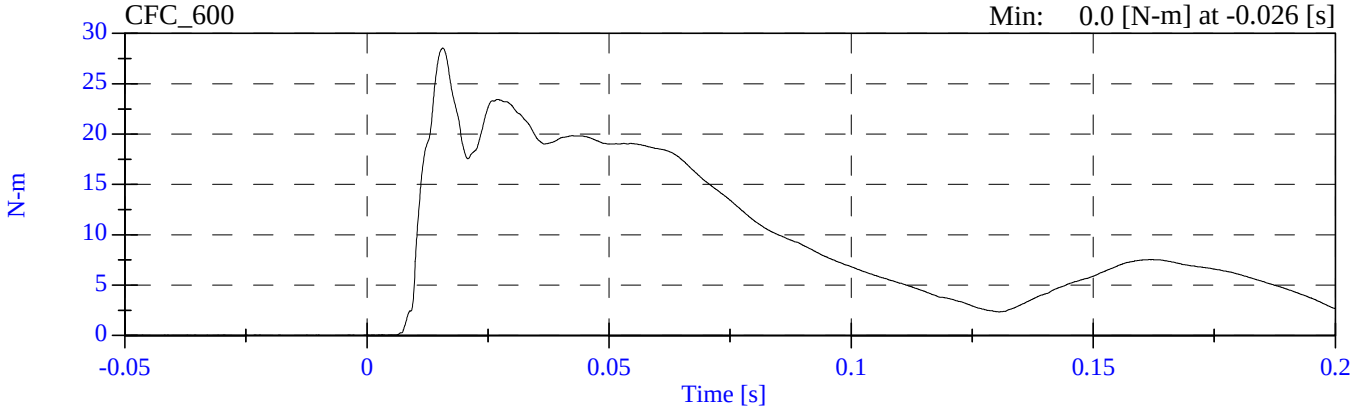
P2 Upper Neck My
CFC_600
Max: 24.1 [N-m] at 0.016 [s]
Min: -16.1 [N-m] at 0.042 [s]



P2 Upper Neck Mz
CFC_600
Max: 3.8 [N-m] at 0.064 [s]
Min: -5.9 [N-m] at 0.016 [s]

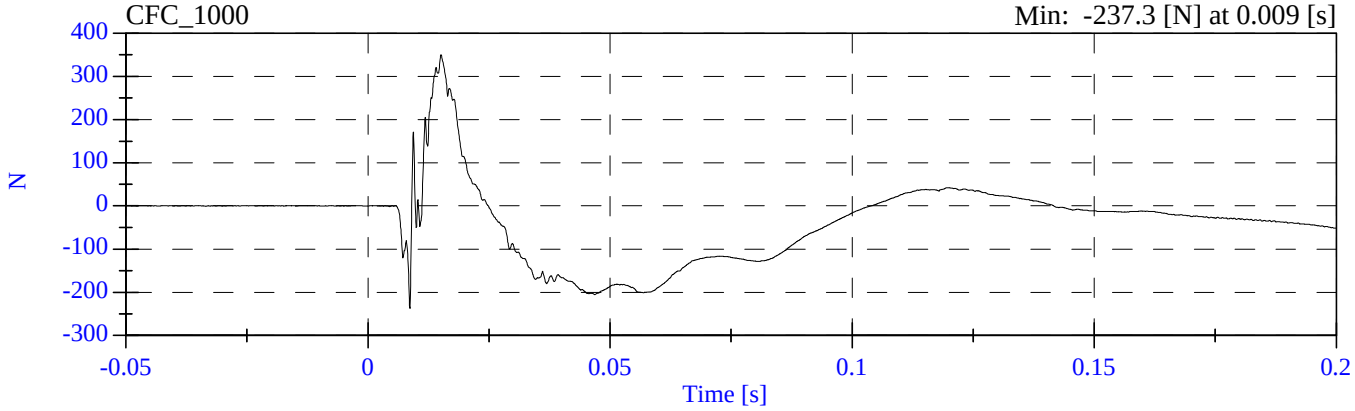


P2 Upper Neck M Resultant
CFC_600
Max: 28.6 [N-m] at 0.016 [s]
Min: 0.0 [N-m] at -0.026 [s]

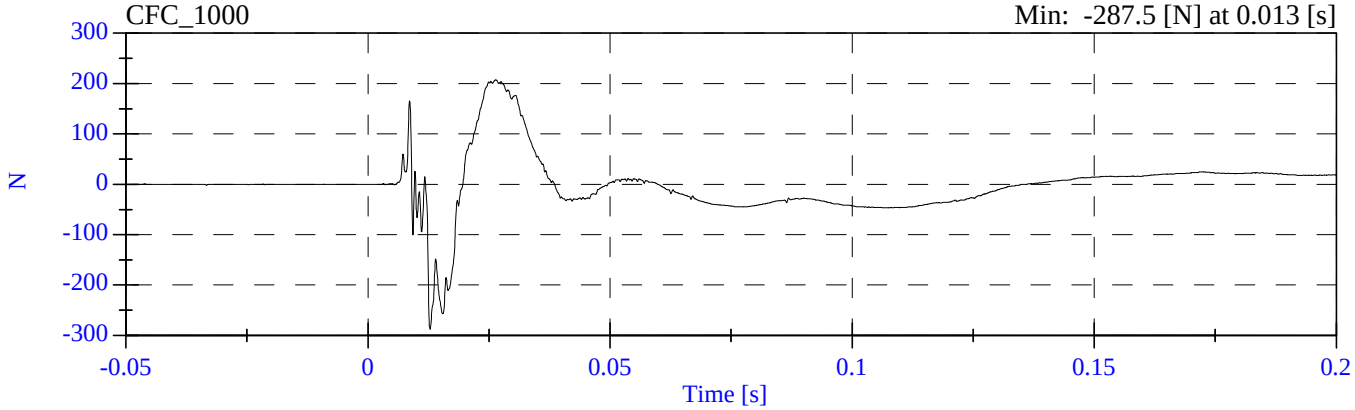


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

P2 Lower Neck Fx
CFC_1000
Max: 350.0 [N] at 0.015 [s]
Min: -237.3 [N] at 0.009 [s]



P2 Lower Neck Fy
CFC_1000
Max: 207.4 [N] at 0.026 [s]
Min: -287.5 [N] at 0.013 [s]



P2 Lower Neck Fz
CFC_1000
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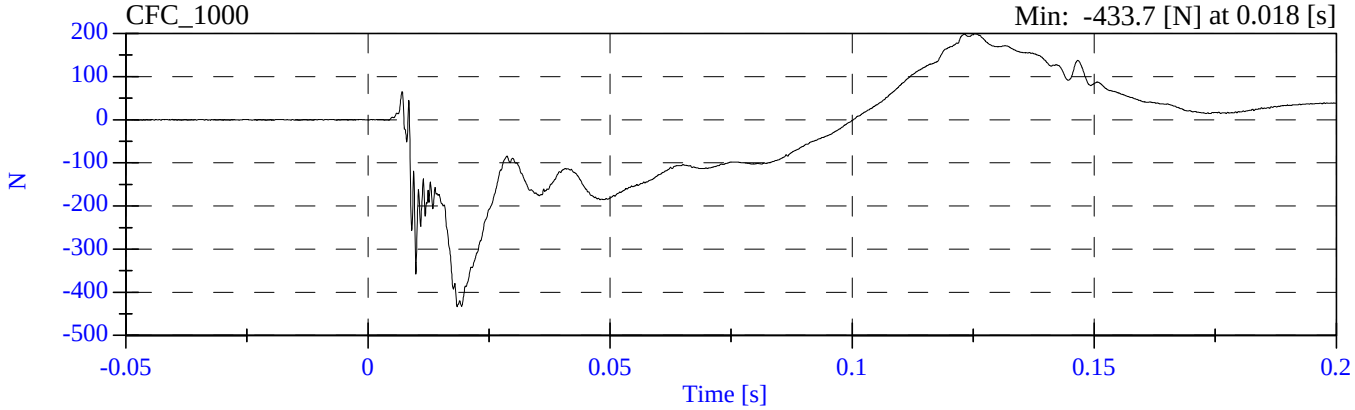
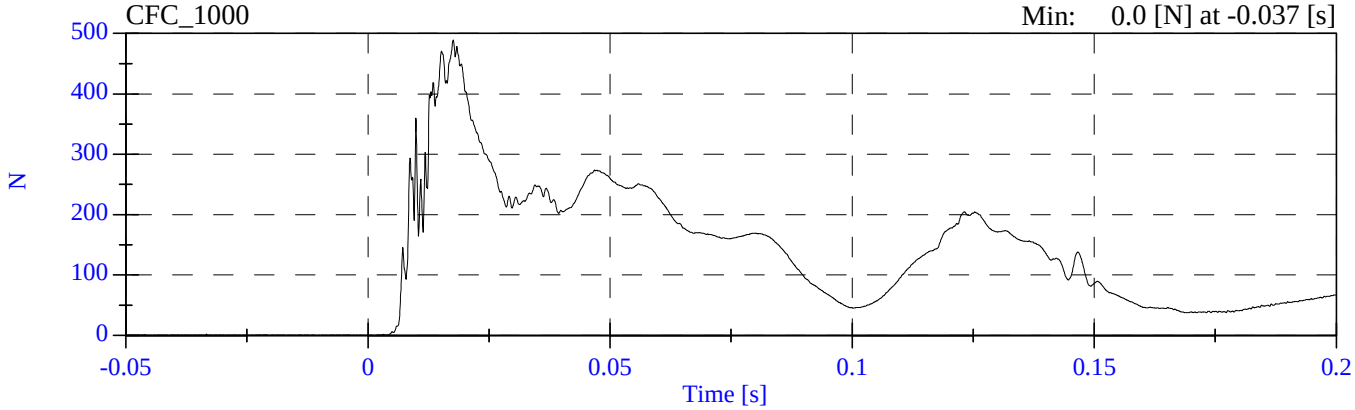
Min: -433.7 [N] at 0.018 [s]

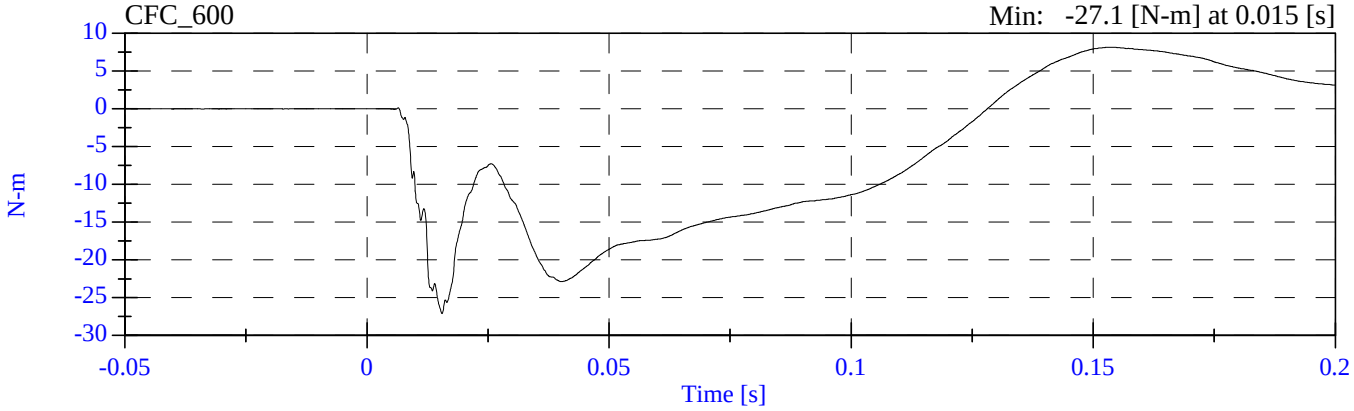


P2 Lower Neck F Resultant
CFC_1000
Max: 489.1 [N] at 0.018 [s]
Min: 0.0 [N] at -0.037 [s]

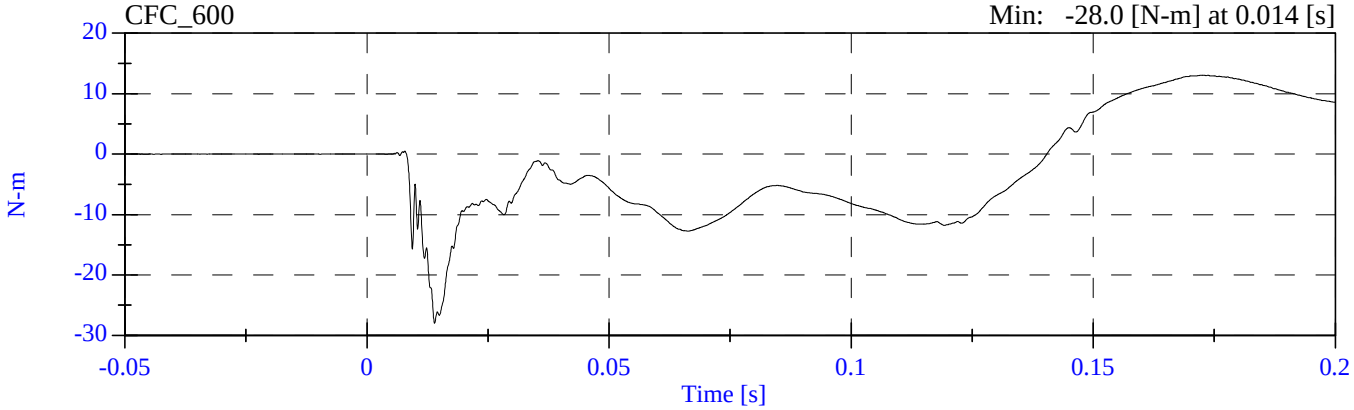


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

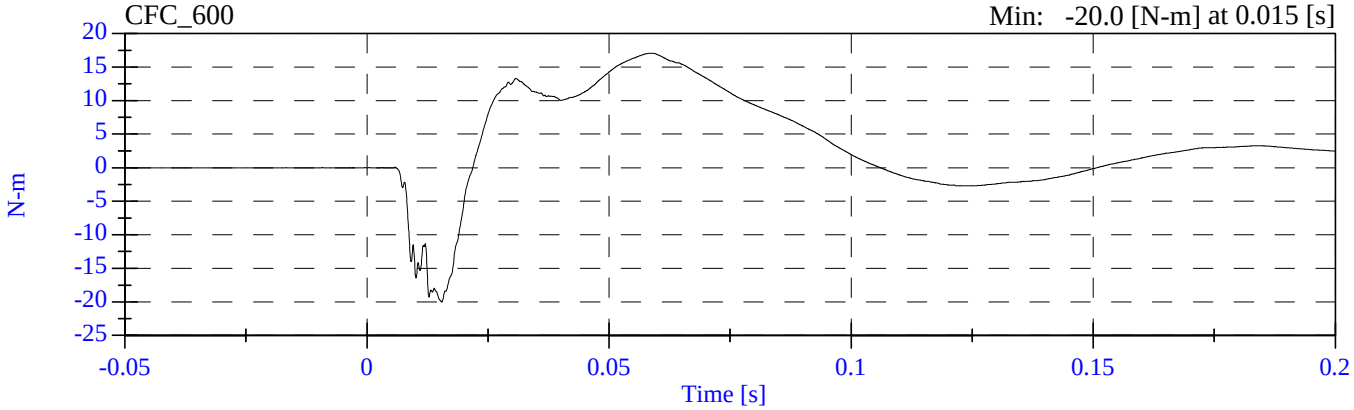
P2 Lower Neck Mx
CFC_600
Max: 8.1 [N-m] at 0.153 [s]
Min: -27.1 [N-m] at 0.015 [s]



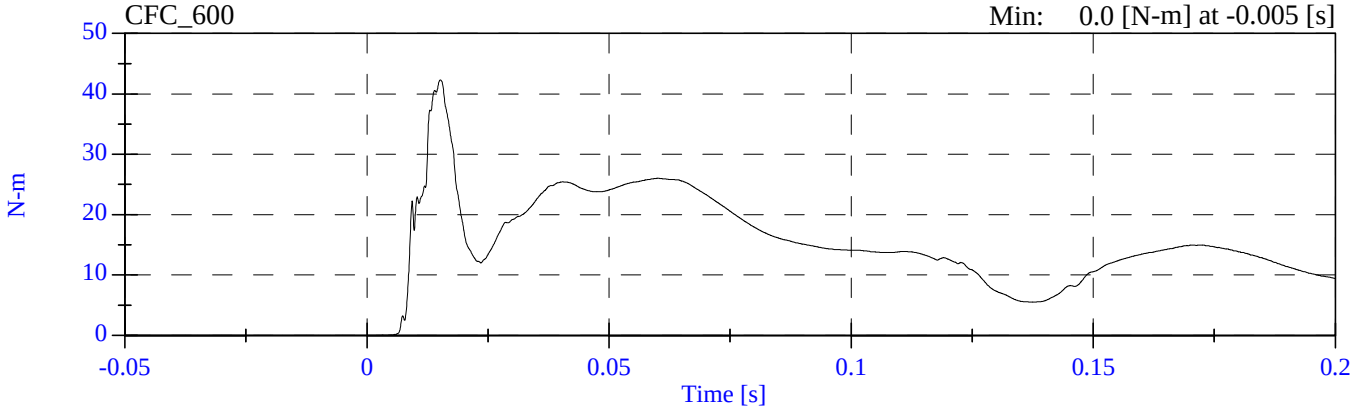
P2 Lower Neck My
CFC_600
Max: 13.1 [N-m] at 0.173 [s]
Min: -28.0 [N-m] at 0.014 [s]



P2 Lower Neck Mz
CFC_600
Max: 17.1 [N-m] at 0.059 [s]
Min: -20.0 [N-m] at 0.015 [s]

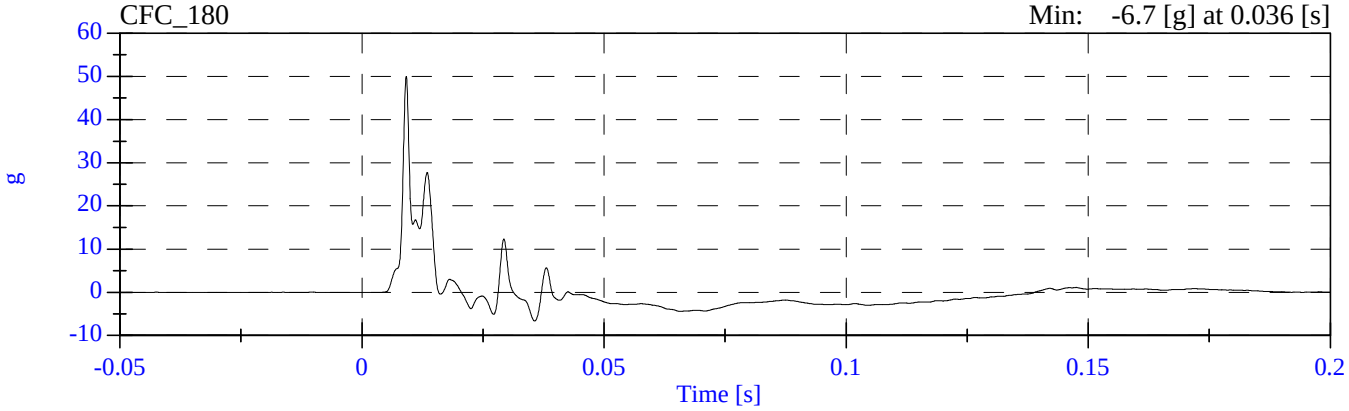


P2 Lower Neck M Resultant
CFC_600
Max: 42.3 [N-m] at 0.015 [s]
Min: 0.0 [N-m] at -0.005 [s]

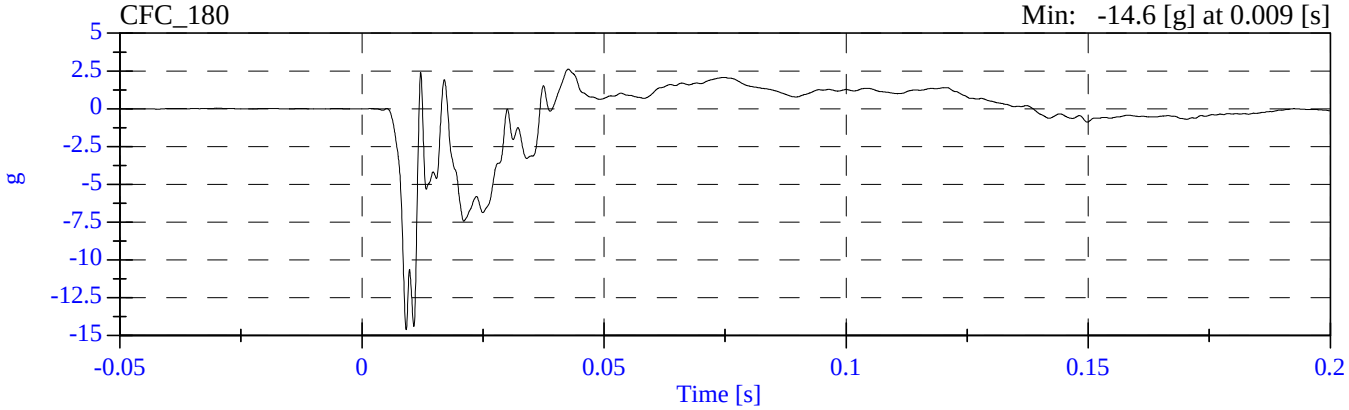


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

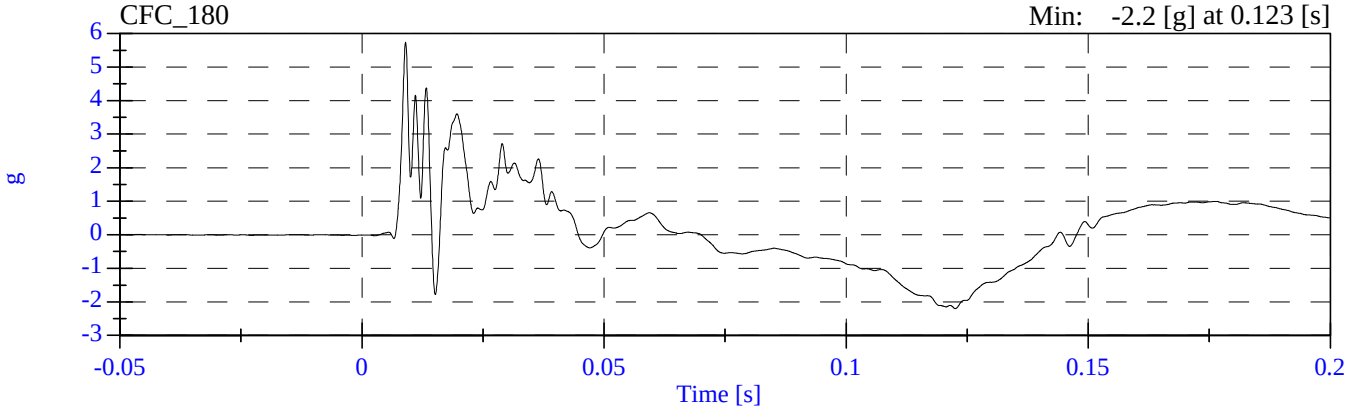
P2 Chest x
CFC_180
Max: 50.0 [g] at 0.009 [s]
Min: -6.7 [g] at 0.036 [s]



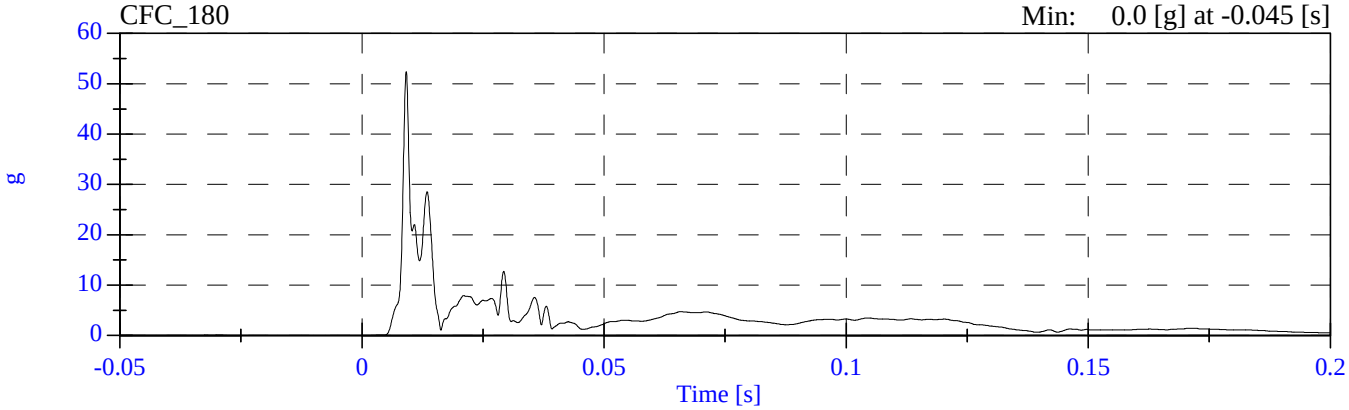
P2 Chest y
CFC_180
Max: 2.6 [g] at 0.043 [s]
Min: -14.6 [g] at 0.009 [s]



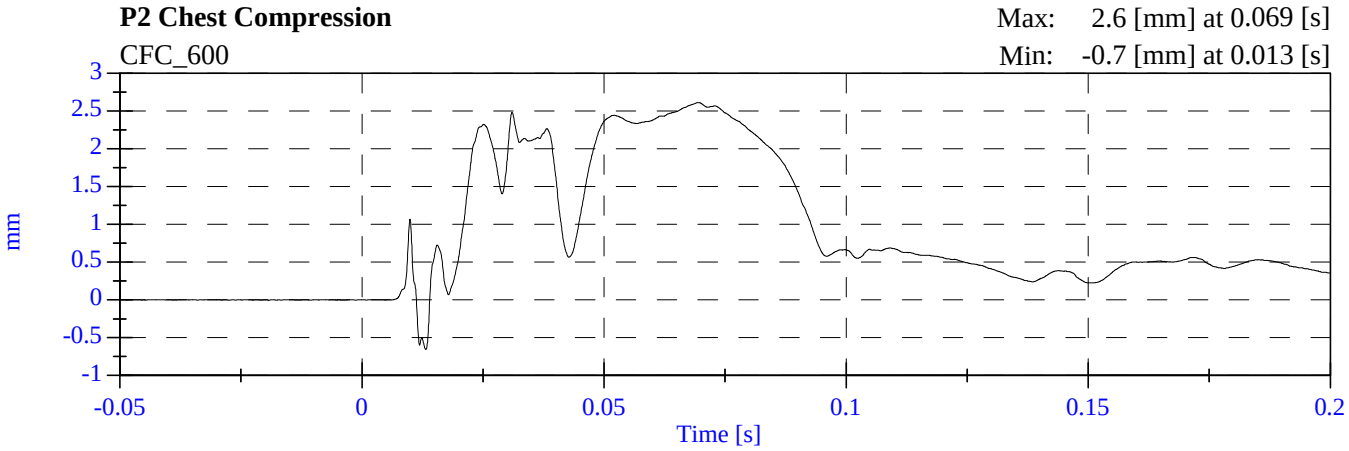
P2 Chest z
CFC_180
Max: 5.7 [g] at 0.009 [s]
Min: -2.2 [g] at 0.123 [s]



P2 Chest Resultant
CFC_180
Max: 52.4 [g] at 0.009 [s]
Min: 0.0 [g] at -0.045 [s]

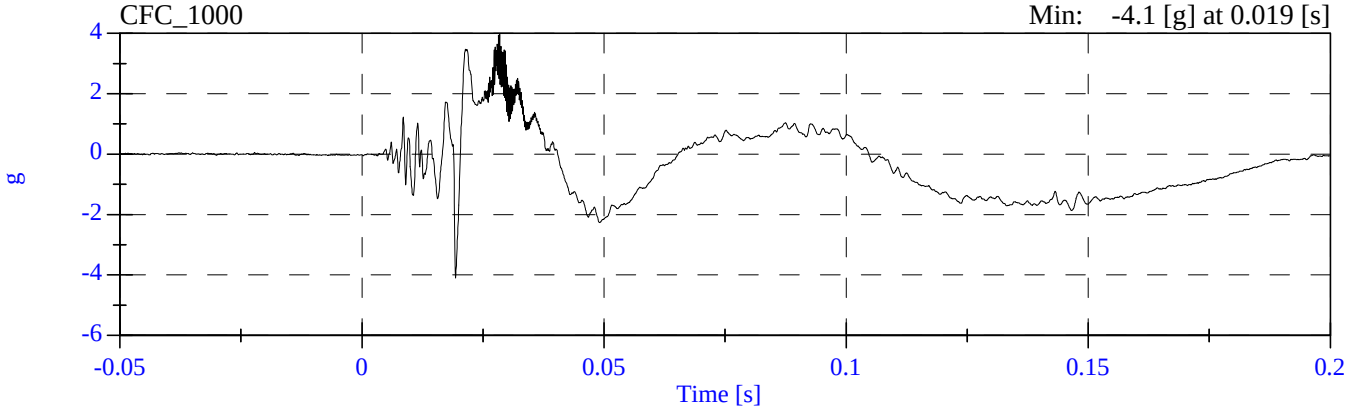


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

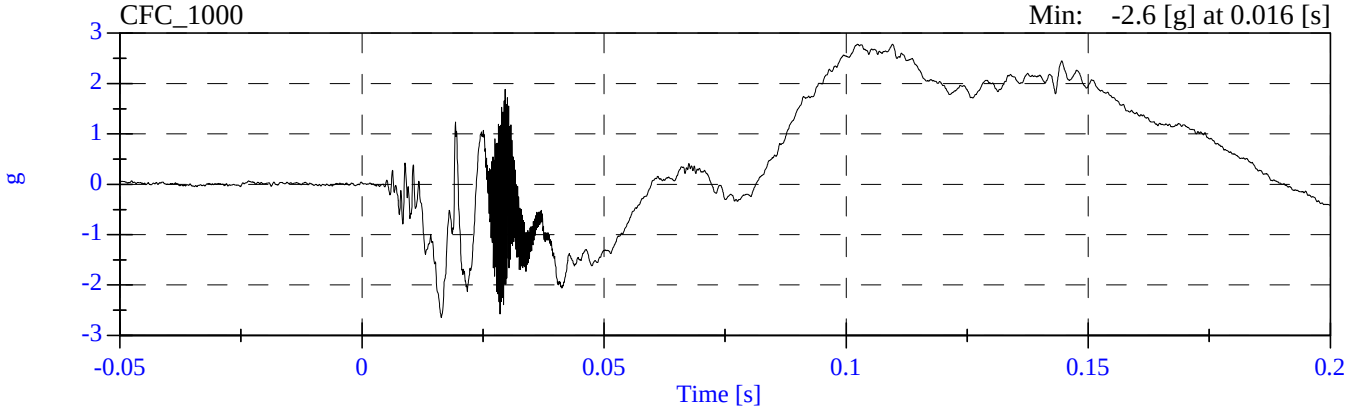


M50114TWG2 - 2005 Pontiac G6
M50114TWG2 - June 13, 2005

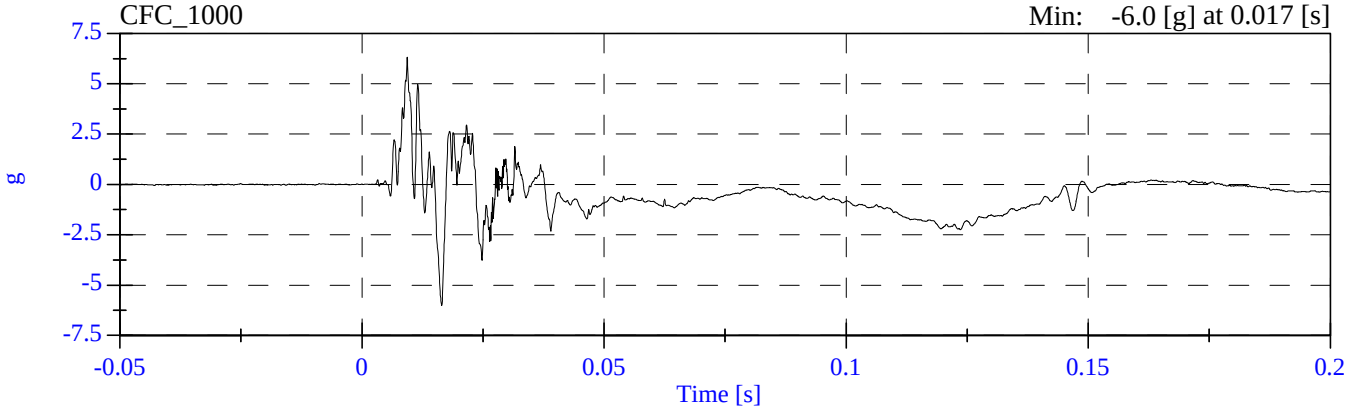
P2 Pelvic x
CFC_1000
Max: 4.0 [g] at 0.028 [s]
Min: -4.1 [g] at 0.019 [s]



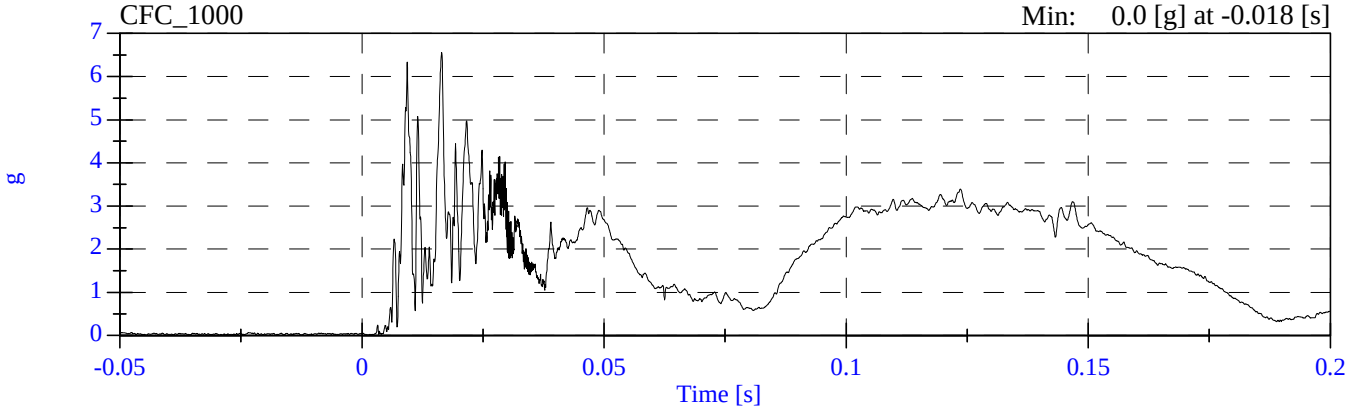
P2 Pelvic y
CFC_1000
Max: 2.8 [g] at 0.110 [s]
Min: -2.6 [g] at 0.016 [s]



P2 Pelvic z
CFC_1000
Max: 6.3 [g] at 0.009 [s]
Min: -6.0 [g] at 0.017 [s]



P2 Pelvic Resultant
CFC_1000
Max: 6.6 [g] at 0.016 [s]
Min: 0.0 [g] at -0.018 [s]



APPENDIX C

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

TEST EQUIPMENT LIST AND CALIBRATION INFORMATION

P572N INSTRUMENTATION

	POSITION #2 (RIGHT FRONT) SERIAL NO.: 186		
	SERIAL NUMBER	MANUFACTURER	CALIBRATION DATE
HEAD AX	AC-99H30-Z09	ENTRAN	02-Feb-05
HEAD AY	AC-J31026	ENDEVCO	18-Aug-04
HEAD AZ	AC-01J02-F08	ENTRAN	02-Feb-05
UPPER NECK FX	LC-1632Fx	DENTON	12-Aug-03
UPPER NECK FY	LC-1632Fy	DENTON	12-Aug-03
UPPER NECK FZ	LC-1632Fz	DENTON	12-Aug-03
UPPER NECK MX	LC-1632Mx	DENTON	12-Aug-03
UPPER NECK MY	LC-1632My	DENTON	12-Aug-03
UPPER NECK MZ	LC-1632Mz	DENTON	12-Aug-03
LOWER NECK FX	LC-138Fx	DENTON	16-Apr-03
LOWER NECK FY	LC-138Fy	DENTON	16-Apr-03
LOWER NECK FZ	LC-138Fz	DENTON	16-Apr-03
LOWER NECK MX	LC-138Mx	DENTON	16-Apr-03
LOWER NECK MY	LC-138My	DENTON	16-Apr-03
LOWER NECK MZ	LC-138Mz	DENTON	16-Apr-03
CHEST AX	AC-02I02I05-F10	ENTRAN	02-Feb-05
CHEST AY	AC-02I02I16-A04	ENTRAN	02-Feb-05
CHEST AZ	AC-03E03E20-N18	ENTRAN	02-Feb-05
CHEST DISPLACEMENT X	DS-186	SERVO	19-May-04
PELVIS AX	AC-02I02I05-F05	ENTRAN	02-Feb-05
PELVIS AY	AC-98H14-K13	ENTRAN	02-Feb-05
PELVIS AZ	AC-02I02I16-A10	ENTRAN	02-Feb-05