REPORT NUMBER: 8708-SLEDNCAP-05

CHILD RESTRAINT SYSTEM IN DYNAMIC SLED TEST COSCO SUMMIT, FORWARD FACING, UPRIGHT EVENFLO EXPRESS, FORWARD FACING, UPRIGHT

TEST NUMBER: 07-3-05

PREPARED BY:
VERIDIAN ENGINEERING
4455 GENESEE STREET
BUFFALO, NEW YORK 14225

JULY 31ST, 2003

DRAFT REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
400 SEVENTH STREET, SW, ROOM 5311
WASHINGTON, D.C. 20590

This final test report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, in response to Contract Number DTNH22-01-D-32005

Prepared by: _____ Date: _____
David P. Roberts, Project Engineer

Reviewed by: _____ Date: _____
David P. Roberts, Head of Occupant Protection and Safety Research

FINAL REPORT ACCEPTED BY:

_____
Manager, New Car Assessment Program

_____
Date of Acceptance

_____
COTR, NCAP Dynamic Sled Test Program

_____
Date of Acceptance

TECHNICAL REPORT STANDARD TITLE PAGE

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15. Supplementary Notes

Reviewed by: _____ Program Manager

Approved by: _____ Head, Occupant Protection & Safety Research Section, Transportation Sciences Center

16. Abstract

This report contains the results of tests performed in accordance with FMVSS 213 Final Rule Published July29th, 2003 for FMVSS 213 Child Restraint Systems.

Two (2) seats were tested during this run. Position 3 was a Cosco Summit Child Restraint System. Position 4 was an Evenflo Express Child Restraint System.

17. Key Words FMVSS 213 Child Restraint Systems Indicant Compliance Testing	18. Distribution Statement		
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages	22. Price

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SECTION 1

PURPOSE AND TEST PROCEDURE

1.1 PURPOSE

This dynamic sled testing is part of the FY' 03 New Car Assessment Program (NCAP) sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract Number DTNH22-01-D-32005. The purpose of this test is to obtain child seat research data for frontal dynamic testing.

1.2 TEST PROCEDURE

This frontal dynamic sled test was conducted in accordance with the child restraint test procedure provided by the FMVSS No. 213 Final Rule published June 24th, 2003. Any reference to FMVSS No. 213 in this document refers to the Final Rule published June 24th, 2003, for FMVSS No. 213 Child Restraint Systems.

The test was conducted at Veridian Engineering on July 31st, 2003 at a speed of 46.6 kph (29.0 mph). The FMVSS No. 213 sled pulse was used as a crash pulse. The requirements specified in the FMVSS No. 213 were also followed.

The bench seat contained two (2) anthropomorphic test devices (ATDs). One (1) Hybrid III 3 year old size ATD, Serial Number S/N 044, was instrumented with head, chest, and pelvic tri-axial accelerometers, and upper and lower neck load cells. This dummy was placed in a Cosco Summit child seat and the seat was located in Position 3 – Right Rear Passenger. One (1) Hybrid III 3 year old size ATD, Serial Number S/N 142, was instrumented with head, chest, and pelvic tri-axial accelerometers, and upper and lower neck load cells. This dummy was placed in an Evenflo Express child seat and the seat was located in Position 4 – Left Rear Passenger. The child ATDs were positioned according to the child seat manufacturer's instructions. The data was digitally sampled at 20,000 samples per second and processed per Section IP11 of the Laboratory Test Procedure.

Data for Position 4 – Lower Neck My was clipped. The chest clip for the Evenflo Express opened on the bottom but did not release (see photo 5).

SECTION 2

CHILD RESTRAINT INFORMATION

Test No.: 07-3-05 Test Date: July 31st, 2003

POSITION 3

Child Restraint Type (forward-facing, rearward facing, booster)	FORWARD FACING
LATCH or NON-LATCH	LATCH
Harness Type	5 POINT
Child Restraint Manufacturer	COSCO
Child Restraint Model	SUMMIT
Model Number	NA
Date of Manufacture	NA
Child Restraint Height Limits	OVER 1 YEAR OLD
Child Restraint Weight Limits (kg)	10-45 KGS
Weight of Child Restraint (kg)	7.3 KGS

POSITION 4

Child Restraint Type (forward-facing, rearward facing, booster)	FORWARD FACING
LATCH or NON-LATCH	LATCH
Harness Type	5 POINT
Child Restraint Manufacturer	EVENFLO
Child Restraint Model	EXPRESS
Model Number	3182198P1
Date of Manufacture	02/24/2003
Child Restraint Height Limits	AT LEAST 1 YEAR OLD
Child Restraint Weight Limits (kg)	9-36
Weight of Child Restraint (kg)	3.9

SECTION 3

POST-TEST OBSERVATIONS

Test No.: 07-3-05 Test Date: July 31st, 2003

POSITION 3

Child Seat	COSCO SUMMIT
Belt Fraying	NONE
Stress Marks	NONE
Cracks	NONE
Buckle Stress	NONE
Latch Hooks	NONE
Max. Head Excursion (mm)	572
Max. Knee Excursion (mm)	678
Velocity	46.6
Acceleration (G's)	23.3

POSITION 4

Child Seat	EVENFLO EXPRESS
Belt Fraying	NONE
Stress Marks	NONE
Cracks	NONE
Buckle Stress	CHEST CLIP OPENED
Latch Hooks	NONE
Max. Head Excursion (mm)	513
Max. Knee Excursion (mm)	671
Velocity	46.6
Acceleration (G's)	23.3

SECTION 4

POSITION 3 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA

Test No.: 07-3-05 Test Date: July 31st, 2003

HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Head CG	X	G's	56.3	191.3	-41.5	73.2
Head CG	Y	G's	5.0	193.5	-3.1	56.6
Head CG	Z	G's	33.4	64.4	-1.1	219.3
Head CG Resultant	N/A	G's	62.3	191.3		

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	G's	9.5	221.5	-35.4	68.7
Chest CG	Y	G's	2.4	216.3	-4.5	83.7
Chest CG	Z	G's	7.8	194.6	-30.0	68.0
Chest CG Resultant	N/A	G's	46.4	67.9		

SEAT BELT SENSOR PEAK VALUES

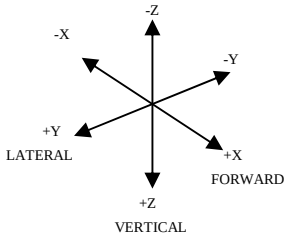
Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Tether Belt	N/A	Newtons	NA	NA		

HEAD INJURY CRITERIA (HIC)

Location	P3 (Right) Rear Passenger			
	HIC	Avg. G's	T^1	T^2
Head CG Primary (36 msec)	339.1	38.9	56.7	92.7
Head CG Primary (15 msec)	182.8	43.1	67.6	82.6

CHEST CLIP (3 MSEC)

Location	P3 (Right) Rear Passenger		
	Clip	T^1	T^2
Chest CG Primary	44.7	66.5	69.5



POSITION 3 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA…(continued)

Test No.: 07-3-05 Test Date: July 31st, 2003

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Pelvis	X	G's	18.1	96.4	-54.2	65.2
Pelvis	Y	G's	3.9	220.5	-9.3	63.4
Pelvis	Z	G's	24.1	31.2	-20.5	75.8

UPPER NECK PEAK FORCES AND MOMENTS

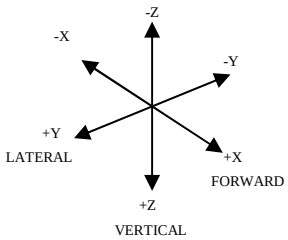
Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	11.4	239.9	-909.9	73.4
Neck Force	Y	Newtons	32.1	81.9	-77.9	101.5
Neck Force	Z	Newtons	1628.6	74.7	-187.2	220.0
Neck Moment	X	Nm	4.6	101.5	-4.0	63.4
Neck Moment	Y	Nm	4.2	134.2	-13.9	75.4
Neck Moment	Z	Nm	2.2	69.5	-2.1	195.8

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	133.9	187.8	-1415.2	75.0
Neck Force	Y	Newtons	361.0	74.6	-6.9	205.3
Neck Force	Z	Newtons	406.2	164.5	-140.7	48.7
Neck Moment	X	Nm	4.1	240.3	-10.9	57.7
Neck Moment	Y	Nm	132.6	73.8	-13.9	188.1
Neck Moment	Z	Nm	1.5	226.6	-8.5	68.7

CHEST PEAK DISPLACEMENTS

Location	Axis	Units	P3 (Right) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	mm	0.0	-19.6	-21.3	108.0



SECTION 4

POSITION 4 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA

Test No.: 07-3-05 Test Date: July 31st, 2003

HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Head CG	X	G's	32.1	175.5	-40.9	75.8
Head CG	Y	G's	2.9	71.6	-4.3	178.8
Head CG	Z	G's	49.1	66.3	-1.1	30.3
Head CG Resultant	N/A	G's	57.4	66.3		

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	G's	12.8	190.4	-36.6	56.0
Chest CG	Y	G's	7.1	71.1	-3.3	190.6
Chest CG	Z	G's	8.3	184.7	-28.3	57.0
Chest CG Resultant	N/A	G's	46.3	56.9		

SEAT BELT SENSOR PEAK VALUES

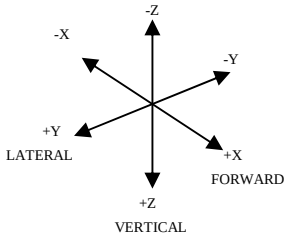
Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Tether Belt	N/A	Newtons	NA	NA		

HEAD INJURY CRITERIA (HIC)

Location	P4 (Left) Rear Passenger			
	HIC	Avg. G's	T^1	T^2
Head CG Primary (36 msec)	542.0	46.9	54.4	90.4
Head CG Primary (15 msec)	331.0	54.6	63.8	78.8

CHEST CLIP (3 MSEC)

Location	P4 (Left) Rear Passenger		
	Clip	T^1	T^2
Chest CG Primary	46.0	52.7	58.0



POSITION 4 - HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA…(continued)

Test No.: 07-3-05 Test Date: July 31st, 2003

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Pelvis	X	G's	12.2	109.0	-48.1	59.1
Pelvis	Y	G's	2.6	95.4	-4.5	210.3
Pelvis	Z	G's	10.1	183.6	-38.1	58.5

UPPER NECK PEAK FORCES AND MOMENTS

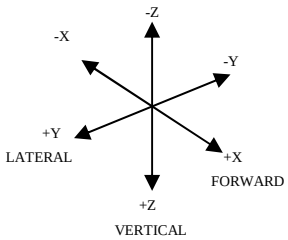
Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	74.5	169.9	-978.3	76.6
Neck Force	Y	Newtons	76.4	71.7	-39.6	175.8
Neck Force	Z	Newtons	1909.6	74.1	-38.0	30.6
Neck Moment	X	Nm	4.2	178.4	-0.7	157.5
Neck Moment	Y	Nm	2.9	69.1	-14.2	53.2
Neck Moment	Z	Nm	2.9	186.8	-1.2	247.9

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	221.9	175.8	-1139.8	75.7
Neck Force	Y	Newtons	125.3	69.7	-55.9	176.6
Neck Force	Z	Newtons	798.2	68.6	-31.6	29.6
Neck Moment	X	Nm	11.5	32.3	-9.4	31.4
Neck Moment	Y	Nm	NA	NA	-14.7	173.1
Neck Moment	Z	Nm	7.0	70.1	-2.7	20.5

CHEST PEAK DISPLACEMENTS

Location	Axis	Units	P4 (Left) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	mm	0.0	14.8	-18.7	78.7



SECTION 5

SLED TEST SET-UP

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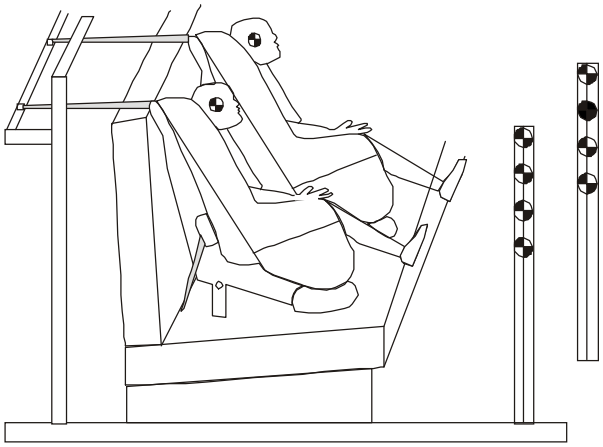
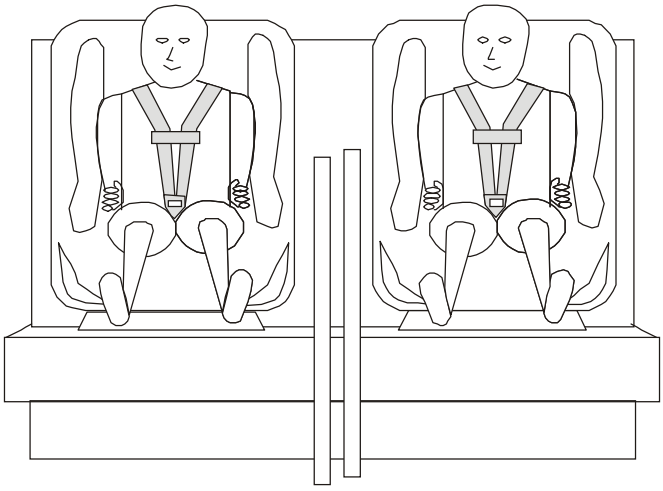
An FMVSS 213 test bench was fastened on the sled in order to simulate a frontal impact. Two child seats were placed on the bench and fastened in a manner suggested in the owner's manual of the child seat. Stadia poles were set up to measure dummy head and knee excursions.

Pre-test Infant and Car Seat Positions



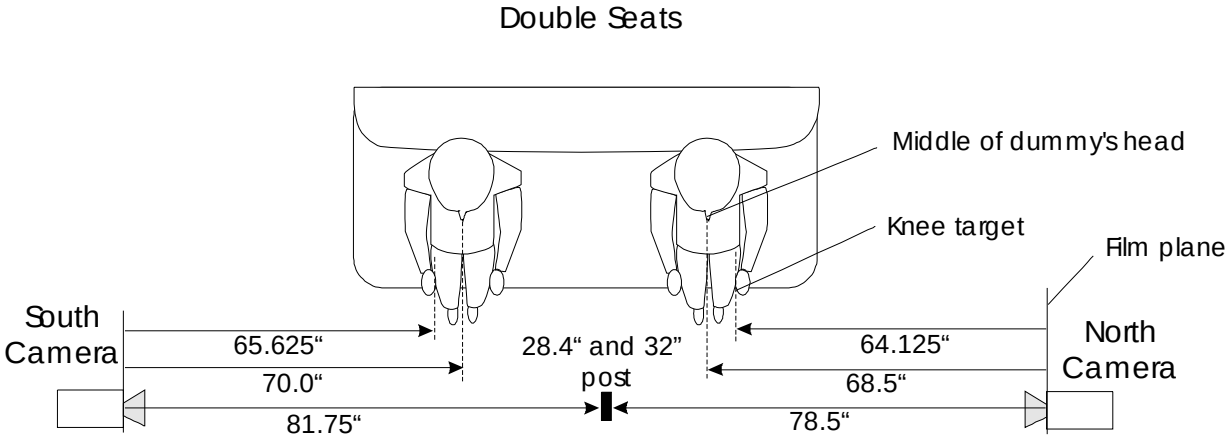


SECTION 6

CAMERA LOCATION

Test No.: 07-3-05 Test Date: July 31st, 2003

There were two cameras mounted onto the sled carriage for views of the left and right side of the child seat.



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PHOTOGRAPHS

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Pre Test Right Side View

Post Test Right Side View

Pre Test Right Front View

Post Test Right Front View

Pre Test Left Front View

Post Test Left Front View

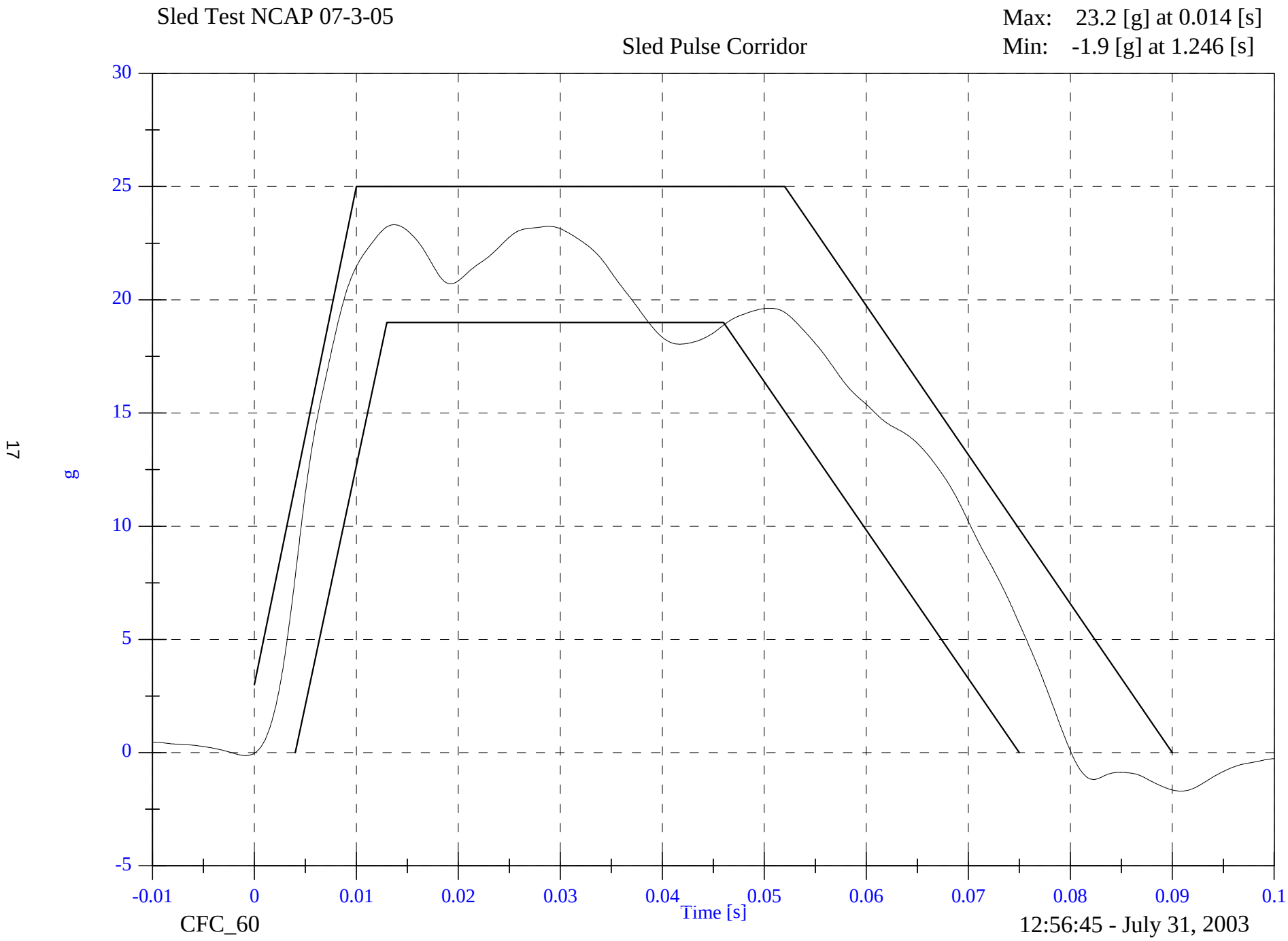
Pre Test Left Side View

Post Test Left Side View

Post Test - P4 Chest Clip

SECTION 8

Data Plots


Sled Test NCAP 07-3-05
Sled Pulse Corridor
Max: 23.2 [g] at 0.014 [s]
Min: -1.9 [g] at 1.246 [s]
30
25
20
15
10
5
0
-5
g
-0.01
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
Time [s]
CFC_60
12:56:45 - July 31, 2003

FACILITY: HYGE SLED DATE: July 31, 2003
TEST#: 07-3-05
TITLE: Sled Test NCAP 07-3-05

CHN	NAME	Unit	Max	msec	Min	msec	Filt	Comment
49	Sled Acceleration	g	23.3	13.7	-1.7	90.8	CFC_60	
50	Sled Acceleration Velocity	kph	46.6	80.0	-0.0	-13.5	CFC_180	
51	Sled Acceleration Displacement	mm	2691.6	250.0	-0.2	-11.1	CFC_180	
52	P3 Head x	g	56.3	191.3	-41.5	73.2	CFC_1000	
53	P3 Head y	g	5.0	193.5	-3.1	56.6	CFC_1000	
54	P3 Head z	g	33.4	64.4	-1.1	219.3	CFC_1000	
55	P3 Head Resultant	g	62.3	191.3	0.0	-12.5	CFC_1000	
56	P3 Upper Neck Fx	N	11.4	239.9	-909.9	73.4	CFC_1000	
57	P3 Upper Neck Fy	N	32.1	81.9	-77.9	101.5	CFC_1000	
58	P3 Upper Neck Fz	N	1628.6	74.7	-187.2	220.0	CFC_1000	
59	P3 Upper Neck F Resultant	N	1860.6	74.4	0.1	-15.1	CFC_1000	
60	P3 Upper Neck Mx	N-m	4.6	101.5	-4.0	63.4	CFC_600	
61	P3 Upper Neck My	N-m	4.2	134.2	-13.9	75.4	CFC_600	
62	P3 Upper Neck Mz	N-m	2.2	69.5	-2.1	195.8	CFC_600	
63	P3 Upper Neck M Resultant	N-m	14.0	75.3	0.0	-15.0	CFC_600	
64	P3 Lower Neck Fx	N	133.9	187.8	-1415.2	75.0	CFC_1000	
65	P3 Lower Neck Fy	N	361.0	74.6	-6.9	205.3	CFC_1000	
66	P3 Lower Neck Fz	N	406.2	164.5	-140.7	48.7	CFC_1000	
67	P3 Lower Neck F Resultant	N	1460.6	75.0	0.1	-15.4	CFC_1000	
68	P3 Lower Neck Mx	N-m	4.1	240.3	-10.9	57.7	CFC_600	
69	P3 Lower Neck My	N-m	132.6	73.8	-13.9	188.1	CFC_600	
70	P3 Lower Neck Mz	N-m	1.5	226.6	-8.5	68.7	CFC_600	
71	P3 Lower Neck M Resultant	N-m	132.8	73.7	0.0	-19.8	CFC_600	
72	P3 Chest x	g	9.5	221.5	-35.4	68.7	CFC_180	
73	P3 Chest y	g	2.4	216.3	-4.5	83.7	CFC_180	
74	P3 Chest z	g	7.8	194.6	-30.0	68.0	CFC_180	
75	P3 Chest Resultant	g	46.4	67.9	0.0	-19.8	CFC_180	
76	P3 Pelvic x	g	18.1	96.4	-54.2	65.2	CFC_1000	
77	P3 Pelvic y	g	3.9	220.5	-9.3	63.4	CFC_1000	
78	P3 Pelvic z	g	24.1	31.2	-20.5	75.8	CFC_1000	
79	P3 Pelvic Resultant	g	54.9	65.2	0.0	-17.5	CFC_1000	
80	P3 Head Red z	g	43.9	75.3	-20.9	190.6	CFC_1000	
81	P3 Chest Compression	mm	0.0	-19.6	-21.3	108.0	CFC_600	
82	P3 Upper Neck Mocy	N-m	4.2	134.2	-13.9	75.4	CFC_600	

FACILITY: HYGE SLED DATE: July 31, 2003
TEST#: 07-3-05
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CHN	NAME	Unit	Max	msec	Min	msec	Filt	Comment
83	P4 Head x	g	32.1	175.5	-40.9	75.8	CFC_1000	
84	P4 Head y	g	2.9	71.6	-4.3	178.8	CFC_1000	
85	P4 Head z	g	49.1	66.3	-1.1	30.3	CFC_1000	
86	P4 Head Resultant	g	57.4	66.3	0.0	-9.6	CFC_1000	
87	P4 Upper Neck Fx	N	74.5	169.9	-978.3	76.6	CFC_1000	4000
88	P4 Upper Neck Fy	N	76.4	71.7	-39.6	175.8	CFC_1000	4000
89	P4 Upper Neck Fz	N	1909.6	74.1	-38.0	30.6	CFC_1000	4000
90	P4 Upper Neck F Resultant	N	2121.2	74.6	0.0	-8.6	CFC_1000	4000
91	P4 Upper Neck Mx	N-m	4.2	178.4	-0.7	157.5	CFC_600	4000
92	P4 Upper Neck My	N-m	2.9	69.1	-14.2	53.2	CFC_600	4000
93	P4 Upper Neck Mz	N-m	2.9	186.8	-1.2	247.9	CFC_600	4000
94	P4 Upper Neck M Resultant	N-m	14.4	53.1	0.0	-14.9	CFC_600	4000
95	P4 Lower Neck Fx	N	221.9	175.8	-1139.8	75.7	CFC_1000	4000
96	P4 Lower Neck Fy	N	125.3	69.7	-55.9	176.6	CFC_1000	4000
97	P4 Lower Neck Fz	N	798.2	68.6	-31.6	29.6	CFC_1000	4000
98	P4 Lower Neck F Resultant	N	1254.8	74.0	0.0	-66.3	CFC_1000	4000
99	P4 Lower Neck Mx	N-m	11.5	32.3	-9.4	31.4	CFC_600	4000
100	P4 Lower Neck My	N-m	22.7	44.5	-14.7	173.1	CFC_600	4000
101	P4 Lower Neck Mz	N-m	7.0	70.1	-2.7	20.5	CFC_600	4000
102	P4 Lower Neck M Resultant	N-m	25.0	72.2	0.0	-15.0	CFC_600	4000
103	P4 Chest x	g	12.8	190.4	-36.6	56.0	CFC_180	
104	P4 Chest y	g	7.1	71.1	-3.3	190.6	CFC_180	
105	P4 Chest z	g	8.3	184.7	-28.3	57.0	CFC_180	
106	P4 Chest Resultant	g	46.3	56.9	0.0	-20.0	CFC_180	
107	P4 Pelvic x	g	12.2	109.0	-48.1	59.1	CFC_1000	4000
108	P4 Pelvic y	g	2.6	95.4	-4.5	210.3	CFC_1000	4000
109	P4 Pelvic z	g	10.1	183.6	-38.1	58.5	CFC_1000	4000
110	P4 Pelvic Resultant	g	61.3	59.1	0.0	-69.0	CFC_1000	4000
111	P4 Chest Compression	mm	0.0	14.8	-18.7	78.7	CFC_600	
112	P4 Head Red z	g	74.0	71.9	-12.1	48.2	CFC_1000	
113	P4 Upper Neck Mocy	N-m	2.9	69.1	-14.2	53.2	CFC_600	4000

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FACILITY: HYGE SLED                          DATE: July 31, 2003
TEST#: 07-3-05
TITLE: Sled Test NCAP 07-3-05
Version 5.00
=========================
P3 HIC(36 ms): 339.1
    t1: 56.7 msec
    t2: 92.7 msec
    Duration: 36.0 msec
    Average Acceleration: 38.9 g
    Input channels: P3 Head x (2) CFC_1000
                    P3 Head y (3) CFC_1000
                    P3 Head z (4) CFC_1000

P3 UP NECK Fx:  Max:     23.0 N1325.4 msec
                Min:   -909.9 N  73.4 msec
    Input channel: P3 Upper Neck Fx (6) CFC_1000

P3 UP NECK Fz:  Max:   1628.6 N  74.7 msec
                Min:   -187.2 N 220.0 msec
    Input channel: P3 Upper Neck Fz (8) CFC_1000

P3 UP NECK Mocy (3YO Child OOP)
                Max:      4.2 N-m 134.2 msec
                Min:    -13.9 N-m  75.4 msec
    Input channels: P3 Upper Neck Fx (6) CFC_600
                    P3 Upper Neck My (10) CFC_600
              Docy: 0

P3 UP NECK Nij (3YO Child OOP)
                Ntf:  0.16 Nij 133.4 msec    CVt: 2120 CVf: 68
                Nte:  1.28 Nij  75.4 msec    CVt: 2120 CVe: 27
                Ncf:  0.06 Nij 361.1 msec    CVc: 2120 CVf: 68
                Nce:  0.50 Nij 210.1 msec    CVc: 2120 CVe: 27
    Input channels: P3 Upper Neck Fz (8) CFC_600
                    P3 Upper Neck Mocy [N-m, CFC_600] (101)
```

```
FACILITY: HYGE SLED                          DATE: July 31, 2003
TEST#: 07-3-05
TITLE: Sled Test NCAP 07-3-05
Version 5.00
=========================
P3 CLIP(3 ms): 44.7 g
    t1: 66.5 msec
    t2: 69.5 msec
    Duration: 3.0 msec
P3 CSI: 296.3
    Input channels: P3 Chest x (18) CFC_180
                    P3 Chest y (19) CFC_180
                    P3 Chest z (20) CFC_180

P3 CHEST DISP:  Max:      0.1 mm 329.5 msec
                Min:    -21.3 mm 108.0 msec
    Input channel: P3 Chest Compression (21) CFC_600

=========================
P3 HIC(15 ms): 182.8
    t1: 67.6 msec
    t2: 82.6 msec
    Duration: 15.0 msec
    Average Acceleration: 43.1 g
    Input channels: P3 Head x (2) CFC_1000
                    P3 Head y (3) CFC_1000
                    P3 Head z (4) CFC_1000

=========================
```

```
FACILITY: HYGE SLED                          DATE: July 31, 2003
TEST#: 07-3-05
TITLE: Sled Test NCAP 07-3-05
Version 5.00
=========================
P4 HIC(36 ms): 542.0
    t1: 54.4 msec
    t2: 90.4 msec
    Duration: 36.0 msec
    Average Acceleration: 46.9 g
    Input channels: P4 Head x (25) CFC_1000
                    P4 Head y (26) CFC_1000
                    P4 Head z (27) CFC_1000

P4 UP NECK Fx:  Max:     74.5 N 169.9 msec
                Min:   -978.3 N  76.6 msec
    Input channel: P4 Upper Neck Fx (29) CFC_1000

P4 UP NECK Fz:  Max:   1909.6 N  74.1 msec
                Min:    -48.1 N 299.0 msec
    Input channel: P4 Upper Neck Fz (31) CFC_1000

P4 UP NECK Mocy (3YO Child OOP)
                Max:      4.3 N-m 330.3 msec
                Min:    -14.2 N-m  53.2 msec
    Input channels: P4 Upper Neck Fx (29) CFC_600
                    P4 Upper Neck My (33) CFC_600
              Docy: 0

P4 UP NECK Nij (3YO Child OOP)
                Ntf:  0.89 Nij  73.6 msec    CVt: 2120 CVf: 68
                Nte:  1.02 Nij  77.8 msec    CVt: 2120 CVe: 27
                Ncf:  0.08 Nij 325.9 msec    CVc: 2120 CVf: 68
                Nce:  0.07 Nij  35.2 msec    CVc: 2120 CVe: 27
    Input channels: P4 Upper Neck Fz (31) CFC_600
                    P4 Upper Neck Mocy [N-m, CFC_600] (107)
```

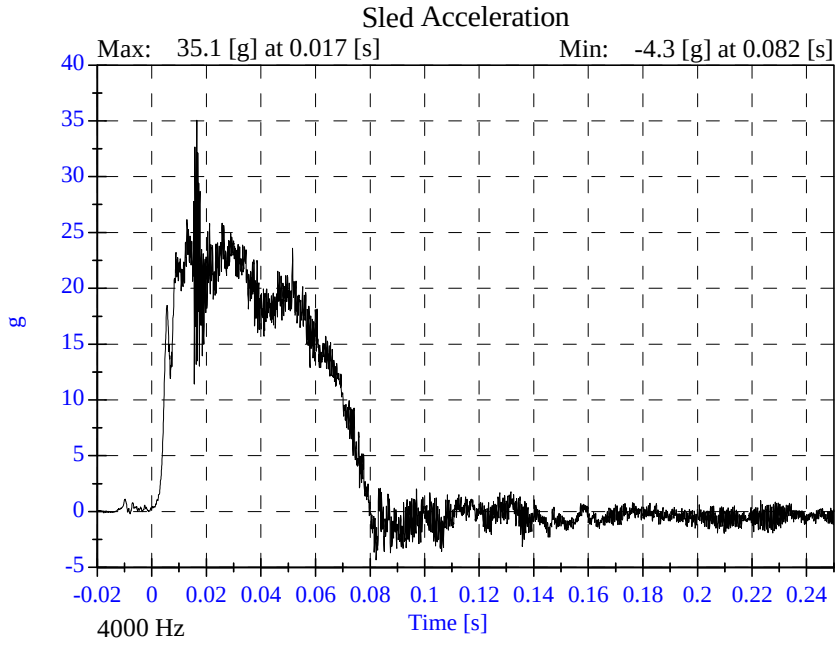
```
FACILITY: HYGE SLED                          DATE: July 31, 2003
TEST#: 07-3-05
TITLE: Sled Test NCAP 07-3-05
Version 5.00
=========================
P4 CLIP(3 ms): 46.0 g
    t1: 52.7 msec
    t2: 58.0 msec
    Duration: 5.3 msec
P4 CSI: 365.6
    Input channels: P4 Chest x (41) CFC_180
                    P4 Chest y (42) CFC_180
                    P4 Chest z (43) CFC_180

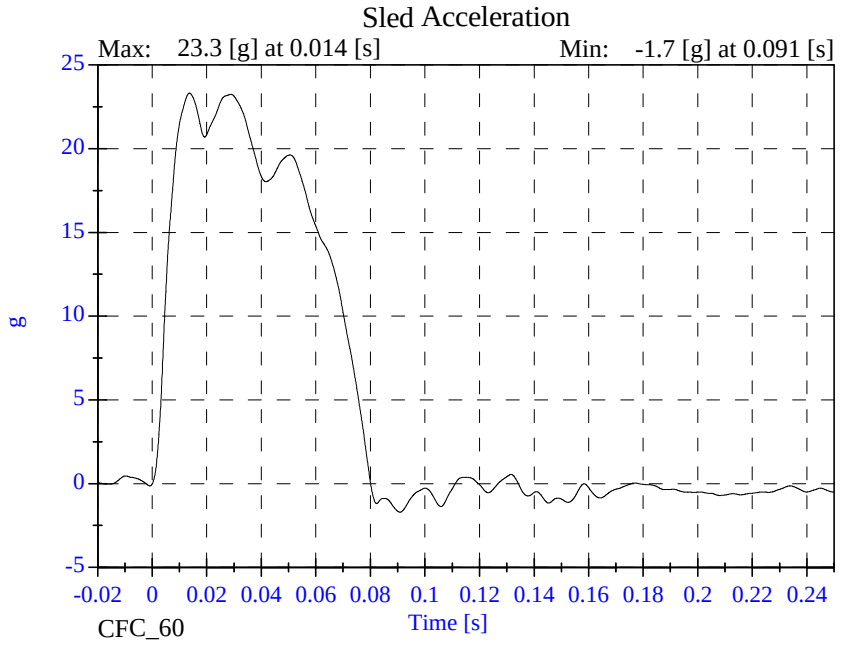
P4 CHEST DISP:  Max:      0.2 mm 851.2 msec
                Min:    -18.7 mm  78.7 msec
    Input channel: P4 Chest Compression (44) CFC_600

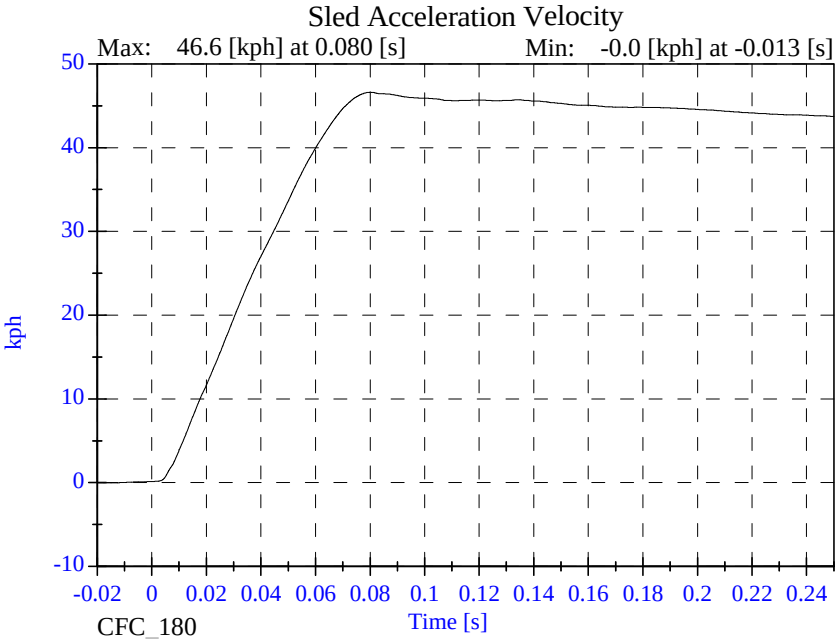
=========================
P4 HIC(15 ms): 331.0
    t1: 63.8 msec
    t2: 78.8 msec
    Duration: 15.0 msec
    Average Acceleration: 54.6 g
    Input channels: P4 Head x (25) CFC_1000
                    P4 Head y (26) CFC_1000
                    P4 Head z (27) CFC_1000

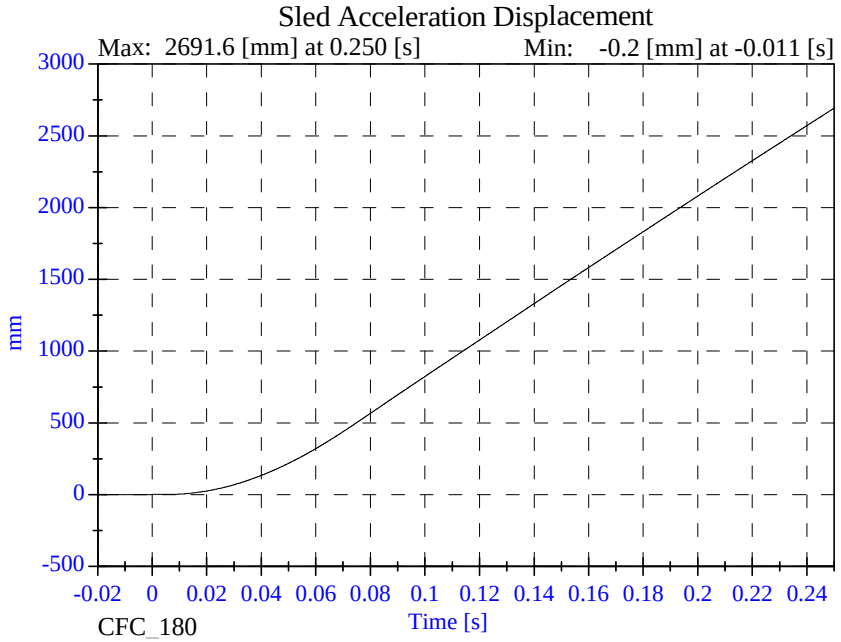
=========================
```

Sled Test NCAP 07-3-05 - July 31, 2003



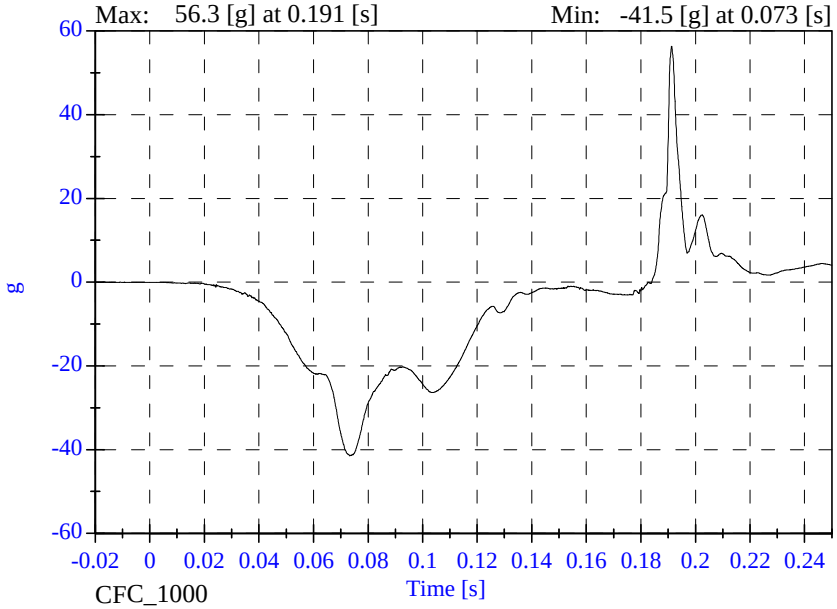




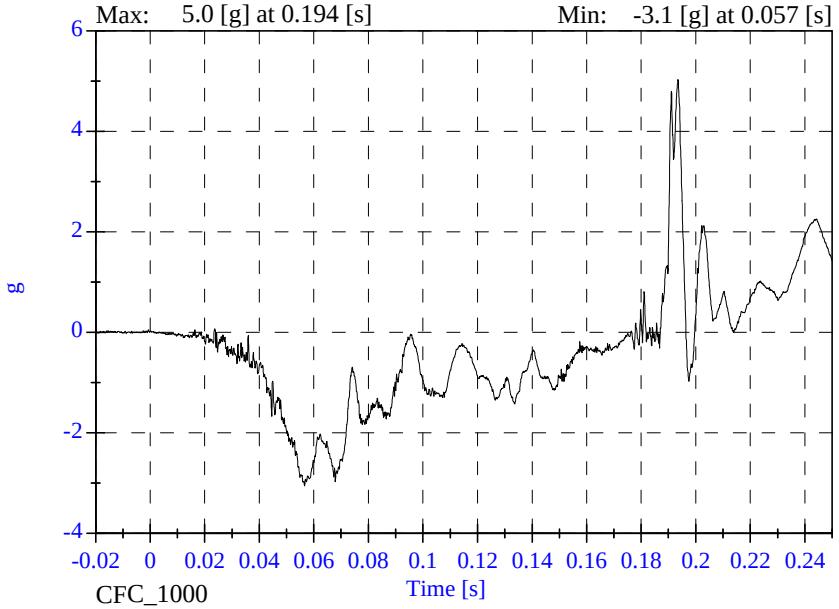


Sled Test NCAP 07-3-05 - July 31, 2003

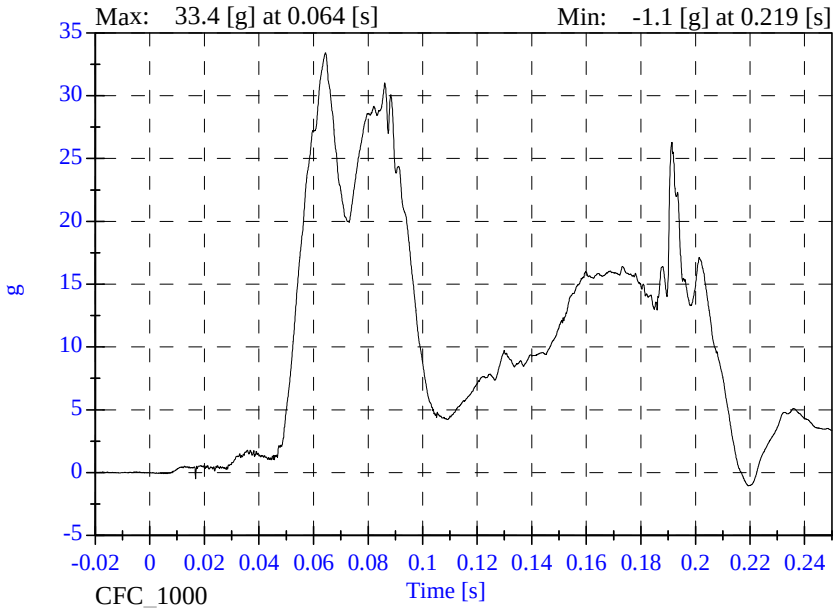
P3 Head x



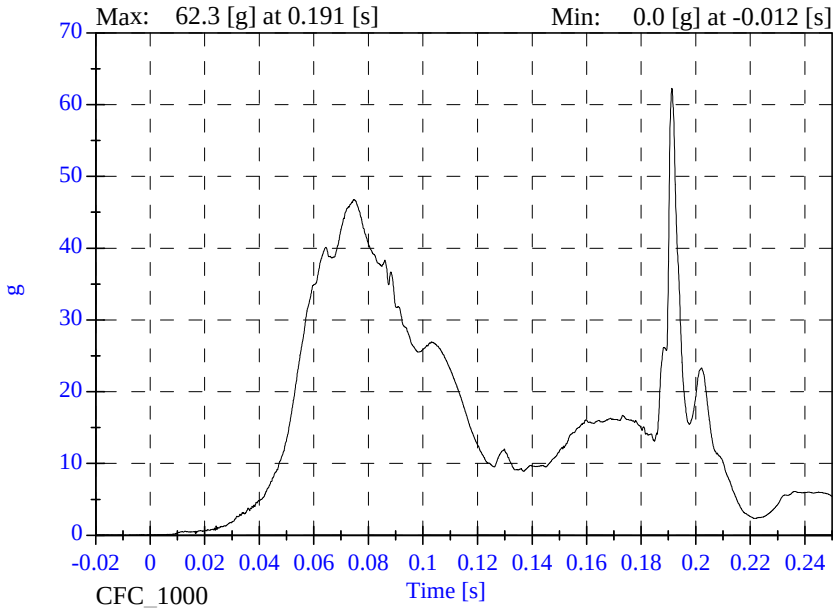
P3 Head y



P3 Head z

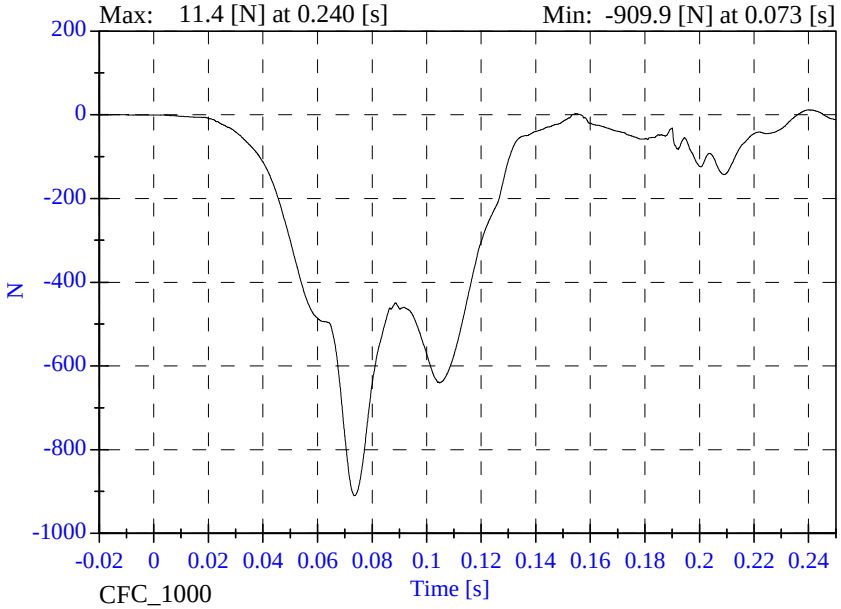


P3 Head Resultant

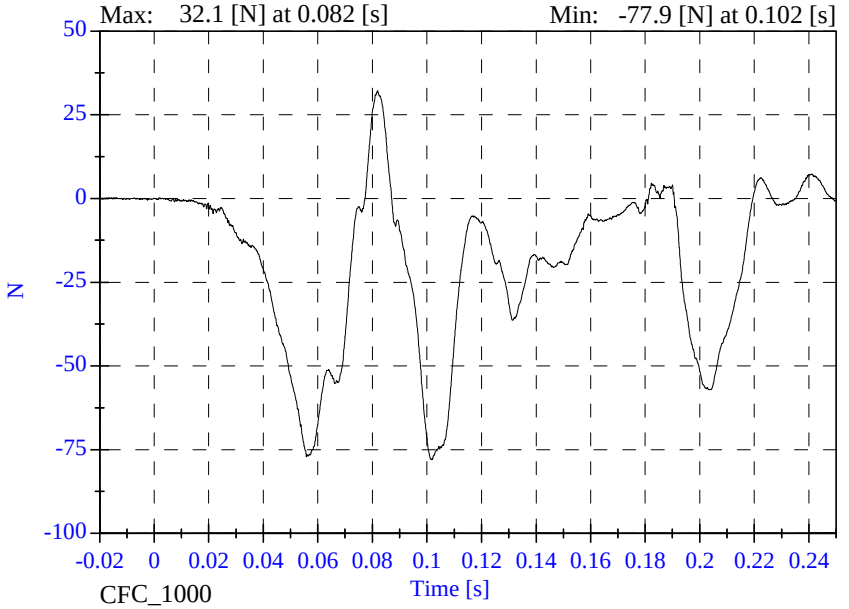


Sled Test NCAP 07-3-05 - July 31, 2003

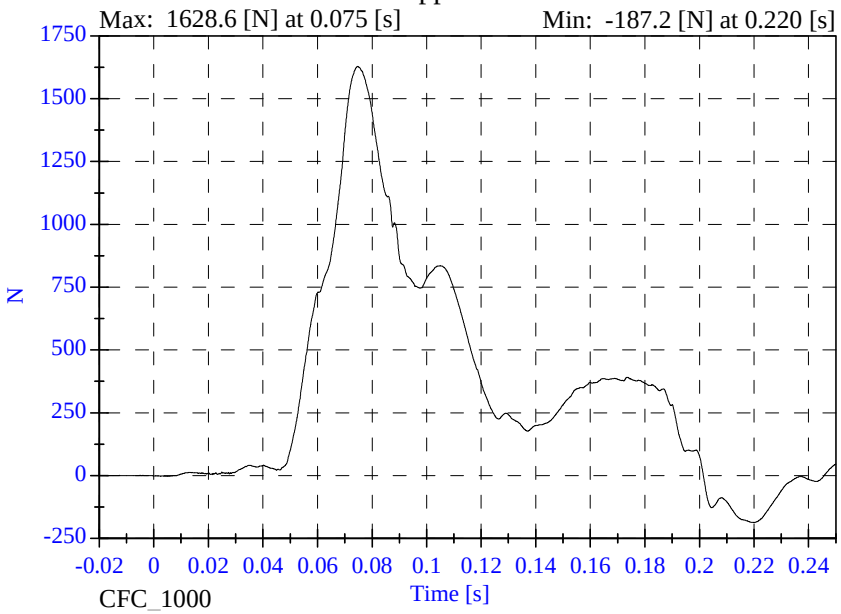
P3 Upper Neck Fx



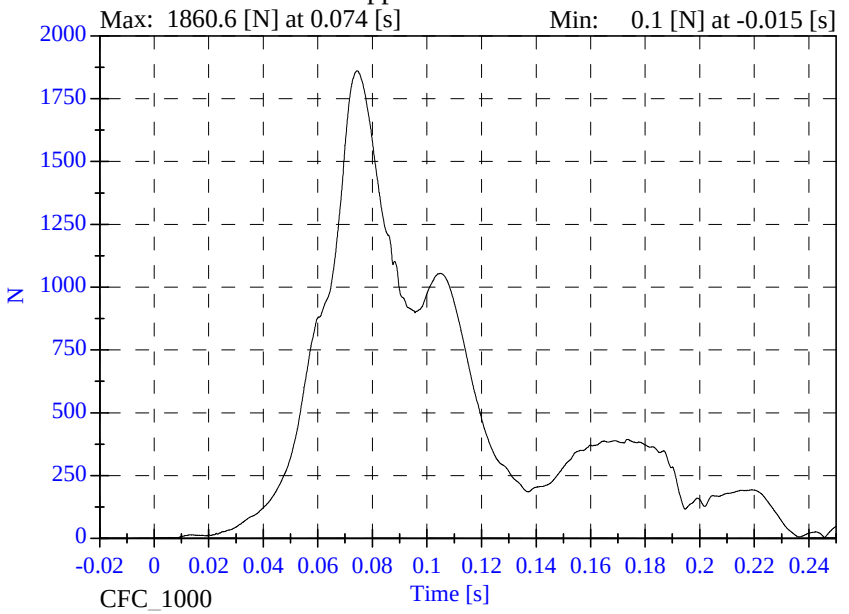
P3 Upper Neck Fy



P3 Upper Neck Fz



P3 Upper Neck F Resultant



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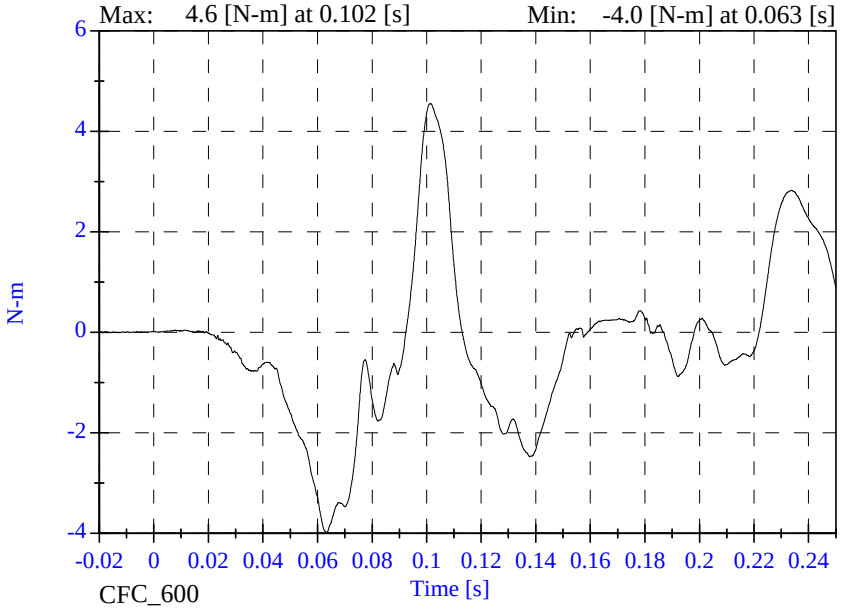
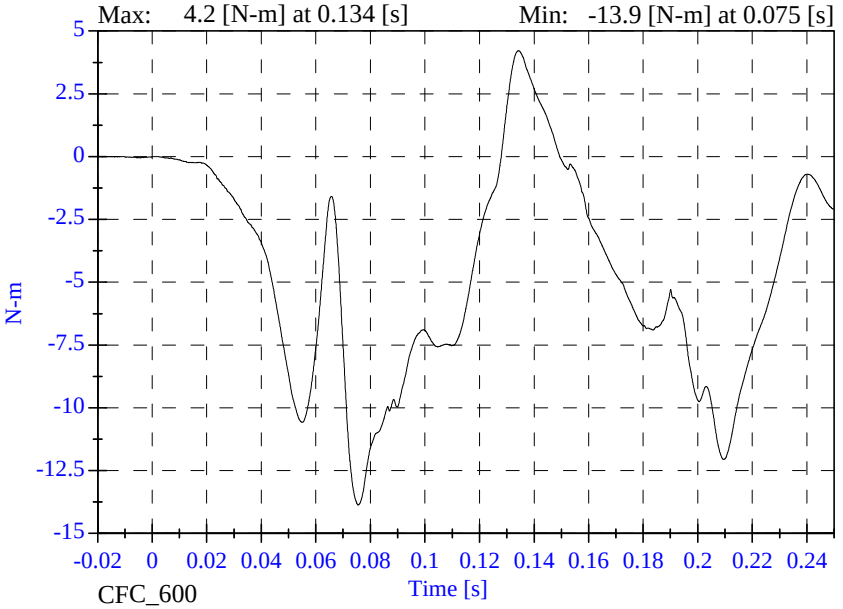
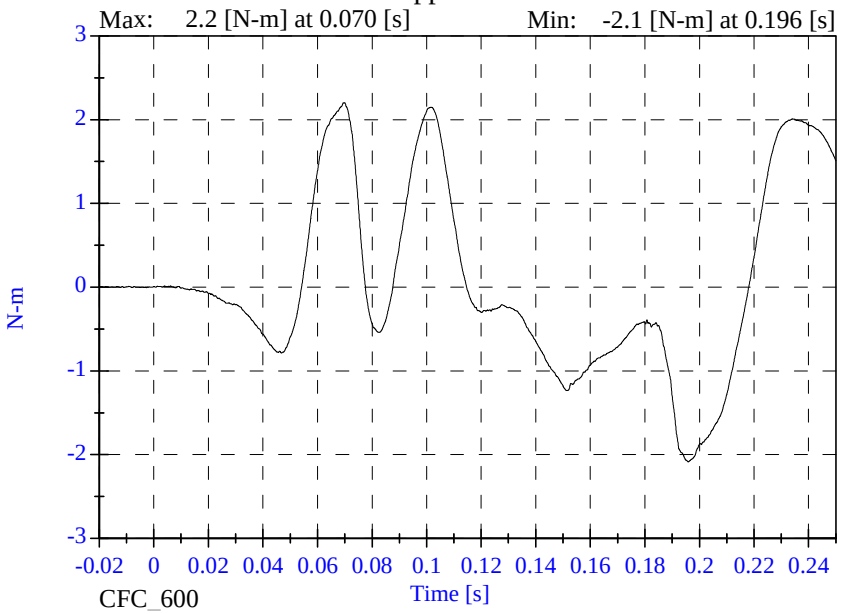
P3 Upper Neck Mx



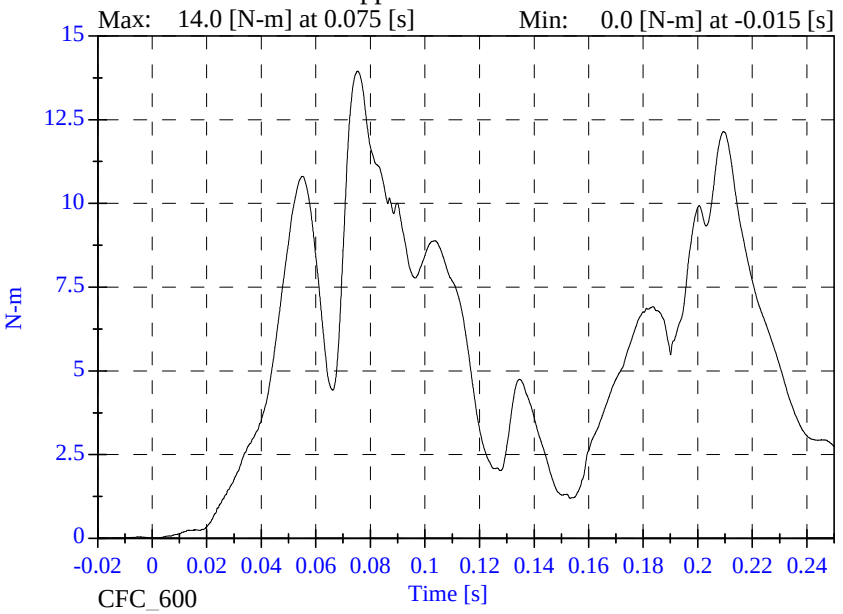
P3 Upper Neck My



P3 Upper Neck Mz



P3 Upper Neck M Resultant



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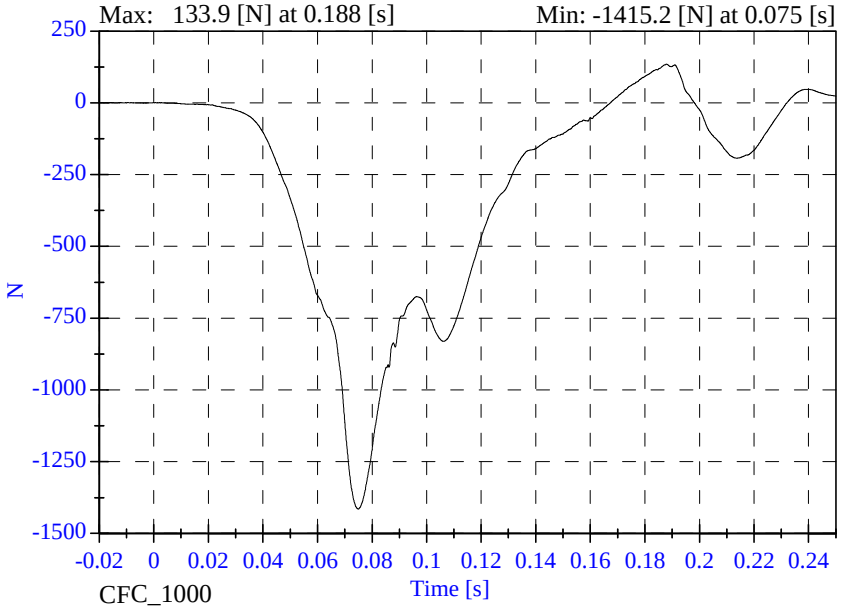
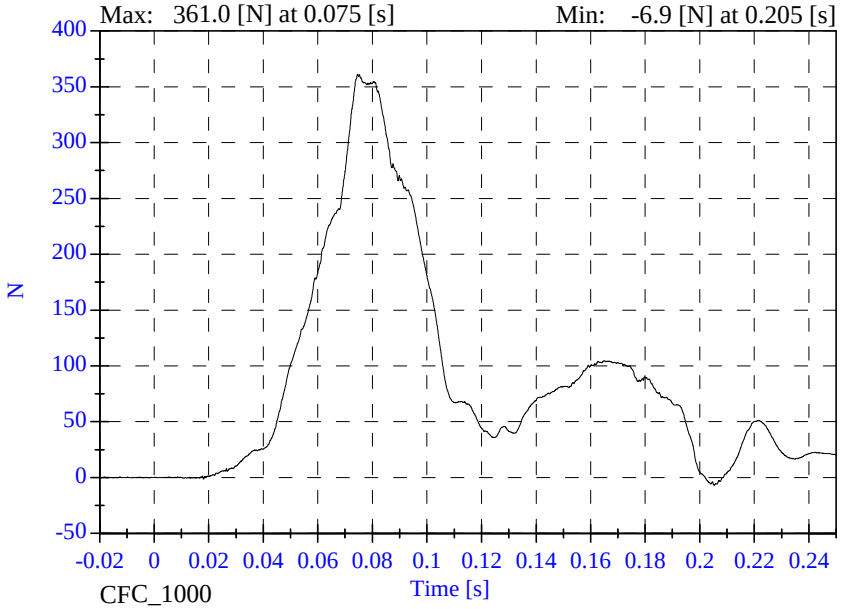
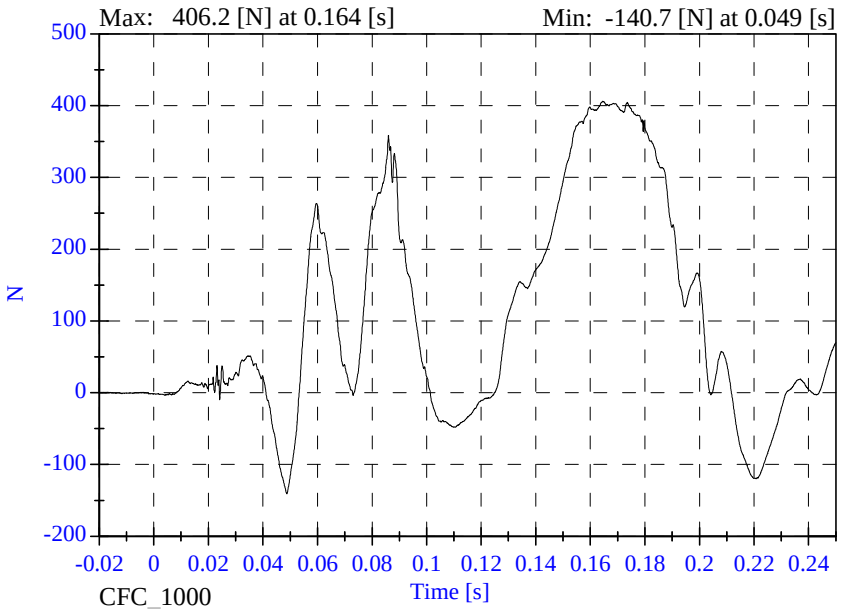
P3 Lower Neck Fx



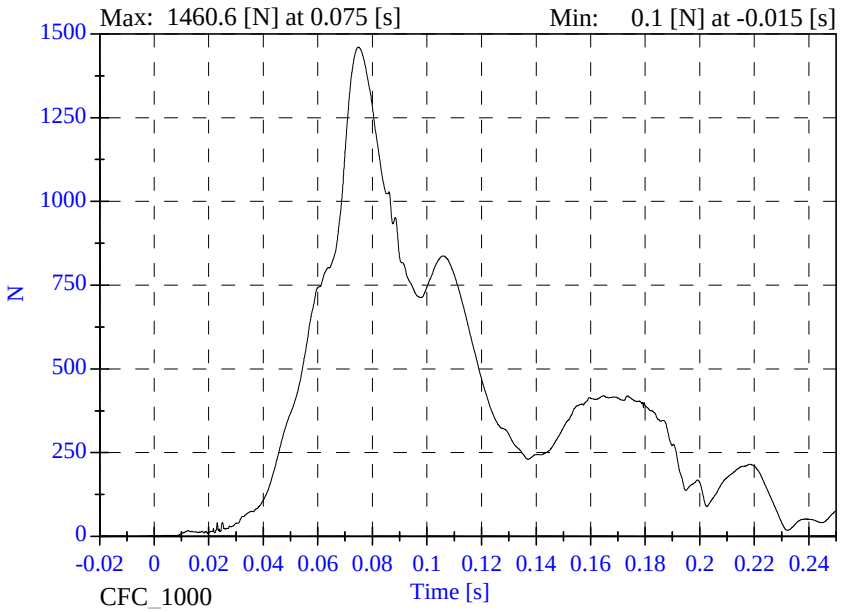
P3 Lower Neck Fy



P3 Lower Neck Fz



P3 Lower Neck F Resultant



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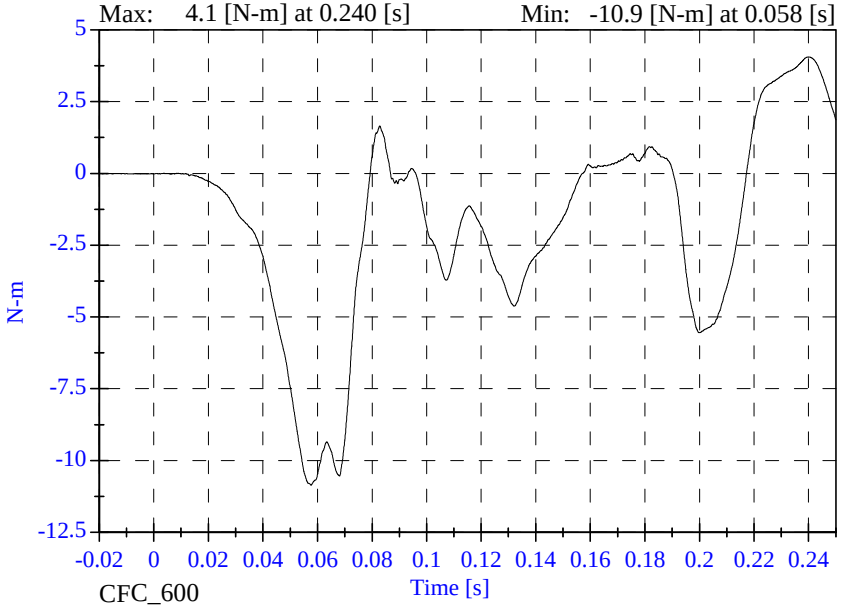
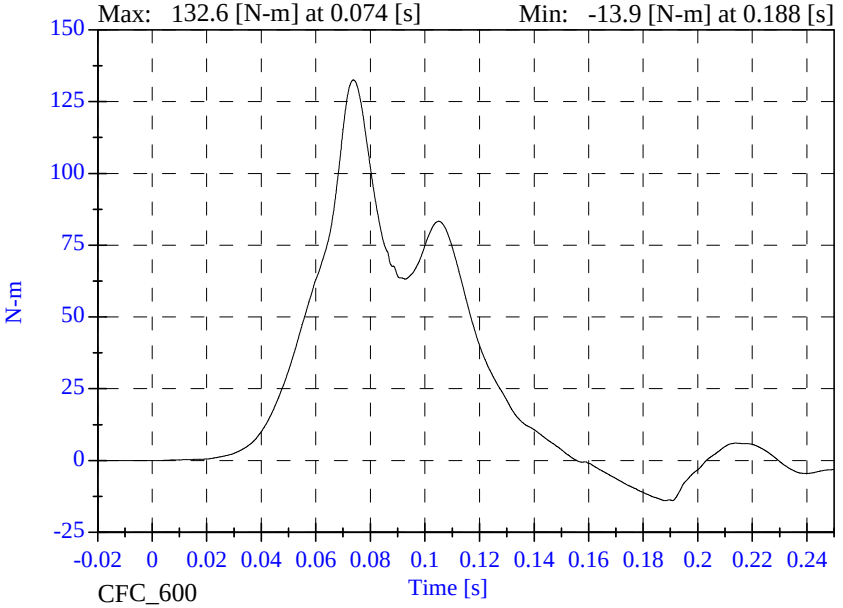
P3 Lower Neck Mx

Max: 4.1 [N-m] at 0.240 [s] Min: -10.9 [N-m] at 0.058 [s]



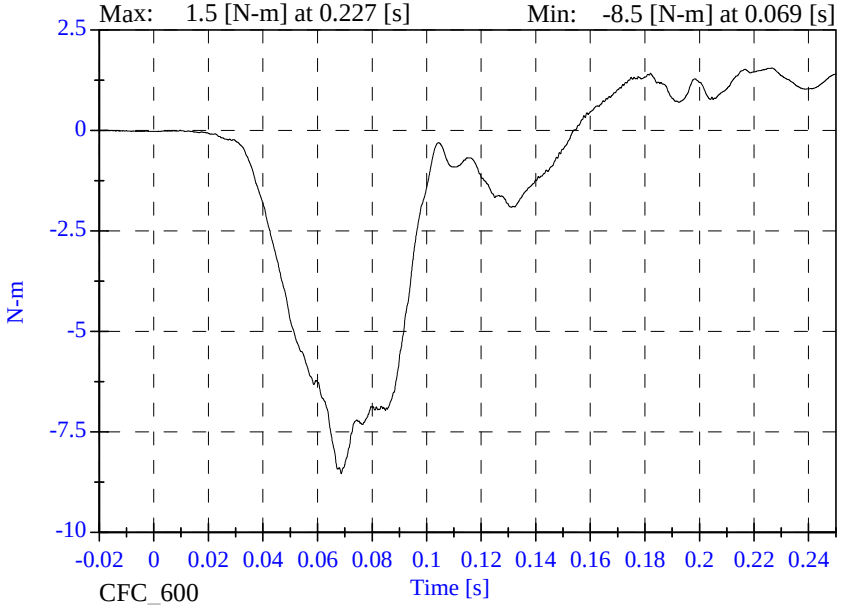
P3 Lower Neck My

Max: 132.6 [N-m] at 0.074 [s] Min: -13.9 [N-m] at 0.188 [s]



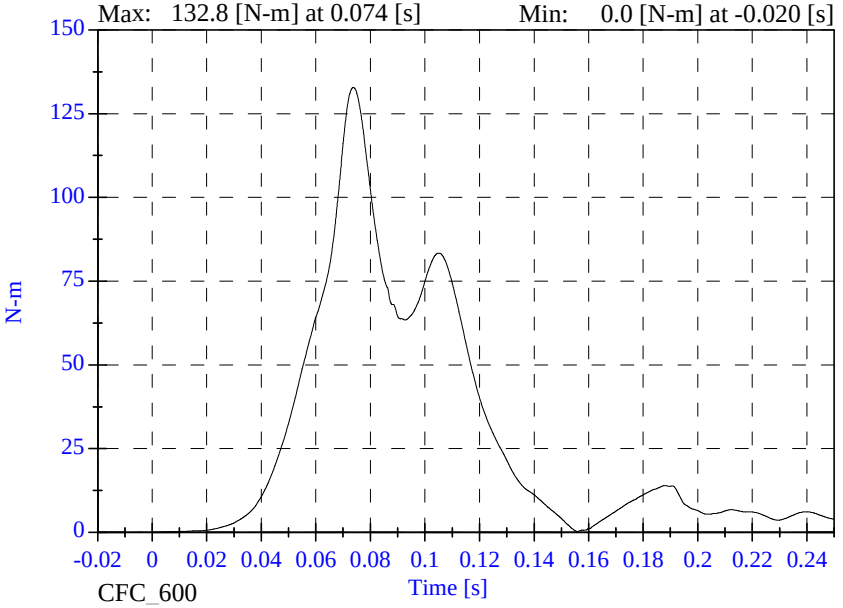
P3 Lower Neck Mz

Max: 1.5 [N-m] at 0.227 [s] Min: -8.5 [N-m] at 0.069 [s]



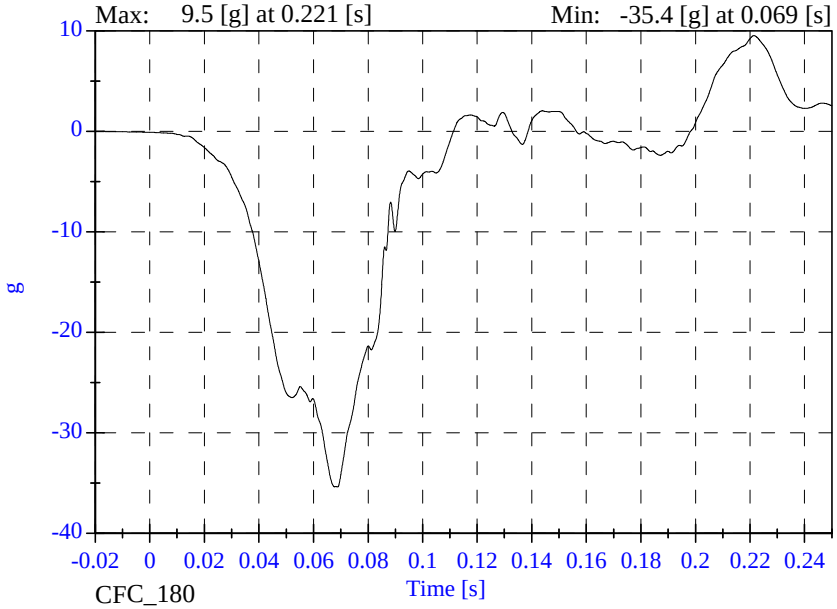
P3 Lower Neck M Resultant

Max: 132.8 [N-m] at 0.074 [s] Min: 0.0 [N-m] at -0.020 [s]

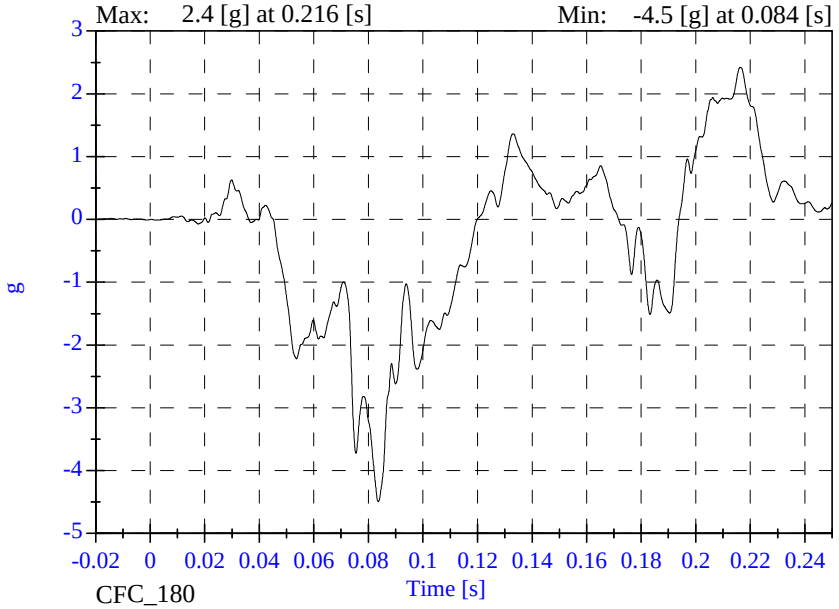


Sled Test NCAP 07-3-05 - July 31, 2003

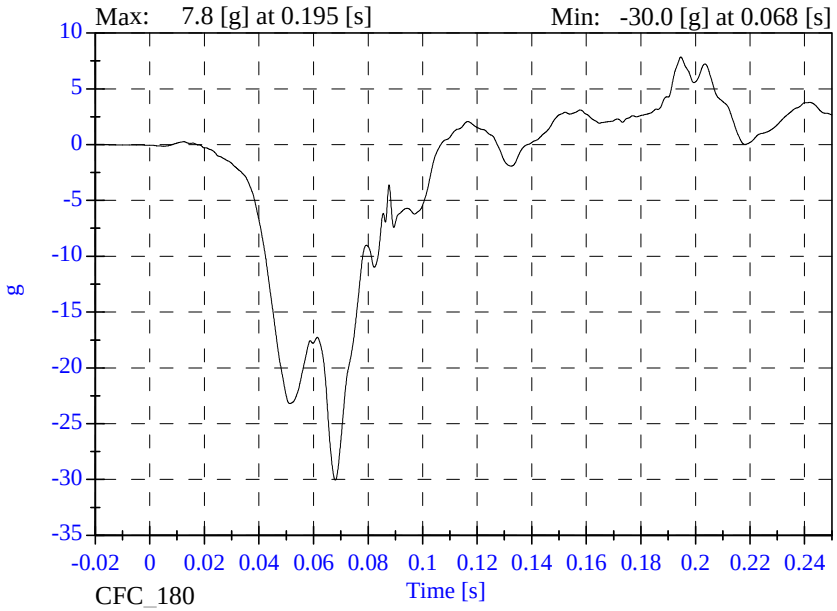
P3 Chest x



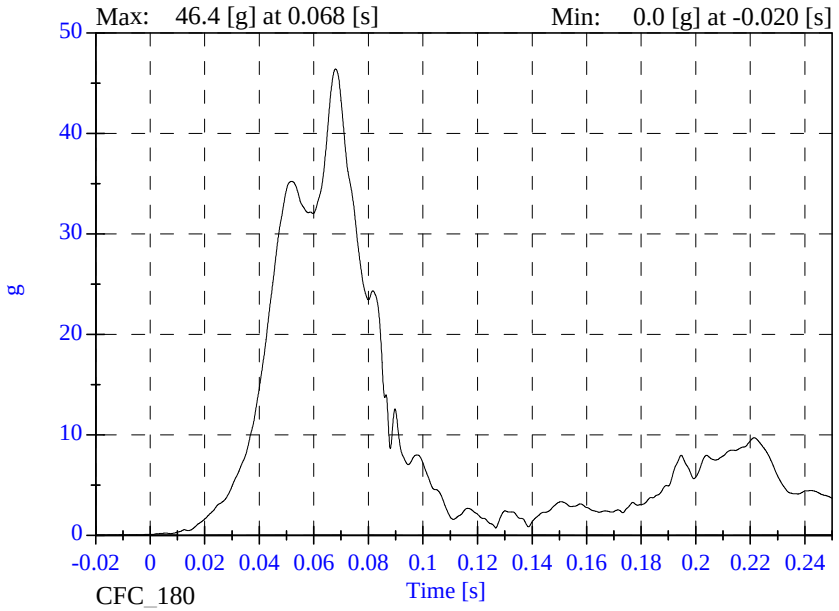
P3 Chest y



P3 Chest z

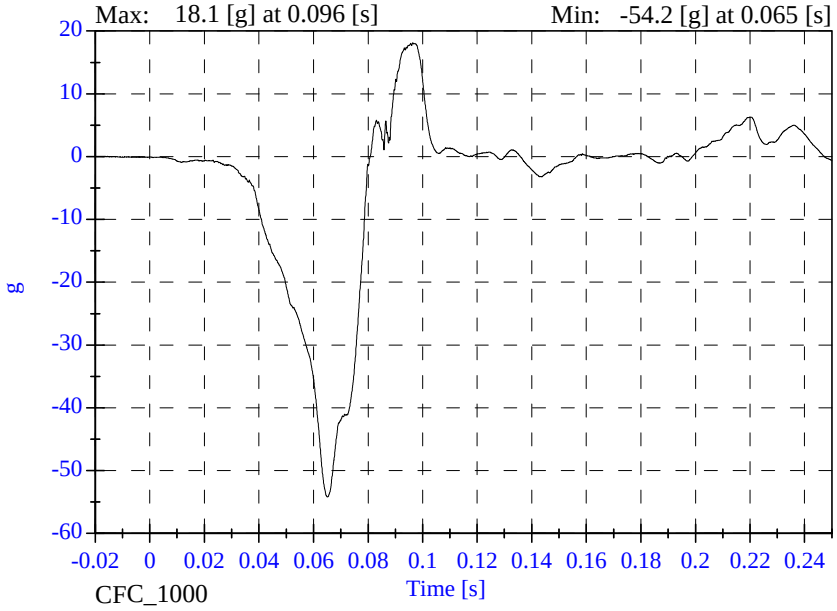


P3 Chest Resultant

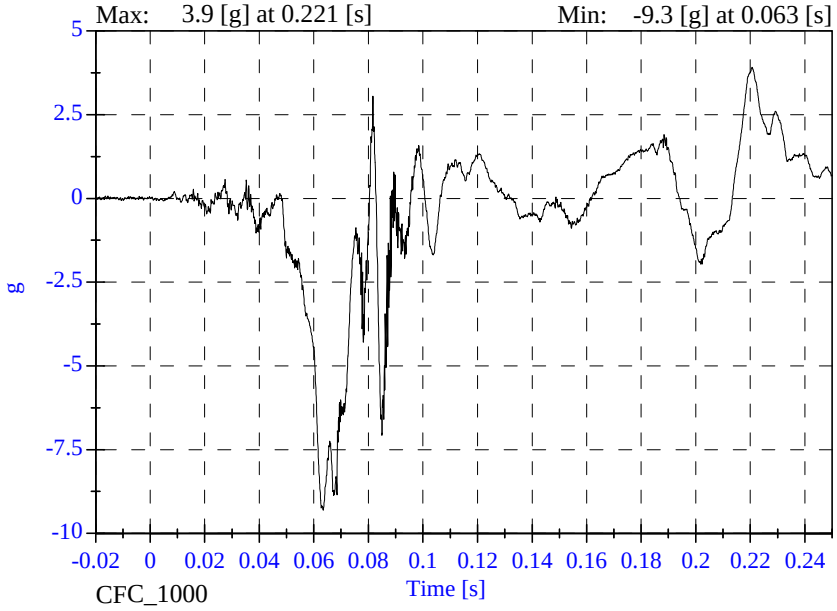


Sled Test NCAP 07-3-05 - July 31, 2003

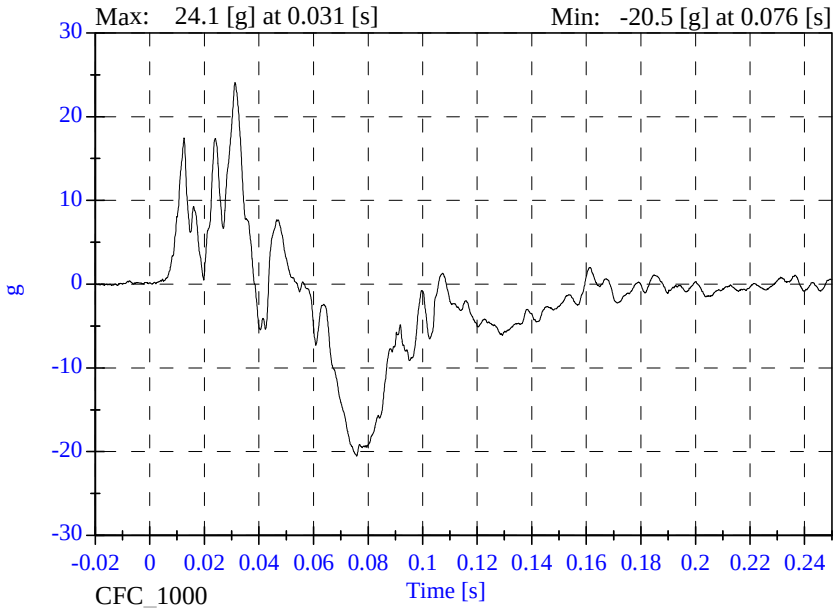
P3 Pelvic x



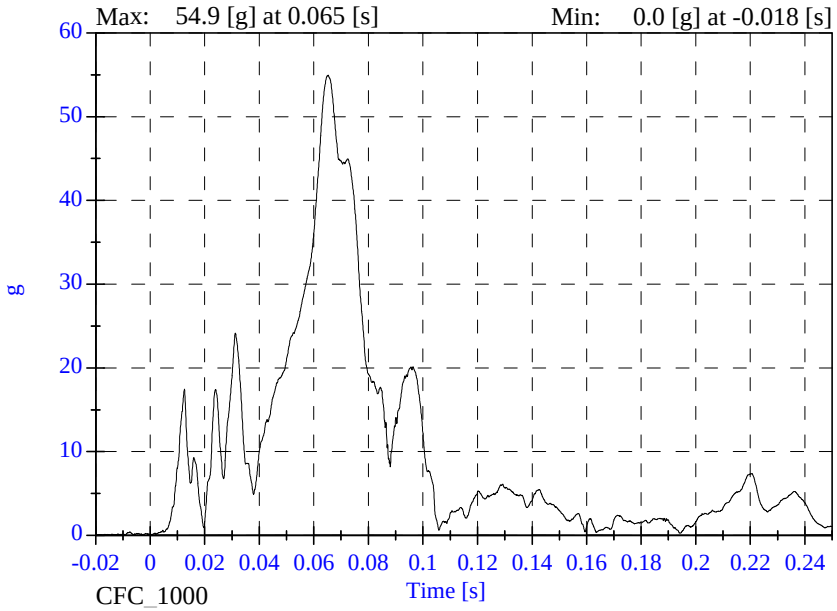
P3 Pelvic y



P3 Pelvic z

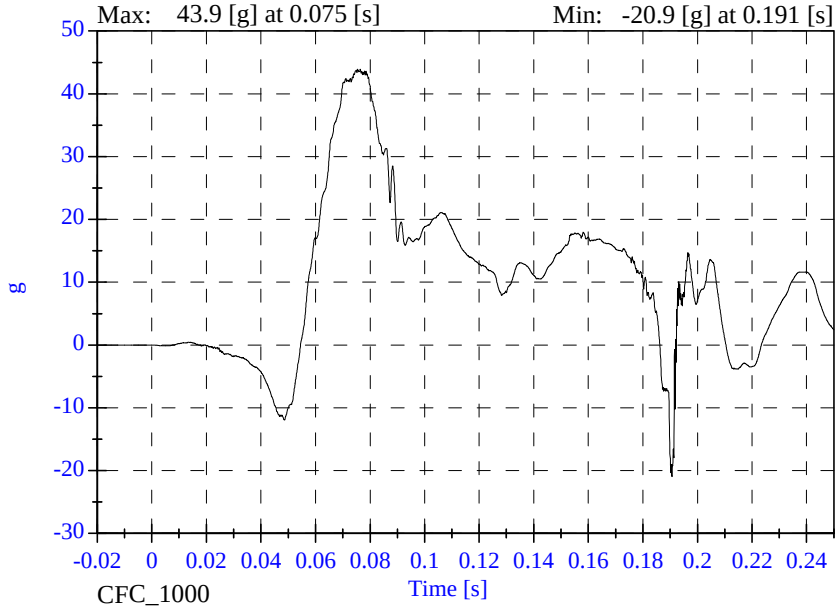


P3 Pelvic Resultant

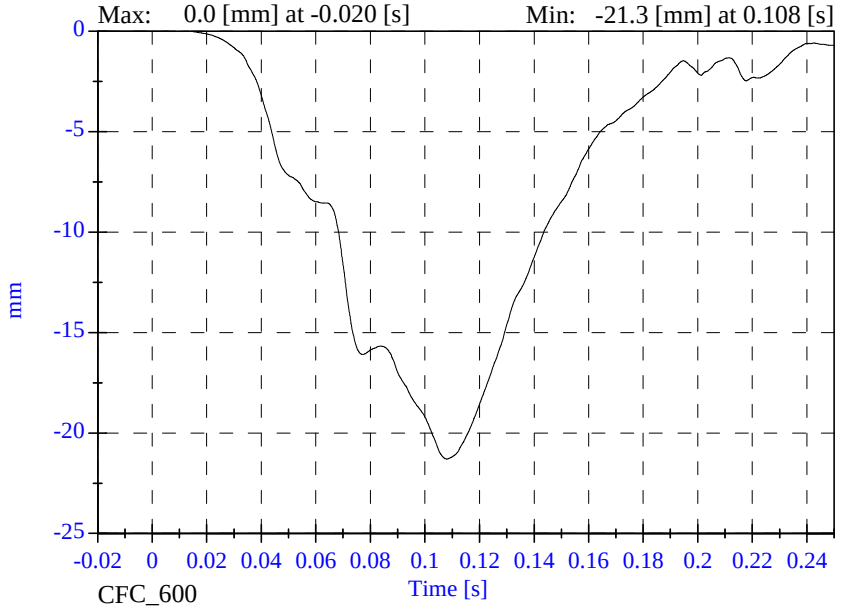


Sled Test NCAP 07-3-05 - July 31, 2003

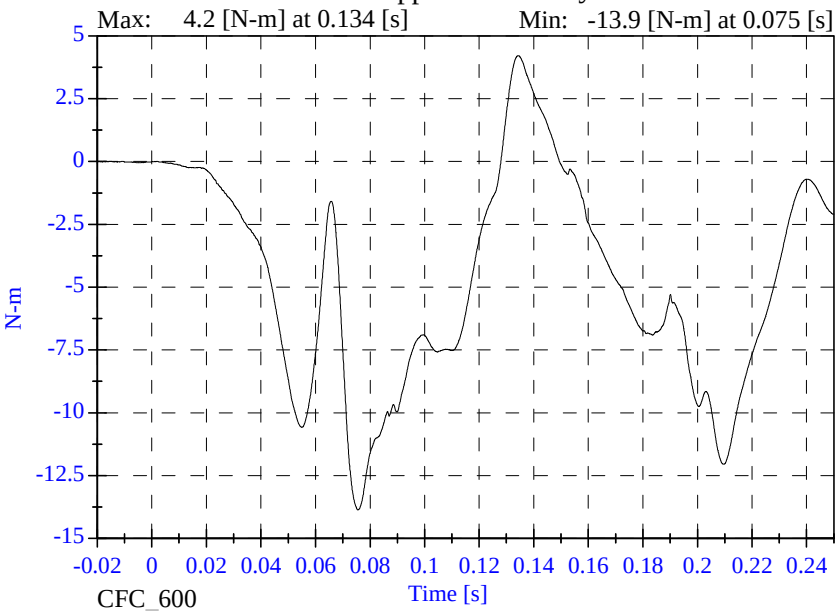
P3 Head Red z



P3 Chest Compression



P3 Upper Neck Mocy



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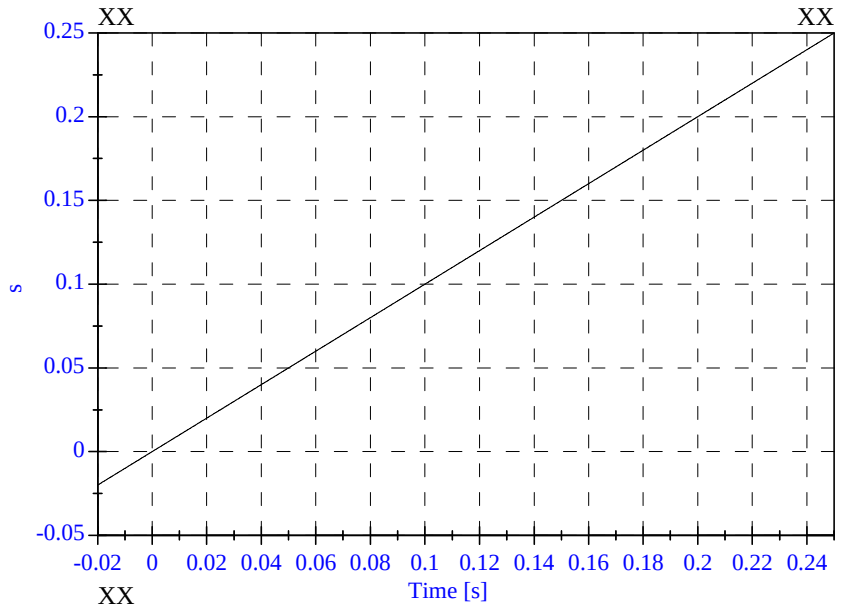
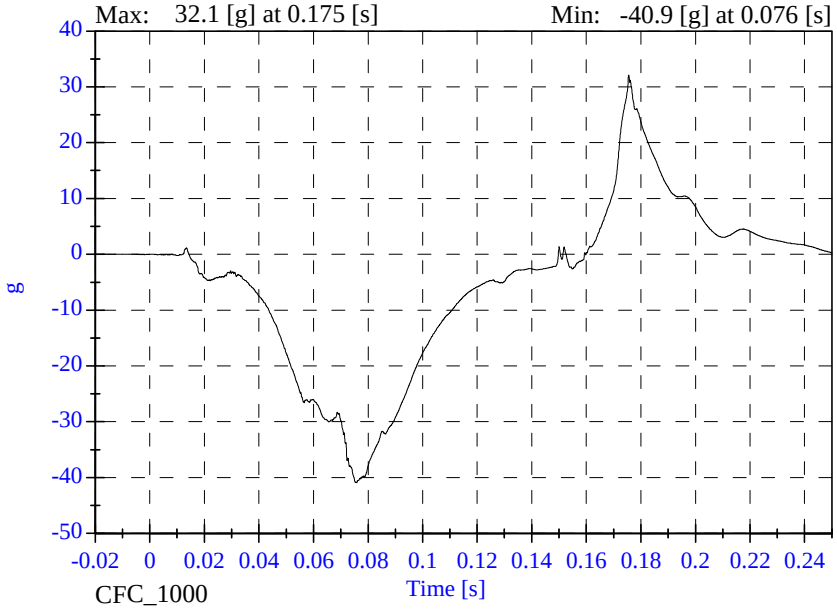
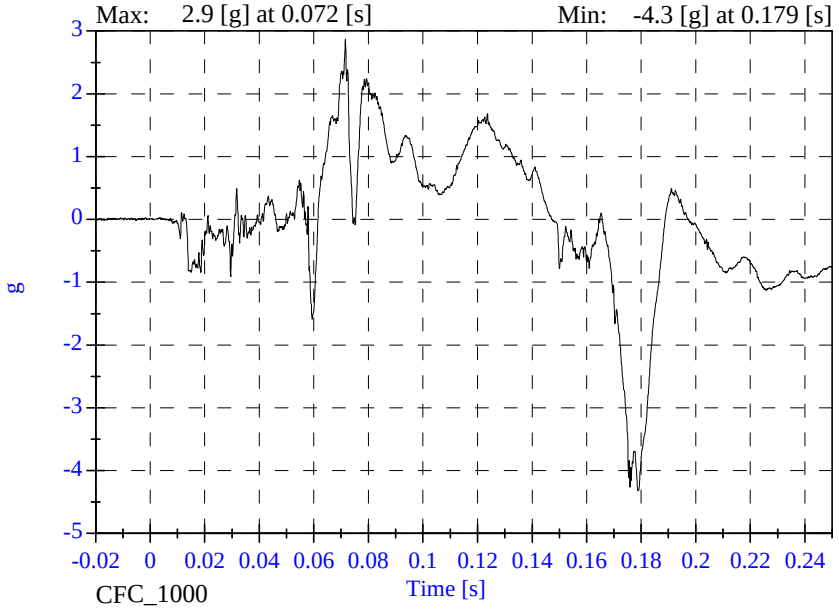


Sled Test NCAP 07-3-05 - July 31, 2003

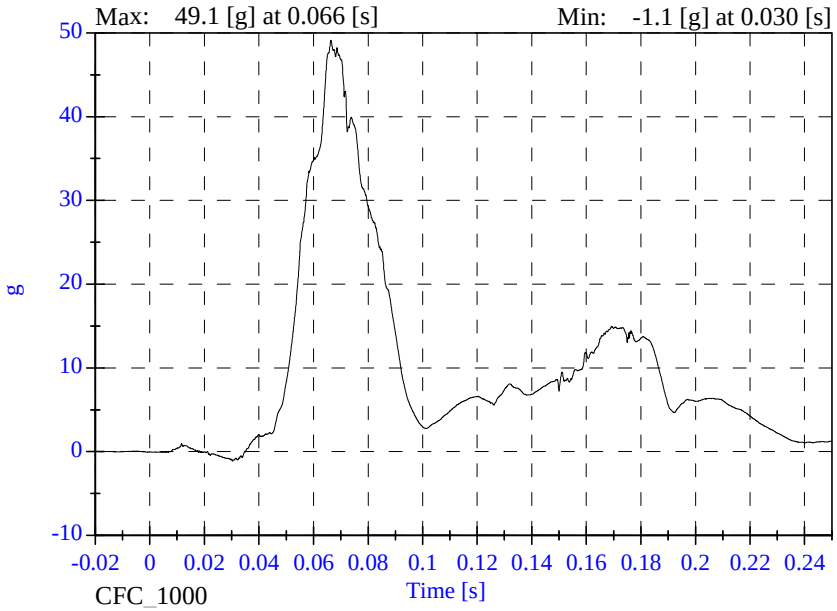
P4 Head x



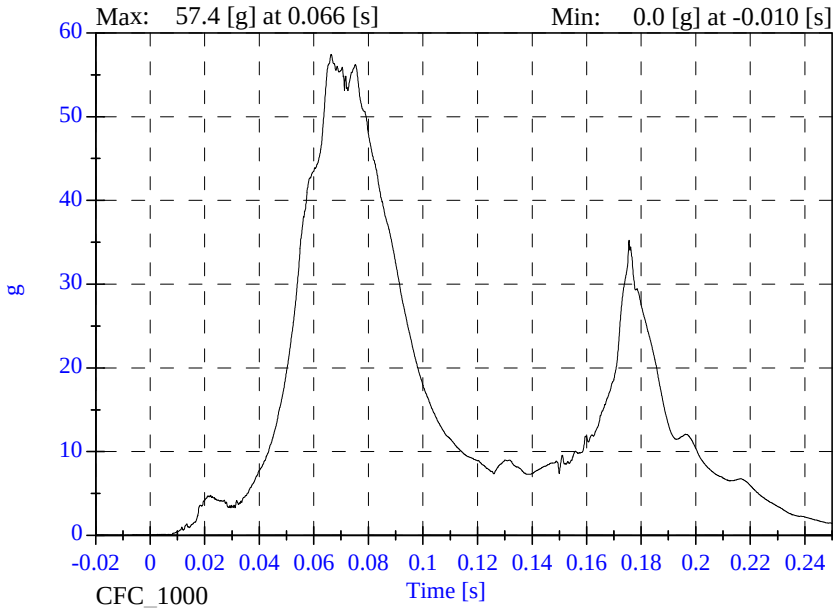
P4 Head y



P4 Head z

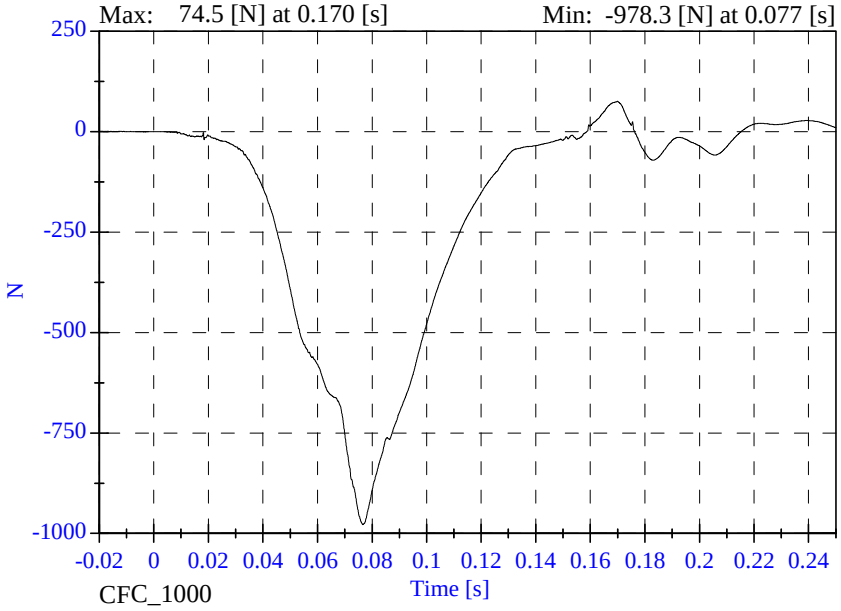


P4 Head Resultant

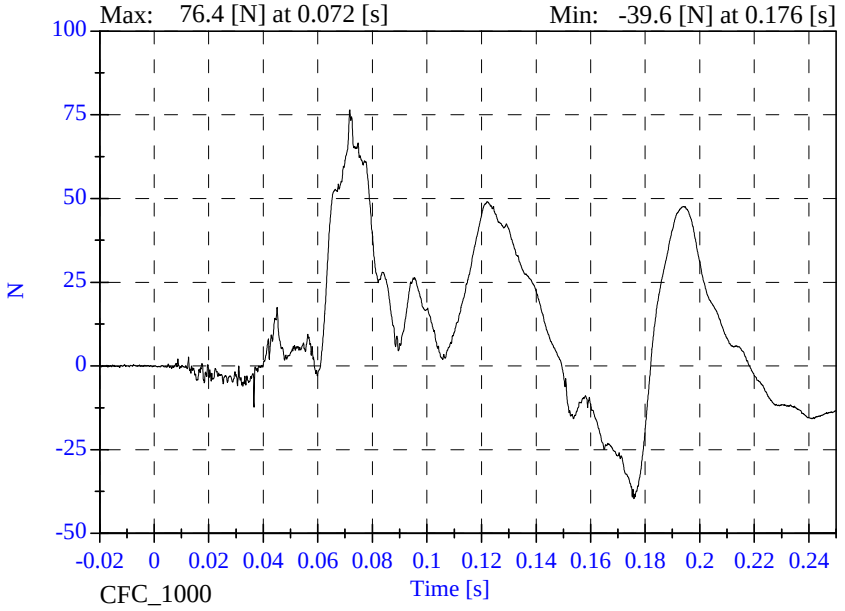


Sled Test NCAP 07-3-05 - July 31, 2003

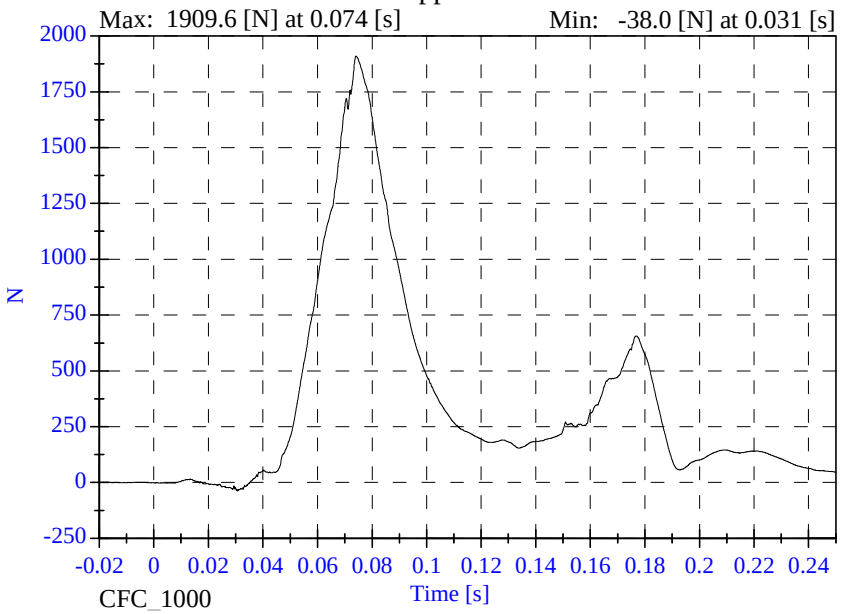
P4 Upper Neck Fx



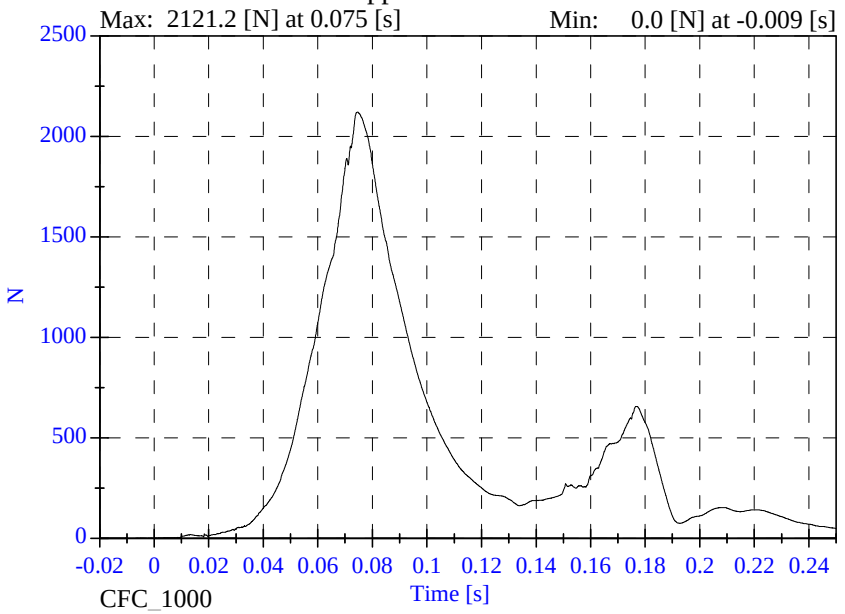
P4 Upper Neck Fy



P4 Upper Neck Fz



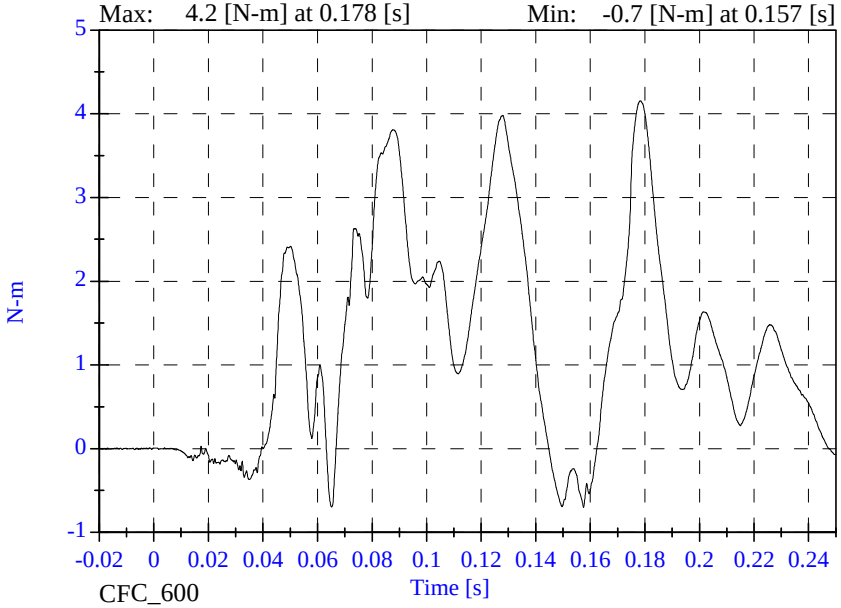
P4 Upper Neck F Resultant



Sled Test NCAP 07-3-05 - July 31, 2003

P4 Upper Neck Mx

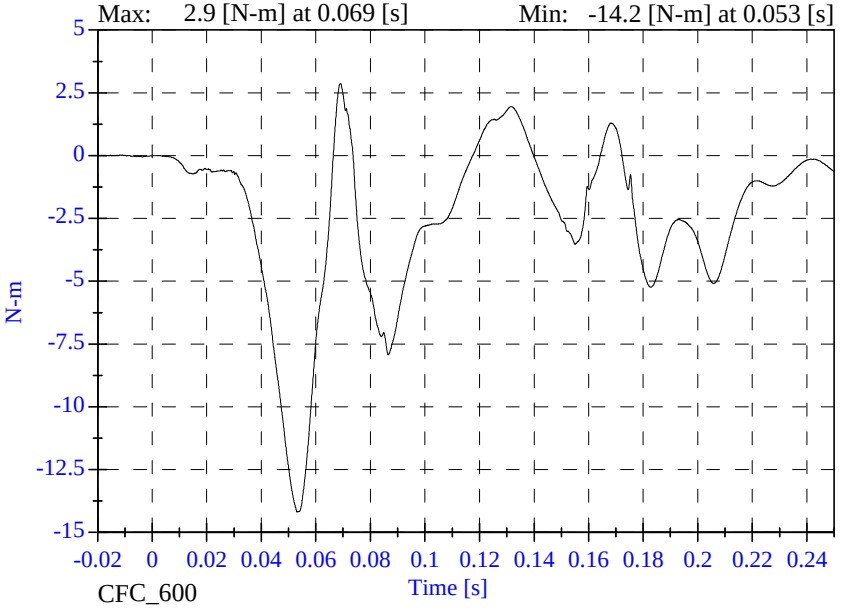
Max: 4.2 [N-m] at 0.178 [s] Min: -0.7 [N-m] at 0.157 [s]



CFC_600

P4 Upper Neck My

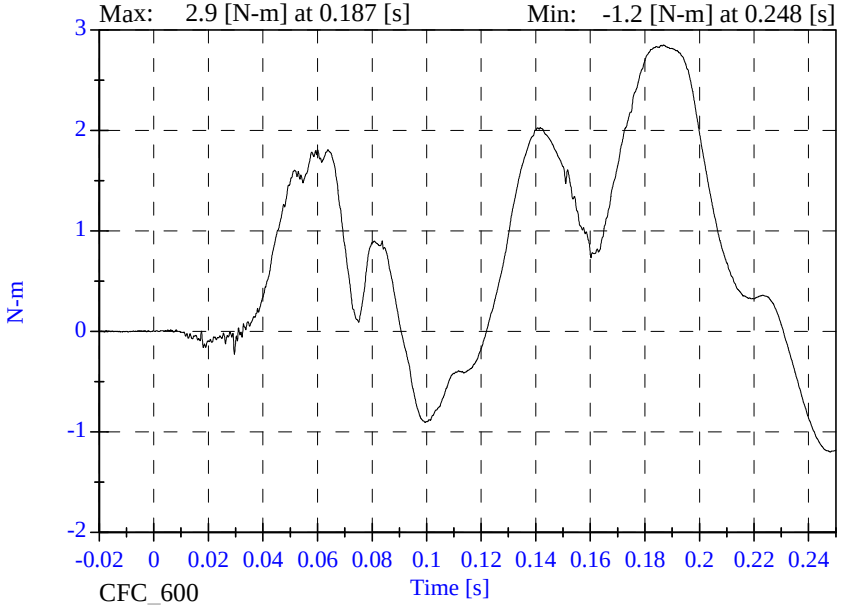
Max: 2.9 [N-m] at 0.069 [s] Min: -14.2 [N-m] at 0.053 [s]



CFC_600

P4 Upper Neck Mz

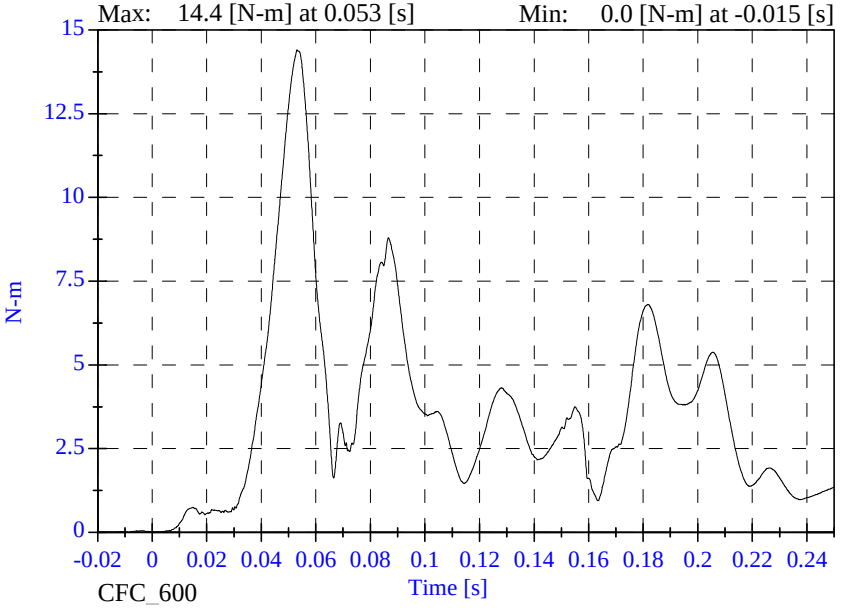
Max: 2.9 [N-m] at 0.187 [s] Min: -1.2 [N-m] at 0.248 [s]



CFC_600

P4 Upper Neck M Resultant

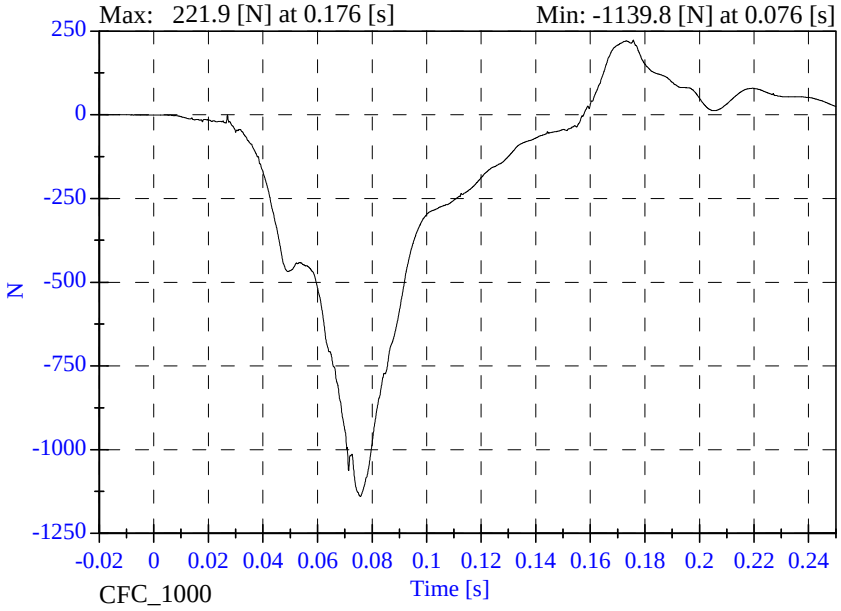
Max: 14.4 [N-m] at 0.053 [s] Min: 0.0 [N-m] at -0.015 [s]



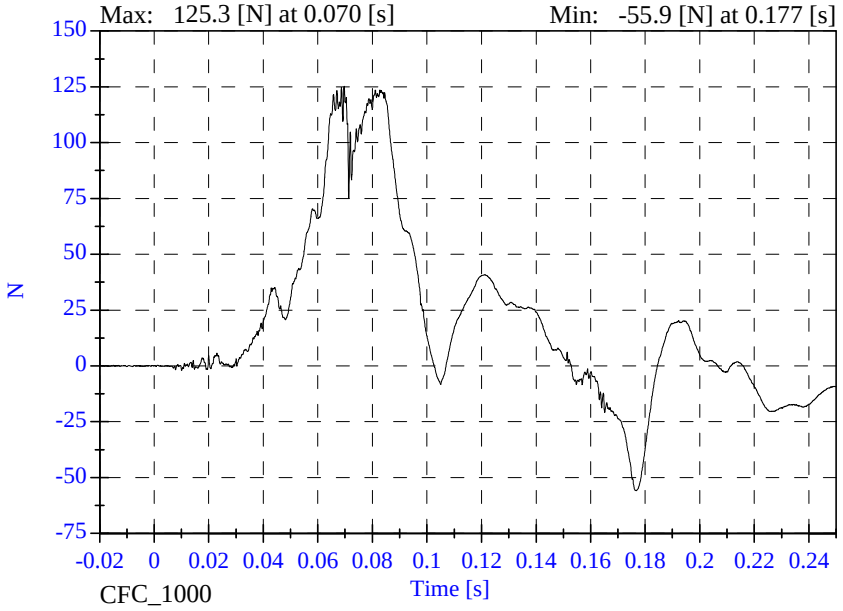
CFC_600

Sled Test NCAP 07-3-05 - July 31, 2003

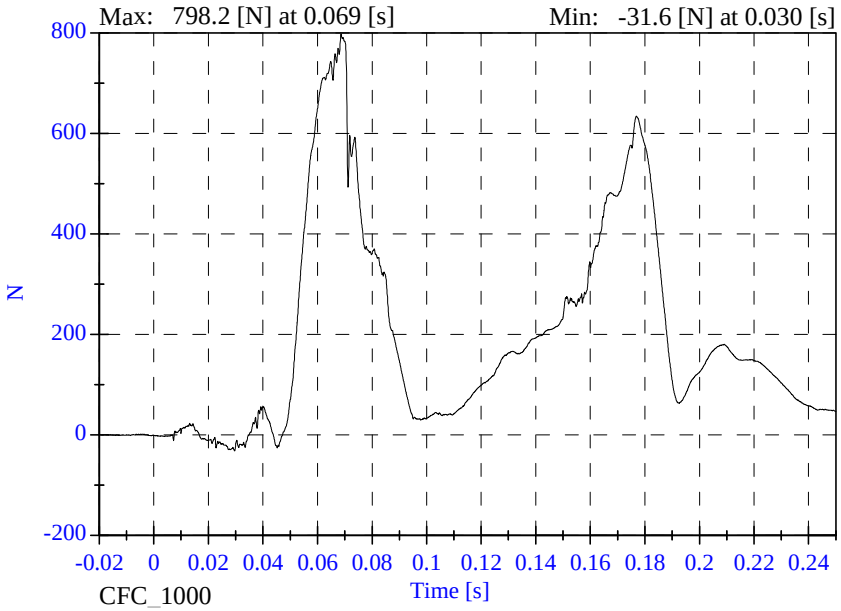
P4 Lower Neck Fx



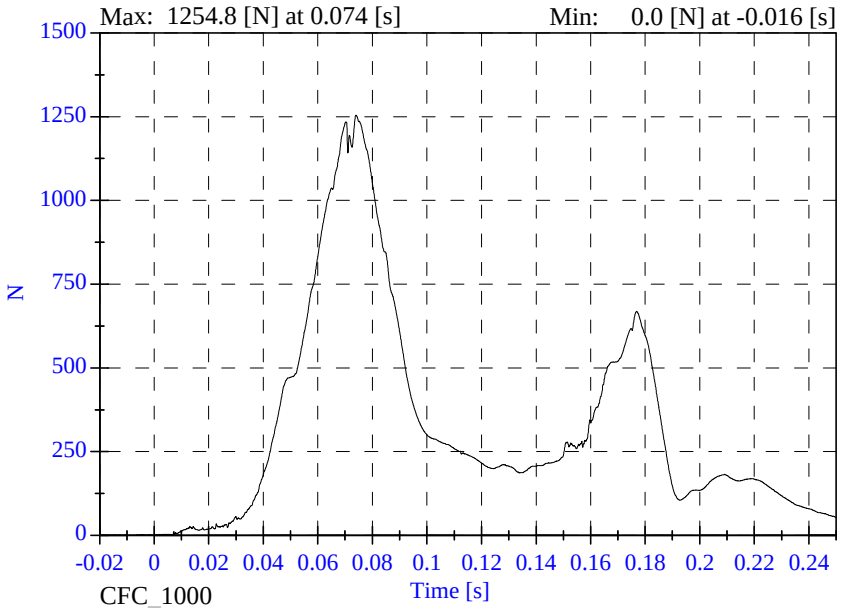
P4 Lower Neck Fy



P4 Lower Neck Fz

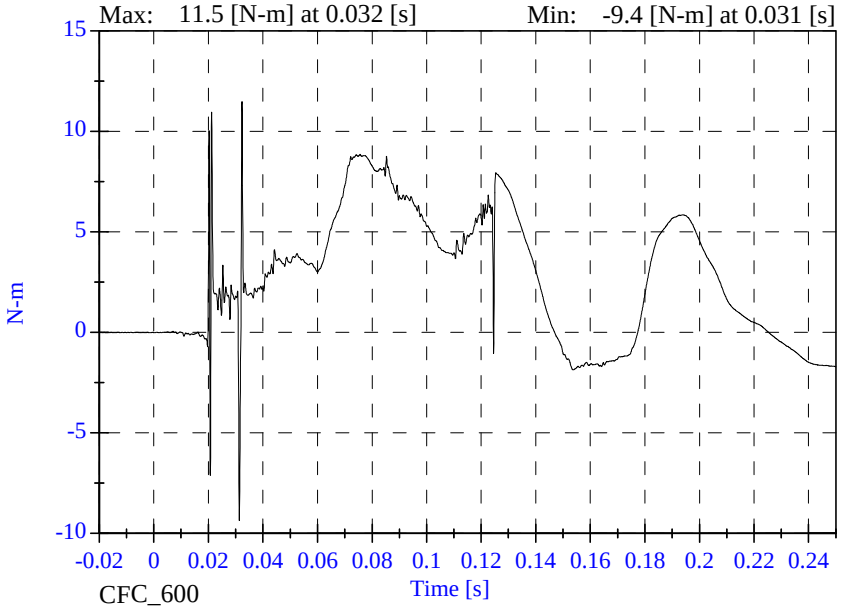


P4 Lower Neck F Resultant

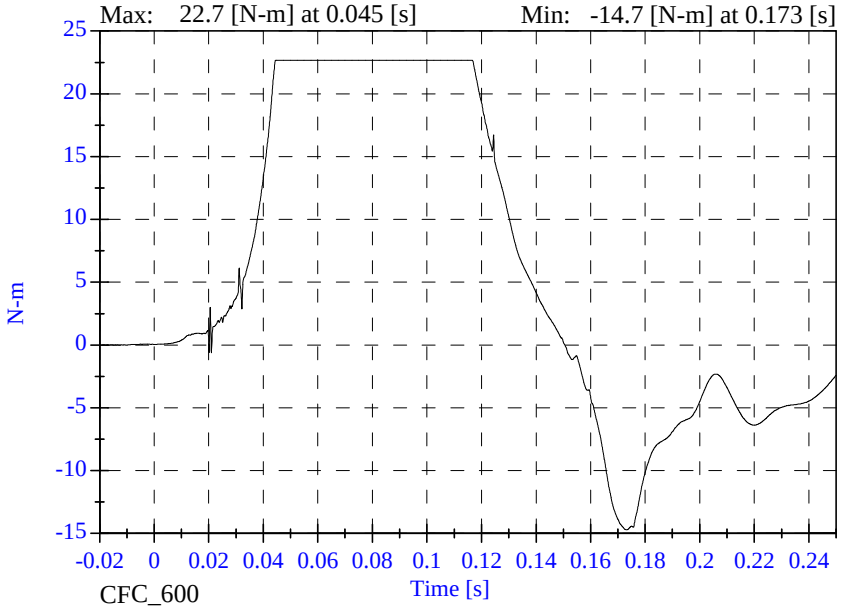


Sled Test NCAP 07-3-05 - July 31, 2003

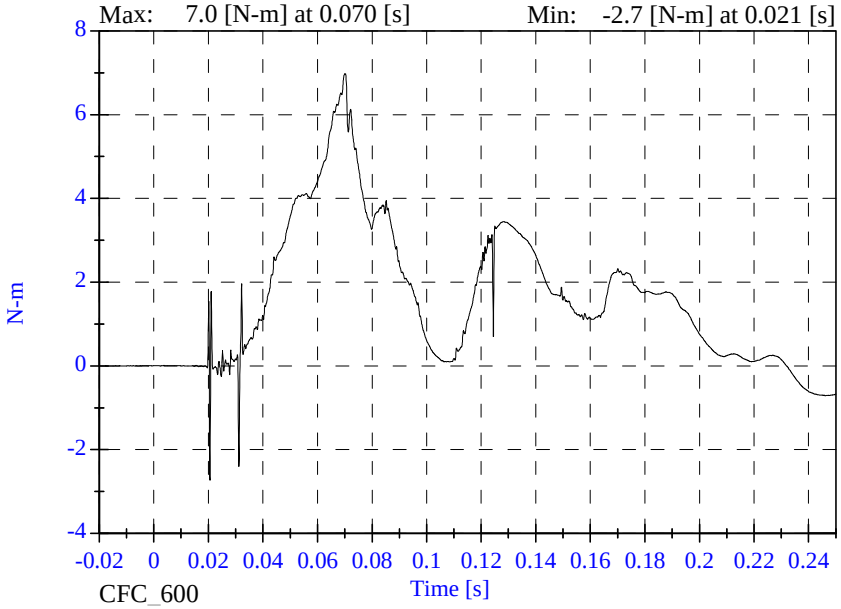
P4 Lower Neck Mx



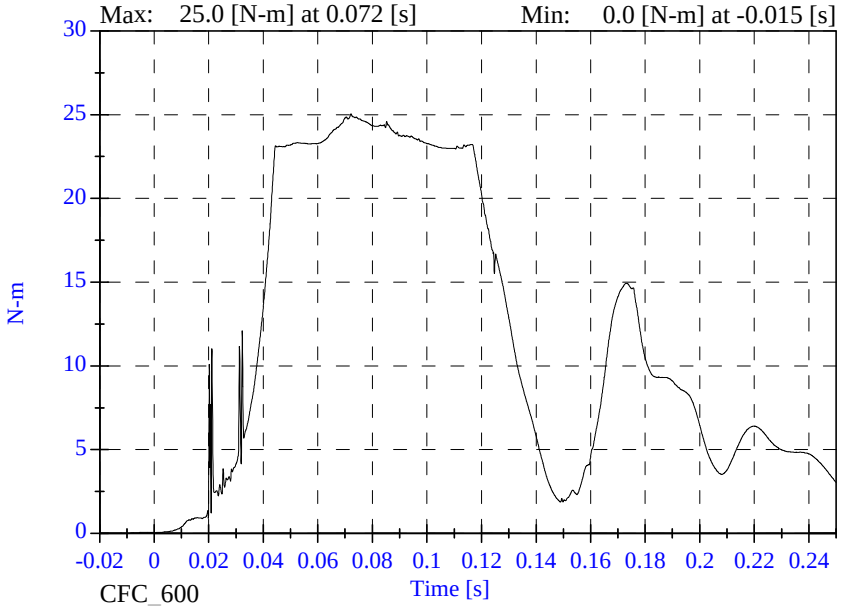
P4 Lower Neck My



P4 Lower Neck Mz

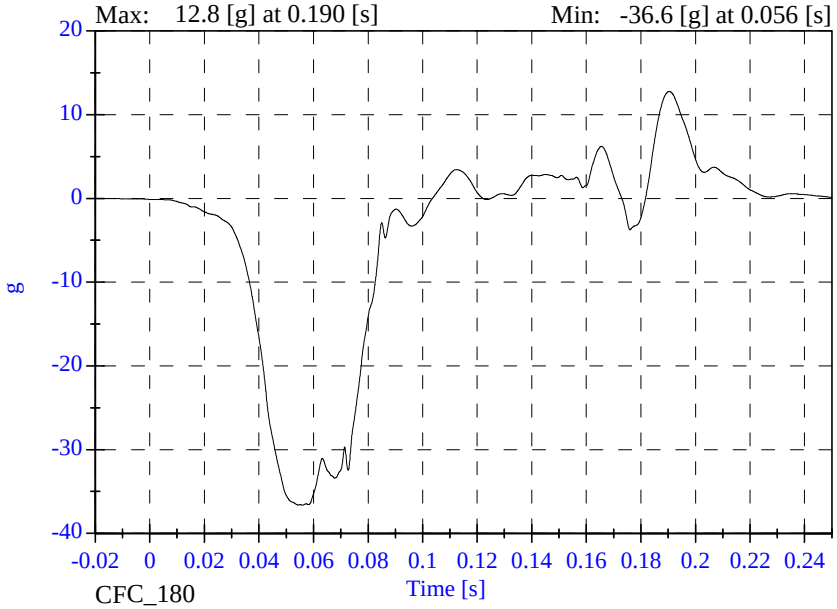


P4 Lower Neck M Resultant

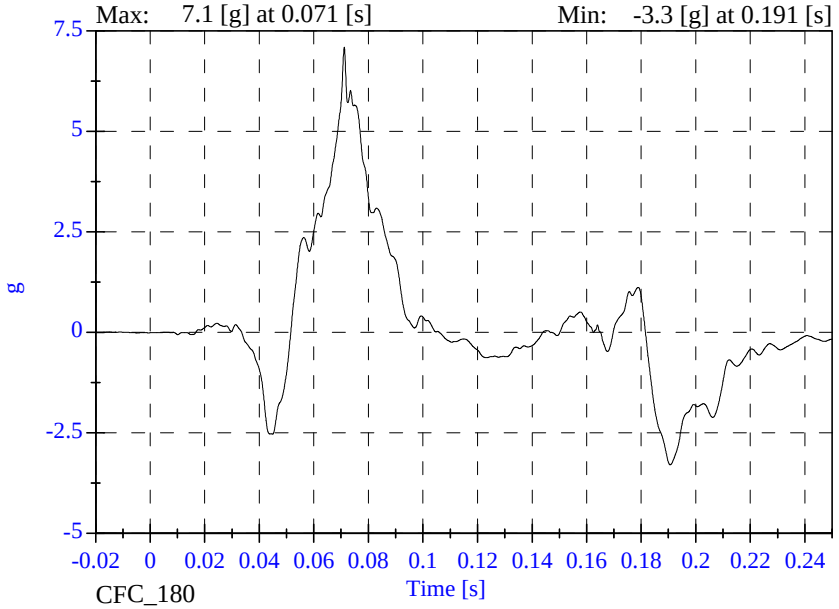


Sled Test NCAP 07-3-05 - July 31, 2003

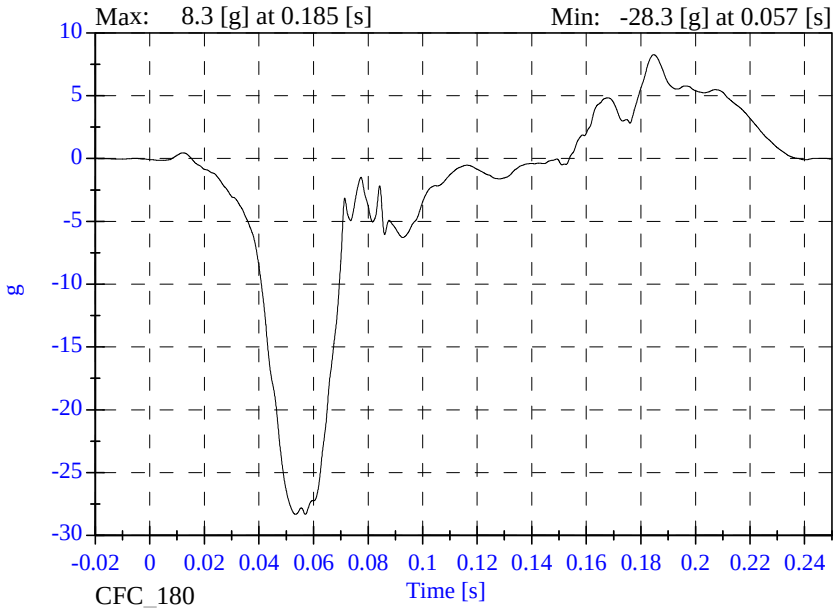
P4 Chest x



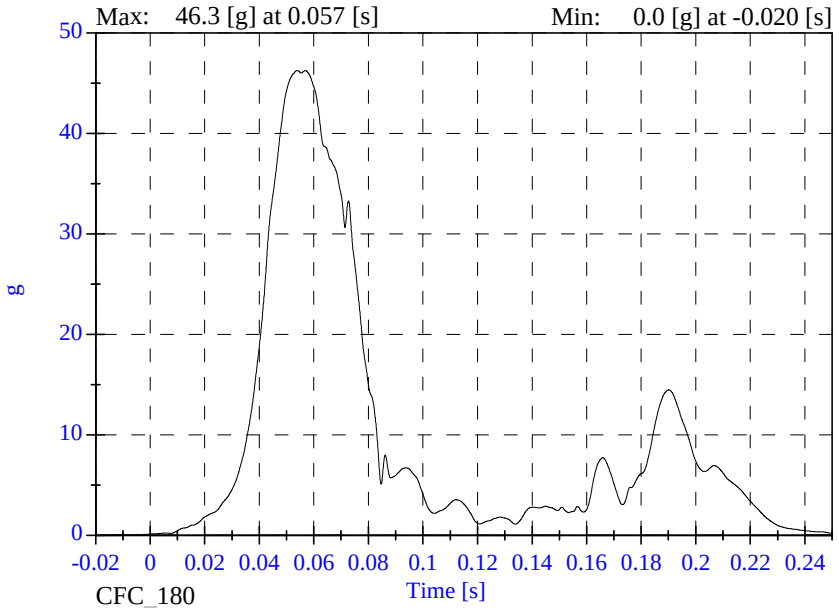
P4 Chest y



P4 Chest z

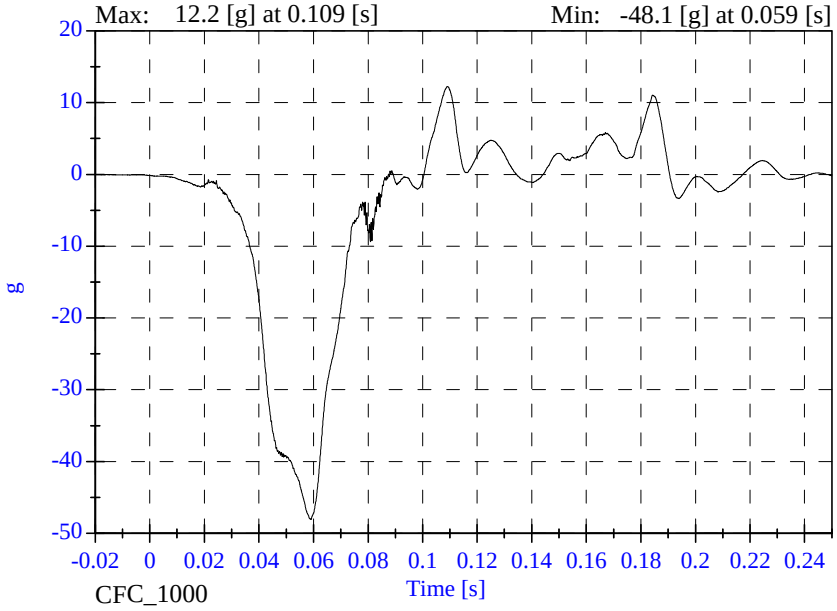


P4 Chest Resultant

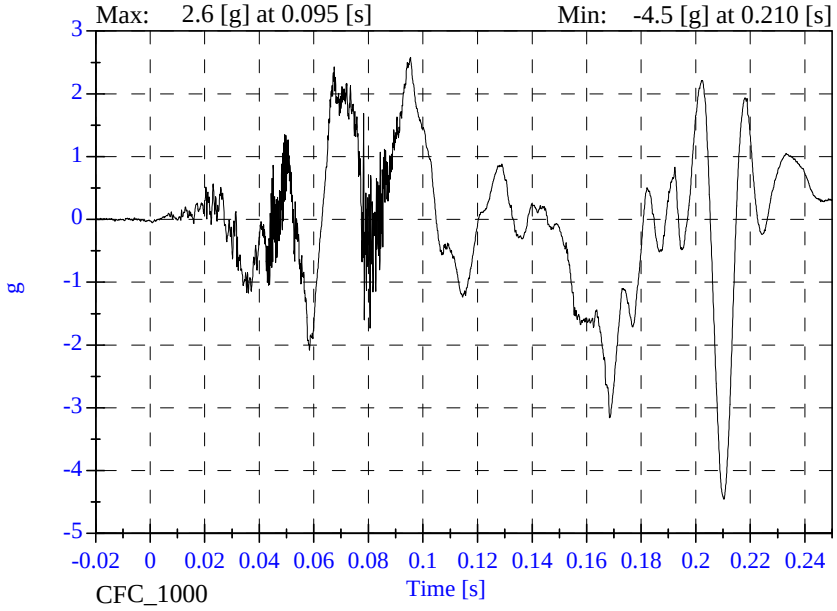


Sled Test NCAP 07-3-05 - July 31, 2003

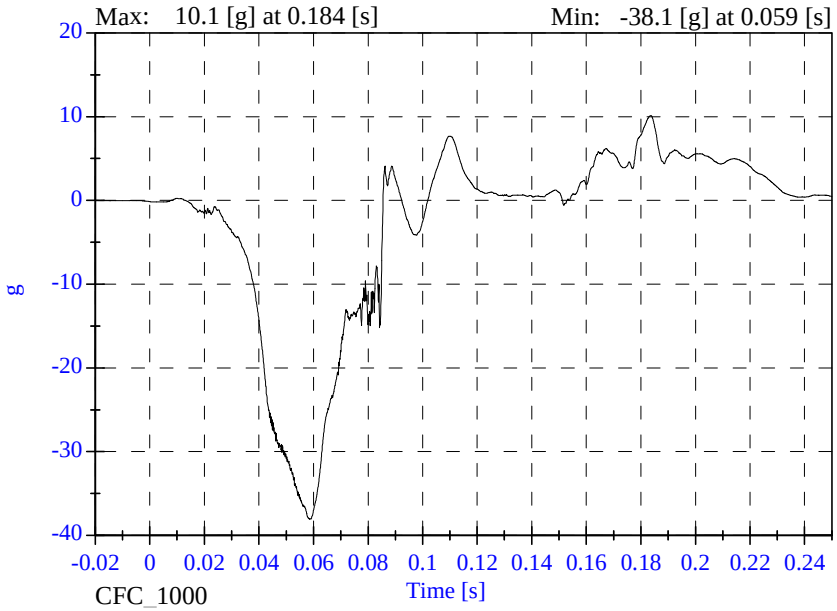
P4 Pelvic x



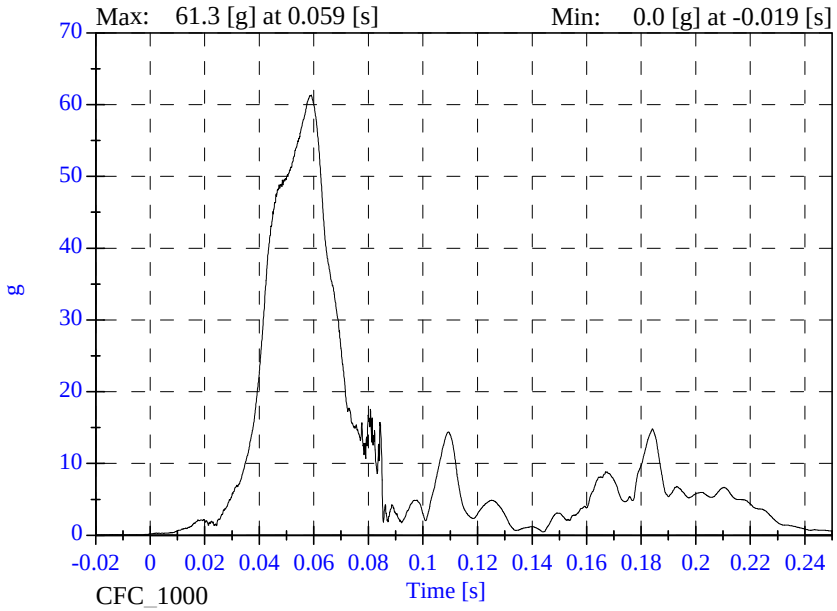
P4 Pelvic y



P4 Pelvic z

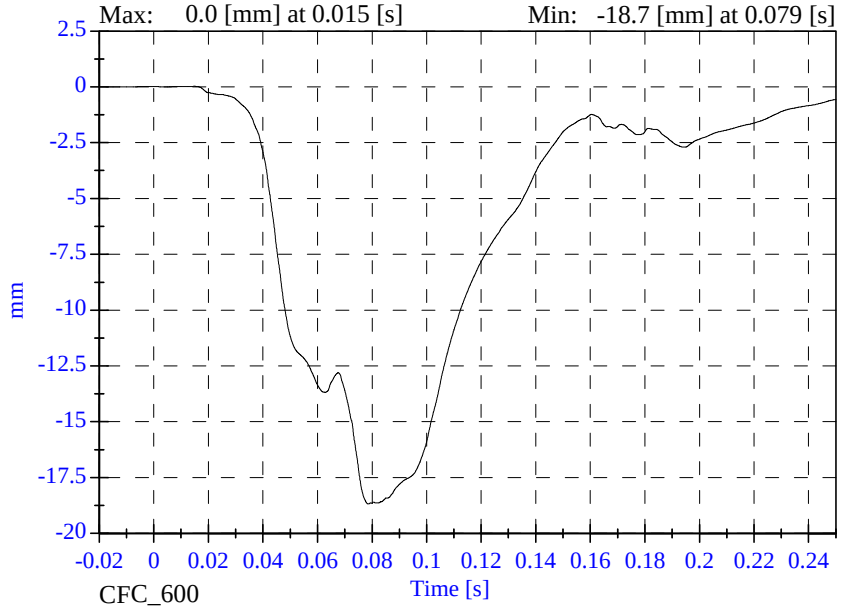


P4 Pelvic Resultant

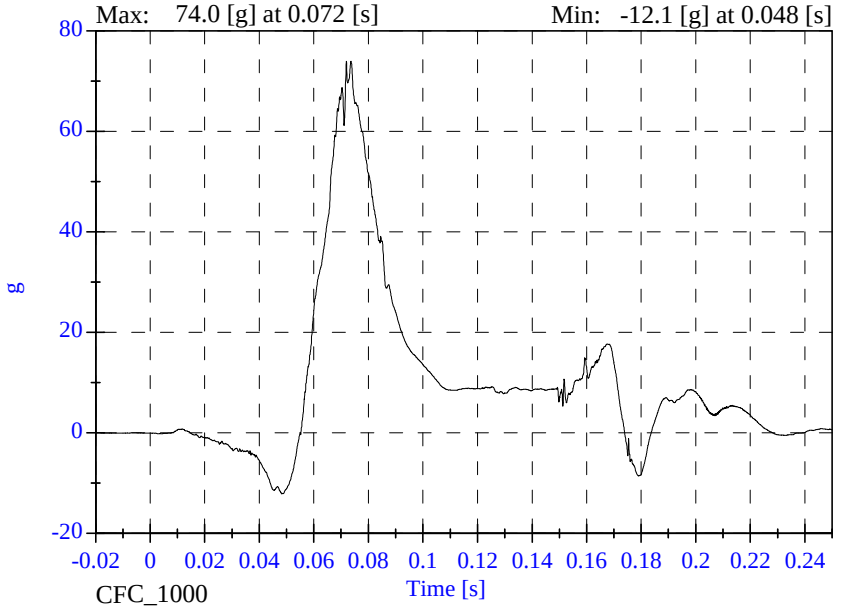


Sled Test NCAP 07-3-05 - July 31, 2003

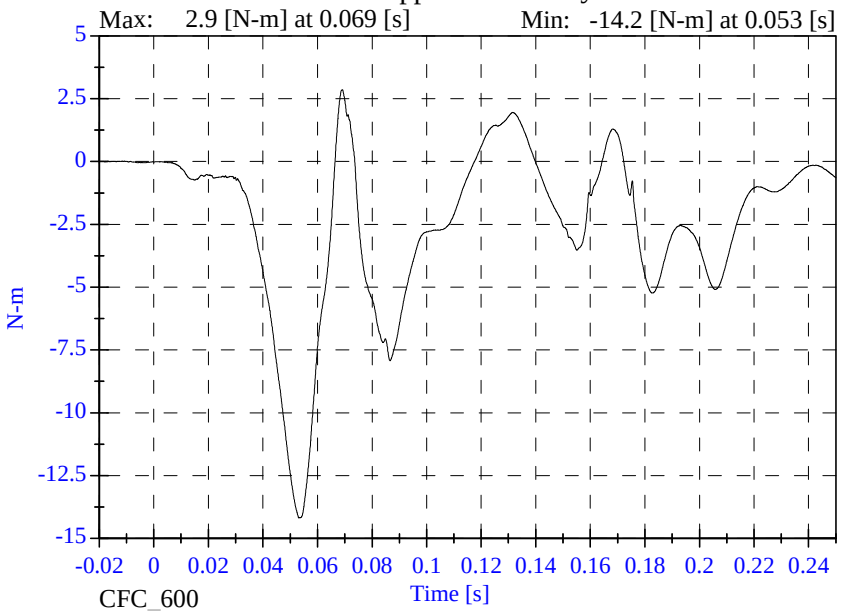
P4 Chest Compression



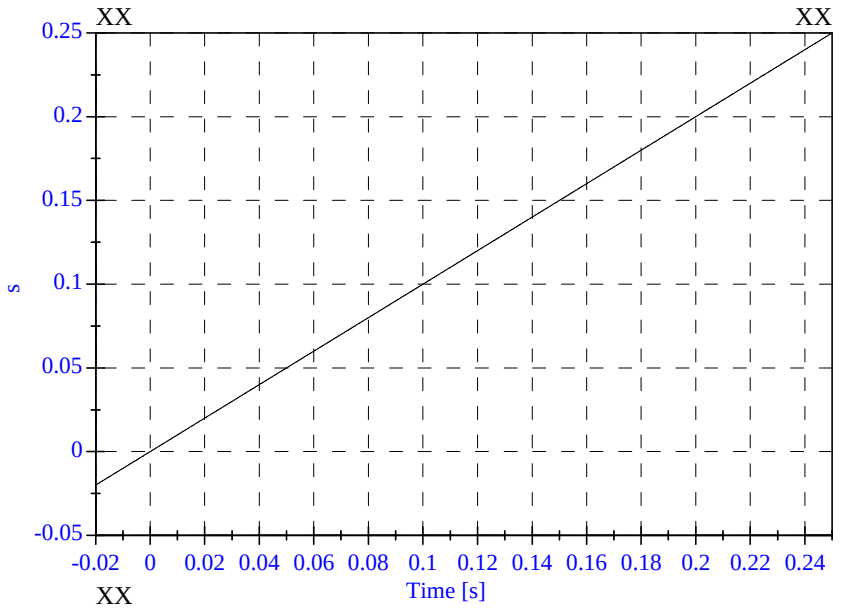
P4 Head Red z



P4 Upper Neck Mocy



BLANK



SECTION 9

Compression – Deflection Resistance Test

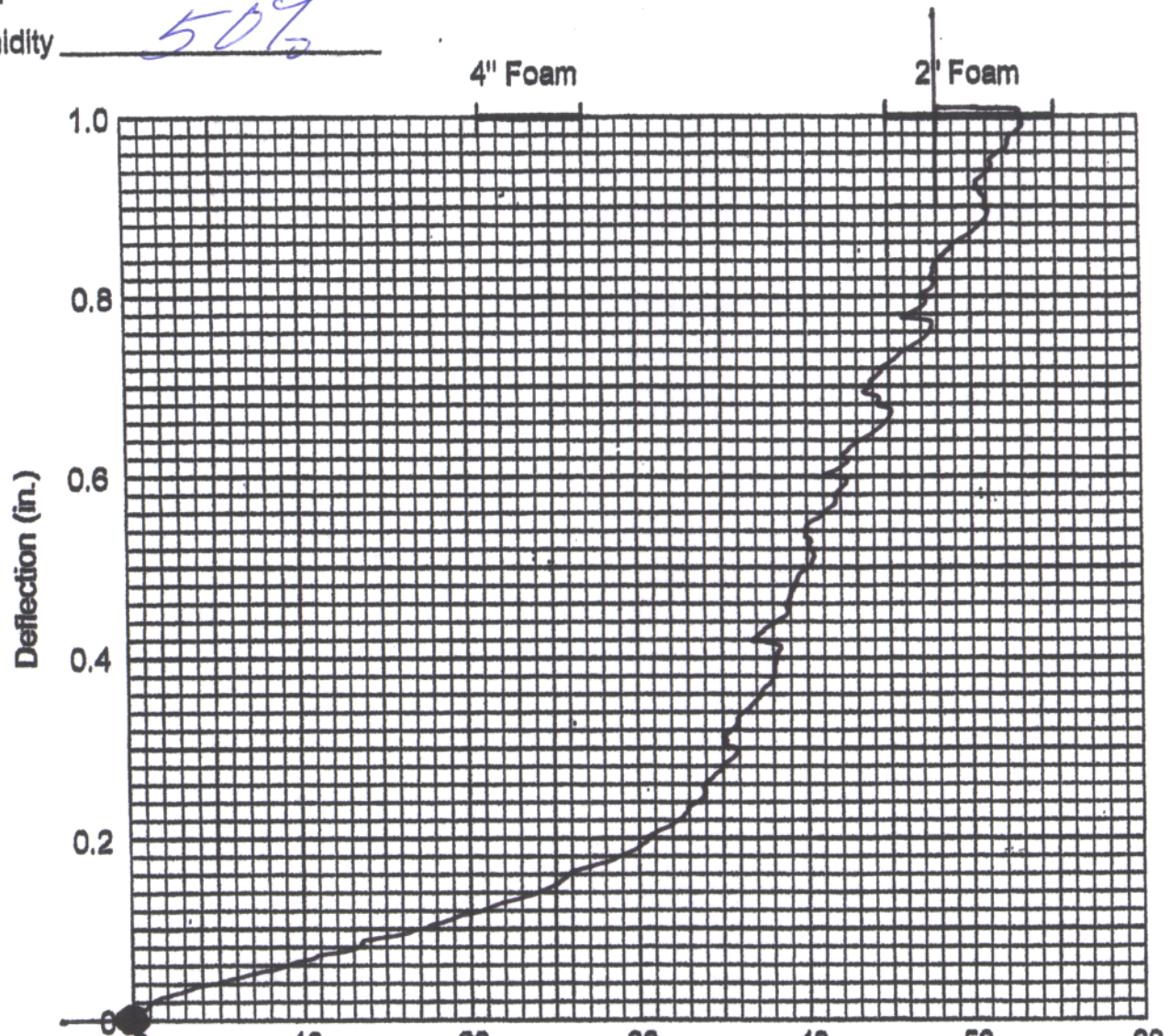
Date 7/31/03

Performed By SJ

Temp. 70°

Humidity 50%

Foam No. 2"x10"2"x19"12



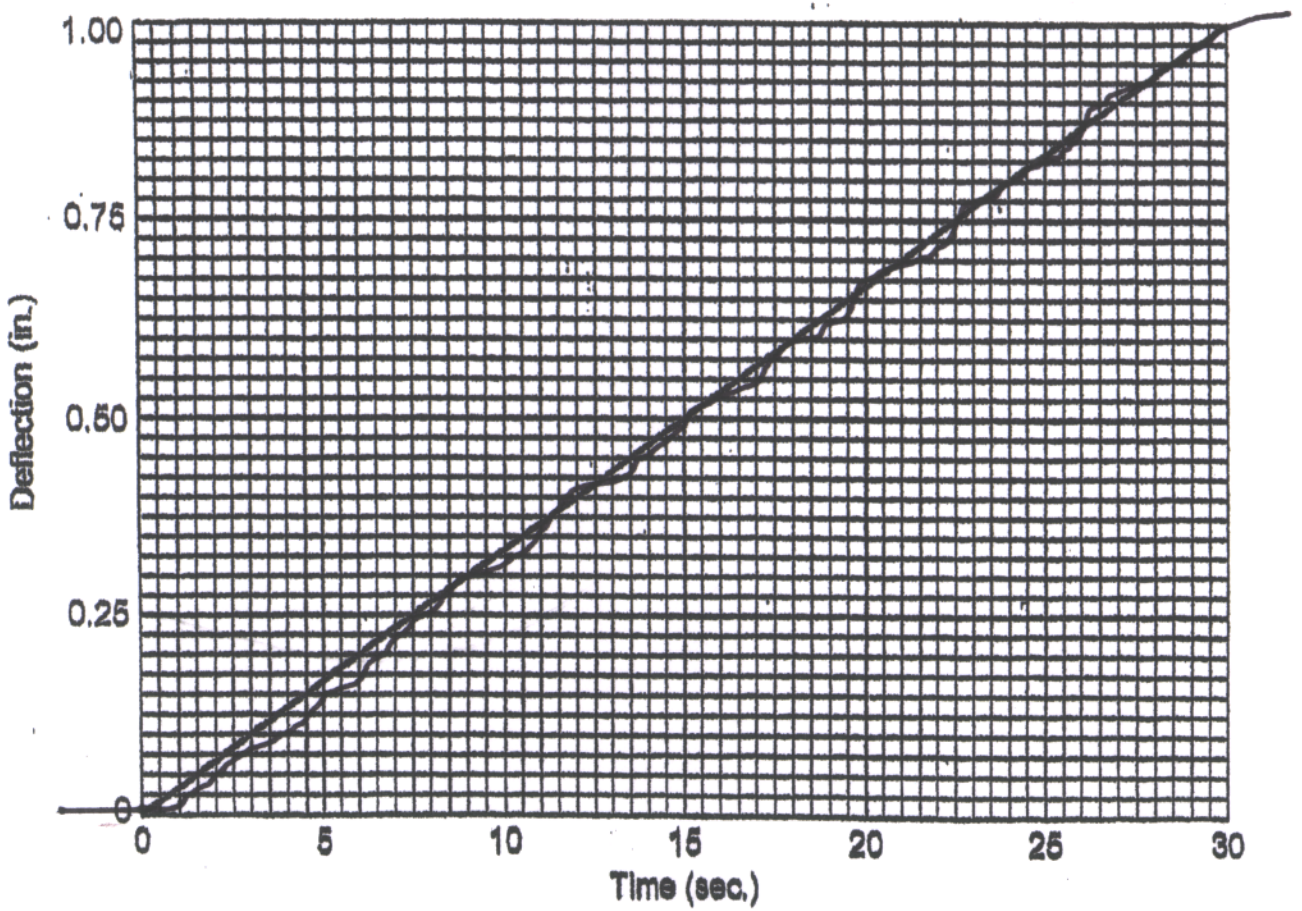
Compression - Deflection Resistance Test
Child Seat Foam

Date 7/31/05

Temp 70°

Humidity 50%

Foam No. 2"X20" 2"X24" 1 2



Compression - Deflection Resistance Test Child Seat Foam

SEAT FOAM USAGE LOG

Foam I.D. Number 2"X20" 2"X24" 12

Date	Peak Load	Pass/Fail
7/31/03	48LBS	

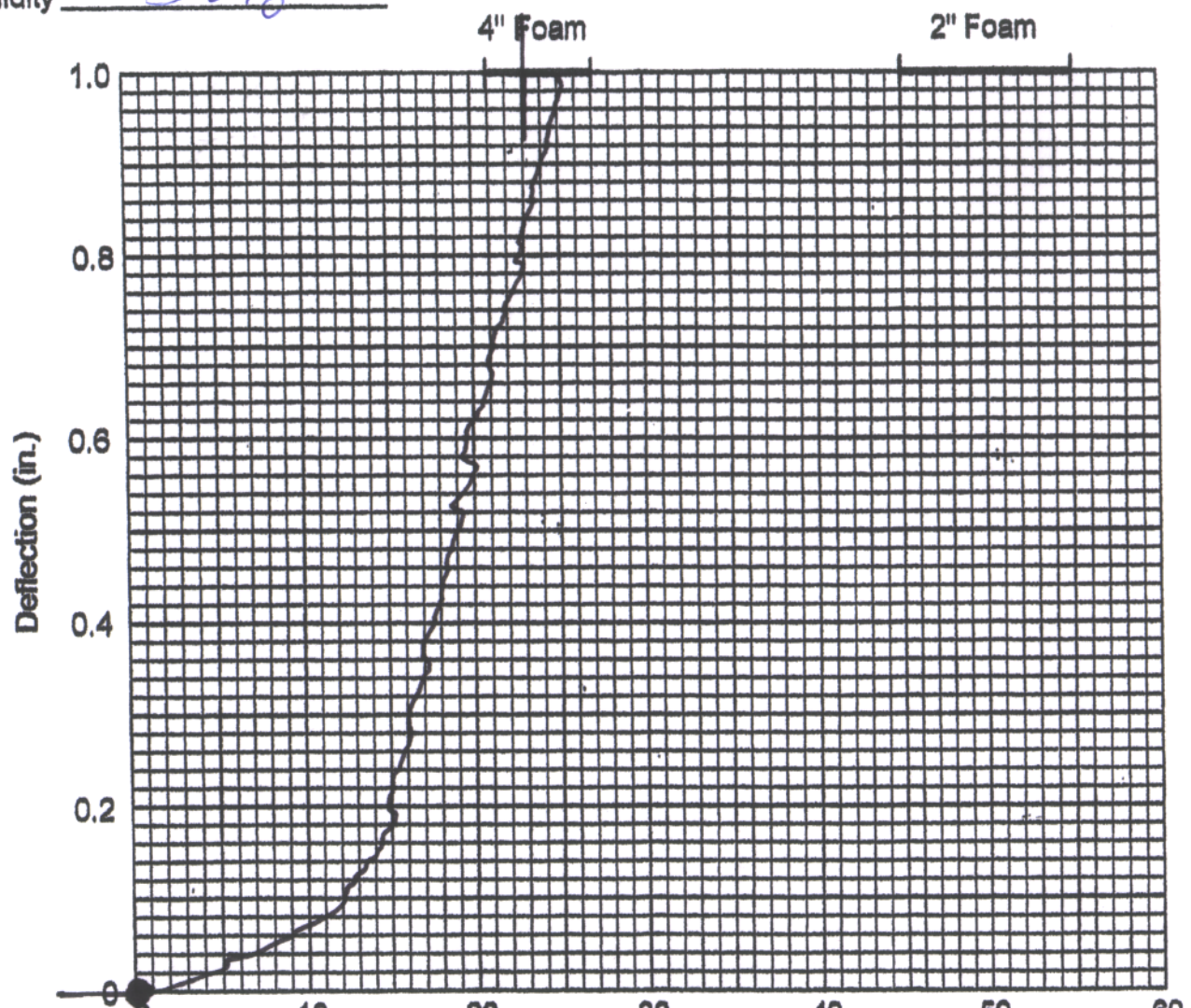
Date 7/31/03

Performed By SD

Temp. 70°

Humidity 50%

Foam No. 4"X20" I2



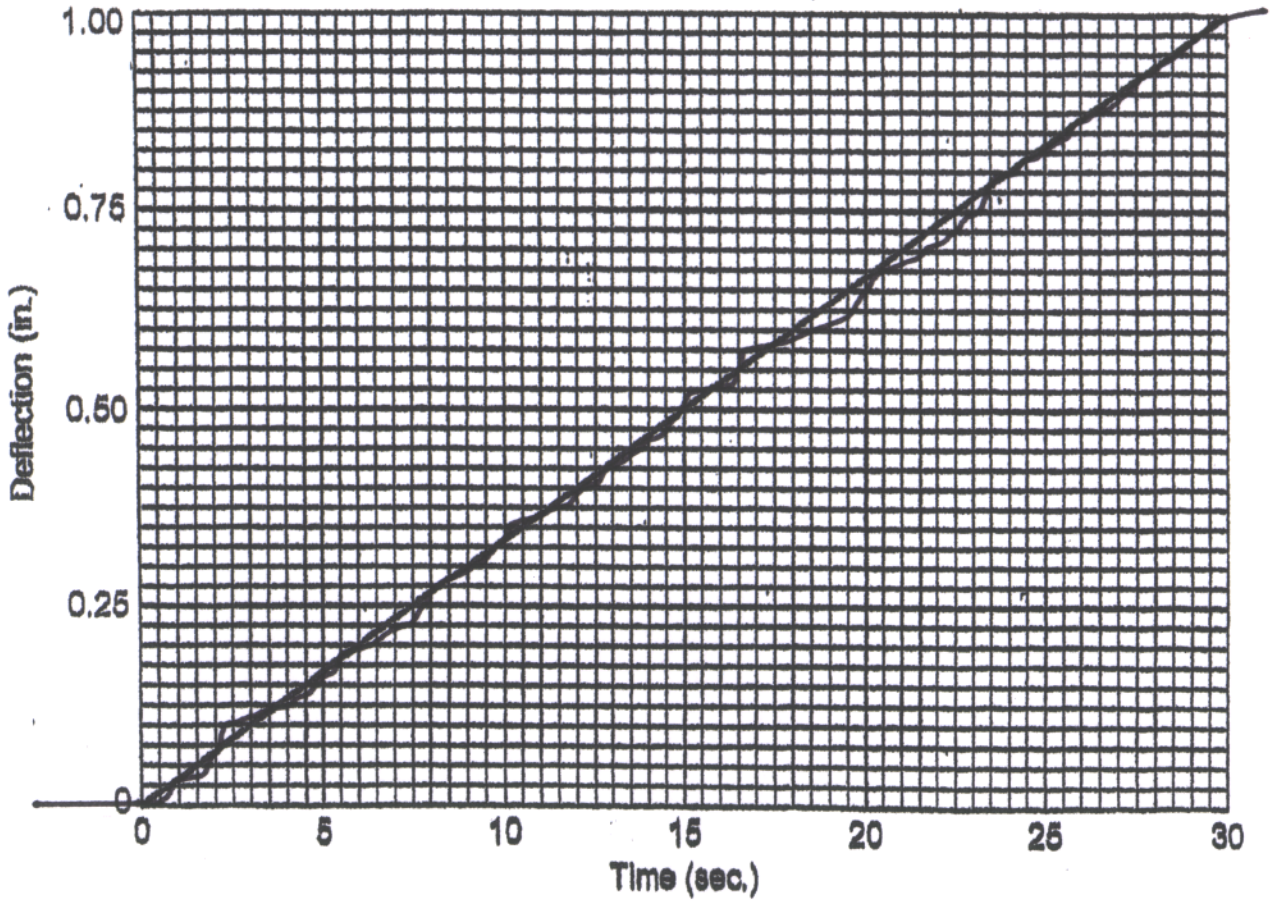
Compression - Deflection Resistance Test
Child Seat Foam

Date 7/31/02

Temp 70°

Humidity 50%

Foam No. 4"X20" I2



Compression - Deflection Resistance Test Child Seat Foam

SEAT FOAM USAGE LOG

Foam I.D. Number 4" X 20" I2

Date	Peak Load	Pass/Fail
4/30/03	234 BS	PASS

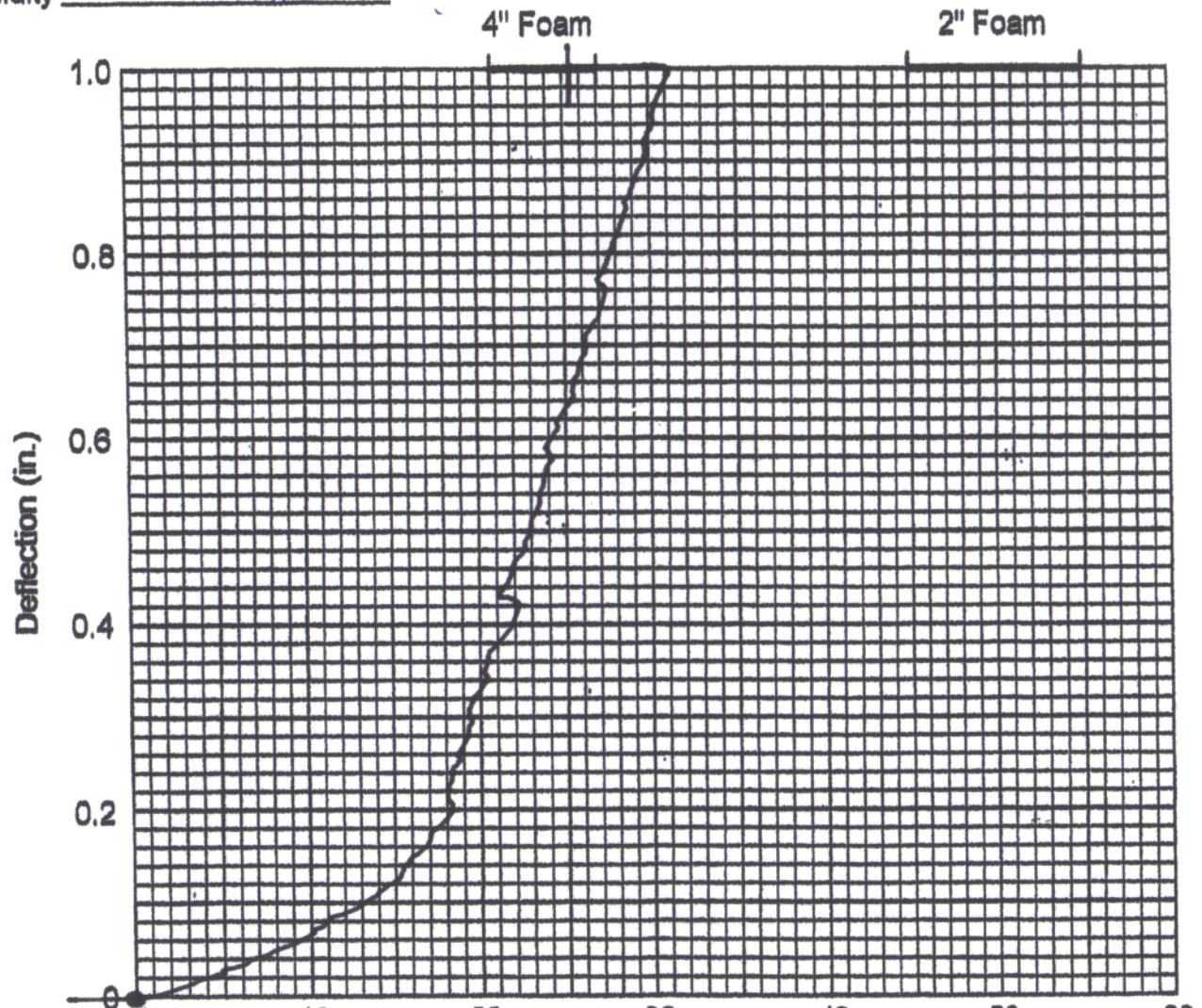
Date 7/31/03

Performed By SD

Temp. 70°

Humidity 50%

Foam No. 4" x 24" I2



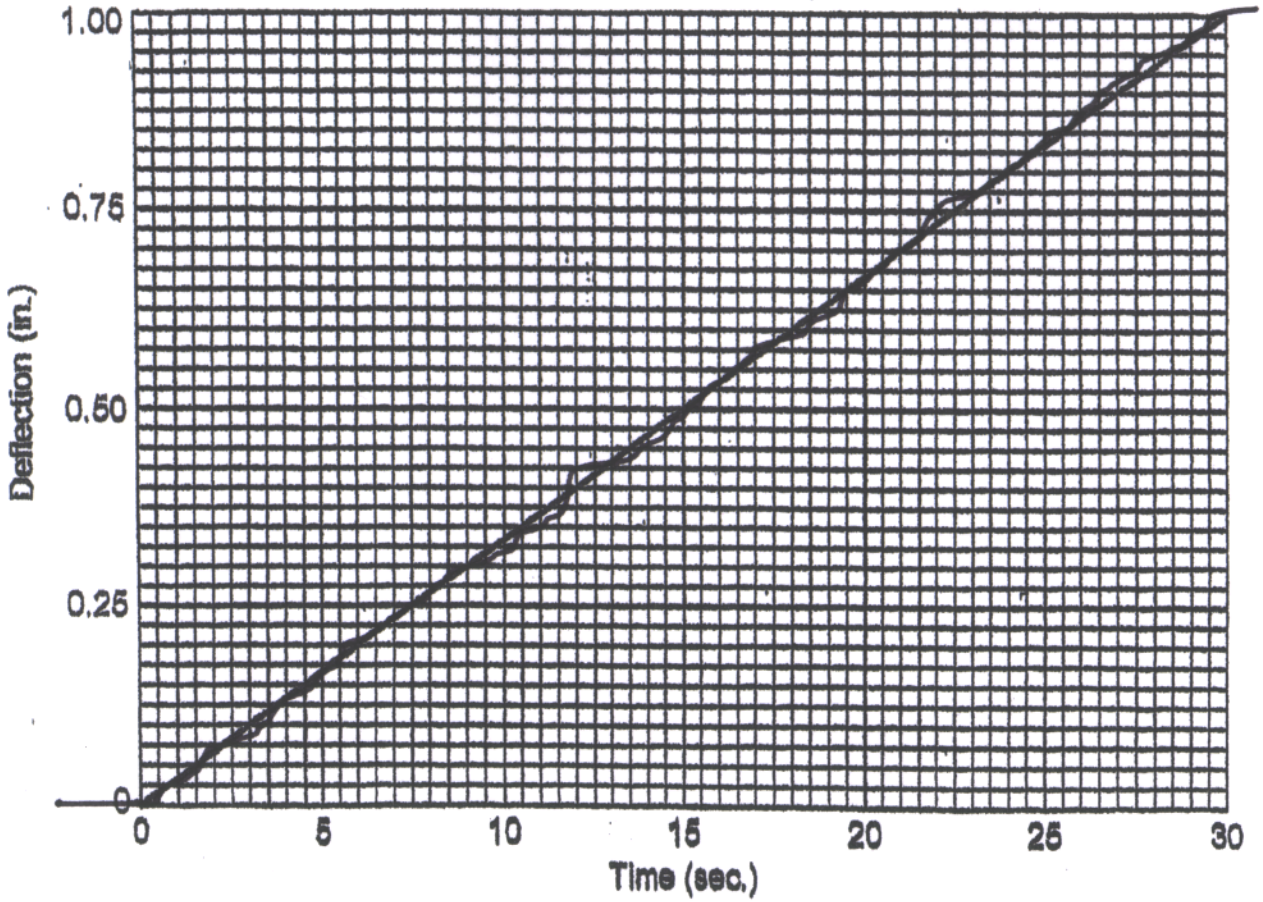
Compression - Deflection Resistance Test
Child Seat Foam

Date 7/31/02

Temp 70°

Humidity 50%

Foam No. 4"X24"I2



Compression - Deflection Resistance Test Child Seat Foam

SEAT FOAM USAGE LOG

Foam I.D. Number 4"X24"I2

Date	Peak Load	Pass/Fail
7/31/03	25.5 LBS	

SECTION 10

Child Dummy Calibration Data Traces and Tables

HYIII 3 Year Old Head Drop Test S/N:044

Part 572P Head Drop | Calibration Date: July 22, 2003

Serial No: 044 | Work File: 4001

----------TEST RESULTS----------

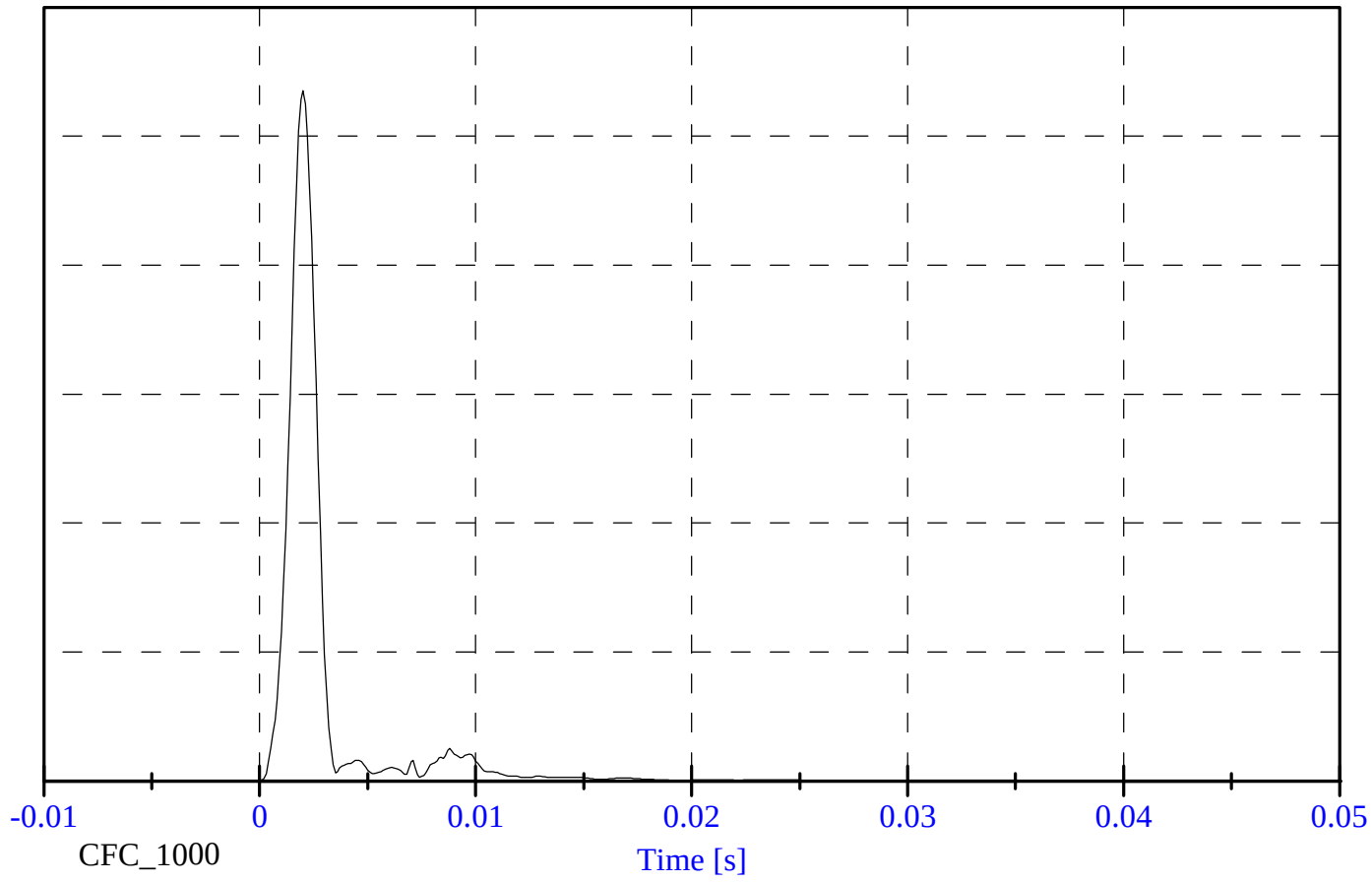
TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	66.0-78.0 F	70.0 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Peak Resultant Accel.:	250-280 Gs	267.66 Gs	Passed
Peak Lateral Accel.:	15 Gs Max	5.53 Gs	Passed
Curve PerCent NonModal:	< 10%	6.05 %	Passed

HYIII 3 Year Old Head Drop Test S/N:044

Head Resultant

Max: 267.7 [g] at 0.002 [s]

Min: 0.0 [g] at -0.080 [s]



Hybrid III Head Neck Extention Test S/N:044

Part 572P	Neck Extension Test	Calibration Date:	July 22, 2003
Serial No:	044	Work File:	4001

----------TEST RESULTS----------

TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	69.0-72.0 F	70.00 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Test Pendulum Speed:	11.58-12.38 ft/s	12.30 ft/s	Passed
----------PENDULUM PULSE----------			
Pulse at 6 ms:	3.30- 4.60 ft/s	3.89 ft/s	Passed
Pulse at 10 ms:	6.20- 8.20 ft/s	6.94 ft/s	Passed
Pulse at 14 ms:	9.20-11.50 ft/s	9.47 ft/s	Passed
----------D PLANE ROTATION----------			
Maximum Rotation:	83.0-93.0 Deg	86.18 Deg	Passed
----------MOMENT ABOUT THE OCCIPITAL CONDYLE----------			
Max Occipital Moment:	-53.30--43.70 N-m	-45.61 N-m	Passed
Occiptal Moment Decay:	60.0-80.0 ms	71.60 ms	Passed

Hybrid III 3 Year Old Head Neck Flexion Test S/N:044

Part 572P	Neck Flexion Test	Calibration Date:	July 22, 2003
Serial No:	044	Work File:	4001

----------TEST RESULTS----------

TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	20.6-22.2 C	21.11 C	Passed
Lab Humidity:	10-70 %	36.00 %	Passed
Test Pendulum Speed:	5.40- 5.60 m/s	5.60 m/s	Passed
----------PENDULUM PULSE----------			
Pulse at 10 ms:	2.00- 2.70 m/s	2.13 m/s	Passed
Pulse at 15 ms:	3.00- 4.00 m/s	3.10 m/s	Passed
Pulse at 20 ms:	4.00- 5.10 m/s	4.20 m/s	Passed
----------D PLANE ROTATION----------			
Maximum Rotation:	70.0-82.0 Deg	81.53 Deg	Passed
----------MOMENT ABOUT THE OCCIPITAL CONDYLE----------			
Max Occipital Moment:	42.00- 53.00 N-m	47.85 N-m	Passed
Occiptal Moment Decay:	60.0-80.0 ms	74.00 ms	Passed

Hybrid III 3 Year Old Thorax Test S/N:044

Part 572P Thorax Impact — Calibration Date: July 22, 2003

Serial No: 044 — Work File: 4001

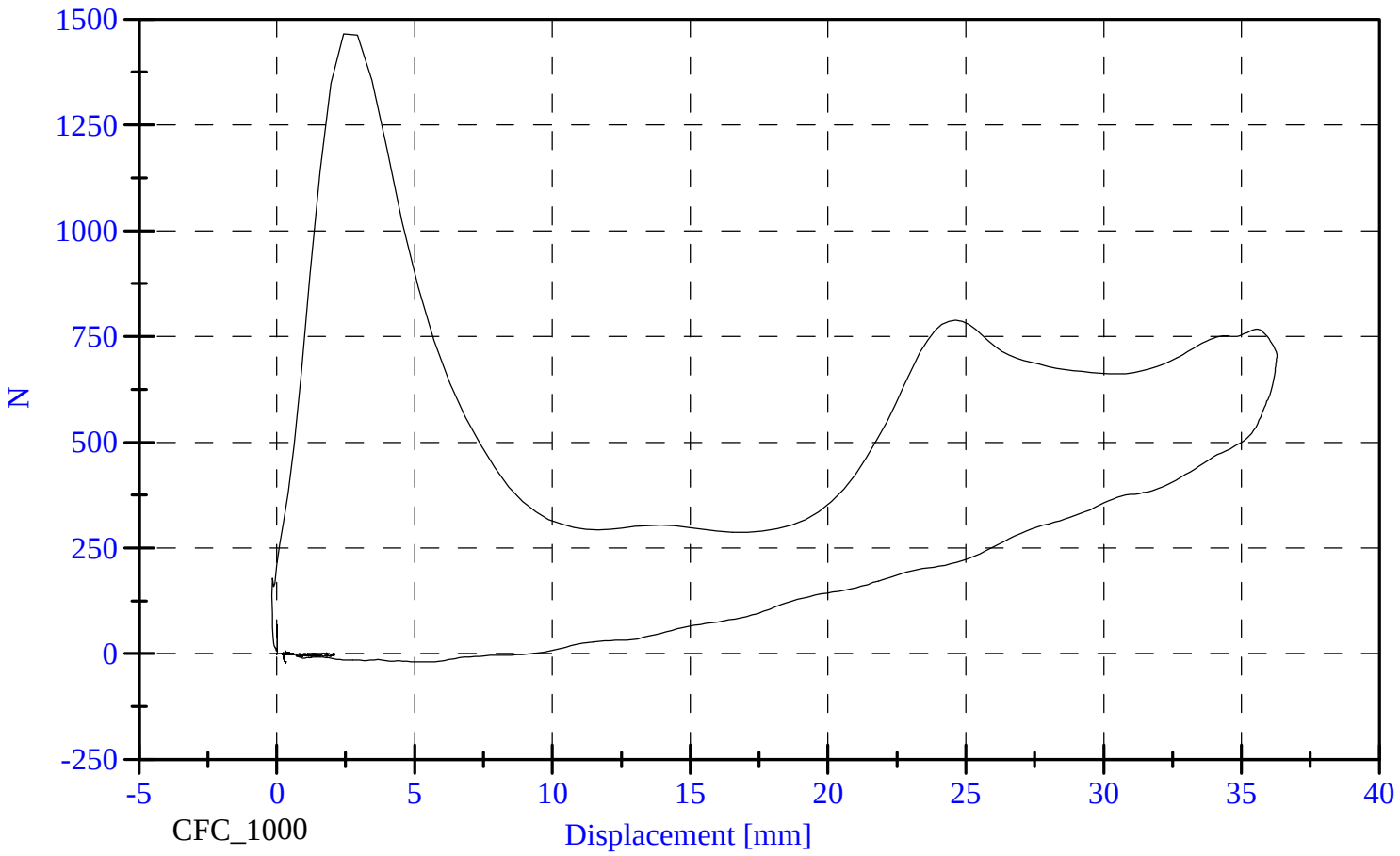
----------TEST RESULTS----------

TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	20.6-22.2 C	21.1 C	Passed
Lab Humidity:	10-70 %	36.00 %	Passed
Pendulum Velocity:	5.90- 6.10 m/s	6.08 m/s	Passed
Maximum Deflection:	32.00-38.00 mm	36.28 mm	Passed
Maximum Res. Force:	680.00- 810.00 N	767.48 N	Passed
Internal Hysteresis:	65-85 %	73.20 %	Passed
Pass Sternum Force Criteria?:	860.00 N	788.71	Passed

Hybrid III 3 Year Old Thorax Test S/N:044 — Probe Force vs. Displacement

Max: 1465.5 [N] at 2.421 [mm

Min: -21.7 [N] at 0.325 [mm]



HYIII 3 Year Old Head Drop Test S/N:142

Part 572P Head Drop | Calibration Date: July 21, 2003

Serial No: 142 | Work File: 4001

----------TEST RESULTS----------

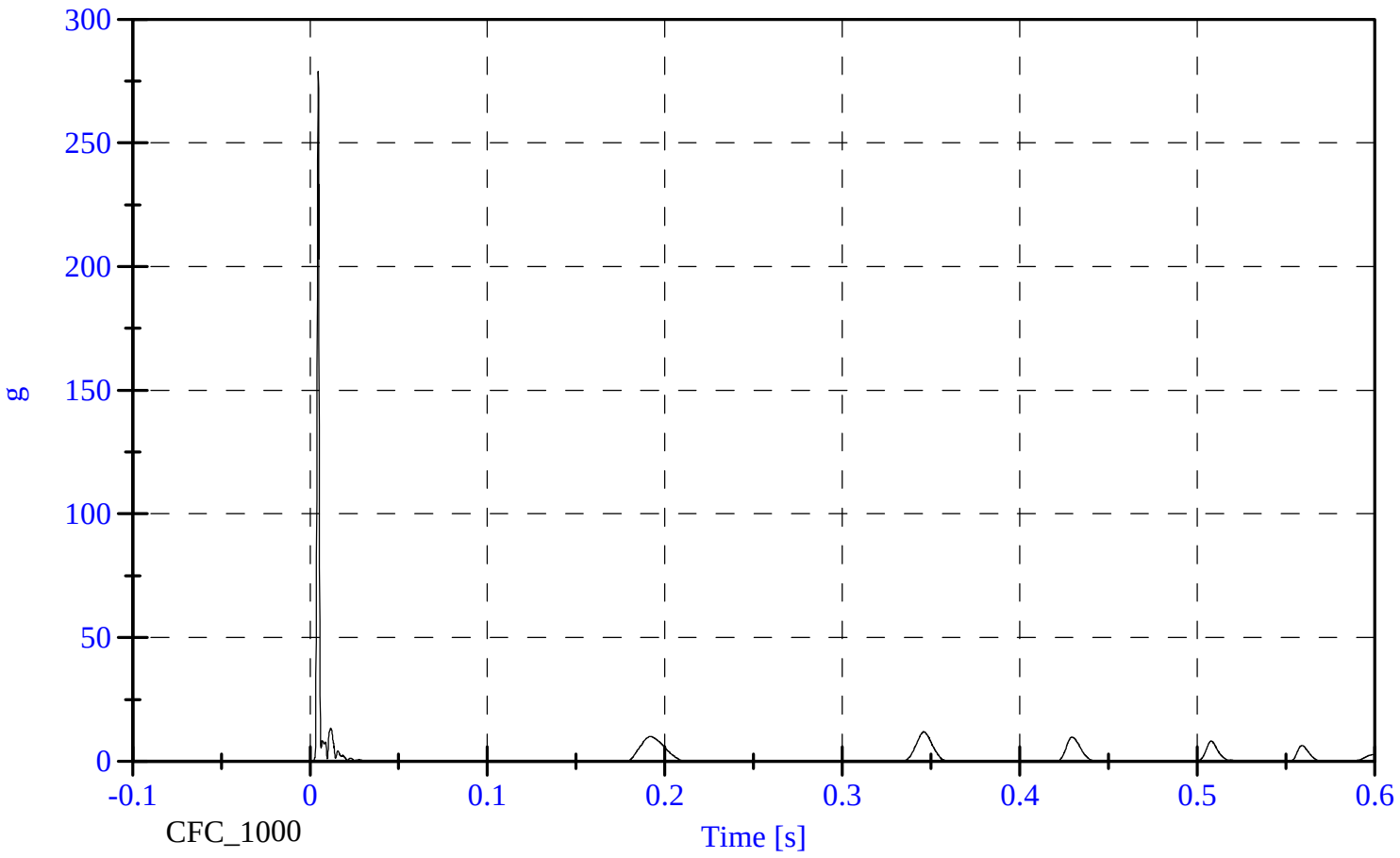
TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	66.0-78.0 F	70.0 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Peak Resultant Accel.:	250-280 Gs	279.06 Gs	Passed
Peak Lateral Accel.:	15 Gs Max	14.76 Gs	Passed
Curve PerCent NonModal:	< 10%	4.82 %	Passed

HYIII 3 Year Old Head Drop Test S/N:142

Head Resultant

Max: 279.1 [g] at 0.005 [s]

Min: 0.0 [g] at 0.398 [s]



Hybrid III Head Neck Extention Test S/N:142

Part 572P	Neck Extension Test	Calibration Date:	July 16, 2003
Serial No:	142	Work File:	4001

----------TEST RESULTS----------

TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	69.0-72.0 F	70.00 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Test Pendulum Speed:	11.58-12.38 ft/s	12.30 ft/s	Passed
----------PENDULUM PULSE----------			
Pulse at 6 ms:	3.30- 4.60 ft/s	3.88 ft/s	Passed
Pulse at 10 ms:	6.20- 8.20 ft/s	6.82 ft/s	Passed
Pulse at 14 ms:	9.20-11.50 ft/s	9.36 ft/s	Passed
----------D PLANE ROTATION----------			
Maximum Rotation:	83.0-93.0 Deg	84.20 Deg	Passed
----------MOMENT ABOUT THE OCCIPITAL CONDYLE----------			
Max Occipital Moment:	-53.30--43.70 N-m	-44.75 N-m	Passed
Occiptal Moment Decay:	60.0-80.0 ms	65.30 ms	Passed

Hybrid III 3 Year Old Head Neck Flexion Test S/N:142

Part 572P	Neck Flexion Test	Calibration Date:	July 16, 2003
Serial No:	142	Work File:	4001

----------TEST RESULTS----------

TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	69.0-72.0 F	70.00 F	Passed
Lab Humidity:	10-70 %	35.00 %	Passed
Test Pendulum Speed:	17.65-18.45 ft/s	18.34 ft/s	Passed
----------PENDULUM PULSE----------			
Pulse at 10 ms:	6.60- 8.90 ft/s	7.19 ft/s	Passed
Pulse at 15 ms:	9.80-13.10 ft/s	10.46 ft/s	Passed
Pulse at 20 ms:	13.10-16.70 ft/s	14.31 ft/s	Passed
----------D PLANE ROTATION----------			
Maximum Rotation:	70.0-82.0 Deg	77.80 Deg	Passed
----------MOMENT ABOUT THE OCCIPITAL CONDYLE----------			
Max Occipital Moment:	42.00- 53.00 N-m	50.03 N-m	Passed
Occiptal Moment Decay:	60.0-80.0 ms	73.8 ms	Passed

Hybrid III 3 Year Old Thorax Test S/N:142

Part 572P Thorax Impact — Calibration Date: July 21, 2003

Serial No: 142 — Work File: 4001

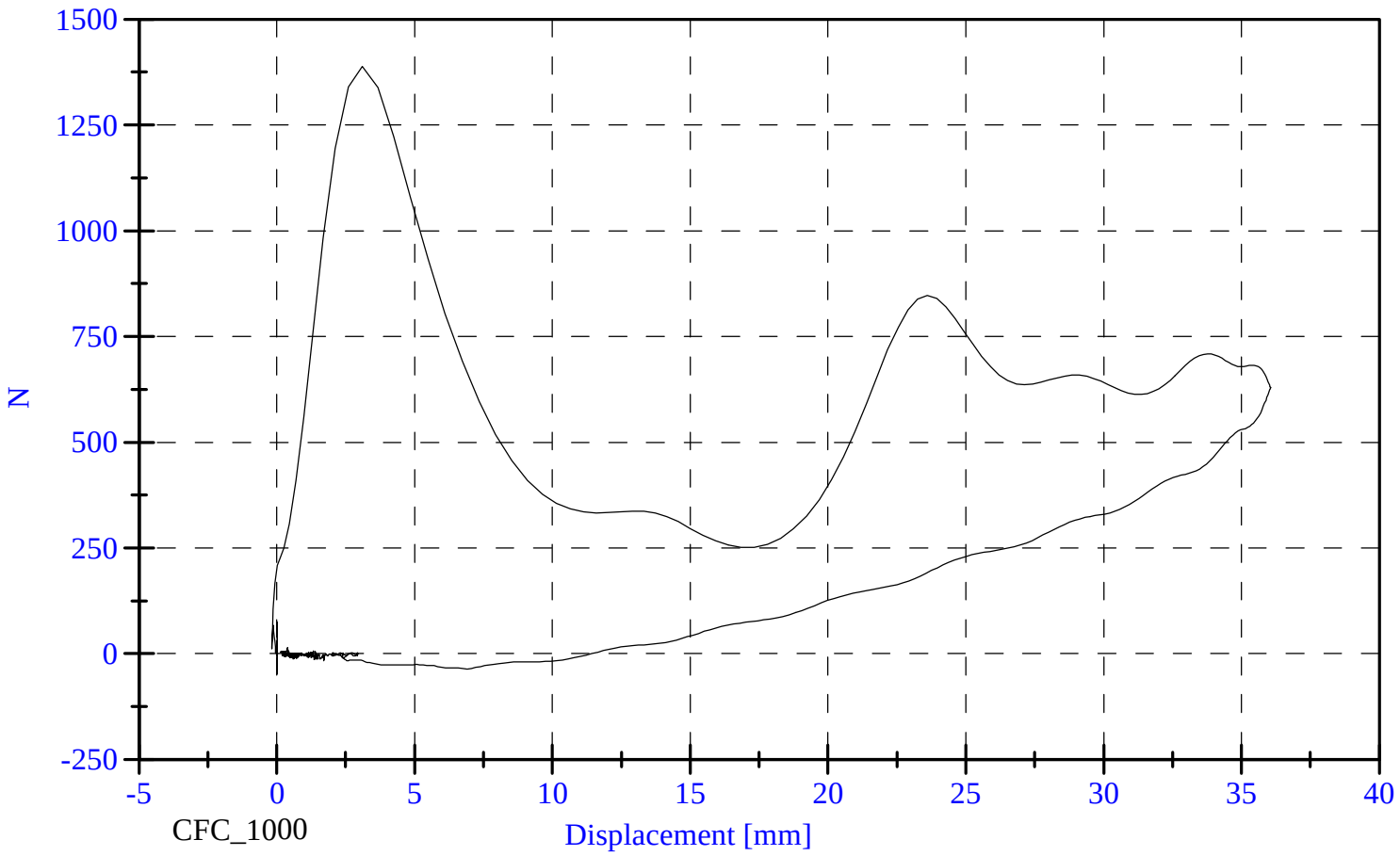
----------TEST RESULTS----------

TEST CONDITION	PARAMETERS	RESULTS	STATUS
Lab Temperature:	20.6-22.2 C	21.1 C	Passed
Lab Humidity:	10-70 %	34.00 %	Passed
Pendulum Velocity:	5.90- 6.10 m/s	6.07 m/s	Passed
Maximum Deflection:	32.00-38.00 mm	36.06 mm	Passed
Maximum Res. Force:	680.00- 810.00 N	709.45 N	Passed
Internal Hysteresis:	65-85 %	75.47 %	Passed
Pass Sternum Force Criteria?:	860.00 N	846.79	Passed

Hybrid III 3 Year Old Thorax Test S/N:142 — Probe Force vs. Displacement

Max: 1388.0 [N] at 3.104 [mm

Min: -48.5 [N] at 0.011 [mm]



SECTION 11

Test Equipment and Instrumentation Calibration

CALIBRATION DATA FOR TEST 07-3-05

SHORTNAME	SENSCOM	CALDATE
Sled Ax	MFG: ENDEVCO S/N: 24144	7/24/2003
P3 Head Ax	MFG: ENDEVCO S/N: P17912	7/17/2003
P3 Head Ay	MFG: ENDEVCO S/N: P17743	10/5/2001
P3 Head Ay	MFG: ENDEVCO S/N: P17743	7/17/2003
P3 Head Az	MFG: ENDEVCO S/N: P15319	6/26/2003
P3 Rendundant Head RAz	MFG: ENDEVCO S/N: P16279	6/25/2003
P3 Chest Ax	MFG: ENDEVCO S/N: P15334	7/17/2003
P3 Chest Ay	MFG: ENDEVCO S/N: P15321	7/17/2003
P3 Chest Az	MFG: ENDEVCO S/N: P17758	7/17/2003
P3 Chest Dx	MFG: SERVO S/N: 044	7/22/2003
P3 Pelvic Ax	MFG: ENDEVCO S/N: P16755	7/17/2003
P3 Pelvic Ay	MFG: ENDEVCO S/N: P15591	7/17/2003
P3 Pelvic Az	MFG: ENDEVCO S/N: P16155	7/17/2003
P3 Upper Neck Load Cell Fx	MFG: Denton S/N: 248-FX	7/18/2003
P3 Upper Neck Load Cell Fy	MFG: Denton S/N: 248-FY	7/18/2003
P3 Upper Neck Load Cell Fz	MFG: Denton S/N: 248-FZ	7/18/2003
P3 Upper Neck Load Cell Mx	MFG: Denton S/N: 248-MX	7/18/2003
P3 Upper Neck Load Cell My	MFG: Denton S/N: 248-MY	7/18/2003
P3 Upper Neck Load Cell Mz	MFG: Denton S/N: 248-MZ	7/18/2003
P3 Lower Neck Load Cell Fx	MFG: Denton S/N: 249Fx	7/18/2003
P3 Lower Neck Load Cell Fy	MFG: Denton S/N: 249Fy	7/18/2003
P3 Lower Neck Load Cell Fz	MFG: Denton S/N: 249Fz	7/18/2003
P3 Lower Neck Load Cell Mx	MFG: Denton S/N: 249Mx	7/18/2003
P3 Lower Neck Load Cell My	MFG: Denton S/N: 249My	7/18/2003
P3 Lower Neck Load Cell Mz	MFG: Denton S/N: 249Mz	7/18/2003
P4 Head Ax	MFG: ENTRAN S/N: 99108-F29	7/15/2003
P4 Head Ay	MFG: ENTRAN S/N: 99102-F12	7/15/2003
P4 Head Az	MFG: ENTRAN S/N: 00L13-F03	7/15/2003
P4 Redundant Head RAz	MFG: ENTRAN S/N: 98G18-F18	7/15/2003
P4 Chest Ax	MFG: ENTRAN S/N: 99108-F30	7/15/2003
P4 Chest Ay	MFG: ENTRAN S/N: 99108-F28	7/15/2003
P4 Chest Az	MFG: ENTRAN S/N: 99H30-Z04	7/15/2003
P4 Chest Dx	MFG: SERVO S/N: 142	7/22/2003
P4 Pelvic Ax	MFG: ENTRAN S/N: 99102-F06	7/15/2003
P4 Pelvic Ay	MFG: ENTRAN S/N: 99102-F15	7/15/2003
P4 Pelvic Az	MFG: ENTRAN S/N: 99G29-Q13	7/15/2003
P4 Upper Neck Load Cell Fx	MFG: Denton S/N: 213-FX	7/21/2003
P4 Upper Neck Load Cell Fy	MFG: Denton S/N: 213-Fy	7/21/2003
P4 Upper Neck Load Cell Fz	MFG: Denton S/N: 213-Fz	7/21/2003
P4 Upper Neck Load Cell Mx	MFG: Denton S/N: 213-Mx	7/21/2003
P4 Upper Neck Load Cell My	MFG: Denton S/N: 213-My	7/21/2003
P4 Upper Neck Load Cell Mz	MFG: Denton S/N: 213-Mz	7/21/2003
P4 Lower Neck Load Cell Fx	MFG: Denton S/N: 214Fx	7/21/2003
P4 Lower Neck Load Cell Fy	MFG: Denton S/N: 214-Fy	7/21/2003
P4 Lower Neck Load Cell Fz	MFG: Denton S/N: 214-Fz	7/21/2003
P4 Lower Neck Load Cell Mx	MFG: Denton S/N: 214-Mx	7/21/2003
P4 Lower Neck Load Cell My	MFG: Denton S/N: 214-My	7/21/2003
P4 Lower Neck Load Cell Mz	MFG: Denton S/N: 214-Mz	7/21/2003

SECTION 12

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