

REPORT NUMBER: SLED-VER-2002-02

**CHILD RESTRAINT SYSTEM IN
DYNAMIC SLED TEST
SAFETY FIRST FORERUNNER, FORWARD-FACING UPRIGHT, CONVERTIBLE**

TEST NUMBER: 22222

**PREPARED BY:
VERIDIAN ENGINEERING
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BUFFALO, NEW YORK 14225**



March 18, 2002

FINAL REPORT

**PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF CRASHWORTHINESS STANDARDS
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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

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Date of Acceptance

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SECTION 1

PURPOSE AND TEST PROCEDURE

1.1 PURPOSE

This dynamic sled testing is part of the FY' 02 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 Office of Crashworthiness Standards (OCS), New Car Assessment Program (NCAP).

The test was conducted at Veridian Engineering on March 18, 2002 at a speed of 46.7 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 one anthropomorphic test device (ATD). One (1) Hybrid III 3 year old size ATD, Serial Number 142, was instrumented with head, chest, and pelvic tri-axial accelerometers, and upper and lower neck load cells. The child ATD was 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.

1.3 POST-TEST COMMENTS

The shell was stressed heavily at the tether anchor.

SECTION 2

CHILD RESTRAINT INFORMATION

Test No.: 22222

Test Date: March 18, 2002

Child Restraint Type (forward-facing, rearward facing, booster)	Forward-Facing, Upright, Convertible
LATCH or NON-LATCH	Latch
Child Restraint Manufacturer	Safety First
Child Restraint Model	Forerunner
Model Number	02925BRD
Date of Manufacture	1/12/2002
Child Restraint Height Limits (mm)	482.6 - 1016.0
Child Restraint Weight Limits (kg)	2.3 – 18.0
Weight of Child Restraint (kg)	4.35
Tether Location	Upper

SECTION 3

POST-TEST OBSERVATIONS

Test No.: 22222

Test Date: March 18, 2002

Child Seat	Safety First Forerunner
Belt Fraying	None
Stress Marks	Shell stressed heavily at tether anchor
Cracks	None
Buckle Stress	None
Latch Hooks	None
Max. Head Excursion (mm)	632.5
Max. Knee Excursion (mm)	660.4
Velocity	29.0 mph, 46.7 kph
Acceleration (G's)	23.1

SECTION 4

HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA

Test No.: 22222

Test Date: March 18, 2002

HEAD PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Head CG	X	G's	44.0	185.6	-57.7	90.7
Head CG	Y	G's	3.2	92.2	-13.2	89.9
Head CG	Z	G's	58.1	74.1	0.0	0.8
Head CG Resultant	N/A	G's	61.2	90.6		

CHEST PRIMARY PEAK ACCELERATIONS

Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	G's	13.0	165.6	-34.0	52.7
Chest CG	Y	G's	3.6	50.5	-6.2	188.5
Chest CG	Z	G's	12.8	78.1	-35.2	53.2
Chest CG Resultant	N/A	G's	48.9	53.0		

SEAT BELT SENSOR PEAK VALUES

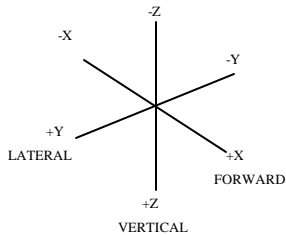
Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Tether Belt	N/A	Newtons	----	----		

HEAD INJURY CRITERIA (HIC)

Location	P6 (Center) Rear Passenger			
	HIC	Avg. G's	T ¹	T ²
Head CG Primary (36 msec)	588	48.4	59.4	95.4
Head CG Primary (15 msec)	369	57.1	65.5	80.5

CHEST CLIP (3 MSEC)

Location	P6 (Center) Rear Passenger		
	Clip	T ¹	T ²
Chest CG Primary	48.2	52.1	55.1



HYBRID III 3 YEAR OLD ATD INJURY CRITERIA AND SENSOR DATA...(continued)

Test No.: 22222

Test Date: March 18, 2002

PELVIC PEAK ACCELERATIONS

Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Pelvis	X	G's	13.2	104.8	-48.1	54.1
Pelvis	Y	G's	3.3	200.6	-5.6	59.1
Pelvis	Z	G's	9.3	190.2	-51.8	54.4

UPPER NECK PEAK FORCES AND MOMENTS

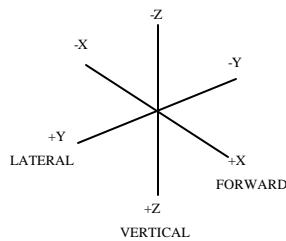
Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	121.7	168.6	-803.7	90.1
Neck Force	Y	Newtons	74.4	90.1	-43.0	167.5
Neck Force	Z	Newtons	1535.2	74.0	-0.9	199.9
Neck Moment	X	Nm	3.4	71.3	-2.5	229.5
Neck Moment	Y	Nm	5.8	139.3	-12.6	195.8
Neck Moment	Z	Nm	1.7	146.0	-1.8	173.4

LOWER NECK PEAK FORCES AND MOMENTS

Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Neck Force	X	Newtons	297.5	183.9	-1107.1	79.3
Neck Force	Y	Newtons	14.5	250.0	-170.1	79.6
Neck Force	Z	Newtons	1054.8	70.4	-221.5	52.4
Neck Moment	X	Nm	7.1	91.5	-5.4	167.1
Neck Moment	Y	Nm	116.9	89.2	-19.1	183.7
Neck Moment	Z	Nm	4.2	66.3	-2.1	188.6

CHEST PEAK DISPLACEMENTS

Location	Axis	Units	P6 (Center) Rear Passenger			
			Max	Time	Min	Time
Chest CG	X	mm			-21.4	91.3



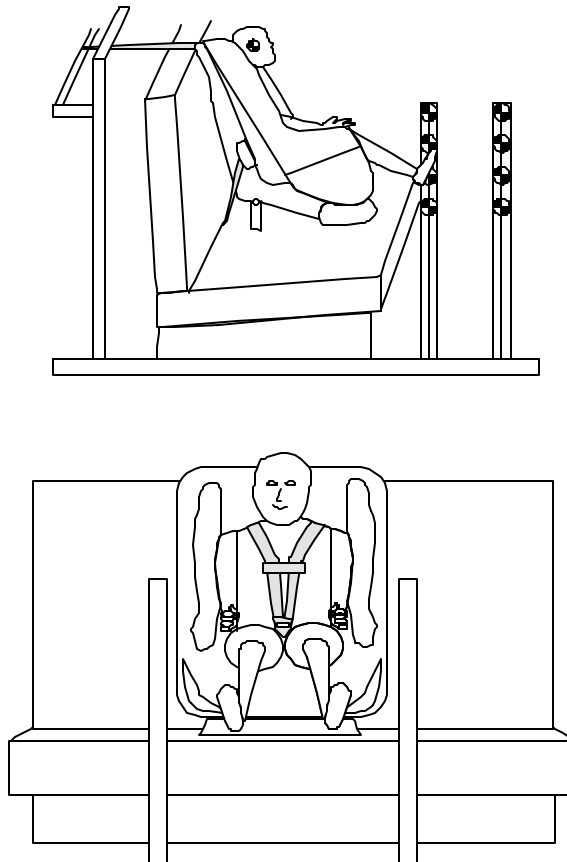
SECTION 5
SLED TEST SET-UP

Test No.: 22222

Test Date: March 18, 2002

An FMVSS 213 test bench was fixtured on the sled in order to simulate a frontal impact. One child seat was 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

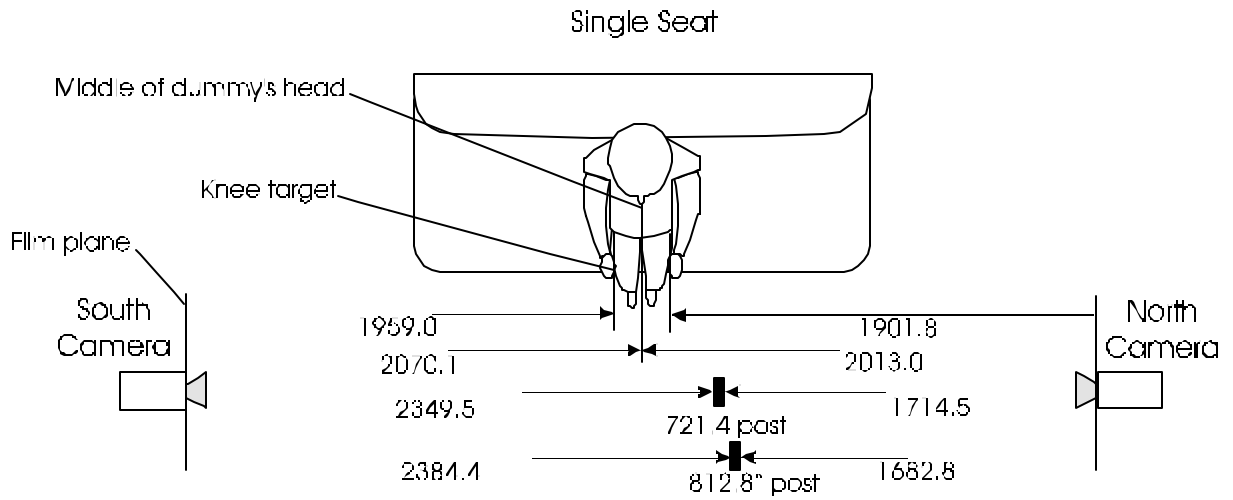


SECTION 6
CAMERA LOCATION

Test No.: 22222

Test Date: March 18, 2002

There were two cameras mounted onto the sled carriage for views of the left and right side of the child seat. All measurements are in millimeters.



SECTION 7
PHOTOGRAPHS

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Run #22222 Photo 1 - Pre-Test Right 3/4 View



Run #22222 Photo 2 - Post-Test Right 3/4 View



Run #22222 Photo 3 - Pre-Test Right Side View



Run #22222 Photo 4 - Post-Test Right Side View



Run #22222 Photo 5 - Pre-Test Left 3/4 View
13



Run #22221 Photo 6 - Post-Test Left 3/4 View

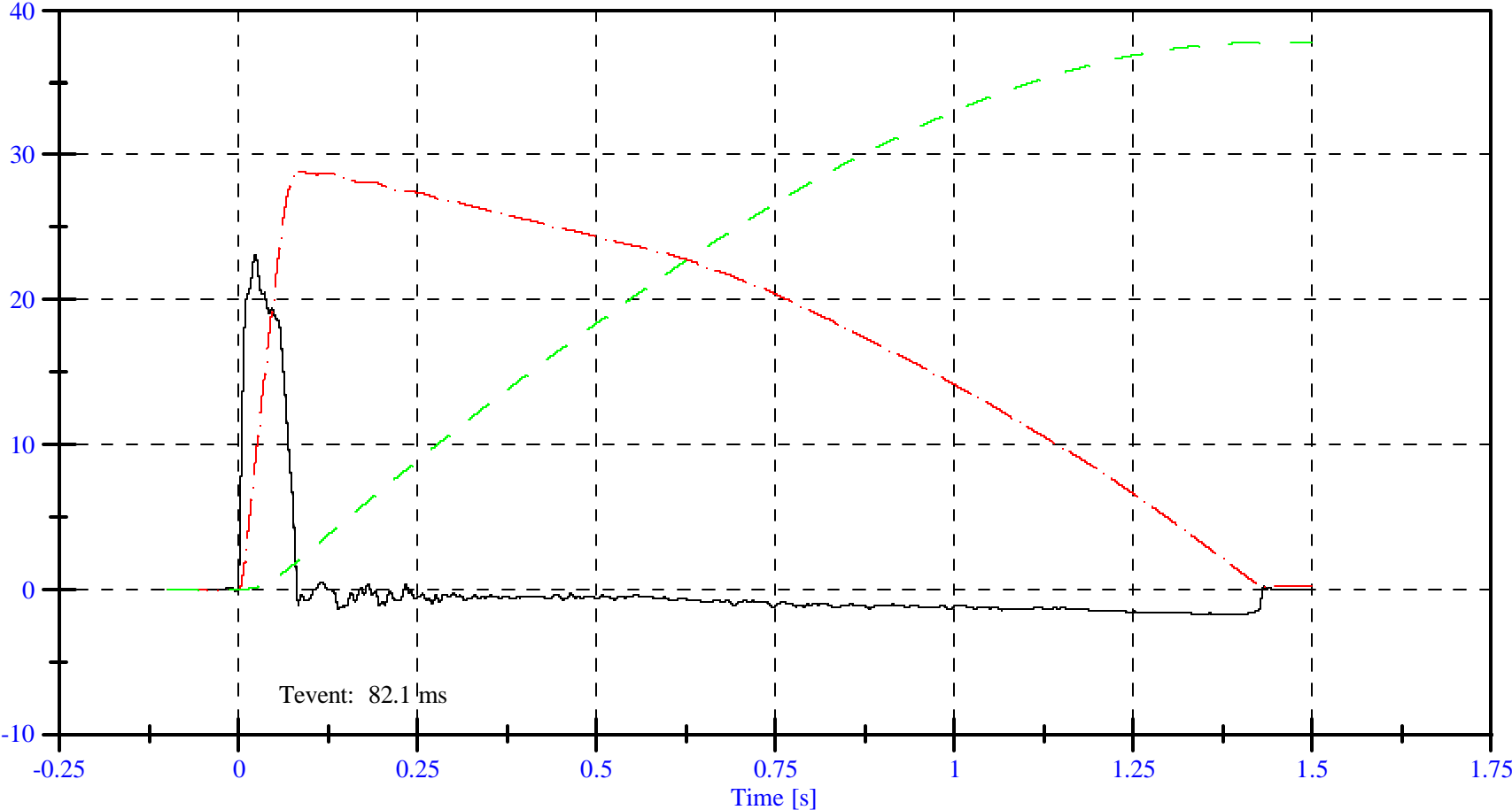


Run #22222 Photo 7 - Pre-Test Left Side View



Run #22222 Photo 8 - Post-Test Left Side View

SECTION 8
DATA PLOTS



		Maximum	Time (ms)	Minimum	Time (ms)	Filter Class
Sled Ax	(g)	23.1	24.0	-1.7	1366.4	CFC_60
Sled Vx	(mph)	29.0	82.1	-0.0	-21.3	CFC_180
Sled Dx	(ft)	37.8	1500.3	-0.0	-9.7	CFC_180

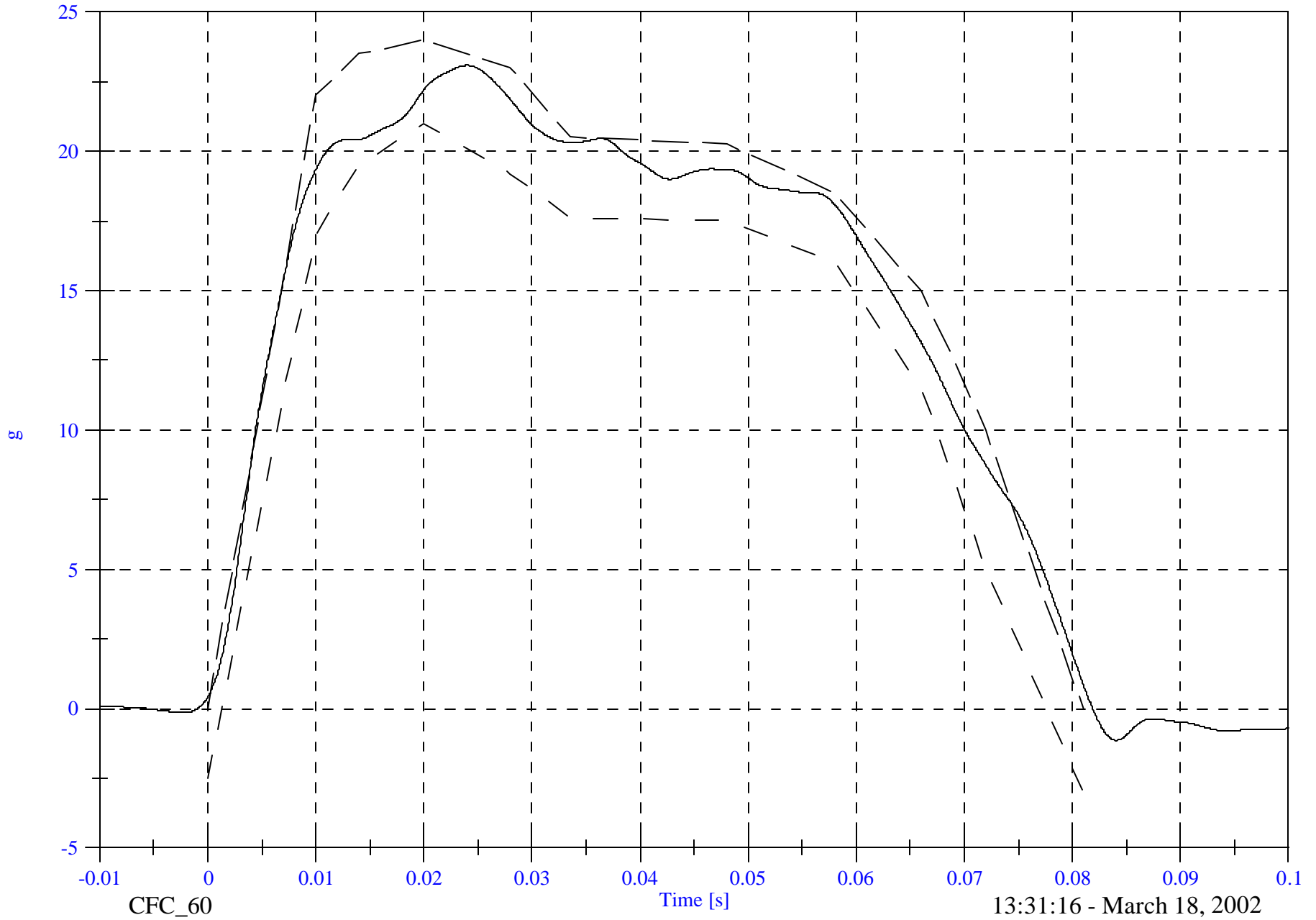
LEGEND	
—	Sled Ax
- . -	Sled Vx
- - -	Sled Dx

Sled Test Run 22222

Sled Pulse Corridor

Max: 23.1 [g] at 0.0240 [s]

Min: -1.4 [g] at 0.1396 [s]



FACILITY: HYGE SLED

DATE: March 18, 2002

TEST#: 22222

TITLE: Sled Test Run 22222

CHN NAME	Unit	Max	msec	Min	msec	Filt	Comment
27 Sled Acceleration	g	23.1	24.0	-1.4	139.6	CFC_60	
28 Sled Acceleration Velocity	kph	46.6	82.1	-0.0	-21.4	CFC_180	
29 Sled Acceleration Displacement	mm	2697.6	250.0	-0.0	-10.0	CFC_180	
30 P6 Head x	g	44.0	185.6	-57.7	90.7	CFC_1000	
31 P6 Head y	g	3.2	92.2	-13.2	89.9	CFC_1000	
32 P6 Head z	g	58.1	74.1	-0.0	0.8	CFC_1000	
33 P6 Head Resultant	g	61.2	90.6	0.0	-16.3	CFC_1000	
34 P6 Chest x	g	13.0	165.7	-34.0	52.7	CFC_180	
35 P6 Chest y	g	3.6	50.5	-6.2	188.5	CFC_180	
36 P6 Chest z	g	12.8	78.1	-35.2	53.2	CFC_180	
37 P6 Chest Resultant	g	48.9	53.0	0.0	-8.6	CFC_180	
38 P6 Pelvic x	g	13.2	104.8	-48.1	54.1	CFC_1000	
39 P6 Pelvic y	g	3.3	200.6	-5.6	59.1	CFC_1000	
40 P6 Pelvic z	g	9.3	190.3	-51.8	54.4	CFC_1000	
41 P6 Pelvic Resultant	g	70.6	54.4	0.0	-32.5	CFC_1000	
42 P6 Upper Neck Fx	N	121.7	168.6	-803.7	90.1	CFC_1000	
43 P6 Upper Neck Fy	N	74.4	90.1	-43.0	167.5	CFC_1000	
44 P6 Upper Neck Fz	N	1535.2	74.0	-0.9	199.9	CFC_1000	
45 P6 Upper Neck F Resultant	N	1598.7	71.8	0.0	-33.5	CFC_1000	
46 P6 Upper Neck Mx	N-m	3.4	71.3	-2.5	229.5	CFC_600	
47 P6 Upper Neck My	N-m	5.8	139.4	-12.6	195.9	CFC_600	
48 P6 Upper Neck Mz	N-m	1.7	146.0	-1.8	173.4	CFC_600	
49 P6 Upper Neck M Resultant	N-m	12.6	195.9	0.0	-26.1	CFC_600	
50 P6 Lower Neck Fx	N	297.5	183.9	-1107.1	79.3	CFC_1000	
51 P6 Lower Neck Fy	N	14.7	250.0	-170.1	79.6	CFC_1000	
52 P6 Lower Neck Fz	N	1054.8	70.4	-221.5	52.4	CFC_1000	
53 P6 Lower Neck F Resultant	N	1474.6	73.5	0.0	-21.3	CFC_1000	
54 P6 Lower Neck Mx	N-m	7.1	91.5	-5.4	167.1	CFC_600	
55 P6 Lower Neck My	N-m	116.9	89.2	-19.1	183.7	CFC_600	
56 P6 Lower Neck Mz	N-m	4.2	66.3	-2.1	188.6	CFC_600	
57 P6 Lower Neck M Resultant	N-m	117.1	89.2	0.0	-20.5	CFC_600	
58 P6 Upper Neck Mocy	N-m	5.8	139.4	-12.6	195.9	CFC_600	
59 P6 Head Red z	g	66.4	76.9	-23.5	184.3	CFC_1000	
60 P6 Chest Compression	mm	0.0	-48.6	-21.4	91.3	CFC_600	

61	P6 Head x	g	42.5	185.4	-48.5	90.9	CFC_60
62	P6 Head x Velocity	kph	0.0	-11.1	-59.3	155.5	CFC_180
63	P6 Head y	g	0.7	131.6	-5.9	89.5	CFC_60
64	P6 Head y Velocity	kph	0.0	25.1	-5.3	234.8	CFC_180
65	P6 Head z	g	58.0	73.9	-0.0	1.1	CFC_60
66	P6 Head z Velocity	kph	105.2	250.0	-0.0	-50.0	CFC_180
67	P6 Head Red z	g	65.9	76.0	-20.4	184.2	CFC_60
68	P6 Head Red z Velocity	kph	106.3	244.9	-4.6	56.9	CFC_180
69	P6 Chest x	g	11.9	165.2	-33.8	53.1	CFC_60
70	P6 Chest x Velocity	kph	0.0	-10.1	-57.4	118.4	CFC_180
71	P6 Chest y	g	3.3	49.7	-3.6	188.5	CFC_60
72	P6 Chest y Velocity	kph	2.8	64.0	-0.0	-7.1	CFC_180
73	P6 Chest z	g	11.9	77.2	-35.2	54.3	CFC_60
74	P6 Chest z Velocity	kph	0.2	30.5	-21.8	67.6	CFC_180
75	P6 Pelvic x	g	12.2	104.6	-47.9	54.1	CFC_60
76	P6 Pelvic x Velocity	kph	0.0	-50.0	-48.4	92.4	CFC_180
77	P6 Pelvic y	g	3.1	201.8	-5.0	59.0	CFC_60
78	P6 Pelvic y Velocity	kph	0.8	49.7	-2.7	177.6	CFC_180
79	P6 Pelvic z	g	8.5	189.3	-51.5	54.7	CFC_60
80	P6 Pelvic z Velocity	kph	0.0	-10.8	-43.3	86.5	CFC_180

FACILITY: HYGE SLED

DATE: March 18, 2002

TEST#: 22222

TITLE: Sled Test Run 22222

Version 5.00

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P6 HIC(FULL): 587.9

t1: 59.3 msec

t2: 95.6 msec

Duration: 36.3 msec

Average Acceleration: 48.3 g

Input channels: P6 Head x (3) CFC_1000

P6 Head y (4) CFC_1000

P6 Head z (5) CFC_1000

P6 UP NECK Fx: Max: 121.7 N 168.6 msec

Min: -803.7 N 90.1 msec

Input channel: P6 Upper Neck Fx (14) CFC_1000

P6 UP NECK Fz: Max: 1535.2 N 74.0 msec

Min: -0.9 N 199.9 msec

Input channel: P6 Upper Neck Fz (16) CFC_1000

P6 UP NECK Mocy (3YO Child OOP)

Max: 5.8 N-m 139.3 msec

Min: -12.6 N-m 195.8 msec

Input channels: P6 Upper Neck Fx (14) CFC_600

P6 Upper Neck My (18) CFC_600

Docy: 0

P6 UP NECK Nij (3YO Child OOP)

Ntf: 0.76 Nij 76.9 msec CVt: 2120 CVf: 68

Nte: 0.79 Nij 69.0 msec CVt: 2120 CVe: 27

Ncf: 0.00 Nij -17.8 msec CVc: 2120 CVf: 68

Nce: 0.39 Nij 199.7 msec CVc: 2120 CVe: 27

Input channels: P6 Upper Neck Fz (16) CFC_600

P6 Upper Neck Mocy [N-m, CFC_600] (84)

P6 CLIP(3 ms): 48.2 g

t1: 52.1 msec

t2: 55.1 msec
Duration: 3.0 msec
P6 CSI: 354.3
Input channels: P6 Chest x (7) CFC_180
P6 Chest y (8) CFC_180
P6 Chest z (9) CFC_180

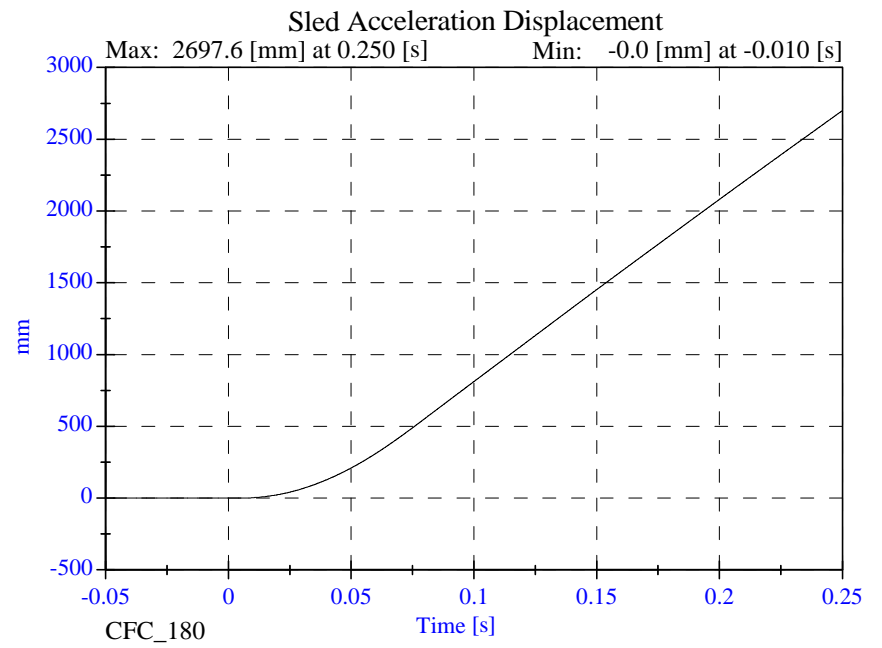
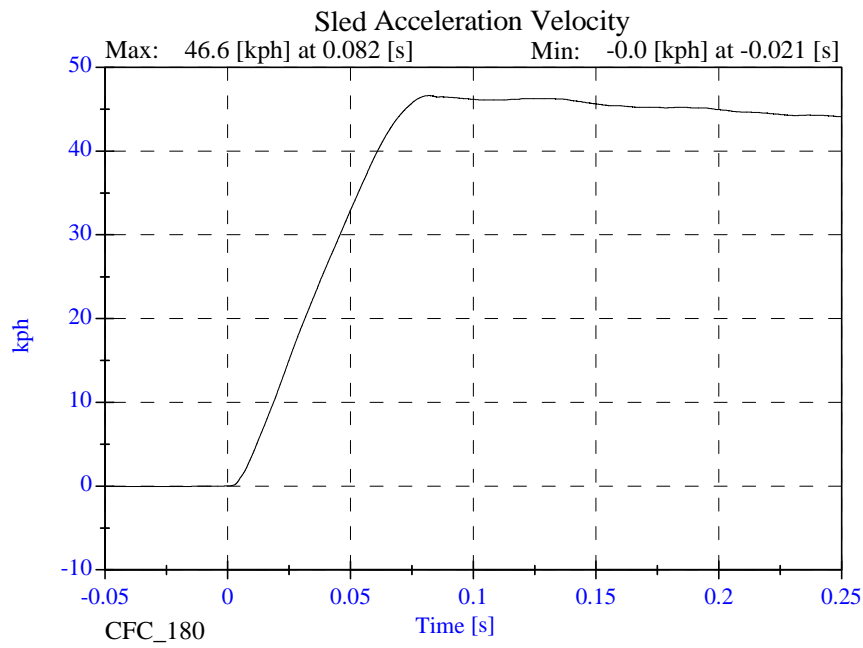
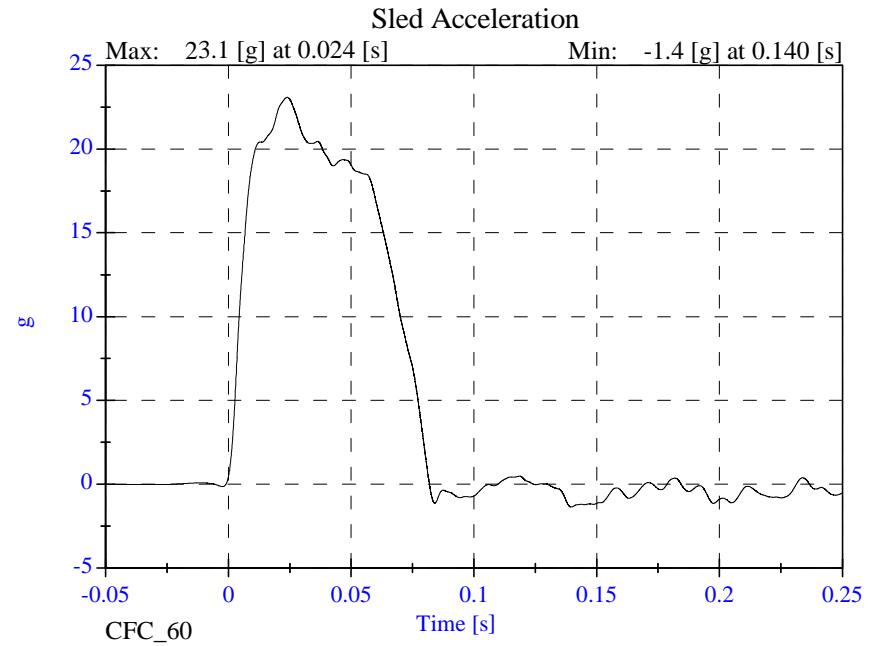
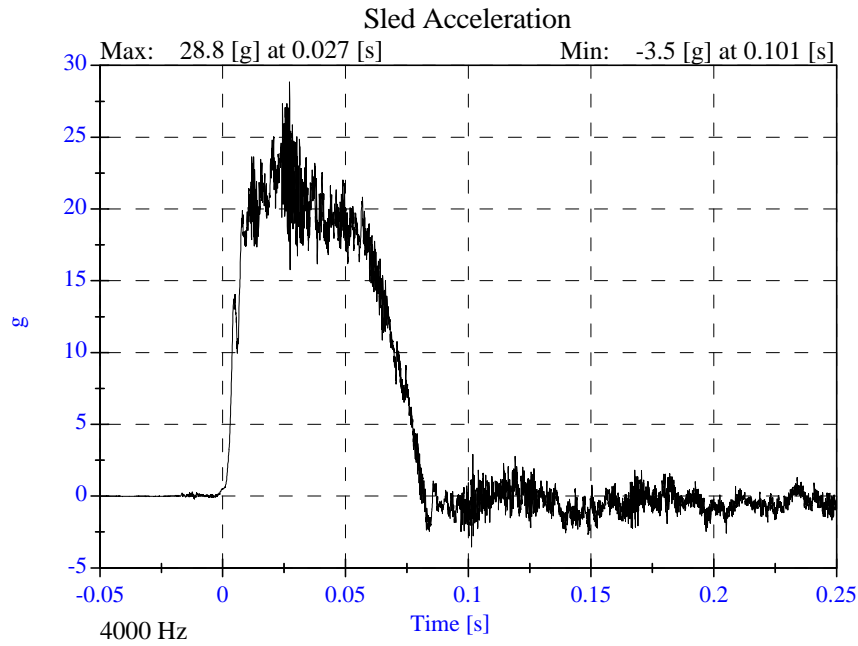
P6 CHEST DISP: Max: 0.0 mm -48.6 msec
Min: -21.4 mm 91.3 msec
Input channel: P6 Chest Compression (10) CFC_600

=====
P6 HIC(36 ms): 587.8
t1: 59.4 msec
t2: 95.4 msec
Duration: 36.0 msec
Average Acceleration: 48.4 g
Input channels: P6 Head x (3) CFC_1000
P6 Head y (4) CFC_1000
P6 Head z (5) CFC_1000

=====
P6 HIC(15 ms): 369.3
t1: 65.5 msec
t2: 80.5 msec
Duration: 15.0 msec
Average Acceleration: 57.1 g
Input channels: P6 Head x (3) CFC_1000
P6 Head y (4) CFC_1000
P6 Head z (5) CFC_1000

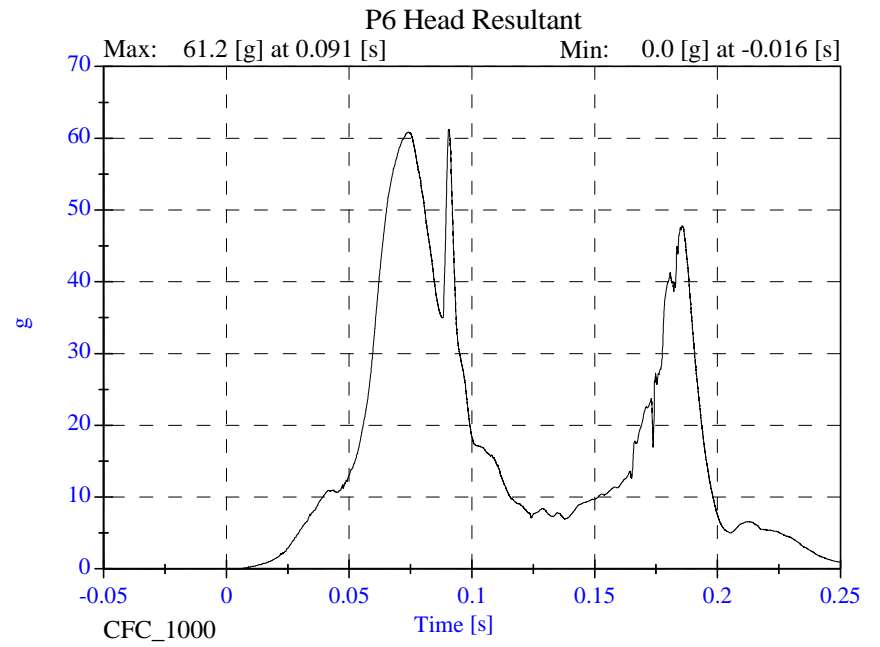
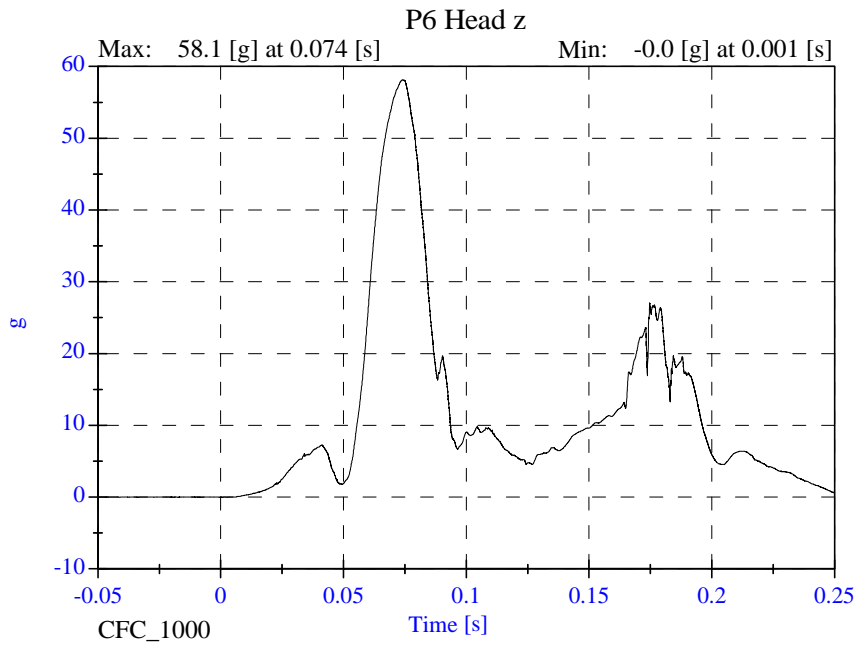
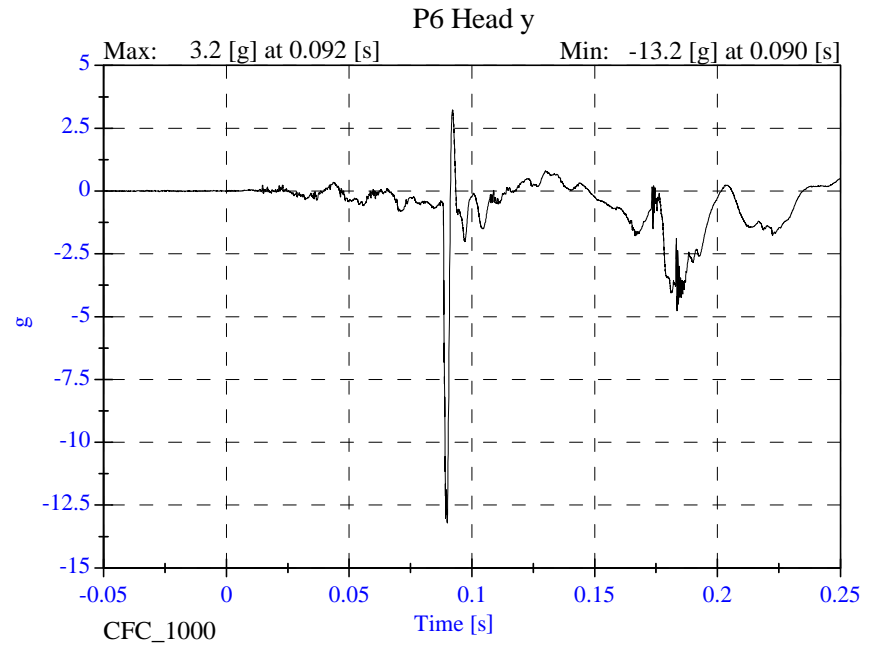
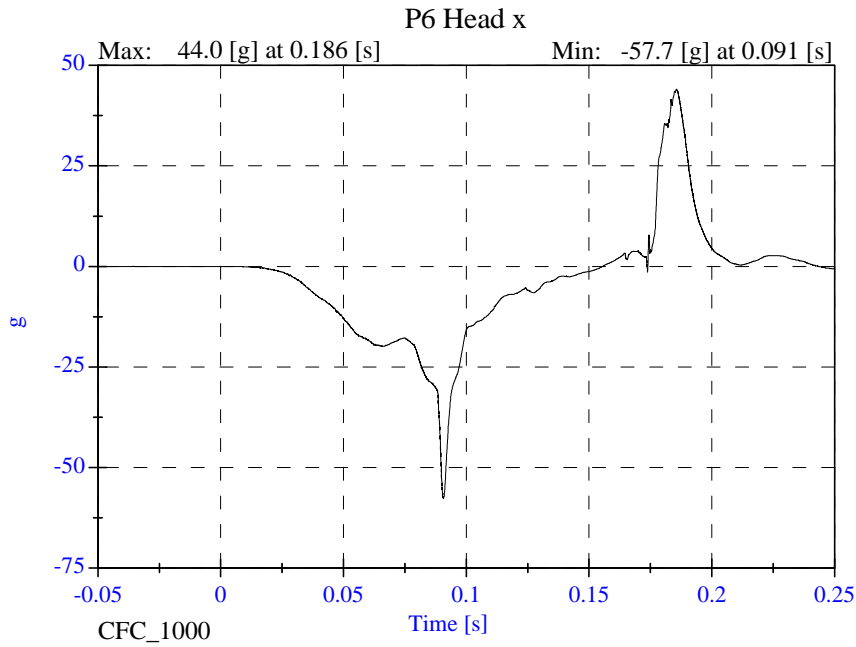
Sled Test Run 22222

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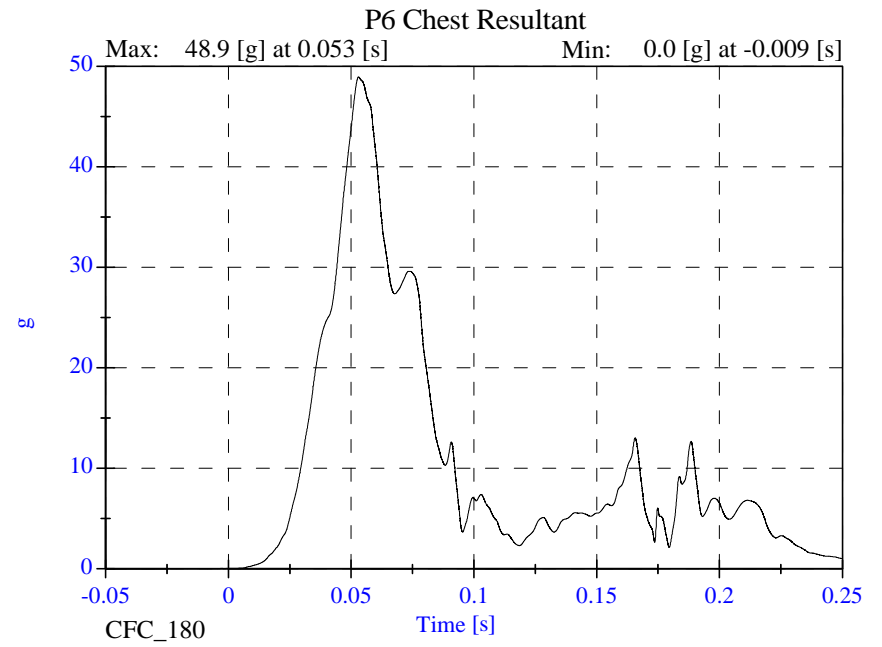
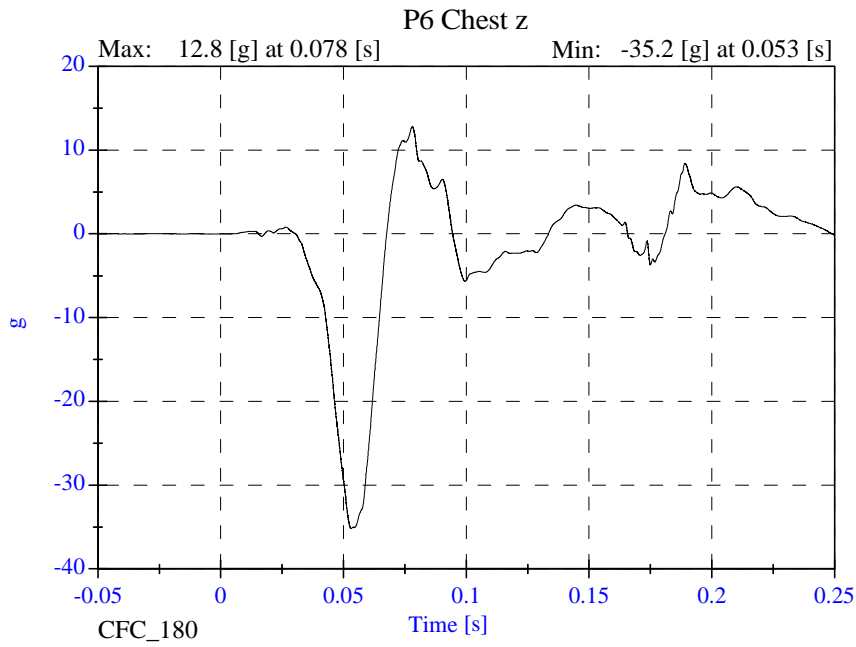
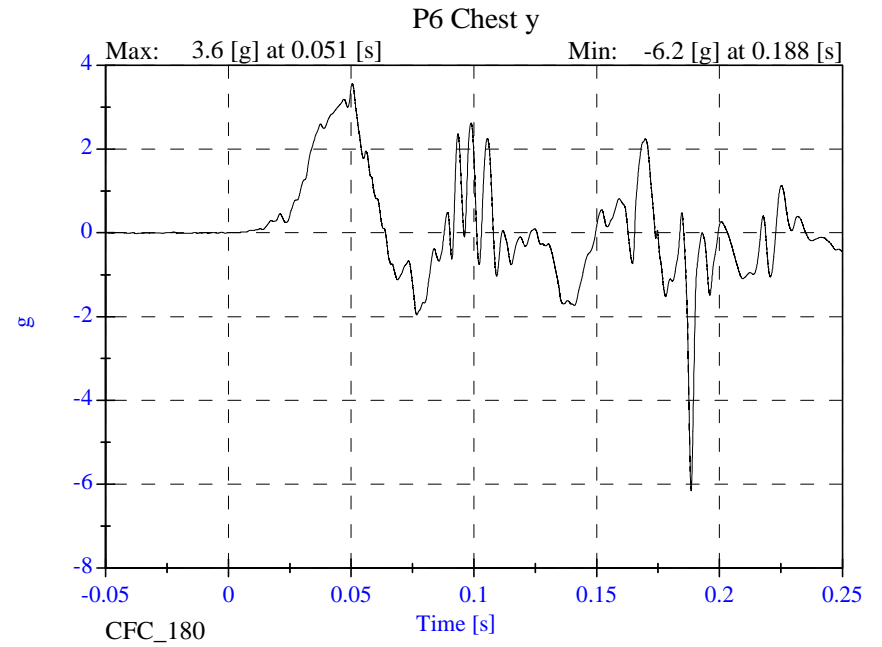
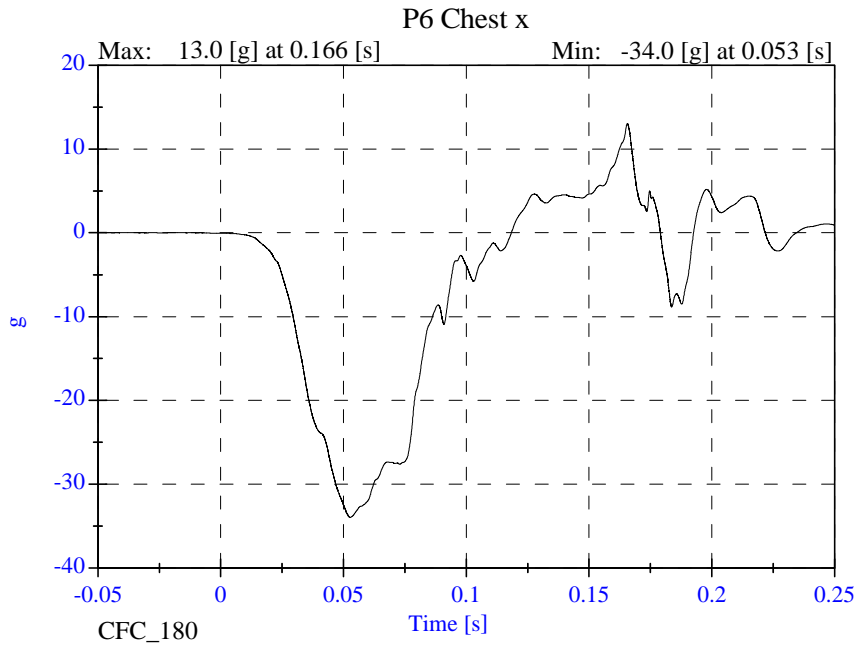
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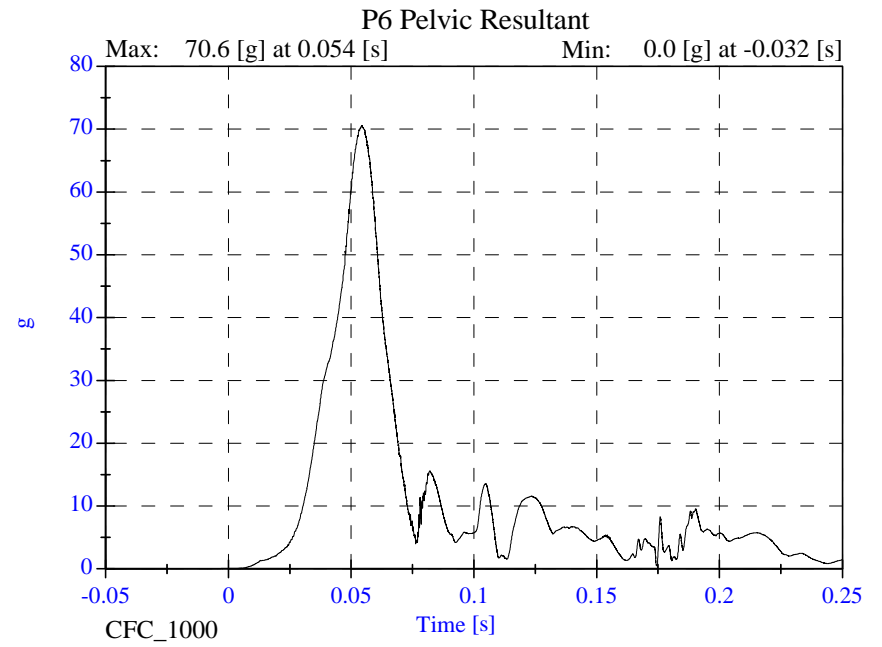
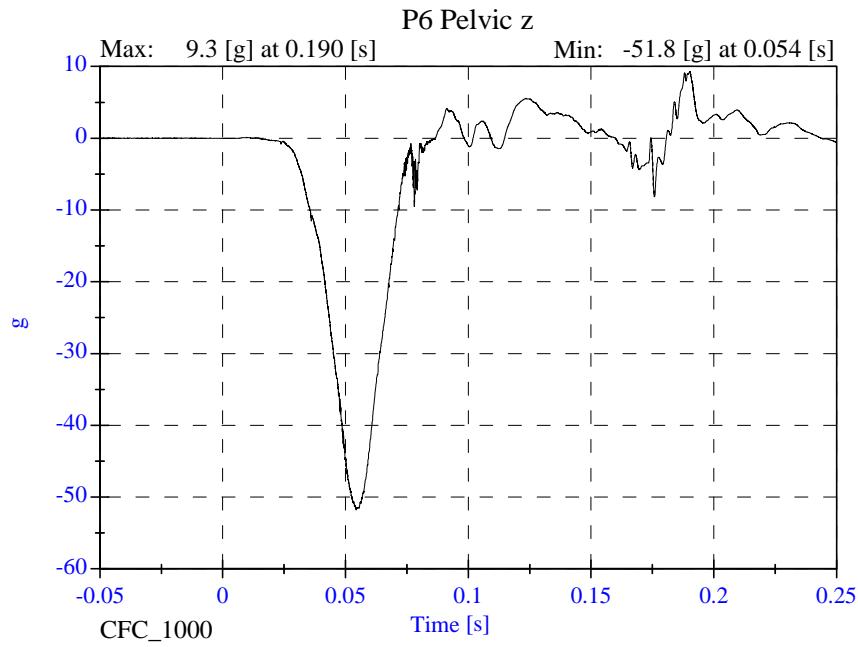
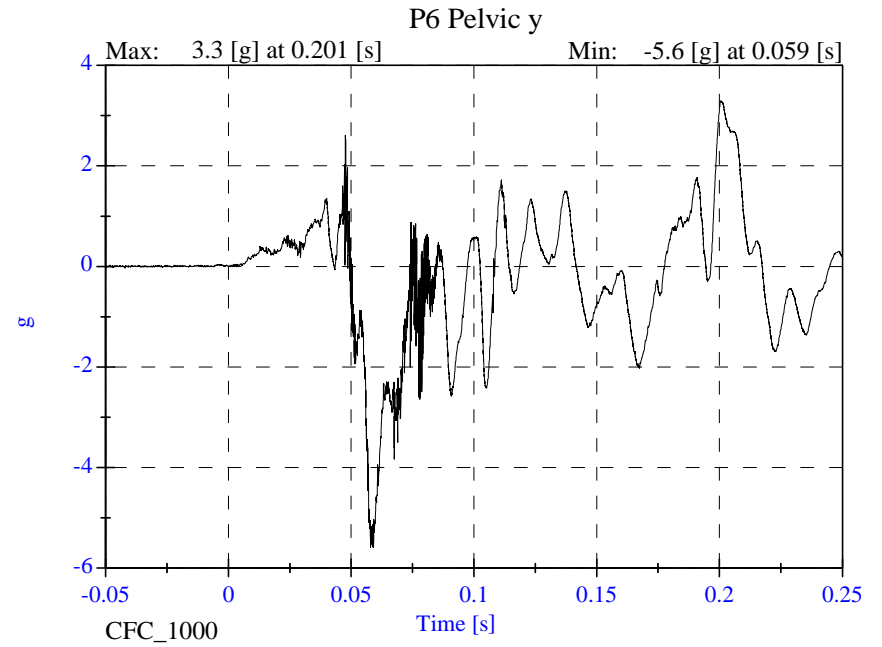
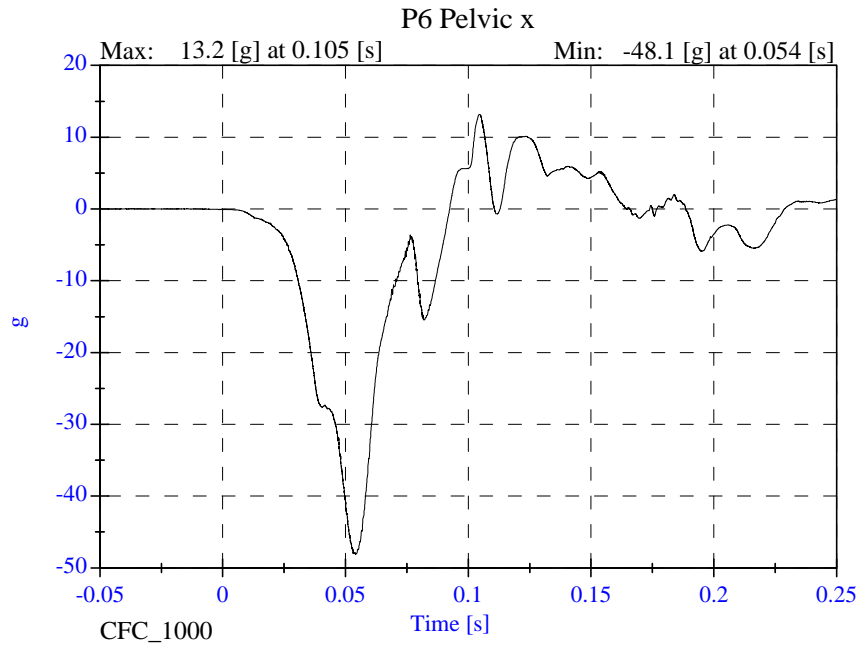
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Sled Test Run 22222

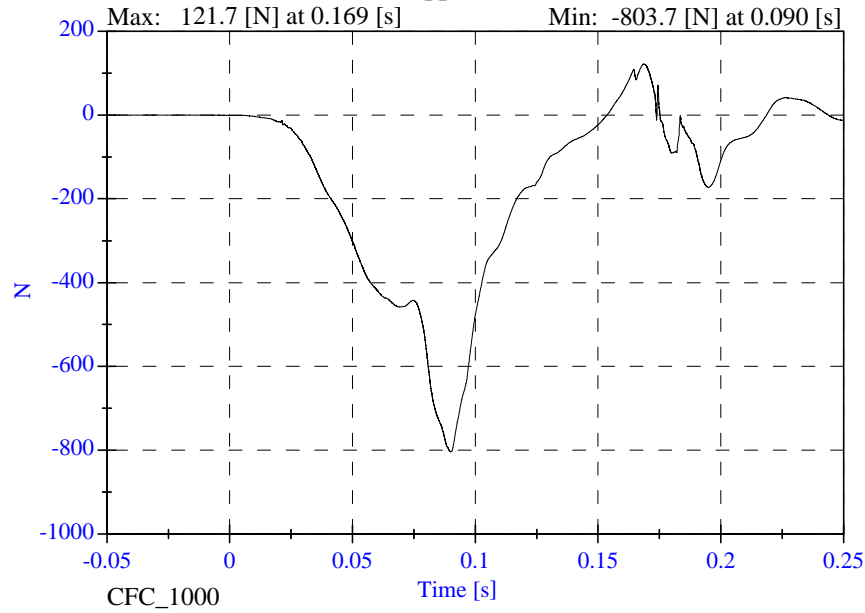
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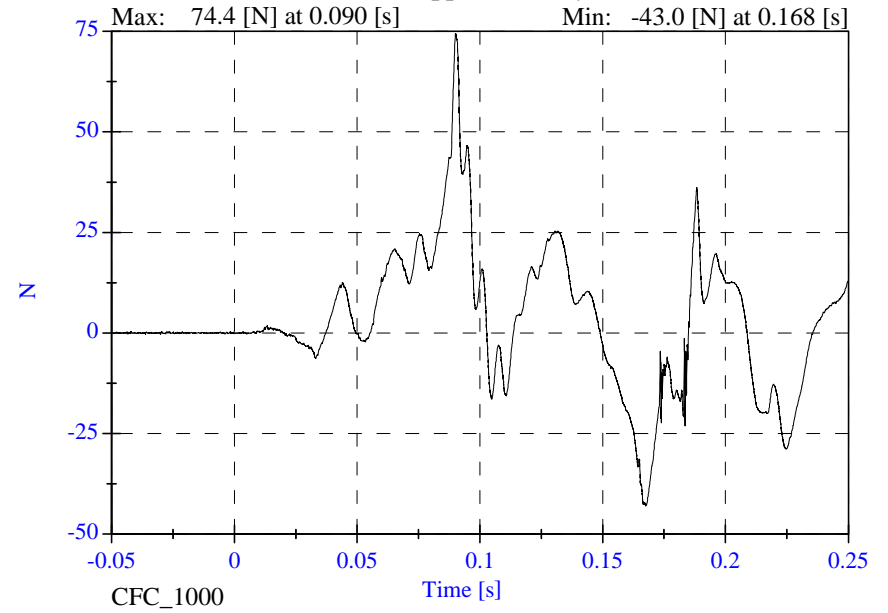
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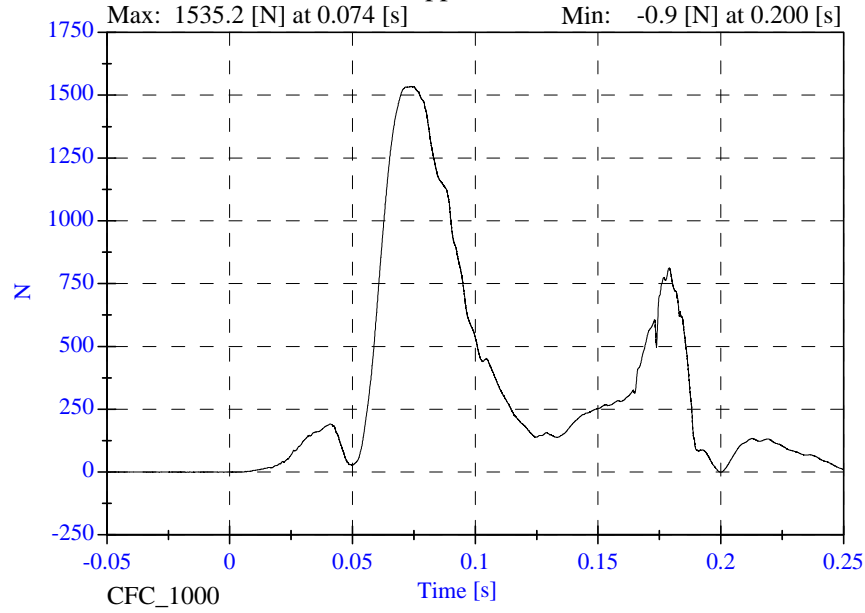
P6 Upper Neck Fx



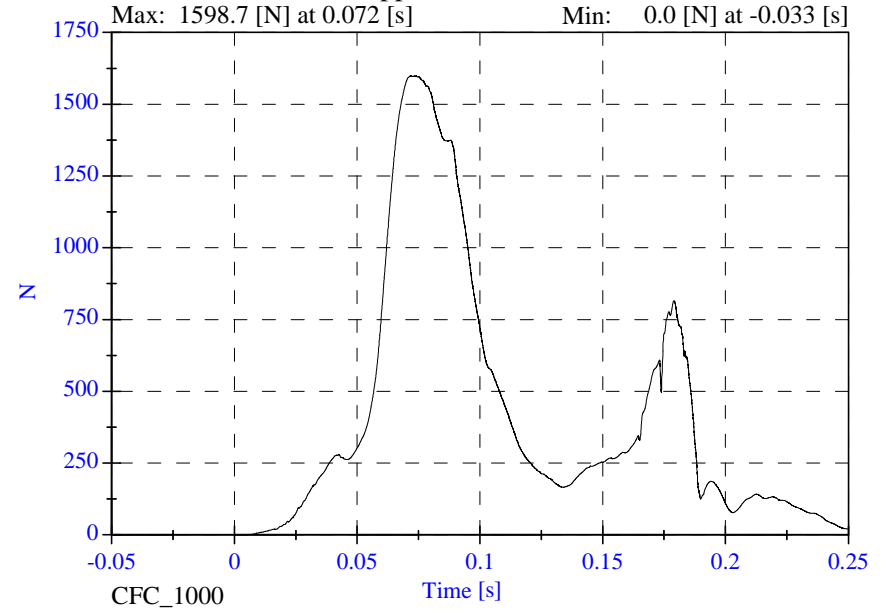
P6 Upper Neck Fy



P6 Upper Neck Fz

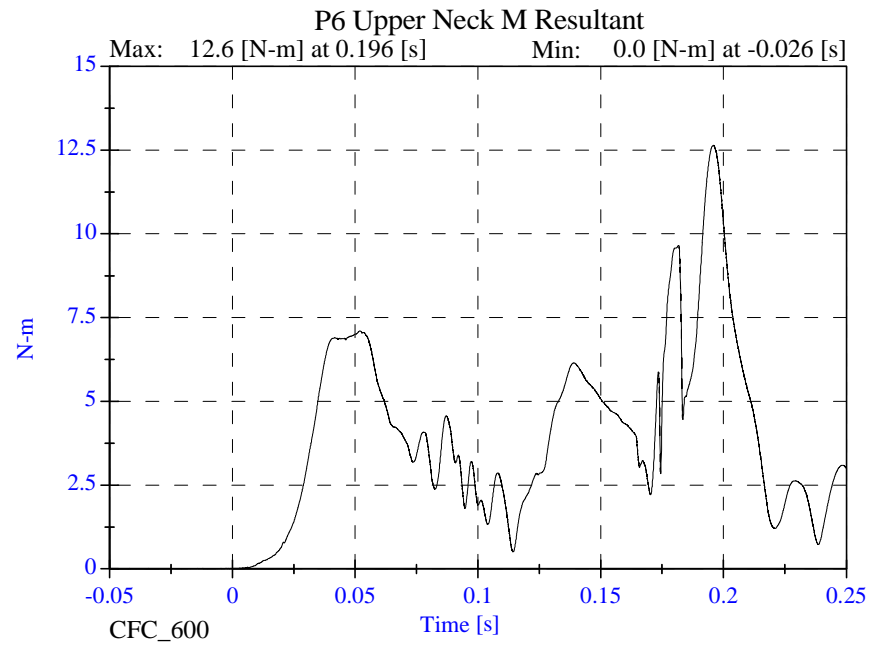
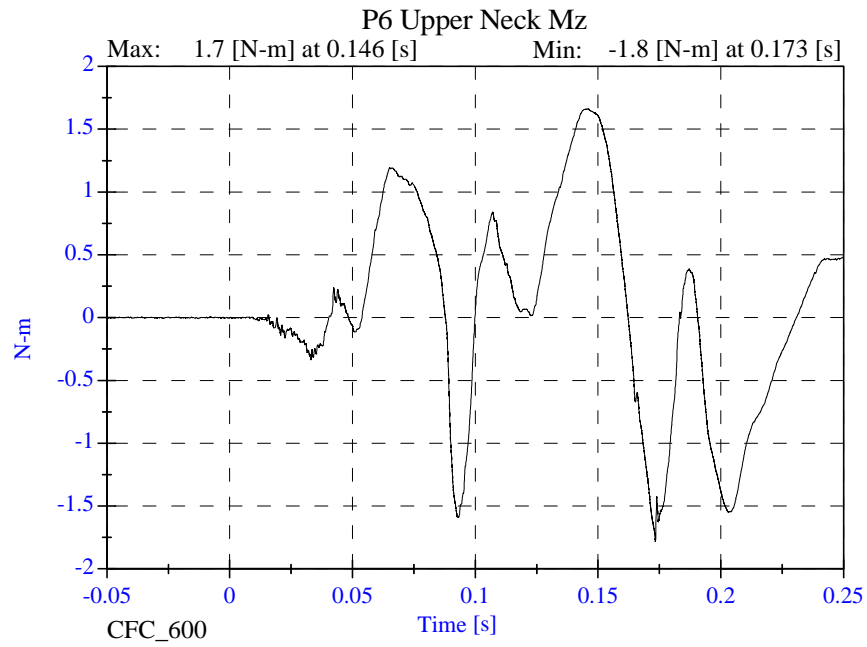
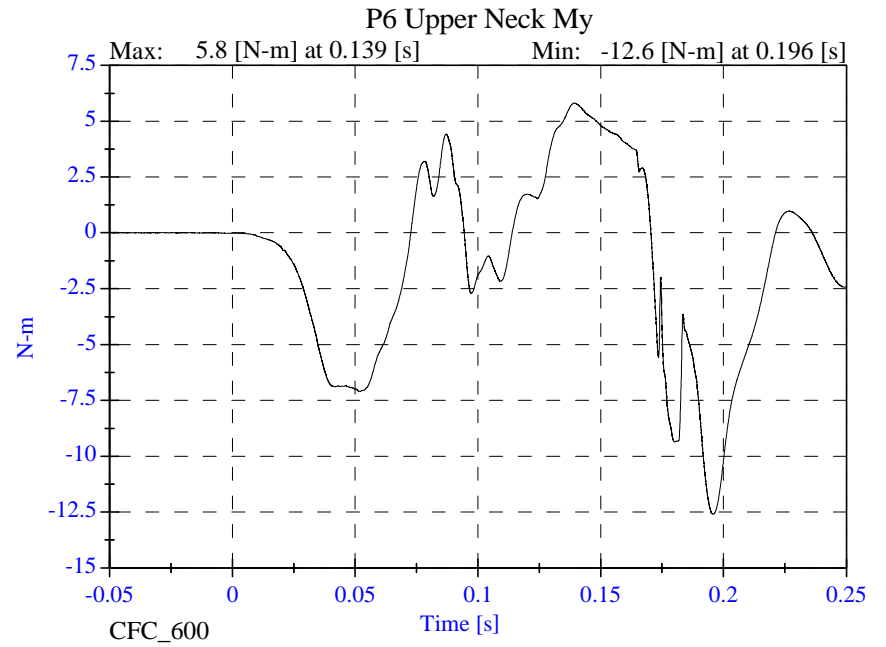
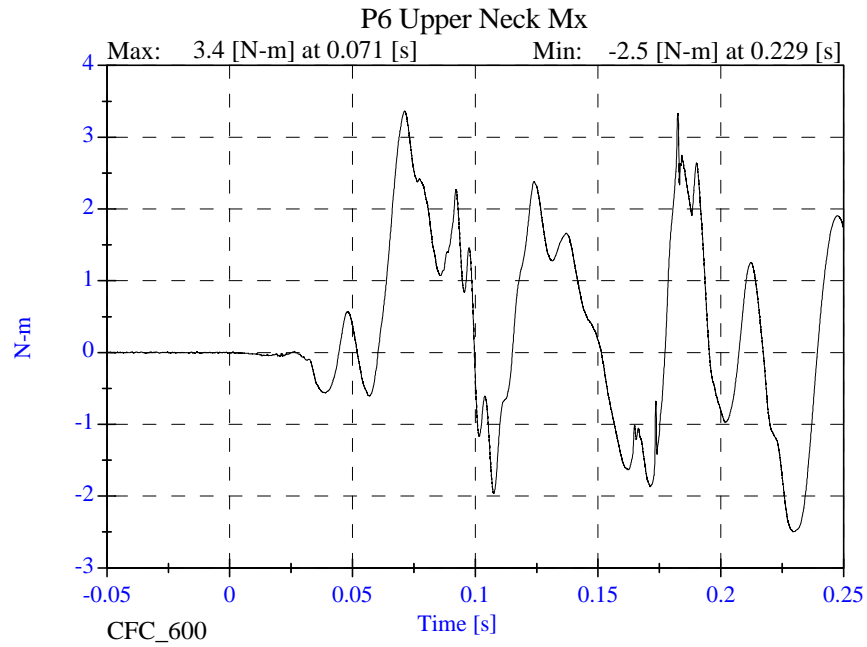


P6 Upper Neck F Resultant



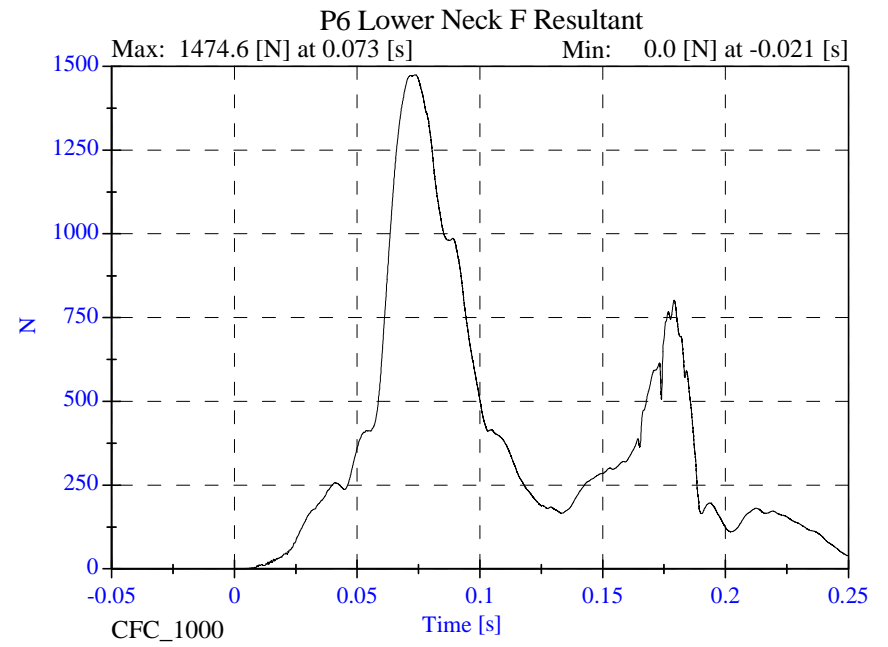
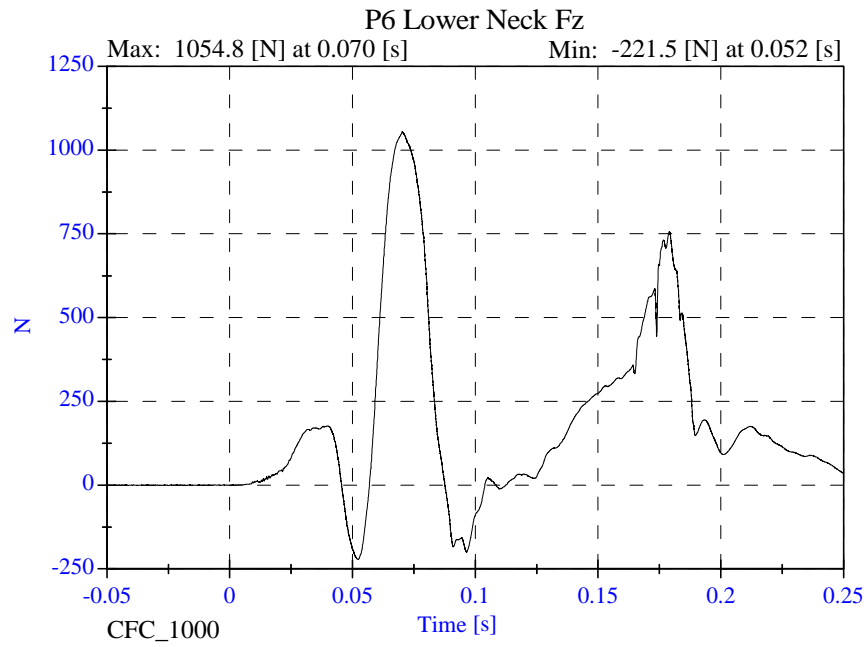
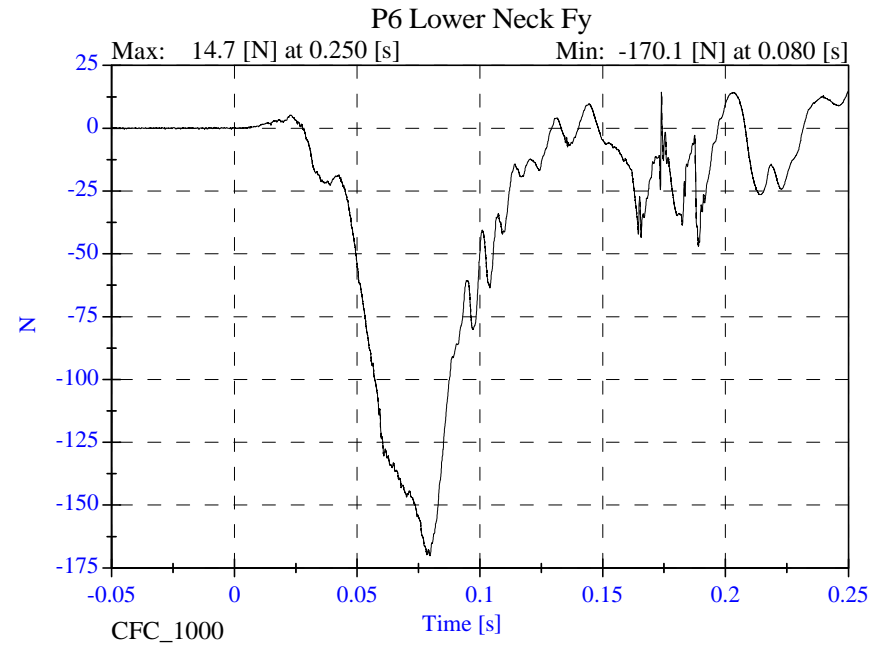
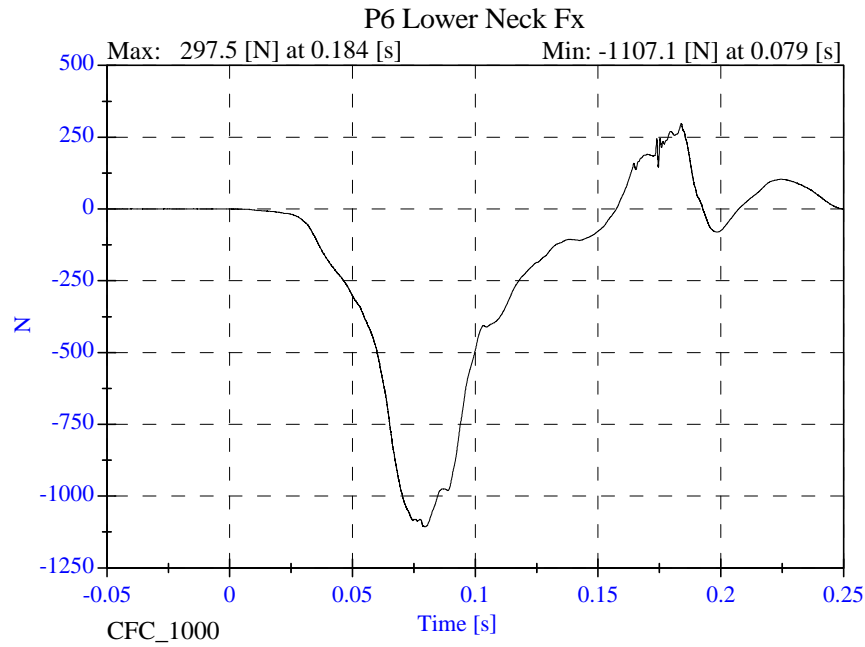
Sled Test Run 22222

- March 18, 2002



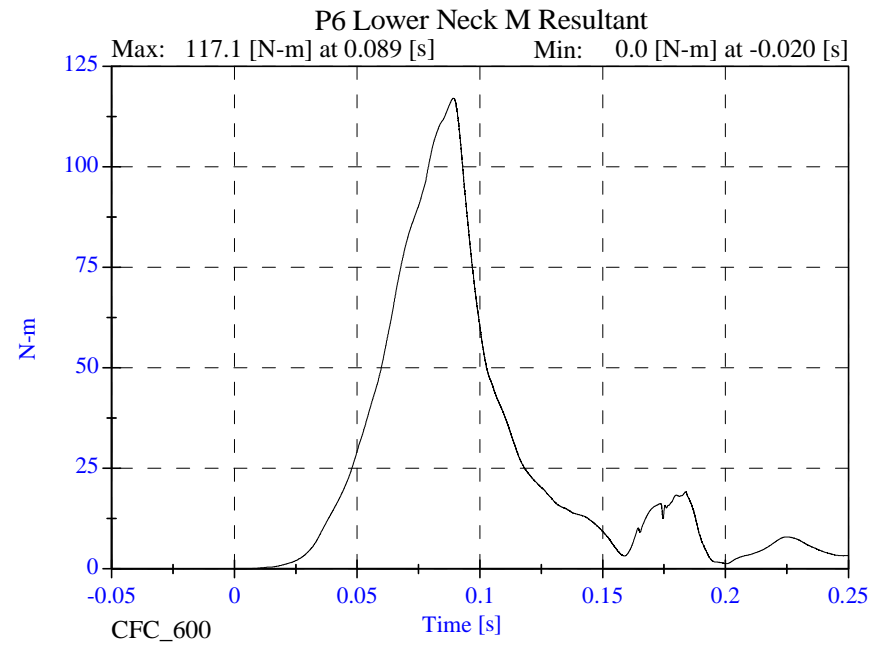
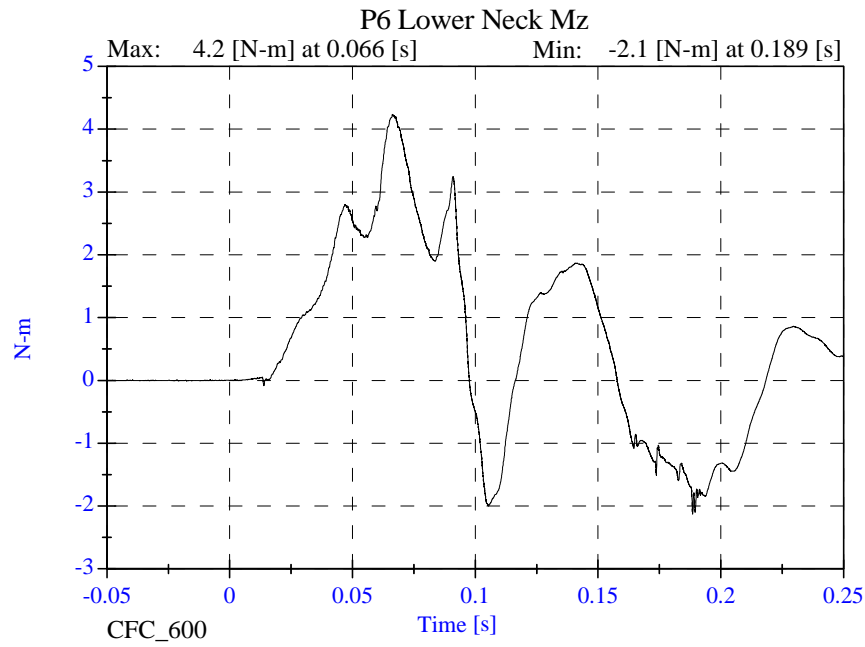
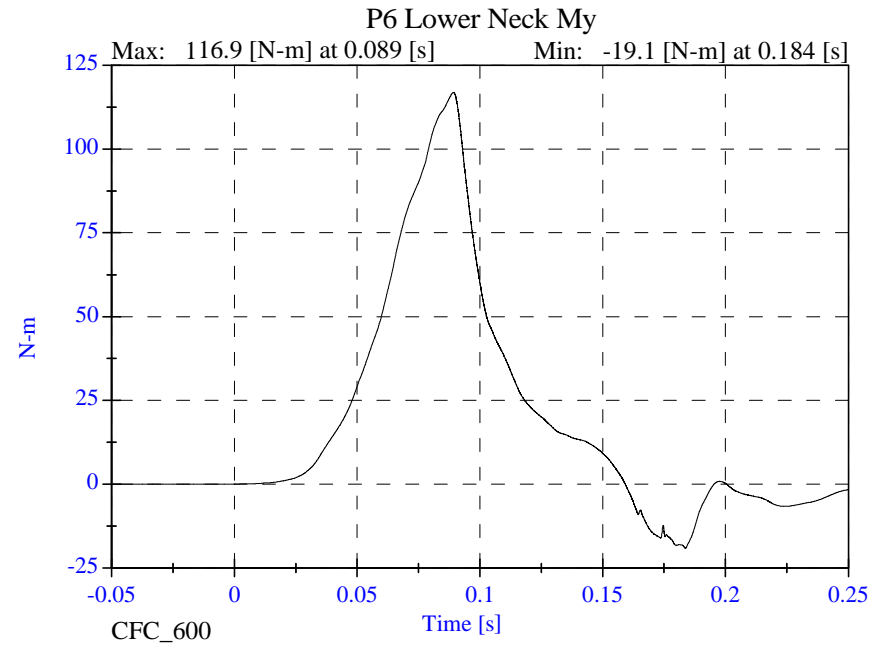
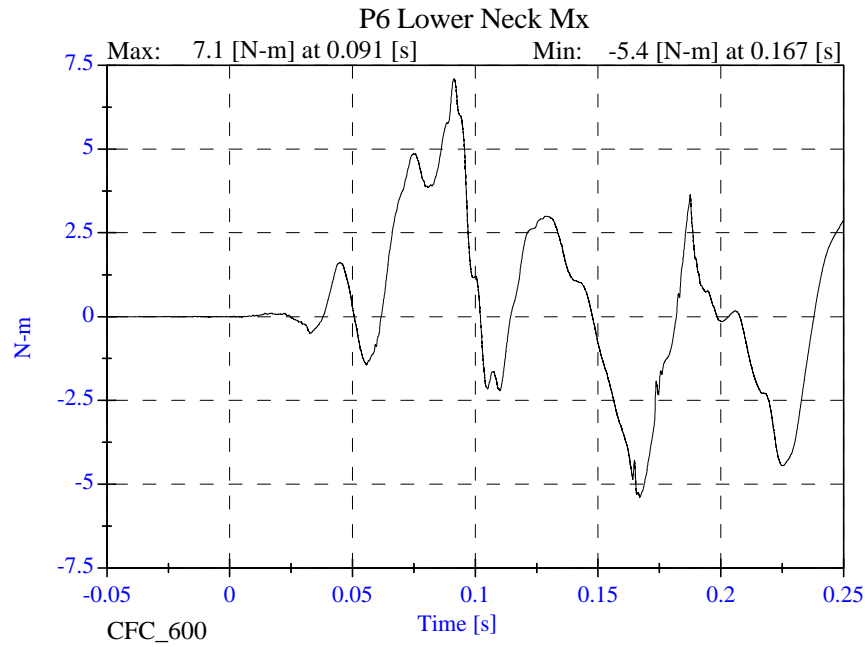
Sled Test Run 22222

- March 18, 2002



Sled Test Run 22222

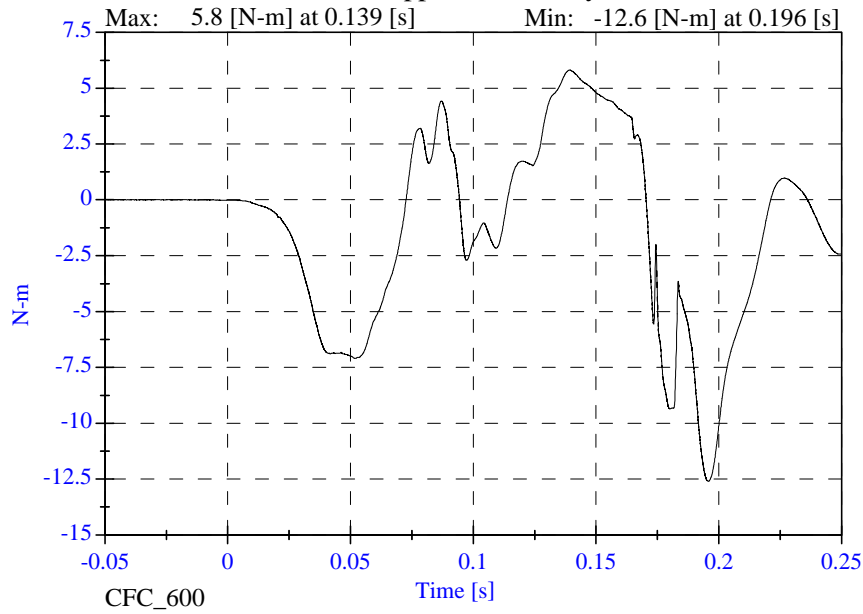
- March 18, 2002



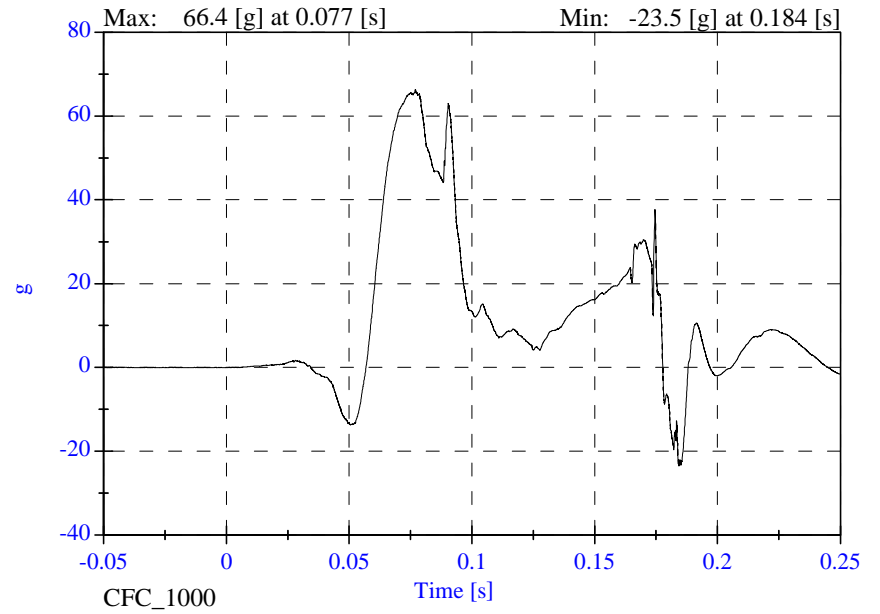
Sled Test Run 22222

- March 18, 2002

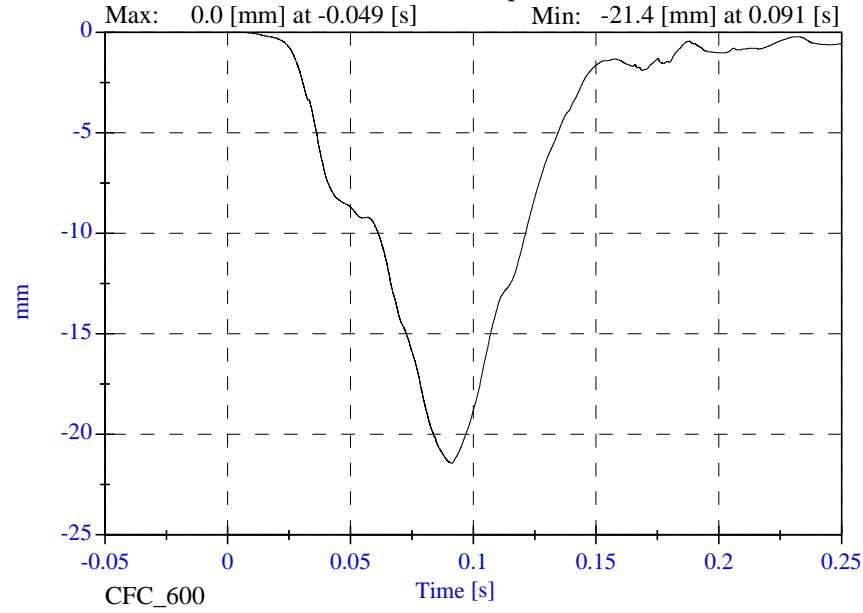
P6 Upper Neck Mocy



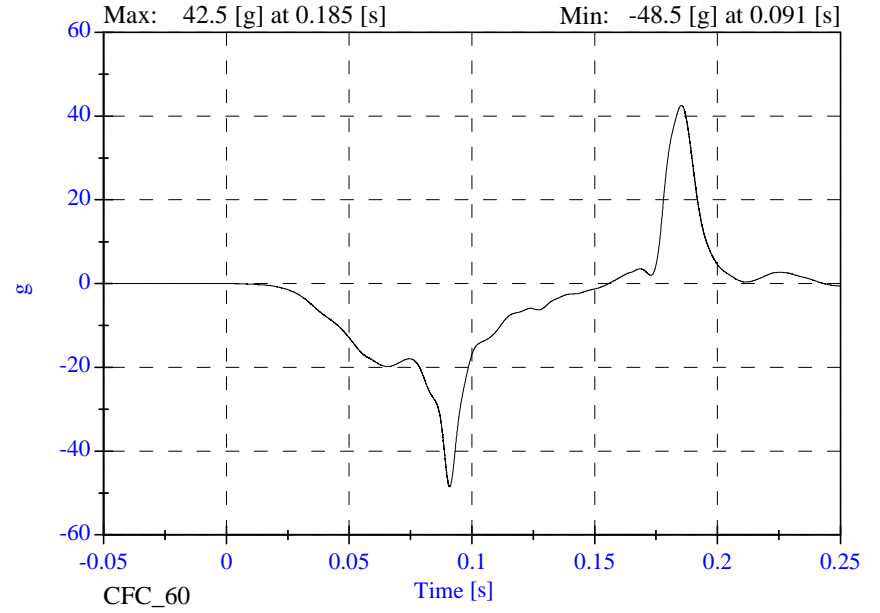
P6 Head Red z



P6 Chest Compression

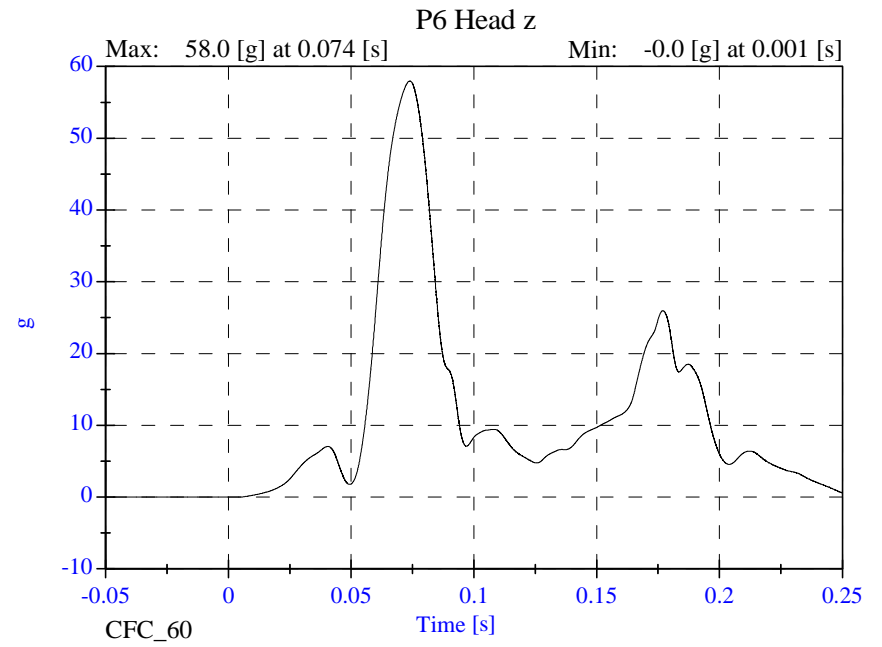
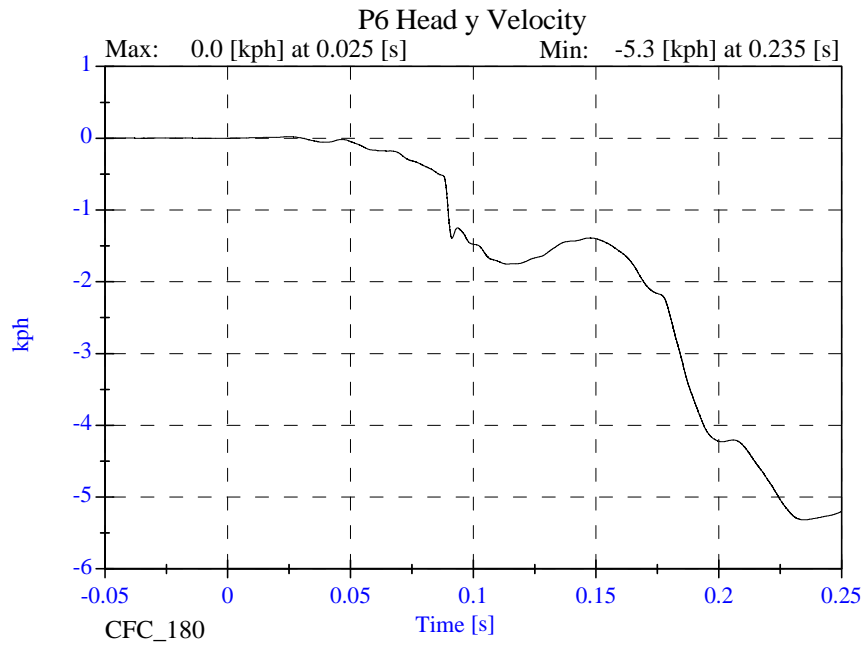
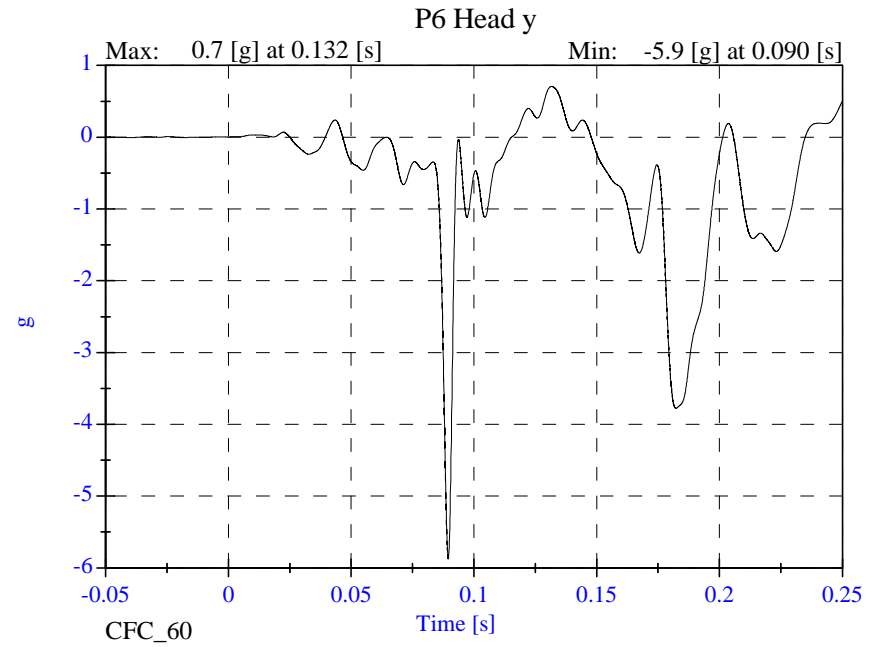
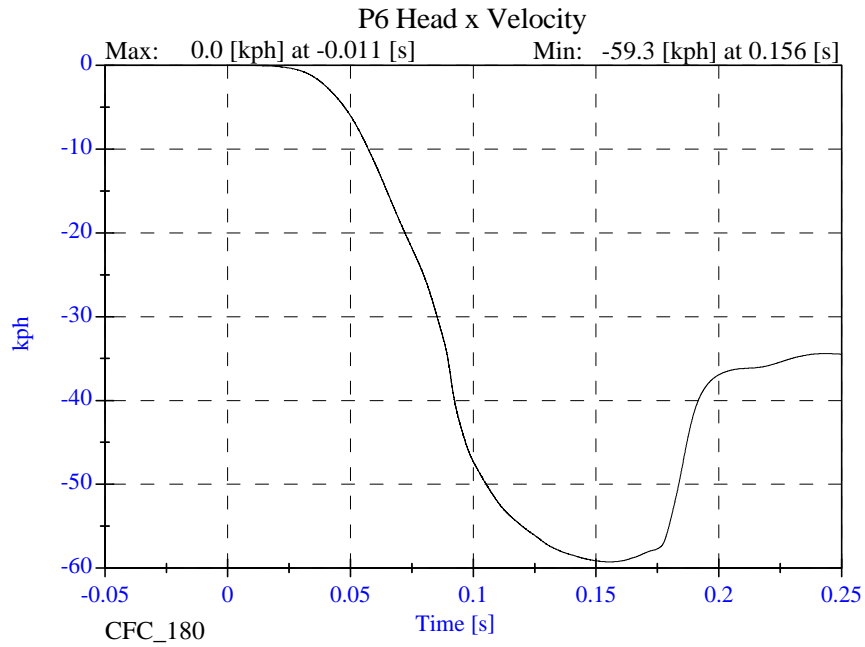


P6 Head x



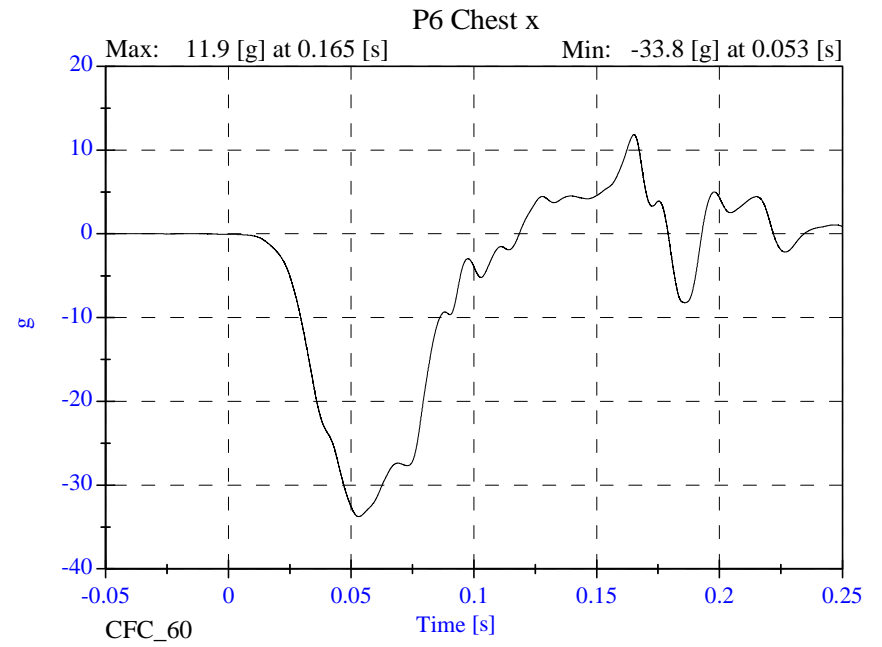
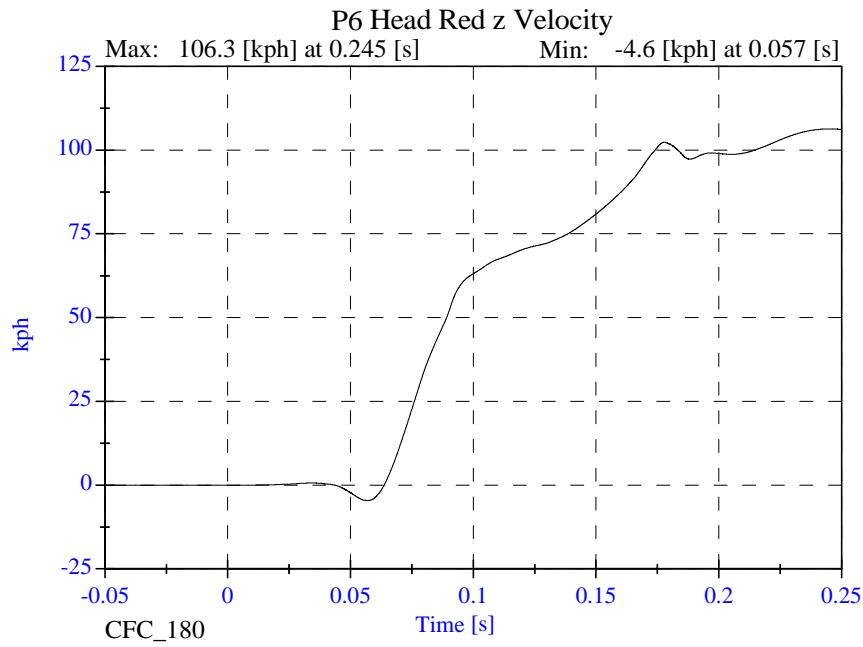
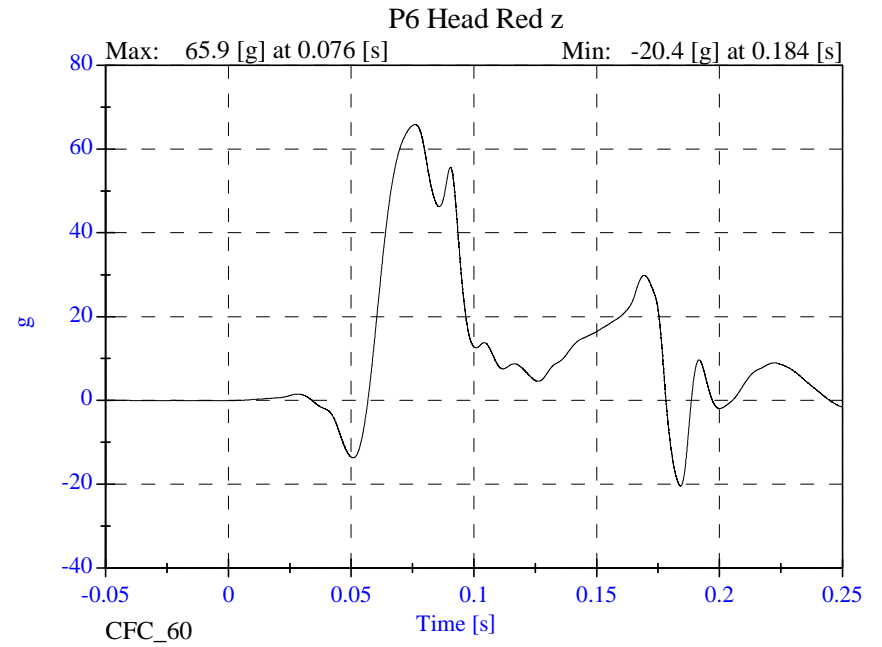
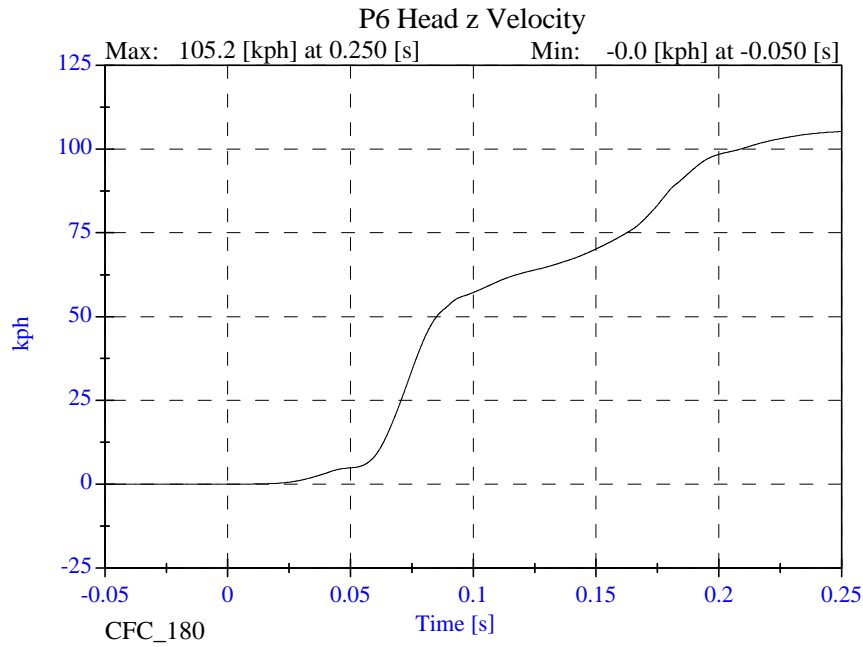
Sled Test Run 22222

- March 18, 2002



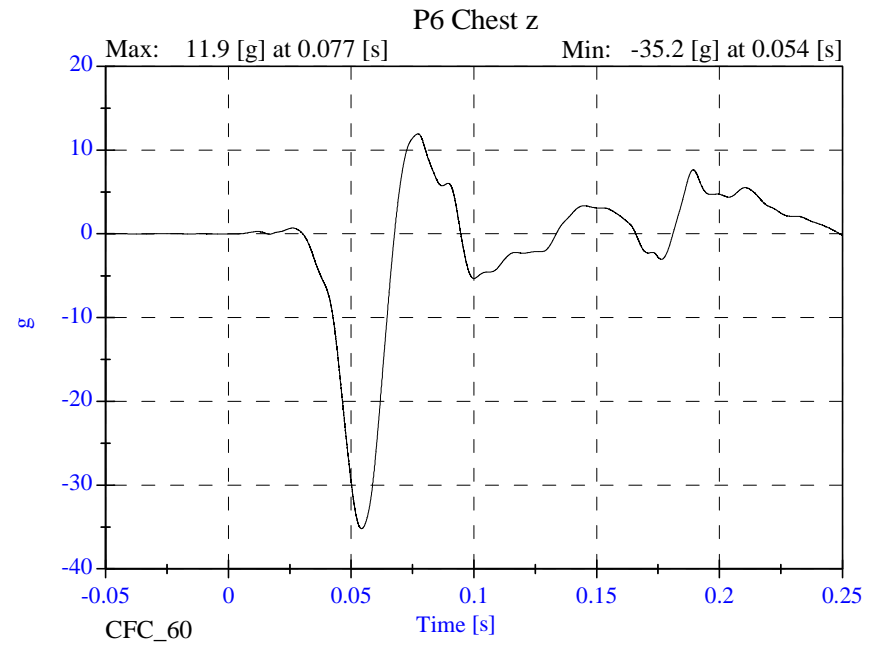
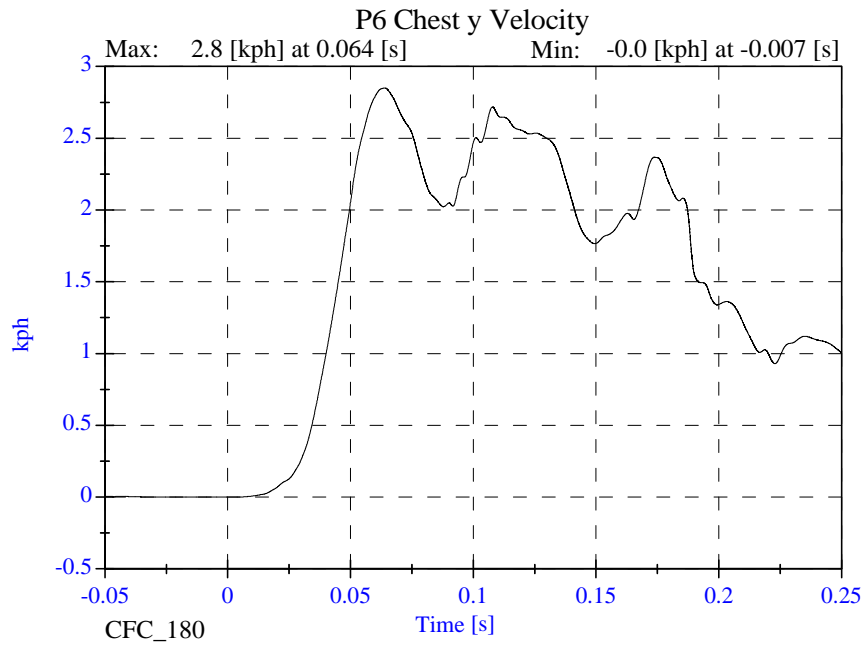
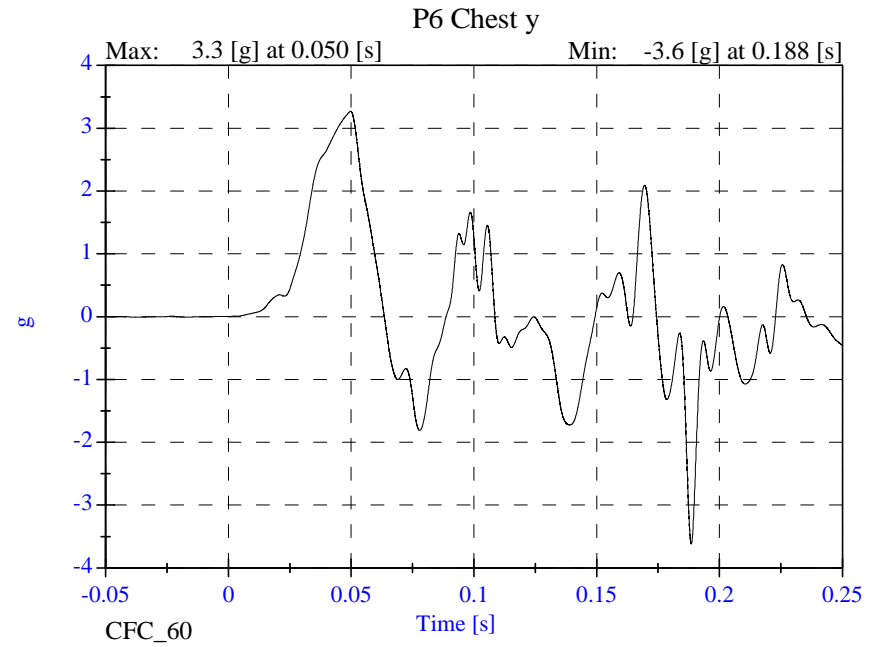
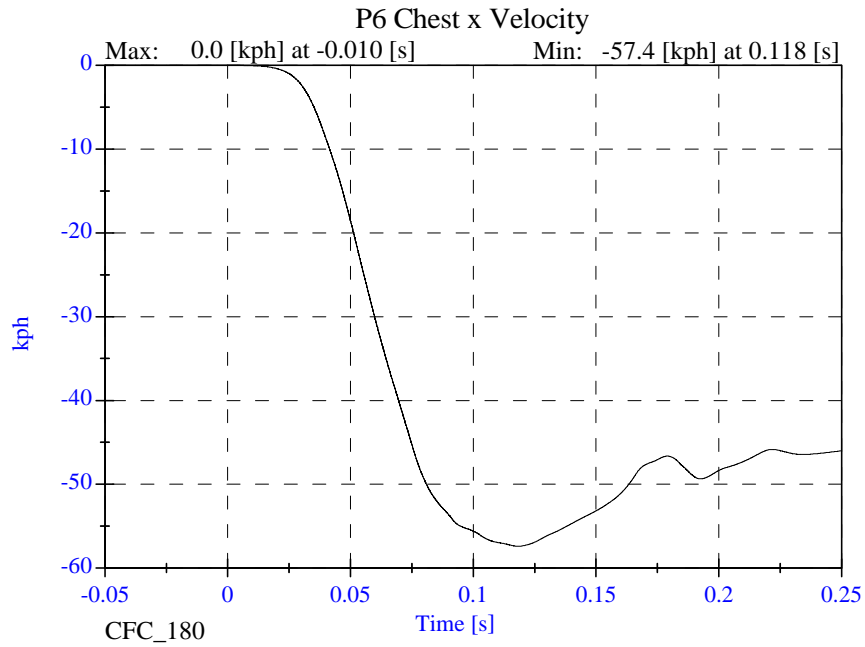
Sled Test Run 22222

- March 18, 2002



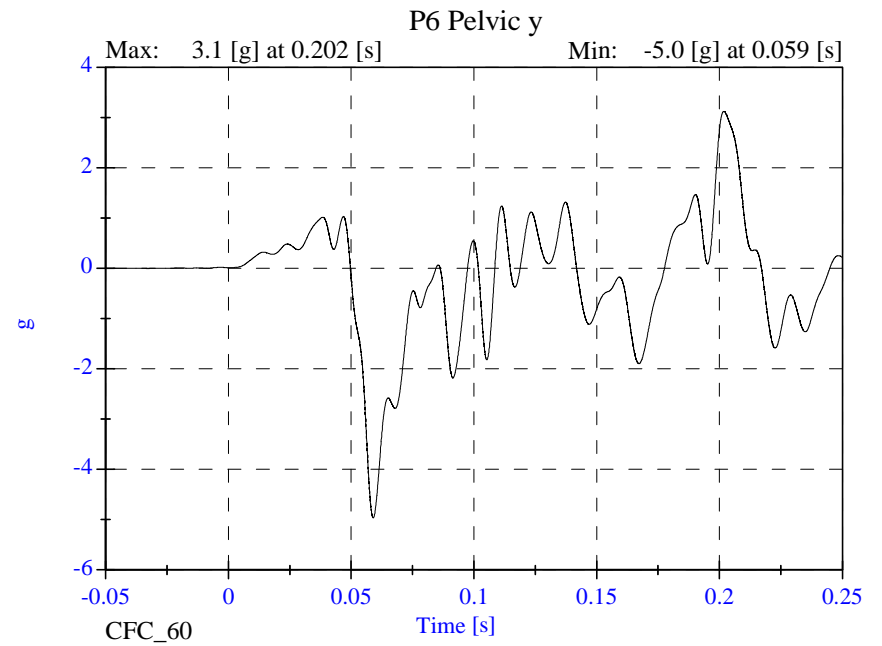
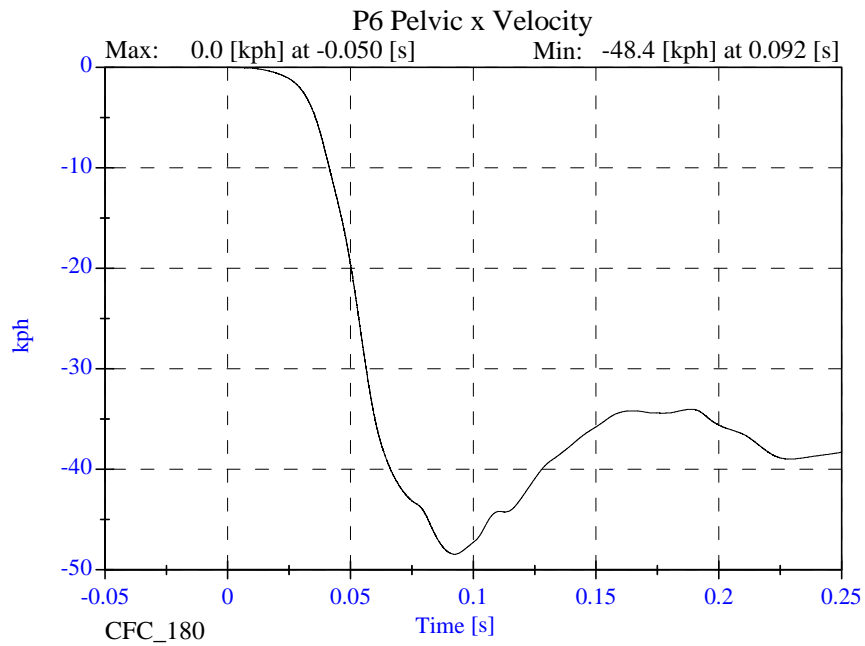
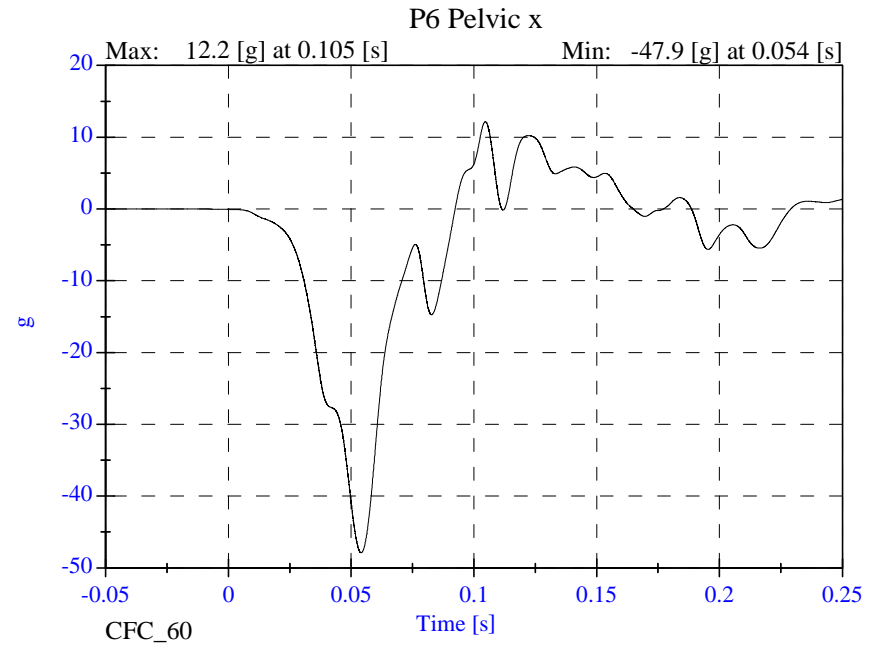
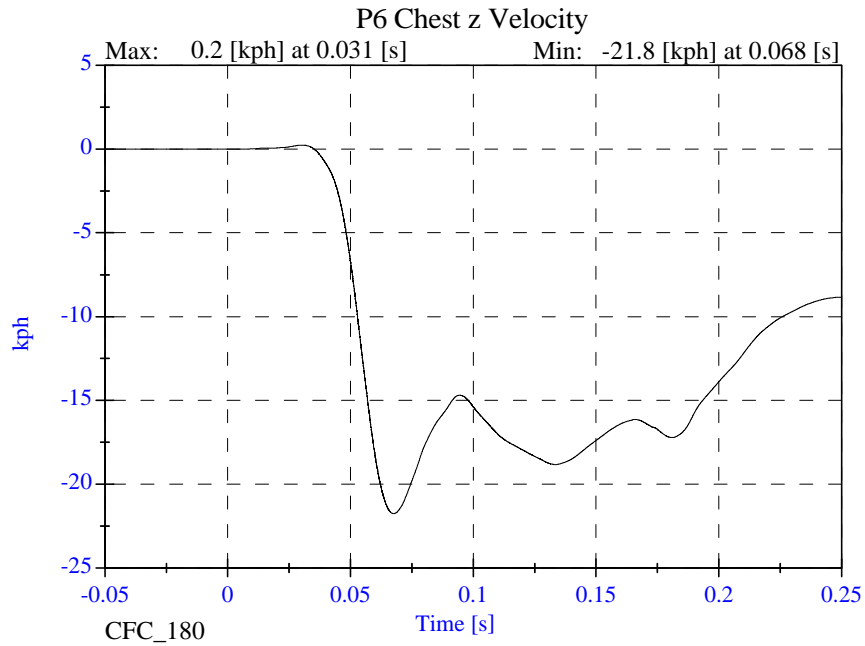
Sled Test Run 22222

- March 18, 2002



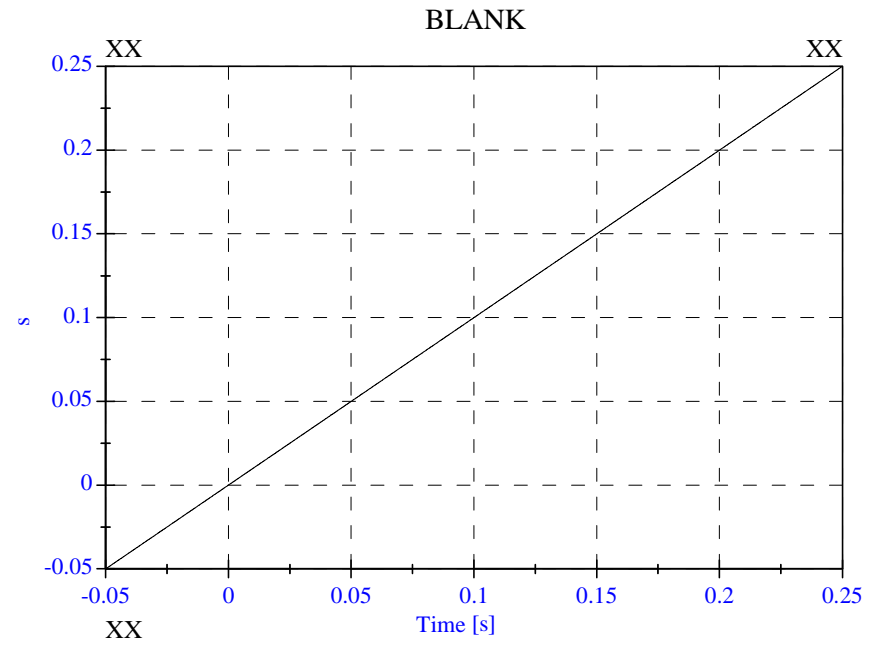
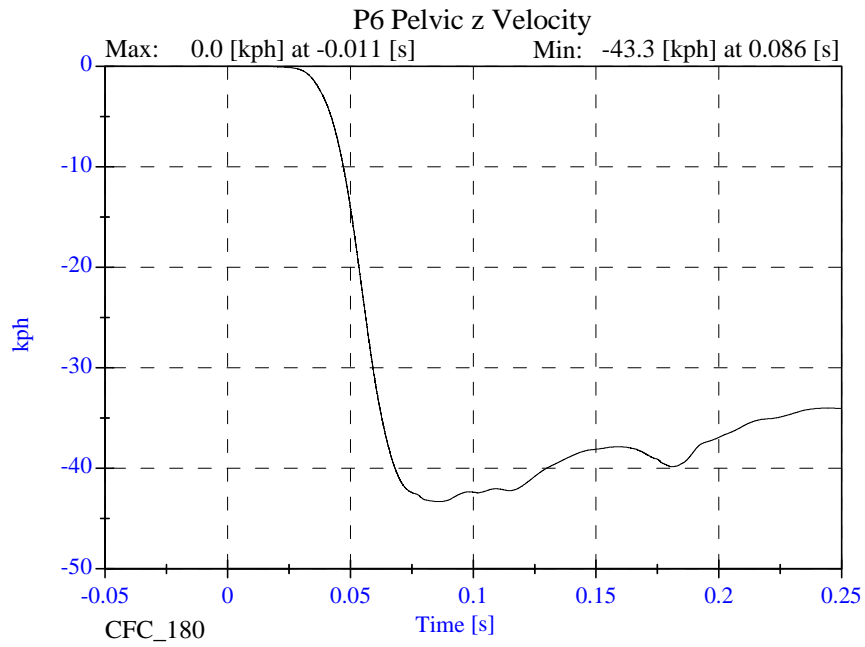
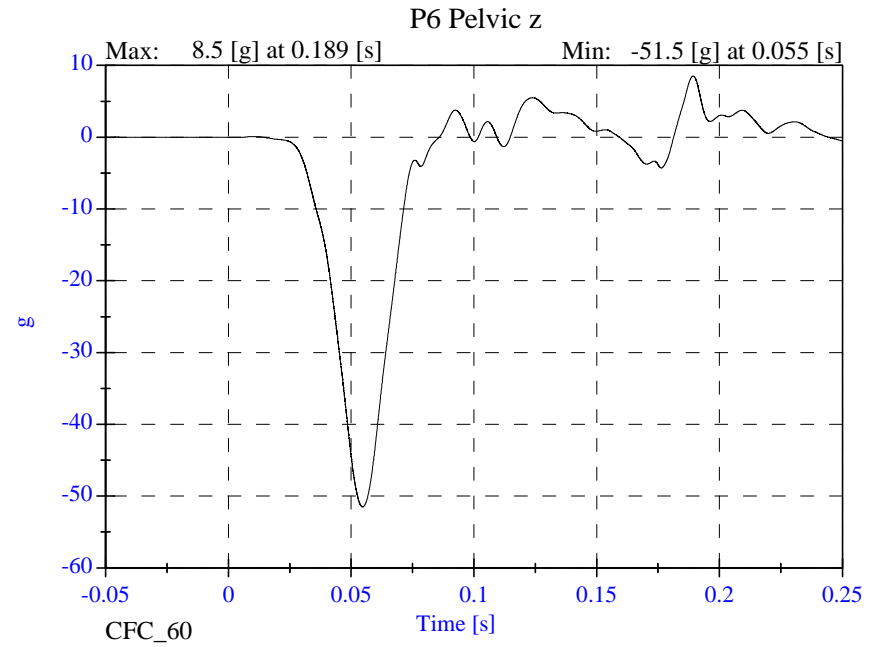
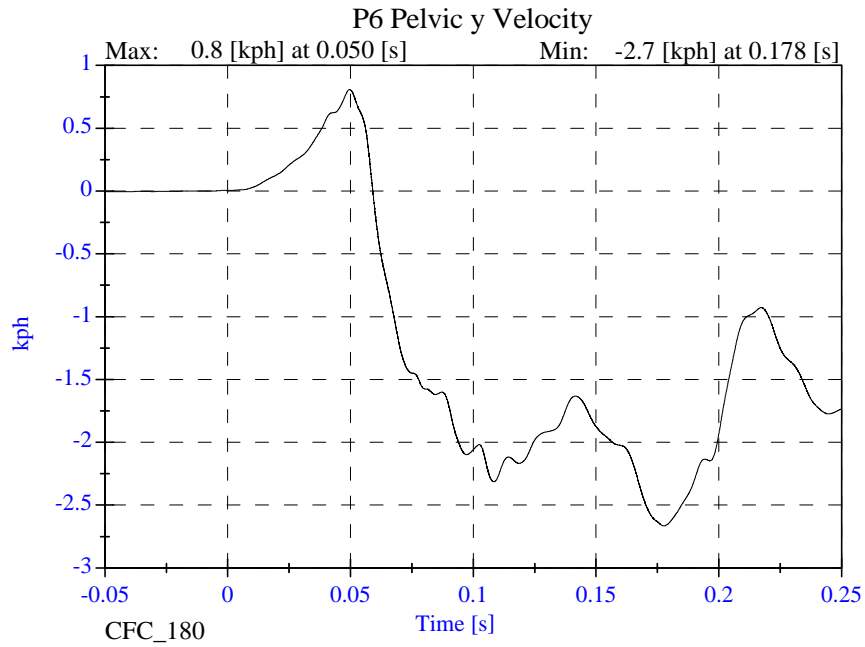
Sled Test Run 22222

- March 18, 2002



Sled Test Run 22222

- March 18, 2002

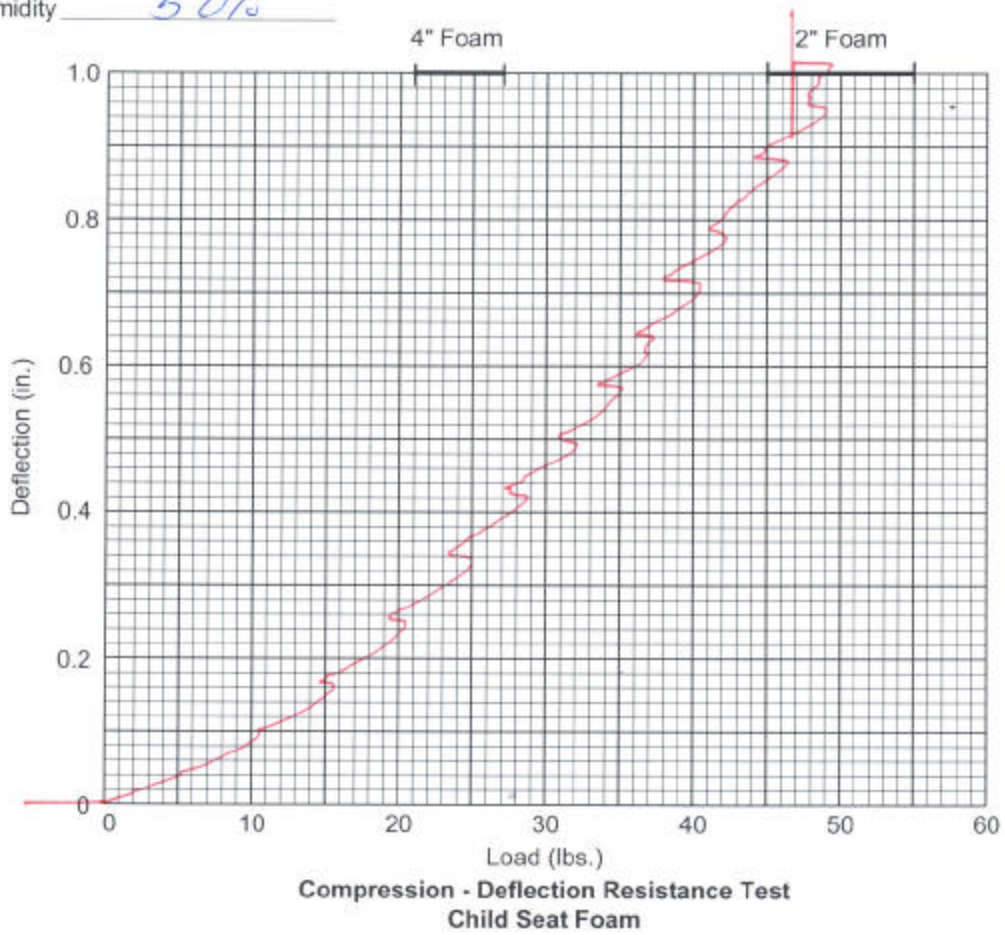


SECTION 9

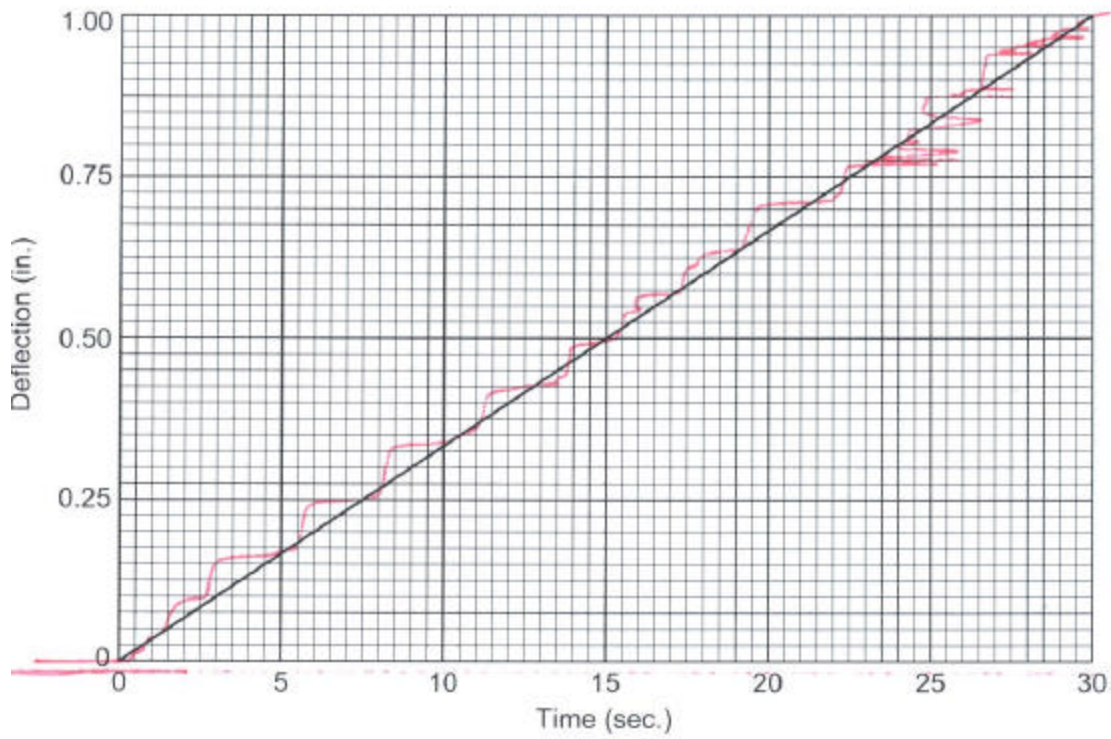
COMPRESSION – DEFLECTION RESISTANCE TEST

Date 3/18/02
Performed By SO
Temp. 70°
Humidity 50%

Foam No. 2x20" 2x29" H16



Date 3/18/02
Temp 70°
Humidity 58%
Foam No. 2" X 20" 2" X 24" H16



Compression - Deflection Resistance Test Child Seat Foam

001-R01

PC32

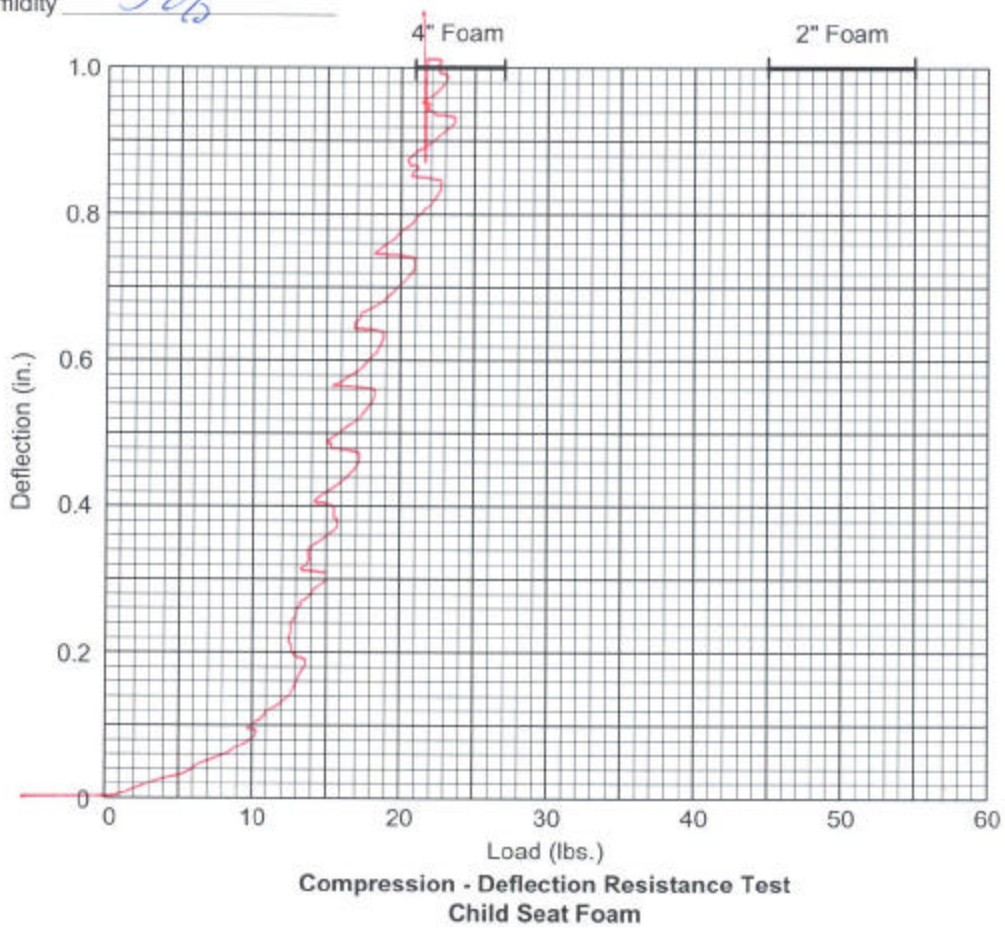
SEAT FOAM USAGE LOG

Foam I.D. Number 2' x 20" 2' x 24" H/16

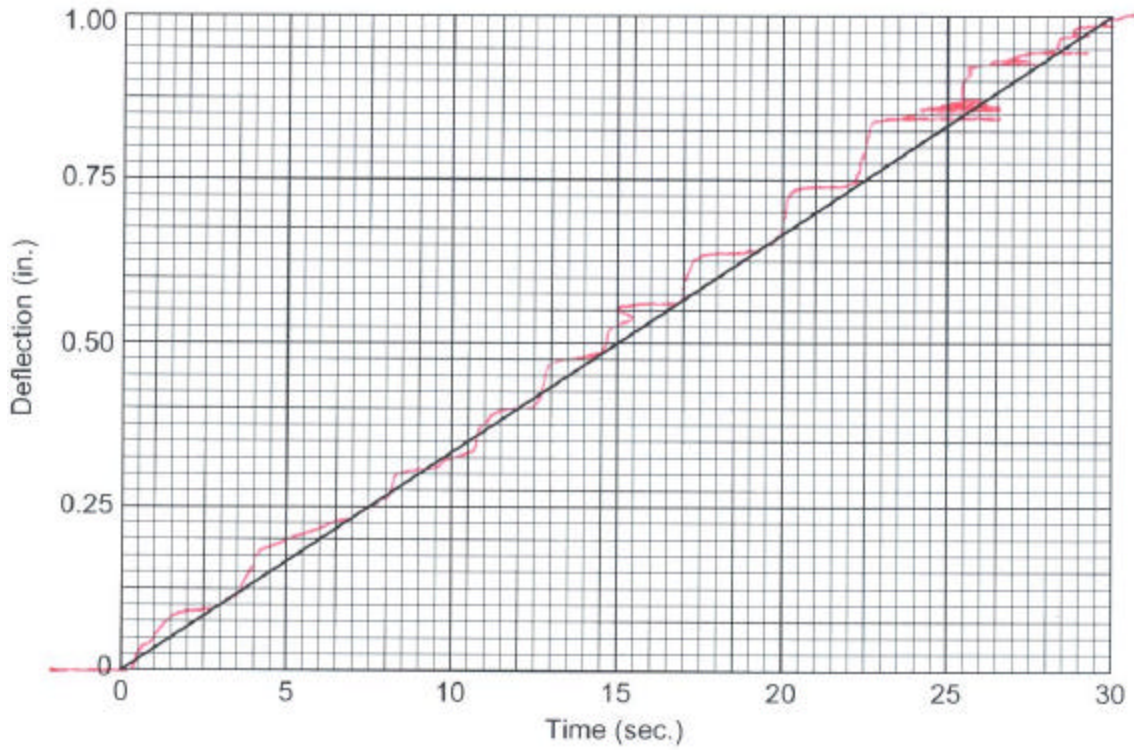
Date	Peak Load	Pass/Fail
3/18/02	46.75 LBS	Pass

Date 3/18/02
Performed By SD
Temp. 70°
Humidity 50%

Foam No. 4 X 20" H/C




Date 3/18/02
Temp 70°
Humidity 50%
Foam No. 4" X 20" H16



Compression - Deflection Resistance Test Child Seat Foam

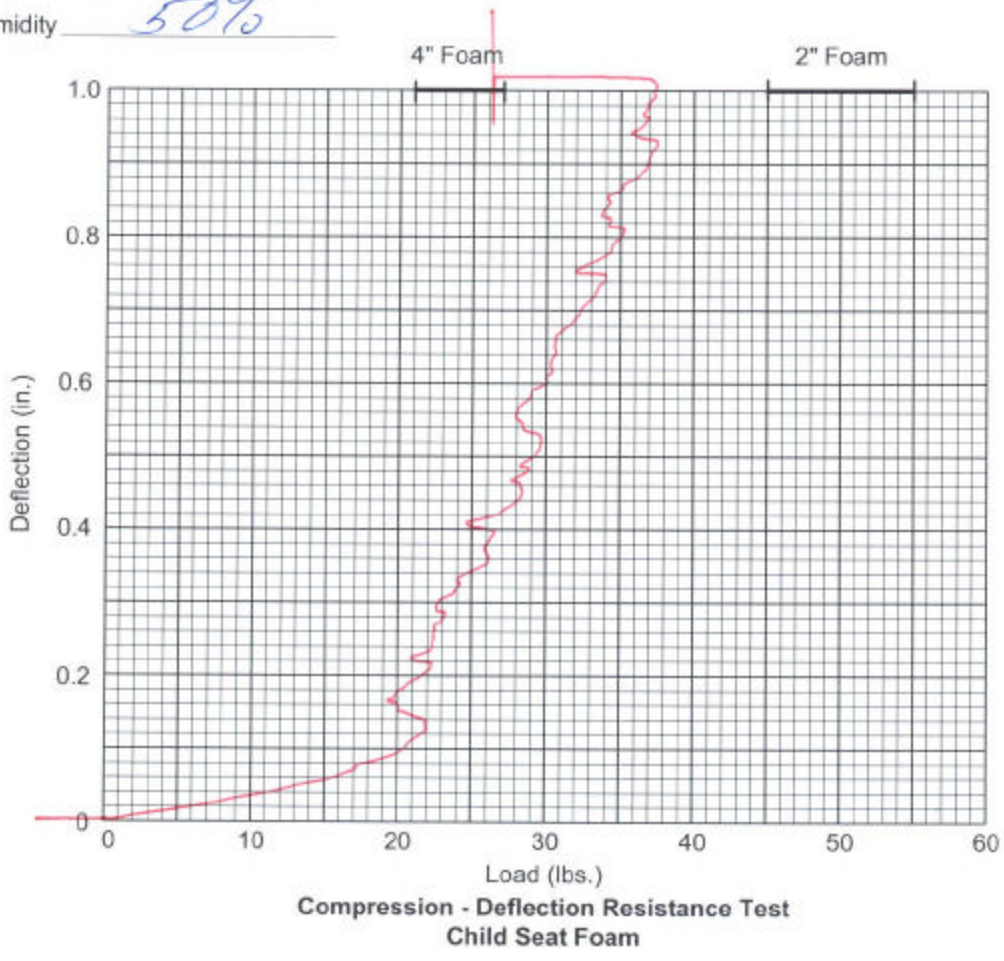
SEAT FOAM USAGE LOG

Foam I.D. Number 9" x 20" H16

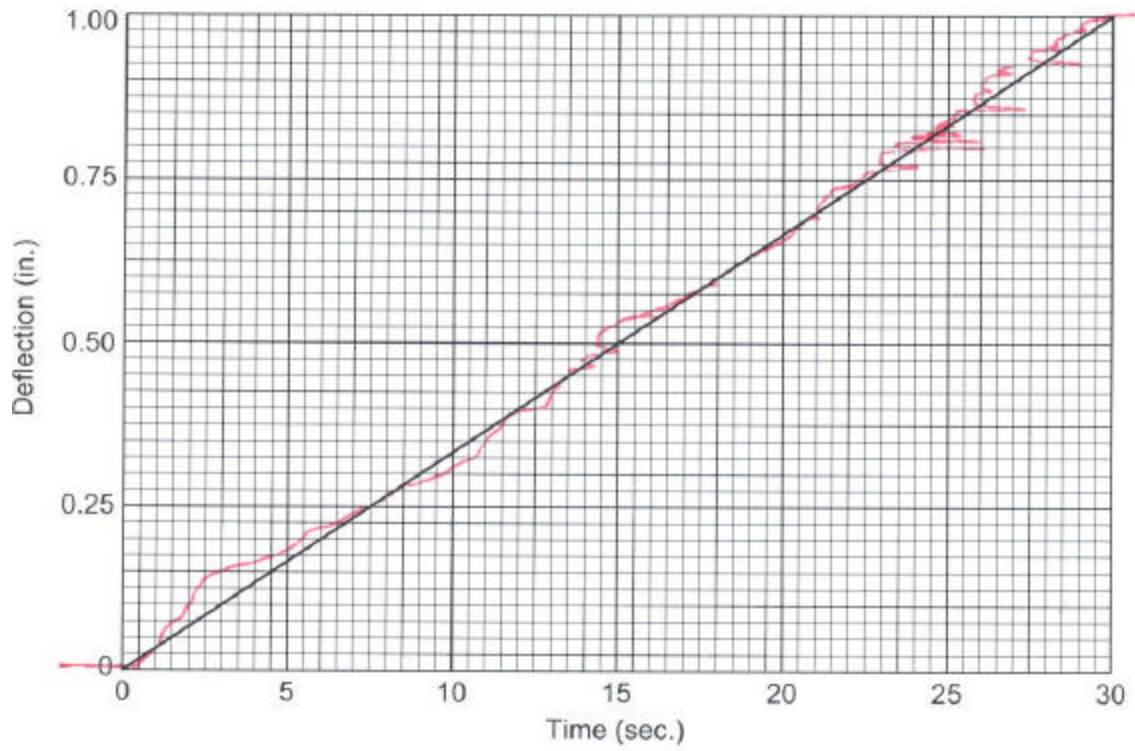
Date	Peak Load	Pass/Fail
3/18/02	21.5 LBS.	

Date 3/18/02
Performed By SD
Temp. 70°
Humidity 50%

Foam No. 7x24" H16



Date 3/18/02
Temp 70°
Humidity 50%
Foam No. 4" X 24" HIC



Compression - Deflection Resistance Test Child Seat Foam

SEAT FOAM USAGE LOG

Foam I.D. Number 4" X 29" H16

Date	Peak Load	Pass/Fail
3/18/02	21.25 LBS	PASS

SECTION 10

CHILD DUMMY CALIBRATION DATA TRACES AND TABLES

1612

upper

Certificate Of Calibration

Calibration ID	10890	Date of Calibration	08-Nov-00
Model	IF-234	Calibration Due Date	09-May-01
Model Description	CHILD NECK	Customer	VRTC US DOT NHTSA
Serial Number	121	Customer ID	D02910
Temp(F)/Humidity	72.0 / 37.0	Customer Order Number	16659
Technician	DENNIS	Units	IMPERIAL

Voltage Calibration Summary

	Direction	Capacity lb/in-lb	Offset mV/V	NonLinearity %Full Scale	Hysteresis %Full Scale	Output@Capacity mV/V	Change %
FX	Positive	1000	0.0145	0.08	0.19	2.6463	0.0
FY	Positive	1000	0.0143	0.15	0.31	2.6745	0.0
FZ	Negative	-1500	-0.0339	0.13	0.13	-1.4467	0.0
MX	Positive	1500	-0.0005	0.13	0.30	2.1227	0.0
MY	Positive	1500	0.0206	0.08	0.29	2.1323	0.0
MZ	Positive	1000	0.0016	0.45	0.79	2.3597	0.0

Wire Color Codes

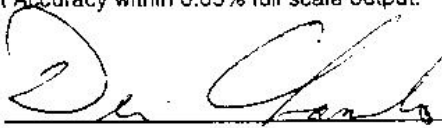
FX and MX		FY and MY		FZ and MZ	
Brown	+Excitation	Red-Stripe	+Excitation	Green	+Excitation
Red	+Signal	Black	+Signal	Blue	+Signal
Orange	-Excitation	White	-Excitation	Violet	-Excitation
Yellow	-Signal	Black-Stripe	-Signal	Gray	-Signal

Reference Load Cell

Manufacturer	Interface - GOLDEN	Calibration Date	07-Sep-00
Model	1610ARC-2K	Calibration Due Date	07-Sep-01
Serial Number	113739		

Reference loadcell calibrated by Interface Inc.
Tracable to the National Institute of Standards and Technology (NIST)

Measurement Accuracy within 0.05% full scale output.

Calibration Certified by 

FTSS Authorized Representative

Calibration Procedure FTSS Load Cell Calibration Procedure



Certificate Of Calibration

Calibration ID	10890	Date of Calibration	08-Nov-00
Model	IF-234	Calibration Due Date	09-May-01
Model Description	CHILD NECK	Customer	VRTC US DOT NHTSA
Serial Number	121	Customer ID	D02910
Temp(F)/Humidity	72.0 / 37.0	Customer Order Number	16659
Technician	DENNIS	Units	IMPERIAL

% Full Scale Crosstalk

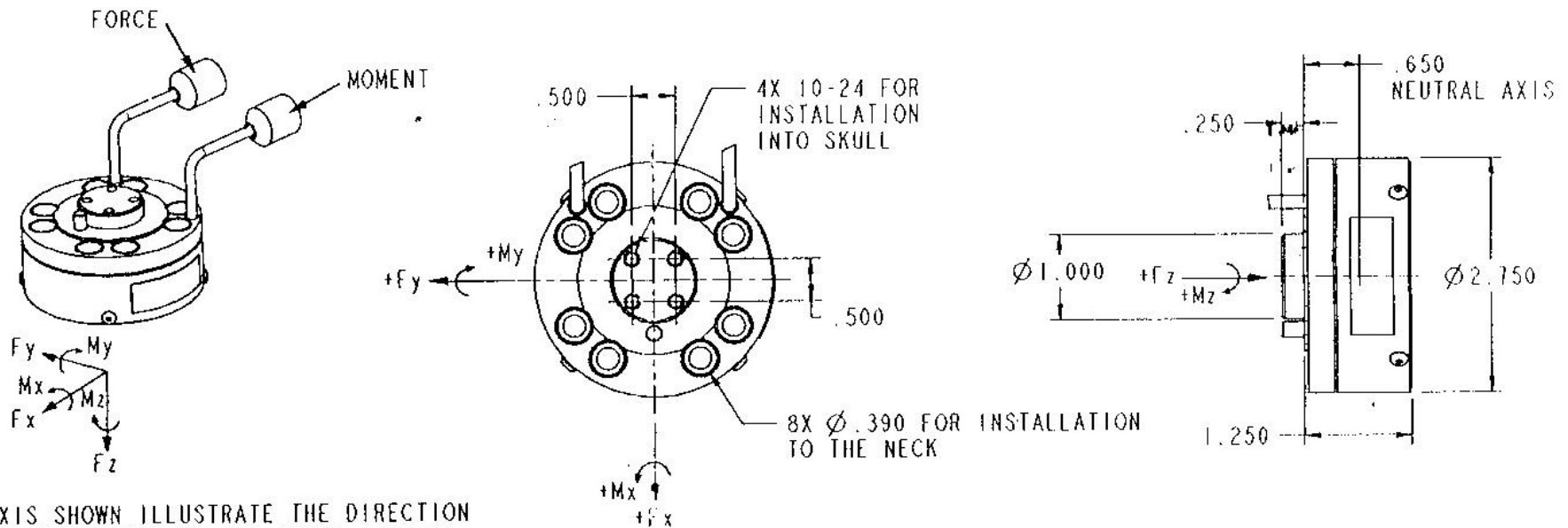
	Direction	Load lb/in-lb	FX %Full Scale	FY %Full Scale	FZ %Full Scale	MX %Full Scale	MY %Full Scale	MZ %Full Scale
FX	Positive	1000	0.00	-1.25	1.27	0.38	1.97	0.30
FY	Positive	1000	1.23	0.00	0.63	-2.49	-0.19	-0.58
FZ	Negative	-1500	0.09	-0.34	0.00	-0.46	-0.24	-0.01
MX	Positive	1500	-0.23	0.60	-2.05	0.00	-1.14	-0.30
MY	Positive	1500	-0.42	-0.03	-1.68	1.19	0.00	-0.39
MZ	Positive	1000	0.42	0.53	-2.05	0.13	0.39	0.00

Shunt Calibration

	Loading	Shunt (Ohms)	+Ex to +Sig	+Ex to -Sig	-Ex to +Sig	-Ex to -Sig	Units	Bridge (Ohms)
FX	Positive	60000	555.6	-555.9	-554.9	555.6	LBF	350
	Positive	80000	417.4	-417.7	-416.6	417.0	LBF	350
	Positive	100000	334.0	-334.4	-333.4	333.9	LBF	350
FY	Positive	60000	549.8	-549.9	-549.5	549.4	LBF	350
	Positive	80000	412.9	-412.8	-412.5	412.4	LBF	350
	Positive	100000	330.5	-330.6	-330.2	330.0	LBF	350
FZ	Negative	120000	1509.4	-1513.3	-1506.4	1509.7	LBF	700
	Negative	150000	1209.4	-1211.6	-1206.0	1208.6	LBF	700
	Negative	300000	605.7	-606.3	-603.4	604.9	LBF	700
MX	Positive	60000	1036.8	-1038.8	-1038.0	1039.4	IN-LBF	350
	Positive	80000	778.8	-779.4	-779.1	780.0	IN-LBF	350
	Positive	100000	623.3	-624.0	-623.5	624.5	IN-LBF	350
MY	Positive	60000	1032.5	-1032.2	-1033.1	1033.5	IN-LBF	350
	Positive	80000	775.6	-775.6	-775.5	775.7	IN-LBF	350
	Positive	100000	620.9	-620.9	-621.0	620.9	IN-LBF	350
MZ	Positive	80000	925.9	-924.9	-926.4	926.3	IN-LBF	700
	Positive	100000	742.0	-741.3	-742.1	741.8	IN-LBF	700
	Positive	120000	618.6	-618.1	-618.7	618.5	IN-LBF	700

All shunt resistors are of 0.01% accuracy.

When the equivalent loads are calculated, the sensitivities of a channel for both positive and negative loading directions are assumed to be the same.



THE AXIS SHOWN ILLUSTRATE THE DIRECTION OF APPLIED FORCES TO THE LOWER PART OF LOADCELL FOR POSITIVE LOADCELL OUTPUT WHEN THIS LOADCELL IS USED AS AN UPPER NECK LOADCELL.

HOWEVER, WHEN THIS LOADCELL IS USED AS A LOWER NECK LOADCELL, THE POLARITY OF THE DATA FOR F_x AND M_x MUST BE CHANGED TO CONFORM TO S.A.E. J-211 SIGN CONVENTION.

SPECIFICATIONS

CAPACITY (LBF/IN-LBF)	CHARTED
OVERLOAD CAPACITY (% F.S.)	150
OUTPUT @ F.S. (mV/V) NOMINAL	CHARTED
EXCITATION (VDC) MAX.	15
BRIDGE RESISTANCE (Ω) NOMINAL	CHARTED
NON-LINEARITY (% F.S.)	1.0
HYSTERESIS (% F.S.)	1.0
OPERATING TEMP. RANGE ($^{\circ}$ F)	-65 TO +250
CROSSTALK (% F.S.)	<5%
WEIGHT (LBS)	0.52

	F_x	F_y	F_z	M_x	M_y	M_z
CAPACITY (LBF/IN-LBF)	1,000	1,000	1,500	1,500	1,500	1,000
OUTPUT (mV/V)	2.8	2.8	1.5	2.2	2.2	2.4
BRIDGE RES. (Ω)	350	350	700	350	350	700

WIRING CODE

F_x - M_x		F_y - M_y		F_z - M_z	
COLOR	FUNCTION	COLOR	FUNCTION	COLOR	FUNCTION
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.

1 FIRST TECHNOLOGY
SAFETY SYSTEMS

CHILD SIX CHANNEL NECK LOADCELL

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

DWG. NO. 1F-234

REV
A

142

lower

Certificate Of Calibration

Calibration ID	10839	Date of Calibration	06-Nov-00
Model	IF-234	Calibration Due Date	06-May-01
Model Description	CHILD NECK	Customer	VRTC US DOT NHTSA
Serial Number	120	Customer ID	D02910
Temp(C)/Humidity	22.2 / 27.0	Customer Order Number	16659
Technician	DENNIS	Units	METRIC

Voltage Calibration Summary

	Direction	Capacity N/N-M	Offset mV/V	NonLinearity %Full Scale	Hysteresis %Full Scale	Output@Capacity mV/V	Change %
FX	Positive	4450	-0.0099	0.14	0.29	2.7148	0.0
FY	Positive	4450	0.0001	0.17	0.34	2.7001	0.0
FZ	Negative	-6670	0.0131	0.12	0.11	-1.4629	0.0
MX	Positive	170	-0.0148	0.10	0.29	2.1545	0.0
MY	Positive	170	-0.0065	0.09	0.33	2.1515	0.0
MZ	Positive	110	0.0220	0.47	0.85	2.3500	0.0

Wire Color Codes

FX and MX		FY and MY		FZ and MZ	
Brown	+Excitation	Red-Stripe	+Excitation	Green	+Excitation
Red	+Signal	Black	+Signal	Blue	+Signal
Orange	-Excitation	White	-Excitation	Violet	-Excitation
Yellow	-Signal	Black-Stripe	-Signal	Gray	-Signal

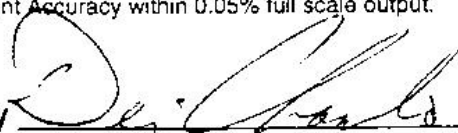
Reference Load Cell

Manufacturer	Interface - GOLDEN	Calibration Date	07-Sep-00
Model	1610ARC-2K	Calibration Due Date	07-Sep-01
Serial Number	113739		

Reference loadcell calibrated by Interface Inc.

Tracable to the National Institute of Standards and Technology (NIST)

Measurement Accuracy within 0.05% full scale output.

Calibration Certified by 
FTSS Authorized Representative

Calibration in conformance with FTSS Loadcell Calibration Procedure.



Certificate Of Calibration

Calibration ID	10839	Date of Calibration	06-Nov-00
Model	IF-234	Calibration Due Date	06-May-01
Model Description	CHILD NECK	Customer	VRTC US DOT NHTSA
Serial Number	120	Customer ID	D02910
Temp(C)/Humidity	22.2 / 27.0	Customer Order Number	16659
Technician	DENNIS	Units	METRIC

% Full Scale Crosstalk

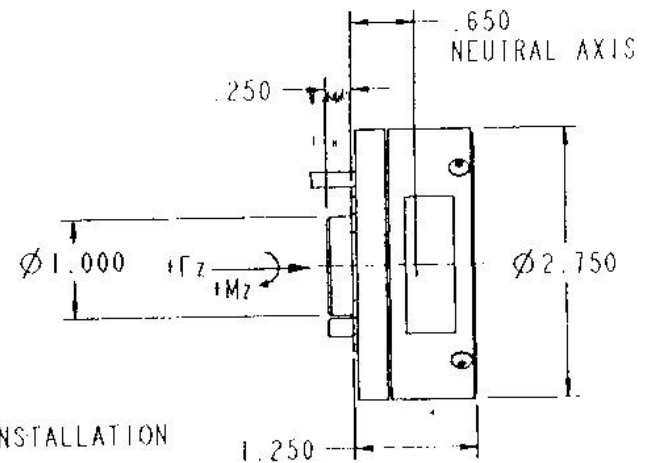
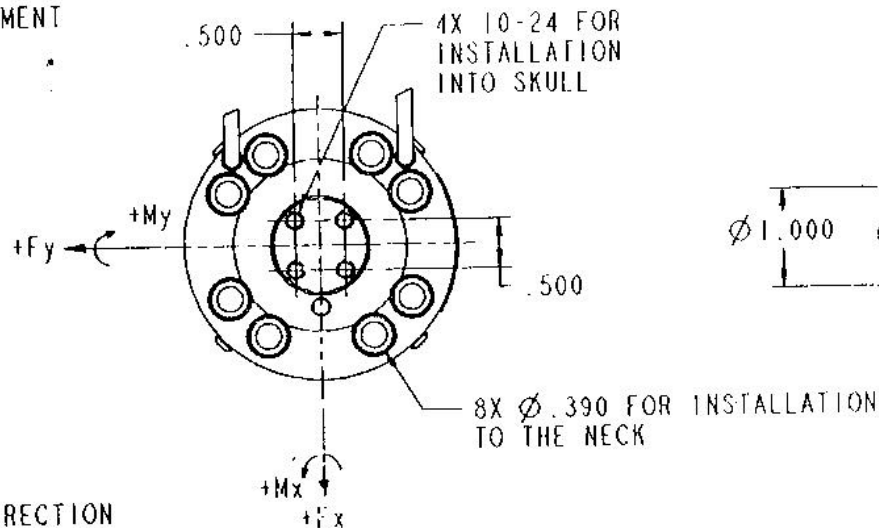
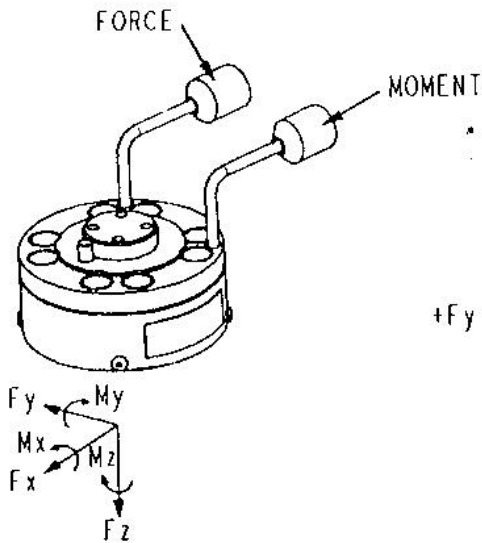
	Direction	Load N/N-M	FX %Full Scale	FY %Full Scale	FZ %Full Scale	MX %Full Scale	MY %Full Scale	MZ %Full Scale
FX	Positive	4450	0.00	0.12	1.09	0.63	2.46	3.00
FY	Positive	4450	-0.35	0.00	-1.45	-2.99	-1.34	2.24
FZ	Negative	-6670	0.12	0.13	0.00	0.12	-0.42	0.14
MX	Positive	170	-0.05	0.20	-0.80	0.00	1.14	-0.52
MY	Positive	170	-0.36	-0.23	-1.14	0.07	0.00	0.38
MZ	Positive	110	0.19	-0.24	-0.55	-0.21	-0.15	0.00

Shunt Calibration

	Loading	Shunt (Ohms)	+Ex to +Sig	+Ex to -Sig	-Ex to +Sig	-Ex to -Sig	Units	Bridge (Ohms)
FX	Positive	60000	2407.4	-2406.9	-2406.5	2405.2	N	350
	Positive	80000	1808.2	-1808.2	-1804.6	1806.4	N	350
	Positive	100000	1447.0	-1447.5	-1444.8	1446.1	N	350
FY	Positive	60000	2424.3	-2419.8	-2420.7	2418.9	N	350
	Positive	80000	1820.7	-1817.5	-1818.0	1817.5	N	350
	Positive	100000	1457.2	-1454.6	-1455.0	1455.0	N	350
FZ	Negative	120000	6649.2	-6645.2	-6650.1	6642.5	N	700
	Negative	150000	5321.0	-5324.5	-5322.7	5320.5	N	700
	Negative	300000	2664.5	-2666.3	-2665.4	2664.0	N	700
MX	Positive	60000	115.6	-115.8	-115.5	115.8	N-M	350
	Positive	80000	87.0	-87.0	-86.9	86.9	N-M	350
	Positive	100000	69.6	-69.6	-69.5	69.6	N-M	350
MY	Positive	60000	115.8	-115.4	-116.0	115.8	N-M	350
	Positive	80000	87.0	-86.8	-87.1	86.8	N-M	350
	Positive	100000	69.6	-69.5	-69.7	69.5	N-M	350
MZ	Positive	80000	102.3	-102.1	-102.3	102.2	N-M	700
	Positive	100000	82.0	-81.8	-81.9	81.8	N-M	700
	Positive	120000	68.3	-68.2	-68.3	68.2	N-M	700

All shunt resistors are of 0.01% accuracy.

When the equivalent loads are calculated, the sensitivities of a channel for both positive and negative loading directions are assumed to be the same.



THE AXIS SHOWN ILLUSTRATE THE DIRECTION OF APPLIED FORCES TO THE LOWER PART OF LOADCELL FOR POSITIVE LOADCELL OUTPUT WHEN THIS LOADCELL IS USED AS AN UPPER NECK LOADCELL.

HOWEVER, WHEN THIS LOADCELL IS USED AS A LOWER NECK LOADCELL, THE POLARITY OF THE DATA FOR F_x AND M_x MUST BE CHANGED TO CONFORM TO S.A.E. J-211 SIGN CONVENTION.

SPECIFICATIONS

CAPACITY (LBF/IN-LBF)	CHARTED
OVERLOAD CAPACITY (% F.S.)	150
OUTPUT @ F.S. (mV/V) NOMINAL	CHARTED
EXCITATION (VDC) MAX.	15
BRIDGE RESISTANCE (Ω) NOMINAL	CHARTED
NON-LINEARITY (% F.S.)	1.0
HYSTERESIS (% F.S.)	1.0
OPERATING TEMP. RANGE ($^{\circ}$ F)	-65 TO +250
CROSSTALK (% F.S.)	<5%
WEIGHT (LBS)	0.52

	F_x	F_y	F_z	M_x	M_y	M_z
CAPACITY (LBF/IN-LBF)	1,000	1,000	1,500	1,500	1,500	1,000
OUTPUT (mV/V)	2.8	2.8	1.5	2.2	2.2	2.4
BRIDGE RES. (Ω)	350	350	700	350	350	700

WIRING CODE

F_x - M_x		F_y - M_y		F_z - M_z	
COLOR	FUNCTION	COLOR	FUNCTION	COLOR	FUNCTION
BROWN	+EXC.	RED STRIPE	+EXC.	GREEN	+EXC.
RED	+SIG.	BLACK	+SIG.	BLUE	+SIG.
ORANGE	-EXC.	WHITE	-EXC.	VIOLET	-EXC.
YELLOW	-SIG.	BLACK STRIPE	-SIG.	GREY	-SIG.

**FIRST TECHNOLOGY
SAFETY SYSTEMS**

CHILD SIX CHANNEL NECK LOADCELL

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES

DWG. NO.

1F-234

REV.

A

*****CALIBRATION CERTIFICATE*****

Vehicle Research & Test Center - PO Box 37 - E. Liberty, Ohio 43319

	Type	Manufacturer	Model	Serial No.
Transducer:	Chest pot	Servo	N/A	142
Cal. Equip:	Power Supply DMM	Elect. Developement Kiethley	Cce-10d 197a	4876 us-894d0

Label	Pin	Color	Excitation	
+ Excit.	(3)	RED	10 Volts	INPUT RESISTANCE: _____ ohms
- Excit.	(7)	BLACK		
+ Signal	(2)	GREEN		SIGNAL RESISTANCE: _____ ohms
- Signal	(8)	WHITE		
Shield	(5)			COMPUTED OFFSET: 5.241133 [Volts]

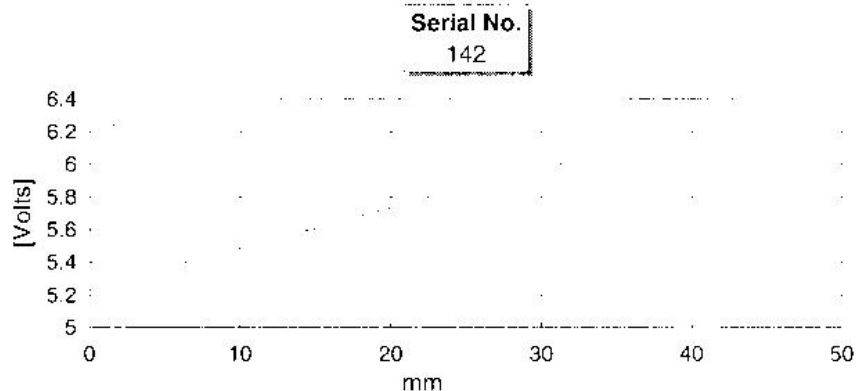
CAL. ROOM TEMP: 70 Deg F MAX NON-LINEARITY: _____ %

CAL ROOM HUMIDITY: _____ % FULL SCALE: 45 mm

CAL. ROOM BAROMETER: _____ inches SENSITIVITY: 2.421 mV/Volt/mm

TECHNICIAN: _____ Date: 1/14/2002
Joshua Smith

ENGINEER UNITS mm	Y-axis READING [Volts]	NON- LINEARITY [%]	%FULL SCALE ERROR		
0	5.231	ERR	0.93%	Regression Output:	
5	5.357	4.37%	0.48%	Constant	5.241133
10	5.486	-1.05%	-0.25%	Std Err of Y Est	0.010967
15	5.609	-1.20%	-0.43%	R Squared	0.999043
20	5.734	-1.69%	-0.80%	No. of Observations	9
25	5.854	-1.16%	-0.70%	Degrees of Freedom	7
30	5.974	-0.81%	-0.60%		
35	6.095	-0.67%	-0.60%	X Coefficient(s)	0.02421
40	6.188	2.32%	1.98%	Std Err of Coef.	0.000283



Servo
N/A

#142 HIII 340
Head X Fnd

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5932

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99108-F29

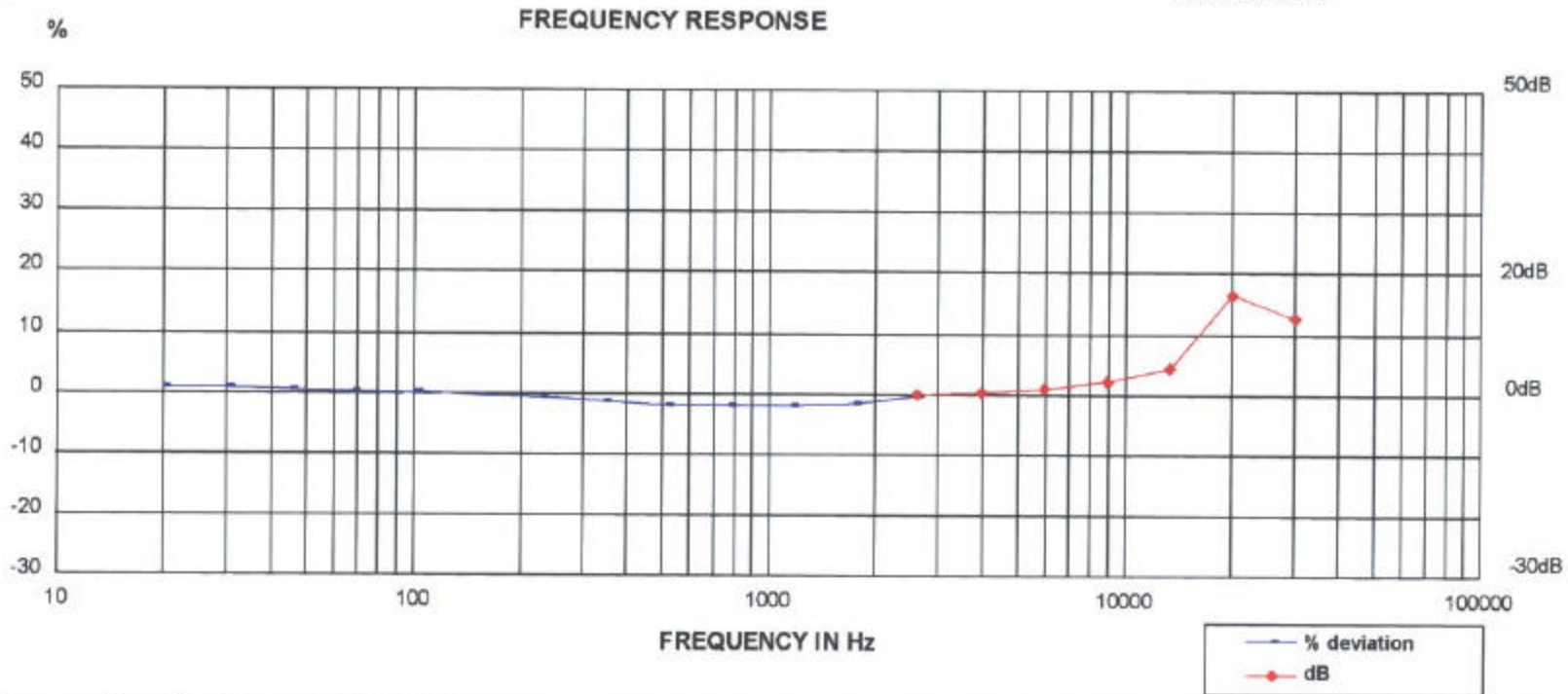
Input Resistance (ohms): 944.51
ZMO (mV): 16.825
Resonance Frequency (Hz): 25146

0.1987 mV/g @ 100 Hz, 10g pk

Last Sens: 1.987E-1, Change: -0.02
Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NC SL Z540-1-1994 (MIL-STD 45662A).

Uncertainty estimate (95% confidence, k=2)

Console serial number: AC27	+/- 1.1 %	100.0 Hz Sensitivity
NIST traceability #: 822/262802-00	+/- 5.0 %	10.0 to 20.0 Hz
Equipment used: 2901	+/- 1.5 %	20.0 to 2000.0 Hz
Test definition: FINAL	+/- 2.5 %	2000.0 to 10000.0 Hz
	+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____
P. KRAMP
Date: 1/9/2002

Endevco
Transportation Research Center

F142 HIII 3Y0
Head Y - LEFT

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5929

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99102-F12

Input Resistance (ohms): 997.42

ZMO (mV): -11.12

Resonance Frequency (Hz): 27776

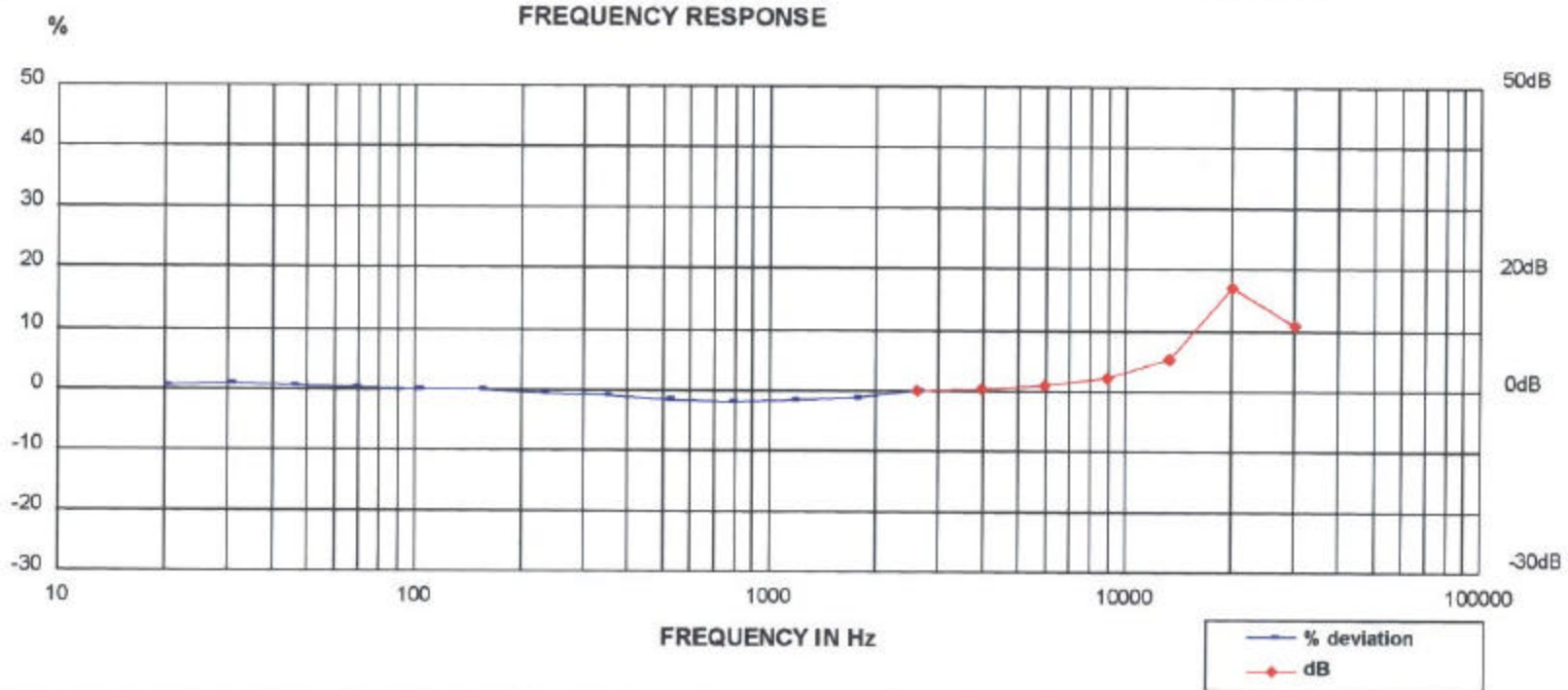
0.1839 mV/g @ 100 Hz, 10g pk

Last Sens: 1.836E-1, Change: 0.19

Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NCSL Z540-1-1994 (MIL-STD 45662A).

Uncertainty estimate (95% confidence, k=2)

Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____
P. KRAMP
Date: 1/9/2002

Endevco
Transportation Research Center

142 H III 340

Head \approx WP

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5934

Description: VRTC - Full Bridge Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BQ-2000BF
Serial Number: 00L13-F03

Input Resistance (ohms): 455.2
Output Resistance (ohms): 458.82
ZMO (mV): -7.172
Resonance Frequency (Hz): 18429

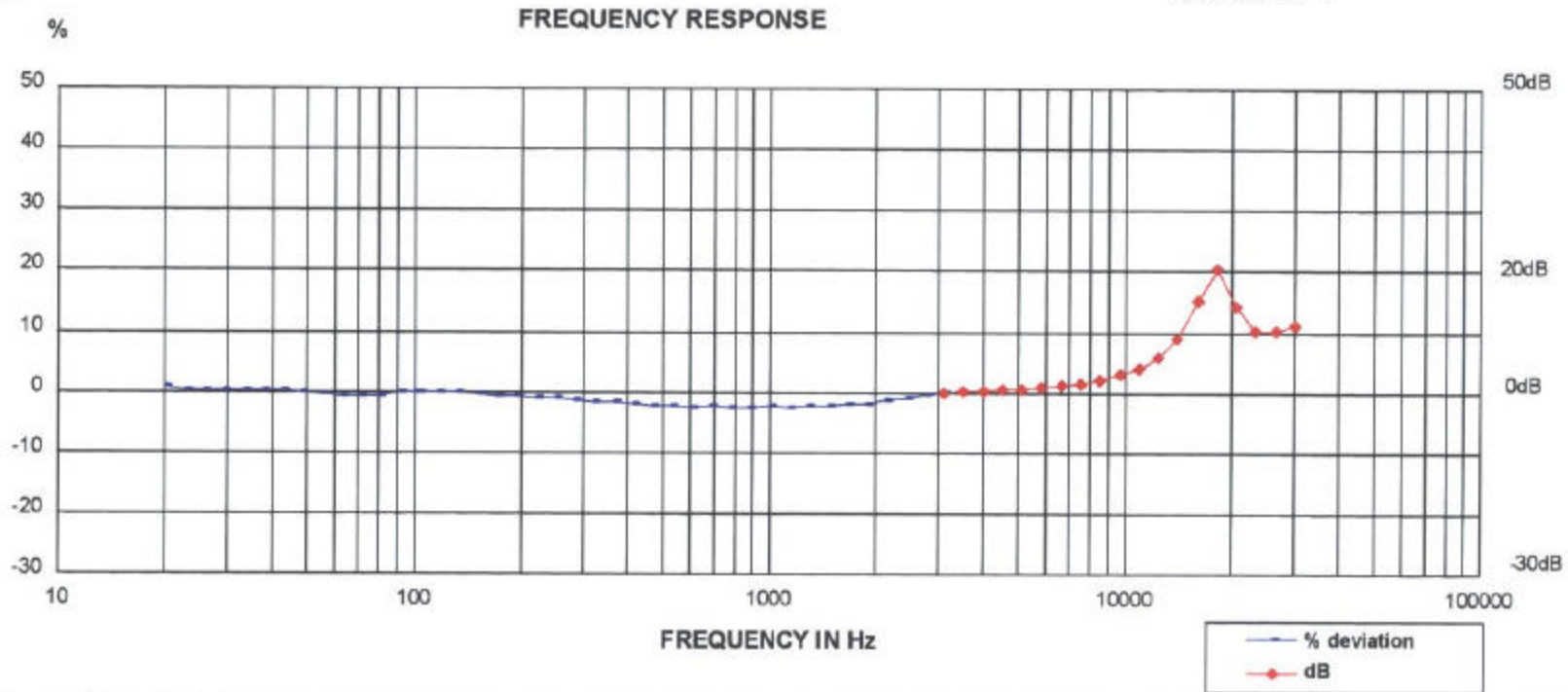
0.2506 mV/g @ 100 Hz, 10g pk

Last Sens: 2.486E-1, Change: 0.79

Next cal date: 1/9/2003

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NCSS Z540-1-1994 (MIL-STD 45662A).

console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

Uncertainty estimate (95% confidence, k=2)

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____

P. KRAMP

Date: 1/9/2002

Endevco

Transportation Research Center

142 HTII 340

Head Red \approx μ P

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5933

Description: VRTC - Full Bridge Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BQ-2000BF
Serial Number: 98G18-F18

Input Resistance (ohms): 501.49
Output Resistance (ohms): 500.5
ZMO (mV): 14.539
Resonance Frequency (Hz): 19536

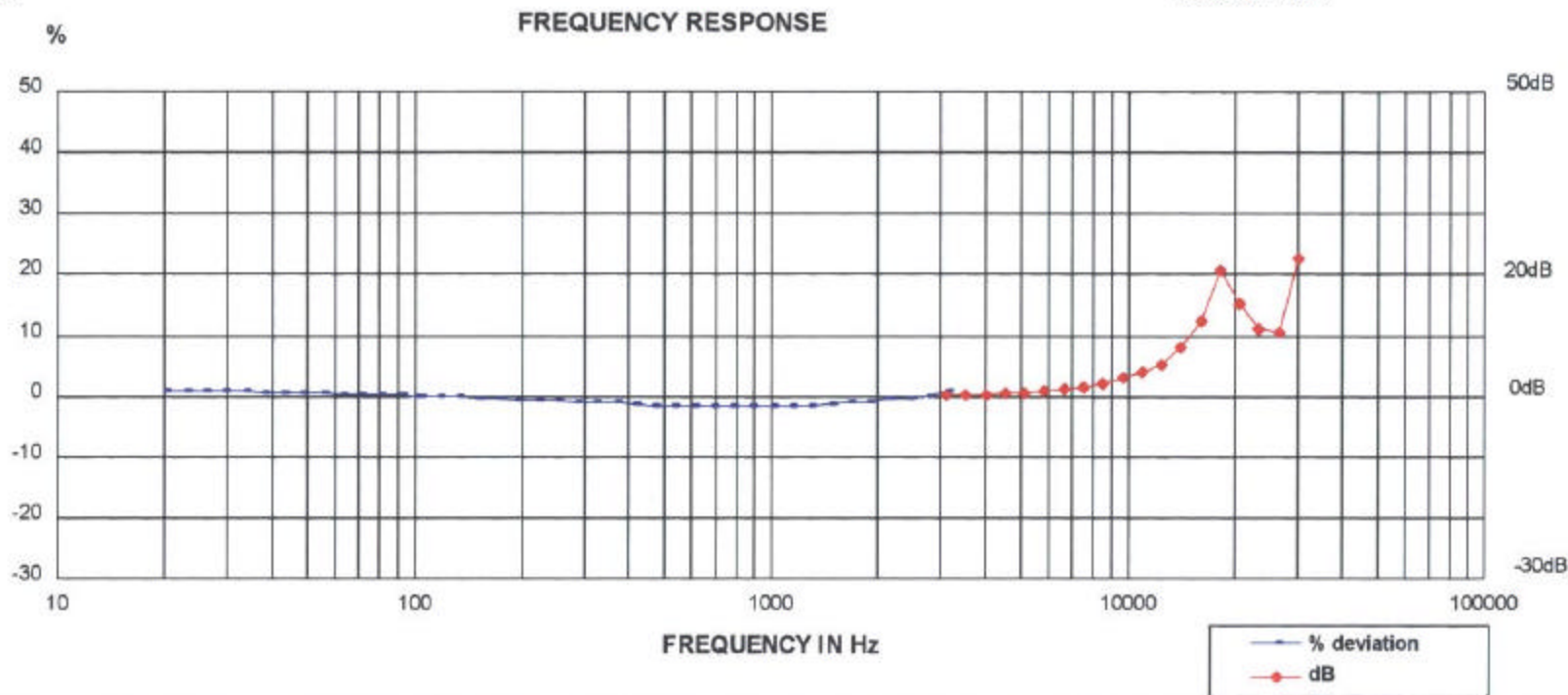
0.1861 mV/g @ 100 Hz, 10g pk

Last Sens: 1.852E-1, Change: 0.46

Next cal date: 1/9/2003

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NC SL Z540-1-1994 (MIL-STD 45662A).

Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

Uncertainty estimate (95% confidence, k=2)

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____
P.KRAMP
Date: 1/9/2002

Endevco
Transportation Research Center

12HIII 3V0

Chest X Fwd

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5920

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99H30-Z04

Input Resistance (ohms): 986.93
ZMO (mV): 0.6887
Resonance Frequency (Hz): 18207

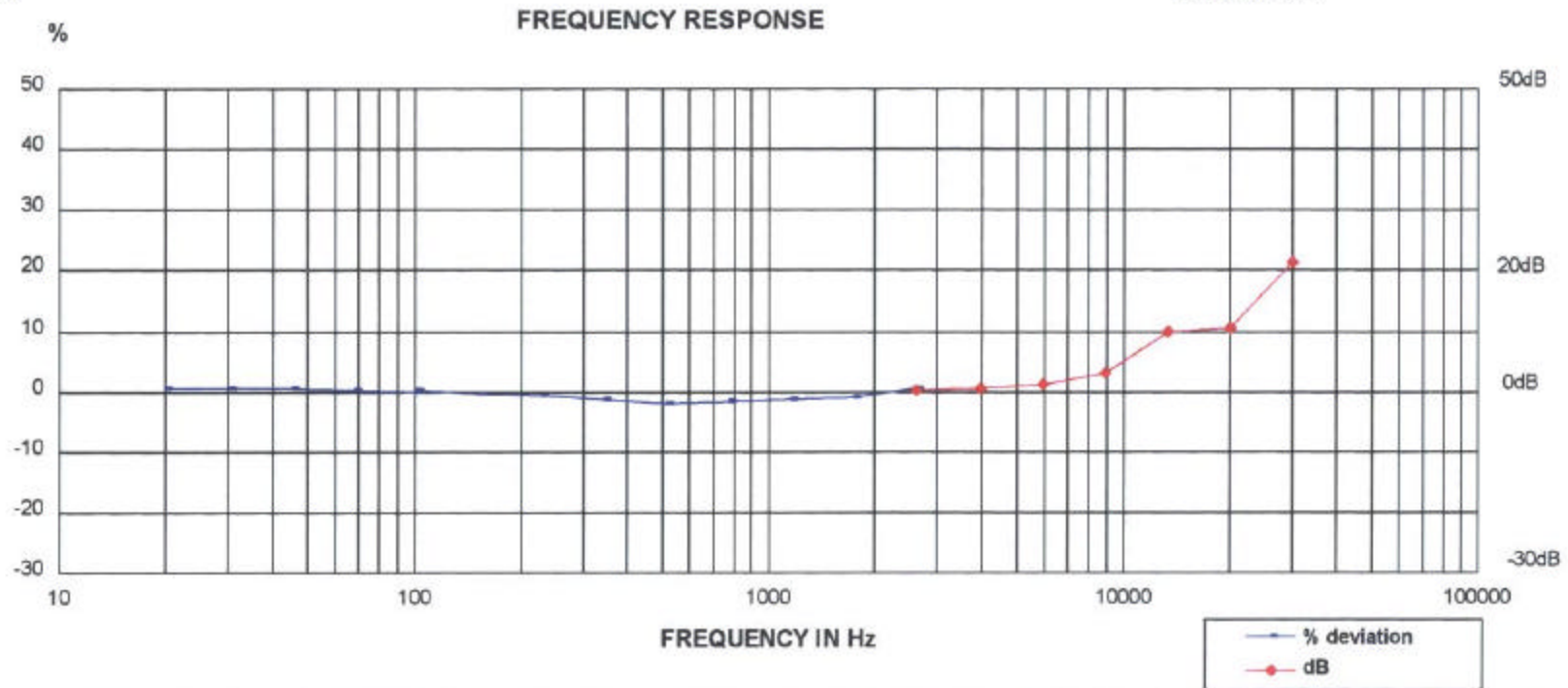
0.2054 mV/g @ 100 Hz, 10g pk

Last Sens: 2.042E-1, Change: 0.59

Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NCSL Z540-1-1994 (MIL-STD 45662A).

Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

Uncertainty estimate (95% confidence, k=2)

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____

P. KRAMP

Date: 1/9/2002

Endevco

Transportation Research Center

#142 HTIII 340

Chest 4 Left

Customer: VRTC
20010620-0270

Calibration Certificate

Document number: 5927

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99108-F28

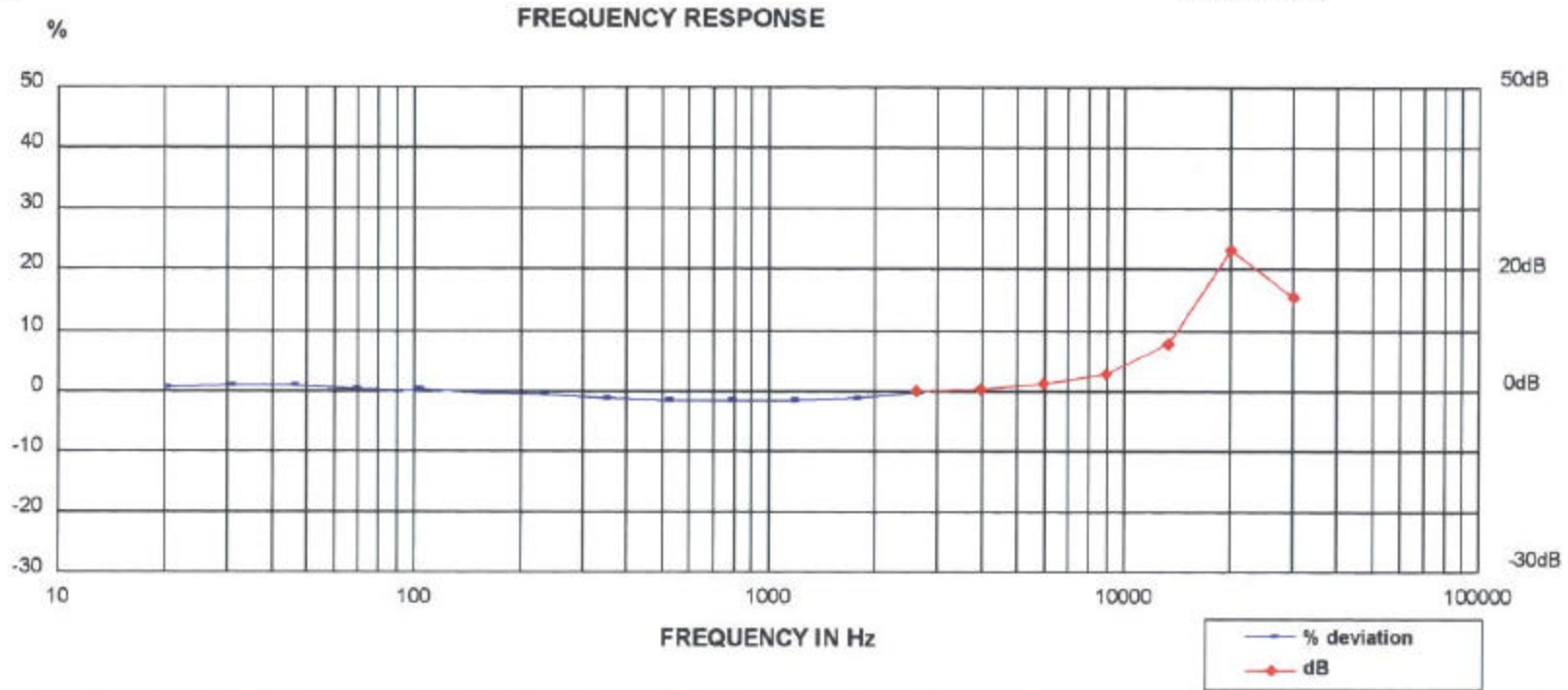
Input Resistance (ohms): 1007.1
ZMO (mV): 1.4745
Resonance Frequency (Hz): 17533

0.2226 mV/g @ 100 Hz, 10g pk

Last Sens: 2.220E-1, Change: 0.27
Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



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Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

Uncertainty estimate (95% confidence, k=2)

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____
P. KRAMP
Date: 1/9/2002

Endevco
Transportation Research Center

#142 HIII 3V0

Chest z wA

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5924

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99108-F30

Input Resistance (ohms): 1039.0

ZMO (mV): -12.98

Resonance Frequency (Hz): 17523

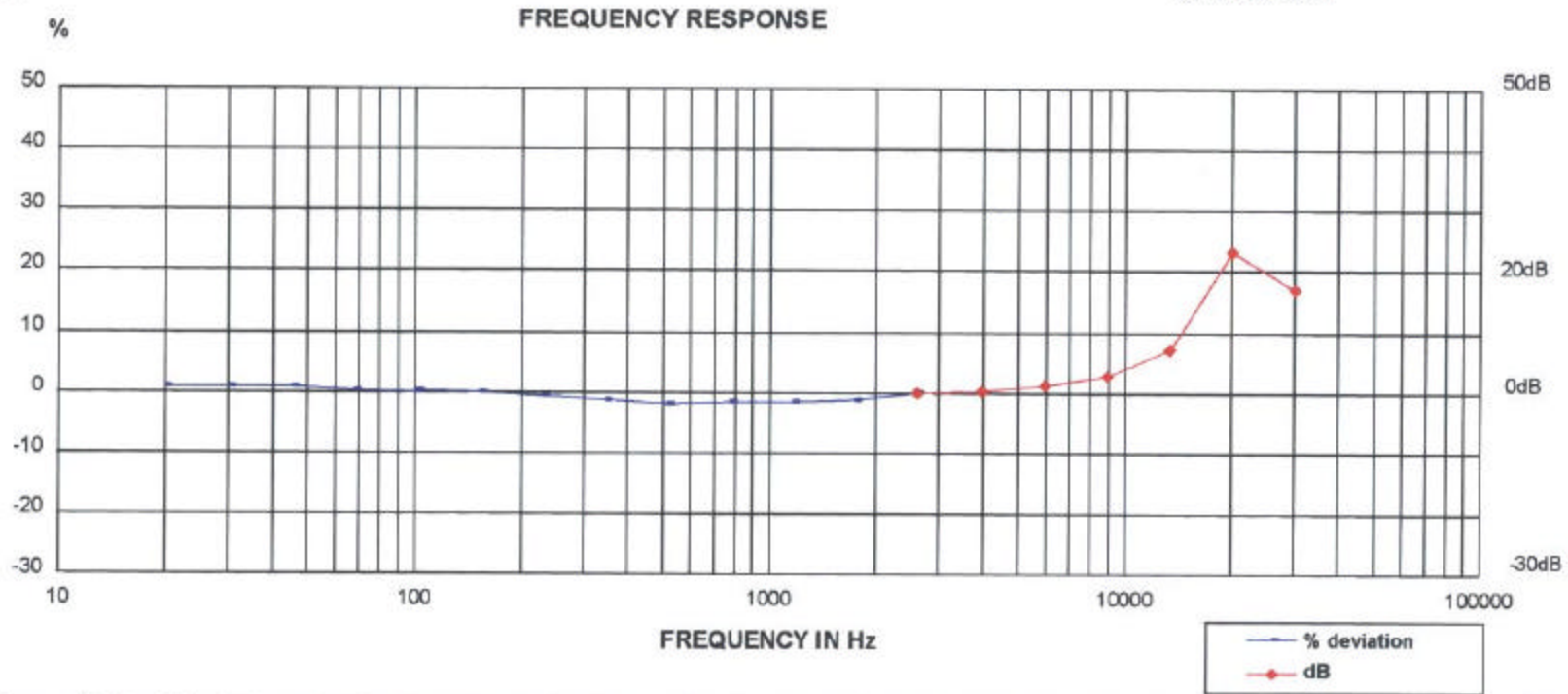
0.2347 mV/g @ 100 Hz, 10g pk

Last Sens: 2.343E-1, Change: 0.16

Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NCSL Z540-1-1994 (MIL-STD 45662A).

Uncertainty estimate (96% confidence, k=2)

Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____

P. KRAMP

Date: 1/9/2002

Endevco

Transportation Research Center

142 H III 340
Pelvis Rear

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5923

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99102-F06

Input Resistance (ohms): 935.54

ZMO (mV): -8.56
Resonance Frequency (Hz): 28185

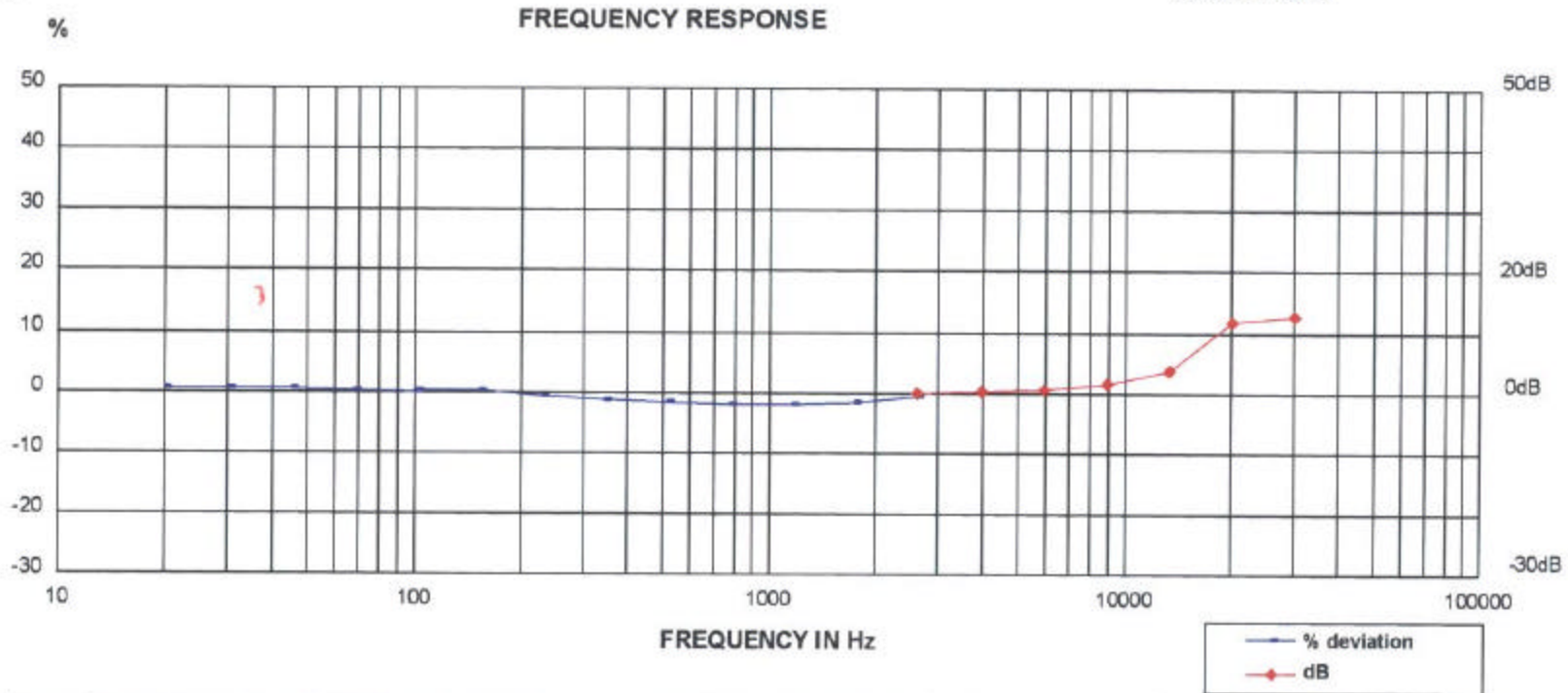
0.1859 mV/g @ 100 Hz, 10g pk

Last Sens: 1.860E-1, Change: -0.01

Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NCSL Z540-1-1994 (MIL-STD 45662A).

Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

Uncertainty estimate (95% confidence, k=2)

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____

P. KRAMP

Date: 1/9/2002

Endevco

Transportation Research Center

#142 + III 340
Pelvis y Left

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5922

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99102-F15

Input Resistance (ohms): 958.27

ZMO (mV): -6.154
Resonance Frequency (Hz): 25281

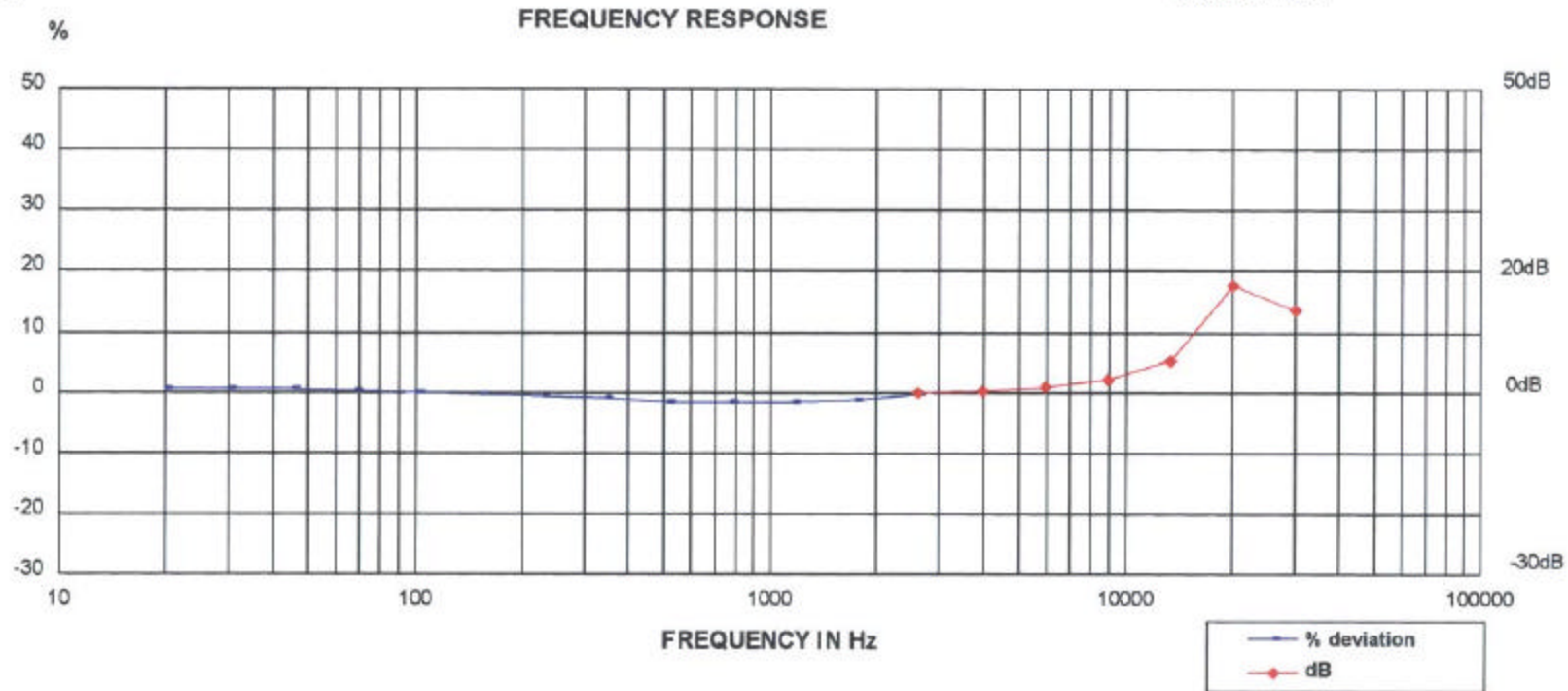
0.1854 mV/g @ 100 Hz, 10g pk

Last Sens: 1.852E-1, Change: 0.14

Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NC SL Z540-1-1994 (MIL-STD 45662A).

Uncertainty estimate (95% confidence, k=2)

Console serial number: AC27
NIST traceability #: 822/262802-00
Equipment used: 2901
Test definition: FINAL

+/- 1.1 %	100.0 Hz Sensitivity
+/- 5.0 %	10.0 to 20.0 Hz
+/- 1.5 %	20.0 to 2000.0 Hz
+/- 2.5 %	2000.0 to 10000.0 Hz
+/- 4.0 %	10000.0 to 20000.0 Hz

By: _____
P. KRAMP

Date: 1/9/2002

Endevco
Transportation Research Center

#142 H11 340

Delvis ZWA

Calibration Certificate

Customer: VRTC
20010620-0270

Document number: 5921

Description: VRTC - Accelerometer
Manufacturer: ENTRAN
Model Number: EGE-73BE0Q-2000BF
Serial Number: 99G29-Q13

Input Resistance (ohms): 632.69

ZMO (mV): -25.21
Resonance Frequency (Hz): 18488

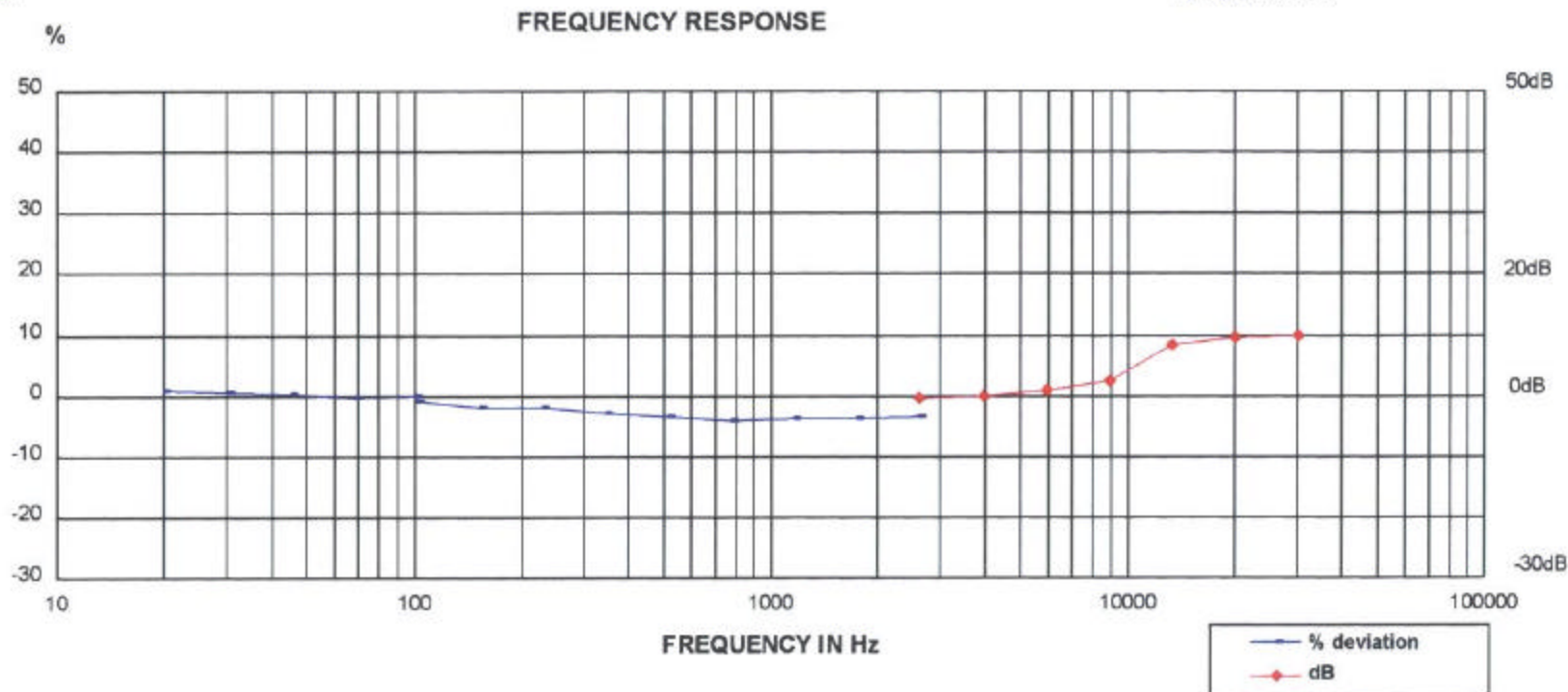
0.2320 mV/g @ 100 Hz, 10g pk

Last Sens: 2.278E-1, Change: 1.83

Next cal date: 7/9/2002

Notes:

Excitation: 10.0 V



Endevco, a division of Meggitt, located at 30700 Rancho Viejo Road, San Juan Capistrano, CA, certifies that the above instrument was tested using comparison calibrations per ANSI S2.2 using Endevco IM68357. This calibration is traceable to the National Institute of Standards and Technology and is in accordance with ANSI/NCSL Z540-1-1994 (MIL-STD 45662A).

Uncertainty estimate (95% confidence, k=2)

Console serial number:	AC27	+/- 1.1 %	100.0 Hz	Sensitivity
NIST traceability #:	822/262802-00	+/- 5.0 %	10.0 to 20.0 Hz	
Equipment used:	2901	+/- 1.5 %	20.0 to 2000.0 Hz	
Test definition:	FINAL	+/- 2.5 %	2000.0 to 10000.0 Hz	
		+/- 4.0 %	10000.0 to 20000.0 Hz	

By: _____
P. KRAMP

Date: 1/9/2002

Endevco
Transportation Research Center

**TRANSPORTATION RESEARCH CENTER INC.
HYBRID III THREE-YEAR-OLD EXTERNAL DIMENSIONS**

SN: 142 MFG: FTSS

DATE: 17-Jan-02

TRC INC. TEST NO: 142C01ED

572P SN142EXT. DIMENSION CAL 01

TEST PARAMETER	DIMEN.	SPECIFICATION	TEST RESULTS
Total Sitting Height	A	538.5 - 553.7 MM	548.6 MM
Shoulder Pivot Height	B	307.4 - 322.6 MM	317.5 MM
Hip Pivot Height	C	33 - 43.2 MM	33.0 MM
Hip Pivot from Backline	D	56.9 - 67.1 MM	63.5 MM
Shoulder Pivot from Backline	E	58.4 - 68.6 MM	66.0 MM
Thigh Clearance	F	81 - 91.2 MM	86.4 MM
Back of Elbow to Wrist Pivot	G	247.4 - 262.6 MM	256.5 MM
Head Back from Backline	H	48.2 - 58.4 MM	53.3 MM
Shoulder to Elbow Length	I	185.4 - 200.6 MM	190.5 MM
Elbow Rest Height	J	133.6 - 148.8 MM	139.7 MM
Buttock to Knee Length	K	287.3 - 302.5 MM	292.1 MM
Popliteal Height	L	221 - 236.2 MM	226.1 MM
Knee to Floor Height	M	241.6 - 256.8 MM	254.0 MM
Buttock Popliteal Length	N	218 - 233.2 MM	223.5 MM
Chest Depth	O	134.6 - 149.8 MM	144.8 MM
Foot Length	P	137.6 - 147.8 MM	139.7 MM
Stature	Q	932.2 - 957.6 MM	942.3 MM
Buttock to Knee Pivot Length	R	251.4 - 261.6 MM	251.5 MM
Head Breadth	S	128.3 - 143.5 MM	137.2 MM
Head Depth	T	167.4 - 182.6 MM	172.7 MM
Hip Breadth	U	200.7 - 215.9 MM	205.7 MM
Shoulder Breadth	V	236.5 - 251.7 MM	241.3 MM
Foot Breadth	W	53.6 - 63.8 MM	57.2 MM
Head Circumference	X	500.4 - 515.6 MM	510.5 MM
Chest Circumference with Jacket	Y	527.1 - 552.5 MM	535.9 MM
Waist Circumference	Z	527.1 - 552.5 MM	541.0 MM
Reference Location for Chest Circumference	AA	248.9 - 259.1 MM	254.0 MM
Reference Location for Waist Circumference	BB	160 - 170.2 MM	165.1 MM

DUMMY MEETS SPECIFICATION

TECHNICIAN: 

TRANSPORTATION RESEARCH CENTER INC.

HEAD DROP TEST

HYBRID III THREE YEAR OLD

17-JAN-02

TRC INC.

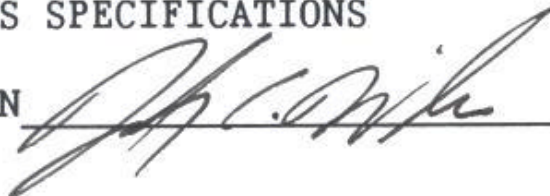
TEST NO: 142C01HD2

572P 3YO SN142 HEAD DROP CAL01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	16.0 %
PEAK RESULTANT ACCELERATION	250 - 280 G	271.87 G
PEAK LATERAL ACCELERATION	15 G MAX	-1.87 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

TEST MEETS SPECIFICATIONS

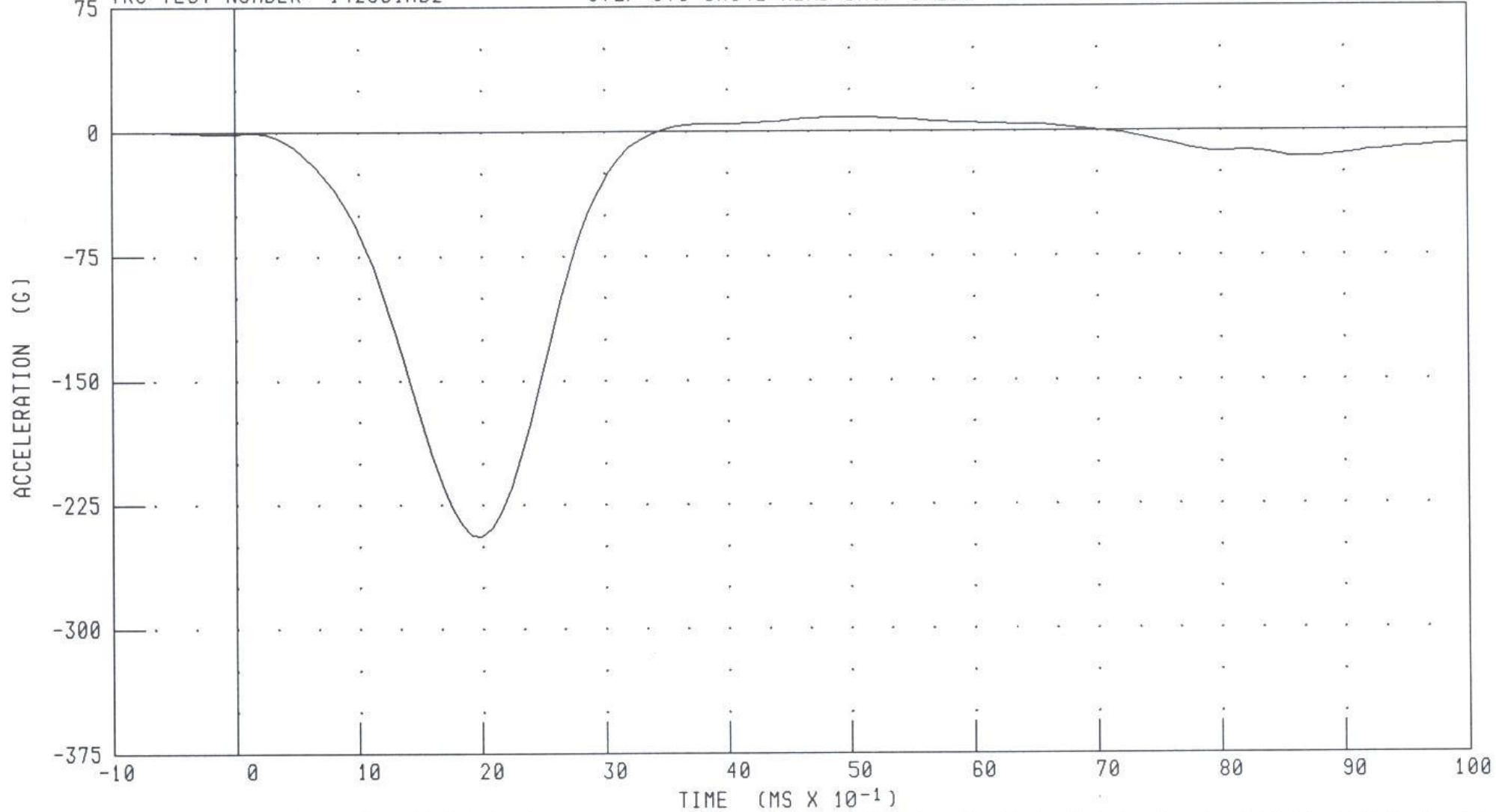
TECHNICIAN



RUN NUMBER: 011702.0645;1

HYBRID III THREE YEAR OLD CHILD DUMMY HEAD CALIBRATION
HEAD ACCELERATION X AXIS

TRC TEST NUMBER: 142C01HD2 572P 3YO SN142 HEAD DROP CAL01 RUN NUMBER: 011702.0647;1

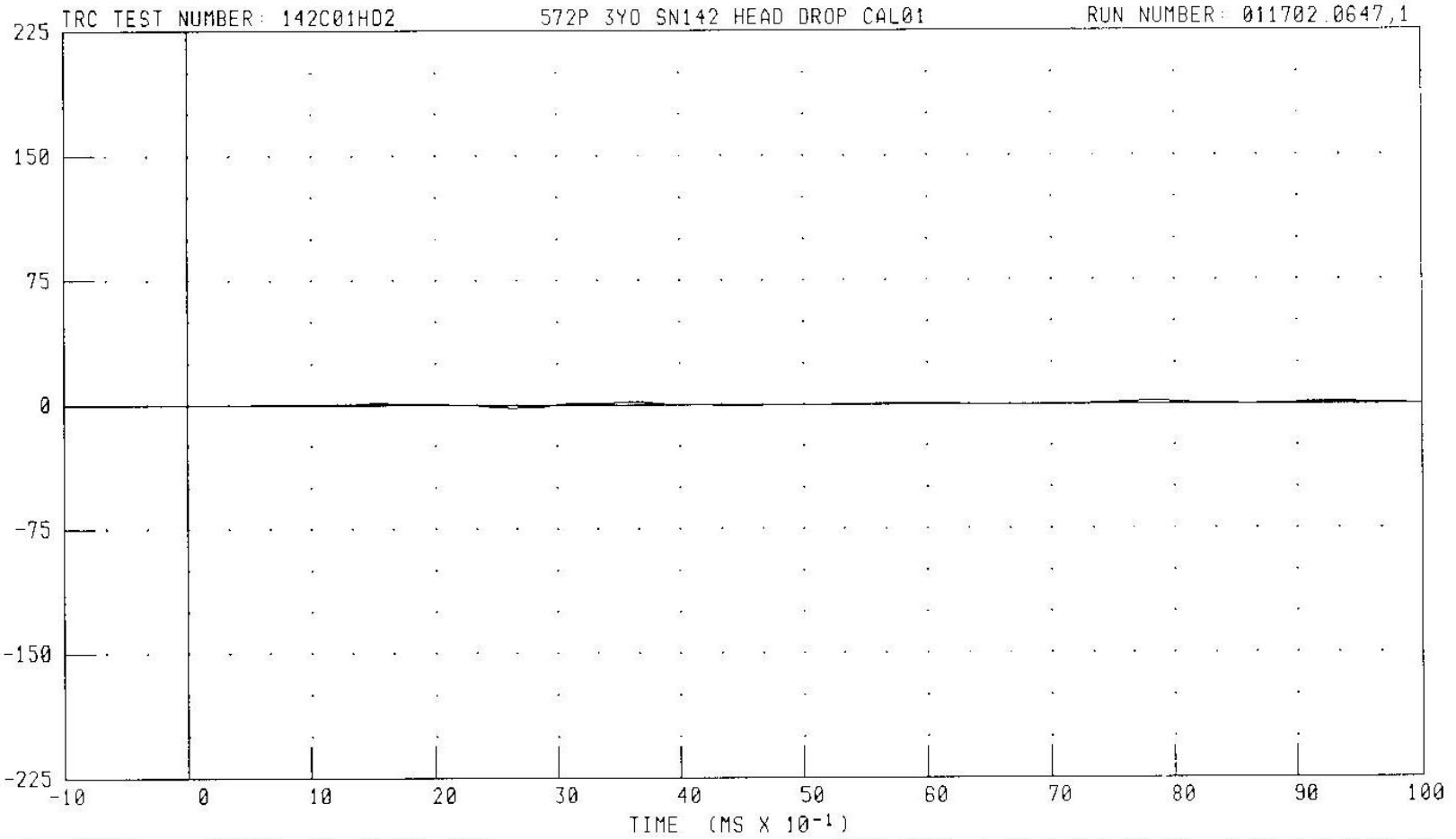


CHANNEL: HEDXC

FILTER: CH. CLASS 1000

PEAK DATA: 8.62 G @ 5.04 MS; -244.24 G @ 2.00 MS

HYBRID III THREE YEAR OLD CHILD DUMMY HEAD CALIBRATION
HEAD ACCELERATION Y AXIS



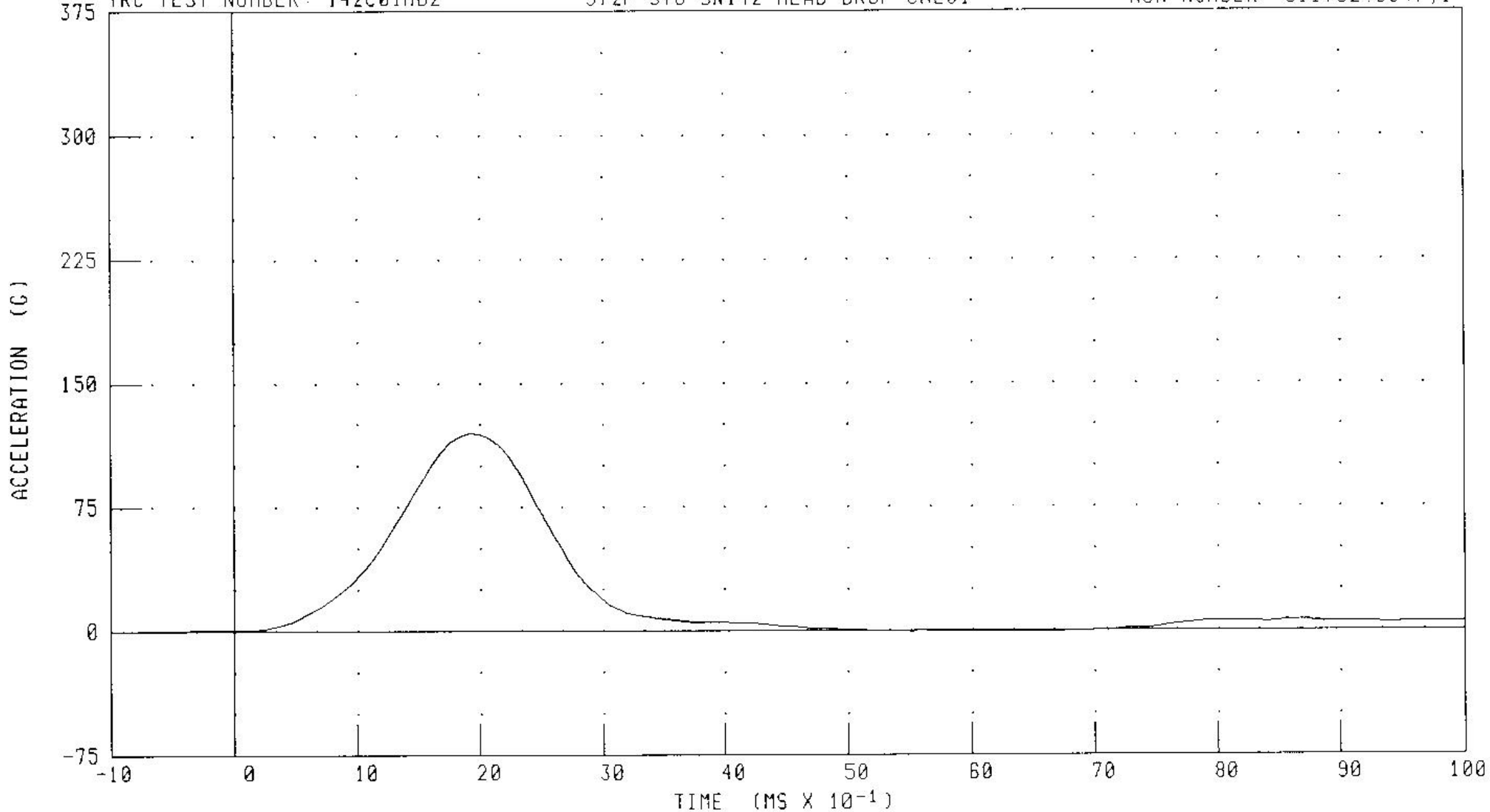
HYBRID III THREE YEAR OLD CHILD DUMMY HEAD CALIBRATION

HEAD ACCELERATION Z AXIS

TRC TEST NUMBER: 142C01HD2

572P 3Y0 SN142 HEAD DROP CAL01

RUN NUMBER 011702.0647,1



CHANNEL: HEDZG

FILTER: CH. CLASS 1000

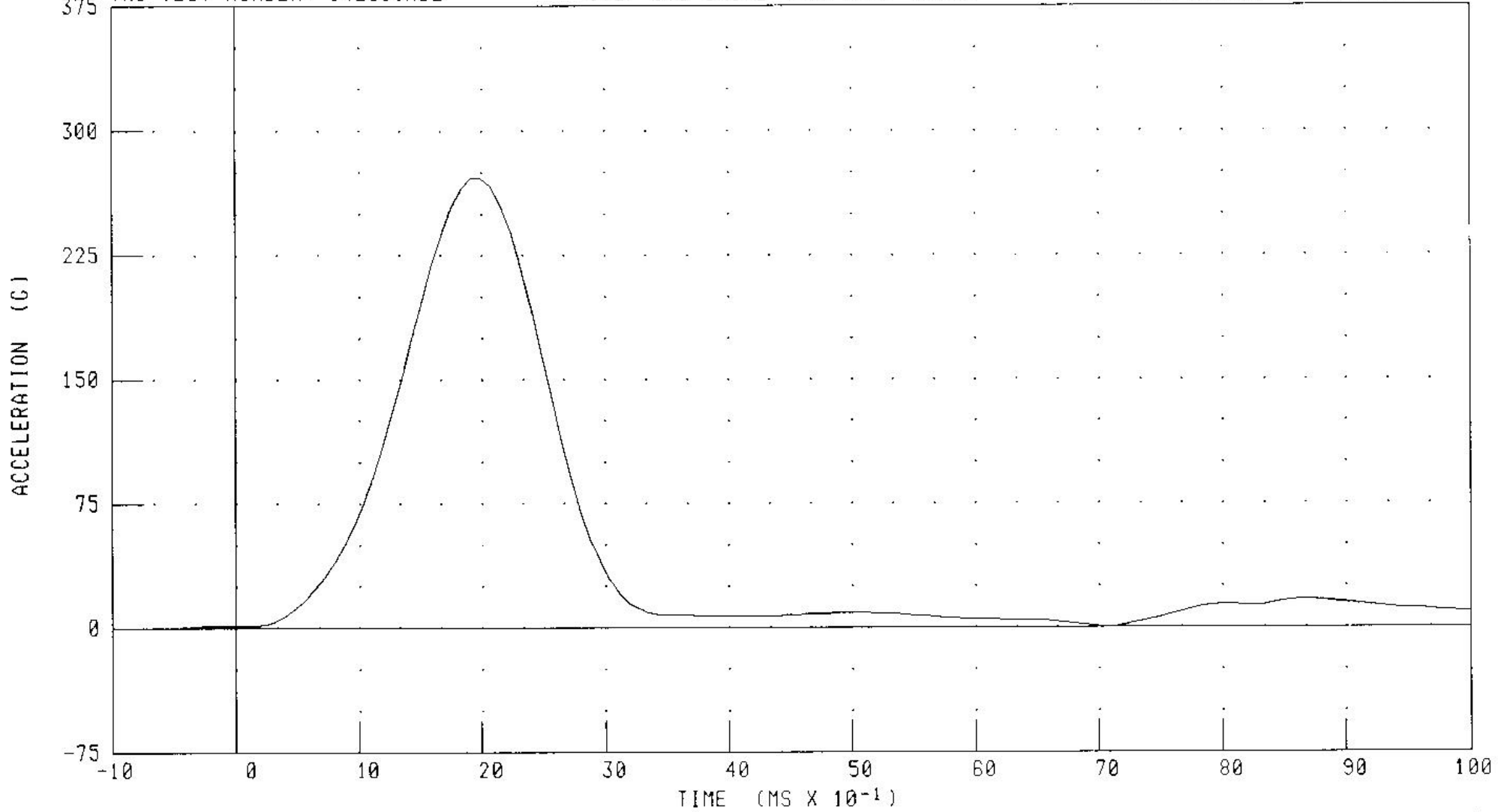
PEAK DATA: 119.68 G @ 1.92 MS, -0.97 G @ 600 MS

HYBRID III THREE YEAR OLD CHILD DUMMY HEAD CALIBRATION
HEAD RESULTANT ACCELERATION

TRC TEST NUMBER: 142C01HD2

572P 3YD SN142 HEAD DROP CAL01

RUN NUMBER 011702.0647;1



CHANNEL: HEDRG

FILTER CH CLASS 1000

PEAK DATA 271.88 G @ 27.88 MS, 0.01 G @ -0.88 MS

TRANSPORTATION RESEARCH CENTER INC.

HYBRID III THREE YEAR OLD

16-JAN-02

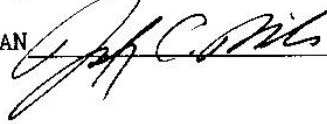
NECK FLEXION TEST

TRC INC. TEST NO: 142C01NF3 572P 3YO SN142 NECK FLEX CAL01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6-22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	16.0 %
IMPACT VELOCITY	5.40 - 5.60 M/S	5.56 M/S
INTEGRATED PENDULUM VELOCITY	10 MS 2.0 - 2.7 M/S	2.51 M/S
	15 MS 3.0 - 4.0 M/S	3.76 M/S
	20 MS 4.0 - 5.1 M/S	5.10 M/S
PEAK D-PLANE ROTATION	70 - 82 DEG.	73.26 DEG.
PEAK MOMENT DURING ROTATION INTERVAL	42 - 53 NM	45.58 NM
POSITIVE MOMENT DECAY TIME TO 10 NM LEVEL	60 - 80 MS	68.72 MS

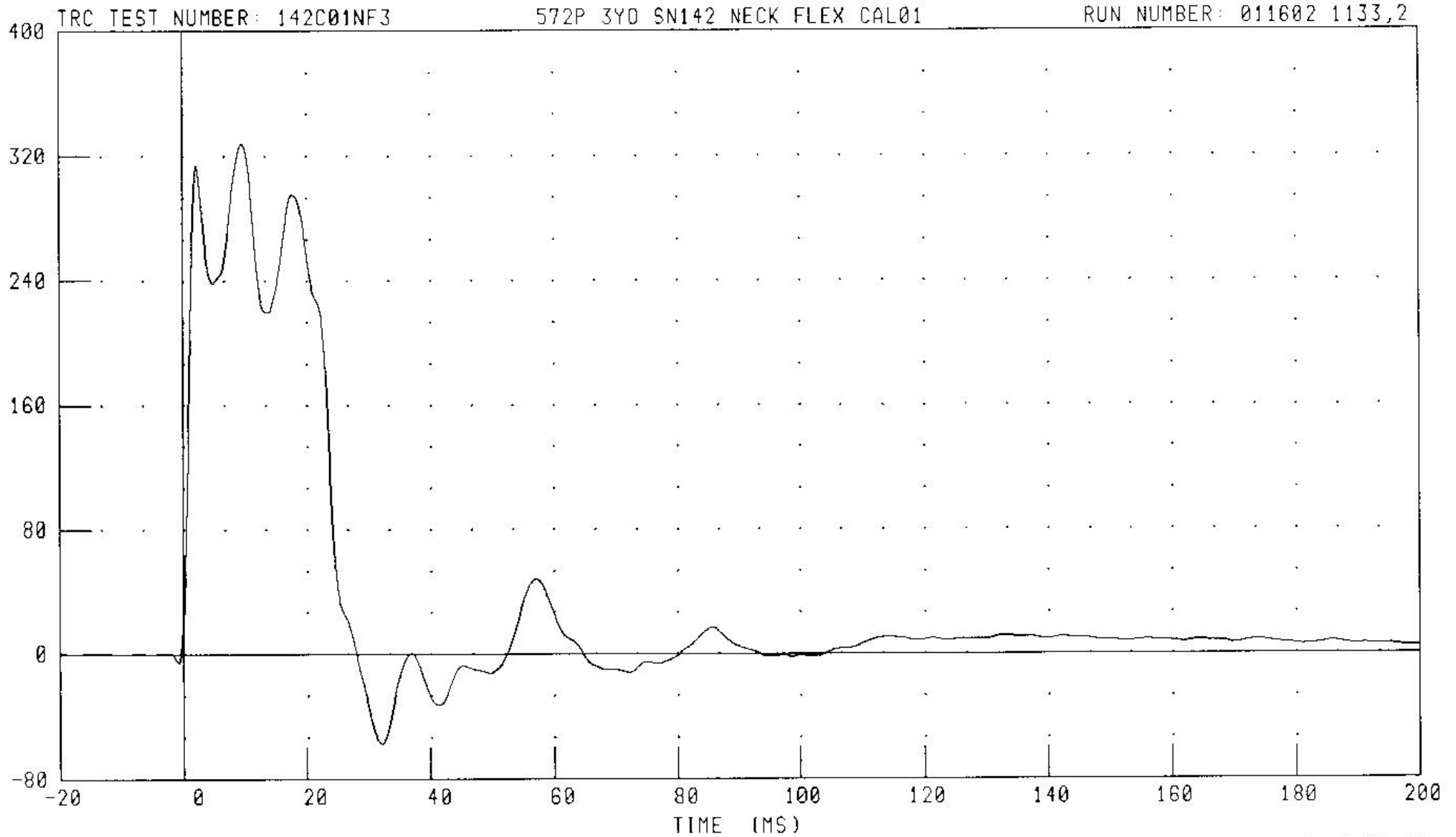
TEST MEETS SPECIFICATIONS

TECHNICIAN



RUN NUMBER: 011602.1112;2

HYBRID III THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION
PENDULUM DECELERATION



CHANNEL: PENXG

FILTER: CH. CLASS 180

PEAK DATA: 32.76 G @ 9.60 MS; -5.75 G @ 32.08 MS

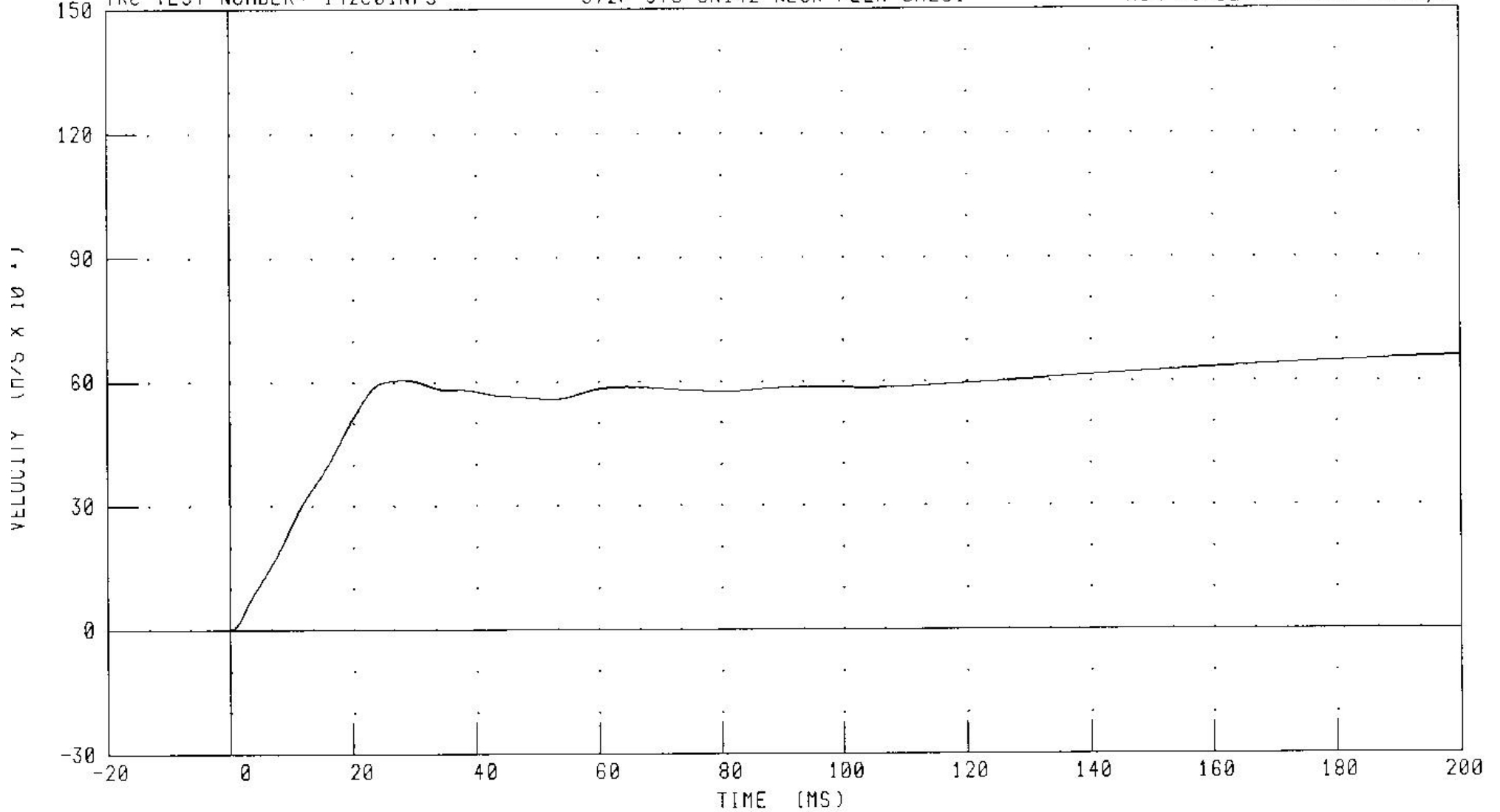
HYBRID III THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION

PENDULUM INTEGRATED VELOCITY

TRC TEST NUMBER: 142C01NF3

572P 3YO SN142 NECK FLEX CAL01

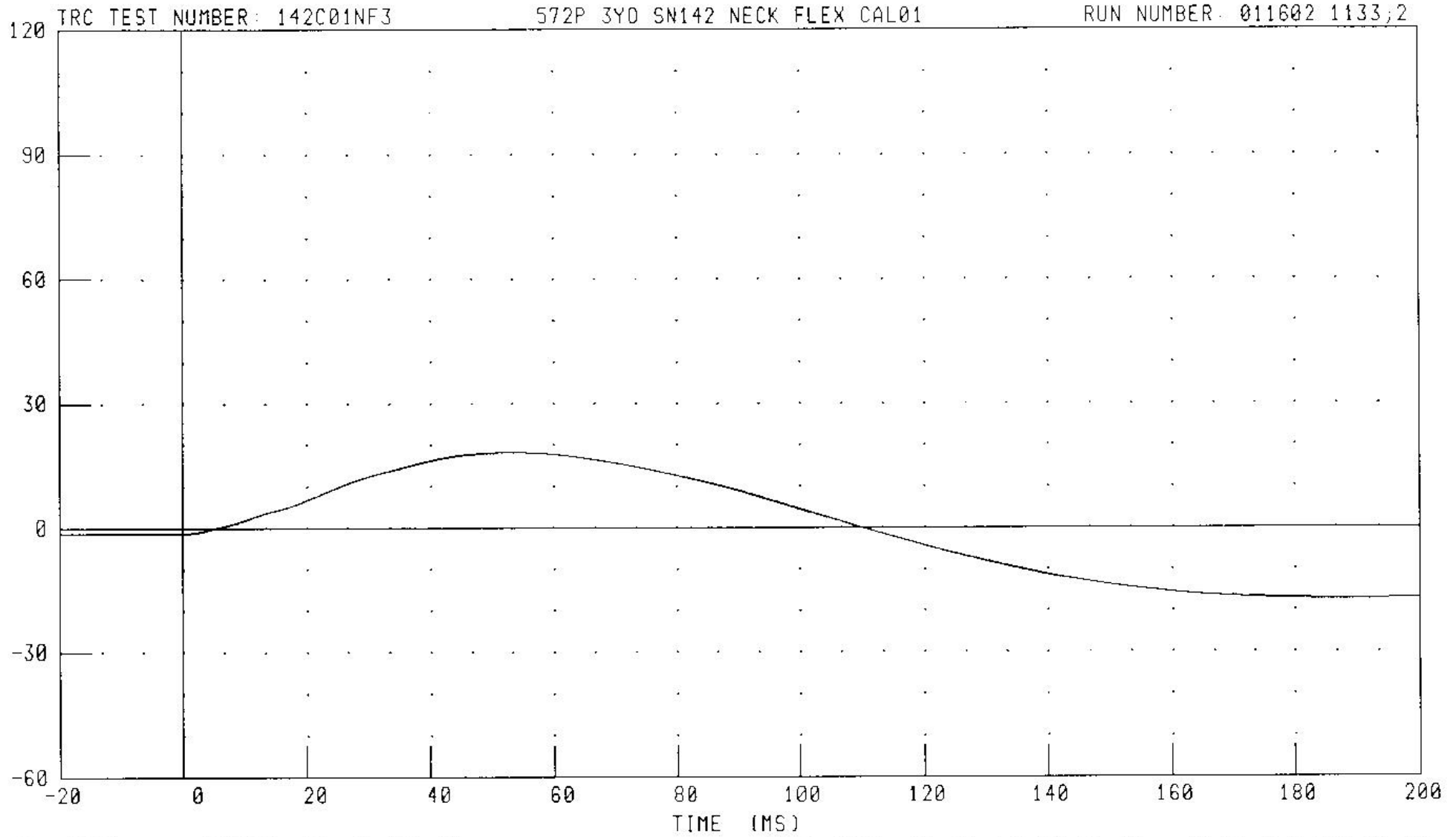
RUN NUMBER 011602 1133;2



CHANNEL PENXVI FILTER: CH CLASS 180

PEAK DATA: 6.60 M/S @ 200.00 MS, -0.01 M/S @ -0.40 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION
ROTATION ABOUT BASE OF NECK



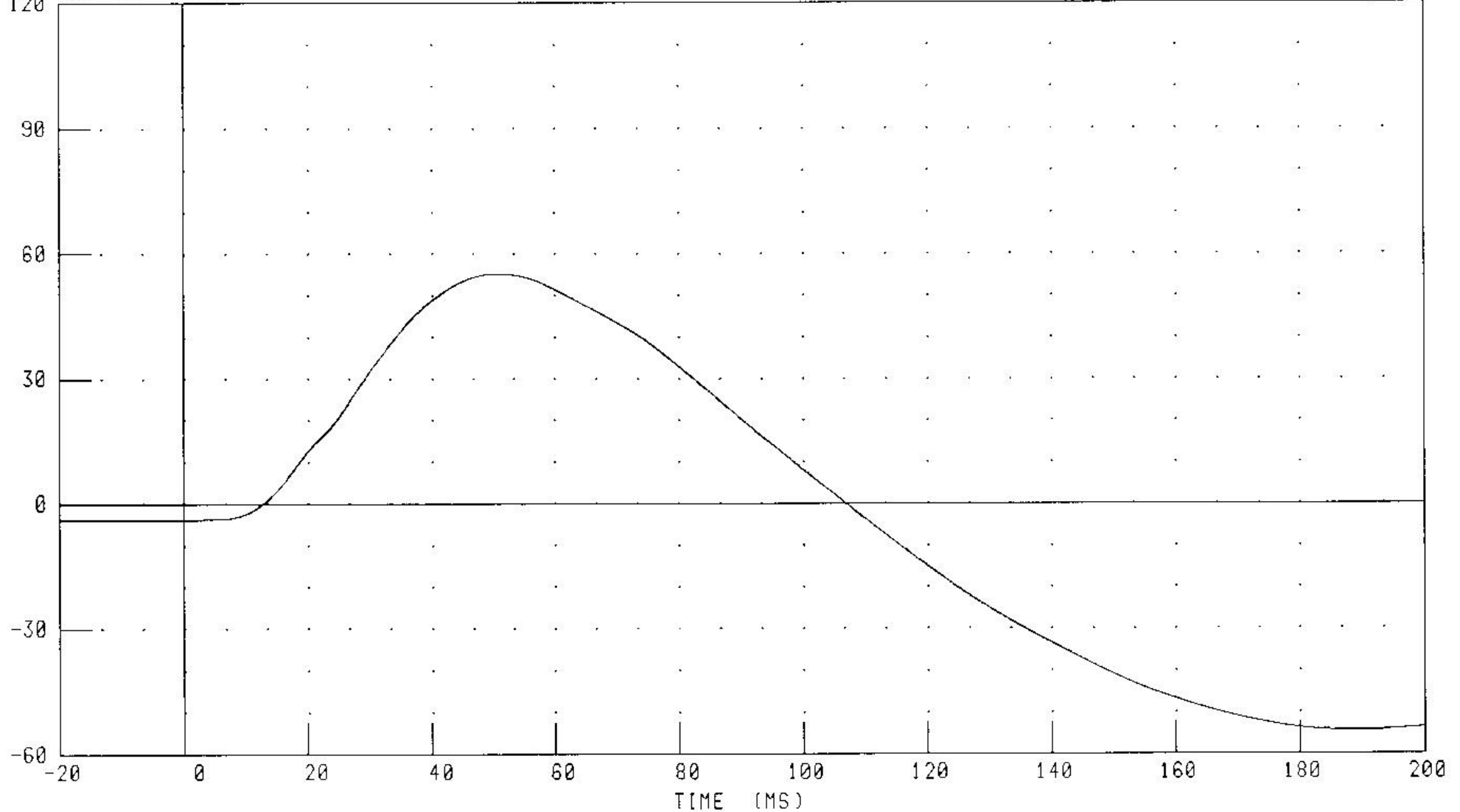
CHANNEL: BETA

FILTER: CH. CLASS 60

PEAK DATA 18.16 ° @ 52.96 MS, -17.31 ° @ 189.36 MS

HYBRID II] THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER: 142C01NF3 572P 3Y0 SN142 NECK FLEX CAL01 RUN NUMBER: 011602.1133,2

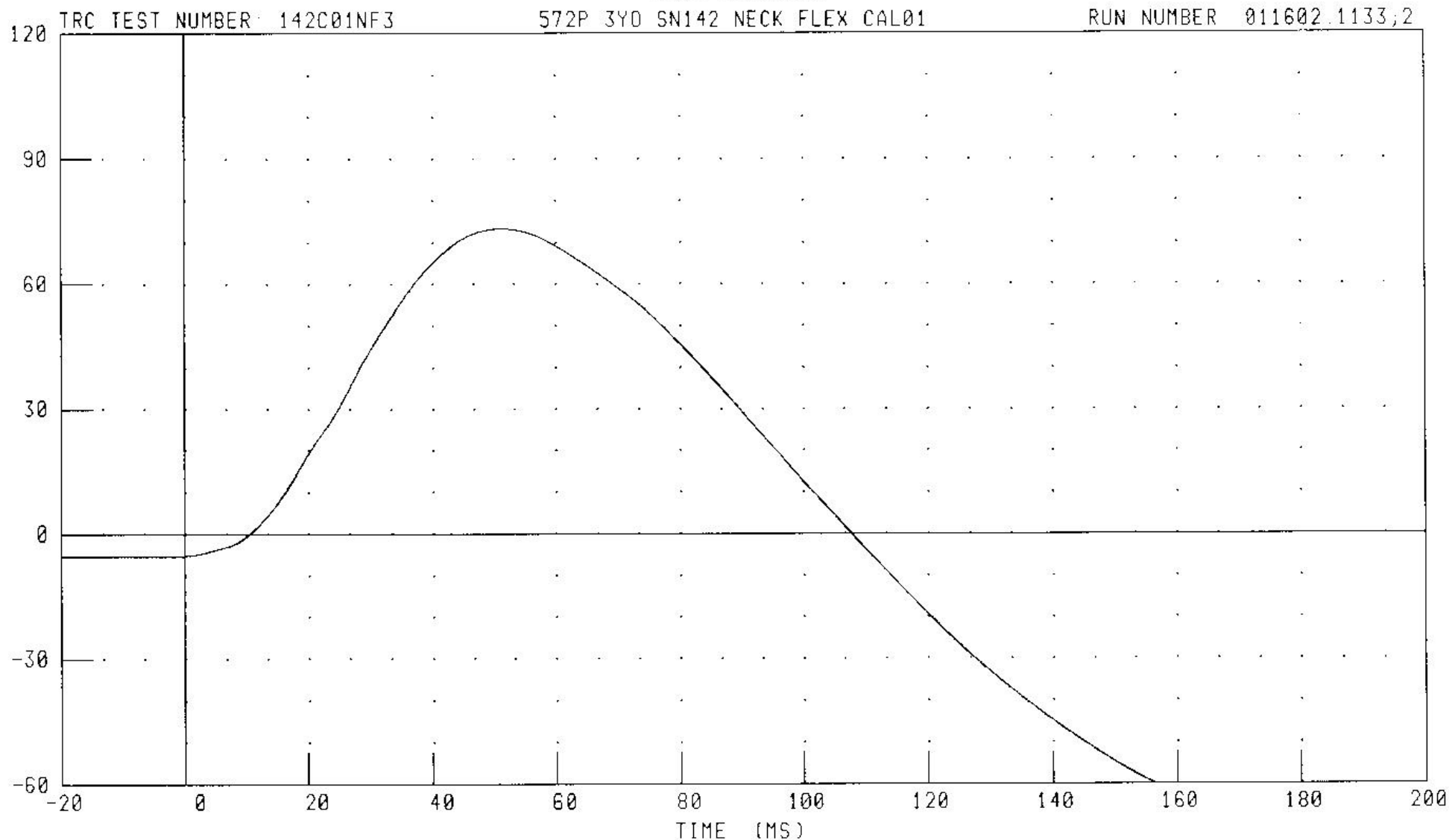


CHANNEL: THETA FILTER CH. CLASS 60

PEAK DATA: 55.16 ° @ 50.72 MS, -54.43 ° @ 188.48 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION

TOTAL ROTATION



CHANNEL: TOTAN

FILTER: CH. CLASS 60

PEAK DATA: 73.27 ° @ 51.36 MS; -71.73 ° @ 188.56 MS

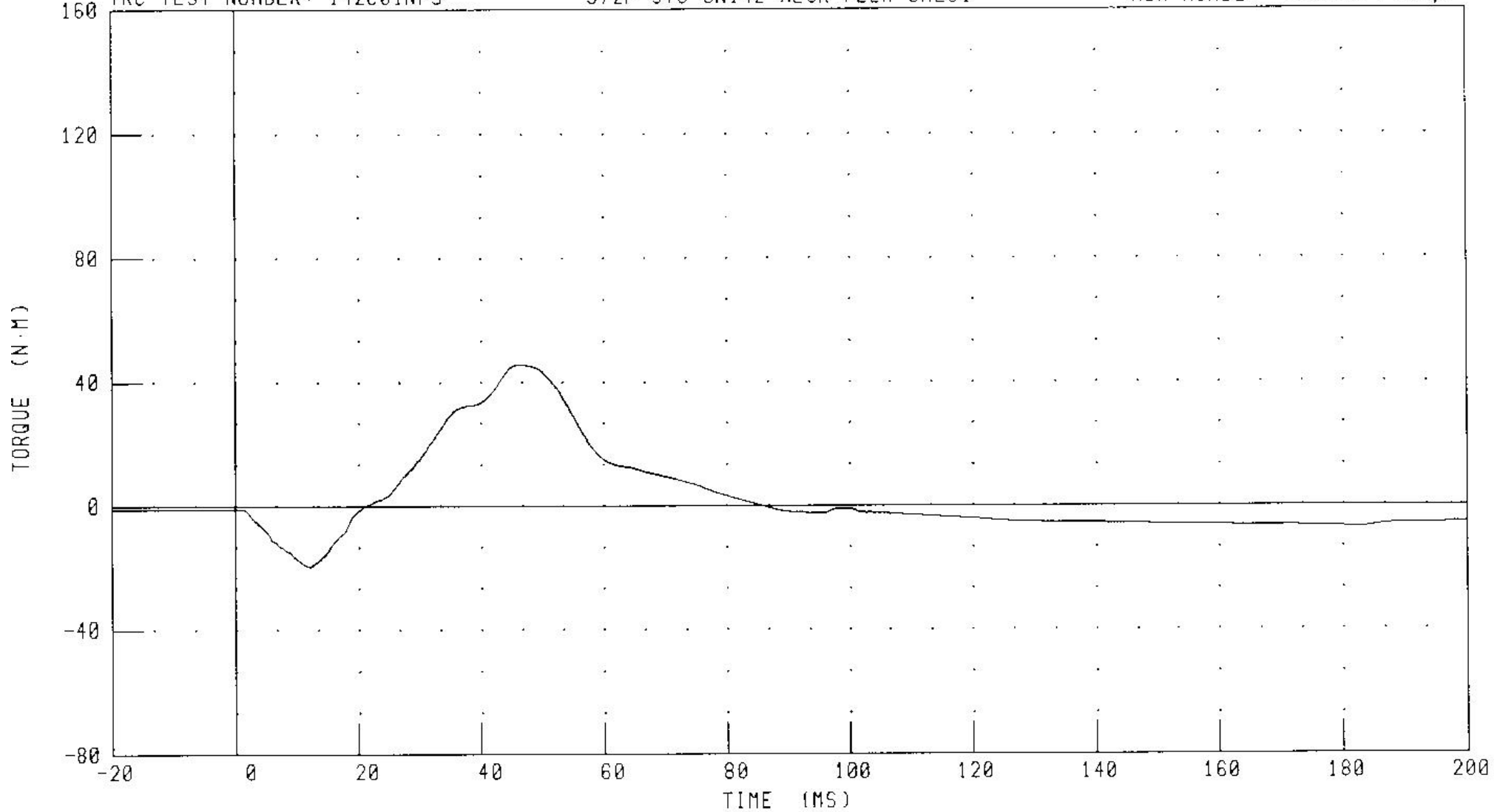
HYBRID III THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION

MOMENT ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER 142C01NF3

572P 3Y0 SN142 NECK FLEX CAL01

RUN NUMBER 011602 1133,2



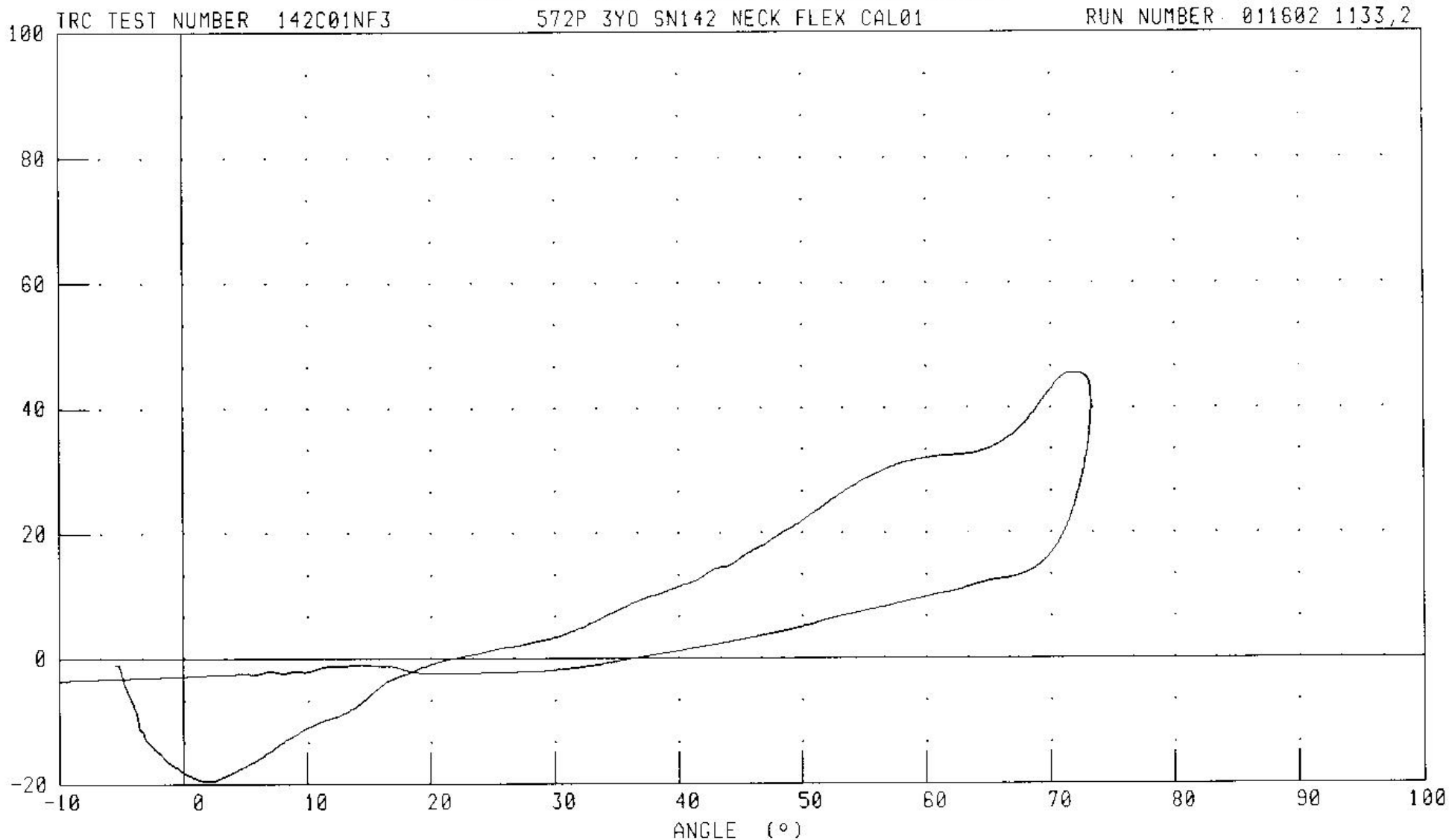
CHANNEL NEKYM

FILTER: CH. CLASS 600

PEAK DATA: 45.58 N·M @ 46.72 MS, -19.59 N·M @ 12.00 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK FLEXION CALIBRATION

TOTAL ROTATION VS OCCIPITAL CONDYLAR MOMENT



CHANNEL: TOTAN
NEKYM

FILTER: CH. CLASS 60
CH. CLASS 600

PEAK DATA: 73.27 ° @ 51.36 MS, -71.73 ° @ 100.56 MS
45.58 N.M @ 46.72 MS, -19.59 N.M @ 12.00 MS

TRANSPORTATION RESEARCH CENTER INC.

HYBRID III THREE YEAR OLD

17-JAN-02

NECK EXTENSION TEST

TRC INC. TEST NO: 142C01NE2 572P 3YO SN142 NECK EXT CAL01

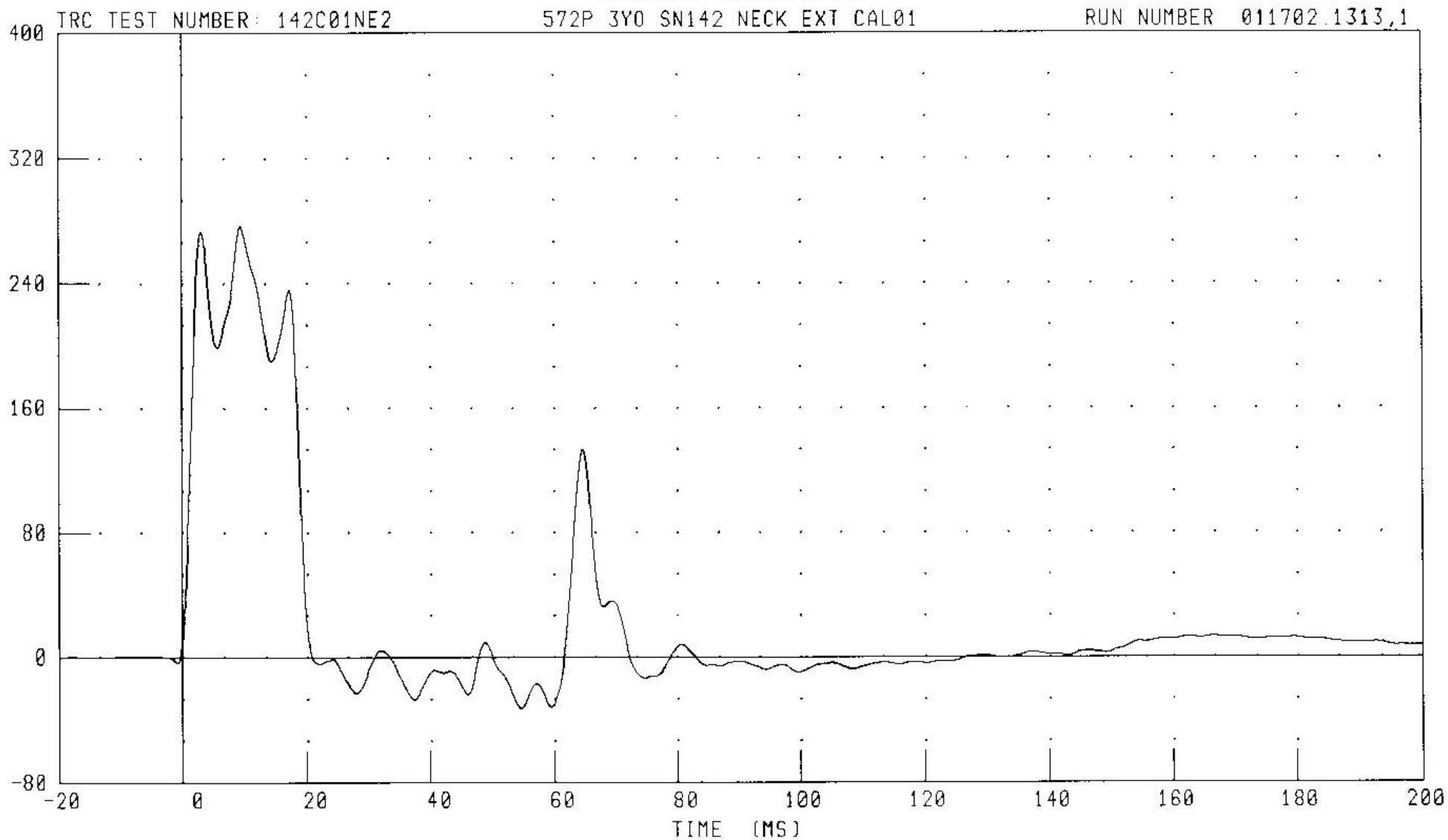
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6 - 22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	15.0 %
IMPACT VELOCITY	3.55 - 3.75 M/S	3.68 M/S
INTEGRATED PENDULUM VELOCITY	6 MS 1.0 - 1.4 M/S	1.12 M/S
	10 MS 1.9 - 2.5 M/S	2.06 M/S
	14 MS 2.8 - 3.5 M/S	2.98 M/S
PEAK D-PLANE ROTATION	83 - 93 DEG.	89.11 DEG.
PEAK MOMENT DURING ROTATION INTERVAL	-43.7 / -53.3 NM	-49.45 NM
NEGATIVE MOMENT DECAY TIME TO -10 NM LEVEL	60 - 80 MS	66.72 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN 

RUN NUMBER: 011702.1251;1

HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION
PENDULUM DECELERATION



CHANNEL: PENXC

FILTER: CH. CLASS 180

PEAK DATA: 27 69 G @ 9.44 MS; -3 24 G @ 54.72 MS

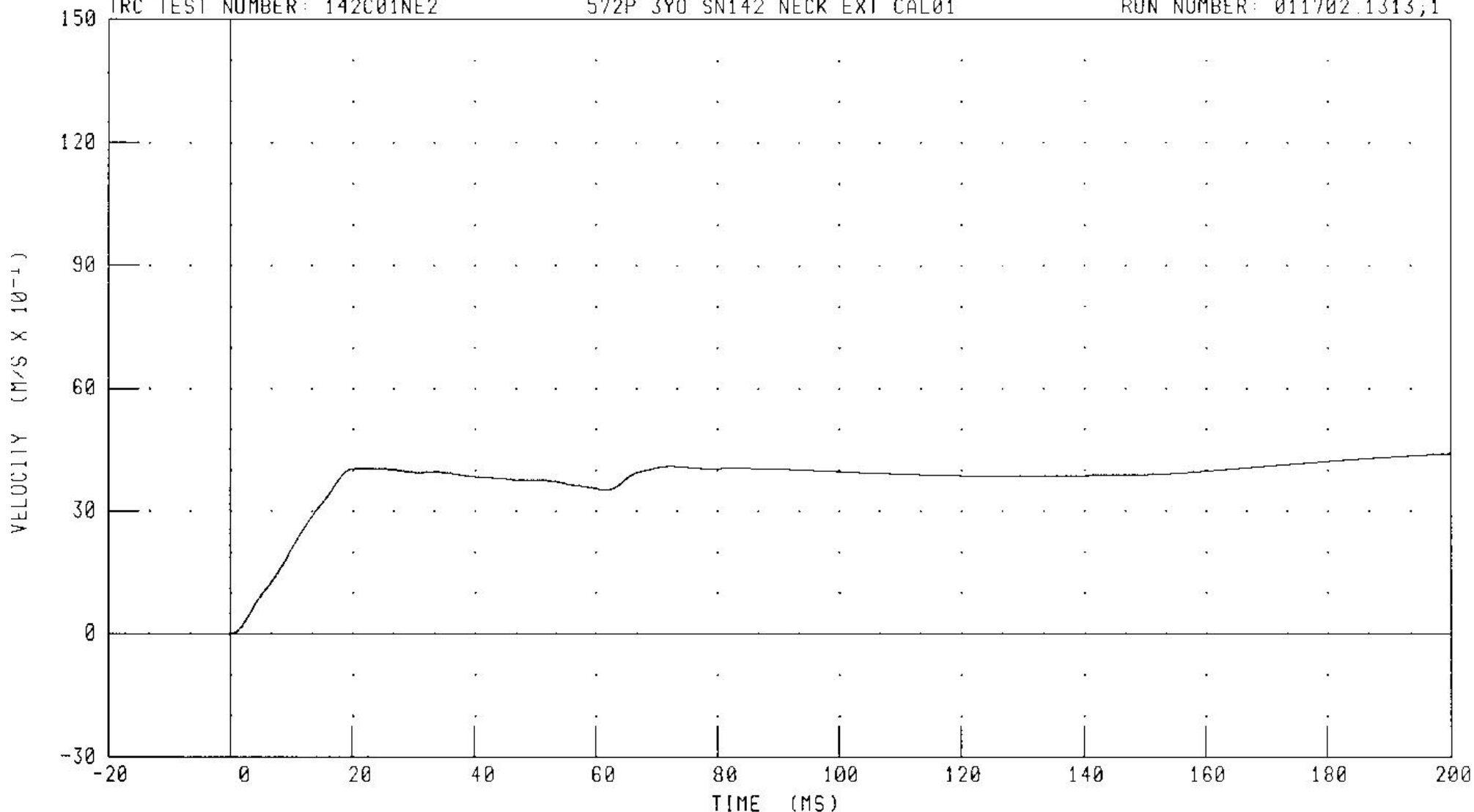
HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION

INTEGRATED PENDULUM VELOCITY

TRC TEST NUMBER: 142C01NE2

572P 3YO SN142 NECK EXT CAL01

RUN NUMBER: 011702.1313;1

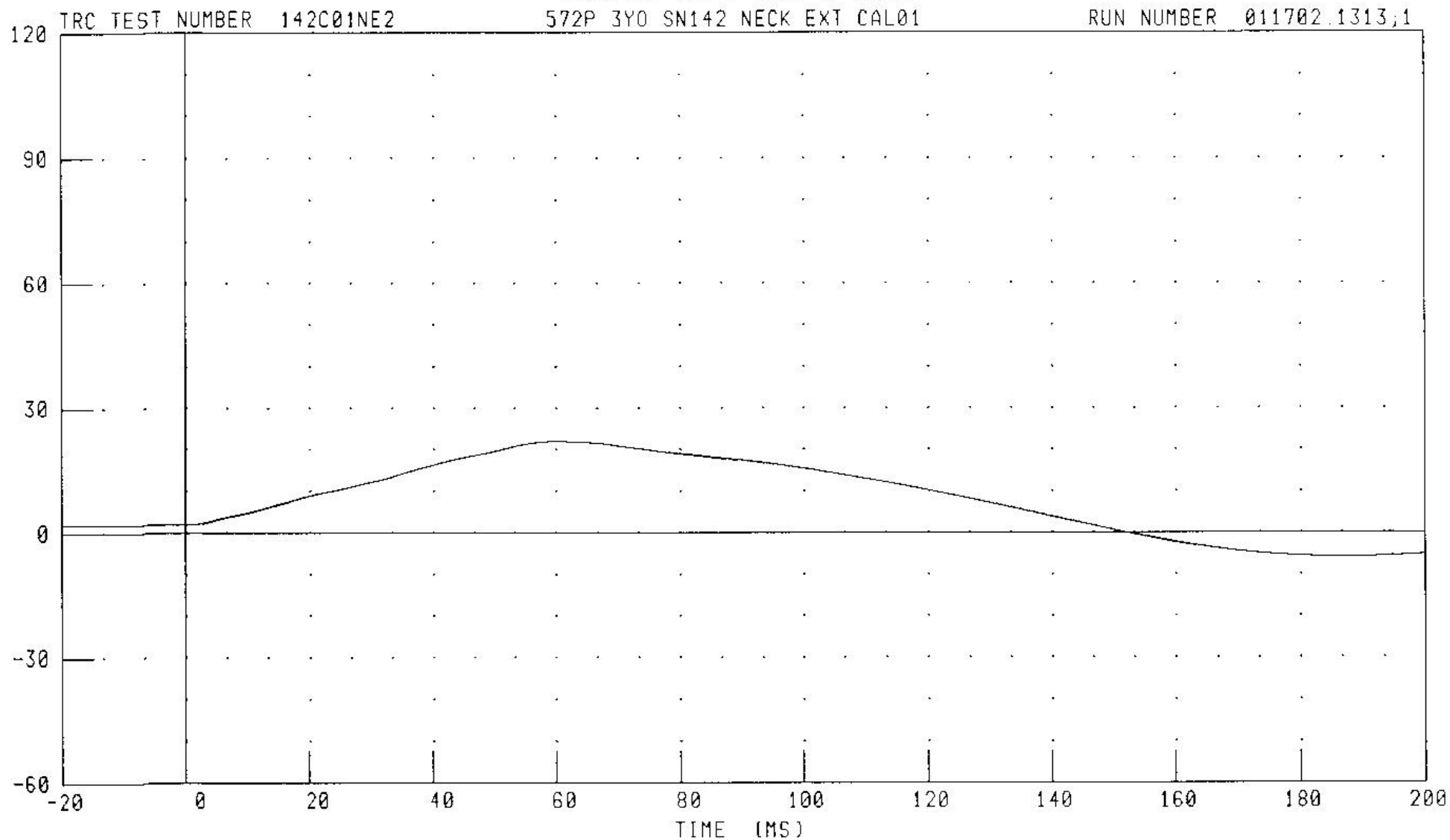


CHANNEL: PENXVI FILTER: CH CLASS 180

PEAK DATA: 4 40 M/S @ 200 00 MS; 0 00 M/S @ -0 32 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION

ROTATION ABOUT BASE OF NECK

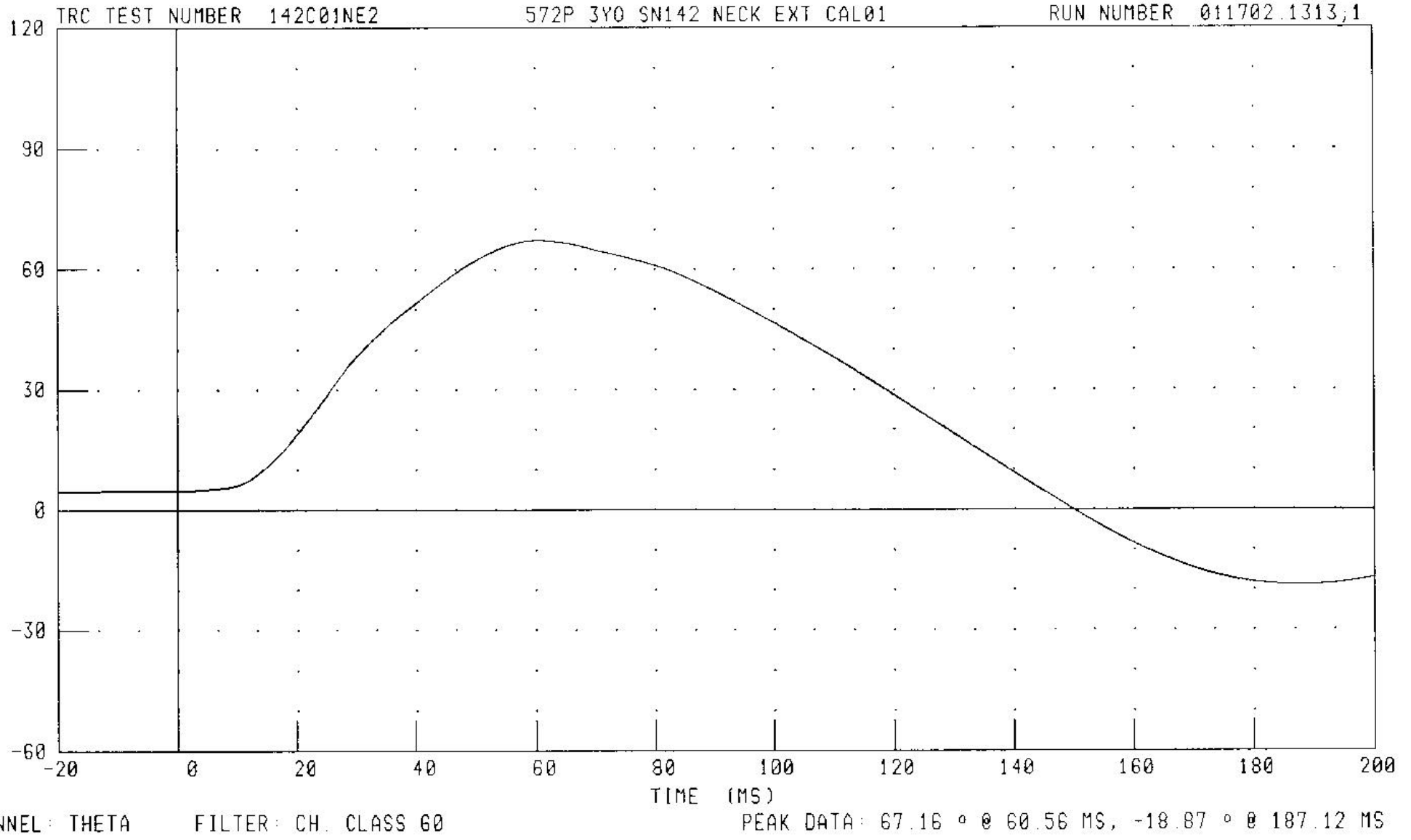


CHANNEL: BETA

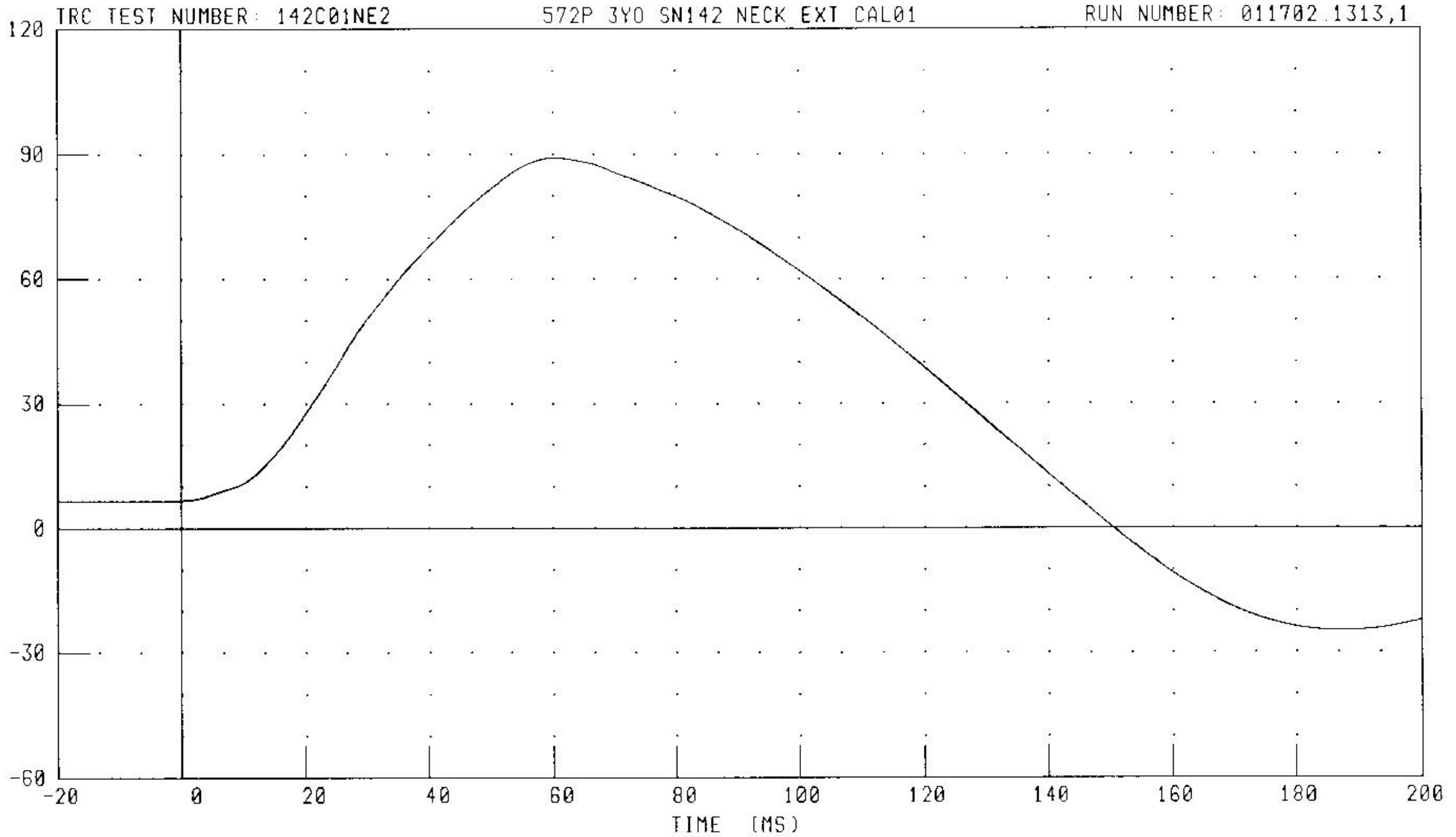
FILTER: CH. CLASS 60

PEAK DATA 21.96 ° @ 60.16 MS; -5.89 ° @ 186.24 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE



HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION
TOTAL ROTATION



CHANNEL: TOTAN

FILTER: CH. CLASS 60

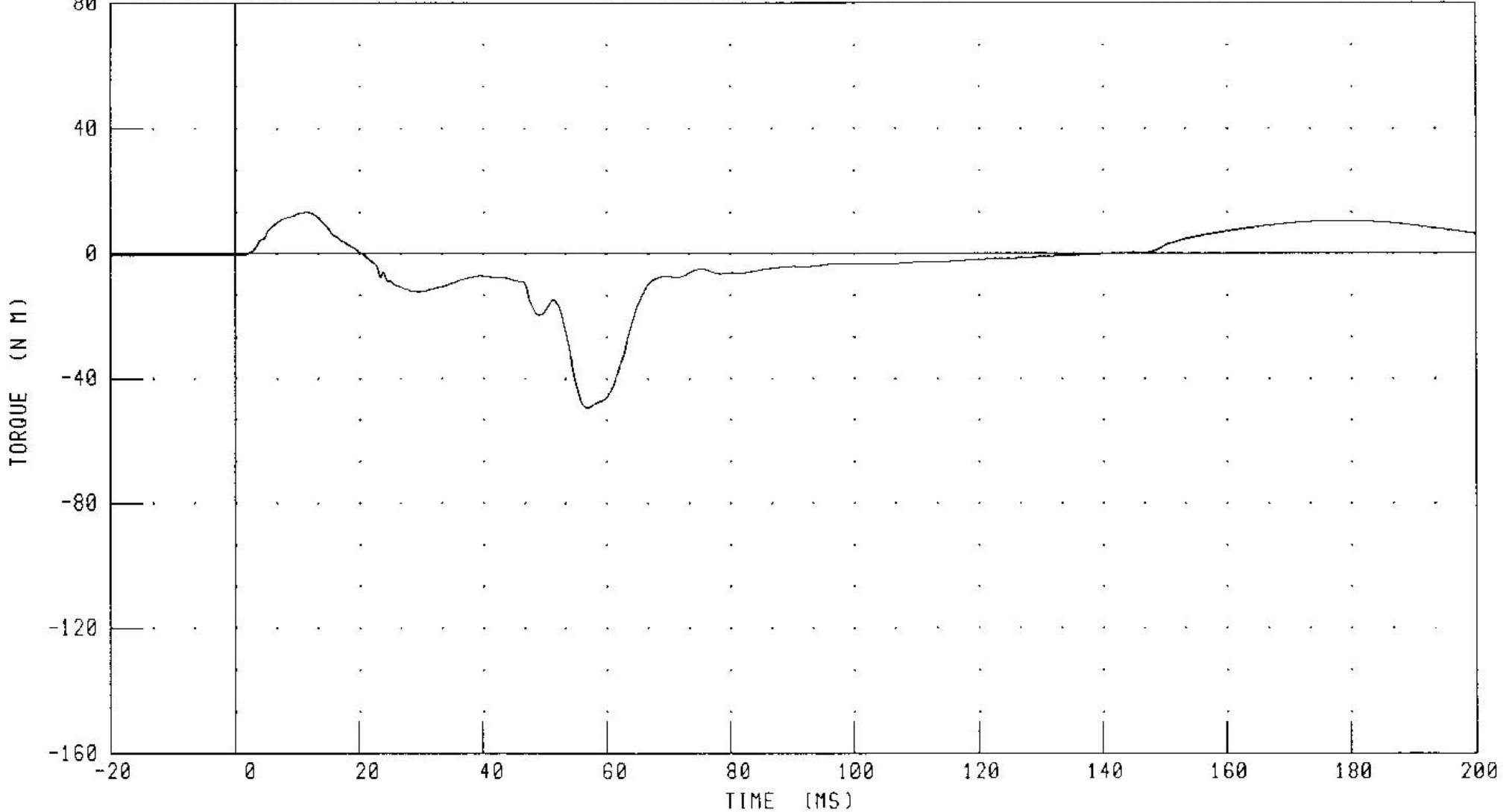
PEAK DATA: 89.11 ° @ 60.40 MS, -24.76 ° @ 186.96 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION
MOMENT ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER: 142C01NE2

572P 3YO SN142 NECK EXT CAL01

RUN NUMBER: 011702.1313;1



CHANNEL: NEKYM

FILTER: CH. CLASS 600

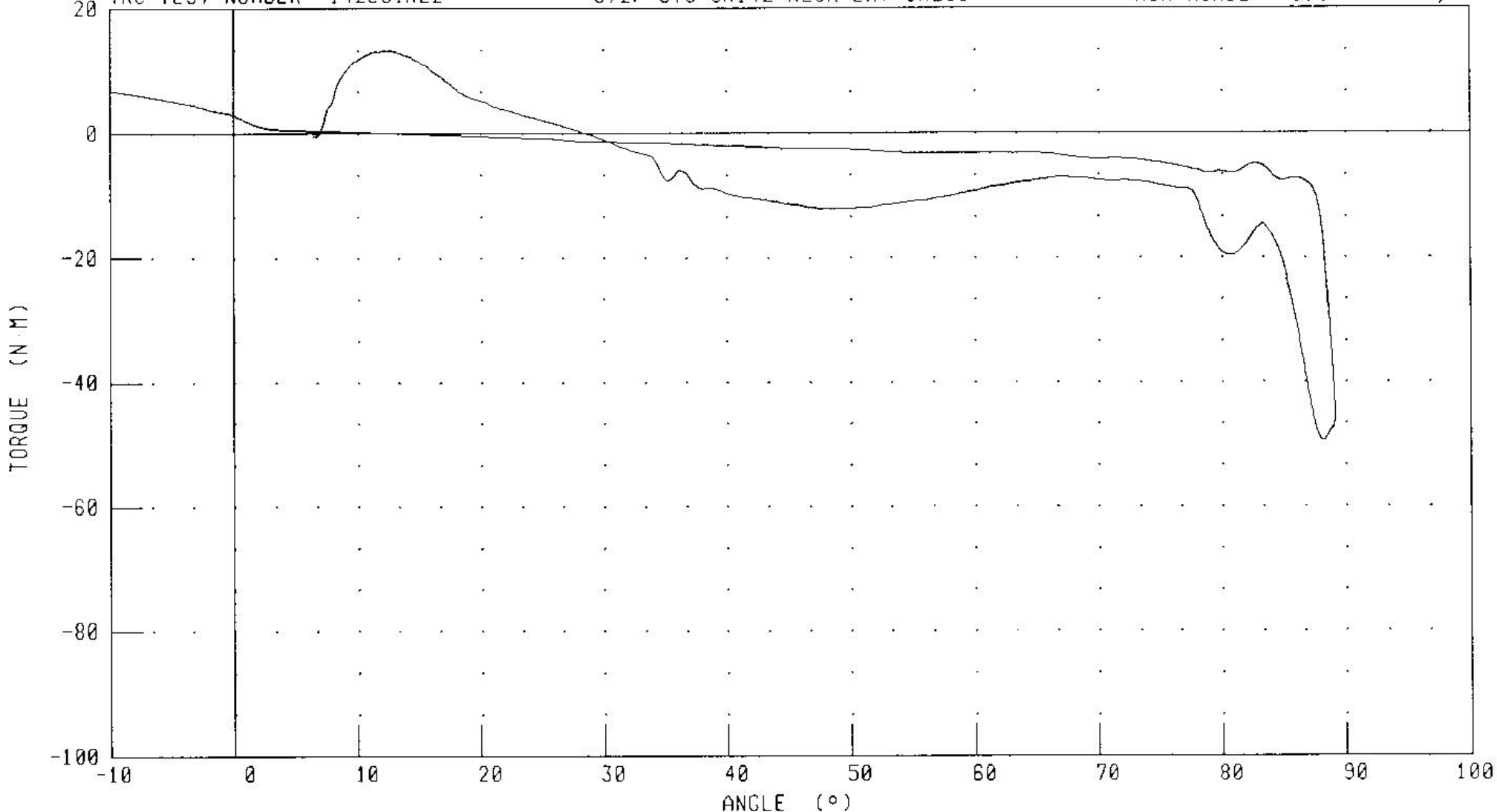
PEAK DATA: 13.26 N M @ 11.52 MS, -49.45 N M @ 57.04 MS

HYBRID III THREE YEAR OLD CHILD DUMMY NECK EXTENSION CALIBRATION
 TOTAL ROTATION VS OCCIPITAL CONDYLAR MOMENT

TRC TEST NUMBER 142C01NE2

572P 3Y0 SN142 NECK EXT CAL01

RUN NUMBER 011702.1313;1



CHANNEL TOTAN FILTER CH CLASS 60
 NEKYM CH CLASS 600

ANGLE (°)

PEAK DATA 89.11 ° @ 60.40 MS; -24.76 ° @ 186.96 MS
 13.26 N.M @ 11.52 MS; -49.45 N.M @ 57.04 MS

TRANSPORTATION RESEARCH CENTER INC.

THORAX IMPACT TEST

HYBRID III THREE YEAR OLD

17-JAN-02

TRC INC.

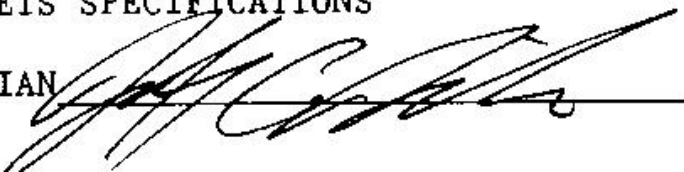
TEST NO: 142C01TH1

572P 3YO SN142 THORAX CAL 01

TEST PARAMETER	HIGH SPEED TEST SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6-22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	14.0 %
PENDULUM VELOCITY	5.90 - 6.10 M/S	5.99 M/S
MAXIMUM DEFLECTION	32 - 38 MM	33.2 MM
MAXIMUM FORCE DURING DEFLECTION INTERVAL	680 - 910 N	735. N
INTERNAL HYSTERESIS	65% - 85%	72.3%
MAXIMUM FORCE BEWTWEEN 12.5 & 32 MM OF DEFLECTION	<= 910. N	799. N

TEST MEETS SPECIFICATIONS

TECHNICIAN



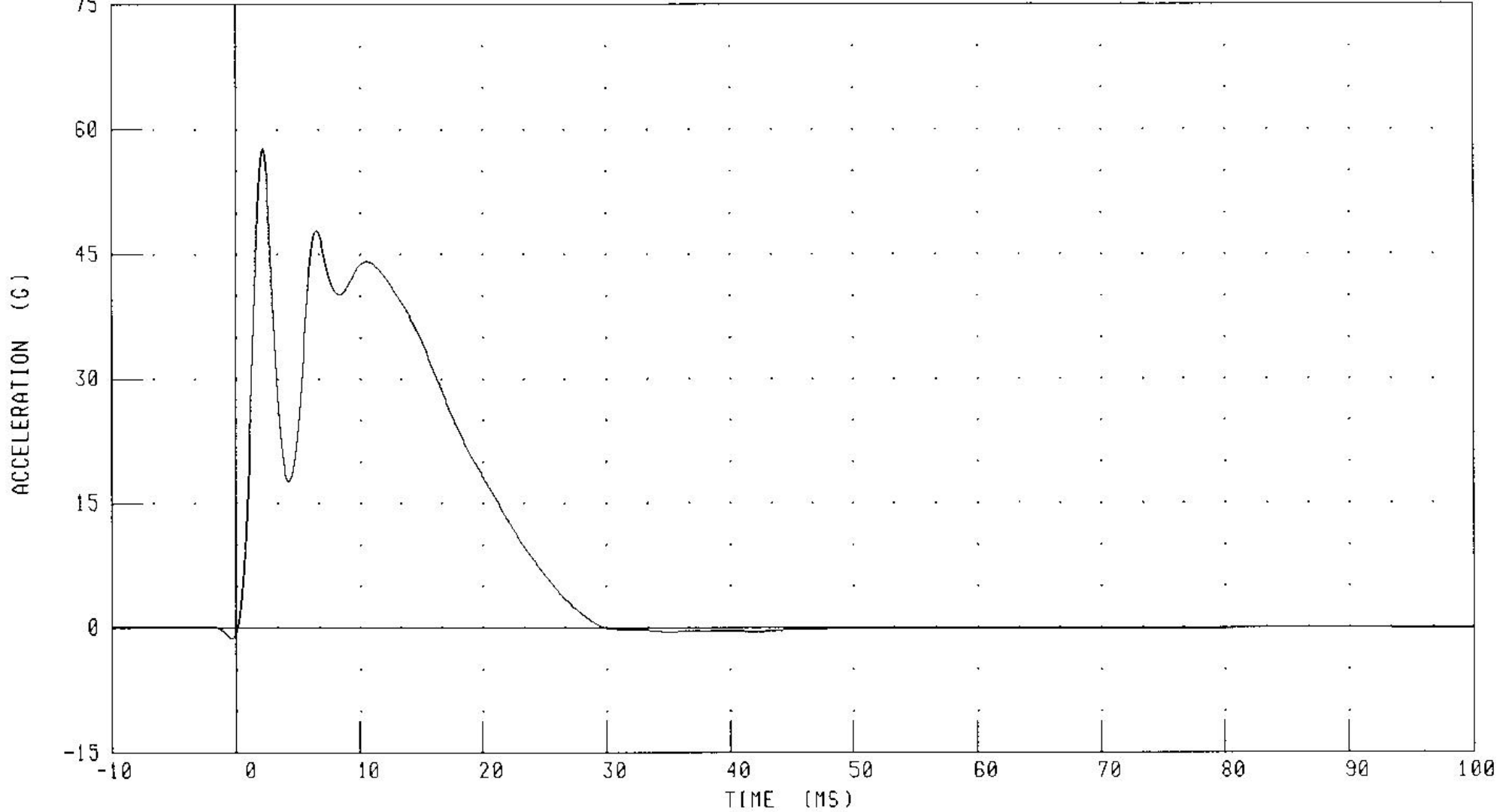
RUN NUMBER: 011702.1504;1

HYBRID III THREE YEAR OLD CHILD DUMMY THORAX CALIBRATION
PENDULUM DECELERATION

TRC TEST NUMBER: 142C01TH1

572P 3Y0 SN142 THORAX CAL 01

RUN NUMBER: 011702 1507,1

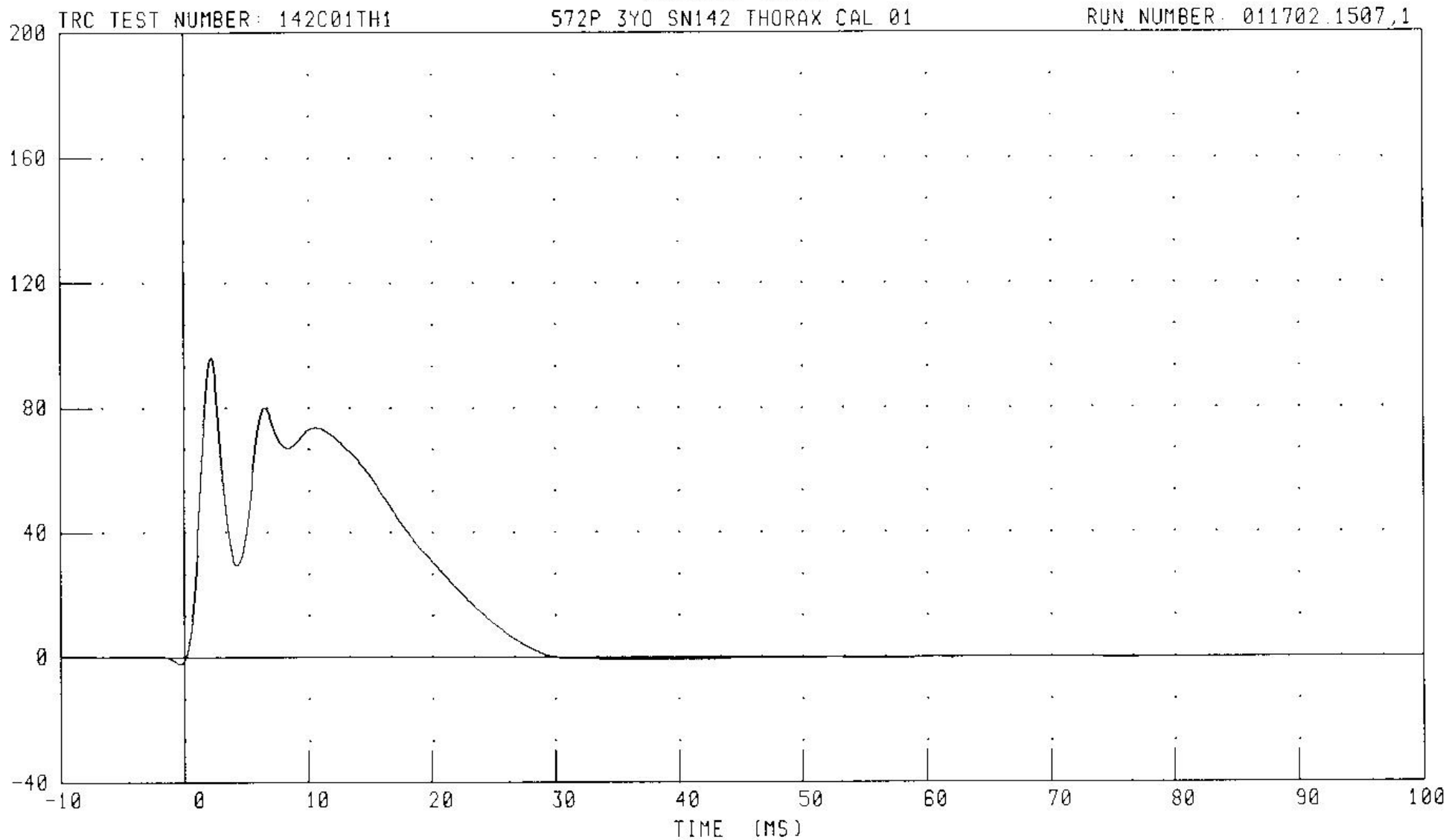


CHANNEL: PENXC

FILTER: CH. CLASS 180

PEAK DATA 57.71 G @ 2.16 MS, -1.34 G @ -0.32 MS

HYBRID III THREE YEAR OLD CHILD DUMMY THORAX CALIBRATION
PENDULUM FORCE

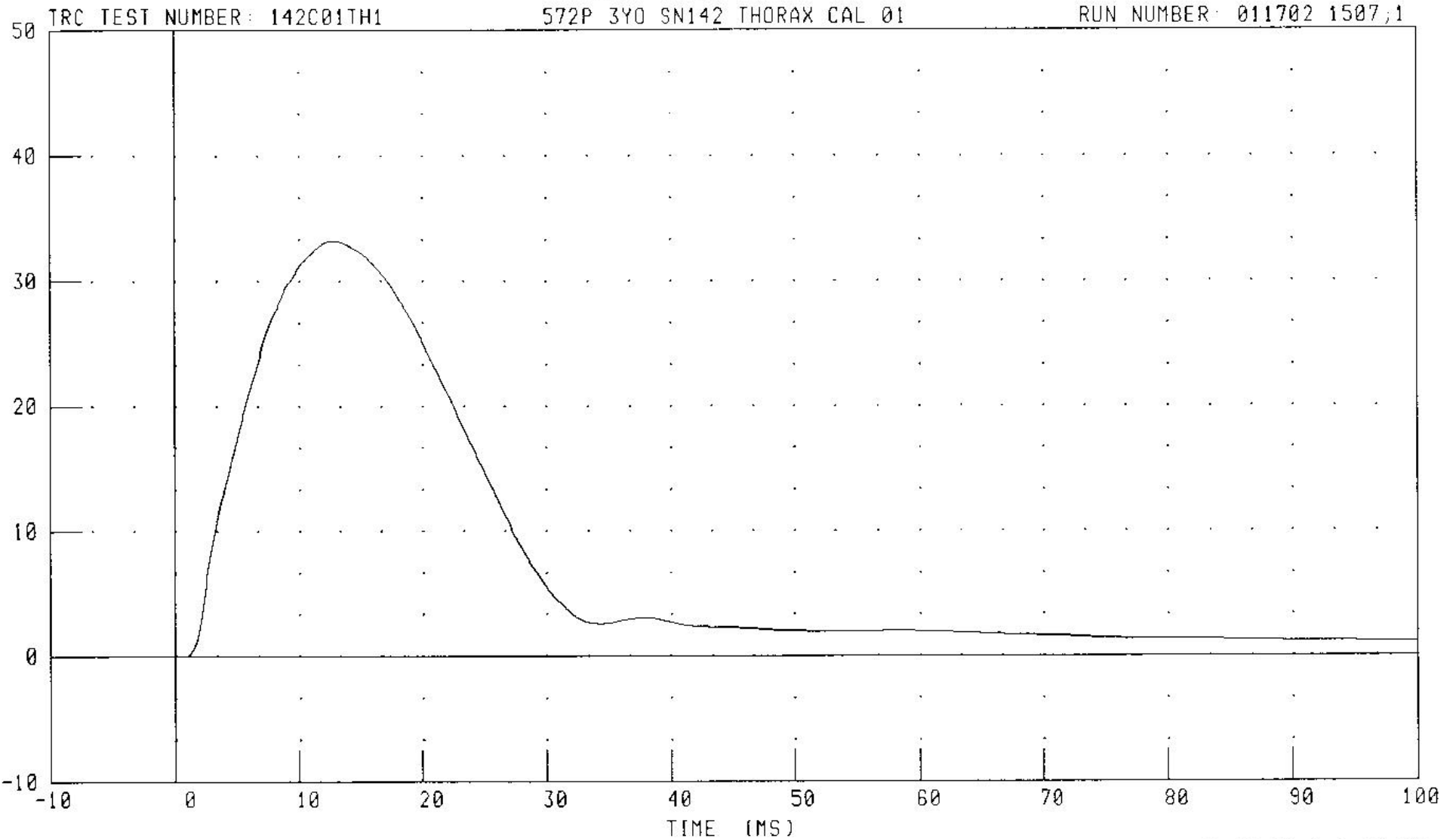


CHANNEL: PENXF

FILTER: CH. CLASS 100

PEAK DATA: 962 61 N @ 2 16 MS; -22.42 N @ -0 32 MS

HYBRID III THREE YEAR OLD CHILD DUMMY THORAX CALIBRATION
STERNUM DISPLACEMENT

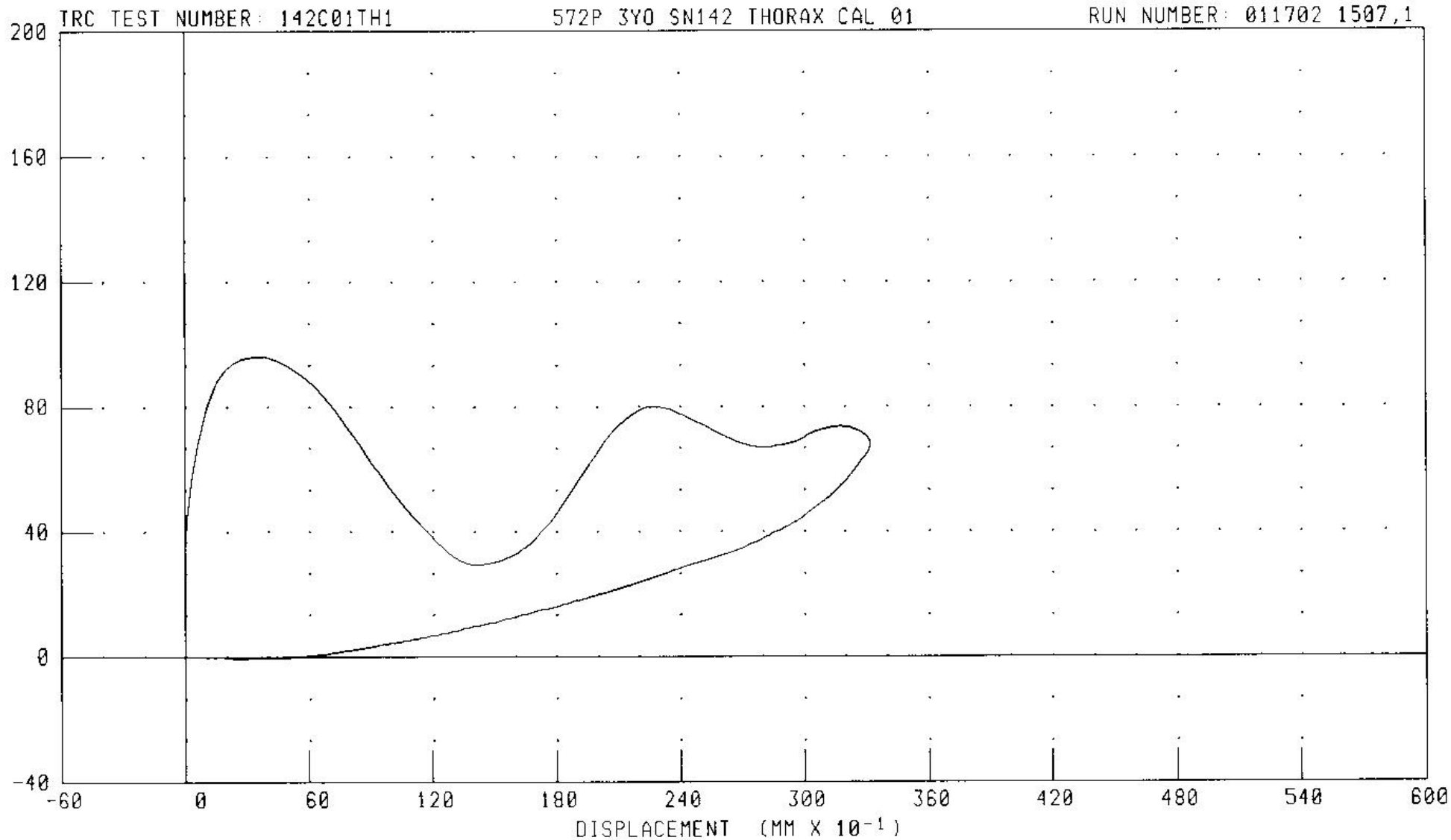


CHANNEL: CSTXD

FILTER CH. CLASS 600

PEAK DATA: 33.21 MM @ 12.80 MS; -0.02 MM @ 0.88 MS

HYBRID III THREE YEAR OLD CHILD DUMMY THORAX CALIBRATION
CHEST DISPLACEMENT VS PENDULUM FORCE



CHANNEL: CSTXD
PENXF

FILTER: CH. CLASS 600
CH. CLASS 180

PEAK DATA: 33.21 MM @ 12.80 MS; -0.02 MM @ 0.88 MS
962.61 N @ 2.16 MS; -22.42 N @ -0.32 MS

TRANSPORTATION RESEARCH CENTER INC.

TORSO FLEXION TEST

HYBRID III THREE-YEAR-OLD

CAL DATE: 15-Jan-02

TRC, INC.

TEST NO: 142C01TF1

572 P SN142 TORSO FLEX CAL 01

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6 – 22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 – 70 %	23 %
INITIAL ANGLE OF UNSUPPORTED DUMMY	<= 15 DEG. REFERENCED TO VERTICAL	1 DEG.
MAXIMUM FORCE AT 45 DEG. DURING 10 SECOND PERIOD	130 – 180 N	169 N
RETURN ANGLE	+/- 10 DEG OF INITIAL ANGLE	3 DEG.

TEST MEETS SPECIFICATIONS

TECHNICIAN



SECTION 11

TEST EQUIPMENT AND INSTRUMENTATION CALIBRATION

CERTIFICATION INSTRUMENTATION

Instrument	Certification Test	Calibration Date	Due Date
Slide Potentiometer Oceanside Mfg. Co. Model LCP 20-50 2.0 inches travel, 10,000 ohms	Neck Pendulum	3/02	9/02
C.G. Head Potentiometer Oceanside Mfg. Co. Model SP 221 Serial HNR2 10K, linearity = 1.5%	Neck Pendulum	3/02	9/02
C.G. Pendulum Potentiometer Oceanside Mfg. Co. Model SP 221 Serial HNR1 10K, linearity = 1.5%	Neck Pendulum	3/02	9/02
Bourns Potentiometer Model 3520S--1-502 5K +/-, linearity = 0.3%	Lumbar Spine Flexion	5/02	11/02
Transducer Inc. Load Cell S/N 20051, 50#	Lumbar Spine Flexion	2/02	6/02
Lebow Load Cell Model 3397-100 S/N 11564	Lumbar Spine Flexion	6/02	12/02
Endevco Accelerometers S/N AC-A183 +/- .075% Accuracy	Neck Pendulum (ATD)	12/01 6/02	6/02 12/02

CERTIFICATION INSTRUMENTATION (cont'd)

Instrument	Certification Test	Calibration Date	Due Date
Chatillon 20 Pound Gauge +/- 8 oz. Accuracy		2/02	8/02
Chatillon 40 Pound Gauge +/- 1% Accuracy		2/02	8/02
Belt Tension Gauge, +/- 1 lb.		2/02	8/02
Force Gauge, Chatillon Model DPTH 250		2/02	8/02
Weather Measure Cord Temp. & Humidity Recorder S/N 1545 +/- 3% Accuracy		6/01	7/02
Pot. #6 CIC Linear Potentiometer (Foam Certification)		2/02	8/02
Load Cell for Foam S/N 72952 +/- .10% Accuracy		2/02	8/02
Load Cell, Lap Belt North Sensotec S/N 283076 +/- 1.32 lbs. Accuracy		5/02	11/02
Load Cell, Lap Belt South Sensotec S/N 288386 +/- 1.32 lbs. Accuracy		5/02	11/02
Dillon Force Gauge Model E Serial # 4346 50#		3/02	9/02

SECTION 12

AVI FILES

AVI FILES (continued)