REPORT NO. 6525-V-4

NEW CAR ASSESSMENT AND STANDARDS ENFORCEMENT INDICANT TESTING FMVSS NOS. 212, 219 AND 301-75

Volkswagen

1979 VW Rabbit 2-Door Hatchback

NHTSA 308-T4-440

CALSPAN CORPORATION
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July 9, 1979

Prepared For

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
Enforcement
Office of Vehicle Safety Compliance
2100 Second Street, S. W., Transpoint Building
Washington, D. C. 20590

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FINAL REPORT ACCEPTED BY:

_____

Contract Technical Manager

_____

Date of Report Acceptance

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16. Abstract

Rear impact test of a 1979 VW Rabbit 2-door Hatchback, was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department facility for the New Car Assessment and Standards Enforcement Indicant Testing for FMVSS 212, 219 and 301-75 - Fuel System Integrity for the Office of Vehicle Safety Compliance, the Office of Automotive Ratings and for Research and Development.

The impact speed was 35.05 mph.

Driver and passenger passed FMVSS 208 injury criteria for head, chest and femurs.

The rear-end crush was 21.35".

Compartment intrusion was 18.3".

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SECTION 1

PURPOSE AND TEST PROCEDURE

PURPOSE: The purpose of this test was to obtain structural and occupant performance information for a 1979 VW Rabbit 2-door Hatchback for the Offices of Research and Development and Automotive Ratings of the NHTSA. This test is part of the New Car Assessment Program BOA, Task 2, sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract DOT-HS-8-01958.

TEST PROCEDURE: The Calspan Corporation, Advanced Technology Center, Transportation Research Department Test Procedure for the New Car Assessment Crash Tests submitted to, and approved by, the Contract Technical Manager (CTM) contains the specific procedures used to perform this test.

With the exception of a higher test speed, this procedure is not in conflict with any portion of FMVSS Procedures issued by the Office of Standard Enforcement and the amendments in effect as noted by the applicable contract.

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SECTION 2

SUMMARY OF TEST NUMBER 4

A 1979 Volkswagen 2-door Hatchback was impacted from the rear by a barrier moving at a velocity of 35.05 mph. The maximum rear end crush measurement was 21.4 inches and vehicle intrusion was 18.3 inches. Pre- and post-test photographs of the vehicle can be found in Appendix A.

The driver and right front passenger positions were occupied by 50th percentile Part 572 anthropometric test devices (ATD). Both of these occupants were restrained with the VW production 2-point passive torso belts. These ATDs were instrumented with femur load cells and triaxial accelerometers in the head and chest regions. Injury criteria data were recorded and are summarized in Table 3. All measured data from both the occupants and the vehicle are presented in Appendix B.

The ATDs were certified prior to this crash test and all pertinent certification and instrumentation data can be found in Appendix C.

Post-impact observations are discussed briefly in General Comments.

Table 1

CRASH TEST SUMMARY

TEST NO. 308-T4-440 PROJECT: NEW CAR ASSESSMENT PROGRAM

DATE: 7/9/79 TIME: 1458 TEMP: 86°F

VEHICLE	VW Rabbit 2-Door Hatchback
TEST WEIGHT (lbs)	2470
IMPACT ANGLE (deg)*	180
IMPACT VELOCITY (mph)**	35.05
MAX. CRUSH (in)	21.35
MAX. INTRUSION (in)	18.3

DUMMIES

TYPE	Hybrid II Part 572
LOCATION	LF(1), RF(2)
RESTRAINT	Passive Belt System

NUMBER OF DATA CHANNELS	28
NUMBER OF HIGH SPEED CAMERAS	5 + Real Time

*With respect to tow track Centerline

**Speed trap measurement (± .05% accuracy)

GENERAL COMMENTS

Rear-end damage to the Volkswagen Hatchback is displayed in the post-test photos found in Appendix A. Both rear side windows and the rear window shattered on impact. There was extensive vehicle damage, including a buckled roof and intruding B-pillars. Both rear tires deflated.

The 50th percentile occupants complied with all FMVSS-208 injury criteria values.

A brief summary of post-impact observations:

- Front bucket seats failed at impact.
- Hatchback window and both rear side windows shattered.
- Both rear tires deflated.
- Right front door opened, driver side door could not be opened.

Table 2

VEHICLE TEST WEIGHTS AS TESTED

Left Front	770 lbs	Left Rear	460 lbs
Right Front	790 lbs	Right Rear	450 lbs
Total Front	1560 lbs	Total Rear	910 lbs

Total Weight = 1560 lbs + 910 lbs = 2470 lbs

Wheel Base = 94.5 inches

$$Cg_{F.W.} = \frac{910 \text{ lbs} \times 94.5 \text{ inches}}{2470 \text{ lbs}} = 34.81 \text{ inches}$$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight (1890 lbs)

VCW = Vehicle Capacity Weight (862 lbs)

DSC = Designated Seating Capacity (4)

RCLW = VCW - 150 (DSC)

RCLW = 862 - 150(4) = 262 lbs

TEST WEIGHT = UDW + RCLW + No. of DUMMIES X 164 lbs

TEST WEIGHT = 1890 lbs + 262 lbs + 2 (164 lbs)

TEST WEIGHT = 2480 lbs

Table 3

DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G") *											
	HEAD				CHEST				PELVIS			
	X	Y	Z	R	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	29	3	14	30	13.5	3	12.5	17				
DUMMY (2)	33	3	18	36	14	1.6	12	17				
DUMMY (3)												
DUMMY (4)												

	MAXIMUM FORCE FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	116	170
DUMMY (2)	170	228
DUMMY (3)		
DUMMY (4)		

	MAXIMUM FORCE SEAT BELTS LOADS (LBS)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
DUMMY (1)	40		
DUMMY (2)	50		
DUMMY (3)			
DUMMY (4)			

	HEAD INJURY CRITERIA**				SEVERITY INDEX	
	HIC	t_1 (SEC)	t_2 (SEC)	AVE ACC (g) t_1 TO t_2	HEAD	CHEST
DUMMY (1)	114.5	.0840	.1308	22.7	157.4	
DUMMY (2)	102.8	.0711	.1476	17.8	140.9	
DUMMY (3)						
DUMMY (4)						

*DEFINED AS EXCEEDING 0.003 SEC. DURATION
**AS DEFINED IN FMVSS NO. 208

FIGURE 1

PRE-TEST AND POST-TEST MEASUREMENT POINTS

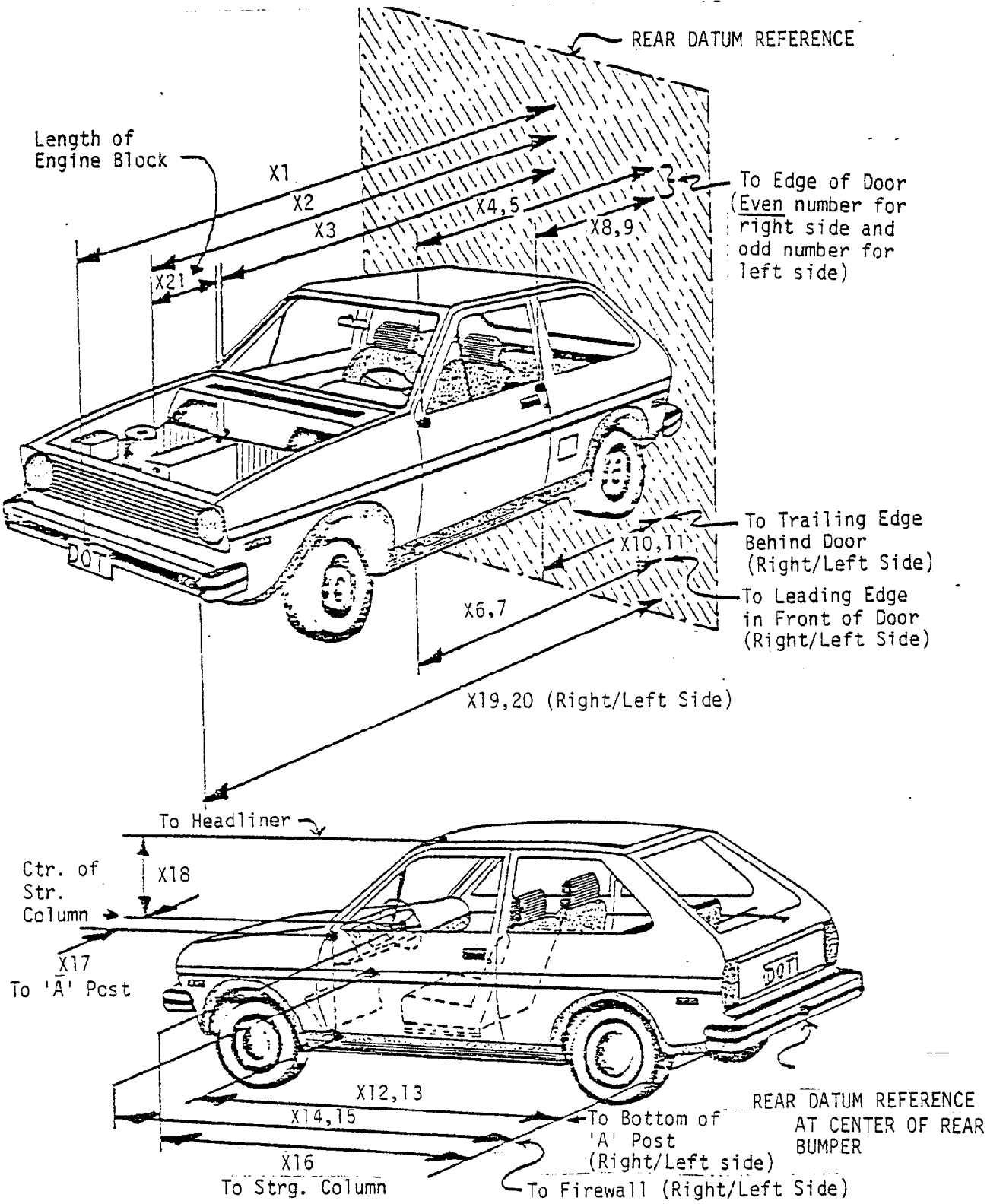
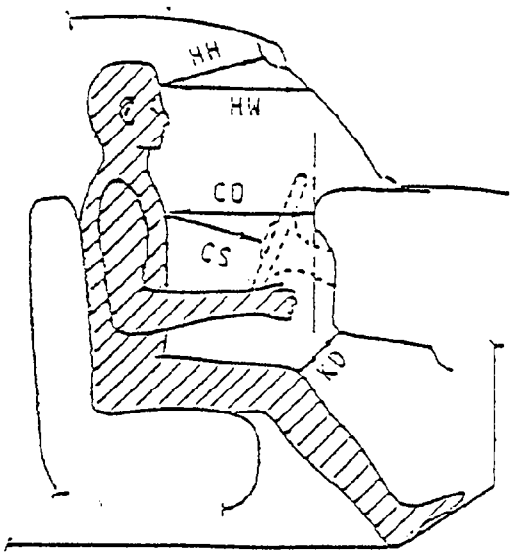


Table 4

NO.	VEHICLE MEASUREMENTS TYPE OF MEASUREMENT	PRE-TEST	POST TEST
X1	Total Length of Vehicle at Centerline	154.4	133.5
X2	Rear Surface of Vehicle to Front of Engine	136.9	116.0
X3	Rear Surface of Vehicle to Firewall	114.2	93.3
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	102.5	78.8
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	102.5	80.5
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	102.5	80.5
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	102.5	81.4
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	58.7	36.0
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	58.6	37.5
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	58.6	36.5
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	58.4	37.5
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	101.7	79.8
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	101.7	80.3
X14	Rear Surface of Vehicle to Firewall - Right Side	113.2	92.5
X15	Rear Surface of Vehicle to Firewall - Left Side	114.2	93.5
X16	Rear Surface of Vehicle to Steering Column	93.5	66.2
X17	Center of Steering Column to "A" Post	11.6	11.6
X18	Center of Steering Column to Headliner	21.5	21.5
X19	Rear Surface of Vehicle to Right Side of Front Bumper	153.5	132.2
X20	Rear Surface of Vehicle to Left Side of Front Bumper	153.4	132.0
X21	Length of Engine Block	22.0	22.0

	DRIVER	PASS
HH	19.5	19.5
HW	25.0	24.75
CD	23.5	25.25
CS	16.0	N/A
KDL	3.25	3.12
KDR	3.50	3.25



HR	6.5	7.75
HS	8.75	9.0
AD	4.0	4.25
HD	6.5	6.5

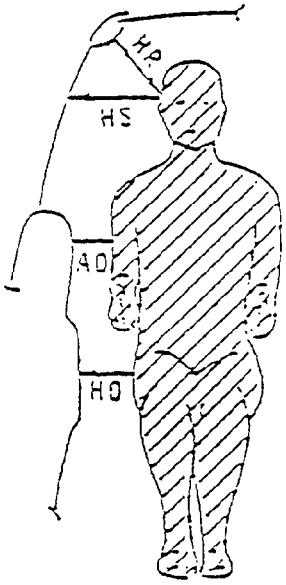
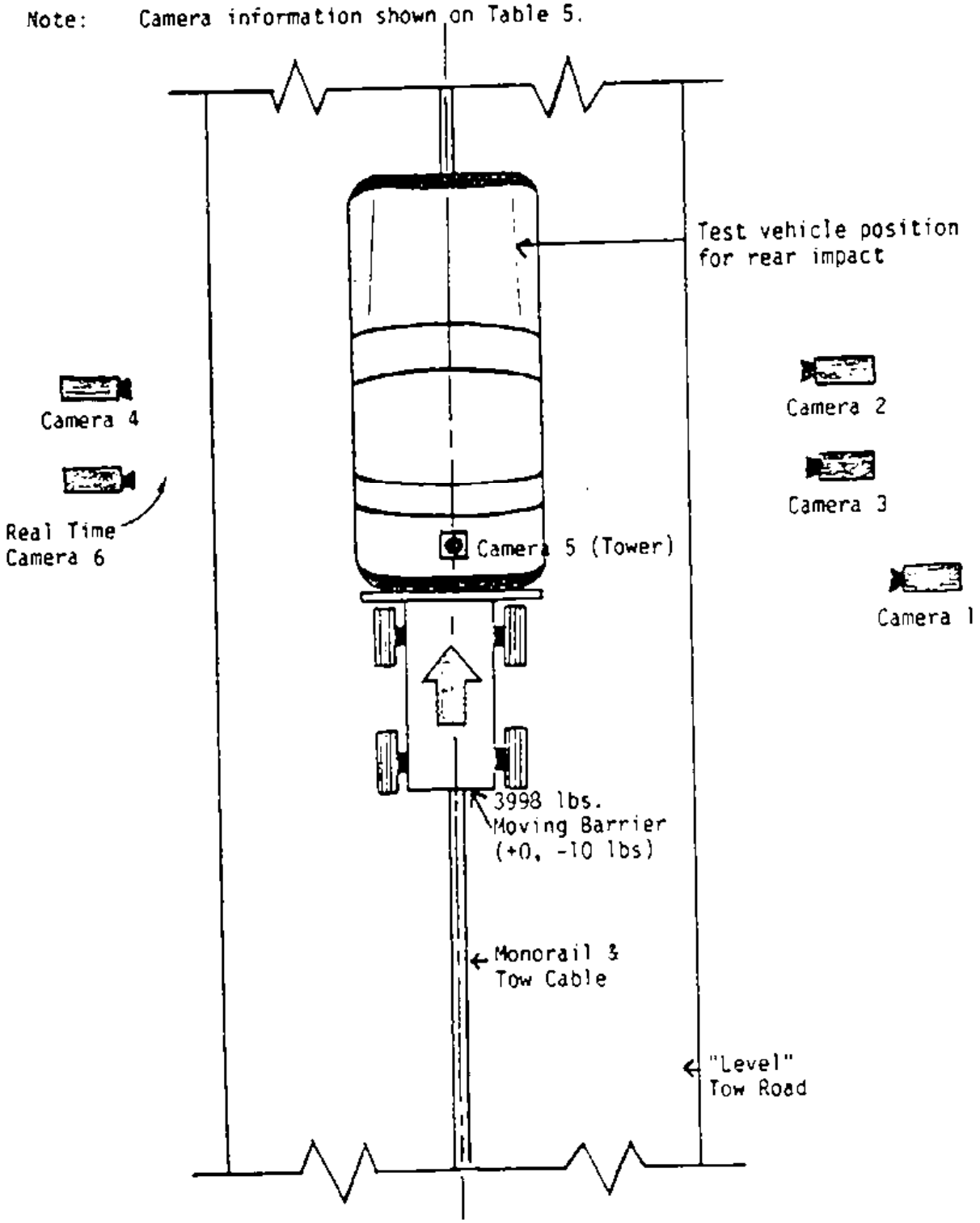


FIGURE 2 OCCUPANT CLEARANCE DIMENSIONS

FIGURE 3

CAMERA POSITIONS FOR REAR IMPACTS

Note: Camera information shown on Table 5.



TOP VIEW

TABLE 5

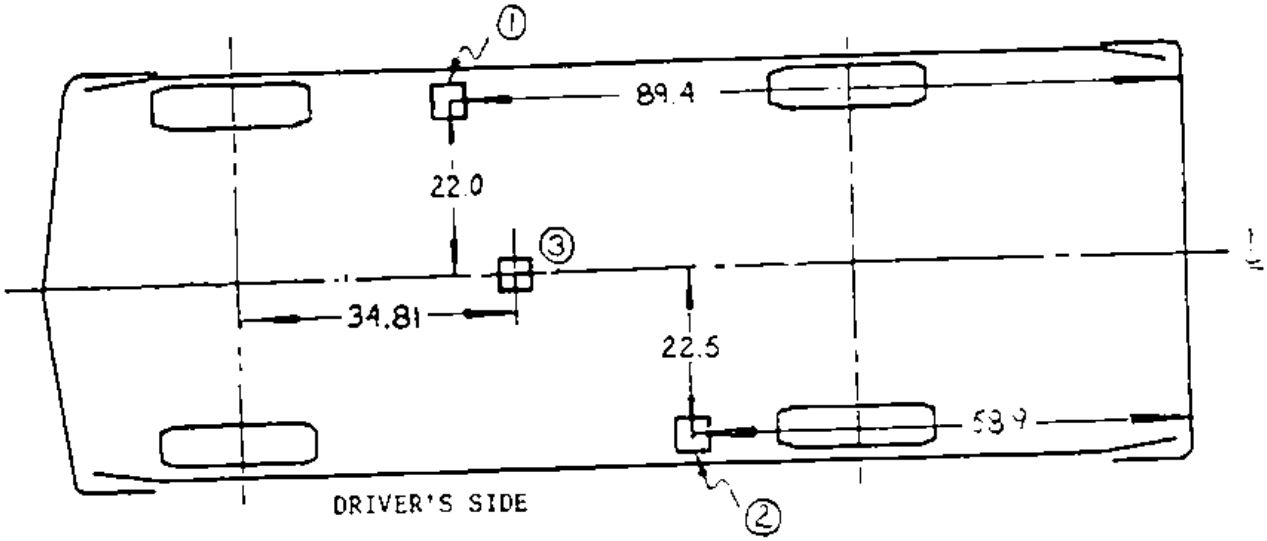
HIGH SPEED CAMERA INFORMATION

308, T4, 440
REAR 1979 VW RABBIT

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	SOUTH WIDE	FASTEX	50 mm	1200
2	SOUTHEAST DUMMY	FASTEX	50 mm	1400
3	SOUTH DUMMY	FASTEX	50 mm	1500
4	NORTH DUMMY	FOSTEX	50 mm	1000
5	TOWER	PHOTOSONIC	13 mm	1050
6	NORTH WIDE	REAL TIME	--	24

NOTE: CAMERAS ARE NUMBERED ACCORDING TO SPLICING SEQUENCE OF FILM.

(24 fps) REAL TIME MOVIE FILM COVERAGE OF PRE-CRASH, POST-CRASH AND CRASH EVENT SPLICED AT START AND END OF FILM.



ACCELEROMETER NUMBER*	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Front Seat "Crossbeam"	x		x
2	Rear Seat "Crossbeam"	x		x
3	CG	x	x	x

*The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

Figure 4 VEHICLE ACCELEROMETER LOCATIONS

Table 6
SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION:

Vehicle Manufacturer: Volkswagen

Make/Model: VW Rabbit

Body Style: 2 Dr. Hatch Back ; Model Year: 79

VIN: 1793858496 ; Build Date: 6-79

NHTSA No.: 308-T4-440 ; Color: Lt. Blue

Engine Data: 4 cylinders; 89 cu.in. displacement

Transmission Data: 4 speed (X) Manual/ ( ) Automatic

Date Vehicle Received by Laboratory: 6/25/79

Dealer's Name & Address: Jim Kelly's, 3325 Genesee St., Buffalo, N.Y.

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR 'B' POST:

Vehicle Manufactured By: VW of America

Date of Manufacture: 6-79 ; VIN: 1793858496

GVWR: 2822 lbs.; GAWR: Front = 1609 lbs.; Rear = 1278 lbs

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.:

Vehicle Load:	FRONT	REAR	RECOMMENDED TIRE SIZE:	LOAD RANGE:
Up to Capacity	27 psi	31 psi	1555R13	(B) C D

Vehicle Capacity:

Type of Seats - [ ] Bench
[X] Bucket
[ ] Split Bench

Number of Occupants (Designated Seating Capacity) = 2 Front, 2 Rear, 4 Total

CARGO LOAD = 262 lbs.

TOTAL = 0862 lbs.

Rim 4 1/2 J

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with max. fluids):

Right Front = 620 lbs. Right Rear = 290 lbs.

Left Front = 620 lbs. Left Rear = 360 lbs.

TOTAL FRONT WEIGHT = 1240 lbs. (65.6 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 650 lbs. (34.4 % of Total Vehicle Weight)

TOTAL DELV. WEIGHT = 1890 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 252 lbs. CARGO:

Right Front = 790 lbs. Right Rear = 450 lbs.

Left Front = 770 lbs. Left Rear = 460 lbs.

TOTAL FRONT WEIGHT = 1560 lbs. (63.2 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 910 lbs. (36.8 % of Total Vehicle Weight)

TOTAL TEST WEIGHT = 2470 lbs.

Weight of ballast secured in vehicle trunk area = 000 lbs.

TEST CONDITIONS:

Date of Test: 7/9/79 ; Time of Test: 1458 am/pm

Ambient Temperature: 85 °F at impact area.

Temp. In Occ. Compart.: 79 °F.; W/Shld. Mldg. Temp.: 96 °F.

Table 6 - continued

VEHICLE ATTITUDE: (all dimensions in inches)

Delivered Attitude: RF 25 1/4" ; LF 25 1/4" ; RR 25 1/4" ; LR 25 1/4"

Test Attitude: RF 23 5/8" ; LF 23 1/2" ; RR 23 3/4" ; LR 23 7/8"

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 27 psi

Rear = 31 psi

Recommended Tire Size: 155SR13

Load Range: B

Tires on Vehicle: 155SR13

Is Spare Tire a "Space Saver": No (yes/no)

Is Spare Tire standard equipment: Yes (yes/no)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent #2; Spec. Grav.: 0.764

Kinematic Viscosity: .96 Centistokes

Spill Point Volume*: 9.44 Gallons (SPV)

Test Volume: 8.58 Gallons (90 to 91% of SPV)

Fuel System Capacity (data from Owner's Manual): 10.5 gal.

Details of fuel system: Fuel Filler Cap is on Right Rear Side of Car

Electric Fuel Pump: X Yes; ___ No; Fuel Injection: X Yes: ___ No

Does electric fuel pump operate with ignition switch "on" and the engine not operating: ___ Yes; X No

VEHICLE REBOUND AND CRUSH:

Overall Length of Test Vehicle: Pre-Test = R153.5/L 153.4 inches

CRUSH=R 21.3 /L 21.4 Post-Test= R132.2/L 132.0 inches

FOR FRONTAL IMPACTS, distance from front of test vehicle to the barrier after impact = ___ inches

*With entire fuel system filled from fuel tank through carburetor bowl.

FIGURE 5

POST IMPACT DATA - STDS. 219 & 301

DATA SHEET

- TYPE OF TEST: ☐ Frontal (90°) Impact
  ☐ Oblique (___°) Impact on ☐ Left (Driver's) Side
  ☐ Right Side
  ☐ Lateral or Side Impact on ☐ Left (Driver's) Side
  ☐ Right Side
  ☒ Rear Impact
- DATE OF TEST: 7/9/79 ; TIME: 1458 ; TEMP.: 85 °F.
- VEH. NHTSA NO.: 308-T4-440 ; VIN: 1793858496
- REQUIRED VEH. VELOCITY RANGE: 34.5 to 35.5 mph
- IMPACT VELOCITY: (traps within 5 feet of impact event)

  Trap #1 = 35.03 mph; Trap #2 = 35.07 mph

  Distance from the vehicle's front bumper to the barrier face
  entering the vehicle velocity measurement device = 58.
  exiting the vehicle velocity measurement device = 18.
- VEH. STATIC CRUSH: (for Frontal and Rear Impacts Only)

  Driver's Side = 21.3 in.; Passenger's Side = 21.4 in.

  Average = 21.35 inches

  Crush Details:
- VEH. STATIC CRUSH: (for Side Impacts Only)

  Amount of Crush = _____ inches on _____ side

  Crush Details:
- VEH. REBOUND: (from rigid barrier only)

  Driver's Side = - inches; Pass. Side = - inches

  Average = - inches
- REMARKS:

FIGURE 5

APPENDIX A

STILL PHOTOGRAPHS

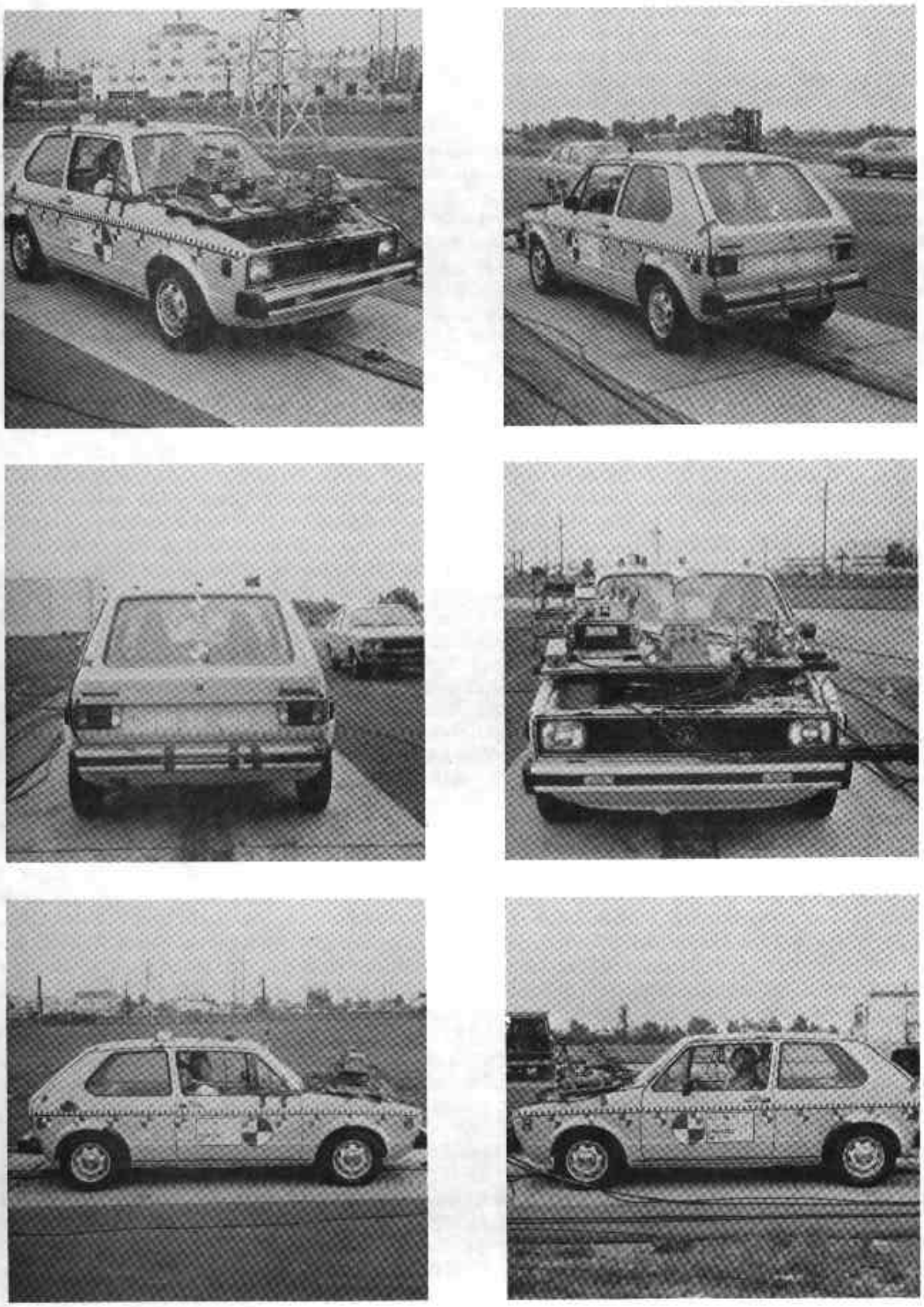


FIGURE 1A PRE-VIEW FULL FRONT, SIDE, REAR AND THREE-QUARTER

FIGURE 2A POST-VIEW FRONT, SIDE, REAR AND THREE-QUARTER

FIGURE 3A PRE- AND POST-TEST DRIVER AND PASSENGER POSITION

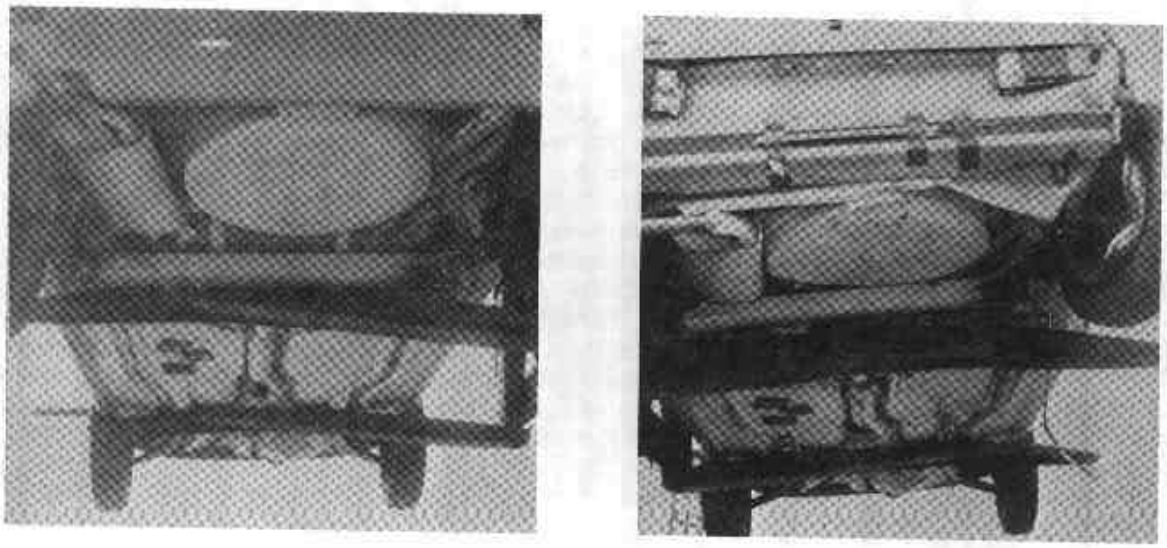


FIGURE 4A PRE- AND POST-TEST VIEW OF REAR UNDERBODY

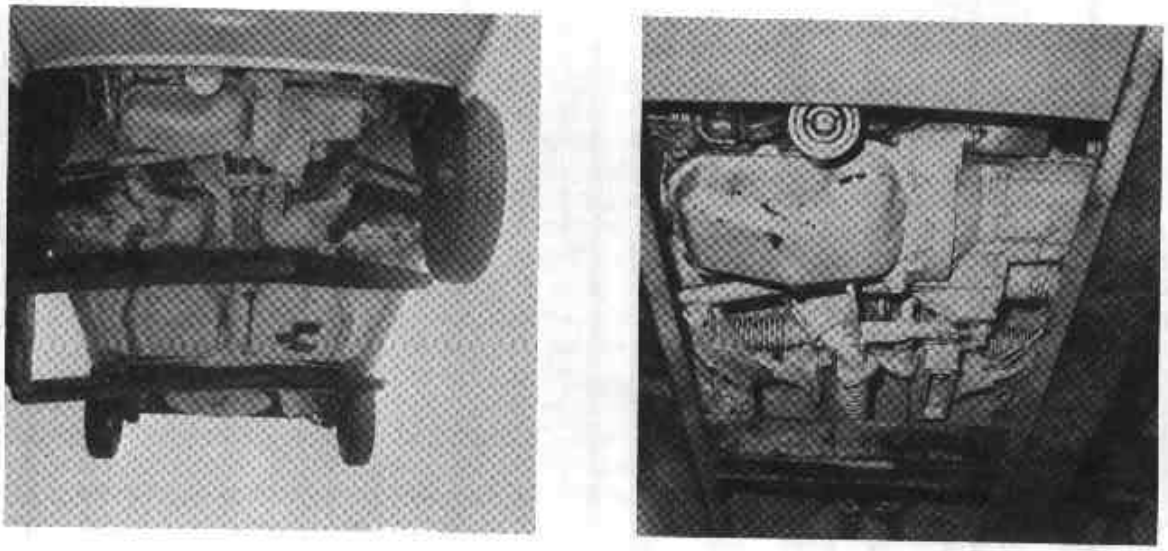


FIGURE 5A PRE- AND POST-TEST VIEW OF FRONT UNDERBODY

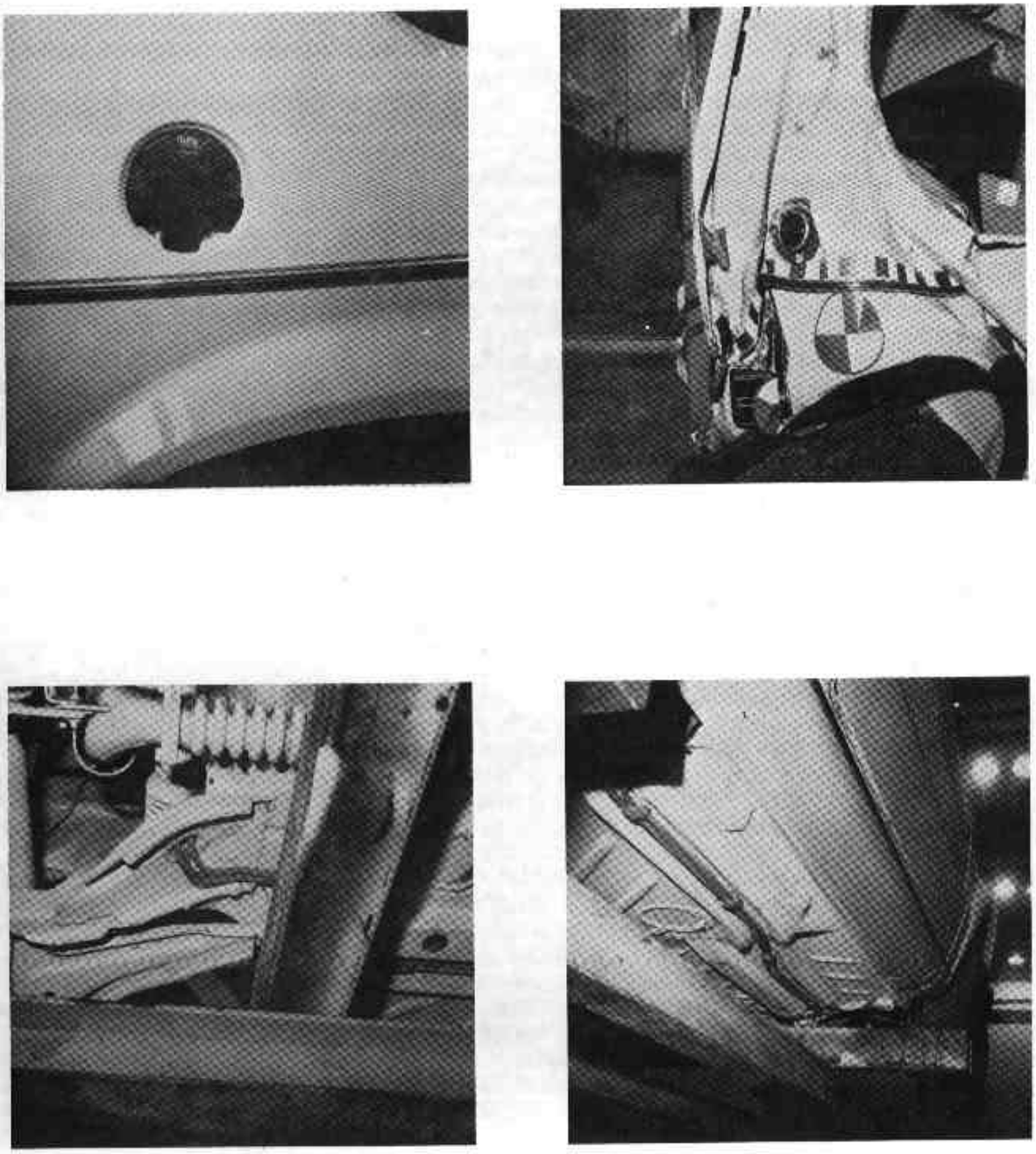


FIGURE 6A FUEL/VAPOR LINES AND FILLER PIPE

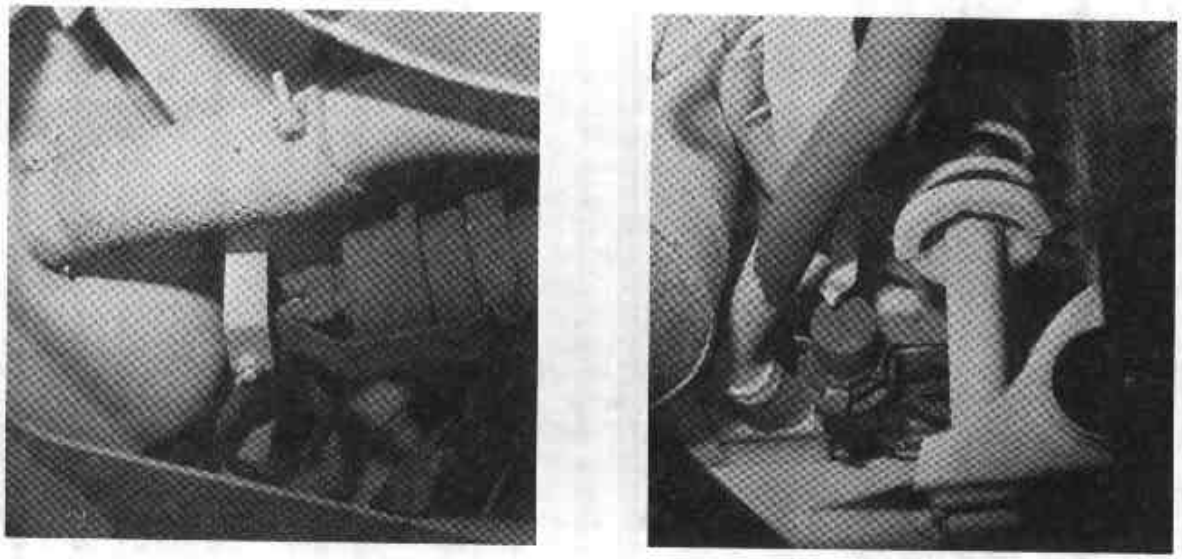


FIGURE 7A PRE-TEST VIEW OF FILL LINE, TANK AND FUEL PUMP

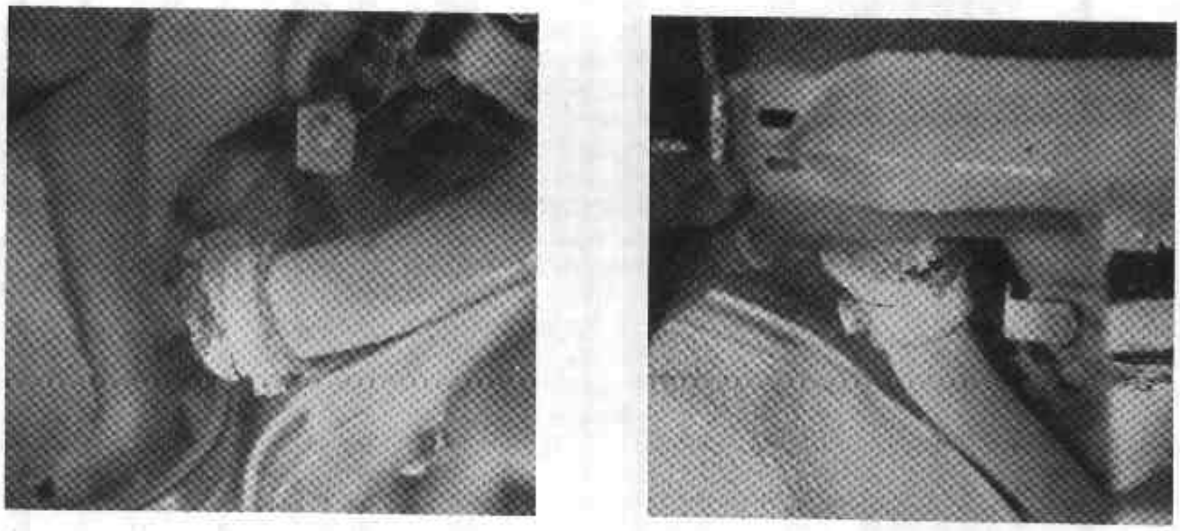


FIGURE 8A POST-VIEW OF FILL TUBE COLLAPSE AND BREAK ALLOWING FUEL LEAKAGE

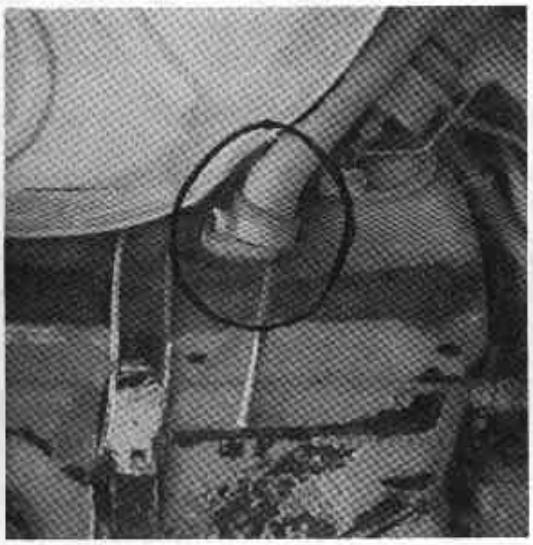


FIGURE 9A PEN INDICATING BREAK IN FILLER TUBE

FIGURE 10A POST-TEST VIEW OF ROOF COLLAPSE

FIGURE 11A VIEW OF MOVING BARRIER

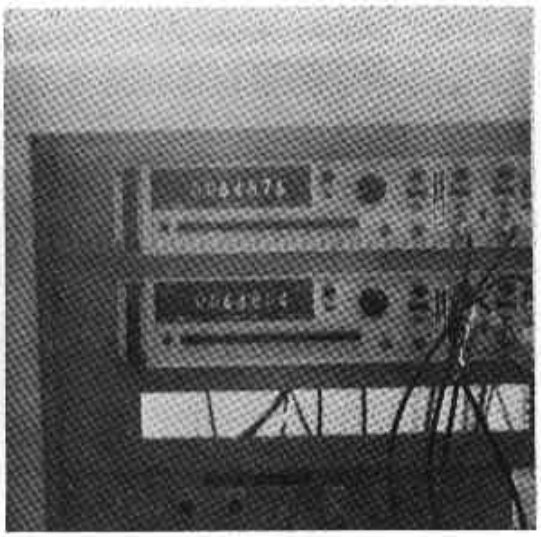


FIGURE 12A VELOCITY TRAP COUNTER DISPLAY

APPENDIX B

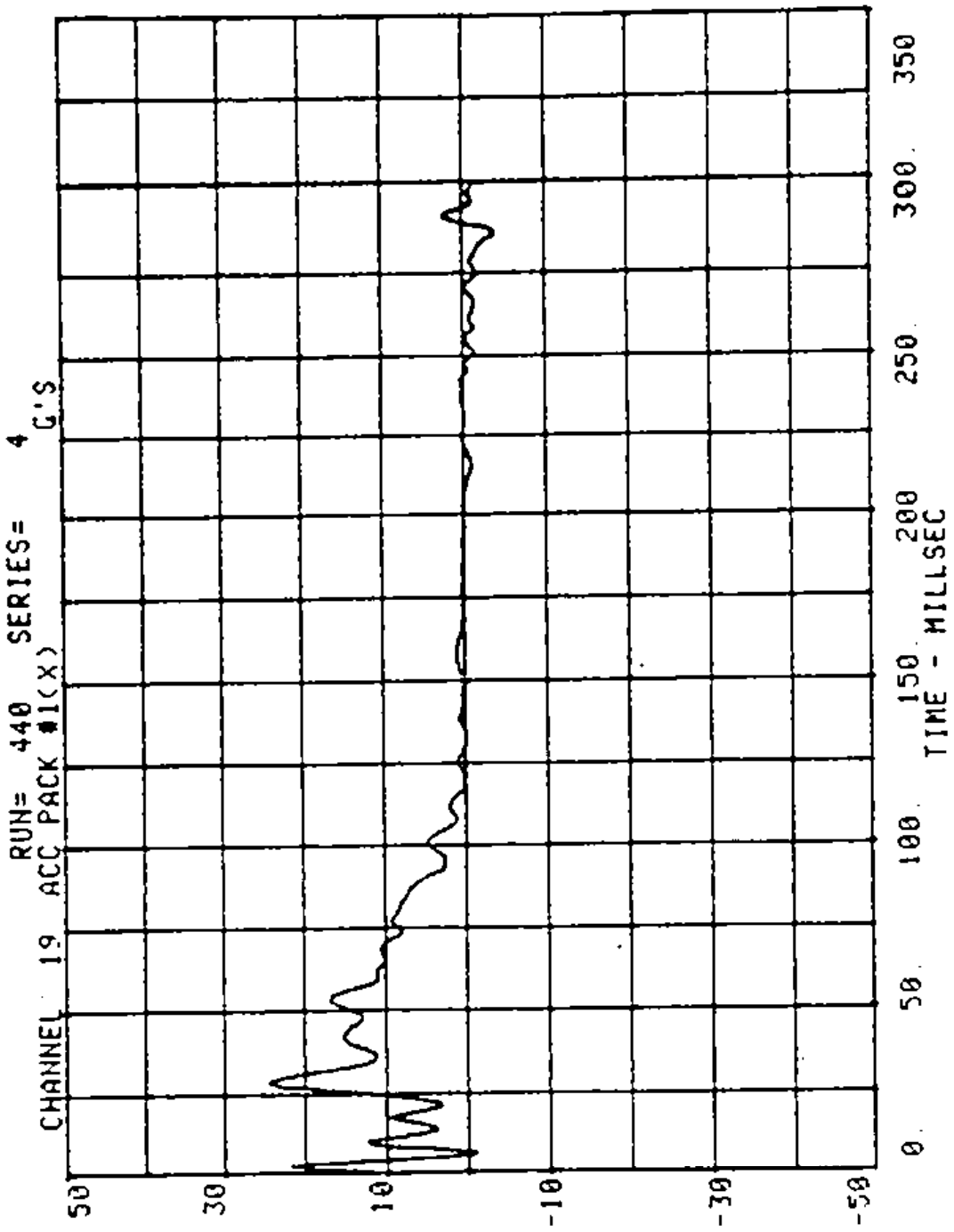
VEHICLE AND DUMMY RESPONSE DATA

TEST NO. 308-T4-440

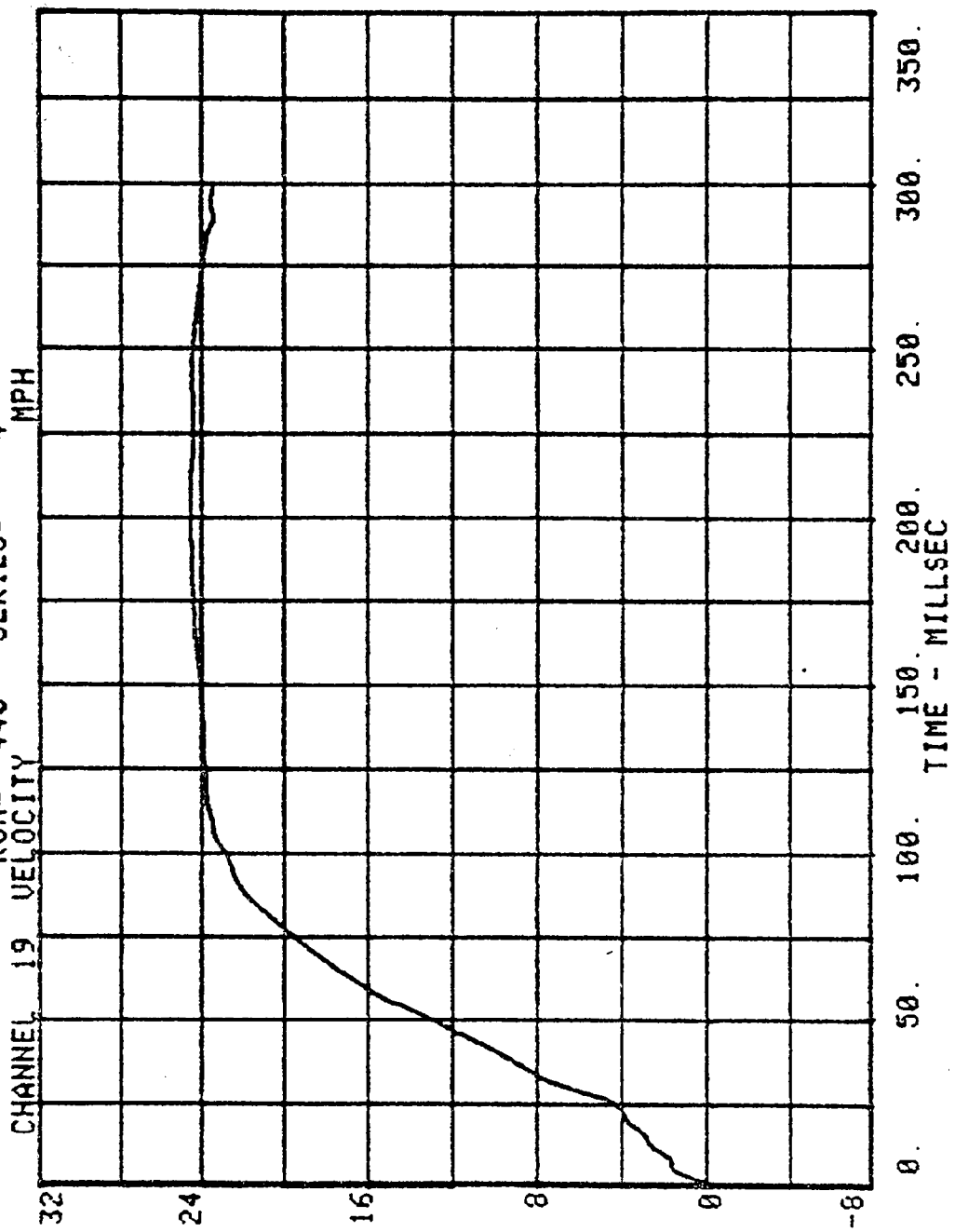
1979 VW RABBIT

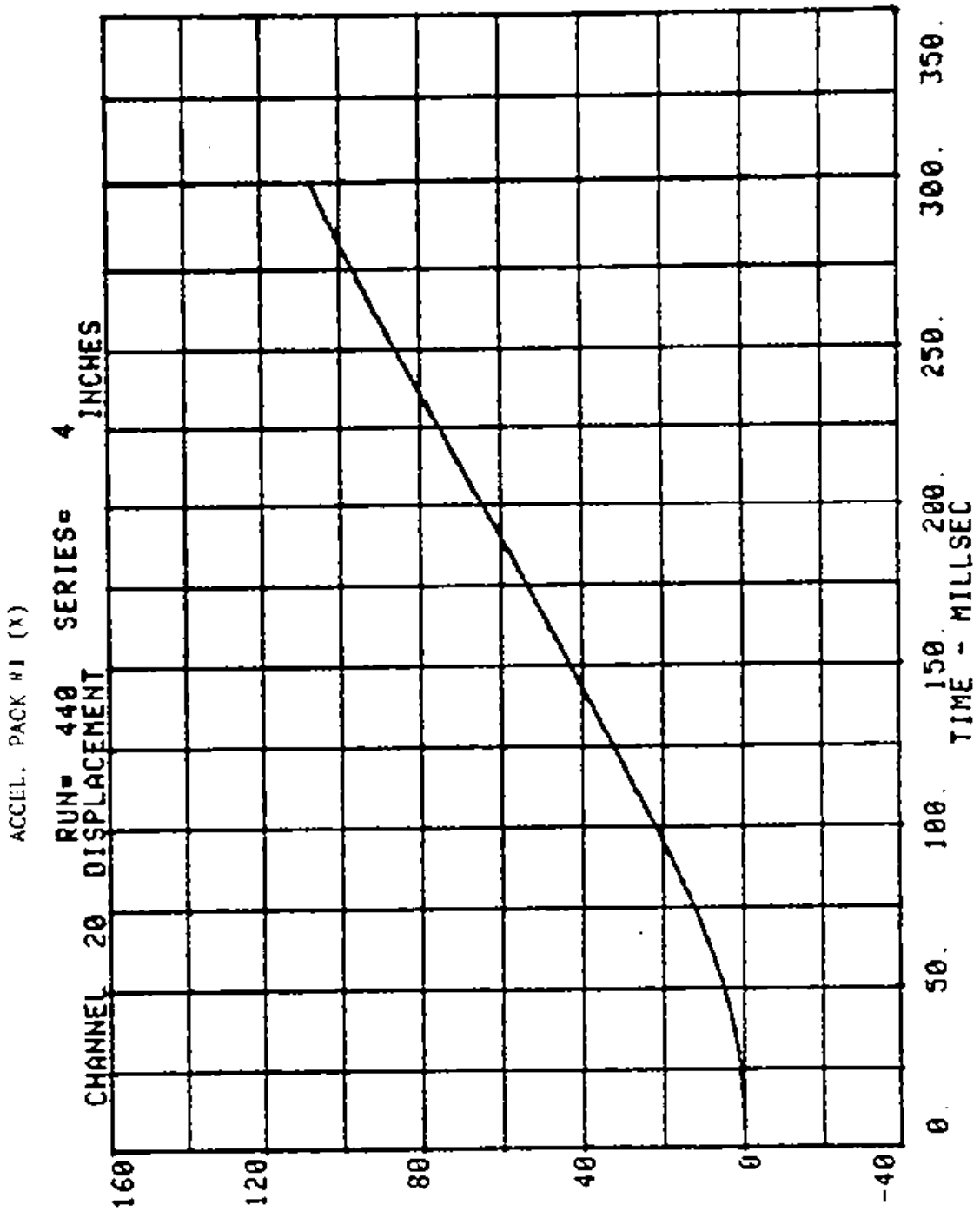
VEHICLE DATA

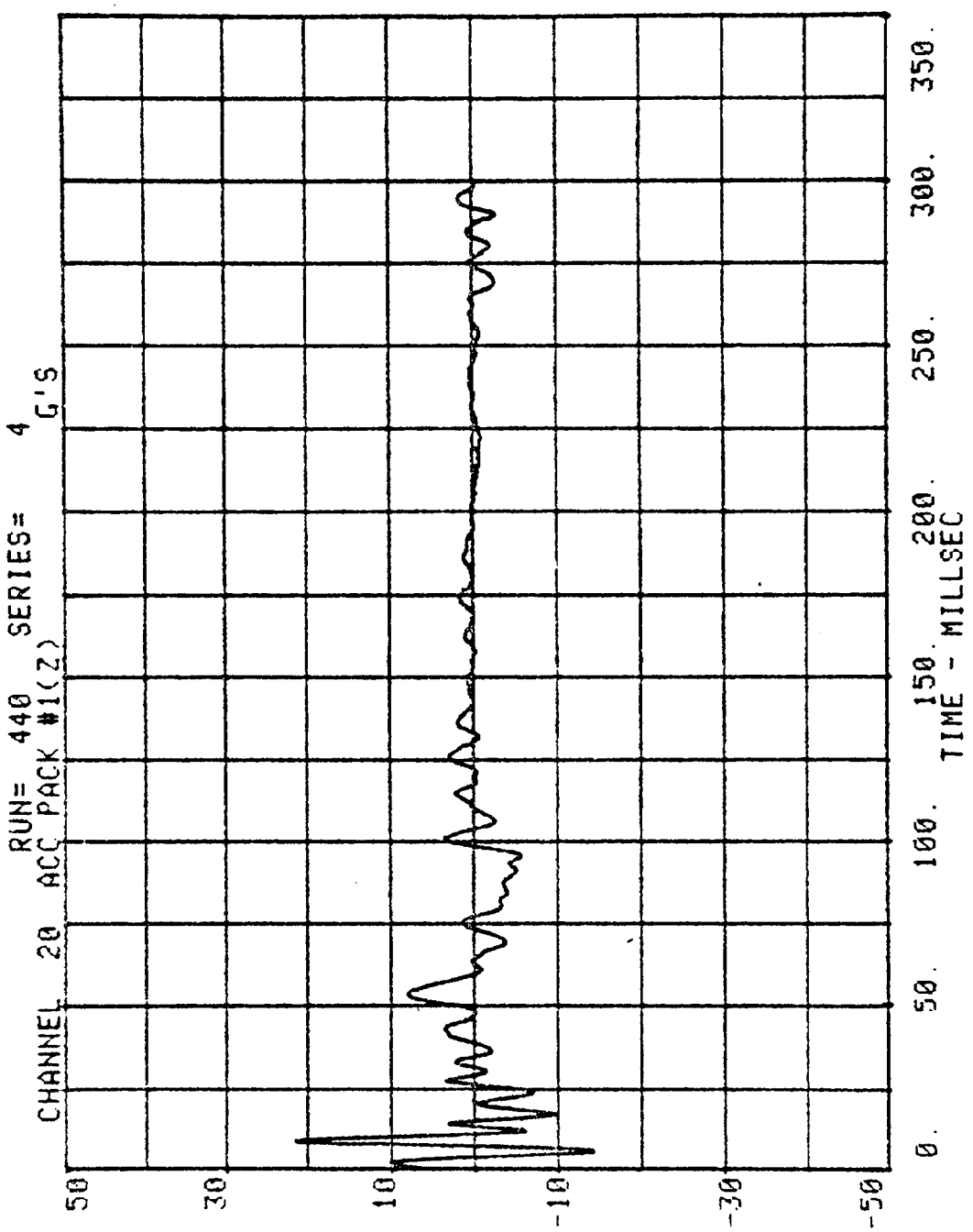
	FILTER CHANNEL CLASS
VEHICLE DATA	60

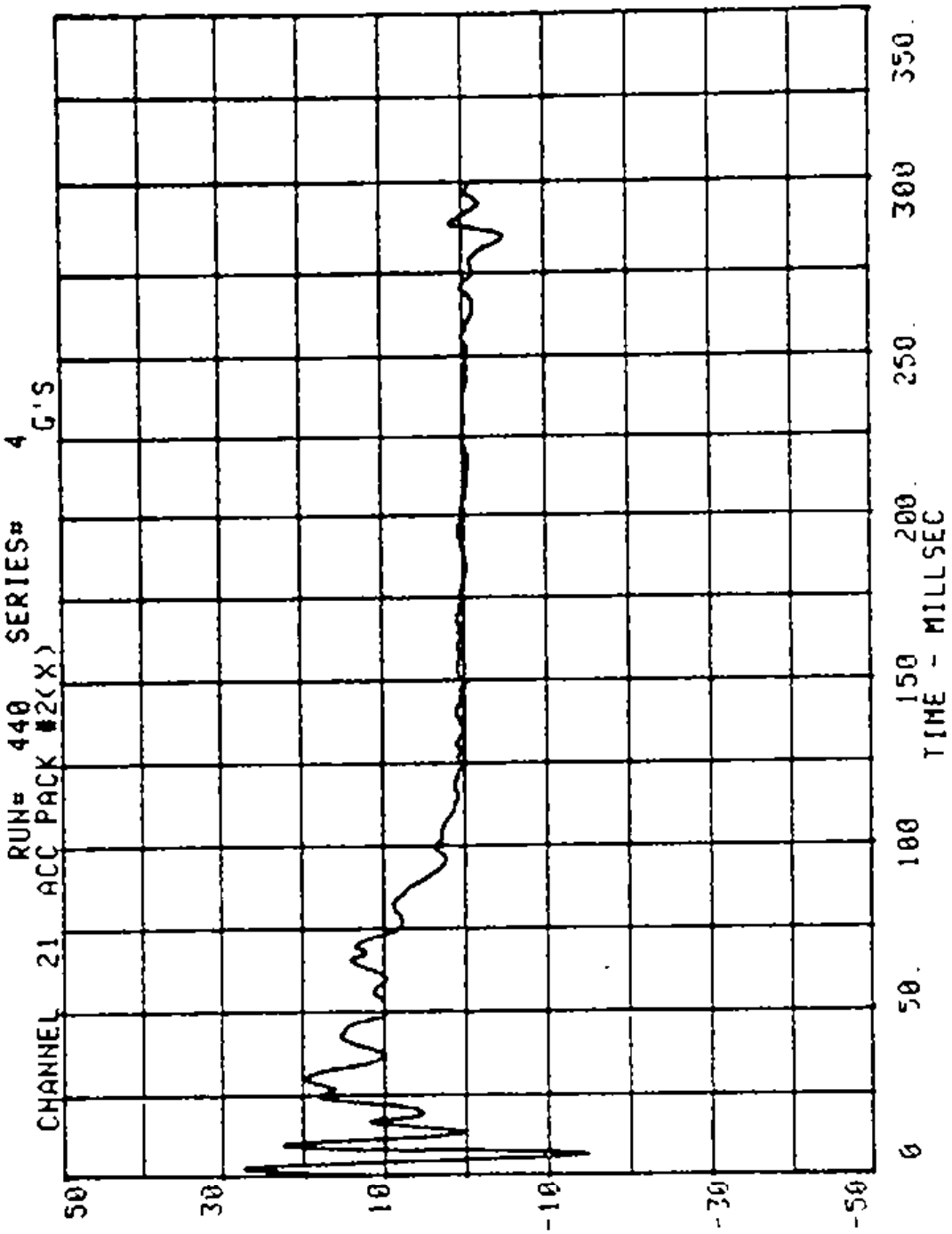

CHANNEL 19 ACC PACK #1(X)
RUN= 440 SERIES= 4
G'S
50
30
10
-10
-30
-50
0
50
100
150
200
250
300
350
TIME - MILLSEC

ACCEL. PACK #1 (X)

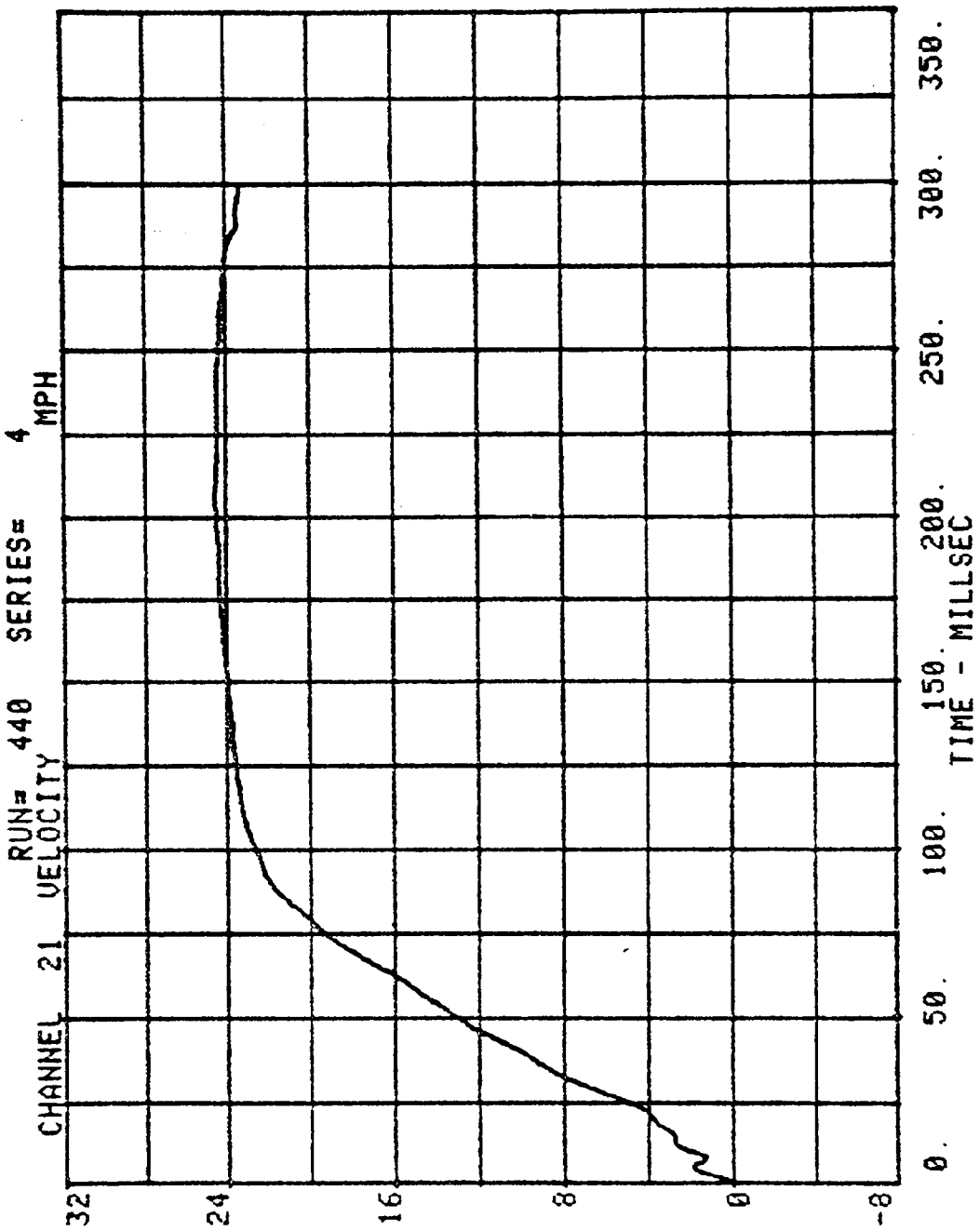



ACCEL. PACK #1 (X)
CHANNEL 20 DISPLACEMENT
RUN= 440 SERIES= 4
INCHES
160
120
80
40
0
-40
0
50.
100
150
200
250.
300.
350.
TIME - MILLSEC

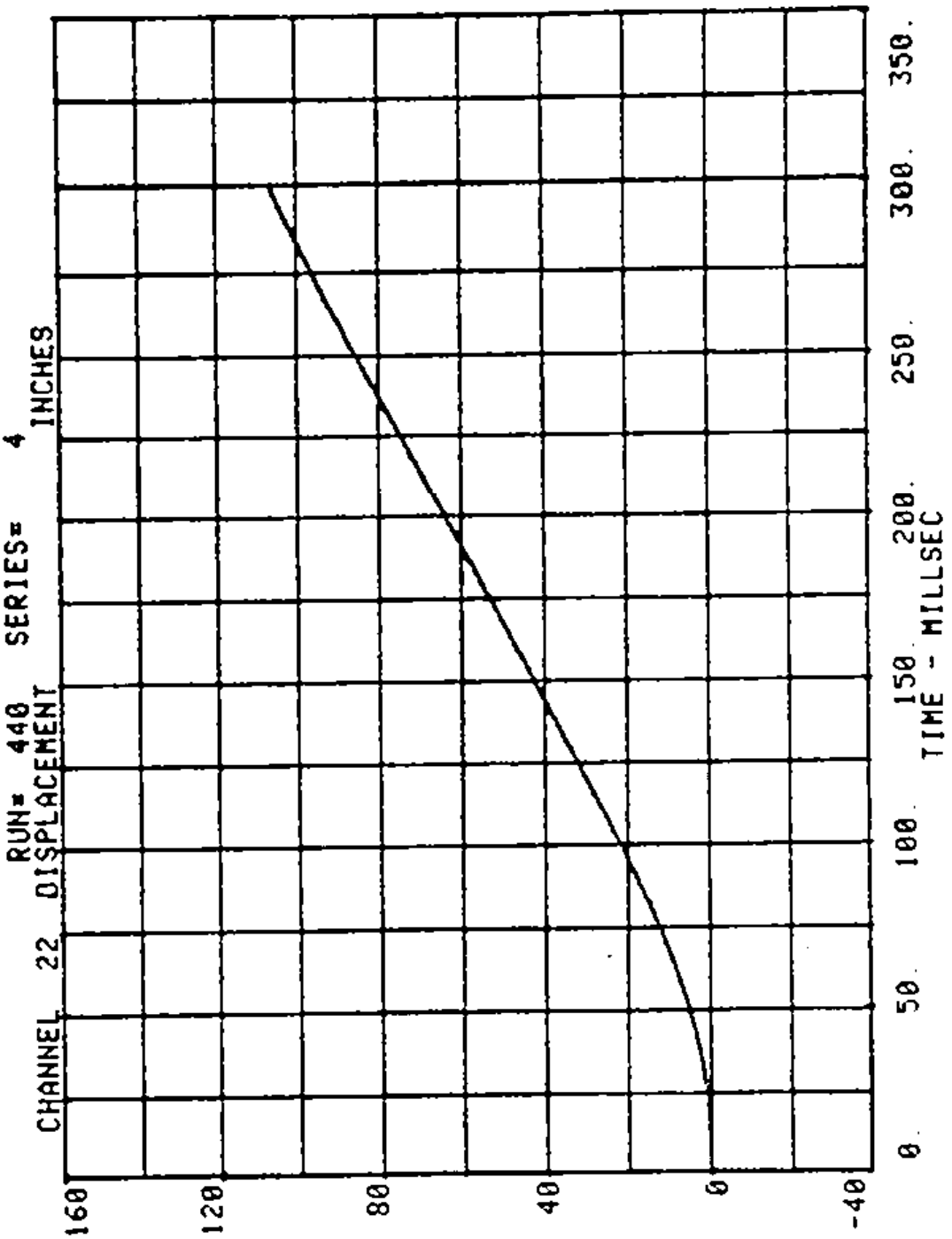

CHANNEL 20 RUN= 440 SERIES= 4
ACC PACK #1(Z)
G'S
50
30
10
-10
-30
-50
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC

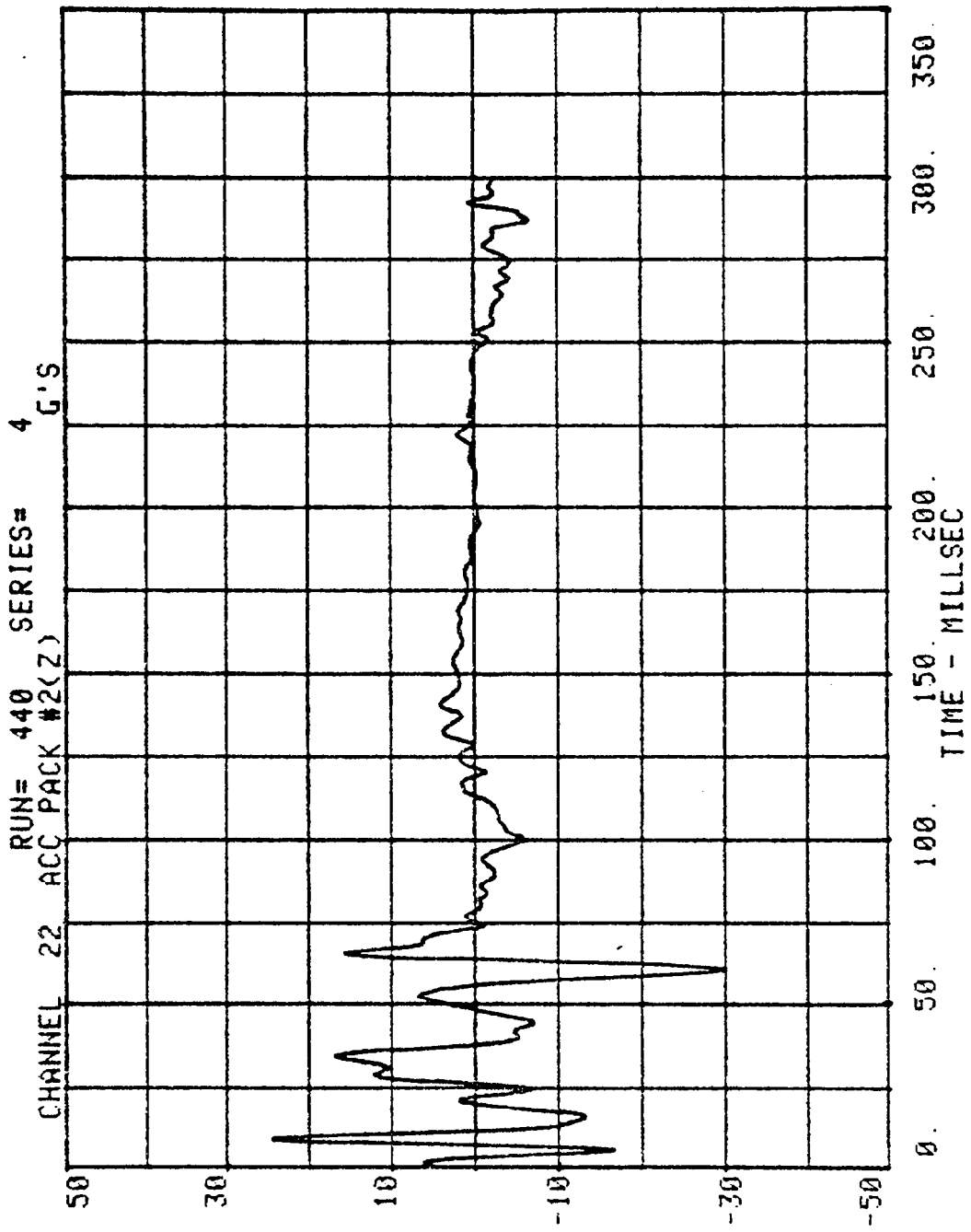

CHANNEL 21 ACC PACK #2(X)
RUN= 440 SERIES= 4
G'S
50
30
10
-10
-30
-50
0
50
100
150
200
250
300
350
TIME - MILLSEC

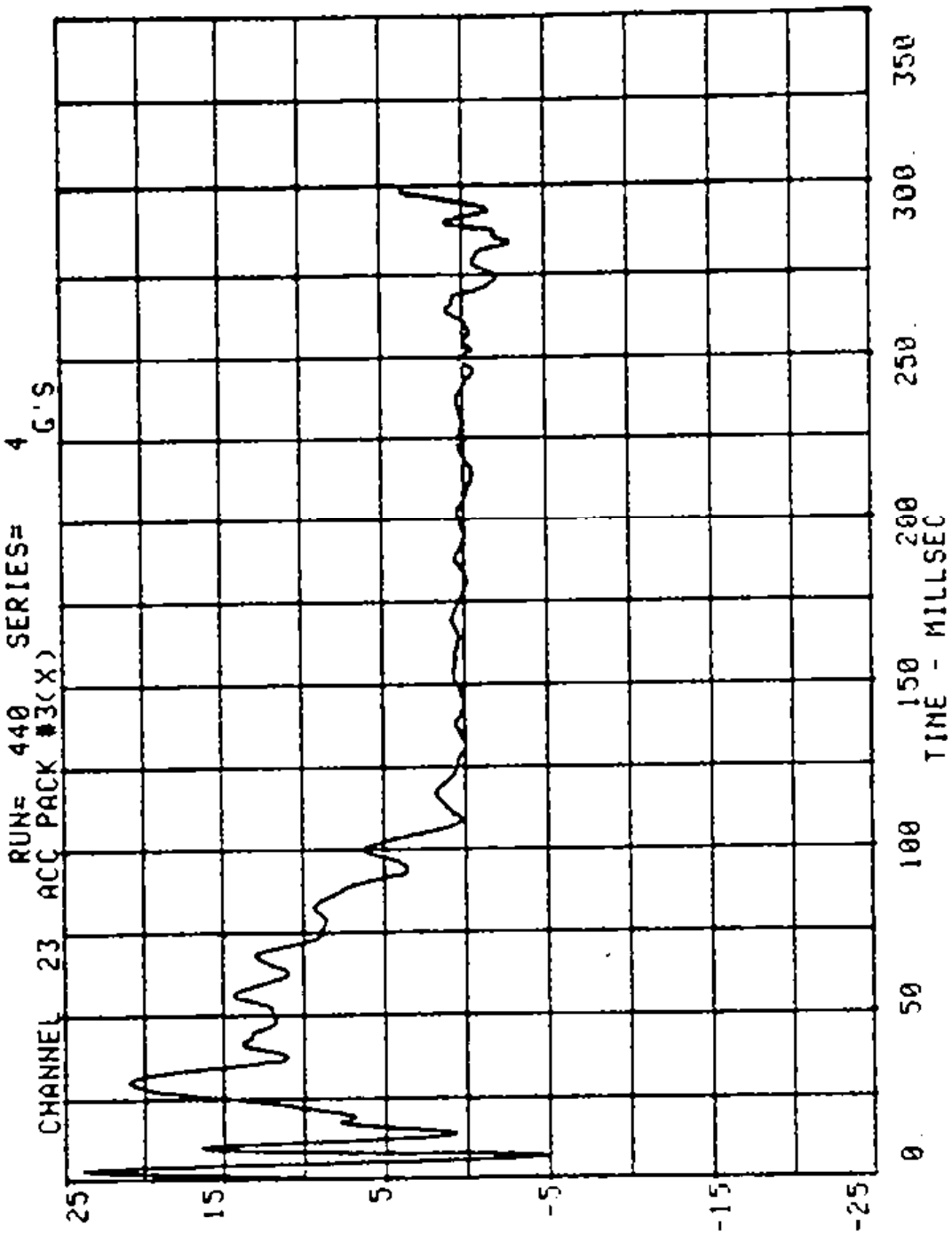
ACCEL. PACK #2 (X)



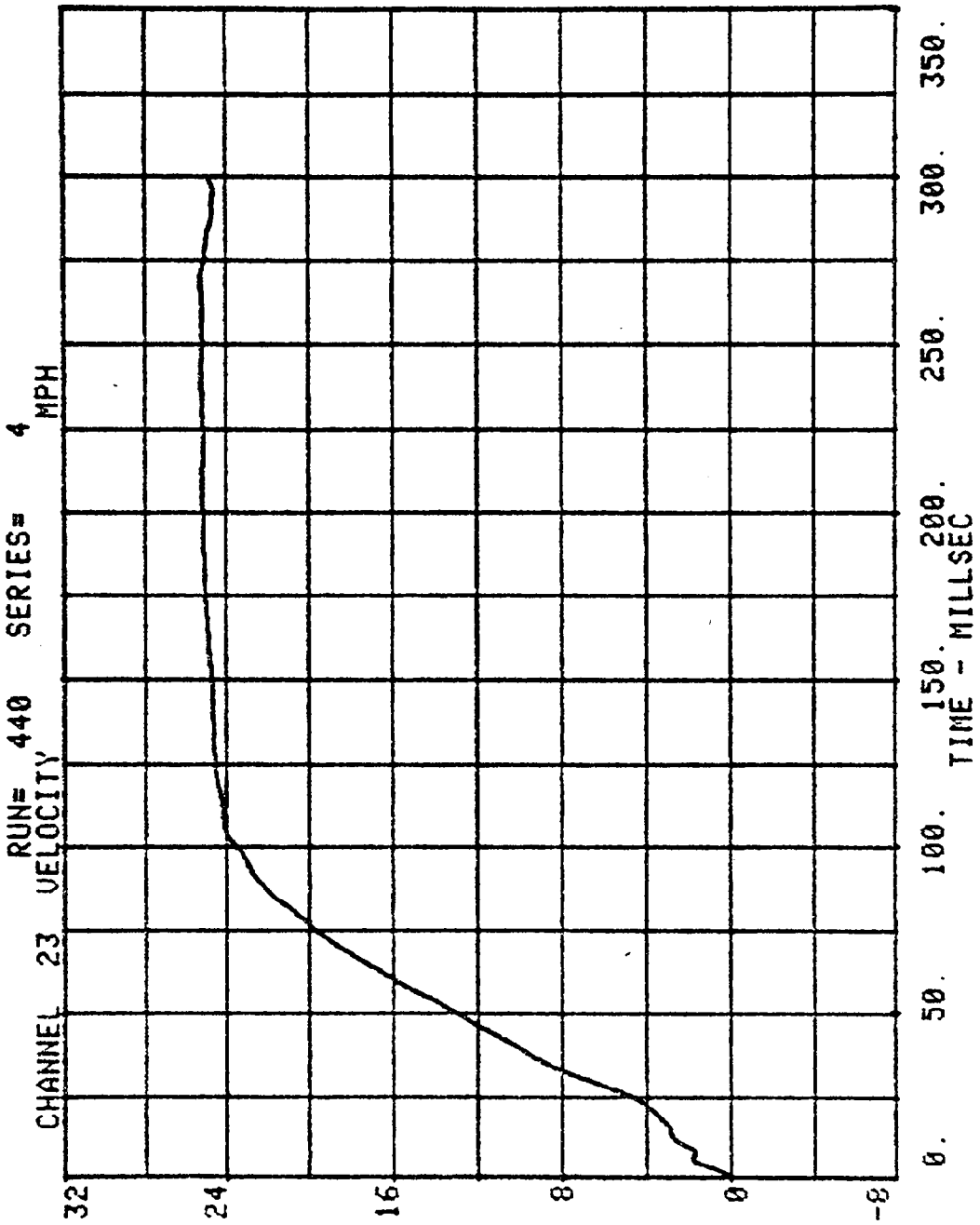
ACCLL. PACK #2 (X)



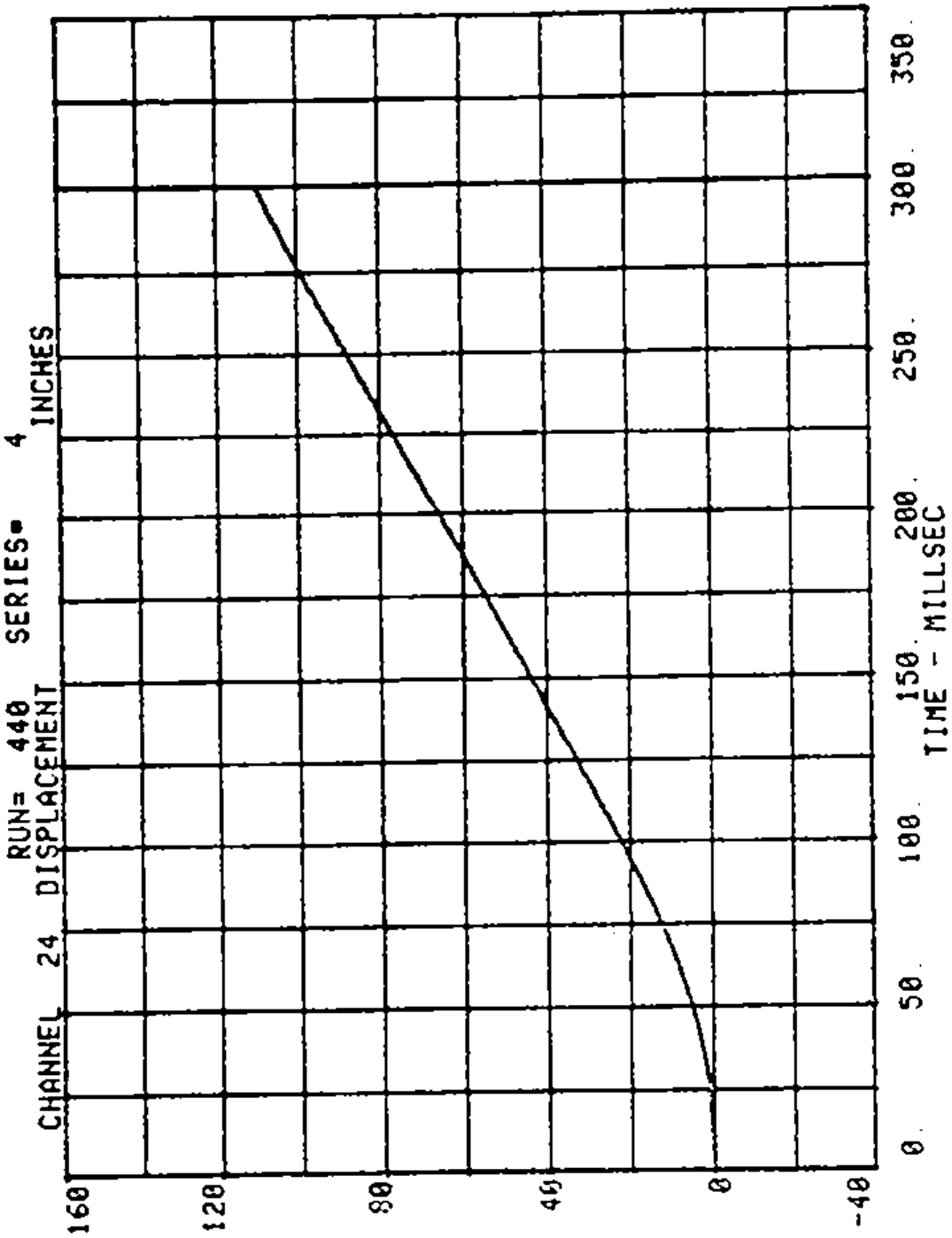

CHANNEL 22 ACC PACK #2(Z)
RUN= 440 SERIES= 4
G'S
50
30
10
-10
-30
-50
0.
50.
100.
150.
200.
250.
300.
350
TIME - MILLSEC

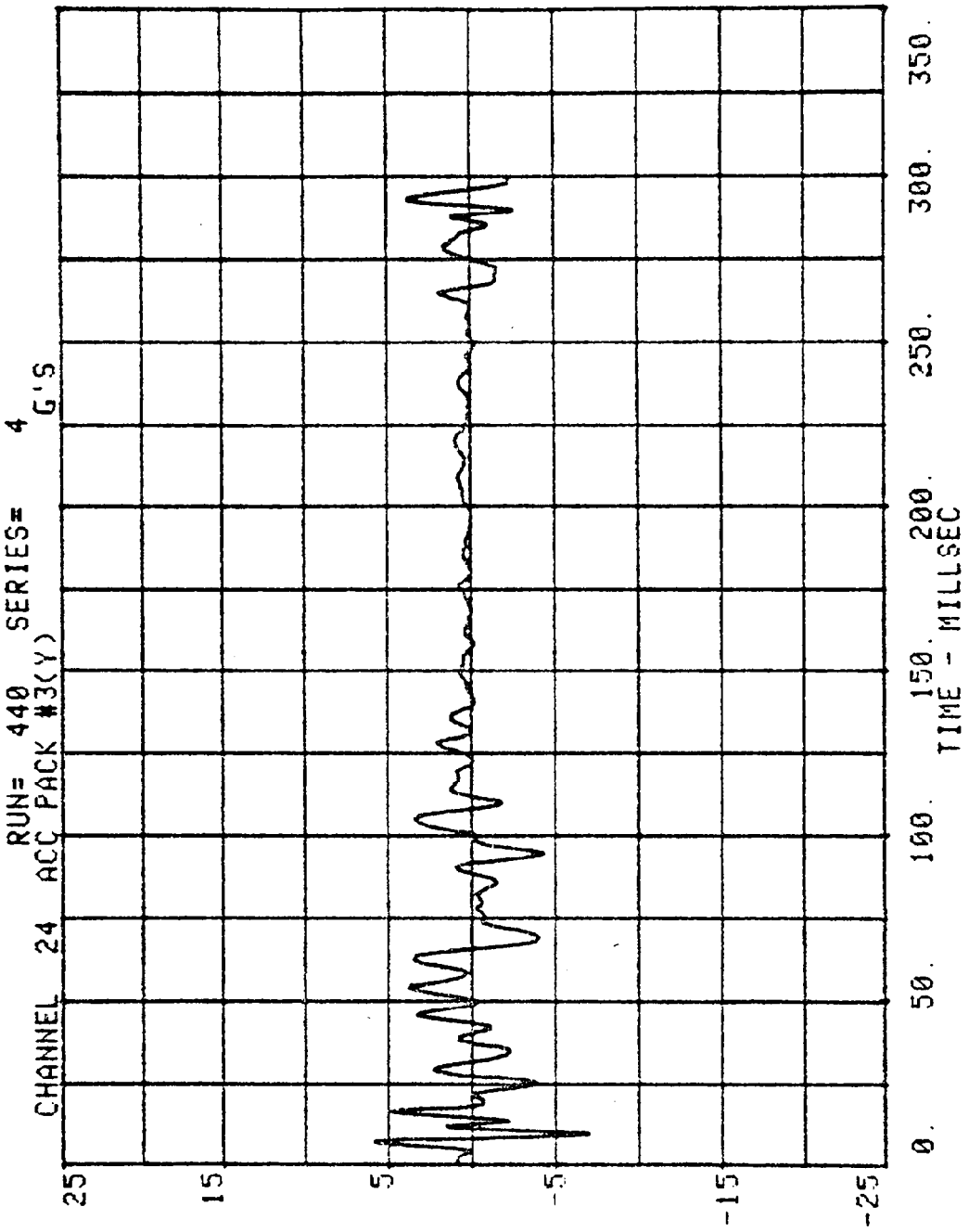

CHANNEL 23 ACC PACK #3(X)
RUN= 440 SERIES= 4
G'S
25
15
5
-5
-15
-25
0
50
100
150
200
250
300
350
TIME - MILLSEC

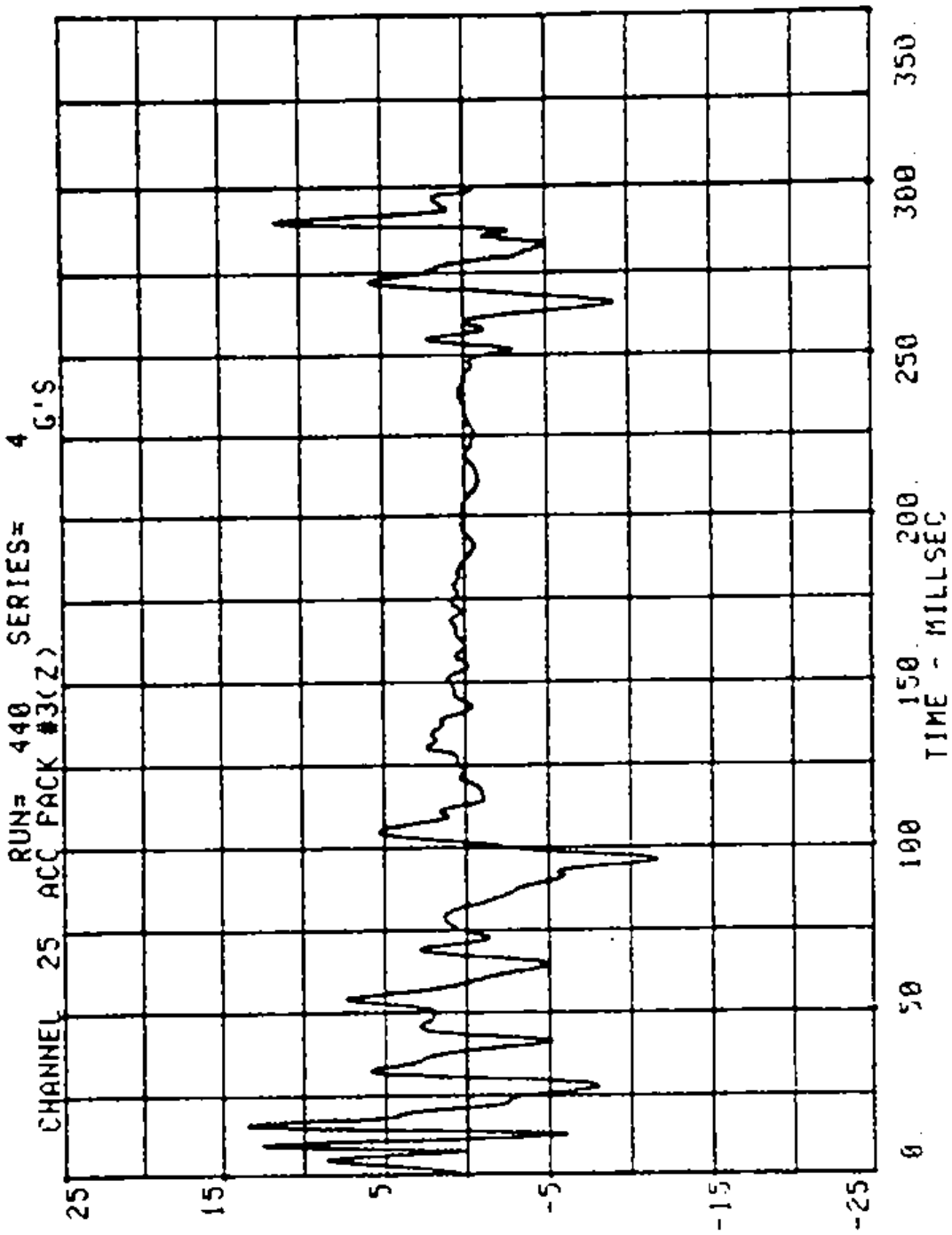
ACCEL. PACK #3 (X)

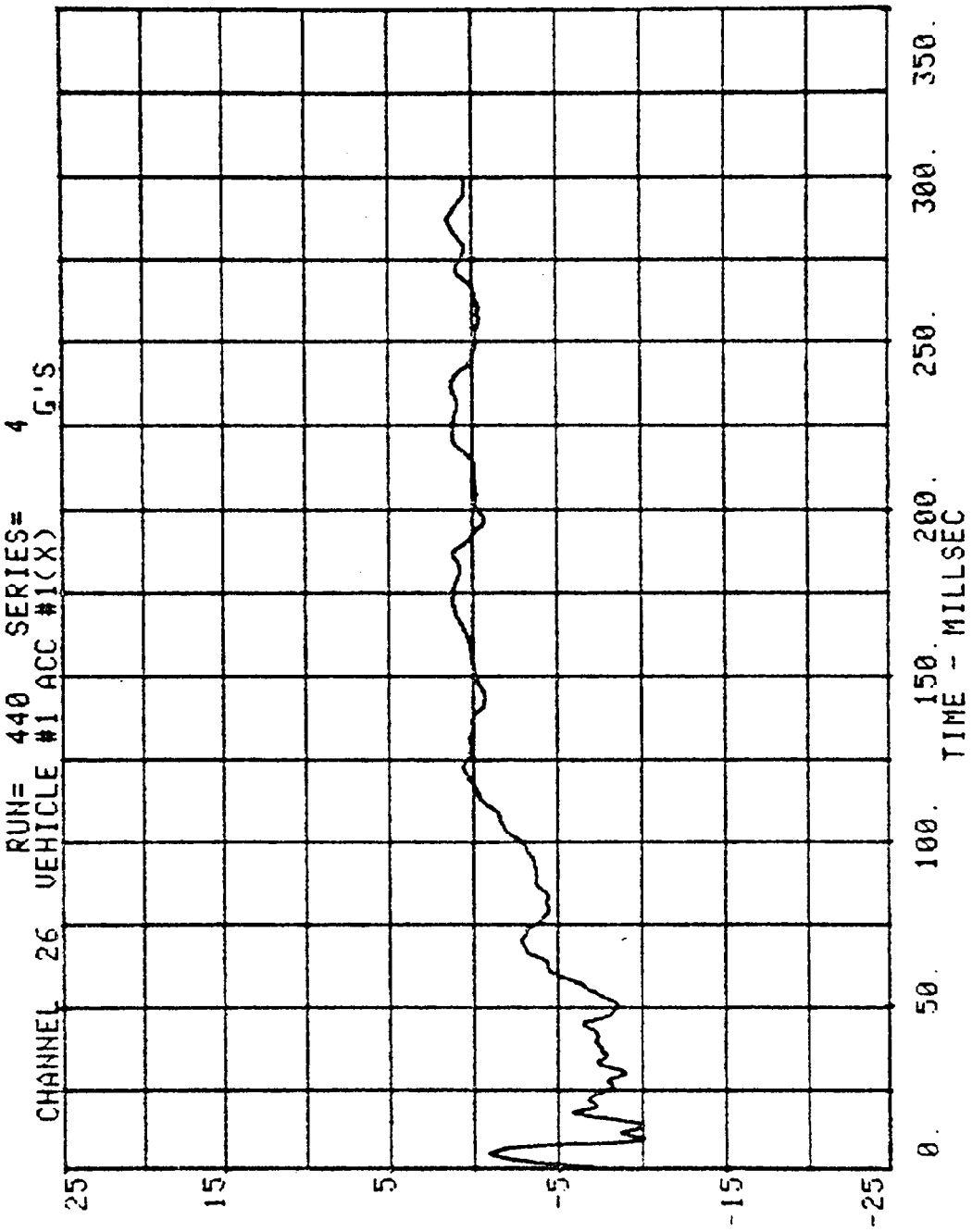


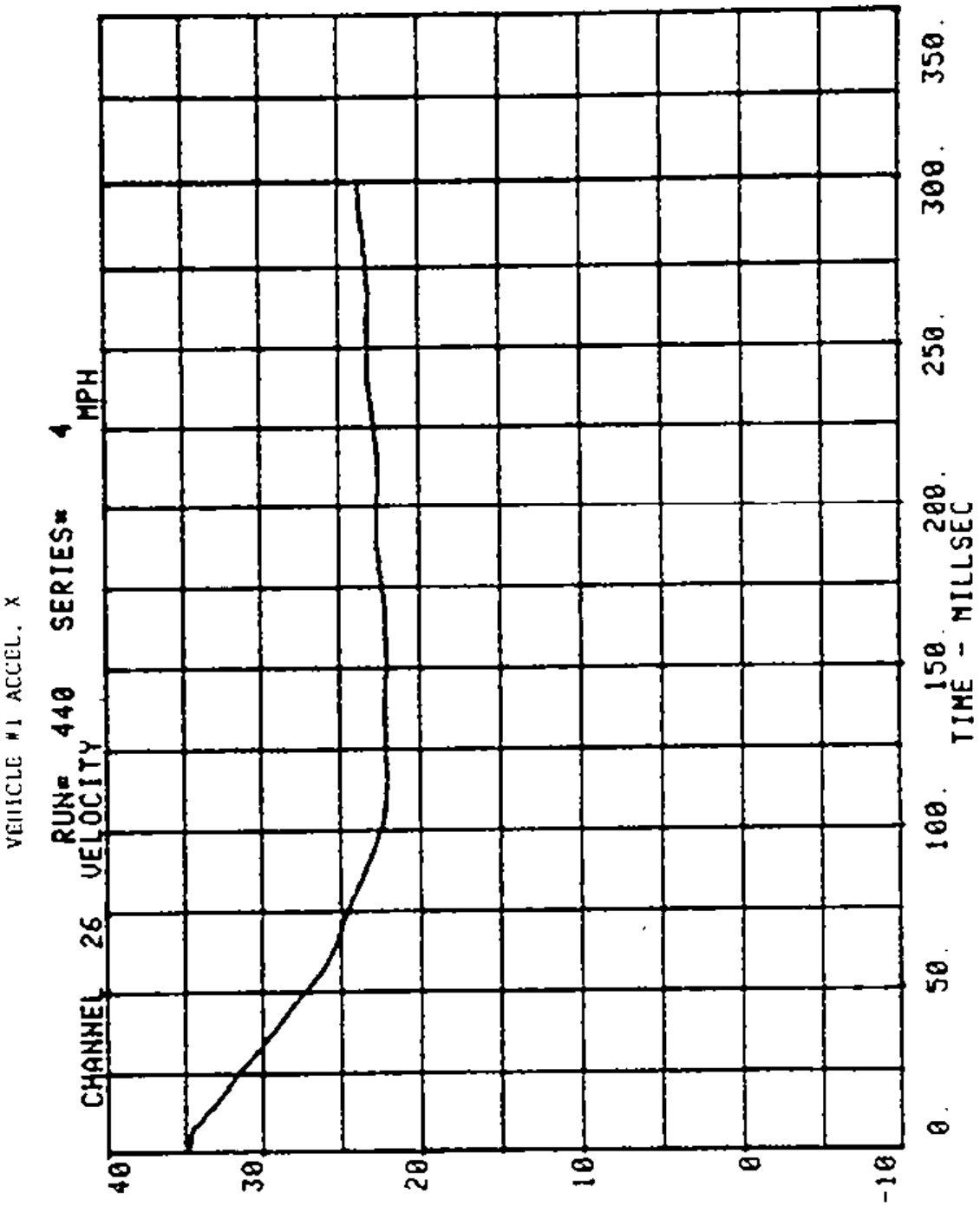
ACCEL. PACK #3 (X)



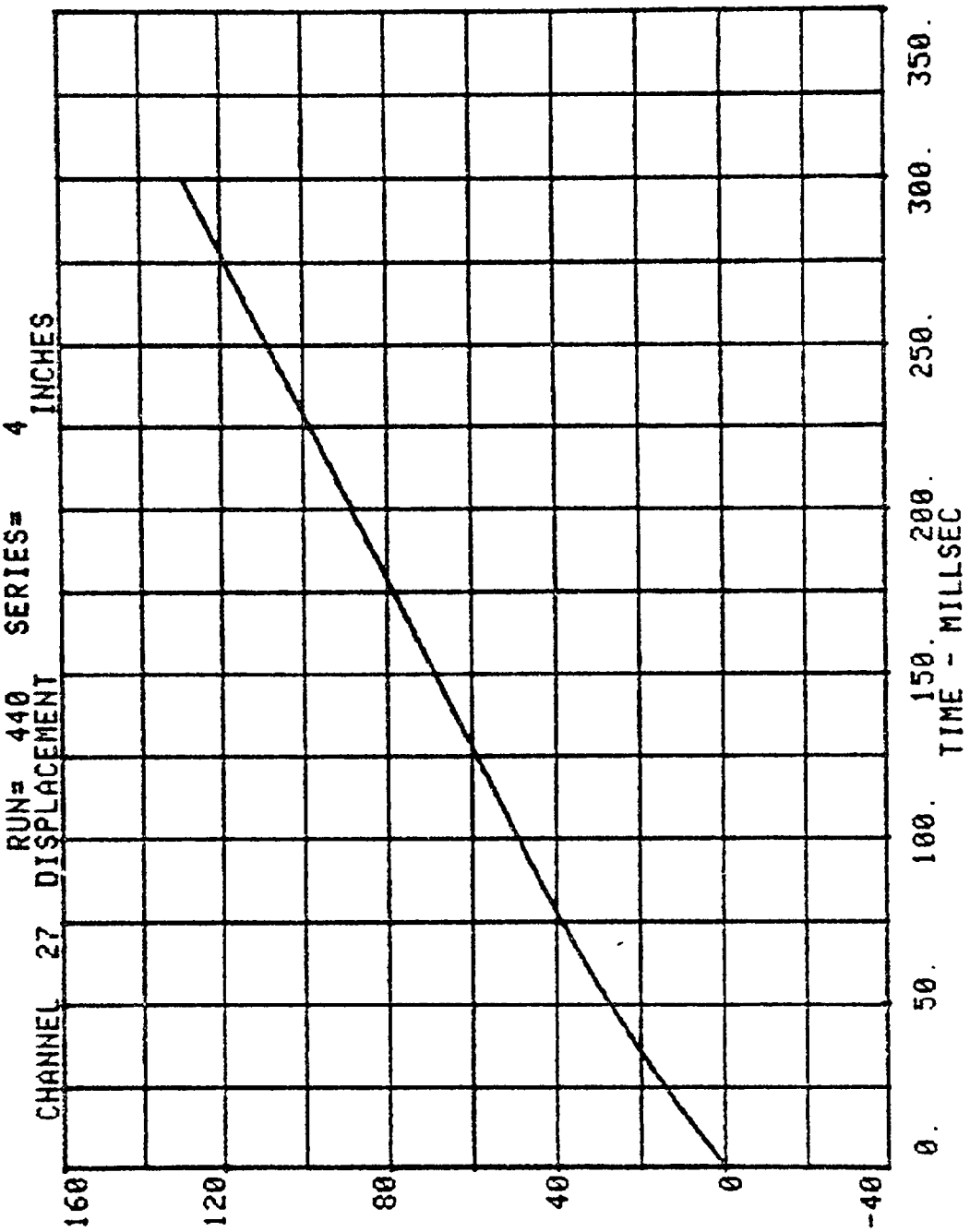

CHANNEL 24
RUN= 440
ACC PACK #3(Y)
SERIES= 4
G'S
25
15
5
-5
-15
-25
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC

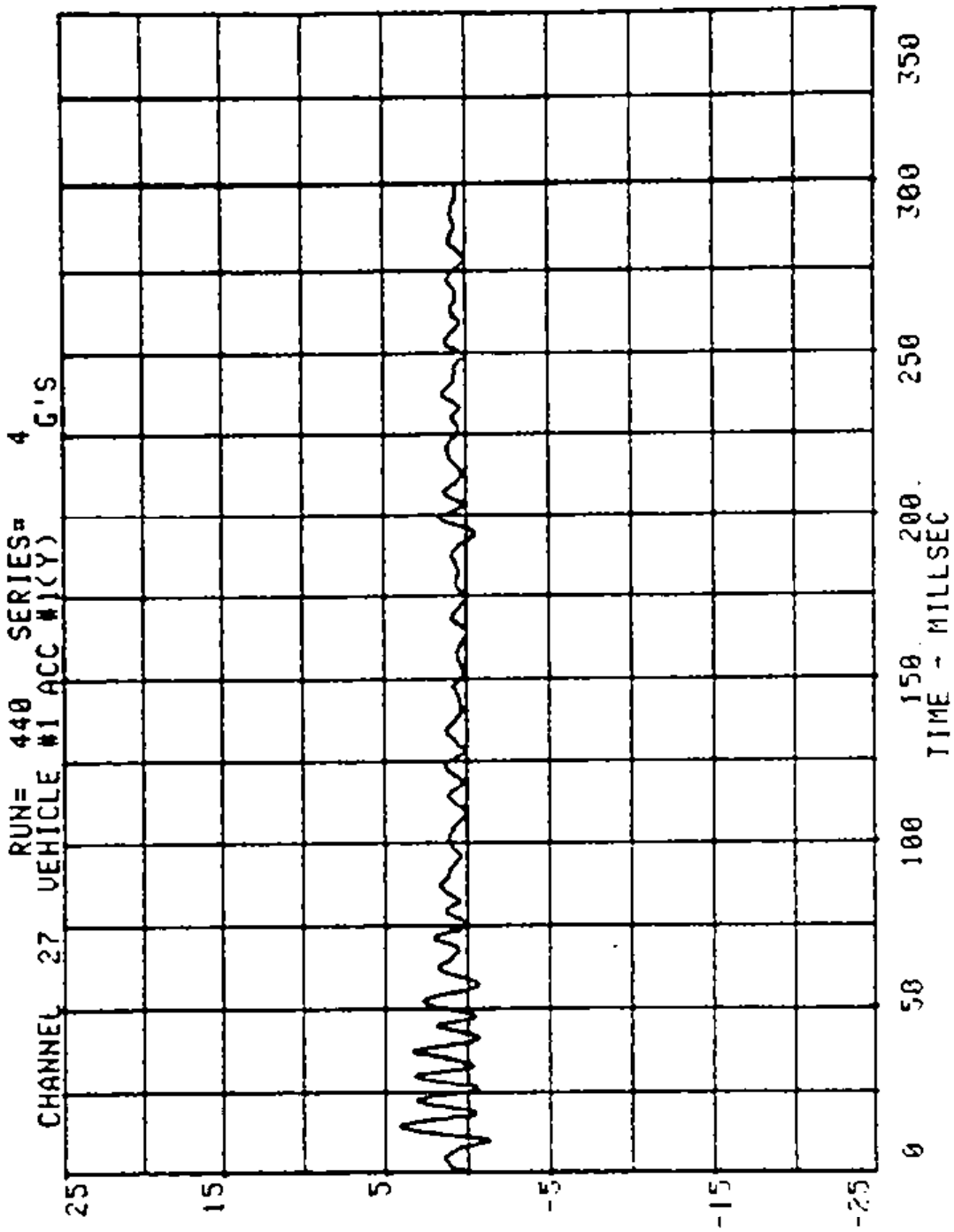

CHANNEL 25 ACC PACK #3(Z)
RUN= 440 SERIES= 4
G'S
25
15
5
-5
-15
-25
0
50
100
150
200
250
300
350
TIME - MILLSEC

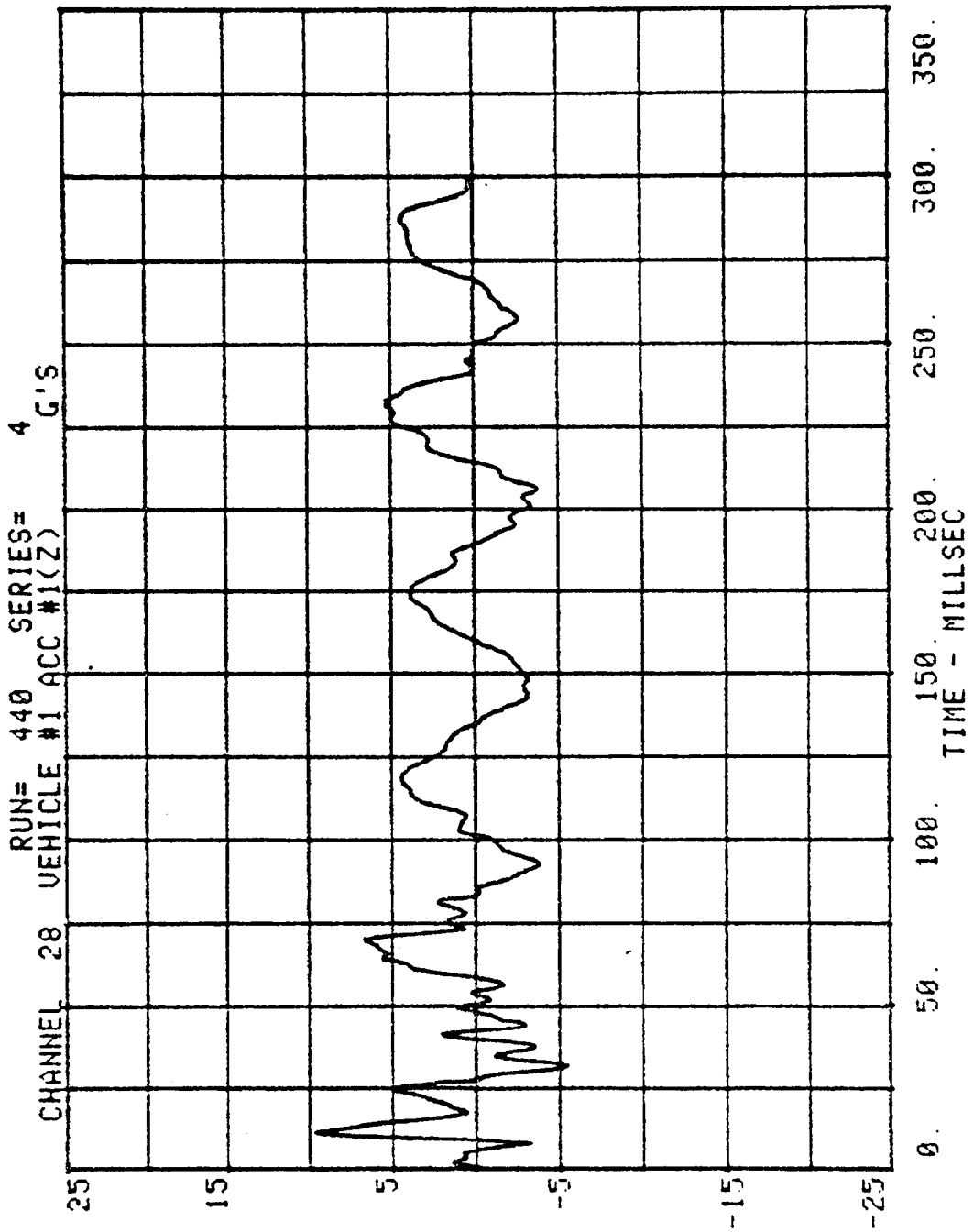

CHANNEL 26 RUN= 440 SERIES= 4
VEHICLE #1 ACC #1(X) G'S
25
15
5
-5
-15
-25
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC


VEHICLE #1 ACCEL. X
CHANNEL 26 VELOCITY
RUN# 440 SERIES# 4
MPH
40
30
20
10
0
-10
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC

VEHICLE #1 ACCEL. X




CHANNEL 27 VEHICLE #1 ACC #1(Y)
RUN= 440 SERIES= 4
G'S
25
15
5
-5
-15
-25
0
50
100
150
200
250
300
350
TIME - MILLSEC


CHANNEL 28
RUN= 440
VEHICLE #1 ACC #1(Z)
SERIES= 4
G'S
25
15
5
-5
-15
-25
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC

TEST 308-T4-440

1979 VW RABBIT

DUMMY DATA

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

BOA #4 RABBIT REAR IMPACT

RUN= 440

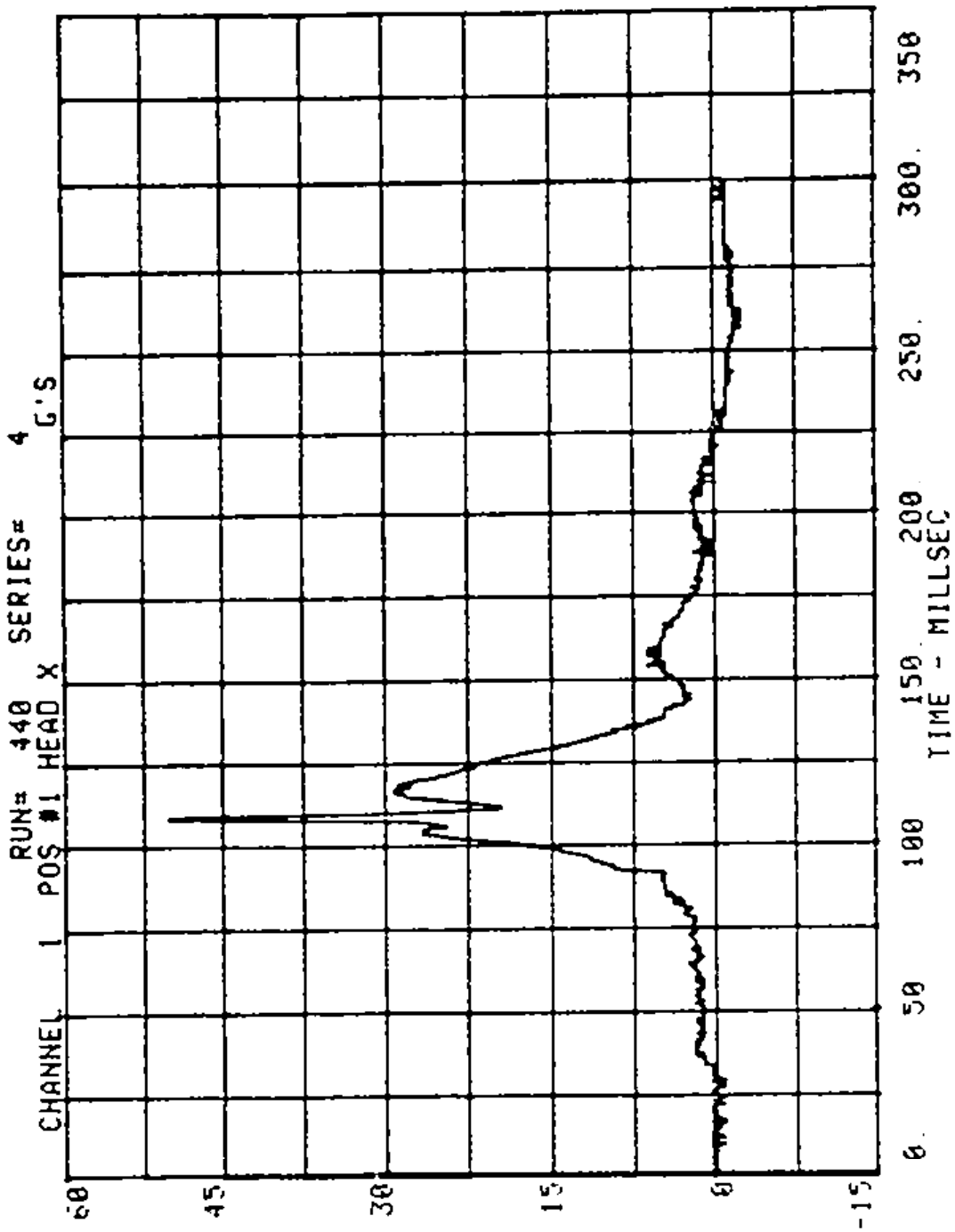
HEAD RESULTANT (1)

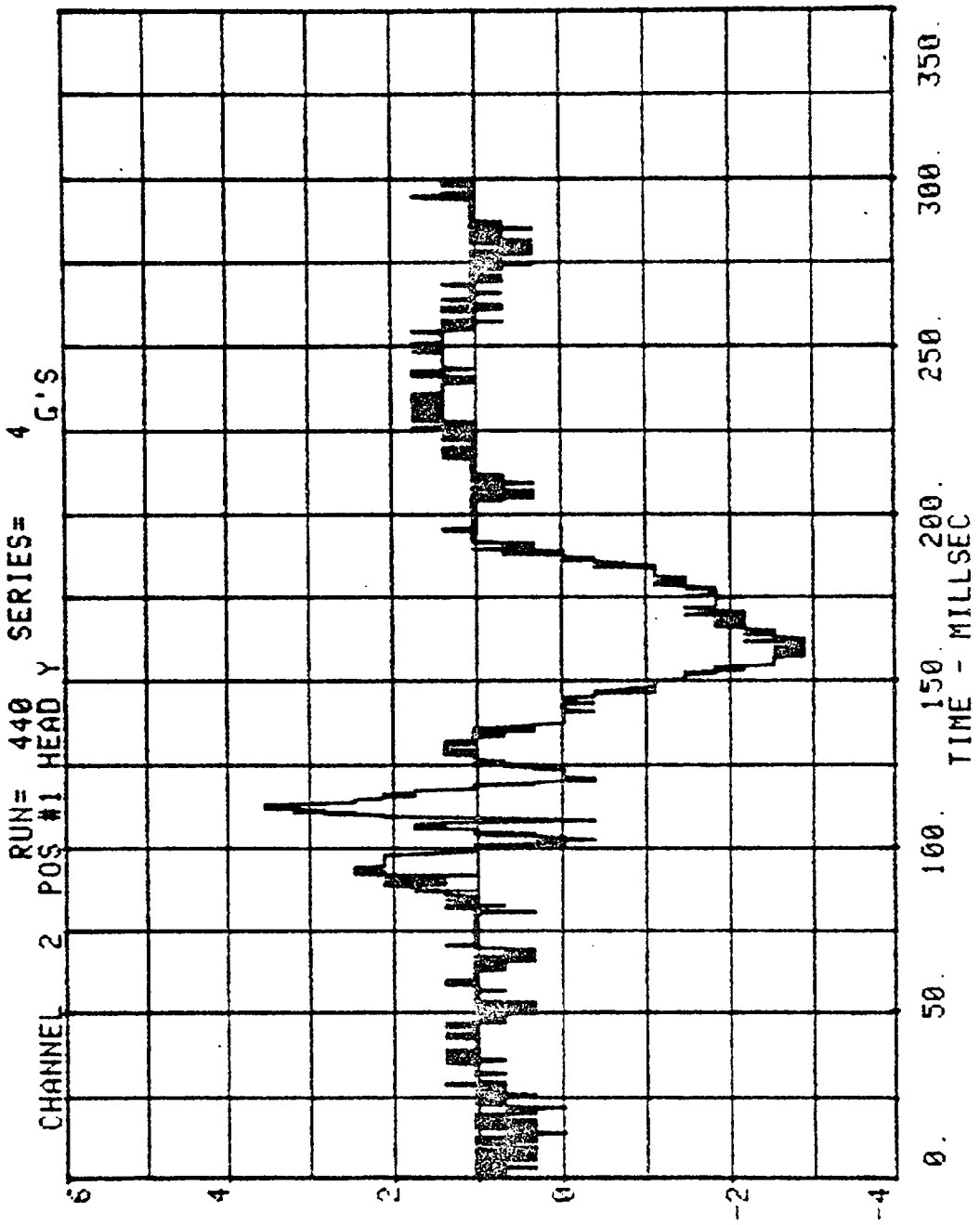
HIC= 114.5 FROM T1= .08400 TO T2= .13080

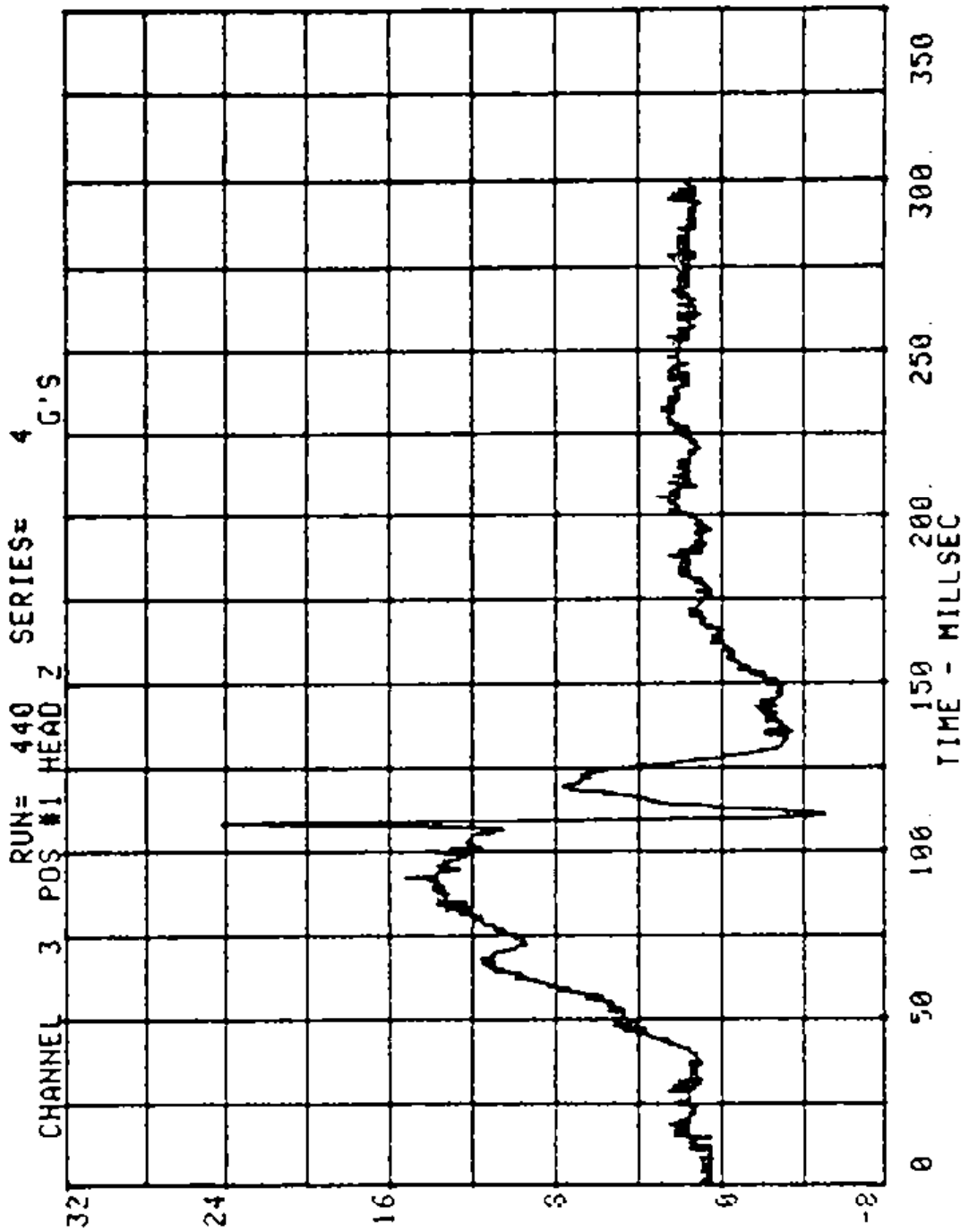
AVERAGE ACCELERATION BETWEEN T1 AND T2= 22.7G'S

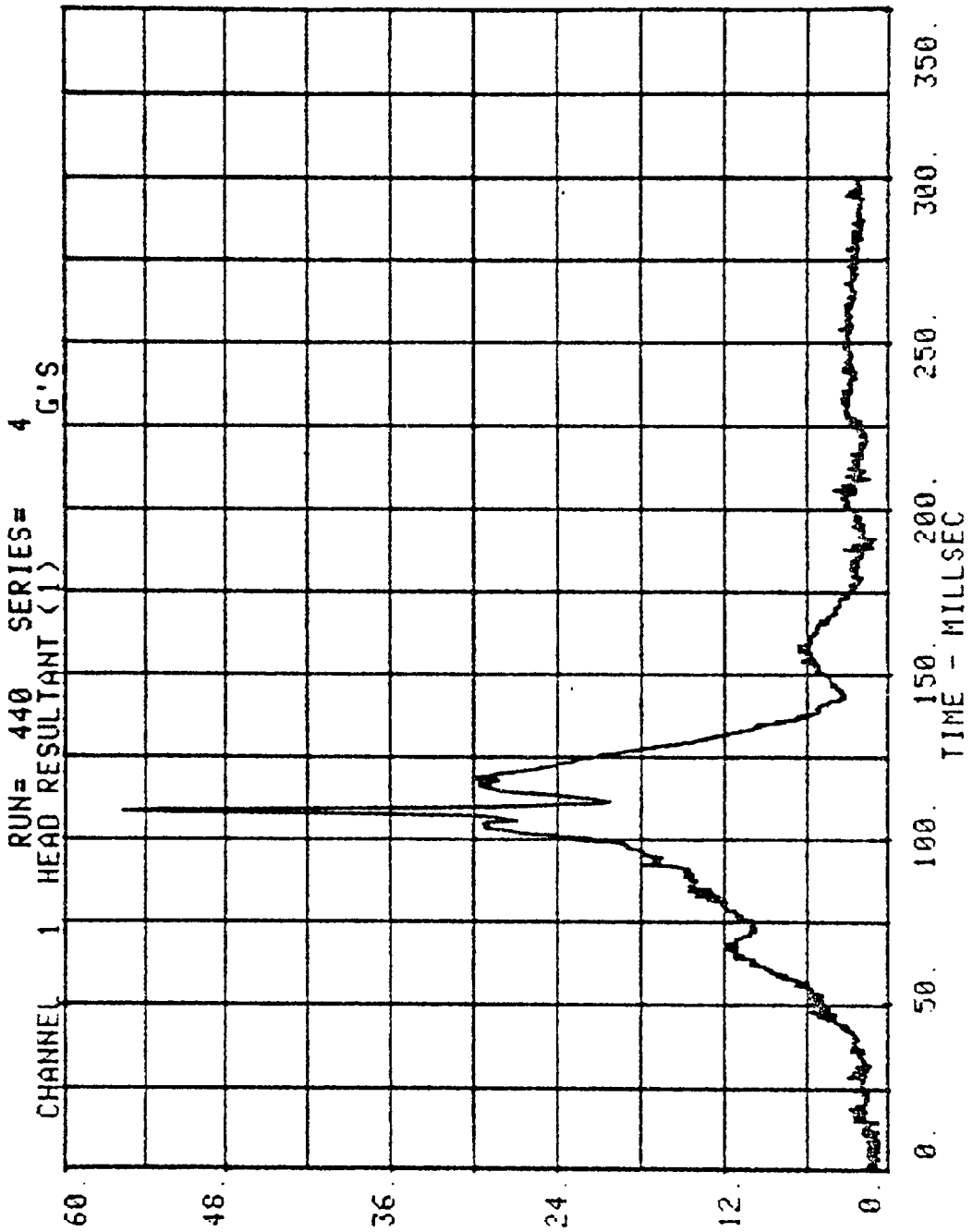
EVENT TIME= 300.0 MSEC

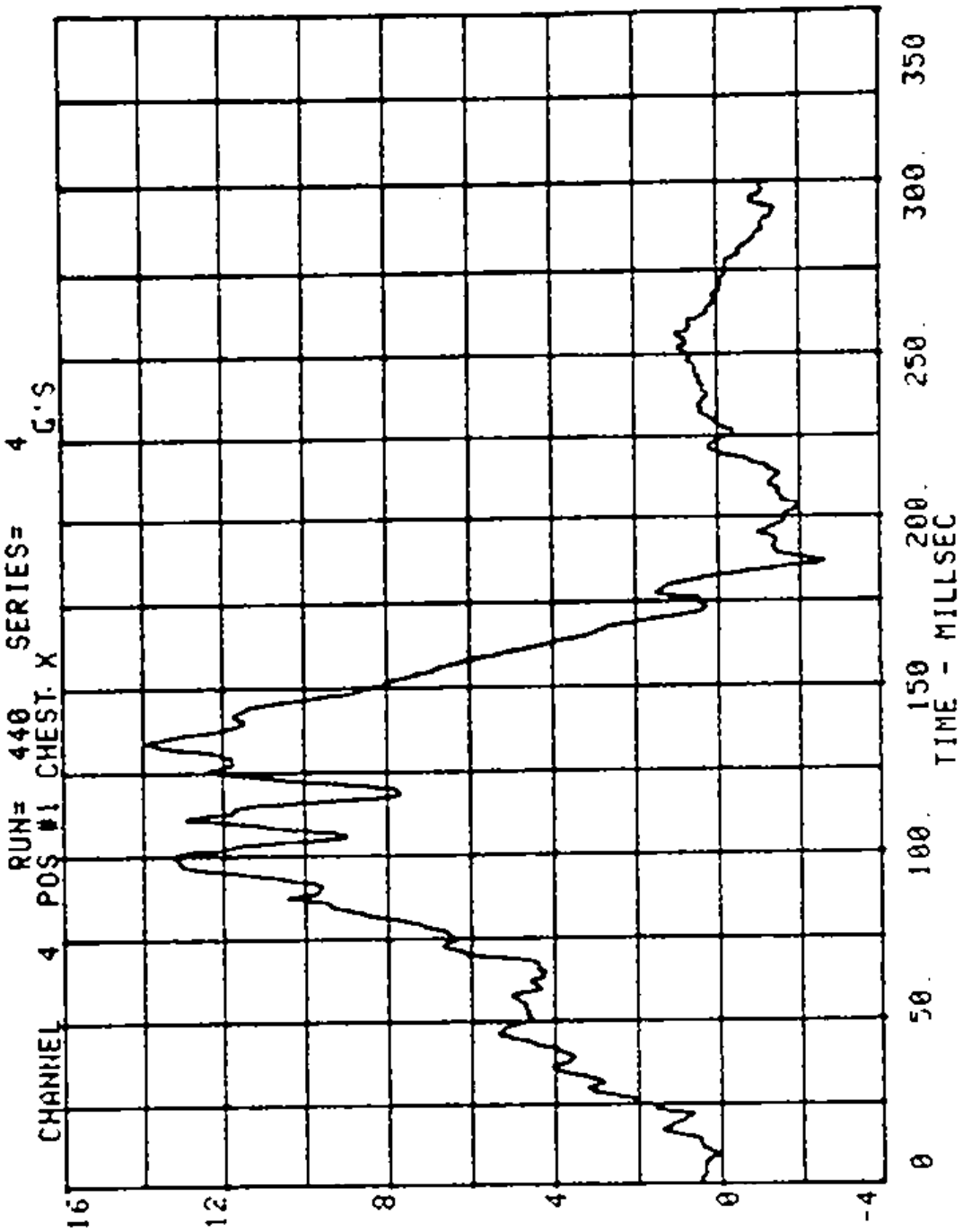
SEVERITY INDEX= 157.4

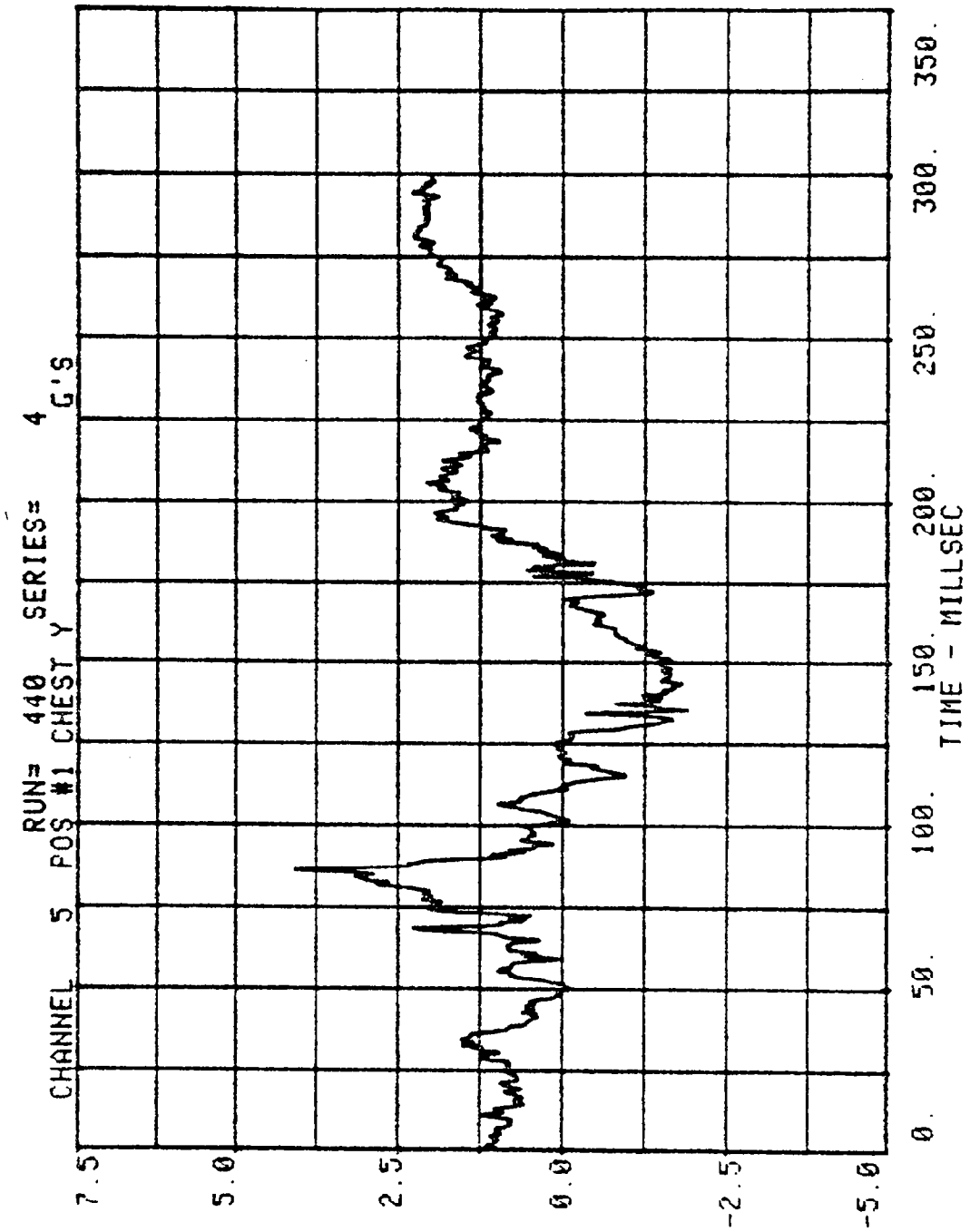

CHANNEL 1 POS #1 HEAD X
RUN= 440 SERIES= 4
G'S
60
45
30
15
0
-15
0
50
100
150
200
250
300
350
TIME - MILLSEC

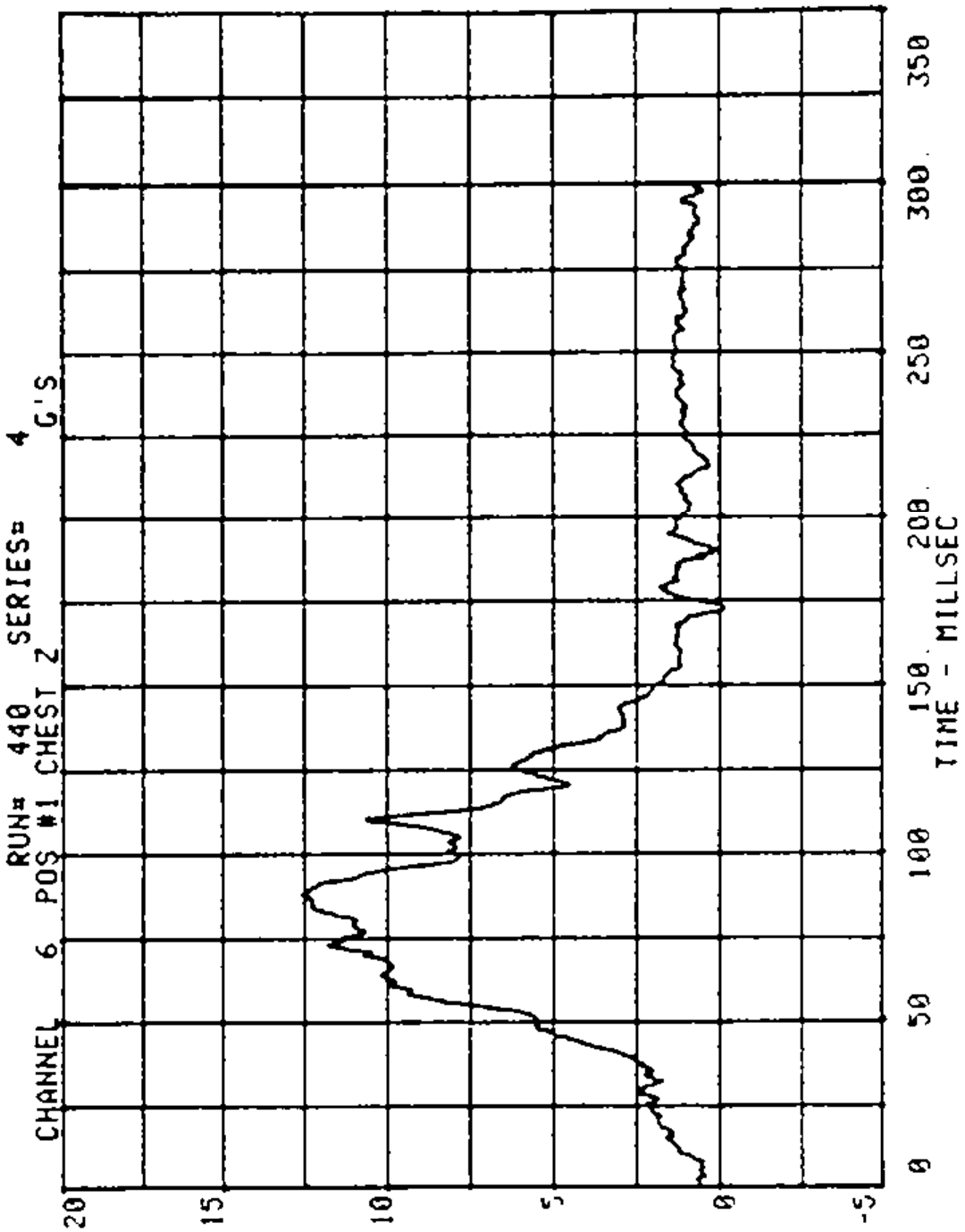

CHANNEL 2 POS #1 HEAD Y
RUN= 440 SERIES= 4
G'S
6
4
2
0
-2
-4
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC

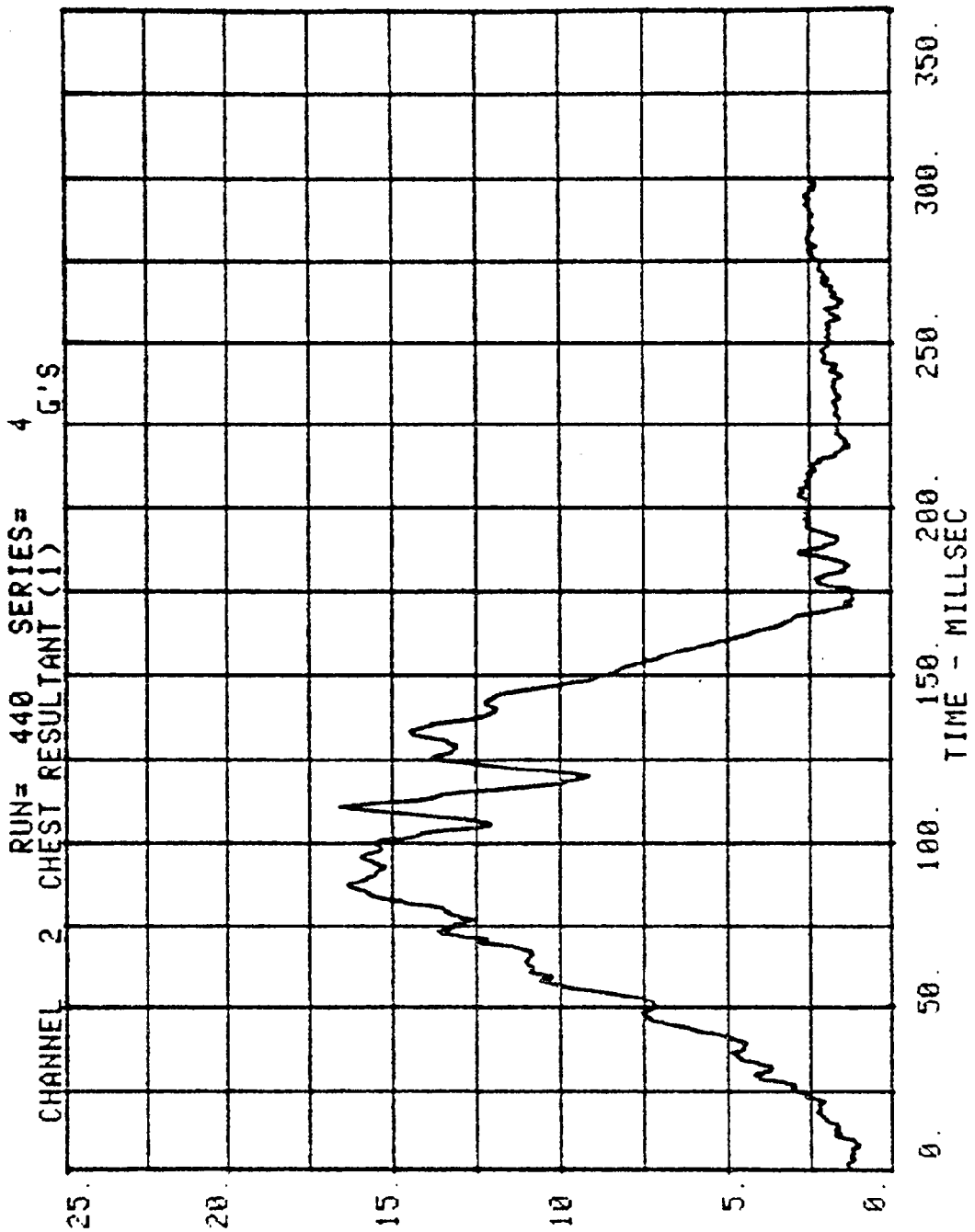

CHANNEL 3 POS #1 HEAD 2
RUN= 440 SERIES= 4
G'S
32
24
16
8
0
-8
0
50
100
150
200
250
300
350
TIME - MILLSEC

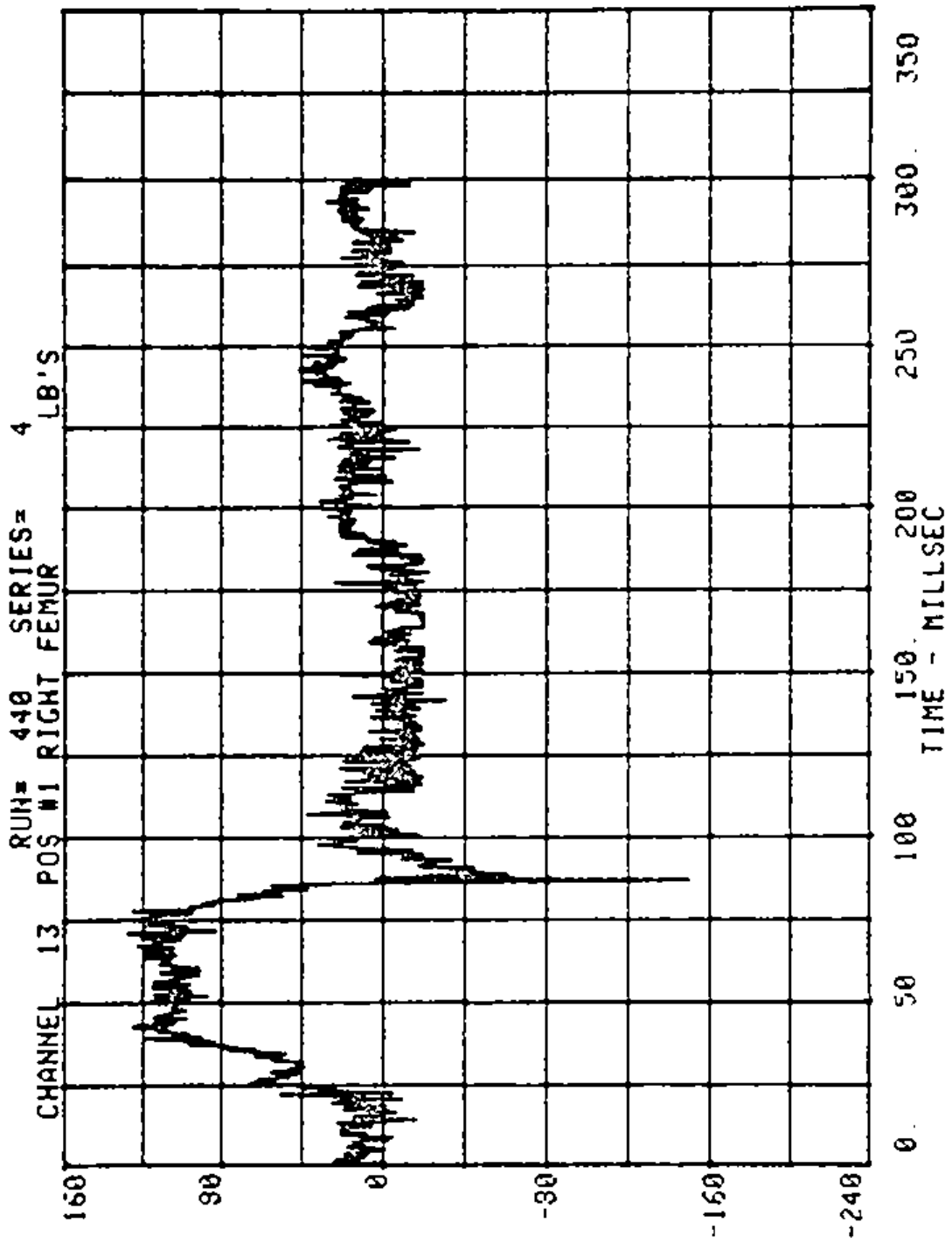

CHANNEL 1 RUN= 440 SERIES= 4
HEAD RESULTANT (1) G'S
60.
48.
36.
24.
12.
0.
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC

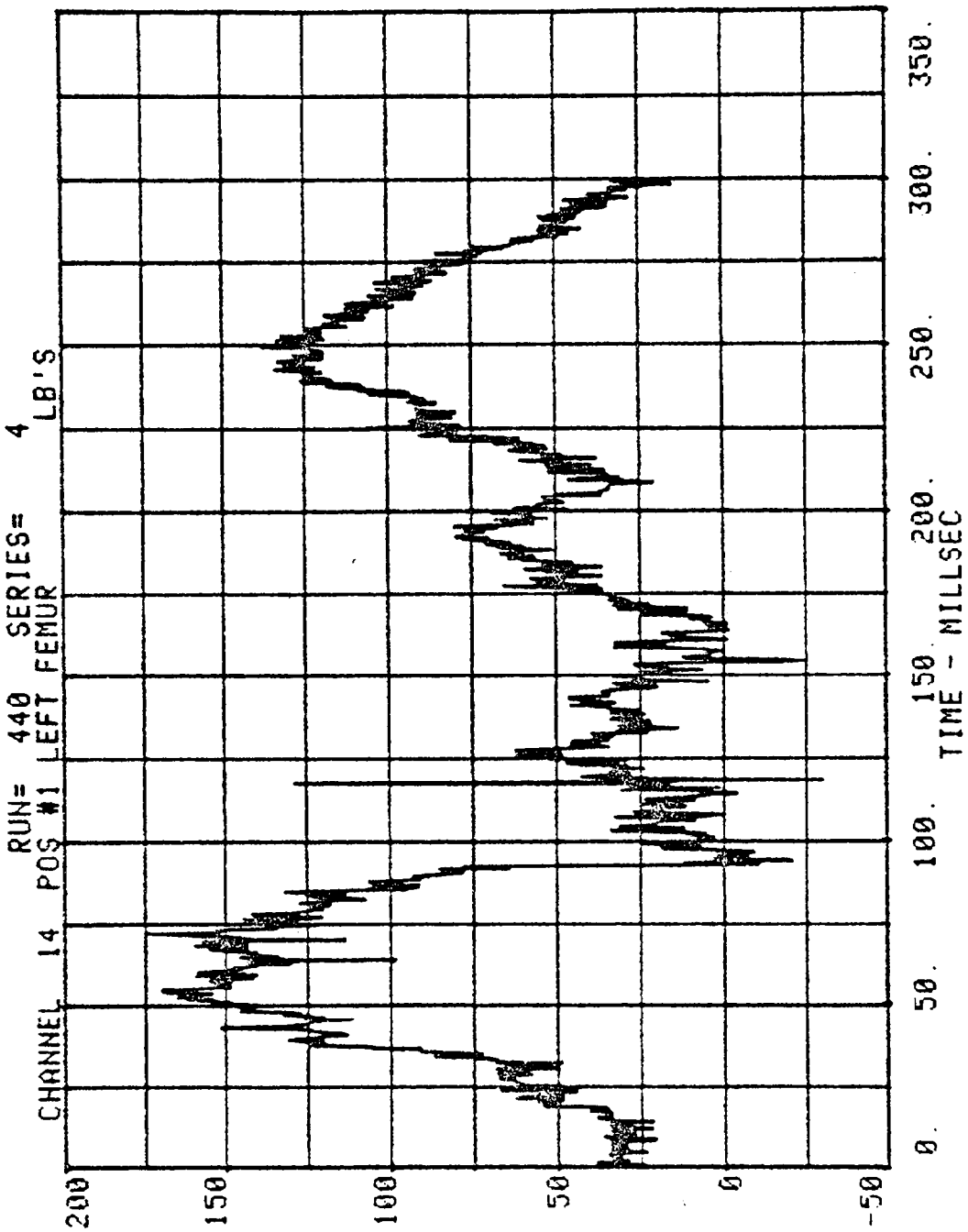

CHANNEL 4 RUN= 440 SERIES= 4
POS #1 CHEST X G'S
16
12
8
4
0
-4
0
50
100
150
200
250
300
350
TIME - MILLSEC

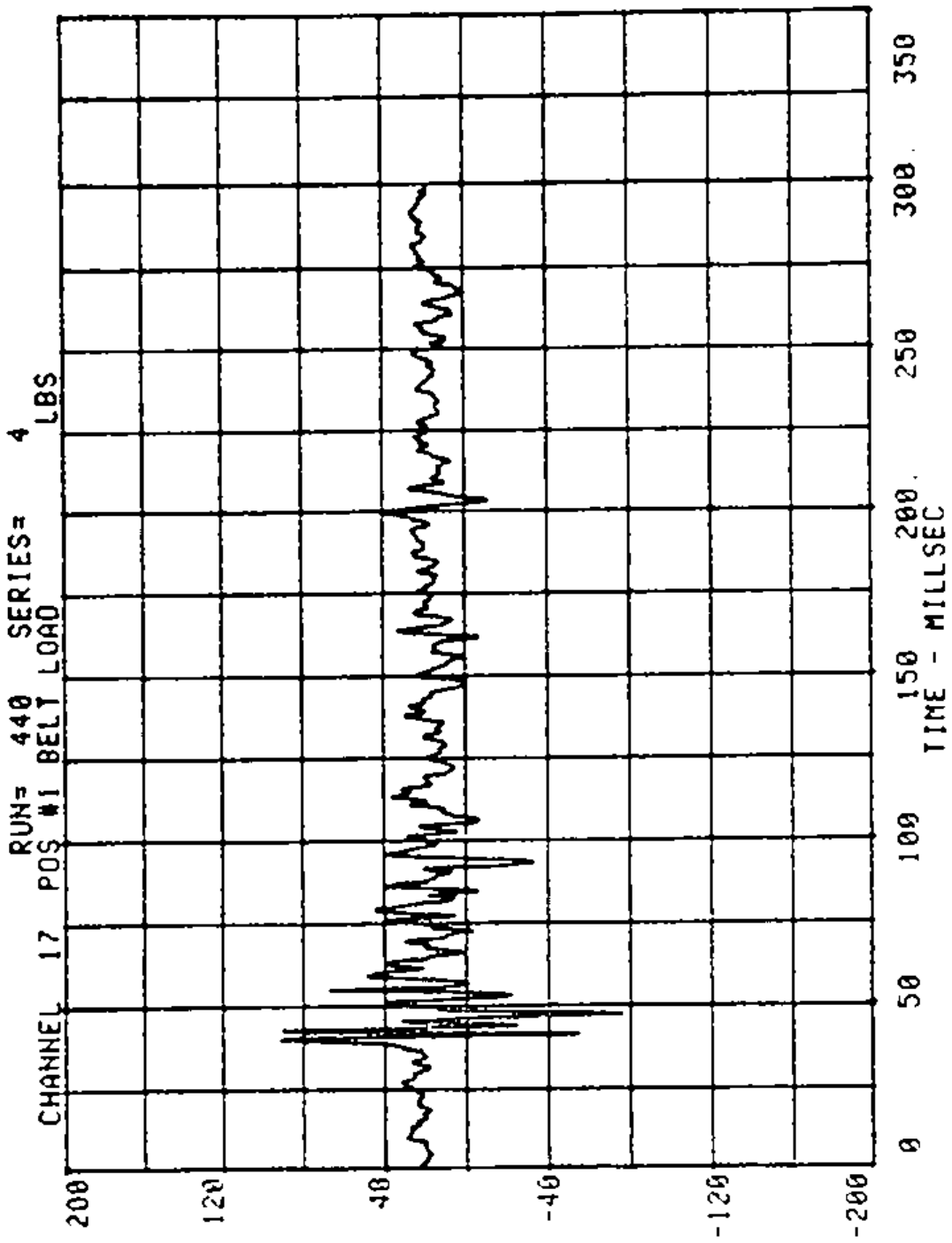

CHANNEL 5 POS #1 CHEST Y
RUN= 440 SERIES= 4
G'S
7.5
5.0
2.5
0.0
-2.5
-5.0
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC


CHANNEL 6 POS #1 CHEST Z
RUN# 440 SERIES# 4
G'S
20
15
10
5
0
-5
0
50
100
150
200
250
300
350
TIME - MILLSEC


CHANNEL 2 RUN= 440 SERIES= 4
CHEST RESULTANT (1) G'S
25.
20.
15.
10.
5.
0.
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC


CHANNEL 13 POS #1 RIGHT FEMUR
RUN= 440 SERIES= 4
LB'S
160
90
0
-80
-160
-240
0
50
100
150
200
250
300
350
TIME - MILLSEC


CHANNEL 14 POS #1 RUN= 440 SERIES= 4
LEFT FEMUR
LB'S
200
150
100
50
0
-50
0.
50.
100.
150
200.
250.
300.
350.
TIME - MILLSEC


CHANNEL 17 POS #1 BELT LOAD
RUN= 440 SERIES= 4 LBS
200
120
40
-40
-120
-200
0
50
100
150
200
250
300
350
TIME - MILLSEC

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

BOA #4 RABBIT REAR IMPACT

RUN= 440

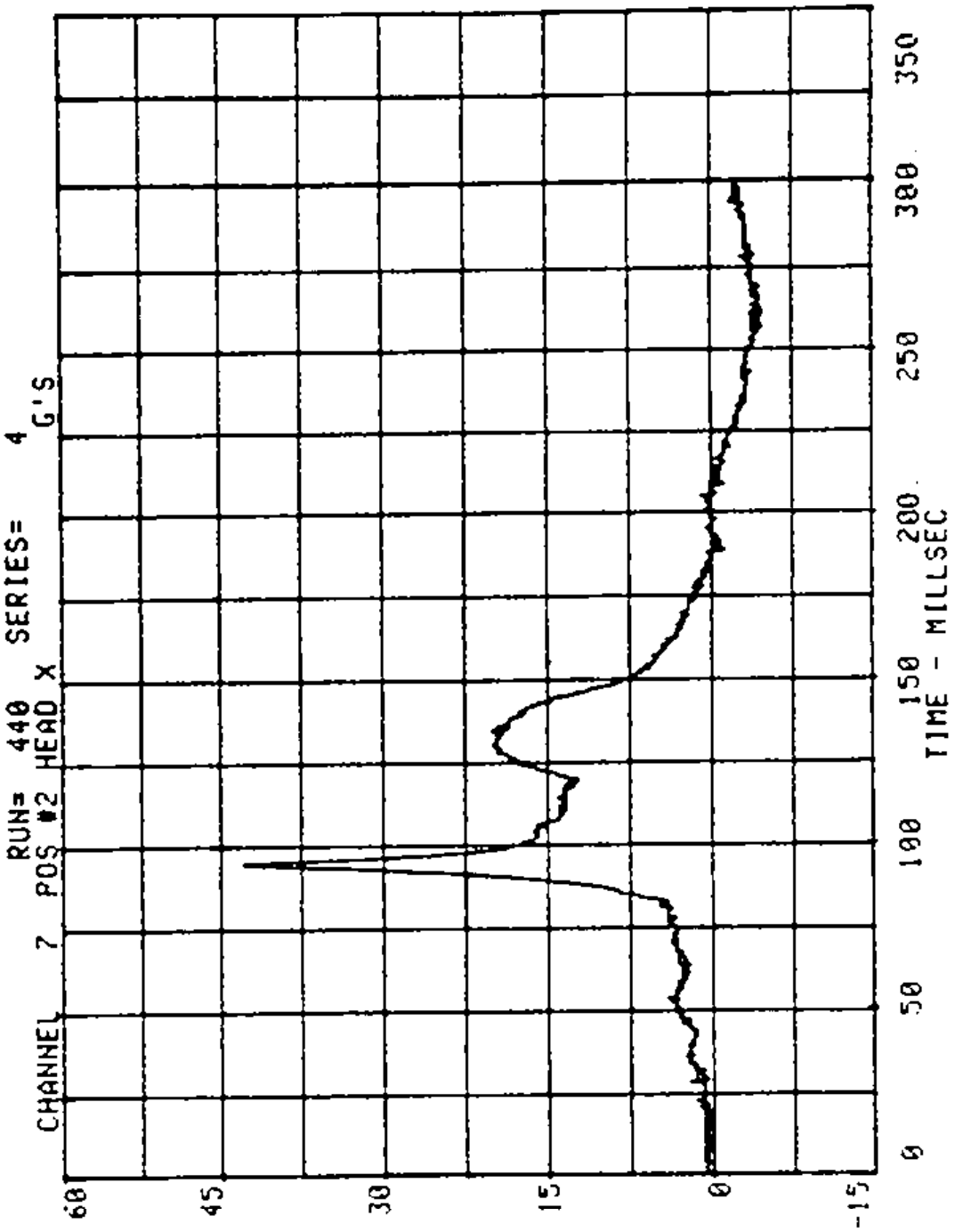
HEAD RESULTANT (2)

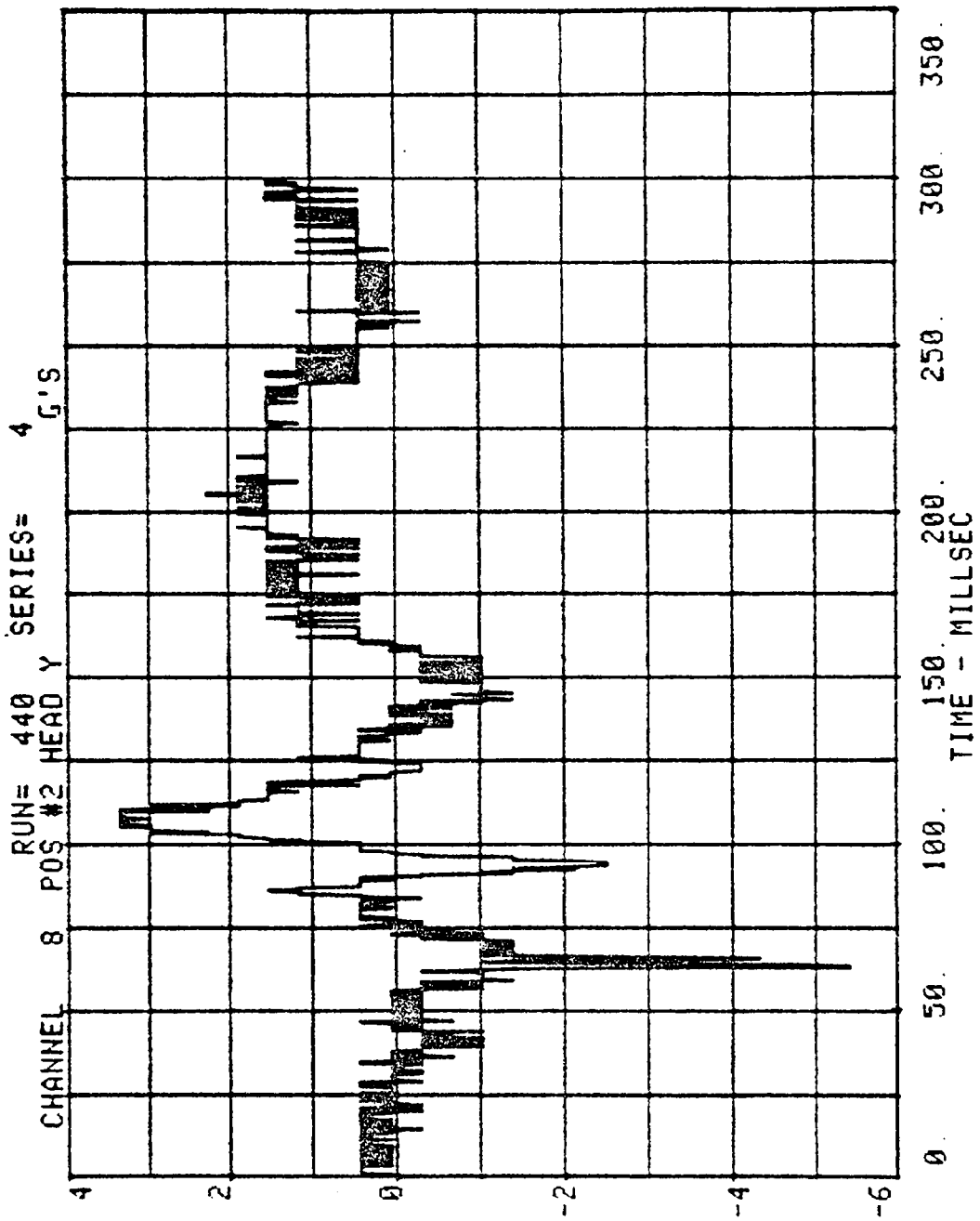
HIC= 102.8 FROM T1= .07110 TO T2= .14760

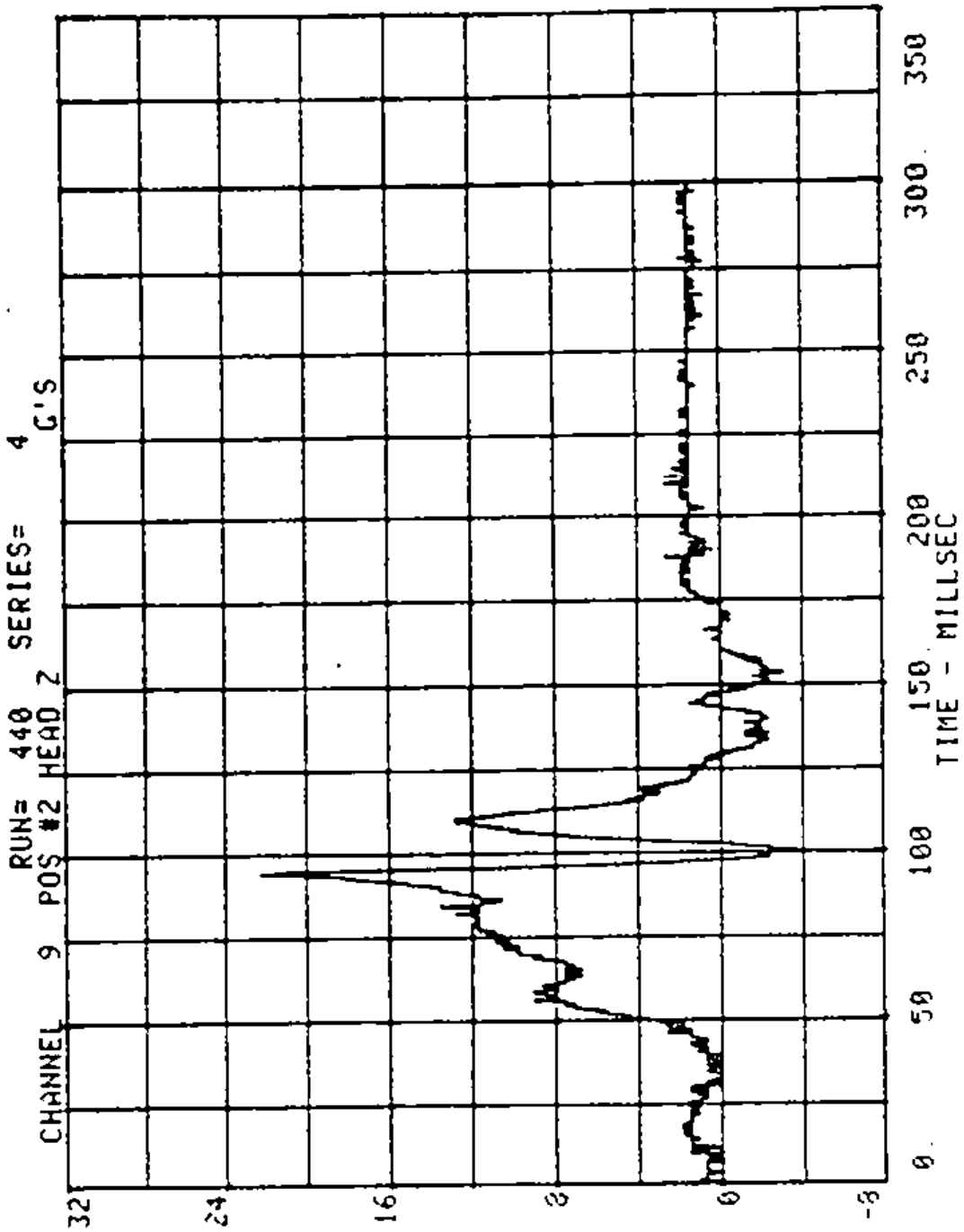
AVERAGE ACCELERATION BETWEEN T1 AND T2= 17.8G'S

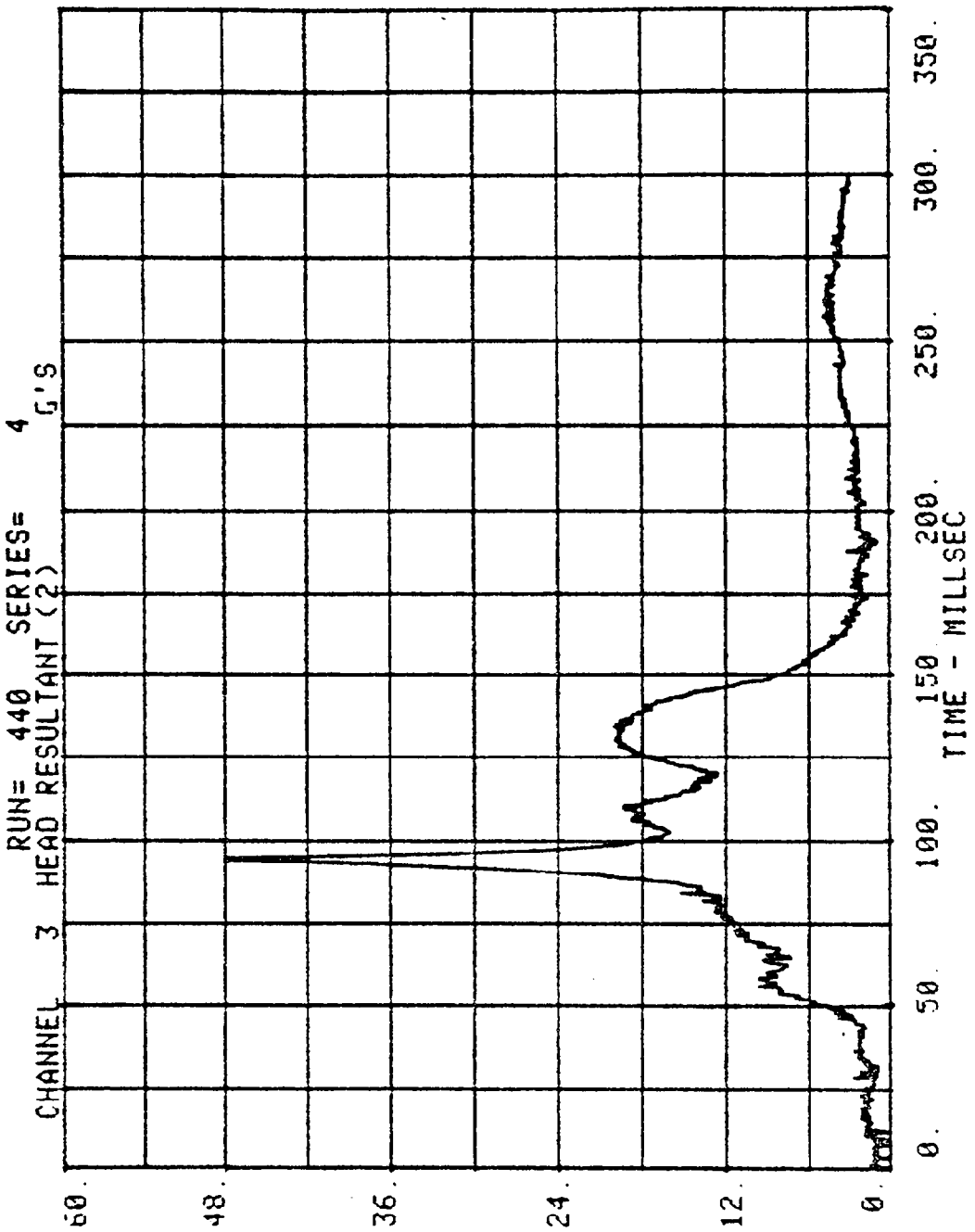
EVENT TIME= 300.0 MSEC

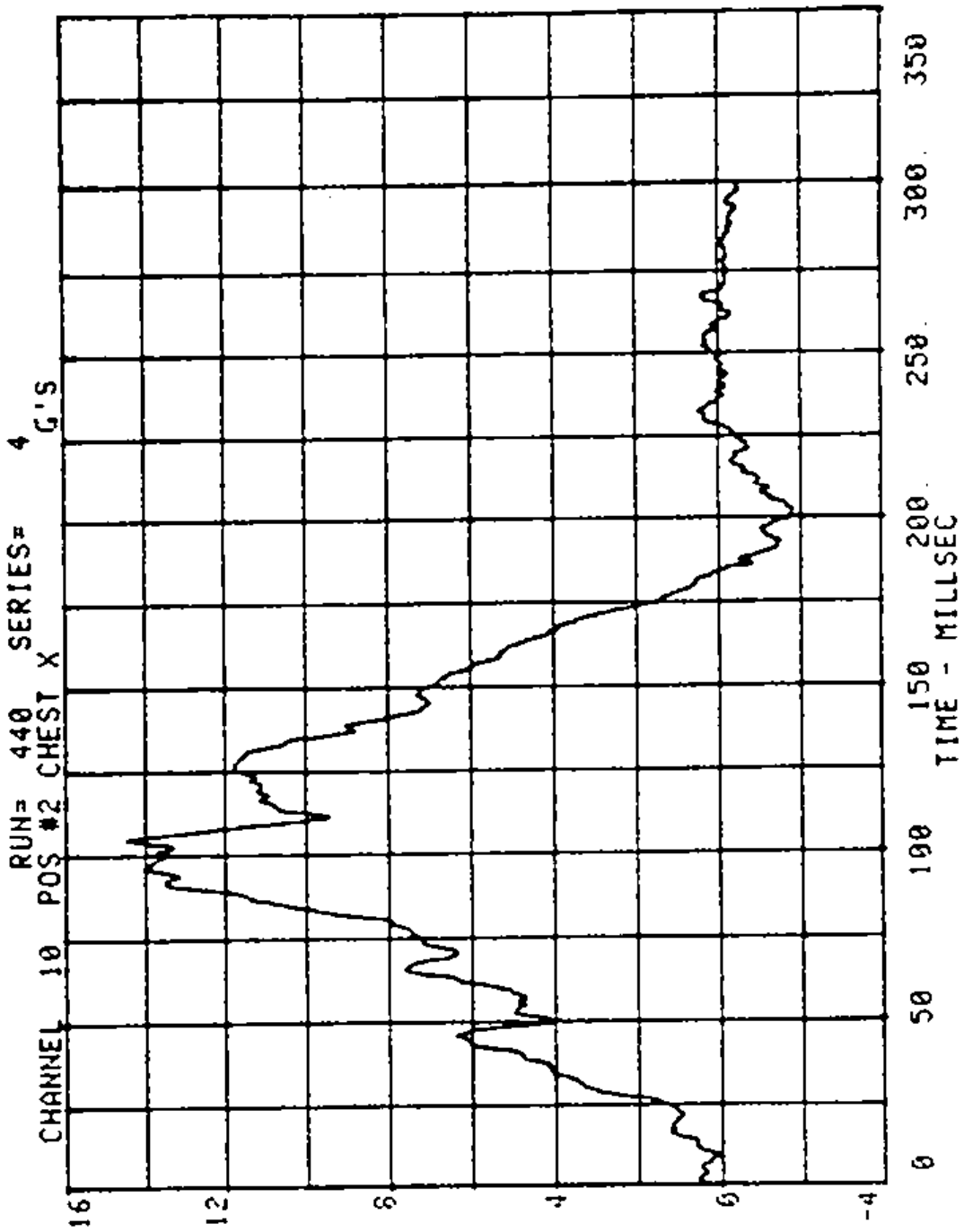
SEVERITY INDEX= 140.9

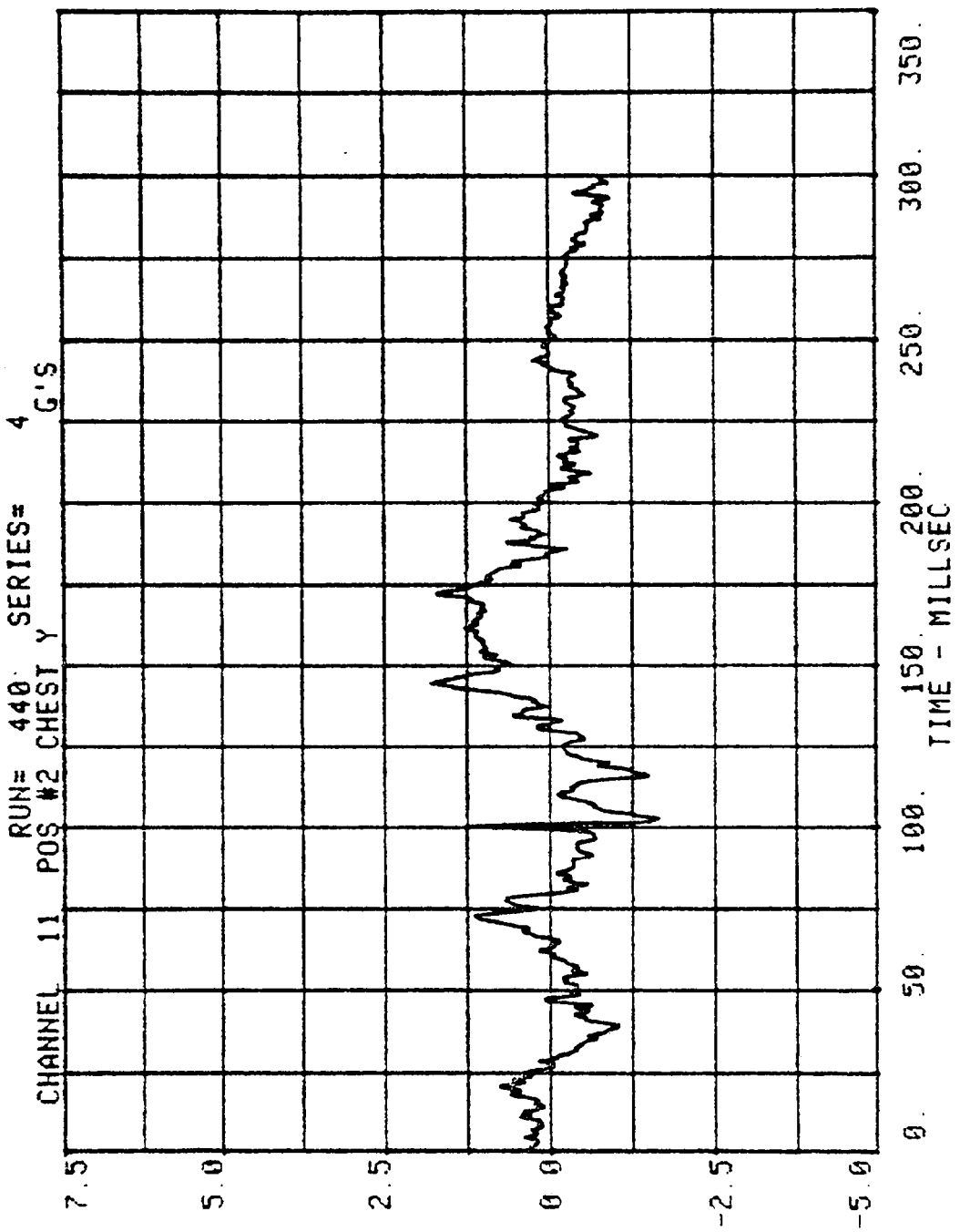

CHANNEL 7 RUN= 440 SERIES= 4
POS #2 HEAD X G'S
60
45
30
15
0
-15
0
50
100
150
200
250
300
350
TIME - MILLSEC

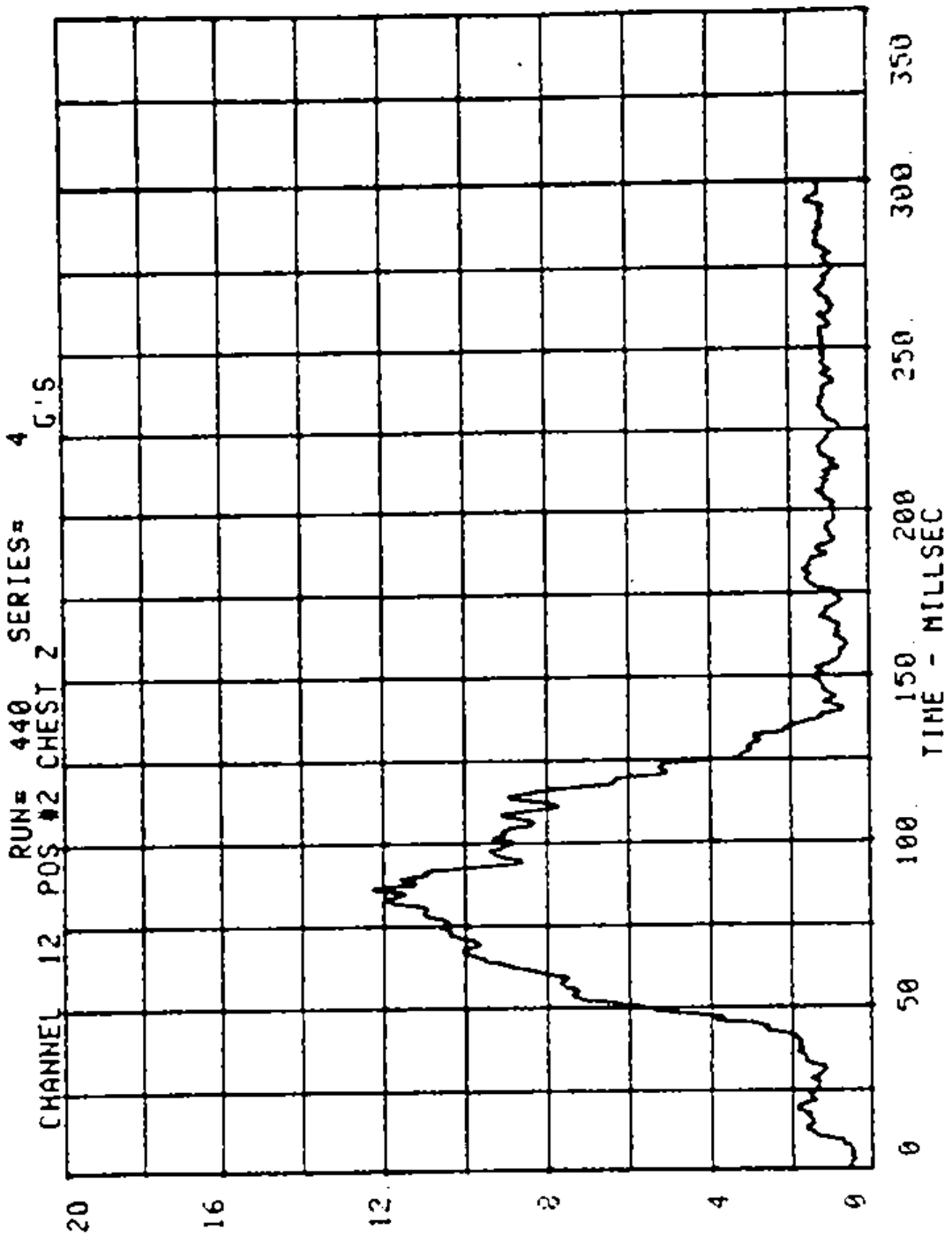

CHANNEL 8 POS #2 HEAD Y
RUN= 440 SERIES= 4
G'S
4
2
0
-2
-4
-6
0
50
100
150
200
250
300
350
TIME - MILLSEC

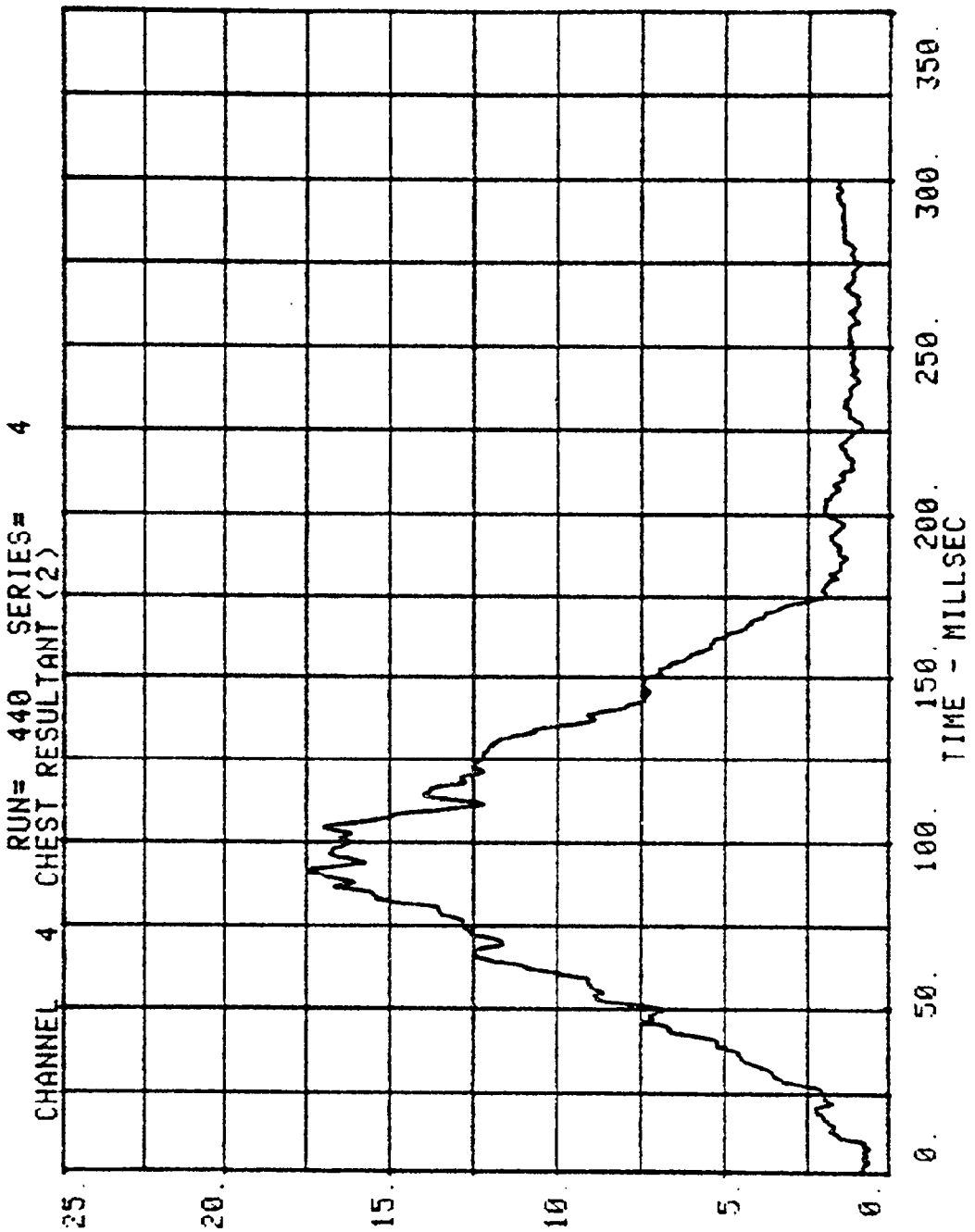

CHANNEL 9 POS #2 HEAD Z
RUN= 440 SERIES= 4
G'S
32
24
16
8
0
-8
0
50
100
150
200
250
300
350
TIME - MILLSEC

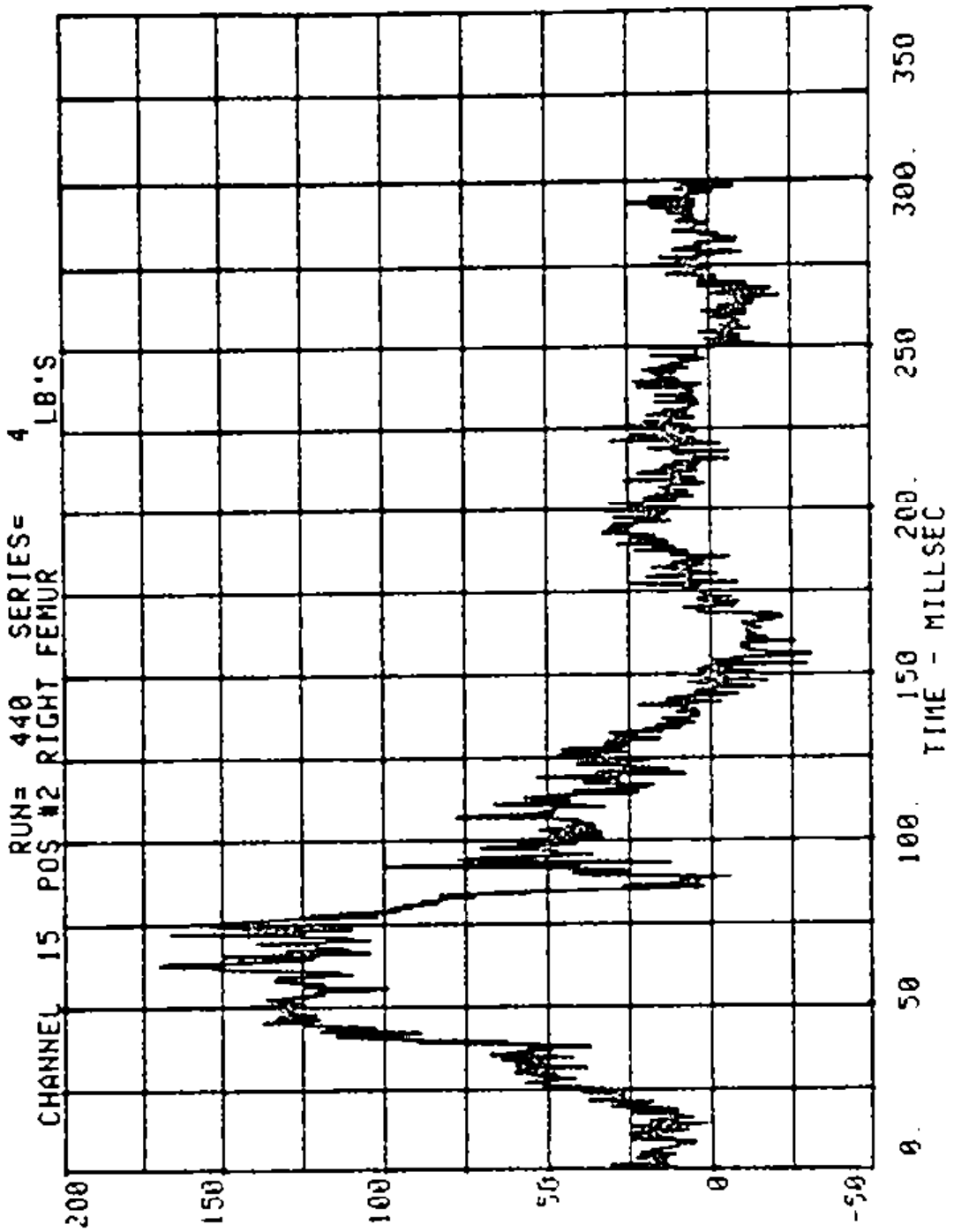

CHANNEL 3 RUN= 440 SERIES= 4
HEAD RESULTANT (2) G'S
60.
48.
36.
24.
12.
0.
0.
50.
100.
150
200.
250.
300.
350.
TIME - MILLSEC

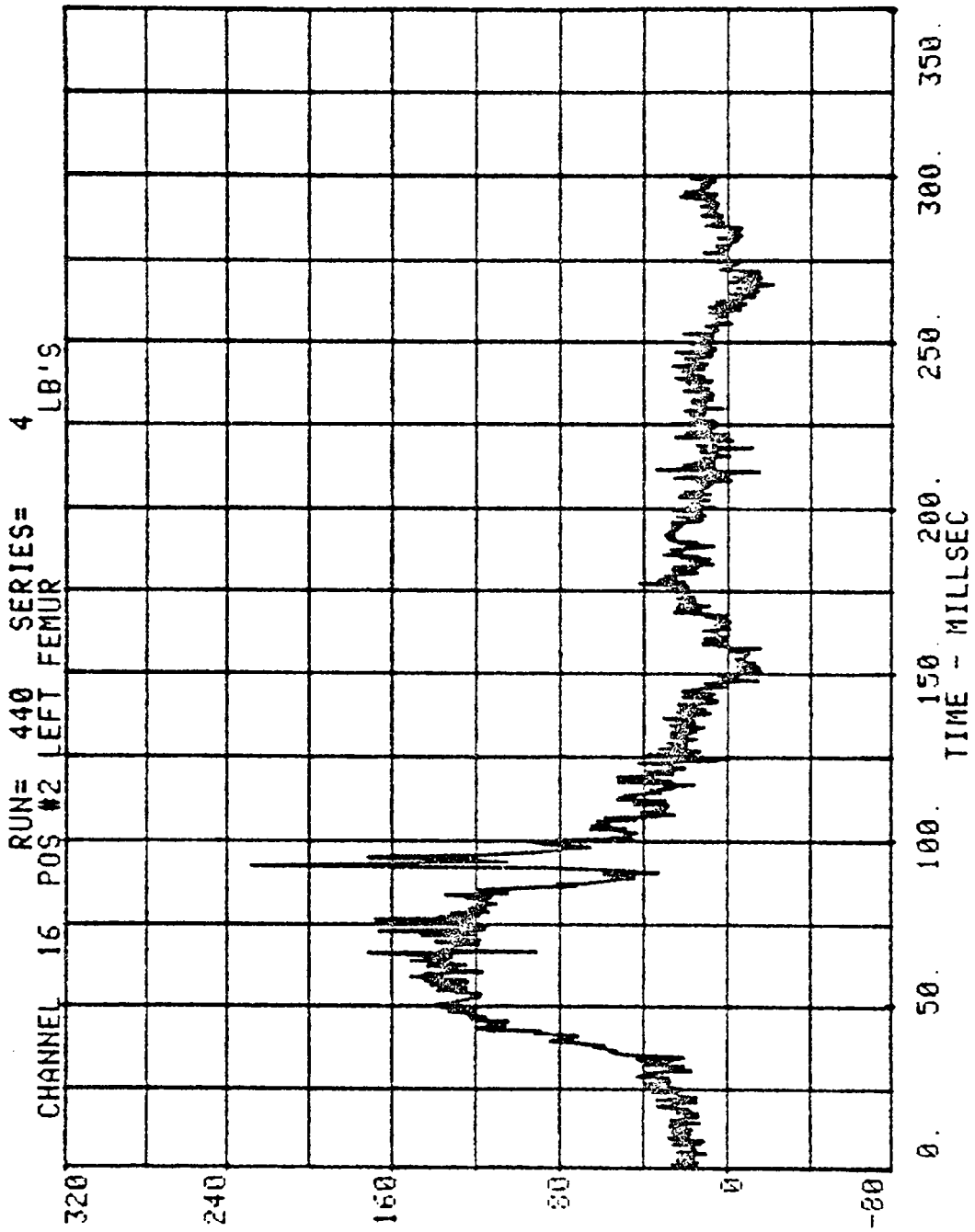

CHANNEL 10 POS #2 CHEST X
RUN= 440 SERIES= 4
G'S
16
12
8
4
0
-4
0
50
100
150
200
250
300
350
TIME - MILLSEC

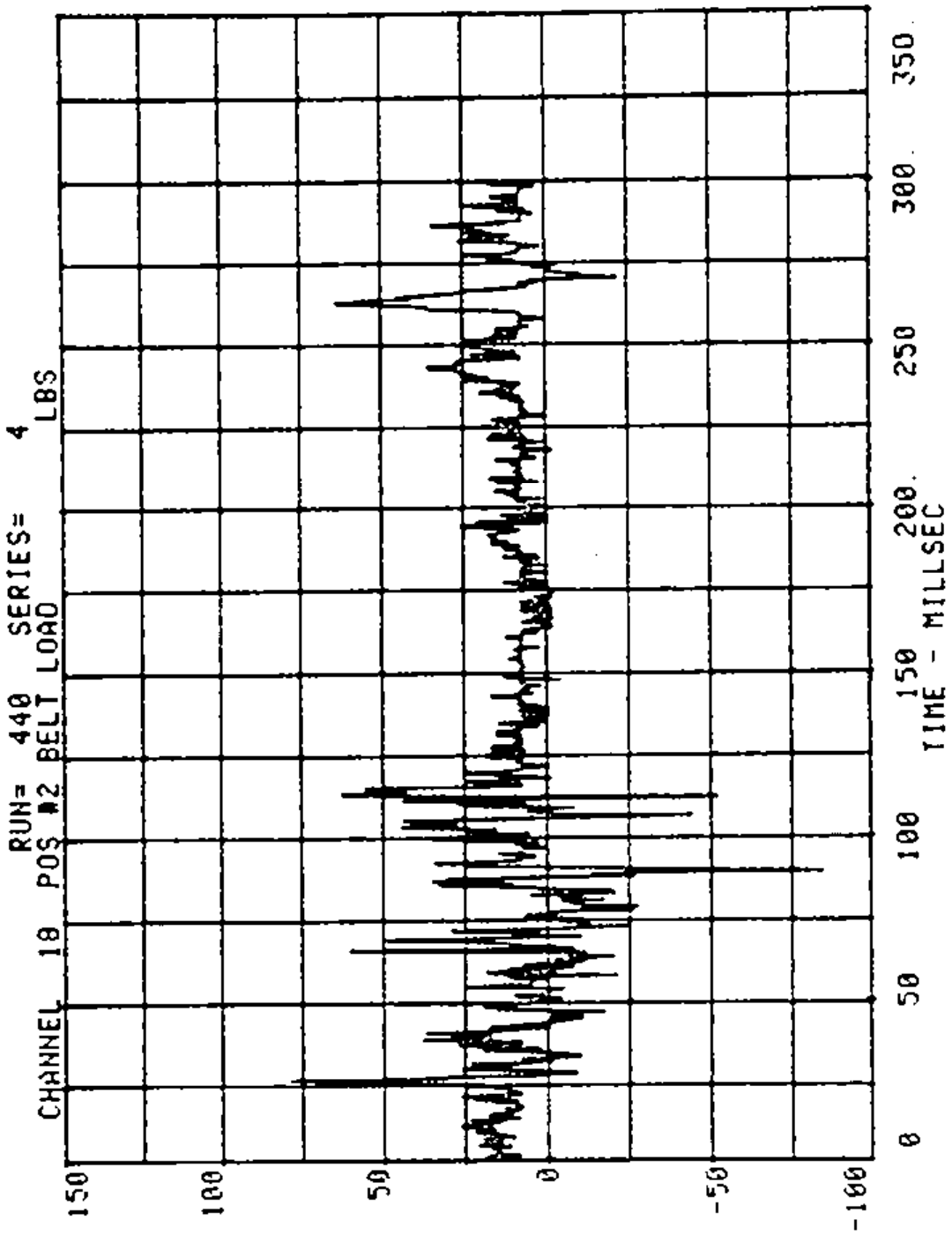

CHANNEL 11 POS #2 CHEST Y
RUN= 440 SERIES= 4
G'S
7.5
5.0
2.5
0.0
-2.5
-5.0
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC


CHANNEL 12 POS #2 CHEST Z
RUN= 440 SERIES= 4
G'S
20
16
12
8
4
0
0
50
100
150
200
250
300
350
TIME - MILLSEC


CHANNEL 4 RUN= 440 SERIES= 4
CHEST RESULTANT (2)
25.
20.
15.
10.
5.
0.
0.
50.
100.
150.
200.
250.
300.
350.
TIME - MILLSEC


CHANNEL 15 POS #2 RIGHT FEMUR
RUN= 440 SERIES= 4
LB'S
200
150
100
50
0
-50
0
50
100
150
200
250
300
350
TIME - MILLSEC


CHANNEL 16 RUN= 440 SERIES= 4
POS #2 LEFT FEMUR LB'S
320
240
160
80
0
-80
0.
50.
100.
150
200.
250.
300.
350.
TIME - MILLSEC


CHANNEL 18 POS #2 BELT LOAD
RUN= 440 SERIES= 4
LBS
150
100
50
0
-50
-100
0
50
100
150
200
250
300
350
TIME - MILLSEC

APPENDIX C

DUMMY CERTIFICATION TEST

This test report contains results from certification tests performed on Alderson Research Laboratories Model ATD 30034, 50th percentile anthropomorphic test dummies, Serial Nos. 319, 320, which were completed on June 29 and July 2, 1979, respectively. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Vol. 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation, Advanced Technology Center. A summary of the test results is presented in the following tables, Table 1C through 8C along with the Part 572 requirements.

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.: 3 1 9

LABORATORY TECHNICIAN: FRED JULIANO

APPROVED BY: B. Donnelly

	Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - - - - - - - - -	29 June 1979	
Calibration Sequential Number for Dummy - - - -		
Temperature in Lab. (Spec. = 66 to 78°F)- - - -		78°
Relative Humidity in Lab. (Spec. = 10 to 70%) -		68%

TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G		228
b. Peak Lateral Accel. - -	≤10G		8
c. Time above 100G - - - -	0.9 to 1.5 ms		1.2
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps		23.60
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G		23
c. Peak Resultant Head Acceleration - - - -	26G maximum		17
d. Pendulum Decel. (t_2-t_1)	≤3 ms		2
e. Pendulum Decel. (t_3-t_2)	25 to 30 ms		27
f. Pendulum Decel. (t_4-t_3)	≤10 ms		7
g. Pendulum Direction Reversal Time - - - -	≥123 ms		113
h. Max. Head Rotation - -	63 to 73°		63.5
i. Chordal Displacement:			
Head Rotation Angle - -			
0° Time	-2 to 2 ms		0
0° Displ.	-.5 to .5 in		0
30° Time	25.6 to 34.4 ms		26
30° Displ.	2.1 to 3.1 in.		2.8
60° Time	40.3 to 51.7 ms		45
60° Displ.	4.3 to 5.3 in.		4.95
Maximum (°) Time	53.2 to 66.8 ms		61
Maximum (°) Displ.	5.0 to 6.0 in.		5.25

Continued

P. 572 DUMMY CALIBRATION TEST DATA .... Continued:

Dummy I.D. No.: 3 1 9

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST .... Continued				
i. Chordal Displacement:				
Head Rotation Angle --				
60°	Time	67.0 to 83.0 ms		88
	Displ.	4.3 to 5.3 in.		4.9
30°	Time	85.4 to 104.6 ms		92
	Displ.	2.1 to 3.1 in.		2.35
0°	Time	101.0 to 123.0 ms		109
	Displ.	-.5 to 0.5 in.		.5
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.		58
b. Force @ 1.3" - - - -		73 to 88 lbs.		86
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - -		22 to 34 lbs.		30
b. Force @ 30° - - - -		34 to 46 lbs.		39
c. Force @ 40° - - - -		46 to 58 lbs.		50
d. Return Angle - - -		12° maximum		6°
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - -		21.78-22.22 fps		21.81
(2) Peak Delfection -		1.7" maximum		1.45
(3) Peak Resistive Force - - - - - -		2250 lbs. maximum		1916
(4) Internal - - - - Hysteresis		50 to 70%		51%
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps		13.88
(2) Peak Deflection -		1.1" maximum		1.0
(3) Peak Resistive Force - - - - - -		1450 lbs. maximum		1201
(4) Internal Hysteresis- - - -		50 to 70%		50%

P.572 DUMMY CALIBRATION TEST DATA .....Continued:

Dummy I.D. No.: 3 1 9

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps		6.94
(2) Maximum Force - -	1850 to 2500 lbs		1850
(3) Time Above 1000#	1.7 ms minimum		2.1
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps		7.03
(2) Maximum Force - -	1850 to 2500 lbs.		2500
(3) Time Above 1000#	1.7 ms minimum		2

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.: 3 1 9

CALIB. SEQ. NOS. FOR DUMMY: _____ & _____

	MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
A. DUMMY INSTRUMENTS:				
1. Head Accelerometers--				
a. Triaxial unit - - - - -				
b. Uniaxial units				
(1) Longitudinal (A_x) -	ENDEVCO	CK54	1-79	1-80
(2) Lateral (A_y) - - -	ENDEVCO	CE82	4-79	1-80
(3) Vertical (A_z) - - -	ENDEVCO	CE76	4-79	1-80
2. Chest Accelerometers-- (Vehicle Crash Test Usage)				
a. Triaxial unit - - - - -				
b. Uniaxial units				
(1) Longitudinal (A_x) -	CEC	17938	1-79	1-80
(2) Lateral (A_y) - - -	ENDEVCO	CG05	1-79	1-80
(3) Vertical (A_z) - - -	CEC	21480	1-79	1-80
3. Chest Potentiometer - - -	HUMANOID SPECIAL			
4. Femur Load Cells--				
a. Right Side - - - - - -	GSE	306	1-79	1-80
b. Left Side	GSE	310	1-79	1-80
B. CALIB. LAB. INSTRUMENTS:				
1. Pendulum Accelerometer - -	B&H	17547	2-79	1-80
2. Test Probe Accelerometer -	B&H	16928	1-79	1-80
3. Lumbar Flexion Test Push Force Gauge - - - - - - -	BLH	73141		
4. Abdominal Compression Test Force Gauge - - - - - - -	BLH	72952		
5. Abdominal Compression Test Displacement Gauge - - - -	CIC	567-11		

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.: 3 2 0

LABORATORY TECHNICIAN: FRED JULIANO

APPROVED BY: [signature]

	Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - - - - - - - - -	2 July 1979	
Calibration Sequential Number for Dummy - - - -		72
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		72
Relative Humidity in Lab. (Spec. = 10 to 70%) -		

TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G		212
b. Peak Lateral Accel. - -	≤10G		18
c. Time above 100G - - - -	0.9 to 1.5 ms		1.2
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps		23.68
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G		24
c. Peak Resultant Head Acceleration - - - -	26G maximum		18
d. Pendulum Decel. (t_2-t_1)	≤3 ms		1.5
e. Pendulum Decel. (t_3-t_2)	25 to 30 ms		26
f. Pendulum Decel. (t_4-t_3)	≤10 ms		.7
g. Pendulum Direction Reversal Time - - - -	≥123 ms		117
h. Max. Head Rotation - -	53 to 73°		70
i. Chordal Displacement:			
Head Rotation Angle - -			
0° Time	-2 to 2 ms		0
0° Displ.	-.5 to .5 in		0
30° Time	25.6 to 34.4 ms		30
30° Displ.	2.1 to 3.1 in.		2.95
60° Time	40.3 to 51.7 ms		47
60° Displ.	4.3 to 5.3 in.		5.05
Maximum (°) Time	53.2 to 66.8 ms		64
Maximum (°) Displ.	5.0 to 6.0 in.		5.8

Continued

P. 572 DUMMY CALIBRATION TEST DATA .... Continued:

Dummy I.D. No.: 3 2 0

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST .... Continued				
i. Chordal Displacement:				
Head Rotation Angle --				
60°	Time	67.0 to 83.0 ms		83
	Displ.	4.3 to 5.3 in.		4.9
30°	Time	85.4 to 104.6 ms		103
	Displ.	2.1 to 3.1 in.		2.25
0°	Time	101.0 to 123.0 ms		119
	Displ.	-.5 to 0.5 in.		.3
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.		54
b. Force @ 1.3" - - - -		73 to 88 lbs.		76
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - -		22 to 34 lbs.		26
b. Force @ 30° - - - -		34 to 46 lbs.		37
c. Force @ 40° - - - -		46 to 58 lbs.		52.5
d. Return Angle - - -		12° maximum		6°
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - -		21.78-22.22 fps		22.03
(2) Peak Delfection -		1.7" maximum		1.54
(3) Peak Resistive Force - - - - - -		2250 lbs. maximum		2124
(4) Internal - - - - Hysteresis		50 to 70%		64%
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps		14.12
(2) Peak Deflection -		1.1" maximum		1.07
(3) Peak Resistive Force - - - - - -		1450 lbs. maximum		1227.6
(4) Internal Hysteresis- - - -		50 to 70%		50%

P.572 DUMMY CALIBRATION TEST DATA .....Continued:

Dummy I.D. No.: 3 2 0

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps		6.98
(2) Maximum Force - -	1850 to 2500 lbs		2200
(3) Time Above 1000#	1.7 ms minimum		1.9
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps		6.98
(2) Maximum Force - -	1850 to 2500 lbs.		2375
(3) Time Above 1000#	1.7 ms minimum		2

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.: 3 2 0

CALIB. SEQ. NOS. FOR DUMMY: _____ & _____

	MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
A. DUMMY INSTRUMENTS:				
1. Head Accelerometers--				
a. Triaxial unit - - - - -				
b. Uniaxial units				
(1) Longitudinal (A_x) -	ENDEVCO	CL60	1-79	1-80
(2) Lateral (A_y) - - -	ENDEVCO	CG34	1-79	1-80
(3) Vertical (A_z) - - -	ENDEVCO	CK11	1-79	1-80
2. Chest Accelerometers-- (Vehicle Crash Test Usage)				
a. Triaxial unit - - - - -				
b. Uniaxial units				
(1) Longitudinal (A_x) -	CEC	18118	4-79	1-80
(2) Lateral (A_y) - - -	ENDEVCO	AA07	4-79	1-80
(3) Vertical (A_z) - - -	CEC	22292	4-79	1-80
3. Chest Potentiometer - - -	HUMANOID SPECIAL			1-80
4. Femur Load Cells--				
a. Right Side - - - - - -	GSE	311	1-79	1-80
b. Left Side	GSE	312	1-79	1-80
B. CALIB. LAB. INSTRUMENTS:				
1. Pendulum Accelerometer - -	B&H	17547	2-79	1-80
2. Test Probe Accelerometer -	B&H	16928	1-79	1-80
3. Lumbar Flexion Test Push Force Gauge - - - - - - -	BLH	73141		
4. Abdominal Compression Test Force Gauge - - - - - - -	BLH	72952		
5. Abdominal Compression Test Displacement Gauge - - - -	CIC	567-11		

Electronic Test Equipment

The complement of signal conditioning recording and display equipment used in conjunction with dummy certification testing is shown in Figure 8.

- Data Acquisition - Sangamo Mod 3500 14 channel FM Tape Transport (recording Speed: 60 in/sec).

- Data Reduction - Brush Mark 260 6-channel recorder or Pace X-Y plotter.

- Signal Conditioning - Calspan designed and fabricated bridge amplifiers providing gain, balance, and shunt calibration of all sensor inputs.

- Computational Equipment - Calspan designed and fabricated analog computer consisting of operational amplifiers in circuit configurations providing continuous computation of acceleration vector magnitude and Severity Index relationships.

- Signal Filtering - Calspan designed and fabricated second order active filters (6 channels) with selectable frequency responses consistent with SAE J211b Class 60, 180, 600, and 1000 requirements. Filters are compensated for 32:1 real time expansion resulting from data recording at 60 in/sec and playback at 1-7/8 in/sec.

- Real Time Reference - Tektronix Time Mark Generator; 1 and 10 millisecond is synchronously recorded with all certification data and reproduced at playback on all strip chart records.

- The data acquisition, reproduction, and time reference equipment is maintained by Calspan's Equipment and Standards Laboratory (ESL), which is an NBS traceable calibration facility. Other special purpose equipment is maintained by qualified test facility personnel using support equipment maintained and standardized by all ESL.

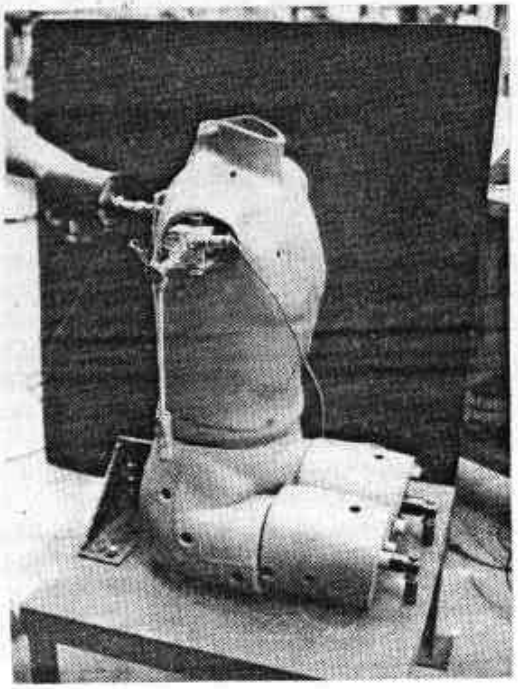


FIGURE C-1

LUMBAR SPINE FLEXION TEST APPARATUS

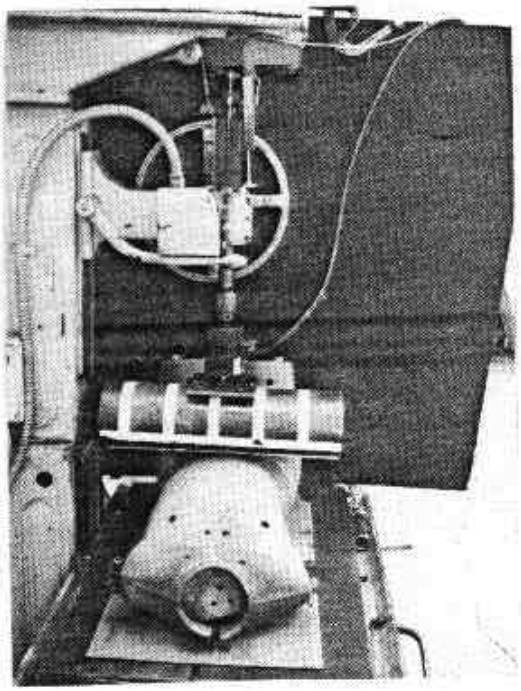


FIGURE C-2

ABDOMEN PRESS TEST APPARATUS

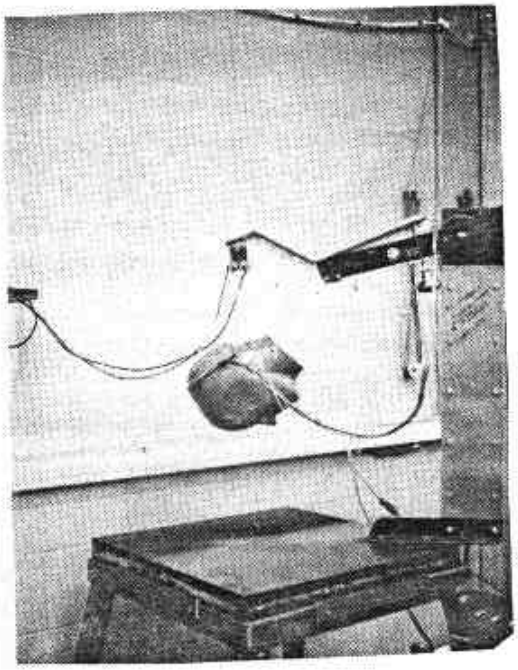


FIGURE C-3

HEAD DROP TEST APPARATUS

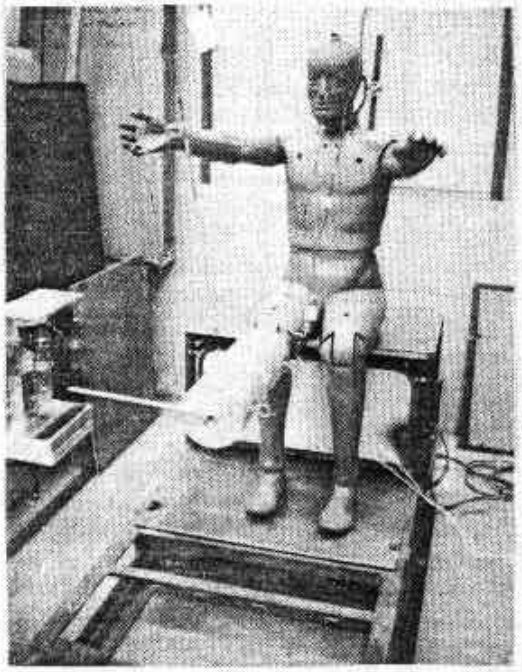


FIGURE C-4
KNEE IMPACT TEST APPARATUS

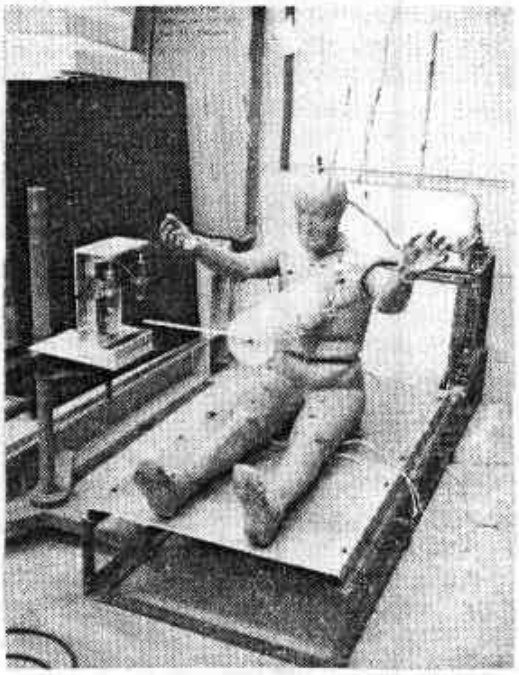


FIGURE C-5
THORAX IMPACT TEST APPARATUS

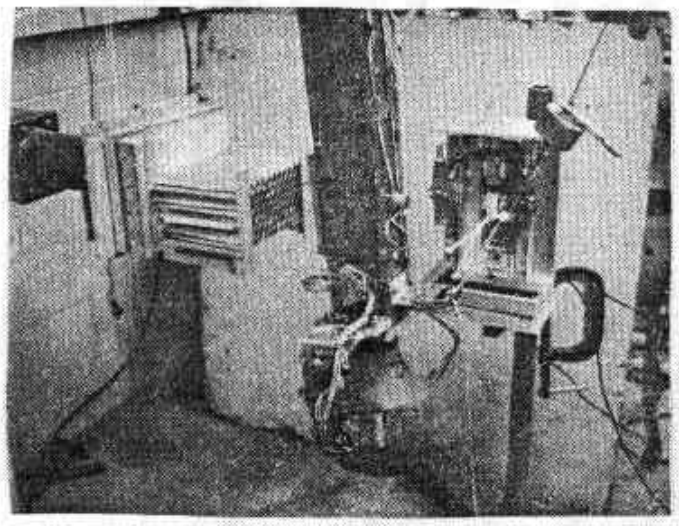


Figure C-6
NECK IMPACT TEST APPARATUS

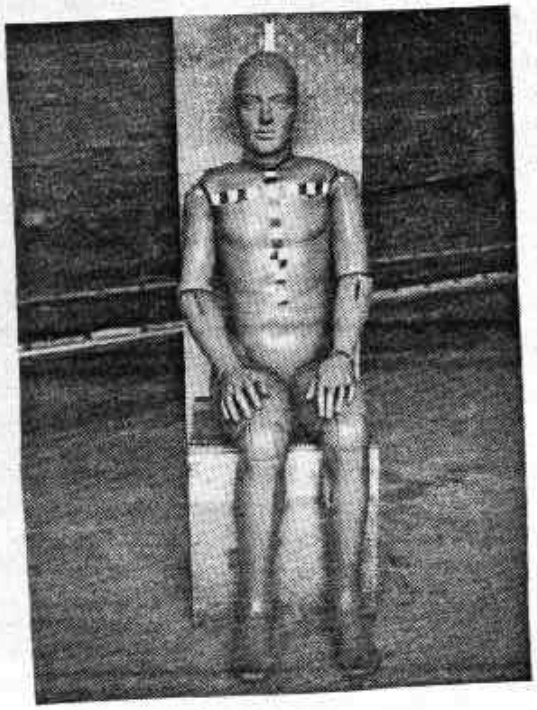


FIGURE C-7

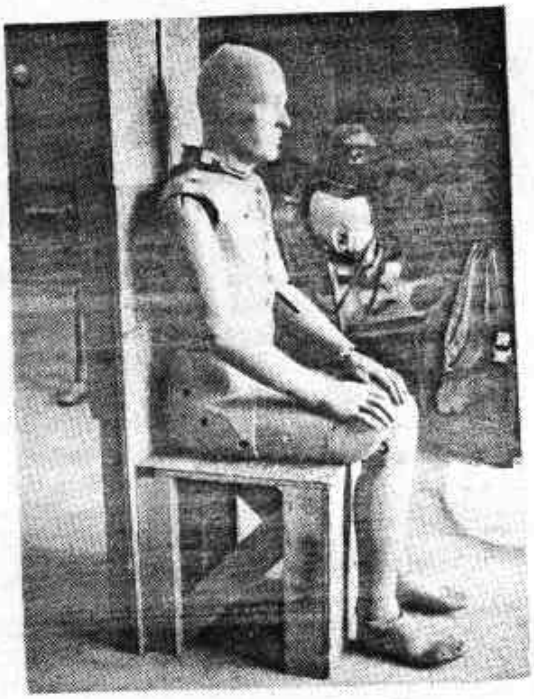


FIGURE C-7
PART 572 TEST DUMMY
FRONT & SIDE VIEW

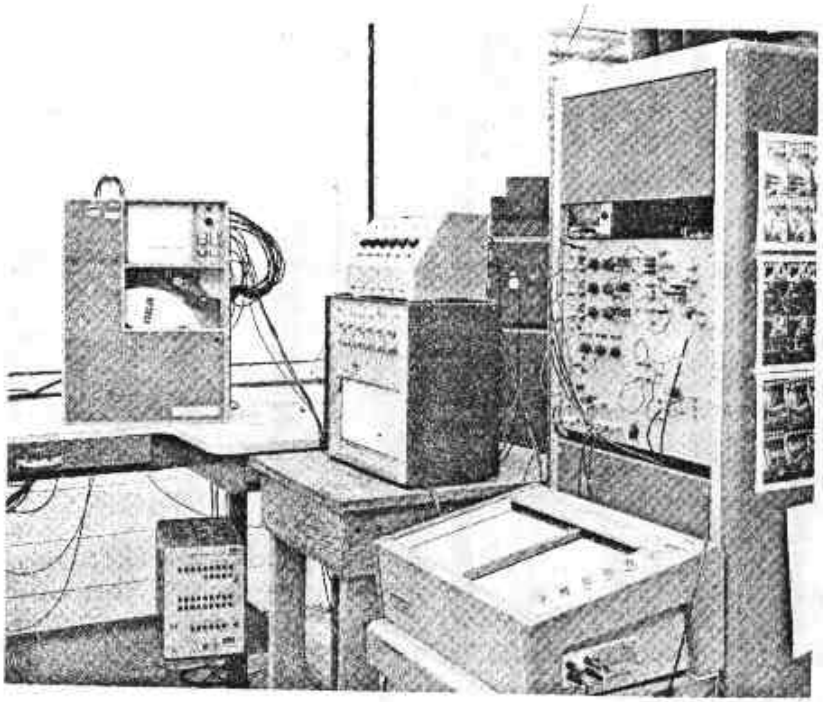


Figure C-8. ELECTRONIC TEST EQUIPMENT