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EVALUATION OF AGGRESSIVENESS TEST TECHNIQUES

Walter E. Levan

CALSPAN REPORT NO. 6892-V-1



TEST: TEST NO. 752-1-527
TYPE OF TEST: SYMMETRIC FRONTAL CAR-TO-BARRIER IMPACT
1981 VOLVO DL
DEFORMABLE MOVING BARRIER
TEST DATE: 10/5/81
CONTRACT NO.: DTNH22-81-C-87088
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16. Abstract A symmetric frontal impact of a 1981 Volvo DL and a deformable moving barrier was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department, Buffalo, NY, on October 5, 1981. Impact speed of each vehicle was 32.06 mph. Ambient temperature on the test data was 63°F. Both the driver and right front passenger of the 1981 Volvo DL complied with FMVSS 208 Injury Criteria for Head, Chest, and Femurs. Maximum crush of the Volvo DL was 24.1 inches on the left front. Maximum firewall intrusion was 8.7 inches. Maximum crush of the honeycomb on the face of the moving barrier was 18.1 inches.					
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SECTION 1

TEST OBJECTIVE

The test objective was to obtain baseline data, using a deformable moving barrier impacting vehicles judged to have dissimilar aggressivity. Secondly it was to determine the feasibility of using such a barrier to evaluate vehicle aggressiveness.

This test was a symmetric frontal impact of a 1981 Volvo DL and a deformable moving barrier with a nominal closing speed of 64.12 mph. This test was performed at Calspan Corporation, Advanced Technology Center on October 5, 1981.

The test program is part of the National Traffic Safety Administration (NHTSA) Contract DTNH22-81-C-87088, Task 2, to evaluate aggressiveness test techniques.

SECTION 2

SUMMARY OF TEST NUMBER 752-1-527

A frontal car-to-barrier impact (Figure A-1) of a 1981 Volvo DL into a deformable moving barrier, with each vehicle travelling at 32.06 mph, was performed at the Calspan Corporation, Advanced Technology Center, on October 5, 1981. A summary of the test conditions can be found in Table 1 and pre- and post-test photographs can be found in Appendix A.

Two Part 572, 50th percentile male Anthropometric Test Devices (ATDs) were placed in the 1981 Volvo DL in the driver and right front passenger seating positions, according to dummy placement procedures specified in Laboratory Procedures for Vehicle Assessment TP-212-02.

The occupant dummies were instrumented with triaxial accelerometer packages in the head and chest region WITH LOAD CELLS ON EACH FEMUR. Load cells were also placed on the lap and shoulder belts to measure dummy torso and lap loading. Each of the ATDs had been certified prior to the test, and certification data sheets, along with instrumentation calibration data, are presented in Appendix C.

The crash event was recorded by 10 high-speed cameras and one real-time camera. The overhead high-speed camera failed to operate due to film breakage. Camera locations and other pertinent camera information are found in Section 3 of this report.

The 60 channels of data were recorded on 5-14 Channel FM tape recorders. All data channels checked out prior to the test. The following are data losses experienced during the test:

Accelerometer Pack #9(X) Zero shift @ 50 ms.

Accelerometer Pack #10(Z) No data (bad cable)

Accelerometer Pack #12(X) Zero shift @ 75 ms.

Accelerometer Pack #B1(X) Bad data after 25 millisec. (reason unknown)

TABLE 1

CRASH TEST SUMMARY

TEST NO.	<u>752-1-527</u>		Evaluation of Aggressiveness
			PROJECT <u>Test Techniques</u>
DATE	<u>10/5/81</u>	TIME	<u>1345</u> TEMP. <u>63°F</u>
TEST CONDITION	<u>Symmetric frontal - 64.12 mph closing speed</u>		
VEHICLE NO. 1	<u>1981 Volvo DL 2-door</u>		
VEHICLE NO. 2	<u>deformable moving barrier</u>		

	VEH. NO. 1	VEH. NO. 2
TEST WEIGHT (lbs)	<u>3480</u>	<u>3450</u>
IMPACT ANGLE (deg)*	<u>0°</u>	<u>0°</u>
IMPACT VELOCITY (mph)**	<u>32.06</u>	<u>32.06</u>
MAX. CRUSH (in) (static)	<u>24.1 (LF side)</u>	<u>18.1</u>
MAX. INTRUSION (in)	<u>8.7</u>	<u>--</u>

OCCUPANTS	VEH. NO. 1	VEH. NO. 2
TYPE	<u>Part 572, 50th percentile male</u>	<u>none</u>
LOCATION	<u>LF (1), RF (2)</u>	<u>none</u>
RESTRAINT	<u>3-point belt system</u>	<u>none</u>
ID No.	<u>162, 183</u>	

NUMBER OF DATA CHANNELS	<u>60</u>
NUMBER OF HIGH SPEED CAMERAS	<u>10 + 1 Real Time</u>

The overhead high-speed camera failed to operate.

* WITH RESPECT TO TOW TRACK CENTERLINE

** SPEED TRAP MEASUREMENT ($\pm 0.5\%$ ACCURACY)

TABLE 1 (cont'd)

OBSERVATIONS (VEHICLE NO. 1) 1981 VOLVO DL

GLAZING Windshield has stress crack, Figure A-10

DOORS Both front doors were operable after impact.

SEAT ANCHORAGES intact.

RESTRAINTS intact, see General Comments below.

OBSERVATIONS (VEHICLE NO. 2) DEFORMABLE MOVING BARRIER

GLAZING ---

DOORS ---

SEAT ANCHORAGES ---

RESTRAINTS ---

GENERAL COMMENTS The production-type 3-point retractor belt system was
modified to a fixed 3-point belt system.

Table 2
VEHICLE TEST WEIGHTS AS TESTED
 1981 VOLVO DL

Left Front	860	lbs	Left Rear	860	lbs
Right Front	880	lbs	Right Rear	880	lbs
TOTAL FRONT	1740	lbs	TOTAL REAR	1740	lbs

Total Weight = $1740 + 1740 = 3480$ lbs

Wheel Base = 105 inches

$Cg_{F.W.} = \frac{1740 \text{ lbs} \times 105 \text{ inches}}{3480 \text{ lbs}} = 52.5 \text{ inches}$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
 UDW = Unloaded Delivered Weight (2890 lbs)
 VCW = Vehicle Capacity Weight (920 lbs)
 DSC = Designated Seating Capacity (5)

RCLW = VCW - 150 (DSC)

RCLW = 920 - 150 (5) = 170 lbs

TEST WEIGHT = UDW + RCLW + (No. Dummies x 164 lbs)

TEST WEIGHT = 2890 lbs + 170 lbs + 2 (164 lbs)

TEST WEIGHT = 3388 lbs (calculated)

INDEX

TEST VEHICLE INFORMATION

Vehicle Manufacturer	Volvo of Gothenburg, Sweden		
Make/Model	Volvo DL 2-door sedan		
Body Style	Tudor	Model Year	1981
VIN	YVIAx4925B1190753	Build Date	9/80
NHTSA No.	752-1-527	Color	Maroon
Engine Data:	4 cylinders	130 cu. in.	displacement
Transmission Data:	4 speed	(X) Manual	() Automatic
Date Rec'd	9/2/81	Air Cond.	no
		PW. STR.	yes
		PW. BR.	yes
Dealer's Name & Address	Beyer Motors, 1231 W. Broad St. Falls Church, VA		

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

Vehicle Manufactured by		Volvo					
Date of Manufacture		9/80		VIN		YVIAx4925B1190753	
GVRW	4030	lbs	GAWR: Front	2180	lbs	Rear	1385 lbs

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

Vehicle Load (up to capacity) - Front 30 psi
Rear 36 psi

Recommended Tire Size 175 SR 14 Load Range: X B C D

Vehicle Capacity: Types of Seats Bench X Bucket Split Bench

Number of Occupants (Designated Seating Capacity): 2 Front
3 Rear
5 TOTAL

Cargo Load = 920 lbs

TOTAL = 170 lbs

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS)

Right Front	<u>720</u>	lbs.	Right Rear	=	<u>710</u>	lbs.
Left Front	=	<u>760</u>	lbs	Left Rear	=	<u>700</u> lbs
TOTAL FRONT WEIGHT	=	<u>1480</u>	lbs	(<u>51.2</u>	% of Total Vehicle Weight)	
TOTAL REAR WEIGHT	=	<u>1410</u>	lbs	(<u>48.8</u>	% of Total Vehicle Weight)	
TOTAL DELV. WEIGHT	=	<u>2890</u>	lbs			

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND	92	lbs CARGO
--	----	-----------

Right Front = 880 lbs Right Rear = 880 lbs
Left Front = 860 lbs Left Rear = 860 lbs
TOTAL FRONT WEIGHT = 1740 lbs (50.0 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1740 lbs (50.0 % of Total Vehicle Weight)
TOTAL TEST WEIGHT = 3480 lbs
Weight of ballast secured in vehicle trunk area = 0 lbs

TABLE 3
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test 10/5/81 Time of Test 1345 am/pm
Ambient Temperature 63 °F at impact area
Temperature in Occupant Compartment 68 °F
Windshield Molding Temperature 74 °F

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude: RF 27.5 LF 27.7 RR 25.25 LR 25.25
Test Attitude: RF 26.2 LF 26.1 RR 24.1 LR 24.1

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 26 psi Rear = 32 psi
Recommended Tire Size 175 R 14 Load Range B
Tires on Vehicle Michelin 175 SR 14
Is Spare Tire a "Space Saver" X yes no
Is Spare Tire Standard Equipment X yes no

TEST FLUID DATA

Test Fluid Type: Red Stoddard Solvent #2 Spec. Grav.: 0.764
Kinematic Viscosity 0.96 Centistokes
EPA Capacity* gal
Test Volume gal (93% of EPA Capacity)
Fuel System Capacity (data from Owner's Manual) 15.8 gal
Details of fuel system No Red Stoddard Solvent in fuel tank. Test was
performed with fuel tank empty.

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 No

VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 189.0 / L 189.0 inches
Post-Test = R 166.4 / L 164.9 inches
Crush = R 22.6 / L 24.1

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.

SECTION 3

VEHICLE AND OCCUPANT INFORMATION

The production-type 3-point retractor belt system was modified to a 3-point fixed belt system by removing the belt from the retractor and replacing the "D" ring with a belt-type clamp.

The driver's seat of the 1981 Volvo DL (Vehicle No. 1) was adjusted with respect to the brake pedal using a box beam measuring 20.5 inches long, 3 inches high, and 2 inches wide. The box beam was placed on the driver seat cushion, and the seat was adjusted per instruction of the CTM as shown in Figure 6. The passenger seat was then adjusted so that the seatback was in line with the driver's seatback.

Vehicle No. 1 - 1981 Volvo DL

The 1981 Volvo DL was a 2-door sedan equipped with a 130 cubic inch, 4-cylinder engine, 4-speed manual transmission, power steering, and power brakes. The total test weight with 2 dummies, instrumentation, and two on-board cameras was 3480 pounds.

Vehicle No. 2 - Deformable Moving Barrier

Vehicle No. 2 was a deformable moving barrier (Figure A-16 and Figure A-17) weighing 3450 pounds. The face of the moving barrier was fitted with honeycomb measuring 64 inches in length, 22 inches in height, and 15 inches in depth. In addition, 4-inch denser honeycomb was placed in front to represent the front bumper. Four load cells were added to the moving barrier as illustrated in Figure 4 to measure peak forces.

Post-Test Observations - 1981 Volvo DL

Both the driver and right front passenger complied with FMVSS 208, Injury Criteria Requirements for Head, Chest, and Femurs. The driver's head struck the center of the steering wheel hub (Figure A-11) as evident by the chalk mark and the high-speed film. Head contact with the steering wheel occurred at 110 millsec. after impact with a peak head resultant acceleration of 80 g's. Occupant results are summarized in Table 11, and the data traces along with vehicle data traces are presented in Appendix B.

Maximum crush of the vehicle was 24.1 inches on the left side, and maximum firewall intrusion was 8.7 inches.

Windshield has stress cracks (Figure A-10), and there was no windshield retention loss.

Both front doors were operable after impact.

Vehicle No. 2 - Deformable Moving Barrier

Maximum crush of the honeycomb on the face of the moving barrier was 18.1 inches. Maximum total force as measured by the four load cells was 100,000 pounds at 45 millsec. after impact. Complete pre- and post-test measurements of the barrier face honeycomb are presented in Table 7, and data traces are found in Appendix B.

FIGURE 1

PRE-TEST AND POST-TEST MEASUREMENT POINTS

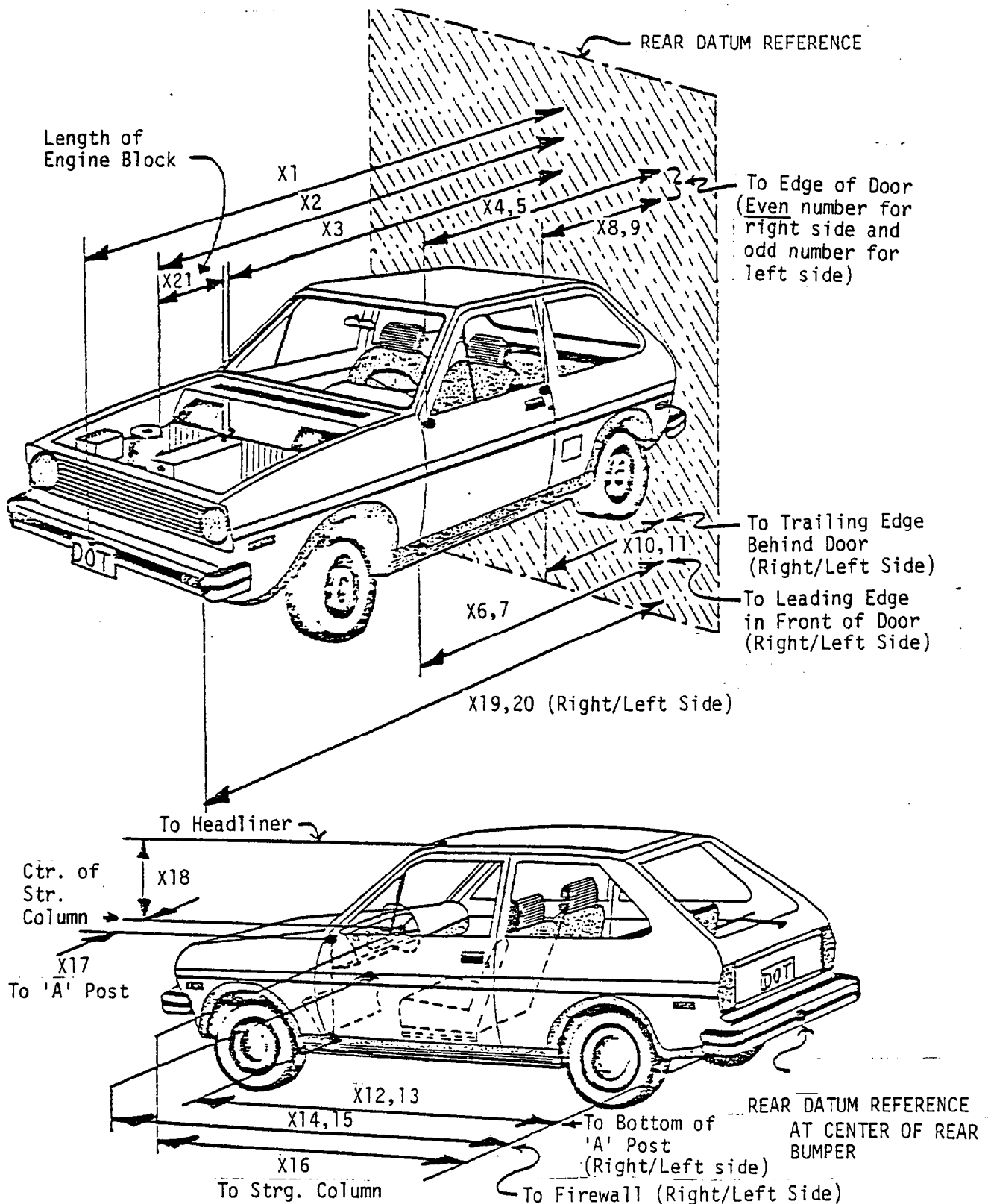


TABLE 4

VEHICLE MEASUREMENTS

VEHICLE NO. 1 - 1981 VOLVO DL		All Dimensions in Inches		
No.		Pre-Test	Post-Test	Difference
X1	Total Length of Vehicle at Centerline	191.7	168.3	23.4
X2	Rear Surface of Vehicle to Front of Engine	162.2	150.5	11.7
X3	Rear Surface of Vehicle to Firewall	141.1	132.4	8.7
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	128.5	128.0	.5
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	128.5	127.3	1.2
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	127.9	127.9	0
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	127.9	126.6	1.3
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	81.7	81.4	.3
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	81.6	80.7	.9
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	81.5	80.5	1.0
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	81.4	80.2	1.2
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	125.5	125.2	.3
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	125.5	125.3	.2
X14	Rear Surface of Vehicle to Firewall, Right Side	140.3	135.0	5.3
X15	Rear Surface of Vehicle to Firewall, Left Side	140.5	134.1	6.4
X16	Rear Surface of Vehicle to Steering Column	112.5	110.7	1.8
X17	Center of Steering Column to "A" Post	13.9	14.5	-.6
X18	Center of Steering Column to Headliner	17.3	17.5	-.2
X19	Rear Surface of Vehicle to Right Side of Front Bumper	189.0	166.4	22.6
X20	Rear Surface of Vehicle to Left Side of Front Bumper	189.0	164.9	24.1
X21	Length of Engine Block	21.0	21.0	0

TABLE 5

VEHICLE WEIGHTS AND RIDE HEIGHTS

Vehicle No. 1 - 1981 Volvo DL

		WEIGHTS & RIDE HEIGHTS				L. BUMPER		R. BUMPER		BOTTOM E.A.	
		L.F.	R.F.	R.R.	L.R.	Upper	Lower	Upper	Lower	Left	Right
CURB WEIGHT	Pounds	760	720	710	700						
RIDE HEIGHTS	Inches	27.7	27.5	25.2	25.2	19.1	12.8	19.6	13.3	15.7	15.6
CURB WEIGHT PLUS DUMMIES	Pounds	900	810	790	820						
RIDE HEIGHTS	Inches	26.4	26.6	24.5	24.7	---	---	---	---	---	---
FINAL WEIGHT INSTRUMENTATION AND DUMMIES	Pounds	860	880	880	860						
RIDE HEIGHTS	Inches	26.1	26.2	24.1	24.1	18.5	12.2	18.7	12.4	15.0	15.2

TABLE 6

Vehicle No. 1 - 1981 Volvo DLDATE 10/5/81REFERENCE DISTANCE FROM REAR 192.3

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6	0	6	12	18	24	30	36
Lower Bumper	Pre		←					14.0						→
	Post		←					20.0						→
Upper Bumper	Pre		←					18.0						→
	Post		←					23.0						→
1/2 Bumper To Hood	Pre		←					26.3						→
	Post		←					29.0						→
Hood	Pre		←					32.0						→
	Post		←					36.0						→

HORIZONTAL DISTANCE FROM REFERENCE

Lower Bumper	Pre		3.4	2.0	1.1	.2	.7	.6	.7	.2	1.1	2.1	3.5	
	Post		26.6	25.3	24.4	23.8	24.0	23.7	24.0	23.4	24.2	24.8	25.9	
	Diff.		23.2	23.3	23.3	23.6	23.3	23.1	23.3	23.2	23.1	22.7	22.4	
Upper Bumper	Pre		3.3	2.0	1.0	.2	.9	.7	.9	.2	1.0	2.0	3.4	
	Post		27.9	26.8	26.0	25.5	25.9	25.6	25.9	25.1	25.3	26.5	27.8	
	Diff.		24.6	24.8	25.0	25.3	25.0	24.9	25.0	24.9	24.3	24.5	24.4	
1/2 Bumper To Hood	Pre		9.4	9.0	8.2	6.2	5.4	4.6	5.4	6.2	8.2	9.0	9.4	
	Post		35.5	25.0	34.5	24.0	35.5	32.3	33.3	34.9	35.3	35.1	34.6	
	Diff.		26.1	26.0	26.3	27.8	30.1	27.7	27.9	28.7	27.1	26.1	25.2	
Hood	Pre		10.9	9.2	8.3	7.3	5.2	4.9	5.2	7.3	8.3	9.2	10.9	
	Post		37.7	29.5	28.8	27.6	26.7	26.9	27.0	26.3	26.2	26.0	36.1	
	Diff.		26.8	20.3	20.5	20.3	21.5	22.0	21.8	19.0	17.9	16.8	25.2	

TABLE 7

Vehicle No. 2 - Deformable Moving BarrierDATE 10/5/81REFERENCE DISTANCE FROM REAR Backing Plate 21.1

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6		6	12	18	24	30	36
Lower Bumper	Pre		←					14.7						→
	Post		←					14.2						→
Upper Bumper	Pre		←					19.7						→
	Post		←					14.5						→
1/2 Bumper to Hood	Pre		←					26.5						→
	Post		←					24.0						→
Hood	Pre		←					32.5						→
	Post		←					30.0						→

HORIZONTAL DISTANCE FROM REFERENCE

Lower bumper	Pre		0	0	0	0	0	0	0	0	0	0	0	
	Post		15.3	15.7	16.3	17.5	18.0	18.1	17.5	17.4	17.3	16.7	16.3	
	Diff.		15.3	15.7	16.3	17.5	18.0	18.1	17.5	17.4	17.3	16.7	16.3	
Upper bumper	Pre		0	0	0	0	0	0	0	0	0	0	0	
	Post		9.9	10.9	11.5	12.4	13.6	13.7	12.7	12.3	11.7	11.2	10.8	
	Diff.		9.9	10.9	11.5	12.4	13.6	13.7	12.7	12.3	11.7	11.2	10.8	
1/2 Bumper to Hood	Pre		4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1	
	Post		10.1	7.9	7.9	7.8	8.9	9.5	7.5	7.5	8.1	8.8	9.1	
	Diff.		6.0	3.8	3.8	3.7	4.8	5.4	3.4	3.4	4.0	4.7	5.0	
Hood	Pre		4.0	4.0	4.0	4.0	4.0	6892-V-1	4.0	4.0	4.0	4.0	4.0	
	Post		4.2	7.0	8.2	7.9	9.1	9.2	8.8	8.4	8.7	8.1	6.6	
	Diff.		.2	3.0	4.2	3.9	5.1	5.2	4.8	4.4	4.7	4.1	2.6	

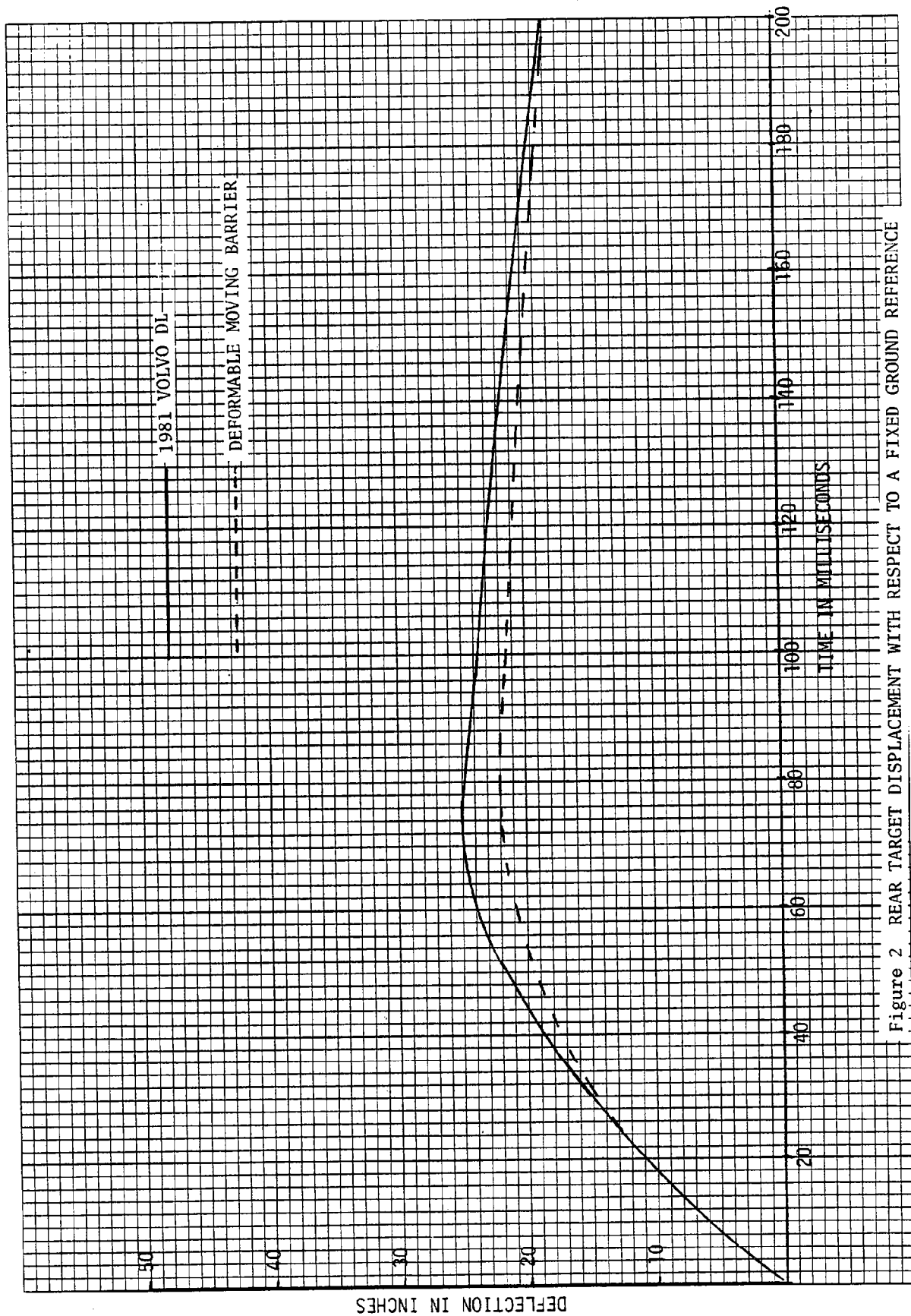
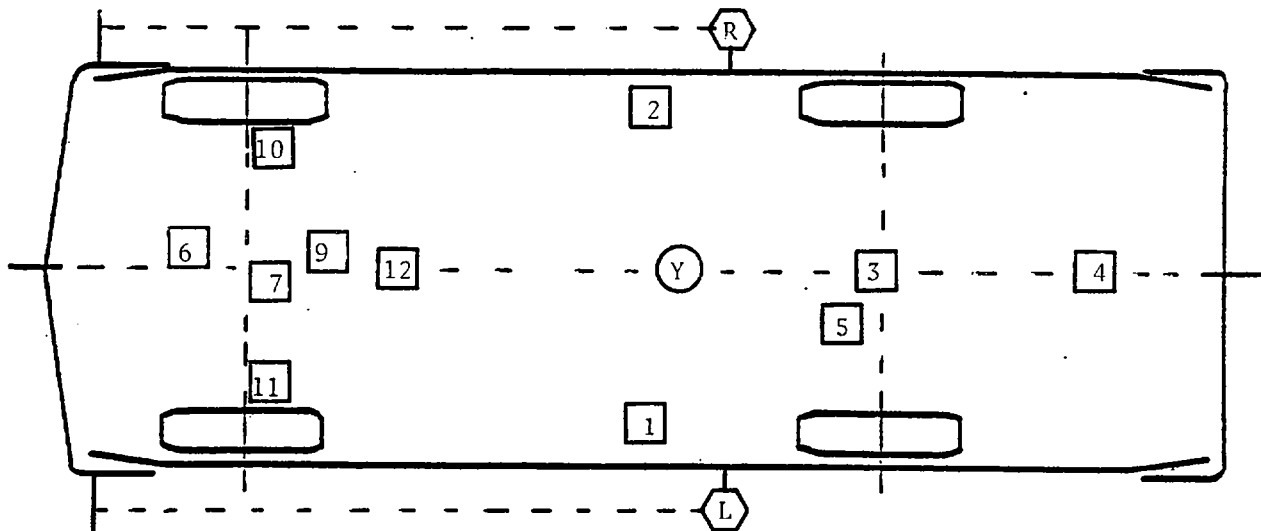


Figure 2 REAR TARGET DISPLACEMENT WITH RESPECT TO A FIXED GROUND REFERENCE

TOP VIEW



ACCELEROMETER NUMBER *	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Rocker panel near LF "B" pillar	X		X
2	Rocker panel near RT "B" pillar	X		X
3	C/L of rear deck	X	X	X
4	Rear bumper crossmember	X		X
5	Rear axle	X		X
6	Top of engine block	X		X
7	Front crossmember	X		X
9	Bottom of engine	X		X
10	RT brake caliber	X		
11	LF brake caliber	X		
12	Firewall	X		X
Y	Yaw rate gyro			X
R	RT bumper deflection	X		
L	LF bumper deflection	X		

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

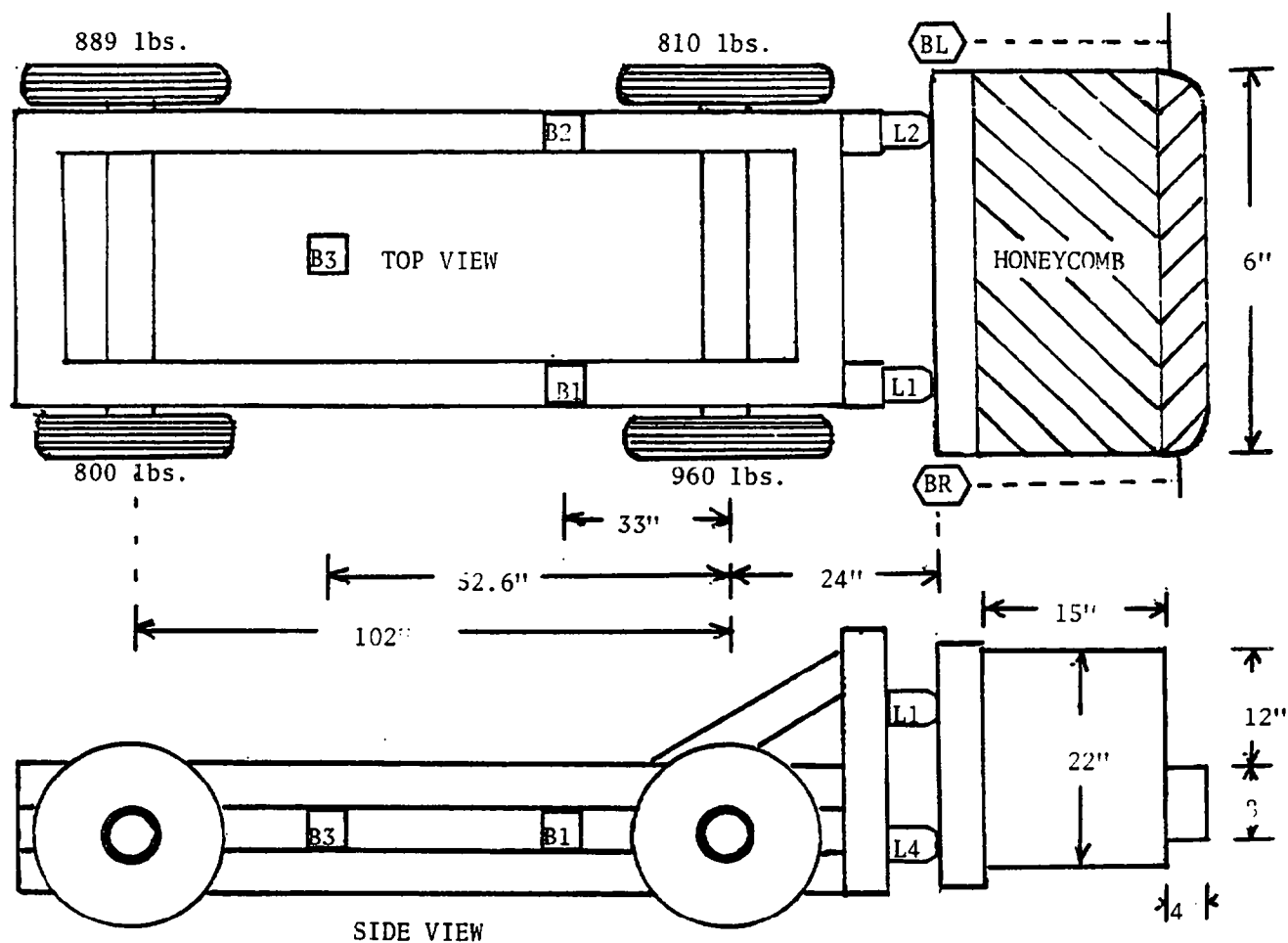
Vehicle No. 1 - 1981 Volvo DL
Figure 3 VEHICLE NO. 1 - INSTRUMENTATION

VEHICLE No. 1 - 1981 Volvo DL

TEST 752-1-527 DATE 10/5/81

TRANSDUCER NUMBER	INCHES FROM REAR	INCHES LEFT OF C/L	ON C/L	INCHES RIGHT OF C/L
1	74.0	20.2		
2	74.0			19.6
3	47.5		X	
4	11.7			17.4
5	49.8	9.5		
6	158.2			4.7
7	151.2			
8				
9	149.3	6.5		
10	151.1	26.5		
11	151.2			26.5
12	141.1	1.0		
Y				

TABLE 8 VEHICLE TRANSDUCER LOCATION MEASUREMENTS



TRANSDUCER NUMBER*	TRANSDUCER LOCATION	DIRECTION		
		X	Y	Z
B1	RT upper frame rail accel.	x		x
B2	LT upper frame rail accel.	x		x
B3	C/G accel.	x	x	x
BR	Right bumper deflection	x		
BL	Left bumper deflection	x		
L1	Top right load cell	x		
L2	Top left load cell	x		
L3	Bottom left load cell	x		
L4	Bottom right load cell	x		

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

Figure 4 VEHICLE NO. 2 - MOVING BARRIER TRANSDUCER LOCATIONS

NOTE: Camera Information Shown on Table 9 and 10

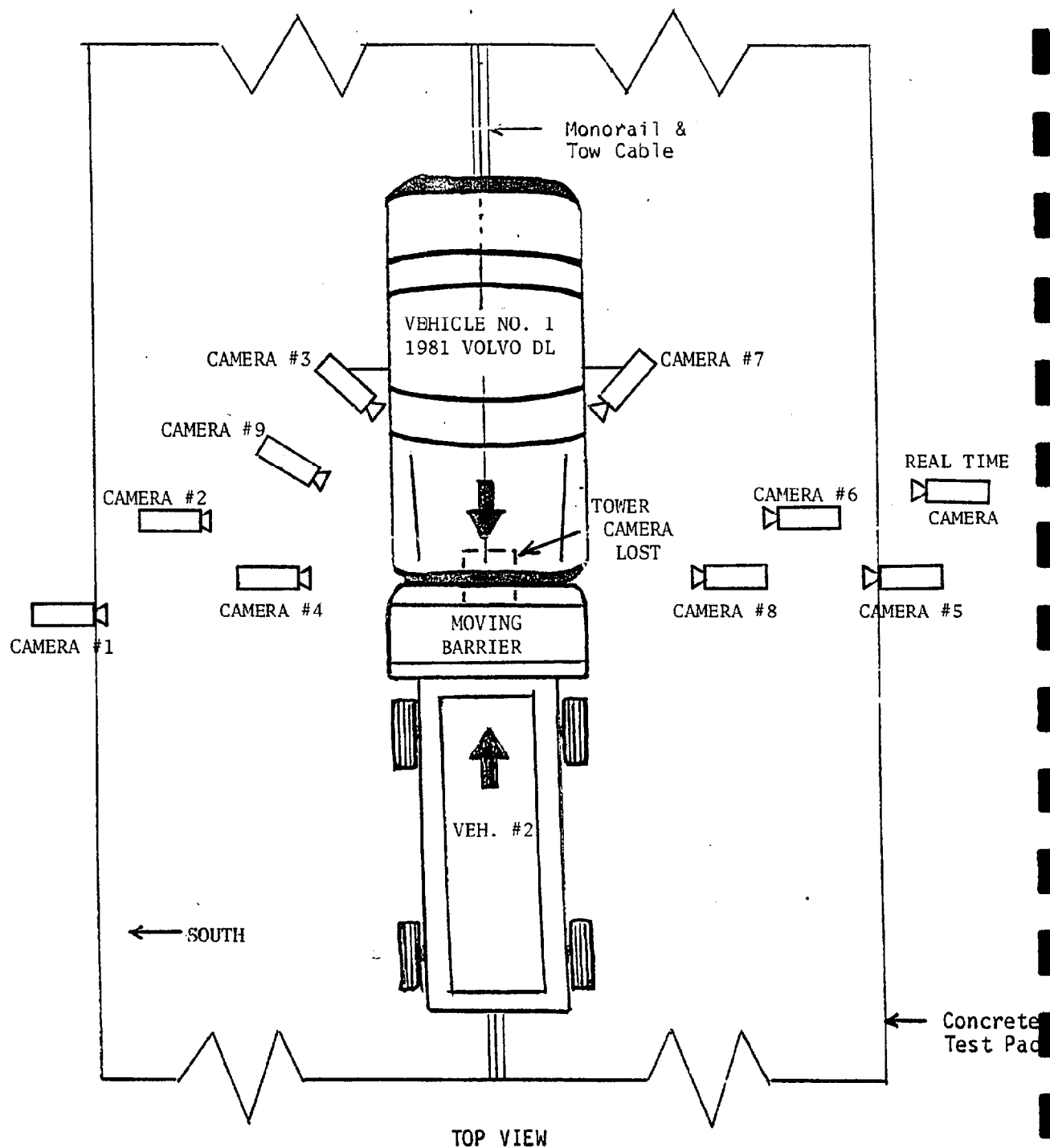


FIGURE 5 CAMERA POSITION FOR FRONTAL IMPACTS

TABLE 9

HIGH SPEED CAMERA LOCATIONSTest No.: 752-1-527Vehicle No. 1 1981 Volvo DL

CAMERA NUMBER	VIEW	CAMERA POSITIONS (IN)*			CAMERA ANGLE (DEG)**	FILM PLANE TO HEAD TARGET (IN) X
		X	Y	Z		
1	Overall of vehicle No. 1 & 2 (RT)	540	0	41	-2	---
2	Overall of vehicle No. 1 (RT)	405	48	42	-1	387
3	Right front passenger	---	--	--	--	---
4	Front of vehicle No. 1 & 2 (RT)	312	0	14	-3	294
5	Overall of vehicle No. 1 & 2 (LF)	504	0	41	-1	---
6	Overall of vehicle No. 1 (LF)	408	36	41	-1	390
7	Driver	---	--	--	--	---
8	Front of vehicle No. 1 & 2 (LF)	399	0	13	+3	381
9	Vehicle No. 1 & 2	222	108	123	-19	---

* X = film plane to monorail centerline

Y = film plane to impact location

Z = film plane to ground

** Referenced to Horizontal Plane

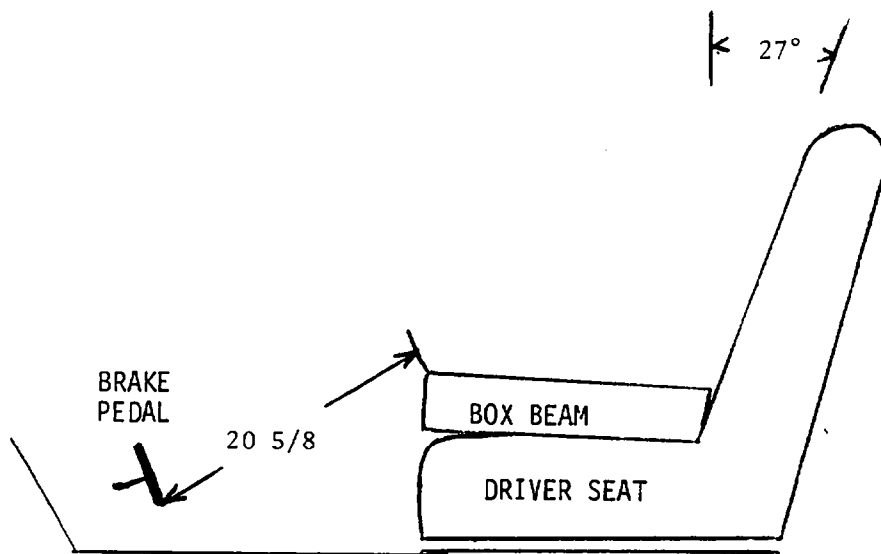
TABLE 10

HIGH SPEED CAMERA INFORMATION (TEST 752-1-527)

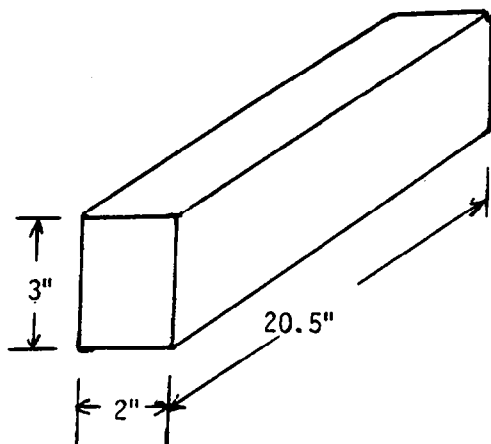
CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	Vehicle No. 1 & 2	Photosonic	13 mm	900
2	Vehicle No. 1	Photosonic	13 mm	900
3	RT front passenger	Stalex	8 mm.	No timing
4	Front of vehicle No. 1 & 2	Photosonic	25 mm	900
5	Vehicle No. 1 & 2	Photosonic	13 mm	900
6	Vehicle No. 1	Photosonic	13 mm	900
7	Driver	Stalex	8 mm	No timing
8	Front of vehicle No. 1 & 2	Photosonic	25 mm	900
9.	Vehicle No. 1 & 2	Photosonic	13 mm	900

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 OF FILM.



DISTANCE AFT FROM MID-SEAT
TRACK POSITION



BOX BEAM DIMENSIONS

FIGURE 6 DRIVER SEAT POSITION

FIGURE 7
PART 572 DUMMY IN-VEHICLE POSITION

Test No. 752-1-527

Vehicle 1981 Volvo DL

SEAT TYPE:

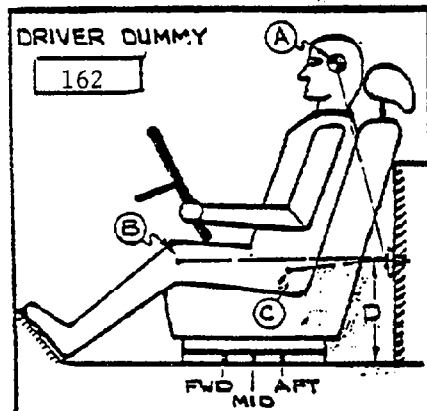
 Bench
 x Bucket
 Split Bench

ADJUSTER TYPE:

 x Manual
 Power

BUCKET SEAT BACK TYPE:

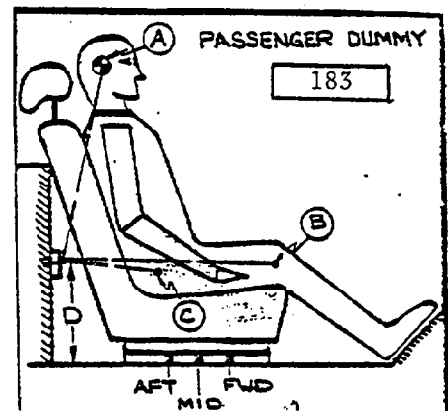
 Fixed
 x Adjustable Reclining



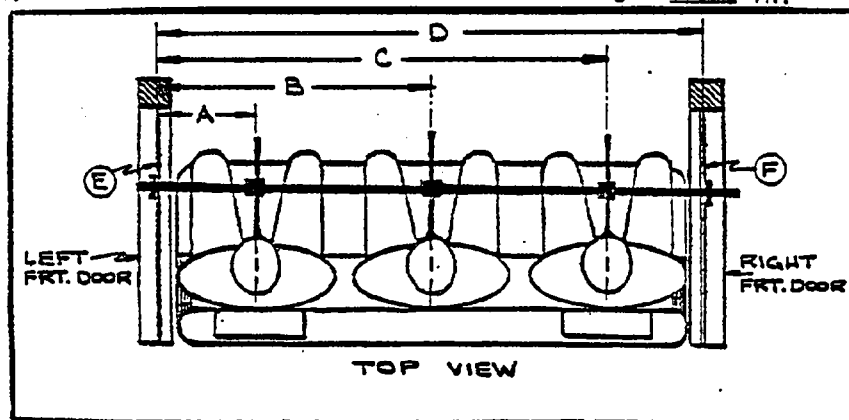
A = 23.0 in. 21.0 Degrees
B = 30.5 in. 96 Degrees
C = 16.0 in. 110 Degrees
D = 15.0 in.

MEASUREMENT LOCATION

A - Head Target
B - Knee Joint
C - Approximate 'H' Point
D - Sill to Reference Point



A = 22.3 in. 20 Degrees
B = 30.2 in. 95 Degrees
C = 15.5 in. 110 Degrees
D = 15.0 in.



TOP VIEW

DUMMY ID

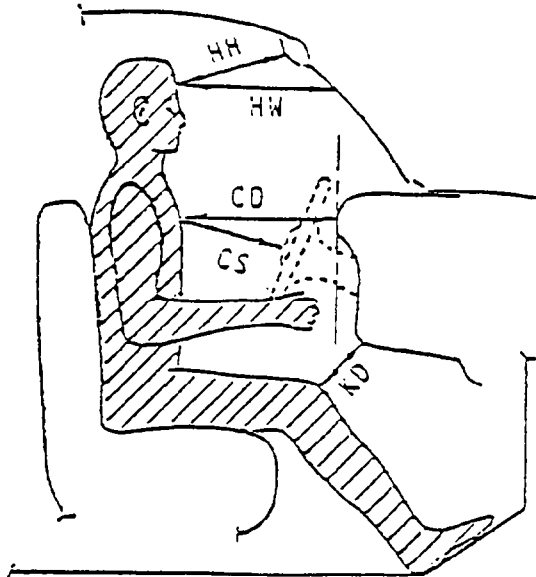
162

183

A	=	Left Door to Driver Centerline	<u>12.5</u> in.
B	=	Left Door to Center Passenger Centerline	<u> </u> in.
C	=	Left Door to Right Passenger Centerline	<u>41.2</u> in.
D	=	Left Door to Right Door	<u>51.5</u> in.
E, F	=	Window Glass Height (Right and Left Must be Equal)	<u>11.0</u> in.

1981 VOLVO DL

	<u>DRIVER</u>	<u>PASS</u>
HH	18.0	18.2
HW	23.7	24.0
CD	22.5	24.2
CS	15.2	
KDL	8.0	8.7
KDR	7.7	8.7



HR	6.2	5.7
HS	7.5	7.2
AD	3.7	4.2
HD	7.7	7.5

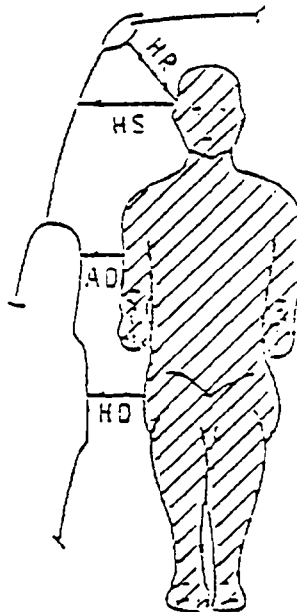


Figure 8 OCCUPANT CLEARANCE DIMENSIONS

TABLE 11
DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G") *							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	-68	-34	28	75.9	-30	-14	-23	31.2
DUMMY (2)	-15	26	30	38.3	-24	29	15	36.7
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	2050	475
DUMMY (2)	750	125
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)	1600	1300	1410
DUMMY (2)	1275	1475	2150
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
DUMMY (1)	352.1	.0411	.1197	28.9	625.6
DUMMY (2)	361.3	.0411	.1803	23.2	443.6
DUMMY (3)					
DUMMY (4)					

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

TABLE 12
TEST PROCEDURE CHECK LIST

ITEM NO.	DESCRIPTION	CHECK BY	DATE	COMMENTS
1.	Inflate tires to recommended mfg's cold pressure for vehicle capacity weight (including spare). Check tires for recommended size.	M.R.	9-15	
2.	Fill out summary sheet. Apply identification number to vehicle.	M.R.	9-15	
3.	Inspect vehicle and record any damage or missing parts.	M.R.	9-15	
4.	Add fluids to specified levels or fill to capacity.	M.R.	9-15	
5.	Weigh vehicle and record weight at each wheel on summary sheet.	M.R.	9-15	
6.	Apply reference height marks at each wheel and record on summary sheet.	M.R.	9-15	
7.	Pump fuel from tank and run engine until fuel lines are empty.	Jc	9/21	
8.	Drain following fluids from vehicle and check N/A if not applicable: ☒ a) coolant ☒ b) engine oil ☒ c) transmission fluid ☒ d) windshield washer fluid ☒ e) battery acid (drain & flush) ☒ f) power steering fluid	Jc	9/21	
9.	Fill fuel tank to recommended EPA capacity with red dyed Stoddard solvent. Record volume of Stoddard on Summary Sheet. Crank engine to fill carburetor.	N/A		
10.	Siphon 7% of solvent from fuel tank and record amount removed on Summary Sheet.	N/A		

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
11.	Perform pre-test vehicle measurements	W.S.	9/21	
12.	Mark forward-most and rear-most positions of seat. Measure and mark seat and sill mid-positions.			
13.	Install mounting plates for accelerometers as specified in the Test Plan.	Jc	9/21	
14.	Install mounting plate and instrumentation in trunk area.	Jc	9/21	
15.	Install accelerometers.	Jc	9/22	
16.	Place certified dummies in both front seats with seats in correct position.	Jc	9/29	
17.	Install seat belt load cells on lap and torso portions on both front seat belts and make provisions to remove weight of the load cells.	DWH	9-29	
18.	Install on-board lighting to illuminate field of view of ground cameras.	DWH	9-29	
19.	Route and secure all electrical cables.	DWH	9-30	
20.	Install speed trap breaker bar on vehicle.	Jc	10/1	
21.	Install guide rollers and abort straps to vehicle.	Jc	10/1	
22.	Weigh vehicle and add ballast if required. Place ballast so that weight distribution will be as close as possible to delivered distribution. Record on Summary Sheet.	Jc	10/1	
23.	Measure and record ride height.	NRZ	10/5/81	
24.	Apply targets and tape striping as specified in TP-212-02 - (Laboratory Procedure for Vehicle Assessment.)	Jc	9/30	

AT IMPACT SITE

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED		DATE	COMMENTS
		BY			
25.	Position vehicle front to bumper at impact point.	WZ		10/5/81	
26.	Photograph the following:				
	a) Vehicle overall & closeup left and right views.	WZ		10/5/81	
	b) Windshields overall and close-up left and right quarter views	WZ			
	c) Real time documentary	WZ			
27.	Align and focus stationary high speed cameras.	WZ			
28.	Measure and document camera positions.	WZ		10/5/81	
29.	Test operation of all high speed cameras.	WZ		10/5/81	
30.	Set up speed traps and measure breaker bar when vehicles are at impact point.	WZ		10/5/81	
31.	Check vehicle attitude and ride height and document on summary sheet.	WZ		10/5/81	
32.	Check speed traps operation.	WZ		10/5/81	
33.	Move test vehicles to starting point	WZ		10/5/81	
<u>STARTING POINT PROCEDURE</u>					
34.	Adjust dummy positions as per dummy positioning check list and make required measurements.	WZ		10/5/81	
35.	Connect umbilical cables.				
36.	Make operation check of all instrumentation and calibrate system.	WZ		10/5/81	
37.	Take all pre-test photographs.	WZ		10/5/81	

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
38.	Check operation of camera interlock and flash bulbs correlation.	RFS	10/5/81	
39.	Latch trunk and leave key in lock.	WZ	10/5/81	
40.	Verify that fuel tank cap is tight.	WZ	10/5/81	
41.	Place transmission in neutral. Release parking brake.	WZ	10/5/81	
42.	Verify that hood latch is latched.	WZ	10/5/81	
43.	Close all windows & vents (except front windows).	WZ	10/5/81	
44.	Close doors leave unlocked.	WZ	10/5/81	
45.	Check operation of all systems.	WZ	10/5/81	
46.	Record temperature of interior of vehicle.	WZ	10/5/81	
47.	Complete countdown procedures and proceed with test.	WZ	10/5/81	
POST-TEST PROCEDURES				
48.	Make operational check of all instrumentation.	WZ	10/5/81	
49.	Photograph with real time camera:	RFS	10/5/81	
a)	Post-test overall scene.			
b)	Close-up of pertinent damage to windshield or fuel system.			
c)	Dummies failed restraints or failed seat anchorages.			
d)	Any other type of failure.			
e)	Opening of vehicle doors.			

TABLE 12 (cont'd)

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
50.	Take post-test still photographs. Record visual observations of vehicle condition, dummy positions, any anomalies, etc.	MLZ	10/5/81	
51.	Separate vehicles and photograph front of each vehicle.	MLZ	10/5/81	
52.	Remove umbilicals.	MLZ	10/5/81	
	Remove vehicles from test track.	MLZ	10/5/81	

APPENDIX A
STILL PHOTOGRAPHS

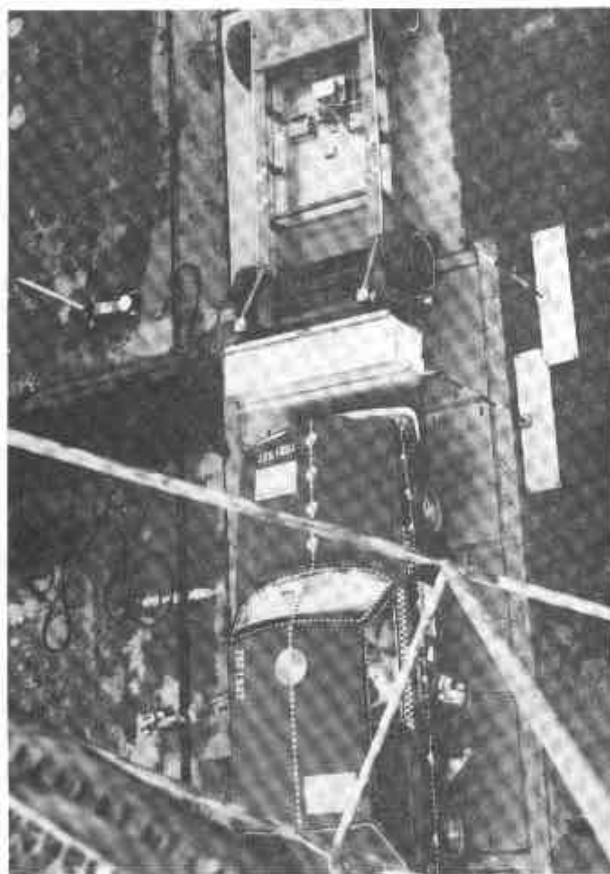
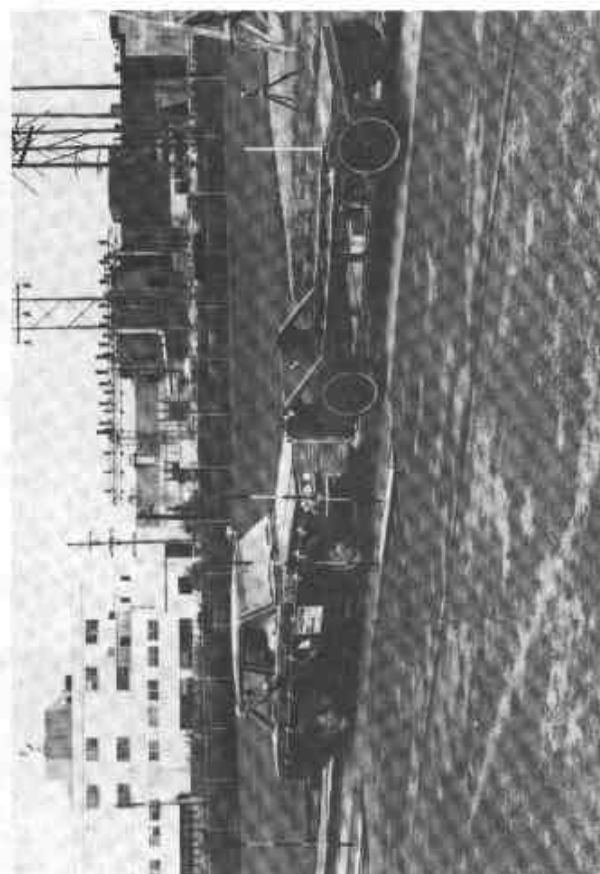
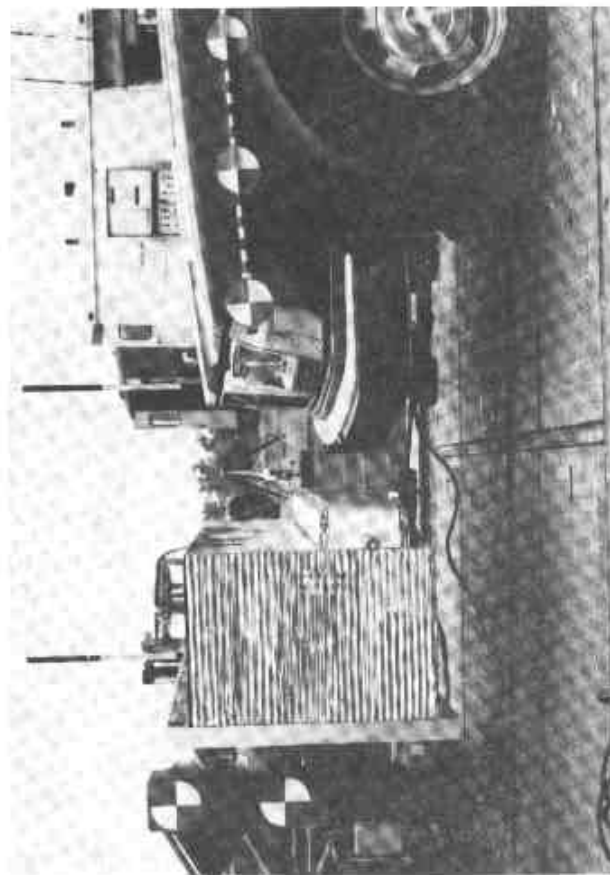
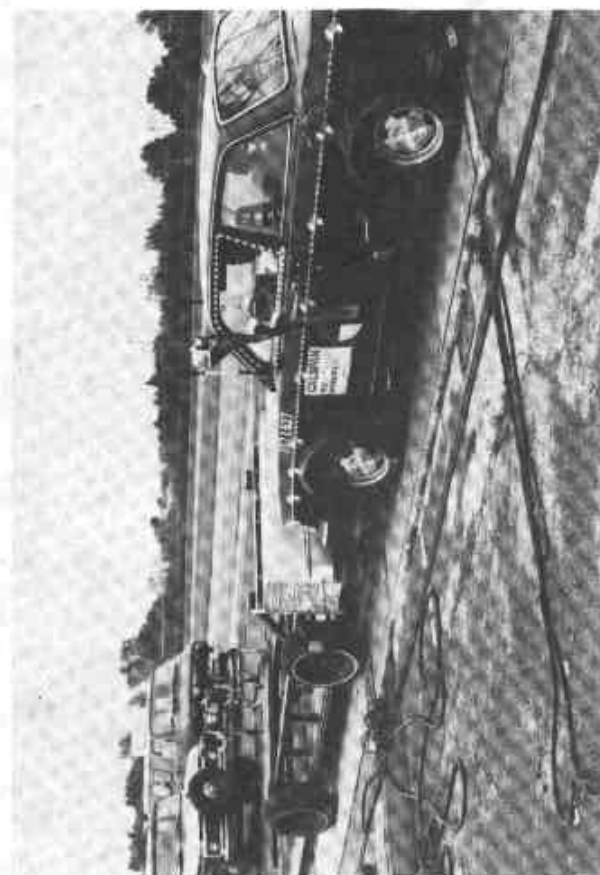


FIGURE A-1 VEHICLES NOS. 1 AND 2 - PRE-TEST IMPACT CONFIGURATION

A-2

6892-V-1

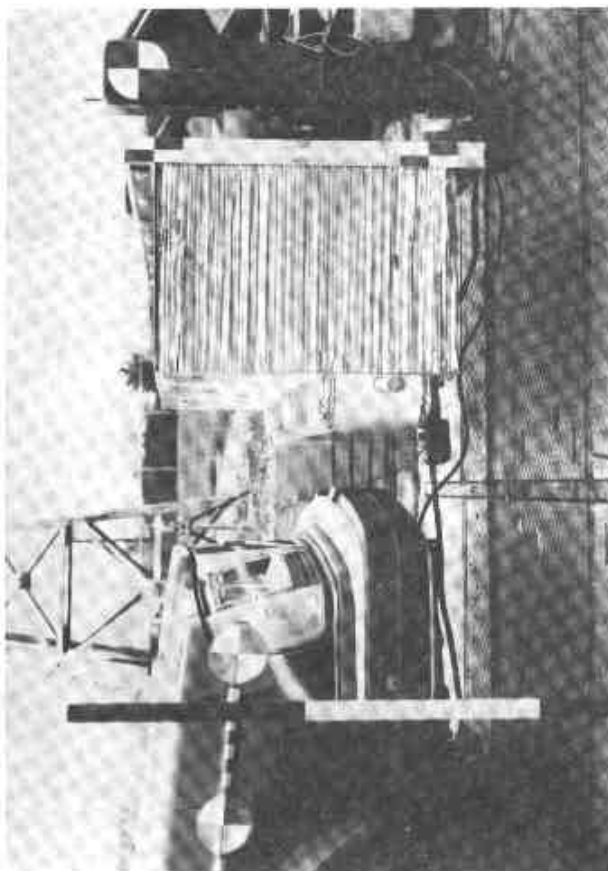
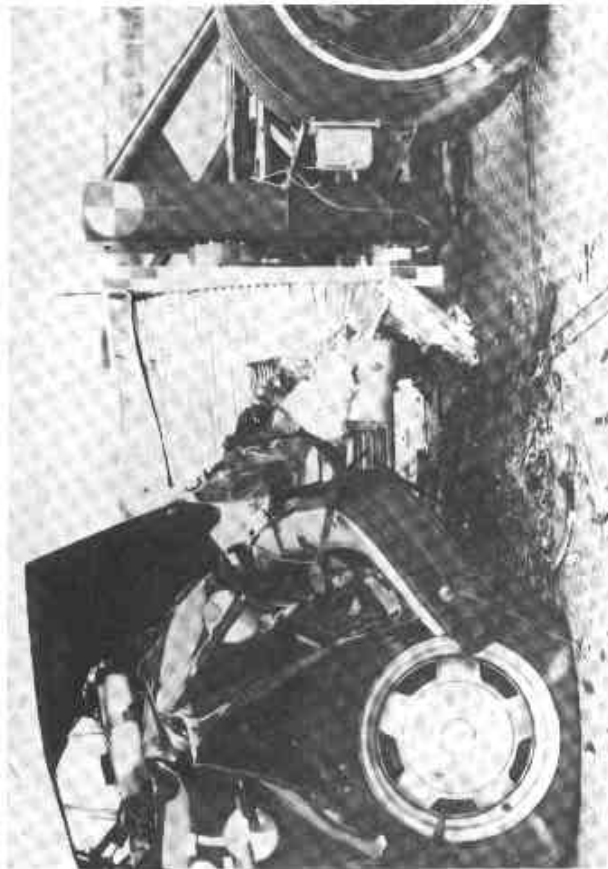
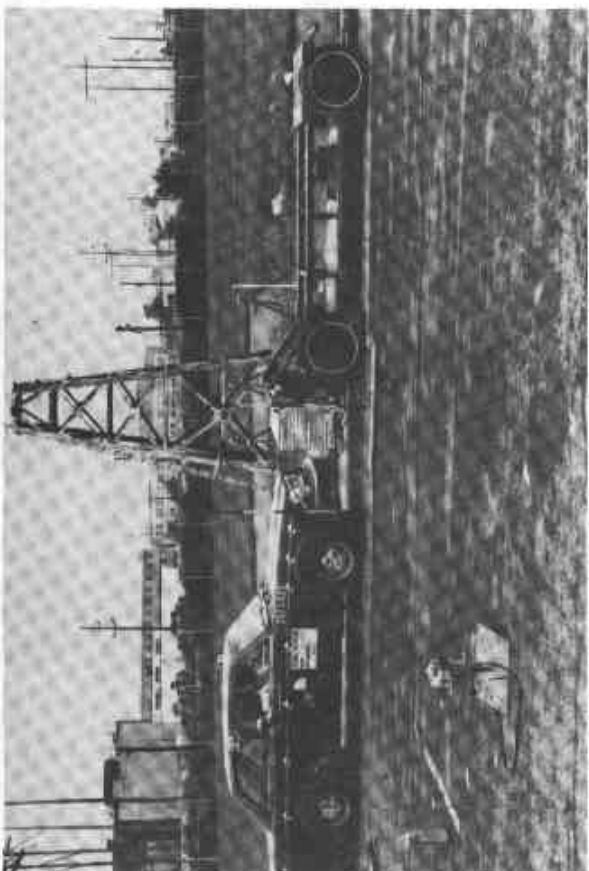
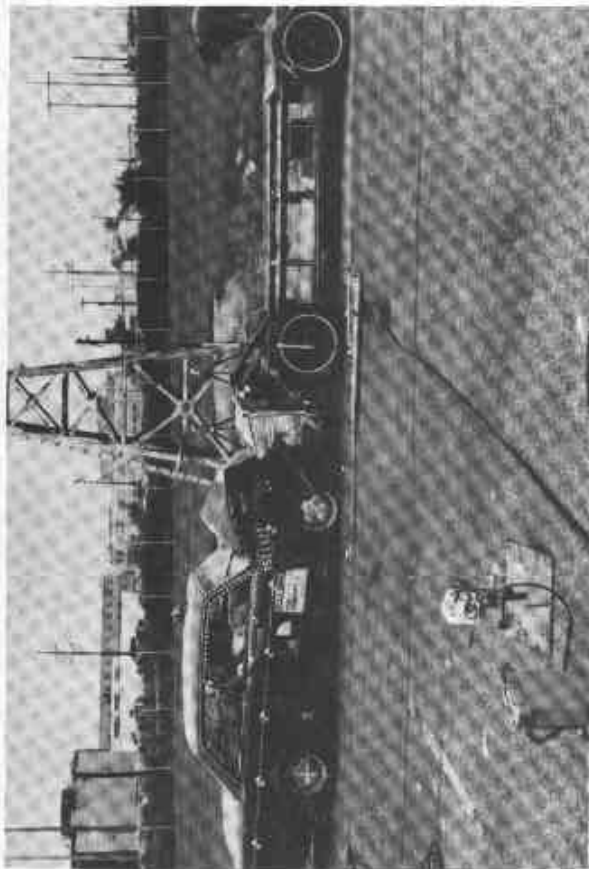


FIGURE A-2 VEHICLES NOS. 1 AND 2 - PRE- AND POST-TEST IMPACT CONFIGURATION

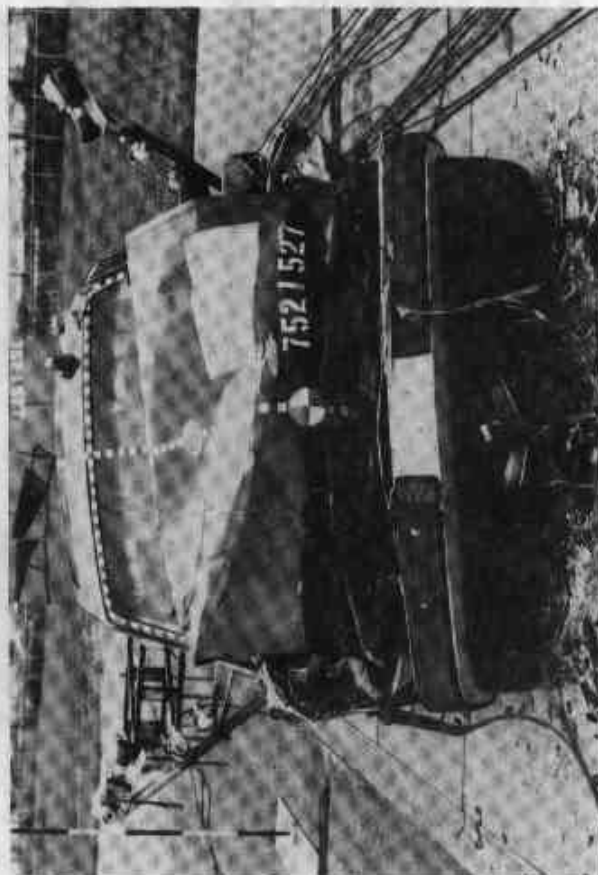
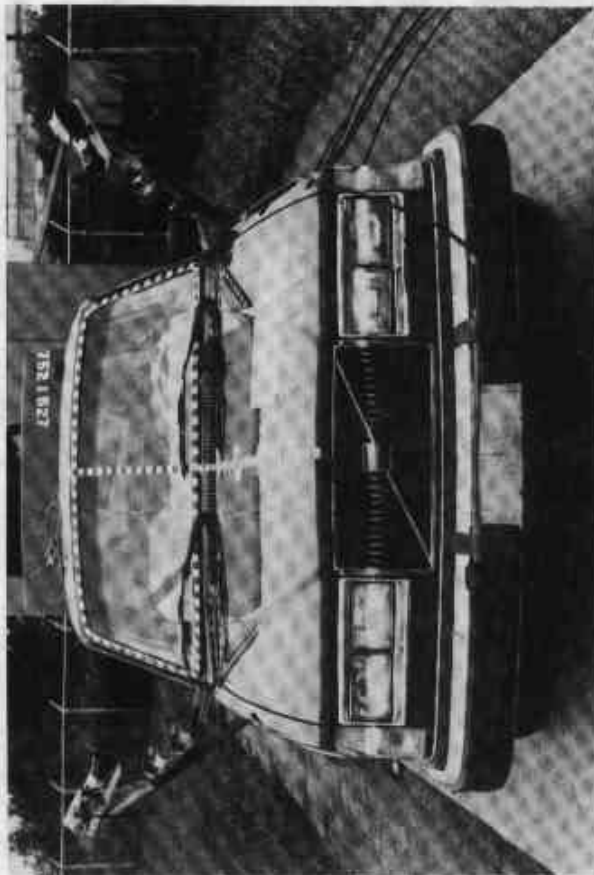
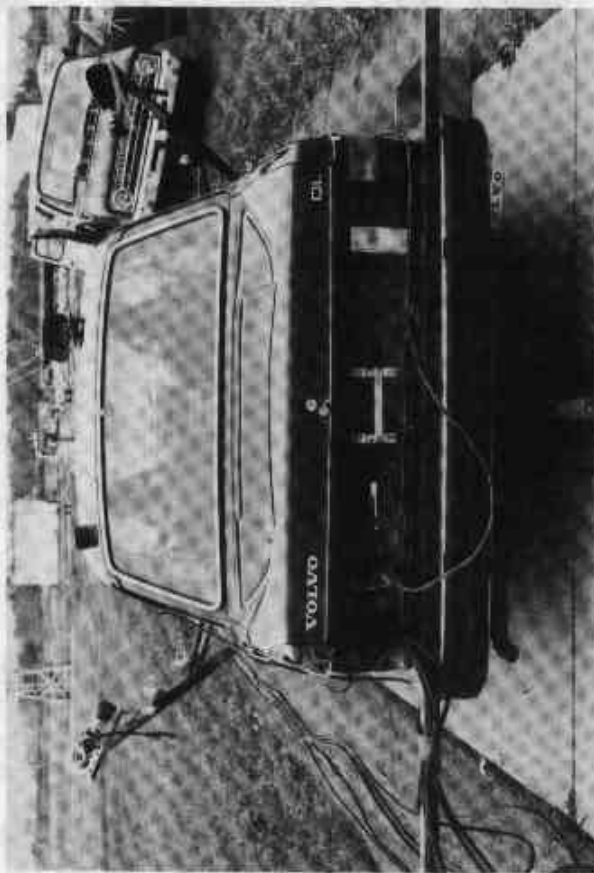


FIGURE A-3 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR

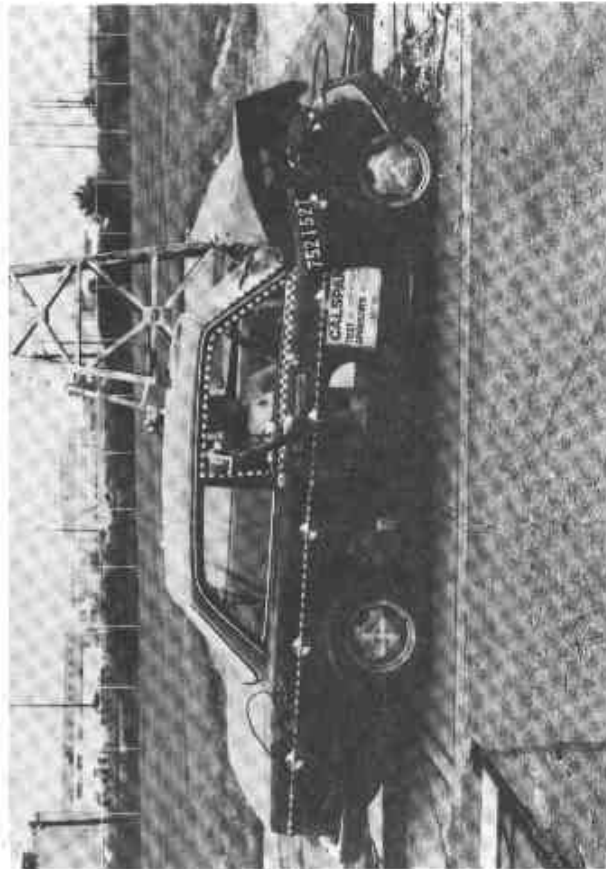
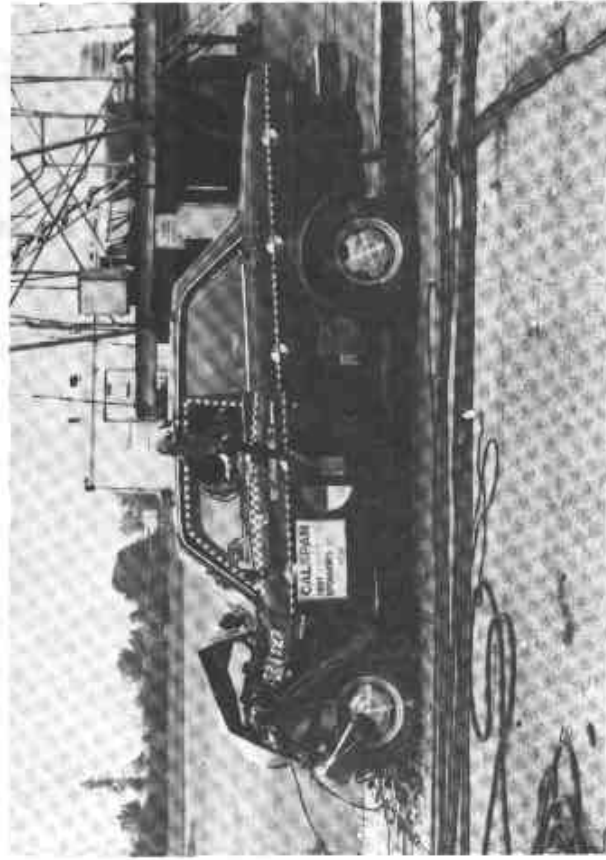
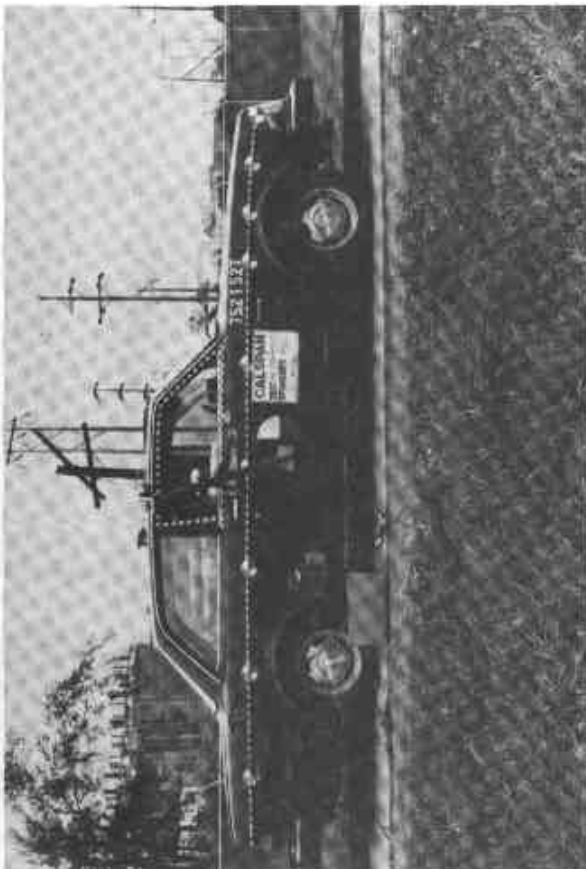
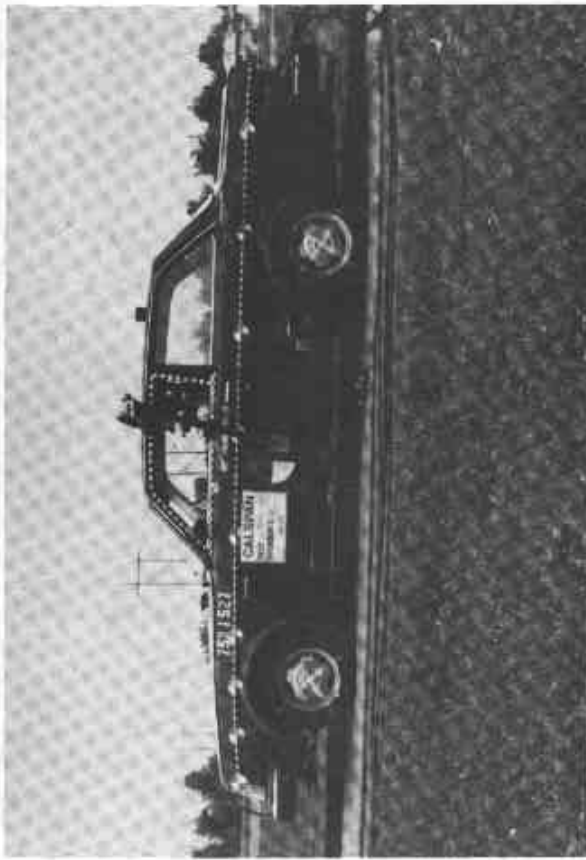


FIGURE A-4 VEHICLE NO. 1 - PRE - AND POST-TEST OF RIGHT AND LEFT SIDES

A-5

6892-V-1

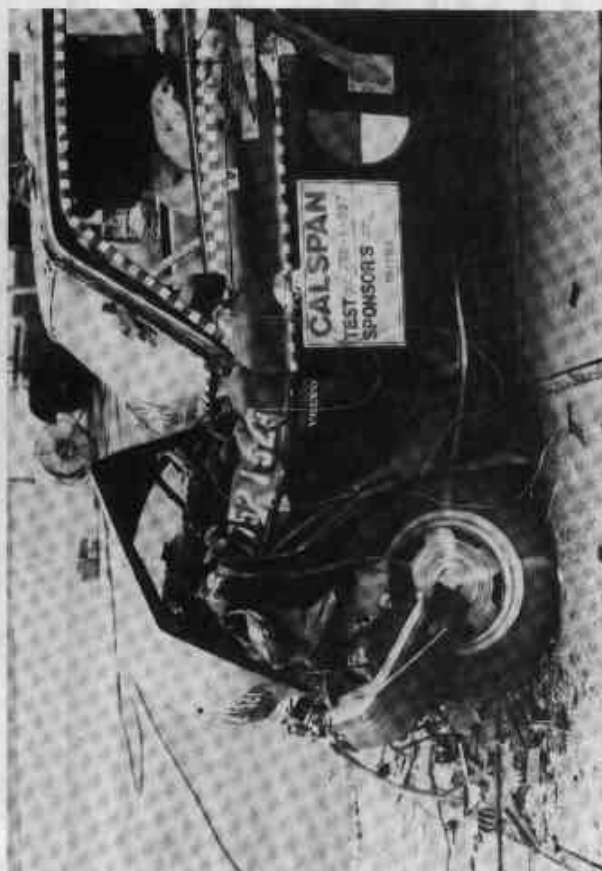
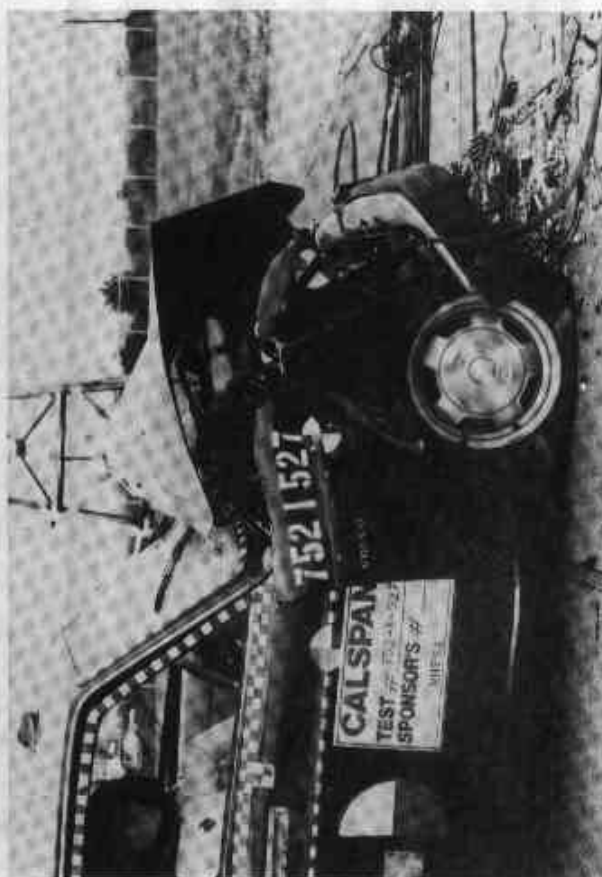
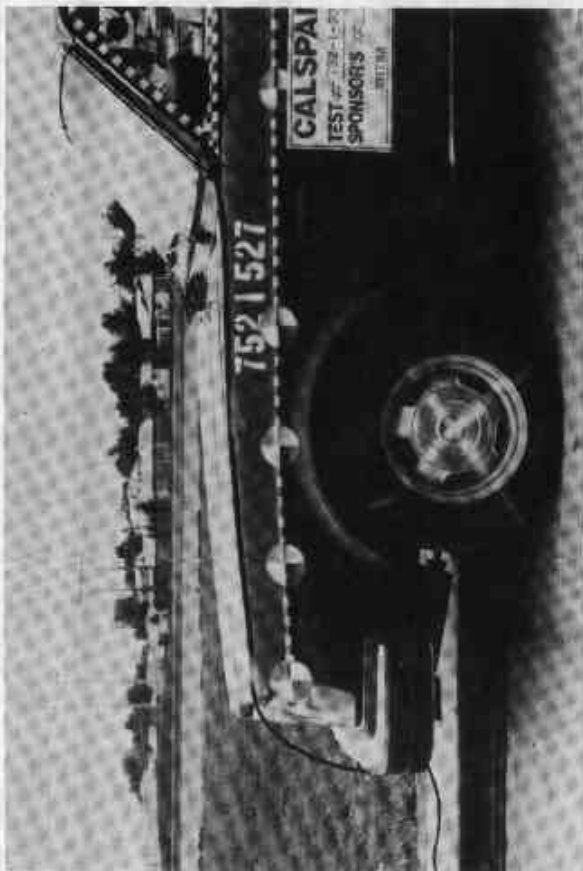


FIGURE A-5 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTERS

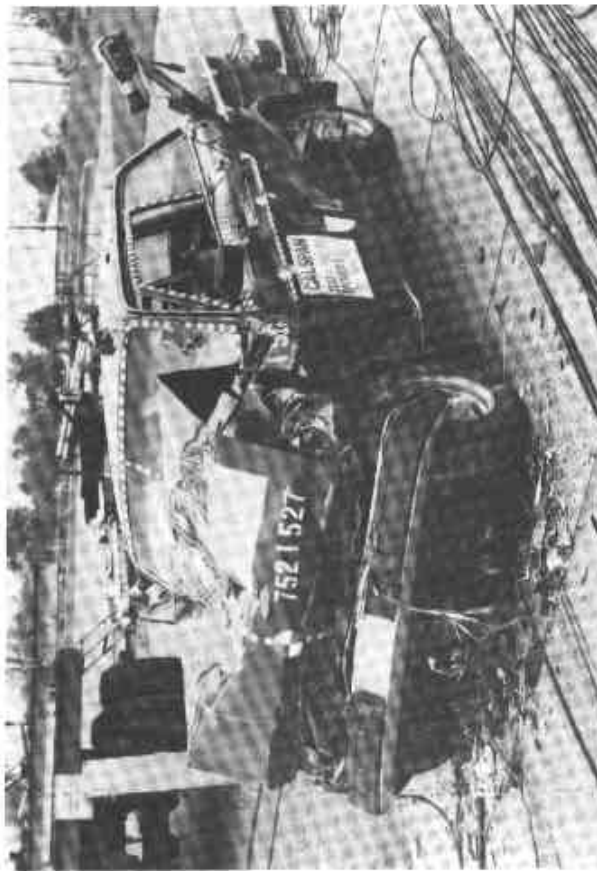


FIGURE A-6 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT THREE-QUARTERS

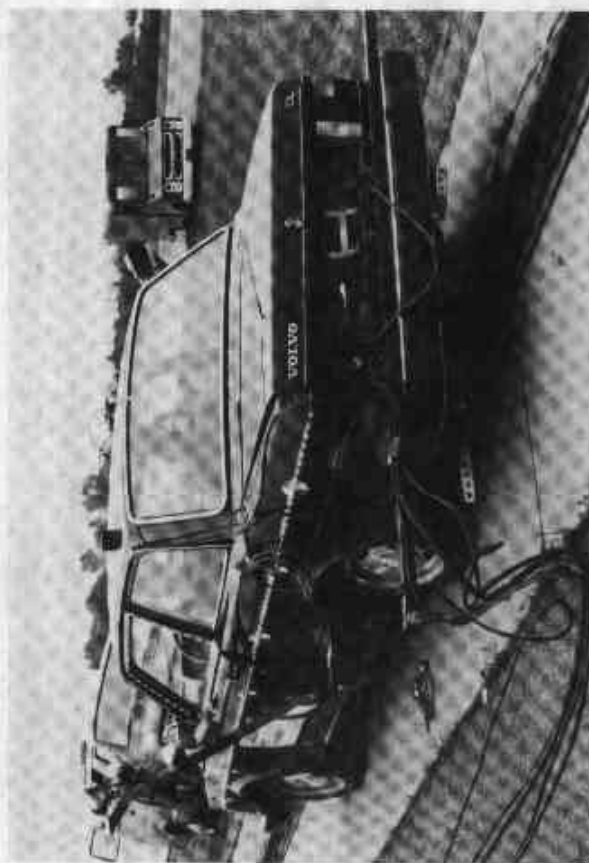


FIGURE A-7 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF REAR THREE-QUARTERS

A-8

6892-V-1

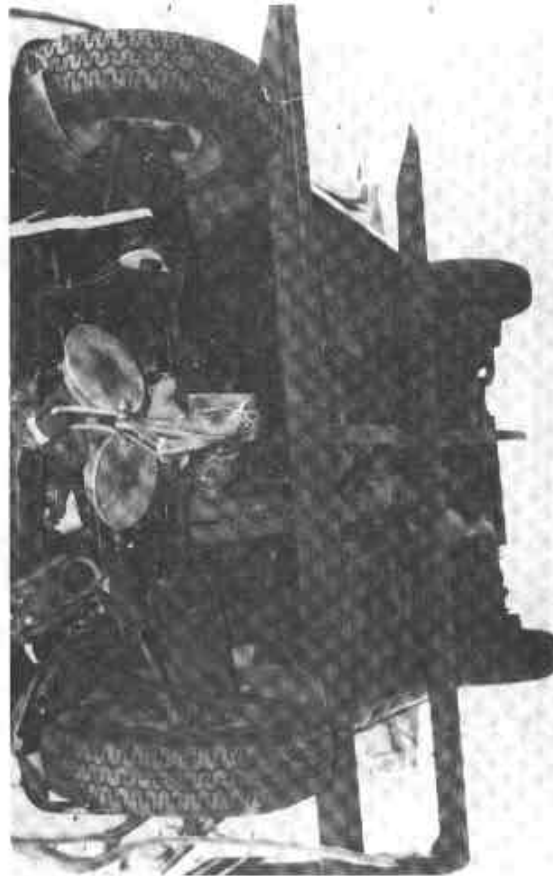
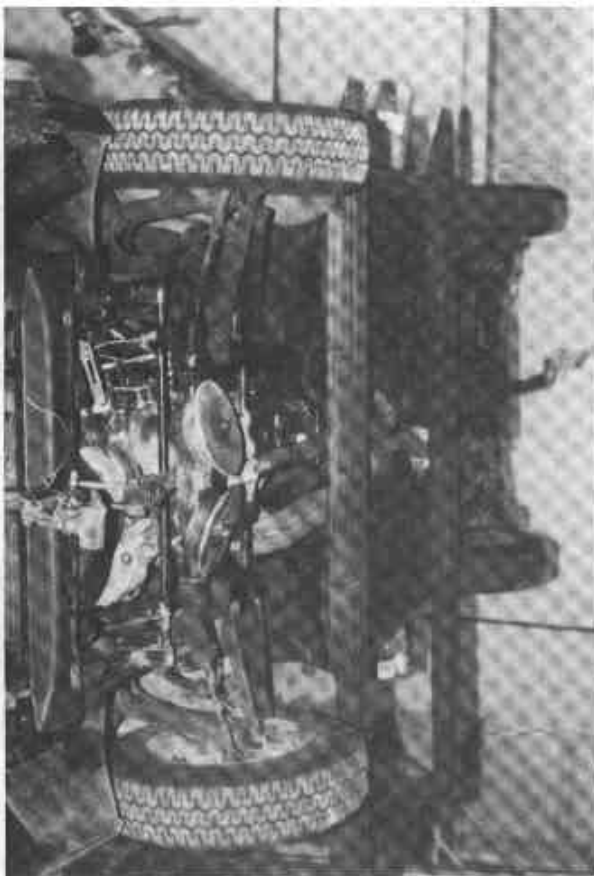
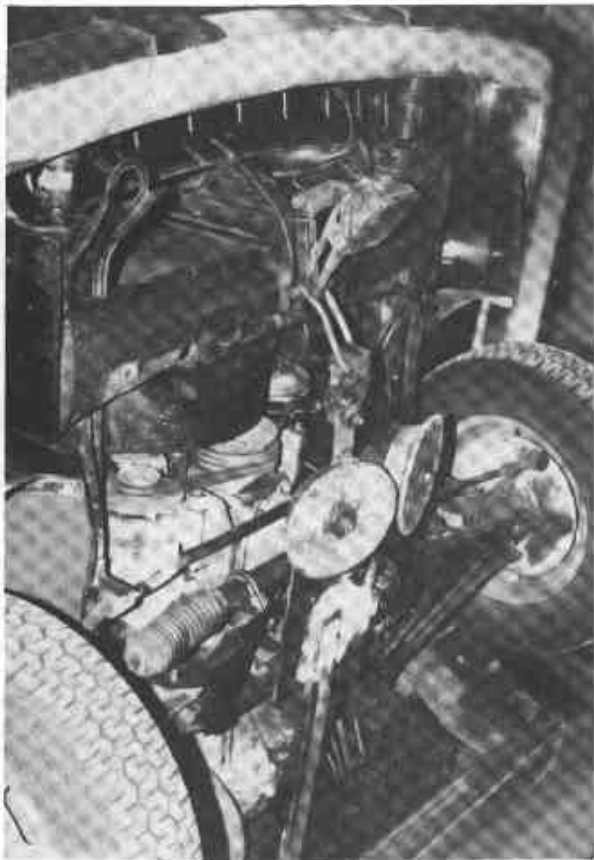


FIGURE A-8 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT UNDERBODY



FIGURE A-9 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF REAR UNDERBODY

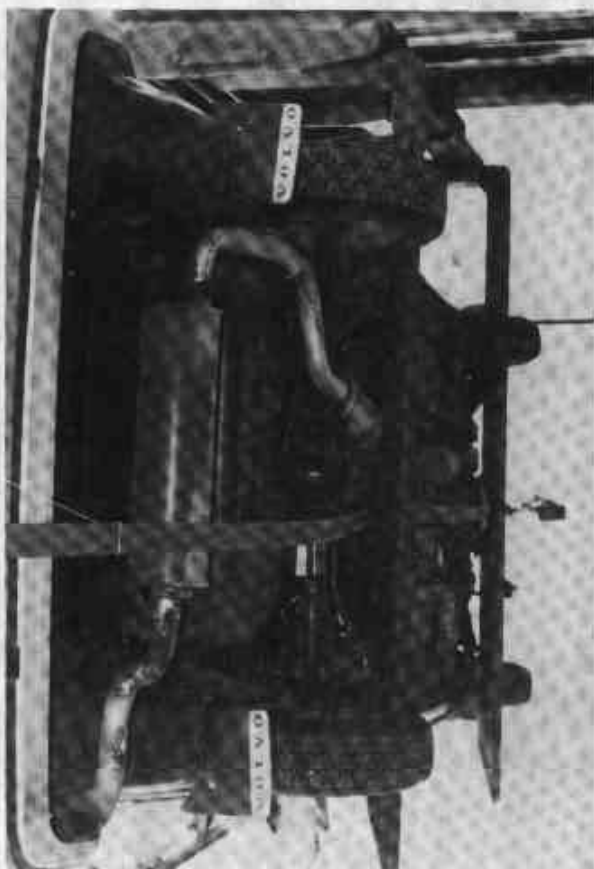
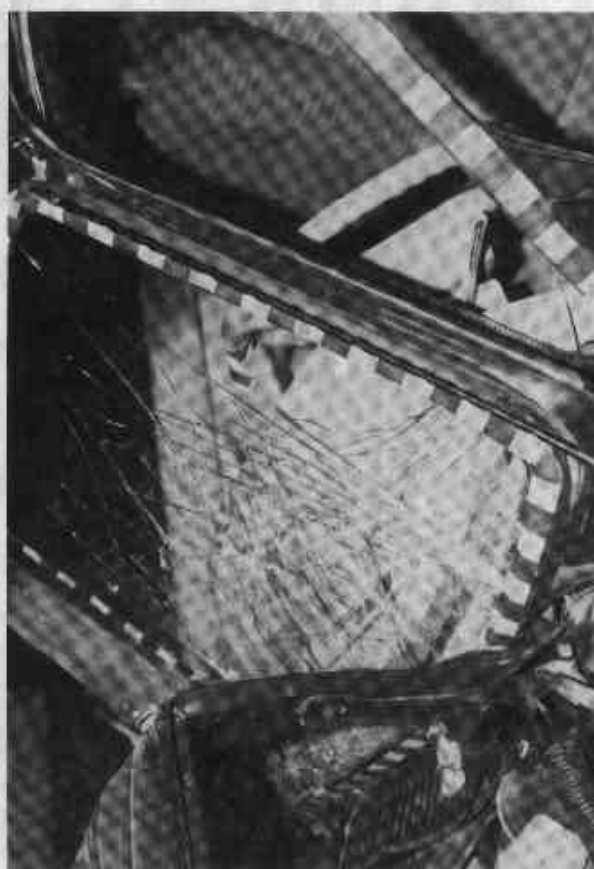


FIGURE A-10 VEHICLE NO. 1 - POST-TEST VIEWS OF WINDSHIELD CRACKS



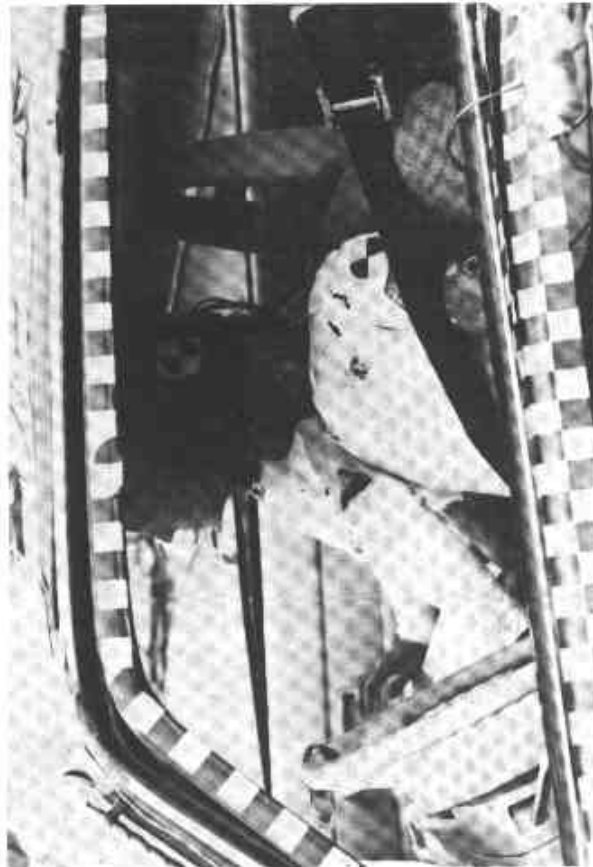


FIGURE A-11 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF DRIVER POSITIONS

A-11

6892-V-1



FIGURE A-12 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OR RIGHT FRONT PASSENGER POSITIONS

A-12

6892-V-1

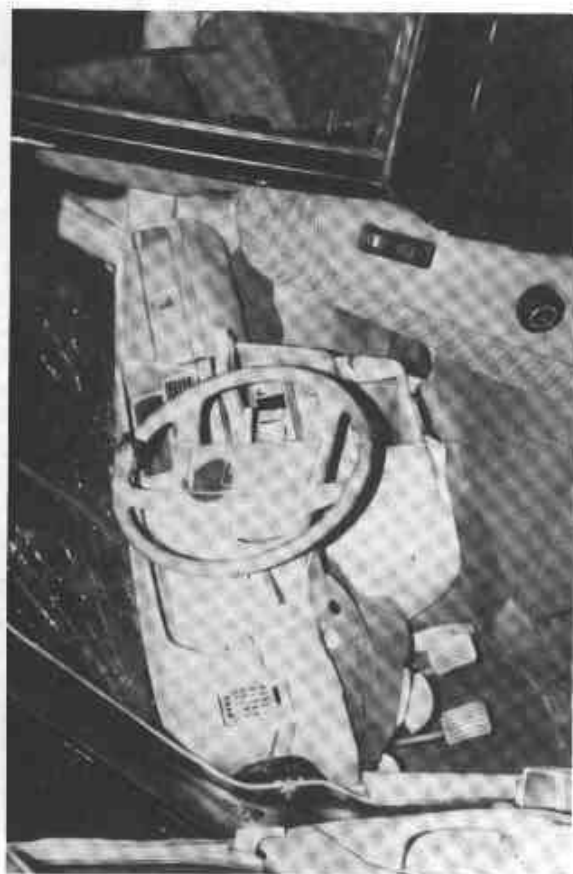


FIGURE A-13 VEHICLE NO. 1 - POST-TEST VIEWS OF VEHICLE INTERIOR



A-13

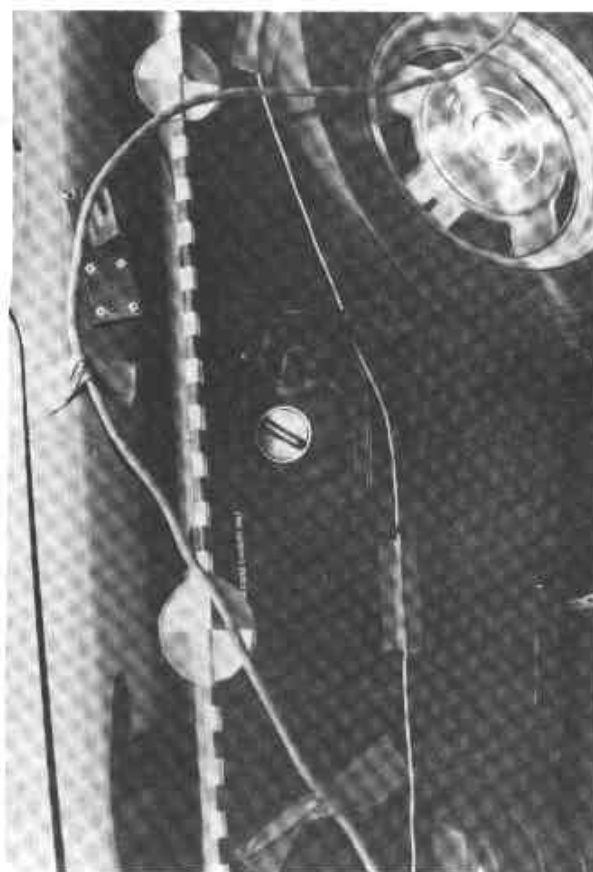
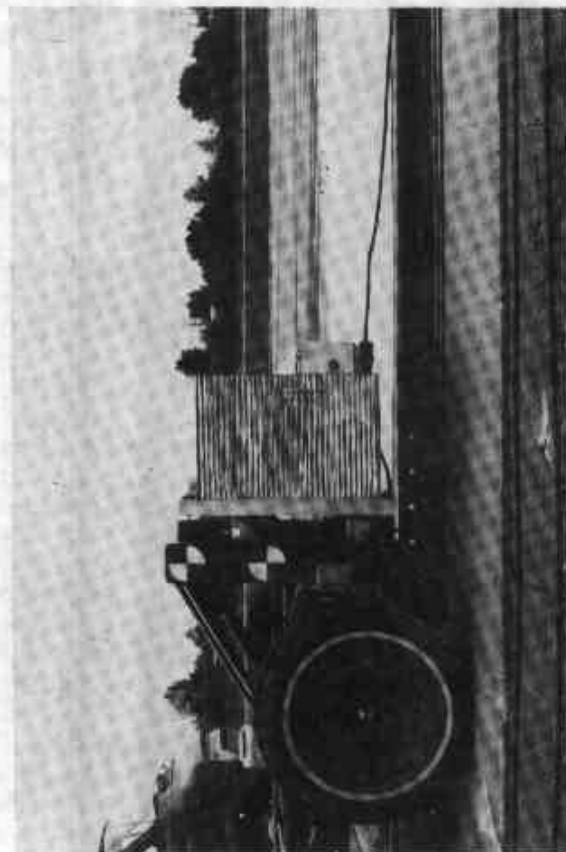


FIGURE A-14 VEHICLE NO. 1 - VIEW OF FILLER TUBE AND CAP

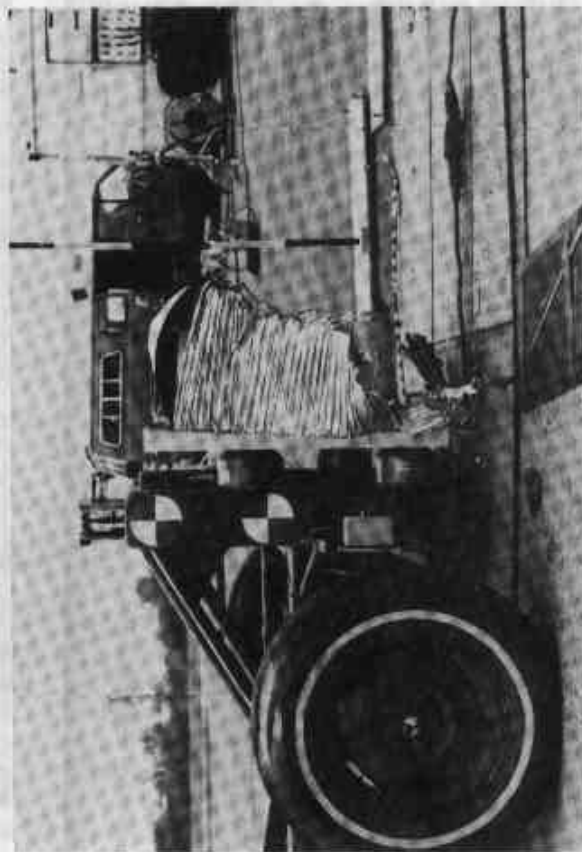
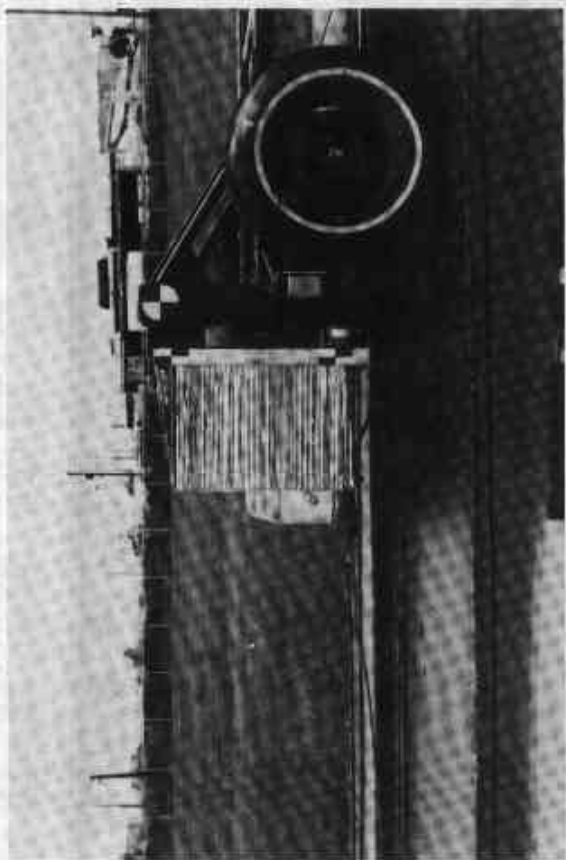
6892-V-1



FIGURE A-15 VELOCITY TRAP COUNTER DISPLAY



A-14



6892-V-1

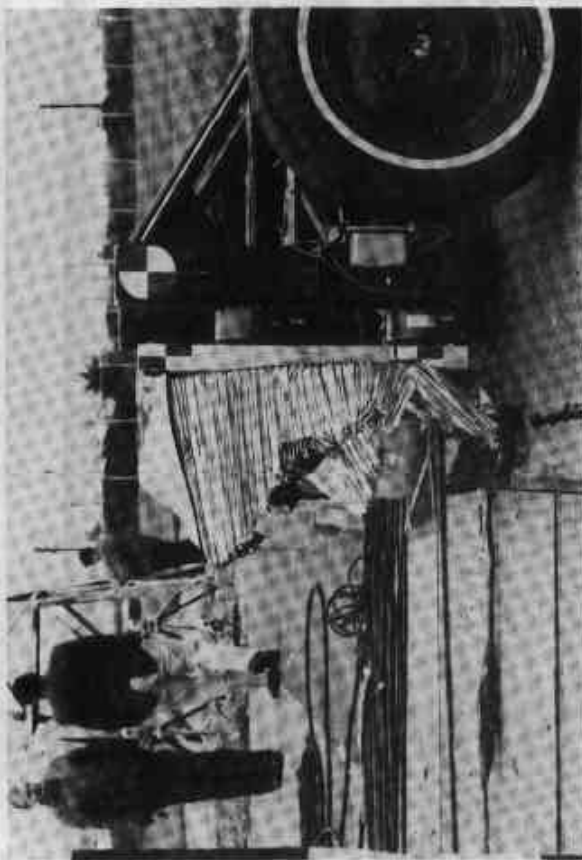


FIGURE A-16 VEHICLE NO. 2 - PRE- AND POST-TEST SIDE VIEWS OF BARRIER HONEYCOMB

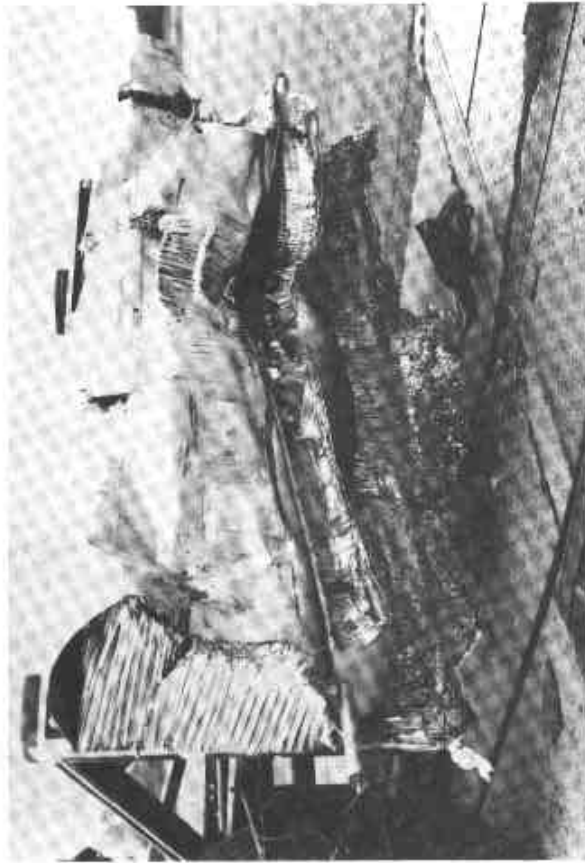
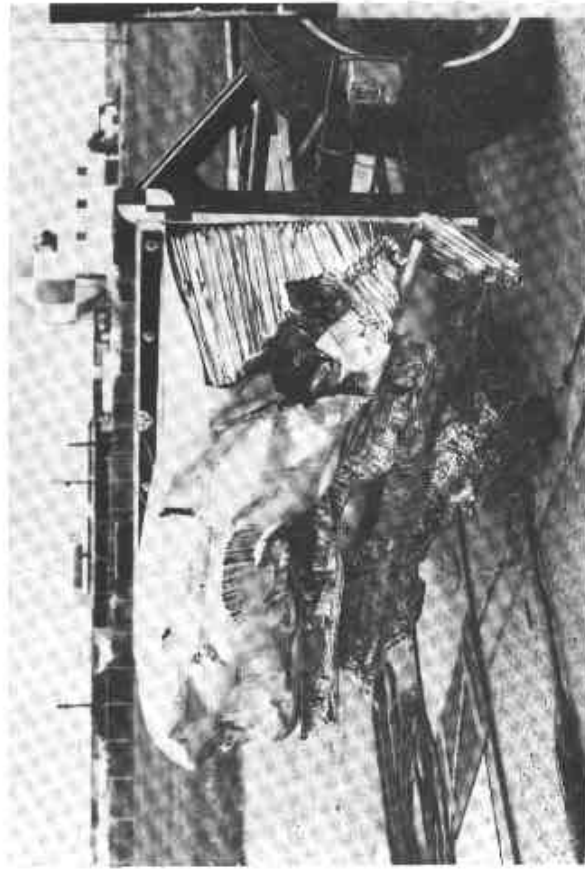
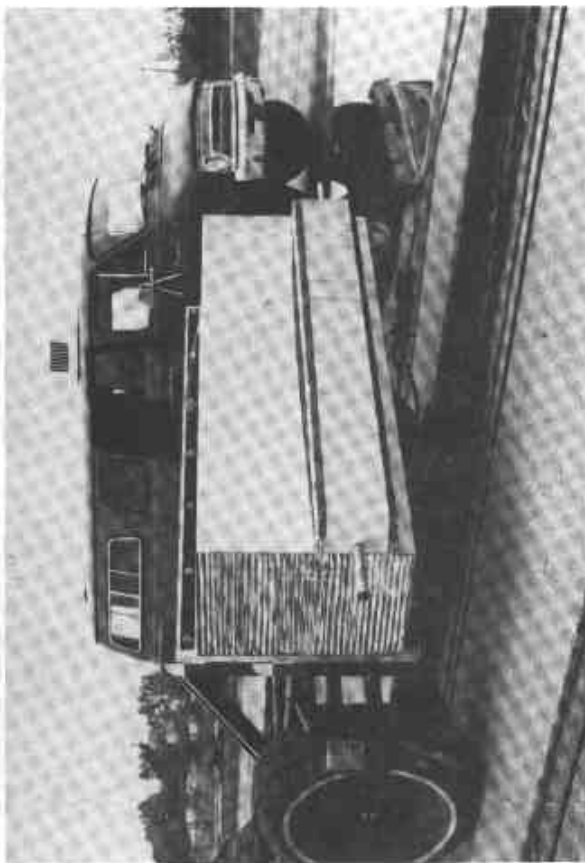
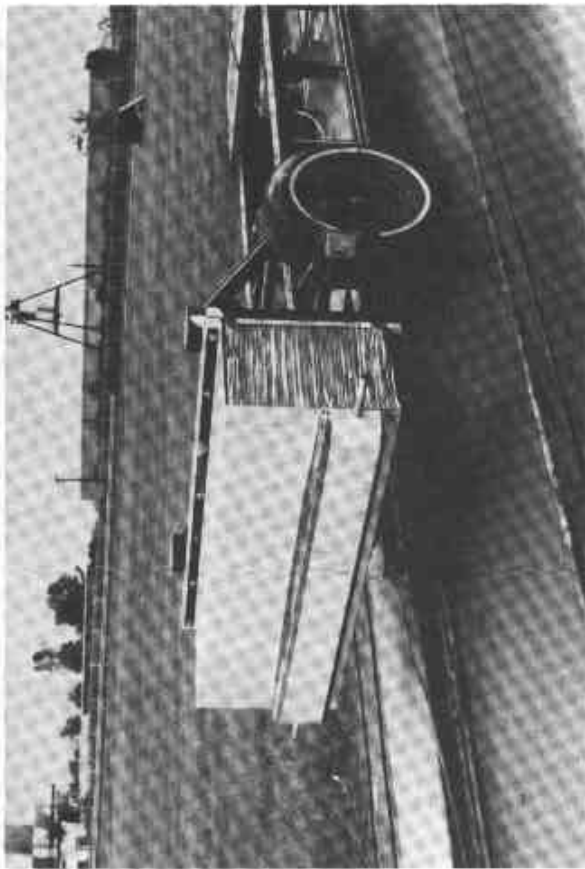


FIGURE A-17 VEHICLE NO. 2 - PRE- AND POST-TEST THREE-QUARTER VIEWS OF BARRIER HONEYCOMB

A-15

6892-V-1

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

TEST NO. 752-1-527

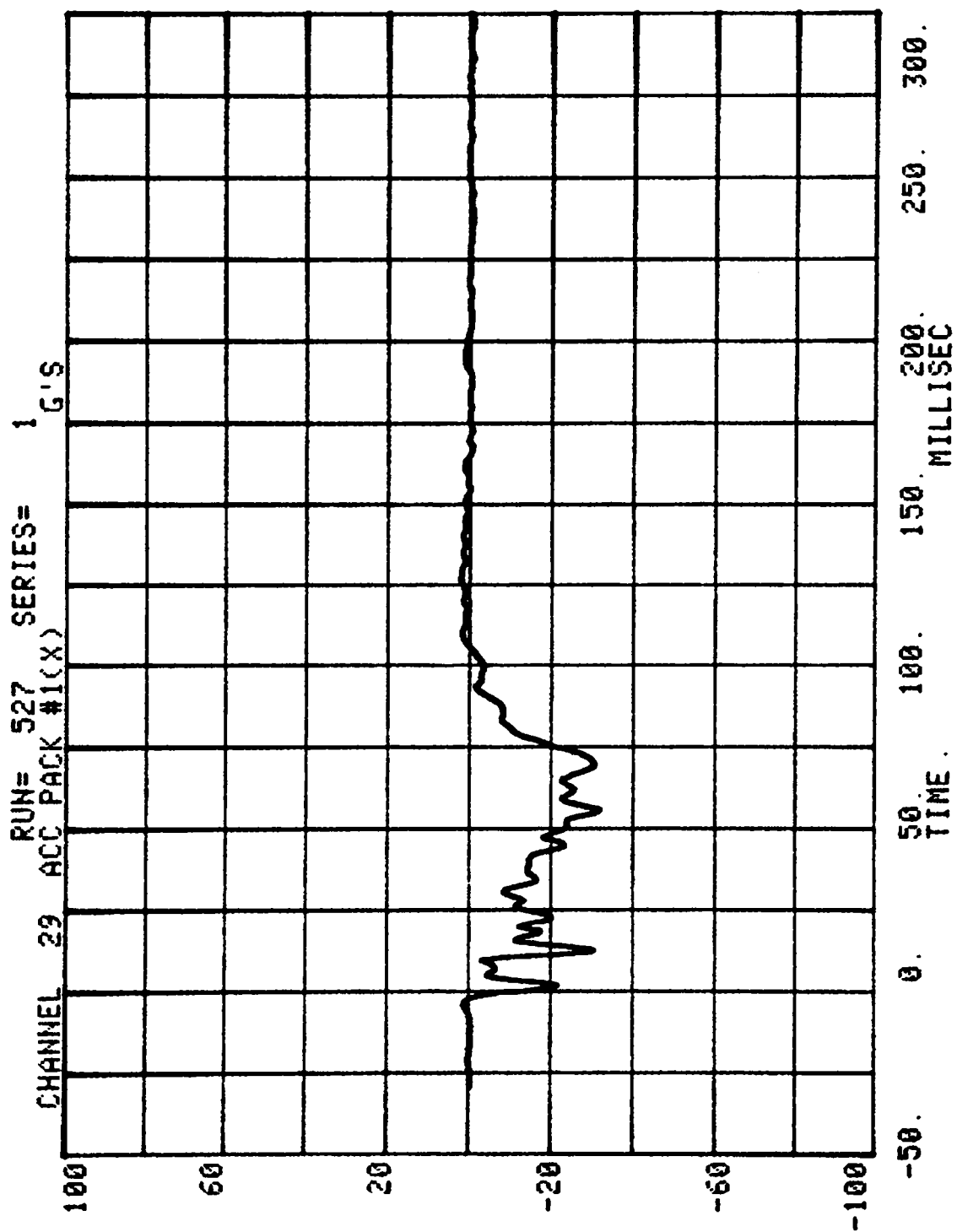
1981 VOLVO DL

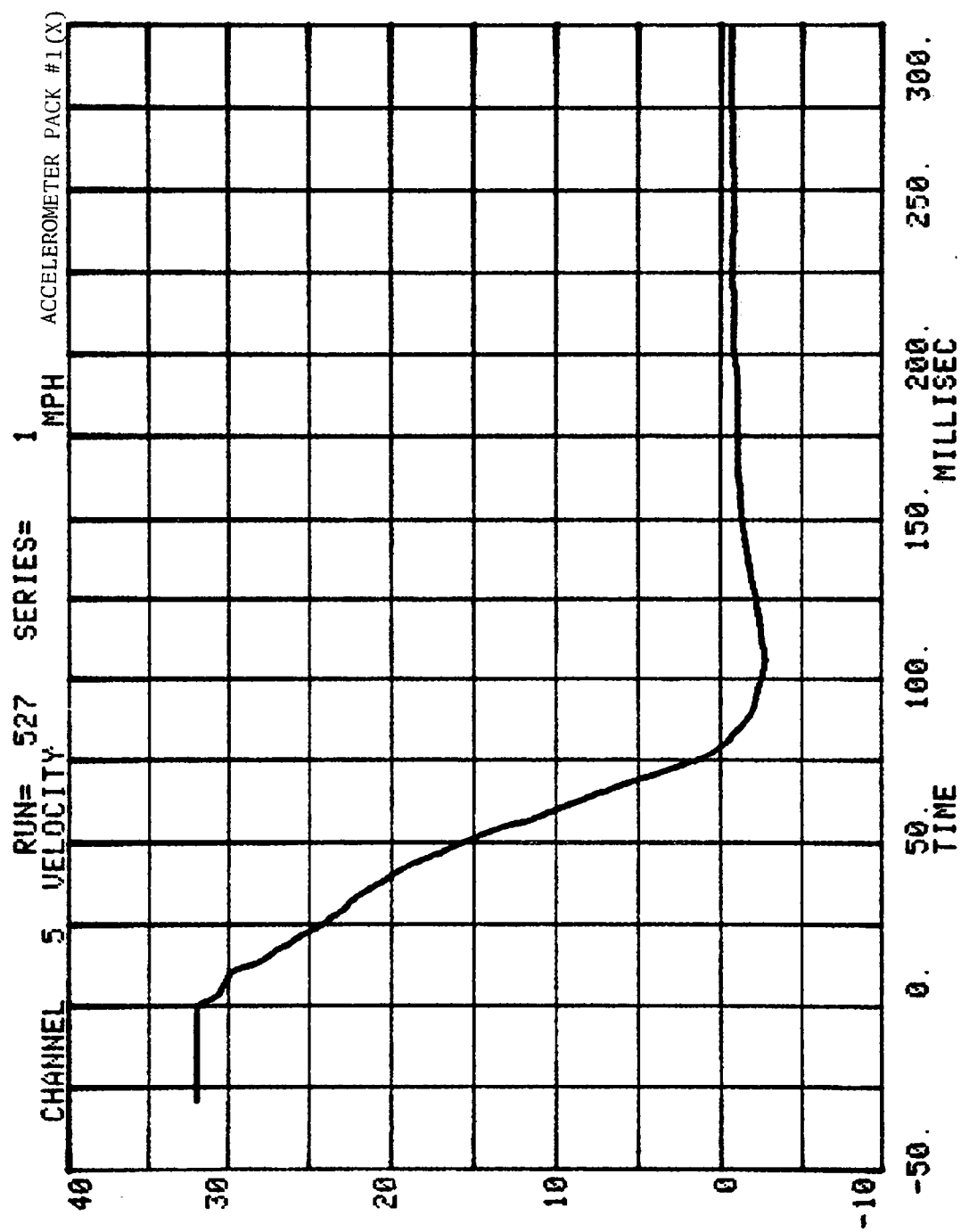
VEHICLE NO. 1 DATA

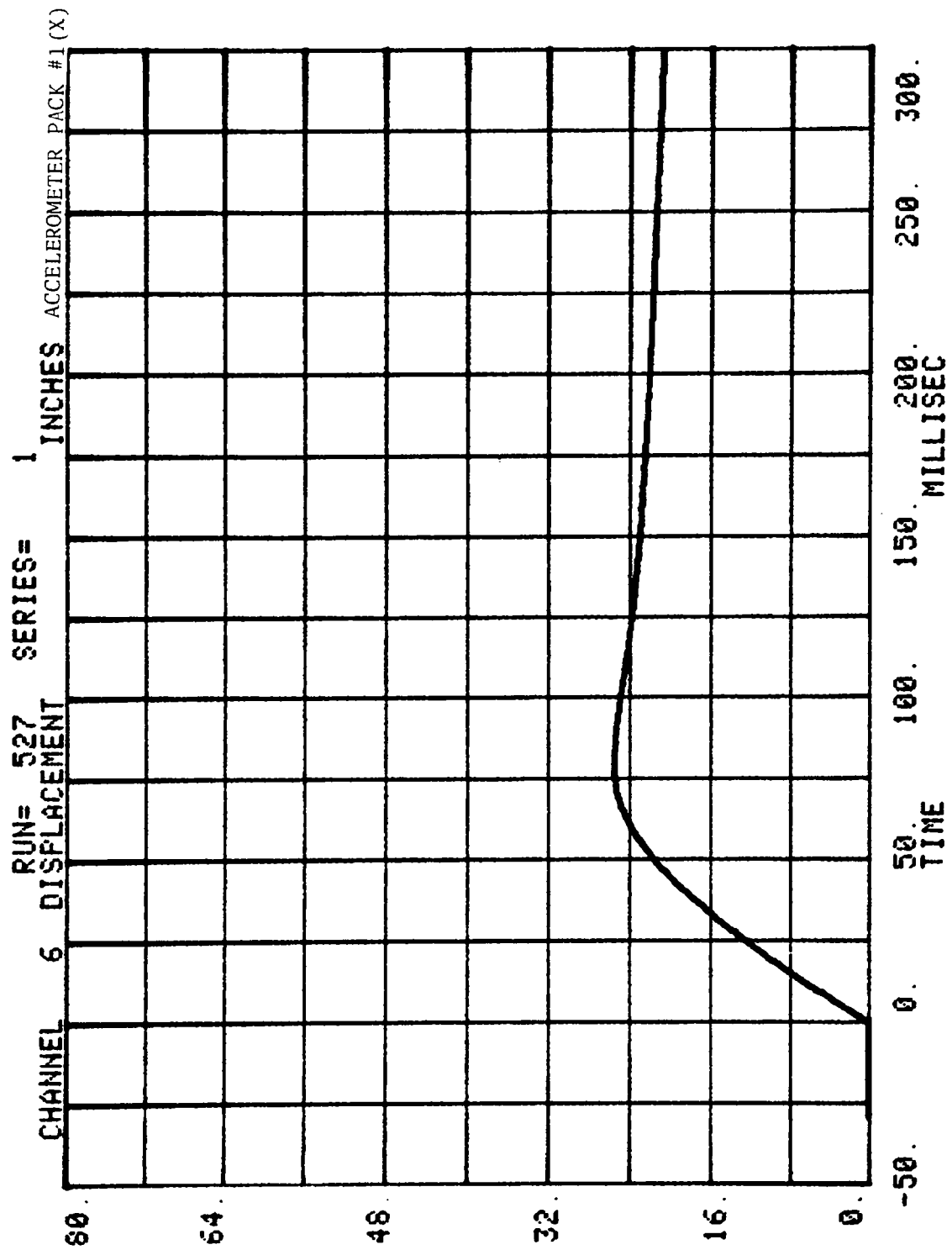
VEHICLE DATA

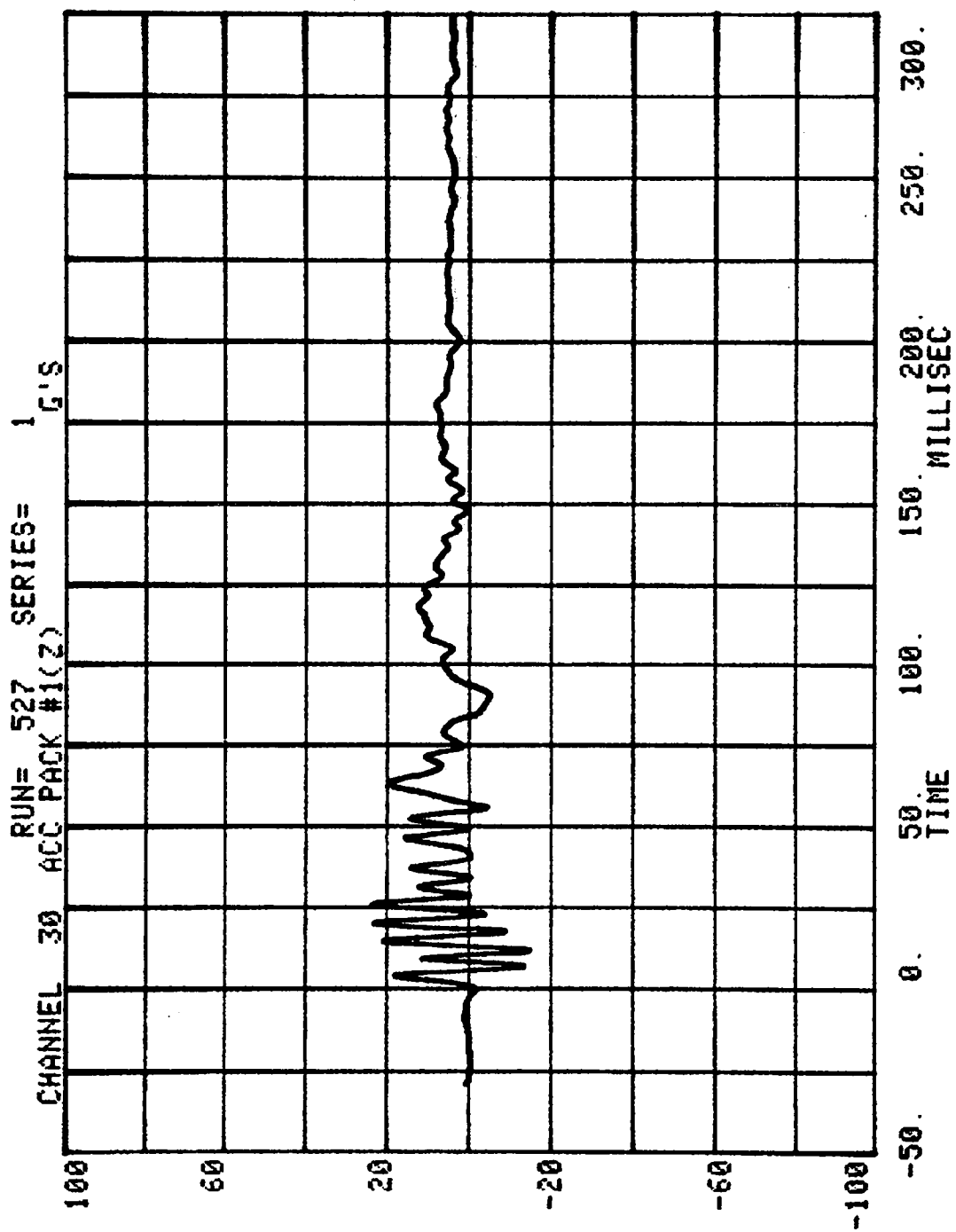
FILTER CHANNEL CLASS

60

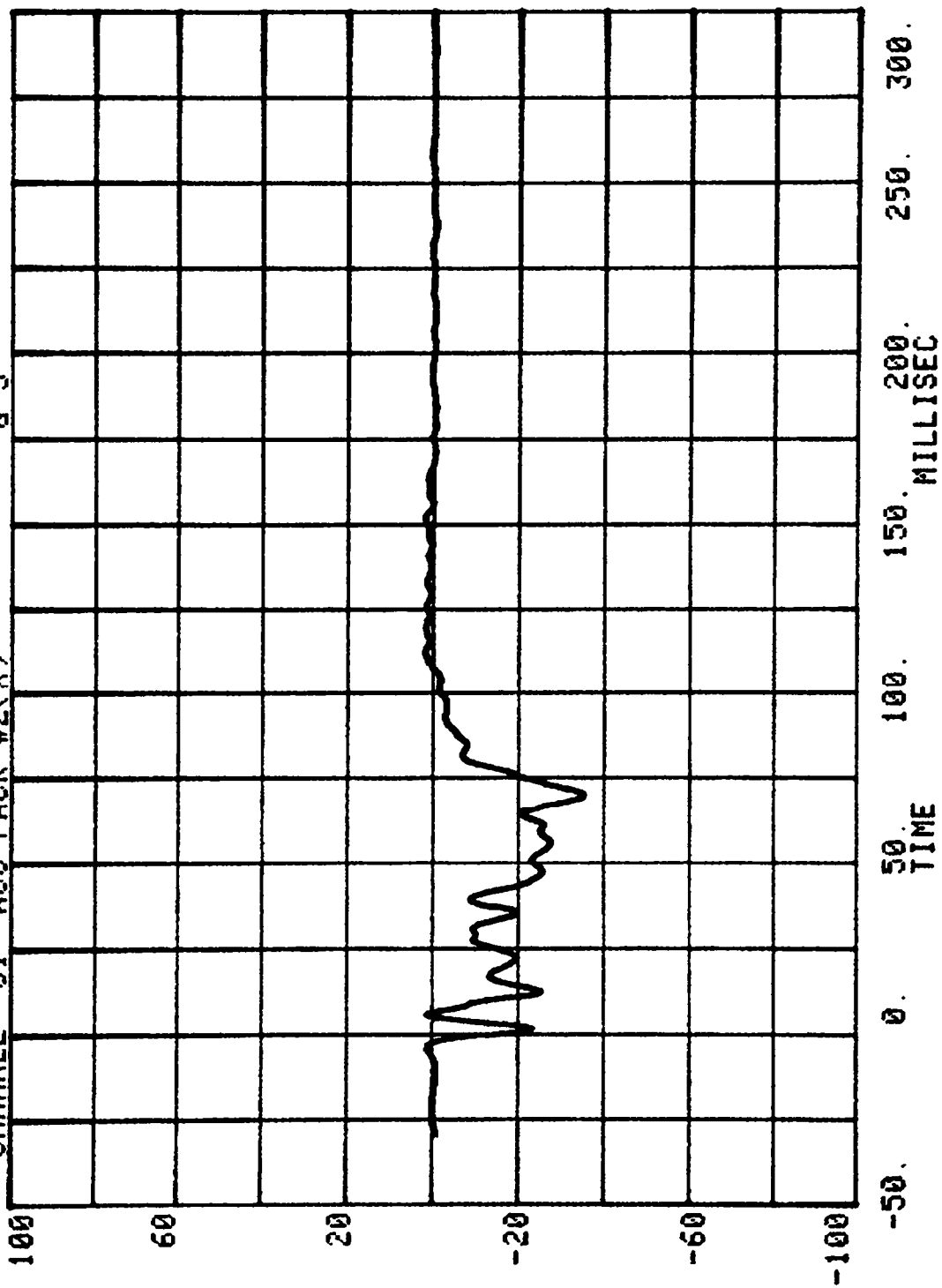


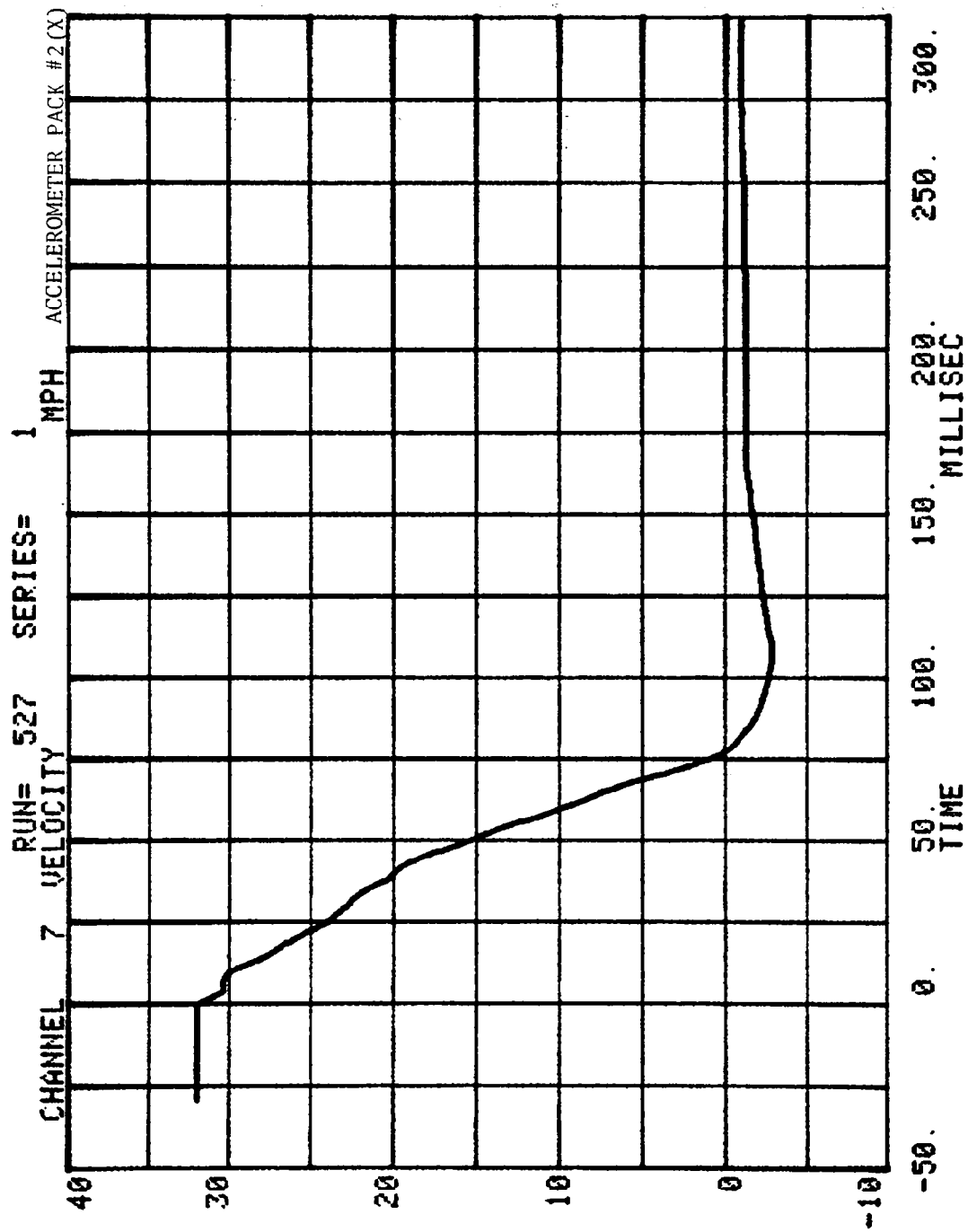


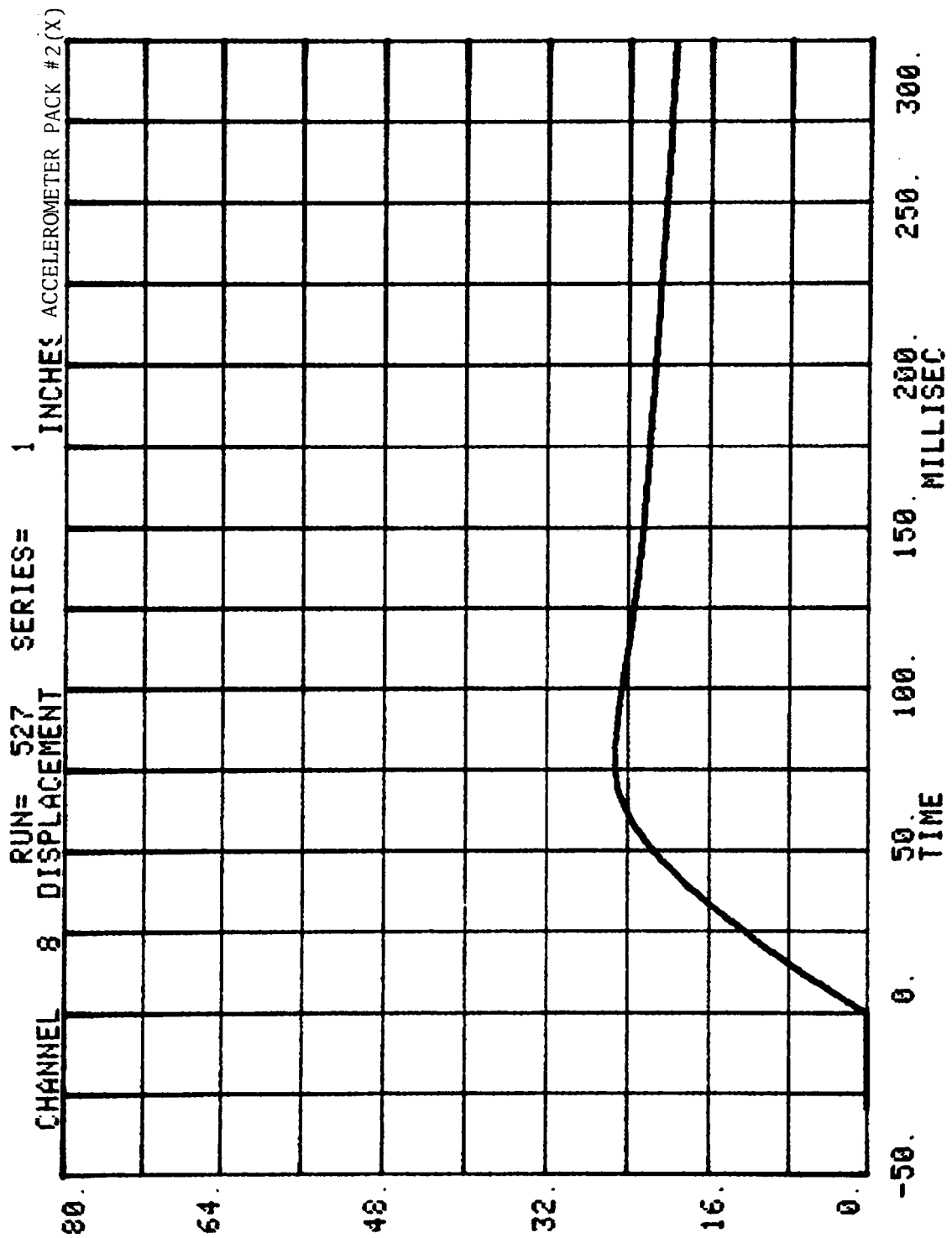


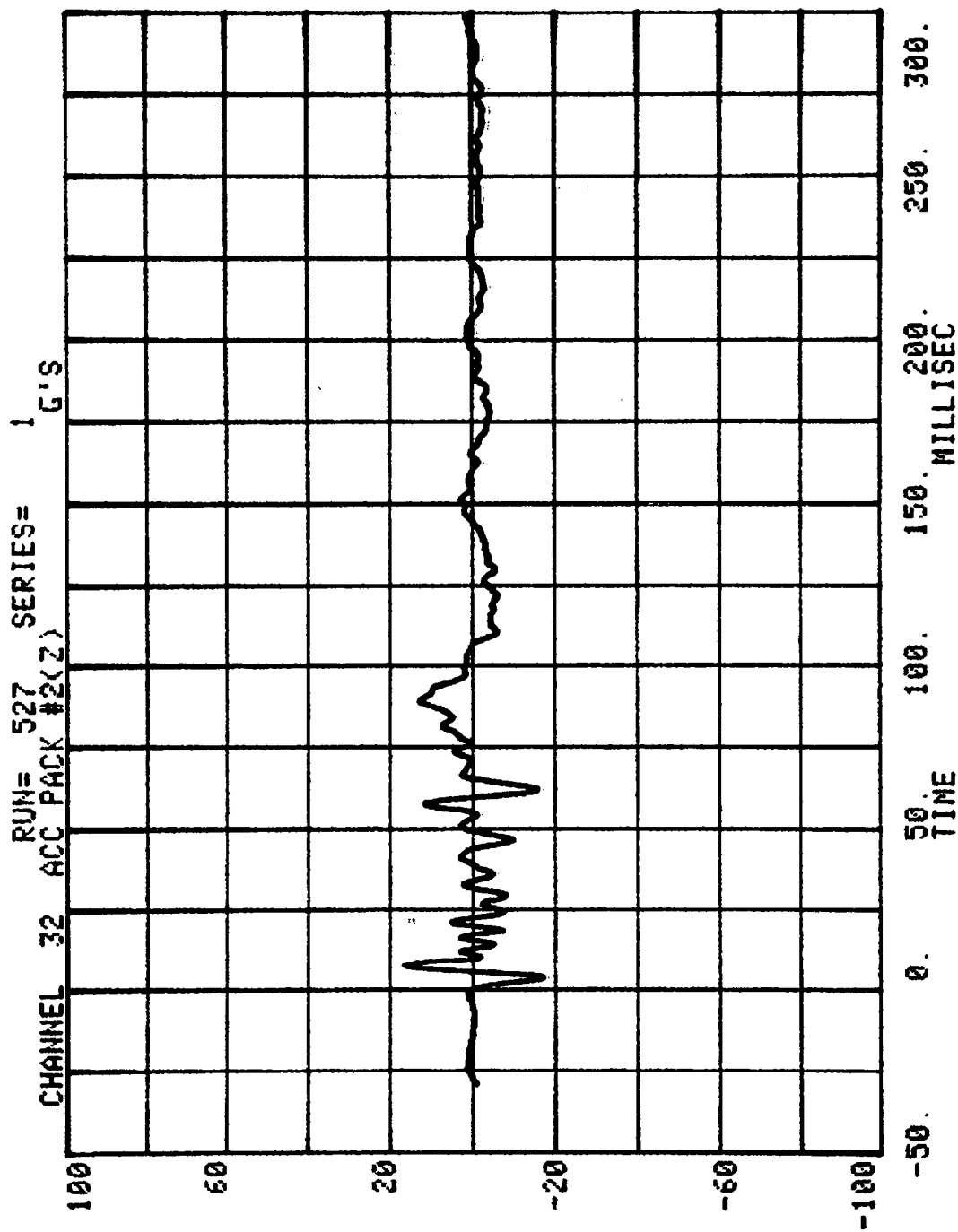


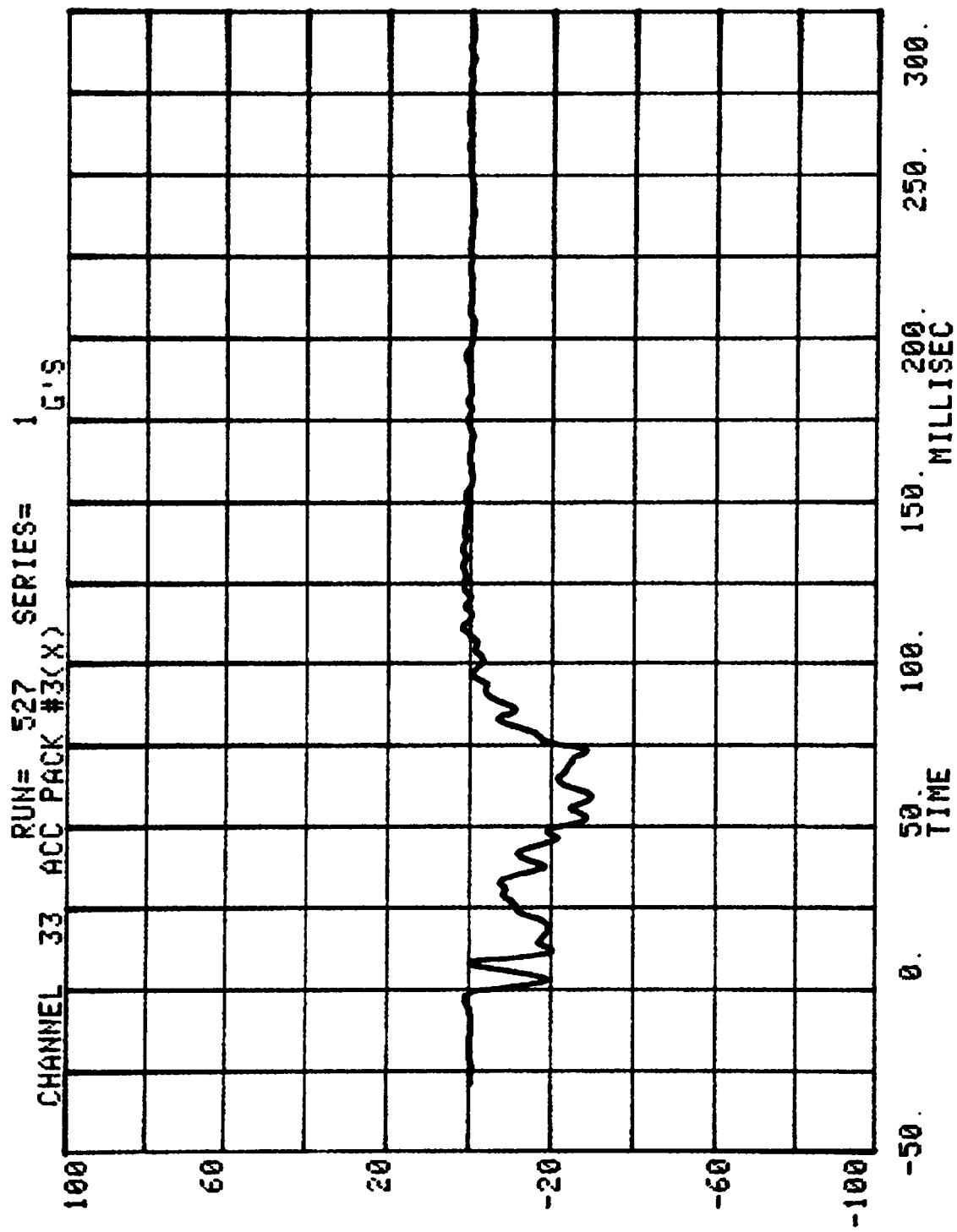
RUN= 527 SERIES= 1
CHANNEL 31 ACC PACK #2(X) G'S

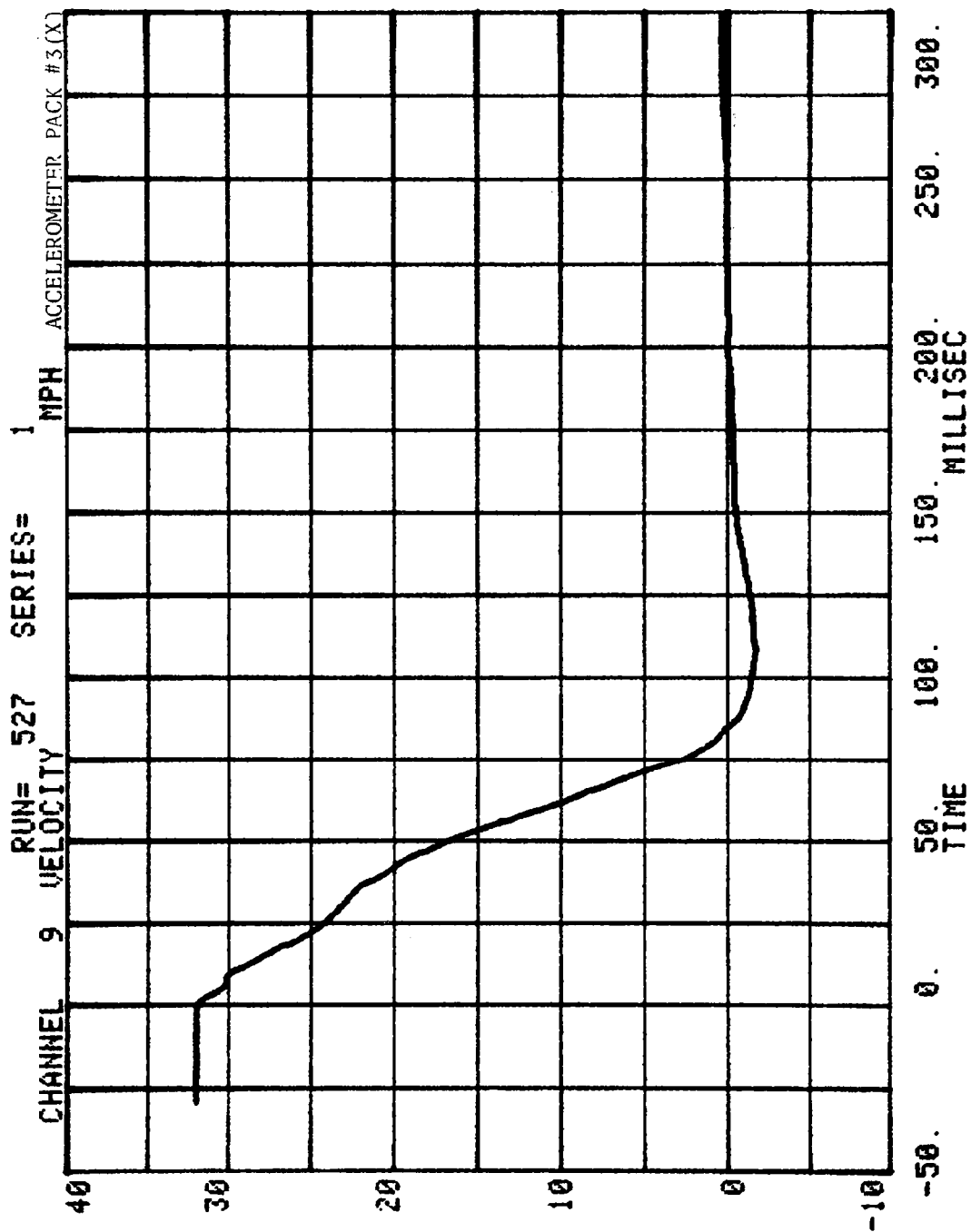


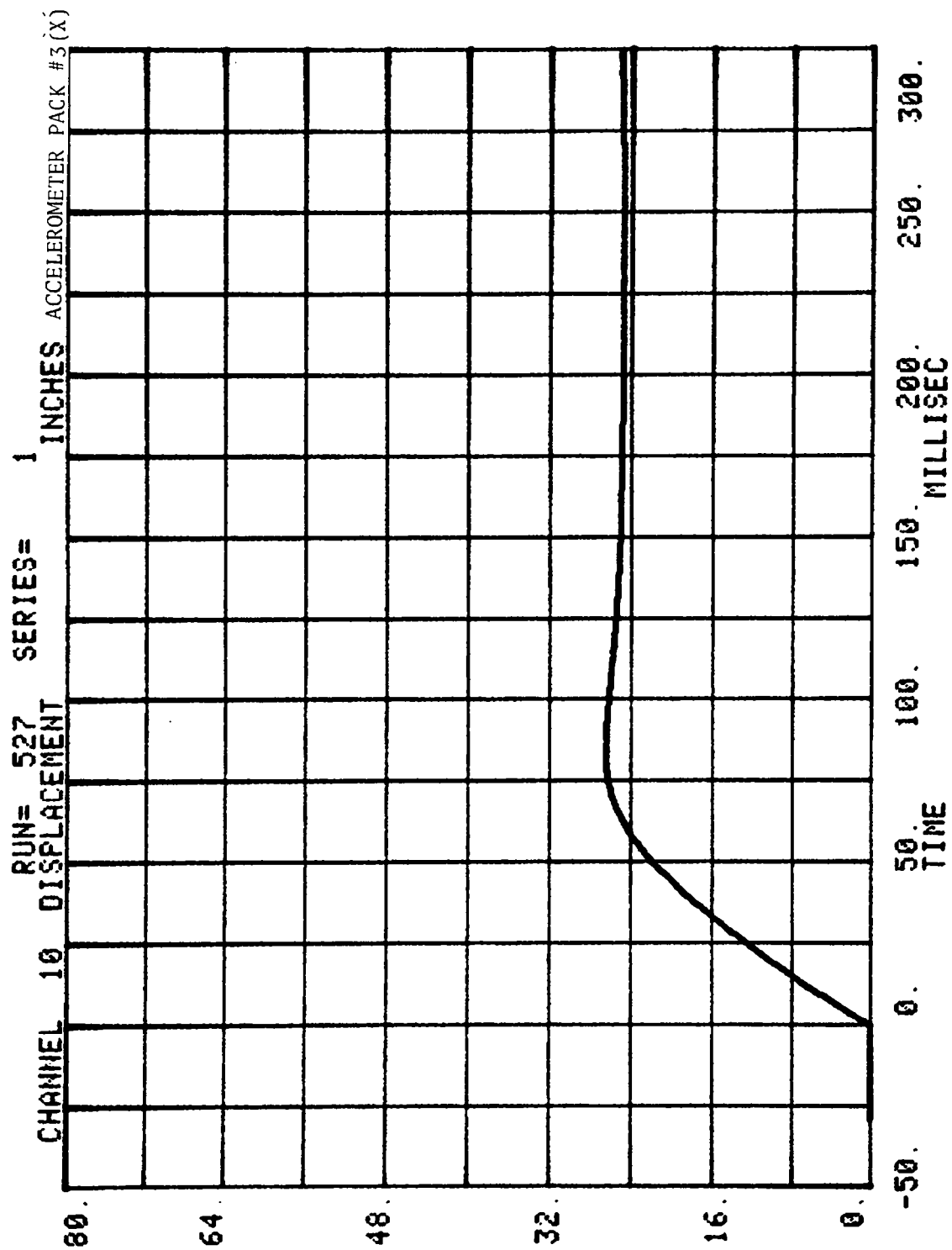


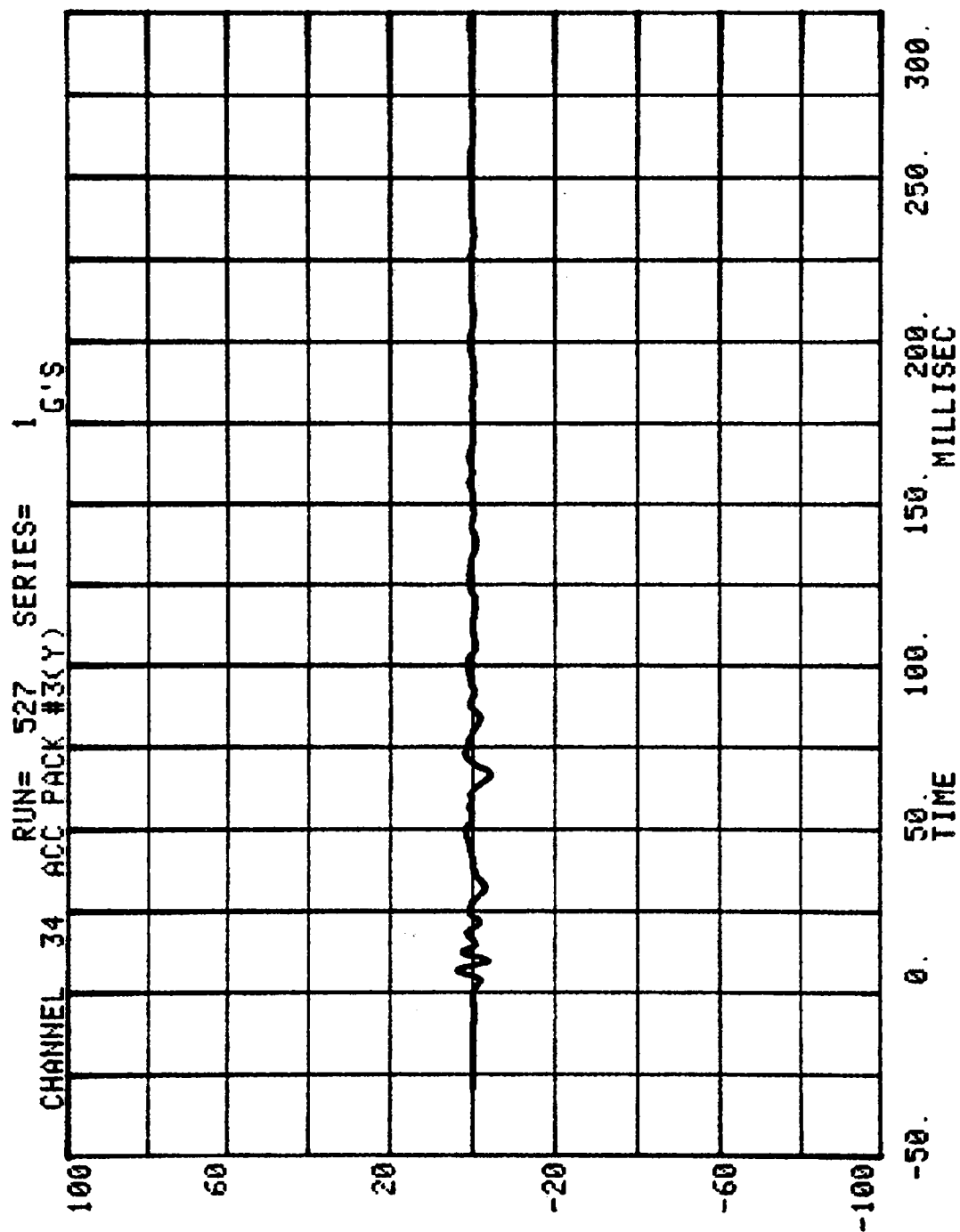




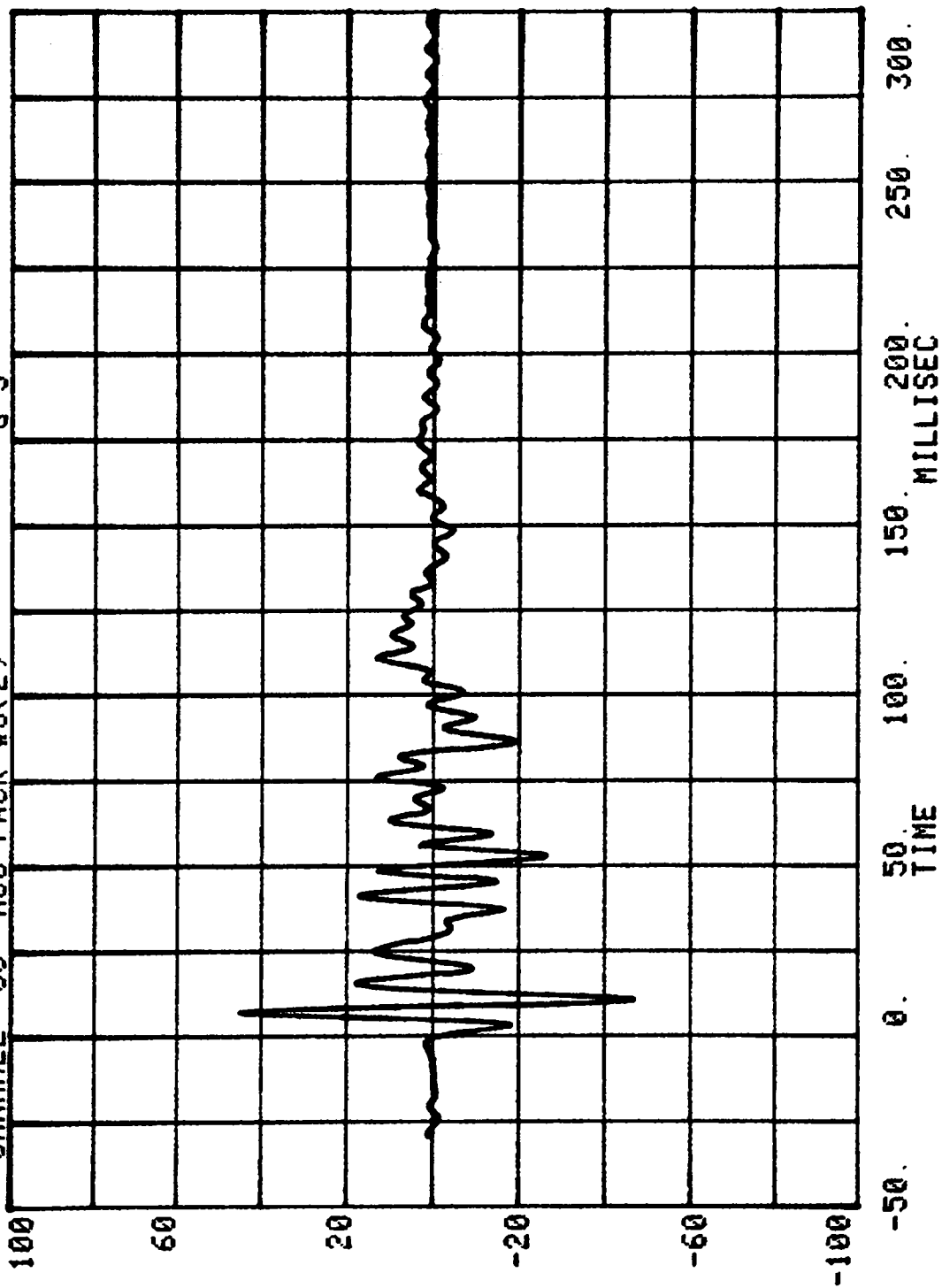


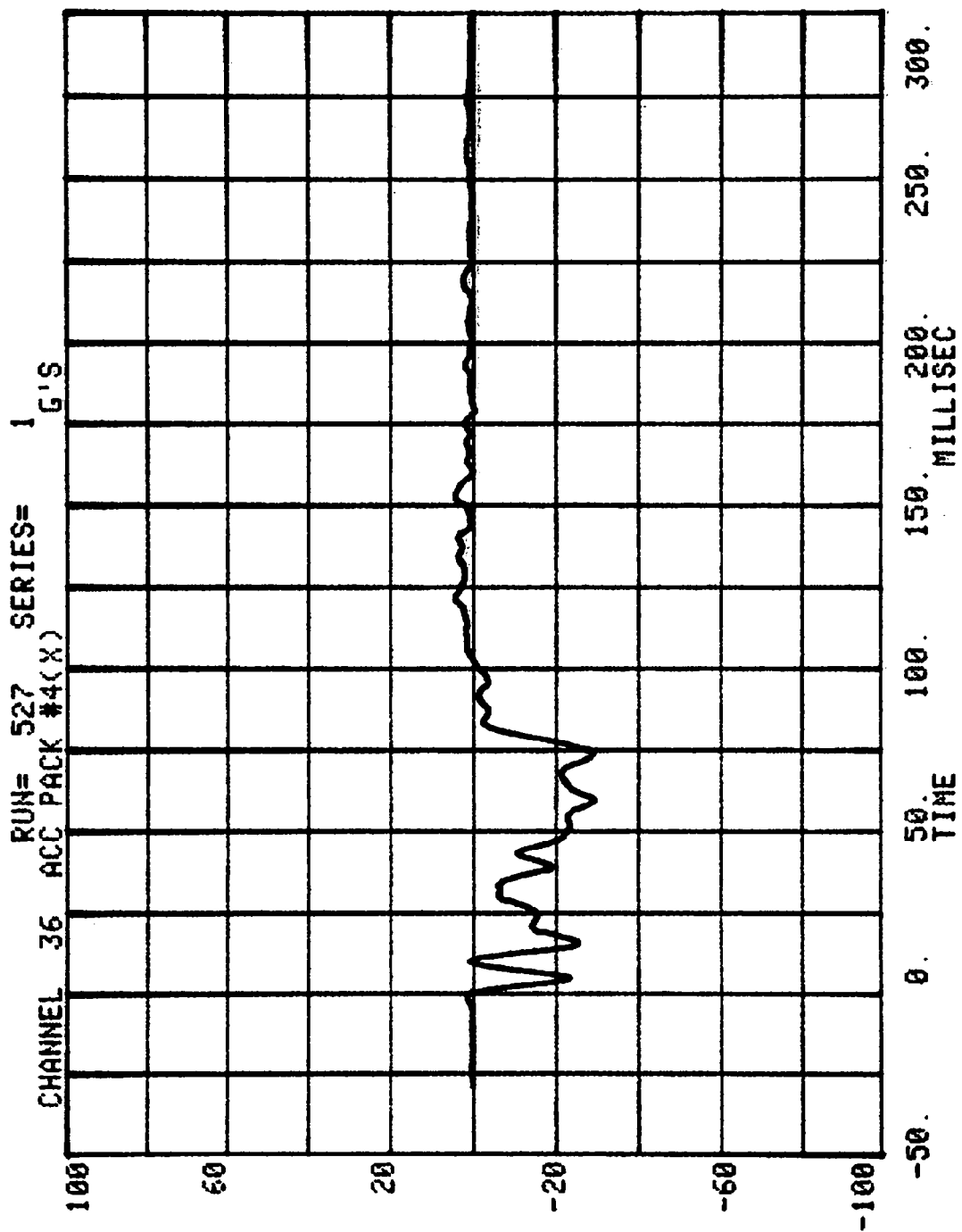


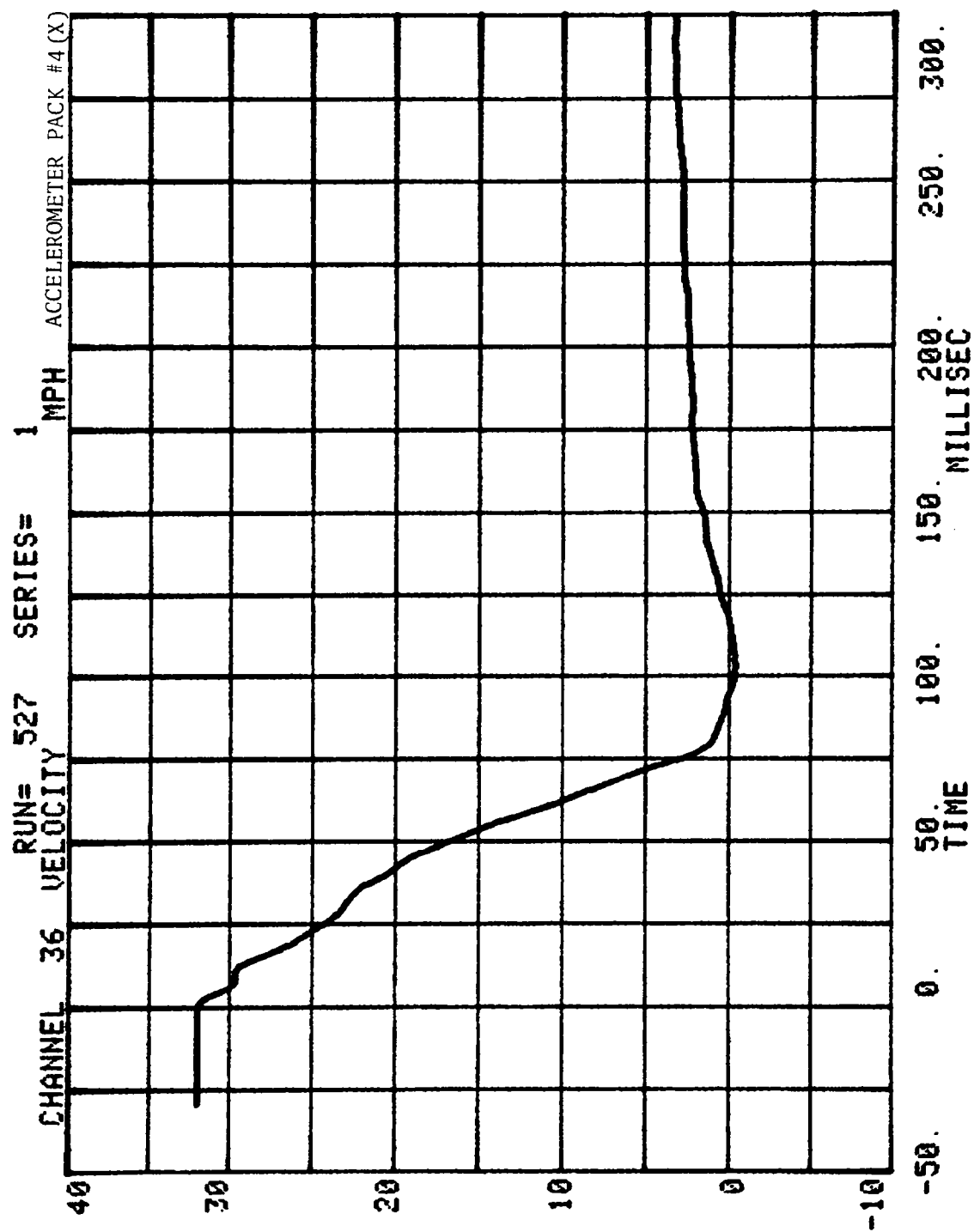


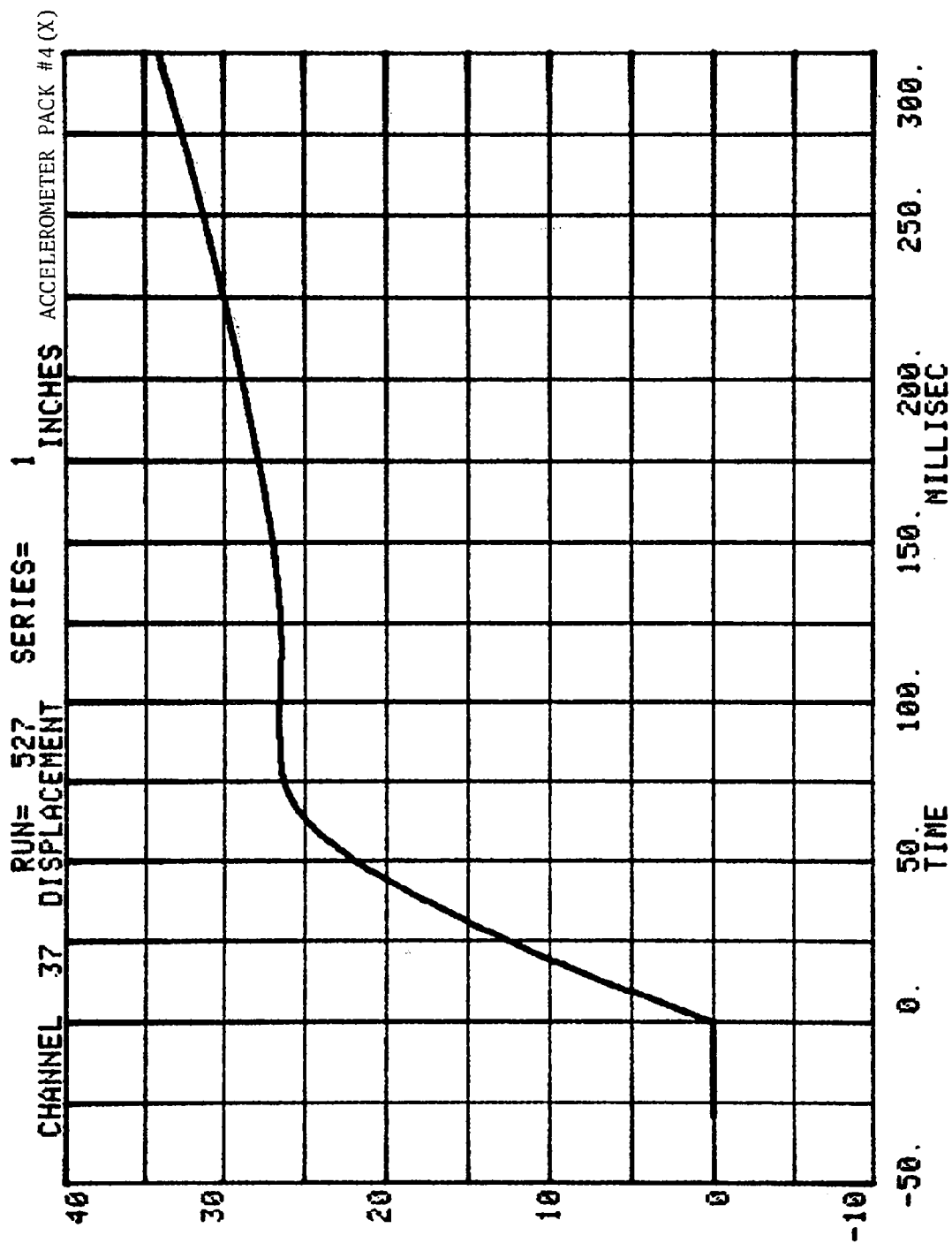


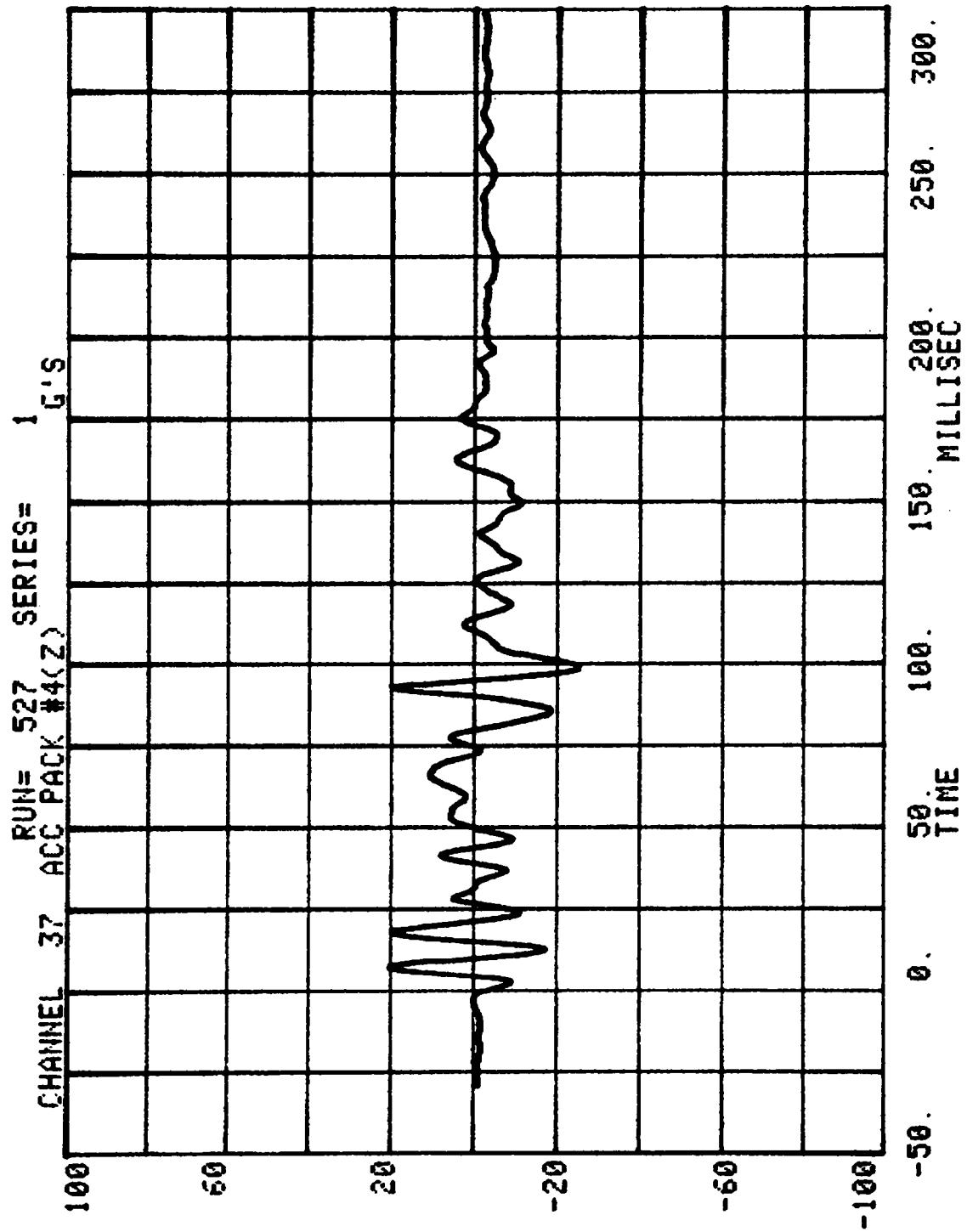
CHANNEL 35 ACC PACK #3(Z) RUN= 527 SERIES= 1 G'S

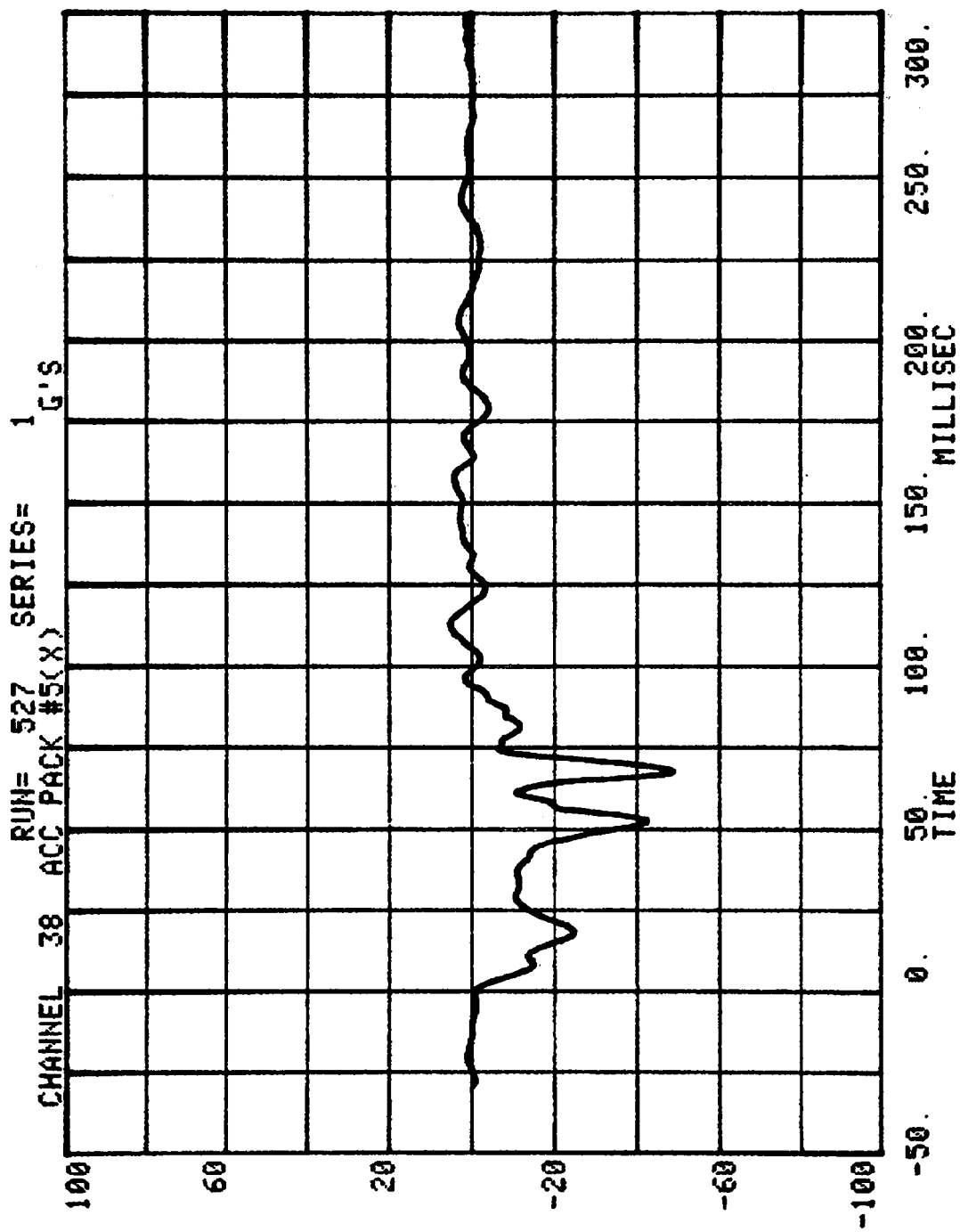


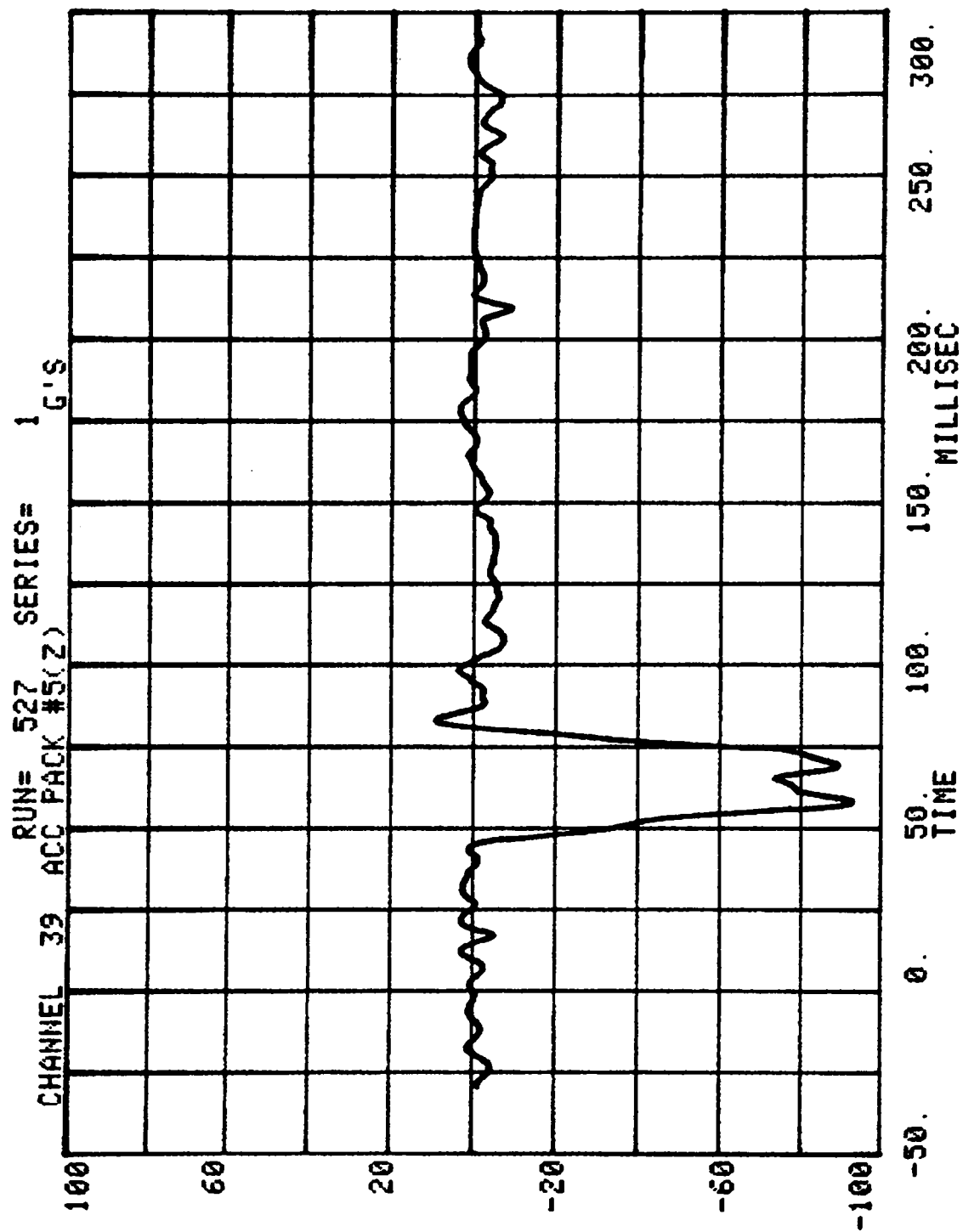


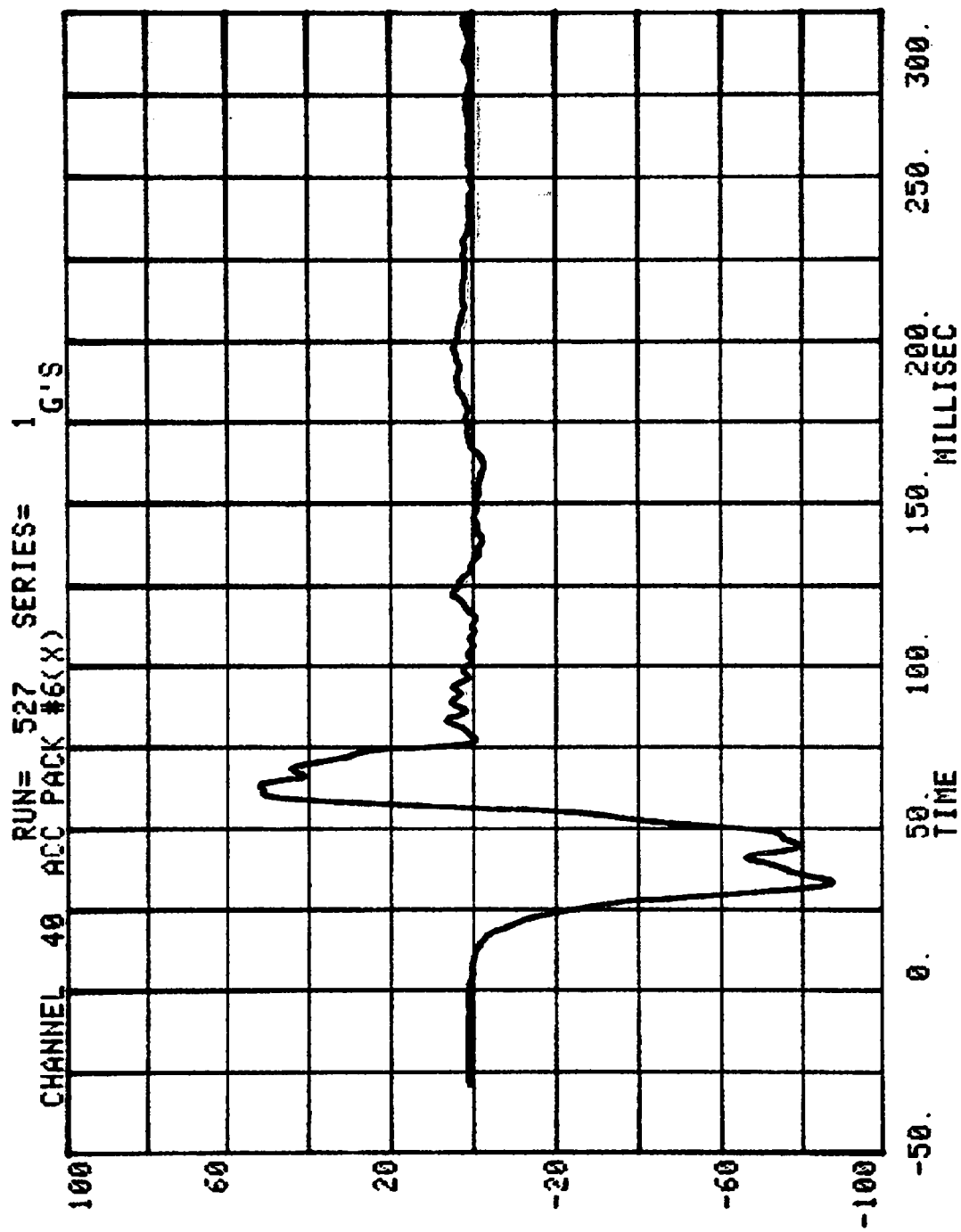


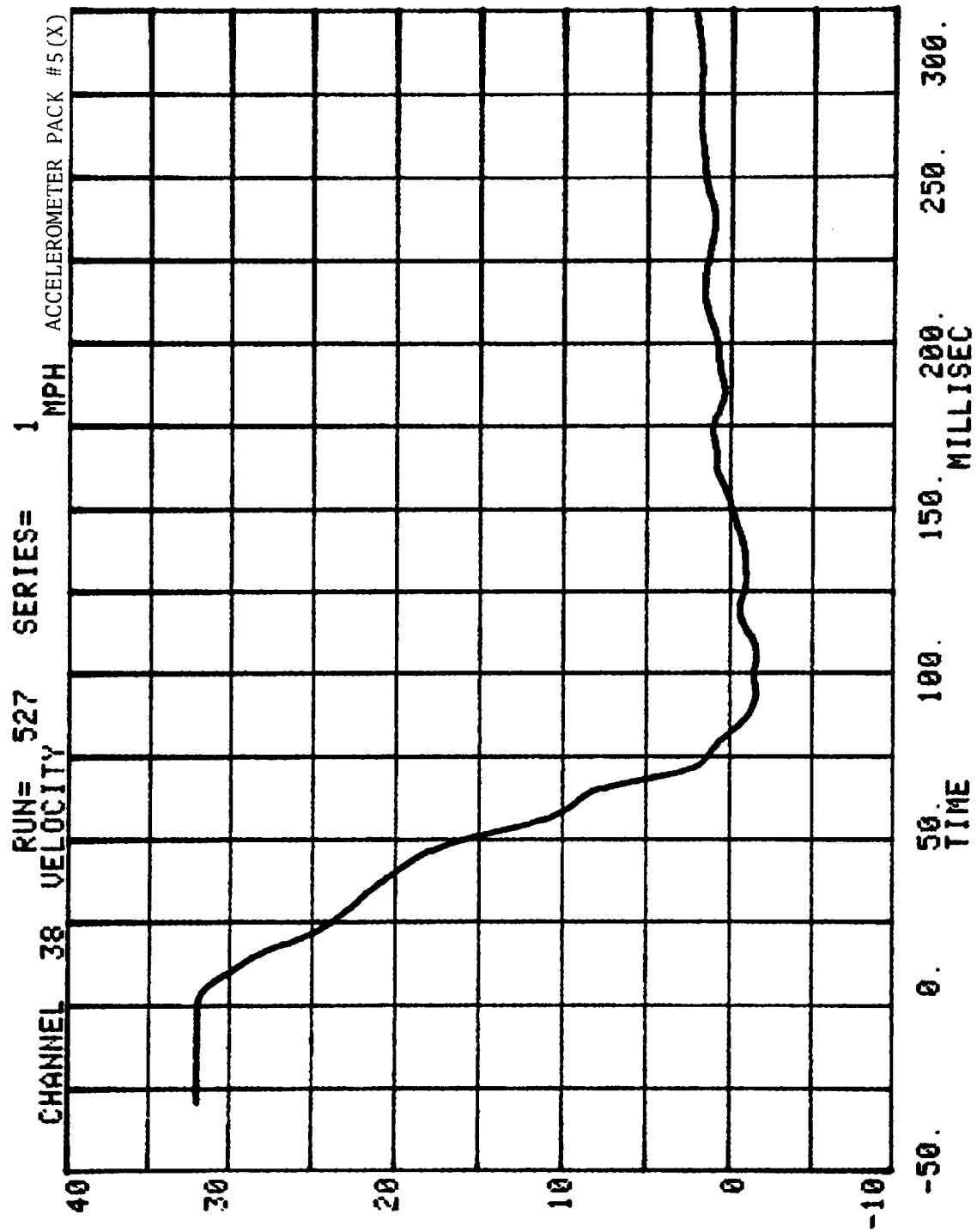


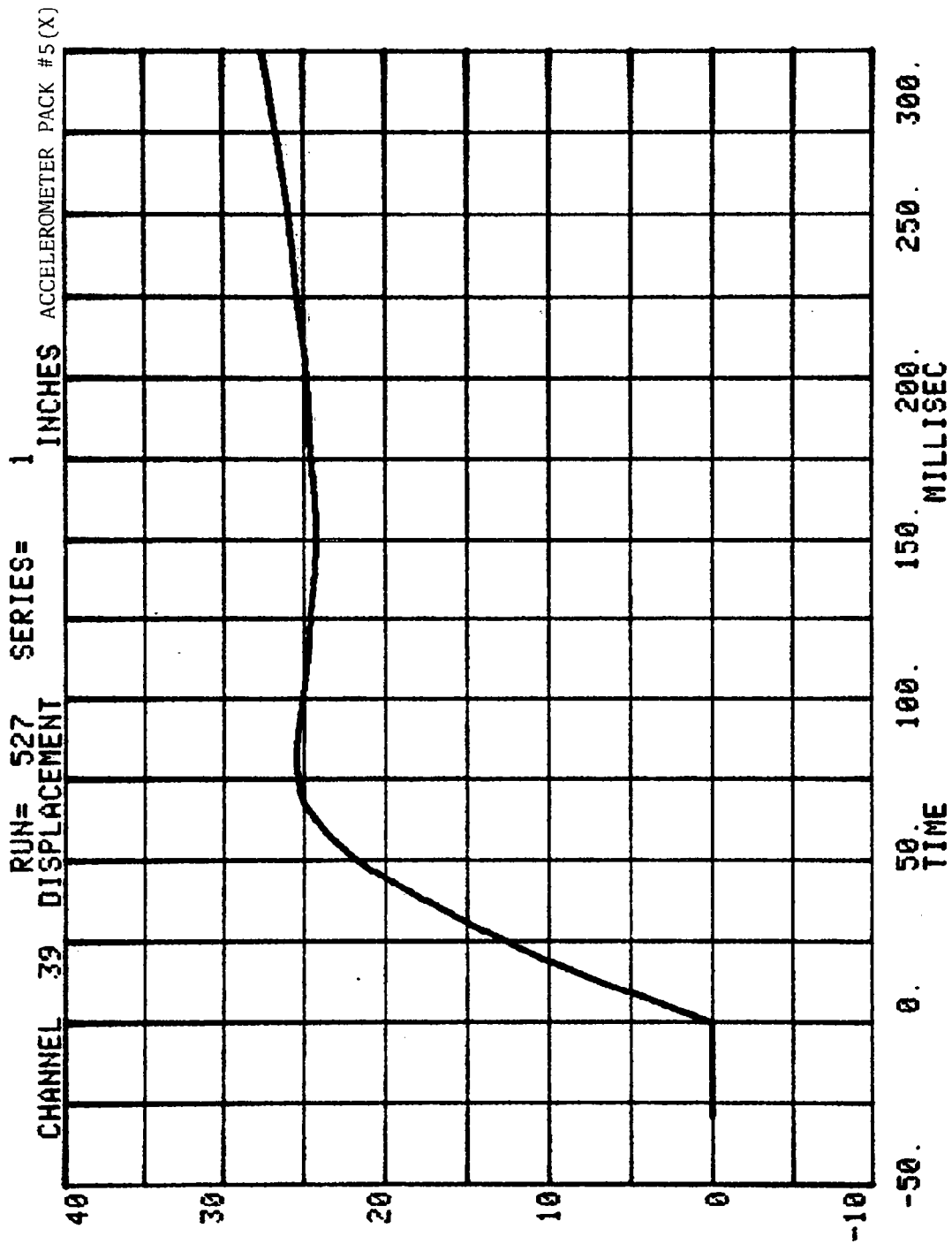


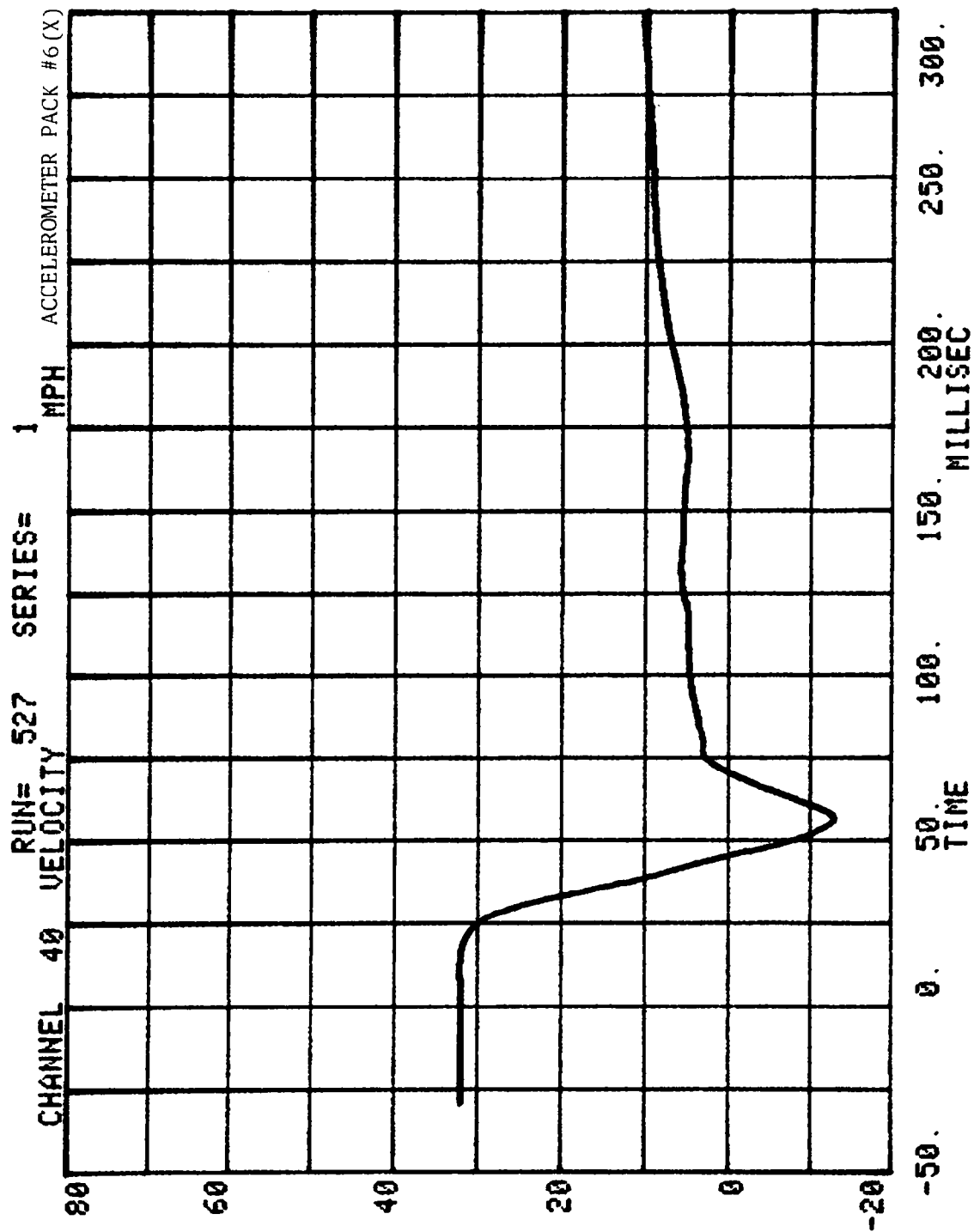


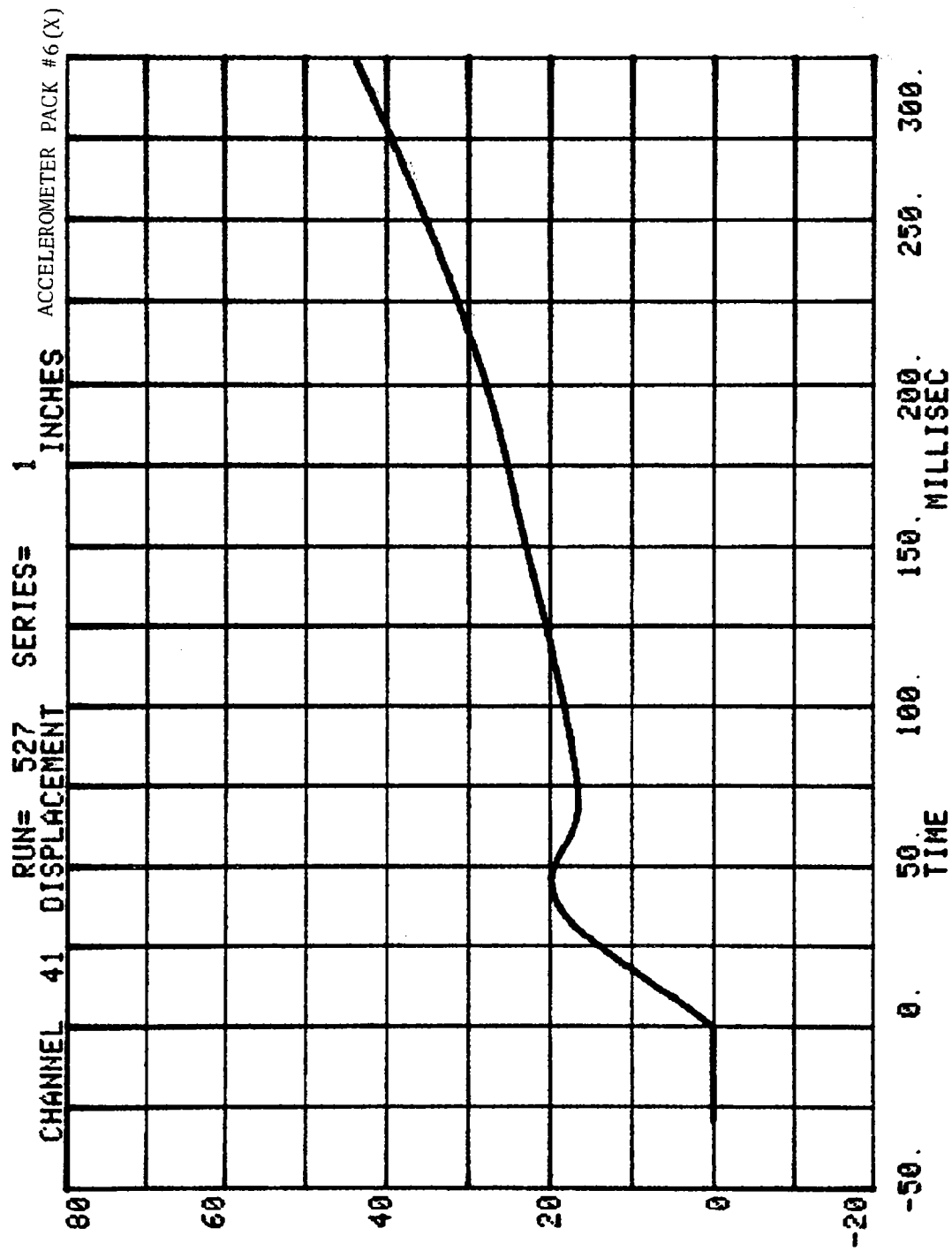


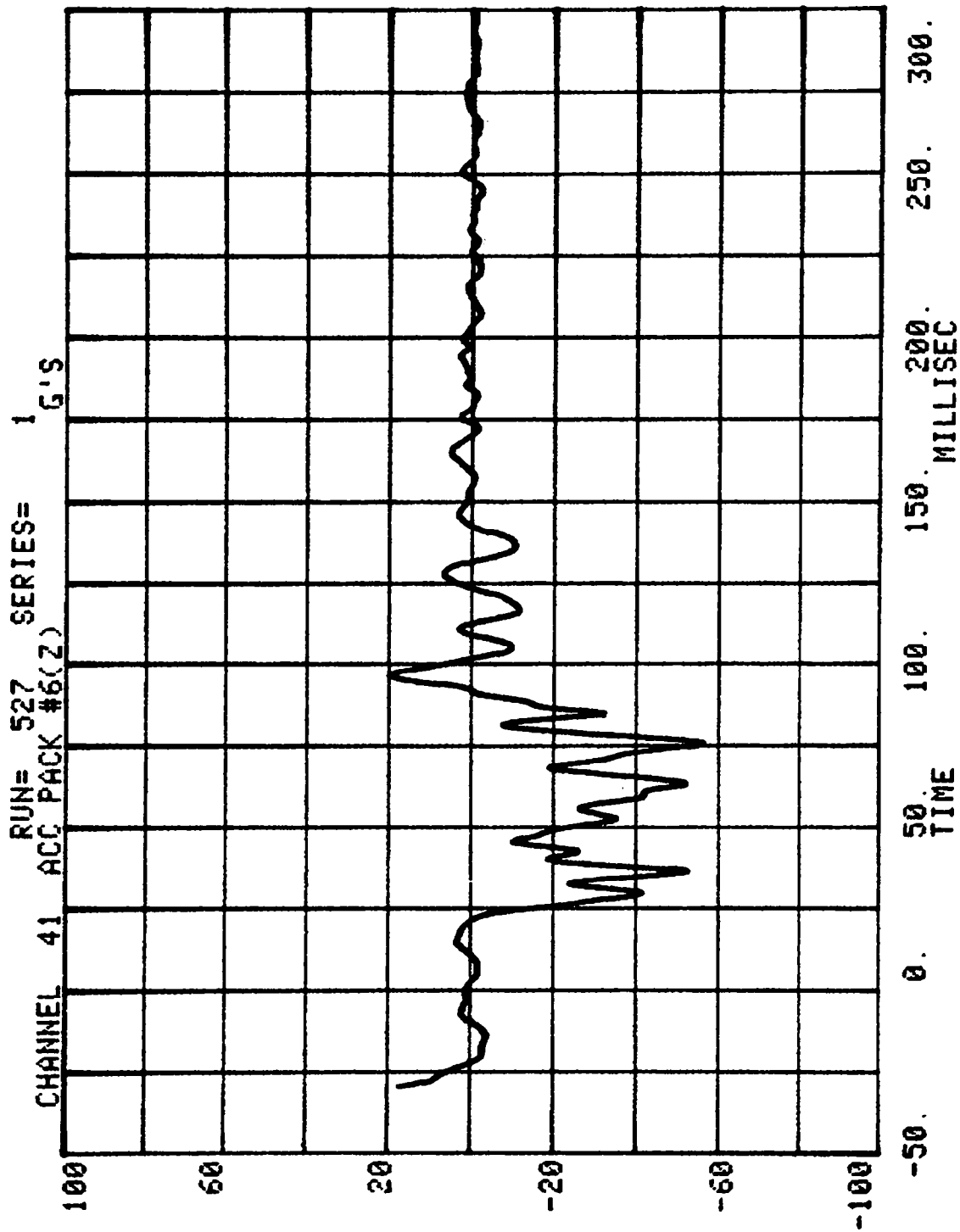


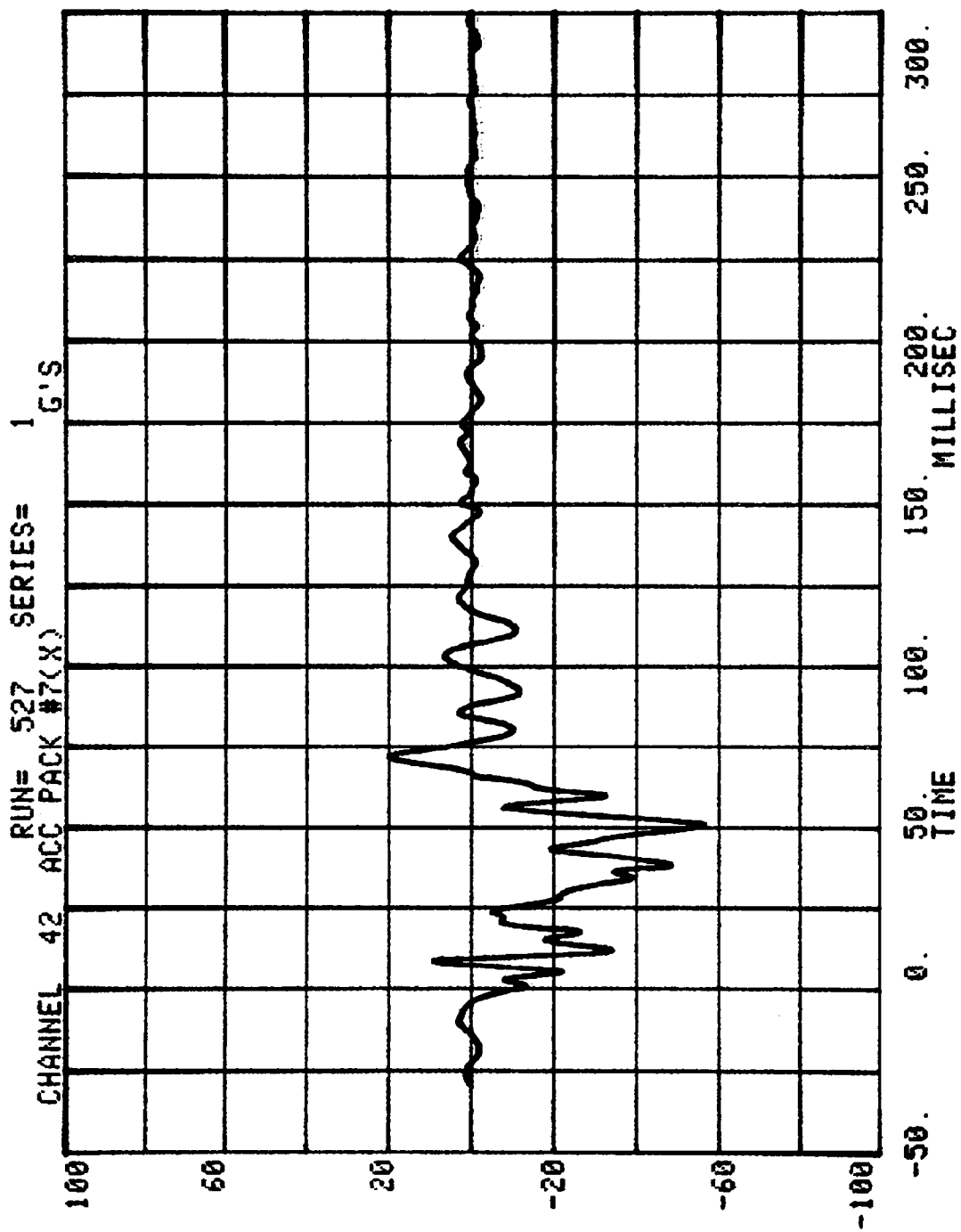


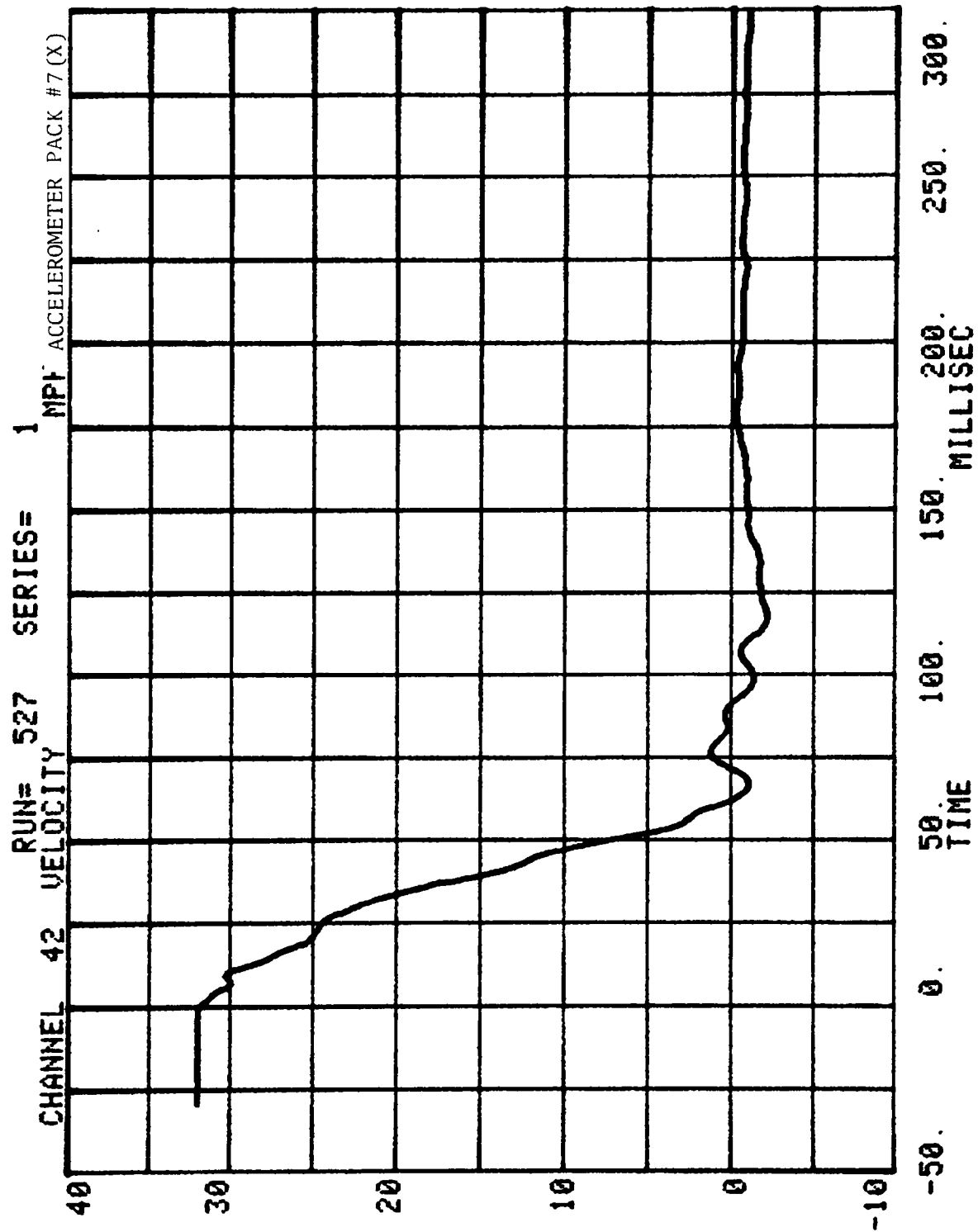


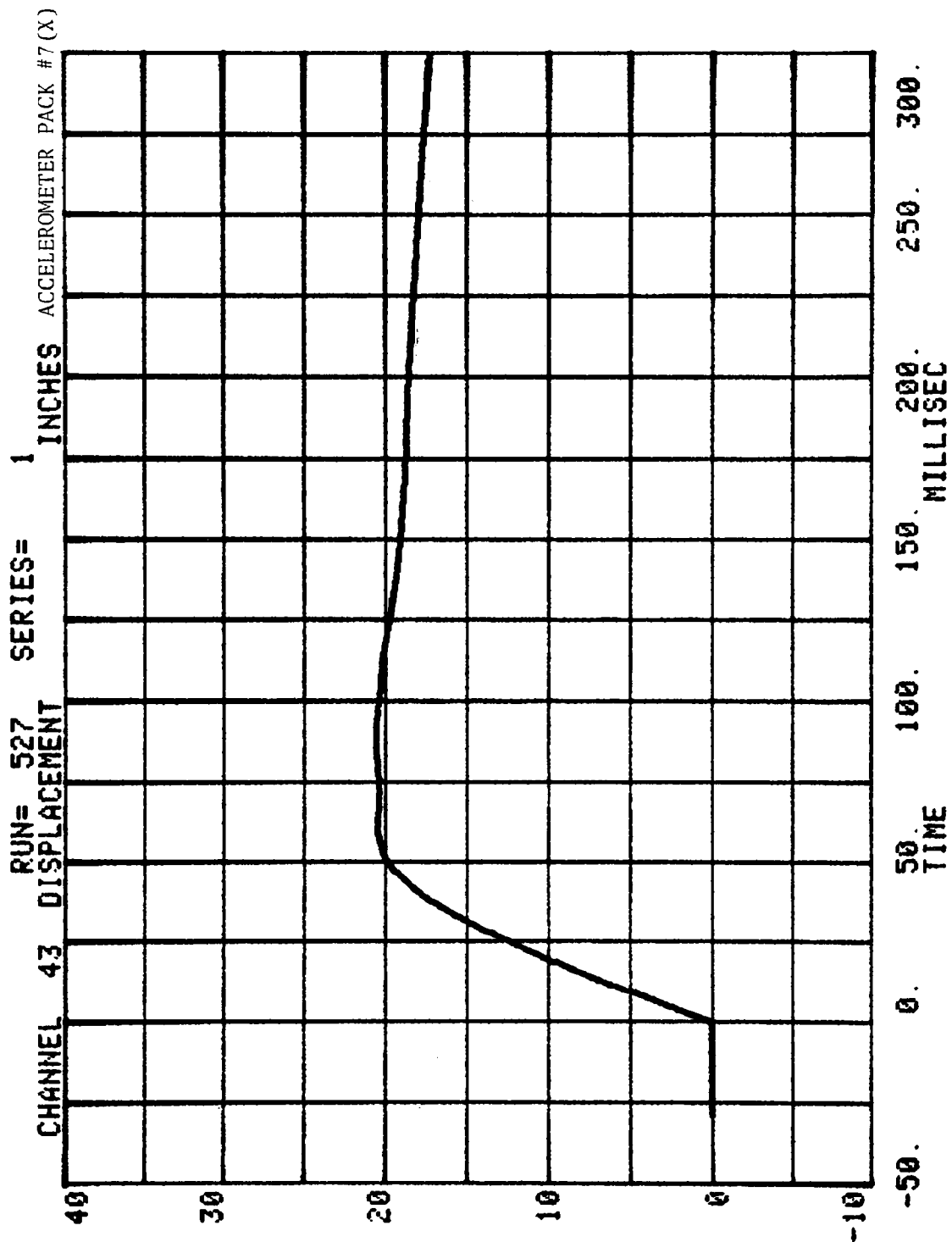




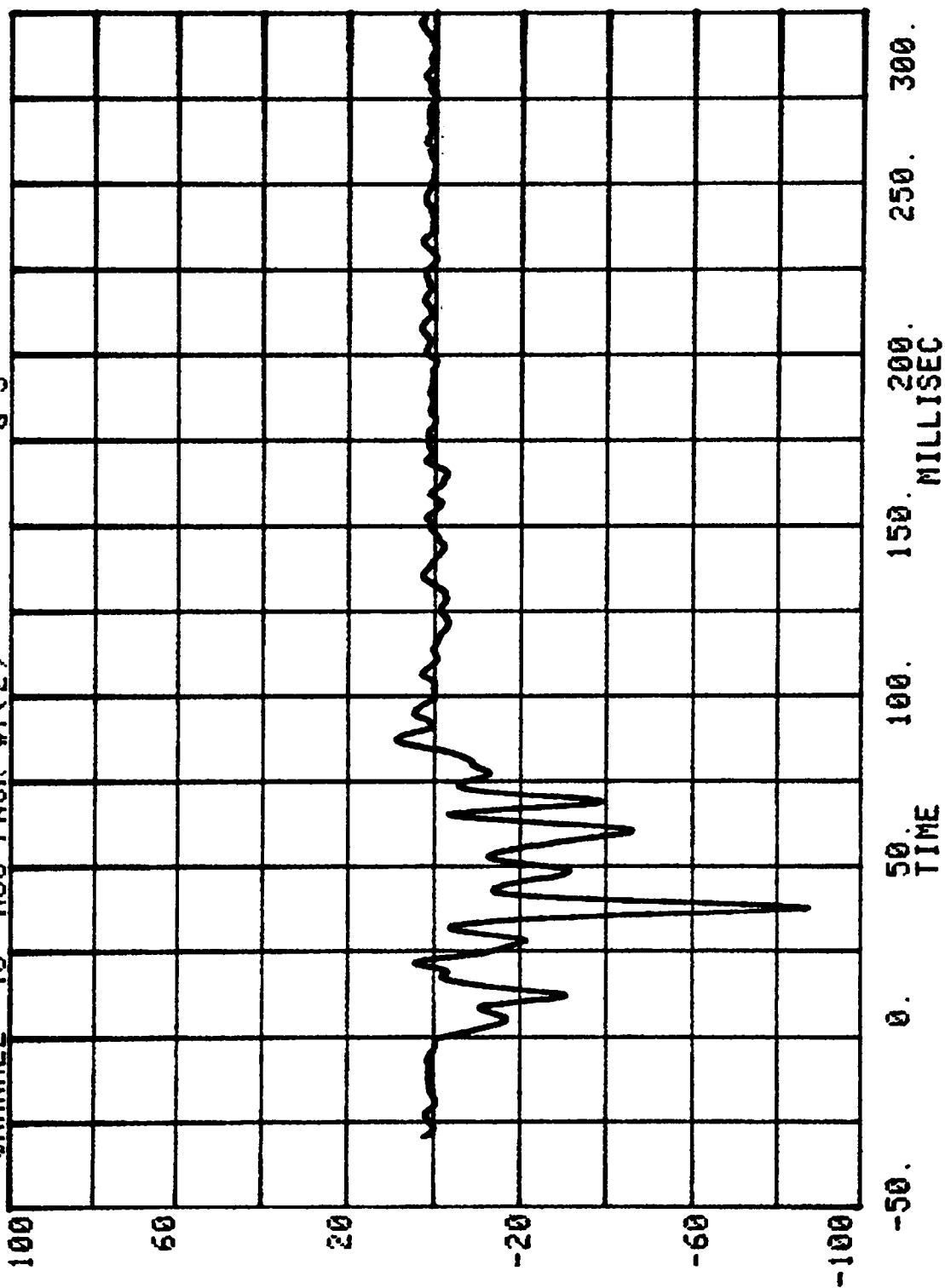


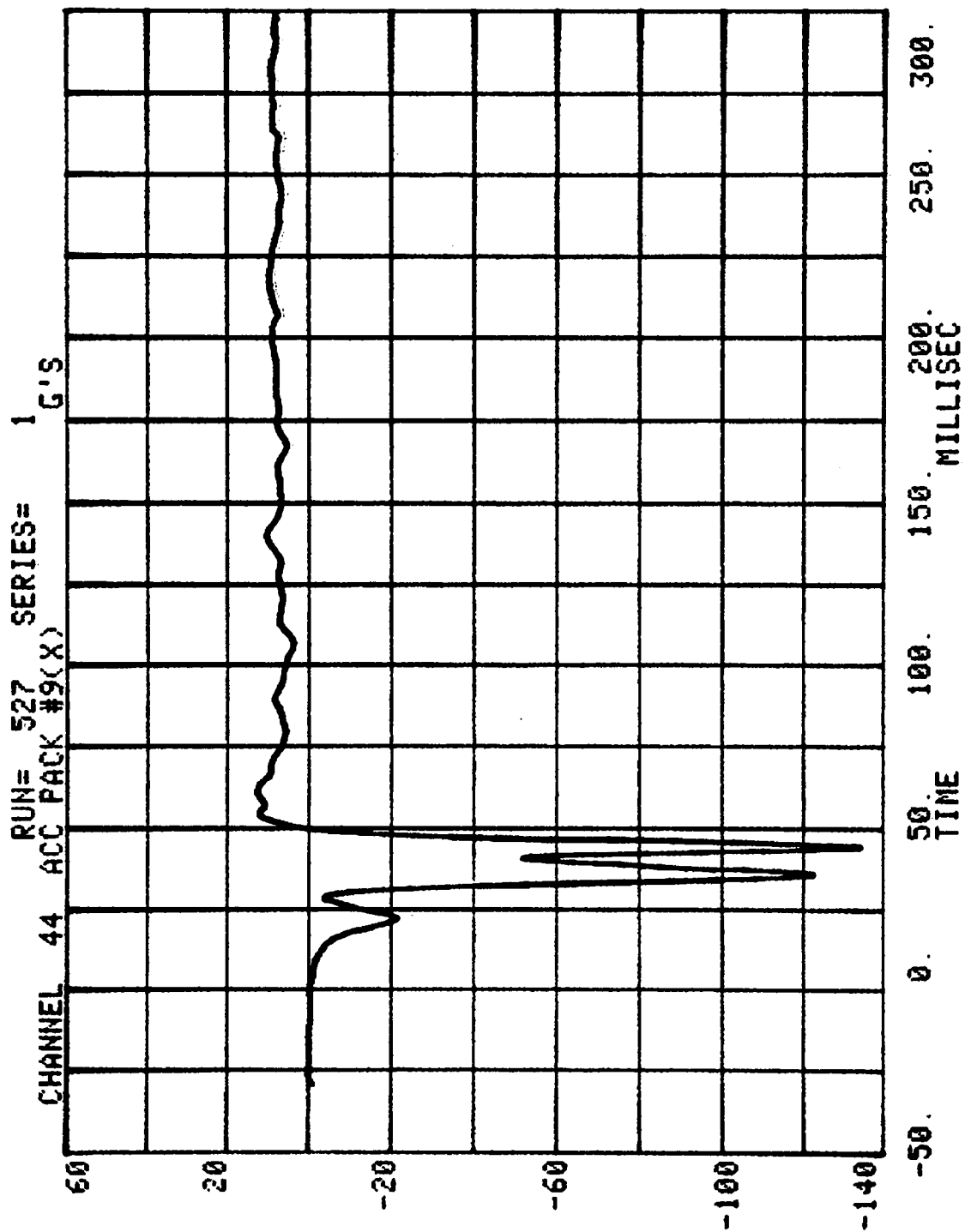


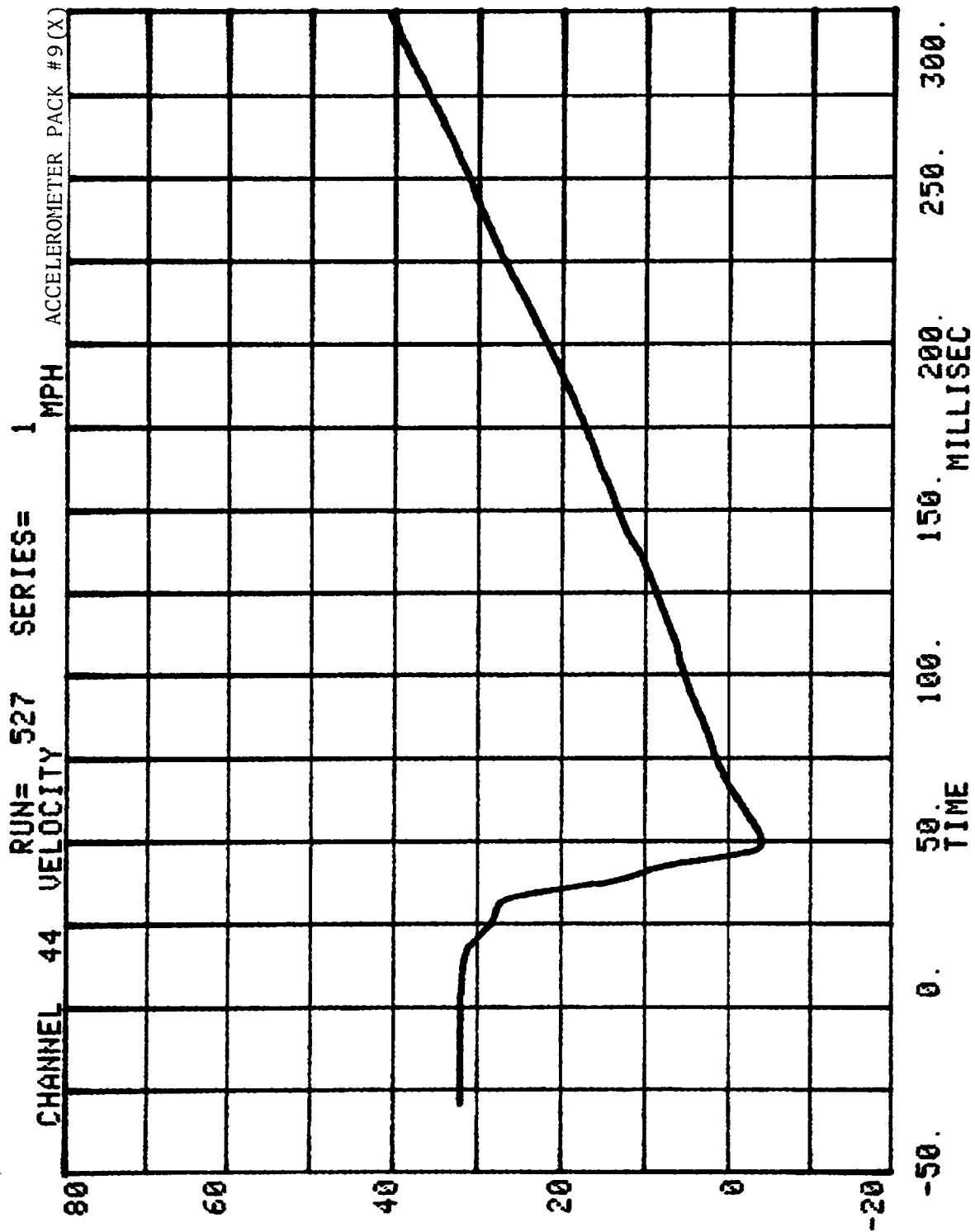


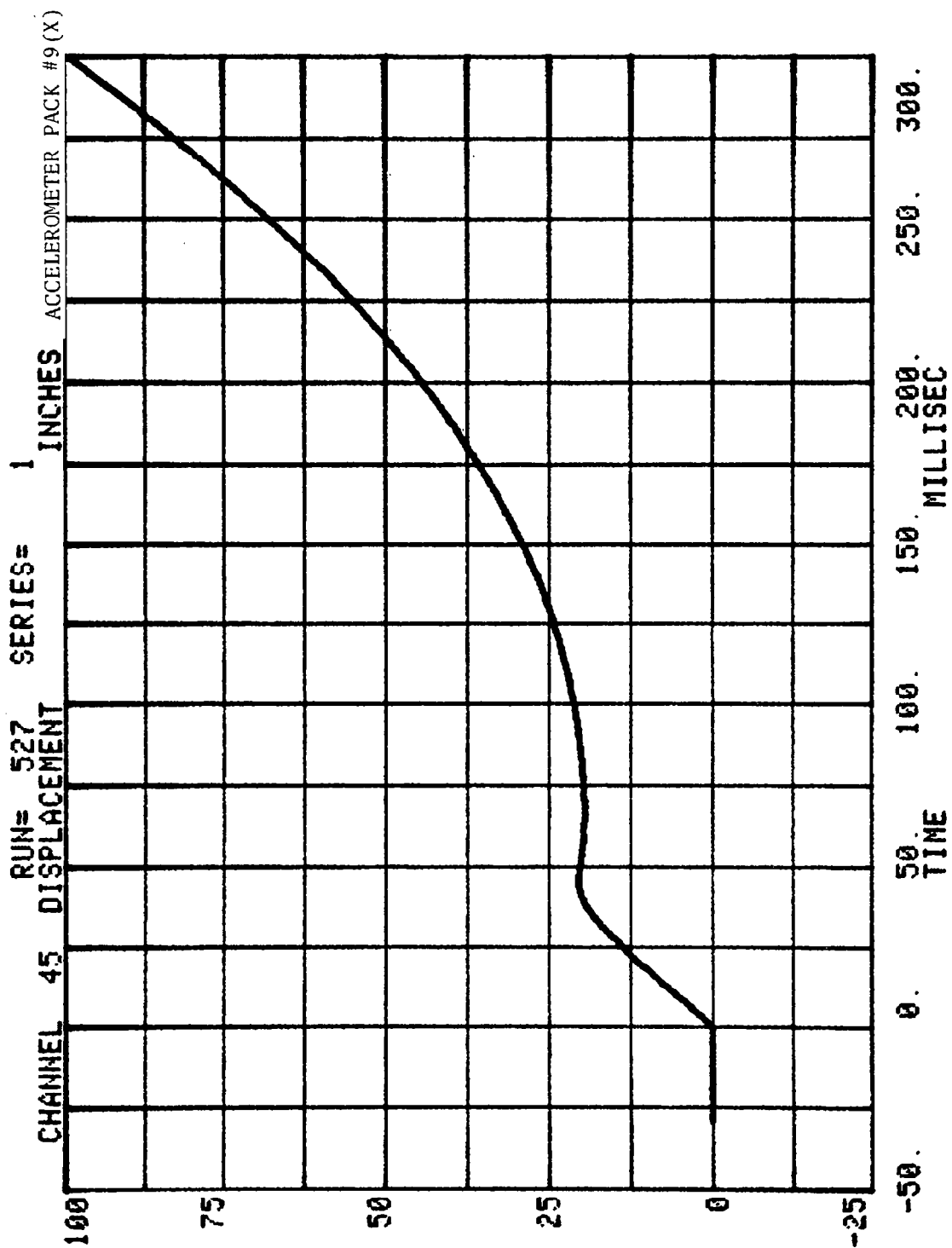


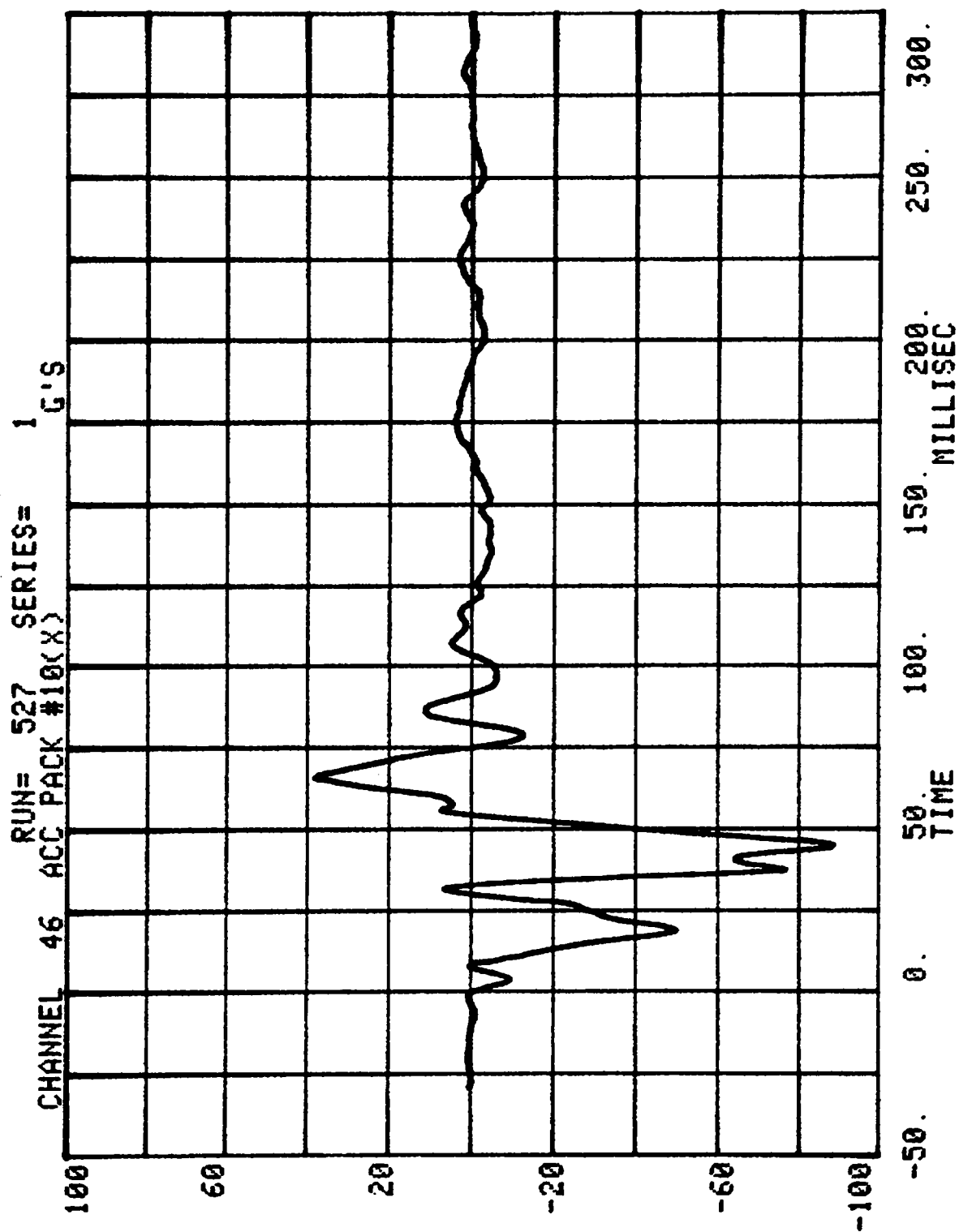
CHANNEL 43 RUN= 527 SERIES= 1
ACC PACK #7(2) G'S

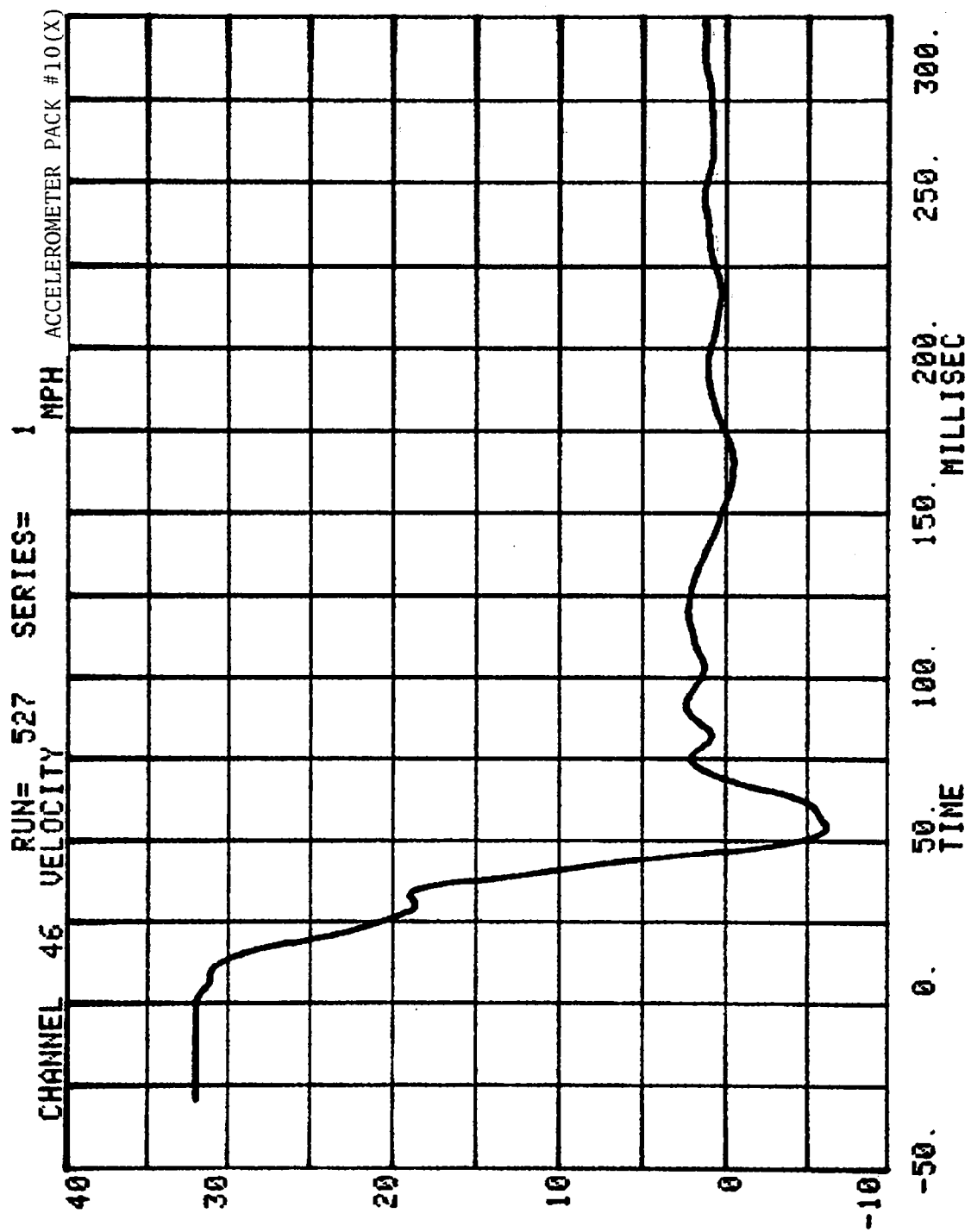




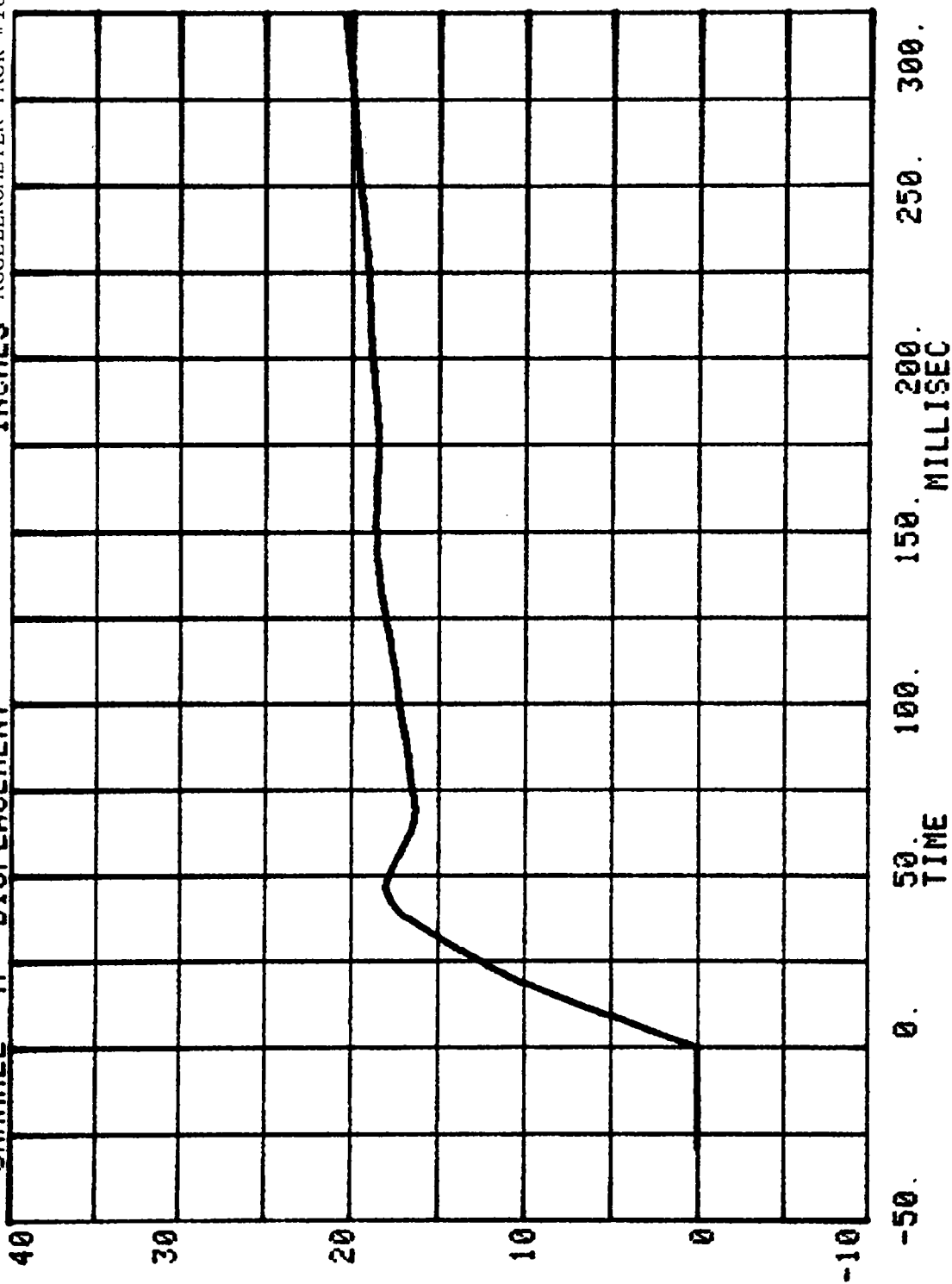


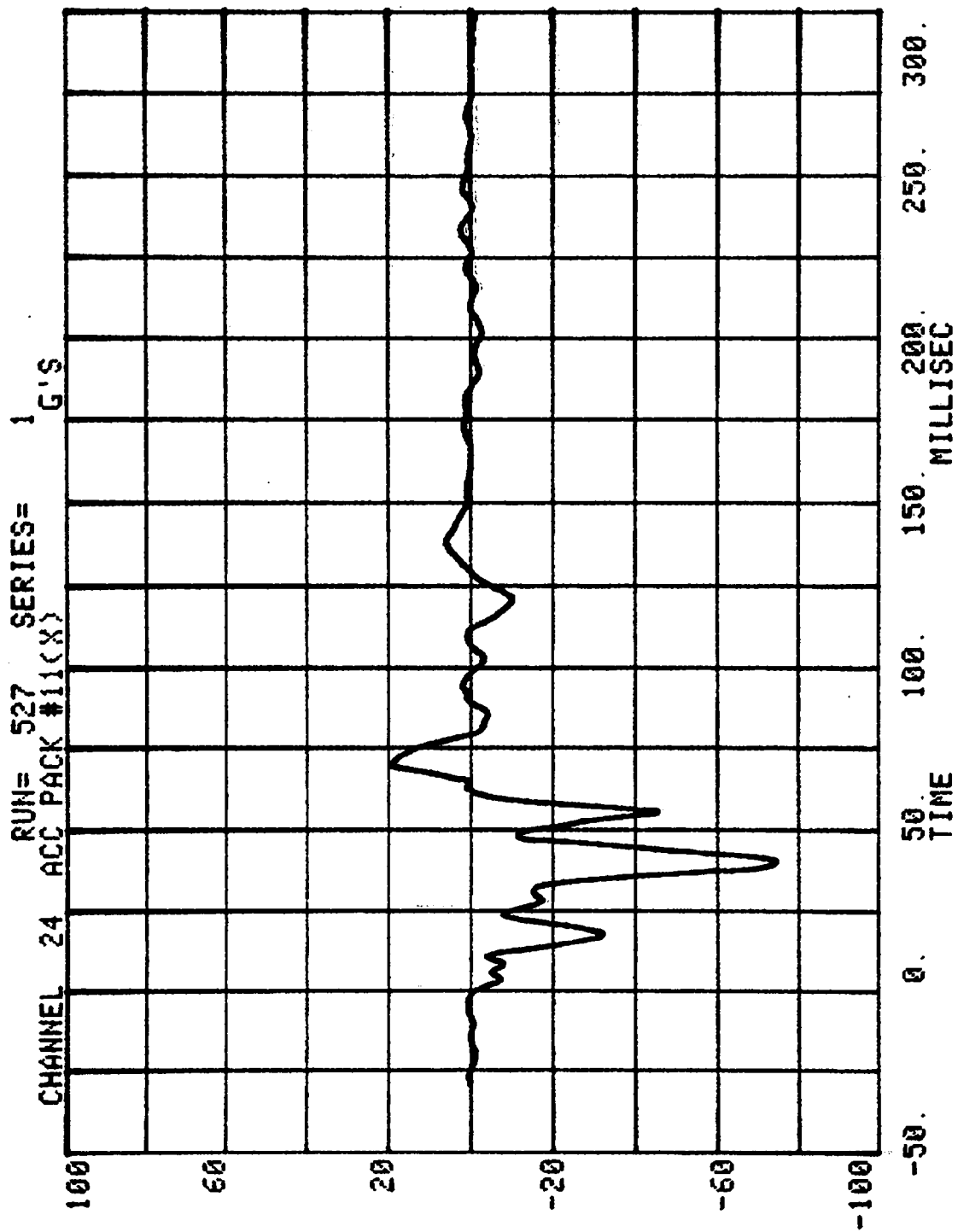


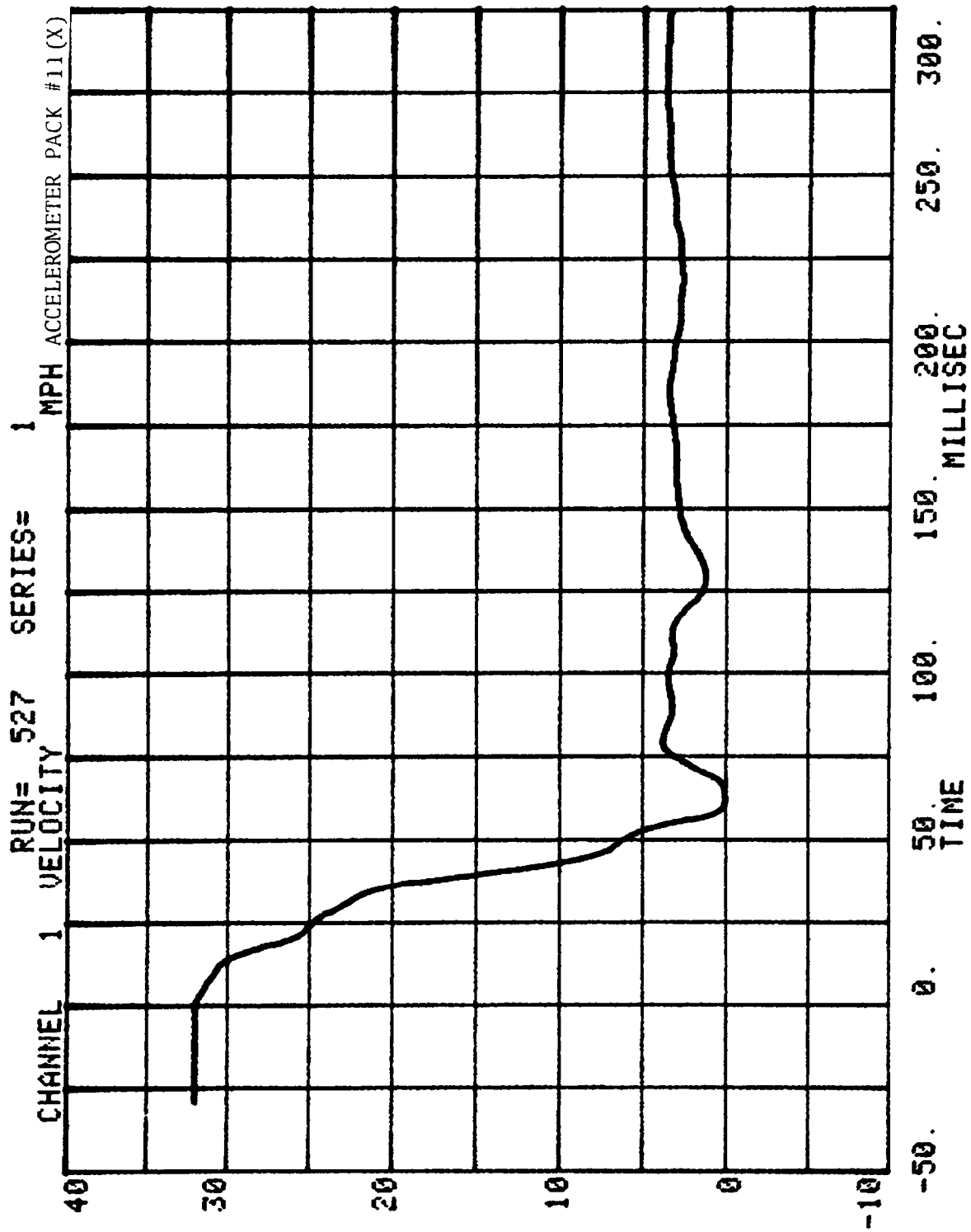


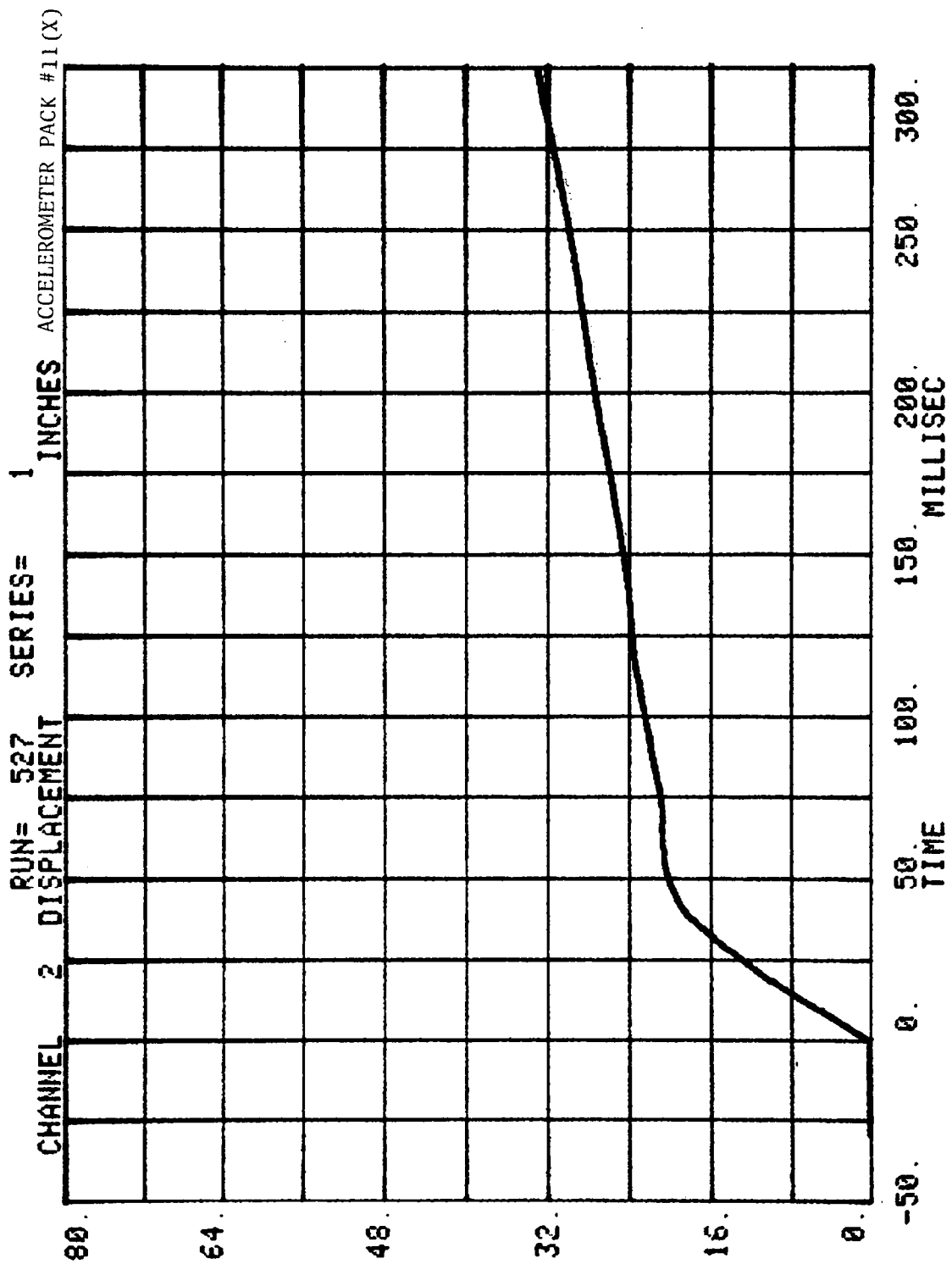


RUN= 527 SERIES= 1 INCHES ACCELEROMETER PACK #10(X)
CHANNEL 47 DISPLACEMENT

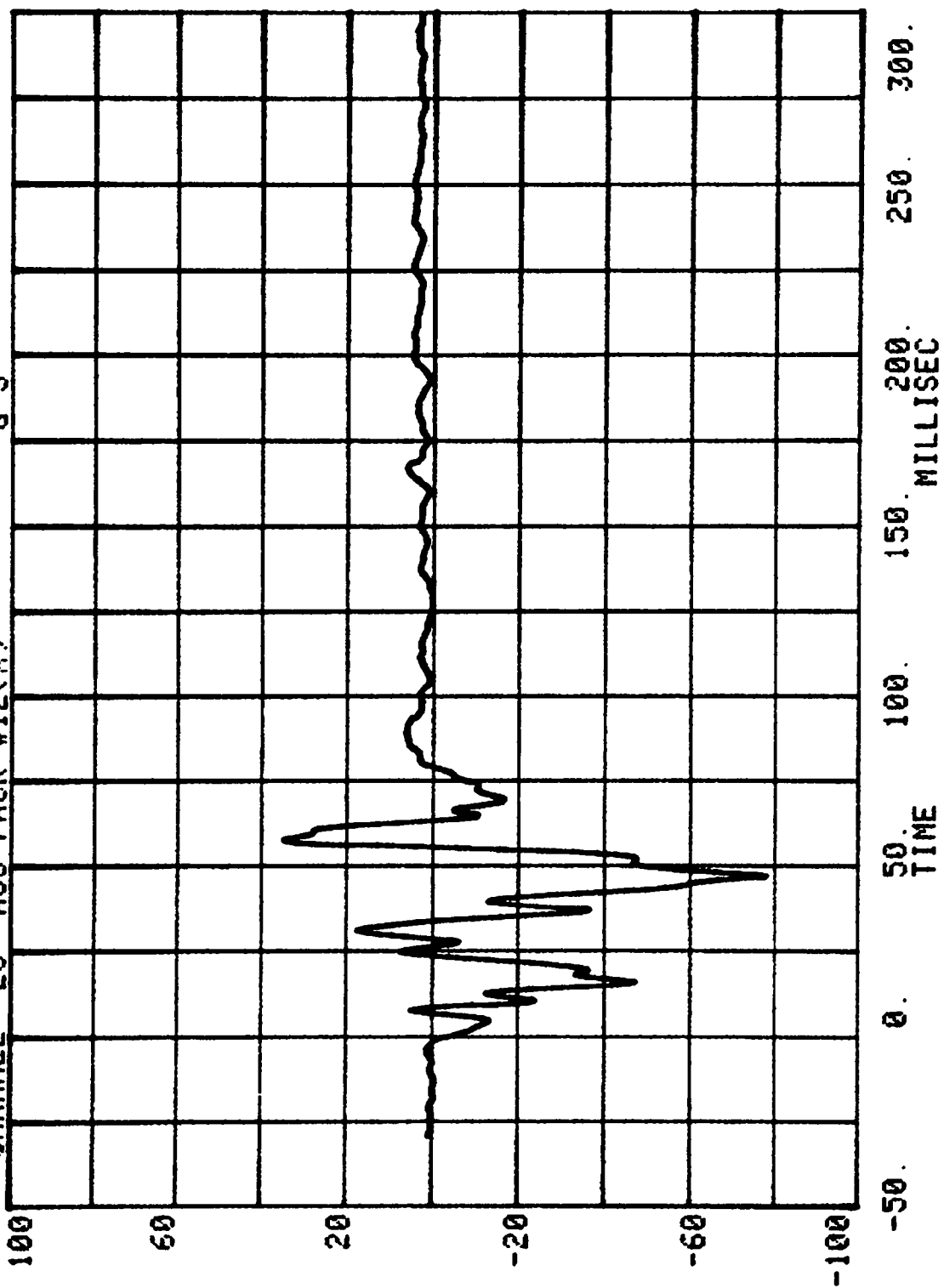


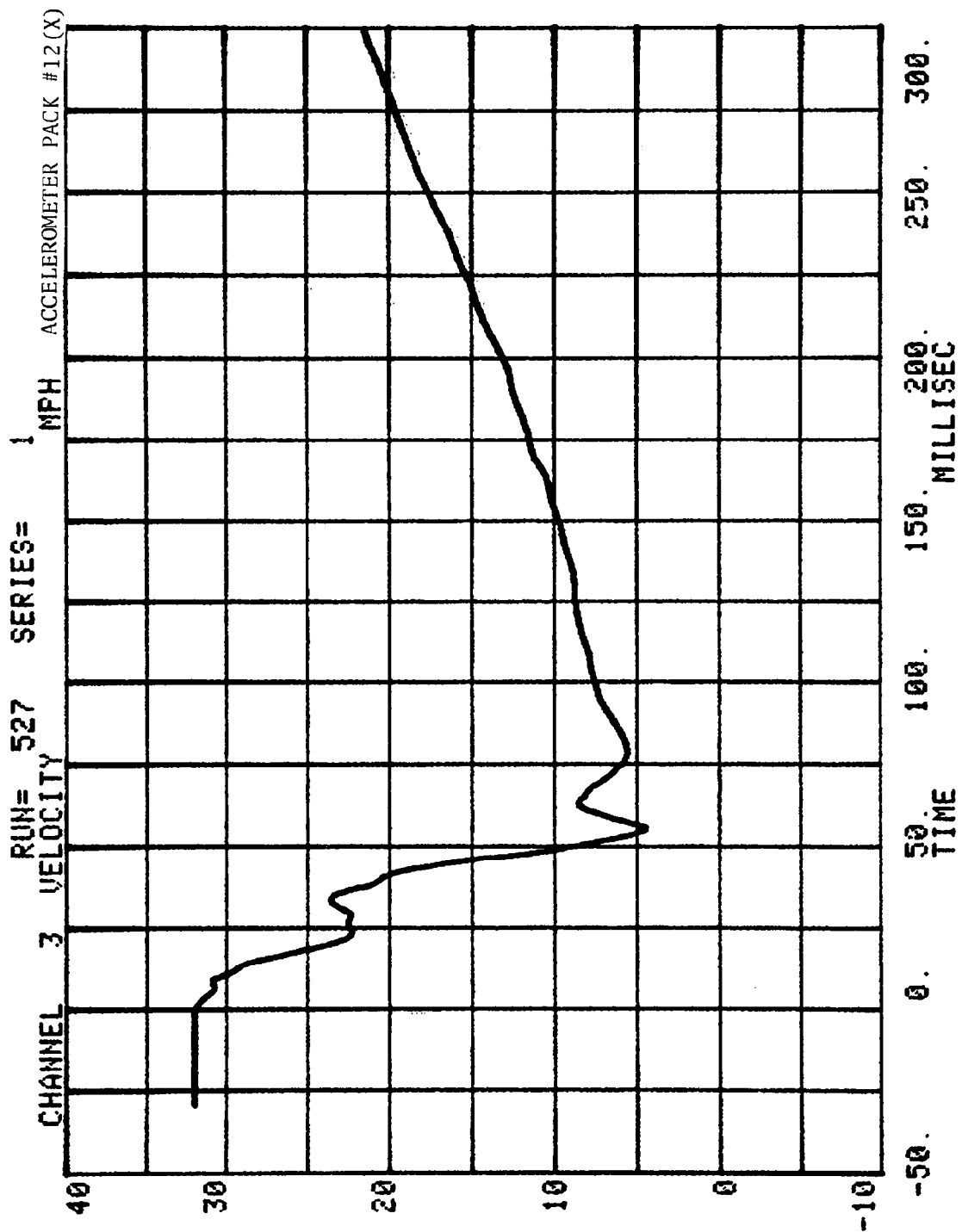


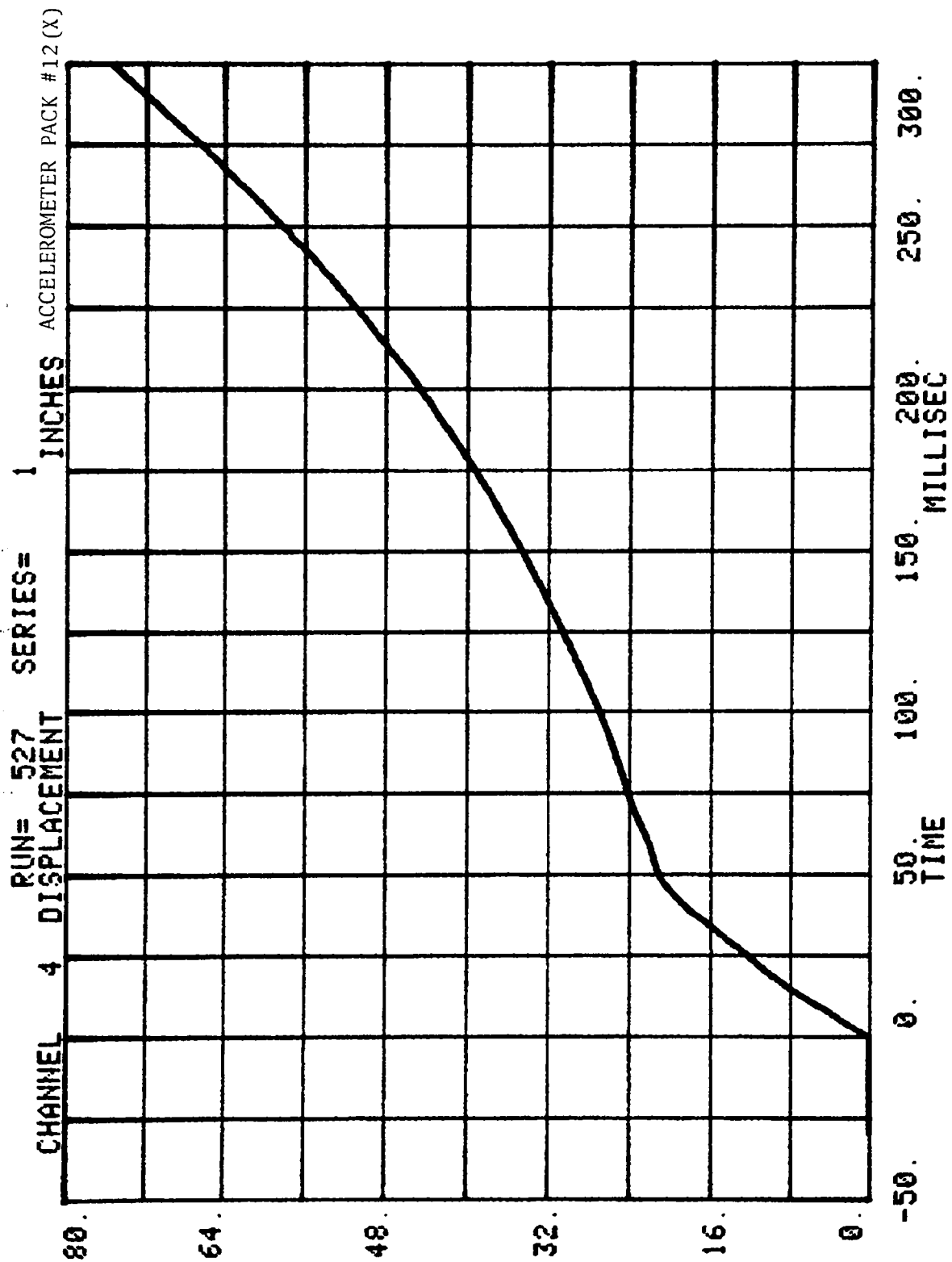


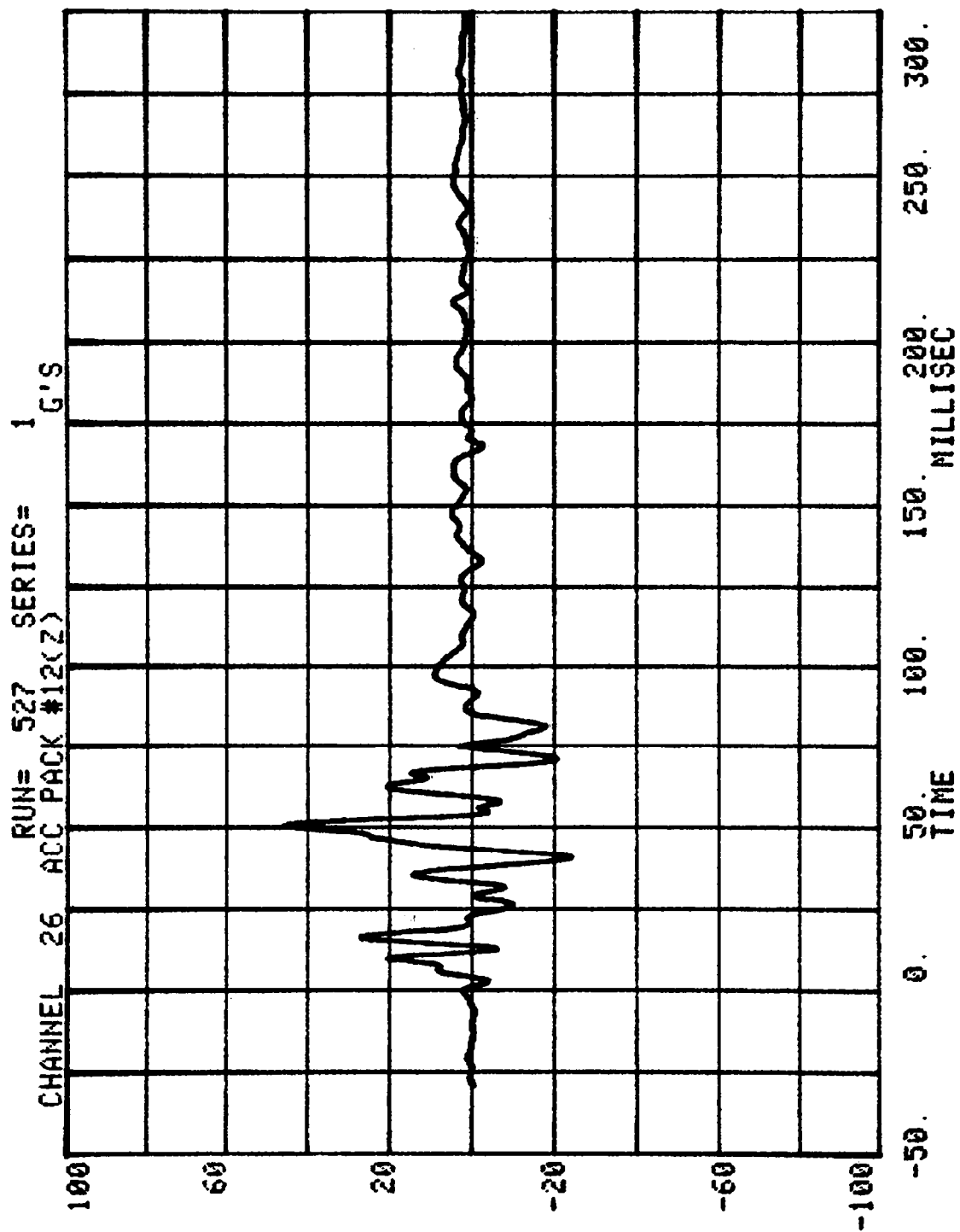


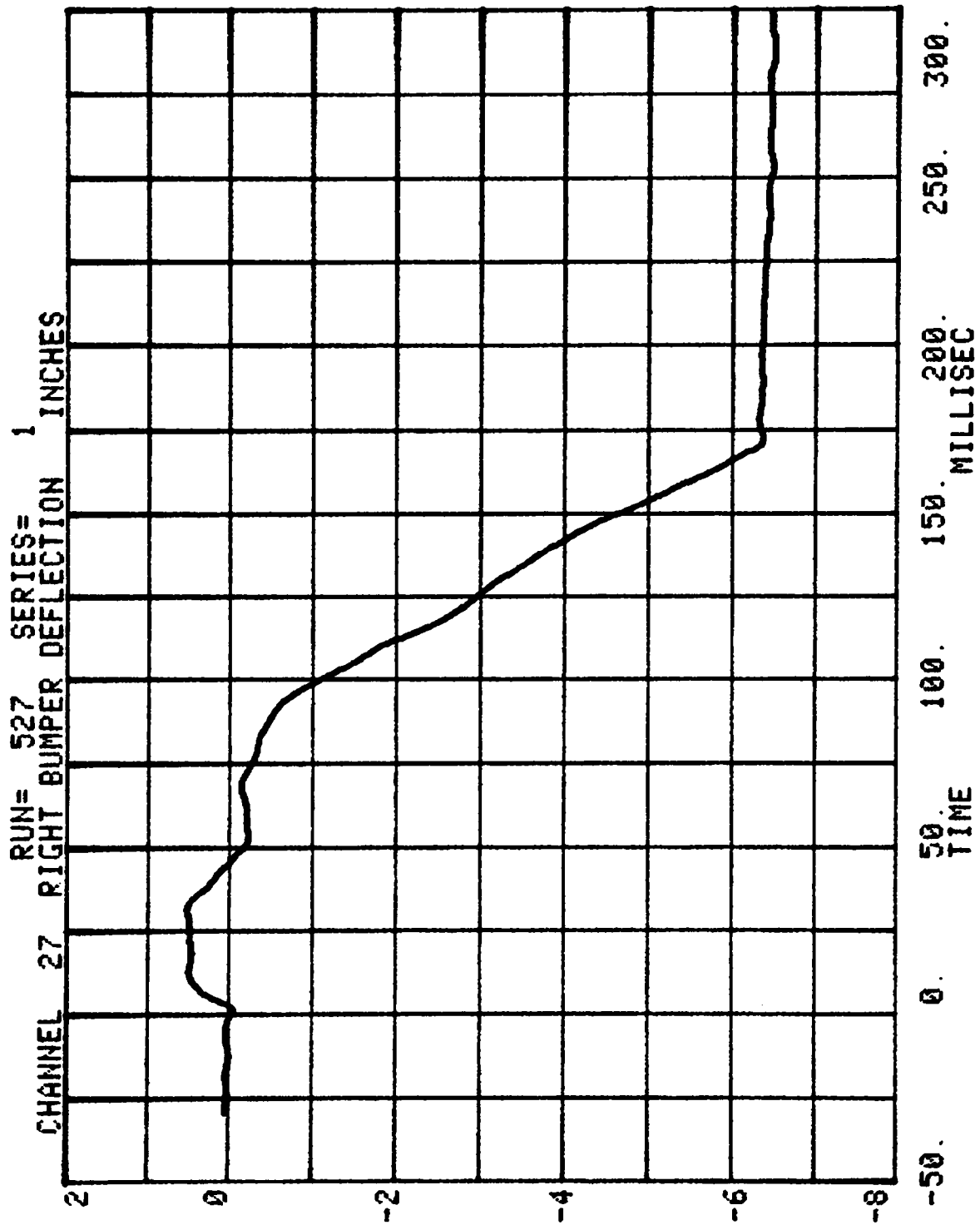
RUN= 527 SERIES= 1
CHANNEL 25 ACC PACK #12(X) G'S

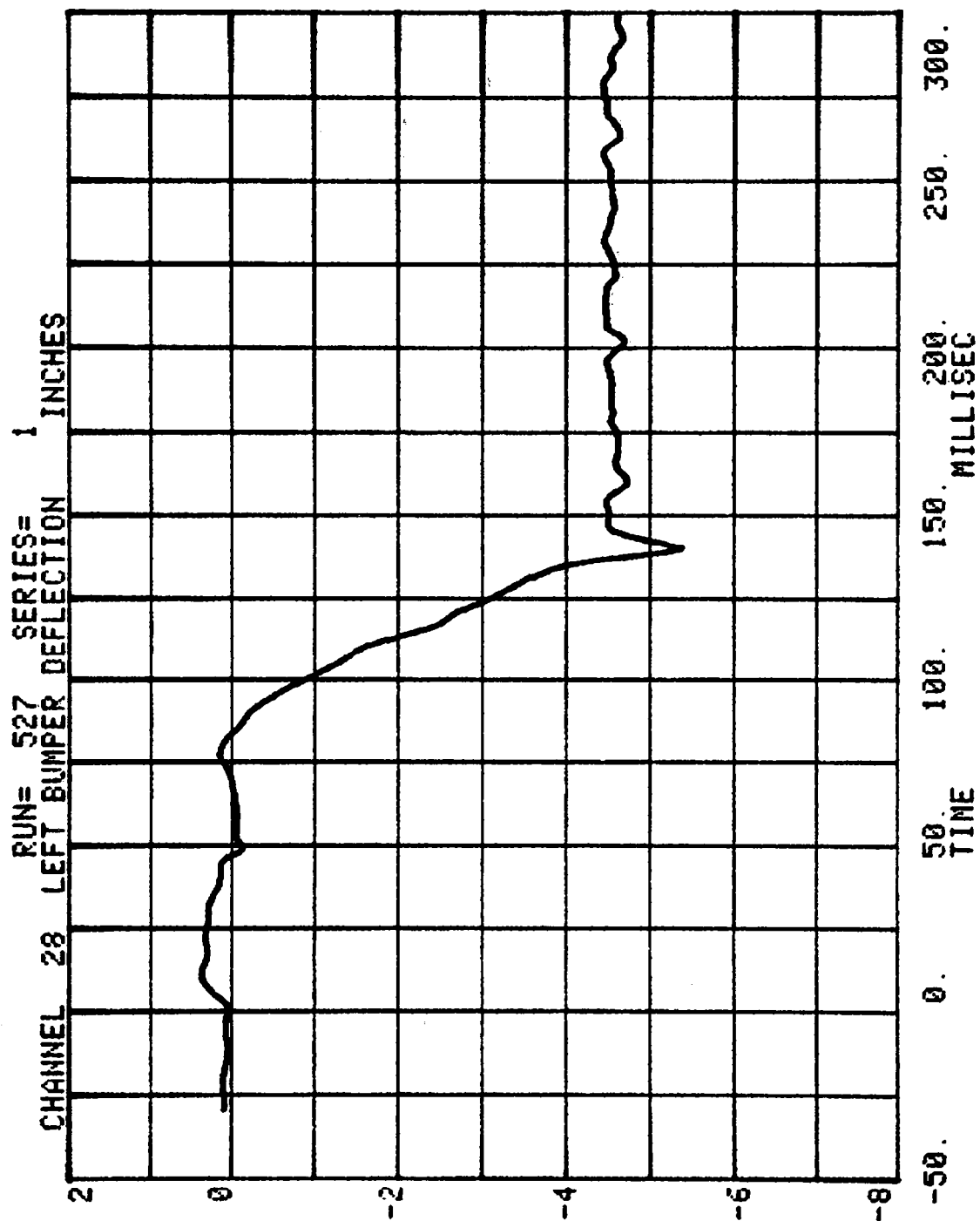


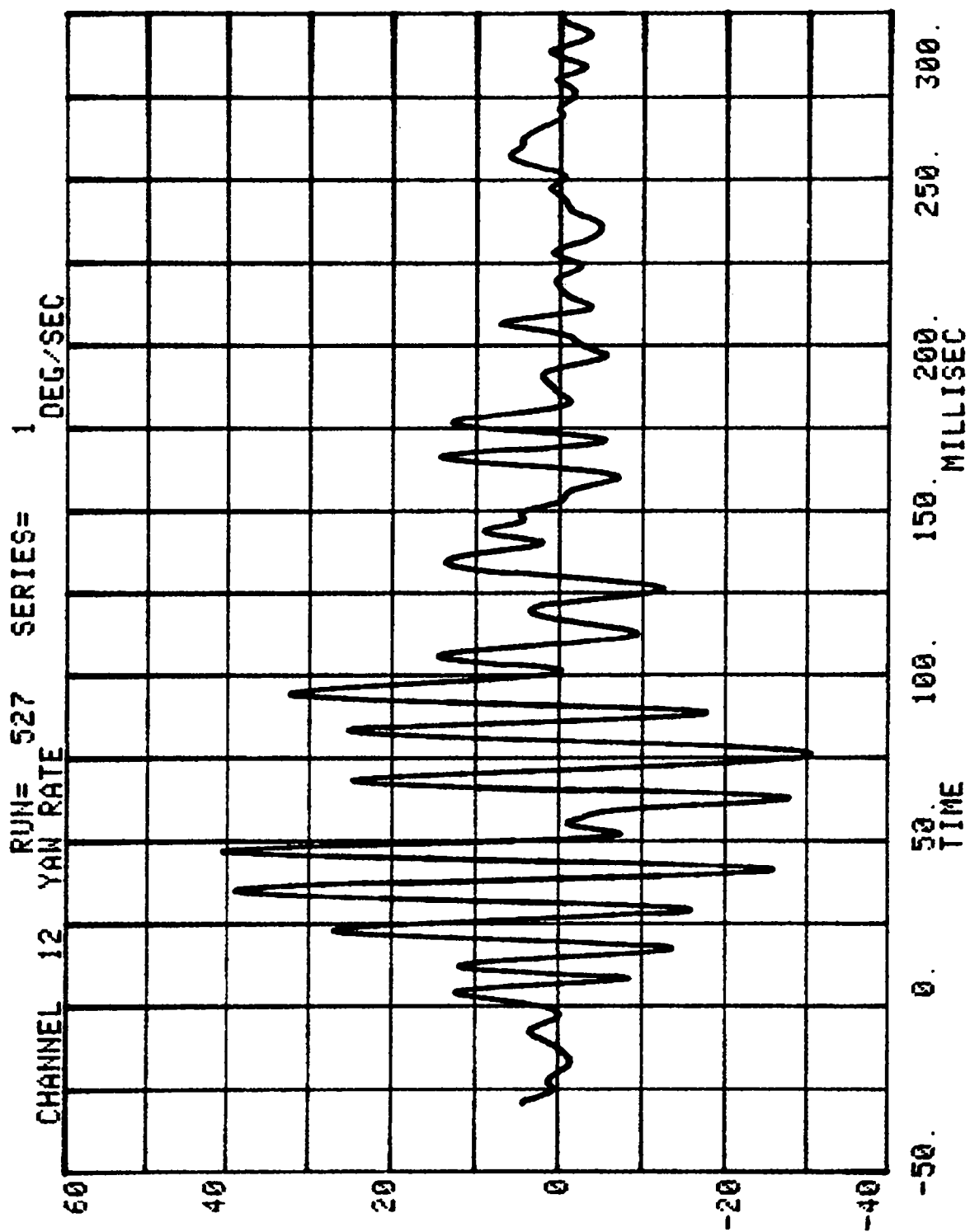


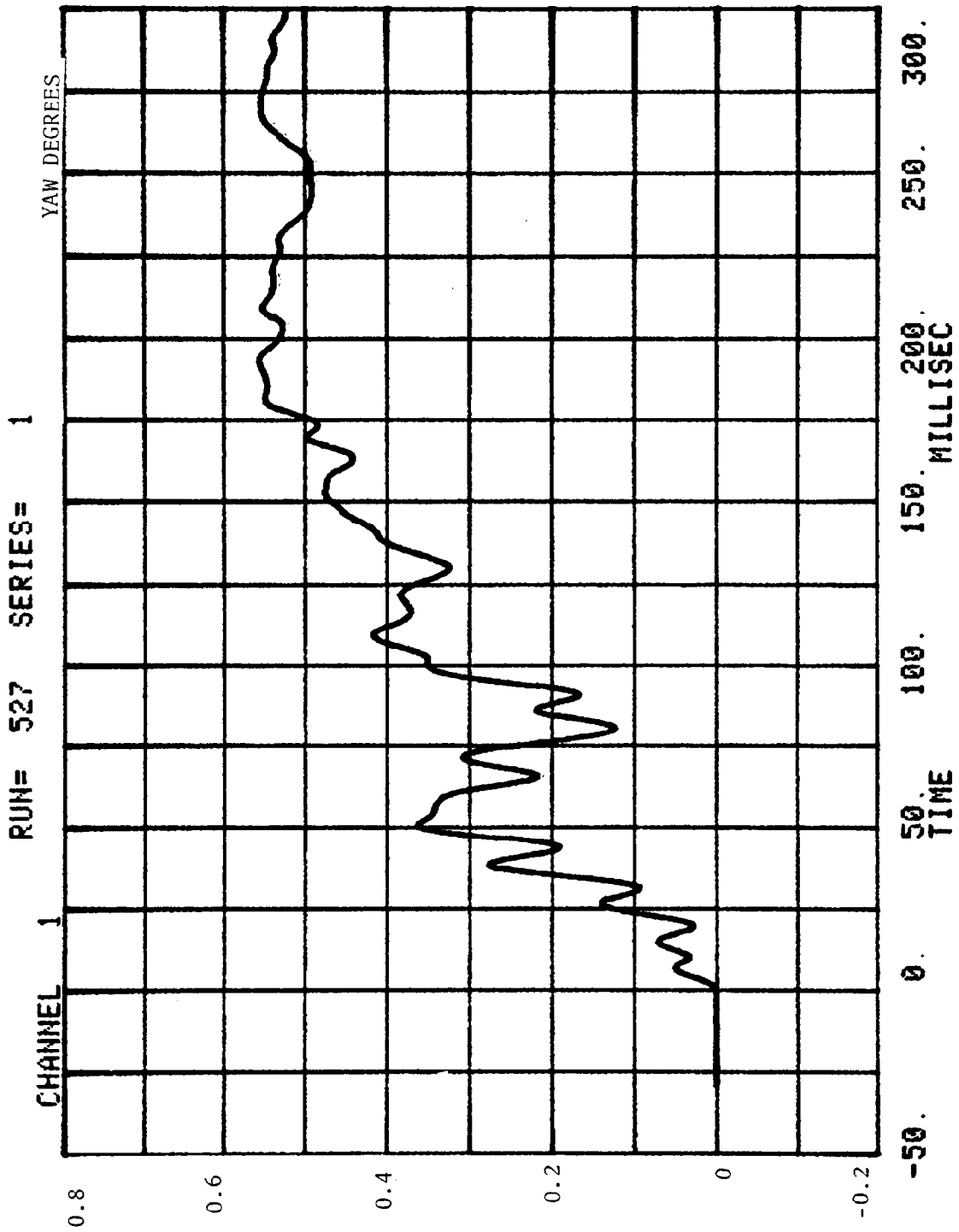












TEST NO. 752-1-527

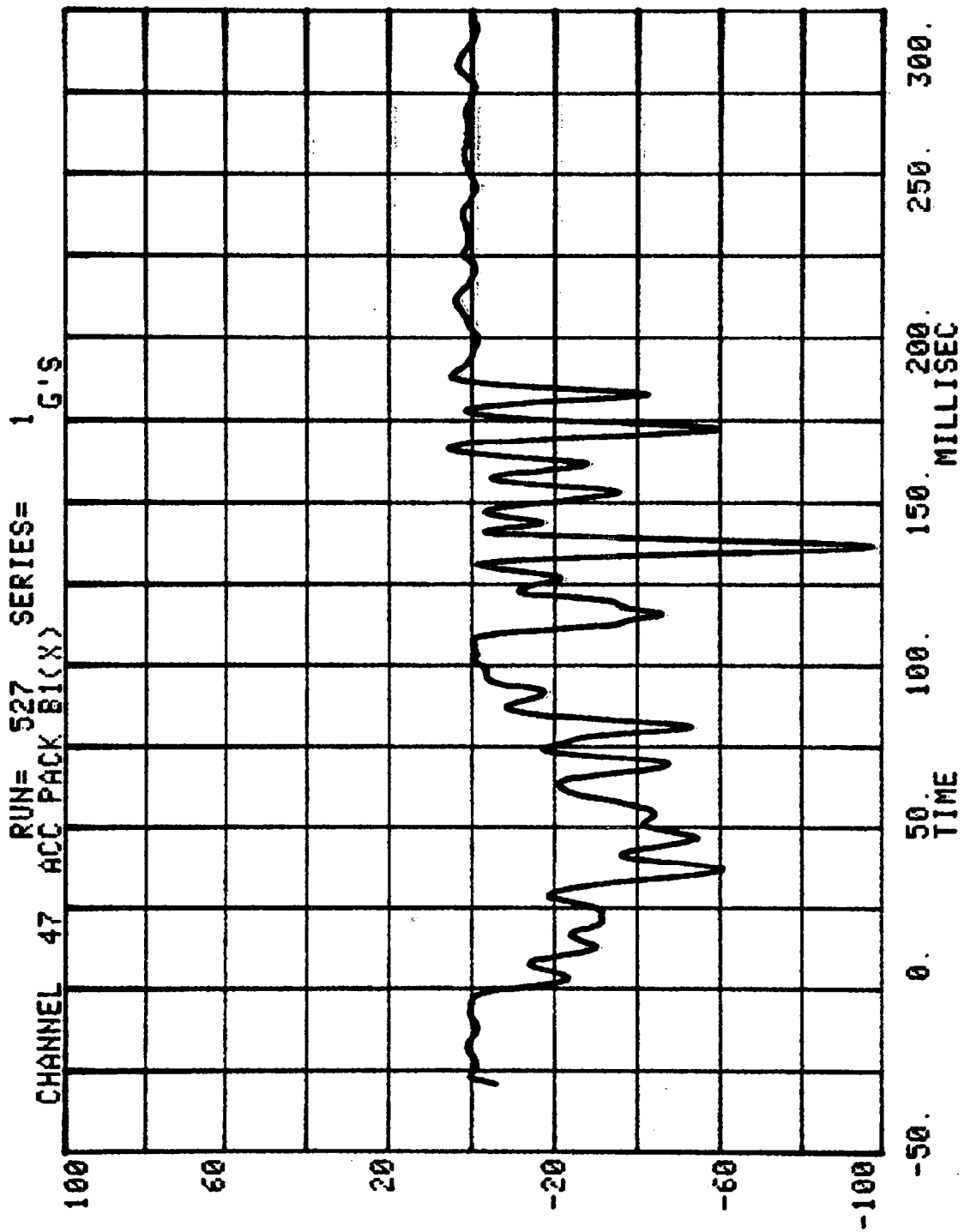
MOVING DEFORMABLE BARRIER

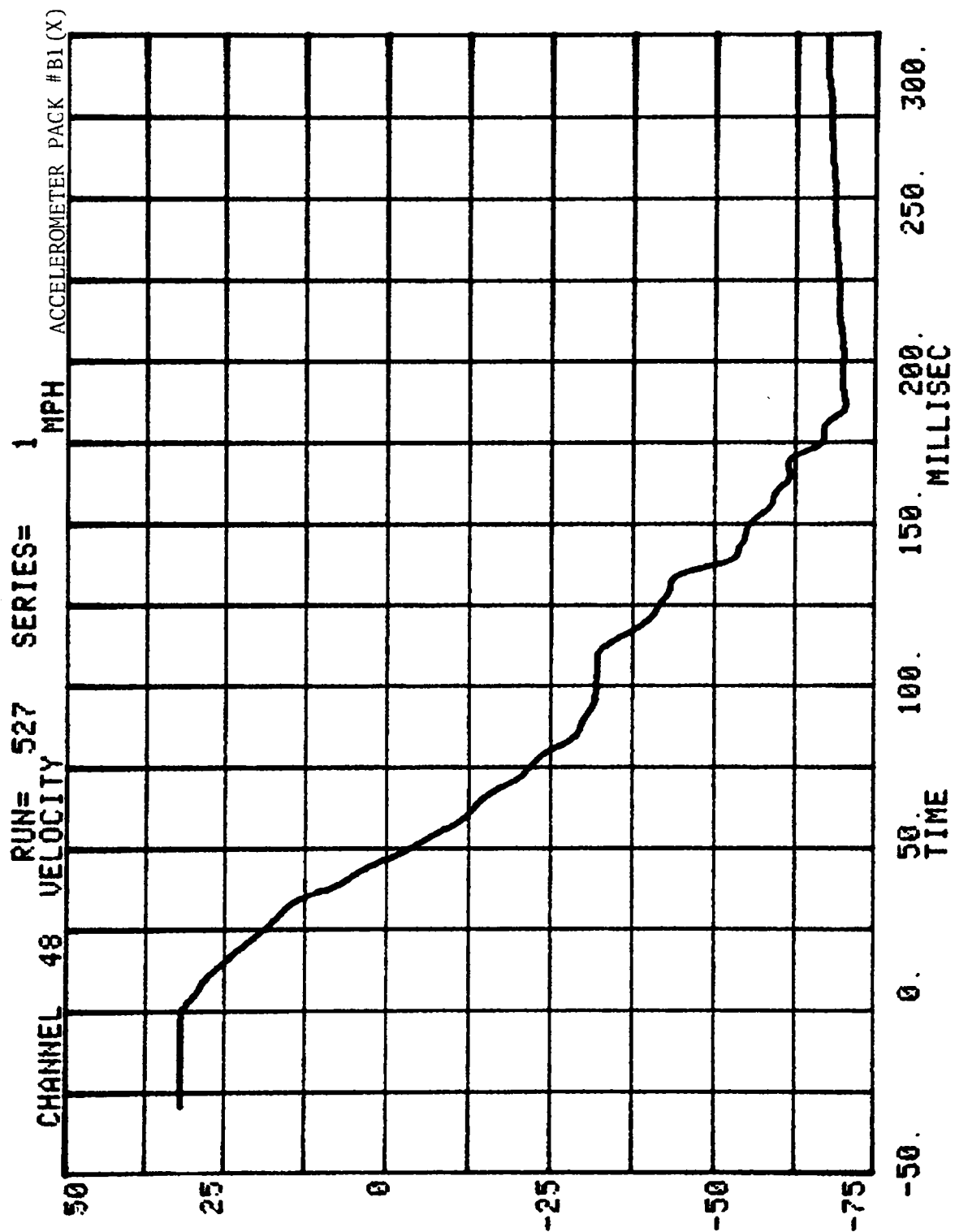
VEHICLE NO. 2

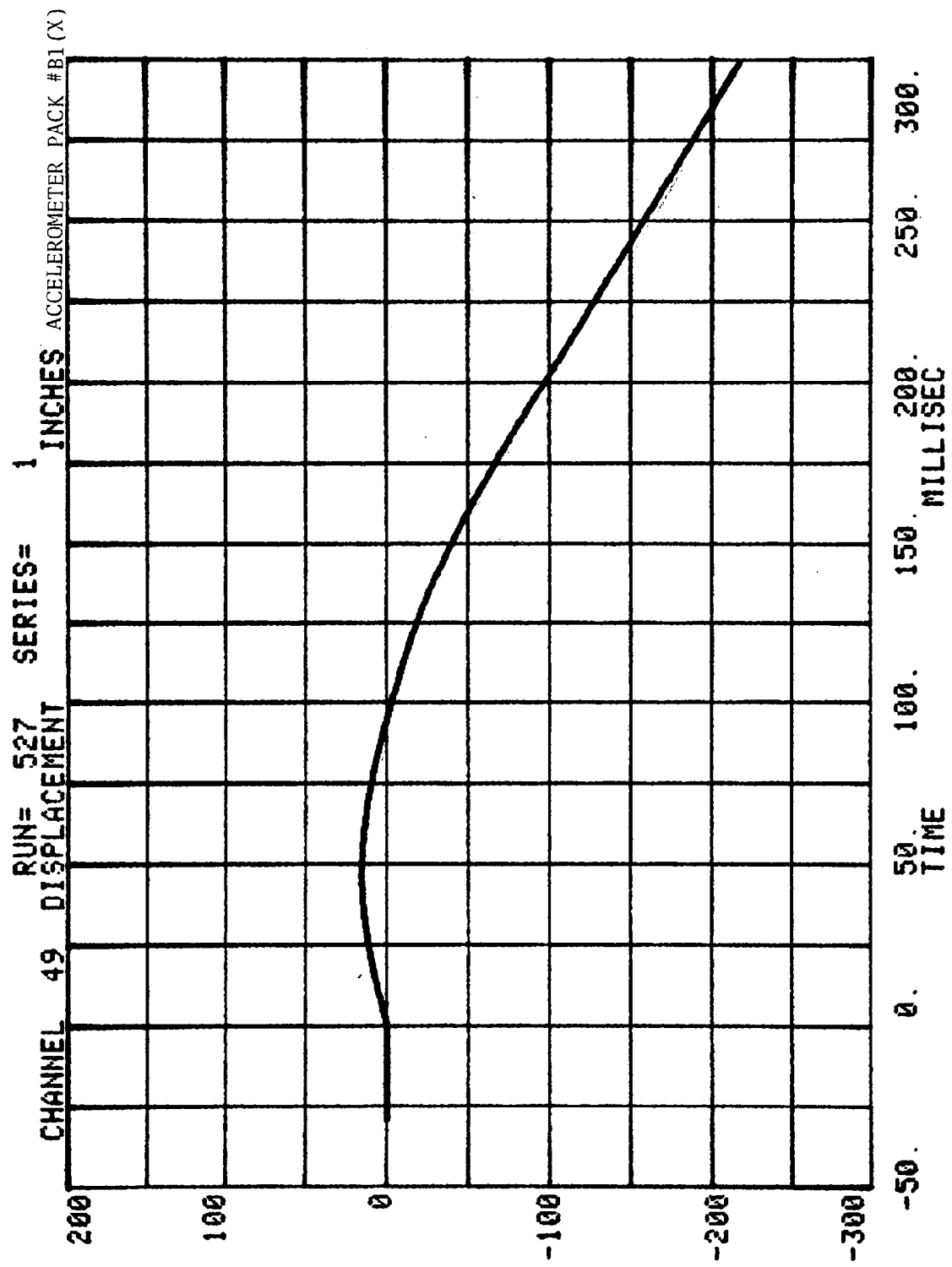
VEHICLE DATA

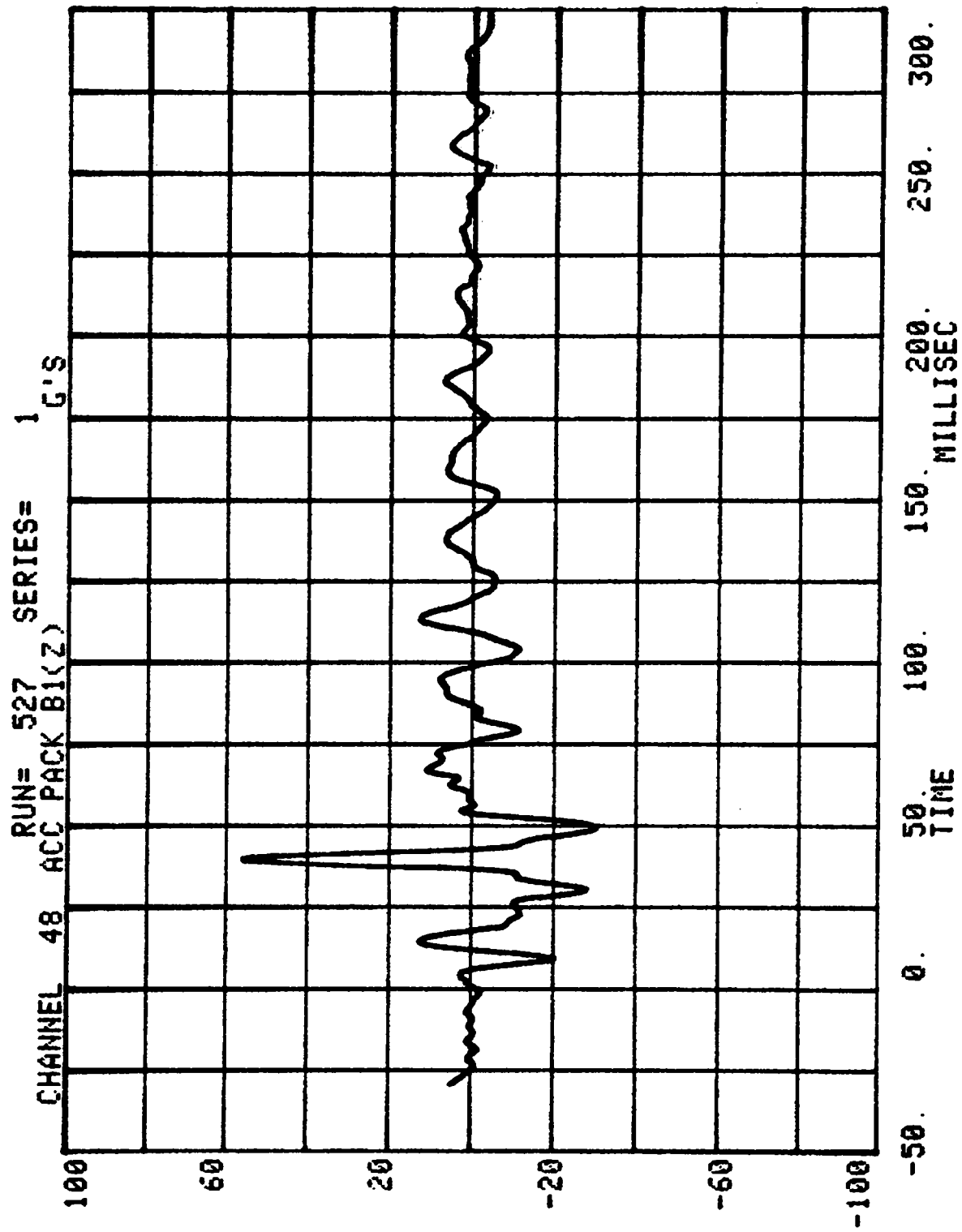
FILTER CHANNEL CLASS

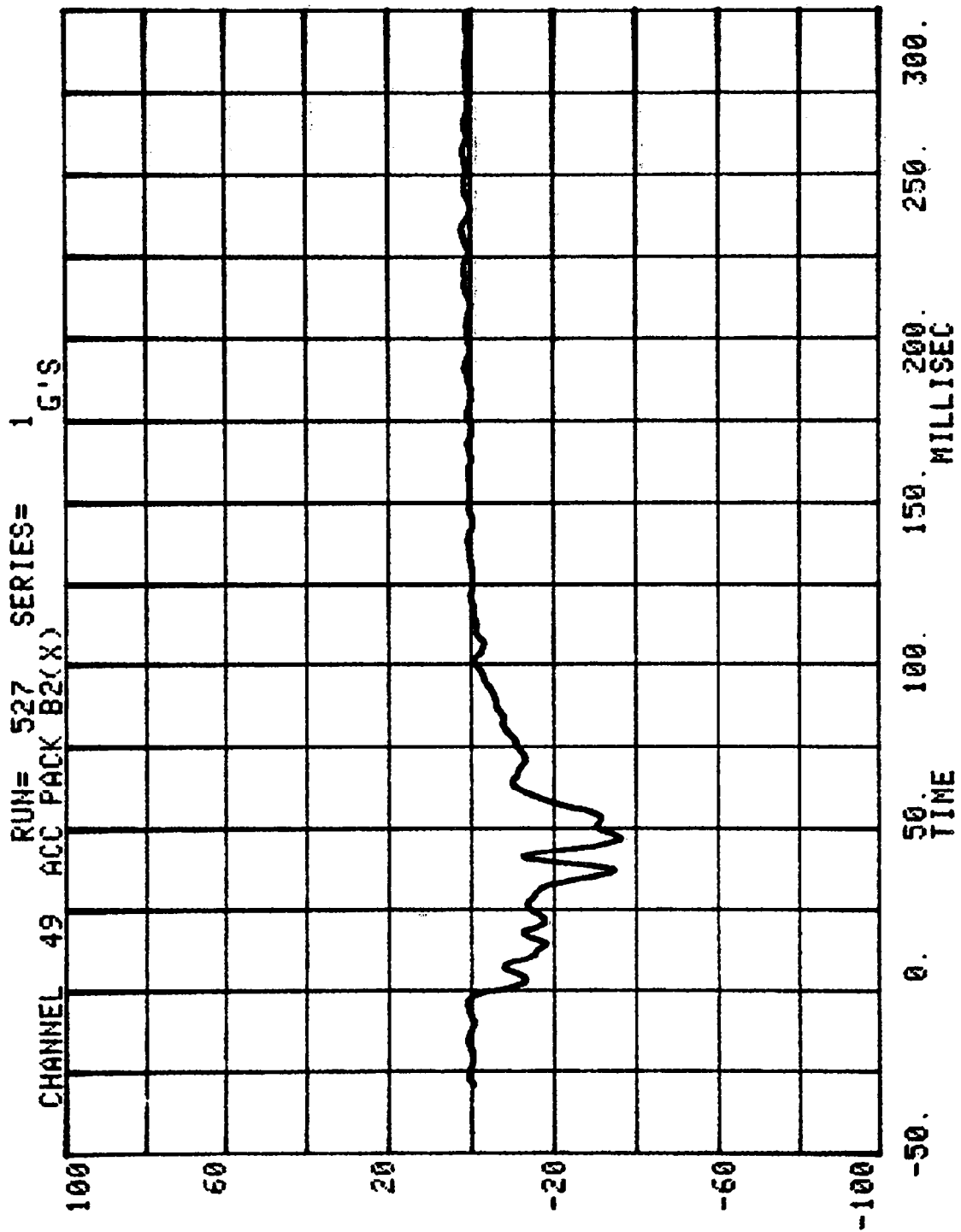
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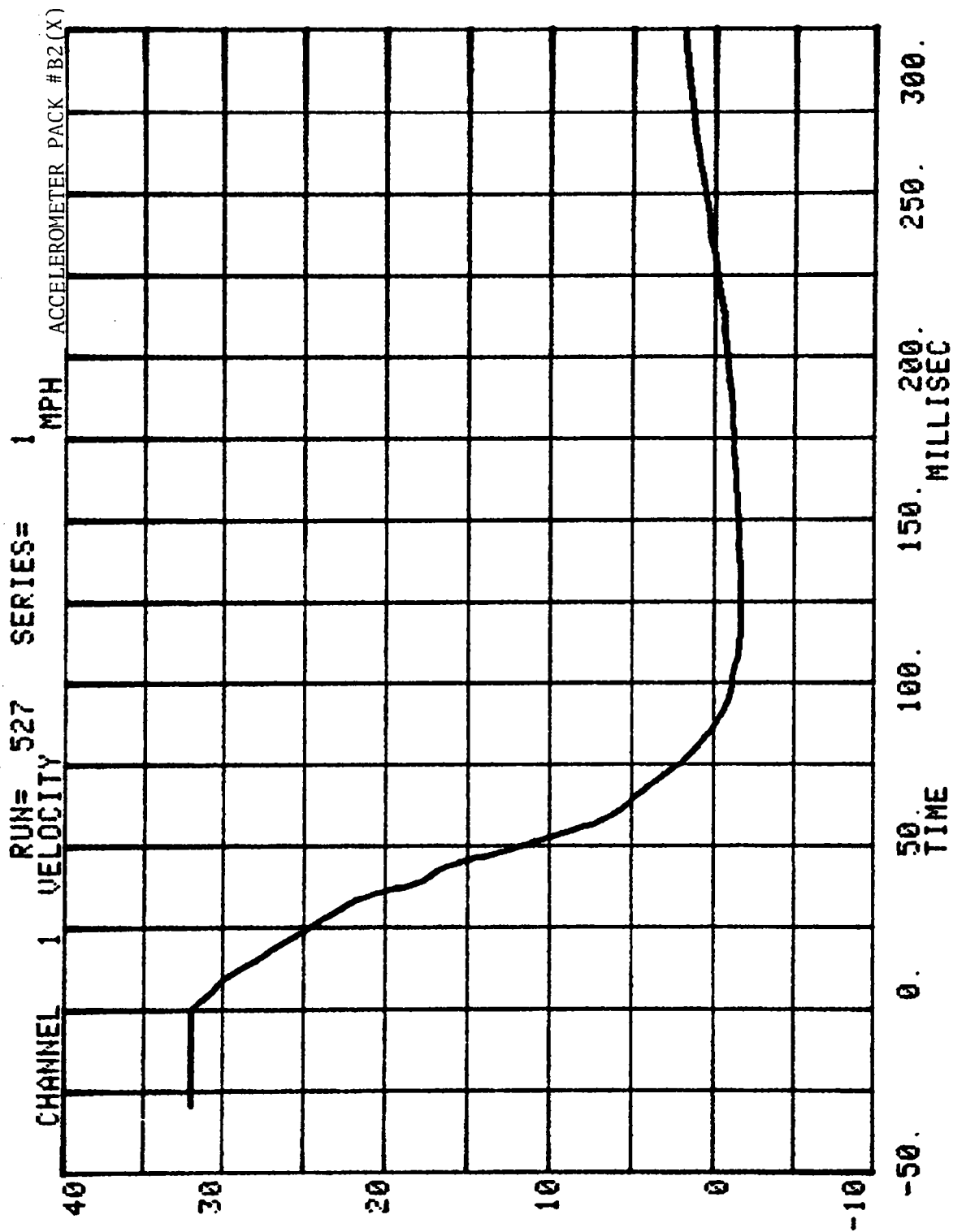


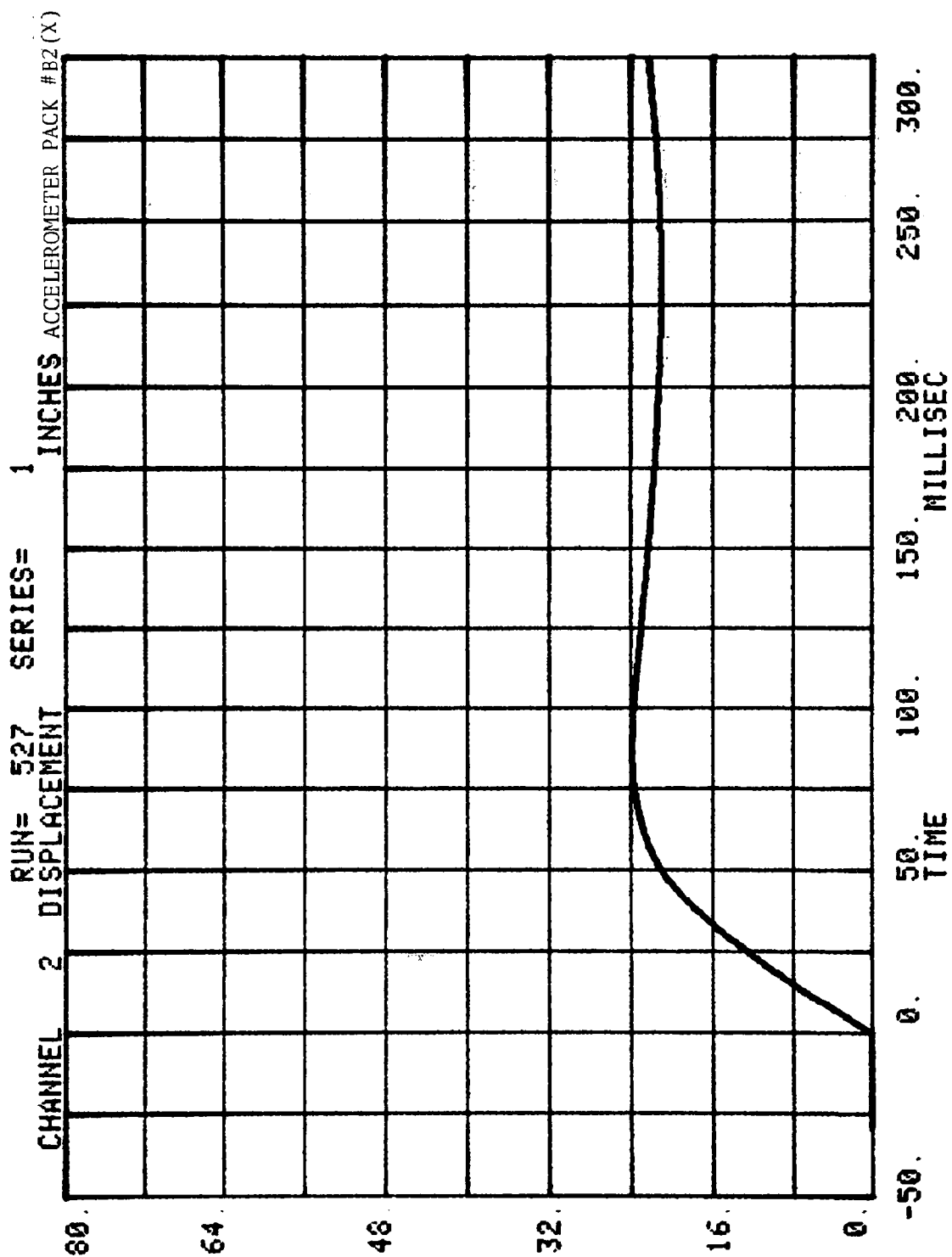




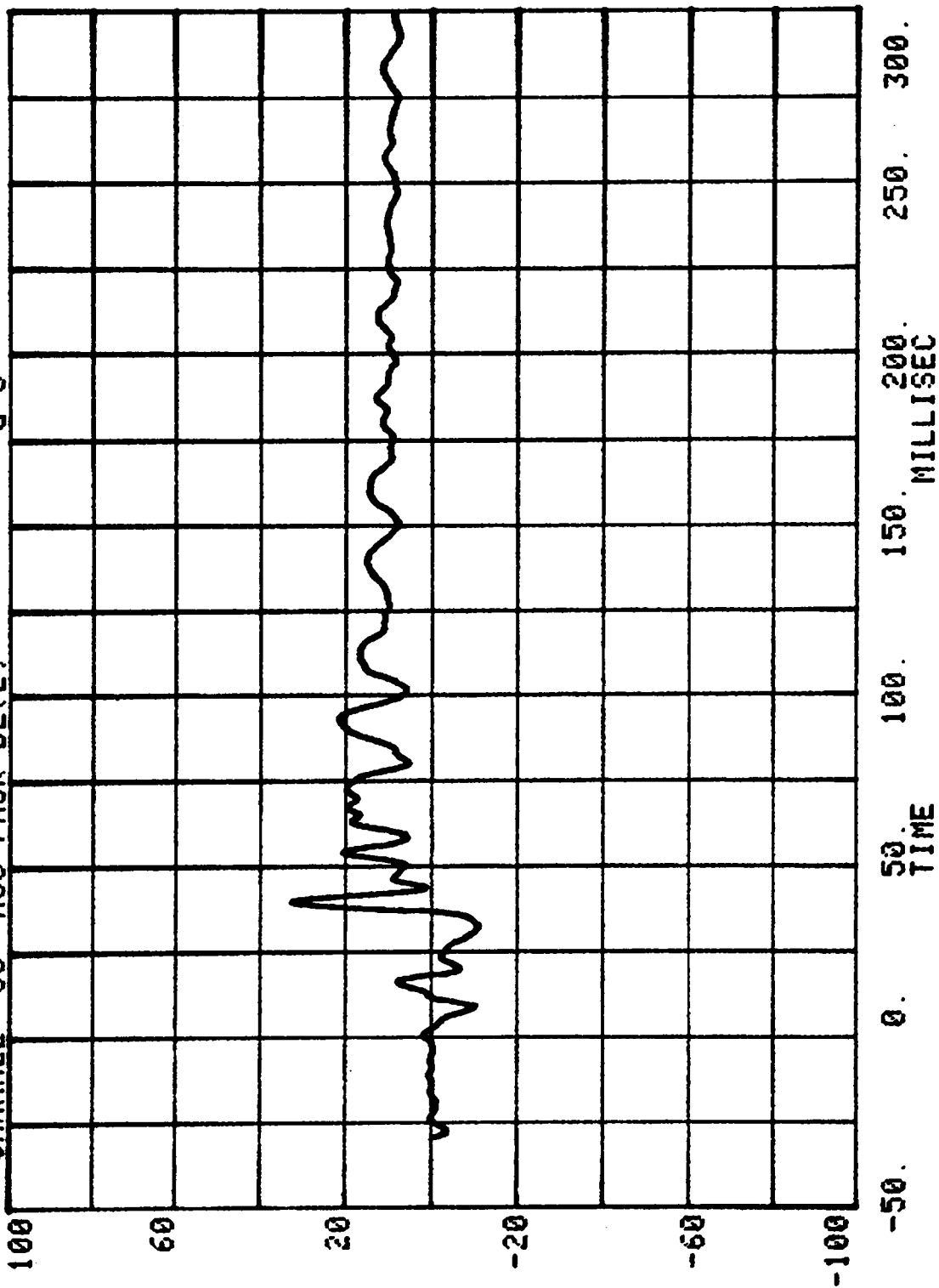




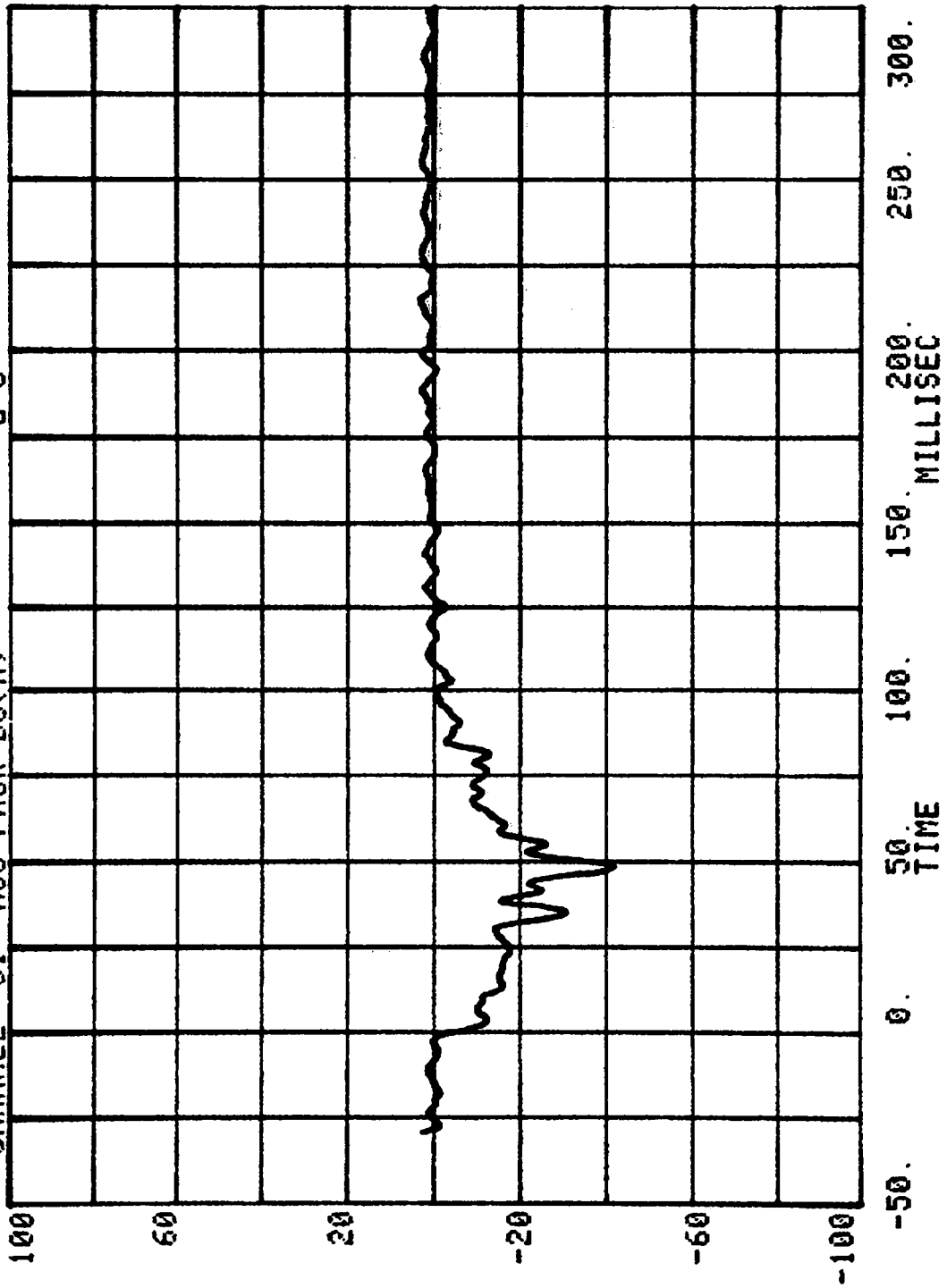


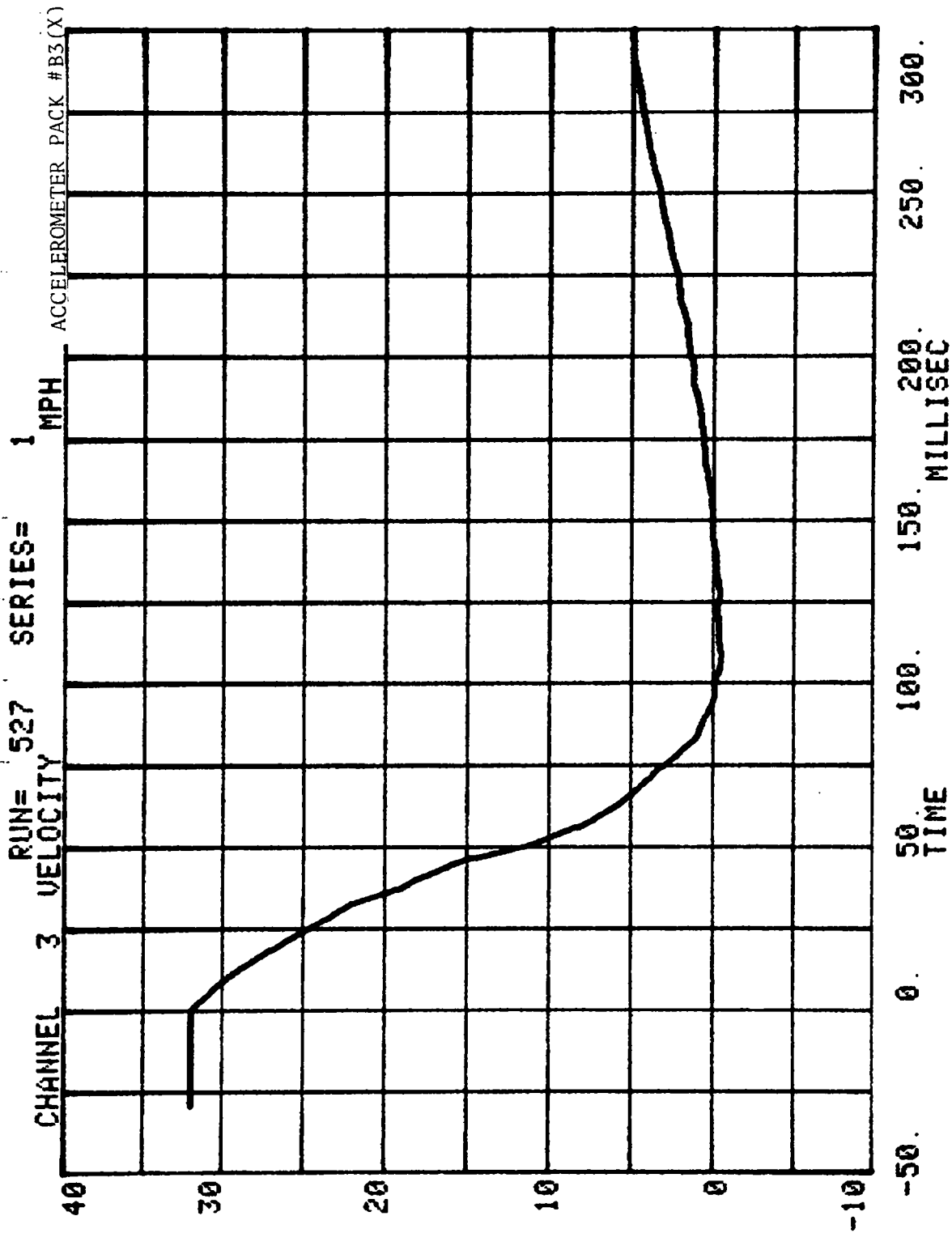


RUN= 527 SERIES= 1 G'S
CHANNEL 50 ACC PACK B2(2)

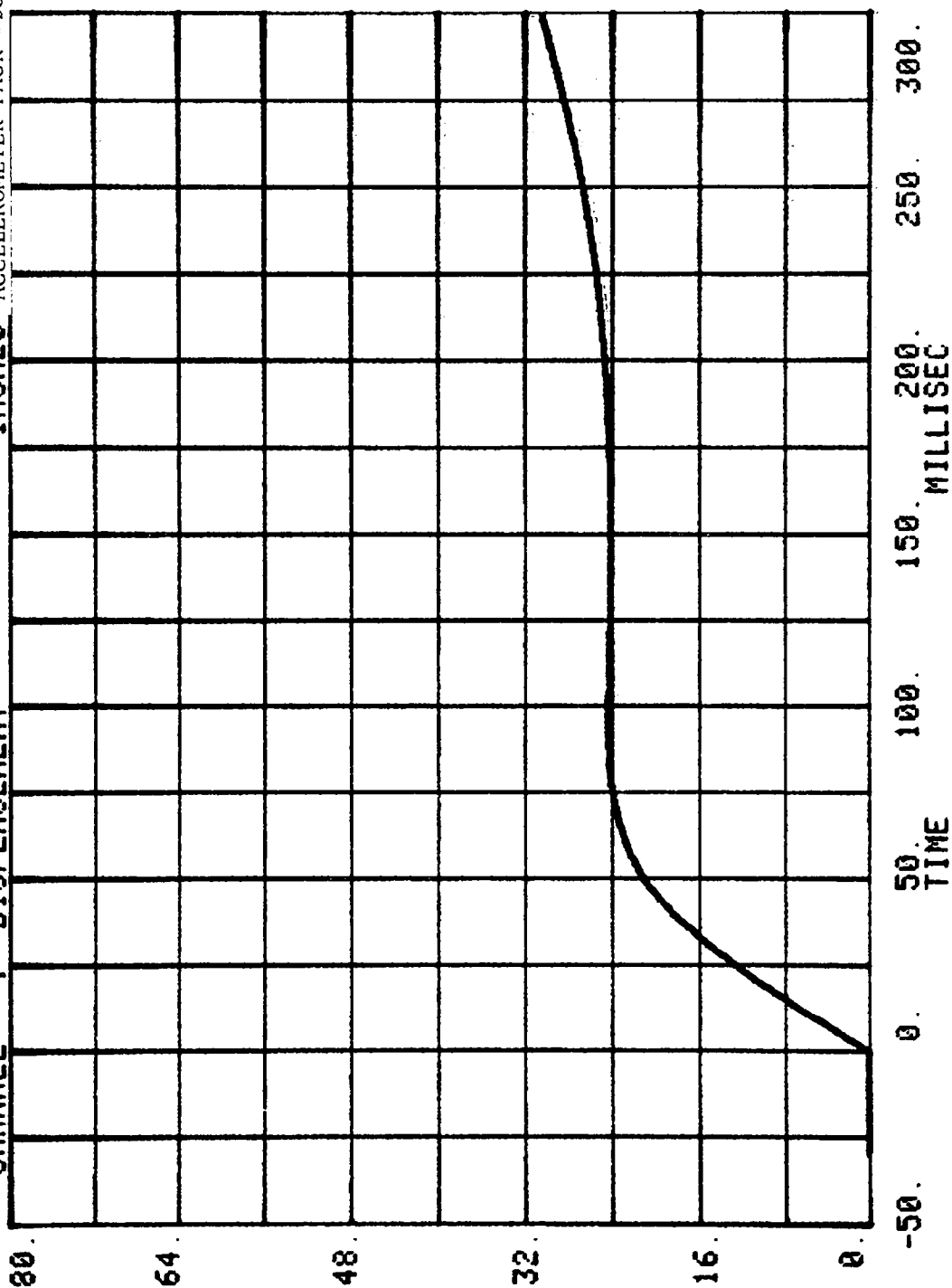


CHANNEL 51 ACC PACK B3(X) RUN= 527 SERIES= 1 G'S

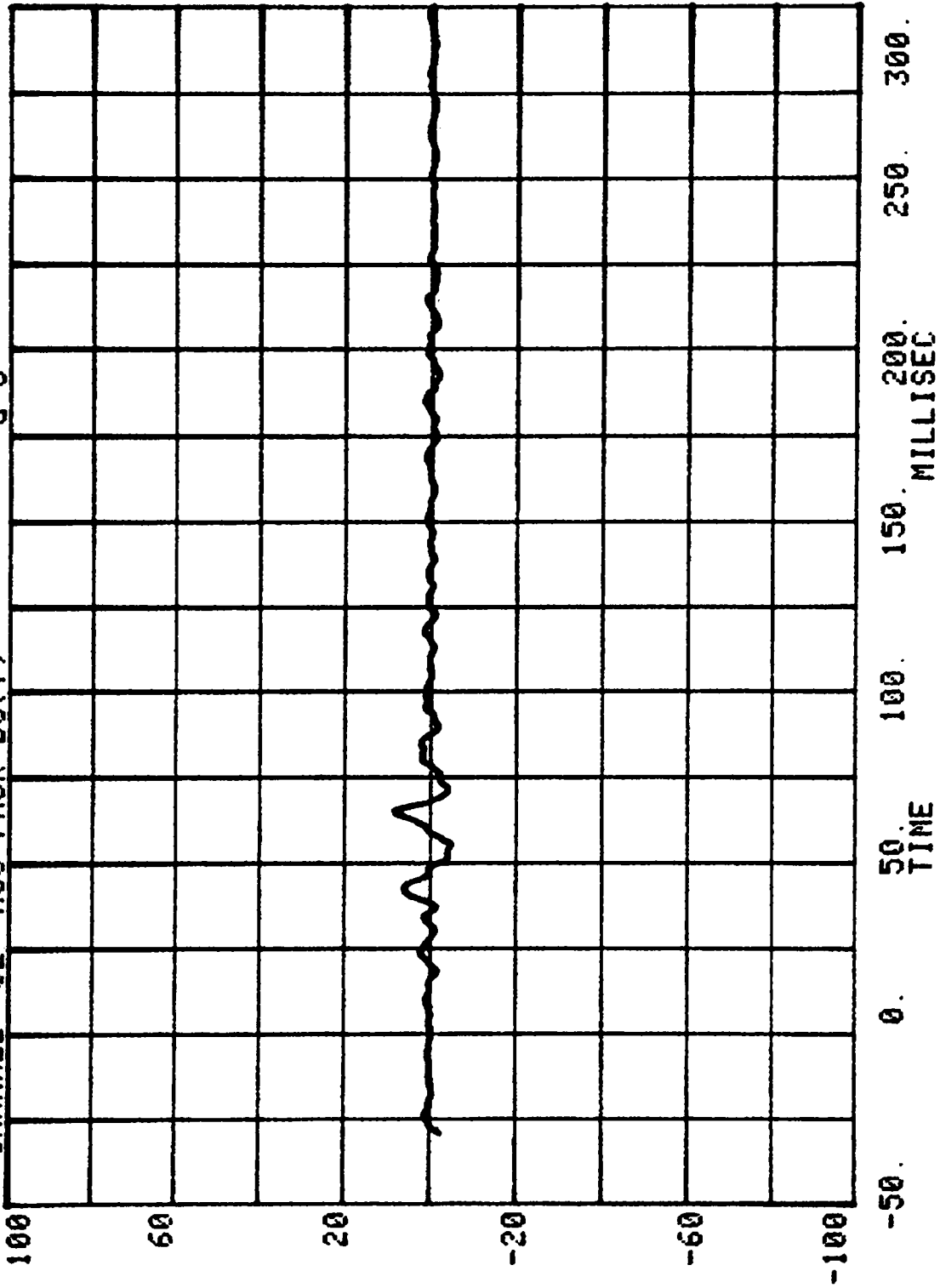


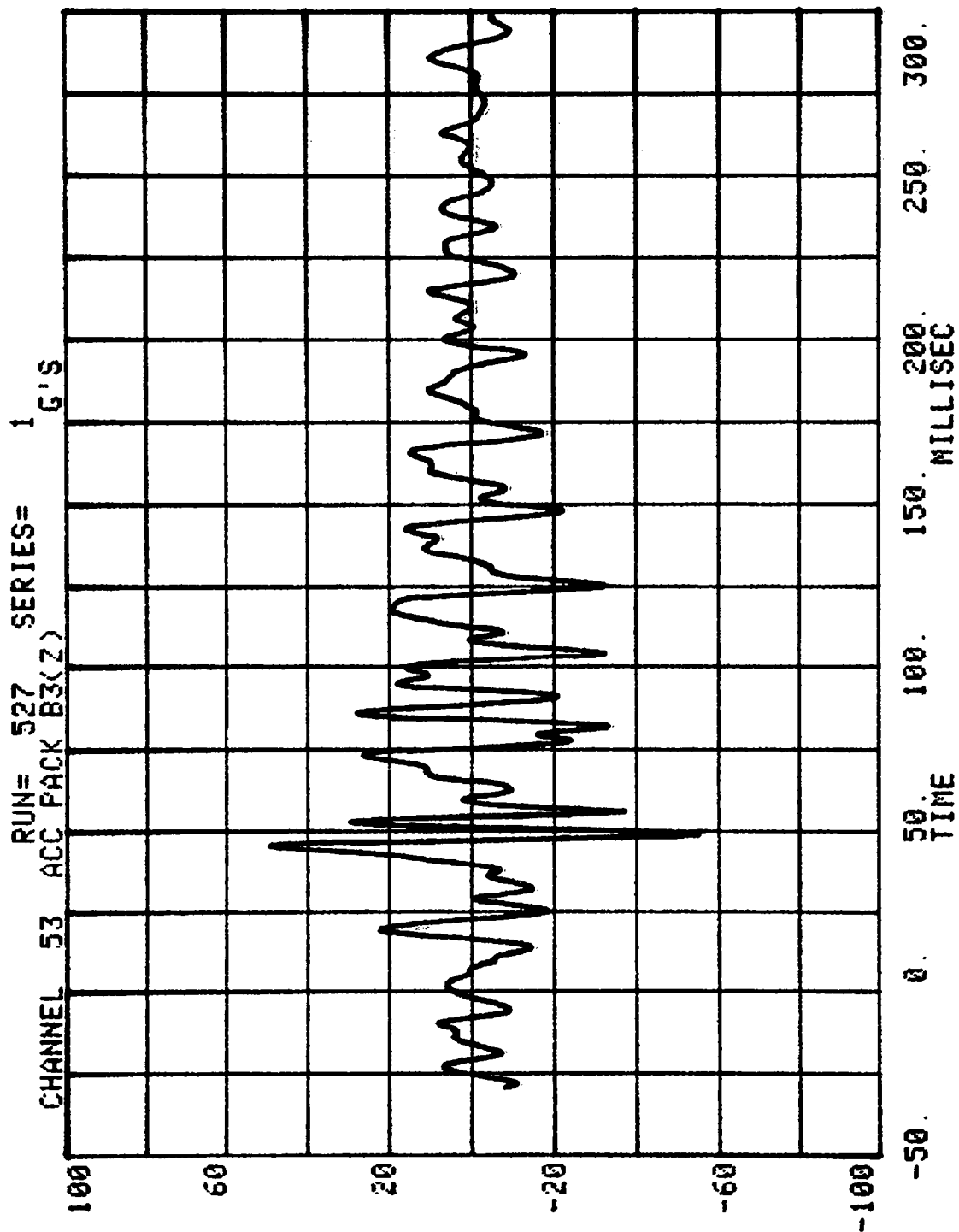


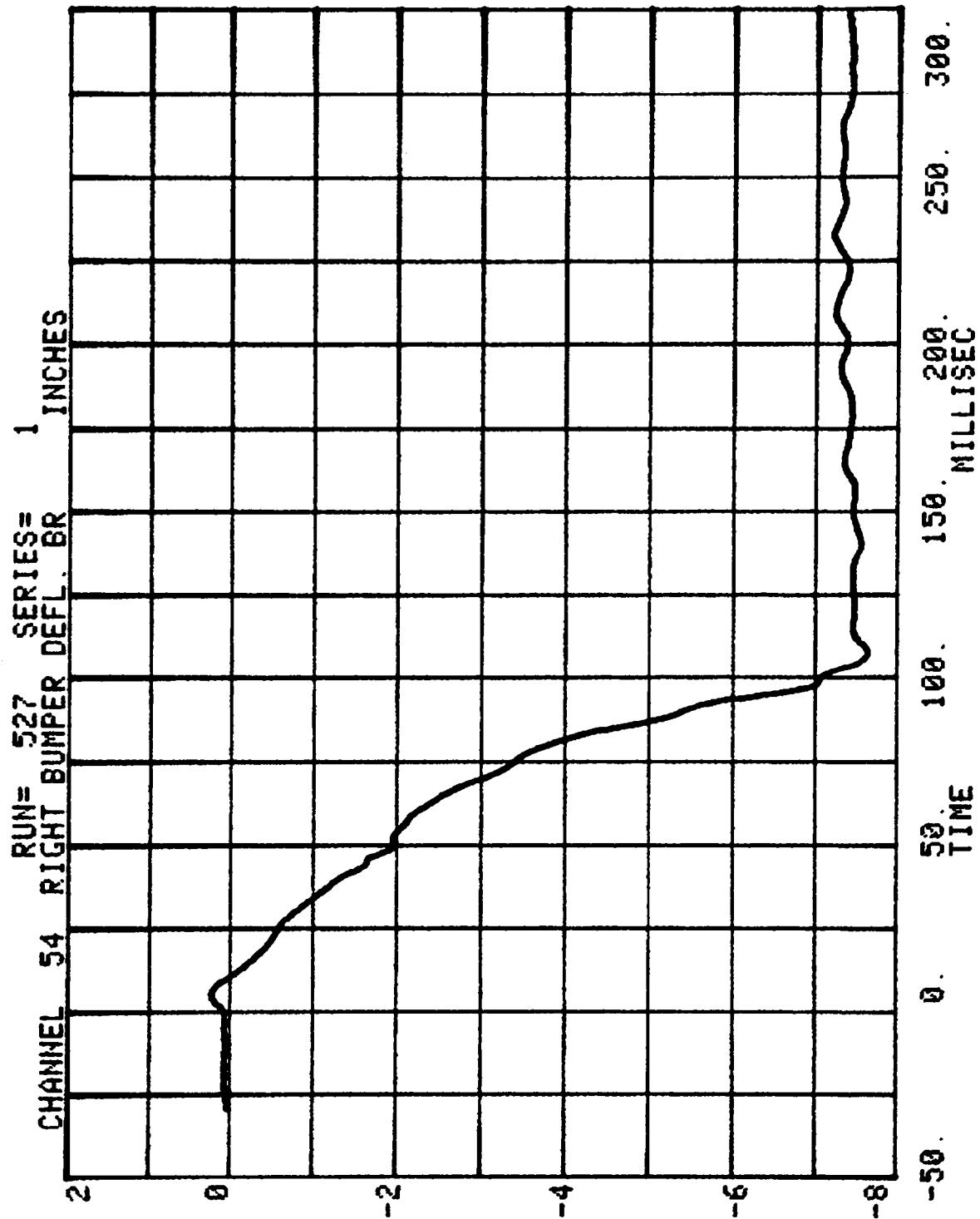
CHANNEL 4 DISPLACEMENT RUN= 527 SERIES= 1 INCHES ACCELEROMETER PACK #B3(X)

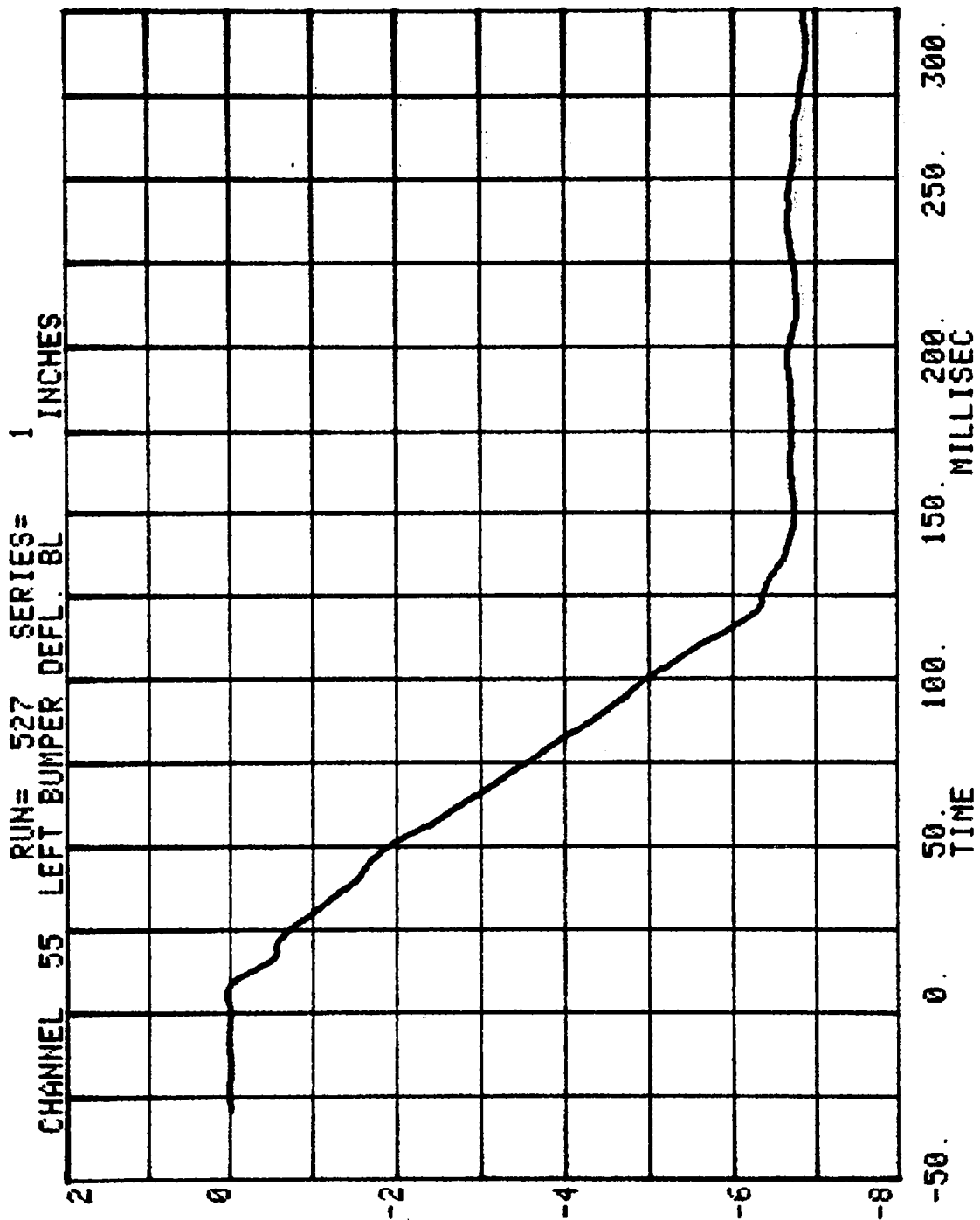


CHANNEL 52 ACC PACK B3(Y) RUN= 527 SERIES= 1 G'S

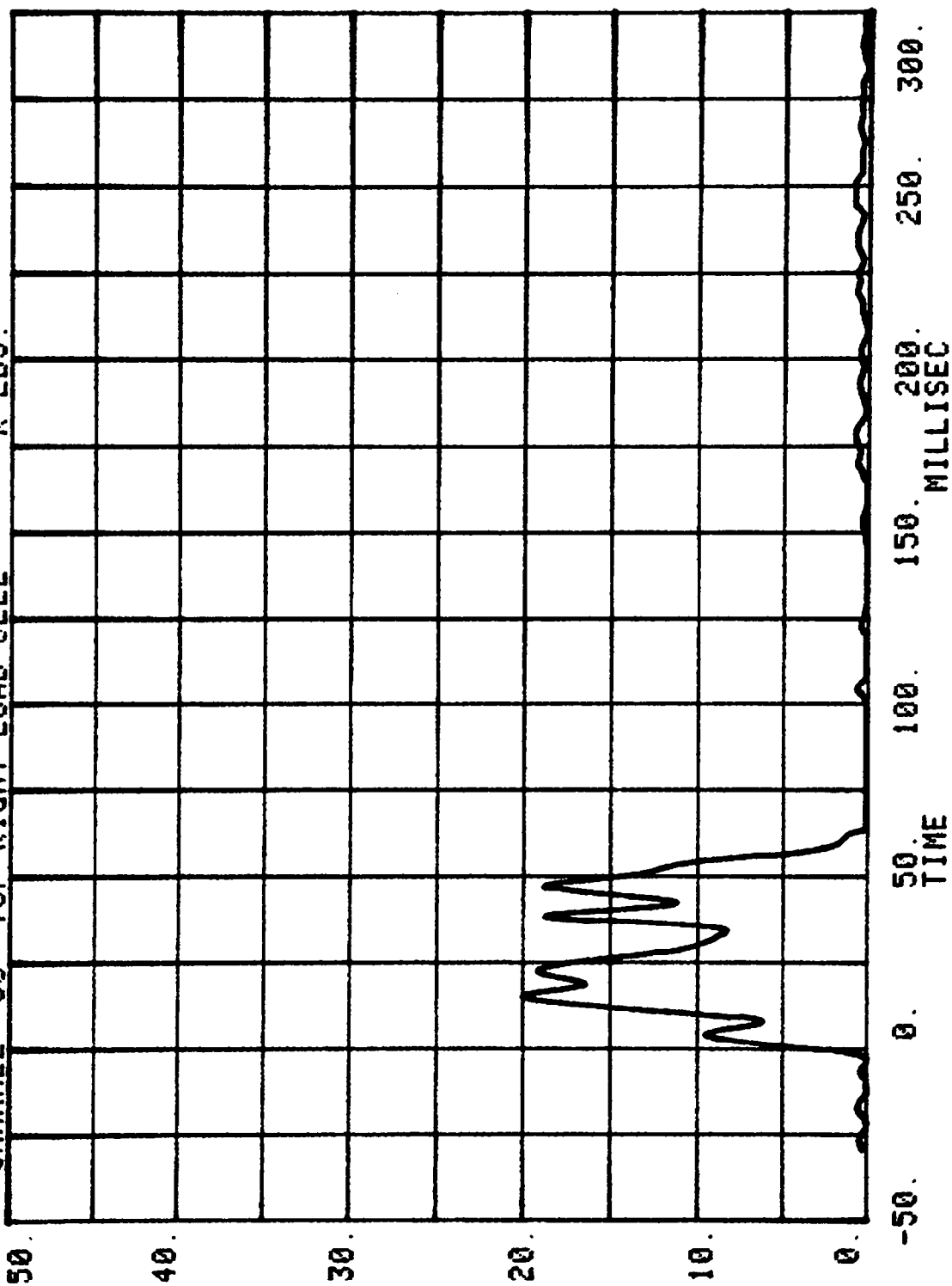


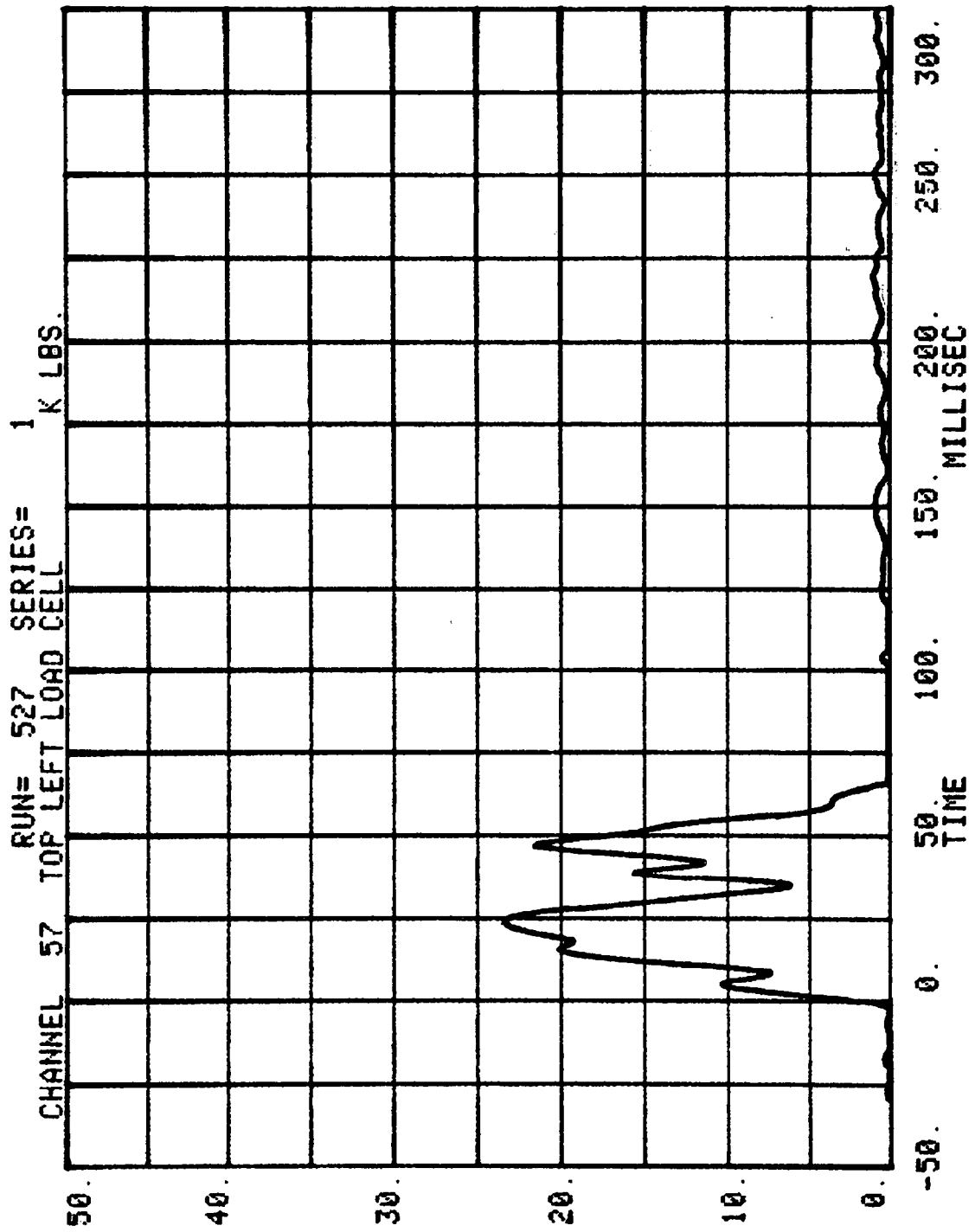


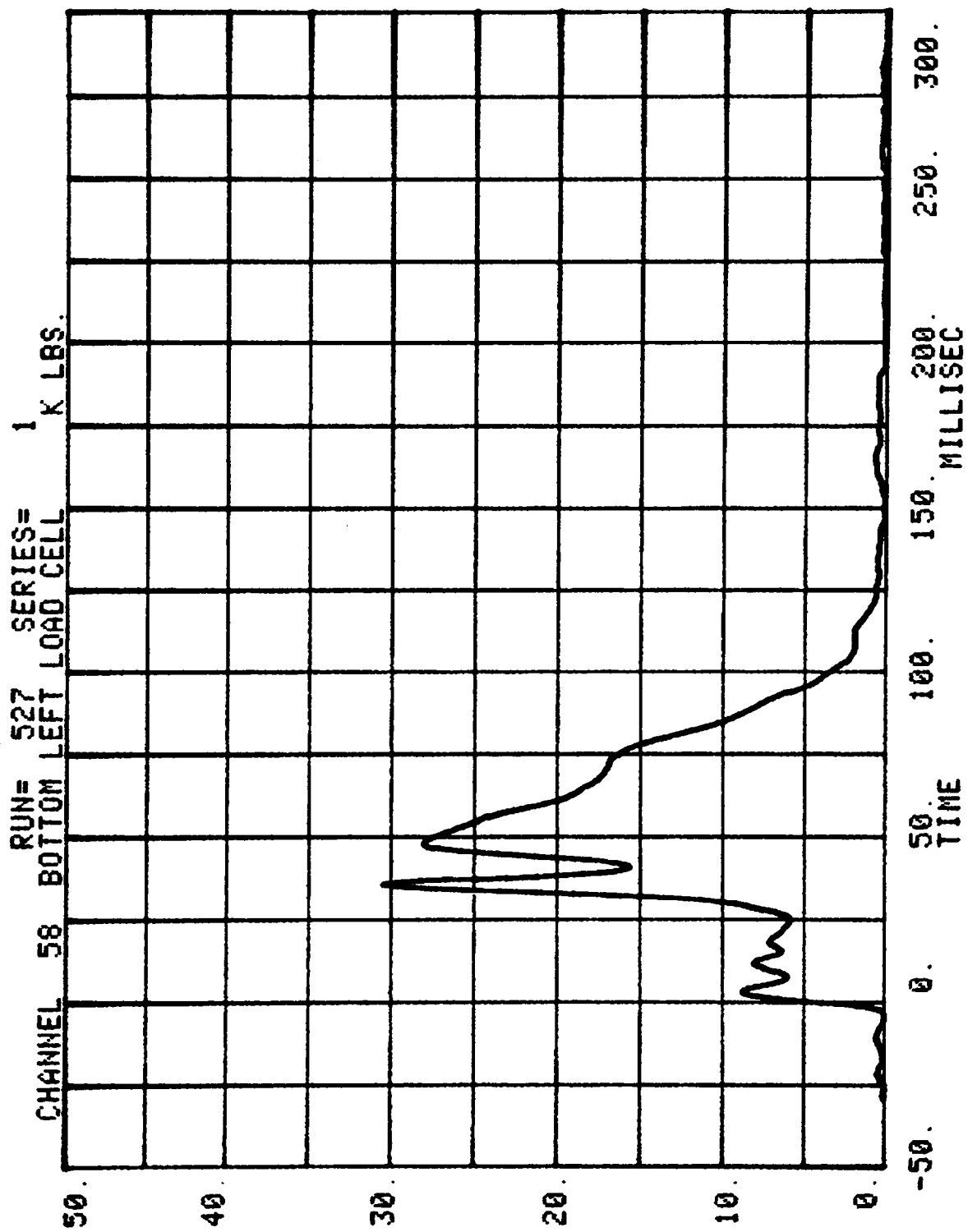


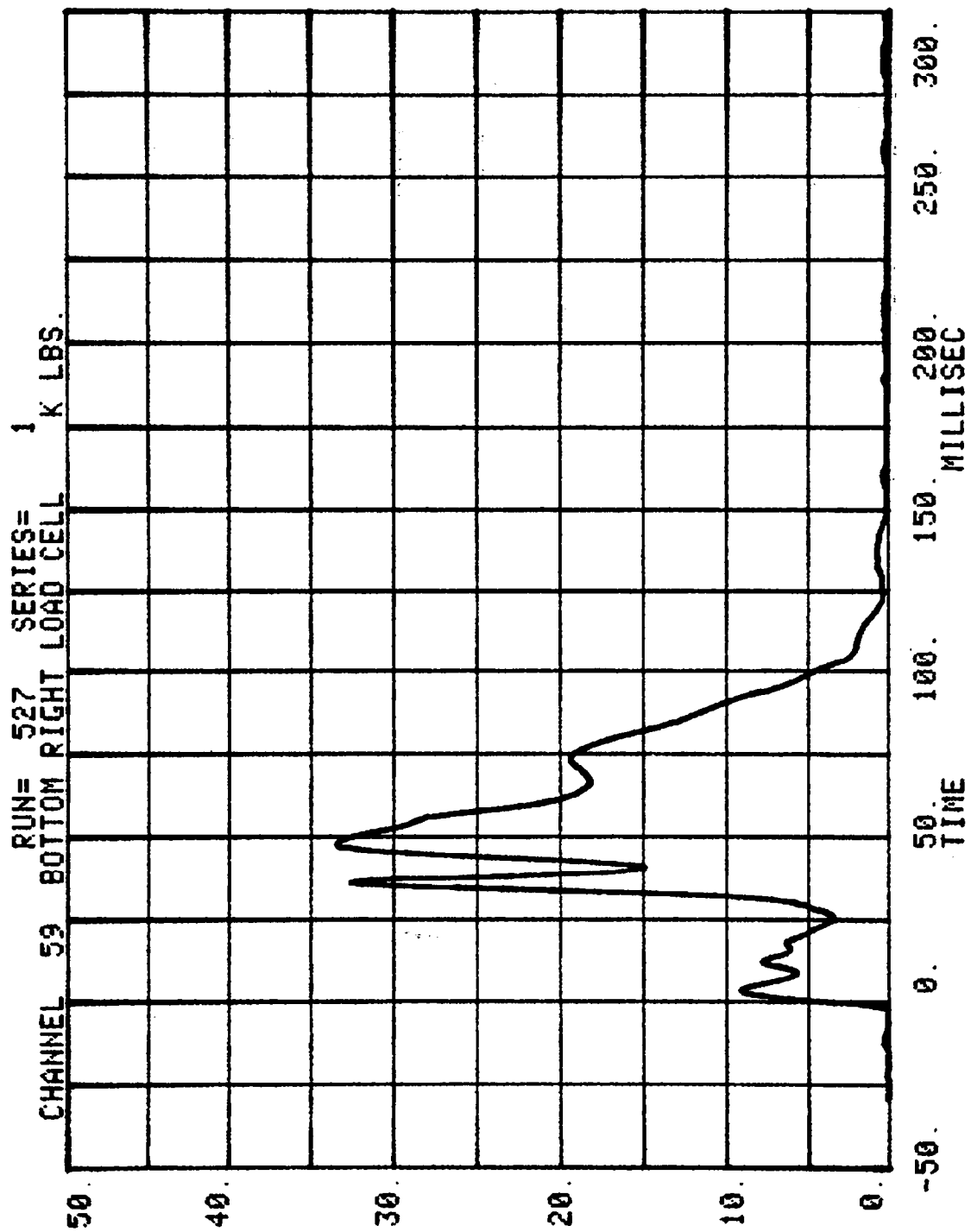


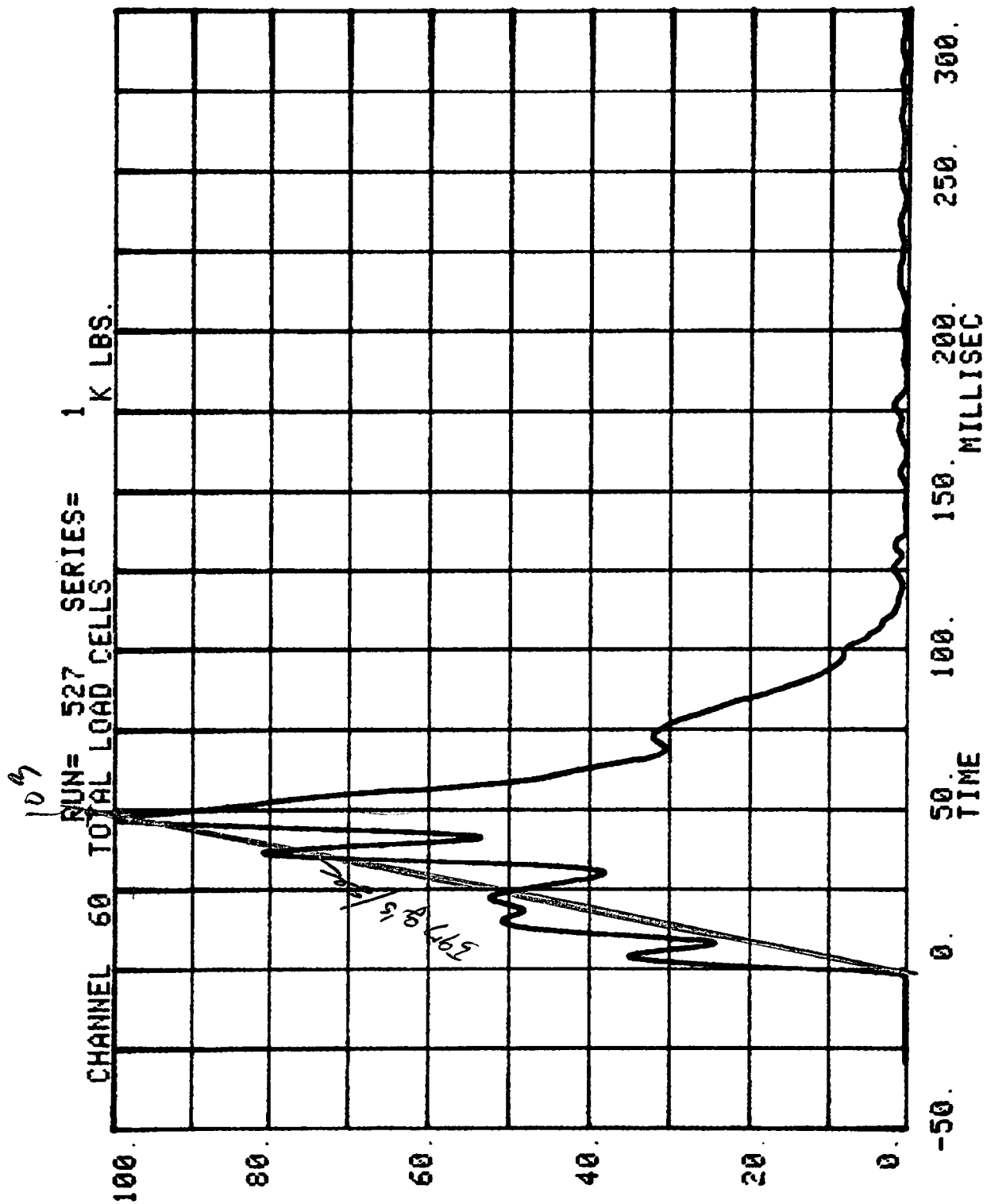
RUN= 527 SERIES= 1
CHANNEL 56 TOP RIGHT LOAD CELL K LBS.











TEST NO. 752-1-527

1981 VOLVO DL

DUMMY DATA

FILTER CHANNEL CLASS

HEAD ACCELERATIONS	1000
CHEST ACCELERATIONS	180
FEMUR FORCES	600
BELT LOADS	60

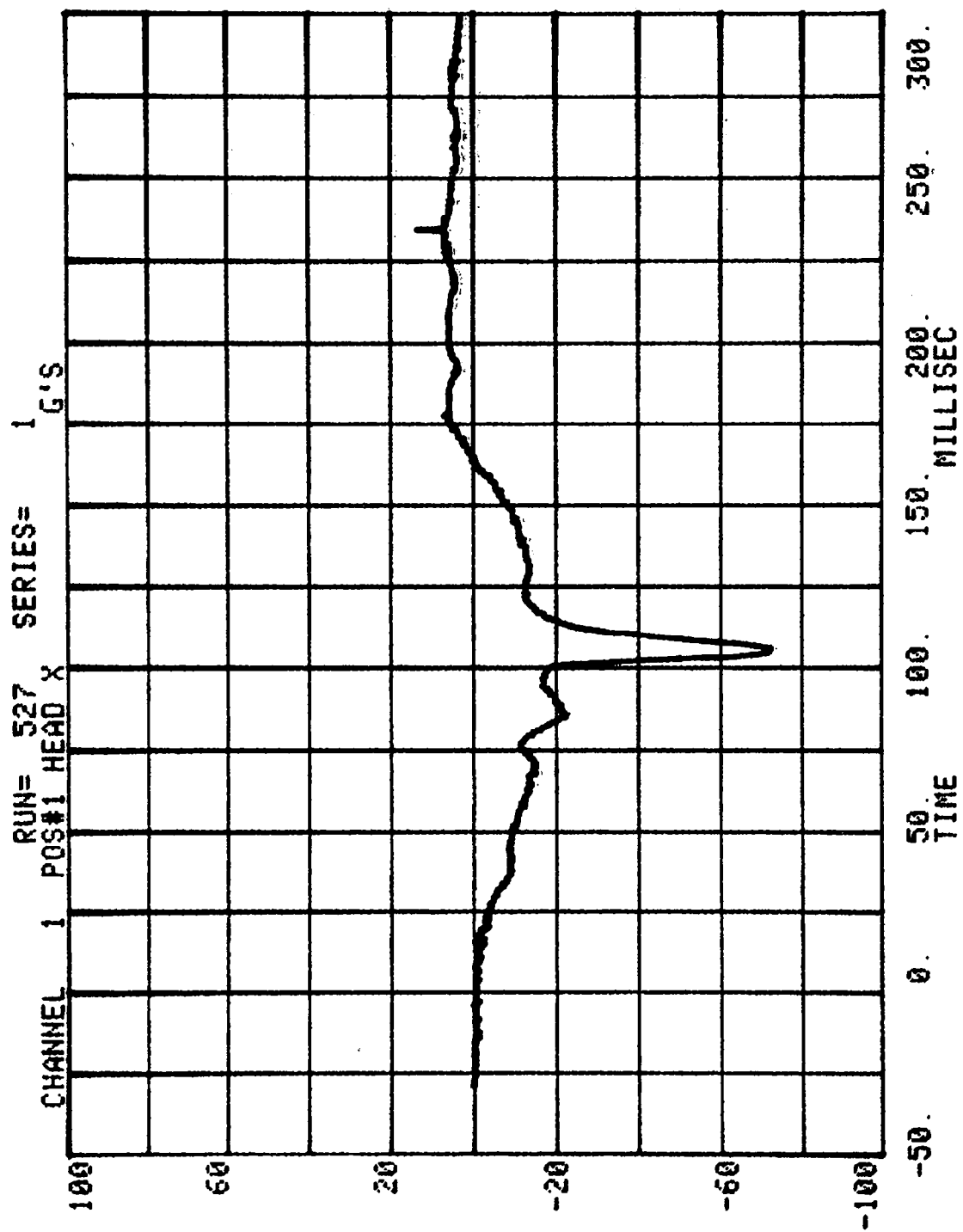
HEAD INJURY CRITERION
HEAD SEVERITY INDEX

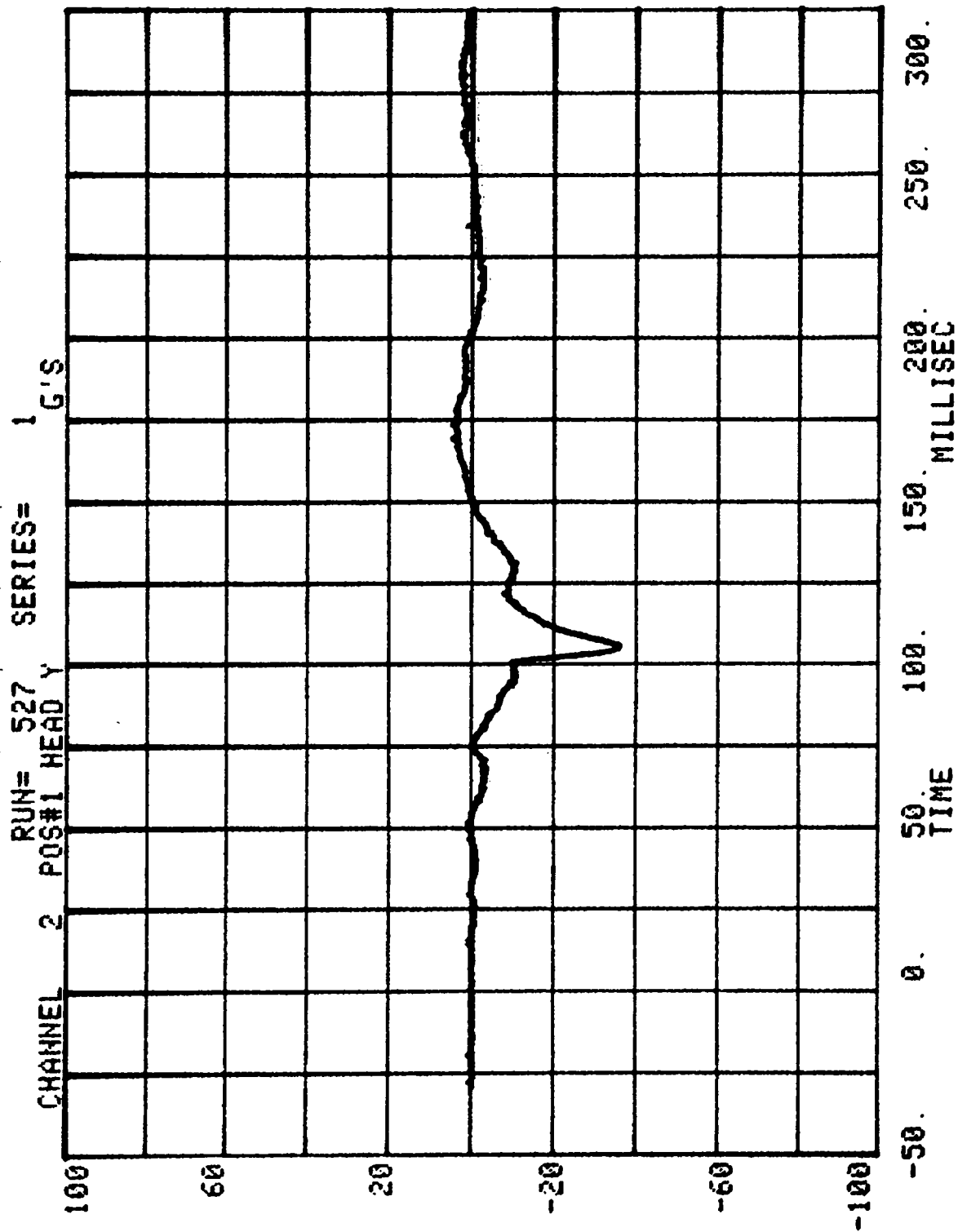
DEFORMABLE BARRIER

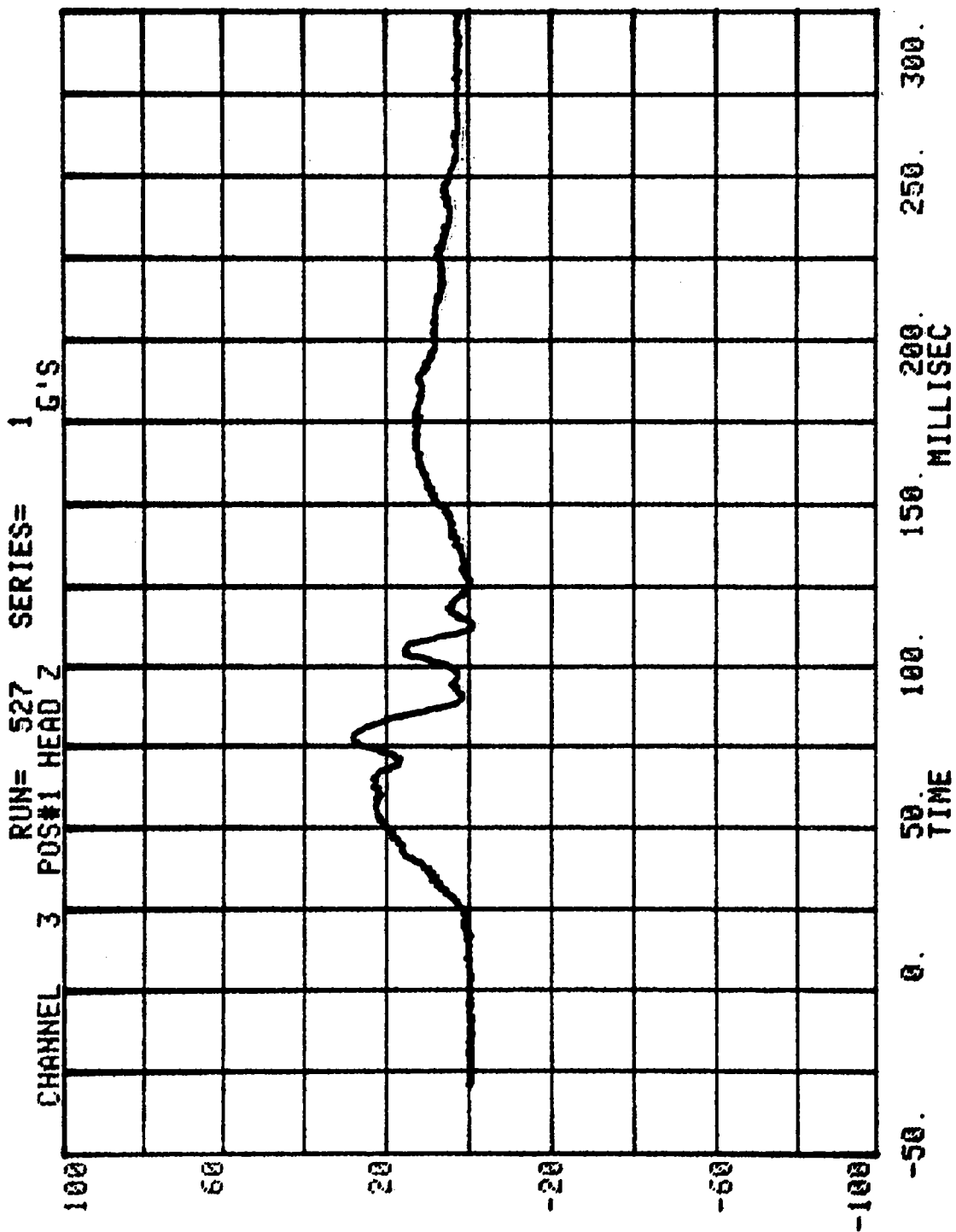
RUN= 527

POS#1 HEAD RESULTANT

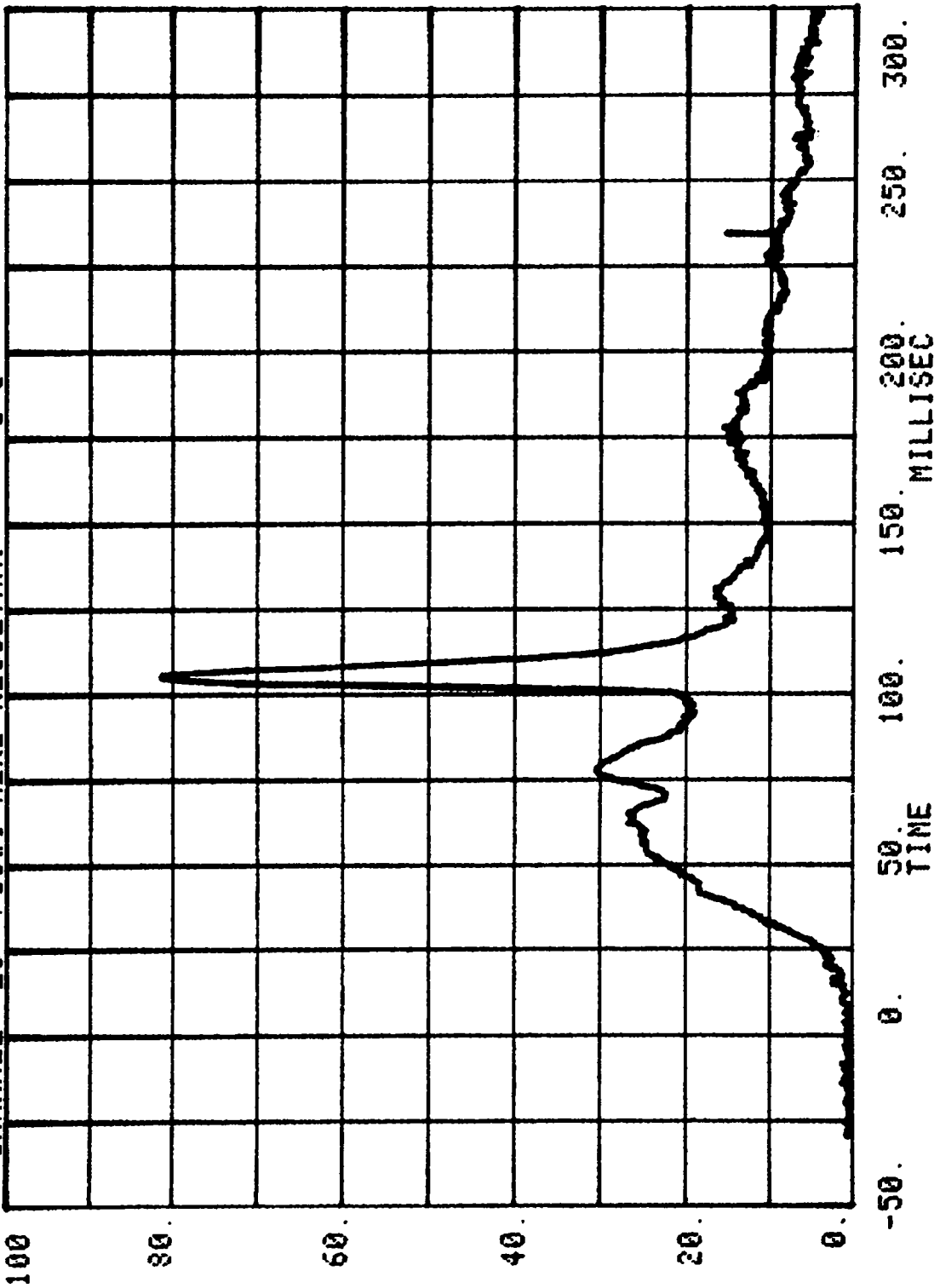
HIC= 352.1 FROM T1= .04110 TO T2= .11970
AVERAGE ACCELERATION BETWEEN T1 AND T2= 28.9G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX= 625.6

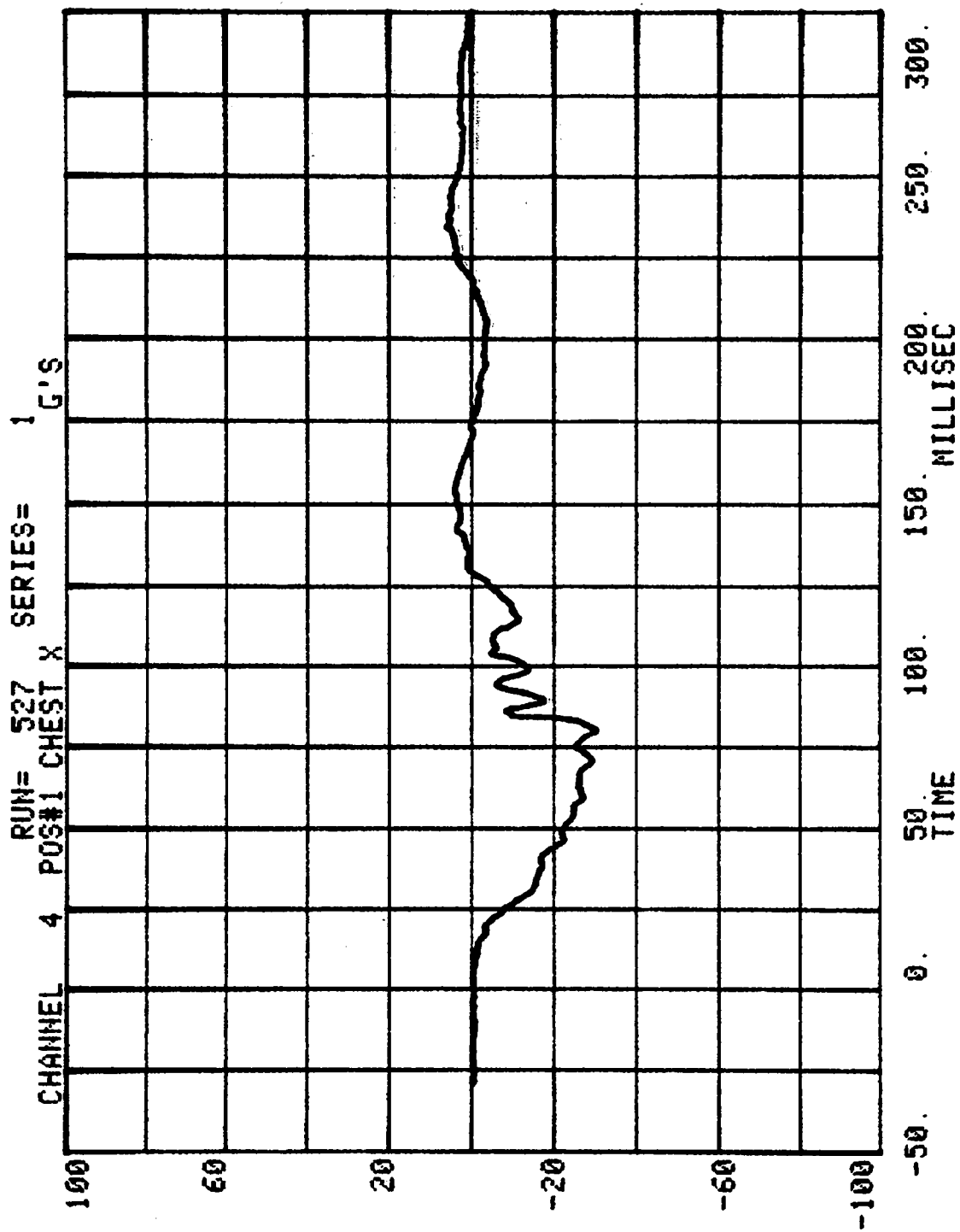


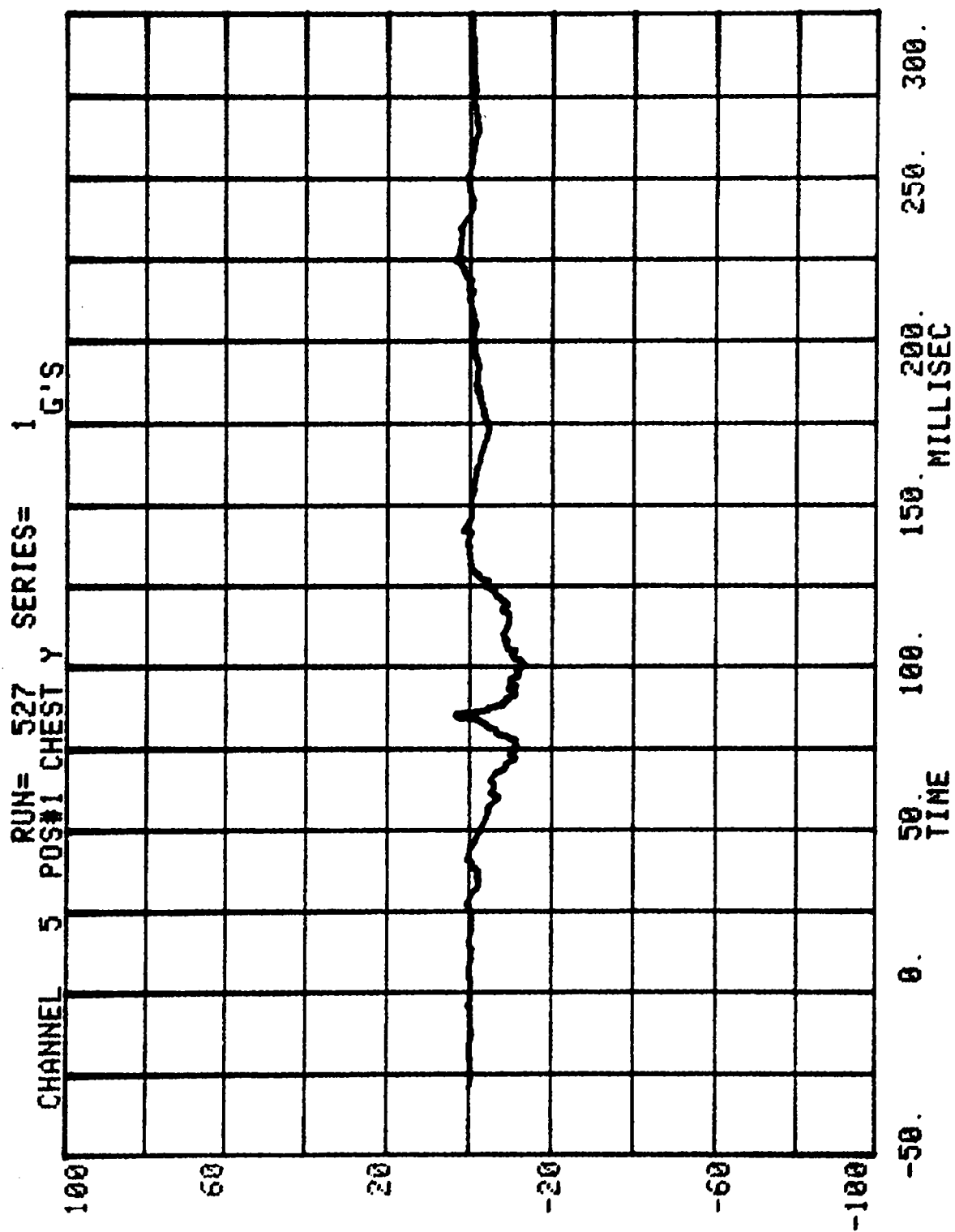


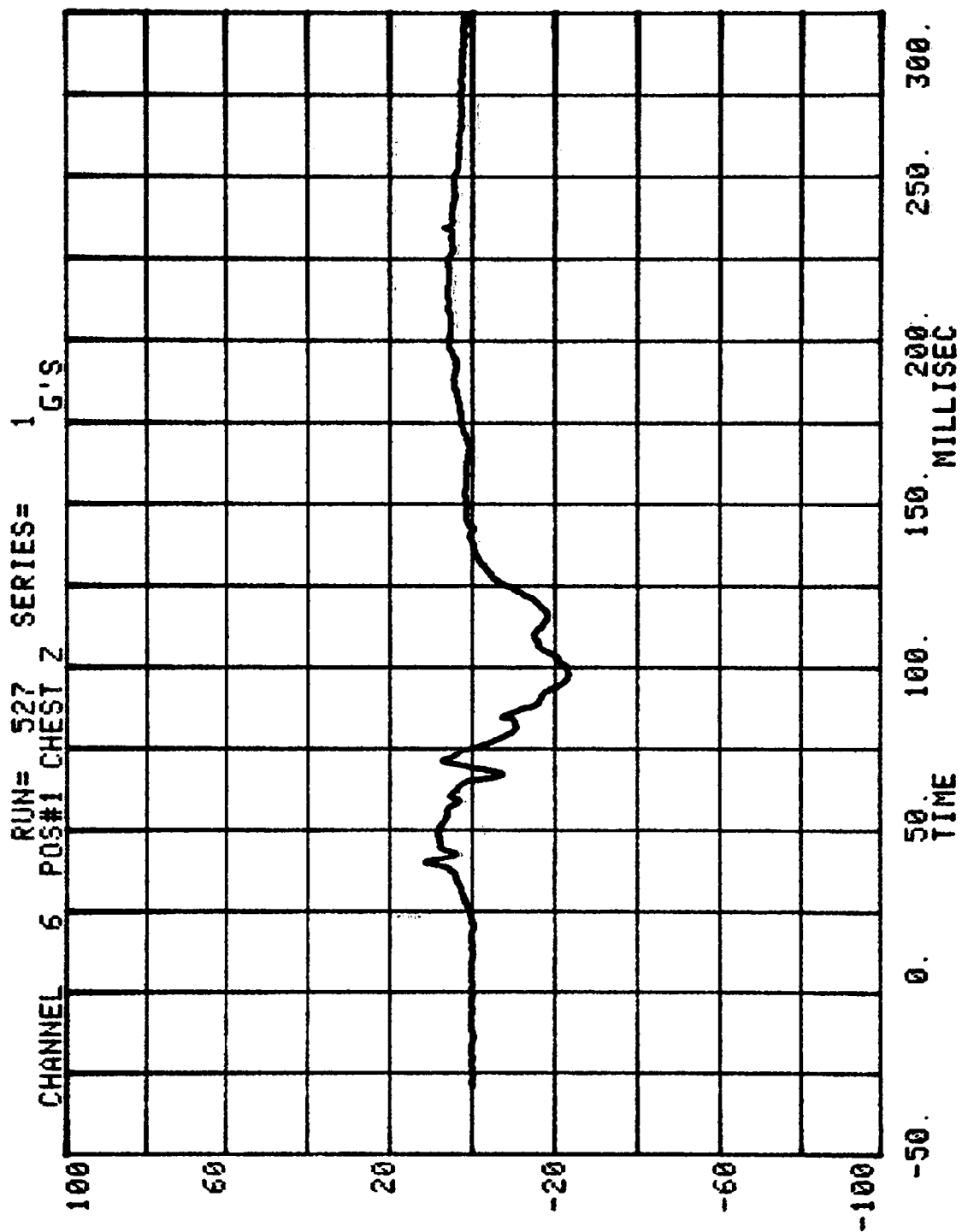


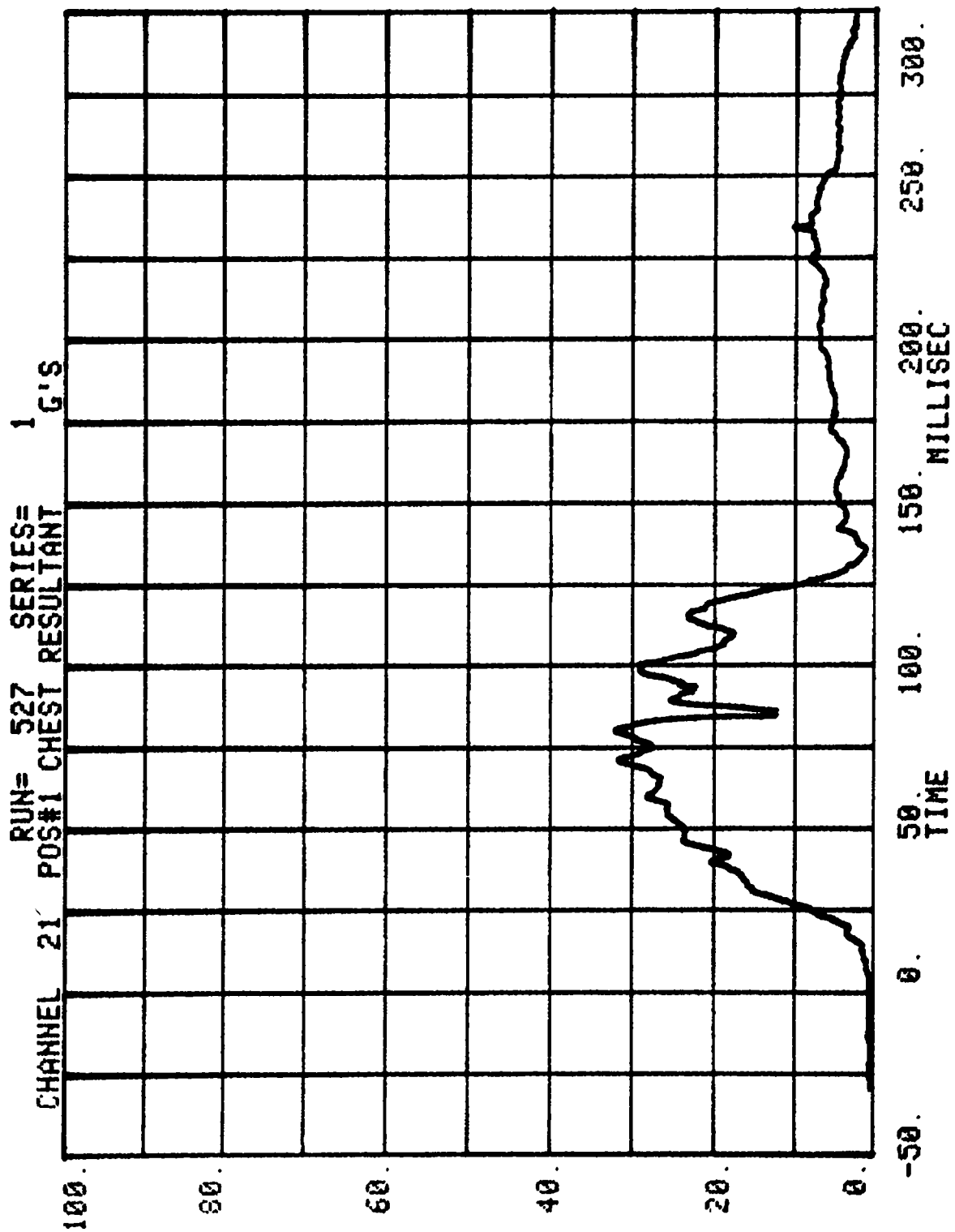
CHANNEL 20 POS#1 HEAD RESULTANT 1 G'S

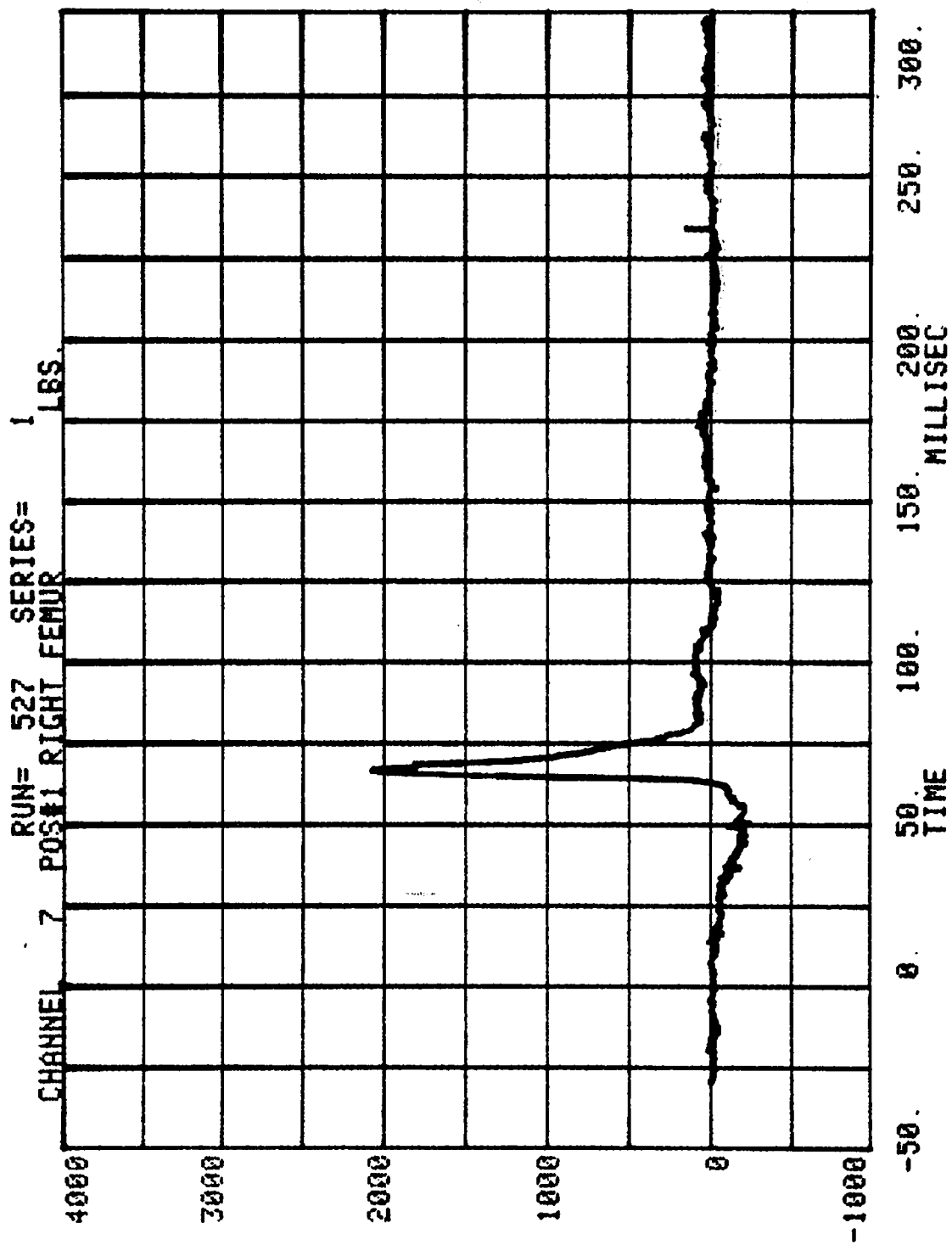


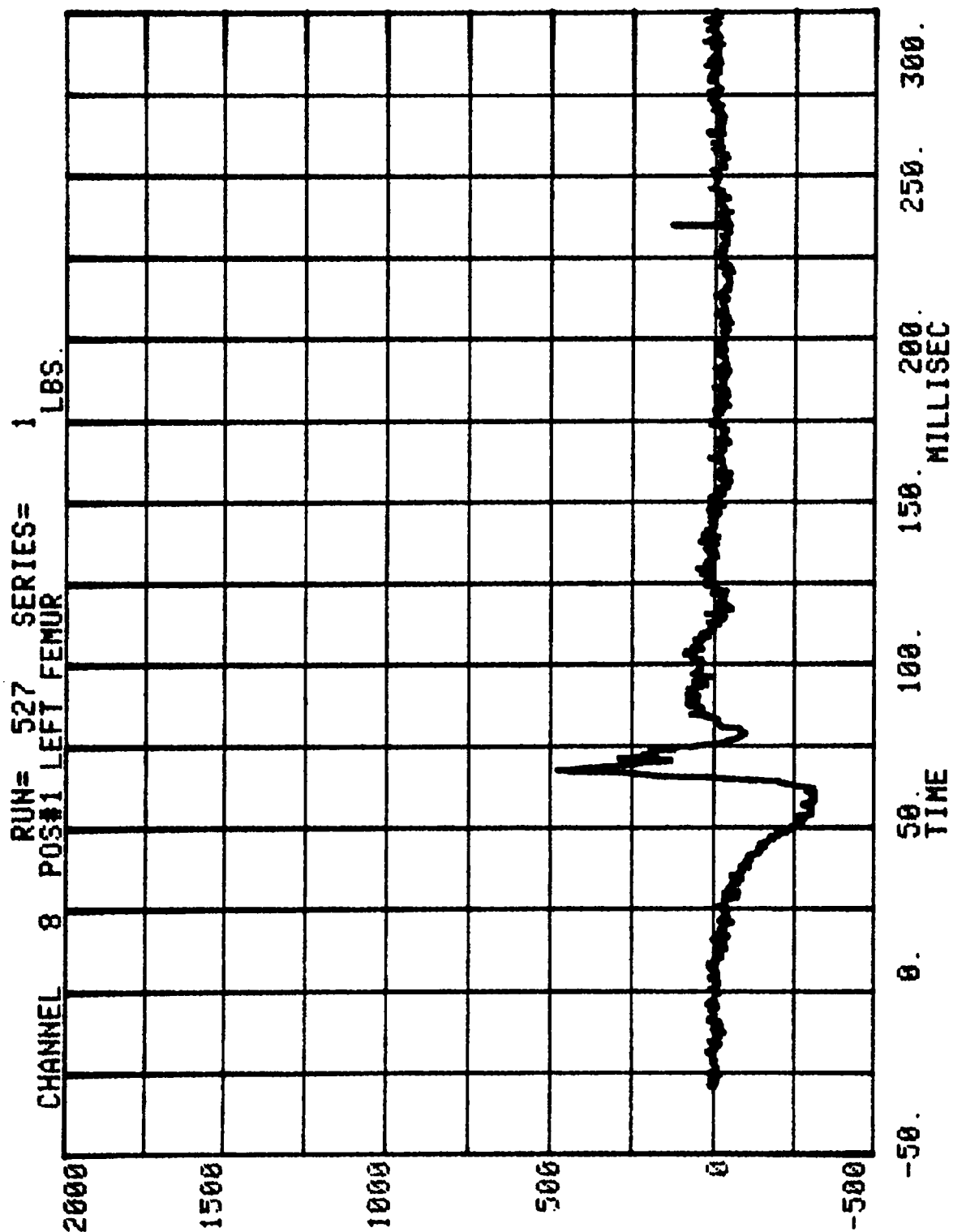


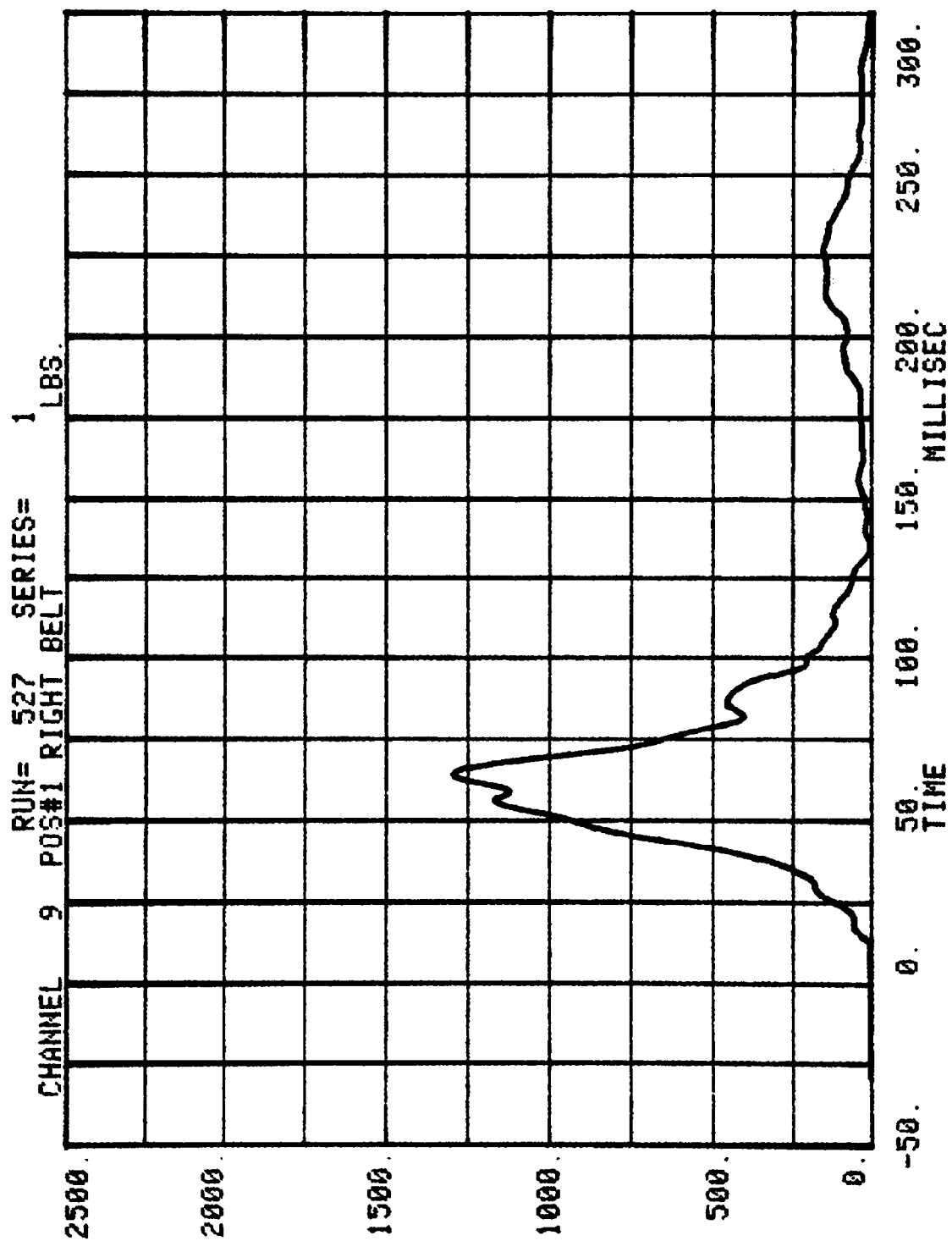


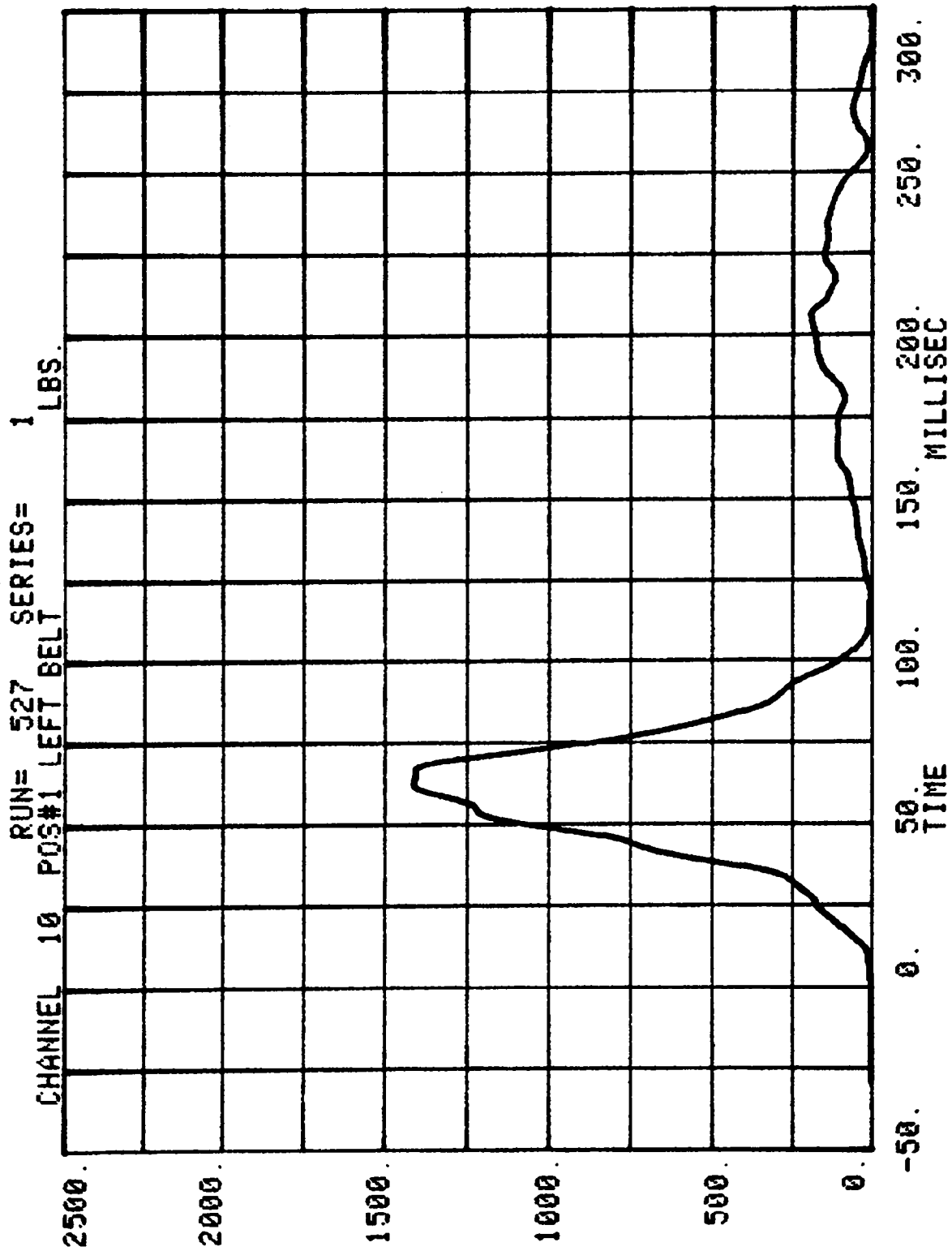


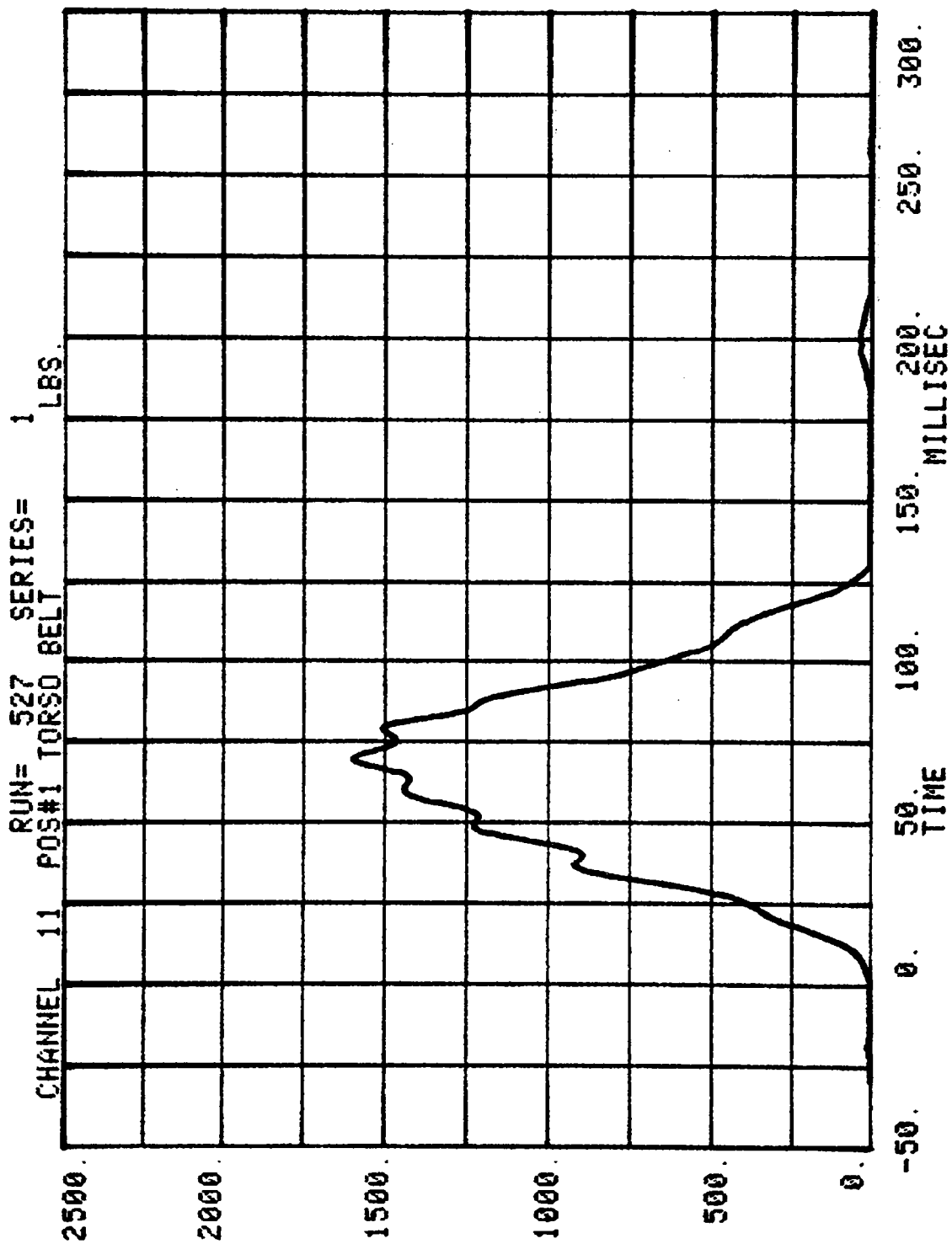












HEAD INJURY CRITERION
HEAD SEVERITY INDEX

DEFORMABLE BARRIER

RUN= 527

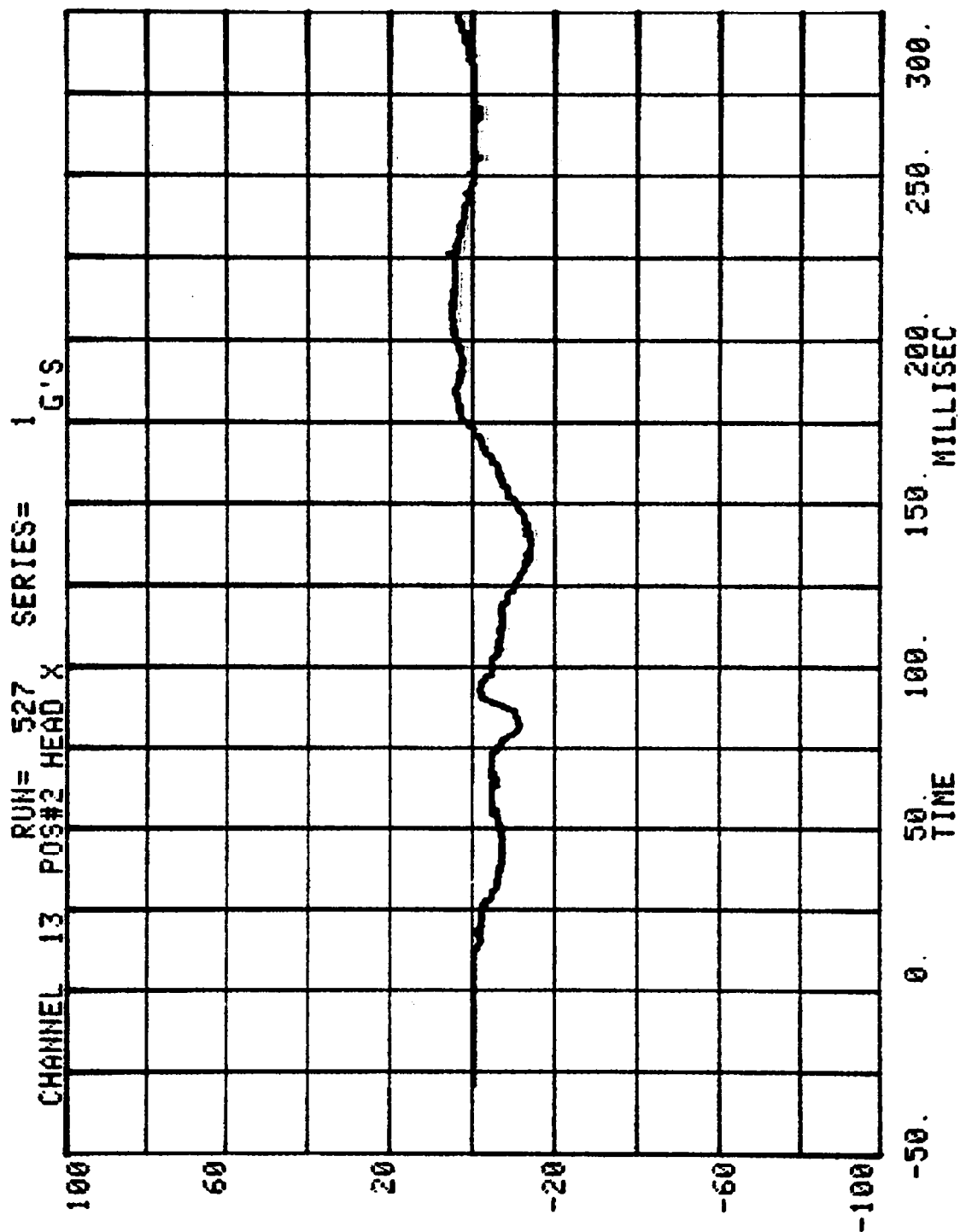
POS#2 HEAD RESULTANT

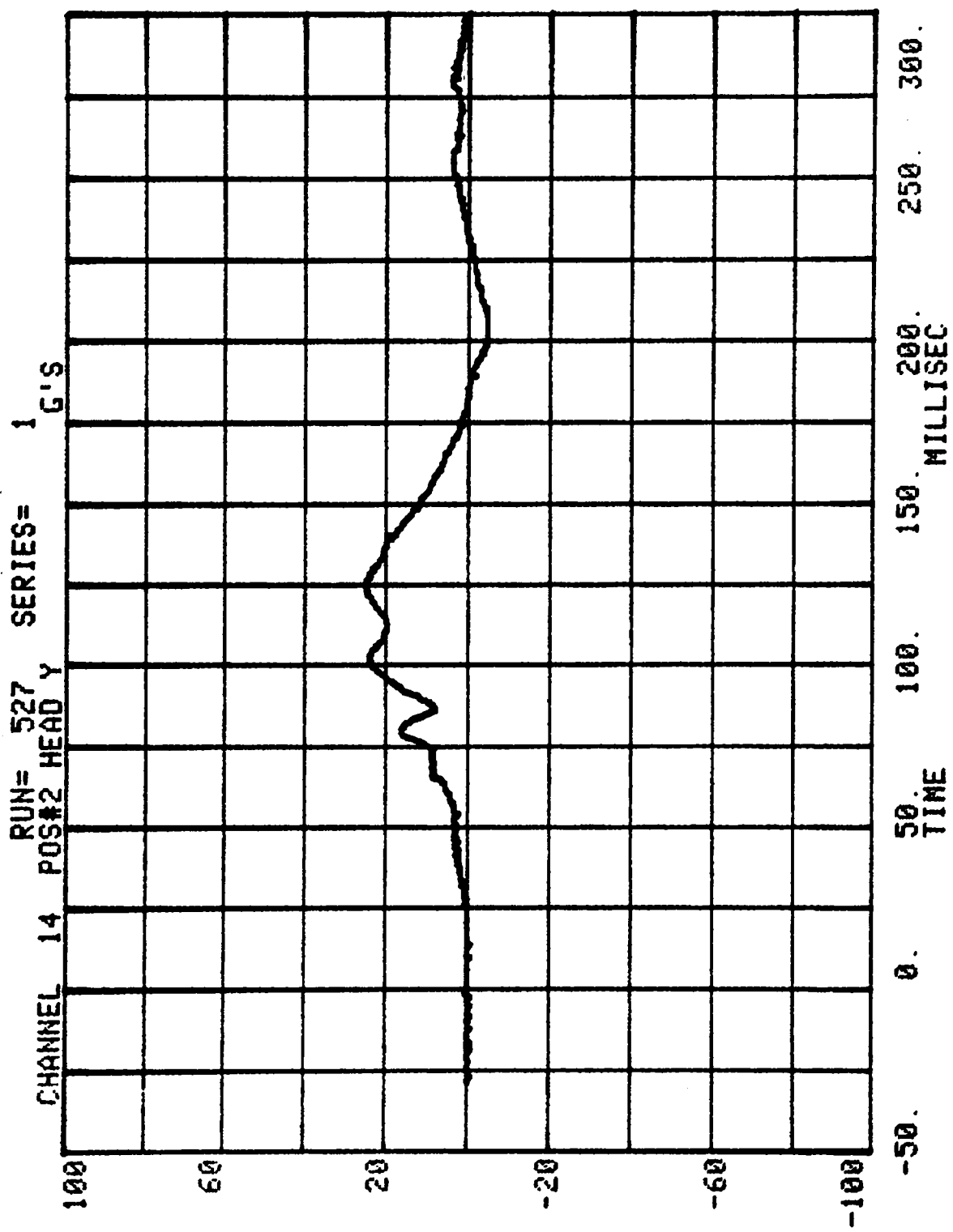
HIC= 361.3 FROM T1= .04110 TO T2= .18030

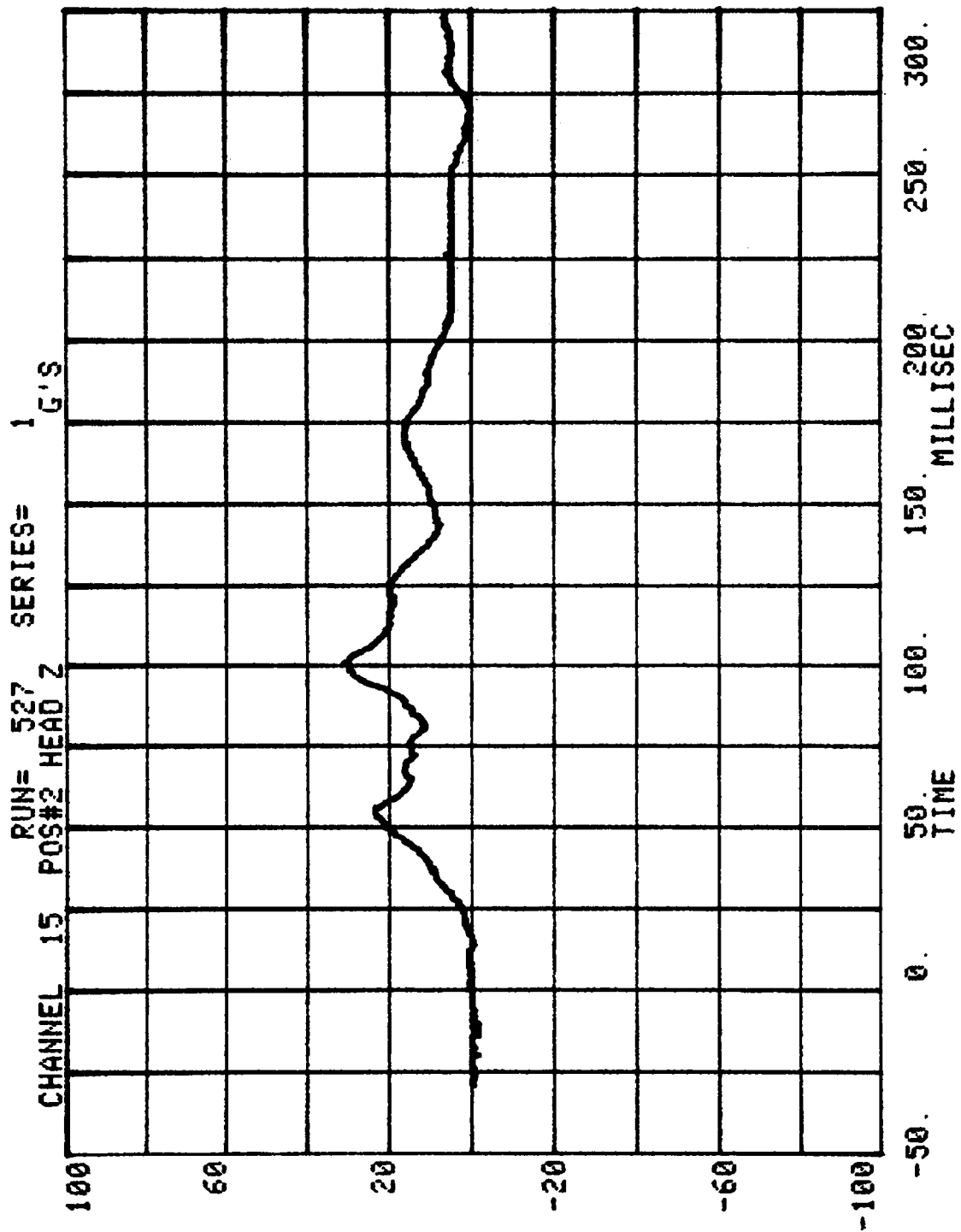
AVERAGE ACCELERATION BETWEEN T1 AND T2= 23.2G'S

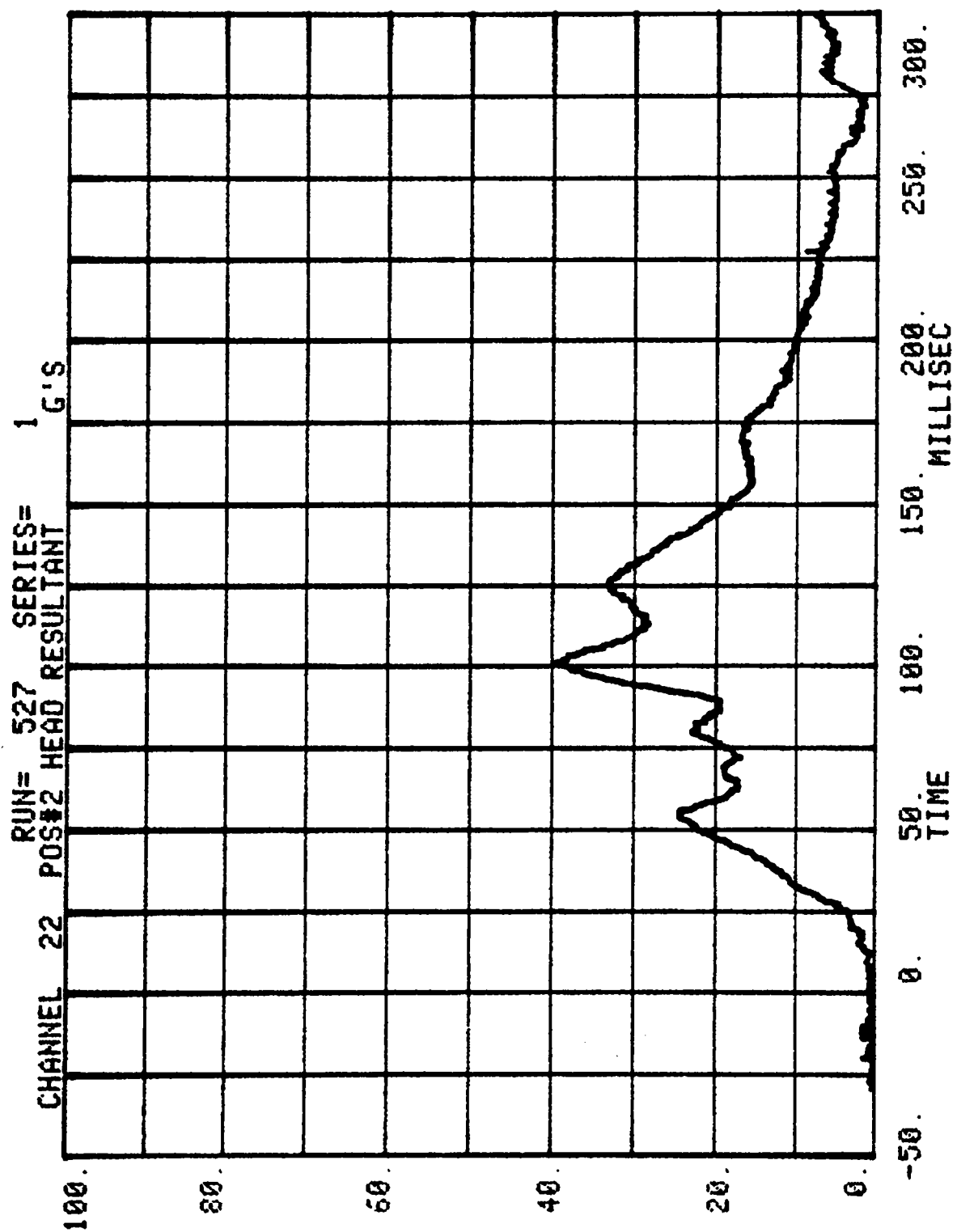
EVENT TIME= 300.0 MSEC

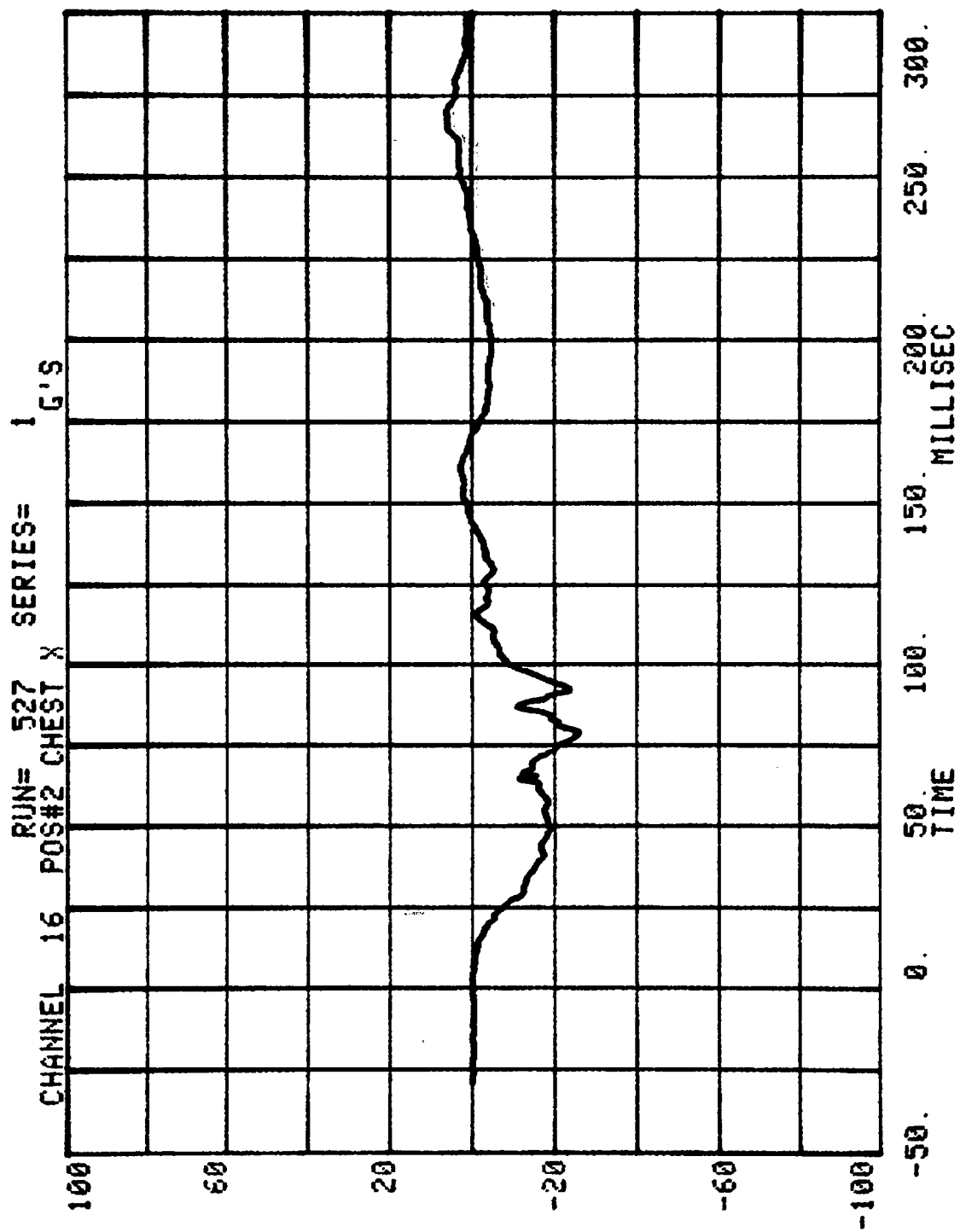
SEVERITY INDEX= 443.6

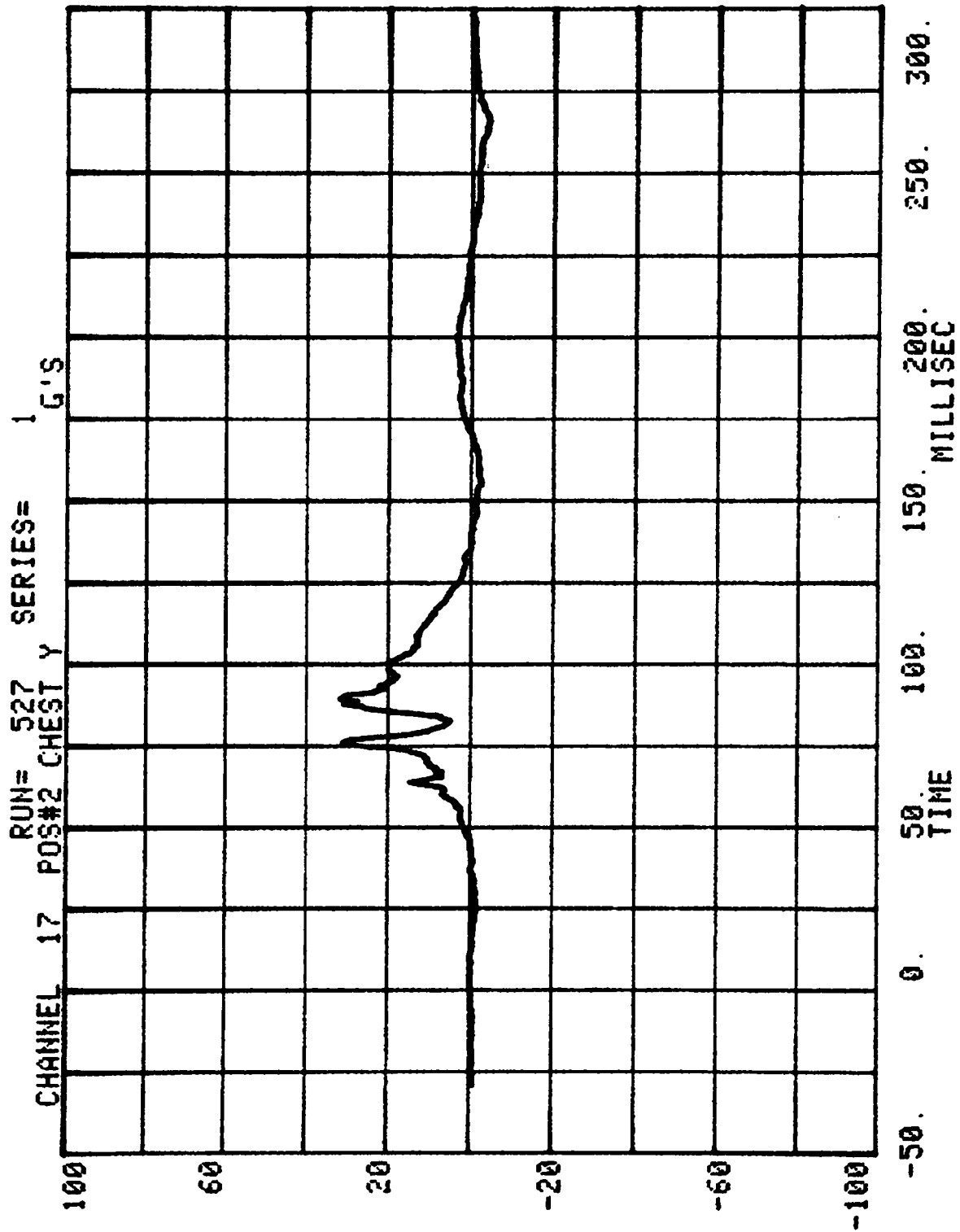


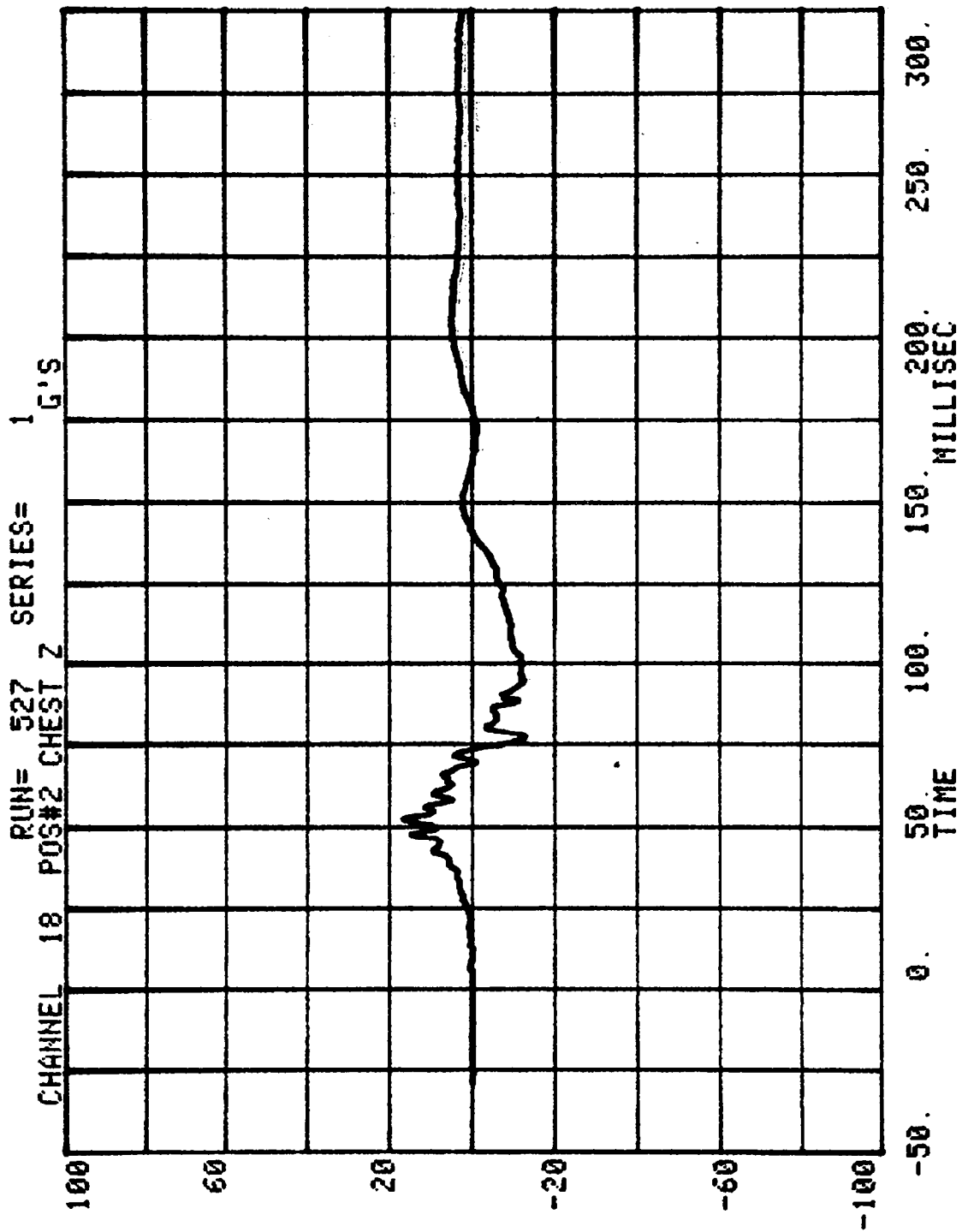


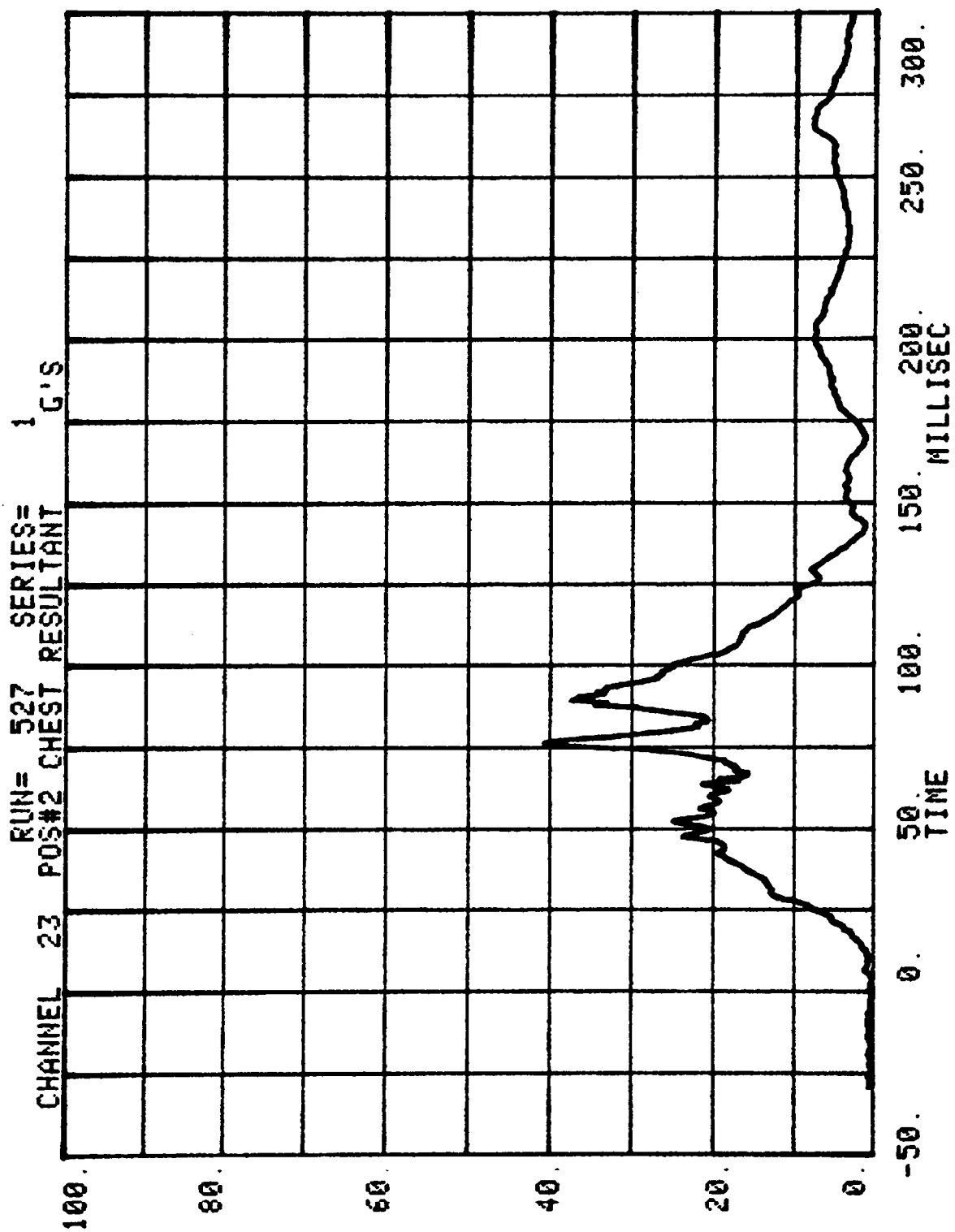


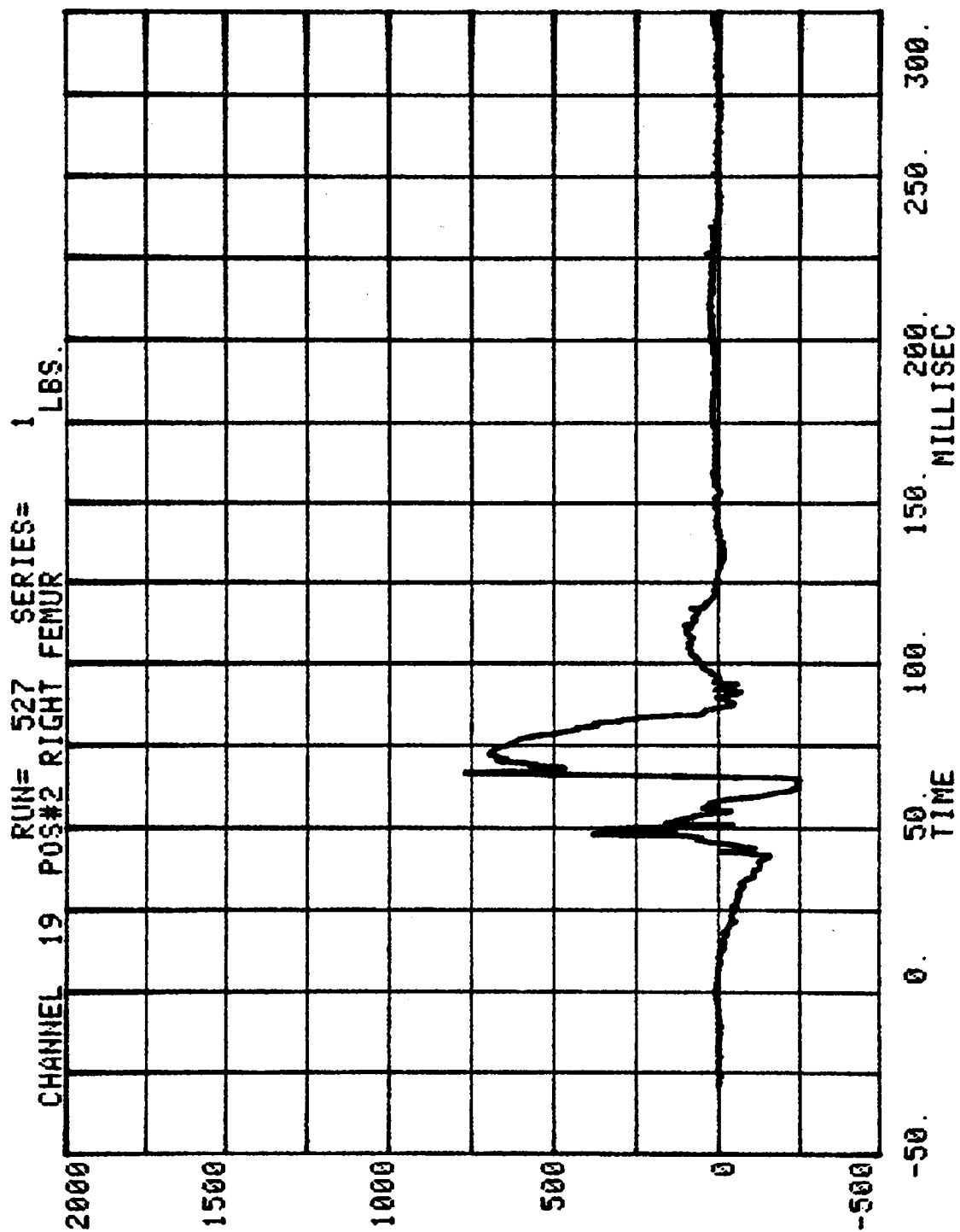


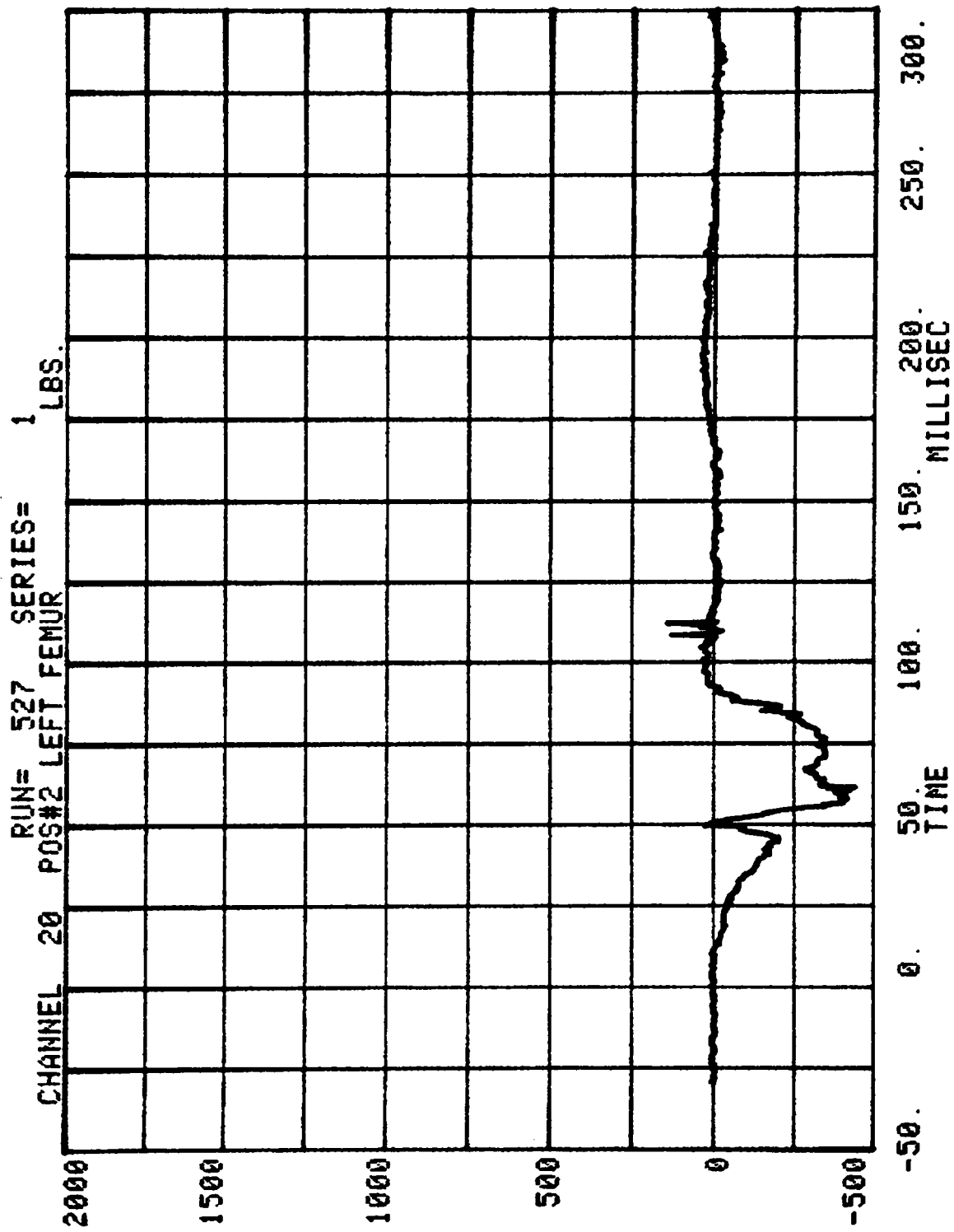


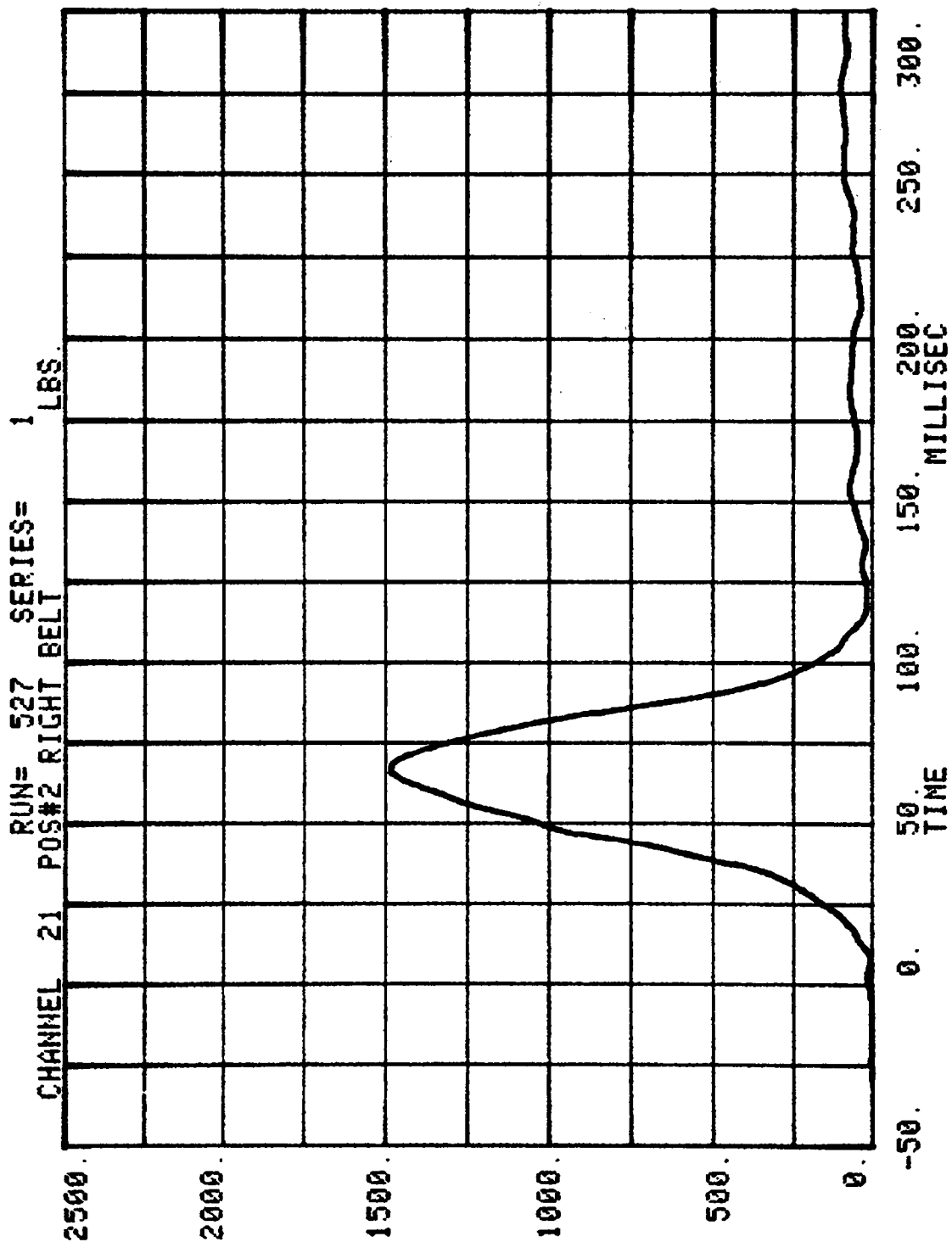




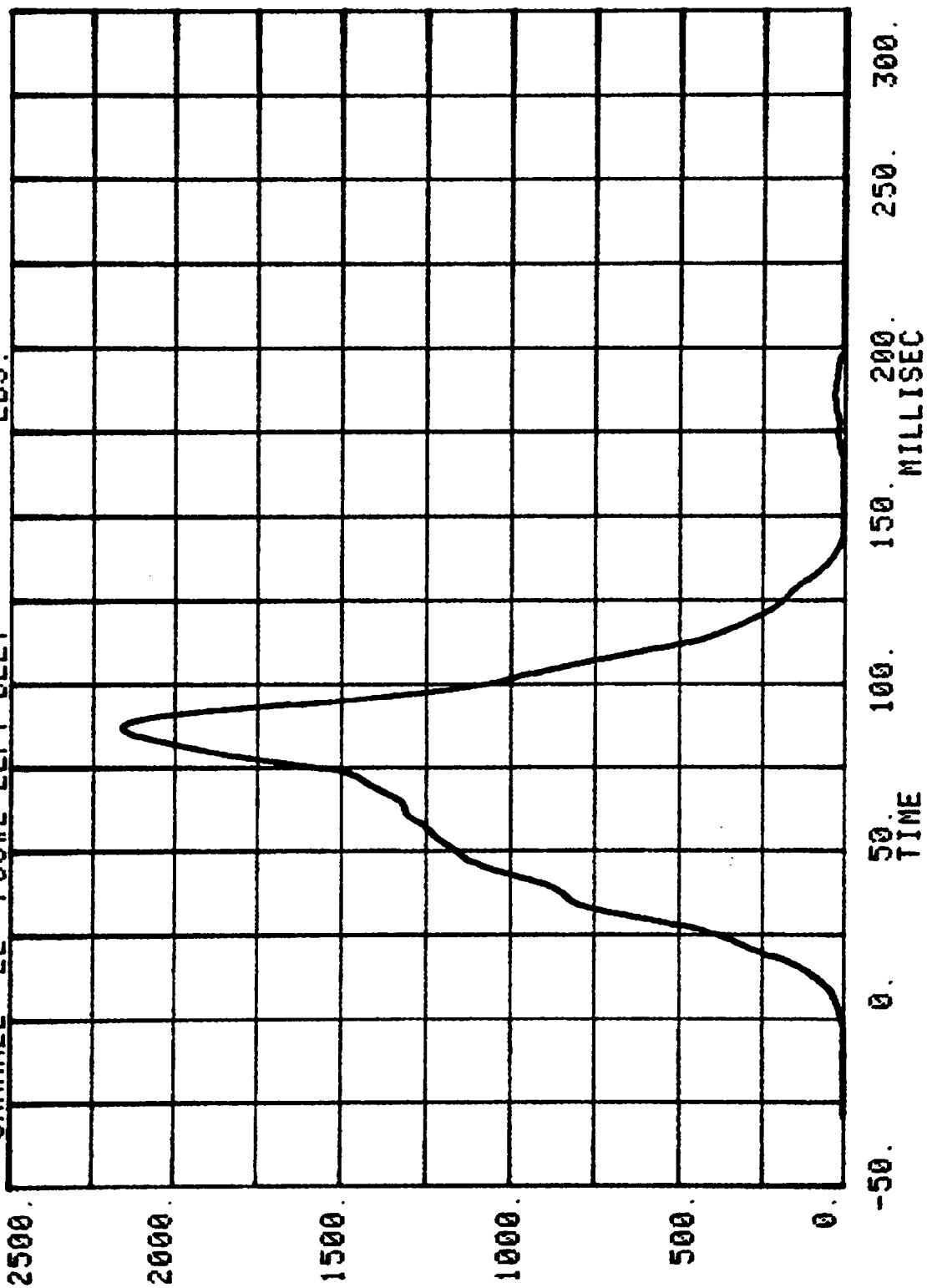


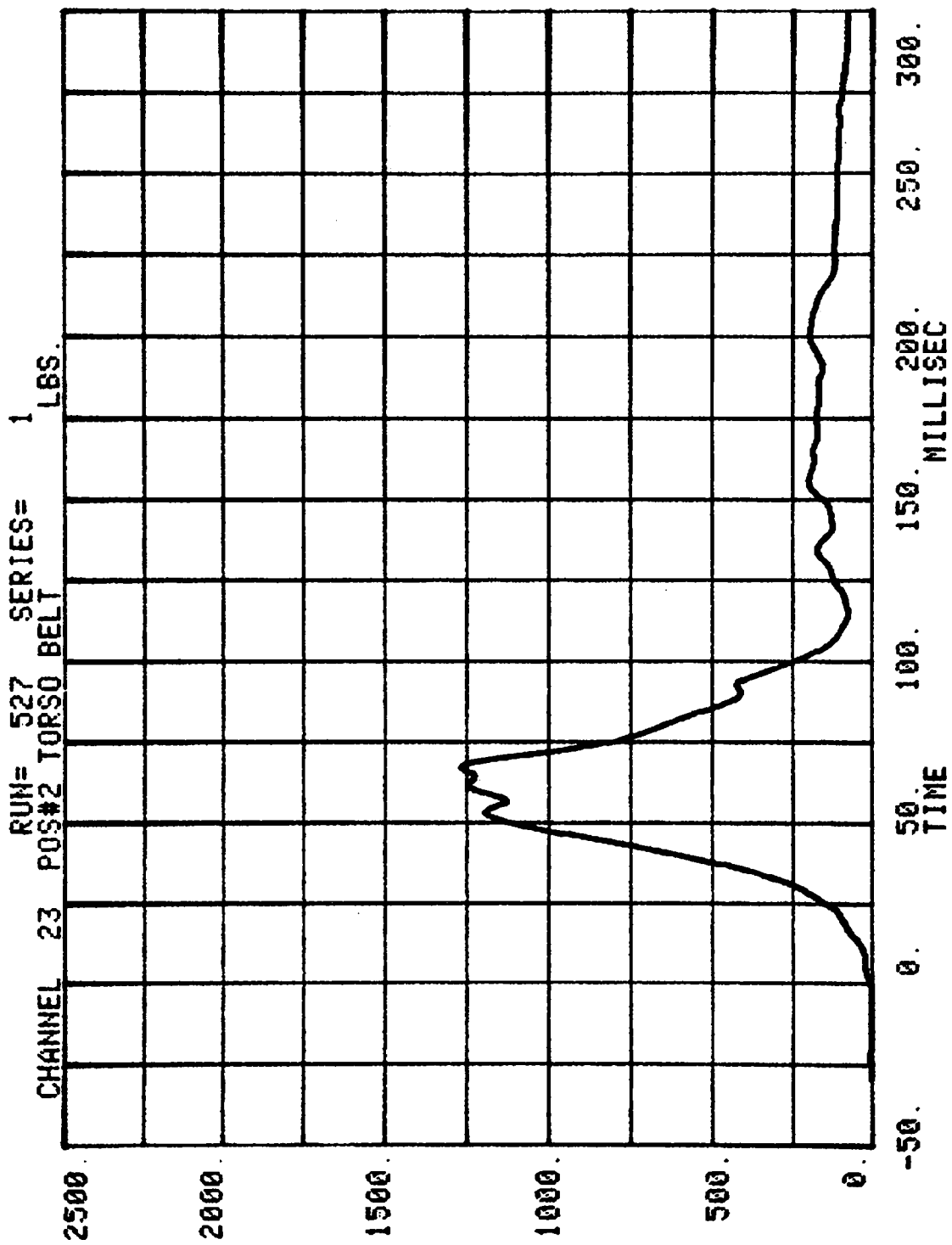






CHANNEL 22 POS#2 LEFT BELT
RUN= 527 SERIES= 1 LBS.





APPENDIX C

DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the Alderson Research Laboratories Model ATD 30034, 50th percentile male anthropometric test devices utilized for this crash test. 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, Part 572 specifications and instrument calibration information is included in this Appendix.

Dummy serial numbers and certification dates are:

<u>Serial No.</u>	<u>Completion Date</u>
162	8/28/81
183	8/28/81

Electronic Test Equipment

The complement of signal conditioning recording and display equipment in conjunction with dummy certification testing can be found in New Car Assessment and Standard Indicant Testing Final Report, Report No. 6525-V-1.

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY ID NO. 162 (Tape 1030)

LABORATORY TECHNICIAN: Gary Gestwick

APPROVED BY: _____

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		8/28/81	
Calibration Sequential Number for Dummy - - - -		6	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		66°-75°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		60%-69%	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	220 G	
b. Peak Lateral Accel. - -	≤10G	8 G	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.15 ms	
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	22.8 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	22.25 G	
c. Peak Resultant Head Acceleration - - - -	26G maximum	26 G	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	2.6 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	27.5 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	5.6 ms	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	106 ms	
h. Max. Head Rotation - -	63 to 73°	66°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0.0 ms
	Displ.	-.5 to .5 in	0.0 in.
30°	Time	25.6 to 34.4 ms	29 ms
	Displ.	2.1 to 3.1 in.	2.7 in.
60°	Time	40.3 to 51.7 ms	45 ms
	Displ.	4.3 to 5.3 in.	4.7 in.
Maximum (°)	Time	53.2 to 66.8 ms	55 ms
	Displ.	5.0 to 6.0 in.	5.1 in.

Continued

P. 572 DUMMY CALIBRATION TEST DATA Continued:

NHTSA DUMMY ID NO. 162

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	68 ms	
	Displ.	4.3 to 5.3 in.	4.7 in.	
30°	Time	85.4 to 104.6 ms	87 ms	
	Displ.	2.1 to 3.1 in.	2.5 in.	
0°	Time	101.0 to 123.0 ms	102 ms	
	Displ.	-.5 to 0.5 in.	0.0 in.	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.	56.0 lbs.	
b. Force @ 1.3" - - - - -		73 to 88 lbs.	88.0 lbs.	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - - -		22 to 34 lbs.	33.5 lbs.	
b. Force @ 30° - - - - -		34 to 46 lbs.	44.0 lbs.	
c. Force @ 40° - - - - -		46 to 58 lbs.	57.5 lbs.	
d. Return Angle - - - - -		12° maximum	3°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - - -	21.78-22.22 fps	21.89 fps		
(2) Peak Deflection - -	1.7" maximum	1.44 in.		
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	1813 lbs.		
(4) Internal Hysteresis - - - - -	50 to 70%	64.04%		
b. Low Speed				
(1) Probe Speed - - -	13.86-14.14 fps	13.97 fps		
(2) Peak Deflection - -	1.1" maximum	.92 in.		
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1217 lbs.		
(4) Internal Hysteresis - - - - -	50 to 7%	58.76%		

P.572 DUMMY CALIBRATION TEST DATAContinued:

NHTSA DUMMY ID NO. 162

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.82 fps	
(2) Maximum Force - -	1850 to 2500 lbs	1925 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.88 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.88 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2100 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.2 ms	

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 162

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

A. DUMMY INSTRUMENTS:

1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

3. Chest Potentiometer - - -

4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push
Force Gauge - - - - -

4. Abdominal Compression Test
Force Gauge - - - - -

5. Abdominal Compression Test
Displacement Gauge - - - -

MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
ENDEVCO	CS75	7/81	1/82
ENDEVCO	C462	7/81	1/82
ENDEVCO	CE18	7/81	1/82
GSE	312	7/81	1/82
GSE	311	7/81	1/82
CEC	22958	7/81	1/82
CEC	26929	7/81	1/82
TRANSDUCER INC.	20051	7/81	1/82
BLH	72952	7/81	1/82
CIC	567-11	7/81	1/82

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY ID NO. 183 (Tape 1030)

LABORATORY TECHNICIAN: Gary Gestwick

APPROVED BY: _____

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		8/28/81	
Calibration Sequential Number for Dummy - - -		3	
Temperature in Lab. (Spec. = 66 to 78°F)- - -		66°-75°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		60%-69%	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	210 G	
b. Peak Lateral Accel. - -	≤10G	7 G	
c. Time above 100G - - -	0.9 to 1.5 ms	1.2 ms	
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	22.3 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	24 G	
c. Peak Resultant Head Acceleration - - - -	26G maximum	26 G	
d. Pendulum Decel. (t_2-t_1)	≤3 ms	1.5 ms	
e. Pendulum Decel. (t_3-t_2)	25 to 30 ms	27.5 ms	
f. Pendulum Decel. (t_4-t_3)	≤10 ms	4.3 ms	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	103 ms	
h. Max. Head Rotation - -	63 to 73°	67°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0.0 ms
	Displ.	-.5 to .5 in	0.0 in.
30°	Time	25.6 to 34.4 ms	28.7 ms
	Displ.	2.1 to 3.1 in.	2.7 in.
60°	Time	40.3 to 51.7 ms	43 ms
	Displ.	4.3 to 5.3 in.	4.7 in.
Maximum (°)	Time	53.2 to 66.8 ms	56.8 ms
	Displ.	5.0 to 6.0 in.	5.2 in.

Continued

P, 572 DUMMY CALIBRATION TEST DATA Continued:

NHTSA DUMMY ID NO. 183

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	67.5 ms	
	Displ.	4.3 to 5.3 in.	4.7 in.	
30°	Time	85.4 to 104.6 ms	86.25 ms	
	Displ.	2.1 to 3.1 in.	2.4 in.	
0°	Time	101.0 to 123.0 ms	101 ms	
	Displ.	-.5 to 0.5 in.	-.2 in.	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.	51.0 lbs.	
b. Force @ 1.3" - - - - -		73 to 88 lbs.	80.0 lbs.	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - - -		22 to 34 lbs.	33.5 lbs.	
b. Force @ 30° - - - - -		34 to 46 lbs.	45.0 lbs.	
c. Force @ 40° - - - - -		46 to 58 lbs.	55.0 lbs.	
d. Return Angle - - -		12° maximum	4°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - -		21.78-22.22 fps	22.10 fps	
(2) Peak Deflection -		1.7" maximum	1.7 in.	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	1839 lbs.	
(4) Internal Hysteresis - - -		50 to 70%	51.48%	
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps	14.08 fps	
(2) Peak Deflection -		1.1" maximum	1.07 in.	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1166 lbs.	
(4) Internal Hysteresis- - -		50 to 7%	53.4%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

NHTSA DUMMY ID NO. 183

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.79 fps	
(2) Maximum Force - -	1850 to 2500 lbs	1950 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.8 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.81 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2025 lbs.	
(3) Time Above 1000#	1.7 ms minimum	2.12 ms	

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 183

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

A. DUMMY INSTRUMENTS:

1. Head Accelerometers--

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

2. Chest Accelerometers-- (Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal (A_x) -

(2) Lateral (A_y) - - -

(3) Vertical (A_z) - - -

3. Chest Potentiometer - - -

4. Femur Load Cells--

a. Right Side - - - - -

b. Left Side

B. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - -

2. Test Probe Accelerometer -

3. Lumbar Flexion Test Push
Force Gauge - - - - -

4. Abdominal Compression Test
Force Gauge - - - - -

5. Abdominal Compression Test
Displacement Gauge - - - -

MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
ENDEVCO	CS75	7/81	1/82
ENDEVCO	C462	7/81	1/82
ENDEVCO	CE18	7/81	1/82
GSE	312	7/81	1/82
GSE	311	7/81	1/82
CEC	22958	7/81	1/82
CEC	26929	7/81	1/82
TRANSDUCER INC.	20051	7/81	1/82
BLH	72952	7/81	1/82
CIC	567-11	7/81	1/82