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CALSPAN ADVANCED TECHNOLOGY CENTER

EVALUATION OF AGGRESSIVENESS TEST TECHNIQUES

Walter E. Levan

CALSPAN REPORT NO. 6707-V-3



TEST:	TEST NO. 3
TYPE OF TEST:	OFFSET FRONTAL CAR-TO-CAR IMPACT 1980 Oldsmobile Cutlass Supreme 1980 Volkswagen Rabbit
TEST DATE:	28 JANUARY 1981
CONTRACT NO.:	DOT-HS-8-01938
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16. Abstract An offset frontal car-to-car crash test of a 1980 Oldsmobile Cutlass Supreme, 2-door sedan and a 1980 Volkswagen Rabbit, 2-door hatchback was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department, Buffalo, New York on January 28, 1981. Impact speed for each vehicle was 30.9 mph. Ambient Temperature on the test date was 24°F. Both occupants of the Oldsmobile Cutlass and the right front passenger of the Volkswagen Rabbit complied with FMVSS 208 Injury Criteria Value. Due to intermittent data of the Volkswagen Rabbit driver's head (X) acceleration, a HIC number could not be calculated. The chest and femurs complied with FMVSS 208 Injury Criteria Value. Maximum crush of the Oldsmobile Cutlass Supreme was 28.8 inches and maximum intrusion of the firewall was 2.7 inches. Both were measured on the left side of the vehicle. Maximum crush of the Volkswagen Rabbit was 27.9 inches and maximum firewall intrusion was 5.7 inches; these measurements were made on the left side of the vehicle.					
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SECTION 1

TEST OBJECTIVE

The test objective was to obtain Baseline data using one of two vehicles judged to have dissimilar aggressivity characteristics against a subcompact vehicle.

The test was an offset frontal (driver side) car-to-car impact involving a 1980 Oldsmobile Cutlass Supreme and a 1980 Volkswagen Rabbit with a nominal closing speed of 61.8 mph. This test was performed at Calspan Corporation, Advanced Technology Center on January 28, 1981.

The test program is part of the National Highway Traffic Safety Administration's (NHTSA) Contract DOT-HS-8-01938, Task 5, to evaluate aggressiveness test techniques.

SECTION 2

SUMMARY OF TEST NUMBER 3

A 1980 Oldsmobile Cutlass Supreme and a 1980 Volkswagen Rabbit were crash tested at Calspan Corporation, Advanced Technology Center on January 28, 1981 in an offset frontal car-to-car impact mode (Figures A-1 and A-2) with a closing speed of 61.8 mph. Ambient temperature on the day of impact was 24°F.

Both vehicles were occupied by Part 572, 50th percentile male Anthropometric Test Devices (ATDs) placed 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 regions with load cells in 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 78 channels of data were recorded on 6 FM tape recorders. Vehicle and dummy response data traces are found in Appendix B.

The crash event was recorded by one real time and eleven high speed cameras. Camera locations and other pertinent camera information are found in Section 3 of this report.

DATA LOSSES EXPERIENCED DURING THE TEST

Vehicle No. 1

Accelerometer Pack #4(X) (Bumper Crossmember Support) zero shift after impact (Reason Unknown) - was operable during checkout.

Accelerometer Pack #9(Z) (Bottom of Engine) zero - shift - (Reason Unknown).

Vehicle No. 2

Accelerometer Pack #5(X) and 5(Z) (Rear Axle) - data does not look accurate and has a zero shift - (Reason Unknown) - was operable during checkout.

Position #1 Head X (Driver) - Intermittent data (Bad Accelerometer Cable) - was operable during checkout.

Table 1

CRASH TEST SUMMARY

TEST NO.	<u>3</u>		PROJECT	<u>Evaluation of Aggressiveness Test Techniques</u>	
DATE	<u>1/28/81</u>		TIME	<u>1536</u>	TEMP. <u>24°F</u>
TEST CONDITION	<u>Offset Frontal - 61.8 mph Closing Speed</u>				
VEHICLE NO. 1	<u>1980 Oldsmobile Cutlass Supreme - 2-door Sedan</u>				
VEHICLE NO. 2	<u>1980 Volkswagen Rabbit - 2-door Hatchback</u>				

	VEH. NO. 1	VEH. NO. 2
TEST WEIGHT (lbs)	<u>3950</u>	<u>2580</u>
IMPACT ANGLE (deg)*	<u>0</u>	<u>0</u> OFFSET
IMPACT VELOCITY (mph)**	<u>30.9</u>	<u>30.9</u>
MAX. CRUSH (in) (STATIC)	<u>28.8 (LF Side)</u>	<u>27.9 (LF Side)</u>
MAX. INTRUSION (in)	<u>2.7</u>	<u>5.7</u>

OCCUPANTS	VEH. NO. 1	VEH. NO. 2
TYPE	<u>Part 572, 50th Percentile Male</u>	<u>Part 572, 50th Percentile Male</u>
LOCATION	<u>LF (1) RF (2)</u>	<u>LF (1) RF (2)</u>
RESTRAINT	<u>3-Point Belt System</u>	<u>3-Point Belt System</u>
ATD ID. NO.	<u>109 183</u>	<u>162 320</u>

NUMBER OF DATA CHANNELS	<u>78</u>
NUMBER OF HIGH SPEED CAMERAS	<u>11 + 1 Real Time</u> <u>Overhead Camera (Tower) Failed. (Film Broke)</u>

* WITH RESPECT TO TOW TRACK CENTERLINE

** SPEED TRAP MEASUREMENT (±0.5% ACCURACY)

OBSERVATIONS (VEHICLE NO. 1) - 1980 Oldsmobile Cutlass Supreme

GLAZING Windshield has stress cracks on driver side (Figure A-13).

DOORS Both driver and passenger doors were operable after impact.

SEAT ANCHORAGES Intact

RESTRAINTS Intact - See General Comments below.

OBSERVATIONS (VEHICLE NO. 2) - 1980 Volkswagen Rabbit

GLAZING At impact the hood struck and broke the windshield (Figure A-27).

DOORS Both front doors were operable after impact.

SEAT ANCHORAGES Intact

RESTRAINTS Intact - See General Comments below:

GENERAL COMMENTS The production type 3-point retractor belt systems were re-
placed in both vehicles with a 3-point adjustable belt with
no retractors.

Table 2

VEHICLE TEST WEIGHTS AS TESTED

Vehicle No. 1 - 1980 Oldsmobile Cutlass Supreme

Left Front	1130 lbs	Left Rear	900 lbs
Right Front	1070 lbs	Right Rear	850 lbs
TOTAL FRONT	2200 lbs	TOTAL REAR	1750 lbs

Total Weight = $\frac{2200 + 1750}{1}$ = 3950 lbs

Wheel Base = 108 inches

$Cg_{F.W.} = \frac{1750 \text{ lbs} \times 108 \text{ inches}}{3950 \text{ lbs}} = 47.5 \text{ inches}$

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
 UDW = Unloaded Delivered Weight (3580 lbs)
 VCW = Vehicle Capacity Weight (1060 lbs)
 DSC = Designated Seating Capacity (6)

RCLW = VCW - 150 (DSC)

RCLW = $\frac{1060}{1} - 150 (6) = 160 \text{ lbs}$

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

TEST WEIGHT = $\frac{3580}{1} \text{ lbs} + \frac{160}{1} \text{ lbs} + 2 (164 \text{ lbs})$

TEST WEIGHT = $\frac{4068}{1} \text{ lbs}$ (CALCULATED)

Table 3

VEHICLE TEST WEIGHTS AS TESTED

Vehicle No. 2 - 1980 Volkswagen Rabbit

Left Front 750 lbs
Right Front 710 lbs
TOTAL FRONT 1460 lbs

Left Rear 570 lbs
Right Rear 550 lbs
TOTAL REAR 1120 lbs

Total Weight = 1460 + 1120 = 2580 lbs

Wheel Base = 95 inches

Cg_{F.W.} = $\frac{1120 \text{ lbs} \times 95 \text{ inches}}{2580 \text{ lbs}}$ = 41.24 inches

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
UDW = Unloaded Delivered Weight (2030 lbs)
VCW = Vehicle Capacity Weight (837 lbs)
DSC = Designated Seating Capacity (4)

RCLW = VCW - 150 (DSC)

RCLW = 837 - 150 (4) = 237 lbs

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

TEST WEIGHT = 2030 lbs + 237 lbs + 2 (164 lbs)

TEST WEIGHT = 2595 lbs (CALCULATED)

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

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

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

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND	42	lbs	CARGO
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Table 4
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test 1/28/81 Time of Test 1536 hrs.
Ambient Temperature 24 °F at impact area
Temperature in Occupant Compartment 67 °F

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude:	RF <u>26.5</u>	LF <u>26</u>	RR <u>26.75</u>	LR <u>26.25</u>
Test Attitude:	RF <u>26.25</u>	LF <u>25.5</u>	RR <u>24.9</u>	LR <u>24.2</u>

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 32 psi Rear = 32 psi
Recommended Tire Size P195R14 Load Range B
Tires on Vehicle Goodyear P195/175R14
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 18 gal
Test Volume* 16.75 gal (93% of EPA Capacity)
Fuel System Capacity (data from Owner's Manual) 18 gal
Details of fuel system Engine operated fuel pump. Fuel tank is located
aft of rear axle and held in place by two tank straps. The fill tube is
located at the rear center of vehicle sealed by a twist-type cap and is
concealed by a license plate hinged door.
Electric Fuel Pump Yes X No Fuel Injection Yes X No
Does electric fuel pump operate with ignition switch "on" and the engine
not operating N/A Yes N/A No

VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 198 /L 198.1 inches
Post-Test = R 204.7 /L 169.3 inches
Crush = R 6.7 /L 28.8

*All Stoddard solvent was removed from tank to bring test weight within specification. This was approved by the CTM.

TEST VEHICLE INFORMATION

Vehicle Manufacturer Volkswagen of America, Inc.
Make/Model Rabbit
Body Style 2-Door Hatchback Model Year 1980
VIN 17A0973008 Build Date 7/80
NHTSA No. 614-3-512 Color White
Engine Data: 4 cylinders 97 in³/~~xxx~~ displacement
Transmission Data: 4 speed (X) Manual () Automatic
Date Rec'd 1/8/81 Air Cond. PW. STR. PW. BR. X
Dealer's Name & Address Kelly's Volkswagen, Cheektowaga, N. Y.

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

Vehicle Manufactured by Volkswagen of America, Inc.
Date of Manufacture 7/80 VIN 17A0973008
GVRW 2280 lbs GAWR: Front 1609 lbs Rear 1278 lbs

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

Vehicle Load (up to capacity) - Front 27 psi
Rear 31 psi
Recommended Tire Size 155R13 Load Range: X B C D
Vehicle Capacity: Types of Seats Bench X Bucket Split Bench
Number of Occupants (Designated Seating Capacity): 2 Front
2 Rear
4 TOTAL
Cargo Load = 237 lbs
TOTAL = 837 lbs

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

Right Front = 630 lbs Right Rear = 380 lbs
Left Front = 640 lbs Left Rear = 390 lbs
TOTAL FRONT WEIGHT = 1260 lbs (62.0 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 770 lbs (38.0 % of Total Vehicle Weight)
TOTAL DELV. WEIGHT = 2030 lbs

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 222 lbs CARGO

Right Front = 710 lbs Right Rear = 550 lbs
Left Front = 750 lbs Left Rear = 570 lbs
TOTAL FRONT WEIGHT = 1460 lbs (56.6 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1120 lbs (43.4 % of Total Vehicle Weight)
TOTAL TEST WEIGHT = 2580 lbs
Weight of ballast secured in vehicle trunk area = 0 lbs

Table 5
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test 1/28/81 Time of Test 1536 hrs.
Ambient Temperature 24 °F at impact area
Temperature in Occupant Compartment 66 °F

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude:	RF <u>25.5</u>	LF <u>25.5</u>	RR <u>25.25</u>	LR <u>25.25</u>
Test Attitude:	RF <u>24.7</u>	LF <u>24.5</u>	RR <u>22.8</u>	LR <u>23.0</u>

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 27 psi Rear = 31 psi
Recommended Tire Size 155R13 Load Range B
Tires on Vehicle Michelin 155SR13
Is Spare Tire a "Space Saver" yes X 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 10 gal
Test Volume 9.3 gal (93% of EPA Capacity)
Fuel System Capacity (data from Owner's Manual) 10 gal
Details of fuel system Engine operated fuel pump. Fuel tank is located forward of rear wheels and held in place by two tank straps. Filler tube is on right side of vehicle and sealed with a twist-type cap.
Electric Fuel Pump Yes X No Fuel Injection X Yes No
Does electric fuel pump operate with ignition switch "on" and the engine not operating N/A Yes N/A No

VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 153.1 / L 153.3 inches
Post-Test = R 154.6 / L 125.4 inches
Crush = R -1.5 / L 27.9

SECTION 3

VEHICLE AND OCCUPANT INFORMATION

The production-type 3-point retractor belt system was removed from each vehicle and replaced with 3-point adjustable belts with no retractors. The belt system for each occupant was instrumented to measure lap and torso belt loads.

The driver seat of each vehicle 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's seat cushion and the seat was adjusted per instructions of the CTM as shown in Figure 8 for the Oldsmobile Cutlass and Figure 9 for the Rabbit. The passenger seat was then adjusted so the seatback was in line with the driver's seatback.

Vehicle No. 1

The Oldsmobile Cutlass Supreme was a 2-door sedan having a 260 cubic inch, 8 cylinder engine, equipped with a three-speed automatic transmission. The vehicle was also equipped with power steering and power brakes. The fuel tank which is located aft of the rear axle was filled with red Stoddard fluid to ninety-three percent of its rated capacity. The total test weight with two dummies, instrumentation and cameras was 3950 pounds.

Vehicle No. 2

The Volkswagen Rabbit was a 2-door hatchback equipped with a 97 cubic inch, 4 cylinder engine, with a 4-speed manual transmission, and power brakes. The fuel tank which is located forward of the rear wheels was also filled with red Stoddard fluid to ninety-three

percent of its rated capacity. Total test weight with two dummies, instrumentation and cameras is 2580 pounds which was 1370 pounds lighter than the Cutlass Supreme.

POST-TEST OBSERVATIONS

Vehicle No. 1 - 1980 Oldsmobile Cutlass Supreme

Both driver and right front passenger complied with injury criteria requirements to FMVSS 208. No interior contact of the dummies was observed. Occupant results are summarized in Table 14 and the data traces, along with vehicle data traces, are presented in Appendix B.

Maximum crush on the vehicle was 28.8 inches and maximum firewall intrusion was 2.7 inches, both measured on the left side of the vehicle. Appendix A contains still photographs of the pre- and post-exterior views.

Vehicle No. 2 - 1980 Volkswagen Rabbit

The right front passenger passed the FMVSS 208 Injury Criteria for head, chest and femurs. The driver's chest and femurs were also in compliance with FMVSS 208; however, the HIC number could not be calculated due to intermittent data from the head (X) accelerometer. The cause of this condition was traced to a defective cable. Visual inspection and film analysis indicate there was no severe head contact, only a slight brushing with the steering wheel. This observation is supported by the lack of high acceleration excursions in the head (Y) and (Z) accelerations. It would be reasonable to expect a HIC number well below 1000.

Maximum crush on the vehicle was 27.9 inches on the left side and firewall intrusion was 5.5 inches.

The windshield of the Rabbit was penetrated by the hood as illustrated in Figure A-27.

It was not possible to perform film analysis to determine dynamic crush on each vehicle due to the impact configuration. Figure 2 does display each vehicle's displacement with respect to time.

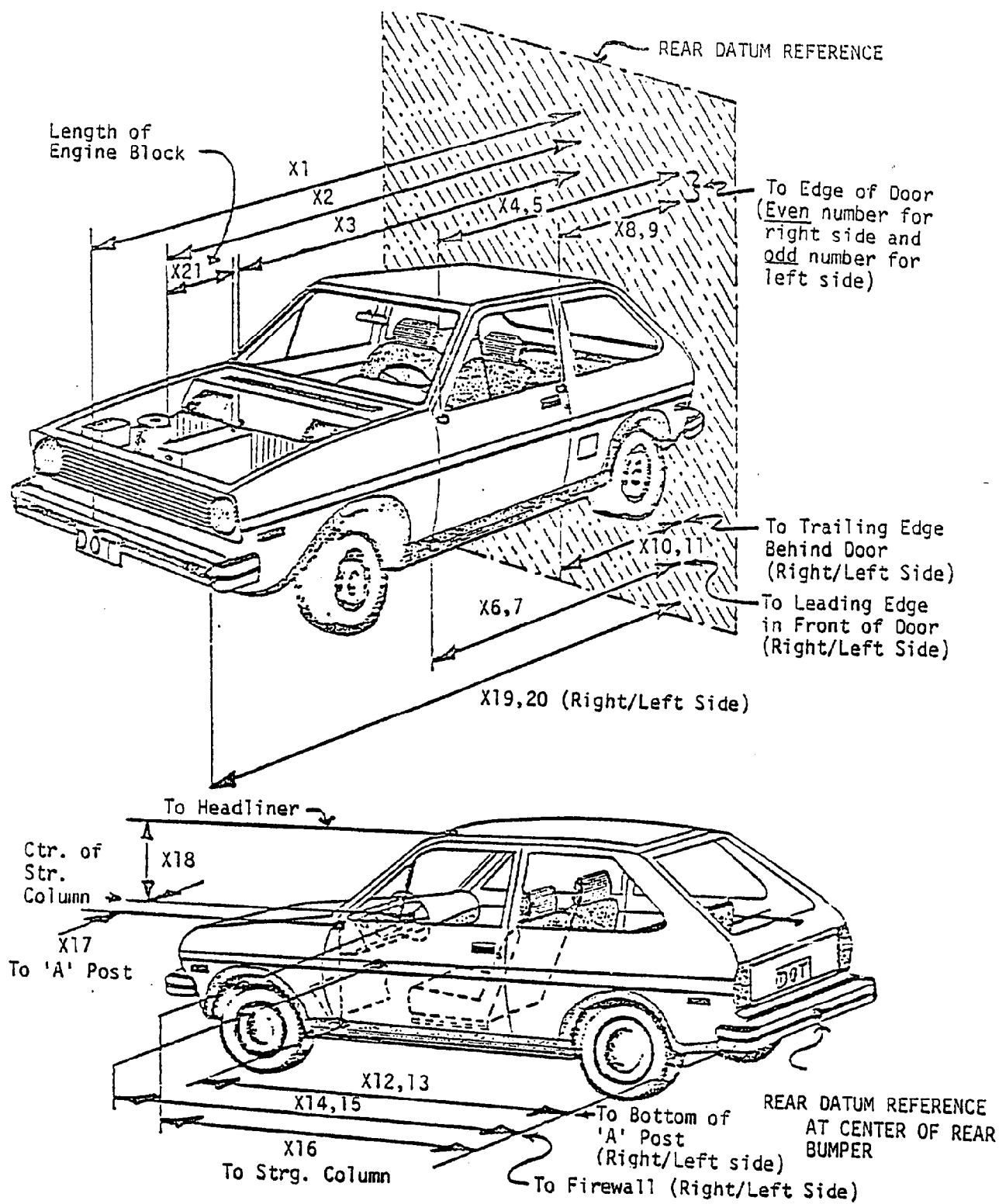


Figure 1 PRE-TEST AND POST-TEST MEASUREMENT POINTS

Table 6

VEHICLE WEIGHTS AND RIDE HEIGHTS

Test No. 3

		WEIGHTS & RIDE HEIGHTS				Vehicle No. 1 - 1980 Oldsmobile Cutlass Supreme			
		L.F.	R.F.	R.R.	L.R.	L. BUMPER	R. BUMPER	CENTERLINE E.	
						Upper	Lower	Upper	Lower
CURB WEIGHT	Pounds	1050	1020	740	770				
RIDE HEIGHTS	Inches	26.0	26.5	26.75	26.25	21.0	12.0	22.0	13.1
CURB WEIGHT PLUS DUMMIES	Pounds	1130	1100	810	840				
RIDE HEIGHTS	Inches	25.5	26.1	26.0	25.6	20.3	11.4	21.2	12.3
FINAL WEIGHT INSTRUMENTATION AND DUMMIES*	Pounds	1130	1070	850	900				
RIDE HEIGHTS	Inches	25.5	26.4	24.9	24.2	20.9	12.0	22.0	13.1

Vehicle No. 2 - 1980 Volkswagen Rabbit

CURB WEIGHT	Pounds	640	620	380	390				
RIDE HEIGHTS	Inches	25.5	25.5	25.25	25.25	20.9	15.9	21.0	16.1
CURB WEIGHT PLUS DUMMIES	Pounds	730	720	460	430				
RIDE HEIGHTS	Inches	24.7	24.5	24.0	24.4	20.0	15.1	20.1	15.2
FINAL WEIGHT INSTRUMENTATION AND DUMMIES*	Pounds	750	710	550	570				
RIDE HEIGHTS	Inches	24.5	24.7	22.8	23.0	19.9	15.0	20.5	15.6

* 95 lbs of Stoddard solvent was removed from fuel tank to set test weight.

Table 7

		TYPE OF MEASUREMENT	ALL DIMENSIONS IN INCHES		DIFF.
			PRE- TEST	POST TEST	
NO.					
X1	Total Length of Vehicle at Centerline		201.5	181.5	20.0
X2	Rear Surface of Vehicle to Front of Engine		169.4	164.4	5.0
X3	Rear Surface of Vehicle to Firewall		140.4	139.2	1.2
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door		134.6	134.6	0
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door		134.4	134.2	.2
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door		135.3	134.9	.4
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door		135.1	135.0	.1
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door		79.2	79.2	0
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door		79.2	79.2	0
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door		78.9	78.8	.1
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door		78.8	78.6	.2
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side		129.1	129.1	0
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side		129.2	129.2	0
X14	Rear Surface of Vehicle to Firewall - Right Side		143.8	143.8	0
X15	Rear Surface of Vehicle to Firewall - Left Side		146.1	143.4	2.7
X16	Rear Surface of Vehicle to Steering Column		115.9	115.9	0
X17	Center of Steering Column to "A" Post		13.9	13.8	.1
X18	Center of Steering Column to Headliner		16.1	16.9	-.8
X19	Rear Surface of Vehicle to Right Side of Front Bumper		198.0	204.7	-6.7
X20	Rear Surface of Vehicle to Left Side of Front Bumper		198.1	169.3	28.8
X21	Length of Engine Block		21.5	21.5	0

VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

DATE January 28, 1981REFERENCE DISTANCE FROM REAR 201.5

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6		6	12	18	24	30	36
Lower Bumper	Pre			←				15.0						→
	Post			←				18.0						→
Upper Bumper	Pre			←				19.2						→
	Post			←				20.5						→
2 Bumper Hood	Pre			←				25.0						→
	Post			←				28.5						→
Rear Hood	Pre			←				30.9						→
	Post			←				35.0						→

HORIZONTAL DISTANCE FROM REFERENCE

Lower Bumper	Pre		4.4	3.8	3.2	2.6	2.5	2.5	2.5	2.6	3.2	3.8	4.4
	Post		36.5	32.9	29.8	26.6	24.1	20.3	16.2	11.5	7.6	3.6	+4.4
			32.1	29.1	26.6	24.0	21.6	17.8	13.7	8.9	4.4	+2.2	+4.0
Upper Bumper	Pre		3.0	2.3	1.6	1.0	.5	0	.5	1.0	1.6	2.3	3.0
	Post		31.6	28.3	26.1	25.4	22.7	18.7	15.1	11.2	6.5	2.3	+1.9
			28.6	26.0	24.5	24.4	22.2	18.7	14.6	10.2	4.9	0	+1.1
2 Bumper Hood	Pre		7.9	7.8	7.1	5.7	5.1	4.5	5.0	5.6	7.0	7.8	7.8
	Post		26.7	26.7	25.2	22.3	19.4	17.8	14.9	11.9	9.7	7.8	7.8
			18.8	18.4	18.1	16.6	14.3	13.3	9.9	6.3	2.7	0	0
Rear Hood	Pre		7.7	7.0	6.4	5.8	5.2	4.8	5.2	5.8	6.4	7.0	7.6
	Post		21.0	22.3	19.8	16.0	14.9	12.8	10.1	9.7	8.4	8.0	7.8
			13.3	15.3	13.4	10.2	9.7	8.0	4.9	3.9	2.0	1.0	.2

Table 9

VEHICLE MEASUREMENTS
1980 Volkswagen Rabbit

NO.	TYPE OF MEASUREMENT	ALL DIMENSIONS IN INCHES		DIFF.
		PRE- TEST	POST TEST	
X1	Total Length of Vehicle at Centerline	155.0	133.1	21.9
X2	Rear Surface of Vehicle to Front of Engine	131.0	122.5	8.5
X3	Rear Surface of Vehicle to Firewall	114.1	108.6	5.5
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	102.1	102.1	0
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	107.2	102.2	0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	102.4	102.3	.1
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	102.5	101.7	.8
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	57.8	57.8	0
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	58.0	58.0	0
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	58.0	58.0	0
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	58.2	58.0	.2
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	98.1	98.1	0
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	98.1	98.1	0
X14	Rear Surface of Vehicle to Firewall - Right Side	111.8	111.7	.1
X15	Rear Surface of Vehicle to Firewall - Left Side	114.5	108.8	5.7
X16	Rear Surface of Vehicle to Steering Column	87.5	85.6	1.9
X17	Center of Steering Column to "A" Post	14.1	15.0	-.9
X18	Center of Steering Column to Headliner	17.2	17.5	-.3
X19	Rear Surface of Vehicle to Right Side of Front Bumper	153.1	154.6	-1.5
X20	Rear Surface of Vehicle to Left Side of Front Bumper	153.3	125.4	27.9
X21	Length of Engine Block	17.5	17.5	0

VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

DATE January 28, 1981REFERENCE DISTANCE FROM REAR 154.6

VERTICAL HEIGHTS

		Inches Left						C/L	Inches Right					
		36	30	24	18	12	6	0	6	12	18	24	30	36
wer mper	Pre			←				17.5				→		
	Post			←				21.0				→		
per mper	Pre			←				20.5				→		
	Post			←				24.0				→		
2 Bumper Hood	Pre			←				25.6				→		
	Post			←				28.0				→		
d	Pre			←				29.6				→		
	Post			←				38.0				→		

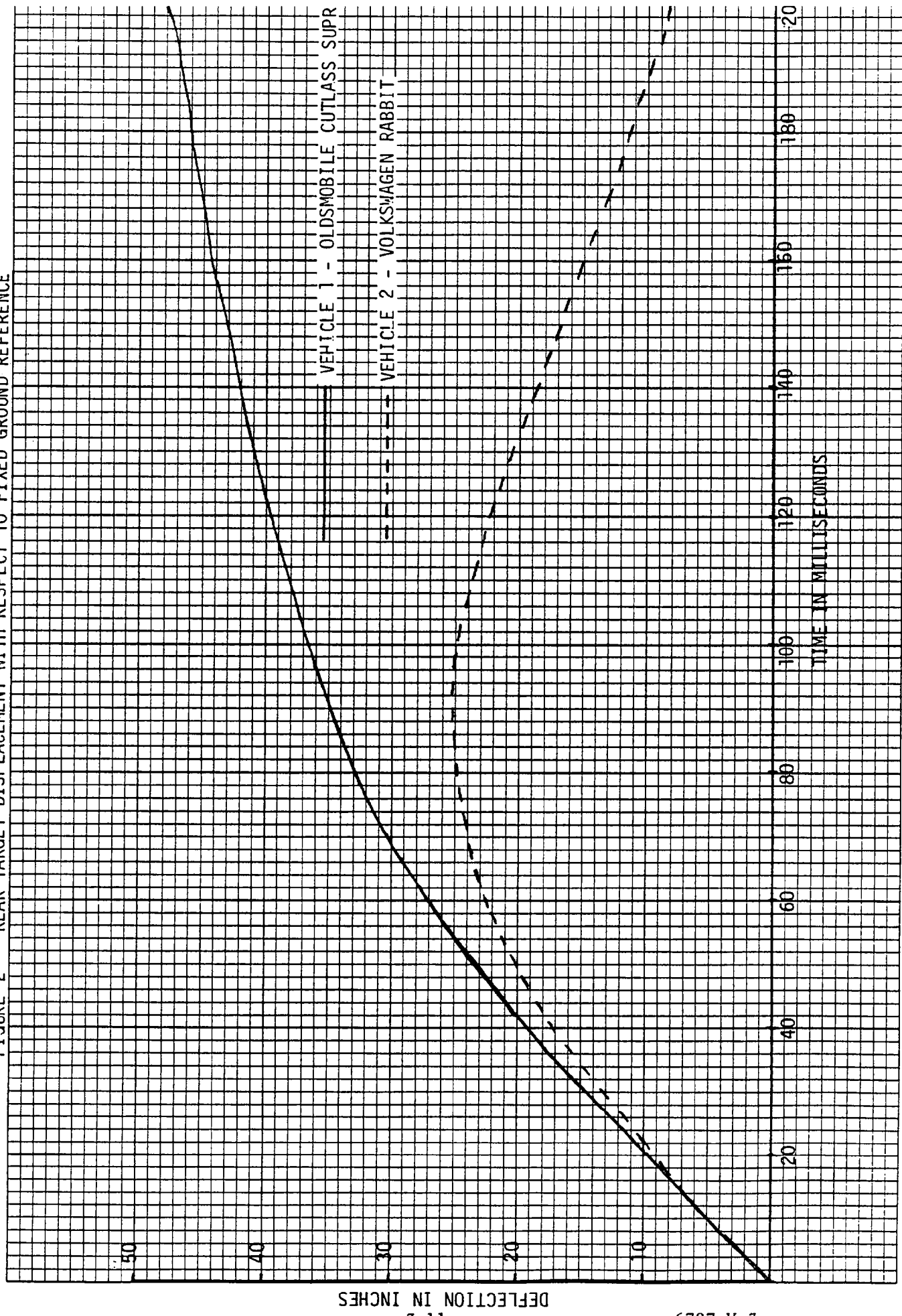
HORIZONTAL DISTANCE FROM REFERENCE

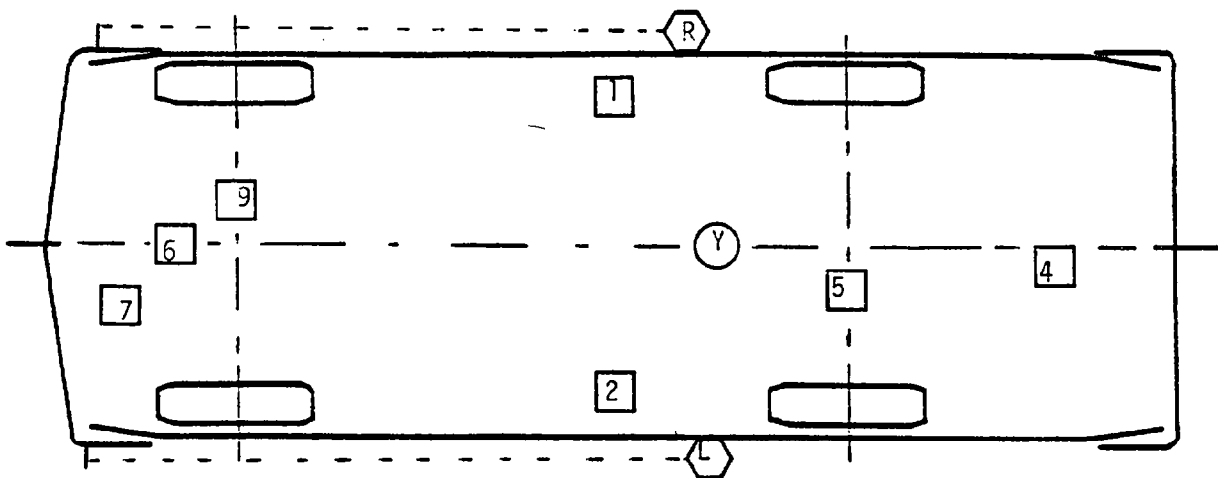
er per	Pre			.8	.5	.25	.1	.1	.1	.25	.5	.8		
	Post			27.8	26.1	24.3	21.8	18.2	15.7	12.1	7.0	1.8		
				27.0	25.6	24.05	21.7	18.1	15.6	11.85	6.5	1.0		
er per	Pre			.8	.5	.25	.1	0	.1	.25	.5	.8		
	Post			29.2	26.9	25.9	23.8	20.2	16.7	12.1	7.5	3.8		
				28.4	26.4	25.65	23.7	20.2	16.6	11.85	7.0	3.0		
Bumper Hood	Pre			7.2	7.2	5.5	5.4	5.2	5.4	5.5	7.2	7.2		
	Post			32.6	31.1	30.1	30.7	27.1	24.8	20.0	18.6	12.5		
				25.4	23.9	24.6	25.3	21.9	19.4	14.5	11.4	5.3		
d	Pre			6.3	5.7	5.5	5.3	5.2	5.3	5.5	5.7	6.3		
	Post			24.9	22.9	23.2	22.6	21.4	19.7	16.7	14.2	12.2		
				18.6	17.2	17.7	17.3	16.2	14.4	1.12	8.5	5.9		

Table 11
VEHICLE TRAJECTORIES

		CUTLASS	RABBIT
IMPACT	X (ft)	-7.4	6.5
	Y (ft)	1.2	-1.4
	HEADING (deg)	0.0	180
FINAL REST	X (ft)	7.9	23.0
	Y (ft)	2.5	-9.7
	HEADING (deg)	-20	125

FIGURE 2 REAR TARGET DISPLACEMENT WITH RESPECT TO FIXED GROUND REFERENCE





ACCELEROMETER NUMBER *			ACCELEROMETER LOCATION		DIRECTION		
					X	Y	Z
	1		Rocker Panel Near Right "B" Pillar		X		X
	2		Rocker Panel Near Left "B" Pillar		X		X
	4		Bumper Crossmember Support		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
		(Y)	Yaw Rate Gyro				
		(R)	Right Bumper Deflection		X		
		(L)	Left Bumper Deflection		X		

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

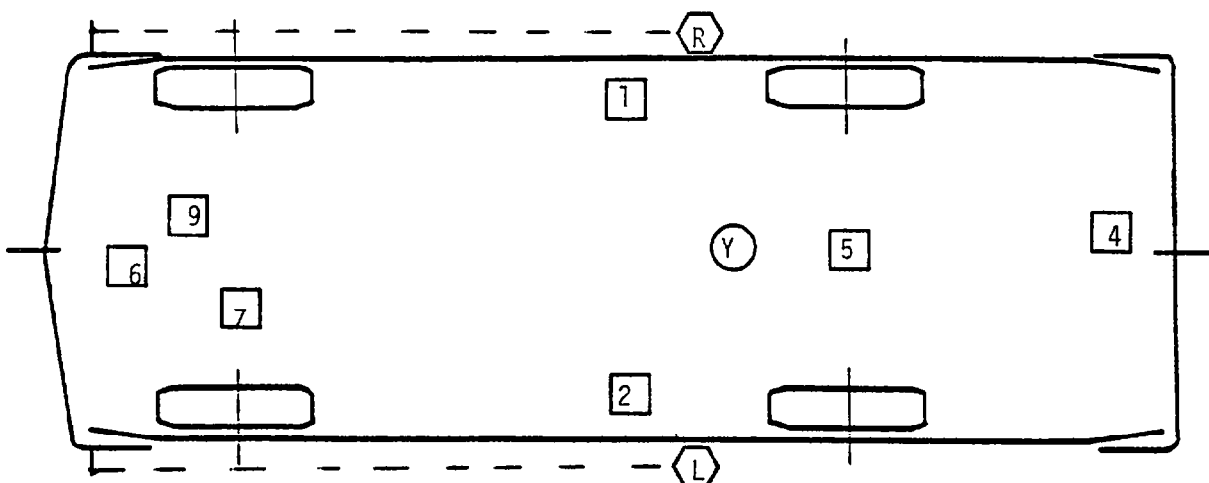
FIGURE 3 VEHICLE ACCELEROMETER LOCATIONS
VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

TEST 614-3-512

TRANSDUCER NUMBER	INCHES FROM REAR	INCHES LEFT OF C/L	ON C/L	INCHES RIGHT OF C/L
1	77.5	24.5		
2	77.5			23.4
3		NOT USED		
4	36	2.5		
5	49.2	11.5		
6	157.9		X	
7	164.9	10.2		
8		NOT USED		
9	151.5			6.0
YAW RATE	67.3		X	

FIGURE 4 VEHICLE TRANSDUCER LOCATION MEASUREMENTS



ACCELEROMETER NUMBER *			DIRECTION		
			X	Y	Z
	1		X		X
	2		X		X
	4		X		X
	5		X		X
	6		X		X
	7		X		X
	9		X		X
	Y				
	R		X		
	L		X		

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

FIGURE 5 VEHICLE ACCELEROMETER LOCATIONS
VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

TEST 614-3-512

TRANSDUCER NUMBER	INCHES FROM REAR	INCHES LEFT OF C/L	ON C/L	INCHES RIGHT OF C/L
1	58.8	21.0		
2	58.8			21.0
3	NOT USED			
4	8.4			3.8
5	41.75		X	
6	127.0	2.5		
7	124.2	11.2		
8	NOT USED			
9	126.4			7.3
YAW RATE	44.8		X	

FIGURE 6 VEHICLE TRANSDUCER LOCATION MEASUREMENTS

NOTE: Camera Information Shown on Tables 12 and 13.

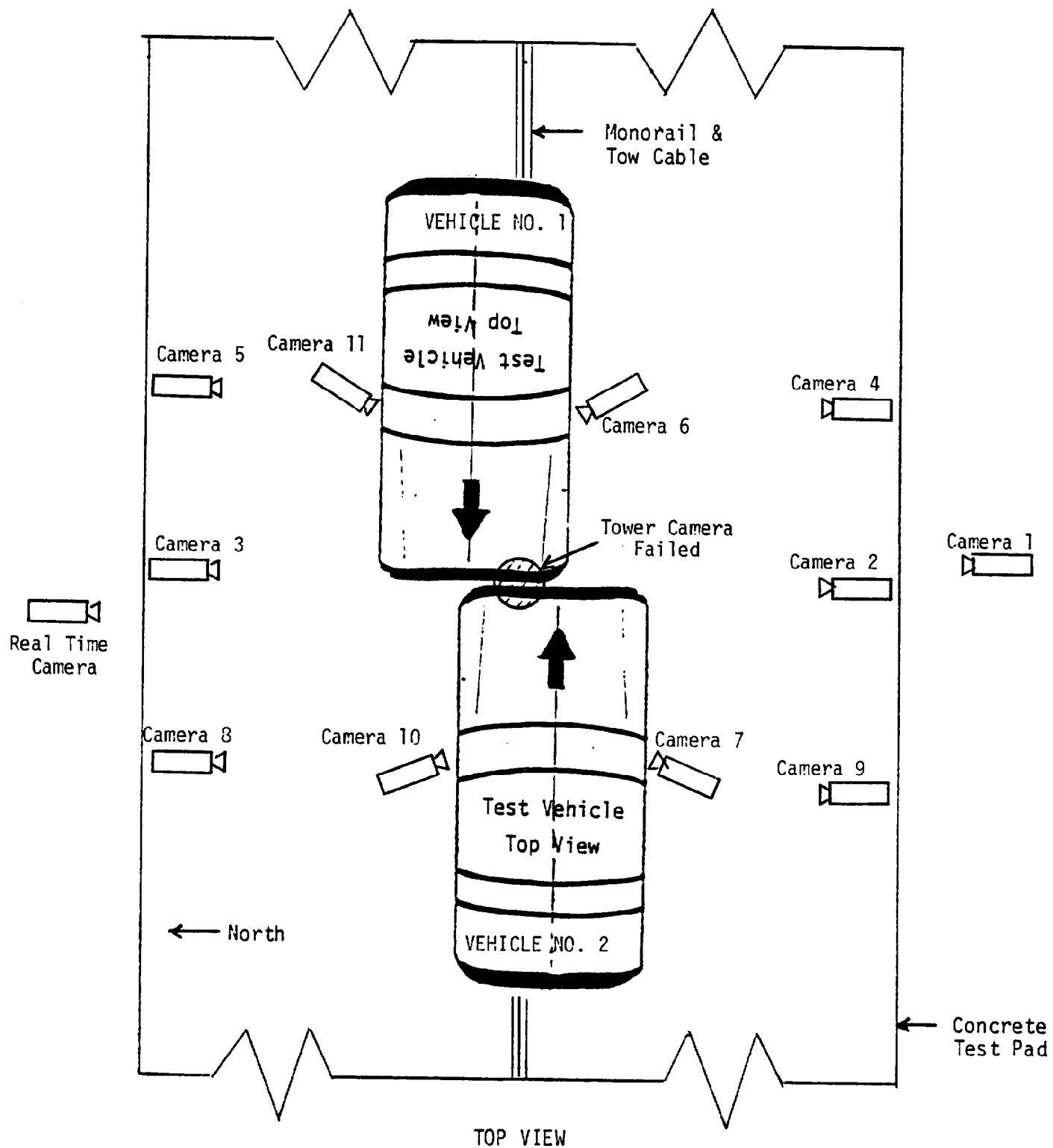


FIGURE 7 CAMERA POSITION FOR FRONTAL IMPACTS

Table 12

HIGH SPEED CAMERA LOCATIONSTest No.: 614-3-512

Vehicle No. 1 -1980 Oldsmobile Cutlass Supreme

Vehicle No. 2 -1980 Volkswagen Rabbit

CAMERA NUMBER	VIEW	CAMERA POSITIONS (IN)*			CAMERA ANGLE (DEG)**	FILM PLANE TO HEAD TARGET (IN) X
		X	Y	Z		
1	IMPACT (OVERALL)	582	87	41	-3	--
2	"B" PILLAR TO "B" PILLAR SOUTH SIDE	481	86	54	-5	--
3	"B" PILLAR TO "B" PILLAR NORTH SIDE	384	0	42	-0	--
4	VEHICLE NO. 1 LEFT SIDE	502	120	42	-2	490
5	VEHICLE NO. 1 RIGHT SIDE	384	96	42	-3	359
6	VEHICLE NO. 1 DRIVER	--	ONBOARD	--		
7	VEHICLE NO. 2 RIGHT FRONT PASSENGER	--	ONBOARD	--		
8	VEHICLE NO. 2 LEFT SIDE	300	60	46	0	290
9	VEHICLE NO. 2 RIGHT SIDE	246	36	41	-2	216
10	VEHICLE NO. 2 DRIVER	--	ONBOARD	--		
11	VEHICLE NO. 1 RIGHT FRONT PASSENGER	--	ONBOARD	--		

TOWER CAMERA FAILED (FILM BROKE IN CAMERA)

* X = film plane to monorail centerline
 Y = film plane to impact location
 Z = film plane to ground

** Referenced to Horizontal Plane

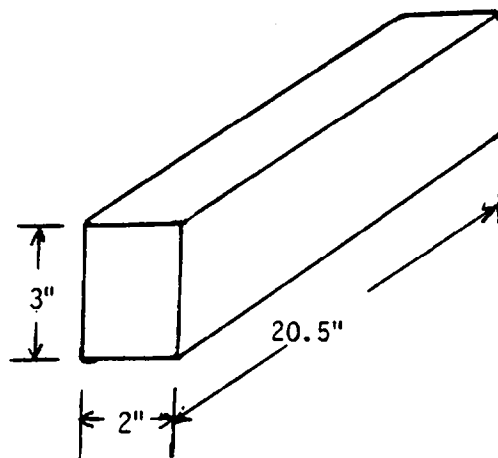
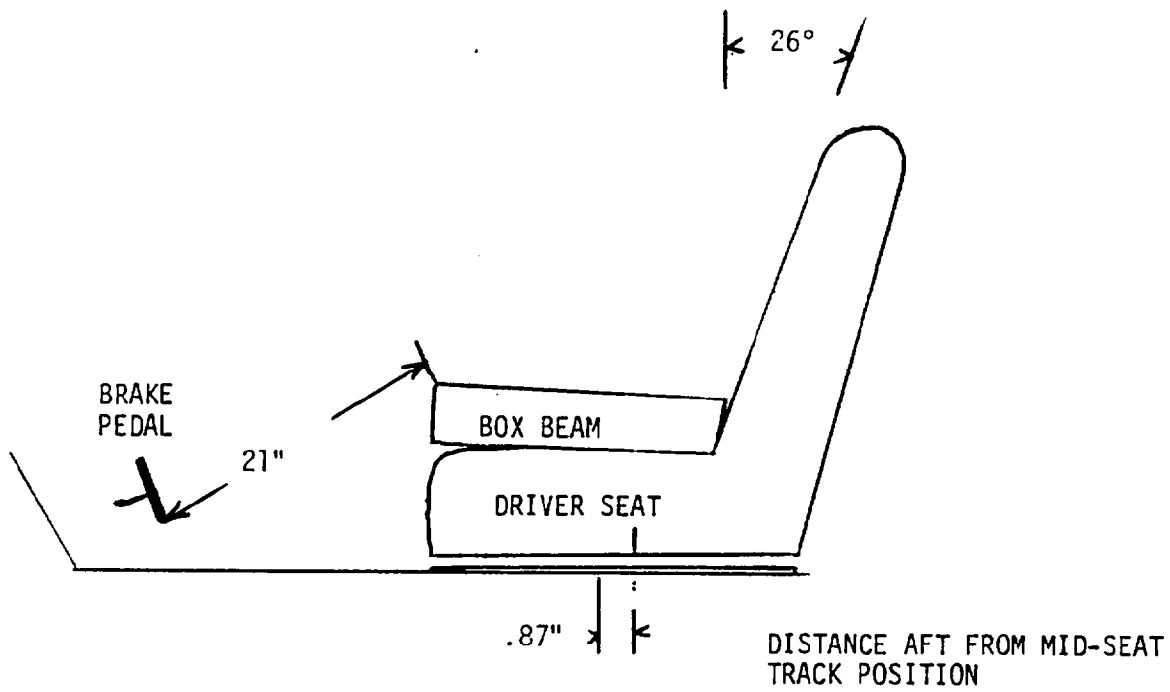
Table 13
HIGH SPEED CAMERA INFORMATION
 (Test 614-3-512)

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	IMPACT (OVERALL)	PHOTOSONIC	13 mm	900
2	IMPACT (NORTH)	PHOTOSONIC	13 mm	450
3	IMPACT (SOUTH)	PHOTOSONIC	13 mm	450
4	VEHICLE NO. 1 LF SIDE	PHOTOSONIC	35 mm	400
5	VEHICLE NO. 1 RT SIDE	PHOTOSONIC	35 mm	450
6	VEHICLE NO. 1 DRIVER	STALEX	8 mm	1650
7	VEHICLE NO. 2 RF PASS.	STALEX	8 mm	1050
8	VEHICLE NO. 2 LF SIDE	PHOTOSONIC	35 mm	500
9	VEHICLE NO. 2 RT SIDE	PHOTOSONIC	35 mm	450
10	VEHICLE NO. 2 DRIVER	STALEX	8 mm	1500
11	VEHICLE NO. 1 RF PASS.	STALEX	8 mm	1200

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.

Timing marks are 10 milliseconds apart (100 Hz).



BOX BEAM DIMENSIONS

FIGURE 8 DRIVER SEAT POSITION

VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

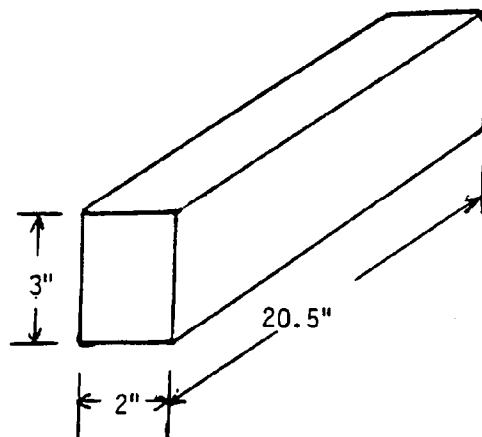


FIGURE 9 DRIVER SEAT POSITION

FIGURE 10
PART 572 DUMMY IN-VEHICLE POSITION

Test No. 614-3-512

Vehicle No. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

SEAT TYPE:

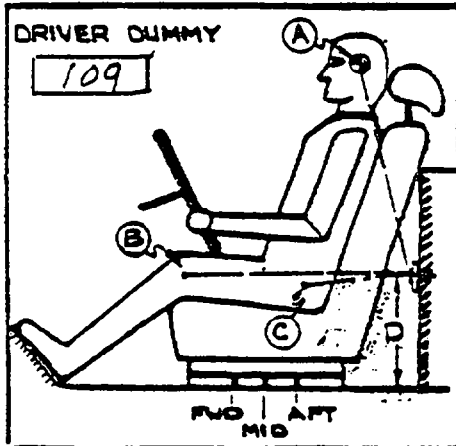
☐ Bench
☐ Bucket
☒ Split Bench

ADJUSTER TYPE:

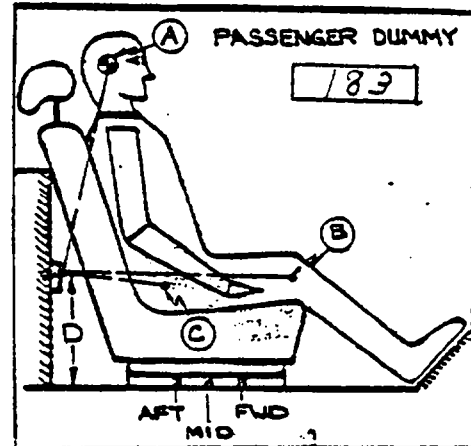
☒ Manual
☐ Power

BUCKET SEAT BACK TYPE:

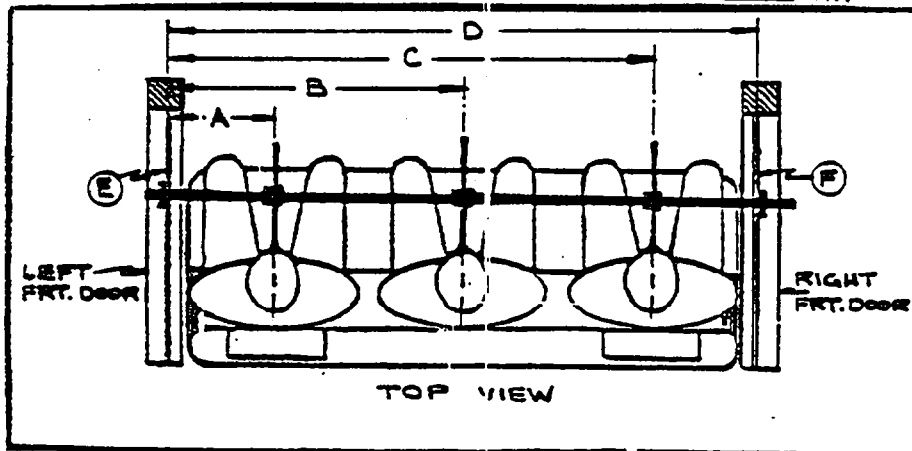
☒ Fixed
☐ Adjustable Reclining



A = 25.0 in. 28 Degrees
B = 36.1 in. 99 Degrees
C = 22.0 in. 104 Degrees
D = 15.0 in.



A = 25.2 in. 28° Degrees
B = 36 in. 93 Degrees
C = 21.2 in. 102 Degrees
D = 15.0 in.



DUMMY ID

109

--

183

A	=	Left Door to Driver Centerline	<u>12.7</u> in.
B	=	Left Door to Center Passenger Centerline	<u>--</u> in.
C	=	Left Door to Right Passenger Centerline	<u>40.5</u> in.
D	=	Left Door to Right Door	<u>53.7</u> in.
E, F	=	Window Glass Height (Right and Left Must be Equal)	<u>12.0</u> in.

FIGURE 11
PART 572 DUMMY IN-VEHICLE POSITION

Test No. 614-3-512

Vehicle No. 2 - 1980 VOLKSWAGEN RABBIT

SEAT TYPE:

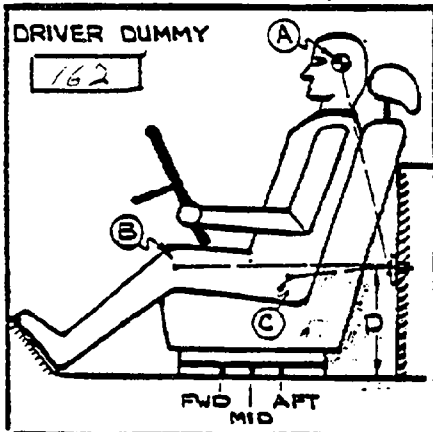
☐ Bench
☒ Bucket
☐ Split Bench

ADJUSTER TYPE:

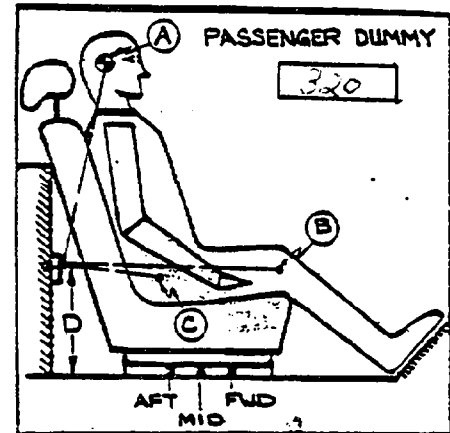
☒ Manual
☐ Power

BUCKET SEAT BACK TYPE:

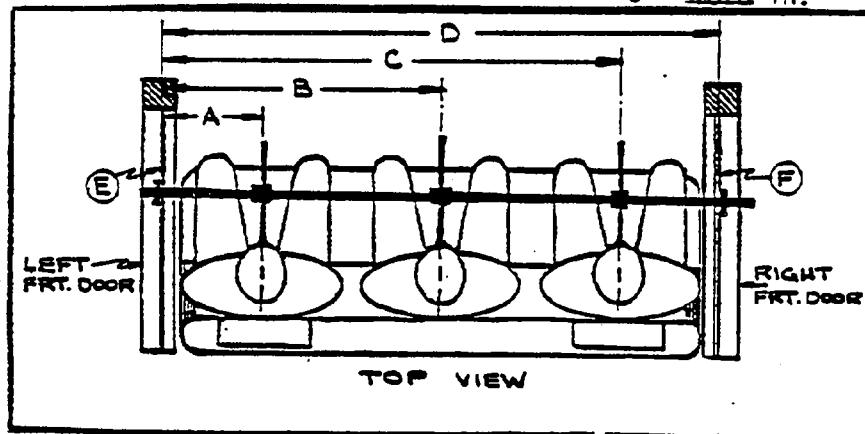
☐ Fixed
☒ Adjustable Reclining



A = 18.0 in. 15 Degrees
B = 29.0 in. 102 Degrees
C = 15.5 in. 128 Degrees
D = 18.0 in.



A = 18.0 in. 16 Degrees
B = 30.0 in. 105 Degrees
C = 16.3 in. 122 Degrees
D = 18.0 in.



DUMMY ID

162

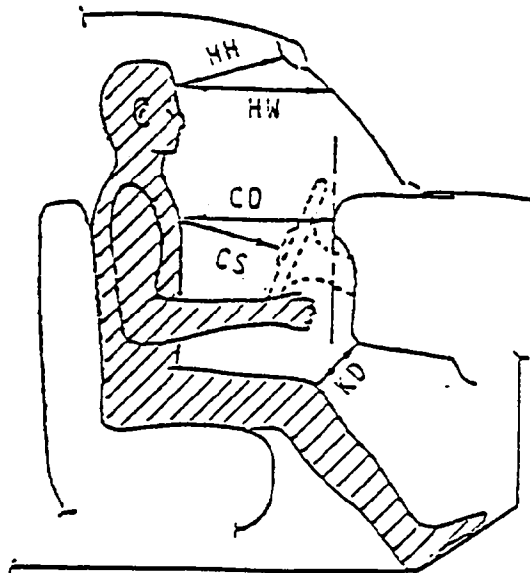
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320

A = Left Door to Driver Centerline
B = Left Door to Center Passenger Centerline
C = Left Door to Right Passenger Centerline
D = Left Door to Right Door
E, F = Window Glass Height (Right and Left Must be Equal)

12.1 in.
-- in.
36.8 in.
49.0 in.
10.0 in.

	<u>DRIVER</u>	<u>PASS</u>
HH	16.5	16.5
HW	23.2	23.0
CD	26.0	29.0
CS	17.2	--
KDL	11.0	11.5
KDR	11.0	11.5



HR	6.0	6.2
HS	8.2	8.5
AD	5.5	5.0
HD	6.6	7.2

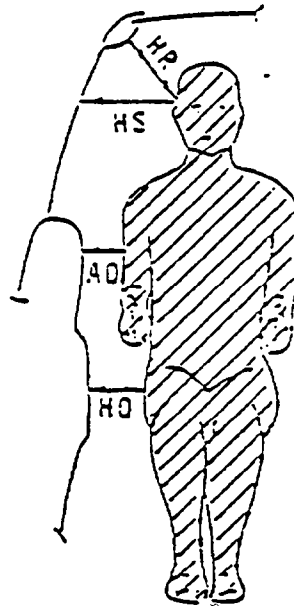
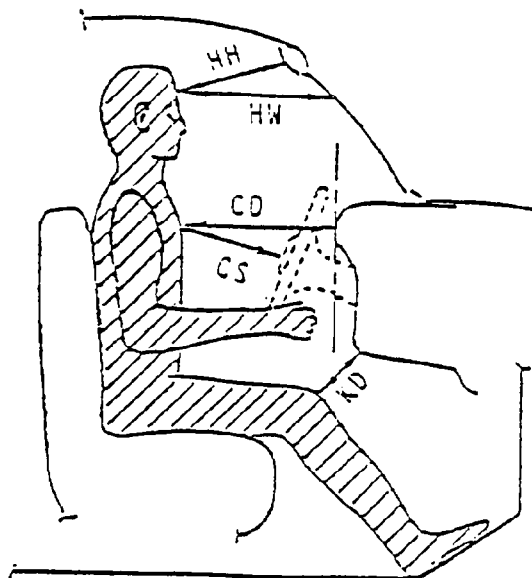


FIGURE 12 OCCUPANT CLEARANCE DIMENSIONS
VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

	<u>DRIVER</u>	<u>PASS</u>
HH	20.5	21.5
HW	25.0	26.0
CD	25.5	27.4
CS	18.5	--
KDL	11.3	11.5
KDR	11.5	11.5



HR	6.0	6.0
HS	6.5	6.5
AD	4.0	4.0
HD	6.0	6.0

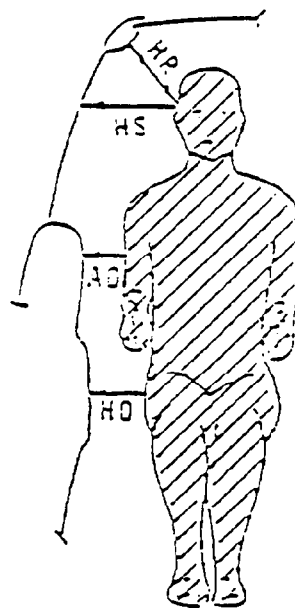


FIGURE 13 OCCUPANT CLEARANCE DIMENSIONS
VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

Table 14

DUMMY INJURY CRITERIA VALUES
VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

	MAXIMUM ACCELERATION ("G") *							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	-24	4.0	17	25	-19	4.0	-21	22
DUMMY (2)	-28	12	14	30	-22	4.0	-18	22
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	296	40
DUMMY (2)	175	176
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)	1140	1300	840
DUMMY (2)	1340	600	1320
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)	145.2	.0624	.1452	19.8	170.3
DUMMY (2)	180.7	.0654	.14280	22.2	223.4
DUMMY (3)					
DUMMY (4)					

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

Table 15

DUMMY INJURY CRITERIA VALUES
VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

	MAXIMUM ACCELERATION ("G") *							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	***	3	26	****	-36	-6	-20	38
DUMMY (2)	-16	16	21	30	-18	22	-10	28
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	168	340
DUMMY (2)	136	120
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)	1500	1600	1420
DUMMY (2)	1360	1150	2040
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)	****	--	--	--	--	
DUMMY (2)	235.8	.0537	.1686	21.1	279.9	
DUMMY (3)						
DUMMY (4)						

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

*** LOST DATA (INTERMITTENT ACCELERATION)

**** CAN NOT CALCULATE WITHOUT Hx

VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME
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.	J	1-10	
2.	Fill out summary sheet. Apply identification number to vehicle.	J	1-19	
3.	Inspect vehicle and record any damage or missing parts.	J	1-19	
4.	Add fluids to specified levels or fill to capacity.	J	1-19	
5.	Weigh vehicle and record weight at each wheel on summary sheet.	J	1-19	
6.	Apply reference height marks at each wheel and record on summary sheet.	J	1-19	
7.	Pump fuel from tank and run engine until fuel lines are empty.	J	1-19	
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	J	1-19	
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/R	1-22	
10.	Siphon 7% of solvent from fuel tank and record amount removed on Summary Sheet.	N/R	1-27	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
11.	Perform pre-test vehicle measurements	W. S.	1-19	
12.	Mark forward-most and rear-most positions of seat. Measure and mark seat and sill mid-positions.	<i>[Signature]</i>	1-19	
13.	Install mounting plates for accelerometers as specified in the Test Plan.	M.R.	1-21	
14.	Install mounting plate and instrumentation in trunk area.	M.R.	1-21	
15.	Install accelerometers.	DWH	1-19	
16.	Place certified dummies in both front seats with seats in correct position.	DWH	1-19	
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	1-19	
18.	Install on-board lighting to illuminate field of view of ground cameras.	M.R.	1-21	
19.	Route and secure all electrical cables.	DWH	1-19	
20.	Install speed trap breaker bar on vehicle.	M.R.	1-21	
21.	Install guide rollers and abort straps to vehicle.	M.R.	1-21	
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.	M.R.	1-21	
23.	Measure and record ride height.	W.S.	1-27	
24.	Apply targets and tape striping as specified in TP-212-02 - (Laboratory Procedure for Vehicle Assessment.)	M.R.	1-21	

AT IMPACT SITE

TEM NO.	DESCRIPTION	CHECKED		DATE	COMMENTS
		BY			
25.	Position vehicle front to bumper at impact point.	W.S		1-28	
26.	Photograph the following:				
	a) Vehicle overall & closeup left and right views.	WZ			
	b) Windshields overall and close-up left and right quarter views	WZ		1-28	
	c) Real time documentary	WZ			
27.	Align and focus stationary high speed cameras.	WZ			
28.	Measure and document camera positions.	WZ		1/28/20	
29.	Test operation of all high speed cameras.	WZ		1/28/20	
30.	Set up speed traps and measure breaker bar when vehicles are at impact point.	WZ		1-22	
31.	Check vehicle attitude and ride height and document on summary sheet.	W.S		1-27	
32.	Check speed traps operation.	W.S		1-28	
33.	Move test vehicles to starting point	W.S		1-28	
<u>STARTING POINT PROCEDURE</u>					
34.	Adjust dummy positions as per dummy positioning check list and make required measurements.	WZ		1/28/20	
35.	Connect umbilical cables.	DWH		1-28	
36.	Make operation check of all instrumentation and calibrate system.	DWH		1-28	
37.	Take all pre-test photographs.	WZ		1/28/20	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
38.	Check operation of camera interlock and flash bulbs correlation.	W.S.	1/28	
39.	Latch trunk and leave key in lock.	W.S.	1/28	
40.	Verify that fuel tank cap is tight.	W.S.	1/28	
41.	Place transmission in neutral. Release parking brake.	W.S.	1/28	
42.	Verify that hood latch is latched.	W.S.	1/28	
43.	Close all windows & vents (except front windows).	W.S.	1/28	
44.	Close doors leave unlocked.	W.S.	1/28	
45.	Check operation of all systems.	DWN	1-28	
46.	Record temperature of interior of vehicle.	W.S.	1/28	
47.	Complete countdown procedures and proceed with test.	W.S.	1-28	
<u>POST-TEST PROCEDURES</u>				
48.	Make operational check of all instrumentation.	DWN	1-28	
49.	Photograph with real time camera:	W.S.	1/28	
a)	Post-test overall scene.	W.S.	1/28	
b)	Close-up of pertinent damage to windshield or fuel system.	W.S.	1/28	
c)	Dummies failed restraints or failed seat anchorages.	W.S.	1/28	
d)	Any other type of failure.	W.S.	1/28	
e)	Opening of vehicle doors.	W.S.	1/28	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
50.	Take post-test still photographs. Record visual observations of vehicle condition, dummy positions, any anomalies, etc.	WZ	1/28	
51.	Separate vehicles and photograph front of each vehicle.	WZ	1/28/6	
52.	Remove umbilicals.	DWH	1-20	
	Remove vehicles from test track.	WZ	1-28	

VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT
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.	<i>JK</i>	1-19	
2.	Fill out summary sheet. Apply identification number to vehicle.	<i>JK</i>	1-19	
3.	Inspect vehicle and record any damage or missing parts.	<i>JK</i>	1-19	
4.	Add fluids to specified levels or fill to capacity.	<i>JK</i>	1-19	
5.	Weigh vehicle and record weight at each wheel on summary sheet.	<i>JK</i>	1-19	
6.	Apply reference height marks at each wheel and record on summary sheet.	<i>JK</i>	1-19	
7.	Pump fuel from tank and run engine until fuel lines are empty.	<i>JK</i>	1-19	
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	<i>JK</i>	1-19	
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.	<i>JK</i>	1-20	
10.	Siphon 7% of solvent from fuel tank and record amount removed on Summary Sheet.	<i>JK</i>	1-20	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
11.	Perform pre-test vehicle measurements	W.S.	1-20	
12.	Mark forward-most and rear-most positions of seat. Measure and mark seat and sill mid-positions.	J.	1-19	
13.	Install mounting plates for accelerometers as specified in the Test Plan.	J.	1-20	
14.	Install mounting plate and instrumentation in trunk area.	J.	1-20	
15.	Install accelerometers.	J.	1-21	
16.	Place certified dummies in both front seats with seats in correct position.	DWH	1-26	
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	1-26	
18.	Install on-board lighting to illuminate field of view of ground cameras.	J.	1-26	
19.	Route and secure all electrical cables.	DWH	1-26	
20.	Install speed trap breaker bar on vehicle.			
21.	Install guide rollers and abort straps to vehicle.	J.	1-26	
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.	J.	1-27	
23.	Measure and record ride height.	W.S.	1-27	
24.	Apply targets and tape striping as specified in TP-212-02 - (Laboratory Procedure for Vehicle Assessment.)	J.	1-26	

AT IMPACT SITE

ITEM NO.	DESCRIPTION	CHECKED	DATE	COMMENTS
		BY		
25.	Position vehicle front to bumper at impact point.	W.S	1-28	
26.	Photograph the following:	W.S		
	a) Vehicle overall & closeup left and right views.	W.S		
	b) Windshields overall and close-up left and right quarter views	W.S	1/28/81	
	c) Real time documentary	W.S		
27.	Align and focus stationary high speed cameras.	W.S		
28.	Measure and document camera positions.	W.S	1/28	
29.	Test operation of all high speed cameras.	W.S	1/28	
30.	Set up speed traps and measure breaker bar when vehicles are at impact point.	J	1-28	
31.	Check vehicle attitude and ride height and document on summary sheet.	W.S	1-27	
32.	Check speed traps operation.	W.S	1-28	
33.	Move test vehicles to starting point	W.S	1-28	

STARTING POINT PROCEDURE

34.	Adjust dummy positions as per dummy positioning check list and make required measurements.	W.S	1/28	
35.	Connect umbilical cables.	DWH	1-28	
36.	Make operation check of all instrumentation and calibrate system.	DWH	1-28	
37.	Take all pre-test photographs.	W.S	1/28	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
38.	Check operation of camera interlock and flash bulbs correlation.			
39.	Latch trunk and leave key in lock.	M/R	1-22	
40.	Verify that fuel tank cap is tight.	M/R	1-22	
41.	Place transmission in neutral. Release parking brake.	M/R	1-22	
42.	Verify that hood latch is latched.	M/R	1-22	
43.	Close all windows & vents (except front windows).	M/R	1-22	
44.	Close doors leave unlocked.	M/R	1/22	
45.	Check operation of all systems.	DWH	1-28	
46.	Record temperature of interior of vehicle.	M/R	1/22	
47.	Complete countdown procedures and proceed with test.	M/R	1/22	
POST-TEST PROCEDURES				
48.	Make operational check of all instrumentation.	DWH	1-28	
49.	Photograph with real time camera:	M/R	1-22	
a)	Post-test overall scene.	M/R	1/22	
b)	Close-up of pertinent damage to windshield or fuel system.	M/R	1/22	
c)	Dummies failed restraints or failed seat anchorages.	M/R	1/22	
d)	Any other type of failure.	M/R	1/22	
e)	Opening of vehicle doors.	M/R	1/22	

ITEM NO.	DESCRIPTION	CHECKED BY	DATE	COMMENTS
50.	Take post-test still photographs. Record visual observations of vehicle condition, dummy positions, any anomalies, etc.	<i>MR</i>	<i>1/28</i>	
51.	Separate vehicles and photograph front of each vehicle.	<i>MR</i>	<i>1/28</i>	
52.	Remove umbilicals.	<i>DWH</i>	<i>1-28</i>	
	Remove vehicles from test track.	<i>MR</i>	<i>1-22</i>	

APPENDIX A

STILL PHOTOGRAPHS

VEHICLE NO. 1 - 1980 OLDSMOBILE CUTLASS SUPREME

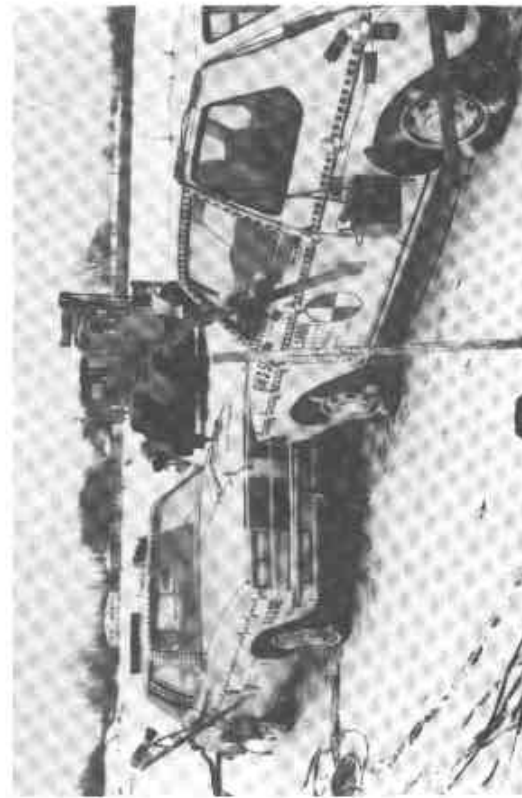
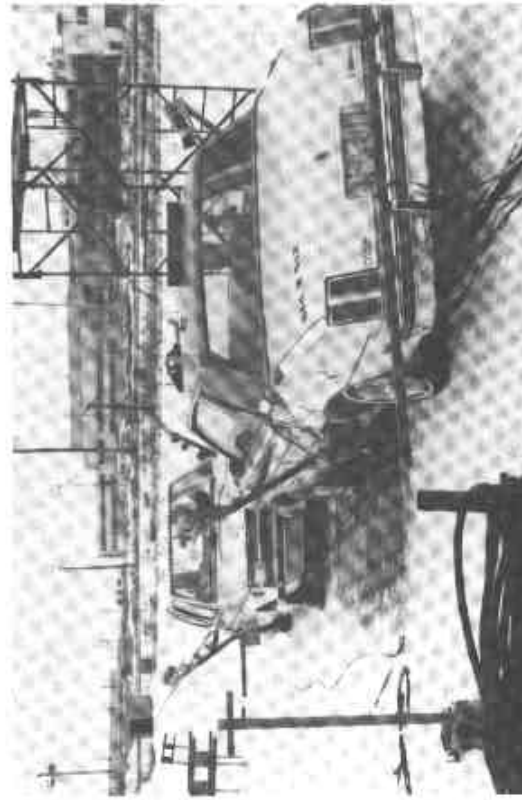
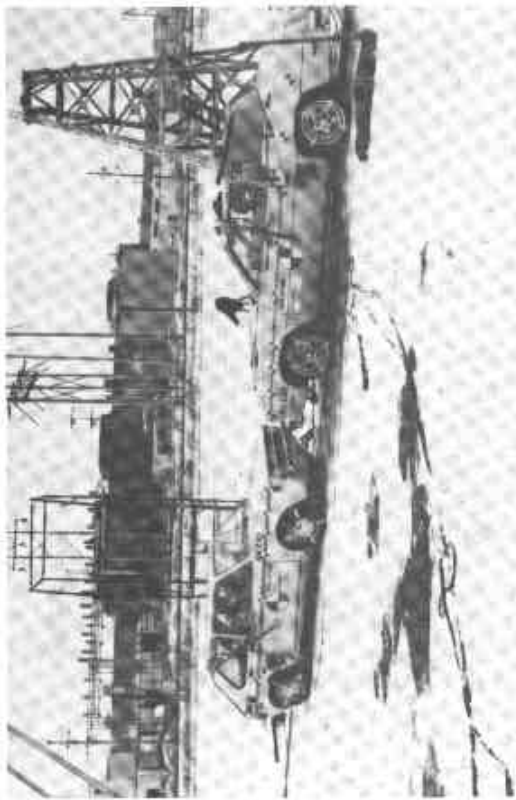


FIGURE A-1 VEHICLES NO. 1 & NO. 2 - PRE-TEST CONFIGURATION VIEWS

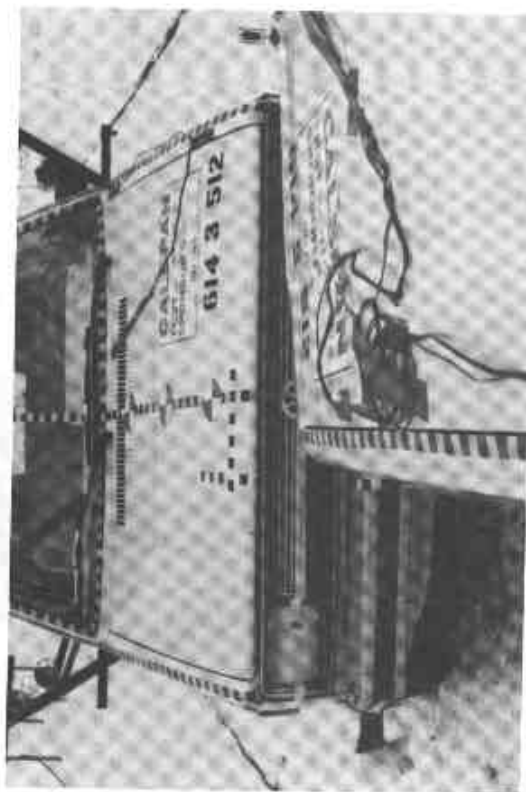


FIGURE A-2 VEHICLES NO. 1 & NO. 2 - PRE-TEST OFFSET VIEWS



FIGURE A-3 VEHICLES NO. 1 & NO. 2 - PRE-TEST BUMPER VIEW

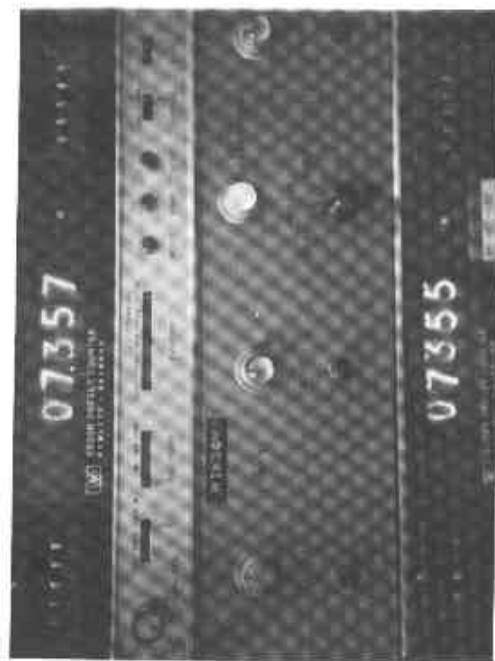


FIGURE A-4 VEHICLE TRAP COUNTER DISPLAY

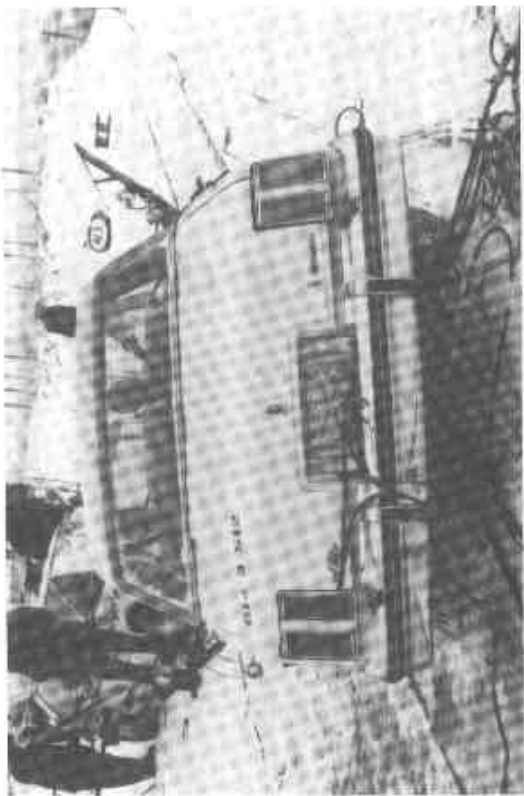
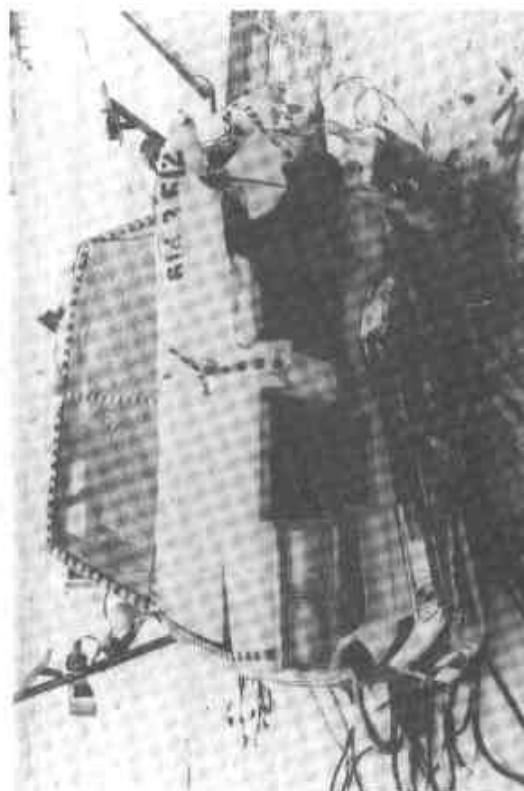
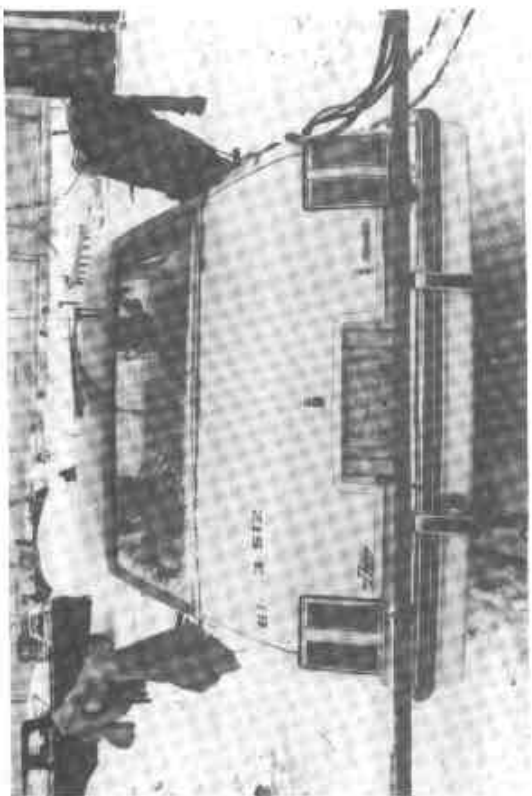
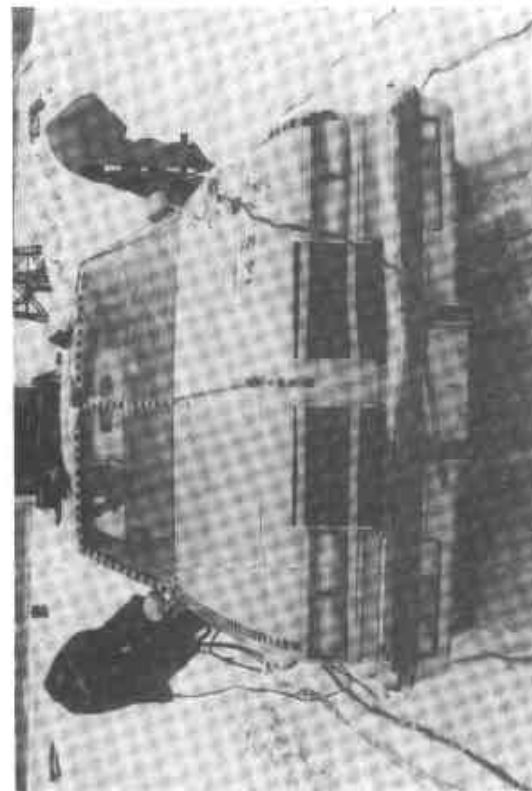


FIGURE A-5 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR

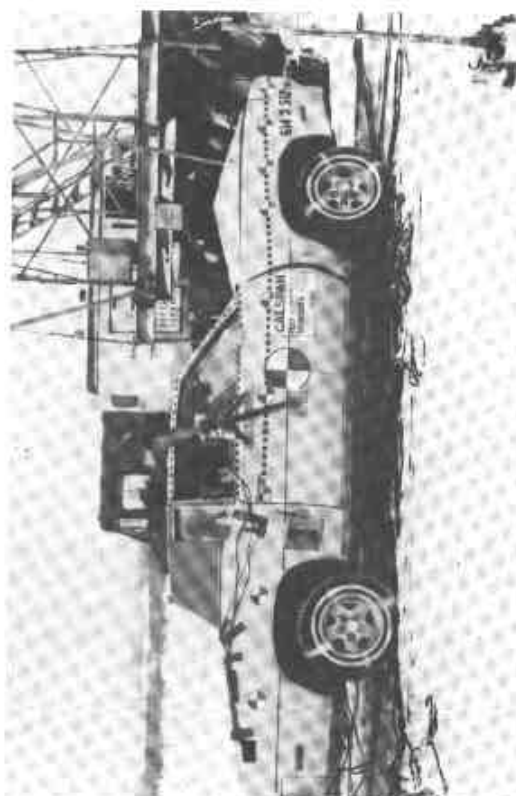
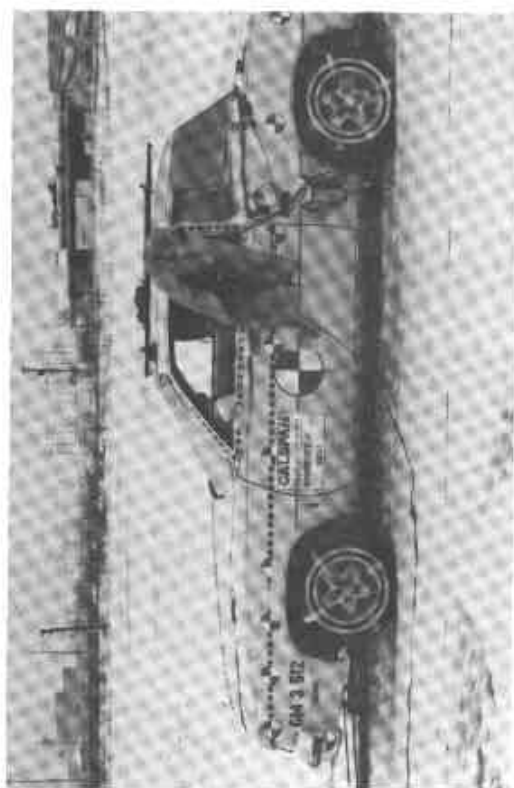
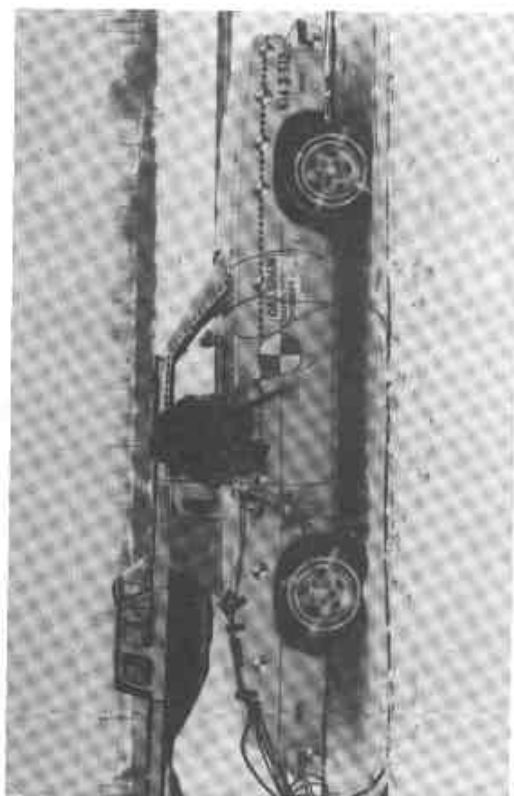


FIGURE A-6 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT SIDES

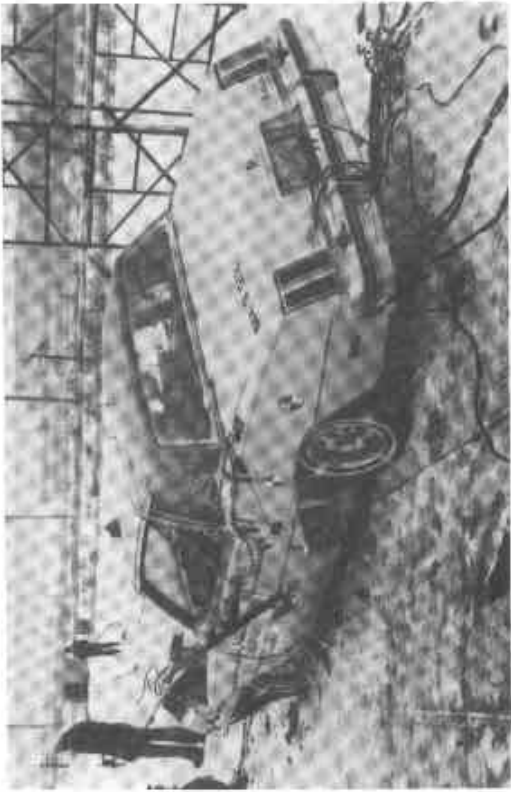
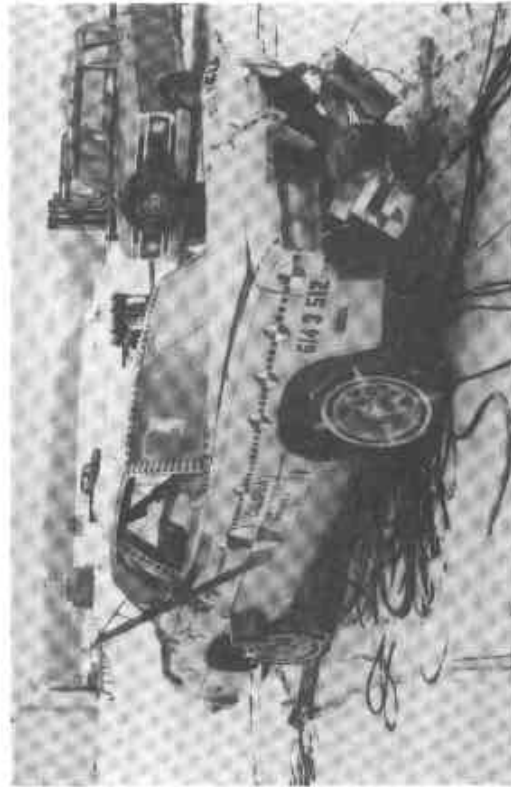
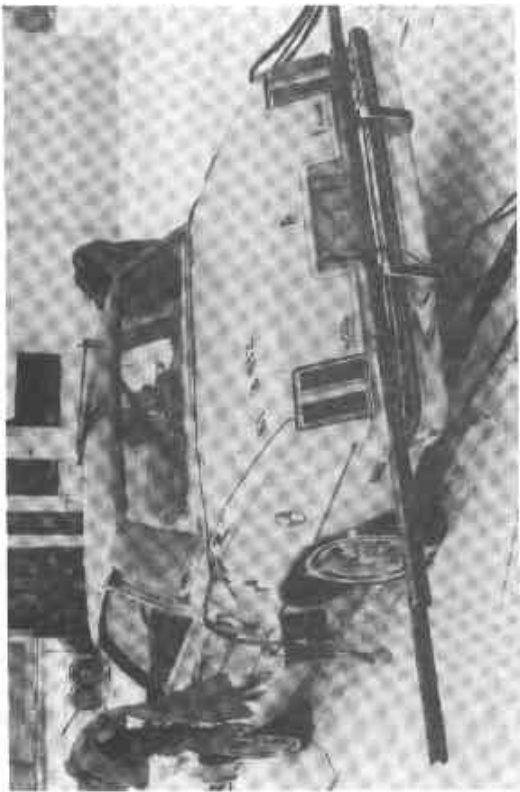
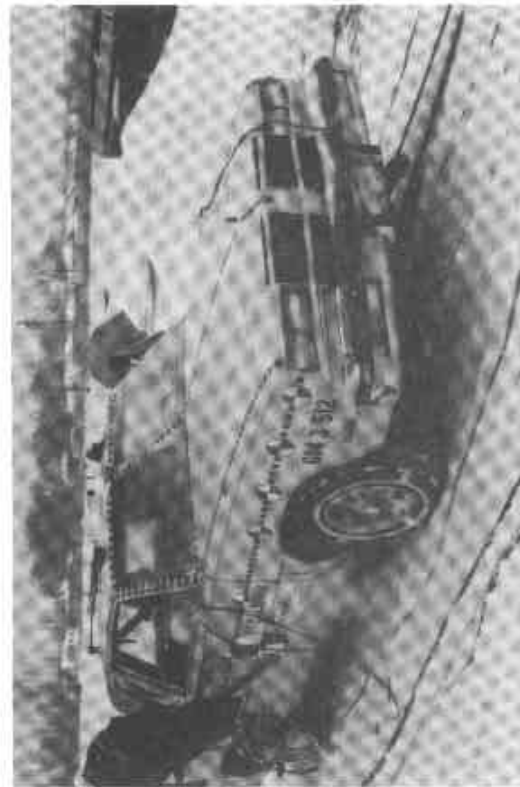


FIGURE 7 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR
THREE-QUARTERS

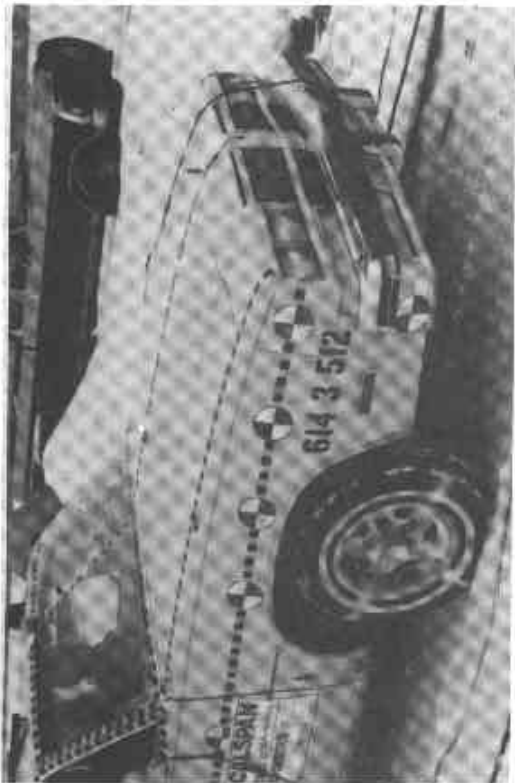
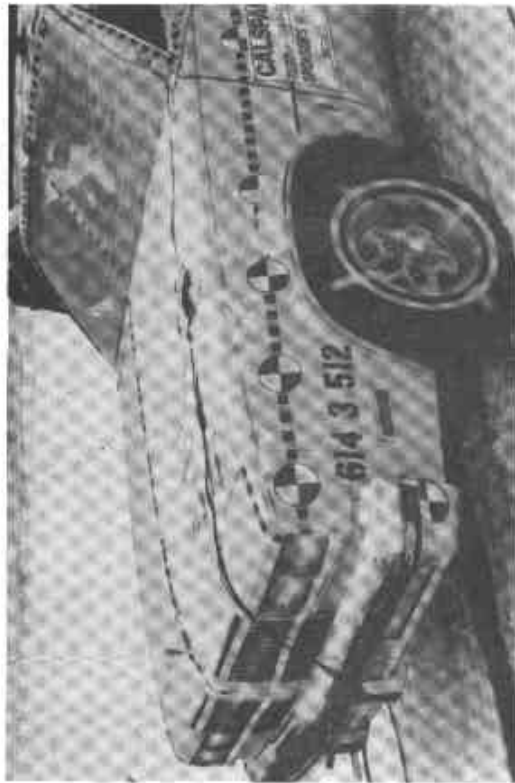


FIGURE A-8 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTERS



FIGURE A-9 VEHICLE NO. 1 - POST-TEST VIEWS OF FRONT BUMPER

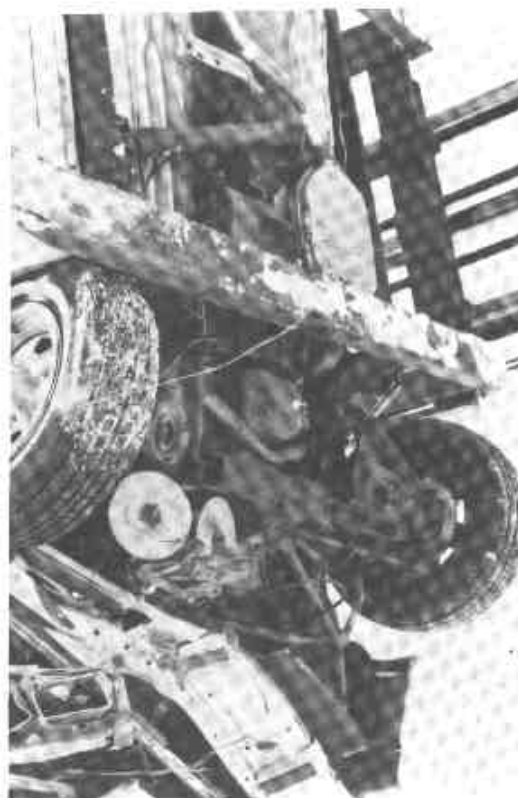
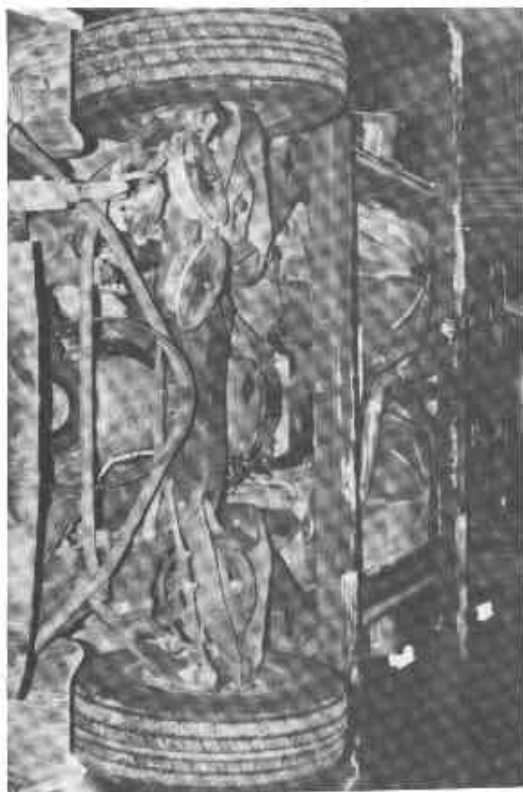


FIGURE A-10 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF FRONT UNDERBODY



FIGURE A-11 VEHICLE NO. 1 - PRE- AND POST TEST VIEWS OF REAR UNDERBODY

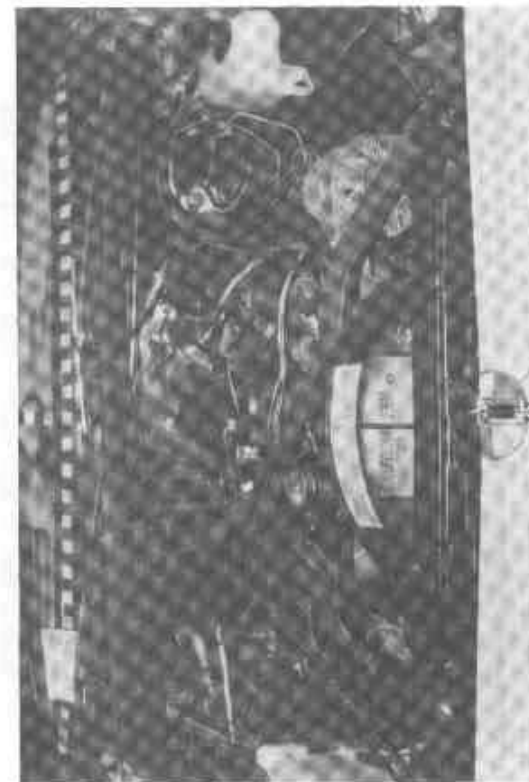
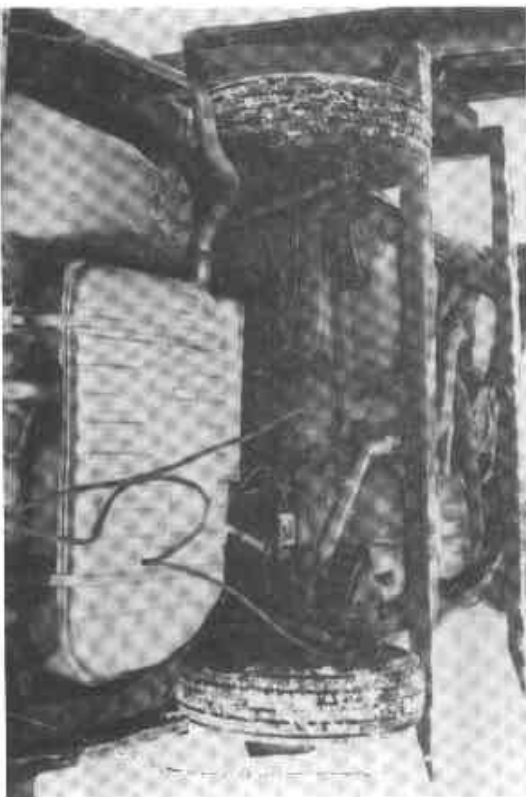


FIGURE A-12 VEHICLE NO. 1 - PRE-TEST VIEW OF ENGINE COMPARTMENT

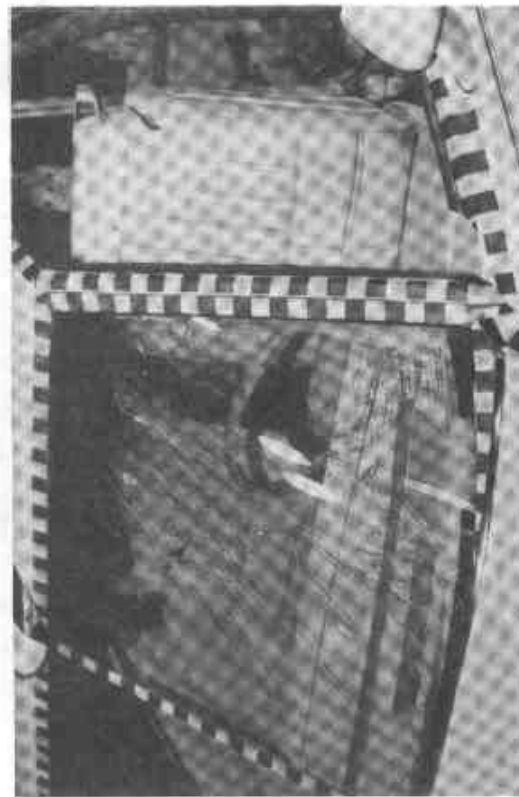


FIGURE A-13 VEHICLE NO. 1 - POST-TEST VIEW OF WINDSHIELD

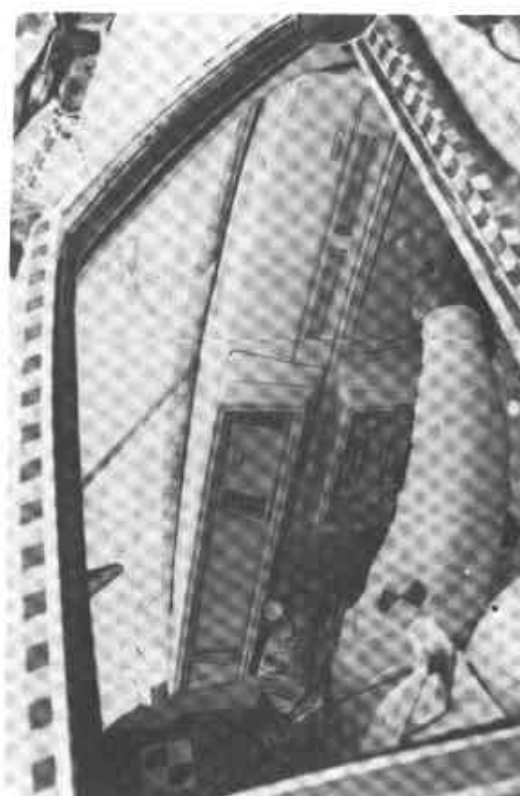
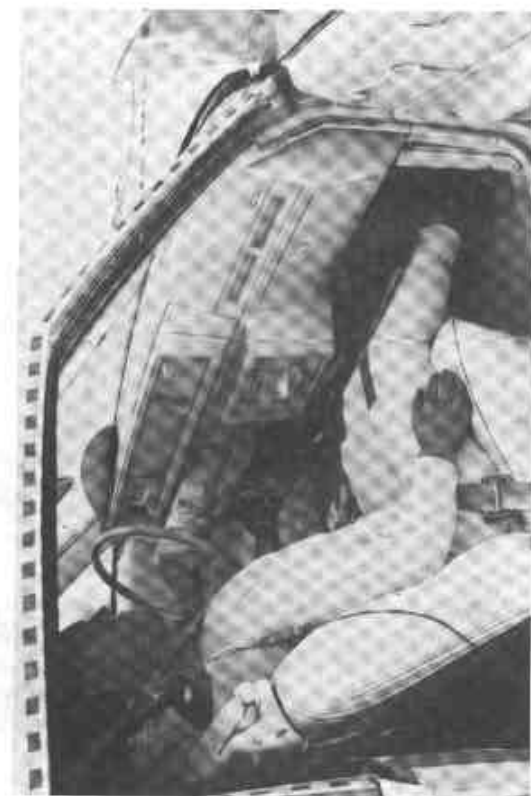


FIGURE A-14 VEHICLE NO. 1 - PRE- AND POST-TEST VIEWS OF DRIVER AND RIGHT FRONT PASSENGER



FIGURE A-15

VEHICLE NO. 1 - POST-TEST VIEWS OF DRIVER AND RIGHT FRONT PASSENGER



FIGURE A-16 VEHICLE NO. 1 - POST-TEST INTERIOR VIEWS



STILL PHOTOGRAPHS

VEHICLE NO. 2 - 1980 VOLKSWAGEN RABBIT

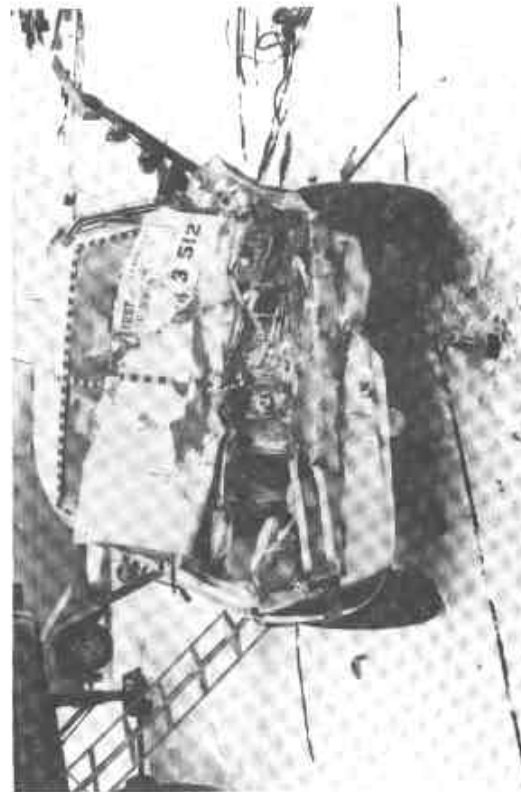
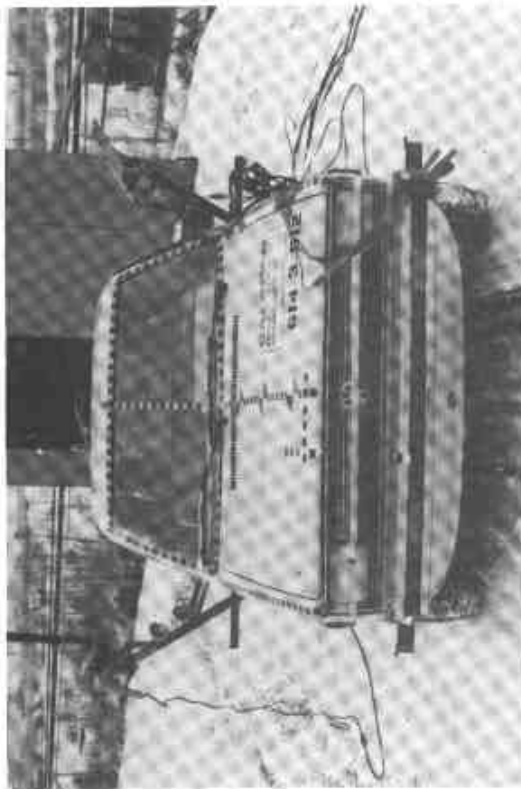
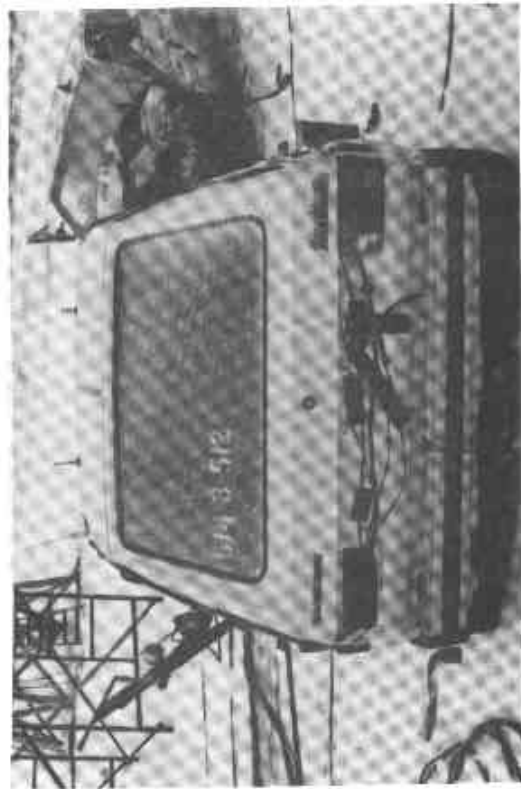
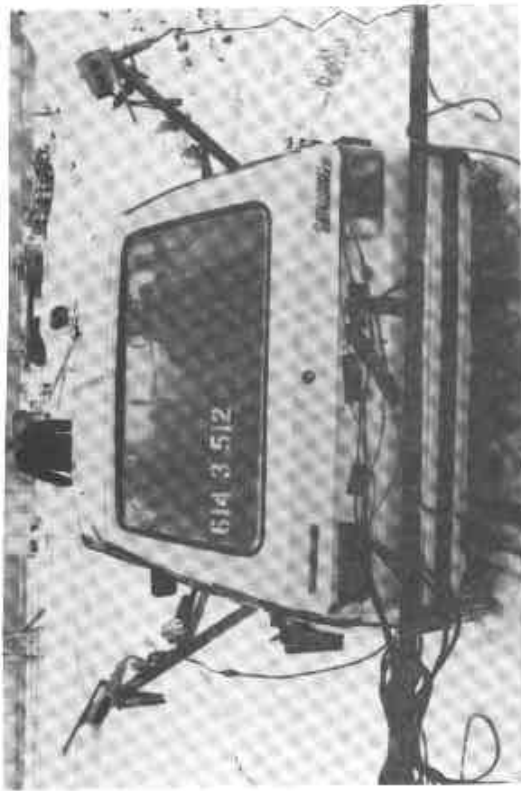


FIGURE A-17 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR

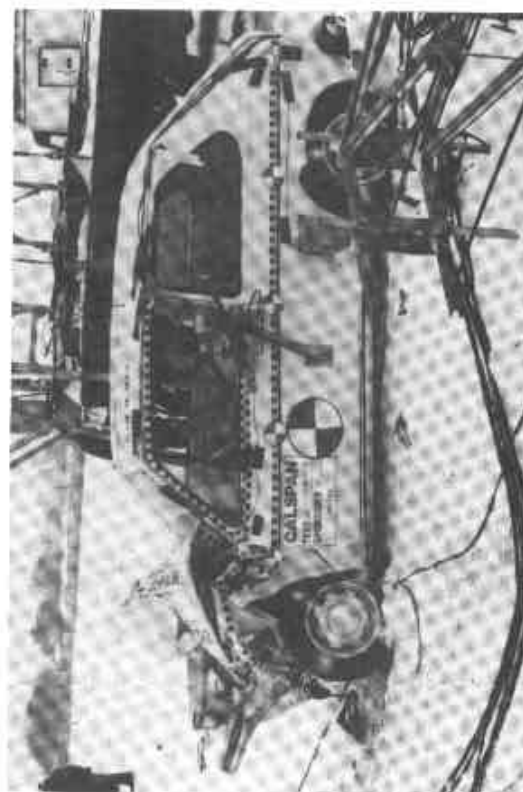
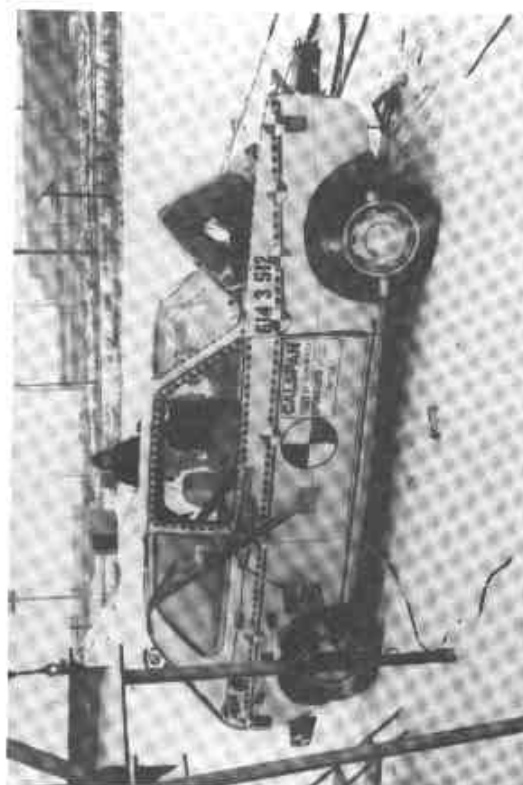
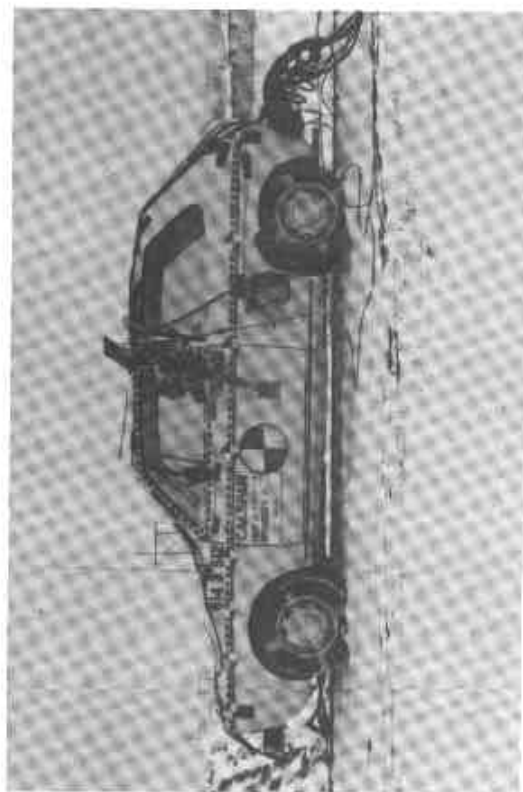
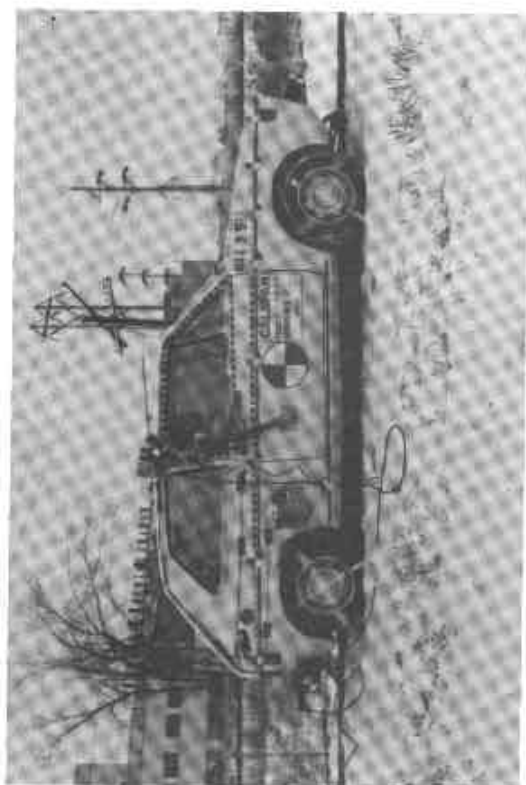


FIGURE A-18 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT SIDES



FIGURE A-19 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF FRONT AND REAR THREE-QUARTERS

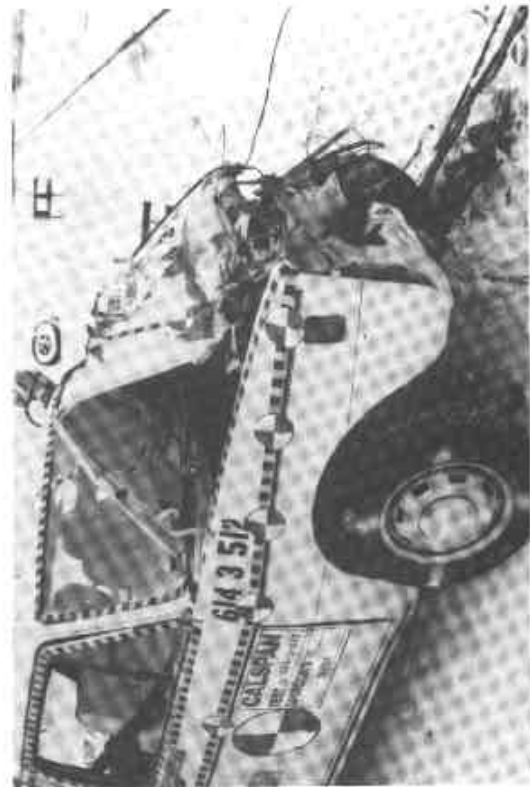
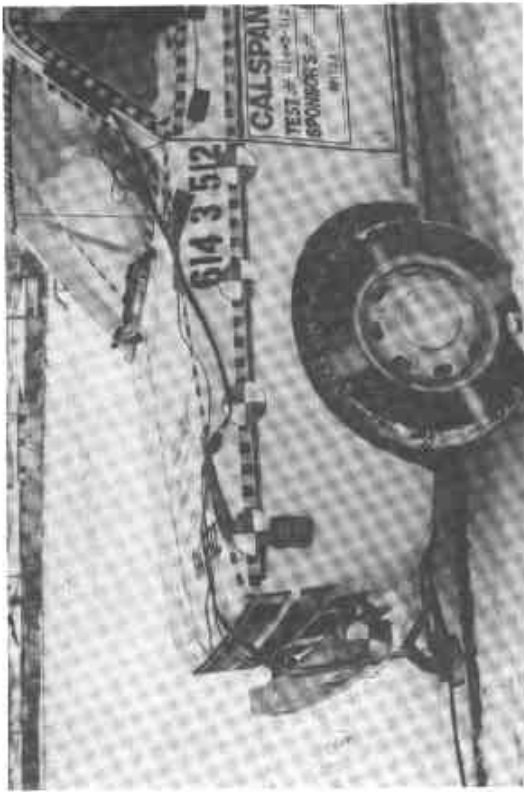
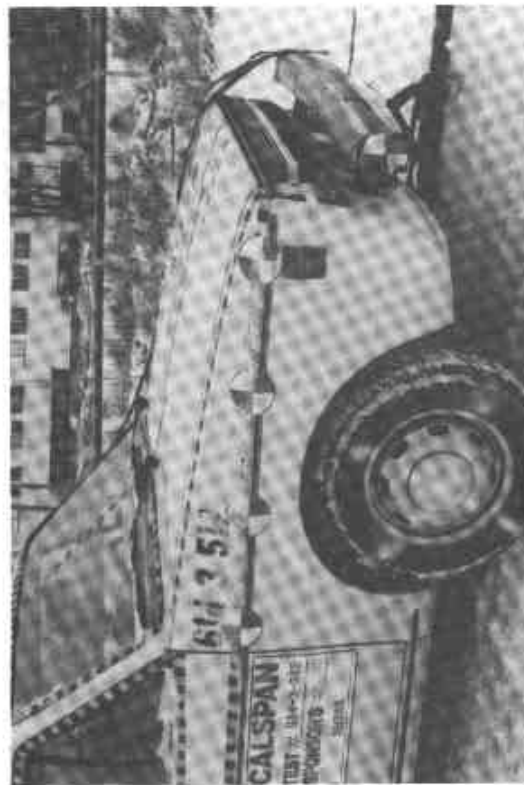


FIGURE A-20 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTERS

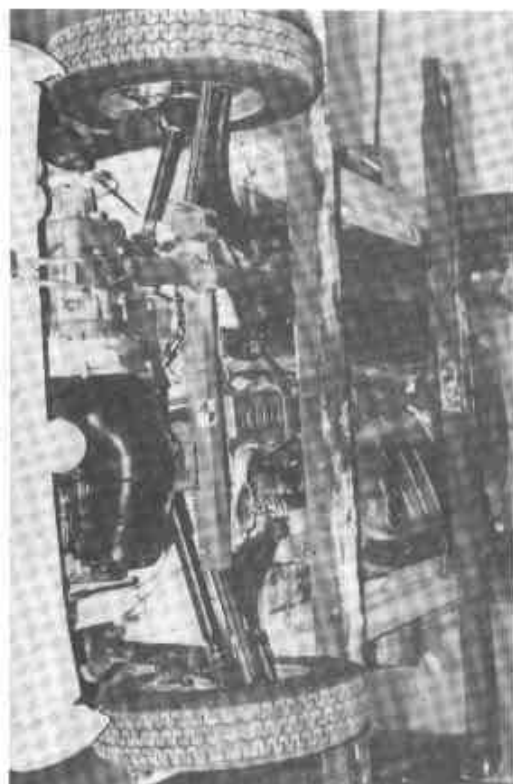
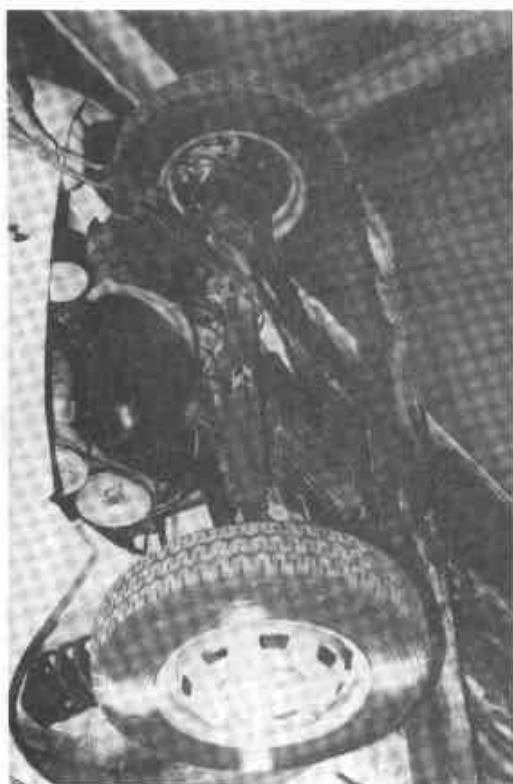


FIGURE A-21 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF FRONT UNDERBODY

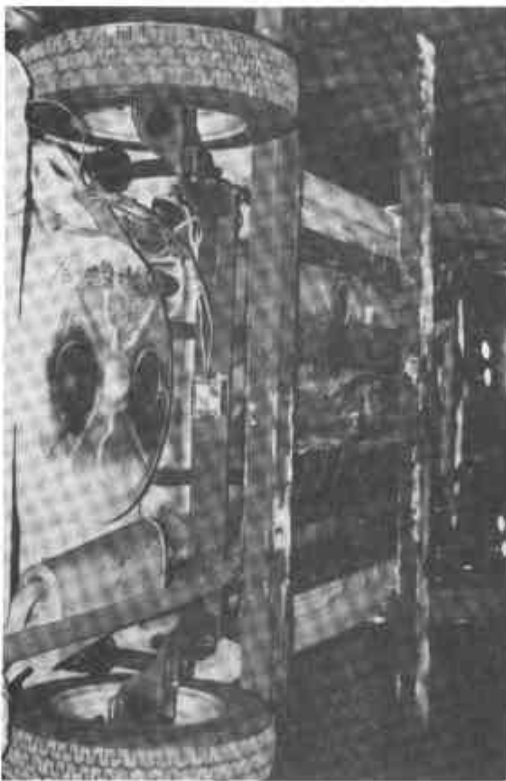


FIGURE A-22 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF REAR UNDERBODY



FIGURE A-24 VEHICLE NO. 2 - POST-TEST VIEW OF FRONT QUARTER UNDERBODY

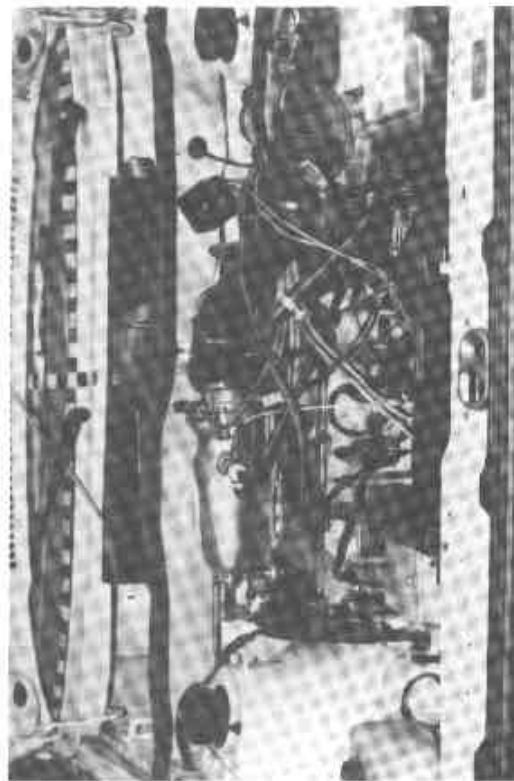


FIGURE A-23 VEHICLE NO. 2 - PRE-TEST VIEW OF ENGINE COMPARTMENT

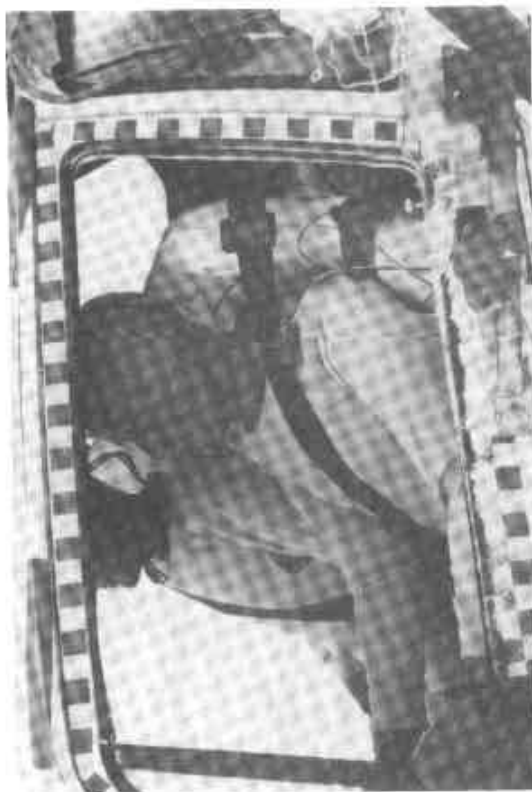
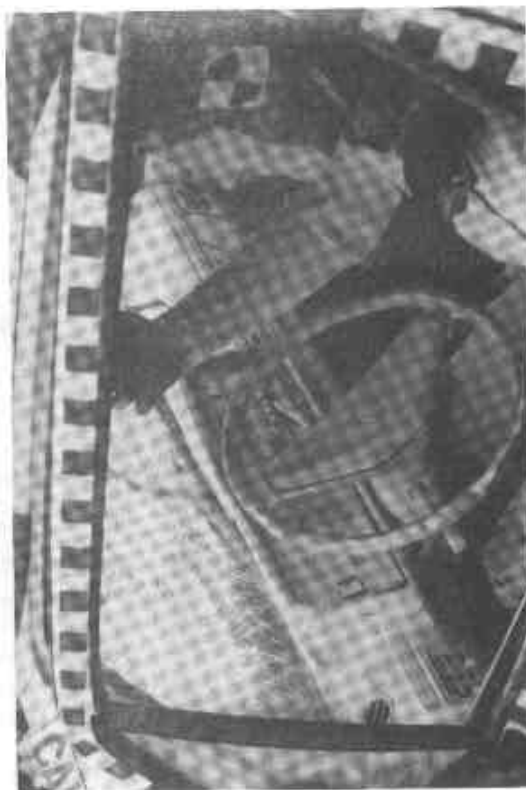


FIGURE A-25. VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF DRIVER POSITIONS

A-20

6707-V-3

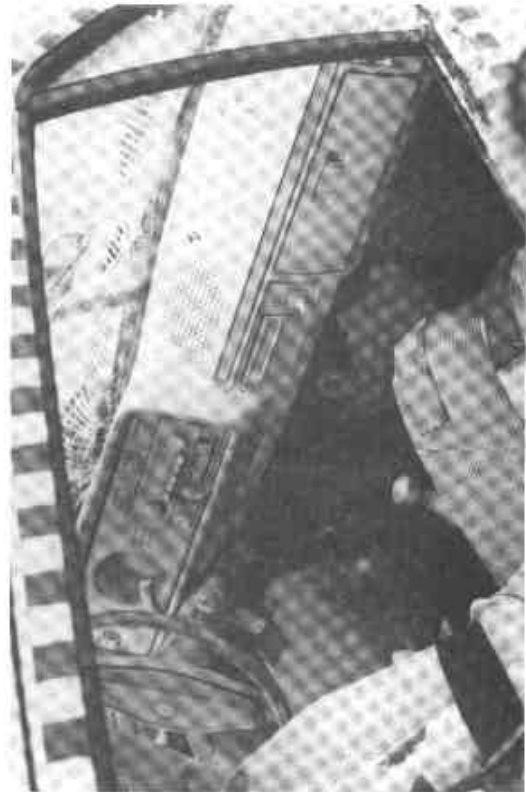


FIGURE A-26 VEHICLE NO. 2 - PRE- AND POST-TEST VIEWS OF RIGHT FRONT PASSENGER POSITIONS



FIGURE A-27 VEHICLE NO. 2 - POST-TEST VIEWS OF WINDSHIELD AND HOOD



FIGURE A-28 VEHICLE NO. 2 - POST-TEST INTERIOR VIEWS

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

Test No. 614-3-512

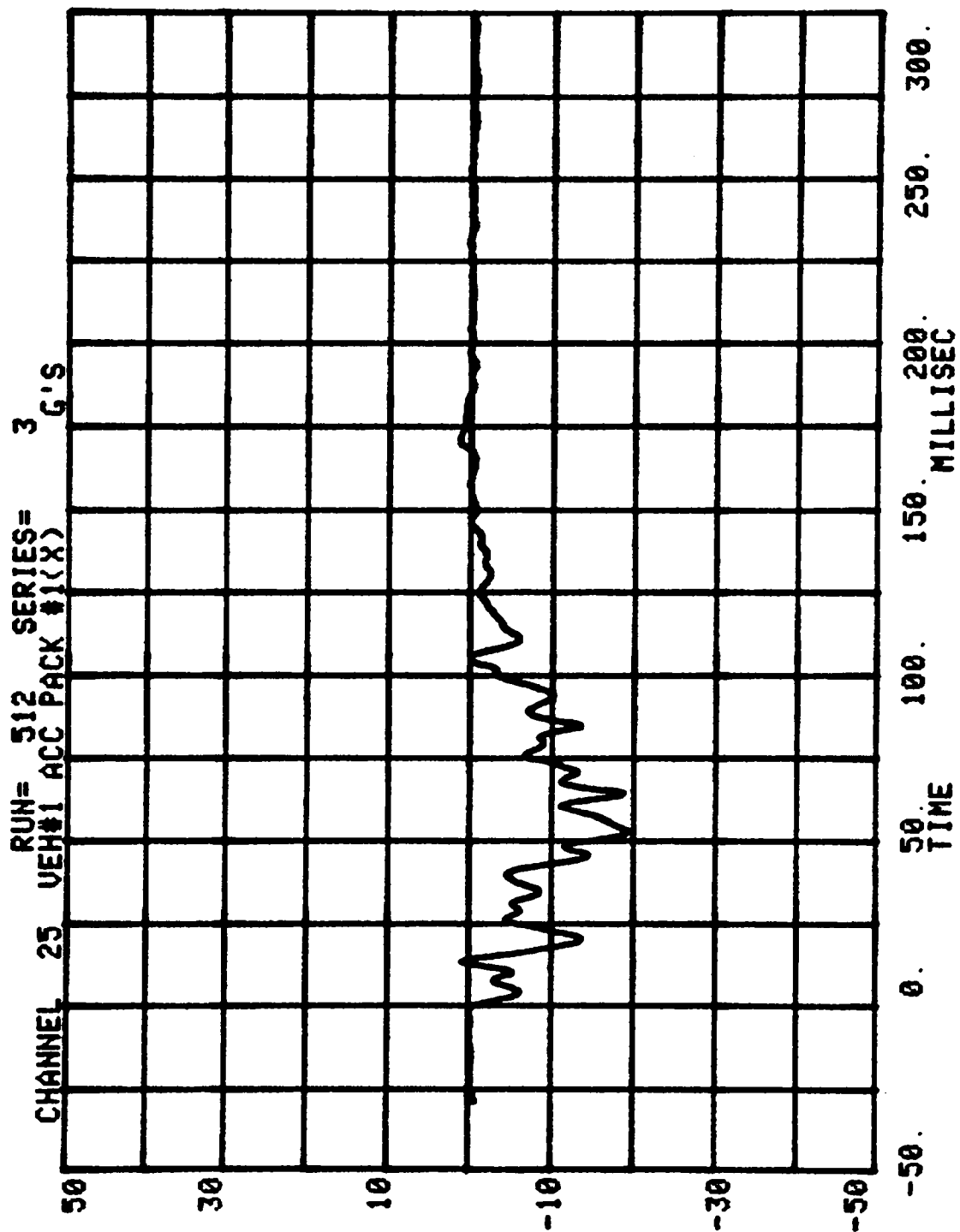
1980 OLDSMOBILE CUTLASS SUPREME

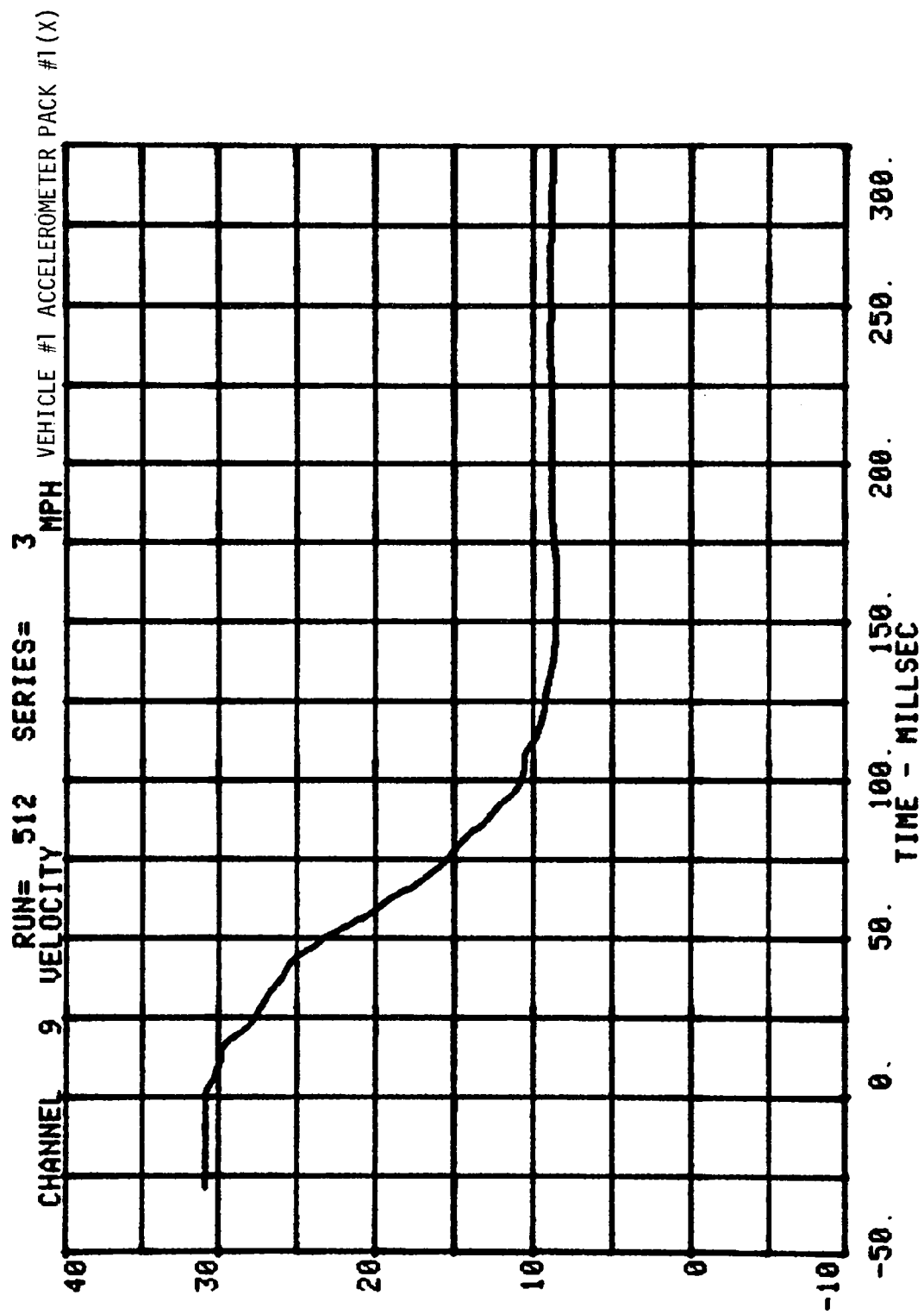
VEHICLE NO. 1 DATA

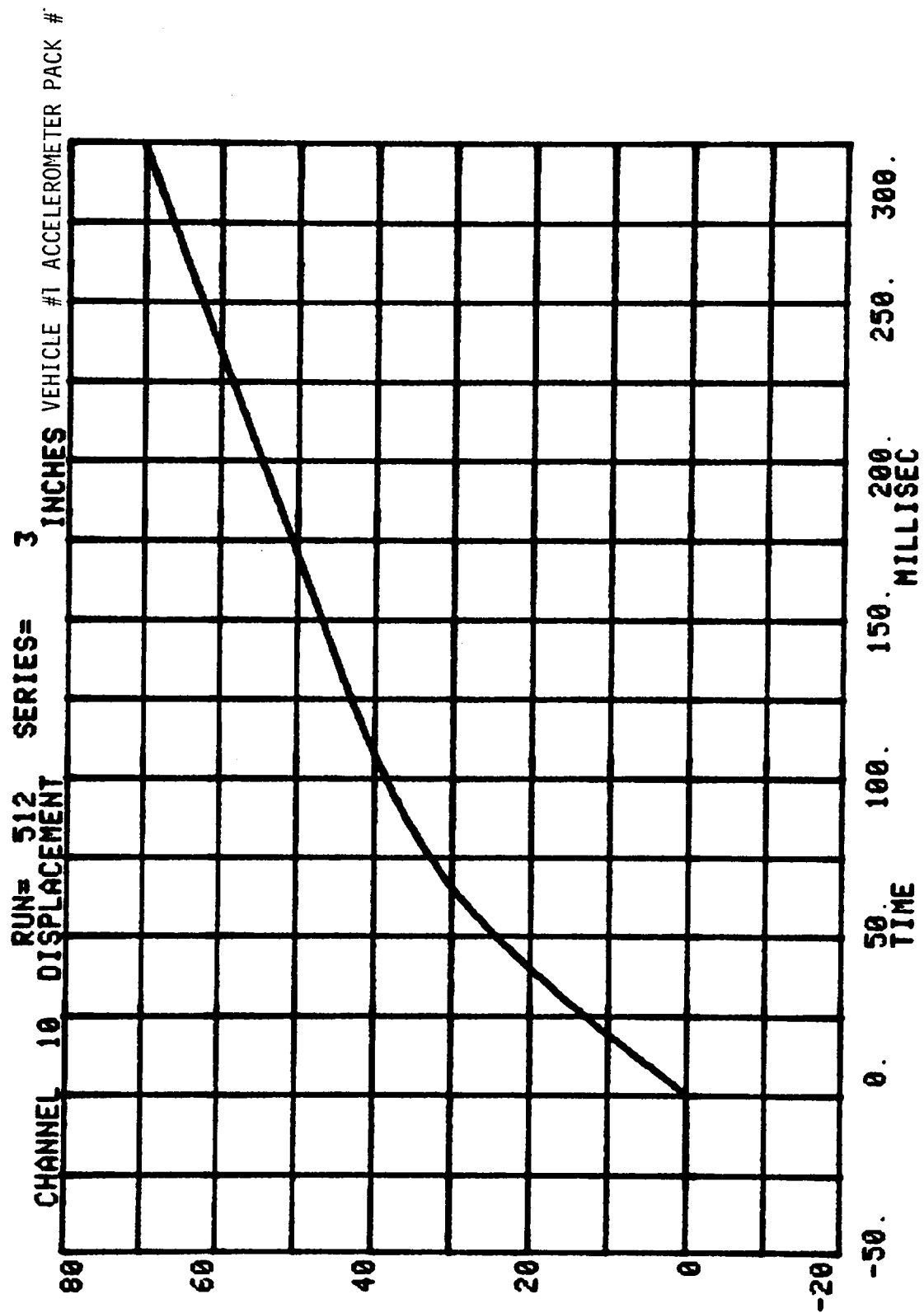
VEHICLE DATA

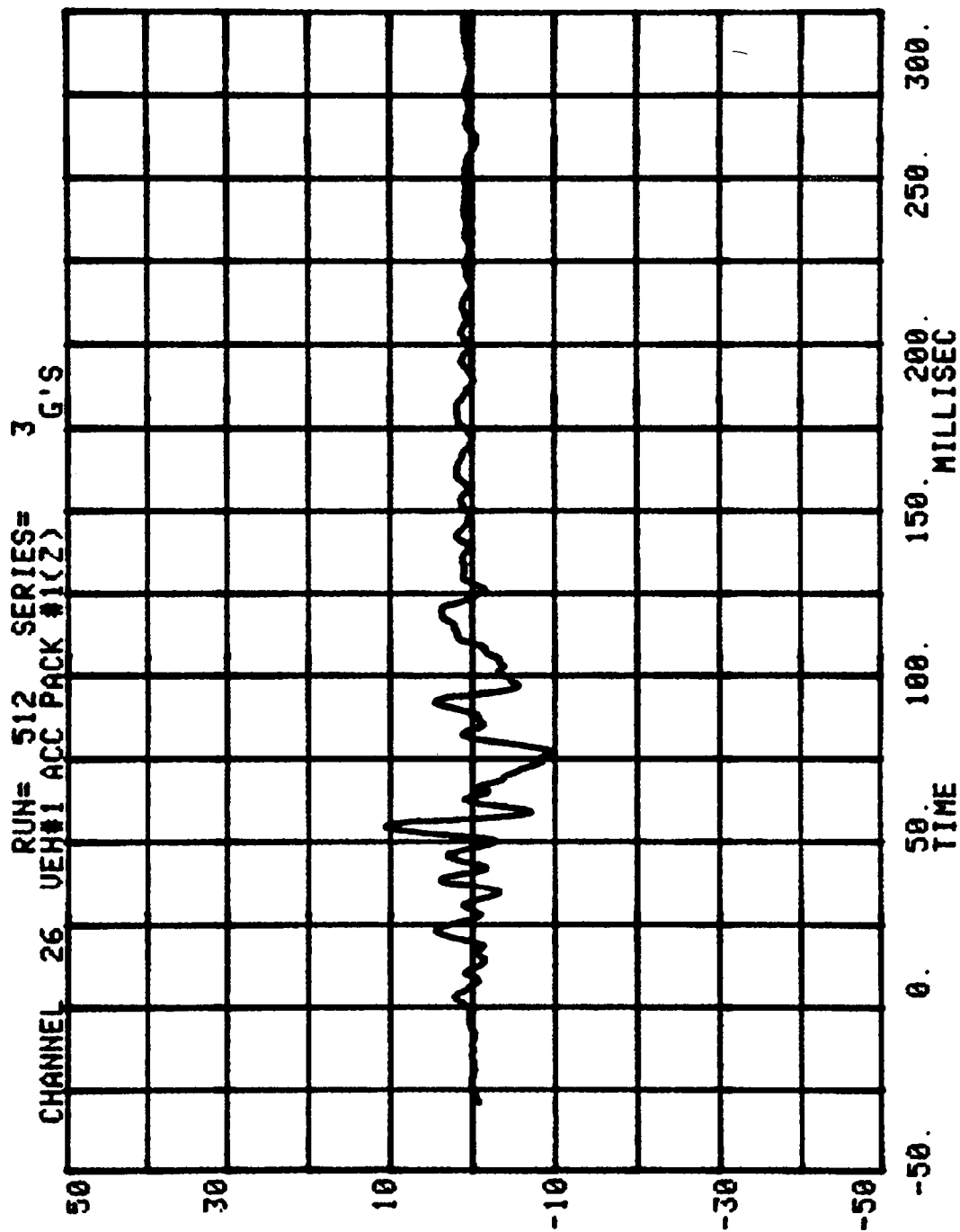
FILTER CHANNEL CLASS

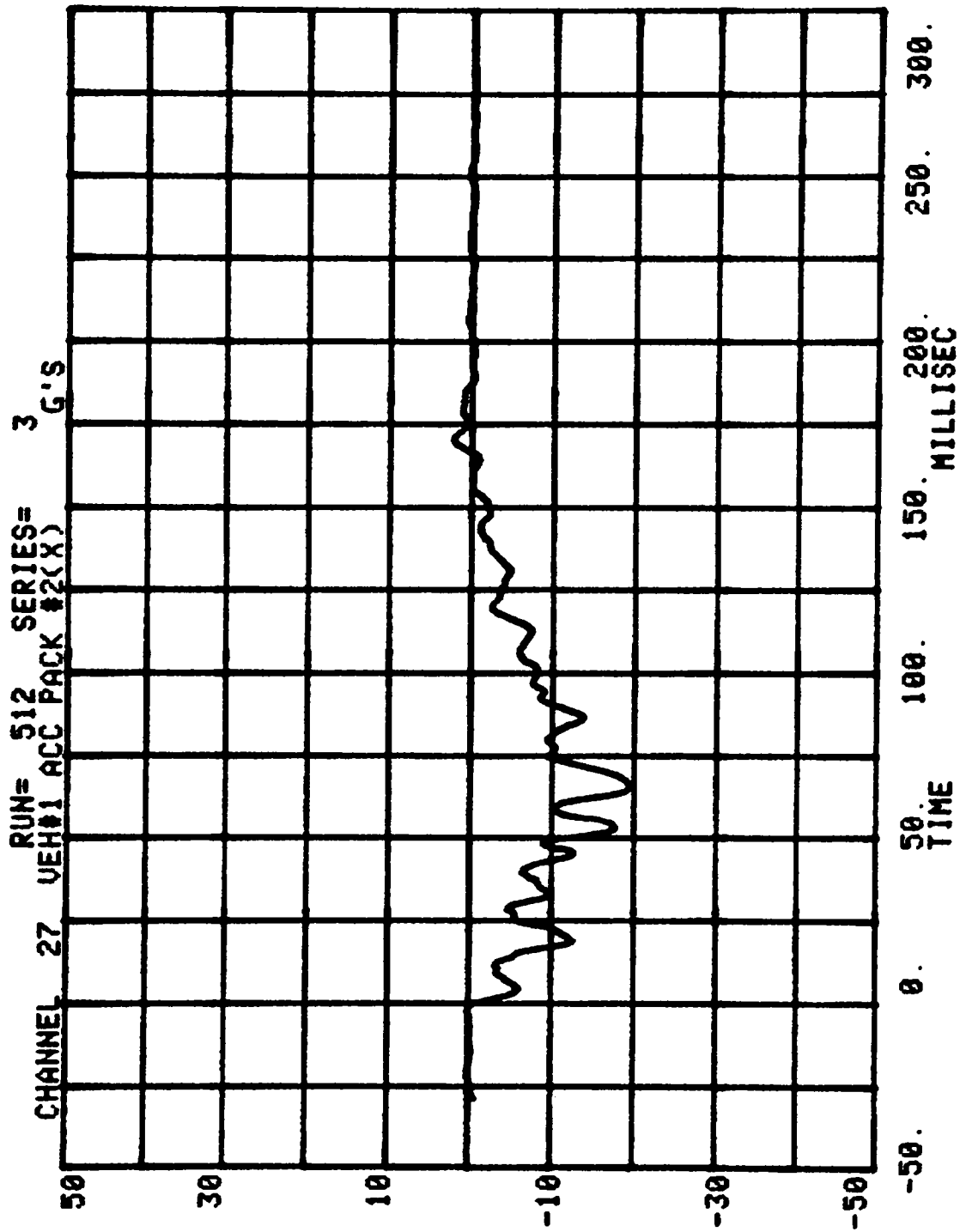
60



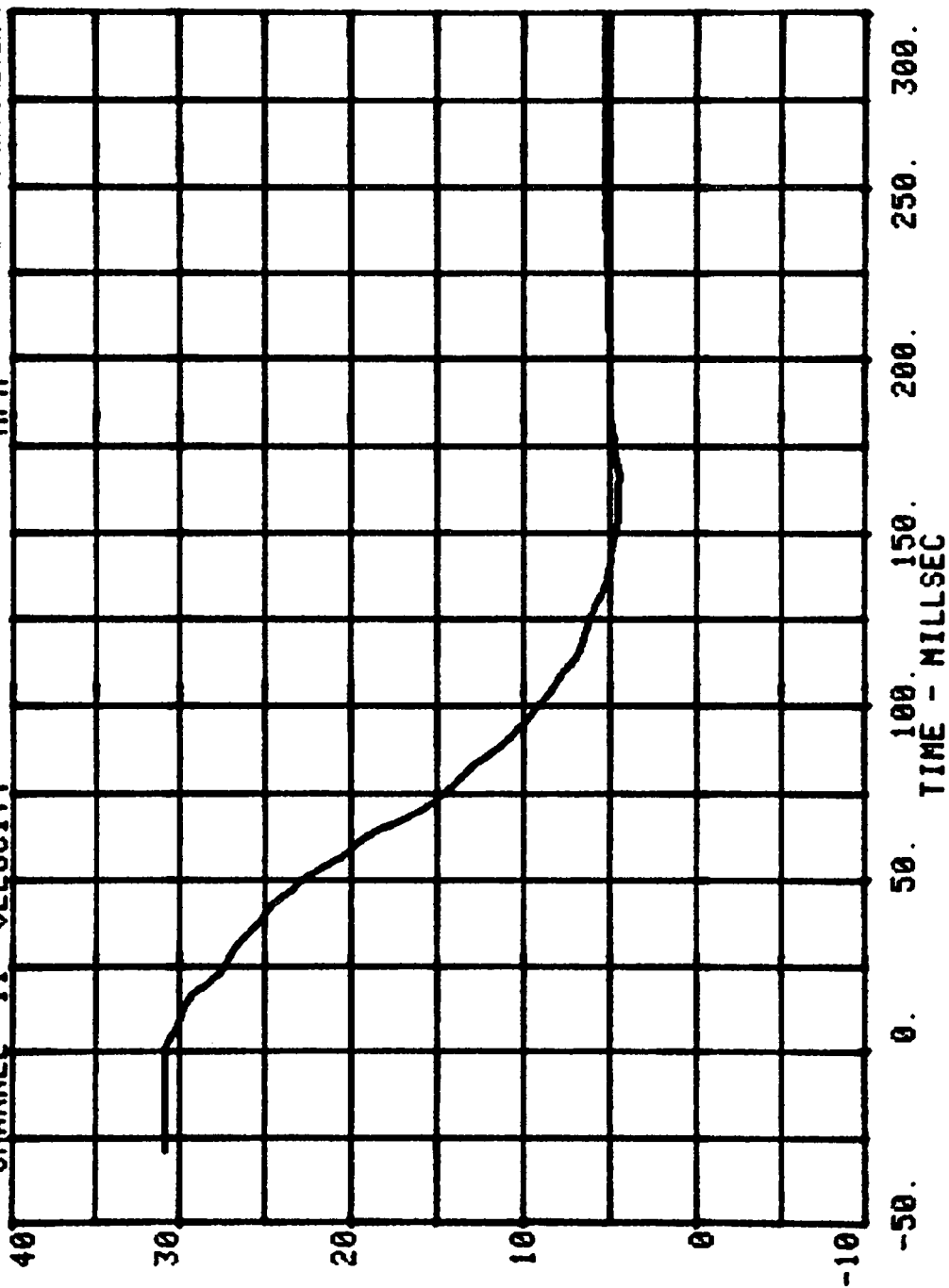




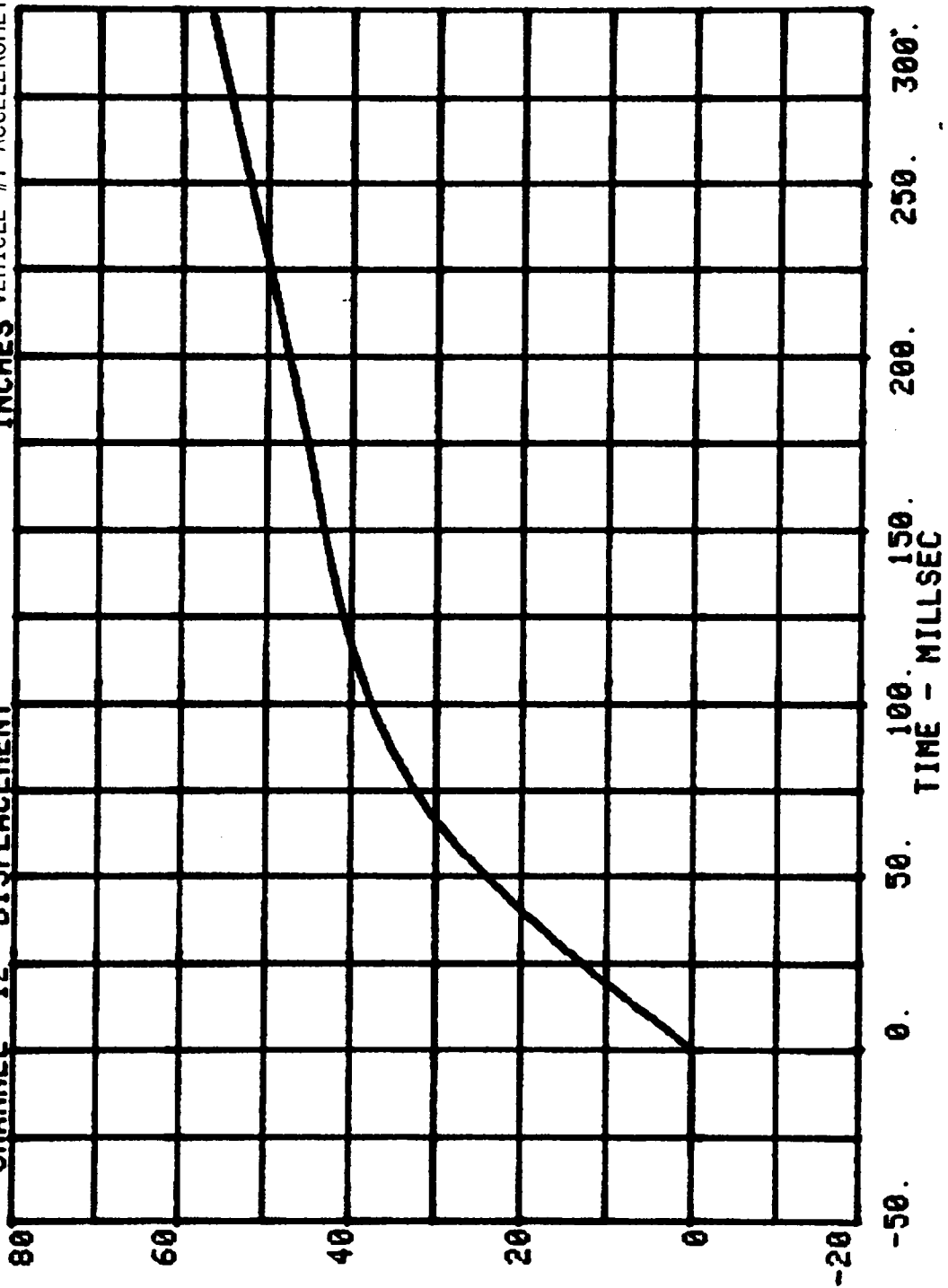




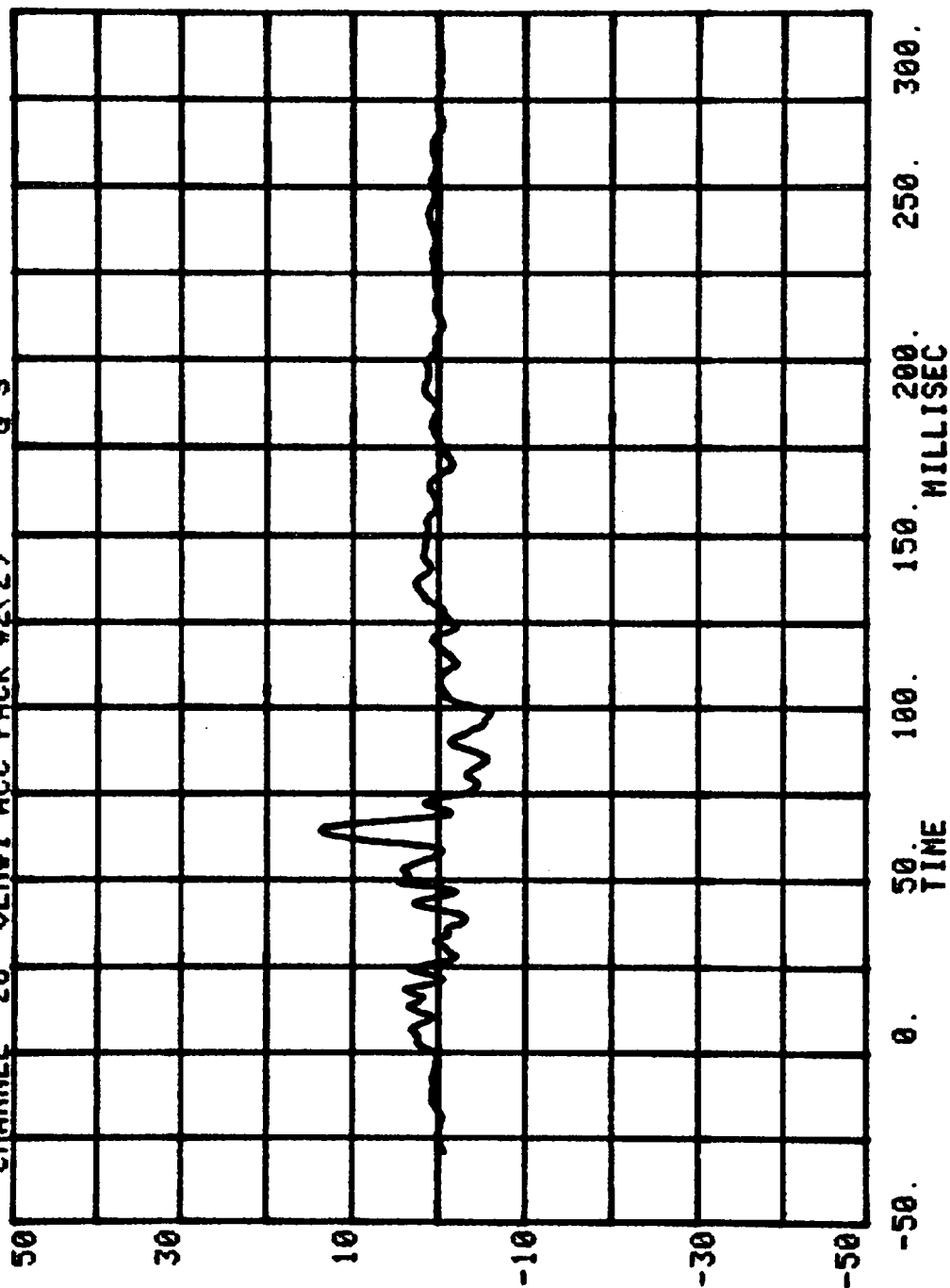
CHANNEL 11 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #1 ACCELEROMETER PACK #2(X)

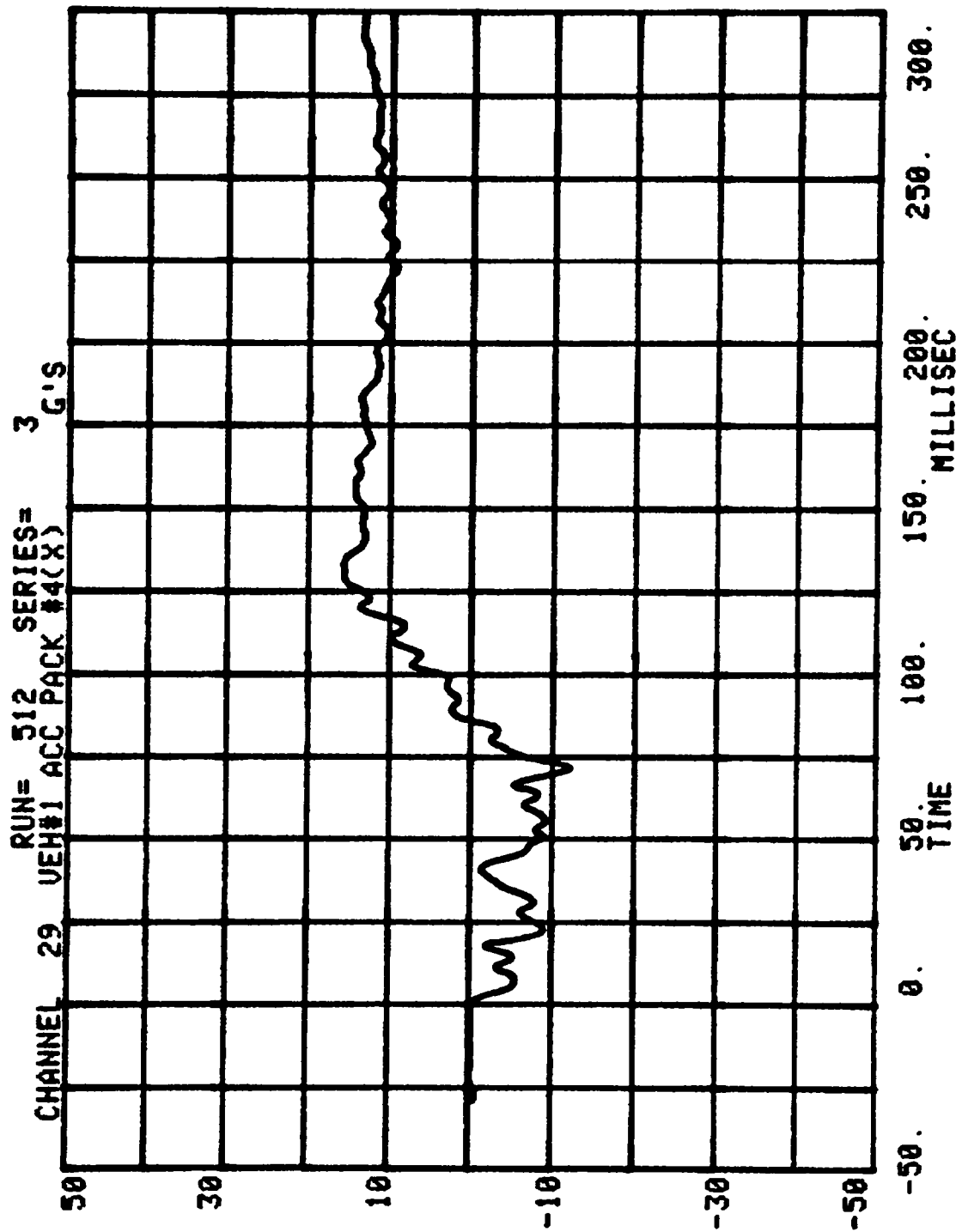


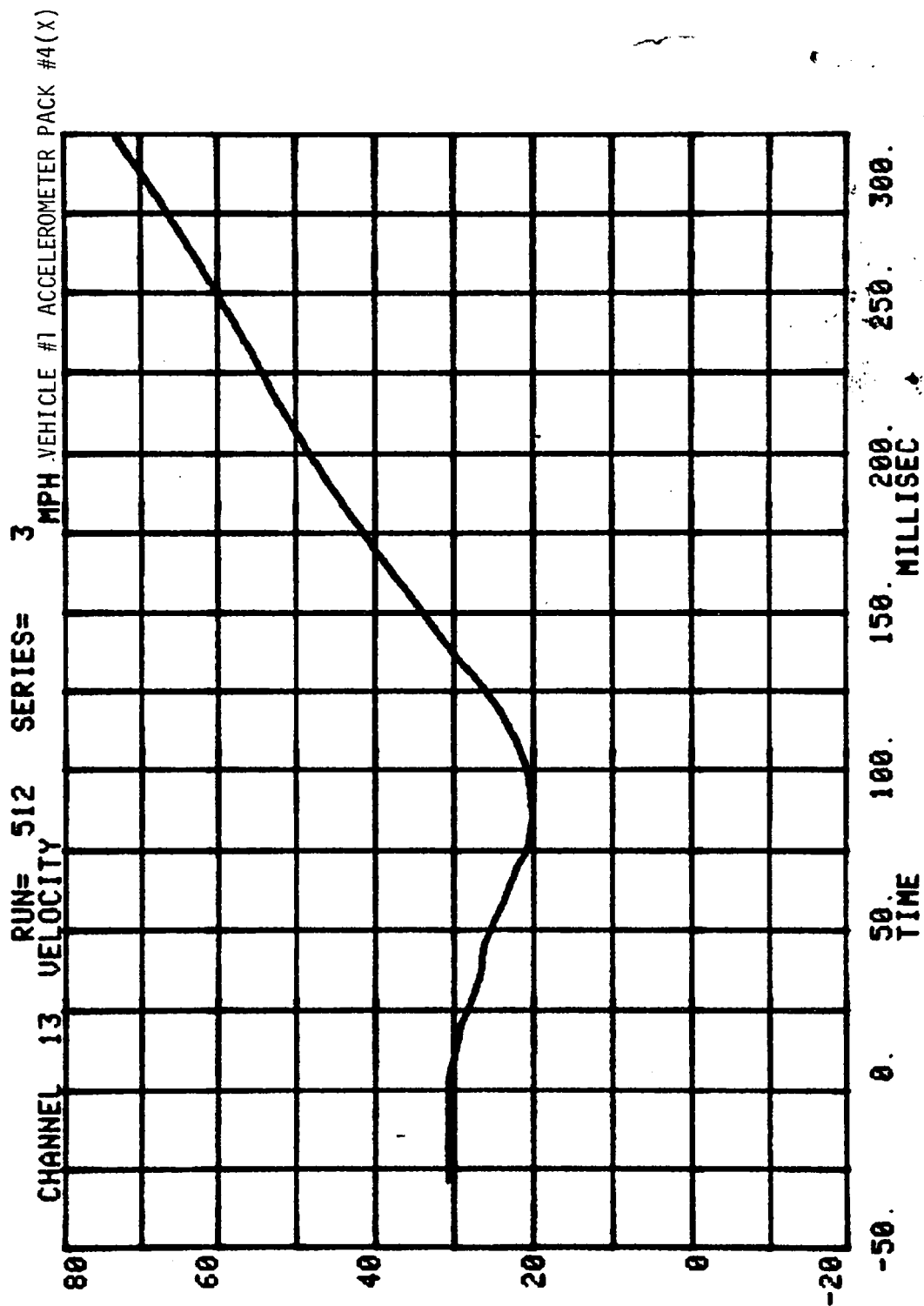
CHANNEL 12 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #1 ACCELEROMETER PACK #



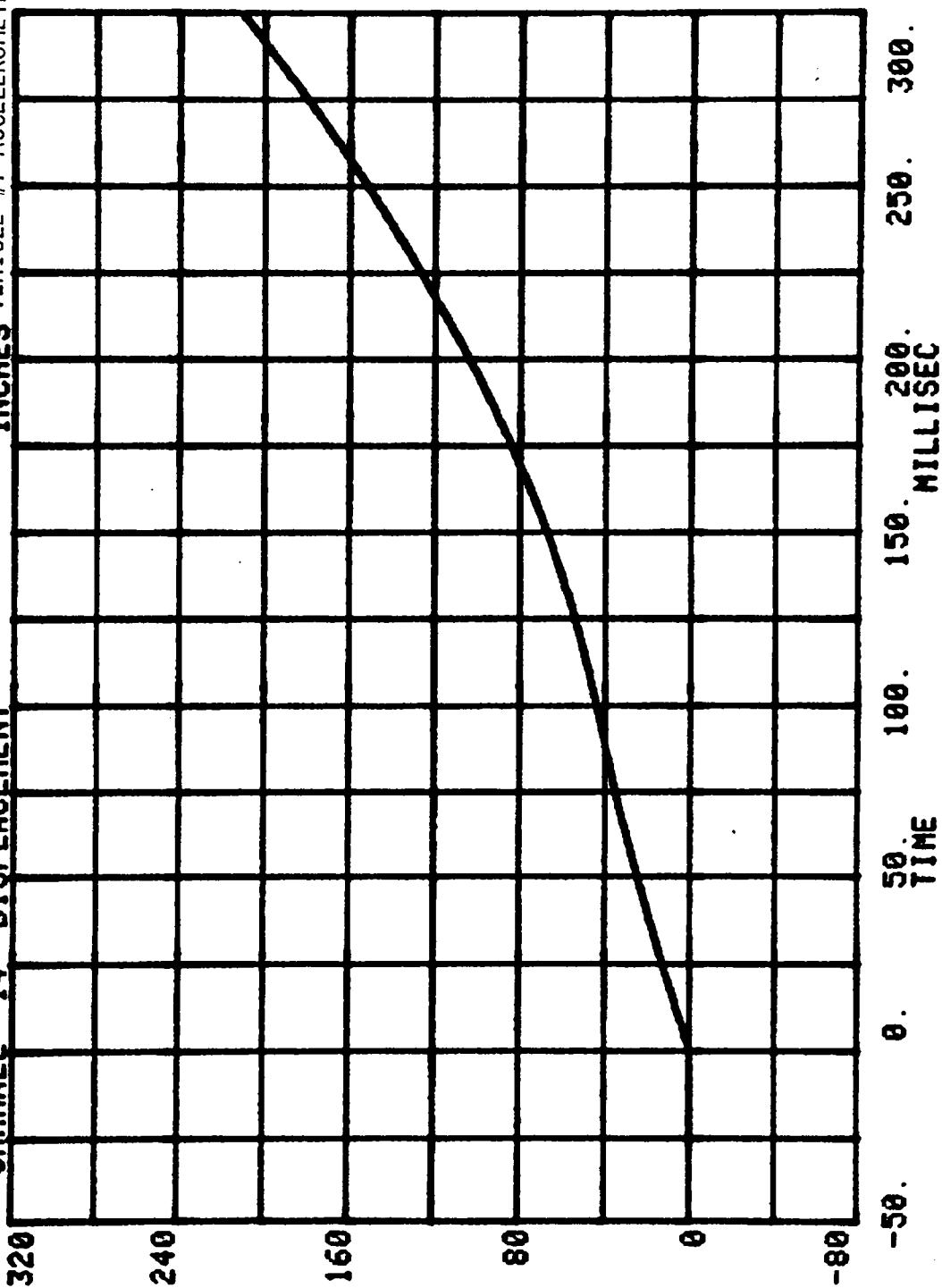
CHANNEL 28 RUN= 512 SERIES= 3
VEH#1 ACC PACK #2(Z) G'S

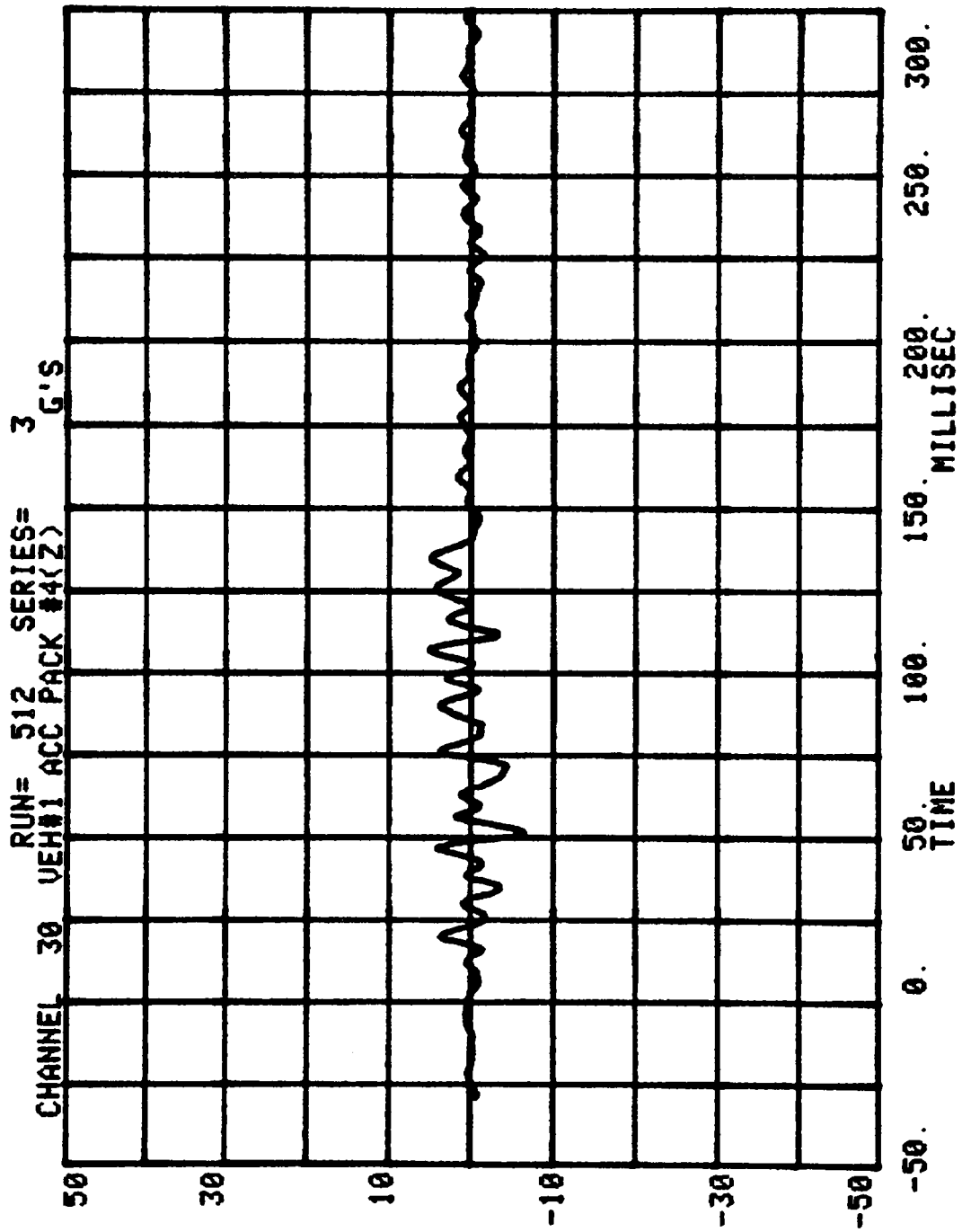


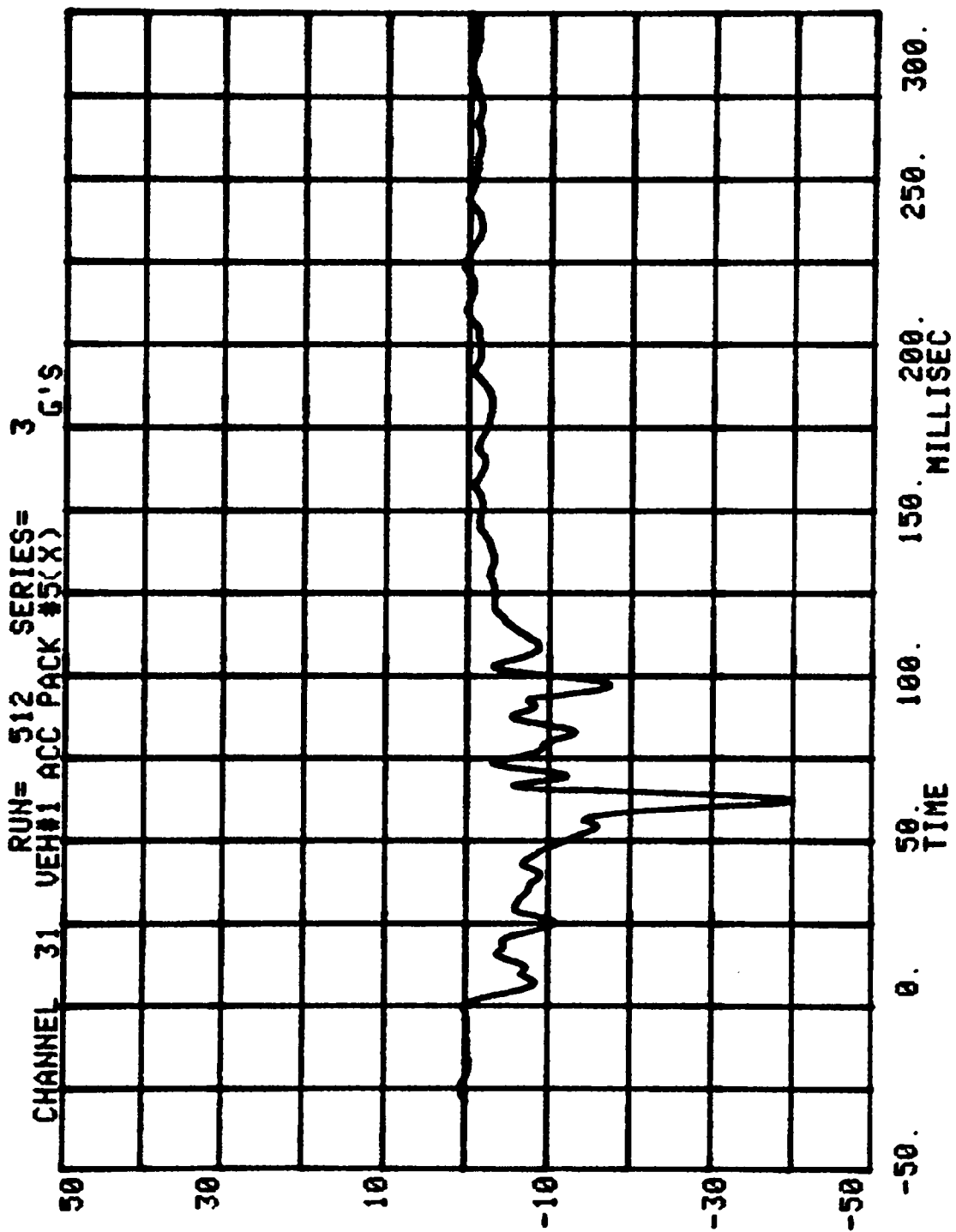




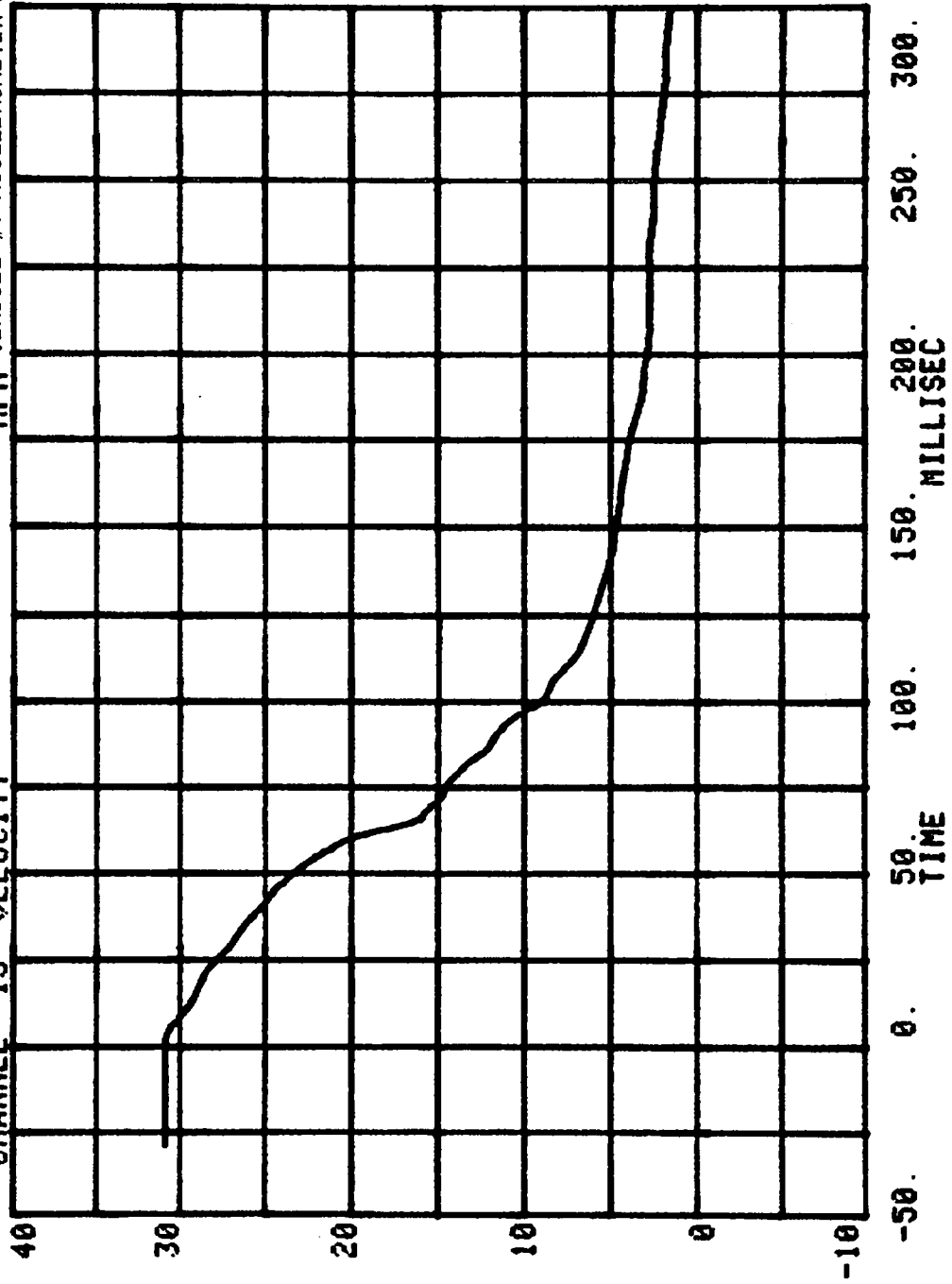
CHANNEL 14 DISPLACEMENT RUN# 512 SERIES= 3 INCHES VEHICLE #1 ACCELEROMETER PACK #4



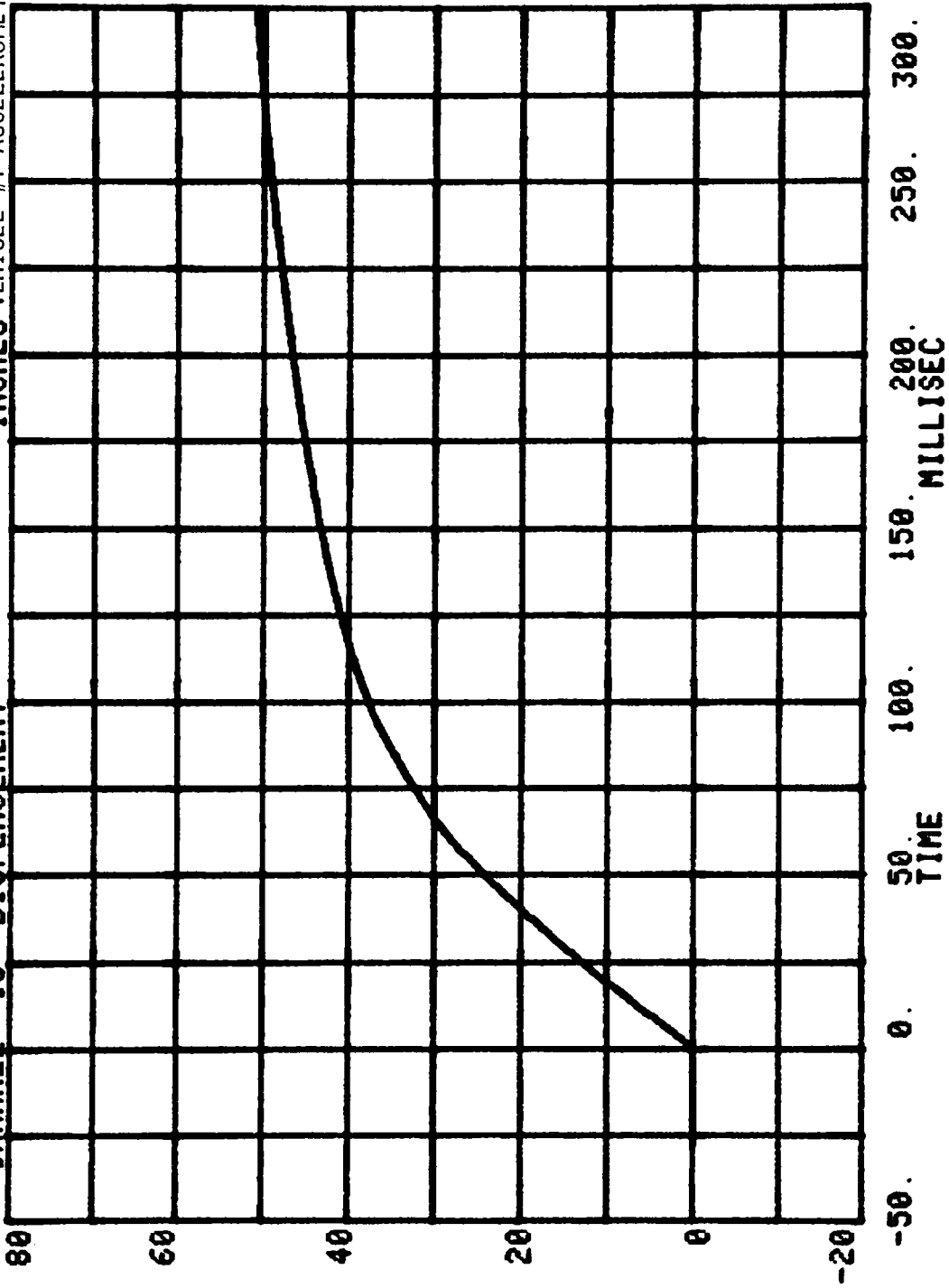


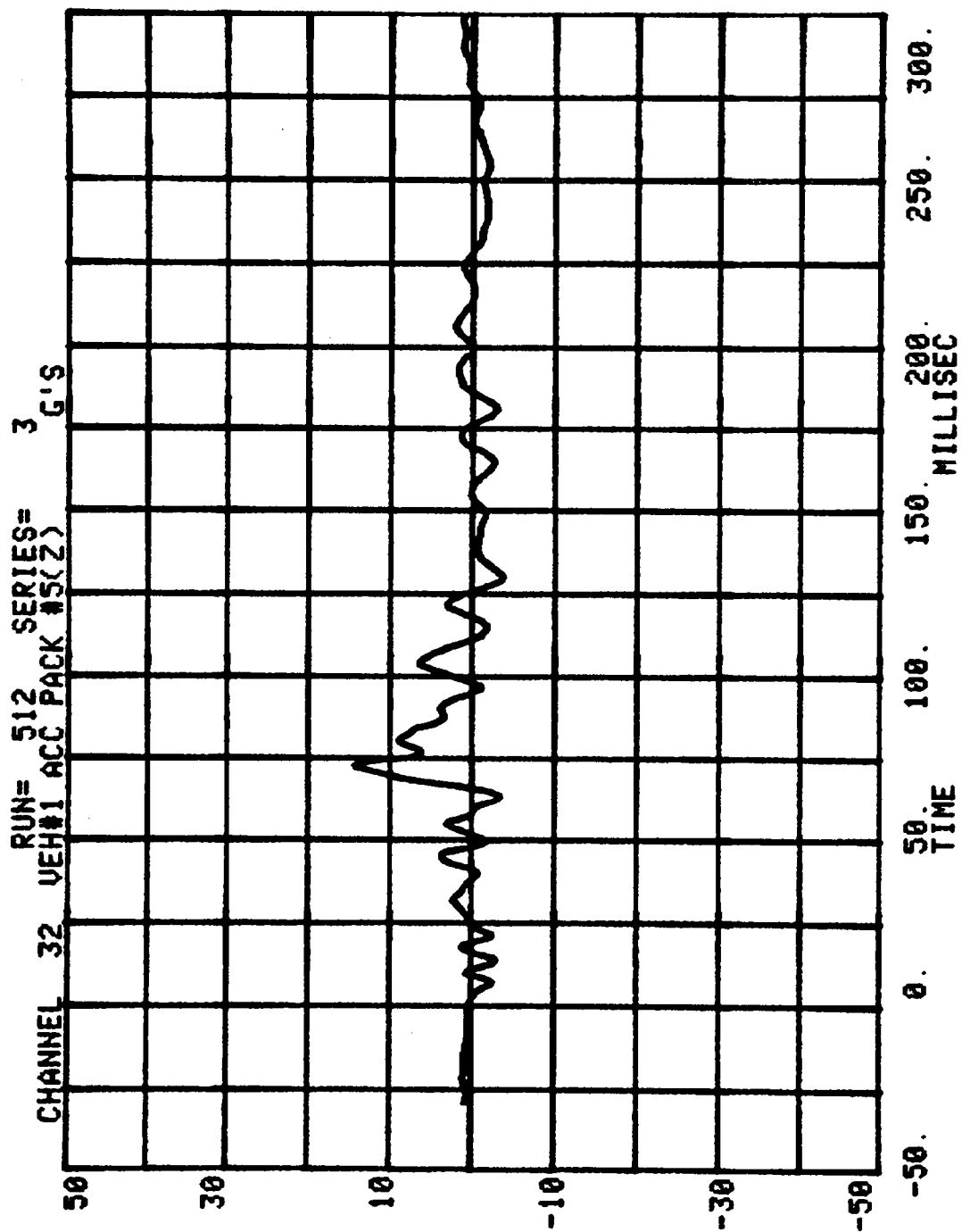


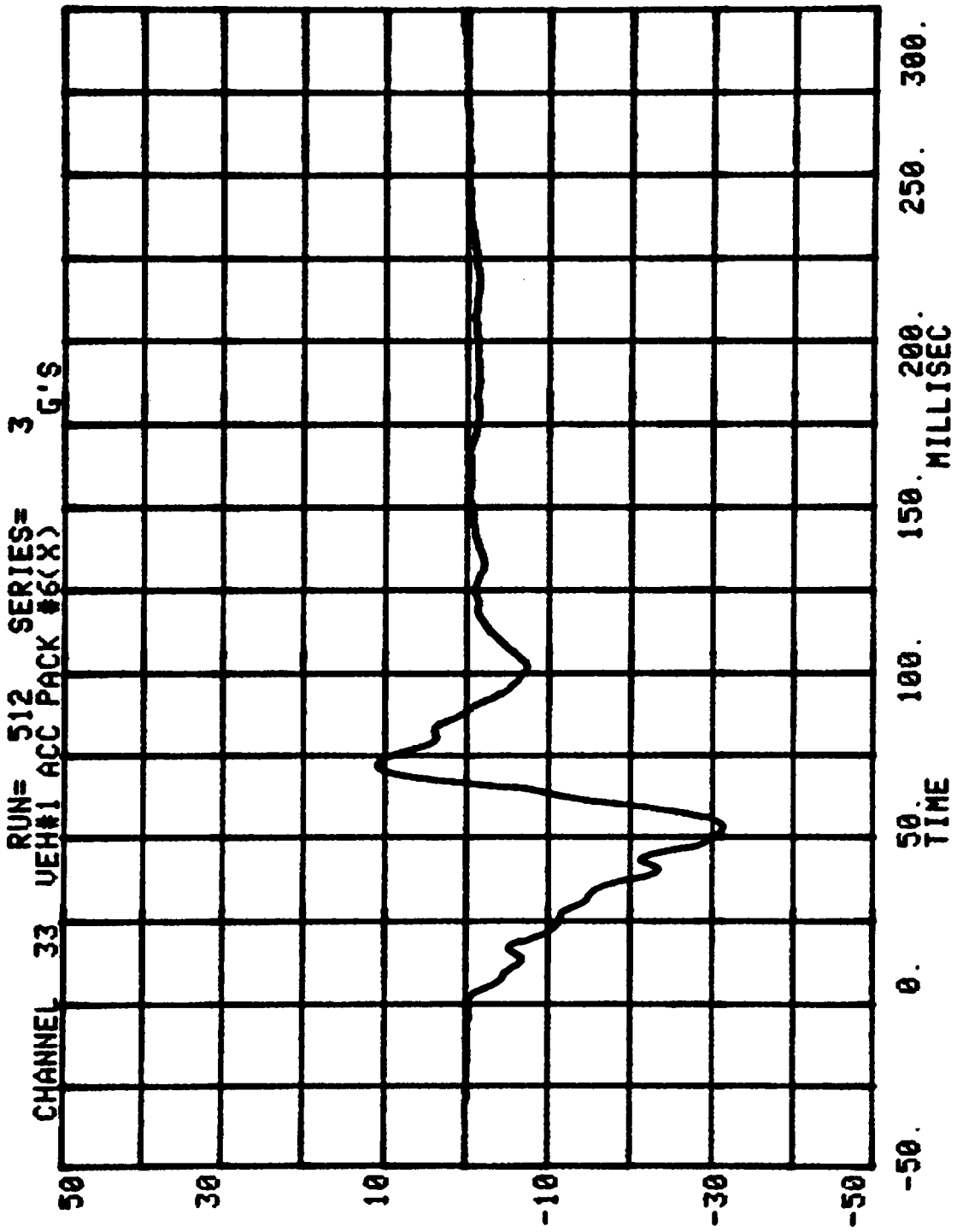
RUN= 512 SERIES= 3
CHANNEL 15 VELOCITY MPH VEHICLE #1 ACCELEROMETER PACK #5(X)



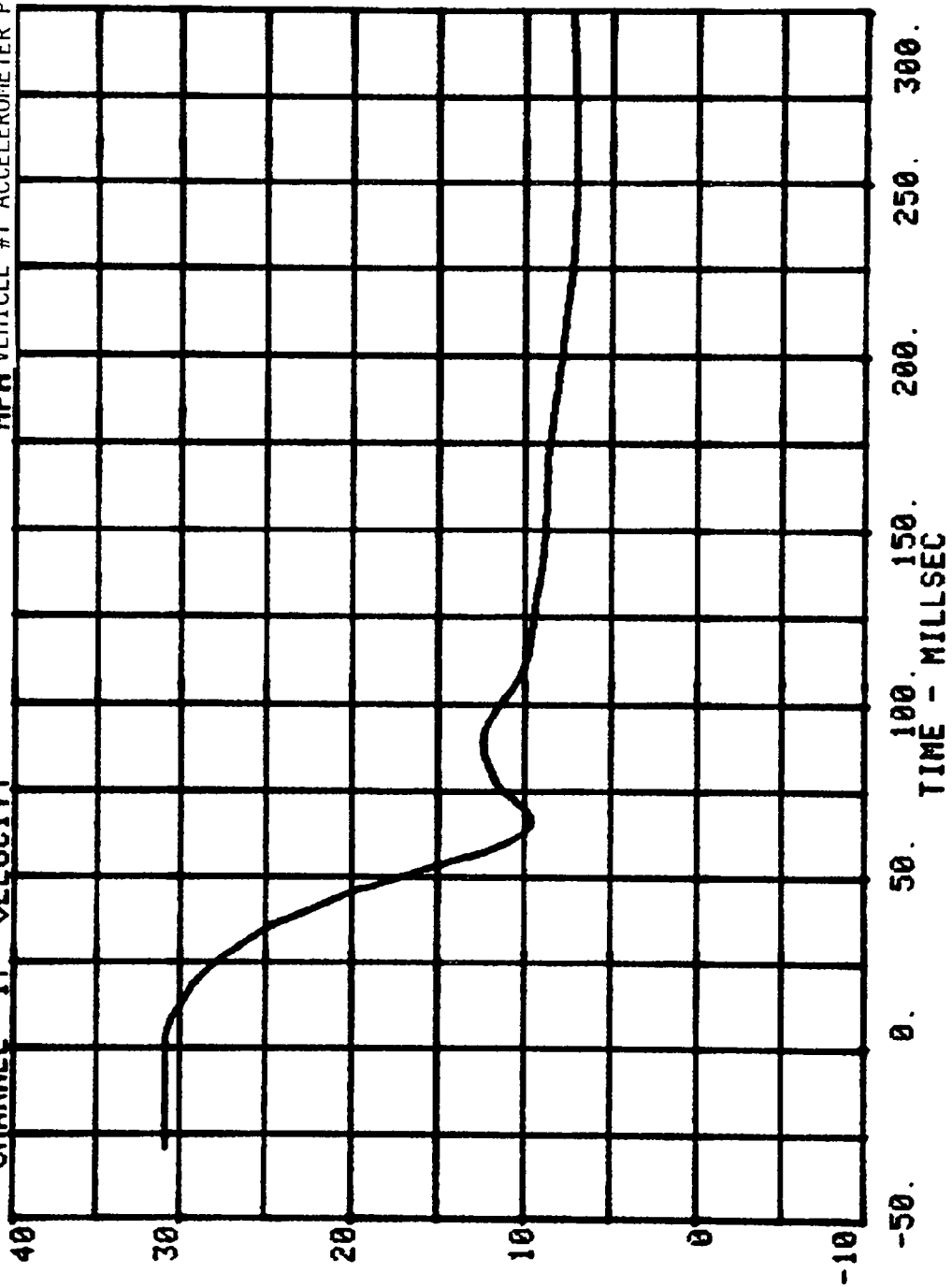
CHANNEL 16 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #1 ACCELEROMETER PACK #1



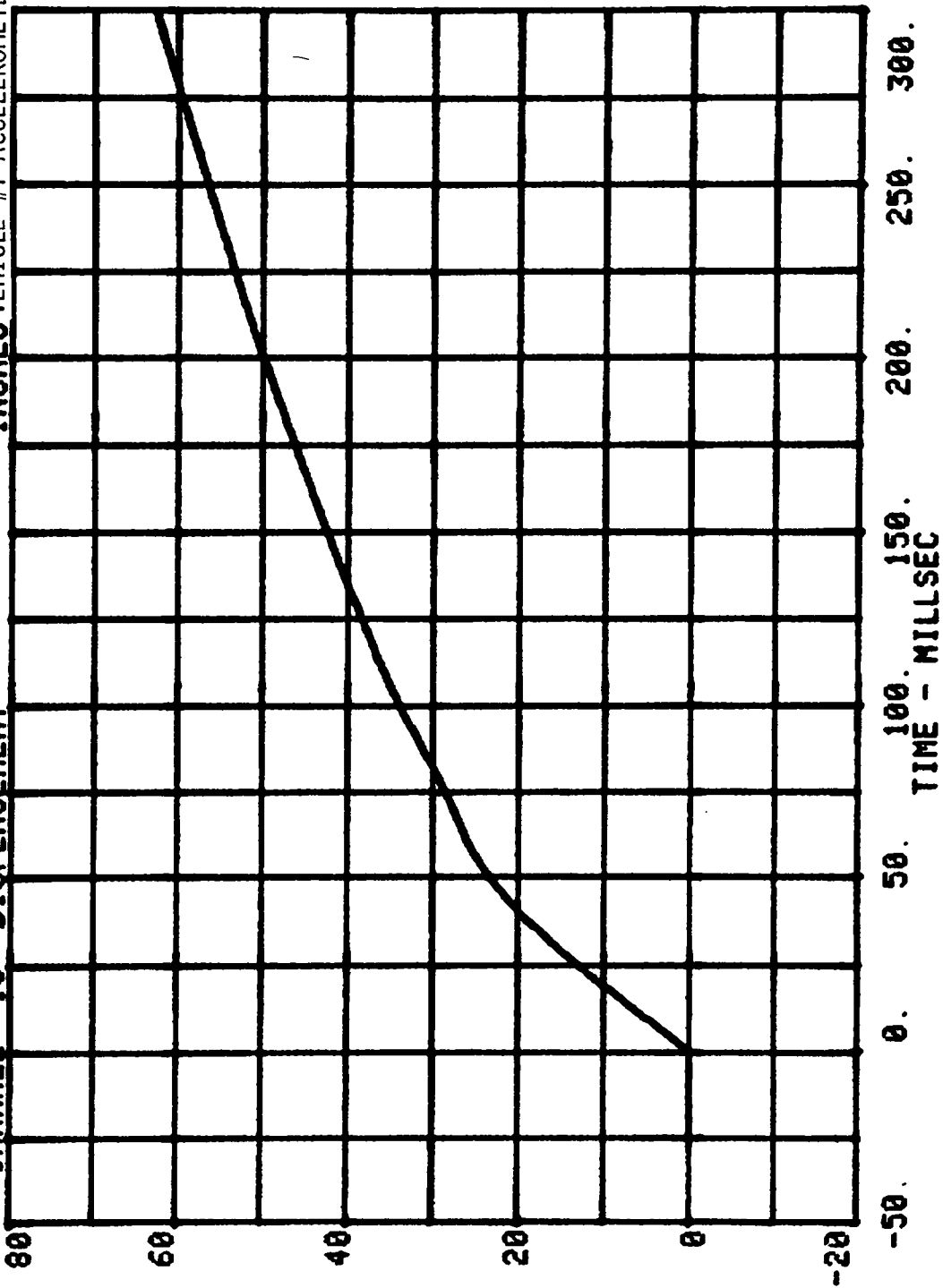


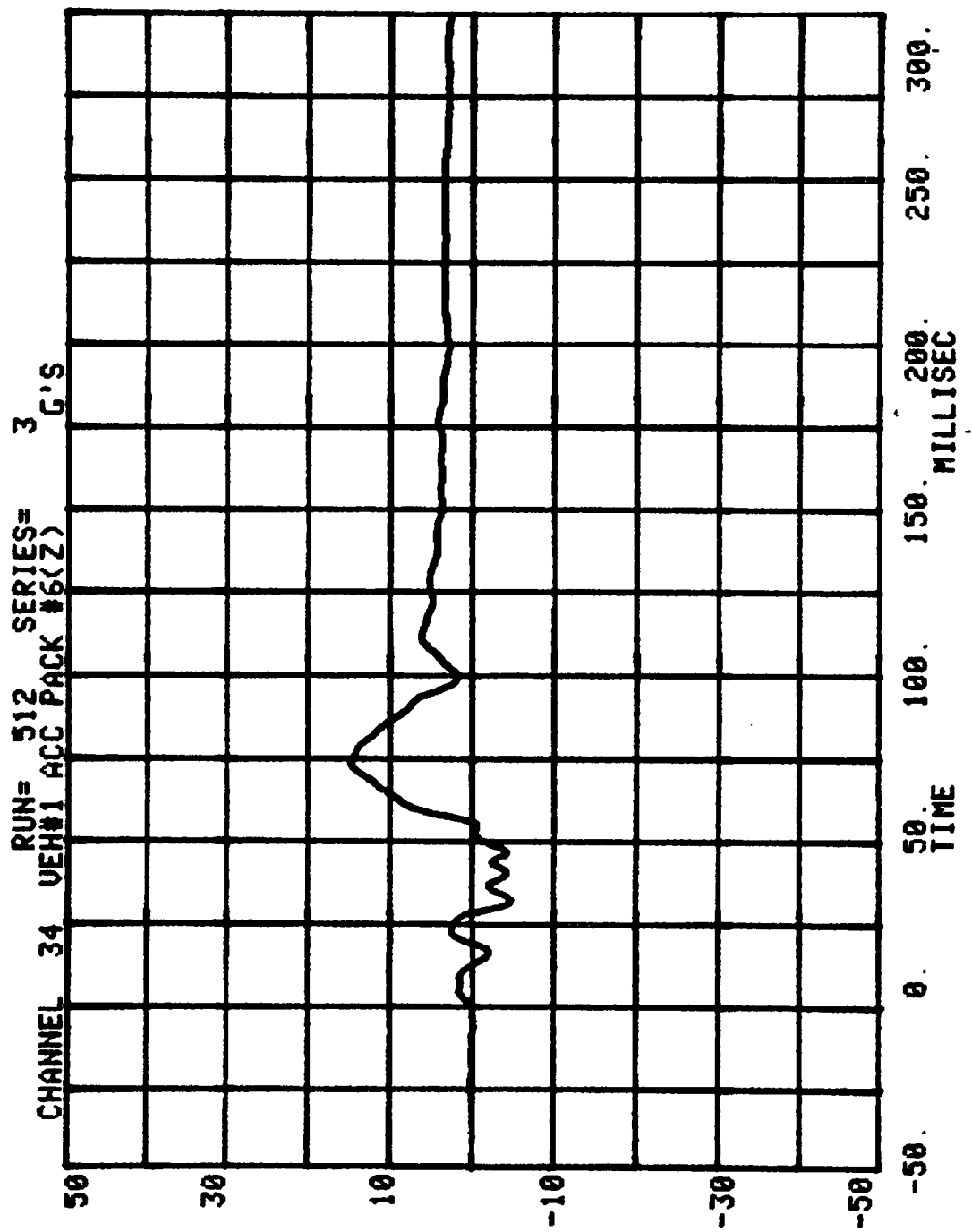


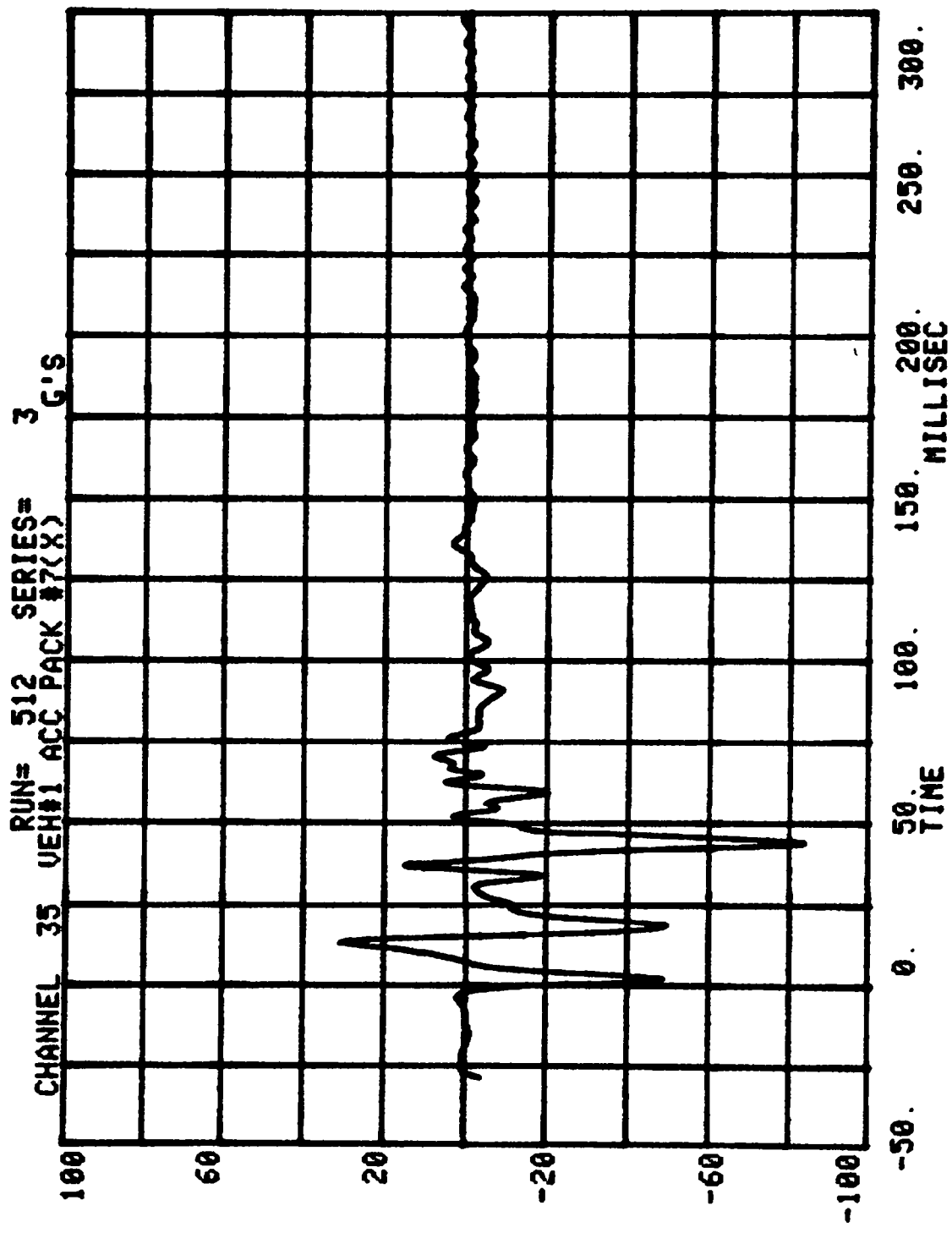
CHANNEL 17 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #1 ACCELEROMETER PACK #6(X)



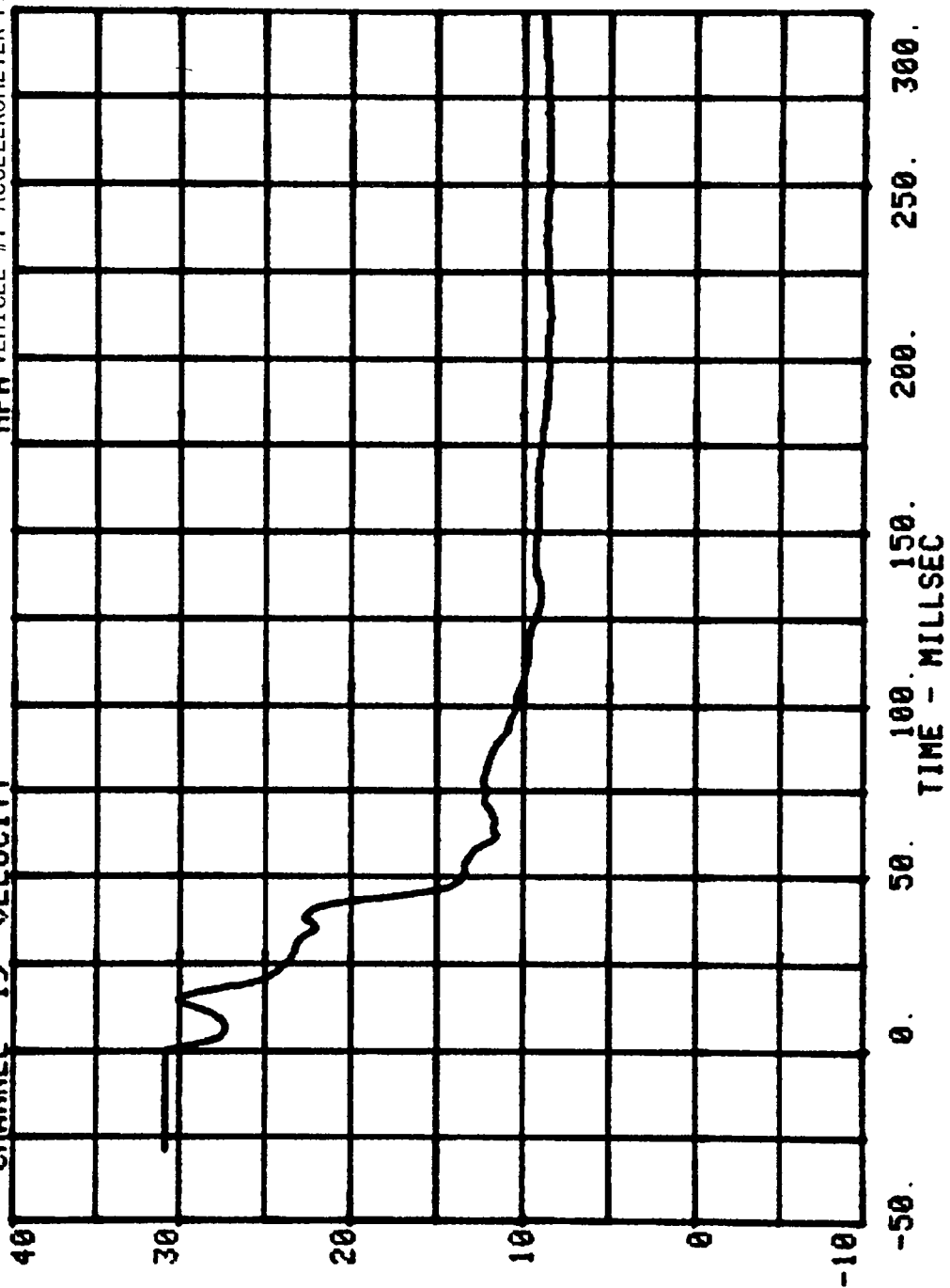
CHANNEL 18 DISPLACEMENT
 RUN= 512 SERIES= 3 INCHES VEHICLE #1 ACCELEROMETER PACK #61



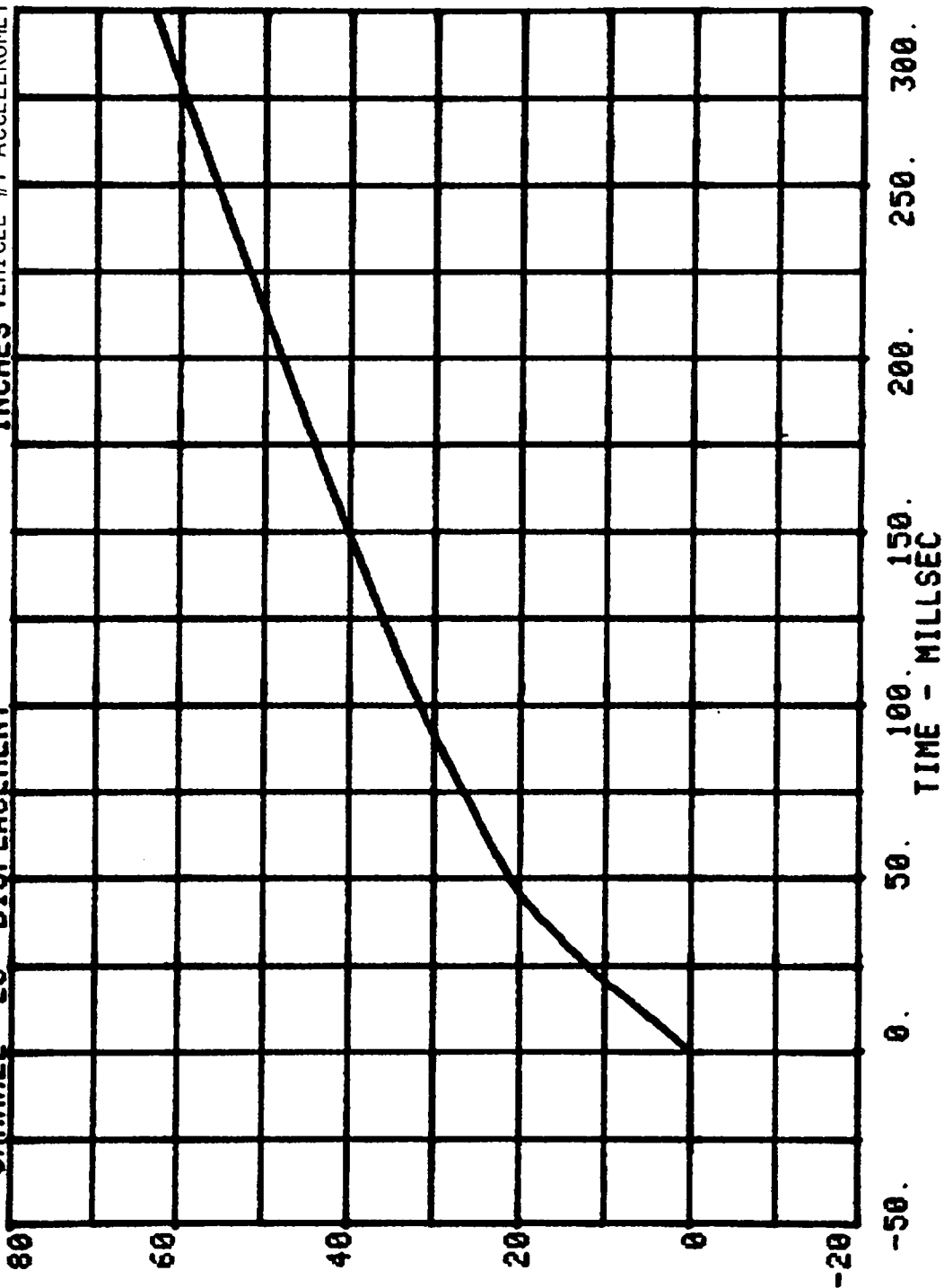


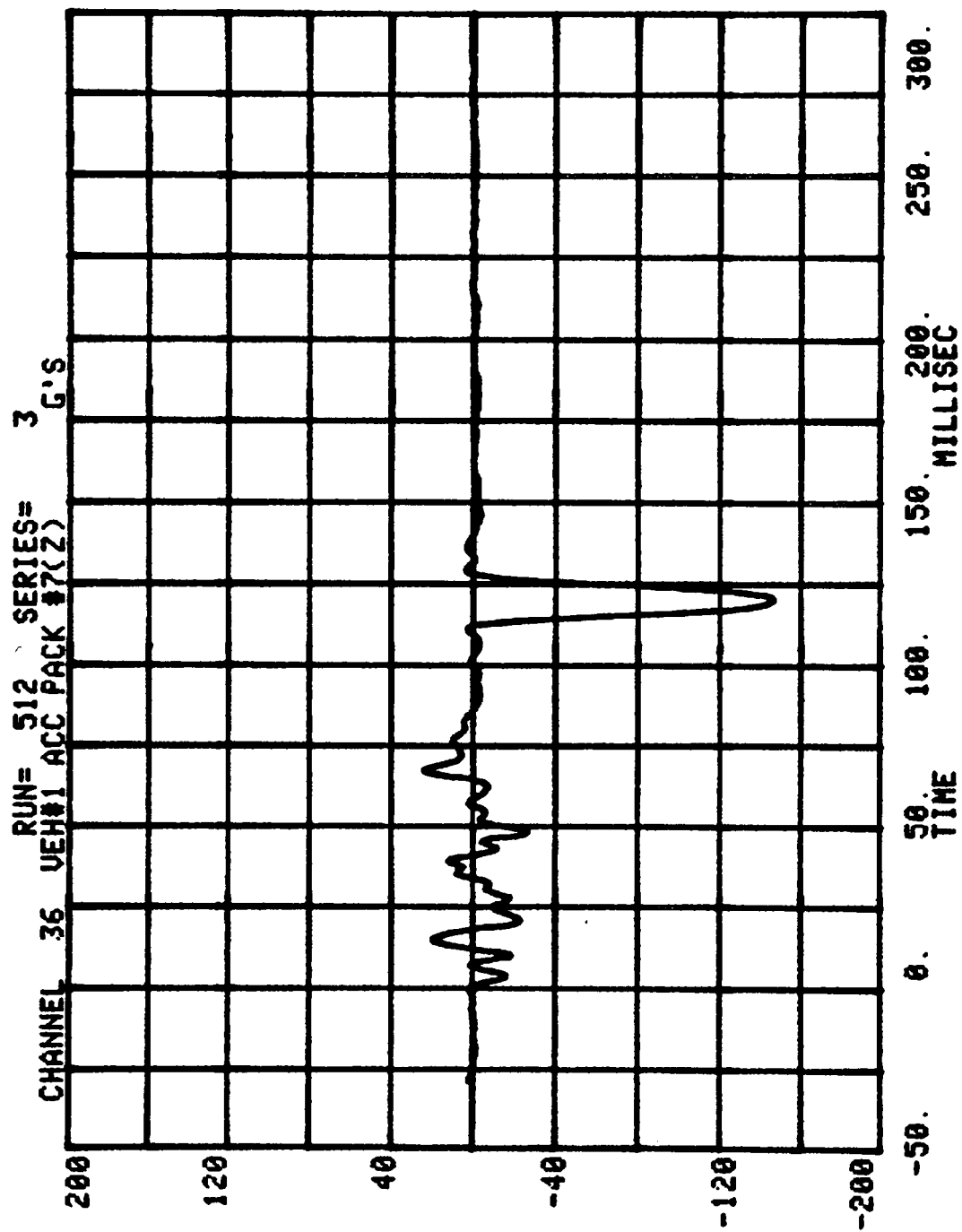


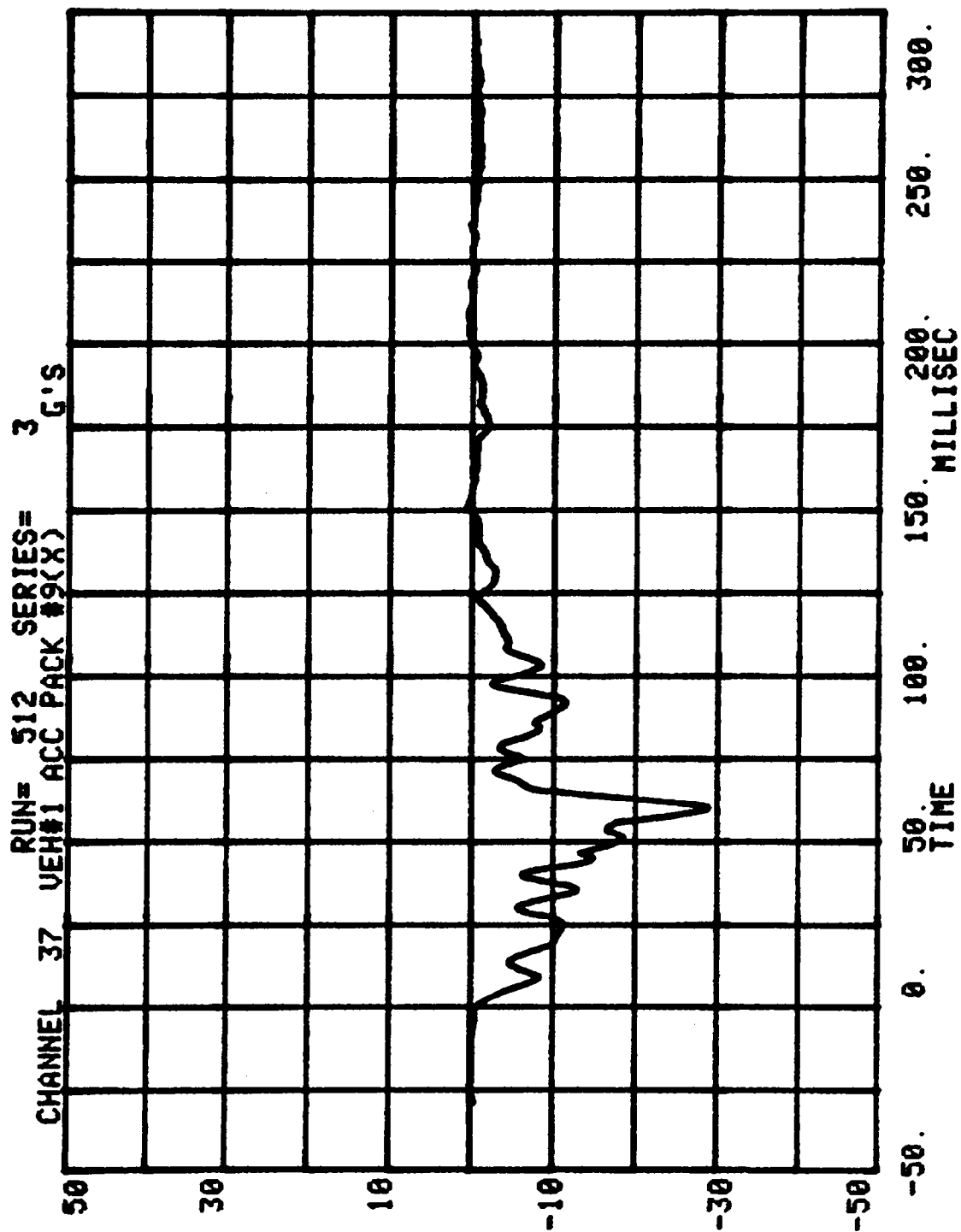
CHANNEL 19 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #1 ACCELEROMETER PACK #7(X)



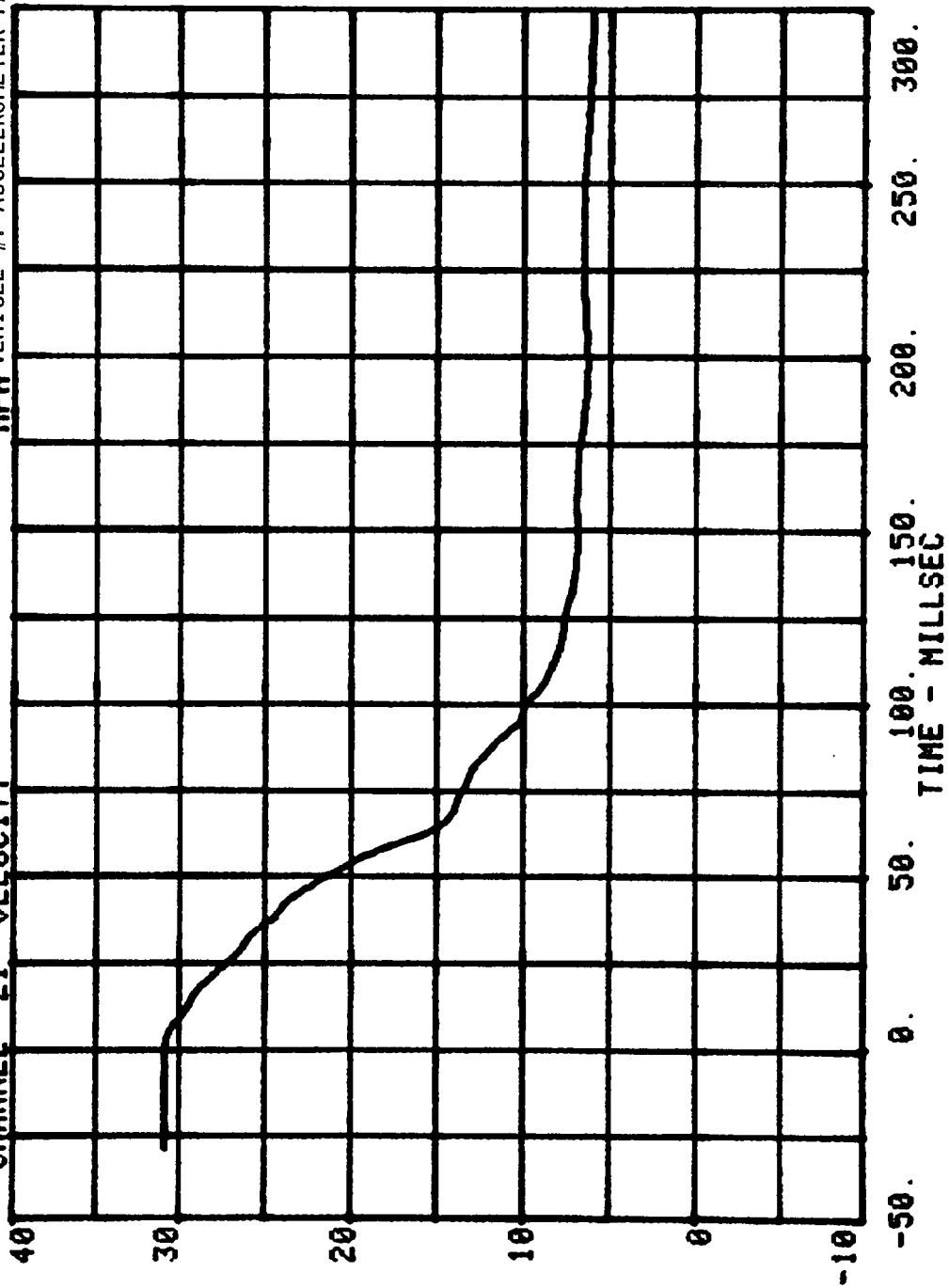
CHANNEL 20 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #1 ACCELEROMETER PACK #7



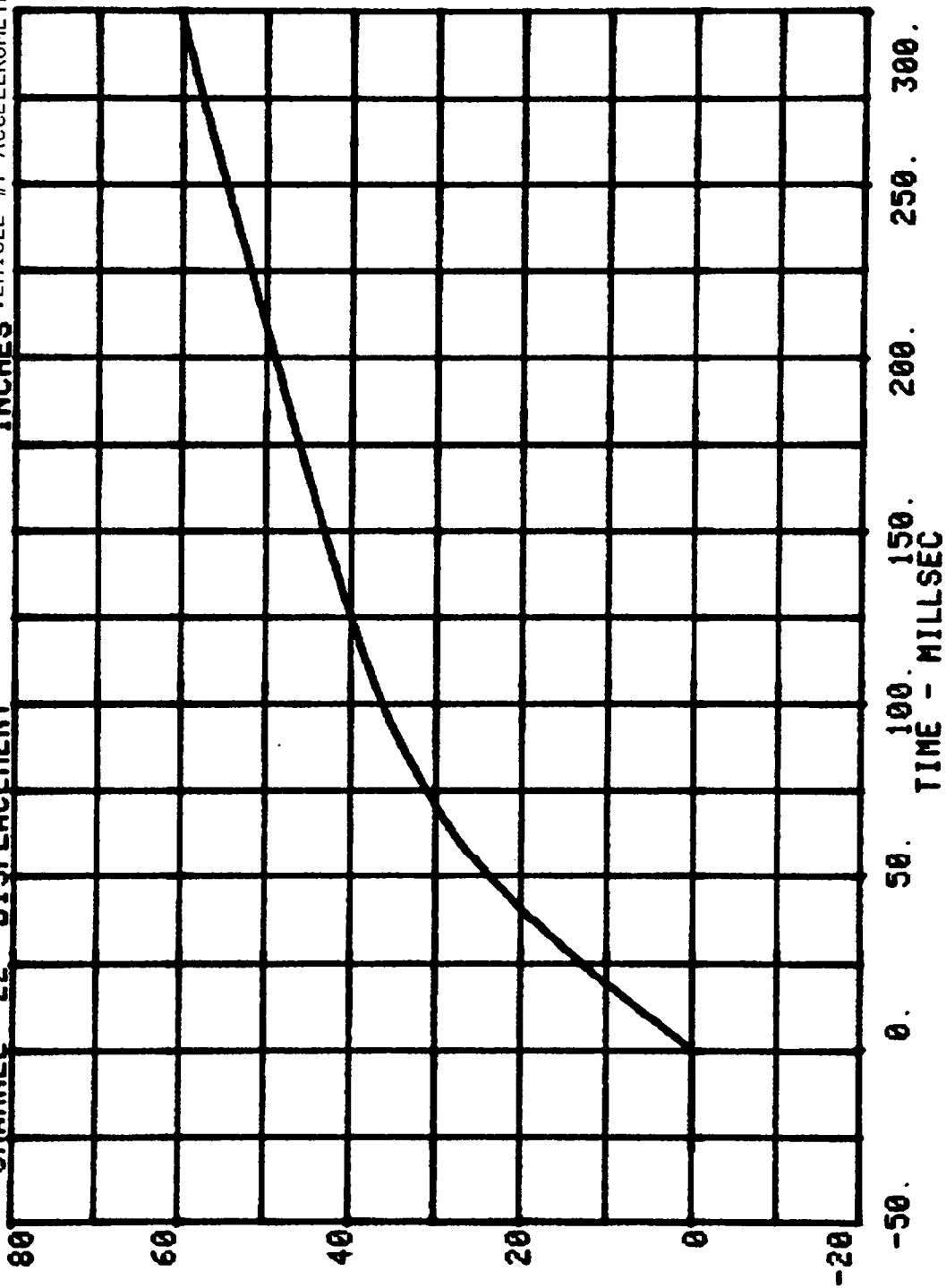


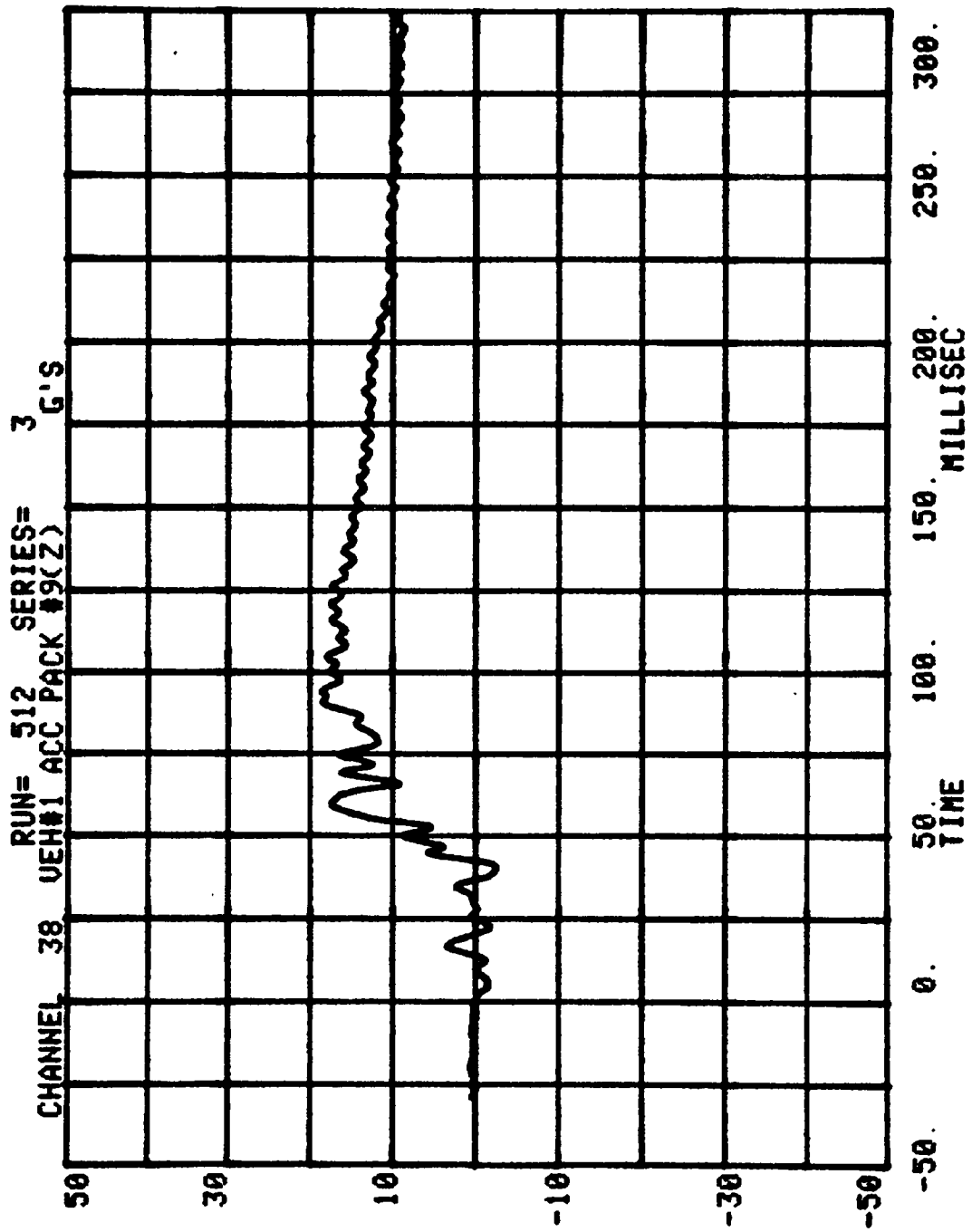


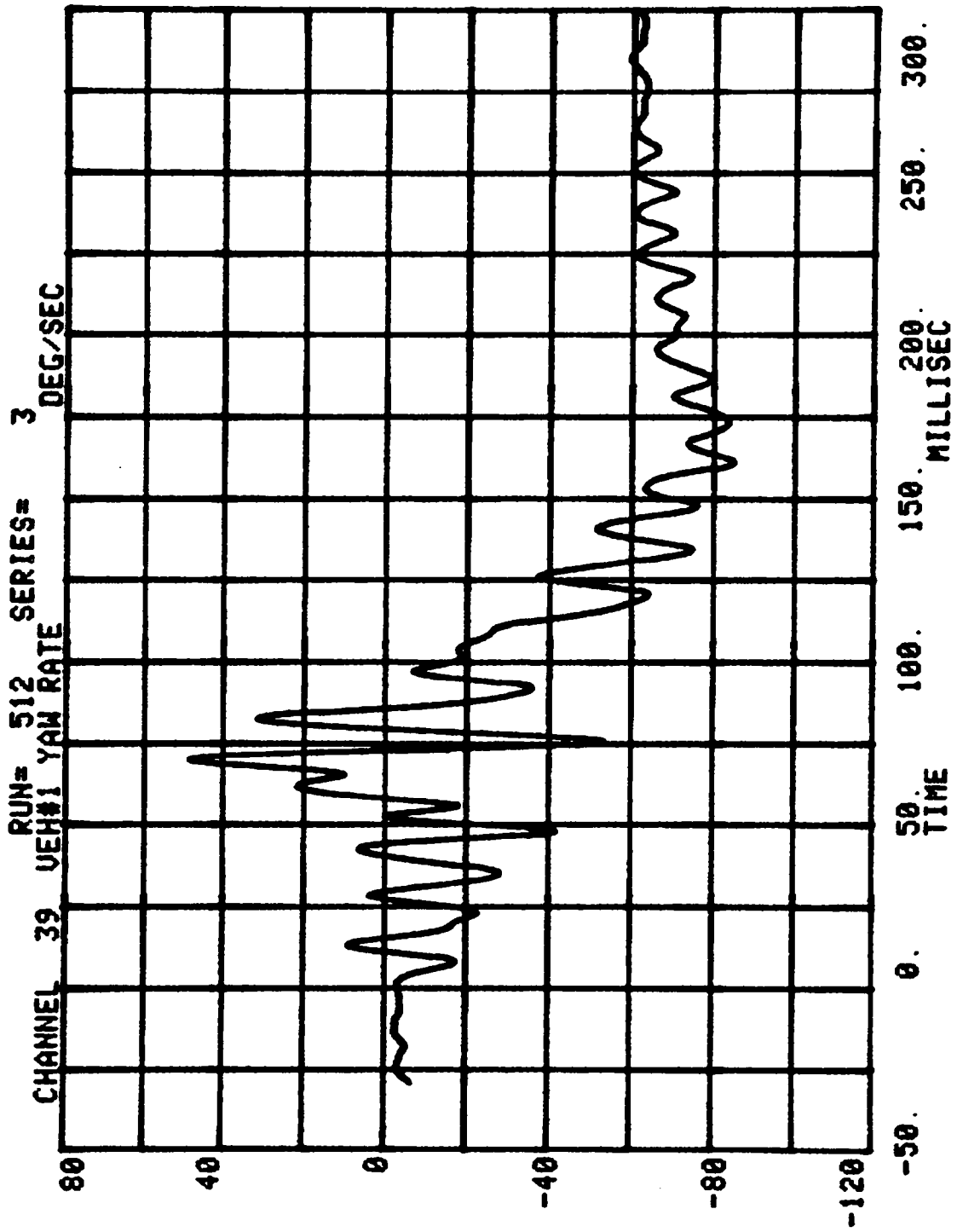
CHANNEL 21 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #1 ACCELEROMETER PACK #9(X)



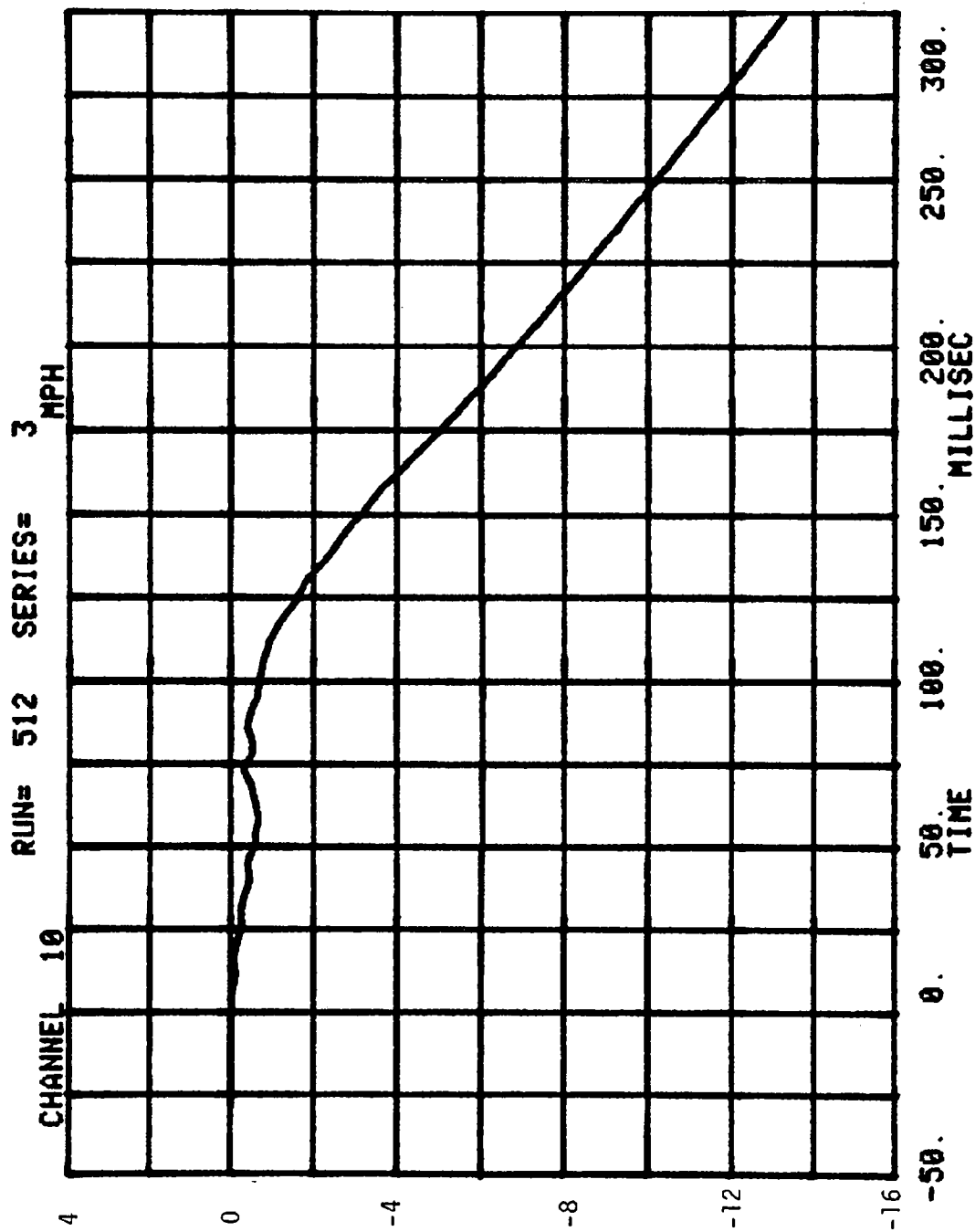
CHANNEL 22 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #1 ACCELEROMETER PACK #9

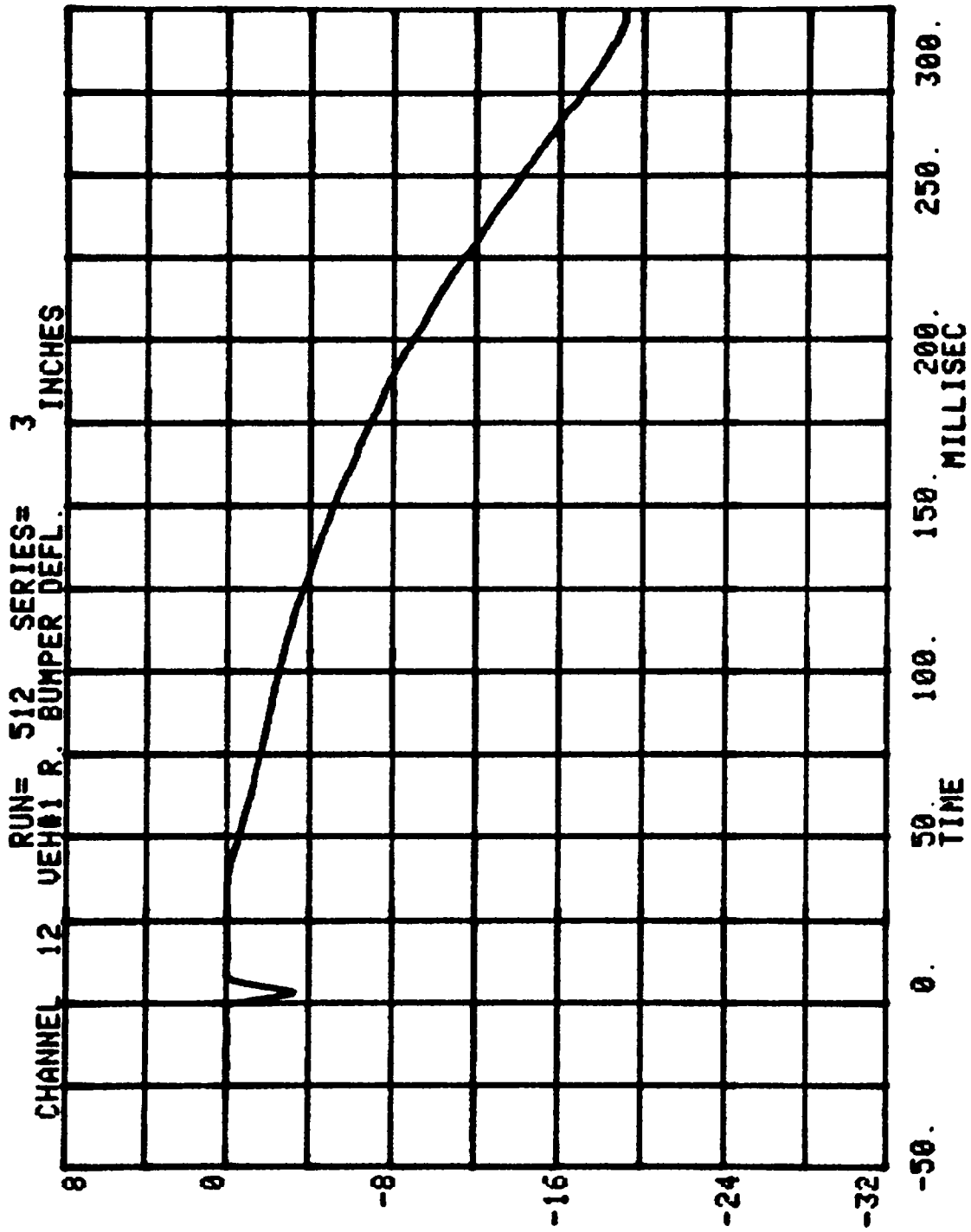


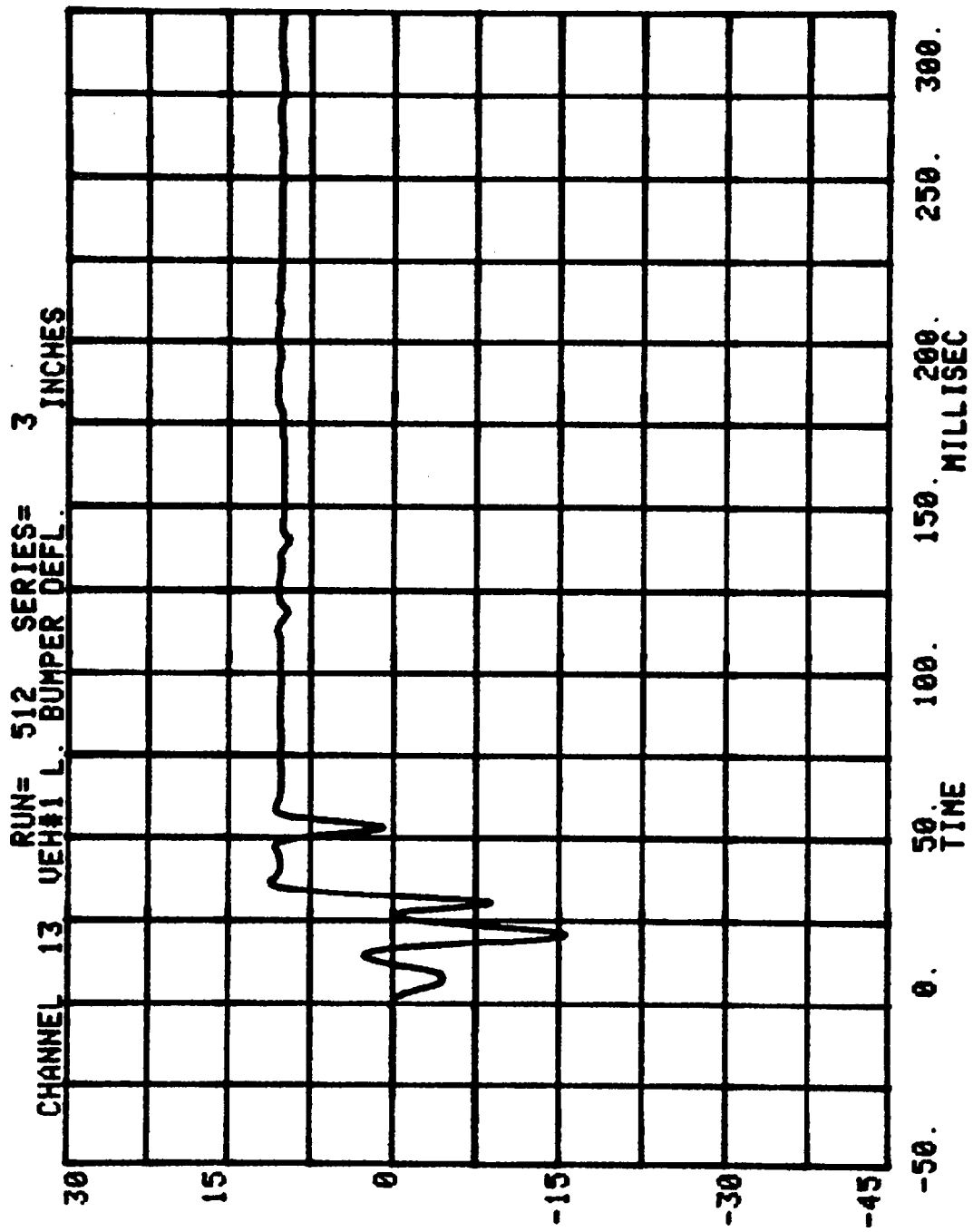




VEHICLE #1 - YAW ~ DEGREES







Test No. 614-3-512

1980 OLDSMOBILE CUTLASS SUPREME

DUMMY DATA

FILTER CHANNEL CLASS

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

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

VEHICLE AGGRESSIVENESS CAR-TO-CAR TEST #3

RUN= 512

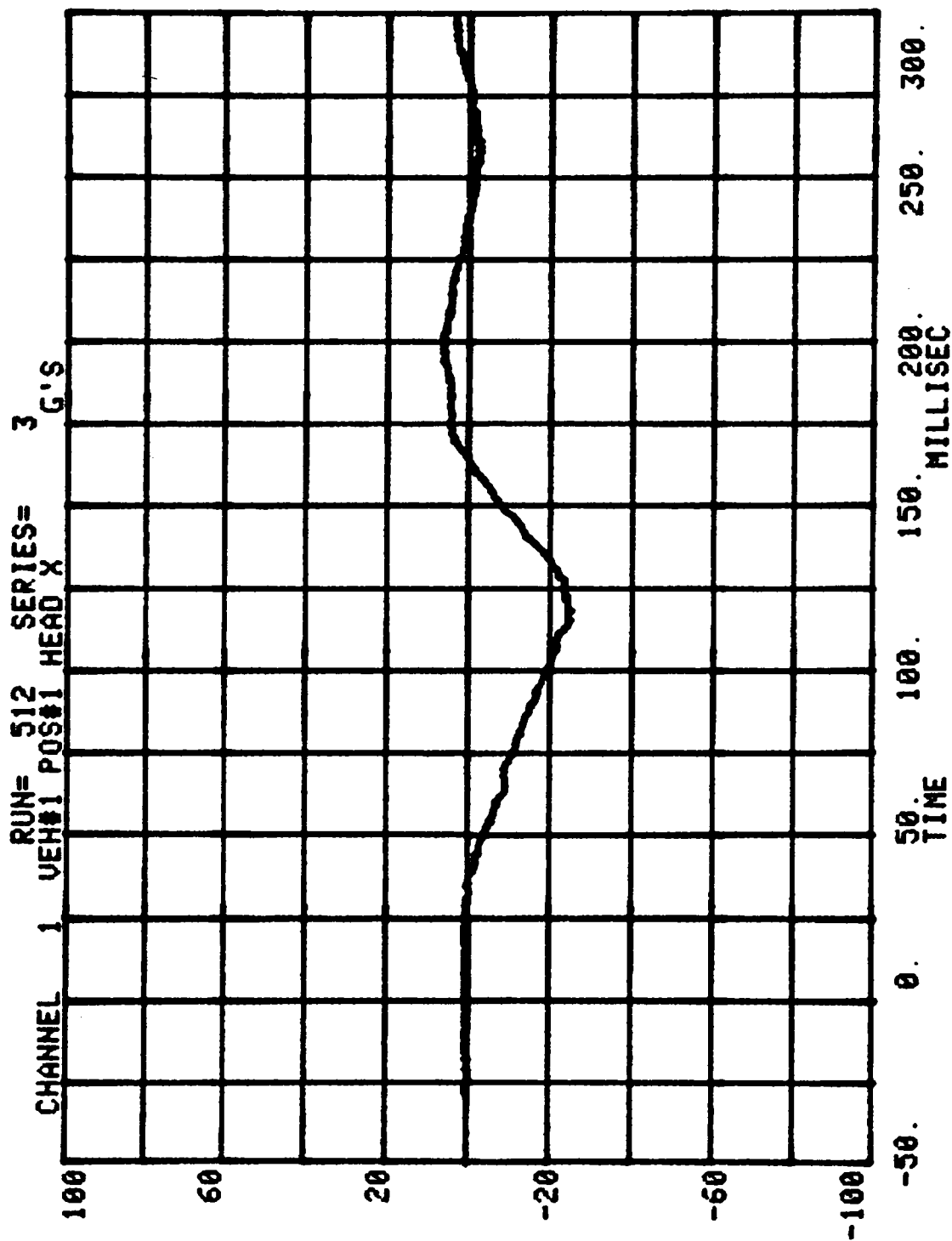
VEH#1 POS#1 HEAD RESULT.

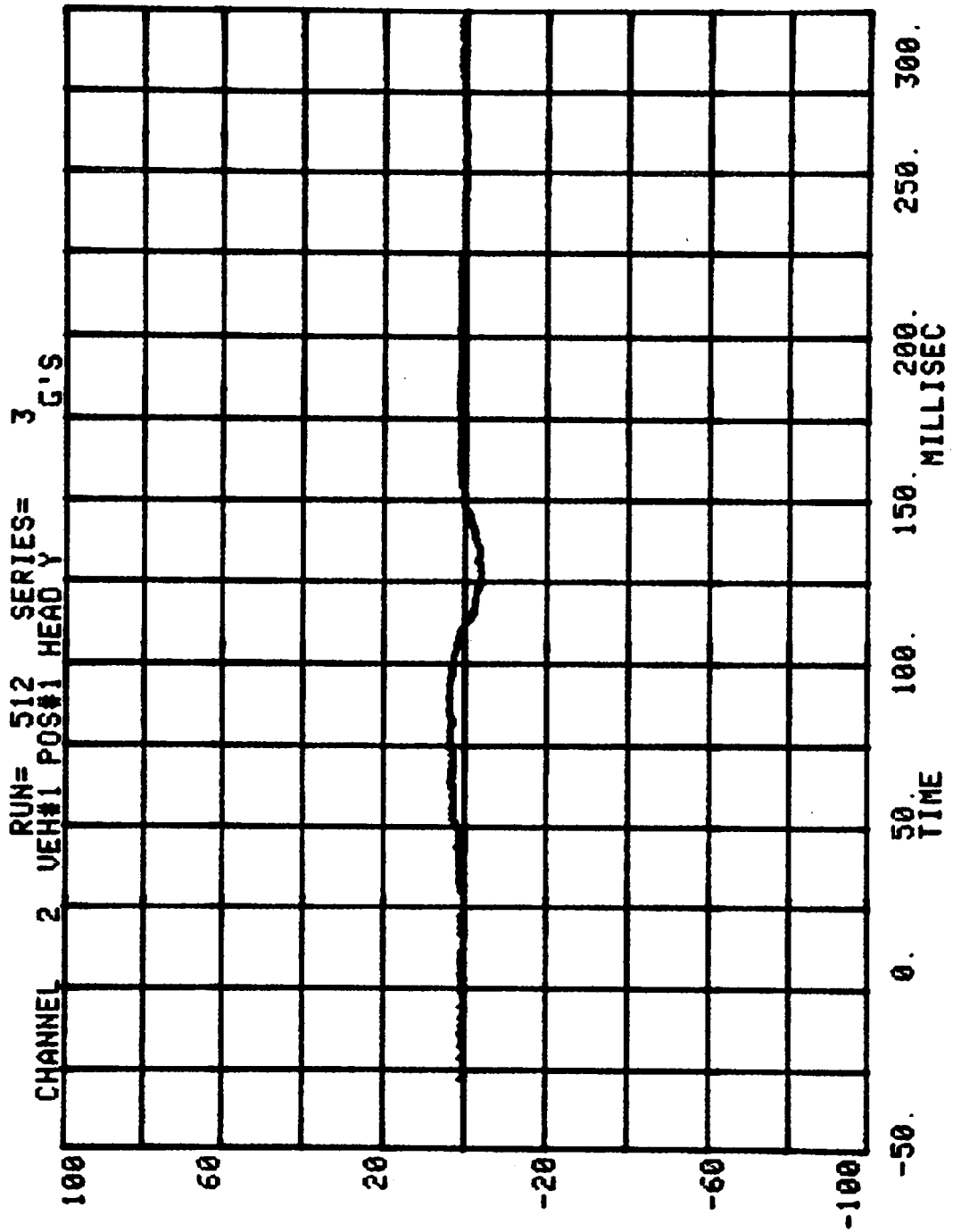
HIC= 145.2 FROM T1= .06240 TO T2= .14520

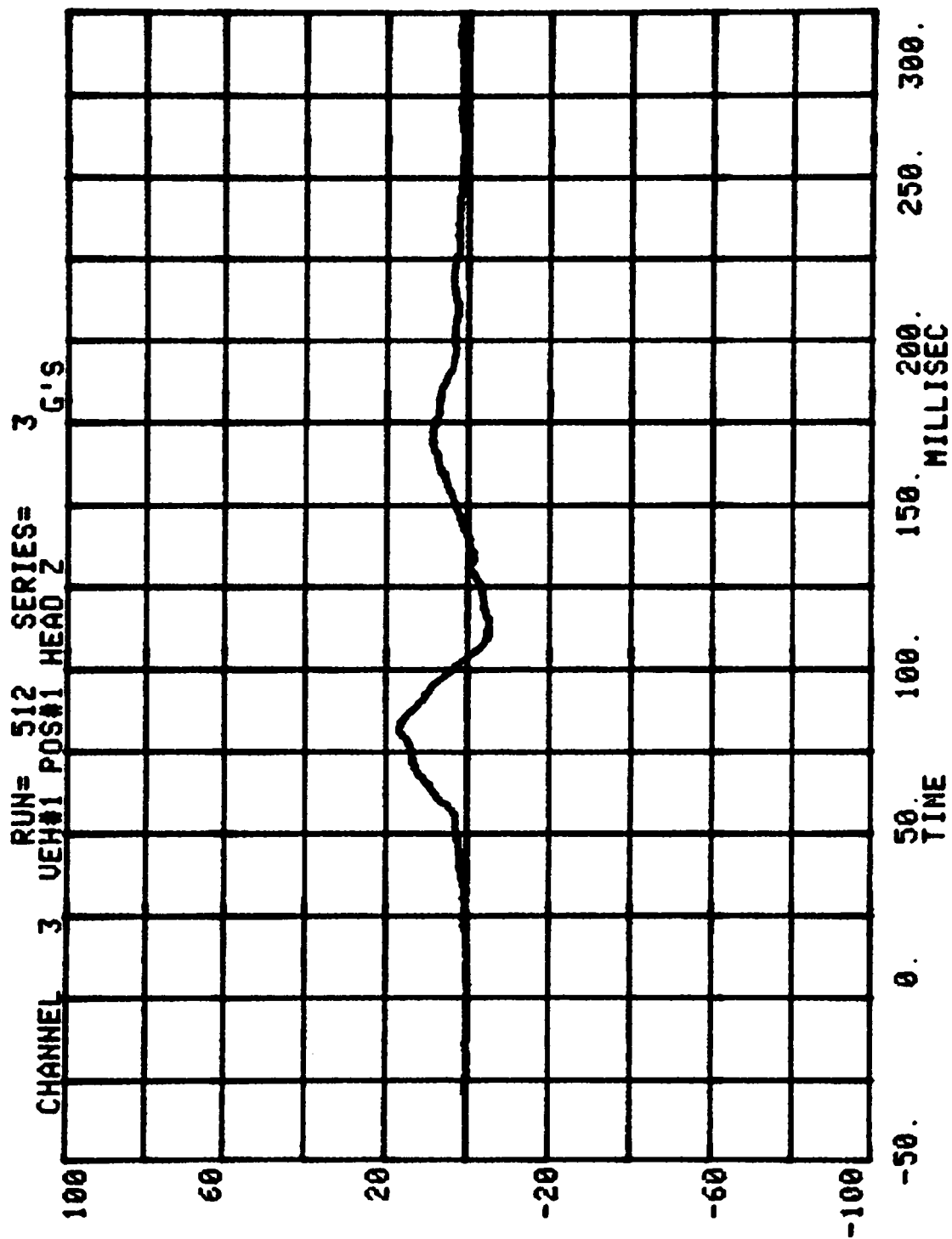
AVERAGE ACCELERATION BETWEEN T1 AND T2= 19.8G'S

EVENT TIME= 300.0 MSEC

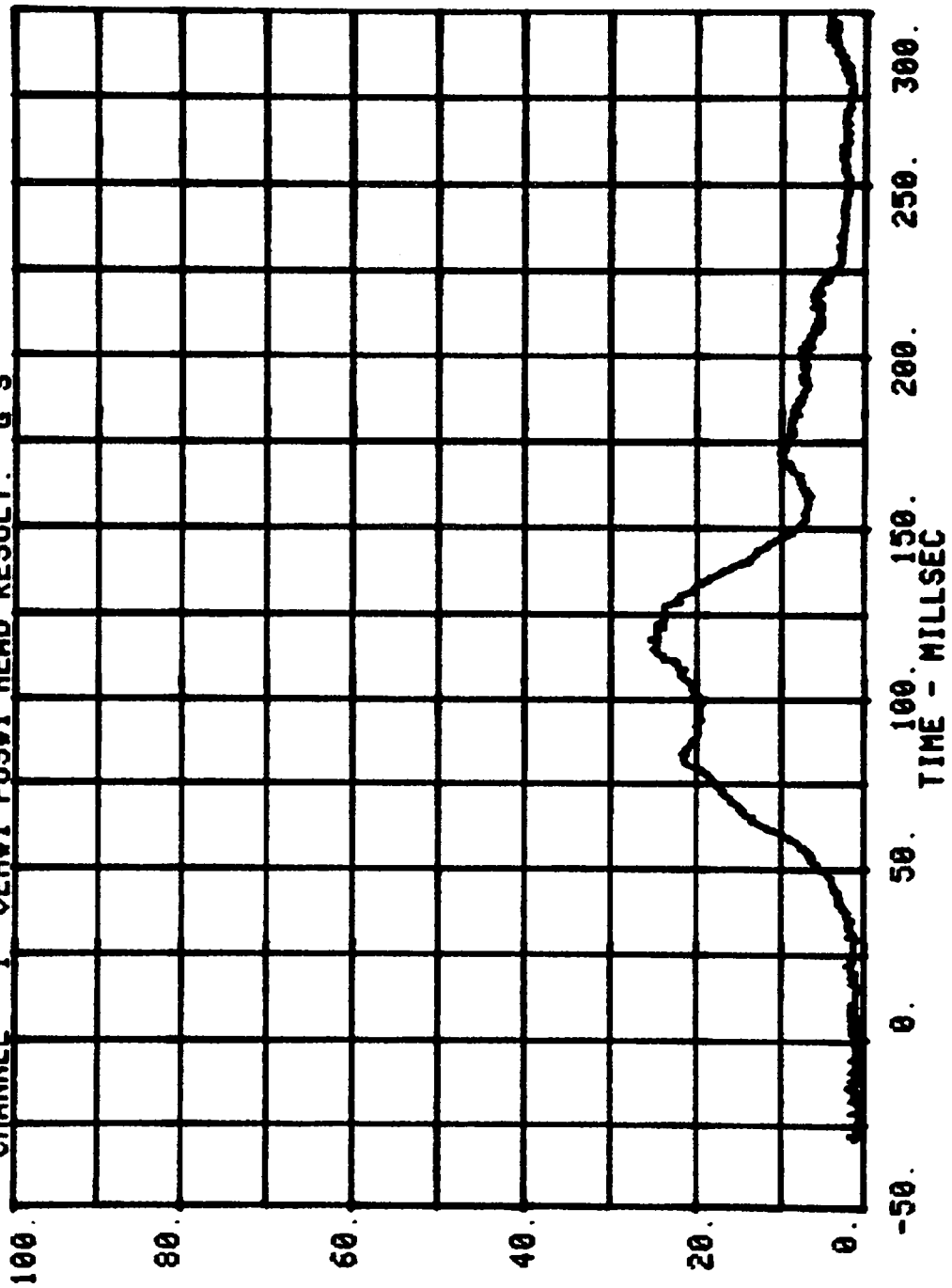
SEVERITY INDEX= 170.3

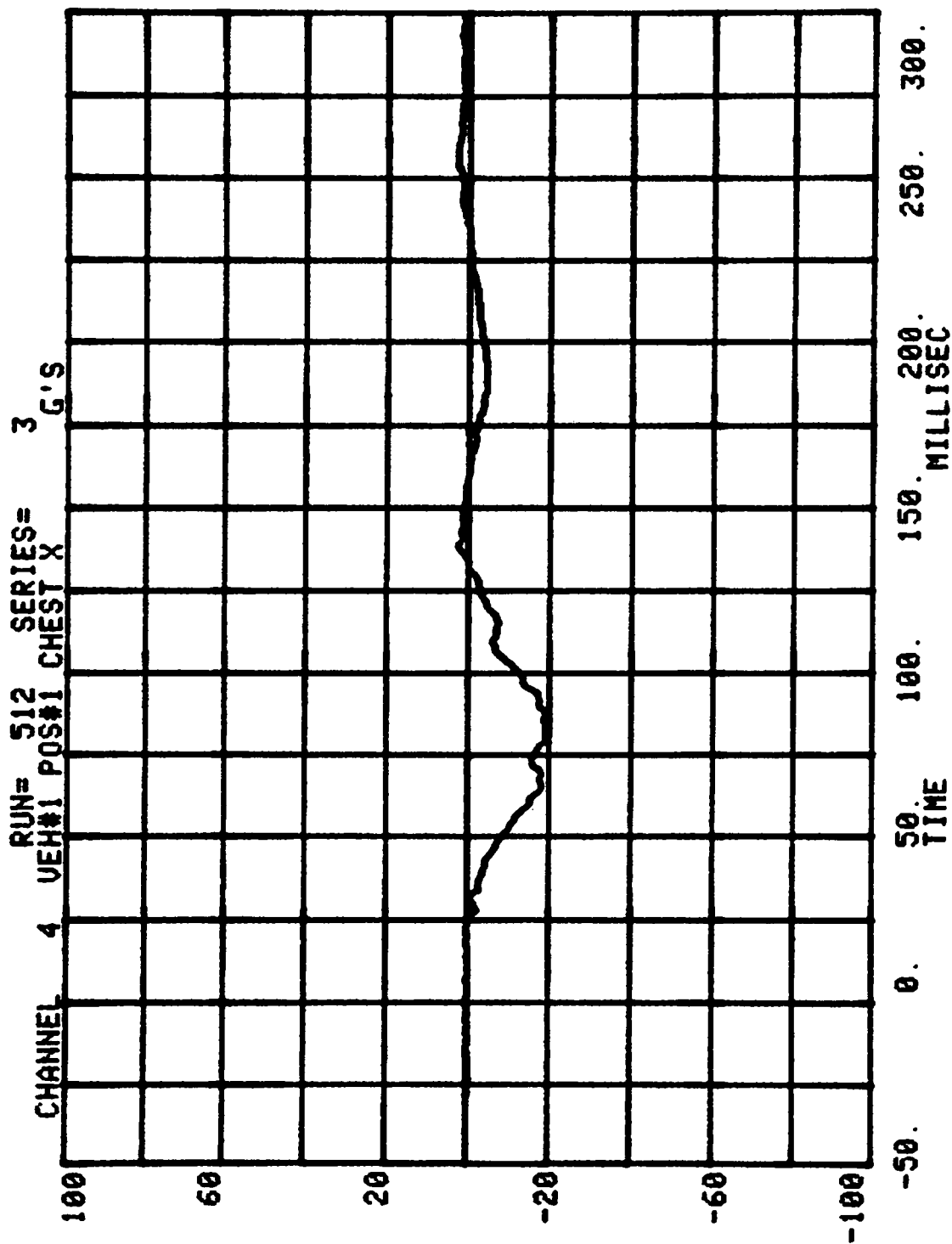


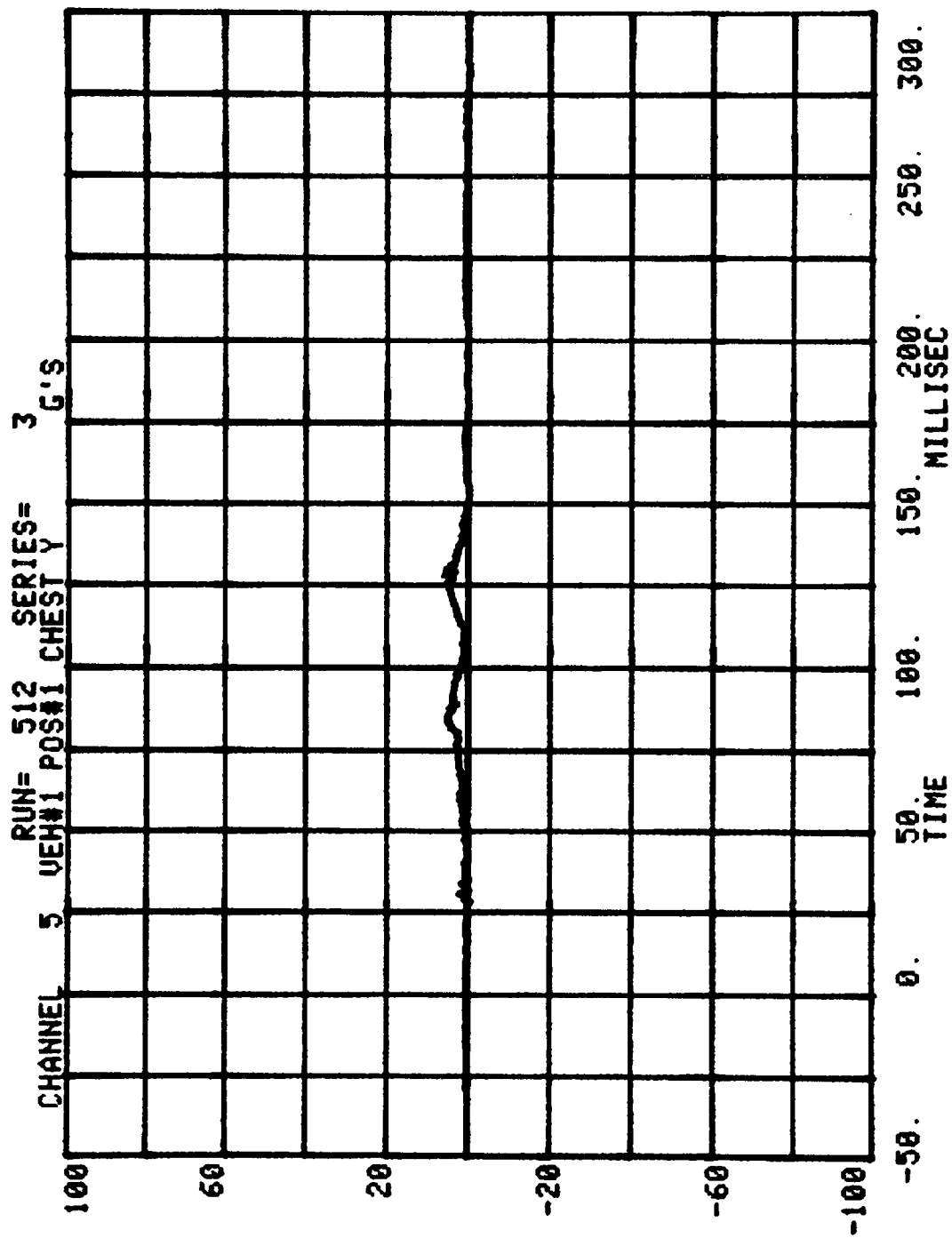


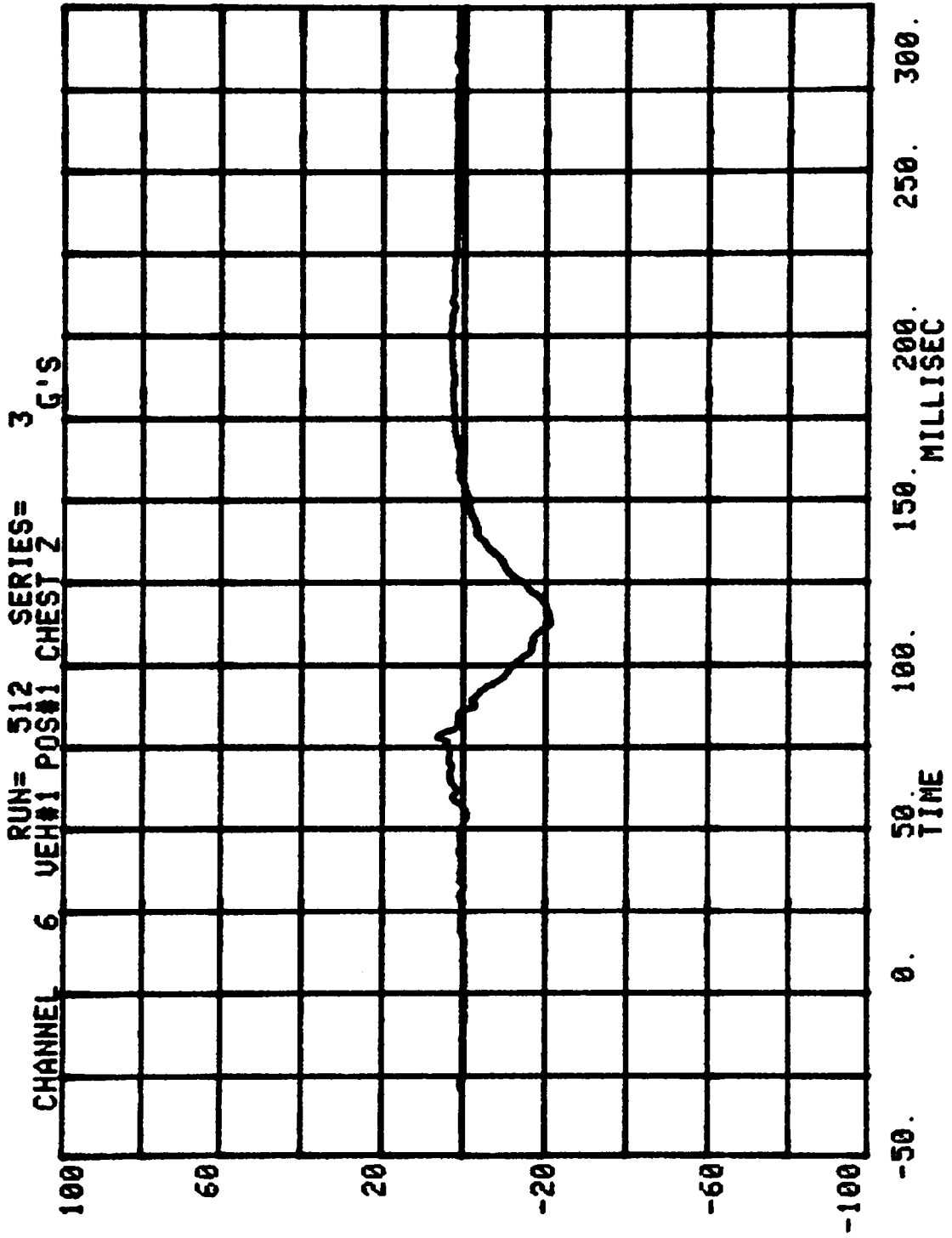


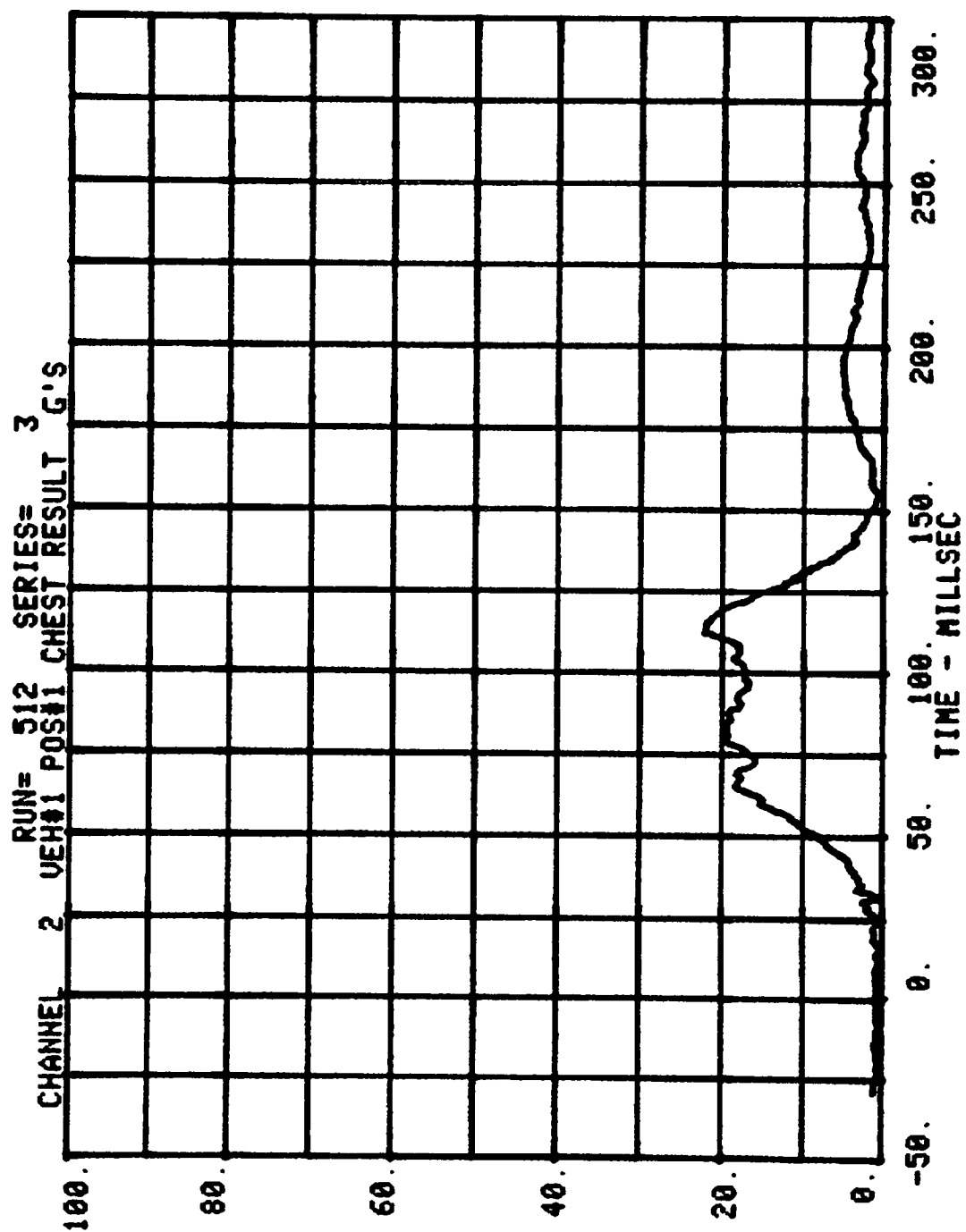
CHANNEL 1 RUN= 512 SERIES= 3
VEH#1 POS#1 HEAD RESULT. G'S

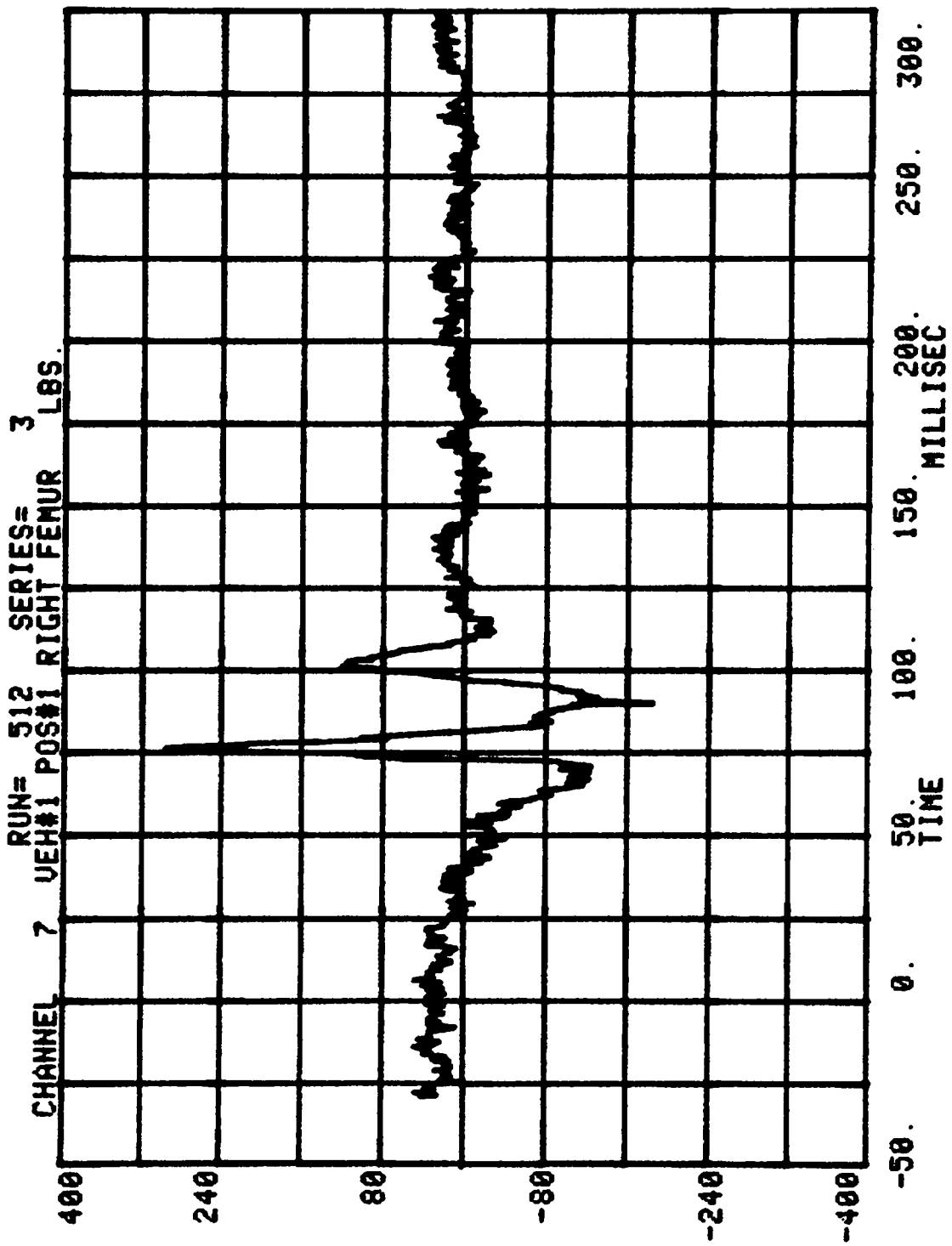


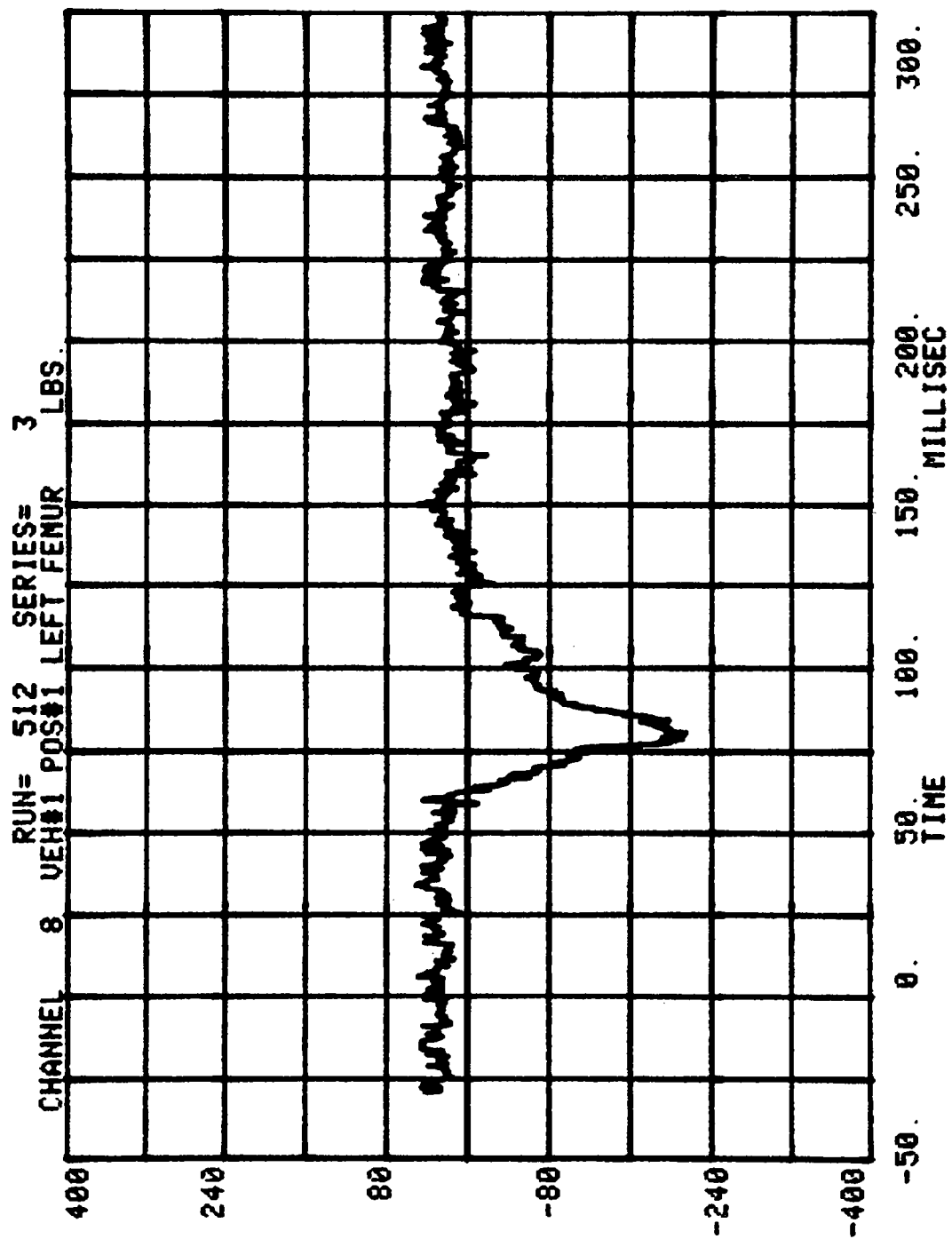


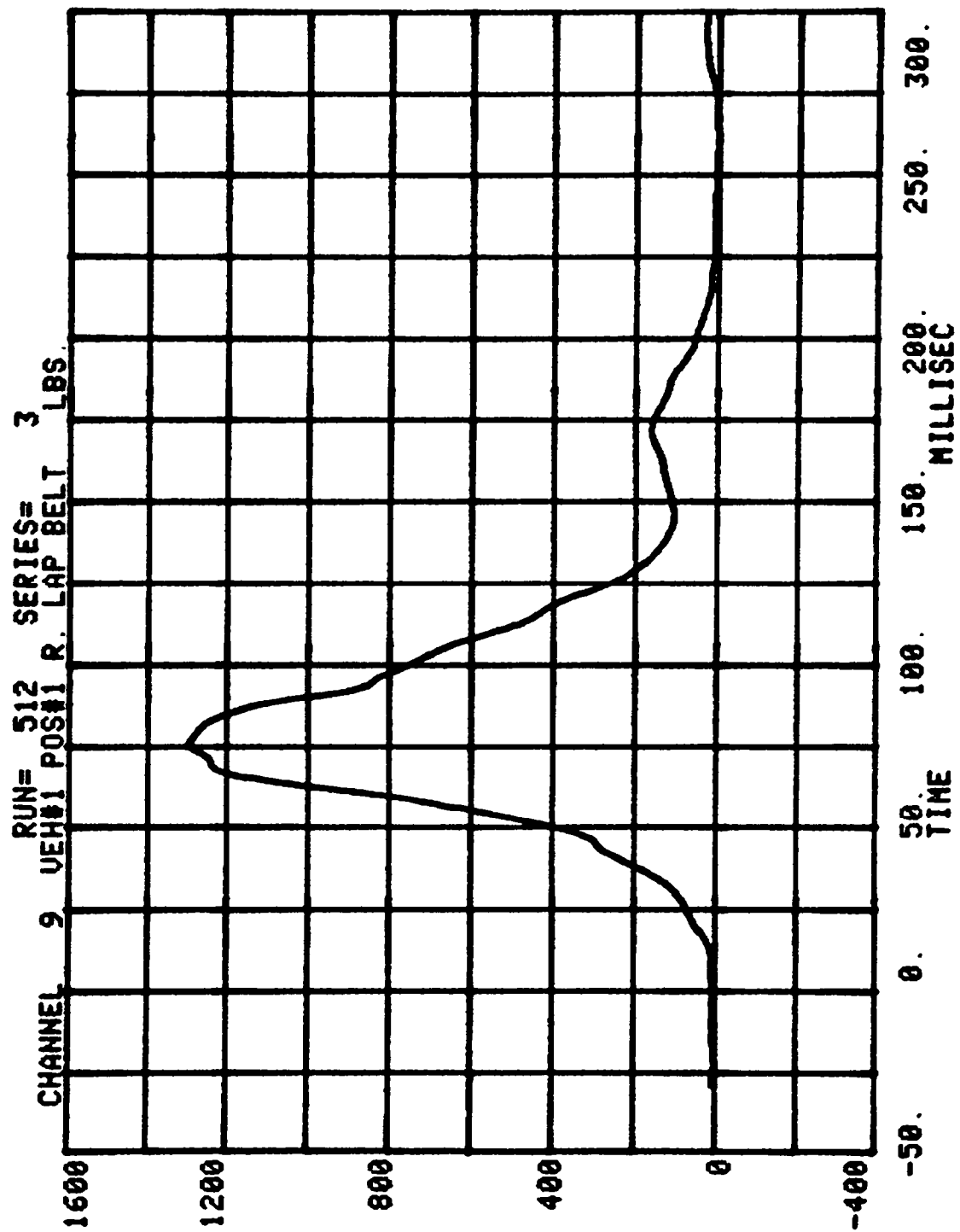


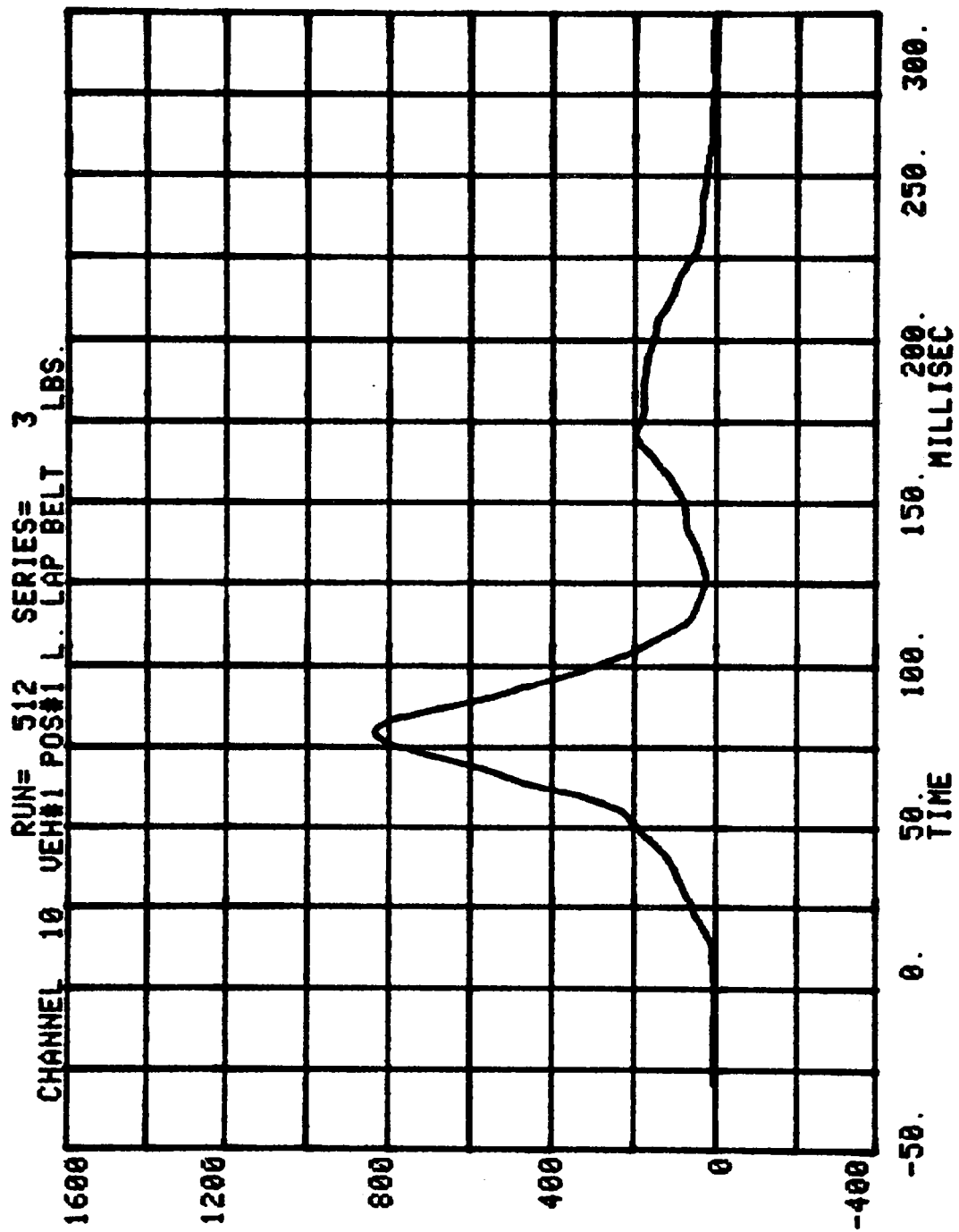


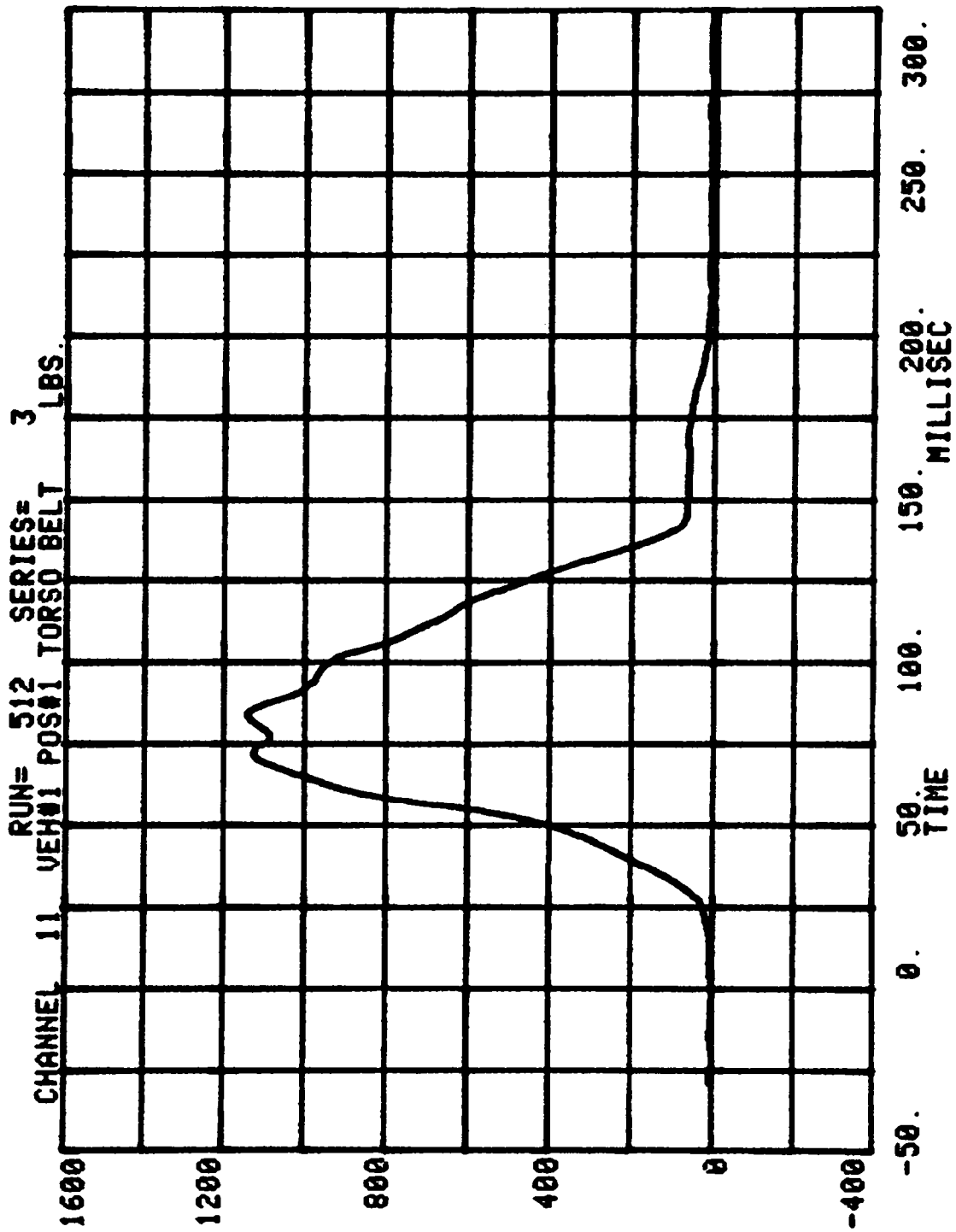












HEAD INJURY CRITERION
HEAD SEVERITY INDEX

VEHICLE AGGRESSIVENESS CAR-TO-CAR TEST #3

RUN= 512

VEH#1 POS#2 HEAD RESULT.

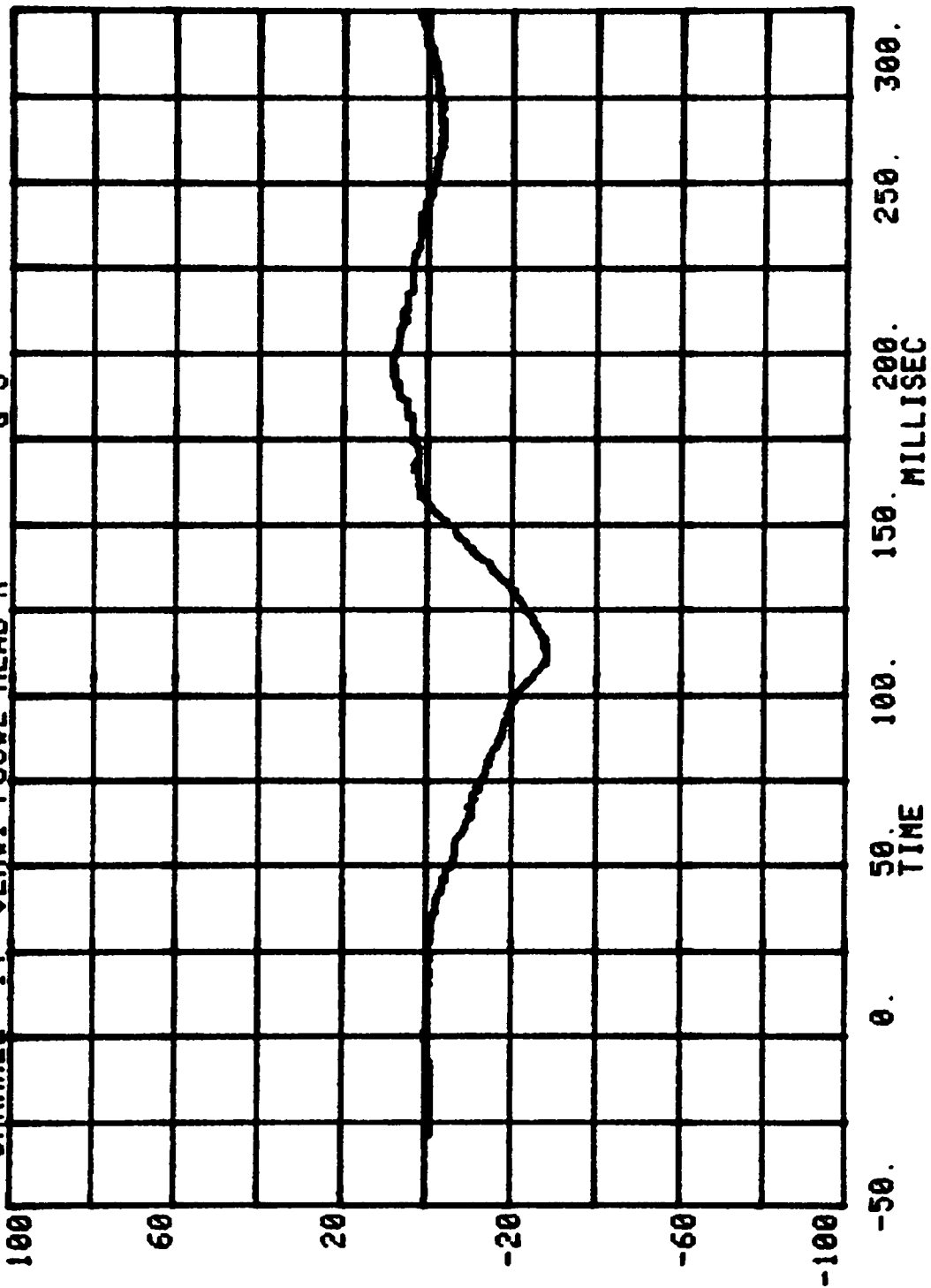
HIC= 180.7 FROM T1= .06540 TO T2= .14280

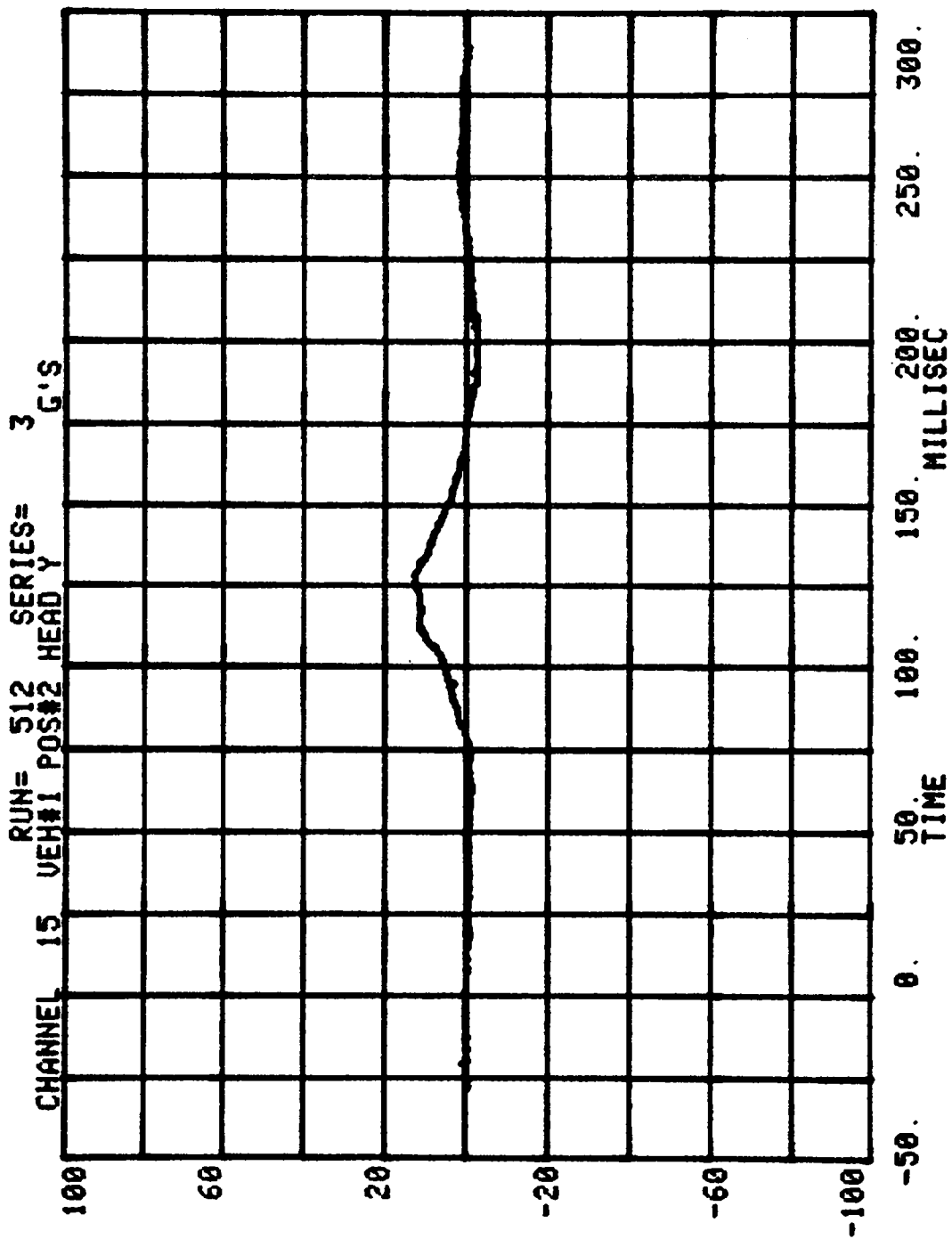
AVERAGE ACCELERATION BETWEEN T1 AND T2= 22.2G'S

EVENT TIME= 300.0 MSEC

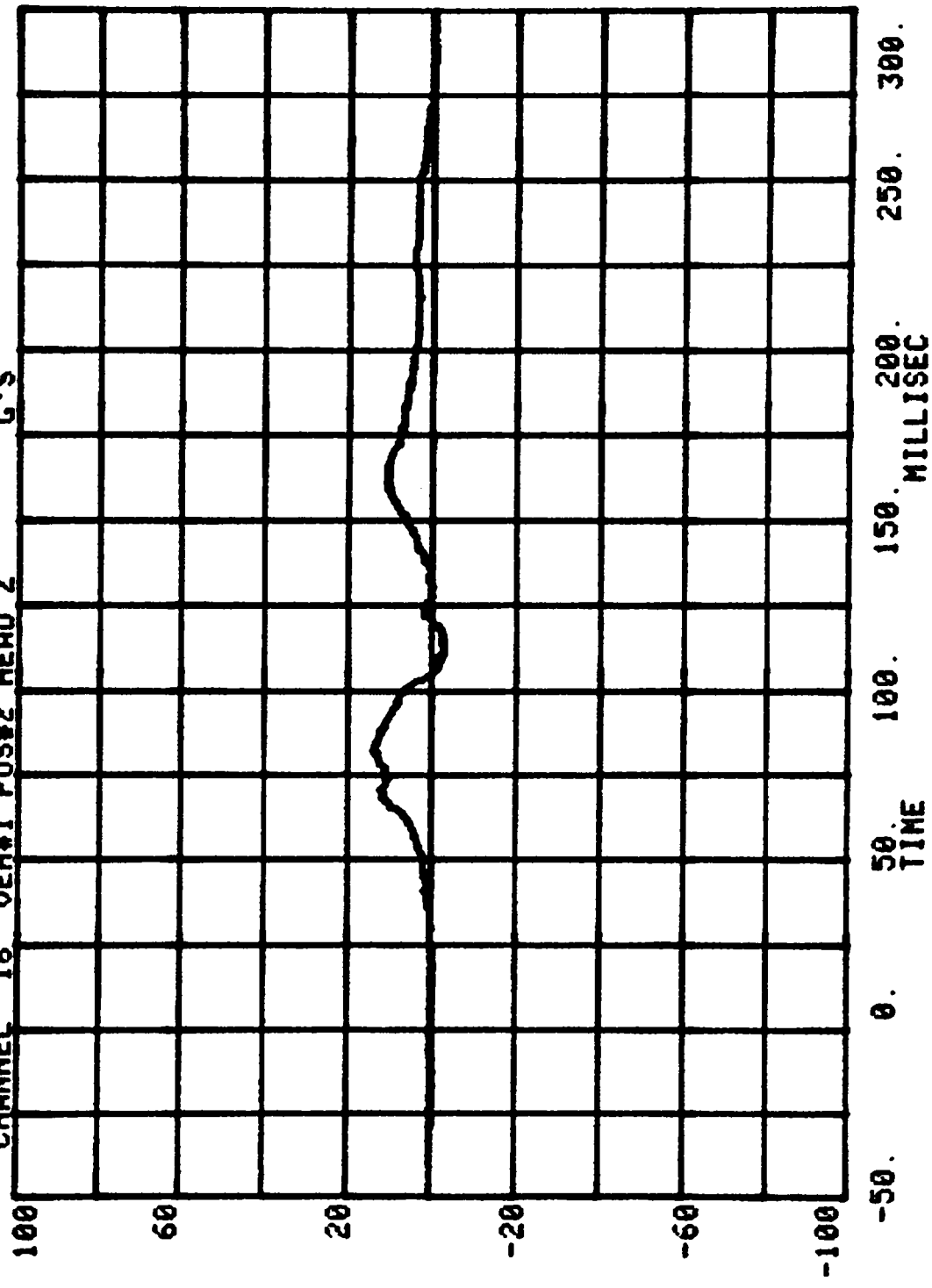
SEVERITY INDEX= 223.4

CHANNEL 14 VEH#1 POS#2 HEAD X 3 G'S

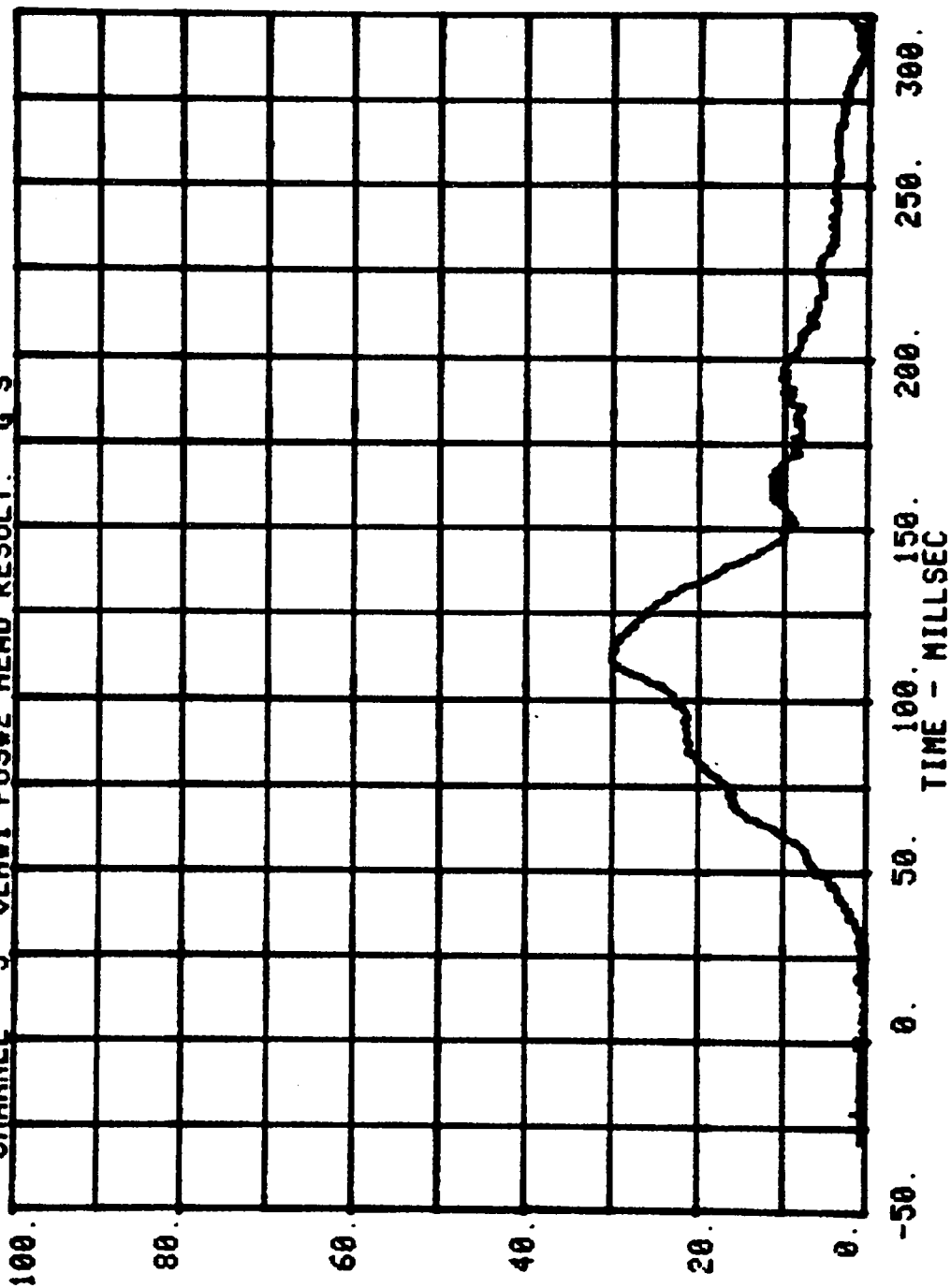


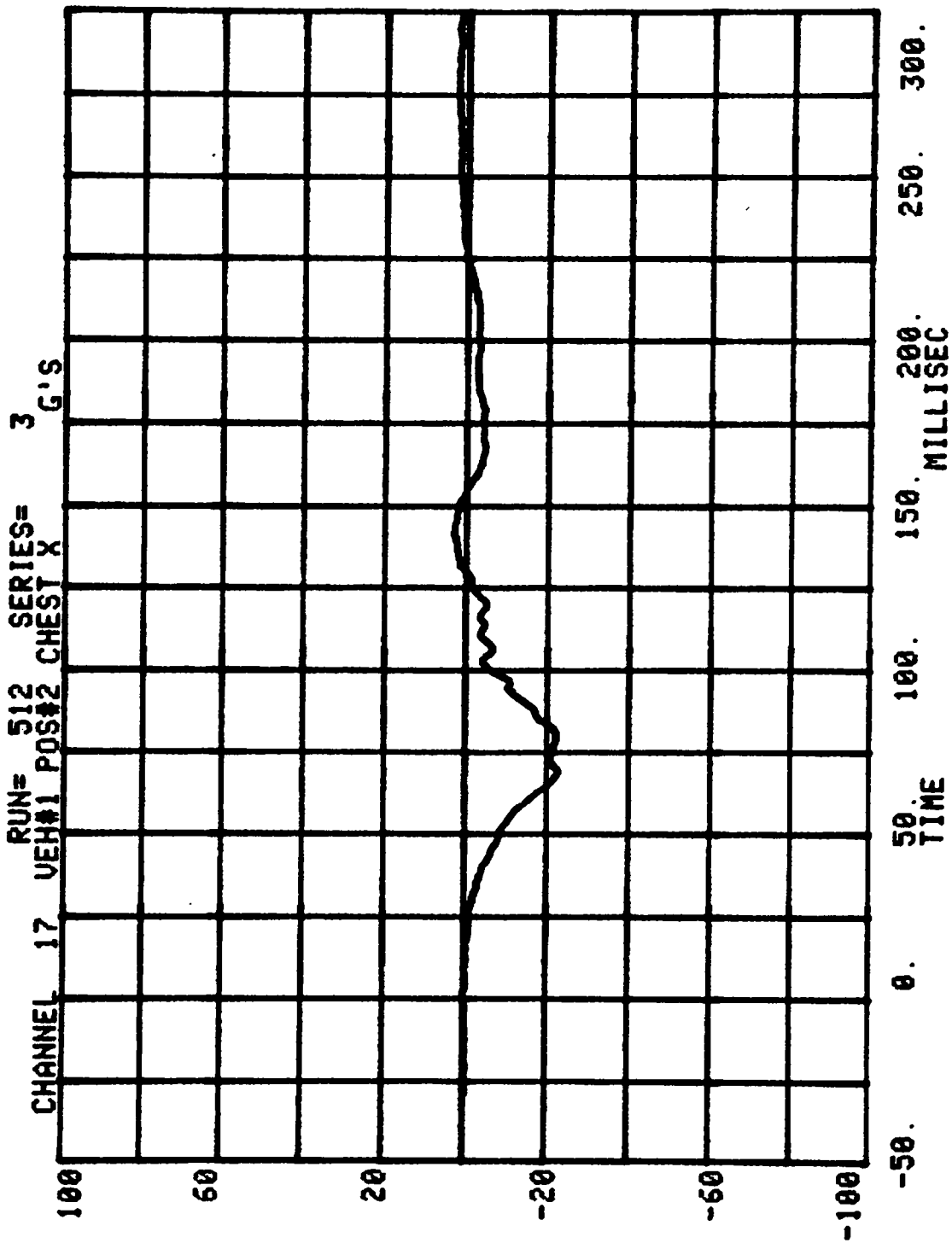


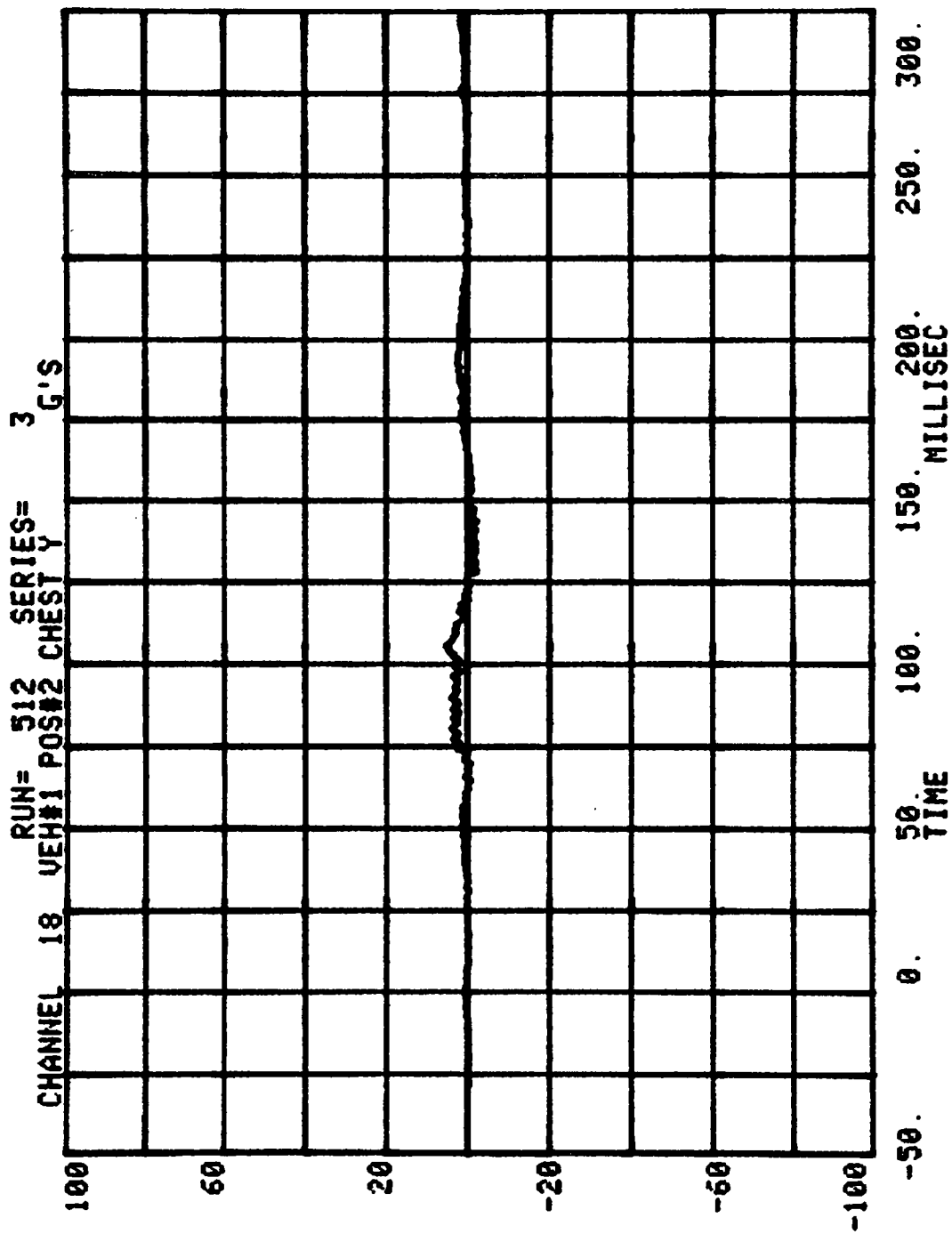
CHANNEL 16 RUN= 512 SERIES= 3
VEH#1 POS#2 HEAD Z G'S

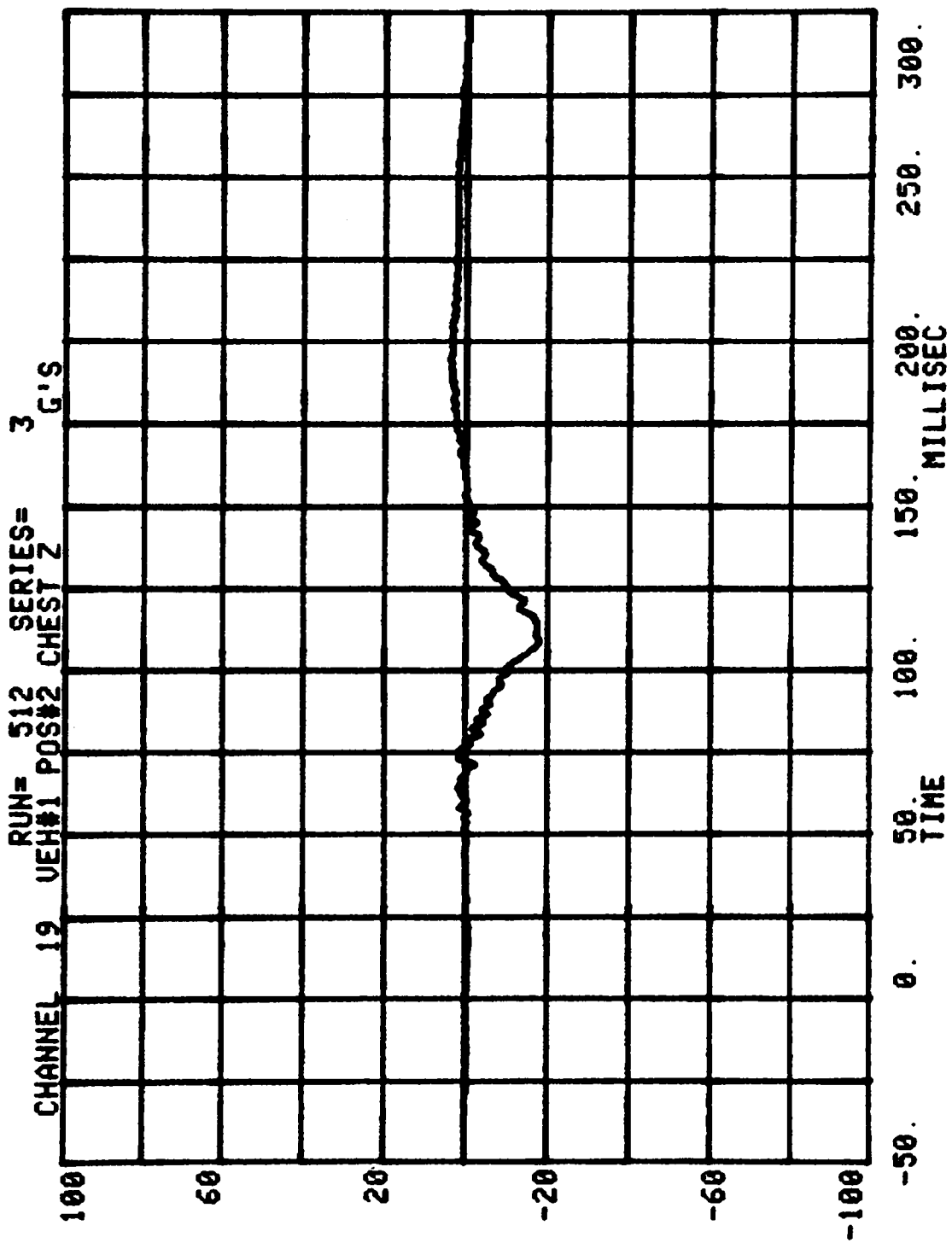


CHANNEL 3 RUN= 512 SERIES= 3
VEH#1 POS#2 HEAD RESULT. G'S

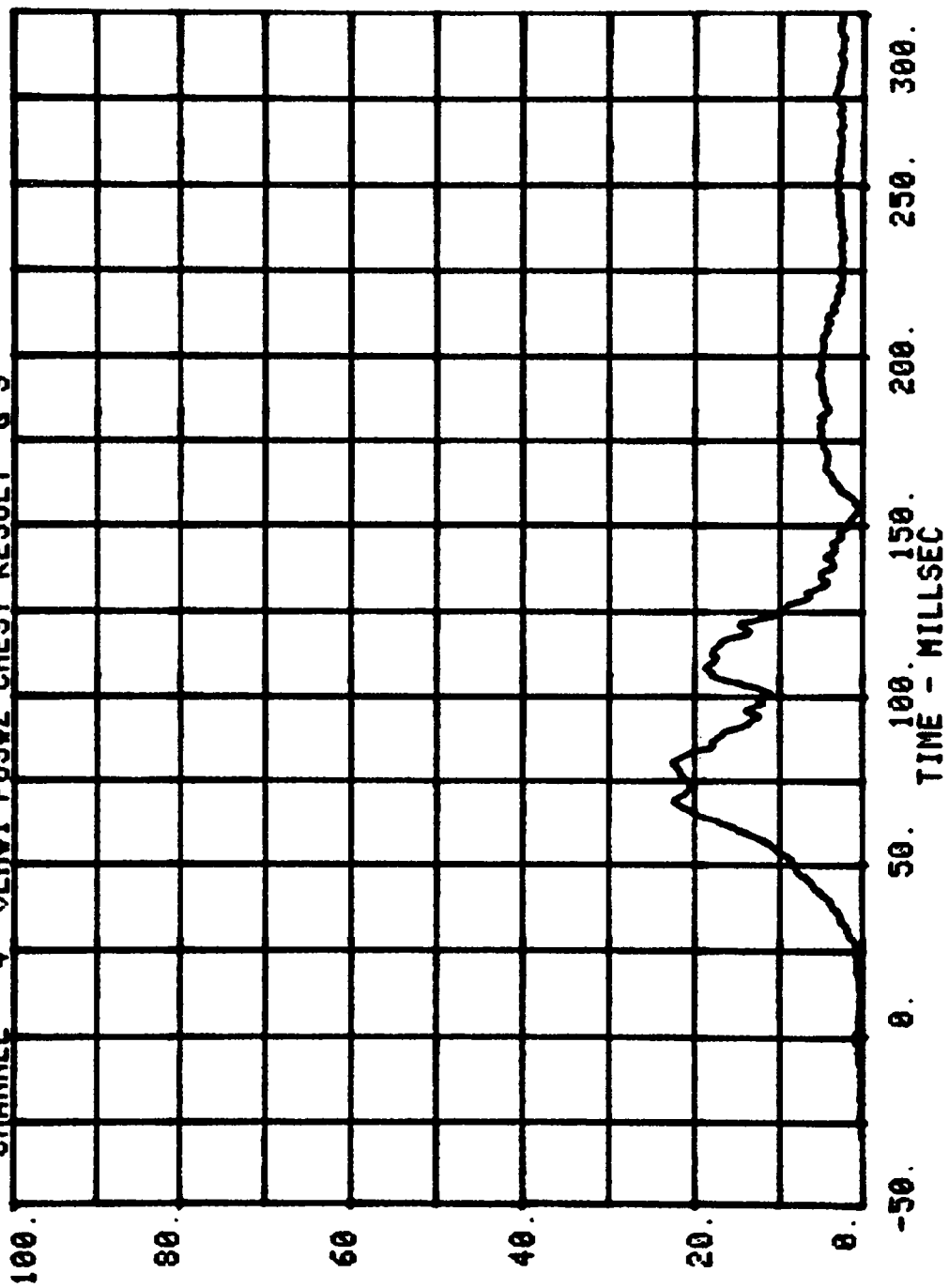


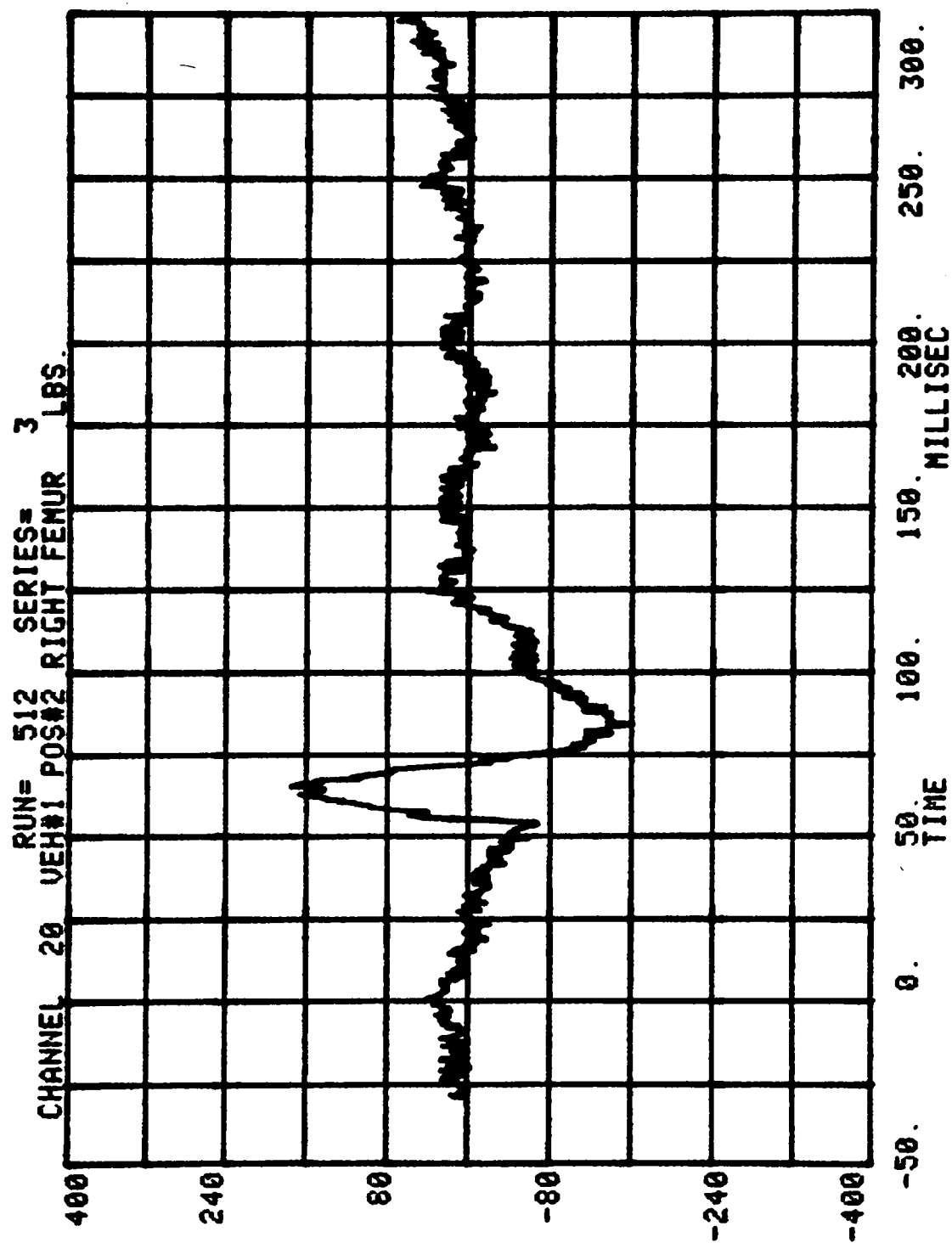


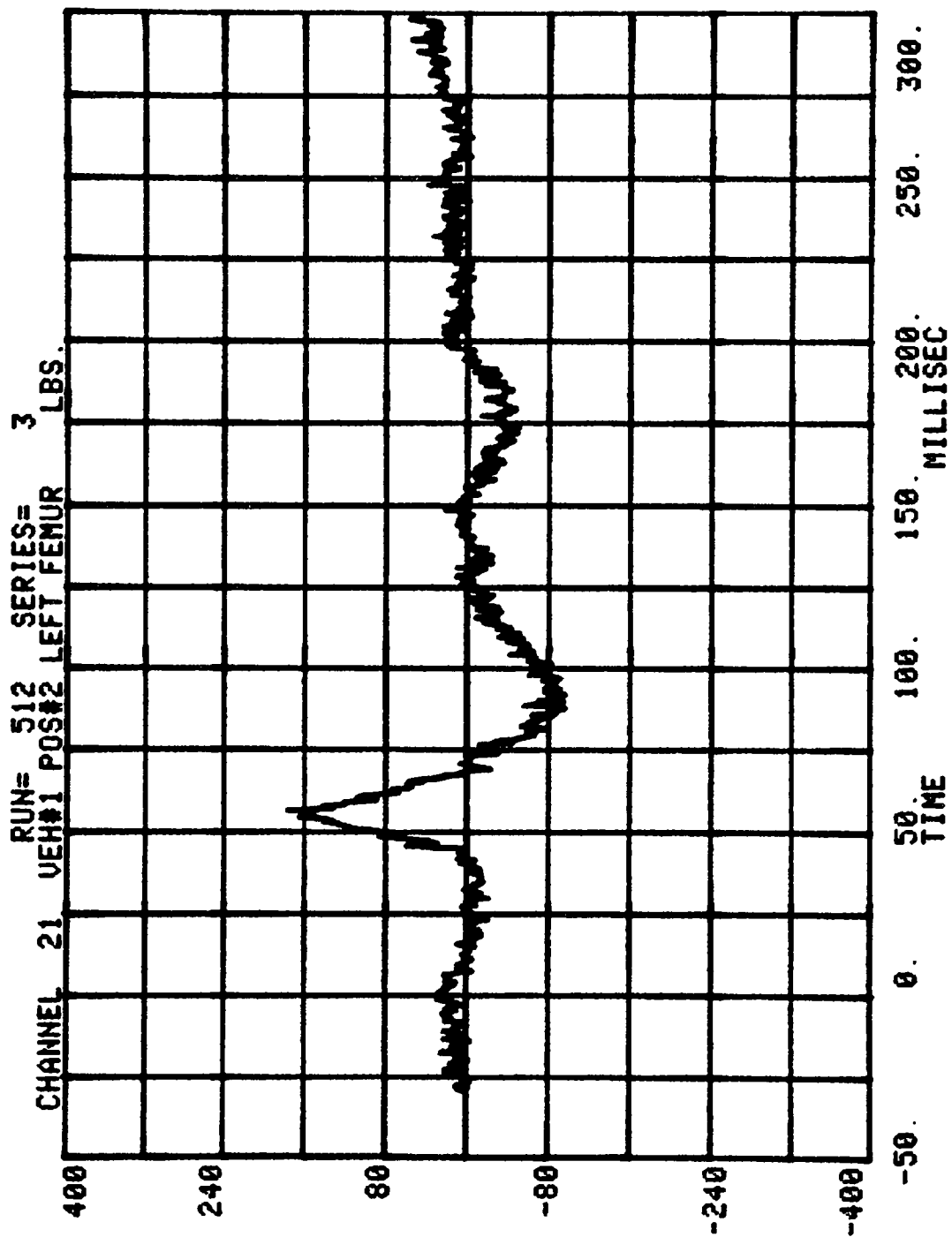




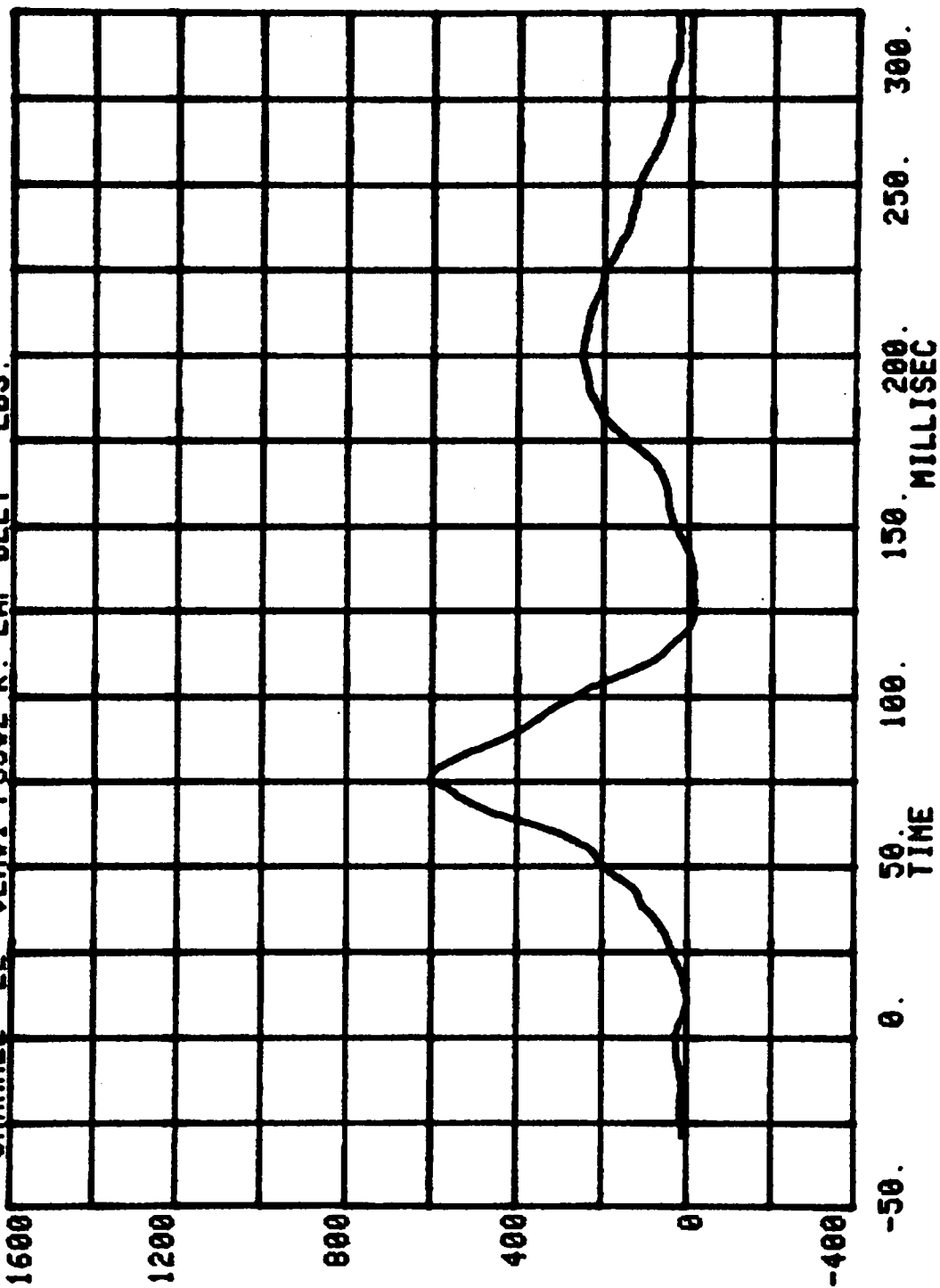
CHANNEL 4 RUN= 512 SERIES= 3
VEH#1 POS#2 CHEST RESULT G'S

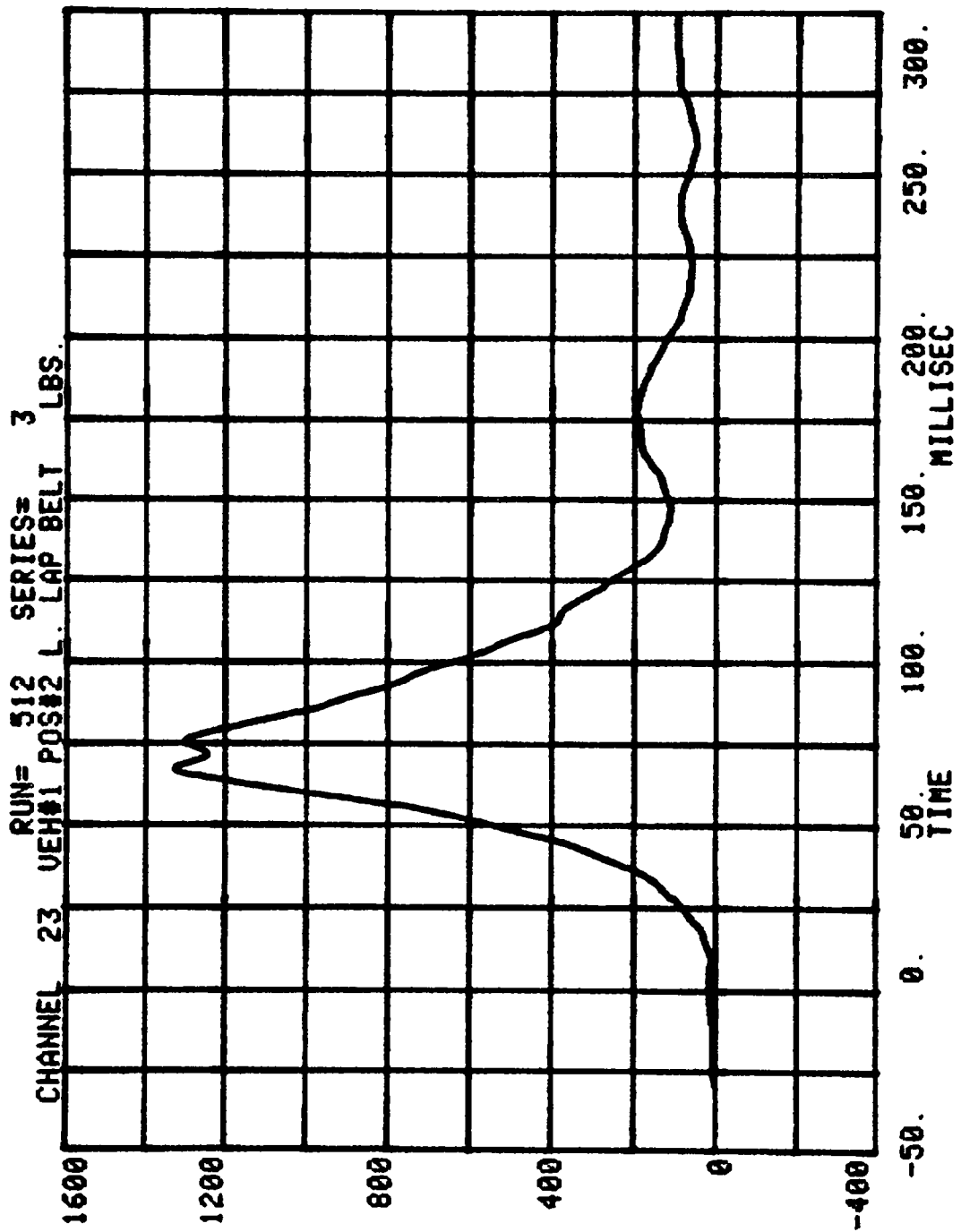




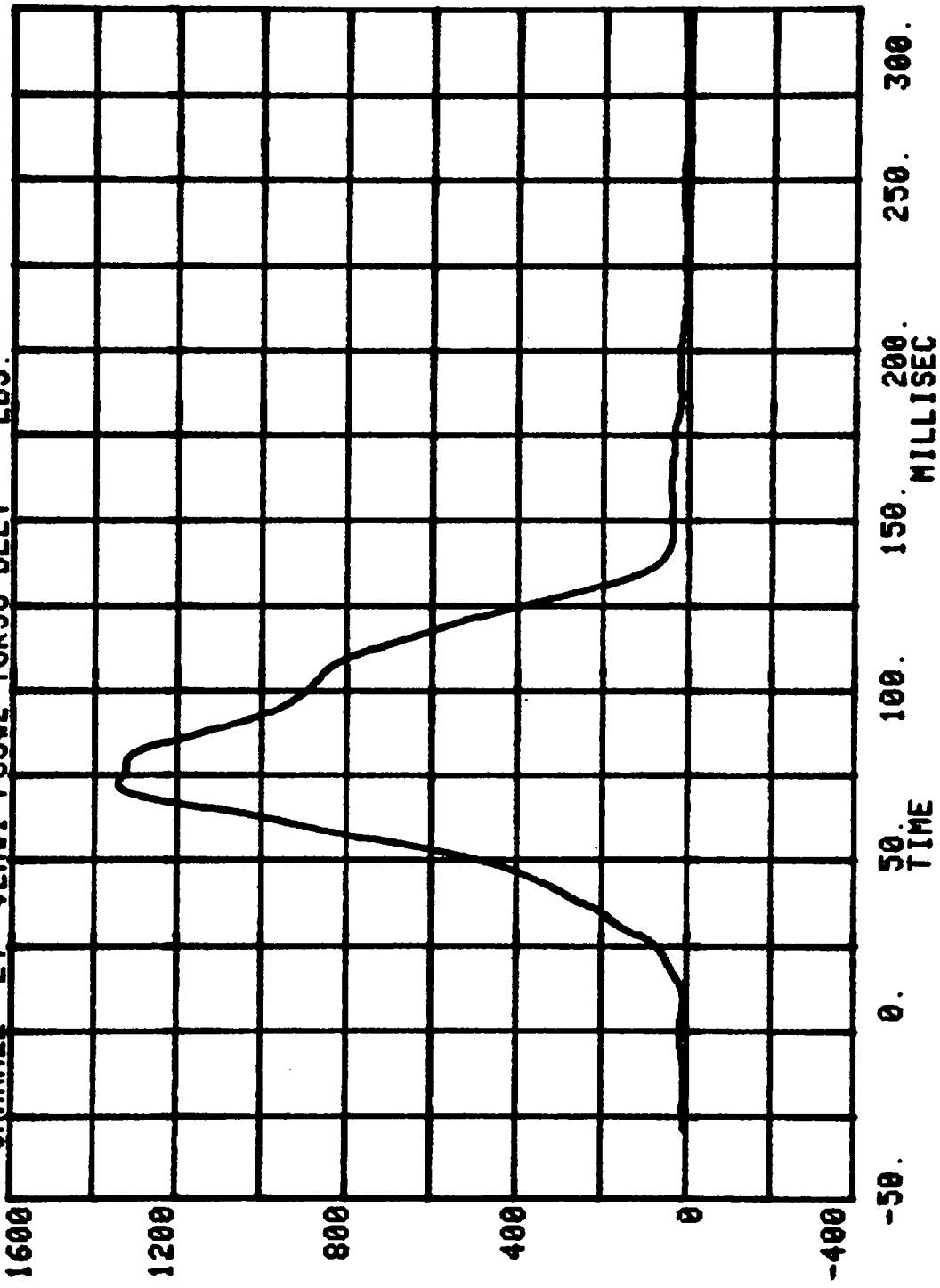


CHANNEL 22 RUN= 512 SERIES= 3
VEH#1 POS#2 R. LAP BELT LBS.





CHANNEL 24 VEH#1 POS#2 TORSO BELT 3 LBS.



Test No. 614-3-512

1980 VOLKSWAGEN RABBIT

VEHICLE NO. 2 DATA

FILTER CHANNEL CLASS

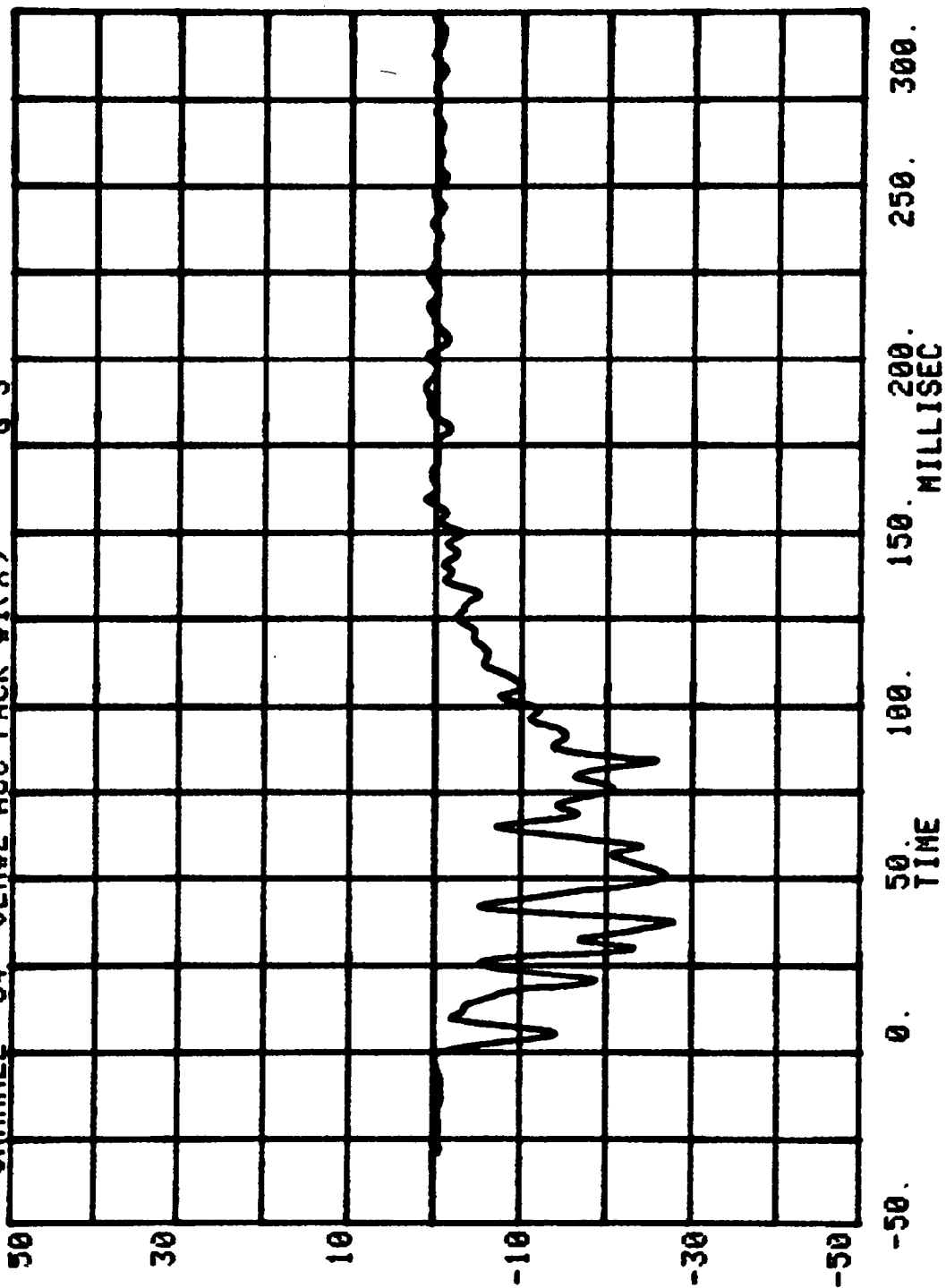
VEHICLE DATA

60

B-64

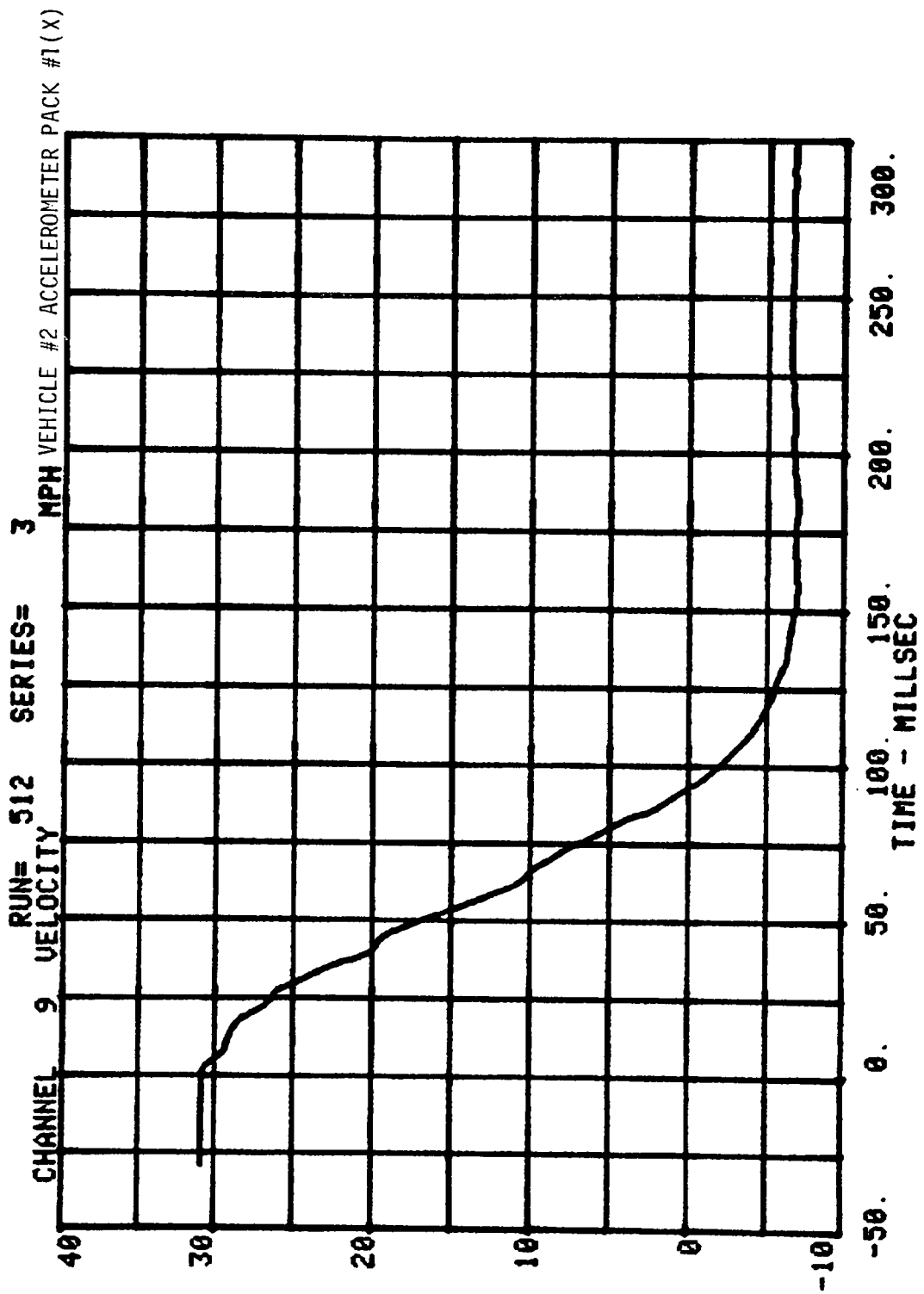
6707-V-3

CHANNEL 64 RUN= 512 SERIES= 3
VEH#2 ACC PACK #1(X) G'S

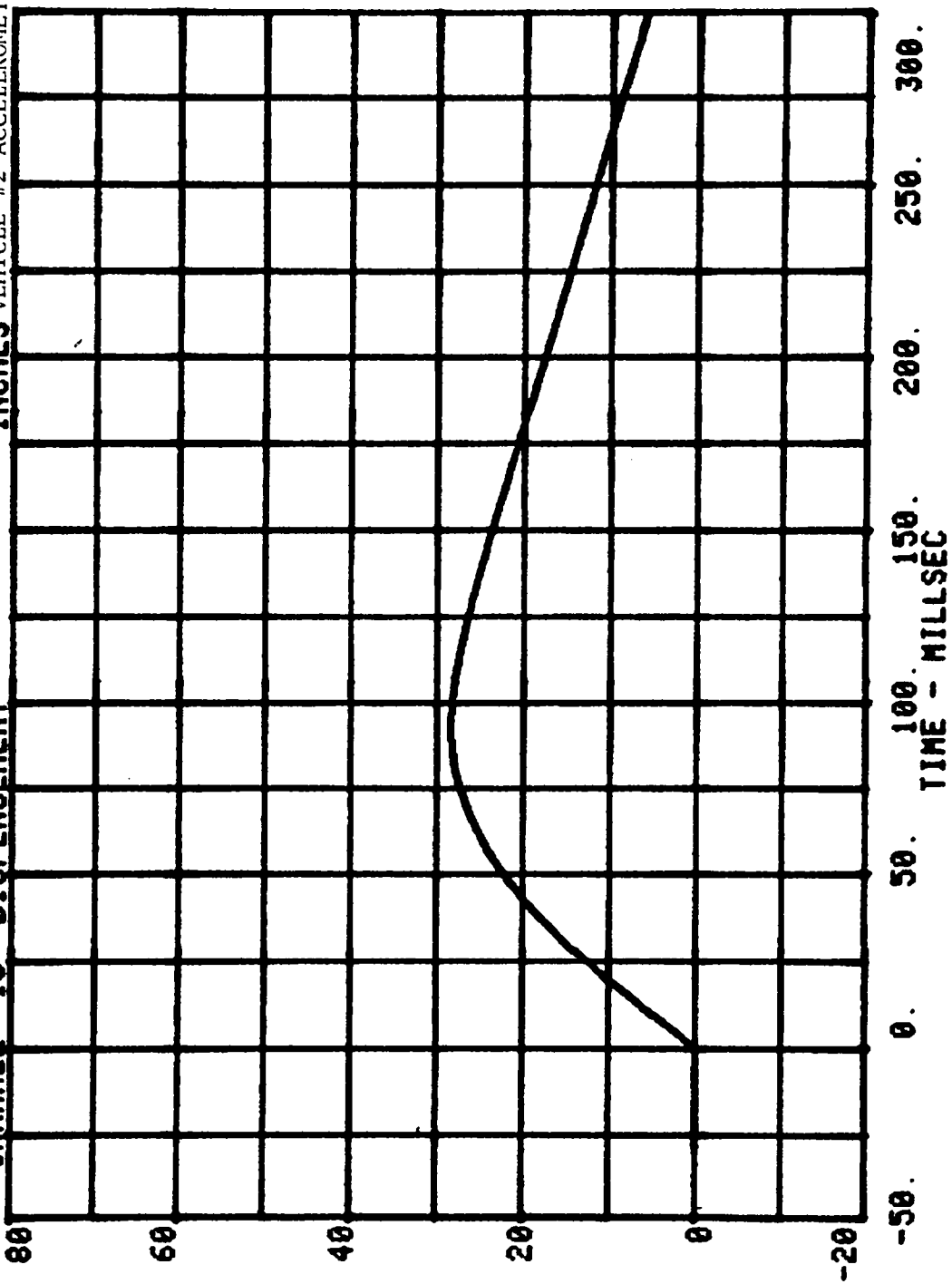


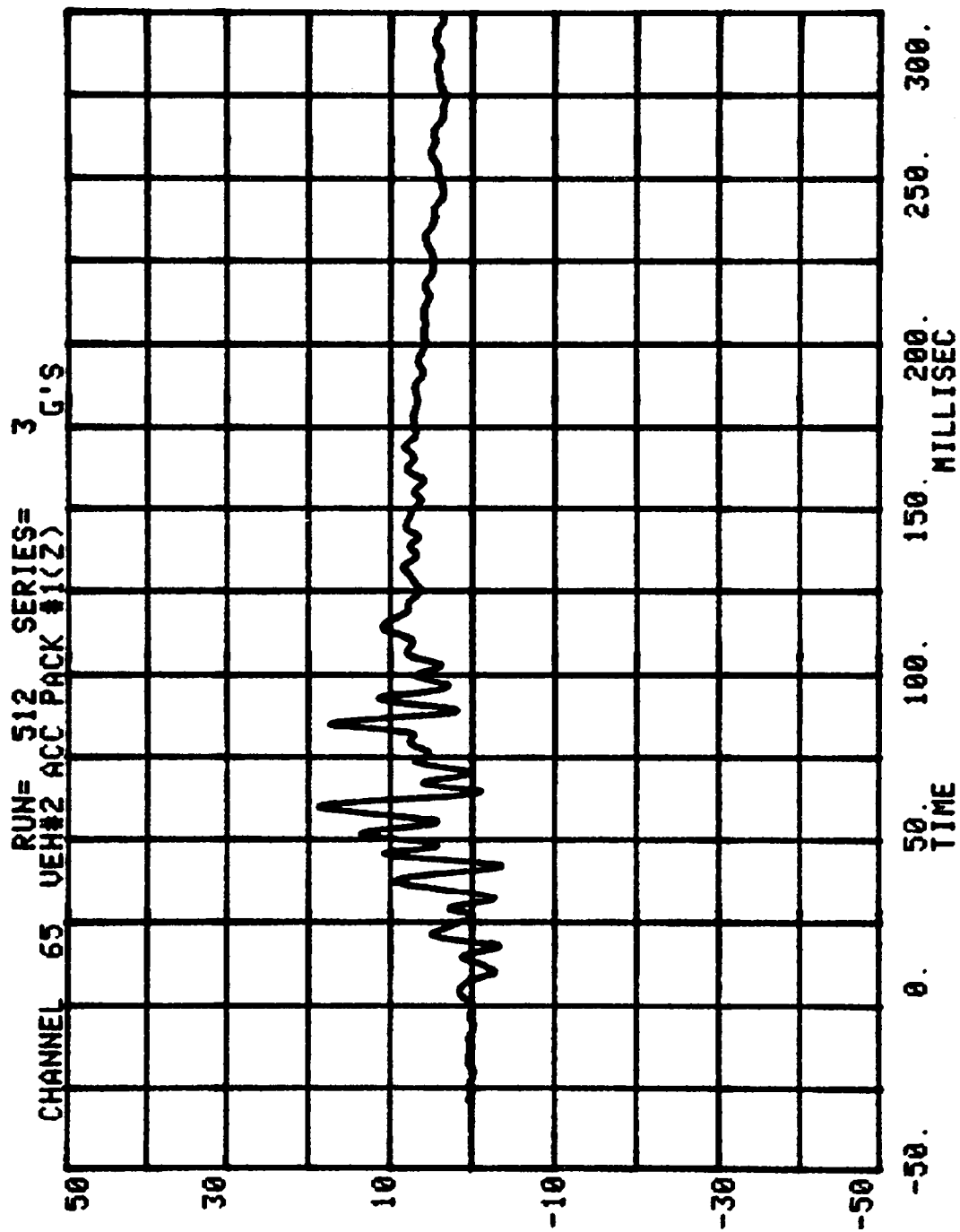
B-C5

6707-V-3

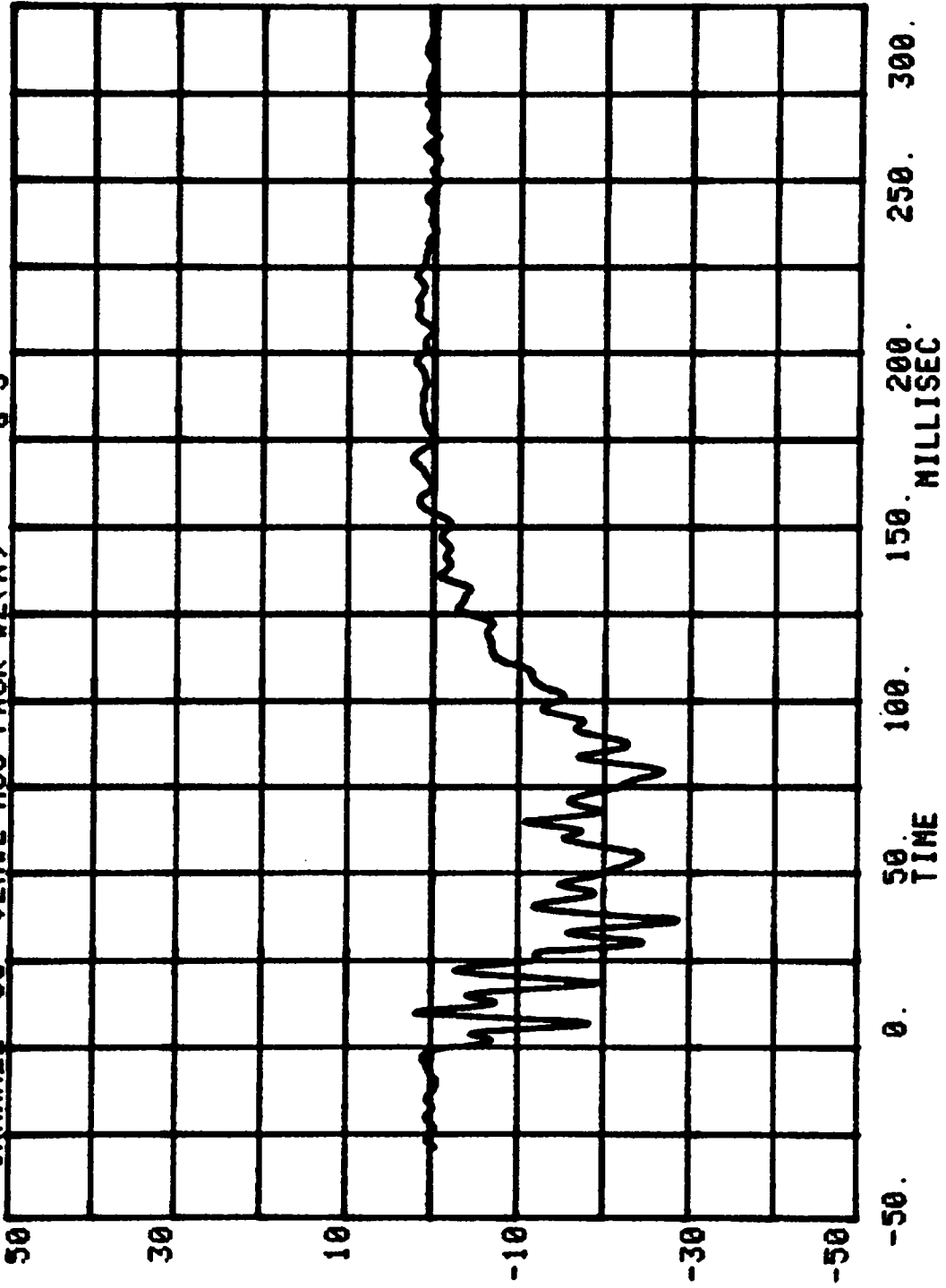


CHANNEL 10 DISPLACEMENT RUN= 312 SERIES= 3 INCHES VEHICLE #2 ACCELEROMETER PACK #1 (

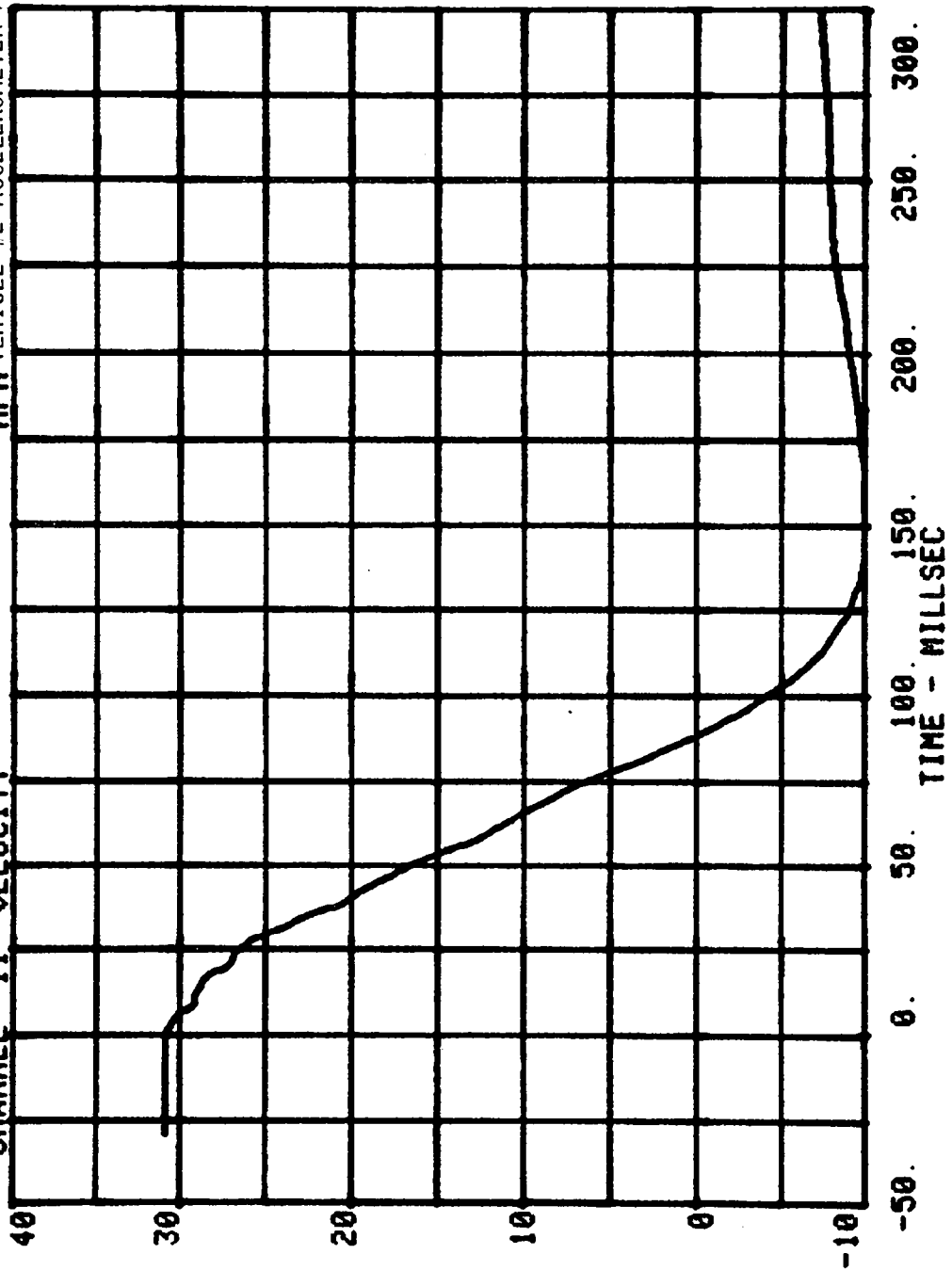




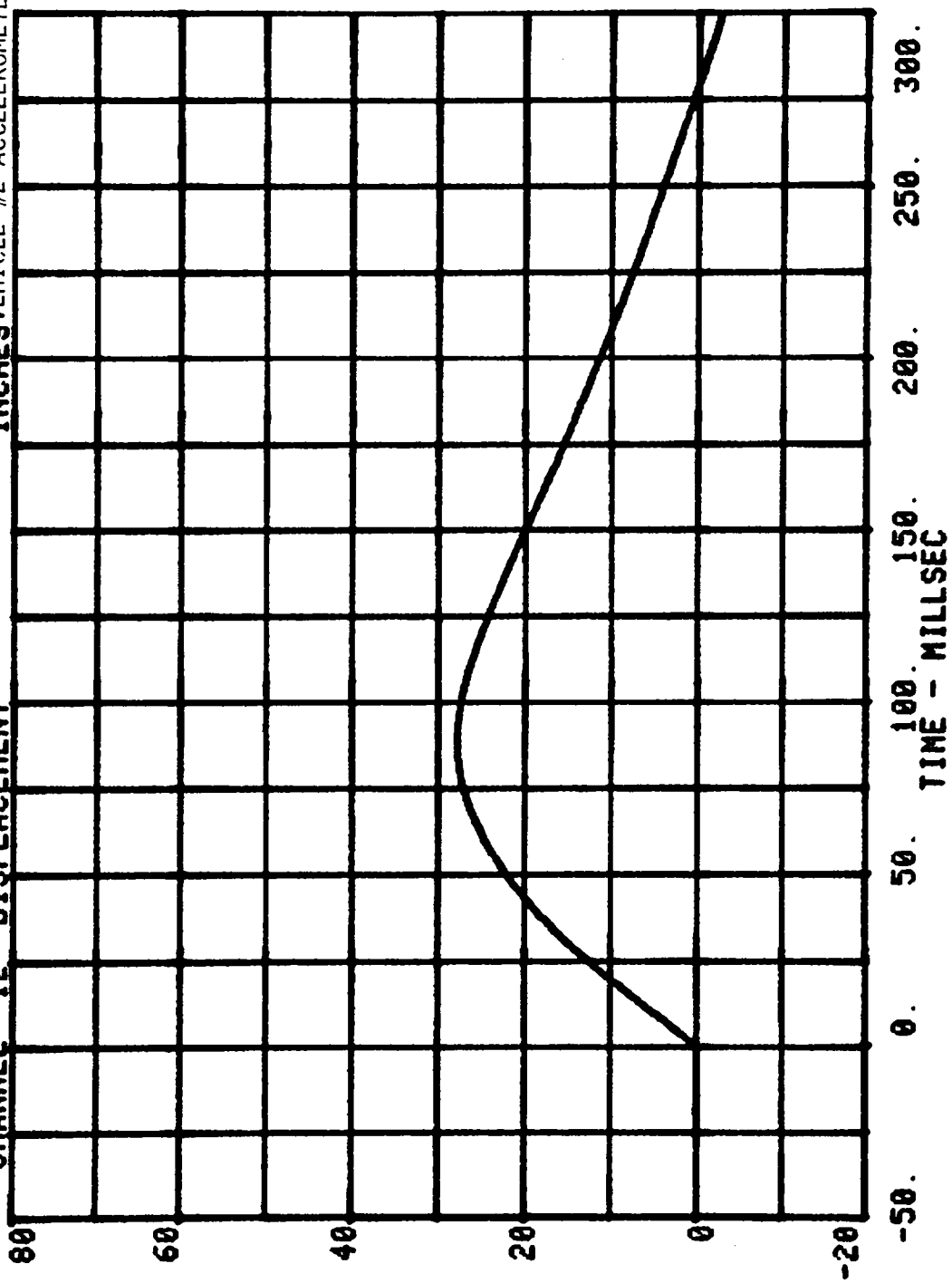
CHANNEL 66 RUN= 512 SERIES= 3
VEH#2 ACC PACK #2(X) G'S

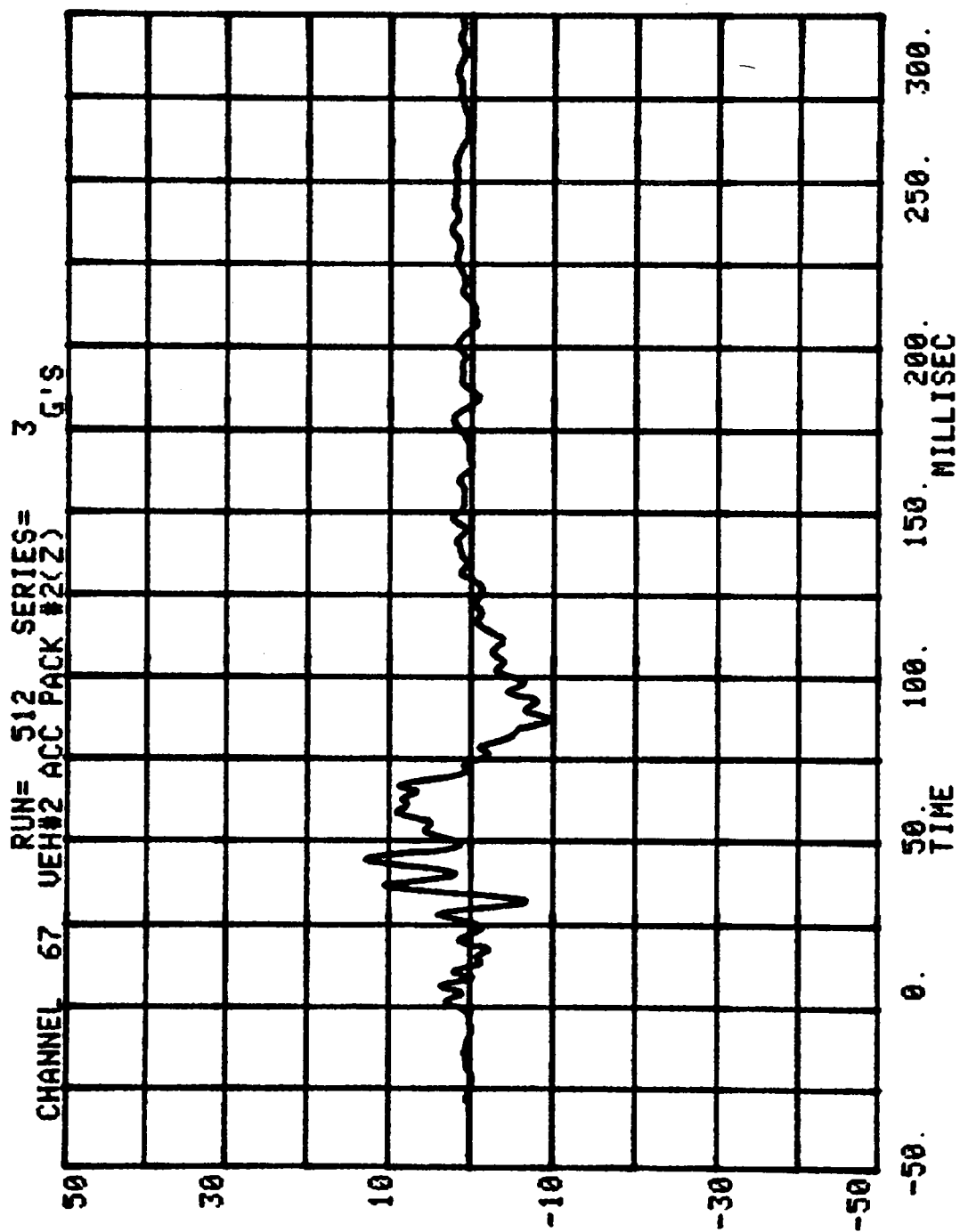


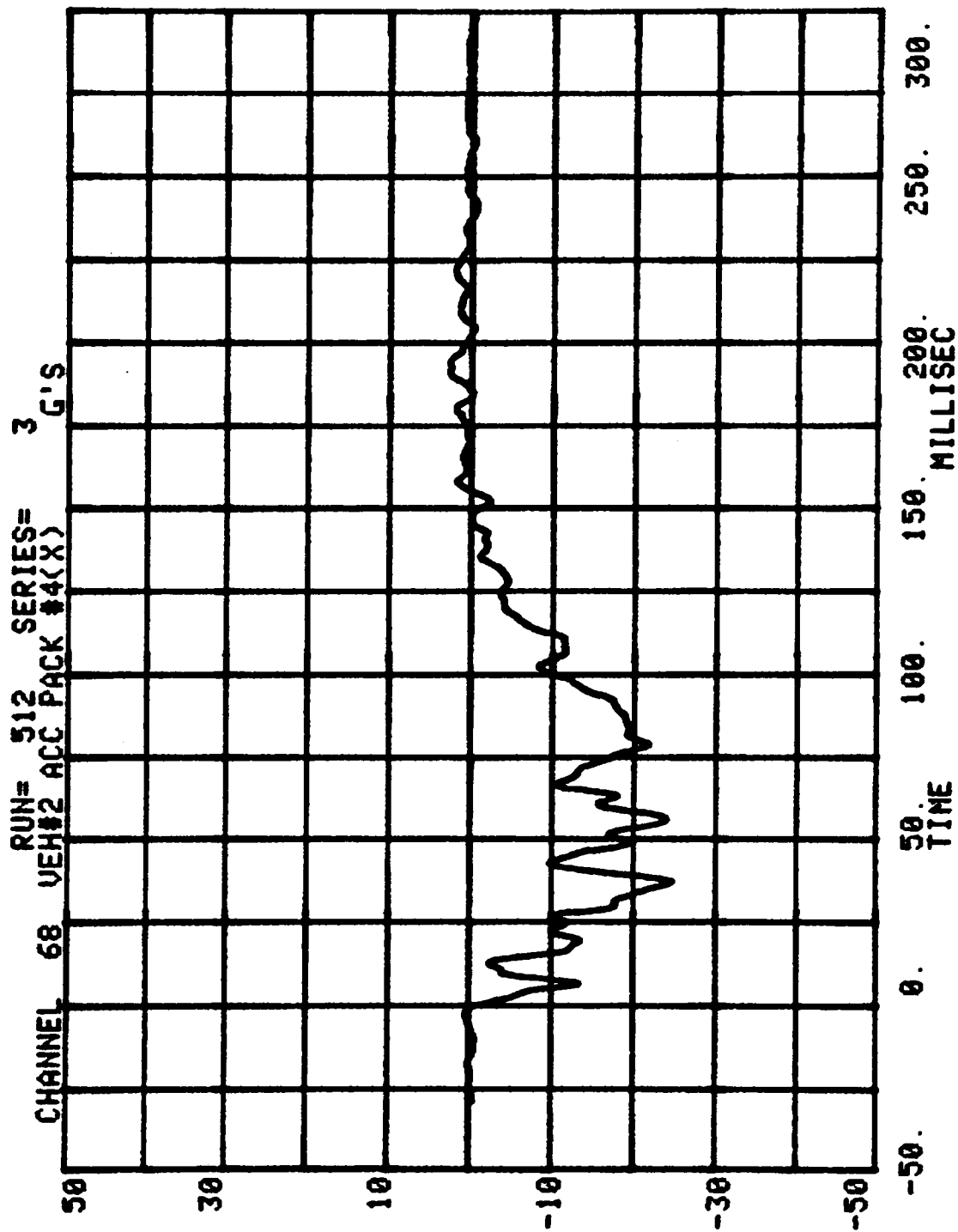
CHANNEL 11 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #2 ACCELEROMETER PACK #2(X)

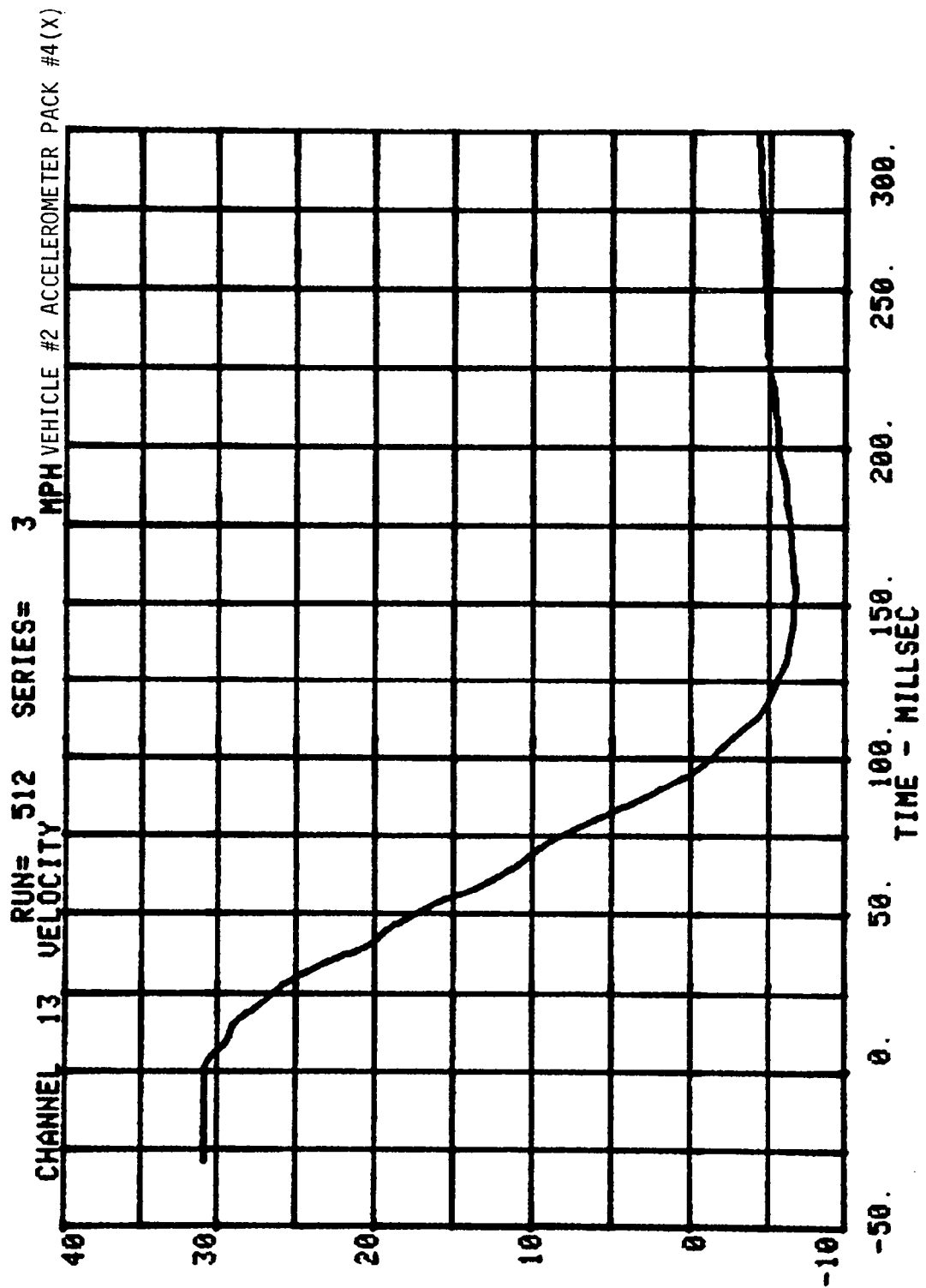


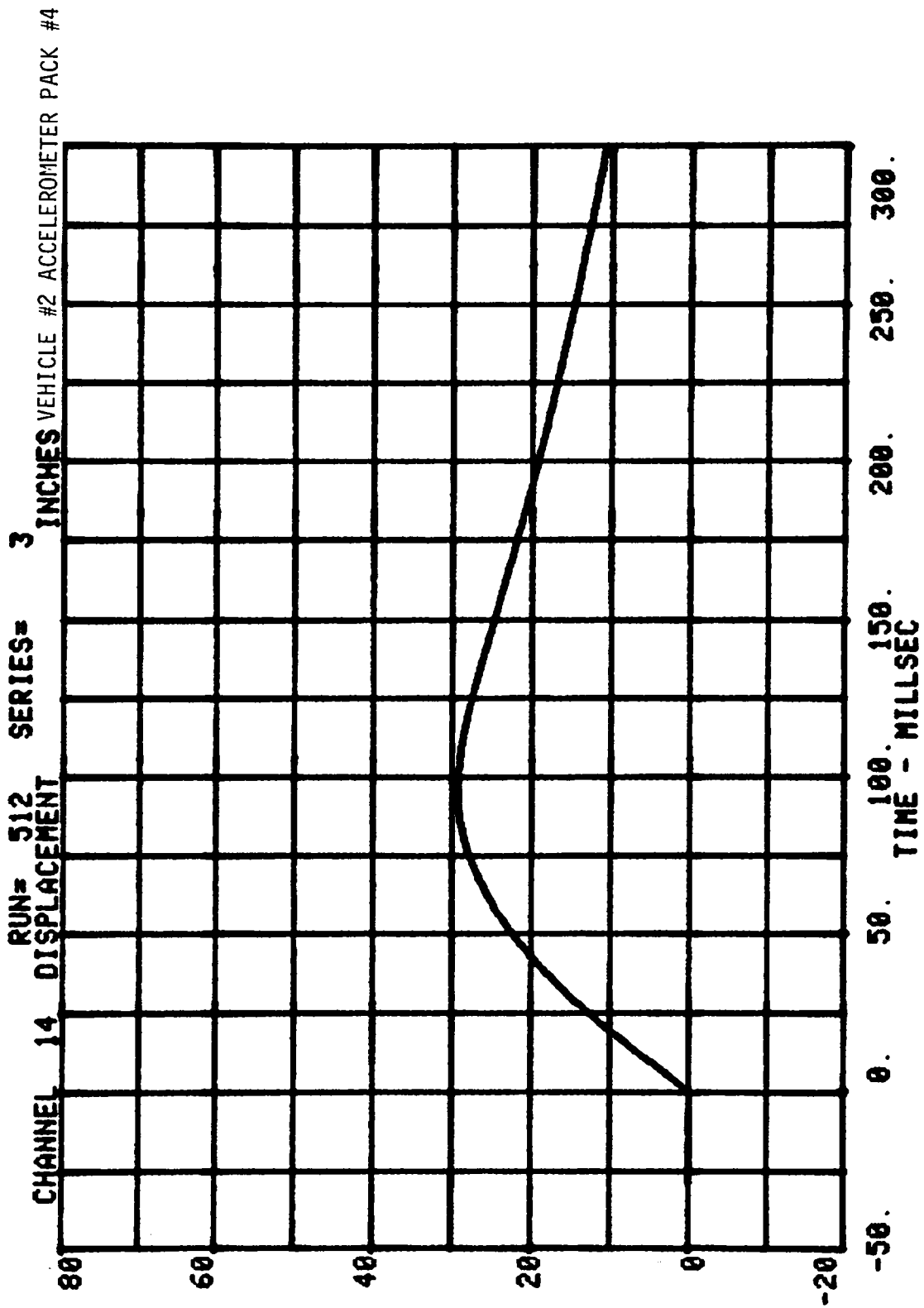
CHANNEL 12 DISPLACEMENT RUN= 512 SERIES= 3 INCHESVEHICLE #2 ACCELEROMETER PACK #2

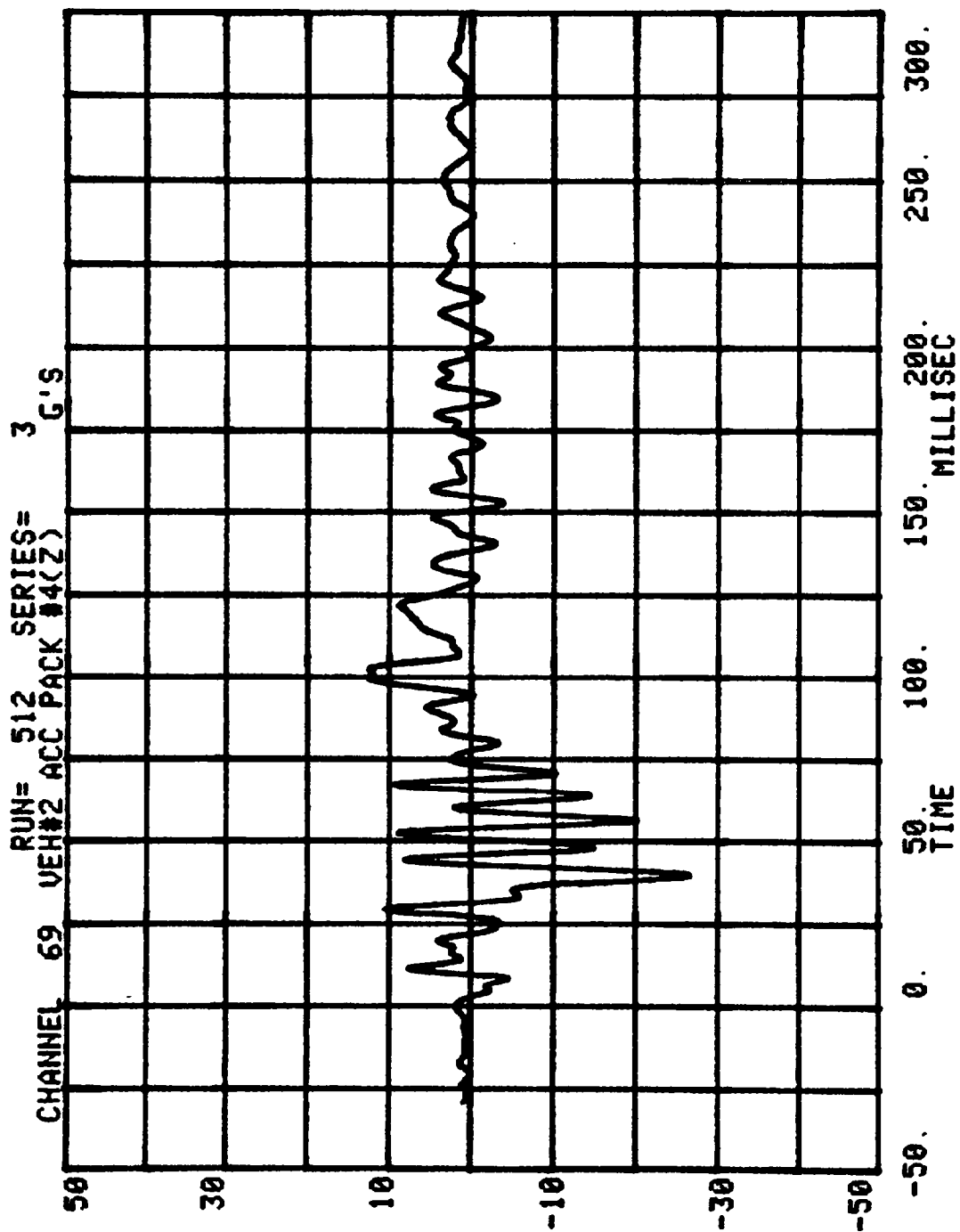


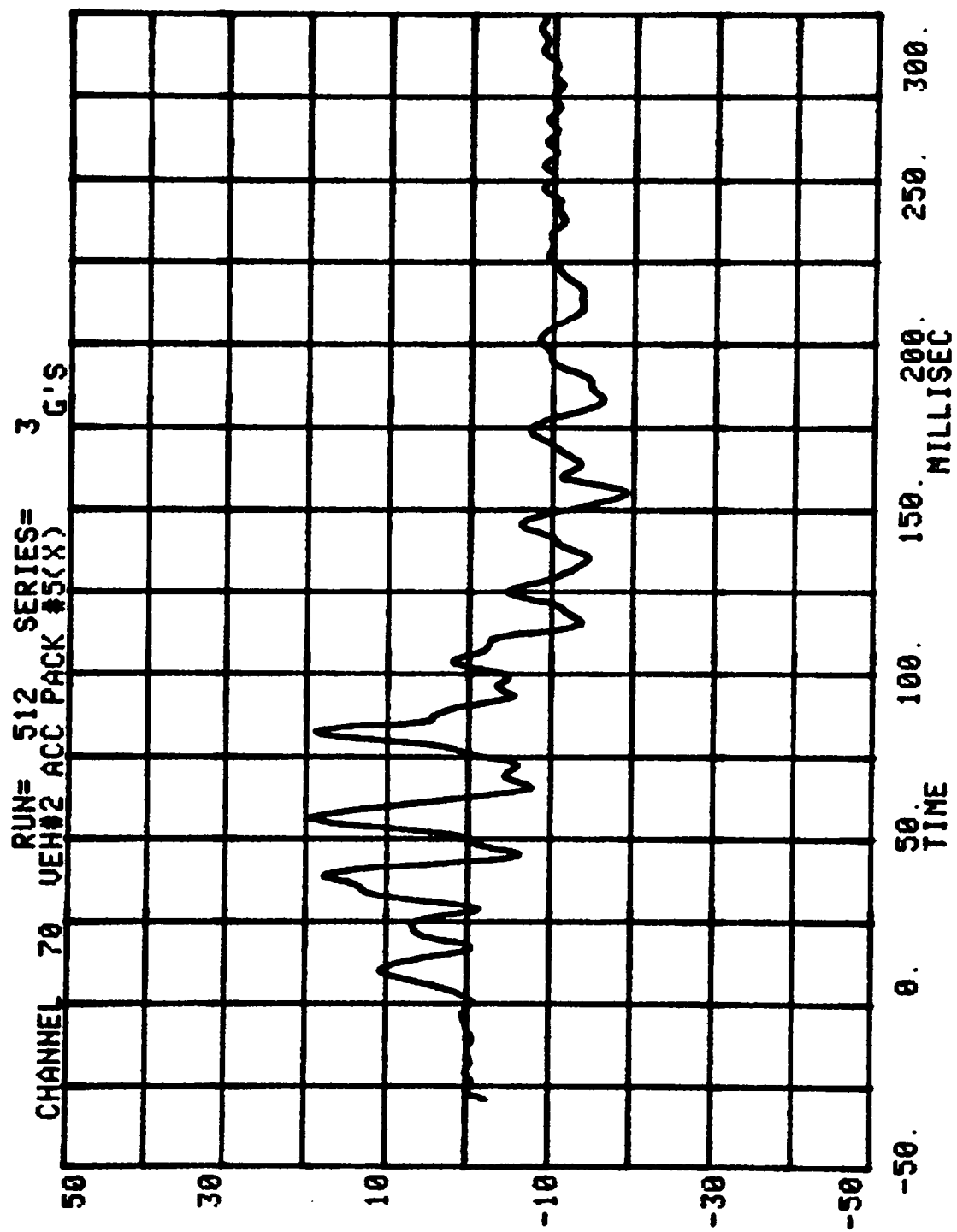




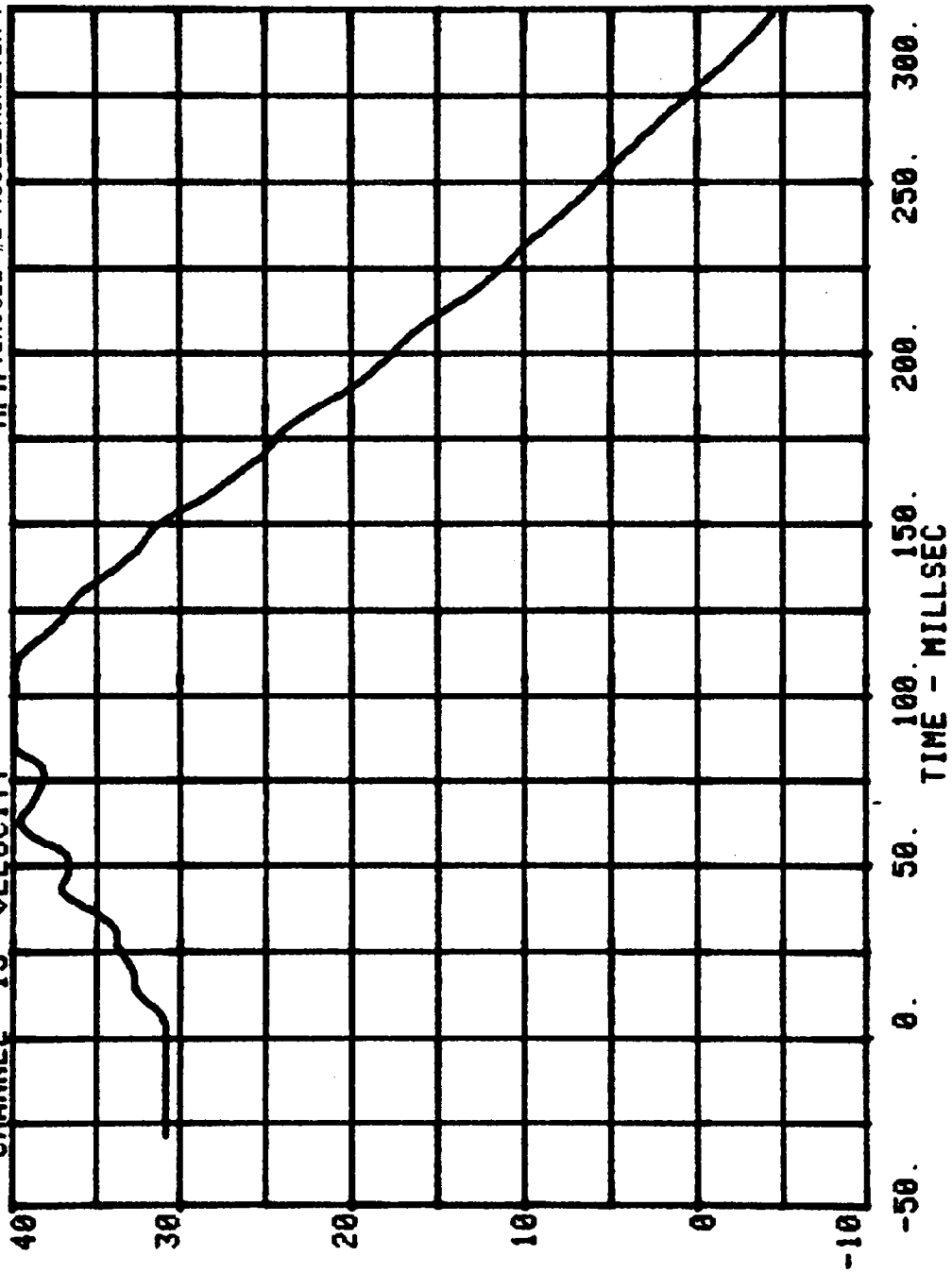


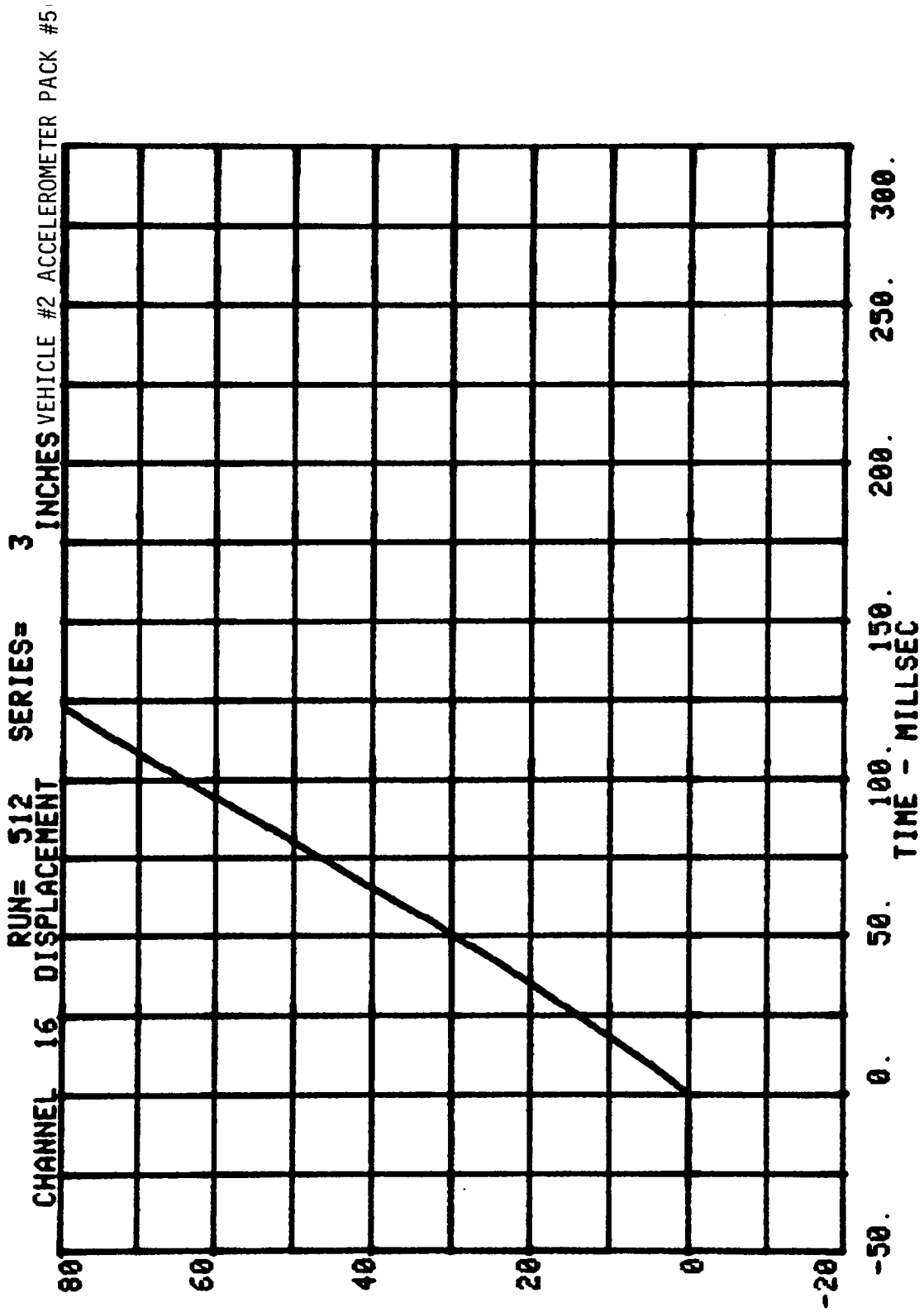


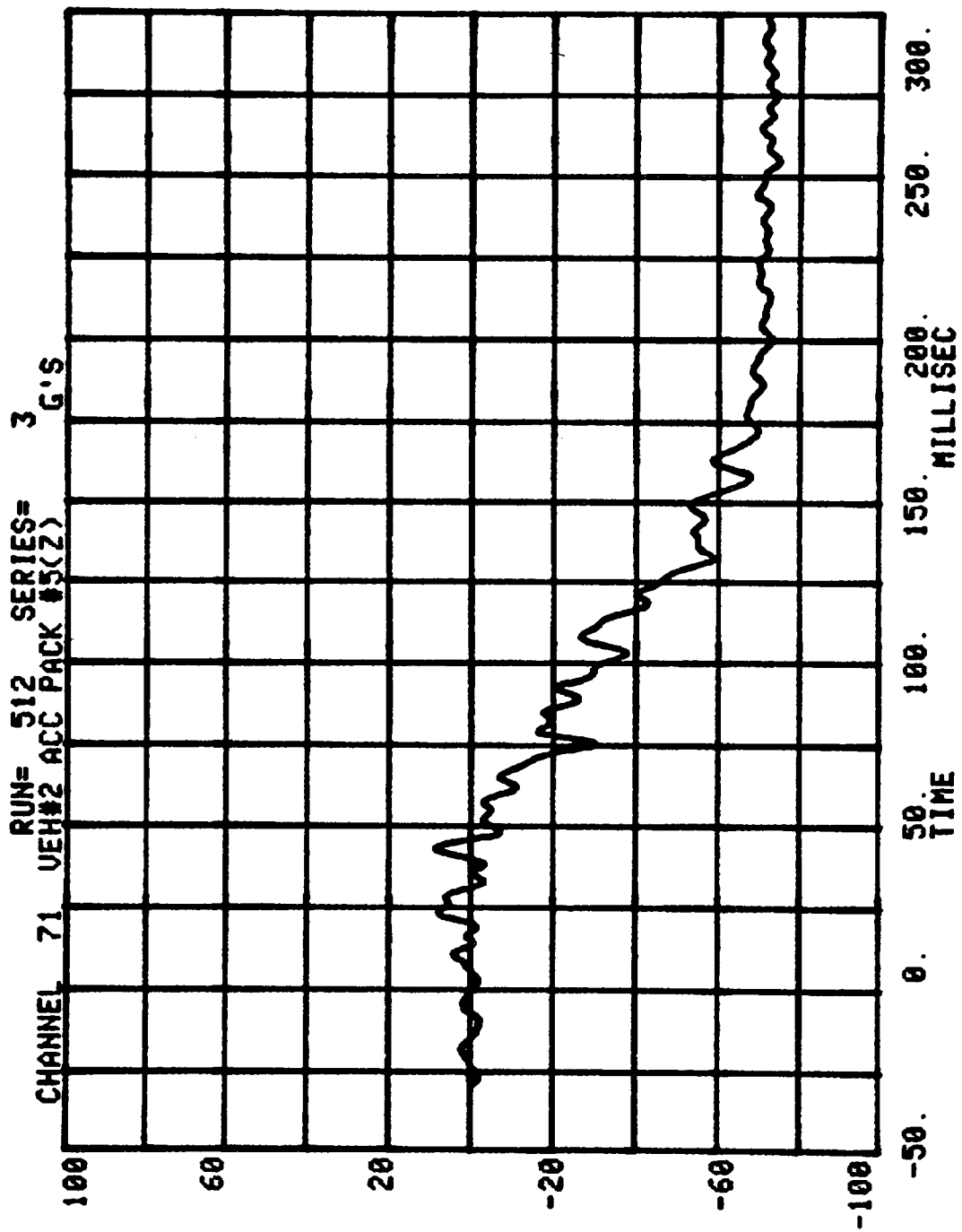


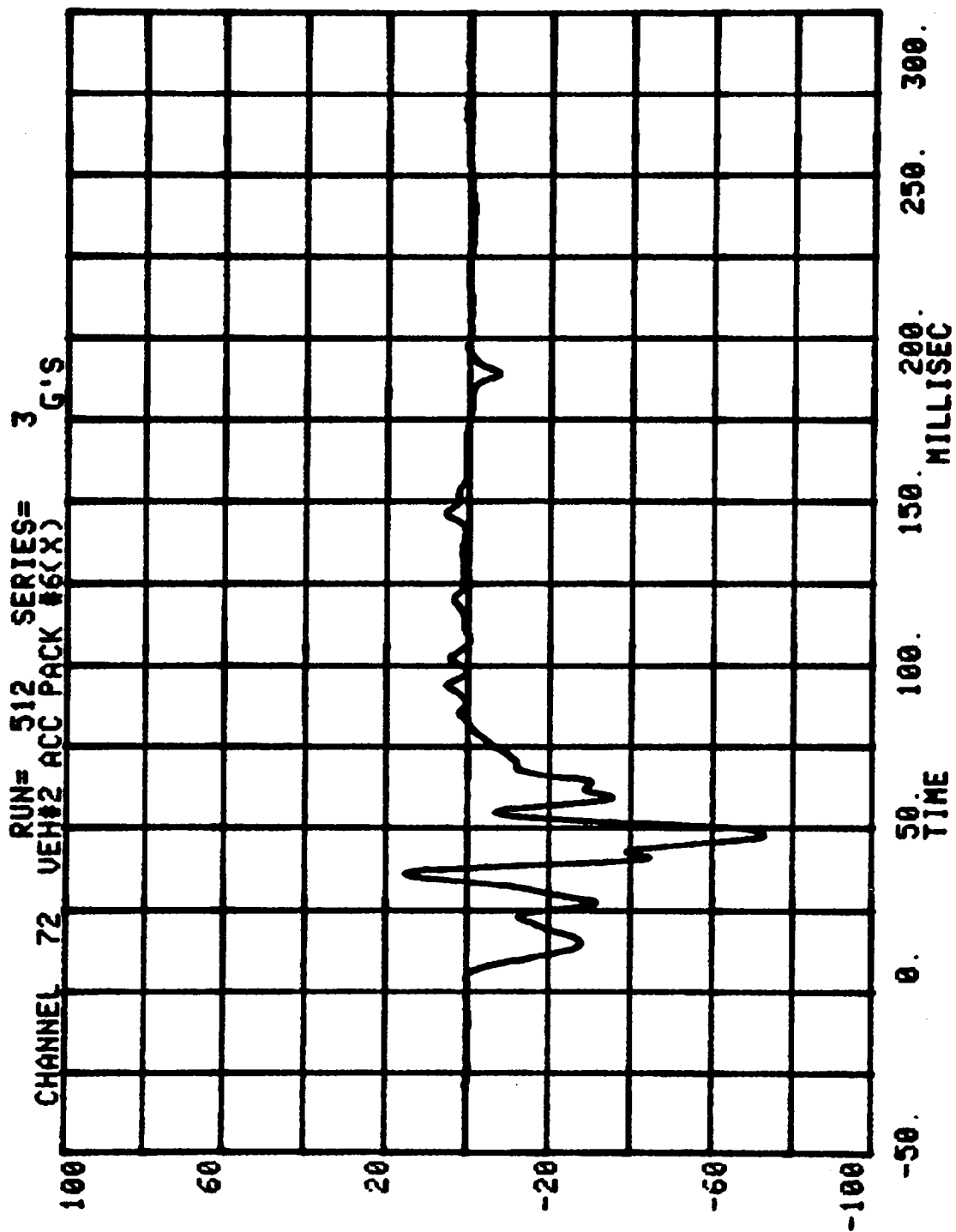


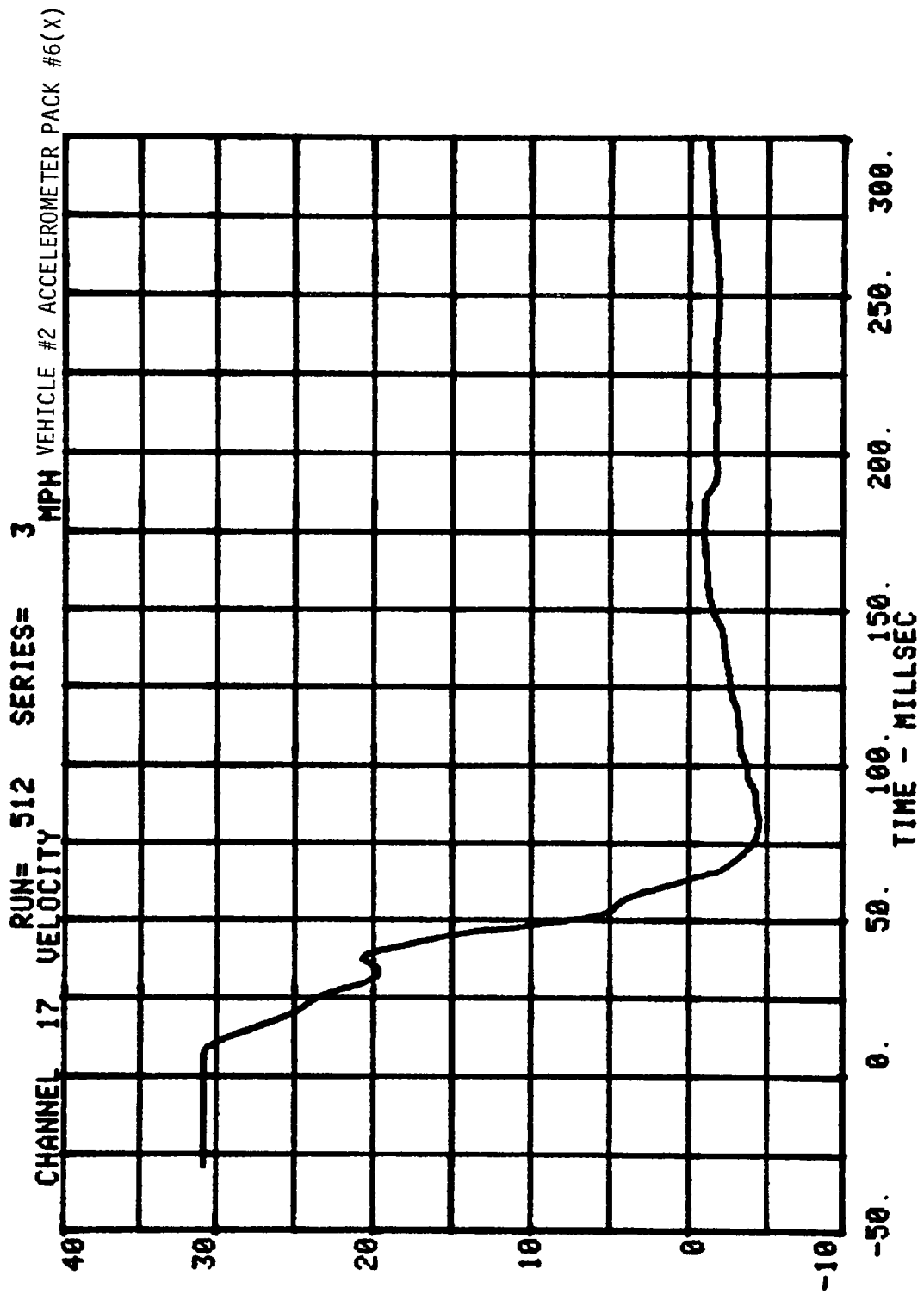
CHANNEL 15 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #2 ACCELEROMETER PACK #5(X)



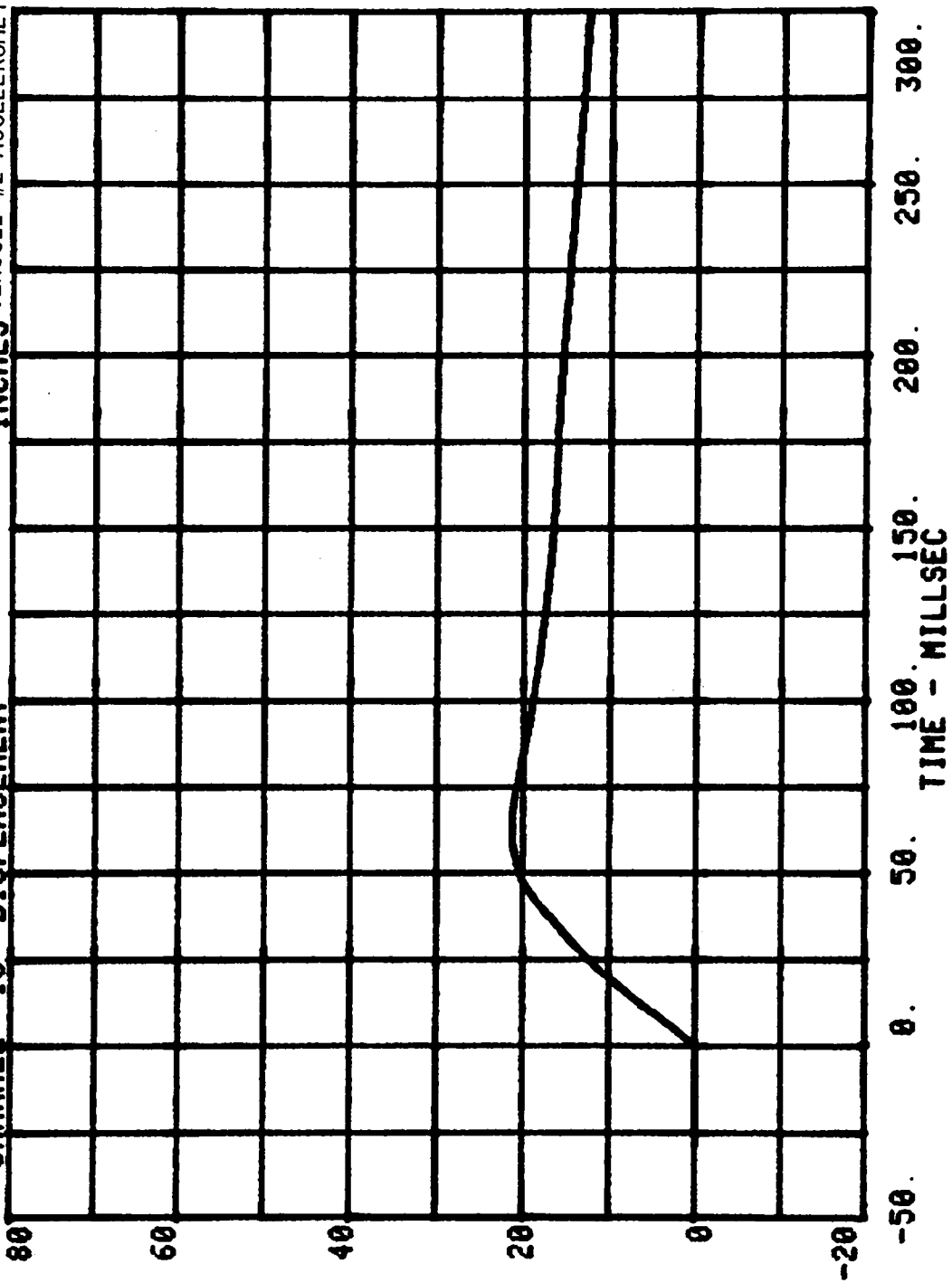


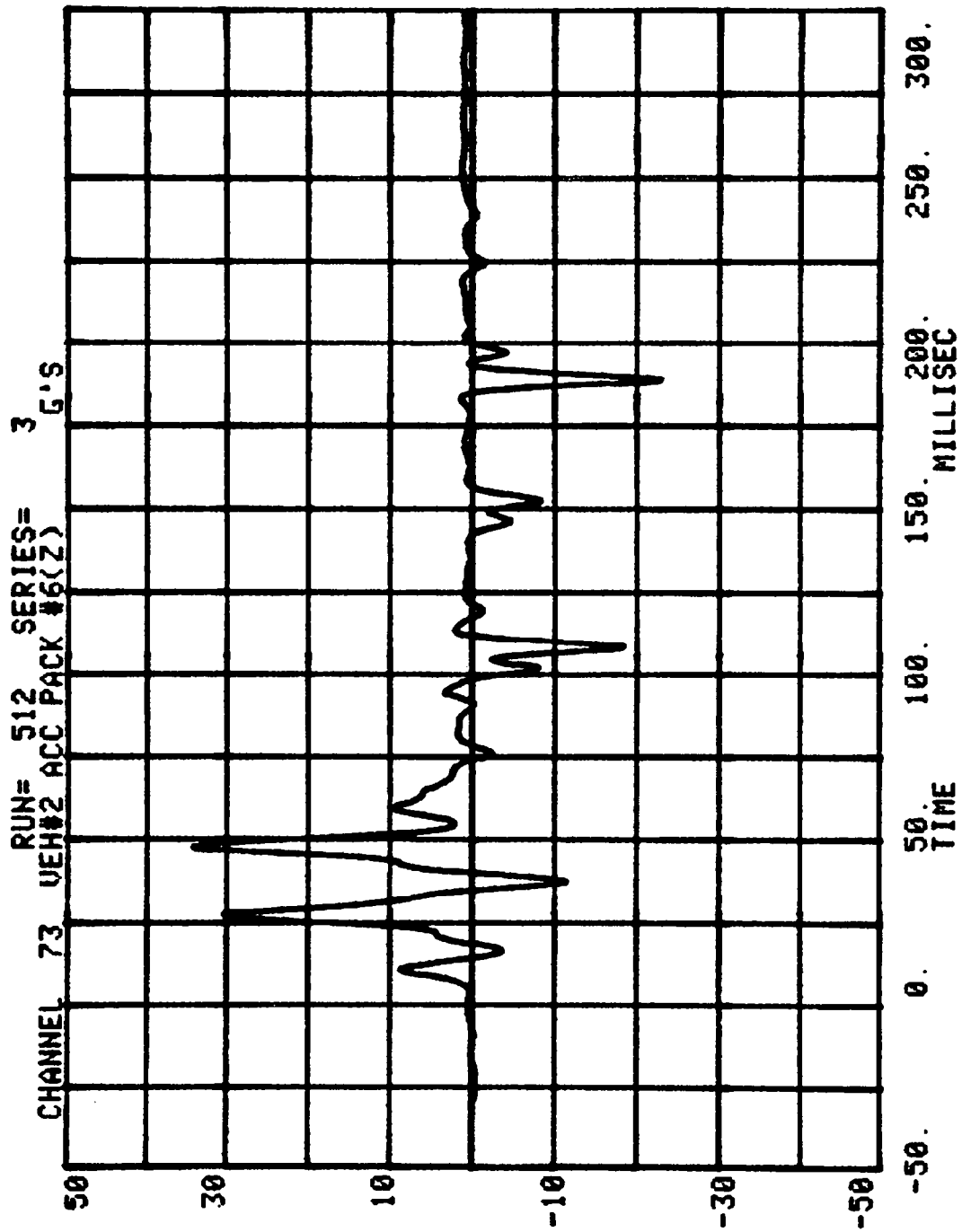


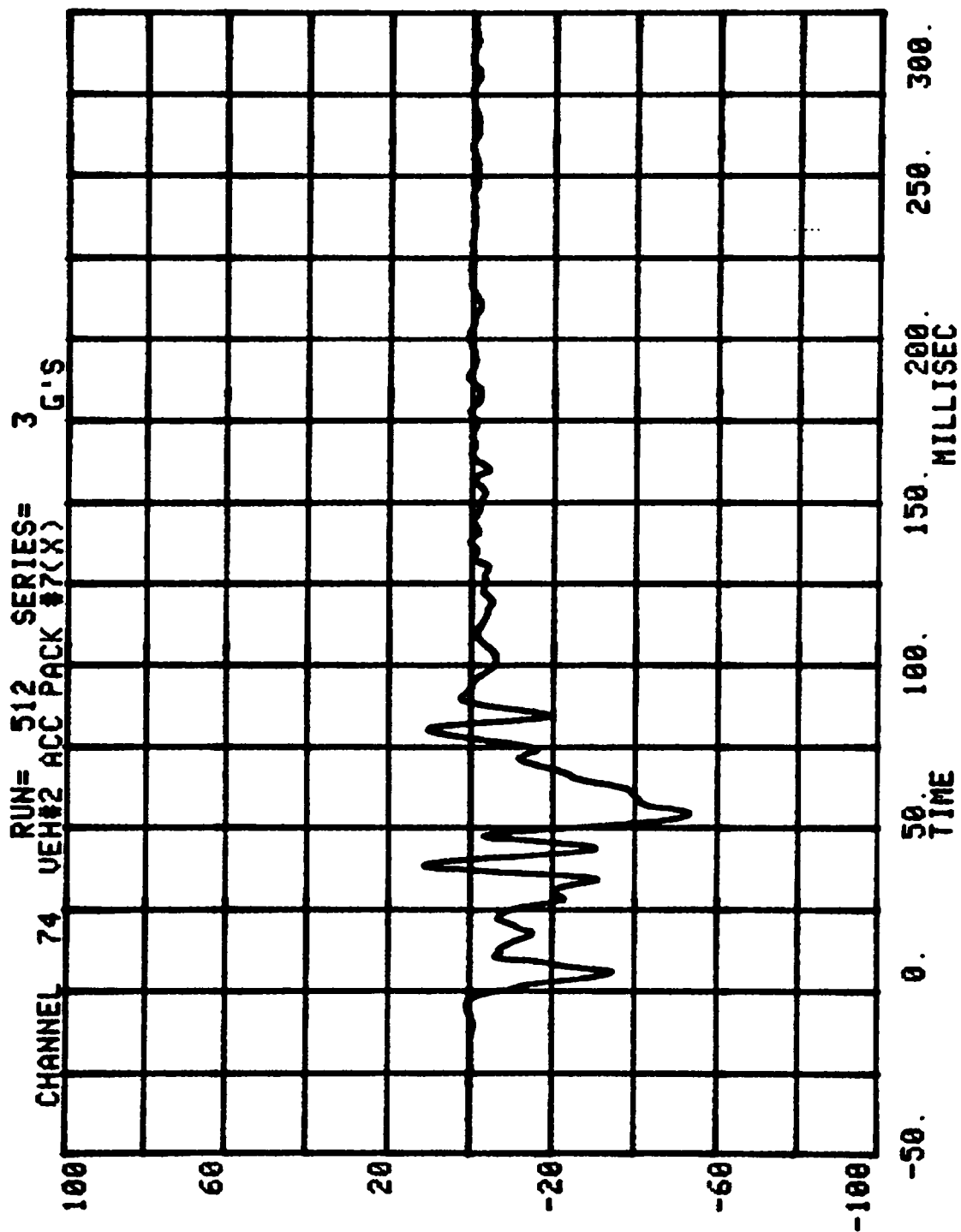




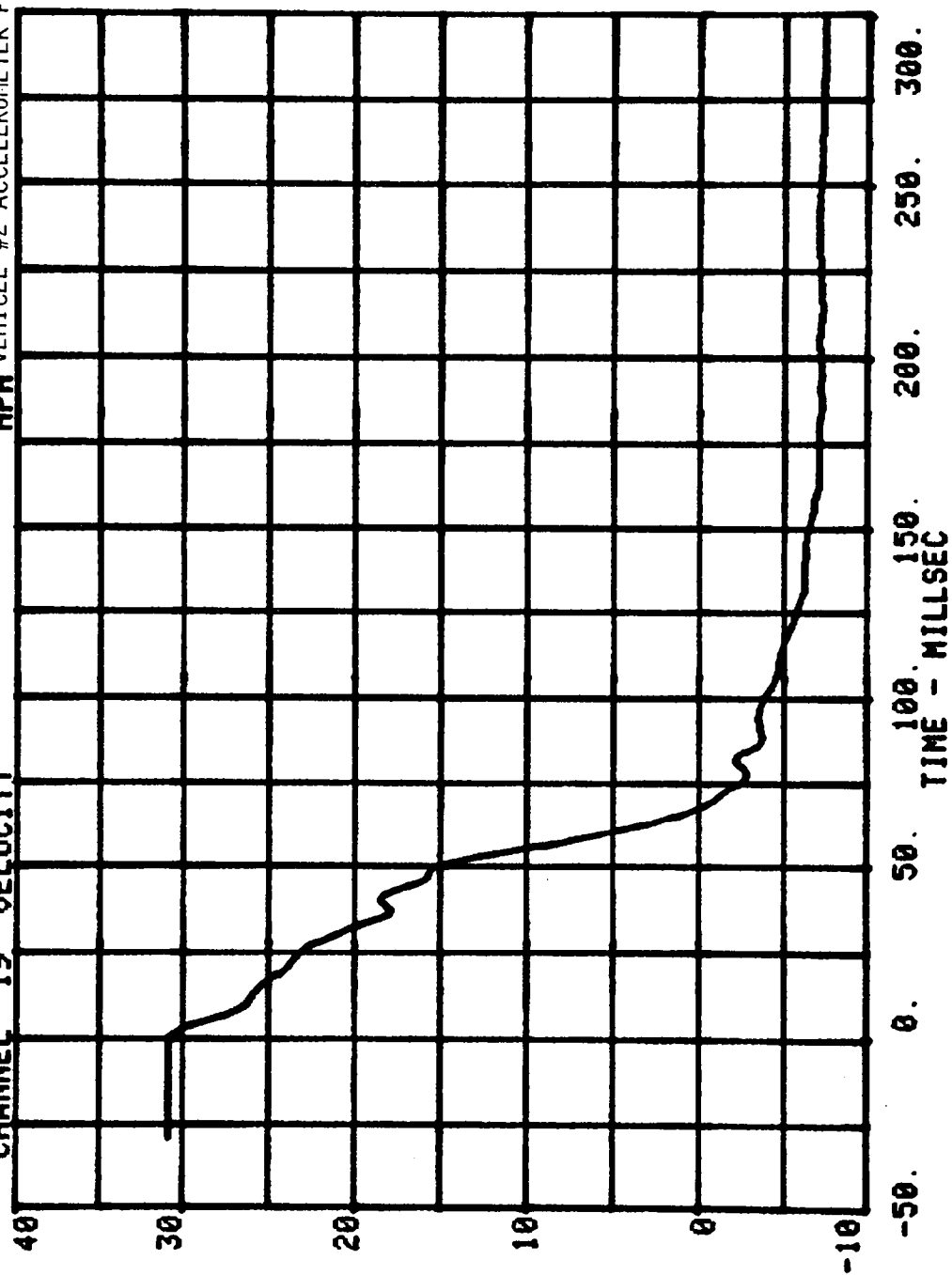
CHANNEL 18 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #2 ACCELEROMETER PACK #61



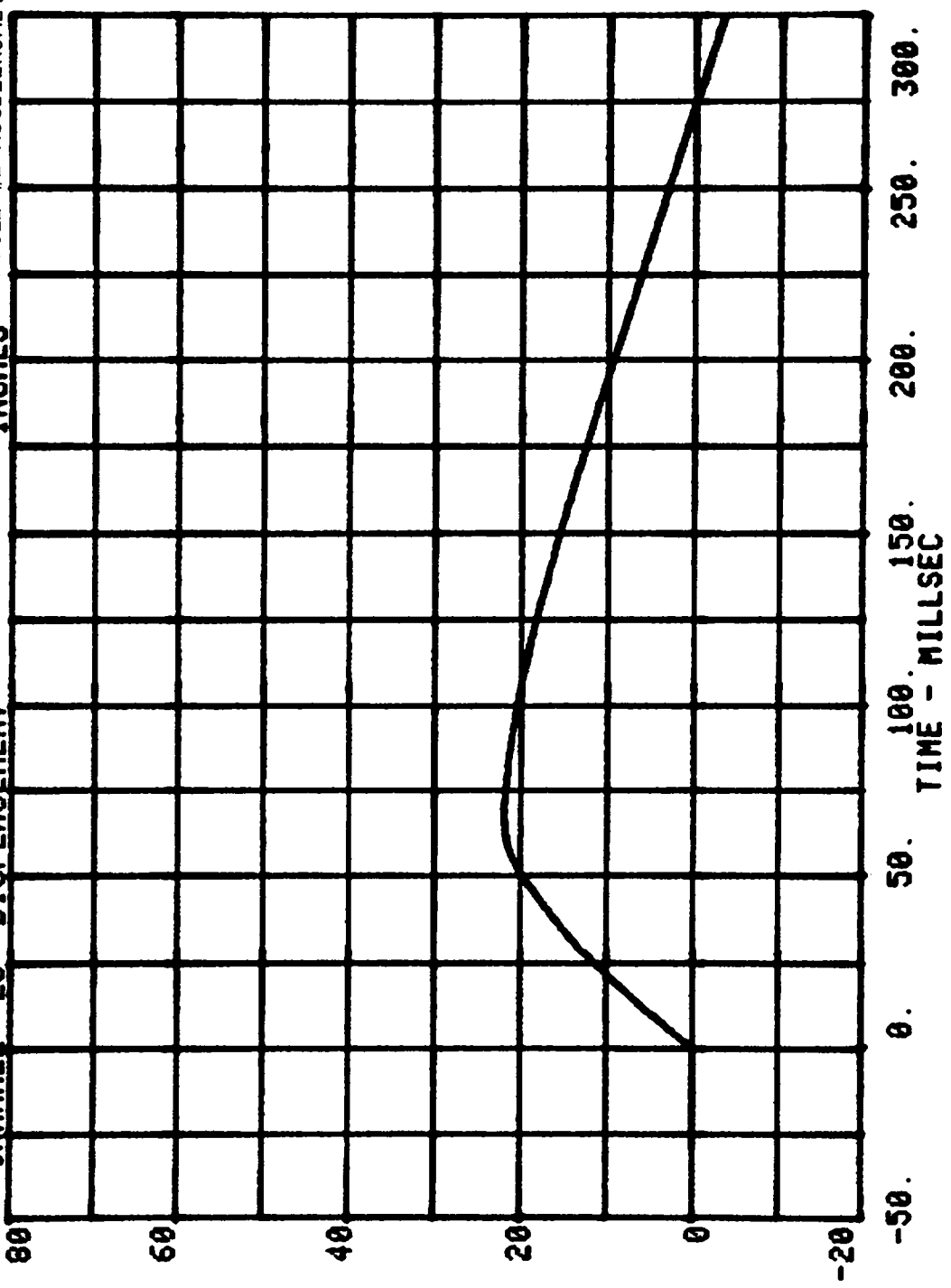


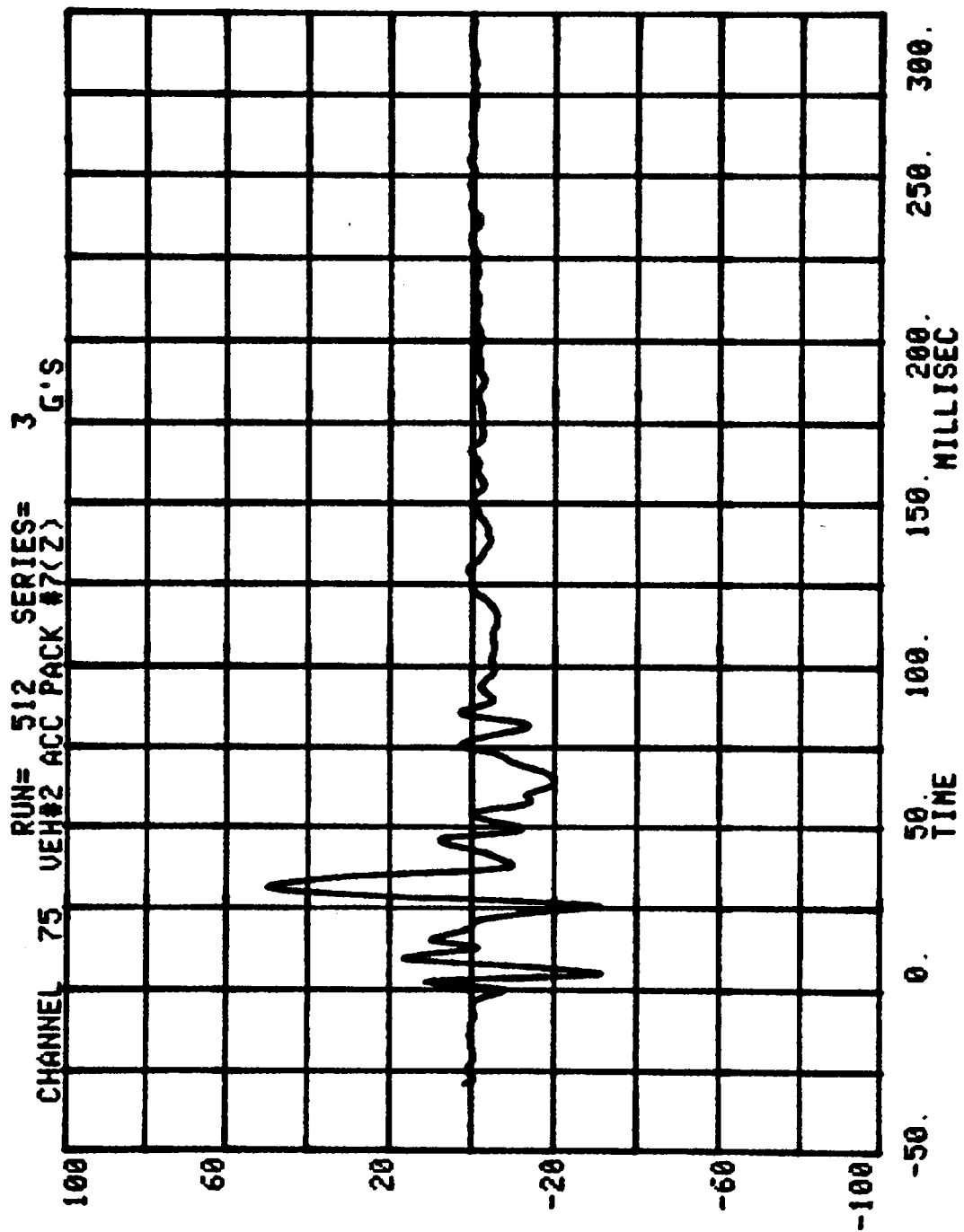


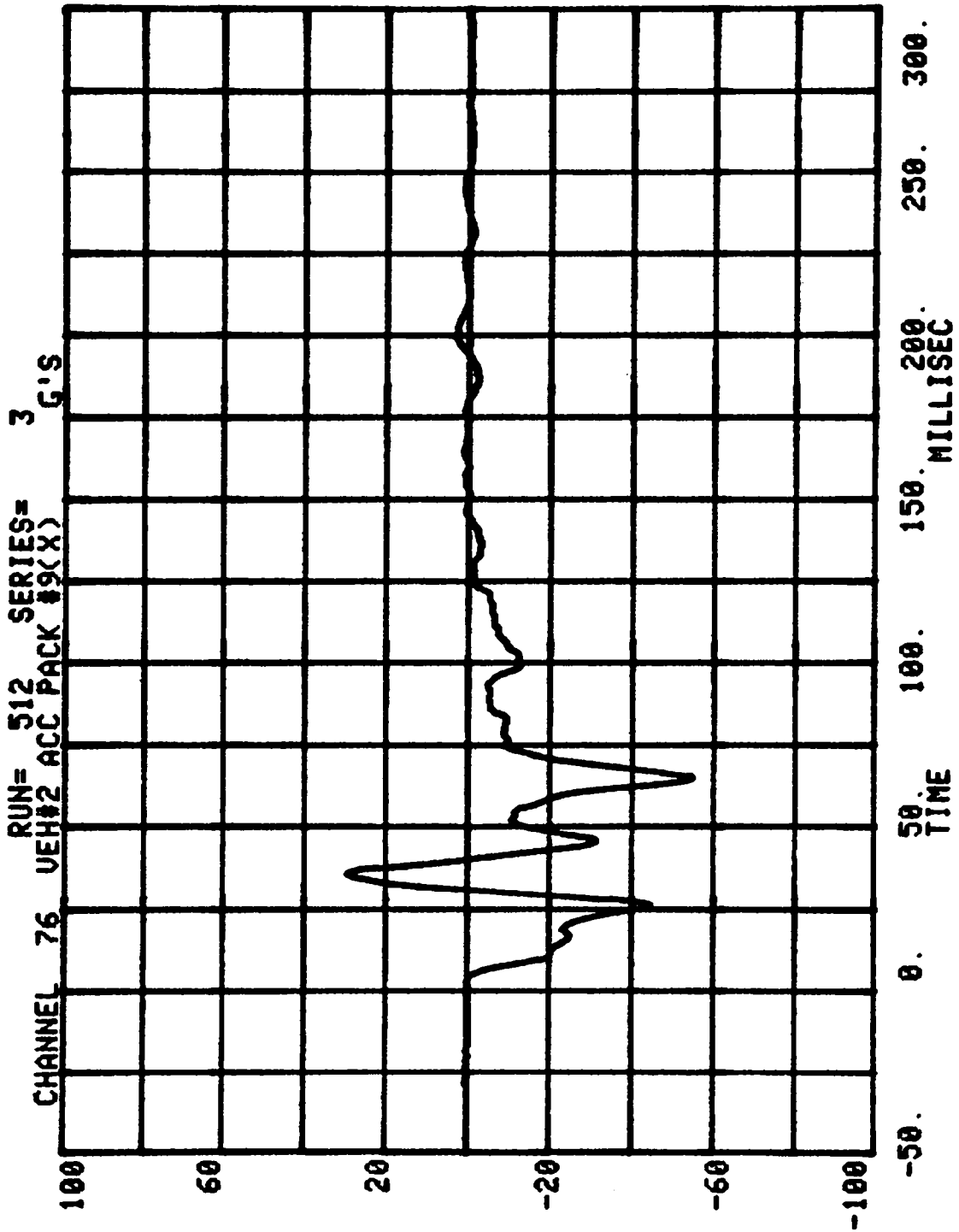
CHANNEL 19 VELOCITY RUN= 512 SERIES= 3 MPH VEHICLE #2 ACCELEROMETER PACK #7(X)



CHANNEL 20 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #2 ACCELEROMETER PACK #7





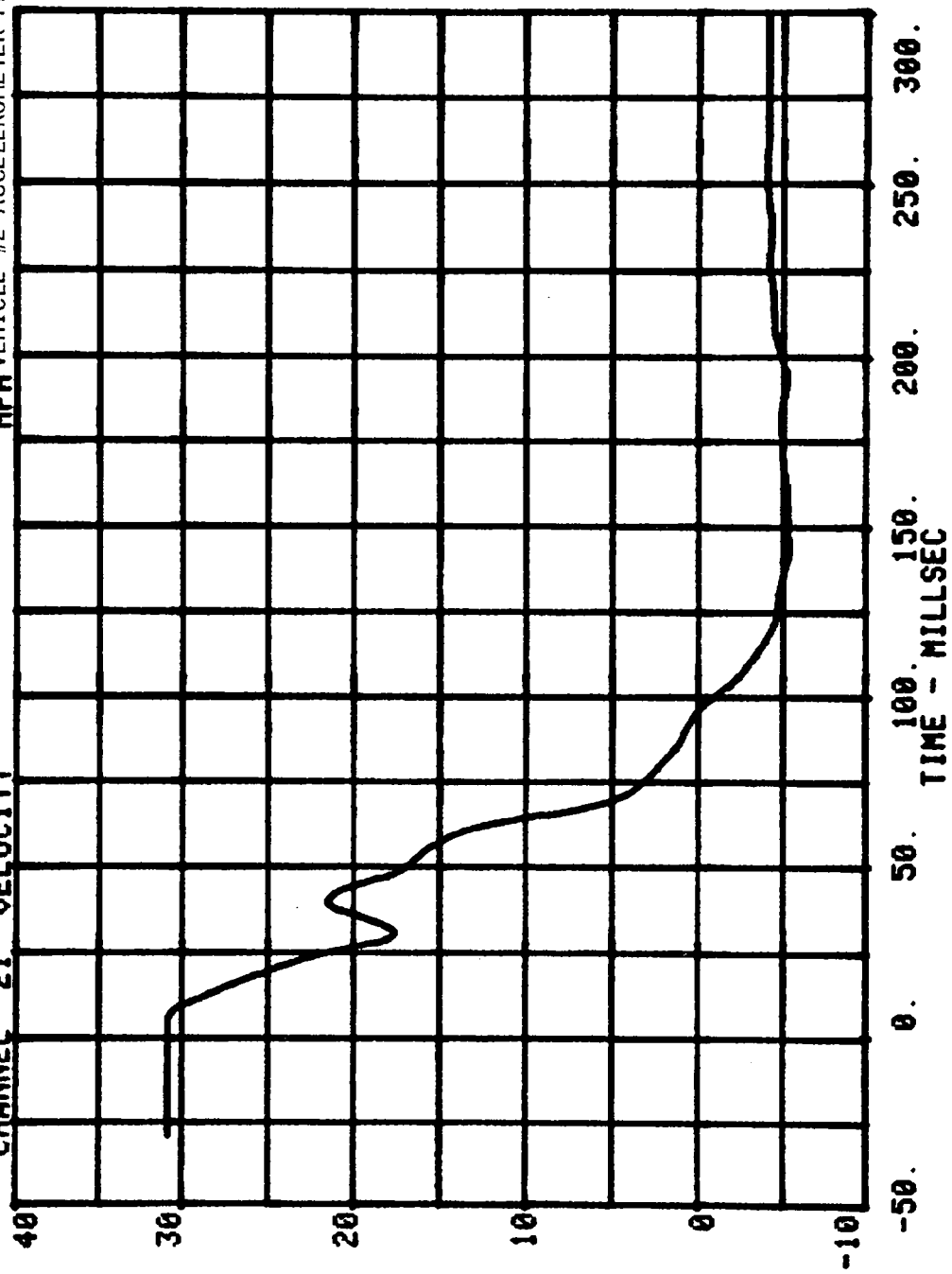


1

CHANNEL 21 VELOCITY

RUN= 512 SERIES= 3

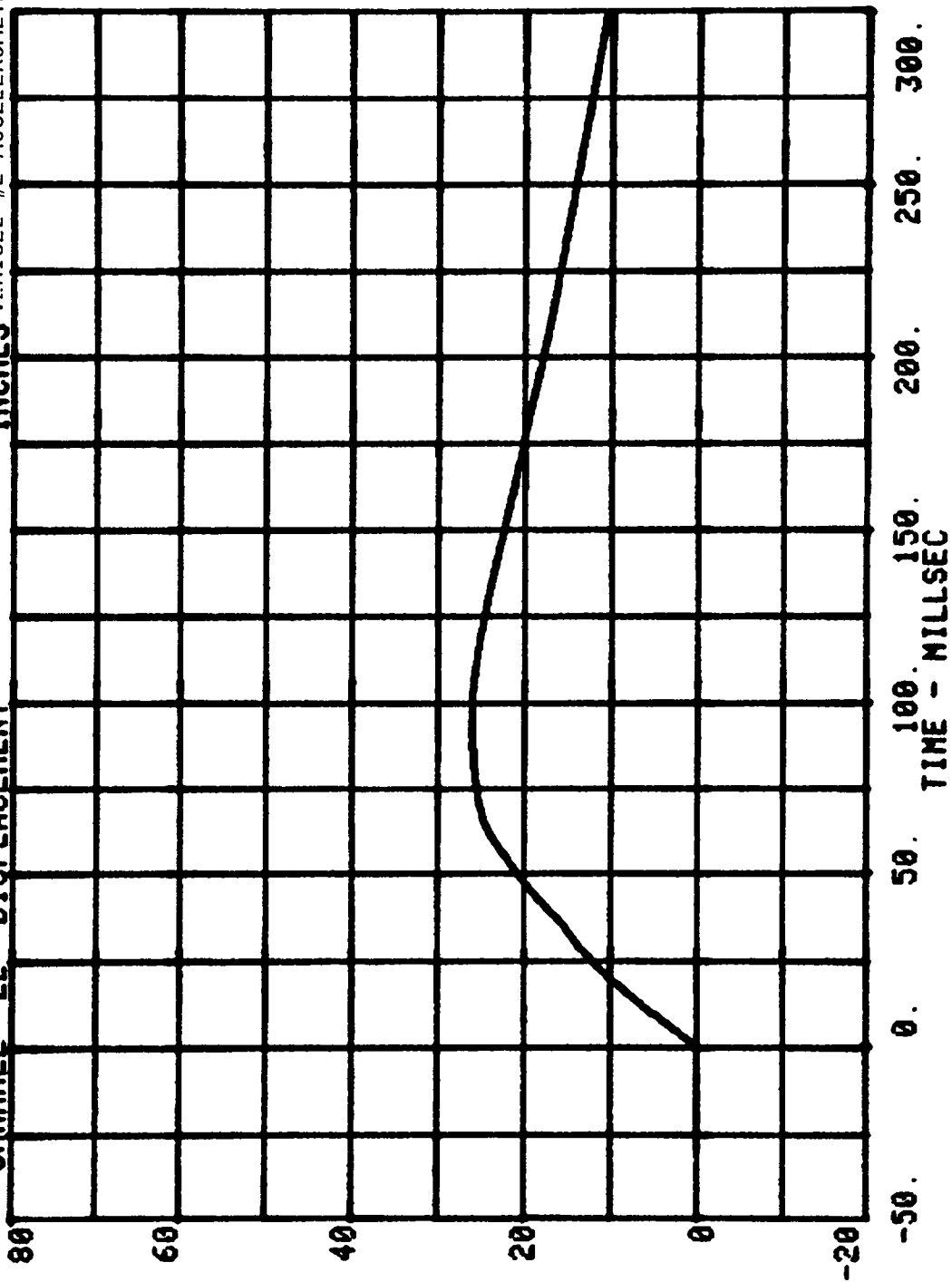
MPH VEHICLE #2 ACCELEROMETER PACK #9(X)

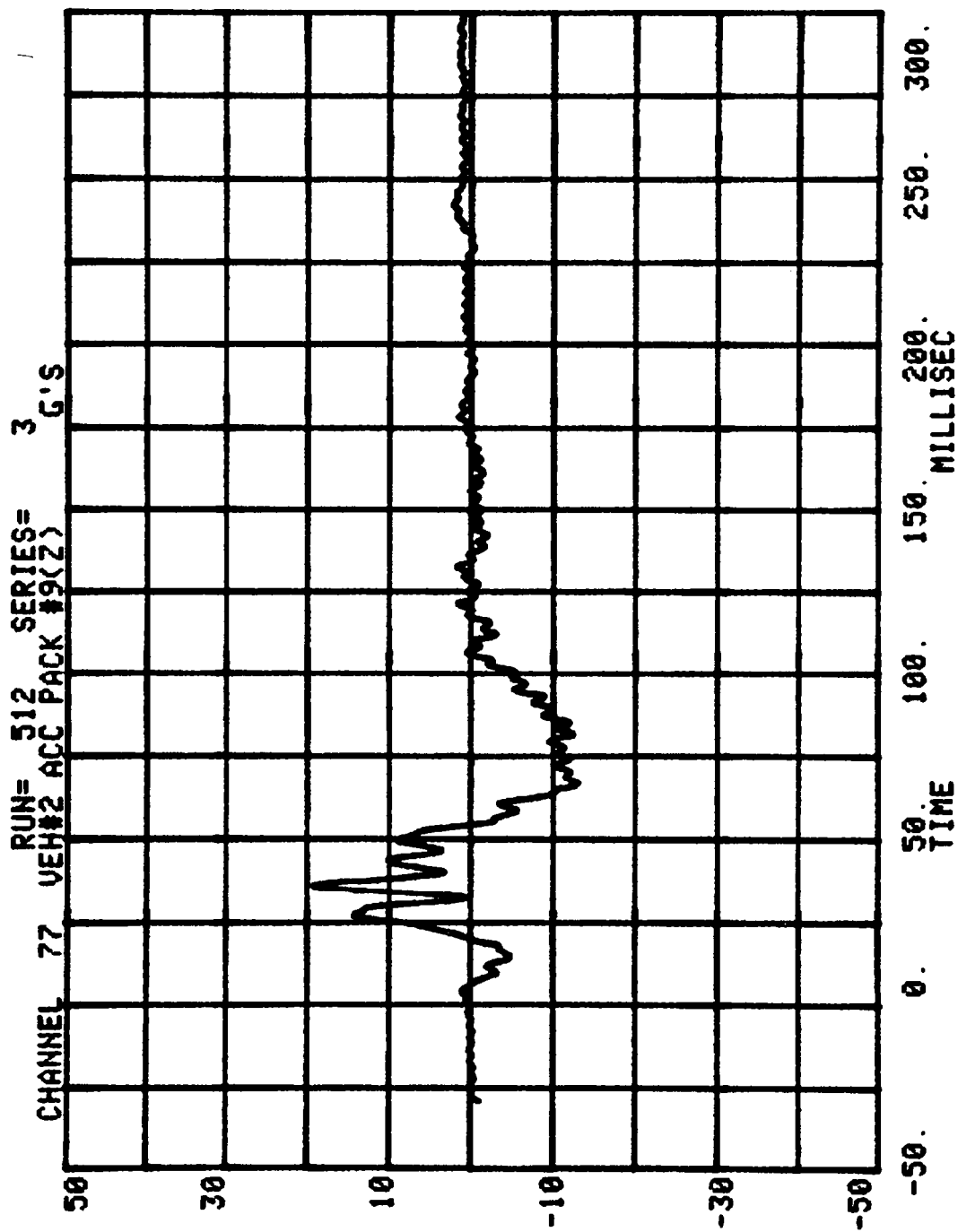


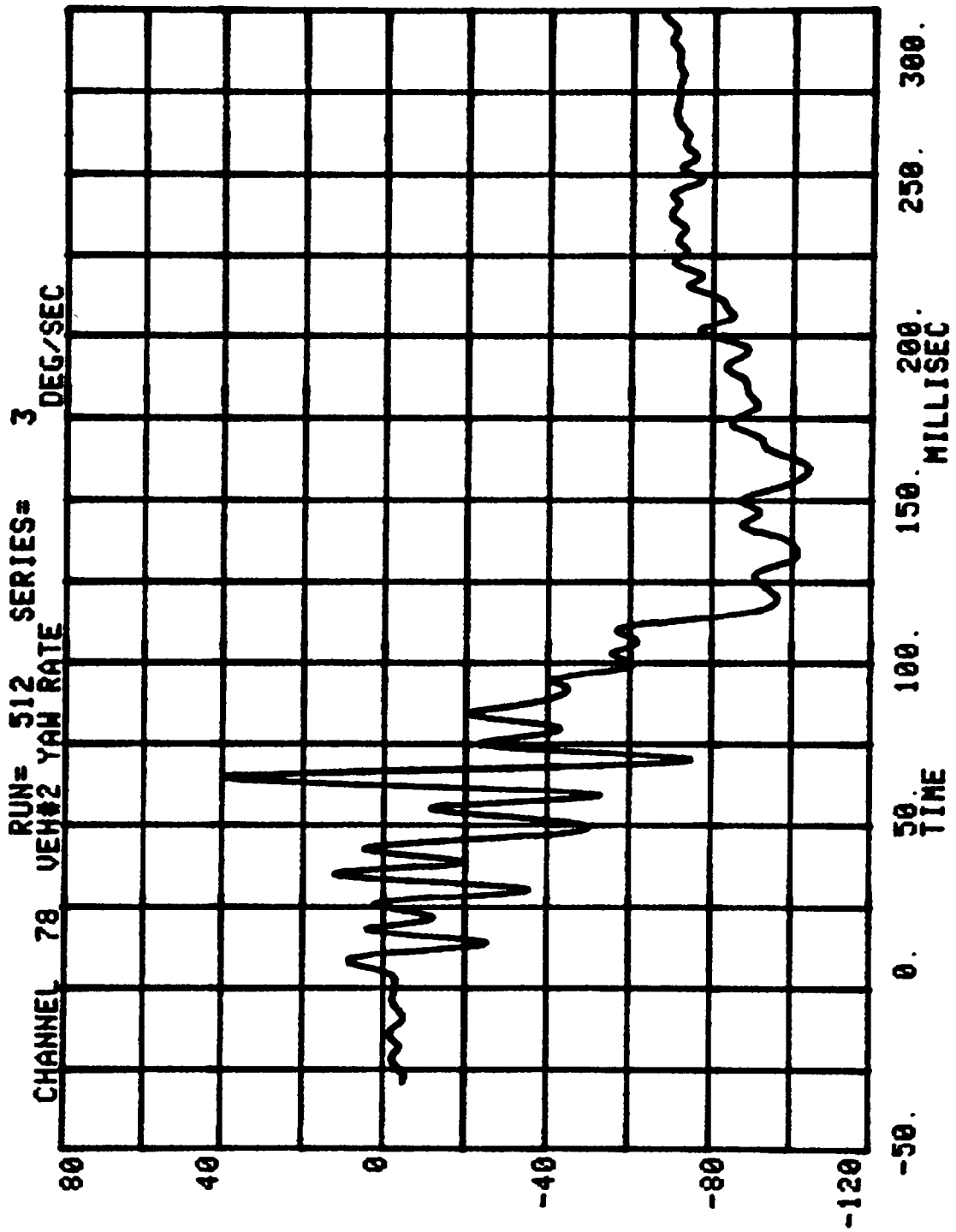
B-90

6707-V-3

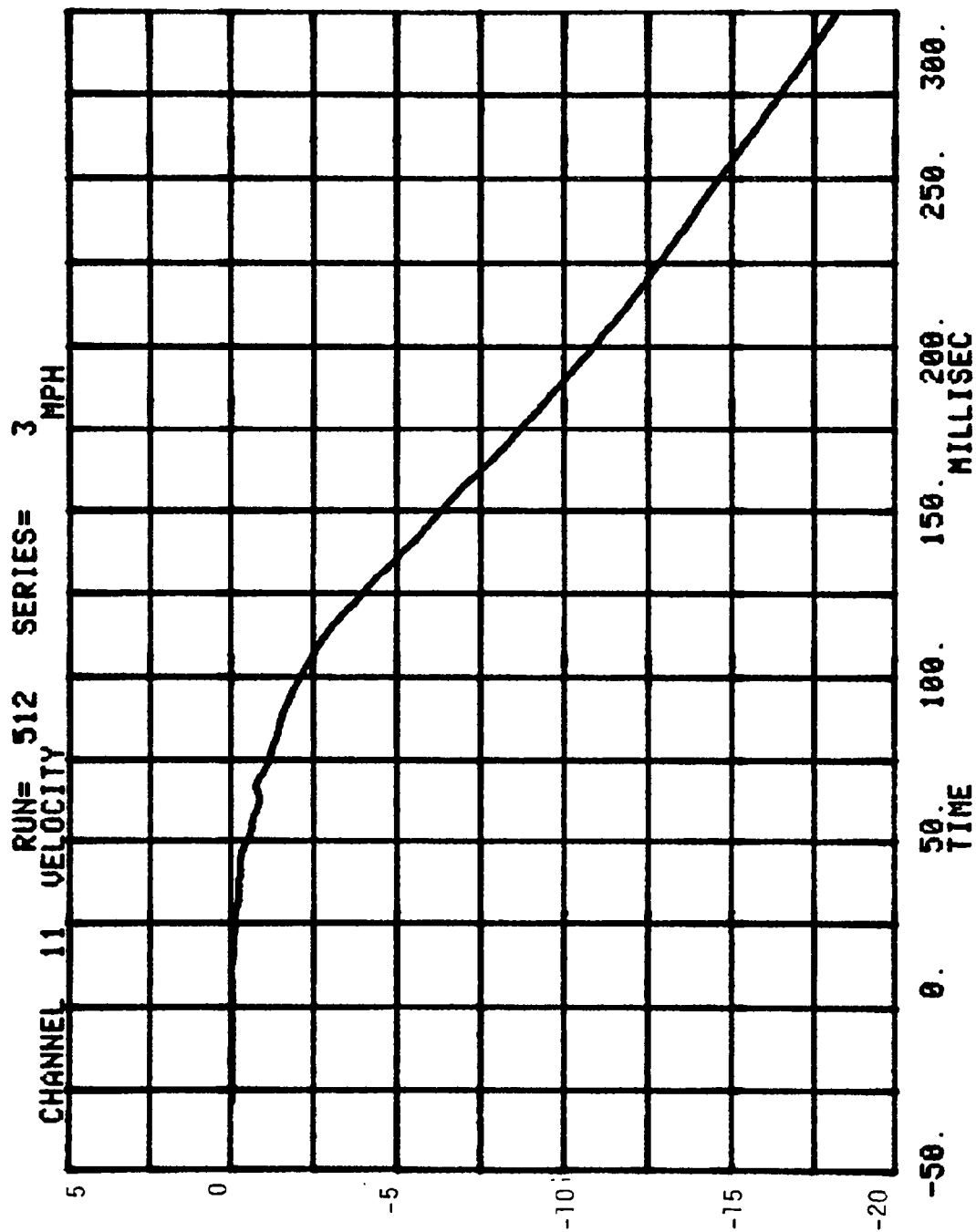
CHANNEL 22 DISPLACEMENT RUN= 512 SERIES= 3 INCHES VEHICLE #2 ACCELEROMETER PACK #9(

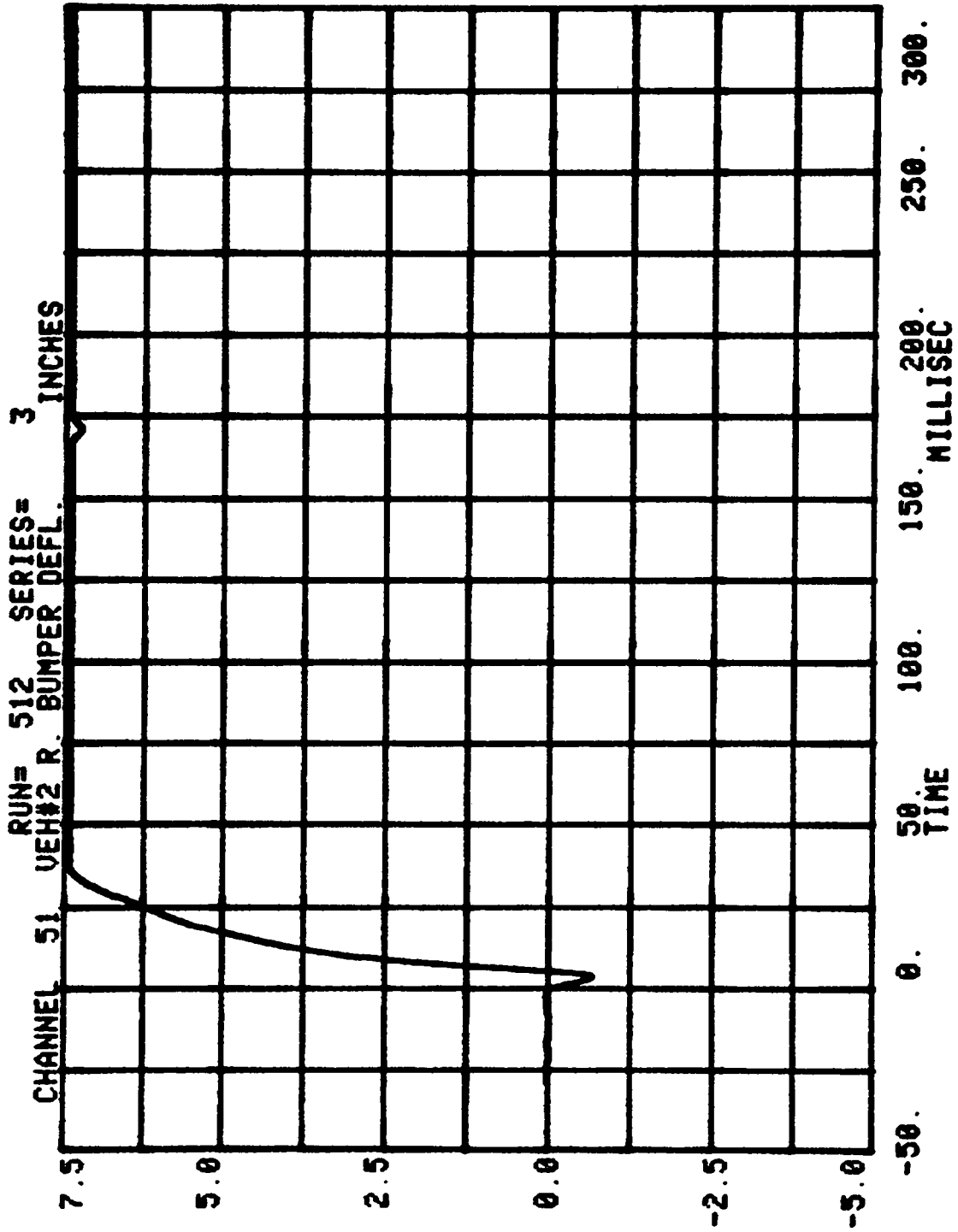




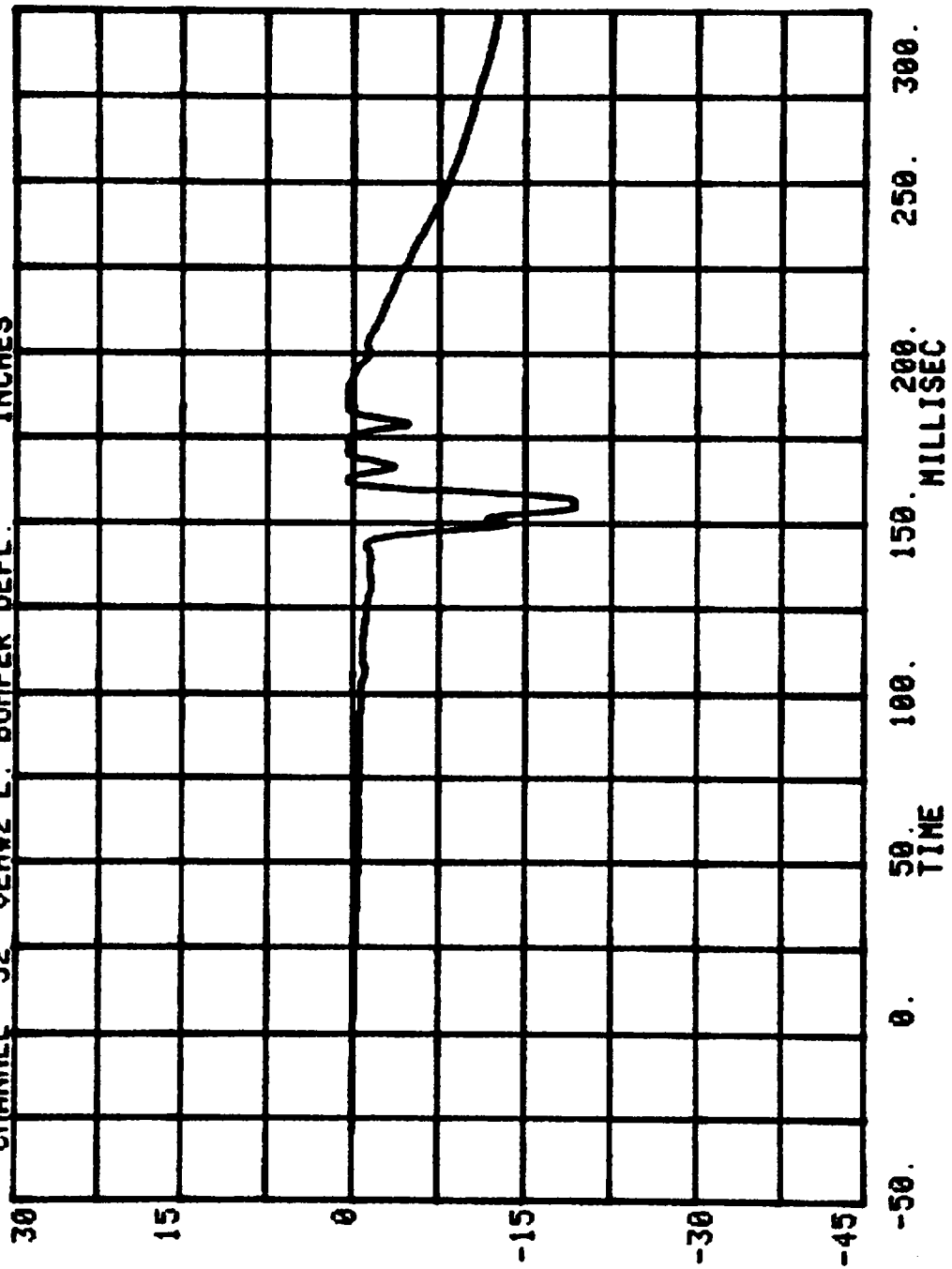


VEHICLE #2 - YAW ~ DEGREES





CHANNEL 52 RUN= 512 SERIES= 3
VEH#2 L. BUMPER DEFL. 3 INCHES



Test No. 614-3-512

1980 VOLKSWAGEN RABBIT

DUMMY DATA

FILTER CHANNEL CLASS

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

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

VEHICLE AGGRESSIVENESS CAR-TO-CAR TEST #3

RUN= 512

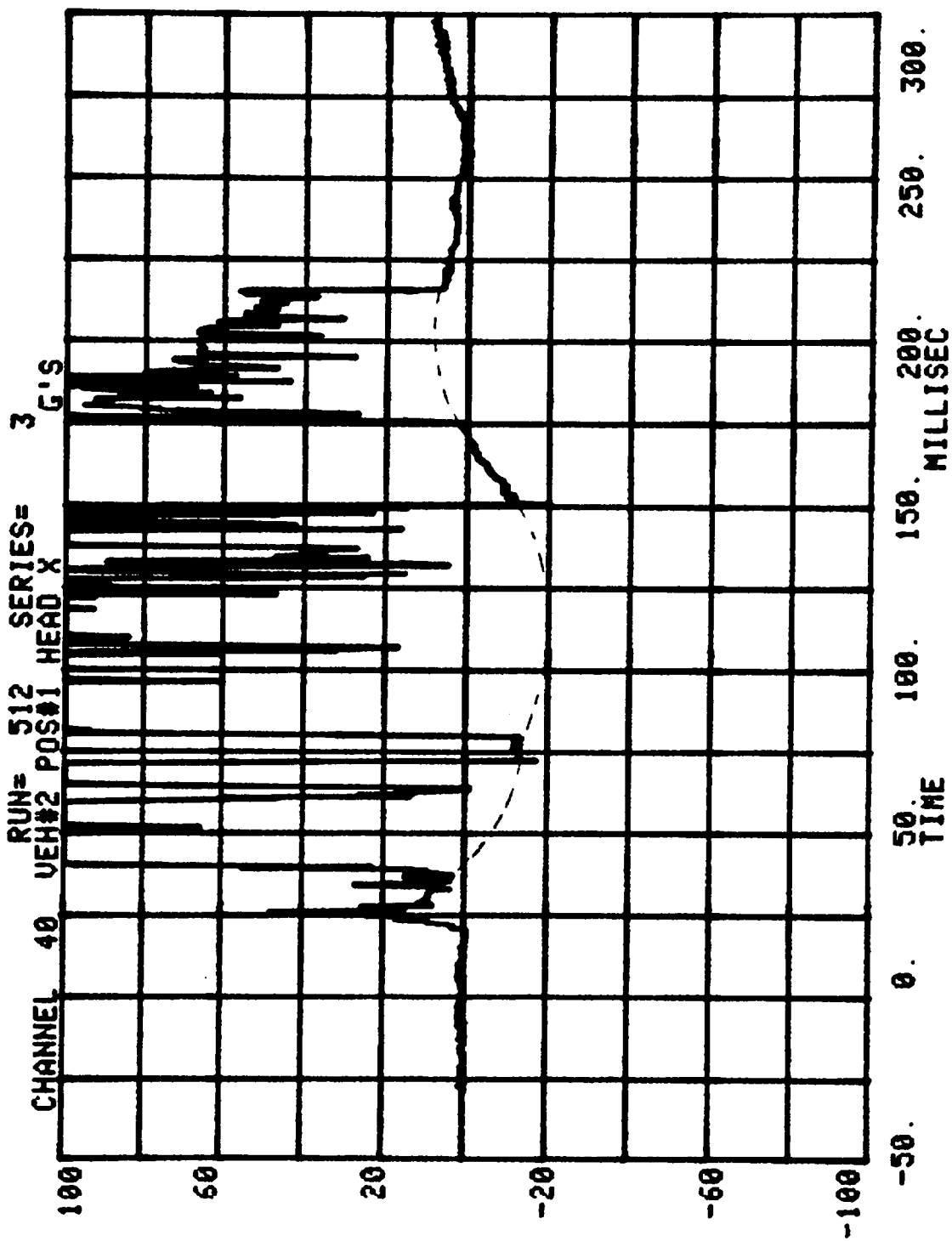
VEH#2 POS#1 HEAD RESULT.

HIC=19942* FROM T1= .04020 TO T2= .14760

AVERAGE ACCELERATION BETWEEN T1 AND T2= 128.1G'S

EVENT TIME= 300.0 MSEC

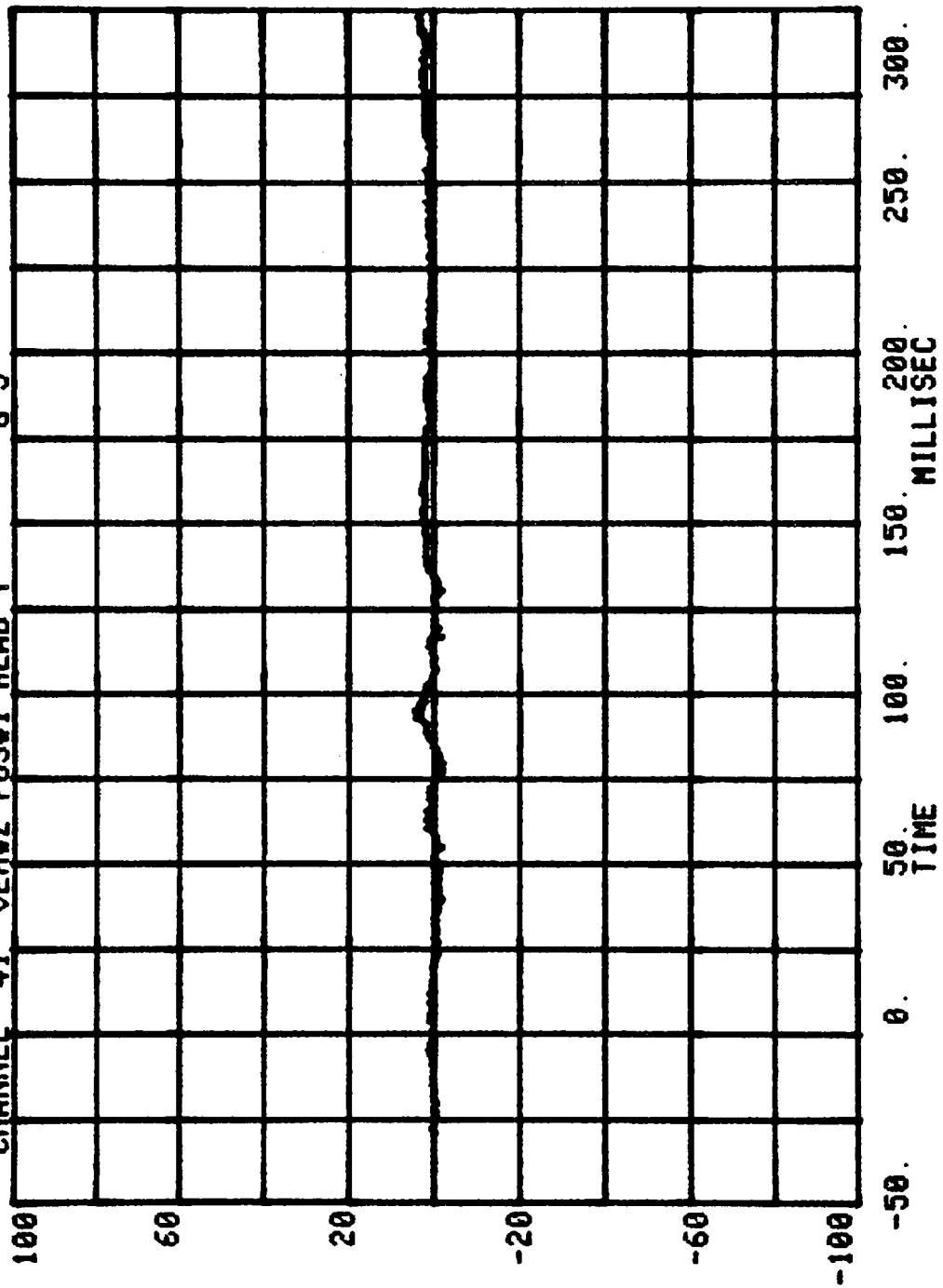
SEVERITY INDEX=30510*

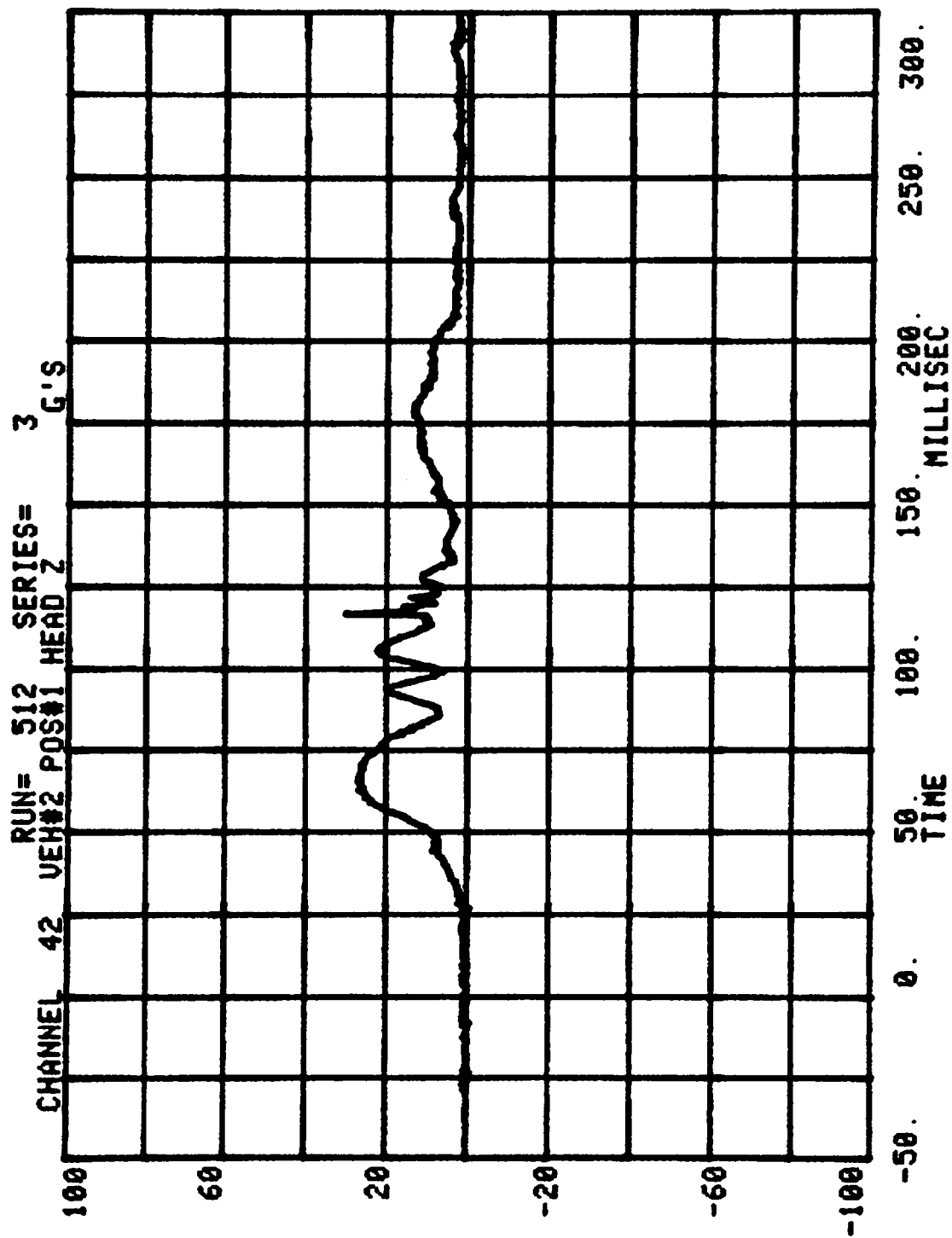


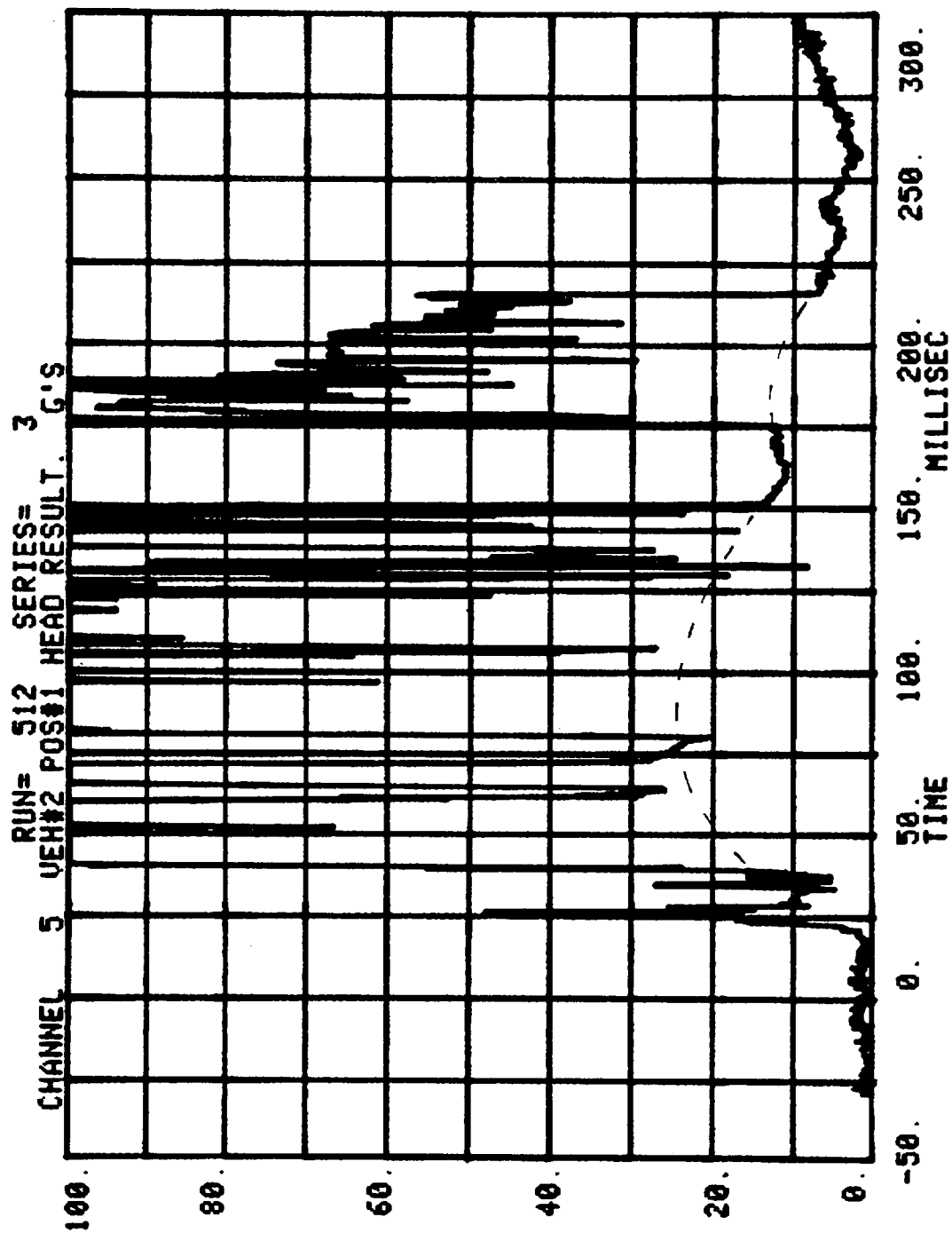
CHANNEL 41. VEH#2 POS#1 HEAD Y

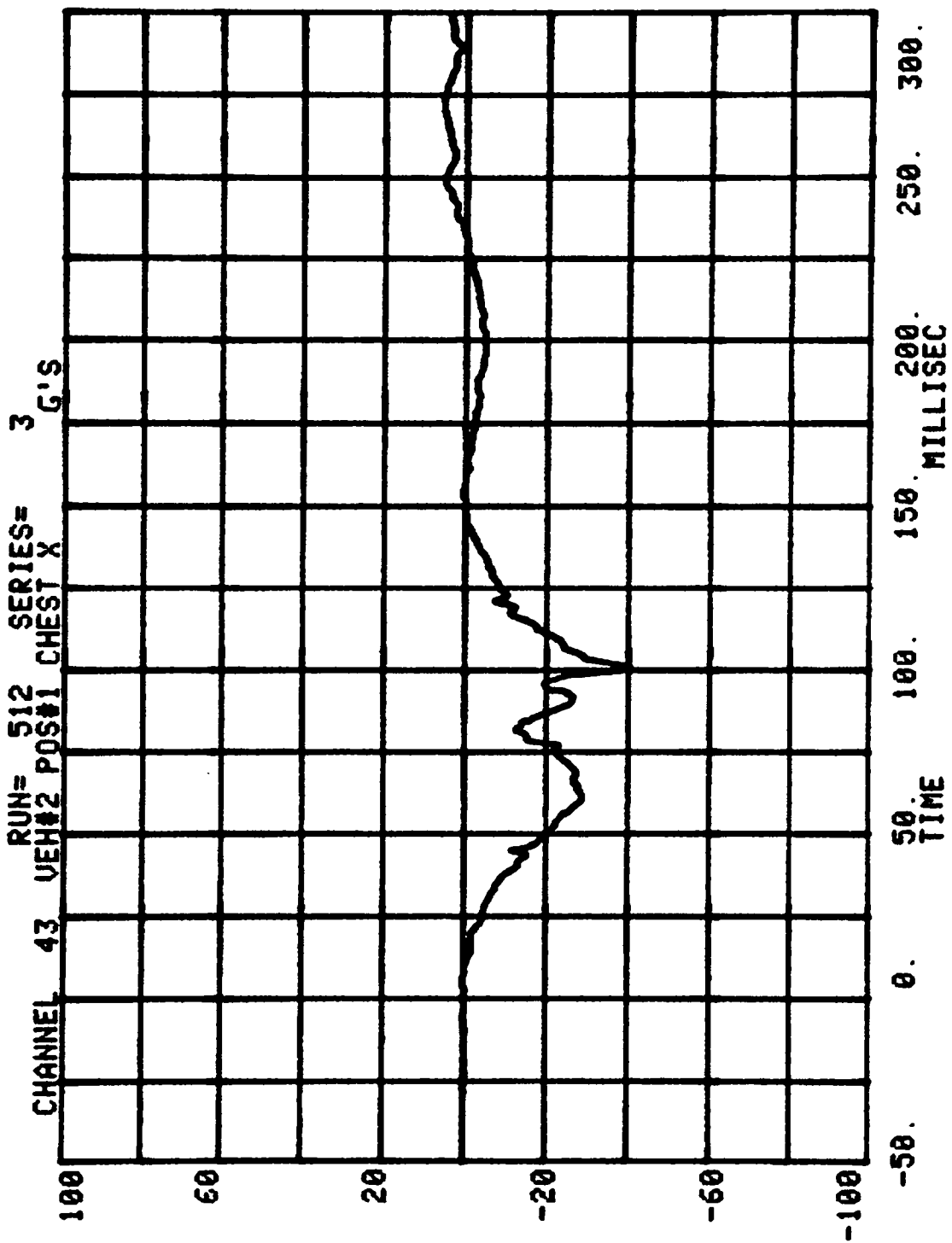
RUN= 512 SERIES= 3

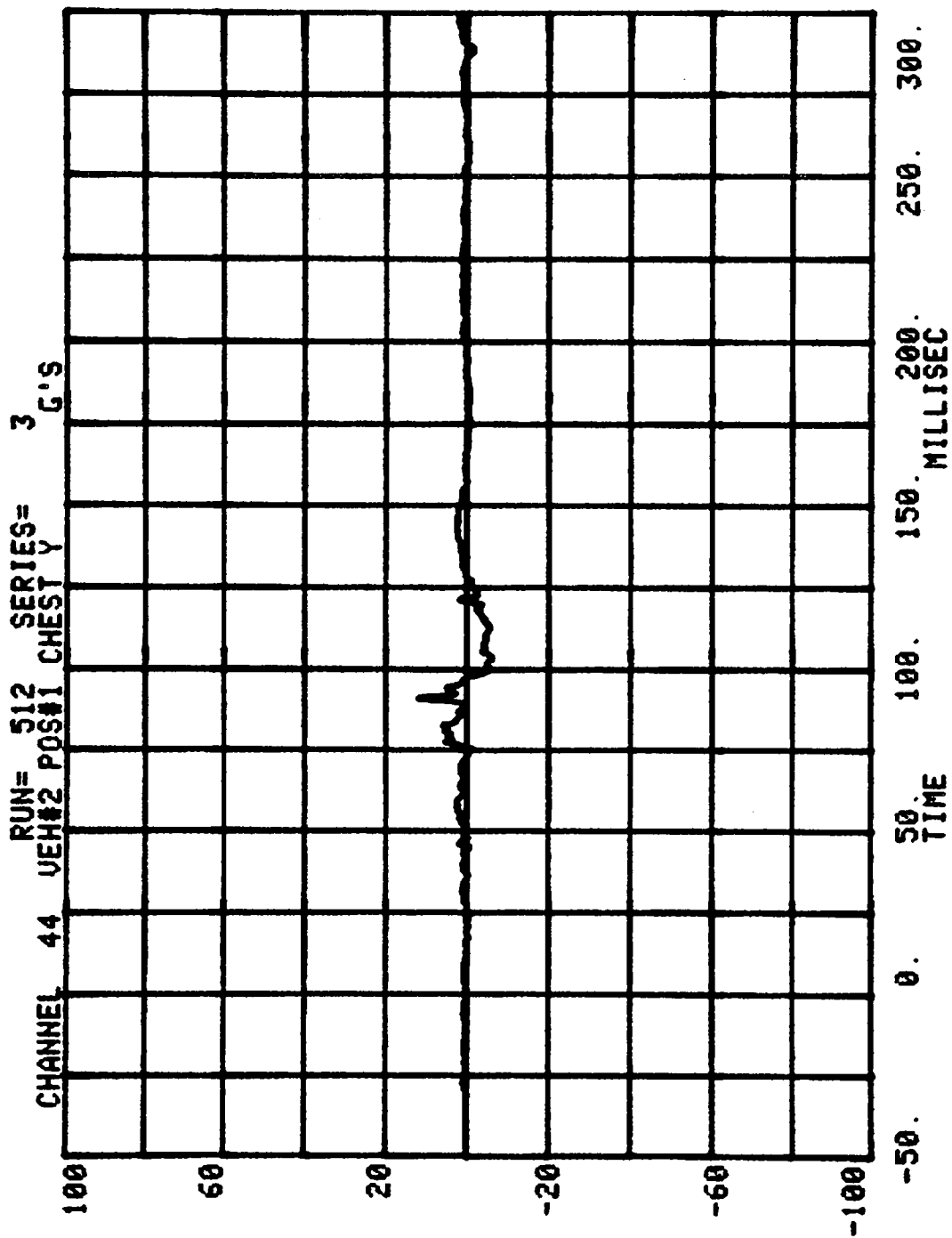
G'S

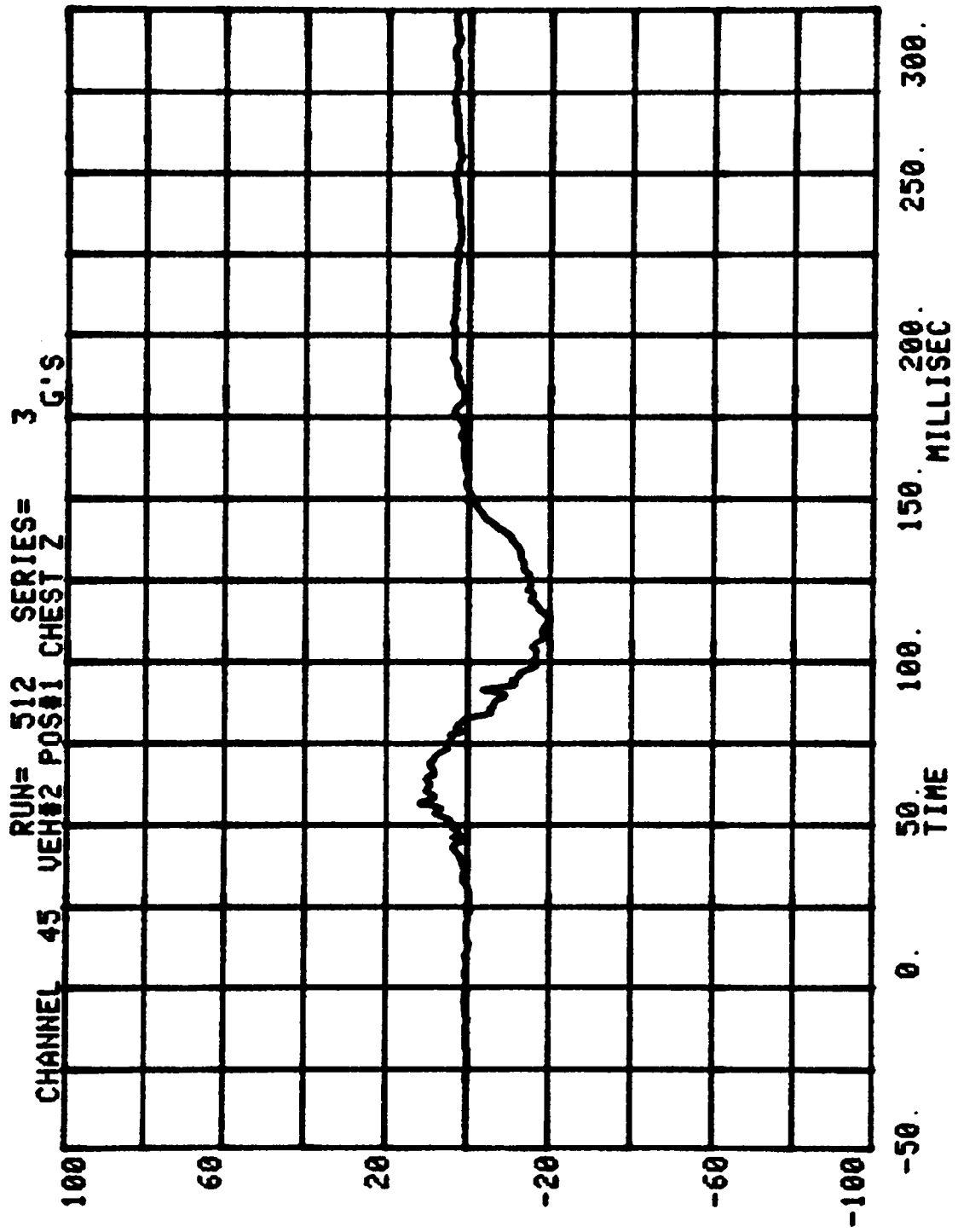


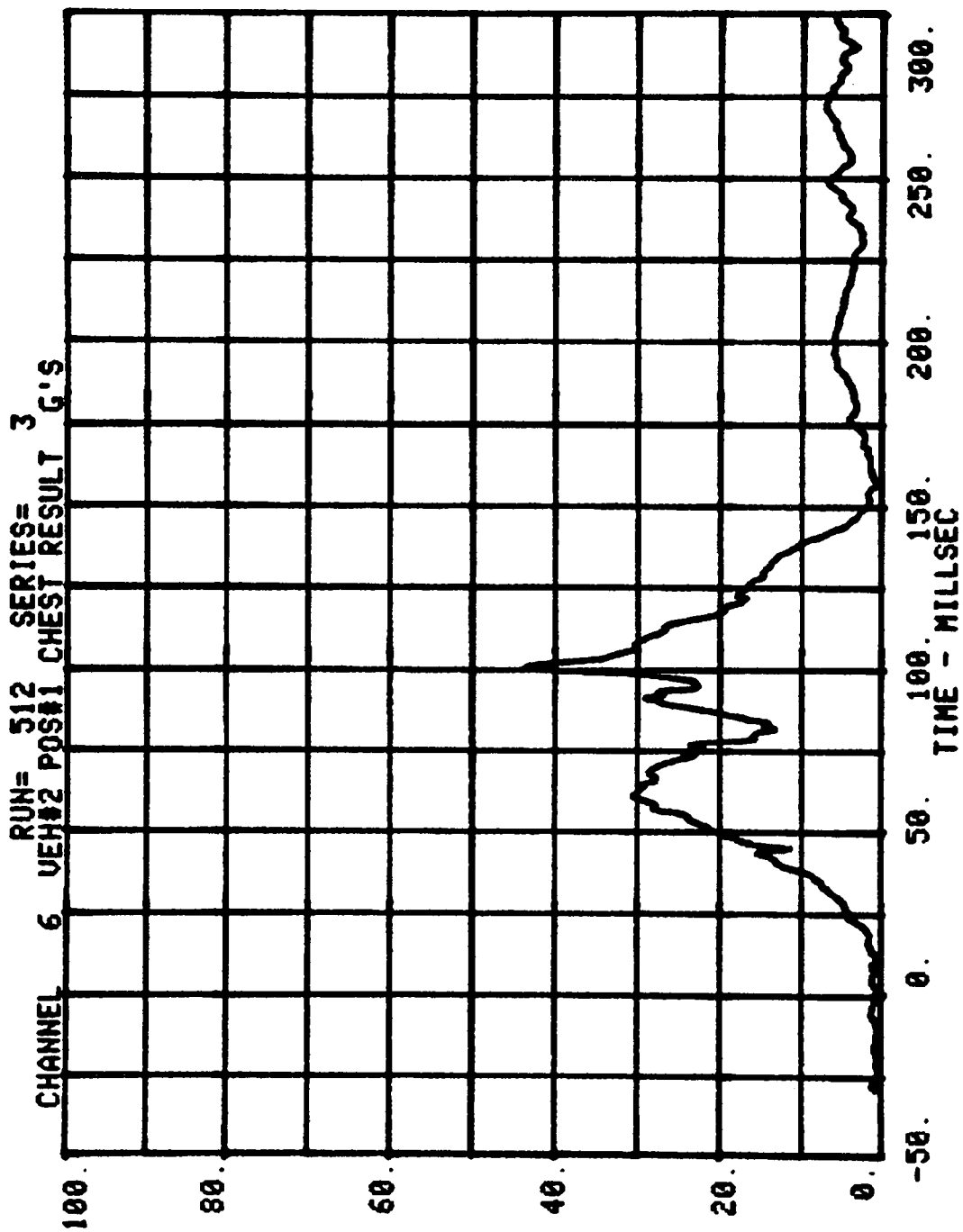




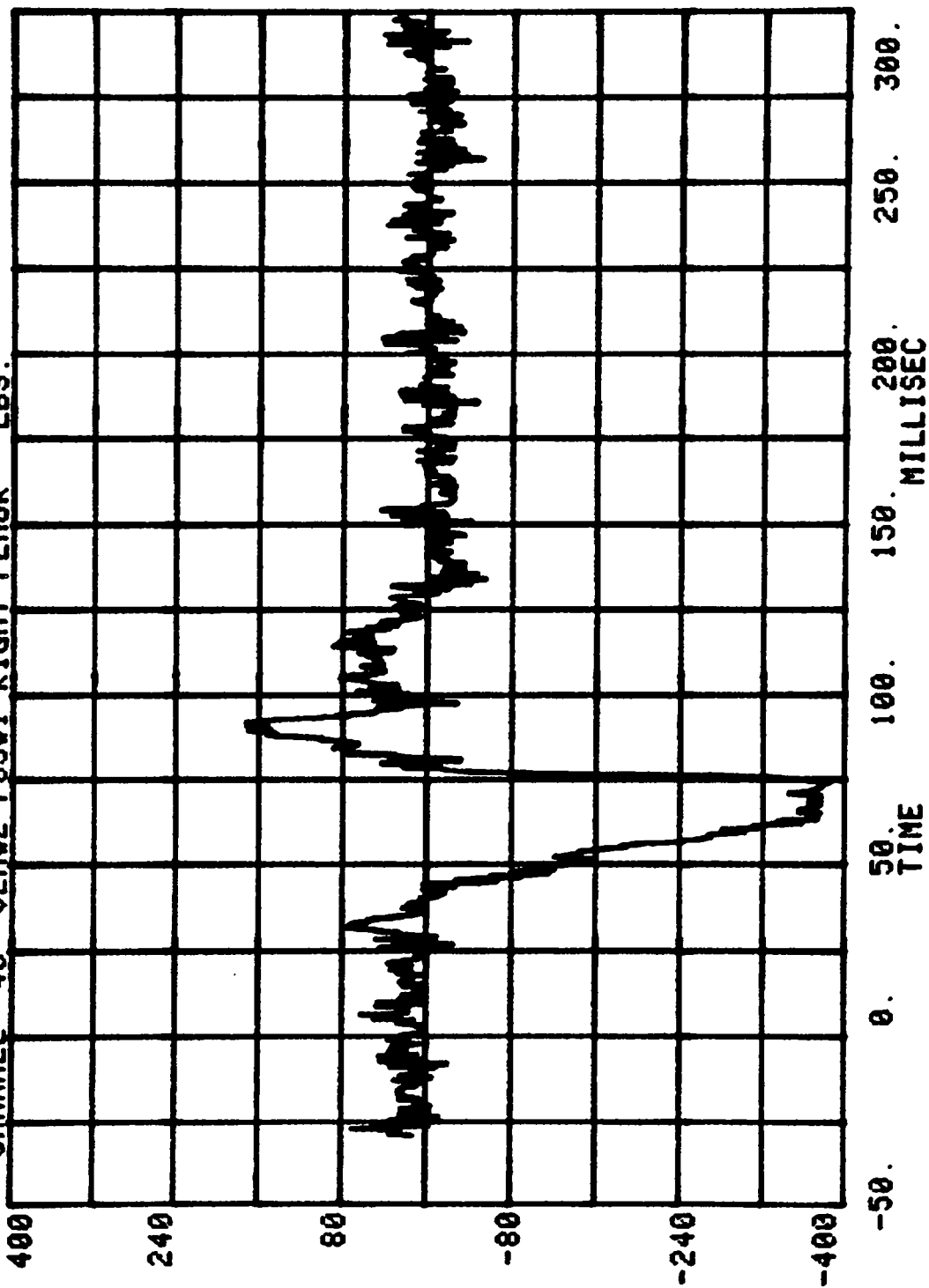


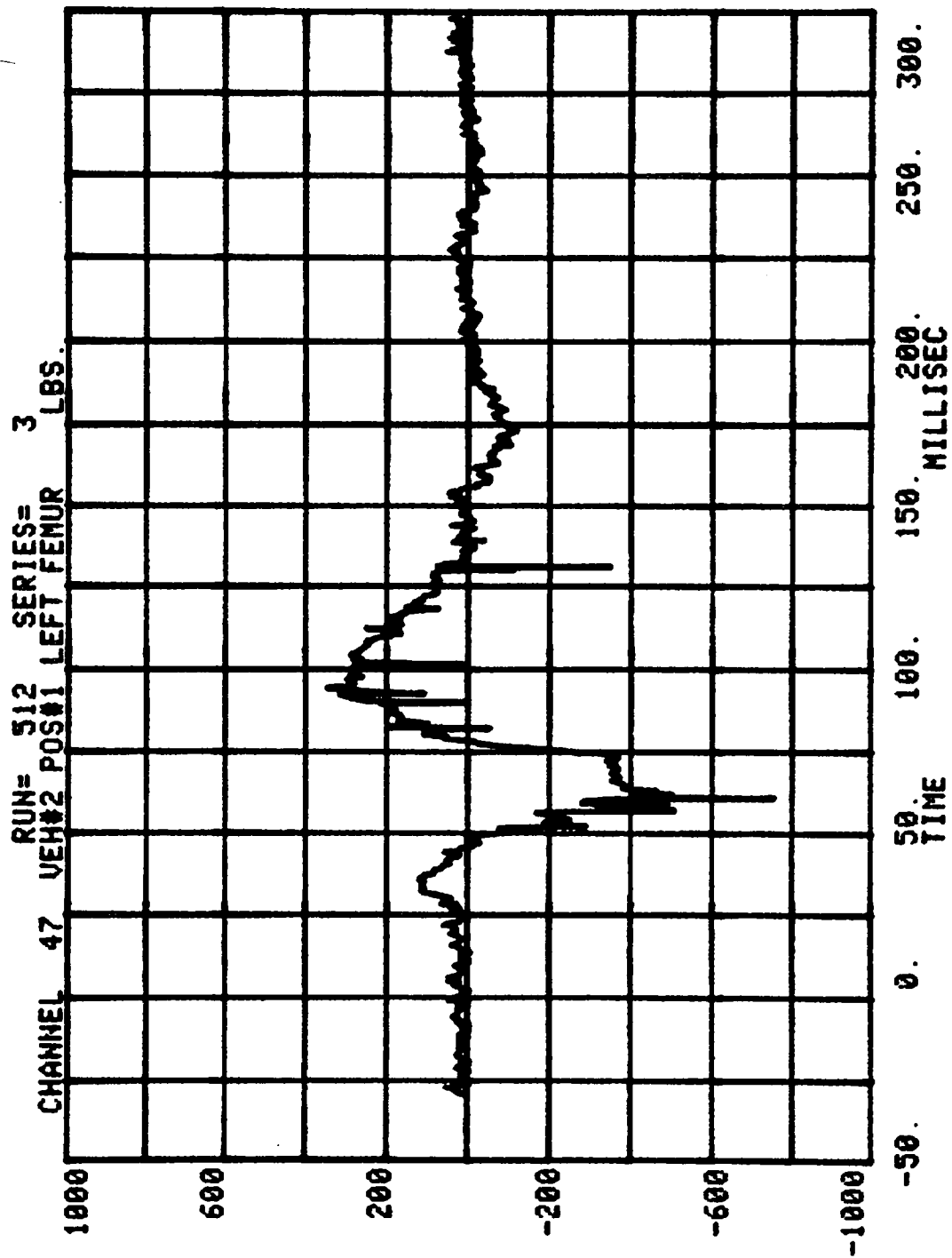




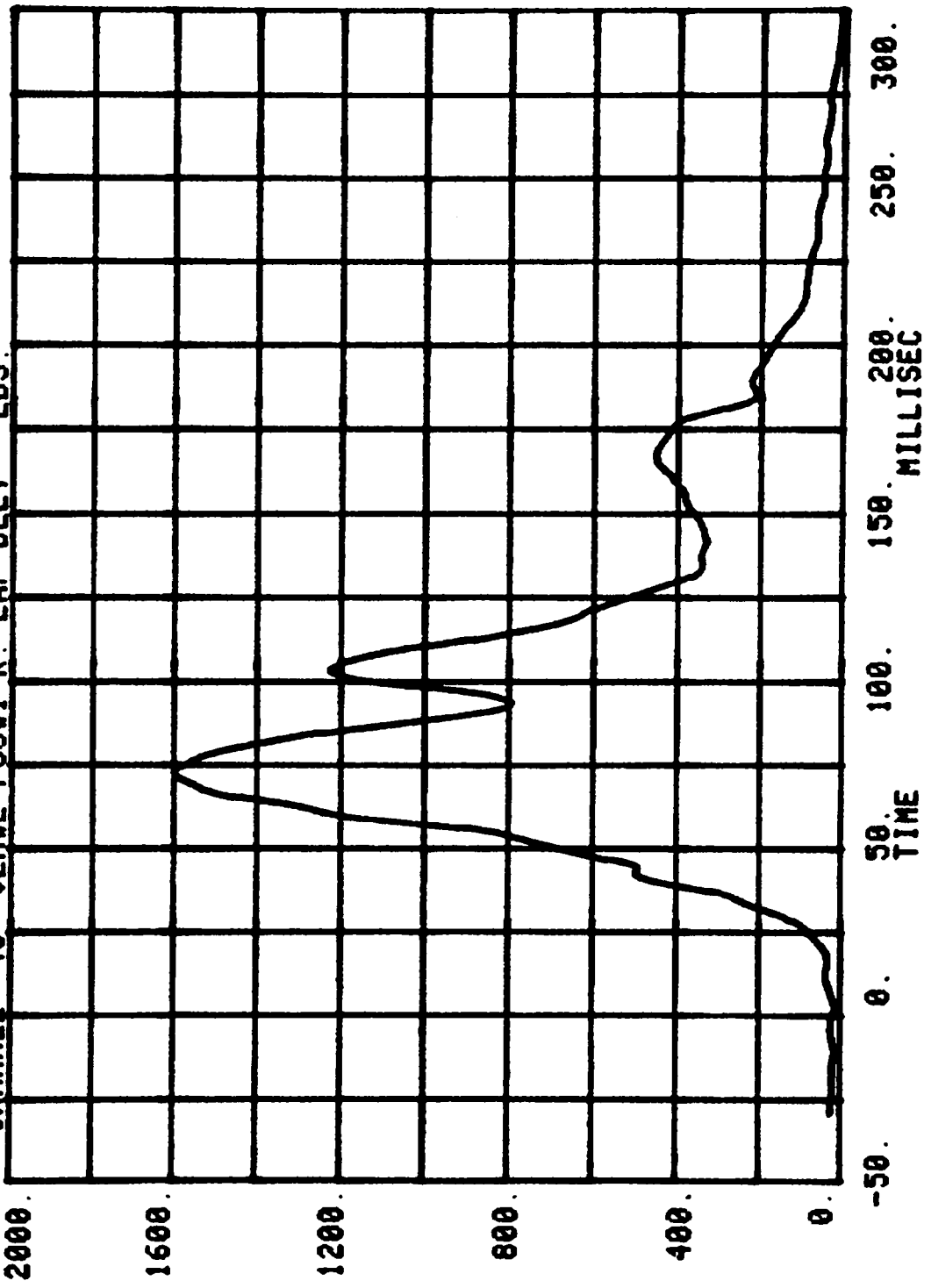


CHANNEL 46 VEH#2 POS#1 RIGHT FEMUR 3 LBS.

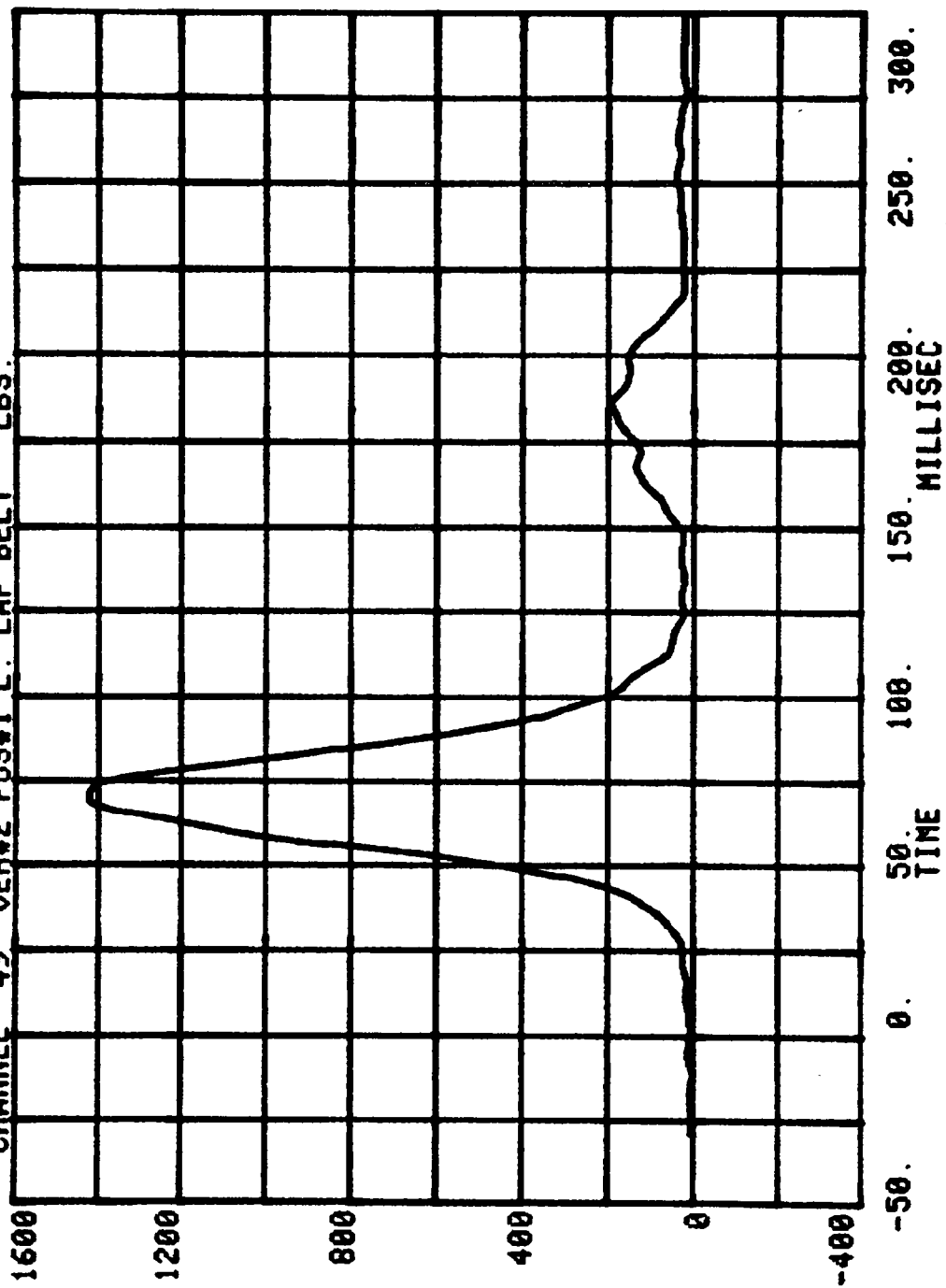


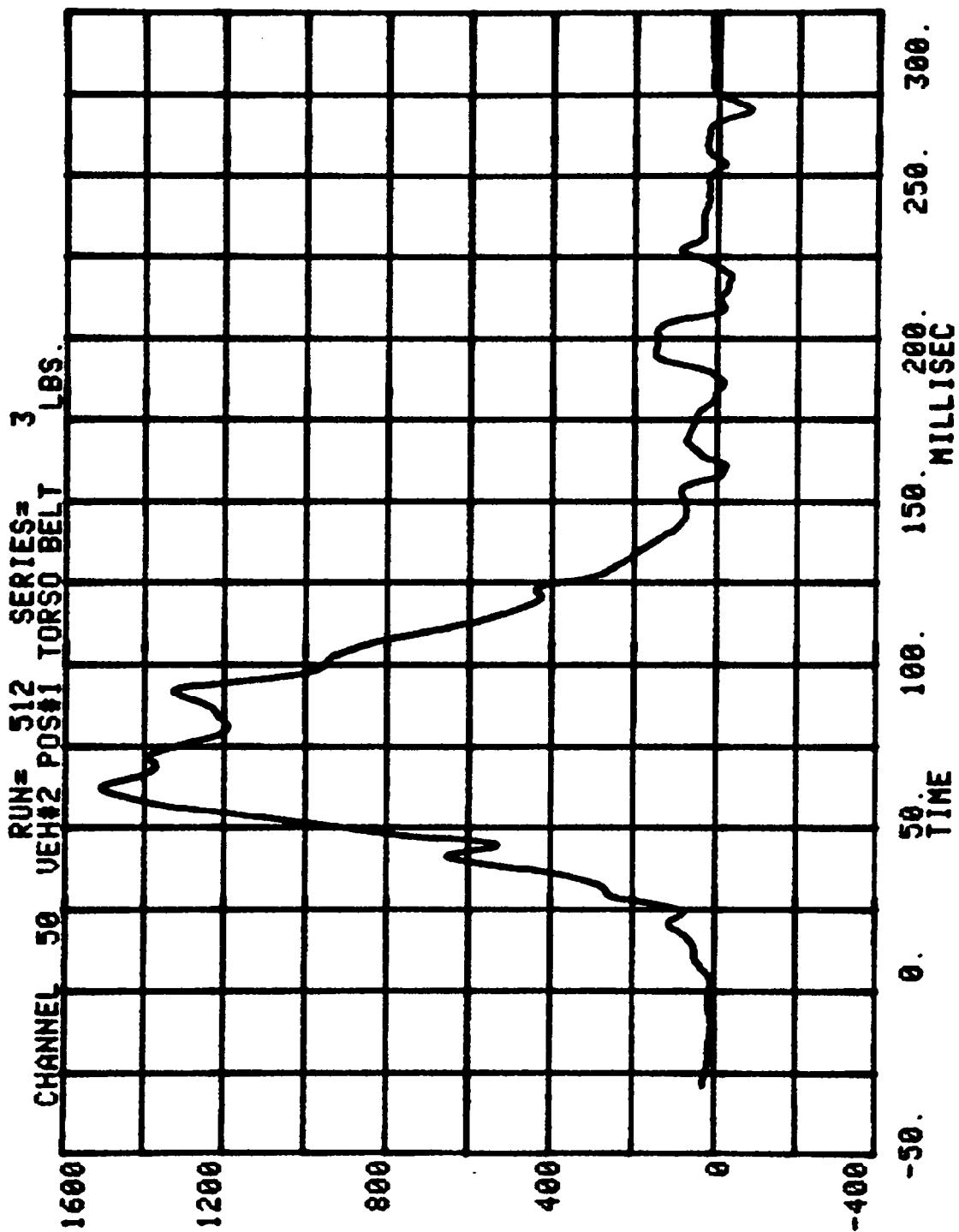


RUN= 512 SERIES= 3
CHANNEL 48 UEH#2 POS#1 R. LAP BELT LBS.



CHANNEL 49 RUN= 512 SERIES= 3
VEH#2 POS#1 L. LAP BELT LBS.





HEAD INJURY CRITERION
HEAD SEVERITY INDEX

VEHICLE AGGRESSIVENESS CAR-TO-CAR TEST #3

RUN= 512

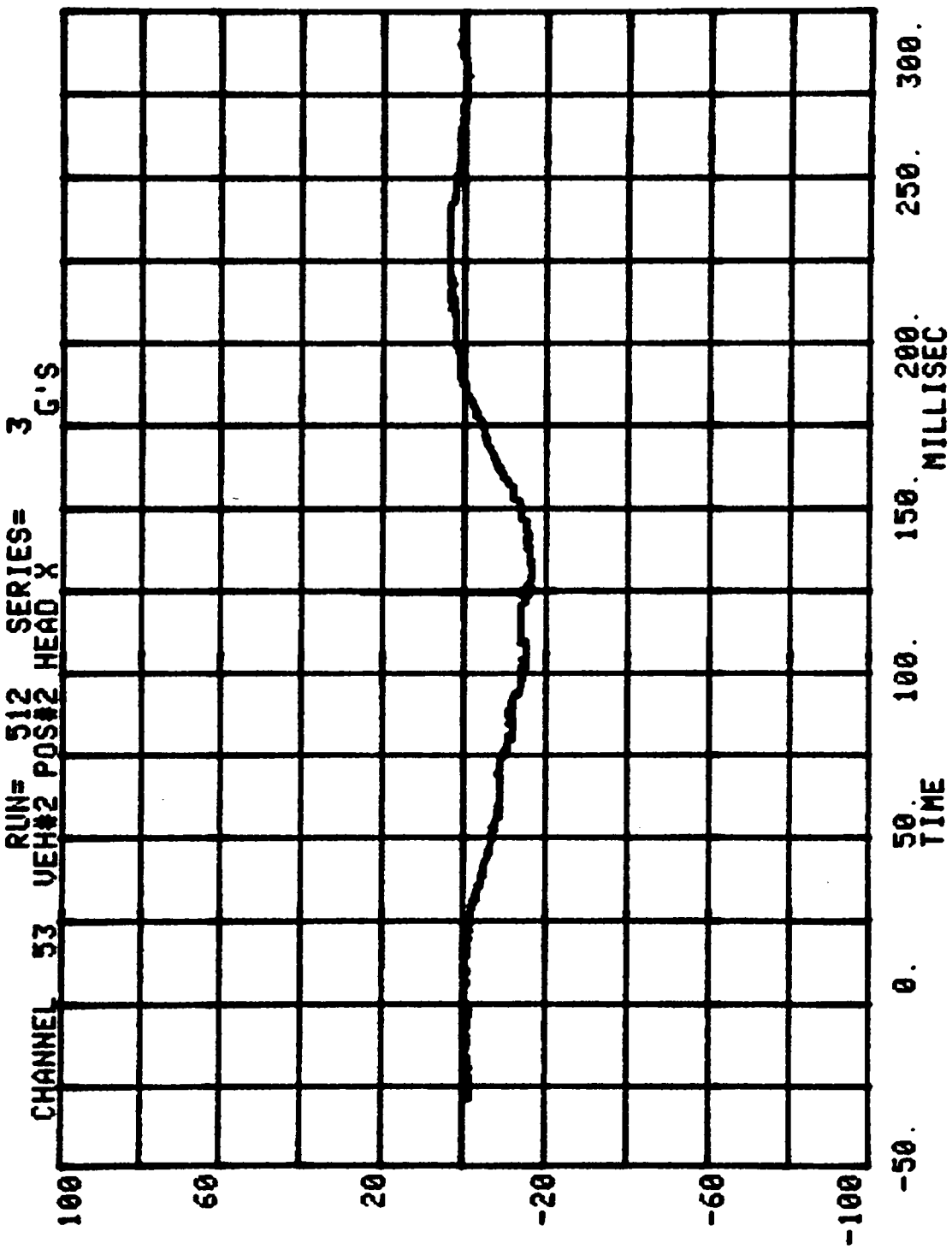
VEH#2 POS#2 HEAD RESULT.

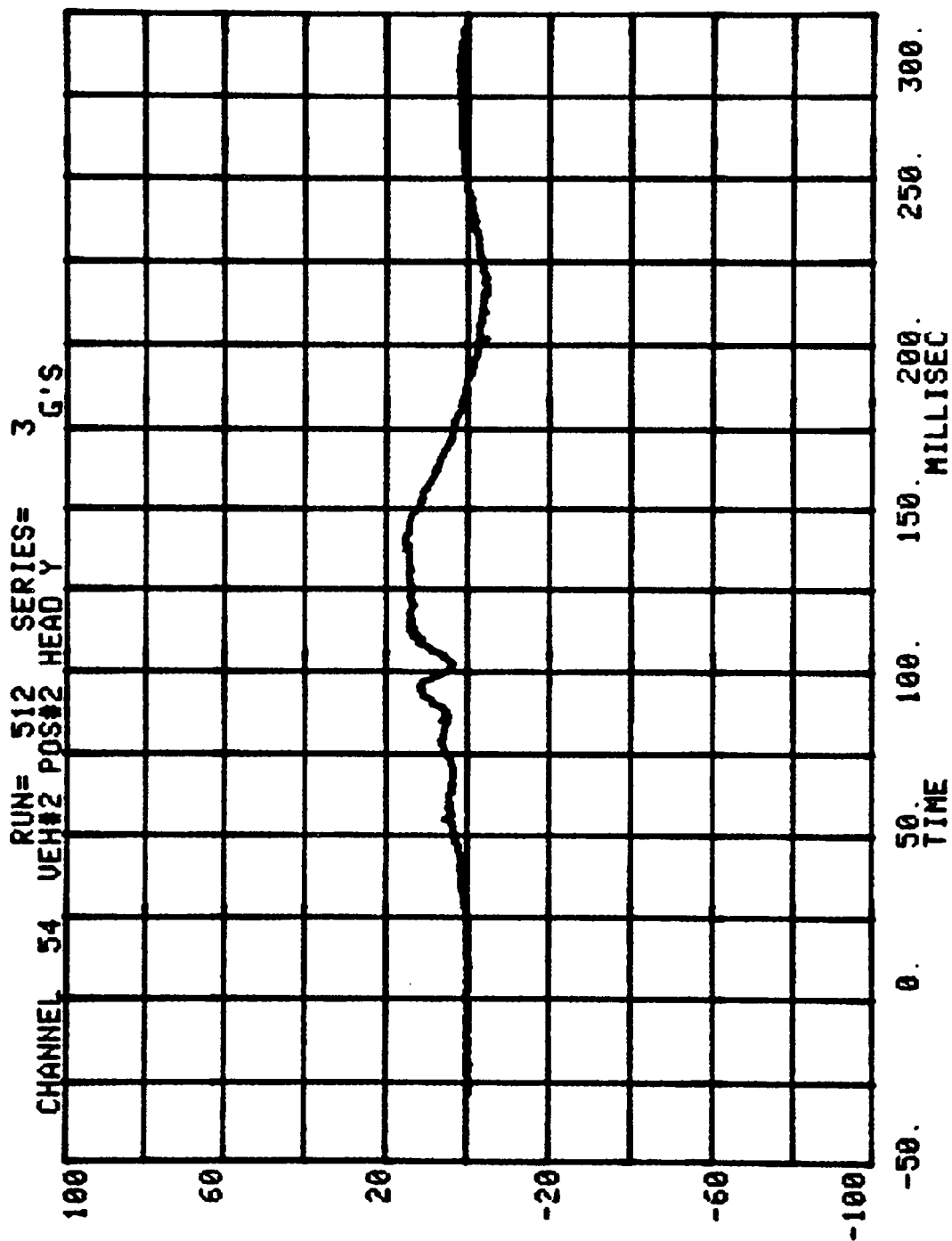
HIC= 235.8 FROM T1= .05370 TO T2= .16860

AVERAGE ACCELERATION BETWEEN T1 AND T2= 21.1G'S

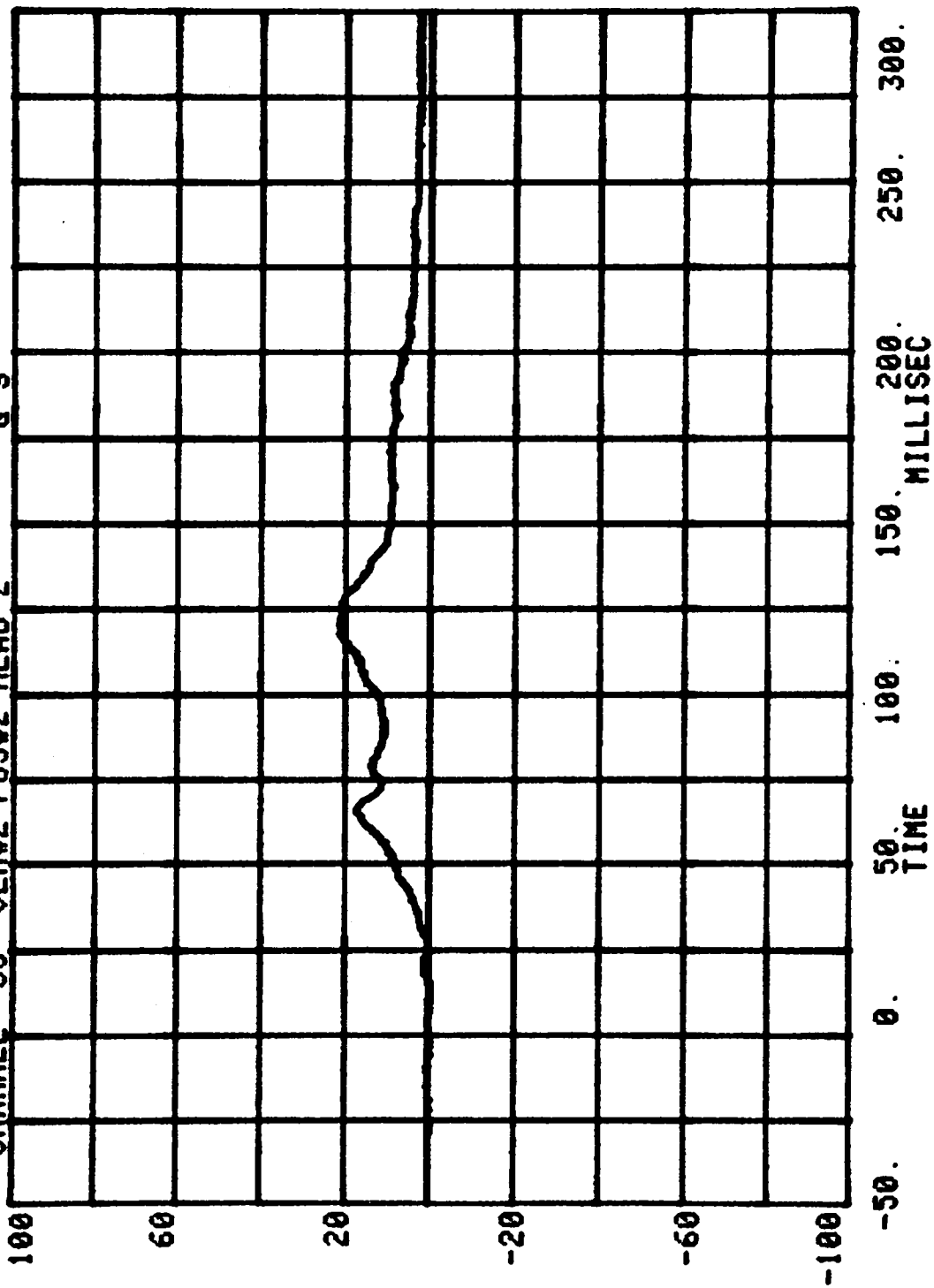
EVENT TIME= 300.0 MSEC

SEVERITY INDEX= 279.9

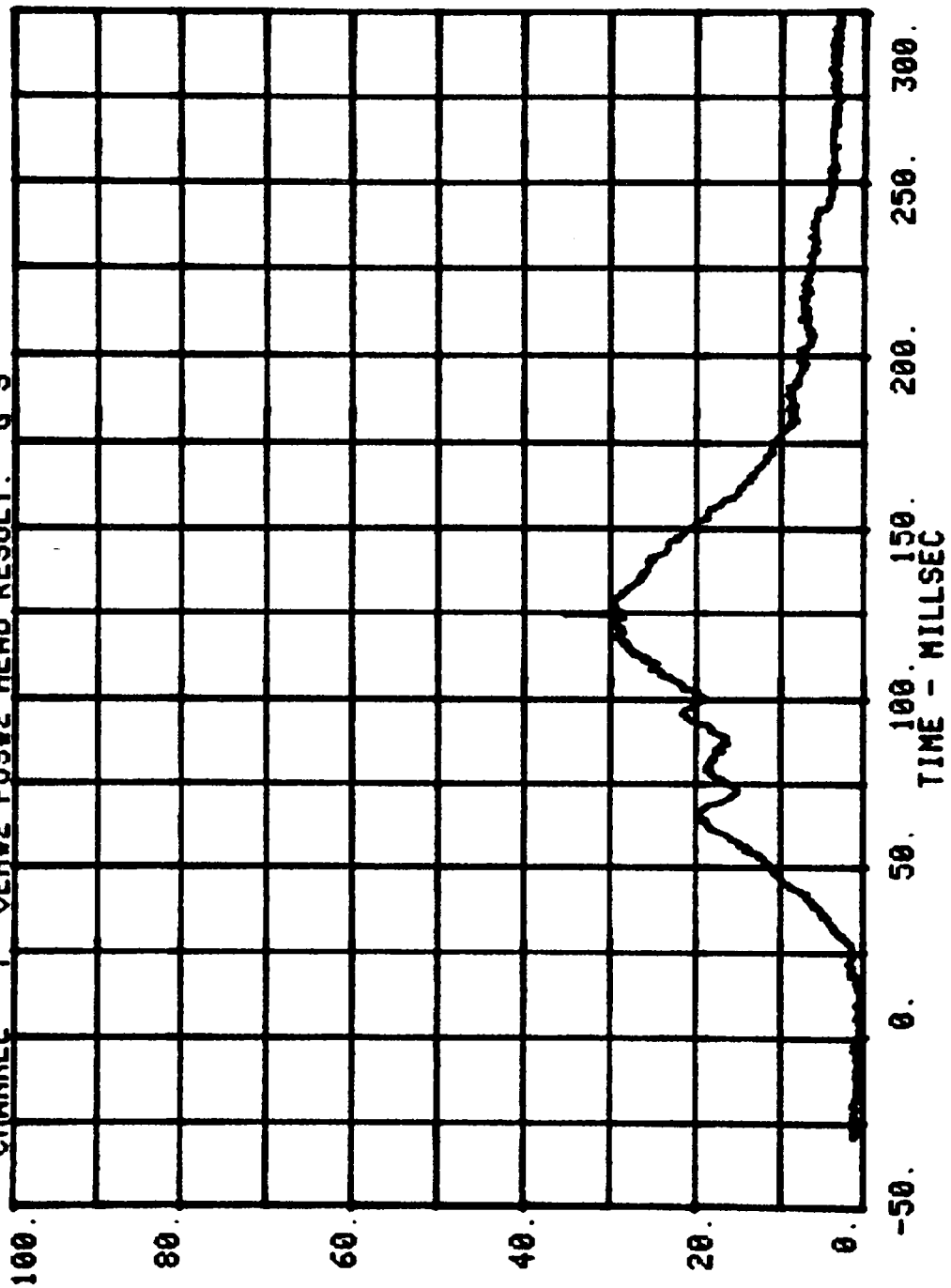


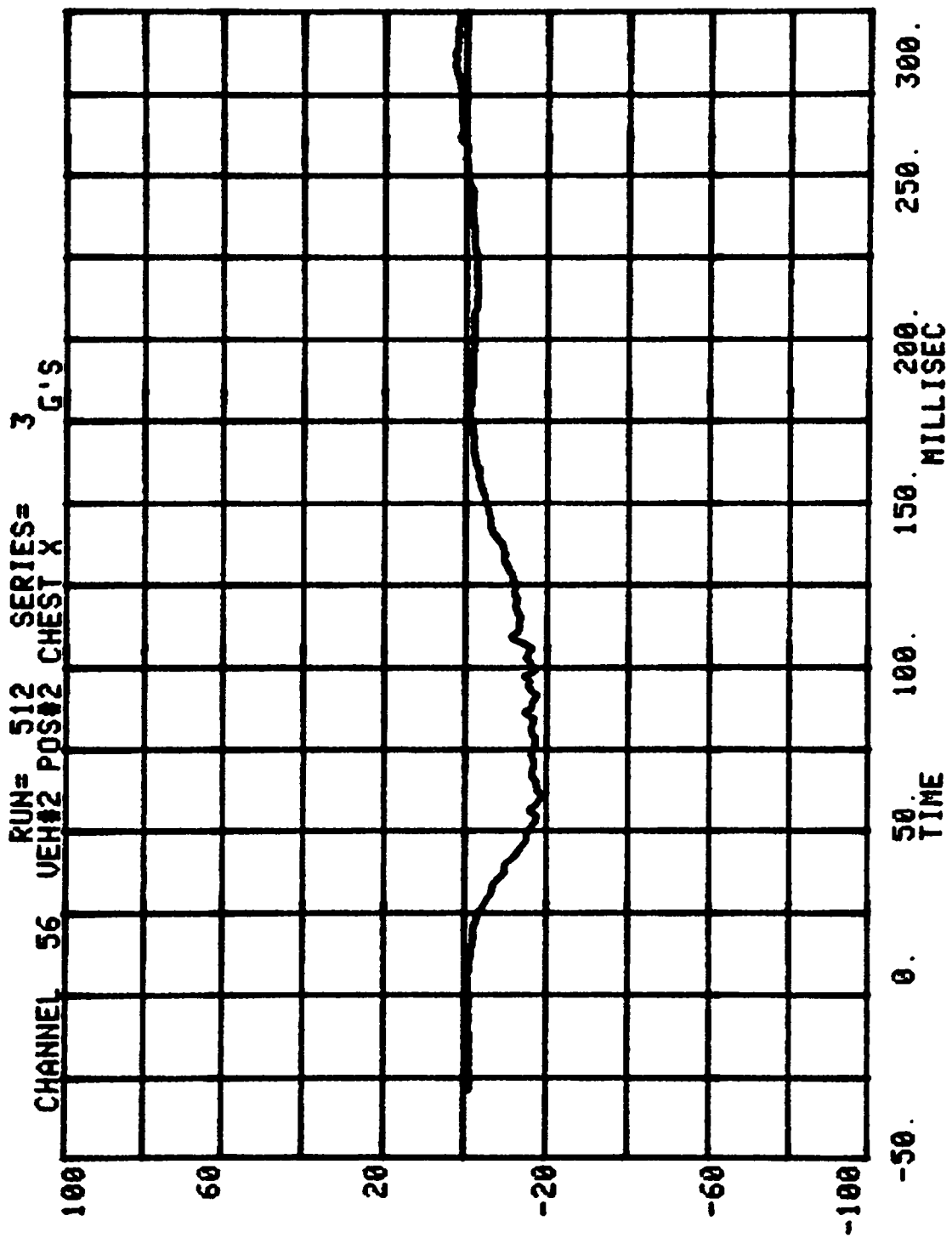


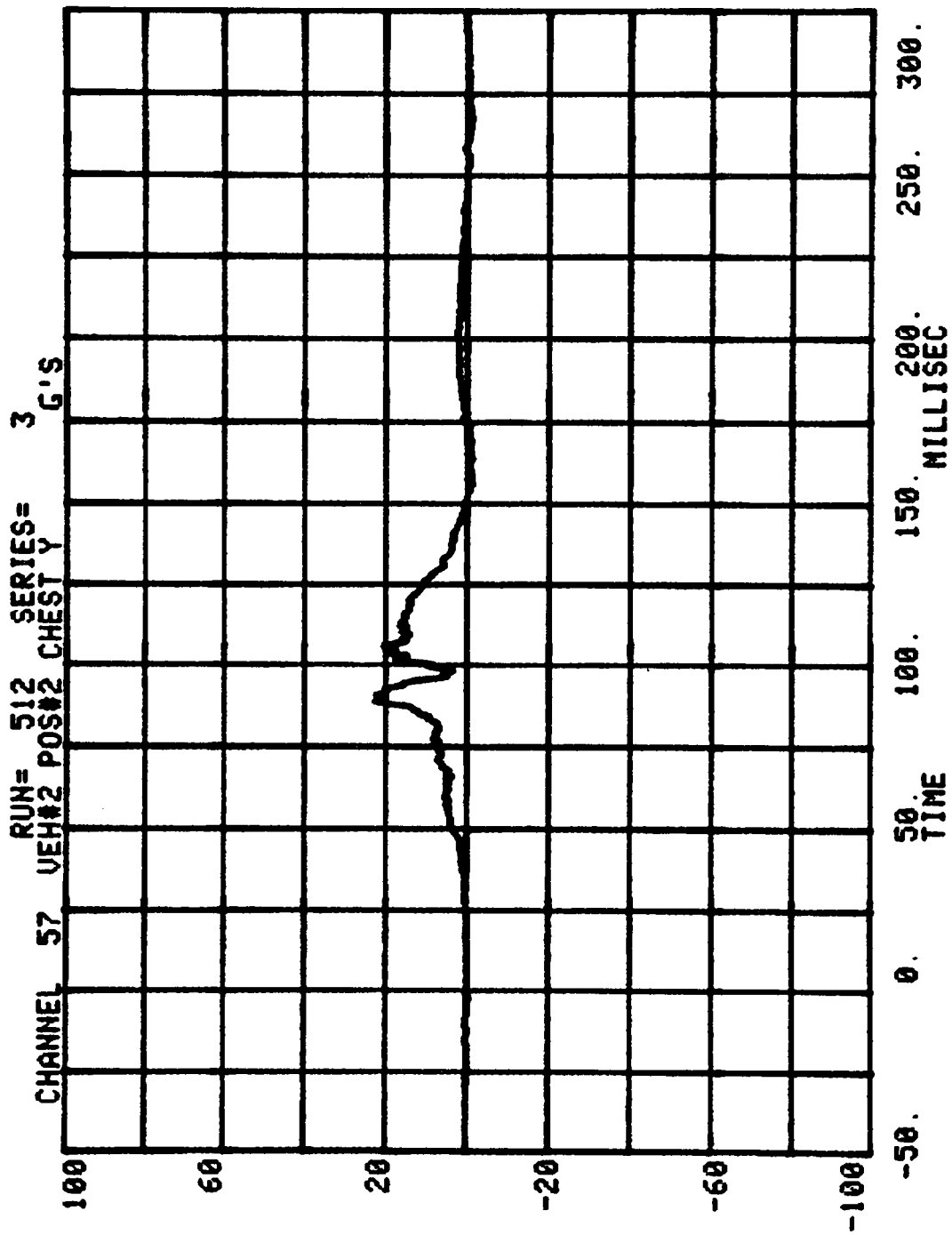
CHANNEL 55 RUN= 512 SERIES= 3
VEH#2 POS#2 HEAD 2 G'S

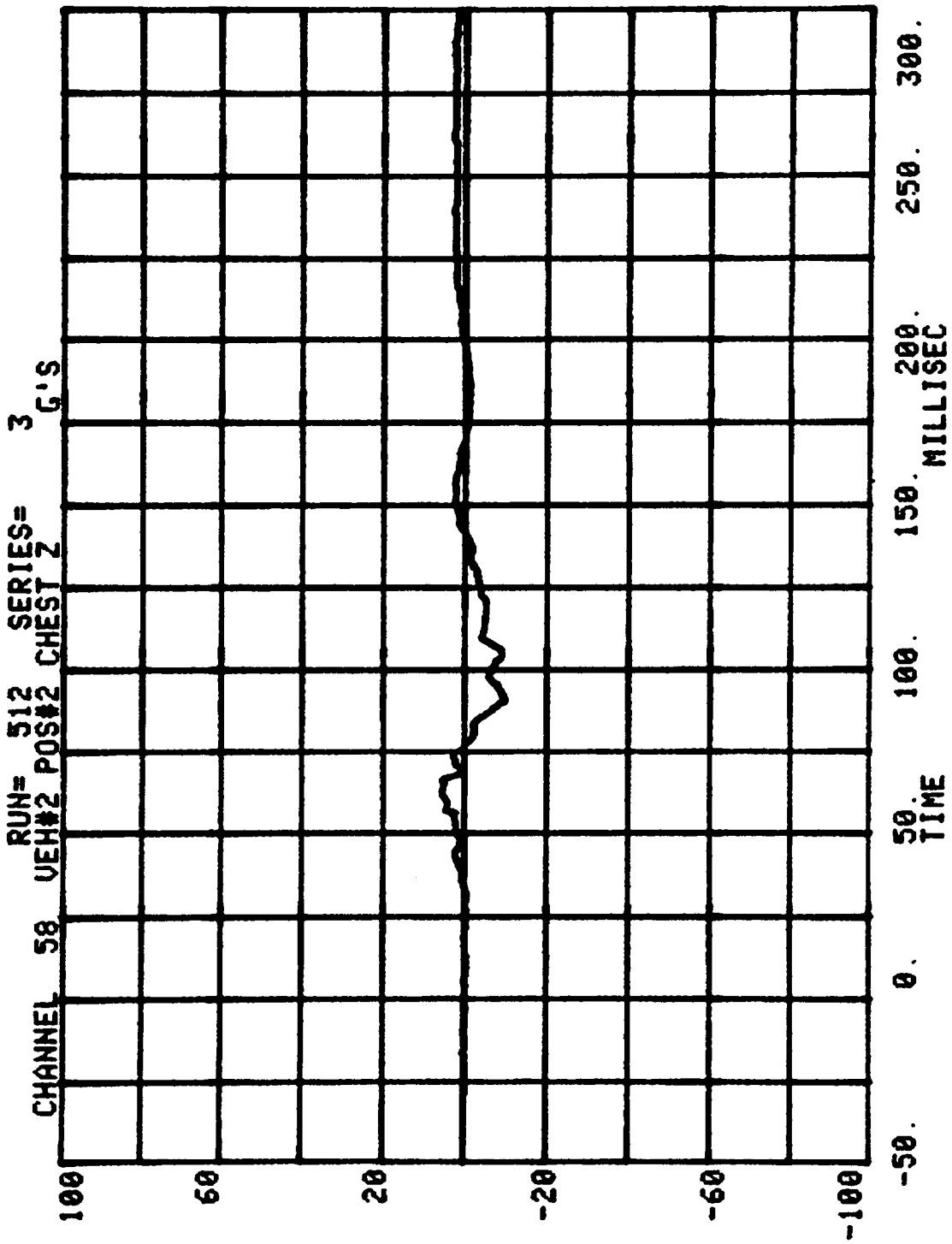


CHANNEL 7 RUN= 512 SERIES= 3
VEH#2 POS#2 HEAD RESULT. G'S



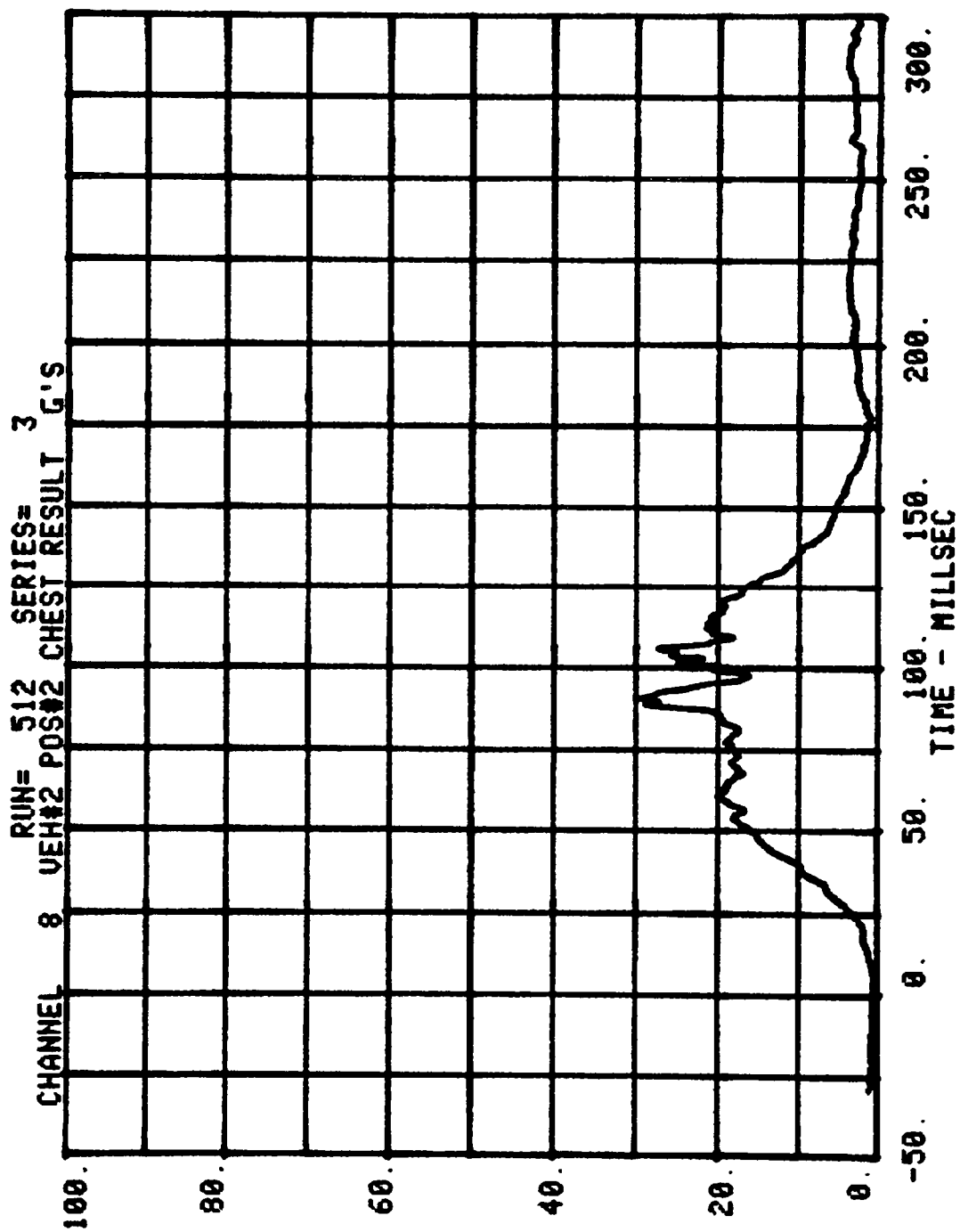


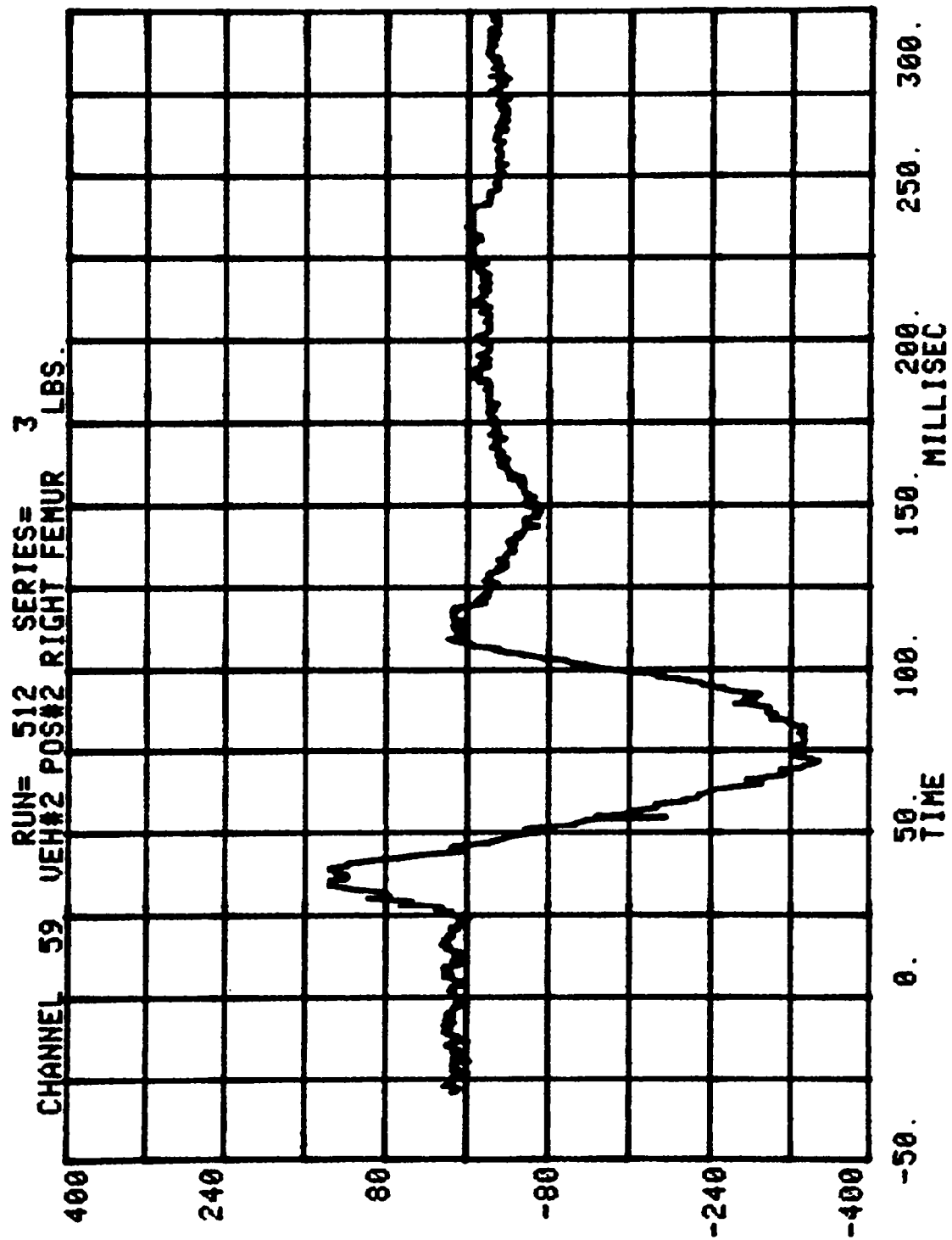


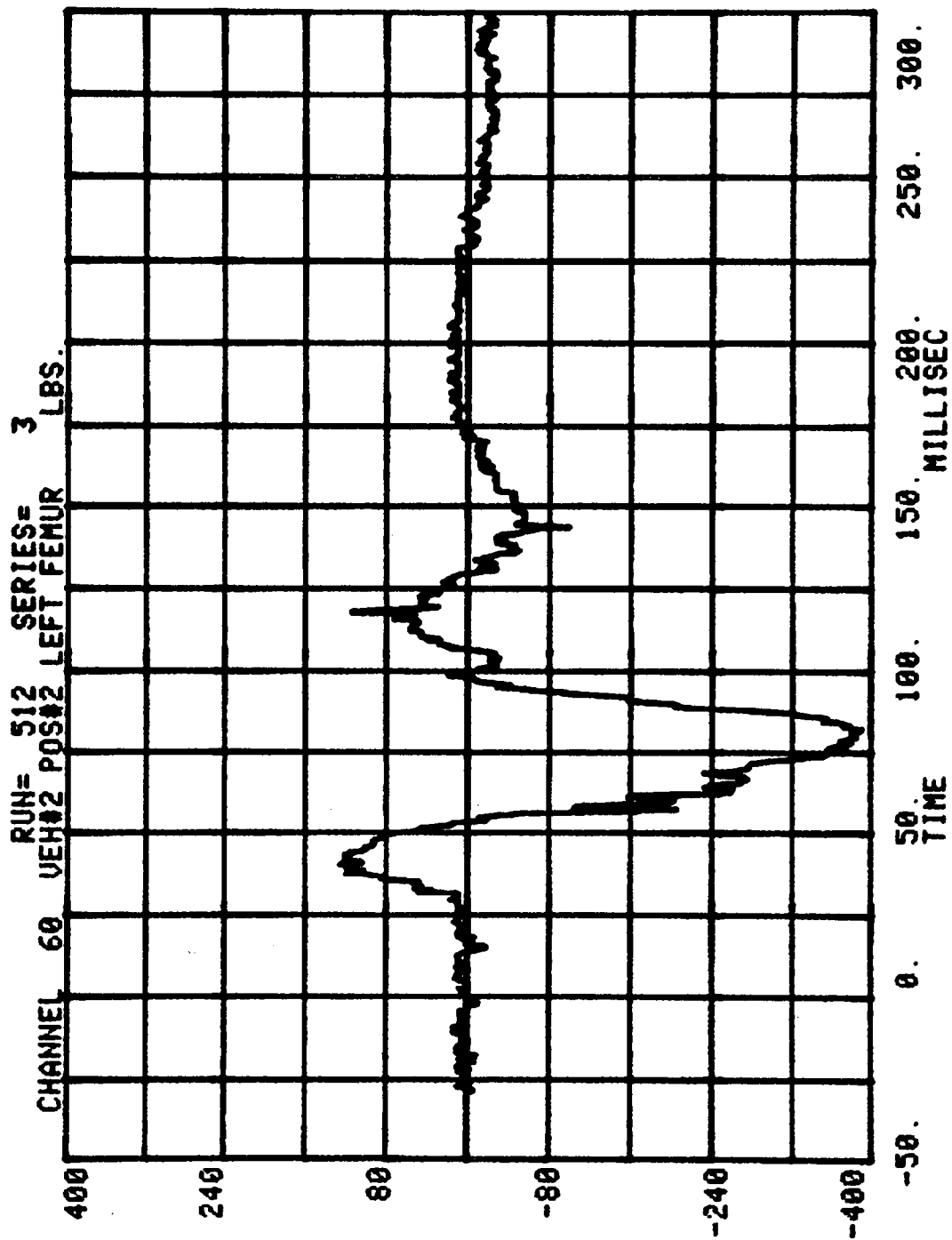


B-119

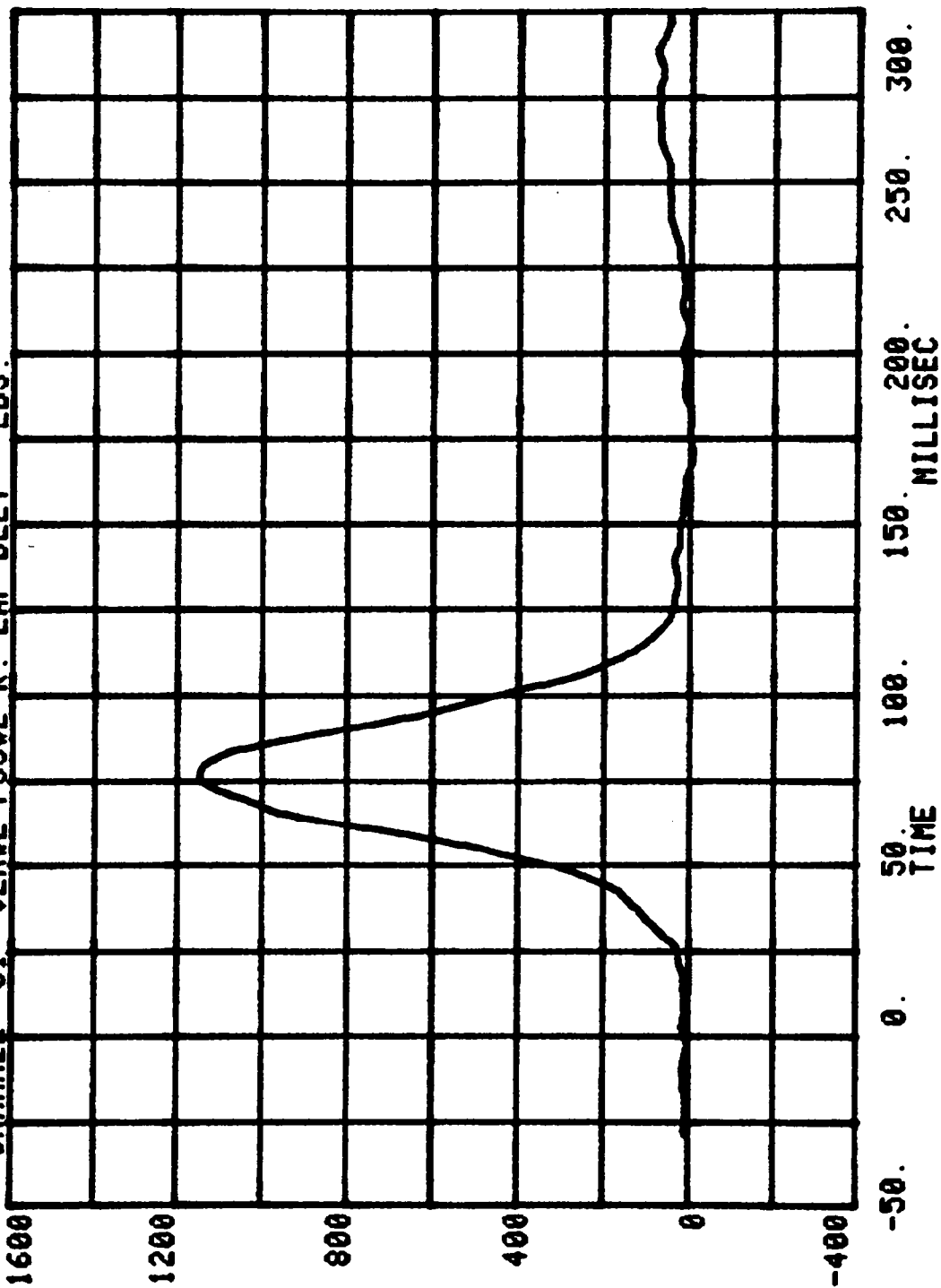
6707-V-3

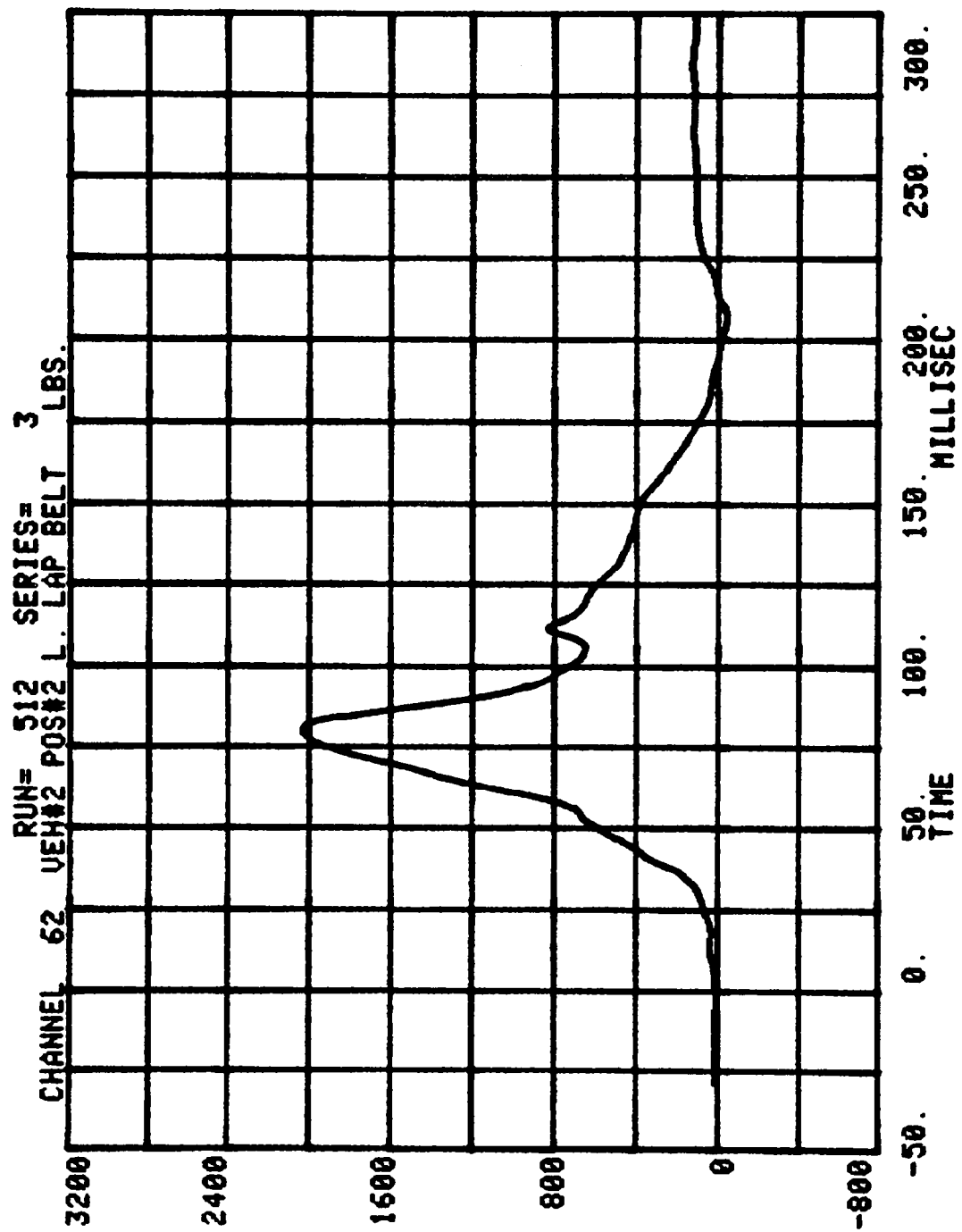


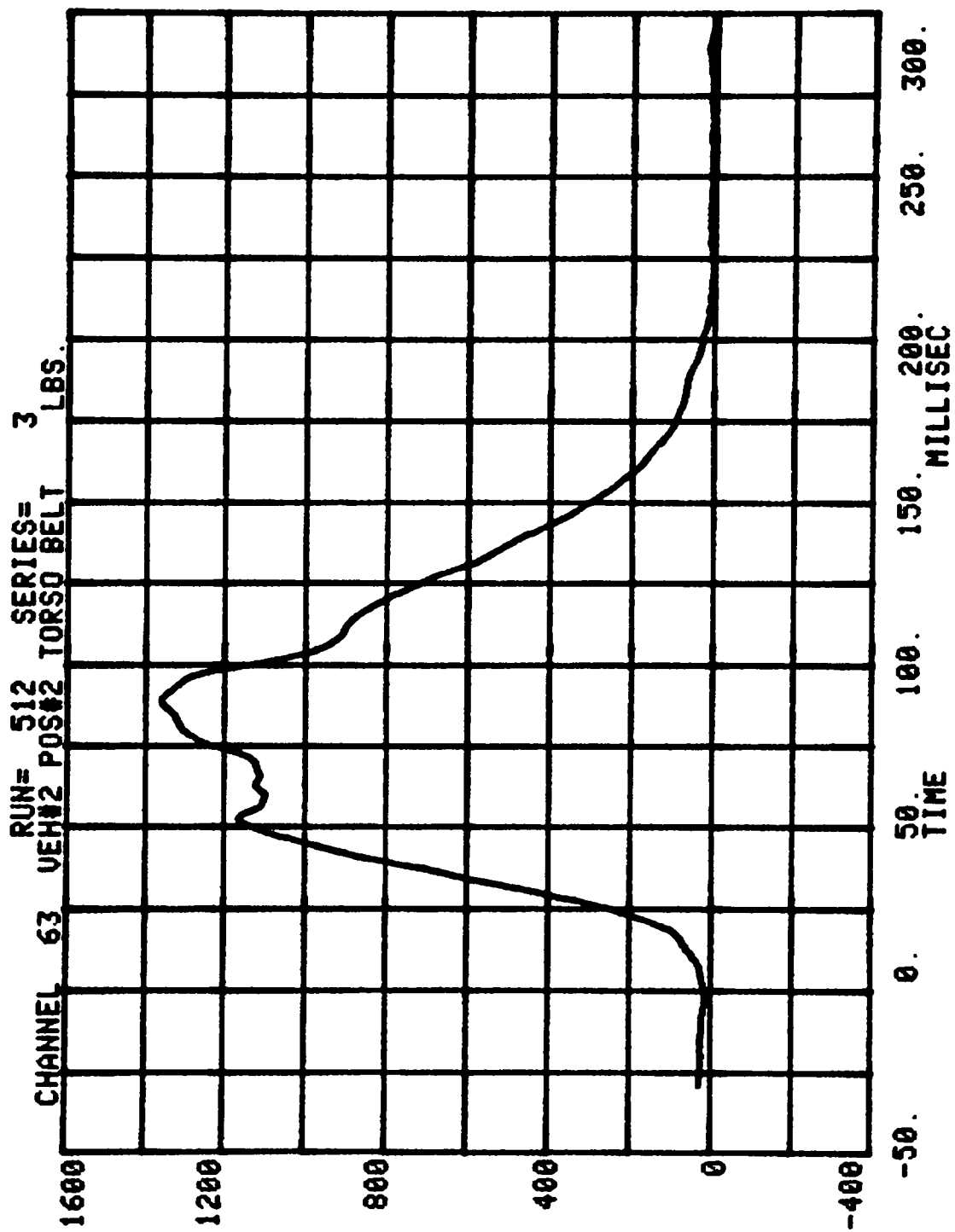




CHANNEL 61. RUN= 512 SERIES= 3
VEH#2 POS#2 R. LAP BELT LBS.







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>
109	1-9-81
162	1-9-81
183	1-9-81
320	1-9-81

Electronic Test Equipment

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

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

1	0	9
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LABORATORY TECHNICIAN: Gary R. Gestwick

APPROVED BY: D. Alcamello

	Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -	1/5/81 - 1/9/81	
Calibration Sequential Number for Dummy - - - -	12	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -	69° - 70°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -	40% - 44%	

TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	225 g	
b. Peak Lateral Accel. - -	≤10G	2 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.1 ms	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	23.5 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	23.5 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	26 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	27 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	5 ms	
g. Pendulum Direction Reversal Time - - - -		103 ms	
h. Max. Head Rotation - -	63 to 73°	66°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0 ms
	Displ.	-.5 to .5 in	0.0 ms
30°	Time	25.6 to 34.4 ms	28 ms
	Displ.	2.1 to 3.1 in.	2.7 in.
60°	Time	40.3 to 51.7 ms	44 ms
	Displ.	4.3 to 5.3 in.	4.8 in.
Maximum	Time	53.2 to 66.8 ms	57.5 ms
(°)	Displ.	5.0 to 6.0 in.	5.3 ms

Continued

P. 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

1 0 9

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST			
<u>Continued</u>			
i. Chordal Displacement:			
Head Rotation Angle --			
60°	Time	67.0 to 83.0 ms	67.5 ms
	Displ.	4.3 to 5.3 in.	4.8 in.
30°	Time	85.4 to 104.6 ms	87 ms
	Displ.	2.1 to 3.1 in.	2.4 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.	54 lbs	
b. Force @ 1.3" - - - -	73 to 88 lbs.	75 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20° - - - -	22 to 34 lbs.	25.5 lbs	
b. Force @ 30° - - - -	34 to 46 lbs.	37.0 lbs	
c. Force @ 40° - - - -	46 to 58 lbs.	47.5 lbs	
d. Return Angle - - - -	12° maximum	2°	
5. CHEST IMPACT TESTS:			
a. High Speed			
(1) Probe Speed - -	21.78-22.22 fps	21.82 fps	
(2) Peak Deflection -	1.7" maximum	1.38 in.	
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	1845 lbs	
(4) Internal Hysteresis - - - -	50 to 70%	56.78%	
b. Low Speed			
(1) Probe Speed - - -	13.86-14.14 fps	14.07 fps	
(2) Peak Deflection -	1.1" maximum	.9 in.	
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1219 lbs	
(4) Internal Hysteresis - - - -	50 to 70%	53.17%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

1	0	9
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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	7.01 fps	
(2) Maximum Force - -	1850 to 2500 lbs	2150 lbs	
(3) Time Above 1000#	1.7 ms minimum	1.95 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.03 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1900 lbs	
(3) Time Above 1000#	1.7 ms minimum	2.0 ms	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1 0 9

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	1/81	7/81
ENDEVCO	CU62	1/81	7/81
ENDEVCO	CE18	1/81	7/81
GSE	75	1/81	7/81
GSE	74	1/81	7/81
CEC	A72 22958	1/81	7/81
CEC	A52 16929	1/81	7/81
TRANSDUCER INC.	20051	1/81	7/81
BLH	72952	1/81	7/81
CIC	567-11	1/81	7/81
C-6	6707-V-3		

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

1	6	2
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LABORATORY TECHNICIAN: Gary R. Gestwick

APPROVED BY: D. DiLeonello

	Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -	1/5/81 - 1/9/81	
Calibration Sequential Number for Dummy - - -	4	
Temperature in Lab. (Spec. = 66 to 78°F) - - -	69° - 70°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -	40% - 44%	

TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	237 g	
b. Peak Lateral Accel. - -	≤10G	4 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.15 ms	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	23.4 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	22 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	23 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤ 3 ms	1.5 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	26 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	6 ms	
g. Pendulum Direction Reversal Time - - - -		107 ms	
h. Max. Head Rotation - -	63 to 73°	65°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0 ms
	Displ.	-.5 to .5 in	0.0 in
30°	Time	25.6 to 34.4 ms	30 ms
	Displ.	2.1 to 3.1 in.	2.7 in.
60°	Time	40.3 to 51.7 ms	47.5 ms
	Displ.	4.3 to 5.3 in.	4.8 in.
Maximum (°)	Time	53.2 to 66.8 ms	58.5 ms
	Displ.	5.0 to 6.0 in.	5.2 in.

Continued

P. 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

1 6 2

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. <u>NECK BENDING TEST</u> <u>Continued</u>				
i. Chordal Displacement:				
Head Rotation Angle --				
60°	Time	67.0 to 83.0 ms	69 ms	
	Displ.	4.3 to 5.3 in.	4.8 in.	
30°	Time	85.4 to 104.6 ms	90 ms	
	Displ.	2.1 to 3.1 in.	2.5 in.	
0°	Time	101.0 to 123.0 ms	106 ms	
	Displ.	-.5 to 0.5 in.	0.1 in.	
3. <u>ABDOMINAL COMPRESSION TEST:</u>				
(Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.	61 lbs	
b. Force @ 1.3" - - - - -		73 to 88 lbs.	83 lbs	
4. <u>LUMBAR FLEXION TEST:</u>				
a. Force @ 20° - - - - -		22 to 34 lbs.	29 lbs	
b. Force @ 30° - - - - -		34 to 46 lbs.	40.5 lbs	
c. Force @ 40° - - - - -		46 to 58 lbs.	52 lbs	
d. Return Angle - - - - -		12° maximum	5°	
5. <u>CHEST IMPACT TESTS:</u>				
a. High Speed				
(1) Probe Speed - - -		21.78-22.22 fps	21.86 fps	
(2) Peak Deflection - -		1.7" maximum	1.28 in.	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	1930 lbs	
(4) Internal Hysteresis - - - - -		50 to 70%	56.58%	
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps	14.09 fps	
(2) Peak Deflection - -		1.1" maximum	.8 in.	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1245 lbs	
(4) Internal Hysteresis - - - - -		50 to 70%	58.24%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

1	6	2
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TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	<u>6.76 to 7.04 fps</u>	6.91 fps	
(2) Maximum Force - -	<u>1850 to 2500 lbs</u>	2200 lbs	
(3) Time Above 1000#	<u>1.7 ms minimum</u>	1.9 ms	
b. Left Side --			
(1) Probe Speed - - -	<u>6.76 to 7.04 fps</u>	6.99 fps	
(2) Maximum Force - -	<u>1850 to 2500 lbs.</u>	2000 lbs	
(3) Time Above 1000#	<u>1.7 ms minimum</u>	2.2 ms	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1	6	2
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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	1/81	7/81
ENDEVCO	CU62	1/81	7/81
ENDEVCO	CE18	1/81	7/81
GSE	75	1/81	7/81
GSE	74	1/81	7/81
CEC	A72 22958	1/81	7/81
CEC	A52 16929	1/81	7/81
TRANSDUCER INC.	20051	1/81	7/81
BLH	72952	1/81	7/81
CIC	567-11	1/81	7/81
C-10	6707-V-3		

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

1	8	3
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LABORATORY TECHNICIAN: Gary R. Gestwick

APPROVED BY: D. Aleonello

	Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -	1/5/81 - 1/9/81	
Calibration Sequential Number for Dummy - - - -	1	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -	69° - 70°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -	40% - 44%	

TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	222 g	
b. Peak Lateral Accel. - -	≤10G	4 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.2 ms	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	23.94 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	23 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	23 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	28 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	4.5 ms	
g. Pendulum Direction Reversal Time - - - -		106 ms	
h. Max. Head Rotation - -	63 to 73°	65°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	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.	2.8 in.
60°	Time	40.3 to 51.7 ms	46.5 ms
	Displ.	4.3 to 5.3 in.	5.0 in.
Maximum	Time	53.2 to 66.8 ms	57 ms
(°)	Displ.	5.0 to 6.0 in.	5.3 in.

Continued

C-11

6707-V-3

P, 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

1 8 3

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST			
<u>Continued</u>			
i. Chordal Displacement:			
Head Rotation Angle --			
60°	Time	67.0 to 83.0 ms	67 ms
	Displ.	4.3 to 5.3 in.	5.0 in.
30°	Time	85.4 to 104.6 ms	86 ms
	Displ.	2.1 to 3.1 in.	2.5 in.
0°	Time	101.0 to 123.0 ms	105 ms
	Displ.	-5 to 0.5 in.	0.1 in.
3. ABDOMINAL COMPRESSION TEST:			
(Preload = 10 pounds)			
a. Force @ 1" - - - -	50 to 63 lbs.	60 lbs	
b. Force @ 1.3" - - - -	73 to 88 lbs.	87 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20° - - - -	22 to 34 lbs.	30 lbs	
b. Force @ 30° - - - -	34 to 46 lbs.	36 lbs	
c. Force @ 40° - - - -	46 to 58 lbs.	49 lbs	
d. Return Angle - - - -	12° maximum	5°	
5. CHEST IMPACT TESTS:			
a. High Speed			
(1) Probe Speed - -	21.78-22.22 fps	13.88 fps	
(2) Peak Deflection -	1.7" maximum	1.52 in.	
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	1864 lbs	
(4) Internal - - - - -			
Hysteresis	50 to 70%	51.5%	
b. Low Speed			
(1) Probe Speed - - -	13.86-14.14 fps	14.10 fps	
(2) Peak Deflection -	1.1" maximum	1.02 in.	
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1217 lbs	
(4) Internal - - - - -			
Hysteresis- - - -	50 to 70%	51.35%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

1	8	3
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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	7.04 fps	
(2) Maximum Force - -	1850 to 2500 lbs	2450 lbs	
(3) Time Above 1000#	1.7 ms minimum	1.95 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.02 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2200 lbs	
(3) Time Above 1000#	1.7 ms minimum	2.1 ms	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1	8	3
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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	1/81	7/81
ENDEVCO	CU62	1/81	7/81
ENDEVCO	CE18	1/81	7/81
GSE	75	1/81	7/81
GSE	74		
	A72		
CEC	22958	1/81	7/81
CEC	A52 16929	1/81	7/81
TRANSDUCER INC.	20051	1/81	7/81
BLH	72952	1/81	7/81
CIC	567-11	1/81	7/81
C-14	6707-V-3		

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

3	2	0
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LABORATORY TECHNICIAN: Gary R. Gestwick

APPROVED BY: D. Alenello

	Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -	1/5/81 - 1/9/81	
Calibration Sequential Number for Dummy - - - -	13	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -	69° - 70°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -	40% - 44%	

TEST PARAMETER	SPECIFICATION		
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1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	238 g	
b. Peak Lateral Accel. - -	≤10G	6 g	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.2 ms	

2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	24.1 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	23.5 g	
c. Peak Resultant Head Acceleration - - - -	26G maximum	26 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	28 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	2.5 ms	
g. Pendulum Direction Reversal Time - - - -		105 ms	
h. Max. Head Rotation - -	63 to 73°	64°	
i. Chordal Displacement:			
Head Rotation Angle - -			

0°	Time	-2 to 2 ms	0 ms	
	Displ.	-.5 to .5 in	0.0 in.	
30°	Time	25.6 to 34.4 ms	28 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.	4.8 in.	
Maximum (°)	Time	53.2 to 66.8 ms	57.5 ms	
	Displ.	5.0 to 6.0 in.	5.2 in.	

Continued

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6707-V-3

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			
<u>Continued</u>			
1. Chordal Displacement:			
Head Rotation Angle --			
60°	Time	67.0 to 83.0 ms	67.5 ms
	Displ.	4.3 to 5.3 in.	4.9 in.
30°	Time	85.4 to 104.6 ms	85.5 ms
	Displ.	2.1 to 3.1 in.	2.4 in.
0°	Time	101.0 to 123.0 ms	104.5 ms
	Displ.	-.5 to 0.5 in.	0.0 in
3. ABDOMINAL COMPRESSION TEST:			
(Preload = 10 pounds)			
a. Force @ 1" - - - - -	50 to 63 lbs.	53 lbs	
b. Force @ 1.3" - - - - -	73 to 88 lbs.	82 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20° - - - - -	22 to 34 lbs.	34 lbs	
b. Force @ 30° - - - - -	34 to 46 lbs.	45 lbs	
c. Force @ 40° - - - - -	46 to 58 lbs.	55 lbs	
d. Return Angle - - - - -	12° maximum	6°	
5. CHEST IMPACT TESTS:			
a. High Speed			
(1) Probe Speed - - - - -	21.78-22.22 fps	21.82 fps	
(2) Peak Deflection - - - - -	1.7" maximum	1.46 in.	
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	1840 lbs	
(4) Internal Hysteresis - - - - -	50 to 70%	51.62%	
b. Low Speed			
(1) Probe Speed - - - - -	13.86-14.14 fps	14.10 fps	
(2) Peak Deflection - - - - -	1.1" maximum	.98 in.	
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1190 lbs	
(4) Internal Hysteresis - - - - -	50 to 70%	51.33%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

3	2	0
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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	7.00 fps	
(2) Maximum Force - -	1850 to 2500 lbs	2100 lbs	
(3) Time Above 1000#	1.7 ms minimum	1.75 ms	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.02 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2300 lbs	
(3) Time Above 1000#	1.7 ms minimum	2.15 ms	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

3 2 0

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	1/81	7/81
ENDEVCO	CU62	1/81	7/81
ENDEVCO	CE18	1/81	7/81
GSE	75	1/81	7/81
GSE	74	1/81	7/81
CEC	A72 22958	1/81	7/81
CEC	A52 16929	1/81	7/81
TRANSDUCER INC.	20051	1/81	7/81
BLH	72952	1/81	7/81
CIC	567-11	1/81	7/81
C-18	6707	V-3	