

DOT0512

Dynamic Science Report No. RD1-DYS-83-005

**NEW VEHICLE ASSESSMENT FOR
SIDE IMPACT PROTECTION**

**CAR-TO-CAR SIDE IMPACT TESTING
26.5° CRABBED SIDE IMPACTOR TO
1982 VOLKSWAGEN RABBIT
2-DOOR HATCHBACK
AT 28.60 MPH**

Prepared by:

**DYNAMIC SCIENCE, INC.
An Exodyne Company
1850 West Pinnacle Peak Road
Phoenix, Arizona 85027**



**TEST REPORT
FEBRUARY 1983**

Prepared for: .

**U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
400 SEVENTH STREET, S.W.
WASHINGTON, D.C. 20590**

dsi Dynamic Science, Inc.
an Exodyne Company

1850 West Pinnacle Peak Road • Phoenix, Arizona 85027-1399 • (602) 869-9331

Prepared for the Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-81-C-07113, T.O. 5. This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for the contents or use thereof.

Prepared by Michael P. Rodack

Approved by Rod Garn

Date 2-11-83

Report Accepted by:

Contract Technical Manager
Office of Vehicle Safety Compliance

Date

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. RD1-DYS-83-005	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle NEW VEHICLE ASSESSMENT FOR SIDE IMPACT PROTECTION -CAR-TO-CAR SIDE IMPACT TESTING - 26.5° CRABBED SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT 2-DOOR HATCHBACK AT 28.60 MPH		5. Report Date February 1983	
		6. Performing Orgn Code	
7. Author(s) M. Rodack, Project Engineer		8. Performing Orgn Rpt No. 3144-83-008/2066	
9. Performing Organization Name and Address Dynamic Science, Inc. An Exodyne Company 1850 West Pinnacle Peak Road Phoenix, Arizona 85027		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-81-C-07113 T.O. 5	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh Street, S.W. Washington, D.C. 20590		13. Type of Report and Period Covered January 1983 FINAL REPORT	
		14. Sponsoring Agency Code	
15. Supplementary Notes			
16. Abstract New Vehicle Assessment for Side Impact Protection Car-to-Car Side Impact Testing was conducted at the Dynamic Science Phoenix, AZ facility on a 1982 Volkswagen Rabbit 2-Door Hatchback. The 26.5° crabbed side impactor impact speed was 28.60 mph. The test simulates a two vehicle moving 90° impact with the "bullet-to-target" velocity ratio of 2:1. Test date was January 12, 1983. The ambient temperature was 74°F. Side impact dummies were placed in the left front and left rear outboard seating positions.			
17. Key Words Occupant Side Impact Protection		18. Distribution Statement Copies are available from Technical Reference Division, National Highway Traffic Safety Administration, Room 5108, 400 Seventh Street, S.W., Washington, D.C. 20590	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. Pages 170	22. Price

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
acres	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
short tons	short tons	0.9	metric ton	t
(2000 lb)				
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
in ³	cubic inches	16	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.8	liters	L
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares	2.5	acres	
(10 000 m ²)				
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton	1.1	short tons	
(1000 kg)				
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
ml	milliliters	0.06	cubic inches	in ³
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F

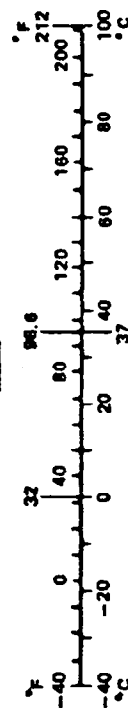


TABLE OF CONTENTS

	<u>Page</u>
1.0 PURPOSE AND TEST INTRODUCTION	1
1.1 PURPOSE	1
1.2 INTRODUCTION	1
2.0 GENERAL TEST AND VEHICLE PARAMETER DATA	2
3.0 DATA REQUIRED BY OAR AND R&D	5
APPENDIX A - PERTINENT PHOTOGRAPHS	26
APPENDIX B - CALCOMP PLOTS FOR 26.5° CRABBED SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT AT 28.60 MPH . . .	42
APPENDIX C - DUMMY CALIBRATION DATA FOR HSRI 122 AND SID 7 - 26.5° CRABBED SIDE IMPACT TO 1982 VOLKSWAGEN RABBIT AT 28.60 MPH	147

1.0 PURPOSE AND TEST INTRODUCTION

1.1 PURPOSE

The purpose of the test is to obtain the necessary data to determine the degree of protection which a specific vehicle provides for the occupant during a side impact collision. The vehicle was tested using test parameters which are not currently contained in a FMVSS to obtain research and vehicle rating baseline data.

1.2 INTRODUCTION

This deformable moving barrier-to-stationary vehicle crash test was conducted at the Dynamic Science side impact facility on January 12, 1983. The 26.5 degree side impactor was accelerated to a test speed of 28.60 mph and allowed to impact the left side of a stationary 1982 Volkswagen Rabbit, such that the left front corner of the side impactor contacted the target vehicle 37 inches forward of the midpoint of the centerline of the front and rear wheels. This test simulated a two vehicle moving, 90 degree impact with the side impactor moving at 26 mph and the target vehicle moving at 13 mph.

Section 2 contains general test and vehicle parameter data. Section 3 contains occupant and vehicle response data. Appendix A contains pre-test and post-test vehicle and dummy photographs. Appendix B contains Calcomp plots. Appendix C contains dummy certification data.

2.0 GENERAL TEST AND VEHICLE PARAMETER DATA

The following data sheets describe the General Test and Vehicle Parameter Data.

GENERAL TEST AND VEHICLE PARAMETER DATA

PRE-IMPACT DATA

Make/Model: Volkswagen Rabbit
Body Style: 2-Door Hatchback Model Year 1982
NHTSA No.: R&D DSI No. 1302 Color: White

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Volkswagen of America
Date of Manufacture: 1/82; VIN: 1VWAB017XCV054548
GVWR: 2822 lb; GAWR: Front = 1609 lb; Rear = 1275 lb

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL

Vehicle Capacity: FRONT REAR RECOMMENDED LOAD RANGE:
Tire Pressure: 27 psi 27 psi TIRE SIZE: Standard
Type of Seats: Bucket P155/80R-13
Designated Seating: 2 Front 2 Rear 4 Total
Cargo load = 185 lb Is Spare Tire: Space Saver? No
TOTAL = 785 lb Standard Equipment? Yes
Engine: 4 cylinder transverse mount, 105 cu. in. Displacement
Transmission: 4 Speed Manual Front Wheel Drive
Date Vehicle Received by Laboratory: 10/26/82; Odometer 456
Dealer Name & Address: Biddulph, 4434 W. Glendale Avenue,
Glendale, Arizona

WEIGHT (LB) OF TEST VEHICLE AS RECEIVED (WITH MAX. FLUIDS) = UDW

Right Front = 619 lb Right Rear = 341 lb
Left Front = 630 lb Left Rear = 342 lb
TOTAL FRONT WEIGHT = 1249 lb (65 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 683 lb (35 % of Total Vehicle Weight)
TOTAL DELV. WEIGHT = 1932 lb

TARGET WEIGHT = UDW + Cargo Load + 328 lbs Dummies = 2445 lb

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 187 LB CARGO:

Right Front = 659 lb Right Rear = 501 lb
Left Front = 705 lb Left Rear = 582 lb
TOTAL FRONT WEIGHT = 1364 lb (56 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1083 lb (44 % of Total Vehicle Weight)
TOTAL TEST WEIGHT = 2447 lb

Weight of ballast secured in vehicle trunk area = 0 lb

VEHICLE ATTITUDE: (inches)

Delivered Attitude: RF 27 LF 27 RR 27 LR 27
Test Attitude: RF 26-7/8 LF 26-1/4 RR 25 LR 24-1/2

REMARKS: _____

GENERAL TEST AND VEHICLE PARAMETER DATA (CONT)

POST-IMPACT DATA

Type of Test: Side (90°) Impact
 Date of Test: 1/12/83 Time: 1520 Temperature 74 °F
 Required Impact Velocity Range: 28.60 to 29.60 mph
 Impact Velocity: Primary = 28.60 mph Secondary = 28.65 mph
 Temperature in Occupant Compartment: 78 °F
 Windshield Moulding Temperature: 74 °F

Distance from the vehicle's front bumper to barrier face entering the vehicle velocity measurement device is 5.0 feet and distance exiting the vehicle velocity measurement device is 1.0 foot.

VEHICLE REBOUND AND CRUSH (in.)

Vehicle Width:	Pre-test = A	<u>60.2</u>	B	<u>59.8</u>	C	<u>63.2</u>
	Post-test = A	<u>47.4</u>	B	<u>48.0</u>	C	<u>60.4</u>
	Crush = A	<u>12.8</u>	B	<u>11.8</u>	C	<u>2.8</u>

26.5 Degree Crabbed Side Impactor Weight 3006 pounds.

VISIBLE DUMMY CONTACT POINTS

	<u>Driver (HSRI 122)</u>	<u>Passenger (SID 7)</u>
Head	<u>None</u>	<u>Headliner over left rear window</u>
Chest	<u>Left side door</u>	<u>Left 1/4 panel</u>
Abdomen	<u>Left side door</u>	<u>Left 1/4 panel</u>
Left Knee	<u>Left side door</u>	<u>Left 1/4 panel</u>
Right Knee	<u>Left knee</u>	<u>Left knee</u>

DOOR OPENING

<u>Front</u>		<u>Rear</u>	
<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
<u>Tools required</u>	<u>Easily</u>	<u>NA</u>	<u>NA</u>

SEAT MOVEMENT

Seat, Back Failure	<u>None</u>	<u>None</u>
Seat Shift (in.)	<u>NA</u>	<u>NA</u>

GLAZING DAMAGE

Backlight/Windshield Left side front window shattered. Left rear window popped out but did not break. Windshield cracked but no retention loss.

OTHER NOTABLE IMPACT EFFECTS: Vehicle deformation noted from forward of A-pillar aft to the rear axle centerline. Left door sill forced inboard. B-pillar contacted left front seat back and forced the seat inboard.

3.0 DATA REQUIRED BY OAR AND R&D

This section of the report contains all data required by OAR and R&D. This includes test conditions, dummy position measurements, dummy injury criteria values, pre- and post-test vehicle measurements, accelerometer locations and data summary, and the photoinstrumentation camera location and specification summary. Also contained in this section are the dummy damage data sheets and a "Test Anomalies and Loss of Data Channels" summary.

Pertinent photographs are presented in Appendix A. Calcomp plots of dummy and vehicle accelerometer data are presented in Appendix B.

POST SIDE IMPACT DATA SHEET

POST-IMPACT DATA

Type of Test: Side (90°) Impact Left (Driver's) Side
Date of Test: 1/12/83 Time: 1520 Temperature 74 °F
NHTSA No.: R&D VIN: 1VWAB017XCV054548
Required Impact Velocity Range: 28.60 to 29.60 mph
Impact Velocity: Primary = 28.60 mph Secondary = 28.65 mph
Vehicle Static Crush: Amount of Crush = 13.0 inches on left side
Crush Details: Vehicle deformation noted from forward of A-
pillar aft to the rear axle centerline. Left door sill forced
inboard. B-pillar contacted left front seat back and forced
the seat inboard.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

PRE-IMPACT DATA

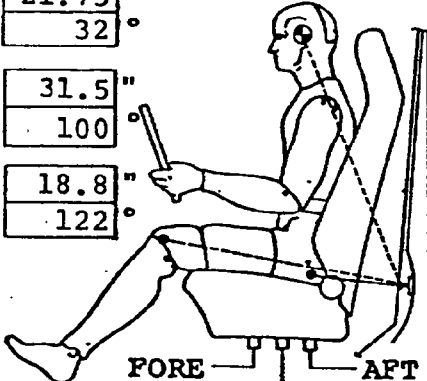
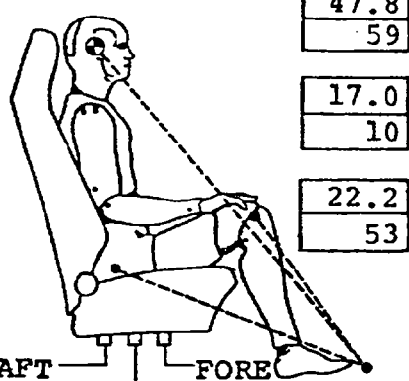
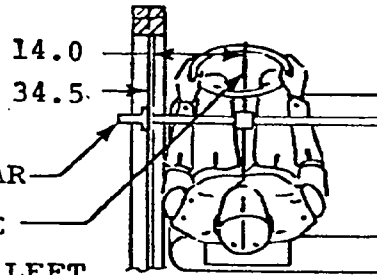
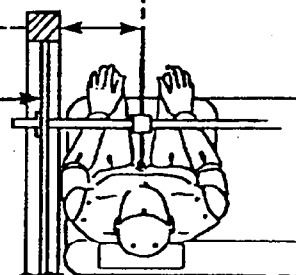
Make/Model: Volkswagen Rabbit
 Body Style: 2-Door Hatchback Model Year: 1982
 NHTSA No. R&D DSI No. 1302 Color: White

DATA FROM CERTIFICATION LABEL

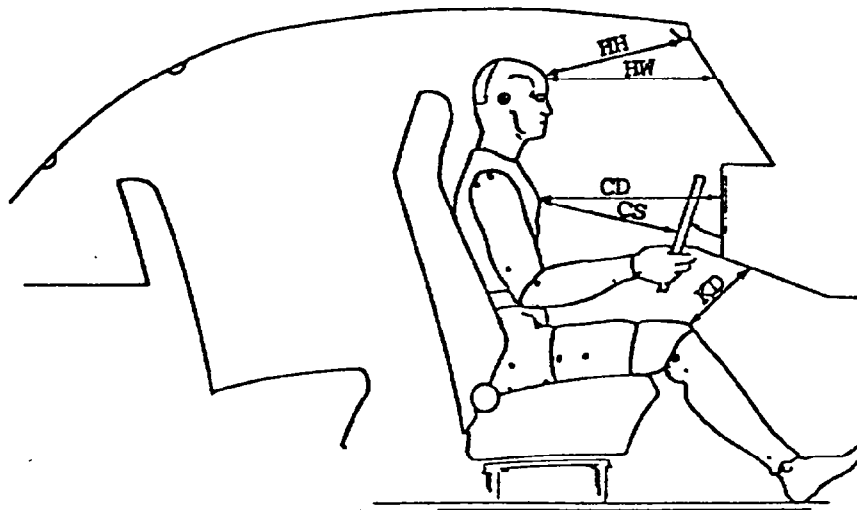
Vehicle Manufacturer: Volkswagen of America
 Date of Manufacture: 1/82; VIN: 1VWAB017XCV054548
 GVWR: 2822 lb; GAWR: Front = 1609 lb; Rear = 1275 lb

POST-IMPACT DATA

Type of Test: Side (90°) Impact
 Date of Test: 1/12/83 Time: 1520 Temperature 74 °F
 Required Impact Velocity Range: 28.60 to 29.60 mph
 Impact Velocity: Primary = 28.60 mph Secondary = 28.65 mph
 Seat Type: Bucket Adjuster Type: Manual
 Bucket Seat Type Back: High back, not adjustable
 Technicians: M. Rodack, C. Brugaletta

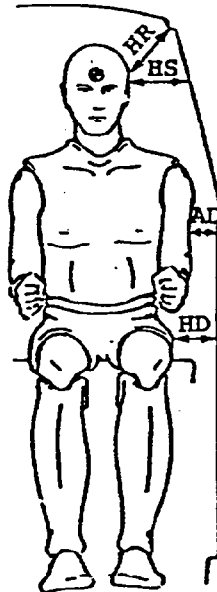
DRIVER DUMMY# HSRI 122 HEAD 21.75 " TARGET 32 ° KNEE JOINT 31.5 " 100 APPROX-IMATE "H" POINT 18.8 " 122 ° 	PASSENGER DUMMY # SID 7 47.8 " HEAD 59 ° TARGET 17.0 " KNEE 10 ° JOINT 22.2 " APPROX-IMATE "H" POINT 53 ° 
DOOR * 14.0 GLASS HEIGHT 34.5 LATERAL BAR ADJUSTABLE POINTER LEFT FRONT DOOR  DRIVER DUMMY # HSRI 122	14.3 DOOR GLASS HEIGHT 32.8 LEFT SIDE OF CAR  PASSENGER DUMMY # SID 7

*Door glass height is equal on the right and left side of vehicle.



301

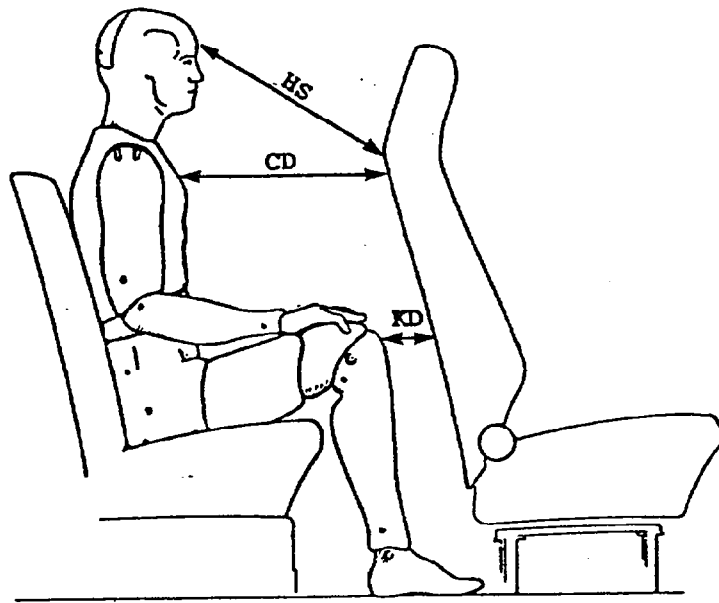
HH = 15.6 INCHES
 HW = 22.5 INCHES
 CD = 20.8 INCHES
 CS = 12.5 INCHES
 KD = 4.0 INCHES/4.1 INCHES (R)



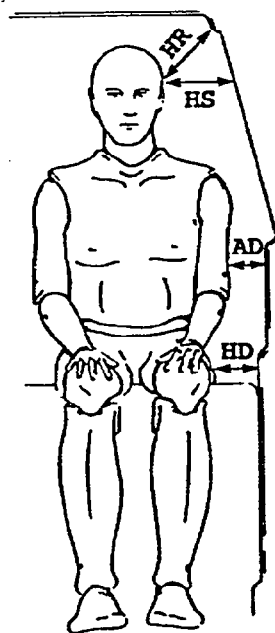
HR = 7.3 INCHES
 HS = 8.0 INCHES
 AD = 3.5 INCHES
 HD = 6.1 INCHES

DRIVER CLEARANCE DIMENSIONS

0327 40 00502



HS = 22.3 INCHES
CD = 17.6 INCHES
KD = 4.0 INCHES/4.0 INCHES



HR = 7.3 INCHES
HS = 8.5 INCHES
AD = 4.2 INCHES
HD = 6.0 INCHES

REAR PASSENGER CLEARANCE DIMENSIONS

SIDE IMPACT DUMMY RESPONSE SUMMARY

TEST NO. 3144-5 TEST DATE 1/12/83

TEST CONFIGURATION:

Target Vehicle	<u>1982 VW Rabbit</u>	Speed	<u>0.0 mph</u>
Bullet Vehicle	<u>26.5° Crabbed Side Impactor</u>	Speed	<u>28.60 mph</u>
Impact Location	<u>37 inches forward of the wheelbase centerline.</u>		
Dummy Model	<u>HSRI 122 (Driver)</u>	Angle	<u>90°</u>

HEAD RESPONSE:

	Positive Peak (G)	ms	Negative Peak (G)	ms
Longitudinal	10.7	62	13.5	84
Lateral	31.8	64	16.6	41
Vertical	42.4	70	15.2	54
Resultant	45.4	69	-	-
HIC	132.6 Between 39.4 and 84.0 ms			

CHEST RESPONSE:

DEFLECTION (IN.): LRDY 1.5 in. @ 118 ms

Location	Pk A (G @ ms)		3ms Clip (G)	SI	ΔV_y (MPH)	Impact Time (ms)
	+	-				
Upper Thorax						
Longitudinal	33.3 @ 58	19.1 @ 43	-	-	-	-
Lateral (P)	86.3 @ 44	22.6 @ 73	78.9	-	22.2	24
Lateral (R)	84.2 @ 43	22.8 @ 73	79.4	-	20.4	25
Vertical	13.6 @ 38	12.4 @ 35	-	-	-	-
Resultant	88.1 @ 44	-	79.9	561	-	-
Resultant (R)	86.2 @ 43	-	81.5	510	-	-
Lower Thorax						
Longitudinal	54.1 @ 58	23.2 @ 40	-	-	-	-
Lateral (P)	117.4 @ 38	24.1 @ 75	94.6	-	27.4	19
Lateral (R)	108.9 @ 38	41.1 @ 57	98.8	-	26.0	20
Vertical	35.3 @ 57	26.3 @ 40	-	-	-	-
Resultant	118.4 @ 38	-	100.3	841	-	-
Resultant (R)	110.1 @ 38	-	102.2	803	-	-
Left Upper Rib						
Lateral (P)	75.0 @ 38	13.0 @ 58	58.9	-	17.0	26
Lateral (R)	74.0 @ 38	9.6 @ 84	66.9	-	17.1	24
Left Lower Rib						
Lateral (P)	90.0 @ 38	13.3 @ 66	79.5	-	23.6	25
Lateral (R)	81.1 @ 38	13.3 @ 66	71.7	-	21.3	23

SIDE IMPACT DUMMY RESPONSE SUMMARY (Continued)

PELVIS RESPONSE

	<u>Positive</u>		<u>Negative</u>	
	<u>Peak (G)</u>	<u>ms</u>	<u>Peak (G)</u>	<u>ms</u>
Longitudinal	17.1	50	29.9	29
Lateral	191.7	34	20.9	47
Vertical	8.0	40	50.0	38
Resultant	193.3	34	-	-
ΔV_y 27.0	mph	SI 1933	Contact Time	19.5 ms

COMMENTS: Post-test inspection revealed no damage to the occupant (HSRI-122).

SIDE IMPACT DUMMY RESPONSE SUMMARY

TEST NO. 3144-5 TEST DATE 1/12/83

TEST CONFIGURATION:

Target Vehicle 1982 VW Rabbit Speed 0.0 mph
 Bullet Vehicle 26.5° Crabbed Side Impactor Speed 28.60 mph
 Impact Location 37 inches forward of the wheelbase centerline.
 Angle 90°
 Dummy Model SID 7 (Left Rear Passenger)

HEAD RESPONSE:

	Positive Peak (G)	ms	Negative Peak (G)	ms
Longitudinal	12.7	63	15.9	82
Lateral	117.2	62	13.9	49
Vertical	16.5	46	48.1	67
Resultant	119.5	63	-	-
HIC	796.9 Between 57.1 and 66.5 ms			

CHEST RESPONSE:

DEFLECTION (IN.): LRDY 1.7 in. @ 73 ms

Location	Pk A (G @ ms)		3ms Clip (G)	SI	ΔV_y (MPH)	Impact Time (ms)
	+	-				
Upper Thorax						
Longitudinal	66.4 @ 74	56.5 @ 76	-	-	-	-
Lateral (P)	83.0 @ 51	46.3 @ 73	62.8	-	17.9	22
Lateral (R)	84.1 @ 52	49.5 @ 74	63.3	-	20.5	18
Vertical	26.8 @ 76	16.1 @ 74	-	-	-	-
Resultant	86.6 @ 51	-	67.3	520	-	-
Resultant (R)	88.1 @ 52	-	67.8	536	-	-
Lower Thorax						
Longitudinal	102.1 @ 73	130.4 @ 40	-	-	-	-
Lateral (P)	76.1 @ 48	132.1 @ 73	66.2	-	20.2	21
Lateral (R)	82.2 @ 47	97.8 @ 73	77.0	-	31.4	21
Vertical	45.1 @ 59	48.0 @ 74	-	-	-	-
Resultant	169.2 @ 73	-	73.0	1023	-	-
Resultant (R)	144.2 @ 73	-	78.9	1077	-	-
Left Upper Rib						
Lateral (P)	102.5 @ 44	6.5 @ 61	83.4	-	16.7	35
Lateral (R)	101.1 @ 45	9.2 @ 61	81.2	-	14.9	34
Left Lower Rib						
Lateral (P)	112.0 @ 46	33.9 @ 78	92.6	-	22.5	36
Lateral (R)	116.6 @ 46	35.7 @ 79	95.6	-	23.0	34

SIDE IMPACT DUMMY RESPONSE SUMMARY (Continued)

PELVIS RESPONSE

	Positive Peak (G)	ms	Negative Peak (G)	ms
Longitudinal	12.8	29	39.4	40
Lateral	128.6	39	38.3	29
Vertical	12.8	76	42.5	40
Resultant	131.1	39	-	-
ΔV_y 25.0 mph SI 1306 Contact Time 19 ms				

COMMENTS: Post-test inspection revealed no further damage to the side impact
dummy (SID 7).

TEST VEHICLE EXTERIOR PROFILES AND STATIC CRUSH

Location	R.P.* Height (in.)	Zero Distance Starting at DOR (IN.)																Pre-test Profile (Distance from R.P. - in.)															
		30	24	18	12	6	0	6	12	18	24	30	36	42	48	54	60	66	72	78	84	90	96										

Axle Height	14.4	9.9	9.5	10.8	9.6	12.1	11.8	11.9	11.9	11.8	11.9	12.1	12.0	12.2	12.0	12.0	10.5	11.6	10.1	10.6	14.0	X	
Door	20.4	-	10.2	10.3	9.7	10.4	10.3	10.4	10.3	10.2	10.2	10.6	10.6	10.7	10.8	10.7	10.8	12.5	11.2	11.0	12.6	X	
Door Center	26.0	10.0	-	-	8.8	10.1	9.9	10.0	9.9	9.9	9.9	10.1	9.9	10.1	10.2	10.0	10.2	10.0	8.4	8.7	11.0	11.8	X
Window Sill	37.0	-	-	-	11.8	11.5	11.3	11.4	11.4	11.2	11.5	11.6	11.5	11.8	11.9	11.7	11.8	11.8	12.0	12.3	12.9	13.9	X
Window Top	54.0	-	-	-	-	-	-	-	-	17.2	17.2	18.2	18.1	18.0	18.4	18.1	18.2	17.9	19.0	-	-	-	X

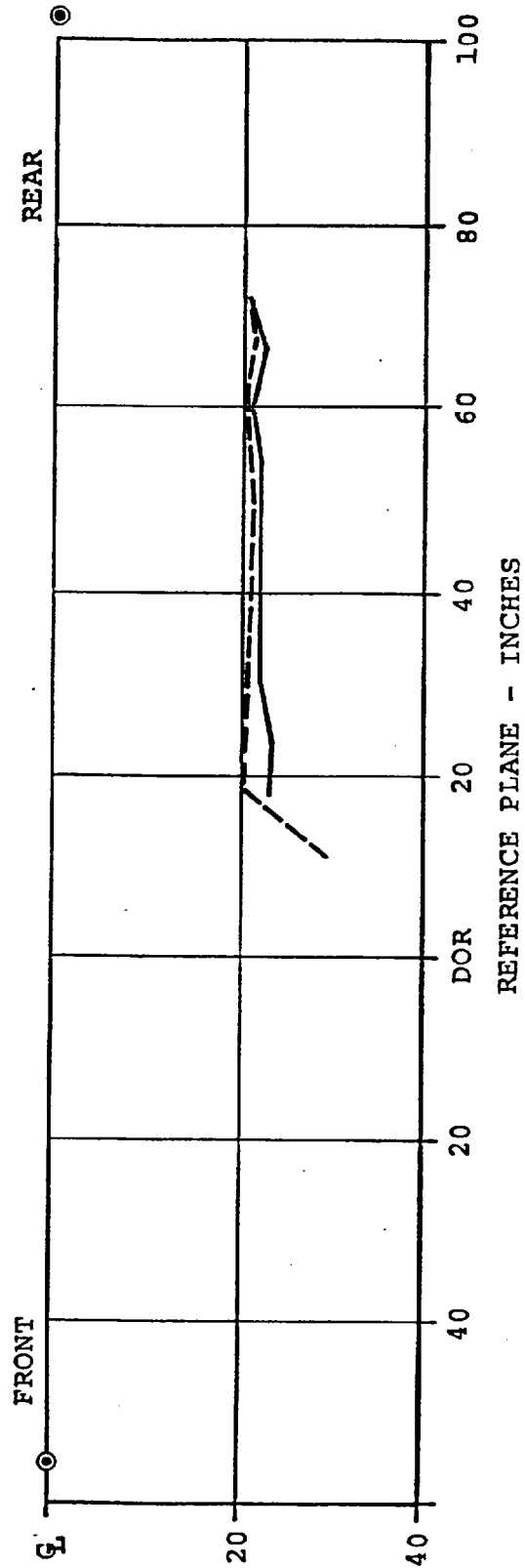
Post-test Profile (Distance From R.P. - in.)

Axle Height	14.4	10.9	10.3	10.8	9.6	17.1	18.6	18.4	18.2	17.9	17.9	17.9	18.0	17.6	17.0	16.8	16.7	11.2	12.0	10.7	11.1	14.3	X
DOR	20.4	11.7	10.9	12.0	9.9	17.8	23.1	23.0	23.0	22.5	22.3	22.3	22.0	21.7	21.0	20.3	18.9	11.4	13.2	13.2	-	12.3	X
Door Center	26.0	11.3	-	-	15.8	20.0	22.7	22.2	22.9	22.3	22.3	22.3	22.1	21.9	22.2	21.1	19.9	13.2	11.2	10.2	12.2	14.3	X
Window Sill	37.0	-	-	-	14.0	14.8	17.7	19.2	19.2	18.8	18.9	18.9	19.3	18.8	18.6	18.9	18.3	14.5	12.2	13.3	13.9	13.4	X
Window Top	54.0	-	-	-	-	-	-	-	12.7	19.2	19.3	19.5	19.4	19.0	18.9	19.2	19.3	19.5	20.0	-	-	-	X

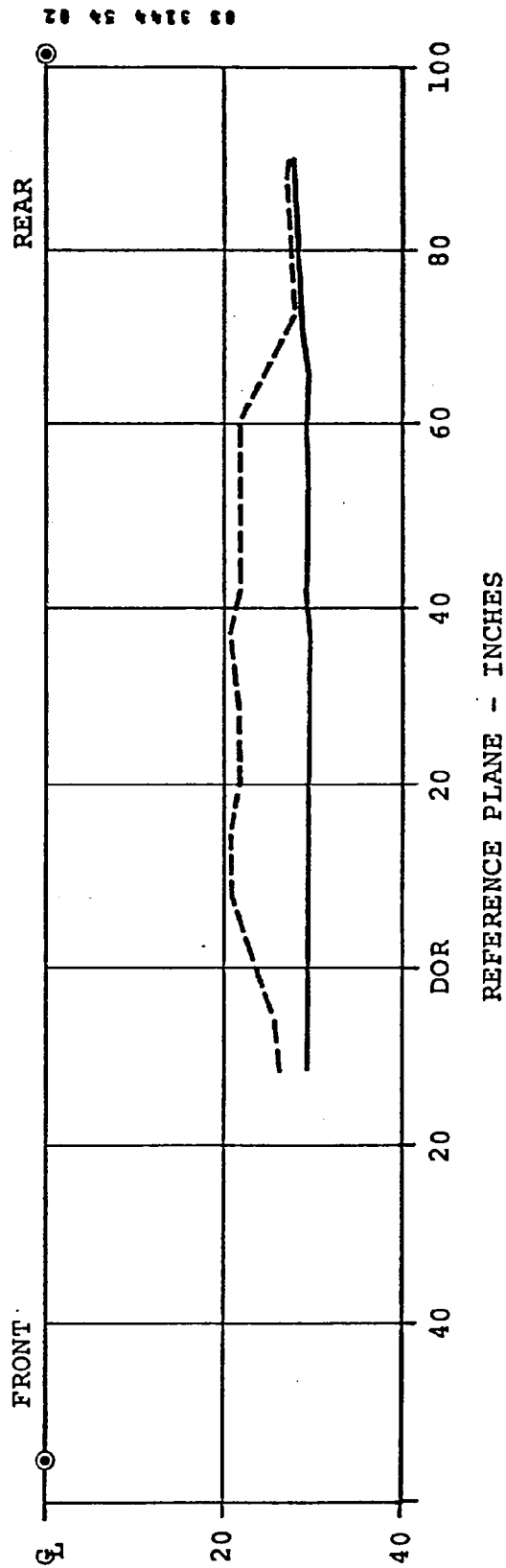
Post-test Static Crush (in.)

Axle Height	1.0	0.8	0.0	0.0	5.0	6.8	6.5	6.3	6.1	6.0	5.8	6.0	5.4	5.0	4.8	4.7	0.7	0.4	0.6	0.5	0.3	X	
DOR	X	0.7	1.7	0.2	7.4	12.8	12.6	12.7	12.3	12.1	11.7	11.4	11.0	10.2	9.6	8.1	0.6	0.7	2.0	X	-0.3	X	
Door Center	1.3	X	X	X	7.0	9.9	12.8	12.2	13.0	12.4	12.4	12.2	11.8	12.0	11.1	9.7	3.2	2.8	1.5	1.2	2.5	X	
Window Sill	X	X	X	X	2.2	3.3	6.4	7.8	7.8	7.6	7.4	7.3	7.8	7.0	6.7	7.2	6.5	2.7	0.2	1.0	1.0	-0.5	X
Window Top	X	X	X	X	X	X	X	X	X	2.0	2.1	1.3	1.3	1.0	0.5	1.1	1.1	1.6	1.0	X	X	X	X

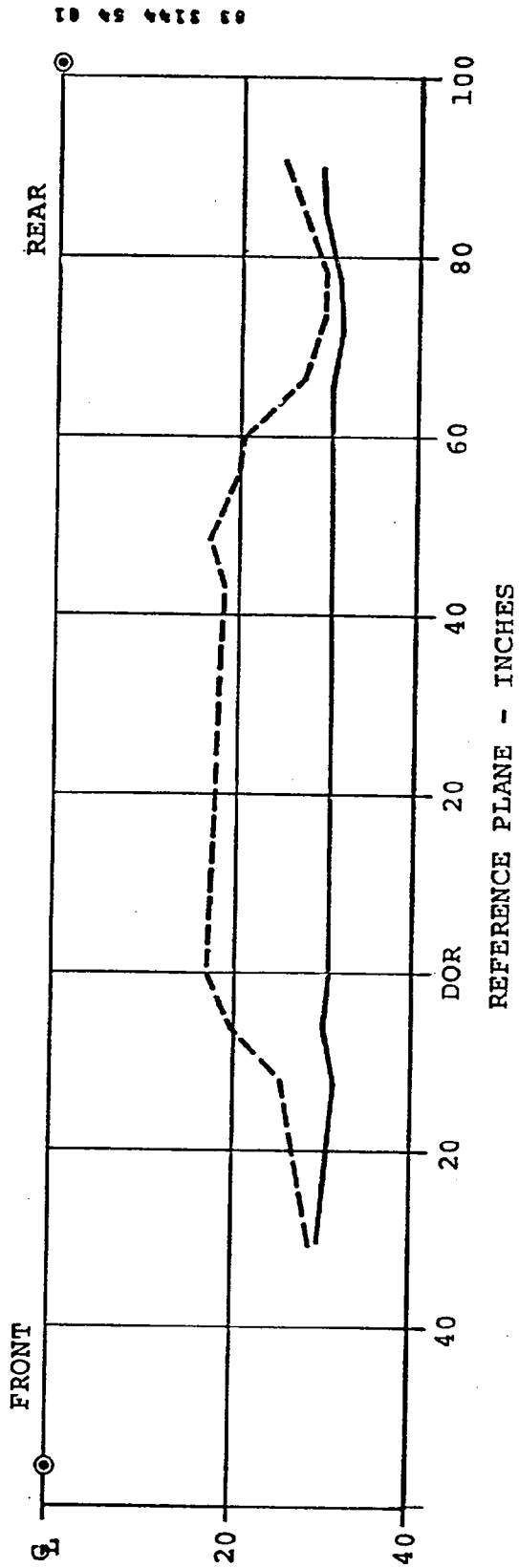
*Zero plane set up 40 inches from rear bumper centerline and 40 inches from front bumper centerline. This plane was set up parallel to the vehicle centerline.



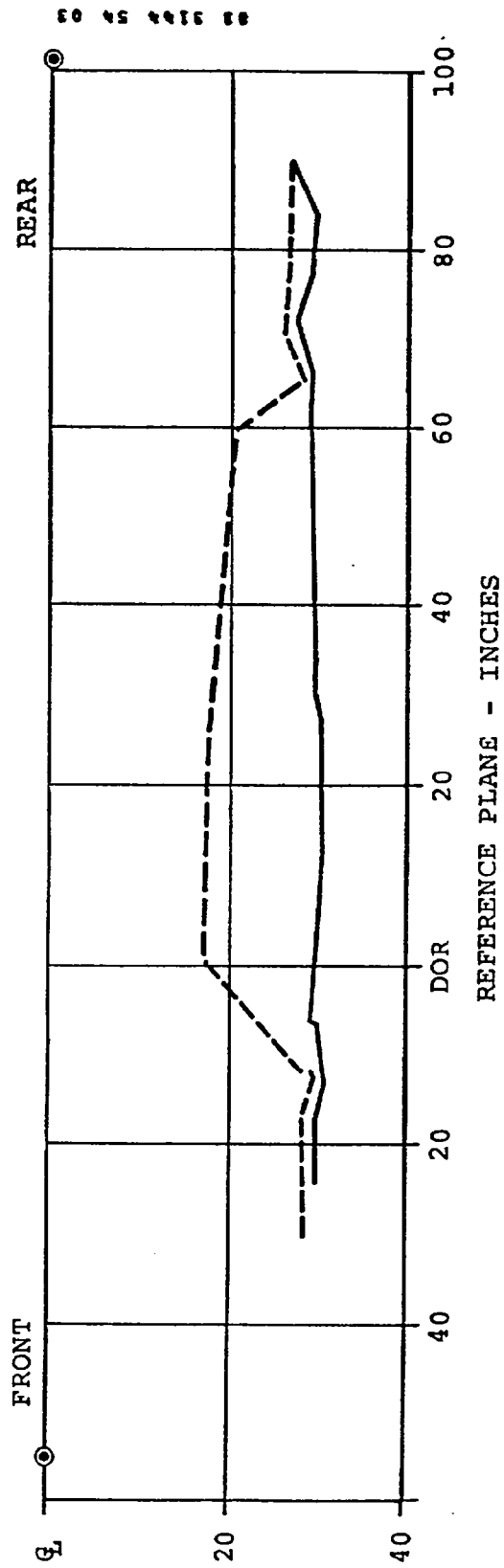
EXTERIOR VEHICLE PROFILE AND STATIC CRUSH MEASUREMENTS - WINDOW TOP LEVEL - 26 DEGREE
CRABBED SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT - 28.6 MPH.



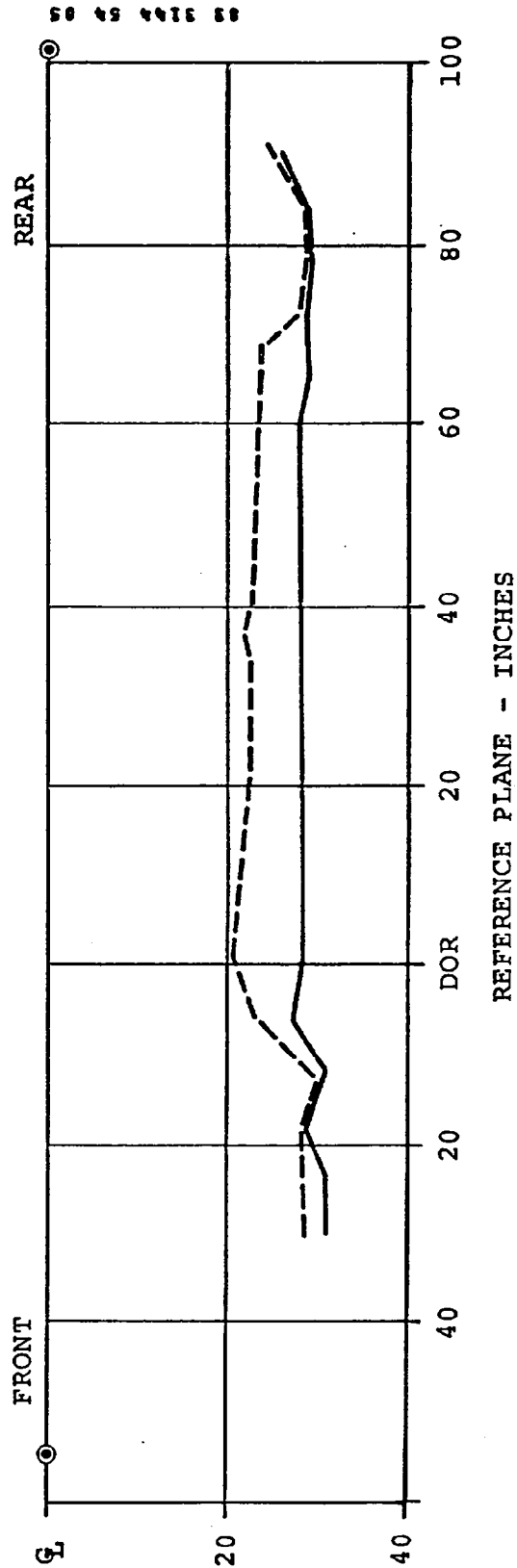
EXTERIOR VEHICLE PROFILE AND STATIC CRUSH MEASUREMENTS - WINDOW SILL LEVEL - 26 DEGREE
 CRABBED SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT - 28.6 MPH.



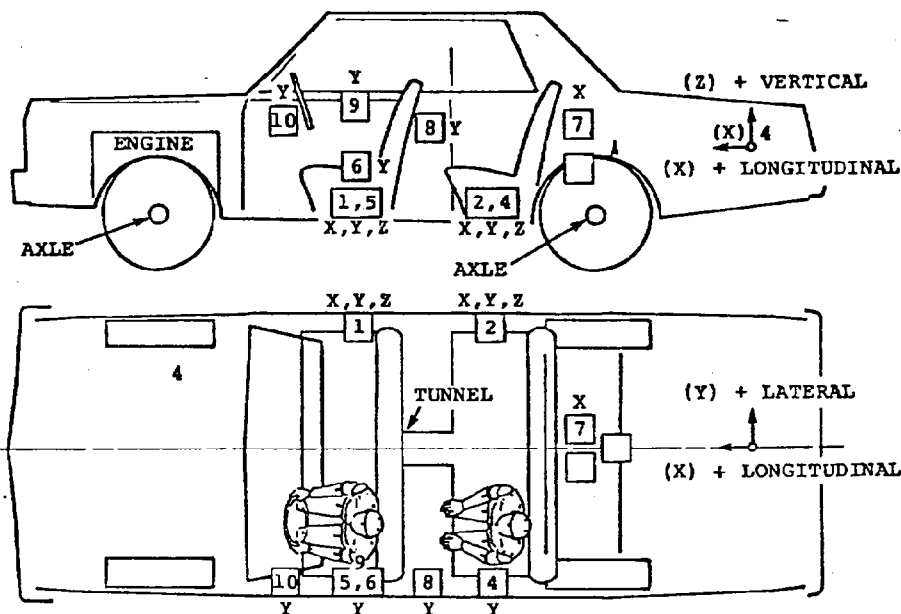
EXTERIOR VEHICLE PROFILE AND STATIC CRUSH MEASUREMENTS - MID-DOOR HEIGHT - 26 DEGREE
CRABBED SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT - 28.6 MPH.



EXTERIOR VEHICLE PROFILE AND STATIC CRUSH MEASUREMENTS - DOR HEIGHT - 26 DEGREE CRABBED
 SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT - 28.6 MPH.



EXTERIOR VEHICLE PROFILE AND STATIC CRUSH MEASUREMENTS - AXLE HEIGHT - 26 DEGREE
 CRABBED SIDE IMPACTOR TO 1982 VOLKSWAGEN RABBIT - 28.6 MPH.

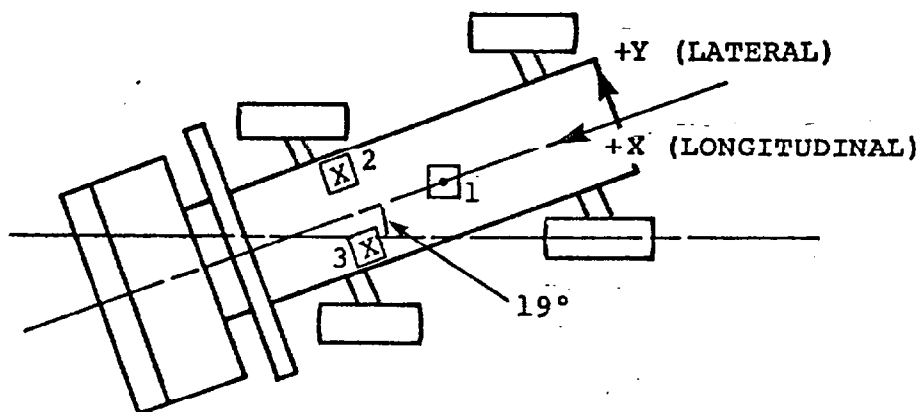


TEST VEHICLE ACCELEROMETER LOCATIONS AND PHYSICAL COORDINATES

No.	Description of Location	X*	Y*	Z*	Positive		Negative	
					G	MS	G	MS
1	Right sill next to front seat (Longitudinal) (Lateral) (Vertical)	82.5 $\Delta V = 14.1$ mph	-23.5	10.5	4.5 23.0 5.4	54 38 82	5.8 7.1 10.5	24 66 9
2	Right sill next to rear seat (Longitudinal) (Lateral) (Vertical)	62.0 $\Delta V = 14.1$ mph	-24.0	10.5	3.8 20.9 7.7	54 23 33	6.0 2.8 7.8	24 104 29
3	Deck over rear axle (Longitudinal) (Lateral) (Vertical)	32.5 $\Delta V = 16.5$ mph	0.0	10.0	3.3 20.1 8.5	53 44 23	9.6 2.6 8.1	34 104 29
4	Left sill next to rear seat (Lateral)	61.0 $\Delta V = 10.3$ mph	24.0	10.5	40.6	6	43.5	17
5	Left sill next to front seat (Lateral)	82.0 $\Delta V = 7.1$ mph	23.6	10.5	69.8	30	95.6	26
6	Left front door centerline (Lateral)	81.7 $\Delta V = 21.4$ mph	25.5	24.0	137.5	11	42.5	32
7	Right rear compartment (Longitudinal)	32.5	15.5	12.5	5.5	30	5.8	35
8	Midrear of left front door (Lateral)	60.2 $\Delta V = 11.6$ mph	25.5	24.5	120.2	30	53.8	19
9	Upper left front door centerline (Lateral)	80.2 $\Delta V = 22.7$ mph	25.5	23.0	109.8	22	85.3	83
10	Midfront of left front door (Lateral)	99.5 $\Delta V = 8.7$ mph	25.5	23.5	111.6	19	43.9	15

*Reference Plane: X - rear bumper, Y - vehicle centerline, Z - ground

VEHICLE ACCELEROMETER LOCATIONS AND PHYSICAL COORDINATES



03 3144 14 07

No.	Description of Location	X*	Y*	Z*	Positive		Negative	
					G	MS	G	MS
1	Center of gravity	76.0	0.0	13.25				
	(Longitudinal)	$\Delta V = 12.9$ mph			1.6	115	16.4	34
	(Lateral)	$\Delta V = 3.1$ mph			2.7	61	6.6	26
	(Vertical)	$\Delta V = 1.2$ mph			13.5	100	16.4	92
2	Left side frame	67.5	23.0	14.0				
	(Longitudinal)	$\Delta V = 14.6$ mph			1.5	142	16.6	34
3	Right side frame	67.5	23.0	14.0				
	(Longitudinal)	$\Delta V = 11.4$ mph			1.2	143	13.0	33

*Positive values are forward of rear frame of side impactor, right of vehicle centerline.

SUMMARY OF CAMERA LOCATIONS AND DESCRIPTIONS

Loc. No.	Location	Field of View	Camera Angle	Lens Size	Frame Rate	Timing Speed	Serial Number	Impact Dist-X	Center-line Dist-Y	Camera Height
1	Right side perpendicular to barrier	Left side of test vehicle	0°	25 mm	404 fps	100 Hz	M7	264 in.	450 in.	60 in.
2	Right side parallel to vehicle	Barrier contact - left side of vehicle	0°	17 mm	363 fps	100 Hz	LC 327	324 in.	462 in.	56.5 in.
3	Right side perpendicular to track	Left side of test vehicle	0°	25 mm	395 fps	101 Hz	LC 326	84 in.	798 in.	51.5 in.
4	Overhead	Barrier/vehicle contact	90°	25 mm	400 fps	100 Hz	M3	60 in.	48.5 in.	360 in.
5	Right side bullet vehicle	Real time documentary	0°	8 mm	390 fps	99 Hz	7	-	-	-
6	Onboard front	Left front occupant compartment (front)	0°	8 mm	394 fps	100 Hz	6	-	-	-
7	Onboard side front	Left front occupant compartment (side)	0°	8 mm	382 fps	111 Hz	12	-	-	-
8	Onboard side rear	Left rear occupant compartment (side)	0°	8 mm	256 fps	98 Hz	4	-	-	-
9	Onboard rear	Left rear occupant compartment (rear)	NA	Var	24 fps	-	-	-	-	-

TEST ANOMALIES AND LOSS OF DATA CHANNEL SUMMARY

There were no test anomalies or loss of any data channels during the conduct of this test.

TEST LOG OF ANTHROPOMORPHIC TEST DEVICE

Contractor: Dynamic Science, Inc.
 Contract Title: Car-to-Car Side Impact Testing
 Contract No.: DTNH22-81-C-07113 T.O. 5
 Contract Technical Manager: W. H. Hollowell
 ATD Mfr.: ARL
 ATD Serial No.: SID 7/174
 Date Submitted: 1/14/83

Test Date	Test No.	Test Description*	$\Delta v, \uparrow$ mph	$\angle, \uparrow$ deg.	Location and Description of Damage (if any)	Project Engineer
10/27/82	3144-00	Initial Inspection	-	-	Head skin indicates SN 175, Pelvis indicates SN 174. Abdominal sack damaged, shelf and outer skin torn.	
11/19/82	3144-2	Left rear position, side impactor to Volkswagen Rabbit 60° side impact 2-car moving simulation	53.38	300	Left knee casting broken, damper heim joint bent, rib ballast on right side dented. Rib displacement transducer installed for remaining tests.	
1/5/83	3144-1	Left rear position, side impactor to Volkswagen Rabbit 60° side impact 2-car moving simulation	34.23	300	Heim joint broken on damper shaft. Displacement pot shaft bent.	
1/12/83	3144-5	Left rear position, side impactor to Volkswagen Rabbit 90° side impact 2-car moving simulation	28.60	270	No damage recorded.	<i>Michael J. Portlock</i>

*Describe, as: Pendulum Impact Simulator, sled wall, car door, restraint, etc. If vehicle test, indicate position of ATD in vehicle.
 †If a sled test. If a vehicle test, the closing speed between vehicles immediately before impact.

**Head-on Impact is defined as zero degrees. Other angles of impact measured counterclockwise from zero degrees.

TEST LOG OF ANTHROPOMORPHIC TEST DEVICE

Contractor: Dynamic Science, Inc.
 Contract Title: Car-to-Car Side Impact Testing
 Contract No.: DTNH22-81-C-07113 T.O. 5
 Contract Technical Manager: W. T. Hollowell
 ATD Mfr.: HSRI
 ATD Serial No.: Thorax 122/Body 8 Date Submitted: 1/14/83

Test Date	Test No.	Test Description*	$\Delta v, \uparrow$ mph	$\angle, \bullet$ deg.	Location and Description of Damage (if any)	Project Engineer
10/27/82	3144-00	Initial inspection	-	-	Skin on pelvis and legs is loose. Abdominal sack is damaged.	<i>Michael J. Rudack</i>
11/19/82	3144-2	Left front position, side impactor to Volkswagen Rabbit 60° side impact 2-car moving simulation	53.38	300	Rib ballast on right side dented, slight cracking in leather backing. Displacement transducer installed for remaining tests.	
1/5/83	3144-1	Left front position, side impactor to Volkswagen Rabbit 60° side impact 2-car moving simulation	34.23	300	Left knee casting broken, cracking a little worse in leather backing.	
1/2/83	3144-5	Left front position, side impactor to Volkswagen Rabbit 90° side impact 2-car moving simulation	28.60	270	No damage recorded.	

*Describe, as: Pendulum Impact Simulator, sled wall, car door, restraint, etc. If vehicle test, indicate position of ATD in vehicle.
 †If a sled test, the closing speed between vehicles immediately before impact.

**Head-on impact is defined as zero degrees. Other angles of impact measured counterclockwise from zero degrees.

APPENDIX A
PERTINENT PHOTOGRAPHS



FIGURE A-1. PRE-TEST FRONT VIEW OF VW RABBIT - 26° CRABBED
SIDE IMPACTOR TO 1982 VW RABBIT - 28.60 MPH.



FIGURE A-2. PRE-TEST REAR VIEW OF VW RABBIT - 26° CRABBED
SIDE IMPACTOR TO 1982 VW RABBIT - 28.60 MPH.



FIGURE A-3. PRE-TEST LEFT SIDE VIEW OF VW RABBIT - 26° CRABBED SIDE IMPACTOR TO 1982 VW RABBIT - 28.60 MPH.



FIGURE A-4. POST-TEST LEFT SIDE VIEW OF VW RABBIT - 26° CRABBED SIDE IMPACTOR TO 1982 VW RABBIT - 28.60 MPH.

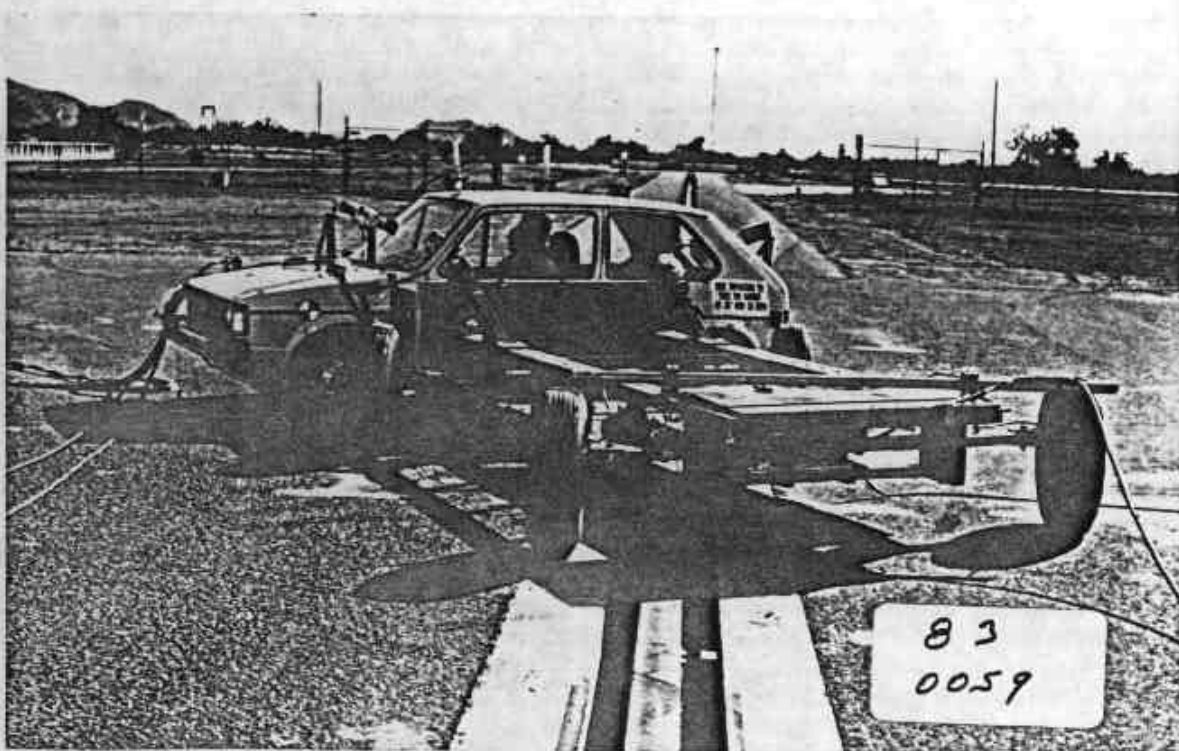


FIGURE A-5. PRE-TEST LEFT SIDE FRONTAL OBLIQUE VIEW OF VW RABBIT.

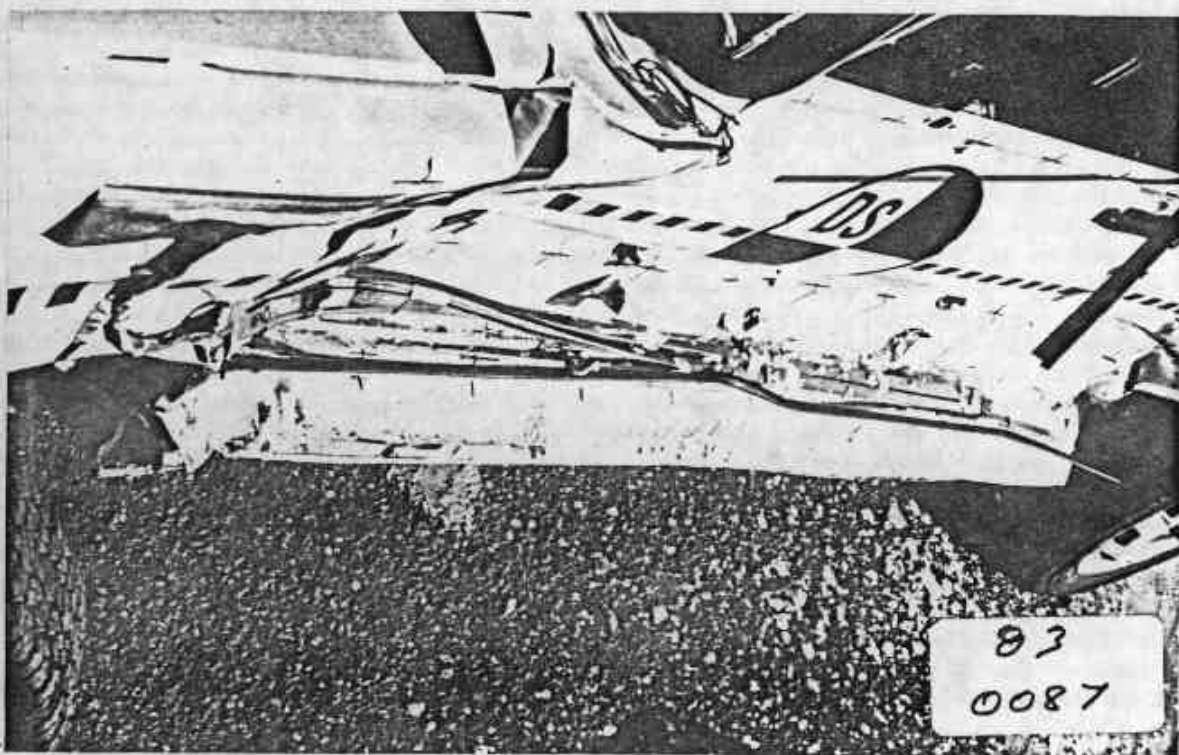


FIGURE A-6. POST-TEST LEFT SIDE FRONTAL OBLIQUE VIEW OF VW RABBIT.

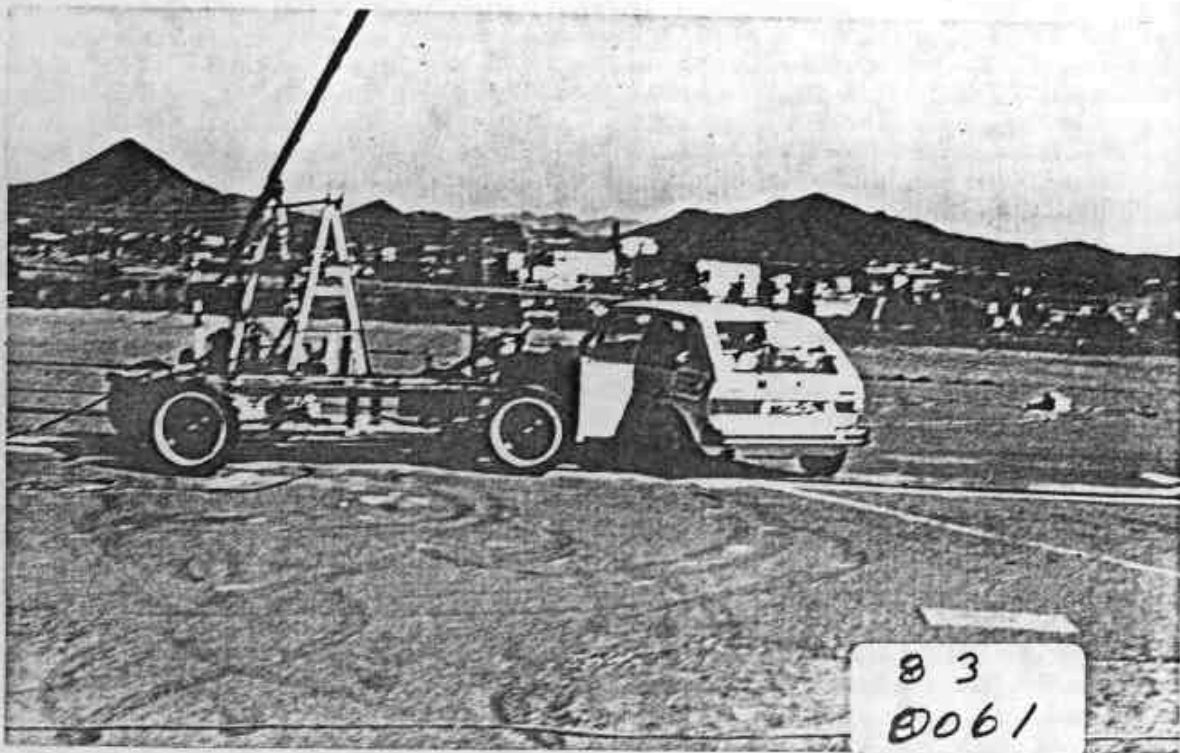


FIGURE A-7. PRE-TEST LEFT SIDE REAR OBLIQUE VIEW OF VW RABBIT.

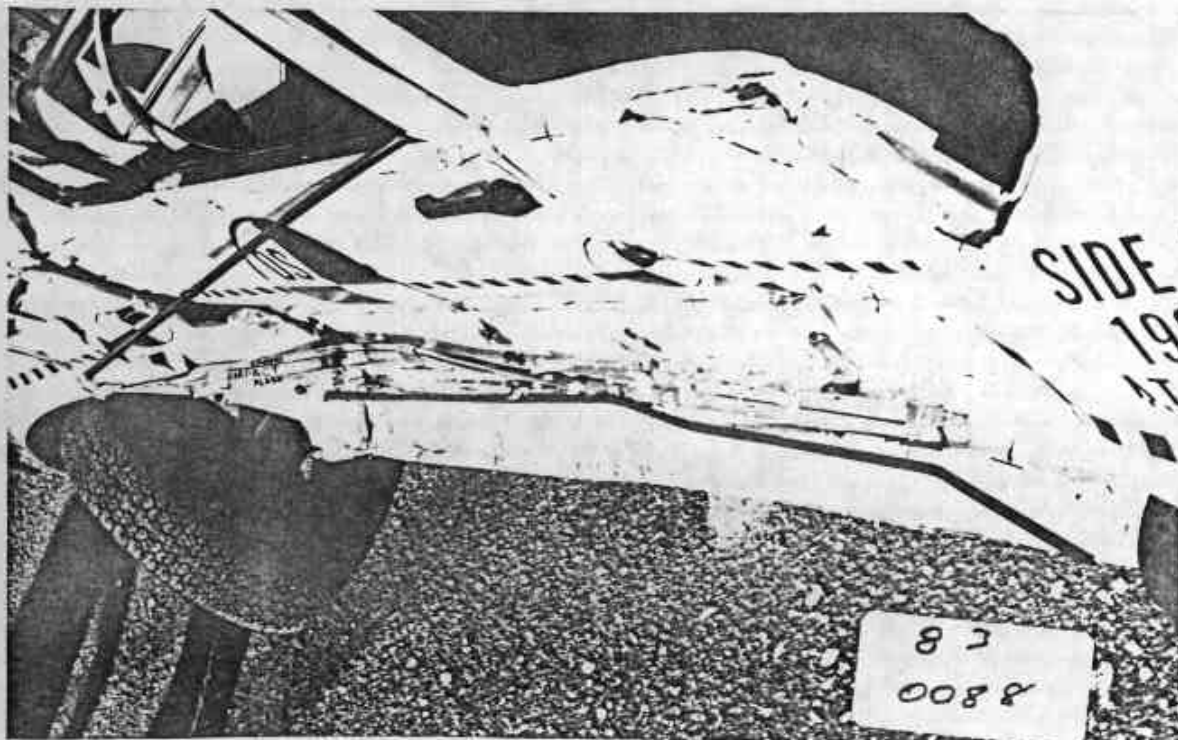


FIGURE A-8. POST-TEST LEFT SIDE REAR OBLIQUE VIEW OF VW RABBIT.

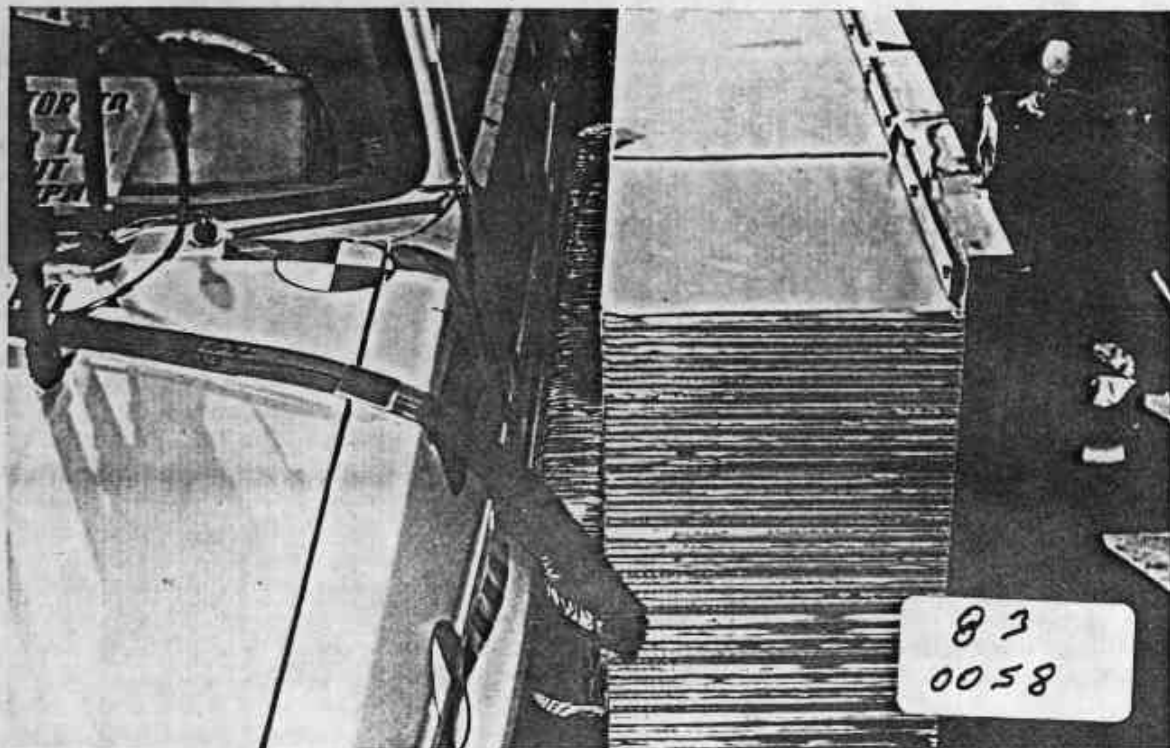


FIGURE A-9. PRE-TEST SIDE VIEW OF BARRIER FACE.



FIGURE A-10a. PRE-TEST SIDE IMPACTOR/VW RABBIT MATCHUP.

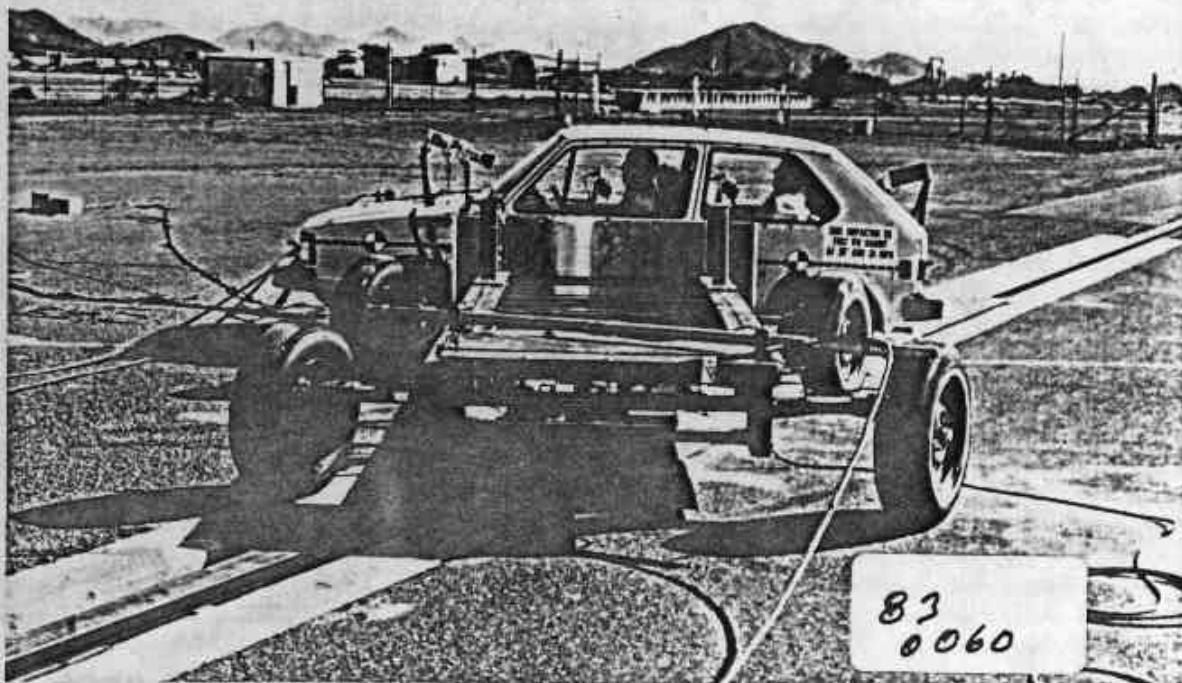


FIGURE A-10b. PRE-TEST IMPACTOR/VW RABBIT MATCHUP.

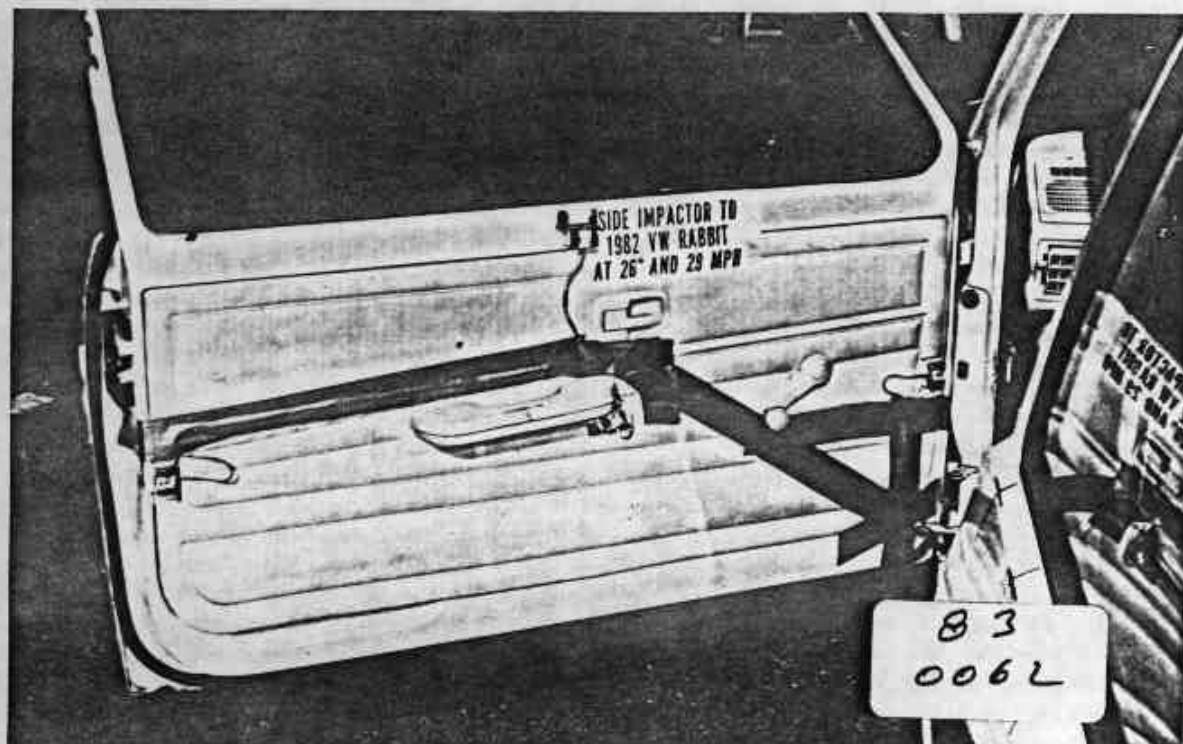


FIGURE A-11. PRE-TEST VW DOOR ACCELEROMETER LOCATIONS.

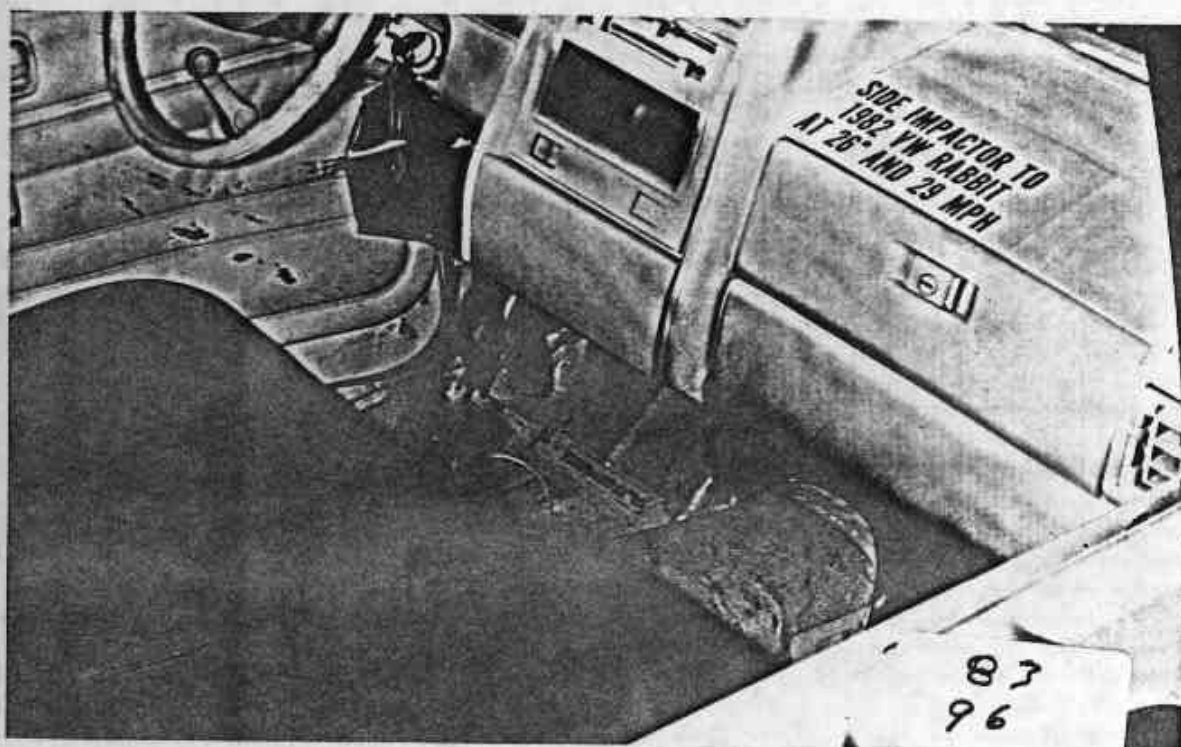


FIGURE A-12a. VW RABBIT POST-TEST INTERIOR DEFORMATION.



FIGURE A-12b. VW RABBIT POST-TEST INTERIOR DEFORMATION.



FIGURE A-12c. VW RABBIT POST-TEST INTERIOR DEFORMATION.

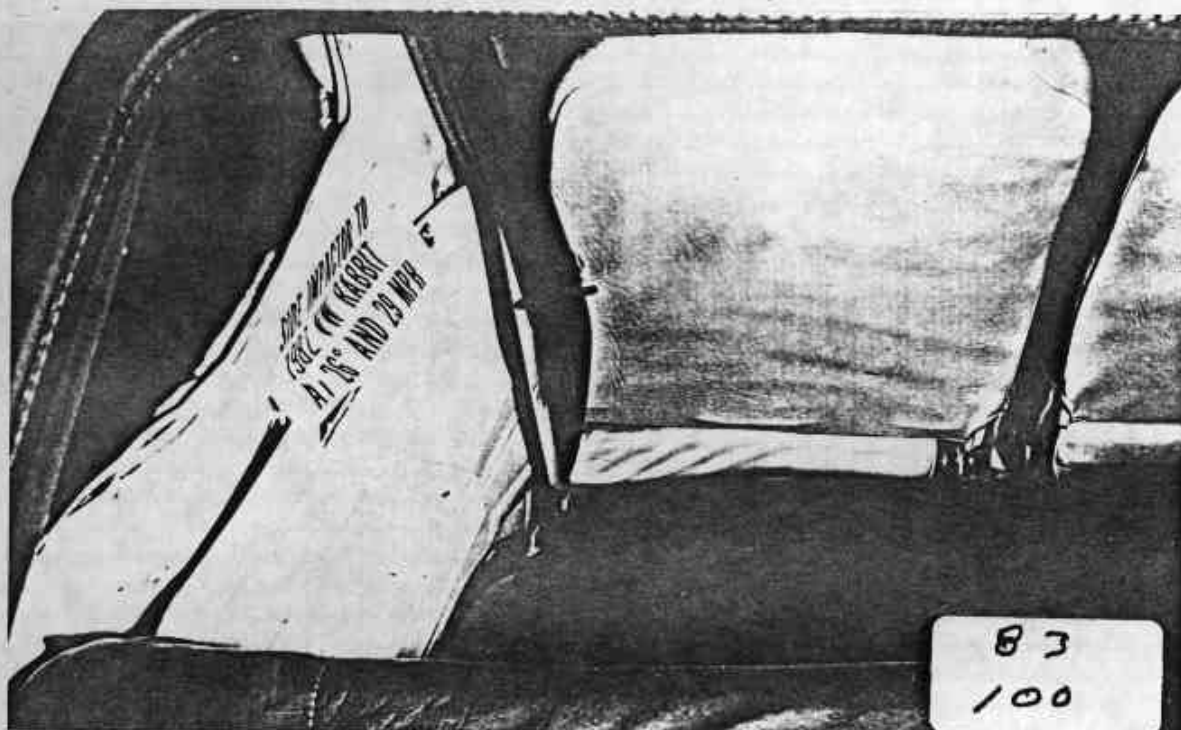


FIGURE A-12d. VW RABBIT POST-TEST INTERIOR DEFORMATION.



FIGURE A-13a. PRE-TEST DRIVER DUMMY POSITION.

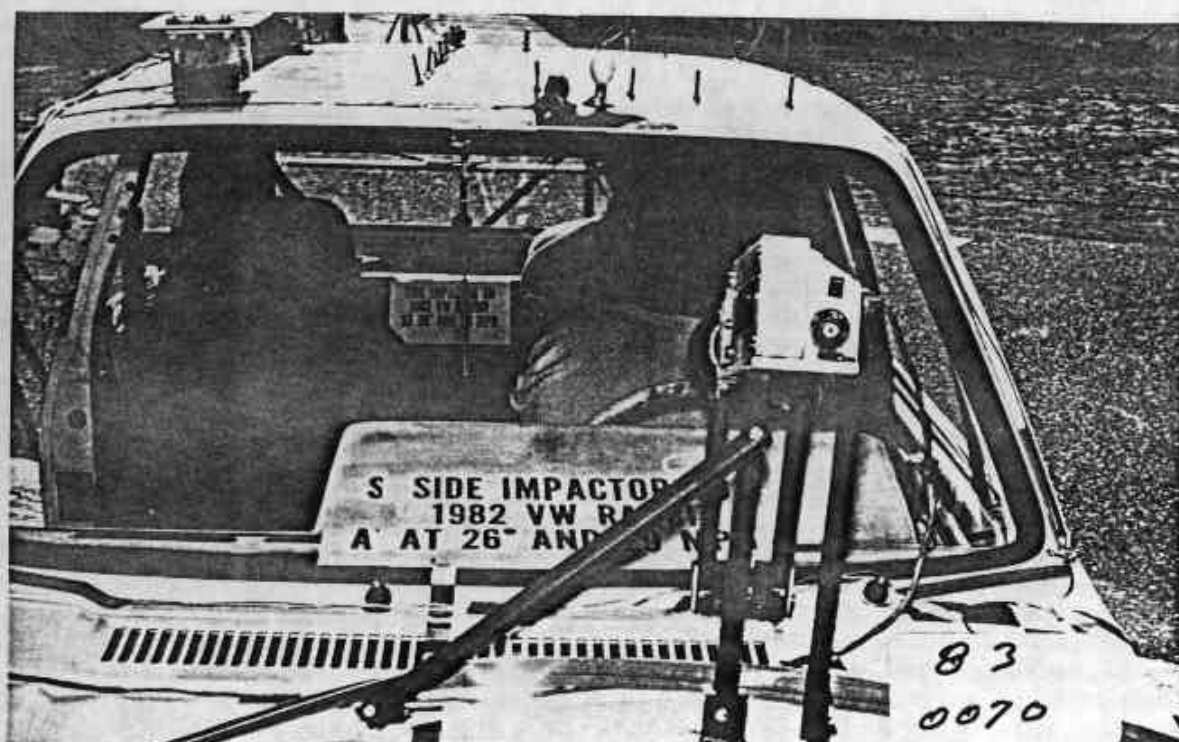


FIGURE A-13b. PRE-TEST DRIVER DUMMY POSITION.

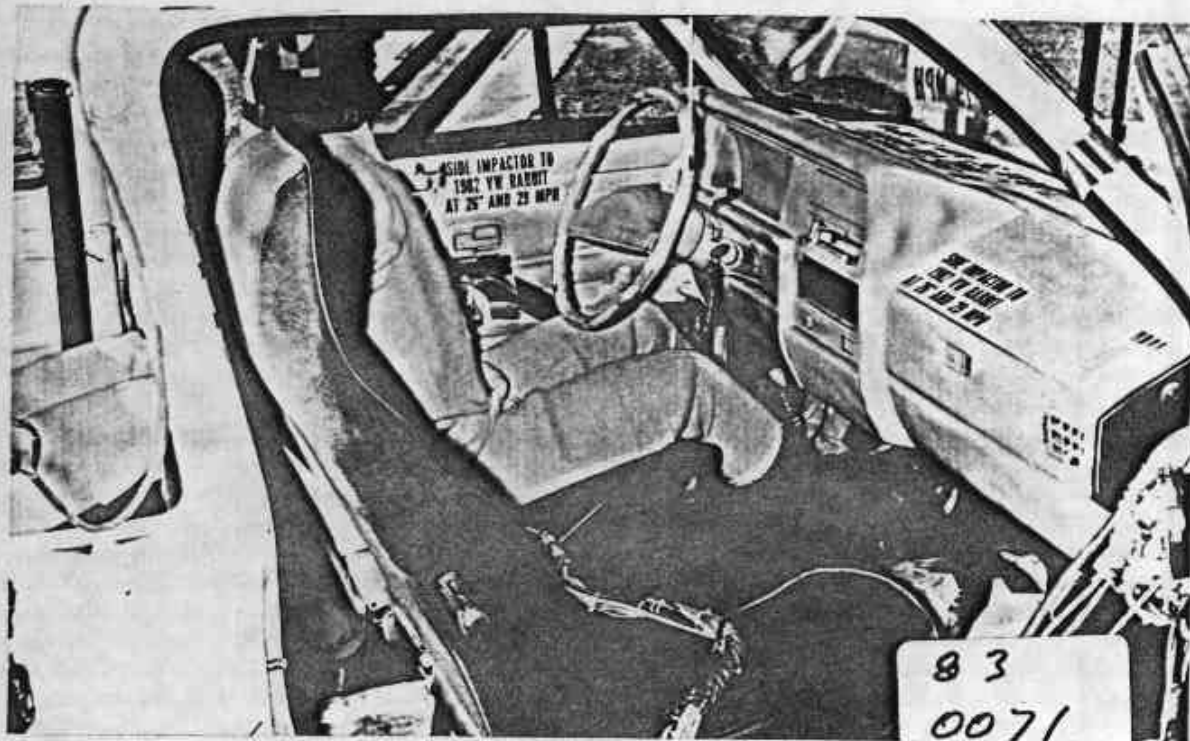


FIGURE A-13c. PRE-TEST DRIVER DUMMY POSITION.

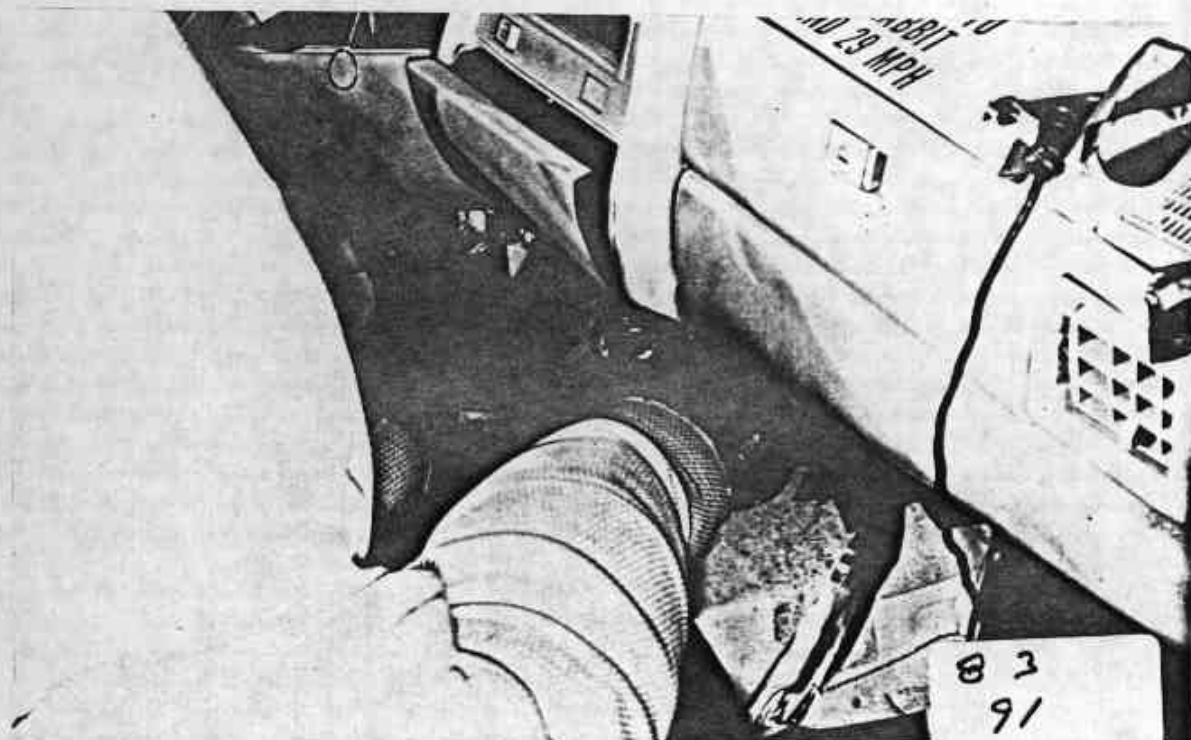


FIGURE A-14a. POST-TEST DRIVER DUMMY POSITION.



FIGURE A-14b. POST-TEST DRIVER DUMMY POSITION.



FIGURE A-14c. POST-TEST DRIVER DUMMY POSITION.

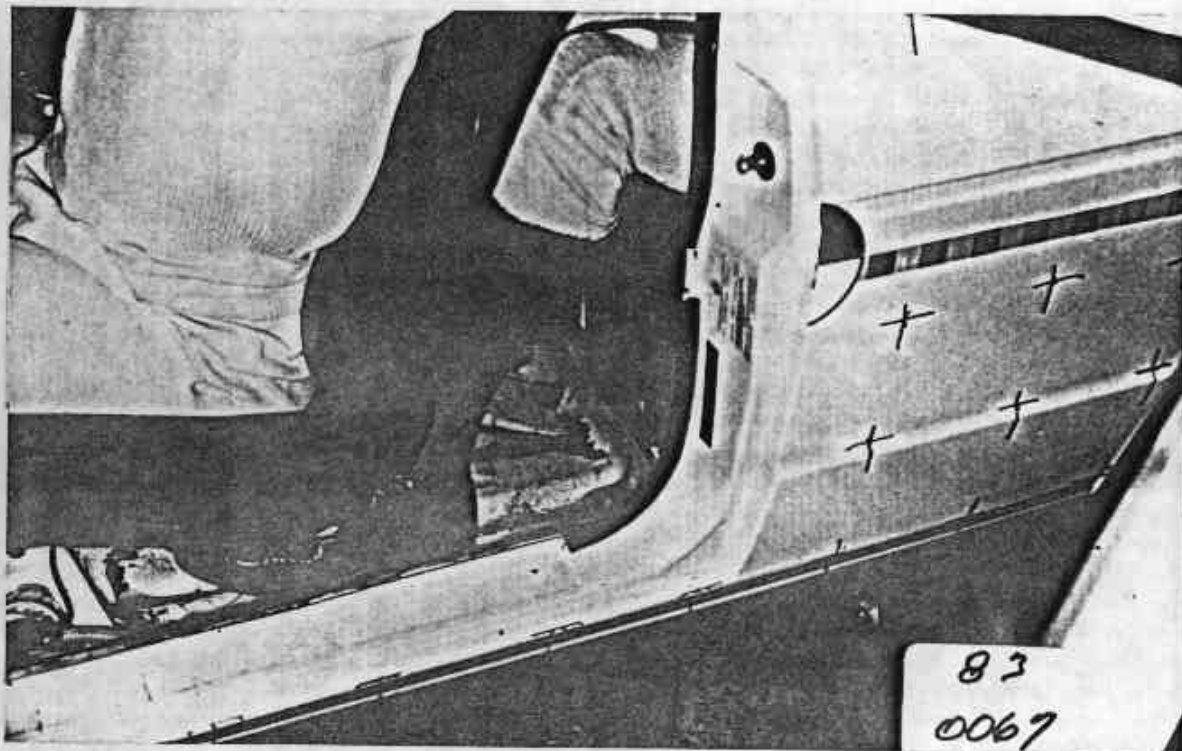


FIGURE A-15a. PRE-TEST LEFT REAR PASSENGER DUMMY POSITION.



FIGURE A-15b. PRE-TEST LEFT REAR PASSENGER DUMMY POSITION.



FIGURE A-15c. PRE-TEST LEFT REAR PASSENGER DUMMY POSITION.

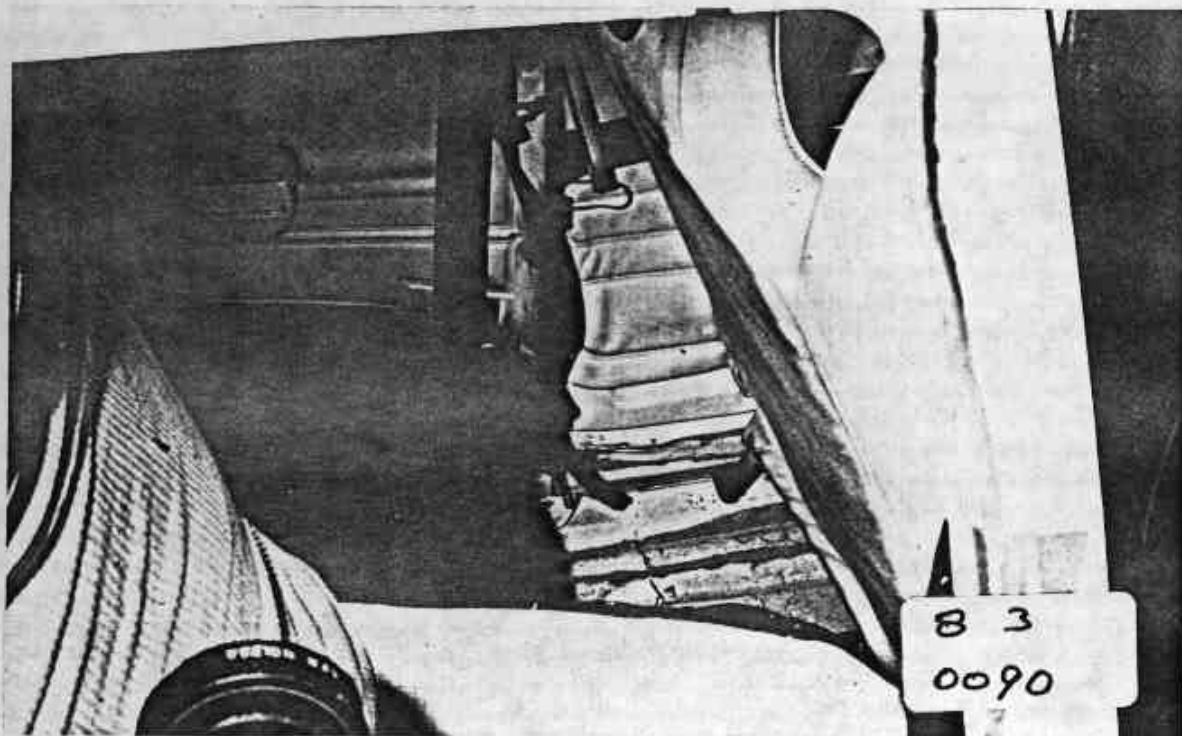


FIGURE A-16a. POST-TEST LEFT REAR PASSENGER DUMMY POSITION.



FIGURE A-16b. POST-TEST LEFT REAR PASSENGER DUMMY POSITION.

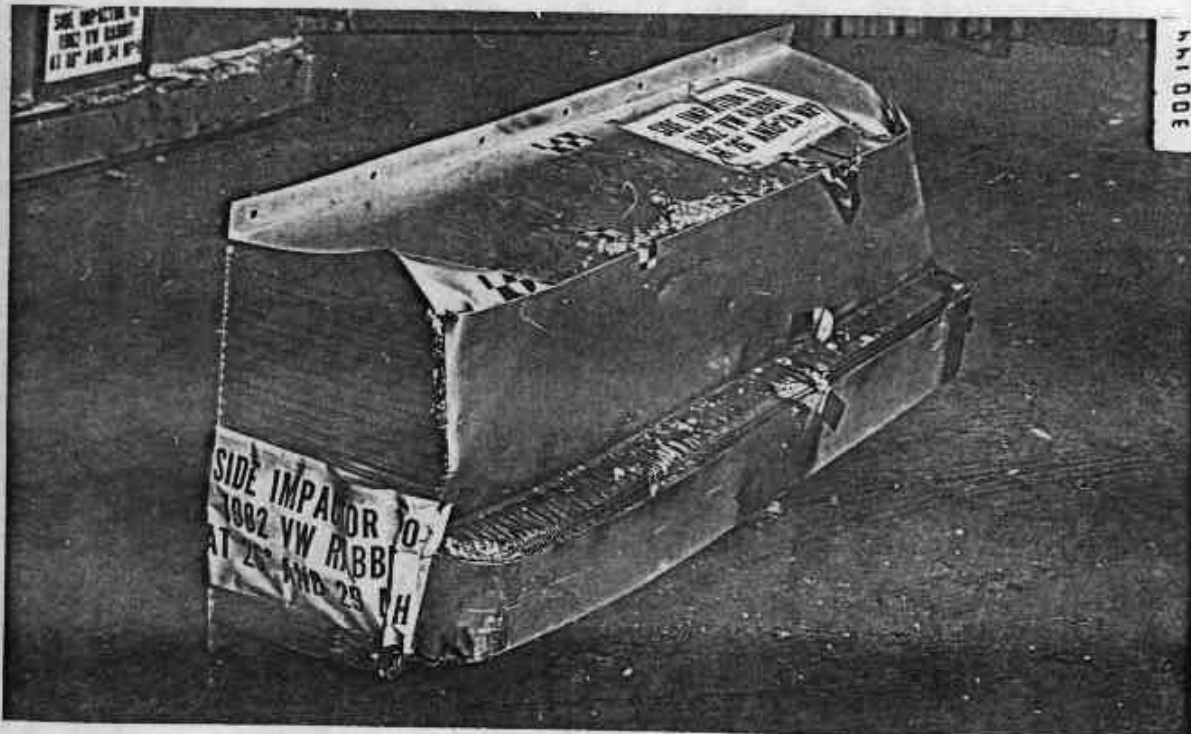


FIGURE A-17. POST-TEST RIGHT SIDE VIEW OF BARRIER.

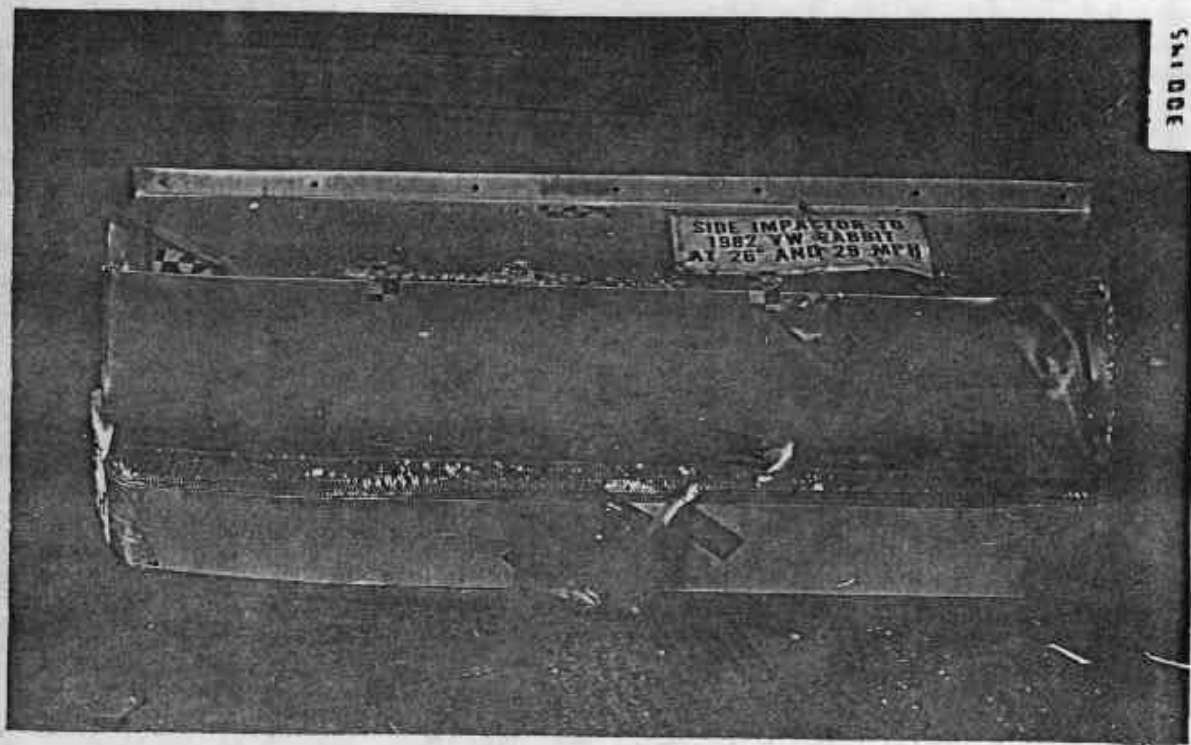


FIGURE A-18. POST-TEST FRONT VIEW OF BARRIER.

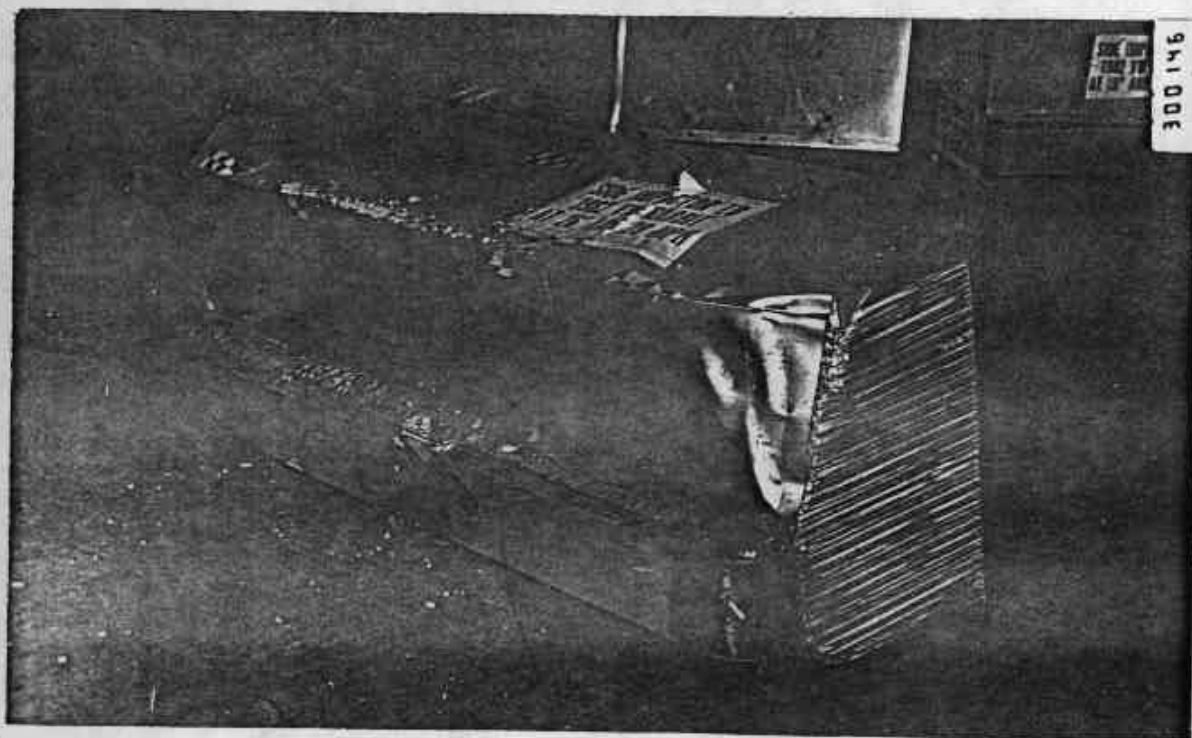
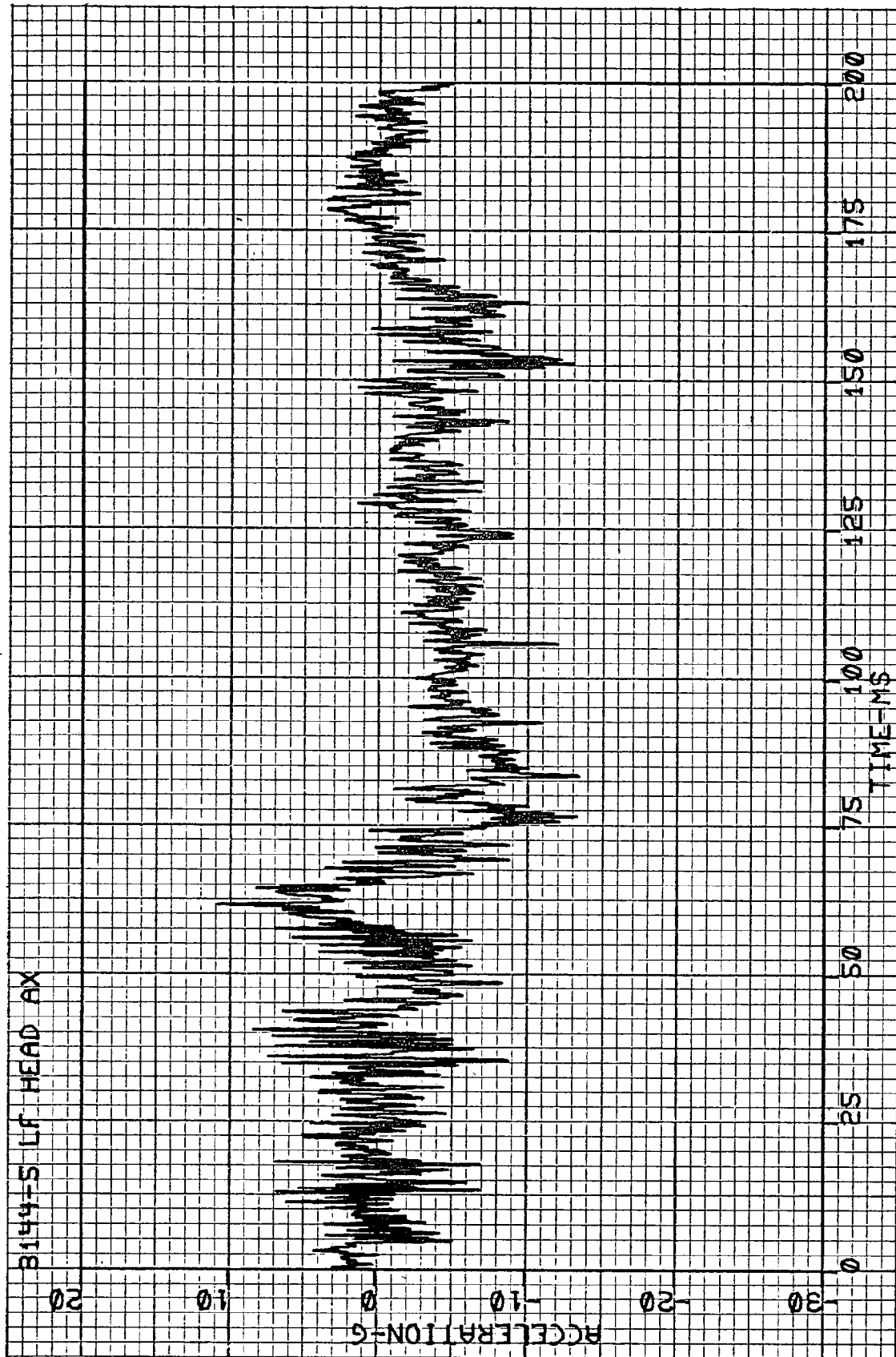
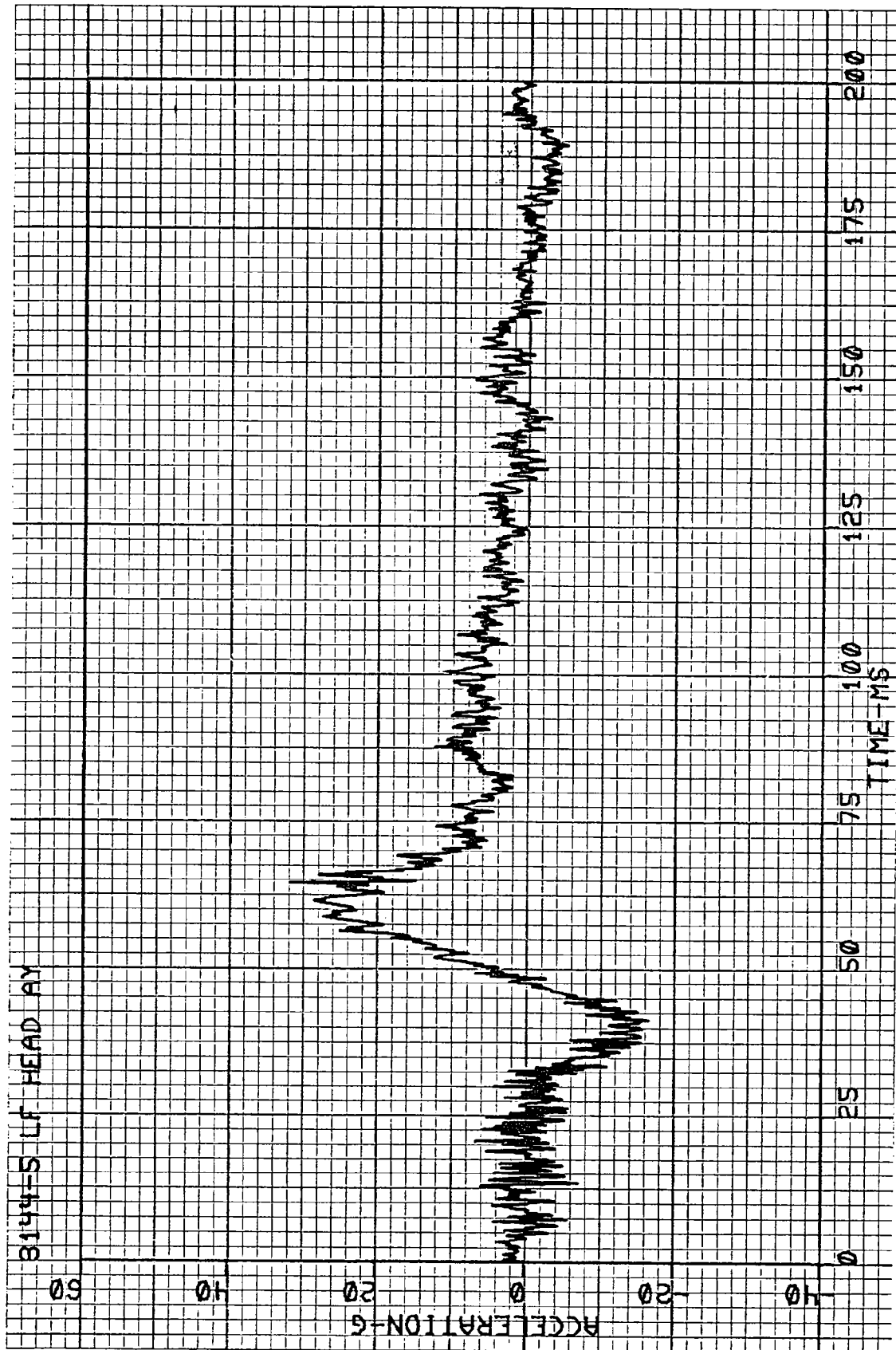
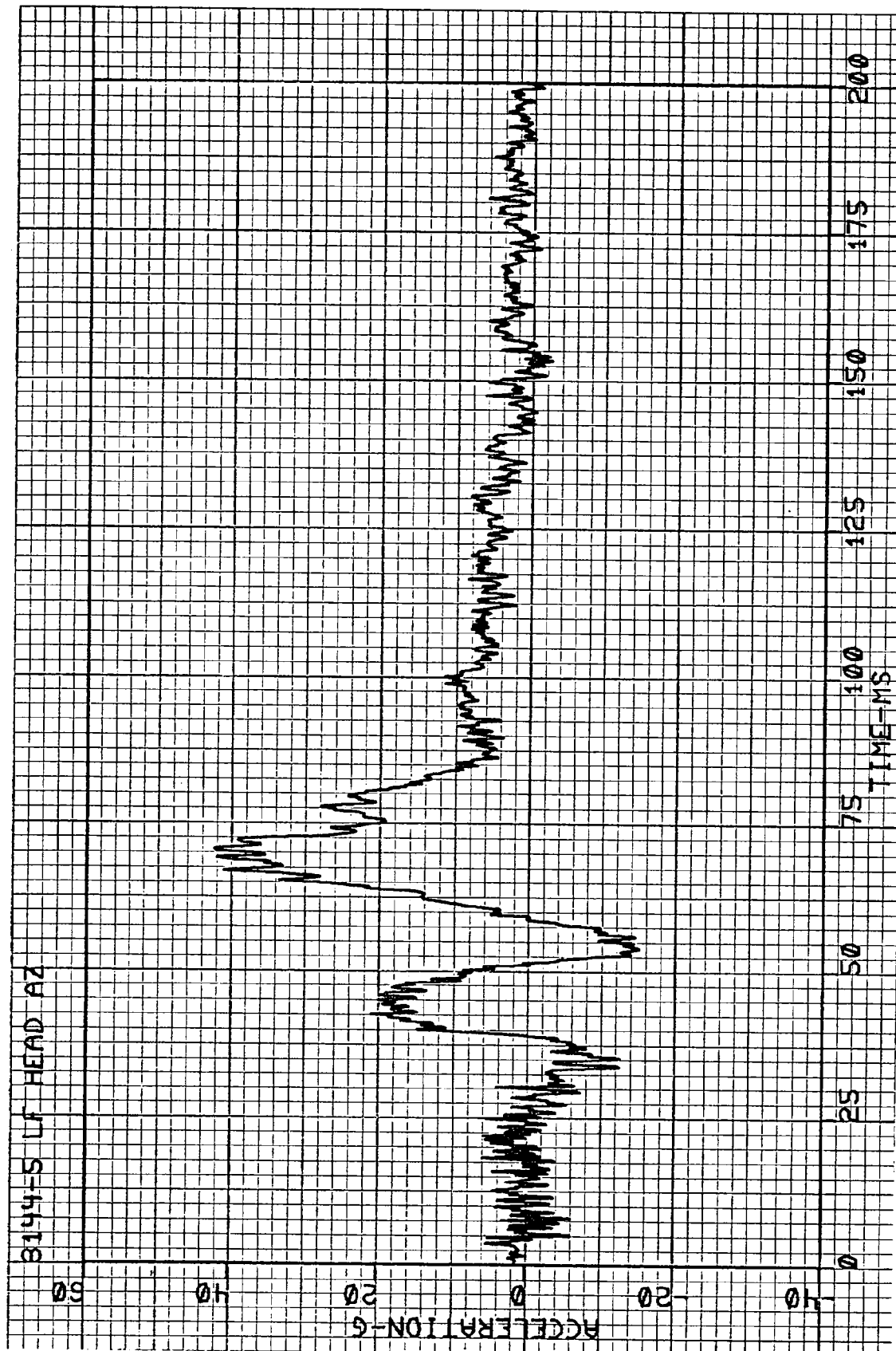


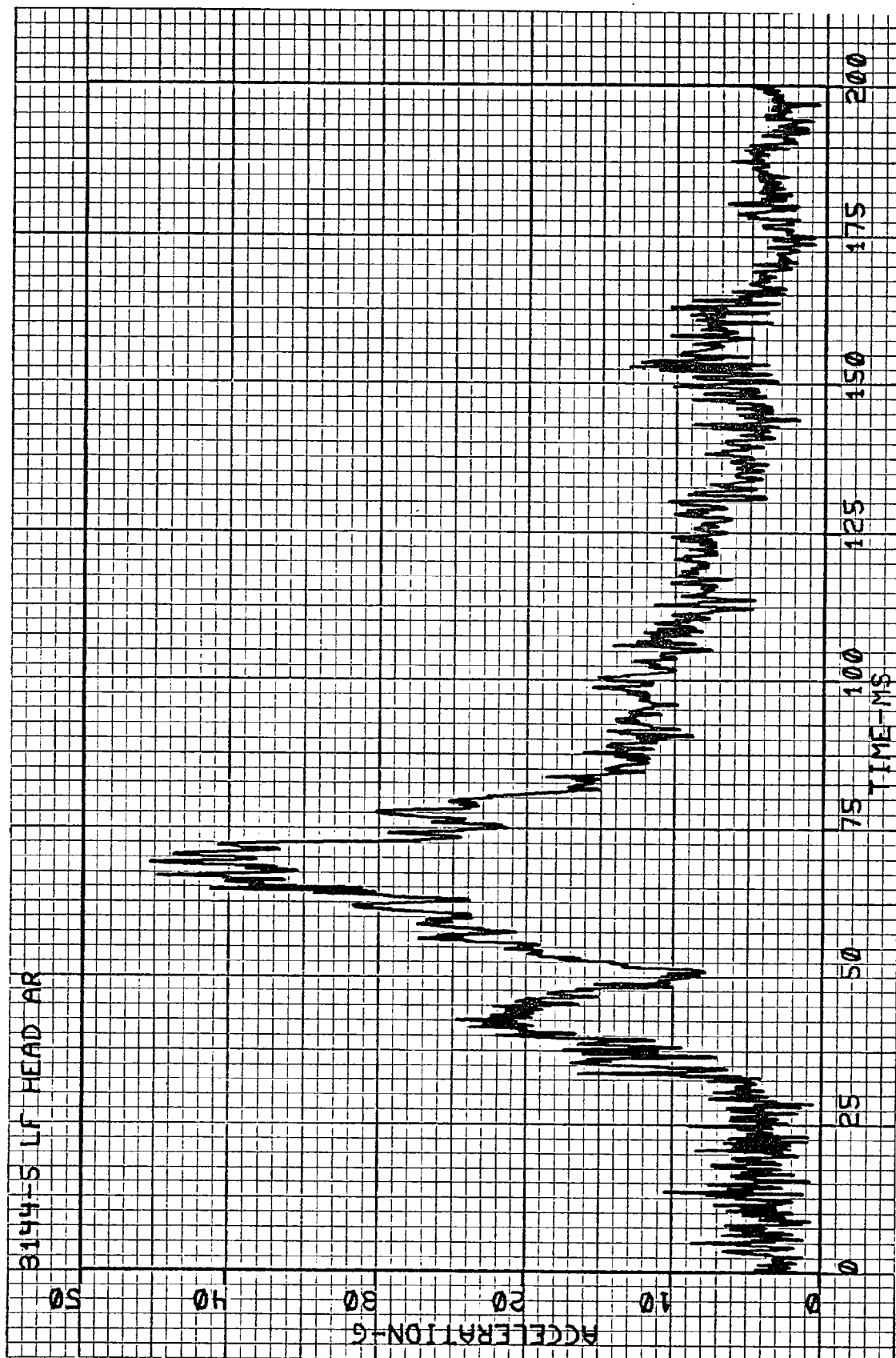
FIGURE A-19. POST-TEST LEFT SIDE VIEW OF BARRIER.

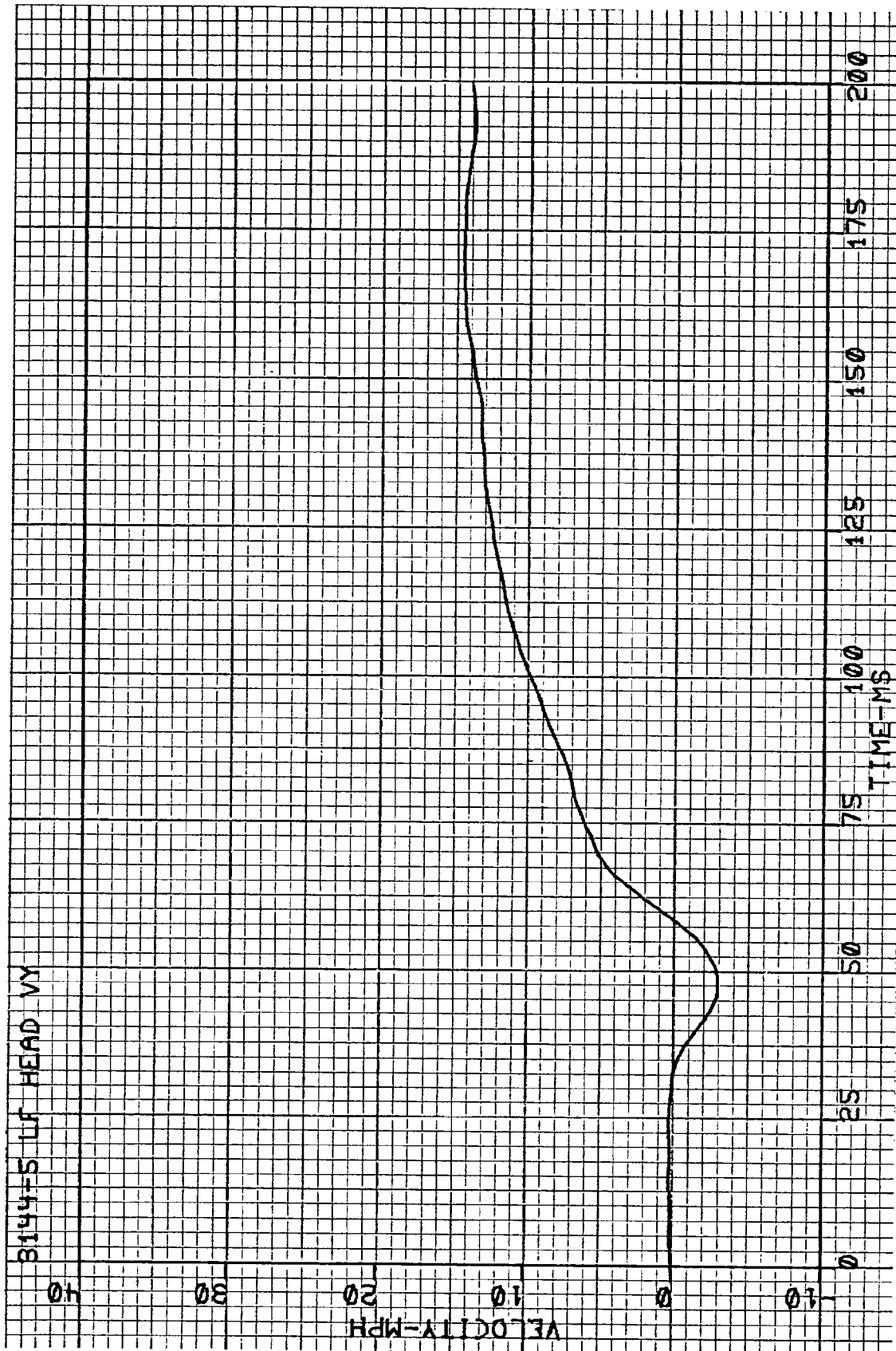
APPENDIX B
CALCOMP PLOTS FOR
26.5° CRABBED SIDE IMPACTOR
TO 1982 VOLKSWAGEN RABBIT
AT 28.60 MPH

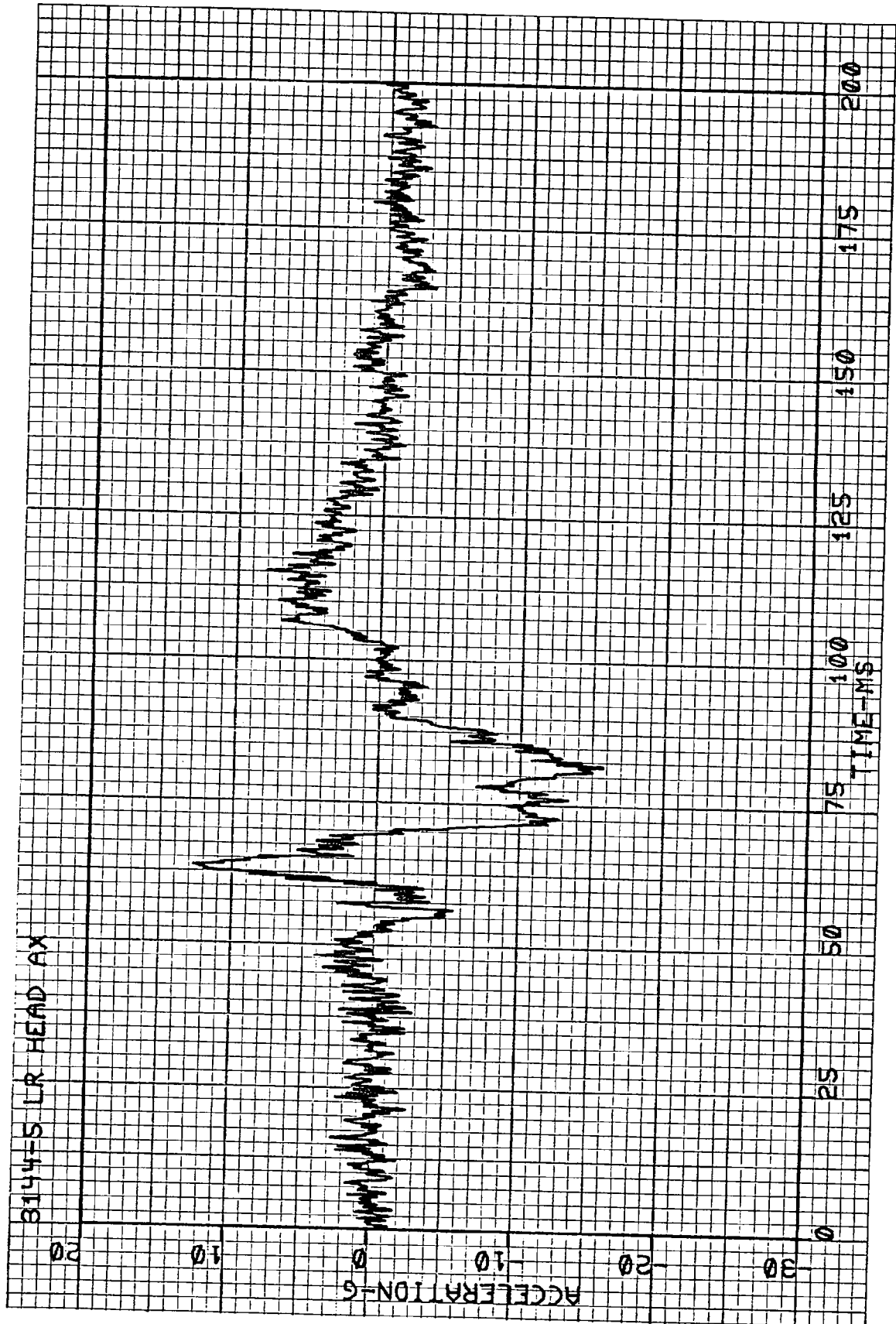


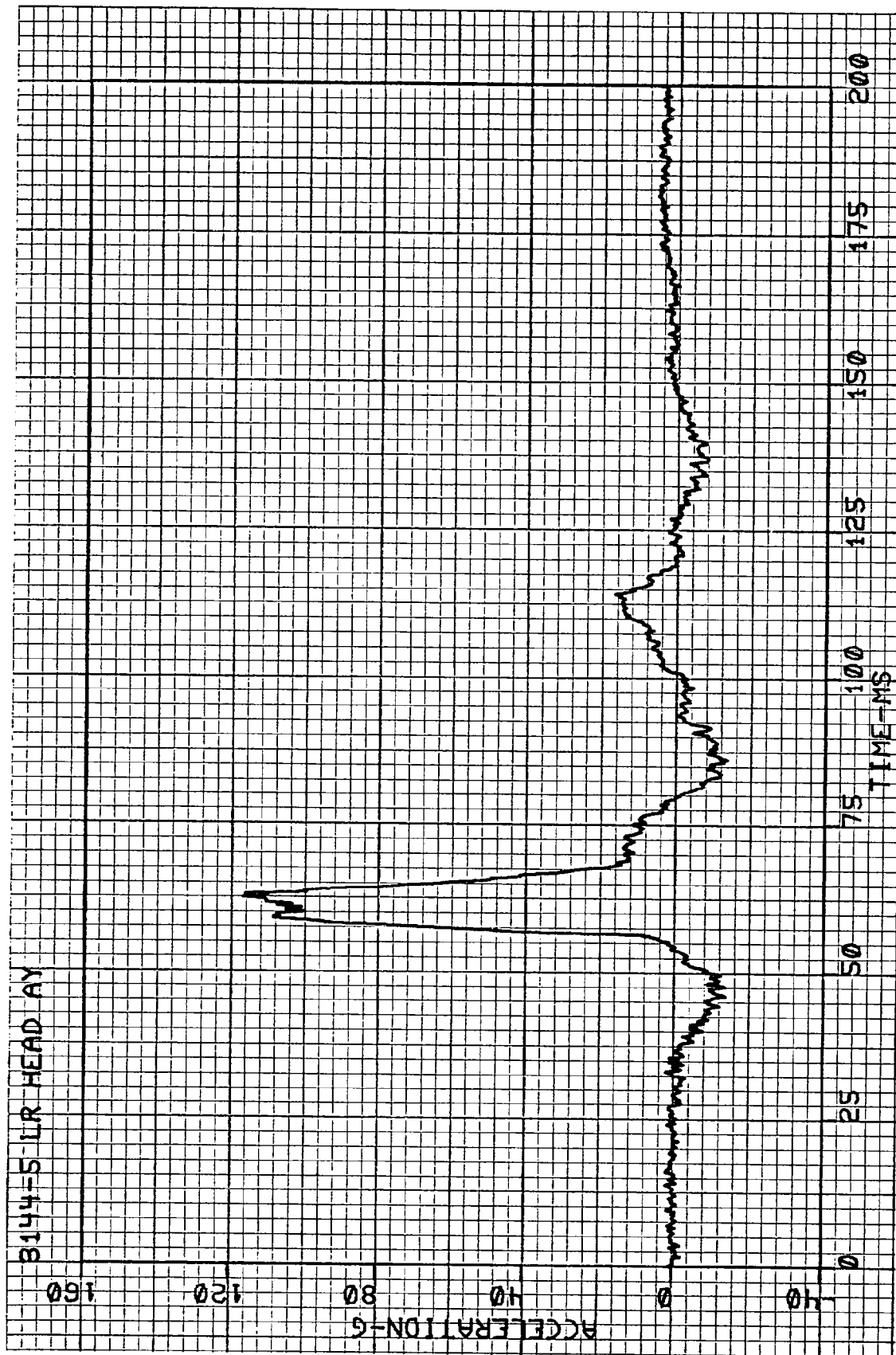


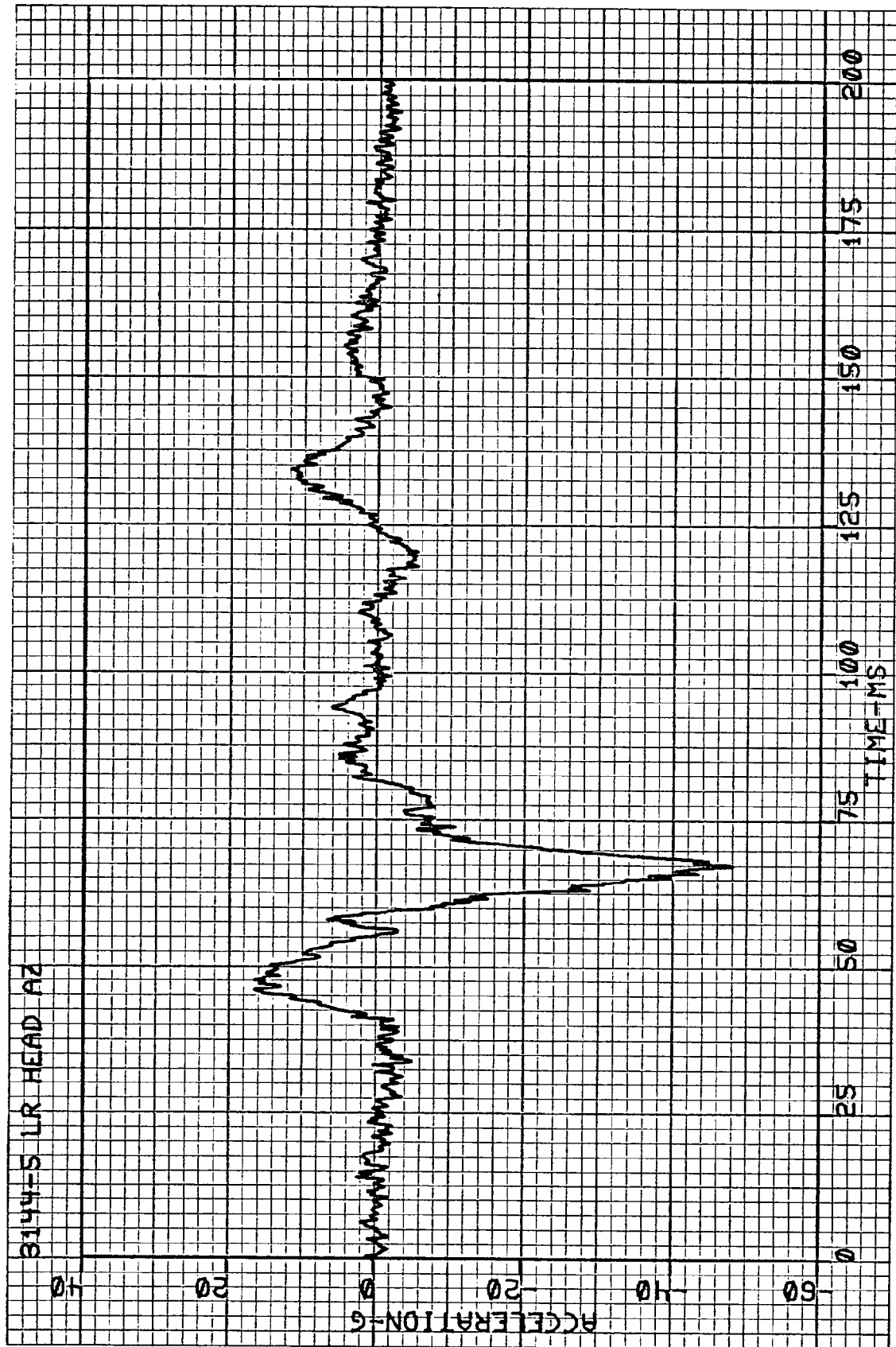


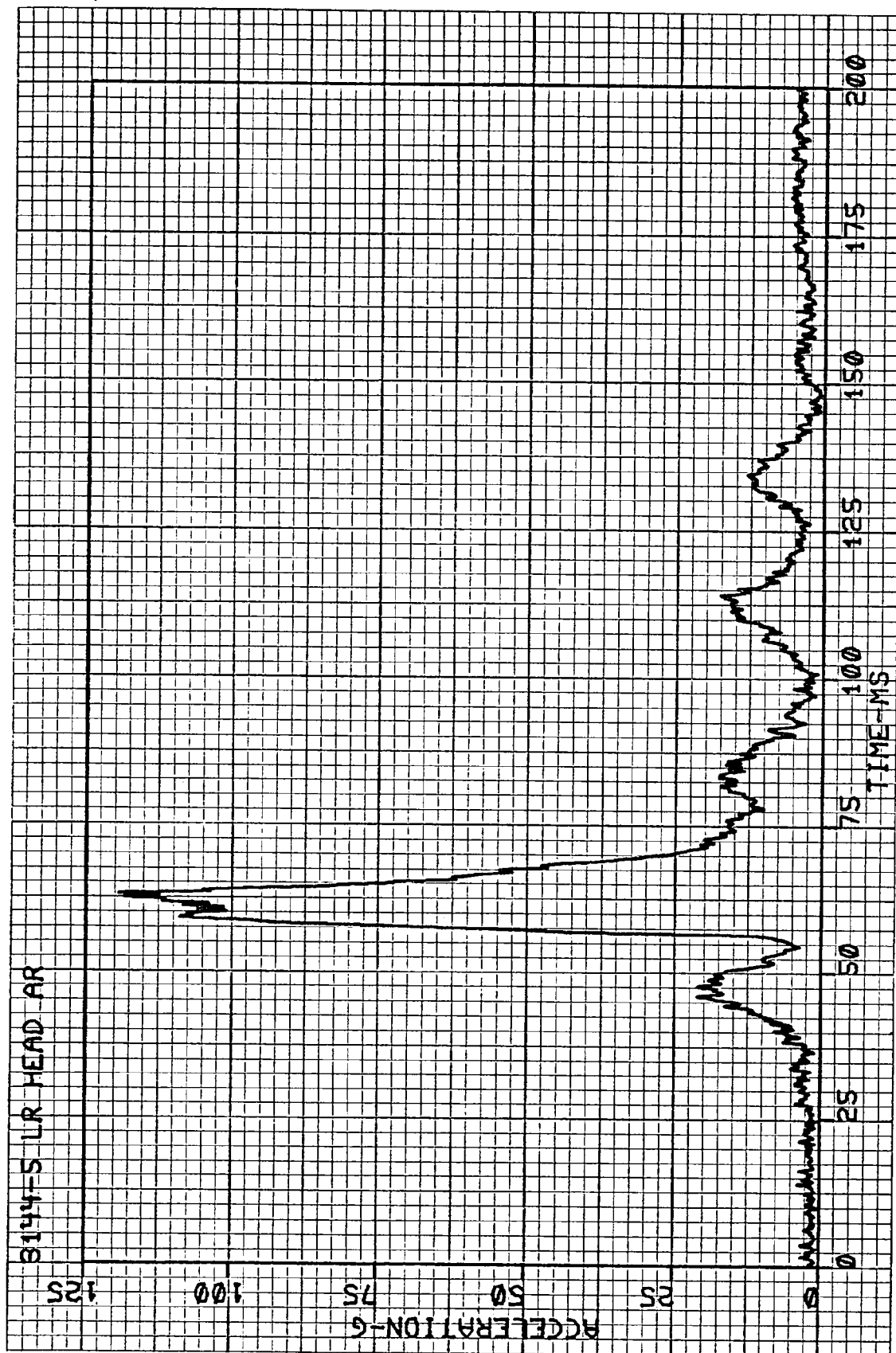


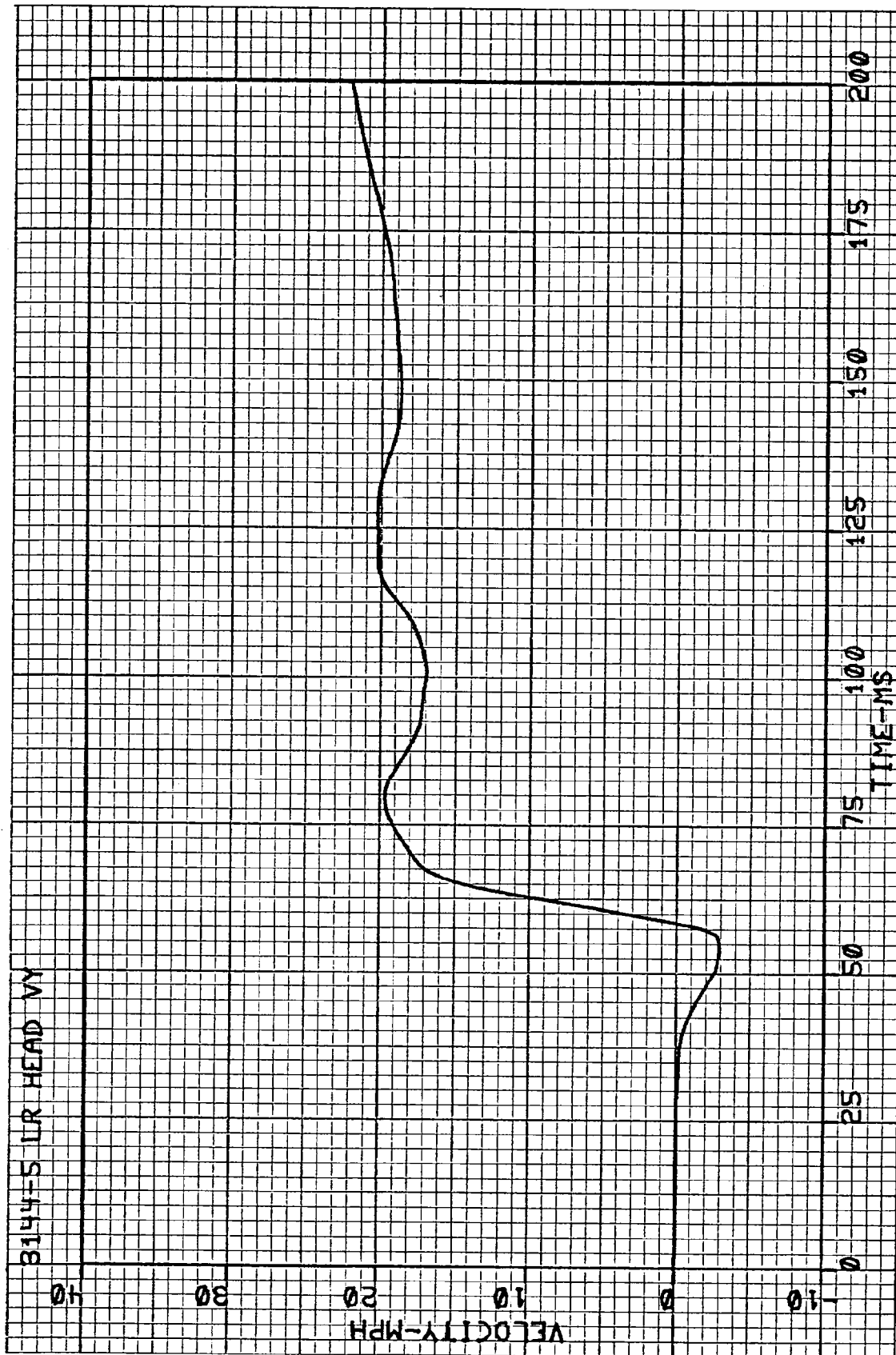


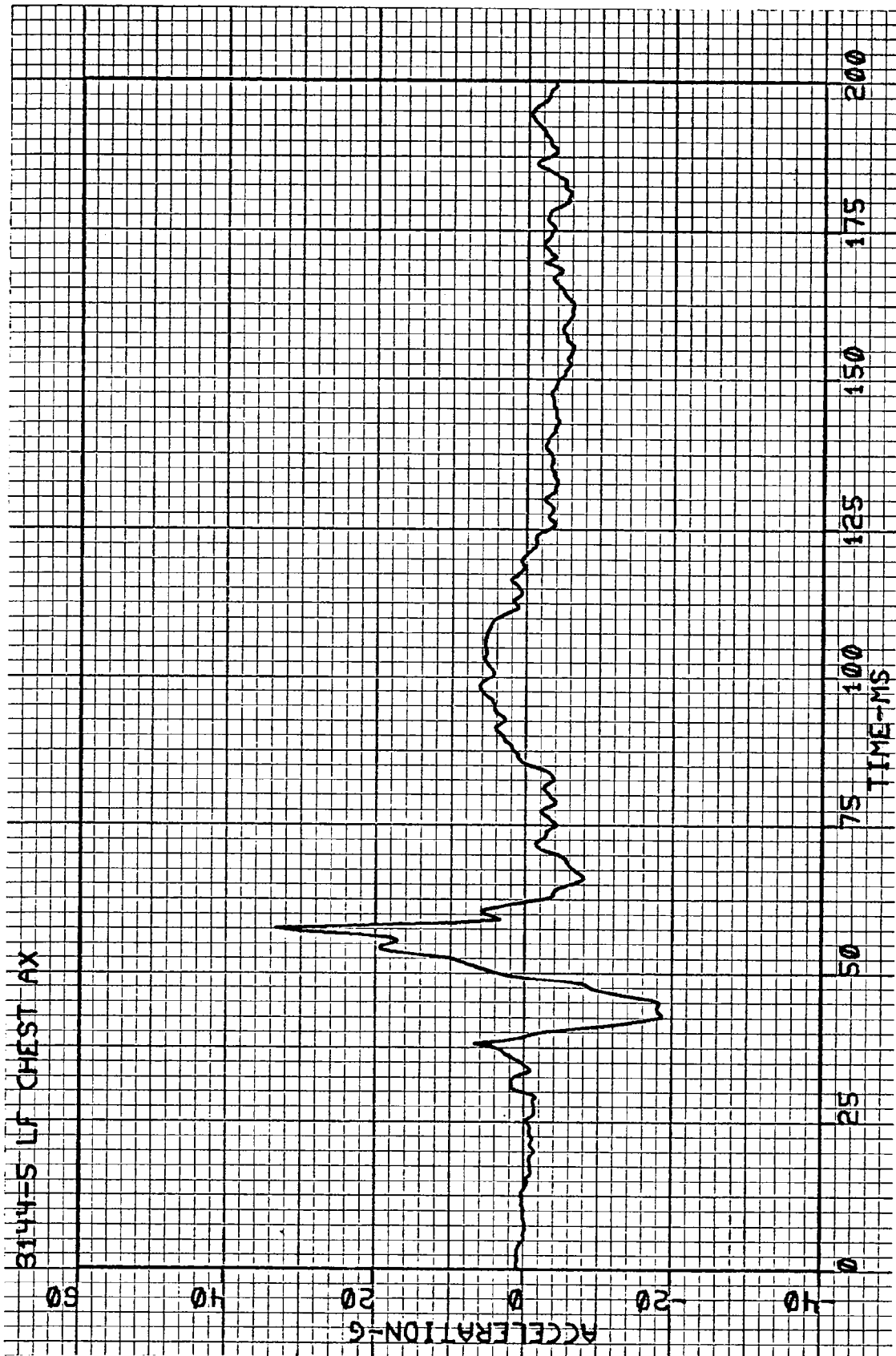


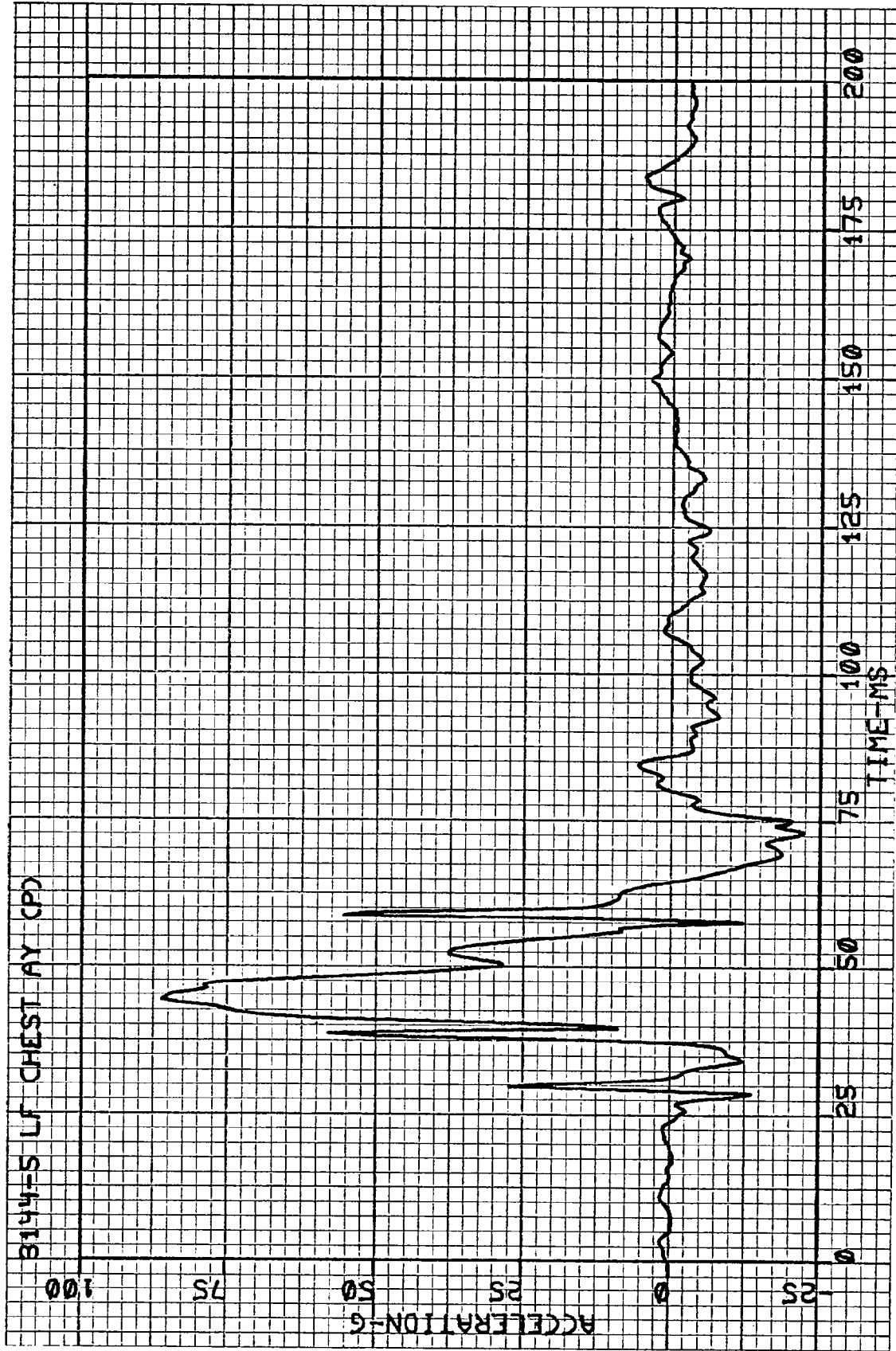


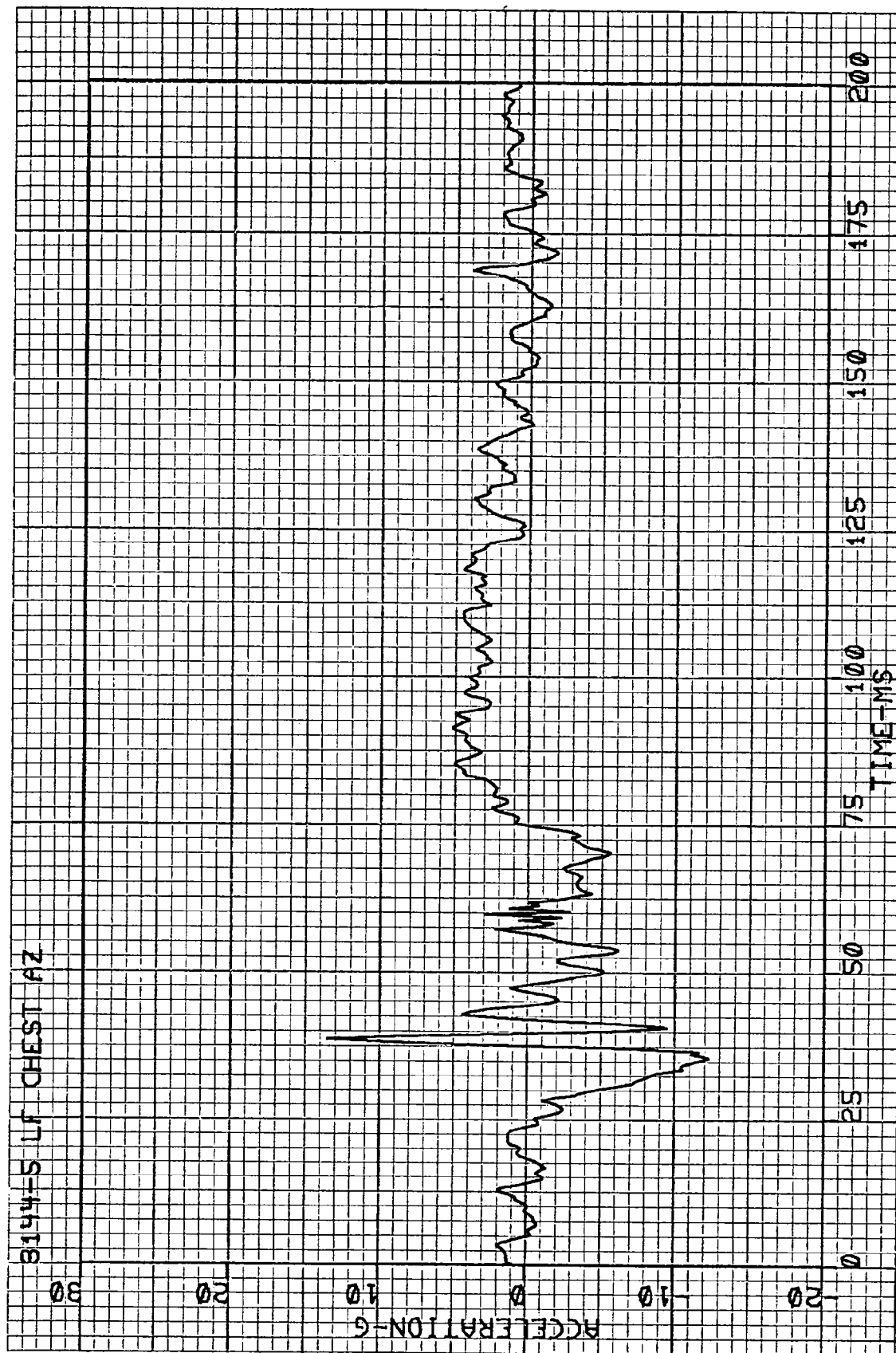


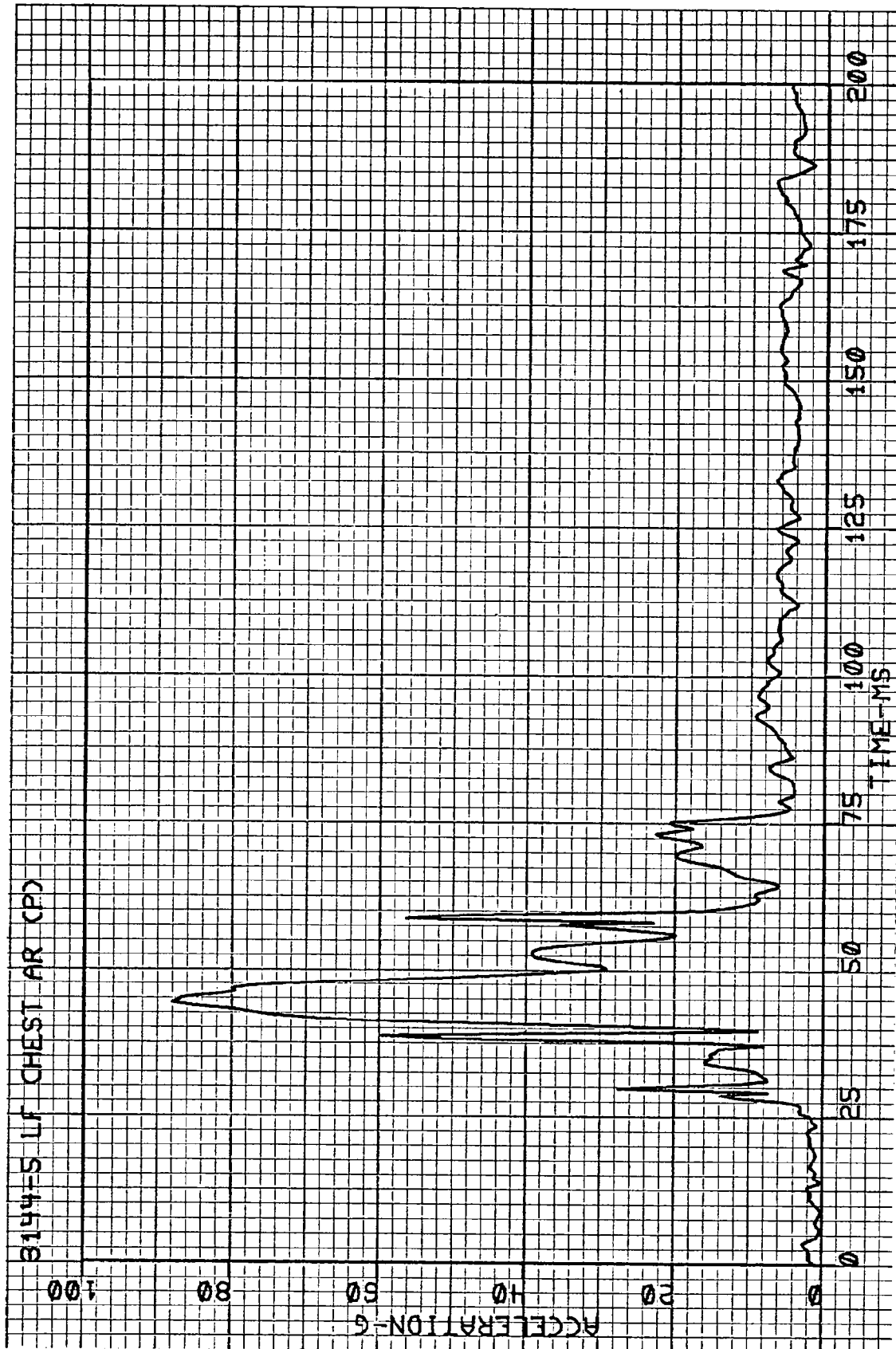


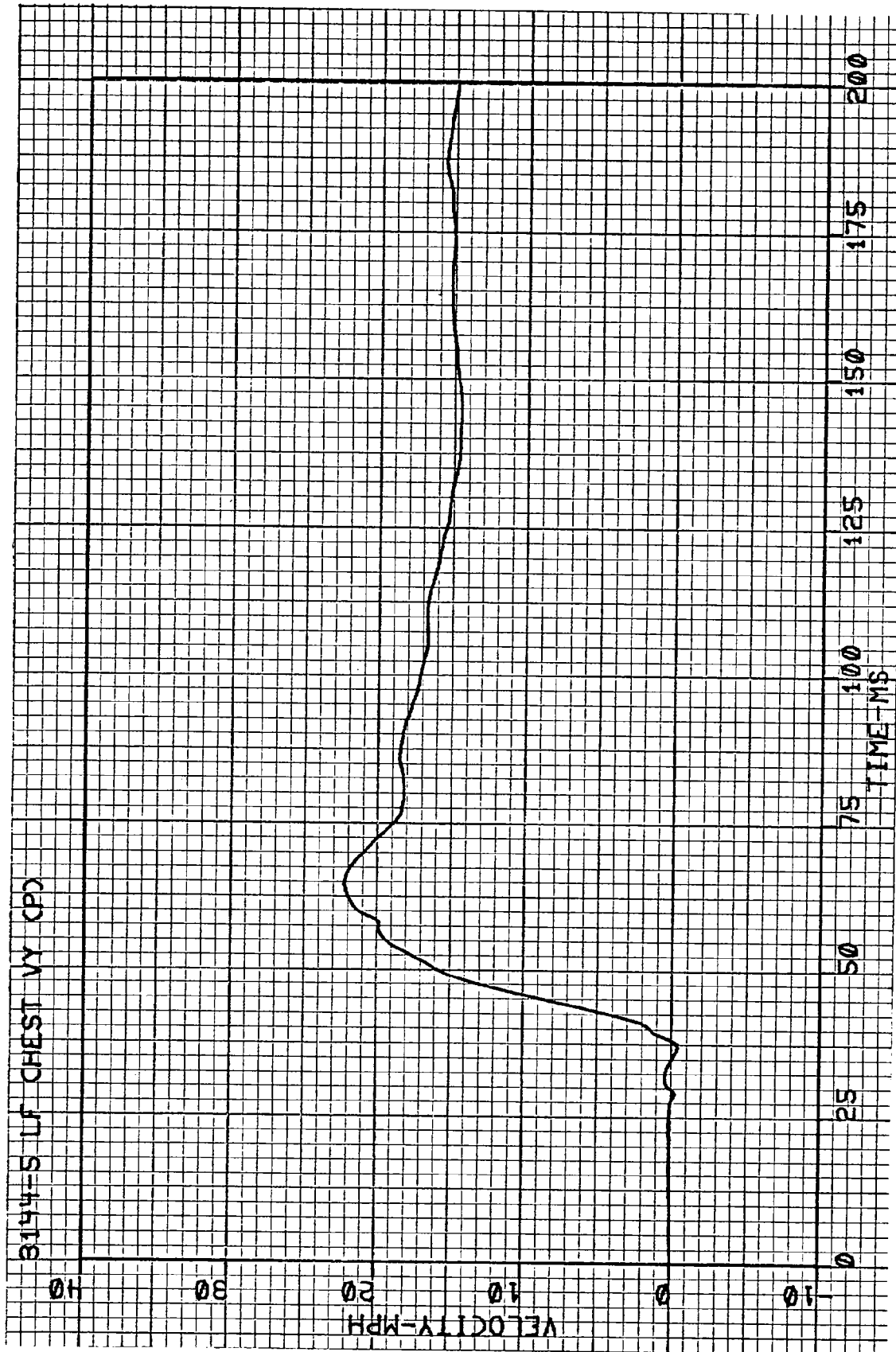


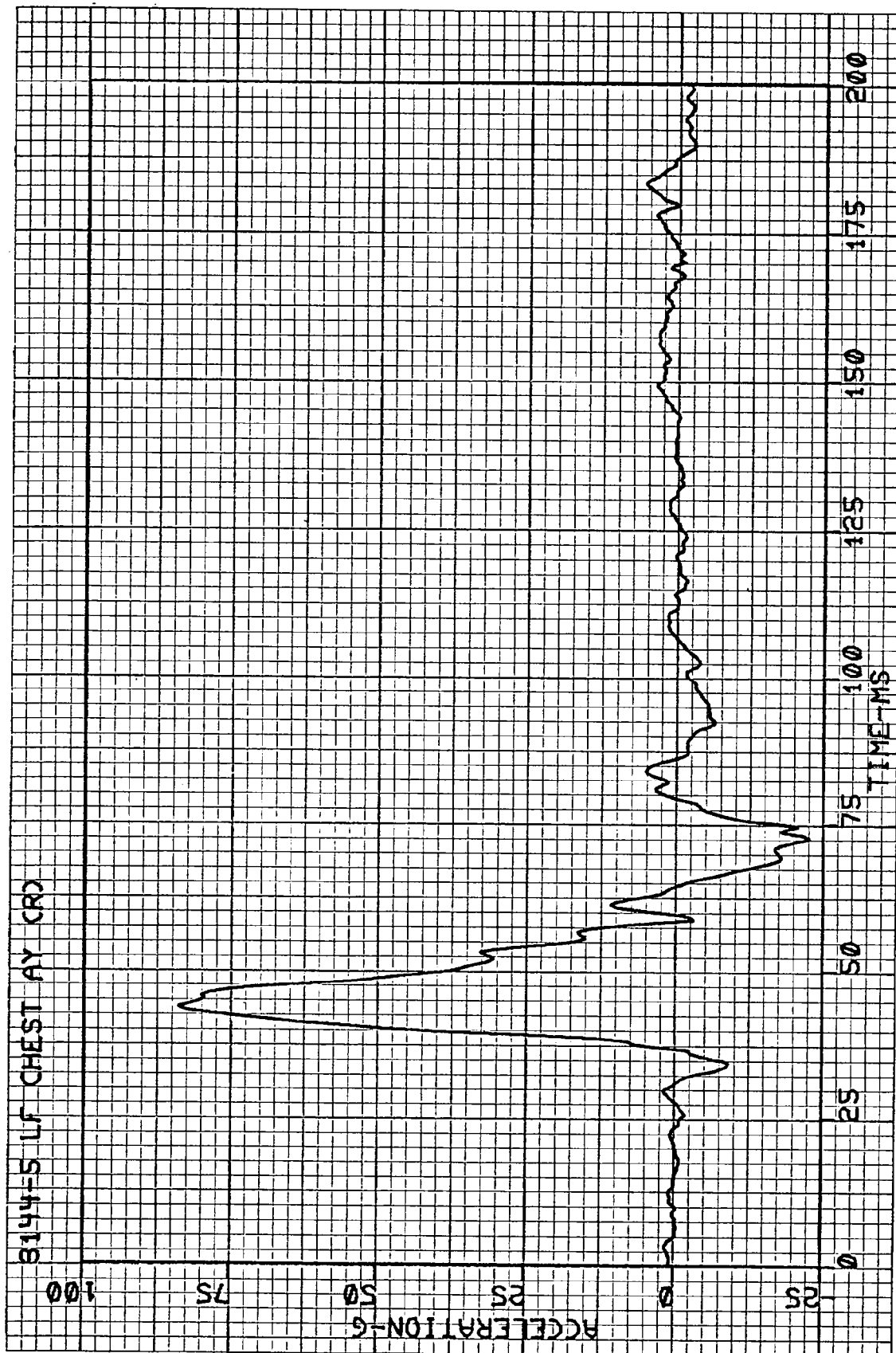


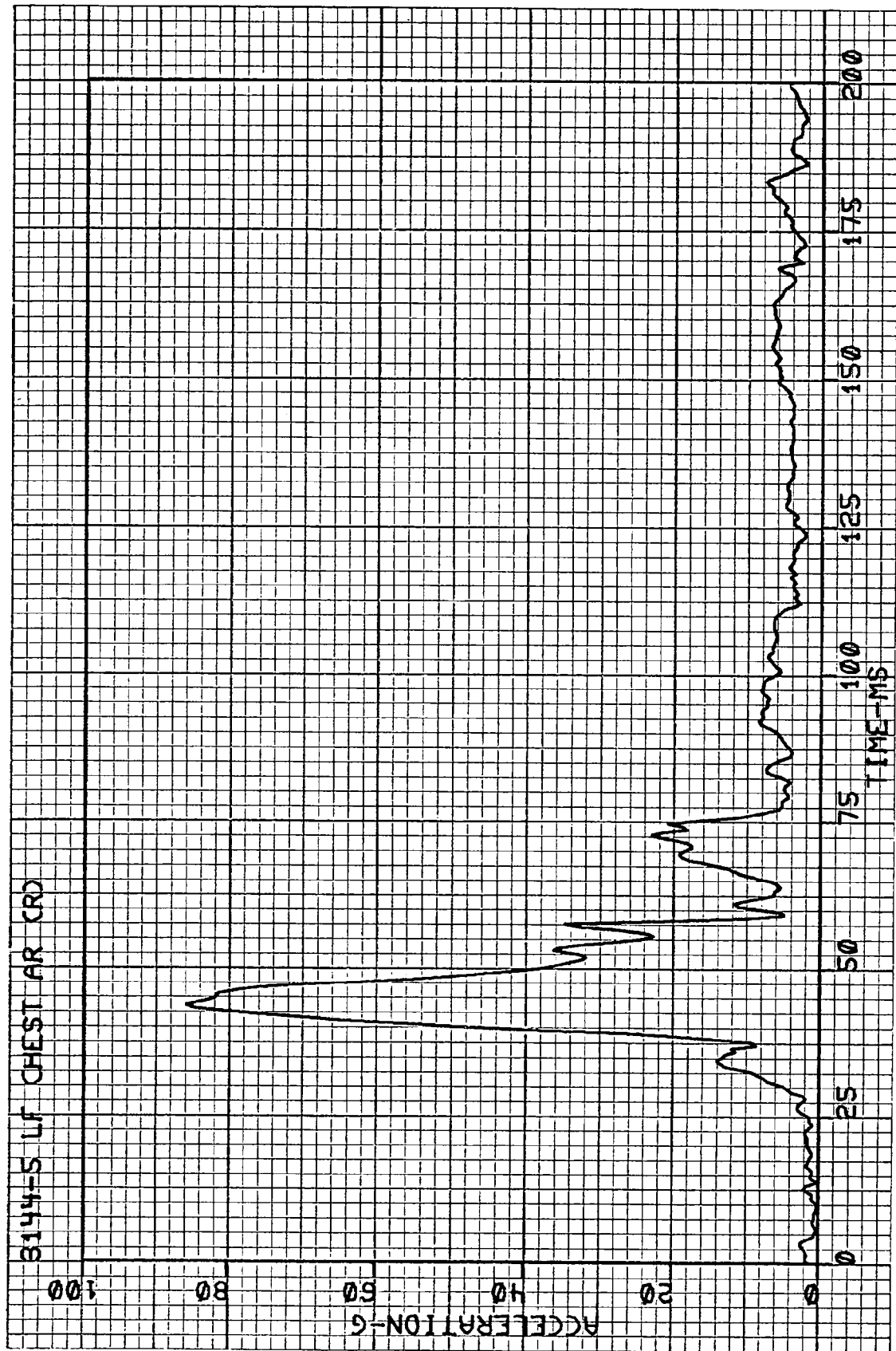


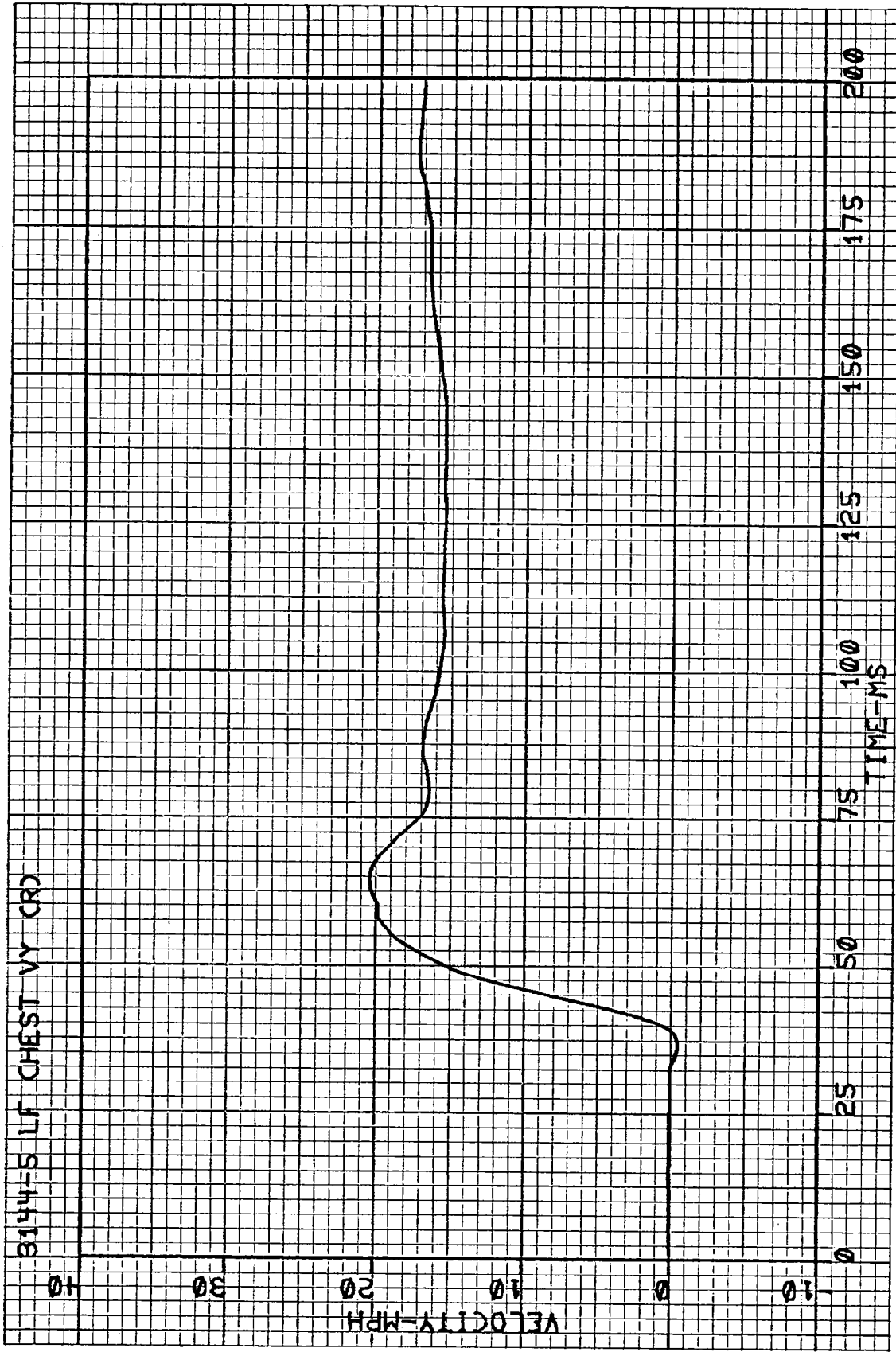


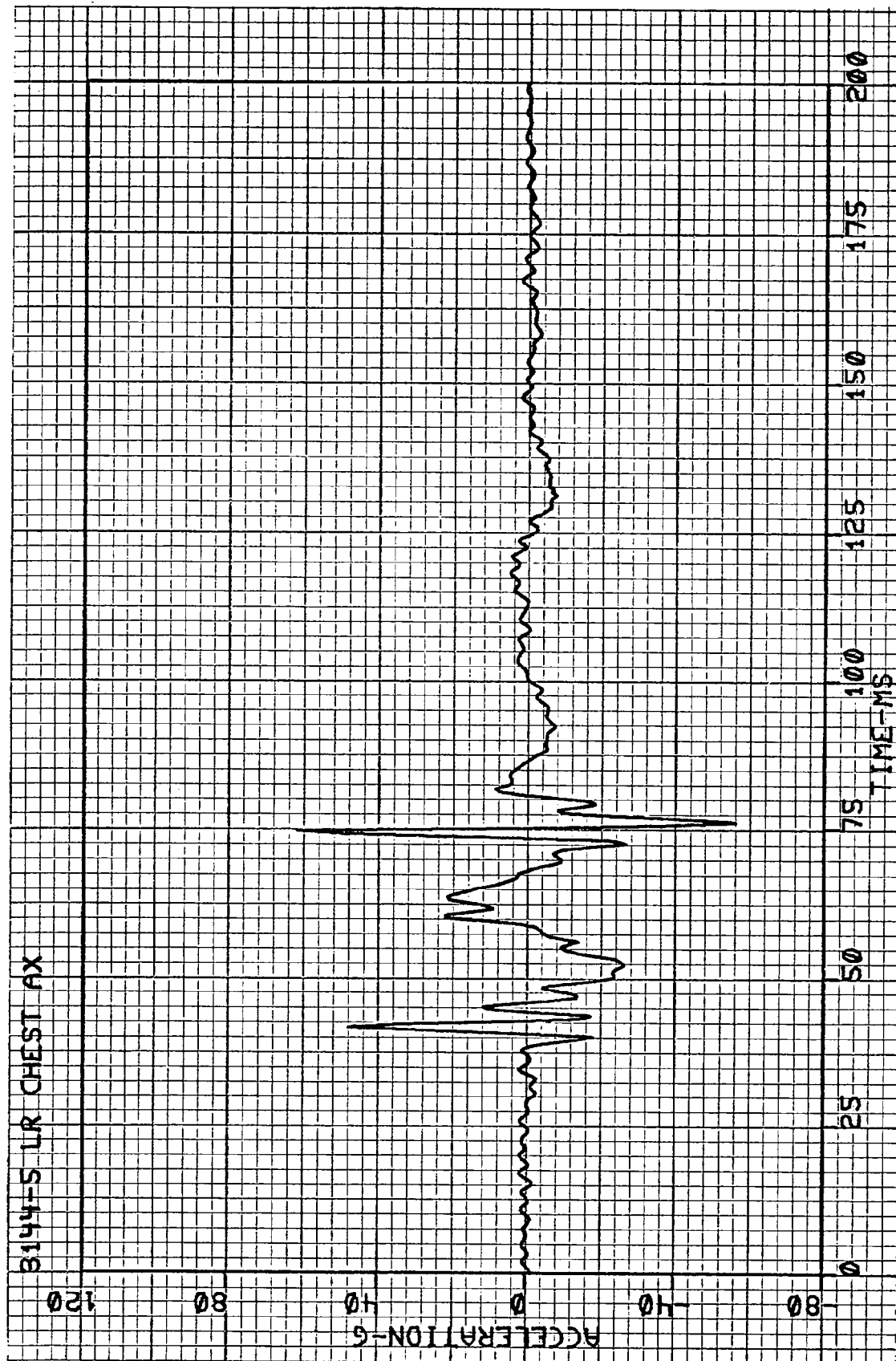


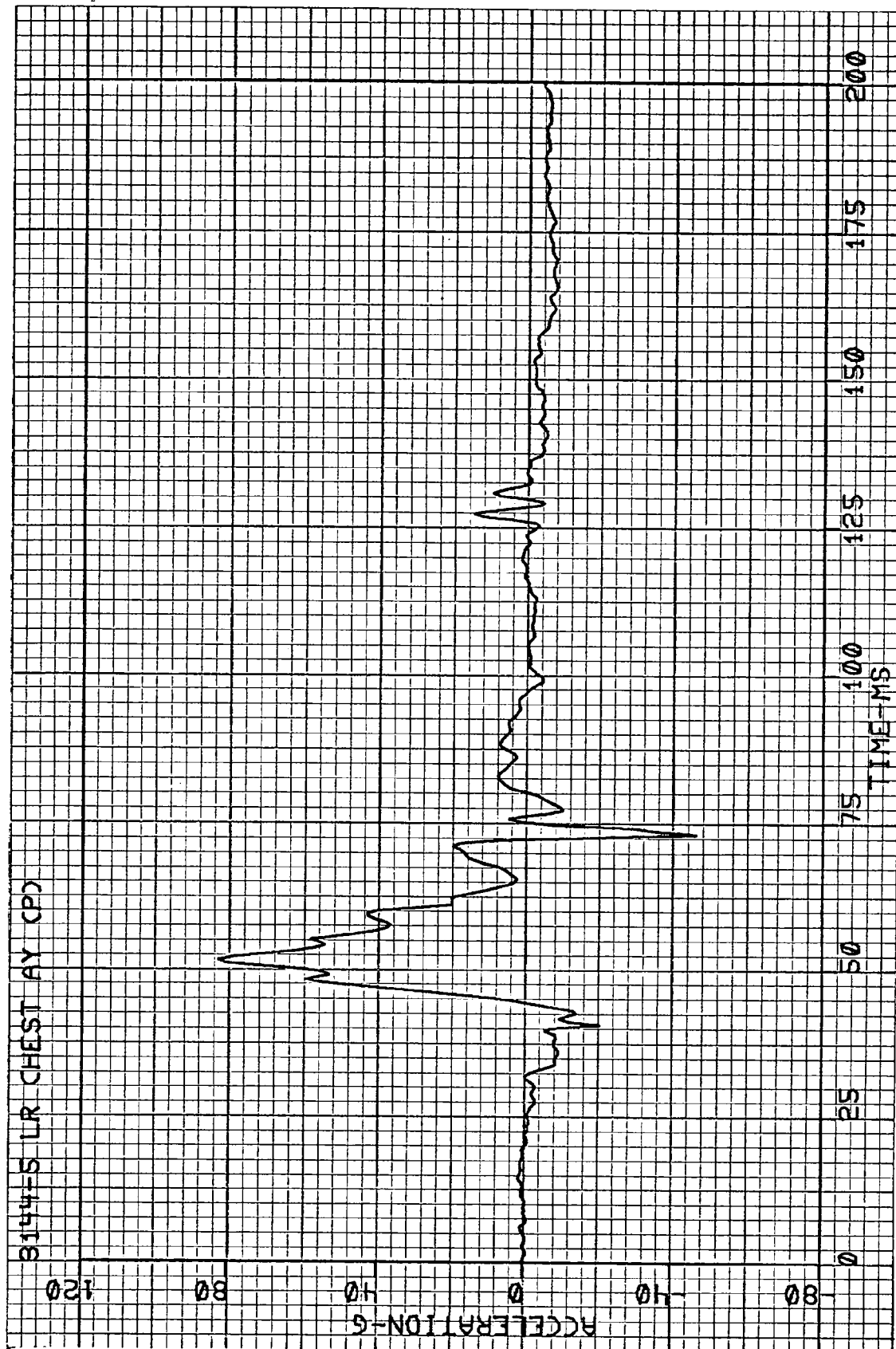


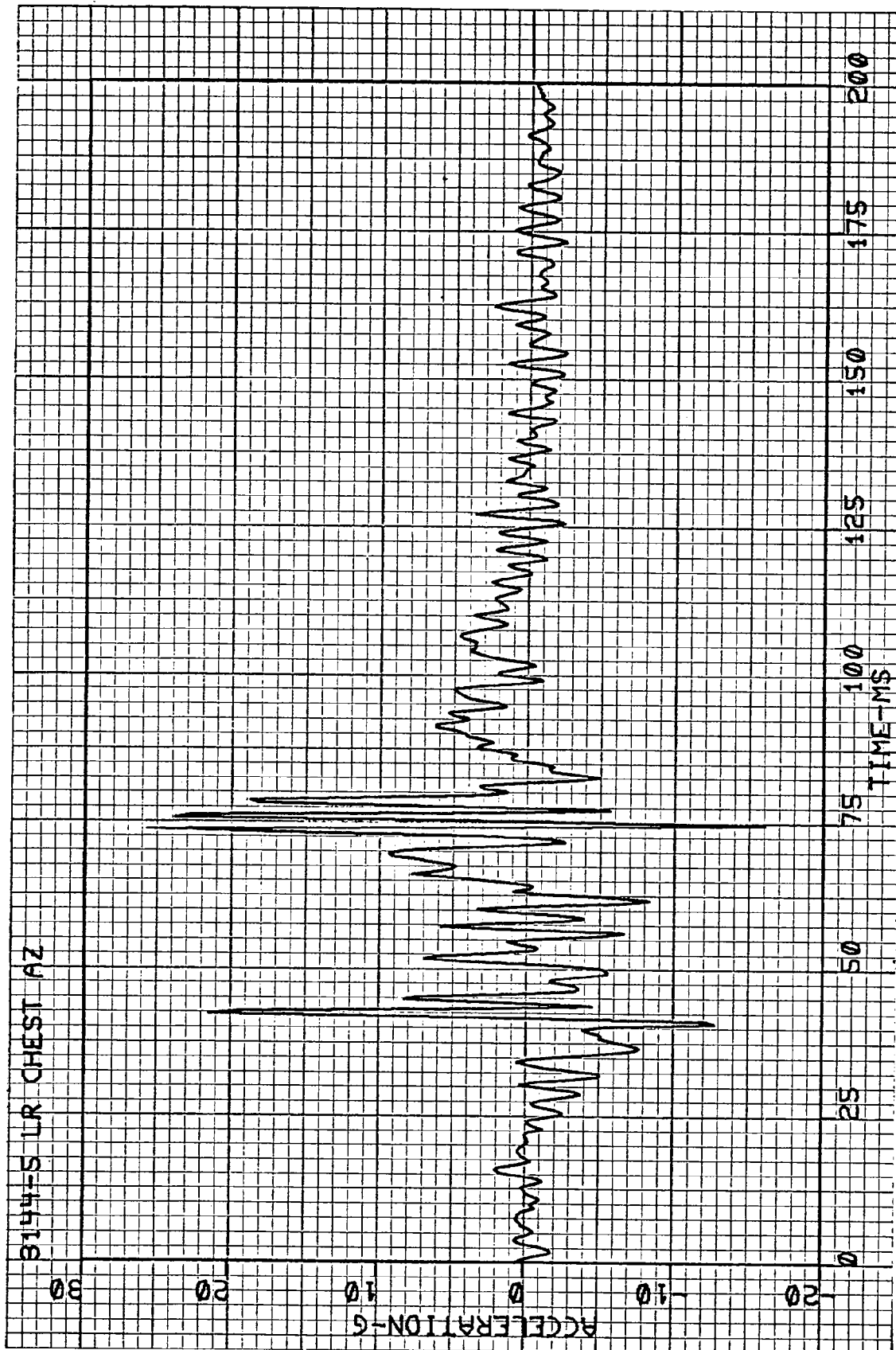


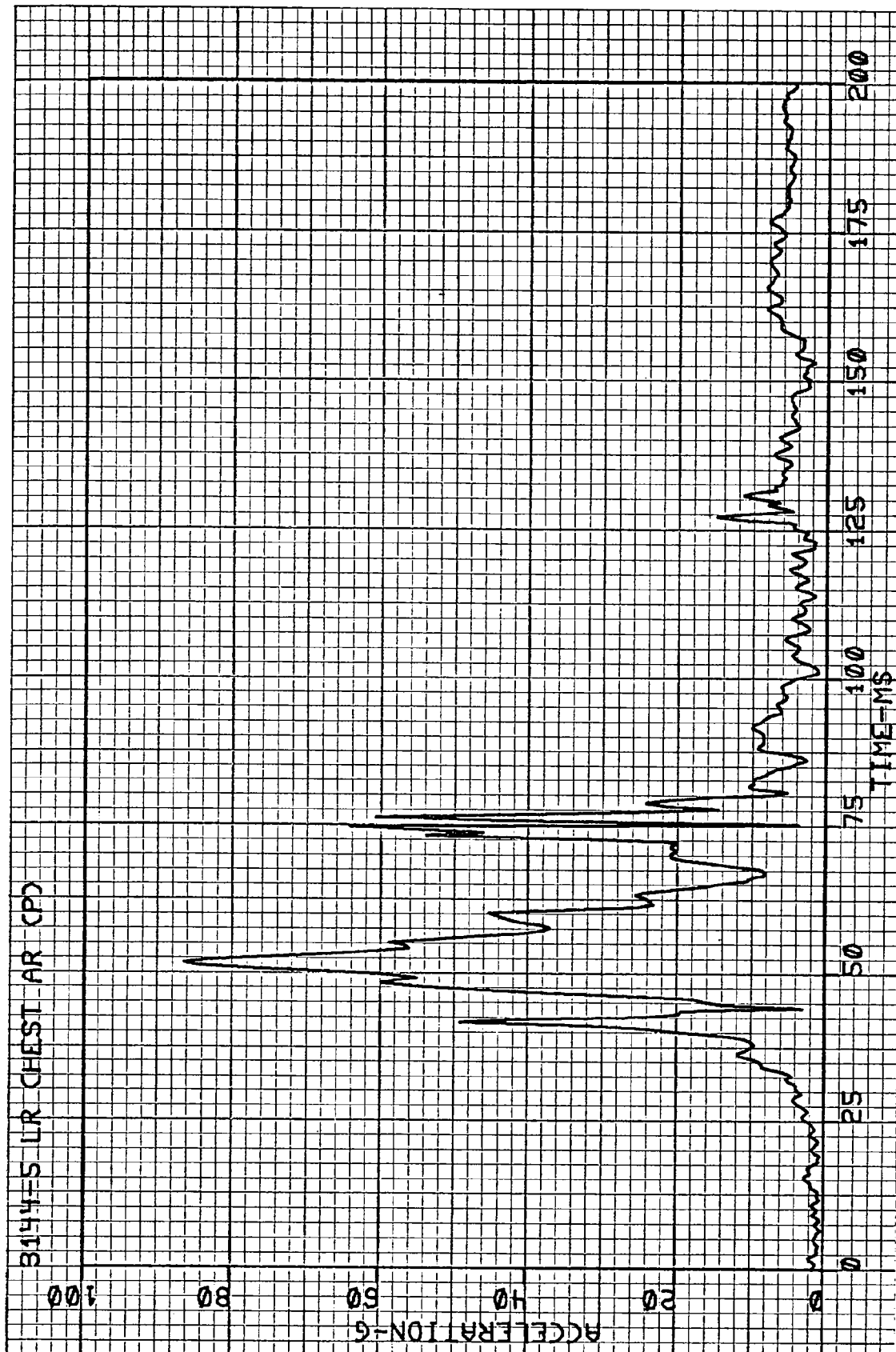


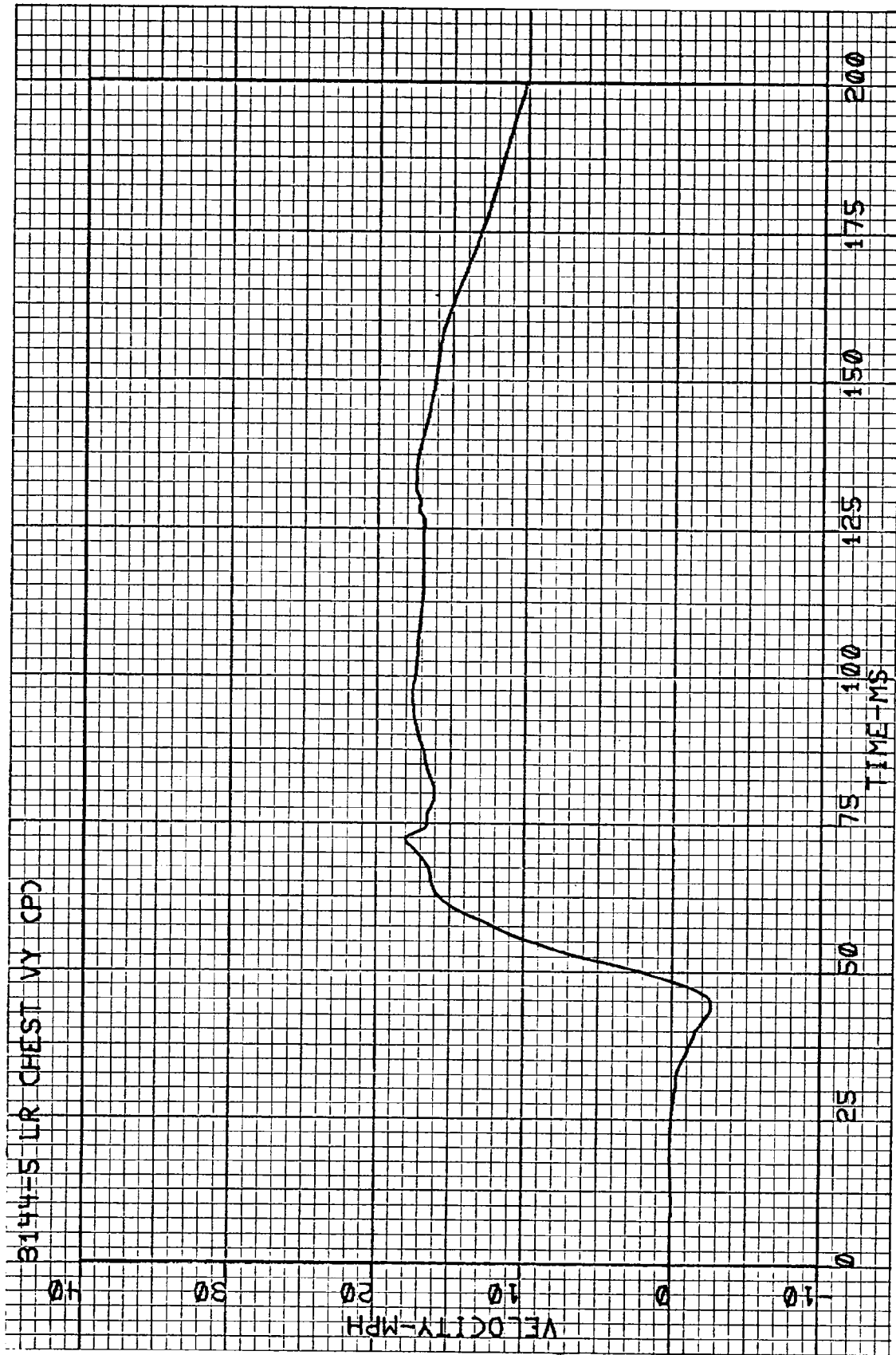


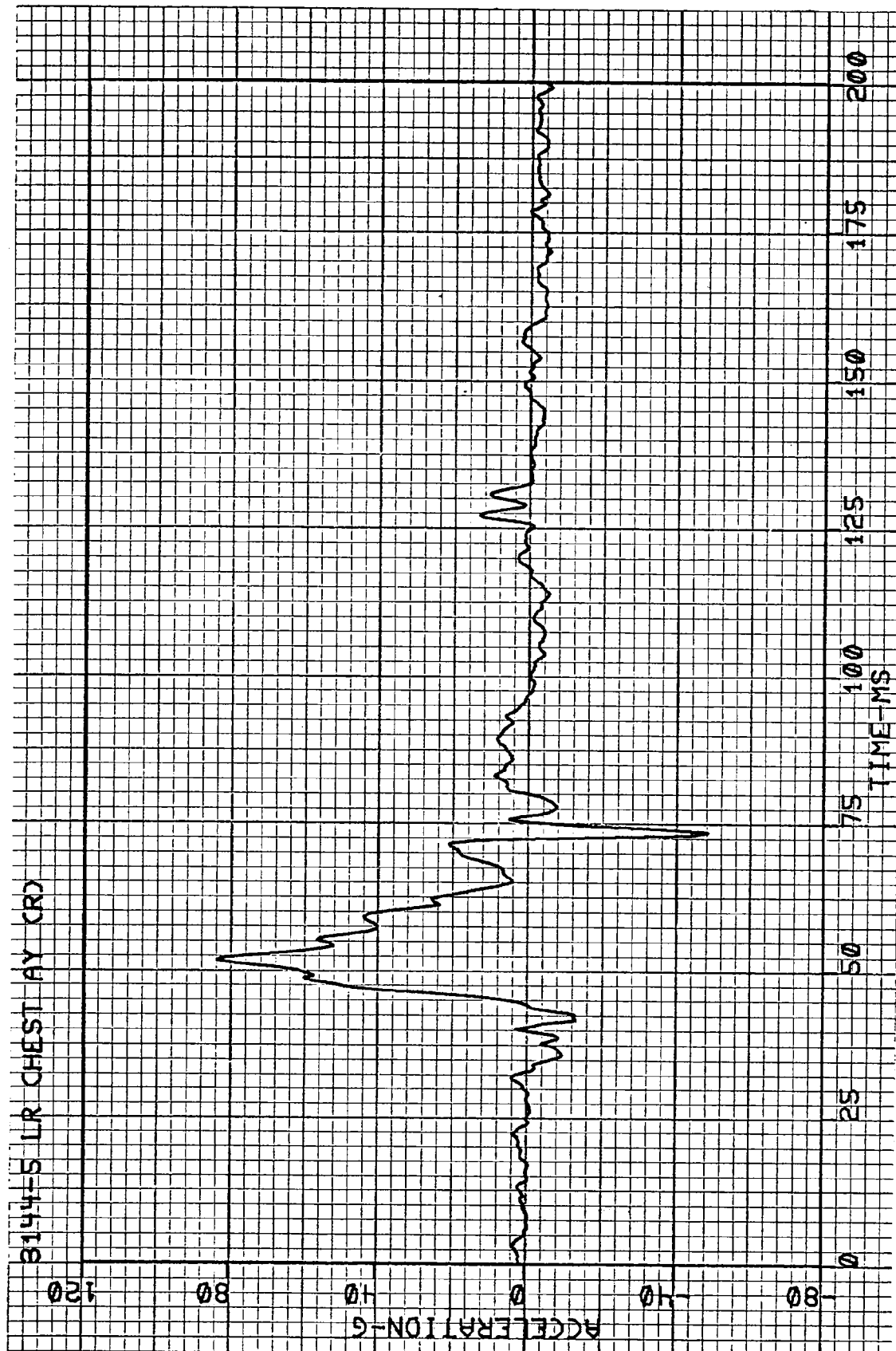


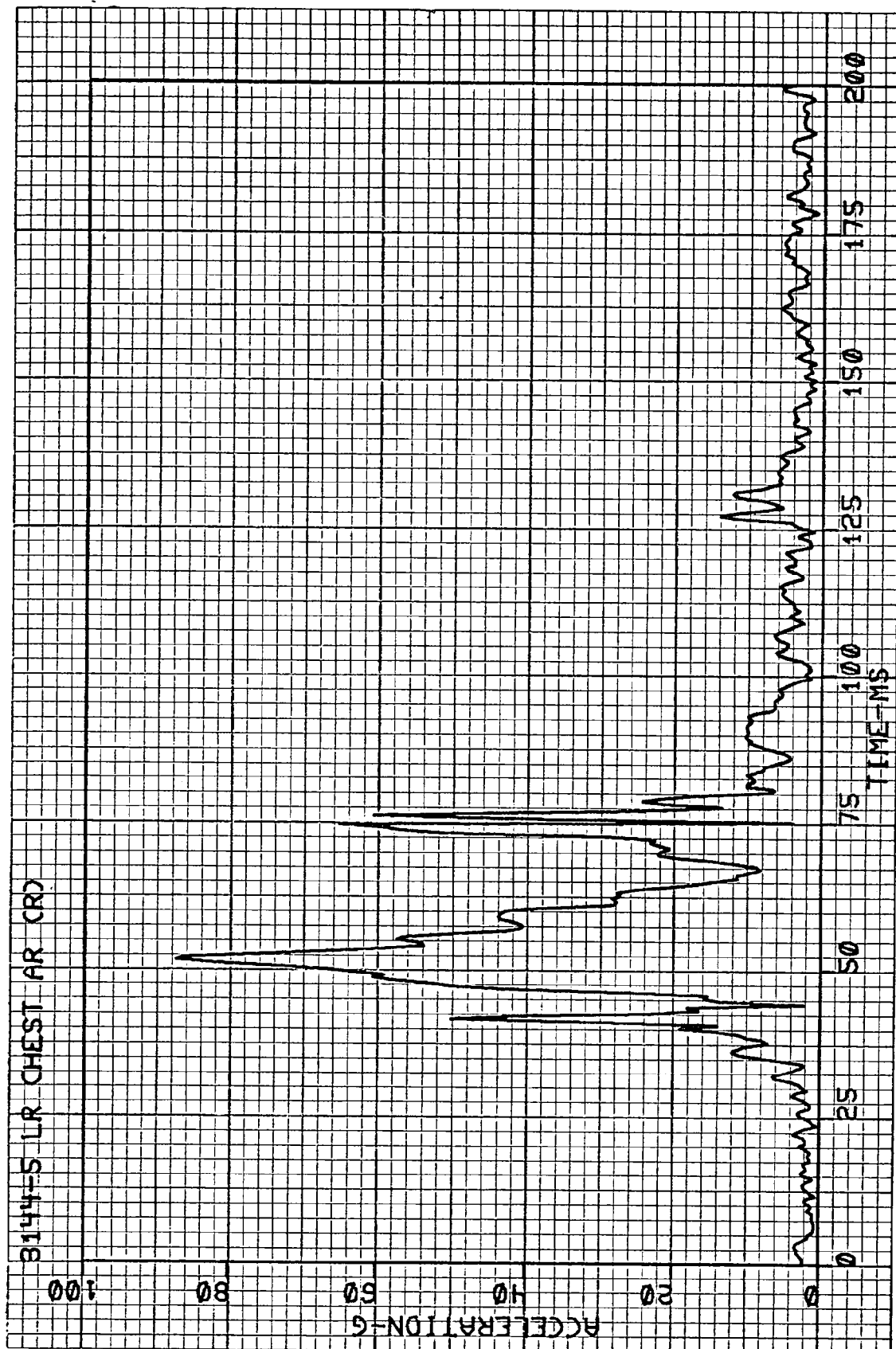


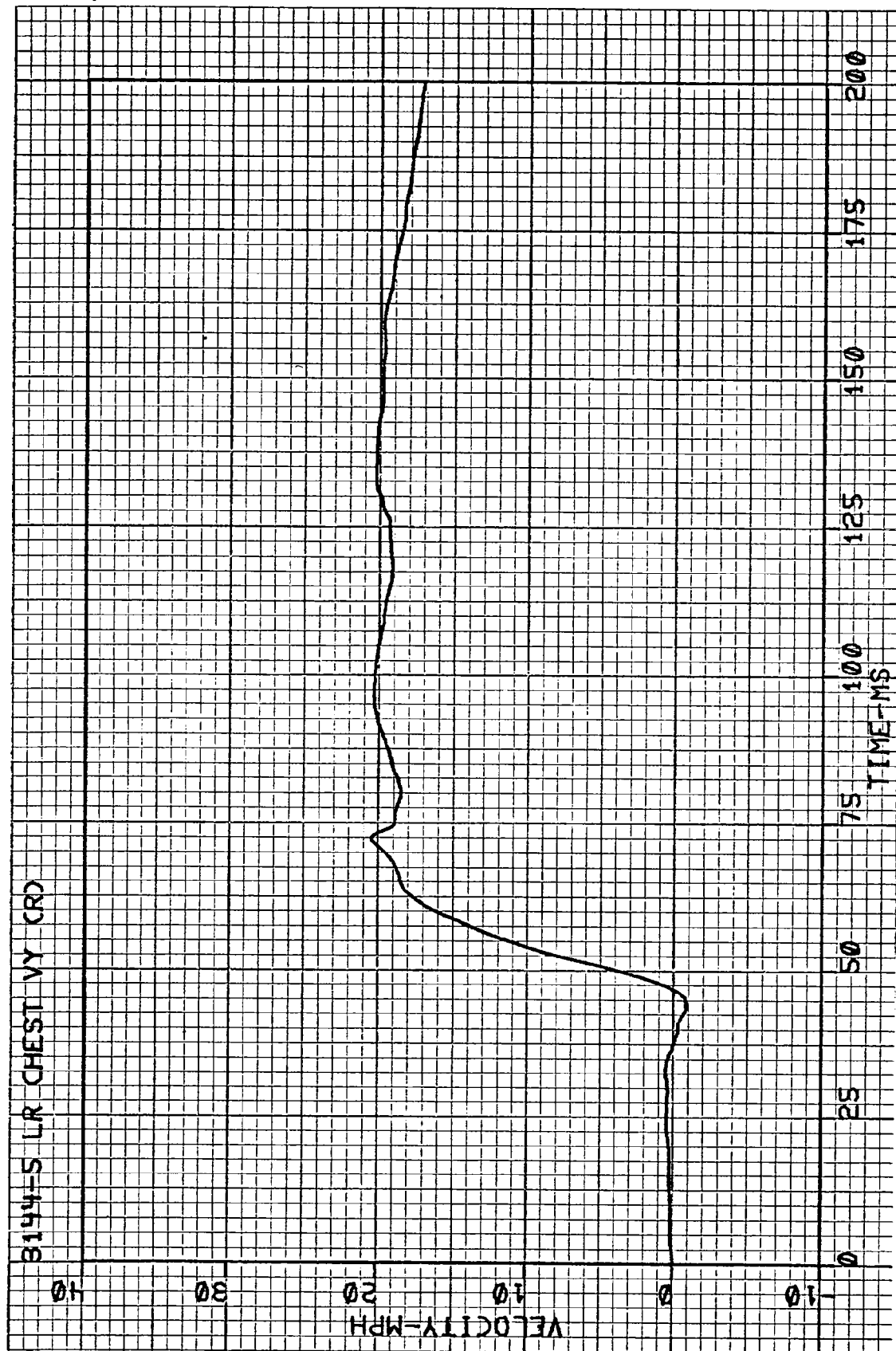


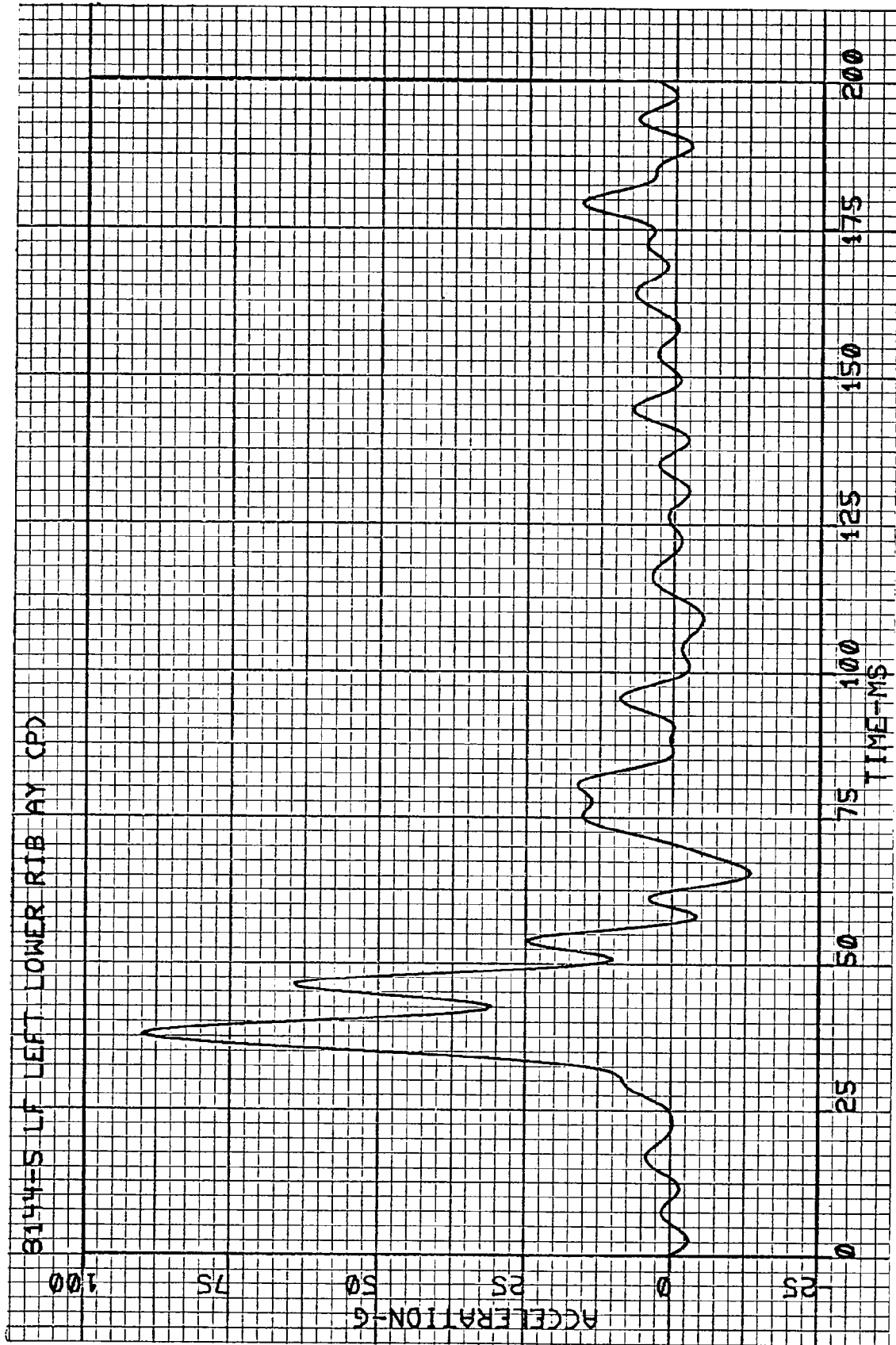


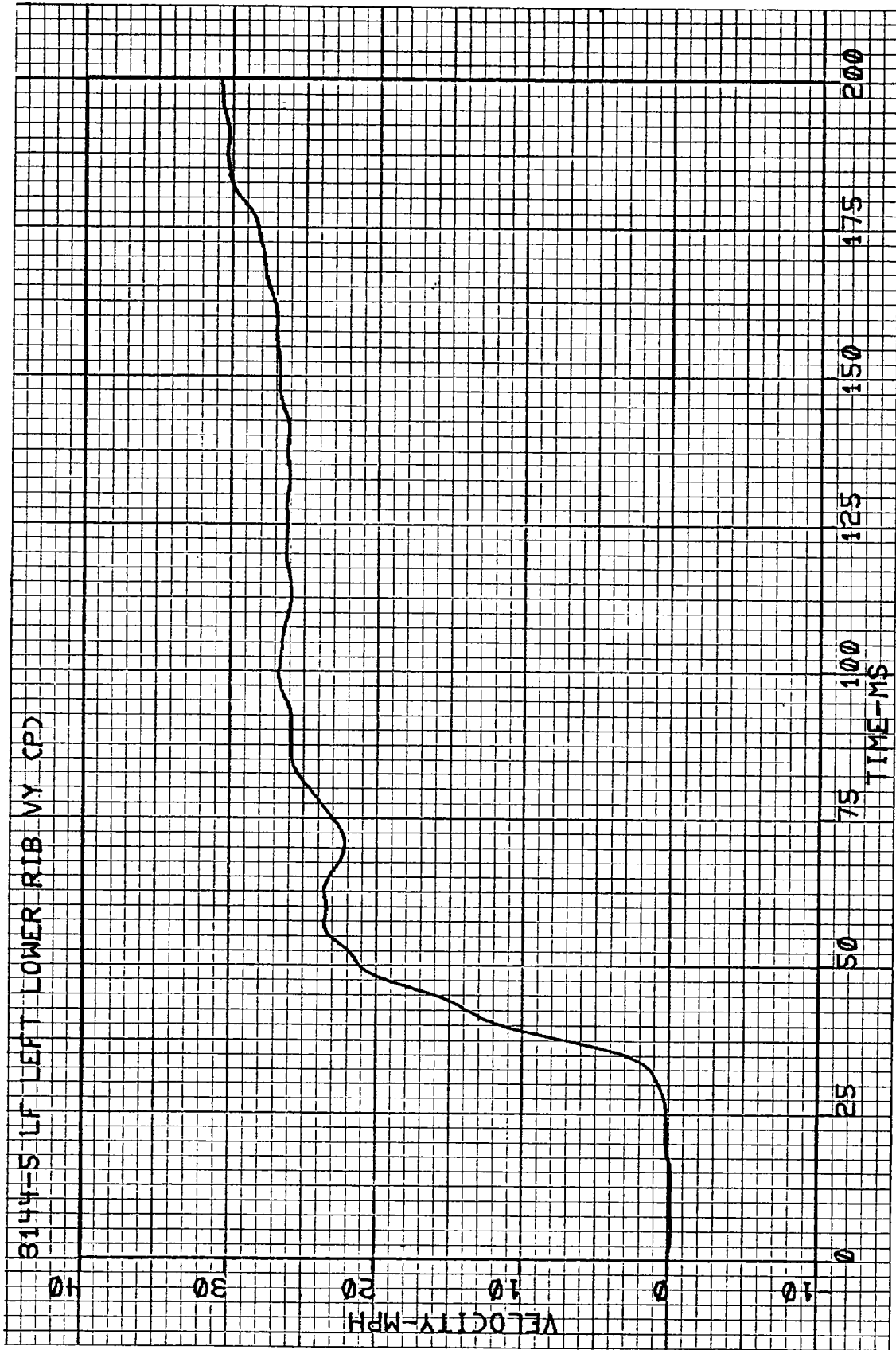


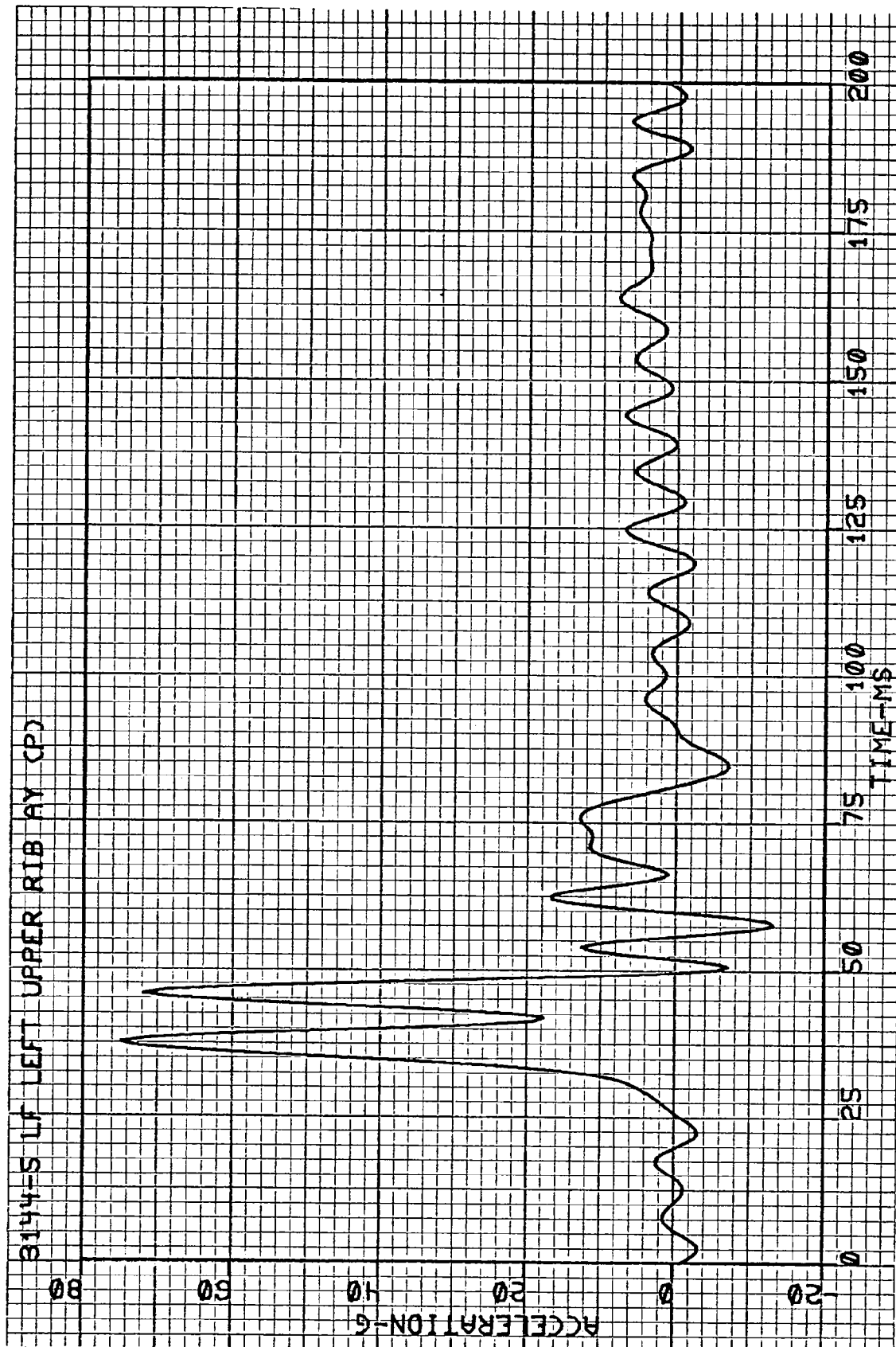




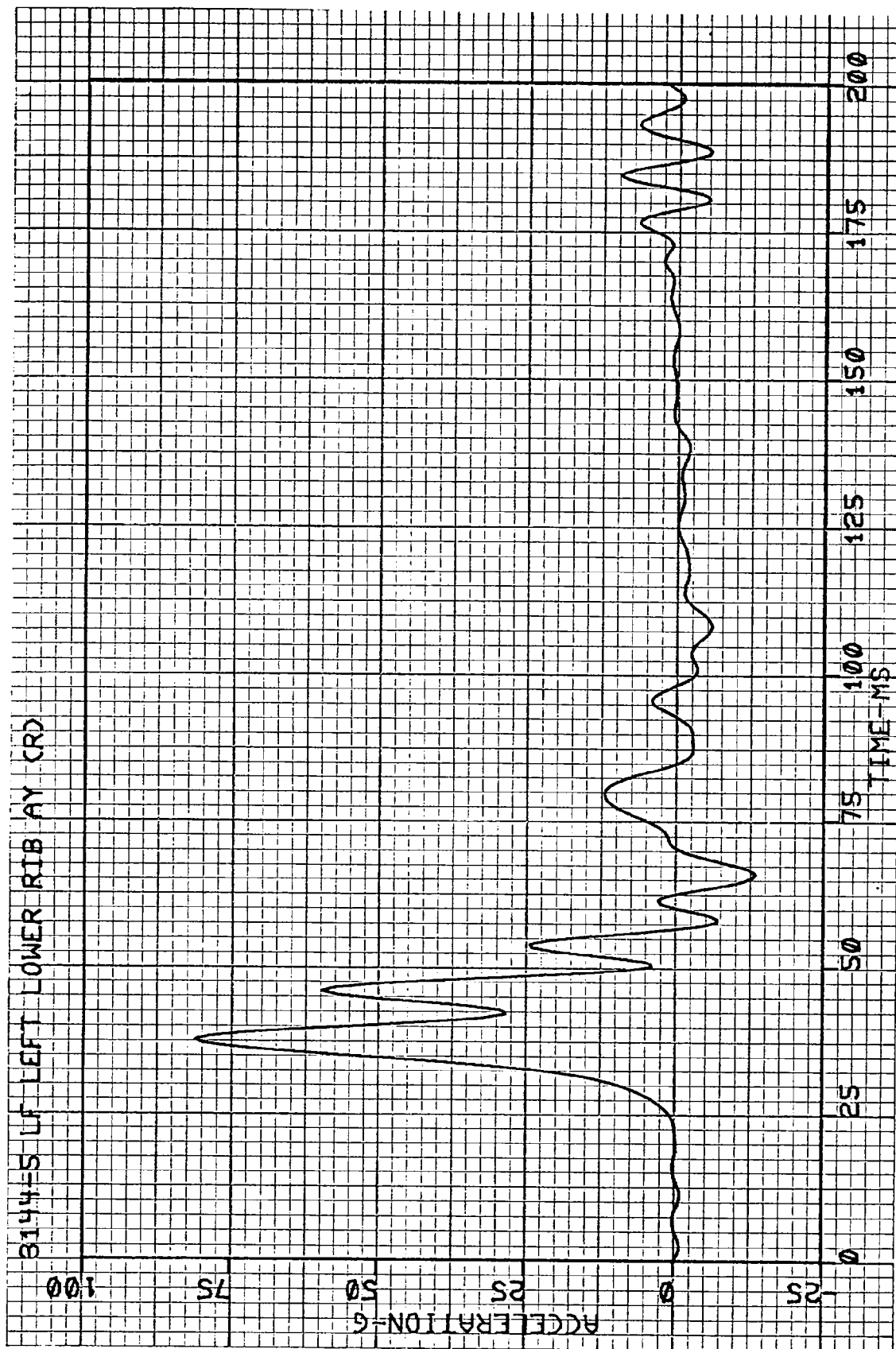


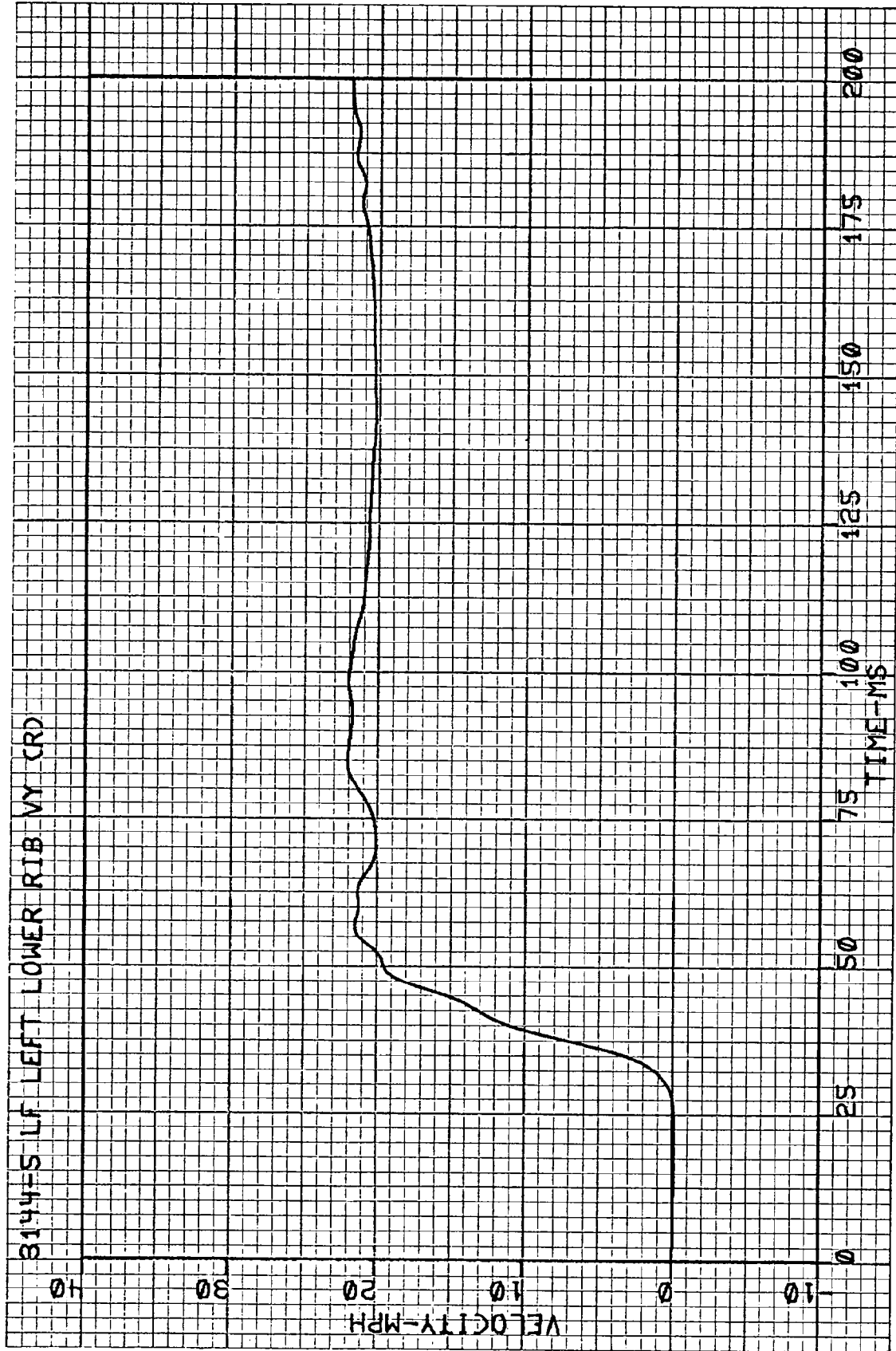


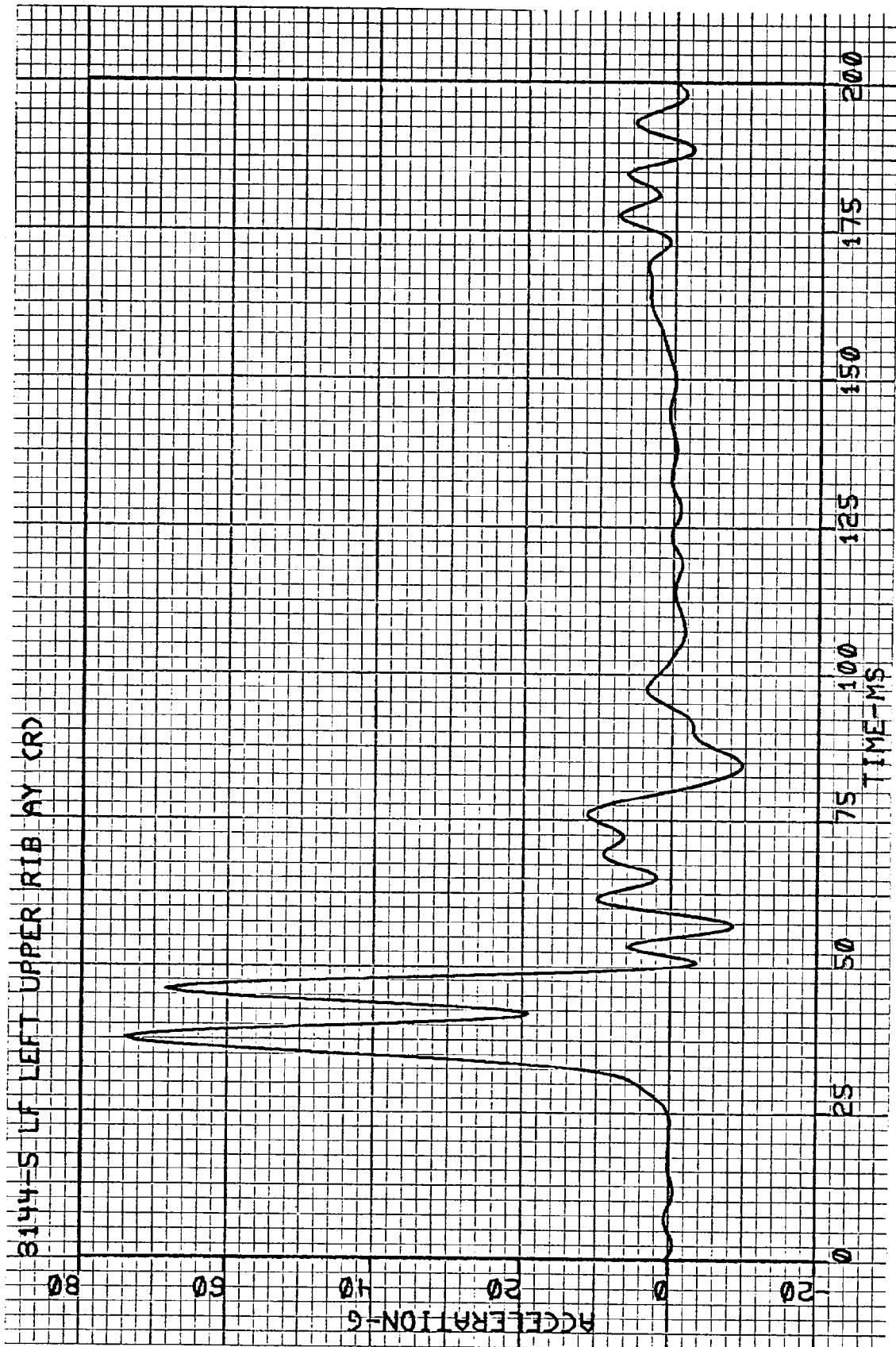


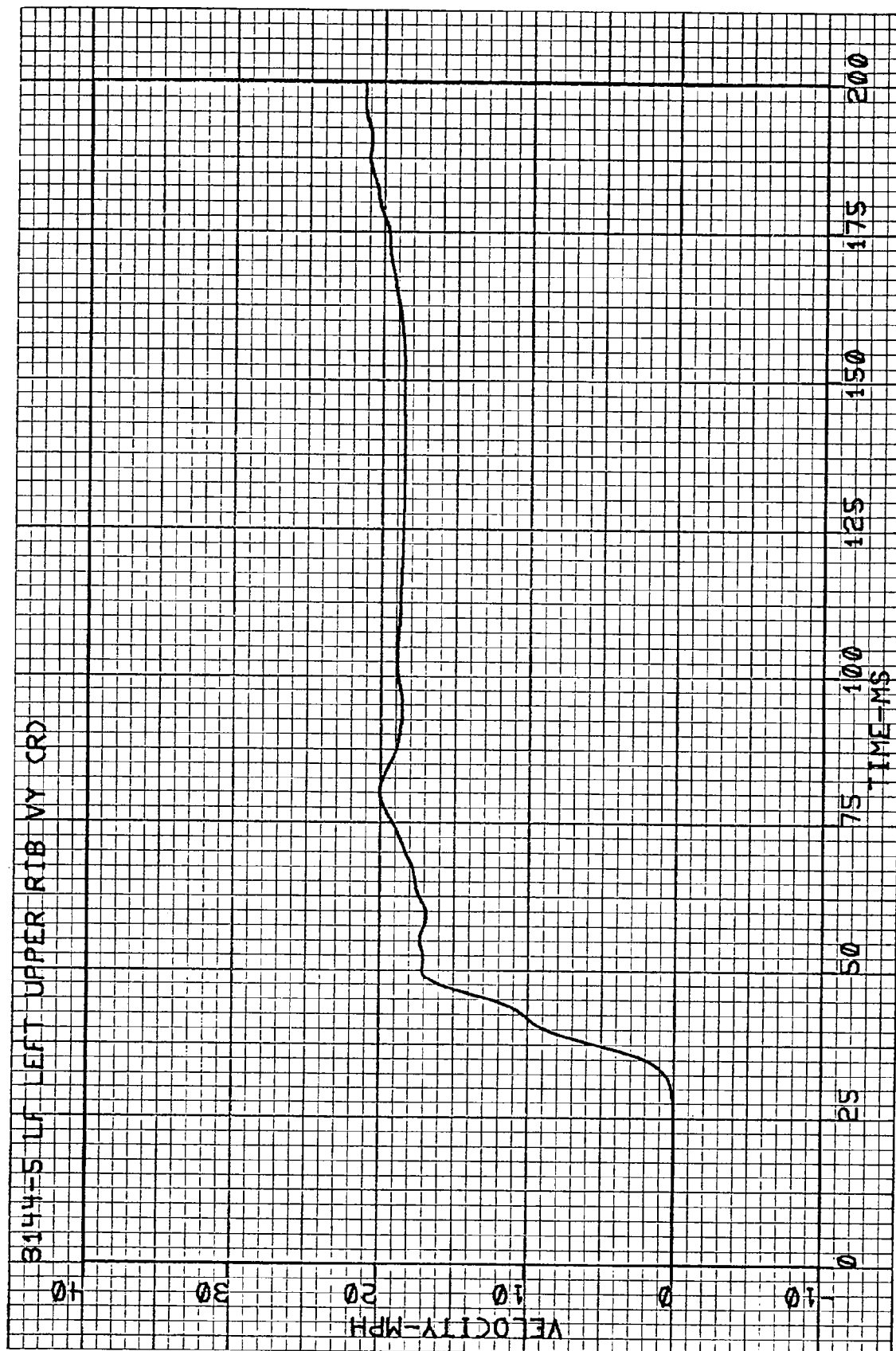


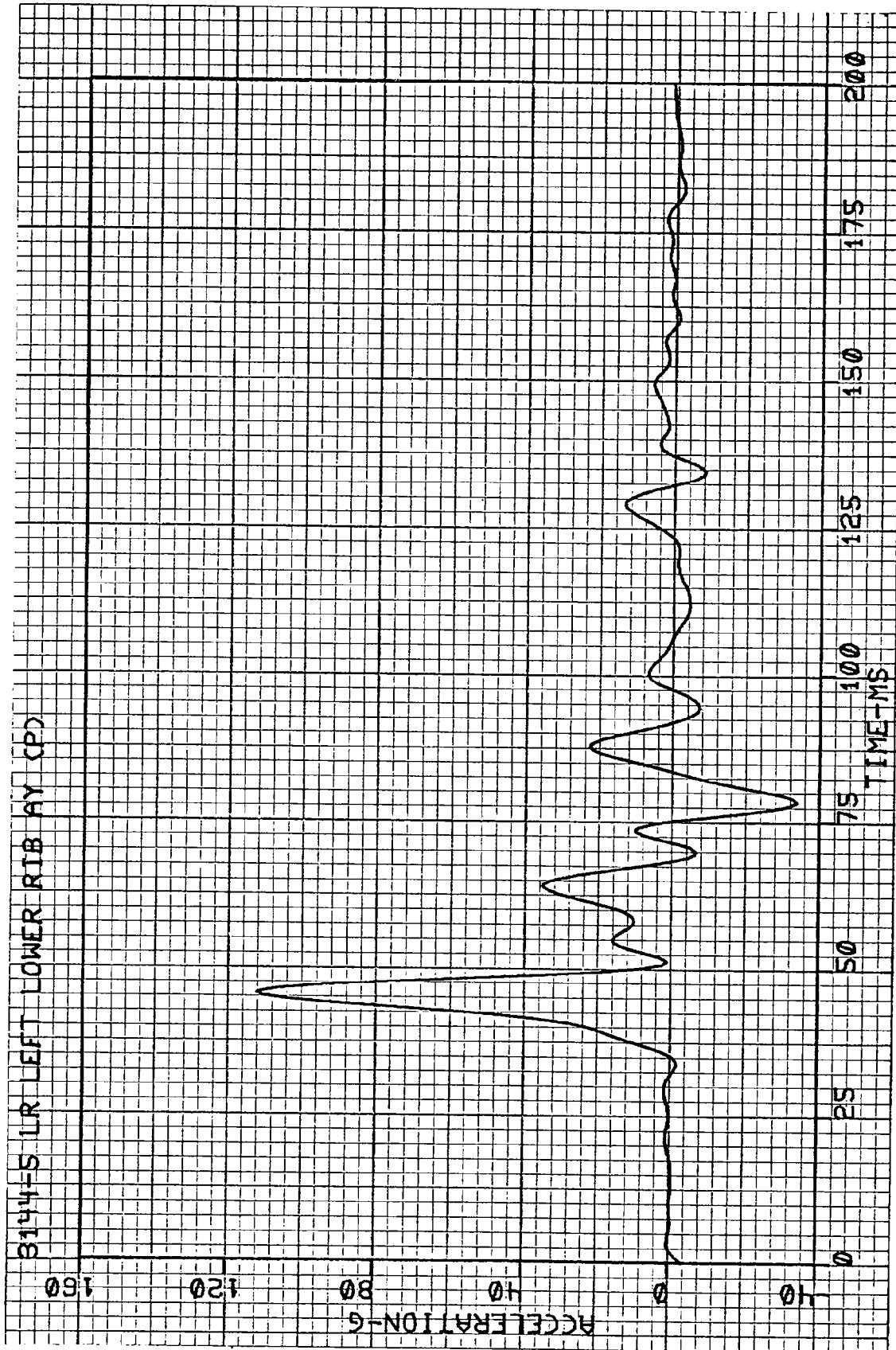


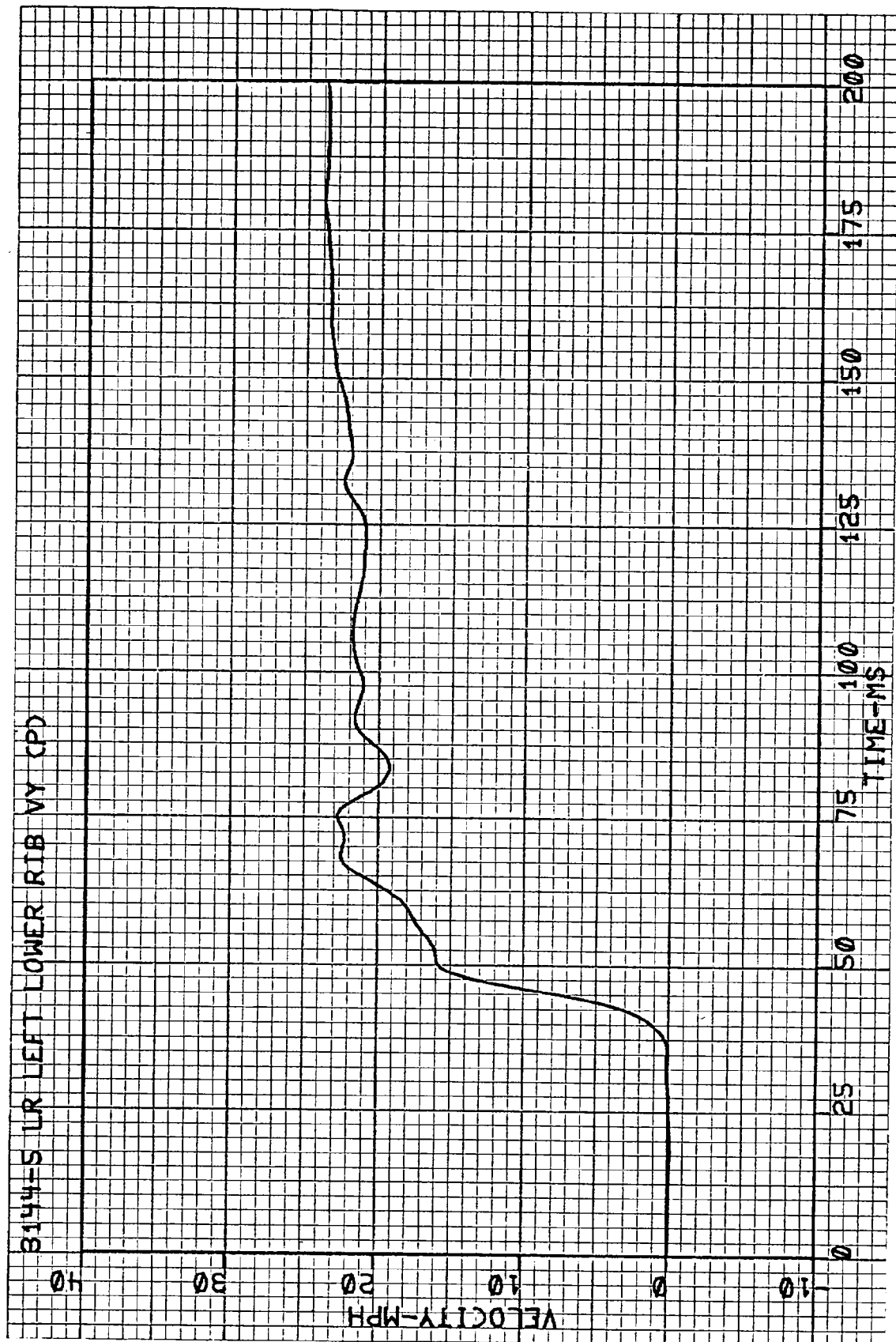


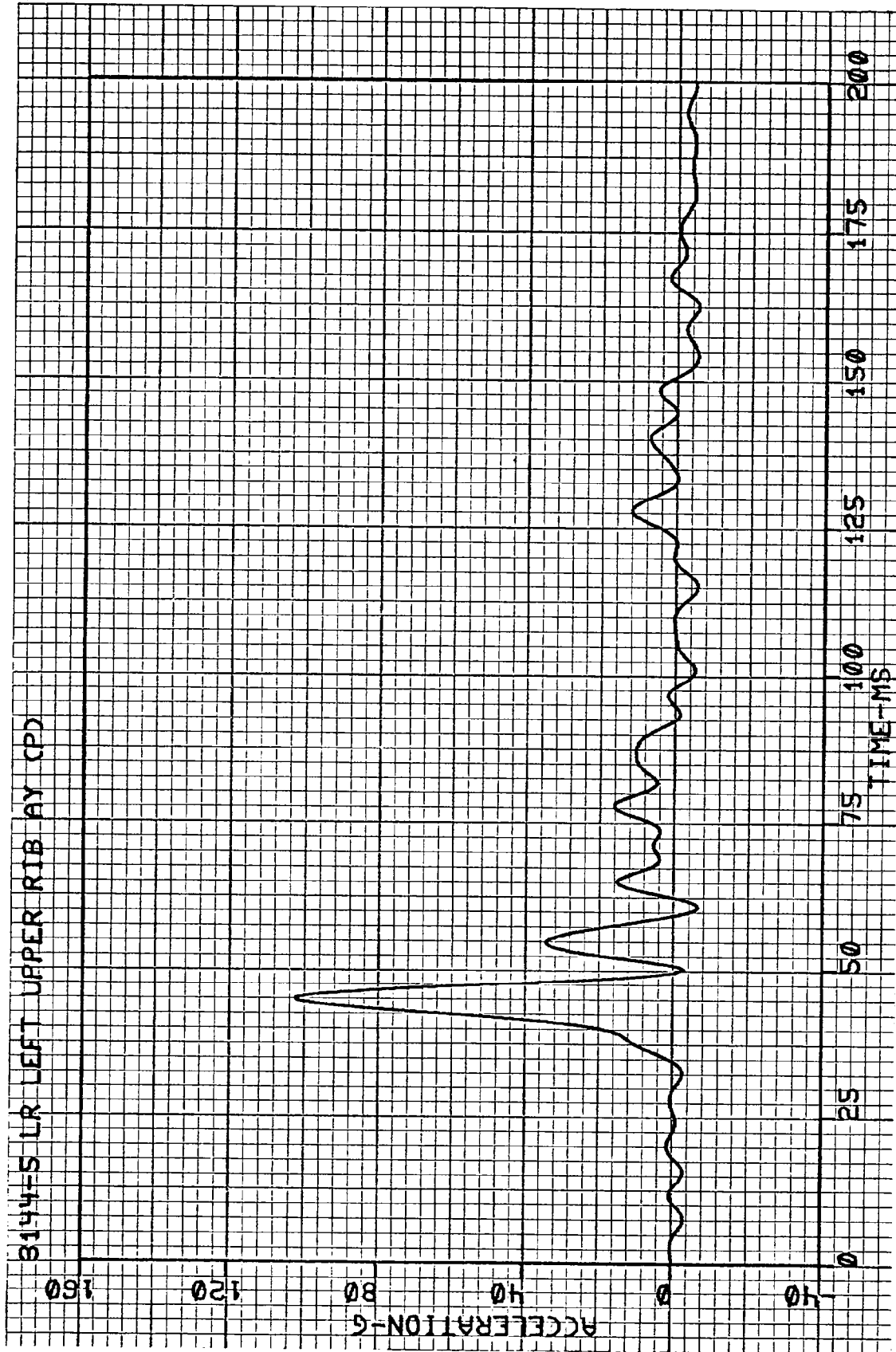


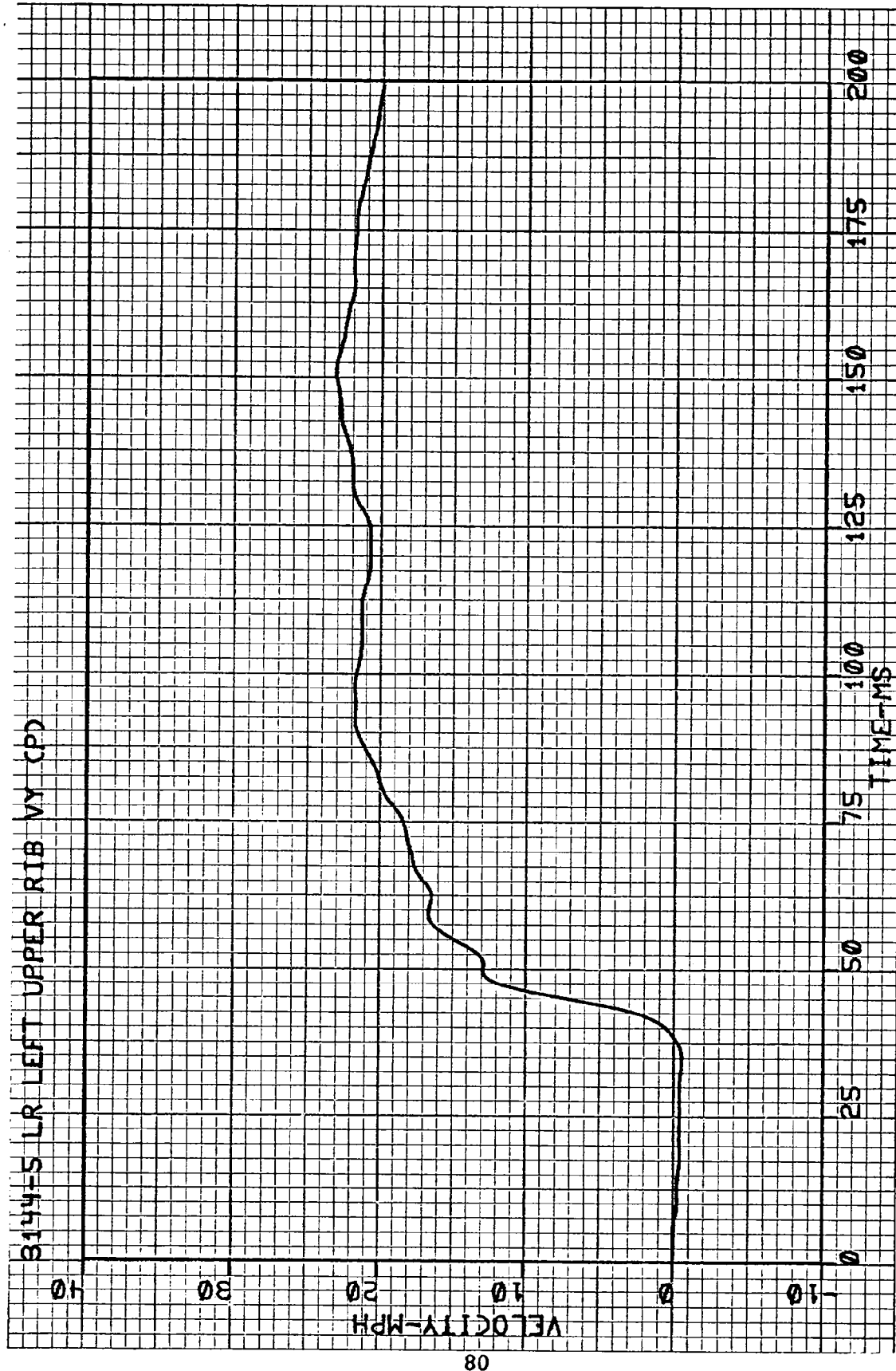


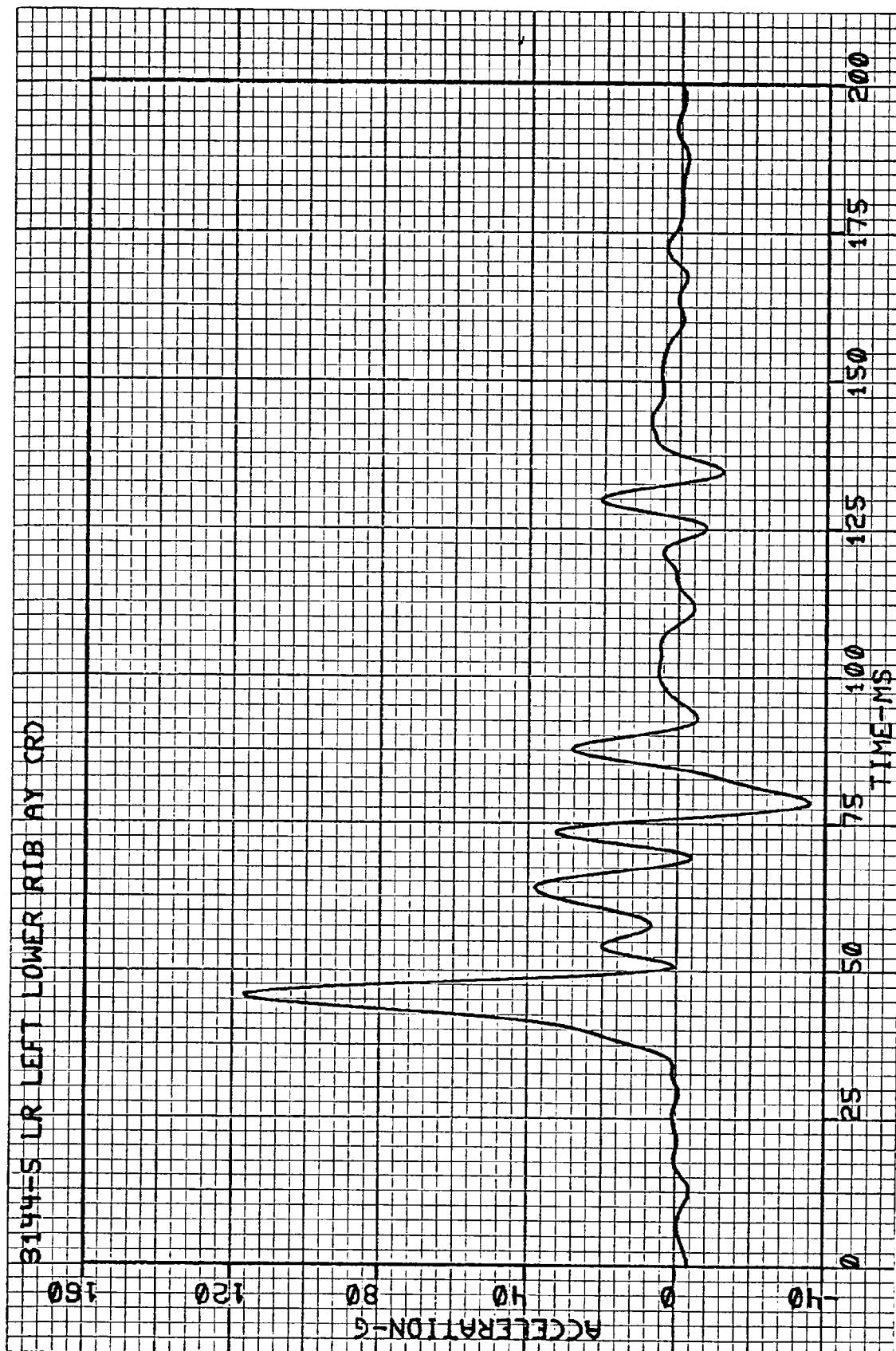


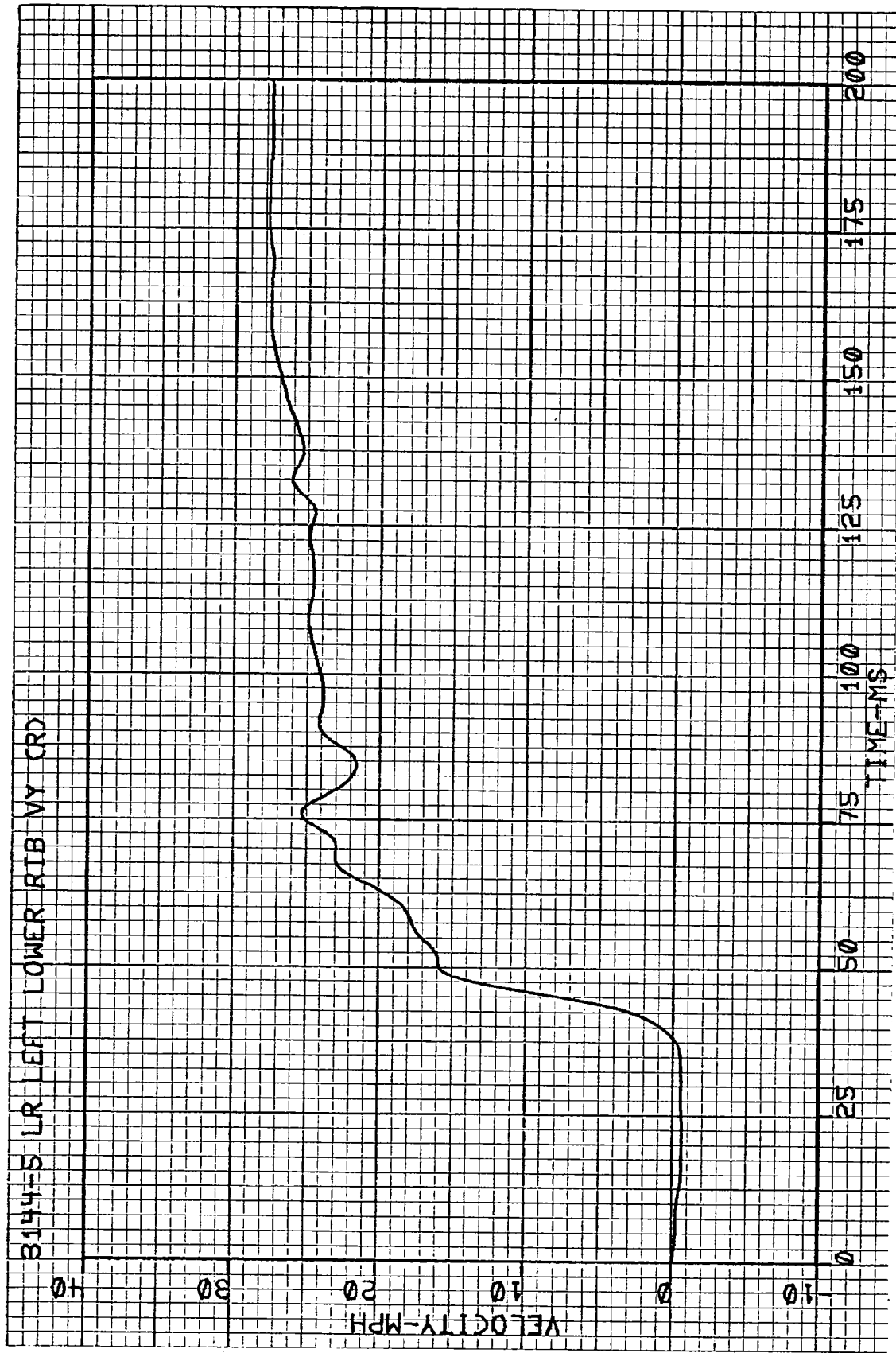


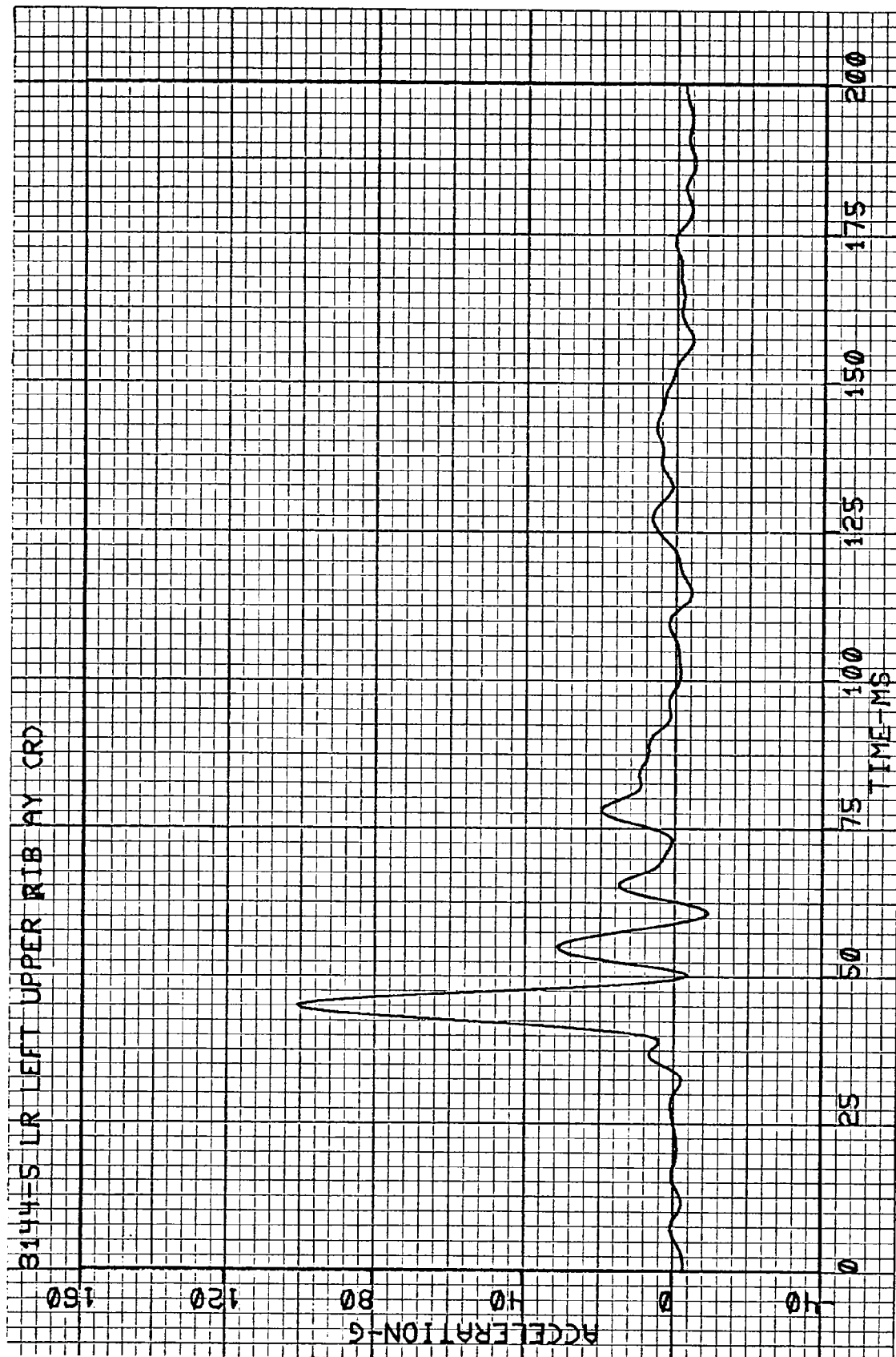


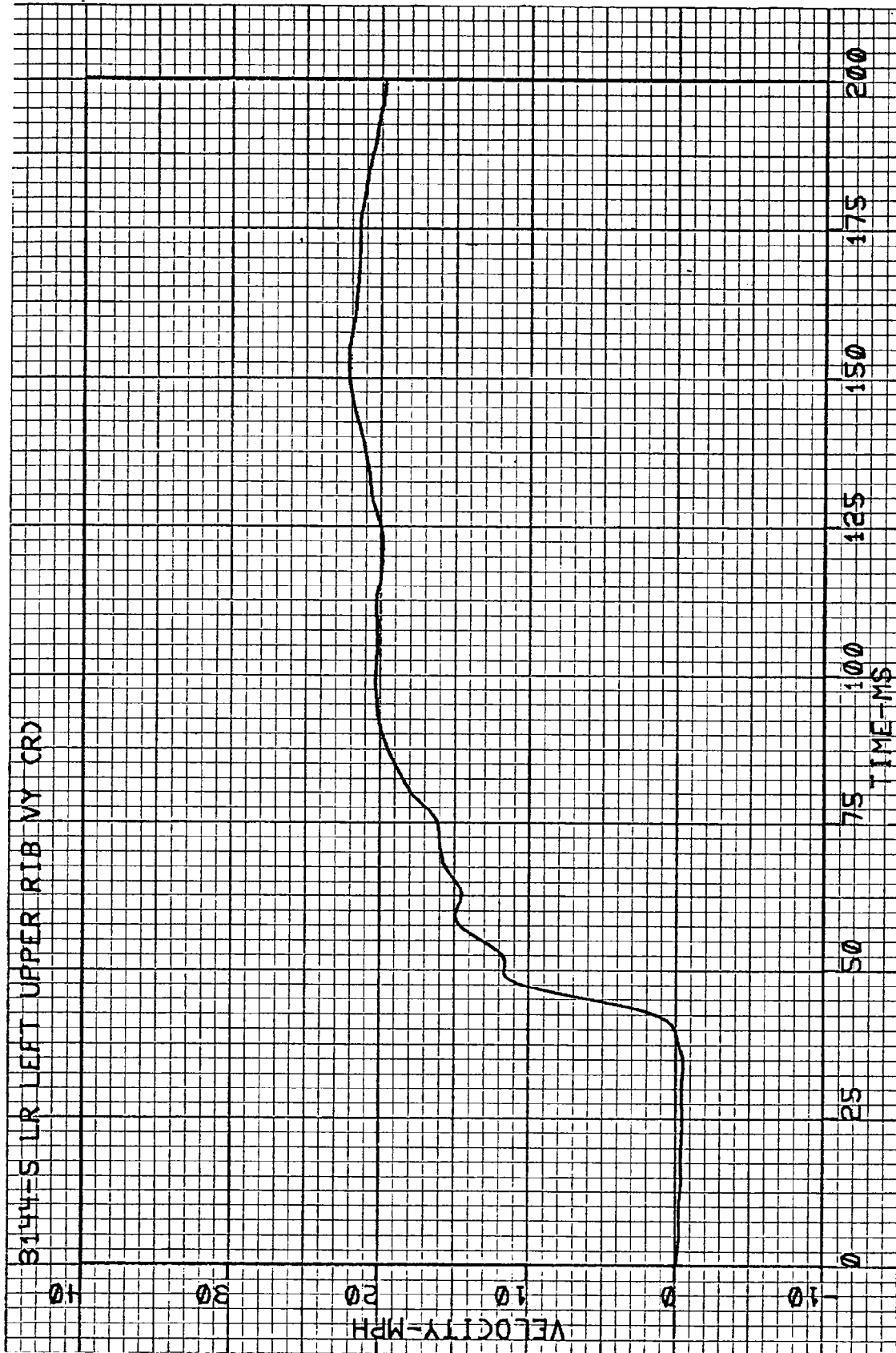


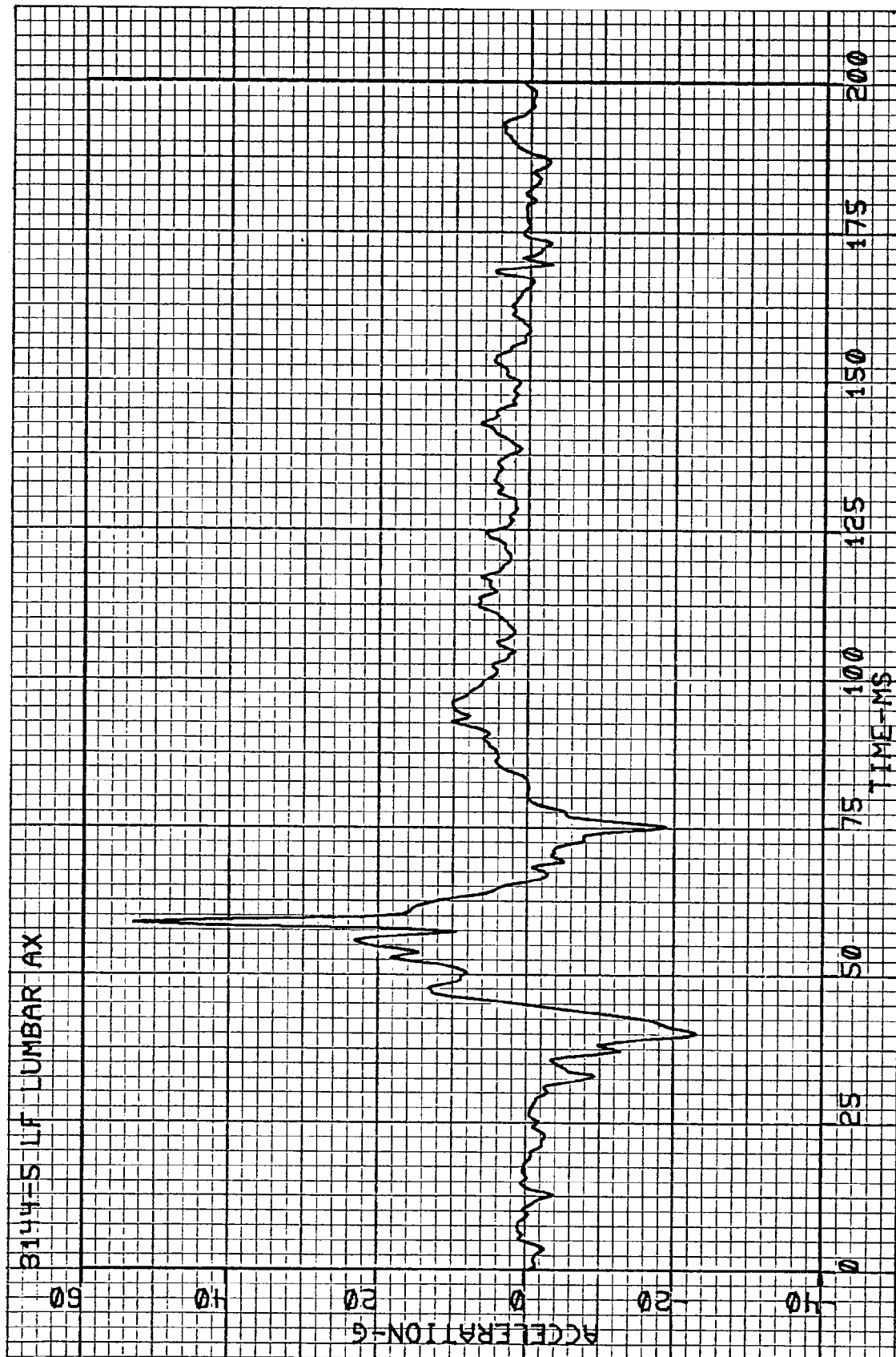


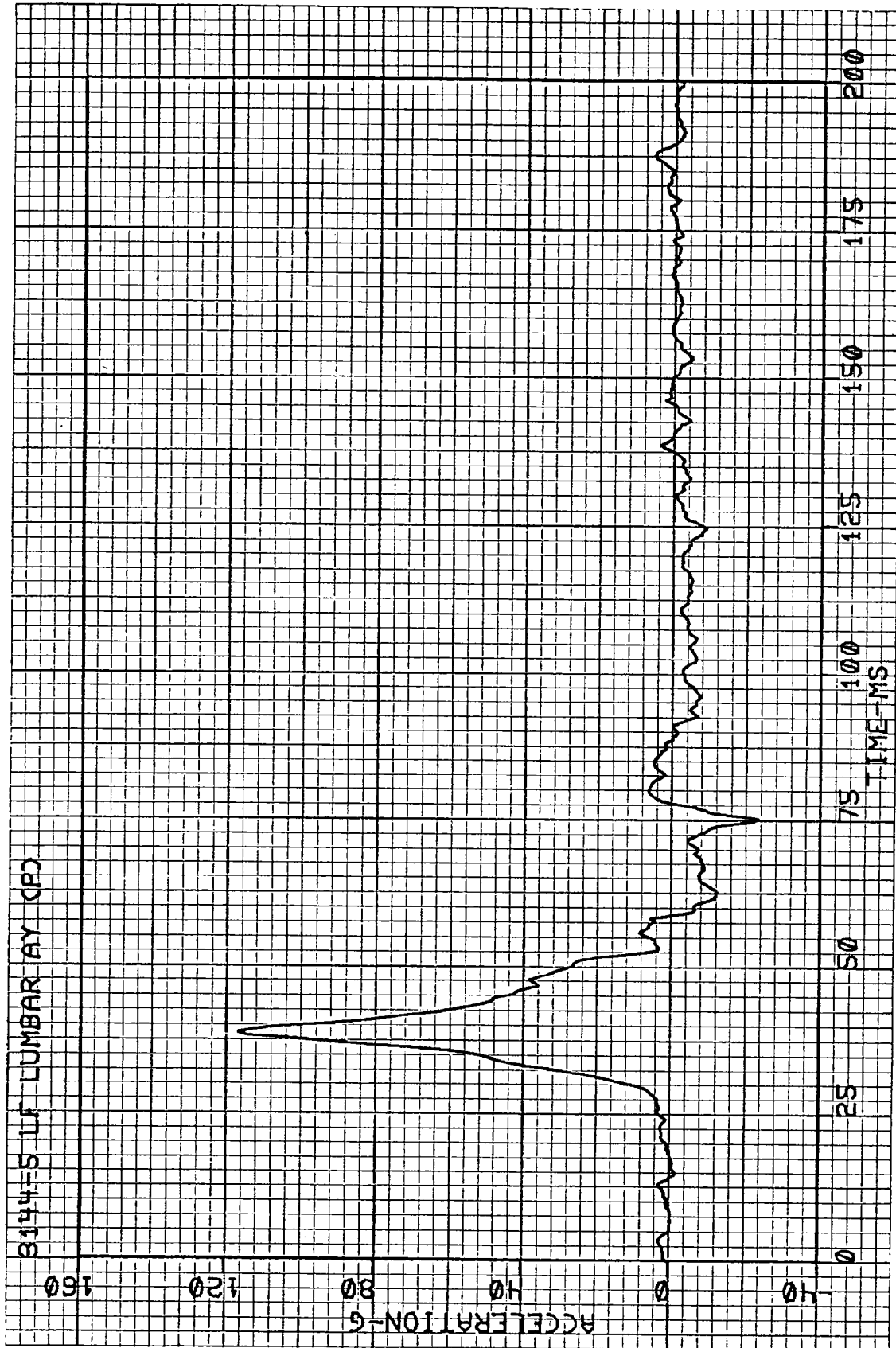


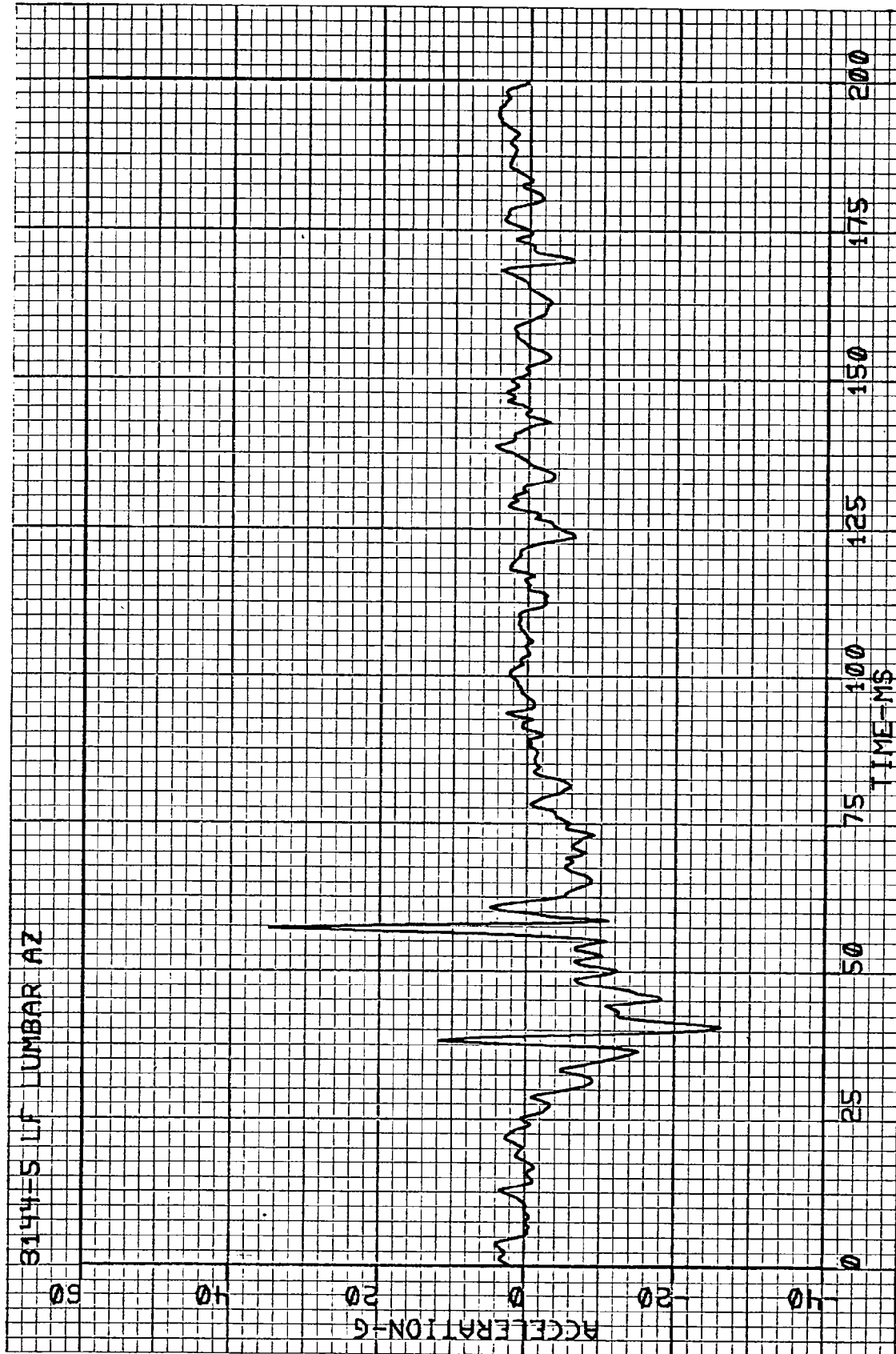


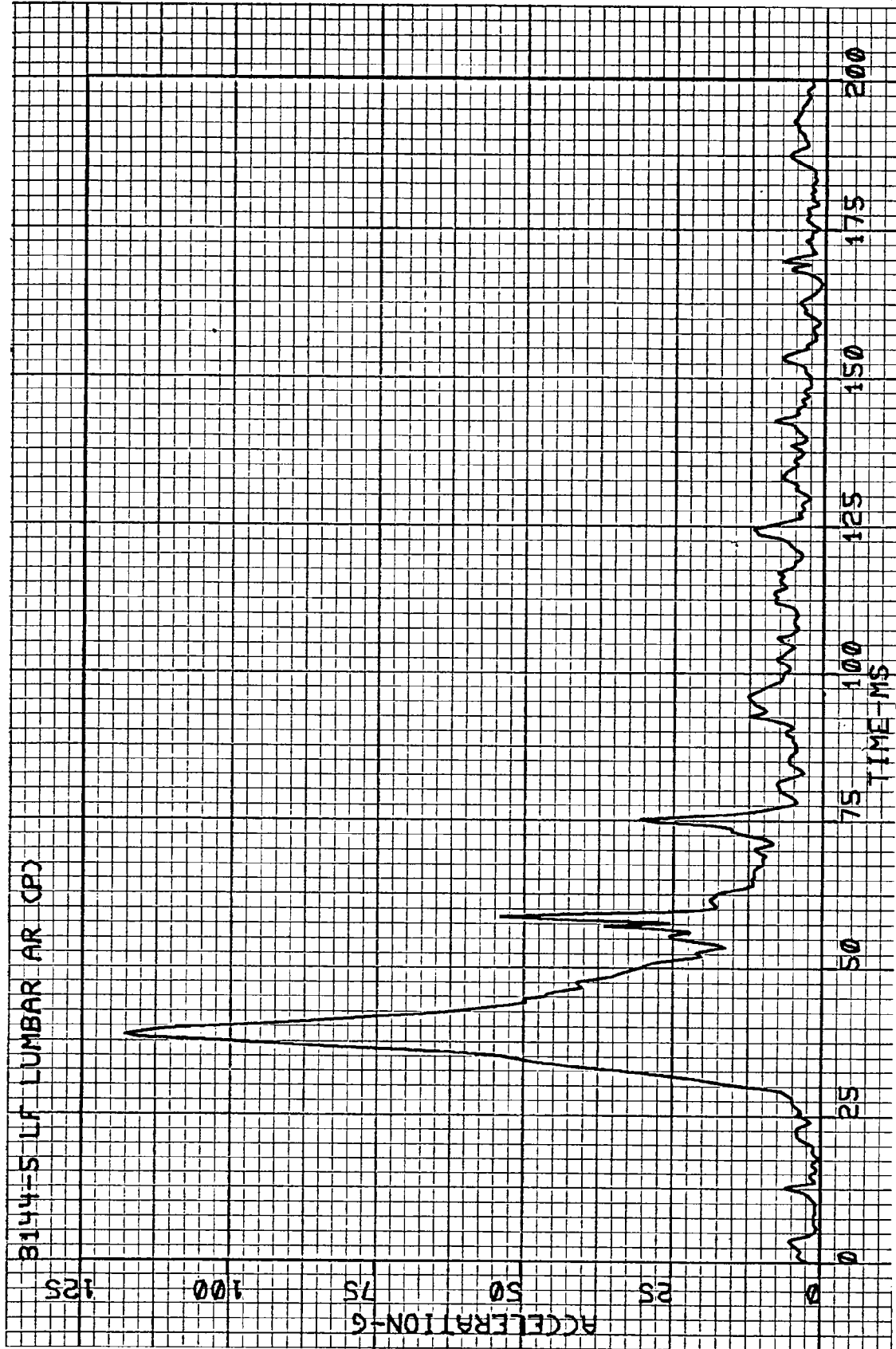


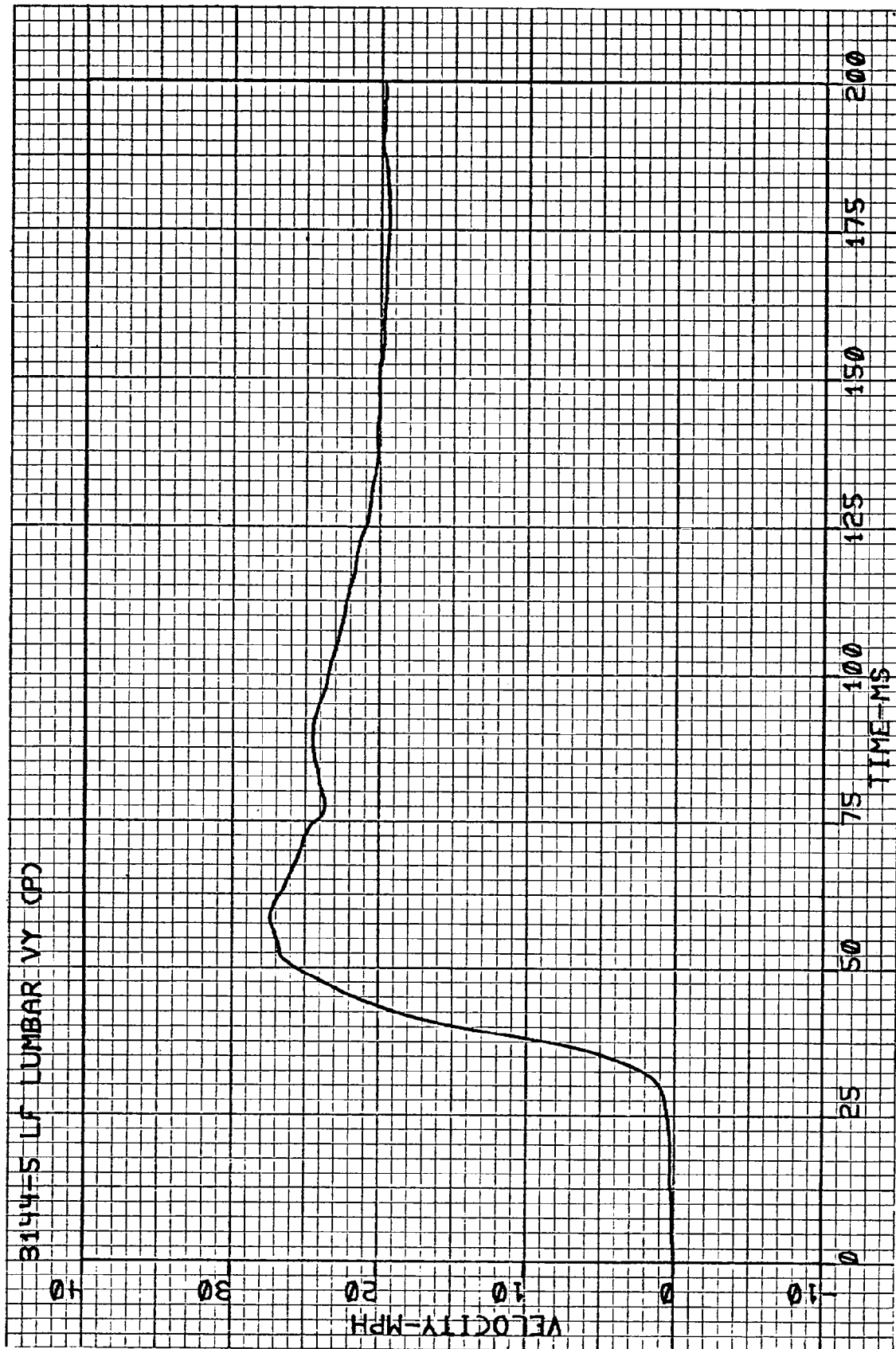


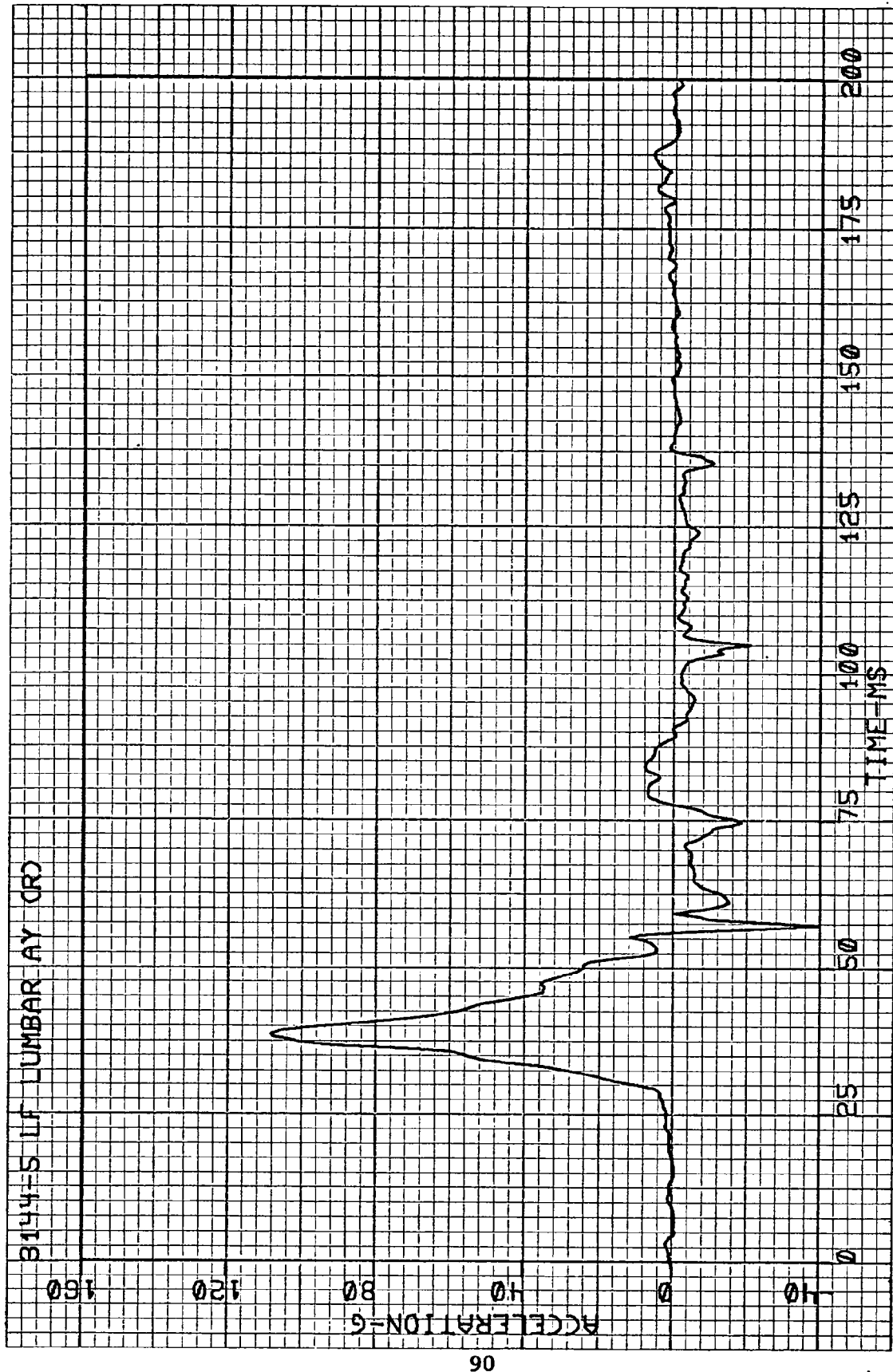


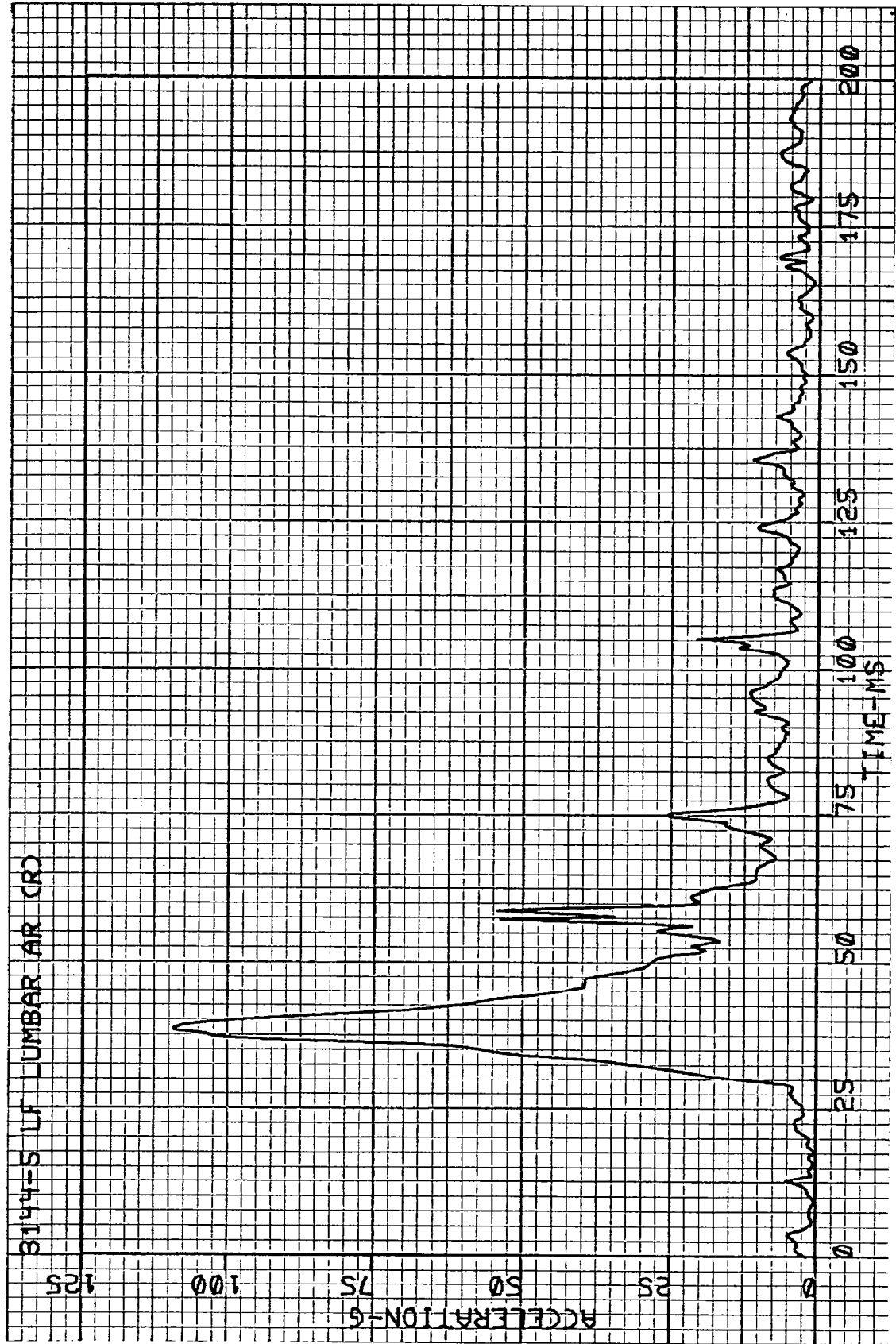


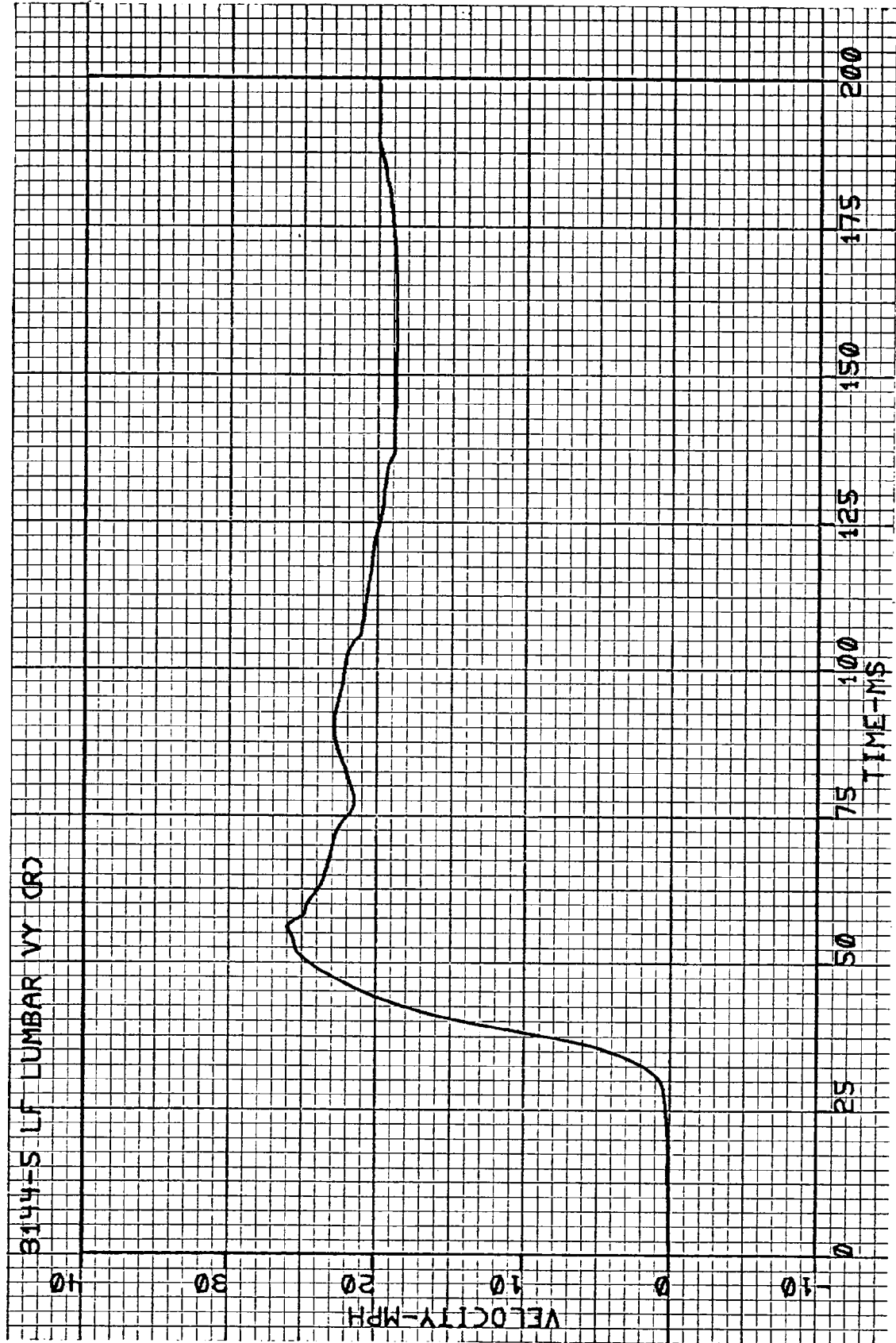


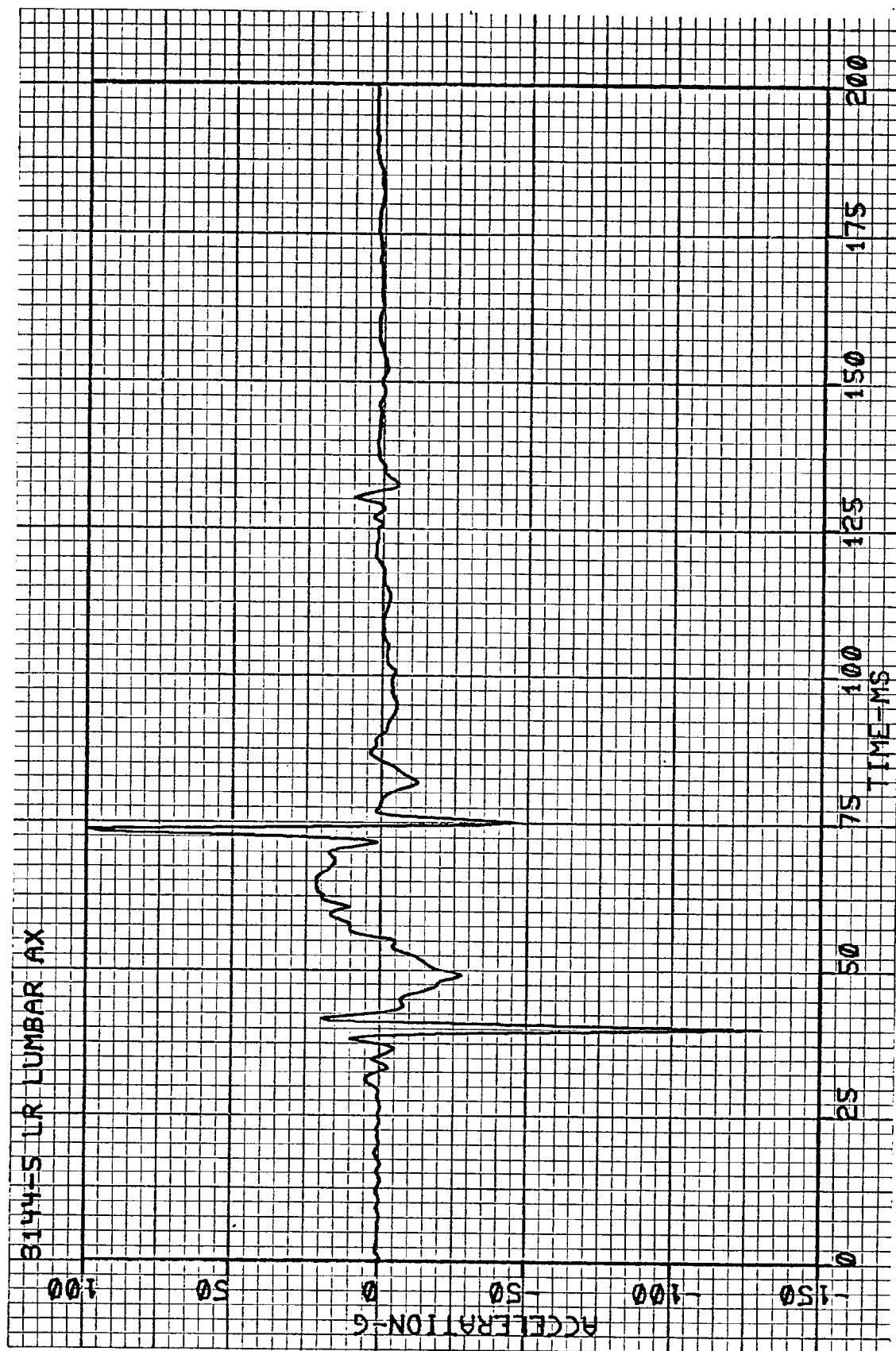


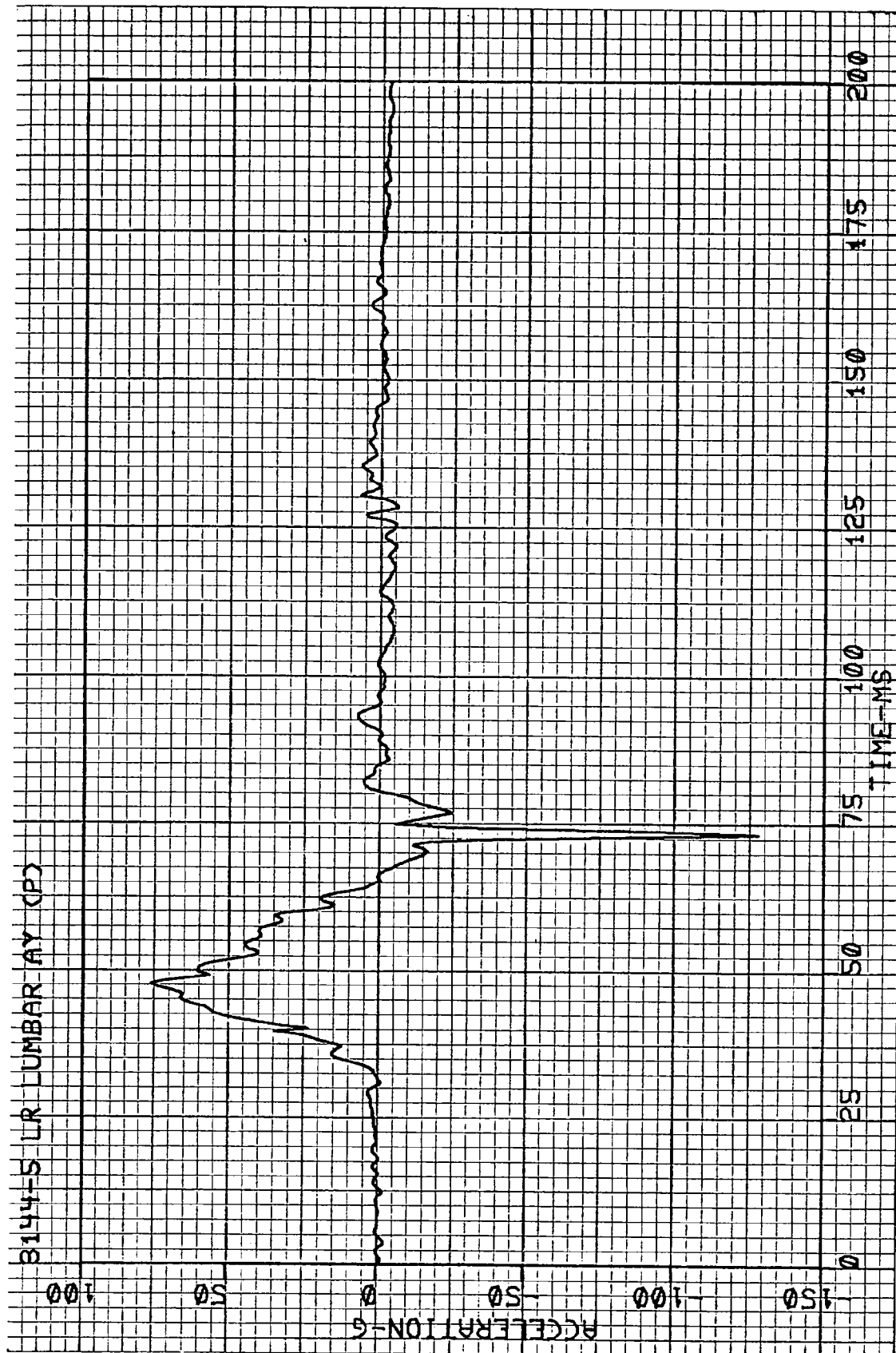


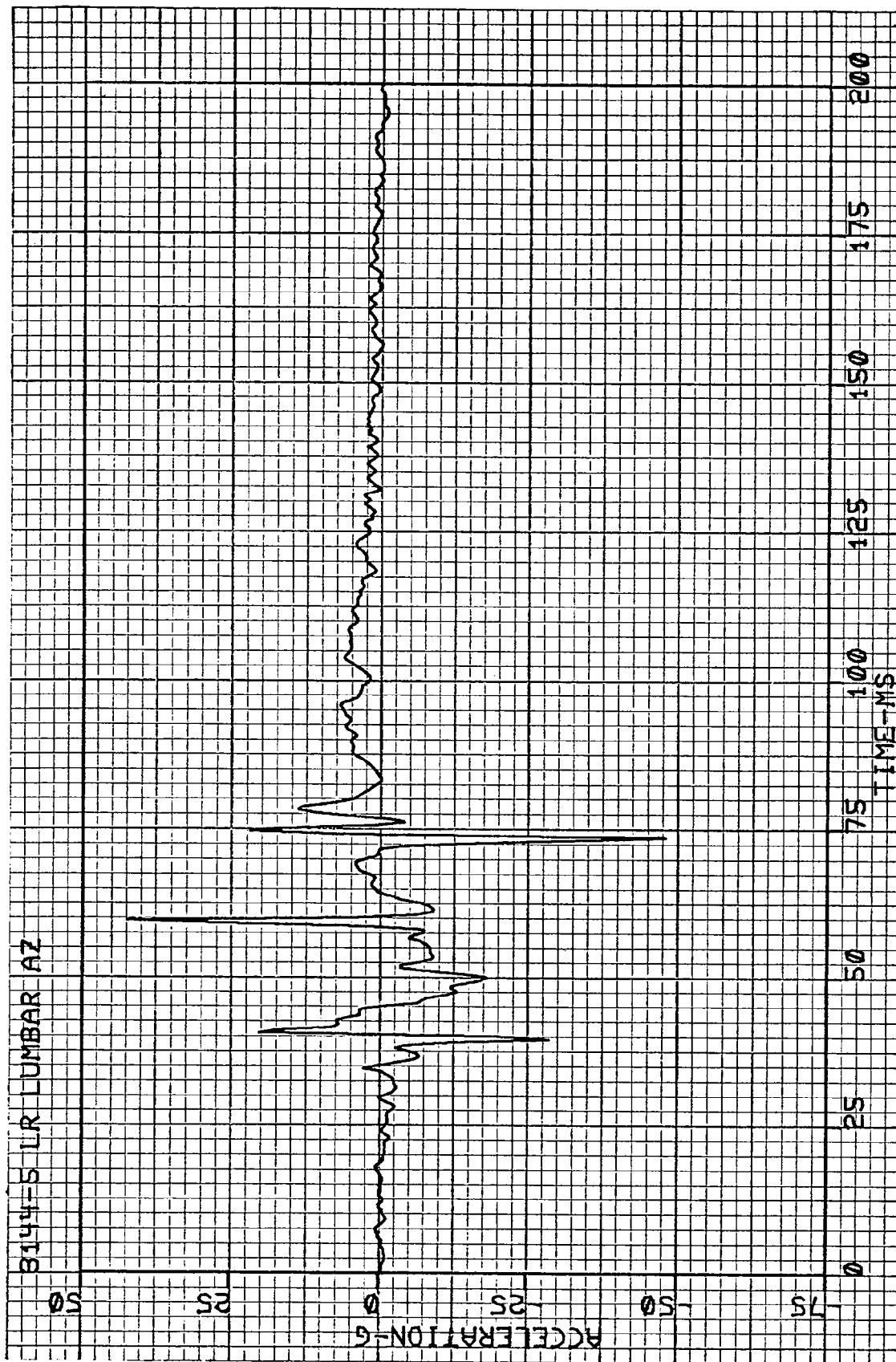


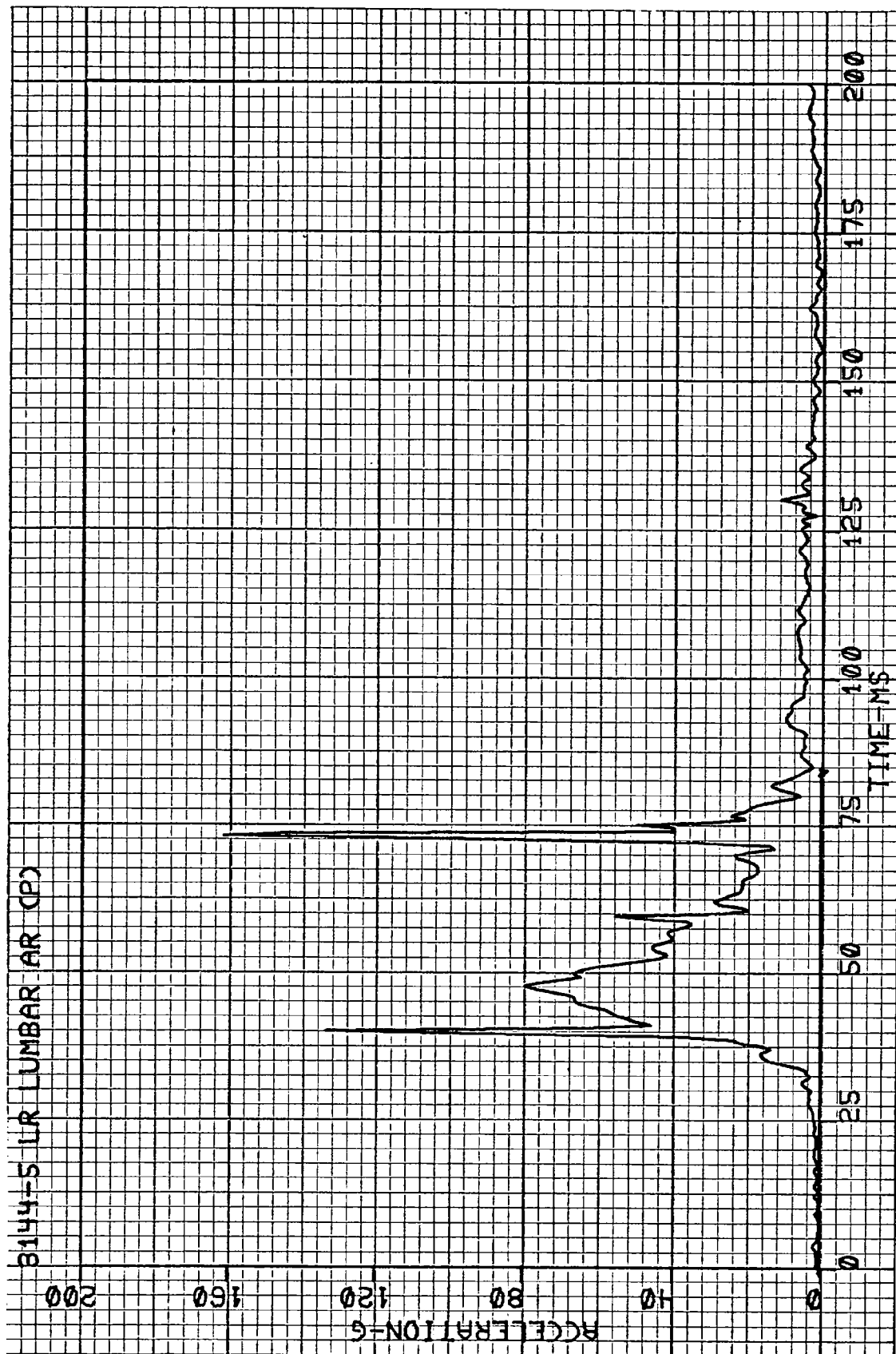


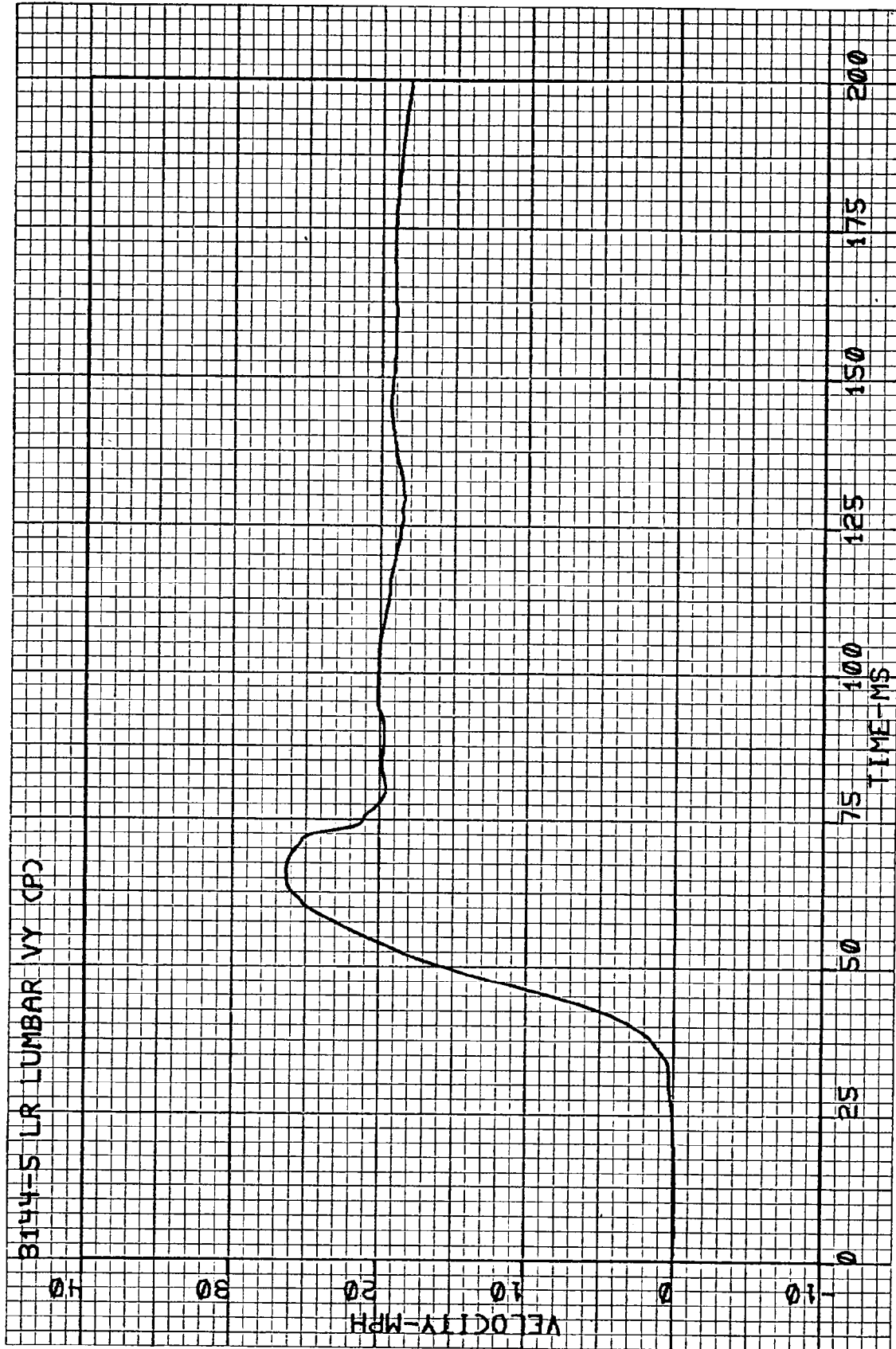


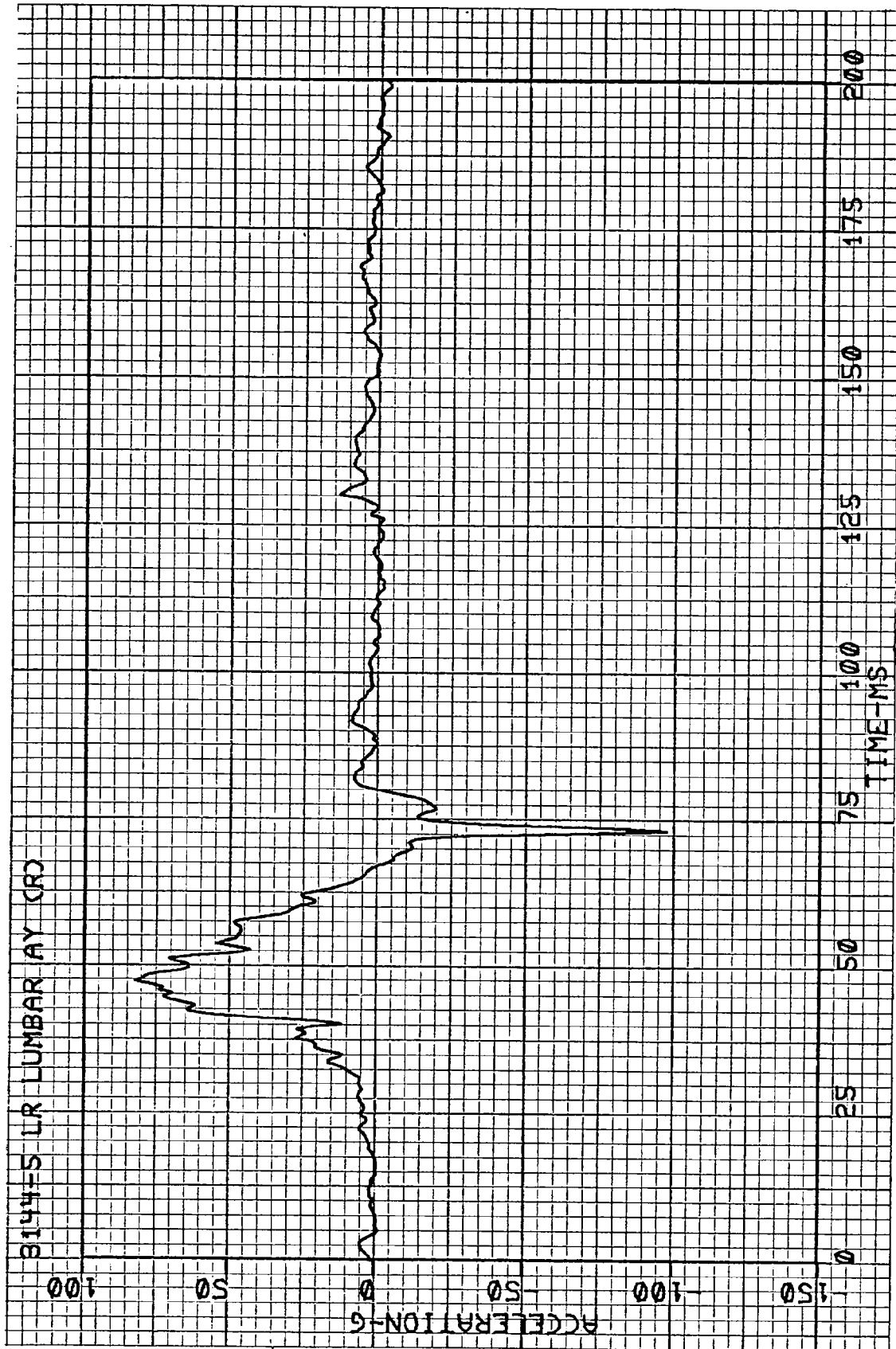


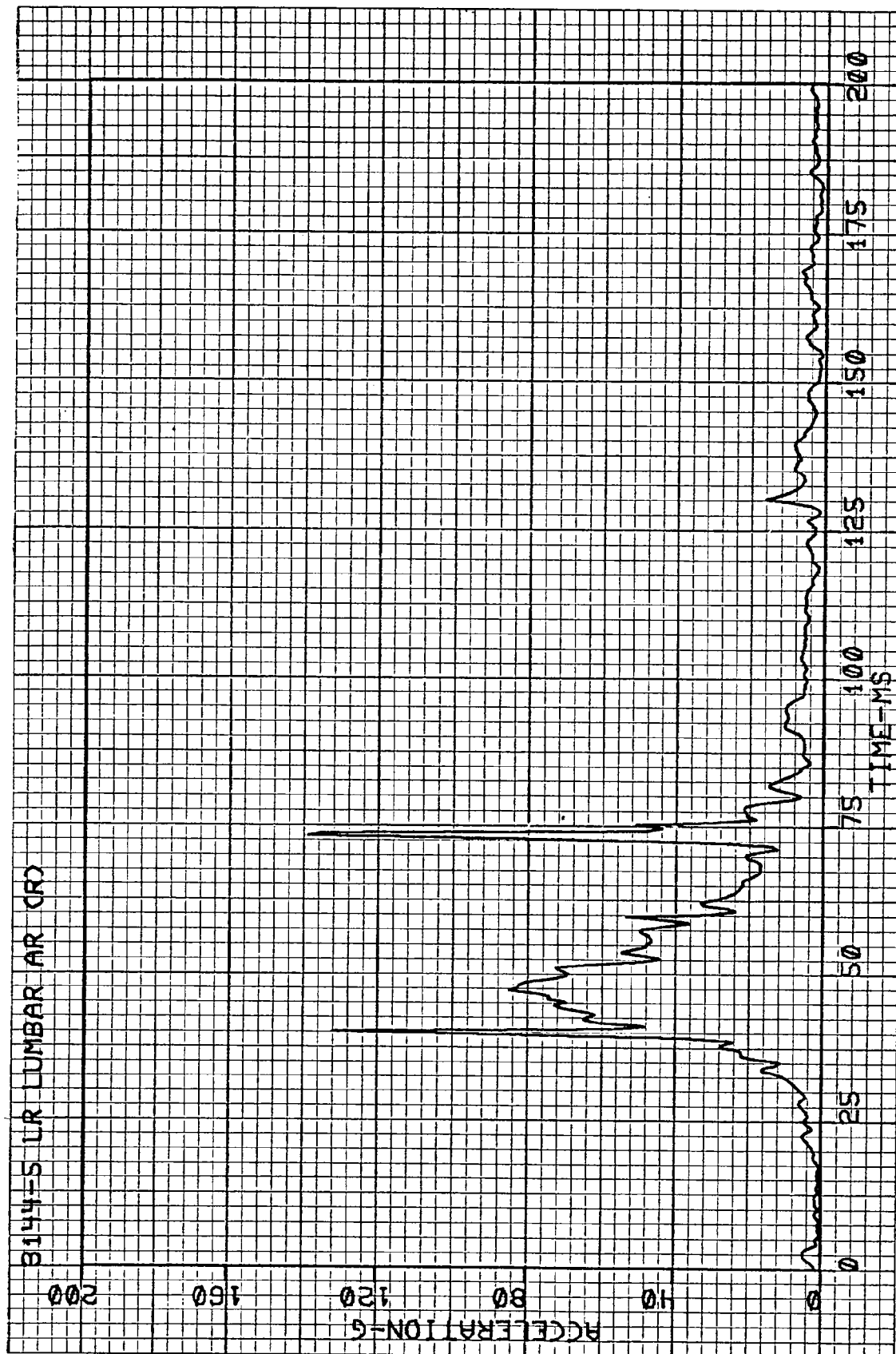


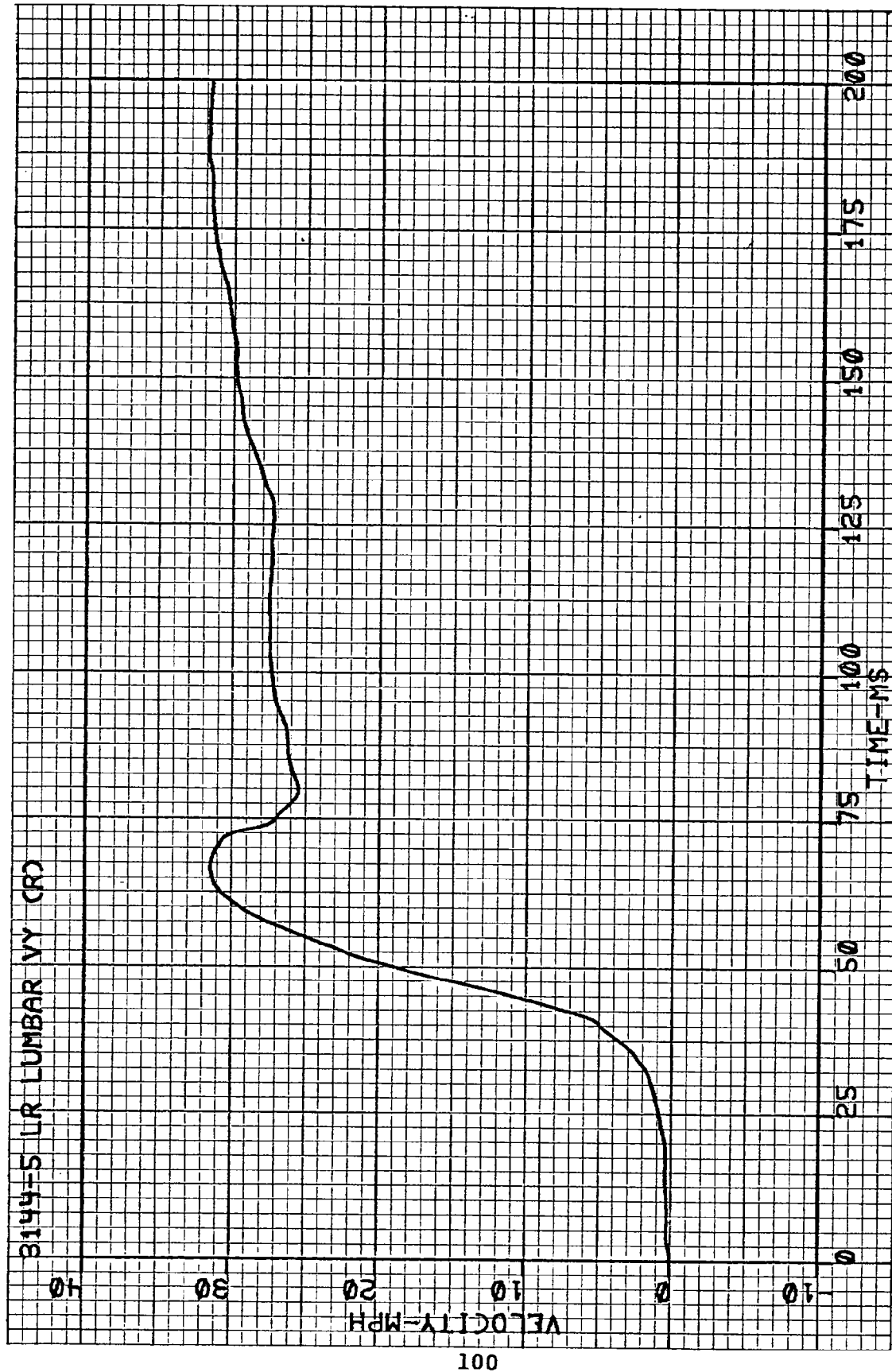


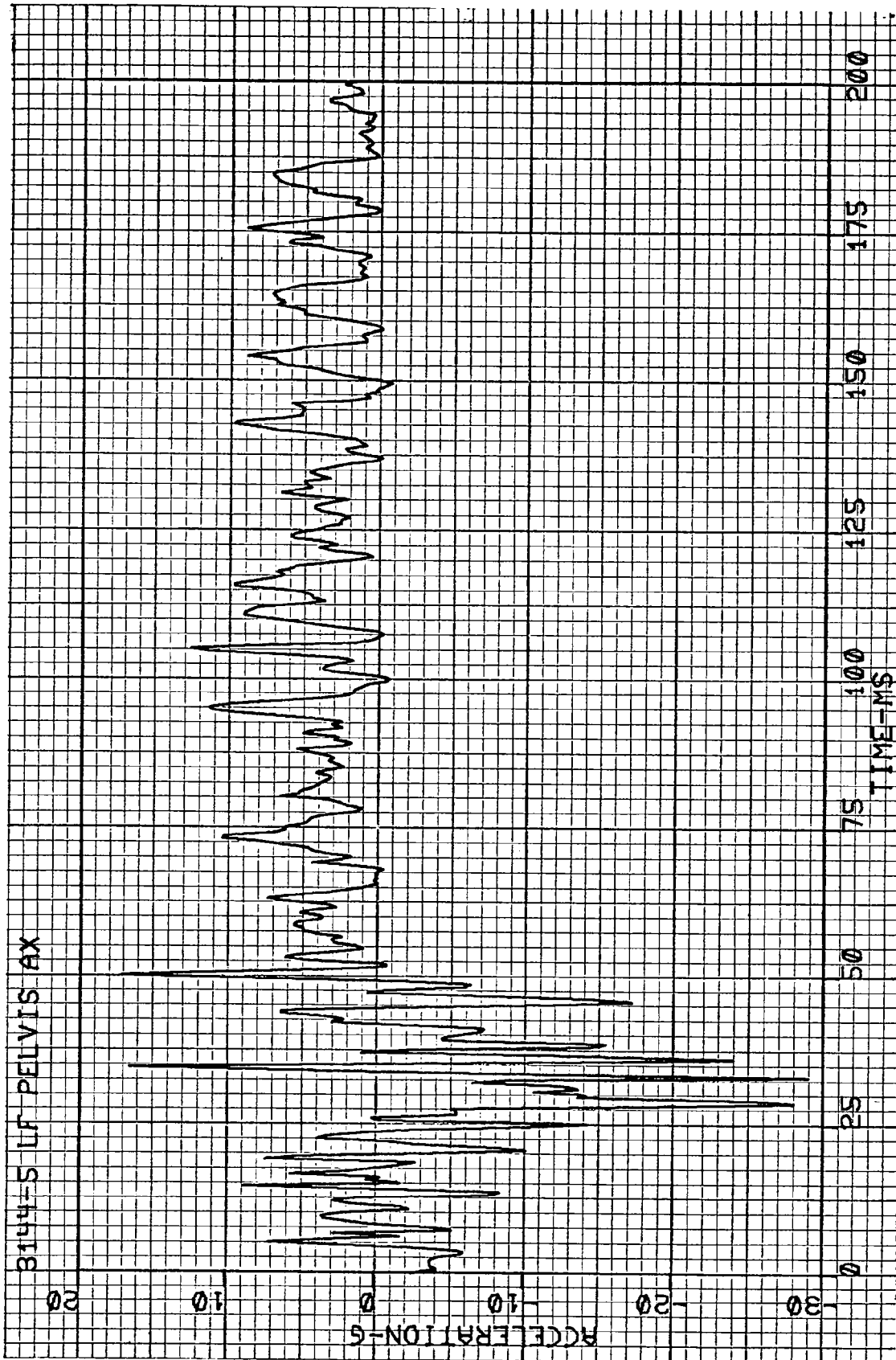


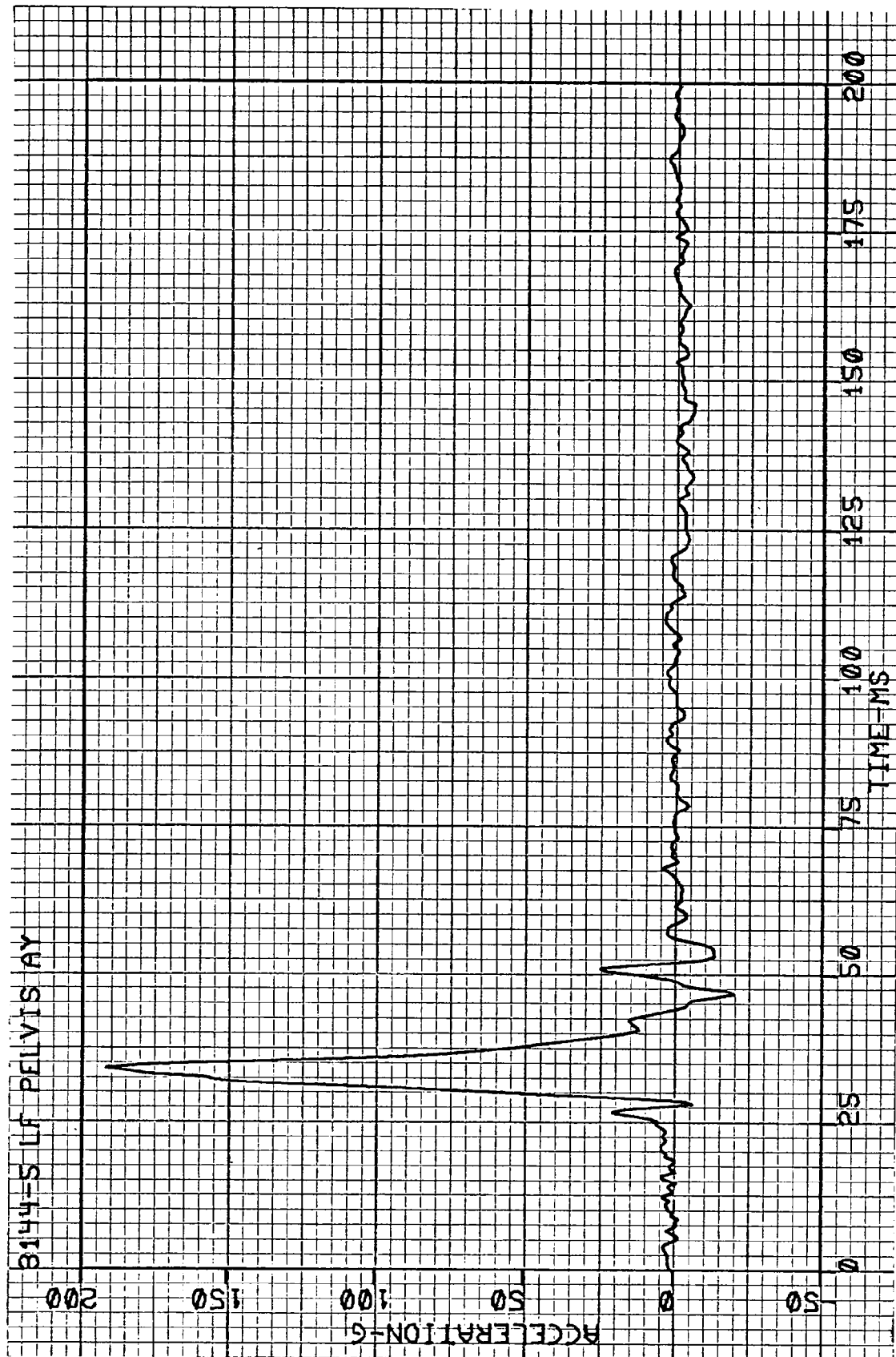


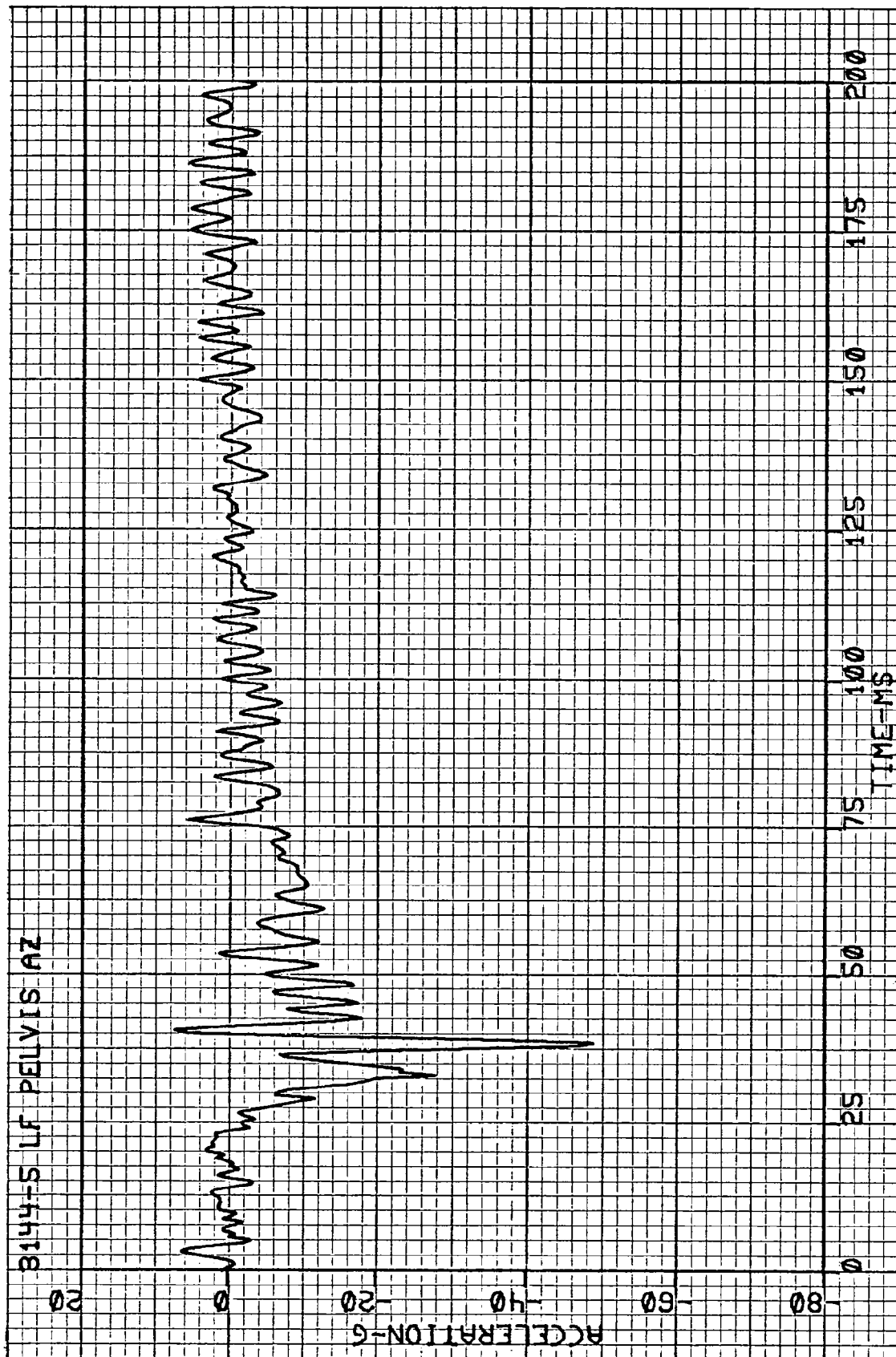


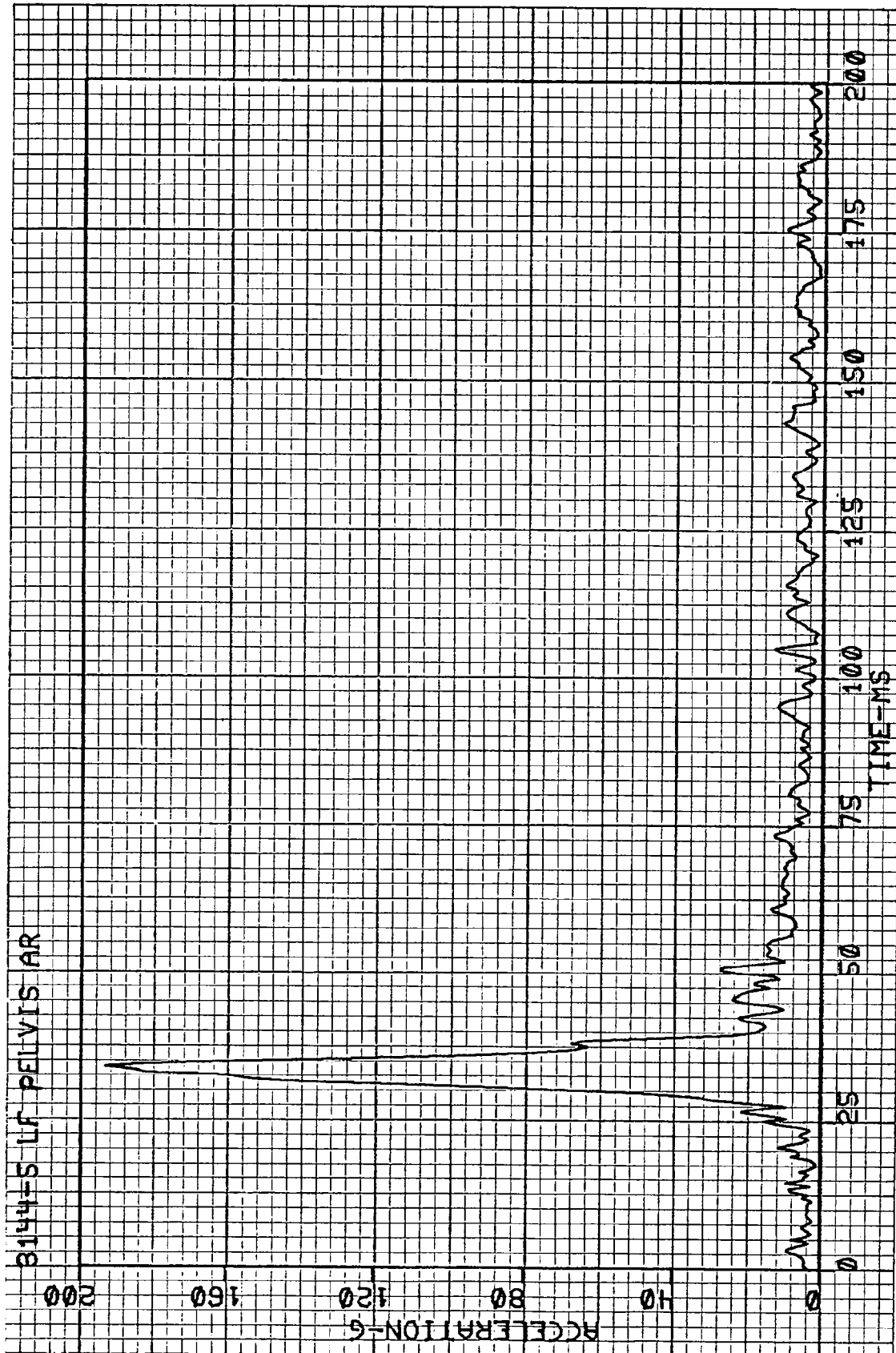


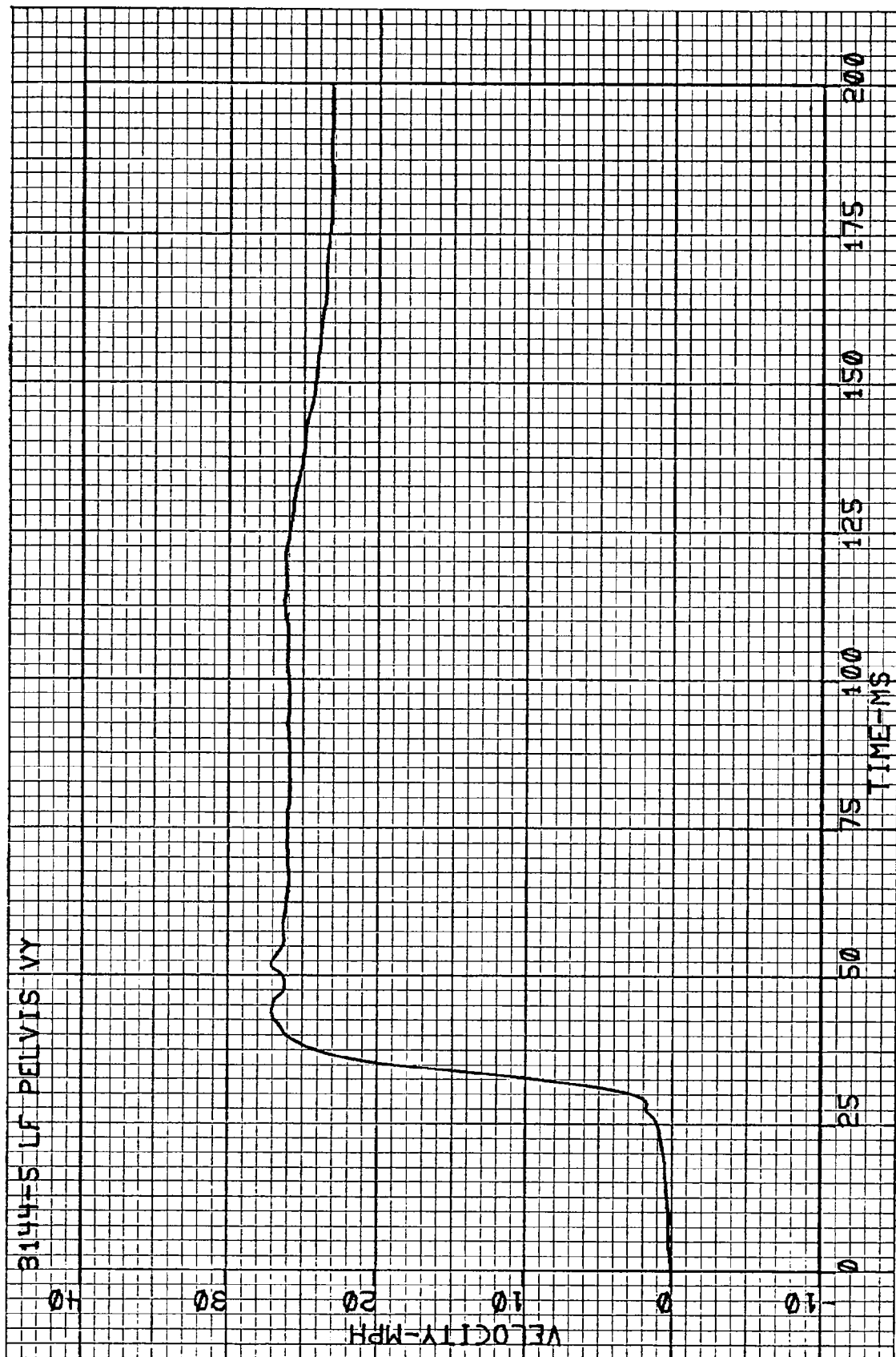


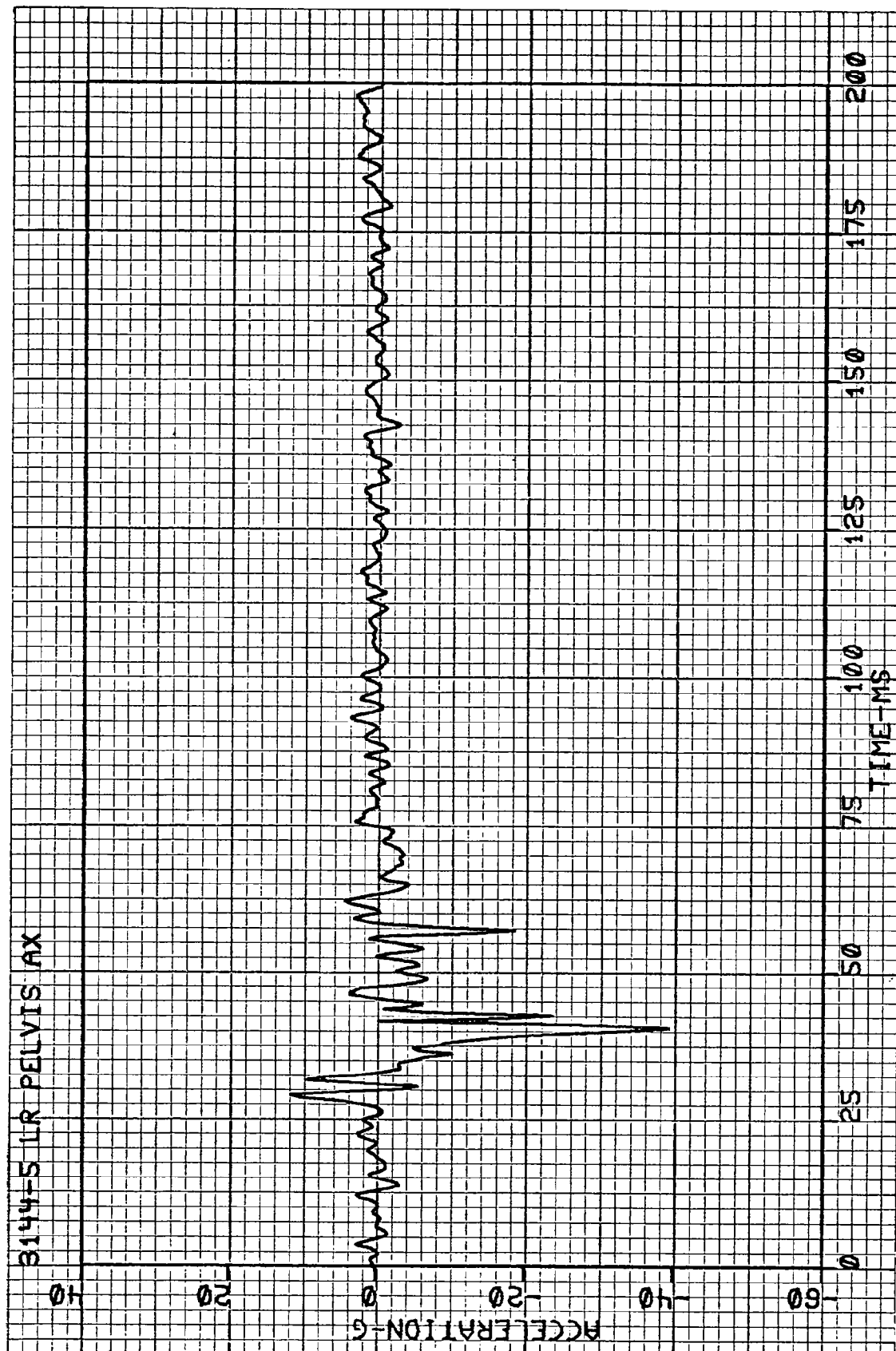


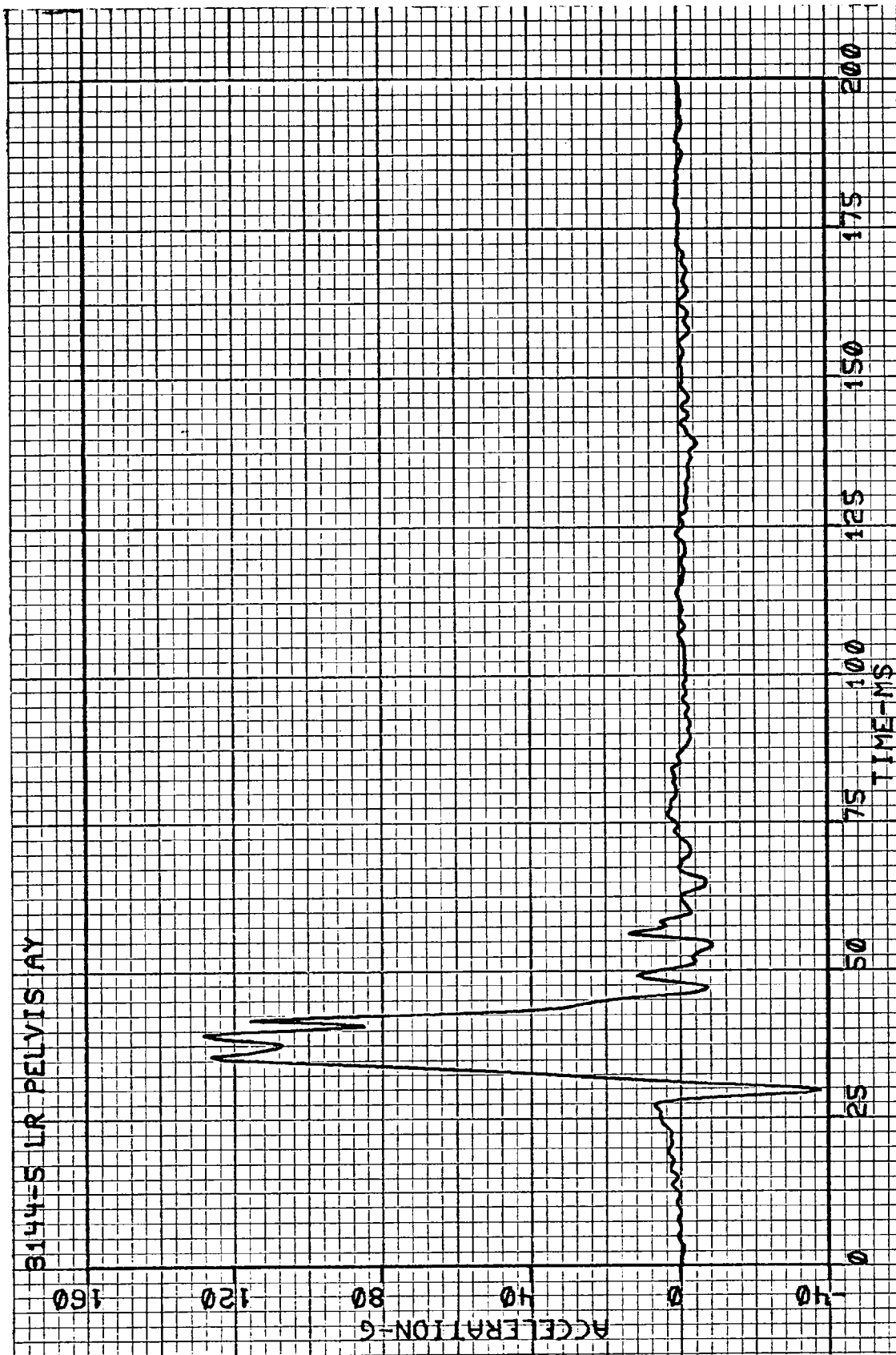


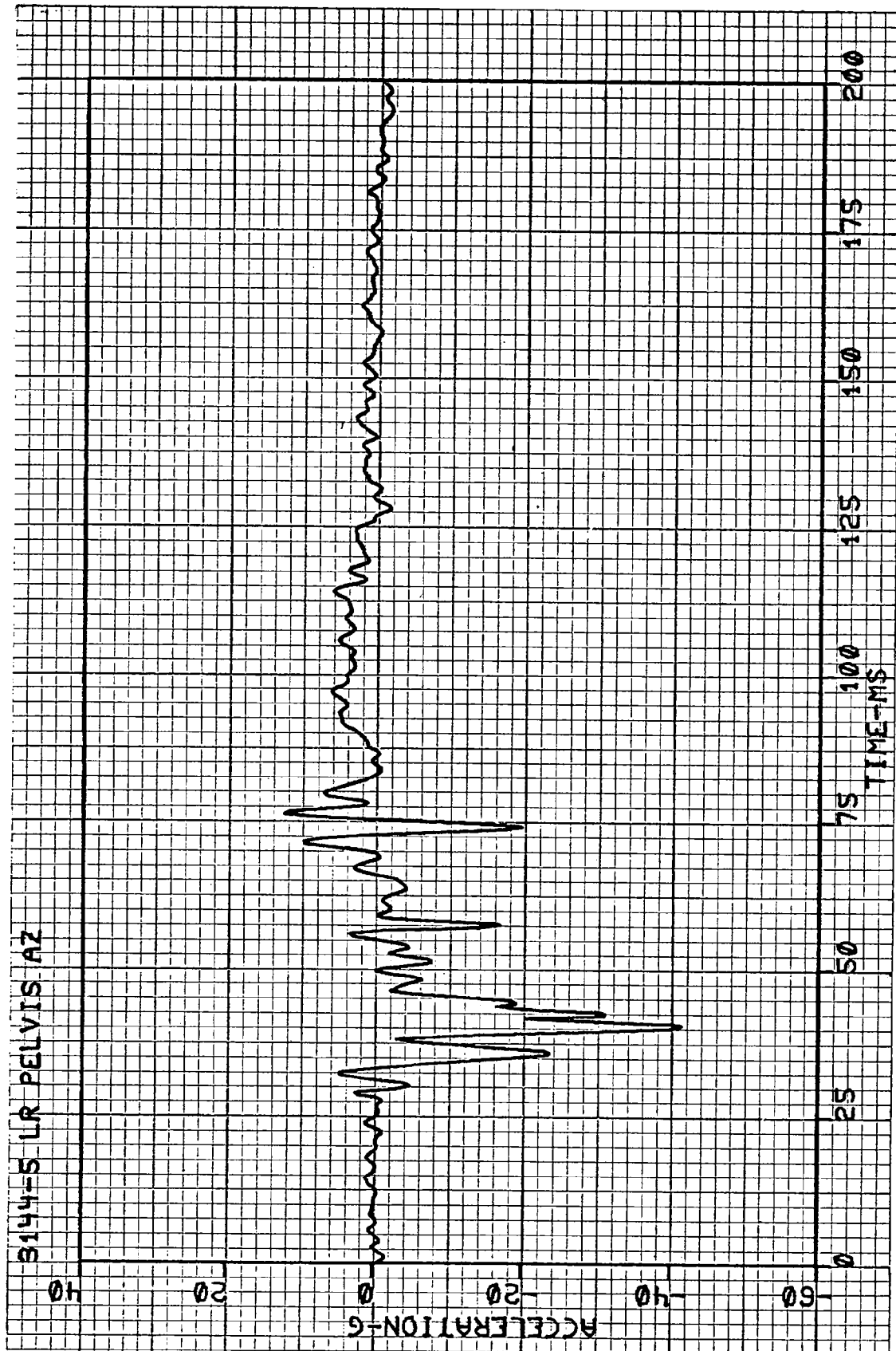


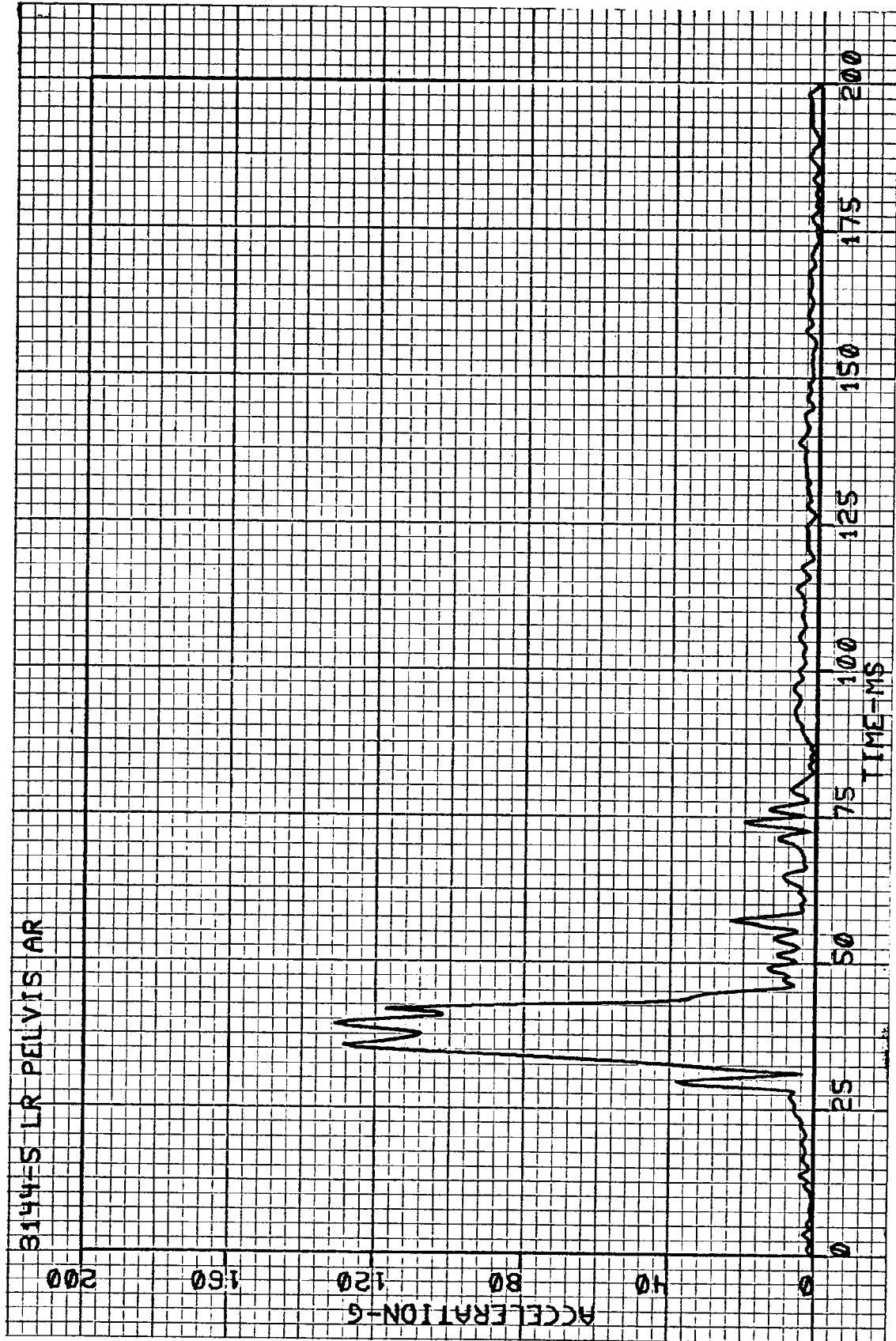


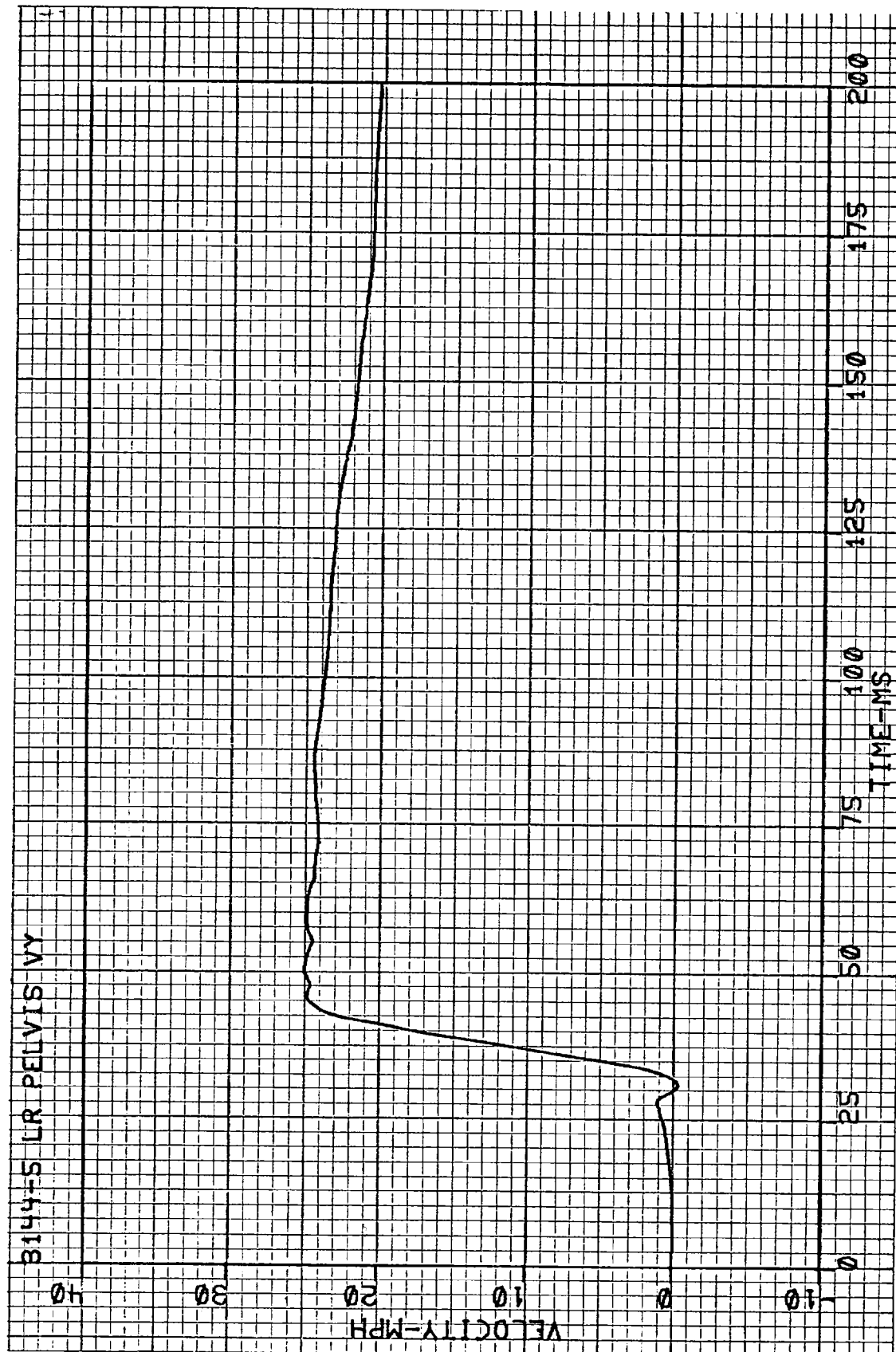


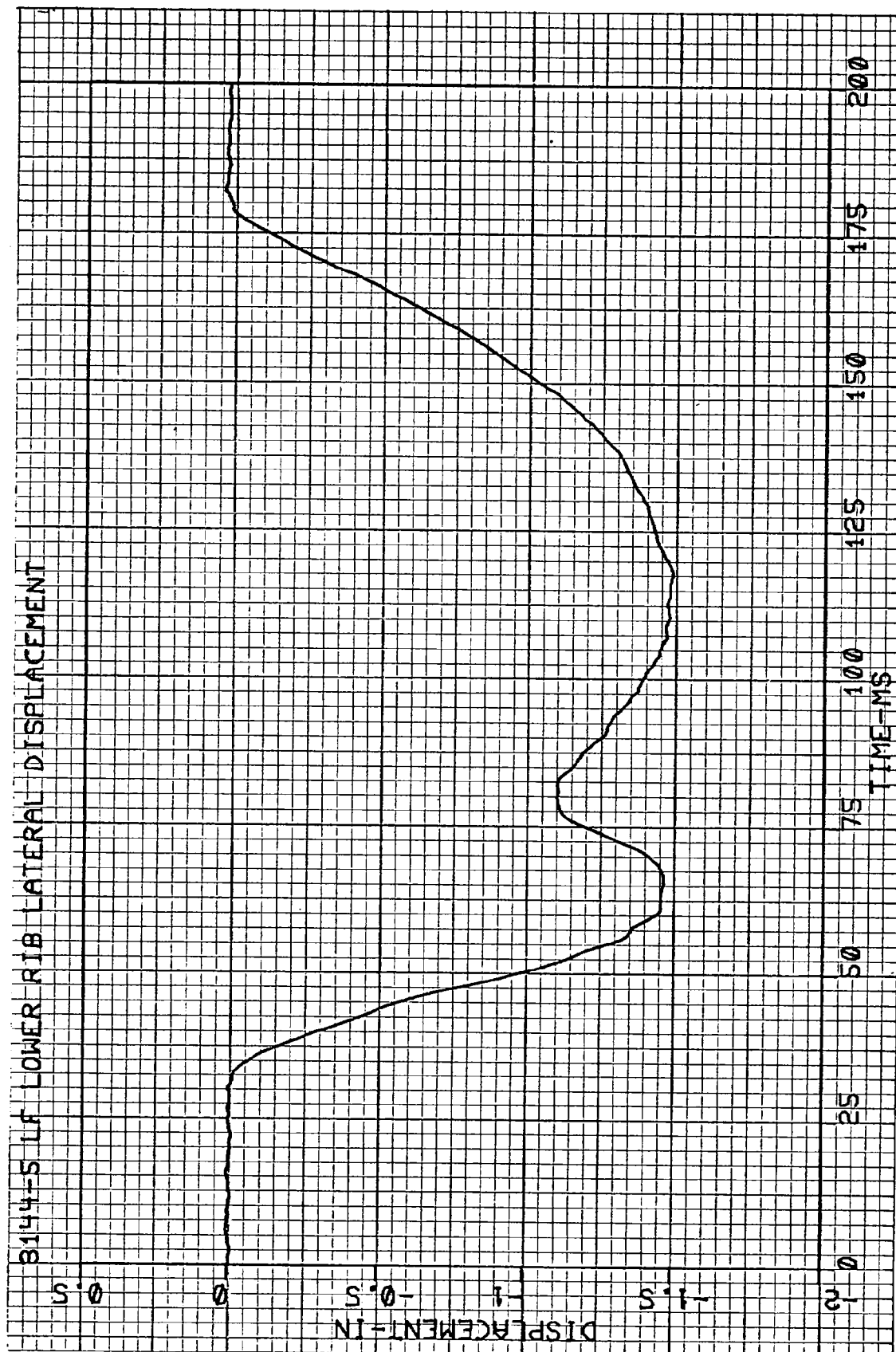


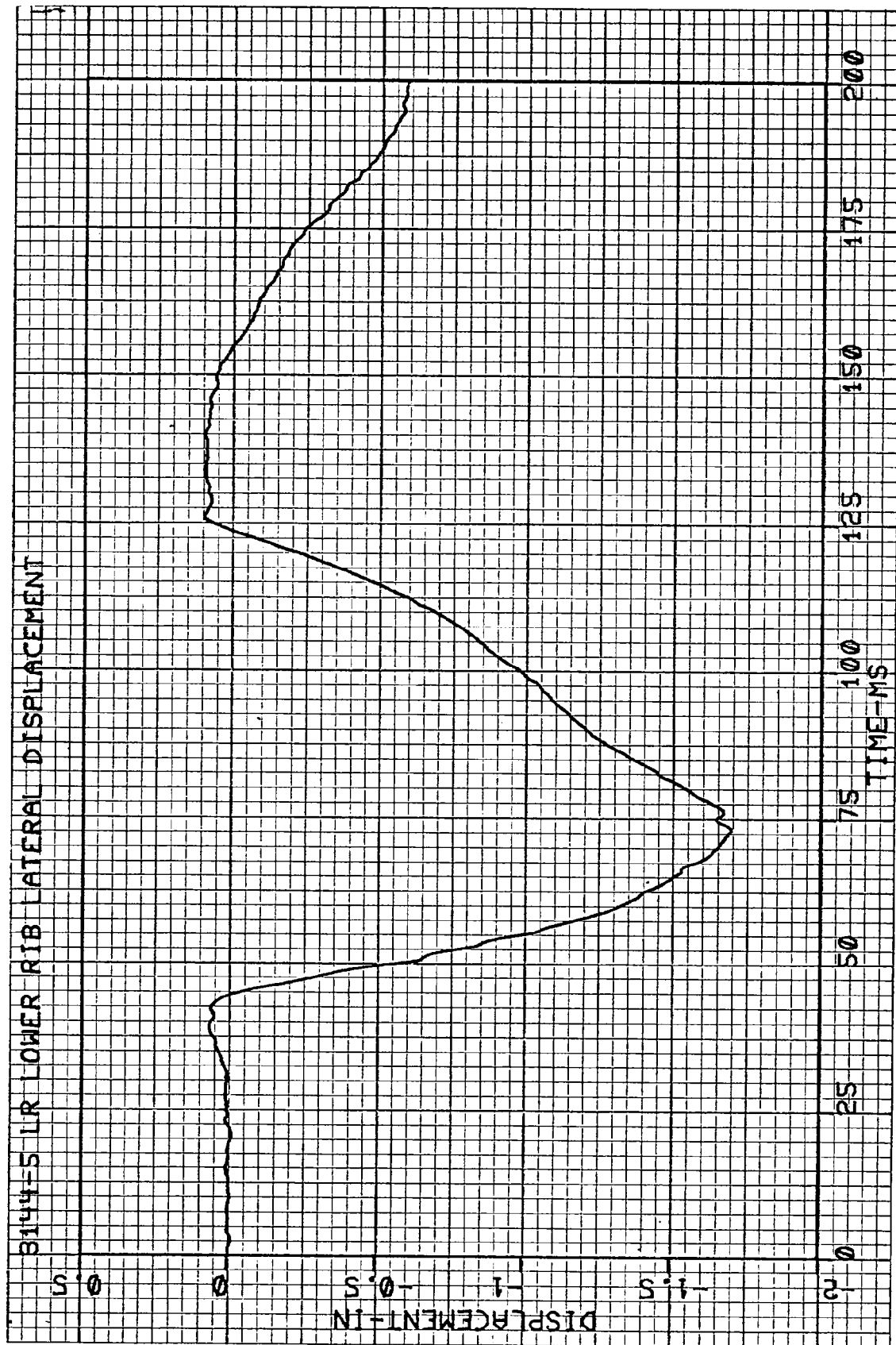


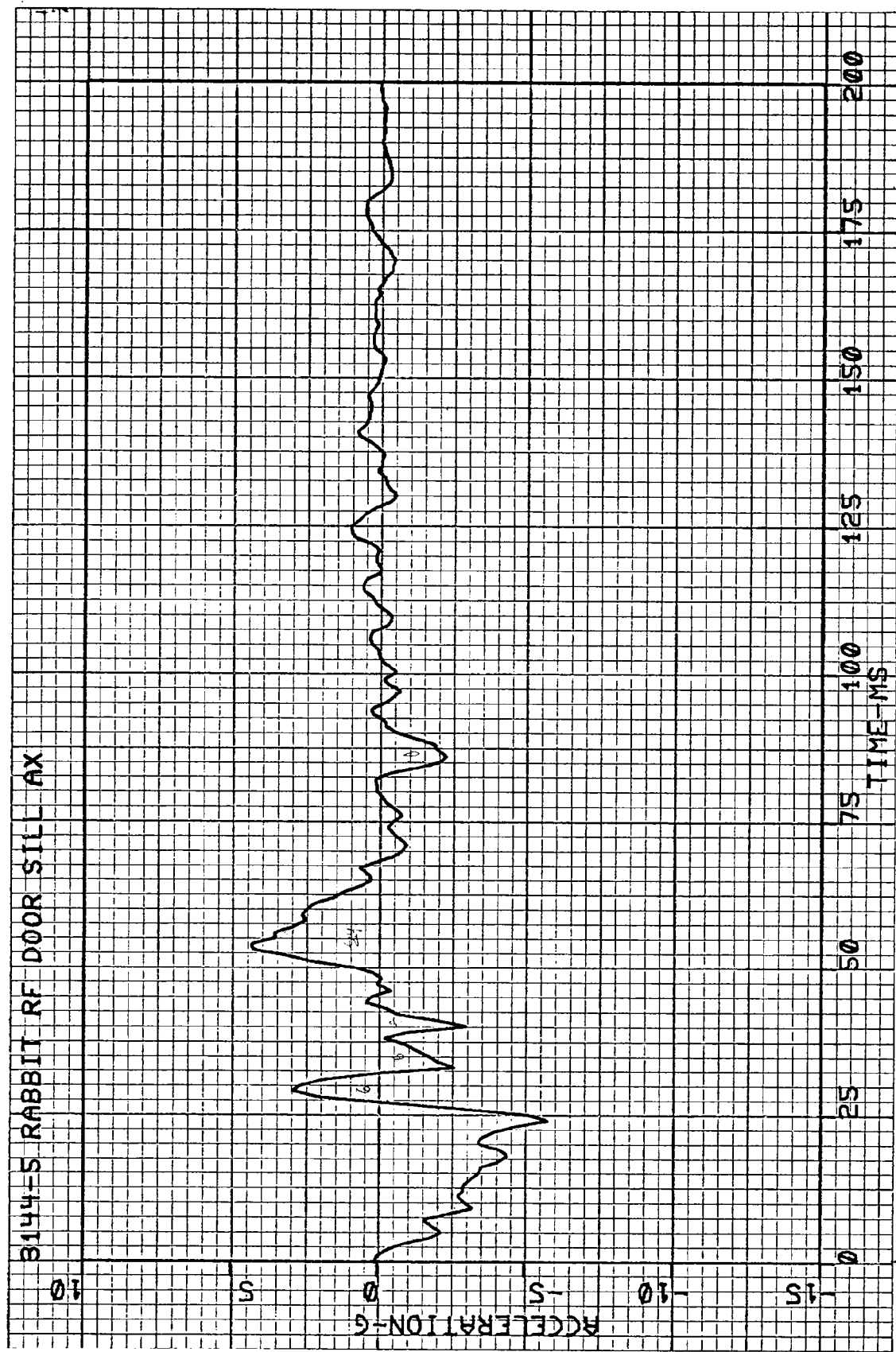


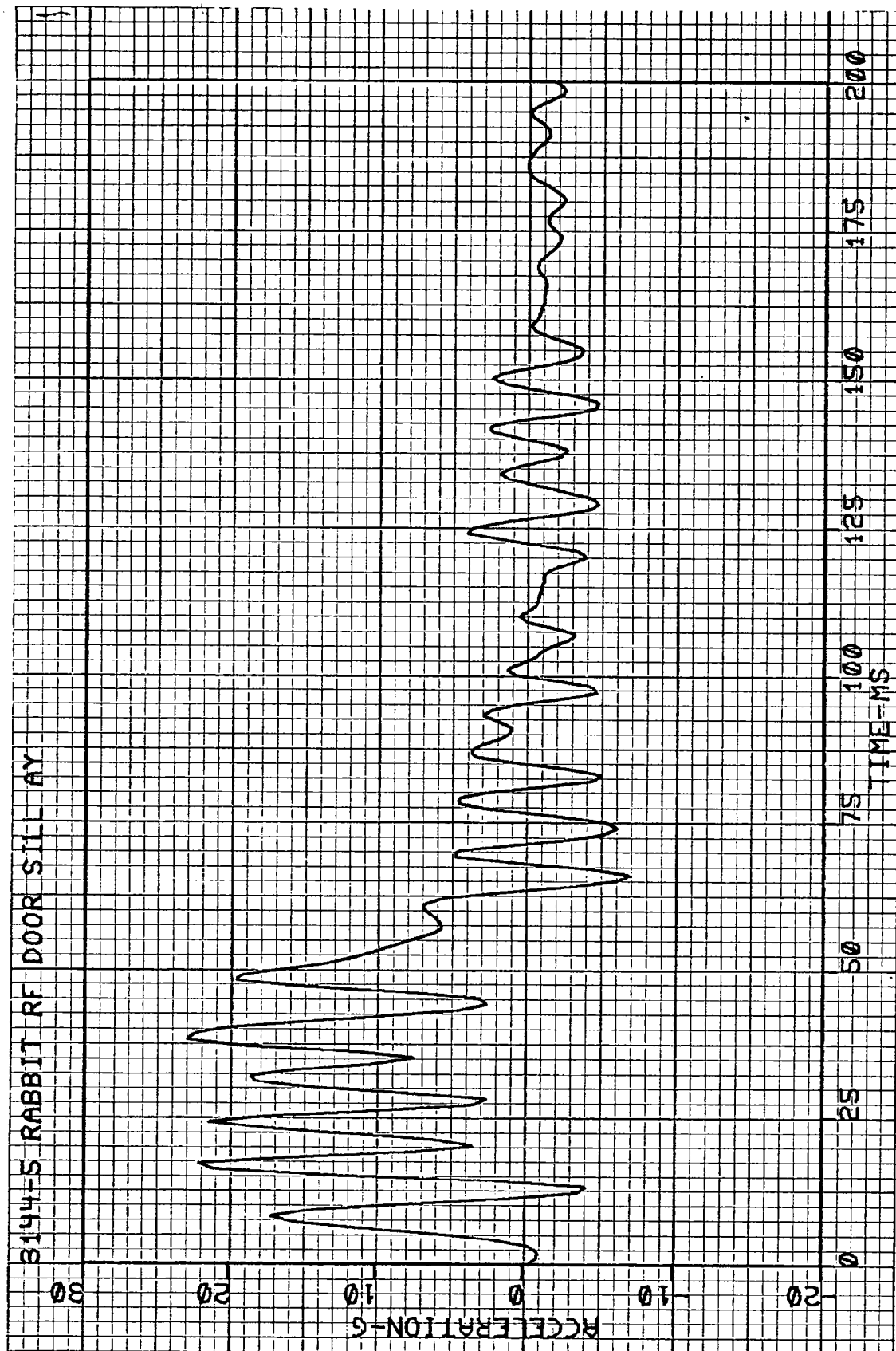


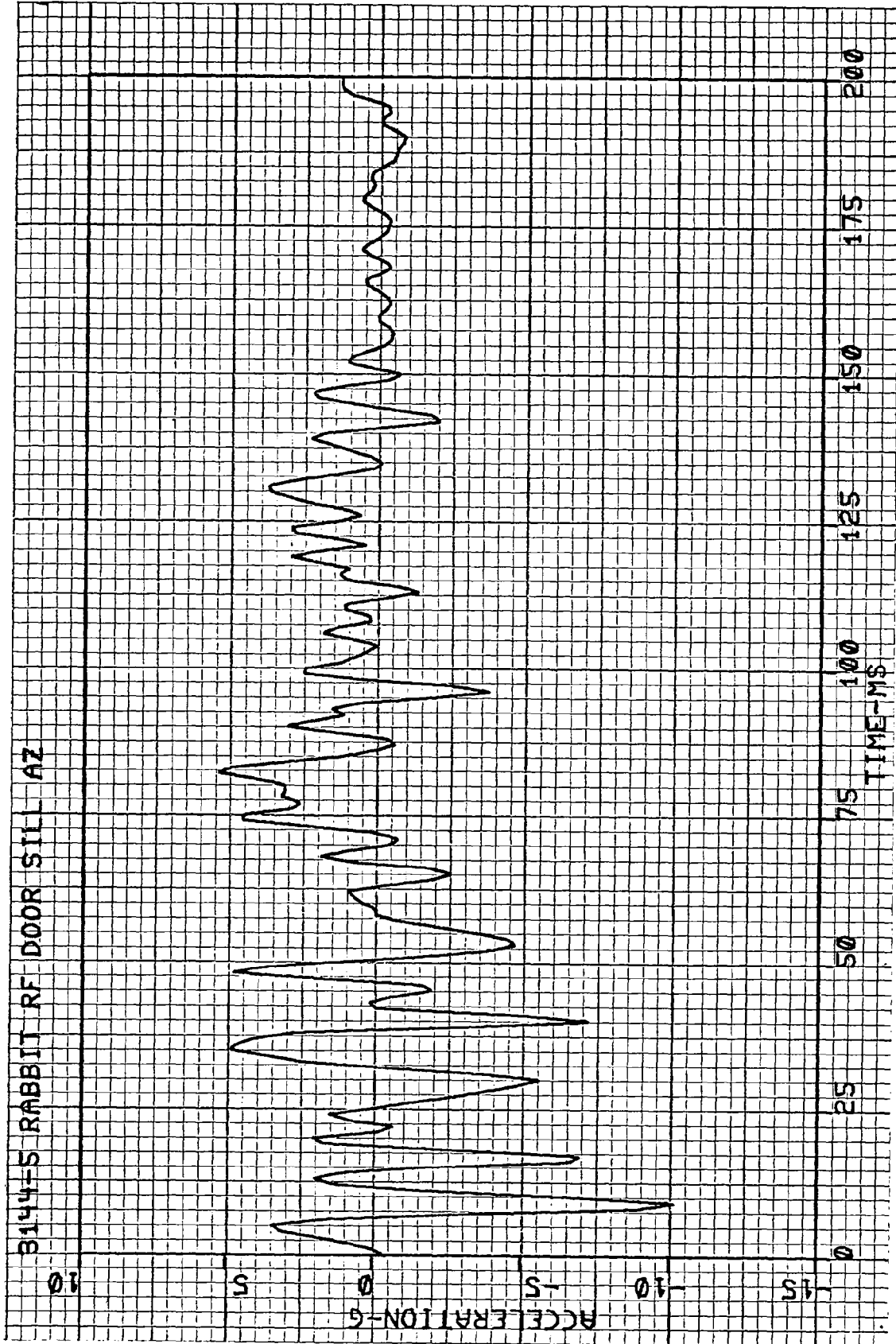




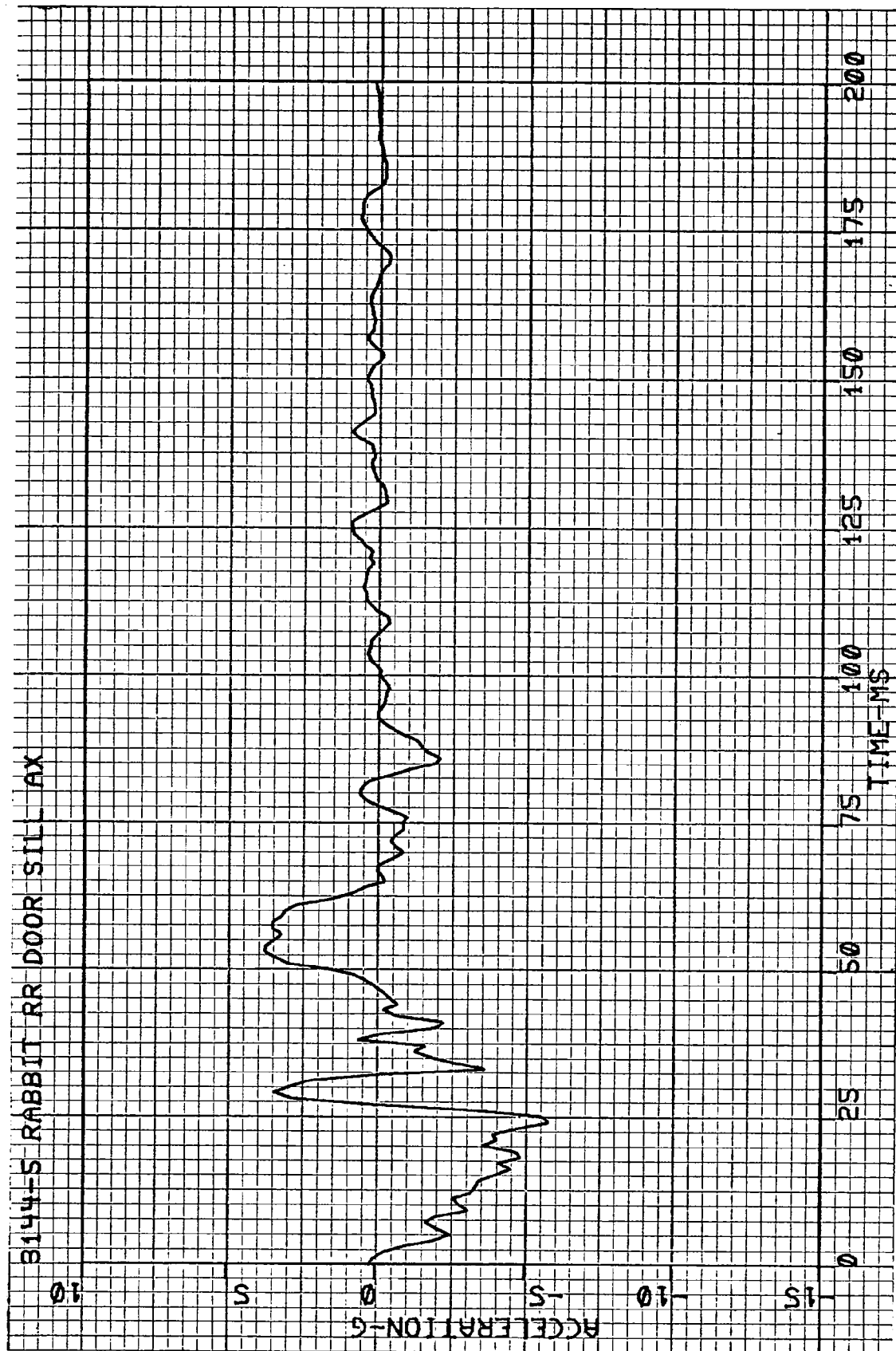


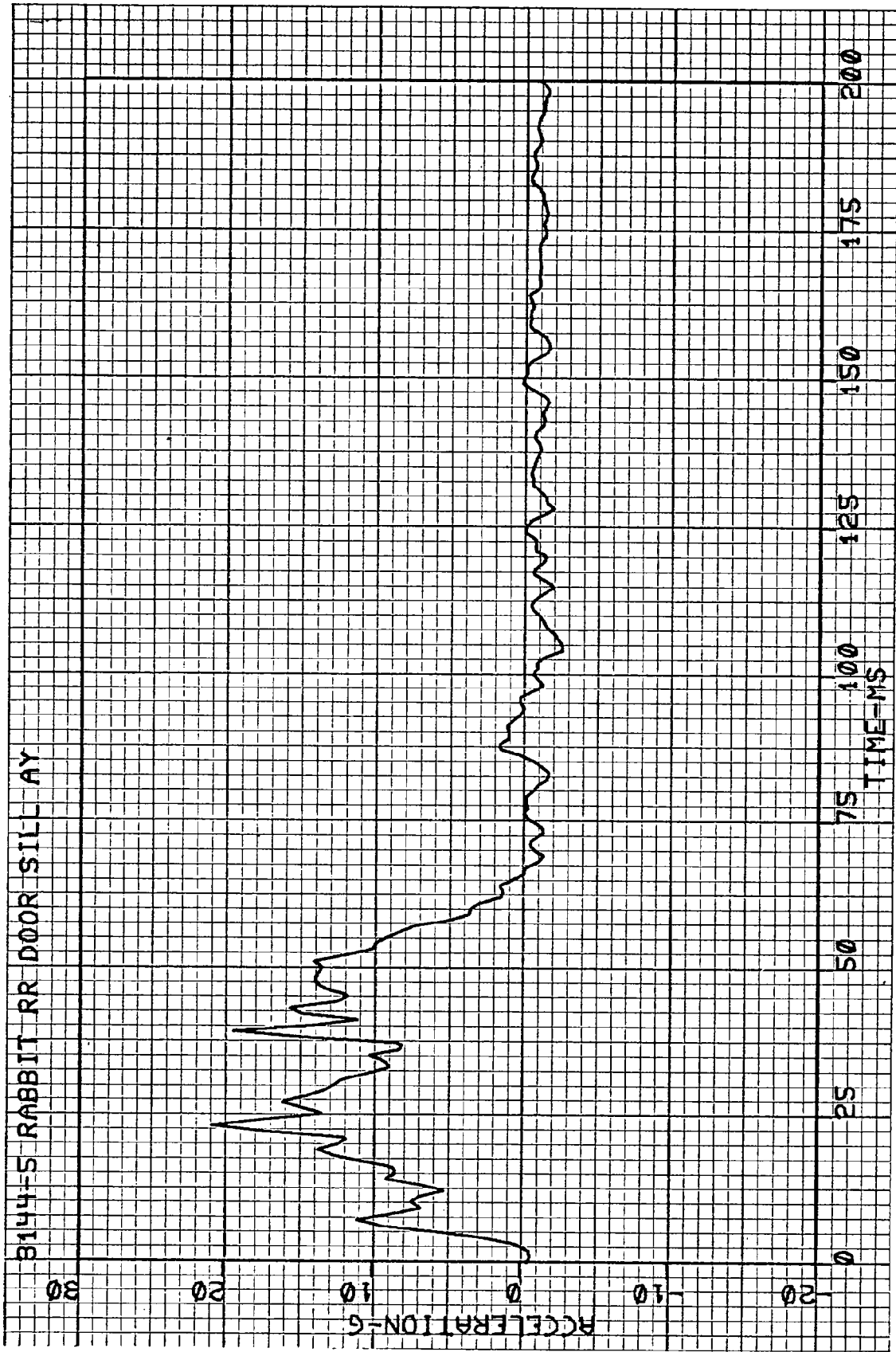


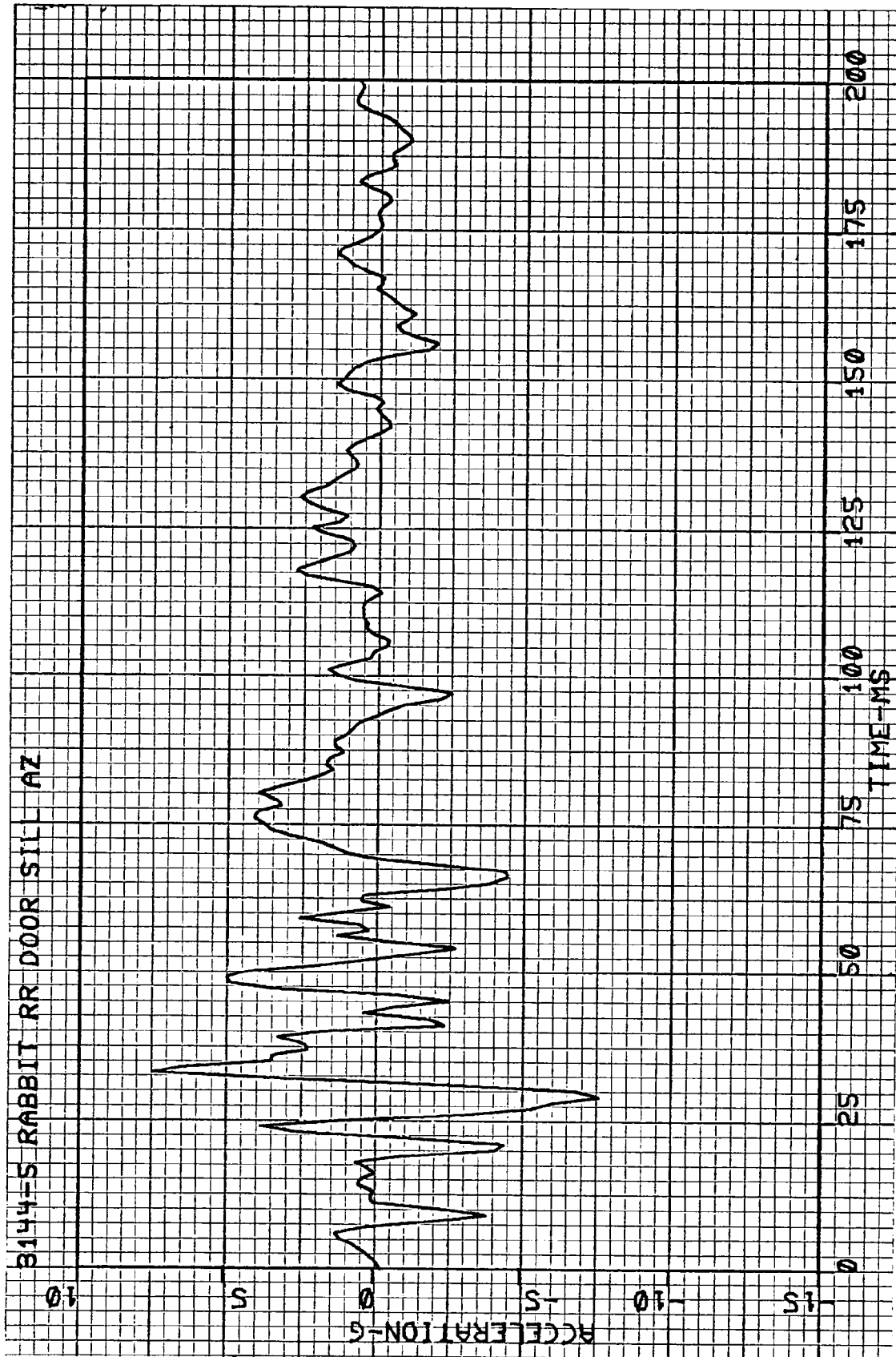


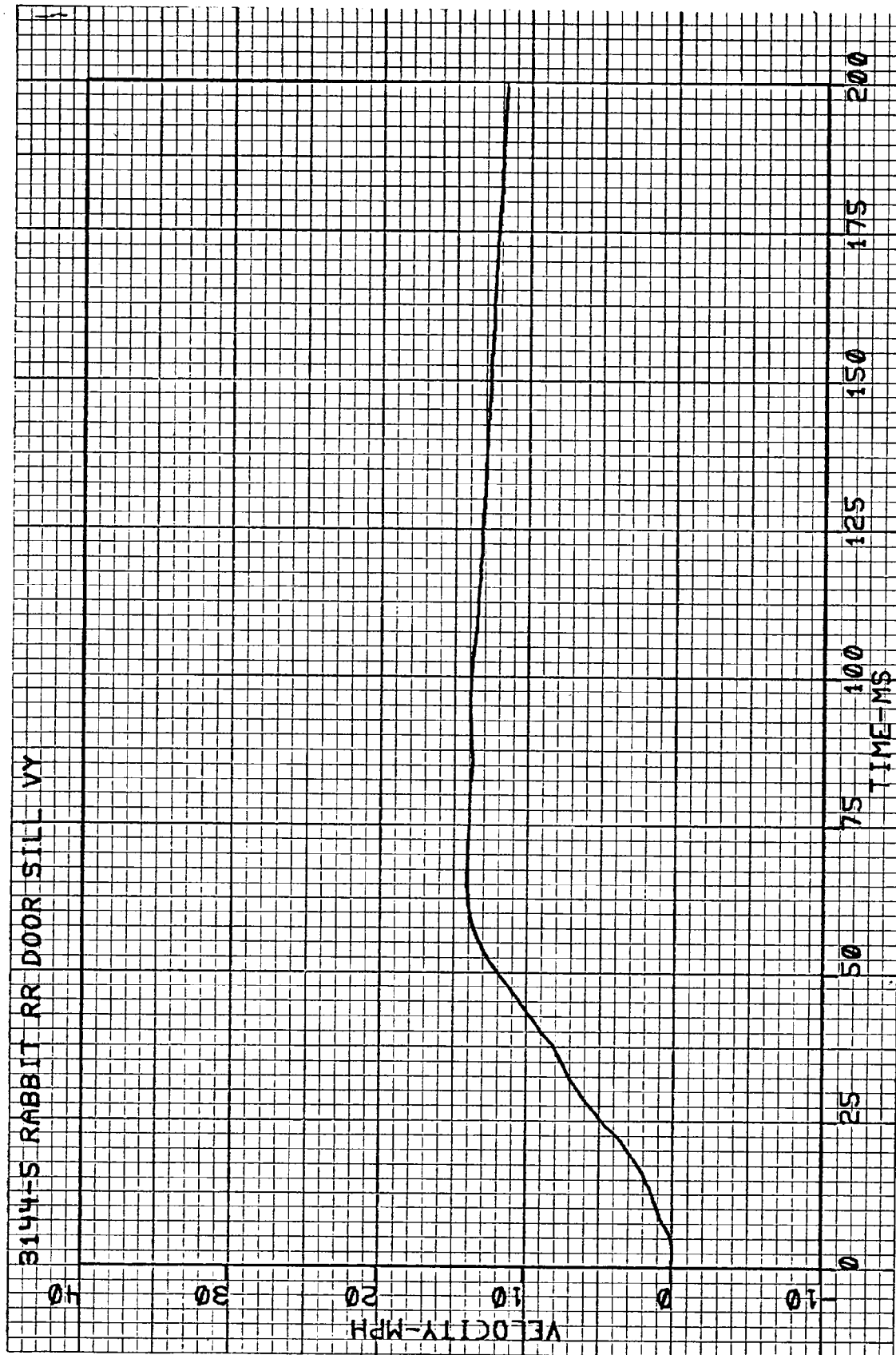


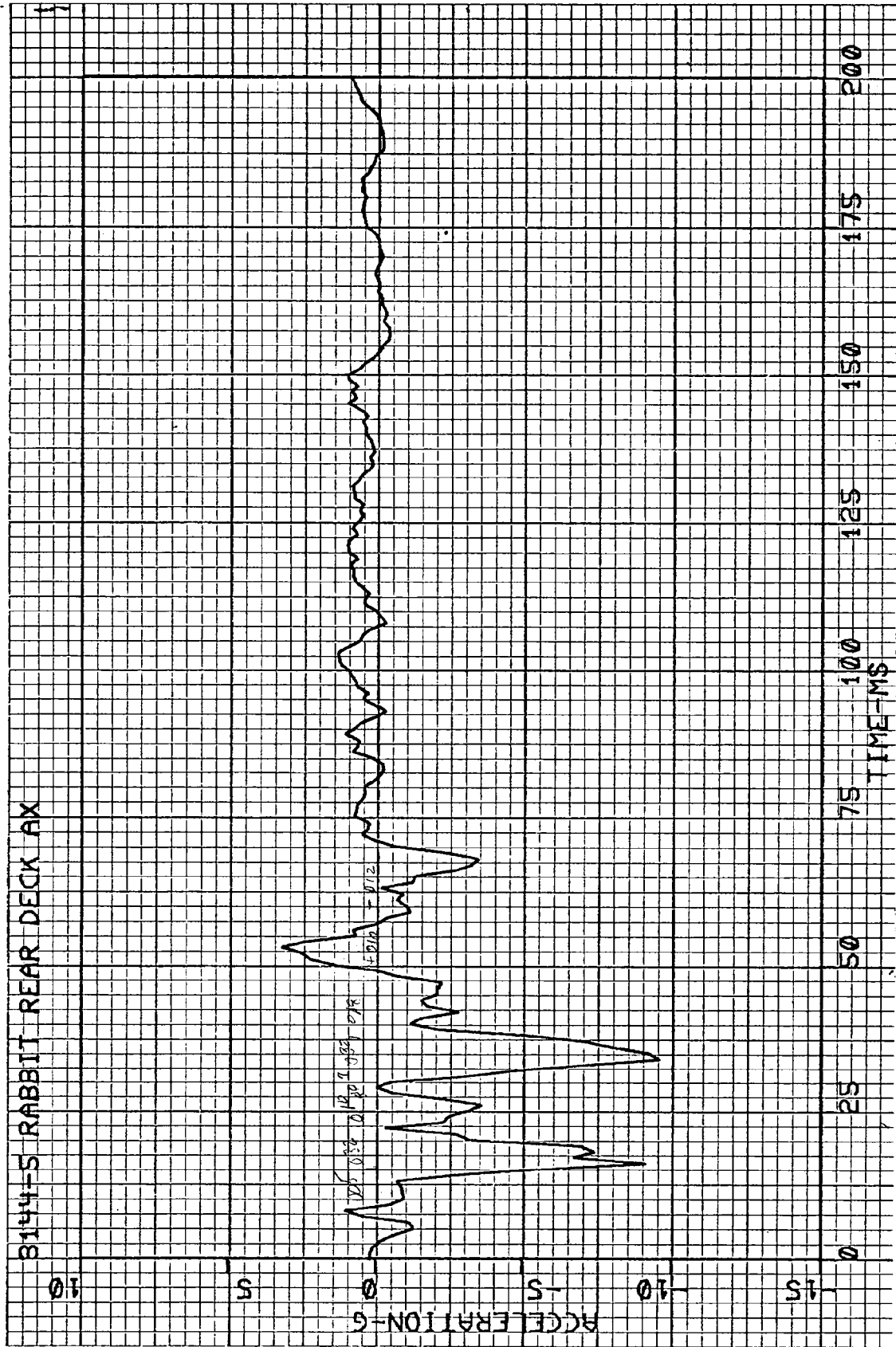


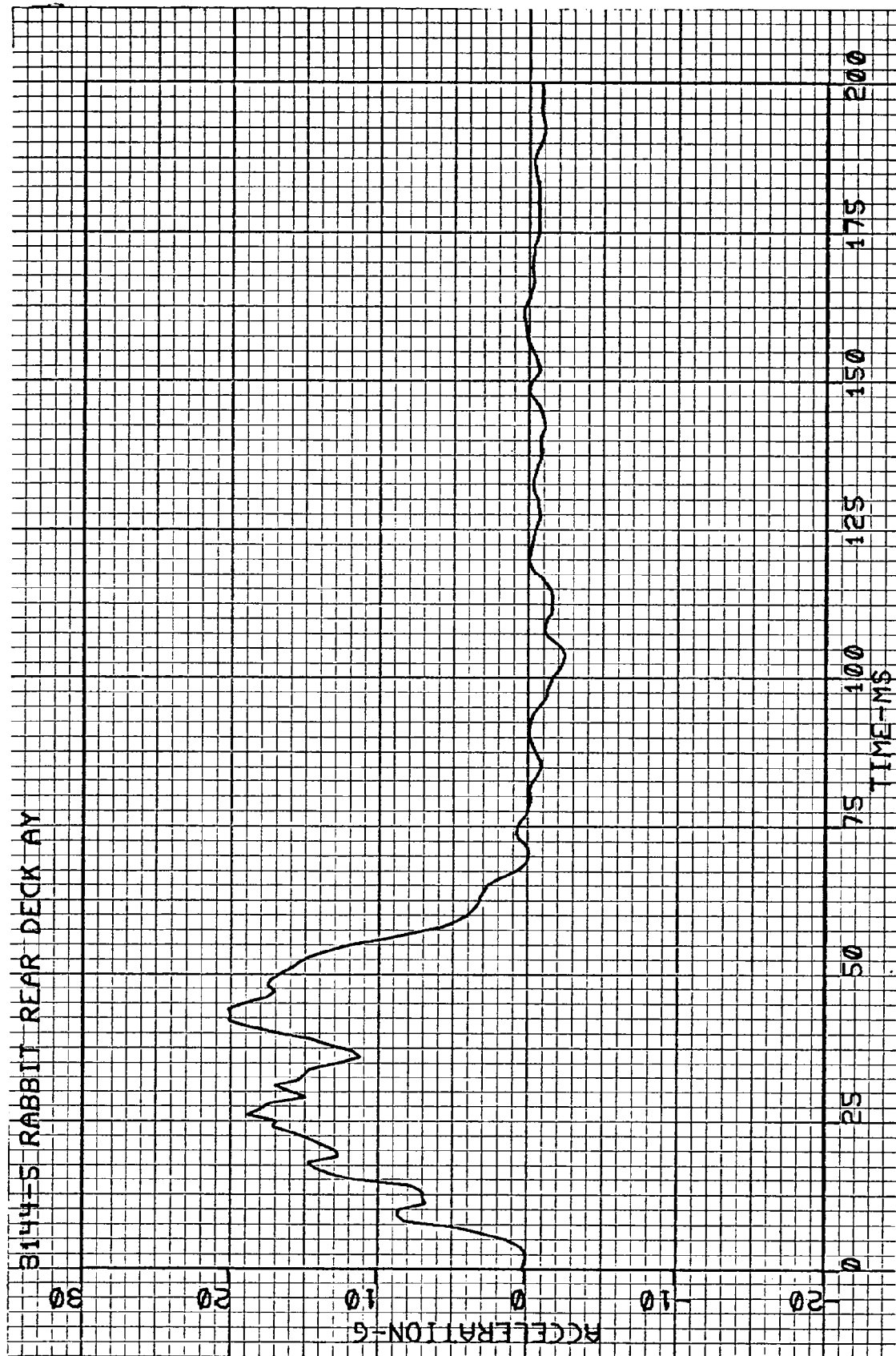


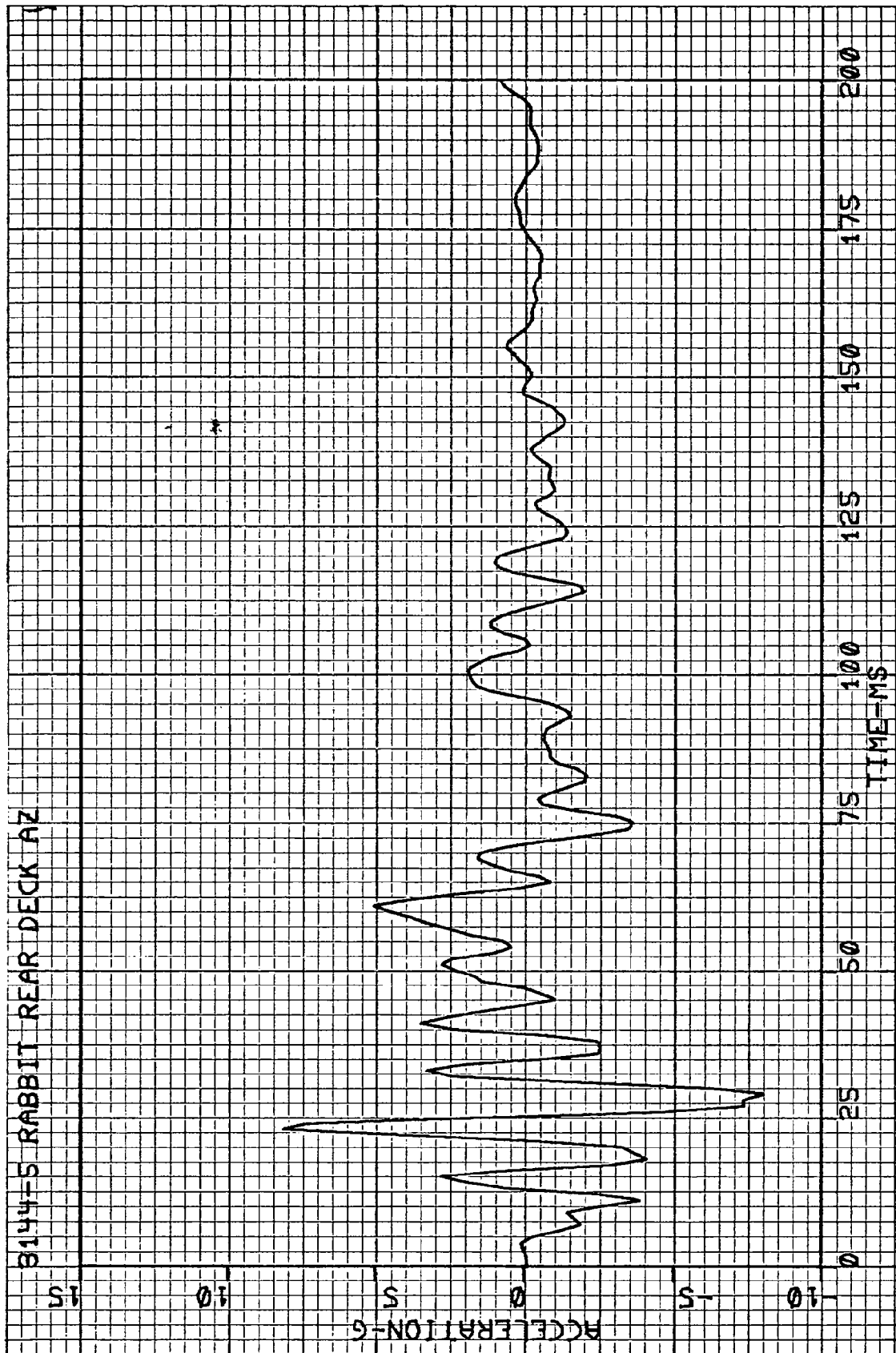


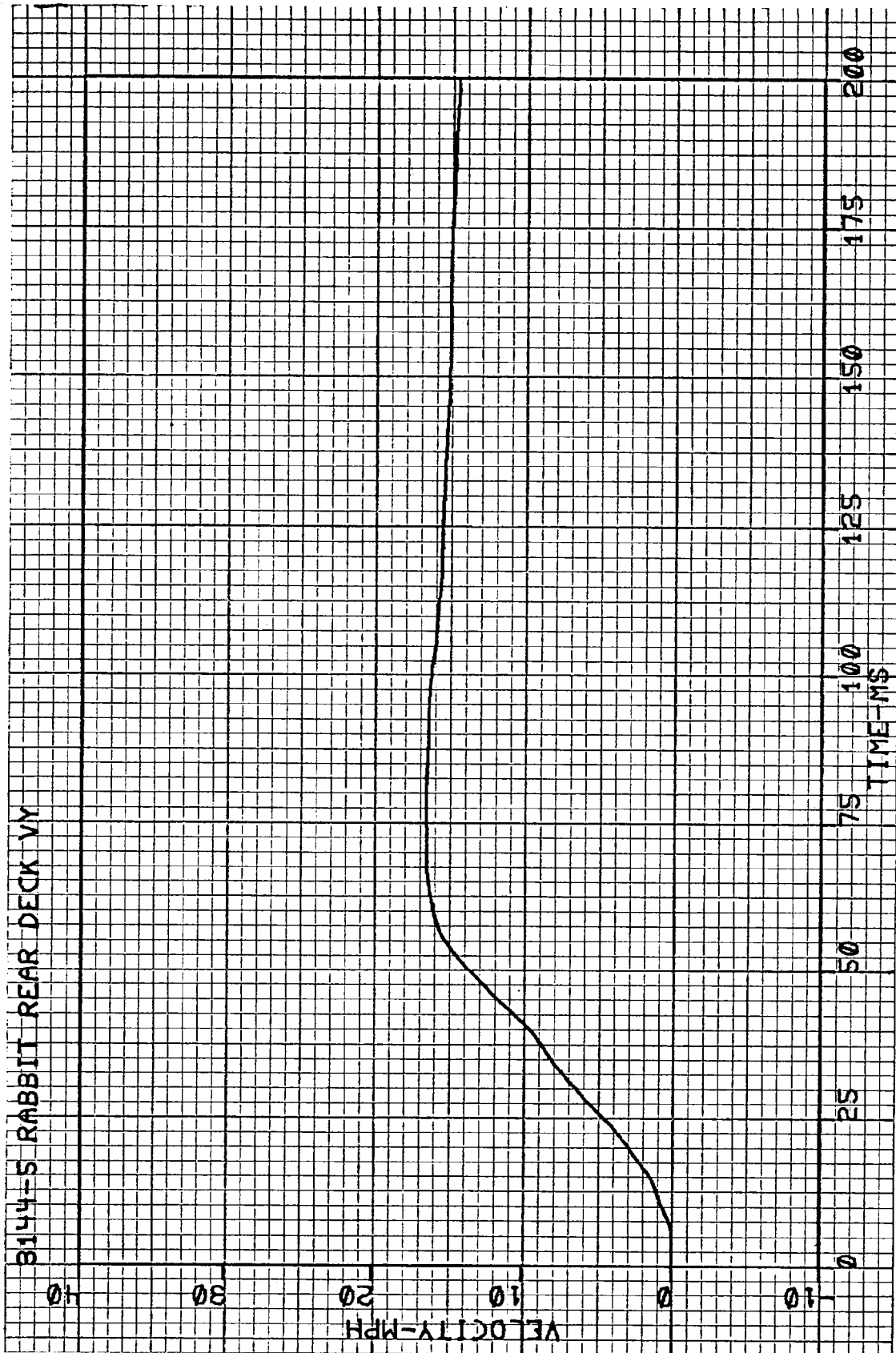


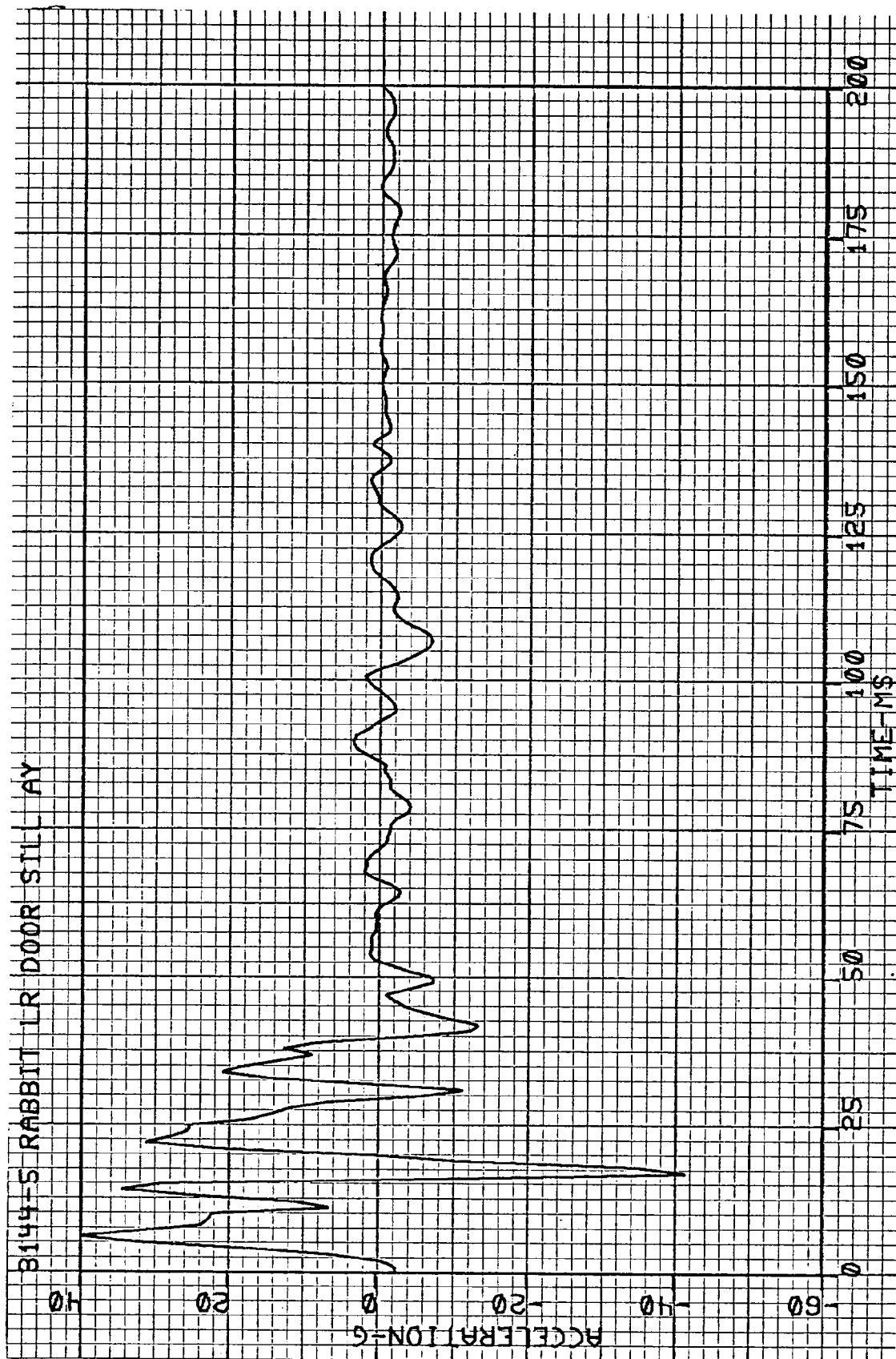


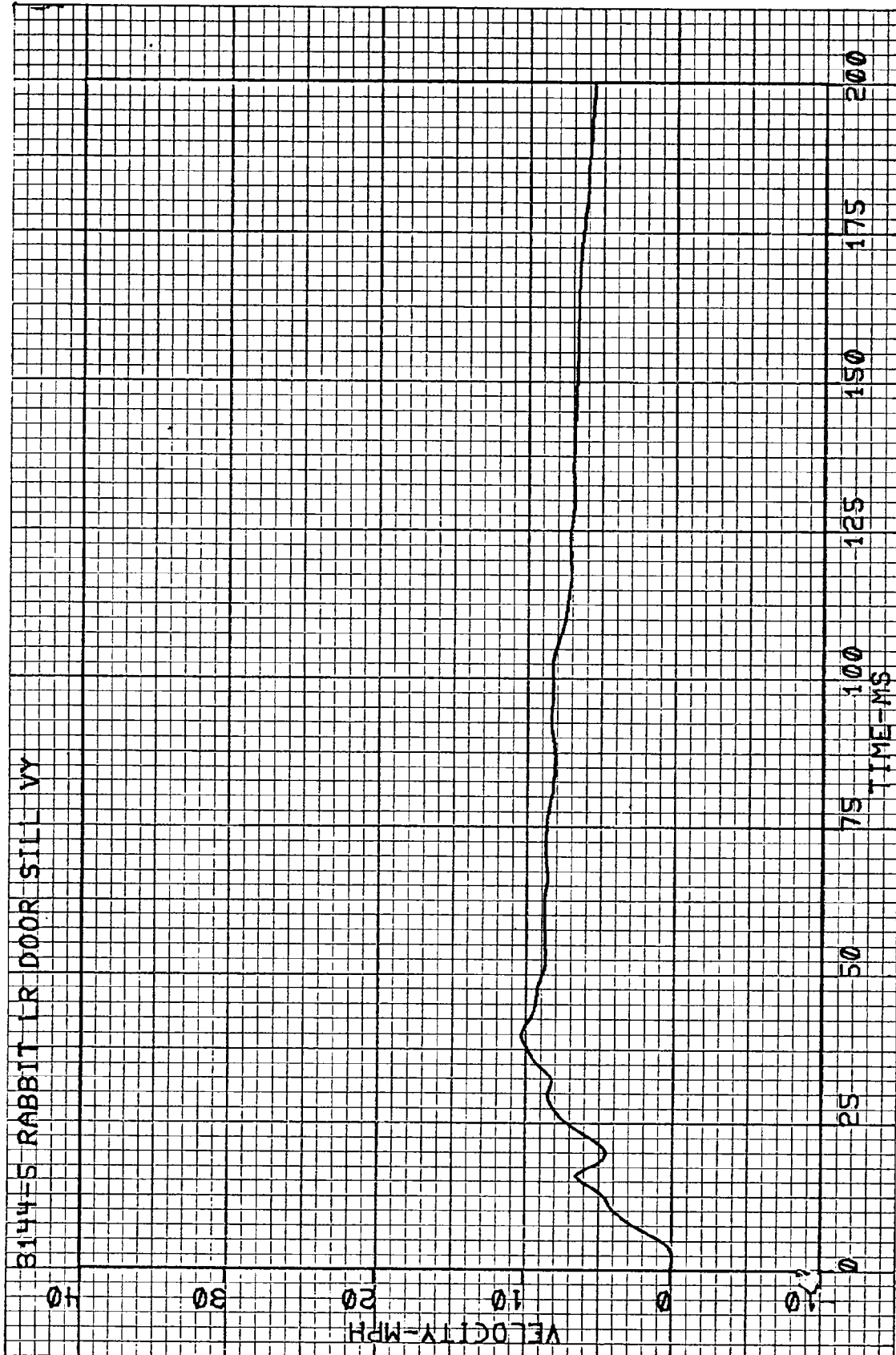


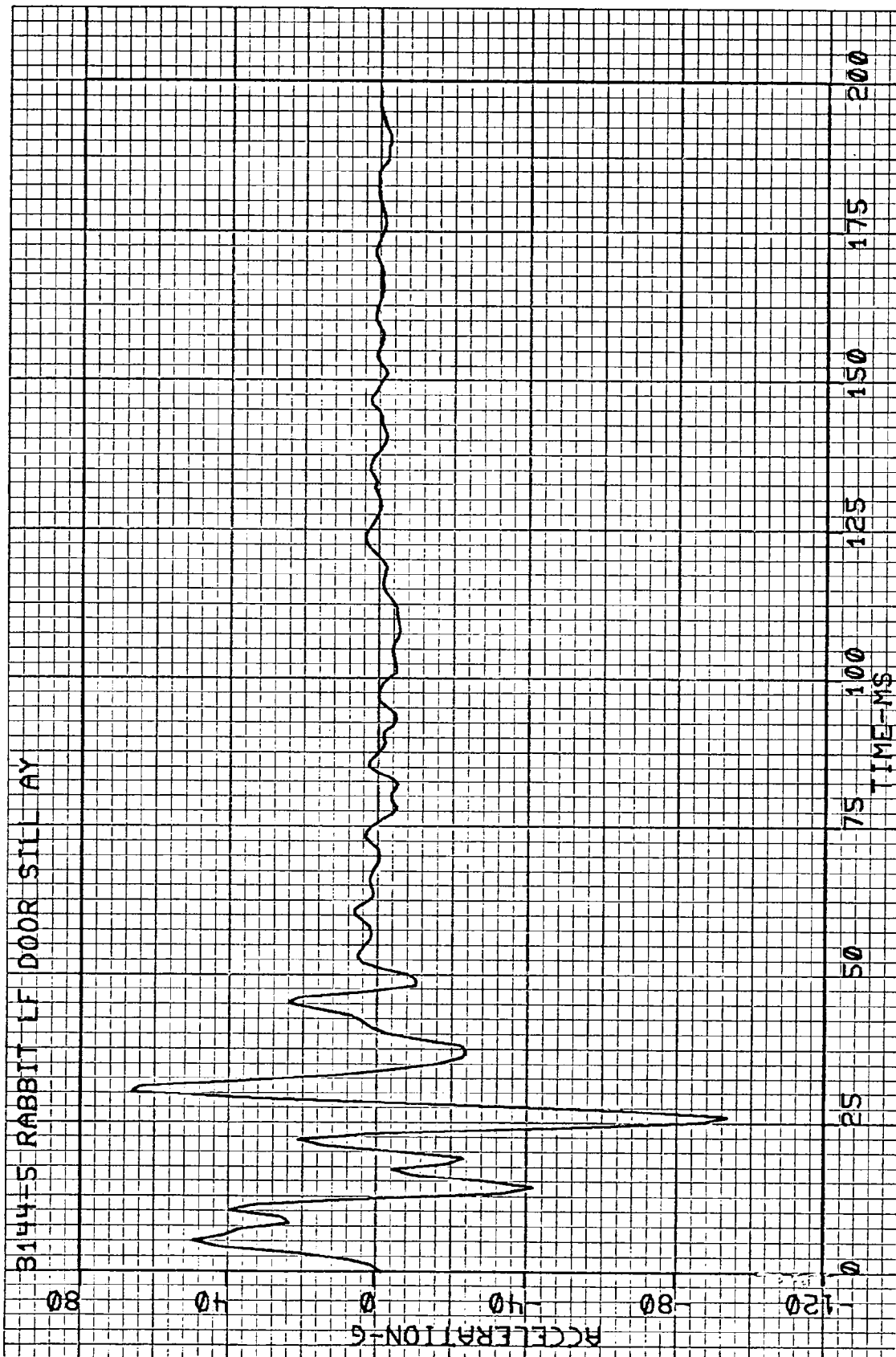


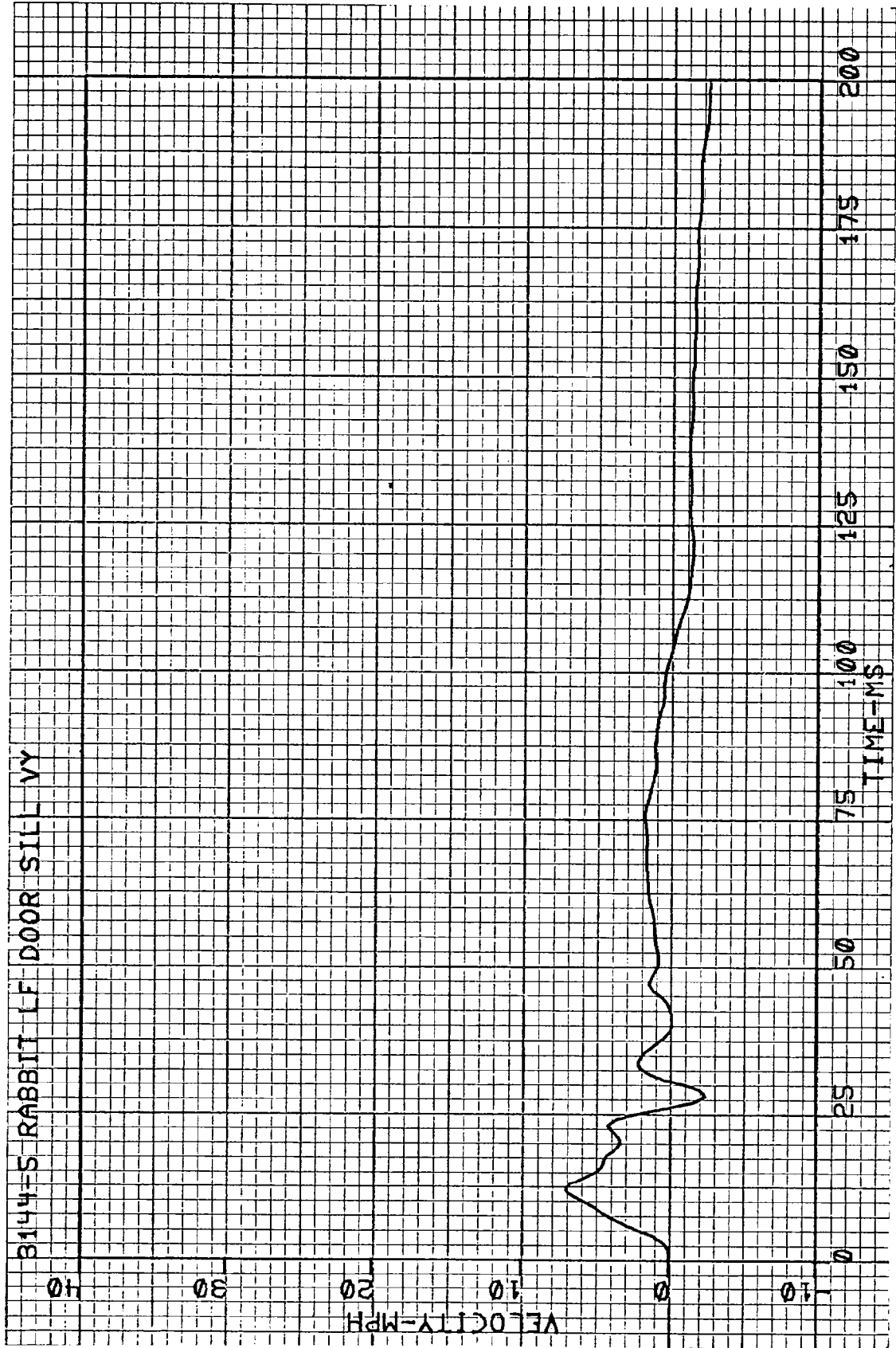


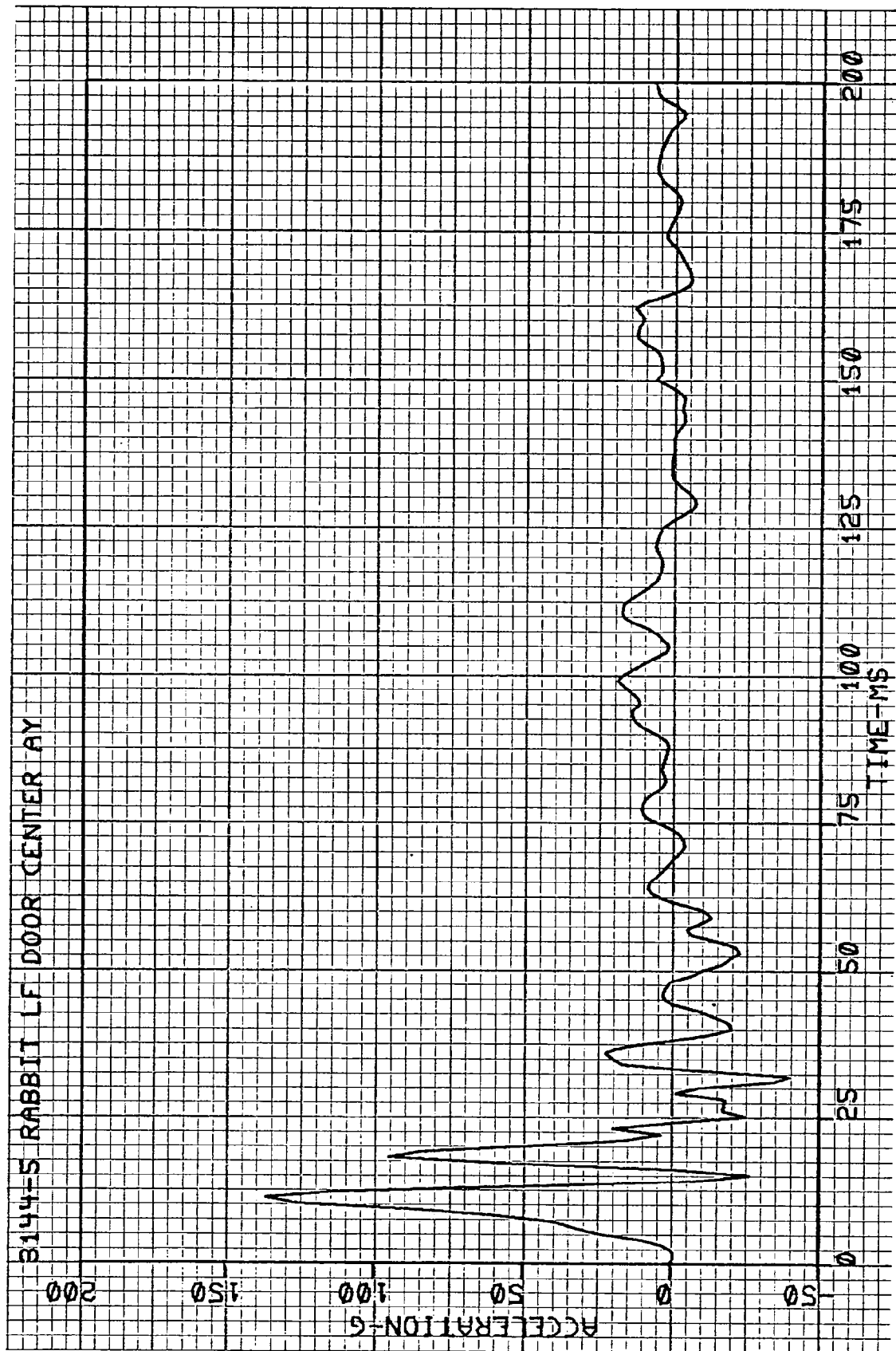


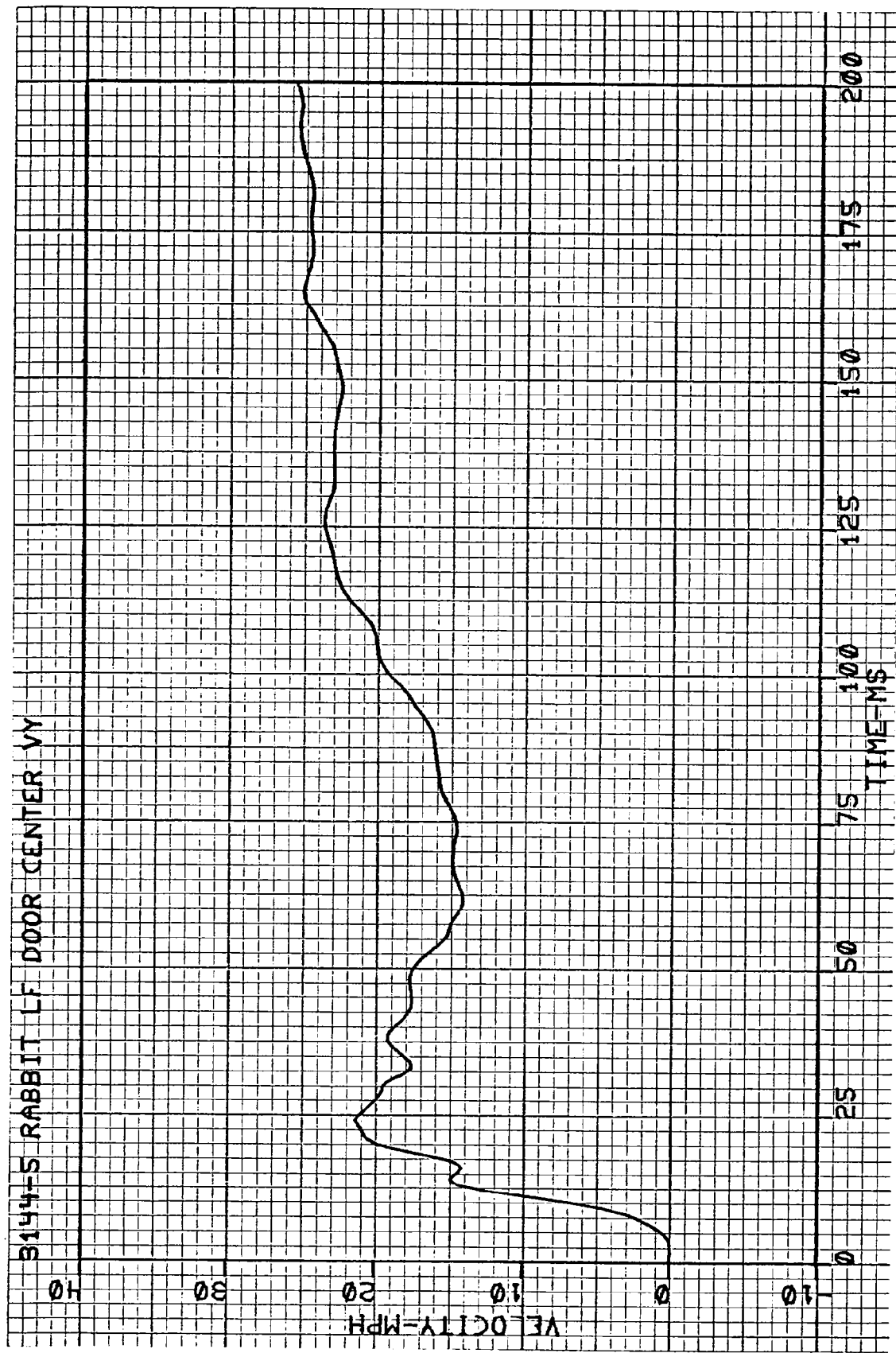


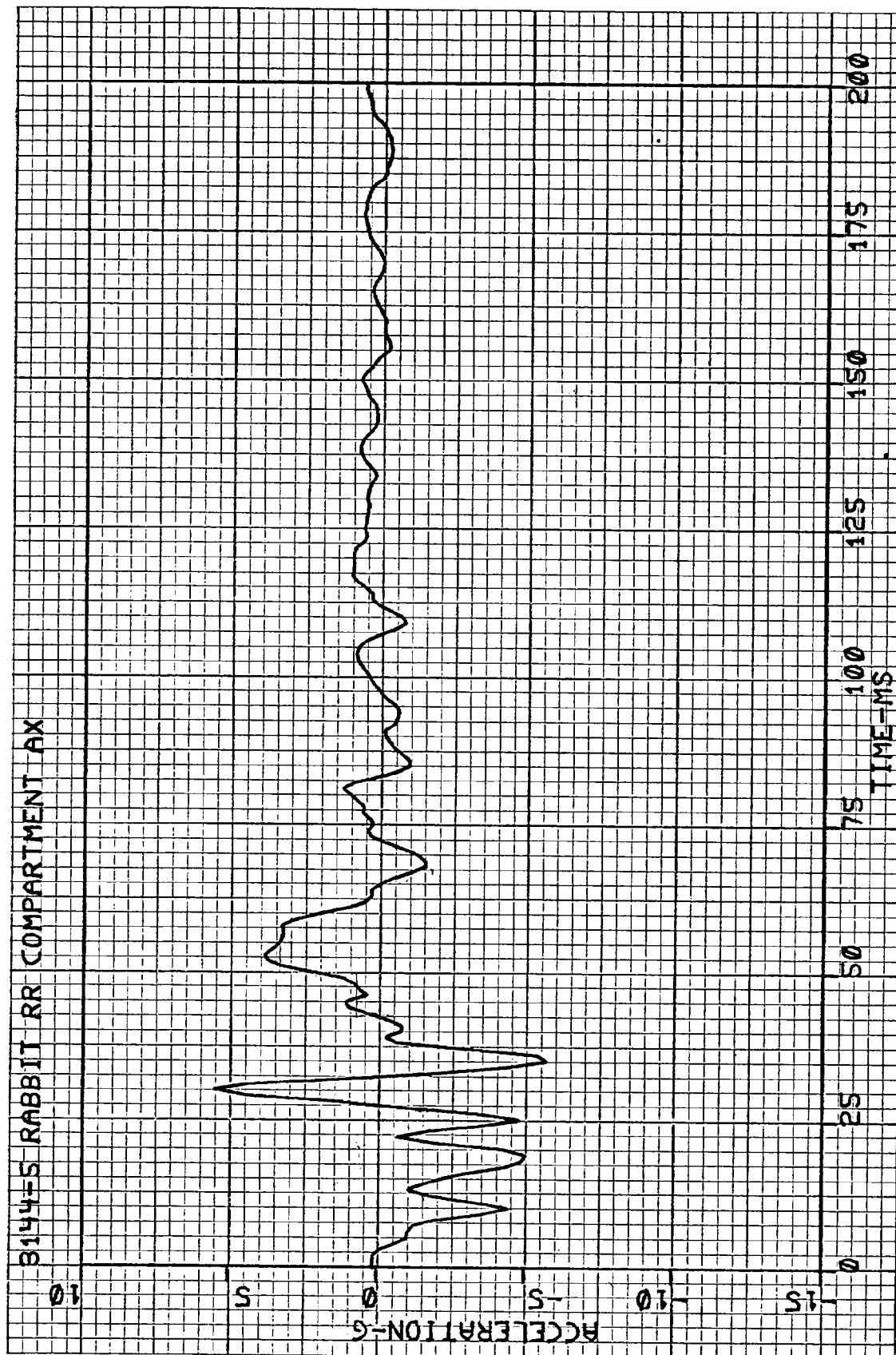


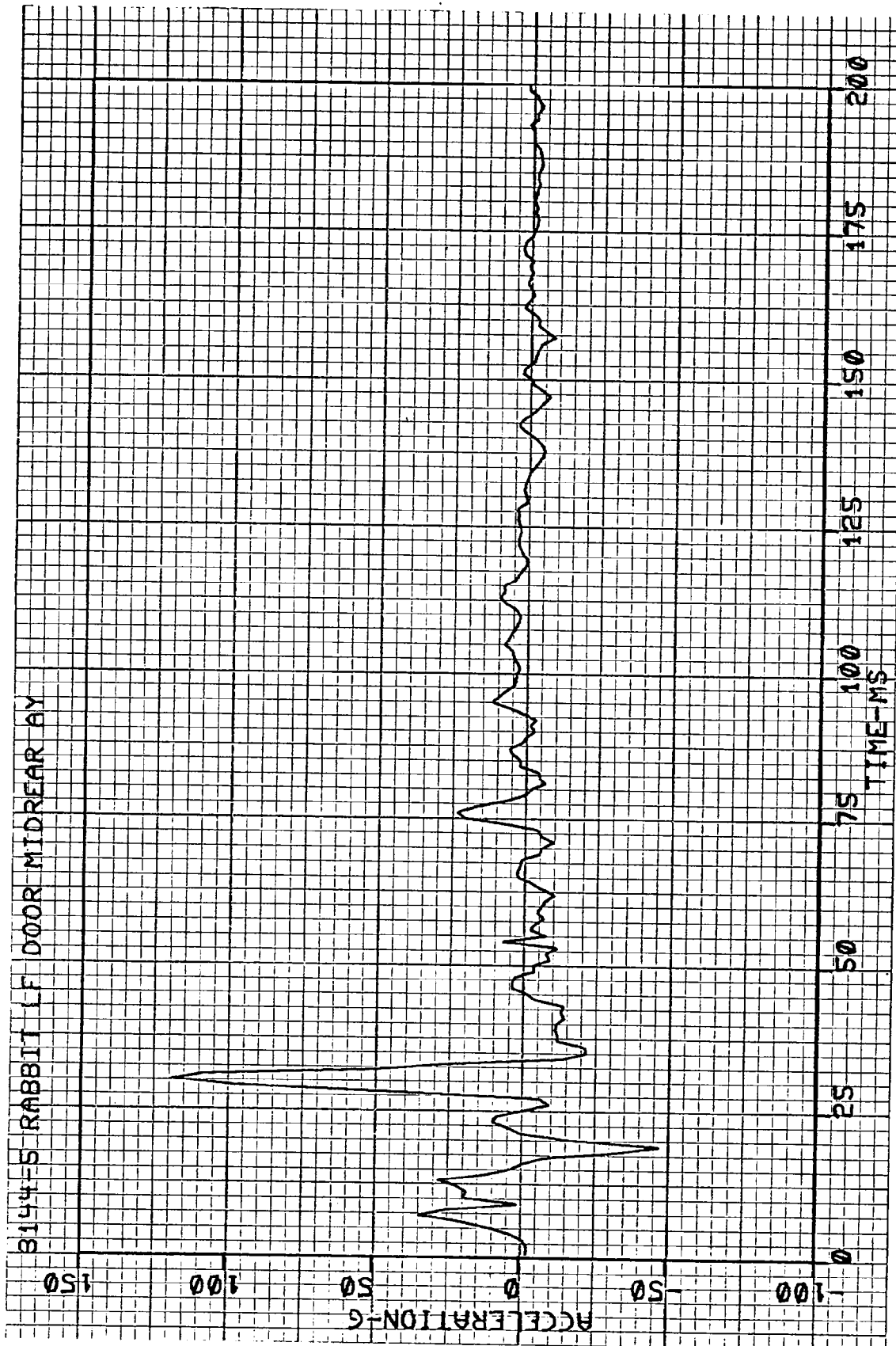


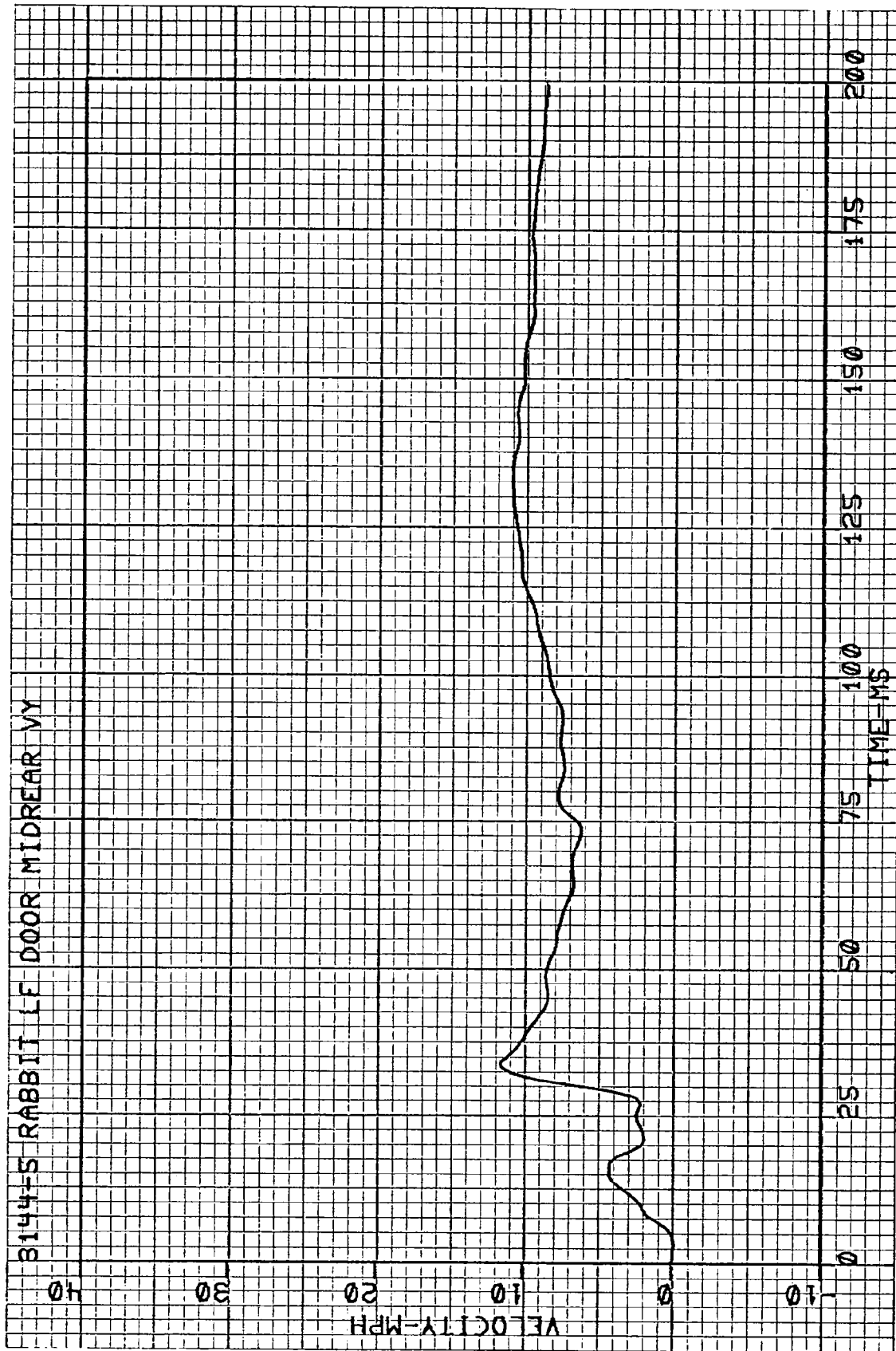


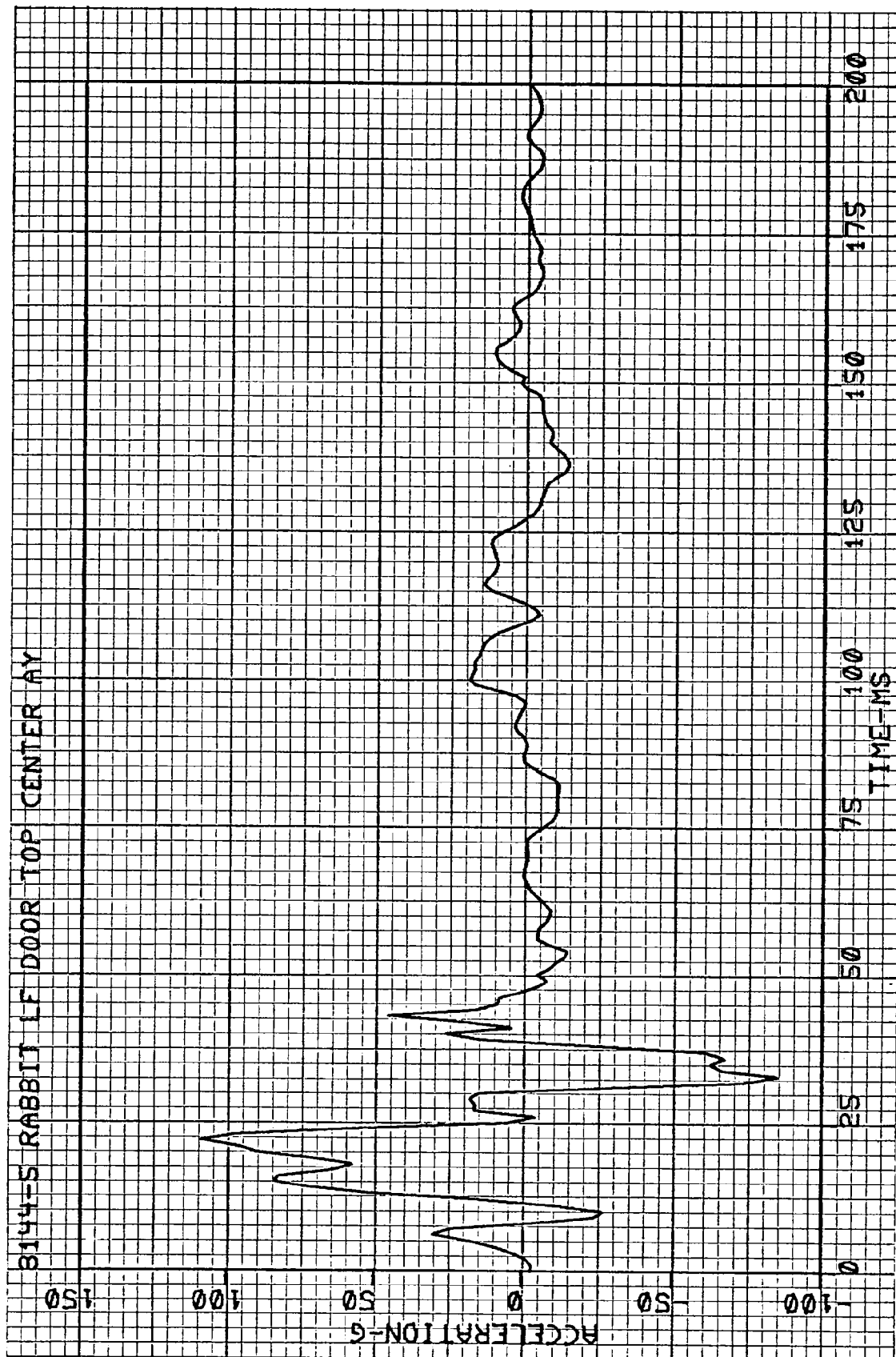


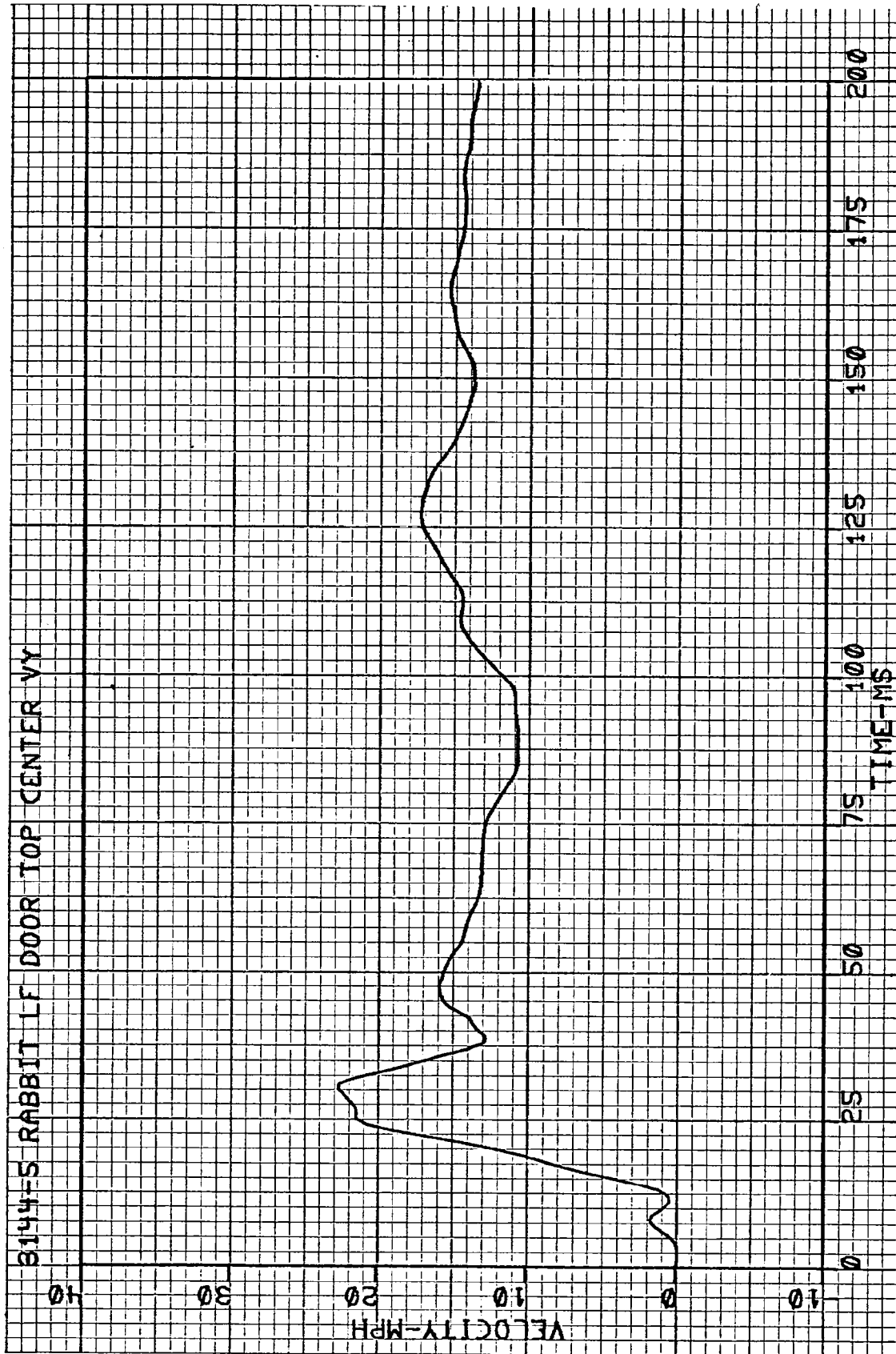


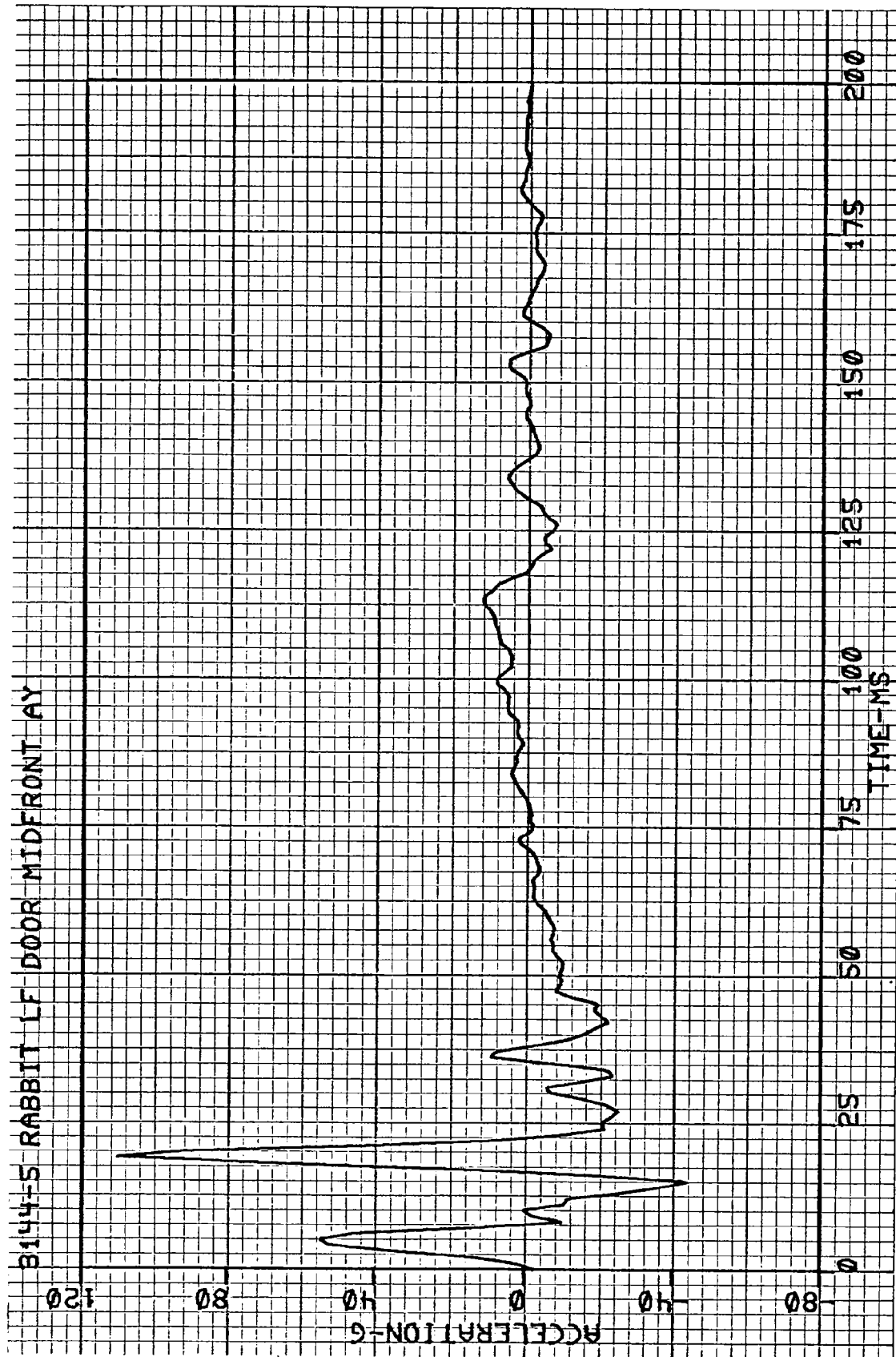


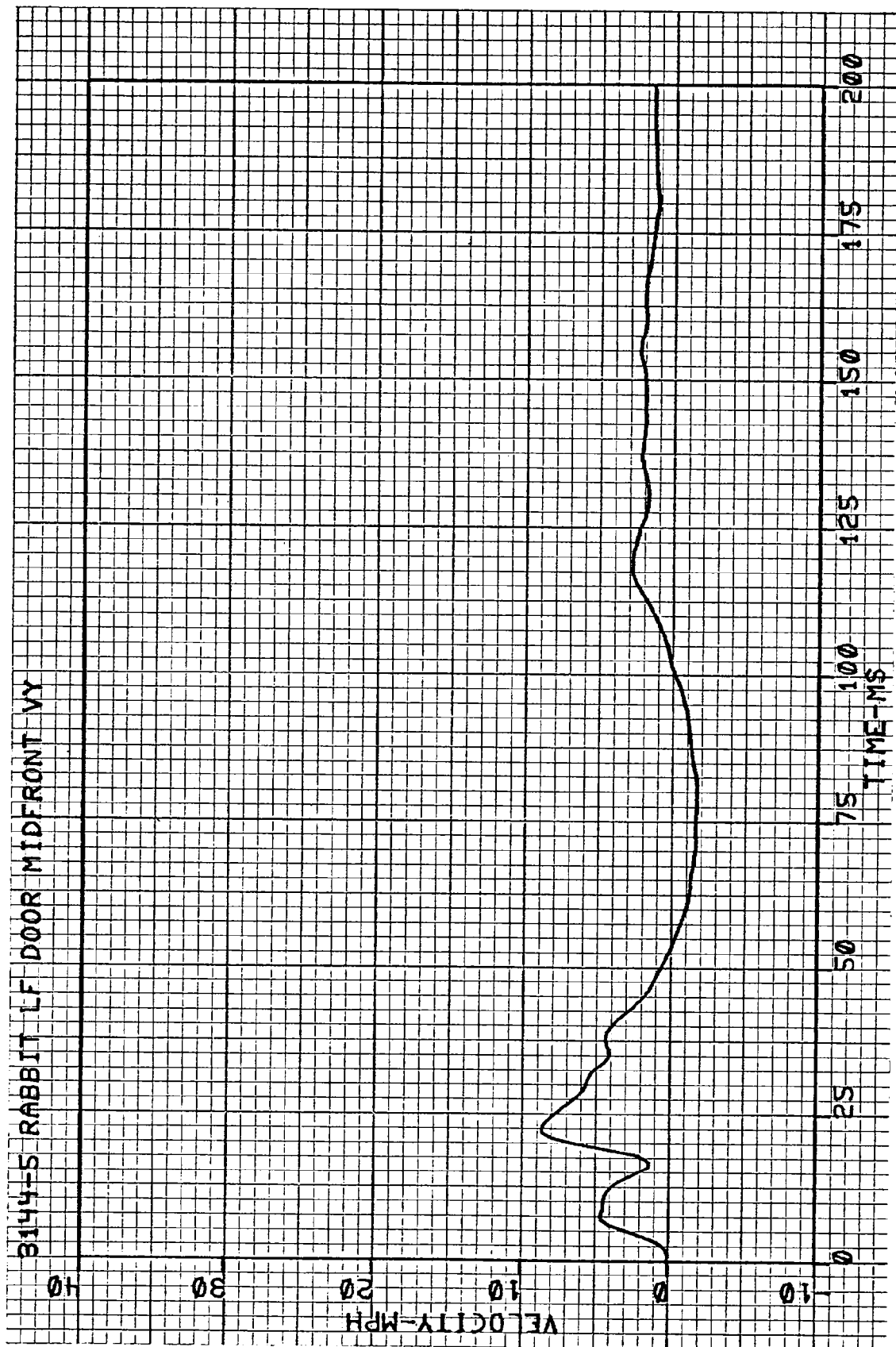


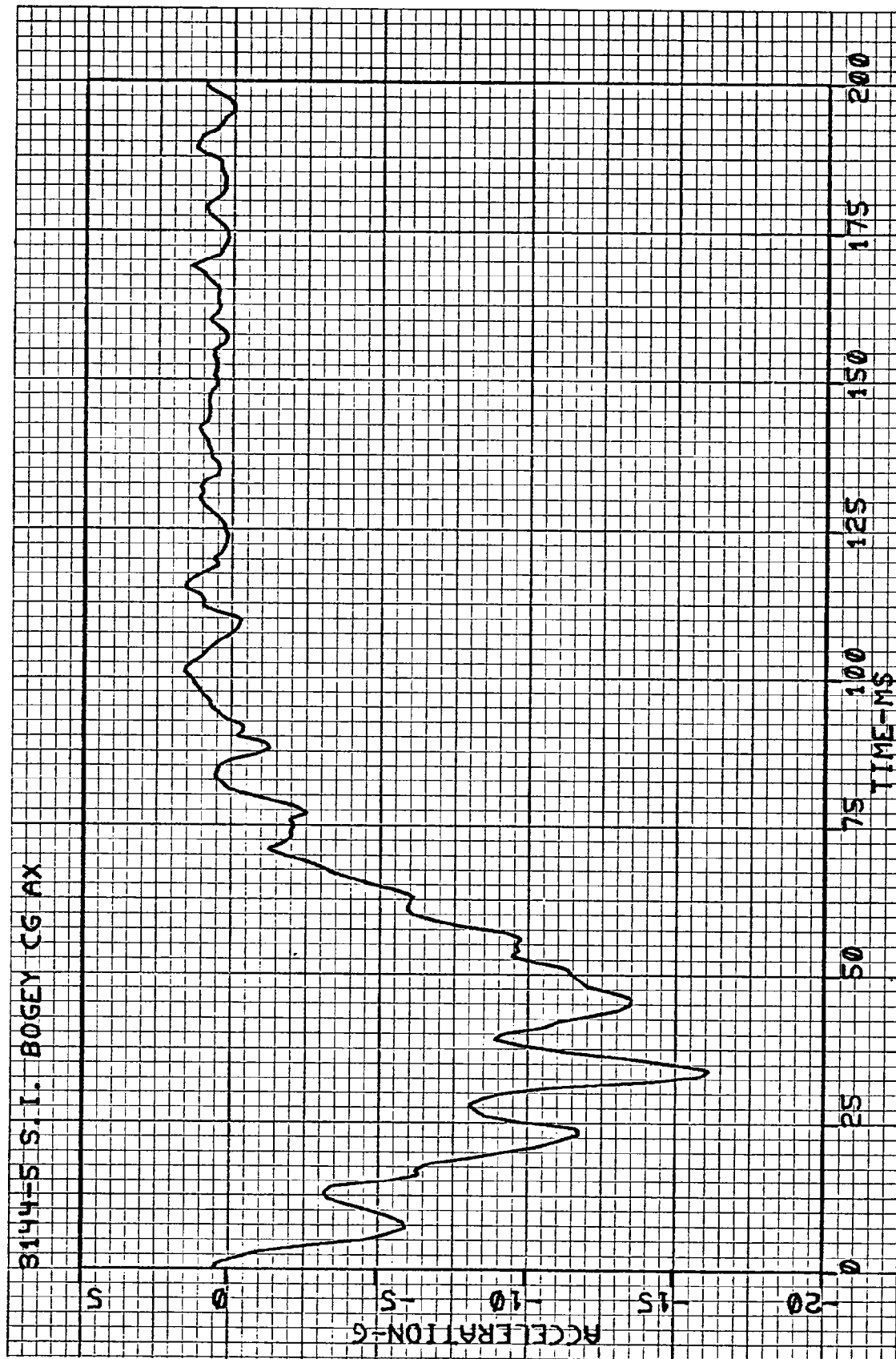


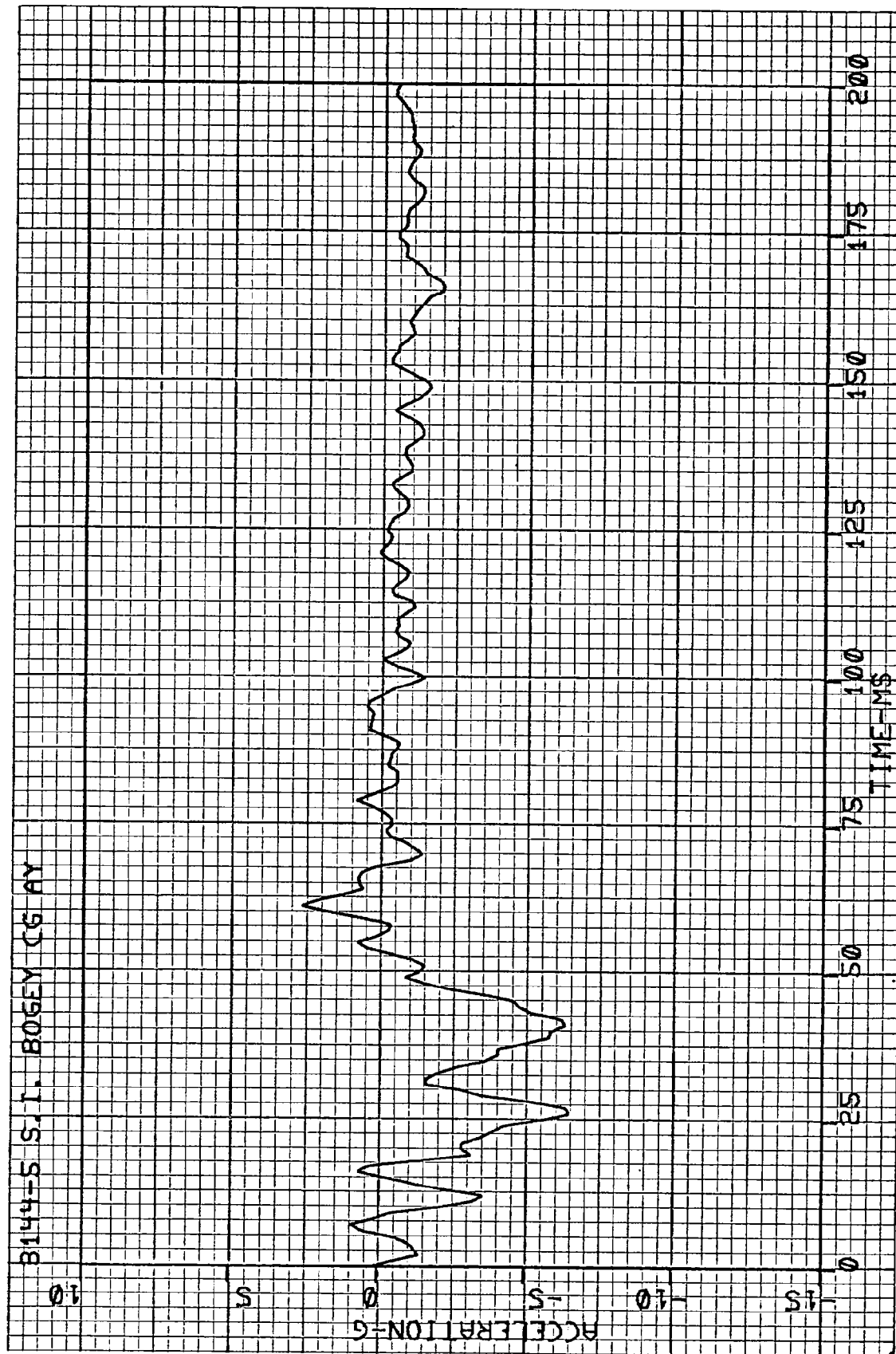


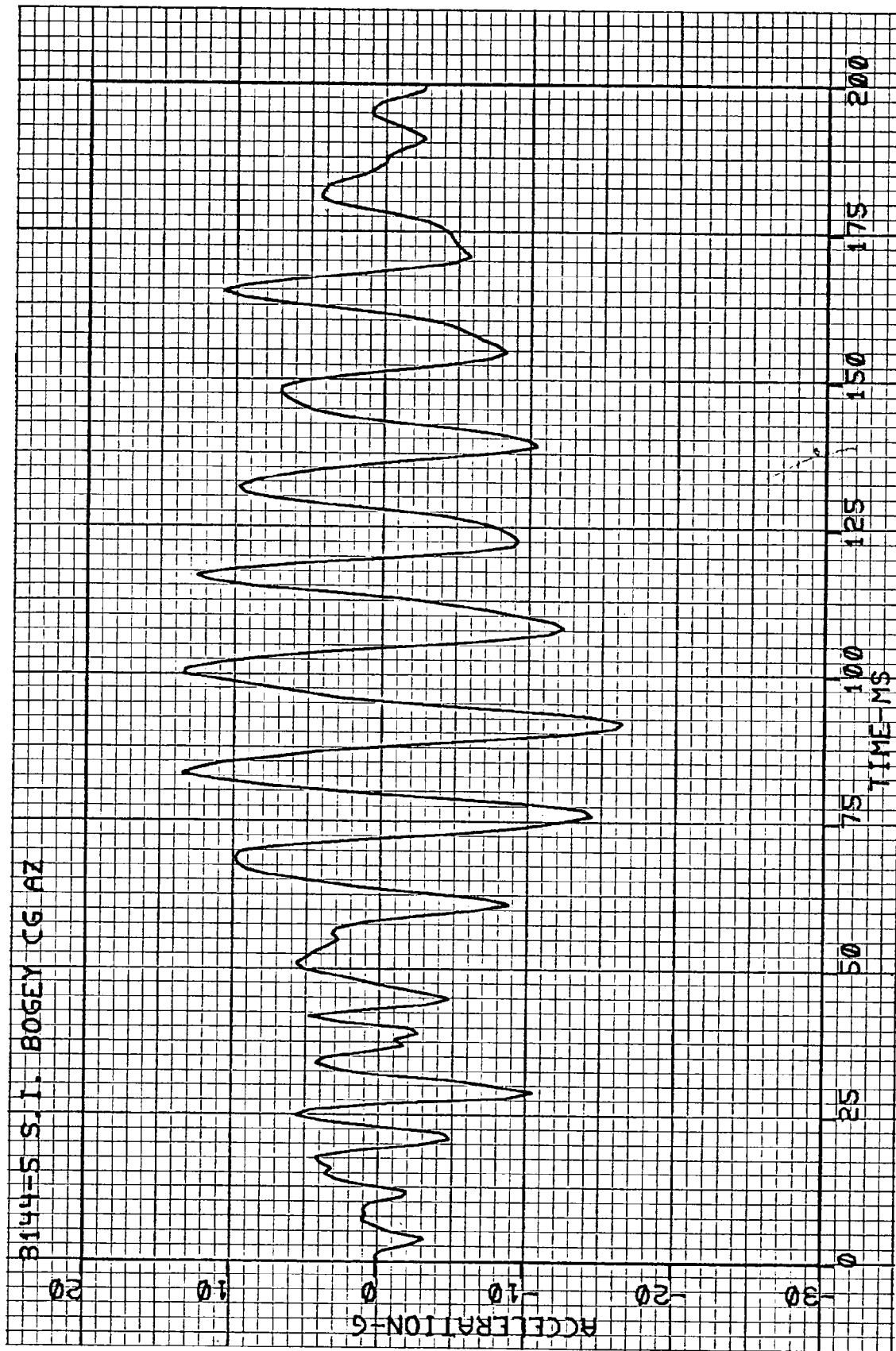


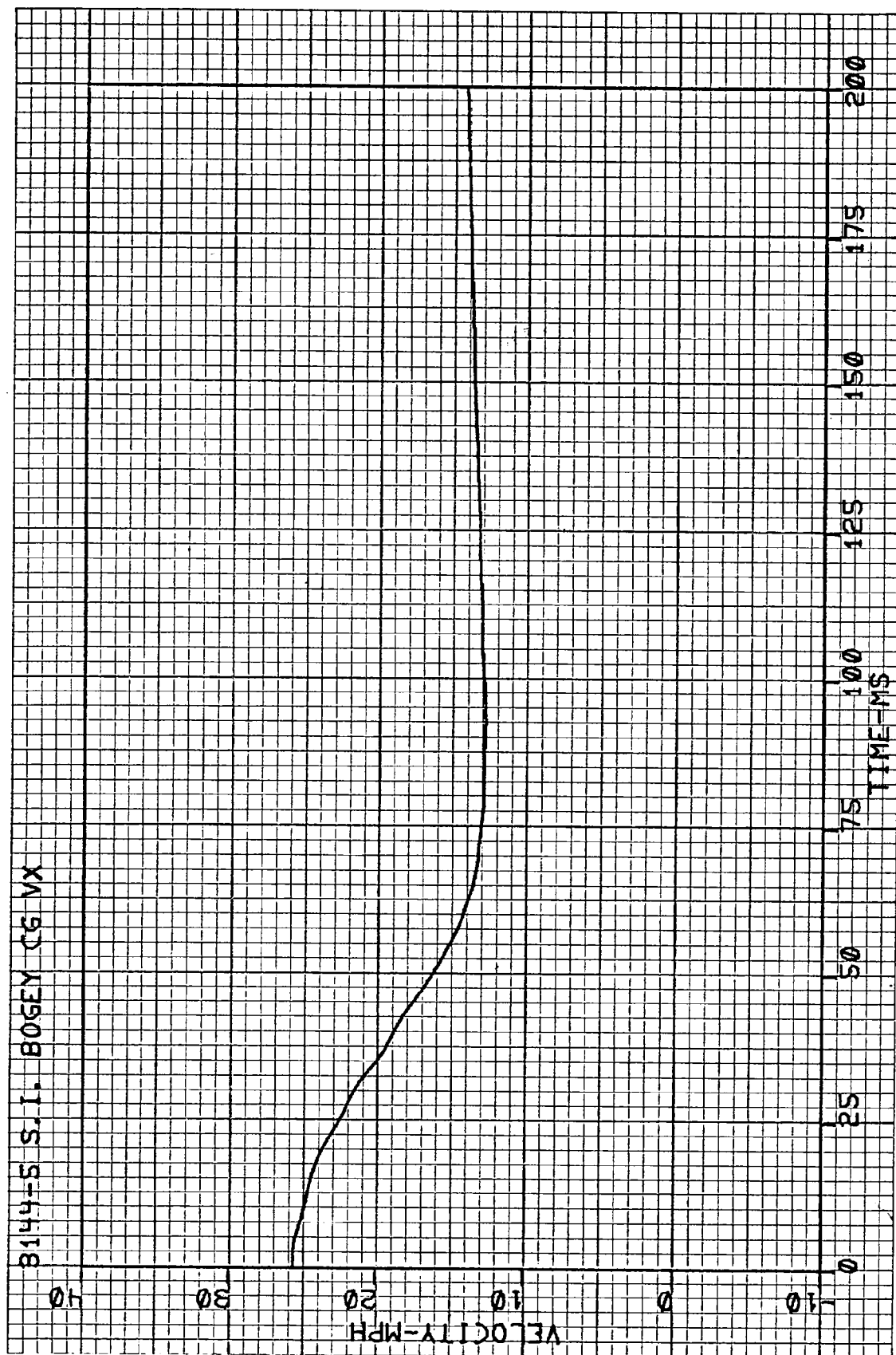


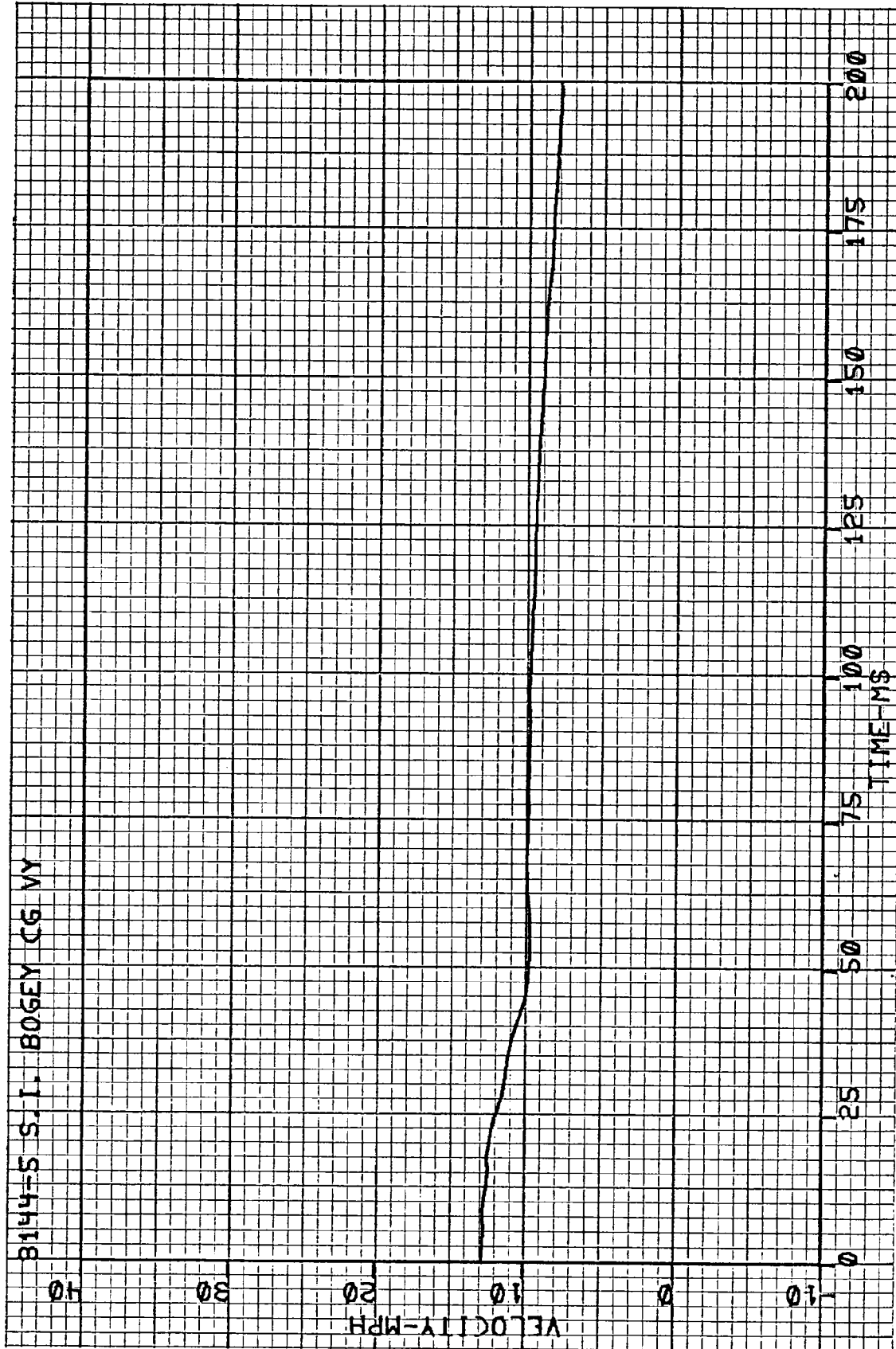


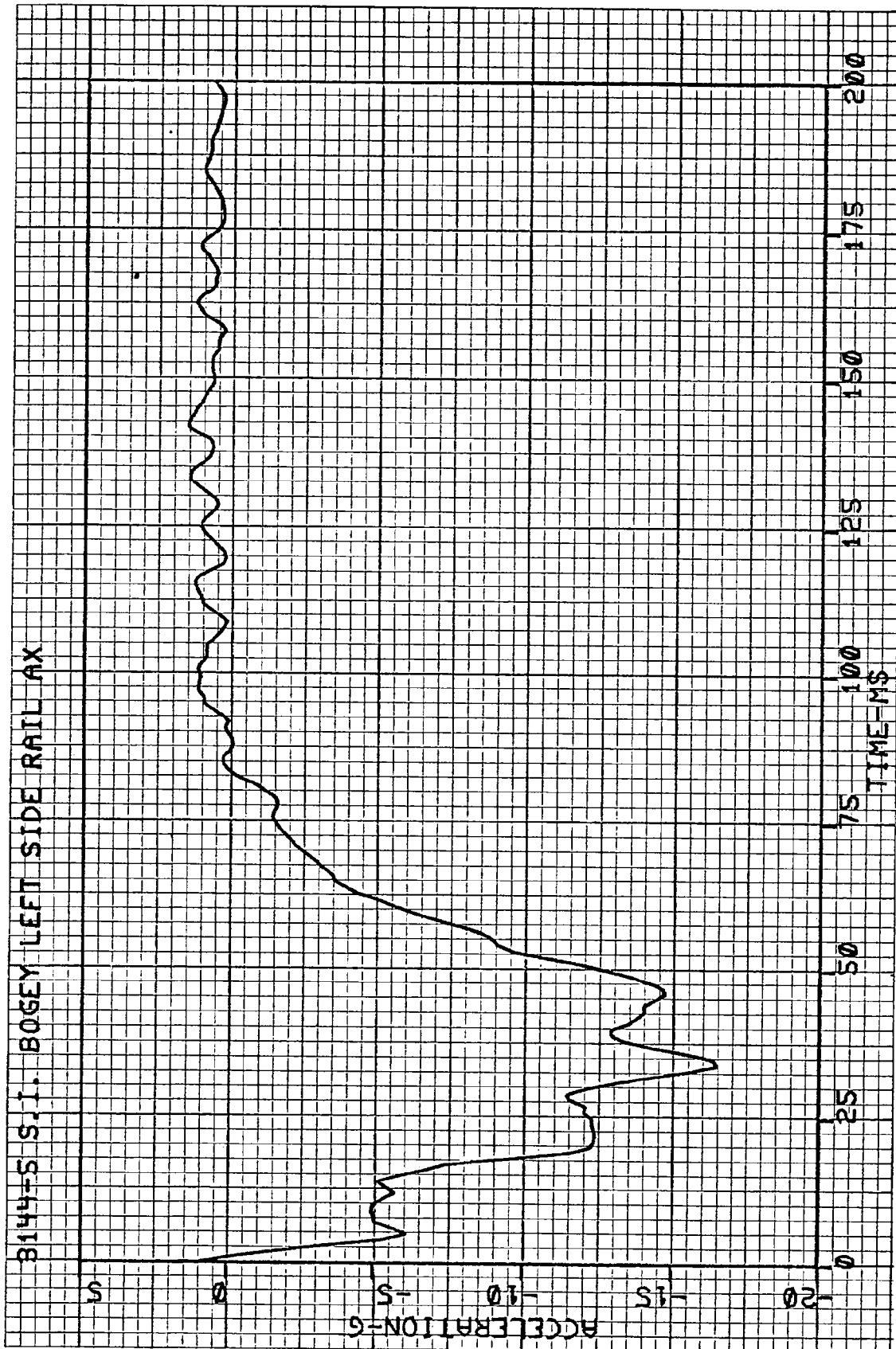


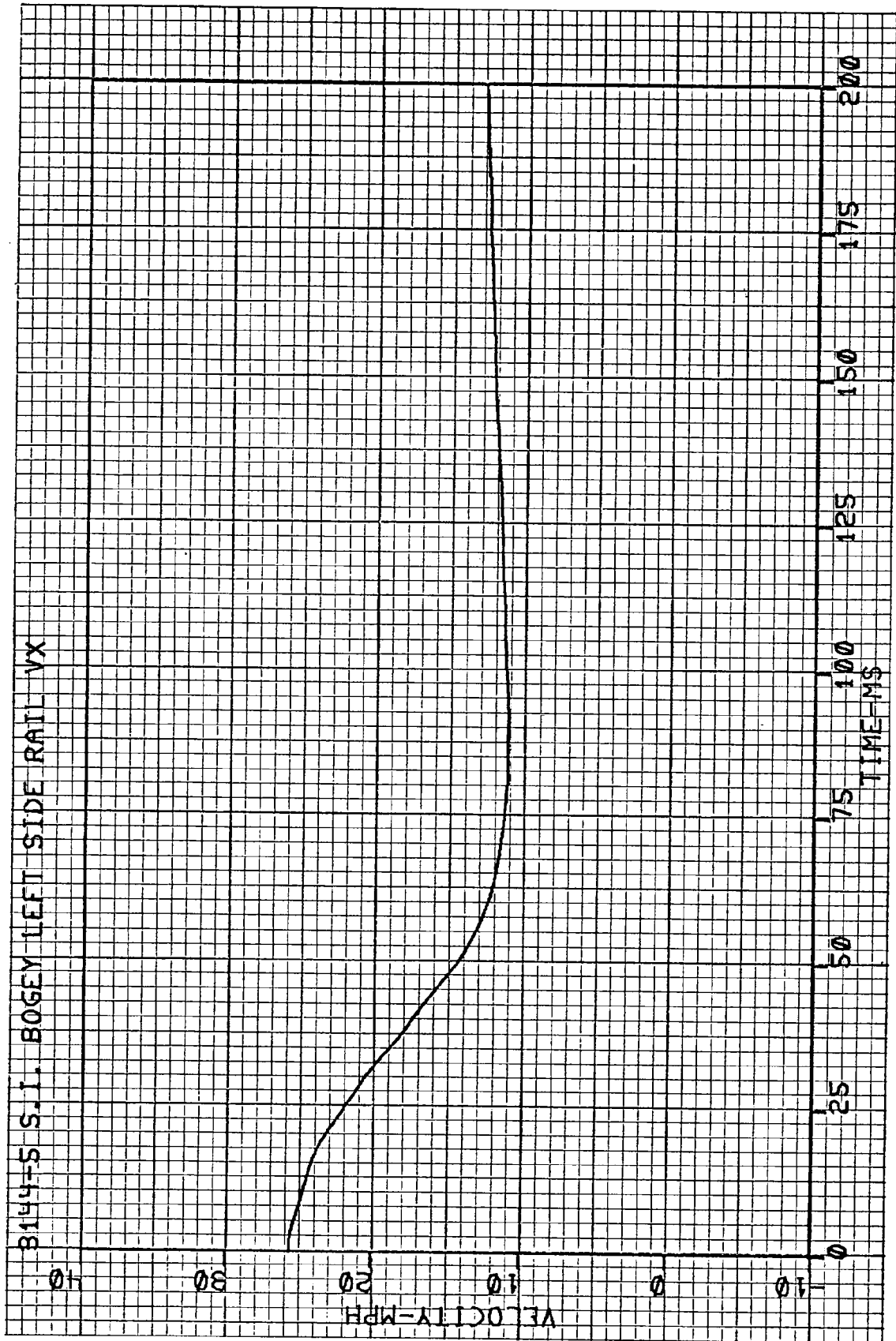


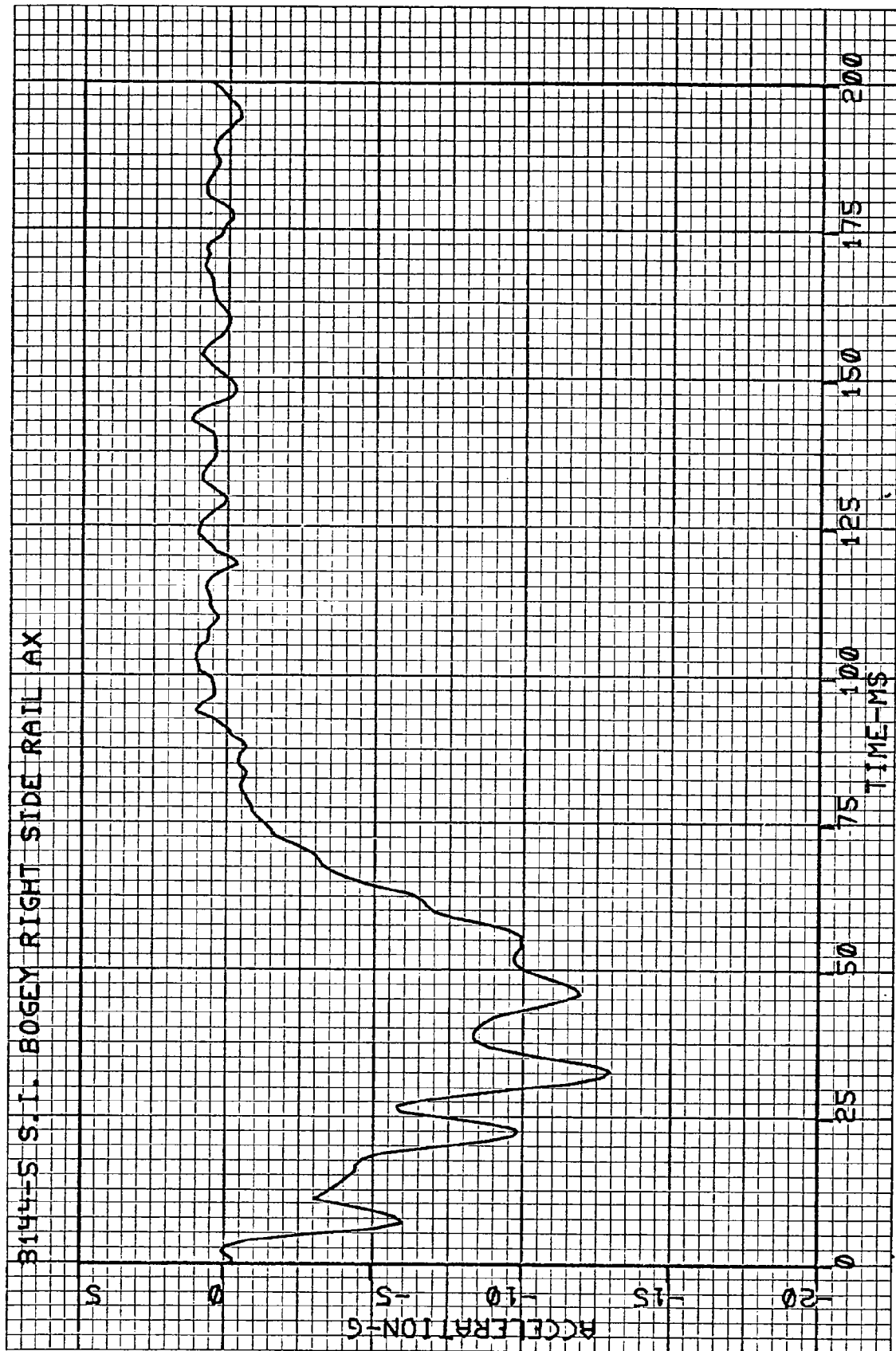


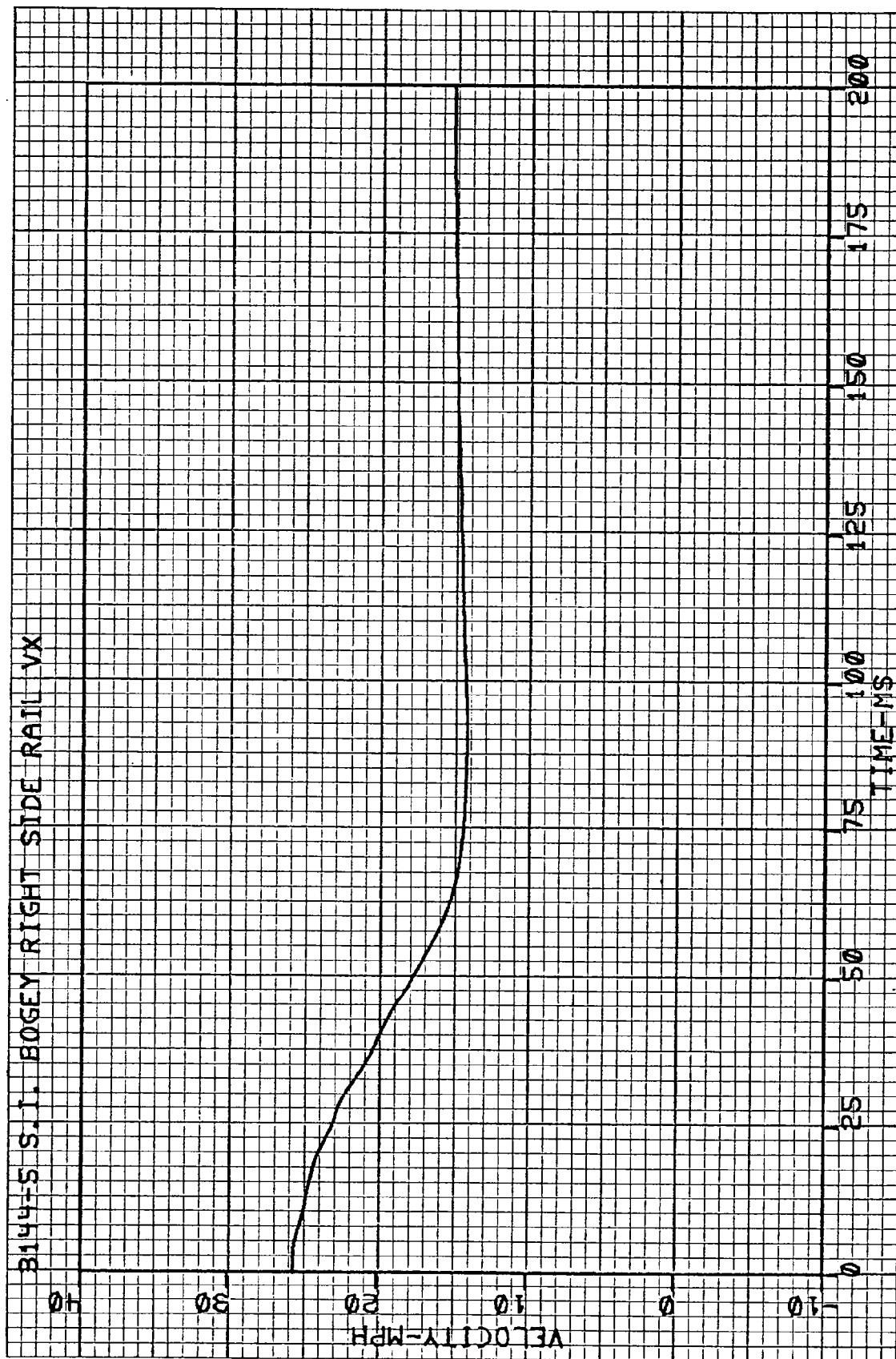












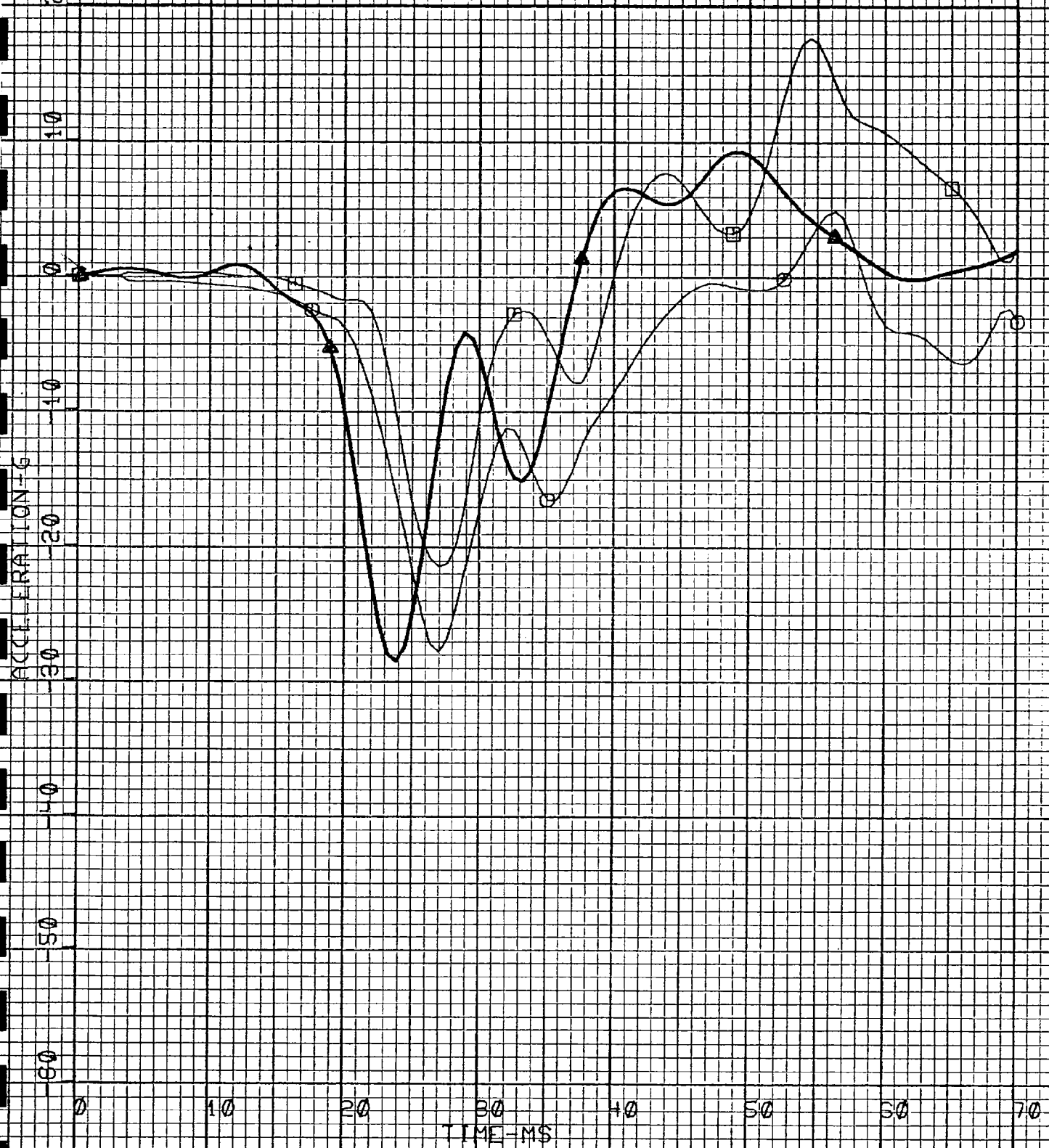
APPENDIX C
DUMMY CALIBRATION DATA
FOR HSRI 122 AND SID 7
26.5° CRABBED SIDE IMPACTOR TO
1982 VOLKSWAGEN RABBIT
AT 28.60 MPH

SID HSRI-122 CAL #7 UPPER LUMBAR LAT P

□ = +2SD

○ = -2SD

▲ = DATA

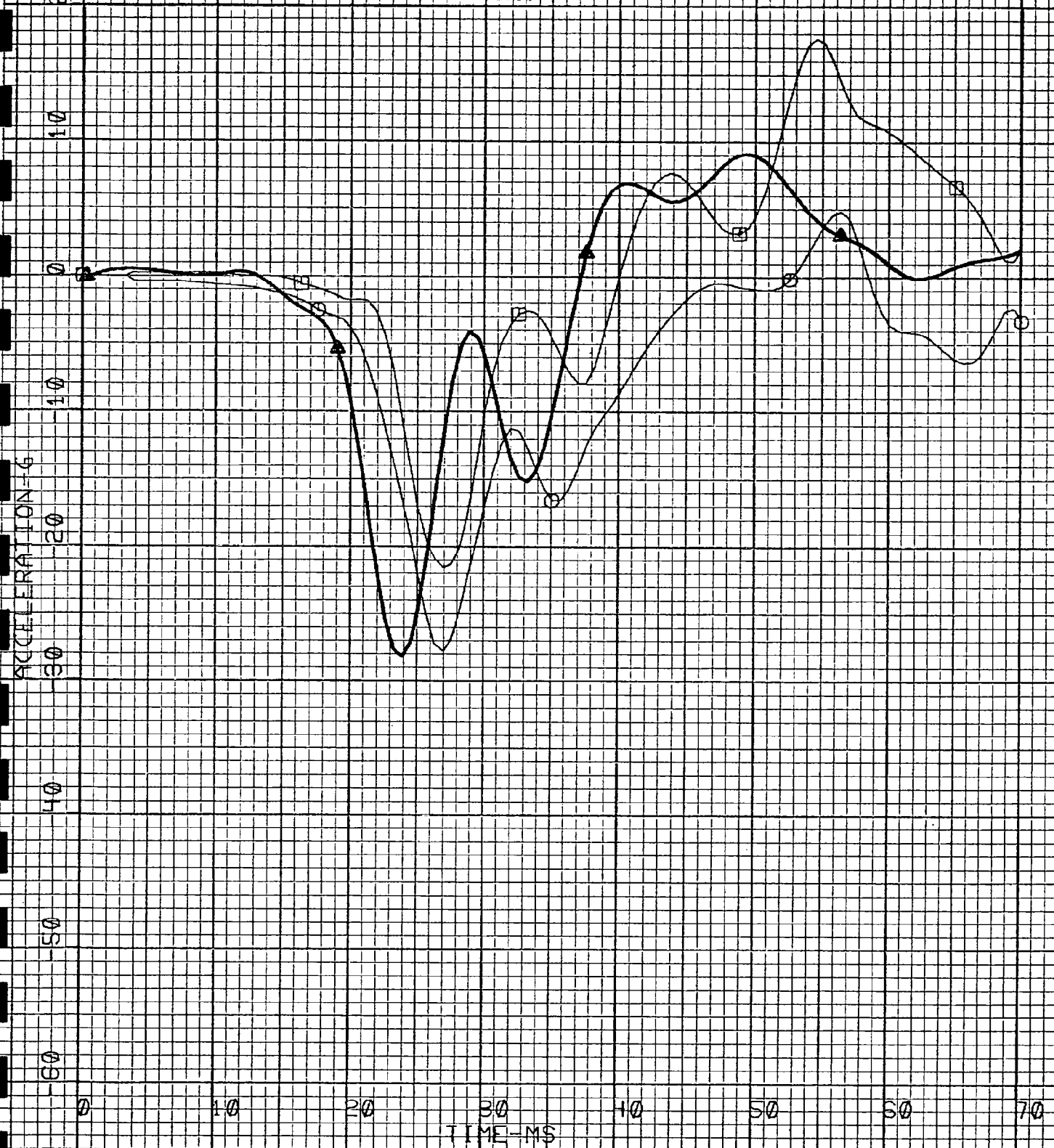


SID HSRI-122 CAL #7 UPPER LUMBAR LAT R

□ = +2SD

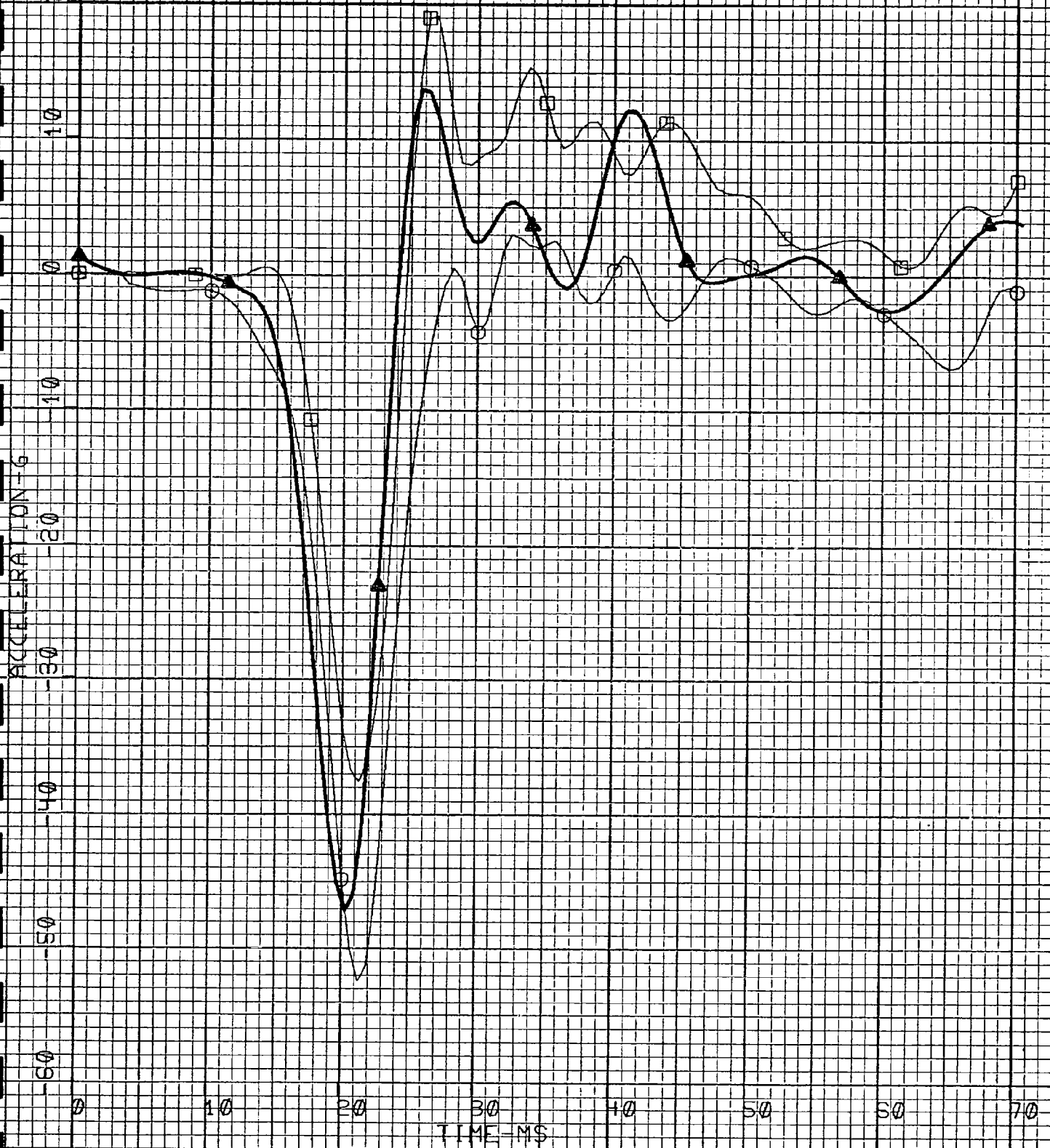
○ = -2SD

Δ = DATA



SID HSRI-122 CAL 47 LEFT LOWER RIB LAT P

□ = +2SD ○ = -2SD ▲ = DATA

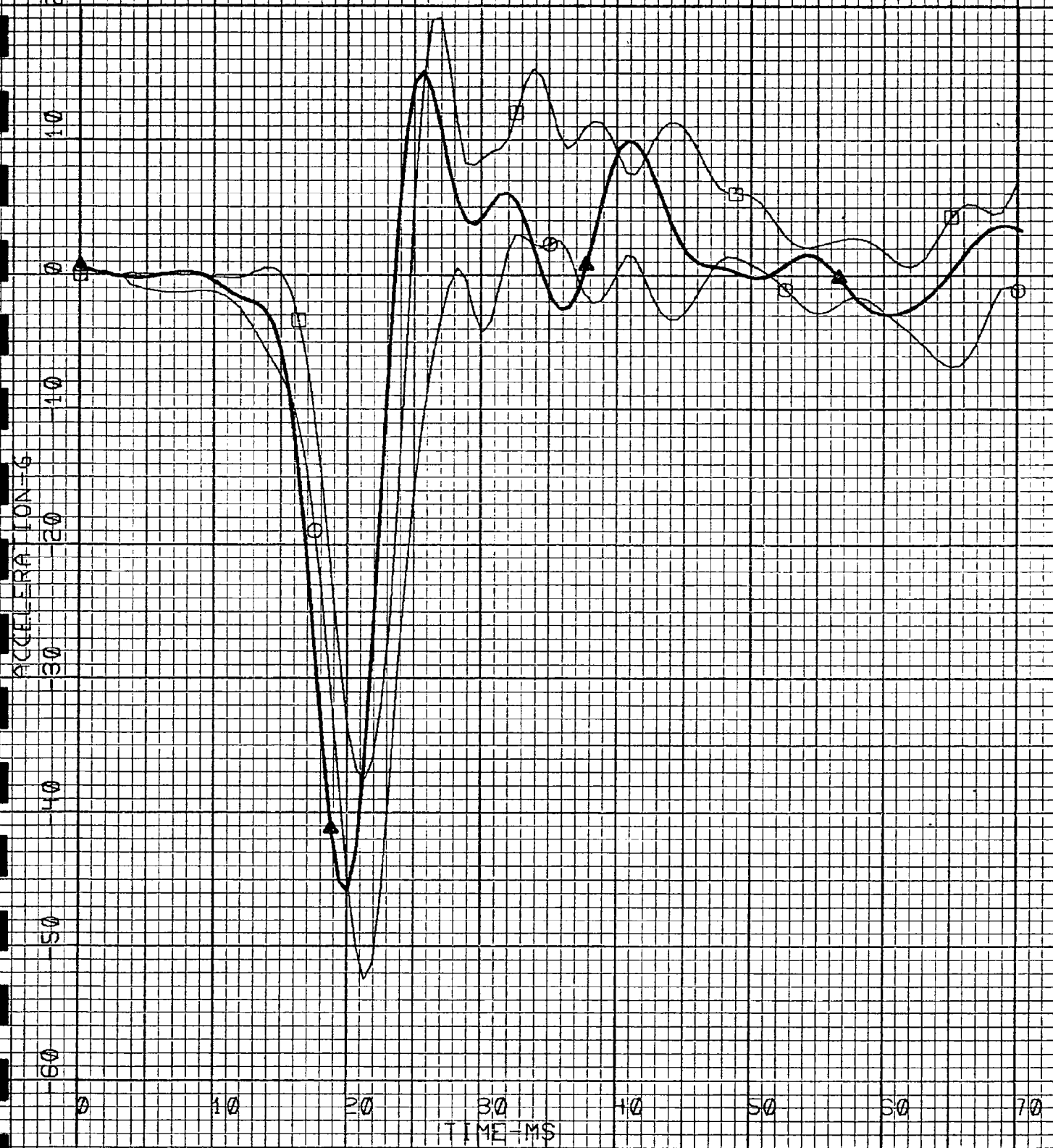


SID HSRI-122 CAL #7 LEFT LOWER RIB LAT R

$\square = +2SD$

$\ominus = -2SD$

$\Delta = \text{DATA}$

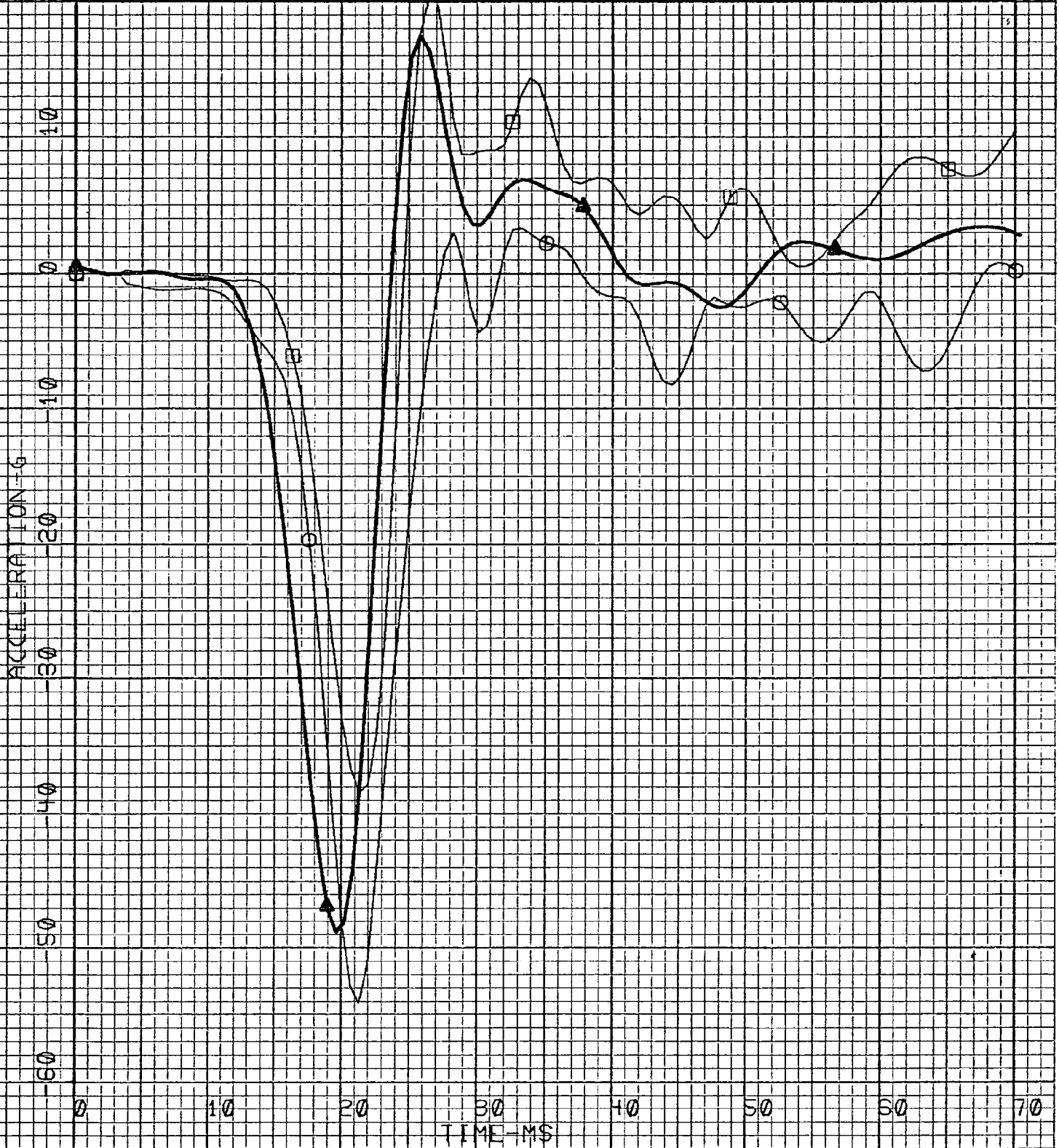


STD HSRI-122 CAL #7 LEFT UPPER RIB LAT P

□ = +2SD

○ = -2SD

Δ = DATA



SID HSRI-122 CAL #7 LEFT UPPER RIB LAT R

□ = +2SD

○ = -2SD

▲ = DATA



SID HSRI=122 CAL #7 LOWER LUMBAR LAT P

□ = +2SD

○ = -2SD

Δ = DATA

ACCELERATION-G

20
10
0
-10
-20
-30
-40
-50
-60

TIME-MS

0 10 20 30 40 50 60 70

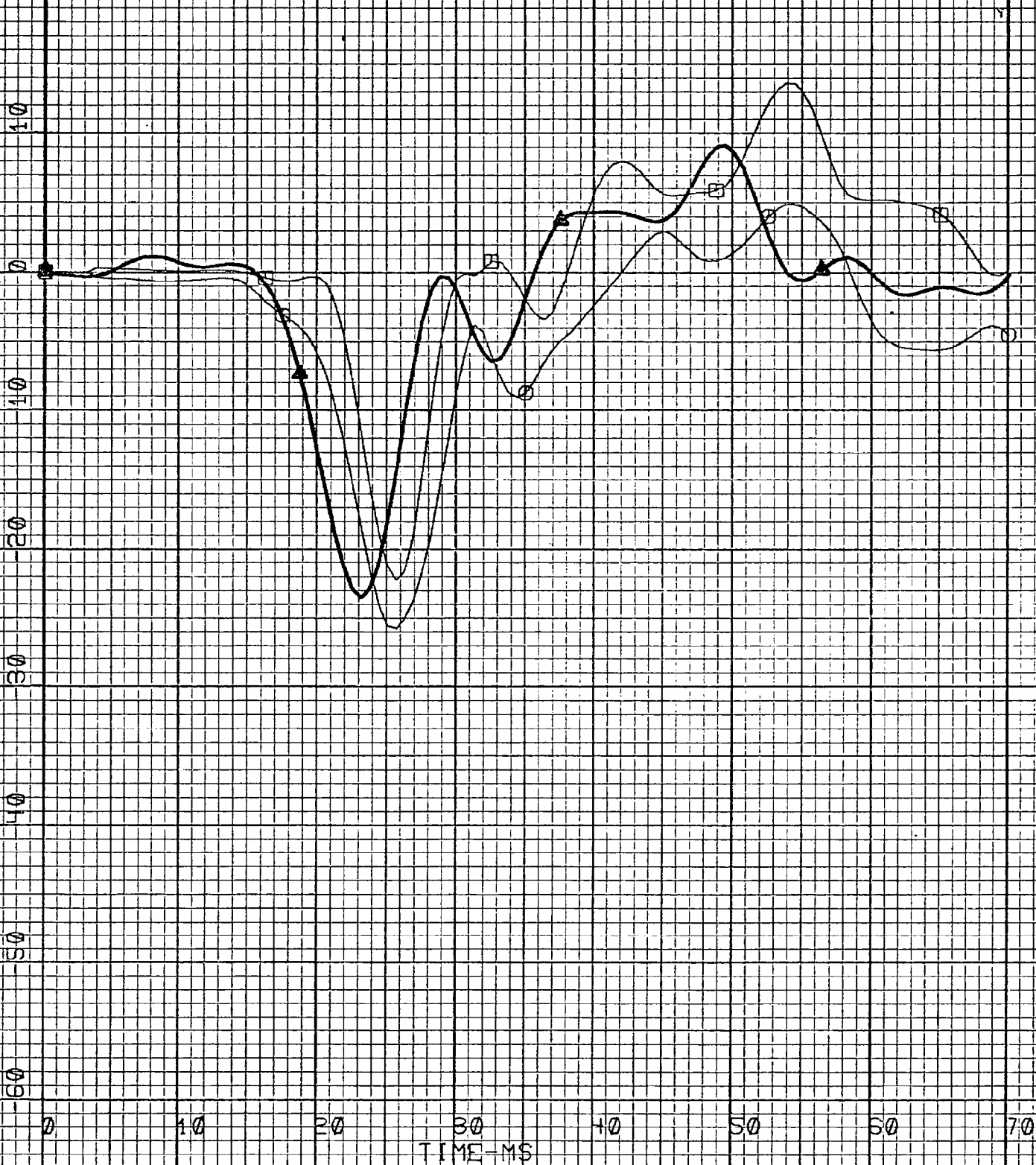
SID HSRI-122 CAL #7 LOWER LUMBAR LAT R

□ = +2SD

○ = -2SD

Δ = DATA

ACCELERATION-G

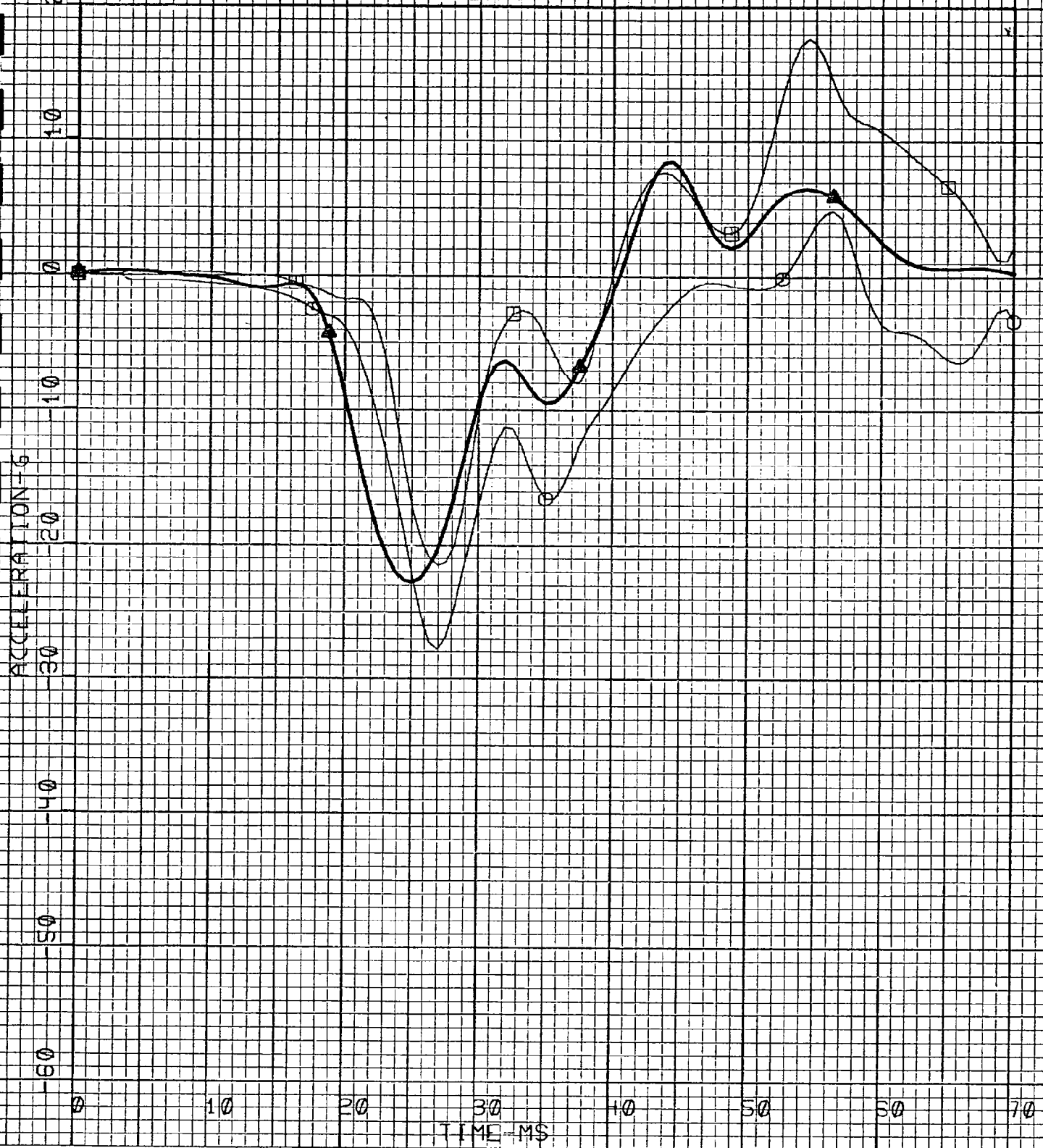


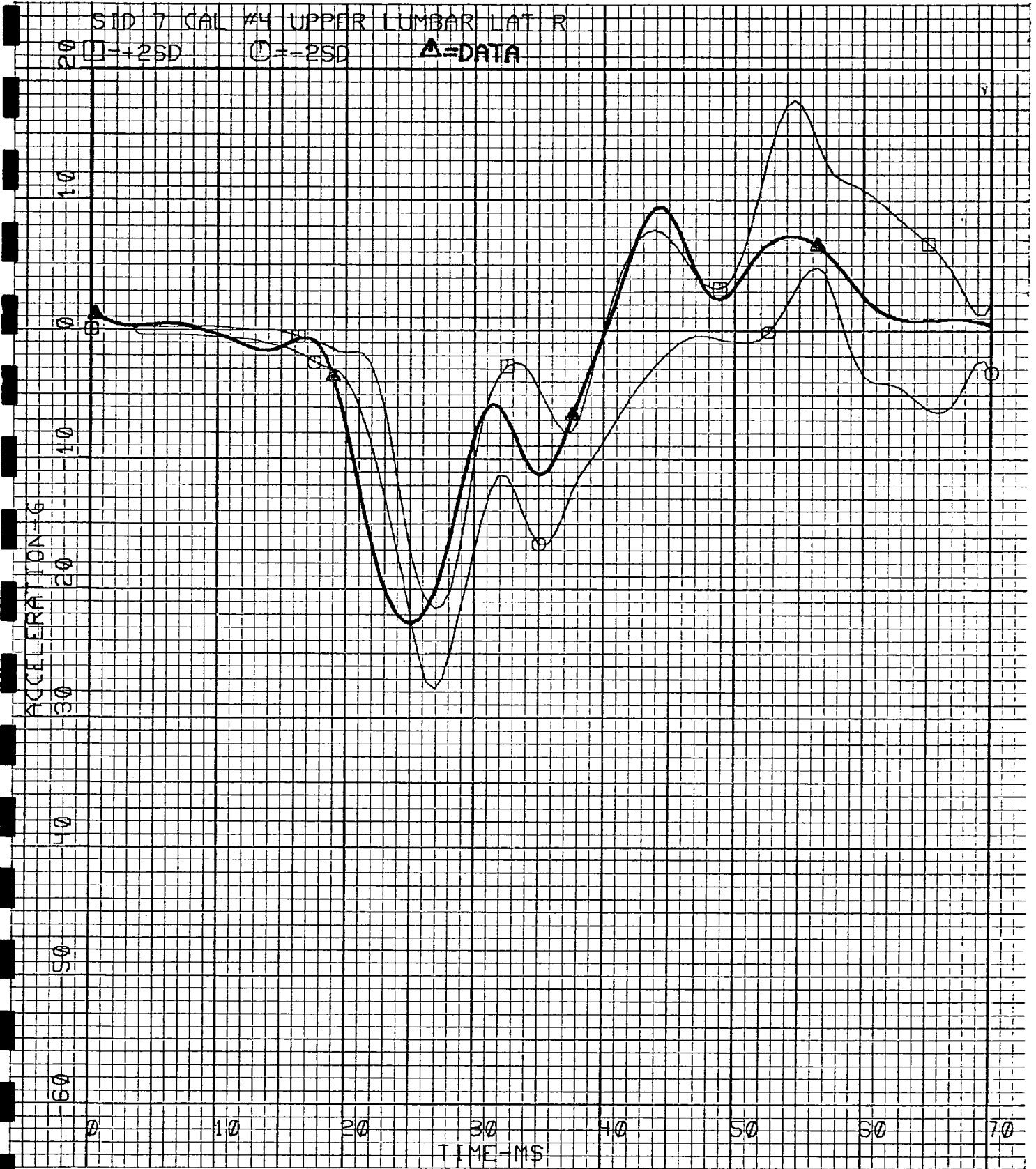
SID 7 CAL #4 UPPER LUMBAR LAT P

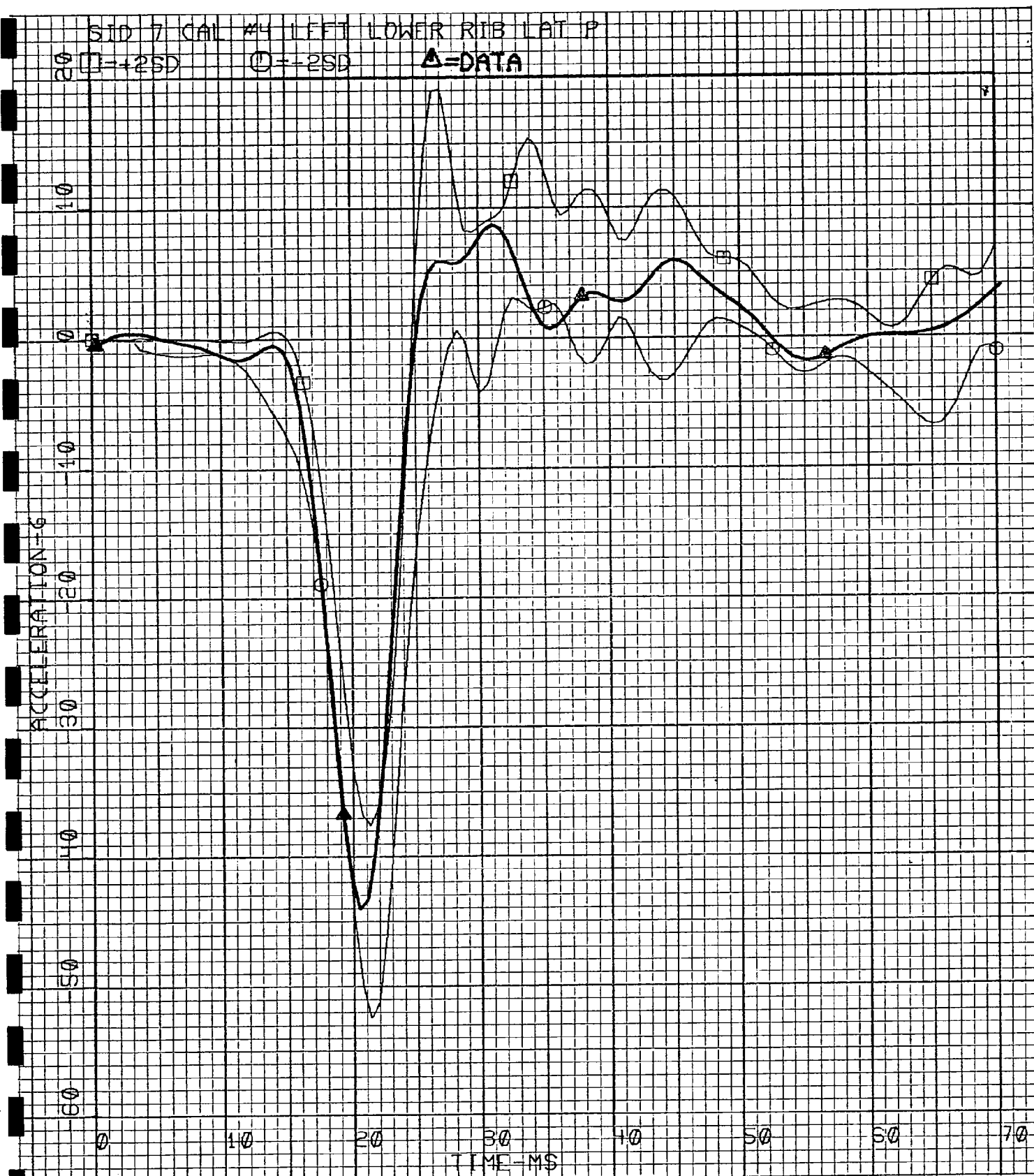
□ = +2SD

○ = -2SD

△ = DATA







SID 7 CAL #4 LEFT LOWER RIB LAT R

$\square = +2SD$

$\circ = -2SD$

$\Delta = DATA$

ACCELERATION-G



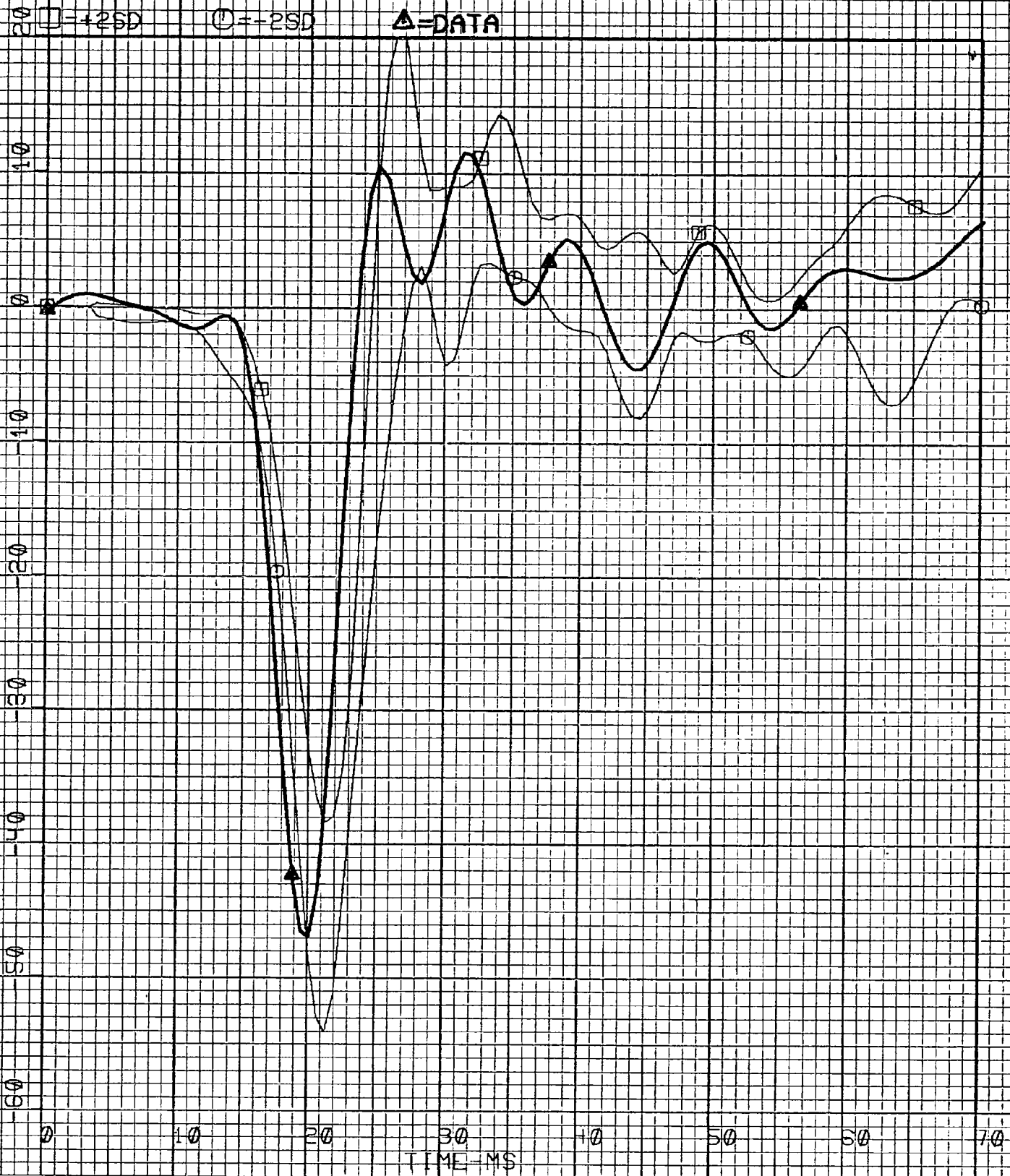
SID 7 CAL #4 LEFT UPPER RIB LAT P

□ = +2SD

○ = -2SD

Δ = DATA

ACCELERATION-G



SID 7 CAL #4 LEFT UPPER RIB LAT R

□ = +2SD

○ = -2SD

Δ = DATA

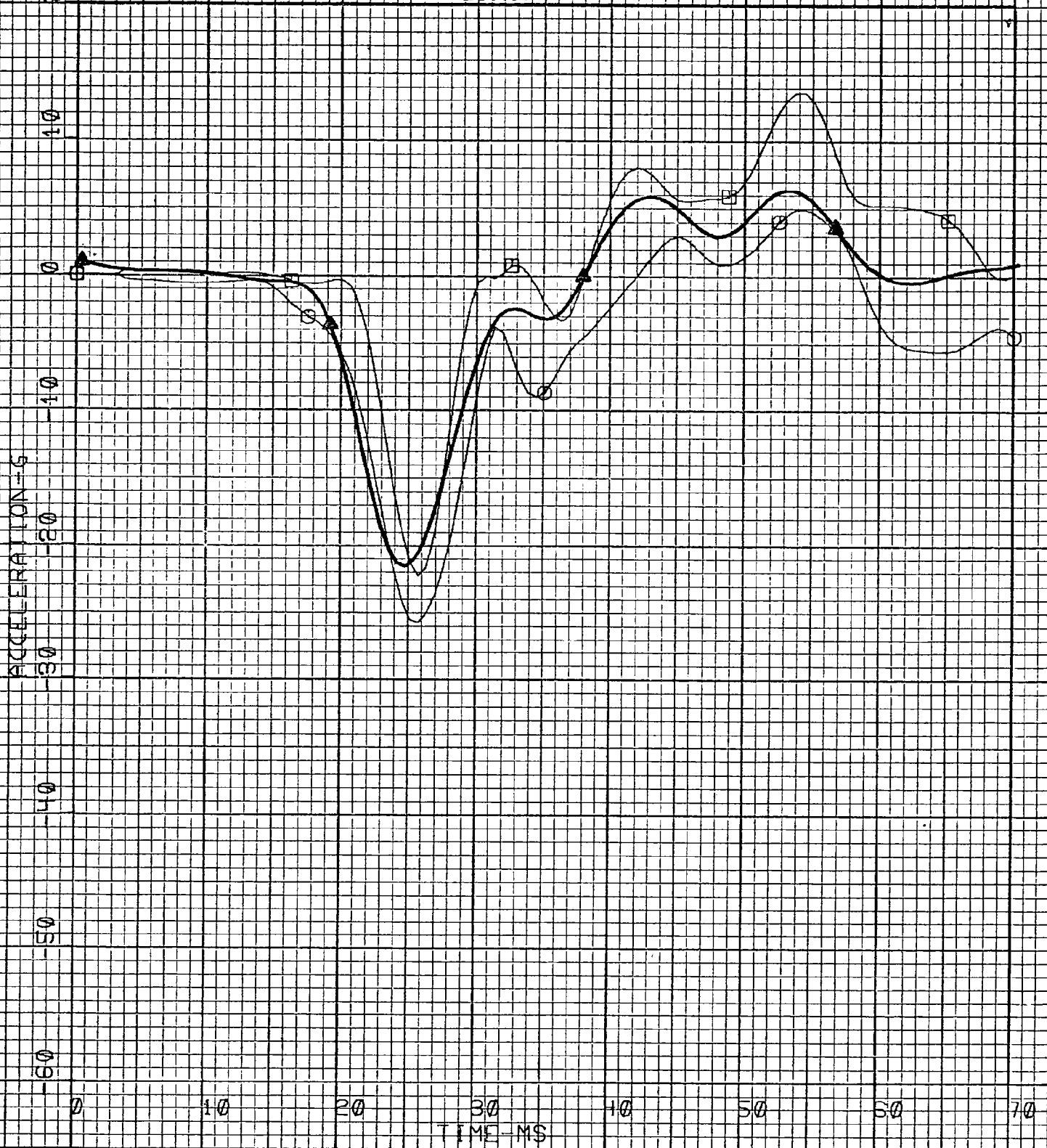


SID 7 CAL #4 LOWER LUMBAR LAT P

□ = +2SD

○ = -2SD

Δ = DATA



SID 7 CAL #4 LOWER LUMBAR LAT R

□ = +2SD

○ = -2SD

▲ = DATA

