

DO 14 60 1

Dynamic Science Report No. 3154-83-046/2104

AIR BAG FLEET RETROFIT PROGRAM  
CRASH TESTS

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TEST NO. 3154-3  
1981 DODGE DIPLOMAT  
4-DOOR SEDAN

Prepared by:

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

October 1983

TEST REPORT

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.**  
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Prepared by R. GARN

Approved by Rod Garn

Date 10-12-83

Report Accepted by:

\_\_\_\_\_  
Contract Technical Manager  
Office of Vehicle Safety Compliance

\_\_\_\_\_  
Date

## TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle AIR BAG FLEET RETROFIT PROGRAM CRASH TEST - TEST NO. 3154-3 - 1981 DODGE DIPLOMAT 4-DOOR SEDAN		5. Report Date October 1983	
		6. Performing Orgn Code	
7. Author(s) Rod Garn, Project Engineer		8. Performing Orgn Rpt No. 3145-83-046/2104	
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. DTNH22-82-A-17148	
		13. Type of Report and Period Covered Test Report October 1983	
12. Sponsoring Agency Name and Address United States Department of Transportation National Highway Traffic Safety Administration 400 Seventh Street, S.W. Washington, D.C. 20590		14. Sponsoring Agency Code	
		15. Supplementary Notes	
16. Abstract			
<p>The objective of this program is to obtain performance data on a driver air bag restraint system retrofitted in police vehicles.</p> <p>One calibrated 50th percentile Part 572 dummy was utilized to obtain occupant response data relative to FMVSS 208 requirements. Various vehicle mounted accelerometers were utilized to monitor vehicle response to the impact environment. Air bag crash sensor actuation, firing squib current, and diagnostic system power source were electronically monitored throughout the impact event.</p> <p>This report contains results of all electronic data obtained during frontal barrier crash testing of a 1981 Dodge Diplomat 4-Door Sedan at Dynamic Science, Inc. on October 3, 1983. Impact speed was 29.44 mph.</p>			
17. Key Words Frontal Barrier Testing, Air Cushion Restraint System		18. Distribution Statement Copies are available from Technical Reference Division, National Highway Traffic Safety Administration, 400 7th Street, S.W., Washington, DC 20590	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. Pages 46	22. Price

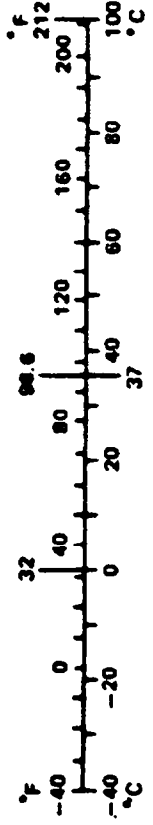
# METRIC CONVERSION FACTORS

## Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
<b>LENGTH</b>				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
<b>AREA</b>				
in <sup>2</sup>	square inches	6.5	square centimeters	cm <sup>2</sup>
ft <sup>2</sup>	square feet	0.09	square meters	m <sup>2</sup>
yd <sup>2</sup>	square yards	0.8	square meters	m <sup>2</sup>
mi <sup>2</sup>	square miles	2.6	square kilometers	km <sup>2</sup>
acres	acres	0.4	hectares	ha
<b>MASS (weight)</b>				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons	0.9	metric ton	t
	(2000 lb)			
<b>VOLUME</b>				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
in <sup>3</sup>	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 <sup>3</sup>	cubic feet	0.03	cubic meters	m <sup>3</sup>
yd <sup>3</sup>	cubic yards	0.76	cubic meters	m <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°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
<b>LENGTH</b>				
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
<b>AREA</b>				
cm <sup>2</sup>	square centimeters	0.16	square inches	in <sup>2</sup>
m <sup>2</sup>	square meters	1.2	square yards	yd <sup>2</sup>
km <sup>2</sup>	square kilometers	0.4	square miles	mi <sup>2</sup>
ha	hectares	2.5	acres	acres
	(10 000 m <sup>2</sup> )			
<b>MASS (weight)</b>				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton	1.1	short tons	
	(1000 kg)			
<b>VOLUME</b>				
ml	milliliters	0.03	fluid ounces	fl oz
ml	milliliters	0.06	cubic inches	in <sup>3</sup>
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m <sup>3</sup>	cubic meters	35	cubic feet	ft <sup>3</sup>
m <sup>3</sup>	cubic meters	1.3	cubic yards	yd <sup>3</sup>
<b>TEMPERATURE (exact)</b>				
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F



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## **1.0 PURPOSE AND TEST PROCEDURE**

### **1.1 PURPOSE**

A series of six tests is planned for inclusion in this program; the objective of each being to obtain performance data on a driver air bag restraint system retrofitted into selected police vehicles. Five of the planned tests will be 90° flat frontal barrier impacts, with the remaining test being a 12-inch diameter pole barrier impact.

### **1.2 TEST PROCEDURE**

One complete air bag restraint system, including steering wheel, inflator, air bag, and auxiliary knee bolster will be retrofitted into each candidate vehicle. Installation will be accomplished in conjunction with, and under the direction of, the air bag system development contractor, Romeo Kojyo Company Ltd.

One 50th percentile Part 572 dummy will be utilized in each test to obtain occupant response data relative to FMVSS 208 requirements. Various vehicle mounted accelerometers will be utilized to monitor vehicle response to the impact environment. Air bag crash sensor actuation, firing squib current, and diagnostic system power source will be electronically monitored throughout the impact event.

Actual test procedures utilized will be in general accordance with NHTSA Laboratory Procedure TP-219-02 with modifications and substitutions as directed by the Statement of Work for Contract No. DTNH22-82-A-17148 and the designated NHTSA Contract Technical Monitor.

## 2.0 REPORT ORGANIZATION

This report contains results of all electronic data obtained during frontal barrier crash testing of a 1981 Dodge Diplomat 4-Door Sedan, at Dynamic Science, Inc. on October 3, 1983. Impact speed was 29.44 mph.

Summary results are presented in tabulated format in the following data sheets:

- General Test and Vehicle Parameter Data
- Part 572 Dummy In-Vehicle Position Recording Sheet
- Summary of Vehicle Accelerometer Data
- FMVSS 208 Dummy Data Summary
- Camera Locations

Calcomp plots of electronic data from the entire impact event are included in Appendix A. Selected pre- and post-test photographs are presented in Appendix B.

GENERAL TEST AND VEHICLE PARAMETER DATA

PRE-IMPACT DATA

Make/Model: Dodge Diplomat
Body Style: 4-Door Sedan (Police) Model Year 1981
NHTSA No. NA DSI No. 1347 Color: Light Blue

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Chrysler Corporation
Date of Manufacture: 2/81; VIN: 183BM46N8B6151820
GVWR: 5205 lb; GAWR: Front = 2605 lb; Rear = 2650 lb

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL

Vehicle Capacity: FRONT REAR RECOMMENDED LOAD RANGE:
Tire Pressure: Max 35 psi 35 psi TIRE SIZE: Standard
P215/70R14
Designated Seating: 3 Front 3 Rear 6 Total
Cargo load = 200 lb Is Spare Tire: Space Saver? No
TOTAL = 1100 lb Standard Equipment? Yes
Engine: 318 C.U. IN. O.H.V-8
Transmission: 3-Speed Automatic Rear Wheel Drive
Date Vehicle Received by Laboratory: 9/9/83; Odometer 88802
Dealer Name & Address: Furnished by Romeo Kojyo Company Ltd

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

Right Front 1142 lb Right Rear = 785 lb
Left Front = 1110 lb Left Rear = 872 lb
TOTAL FRONT WEIGHT = 2252 lb (58 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1657 lb (42 % of Total Vehicle Weight)
TOTAL DELV. WEIGHT = 3909 lb

TARGET WEIGHT = UDW + Cargo Load + 164 lb Dummy = 4273 lb

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 200 LB CARGO:

Right Front = 1161 lb Right Rear = 911 lb
Left Front = 1145 lb Left Rear = 1052 lb
TOTAL FRONT WEIGHT = 2306 lb (54 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1963 lb (46 % of Total Vehicle Weight)
TOTAL TEST WEIGHT = 4269 lb
Weight of ballast secured in vehicle trunk area = 0 lb

VEHICLE ATTITUDE: (inches)

Delivered Attitude: RF 31.0 LF 31.0 RR 31.0 LR 31.0
Test Attitude: RF 31.3 LF 31.0 RR 30.0 LR 29.5

REMARKS:

**GENERAL TEST AND VEHICLE PARAMETER DATA (CONT)**

POST-IMPACT DATA

Type of Test: Frontal (0°) Impact  
 Date of Test: 10/3/83 Time: 1345 Temperature 80 °F  
 Required Impact Velocity Range: 28.5 to 30.5 mph  
 Impact Velocity: Primary = 29.44 mph Secondary = N/A mph

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 Length: Pre-test =	R <u>201.8</u>	€ <u>204.8</u>	L <u>201.7</u>
Post-test =	R <u>182.7</u>	€ <u>183.5</u>	L <u>182.8</u>
Crush =	R <u>19.1</u>	€ <u>21.3</u>	L <u>18.9</u>

Distance from front of test vehicle to point of impact:

R <u>14.7</u>	€ <u>15.0</u>	L <u>15.3</u>
---------------	---------------	---------------

VISIBLE DUMMY CONTACT POINTS

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Air bag</u>	<u></u>
Chest	<u>Air bag</u>	<u></u>
Abdomen	<u></u>	<u></u>
Left Knee	<u>Knee bolster</u>	<u></u>
Right Knee	<u>Knee bolster</u>	<u></u>

DOOR OPENING

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
	<u>Difficult</u>	<u>Difficult</u>	<u>Difficult</u>	<u>Difficult</u>

SEAT MOVEMENT

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

GLAZING DAMAGE

Backlight/Windshield Windshield cracking on driver side due to force of air bag contact.

OTHER NOTABLE IMPACT EFFECTS: \_\_\_\_\_

**PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET**

**PRE-IMPACT DATA**

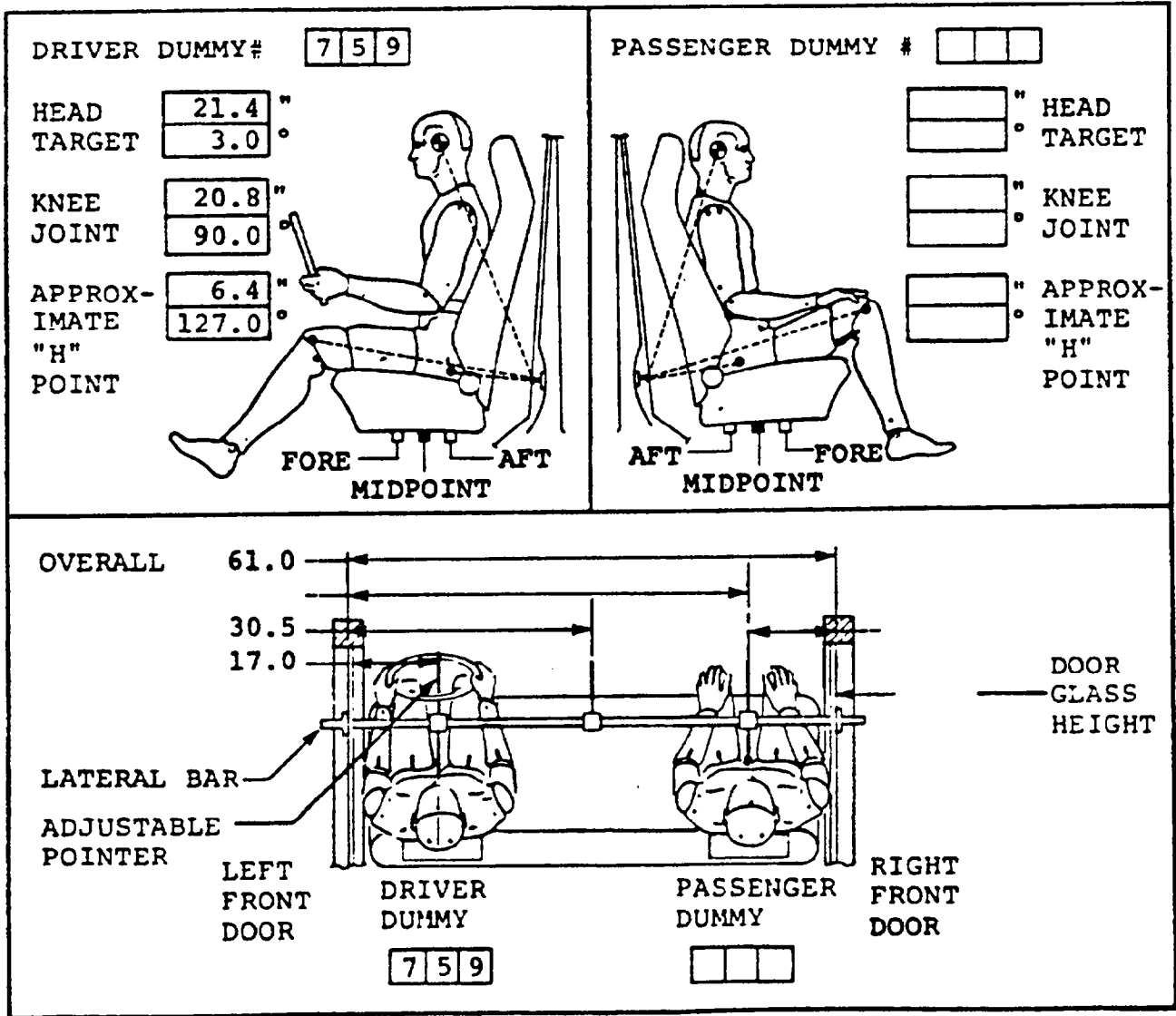
Make/Model: Dodge Diplomat  
 Body Style: 4-Door Sedan (Police) Model Year: 1981  
 NHTSA No. NA DSI No. 1347 Color: Light Blue

**DATA FROM CERTIFICATION LABEL**

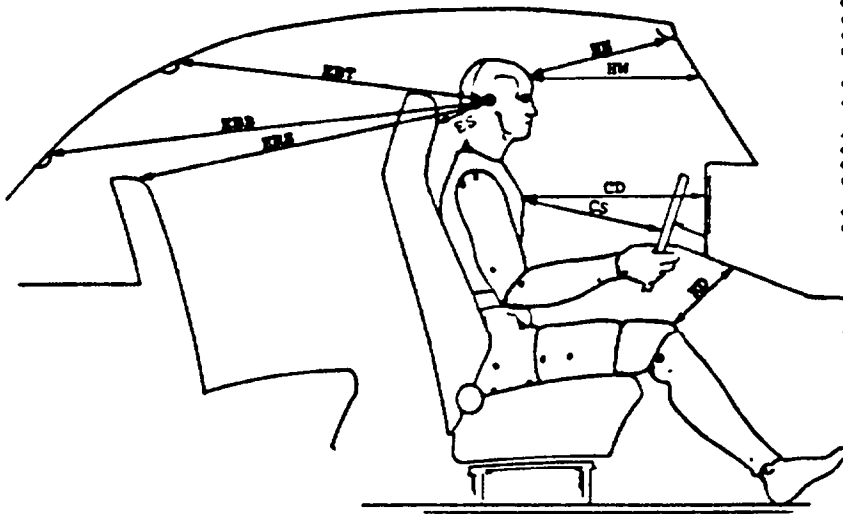
Vehicle Manufacturer: Chrysler Corporation  
 Date of Manufacture: 2/81; VIN: 183BM46N8B6151820  
 GVWR: 5205 lb; GAWR: Front = 2605 lb; Rear = 2650 lb

**POST-IMPACT DATA**

Type of Test: Frontal (0°) Impact  
 Date of Test: 10/3/83 Time: 1345 Temperature 80 °F  
 Required Impact Velocity Range: 28.5 to 30.5 mph  
 Impact Velocity: Primary = 29.44 mph Secondary = N/A mph  
 Seat Type: Bucket Adjuster Type: Electric  
 Bucket Seat Type Back: Low back - head rest  
 Technicians: M. Reaves, R. Garn



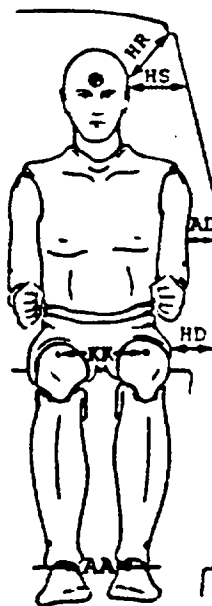
**PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET**



00 0314 40 00308

	Driver	Passenger
HH	14.5	
HW	20.2	
CD	21.5	
CS	12.5	
KD L	7.1	
KD R	6.5	
Torso		Torso
Angle	17°	Angle °
Seat Back		Seat Back
Angle	20°	Angle °
HSW	18.8	

- HH = Head to Windshield Header
  - HW = Head to Windshield
  - CD = Chest to Dash
  - CS = Chest to Steering Wheel
  - KD = Knees to Dash
  - HR = Head to Side Roof
  - HS = Head to Side Window
  - AD = Arm to Door
  - HD = Hip to Door
  - KK - Knee to Knee
- Torso and seat back angles are relative to vertical.



00 0314 40 00303

	Driver	Passenger
HR	5.7	
HS	10.1	
AD	4.2	
HD	6.8	
KK	11.0	
AA	10.0	

**SUMMARY OF VEHICLE ACCELEROMETER DATA**

Vehicle: 1981 Dodge Diplomat Test Date: 10/3/83  
 Test No.: 3154-3 Test Speed: 29.44 mph

Accelerometer		Maximum Acceleration				
No.	Location	Scale	+A (g)	T (msec)	-A (g)	T (msec)
1X	Steering column	±250g	61.7	86.4	101.1	92.5
2X	"B" Pillar	±250g	7.4	10.3	31.6	59.8
3X	Left fender	±250g	5.0	57.4	42.4	52.1
3Y	Left fender	±250g	107.2	61.5	51.2	52.0
4X	Right fender	±250g	71.3	58.9	149.9	53.3
4Y	Right fender	±250g	89.9	55.4	46.9	60.6
ΔV = 31.3 mph						

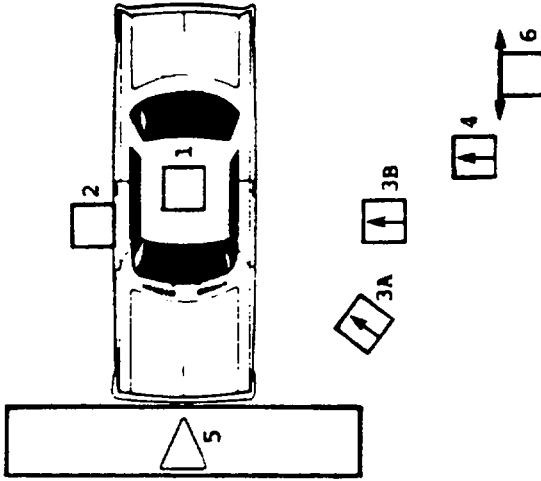
Positive Direction: X = Forward, Y = Rightward, Z = Downward

**FMVSS 208 DUMMY DATA SUMMARY**

	Driver Dummy				Passenger Dummy			
	Positive Direction*		Negative Direction**		Positive Direction*		Negative Direction**	
	Peak (G)	Time (msec)	Peak (G)	Time (msec)	Peak (G)	Time (msec)	Peak (G)	Time (msec)
<b>Head Acceleration</b>								
Longitudinal	27.4	186.0	75.9	106.6				
Lateral	13.6	187.6	10.3	236.0				
Vertical	44.7	113.0	5.8	44.8				
Resultant	86.4	109.4	-	-				
<hr/>								
HIC	990.83 between 95.5 and 123.4 msec							
<hr/>								
<b>Chest Acceleration</b>								
Longitudinal	9.5	191.3	56.4	107.4				
Lateral	3.9	127.6	3.2	102.6				
Vertical	12.3	72.3	5.9	118.0				
Resultant (Max)	56.7	107.5	-	-				
Resultant (clip)	55.0	-	-	-				
<hr/>								
TIME > 60 G	0 msec							
<hr/>								
SEVERITY INDEX	461.6 @ 320 msec							
<hr/>								
	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)
<b>Femur Loads</b>								
Left	313.8	62.5	1557.0	95.0				
Right	127.6	262.5	1427.0	91.5				
<hr/>								
<b>Belt Loads</b>								
Lap	Not instrumented							
Torso								
<hr/>								
	Vehicle Impact Speed (mph): <u>29.44</u>							
<hr/>								
*Longitudinal:	Forward				**Longitudinal:	Rearward		
Lateral:	Rightward				Lateral:	Leftward		
Vertical:	Downward				Vertical:	Upward		

CAMERA LOCATIONS

Test No: 3154-3 Test Date: 10/3/83  
 Test Type: 90° Frontal Barrier  
 Vehicle A: 1981 Dodge Diplomat  
 Vehicle B:  
 Comments: Air Bag Test

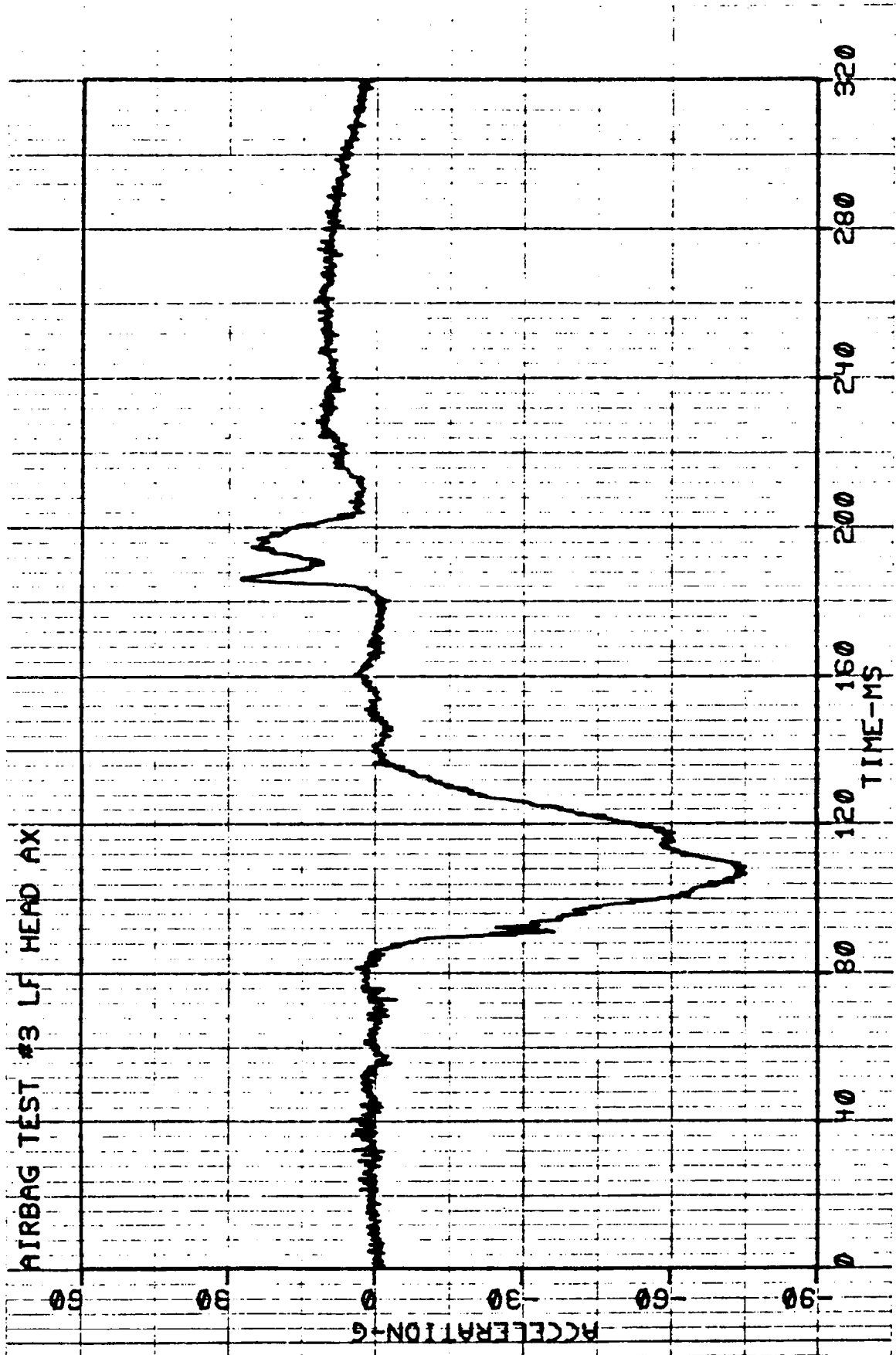


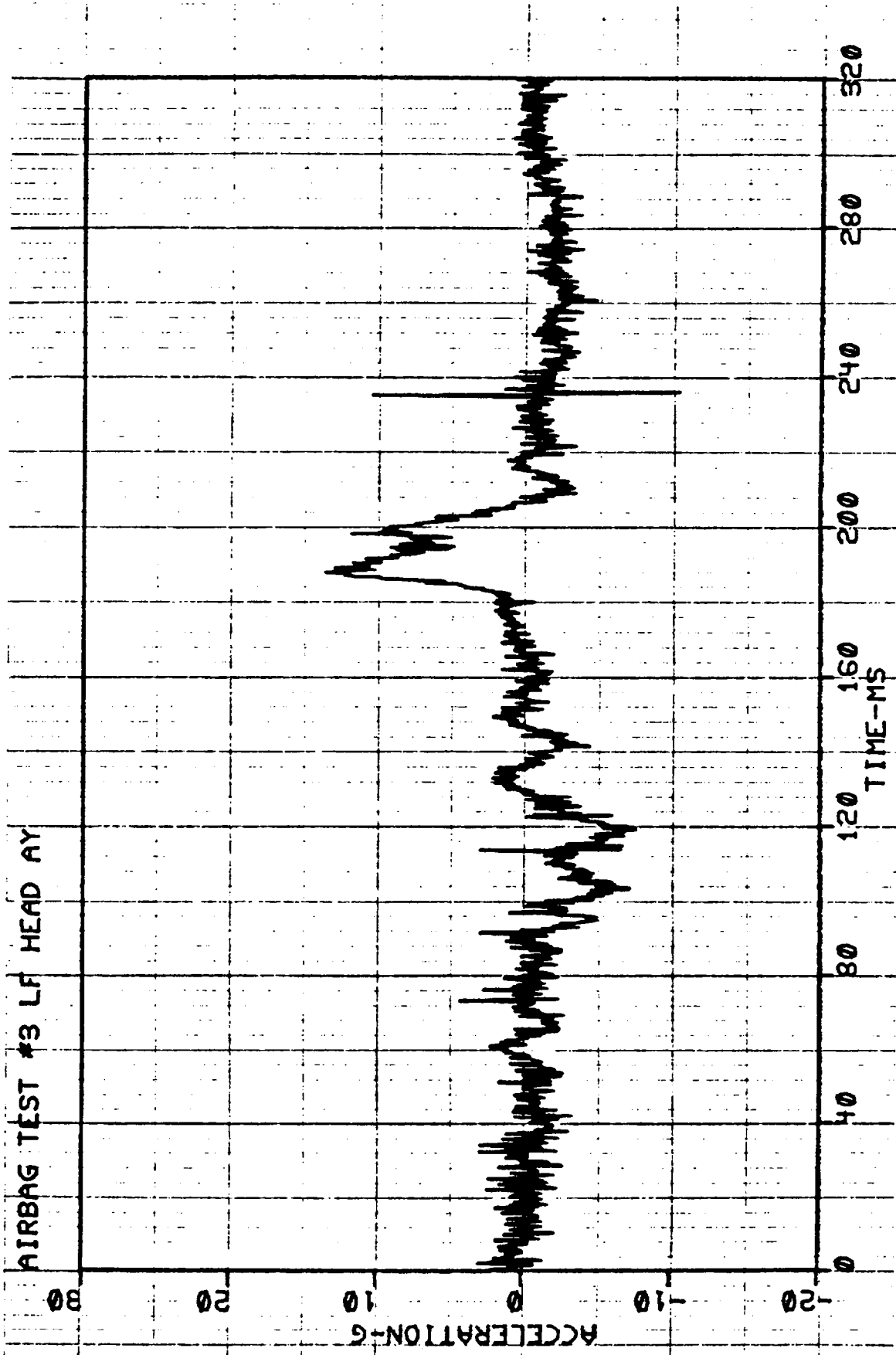
- CAMERA SYMBOLS
- PIT
  - GROUND
  - BARRIER
  - OVERHEAD
  - ON-BOARD
  - PANNING
- FRAME RATE
1. 1000 fr/sec
  2. 200 fr/sec
  3. Other 24 fr/sec
  4. 400 fr/sec
  5. 500 fr/sec
- TIMING LIGHT SPEED
1. 100 Hz (10 msec/light)
  2. 200 Hz (5 msec/light)
  3. Other

CAMERA	YES
STILLS	
SLIDES	
MOVIE	
POLAROID	
VIDEO	

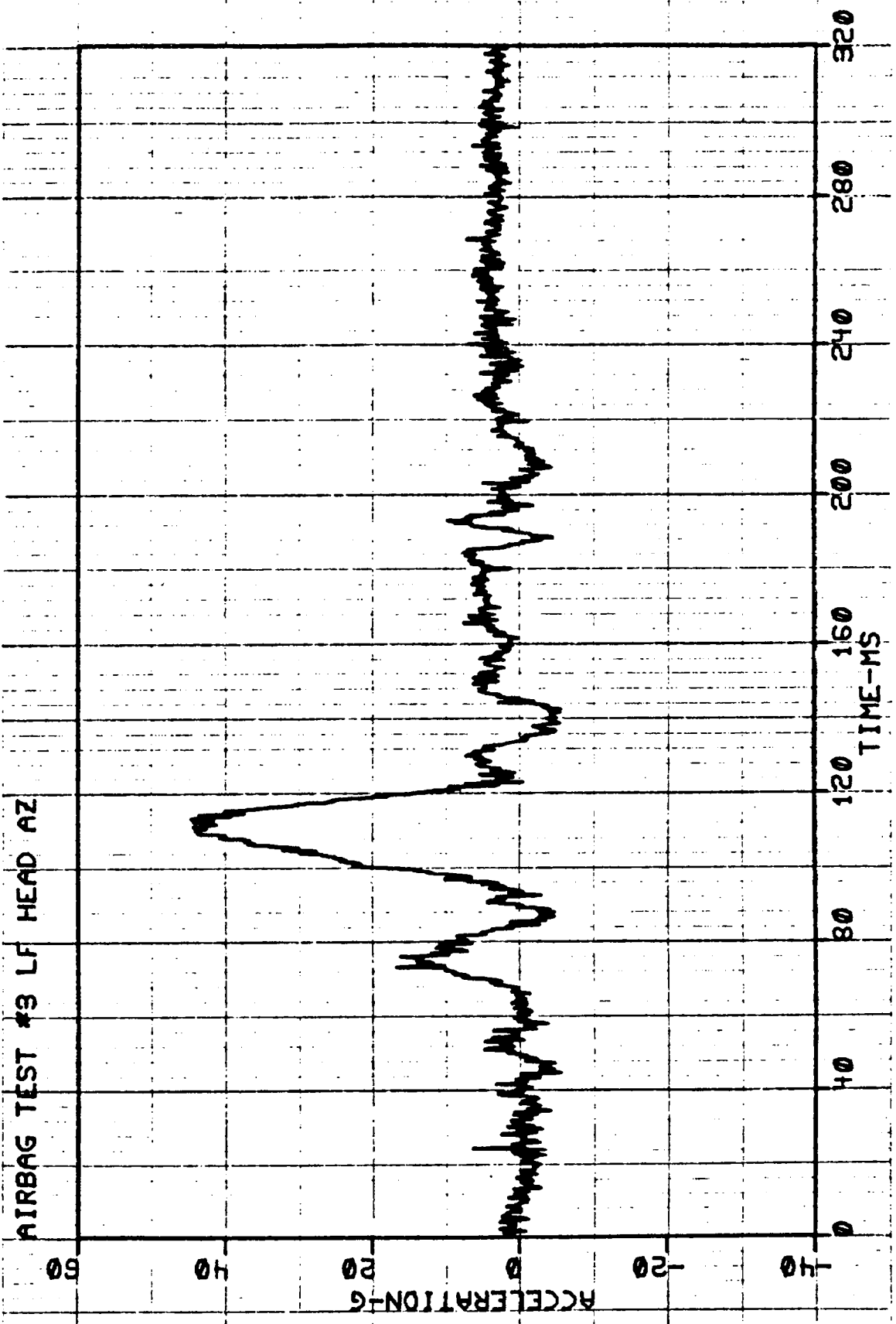
Loc. No.	Location	Field of View	Lens Size	Frm Rate	Tmng Spd	Ser No	Impact Dist-X	C.L. Dist-Y	CAM Hght-Z
1	On-board vehicle roof	Over driver shoulder at dummy and airbag	8	4	1	7	NA	NA	NA
2	On-board pass. door	90° view of driver dummy & air bag deployment	8	4	1	12	NA	NA	NA
3A	Left side ground based	Close-up of driver dummy through windows	16	4	1	M10	103"	84"	70"
3B	Left side ground based	Close-up of driver dummy through windows	16	4	1	M11	103"	84"	70"
4	Left side ground based	Overall view of vehicle throughout crash event	16	4	1	M3	106"	436"	52"
5	Barrier overhead	View of air bag deployment through windshield	10	4	1	M7	17"	0	111.5"
6	Ground based panning	Overall view of vehicle through crash event	Var.	3	-	-	-	-	-

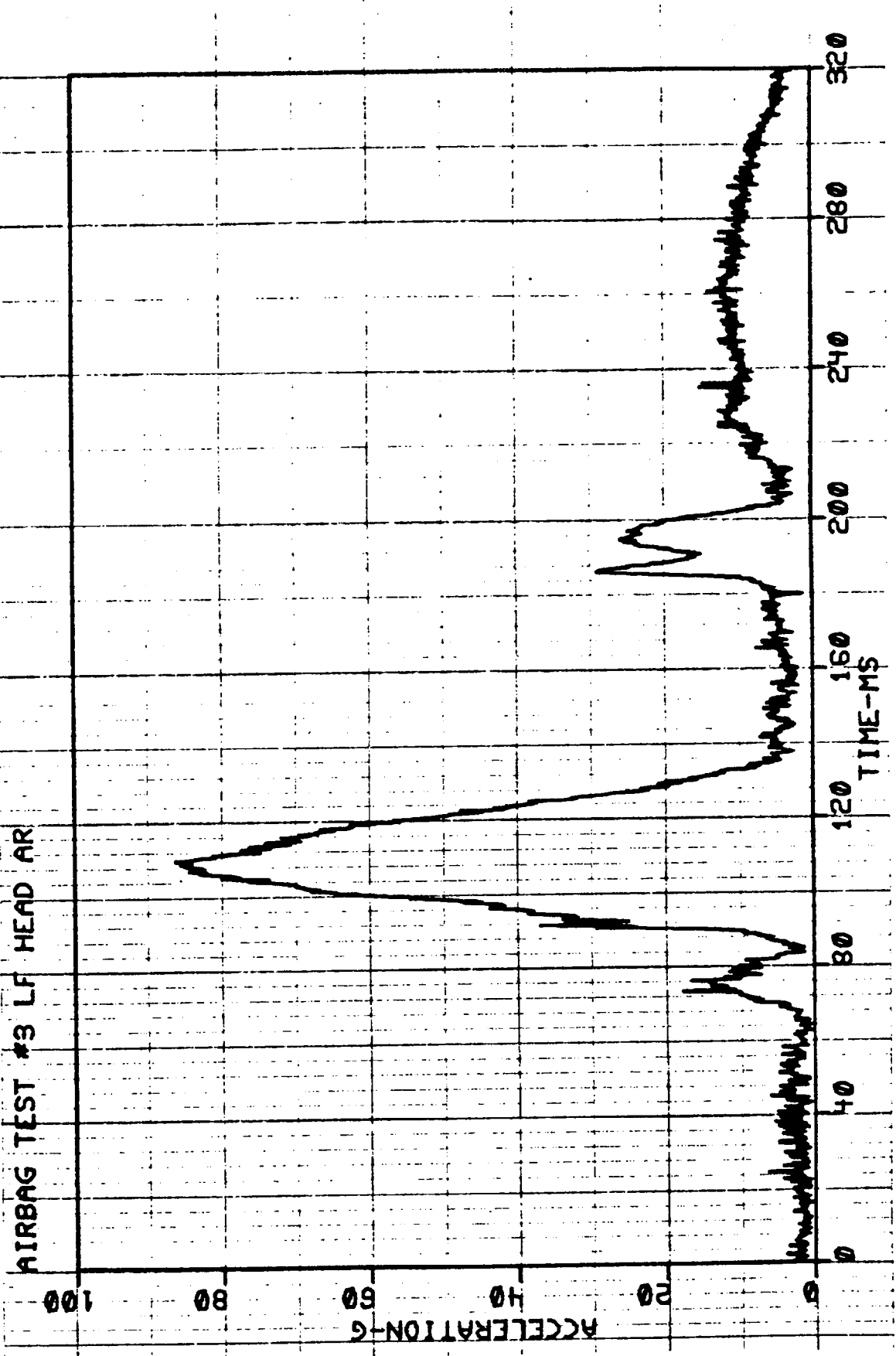
**APPENDIX A**  
**CALCOMP PLOTS OF ELECTRONIC DATA**

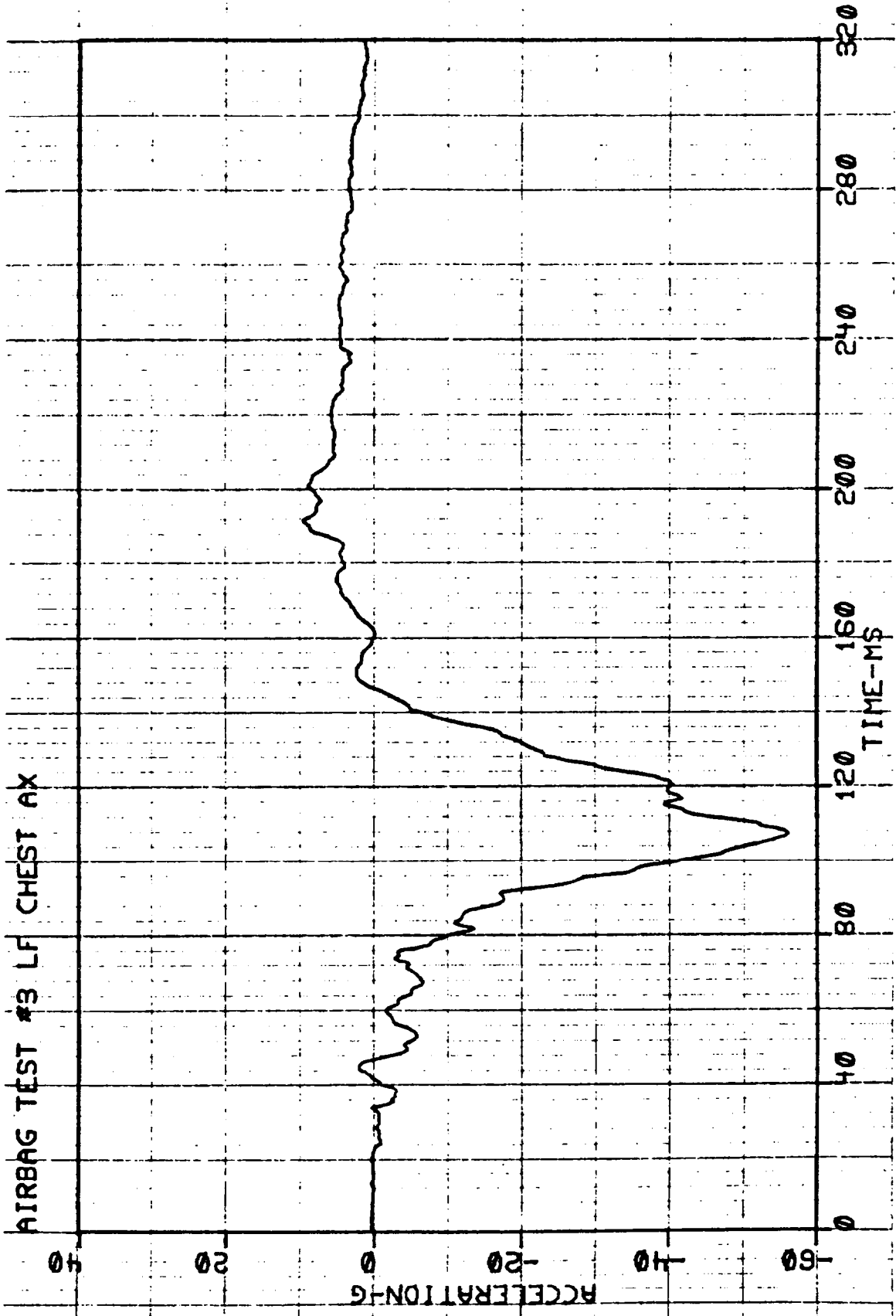


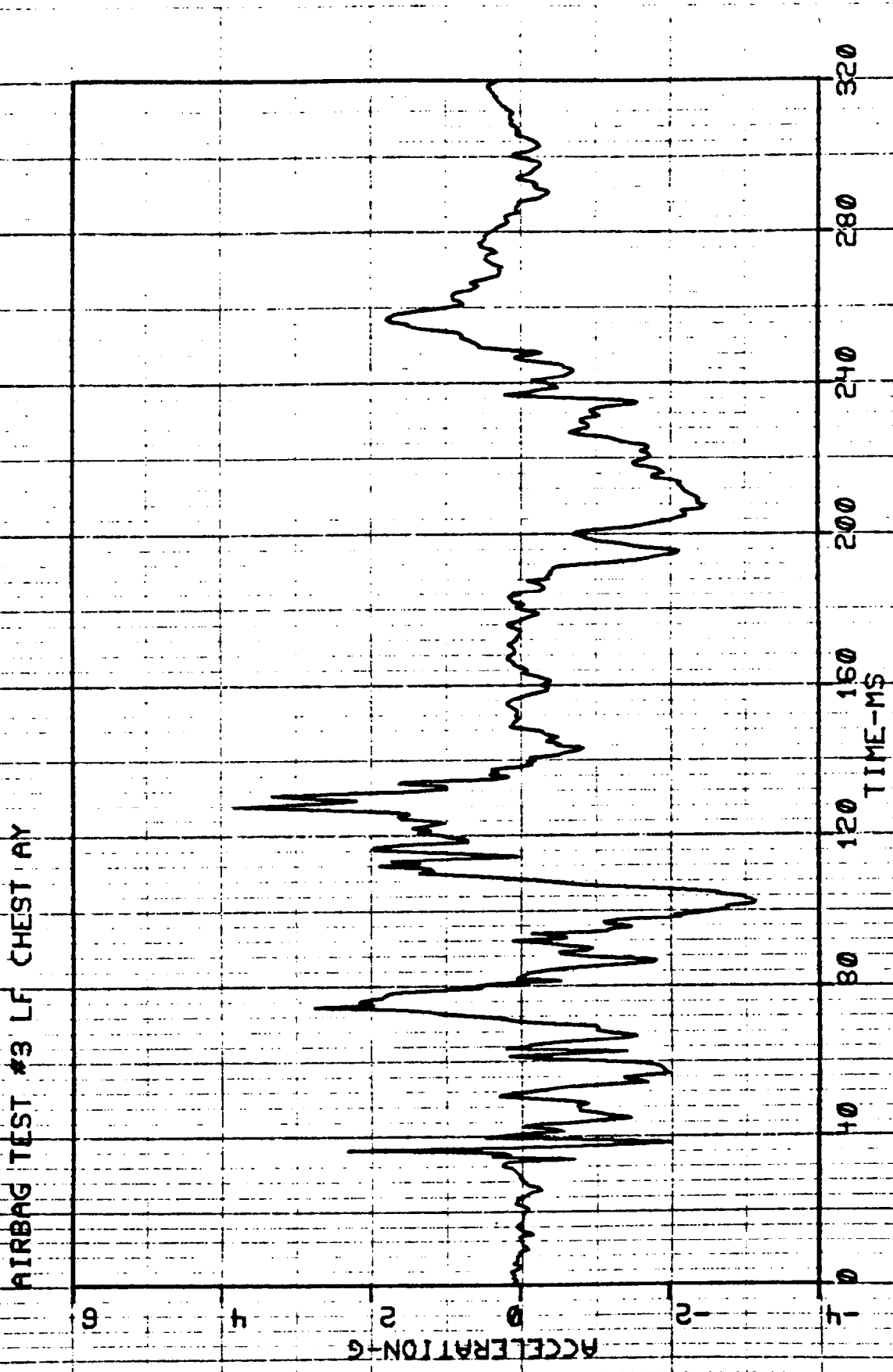


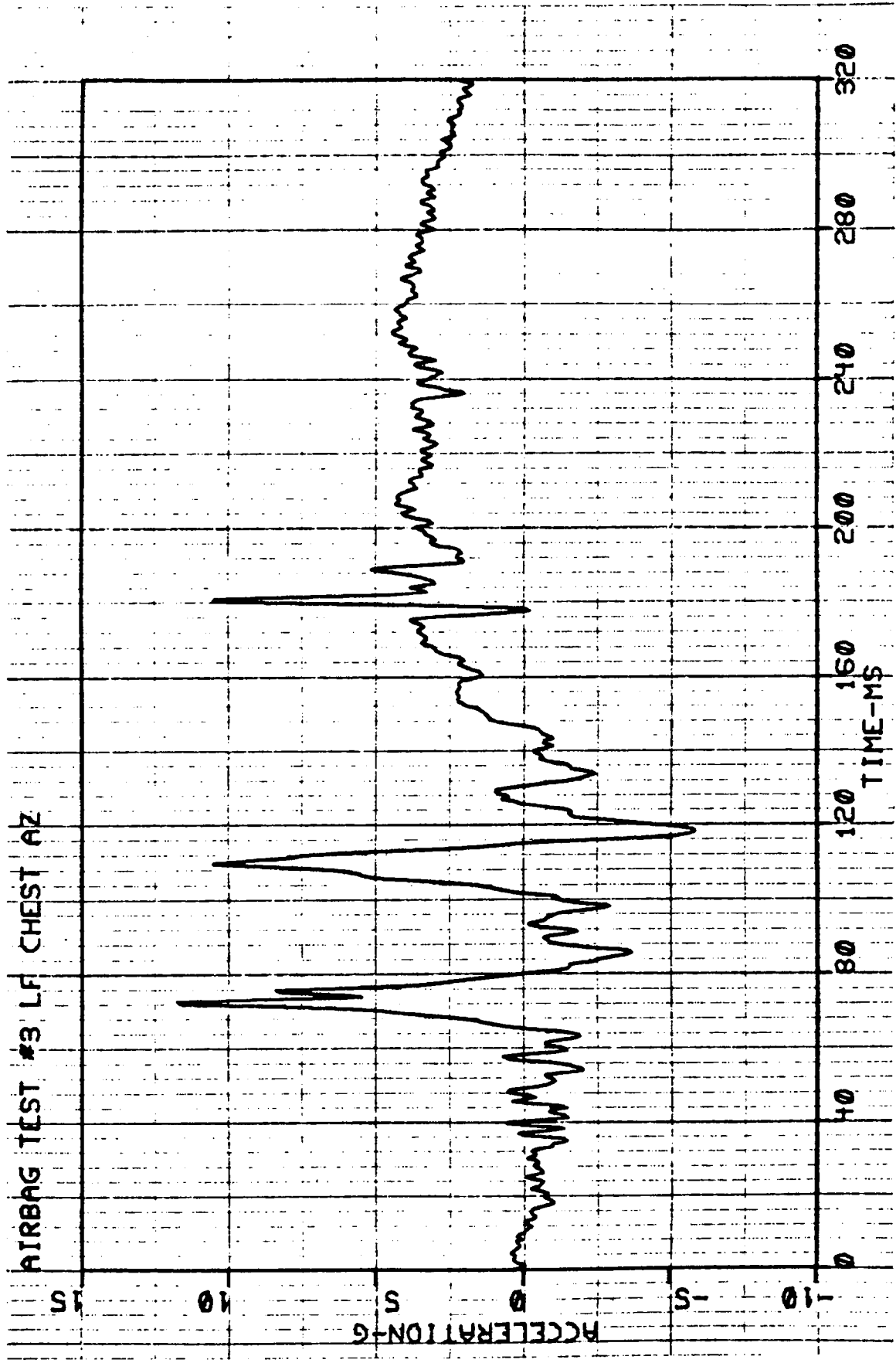
AIRBAG TEST #3 LF HEAD AZ

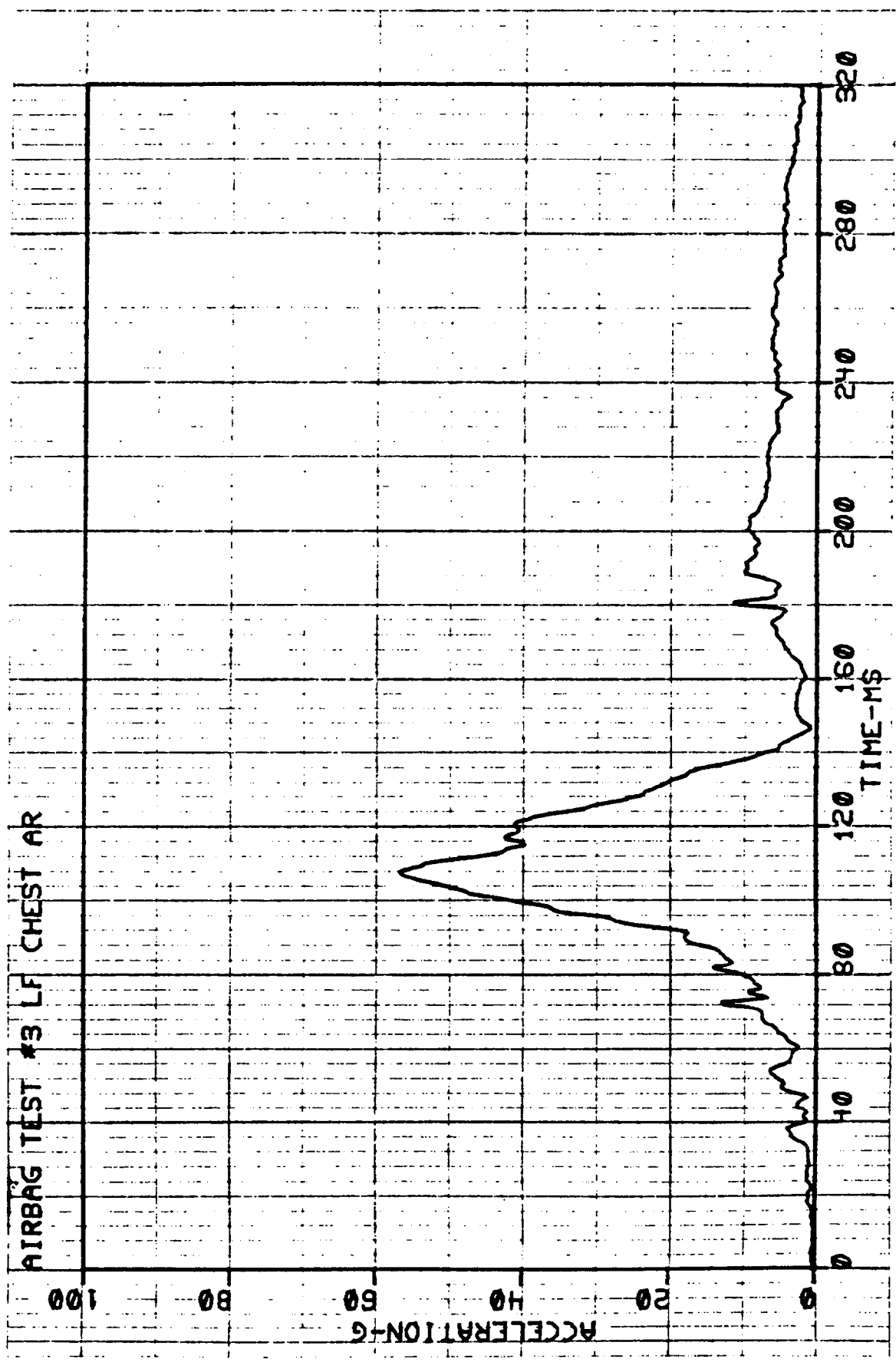


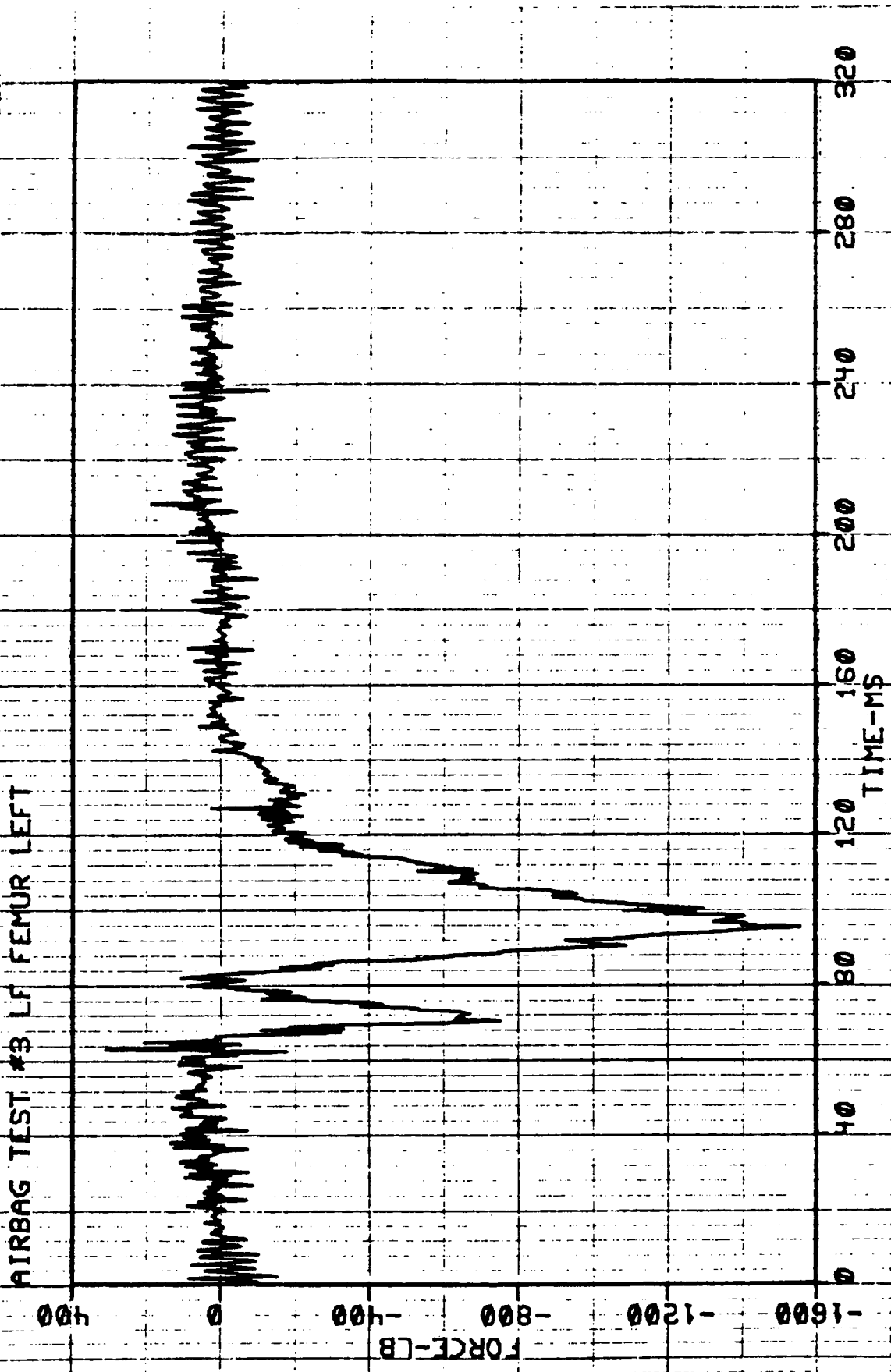


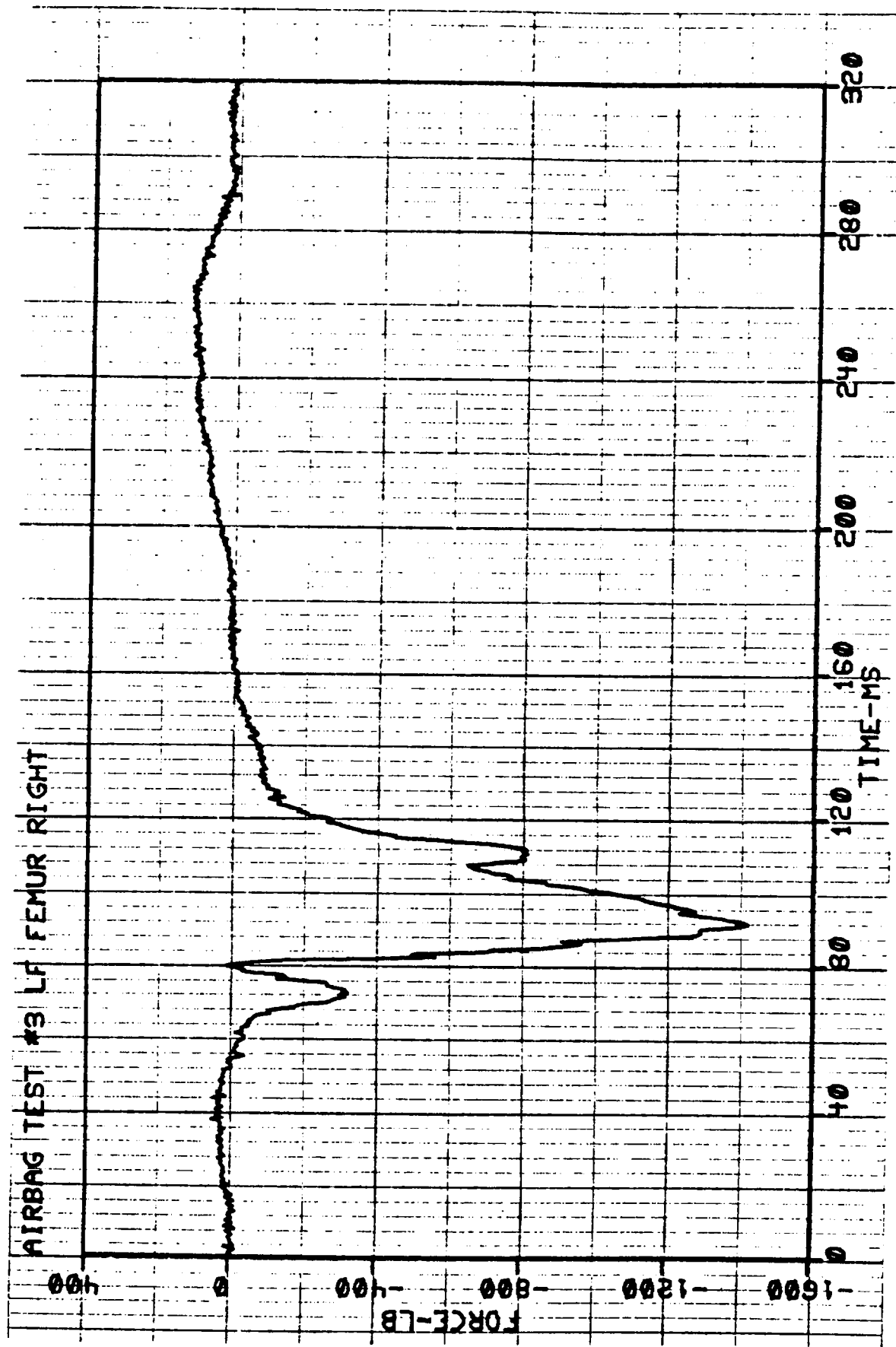


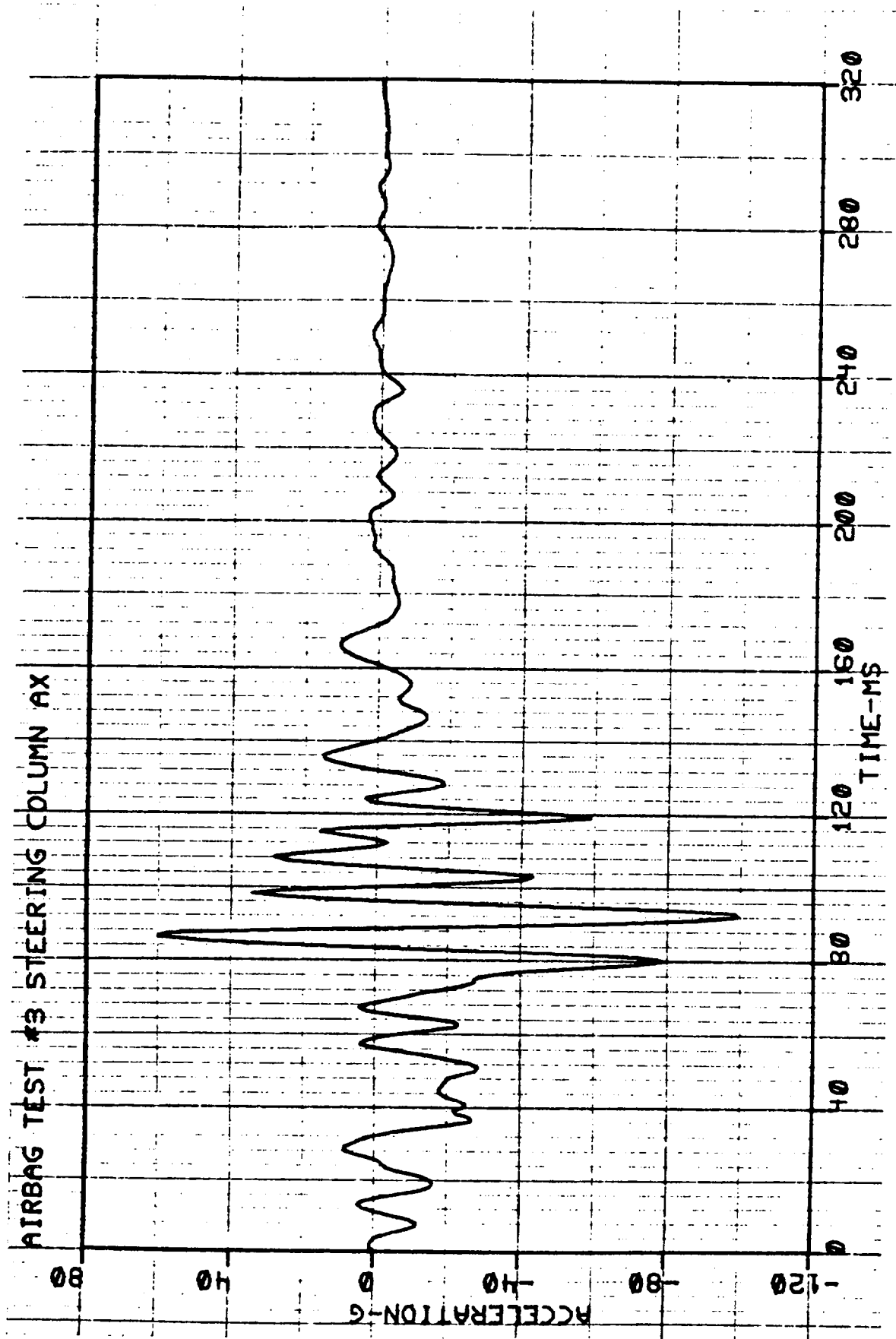


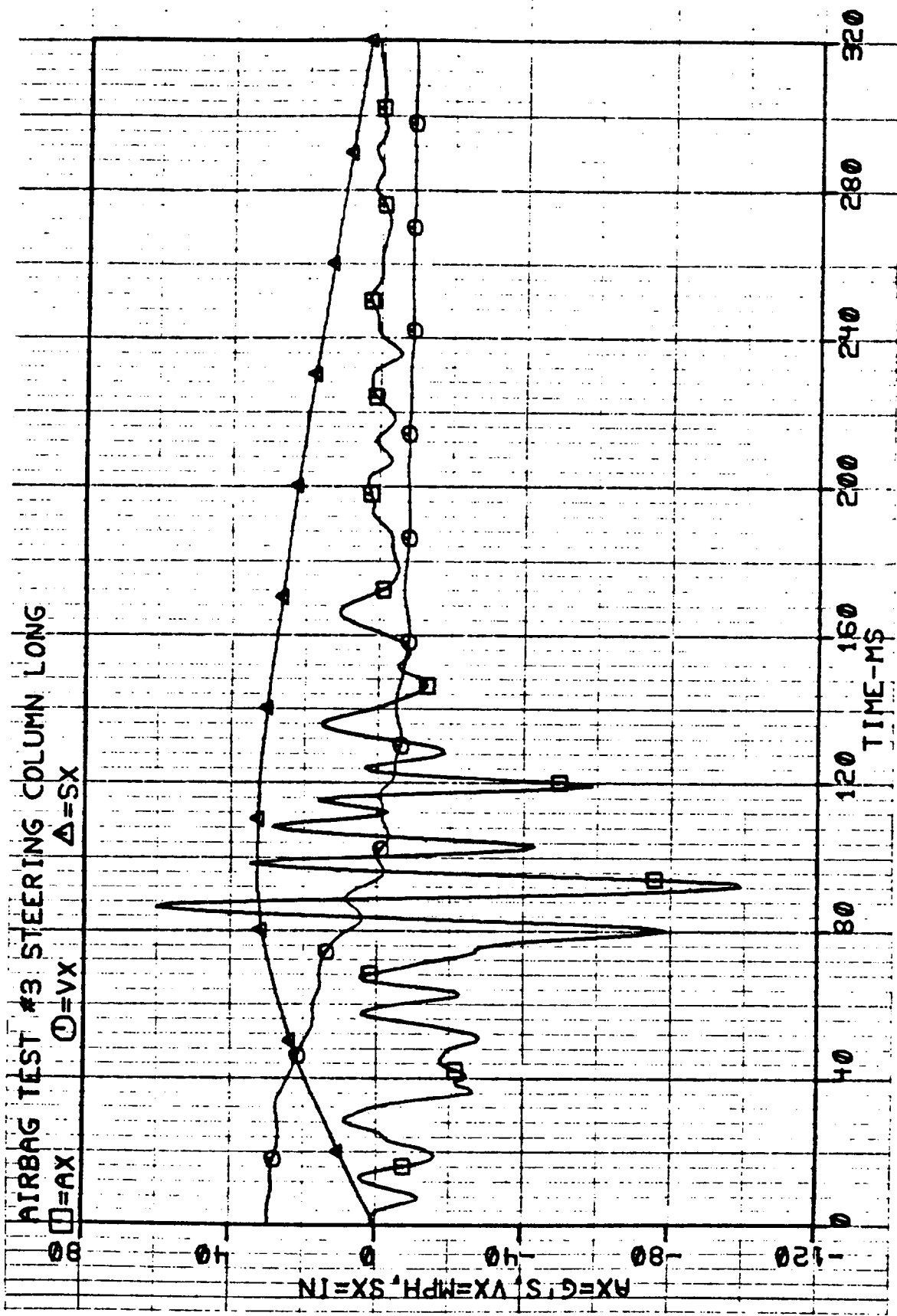


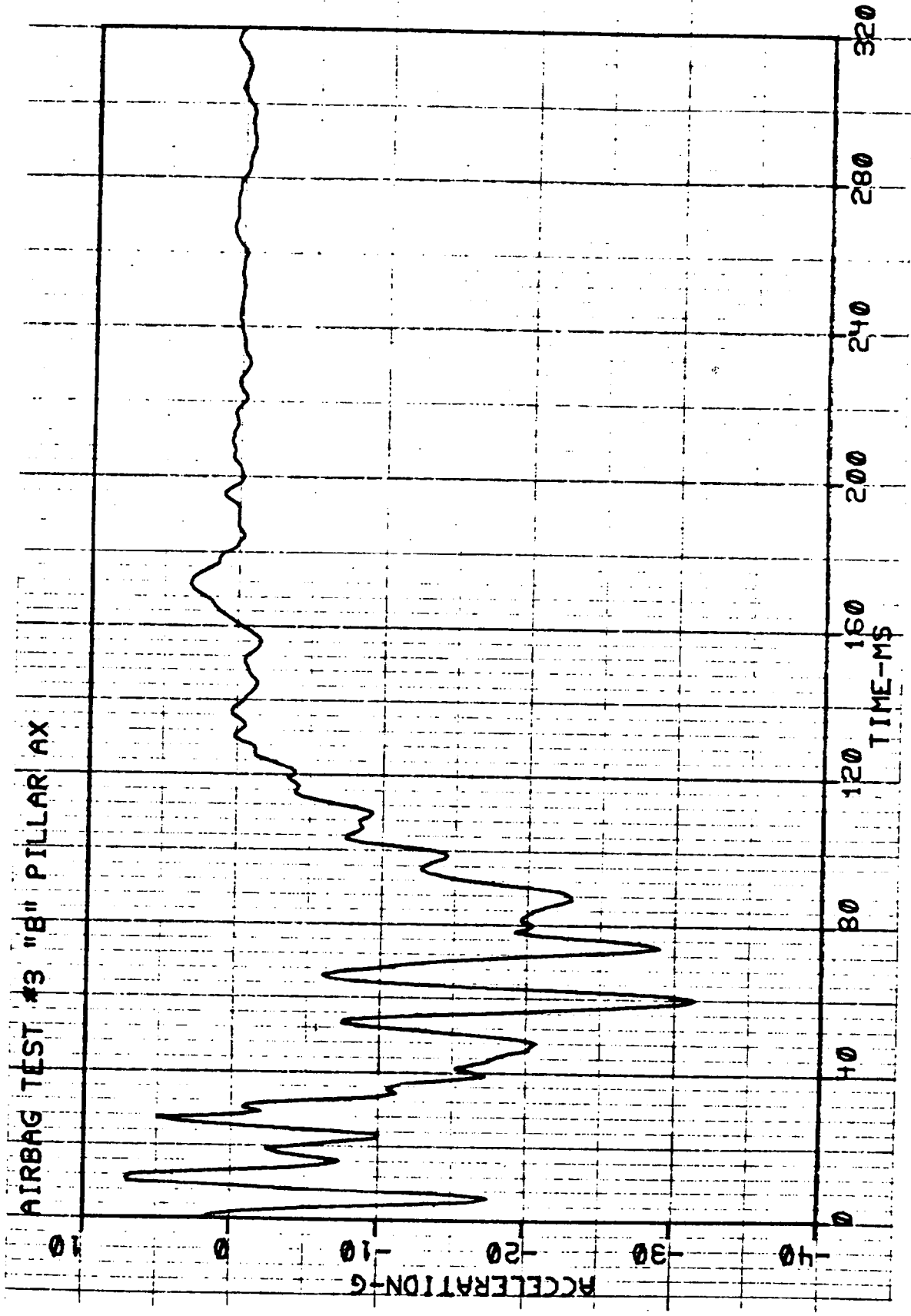


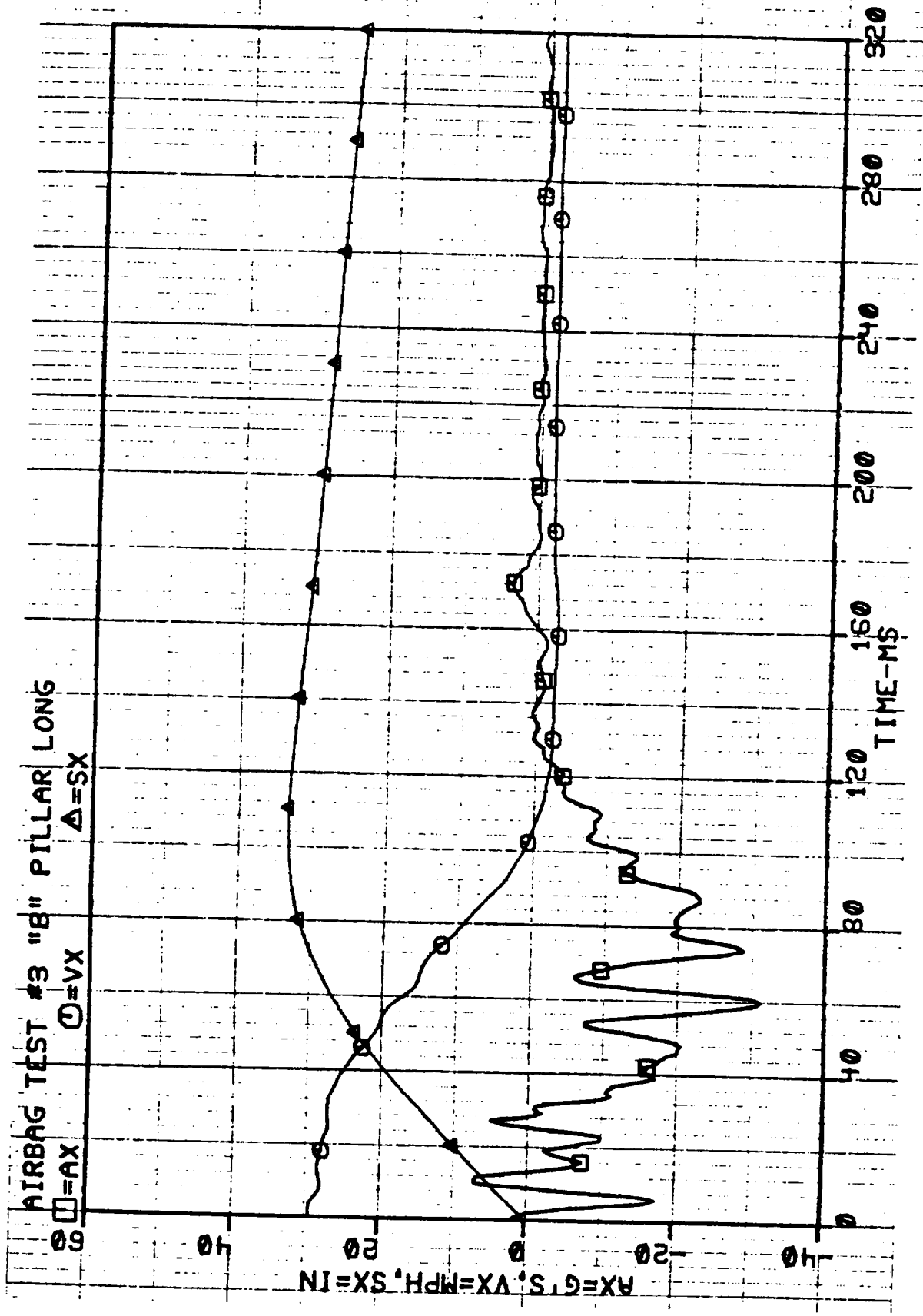


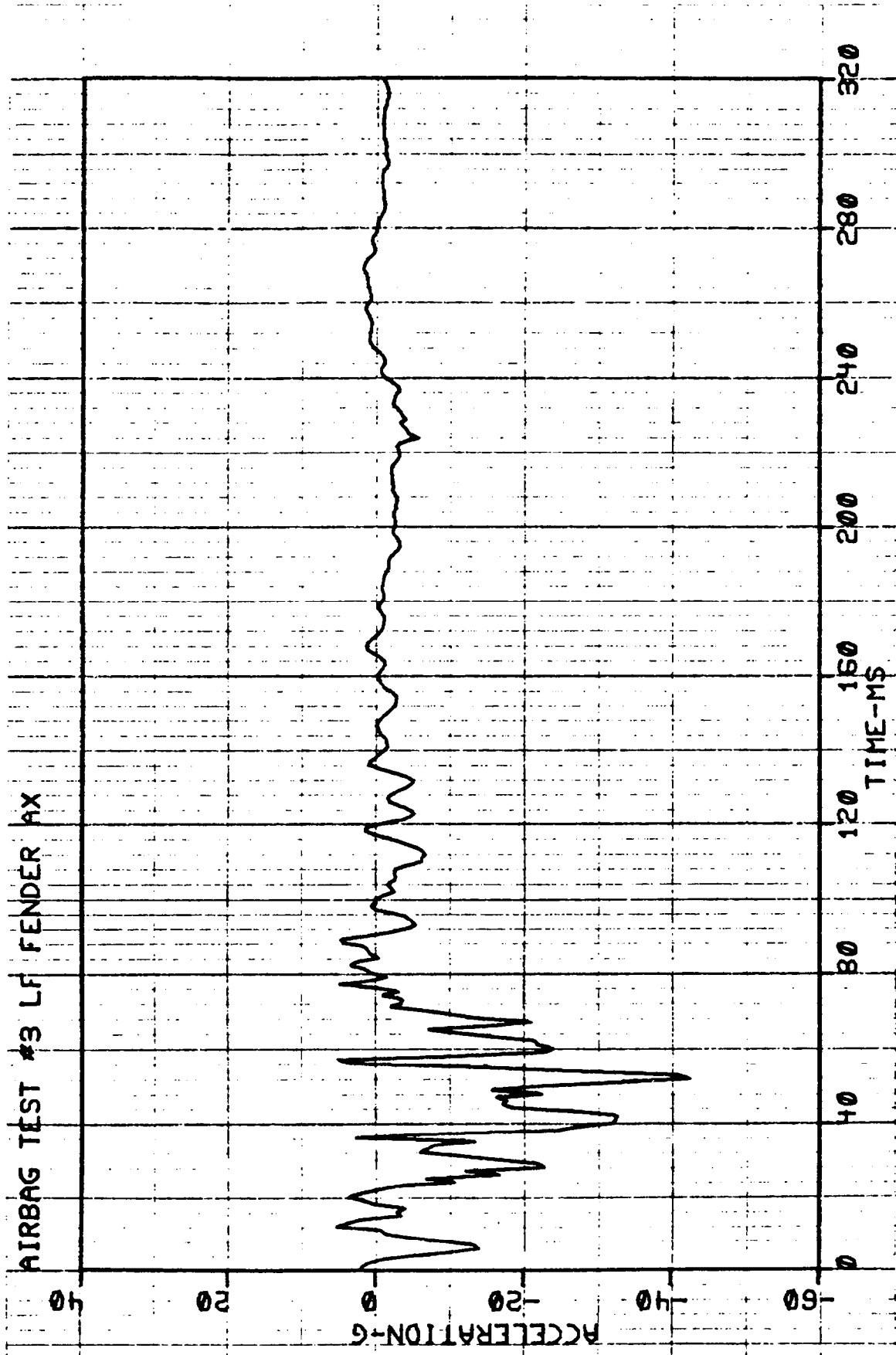


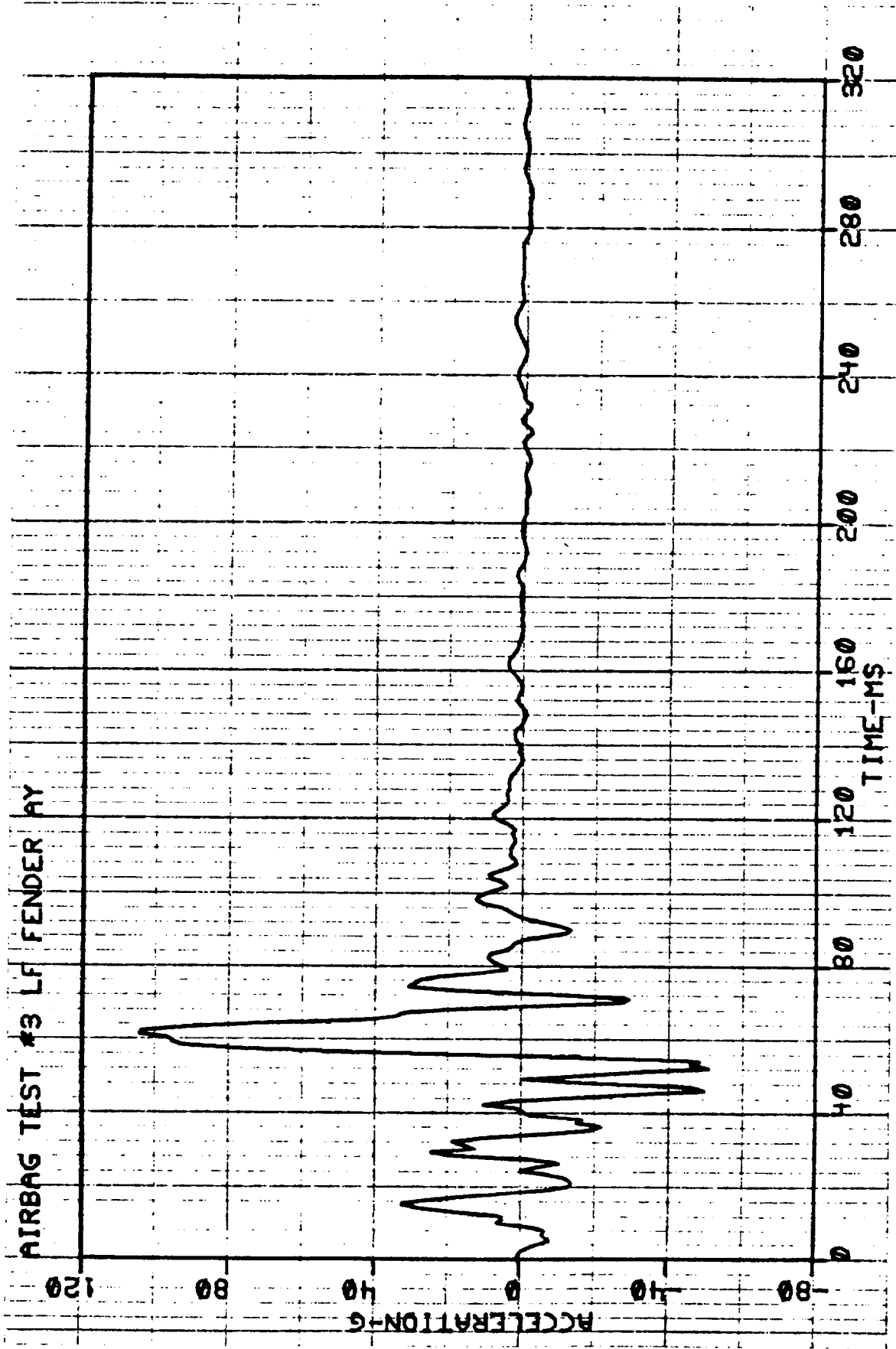


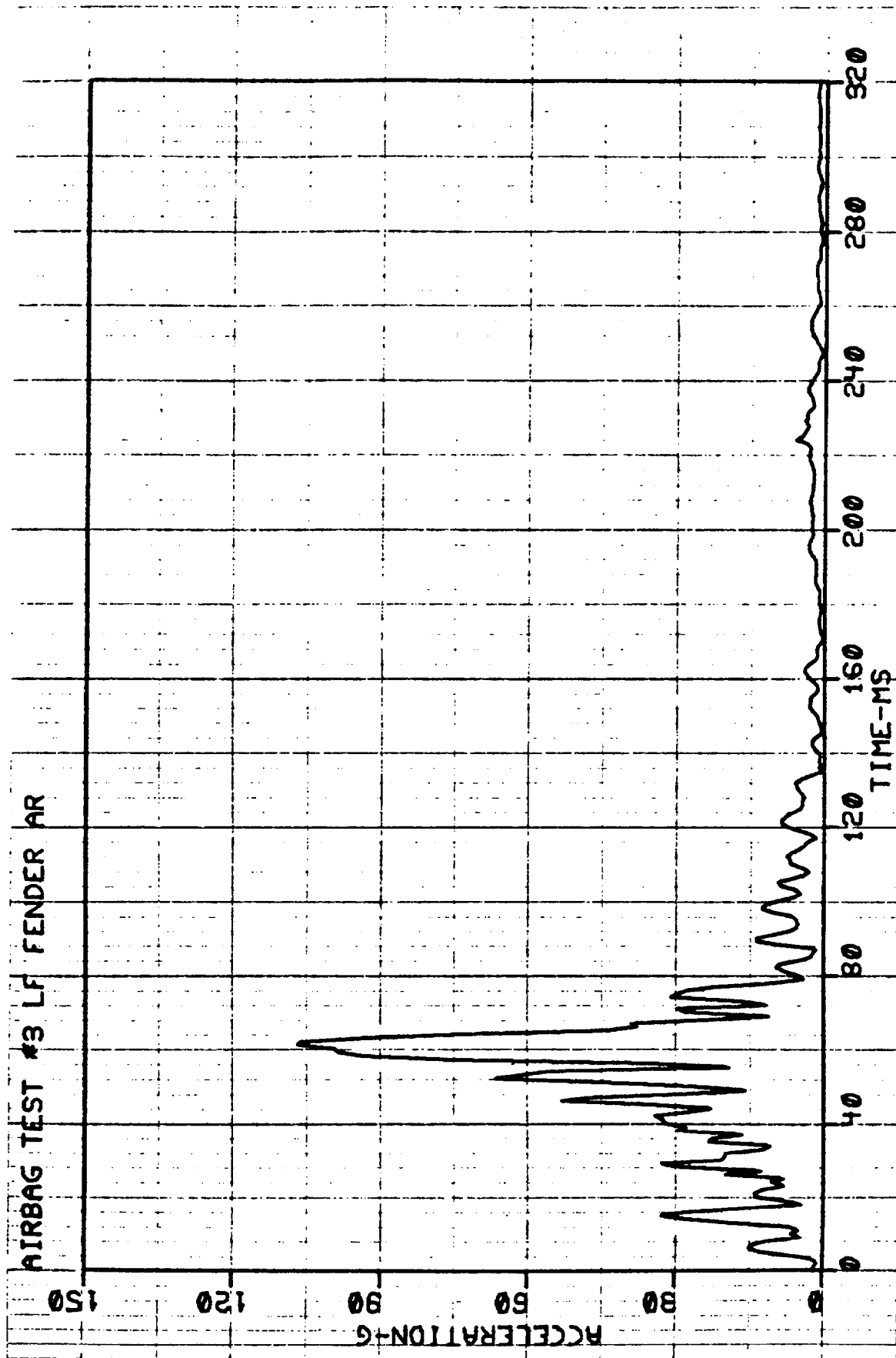


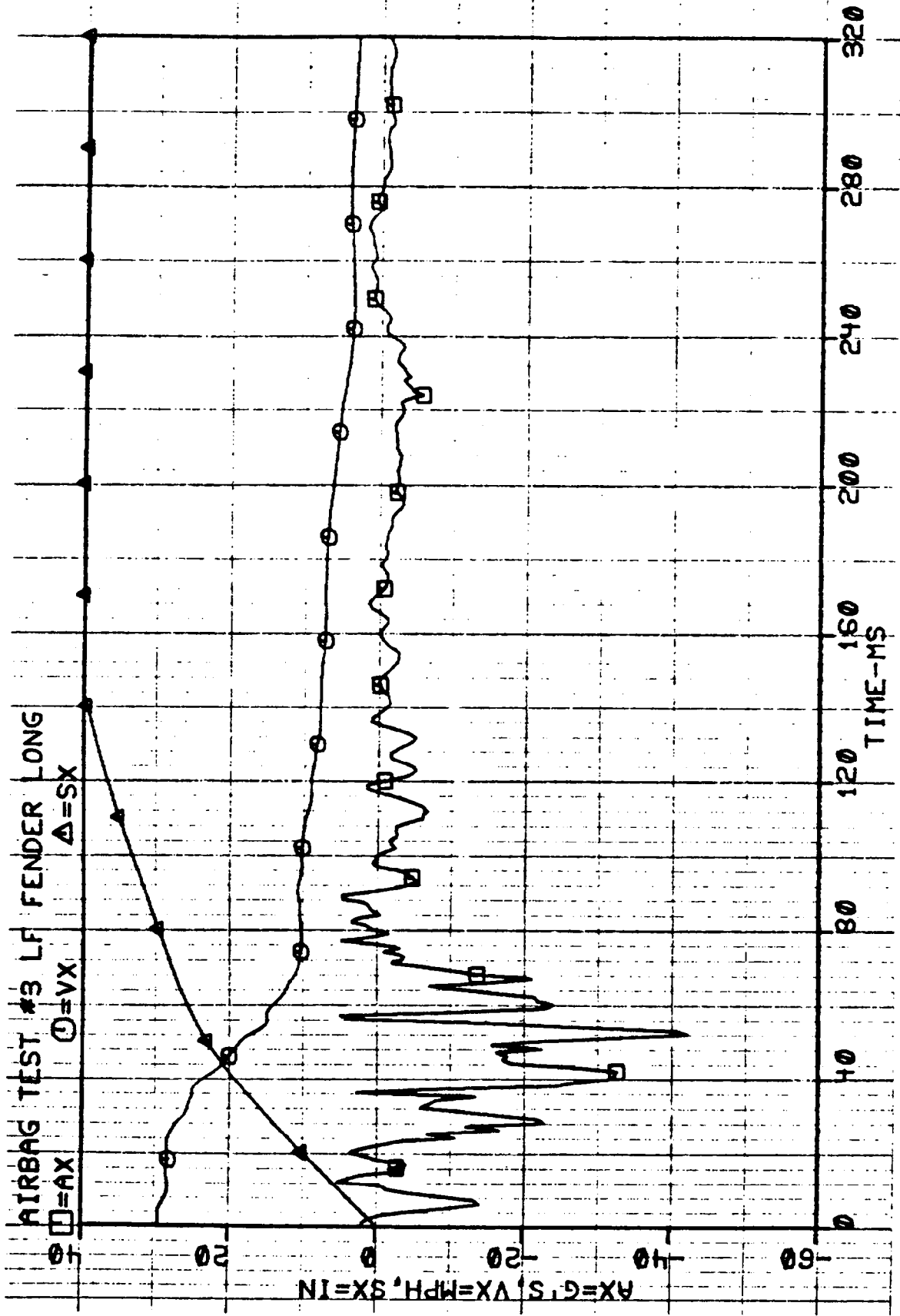


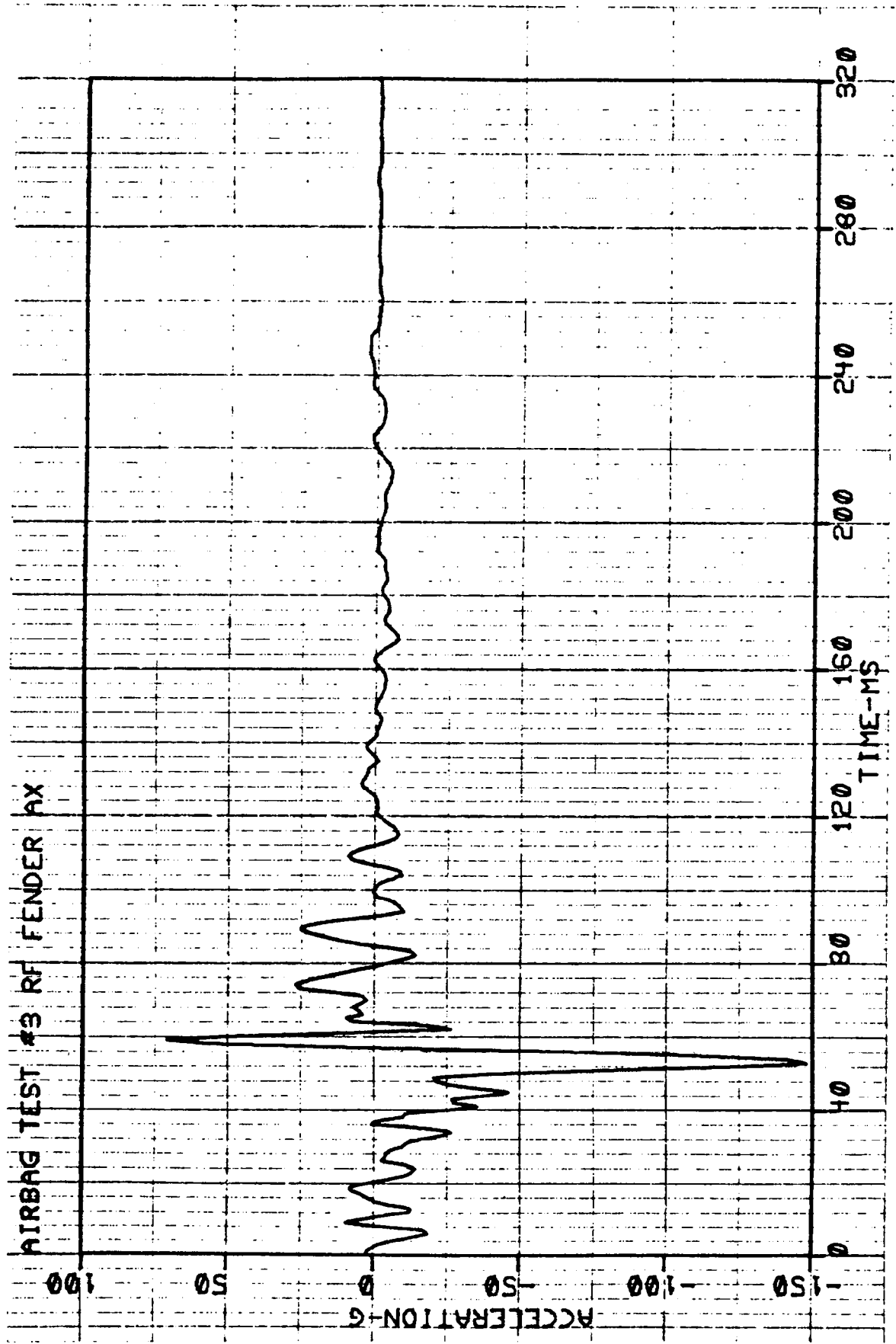


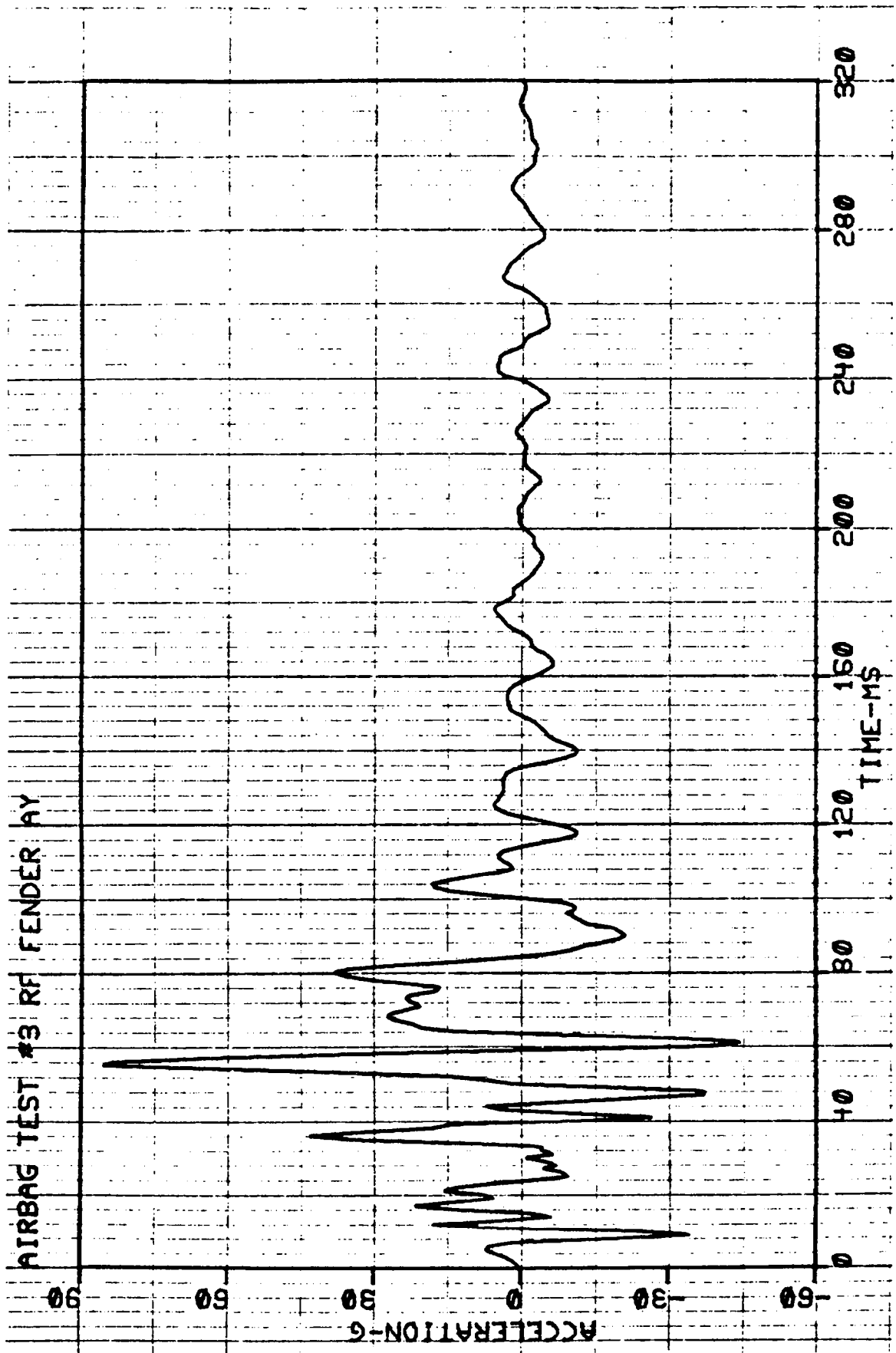


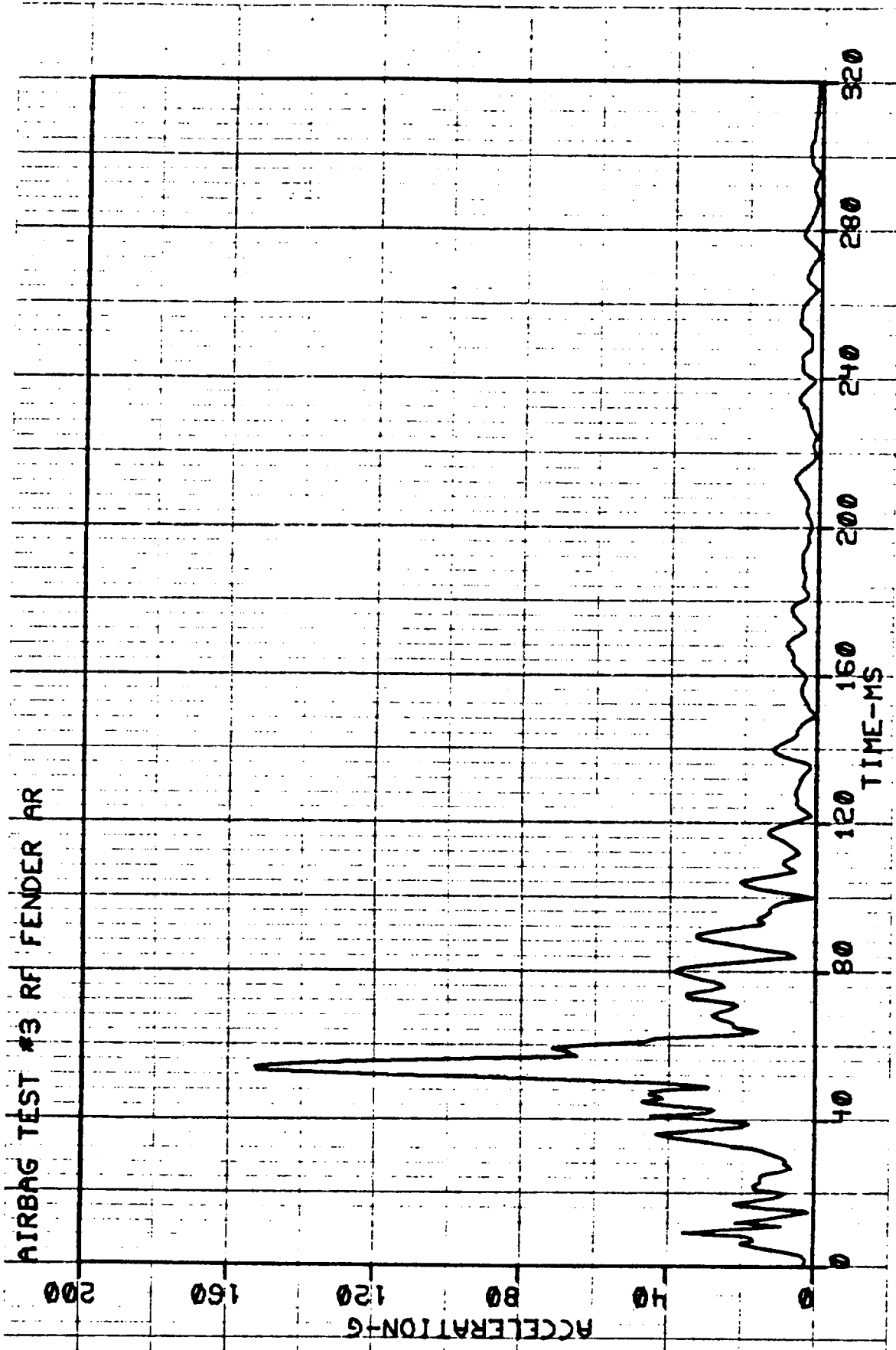


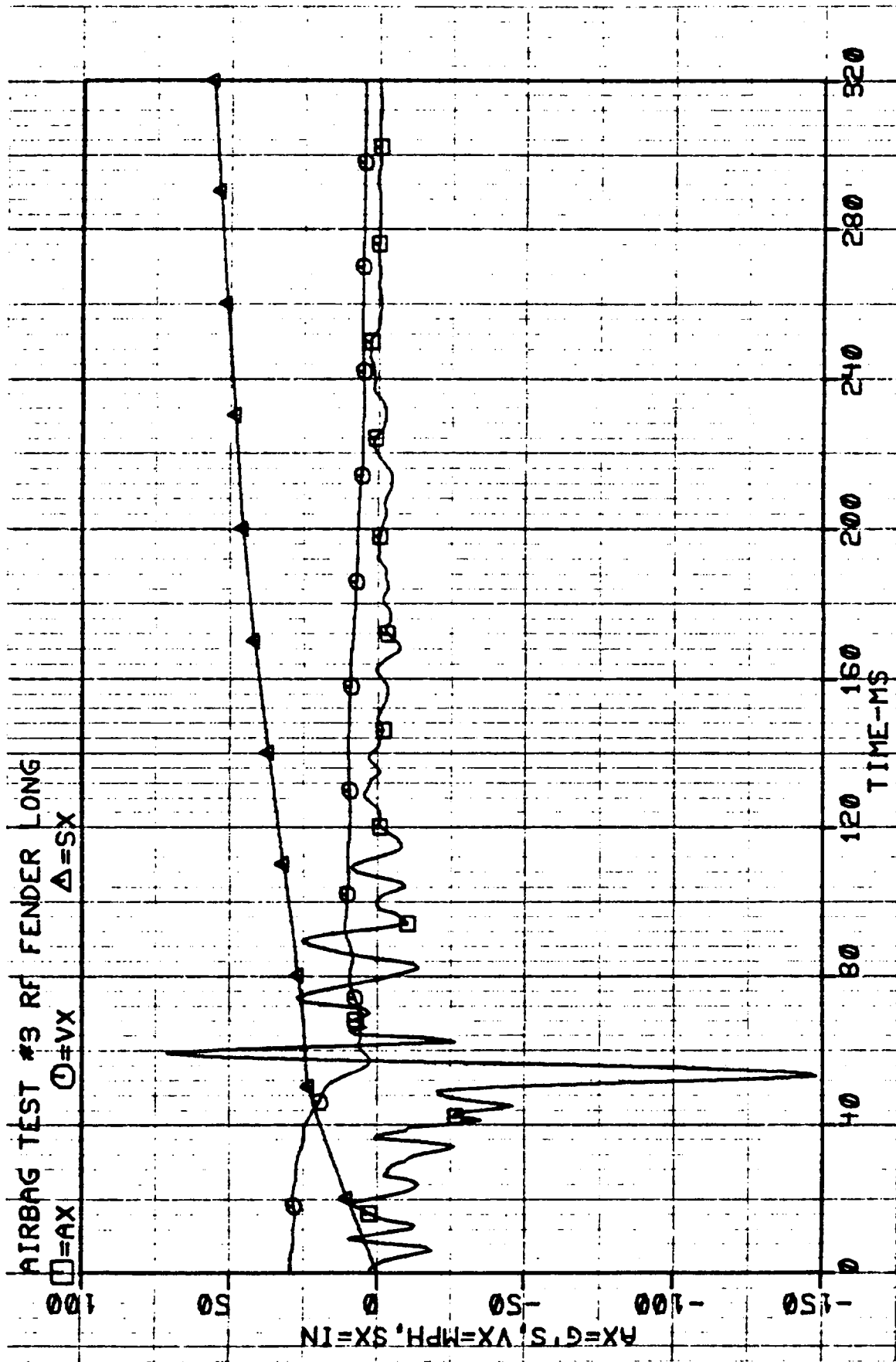


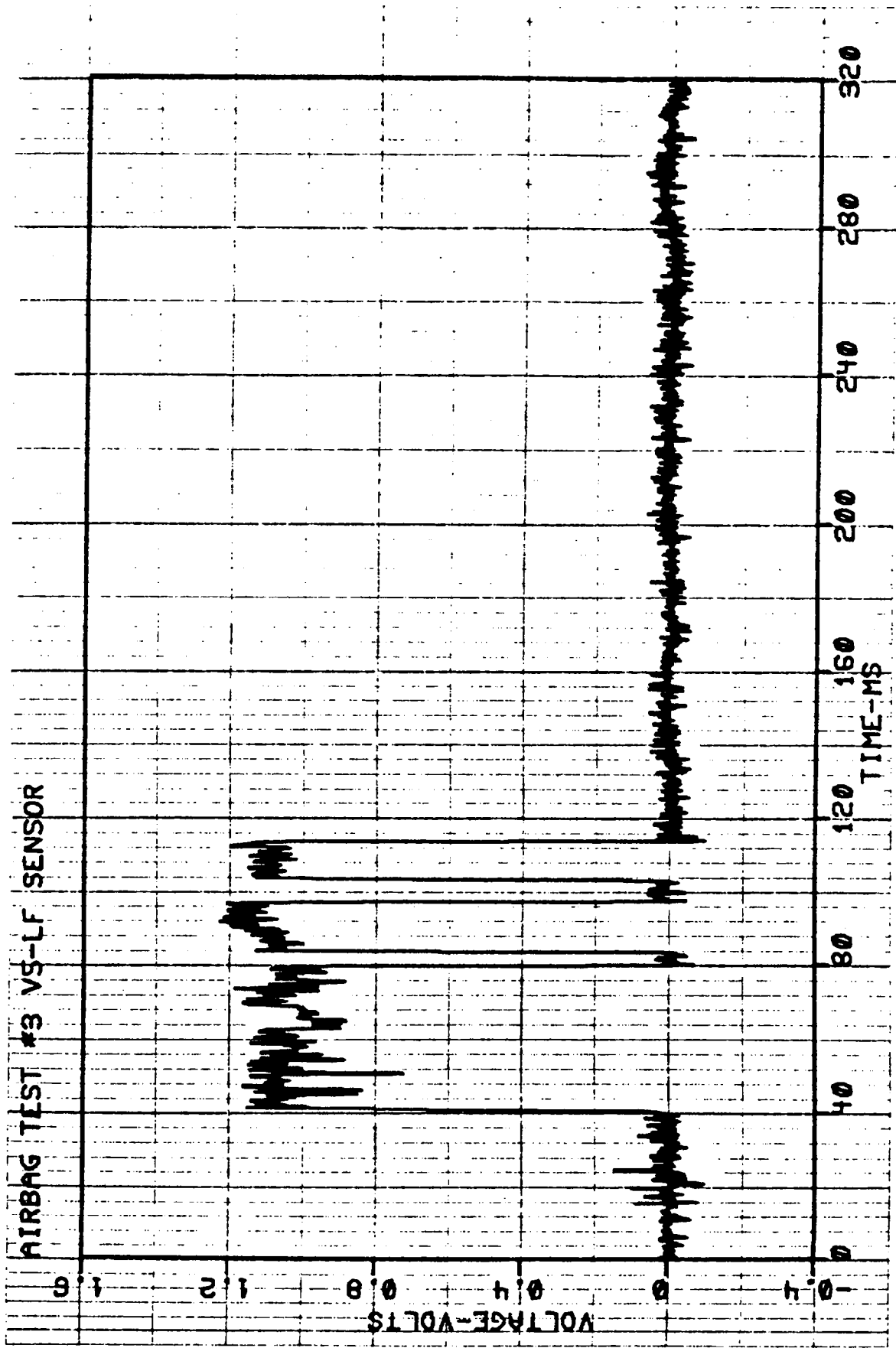


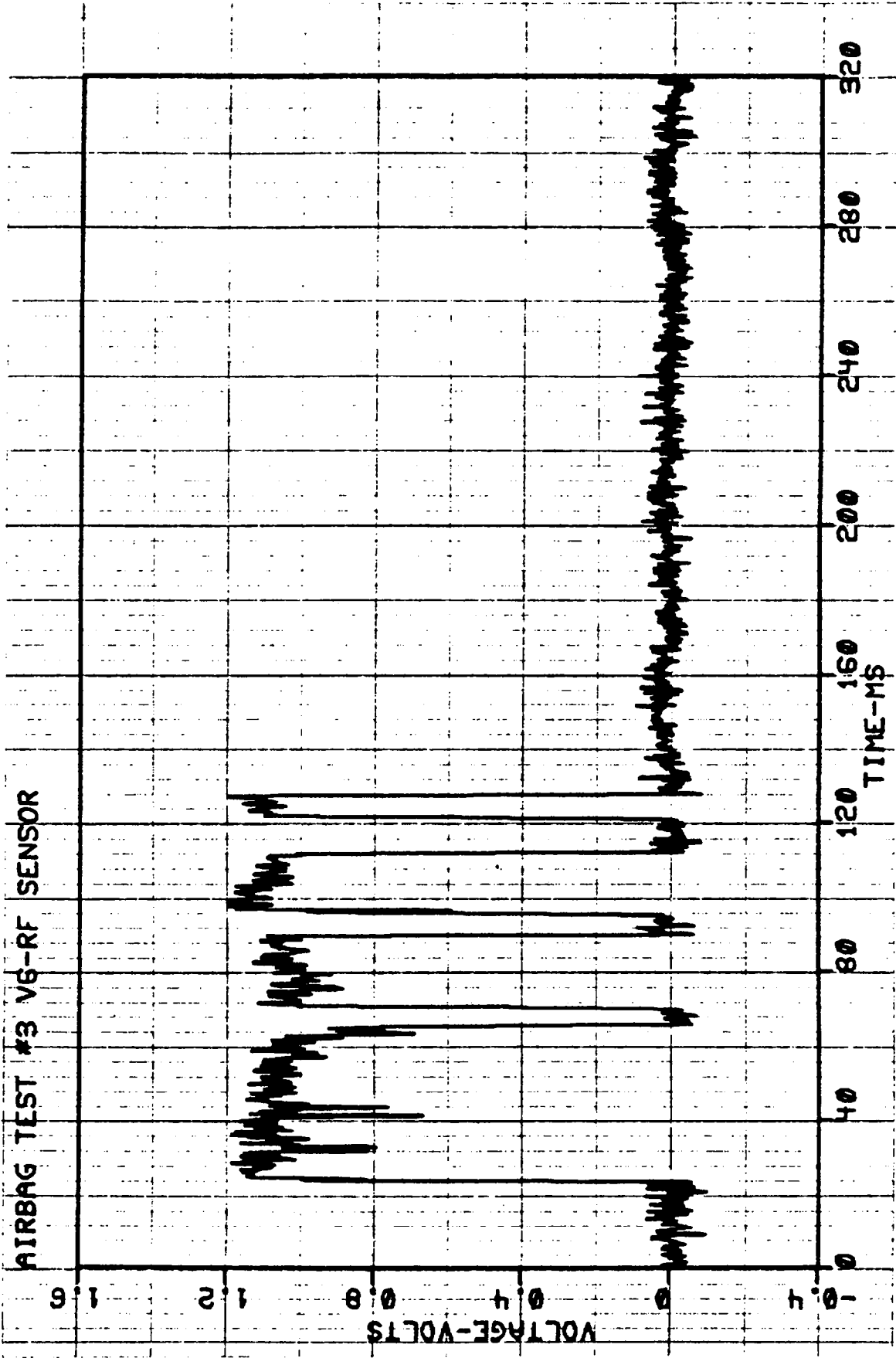




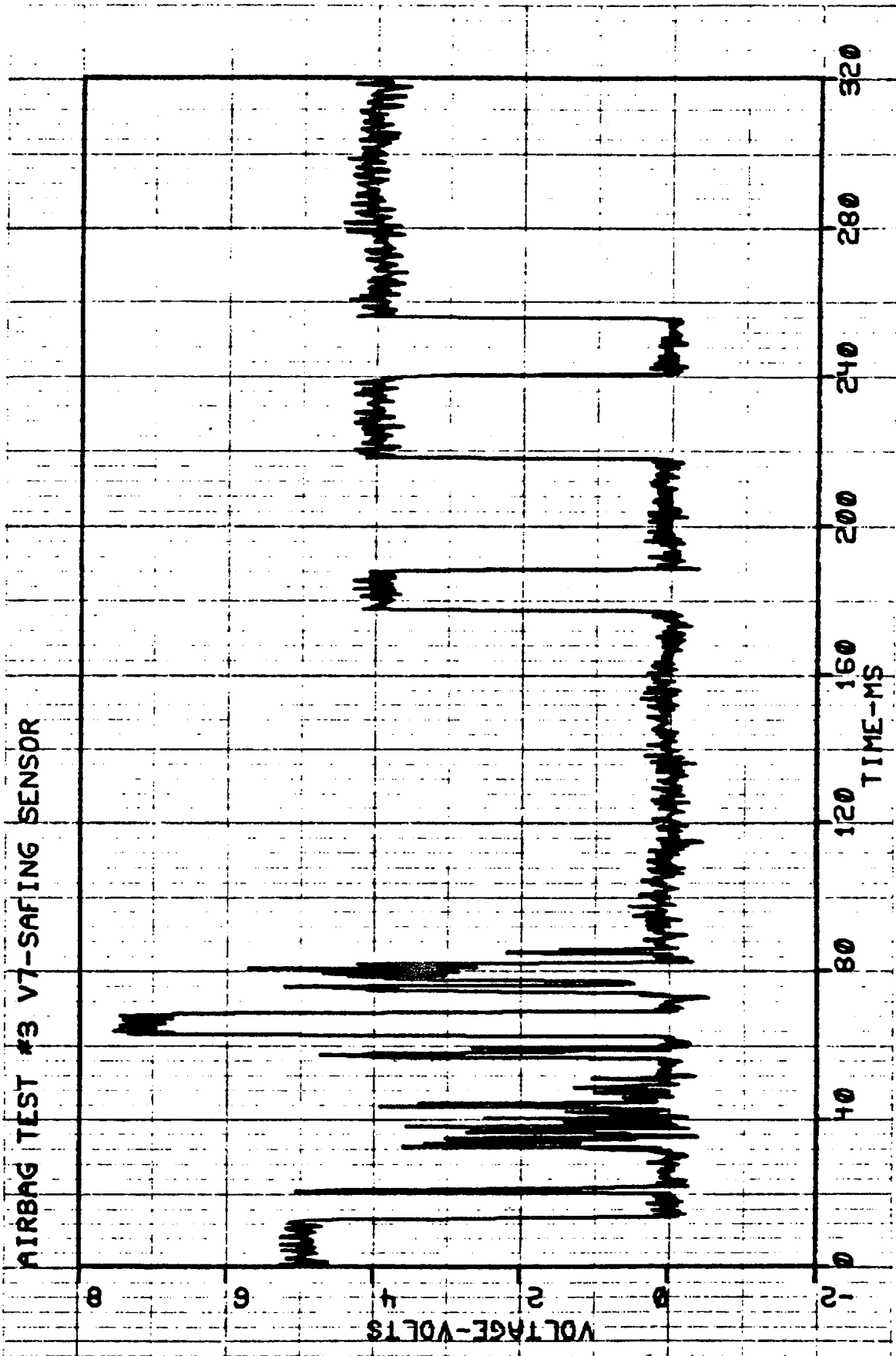




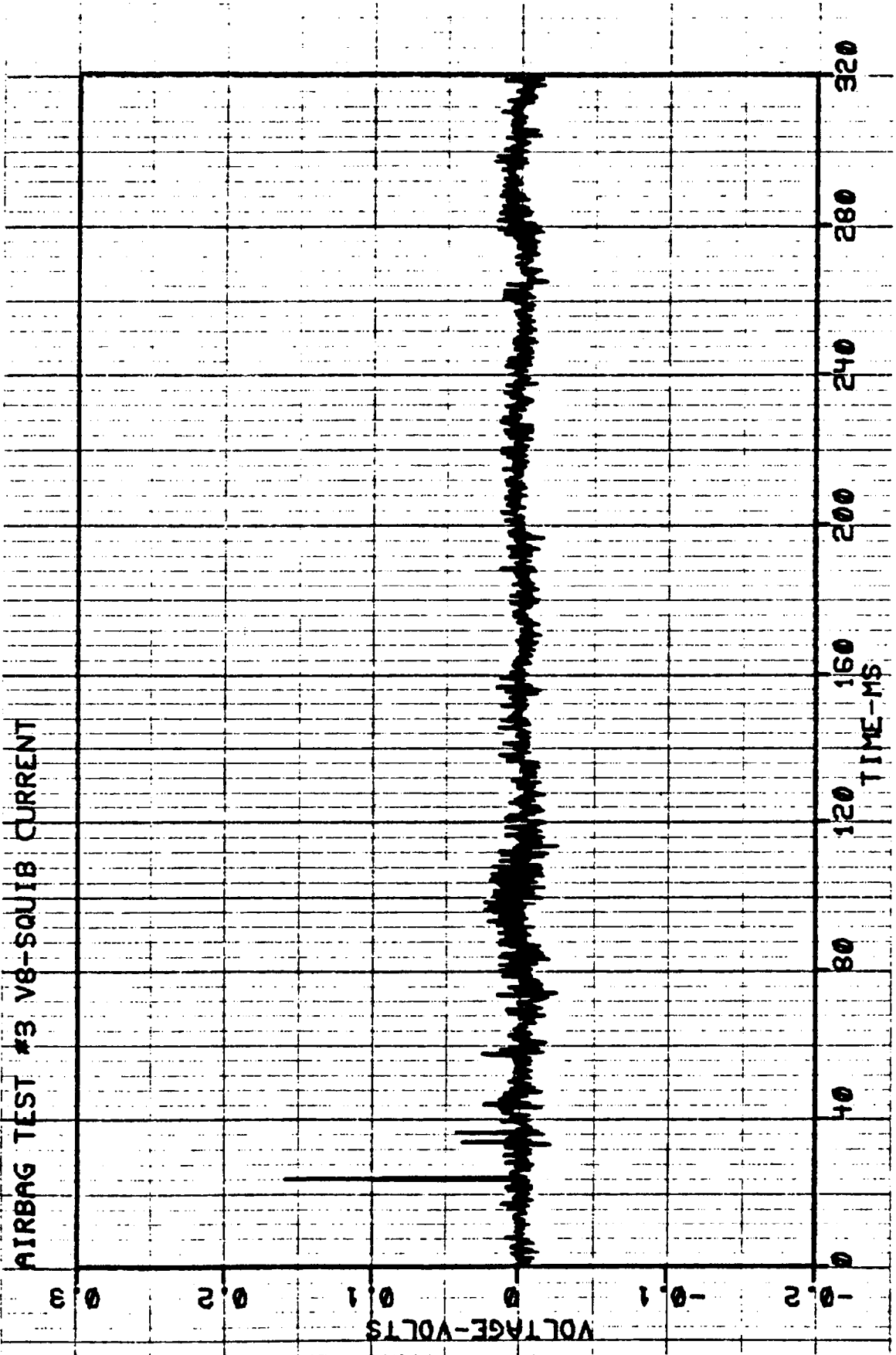




AIRBAG TEST #3 V7-SAFING SENSOR



AIRBAG TEST #3 V8-SQUIB CURRENT



**APPENDIX B**  
**PHOTOGRAPHS**



FIGURE B-1. PRE-TEST OVERALL VIEW OF VEHICLE.



FIGURE B-2. POST-TEST OVERALL VIEW OF VEHICLE.

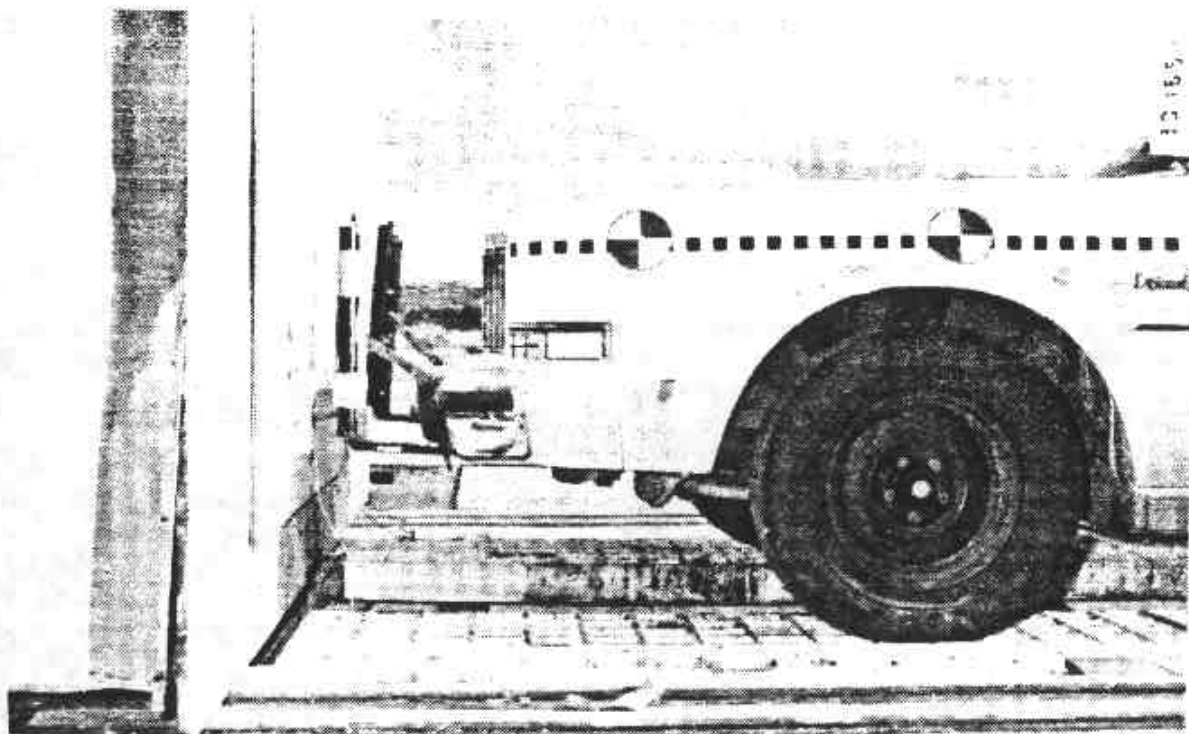


FIGURE B-3. PRE-TEST VIEW OF VEHICLE FRONT.

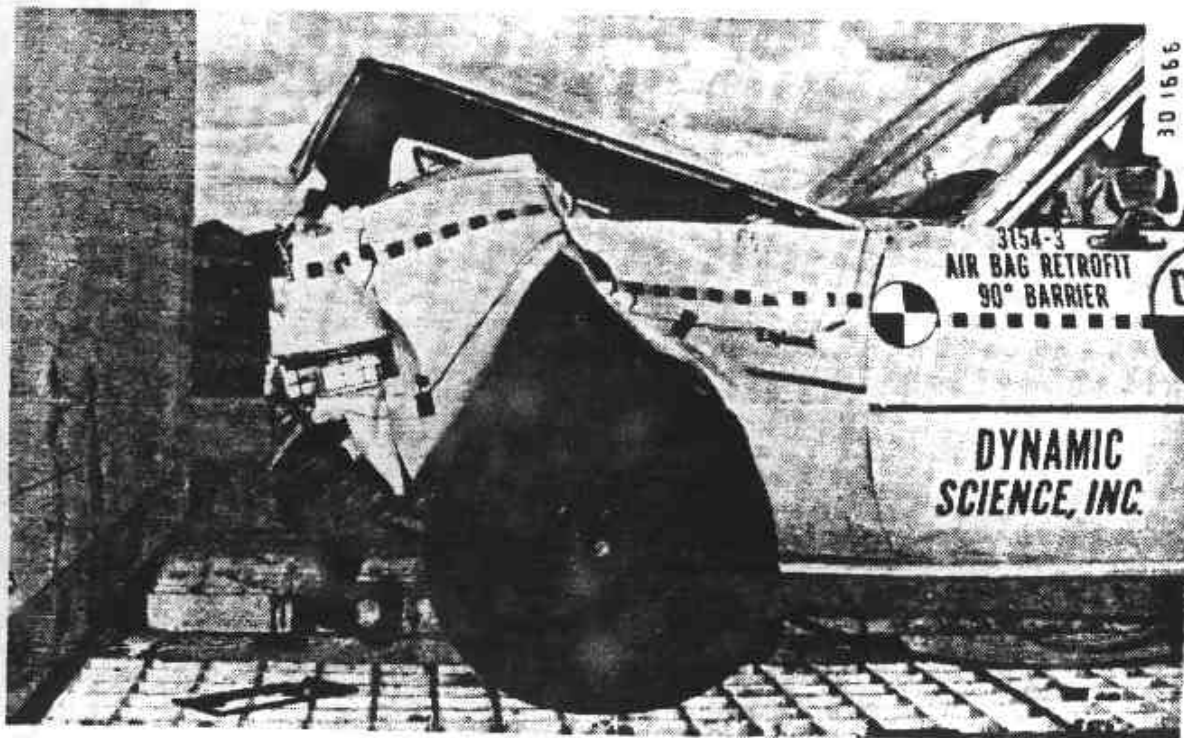


FIGURE B-4. POST-TEST VIEW OF VEHICLE FRONT.



FIGURE B-5. PRE-TEST VIEW OF DRIVER.



FIGURE B-6. POST-TEST VIEW OF DRIVER.

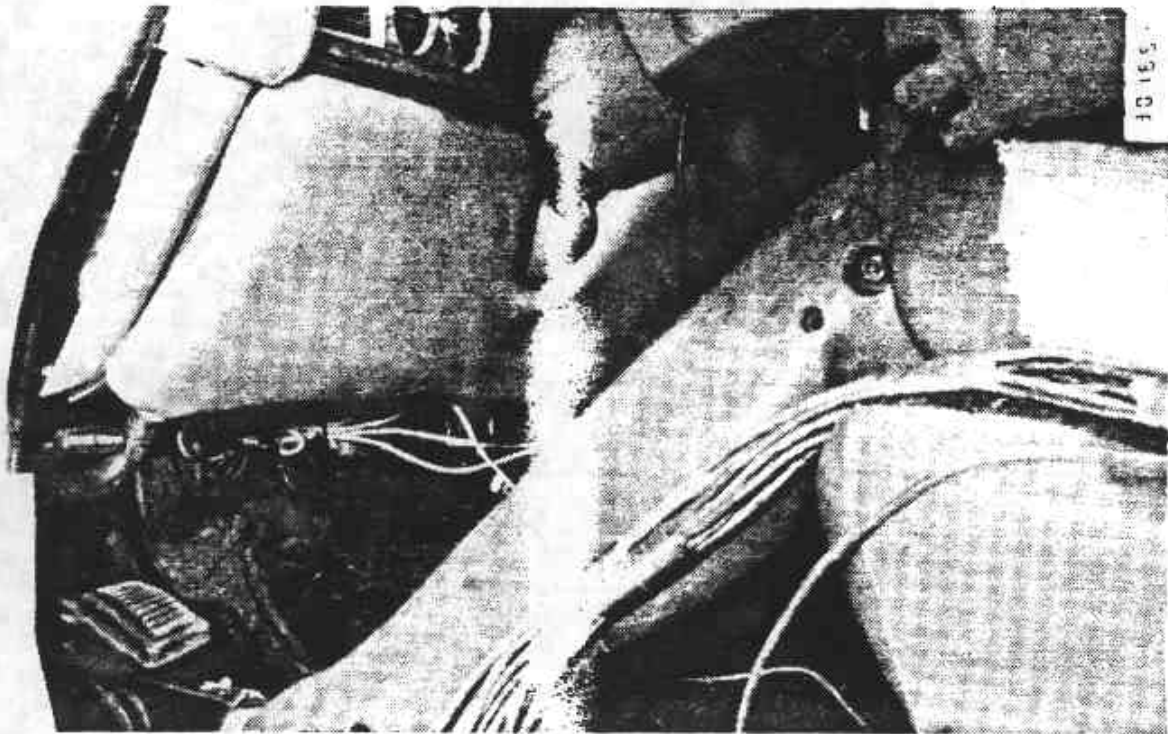


FIGURE B-7. PRE-TEST VIEW OF KNEE BOLSTER.

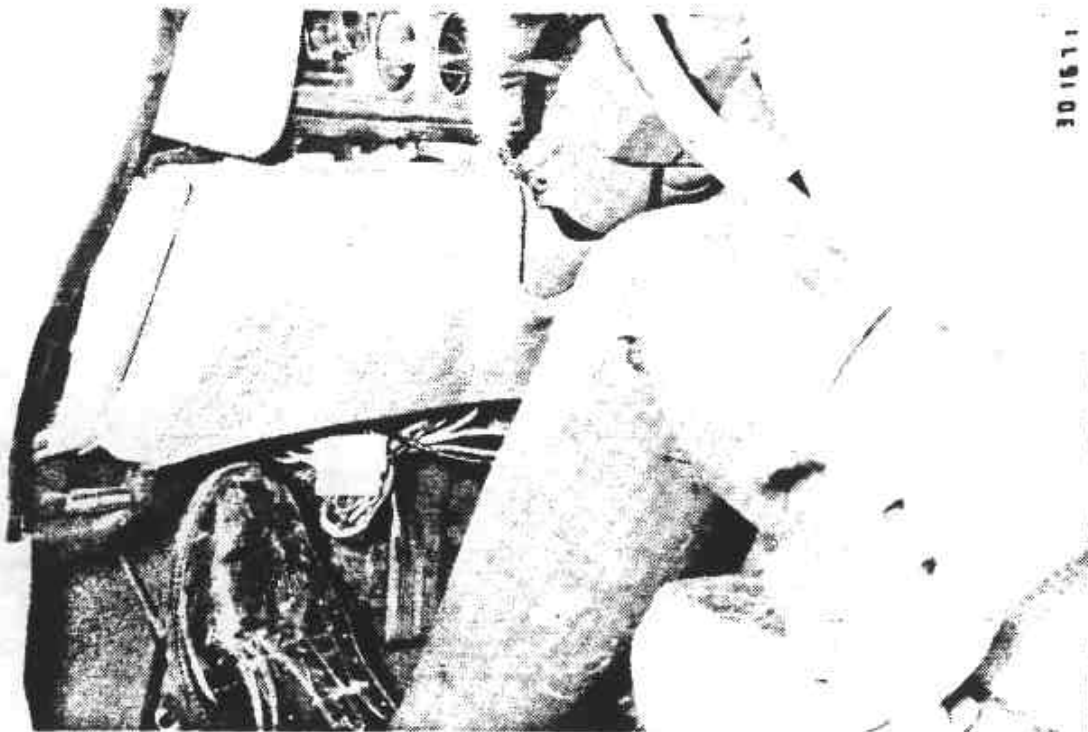


FIGURE B-8. POST-TEST VIEW OF KNEE BOLSTER.