Dynamic Science Report No. 3156-83-047/2105

DOT Ø611

# FRONTAL IMPACT CRASH TESTS INVOLVING ALTERNATIVE VEHICLE DESIGNS UNDER VARYING CRASH CONDITIONS

## TEST NO. 3156-1
## 1983 DODGE OMNI-TO-DEFORMABLE MOVING BARRIER
## FULL FRONTAL TEST AT 62.5 MPH
## 1 DMB

Prepared by:

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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

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Prepared by Matthew L. Reaves

Approved by Rod Garn

Date 1 Nov. 1983

Report Accepted by:

_____

Contract Technical Manager
Office of Vehicle Safety Compliance

_____

Date

## TECHNICAL REPORT STANDARD TITLE PAGE

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| 4. Title and Subtitle FRONTAL IMPACT TESTS OF ALTERNATE VEHICLE DESIGNS UNDER VARYING CRASH CONDITIONS - TEST NO. 3156-1, FULL FRONTAL DODGE OMNI-TO-DMB AT 62.5 MPH - 1 DMB | | 5. Report Date<br>October 1983<br>6. Performing Orgn Code |
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| 15. Supplementary Notes | | |


16. Abstract

The objective of this test program is to obtain structural performance data for selected vehicle types when subjected to a range of impact conditions.

Car-to-car, car-to-fixed object, and car-to-deformable moving barrier tests will be utilized to obtain baseline data for vehicles having dissimilar structural characteristics.

This report contains results of all electronic instrumentation data obtained during full frontal impact testing of a 1983 Dodge Omni 4-Door Hatchback and the NHTSA Deformable Moving Barrier. Testing was conducted by Dynamic Science, Inc. on October 13, 1983 with a closing speed of 62.36 mph. Instrumented 50th percentile dummies were utilized to obtain occupant response data; unrestrained Hybrid III in the passenger position, and restrained standard Part 572 in the driver position.


| 17. Key Words | 18. Distribution Statement |
|---|---|
| Full Frontal Impact Test,<br>Deformable Moving Barrier (DMB) | Copies are available from Technical Reference Division, National Highway Traffic Safety Administration, 400 7th Street, SW, Washington, DC 20590 |

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Form DOT F 1700.7 (8-69)

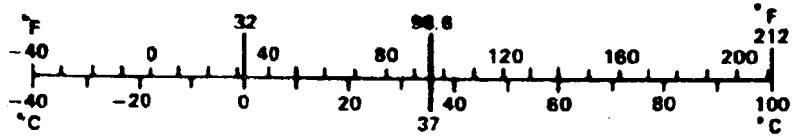
# METRIC CONVERSION FACTORS

## 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 | 0.4 | hectares | ha |
| | **MASS (weight)** | | | |
| oz | ounces | 28 | grams | g |
| lb | pounds | 0.45 | kilograms | kg |
| | short tons (2000 lb) | 0.9 | metric ton | t |
| | **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 (10 000 $m^2$) | 2.5 | acres | |
| | **MASS (weight)** | | | |
| g | grams | 0.035 | ounces | oz |
| kg | kilograms | 2.2 | pounds | lb |
| t | metric ton (1000 kg) | 1.1 | short tons | |
| | **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

# 1.0 PURPOSE AND TEST PROCEDURE

## 1.1 PURPOSE

A series of 32 impact tests is planned for inclusion in this program; the objective of each being to obtain structural performance data for selected vehicle types when subjected to a range of impact conditions.

Passenger car-to-passenger car, passenger car-to-fixed object, and passenger car-to-deformable moving barrier crash tests will be conducted to obtain baseline test data for vehicles having dissimilar structural characteristics. Electronic data to be collected will include occupant and structural responses of the striking and, when appropriate, struck vehicles.

## 1.2 TEST PROCEDURE

One 50th percentile Part 572 dummy and one 50th percentile Hybrid III dummy will be utilized in each test to obtain occupant response data relative to FMVSS 208 requirements. Various vehicle mounted accelerometers and a position rate gyro will be utilized to monitor vehicle response to the impact environment. In addition, load cells will be mounted behind the impact face of the deformable moving barrier and stationary pole barrier to monitor total force distribution generated by the impact event.

Actual procedures utilized for vehicle preparation and test conduct will be in general accordance with NHTSA New Car Assessment Program Test Procedure TP-212-02 with modifications and substitutions as directed by the Statement of Work for Contract No. DTNH22-82-A-17148 and the designated NHTSA Contract Technical Monitors.

## 2.0 REPORT ORGANIZATION

This report contains results of all electronic instrumentation data obtained during full frontal impact testing of a 1983 Dodge Omni 4-Door Hatchback and the NHTSA Deformable Moving Barrier. Testing was conducted by Dynamic Science, Inc. on October 13, 1983. Impact closing speed was 62.36 mph. NHTSA test designation is 1 DMB.

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

- General Test and Vehicle Parameter Data
- Dummy Occupant In-Vehicle Position Recording Sheet
- Summary of Vehicle Accelerometer Data
- FMVSS 208 Dummy Data Summary
- Instrumentation Camera Locations
- Test Vehicle and Dummy Occupant High-Speed Film Kinematic Analysis Summary
- High-Speed Film Data Table
- Test Vehicle Frontal Profile Data Sheet
- Deformable Moving Barrier Frontal Profile Data Sheet
- Test Vehicle Pre- and Post-Test Exterior Static Measurement Data
- Test Vehicle Pre- and Post-Test Interior Static Intrusion Measurement Data
- Pre- and Post-Test Position of Test Vehicle Accelerometer Mounting Locations
- Miscellaneous Test-Related Data Summary Sheet

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. Test log of anthropomorphic test devices are presented in Appendix C.

Complete test documentation includes one copy of all high-speed motion picture film and one magnetic computer tape containing all vehicle and occupant test results in digital format for

inclusion in the NHTSA Crash Test Data Base. These latter two items will be forwarded to the designated NHTSA CTM under separate cover.

## GENERAL TEST AND VEHICLE PARAMETER DATA

PRE-IMPACT DATA

Make/Model: Dodge Omni

Body Style: 4-Door Hatchback Model Year 1983

NHTSA No. NA DSI No. 1375 Color: White

DATA FROM CERTIFICATION LABEL

Vehicle Manufacturer: Chrysler Corporation

Date of Manufacture: 7/83 ; VIN: 1B3BZ18C6DD292501

GVWR: 3305 lb; GAWR: Front = 1770 lb; Rear = 1585 lb

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL

Vehicle Capacity: FRONT REAR RECOMMENDED LOAD RANGE:

Tire Pressure: Max 35 psi 35 psi TIRE SIZE: Standard

P175/75R13

Designated Seating: 2 Front 3 Rear 5 Total

Cargo load = 115 lb Is Spare Tire: Space Saver? Yes

TOTAL = 865 lb Standard Equipment? Yes

Engine: 4 Cylinder 135 CID

Transmission: 5-Speed Manual Front Wheel Drive

Date Vehicle Received by Laboratory: 9/16/83 ; Odometer 15

Dealer Name & Address: Carl Burger Dodge

8355 Hercules Street, La Mesa, CA

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

Right Front 721 lb Right Rear = 402 lb

Left Front = 711 lb Left Rear = 421 lb

TOTAL FRONT WEIGHT = 1432 lb ( 64 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 823 lb ( 36 % of Total Vehicle Weight)

TOTAL DELV. WEIGHT = 2255 lb

TARGET WEIGHT SPECIFIED IN STATEMENT OF WORK = 2600 lb

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 0 LB CARGO:

Right Front = 781 lb Right Rear = 502 lb

Left Front = 787 lb Left Rear = 532 lb

TOTAL FRONT WEIGHT = 1568 lb ( 60 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 1034 lb ( 40 % of Total Vehicle Weight)

TOTAL TEST WEIGHT = 2602 lb

Weight of ballast secured in vehicle trunk area = 0 lb

VEHICLE ATTITUDE: (inches)

Delivered Attitude: RF 28.0 LF 28.0 RR 28.0 LR 28.0

Test Attitude: RF 27.1 LF 27.4 RR 26.4 LR 26.7

REMARKS: Steering column angle 63° clockwise from vertical.

## GENERAL TEST AND VEHICLE PARAMETER DATA (CONT)

POST-IMPACT DATA

Type of Test: Frontal (DMB) (0°) Impact

Date of Test: 10/13/83 Time: 1316 Temperature 82 °F

Required Impact Velocity Range: 62.3 to 63.7 mph

Impact Velocity: Primary = 62.36 mph Secondary = N/A mph

VEHICLE REBOUND AND CRUSH (in.)

| | | R | ℄ | L |
|---|---|---|---|---|
| Vehicle Length: | Pre-test = | 162.6 | 164.5 | 162.5 |
| | Post-test = | 135.9 | 136.1 | 134.4 |
| | Crush = | 26.7 | 28.4 | 28.1 |

Distance from front of test vehicle to point of impact:

| R | ℄ | L |
|---|---|---|
| NA | 8.9 | NA |

VISIBLE DUMMY CONTACT POINTS

| | Driver | Passenger |
|---|---|---|
| Head | Steering wheel rim | Windshield |
| Chest | Steering wheel hub | Instrument Panel |
| Abdomen | Lower steering wheel rim | None |
| Left Knee | Lower instrument panel | Lower instrument panel |
| Right Knee | Lower instrument panel | Lower instrument panel |

| DOOR OPENING | Front | | Rear | |
|---|---|---|---|---|
| | Left | Right | Left | Right |
| | Difficult | Difficult | NA | NA |

SEAT MOVEMENT

| | | |
|---|---|---|
| Seat Back Failure | None | None |
| Seat Shift (in.) | None | None |

GLAZING DAMAGE: Windshield shattered, loss of retention in lower left-hand corner; door window jammed forward.

NOTABLE IMPACT EFFECTS: Residual post-test pitch angle due to structural deformation of the vehicle measures approximately three degrees.

**DUMMY OCCUPANT IN-VEHICLE POSITION RECORDING SHEET**

Test Description: Passenger Car-to-NHTSA DMB Full Frontal, 62.5 mph

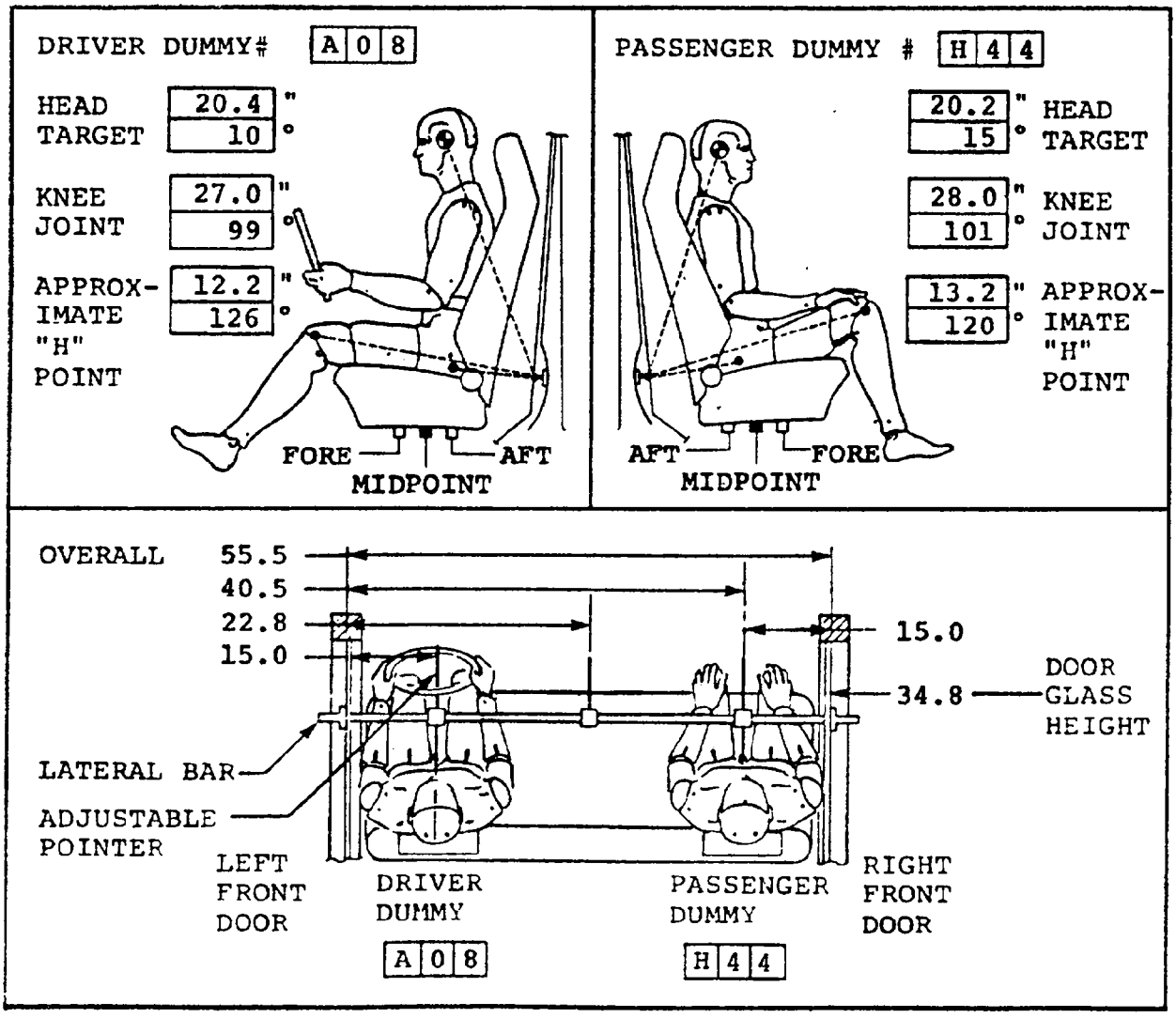
Test Vehicle: 1983 Dodge Omni 4-Door Hatchback DSI No. 1375

Seat Type: Bucket Adjust Type: 15 position manual

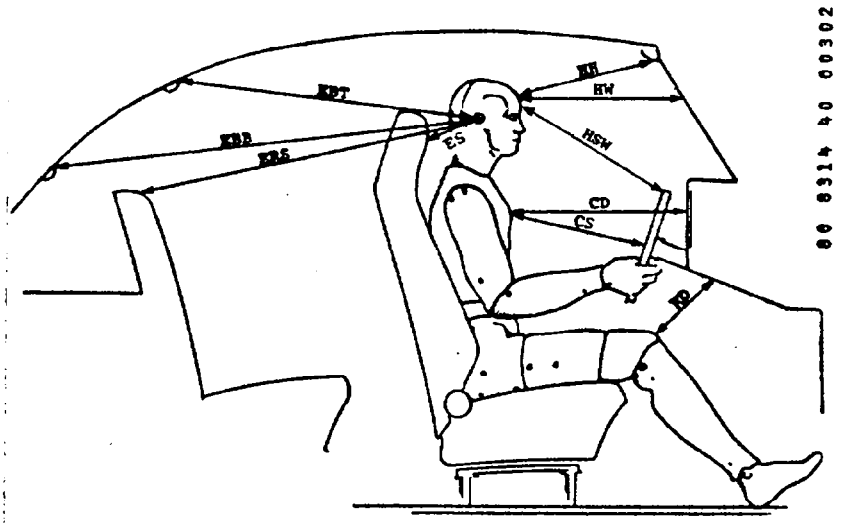
Seat Back Type: High back with adjustable headrests fully extended

Dummy Description: Part 572 driver, restrained; Hybrid III passenger, unrestrained

Dummy Interior Temperature Prior to Test Initiation: 70 °F



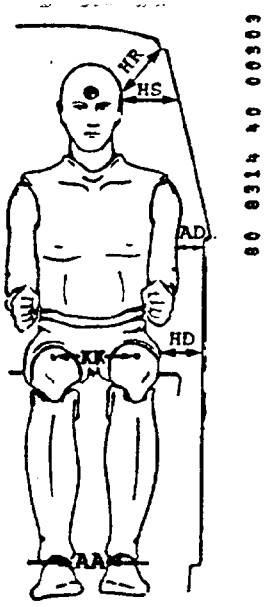
## DUMMY OCCUPANT IN-VEHICLE POSITION RECORDING SHEET




| | Driver | Passenger |
|---|---|---|
| HH | 12.5 | 11.3 |
| HW | 18.8 | 18.1 |
| CD | N/A | 23.2 |
| CS | 17.2 | N/A |
| KD L | 6.3 | 6.1 |
| KD R | 6.3 | 6.0 |
| HIP | NA | 28.1 |
| Torso Angle | 23° | Torso Angle 18° |
| Seat Back Angle | 21° | Seat Back Angle 22° |
| HSW | 20.0 | N/A |

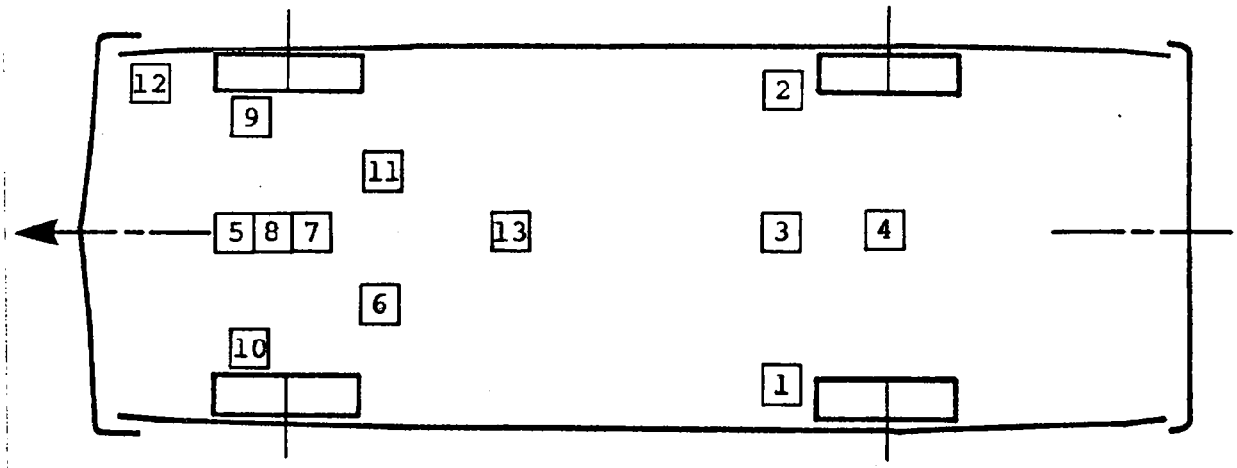
HH = Head to Windshield Header
HW = Head to Windshield
CD = Chest to Dash
CS = Chest to Steering Wheel
KD = Knees to Dash
HR = Head to Side Roof
HS = Head to Side Window
AD = Arm to Door
HD = Hip to Door
KK = Knee to Knee
HIP = Head to Instrument panel
Torso and seat back angles are relative to vertical.

REMARKS: Dummies positioned with reference to OVSC recommended procedure for positioning Part 572 dummies in test vehicle.




| | Driver | Passenger |
|---|---|---|
| HR | 7.0 | 7.0 |
| HS | 8.9 | 9.2 |
| AD | 3.6 | 4.0 |
| HD | 6.3 | 6.5 |
| KK | 9.8 | 9.8 |
| AA | 10.5 | 8.5 |

## SUMMARY OF VEHICLE ACCELEROMETER DATA

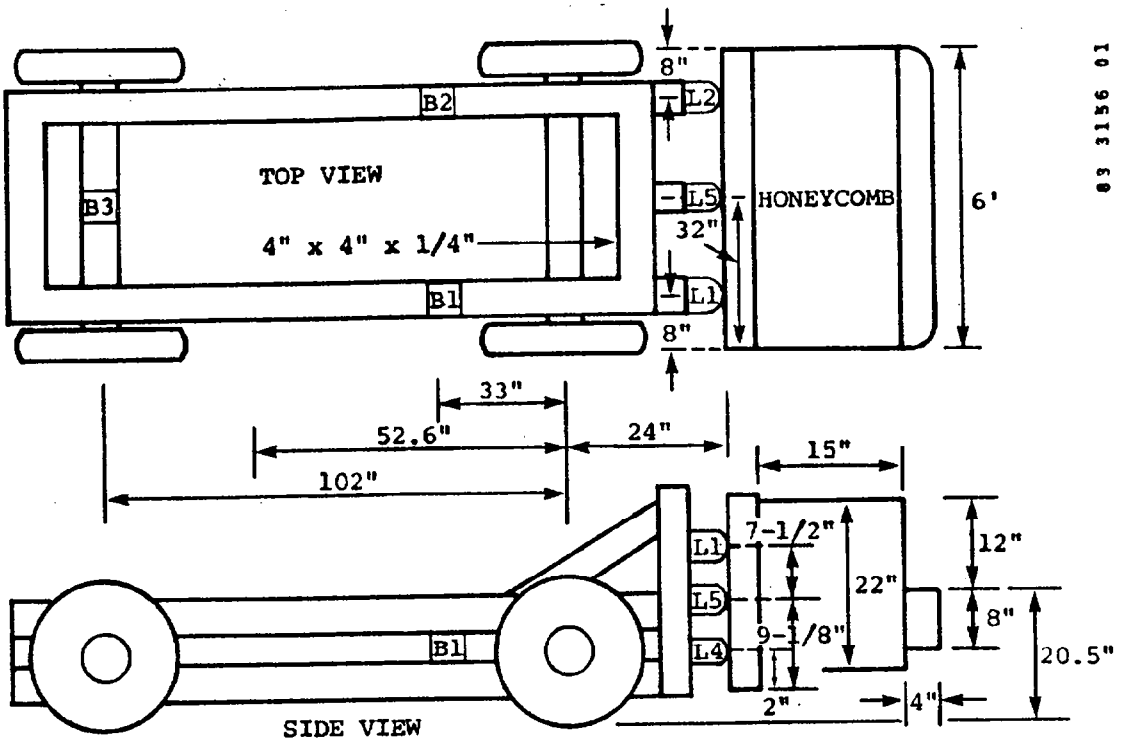



Vehicle: 1983 Dodge Omni 4-Door Hatchback DSI No. 1375

| Loc. No. | Description | Direction | Maximum Value "-" | msec | "+" | msec |
|---|---|---|---|---|---|---|
| 1 | Rear seat X-member - left side primary | X | 39.1 | 29.8 | 6.4 | 140.9 |
| 1* | Rear seat X-member - left side redundant | X | 34.6 | 30.1 | 4.6 | 140.9 |
| 2 | Rear seat X-member - right side primary | X | 34.9 | 31.9 | 4.2 | 139.8 |
| 2* | Rear seat X-member - right side redundant | X | 36.3 | 49.5 | 4.3 | 140.0 |
| 3 | Rear seat X-member - centerline | X | 48.9 | 54.0 | 18.2 | 15.9 |
| 3 | Rear seat X-member - centerline | Y | 12.7 | 45.8 | 12.8 | 17.1 |
| 3 | Rear seat X-member - centerline | Z | 29.6 | 44.4 | 36.4 | 39.0 |
| 4 | Rear axle centerline | X | 37.0 | 33.4 | 7.4 | 117.1 |
| 4 | Rear axle centerline | Z | 7.6 | 29.0 | 9.9 | 45.9 |
| 5 | Top of engine block | X | 132.1 | 96.4 | 14.9 | 73.3 |
| 5 | Top of engine block | Z | 26.2 | 15.9 | 29.9 | 44.9 |
| 6 | Steering wheel hub | X | 77.4 | 53.9 | 57.1 | 59.9 |
| 6 | Steering wheel hub | Z | 46.3 | 67.8 | 80.9 | 58.6 |
| 7 | Front suspension X-member | X | 68.9 | 16.8 | 71.6 | 35.4 |
| 7 | Front suspension X-member | Z | 18.9 | 3.6 | 37.4 | 33.1 |
| 8 | Bottom of engine | X | 134.9 | 18.4 | 25.0 | 33.6 |
| 9 | Right front brake caliper | X | 85.2 | 43.4 | 50.0 | 54.4 |
| 10 | Left front brake caliper | X | 87.3 | 35.1 | 27.0 | 52.9 |
| 11 | Instrument panel | X | 123.5 | 68.5 | 184.0 | 61.1 |
| 11 | Instrument panel | Z | 62.5 | 67.4 | 51.4 | 41.6 |
| 12 | Air bag sensor location | X | 1430.9 | 207.3 | 385.9 | 26.1 |
| 13 | Yaw rate gyro (deg) | Z | NA | NA | NA | NA |

*Mounted on rubber isolation pad.

## SUMMARY OF MOVING BARRIER ACCELEROMETER DATA




WEIGHT BY WHEEL

LF 984 RF 940 LR 530 RR 544 Total 2998 pounds

| Loc. No. | Description | Direction | Maximum Value "-" | msec | "+" | msec |
|---|---|---|---|---|---|---|
| B1 | Right upper frame rail | X* | 30.2 | 44.5 | 1.6 | 253.5 |
| B1 | Right upper frame rail | Z | 9.8 | 28.1 | 11.1 | 20.0 |
| B2 | Left upper frame rail | X | 30.4 | 42.9 | 1.8 | 159.5 |
| B2 | Left upper frame rail | Z* | 8.7 | 47.3 | 15.6 | 19.6 |
| B3 | Rear axle centerline | X | 30.5 | 43.0 | 5.8 | 8.3 |
| B3 | Rear axle centerline | Y | 4.0 | 49.5 | 4.2 | 99.9 |
| B3 | Rear axle centerline | Z | 17.3 | 20.5 | 25.5 | 24.4 |
| L1 | Top right load cell | X | 20093 | 45.0 | 531 | 118.0 |
| L2 | Top left load cell | X | 19898 | 44.0 | 1285 | 277.0 |
| L3 | Bottom left load cell | X | 9992 | 12.0 | 1274 | 169.0 |
| L4 | Bottom right load cell | X | 24707 | 12.0 | 3478 | 136.0 |
| L5 | Center load cell | X | 16742 | 45.0 | 1238 | 136.0 |

*Mounted on rubber isolation pad.

## 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) |
| Head Acceleration | | | | | | | | |
| Longitudinal | 21.5 | 169.3 | 118.6 | 66.0 | 32.6 | 90.1 | 89.3 | 98.0 |
| Lateral | 27.6 | 169.4 | 89.7 | 66.1 | 23.4 | 99.6 | 13.0 | 84.4 |
| Vertical | 44.1 | 81.0 | 8.2 | 14.6 | 92.2 | 73.6 | 168.7 | 88.1 |
| Resultant | 151.8 | 66.0 | - | - | 171.1 | 88.1 | - | - |
| HIC | 1736.5 between 49.9 and 99.9 msec; | | | | 2027.1 between 69.4 and 104.1 msec | | | |
| Chest Acceleration | | | | | | | | |
| Longitudinal | 5.0 | 171.9 | 46.7 | 65.4 | 15.1 | 113.9 | 133.5 | 88.8 |
| Lateral | 11.5 | 83.6 | 29.6 | 65.0 | 5.3 | 74.8 | 8.2 | 81.3 |
| Vertical | 22.1 | 52.0 | 17.1 | 74.1 | 91.6 | 71.5 | 19.0 | 97.8 |
| Resultant (Max) | 55.6 | 65.3 | - | - | 134.4 | 88.8 | - | - |
| Resultant (Clip) | 47.5 | - | - | - | 94.0 | - | - | - |
| TIME > 60 G | N/A | | | | 20 msec | | | |
| SEVERITY INDEX | 396.8 @ 320 msec | | | | 1570.7 @ 320 msec | | | |
| Upper Sternum Acceleration | | | | | | | | |
| Longitudinal | N/A | - | N/A | - | 60.3 | 105.1 | 124.4 | 85.3 |
| TIME > 60 G | N/A | | | | 9.5 msec | | | |
| SEVERITY INDEX | N/A | | | | 1107.0 @ 320 msec | | | |
| Lower Sternum Acceleration | | | | | | | | |
| Longitudinal | N/A | - | N/A | - | 28.1 | 83.0 | 48.8 | 77.1 |
| TIME > 60 G | N/A | | | | 0 msec | | | |
| SEVERITY INDEX | N/A | | | | 96.5 @ 320 msec | | | |

*Longitudinal: Forward
Lateral: Rightward
Vertical: Downward

**Longitudinal: Rearward
Lateral: Leftward
Vertical: Upward

## FMVSS 208 DUMMY DATA SUMMARY (Continued)

| | Driver Dummy | | | | Passenger Dummy | | | |
|---|---|---|---|---|---|---|---|---|
| | Positive Direction* | | Negative Direction** | | Positive Direction* | | Negative Direction** | |
| | Peak (lb) | Time (msec) | Peak (lb) | Time (msec) | Peak (lb) | Time (msec) | Peak (lb) | Time (msec) |
| Neck Loads | | | | | | | | |
| Longitudinal | N/A | - | N/A | - | 417.7 | 99.0 | 49.0 | 91.0 |
| Lateral | N/A | - | N/A | - | 2150.7 | 100.0 | 2332.5 | 90.0 |
| Vertical Moment (ft-lb) | N/A | - | N/A | - | 9.3 | 196.0 | 299.8 | 89.0 |
| Femur Loads | | | | | | | | |
| Left | 169.5 | 48.0 | 761.6 | 67.0 | 403.6 | 244.0 | 2059.4 | 59.0 |
| Right | 386.0 | 52.0 | 1641.0 | 62.0 | 121.3 | 117.5 | 3045.9 | 76.0 |
| Belt Loads | | | | | | | | |
| Lap | 1115.4 | 53.0 | 4.8 | 7.0 | N/A | - | N/A | - |
| Torso | 543.1 | 70.0 | 39.1 | 172.0 | N/A | - | N/A | - |
| Chest Pot | N/A | - | N/A | - | 13.3° | 76.0 | 51.7° | 89.0 |

*Longitudinal: Forward
Lateral: Rightward
Vertical: Downward

**Longitudinal: Rearward
Lateral: Leftward
Vertical: Upward

## CAMERA LOCATIONS

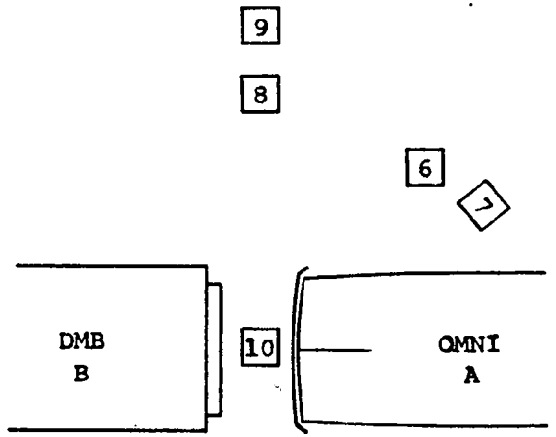
Test No: 3156-1 Test Date: 10/13/83

Test Type: DMB to Omni Full Frontal

Vehicle A (Away): Omni

Vehicle B (Barrier): DMB

Comments: Both vehicles moving, camera locations verified by CTM.




| CAMERA | YES |
|---|---|
| STILLS | |
| SLIDES | |
| MOVIE | |
| POLAROID | |
| VIDEO | |
| | |

CAMERA SYMBOLS

- ⊙ PIT
- ↑ GROUND
- △ BARRIER
- ☒ OVERHEAD
- ☐ ON-BOARD

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

? 1077FPS 875

| 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 | Inline vehicle door - left side | Driver dummy close-up - Hycam | 25 | 1406 | 98 | 228 | 6'3" | 19'5" | 4'1" |
| 2 | Oblique vehicle door - left side | Driver dummy close-up - Photosonic | 25 | 1005 | 99 | 6 | 10'2" | 19'5" | 5'9" |
| 3 | Perpendicular to impact - left side | Overall impact close-up - Hycam | 40 | 904 | 101 | 698 | 0 | 46'1" | 3'9" |
| 4 | Perpendicular to impact - left side | Overall impact - Photosonic | 15 | 825 | 100 | 10 | 0 | 48' | 4'10" |
| 5 | Oblique to vehicle - left side | Front left of vehicle and driver dummy - Phot. | 25 | 915 | 100 | 12 | -14'9" | 16'2" | 6'2" |
| 6 | Inline vehicle door - right side | Passenger dummy close-up - Photosonic | 25 | 1305 | 145 | 7 | 6'9" | 20'10" | 4'3" |
| 7 | Oblique vehicle door - right side | Passenger dummy close-up redundant - Hycam | 25 | 429 | 101 | 509 | 12'0" | 17'7" | 5'7" |
| 8 | Perpendicular to impact - right side | Overall impact close-up - Hycam | 40 | 1122 | 101 | 797 | 0'9" | 46'1" | 3'10" |
| 9 | Perpendicular to impact - right side | Overall impact - Photosonic | 15 | 1025 | 100 | 11 | 0'9" | 48'5" | 4'8" |
| 10 | Pit | Engine and front underside of Omni - Phot. | 13 | 842 | 100 | 5 | 2'2" | 0 | -10'9" |
| 11 | Left side impact | Overall panning - Canon Scoopic | Var. | 24 | N/A | N/A | N/A | N/A | N/A |
| | | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

## TEST VEHICLE AND DUMMY OCCUPANT

## HIGH-SPEED FILM KINEMATIC ANALYSIS SUMMARY

| Time (msec) | |
|---|---|
| 0 | Impact. |
| 5 | Vehicle bumper contacts grille. |
| 13 | Engine compartment begins deformation. |
| 18 | Instrument panel begins deformation. |
| 26 | Steering assembly begins intrusion into occupant compartment. |
| 32 | Vehicle floorpan begins distortion. |
| 45 | Driver dummy head passes through 15 inch reference plane at 45.0 ft/sec. |
| 58 | Passenger dummy chest passes through 12 inch reference plane at 47.2 ft/sec. |
| 60 | Passenger dummy head passes through 15 inch reference plane at 47.6 ft/sec. |
| 63 | Driver dummy head contacts steering wheel rim at 42.9 ft/sec. Head impact velocity = (velocity of head - velocity of steering) = 42.9 - (-1.7) = 44.6 ft/sec. |
| 68 | Passenger dummy head contacts windshield at 45.9 ft/sec. |
| 76 | Driver dummy chest contacts intruding steering wheel hub. |
| 78 | Rebound begins with maximum dynamic crush of 31.4 inches. |
| 80 | Steering assembly ends intrusion into occupant compartment. |
| 84 | Passenger dummy chest contacts instrument panel. |
| 92 | Instrument panel ends deformation. |

## HIGH-SPEED FILM DATA TABLE

| | Driver | | | Passenger | | |
|---|---|---|---|---|---|---|
| | Head | Chest | Steering Column | Head | Chest | Instrument Panel |
| $t_1$ | - | - | 26 msec | - | - | 18 msec |
| $t_2$ | - | - | 80 msec | - | - | 92 msec |
| $t_c$ | 63 msec | 76 msec | - | 68 msec | 84 msec | - |
| $t_i$ | 45 msec | 74 msec | - | 60 msec | 58 msec | - |
| $v_c$ | 42.9 ft/sec | - | -1.7 ft/sec | 45.9 ft/sec | - | - |
| $v_i$ | 45.0 ft/sec | 38.4 ft/sec | - | 47.6 ft/sec | 47.2 ft/sec | - |
| $D_1$ | - | - | 13.8 in. | - | - | 9.0 in. |
| $D_2$ | - | - | 19.3 in. | - | - | 21.0 in. |
| $B_1$ | - | - | 12.3 in. | - | - | 9.1 in. |
| $B_2$ | - | - | 21.6 in. | - | - | 21.3 in. |
| $P_1$ | - | - | 8.2 in. | - | - | 4.8 in. |
| $P_2$ | - | - | 21.6 in. | - | - | 23.7 in. |

Where:

$t_1$ = time begining of intrusion or deformation

$t_2$ = time ending of intrusion or deformation

$t_c$ = time of contact

$t_i$ = time passing through 15 inch reference plane for head or 12 inch reference plane for chest

$v_c$ = velocity at contact

$v_i$ = velocity at reference plane

$D_1$ = vehicle travel from time of impact to $t_1$

$D_2$ = vehicle travel from time of impact to $t_2$

$B_1$ = barrier travel from time of impact to $t_1$

$B_2$ = barrier travel from time of impact to $t_2$

$P_1$ = plane of impact travel from time of impact to $t_1$

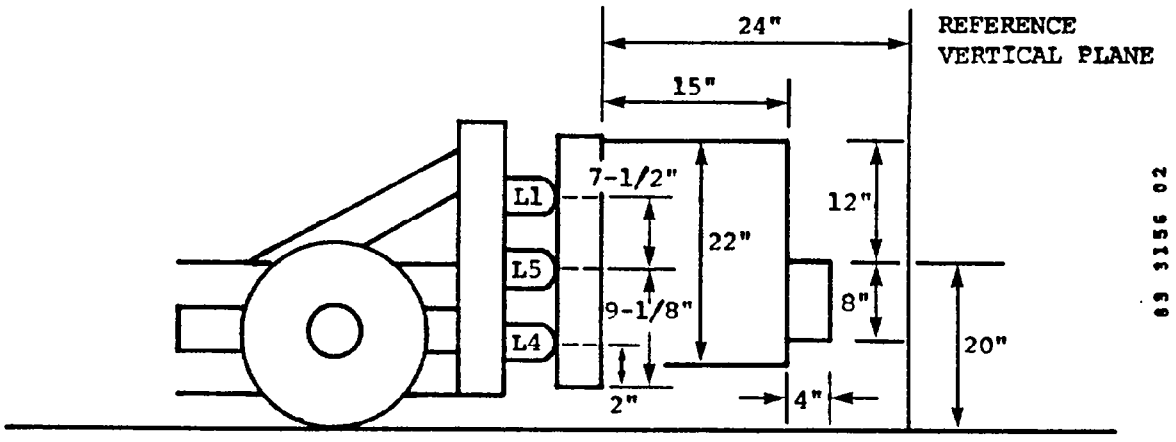
$P_2$ = plane of impact travel from time of impact to $t_2$

## TEST VEHICLE FRONTAL PROFILE DATA SHEET

Measurements referenced to plane 170 inches forward of rear bumper centerline.

| | | Vehicle Left (In.) | | | | | Vehicle Right (In.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Height | 24 | 18 | 12 | 6 | ℄ | 6 | 12 | 18 | 24 |
| | | | | Pre-Test | | | | | | |
| Bottom of Front Bumper | 15.7 | 9.1 | 8.8 | 8.4 | 8.2 | 8.0 | 8.1 | 8.1 | 8.6 | 9.2 |
| Top of Front Bumper | 20.0 | 9.0 | 8.7 | 8.3 | 8.1 | 7.9 | 8.0 | 8.2 | 8.6 | 9.0 |
| Center of Grille Area | 24.7 | 14.9 | 15.6 | 13.8 | 13.5 | 12.9 | 13.5 | 13.7 | 15.4 | 14.8 |
| Front of Hood | 28.8 | 16.0 | 15.3 | 14.7 | 14.5 | 14.3 | 14.5 | 14.8 | 15.2 | 15.9 |
| | | | | Post-Test | | | | | | |
| Bottom of Front Bumper | 16.6 | 36.6 | 35.8 | 35.8 | 34.2 | 35.7 | 35.3 | 34.3 | 37.9 | 34.7 |
| Top of Front Bumper | 20.5 | 35.5 | 35.8 | 34.9 | 33.5 | 33.9 | 33.3 | 33.4 | 33.5 | 34.0 |
| Center of Grille Area | 24.7 | 37.9 | 38.4 | 37.3 | 35.5 | 36.7 | 34.9 | 34.7 | 35.5 | 35.1 |
| Front of Hood | 25.7 | 36.4 | 37.2 | 37.9 | 37.6 | 36.2 | 37.2 | 37.9 | 38.0 | 35.9 |
| | | | | Change | | | | | | |
| Bottom of Front Bumper | | 27.5 | 27.0 | 27.4 | 26.0 | 27.7 | 27.2 | 26.2 | 29.3 | 25.5 |
| Top of Front Bumper | | 26.5 | 27.1 | 26.6 | 25.4 | 26.0 | 25.3 | 25.2 | 24.9 | 25.0 |
| Center of Grille Area | | 23.0 | 22.8 | 23.5 | 22.0 | 23.8 | 21.4 | 21.0 | 20.1 | 20.3 |
| Front of Hood | | 20.4 | 21.9 | 23.2 | 23.1 | 21.9 | 22.7 | 23.1 | 22.8 | 20.0 |

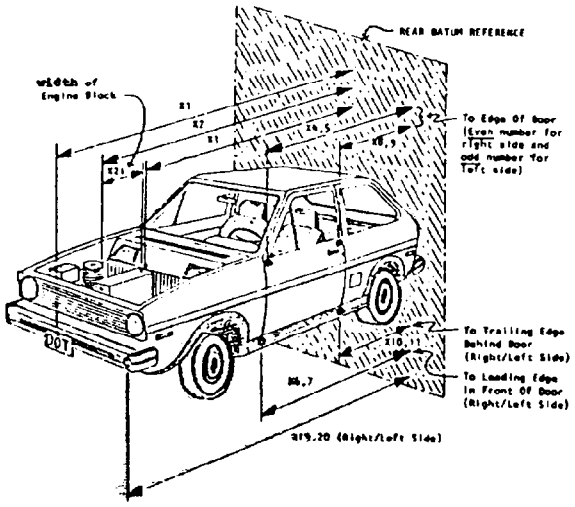
## DEFORMABLE MOVING BARRIER (DMB) FRONTAL PROFILE DATA SHEET

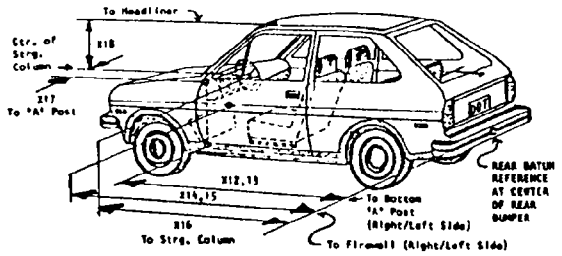



Test Description Passenger Car-to-NHTSA DMB Full Frontal 62.5 mph

Measurements referenced from vertical plane 24 inch from front backing face of DMB.

| | Height | 30 | 24 | 18 | 12 | 6 | C | 6 | 12 | 18 | 24 | 30 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Pre-Test | | | | | | |
| Top of Face | 32.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| Midpoint of Face | 26.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 | 9.0 |
| Top of Bumper | 20.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Bottom of Bumper | 12.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| | | | | | | Post-Test | | | | | | |
| Top of Face | 26.8 | 13.7 | 16.2 | 14.2 | 14.2 | 14.9 | 15.8 | 14.6 | 14.4 | 14.4 | 15.4 | 14.8 |
| Midpoint of Face | 21.0 | 15.6 | 16.2 | 18.2 | 19.3 | 18.2 | 18.3 | 17.4 | 16.7 | 16.3 | 16.1 | 15.3 |
| Top of Bumper | 17.8 | 16.7 | 17.8 | 18.8 | 19.0 | 18.3 | 17.0 | 17.5 | 17.4 | 17.3 | 16.9 | 16.2 |
| Bottom of Bumper | 11.5 | 15.5 | 16.1 | 16.7 | 17.0 | 16.3 | 16.7 | 16.2 | 15.7 | 15.6 | 15.2 | 14.5 |
| | | | | | | Crush | | | | | | |
| Top of Face | | 4.7 | 7.2 | 5.2 | 5.2 | 5.9 | 6.8 | 5.6 | 5.4 | 5.4 | 6.4 | 5.8 |
| Midpoint of Face | | 6.6 | 7.2 | 9.2 | 10.3 | 9.2 | 9.3 | 8.4 | 7.7 | 7.3 | 7.1 | 6.3 |
| Top of Bumper | | 11.7 | 12.8 | 13.8 | 14.0 | 13.3 | 12.8 | 12.5 | 12.4 | 12.3 | 11.9 | 11.2 |
| Bottom of Bumper | | 10.5 | 11.1 | 11.7 | 12.0 | 11.3 | 11.7 | 11.2 | 10.7 | 10.6 | 10.2 | 9.5 |




TEST VEHICLE PRE-/POST-TEST EXTERIOR STATIC MEASUREMENT DATA

Vehicle: Dodge Omni NHTSA No.: N/A

Test Date: 10/13/83 D.S. No.: 1375

| Reference Dimension | Pre-test Measurement | Post-test Measurement | Change |
|---|---|---|---|
| $X_1$ | 164.5 | 136.1 | 28.4 |
| $X_2$ | 147.2 | 131.1 | 16.1 |
| $X_3$ | 121.5 | 117.1 | 4.4 |
| $X_4$ | 107.5 | 106.5 | 1.0 |
| $X_5$ | 107.6 | 104.5 | 3.1 |
| $X_6$ | 109.9 | 106.7 | 3.2 |
| $X_7$ | 109.8 | 105.5 | 4.3 |
| $X_8$ | 71.2 | 70.4 | 0.8 |
| $X_9$ | 71.2 | 69.5 | 1.7 |
| $X_{10}$ | 71.0 | 69.2 | 1.8 |
| $X_{11}$ | 70.9 | 67.0 | 3.9 |
| $X_{12}$ | 114.3 | 106.5 | 7.8 |
| $X_{13}$ | 114.1 | 106.5 | 7.9 |
| $X_{14}$ | 123.8 | 113.3 | 10.5 |
| $X_{15}$ | 121.8 | 111.1 | 10.7 |
| $X_{16}$ | 98.7 | 90.5 | 8.2 |
| $X_{17}$ | 13.5 | 14.0 | 0.5 |
| $X_{18}$ | 20.5 | 15.5 | 5.0 |
| $X_{19}$ | 162.5 | 134.4 | 28.1 |
| $X_{20}$ | 162.6 | 135.9 | 26.7 |
| $X_{21}$ | 21.0 | 19.0 | 2.0 |

## TEST VEHICLE PRE- AND POST-TEST INTERIOR STATIC INTRUSION MEASUREMENT DATA

Test Description: Passenger Car-To-NHTSA DMB Full Frontal; 62.5 mph

Test Vehicle: 1983 Dodge 4-Door Hatchback DSI No. 1375

Measurements referenced from a vertical plane 90 inches from the rear bumper.

First Level = Top of driver instrument panel
Second Level = Center of instrument panel
Third Level = Bottom of instrument panel

| | 20 | 15 | 10 | 5 | ℄ | 5 | 10 | 15 | 20 |
|---|---|---|---|---|---|---|---|---|---|
| **Pre-Test** | | | | | | | | | |
| First Level | | 12.7 | 12.7 | | | | | | |
| Second Level | 15.2 | 14.8 | 14.8 | 16.3 | 16.5 | 17.2 | 17.0 | 16.8 | 16.4 |
| Third Level | 18.7 | 19.0 | 19.7 | 19.7 | 19.7 | 19.8 | 19.8 | 19.8 | 19.5 |
| **Post-Test** | | | | | | | | | |
| First Level | | 10.7 | 10.7 | | | | | | |
| Second Level | 10.7 | 10.7 | 10.9 | 10.9 | 10.9 | 10.6 | 10.5 | 10.5 | 10.5 |
| Third Level | 11.5 | 11.7 | 11.8 | 12.0 | 11.5 | 11.5 | 11.5 | 11.5 | 11.5 |
| **Intrusion** | | | | | | | | | |
| First Level | | 2.0 | 2.0 | | | | | | |
| Second Level | 4.5 | 4.1 | 3.9 | 5.4 | 5.6 | 6.6 | 6.5 | 6.3 | 5.9 |
| Third Level | 7.2 | 7.3 | 7.9 | 7.7 | 8.2 | 8.3 | 8.3 | 8.3 | 8.0 |

## PRE- AND POST-TEST POSITION OF TEST VEHICLE ACCELEROMETER MOUNTING LOCATIONS

Test Description: Passenger Car-To-NHTSA DMB, Full Frontal; 62.5 mph

Test Vehicle: 1983 Dodge Omni 4-Door Hatchback DSI No. 1375

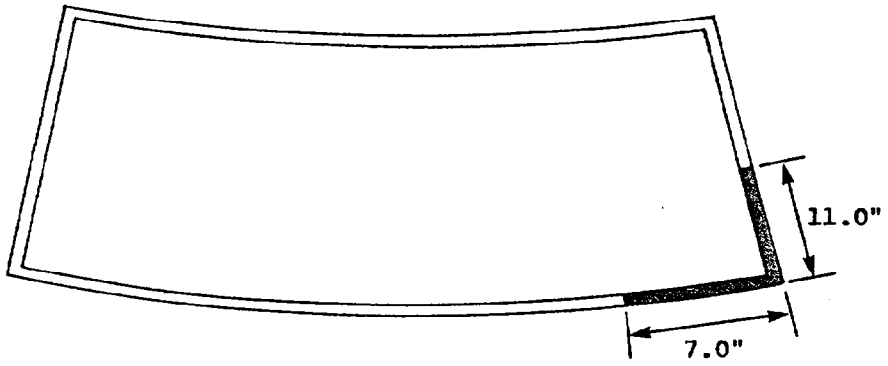
Reference Plane: Vertical plane at rear bumper

| Accelerometer Description | Longitudinal Location | | |
|---|---|---|---|
| | Pre-Test | Post-Test | Change |
| Rear seat X-member - left side primary | 57.9 | 56.0 | 1.9 |
| Rear seat X-member - left side redundant | 54.4 | 52.5 | 1.9 |
| Rear seat X-member - right side primary | 57.9 | 57.2 | 0.7 |
| Rear seat X-member - right side redundant | 54.4 | 53.7 | 0.7 |
| Rear seat X-member - centerline | 57.9 | 56.5 | 1.4 |
| Rear axle centerline | 38.8 | 38.0 | 0.8 |
| Top of engine block | 136.7 | 124.7 | 12.0 |
| Steering wheel hub | 100.7 | 88.5 | 12.2 |
| Front suspension X-member | 127.1 | 109.1 | 18.0 |
| Bottom of engine | 140.6 | 123.5 | 17.1 |
| Right front brake caliper | 136.2 | 124.9 | 11.3 |
| Left front brake caliper | 136.2 | 124.7 | 11.5 |
| Instrument panel | 105.1 | 101.0 | 4.1 |
| Air bag sensor location | 147.7 | 129.9 | 17.8 |
| Yaw rate gyro | 104.4 | 100.5 | 3.9 |

## MISCELLANEOUS TEST RELATED DATA SUMMARY SHEET

Listed below is test related information of a general nature regarding the test vehicle, moving barrier, fixed barrier, or dummy occupants. Items of interest or anomolies from one test to another may be noted.

A. Pre-test windshield perimeter of the Dodge Omni measured 143.0 inches. Post-test inspection revealed a loss of windshield retention over an approximate total span of 18 inches (12.6 percent of pre-test measurement) located in the lower left hand corner.




FRONT VIEW

B. Pre- and post-test reference measurements were obtained to assess relative collapse of the steering column:

From forward face of steering wheel (instrument panel side) to:

| | Pre-Test | Post-Test |
|---|---|---|
| Shear capsule mounting bolts | 7.6 in. | 8.3 in. |
| Steering shaft U-joint | 16.8 in. | 16.7 in. |

C. Comments on Data Acquisition

The following test vehicle sensor locations experienced transducer cable separation at the approximate times indicated:

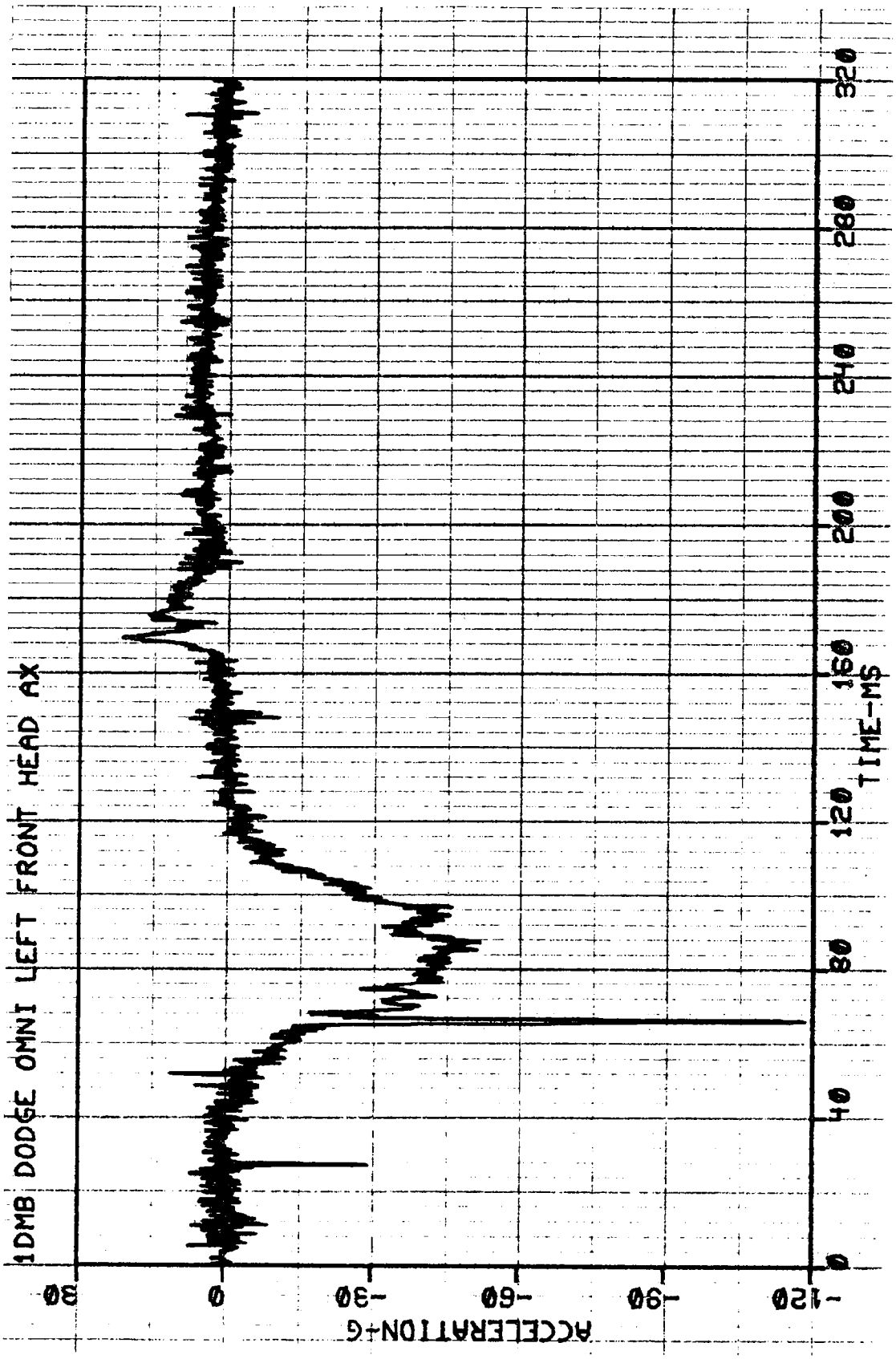
Location 5, Upper Engine Long. at 80-100 msec
Location 8, Lower Engine Long. at 70-80 msec
Location 12, Air Bag Sensor at 70-80 msec

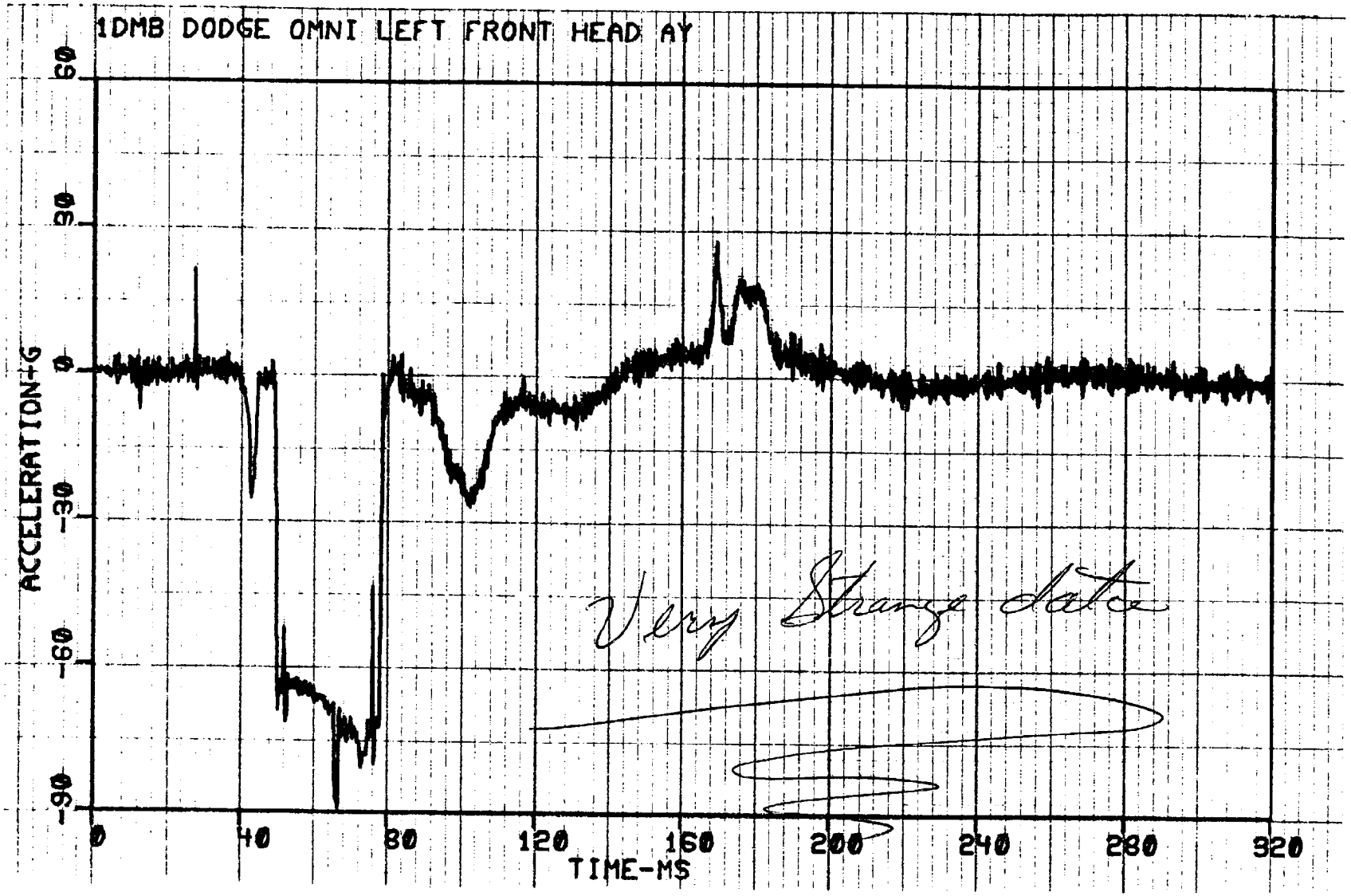
Engine compartment sensor cable separation is not an unusual event in a test of this nature due to the degree of structural deformation experienced, and may be expected to occur subsequent to the primary time frame of interest.

Data from Location L5, center mounted load cell on the Deformable Moving Barrier, was not obtained due to electronic failure in the signal conditioning differential amplifier. For purpose of plotting total load versus mutual displacement, maximum load data obtained from each of the remaining four load cells will be averaged to obtain a fifth value for insertion into the data base.

# APPENDIX A

## CALCOMP PLOTS OF ELECTRONIC DATA


1DMB DODGE OMNI LEFT FRONT HEAD AX
ACCELERATION-G
30
0
-30
-60
-90
-120
0
40
80
120
150
200
240
280
320
TIME-MS


1DMB DODGE OMNI LEFT FRONT HEAD AY
ACCELERATION-G
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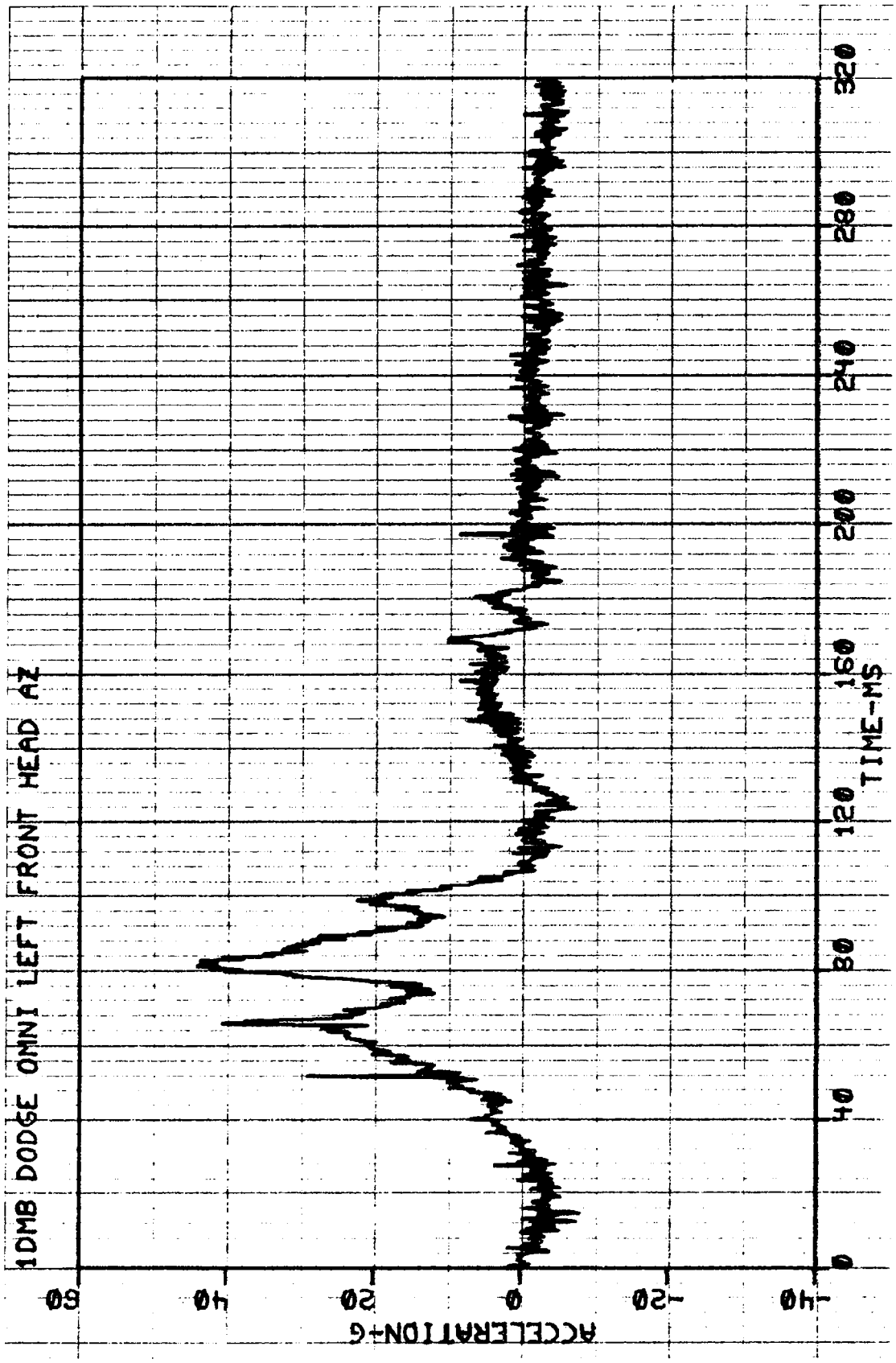
-30
-60
-90
0
40
80
120
160
200
240
280
320
TIME-MS
Very Strange data


1DMB DODGE OMNI LEFT FRONT HEAD AZ
ACCELERATION+G
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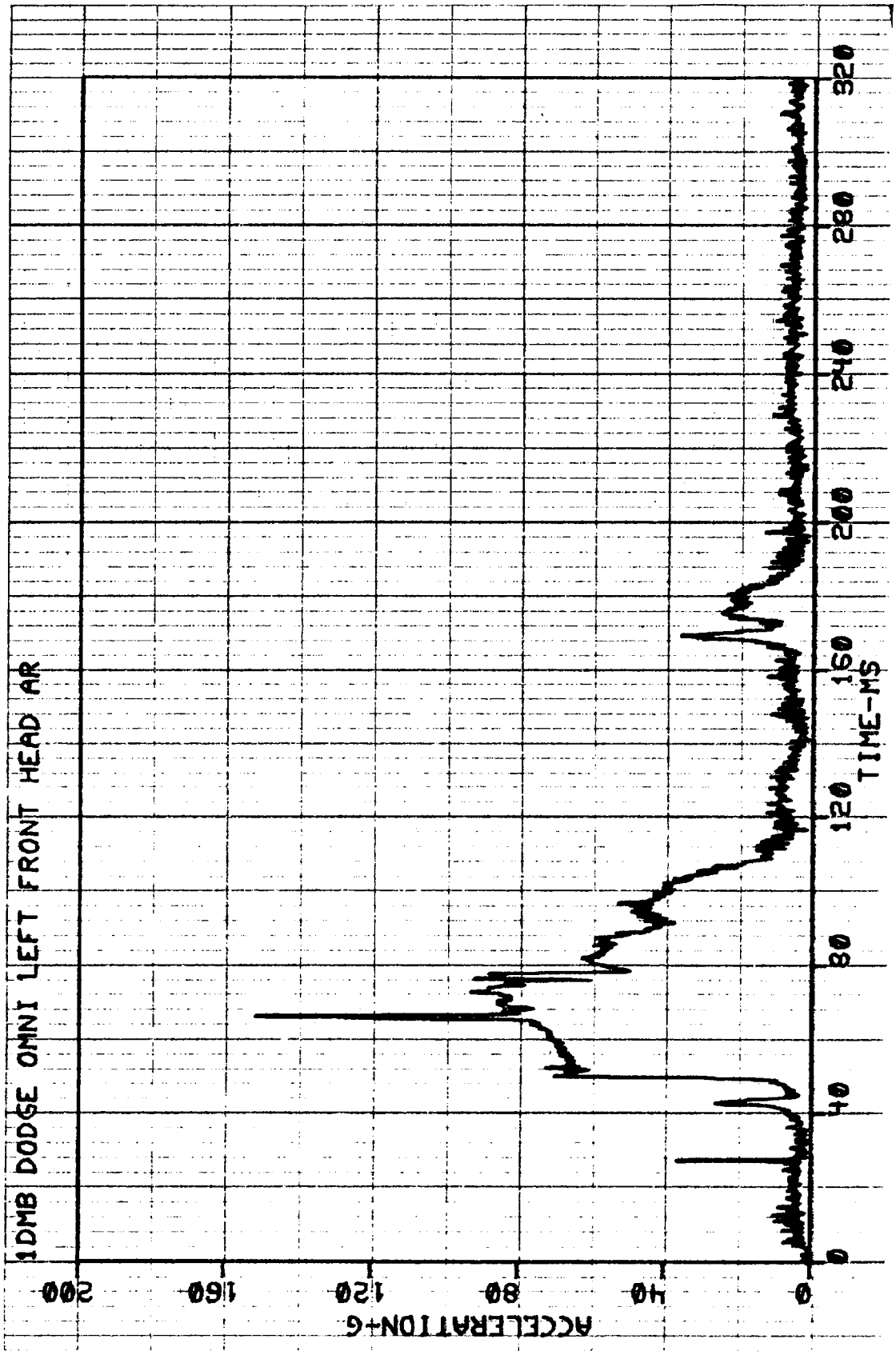
40
20
0
-20
-40
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI LEFT FRONT HEAD AR
ACCELERATION+G
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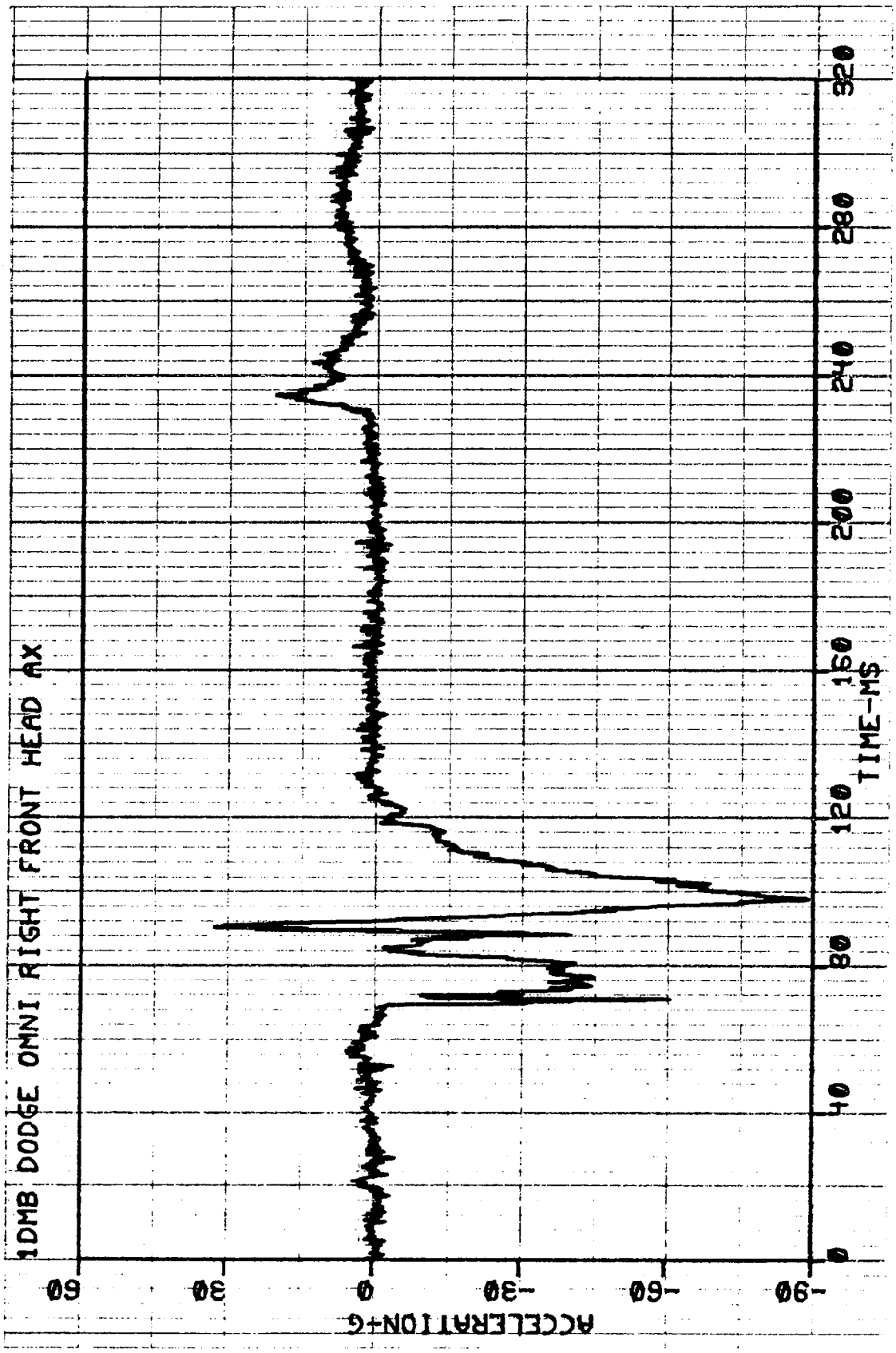
40
80
120
160
200
TIME-MS
0
40
80
120
160
200
240
280
320


10MB DODGE OMNI RIGHT FRONT HEAD AX
ACCELERATION+G
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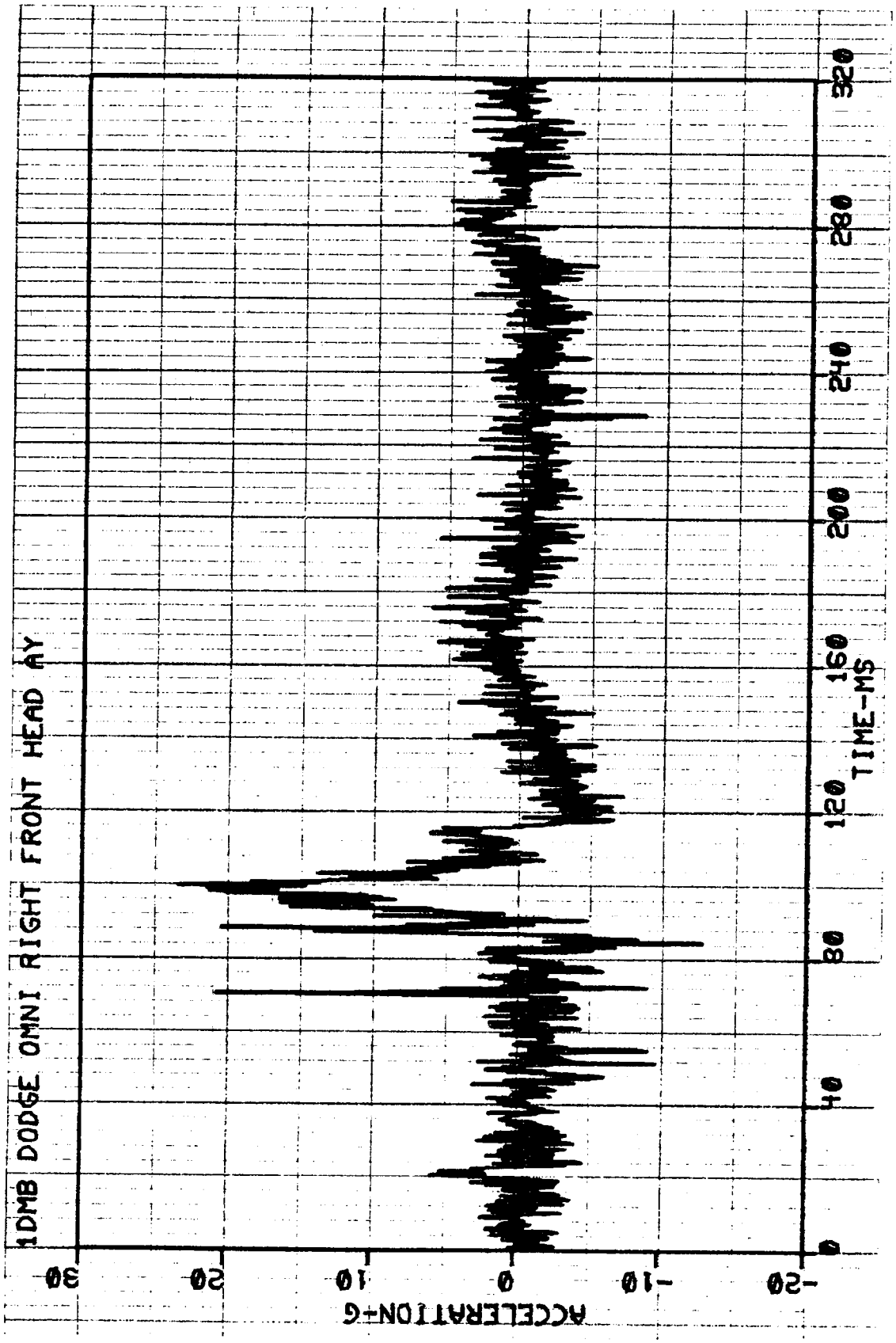
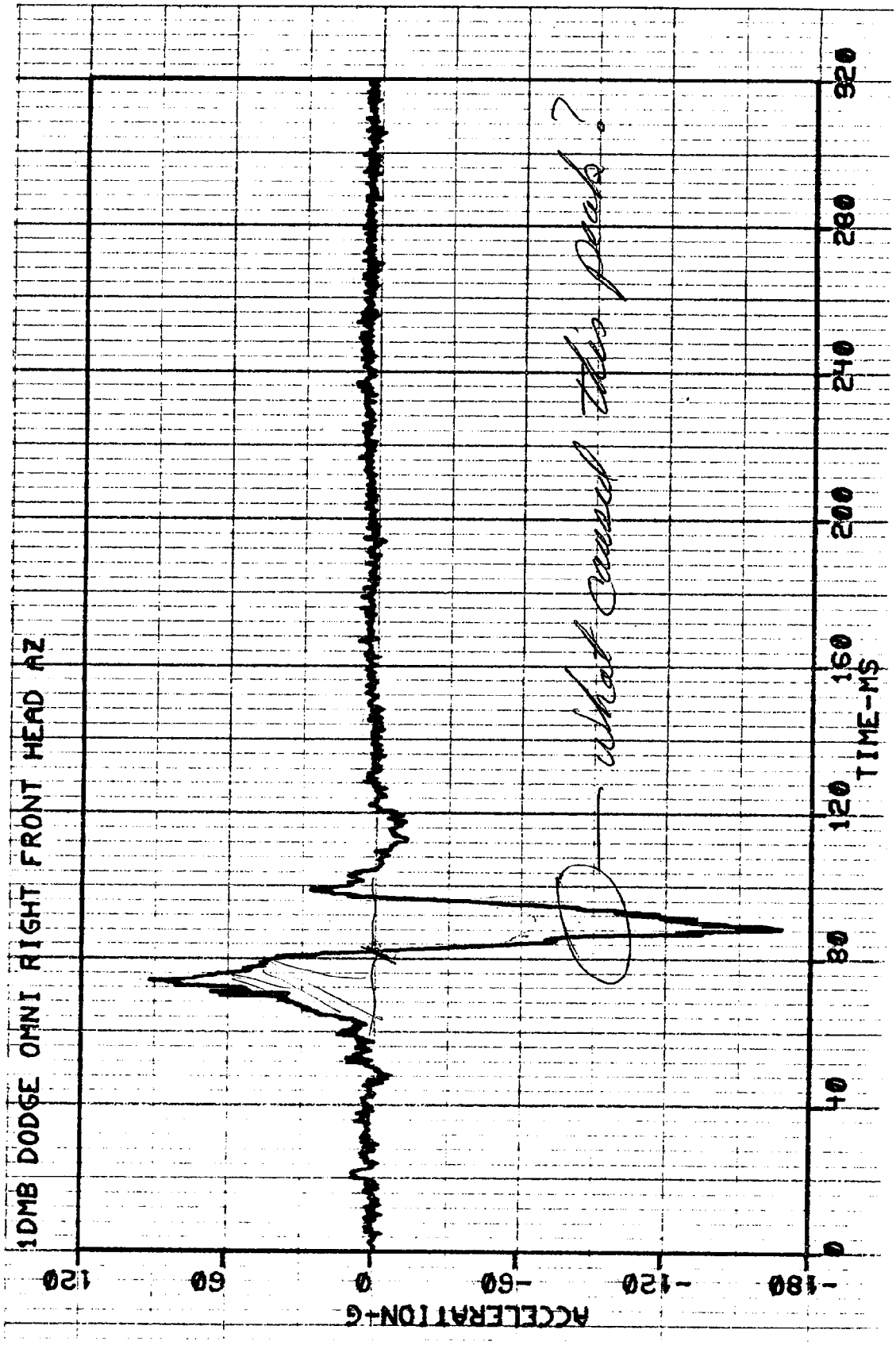
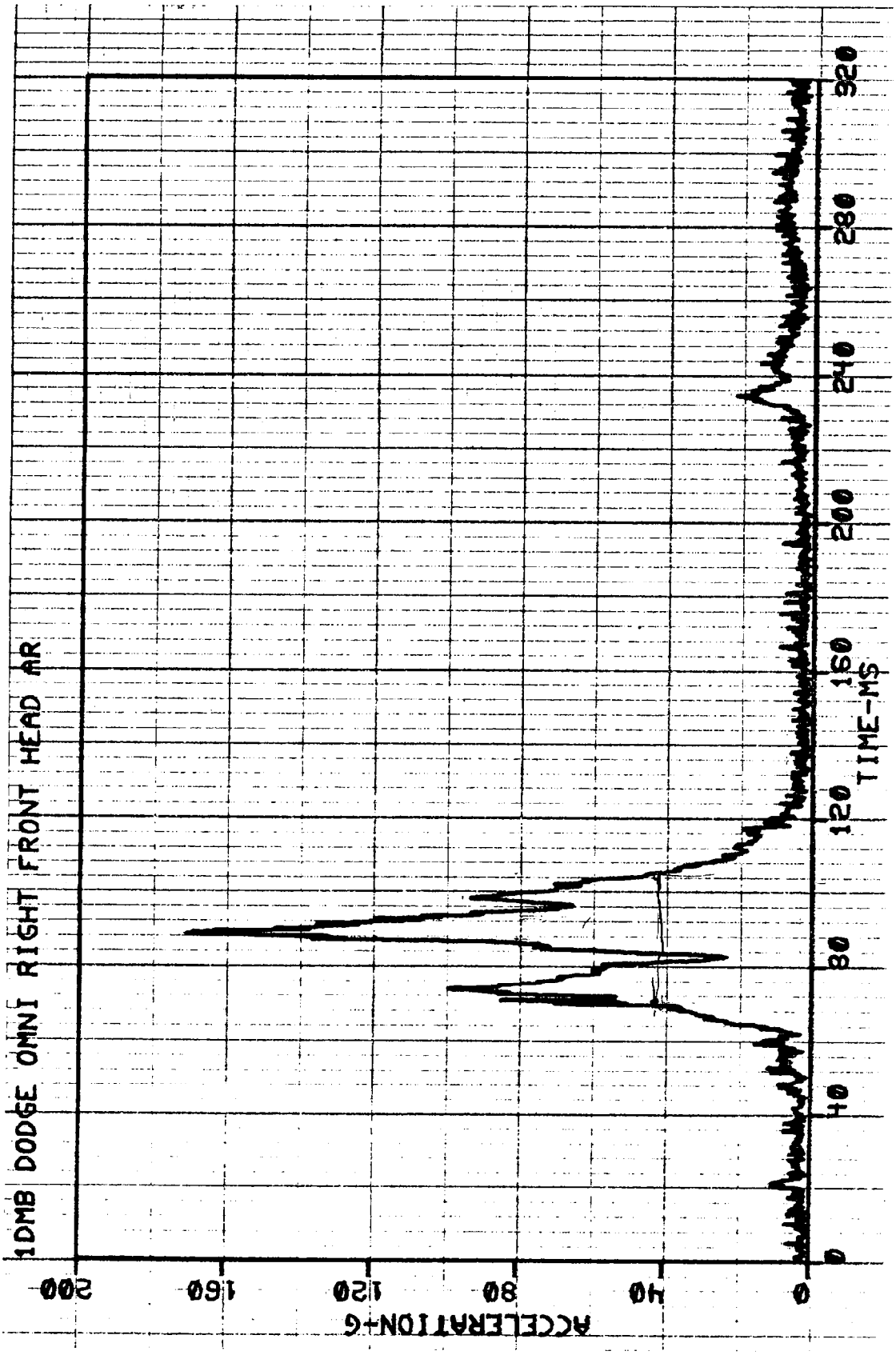
0
-30
-60
-90
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI RIGHT FRONT HEAD AY
ACCELERATION-G
30
20
10
0
-10
-20
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI RIGHT FRONT HEAD AZ
ACCELERATION-G
120
60
0
-60
-120
-180
TIME-MS
0
40
80
120
160
200
240
280
320


1DMB DODGE OMNI RIGHT FRONT HEAD AR
ACCELERATION-G
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80
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160
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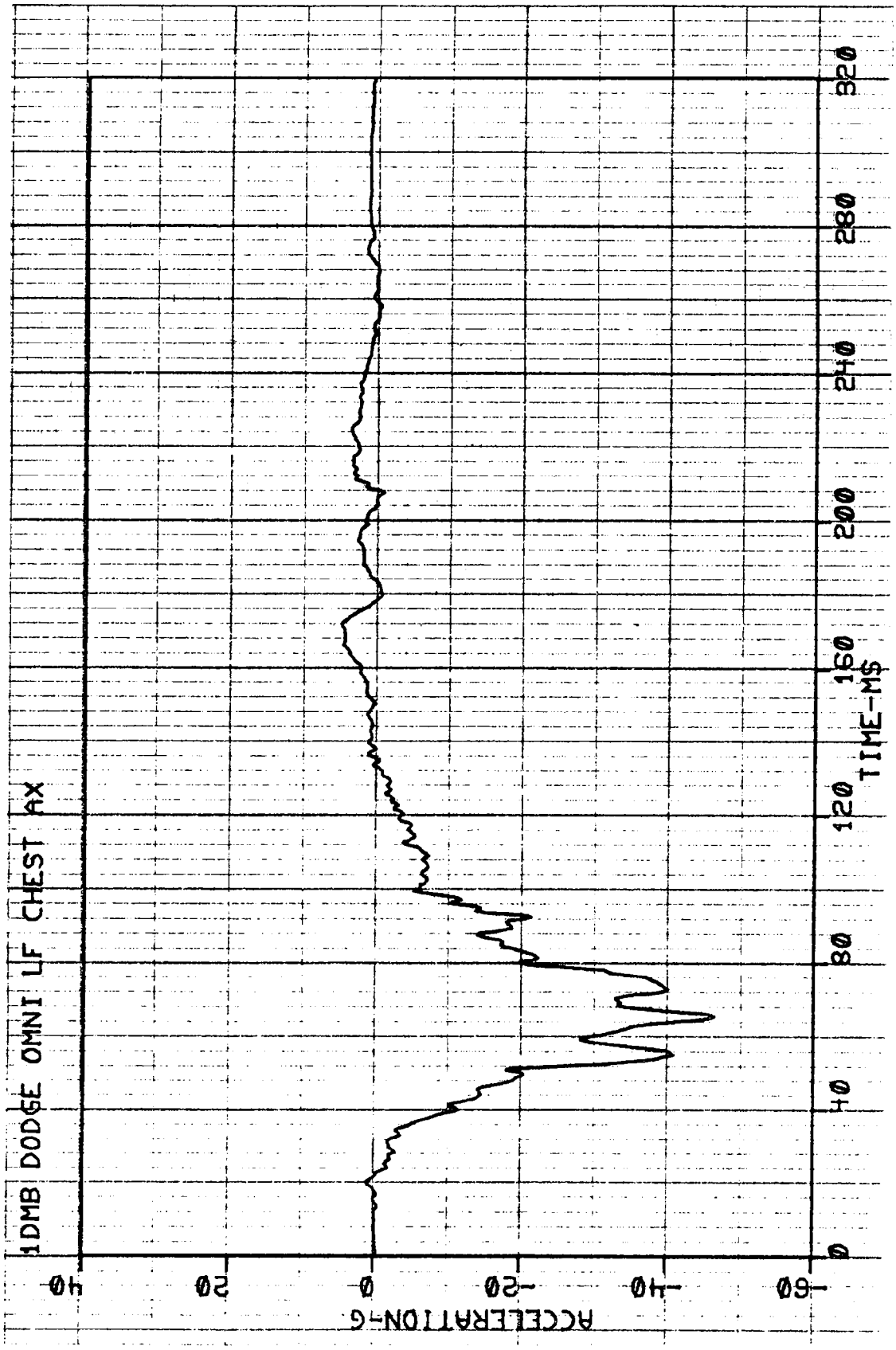
TIME-MS
0
40
80
120
160
200
240
280
320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ACCELERATION-G
TIME-MS
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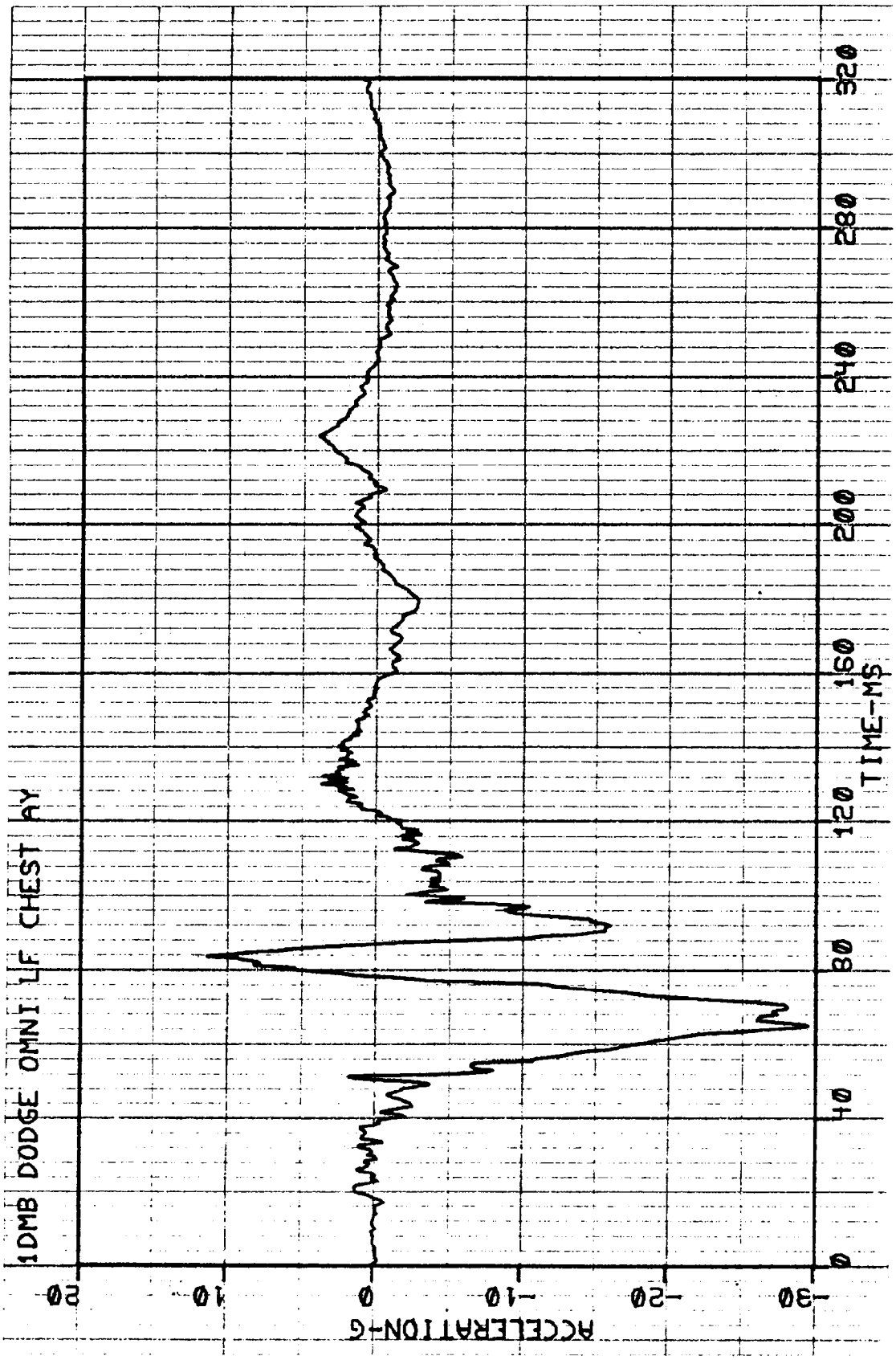
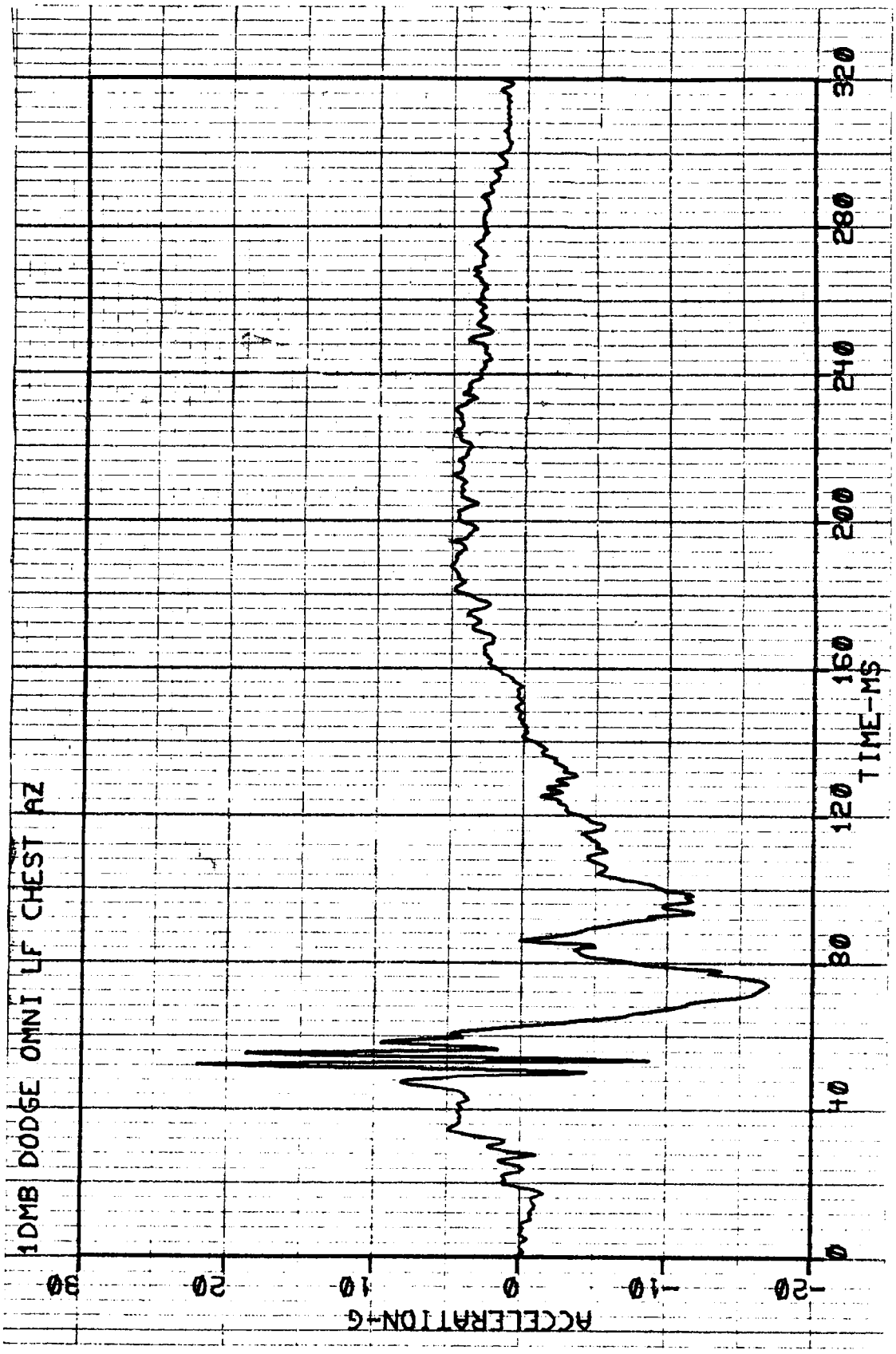
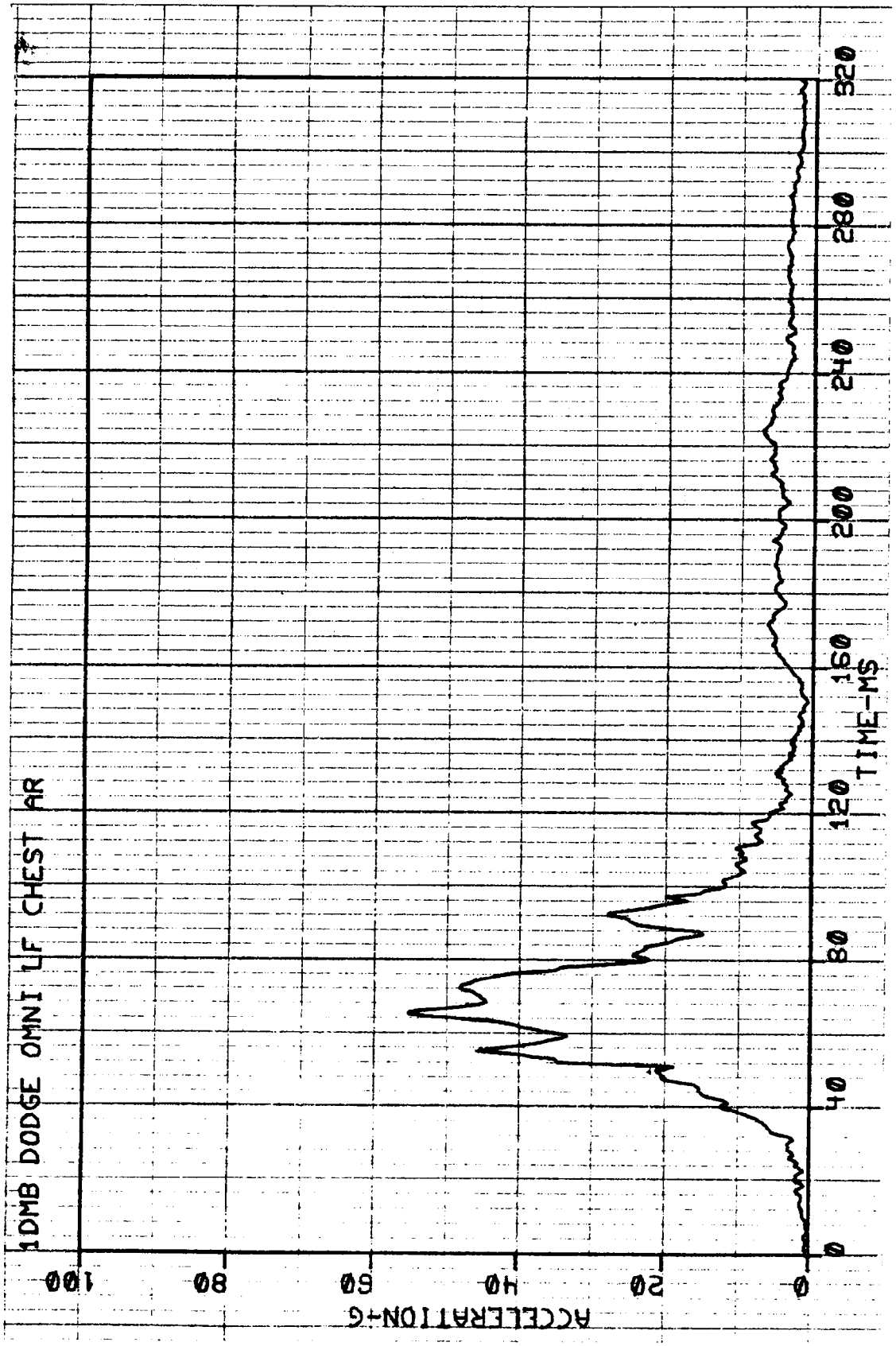
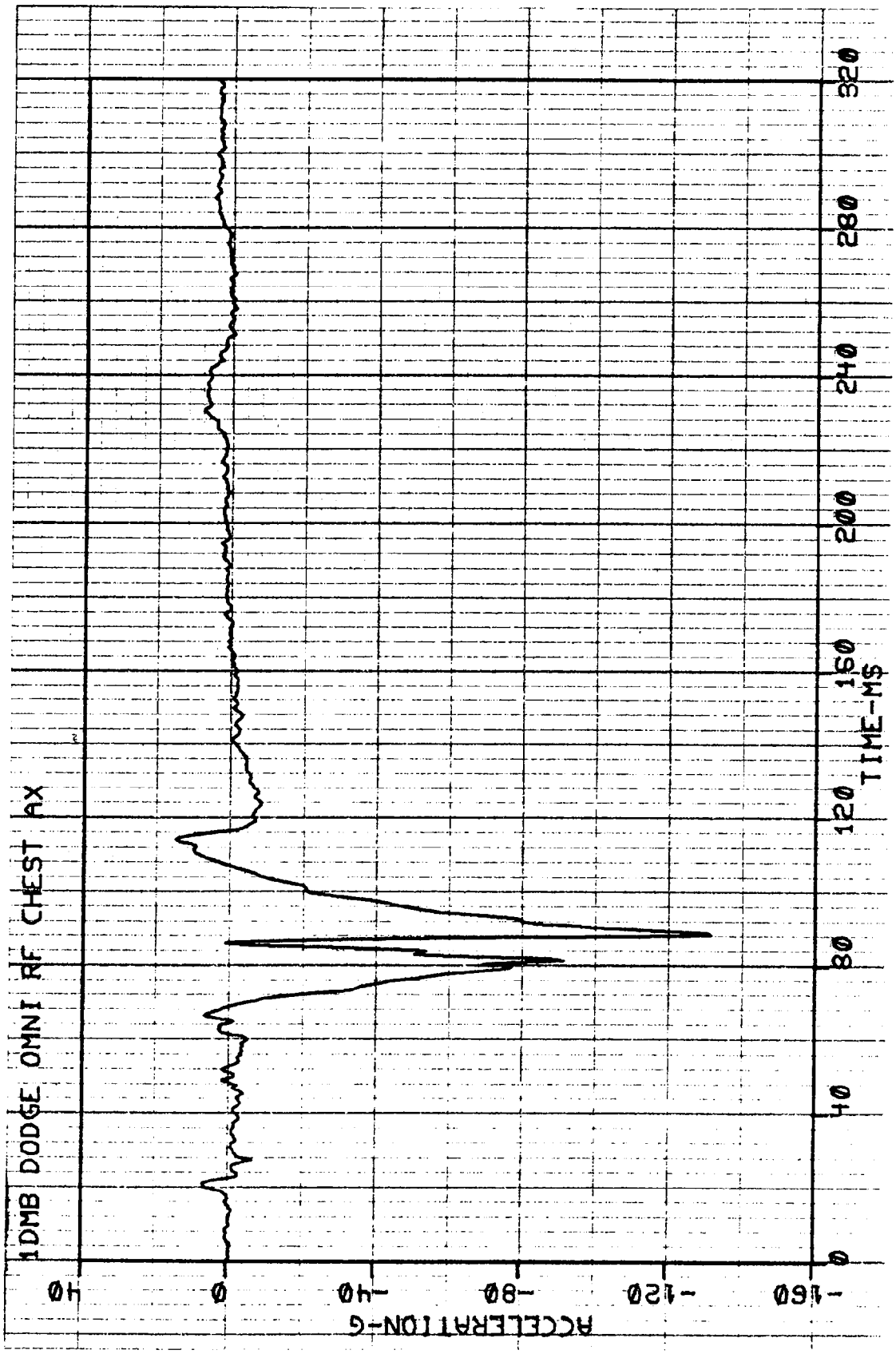
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320


1DMB DODGE OMNI LF CHEST AY
ACCELERATION-G
20
10
0
-10
-20
-30
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI LF CHEST AZ
ACCELERATION-G
30
20
10
0
-10
-20
0
40
80
120
150
200
240
280
320
TIME-MS


1DMB DODGE OMNI LF CHEST AR
ACCELERATION-G
0
20
40
60
80
100
TIME-MS
0
40
80
120
160
200
240
280
320


1DMB DODGE OMNI RF CHEST AX
ACCELERATION-G
TIME-MS
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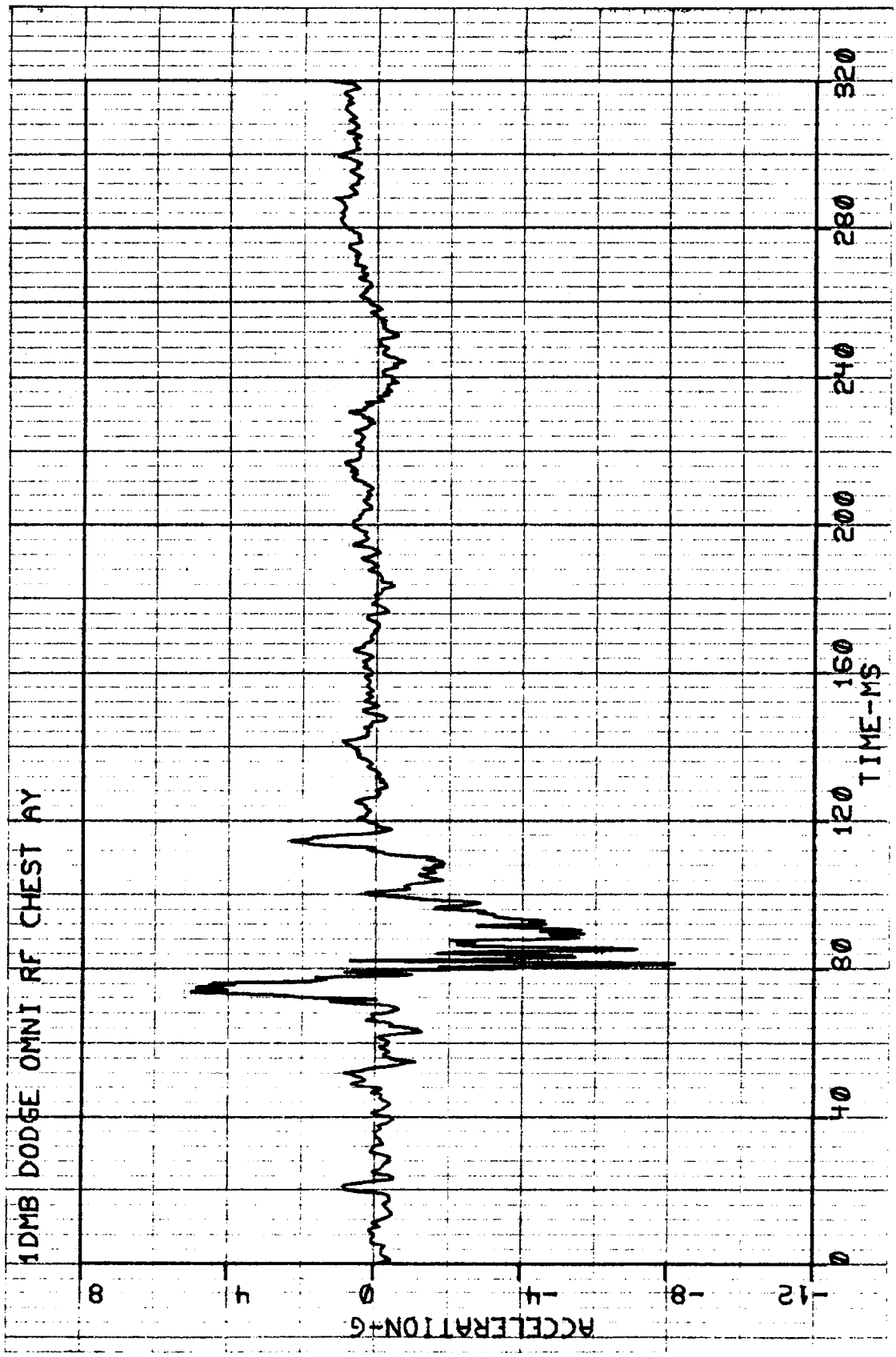
0
-40
-80
-120
-160
0
40
80
120
160
200
240
280
320


1DMB DODGE OMNI RF CHEST AY
ACCELERATION+G
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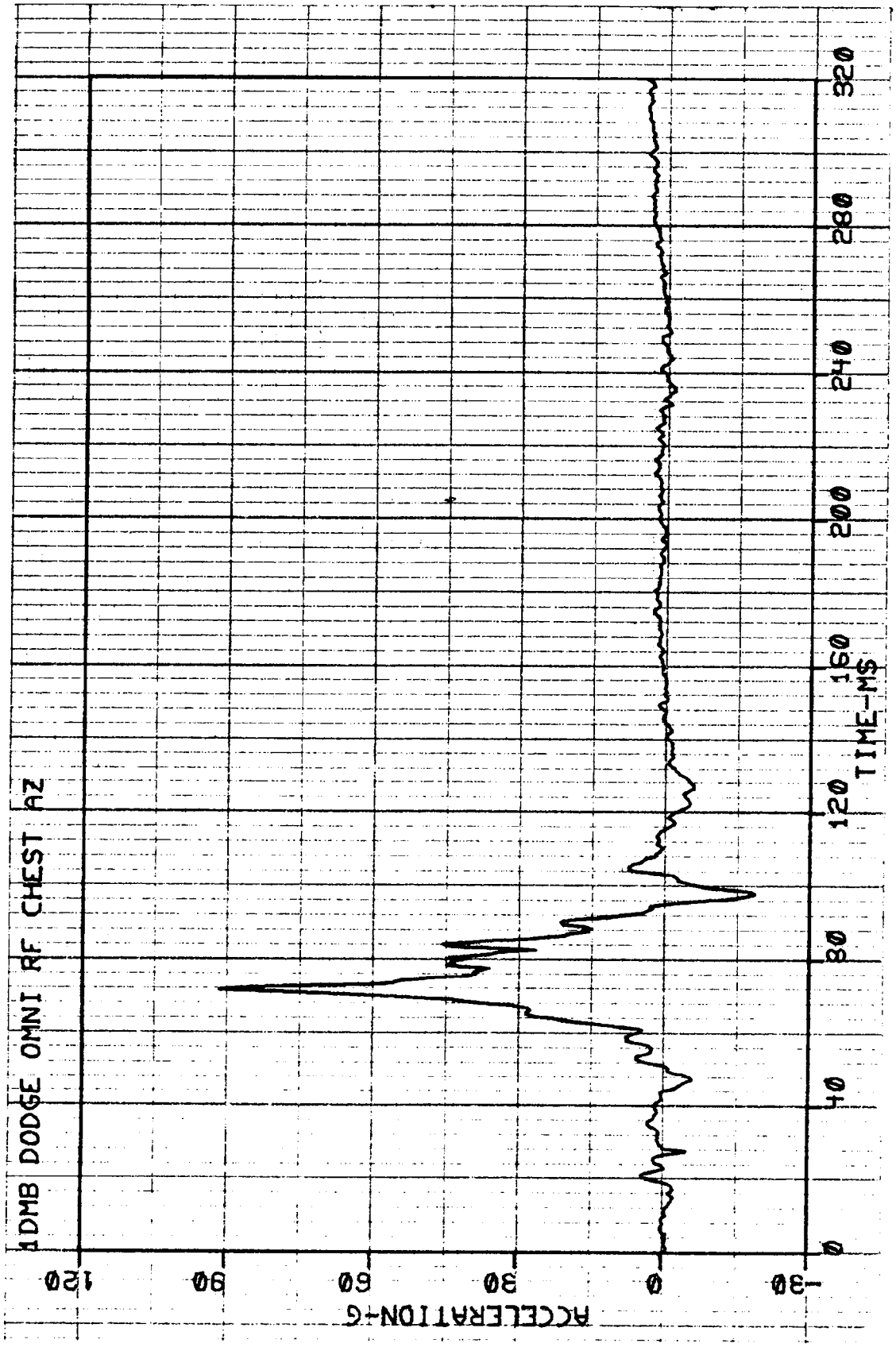
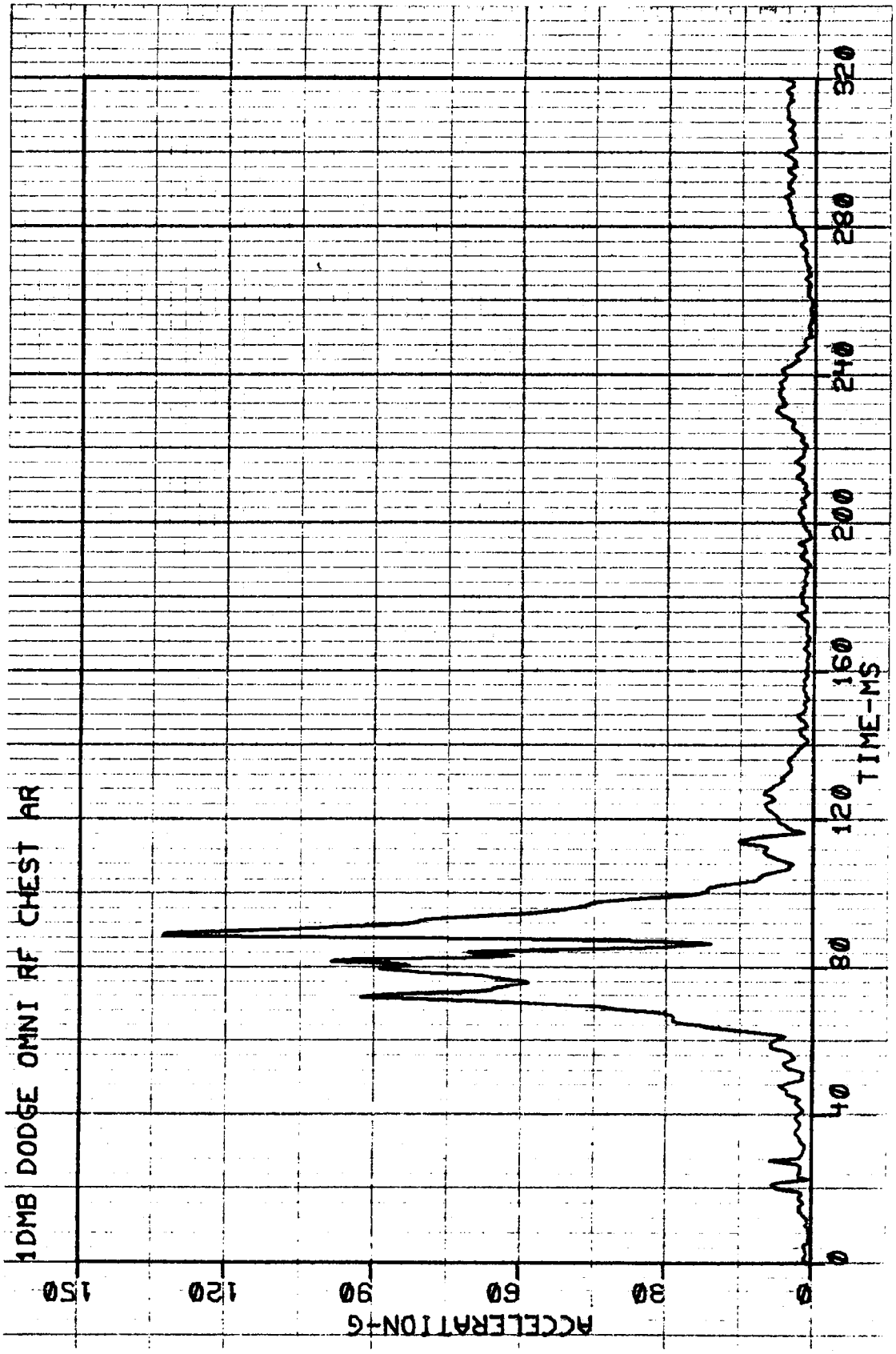
4
0
-4
-8
-12
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI RF CHEST AZ
ACCELERATION-G
120
90
60
30
0
-30
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI RF CHEST AR
ACCELERATION-G
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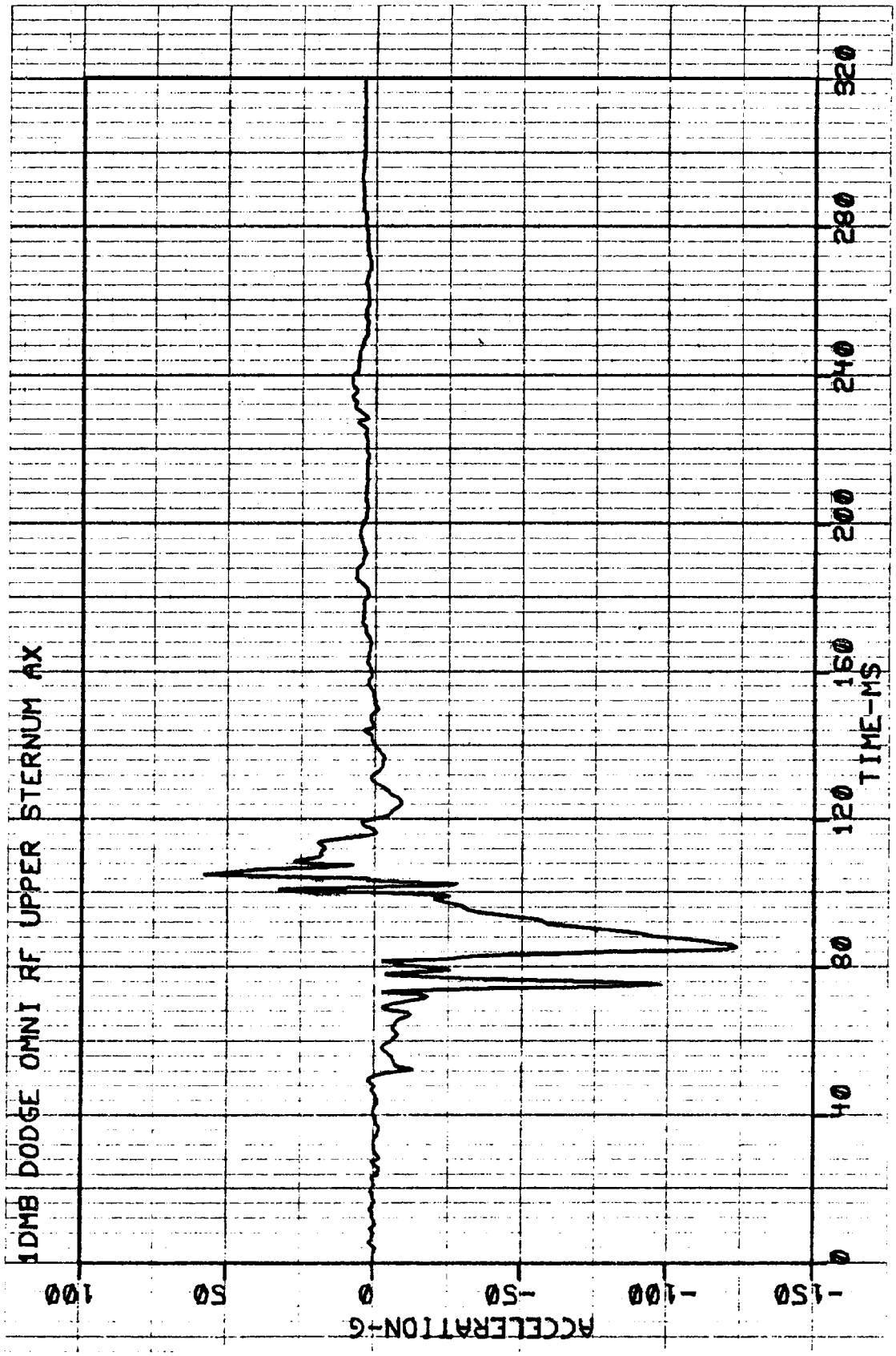
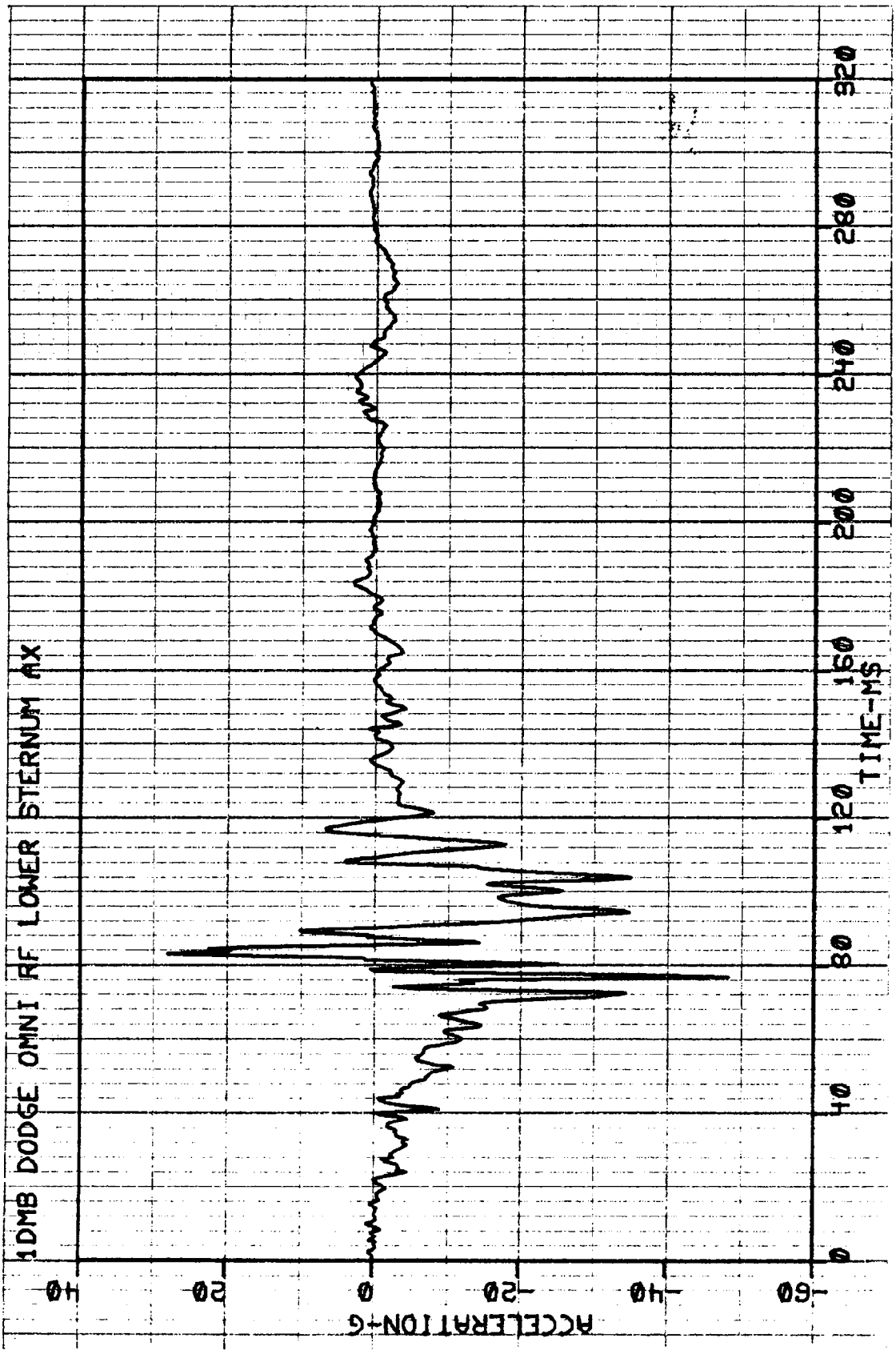
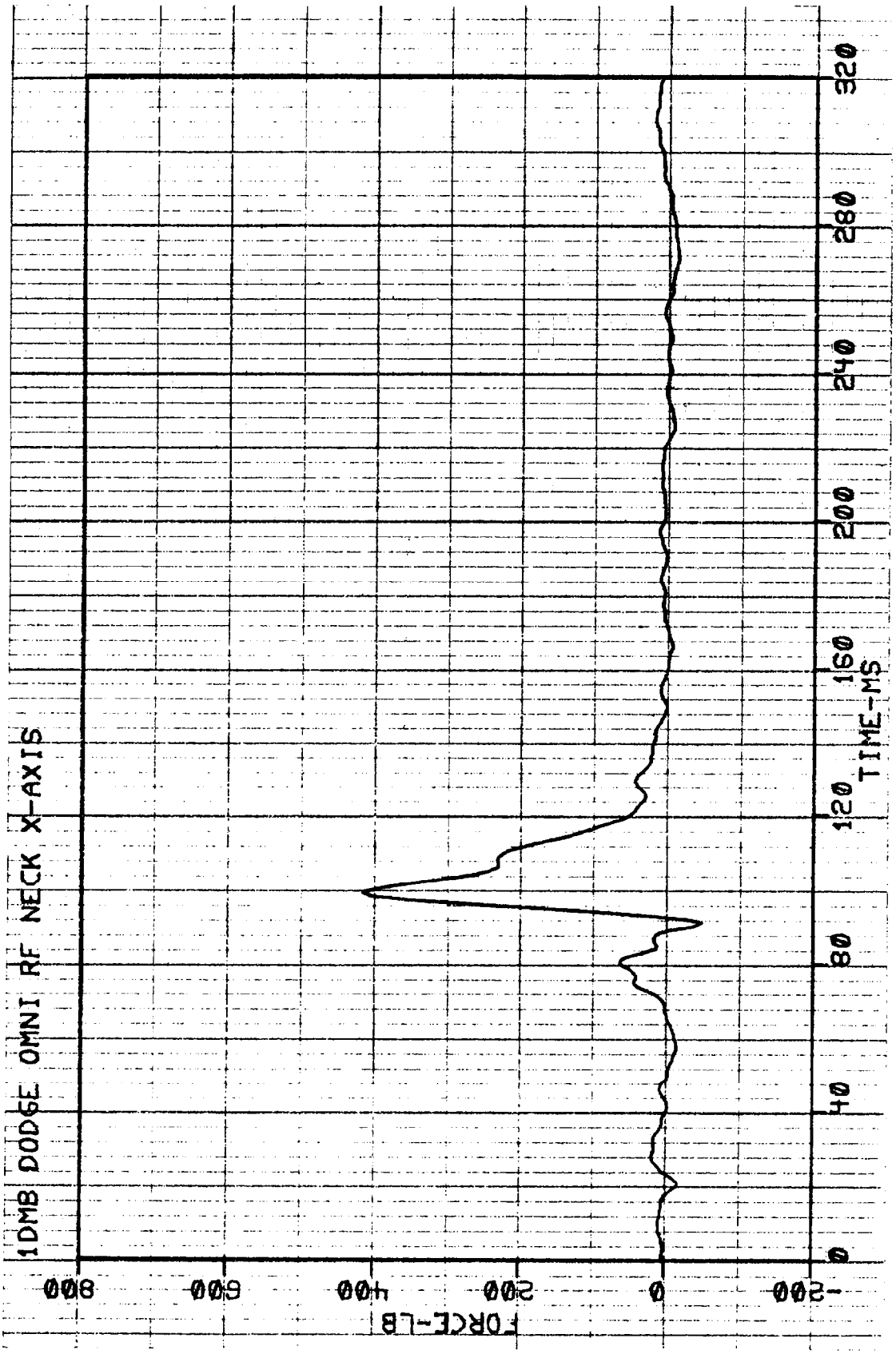
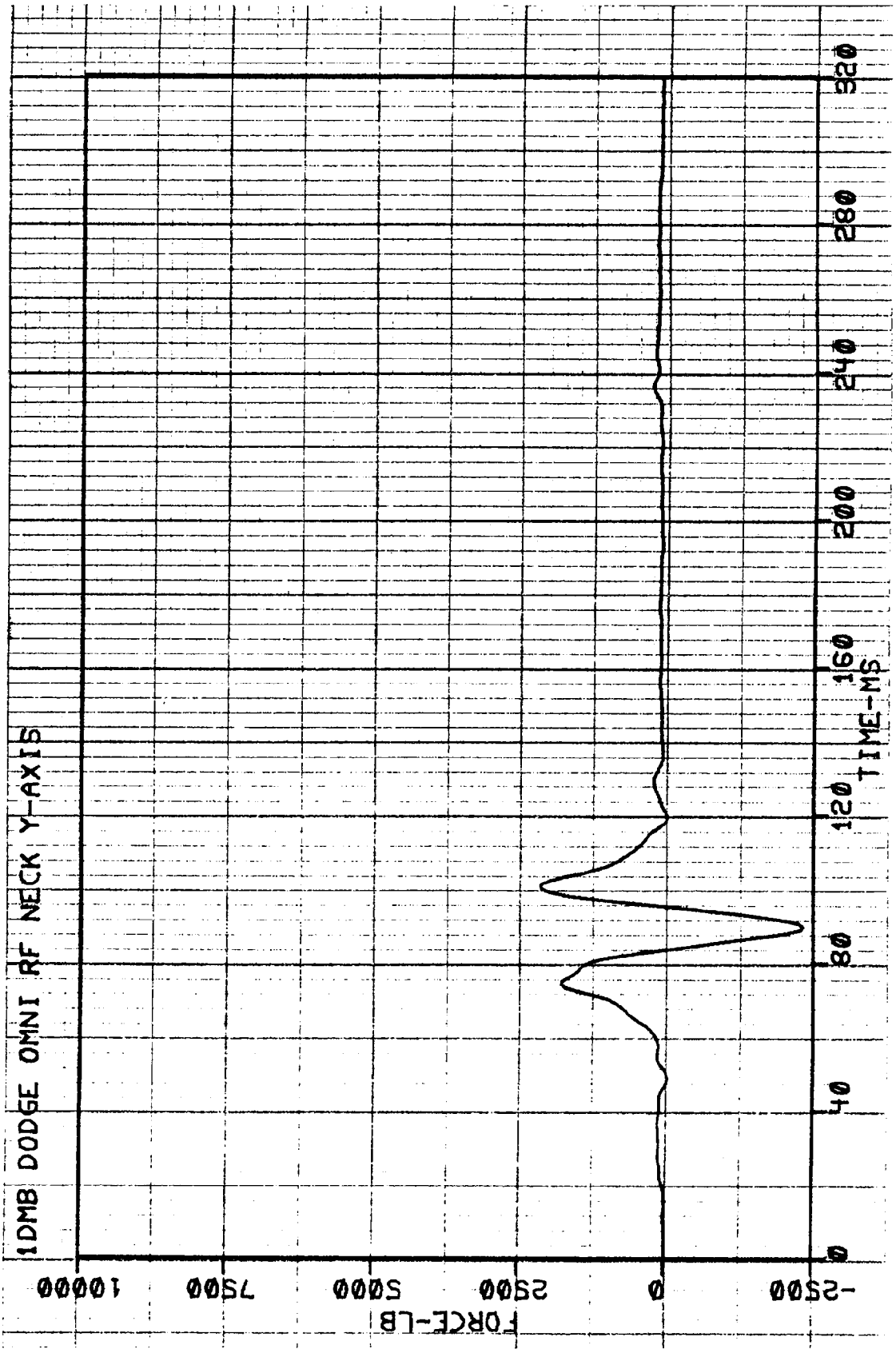
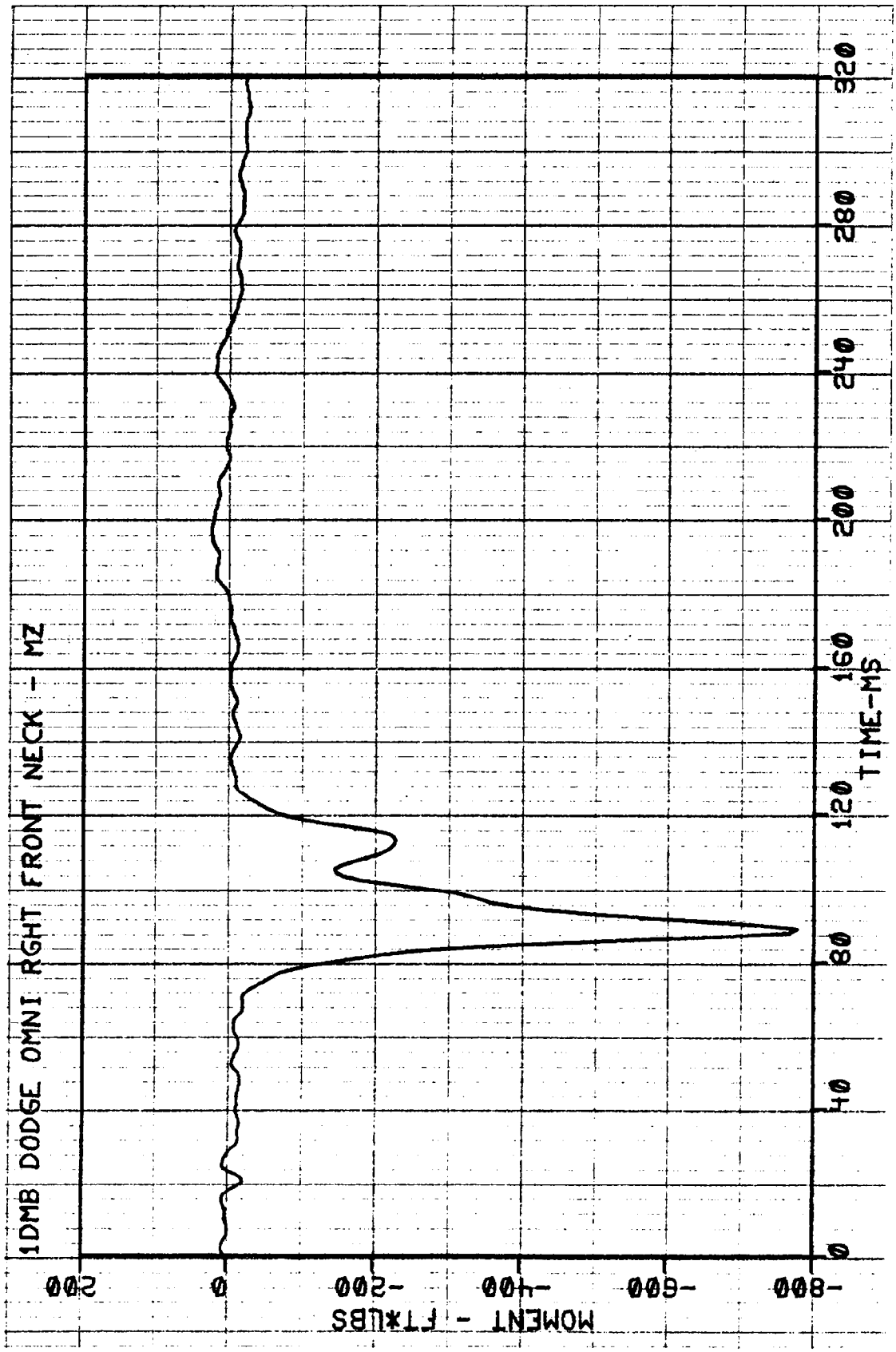
30
60
90
120
150
TIME-MS
0
40
80
120
160
200
240
280
320

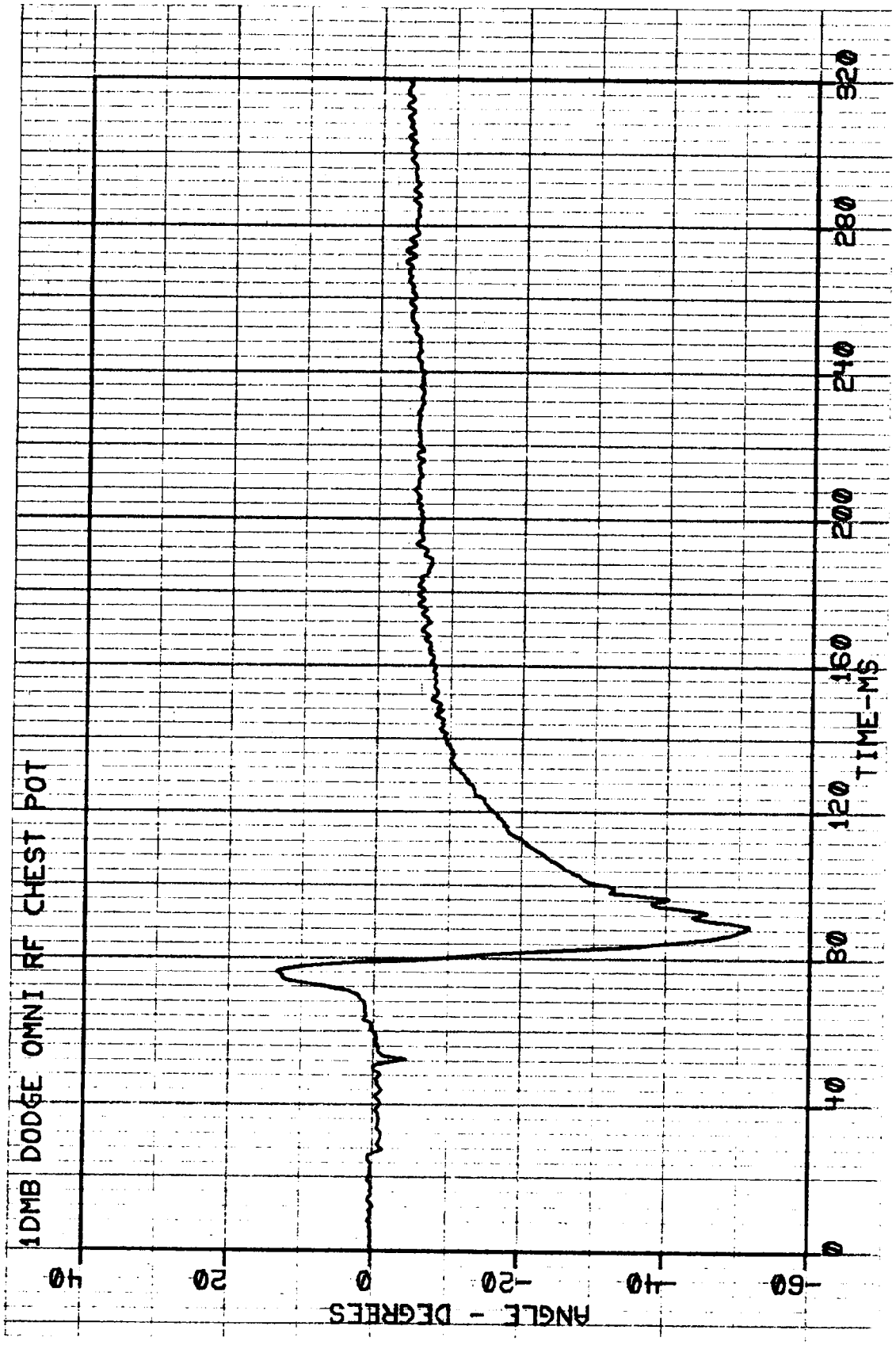

1DMB DODGE OMNI RF UPPER STERNUM AX
ACCELERATION-G
100
50
0
-50
-100
-150
0
40
80
120
160
200
240
280
320
TIME-MS

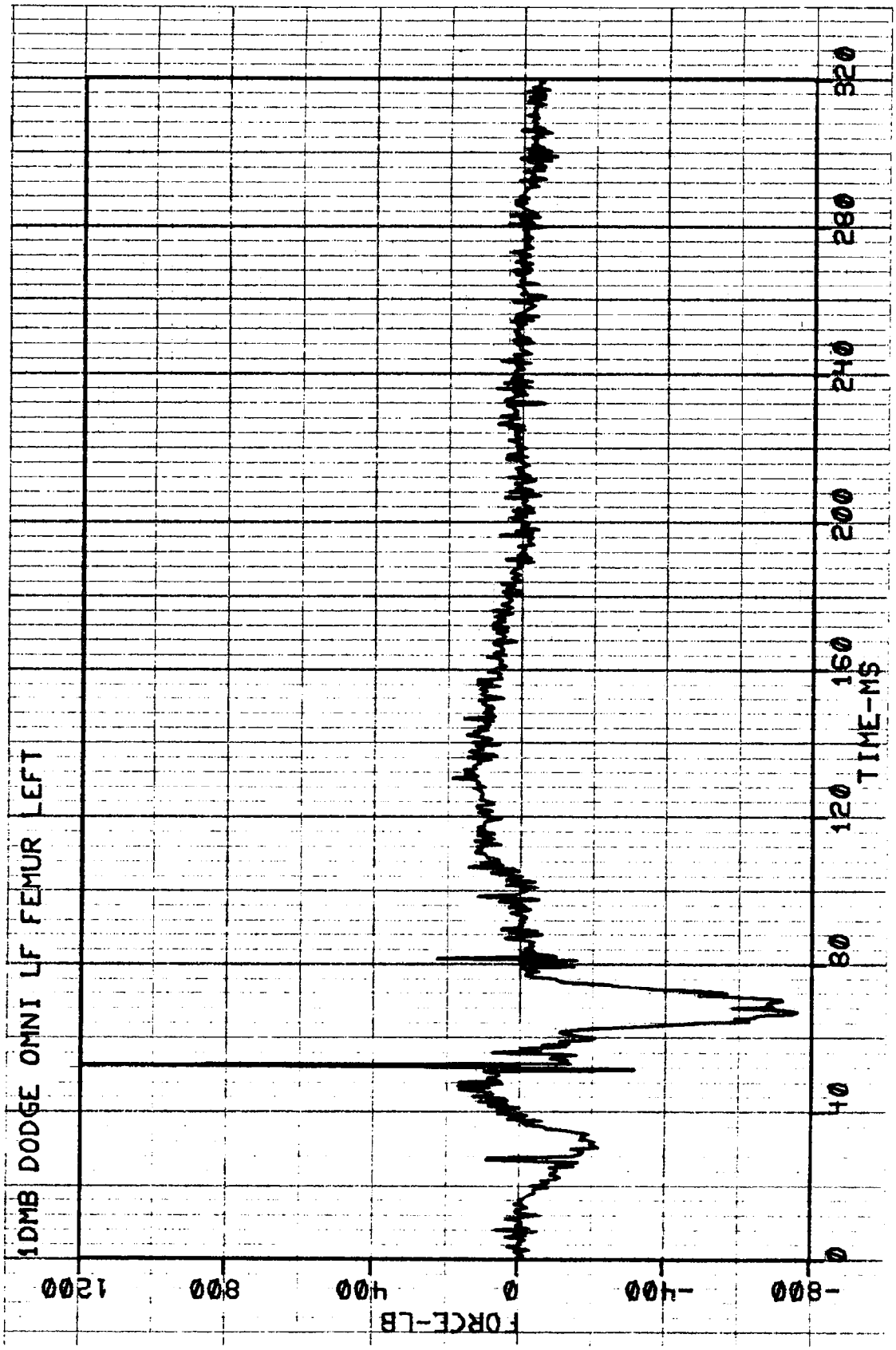

1DMB DODGE OMNI RF LOWER STERNUM AX
ACCELERATION-G
TIME-MS
0
40
80
120
160
200
240
280
320
-60
-40
-20
0
20
40

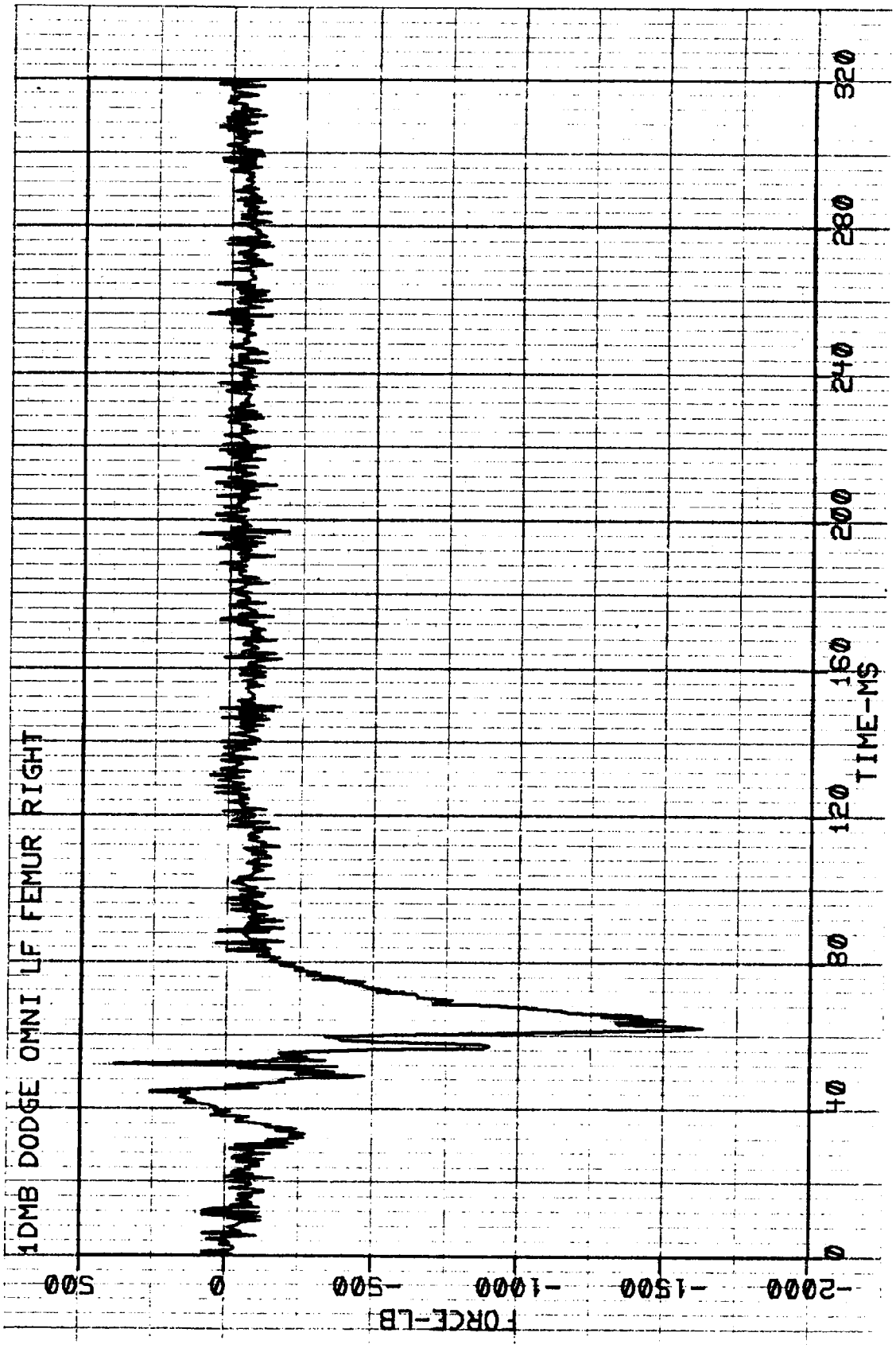

10MB DODGE OMNI RF NECK X-AXIS
FORCE-LB
800
600
400
200
0
-200
0
40
80
120
160
200
240
280
320
TIME-MS

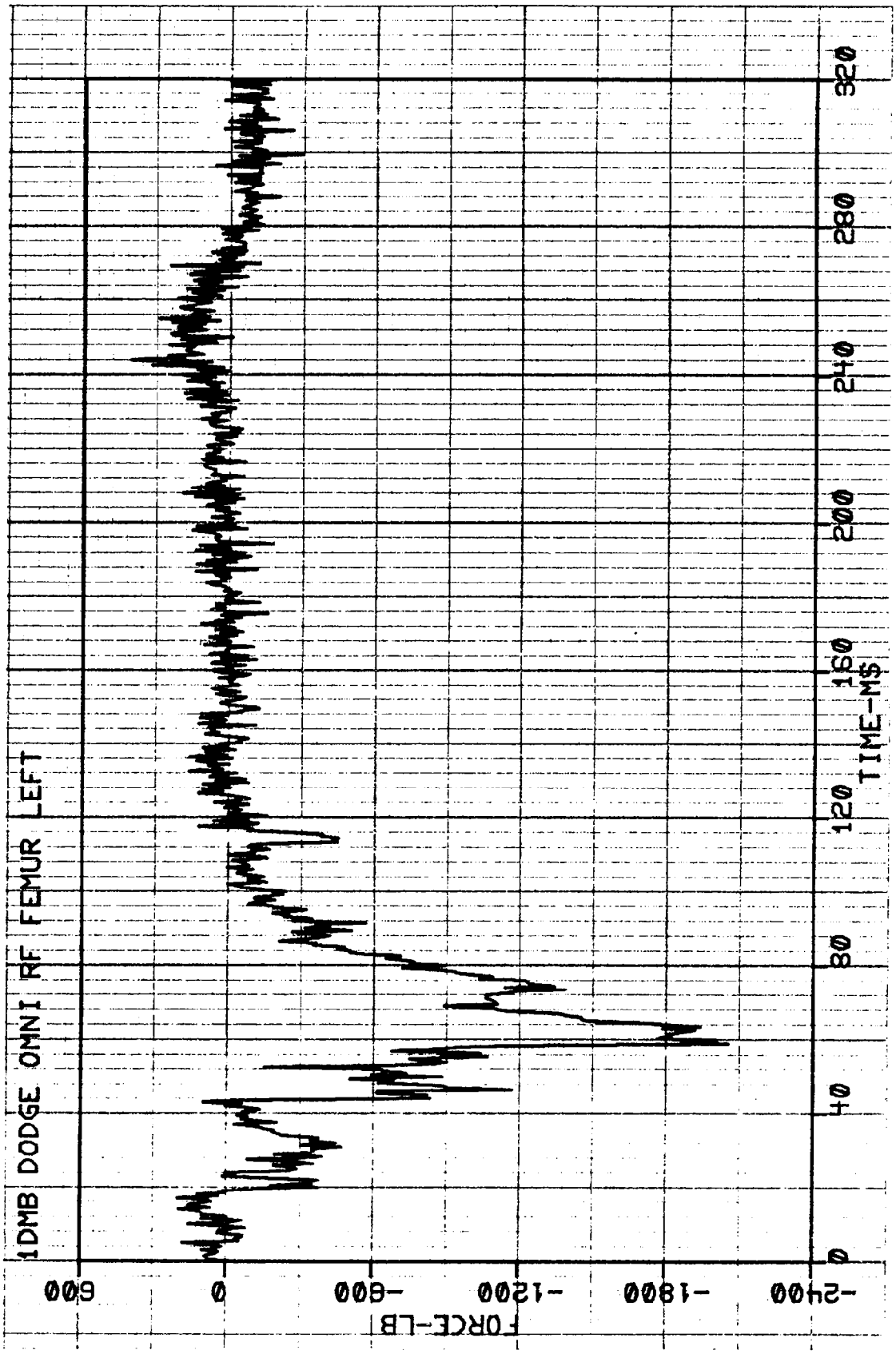

1DMB DODGE OMNI RF NECK Y-AXIS
FORCE-LB
-2500
0
2500
5000
7500
10000
TIME-MS
0
40
80
120
160
200
240
280
320

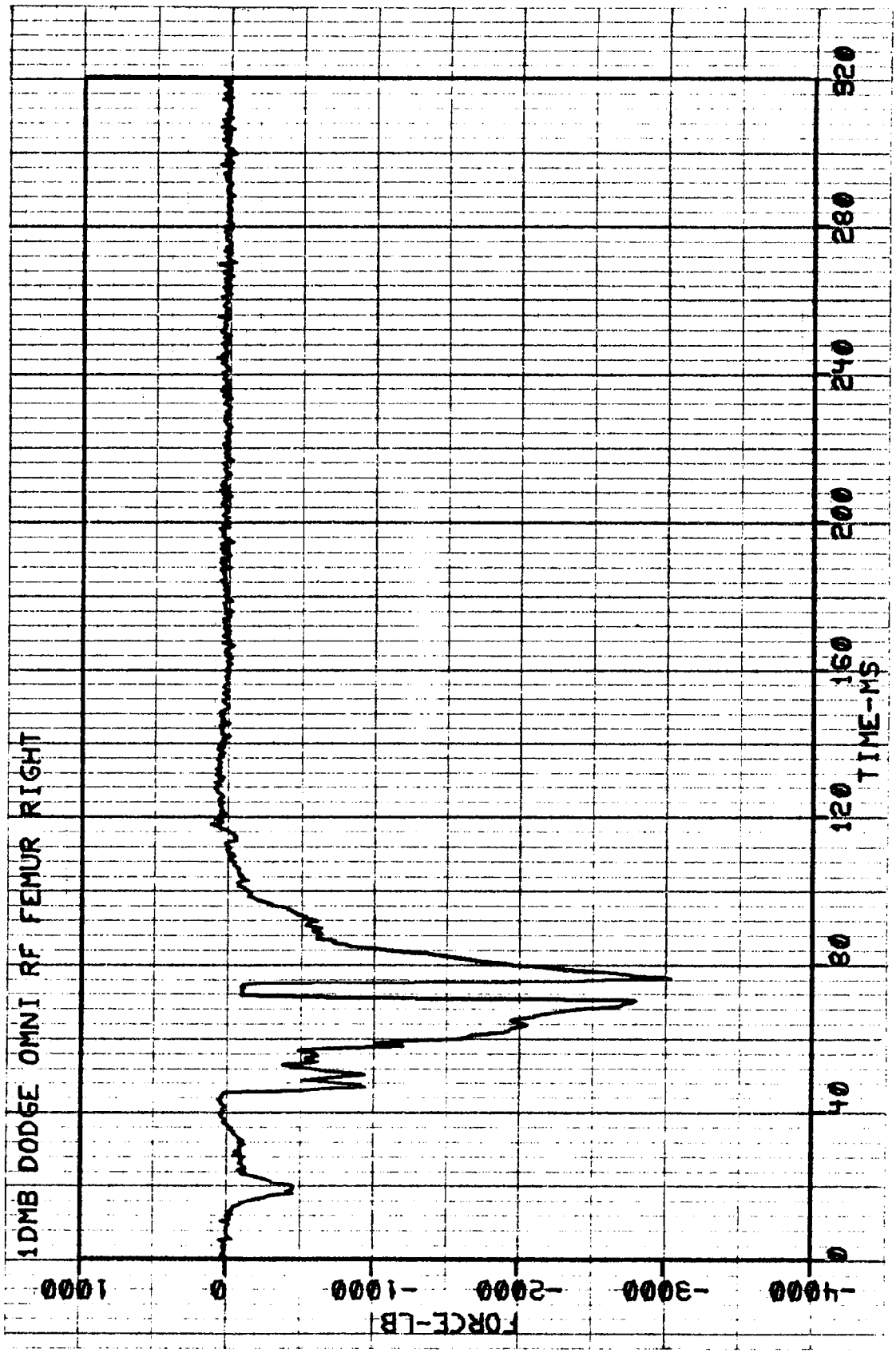

1DMB DODGE OMNI RGHT FRONT NECK - MZ
MOMENT - FT*LBS
200
0
-200
-400
-600
-800
TIME-MS
0
40
80
120
160
200
240
280
320

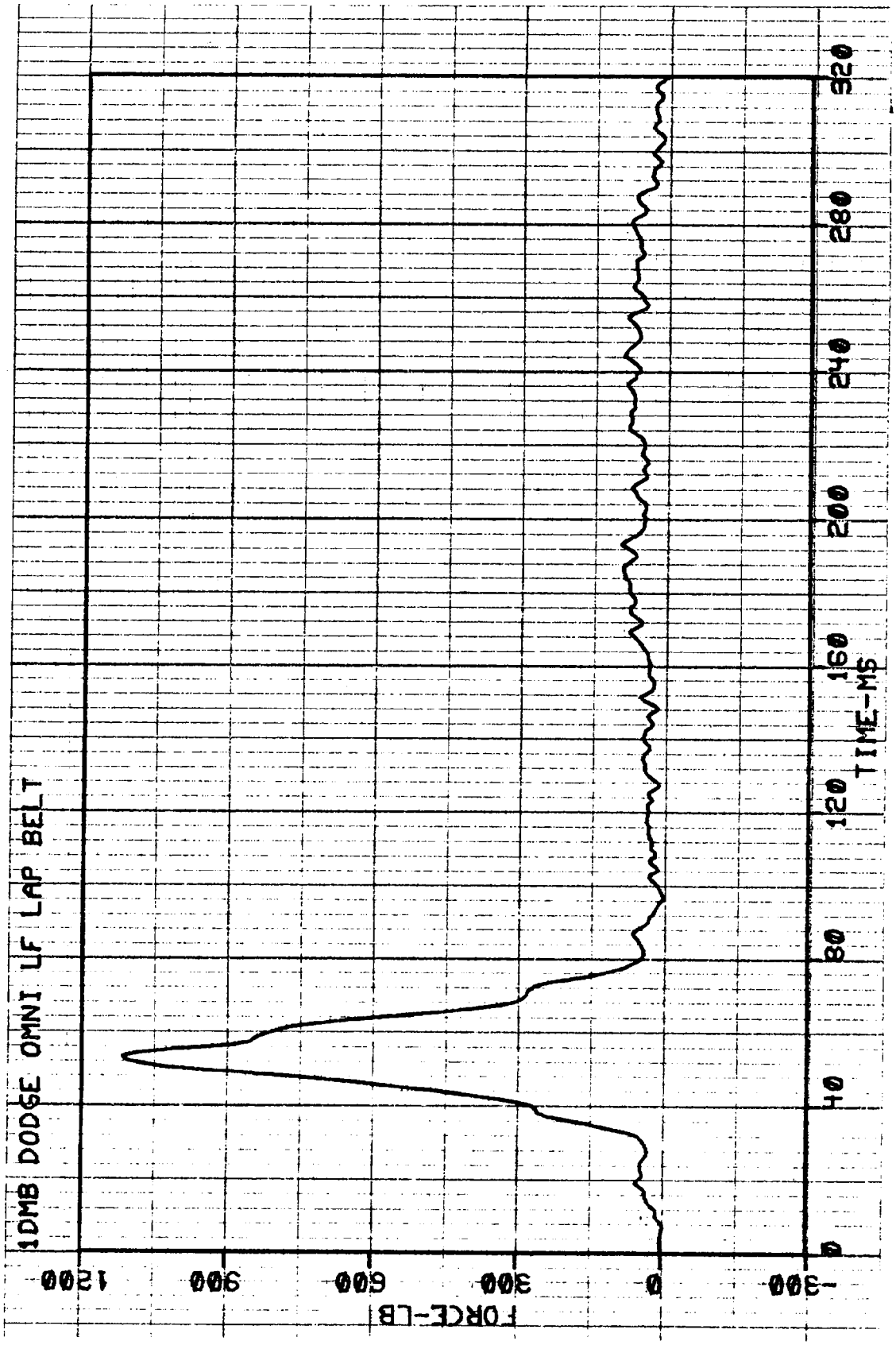

1DMB DODGE OMNI RF CHEST POT
ANGLE - DEGREES
TIME-MS
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320

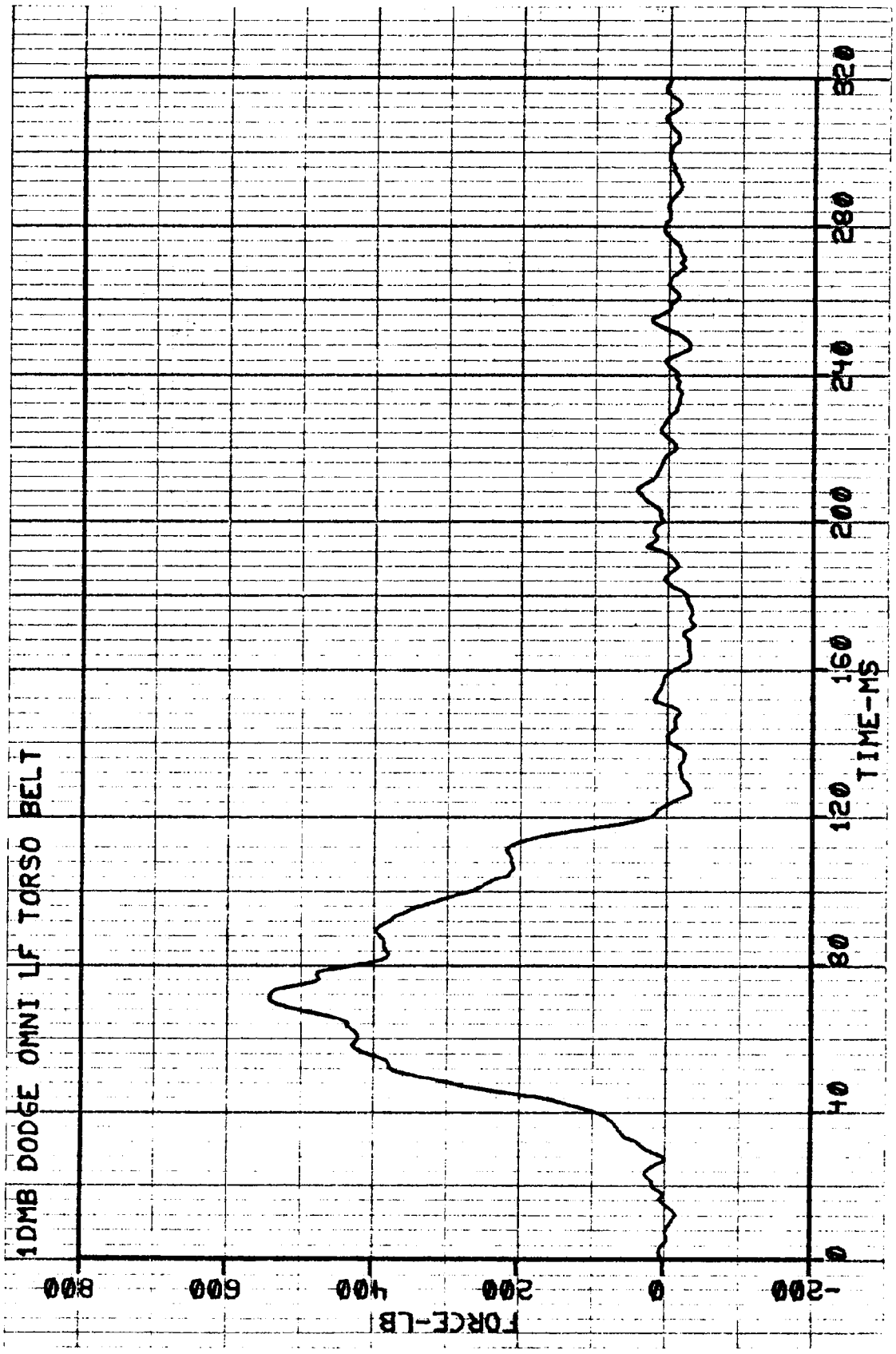

1DMB DODGE OMNI LF FEMUR LEFT
FORCE-LB
1200
800
400
0
-400
-800
0
40
80
120
160
200
240
280
320
TIME-MS

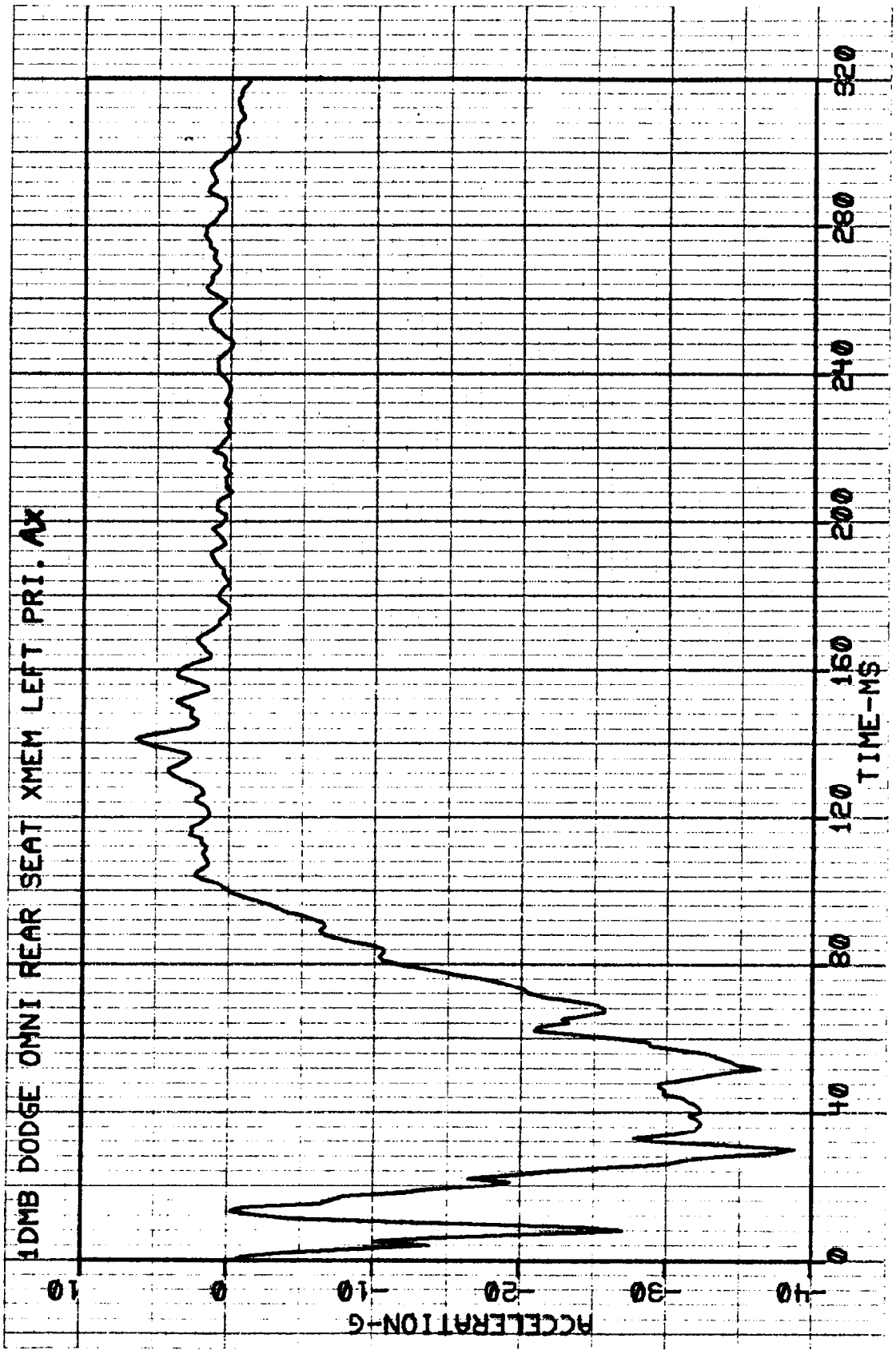

1DMB DODGE OMNI LF FEMUR RIGHT
FORCE-LB
500
0
-500
-1000
-1500
-2000
0
40
80
120
160
200
240
280
320
TIME-MS

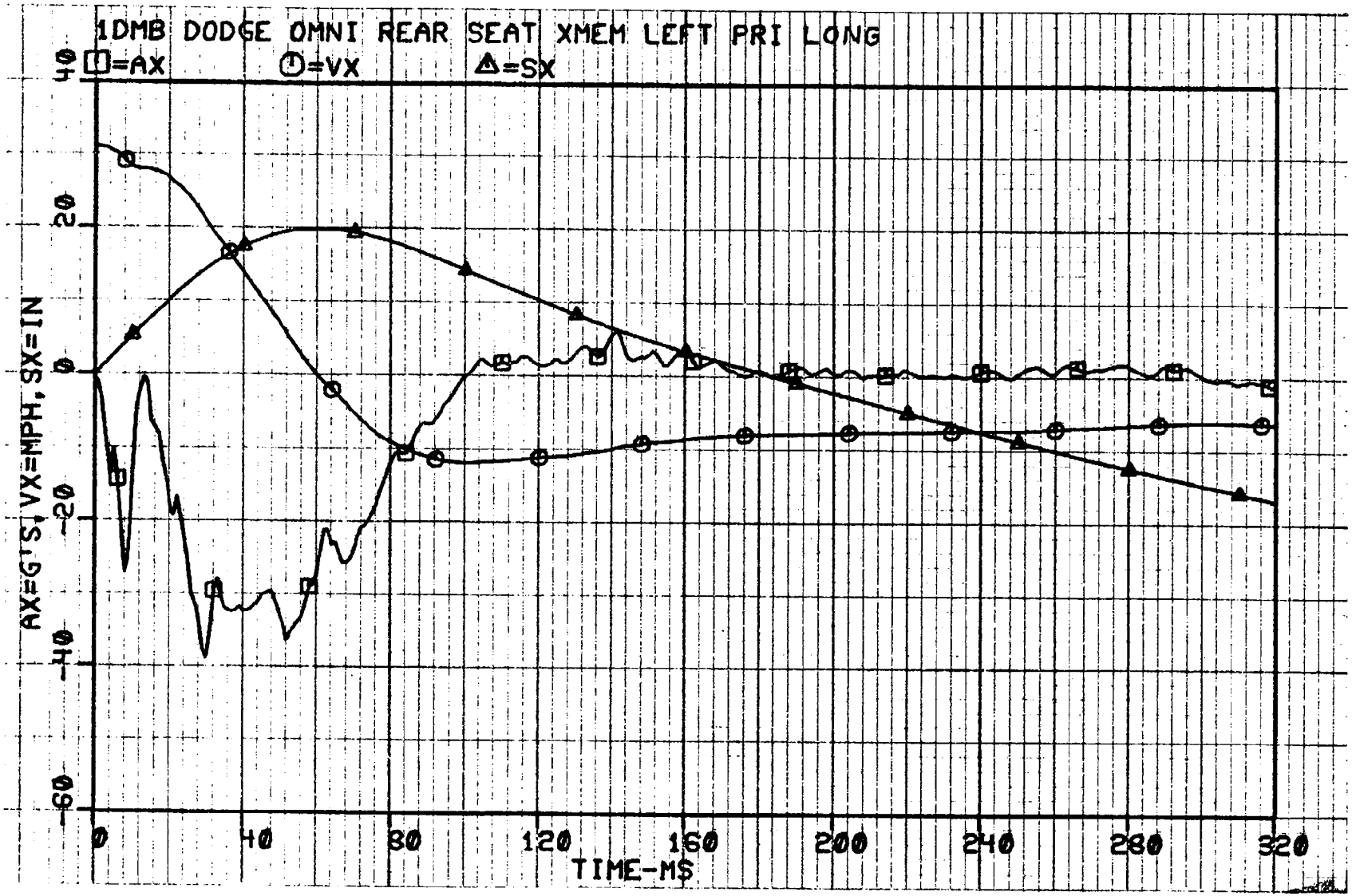

1DMB DODGE OMNI RF FEMUR LEFT
FORCE-LB
600
0
-600
-1200
-1800
-2400
0
40
80
120
160
200
240
280
320
TIME-MS

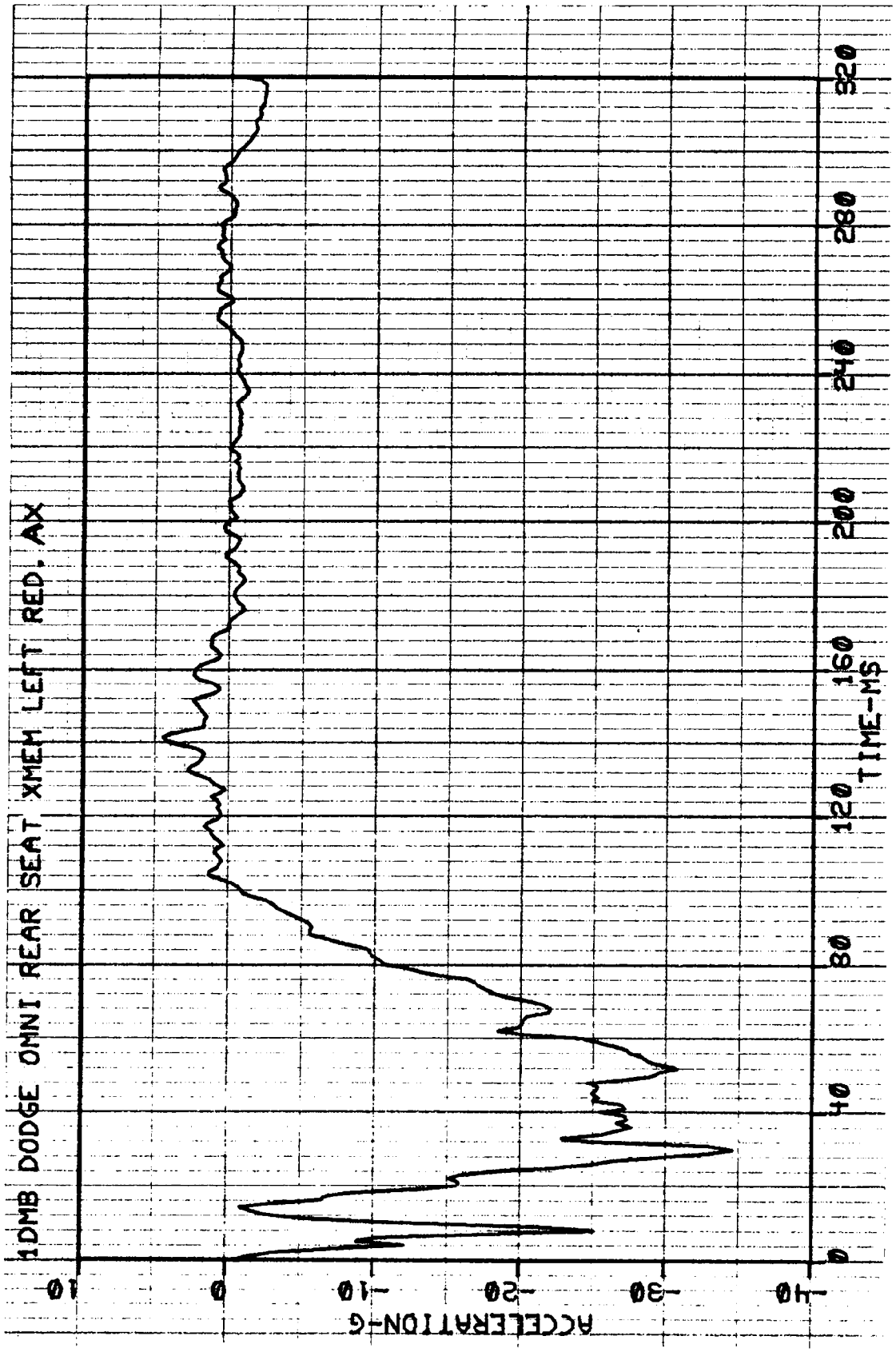

1DMB DODGE OMNI RF FEMUR RIGHT
FORCE-LB
1000
0
-1000
-2000
-3000
-4000
0
40
80
120
160
200
240
280
320
TIME-MS

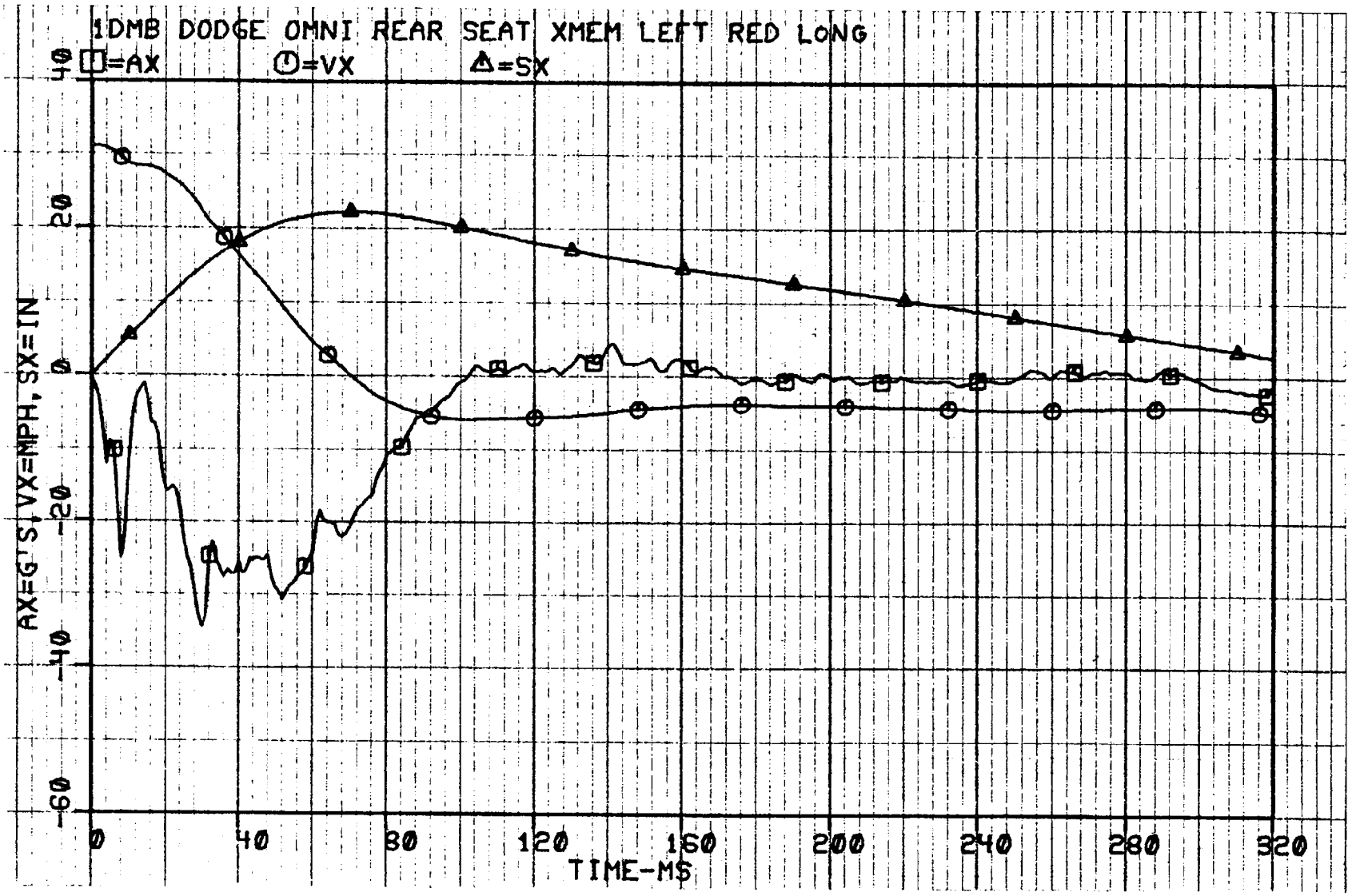

1DMB DODGE OMNI LF LAP BELT
FORCE-LB
-300
0
300
600
900
1200
TIME-MS
0
40
80
120
160
200
240
280
320

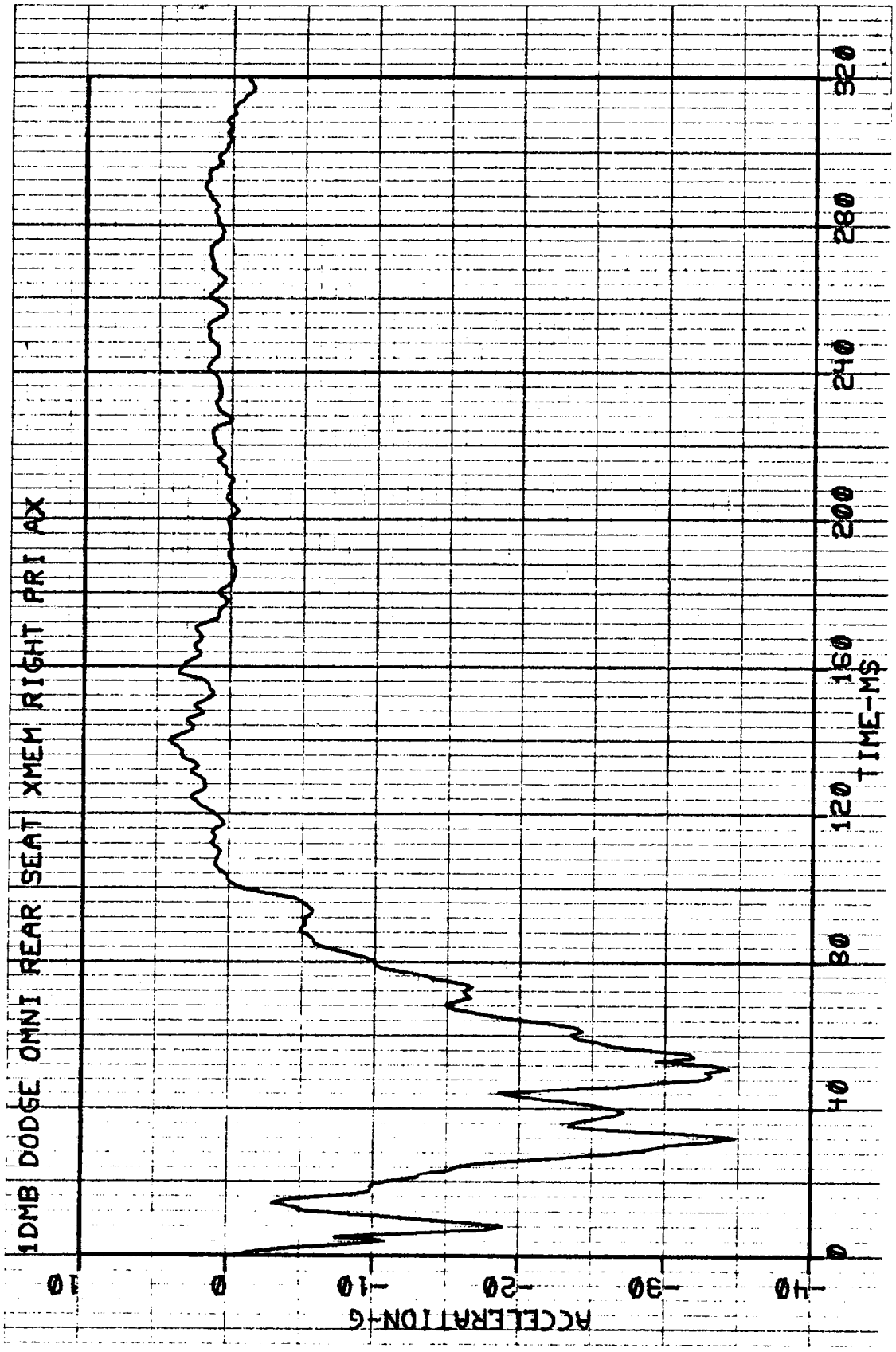

1DMB DODGE OMNI LF TORSO BELT
FORCE-LB
800
600
400
200
0
-200
0
40
80
120
160
200
240
280
320
TIME-MS

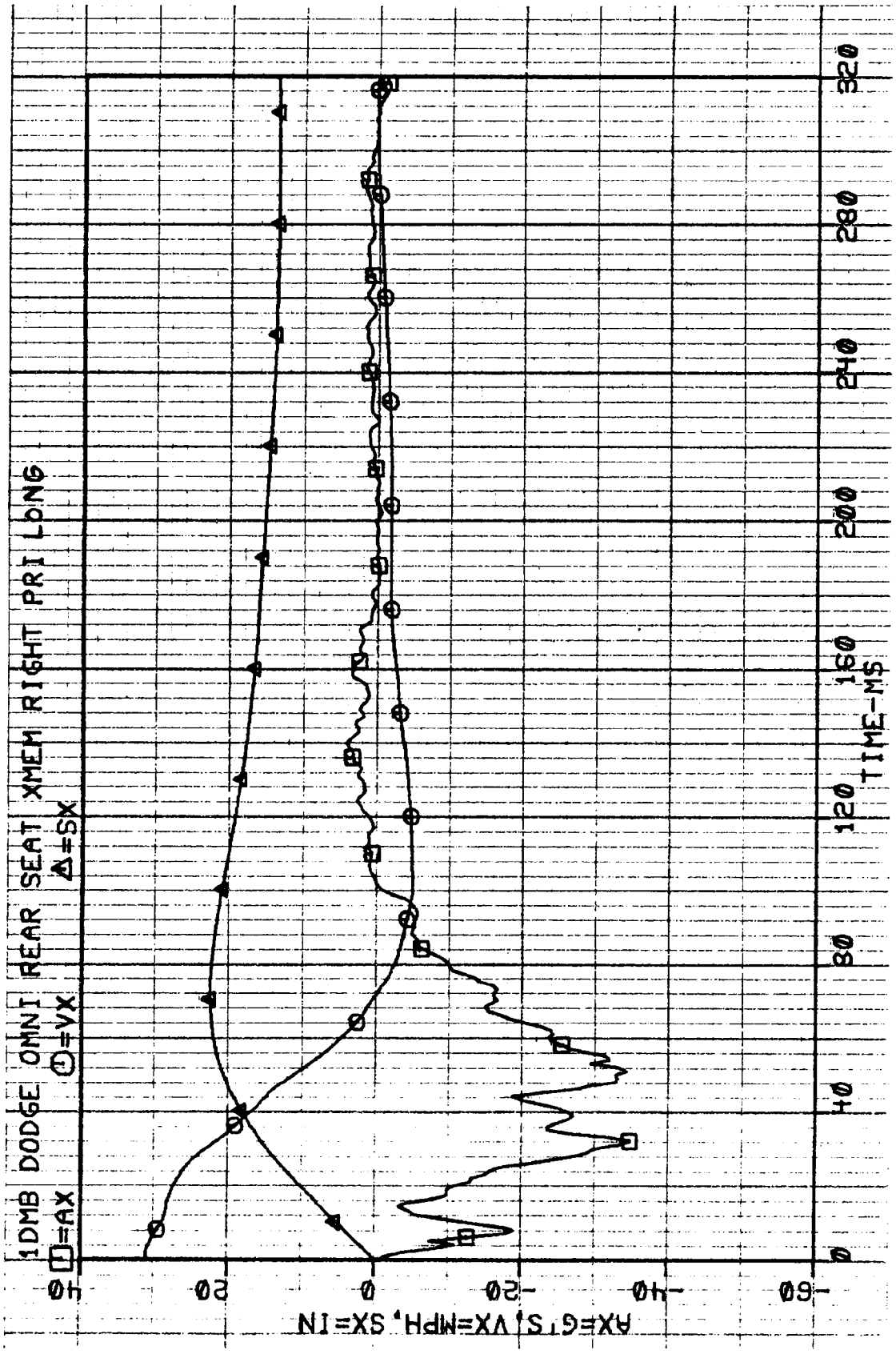

1DMB DODGE OMNI REAR SEAT XMEM LEFT PRI. Ax
ACCELERATION-G
10
0
-10
-20
-30
-40
0
40
80
120
160
200
240
280
320
TIME-MS

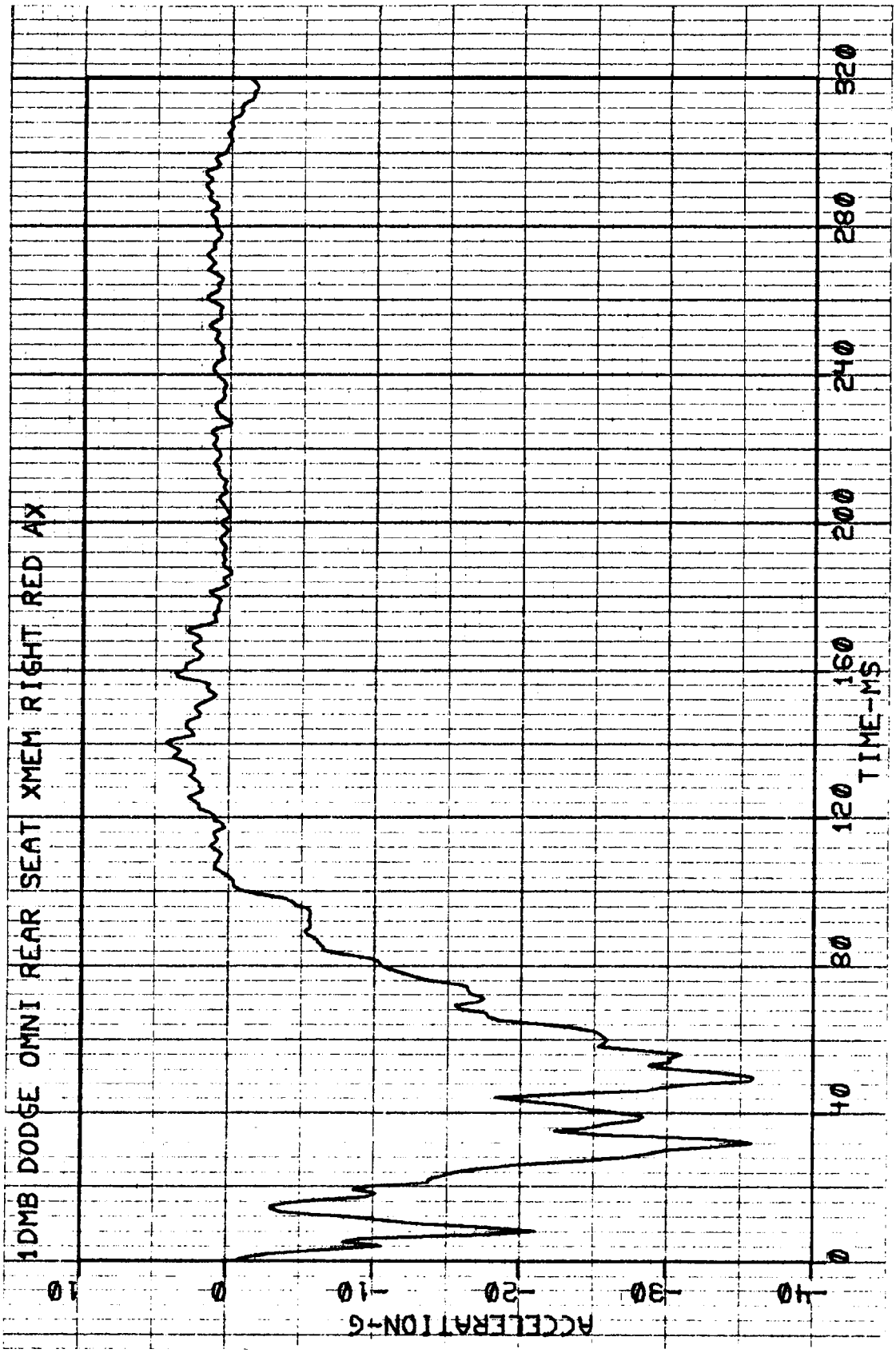

1DMB DODGE OMNI REAR SEAT XMEM LEFT PRI LONG
□=AX
○=VX
△=SX
AX=G'S,VX=MPH,SX=IN
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320
TIME-M$

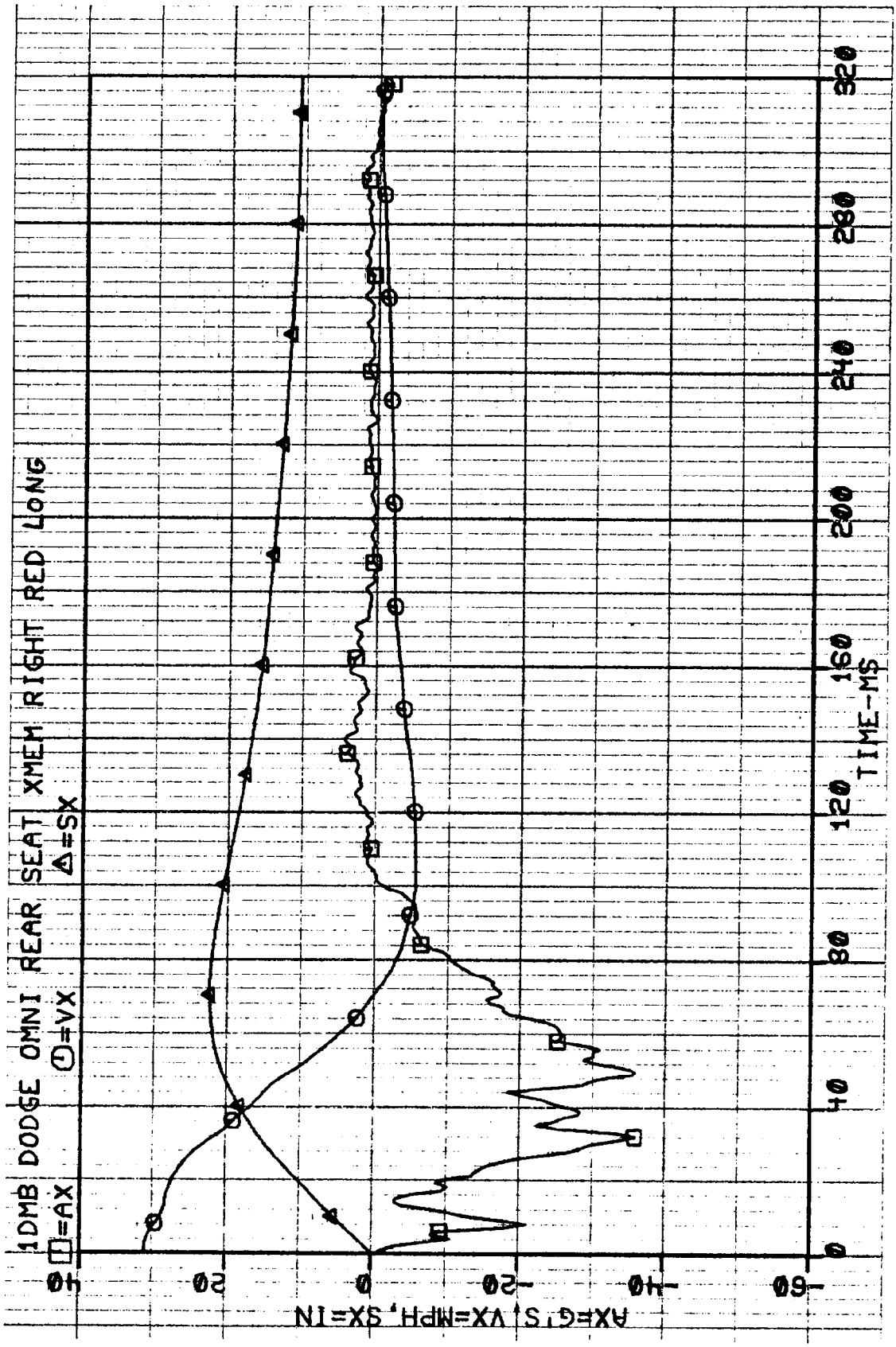

1DMB DODGE OMNI REAR SEAT XMEH LEFT RED. AX
ACCELERATION-G
10
0
-10
-20
-30
-40
0
40
80
120
160
200
240
280
320
TIME-MS

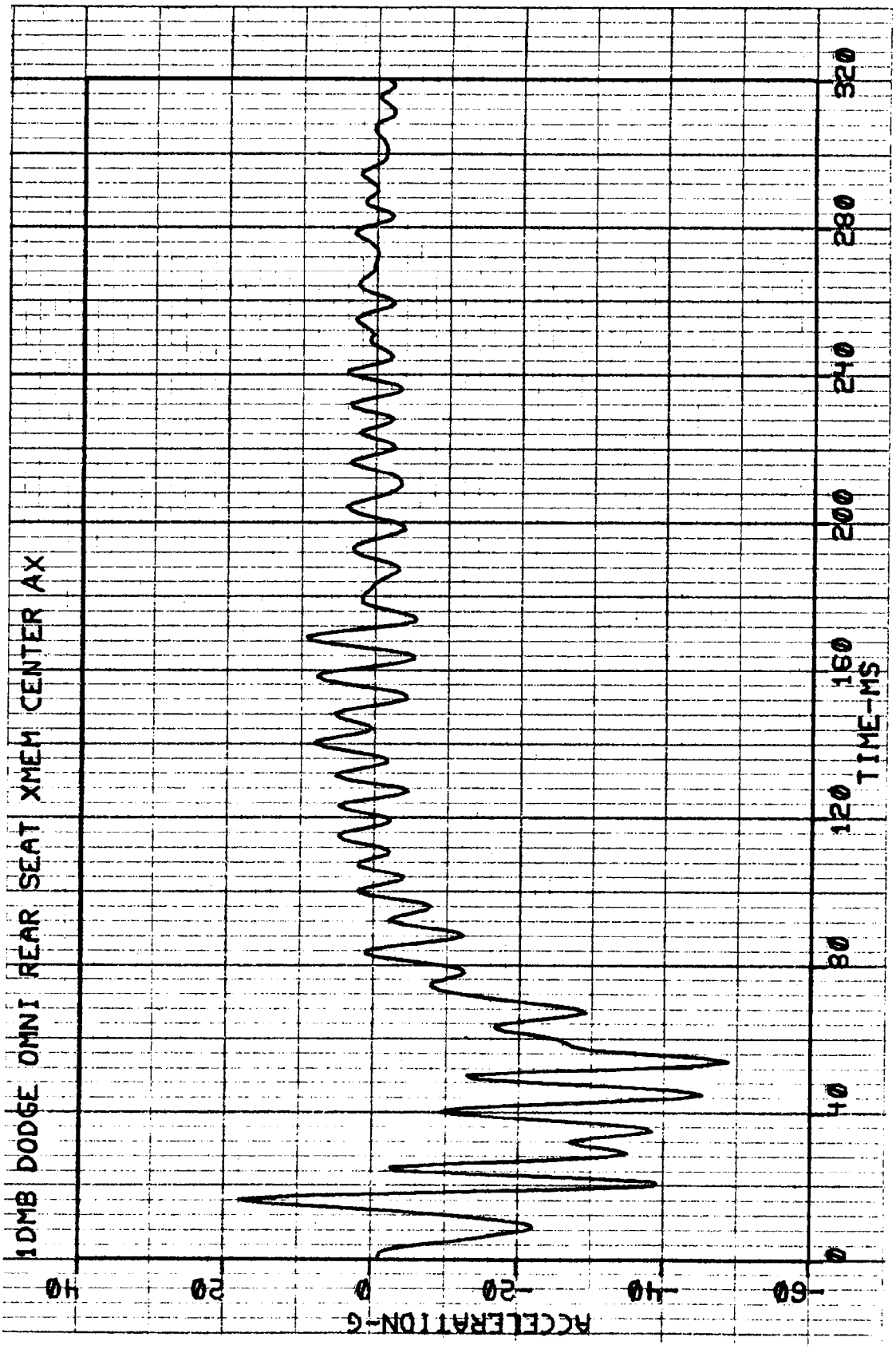

1DMB DODGE OMNI REAR SEAT XMEM LEFT RED LONG
□=AX
○=VX
△=SX
AX=G'S, VX=MPH, SX=IN
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320
TIME-M$

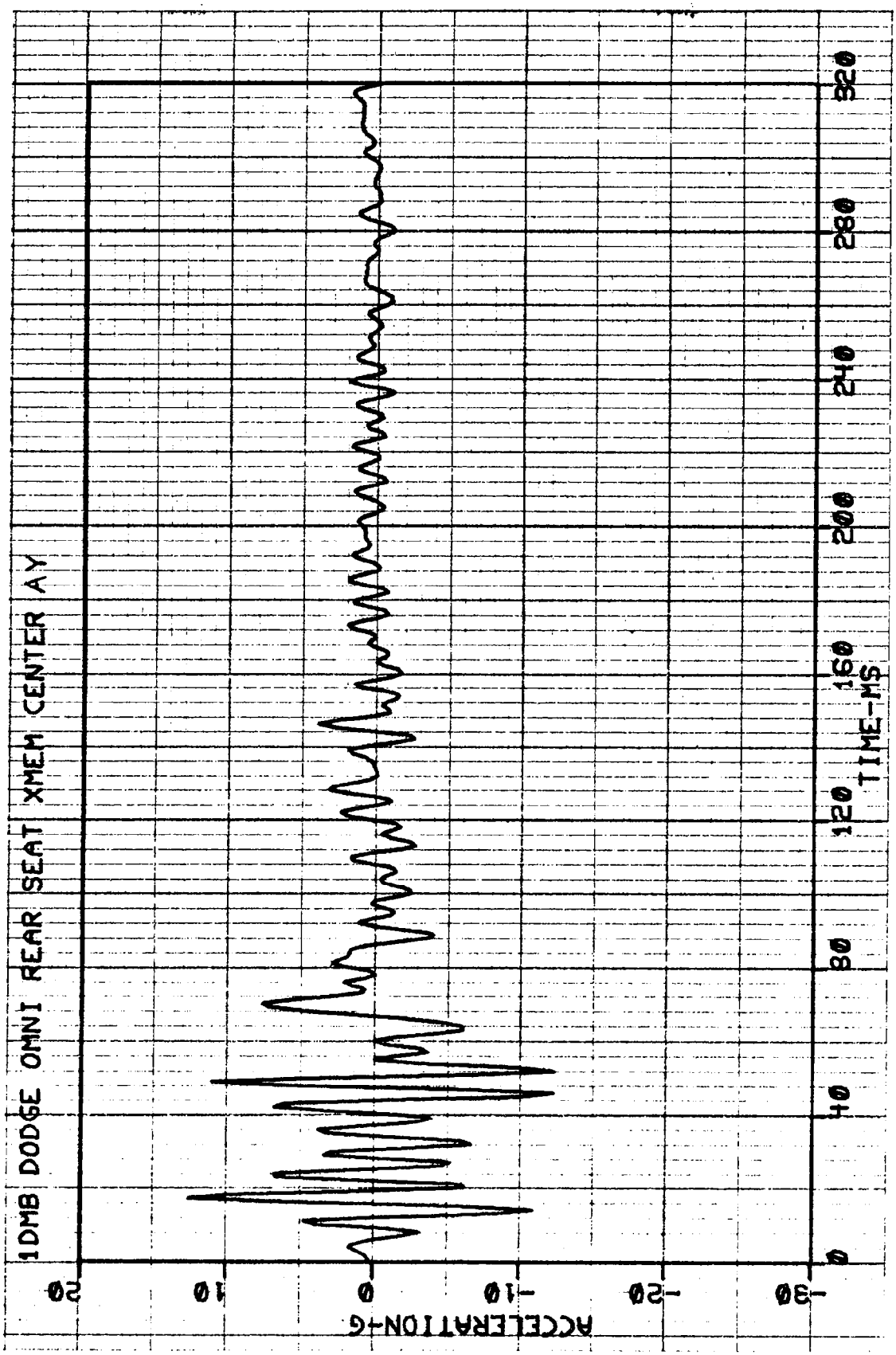

1DMB DODGE OMNI REAR SEAT XMEM RIGHT PRI AX
ACCELERATION-G
10
0
-10
-20
-30
-40
0
40
80
120
160
200
240
280
320
TIME-MS

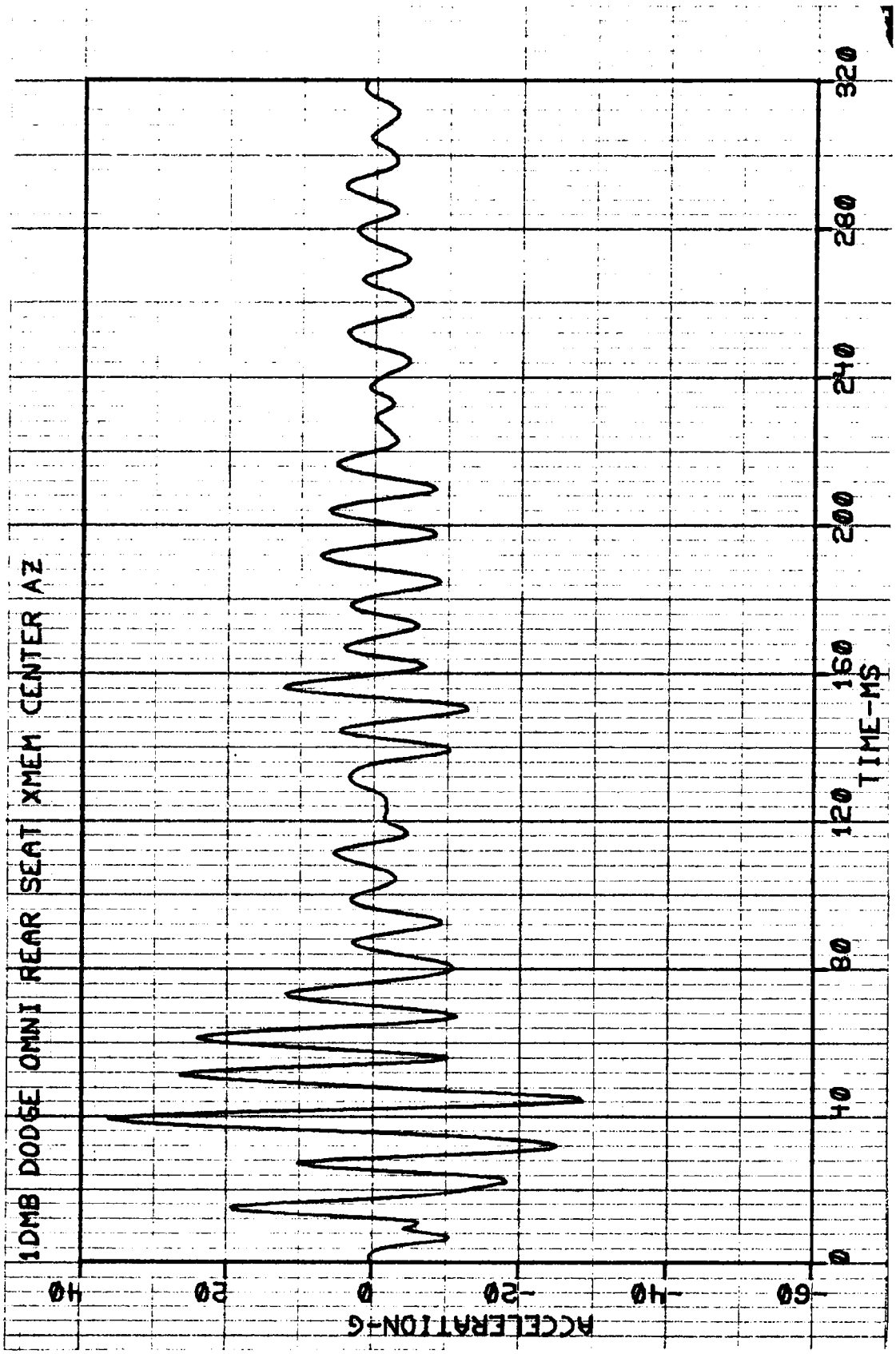

1DMB DODGE OMNI REAR SEAT XMEM RIGHT PRI LONG
□=AX ○=VX Δ=SX
AX=G'S, VX=MPH, SX=IN
TIME-MS
40
0
-20
-40
-60
0
40
80
120
160
200
240
280
320

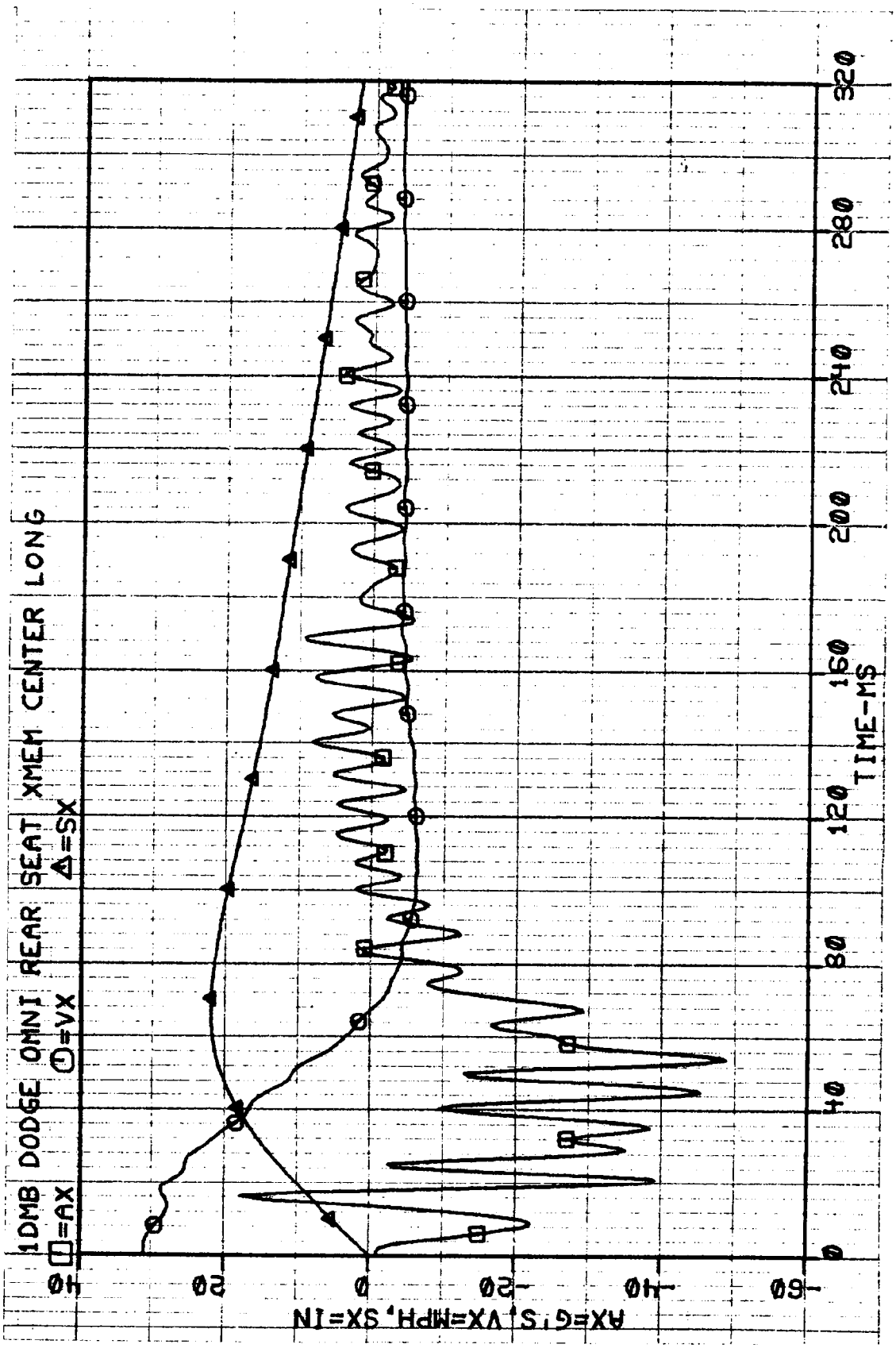

1DMB DODGE OMNI REAR SEAT XMEM RIGHT RED AX
ACCELERATION-G
10
0
-10
-20
-30
-40
TIME-MS
0
40
80
120
160
200
240
280
320

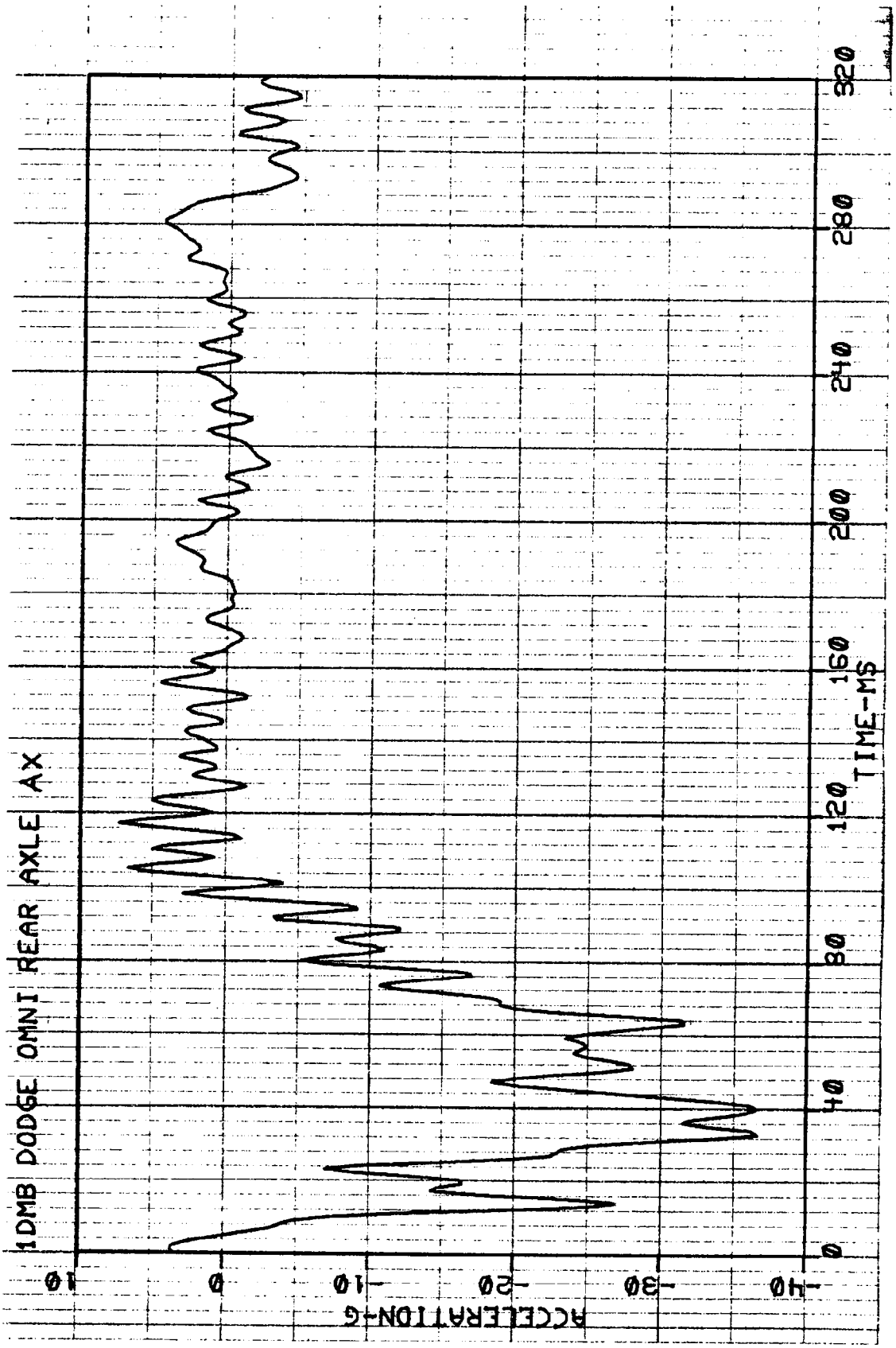

1DMB DODGE OMNI REAR SEAT XMEM RIGHT RED LONG
□=AX
○=VX
Δ=SX
AX=G'S, VX=MPH, SX=IN
TIME-MS
40
0
-20
-40
-60
20
40
80
120
160
200
240
280
320

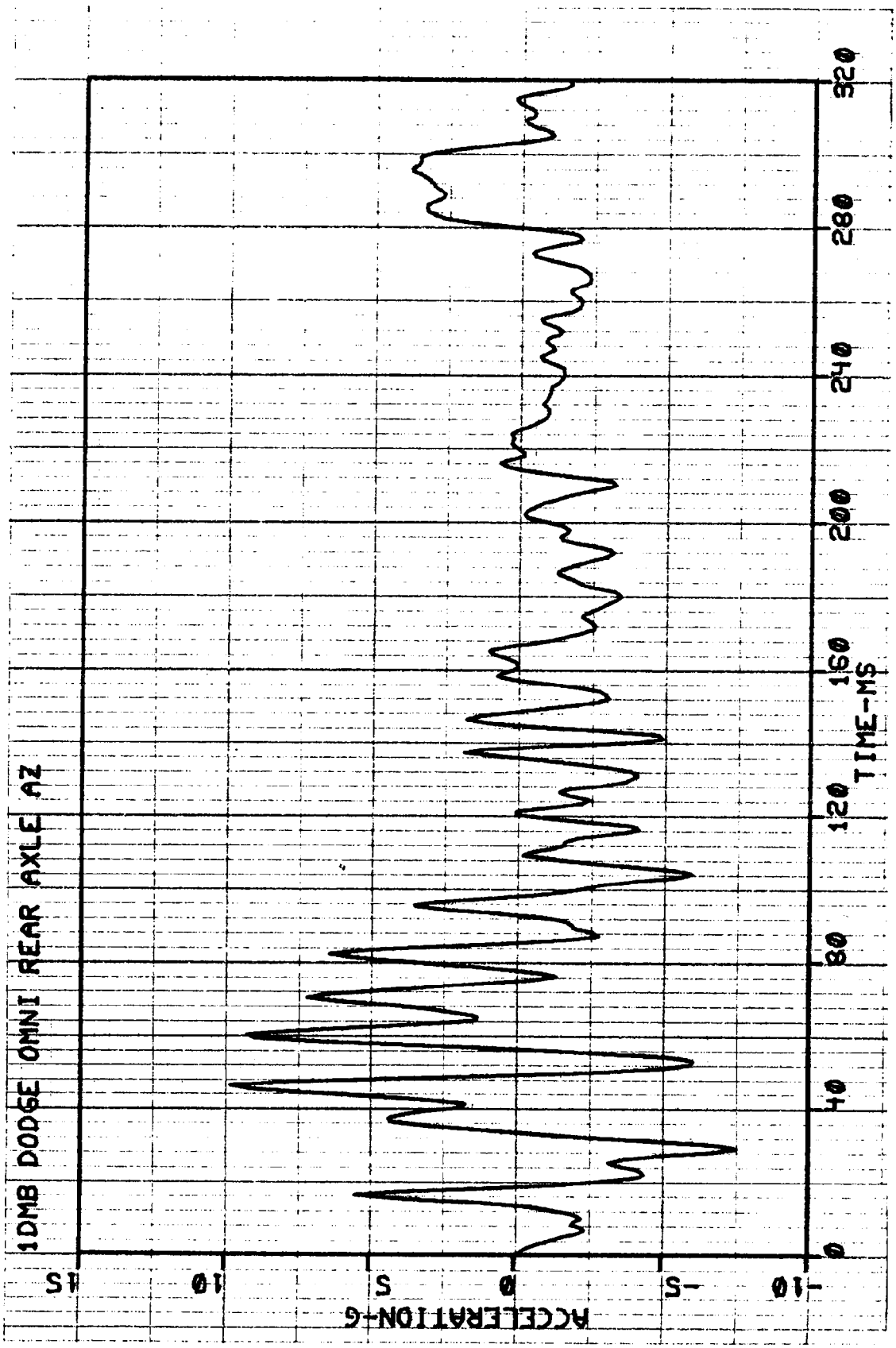

1DMB DODGE OMNI REAR SEAT XMEM CENTER AX
ACCELERATION-G
TIME-MS
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320

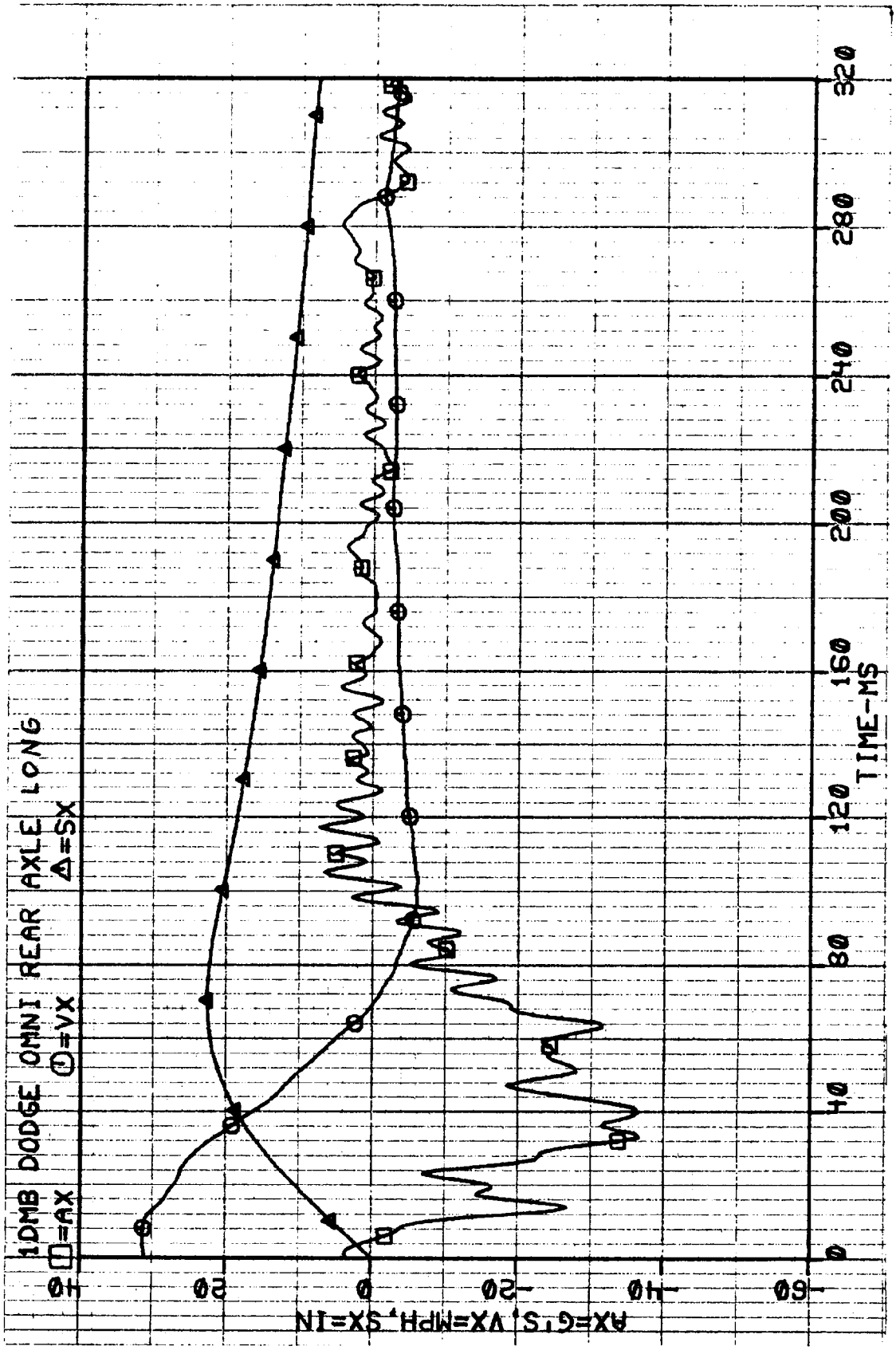

1DMB DODGE OMNI REAR SEAT XMEM CENTER AY
ACCELERATION-G
TIME-MS
20
10
0
-10
-20
-30
0
40
80
120
160
200
240
280
320

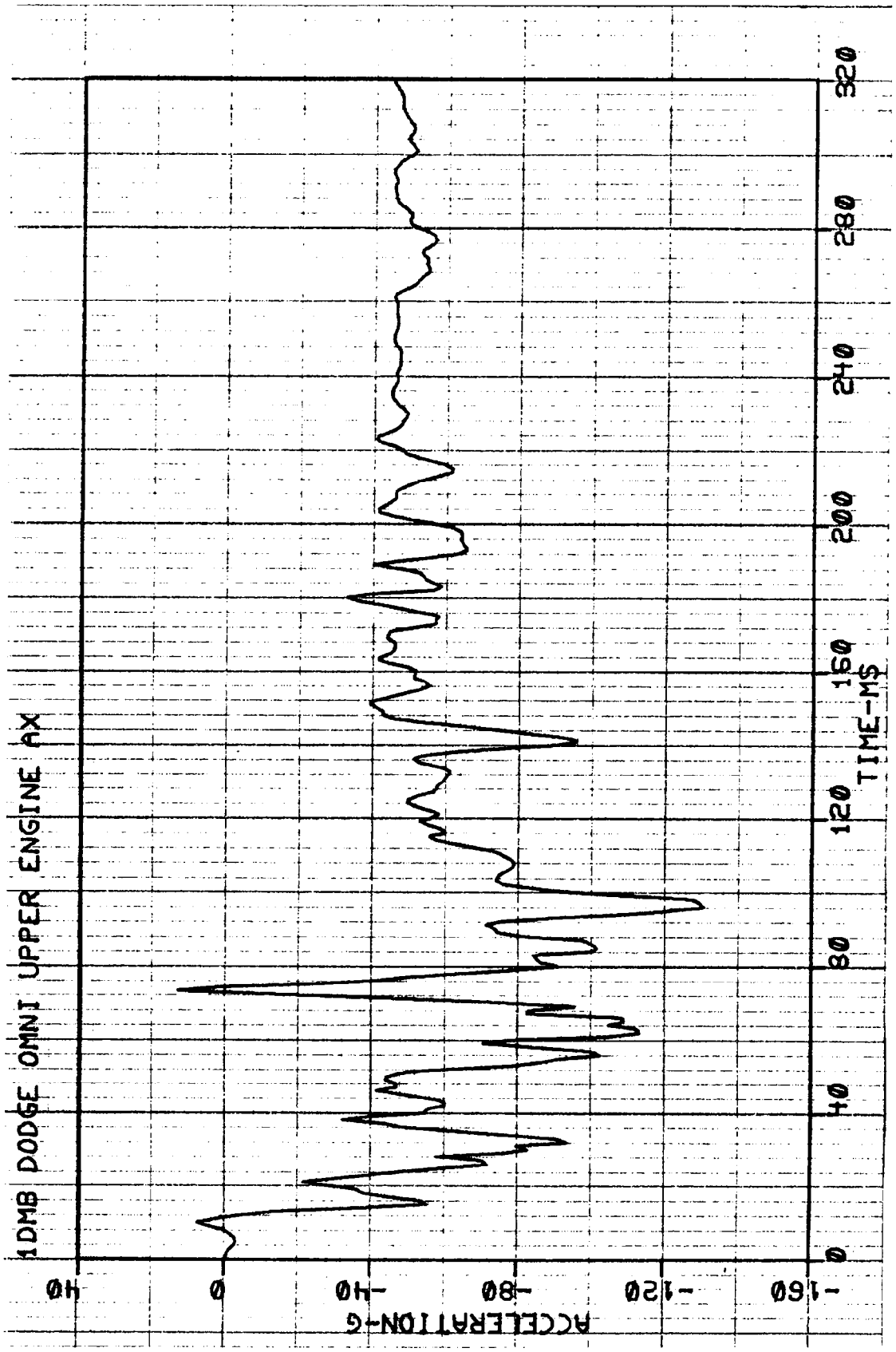

1DMB DODGE OMNI REAR SEAT XMEM CENTER AZ
ACCELERATION-G
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320
TIME-MS

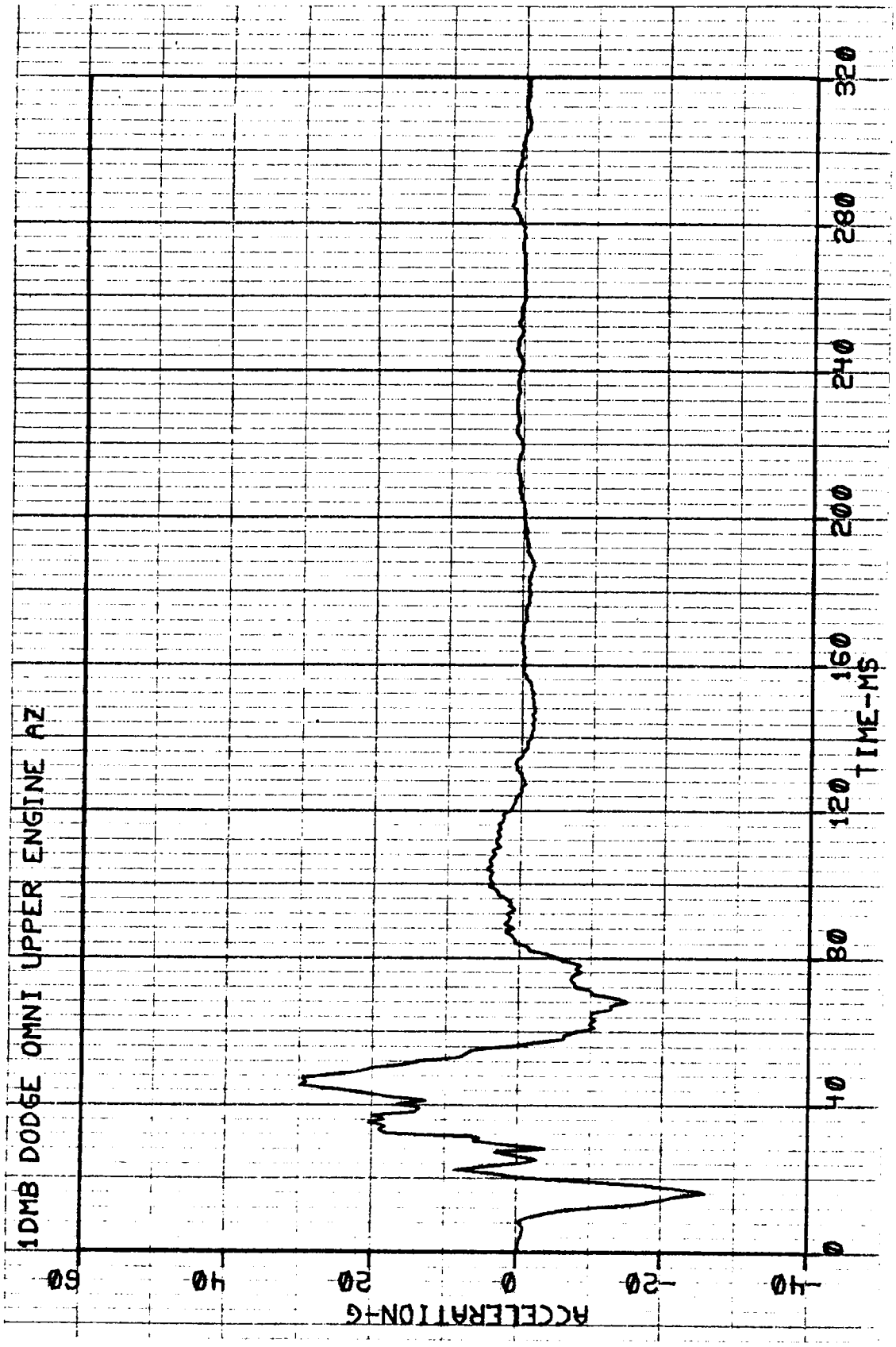

1DMB DODGE OMNI REAR SEAT XMEM CENTER LONG
□=AX
○=VX
Δ=SX
AX=G'S, VX=MPH, SX=IN
TIME-MS
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320

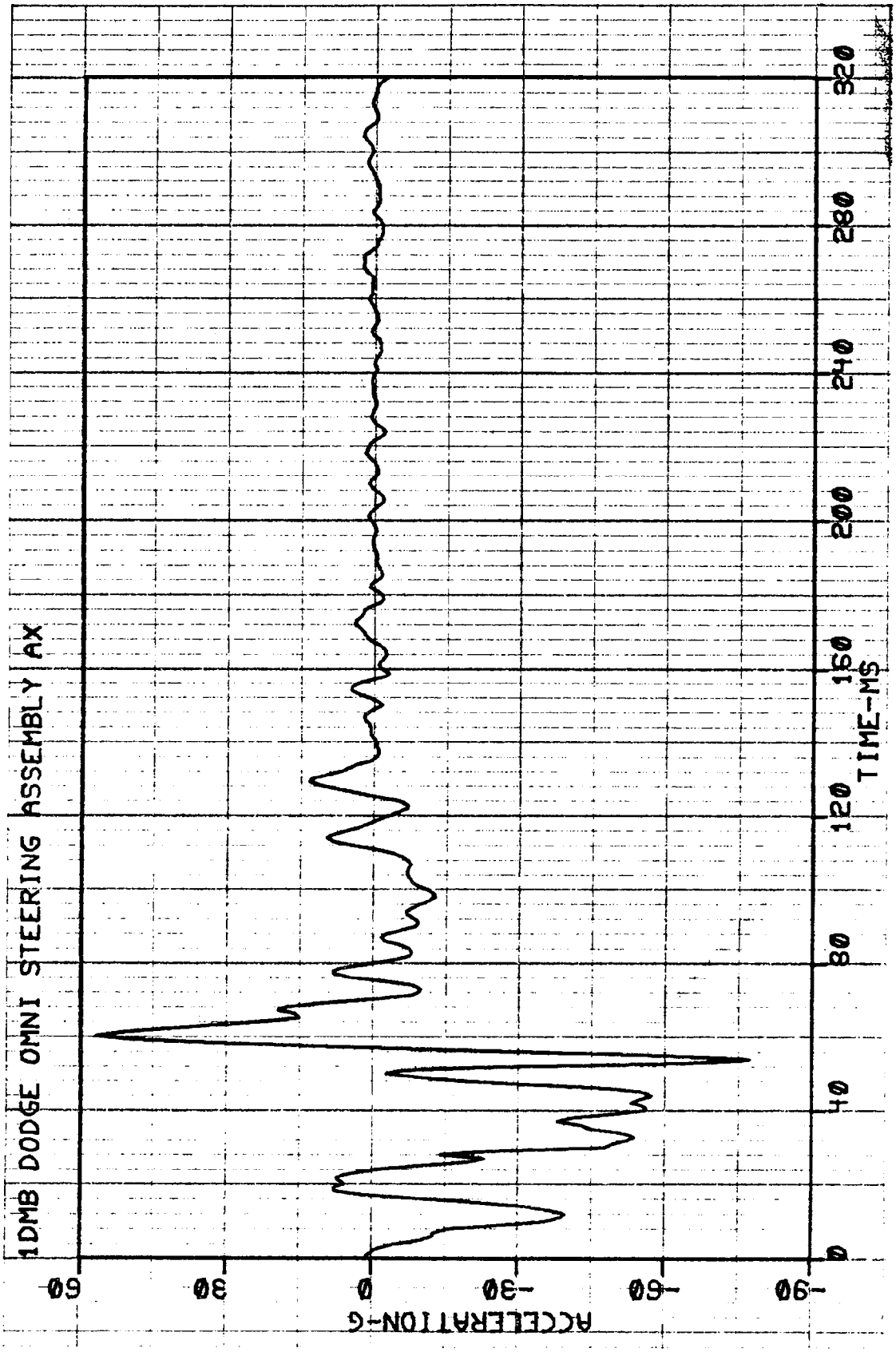

1DMB DODGE OMNI REAR AXLE AX
ACCELERATION-G
10
0
-10
-20
-30
-40
0
40
80
120
160
200
240
280
320
TIME-MS

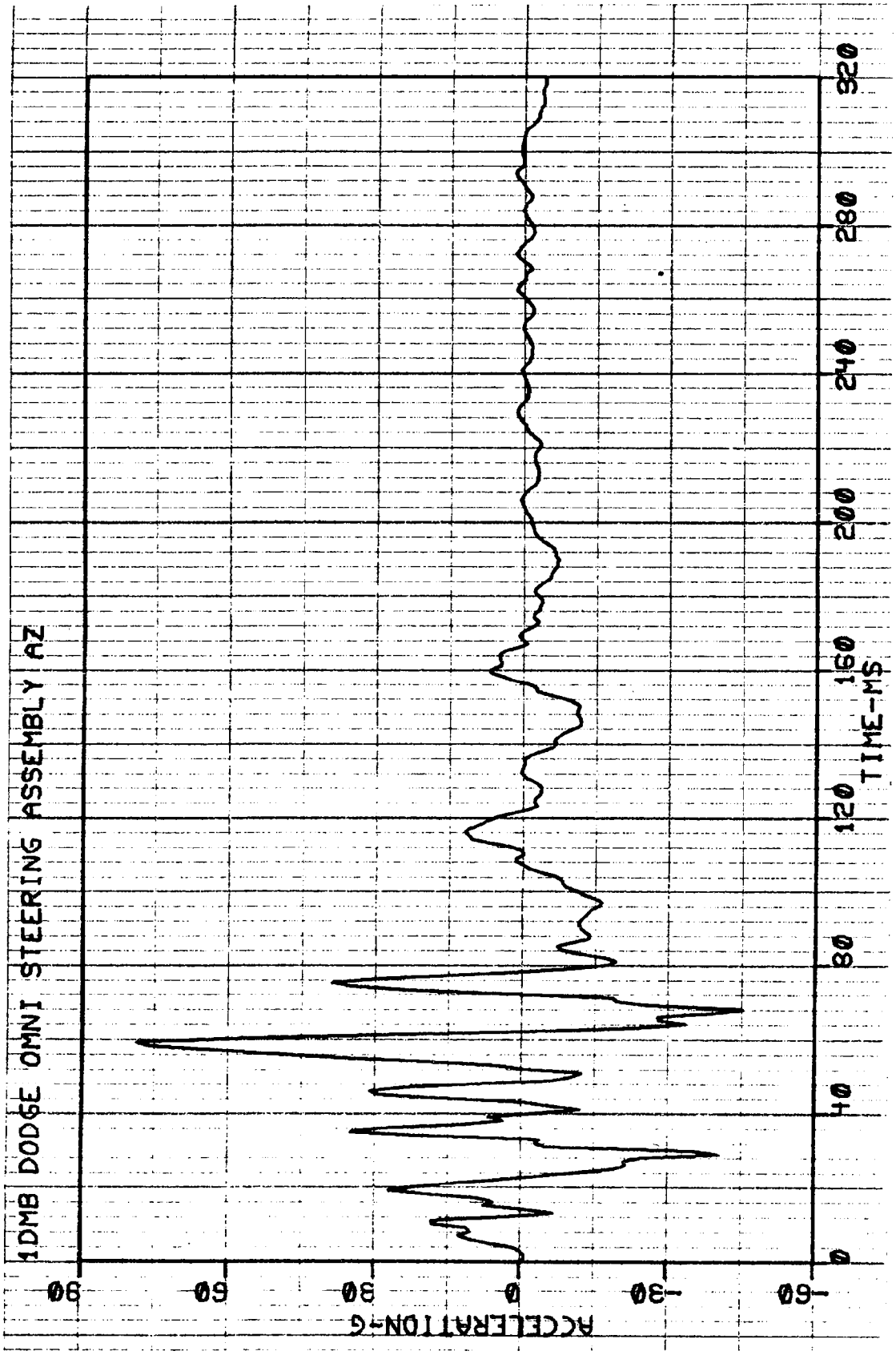

1DMB DODGE OMNI REAR AXLE AZ
ACCELERATION-G
15
10
5
0
-5
-10
0
40
80
120
160
200
240
280
320
TIME-MS

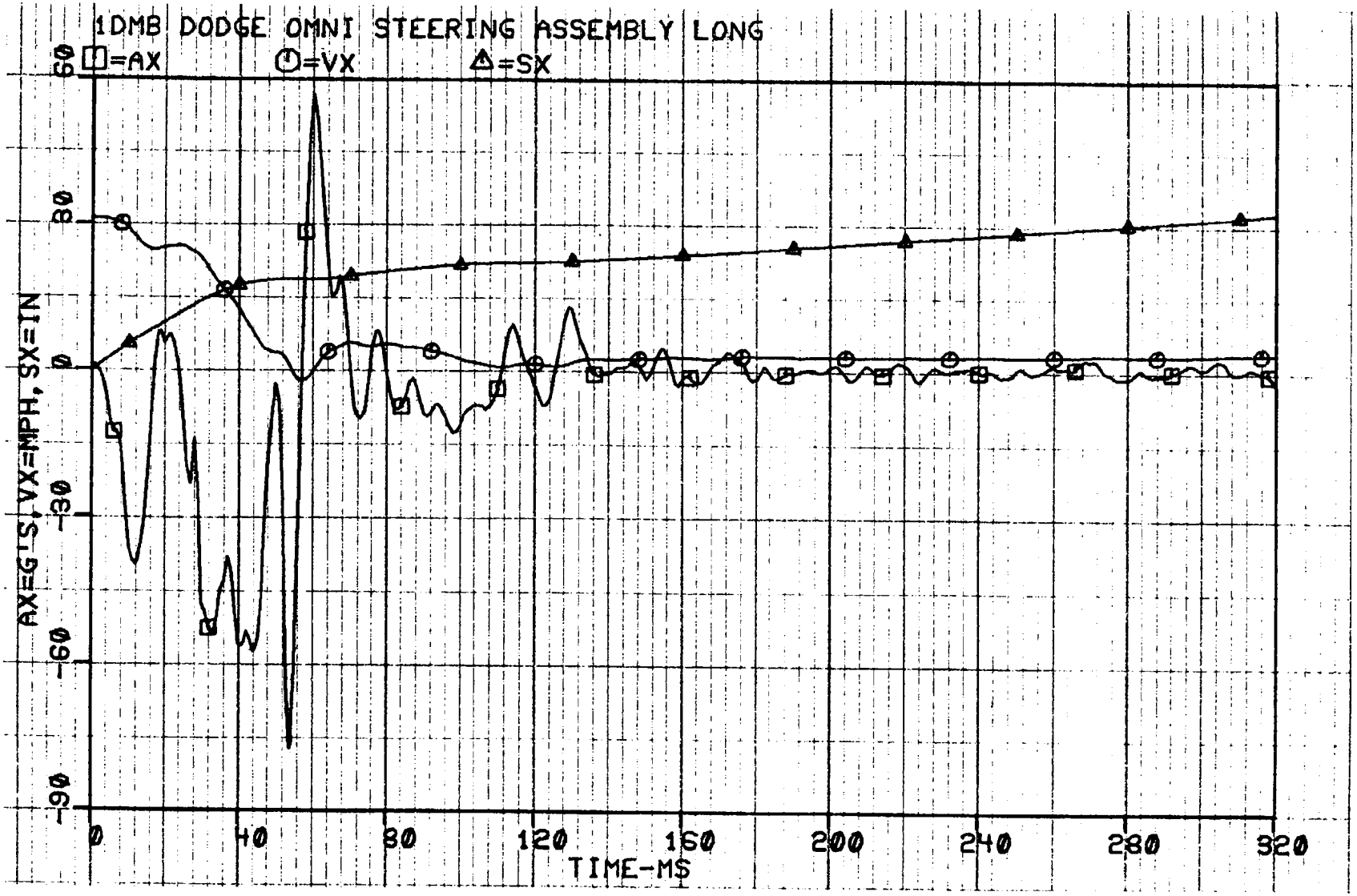

10MB DODGE OMNI REAR AXLE LONG
□=AX
○=VX
Δ=SX
AX=G'S, VX=MPH, SX=IN
TIME-MS
-60
-40
-20
0
20
40
0
80
120
160
200
240
280
320

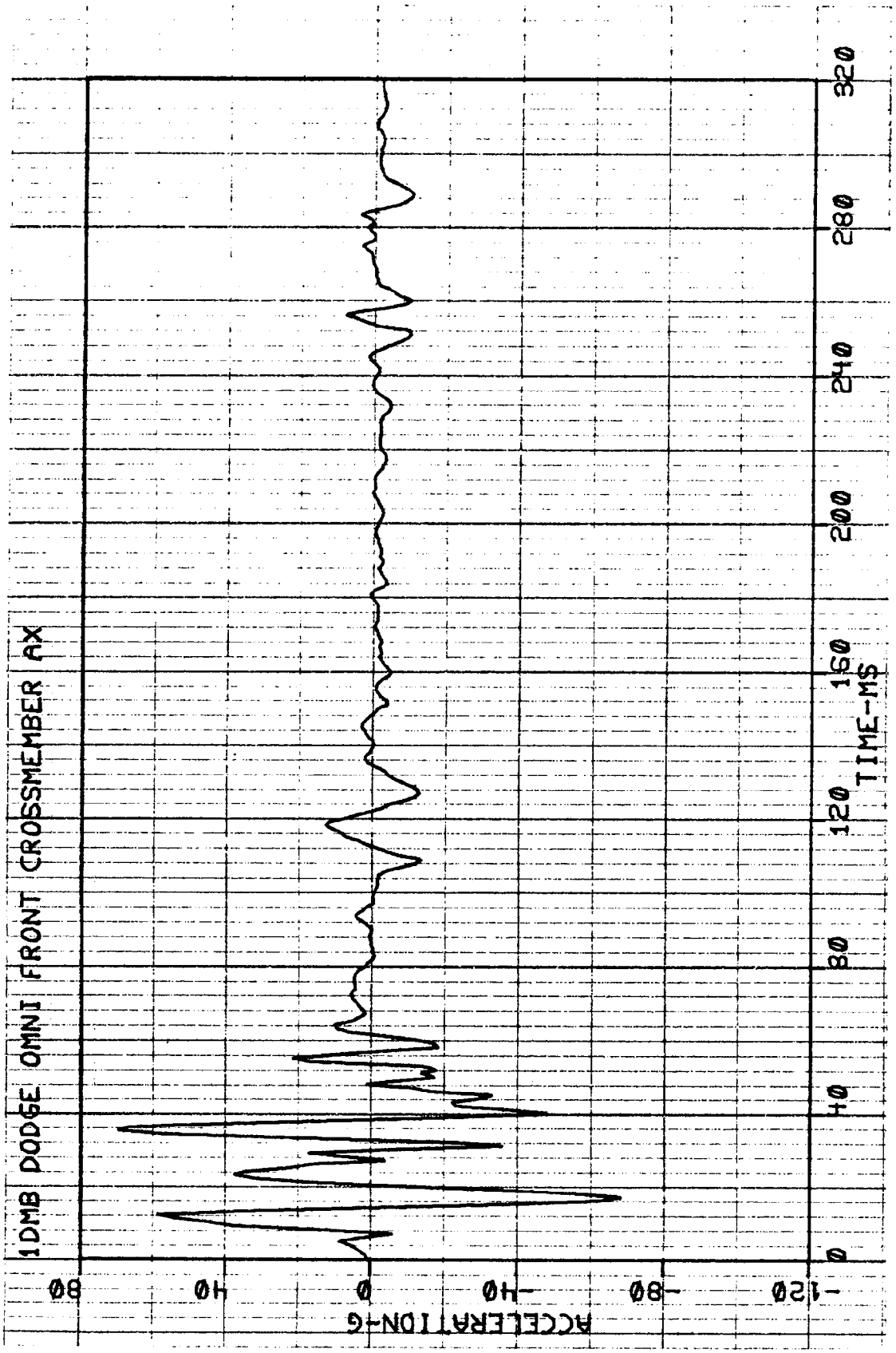

1DMB DODGE OMNI UPPER ENGINE AX
ACCELERATION-G
40
0
-40
-80
-120
-160
0
40
80
120
160
200
240
280
320
TIME-MS

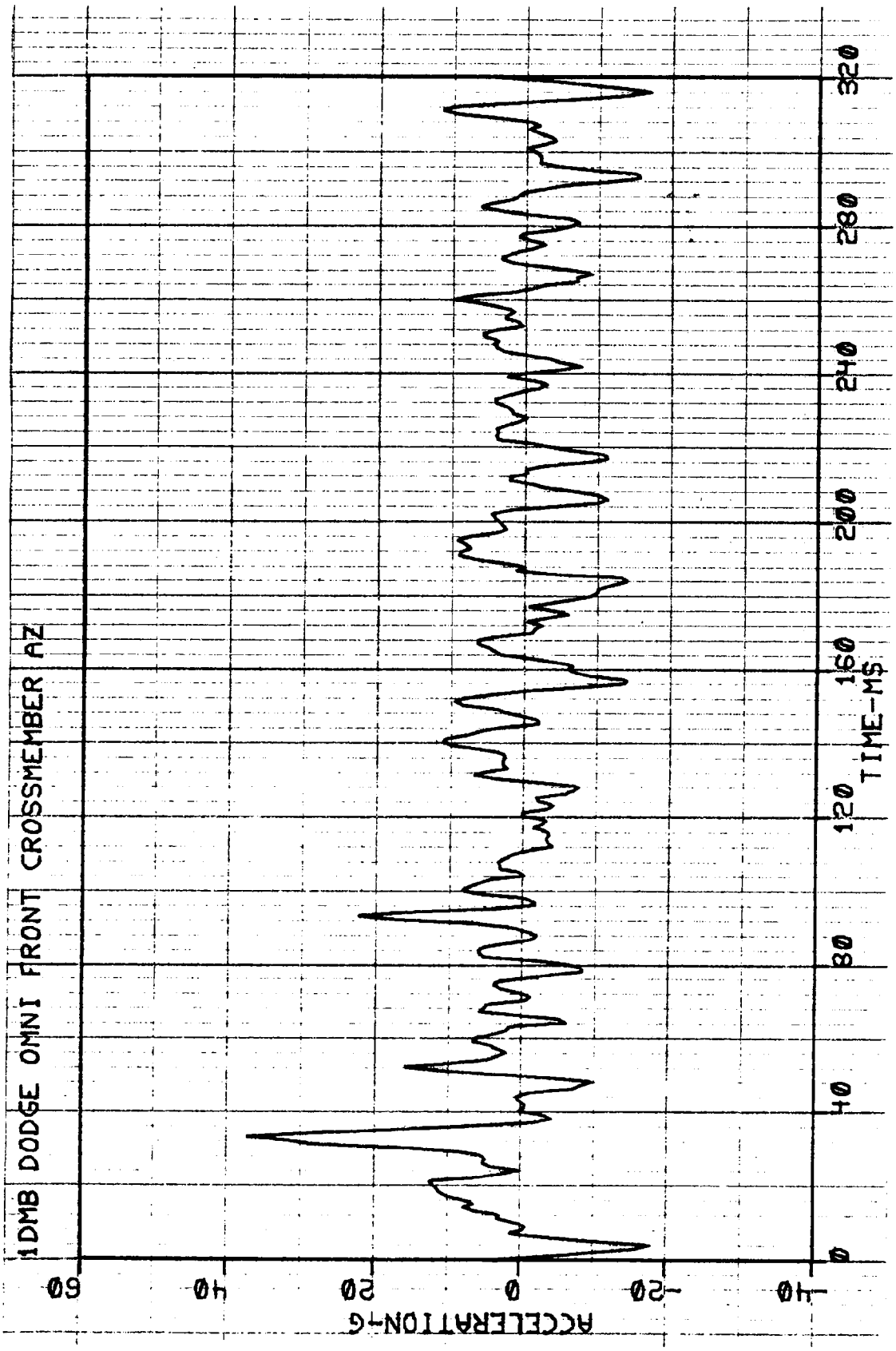

1DMB DODGE OMNI UPPER ENGINE AZ
ACCELERATION-G
60
40
20
0
-20
-40
TIME-MS
0
40
80
120
160
200
240
280
320


1DMB DODGE OMNI STEERING ASSEMBLY AX
ACCELERATION-G
60
30
0
-30
-60
-90
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI STEERING ASSEMBLY AZ
ACCELERATION-G
90
60
30
0
-30
-60
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI STEERING ASSEMBLY LONG
□=AX
○=VX
△=SX
AX=G'S, VX=MPH, SX=IN
60
30
0
-30
-60
-90
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI FRONT CROSSMEMBER AX
ACCELERATION-G
80
40
0
-40
-80
-120
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI FRONT CROSSMEMBER AZ
ACCELERATION-G
60
40
20
0
-20
-40
TIME-MS
0
40
80
120
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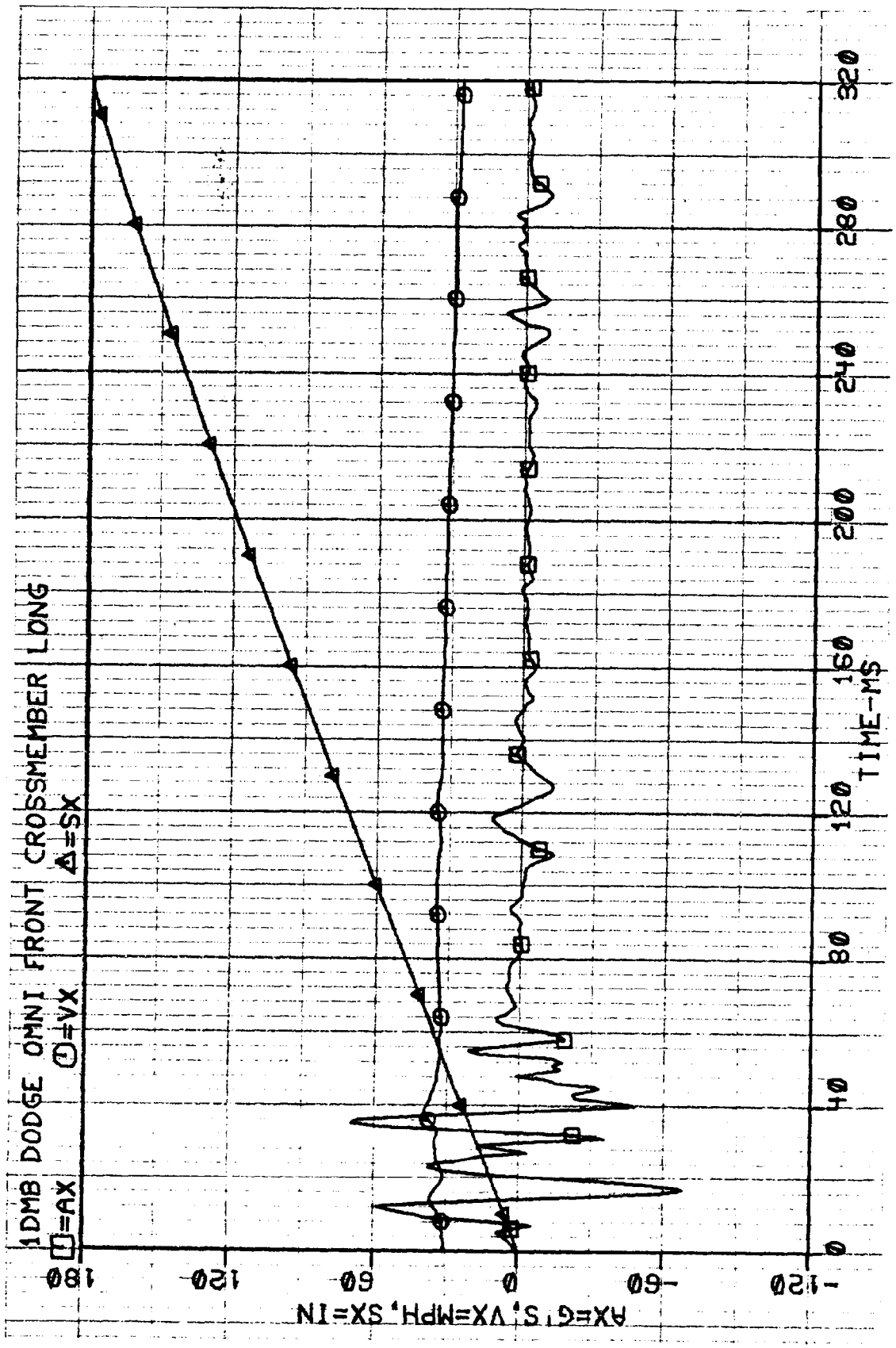
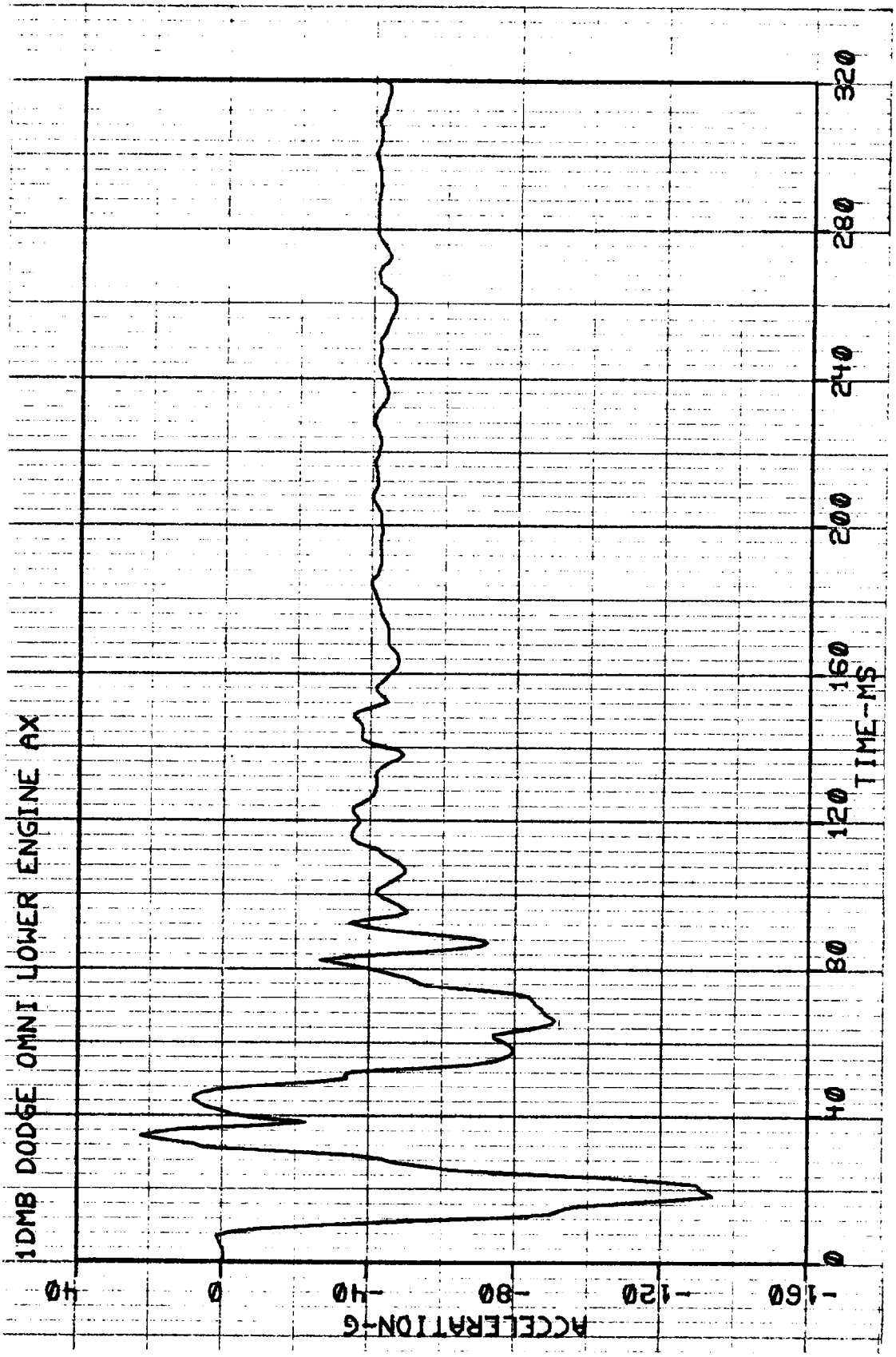
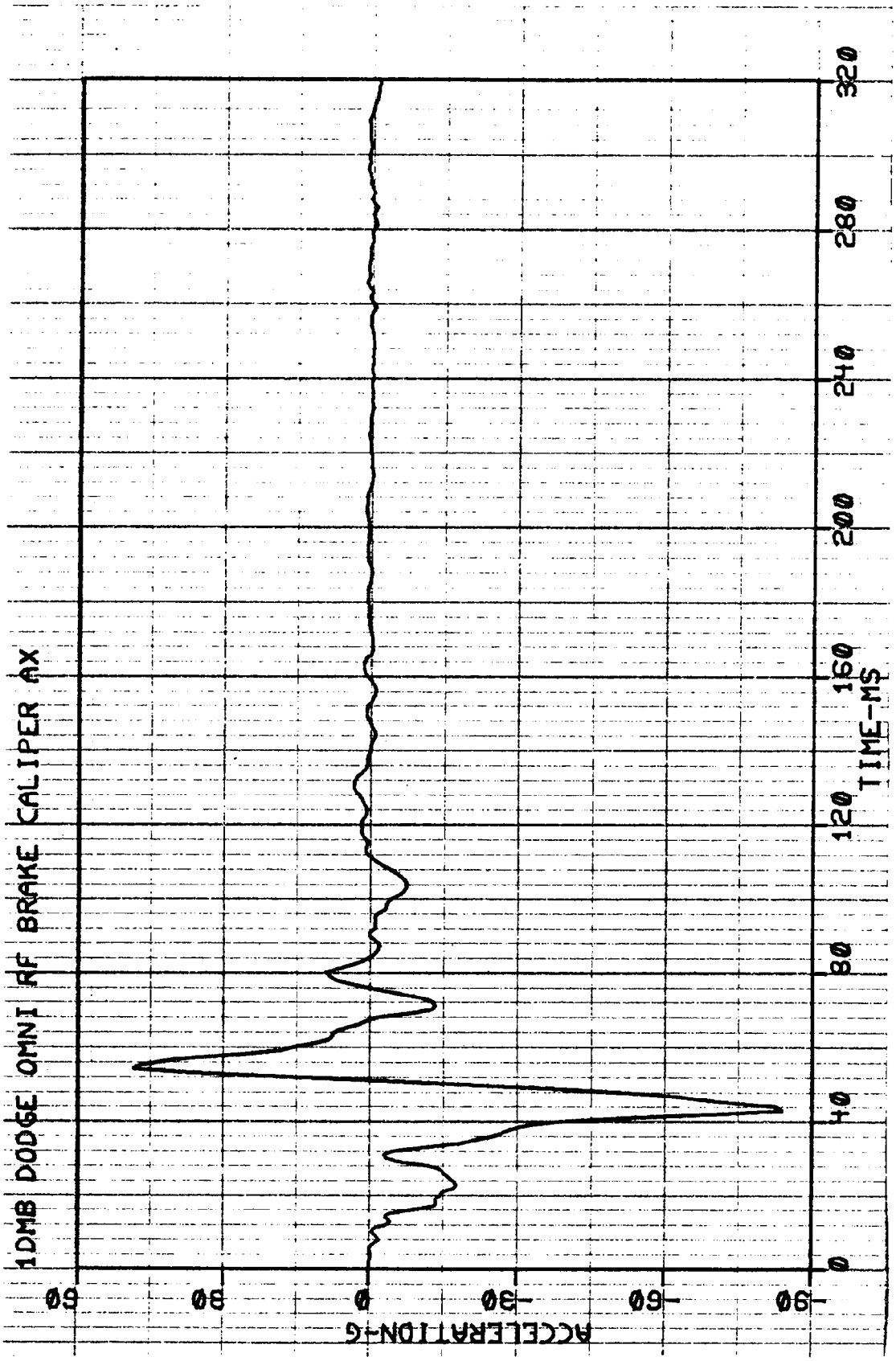
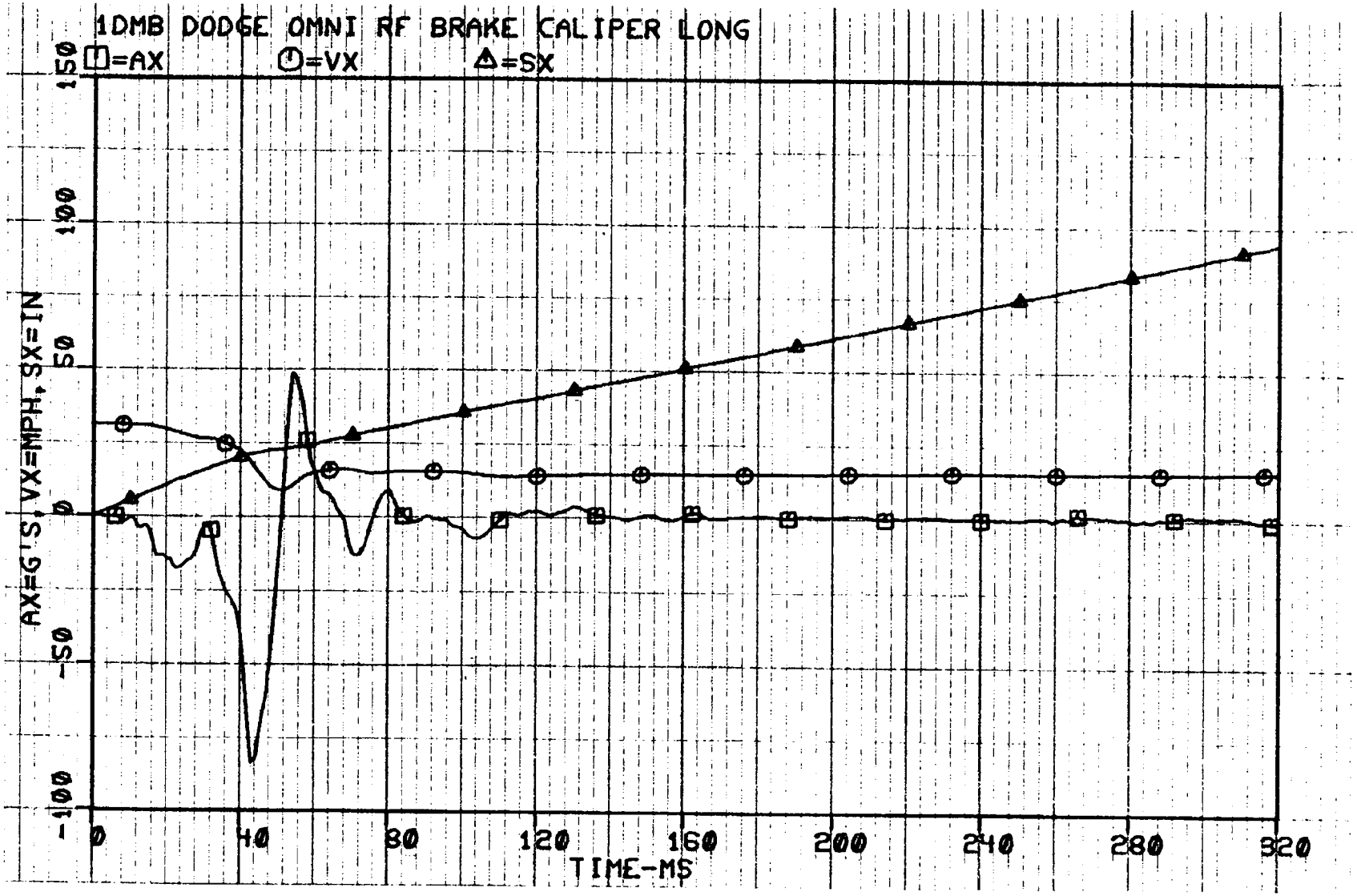
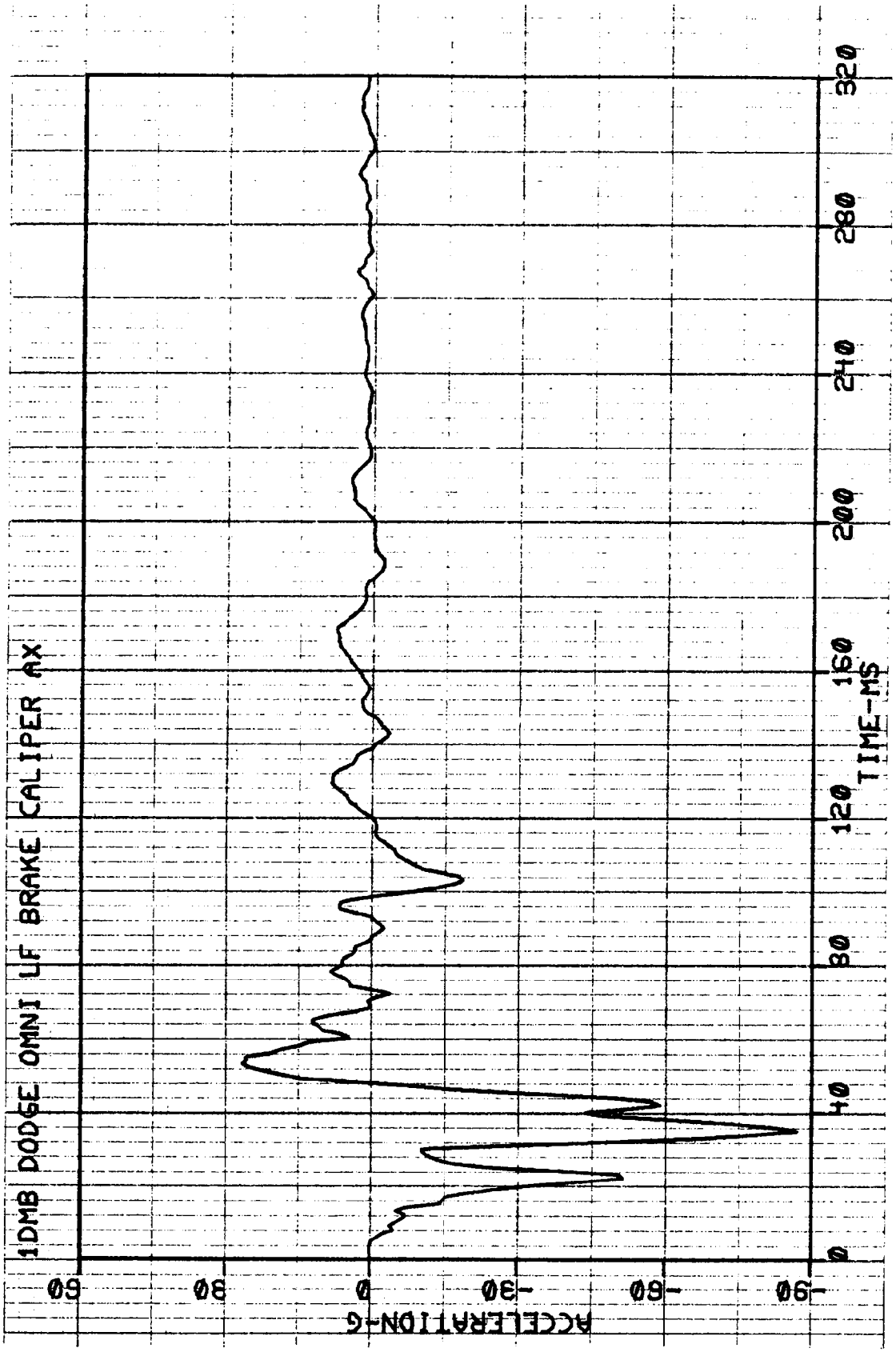
200
240
280
320

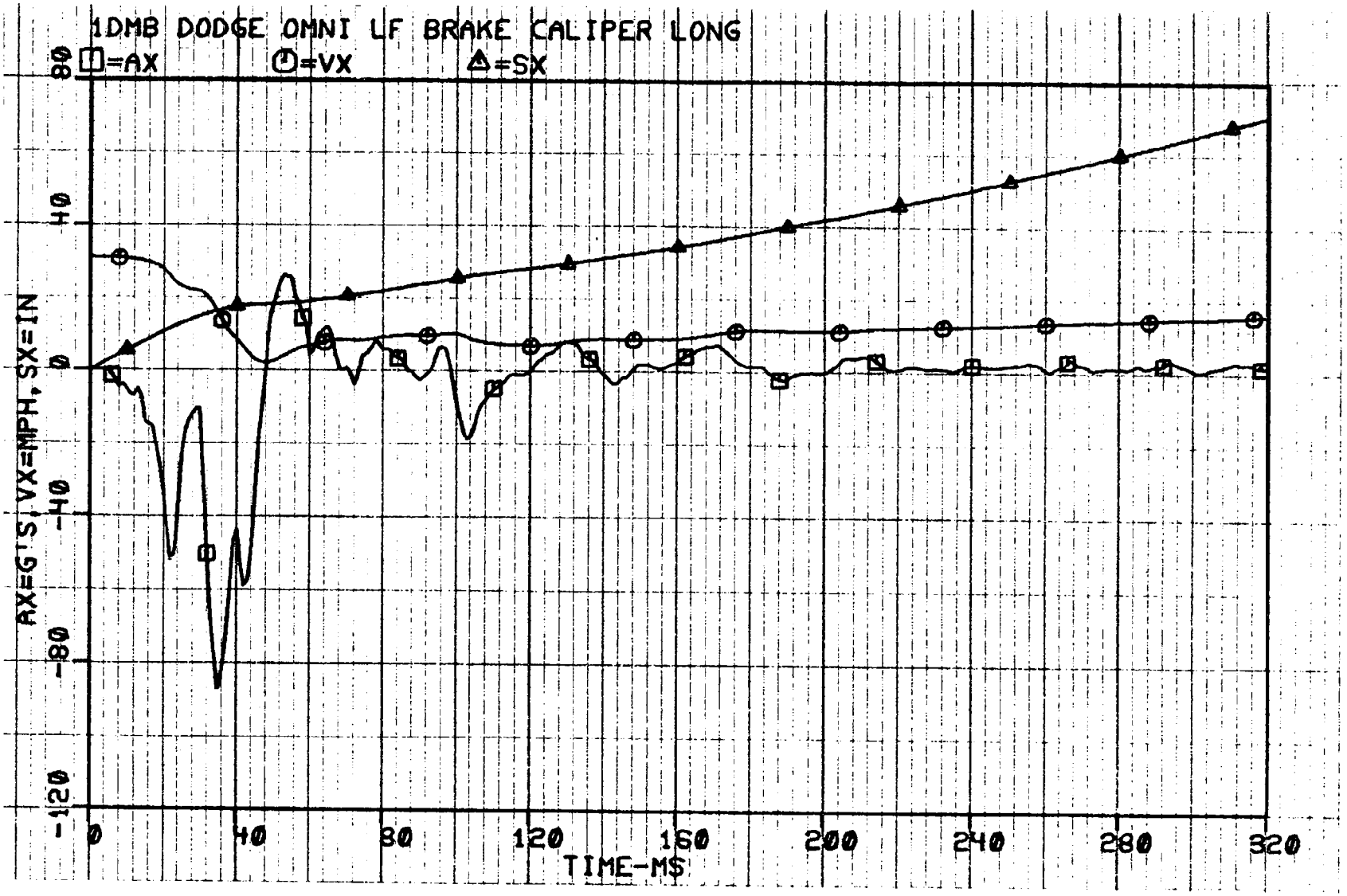

1DMB DODGE OMNI FRONT CROSSMEMBER LONG
□=AX
○=VX
Δ=SX
AX=G'S, VX=MPH, SX=IN
180
120
60
0
-60
-120
0
40
80
120
160
200
240
280
320
TIME-MS

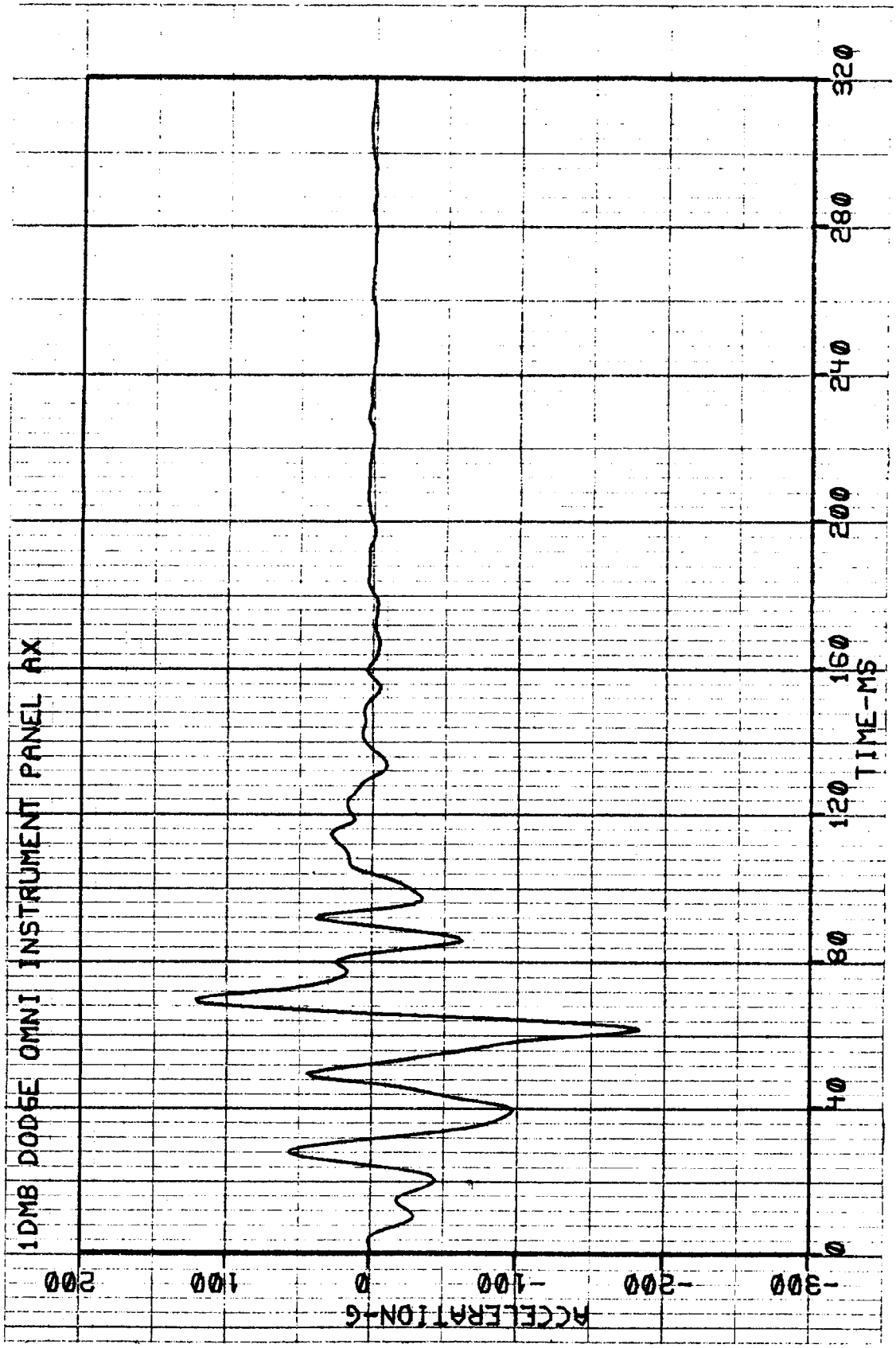

1DMB DODGE OMNI LOWER ENGINE AX
ACCELERATION-G
TIME-MS
40
0
-40
-80
-120
-160
0
40
80
120
160
200
240
280
320

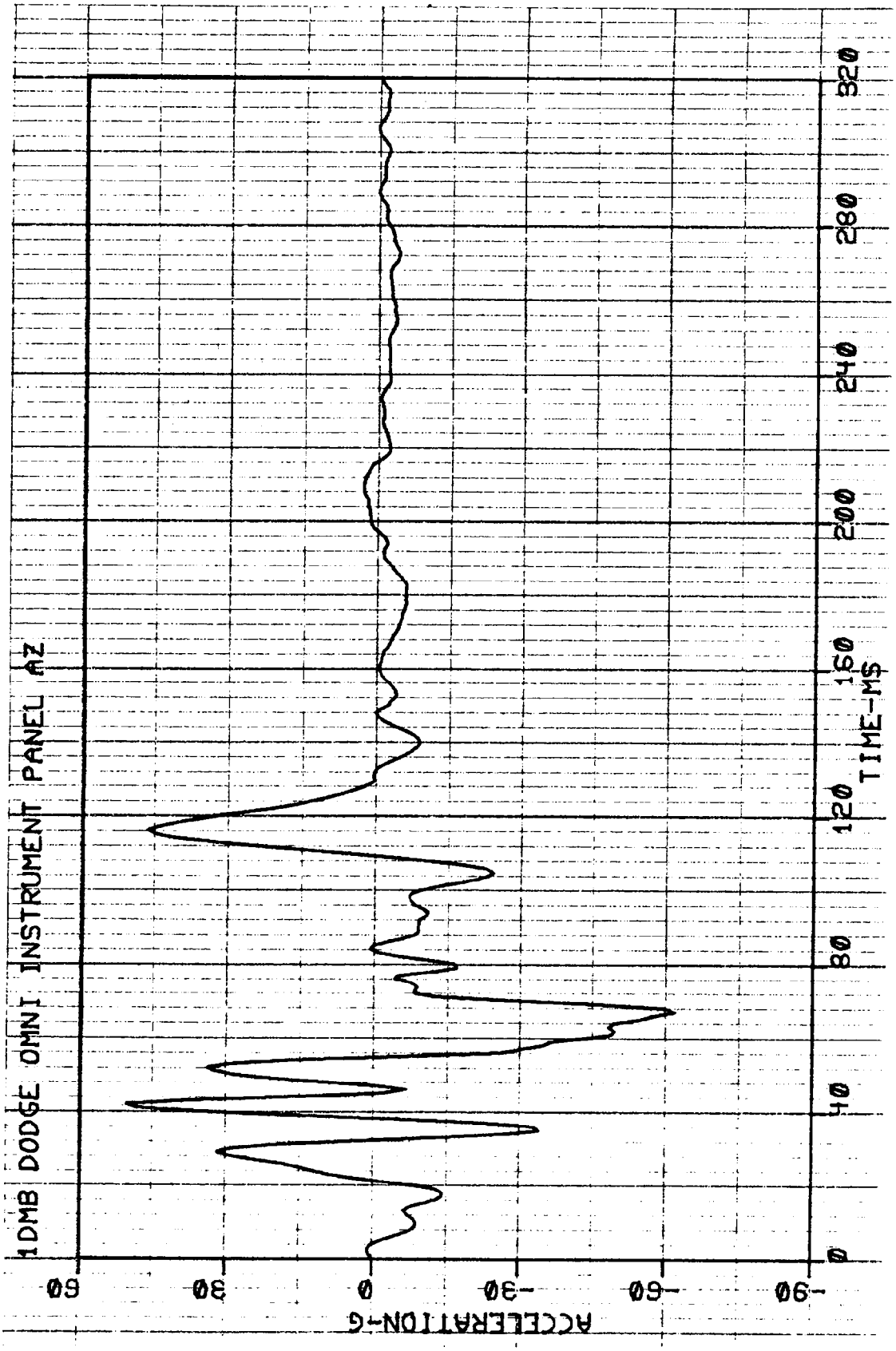

1DMB DODGE OMNI RF BRAKE CALIPER AX
ACCELERATION-G
60
30
0
-30
-60
-90
TIME-MS
0
40
80
120
160
200
240
280
320

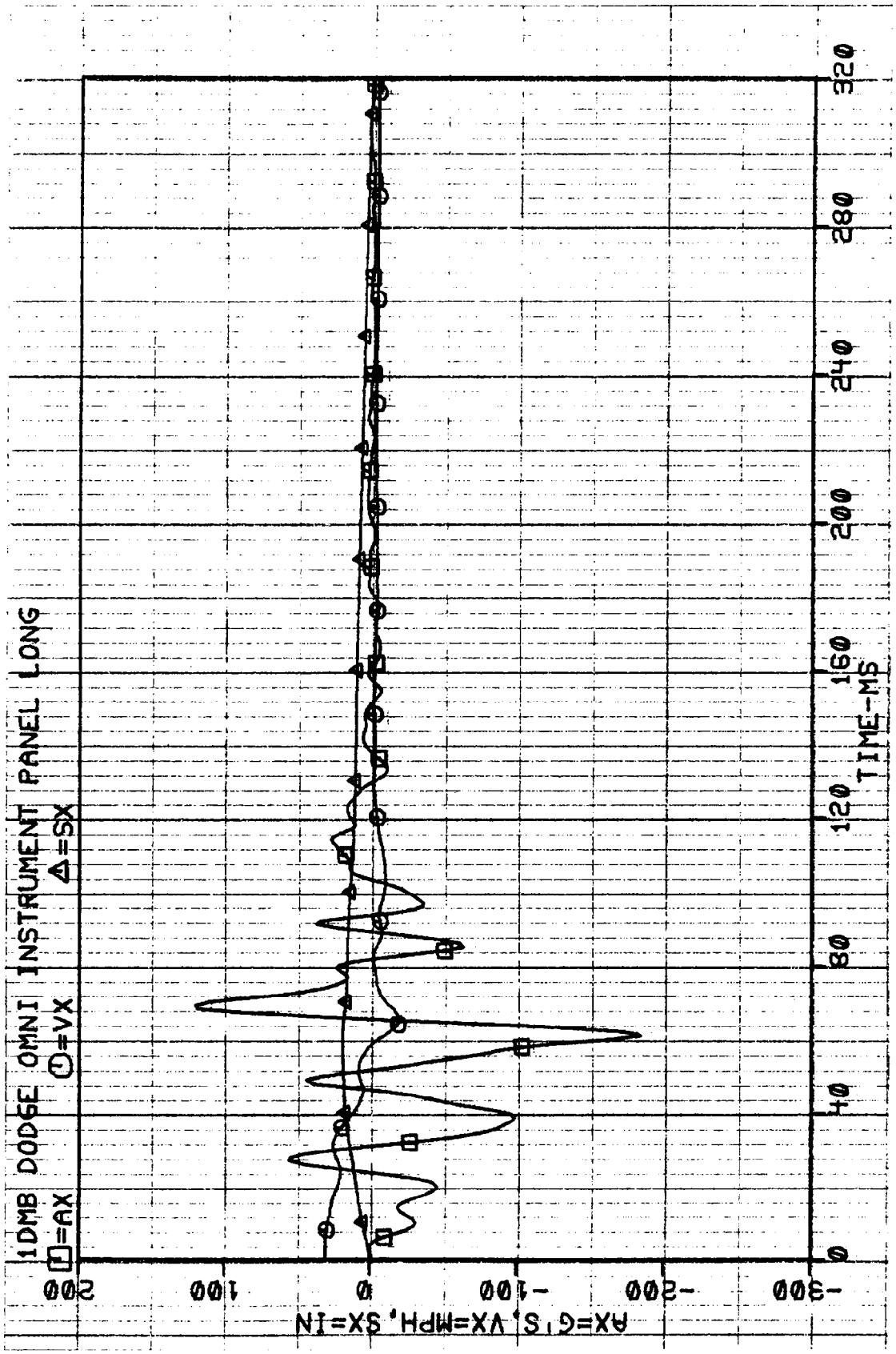

1DMB DODGE OMNI RF BRAKE CALIPER LONG
□=AX
○=VX
△=SX
AX=G'S, VX=MPH, SX=IN
150
100
50
0
-50
-100
0
40
80
120
160
200
240
280
320
TIME-MS

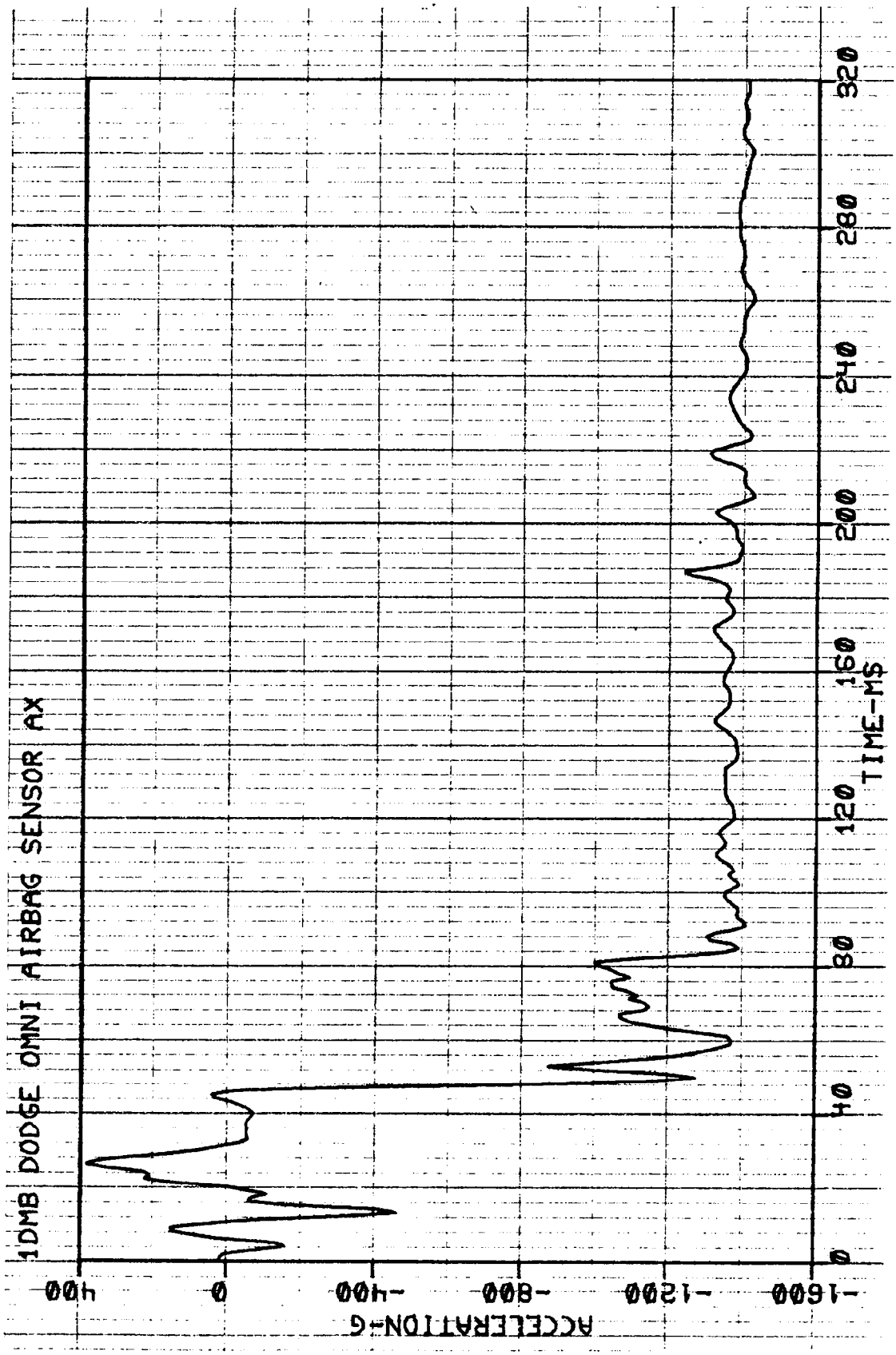

1DMB DODGE OMNI LF BRAKE CALIPER AX
ACCELERATION-G
60
30
0
-30
-60
-90
0
40
80
120
160
200
240
280
320
TIME-MS

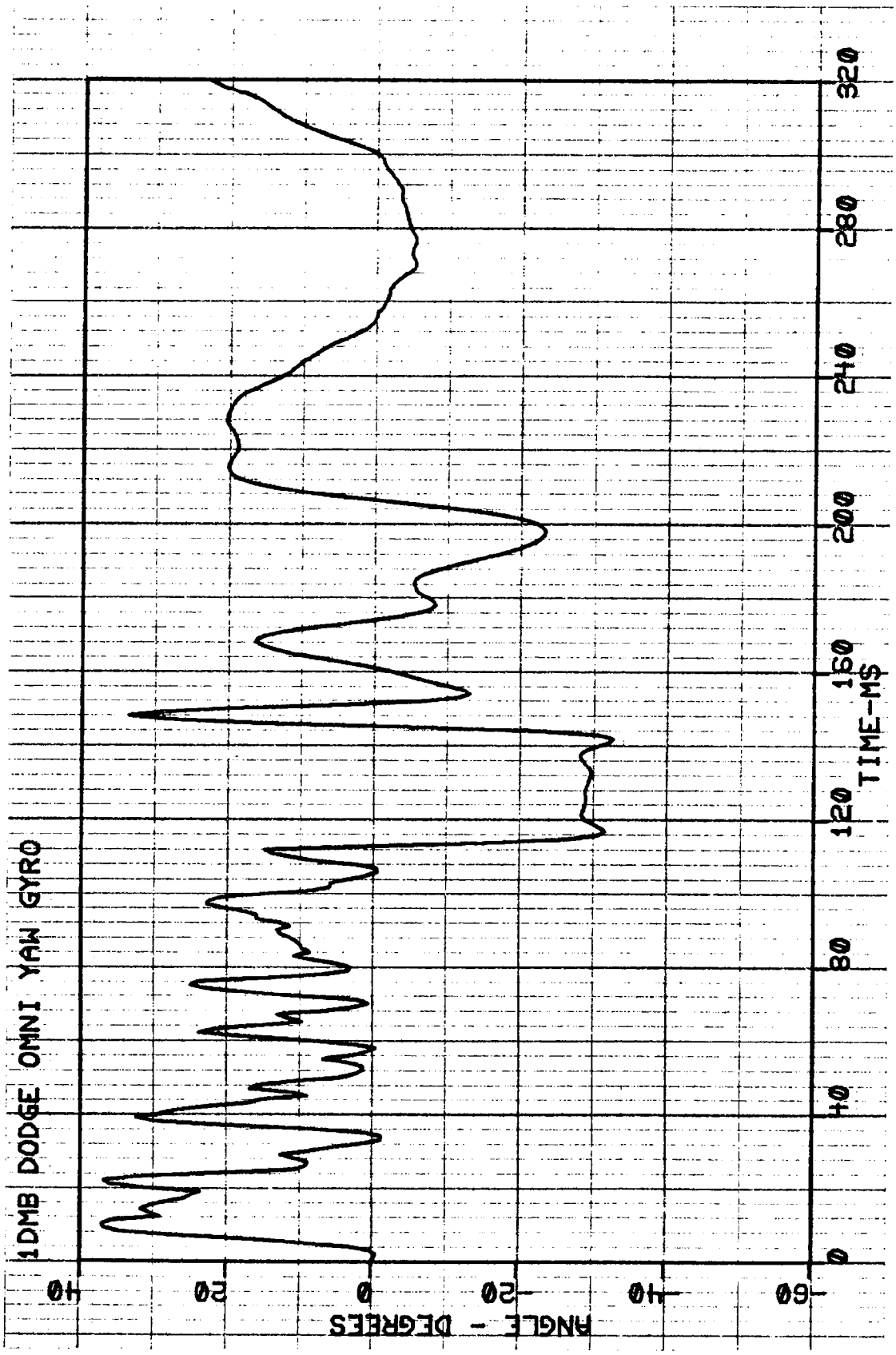

1DMB DODGE OMNI LF BRAKE CALIPER LONG
□=AX
○=VX
△=SX
AX=G'S, VX=MPH, SX=IN
80
40
0
-40
-80
-120
0
40
80
120
160
200
240
280
320
TIME-MS

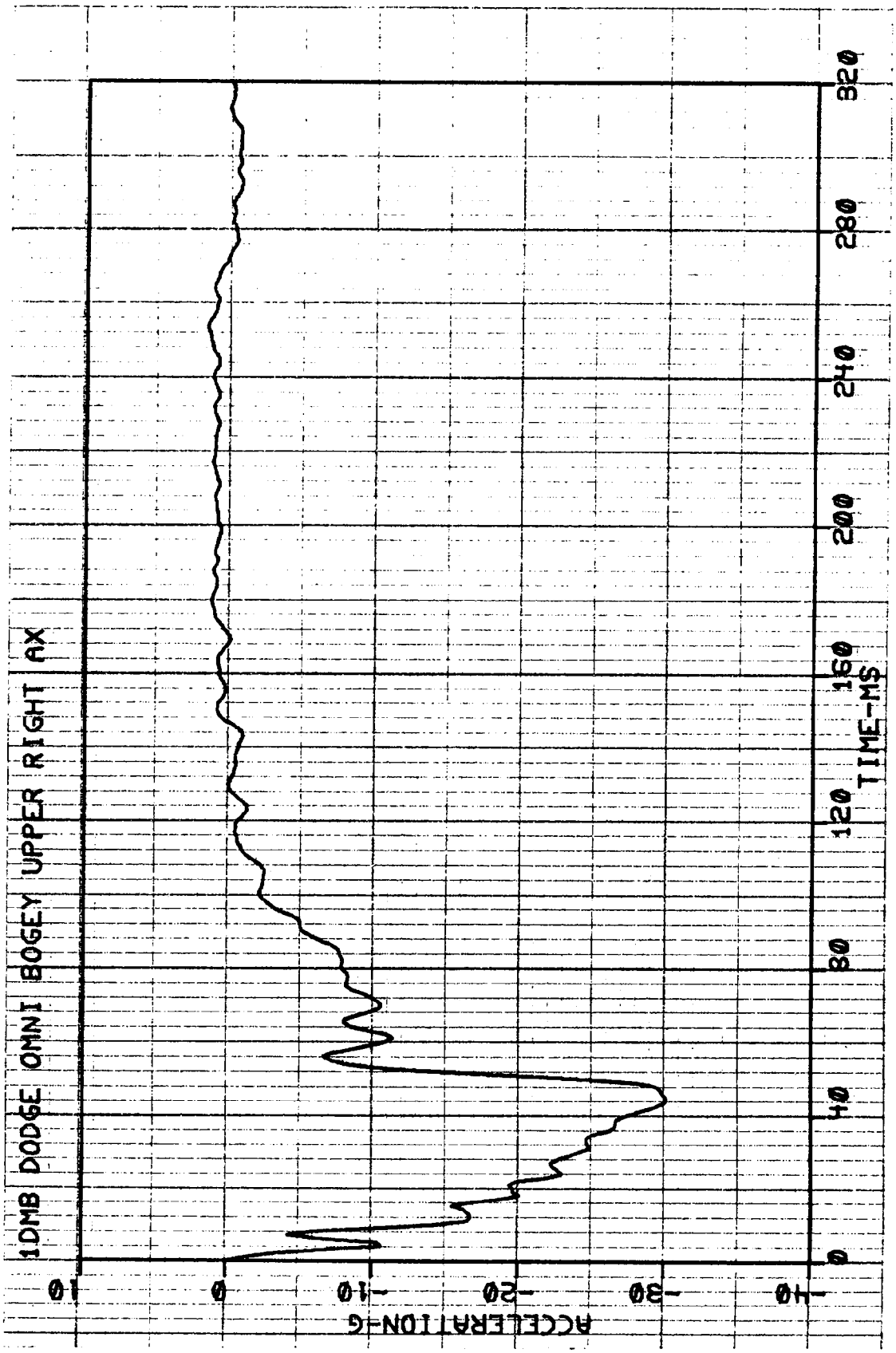

1DMB DODGE OMNI INSTRUMENT PANEL AX
ACCELERATION-G
200
100
0
-100
-200
-300
0
40
80
120
160
200
240
280
320
TIME-MS

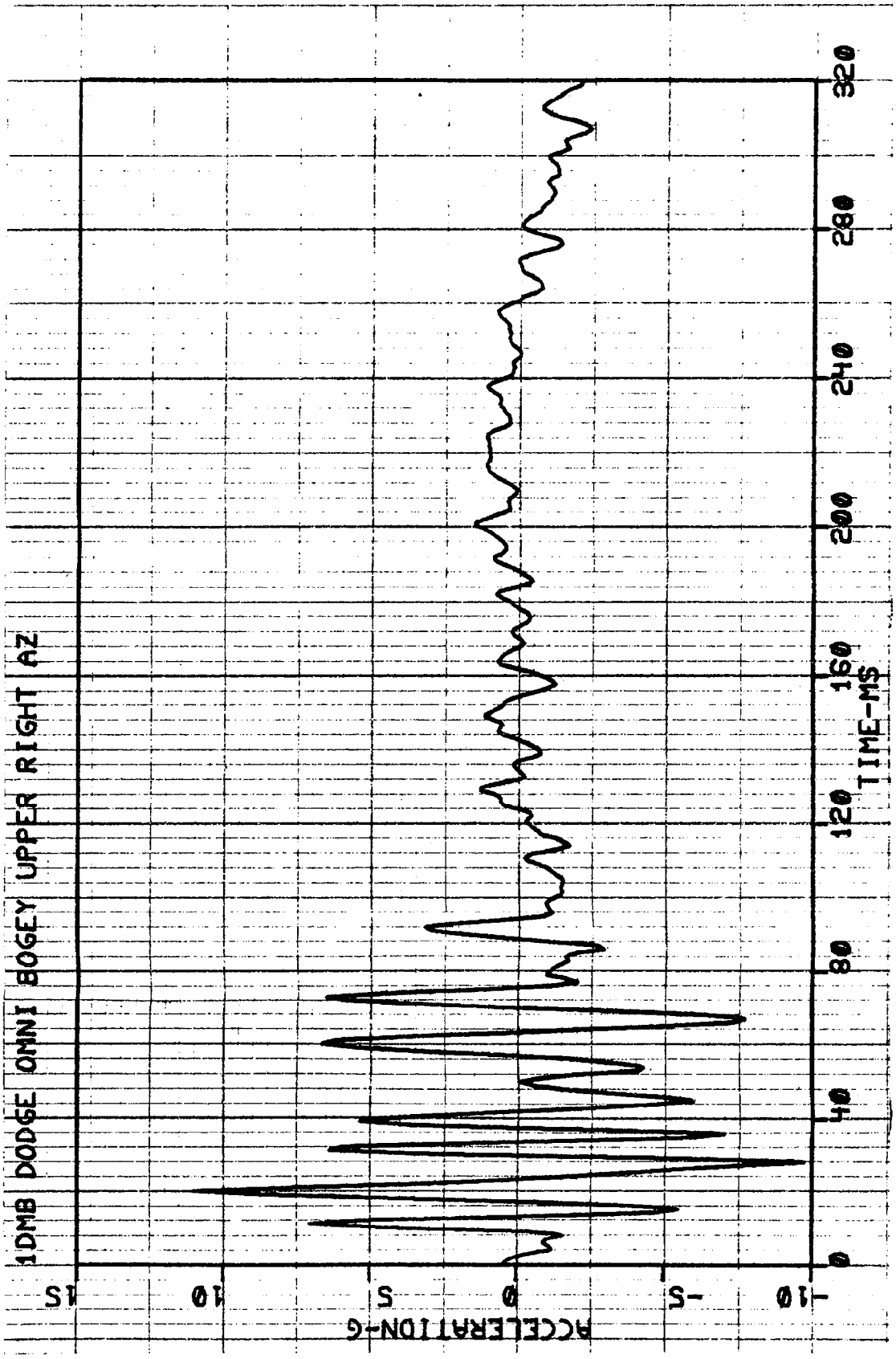

1DMB DODGE OMNI INSTRUMENT PANEL AZ
ACCELERATION-G
60
30
0
-30
-60
-90
0
40
80
120
160
200
240
280
320
TIME-MS

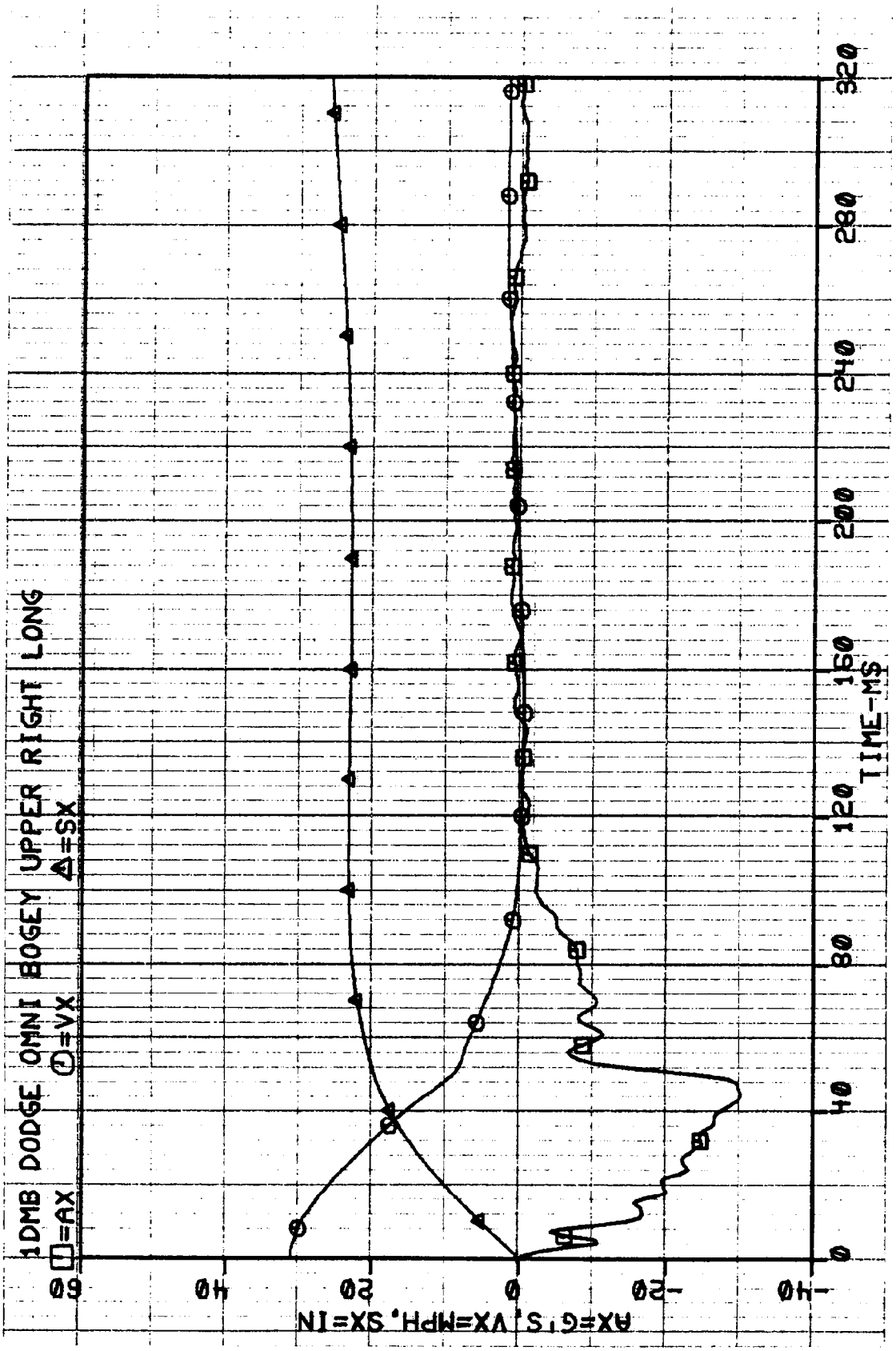

1DMB DODGE OMNI INSTRUMENT PANEL LONG
□=AX
○=VX
Δ=SX
AX=G'S, VX=MPH, SX=IN
200
100
0
-100
-200
-300
0
40
80
120
160
200
240
280
320
TIME-MS

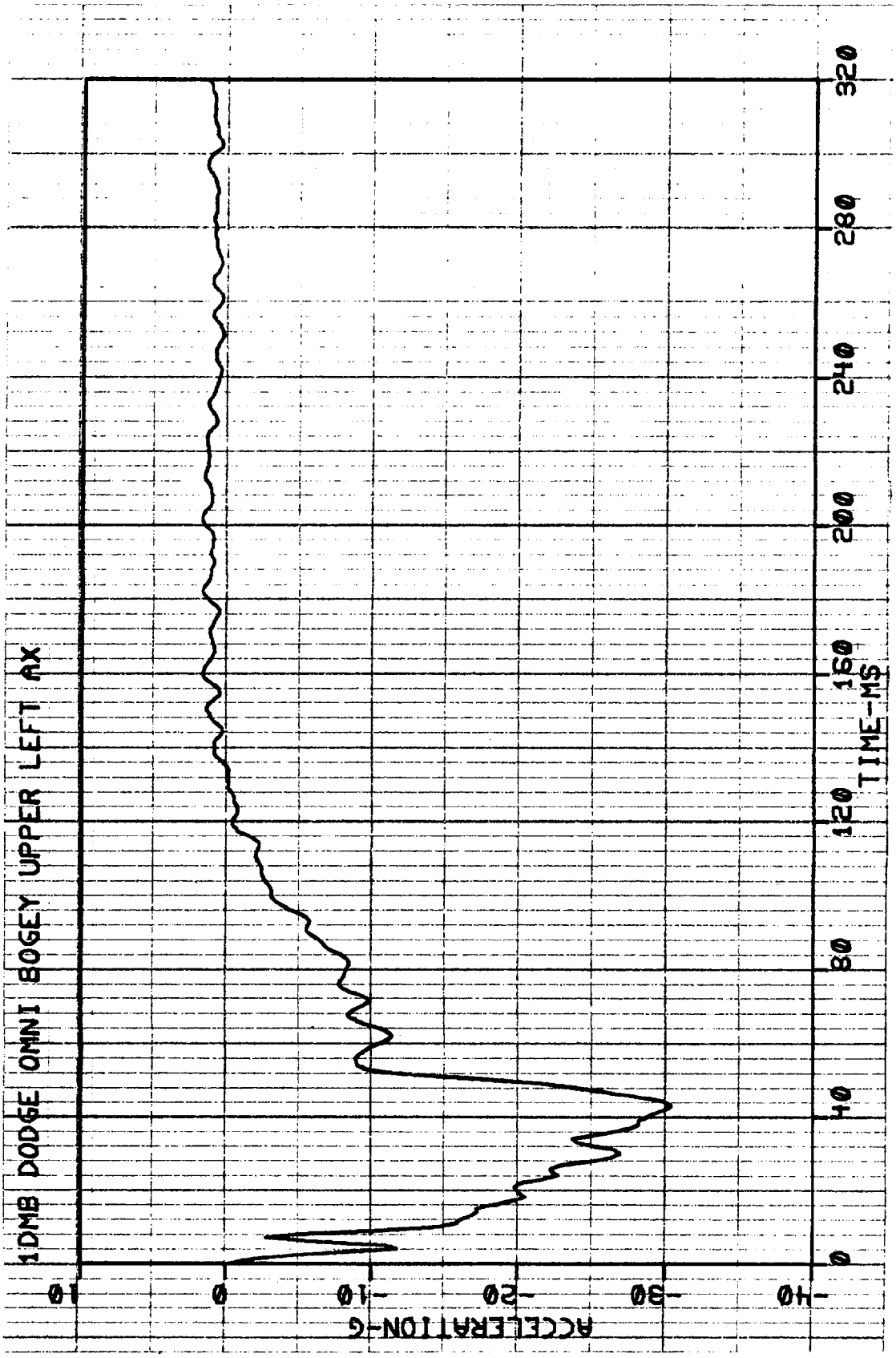

1DMB DODGE OMNI AIRBAG SENSOR AX
ACCELERATION-G
TIME-MS
400
0
-400
-800
-1200
-1600
0
40
80
120
160
200
240
280
320

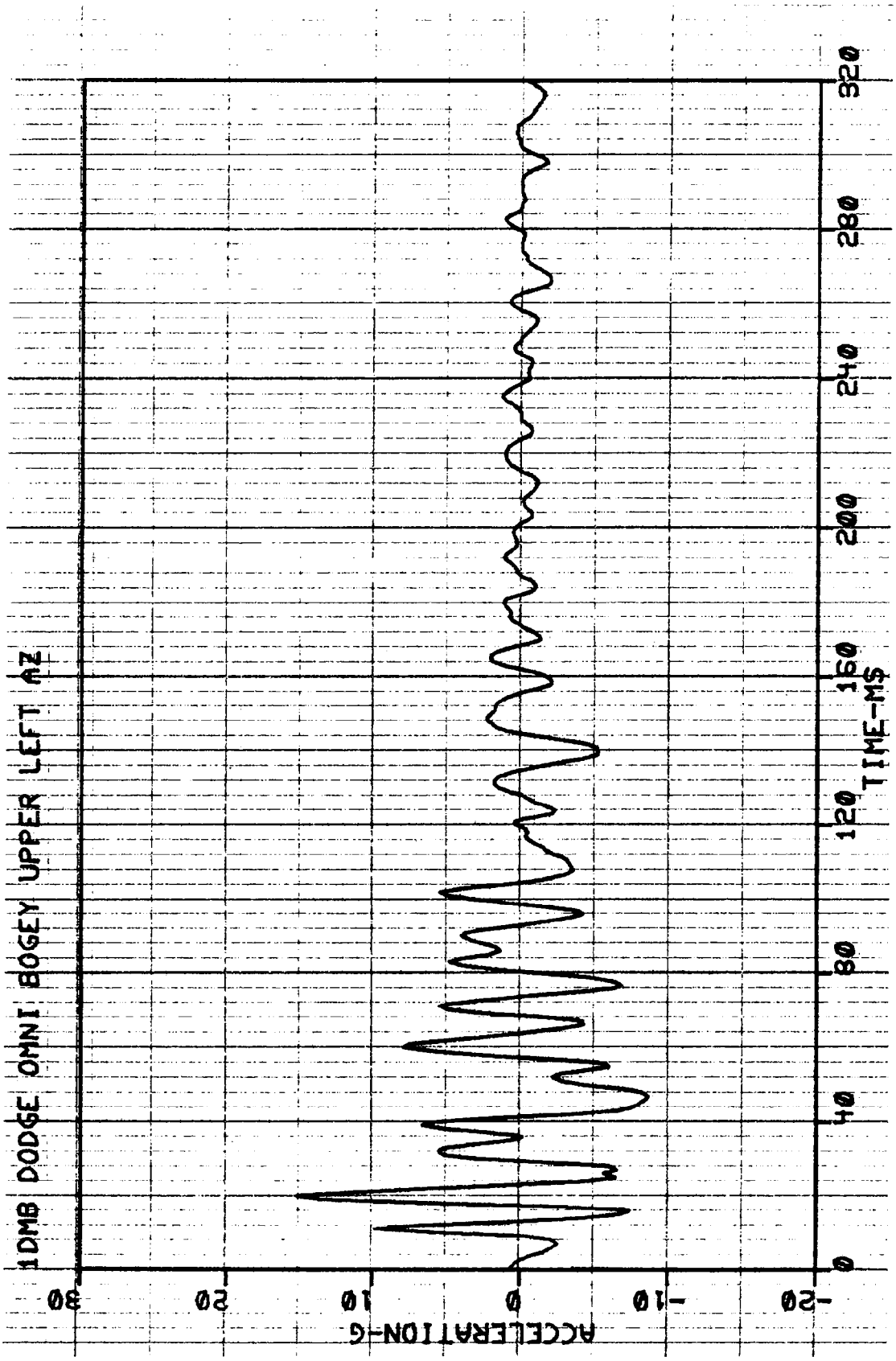

1DMB DODGE OMNI YAW GYRO
ANGLE - DEGREES
TIME-MS
40
20
0
-20
-40
-60
0
40
80
120
160
200
240
280
320

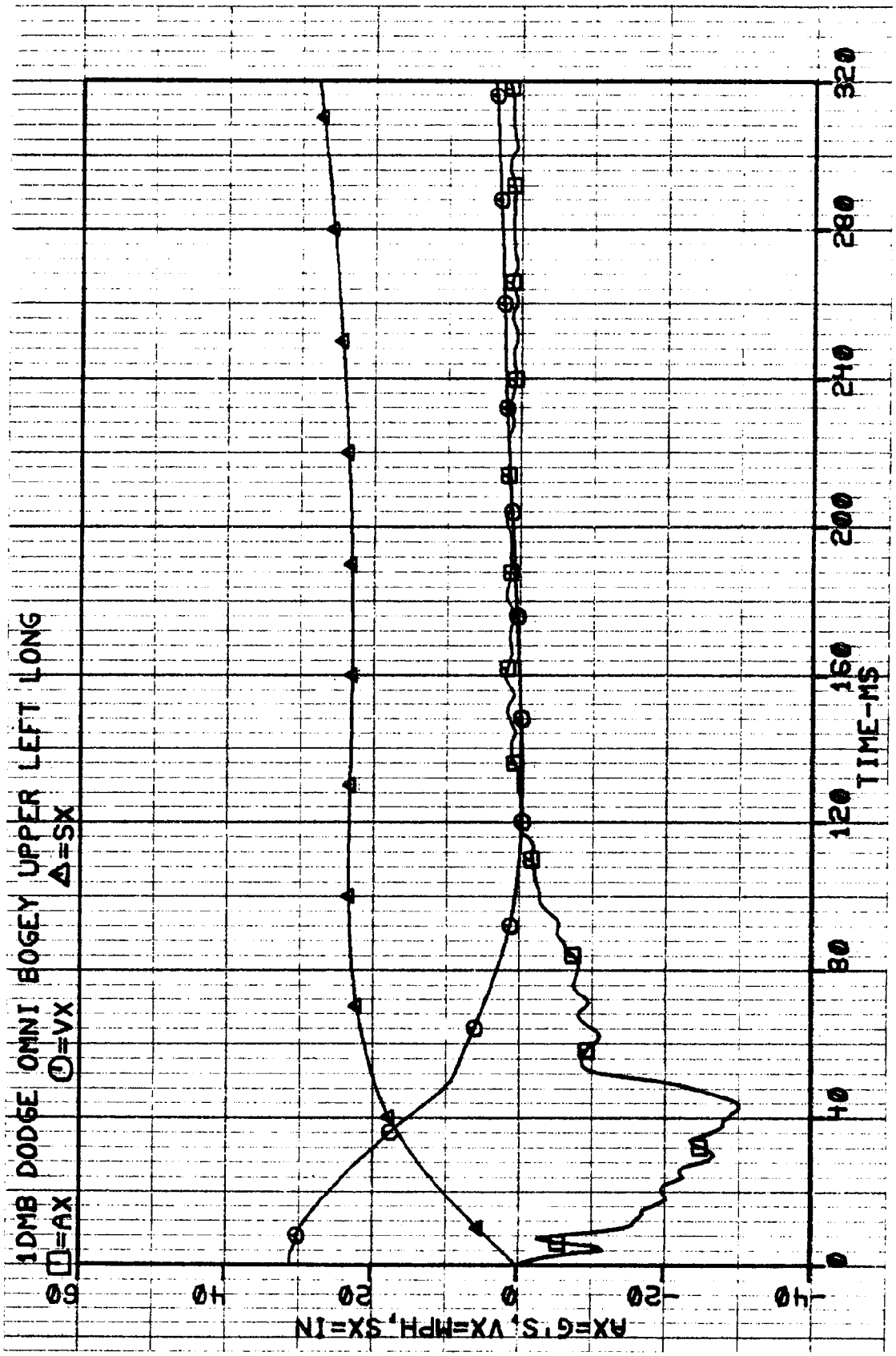

1DMB DODGE OMNI BOGEY UPPER RIGHT AX
ACCELERATION-G
0
-10
-20
-30
-40
TIME-MS
0
40
80
120
160
200
240
280
320

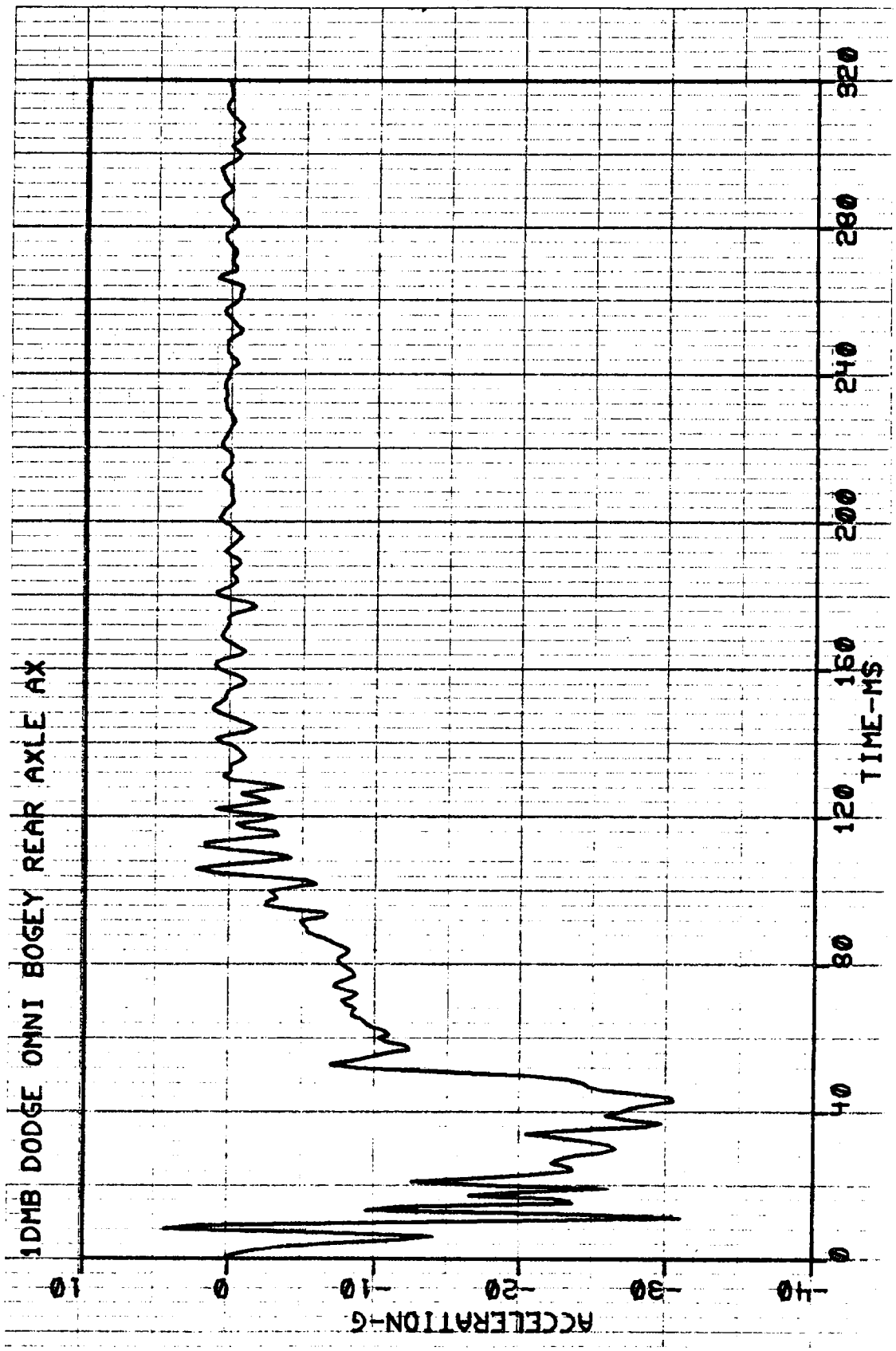

1DMB DODGE OMNI BOGEY UPPER RIGHT AZ
ACCELERATION-G
15
10
5
0
-5
-10
0
40
80
120
160
200
240
280
320
TIME-MS

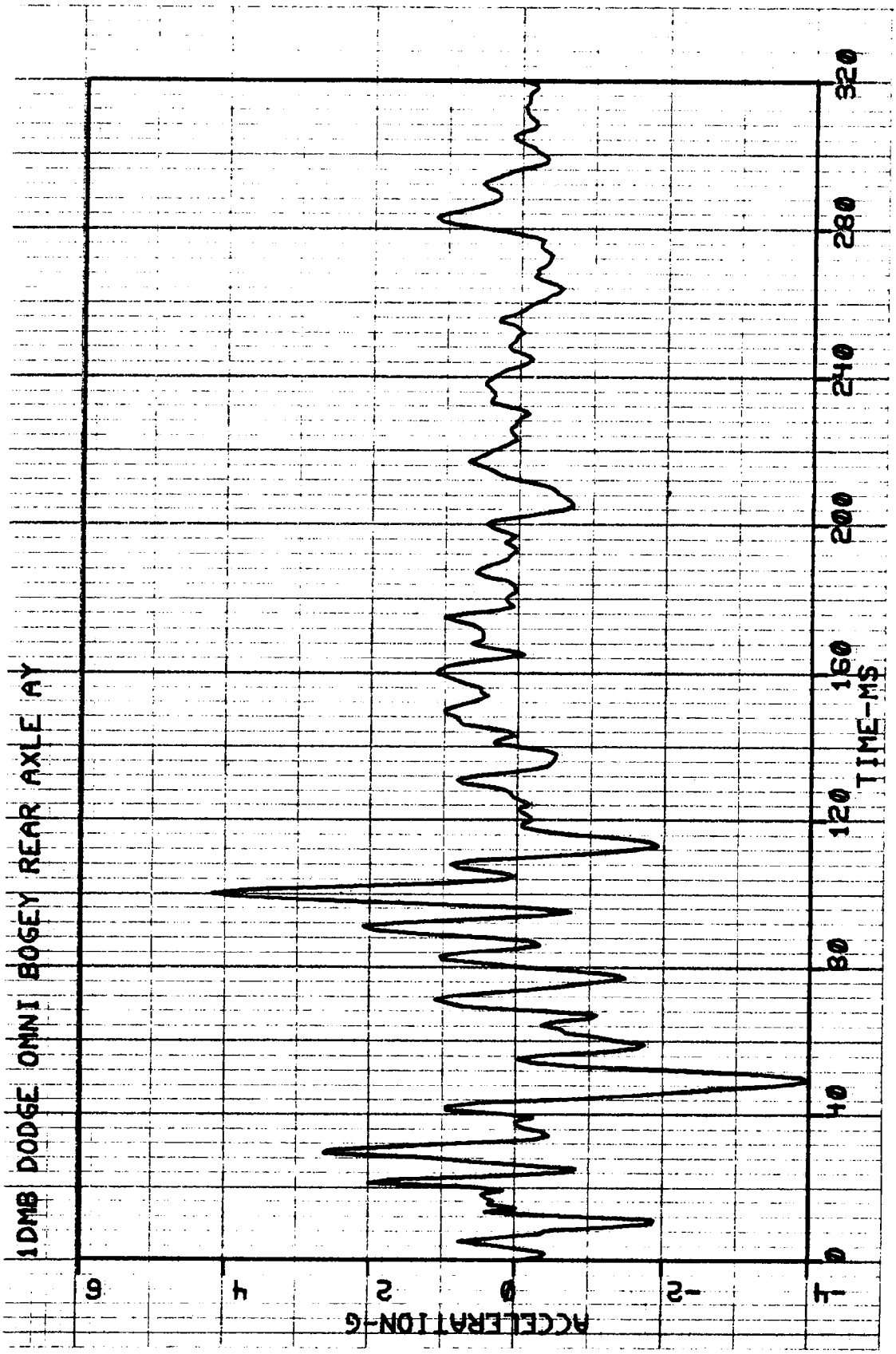

1DMB DODGE OMNI BOGEY UPPER RIGHT LONG
□=AX
○=VX
Δ=SX
AX=G'S, VX=MPH, SX=IN
60
40
20
0
-20
-40
0
40
80
120
160
200
240
280
320
TIME-MS

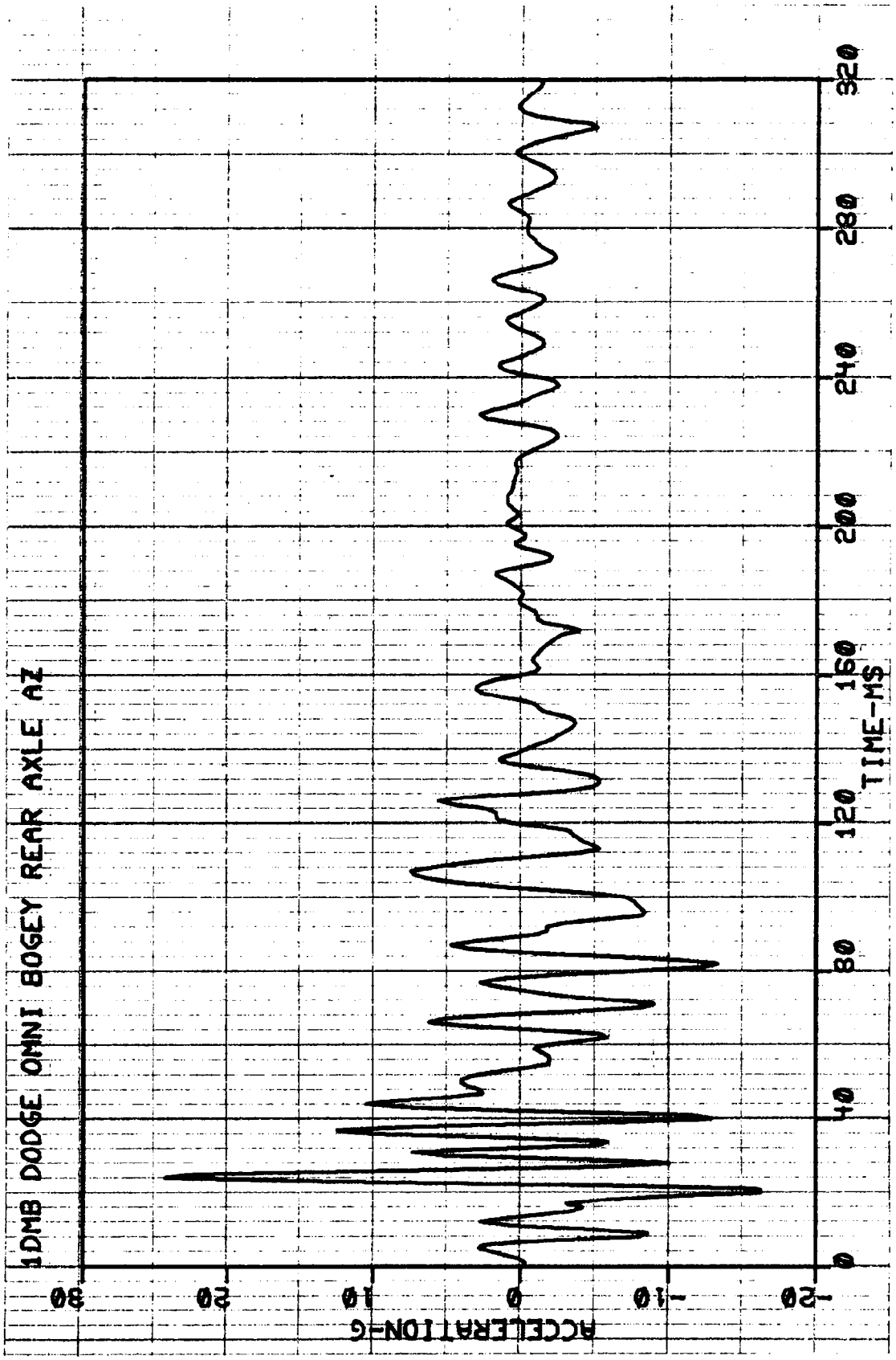

1DMB DODGE OMNI BOGEY UPPER LEFT AX
ACCELERATION-G
TIME-MS
0
40
80
120
160
200
240
280
320
-40
-30
-20
-10
0
10

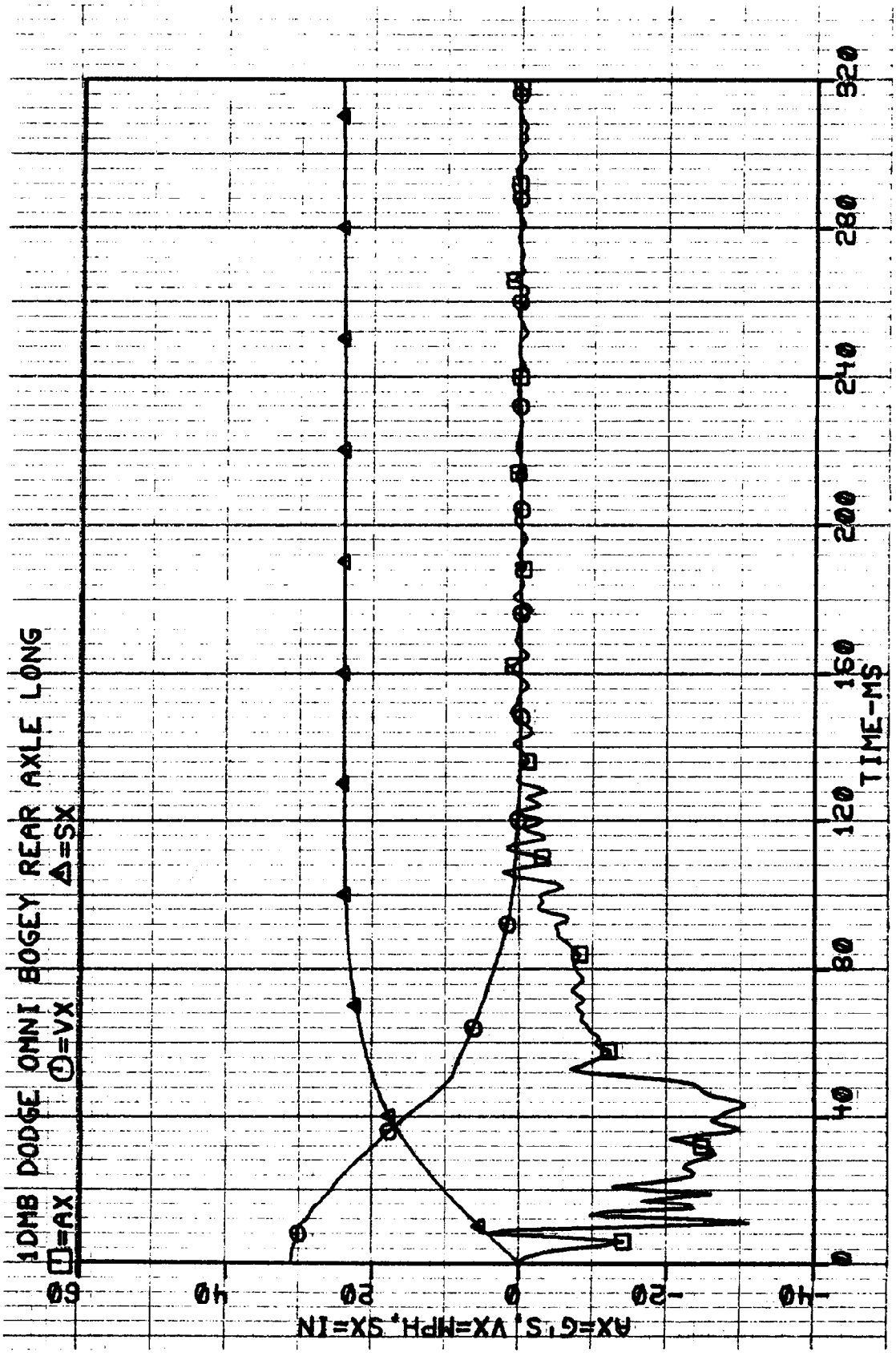

1DMB DODGE OMNI BOGEY UPPER LEFT AZ
ACCELERATION-G
30
20
10
0
-10
-20
TIME-MS
0
40
80
120
160
200
240
280
320

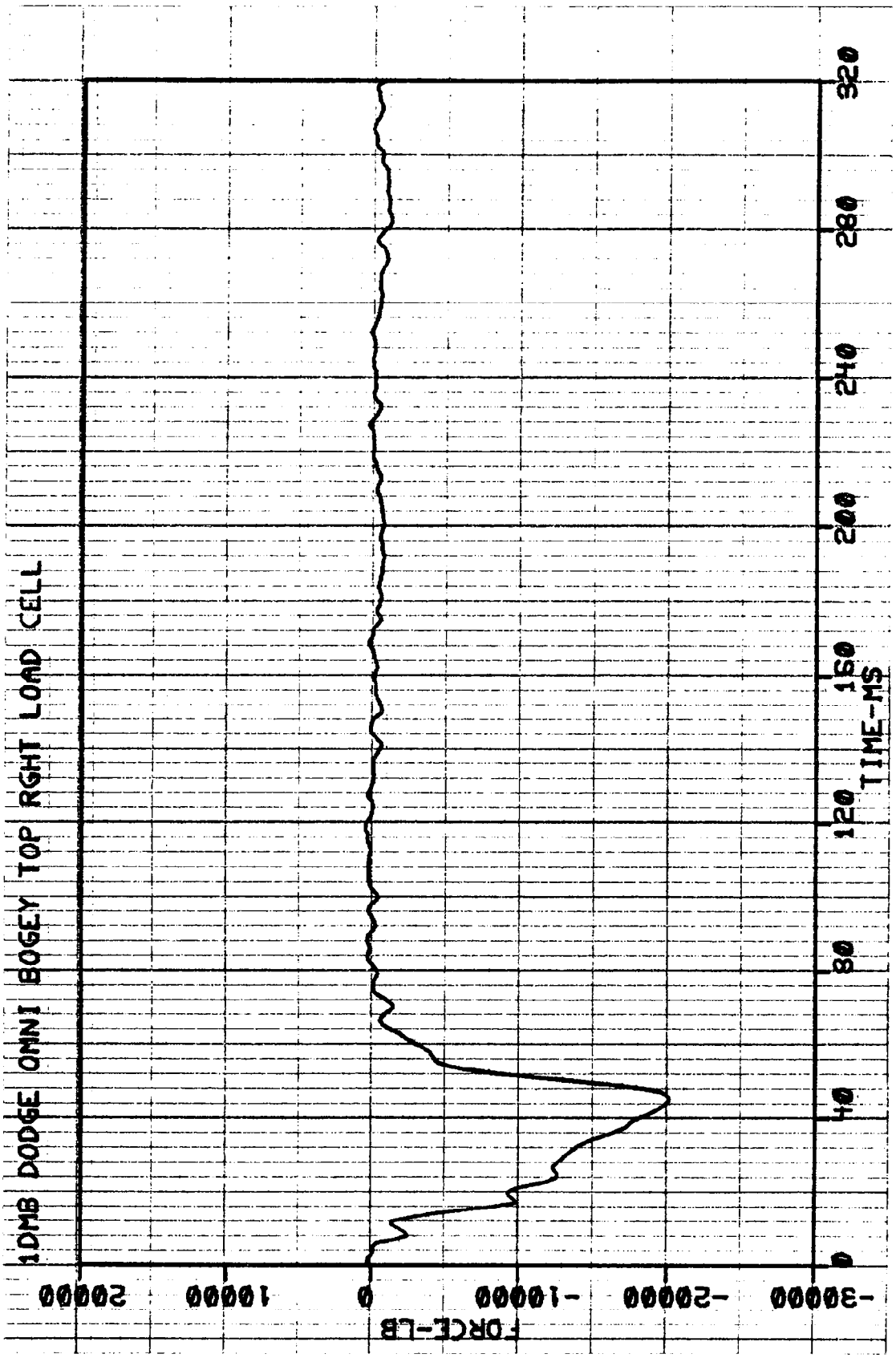

1DMB DODGE OMNI BOGEY UPPER LEFT LONG
□=AX ○=VX Δ=SX
AX=G'S, VX=MPH, SX=IN
TIME-MS
60
40
20
0
-20
-40
0
40
80
120
160
200
240
280
320

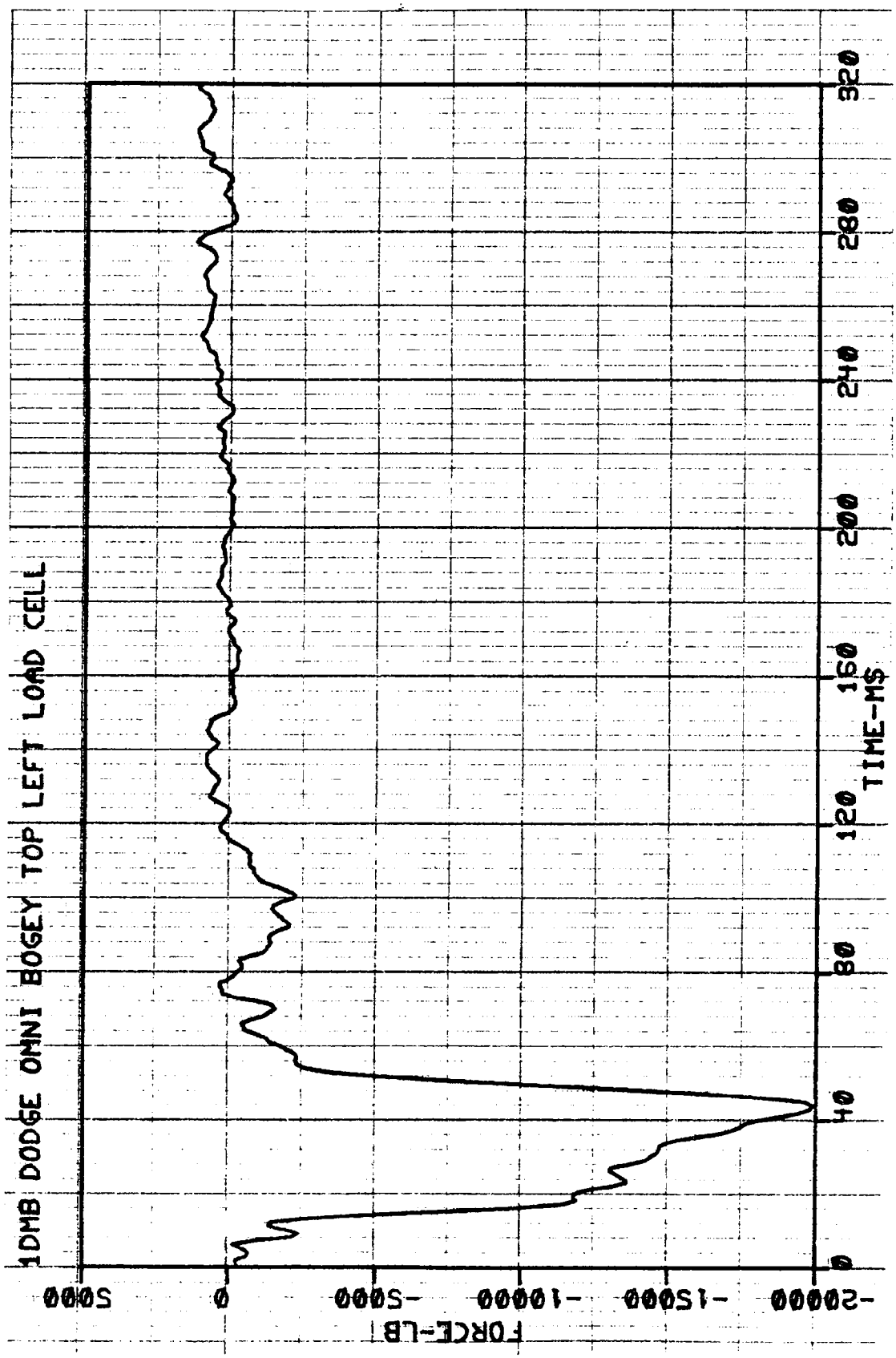

1DMB DODGE OMNI BOGEY REAR AXLE AX
ACCELERATION-G
10
0
-10
-20
-30
-40
0
40
80
120
160
200
240
280
320
TIME-MS

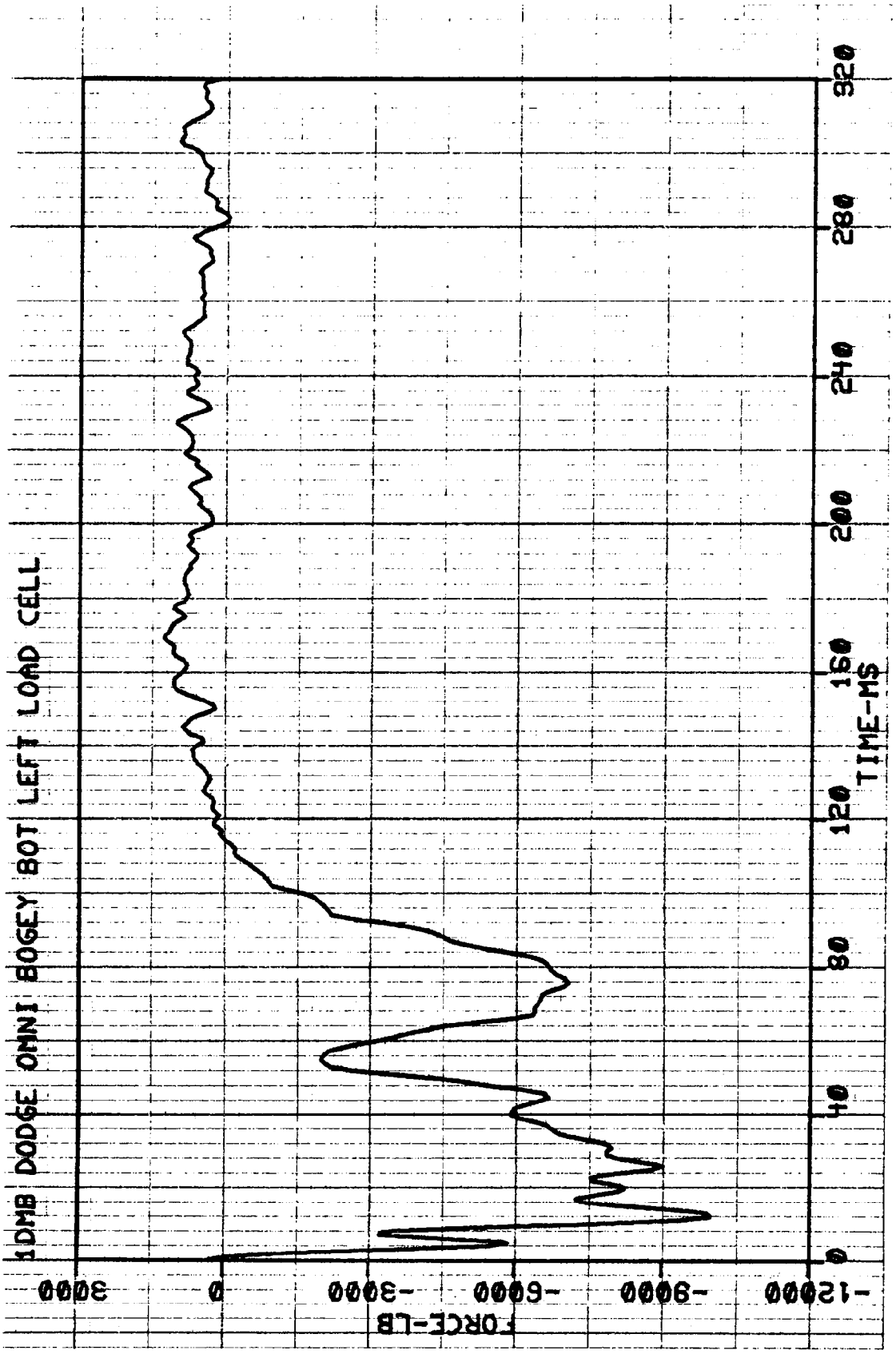

1DMB DODGE OMNI BOGEY REAR AXLE AY
ACCELERATION-G
6
4
2
0
-2
-4
0
40
80
120
160
200
240
280
320
TIME-MS

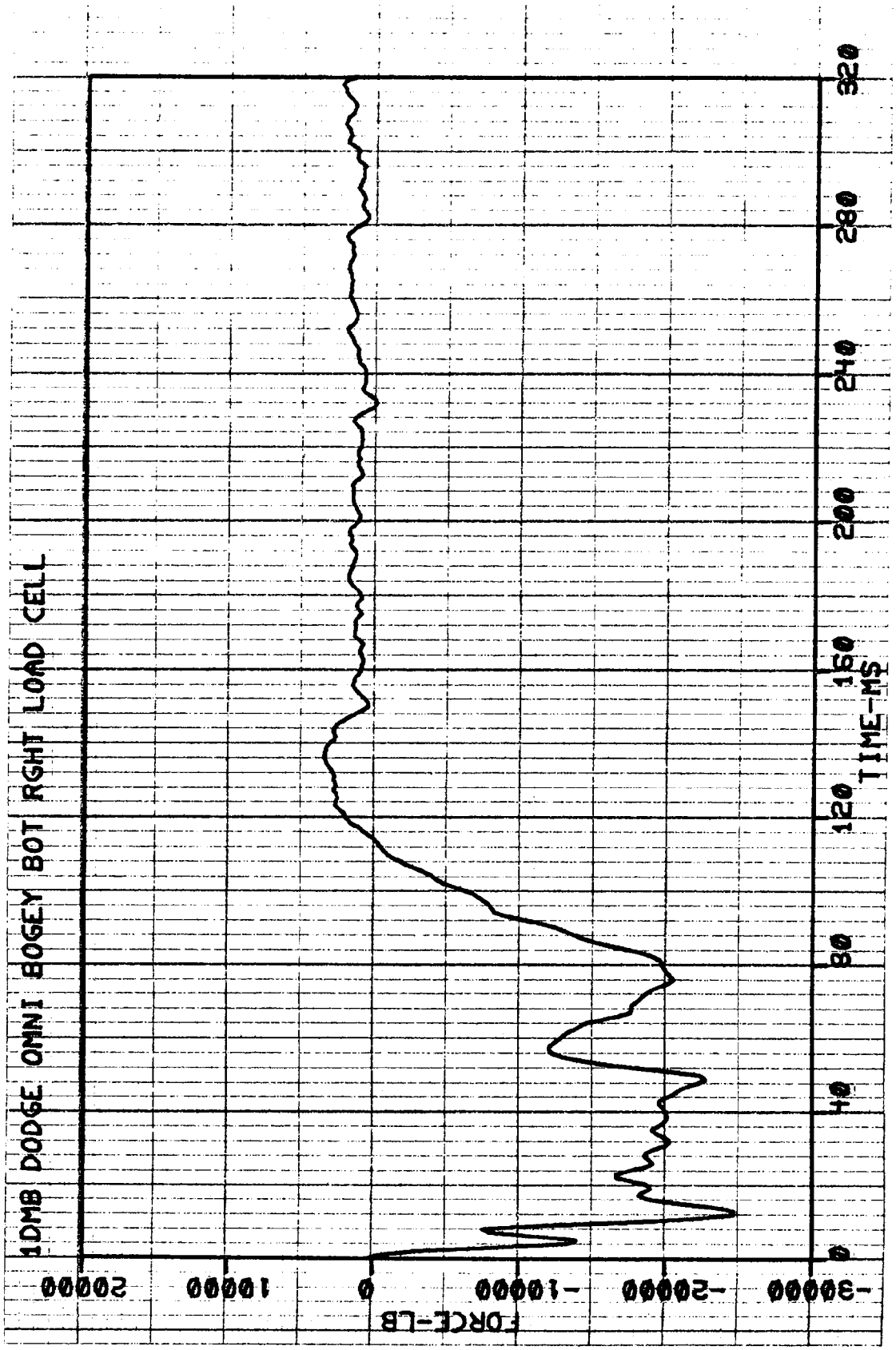

1DMB DODGE OMNI BOGEY REAR AXLE AZ
ACCELERATION-G
30
20
10
0
-10
-20
TIME-MS
0
40
80
120
160
200
240
280
320

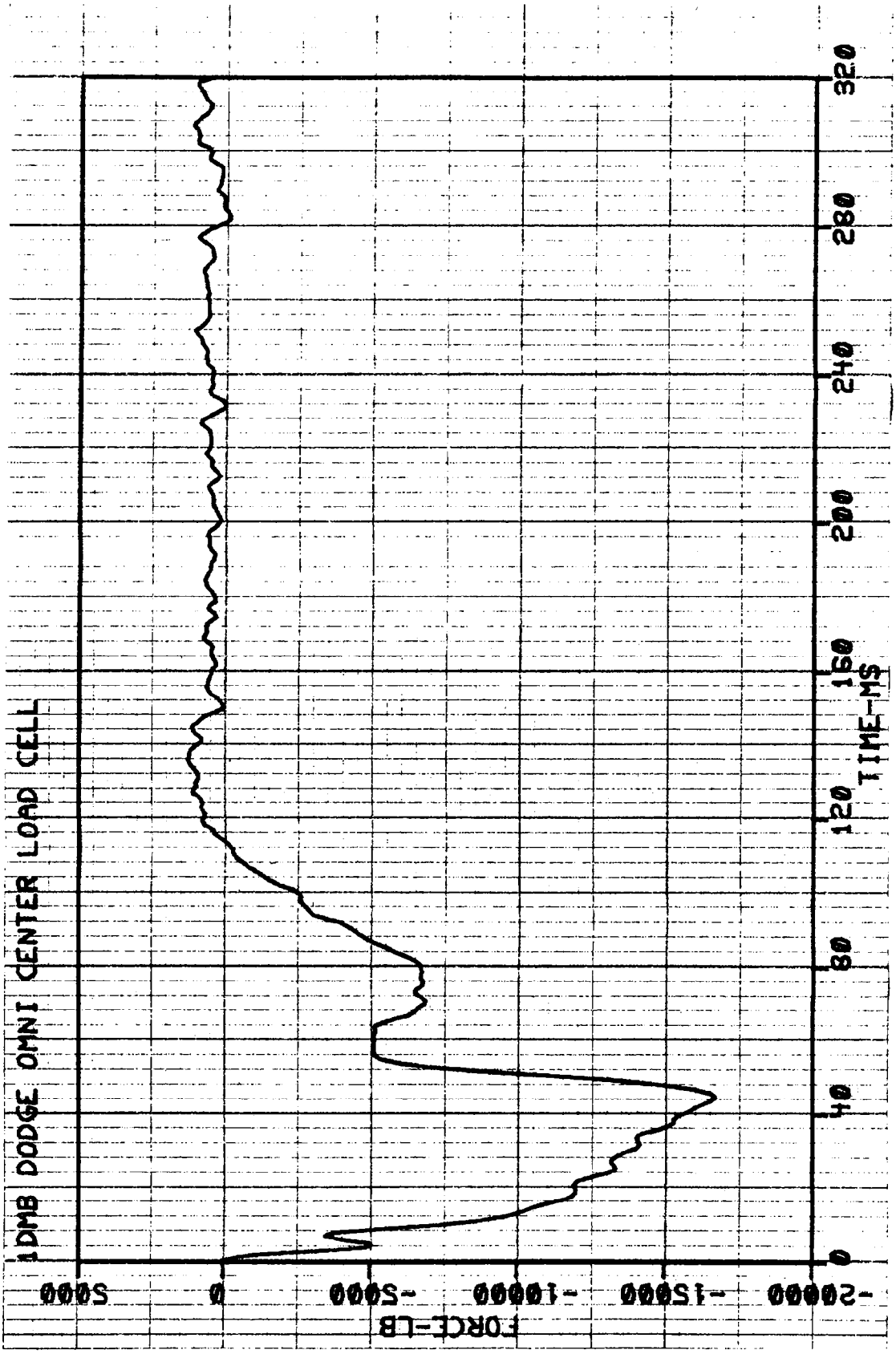

1DHB DODGE OMNI BOGEY REAR AXLE LONG
□=AX ○=VX Δ=SX
AX=G'S, VX=MPH, SX=IN
TIME-MS
60
40
20
0
-20
-40
0
40
80
120
160
200
240
280
320

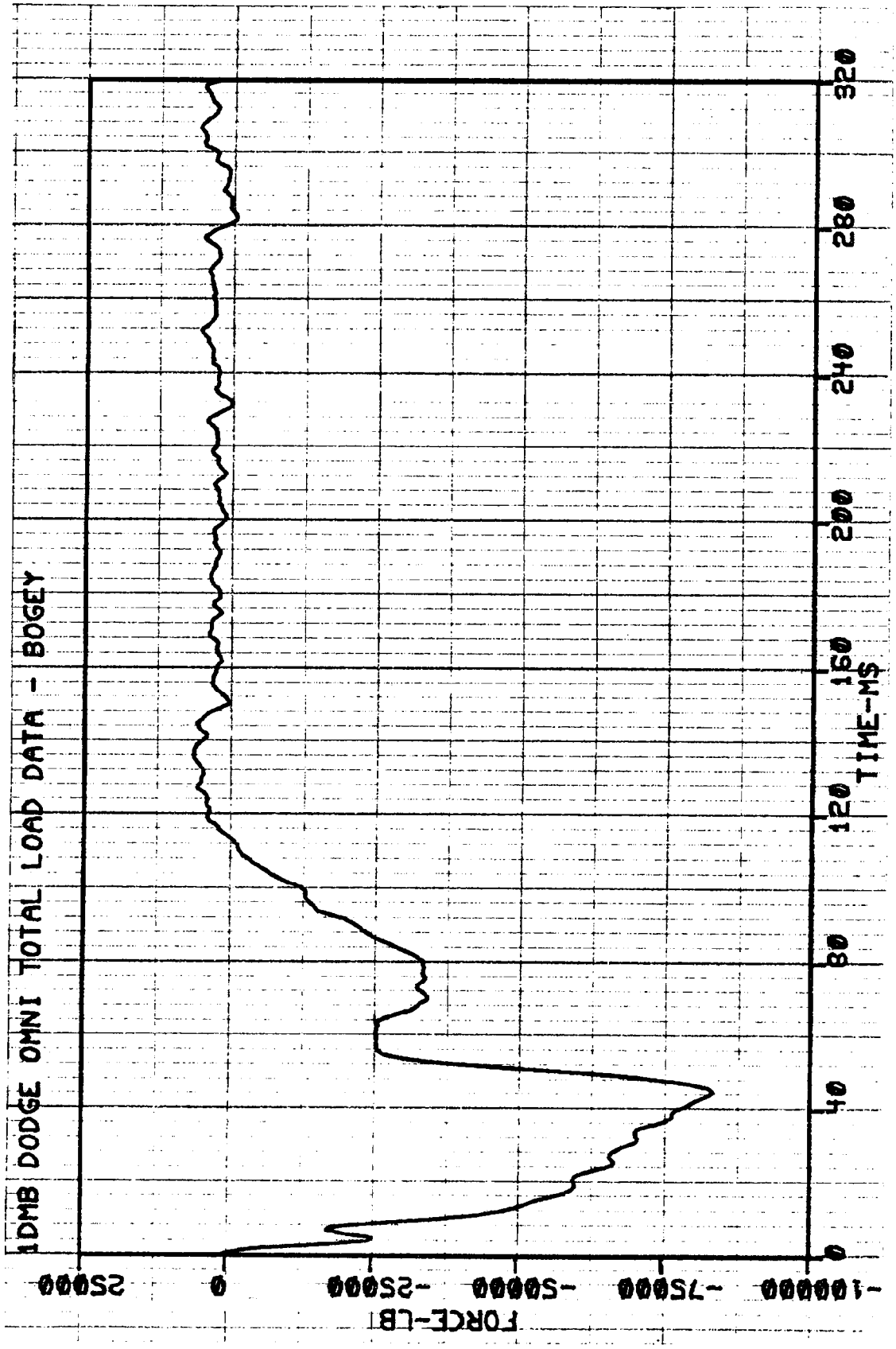

1.0MB DODGE OMNI BOGEY TOP RGHT LOAD CELL
FORCE-LB
20000
10000
0
-10000
-20000
-30000
0
40
80
120
160
200
240
280
320
TIME-MS

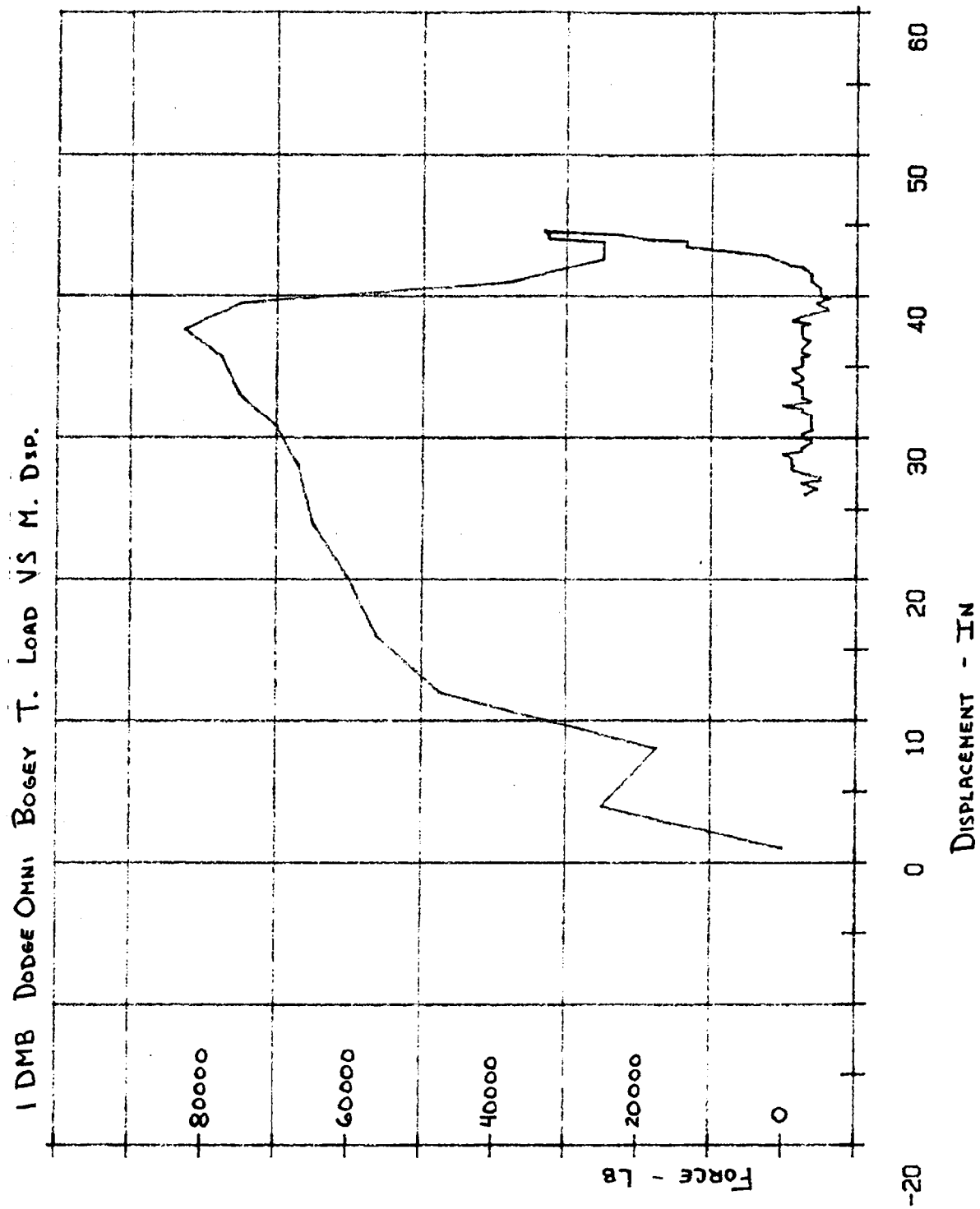

1DMB DODGE OMNI BOGEY TOP LEFT LOAD CELL
FORCE-LB
5000
0
-5000
-10000
-15000
-20000
TIME-MS
0
40
80
120
160
200
240
280
320


1DMB DODGE OMNI BOGEY BOT LEFT LOAD CELL
FORCE-LB
3000
0
-3000
-6000
-9000
-12000
TIME-MS
0
40
80
120
160
200
240
280
320


1DM8 DODGE OMNI BOGEY BOT RGHT LOAD CELL
FORCE-LB
20000
10000
0
-10000
-20000
-30000
0
40
80
120
160
200
240
280
320
TIME-MS


1DM8 DODGE OMNI CENTER LOAD CELL
FORCE-LB
5000
0
-5000
-10000
-15000
-20000
0
40
80
120
160
200
240
280
320
TIME-MS


1DMB DODGE OMNI TOTAL LOAD DATA - BOGEY
FORCE-LB
25000
0
-25000
-50000
-75000
-100000
0
40
80
120
160
200
240
280
320
TIME-MSEC


1 DMB Dodge Omni Bogey T. Load VS M. Disp.
Force - Lb
80000
60000
40000
20000
0
-20
0
10
20
30
40
50
60
Displacement - In

# APPENDIX B

# PHOTOGRAPHS


FIGURE B-1. PRE-TEST OVERALL VIEW OF 1983 DODGE OMNI.

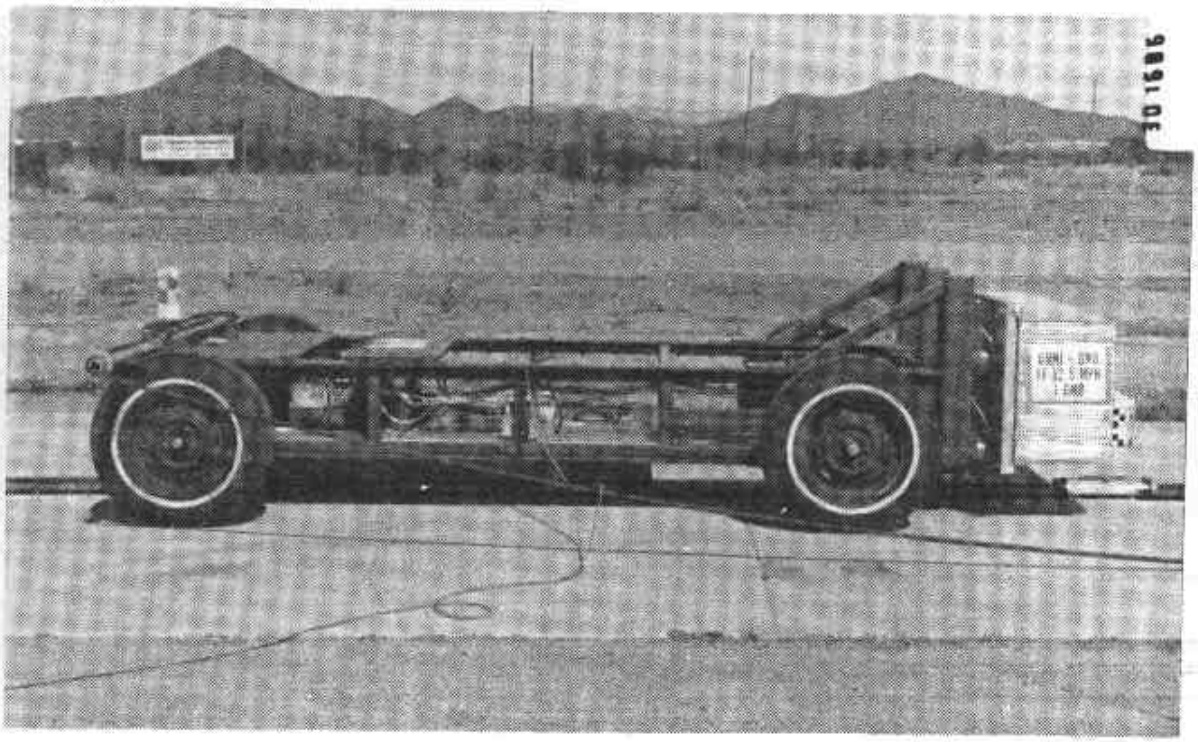



FIGURE B-2. PRE-TEST OVERALL VIEW OF DEFORMABLE MOVING BARRIER.

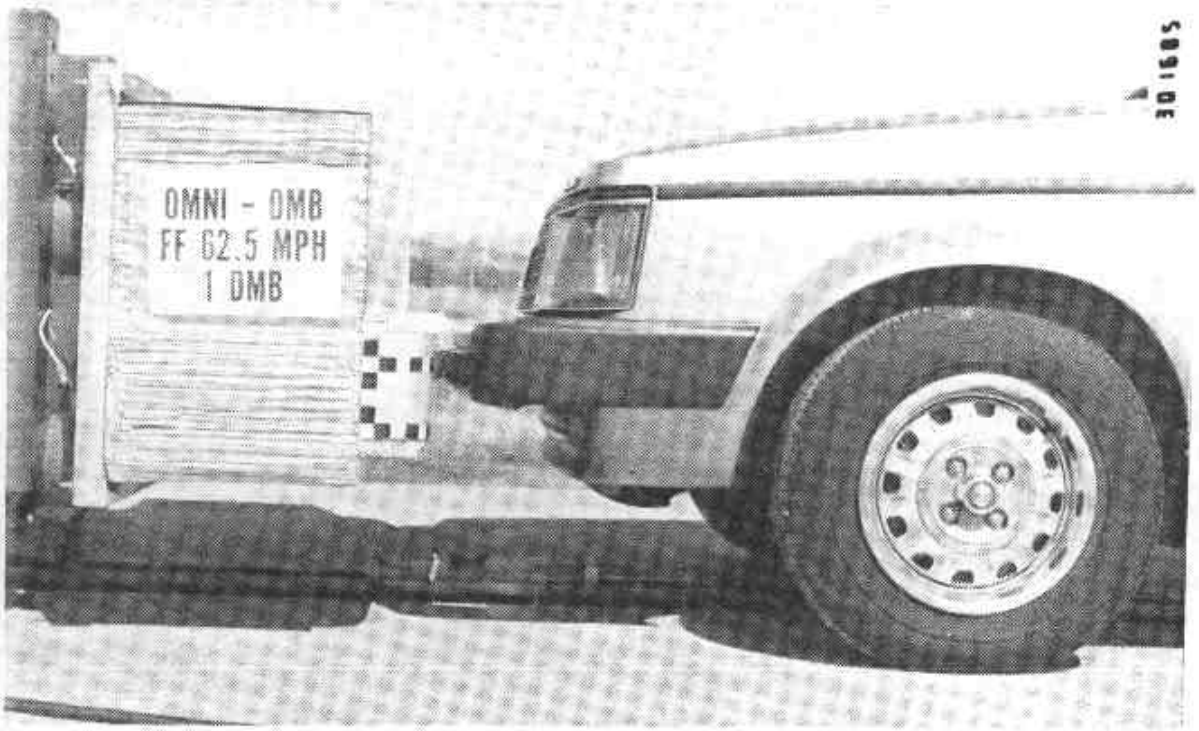



FIGURE B-3. PRE-TEST VIEW OF BUMPER MATCHUP.

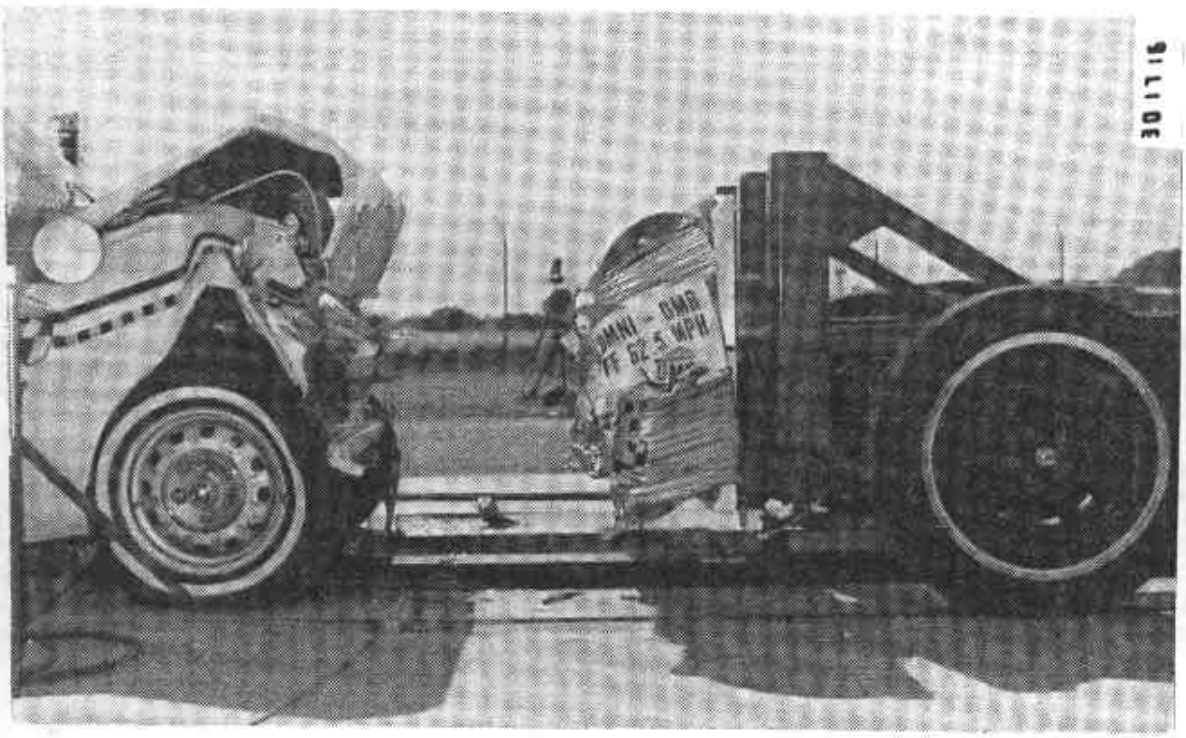



FIGURE B-4. POST-TEST VIEW OF 1983 DODGE OMNI AND DEFORMABLE MOVING BARRIER.

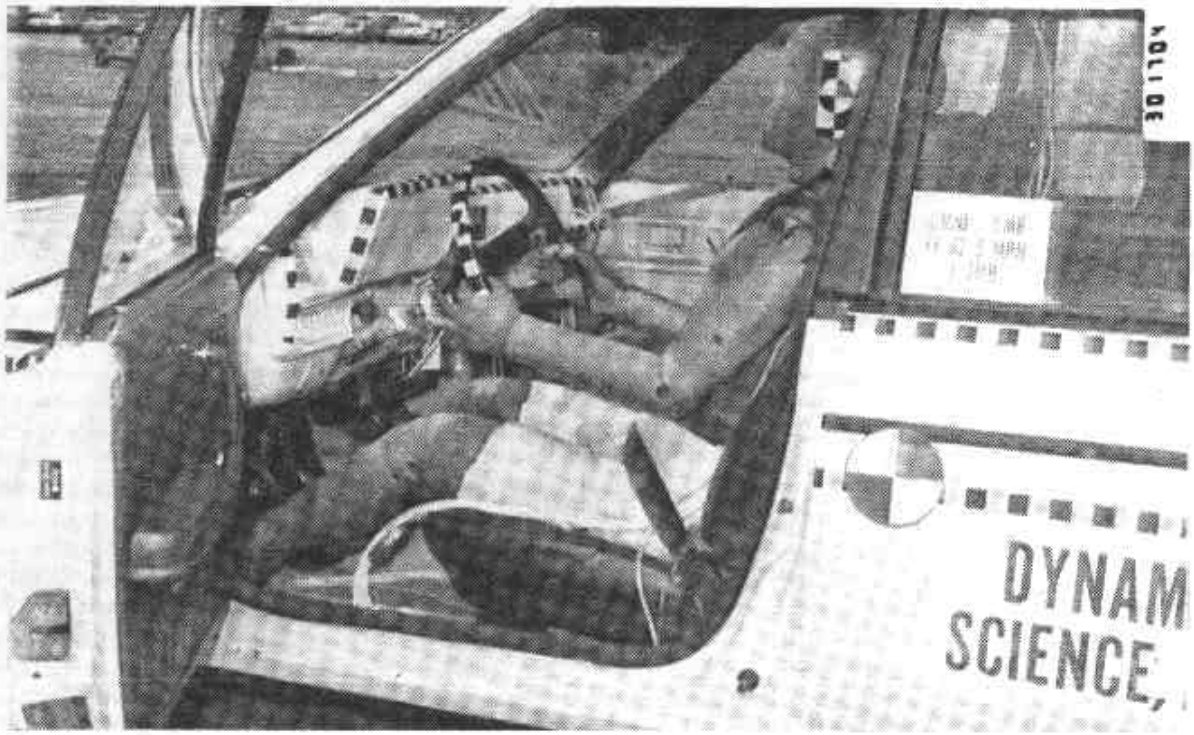



FIGURE B-5. PRE-TEST VIEW OF OCCUPANT COMPARTMENT (DRIVER SIDE).

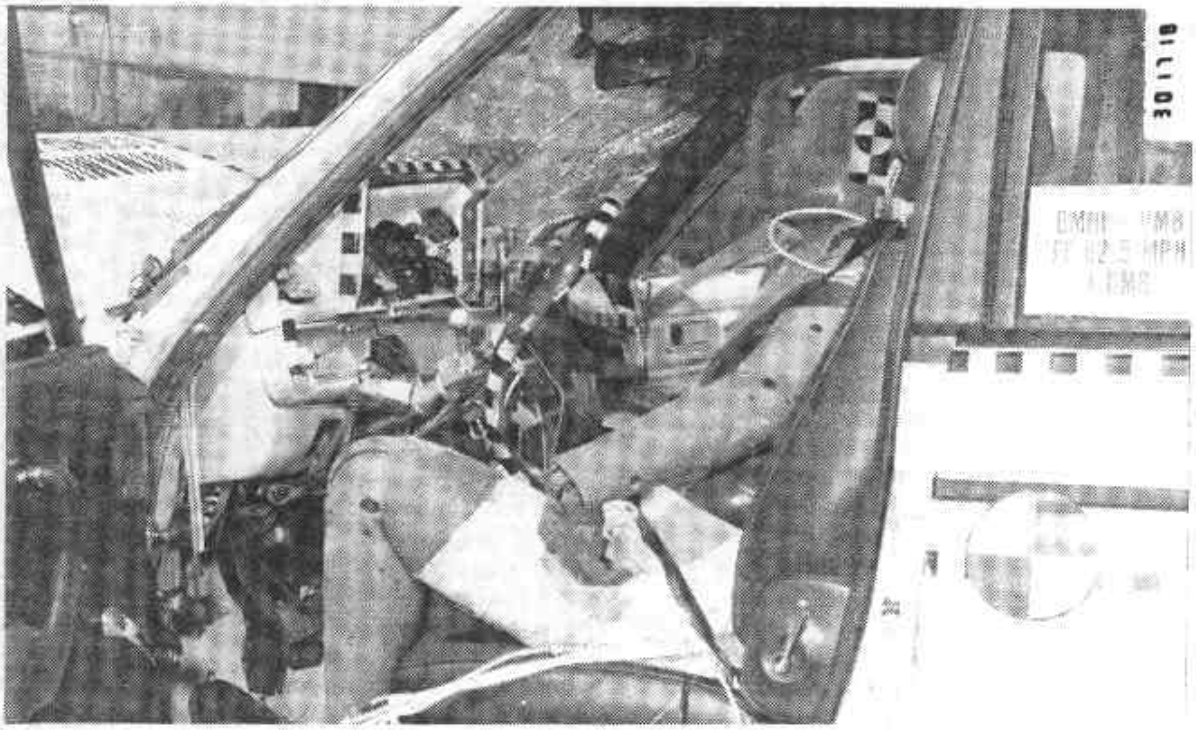


FIGURE B-6. POST-TEST VIEW OF OCCUPANT COMPARTMENT (DRIVER SIDE).

# APPENDIX C

## TEST LOG OF ANTHROPOMORPHIC TEST DEVICE

# TEST LOG OF ANTHROPOMORPHIC TEST DEVICE

Contractor: Dynamic Science, Inc.
Contract Title: Moving Car to Moving Barrier
Contract No.: DTNH22-82-A-17148
Contract Technical Manager: Carl Ragland

ATD Mfr.: Alderson
ATD Serial No.: A08 (572 Hybrid II) Date Submitted: 10/10/83

| Test Date | Test No. | Test Description* | Δ v,† mph | ∠,** deg. | Location and Description of Damage (if any) | Project Engineer |
|---|---|---|---|---|---|---|
| 10/10/83 | 3156-00 | Initial Inspection | - | - | Head - There is a scrape on the forehead just above the left eye. There is also a scrape on the center of the chin which travels up the left side.<br><br>Left Arm - There is paint on the inside of the upper arm, also on the outside of the forearm. The upper arm has cracks in the skin near the inside elbow. The skin is also ripped on the forearm at the outside of the wrist. There is also a crack between the 3-4 finger.<br><br>Right Arm - There is paint on the forearm on the outside; also on the outside of the hand.<br><br>The upper arm skin has a rip in it at inside of the elbow. Dummy certified 10/7/83. | Robert Clay 10/10/83 |

*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: Moving Car to Moving Barrier
Contract No.: DTNH22-82-A-17148
Contract Technical Manager: Carl Ragland

ATD Mfr.: Alderson
ATD Serial No.: A08 (572 Hybrid II) Date Submitted: 10/13/83

| Test Date | Test No. | Test Description* | Δ v,† mph | ∠,** deg. | Location and Description of Damage (if any) | Project Engineer |
|---|---|---|---|---|---|---|
| 10/13/83 | 3156-01 (1 DMB) | Instrumented Dummy In Driver Seat, Seat Belt Fastened. Installed in Omni. | 62.36 | 0° | Dummy died in crash. Head hit steering wheel. Steering wheel also hit the chest. No damage to dummy. | Robert Clay 10/14/83 |

*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: Moving Car to Moving Barrier
Contract No.: DTNH22-82-A-17148
Contract Technical Manager: Carl Ragland

ATD Mfr.: Humanoid Systems
ATD Serial No.: 44 (572 Hybrid III) Date Submitted: 10/10/83

| Test Date | Test No. | Test Description* | Δ v,† mph | ∠,** deg. | Location and Description of Damage (if any) | Project Engineer |
|---|---|---|---|---|---|---|
| 10/10/83 | 3156-00 | Initial Inspection | - | - | New dummy, first test; no defects. Dummy certified by Transportation Research Center of Ohio on 7/29/83 | Robert Clay 10/10/83 |
| 10/13/83 | 3156-01 (1 DMB) | Instrumented Dummy in Passenger's Seat. No seat belt. Installed in Omni. | 62.36 | 0° | Right Arm - paint on forearm outside and hand outside.<br><br>Head - scratches and scrapes from the chin to the forehead.<br><br>Dummy died in this crash. | Robert Clay 10/14/83 |

*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.