

DOT 4847

REPORT NO. CAL-85-N-10

NEW CAR ASSESSMENT PROGRAM (NCAP)  
FRONTAL BARRIER IMPACT TEST

VOLVO GOTEBOG, SWEDEN  
1985 VOLVO DL WAGON

NHTSA NO. CF5902  
CALSPAN TEST NO. 7333-11

CALSPAN CORPORATION  
ADVANCED TECHNOLOGY CENTER  
P.O. BOX 400  
BUFFALO, NEW YORK 14225

APRIL 19, 1985



FINAL REPORT

Prepared for:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
OFFICE OF MARKET INCENTIVES  
400 SEVENTH STREET, S.W.  
ROOM NO. 5313 (NRM-22)  
WASHINGTON D.C. 20590

This Final Test Report was prepared for the U. S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-84-D-01149. This document is disseminated under the sponsorship of the U. S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

Prepared: Walter E. Levan  
Walter E. Levan, Test Engineer

Approved: Donald A. Alianello  
Donald A. Alianello, Program Manager  
Transportation Research/  
Physical Sciences Department

FINAL REPORT ACCEPTED BY:

A. R. Jones  
Manager, New Car Assessment Program (NCAP)

MAY 6 1985

Date of Report Acceptance

# **TECHNICAL REPORT STANDARD TITLE PAGE**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                             |                                                                                                                                                                                                                                       |                               |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--|
| 1. Report No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  | 2. Government Accession No.                                                 |                                                                                                                                                                                                                                       | 3. Recipient's Catalog No.    |  |
| 4. Title and Subtitle<br>NHTSA New Car Assessment Program (NCAP)<br>Frontal Barrier Impact Test on a 1985 Volvo DL<br>Wagon to Indicant Requirements of FMVSS 212, 219<br>(Partial), and 301-75                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | 5. Report Date<br>April 19, 1985                                            |                                                                                                                                                                                                                                       |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | 6. Performing Organization Code<br>CAL                                      |                                                                                                                                                                                                                                       |                               |  |
| 7. Author(s)<br>Walter E. Levan, Test Engineer<br>Donald A. Alianello, Program Manager                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | 8. Performing Organization Report No.<br>7333-11                            |                                                                                                                                                                                                                                       |                               |  |
| 9. Performing Organization Name and Address<br>Calspan Advanced Technology Center<br>P.O. Box 400<br>Buffalo, NY 14225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | 10. Work Unit No.<br>880-10-657                                             |                                                                                                                                                                                                                                       |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | 11. Contract or Grant No.<br>DTNH22-84-D-01149                              |                                                                                                                                                                                                                                       |                               |  |
| 12. Sponsoring Agency Name and Address<br>U. S. Department of Transportation<br>National Highway Traffic Safety Administration<br>Office of Vehicle Safety Compliance (NRM-20)<br>400 Seventh Street, S.W., Washington, DC 20590                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  | 13. Type of Report and Period Covered<br>Final Report<br>March - April 1985 |                                                                                                                                                                                                                                       |                               |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | 14. Sponsoring Agency Code<br>DOT/NHTSA/RM/OMI                              |                                                                                                                                                                                                                                       |                               |  |
| 15. Supplementary Notes                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |                                                                             |                                                                                                                                                                                                                                       |                               |  |
| <p>16. Abstract</p> <p>A frontal load cell barrier test of a 1985 Volvo DL Wagon was performed at the Calspan Corporation, Advanced Technology Center crash test facility in Buffalo, New York; on March 19, 1985.</p> <p>Impact speed was 34.6 mph, and the ambient temperature at the barrier face at the time of impact was 41°F. The maximum post-test vehicle crush was 23.8 inches.</p> <p>The test vehicle appeared to comply with the indicant requirements of the following Federal Motor Vehicle Safety Standards:</p> <ol style="list-style-type: none"> <li>1. FMVSS No. 212, "Windshield Mounting"</li> <li>2. FMVSS No. 219 (Partial), "Windshield Zone Intrusion"</li> <li>3. FMVSS No. 301-75, "Fuel System Integrity"</li> </ol> <p>Type of Restraint System - 3-point continuous webbing, manual system at each front outboard seating position.</p> |  |                                                                             |                                                                                                                                                                                                                                       |                               |  |
| 17. Key Words<br>35 mph Frontal Barrier Impact Test<br>New Car Assessment Program (NCAP)<br>FMVSS 212 Indicant Testing<br>FMVSS 219 (Partial) Indicant Testing<br>FMVSS 301-75 Indicant Testing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |                                                                             | 18. Distribution Statement<br><u>Copies of this report are available from:</u><br>Technical Reference Division<br>National Highway Traffic Safety Admin.<br>Nassif Building, Room 5108<br>400 Seventh St., S.W., Washington, DC 20590 |                               |  |
| 19. Security Classif. (of this report)<br>Unclassified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  | 20. Security Classif. (of this page)<br>Unclassified                        |                                                                                                                                                                                                                                       | 21. No. of Pages<br>22. Price |  |

## TABLE OF CONTENTS

| <u>Section</u> |                                                         | <u>Page No.</u> |
|----------------|---------------------------------------------------------|-----------------|
| 1              | PURPOSE AND TEST PROCEDURE                              | 1-1             |
| 2              | SUMMARY OF TEST NO. CF5902                              | 2-1             |
| 3              | SUMMARY OF RESULTS FOR FMVSS NOS. 212, 219,<br>& 301-75 | 3-1             |
| 4              | OCCUPANT AND VEHICLE INFORMATION                        | 4-1             |
| APPENDIX A     | PHOTOGRAPHS                                             | A-1             |
| APPENDIX B     | VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA      | B-1             |
| APPENDIX C     | DUMMY CONFIGURATION & PERFORMANCE VERIFICATION DATA     | C-1             |
| APPENDIX C     | RESTRAINT INSTRUCTIONS FROM OWNER'S MANUAL              | D-1             |

## LIST OF FIGURES

| <u>Figure No.</u> |                                                            | <u>Page No.</u> |
|-------------------|------------------------------------------------------------|-----------------|
| 1                 | FMVSS No. 212, "Windshield Mounting" Data                  | 3-2             |
| 2                 | FMVSS No. 219, (Partial), "Windshield Zone Intrusion" Data | 3-3             |
| 3                 | FMVSS No. 301-75, "Fuel System Integrity" Data             | 3-4             |
| 4                 | Part 572 Dummy In-Vehicle Position                         | 4-3             |
| 5                 | Occupant Clearance Dimensions                              | 4-4             |
| 6                 | Seat Belt Positioning Data                                 | 4-5             |
| 7                 | Driver Dummy to Steering Column/Wheel Dimensions           | 4-7             |
| 8                 | Camera Position for Frontal Impacts                        | 4-8             |
| 9                 | Vehicle Target Locations                                   | 4-10            |
| 10                | Load Cell Locations on Fixed Barrier                       | 4-11            |
| 11                | Vehicle Accelerometer Locations                            | 4-12            |
| 12                | Test Vehicle Measurements                                  | 4-13            |
| 13                | Test Vehicle Damage Details                                | 4-17            |

## LIST OF TABLES

| <u>Table No.</u> |                                            | <u>Page No.</u> |
|------------------|--------------------------------------------|-----------------|
| 1                | General Test and Vehicle Data              | 2-3             |
| 2                | Dummy Injury Criteria Values               | 4-2             |
| 3                | Seat Belt Performance Assessment Test Data | 4-6             |
| 4                | High Speed Camera Locations                | 4-9             |
| 5                | Vehicle Measurements                       | 4-14            |
| 6                | Accident Investigation Division Data       | 4-15            |

## SECTION 1

### PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY 85 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-84-D-01149. The purpose of this test was to obtain vehicle crash-worthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph FMVSS 212/219/301-75 requirements.

The 35 mph frontal barrier impact test was conducted in accordance with the Office of Market Incentives (OMI) Laboratory Indicant Test Procedure. Standards Enforcement Indicant Test Program data for FMVSS No. 212, "Windshield Mounting," FMVSS No. 219 (Partial), "Windshield Zone Intrusion," FMVSS No. 301-75, "Fuel System Integrity," as well as occupant performance data are provided herein.

SECTION 2  
SUMMARY OF TEST NUMBER CF5902

A load cell barrier consisting of 36 load cells was impacted by a 1985 Volvo DL Wagon at a velocity of 34.6 mph. The test was performed at the Calspan Corporation Advanced Technology Center on March 19, 1985. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by one real-time camera and 16 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions, according to dummy placement instructions specified in Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head and chest triaxial accelerometers and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. These ATDs had been certified prior to the test, and certification details along with instrumentation calibration data, are found in Appendix C.

The 67 channels of data were recorded on six 14-channel FM tape recorders. Appendix B contains the vehicle, load cell barrier and dummy response data traces.

The driver's head struck the steering wheel rim and hub and his HIC was 621. The maximum chest deceleration over 3 milliseconds was 33 g's and femur loads were 1005 and 100 pounds.

The right-front passenger HIC was 262 and maximum chest deceleration over 3 milliseconds was 31 g's. Femur loads were 615 and 630 pounds.

Table 1

GENERAL TEST AND VEHICLE DATA

Vehicle Year/Make/Model/Body Style 1985 Volvo DL Wagon

NHTSA No. CF5902 VIN. YVIAX8851F3602938

Body Color Tan Date of Manufacture 10/85

Engine: 4 cylinders; 141 C.I.D.; 2.32 Liters;        CC  
x Gas;        Diesel;        Turbocharged  
x Longitudinal;        Transverse

Transmission 4 Speed x Manual        Automatic x Overdrive  
Final Drive;        Front Wheel; x Rear Wheel;        Four Wheel

Date Received 12/23/84 Odometer Reading; 4.7  
       A/C; x P/S; x P/B;        P/wdo.;        Tilt Wheel  
       P/seats;        Cruise Control

Type of Occupant Restraint 3-point continuous belt system

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 35 psi, Rear 35 psi

Recommended Tire Size: P185/75R14

Recommended Cold Tire Pressure: Front 26 psi, Rear 30 psi

Tires on Vehicle: P185/75R14; Manufacture: Goodyear Arriva

Number of Occupants: 2 Front; 3 Rear;        3rd Seat; 5 TOTAL

Type of Front Seats: x Bucket;        Bench;        Split Bench

Type of Front Seat Back:        Fixed; x Adj. With        Lever        Rot. Knob

Vehicle Capacity Weight (VCW) = 1089 lbs. (A)

No. of Occupants x 150 lbs. = 750 lbs. (B)

Rated Cargo and Luggage  
Weight (RCLW) A-B = 339 lbs.

GVWR 4180 lbs. GAWR: Front 1881 lbs. Rear 2464 lbs.

Table 1  
GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

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

Right Front = 750 lbs.    Right Rear = 790 lbs.  
Left Front = 760 lbs.    Left Rear = 790 lbs.  
TOTAL FRONT WEIGHT = 1510 lbs. (48.9 % of Total Vehicle Weight)  
TOTAL REAR WEIGHT = 1580 lbs. (51.1 % of Total Vehicle Weight)  
TOTAL DELIVERY WEIGHT = 3090 lbs.

CALCULATION FOR TARGET TEST WEIGHT

UDW = Unloaded Delivered Weight (3090 lbs.)  
VCW = Vehicle Capacity Weight (1089 lbs.)  
DSC = Designated Seating Capacity ( 5 )  
RCLW = VW - 150 (DSC) = 339 lbs.  
Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)  
Target Test Weight = 3757 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 172 POUNDS CARGO

Right Front = 800 lbs.    Right Rear = 970 lbs.  
Left Front = 850 lbs.    Left Rear = 970 lbs.  
TOTAL FRONT WEIGHT = 1650 lbs. (46.0 % of Total Vehicle Weight)  
TOTAL REAR WEIGHT = 1940 lbs. (54.0 % of Total Vehicle Weight)  
TOTAL TEST WEIGHT = 3590 lbs.  
Weight of ballast secured in vehicle trunk area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude: RF 24.8 LF 28.2 RR 26.1 LR 25.9  
Test Attitude: RF 27.6 LF 27.7 RR 25.0 LR 25.0  
Wheel Base: 104.3 in.; C.G. = 56.4 in. rearward of front wheel C/L  
Remarks: \_\_\_\_\_

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)POST-IMPACT DATA

Type of Test Frontal Barrier Impact Angle 0 °

Date of Test 3/19/85 Time of Test 1215 hrs.

Ambient Temperature 41 °F. at impact area

Temperature in Occupant Compartment 72 °F.

Windshield Molding Temperature 70 °F.

Required Impact Velocity Range: 34.5 to 35.5 mph

Impact Velocity: primary = 34.6 mph, secondary 34.6 mph

Distance From Front Bumper to Barrier Face When Entering Speed Trap 52 inches; Exiting Speed Trap 12 inches

VEHICLE REBOUND AND CRUSH (inches)

Vehicle Length: Pre-test = R 189.6 C 191.5 L 189.7

Post-test = R 165.8 C 168.2 L 166.3

Crush = R 23.8 C 23.3 L 23.4

Distance from front of test vehicle to point of impact:

R 6.5 C/L 6.5 L 7.0

VISIBLE DUMMY CONTACT POINTS

|            | <u>Driver</u>                     | <u>Passenger</u>                |
|------------|-----------------------------------|---------------------------------|
| Head       | <u>Steering wheel rim and hub</u> | <u>None</u>                     |
| Chest      | <u>None</u>                       | <u>None</u>                     |
| Abdomen    | <u>None</u>                       | <u>None</u>                     |
| Left Knee  | <u>Contacted dash</u>             | <u>Slight contact with dash</u> |
| Right Knee | <u>Contacted dash</u>             | <u>Slight contact with dash</u> |

Table 1  
GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

|              | <u>Front</u>    |                 | <u>Rear</u>     |                 |
|--------------|-----------------|-----------------|-----------------|-----------------|
|              | <u>Left</u>     | <u>Right</u>    | <u>Left</u>     | <u>Right</u>    |
|              | Not             | Not             |                 |                 |
| Door Opening | <u>Operable</u> | <u>Operable</u> | <u>Operable</u> | <u>Operable</u> |

|                      | <u>Front</u> |              |
|----------------------|--------------|--------------|
| <u>Seat Movement</u> | <u>Left</u>  | <u>Right</u> |
| Seat Back Failure    | <u>None</u>  | <u>None</u>  |
| Seat Shift (in.)     | <u>None</u>  | <u>None</u>  |

Glazing Damage

|                      |                      |
|----------------------|----------------------|
| Backlight/Windshield | <u>Slight cracks</u> |
|----------------------|----------------------|

### SECTION 3

#### SUMMARY OF RESULTS FOR FMVSS NOS. 212, 219, & 301-75

- "Windshield Mounting," FMVSS No. 212 Data
- "Windshield Zone Intrusion," FMVSS No. 219 (Partial) Data
- "Fuel System Integrity," FMVSS No. 301-75

Figure 1

FMVSS NO. 212, "WINDSHIELD MOUNTING", DATA SHEET

Details of windshield mounting such as retention method, trim type, etc.:

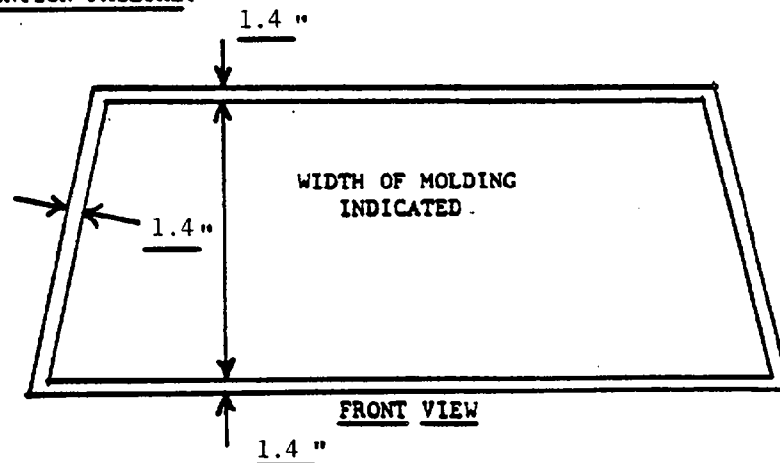
Windshield is bonded in place and has a 1.4 inch rubber molding with a 0.9 inch chrome strip around the perimeter.

FMVSS 212 REQUIREMENTS: The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

|            | WINDSHIELD PERIPHERY |                 |                   |
|------------|----------------------|-----------------|-------------------|
|            | PRE-TEST (in.)       | POST-TEST (in.) | PERCENT RETENTION |
| RIGHT SIDE | 74.5                 | 74.5            | 100%              |
| LEFT SIDE  | 74.5                 | 74.5            | 100%              |
| TOTAL      | 149.0                | 149.0           | 100%              |

AREA OF RETENTION FAILURE:



FAILURE DETAILS:

None

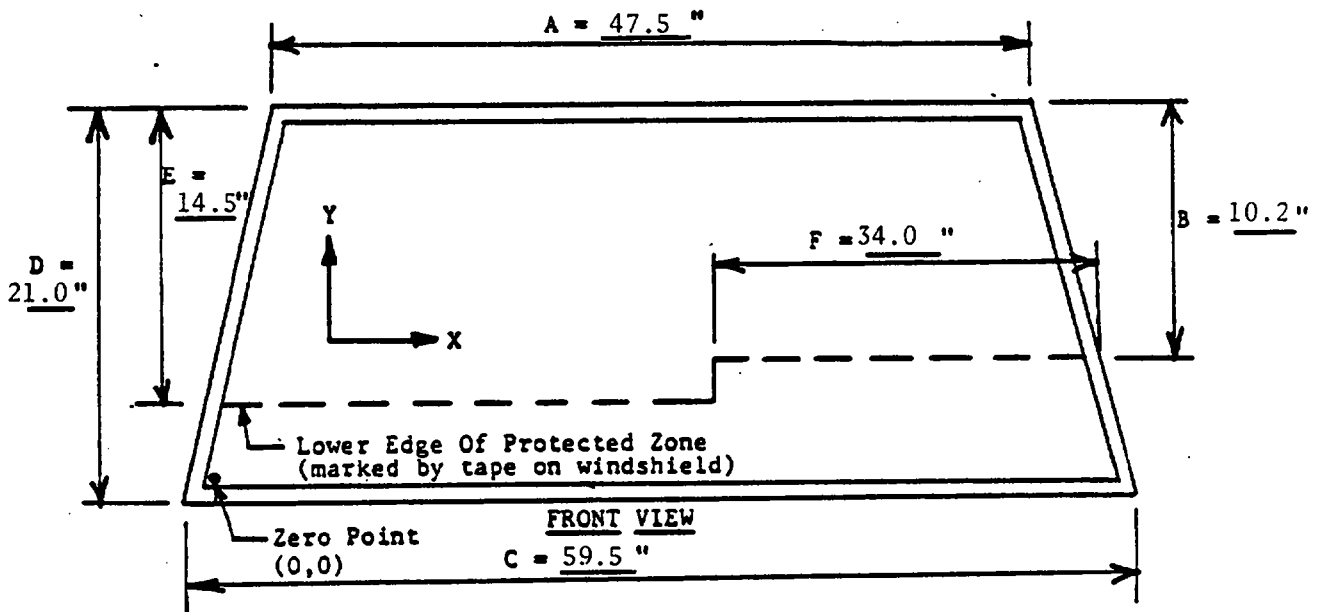
Figure 2

FMVSS NO. 219, (PARTIAL) "WINDSHIELD ZONE INTRUSION", DATA SHEET

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5" dia. rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. Draw the locus of points on the inner surface of the windshield contactable by the sphere across the width of the instrument panel. From the outermost contactable points, extend the locus line horizontally to the edges of the windshield, and then draw a line on the inner surface of the windshield below and 1/2" distant from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection onto the outer surface of the windshield of this line.

FMVSS 219 TEST DATA:



DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":  
(Show location of penetration on above sketch)

| COORDINATES |   |
|-------------|---|
| X           | Y |
| 1.          |   |
| 2.          |   |
| 3.          |   |
| 4.          |   |

None

Figure 3

FMVSS NO. 301-75, "FUEL SYSTEM INTEGRITY", DATA SHEETS

TEST VEHICLE NHTSA NO.: CF5902; TEST DATE: 3/19/85

VEHICLE MAKE/MODEL/BODY STYLE: 1985 Volvo DL Wagon

USABLE CAPACITY OF VEHICLE'S FUEL TANK: 15.5 Gallons (figure furnished by  
vehicle manufacturer)

TEST REQUIREMENTS:

Test vehicle's engine operated to "run dry" condition, and then a small amount of Stoddard solvent which has been dyed RED shall be added to the vehicle's fuel tank. Operate the fuel pump enough to completely fill the fuel system ahead of the fuel tank, and add 92 to 94% of the stated USABLE CAPACITY to the fuel tank.

AMOUNT OF STODDARD SOLVENT ADDED TO VEHICLE'S FUEL TANK:

14.4 Gallons Which is 93 % of the Stated USABLE CAPACITY.

SOLVENT SPILLAGE MEASUREMENT AFTER 35 MPH FRONTAL BARRIER IMPACT TEST:

|                                                 | <u>Actual</u> | <u>Maximum Allowable</u> |
|-------------------------------------------------|---------------|--------------------------|
| From impact until vehicle motion ceases - - - - | <u>0</u>      | 1 oz.                    |
| For 5 min. period after vehicle motion ceases - | <u>0</u>      | 5 oz.                    |
| For next 25 minutes at barrier face - - - - -   | <u>0</u>      | 1 oz./1 minute           |

SOLVENT SPILLAGE DETAILS:

None

STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1 to 3 minutes)

Time reqd. for machine to rotate 90° = 2 minutes, 57 seconds  
FMVSS 301-75 Position Hold Time = 5 minutes, 0 seconds  
TOTAL - - - - - = 7 minutes, 57 seconds  
Next Whole Minute Interval - - - - - = 8 minutes

Figure 3  
FMVSS NO. 301-75 TEST DATA....Continued:

VEHICLE STATIC ROLLOVER DATA:

|                                        | First 5 Minutes<br>FROM ONSET OF ROTATION | 6th.<br>Minute | 7th.<br>Minute | 8th.<br>Minute |
|----------------------------------------|-------------------------------------------|----------------|----------------|----------------|
| Maximum Allowable Solvent Spillage - - | 5 oz.                                     | 1 oz.          | 1 oz.          | 1 oz.          |
| 0 to 90° (filler cap down) - - - - -   | 0                                         | 0              | 0              | 0              |
| 90 to 180° - - - - -                   | 0                                         | 0              | 0              | 0              |
| 180 to 270° - - - - -                  | 0                                         | 0              | 0              | 0              |
| 270 to 360° - - - - -                  | 0                                         | 0              | 0              | 0              |

Solvent Spillage Location(s):

None

## OMI FINAL DATA

### SECTION 4

#### Occupant and Vehicle Information

##### I. OMI DATA

1. Dummy Injury Criteria Data Summary
2. Dummy Positioning Data
3. Seat Belt Positioning Data
4. Seat Belt Performance Assessment Data
5. Driver Dummy to Steering Column Dimensions
6. Camera Locations
7. Vehicle Target Locations

##### II. OVR DATA

1. Load Cell Barrier Data
2. Vehicle Accelerometer Data

##### III. AID DATA

1. Test Vehicle Measurements
2. Accident Investigation Damage Data Summary

Table 2  
DUMMY INJURY CRITERIA VALUES

|           | MAXIMUM ACCELERATION ("G") |     |    |    |       |     |    |     |
|-----------|----------------------------|-----|----|----|-------|-----|----|-----|
|           | HEAD                       |     |    |    | CHEST |     |    |     |
|           | X                          | Y   | Z  | R  | X     | Y   | Z  | R * |
| DUMMY (1) | -57                        | -12 | 56 | 68 | -34   | 4.0 | -9 | 33  |
| DUMMY (2) | -32                        | 15  | 40 | 43 | -32   | 17  | 12 | 31  |
| DUMMY (3) |                            |     |    |    |       |     |    |     |
| DUMMY (4) |                            |     |    |    |       |     |    |     |

|           | MAXIMUM FORCE-FEMUR LOAD (LBS) |            |
|-----------|--------------------------------|------------|
|           | RIGHT FEMUR                    | LEFT FEMUR |
| DUMMY (1) | 1005                           | 100        |
| DUMMY (2) | 615                            | 630        |
| DUMMY (3) |                                |            |
| DUMMY (4) |                                |            |

|           | MAXIMUM FORCE-SEAT BELTS LOADS (LBS) |                              |                             |
|-----------|--------------------------------------|------------------------------|-----------------------------|
|           | SHOULDER STRAP<br>UPPER BELT LOAD    | LAP STRAP<br>RIGHT BELT LOAD | LAP STRAP<br>LEFT BELT LOAD |
| DUMMY (1) | 1425                                 | --                           | 1010                        |
| DUMMY (2) | 1700                                 | 975                          | --                          |
| DUMMY (3) |                                      |                              |                             |
| DUMMY (4) |                                      |                              |                             |

|           | HEAD INJURY CRITERIA** |                      |                      |                                                   |
|-----------|------------------------|----------------------|----------------------|---------------------------------------------------|
|           | HIC                    | t <sub>1</sub> (SEC) | t <sub>2</sub> (SEC) | AVE. ACC. (g)<br>t <sub>1</sub> TO t <sub>2</sub> |
| DUMMY (1) | 621                    | .07440               | .10875               | 50                                                |
| DUMMY (2) | 262                    | .05137               | .15817               | 23                                                |
| DUMMY (3) |                        |                      |                      |                                                   |
| DUMMY (4) |                        |                      |                      |                                                   |

\*DEFINED AS EXCEEDING 0.003 SEC. DURATION  
\*\*AS DEFINED IN FMVSS NO. 208

Figure 4

**PART 572 DUMMY IN-VEHICLE POSITION**

Test No. CF5902

Vehicle 1985 Volvo DL Wagon

**SEAT TYPE:**

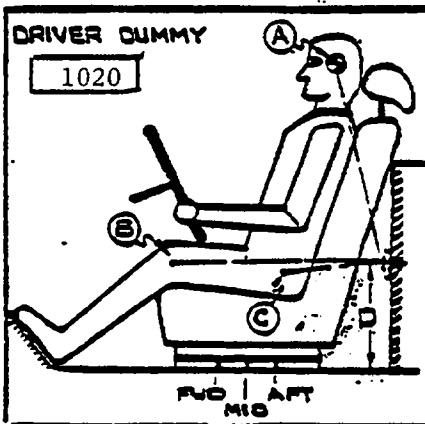
       Bench  
  x   Bucket  
       Split Bench

**ADJUSTER TYPE:**

  x   Manual  
       Power

**BUCKET SEAT BACK TYPE:**

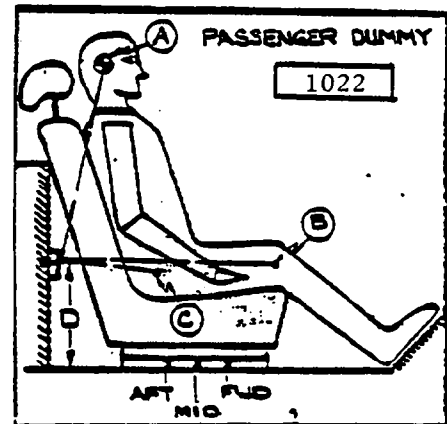
       Fixed  
  x   Adjustable Reclining



A = 20.7 in. 3 Degrees  
 B = 23.0 in. 95 Degrees  
 C = 8.5 in. 138 Degrees  
 D = 15.9 in.

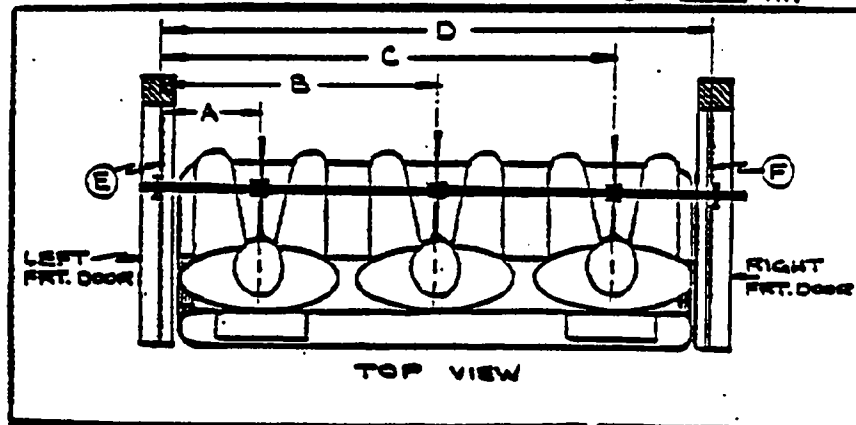
**MEASUREMENT LOCATION**

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



A = 20.4 in. 5 Degrees  
 B = 22.7 in. 97 Degrees  
 C = 9.7 in. 143 Degrees  
 D = 15.9 in.

Driver seat set in 9th notch back, total 16 notches.



Passenger seat set in 5th notch back, total 9 notches

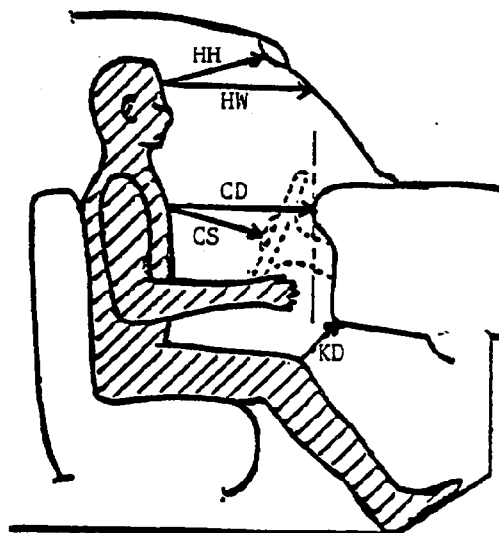
A = Left Door to Driver Centerline  
 B = Left Door to Center Passenger Centerline  
 C = Left Door to Right Passenger Centerline  
 D = Left Door to Right Door  
 E, F = Window Glass Height (Right and Left Must be Equal)

11.5 in.  
   in.  
39.5 in.  
50.75 in.  
10.5 in.

|     | DRIVER | PASSENGER |
|-----|--------|-----------|
| HH  | 17.6   | 17.5      |
| HW  | 22.5   | 22.0      |
| CD  | 20.5   | 23.0      |
| CS  | 13.5   | --        |
| KDL | 4.5    | 7.2       |
| KDR | 4.7    | 7.2       |
| SA  | *      | *         |
| TA  | 25°    | 24°       |

HH = Head to Windshield Header  
 HW = Head to Windshield  
 CD = Chest to Dash  
 CS = Chest to Steering Wheel  
 KD = Knee to Dash  
 SA = Seat Back Angle  
 TA = Torso Angle  
 \* = Back of Head Rest Set to 0°

HR = Head to Side Roof  
 HS = Head to Side Window  
 AD = Arm to Door  
 HD = Hip to Door



|    | DRIVER | PASSENGER |
|----|--------|-----------|
| HR | 6      | 6         |
| HS | 8      | 7.7       |
| AD | 3.5    | 3.6       |
| HD | 7.0    | 6.7       |

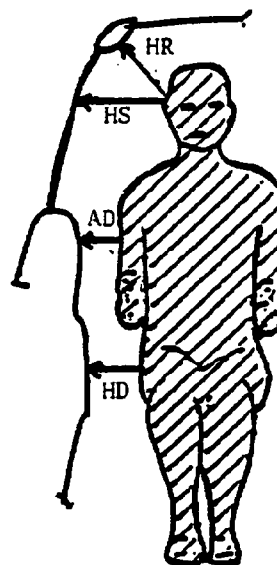
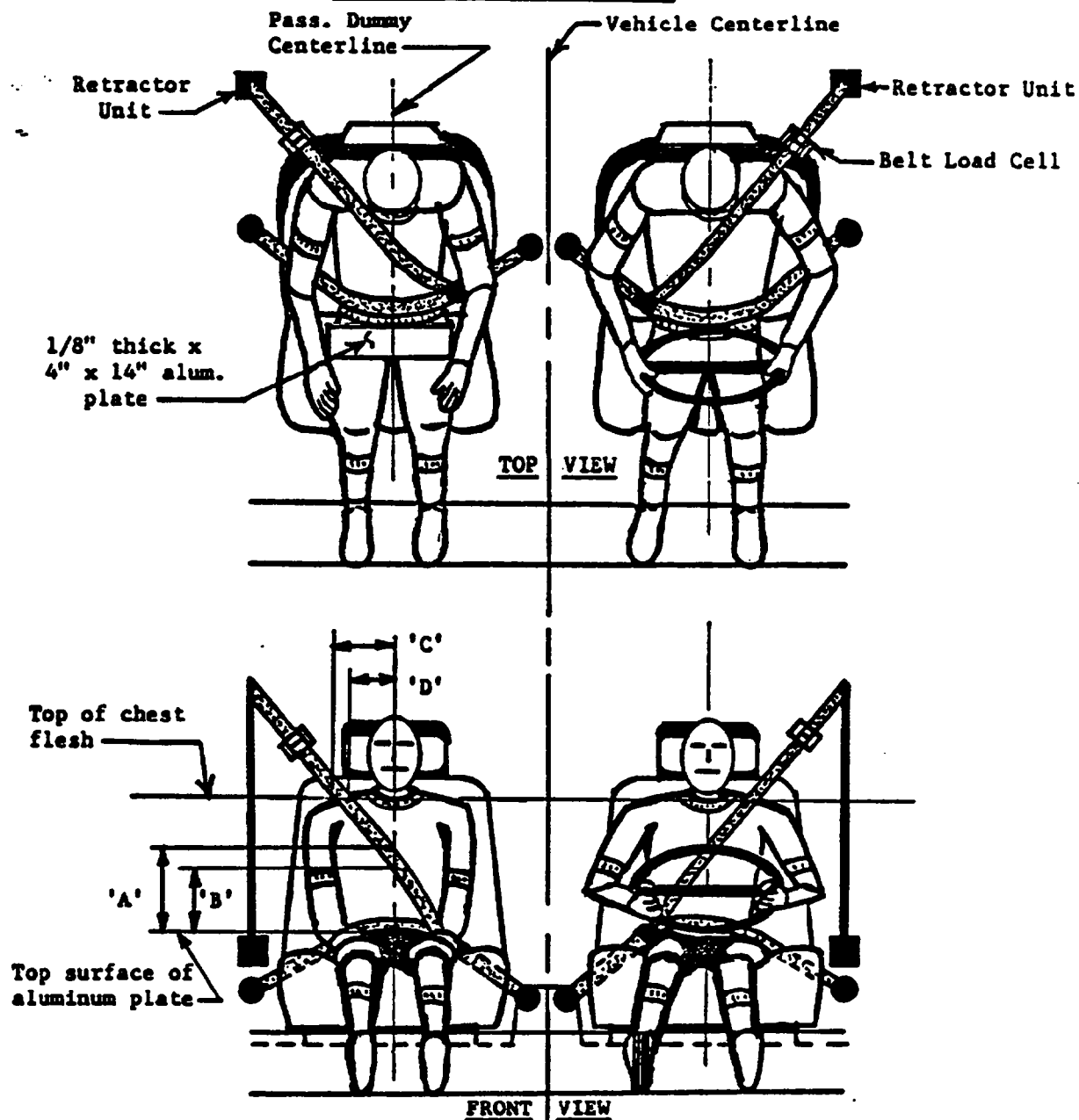


Figure 5 OCCUPANT CLEARANCE DIMENSIONS

Figure 6

SEAT BELT POSITIONING DATA



|                                                                      | DRIVER DUMMY (in.) | PASS. DUMMY (in.) |
|----------------------------------------------------------------------|--------------------|-------------------|
| 1. Dimension 'A'--alum. plate to belt upper edge on dummy centerline | 13.5               | 13.0              |
| 2. Dimension 'B'--alum. plate to belt lower edge on dummy centerline | 10.5               | 10.2              |
| 3. Dimension 'C'--dummy centerline to outer edge at chest flesh top  | 6.7                | 7.1               |
| 4. Dimension 'D'--dummy centerline to inner edge at chest flesh top  | 4.2                | 5.0               |
| 5. Lap belt tension (lbs.)                                           | --                 | --                |
| 6. Shoulder belt tension (lbs.)                                      | 4.2                | 4.5               |

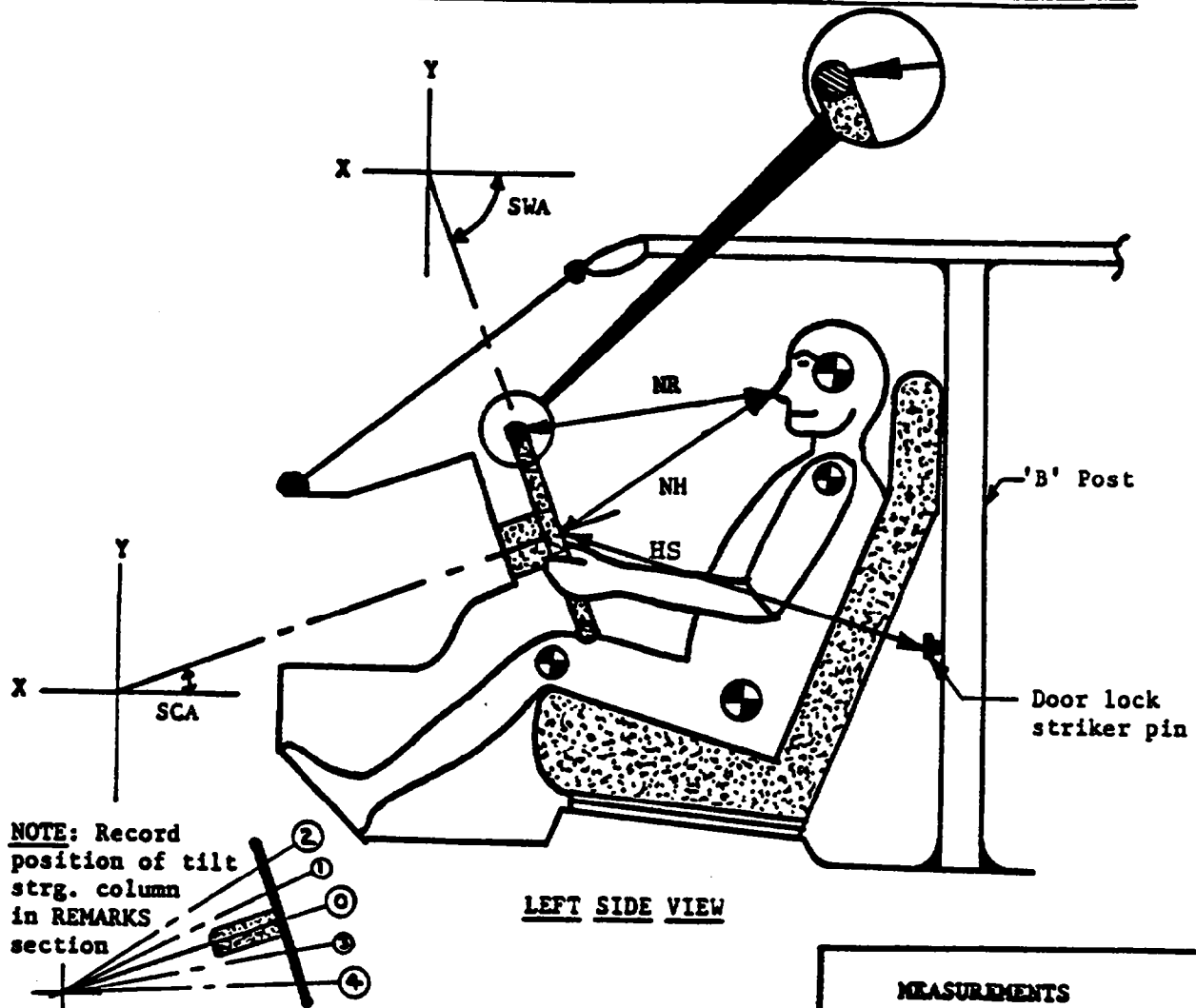
Table 3

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

| <u>Belt Length Data:</u>                                                                   | <u>Driver</u>   | <u>Passenger</u> |
|--------------------------------------------------------------------------------------------|-----------------|------------------|
| Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems. | <u>86.5</u>     | <u>87.0</u>      |
| Shoulder belt length as measured on Part 572 Dummy.                                        | <u>35.5</u>     | <u>36.0</u>      |
| Lap belt length as measured on Part 572 Dummy.                                             | <u>40.0</u>     | <u>40.0</u>      |
| <u>Belt Spool-Off Data:</u>                                                                |                 |                  |
| As determined by film analysis.                                                            | <u>1.7</u>      | <u>1.6</u>       |
| As determined mechanically.                                                                | <u>1.7</u>      | <u>1.7</u>       |
| As determined electronically.                                                              | <u>2.7</u>      | <u>1.6</u>       |
| <u>Belt Stretch Data:</u>                                                                  |                 |                  |
| Measured electronically between shoulder belt load cell and the "D" ring.                  | <u>.6 in/ft</u> | <u>.63 in/ft</u> |
| Measured mechanically                                                                      | <u>0</u>        | <u>0</u>         |

Figure 7

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



| MEASUREMENTS                                                                                                 |                      |         |
|--------------------------------------------------------------------------------------------------------------|----------------------|---------|
| <u>NR</u> --Distance from tip of dummy's nose to Top Rear surface of steering wheel rim                      | 16.7                 | Inches  |
| <u>NH</u> --Distance from tip of dummy's nose to center of steering column hub                               | 18.2                 | Inches  |
| <u>HS</u> --Distance from center of steering column hub to the forward surface of the door lock striker pin. | X = 19.7<br>Y = 17.0 | Inches  |
| <u>SCA</u> --Angle of steering column relative to the horizontal X axis                                      | 23                   | Degrees |
| <u>SWA</u> --Angle of steering wheel relative to the horizontal X axis.                                      | 67                   | Degrees |

REMARKS CONCERNING ADJUSTABLE OR TILT STEERING COLUMN IF VEHICLE IS SO EQUIPPED:  
not adjustable

NOTE: Camera Information Shown on Table 4

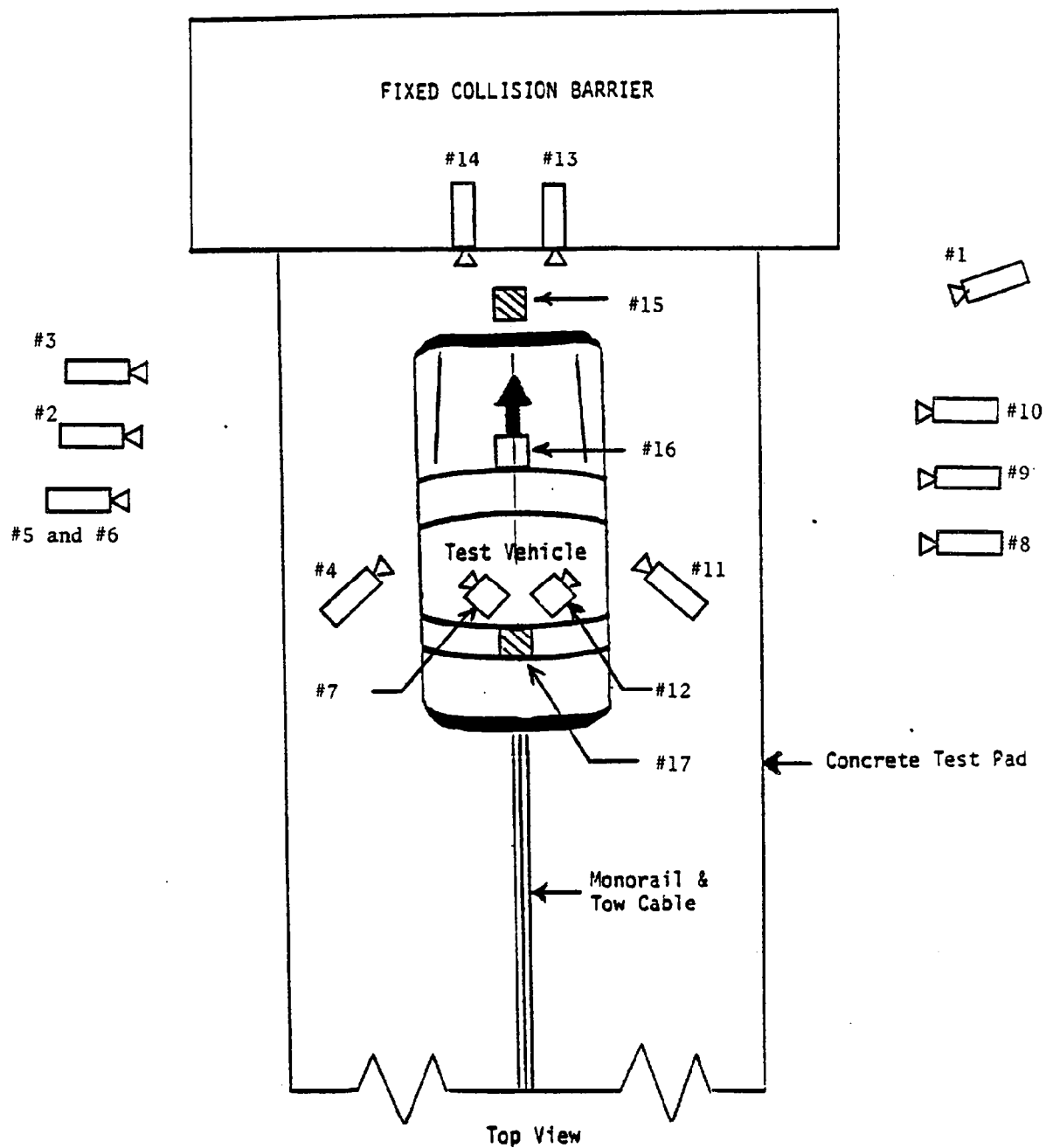


Figure 8 CAMERA POSITION FOR FRONTAL IMPACTS

Table 4  
HIGH-SPEED CAMERA LOCATIONS

Test No. CF5902 Vehicle 1985 Volvo DL Wagon

| CAMERA NO. | VIEW                        | CAMERA POSITIONS (in) * |     |      | ANGLE ** (deg) | FILM PLANE TO HEAD TARGET | LENS (mm) | APPROX. SPEED (fps)*** |
|------------|-----------------------------|-------------------------|-----|------|----------------|---------------------------|-----------|------------------------|
| 1          | Real Time Camera            | --                      | --  | --   | --             | --                        | --        | 24                     |
| 2          | Overall Left Side           | 260                     | 57  | 41   | -5             | --                        | 13        | 530                    |
| 3          | Left Side View              | --                      | --  | --   | FILM           | BROKE                     | --        | --                     |
| 4          | Driver and Interior View    | 101                     | 124 | 72   | -15            | --                        | 25        | 550                    |
| 5          | Steering Column (Bottom)    | 284                     | 75  | 46   | -5             | 267                       | 25        | 550                    |
| 6          | Steering Column (Top)       | 284                     | 75  | 70   | -10            | 267                       | 25        | 550                    |
| 7          | Left Belt                   | --                      | --  | --   | --             | --                        | 8         | 1300                   |
| 8          | Overall Right Side          | 289                     | 91  | 58   | -6             | --                        | 13        | 800                    |
| 9          | Right Side View             | 265                     | 79  | 47   | -5             | --                        | 25        | 900                    |
| 10         | Right Passenger View        | 289                     | 67  | 51   | -4             | 272                       | 35        | 670                    |
| 11         | Passenger and Interior View | 101                     | 124 | 72   | -15            | --                        | 25        | 600                    |
| 12         | Right Belt                  | --                      | --  | --   | --             | --                        | 8         | 1270                   |
| 13         | Passenger Front View        | 21                      | 0   | 72   | -33            | 97                        | 13        | 560                    |
| 14         | Driver Front View           | 21                      | 0   | 72   | -33            | 97                        | 13        | 630                    |
| 15         | Windshield View             | 0                       | 0   | 126  | -53            | --                        | 13        | 530                    |
| 16         | Pit View of Engine          | 0                       | 36  | -120 | 90             | --                        | 13        | 800                    |
| 17         | Pit View of Fuel Tank       | 0                       | 85  | -120 | 90             | --                        | 13        | 800                    |
|            |                             |                         |     |      |                |                           |           |                        |
|            |                             |                         |     |      |                |                           |           |                        |
|            |                             |                         |     |      |                |                           |           |                        |

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

\*\*\*The master timing circuit power supply breaker tripped prior to the impact. The speed (fps) shown are average speeds over several previous tests.



Figure 10

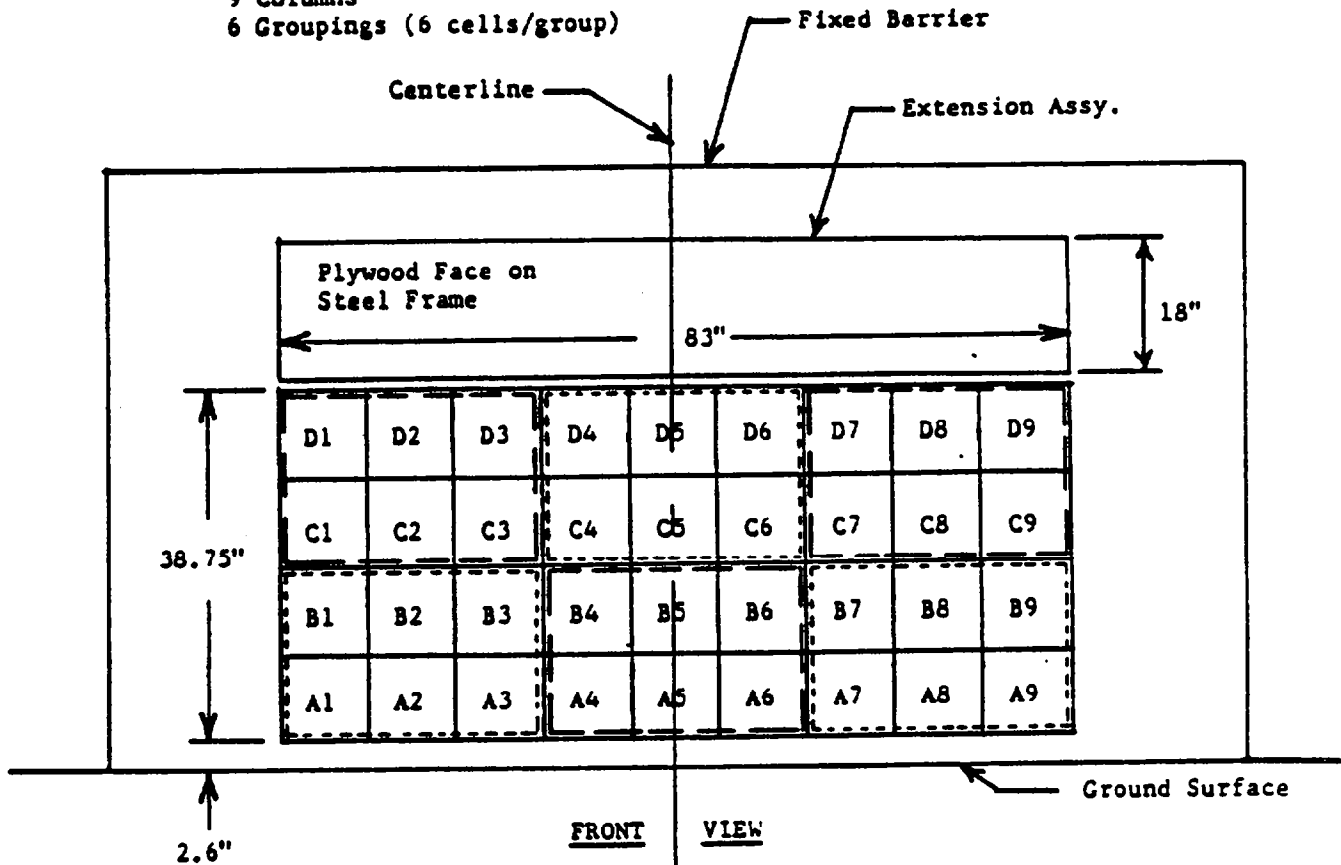
LOAD CELL LOCATIONS ON FIXED BARRIER

36 Load Cells

4 Rows

9 Columns

6 Groupings (6 cells/group)



6 GROUPINGS OF 6 LOAD CELLS EACH

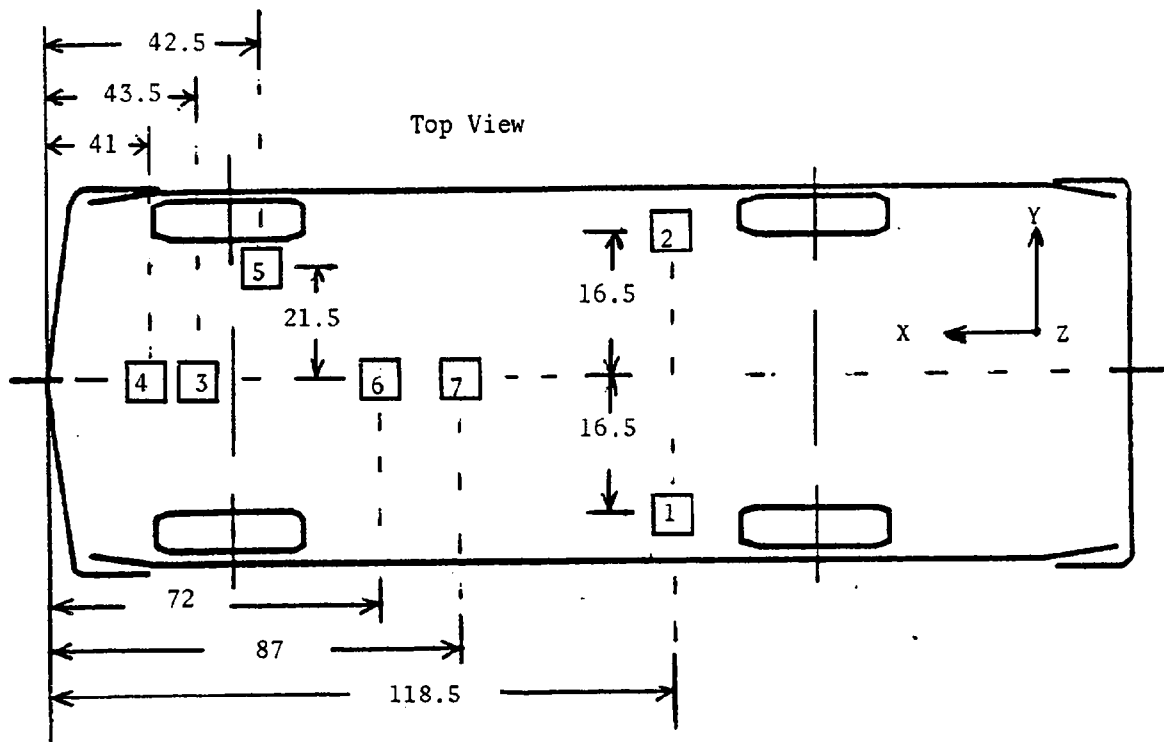
|                       |                       |                       |
|-----------------------|-----------------------|-----------------------|
| Group 4<br>C1 thru D3 | Group 5<br>C4 thru D6 | Group 6<br>C7 thru D9 |
| Group 1<br>A1 thru B3 | Group 2<br>A4 thru B6 | Group 3<br>A7 thru B9 |

The following data is presented in Appendix B:

(1) Data from 36 individual load cells

(2) Total or Sum of 36 individual load cells

(3) Data from 6 Groupings shown above (6 cells/group)



| ACCELEROMETER<br>NUMBER * | ACCELEROMETER LOCATION      | DIRECTION |   |   |
|---------------------------|-----------------------------|-----------|---|---|
|                           |                             | X         | Y | Z |
| 1                         | Left Rear Seat Crossmember  | X         |   |   |
| 2                         | Right Rear Seat Crossmember | X         |   |   |
| 3                         | Top of Engine               | X         |   |   |
| 4                         | Bottom of Engine            | X         |   |   |
| 5                         | Right Disc Brake Caliper    | X         |   |   |
| 6                         | Instrument Panel            | X         |   |   |
| 7                         | Center of Gravity (C/G)     | X         |   |   |

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

FIGURE 11 VEHICLE ACCELEROMETER LOCATIONS

Figure 12

TEST VEHICLE MEASUREMENTS

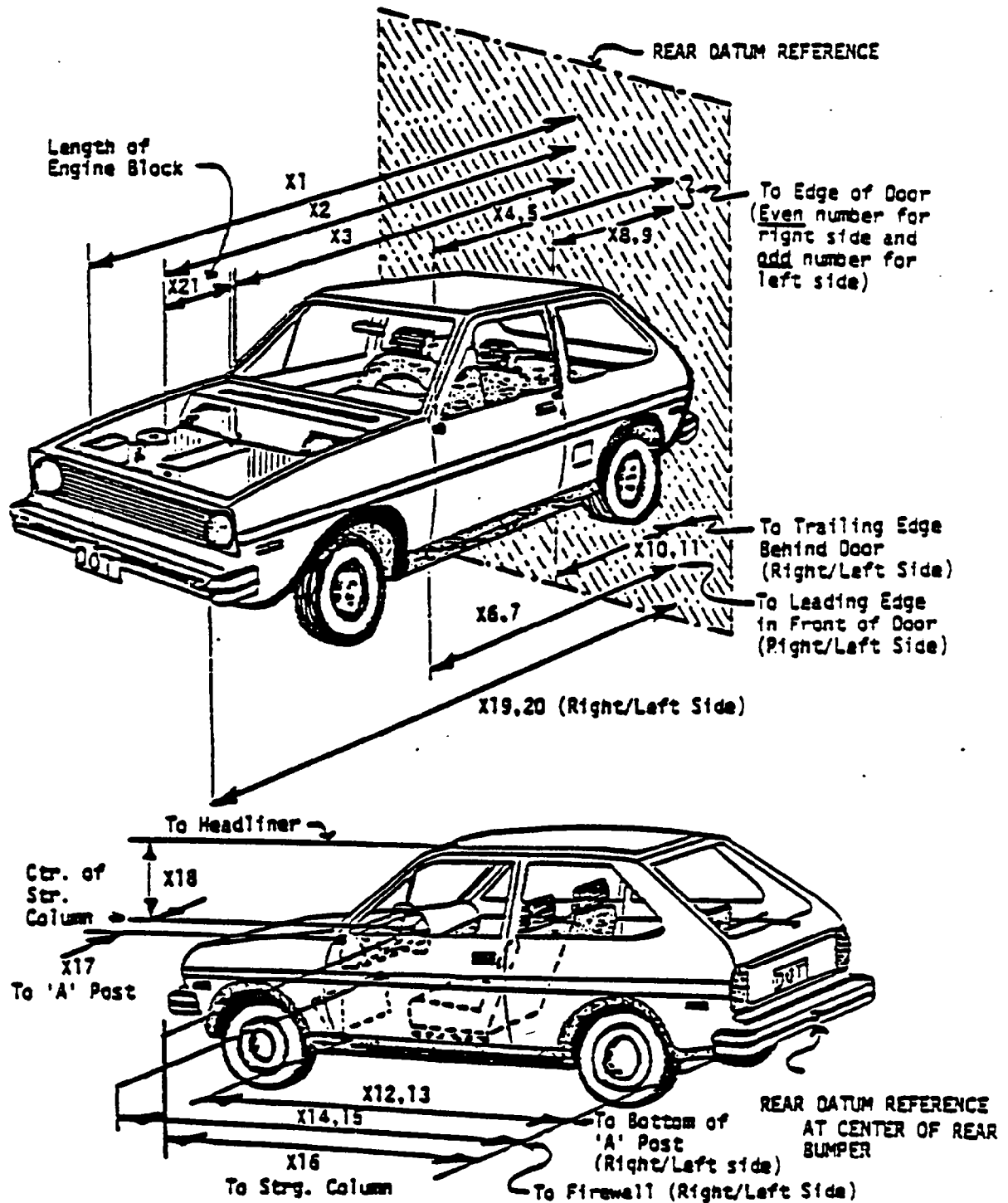


Table 5

## VEHICLE MEASUREMENTS

| All Dimensions in Inches |                                                              |                               |           |            |
|--------------------------|--------------------------------------------------------------|-------------------------------|-----------|------------|
| No.                      |                                                              | Pre-Test Post-Test Difference |           |            |
|                          |                                                              | Pre-Test                      | Post-Test | Difference |
| X1                       | Total Length of Vehicle at Centerline                        | 191.5                         | 168.2     | 23.3       |
| X2                       | Rear Surface of Vehicle to Front of Engine                   | 160.3                         | 153.4     | 6.9        |
| X3                       | Rear Surface of Vehicle to Firewall                          | 140.6                         | 140.2     | 0.4        |
| X4                       | Rear Surface of Vehicle to Upper Leading Edge of Right Door  | 128.0                         | 127.9     | 0.1        |
| X5                       | Rear Surface of Vehicle to Upper Leading Edge of Left Door   | 128.2                         | 127.9     | 0.3        |
| X6                       | Rear Surface of Vehicle to Lower Leading Edge of Right Door  | 127.6                         | 126.5     | 1.1        |
| X7                       | Rear Surface of Vehicle to Lower Leading Edge of Left Door   | 127.7                         | 126.7     | 1.0        |
| X8                       | Rear Surface of Vehicle to Upper Trailing Edge of Right Door | 92.3                          | 92.3      | 0.0        |
| X9                       | Rear Surface of Vehicle to Upper Trailing Edge of Left Door  | 92.5                          | 92.3      | 0.2        |
| X10                      | Rear Surface of Vehicle to Lower Trailing Edge of Right Door | 92.1                          | 91.0      | 1.1        |
| X11                      | Rear Surface of Vehicle to Lower Trailing Edge of Left Door  | 92.2                          | 91.3      | 0.9        |
| X12                      | Rear Surface of Vehicle to Bottom of "A" Post of Right Side  | 126.2                         | 125.4     | 0.8        |
| X13                      | Rear Surface of Vehicle to Bottom of "A" Post of Left Side   | 126.3                         | 125.5     | 0.8        |
| X14                      | Rear Surface of Vehicle to Firewall, Right Side              | 139.5                         | 136.1     | 3.4        |
| X15                      | Rear Surface of Vehicle to Firewall, Left Side               | 140.0                         | 134.5     | 5.5        |
| X16                      | Rear Surface of Vehicle to Steering Column                   | 112.8                         | 111.4     | 1.4        |
| X17                      | Center of Steering Column to "A" Post                        | 13.5                          | 14.1      | -0.6       |
| X18                      | Center of Steering Column to Headliner                       | 17.7                          | 18.7      | -1.0       |
| X19                      | Rear Surface of Vehicle to Right Side of Front Bumper        | 189.6                         | 165.8     | 23.8       |
| X20                      | Rear Surface of Vehicle to Left Side of Front Bumper         | 189.7                         | 166.3     | 23.4       |
| X21                      | Length of Engine Block                                       | 21.0                          | 21.0      | 0.0        |

Table 6

**ACCIDENT INVESTIGATION DIVISION DATA**  
**FOR 35 MPH FRONTAL BARRIER IMPACT**

VEHICLE MAKE/MODEL/BODY STYLE: 1985 Volvo DL Wagon  
 VEH. NHTSA NO.: CF5902; VIN: YVIA8851F3602938  
 MODEL YEAR: 1985; BUILD DATE: 10/84; TEST DATE: 3/19/85  
 VEH. SIZE CATEGORY: mid-size; TEST WEIGHT: 3590  
 VEH. WHEELBASE: 104.3; FRONT OVERHANG: 37.9; OVERALL WIDTH: 67.3

**ACCELEROMETER DATA:**

LOCATION: 56.4 inches rearward of front wheel C/L

CALIBRATION PROCEDURE: Shaker Table/Least Squares

LINEARITY: ±0.75%; INTEGRATION ALGORITHM: Hybrid Simpson-Newton 3/8

VEH. IMPACT SPEED: 34.6 mph; TIME OF SEPARATION: 255.8 msec.

VELOCITY CHANGE: 38.0

■ COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

F (Frontal) 12FDEW3

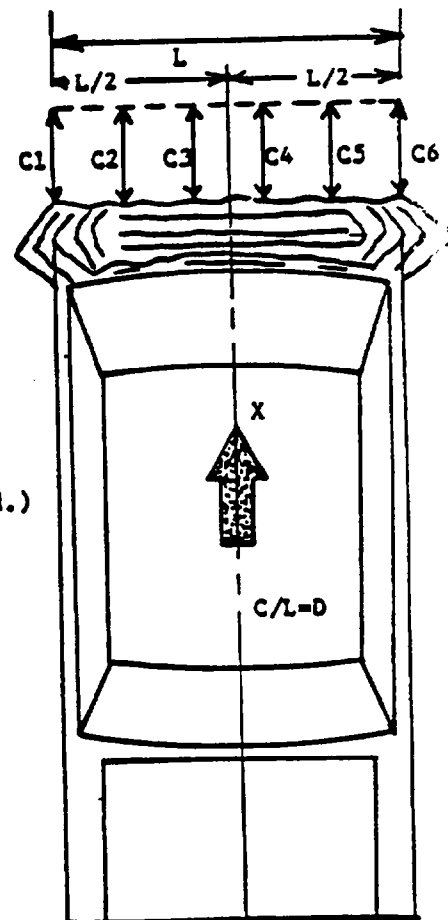
CRUSH DEPTH  
DIMENSIONS:

C1= 22.4 inches  
 C2= 22.8 inches  
 C3= 23.9 inches  
 C4= 23.5 inches  
 C5= 22.7 inches  
 C6= 22.0 inches

MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitud.)

LENGTH OF DAMAGED  
REGION:

L = 62.8 inches



National Accident Sampling System — Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

NCI

1985 VOLVO WAGON

| Complete When Applicable                                                                                                                                                                                                                                                    |                                                                                                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| End Damage                                                                                                                                                                                                                                                                  | Side Damage                                                                                                                                                                    |
| <p>Undeformed end width <u>62.8</u></p> <p>Corner shift: A1 _____</p> <p style="padding-left: 100px;">A2 _____</p> <p>End shift at frame (CDC)<br/>(check one)</p> <p style="padding-left: 20px;">&lt;4 inches _____</p> <p style="padding-left: 20px;">≥4 inches _____</p> | <p>Bowing: B1 _____ X1 _____</p> <p style="padding-left: 100px;">B2 _____ X2 _____</p> <p>Bowing constant</p> <p><math>\frac{X1 + X2}{2} = \underline{\hspace{2cm}}</math></p> |

Note: Measure C1 to C6 from Driver to Passenger side in Front or Rear impacts—  
Rear to Front in Side impacts.

12FDEW3

| Specific Impact Number | Plane* of C-Measurements | Direct Damage |              | Field L** | C <sub>1</sub> | C <sub>2</sub> | C <sub>3</sub> | C <sub>4</sub> | C <sub>5</sub> | C <sub>6</sub> | ±D |
|------------------------|--------------------------|---------------|--------------|-----------|----------------|----------------|----------------|----------------|----------------|----------------|----|
|                        |                          | Width** (CDC) | Max*** Crush |           |                |                |                |                |                |                |    |
| 1                      | Bumper                   | 62.8          | 23.9         | 62.8      | 26.9           | 24.1           | 24.4           | 24.4           | 24.0           | 26.5           | Ø  |
|                        | Free/space               |               |              |           | 4.5            | 1.3            | .9             | .9             | 1.3            | 4.5            |    |
| 1                      | ACTUAL CRUSH             |               |              | 62.8      | 22.4           | 22.8           | 23.9           | 23.5           | 22.7           | 22.0           | Ø  |
|                        |                          |               |              |           |                |                |                |                |                |                |    |
|                        |                          |               |              |           |                |                |                |                |                |                |    |
|                        |                          |               |              |           |                |                |                |                |                |                |    |
|                        |                          |               |              |           |                |                |                |                |                |                |    |
|                        |                          |               |              |           |                |                |                |                |                |                |    |
|                        |                          |               |              |           |                |                |                |                |                |                |    |
|                        |                          |               |              |           |                |                |                |                |                |                |    |

\*Identify the plane at which the C-measurements are taken (e.g., at bumper, above bumper, at sill, above sill, at beltline, etc.) or label adjustments (e.g., free space).

Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

\*\*Measure and document on the vehicle diagram the beginning or end of the direct damage width and field L (e.g., side damage with respect to undamaged axle.)

\*\*\*Measure and document on the vehicle diagram the location of the maximum crush.

Note: Use as many lines/columns as necessary to describe each damage profile.

**DAMAGE DESCRIPTION**

**Tire—Wheel Damage**

a. Rotation physically restricted

RF 1  
LF 1  
RR 2  
LR 2

b. Tire deflated

RF 2  
LF 2  
RR 2  
LR 2

(1) Yes, (2) No, (8) NA, (9) Unk.

**TYPE OF TRANSMISSION**

☒ Manual ☐ Automatic

Average Track: —

Maximum Width: —

Test Curb Weight: 3590

Overall Length: 191.5

Wheel Base: 104.3

Engine Size: cyl. —

displ. —

**WHEEL STEER ANGLES**

(For locked front wheels or displaced rear axles only)

RF ± 00°

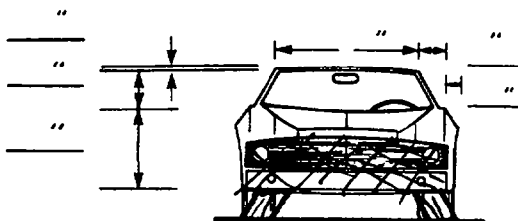
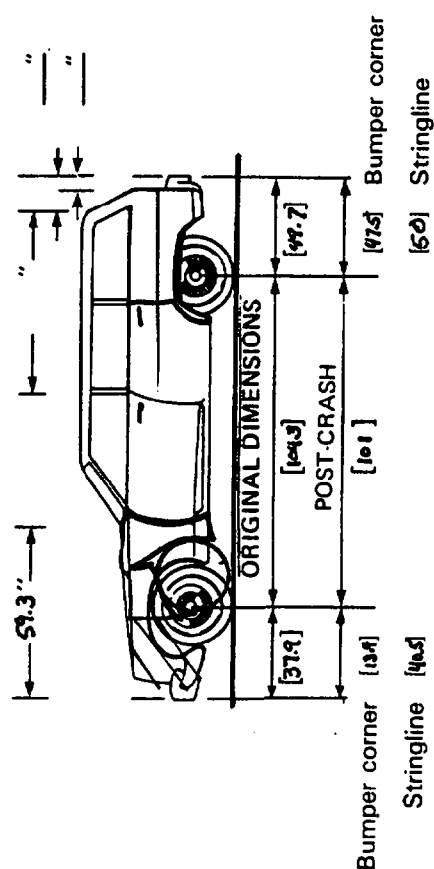
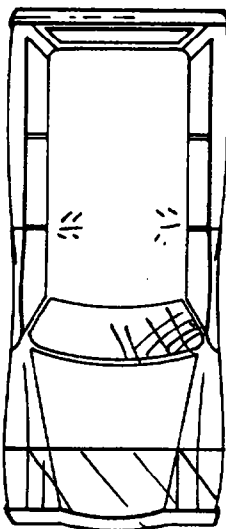
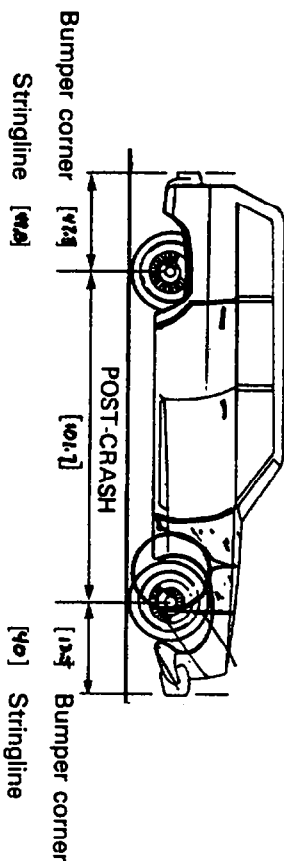
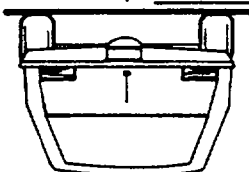
LF ± 00°

RR ± N/A°

LR ± N/A°

Within ± 5 degrees

1985 Volvo WAGON



**Note:** Sketch new perimeter and cross hatch direct damage and single hatch induced damage on all views. Annotate observations which might be useful in reconstructing the accident (e.g., grass in tire bead, direction of striations, scuff on sidewall, etc.) If pulling trailer sketch type of trailer and damage received on the back of this page. Annotate any damage caused by extrication such as component removal by torching, prying or hydraulic shears. If the vehicle contacted a pedestrian, complete page 6R.

APPENDIX A  
PHOTOGRAPHS

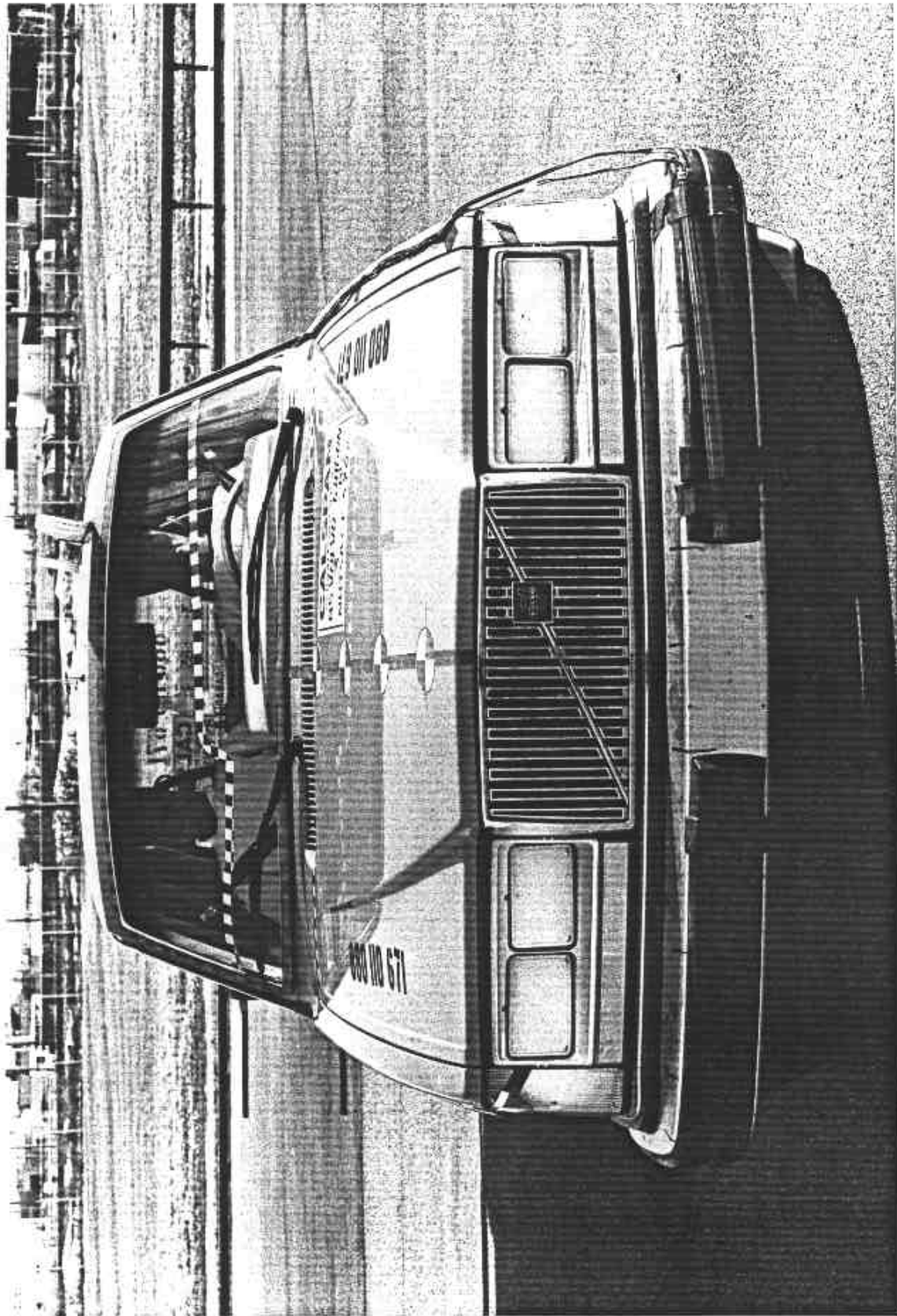


Figure A-1 PRE-TEST FRONT VIEW

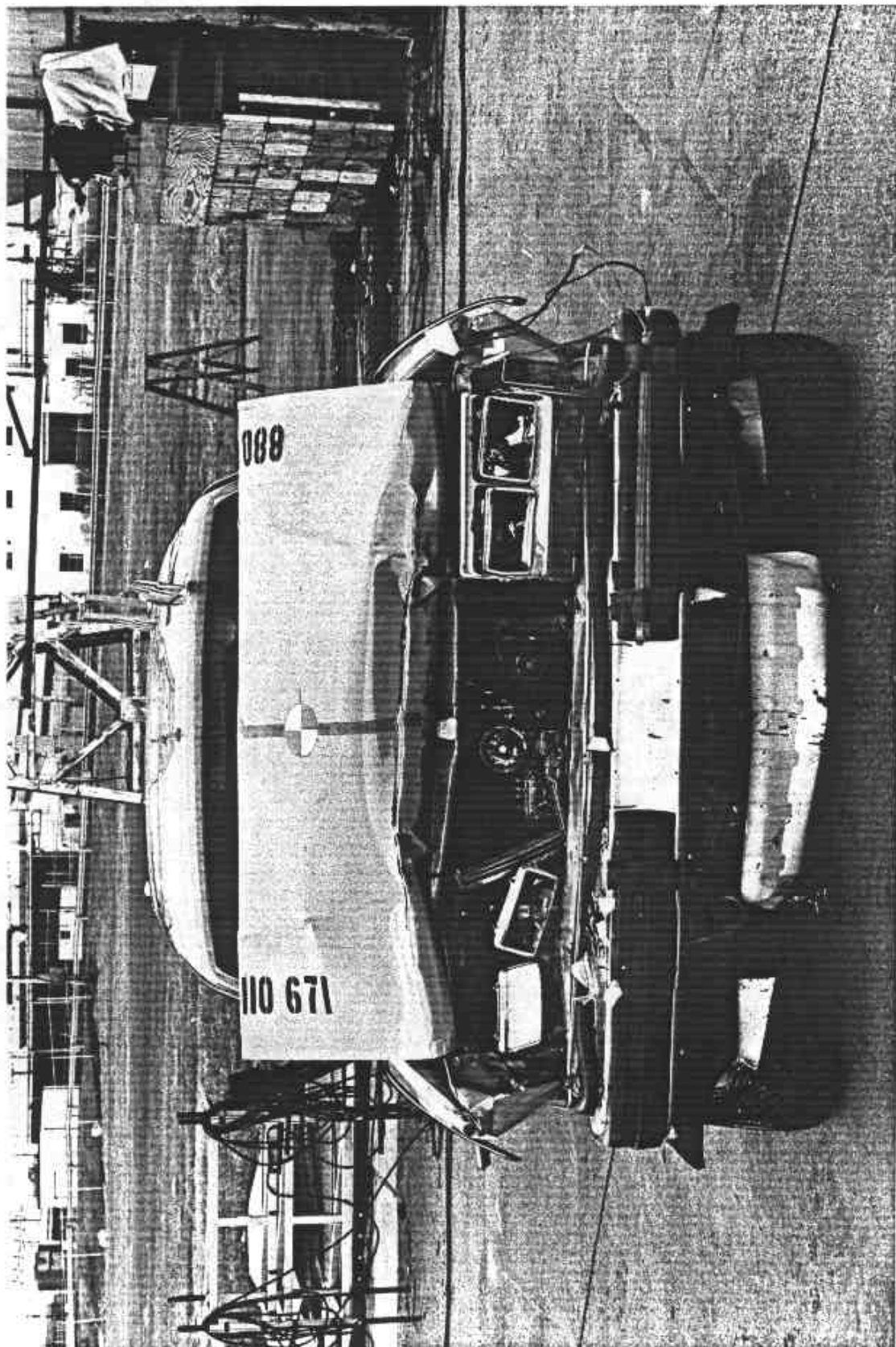


Figure A-2 POST-TEST FRONT VIEW



Figure A-3 PRE-TEST LEFT SIDE VIEW



Figure A-4 POST-TEST LEFT SIDE VIEW

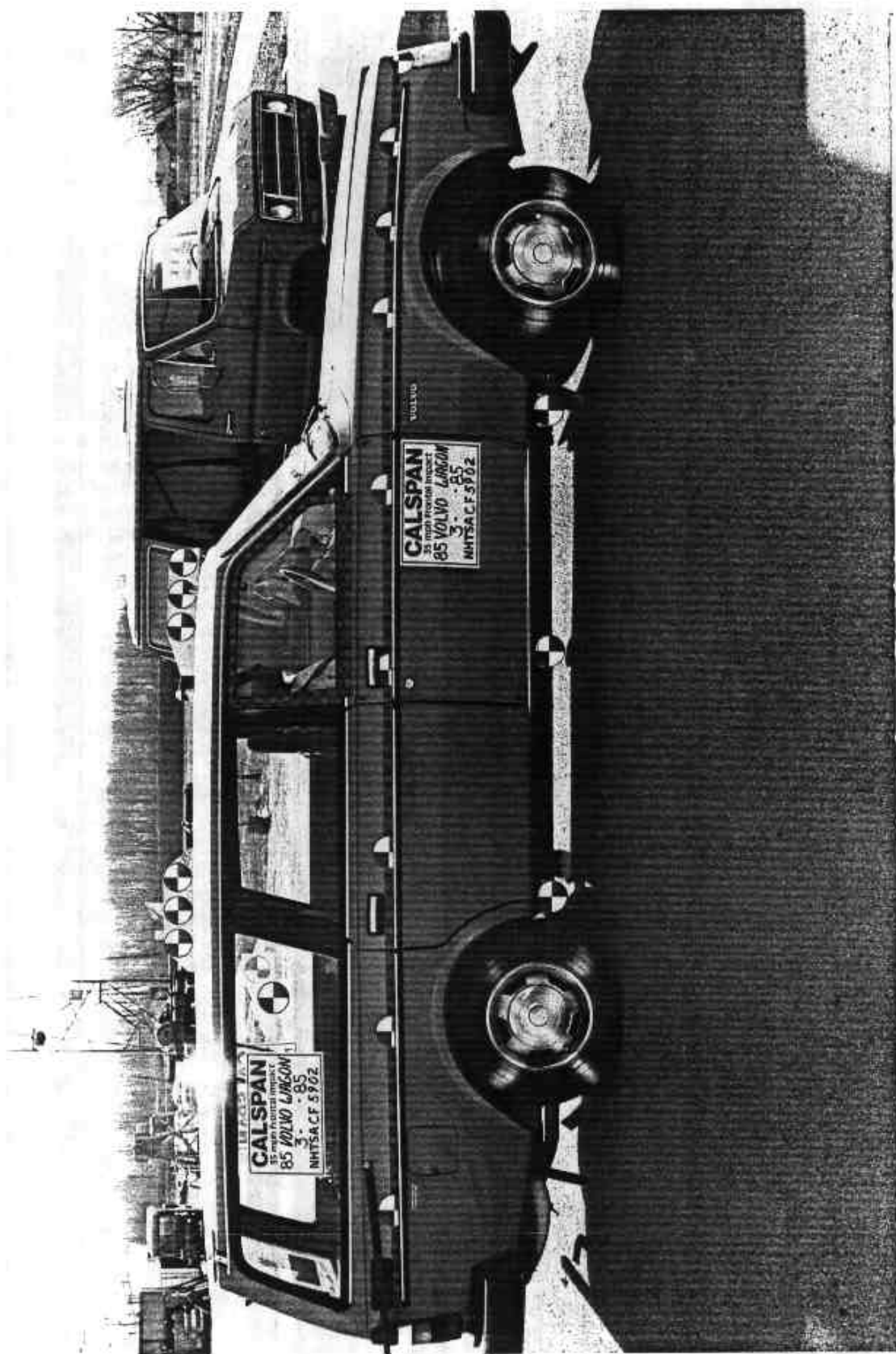


Figure A-5 PRE-TEST RIGHT SIDE VIEW

A-6

7333-11

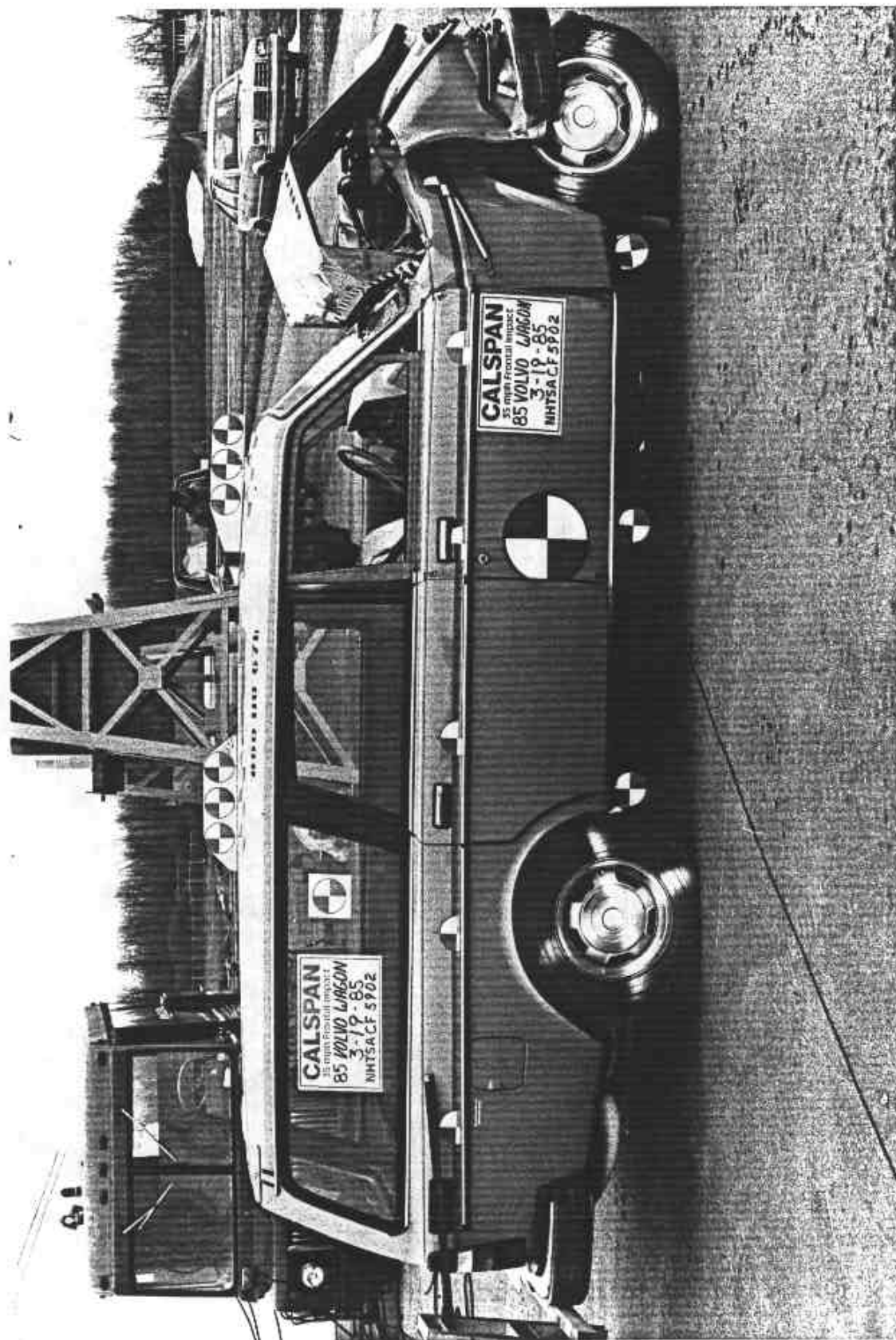


Figure A-6 POST-TEST RIGHT SIDE VIEW



Figure A-7 PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

A-8

7333-11



Figure A-8 POST-TEST RIGHT FRONT THREE-QUARTER VIEW



Figure A-9 PRE-TEST LEFT REAR THREE-QUARTER VIEW

A-10

7333-11



Figure A-10 POST-TEST LEFT REAR THREE-QUARTER VIEW

A-11

7333-11

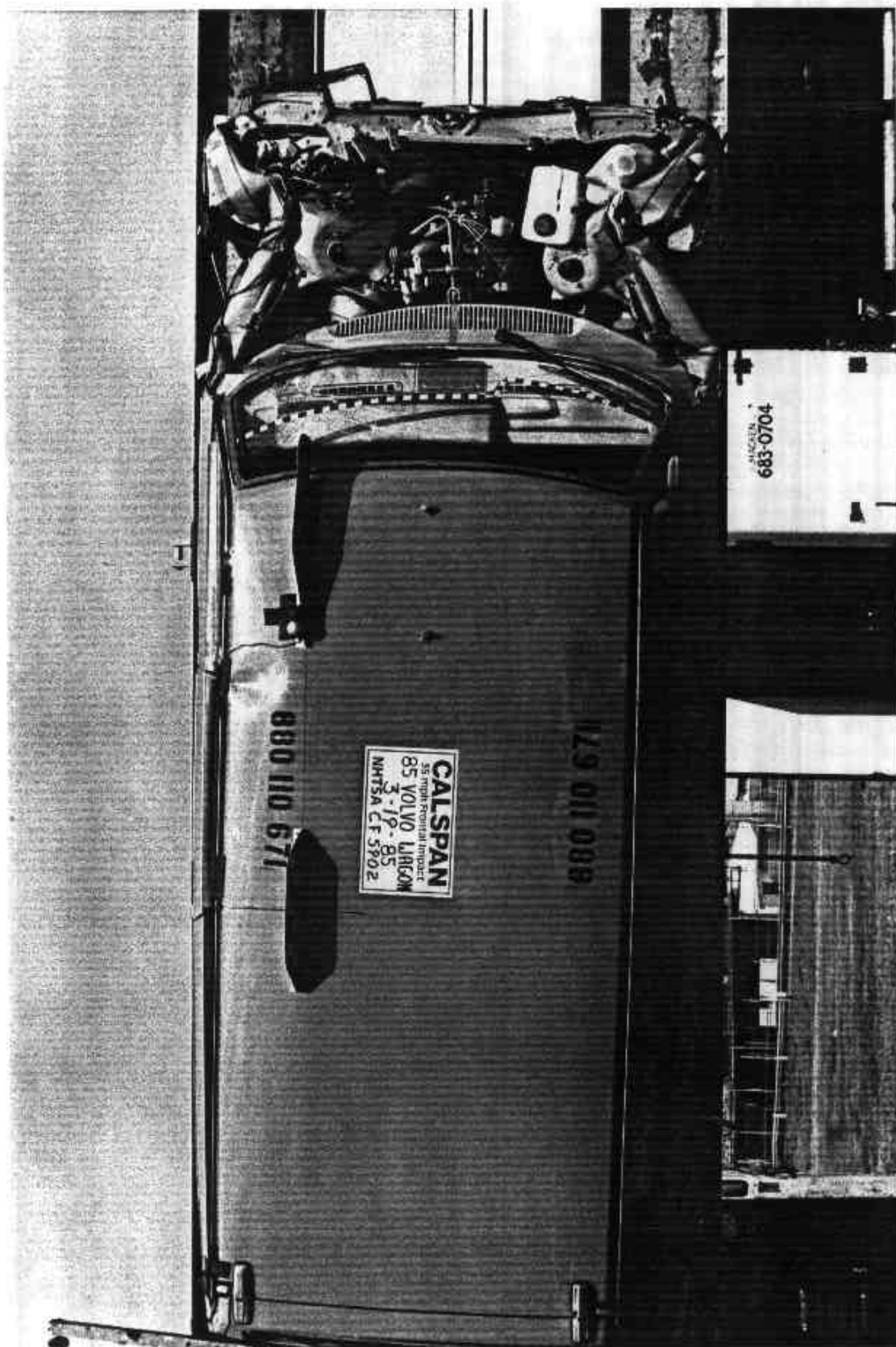


Figure A-11 POST-TEST TOP VIEW

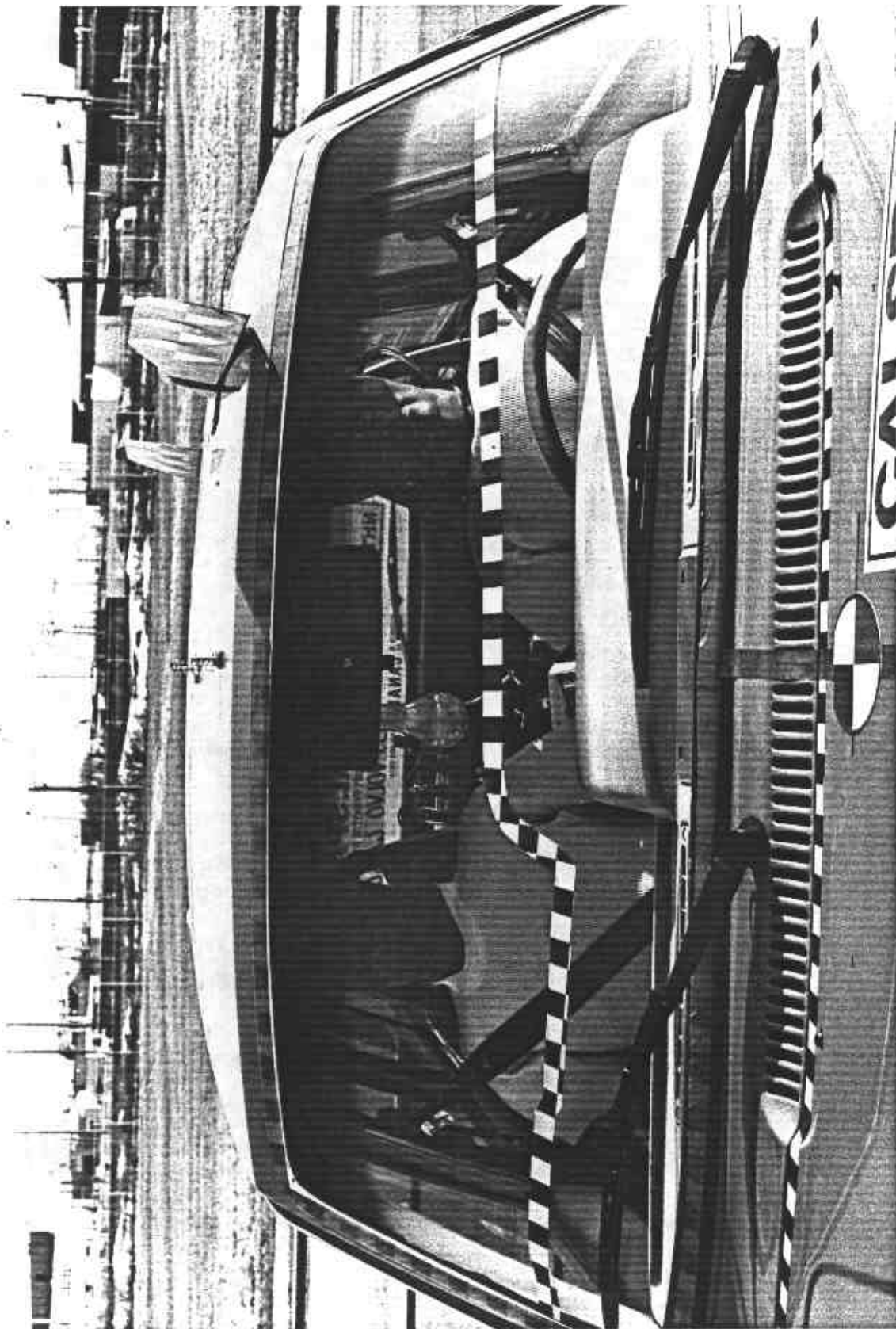


Figure A-12 PRE-TEST WINDSHIELD VIEW

A-13

7333-11

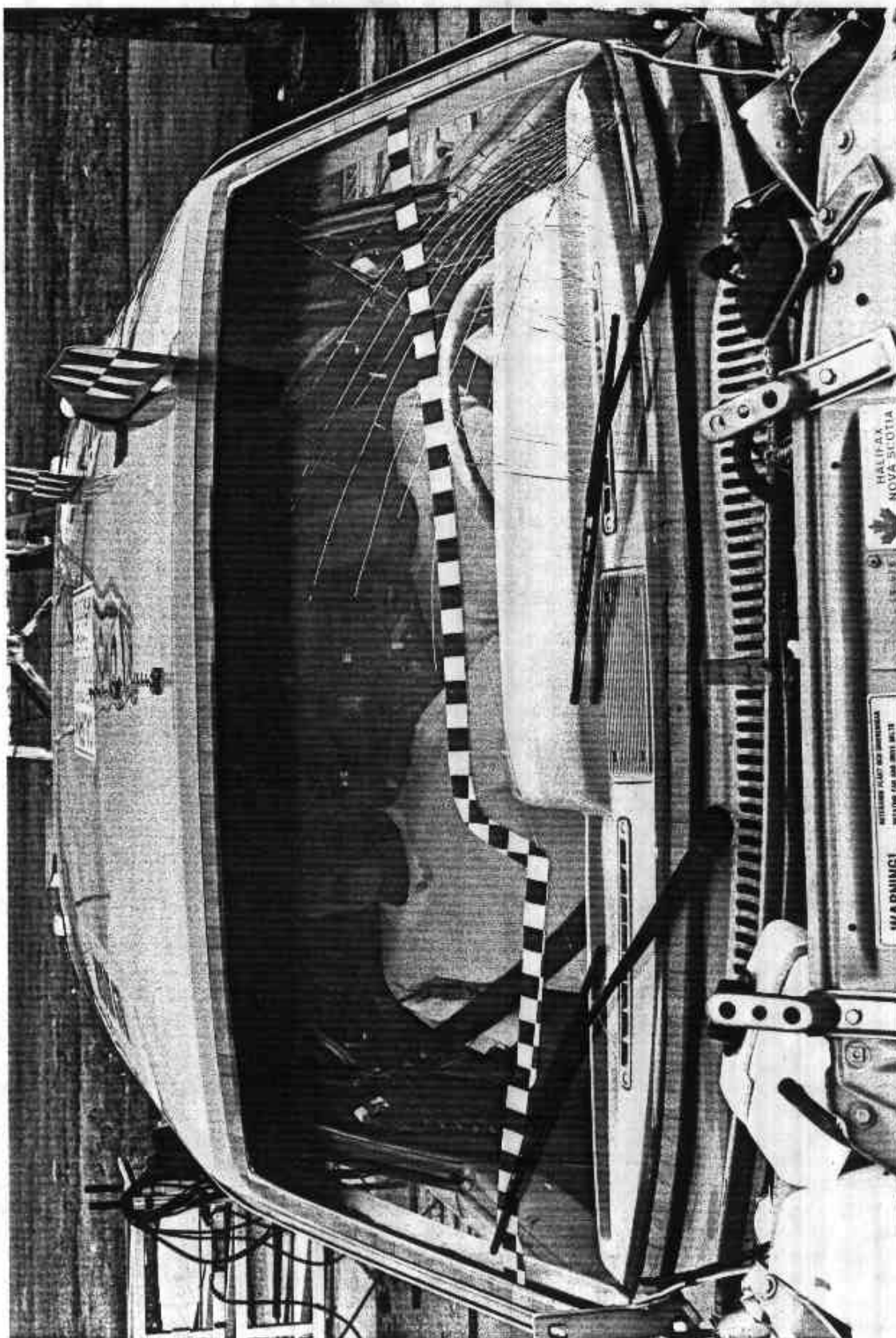


Figure A-13 POST-TEST WINDSHIELD VIEW

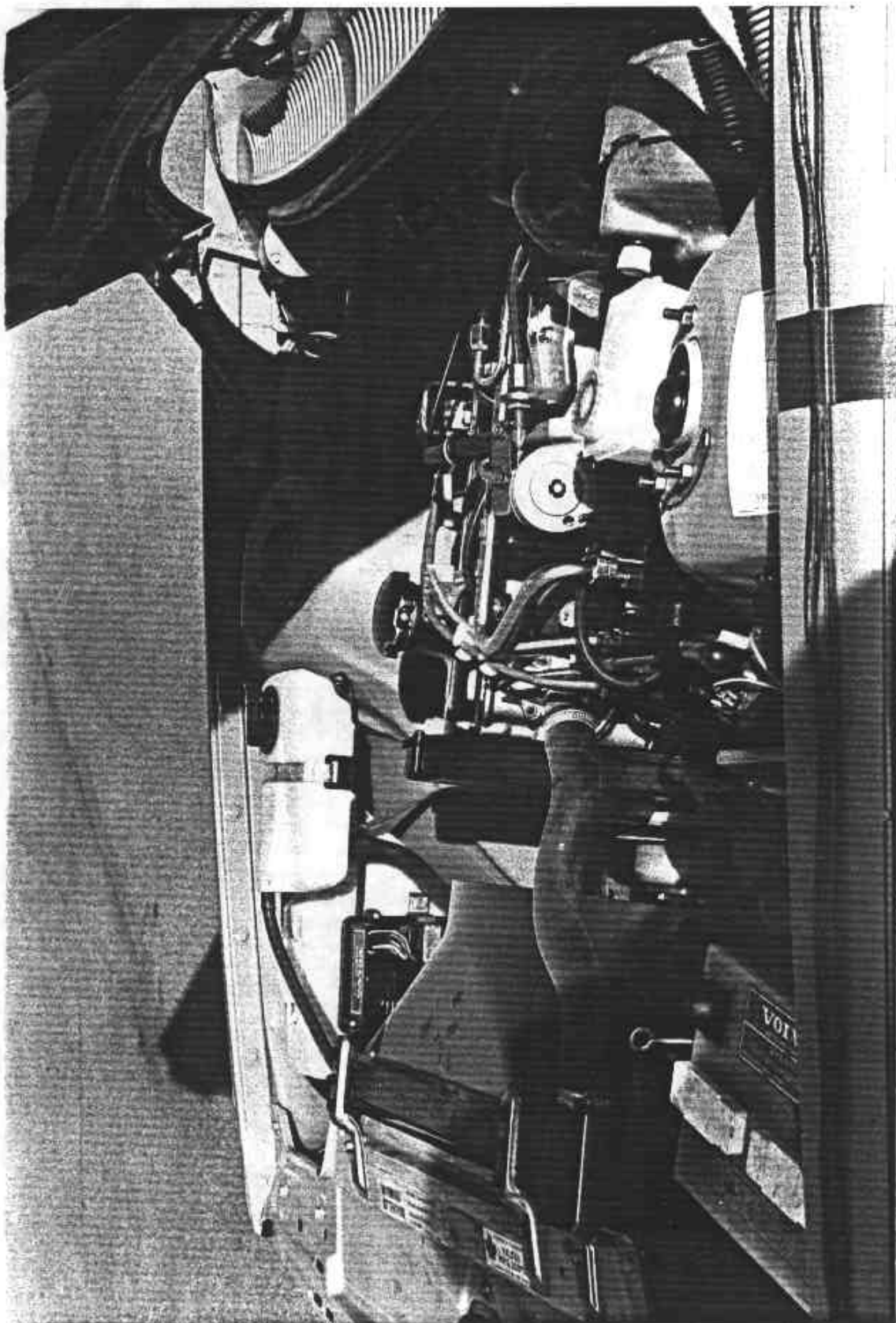


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-15

7333-11

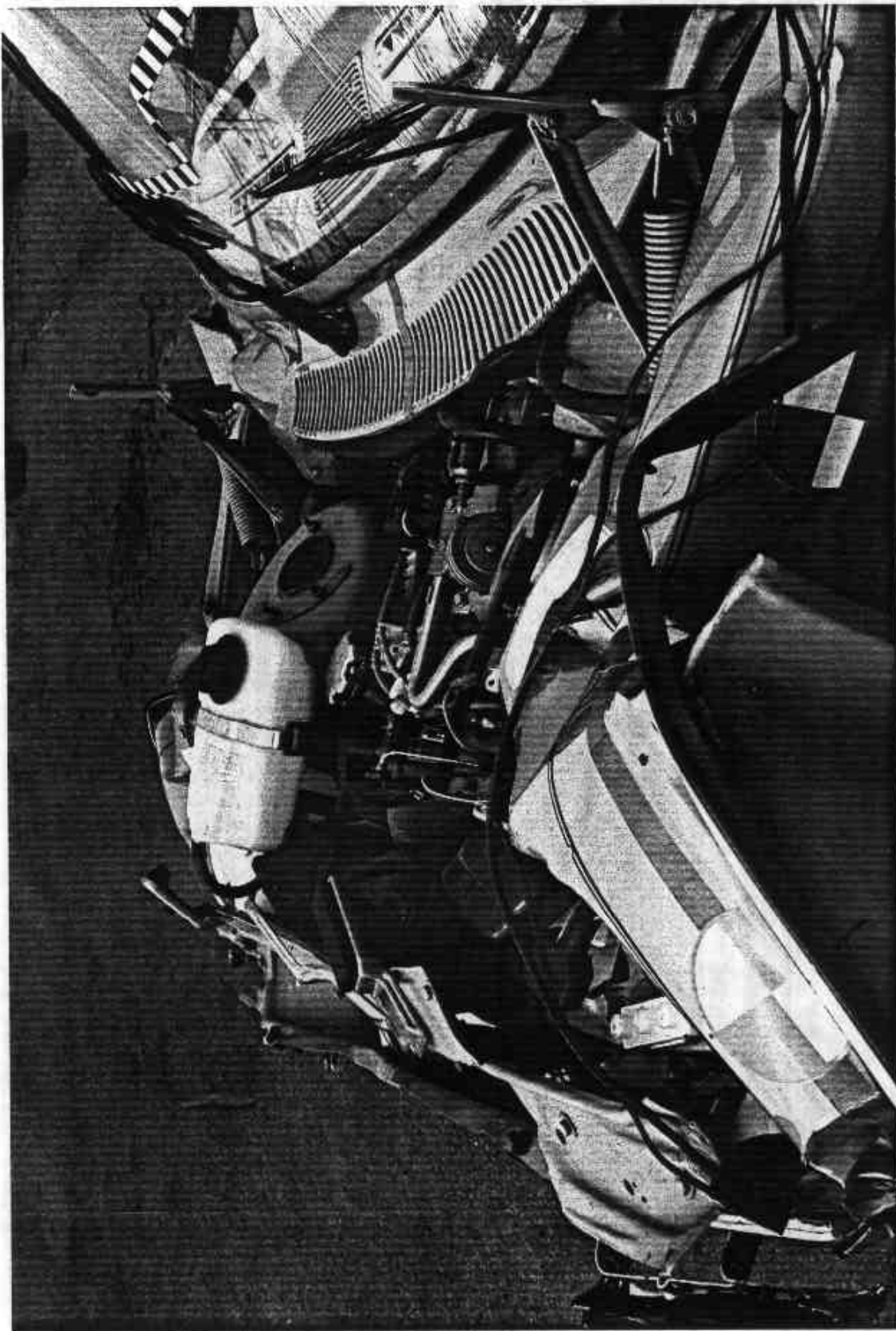


Figure A-15 POST-TEST ENGINE COMPARTMENT VIEW

A-16

7333-11

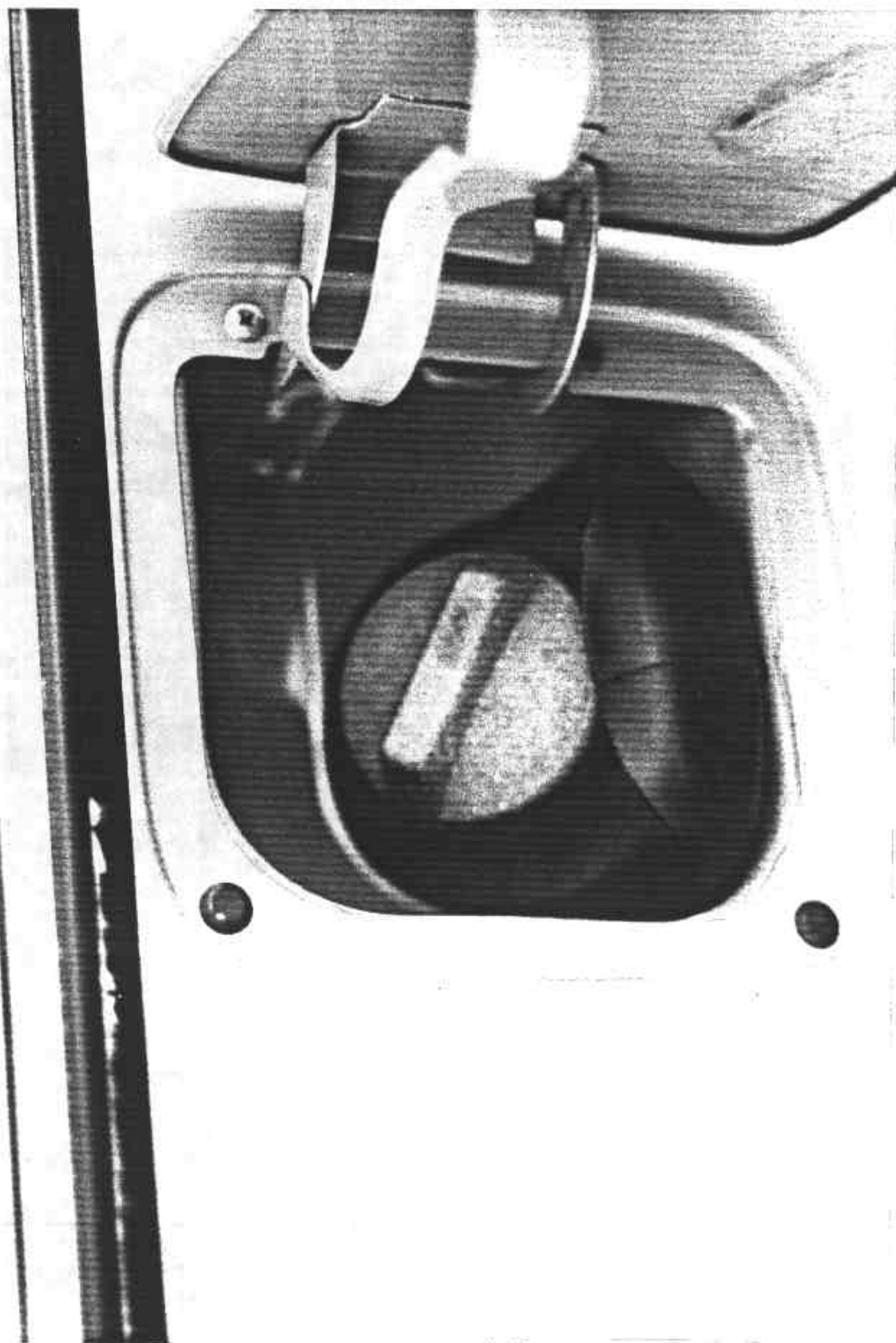


Figure A-16 PRE-TEST FUEL FILLER CAP VIEW

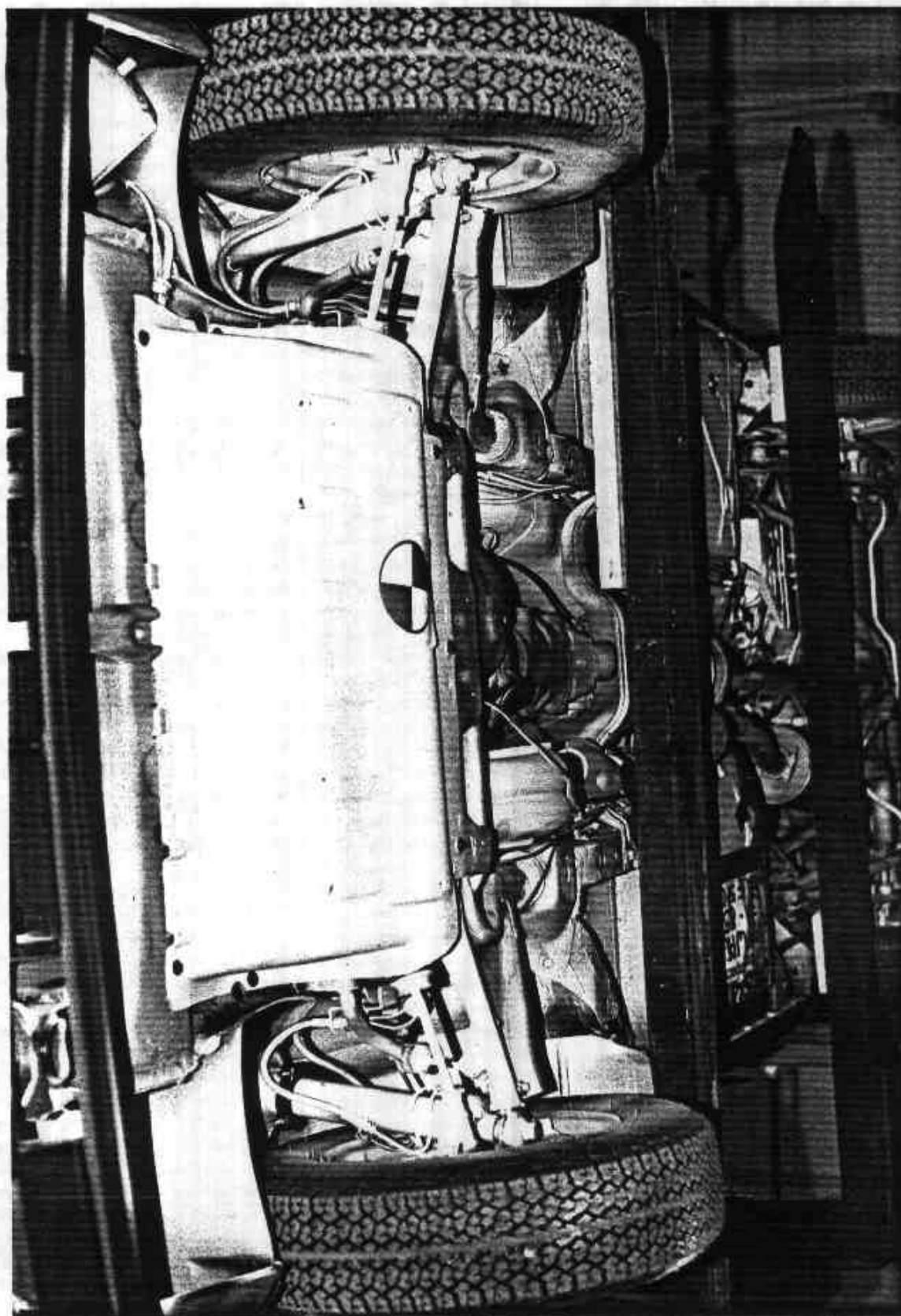


Figure A-17 PRE-TEST FRONT UNDERBODY VIEW

A-18

7333-11

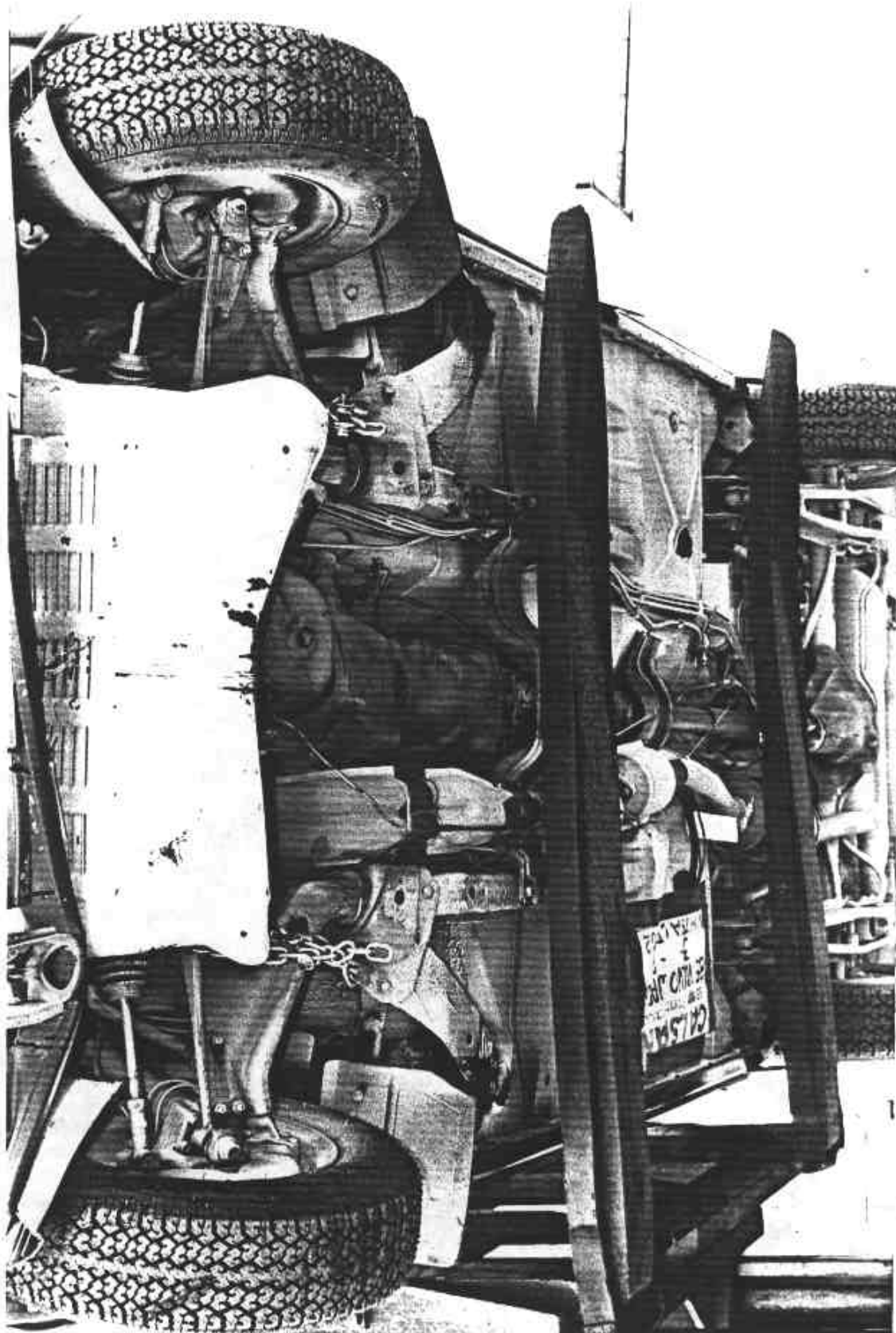


Figure A-18 POST-TEST FRONT UNDERBODY VIEW

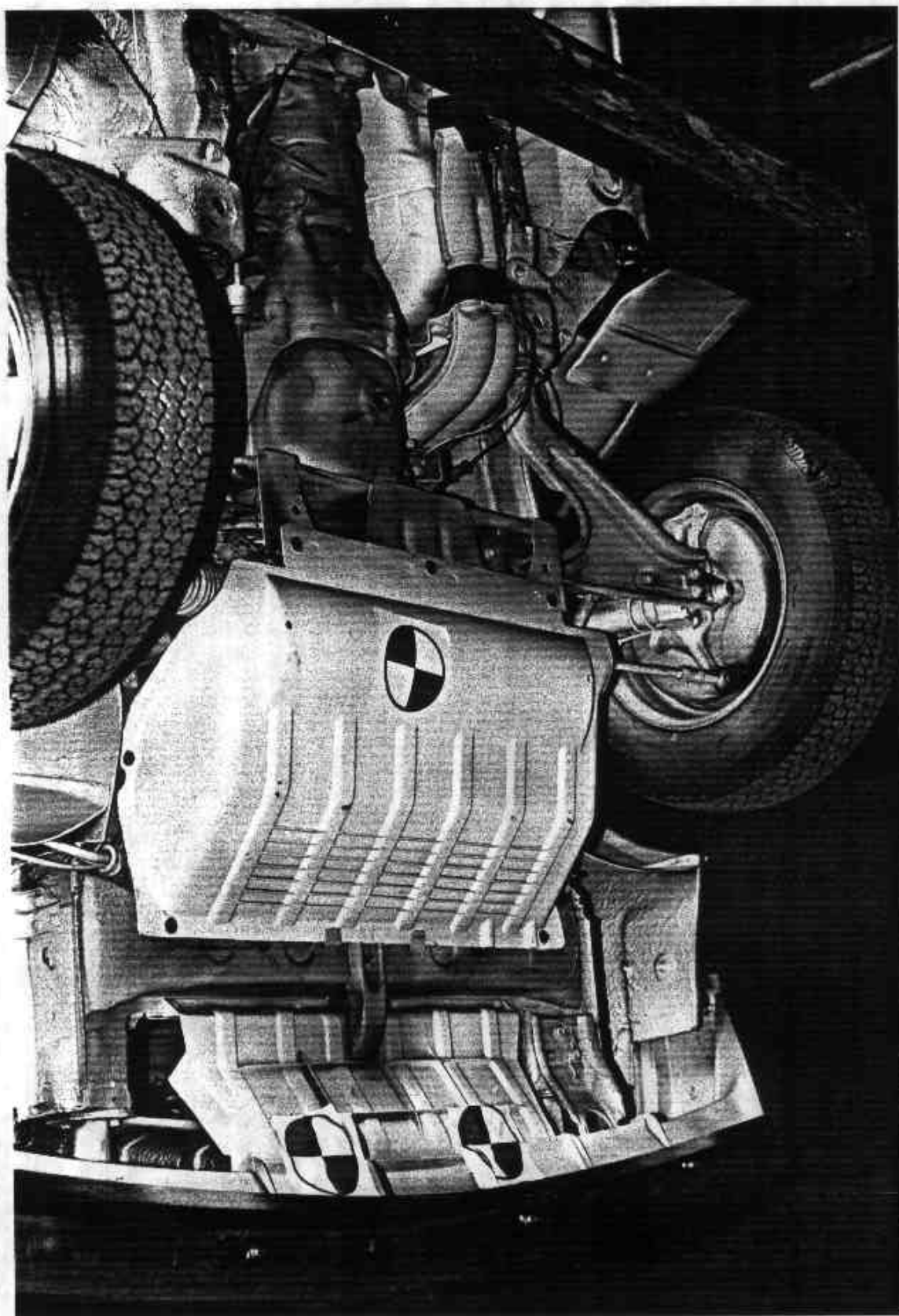


Figure A-19 PRE-TEST FRONT-SIDE UNDERBODY VIEW

A-20

7333-11



Figure A-20 POST-TEST FRONT-SIDE UNDERBODY VIEW

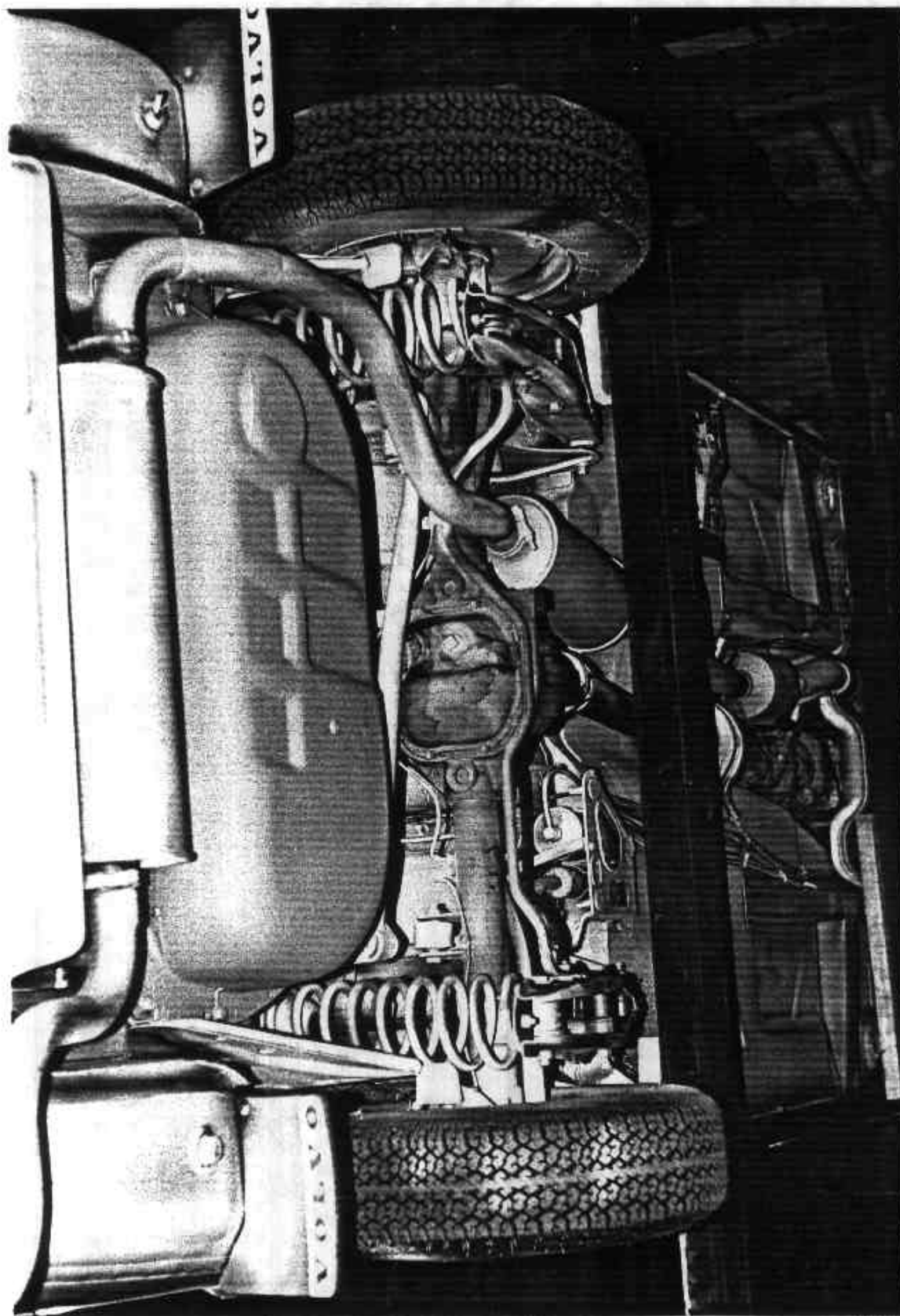


Figure A-21 PRE-TEST REAR UNDERBODY VIEW

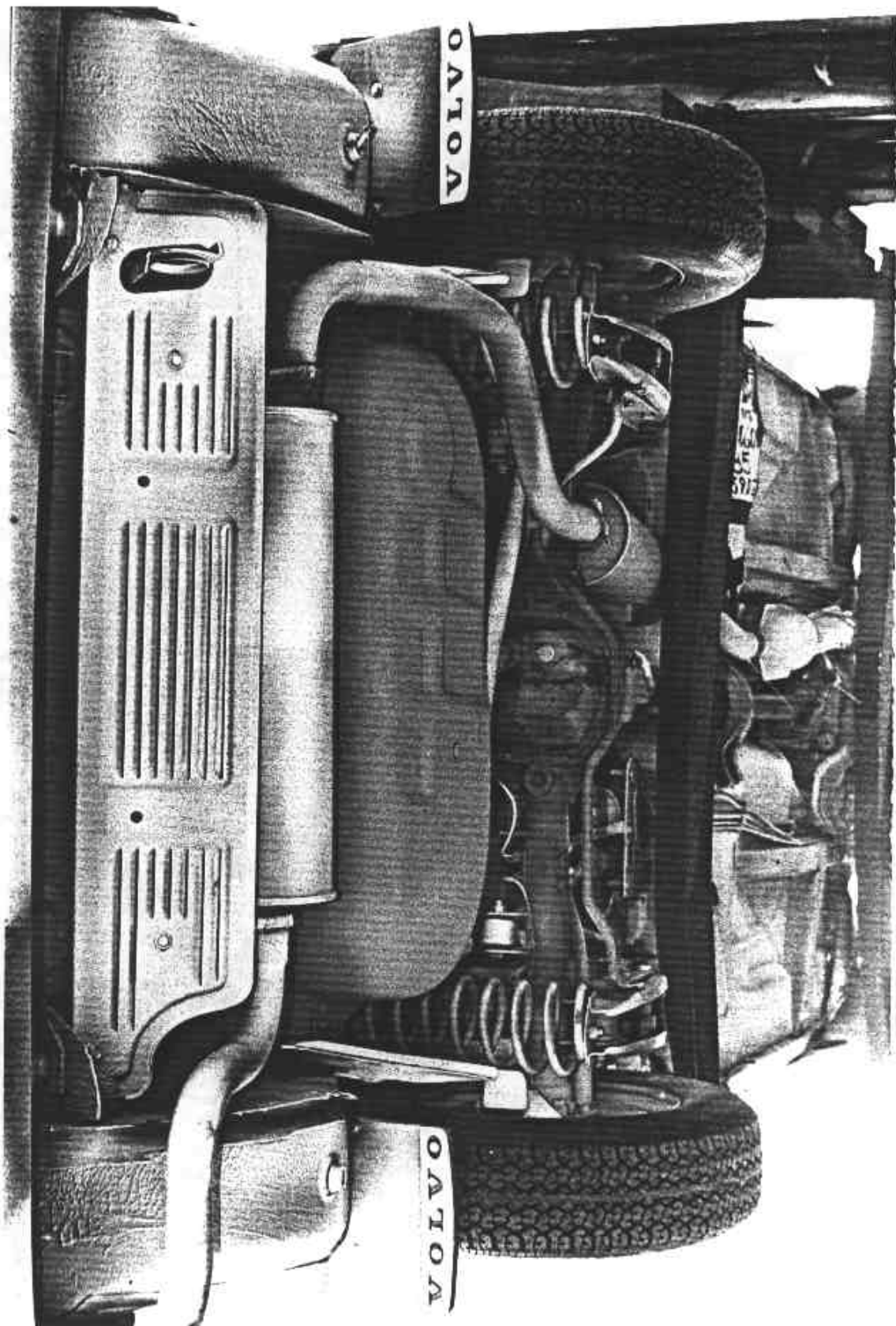


Figure A-22 POST-TEST REAR UNDERBODY VIEW

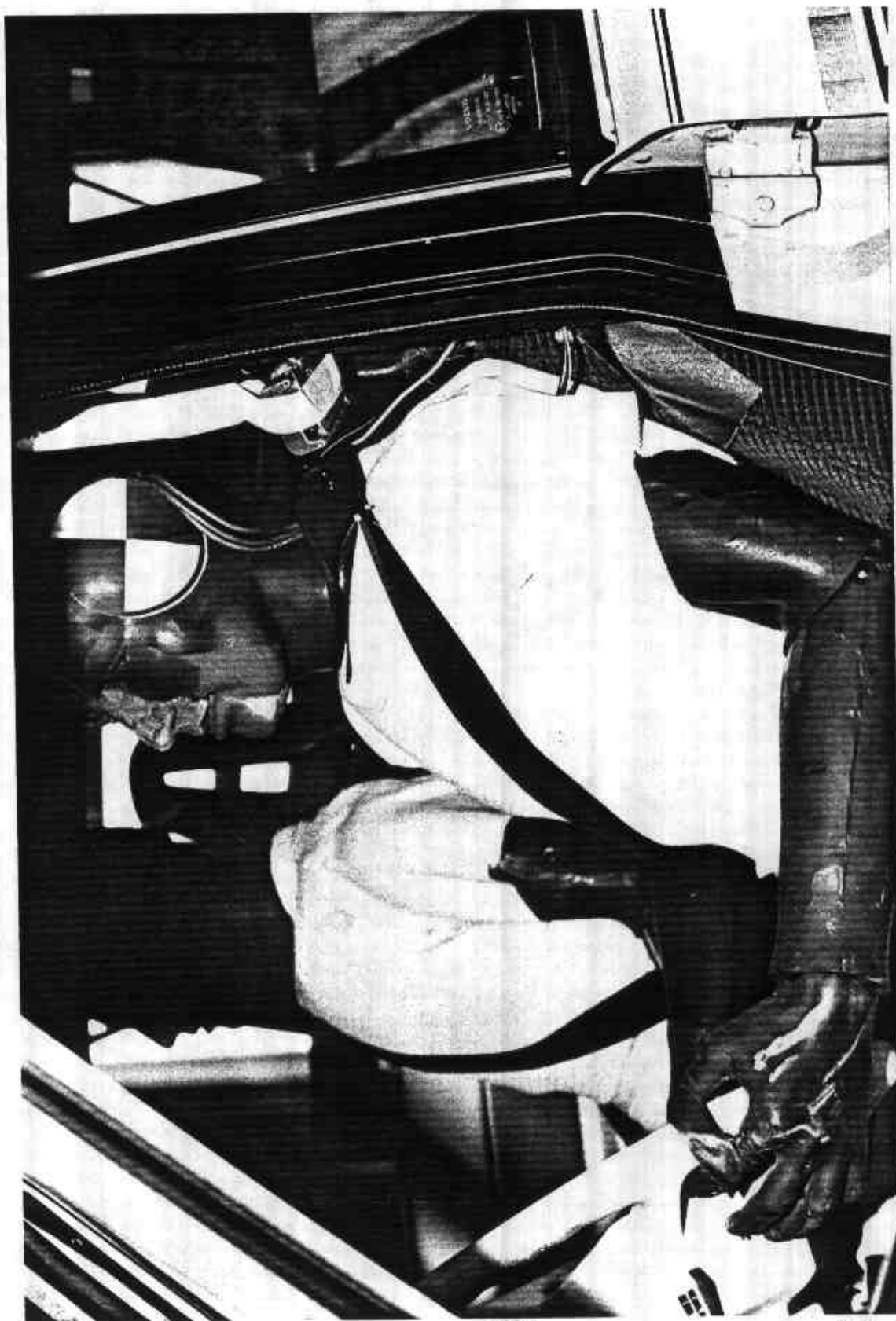


Figure A-23 PRE-TEST DRIVER POSITION VIEW

A-24

7333-11

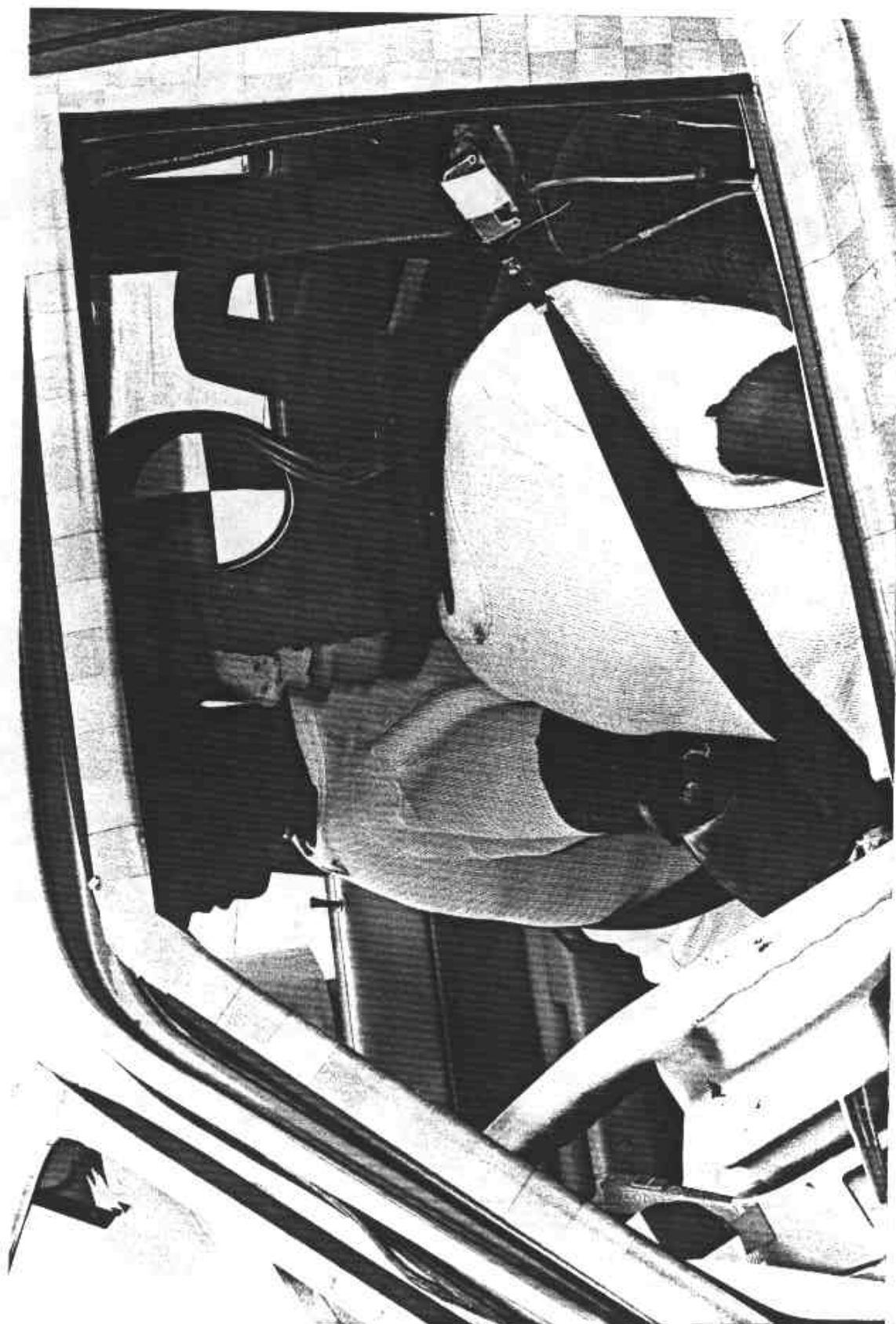


Figure A-24 POST-TEST DRIVER POSITION VIEW

A-25

7333-11



Figure A-25 PRE-TEST PASSENGER POSITION VIEW



Figure A-26 POST-TEST PASSENGER POSITION VIEW



Figure A-27 PRE-TEST DRIVER AND INTERIOR VIEW

A-28

7333-11



Figure A-28 POST-TEST DRIVER AND INTERIOR VIEW

A-29

7333-11

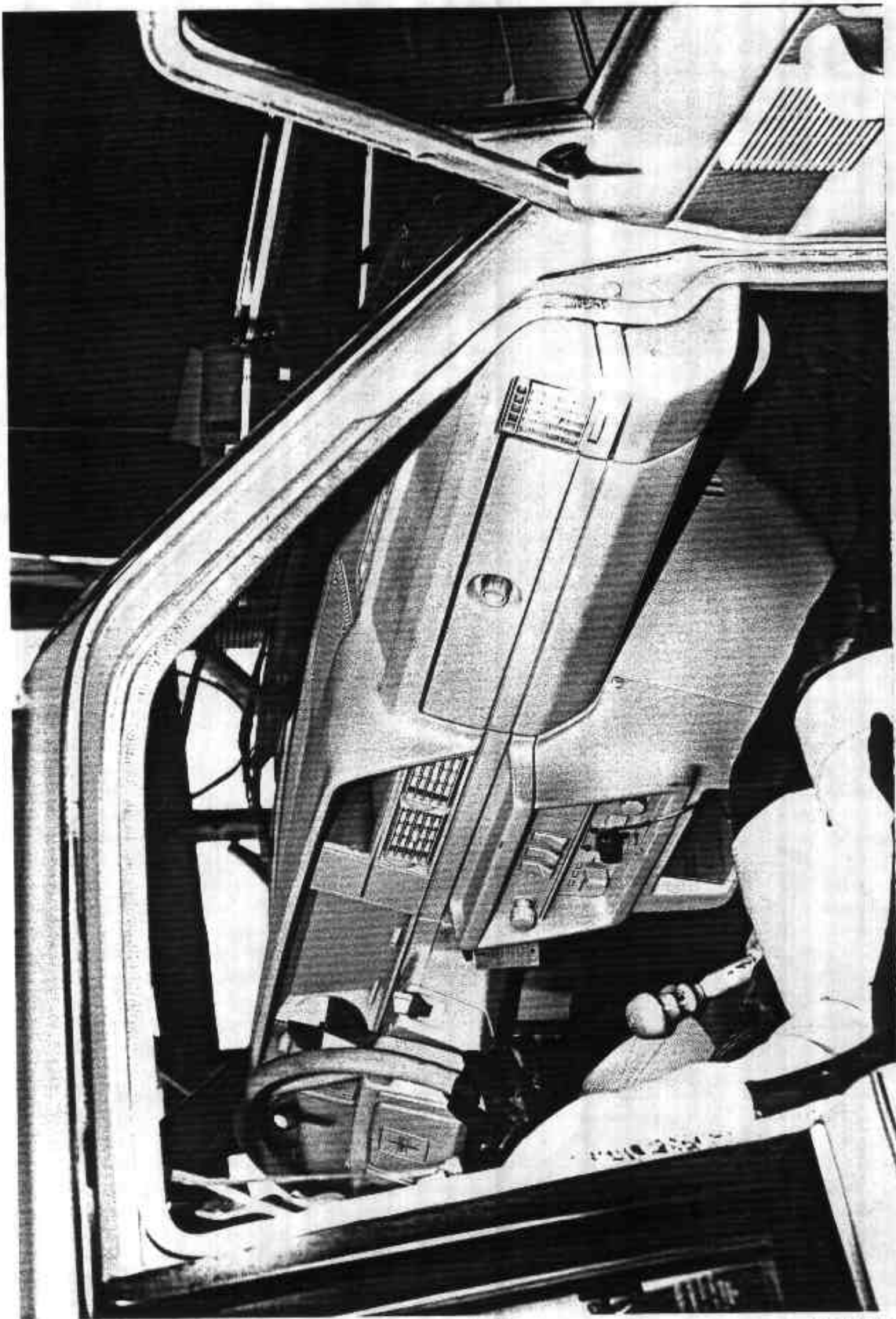


Figure A-29 PRE-TEST PASSENGER AND INTERIOR VIEW

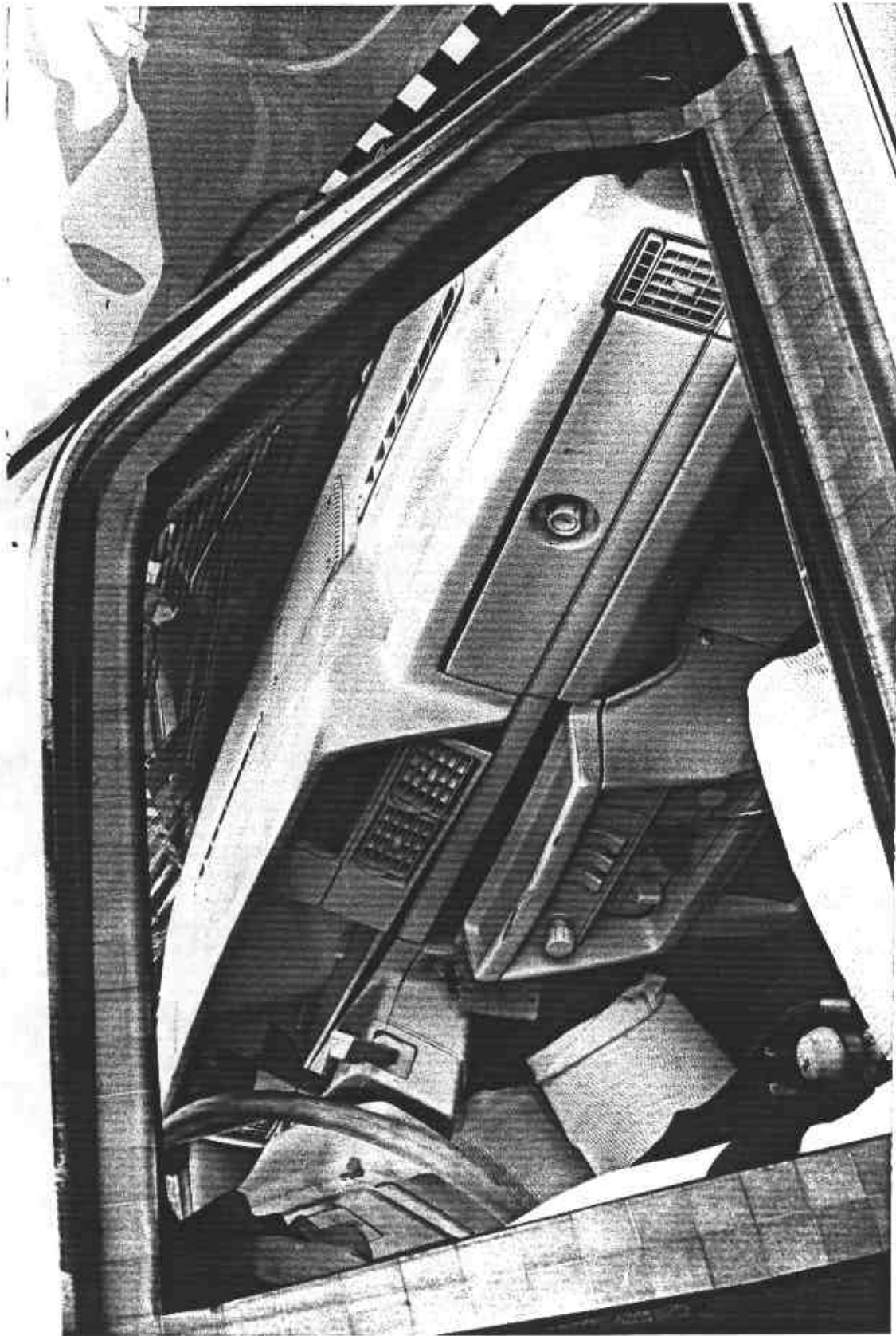


Figure A-30 POST-TEST PASSENGER AND INTERIOR VIEW

A-31

7333-11

APPENDIX B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

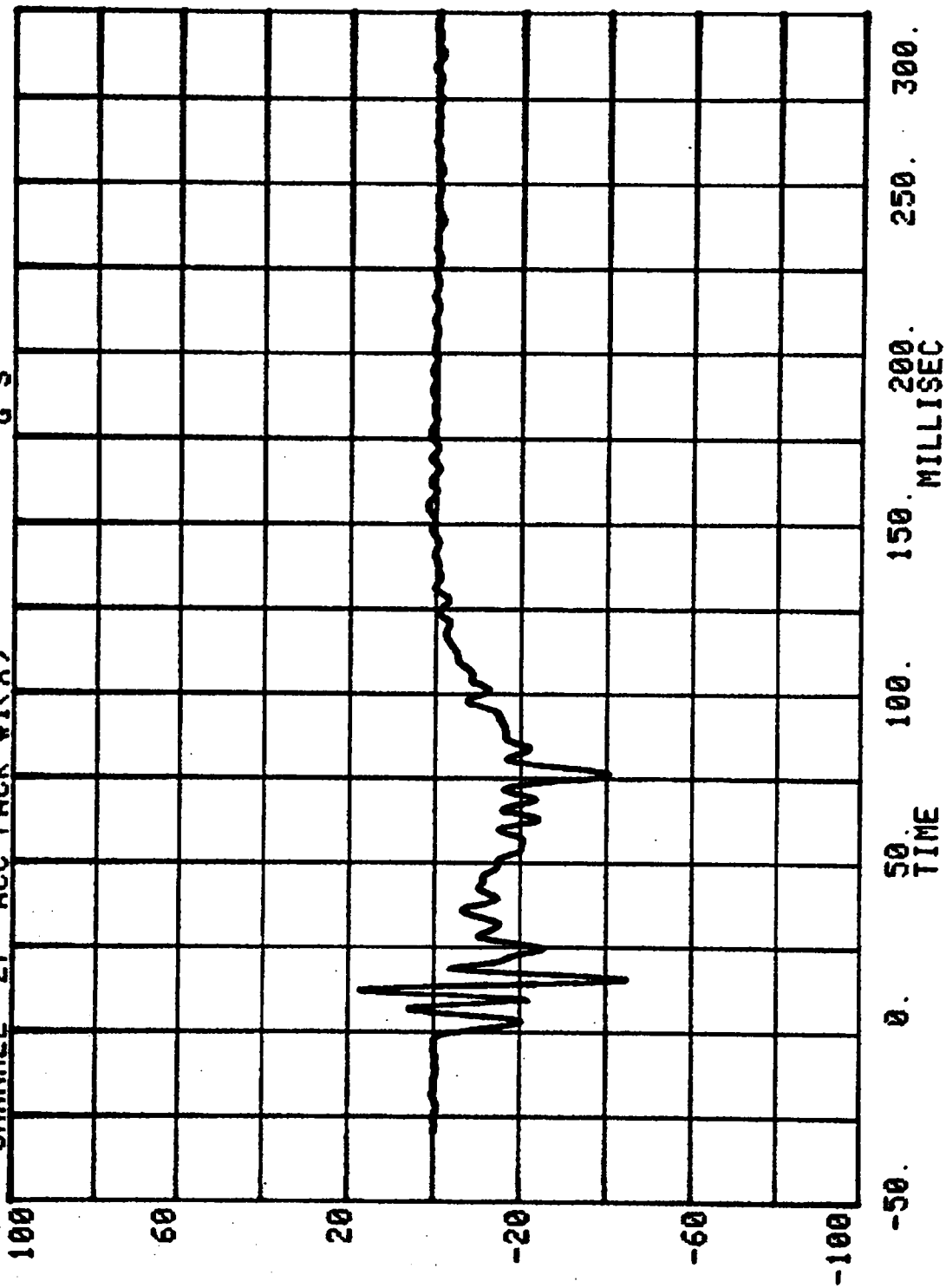
TEST NO. CF5901

VEHICLE DATA

FILTER CHANNEL CLASS

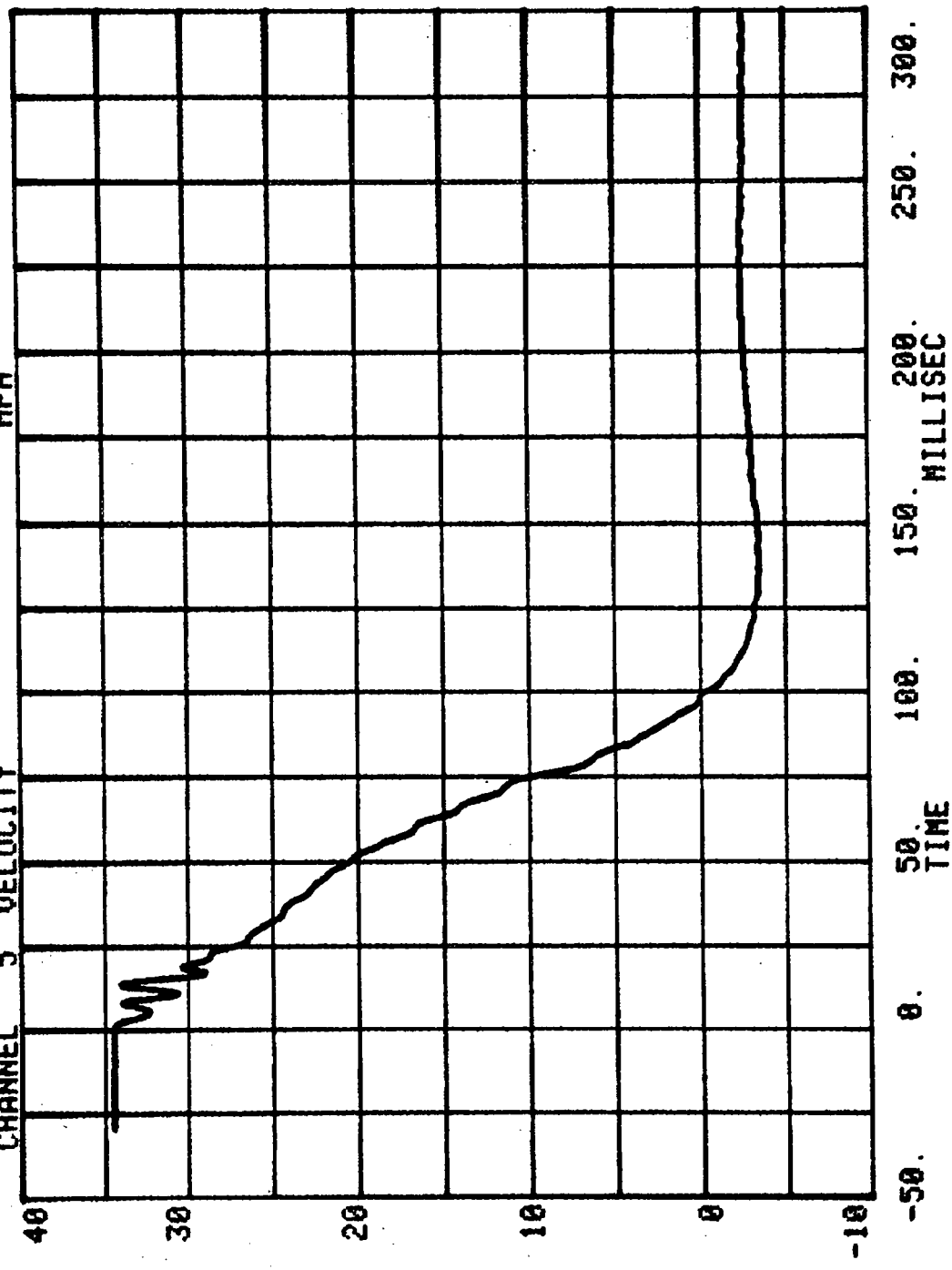
60

RUN= 671 SERIES= 5902 G'S  
CHANNEL 27 ACC PACK #1(X)

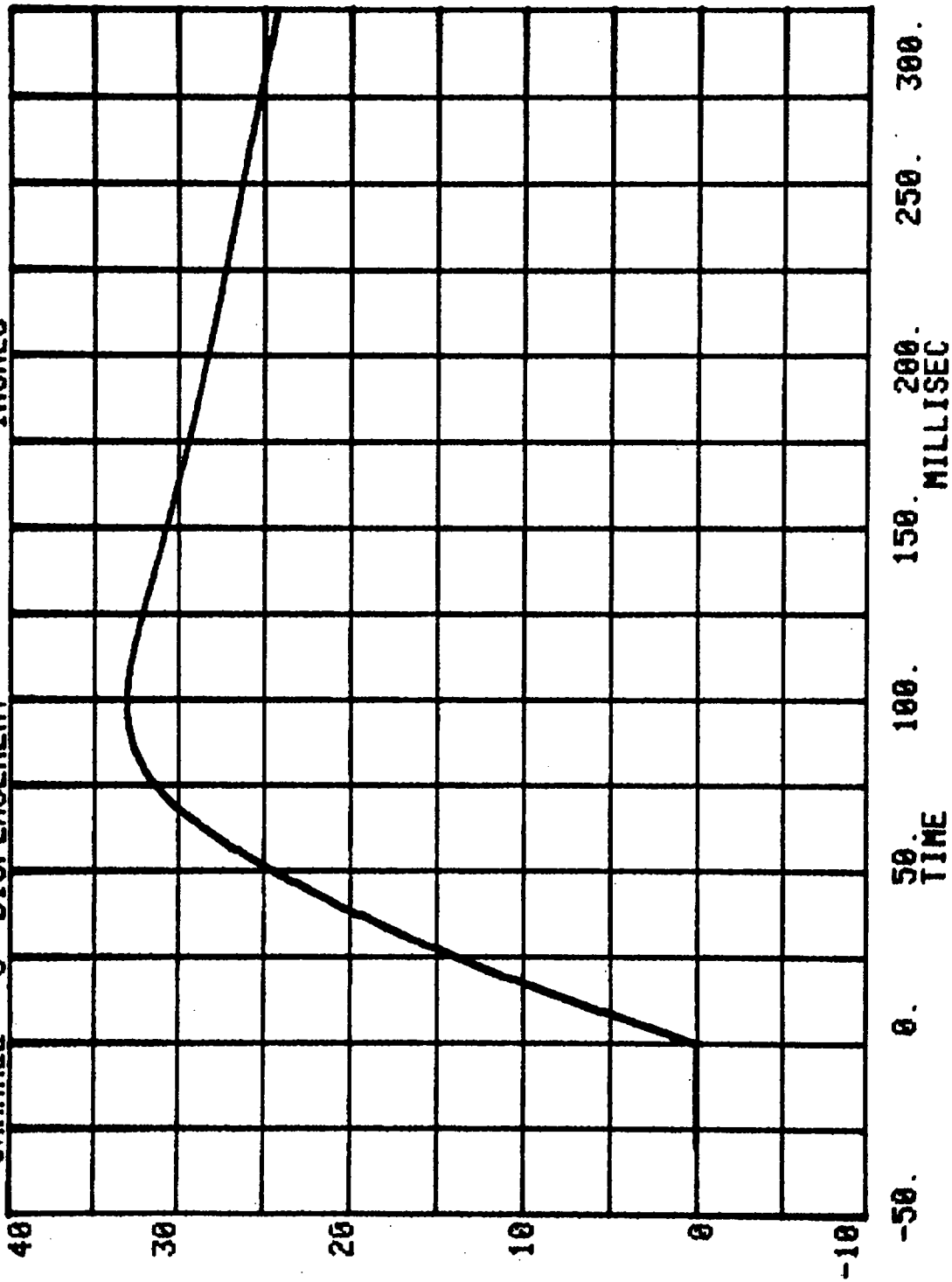


ACC. #1(X)

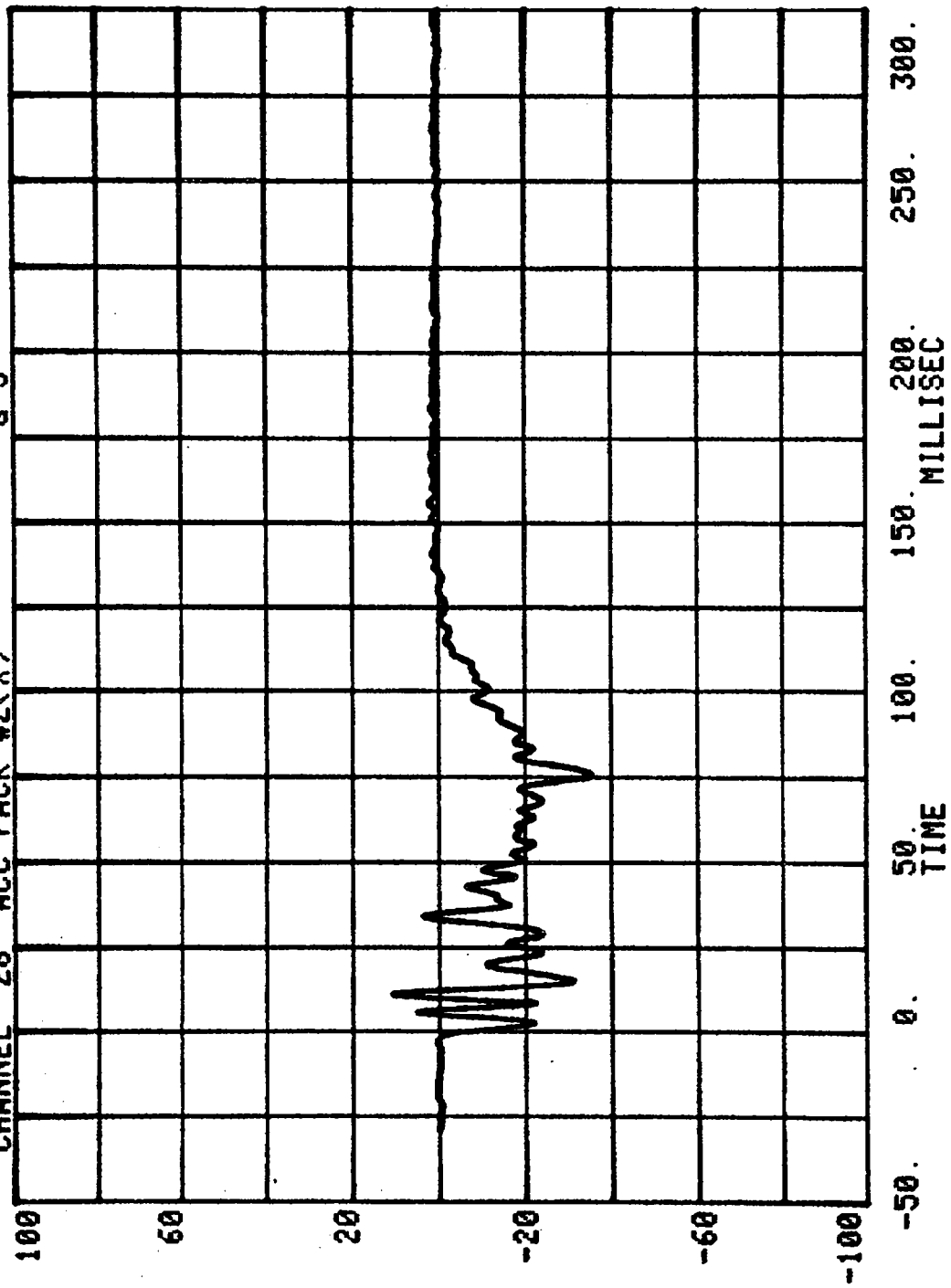
RUN= 671 SERIES= 5902  
CHANNEL 5 VELOCITY MPH

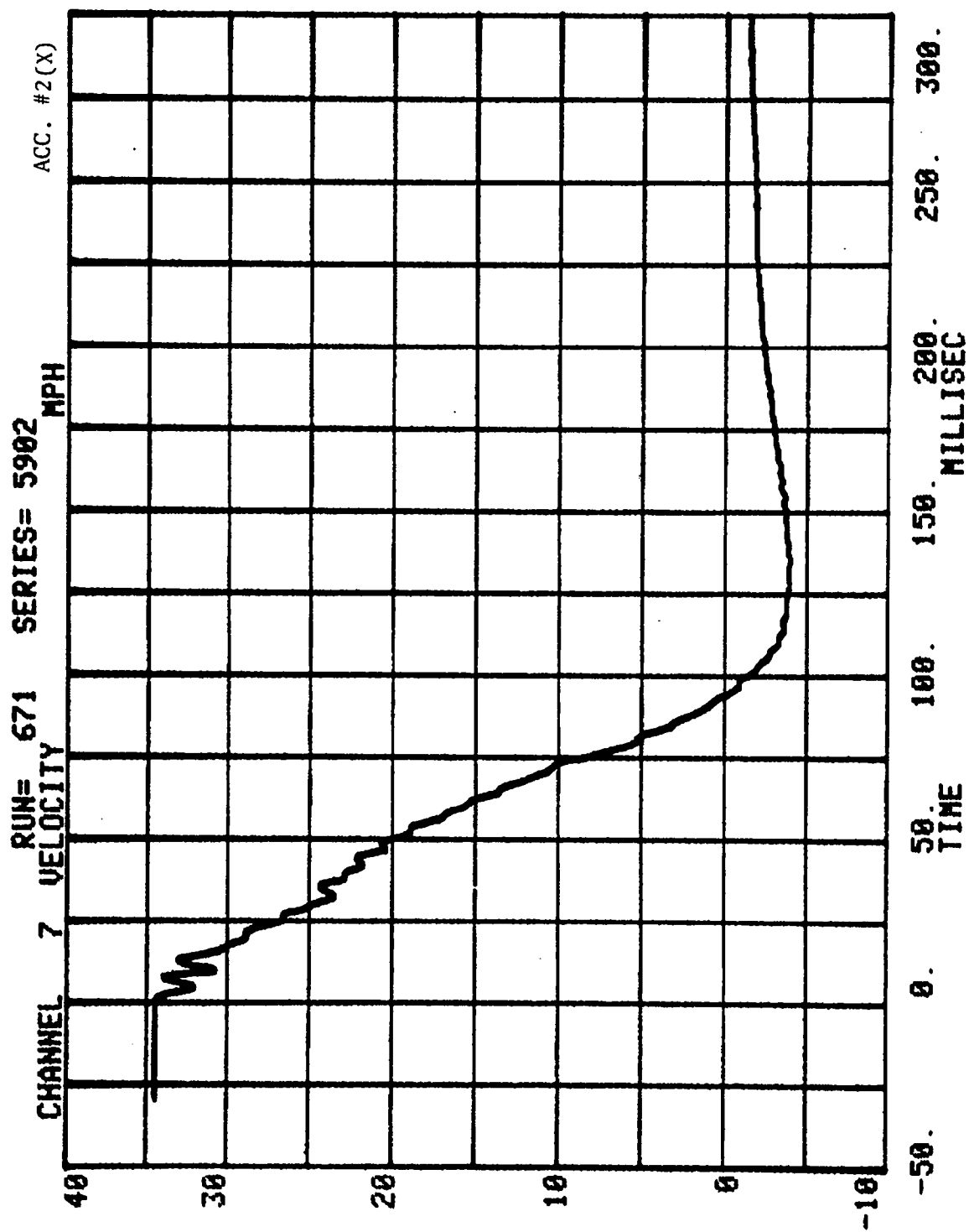


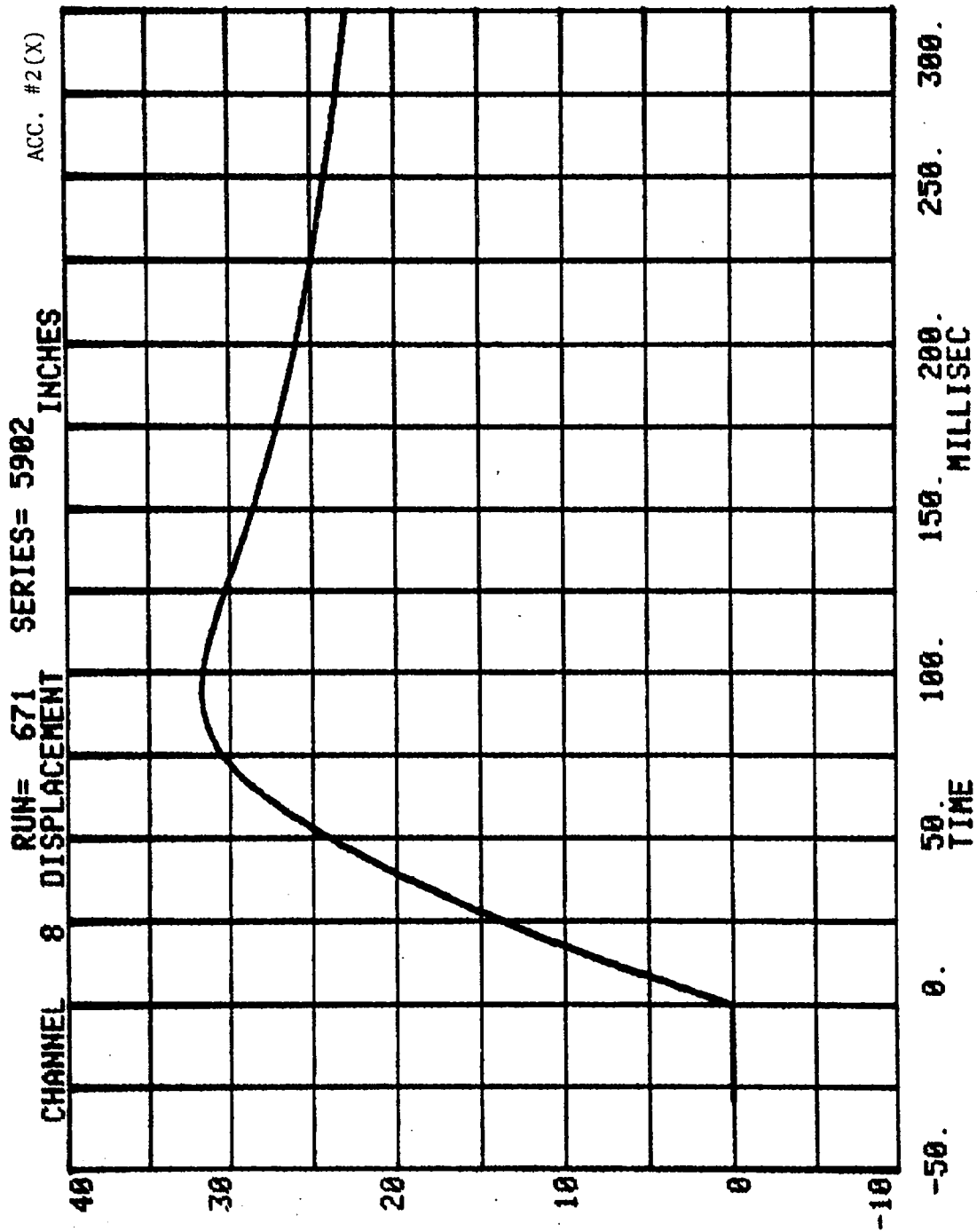
CHANNEL 6 DISPLACEMENT RUN= 671 SERIES= 5902 ACC. #1(X)



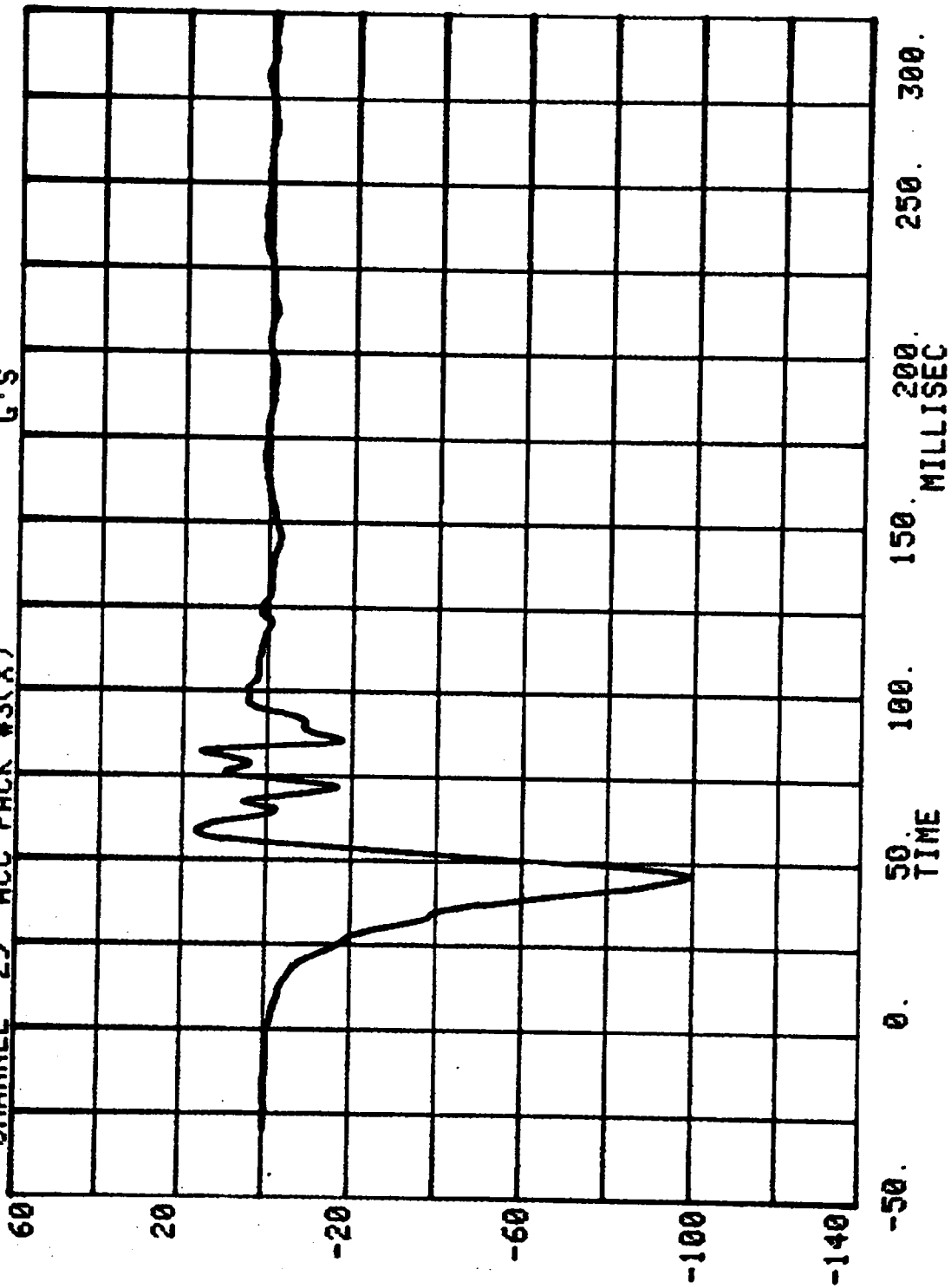
CHANNEL 28 ACC PACK #2(X) RUN= 671 SERIES= 5902 G'S

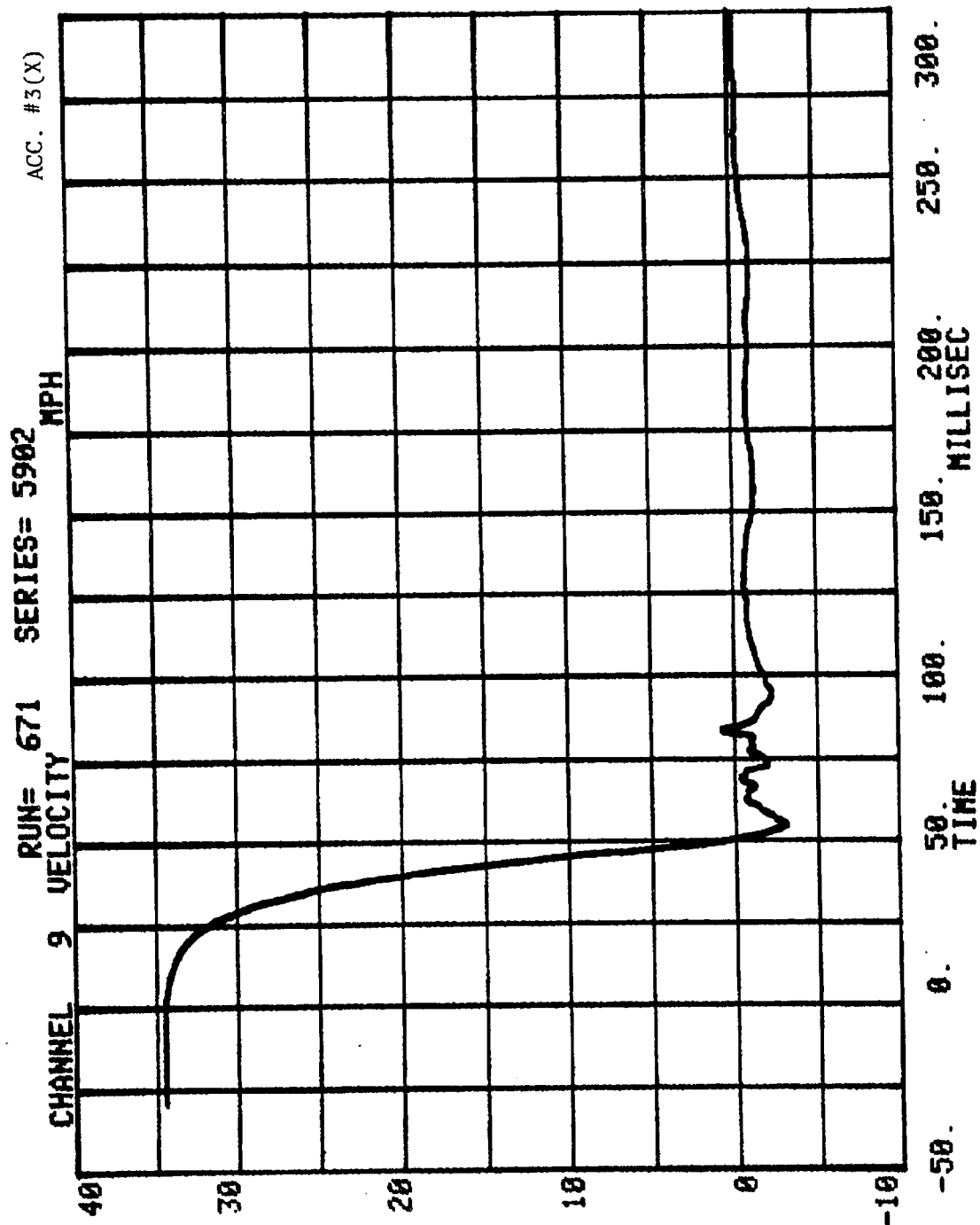






RUN= 671 SERIES= 5902 G'S  
CHANNEL 29 ACC PACK #3(X)



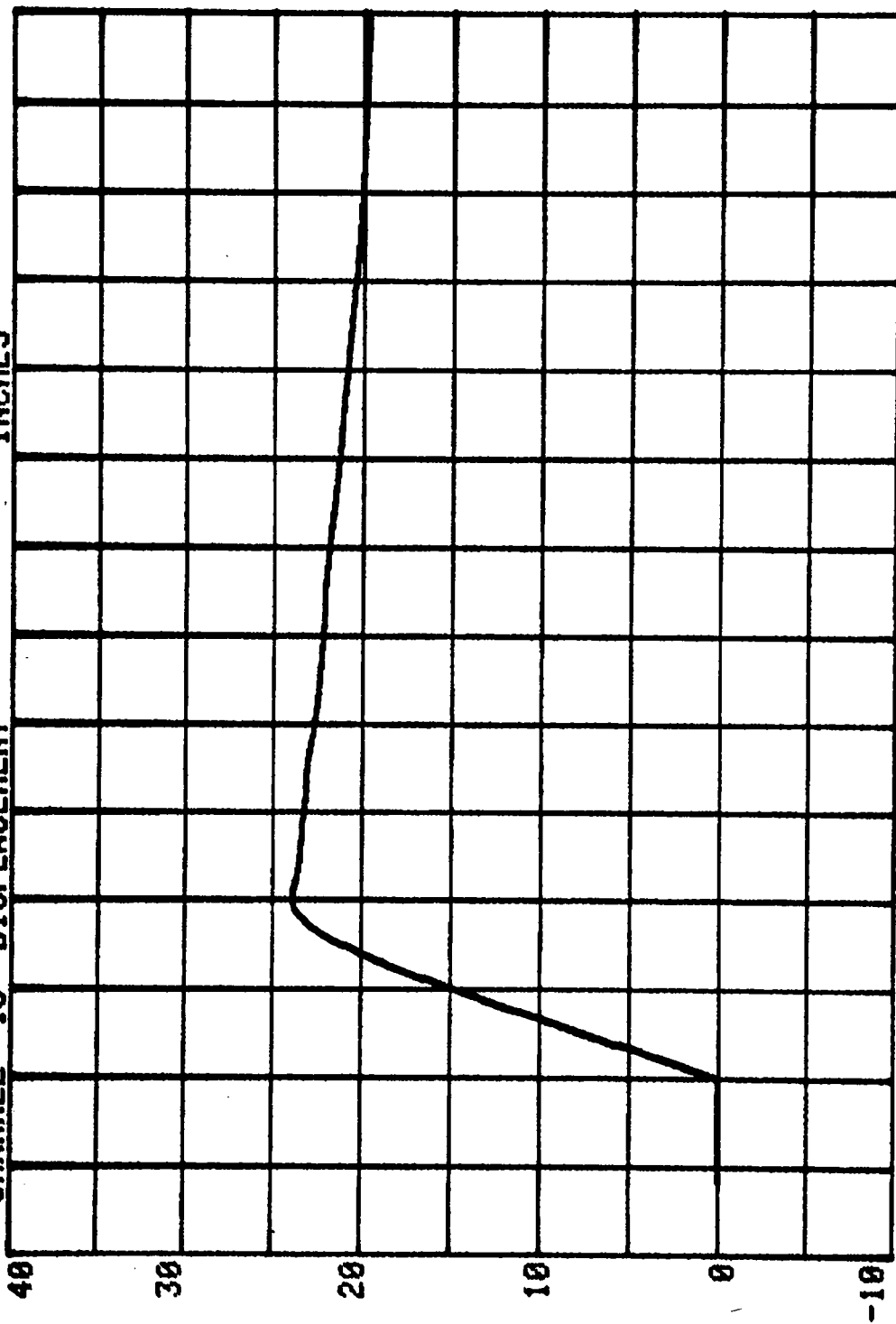


RUN= 671    SERIES= 5902    ACC. #3(X)

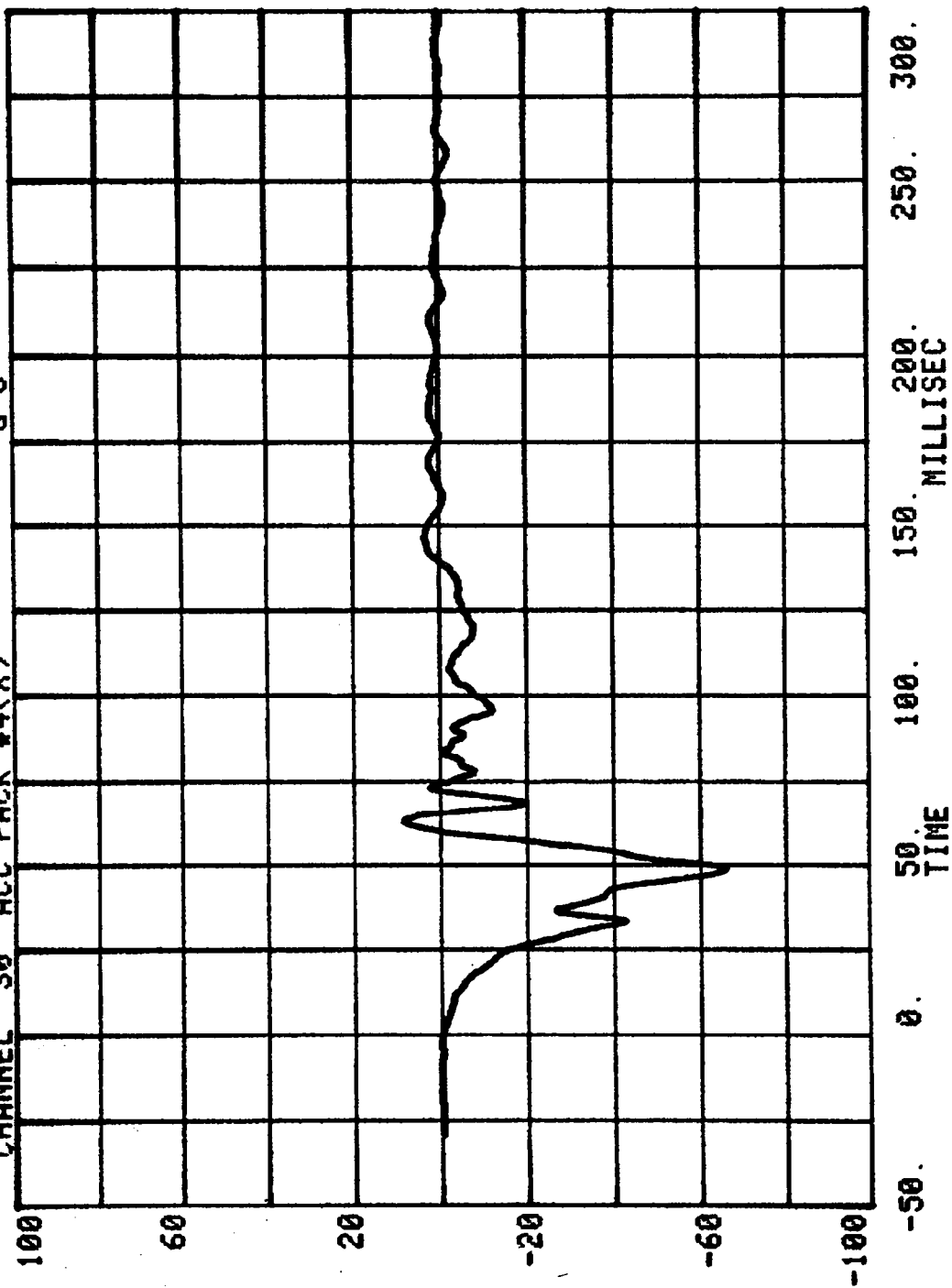
INCHES

DISPLACEMENT

CHANNEL 10



RUN= 671 SERIES= 5902 G'S  
CHANNEL 30 ACC PACK #4(X)



ACC. #4 (X)

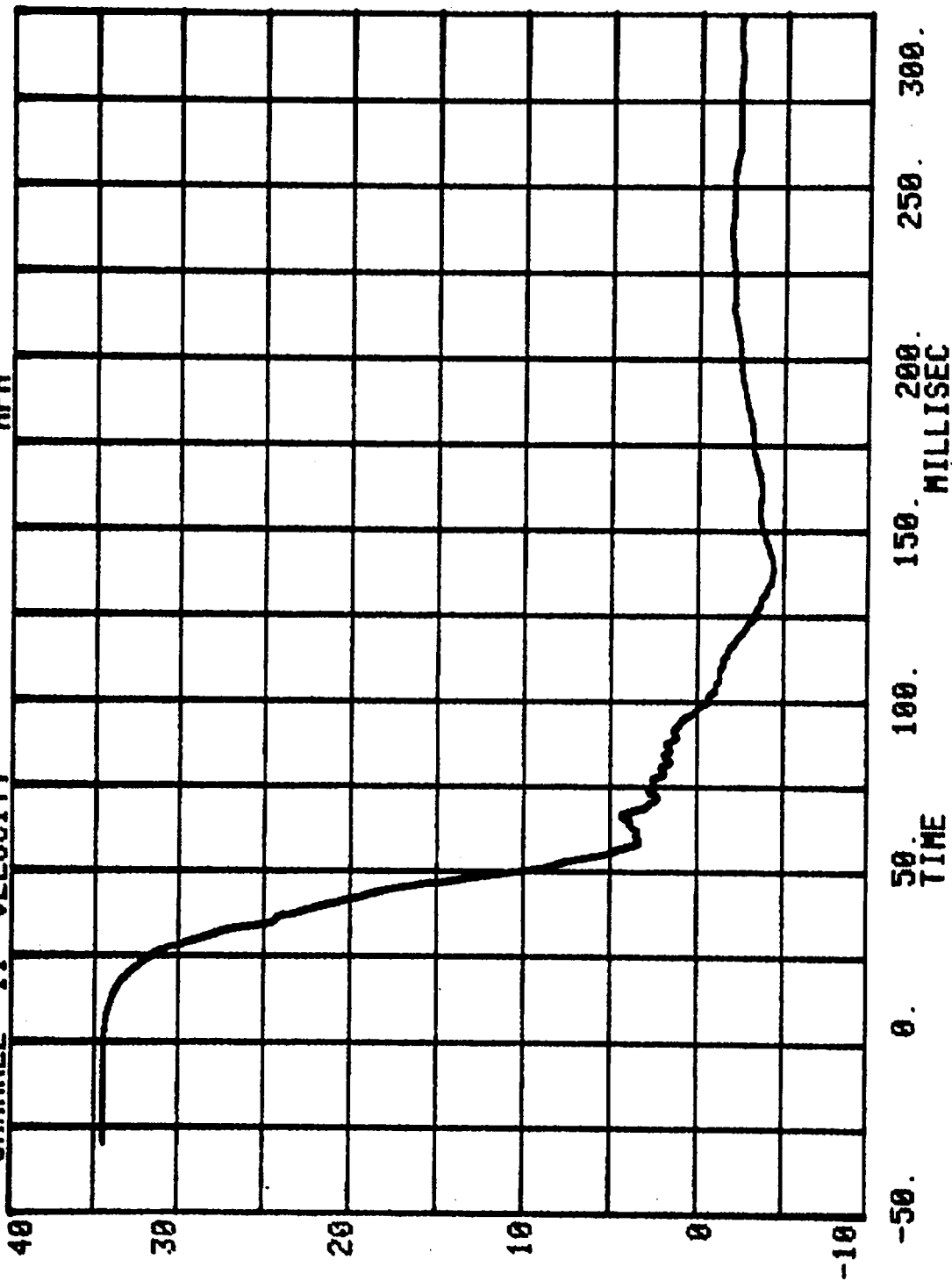
RUN= 671 SERIES= 5902

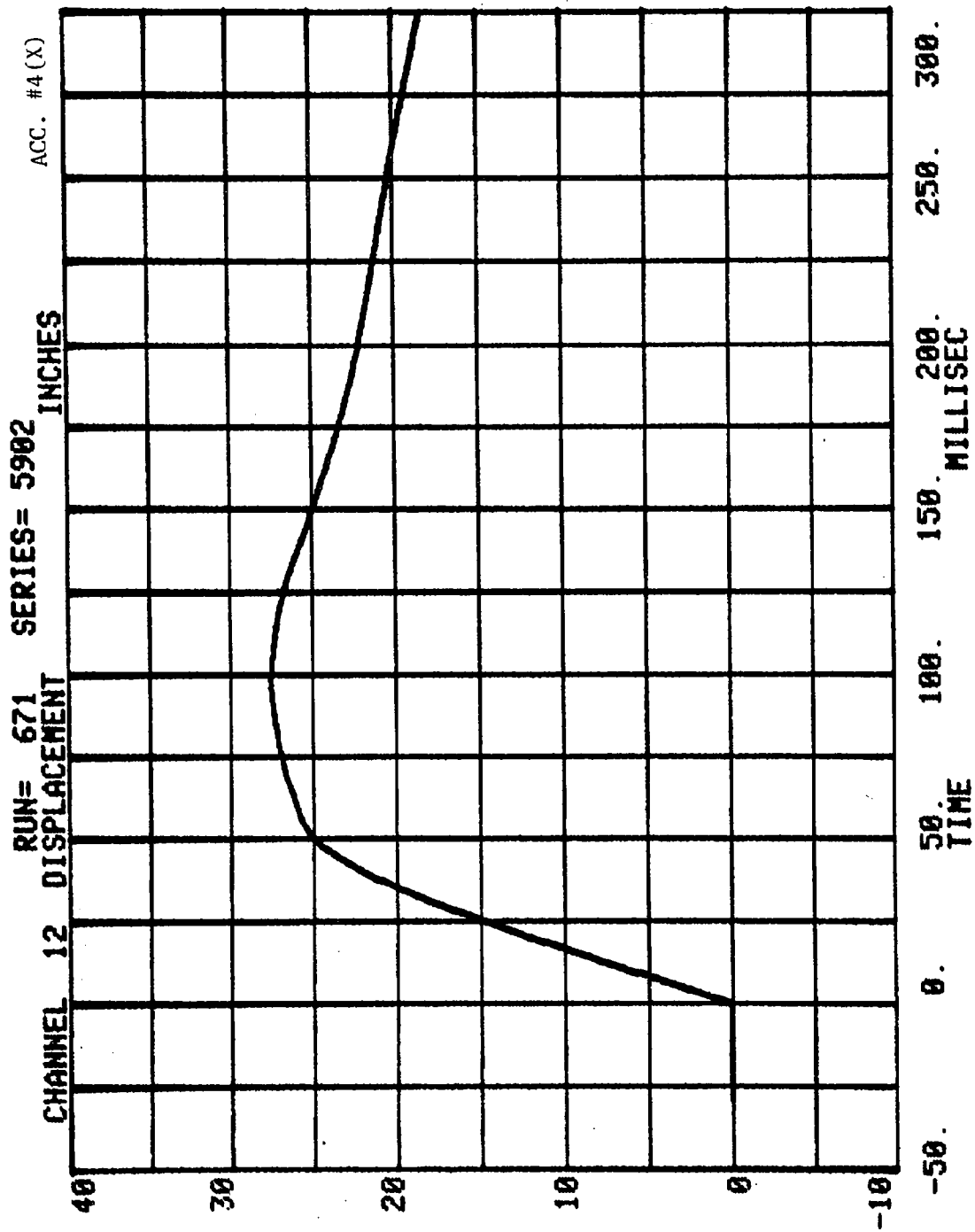
MPH

VELOCITY

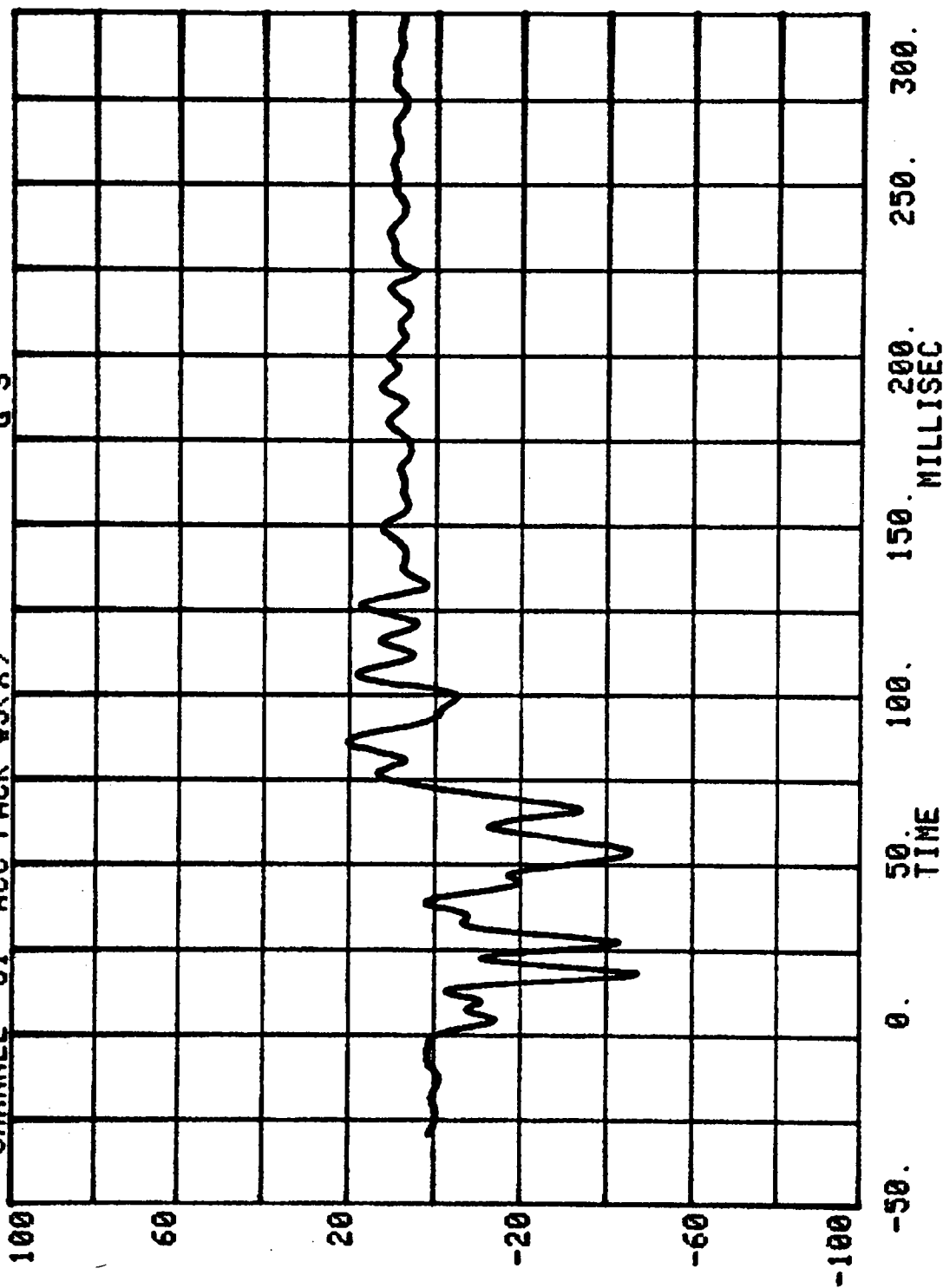
CHANNEL 11

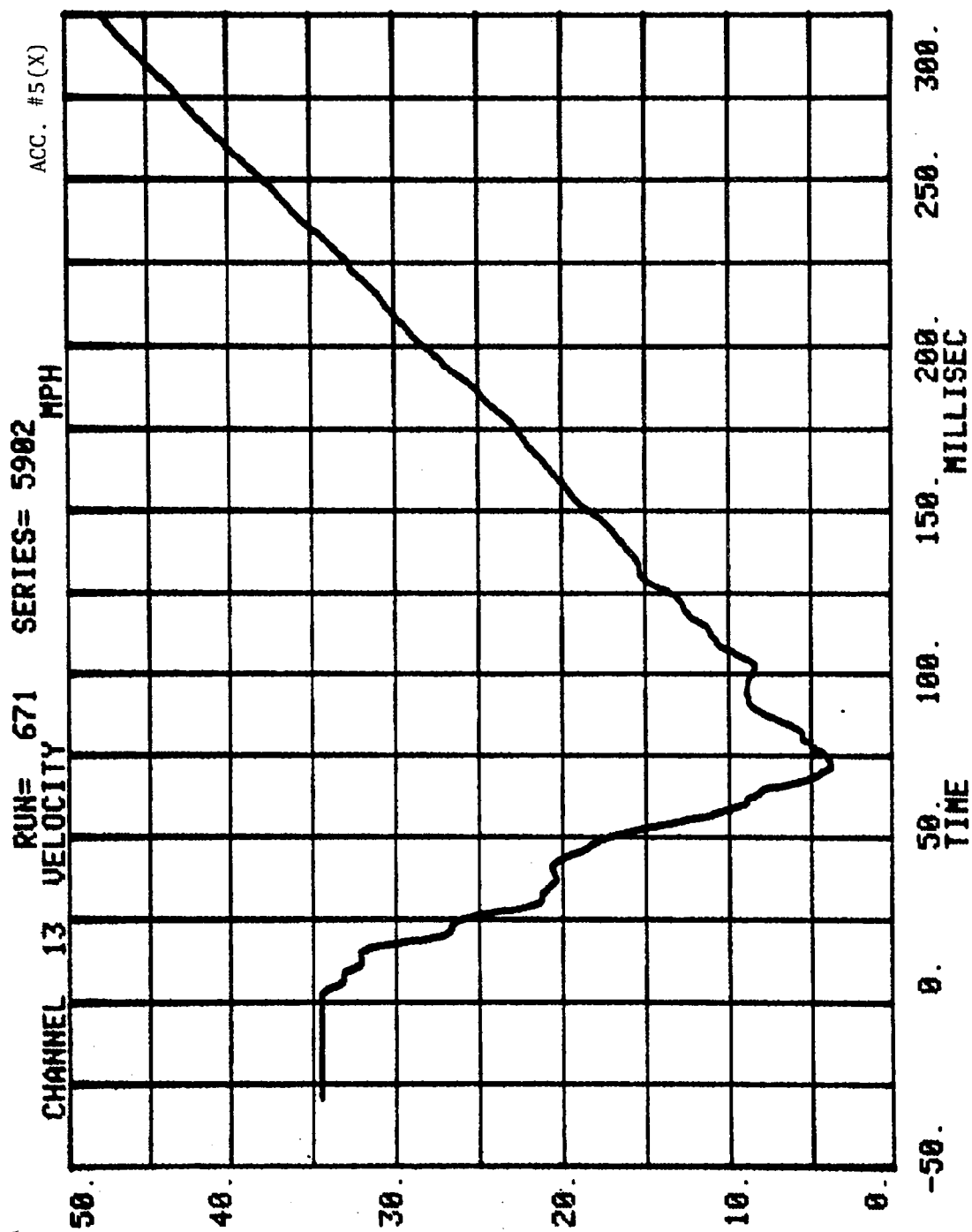
TIME

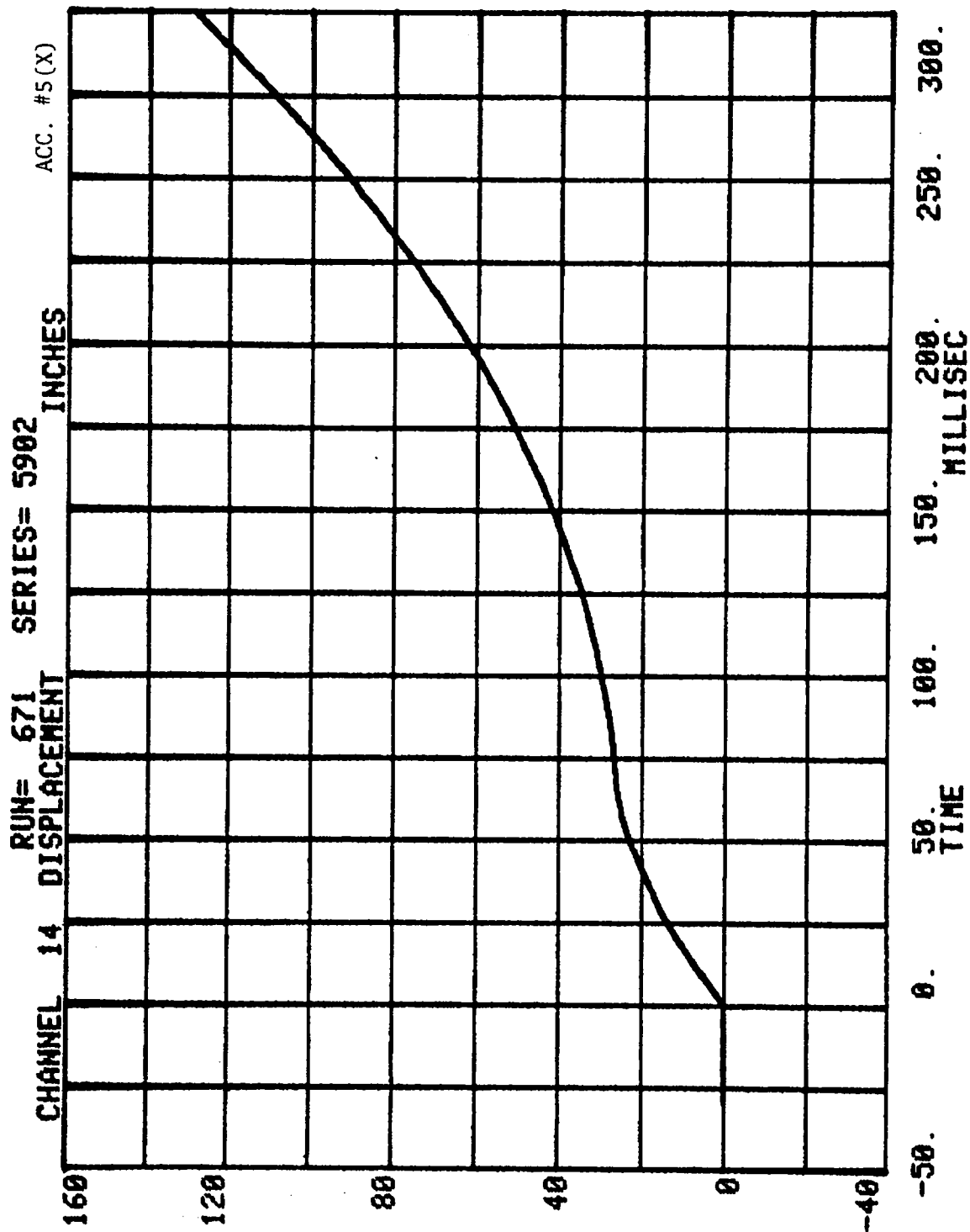




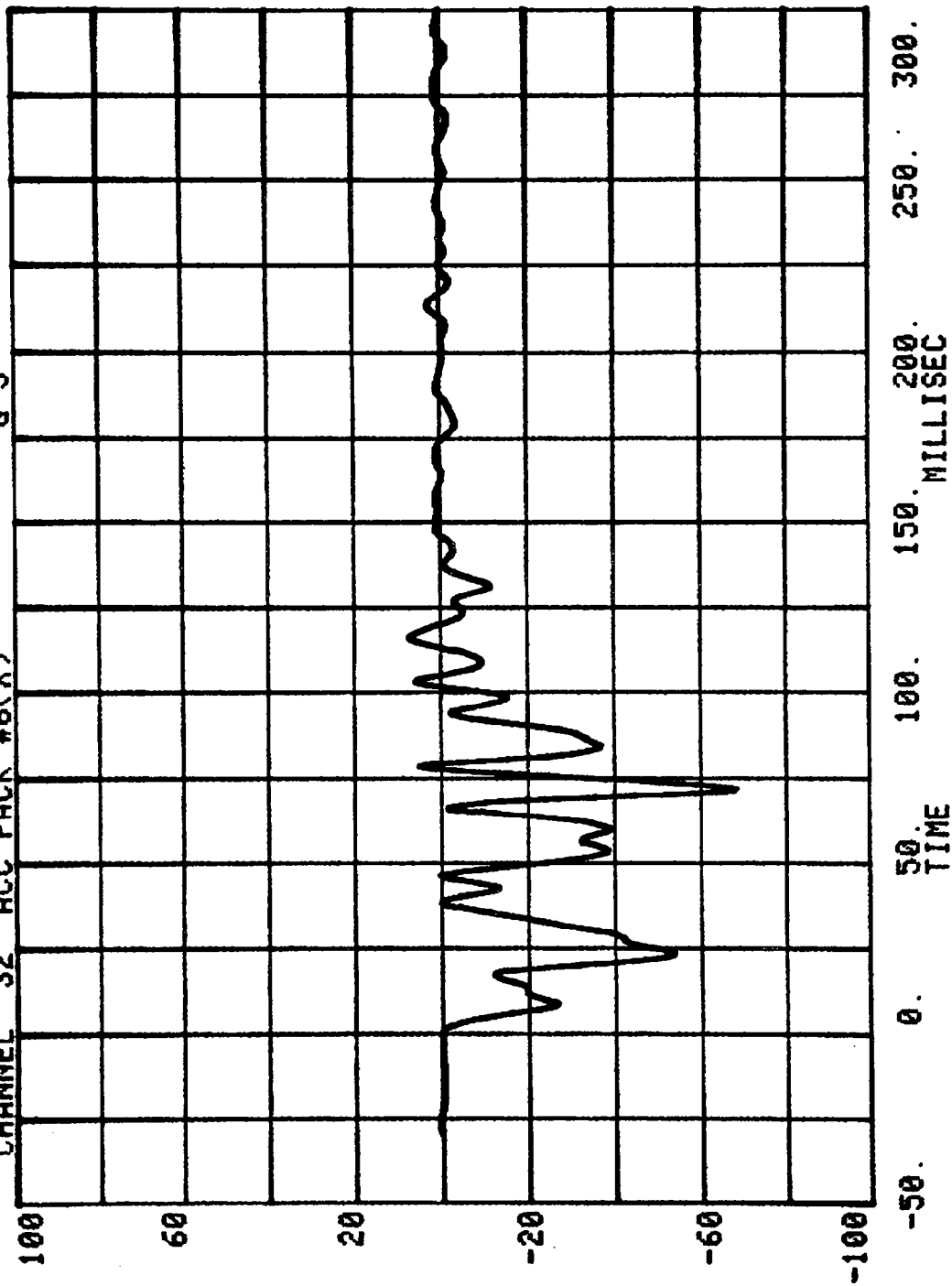
RUN= 671 SERIES= 5902  
CHANNEL 31 ACC PACK #5(X) G'S

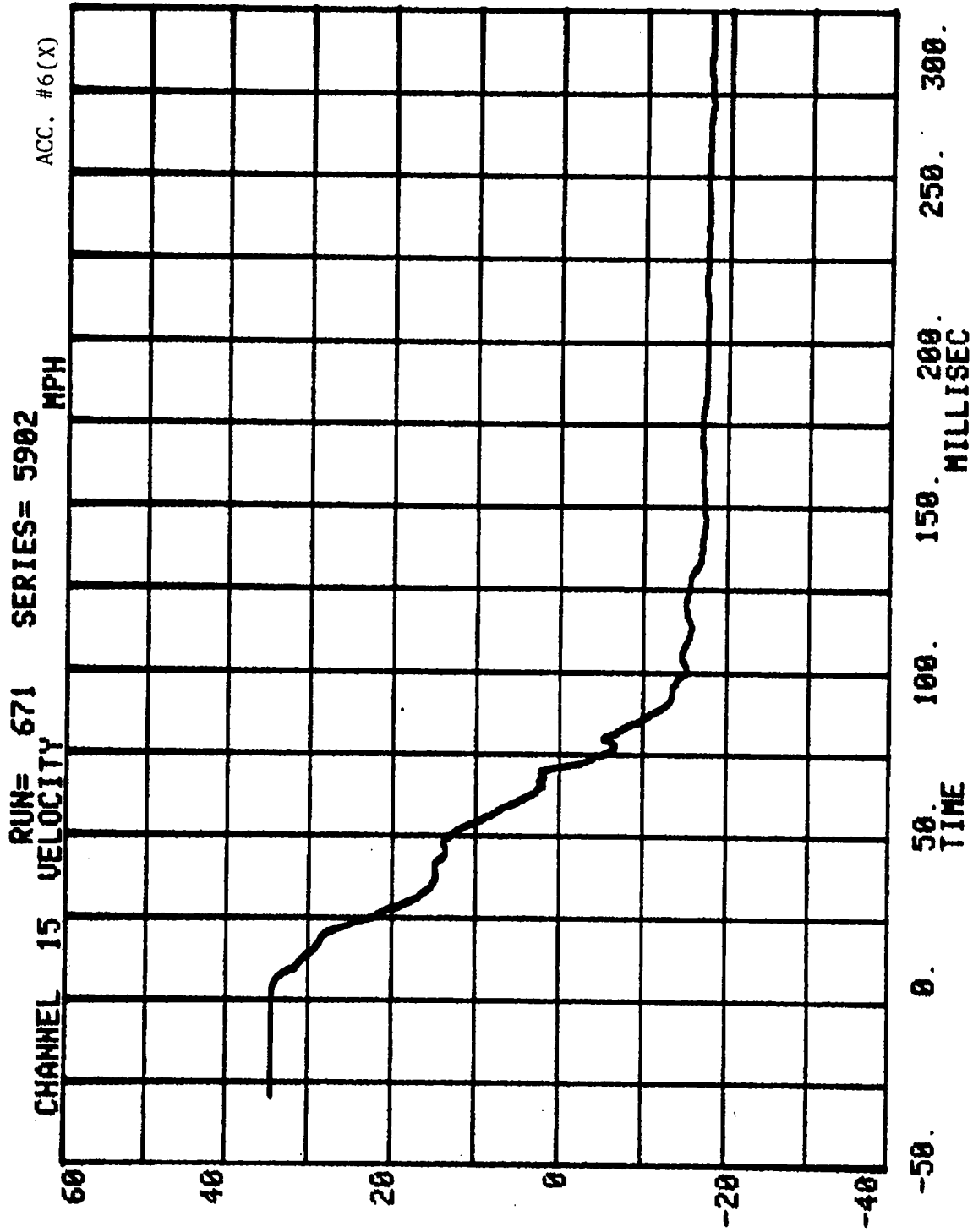


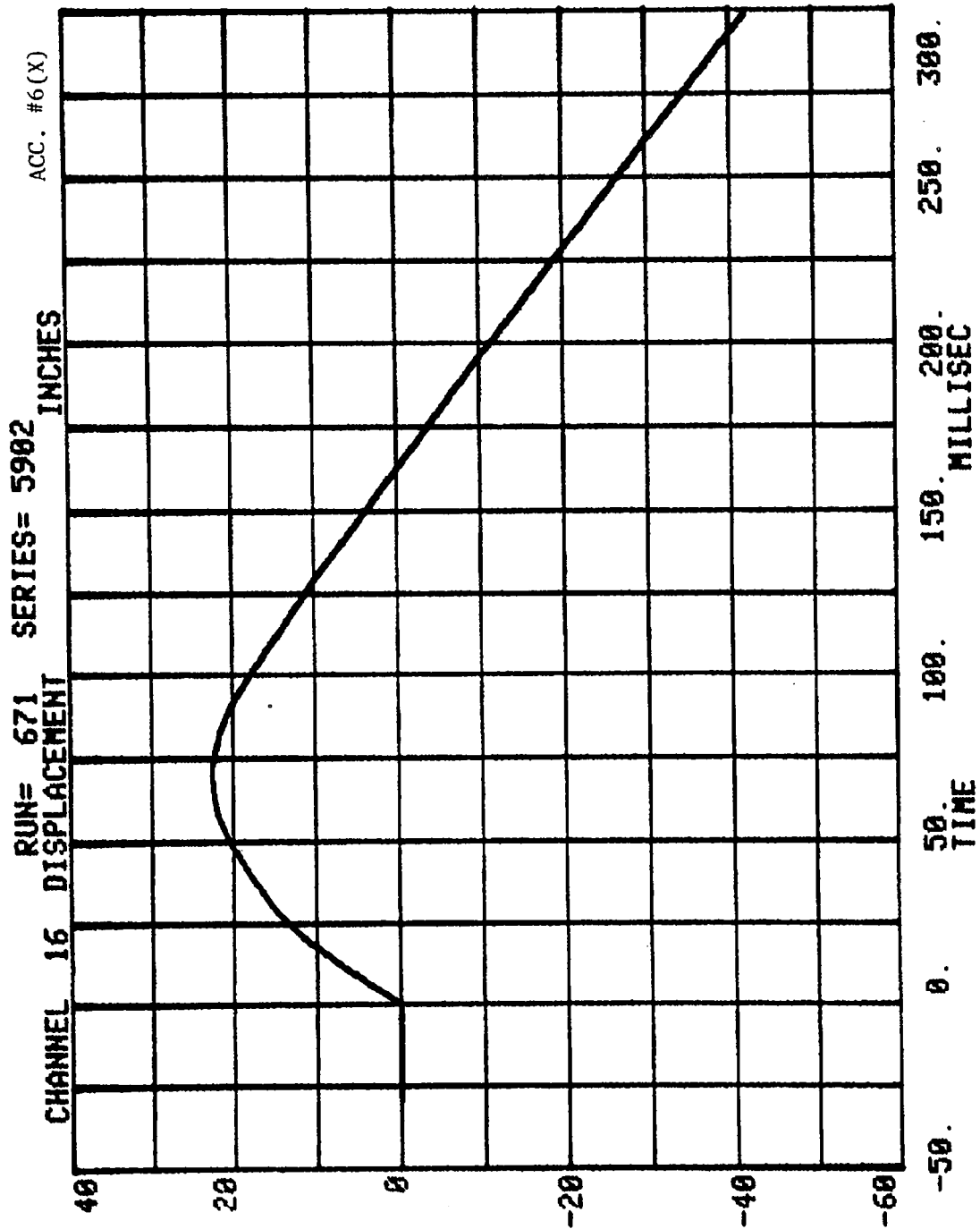




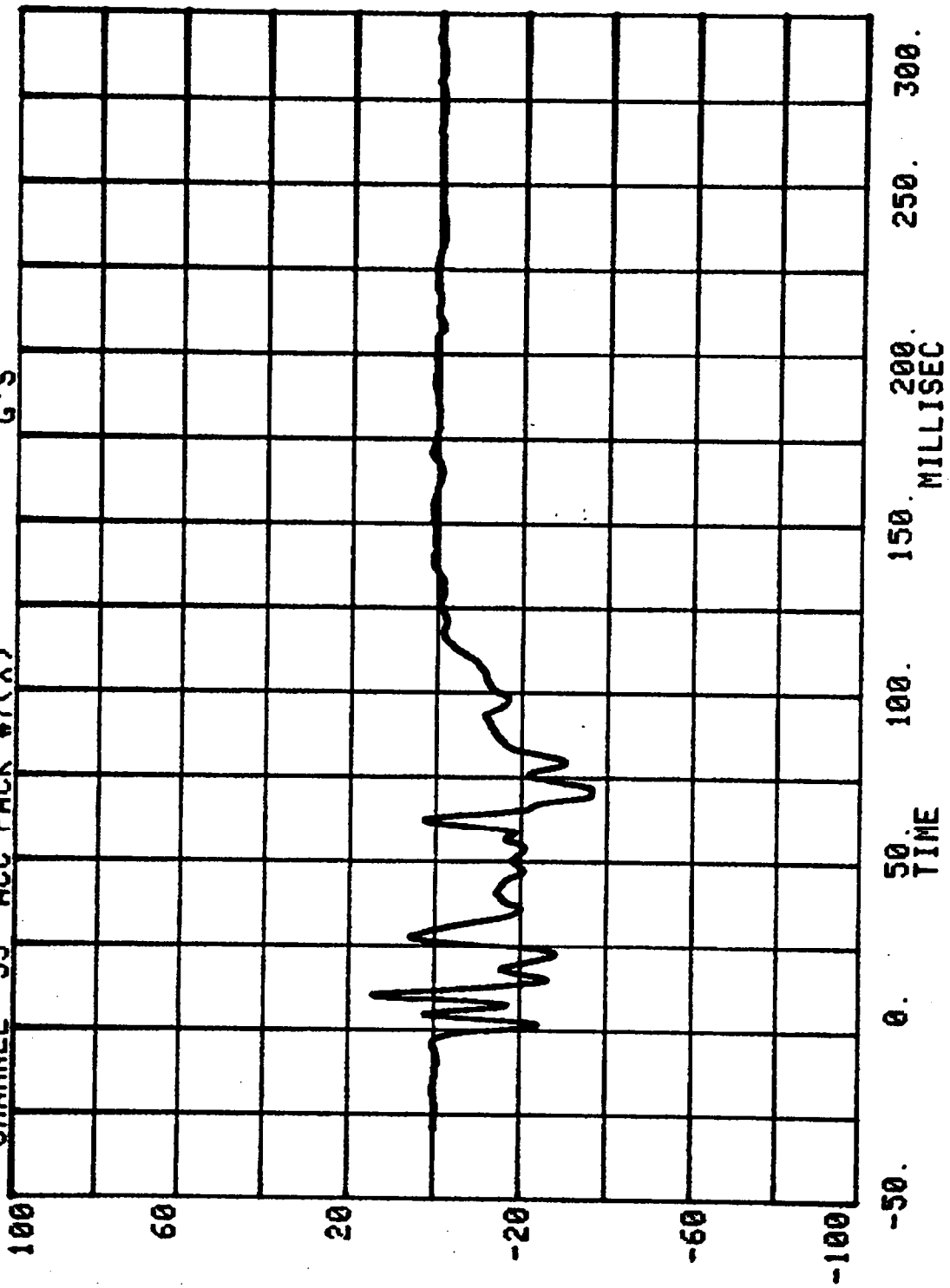
RUN= 671 SERIES= 5902  
CHANNEL 32 ACC PACK #6(X) G'S





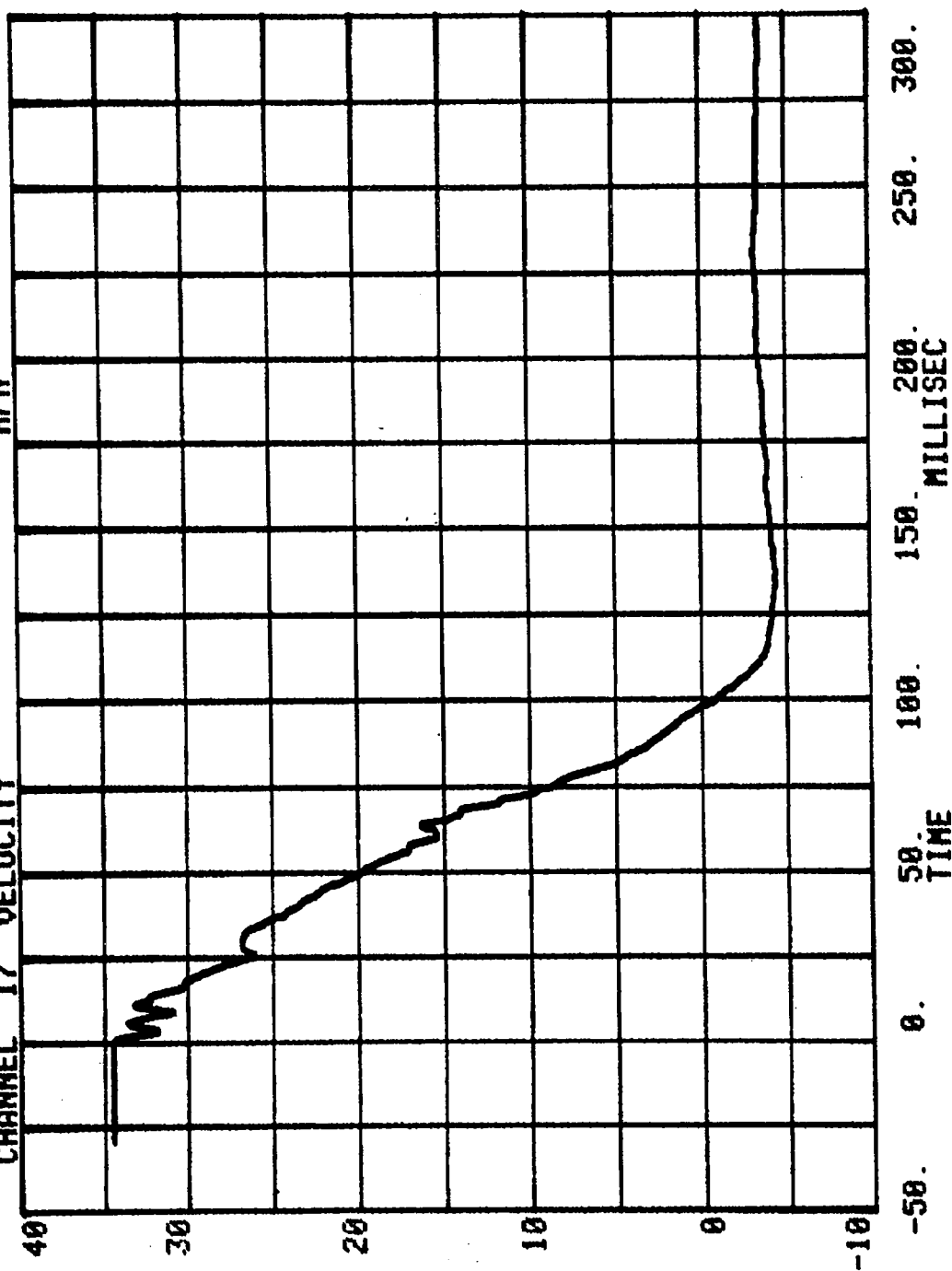


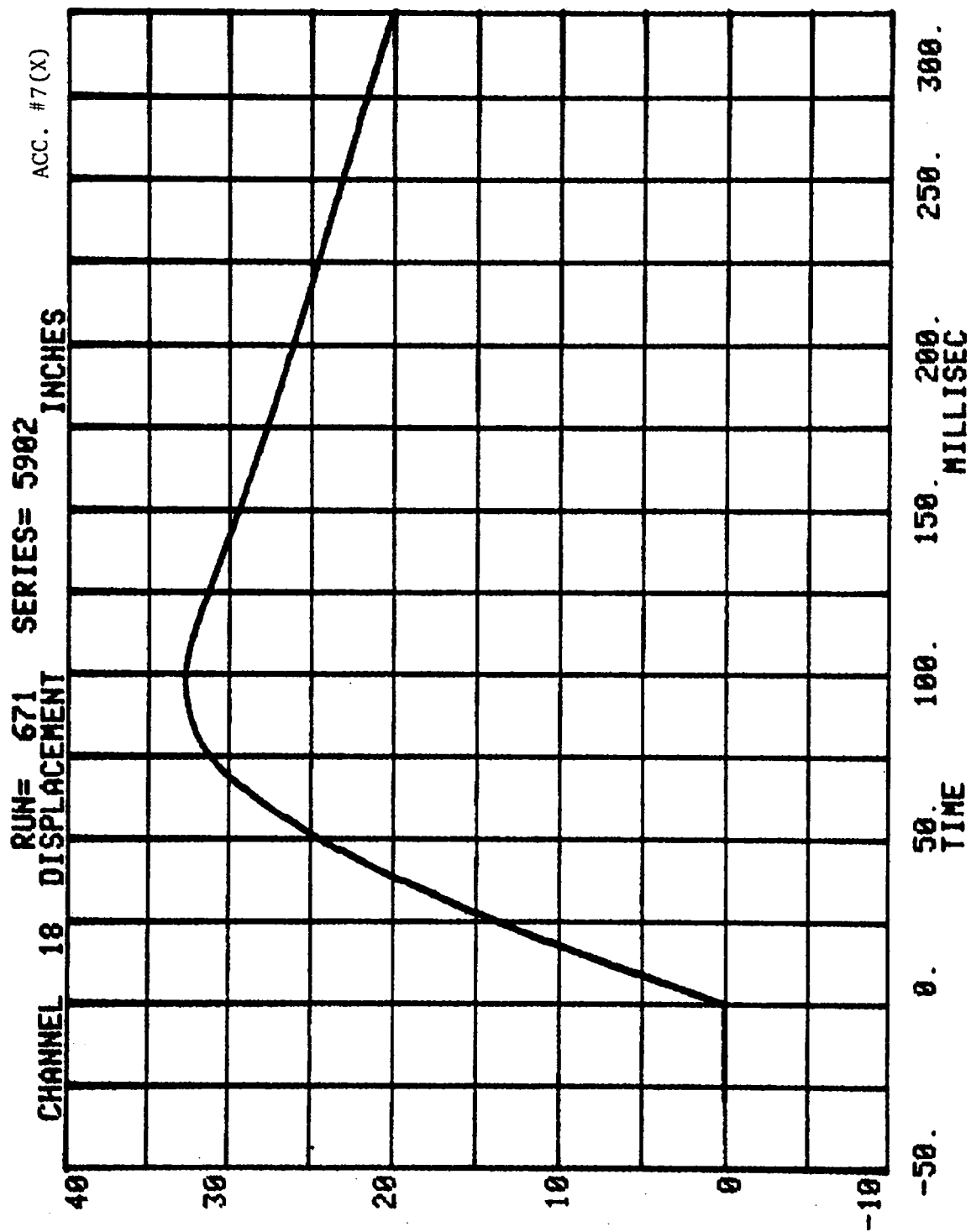
RUN= 671 SERIES= 5902  
CHANNEL 33 ACC PACK #7(X) G'S



ACC. #7(X)

RUN= 671 SERIES= 5982  
CHANNEL 17 VELOCITY MPH



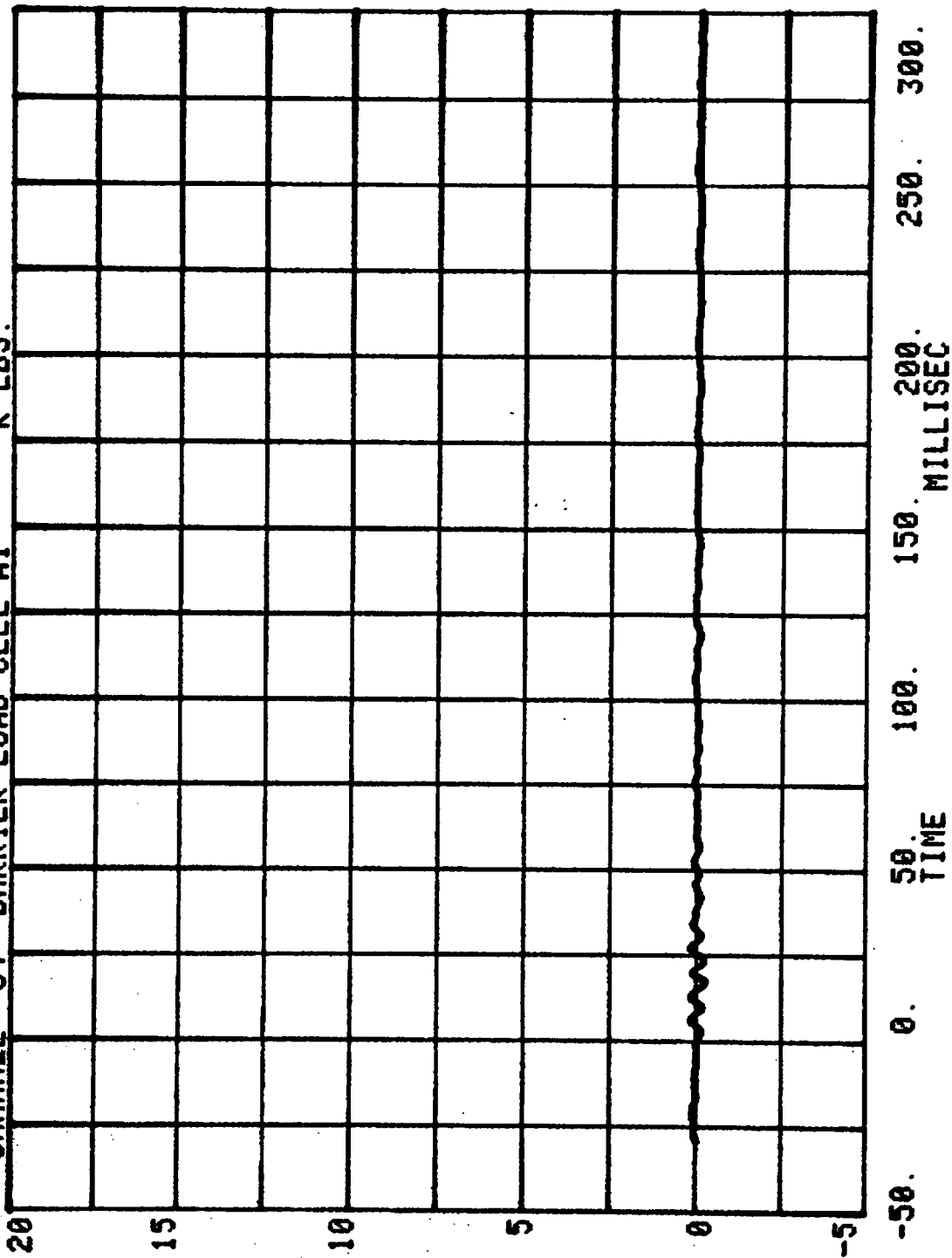


TEST NO. CF5902

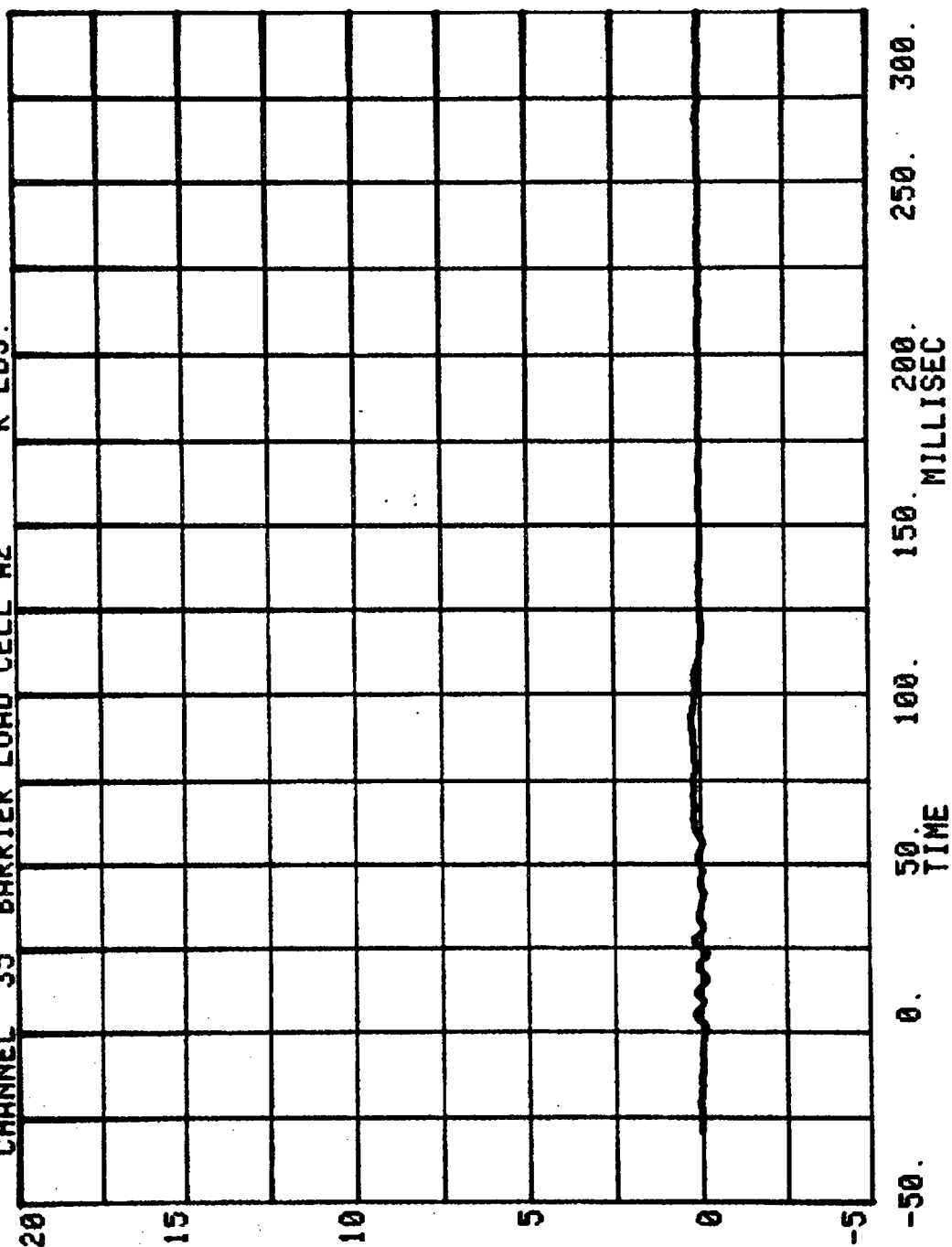
LOAD CELL BARRIER DATA  
FILTER CHANNEL CLASS

60

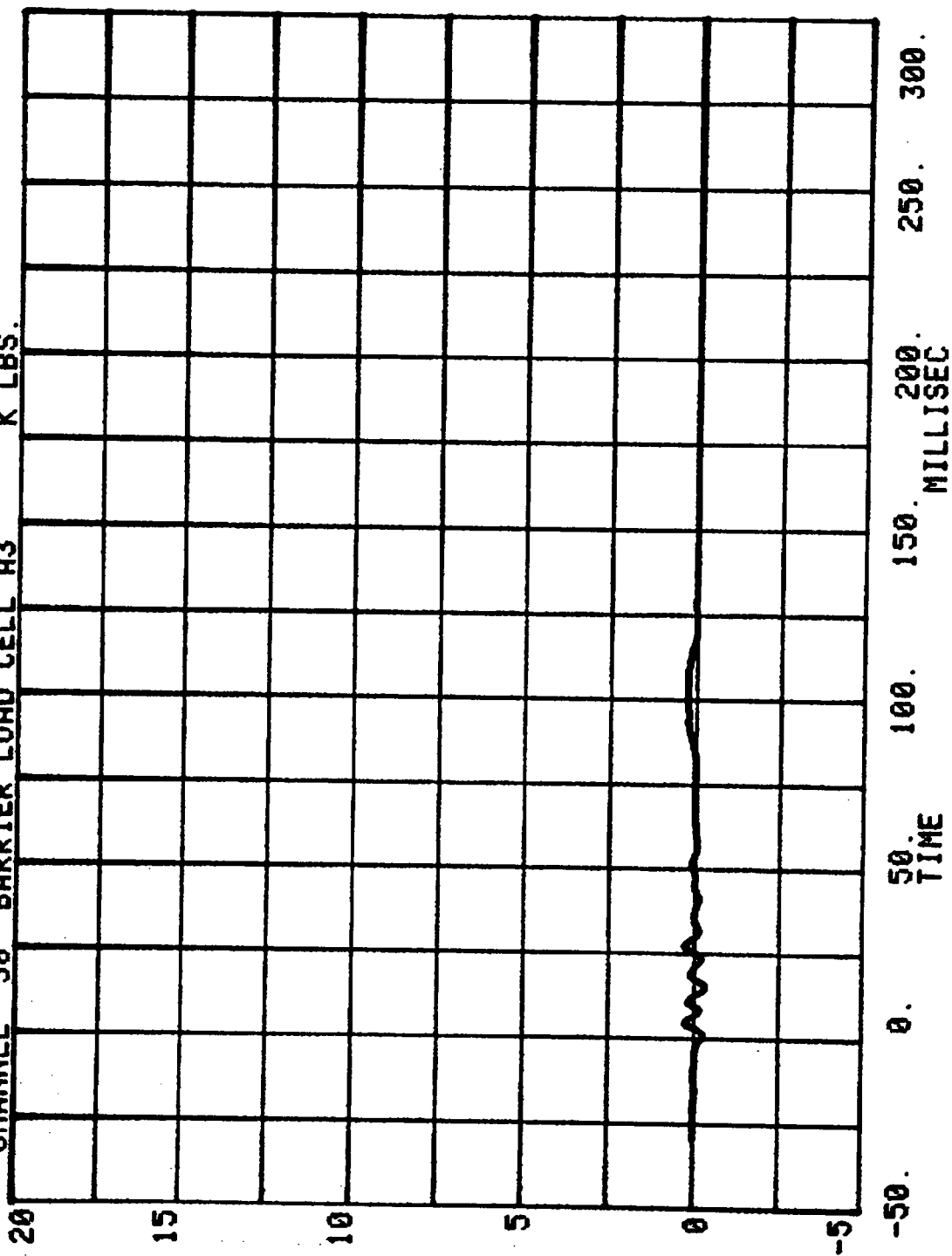
CHANNEL 34 BARRIER LOAD CELL A1 RUN= 671 SERIES= 5902 K LBS.



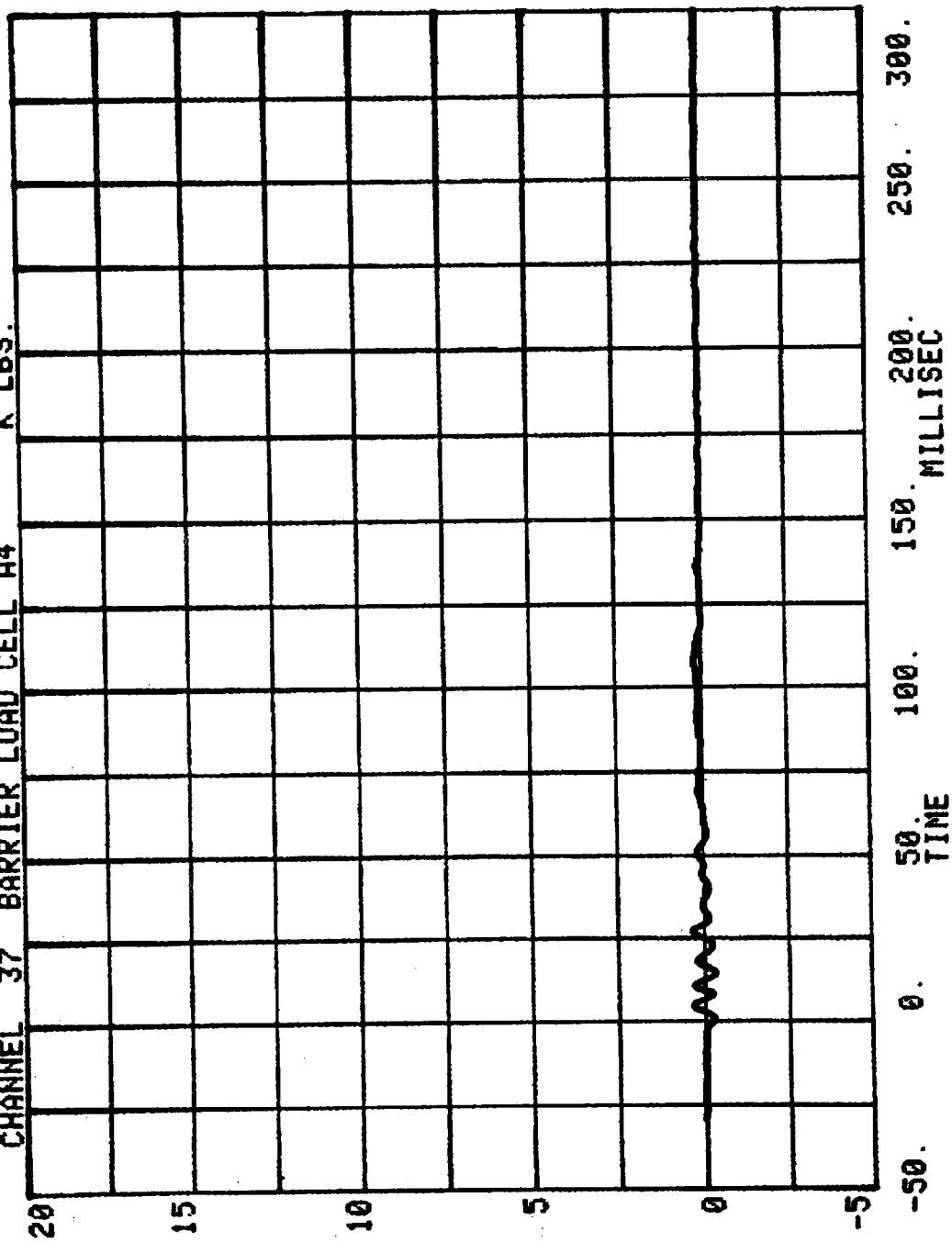
RUN= 671 SERIES= 5902  
CHANNEL 35 BARRIER LOAD CELL A2 K LBS.



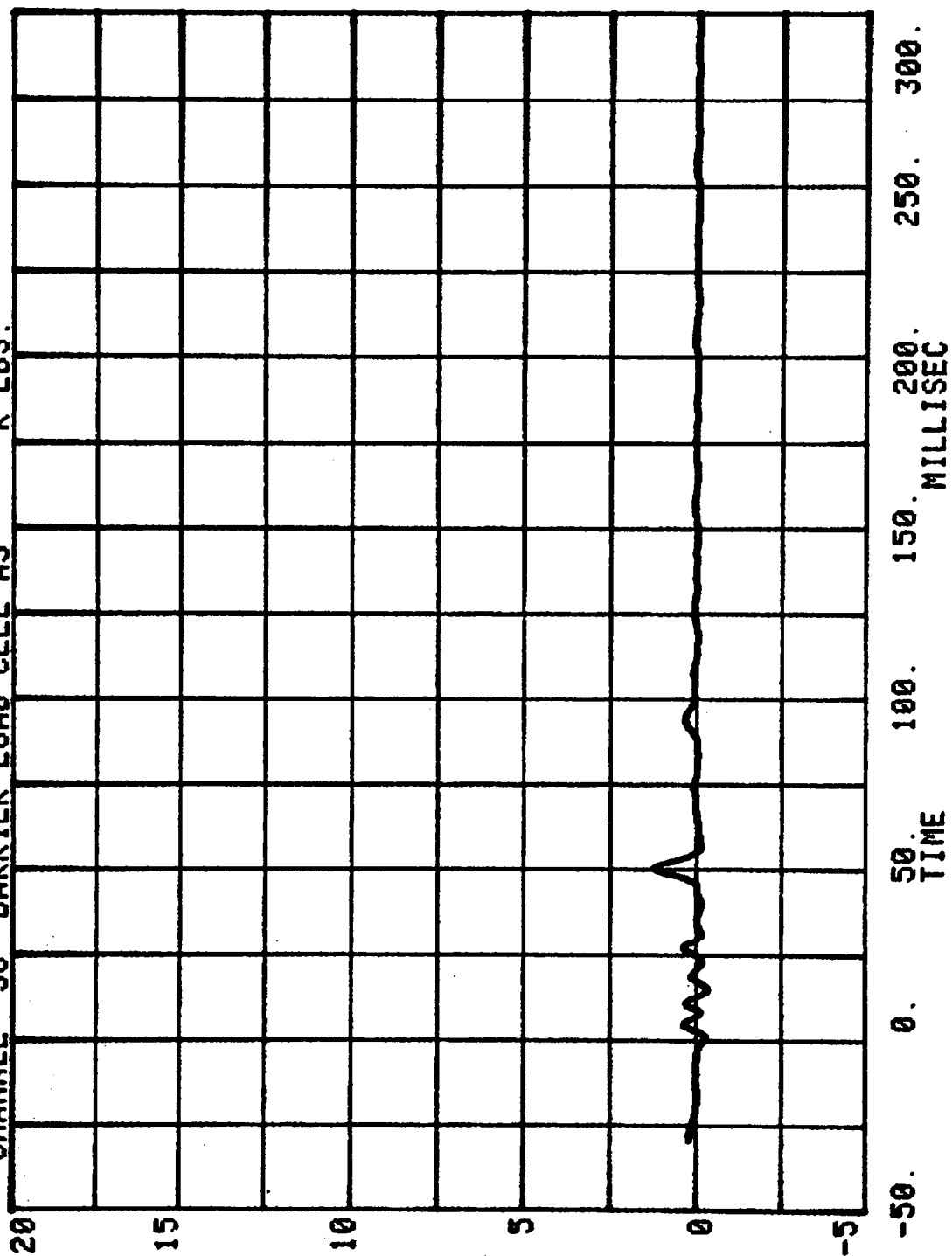
RUN= 671 SERIES= 5902  
CHANNEL 36 BARRIER LOAD CELL A3 K LBS.



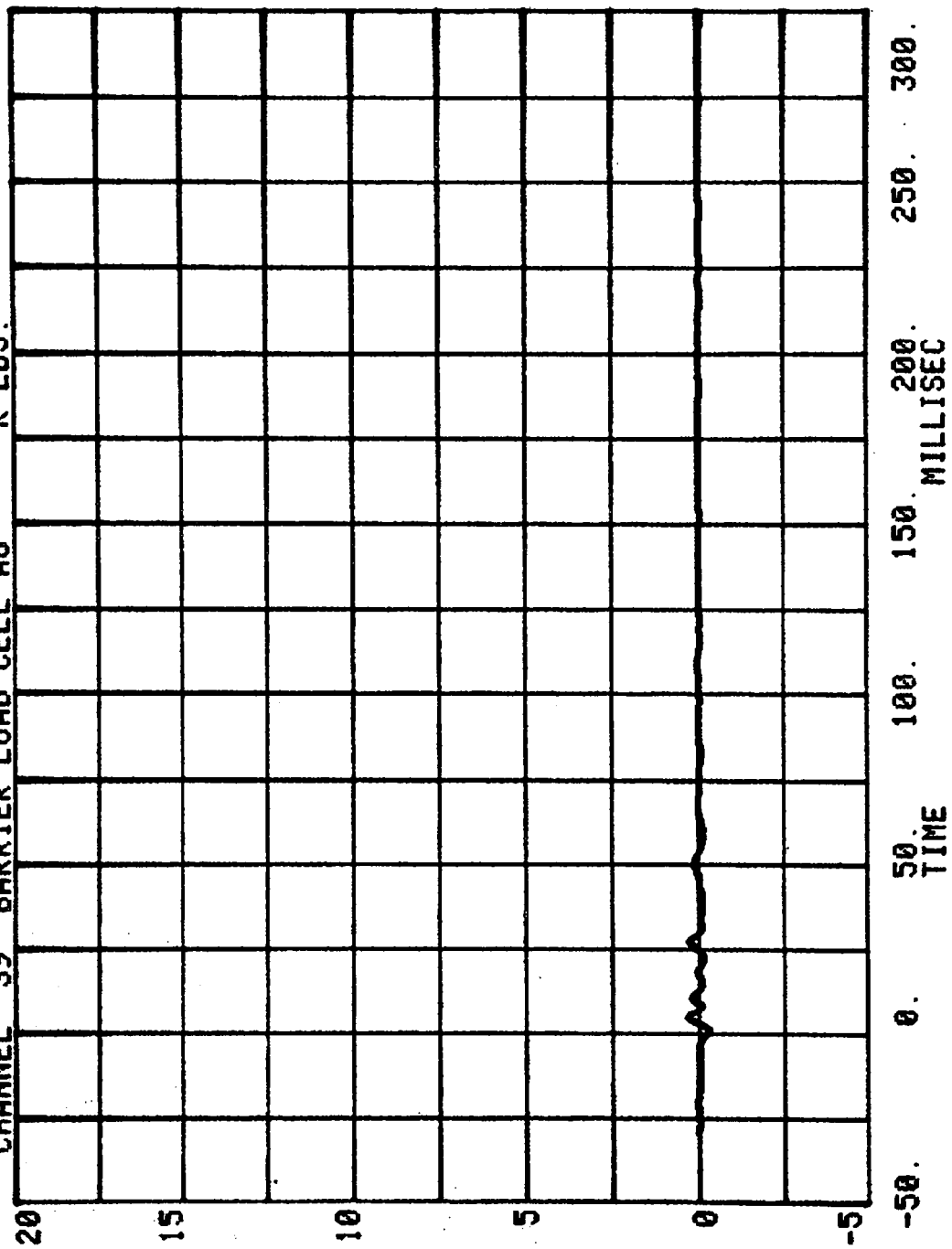
CHANNEL 37 RUN= 671 SERIES= 5902  
BARRIER LOAD CELL A4 K LBS.



RUN= 671. SERIES= 5902  
CHANNEL 38 BARRIER LOAD CELL A5 K LBS.

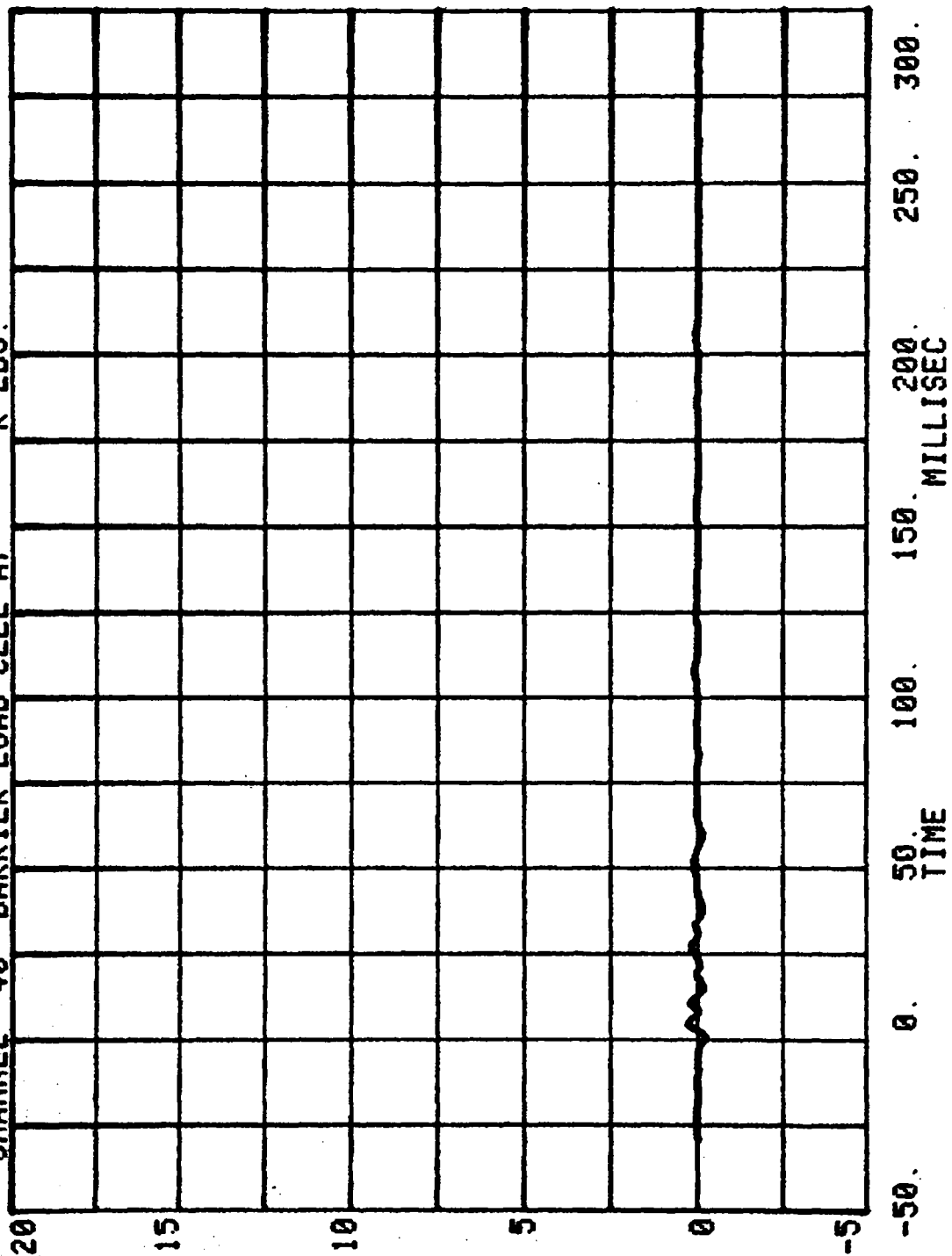


CHANNEL 39 BARRIER LOAD CELL A6  
RUN= 671 SERIES= 5902 K LBS.



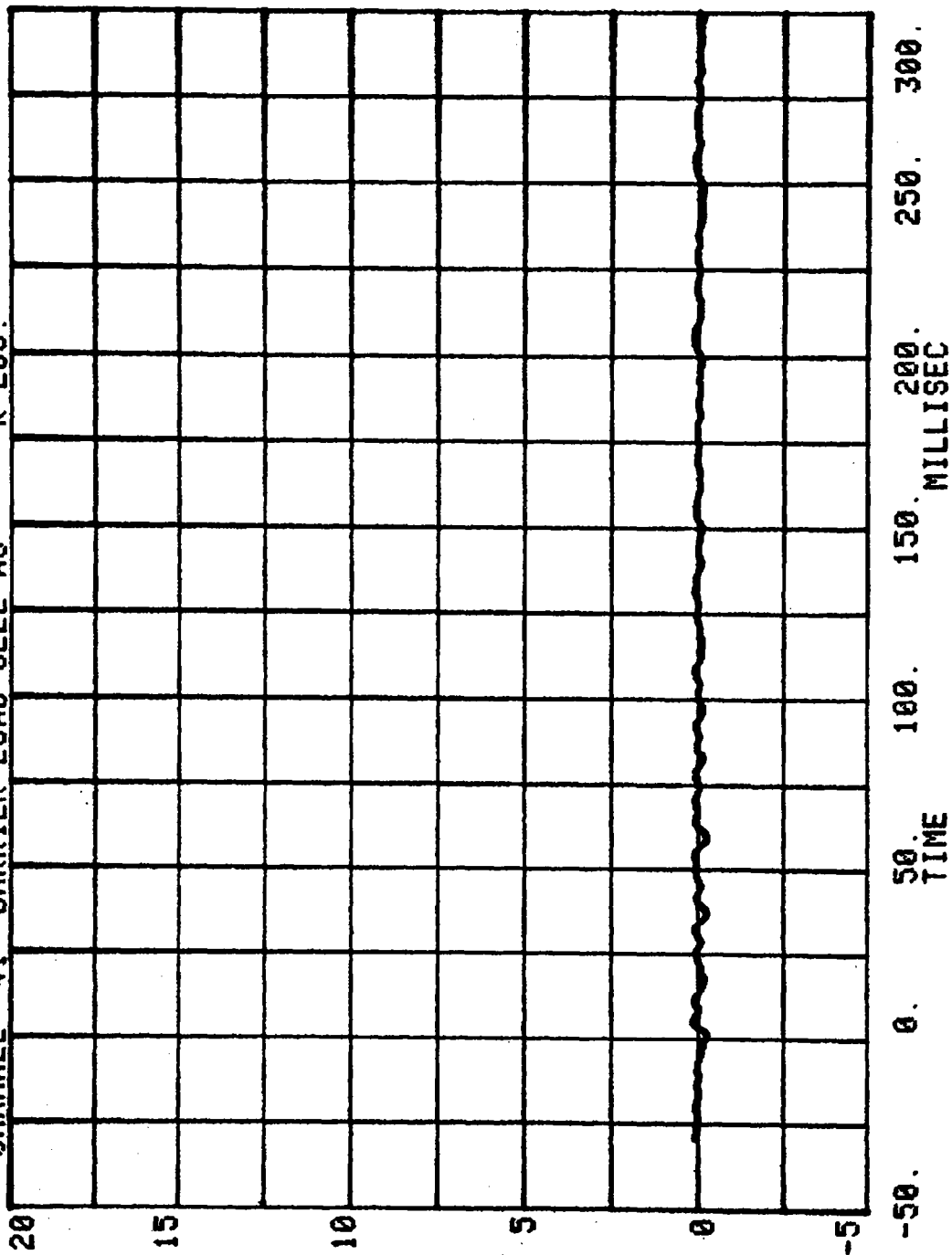
CHANNEL 40 BARRIER LOAD CELL A7 K LBS.

RUN= 671 SERIES= 5902

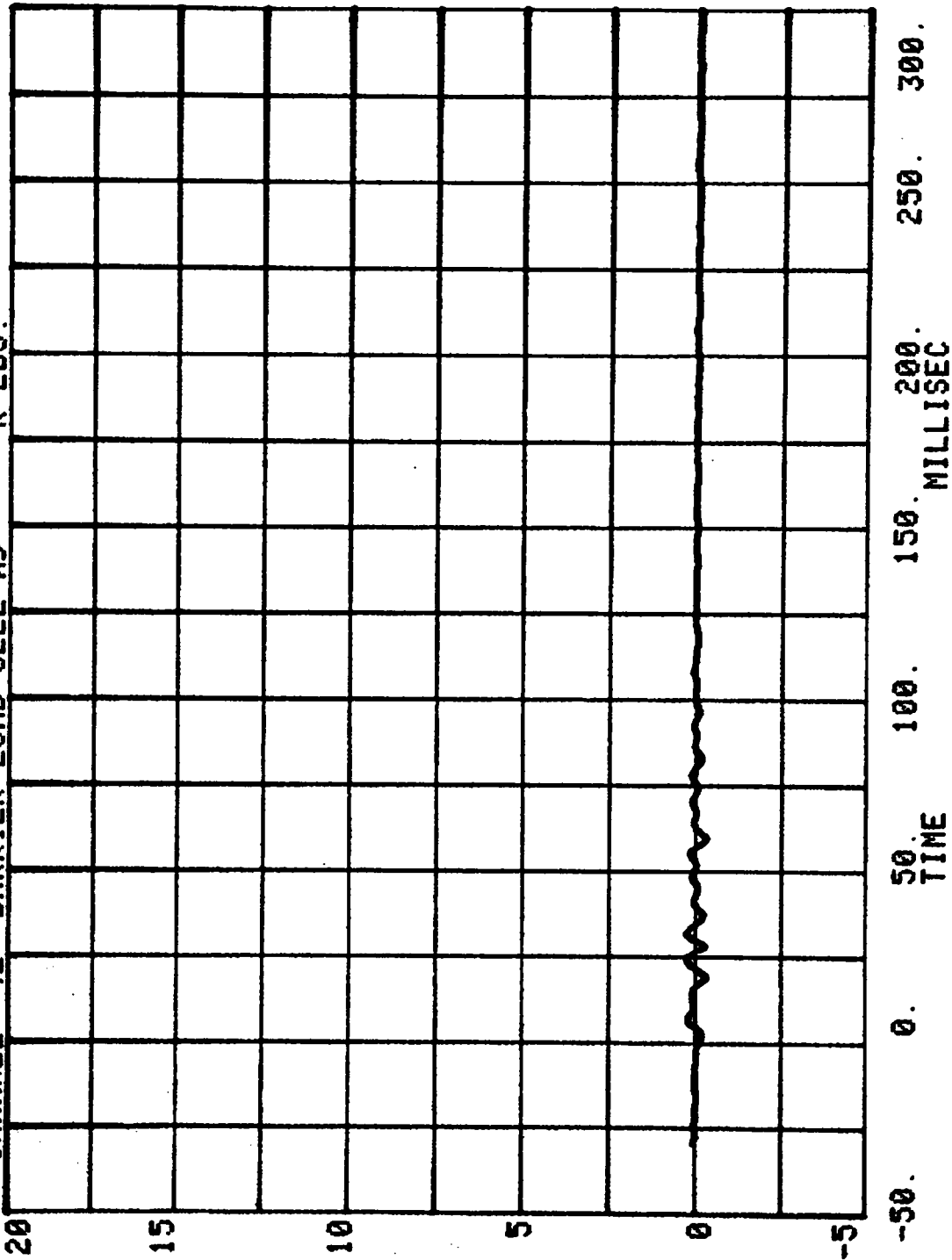


CHANNEL 41 BARRIER LOAD CELL A8 K LBS.

RUN= 671 SERIES= 5902

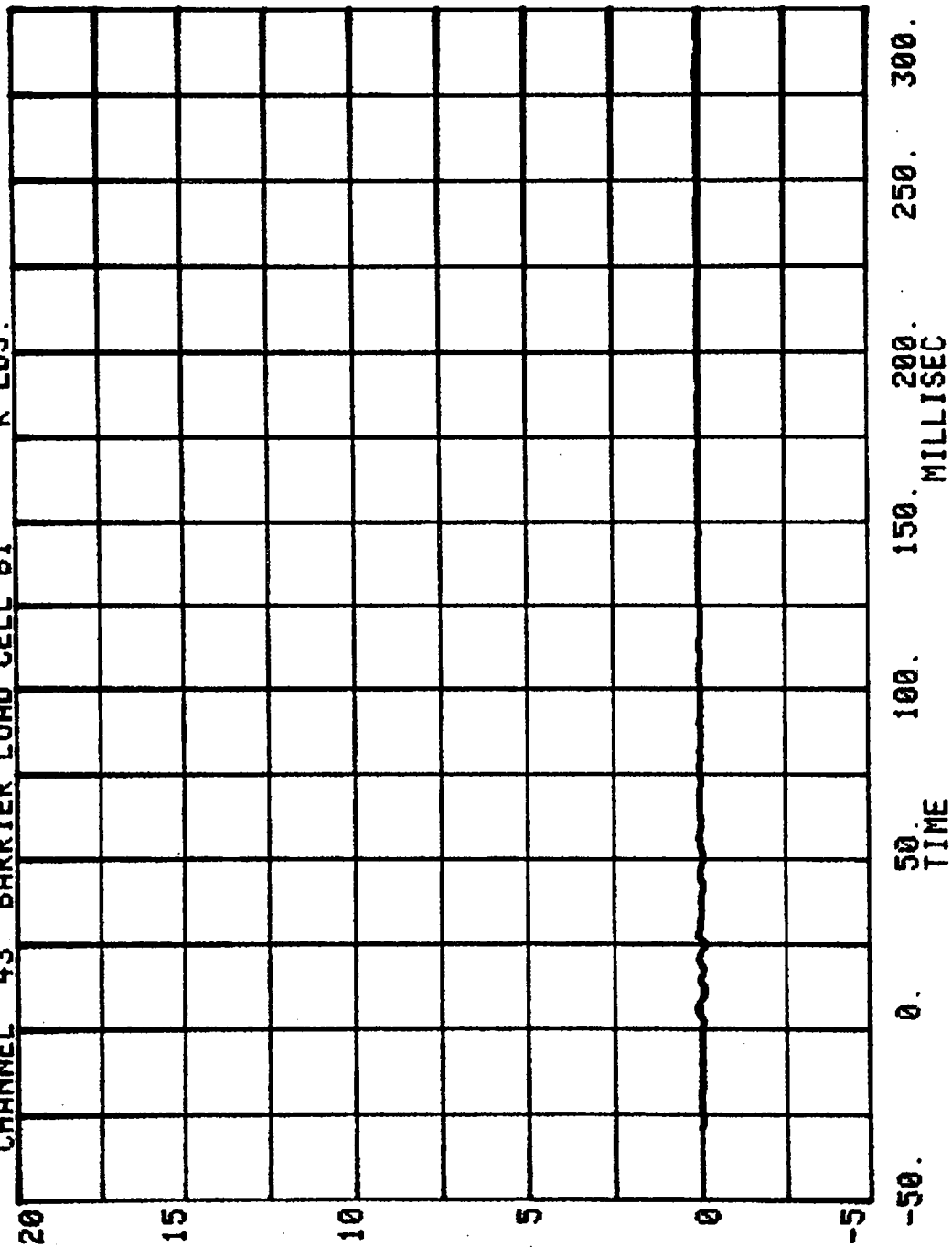


RUN= 671 SERIES= 5902  
CHANNEL 42 BARRIER LOAD CELL A9 K LBS.

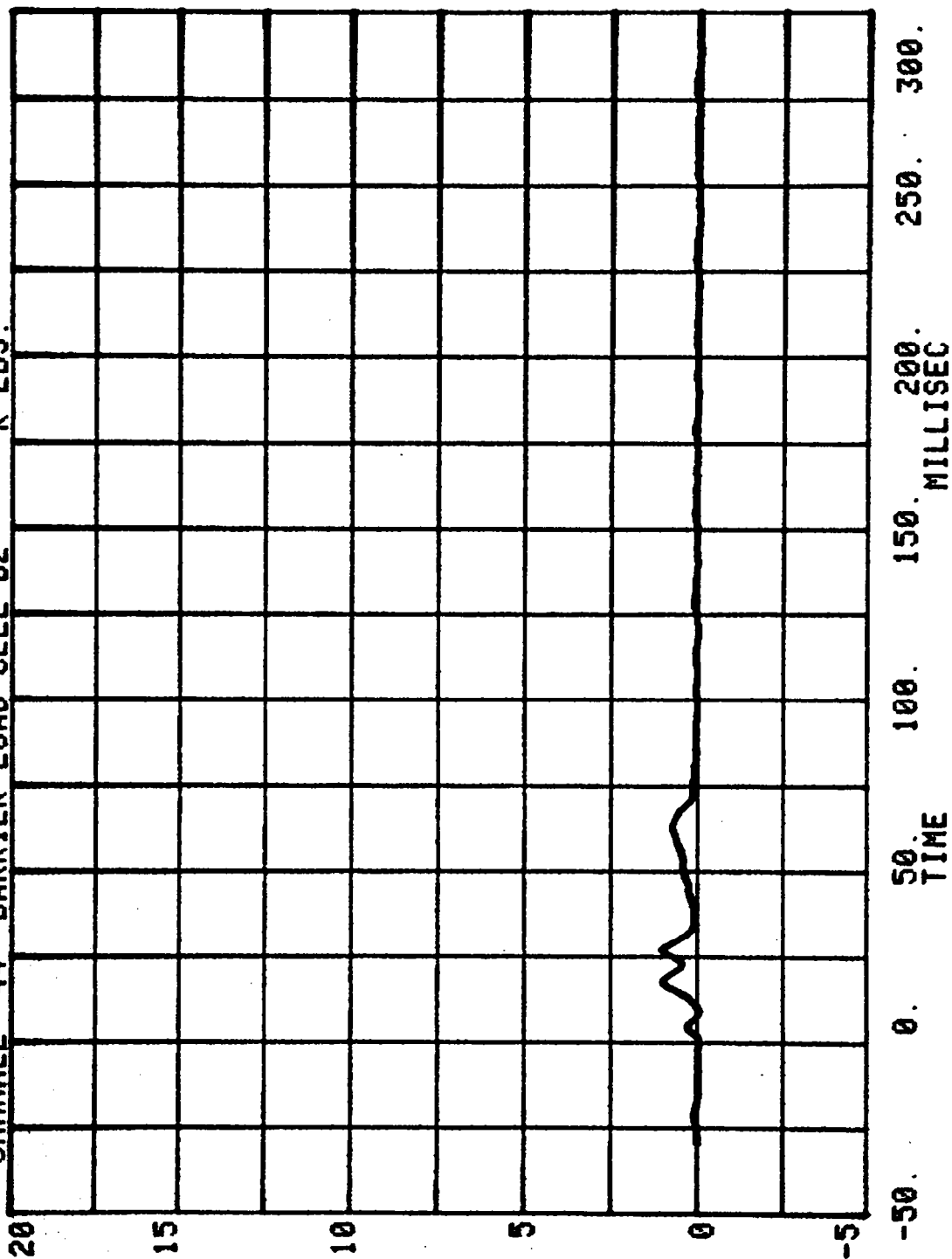


CHANNEL 43 BARRIER LOAD CELL B1 K LBS.

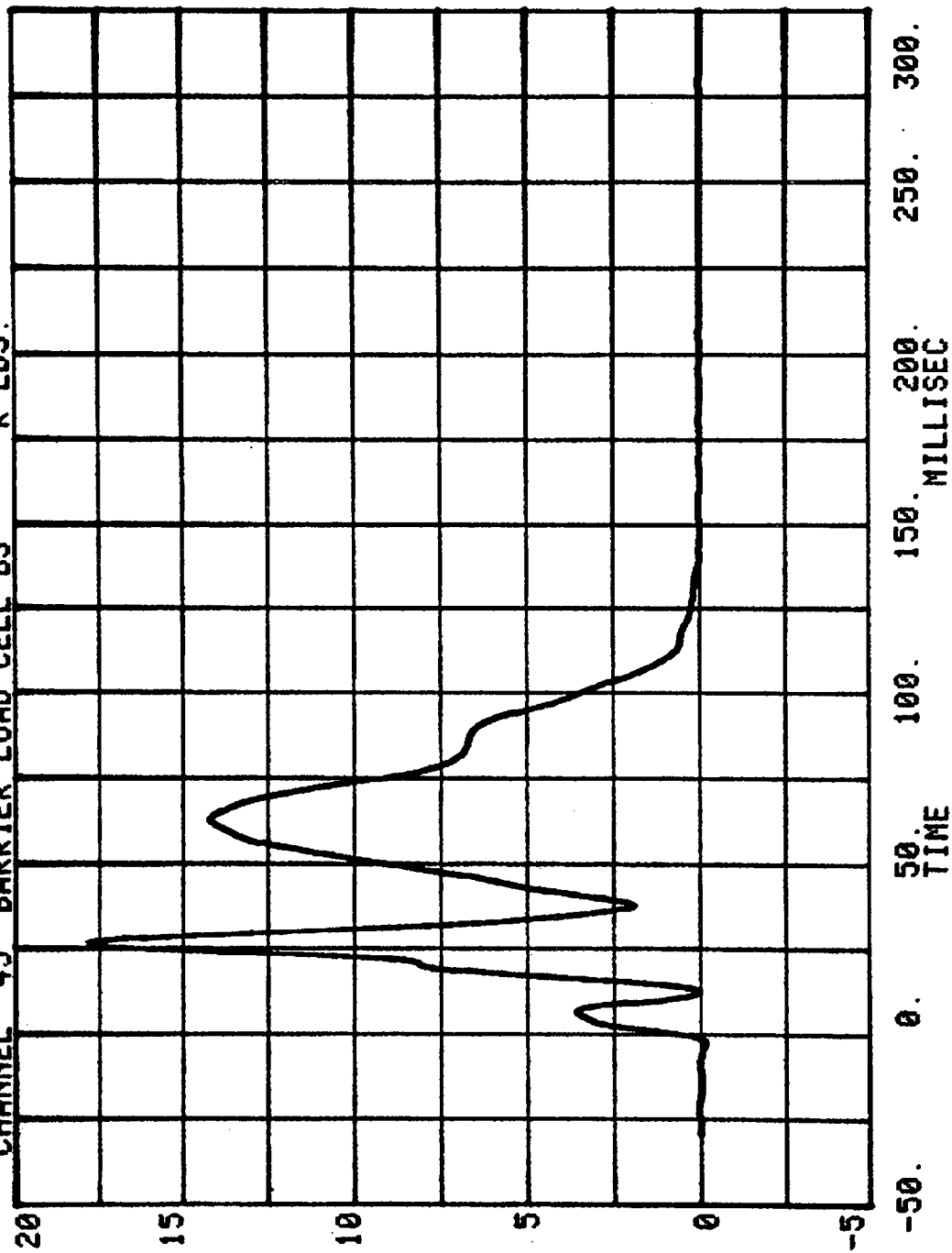
RUN= 671 SERIES= 5902



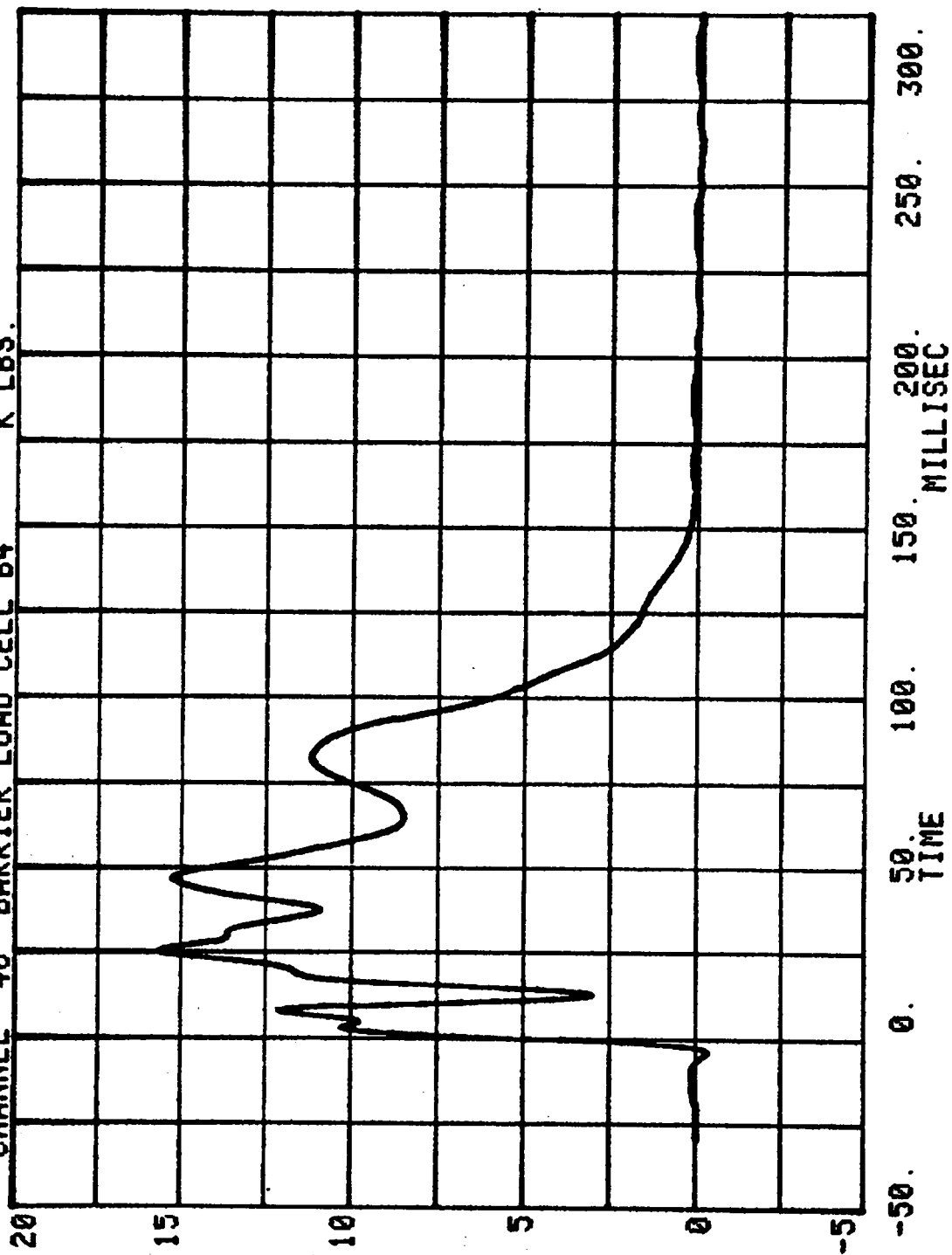
CHANNEL 44 RUN= 671 SERIES= 5902  
BARRIER LOAD CELL B2 K LBS.



RUN= 671 SERIES= 5902  
CHANNEL 45 BARRIER LOAD CELL 83 K LBS.

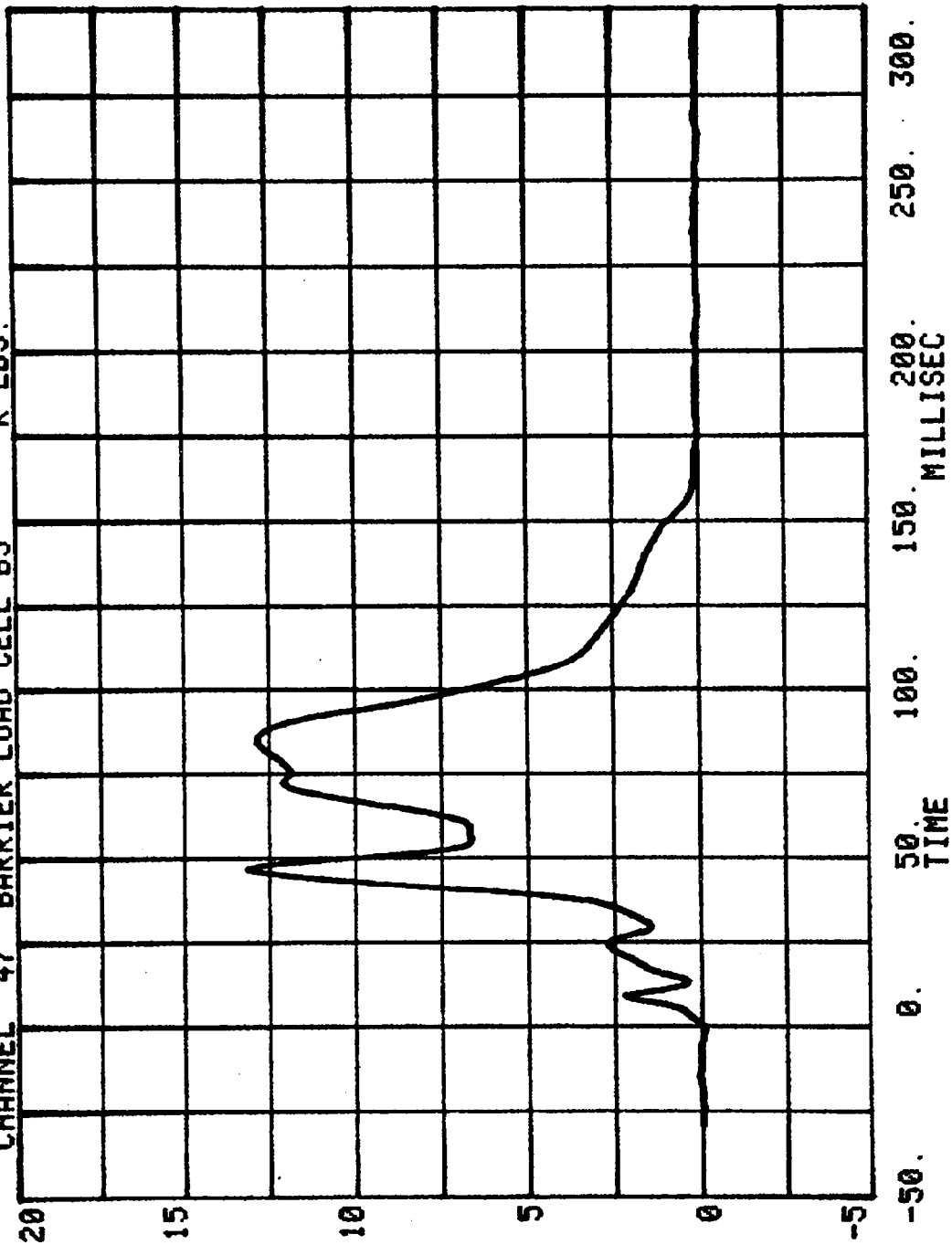


RUN= 671 SERIES= 5902  
CHANNEL 46 BARRIER LOAD CELL B4 K LBS.

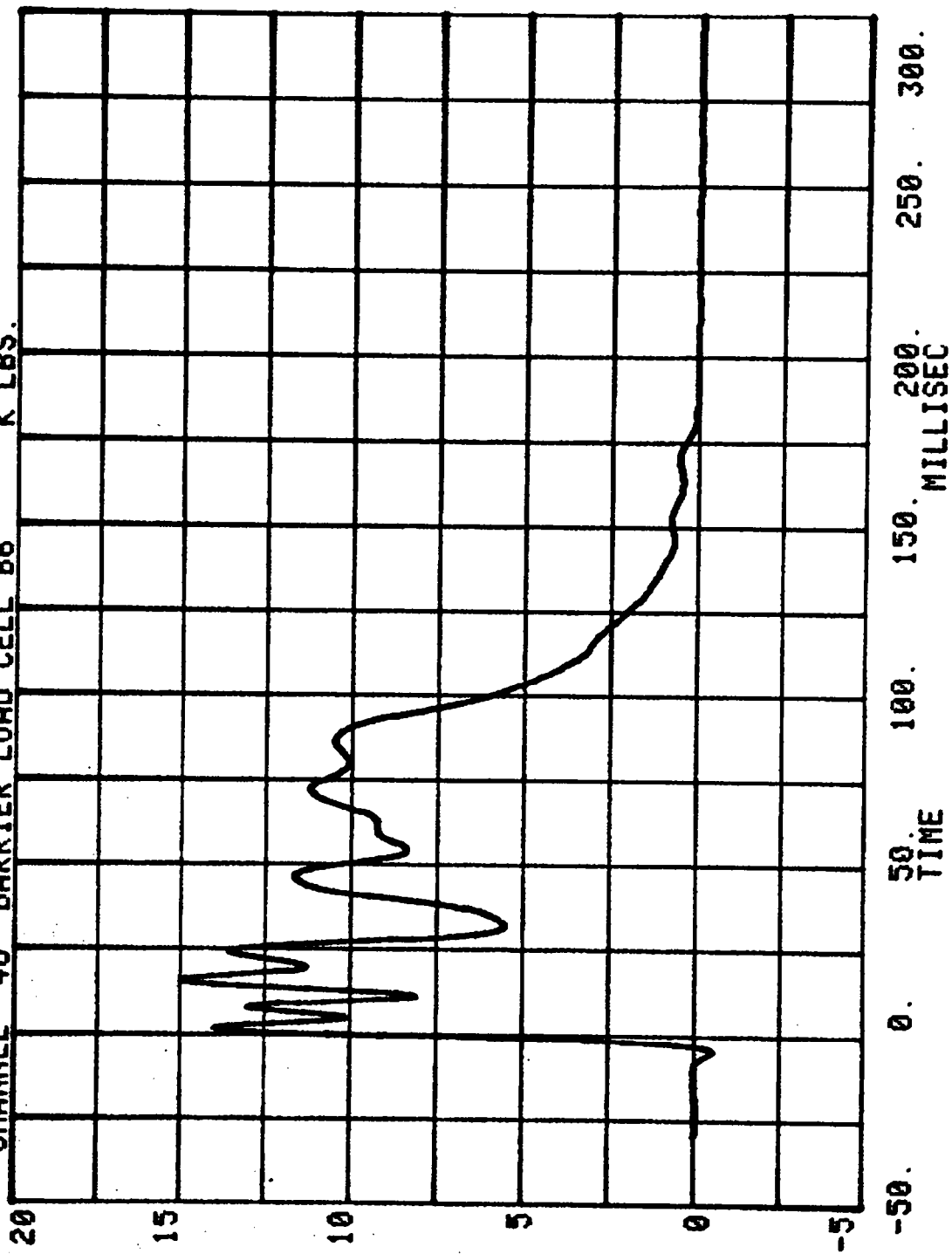


CHANNEL 47 BARRIER LOAD CELL B5 K LBS.

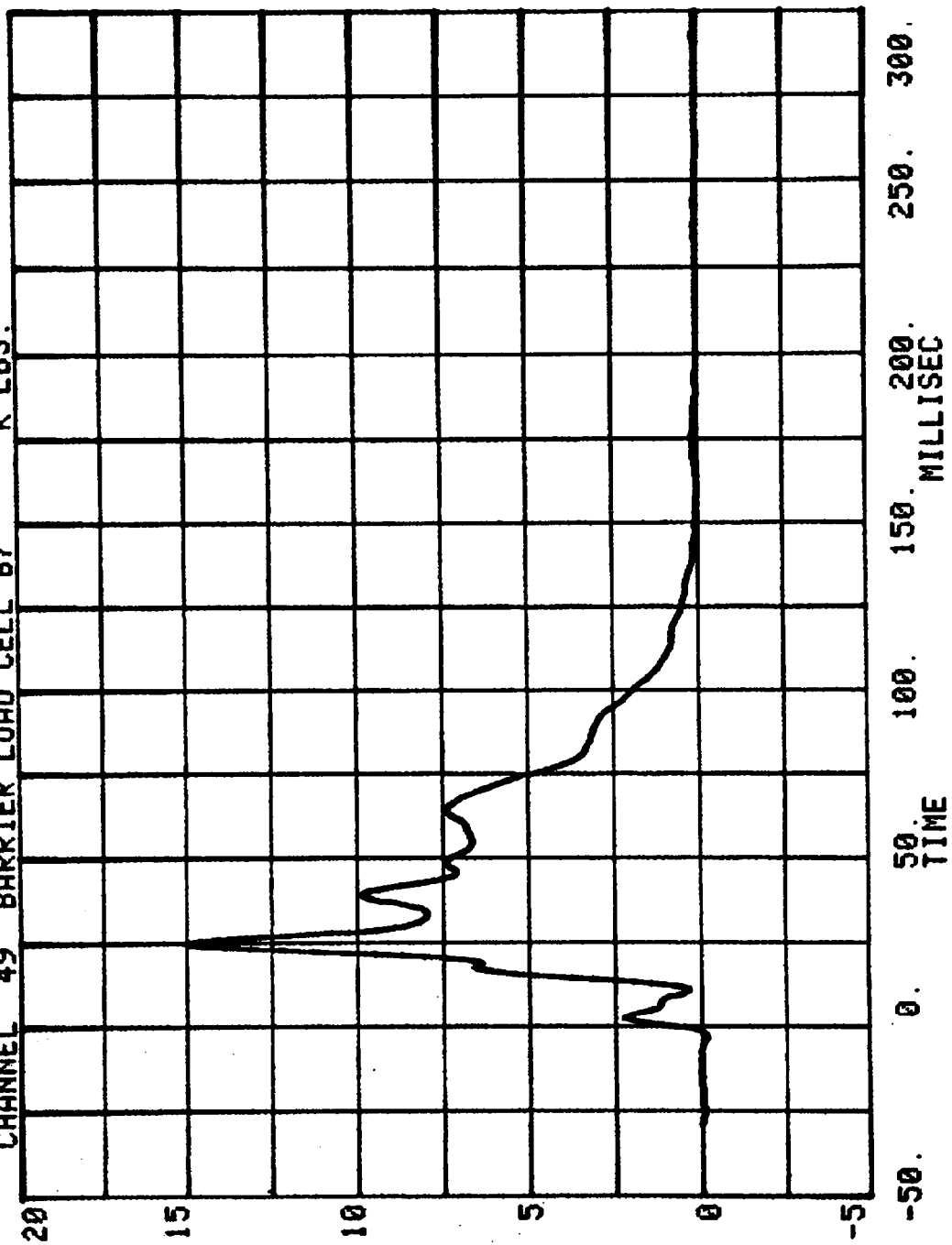
RUN= 671 SERIES= 5902



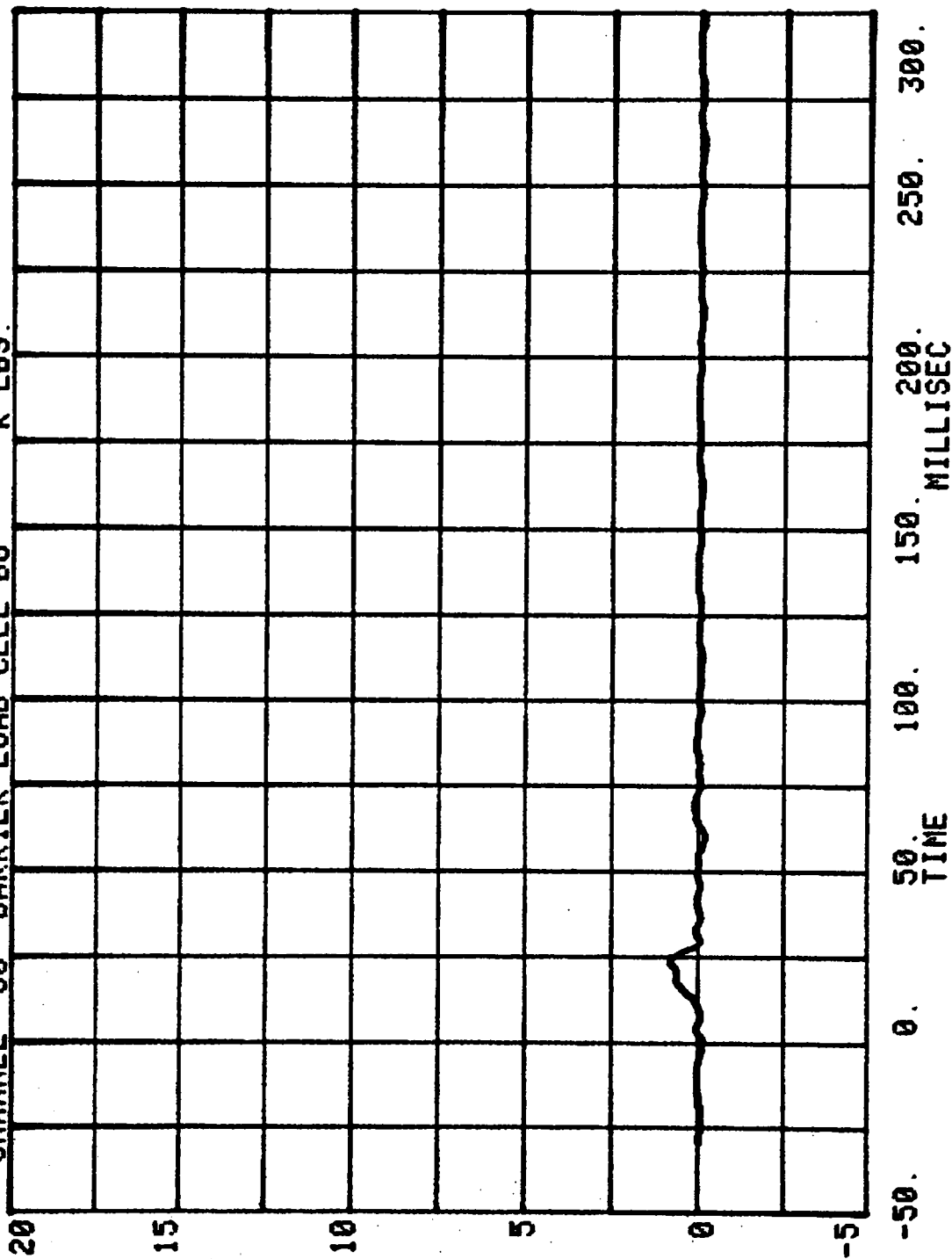
RUN= 671 SERIES= 5902  
CHANNEL 48 BARRIER LOAD CELL B6 K LBS.



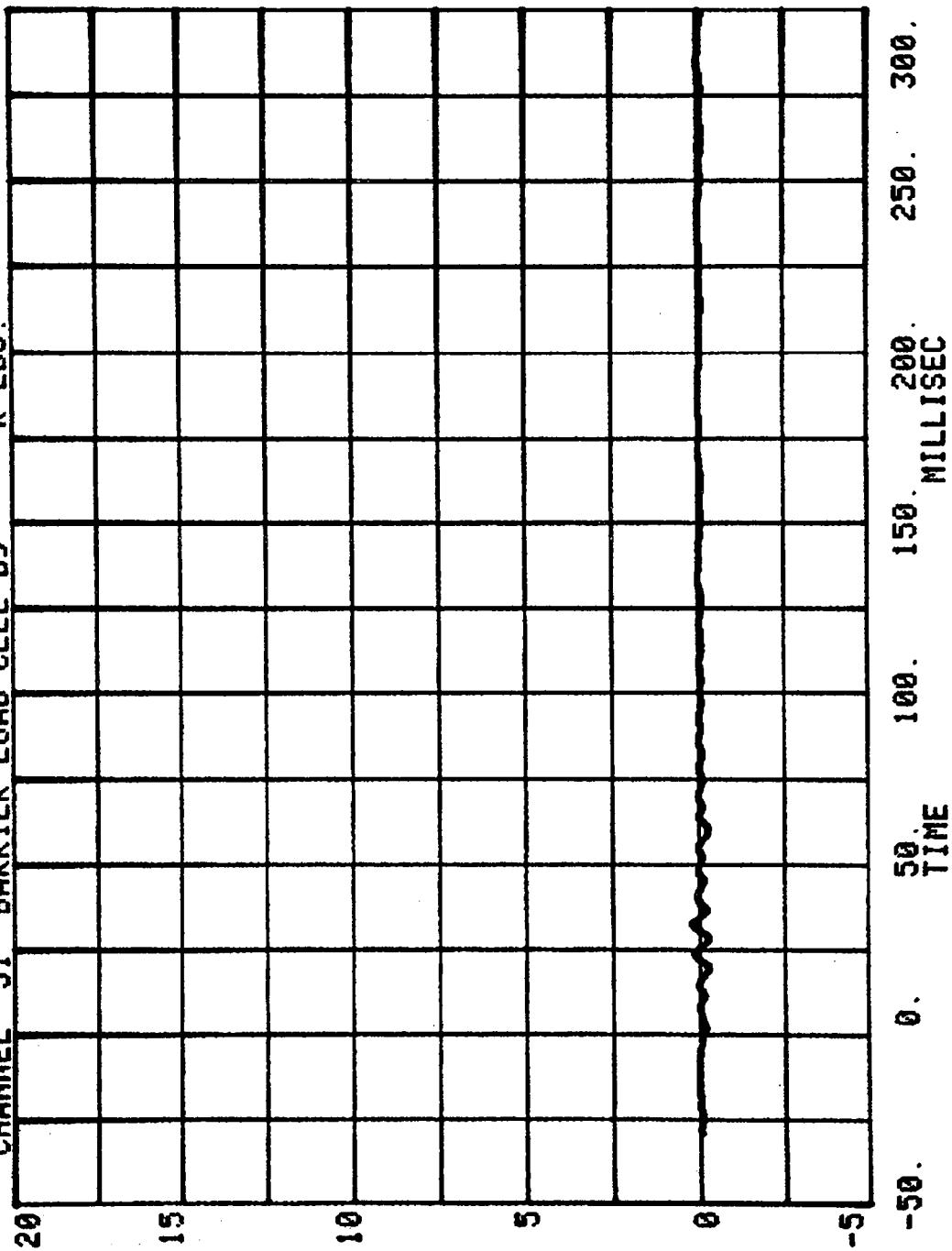
RUN= 671 SERIES= 5902  
CHANNEL 49 BARRIER LOAD CELL B7 K LBS.



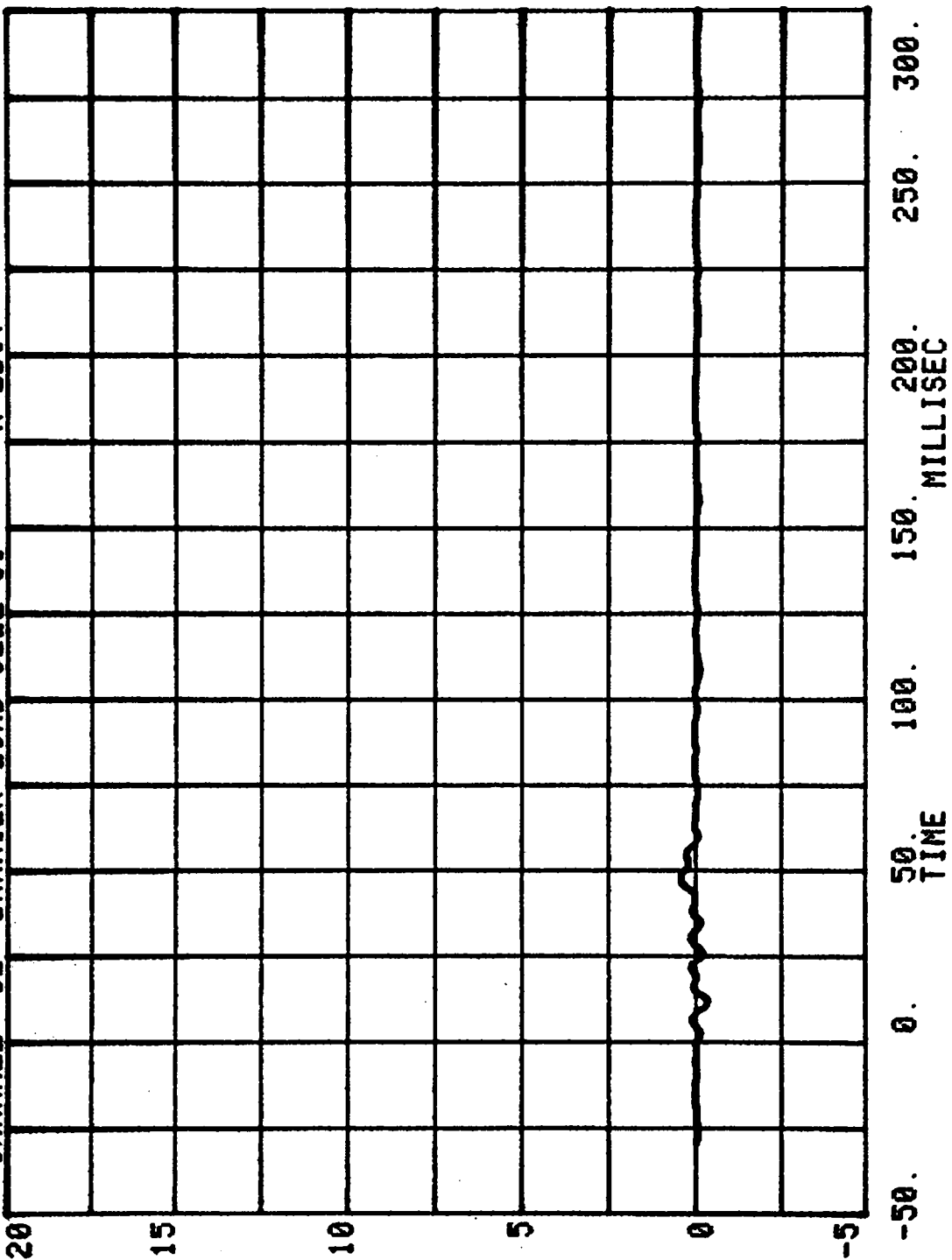
RUN= 671 SERIES= 5902  
CHANNEL 50 BARRIER LOAD CELL B8 K LBS.



RUN= 671 SERIES= 5902  
CHANNEL 51 BARRIER LOAD CELL B9 K LBS.



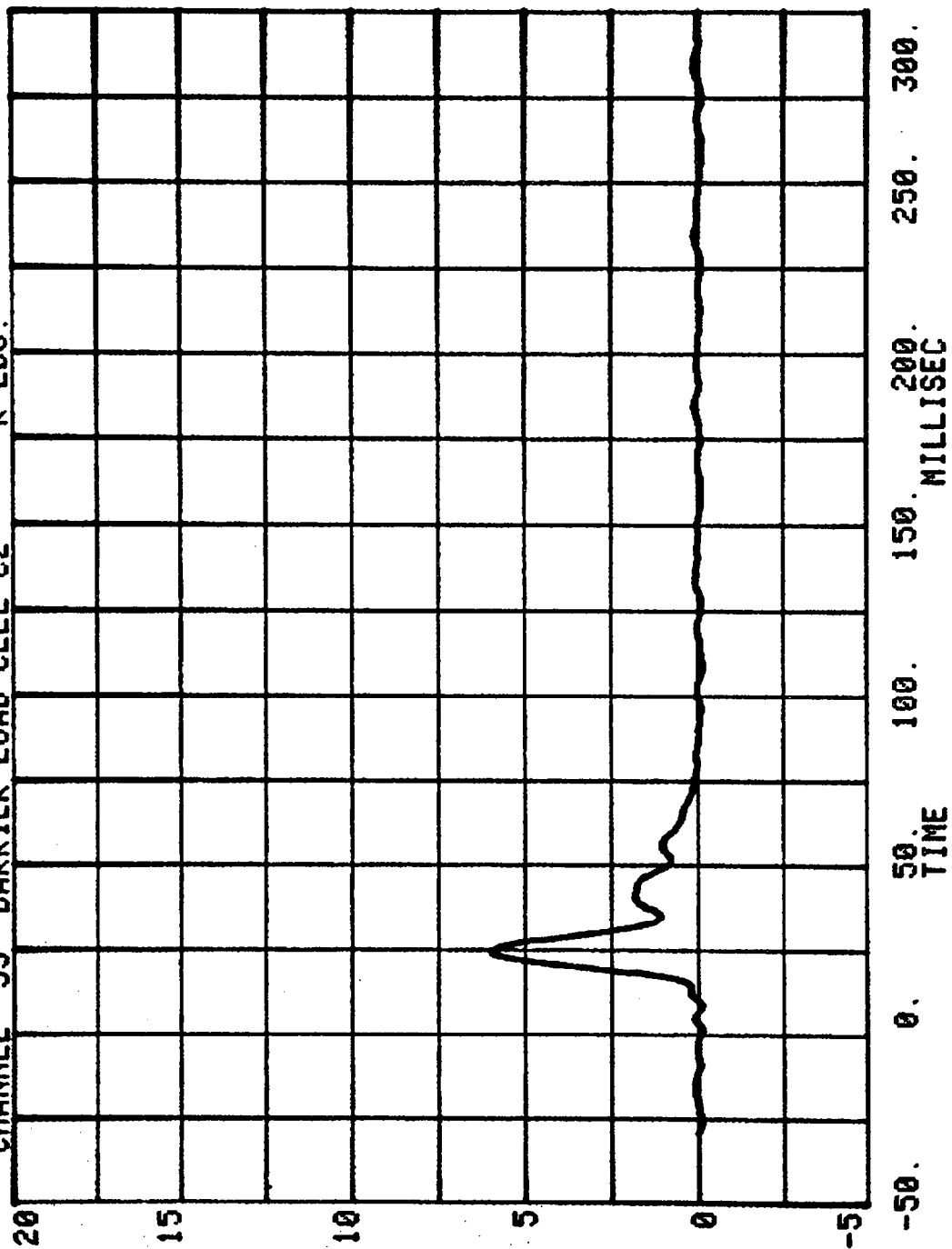
RUN= 671 SERIES= 5902  
CHANNEL 52 BARRIER LOAD CELL C1 K LBS.



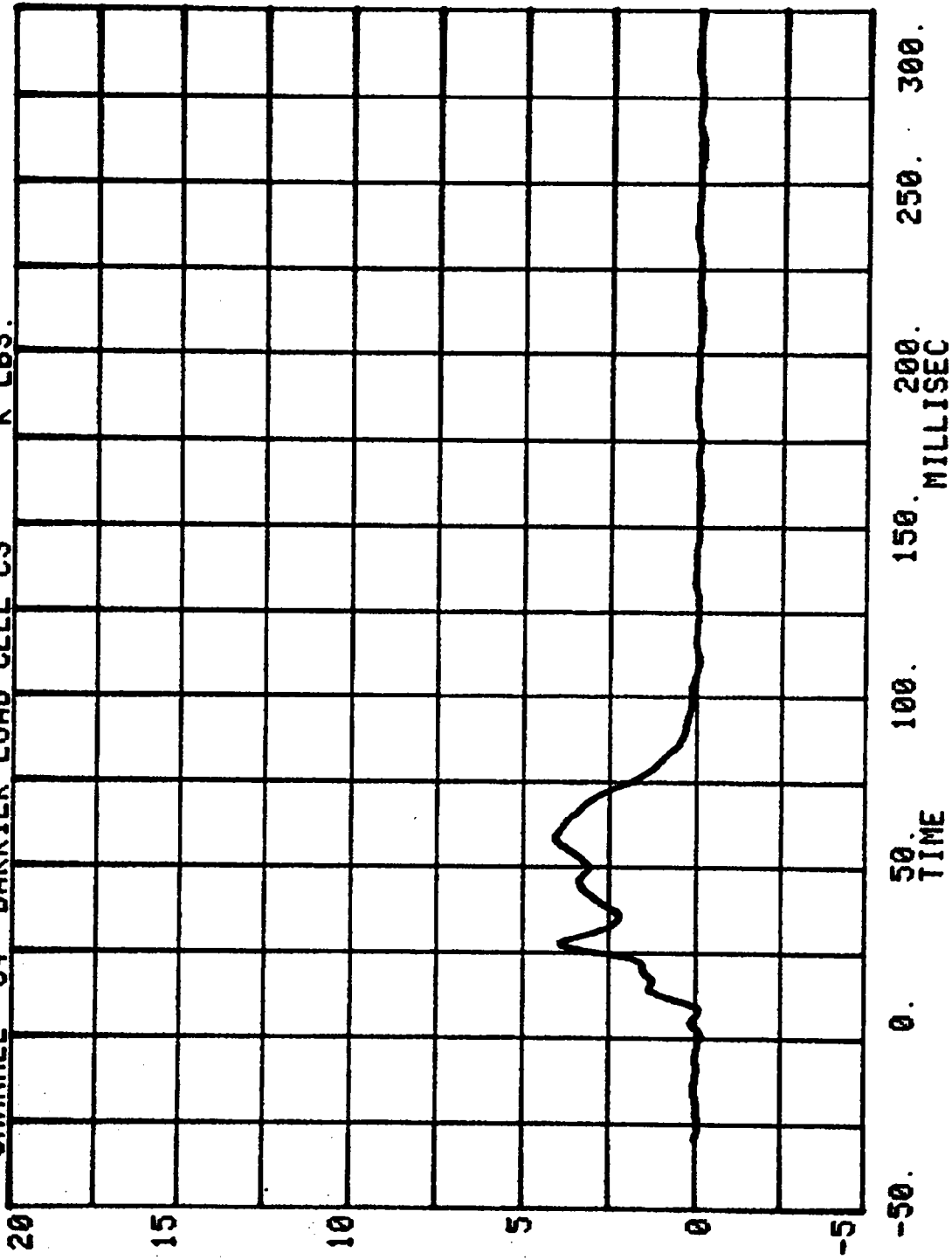
CHANNEL 53 BARRIER LOAD CELL C2

RUN= 671 SERIES= 5902

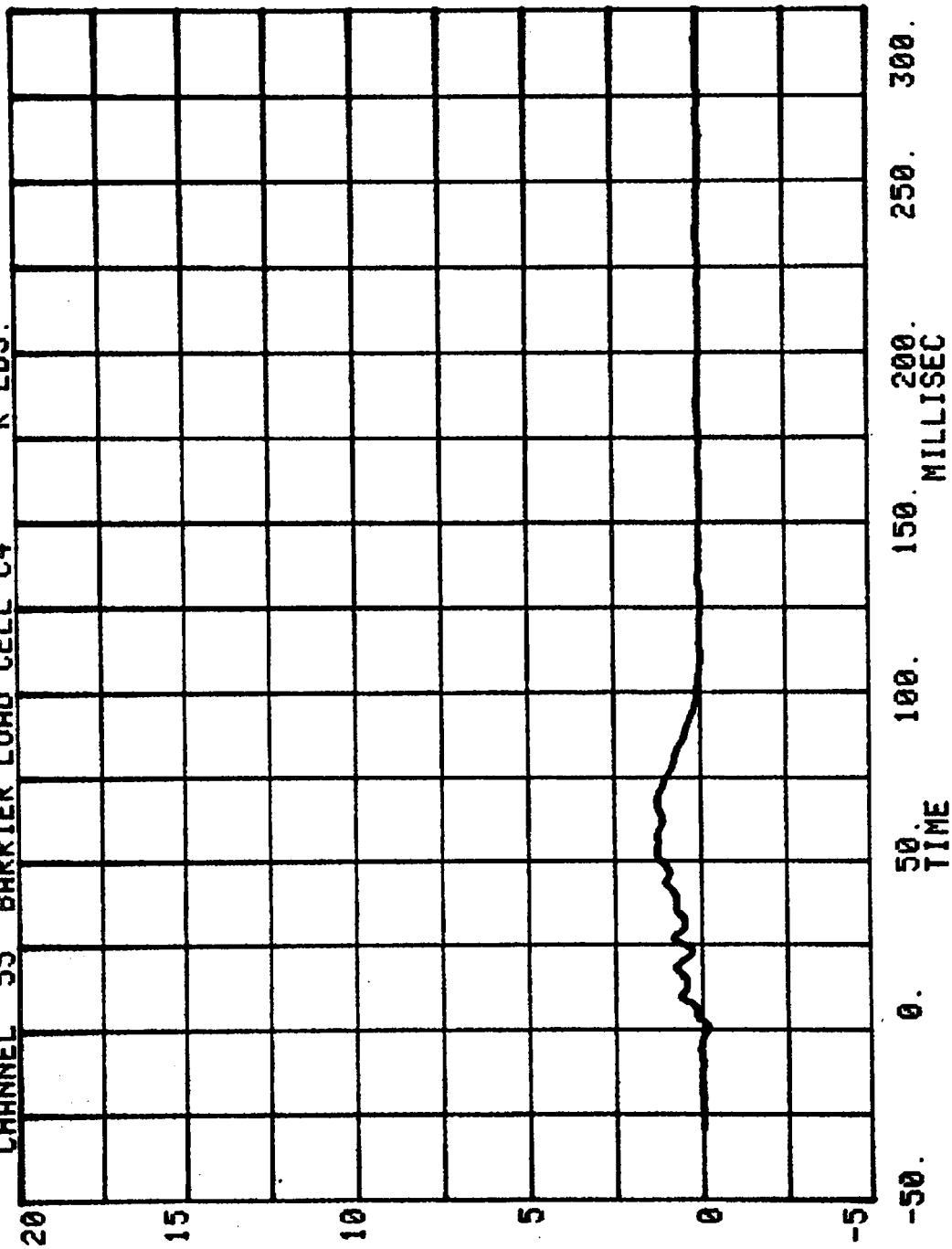
K LBS.



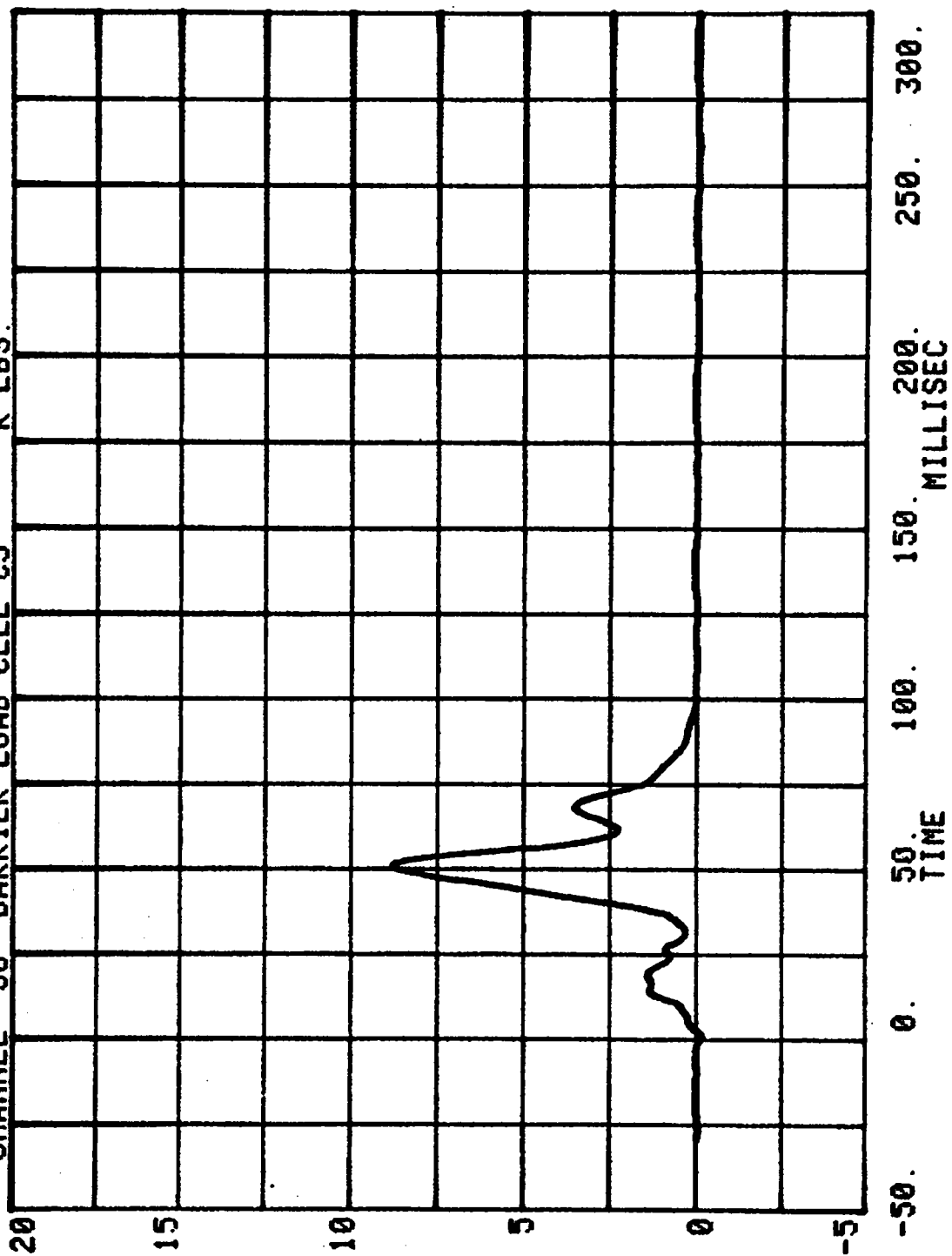
RUN= 671 SERIES= 5902  
CHANNEL 54 BARRIER LOAD CELL C3 K LBS.

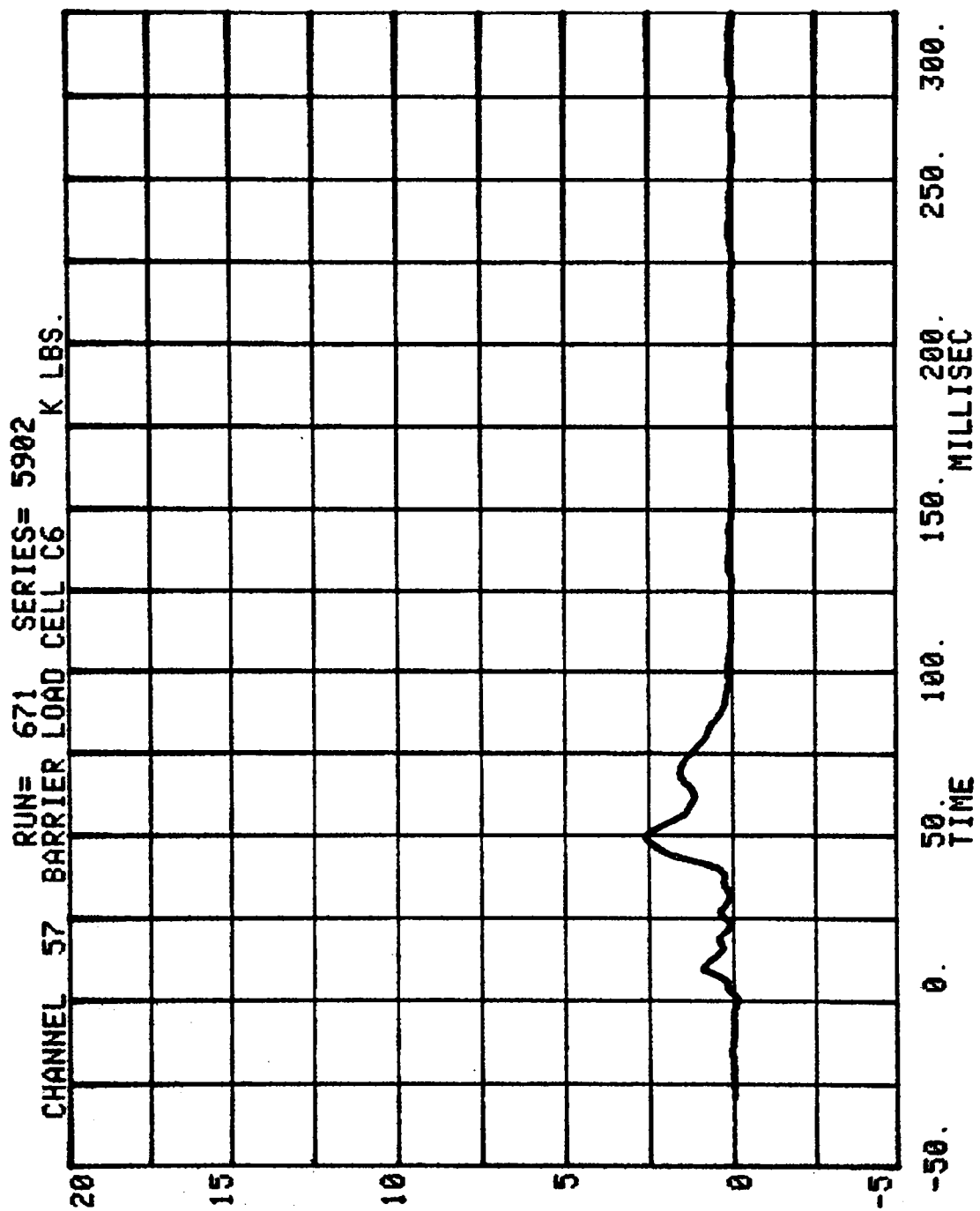


RUN= 671 SERIES= 5902  
CHANNEL 55 BARRIER LOAD CELL C4 K LBS.

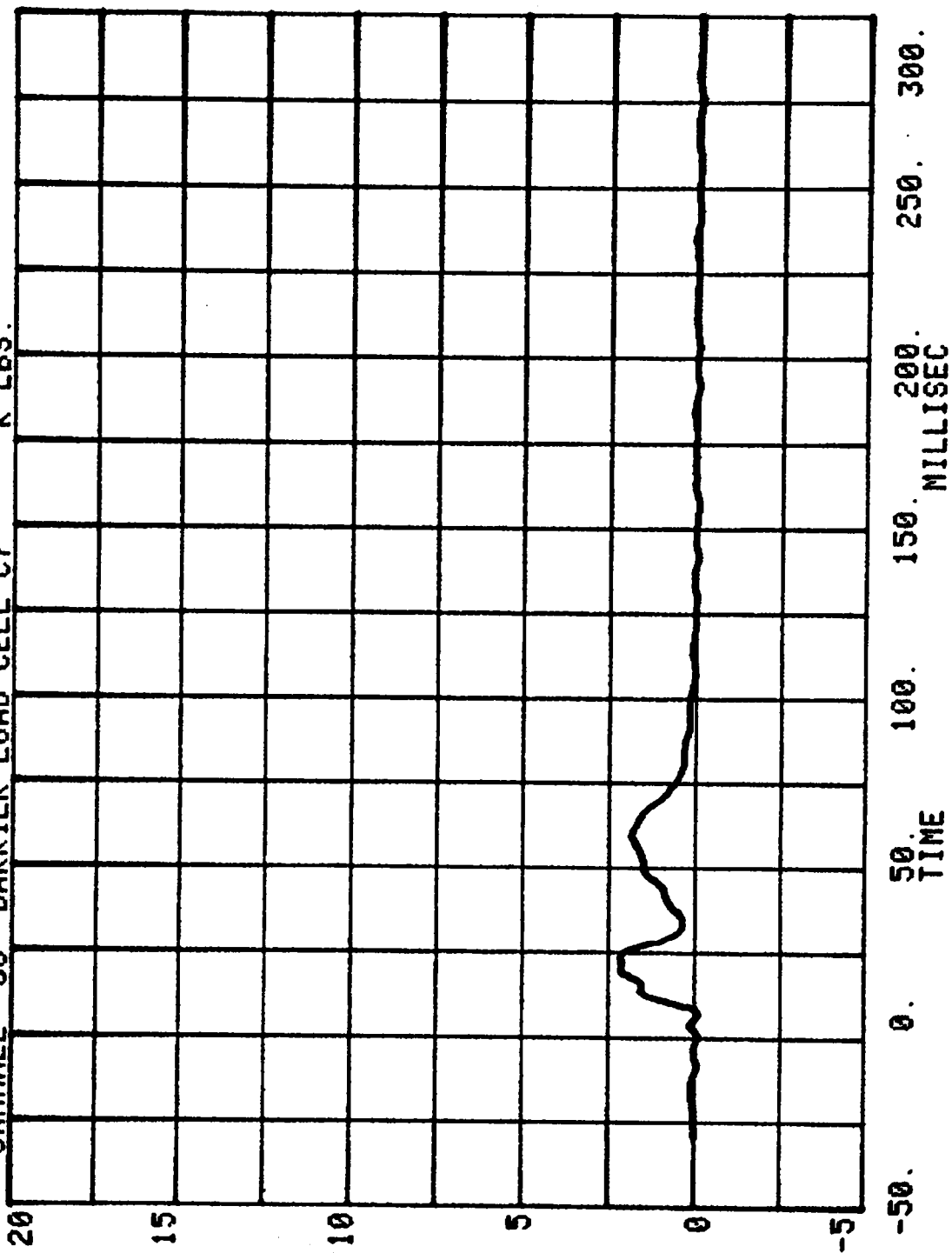


RUN= 671 SERIES= 5902  
CHANNEL 56 BARRIER LOAD CELL C5 K LBS.

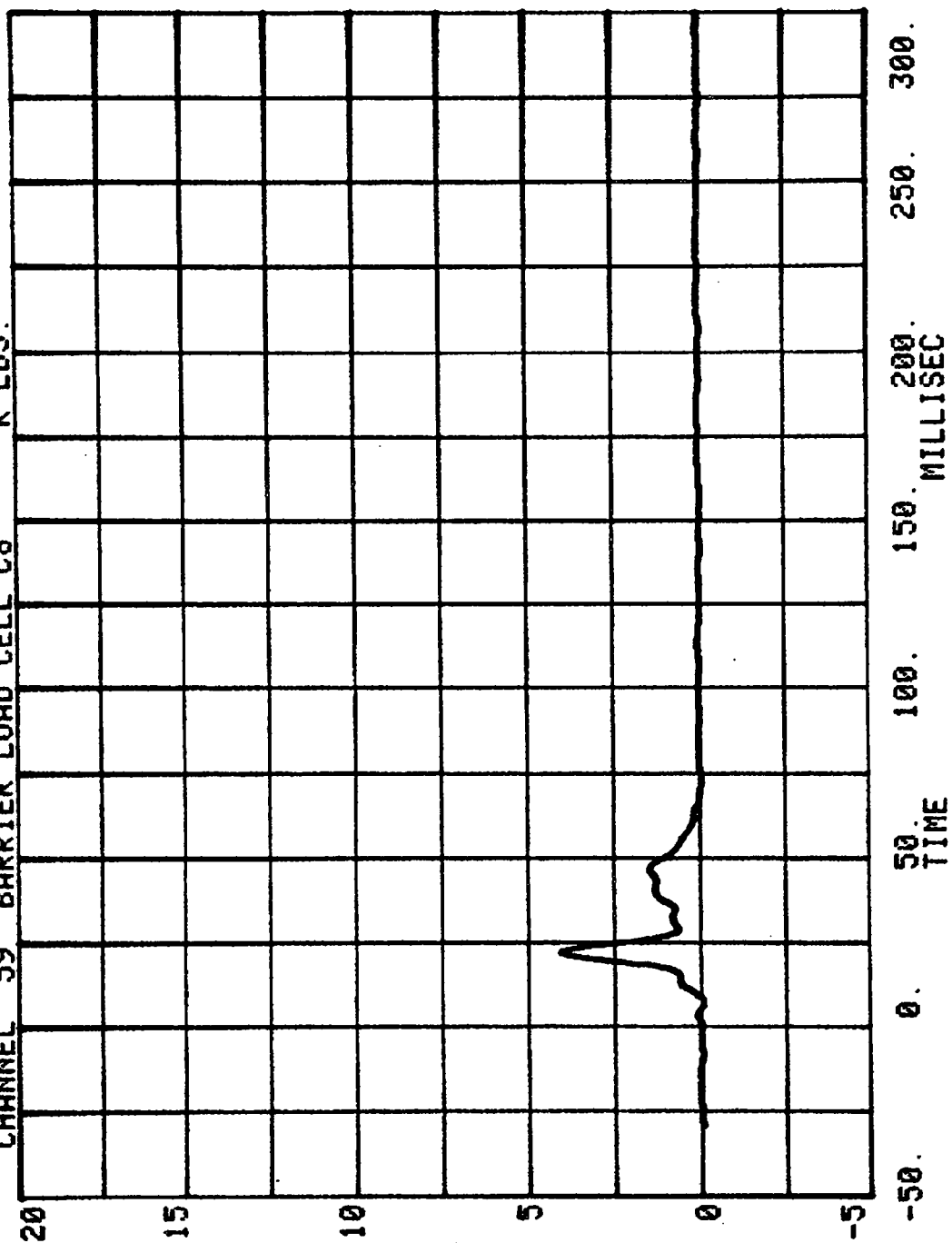




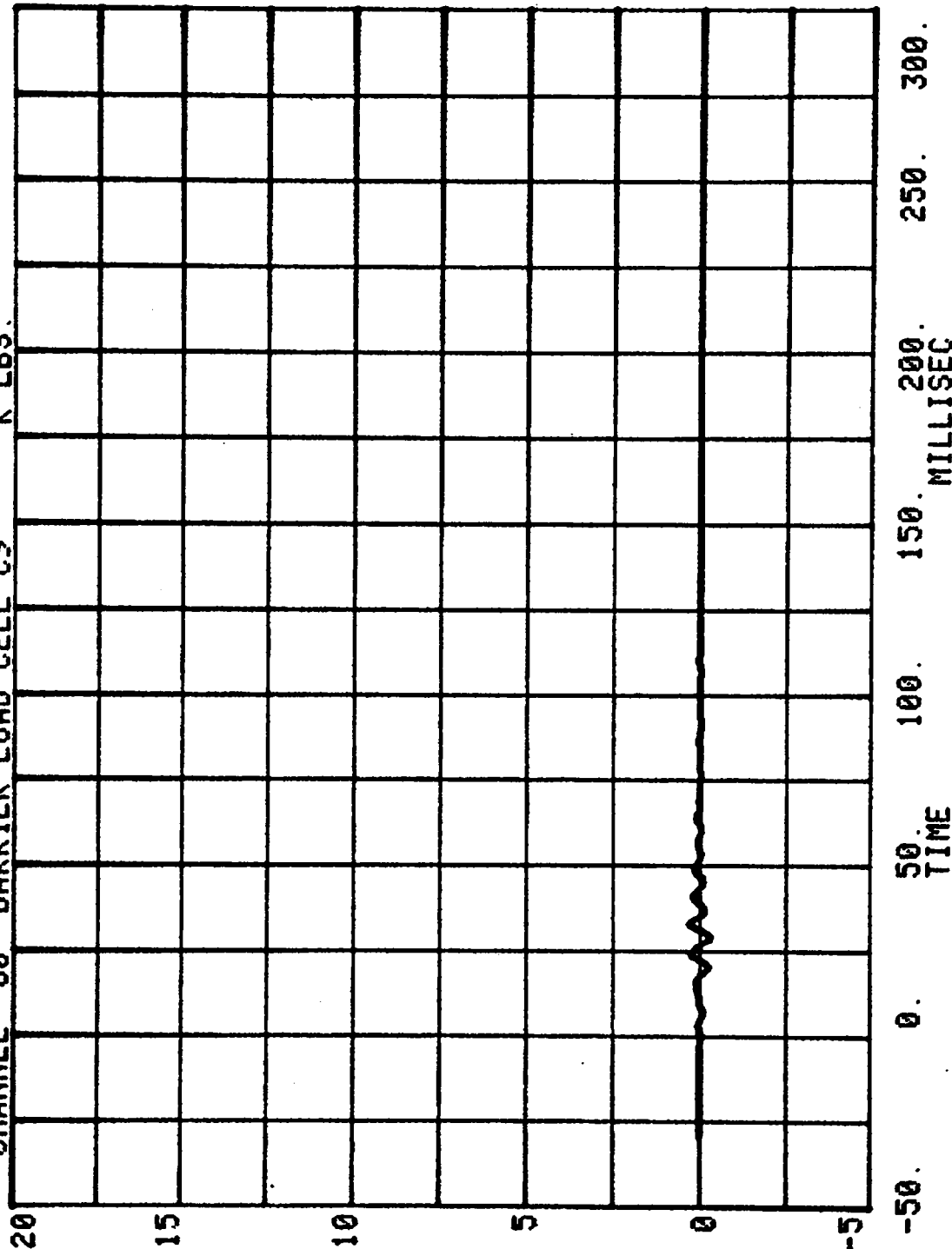
RUN= 671 SERIES= 5902  
CHANNEL 58 BARRIER LOAD CELL C7 K LBS.



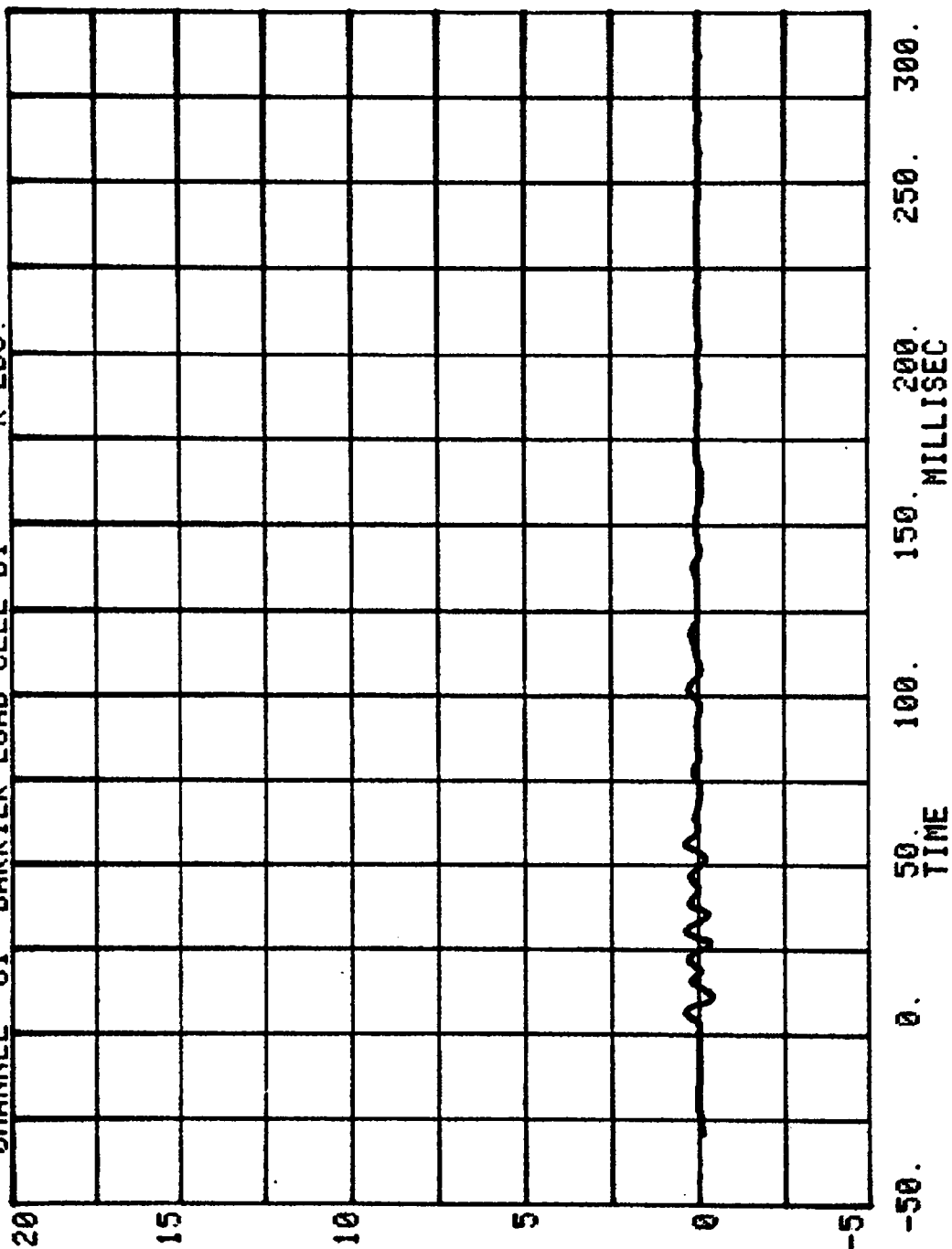
RUN= 671 SERIES= 5902  
CHANNEL 59 BARRIER LOAD CELL C8 K LBS.



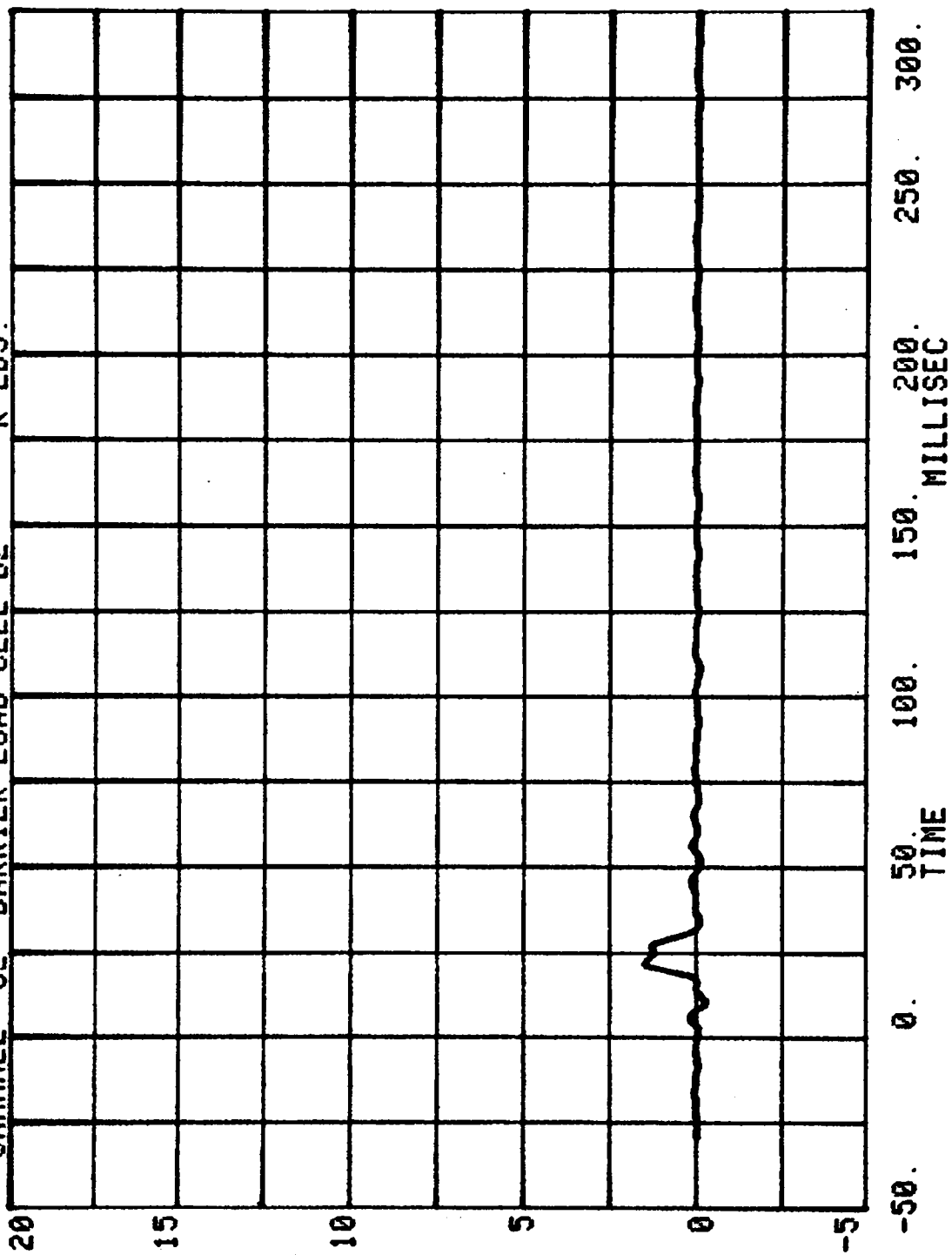
RUN= 671 SERIES= 5902  
CHANNEL 60 BARRIER LOAD CELL C9 K LBS.



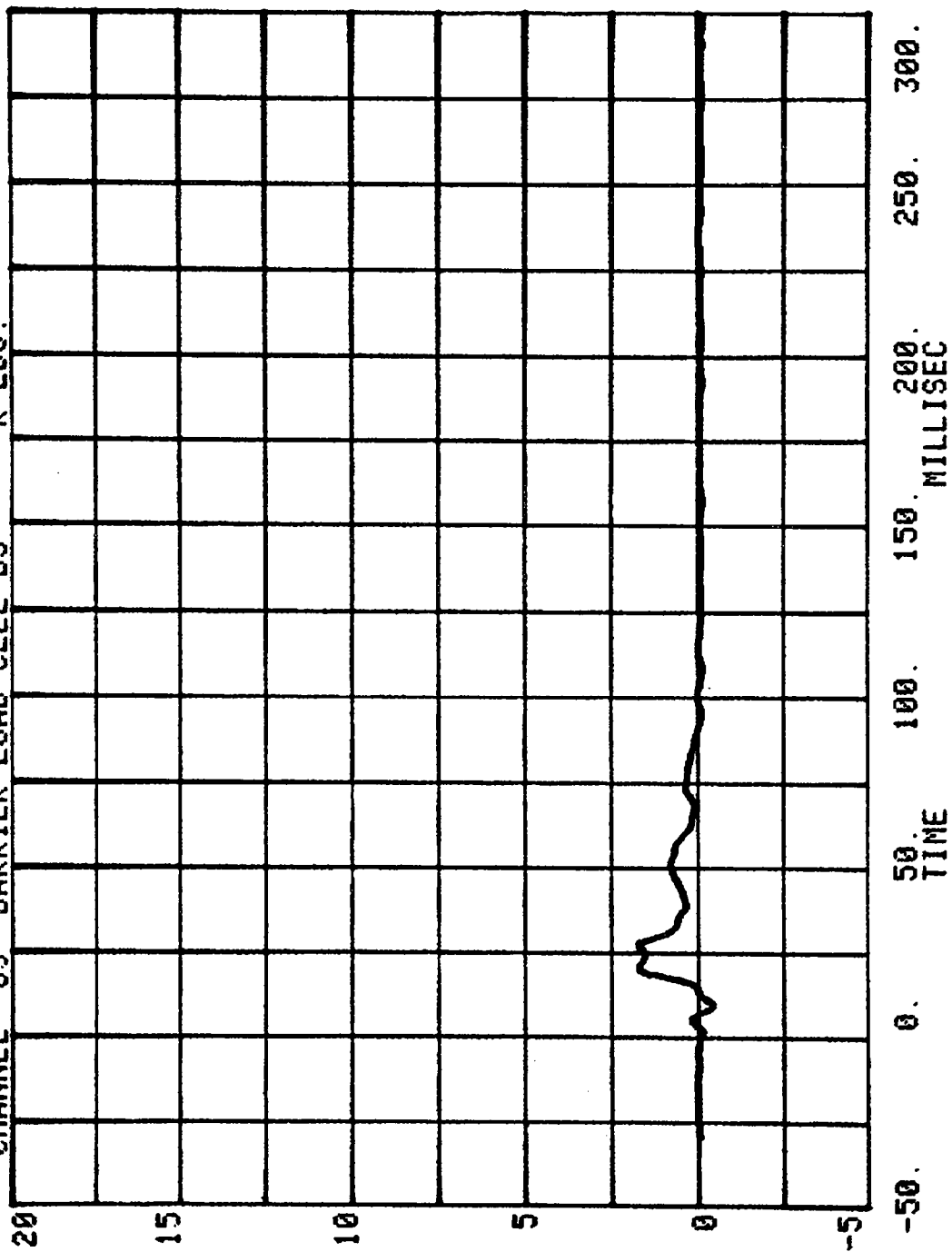
RUN= 671 SERIES= 5902  
CHANNEL 61 BARRIER LOAD CELL D1 K LBS.



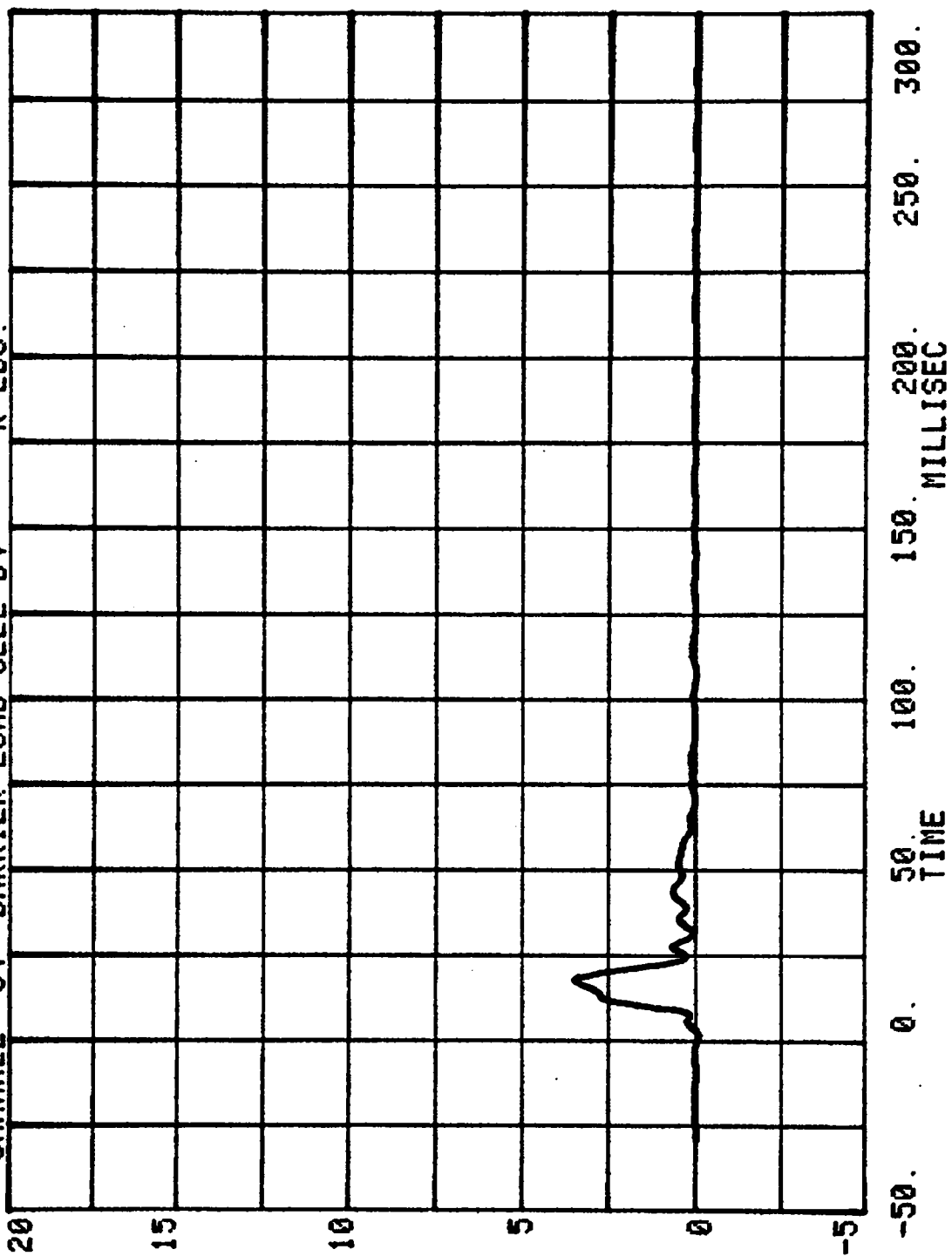
CHANNEL 62    RUN= 671    SERIES= 5902    K LBS.



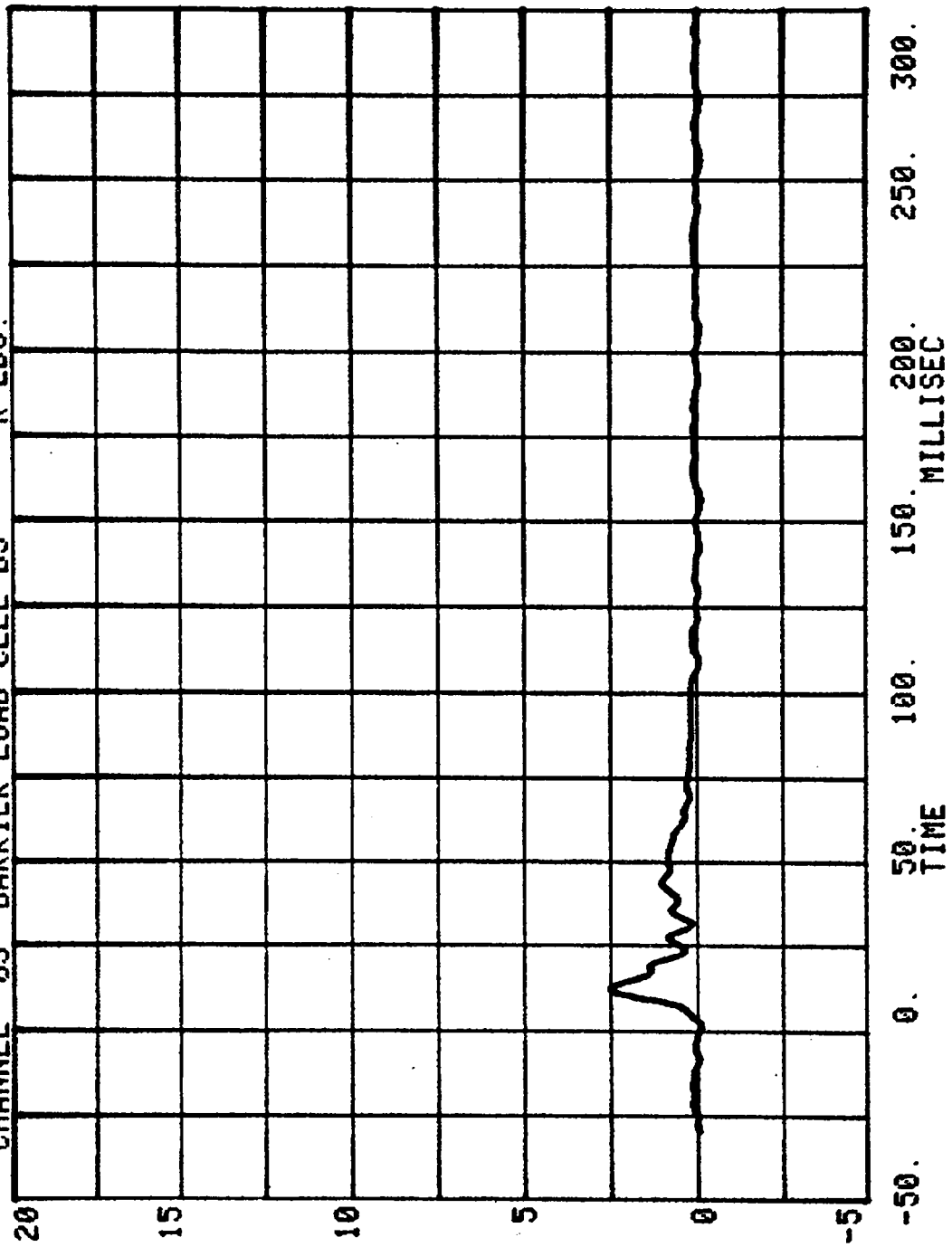
RUN= 671 SERIES= 5902  
CHANNEL 63 BARRIER LOAD CELL D3 K LBS.



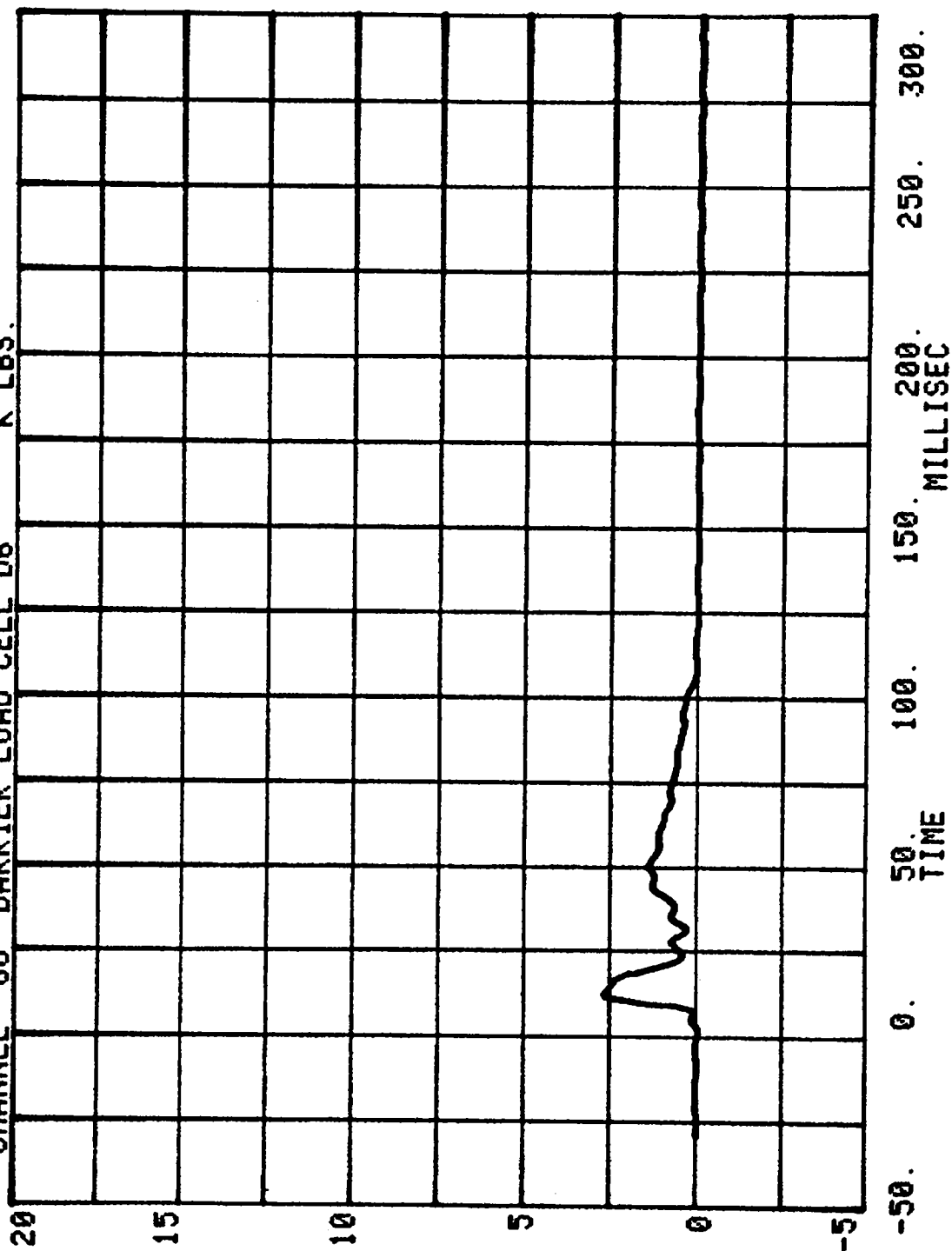
RUN= 671 SERIES= 5902  
CHANNEL 64 BARRIER LOAD CELL D4 K LBS.



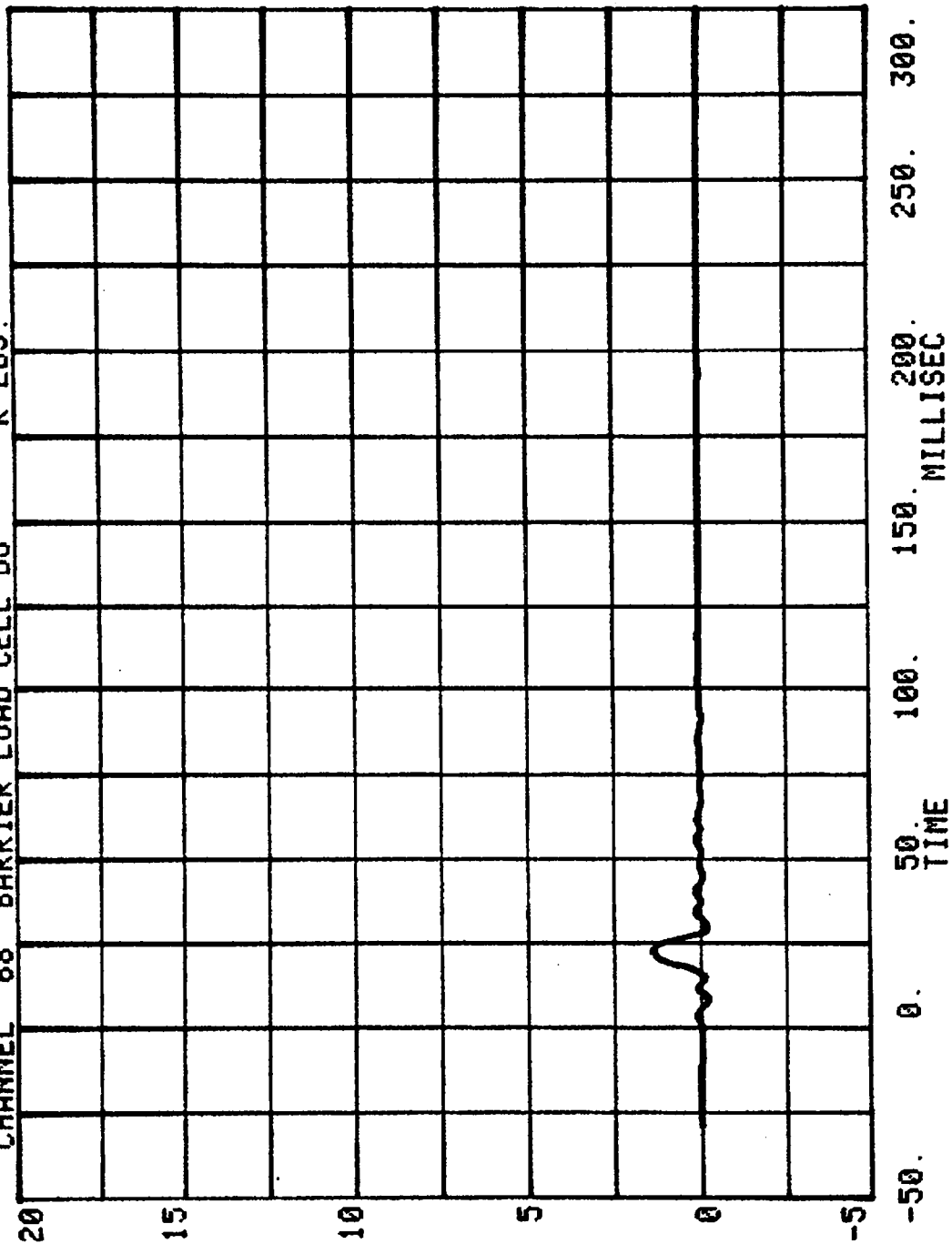
RUN= 671 SERIES= 5902  
CHANNEL 65 BARRIER LOAD CELL D5 K LBS.



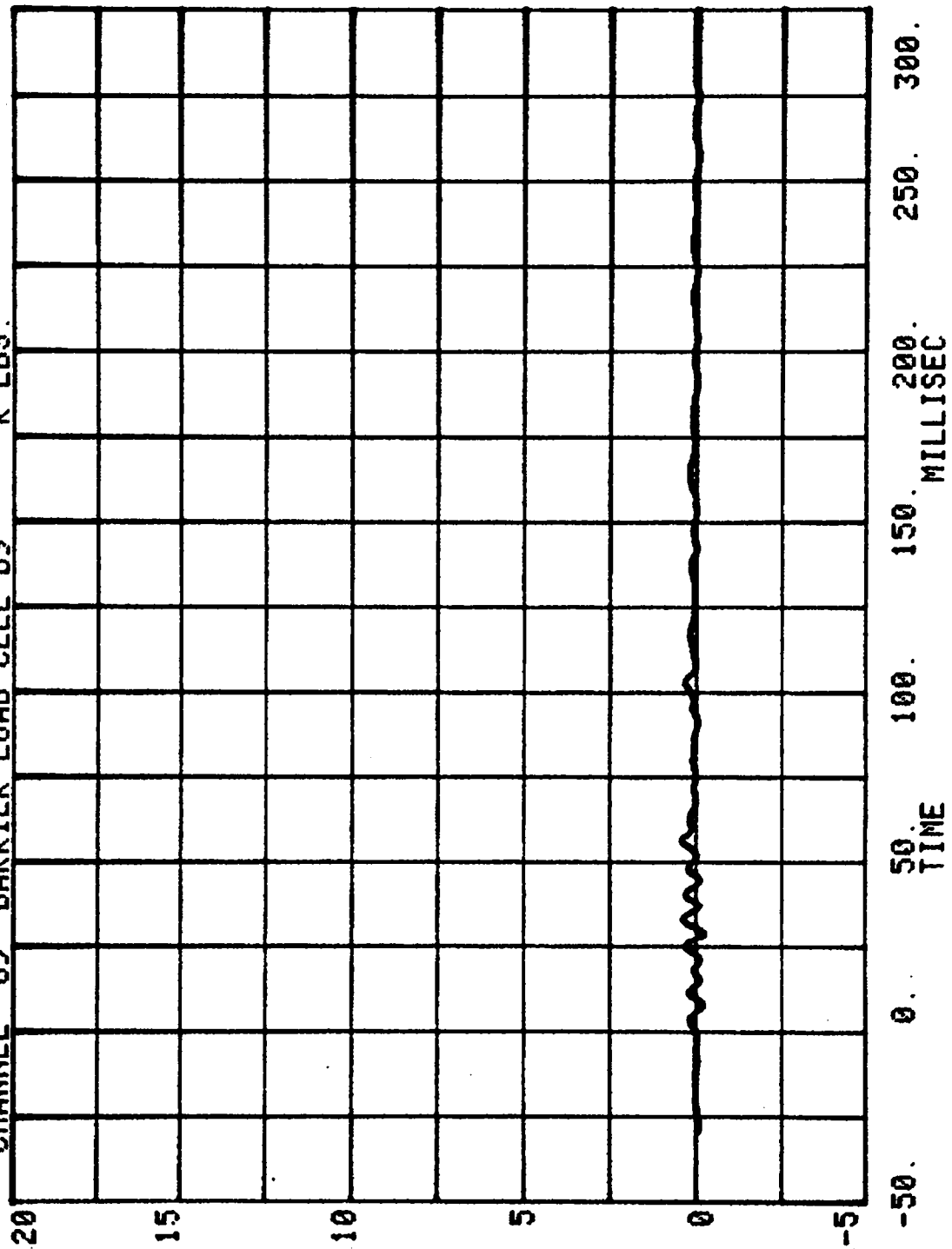
RUN= 671 SERIES= 5902  
CHANNEL 66 BARRIER LOAD CELL D6 K LBS.



CHANNEL 68 BARRIER LOAD CELL D8 RUN= 671 SERIES= 5902 K LBS.



RUN= 671 SERIES= 5902  
CHANNEL 69 BARRIER LOAD CELL 09 K LBS.



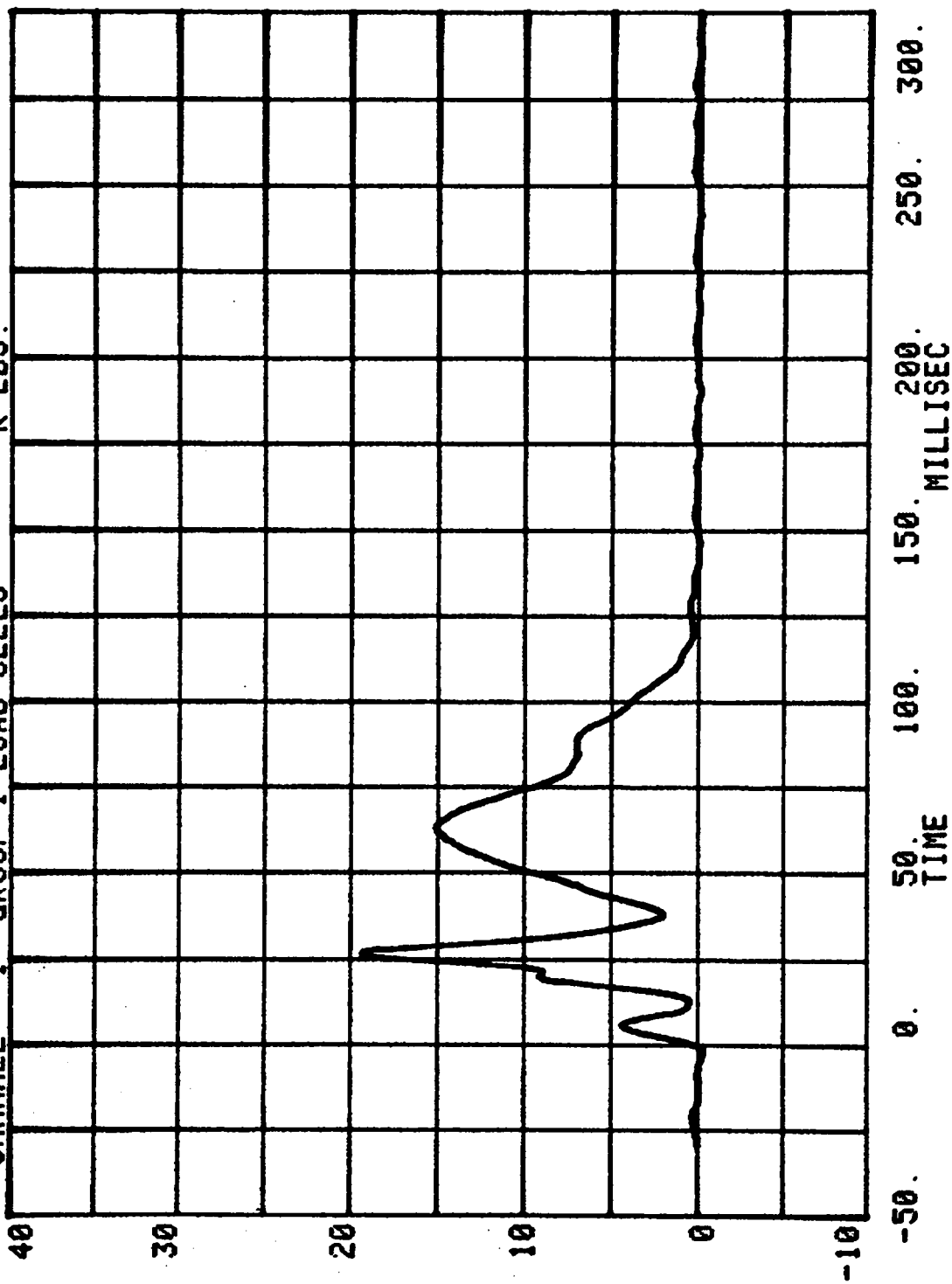
# CAR TO LOAD CELL BARRIER

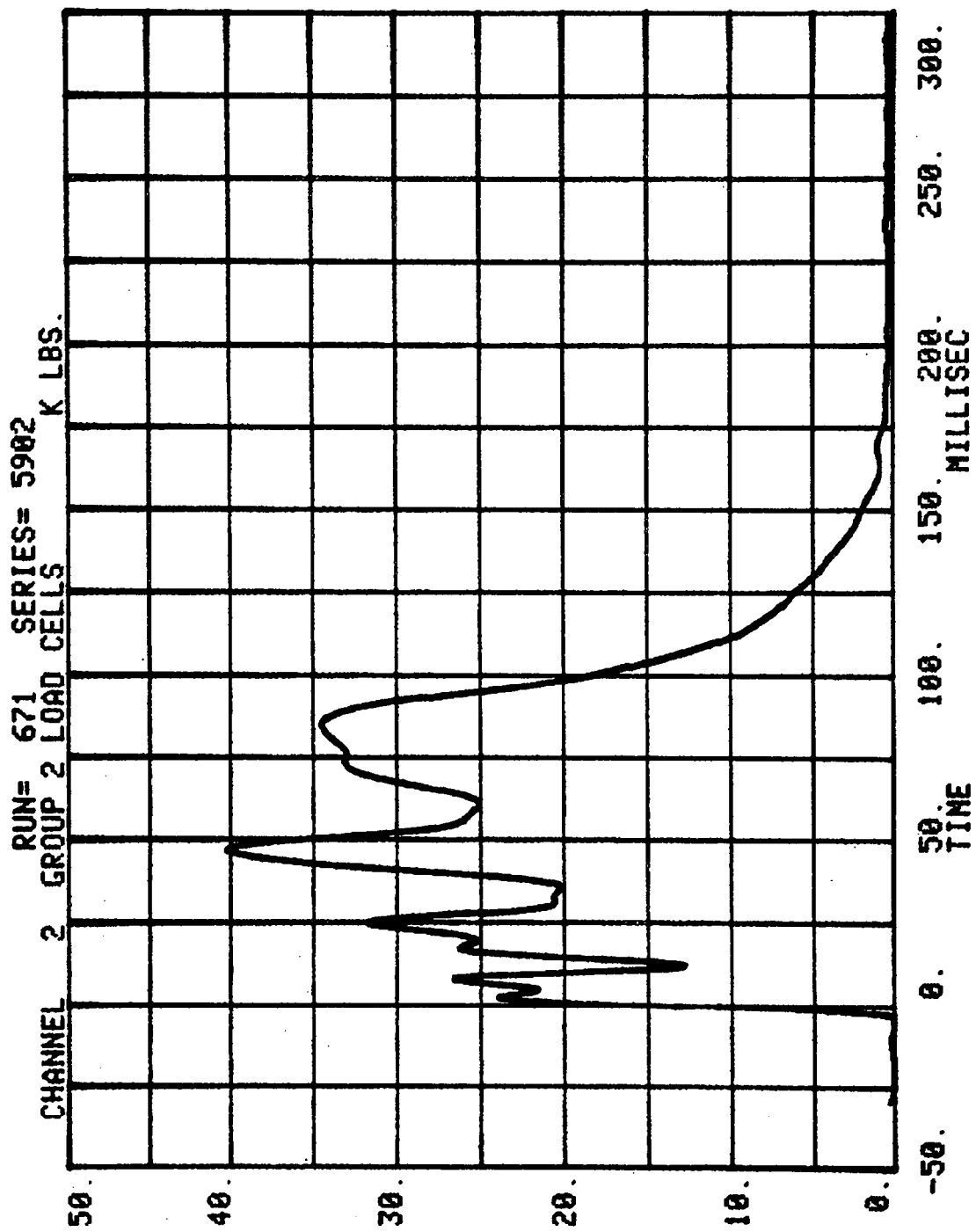
RUN # 671

SERIES # 5902

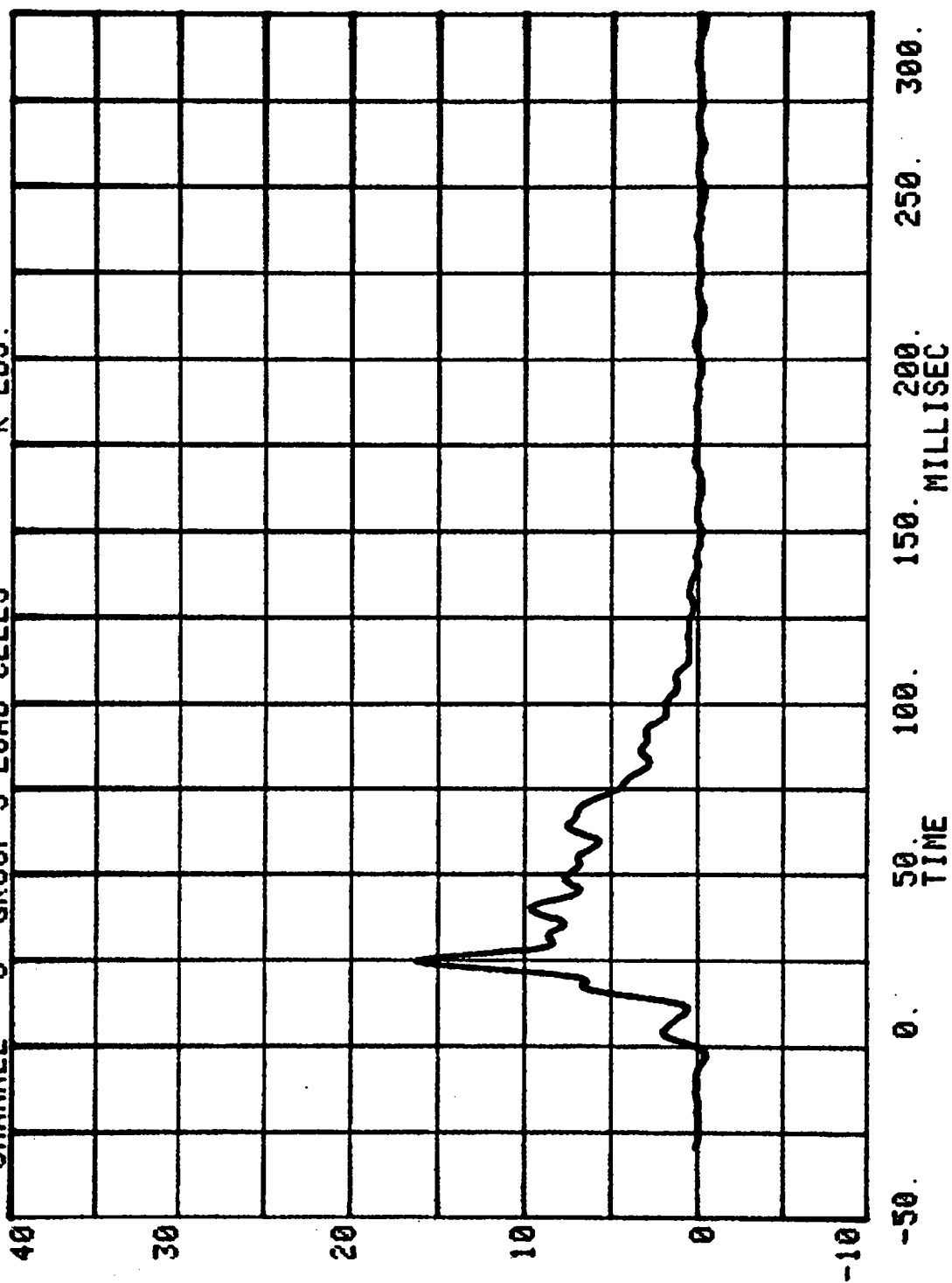
| CHAN | TITLE               | MINIMUM | MAXIMUM       |
|------|---------------------|---------|---------------|
| 1    | GROUP 1 LOAD CELLS  | -.268   | 19.442 K LBS. |
| 2    | GROUP 2 LOAD CELLS  | -.886   | 40.292 K LBS. |
| 3    | GROUP 3 LOAD CELLS  | -.432   | 16.314 K LBS. |
| 4    | GROUP 4 LOAD CELLS  | -.939   | 11.695 K LBS. |
| 5    | GROUP 5 LOAD CELLS  | -.636   | 15.264 K LBS. |
| 6    | GROUP 6 LOAD CELLS  | -.720   | 8.719 K LBS.  |
| 7    | TOTAL LOAD CELL SUM | -1.299  | 86.356 K LBS. |

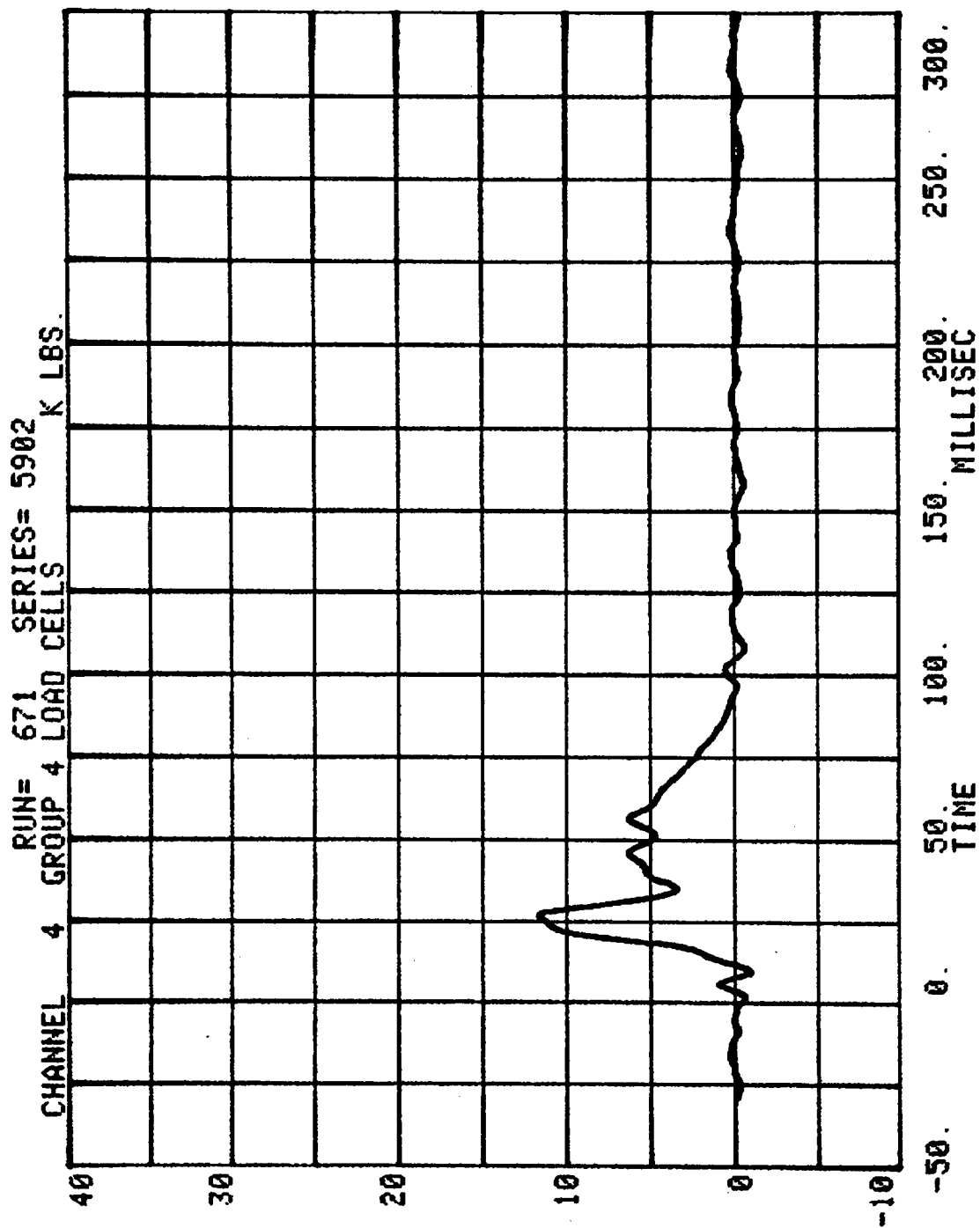
RUN= 671 SERIES= 5902  
CHANNEL 1 GROUP 1 LOAD CELLS K LBS.





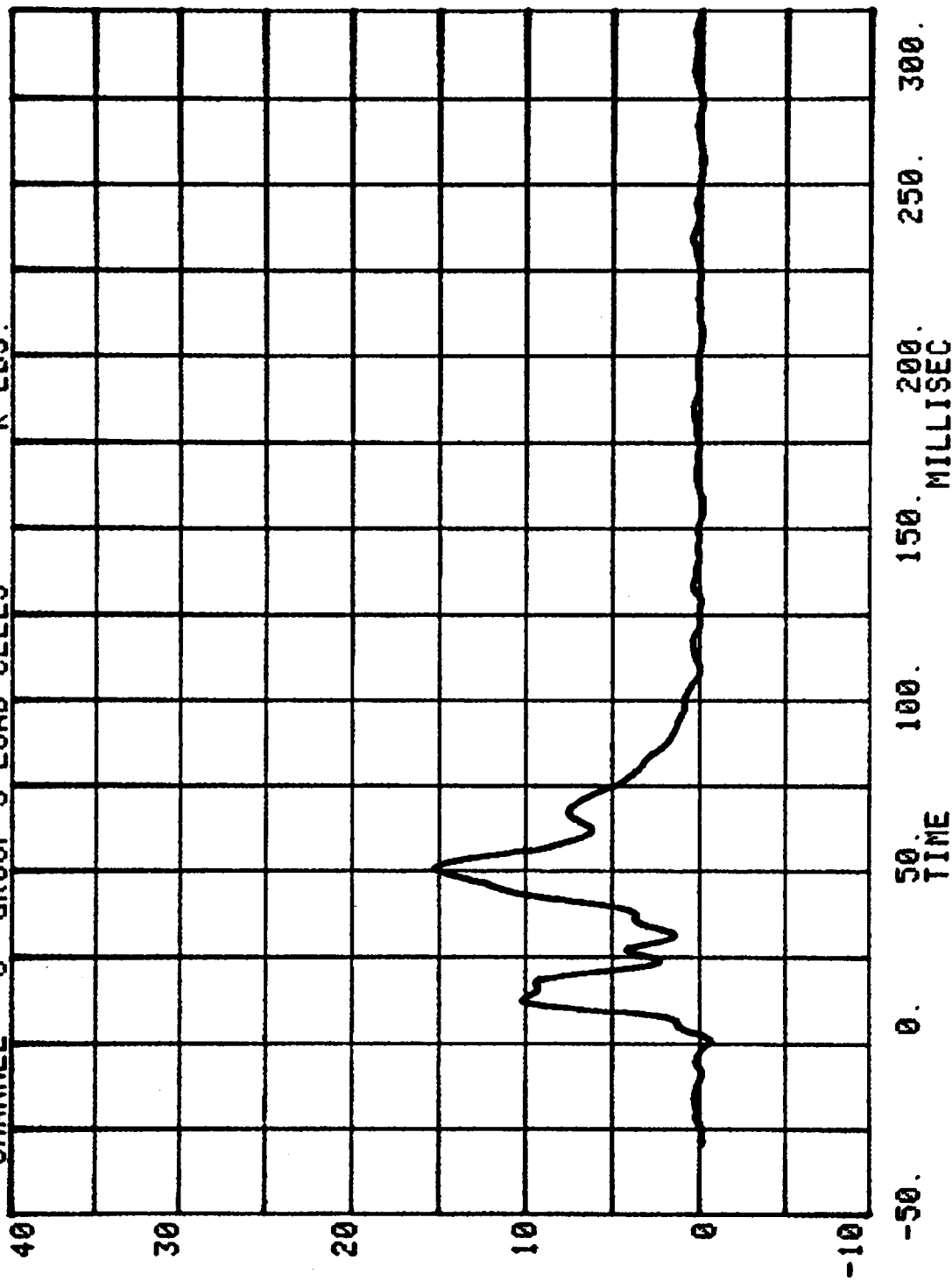
RUN= 671 SERIES= 5902  
CHANNEL 3 GROUP 3 LOAD CELLS K LBS.



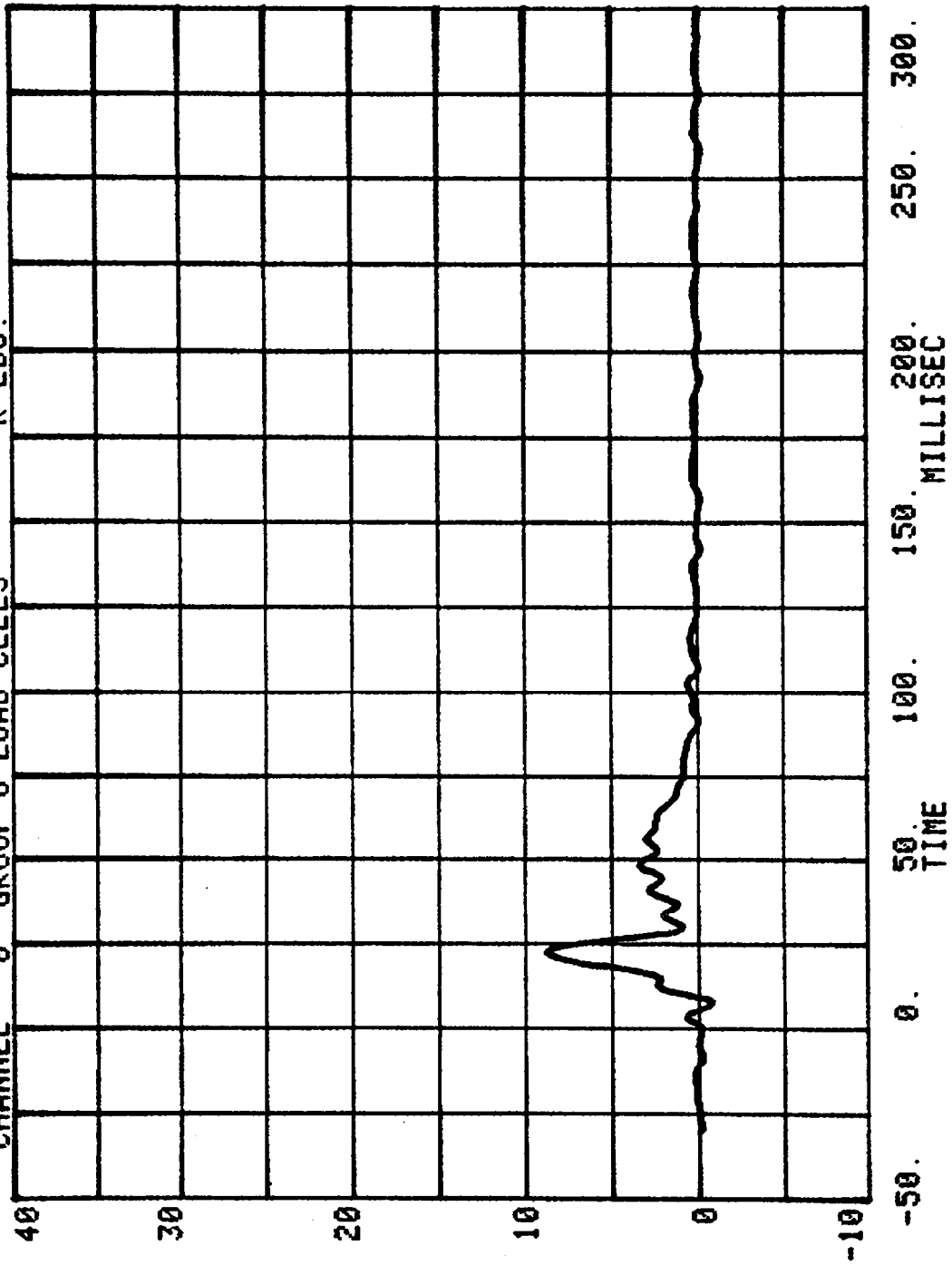


CHANNEL 5 GROUP 5 LOAD CELLS K LBS.

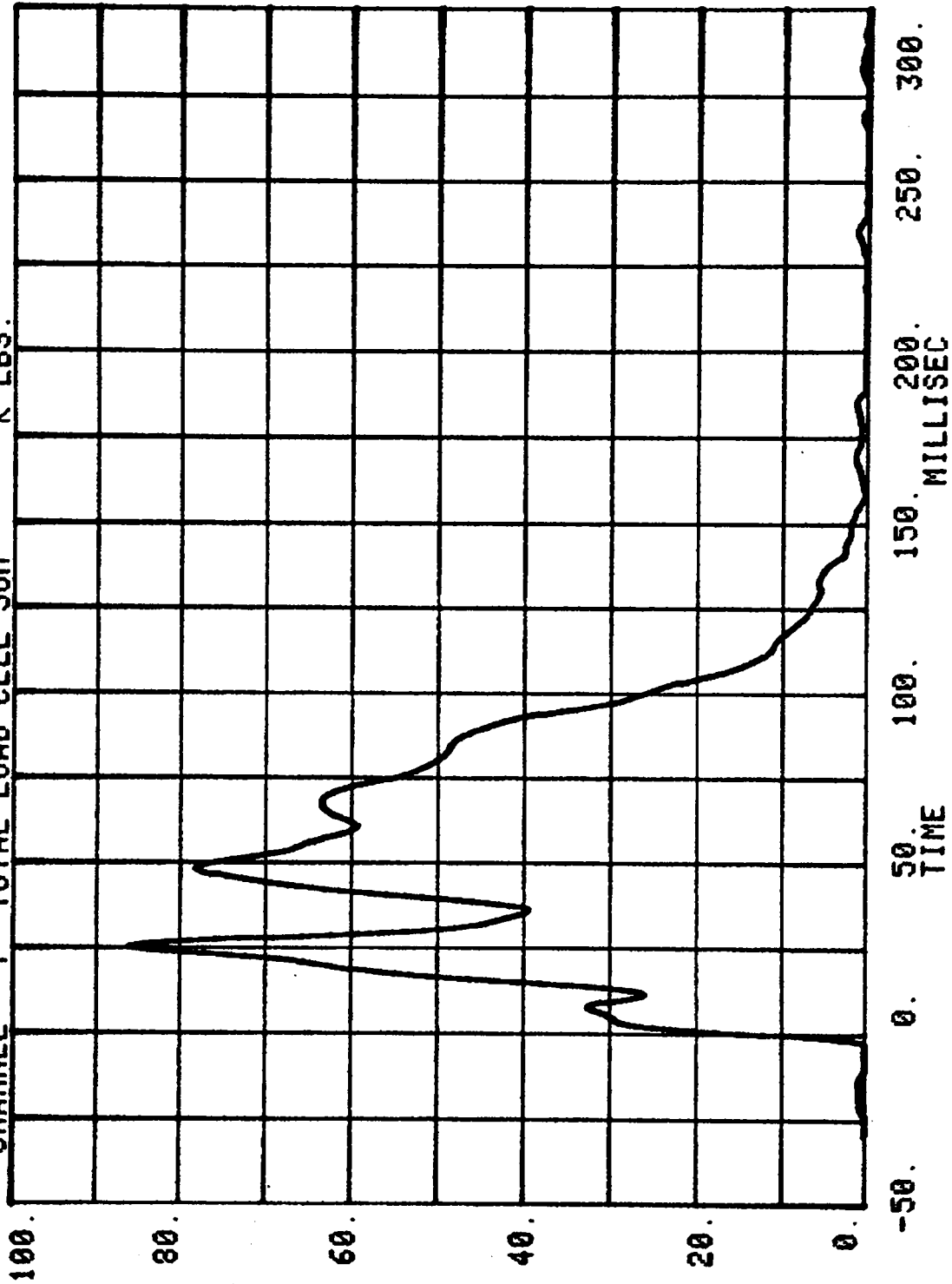
RUN= 671 SERIES= 5902



RUN= 671 SERIES= 5902  
CHANNEL 6 GROUP 6 LOAD CELLS K LBS.



CHANNEL 7 TOTAL LOAD CELL SUM RUN= 671 SERIES= 5902 K LBS.



TEST NO. CF5902

DUMMY DATA

|                     | FILTER CHANNEL CLASS |
|---------------------|----------------------|
| HEAD ACCELERATIONS  | 1000                 |
| CHEST ACCELERATIONS | 180                  |
| FEMUR FORCES        | 600                  |
| BELT LOADS          | 60                   |

HEAD INJURY CRITERION  
HEAD SEVERITY INDEX

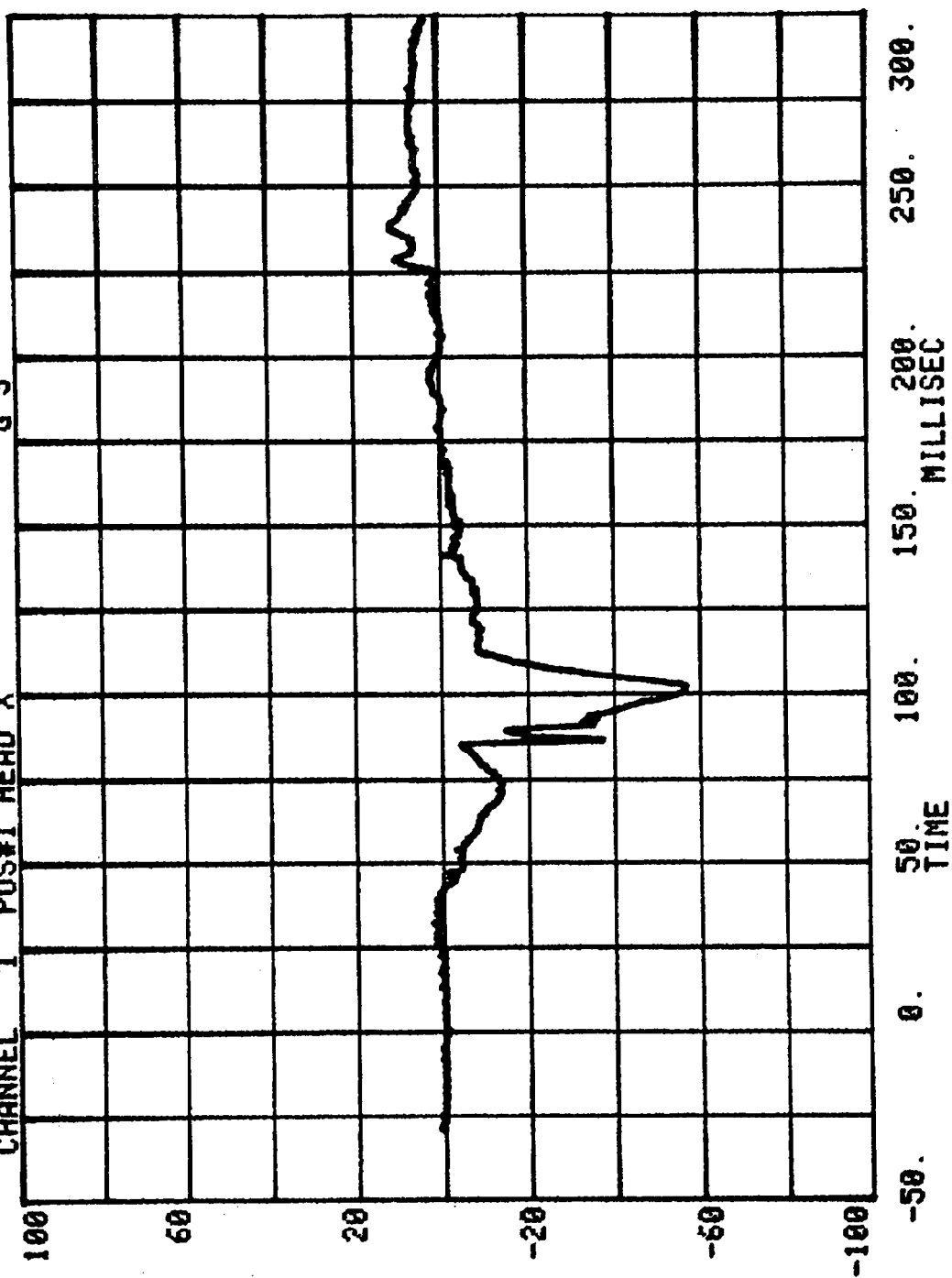
CAR TO LOAD CELL BARRIER

RUN= 671

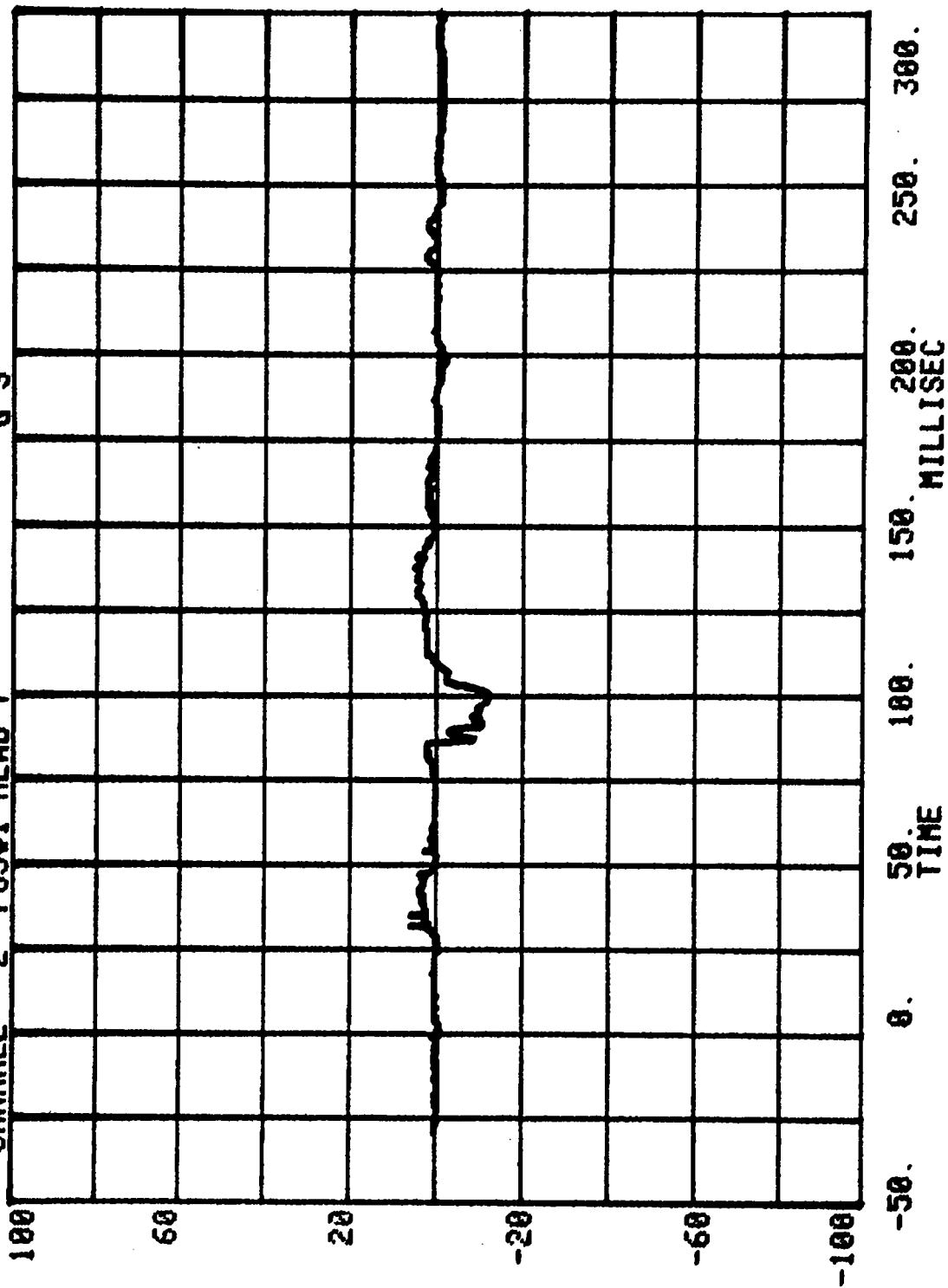
POS#1 HEAD RESULTANT

HIC= 620.9 FROM T1= .07440 TO T2= .10875  
AVERAGE ACCELERATION BETWEEN T1 AND T2= 50.4G'S  
EVENT TIME= 300.0 MSEC  
SEVERITY INDEX= 774.4

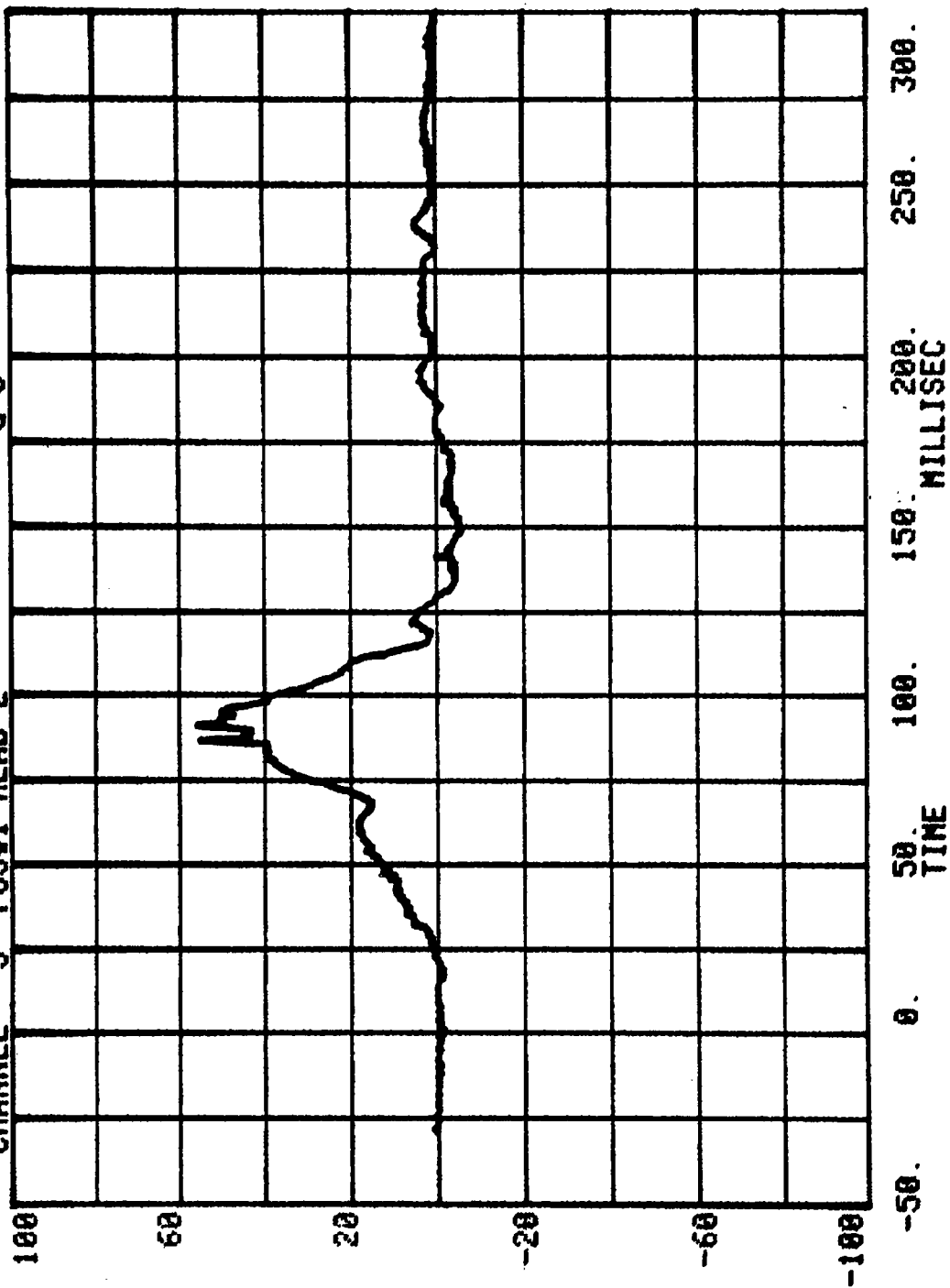
CHANNEL 1 POS#1 HEAD X  
RUN= 671 SERIES= 5902 G'S



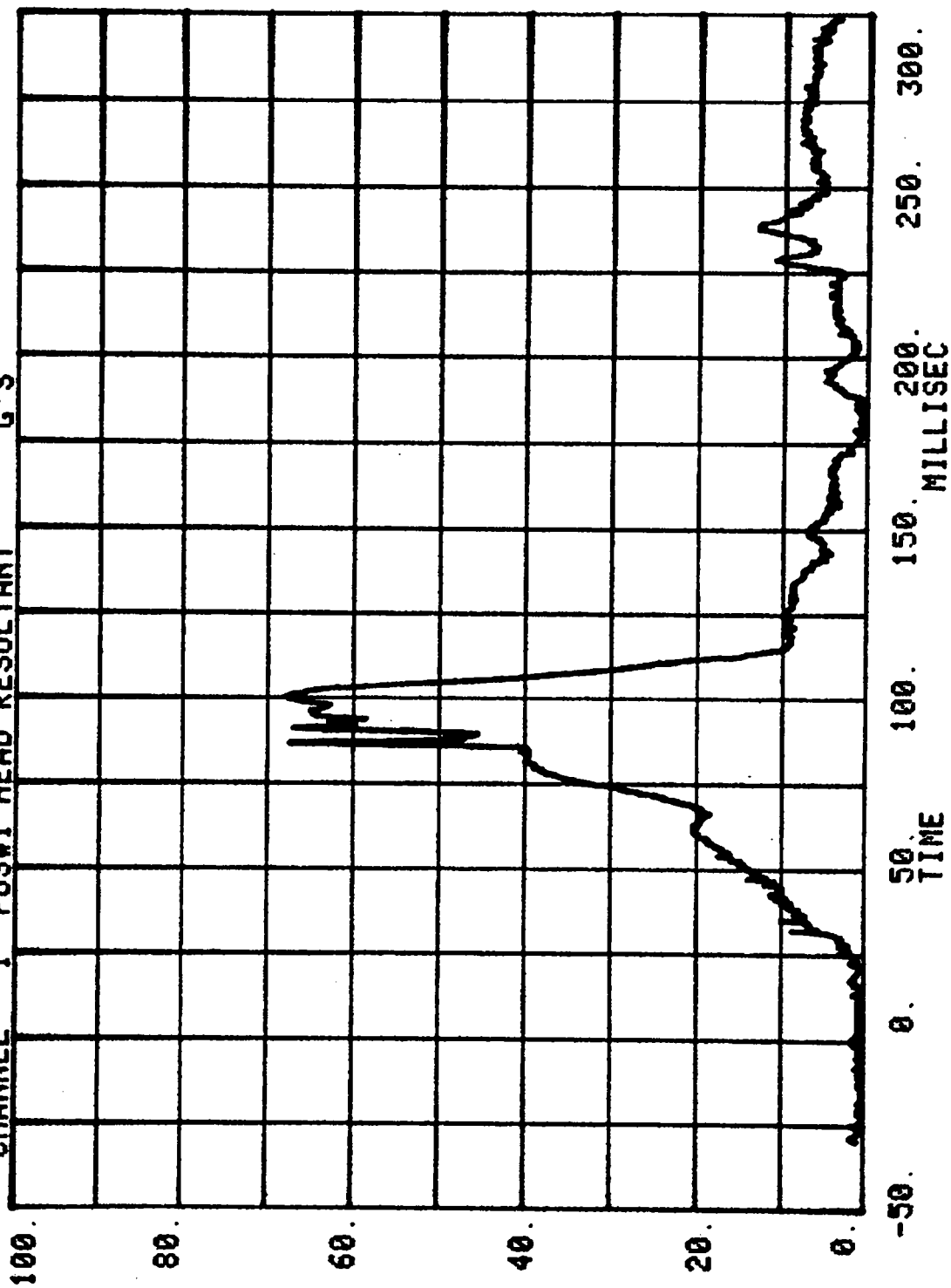
CHANNEL 2 POS#1 HEAD Y  
RUN= 671 SERIES= 5902 G'S



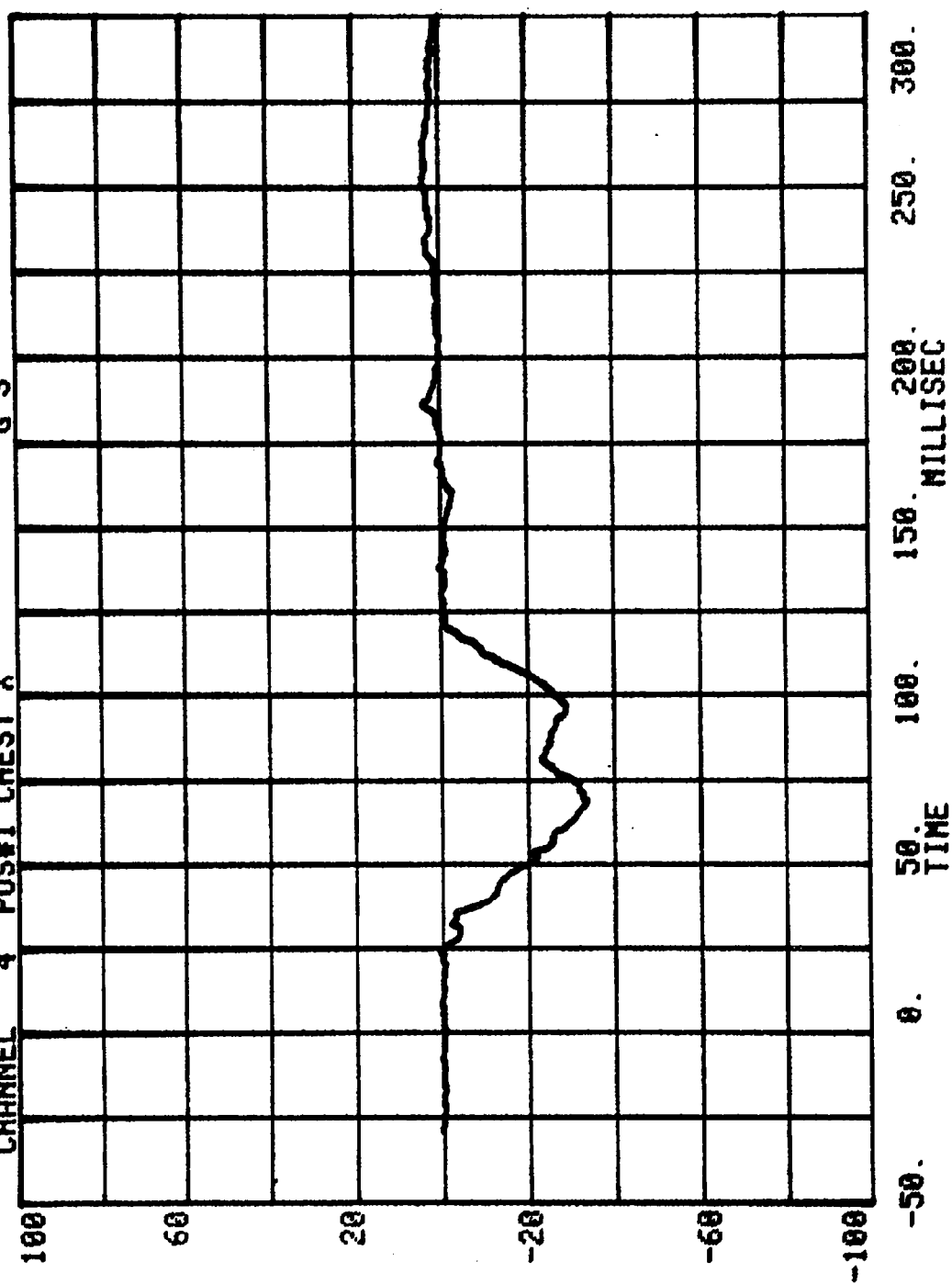
RUN= 671    SERIES= 5902  
CHANNEL 3   POS#1 HEAD 2   G'S



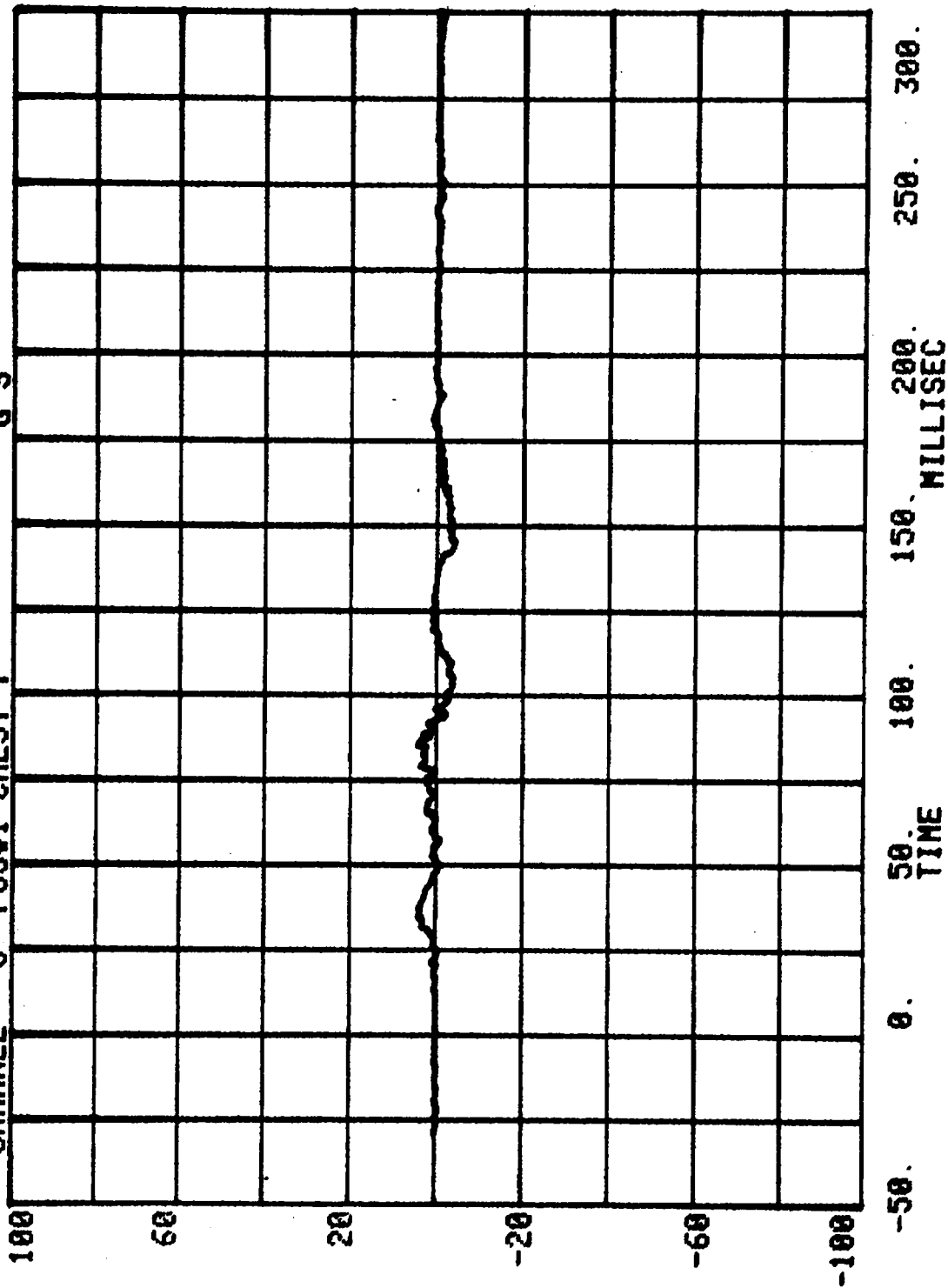
RUN= 671 SERIES= 5902  
CHANNEL 1 POS#1 HEAD RESULTANT G'S



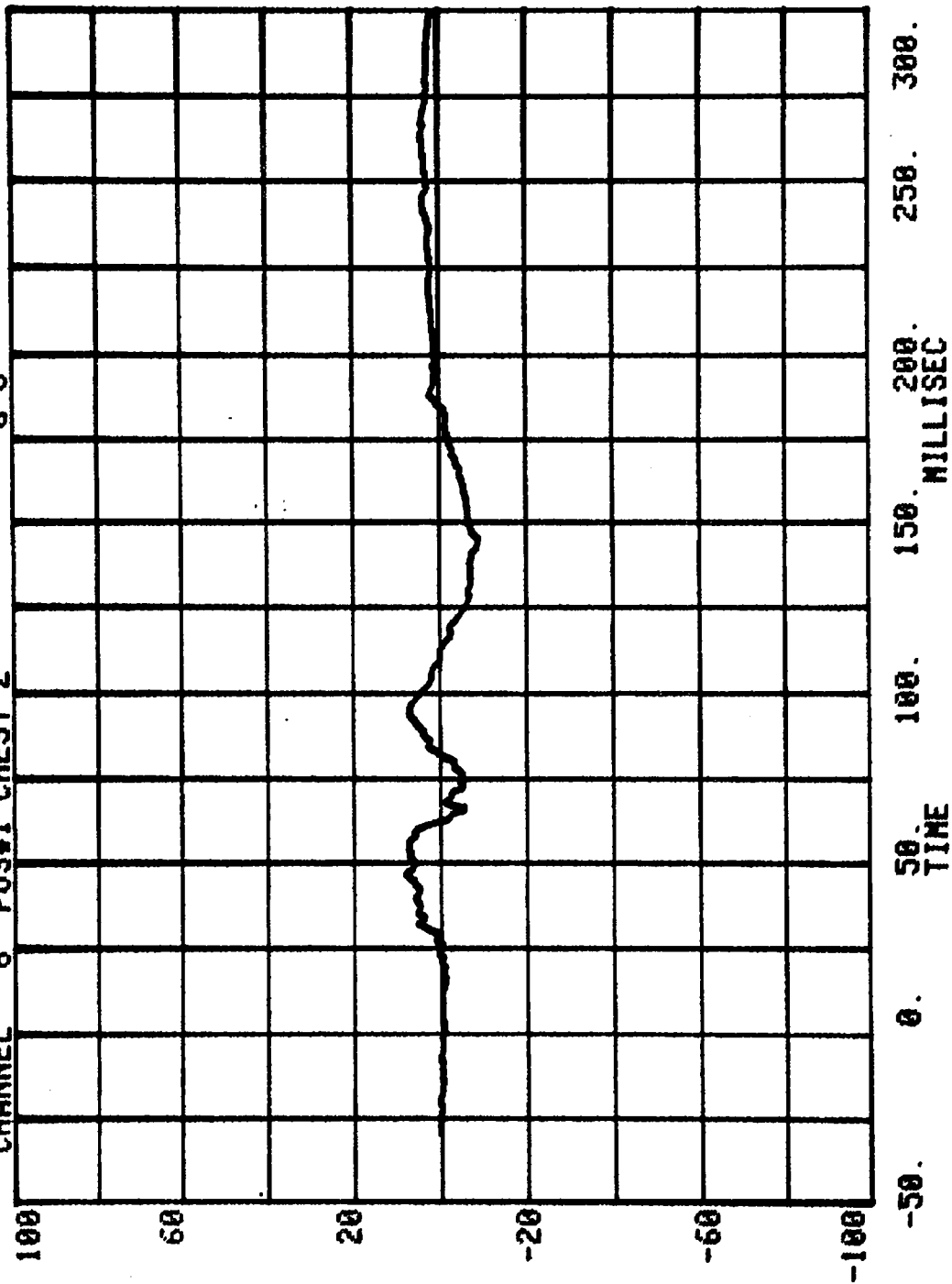
CHANNEL 4 POS#1 CHEST X  
RUN= 671 SERIES= 5902 G'S



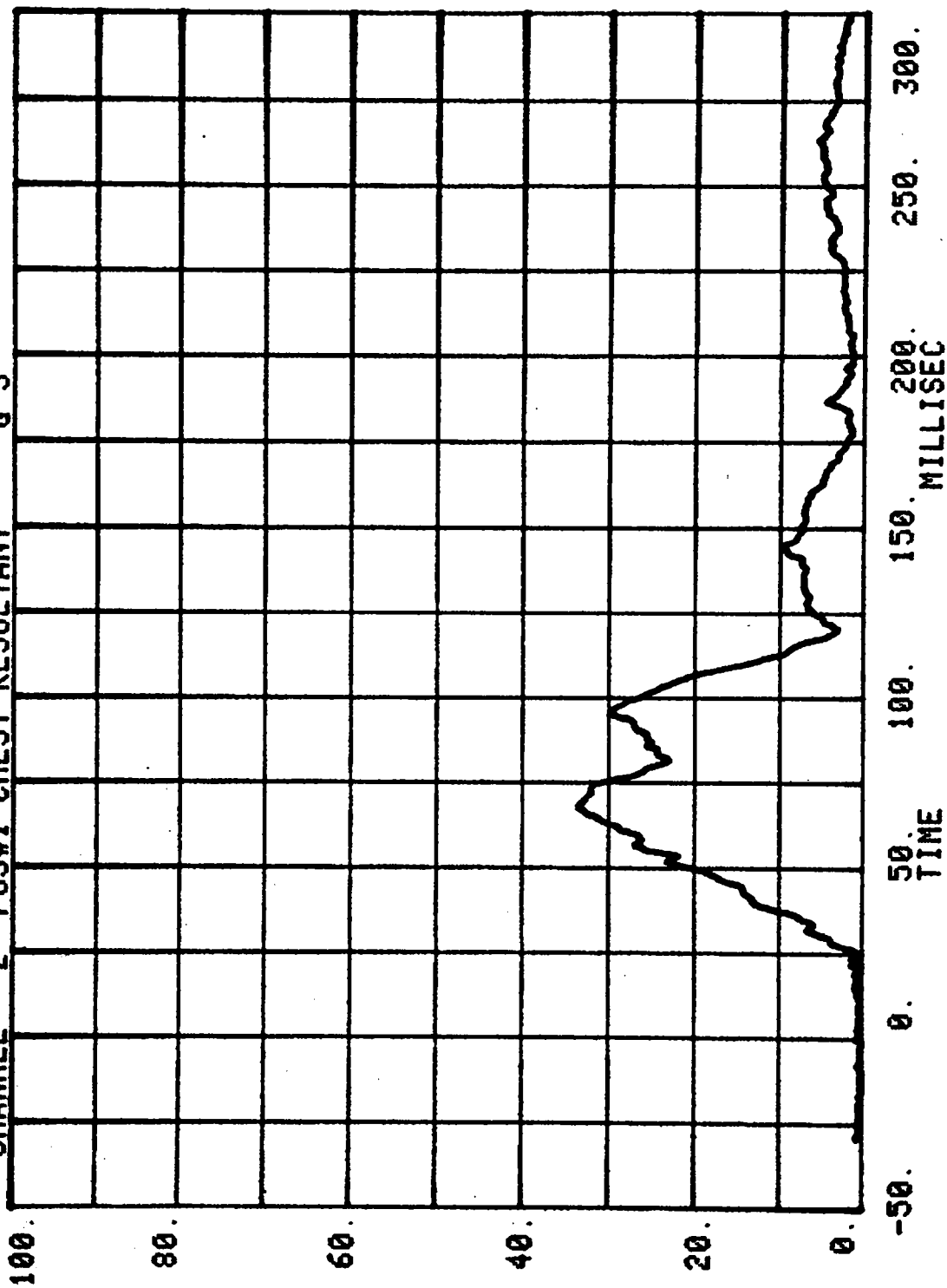
RUN= 671 SERIES= 5902  
CHANNEL 5 POS#1 CHEST Y G'S



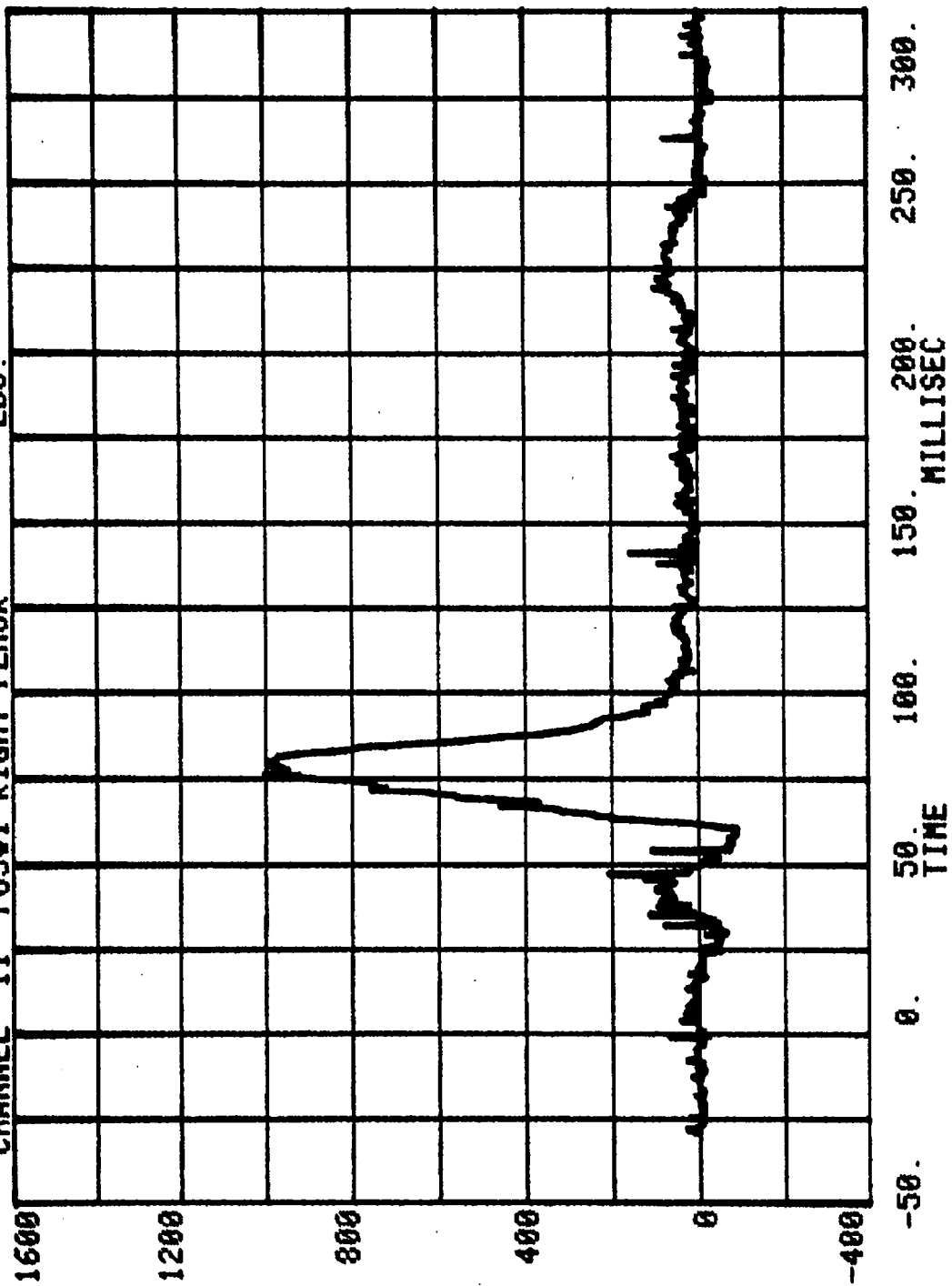
RUN= 671 SERIES= 5902  
CHANNEL 6 POS#1 CHEST Z G'S



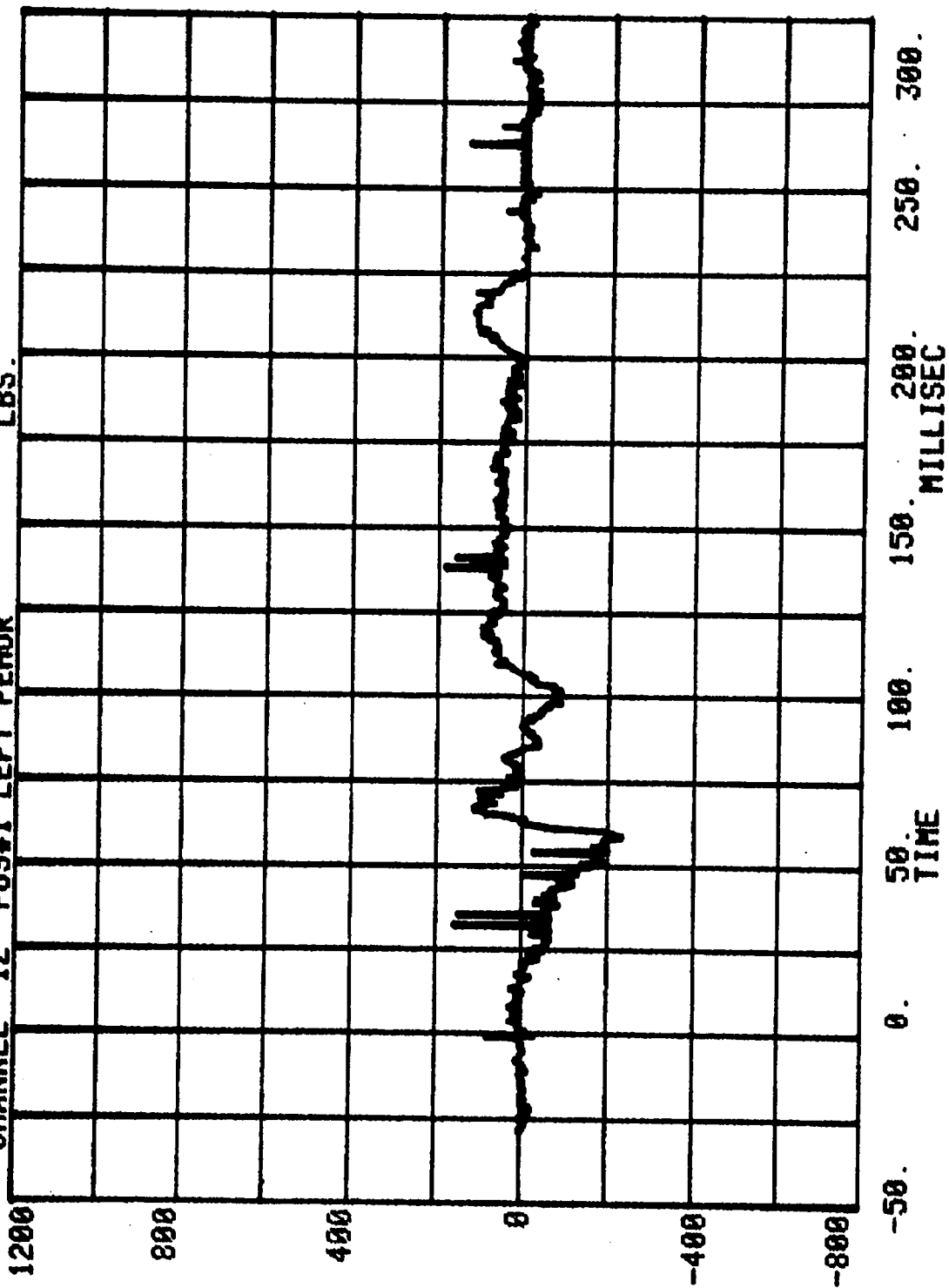
CHANNEL 2 RUN= 671 SERIES= 5902  
POS#1 CHEST RESULTANT G'S



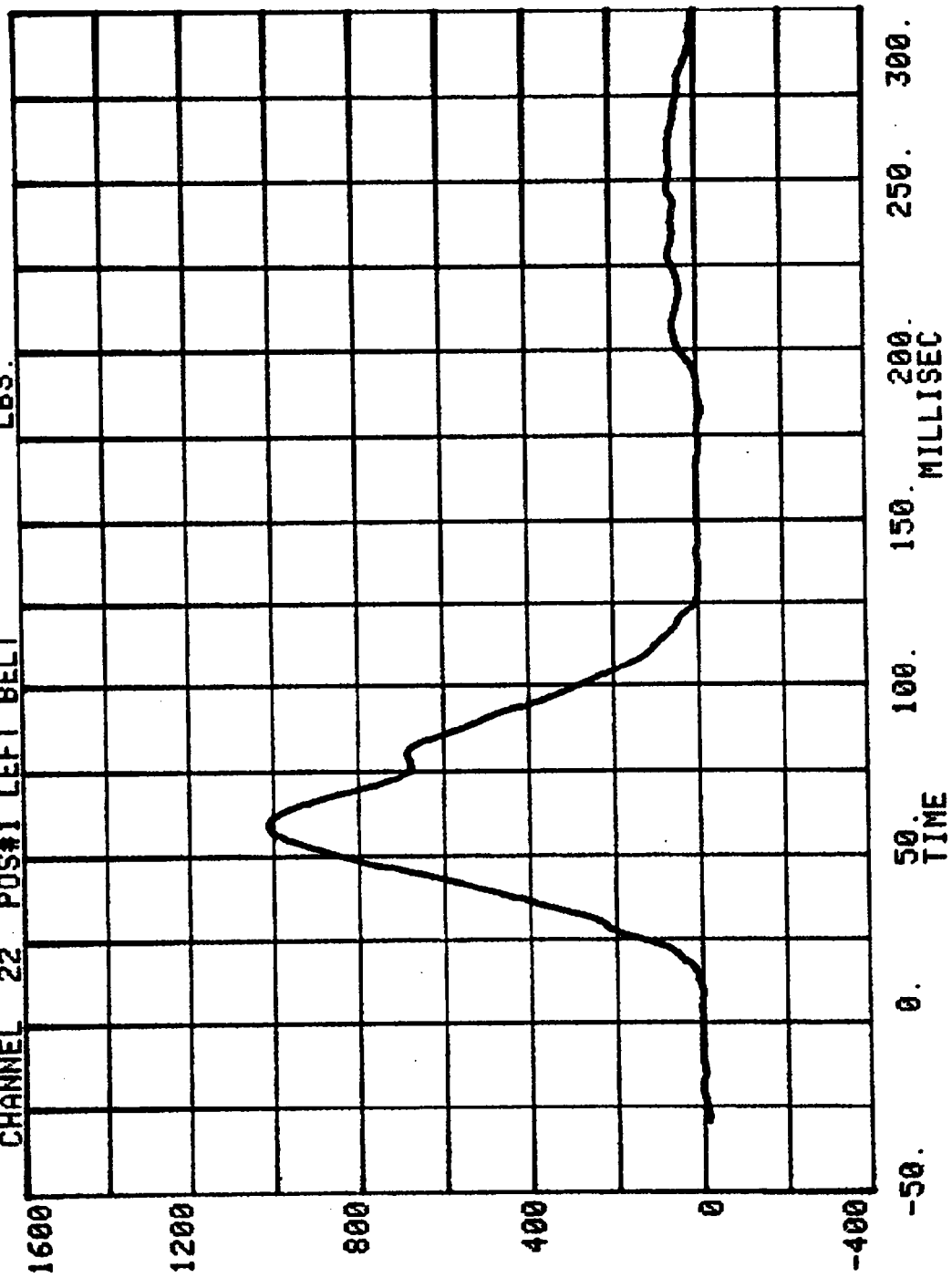
CHANNEL 11 POS#1 RIGHT FEMUR  
RUN= 671 SERIES= 5902 LBS.



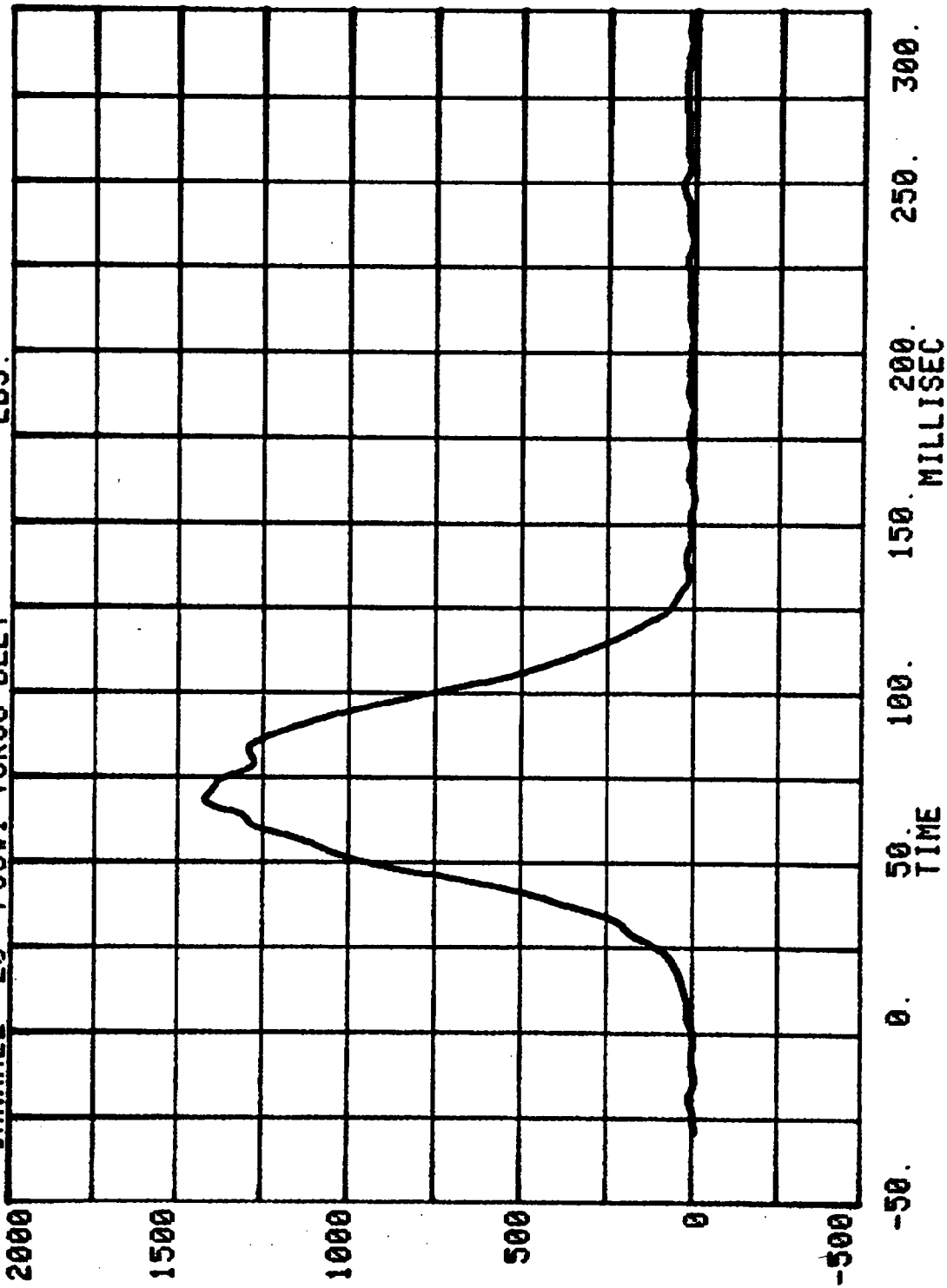
RUN= 671 SERIES= 5902  
CHANNEL 12 POS#1 LEFT FEHUR LBS.



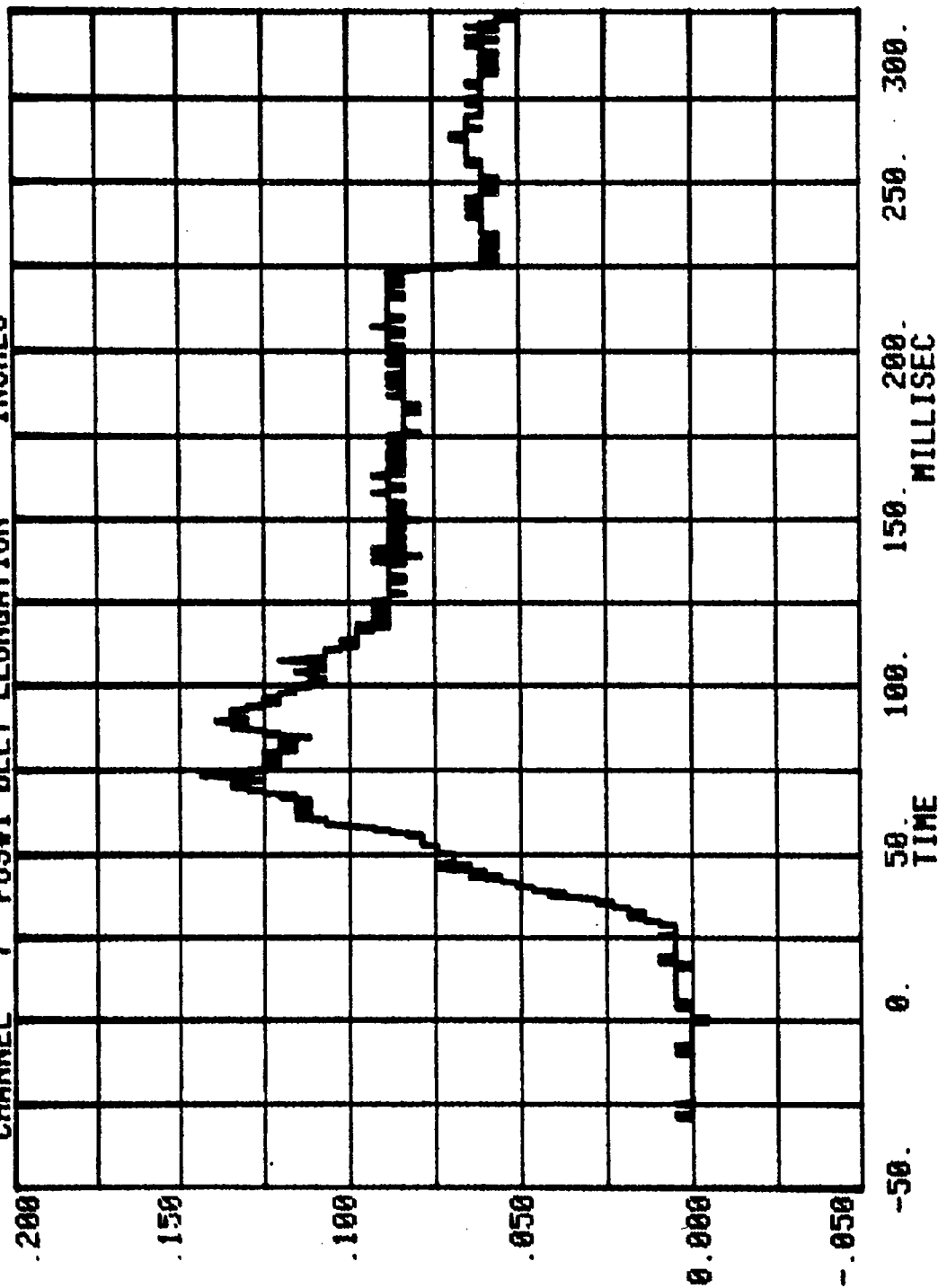
RUN= 671 SERIES= 5902 LBS.  
CHANNEL 22 POS#1 LEFT BELT



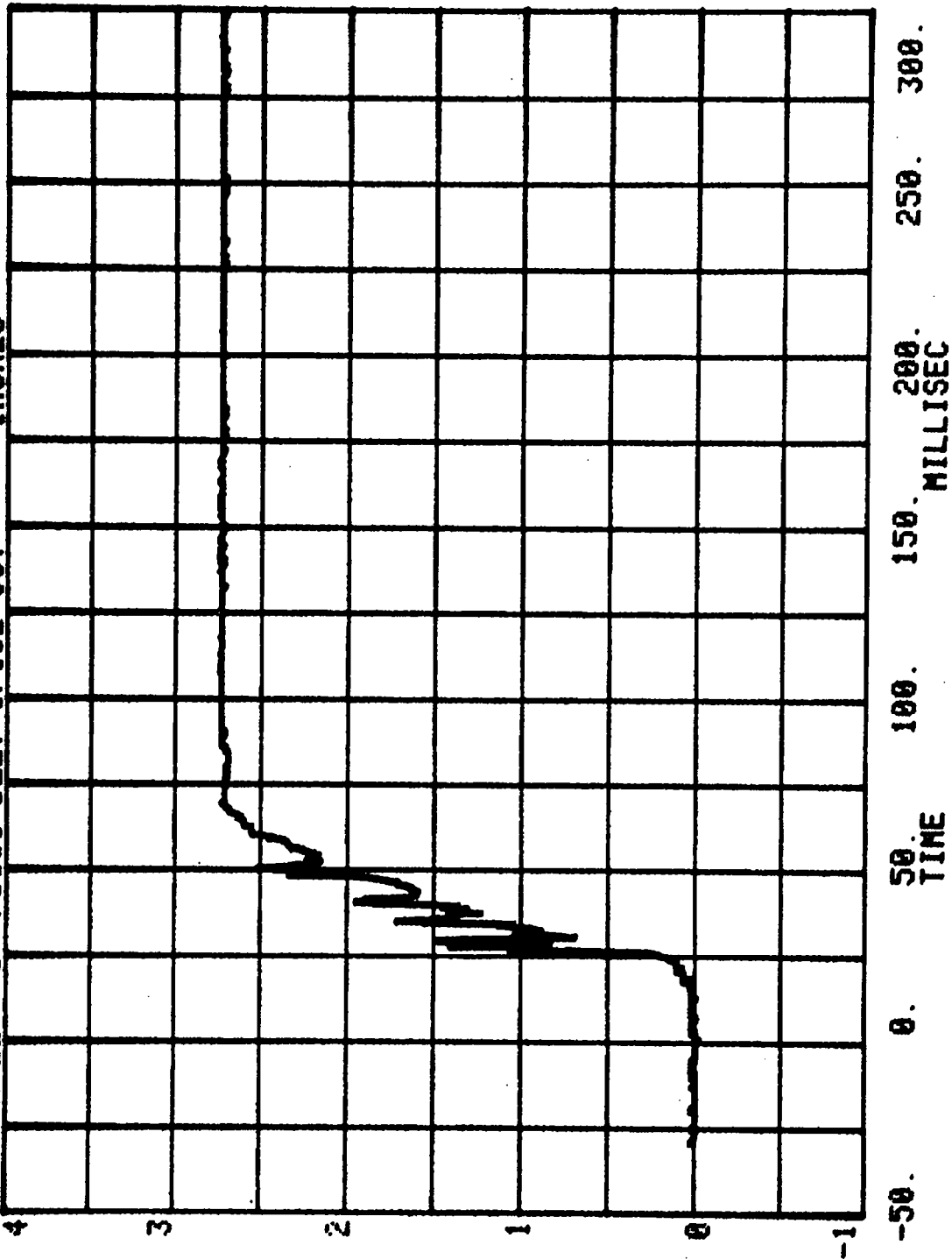
CHANNEL 23 POS#1 TORSO BELT  
RUN= 671 SERIES= 5902 LBS.



CHANNEL 7 POS#1 BELT ELONGATION RUN= 671 SERIES= 5902 MEASURED OVER 2.5 INCHES



RUN= 671 SERIES= 5902  
CHANNEL 8 POS#1 BELT SPOOL OUT INCHES



HEAD INJURY CRITERION  
HEAD SEVERITY INDEX

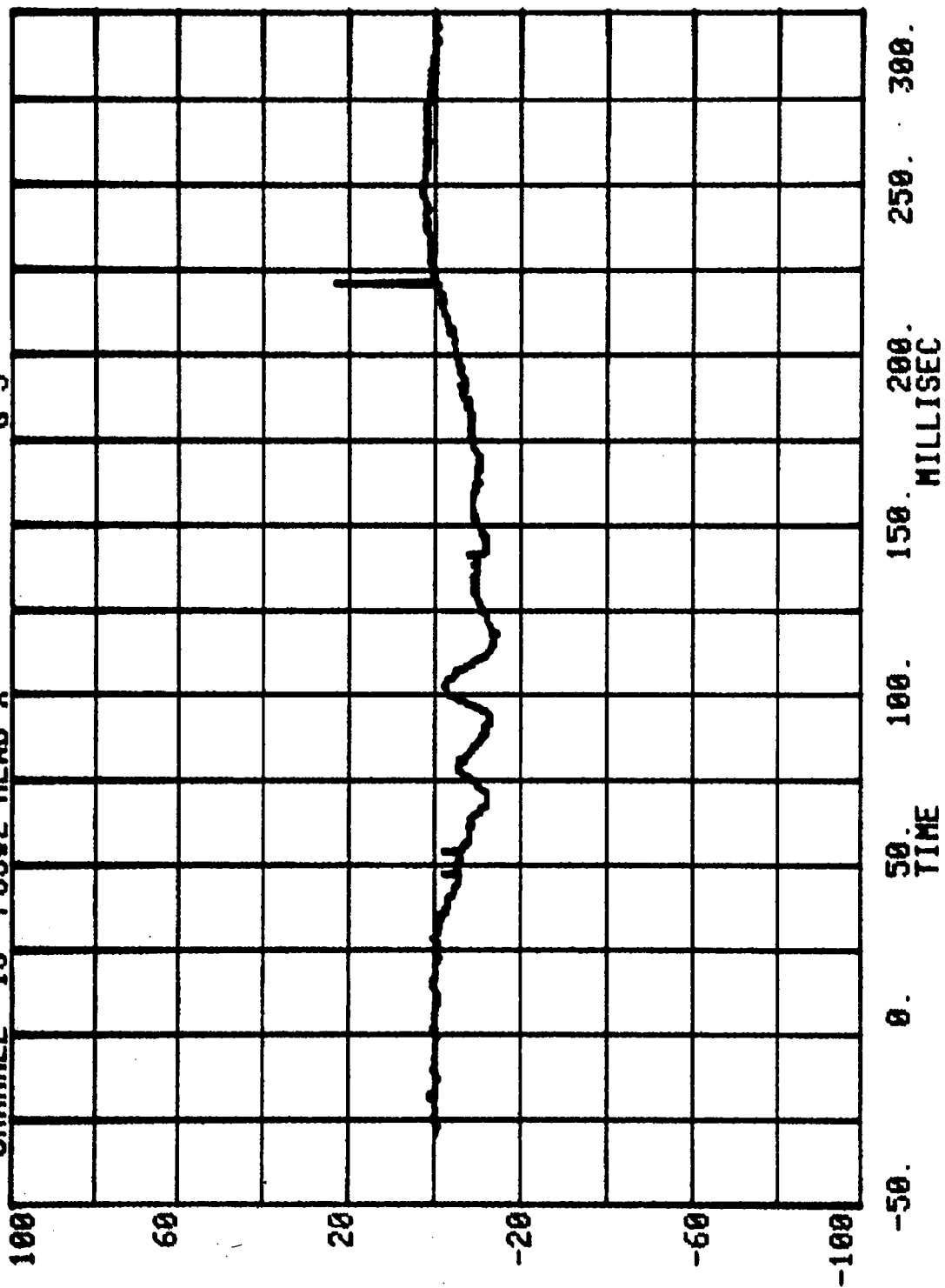
CAR TO LOAD CELL BARRIER

RUN= 671

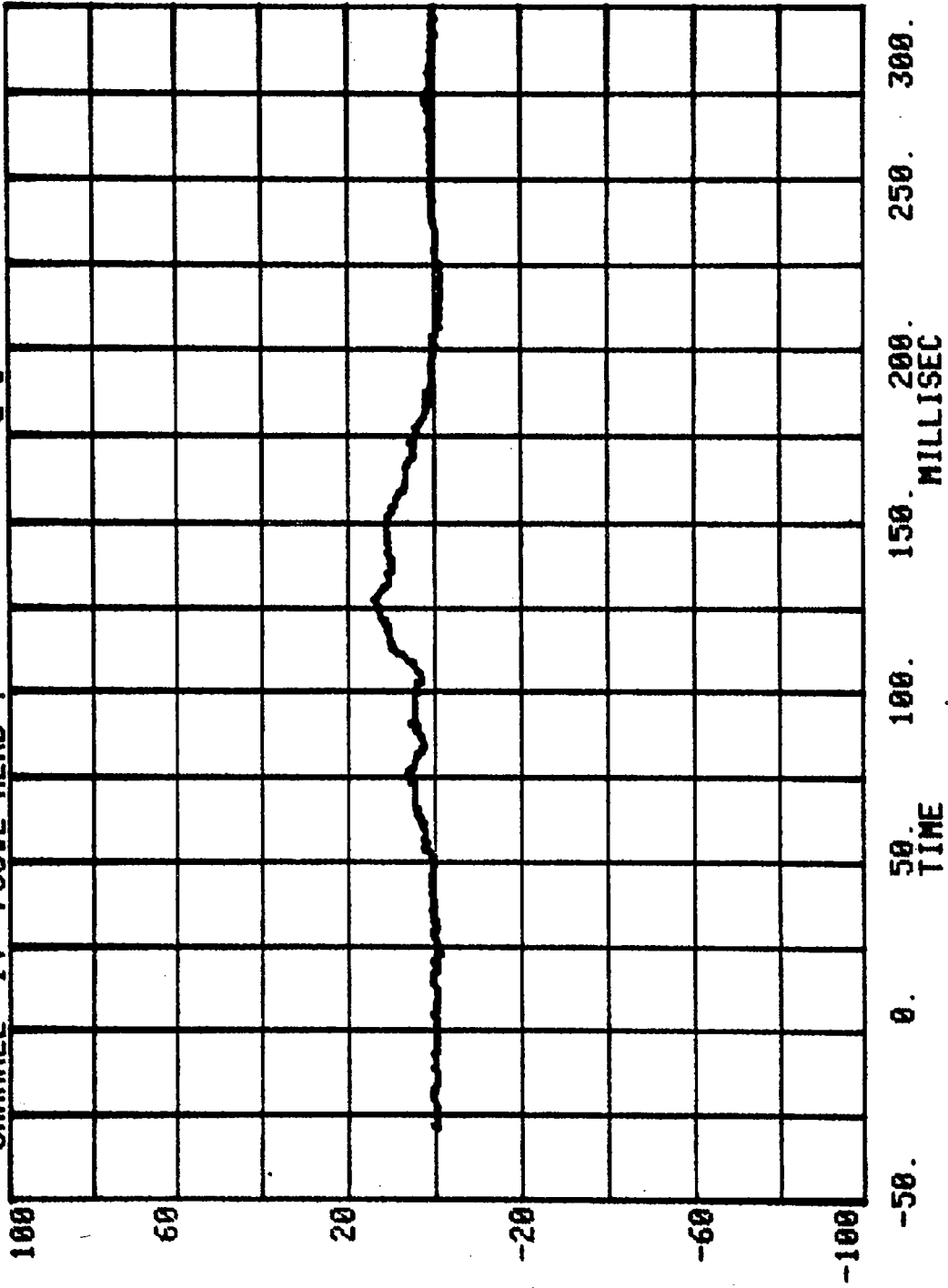
POS#2 HEAD RESULTANT

HIC= 262.0 FROM T1= .05137 TO T2= .15817  
AVERAGE ACCELERATION BETWEEN T1 AND T2= 22.7G'S  
EVENT TIME= 300.0 MSEC  
SEVERITY INDEX= 332.8

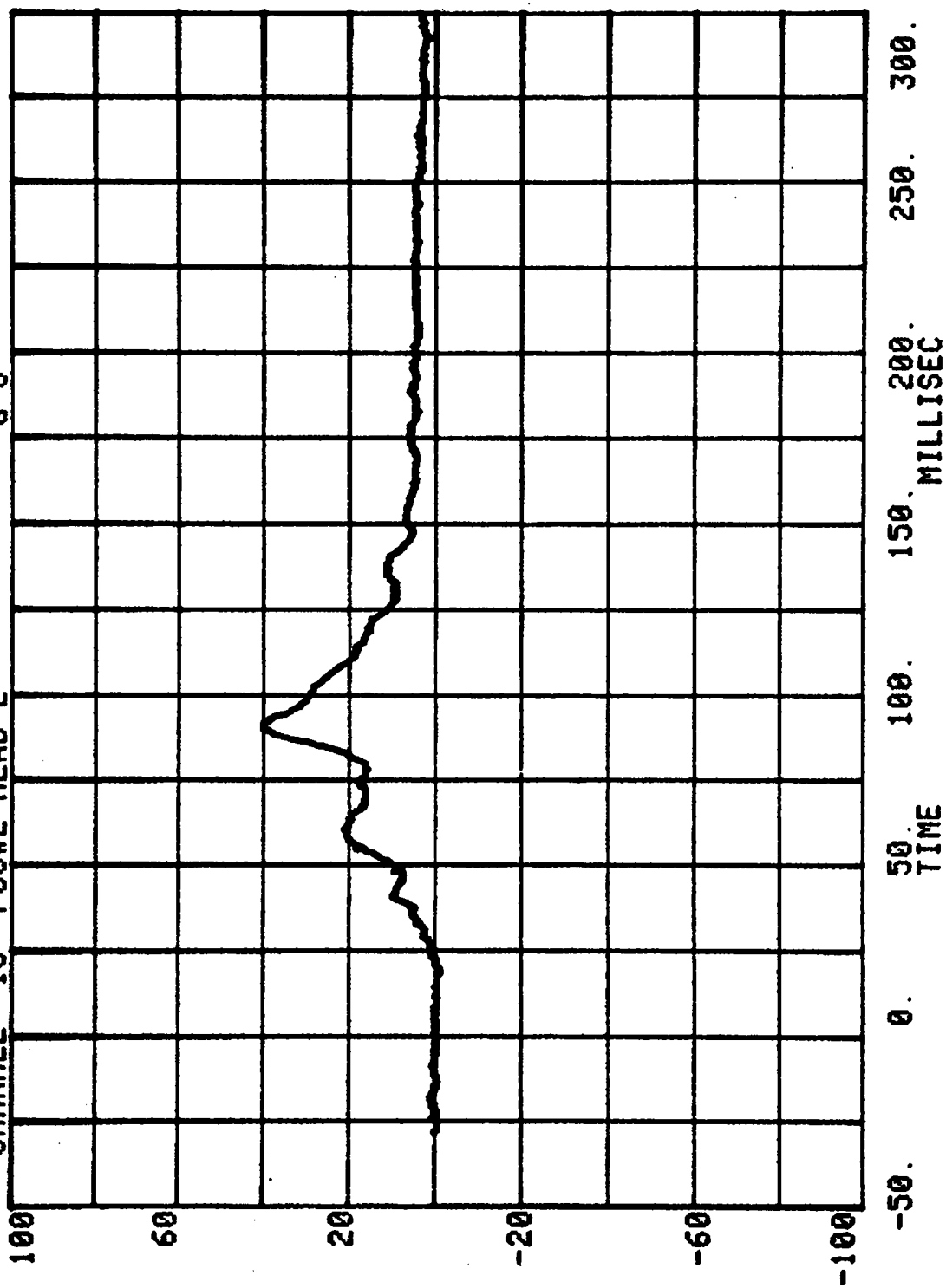
RUN= 671 SERIES= 5902  
CHANNEL 13 POS#2 HEAD X G'S



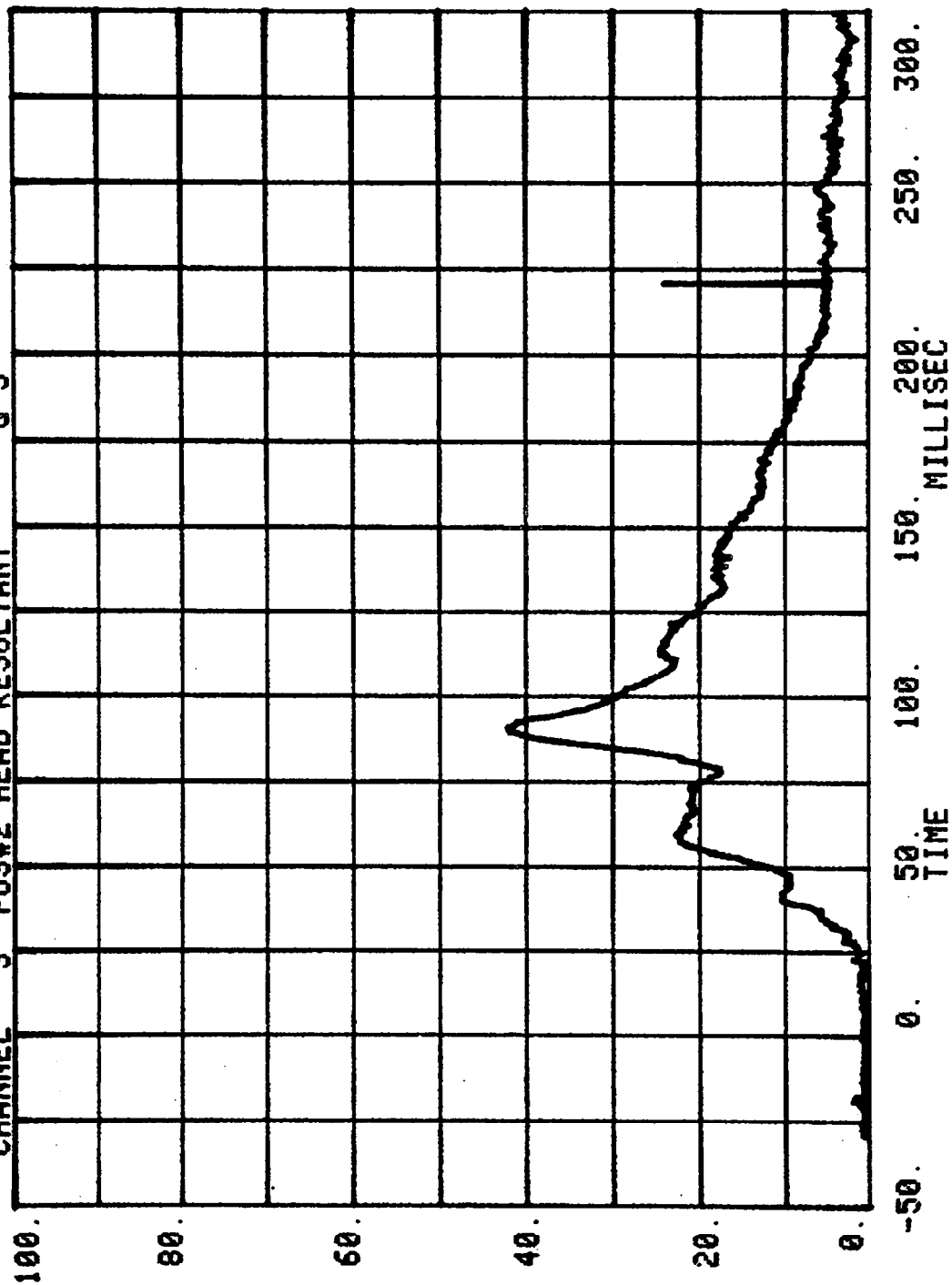
CHANNEL 14 POS#2 HEAD Y RUN= 671 SERIES= 5902 G'S



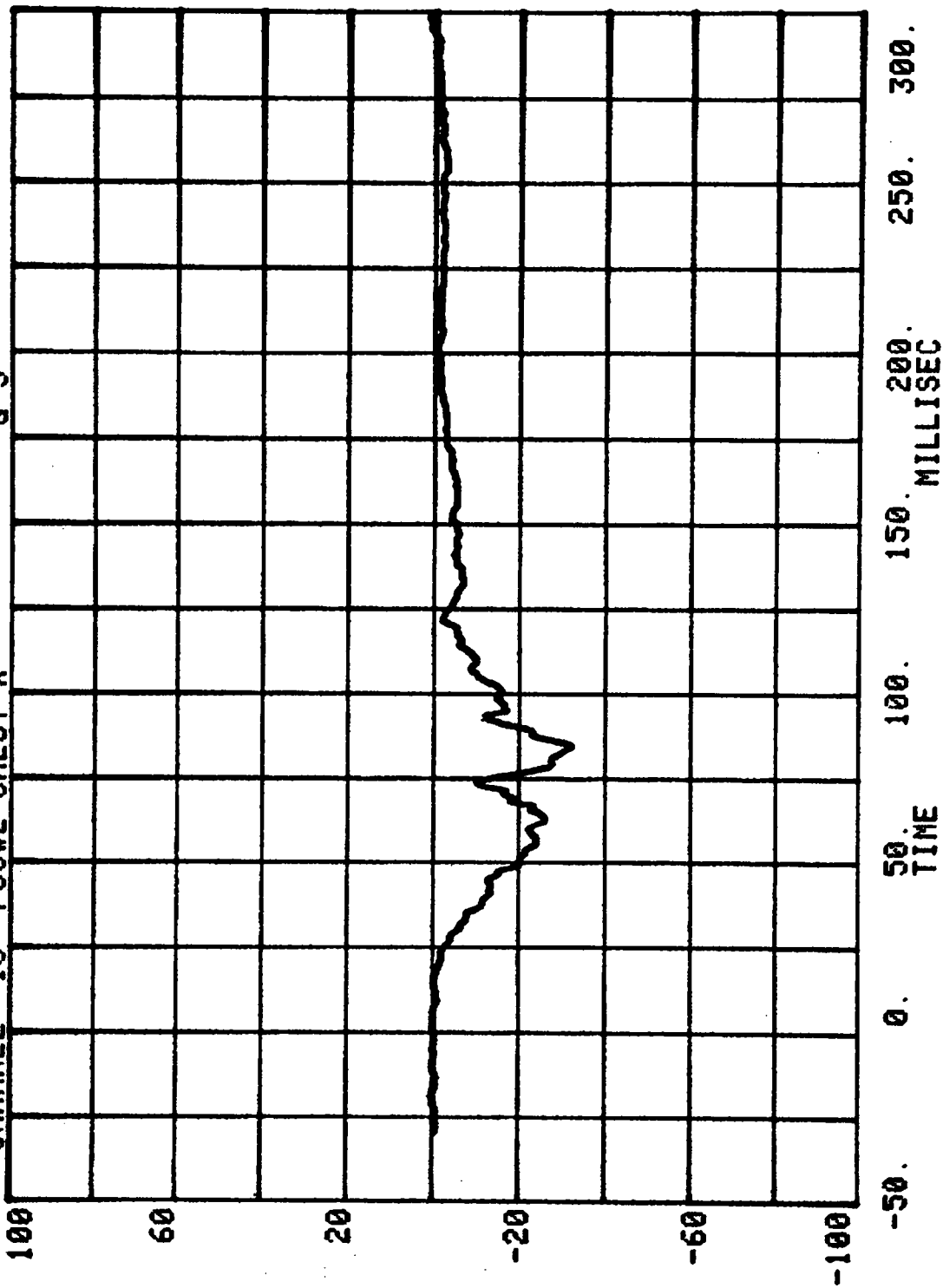
RUN= 671 SERIES= 5902  
CHANNEL 15 POS#2 HEAD 2 G'S



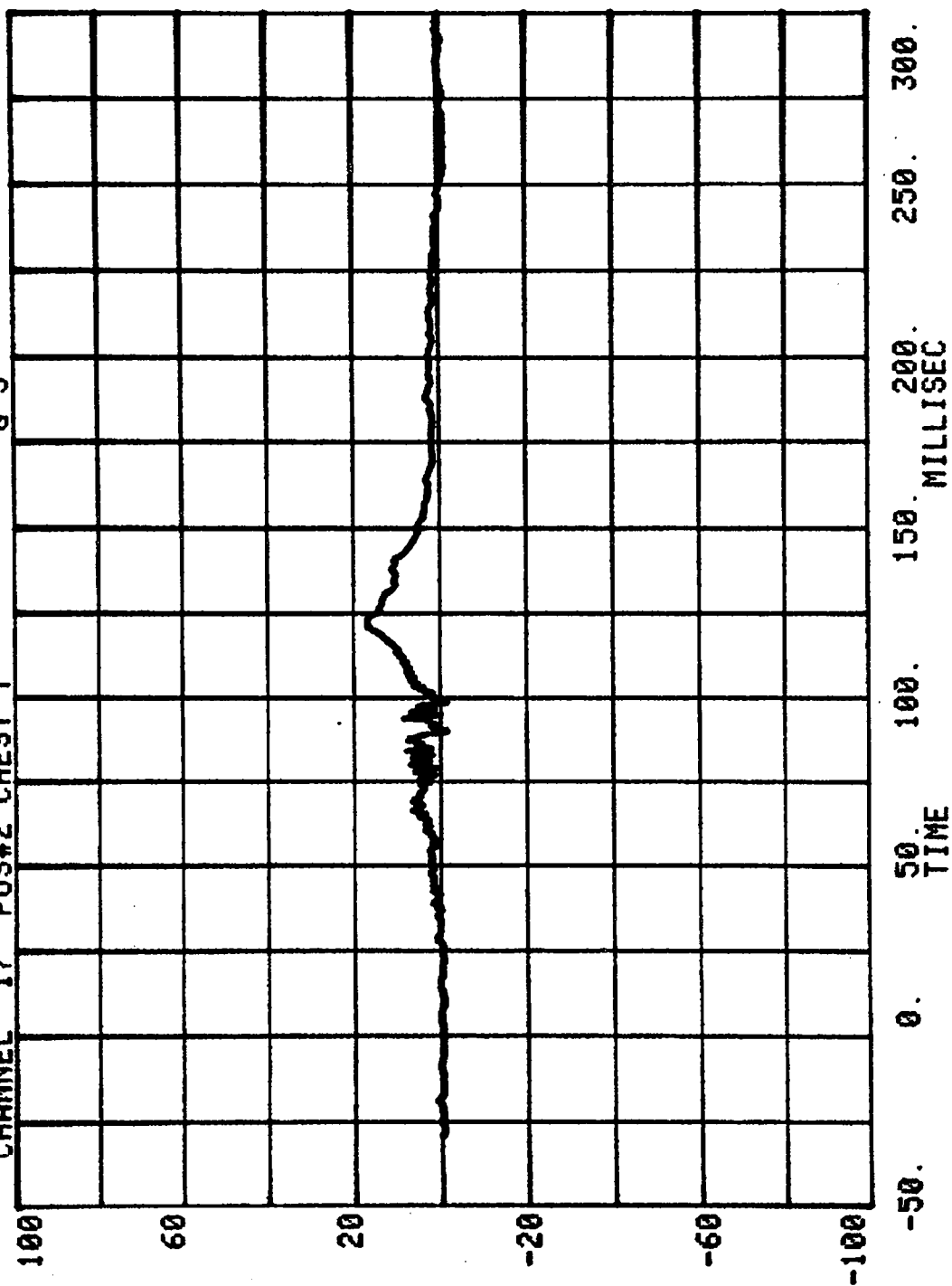
RUN= 671 SERIES= 5902  
CHANNEL 3 POS#2 HEAD RESULTANT G'S



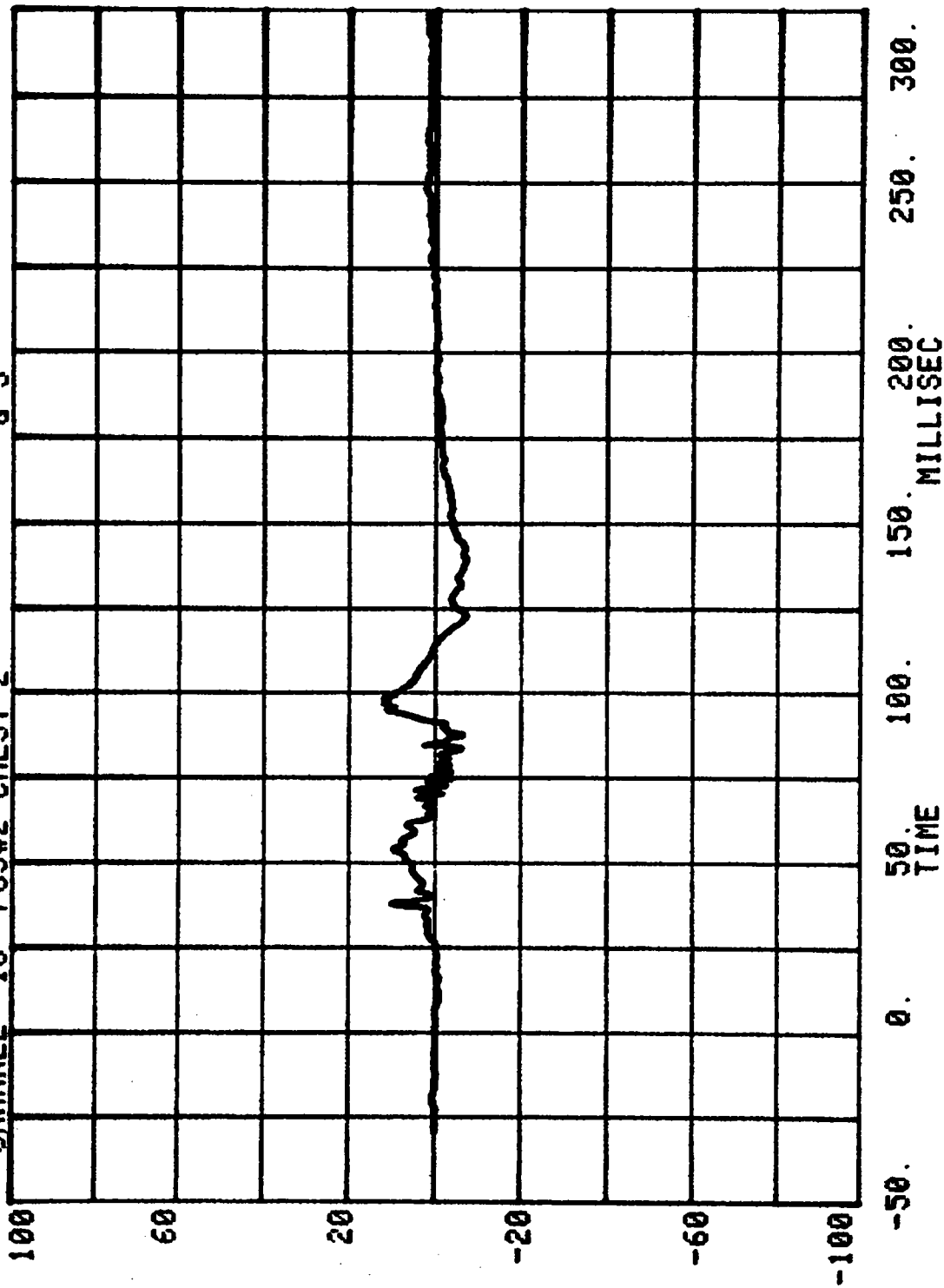
RUN= 671 SERIES= 5902  
CHANNEL 16 POS#2 CHEST X G'S



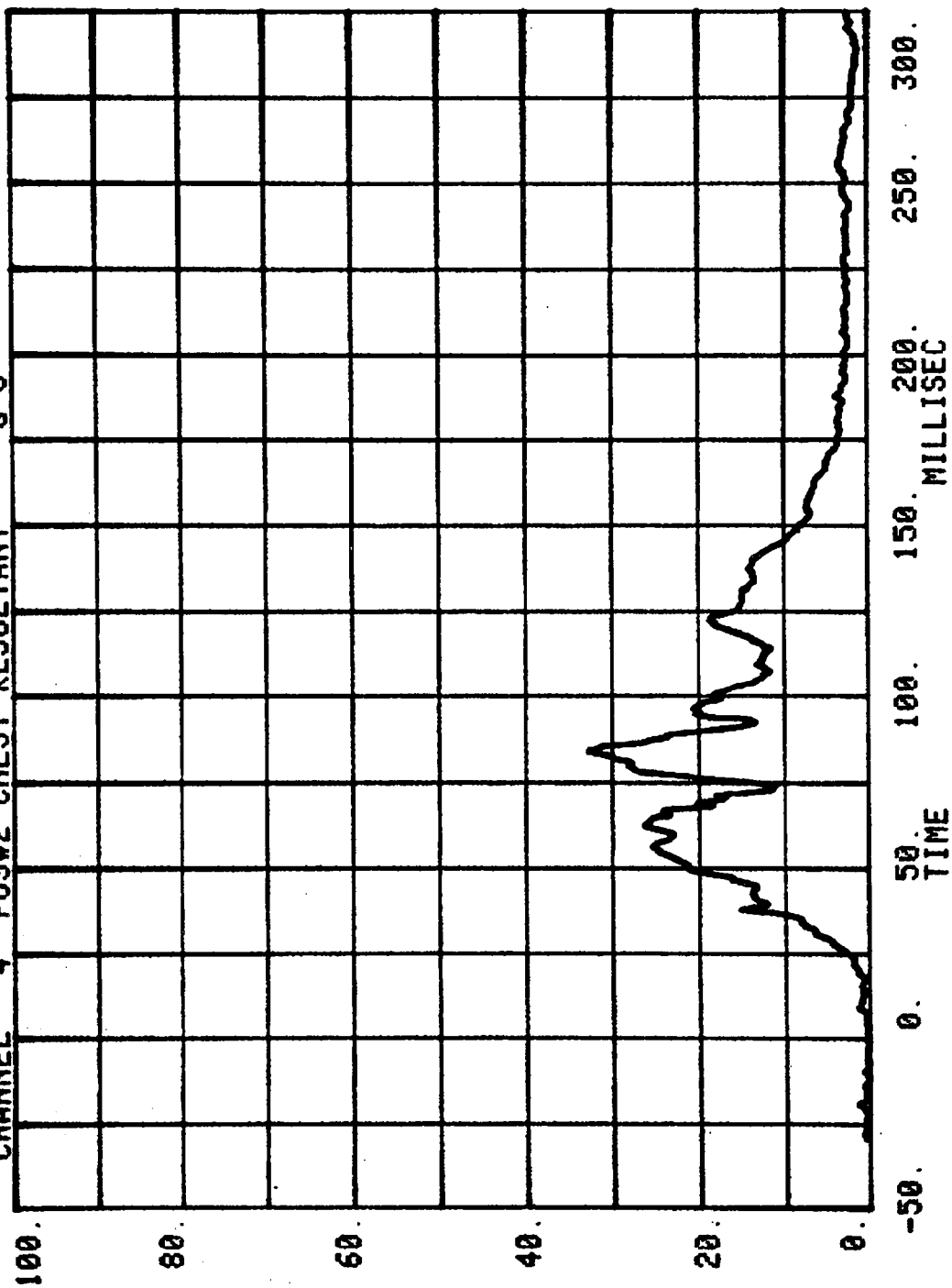
CHANNEL 17 POS#2 CHEST Y  
RUN= 671 SERIES= 5902 G'S



RUN= 671 SERIES= 5902  
CHANNEL 18 POS#2 CHEST 2 G'S

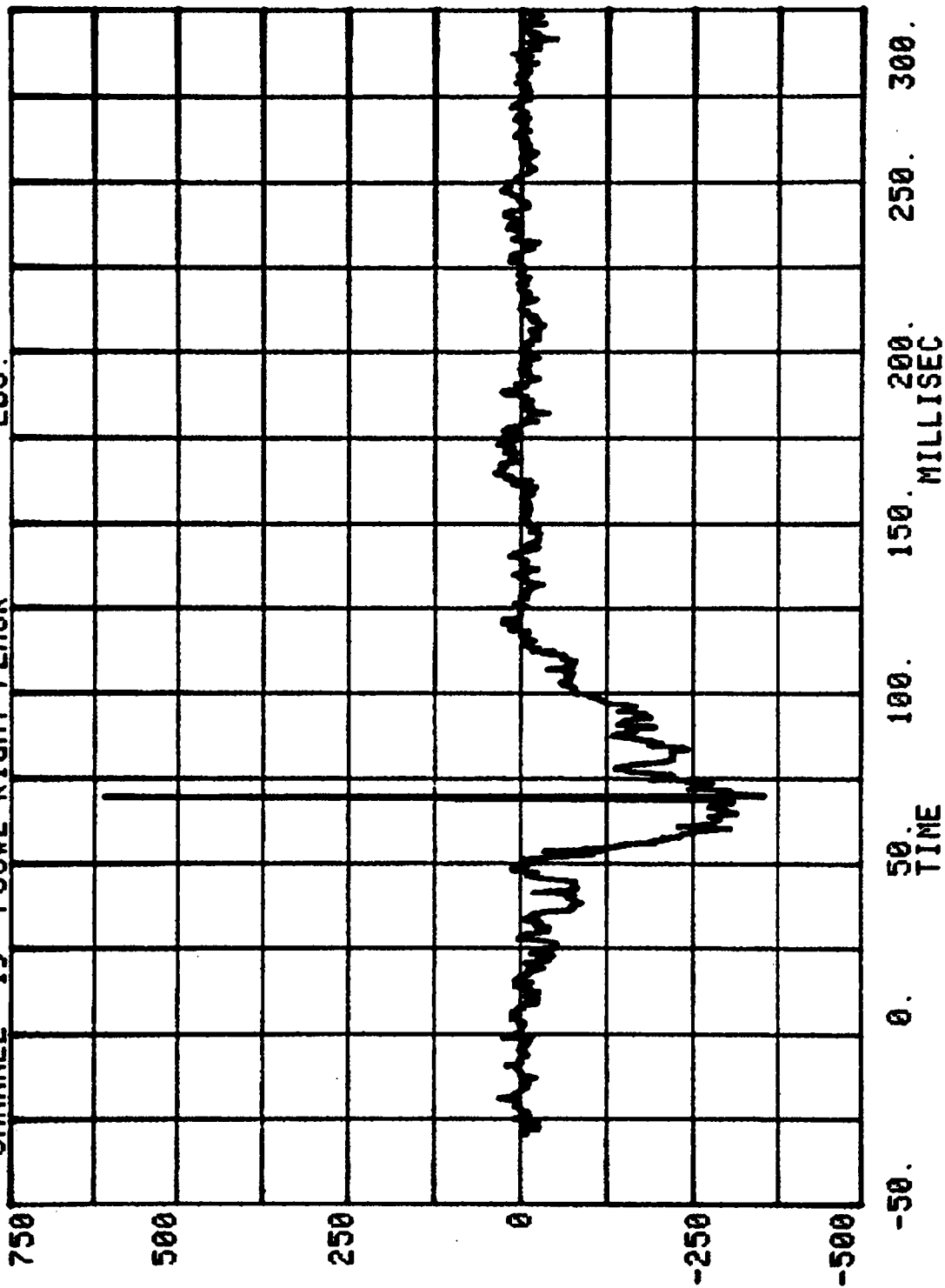


RUN= 671 SERIES= 5902  
CHANNEL 4 POS#2 CHEST RESULTANT G'S

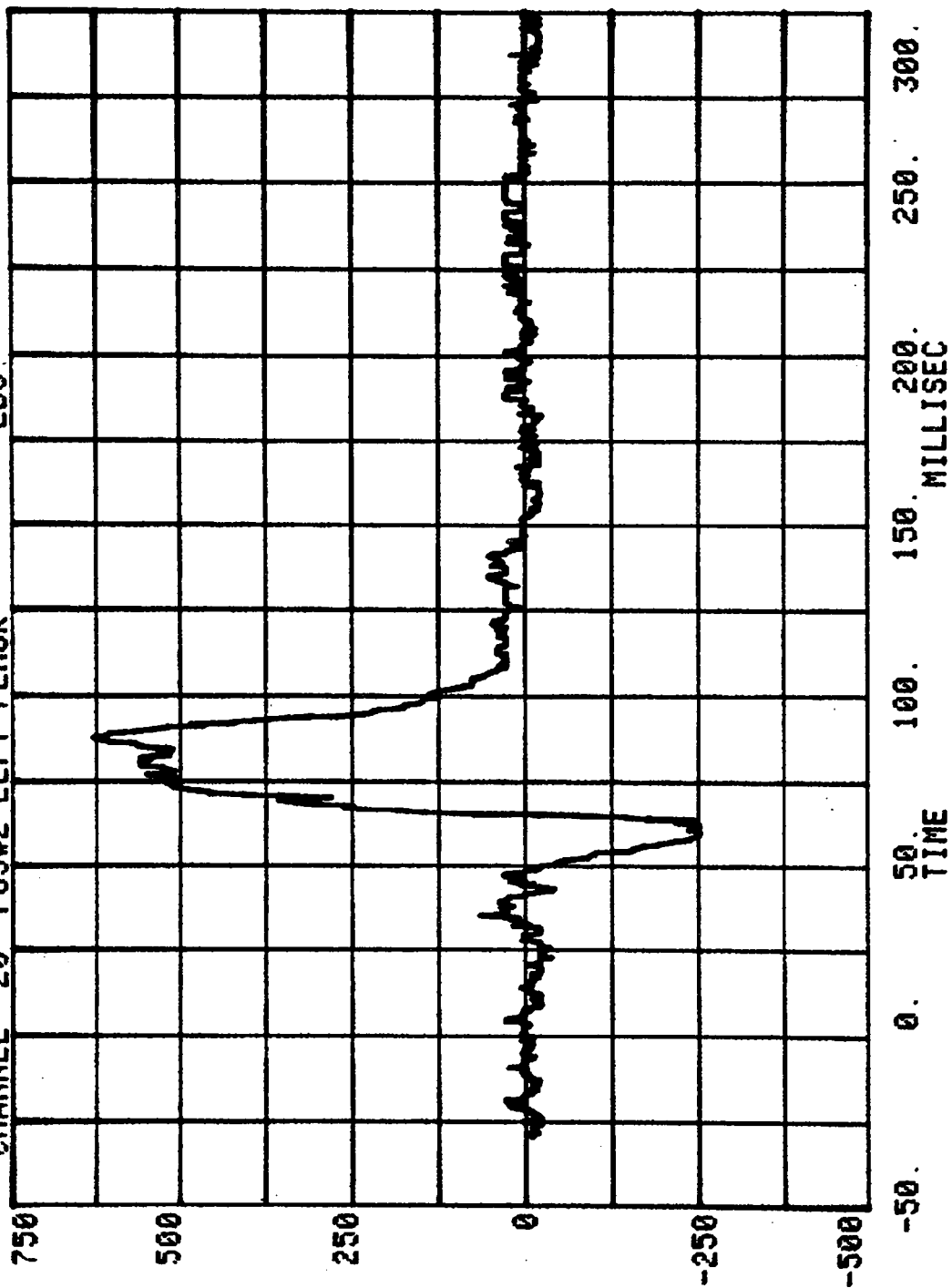


CHANNEL 19 POS#2 RIGHT FEMUR LBS.

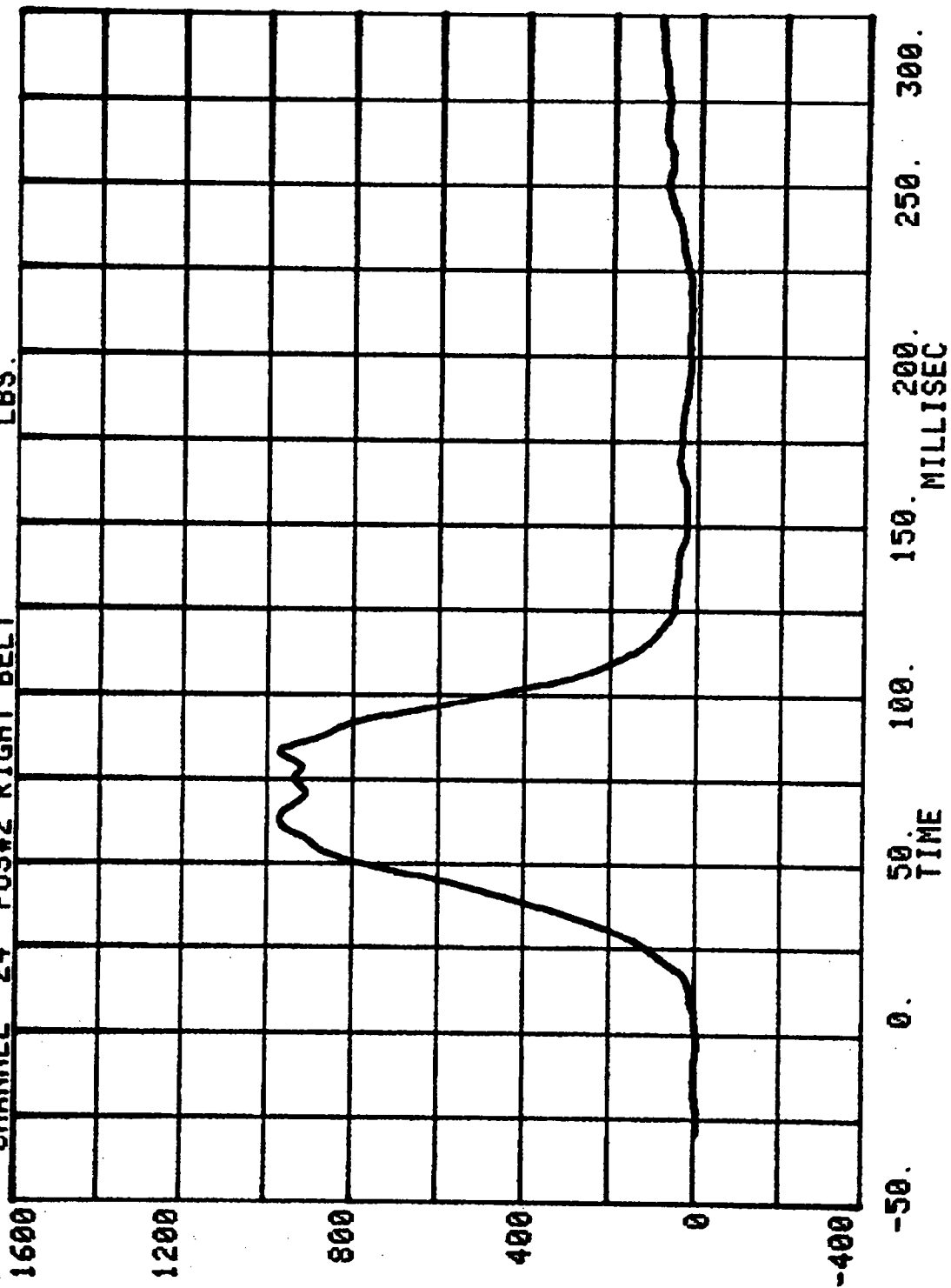
RUN= 671 SERIES= 5902

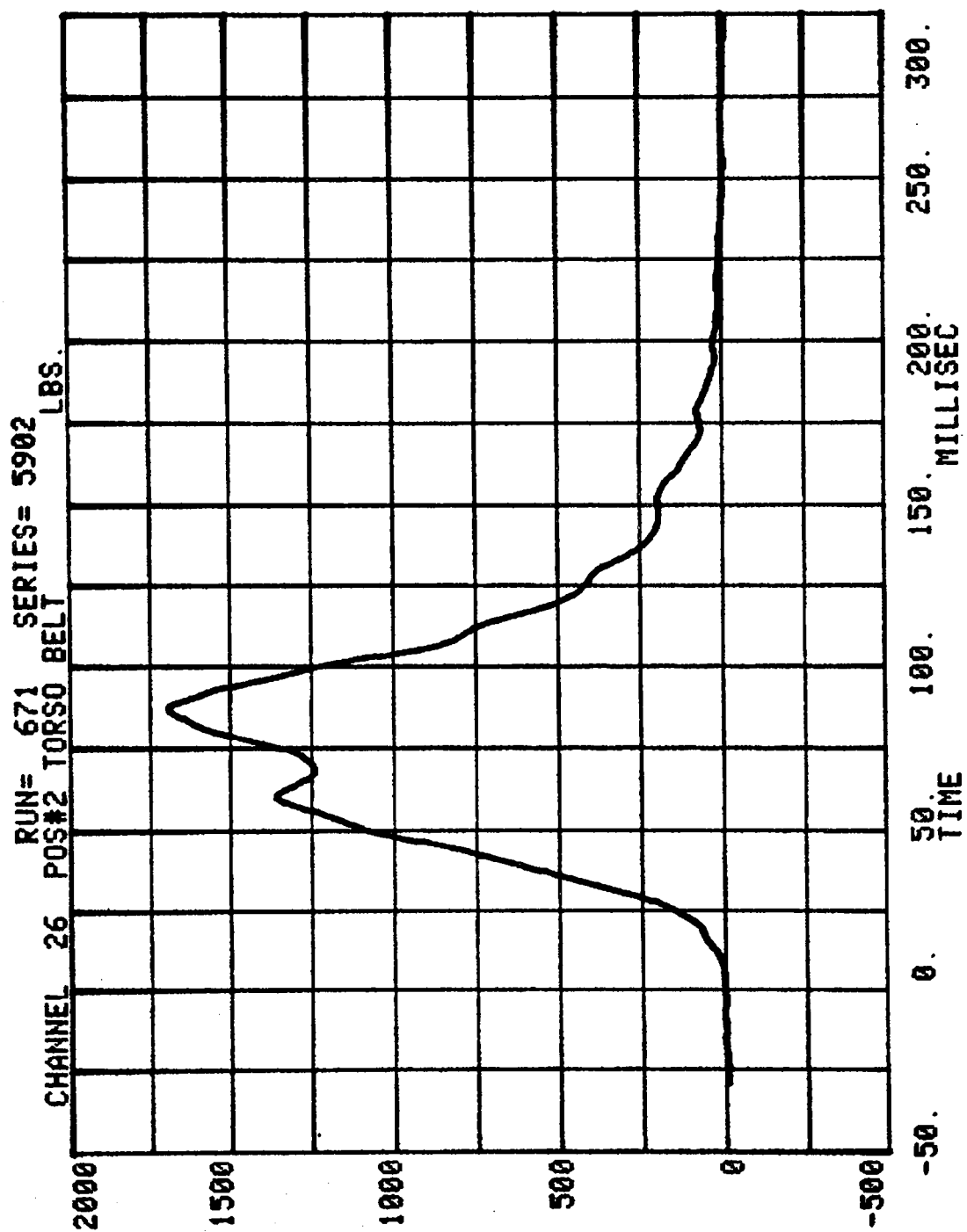


RUN= 671 SERIES= 5902 LBS.  
CHANNEL 20 POS#2 LEFT FEMUR



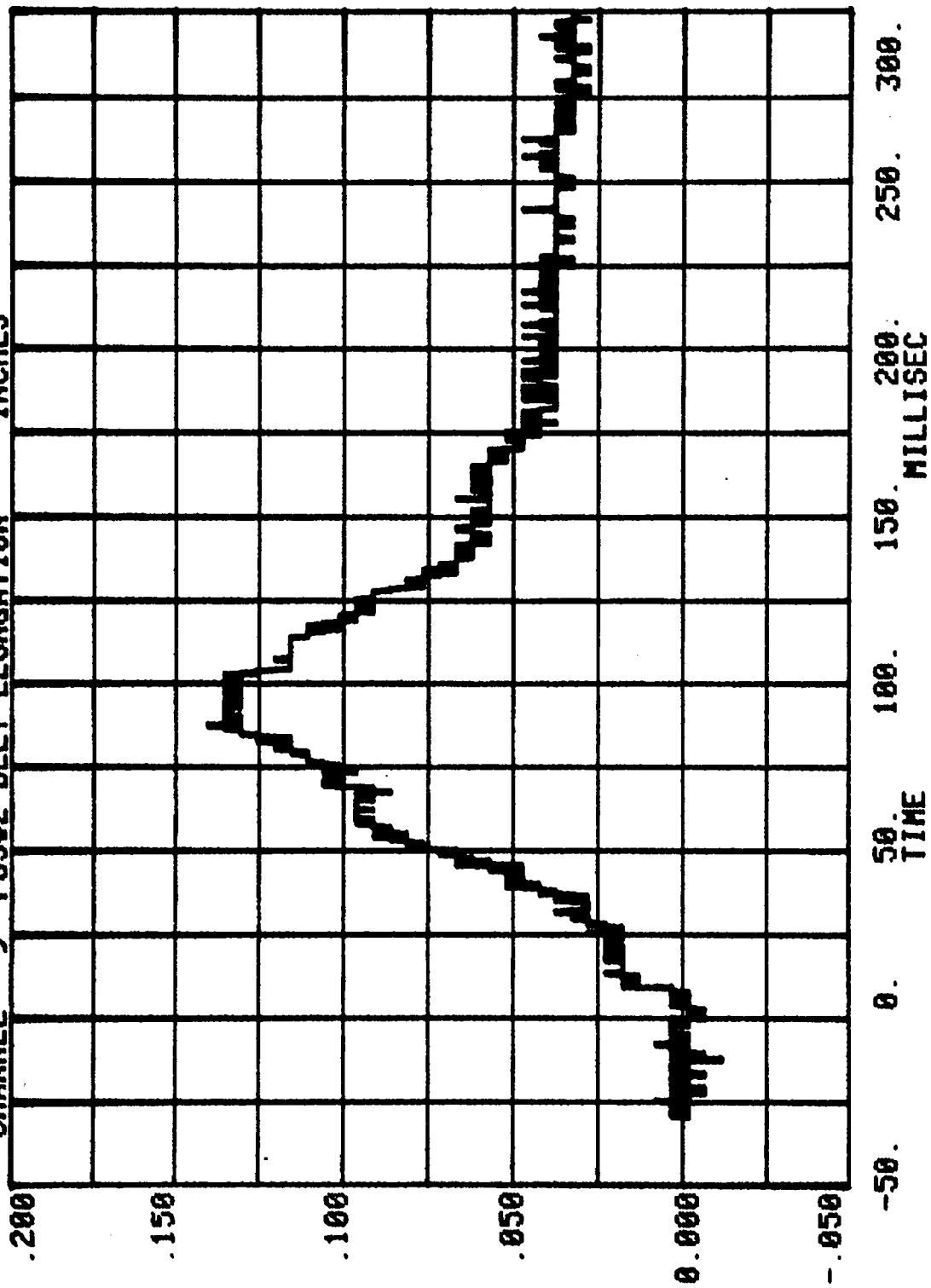
RUN= 671 SERIES= 5902 LBS.  
CHANNEL 24 POS#2 RIGHT BELT



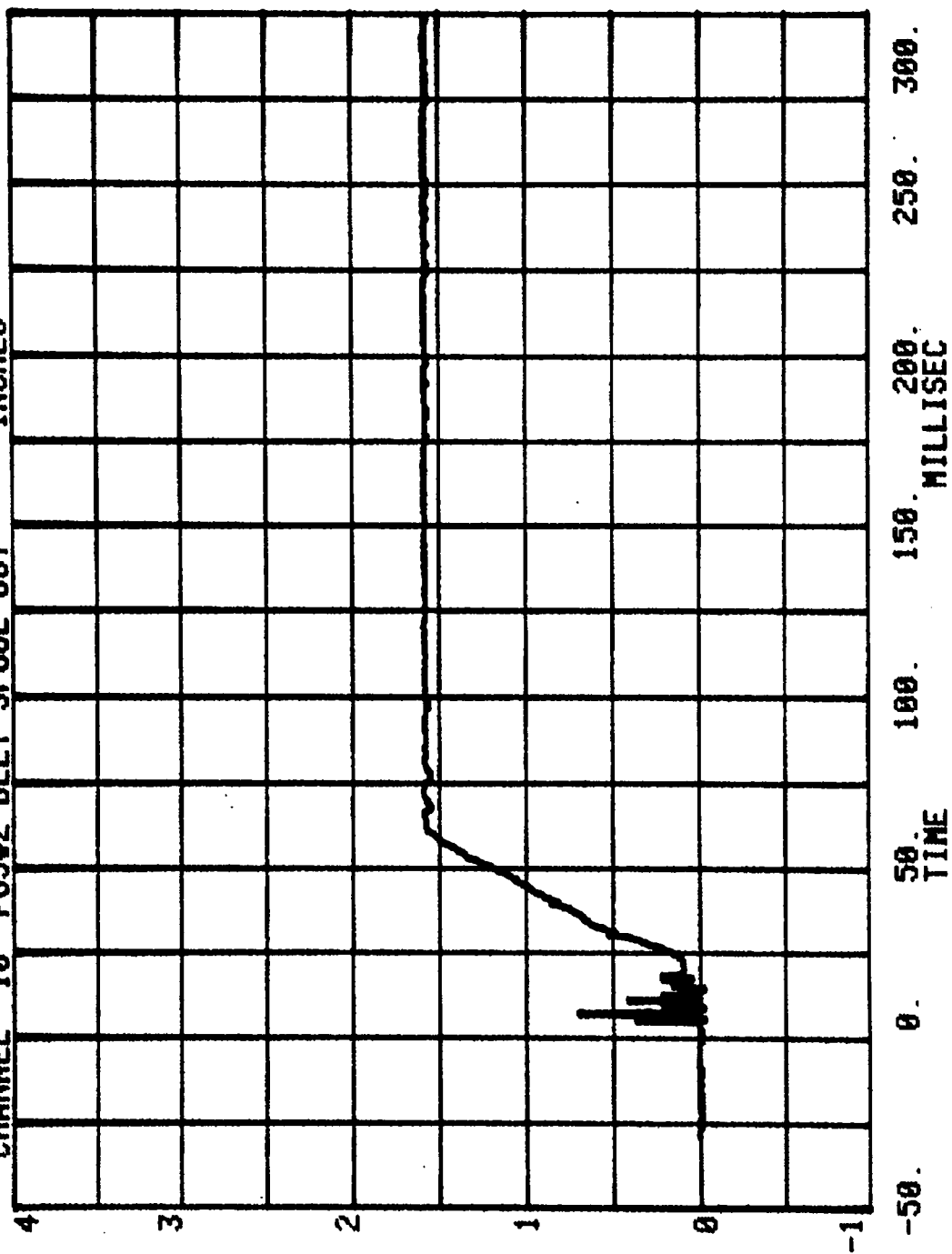


RUN= 671 SERIES= 5902  
MEASURED OVER 2.5 INCHES

CHANNEL 9 POS#2 BELT ELONGATION INCHES



RUN= 671 SERIES= 5902  
CHANNEL 10 POS#2 BELT SPOOL OUT INCHES



APPENDIX C  
DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the 50th percentile male anthropometric test devices utilized for this crash test. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Volume 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation, Advanced Technology Center. A summary of the test results, Part 572 specifications and instrument calibration information is included in this Appendix.

Dummy serial numbers and certification dates are:

| <u>Serial No.</u> | <u>Completion Date</u> |
|-------------------|------------------------|
| 1020              | 2/19/85                |
| 1022              | 2/19/85                |

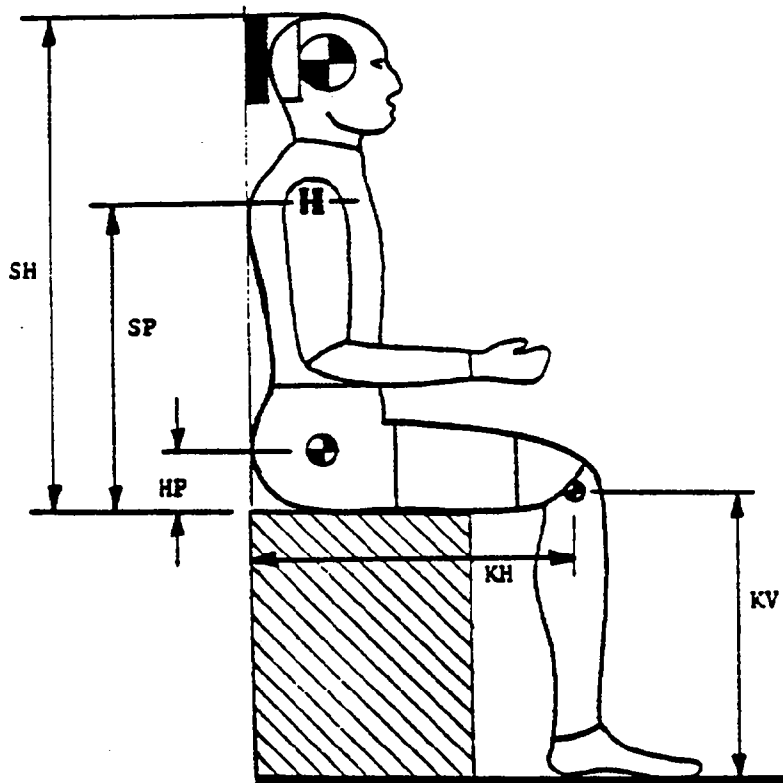
#### Electronic Test Equipment

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

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NO.: 1020

1. CONFIGURATION VERIFICATION DATA:



|                                    | P. 572<br>SPECIFICATION | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|------------------------------------|-------------------------|---------------------------|----------------------------|
| DATE OF CONFIGURATION VERIFICATION |                         | 2/19/85                   |                            |
| VERIFICATION NUMBER FOR DUMMY*     |                         | 2                         |                            |
| SH - Seated Height- - - - -        | 35.6 to 35.8"           | 35.6"                     |                            |
| SP - Shoulder Pivot Height- - -    | 21.8 to 22.4"           | 22.0"                     |                            |
| HP - Hip Pivot Height - - - - -    | 3.9" ref.               | 3.9"                      |                            |
| KH - Knee Pivot from back line- -  | 20.1 to 20.7"           | 20.6"                     |                            |
| KV - Knee Pivot from floor- - -    | 19.3 to 19.9"           | 19.6"                     |                            |
| SW - Shoulder Width - - - - -      | 17.8 to 18.4"           | 17.9"                     |                            |
| HW - Hip Width- - - - -            | 14.0 to 15.4"           | 14.6"                     |                            |

TECHNICIAN'S NAME: G. Gestwick

\* Sequential number beginning with "1" at the start of each fiscal year's crash test program

DUMMY CONFIG. & PERF. VERIF. DATA....Continued:

II. PERFORMANCE VERIFICATION DATA:

NHTSA DUMMY I.D. NO.: 1020

TECHNICIAN'S NAME: G. Gestwick

|                                                              |                        | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|--------------------------------------------------------------|------------------------|---------------------------|----------------------------|
| DATE OF PERFORMANCE VERIFICATION-----                        |                        | 2/25/85                   |                            |
| SEQUENTIAL VERIFICATION NUMBER FOR DUMMY*-----               |                        | 2                         |                            |
| VERIF. LAB. TEMPERATURE (66 to 78°F Range)-----              |                        | 68° - 70° °F.             | °F.                        |
| VERIF. LAB. HUMIDITY (10 to 70% Range)                       |                        | 22% - 37% %               | %                          |
| TEST PARAMETER                                               | SPECIFICATION          |                           |                            |
| <b>1. HEAD DROP TEST--</b>                                   |                        |                           |                            |
| a. Peak Resultant Accel.-                                    | 210 to 260G            | 250 g                     |                            |
| b. Peak Lateral Accel.-                                      | ≤ - 10G                | 6 g                       |                            |
| c. Time above 100G- - -                                      | 0.9 to 1.5ms           | 1.2 ms                    |                            |
| <b>2. NECK BENDING TEST--</b>                                |                        |                           |                            |
| a. Pendulum Speed - - -                                      | 21.5 to 25.5 fps       | 23.7 fps                  |                            |
| b. Pend. Avg. Decel. over<br>t <sub>3</sub> - t <sub>2</sub> | 20 to 24G              | 23.5 g                    |                            |
| c. Peak Resultant Head<br>Acceleration - - - -               | 26G max.               | 26 g                      |                            |
| d. Pendulum Decel.(t <sub>2</sub> -t <sub>1</sub> )          | ≤ - 3ms                | 2.5 ms                    |                            |
| e. Pendulum Decel.(t <sub>3</sub> -t <sub>2</sub> )          | 25 to 30 ms            | 28.1 ms                   |                            |
| f. Pendulum Decel.(t <sub>4</sub> -t <sub>3</sub> )          | ≤ - 10ms               | 5.3 ms                    |                            |
| g. Max. Head Rotation -                                      | 63 to 73°              | 72°                       |                            |
| h. Chordal Displacement--<br>Head Rotation Angle-            |                        |                           |                            |
| 0°                                                           | Time- - -2 to 2 ms     | 0 ms                      |                            |
|                                                              | Displ.- -.5 to .5"     | 0.0"                      |                            |
| 30°                                                          | Time- - 25.6 to 34.4ms | 29.5 ms                   |                            |
|                                                              | Displ.- 2.1 to 3.1"    | 3.1"                      |                            |
| 60°                                                          | Time- - 40.3 to 51.7ms | 43.5 ms                   |                            |
|                                                              | Displ.- 4.3 to 5.3"    | 5.2"                      |                            |
| Maximum<br>( 72 °)                                           | Time- - 53.2 to 66.8ms | 59 ms                     |                            |
|                                                              | Displ.- 5.0 to 6.0"    | 6.0"                      |                            |

\*beginning with "1" at the start of each fiscal year's crash test program

DUMMY CONFIG. & PERF. VERIF. DATA....Continued:

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.: 1020

TECHNICIAN'S NAME: G. Gestwick

| TEST PARAMETER                               |               | SPECIFICATION            | Pre-Test<br>(if required) | Post-Test<br>(if required) |
|----------------------------------------------|---------------|--------------------------|---------------------------|----------------------------|
| <b>2. <u>NECK BENDING TEST</u>....</b>       |               |                          |                           |                            |
| <b><u>Continued:</u></b>                     |               |                          |                           |                            |
| <b>h. Chordal Displacement:</b>              |               |                          |                           |                            |
| <b>Head Rotation Angle--</b>                 |               |                          |                           |                            |
| <b>60°</b>                                   | <b>Time</b>   | <b>67.0 to 83.0 ms</b>   | <b>76 ms</b>              |                            |
|                                              | <b>Displ.</b> | <b>4.3 to 5.3 in.</b>    | <b>5.0"</b>               |                            |
| <b>30°</b>                                   | <b>Time</b>   | <b>85.4 to 104.6 ms</b>  | <b>93 ms</b>              |                            |
|                                              | <b>Displ.</b> | <b>2.1 to 3.1 in.</b>    | <b>2.6"</b>               |                            |
| <b>0°</b>                                    | <b>Time</b>   | <b>101.0 to 123.0 ms</b> | <b>107.5 ms</b>           |                            |
|                                              | <b>Displ.</b> | <b>-.5 to 0.5 in.</b>    | <b>0.0"</b>               |                            |
| <b>3. <u>ABDOMINAL COMPRESSION TEST:</u></b> |               |                          |                           |                            |
| <b>(Preload = 10 pounds)</b>                 |               |                          |                           |                            |
| <b>a. Force @ .5"- - - - -</b>               |               | <b>23 to 36 lbs.</b>     | <b>25 lbs.</b>            |                            |
| <b>b. Force @ .75"- - - - -</b>              |               | <b>36 to 50 lbs.</b>     | <b>50 lbs.</b>            |                            |
| <b>c. Force @ 1.0"- - - - -</b>              |               | <b>50 to 63 lbs.</b>     | <b>59 lbs.</b>            |                            |
| <b>d. Force @ 1.3"- - - - -</b>              |               | <b>73 to 88 lbs.</b>     | <b>85 lbs.</b>            |                            |
| <b>4. <u>LUMBAR FLEXION TEST:</u></b>        |               |                          |                           |                            |
| <b>a. Force @ 20°- - - - -</b>               |               | <b>22 to 34 lbs.</b>     | <b>27.5 lbs.</b>          |                            |
| <b>b. Force @ 30°- - - - -</b>               |               | <b>34 to 46 lbs.</b>     | <b>35 lbs.</b>            |                            |
| <b>c. Force @ 40°- - - - -</b>               |               | <b>46 to 58 lbs.</b>     | <b>46.5 lbs.</b>          |                            |
| <b>d. Return Angle - - - - -</b>             |               | <b>12° maximum</b>       | <b>5°</b>                 |                            |
| <b>5. <u>CHEST IMPACT TESTS:</u></b>         |               |                          |                           |                            |
| <b>a. High Speed</b>                         |               |                          |                           |                            |
| <b>(1) Probe Speed- - - - -</b>              |               | <b>21.78-22.22 fps</b>   | <b>22.15 fps</b>          |                            |
| <b>(2) Peak Deflection- - - - -</b>          |               | <b>1.7" maximum</b>      | <b>1.6"</b>               |                            |
| <b>(3) Peak Resistive Force- - - - -</b>     |               | <b>2250 lbs. maximum</b> | <b>2175 lbs.</b>          |                            |
| <b>(4) Internal Hysteresis - - - - -</b>     |               | <b>50 to 70%</b>         | <b>51.1%</b>              |                            |
| <b>b. Low Speed</b>                          |               |                          |                           |                            |
| <b>(1) Probe Speed- - - - -</b>              |               | <b>13.86-14.14 fps</b>   | <b>13.87 fps</b>          |                            |
| <b>(2) Peak Deflection- - - - -</b>          |               | <b>1.1" maximum</b>      | <b>.9"</b>                |                            |
| <b>(3) Peak Resistive Force- - - - -</b>     |               | <b>1450 lbs. maximum</b> | <b>1290 lbs.</b>          |                            |
| <b>(4) Internal Hyster. - - - - -</b>        |               | <b>50 to 70%</b>         | <b>51.6%</b>              |                            |

DUMMY CONFIG. & PERF. VERIF. DATA....Continued:

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.: 1020

TECHNICIAN'S NAME: G. Gestwick

| TEST PARAMETER               | SPECIFICATION     | Pre-Test<br>(if required) | Post-Test<br>(if required) |
|------------------------------|-------------------|---------------------------|----------------------------|
| <b>6. KNEE IMPACT TESTS:</b> |                   |                           |                            |
| <b>a. Right Side--</b>       |                   |                           |                            |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.97 fps                  |                            |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2350 lbs.                 |                            |
| (3) Time Above 1000g-        | 1.7 ms minimum    | 1.75 ms                   |                            |
| <b>b. Left Side--</b>        |                   |                           |                            |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.92 fps                  |                            |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2050 lbs.                 |                            |
| (3) Time Above 1000g-        | 1.7 ms minimum    | 2.0 ms                    |                            |

REMARKS:

# INSTRUMENT CALIBRATION INFORMATION

ITSA DUMMY ID NO. 1020 CALIB. SEQ. NOS. FOR DUMMY: 2

## DUMMY INSTRUMENTS:

### 1. Head Accelerometers --

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 2. Chest Accelerometers --

(Vehicle Crash Test Usage)

a. Triaxial unit - - - - -

b. Uniaxial units

(1) Longitudinal ( $A_x$ ) -

(2) Lateral ( $A_y$ ) - - -

(3) Vertical ( $A_z$ ) - - -

### 3. Chest Potentiometer - - -

### 4. Femur Load Cells --

a. Right Side - - - - -

b. Left Side - - - - -

## 1. CALIB. LAB. INSTRUMENTS:

1. Pendulum Accelerometer - - -

2. Test Probe Accelerometer - - -

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

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

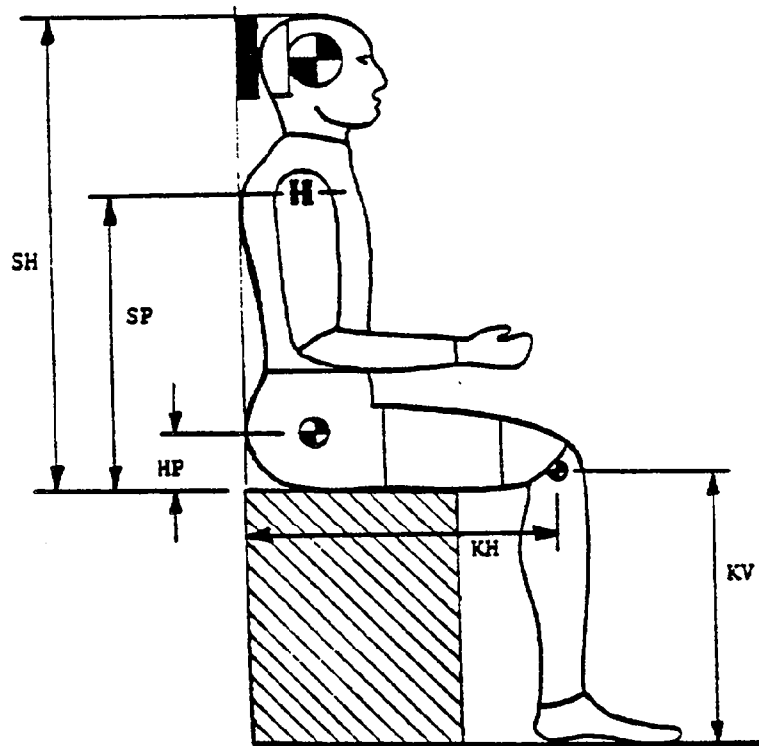
5. Abdominal Compression Test  
Displacement Gauge - - - - -

| <u>MANUFACTURER</u> | <u>SERIAL<br/>NUMBER</u> | <u>DATE LAST<br/>CALIBRATED</u> | <u>DATE OF<br/>NEXT<br/>CALIBRATION</u> |
|---------------------|--------------------------|---------------------------------|-----------------------------------------|
|                     |                          |                                 |                                         |
| Endevco             | CJ22                     | 10-84                           | 4-85                                    |
| Endevco             | CS41                     |                                 |                                         |
| Endevco             | CH21                     |                                 |                                         |
|                     |                          |                                 |                                         |
| CEC                 | 22960                    |                                 |                                         |
| Endevco             | CE06                     |                                 |                                         |
| CEC                 | 22703                    |                                 |                                         |
| Ohmite              | 7915                     | 1-85                            | 7-85                                    |
|                     |                          |                                 |                                         |
| GSE                 | 76                       | 10-84                           | 4-85                                    |
| GSE                 | 77                       | 10-84                           | 4-85                                    |
|                     |                          |                                 |                                         |
| CEC                 | 19965                    | 1-85                            | 7-85                                    |
| CEC                 | 25184                    |                                 |                                         |
| Transducer<br>Inc.  | 20051                    |                                 |                                         |
| BLH                 | 72952                    |                                 |                                         |
| CIC                 | 567-11                   |                                 |                                         |

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NO.: 1022

I. CONFIGURATION VERIFICATION DATA:



|                                    | P. 572<br>SPECIFICATION | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|------------------------------------|-------------------------|---------------------------|----------------------------|
| DATE OF CONFIGURATION VERIFICATION |                         | 2/21/85                   |                            |
| VERIFICATION NUMBER FOR DUMMY*     |                         | 3                         |                            |
| SH - Seated Height- - - - -        | 35.6 to 35.8"           | 35.7"                     |                            |
| SP - Shoulder Pivot Height- - -    | 21.8 to 22.4"           | 22.0"                     |                            |
| HP - Hip Pivot Height - - - - -    | 3.9" ref.               | 3.9"                      |                            |
| KH - Knee Pivot from back line- -  | 20.1 to 20.7"           | 20.6"                     |                            |
| KV - Knee Pivot from floor- - -    | 19.3 to 19.9"           | 19.7"                     |                            |
| SW - Shoulder Width - - - - -      | 17.8 to 18.4"           | 17.9"                     |                            |
| HW - Hip Width- - - - -            | 14.0 to 15.4"           | 14.8"                     |                            |

TECHNICIAN'S NAME: G. Gestwick

\* Sequential number beginning with "1" at the start of each fiscal year's crash test program

DUMMY CONFIG. & PERF. VERIF. DATA....Continued:

II. PERFORMANCE VERIFICATION DATA:

NHTSA DUMMY I.D. NO.: 1022

TECHNICIAN'S NAME: G. Gestwick

|                                                              |                        | PRE-TEST<br>(if required) | POST-TEST<br>(if required) |
|--------------------------------------------------------------|------------------------|---------------------------|----------------------------|
| DATE OF PERFORMANCE VERIFICATION-----                        |                        | 2/25/85                   |                            |
| SEQUENTIAL VERIFICATION NUMBER FOR DUMMY*-----               |                        | 3                         |                            |
| VERIF. LAB. TEMPERATURE (66 to 78°F Range)-----              |                        | 68° - 70° °F.             | °F.                        |
| VERIF. LAB. HUMIDITY (10 to 70% Range)                       |                        | 22% - 37% %               | %                          |
| TEST PARAMETER                                               | SPECIFICATION          |                           |                            |
| <b>1. HEAD DROP TEST--</b>                                   |                        |                           |                            |
| a. Peak Resultant Accel.-                                    | 210 to 260G            | 235 g                     |                            |
| b. Peak Lateral Accel.-                                      | ≤ - 10G                | 5 g                       |                            |
| c. Time above 100G- - -                                      | 0.9 to 1.5ms           | 1.2 ms                    |                            |
| <b>2. NECK BENDING TEST--</b>                                |                        |                           |                            |
| a. Pendulum Speed - - -                                      | 21.5 to 25.5 fps       | 23.1 fps                  |                            |
| b. Pend. Avg. Decel. over<br>t <sub>3</sub> - t <sub>2</sub> | 20 to 24G              | 24 g                      |                            |
| c. Peak Resultant Head<br>Acceleration - - - -               | 26G max.               | 25 g                      |                            |
| d. Pendulum Decel.(t <sub>2</sub> -t <sub>1</sub> )          | ≤ - 3ms                | 2.2 ms                    |                            |
| e. Pendulum Decel.(t <sub>3</sub> -t <sub>2</sub> )          | 25 to 30 ms            | 28.4 ms                   |                            |
| f. Pendulum Decel.(t <sub>4</sub> -t <sub>3</sub> )          | ≤ - 10ms               | 5.3 ms                    |                            |
| g. Max. Head Rotation - -                                    | 63 to 73°              | 70°                       |                            |
| h. Chordal Displacement--<br>Head Rotation Angle-            |                        |                           |                            |
| 0°                                                           | Time- - -2 to 2 ms     | 0 ms                      |                            |
|                                                              | Displ.- -.5 to .5"     | 0.0"                      |                            |
| 30°                                                          | Time- - 25.6 to 34.4ms | 29 ms                     |                            |
|                                                              | Displ.- 2.1 to 3.1"    | 3.0"                      |                            |
| 60°                                                          | Time- - 40.3 to 51.7ms | 44 ms                     |                            |
|                                                              | Displ.- 4.3 to 5.3"    | 5.1"                      |                            |
| Maximum                                                      | Time- - 53.2 to 66.8ms | 58 ms                     |                            |
| ( 70°)                                                       | Displ.- 5.0 to 6.0"    | 5.8"                      |                            |

\*beginning with "1" at the start of each fiscal year's crash test program

DUMMY CONFIG. & PERF. VERIF. DATA....Continued:

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.: 1022

TECHNICIAN'S NAME: G. Gestwick

| TEST PARAMETER                        |        | SPECIFICATION     | Pre-Test<br>(if required) | Post-Test<br>(if required) |
|---------------------------------------|--------|-------------------|---------------------------|----------------------------|
| <b>2. NECK BENDING TEST....</b>       |        |                   |                           |                            |
| <u>Continued:</u>                     |        |                   |                           |                            |
| <b>h. Chordal Displacement:</b>       |        |                   |                           |                            |
| <b>Head Rotation Angle--</b>          |        |                   |                           |                            |
| 60°                                   | Time   | 67.0 to 83.0 ms   | 73.5 ms                   |                            |
|                                       | Displ. | 4.3 to 5.3 in.    | 5.0"                      |                            |
| 30°                                   | Time   | 85.4 to 104.6 ms  | 91 ms                     |                            |
|                                       | Displ. | 2.1 to 3.1 in.    | 2.6"                      |                            |
| 0°                                    | Time   | 101.0 to 123.0 ms | 106 ms                    |                            |
|                                       | Displ. | -.5 to 0.5 in.    | 0.0"                      |                            |
| <b>3. ABDOMINAL COMPRESSION TEST:</b> |        |                   |                           |                            |
| (Preload = 10 pounds)                 |        |                   |                           |                            |
| a. Force @ .5" - - - -                |        | 23 to 36 lbs.     | 26 lbs.                   |                            |
| b. Force @ .75" - - - -               |        | 36 to 50 lbs.     | 41 lbs.                   |                            |
| c. Force @ 1.0" - - - -               |        | 50 to 63 lbs.     | 57 lbs.                   |                            |
| d. Force @ 1.3" - - - -               |        | 73 to 88 lbs.     | 80 lbs.                   |                            |
| <b>4. LUMBAR FLEXION TEST:</b>        |        |                   |                           |                            |
| a. Force @ 20° - - - -                |        | 22 to 34 lbs.     | 29.5 lbs.                 |                            |
| b. Force @ 30° - - - -                |        | 34 to 46 lbs.     | 37.5 lbs.                 |                            |
| c. Force @ 40° - - - -                |        | 46 to 58 lbs.     | 47.5 lbs.                 |                            |
| d. Return Angle - - - -               |        | 12° maximum       | 7°                        |                            |
| <b>5. CHEST IMPACT TESTS:</b>         |        |                   |                           |                            |
| <b>a. High Speed</b>                  |        |                   |                           |                            |
| (1) Probe Speed - - -                 |        | 21.78-22.22 fps   | 22.18 fps                 |                            |
| (2) Peak Deflection -                 |        | 1.7" maximum      | 1.62"                     |                            |
| (3) Peak Resistive Force - - - - -    |        | 2250 lbs. maximum | 2175 lbs                  |                            |
| (4) Internal Hysteresis - - -         |        | 50 to 70%         | 53.6%                     |                            |
| <b>b. Low Speed</b>                   |        |                   |                           |                            |
| (1) Probe Speed - - -                 |        | 13.86-14.14 fps   | 14.02 fps                 |                            |
| (2) Peak Deflection -                 |        | 1.1" maximum      | .98"                      |                            |
| (3) Peak Resistive Force - - - - -    |        | 1450 lbs. maximum | 1295 lbs                  |                            |
| (4) Internal Hyster. -                |        | 50 to 70%         | 55.4%                     |                            |

DUMMY CONFIG. & PERF. VERIF. DATA....Continued:

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.: 1022

TECHNICIAN'S NAME: G. Gestwick

| TEST PARAMETER               | SPECIFICATION     | Pre-Test<br>(if required) | Post-Test<br>(if required) |
|------------------------------|-------------------|---------------------------|----------------------------|
| <b>6. KNEE IMPACT TESTS:</b> |                   |                           |                            |
| <b>a. Right Side--</b>       |                   |                           |                            |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 7.03 fps                  |                            |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2400 lbs.                 |                            |
| (3) Time Above 1000g-        | 1.7 ms minimum    | 1.9 ms                    |                            |
| <b>b. Left Side--</b>        |                   |                           |                            |
| (1) Probe Speed - - -        | 6.76 to 7.04 fps  | 6.89 fps                  |                            |
| (2) Maximum Force - -        | 1850 to 2500 lbs. | 2075 lbs.                 |                            |
| (3) Time Above 1000g-        | 1.7 ms minimum    | 2.0 ms                    |                            |

REMARKS:

# INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 1022 CALIB. SEQ. NOS. FOR DUMMY: 3

## A. DUMMY INSTRUMENTS:

### 1. Head Accelerometers --

- a. Triaxial unit - - - - -
- b. Uniaxial units
  - (1) Longitudinal ( $A_x$ ) -
  - (2) Lateral ( $A_y$ ) - - -
  - (3) Vertical ( $A_z$ ) - - -

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

- a. Triaxial unit - - - - -
- b. Uniaxial units
  - (1) Longitudinal ( $A_x$ ) -
  - (2) Lateral ( $A_y$ ) - - -
  - (3) Vertical ( $A_z$ ) - - -

### 3. Chest Potentiometer - - -

### 4. Femur Load Cells --

- a. Right Side - - - - -
- b. Left Side - - - - -

## B. CALIB. LAB. INSTRUMENTS:

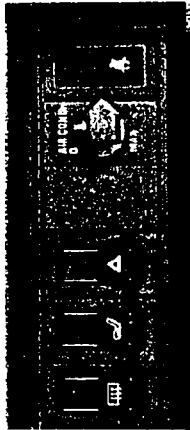
- 1. Pendulum Accelerometer - - -
- 2. Test Probe Accelerometer - - -
- 3. Lumbar Flexion Test Push  
Force Gauge - - - - -
- 4. Abdominal Compression Test  
Force Gauge - - - - -
- 5. Abdominal Compression Test  
Displacement Gauge - - - - -

| MANUFACTURER | SERIAL<br>NUMBER | DATE LAST<br>CALIBRATED | DATE OF<br>NEXT<br>CALIBRATION |
|--------------|------------------|-------------------------|--------------------------------|
| NA           |                  |                         |                                |
| Endevco      | CL60             | 10-84                   | 4-85                           |
|              | CG34             | 10-84                   | 4-85                           |
|              | CN24             | 10-84                   | 4-85                           |
| NA           |                  |                         |                                |
| CEC          | 18341            | 10-84                   | 4-85                           |
| Endevco      | CN64             | 10-84                   | 4-85                           |
| CEC          | 22705            | 10-84                   | 4-85                           |
| Ohmite       | 7915             | 1-85                    | 7-85                           |
| GSE          | 548              | 10-84                   | 4-85                           |
| GSE          | 549              | 10-84                   | 4-85                           |
| CEC          | 19965            | 1-85                    | 7-85                           |
| CEC          | 25184            | 1-85                    | 7-85                           |
| Transducer   | 20051            | 1-85                    | 7-85                           |
| BLH          | 72952            | 1-85                    | 7-85                           |
| CIC          | 567-11           | 1-85                    | 7-85                           |

APPENDIX D

VEHICLE ' OWNERS MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

## Seat belts



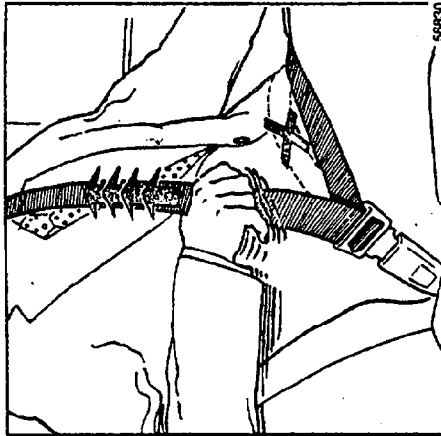
### Seat belts, retractable

**Fasten the seat belts whenever you drive or ride.**  
Two lights will be illuminated for 4–8 seconds after the starting (ignition) key is turned to driving position. One light is located in the instrument cluster and one in the console between the front seats.

A chime will sound at the same time if the driver has not fastened his seat belt. The front and rear outboard seats are provided with self-retracting inertia-reel belts.



Release buttons, front seats



**Note:** The lap belt should sit low and tight under abdomen.

The seat belt retractors are normally "unlocked". The retractors will lock up as follows:

- if belt is pulled out rapidly
- during braking and acceleration
- if the vehicle is leaning excessively
- when driving in turns

Check seat belt mechanism function as follows:

1. Attach the seat belt. Pull rapidly on the strap.
2. **CAUTION: Check other traffic before performing this check.**

Brake firmly from approximately 30 mph (50 km/h) or turn in a tight circle while pulling on the belt.

In all the above checks you should not be able to pull the belt out.

Figure D-1 VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS