

REPORT NUMBER: CAL-90-N19

**NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST**

**GENERAL MOTORS CORPORATION
1990 CHEVROLET CAVALIER
4-DOOR SEDAN**

NHTSA NUMBER: MLO103

CALSPAN TEST NUMBER: 7776-19

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FINAL REPORT

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Office of Market Incentives
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16. Abstract A frontal load cell barrier test of a 1990 Chevrolet Cavalier 4-Door Sedan was performed at Calspan Advanced Technology Center crash test facility in Buffalo, New York on May 4, 1990. The impact speed was 35.0 mph and the ambient temperature at the barrier face at the time of impact was 62°F. The maximum post-test vehicle crush was 26.2 inches. The test vehicle was equipped with an automatic 3-point continuous belt system at each of the front outboard seating positions. With regard to FMVSS 208-"Occupant Crash Protection," injury criteria, both the driver and passenger dummies appear to satisfy the head, chest and femur requirements.					
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TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	PURPOSE AND TEST PROCEDURE	1-1
2	SUMMARY OF FRONTAL BARRIER IMPACT TEST	2-1
3	OCCUPANT AND VEHICLE INFORMATION	3-1
APPENDIX A	PHOTOGRAPHS	A-1
APPENDIX B	VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA	B-1
APPENDIX C	DUMMY CONFIGURATION TESTS	C-1
APPENDIX D	VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS	D-1

LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1	Part 572 Dummy In-Vehicle Position	3-3
2	Occupant Clearance Dimensions	3-4
3	Seat Belt Positioning Data	3-5
4	Driver Dummy to Steering Column/Wheel Dimensions	3-7
5	Camera Positions for Frontal Impacts	3-8
6	Vehicle Target Locations	3-10
7	Load Cell Locations on Fixed Barrier	3-11
8	Vehicle Accelerometer Locations	3-12
9	Test Vehicle Measurements	3-13
10	Dummy Configuration Dimensions	C-3

LIST OF TABLES

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

Section I
PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY 90 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-87-D-02012. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 30 mph requirements.

The 35 mph frontal barrier impact test was conducted in accordance with the Office of Market Incentives (OMI) Laboratory Indicant Test procedure.

Section 2

SUMMARY OF TEST NUMBER ML0103

A load cell barrier consisting of 36 load cells was impacted by a 1990 Chevrolet Cavalier 4-Door Sedan at a velocity of 35.0 mph. The test was performed at the Calspan Corporation Advanced Technology Center on May 4, 1990. 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 15 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 the 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 used in two previous tests. The driver ATD (Serial No. 45) was used in tests ML0300 and ML0102. The right front passenger ATD (Serial No. 150) was used in tests ML0301 and ML0102. The Injury Criteria Values were not exceeded in these tests. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 79 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. Barrier load cells A1, A5 and D5 did not record accurately. These load cells were not used in the load cell sum calculations. Position #1 Belt Elongation did not record accurately.

The driver's head struck the steering wheel rim and hub; the HIC was 770.1. The maximum chest deceleration over 3 milliseconds was 49.1 g's and femur loads were 775.0 and 1749.0 pounds.

The right front passenger's HIC was 485.3. The maximum chest deceleration over 3 milliseconds was 37.4 g's and femur loads were 530.6 and 890.3 pounds.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1990 Chevrolet Cavalier 4-Door Sedan

NHTSA No.: ML0103 VIN.: 1G1JC54GXL7101163

Body Color: Dark Blue Date Of Manufacture: August 1989

Engine: 4 Cylinders; 134 C.I.D.; 2.2 Liters; - CC
X Gas; - Diesel; - Turbocharged
- Longitudinal; X Transverse

Transmission: 3 Speed; - Manual; X Automatic; - Overdrive

Final Drive: X Front Wheel; - Rear Wheel; - Four Wheel

Date Received: 09-29-89 Odometer Reading: 36.0

- A/C; X P/S; X P/B; - P/wdo.; - Tilt Wheel
- P/seats; - Cruise Control

Type of Occupant Restraint: 3 Point Automatic Restraint System.

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

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

Recommended Tire Size: P185/80R13

Recommended Cold Tire Pressure: Front 35 psi, Rear 35 psi

Tires on Vehicle: P185/80R13 M&S; Manufacturer: General

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 X Lever - Rot. Knob

Truck Payload = 838 lbs.

No. of Occupants x 150 lbs. = 750 lbs.

Rated Cargo and Luggage

Weight (RCLW) A-B = 88 lbs.

GVWR 3459 lbs. GAWR: Front 1849 lbs. Rear 1610 lbs.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

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

Right Front = 790 lbs. Right Rear = 460 lbs.
 Left Front = 790 lbs. Left Rear = 500 lbs.
 TOTAL FRONT WEIGHT = 1580 lbs. (62 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 960 lbs. (38 % of Total Vehicle Weight)
 TOTAL DELIVERY WEIGHT = 2540 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (2540 lbs.)
 VCW = Vehicle Capacity Weight (838 lbs.)
 DSC = Designated Seating Capacity (5)
 RCLW = VCW - 150 (DSC) = 88 lbs.
 Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)
 Target Test Weight = 2956 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 192 POUNDS CARGO:

Right Front = 860 lbs. Right Rear = 640 lbs.
 Left Front = 910 lbs. Left Rear = 650 lbs.
 TOTAL FRONT WEIGHT = 1770 lbs. (58 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 1290 lbs. (42 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 3060 lbs.
 Weight of ballast secured in vehicle trunk area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude: RF 27.2 LF 26.9 RR 26.5 LR 26.5
 Test Attitude: RF 26.4 LF 25.9 RR 23.9 LR 23.4
 Wheel Base: 101.2 in.; C.G. = 42.7 in. rearward of front wheel C/L
 Remarks: 12.6 gallons of stoddard solution was placed inside the fuel tank.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Angle: 0°
 Date of Test: May 4, 1990 Time of Test: 12:20
 Ambient Temperature: 62 °F at impact area
 Temperature in Occupant Compartment: 72 °F
 Windshield Molding Temperature: 72 °F
 Required Impact Velocity Range: 34.5 to 35.5 mph
 Impact Velocity: primary = 35.0 mph, secondary = 35.0 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 <u>174.0</u>	C _L <u>178.2</u>	L <u>174.0</u>
	Post-test	= R <u>151.6</u>	C _L <u>152.0</u>	L <u>154.8</u>
	Crush	= R <u>22.4</u>	C _L <u>26.2</u>	L <u>19.2</u>

Distance from front of test vehicle to point of impact:

R 12.2" C_L 11.2" L 12.2"

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Upper Steering Rim and Hub</u>	<u>No Contact</u>
Chest	<u>Lower Steering Rim</u>	<u>No Contact</u>
Abdomen	<u>No Contact</u>	<u>No Contact</u>
Left Knee	<u>Dash Panel</u>	<u>Dash Panel</u>
Right Knee	<u>Dash Panel</u>	<u>Dash Panel</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>
Door Opening	<u>operable</u>	<u>operable</u>	<u>operable</u>	<u>operable</u>

<u>Seat Movement</u>	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Seat Back Failure	<u>none</u>	<u>none</u>	<u>-</u>	<u>-</u>
Seat Shift (in.)	<u>0.0</u>	<u>0.0</u>	<u>-</u>	<u>-</u>

Glazing Damage

Backlight/Windshield: The windshield sustained stress fractures, but remained intact.

Other Notable impact Effects: None.

Section 3
OMI FINAL DATA

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
3. Test Vehicle Measurements

Table 2
DUMMY INJURY CRITERIA VALUES

NHTSA No.: ML0103 Vehicle: 1990 Chevrolet Cavalier 4-Door Sedan

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-136.9	17.6	38.6	141.1
Position #2 - Passenger	-36.4	-9.9	43.2	51.9

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-50.5	-7.0	24.3	49.1
Position #2 - Passenger	-37.7	-19.8	-14.7	37.4

The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

	MAXIMUM FORCE - FEMUR LOAD (lbs.)	
	LEFT FEMUR	RIGHT FEMUR
Position #1 - Driver	775.0	1749.0
Position #2 - Passenger	530.6	890.3

	MAXIMUM FORCE - SEAT BELT LOADS (lbs.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	1778.5	-	233.9
Position #2 - Passenger	1724.9	1022.9	-

	HEAD INJURY CRITERIA (HIC)			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
Position #1 - Driver	770.1	.06517	.09637	57.1
Position #2 - Passenger	485.3	.07275	.10875	44.9

HIC is as defined in FMVSS 208. The maximum time interval from t₁ to t₂ is 36 milliseconds.

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION

Test No.: ML0103 Vehicle: 1990 Chevrolet Cavalier 4-Door Sedan

SEAT TYPE:

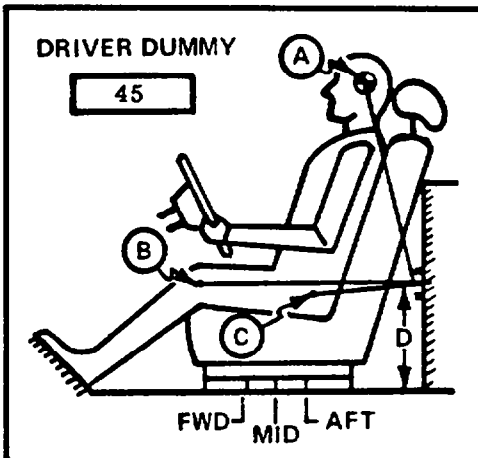
 - Bench
 X - Bucket
 - Split Bench

ADJUSTER TYPE:

 X Manual
 - Power

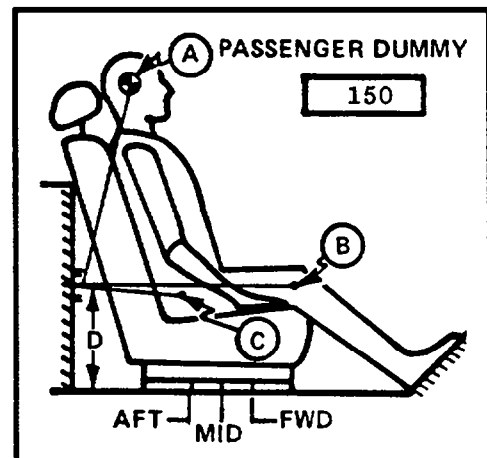
SEAT BACK TYPE:

 - Fixed
 X Adjustable Reclining



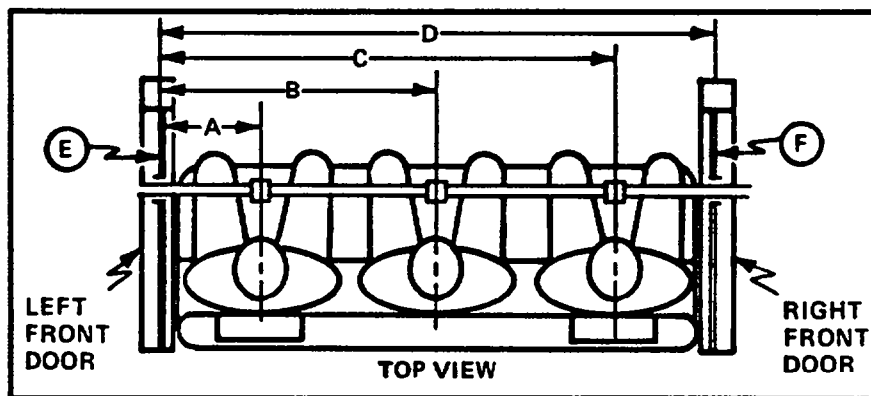
MEASUREMENT LOCATION

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



A = 20.6 in. 15 Degrees
 B = 24.8 in. 93 Degrees
 C = 8.0 in. 129 Degrees
 D = 13.0 in.

A = 20.2 in. 13 Degrees
 B = 24.8 in. 94 Degrees
 C = 8.0 in. 129 Degrees
 D = 13.0 in.



45

DUMMY ID

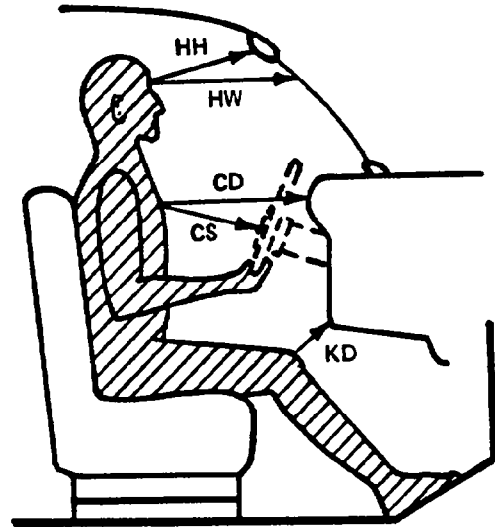
150

A = Left Door to Driver Centerline 12.1 in.
 B = Left Door to Center Passenger Centerline in.
 C = Left Door to Right Passenger Centerline 39.0 in.
 D = Left Door to Right Door 51.4 in.
 E,F = Window Glass Height (Right and Left Must Be Equal) 10.0 in.

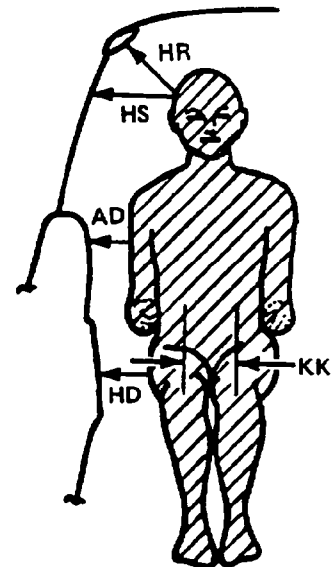
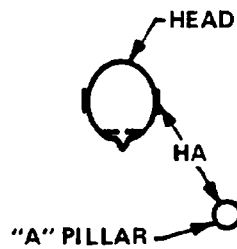
Figure 2

OCCUPANT CLEARANCE DIMENSIONS

	DRIVER	PASSENGER
HH	11.5	11.4
HW	18.6	18.4
CD	16.6	20.5
CS	11.5	-
KDL	2.4	5.7
KDR	2.0	5.5
SA	21°	21°
TA	24°	23°

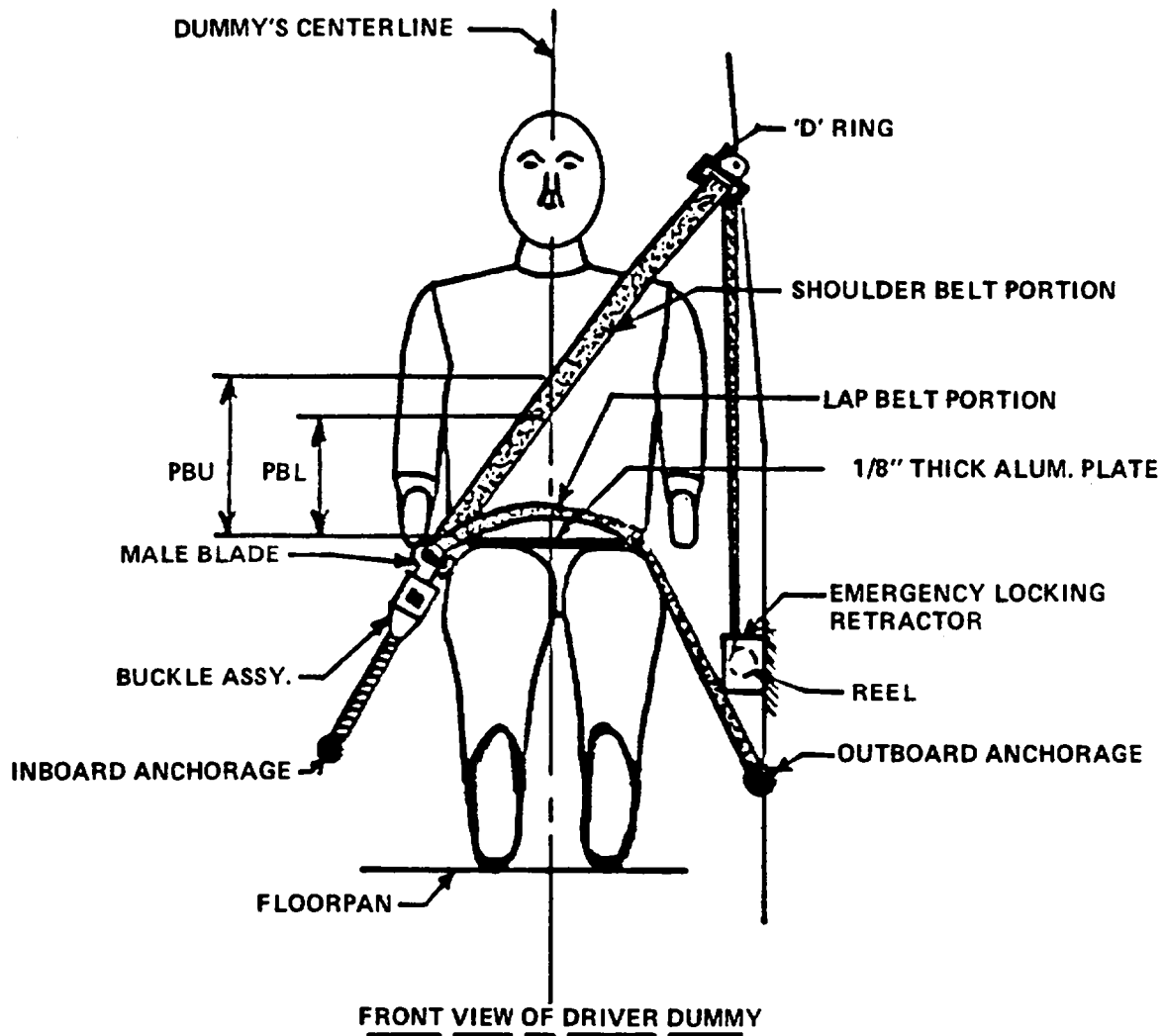


- HH = Head to Windshield Header
 HW = Head to Windshield
 CD = Chest to Dash
 CS = Chest to Steering Wheel
 KD(L/R) = Knee to Dash (Left/Right)
 SA = Seat Back Angle
 TA = Torso Angle
- HA = Head Target to "A" Pillar
 HR = Head to Side Roof
 HS = Head to Side Window
 AD = Arm to Door
 HD = Hip to Door
 KK = Knee to Knee



	DRIVER	PASSENGER
HR	6.8	7.0
HS	9.0	9.3
AD	4.2	4.3
HD	3.4	3.6
KK	6.8	6.8
HA	18.5	18.3

Figure 3
SEAT BELT POSITIONING DATA



	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
<u>PBU</u> -- Top surface of alum. plate to upper edge	12.3	12.0
<u>PBL</u> -- Top surface of alum. plate to belt lower edge	9.3	9.0

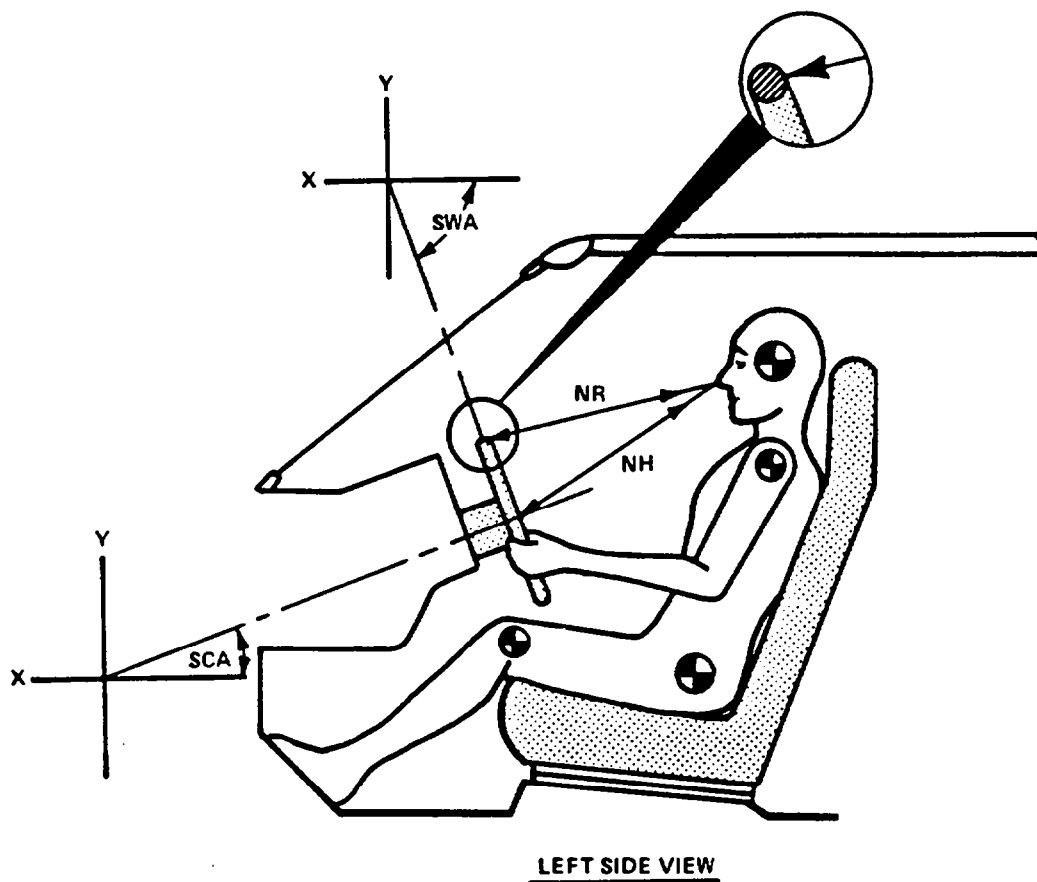
Table 3

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>69.3"</u>	<u>69.3"</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>32.8"</u>	<u>32.8"</u>
Lap belt length as measured on Part 572 Dummy.	<u>24.2"</u>	<u>24.2"</u>
<u>SHOULDER BELT SPOOL-OFF DATA:</u>		
As determined by film analysis.	<u>2.0"</u>	<u>1.5"</u>
As determined mechanically.	<u>1.0"</u>	<u>1.0"</u>
<u>BELT STRETCH DATA:</u>		
Measured electronically between shoulder belt load cell and the "D" ring.	<u>Not Available</u>	<u>0.8 in/ft</u>
Measured mechanically	<u>0.0 in/ft</u>	<u>0.0 in/ft</u>

Figure 4

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



LEFT SIDE VIEW

		MEASUREMENTS	
<u>NR</u>	-- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim	12.1	Inches
<u>NH</u>	-- Distance from tip of dummy's nose to center of steering column hub	14.3	Inches
<u>SCA</u>	-- Angle of steering column relative to the horizontal X axis	18.0	Degrees
<u>SWA</u>	-- Angle of steering wheel relative to the horizontal X axis	-72.0	Degrees

Figure 5
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

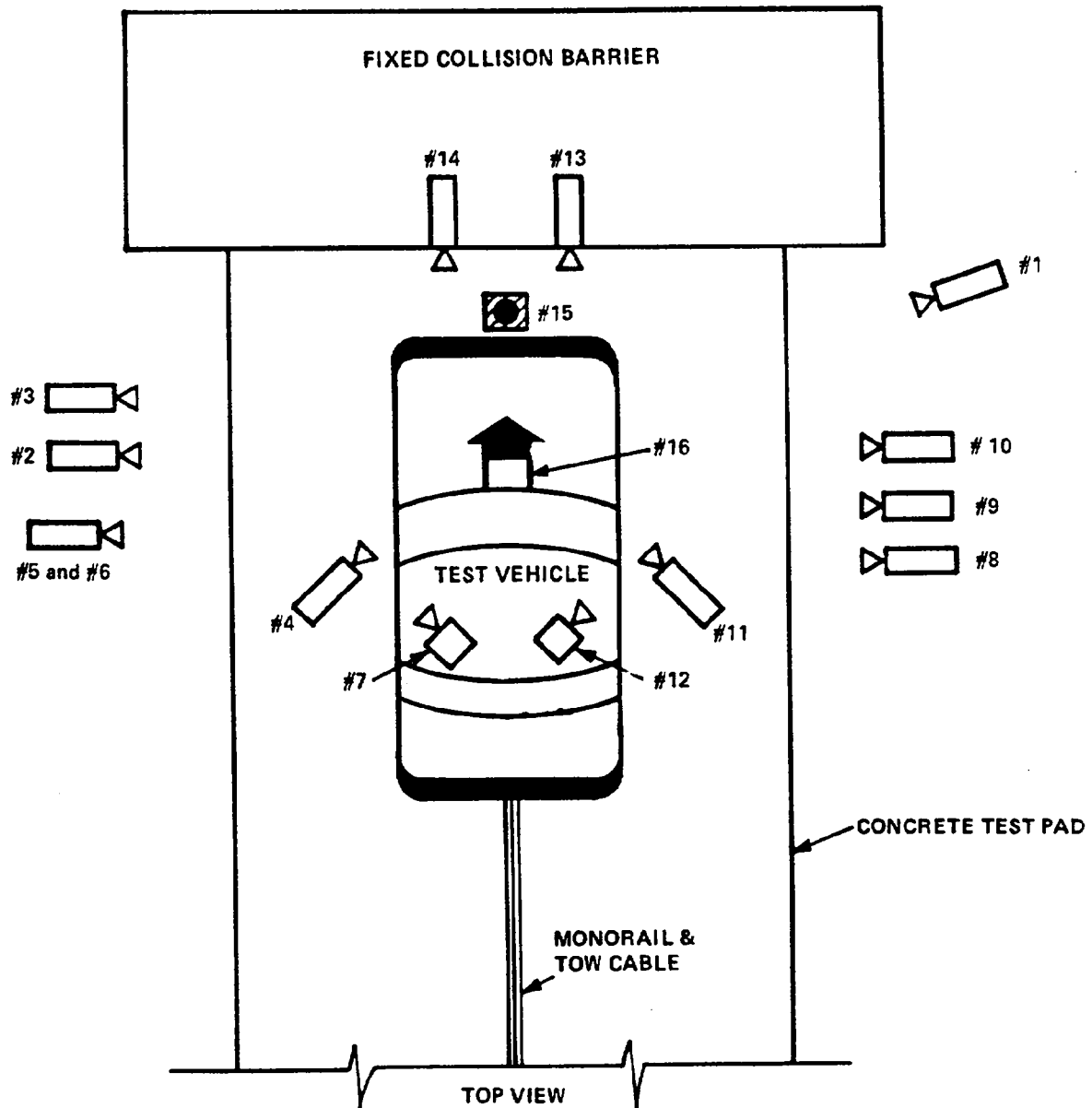


Table 4
HIGH-SPEED CAMERA LOCATIONS

Test No. ML0103 Vehicle: 1990 Chevrolet Cavalier 4-Door Sedan

CAMERA NO.	VIEW	CAMERA POSITIONS (in)*			ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Camera	-	-	-	-	-	-	24
2	Overall Left Side	229	56	41	-4	213	13	540
3	Left Side View	309	31	41	-4	293	25	540
4	Driver and Interior View	112	101	73	-18	96	13	860
5	Steering Column (Bottom)	294	83	46	-3	278	25	560
6	Steering Column (Top)	294	83	70	-10	278	25	560
7	Left Belt	-	-	-	-	-	8	605
8	Overall Right Side	238	68	42	-4	222	13	795
9	Right Side View	300	42	41	-2	284	25	760
10	Right Passenger View	293	54	59	-5	277	35	675
11	Passenger and Interior View	115	97	74	-24	99	25	740
12	Right Belt	-	-	-	-	-	8	540
13	Passenger Front View	24	-5	73	-36	-	13	660
14	Driver Front View	24	-5	73	-35	-	13	535
15	Windshield View	0	0	126	-45	-	13	500
16	Pit View of Engine	0	32	-120	90	-	13	845

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

Figure 6
VEHICLE TARGET LOCATIONS

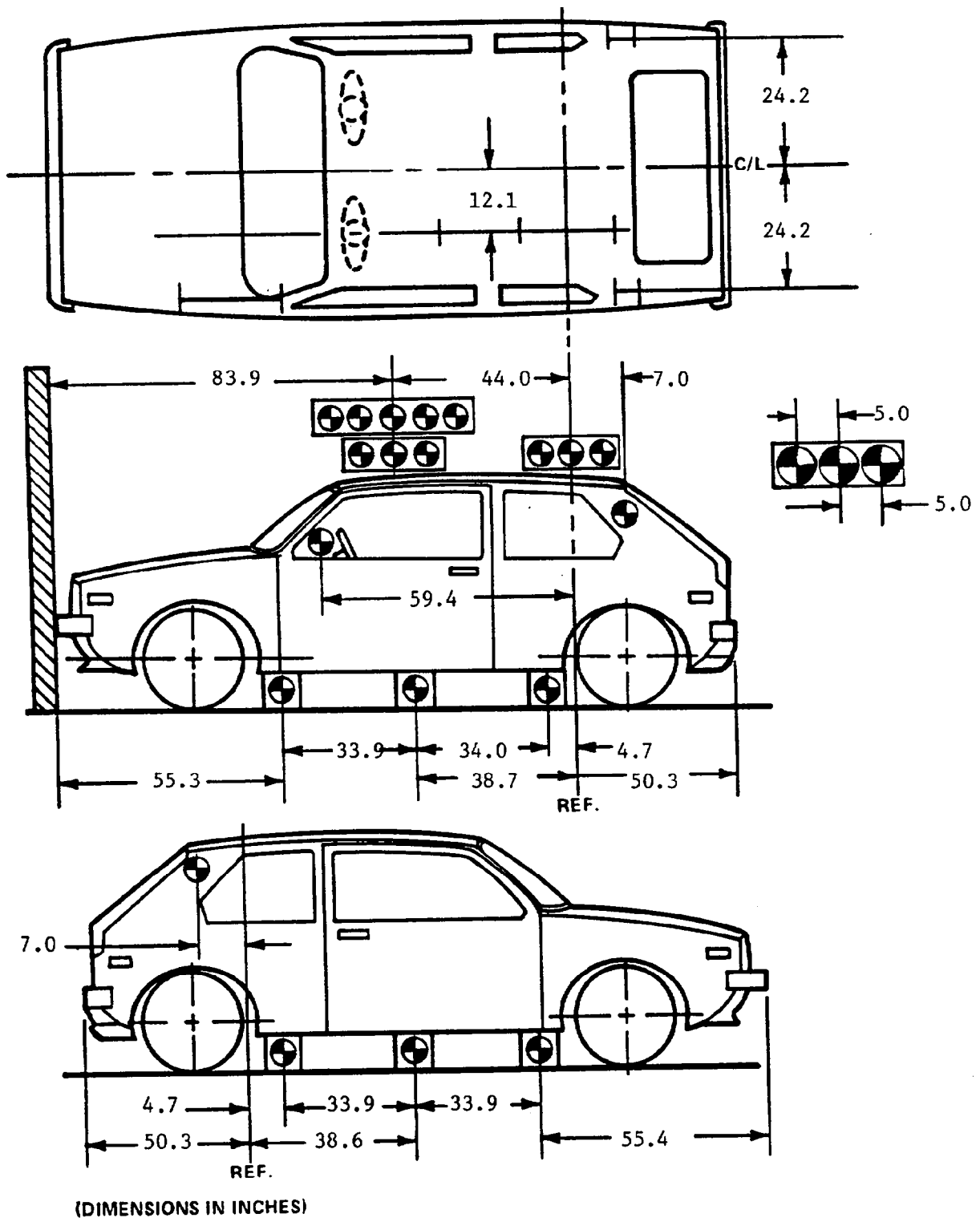
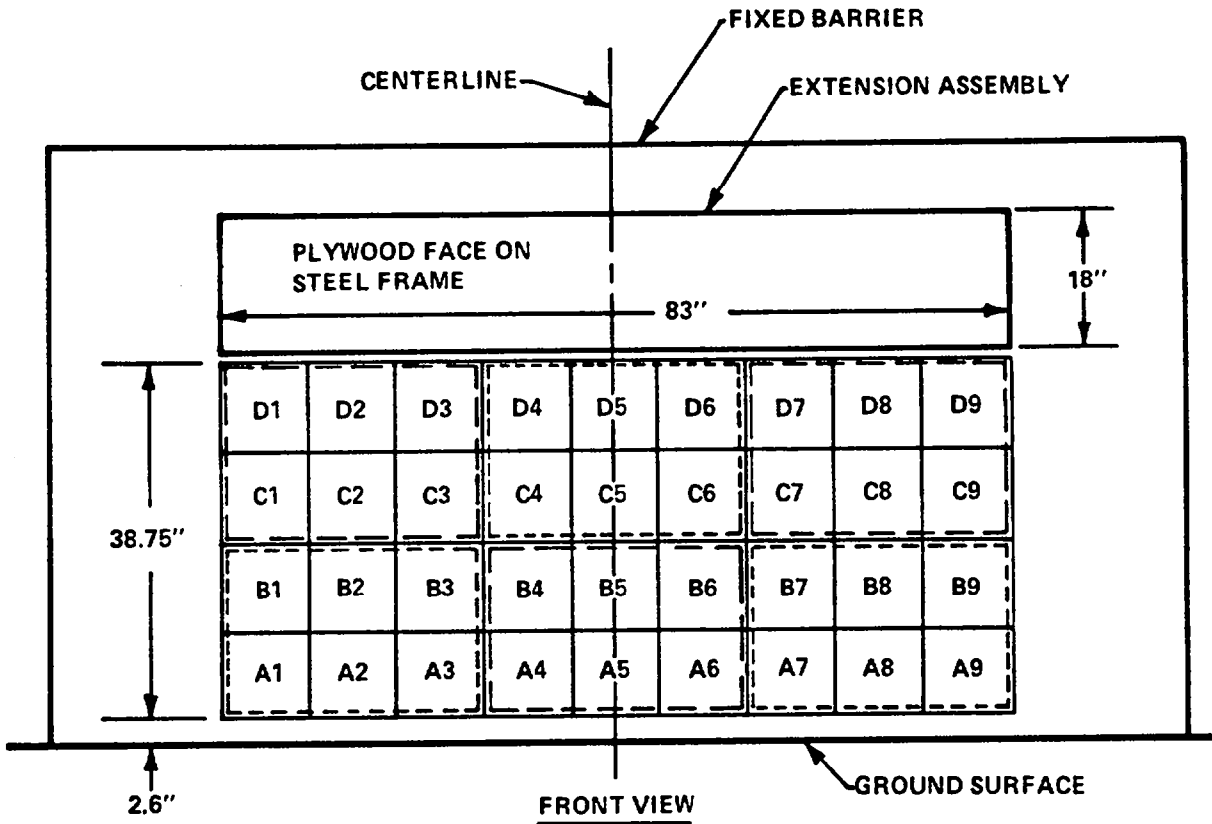


Figure 7

LOAD CELL LOCATIONS ON FIXED BARRIER

- 36 Load Cells
- 4 Rows
- 9 Columns
- 6 Groupings (6 cells/group)



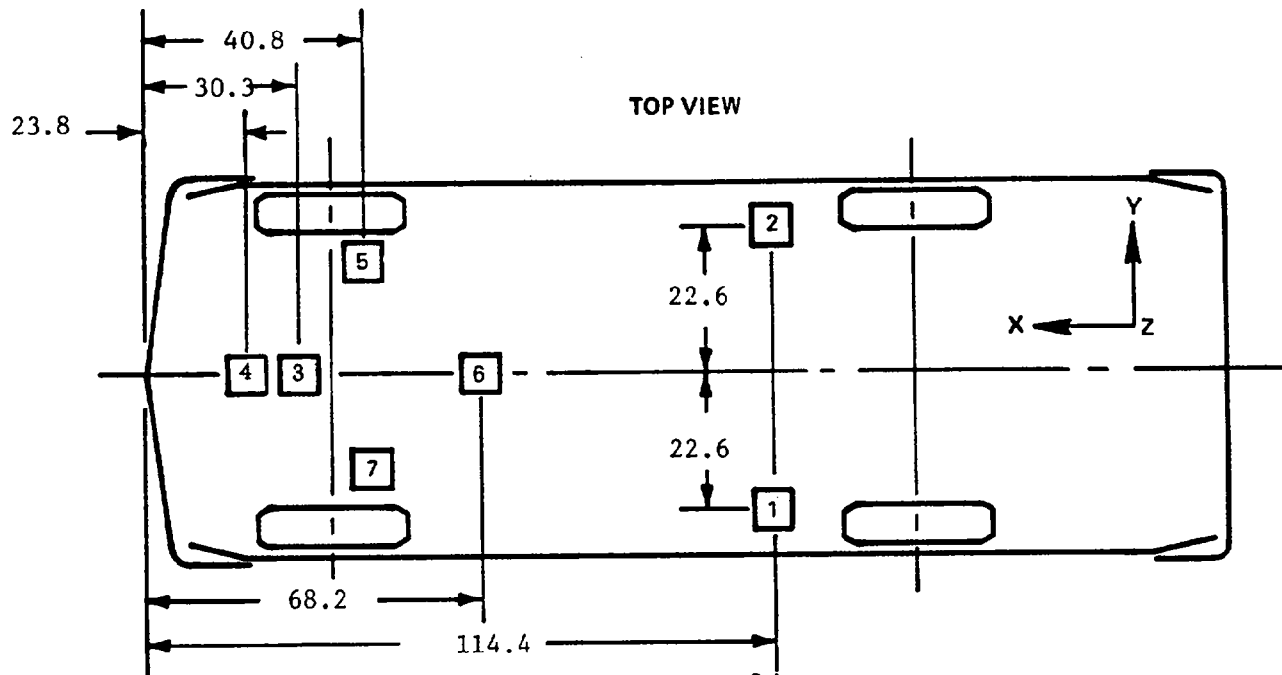
6 GROUPS OF 6 LOAD CELLS EACH

Group 4	Group 5	Group 6
C1 thru D3	C4 thru D6	C7 thru D9
Group 1	Group 2	Group 3
A1 thru B3	A4 thru B6	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)

Figure 8
VEHICLE ACCELEROMETER LOCATIONS



ACCELEROMETER 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	Left Disc Brake Caliper	X		

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

Figure 9
TEST VEHICLE MEASUREMENTS

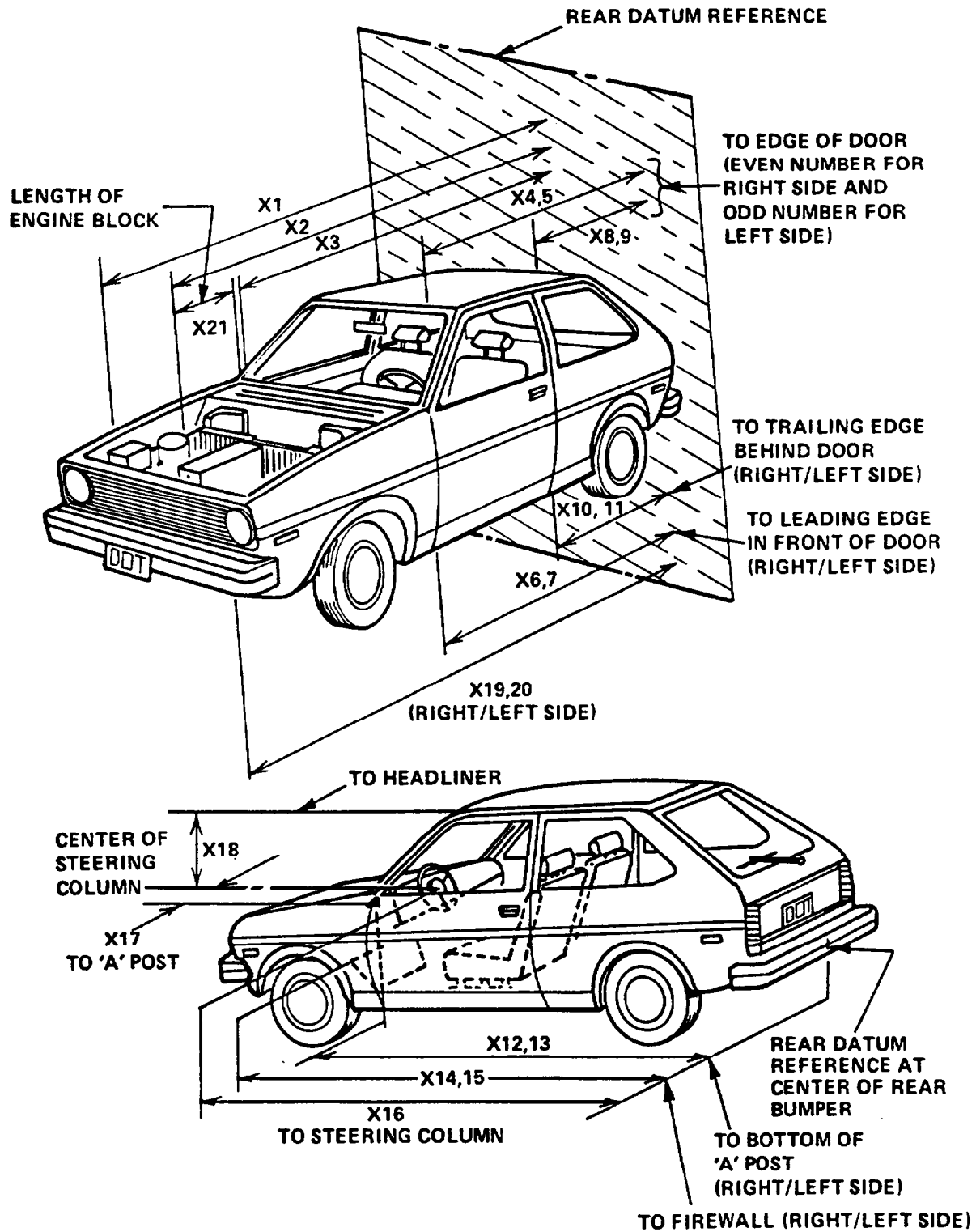


Table 5

VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	178.2	152.0	26.2
X2	Rear Surface of Vehicle to Front of Engine	150.0	137.4	12.6
X3	Rear Surface of Vehicle to Firewall	130.2	121.7	8.5
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	118.5	118.0	0.5
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	118.4	118.4	0.0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	118.2	117.4	0.8
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	117.7	117.5	0.2
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	80.3	79.4	0.9
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	79.8	80.0	-0.2
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	80.3	79.5	0.8
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	79.6	79.8	-0.2
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	118.6	117.7	0.9
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	118.1	118.1	0.0
X14	Rear Surface of Vehicle to Firewall, Right Side	131.0	122.0	9.0
X15	Rear Surface of Vehicle to Firewall, Left Side	130.0	124.2	5.8
X16	Rear Surface of Vehicle to Steering Column	103.3	102.0	1.3
X17	Center of Steering Column to "A" Post	16.9	15.6	1.3
X18	Center of Steering Column to Headliner	17.7	16.4	1.3
X19	Rear Surface of Vehicle to Right Side of Front Bumper	174.0	151.6	22.4
X20	Rear Surface of Vehicle to Left Side of Front Bumper	174.0	154.8	19.2
X21	Length of Engine Block	15.0	15.0	0.0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	112.5	111.3	1.2
CD	Rear Surface of Vehicle to Center of Dash Panel	108.0	105.6	2.4
LD	Rear Surface of Vehicle to Left Side of Dash Panel	112.1	110.9	1.2

Appendix A

PHOTOGRAPHS

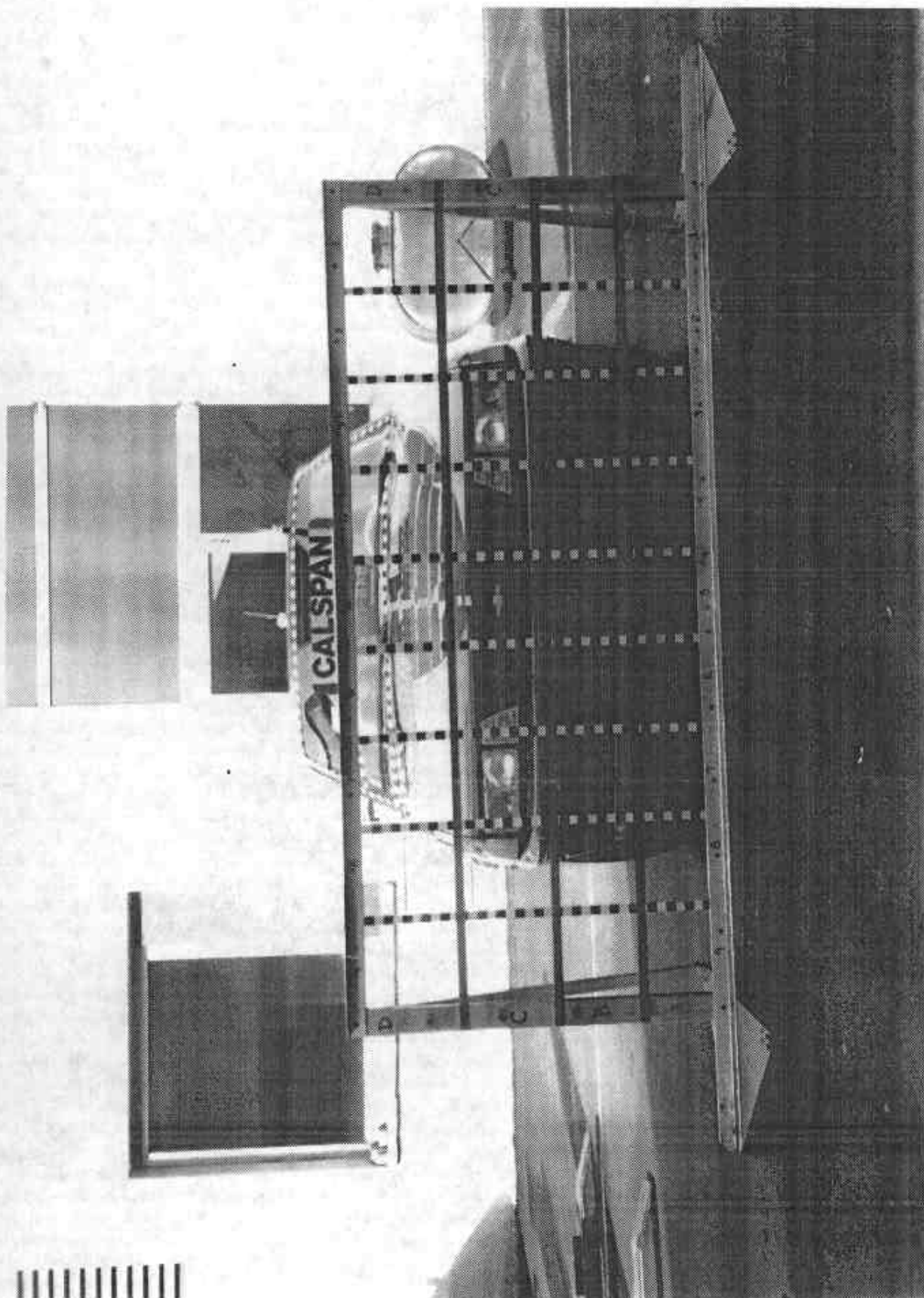


FIGURE A-1 LOAD CELL LOCATIONS

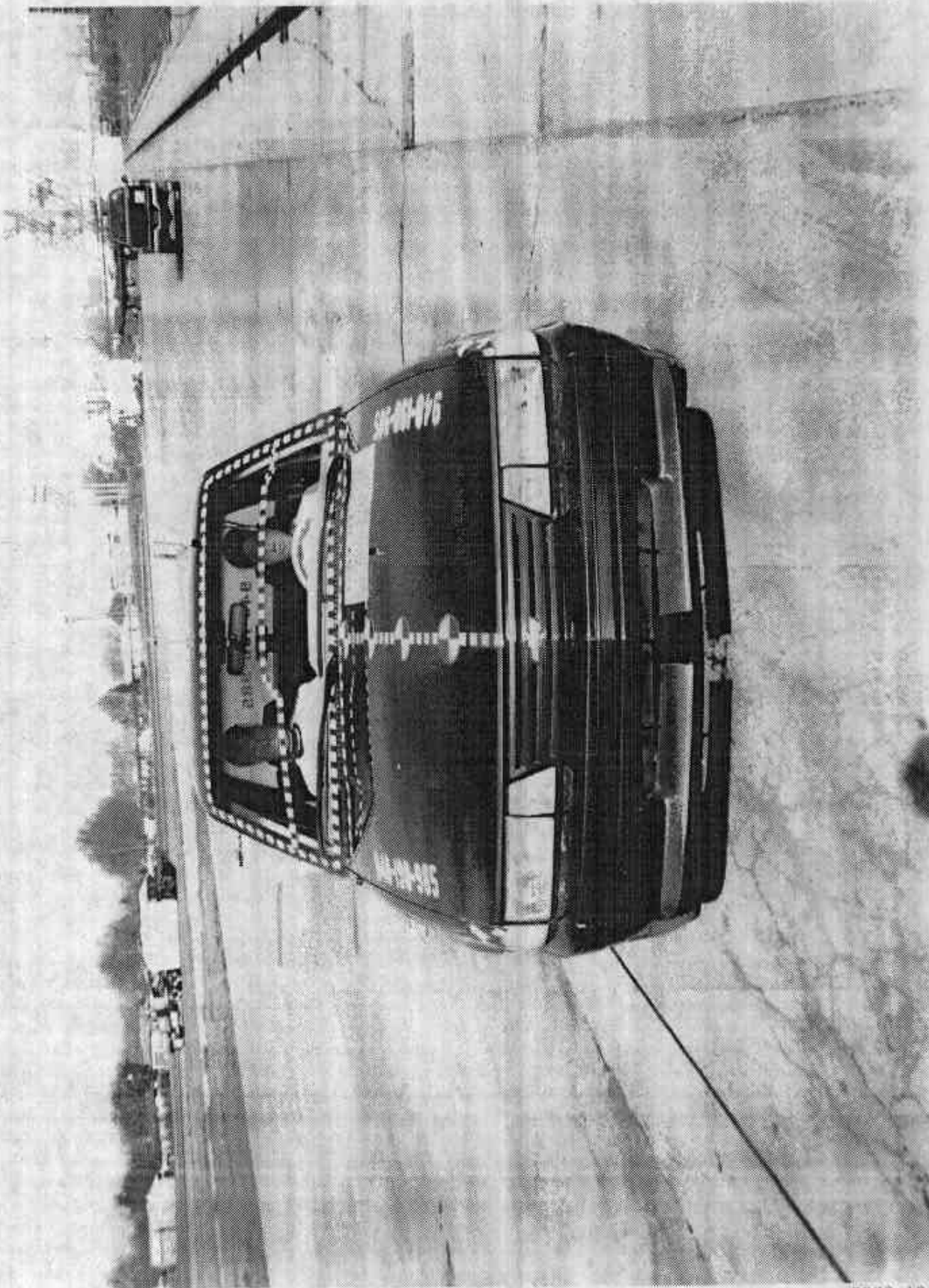


FIGURE A-2 PRE-TEST FRONT VIEW

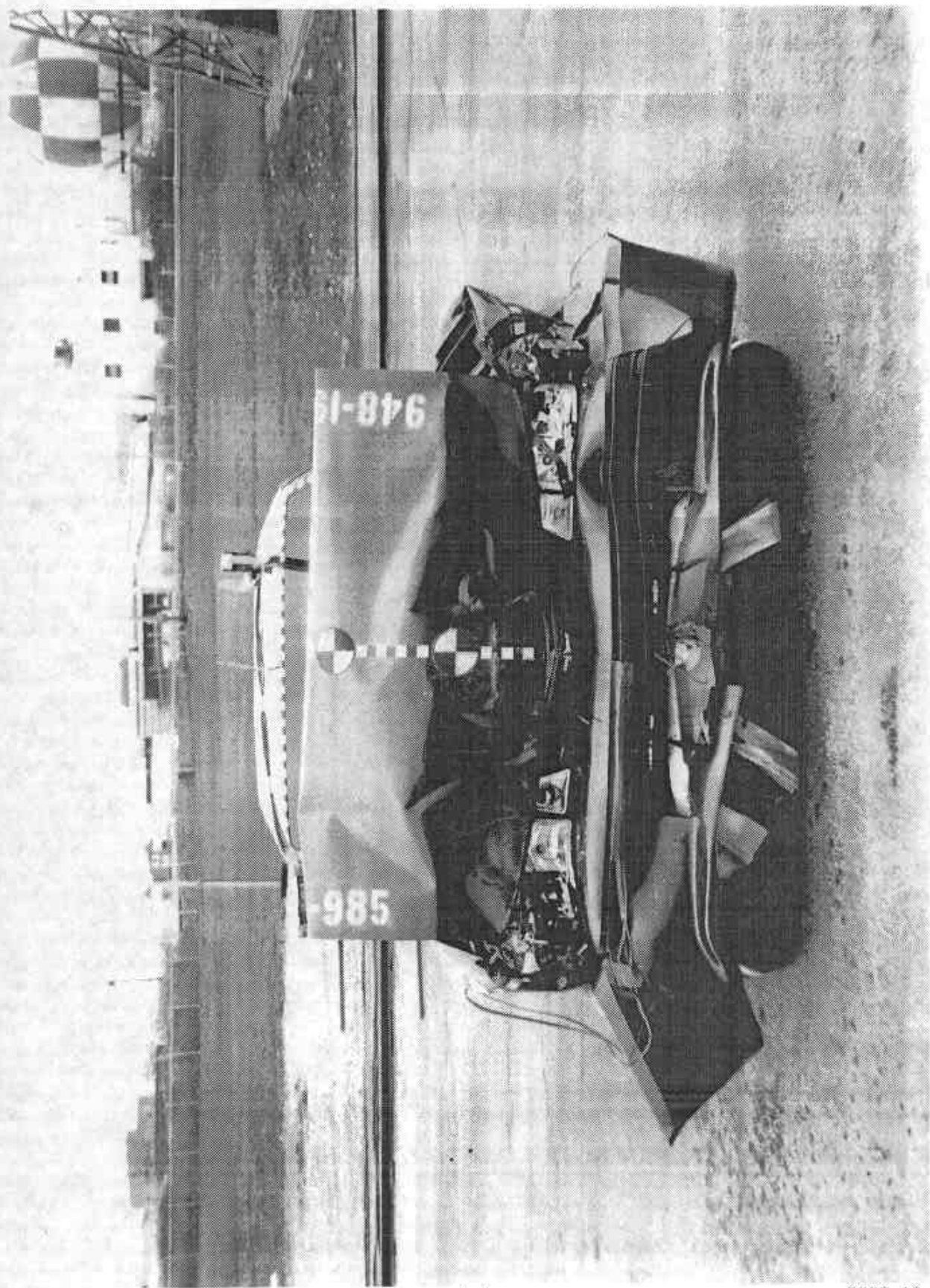


Figure A-3 POST TEST FRONT VIEW

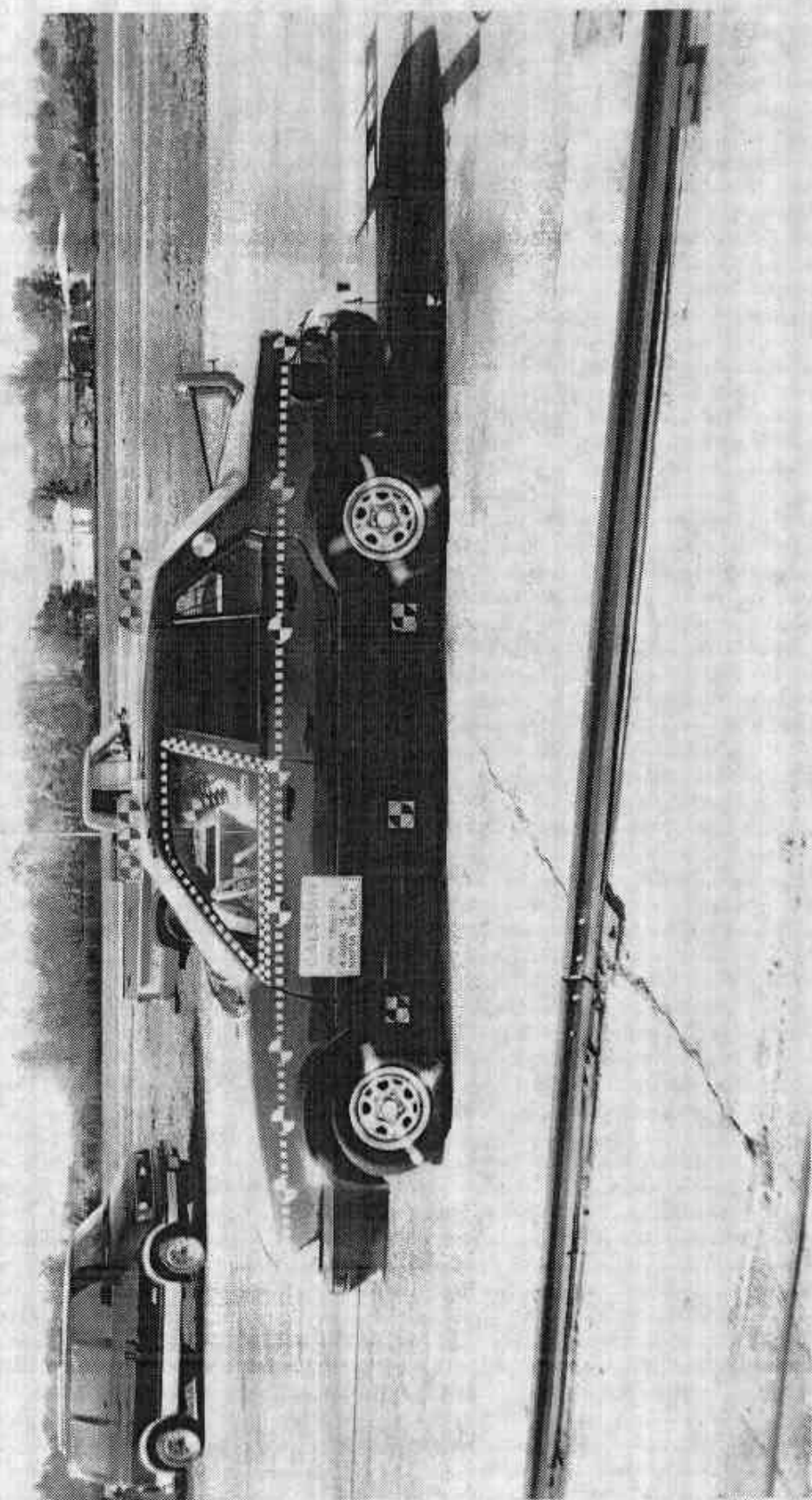


Figure A-4 PRE-TEST LEFT SIDE VIEW

A-5

7776-19

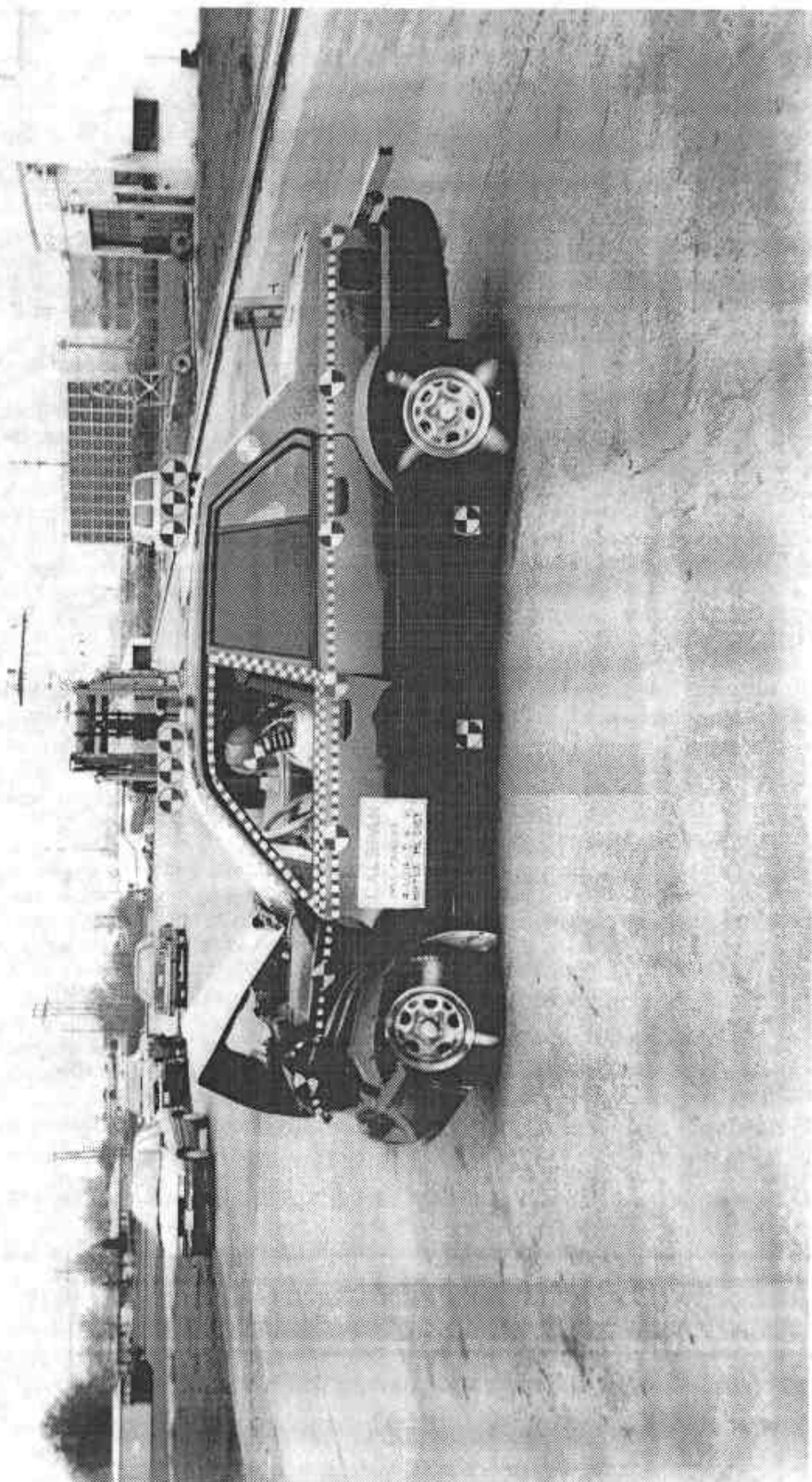


Figure A-5 POST TEST LEFT SIDE VIEW

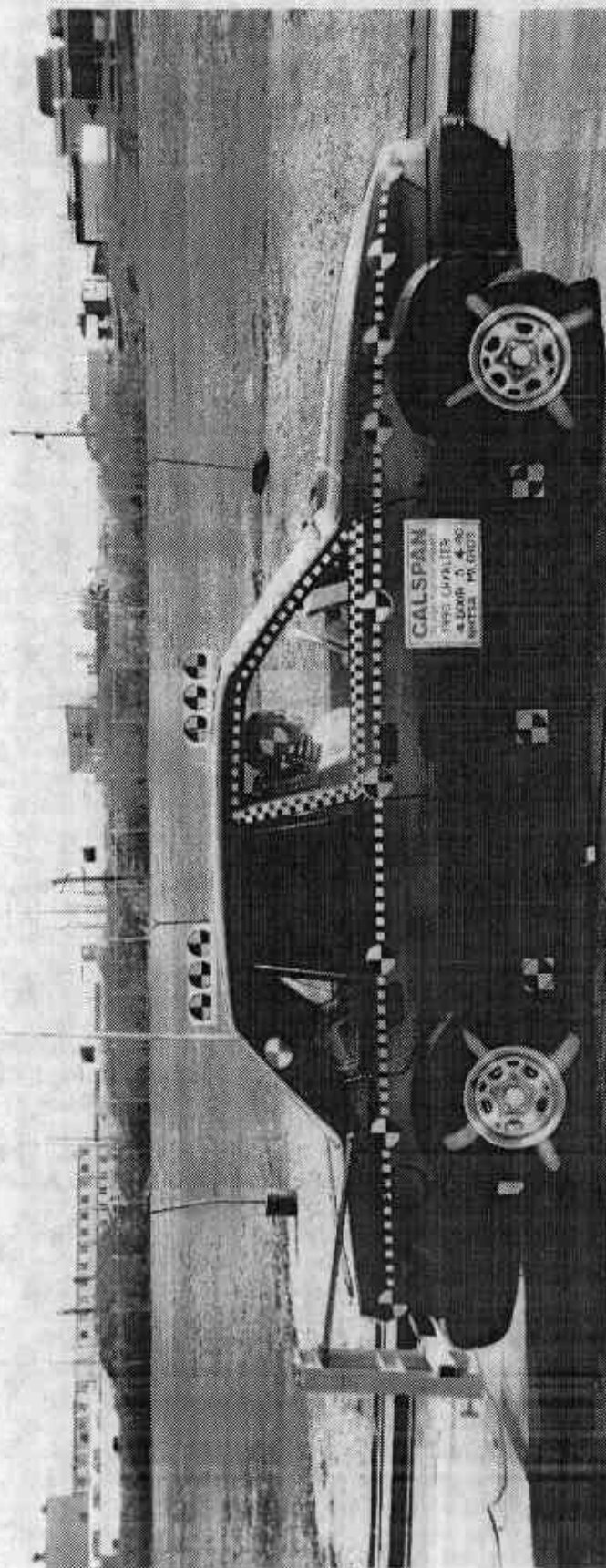


Figure A-6 PRE-TEST RIGHT SIDE VIEW

A-7

7776-19

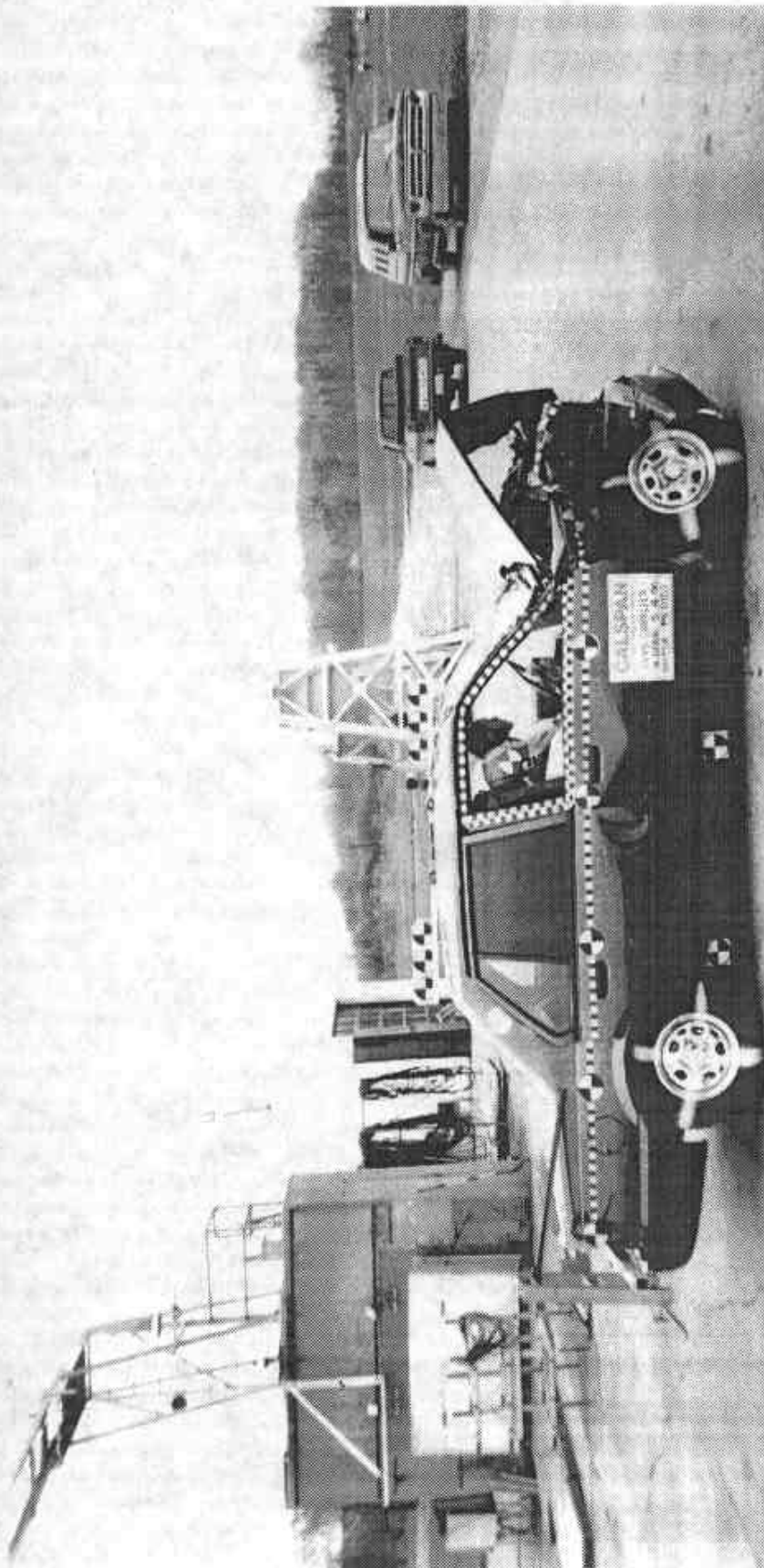


FIGURE A-7 POST-TEST RIGHT SIDE VIEW



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

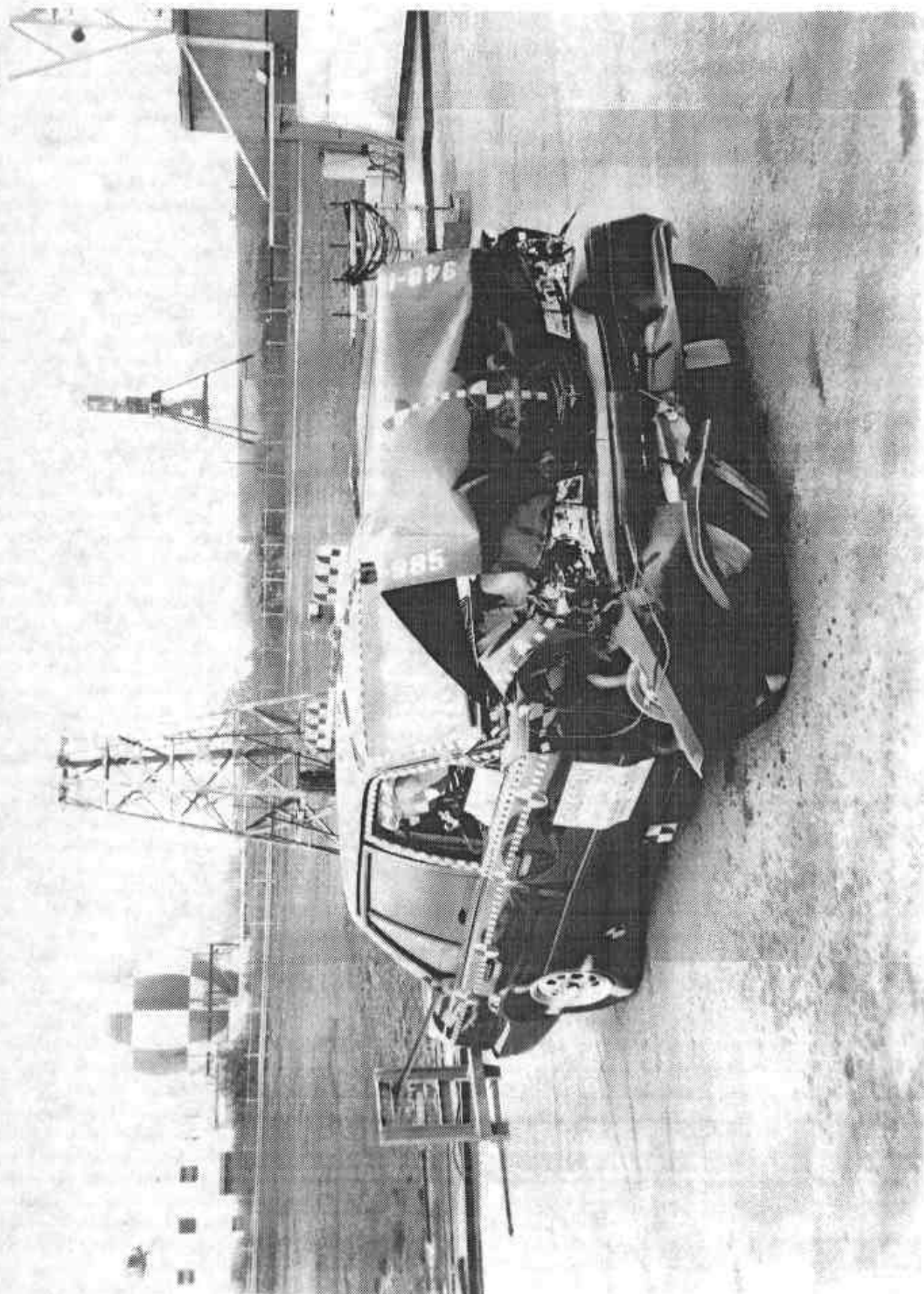


FIGURE A-9. POST-TEST RIGHT FRONT THREE-QUARTER VIEW

A-10

7778-1B

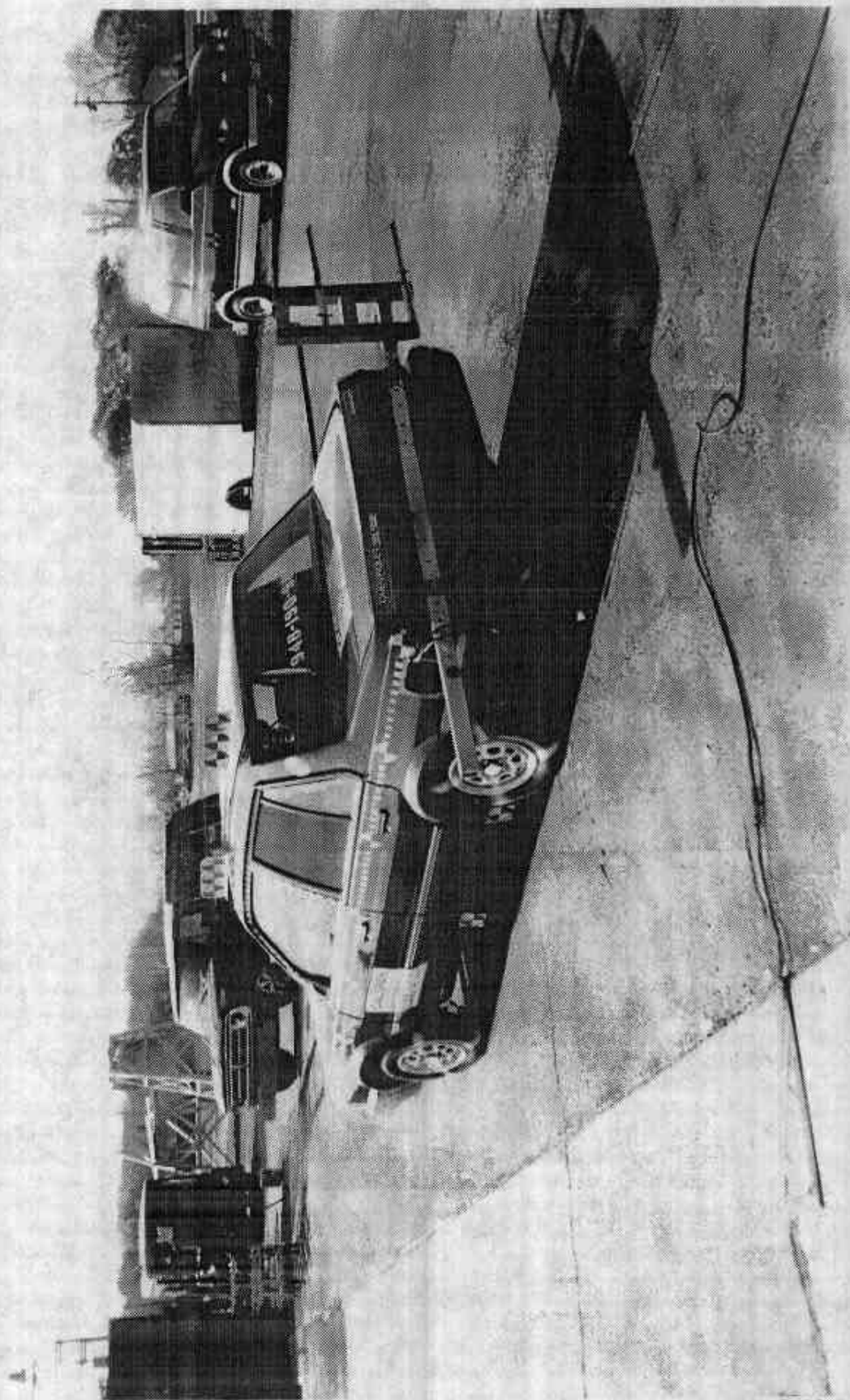


FIGURE A-10 PRE-TEST LEFT REAR THREE-QUARTER VIEW

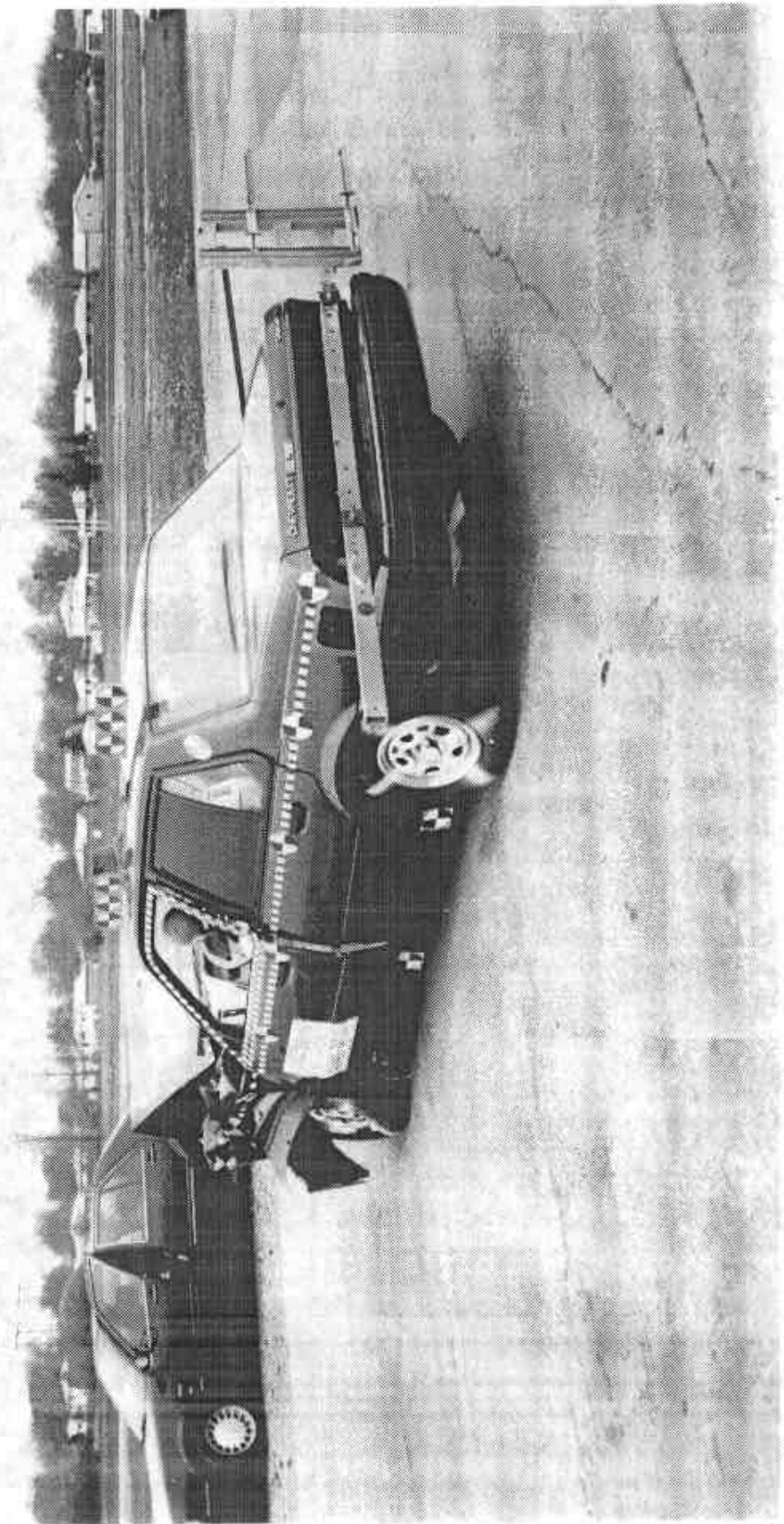


FIGURE A-11 POST-TEST LEFT REAR THREE-QUARTER VIEW

A-12

7776-10

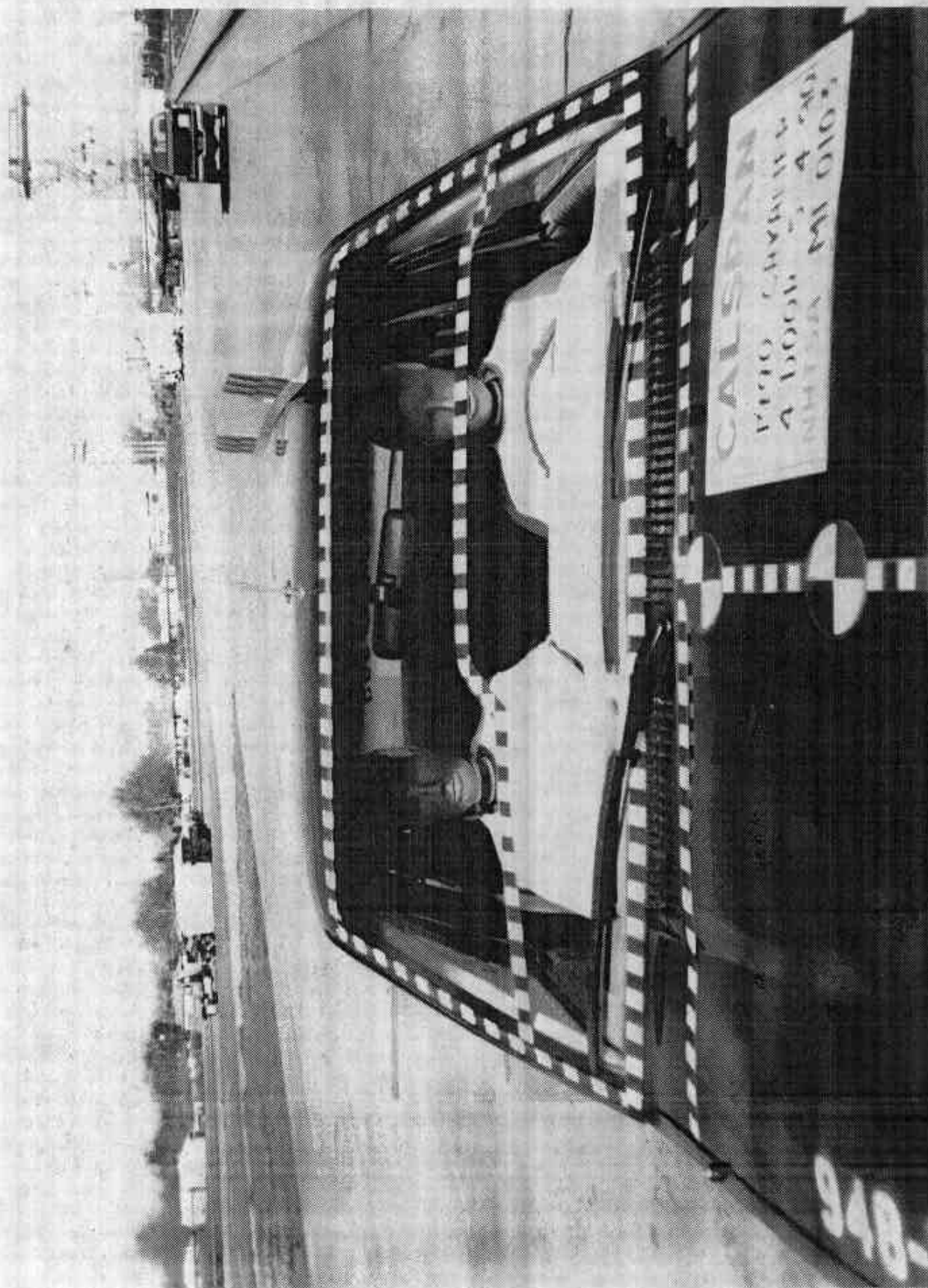


Figure A-12 PRE-TEST WINDSHIELD VIEW

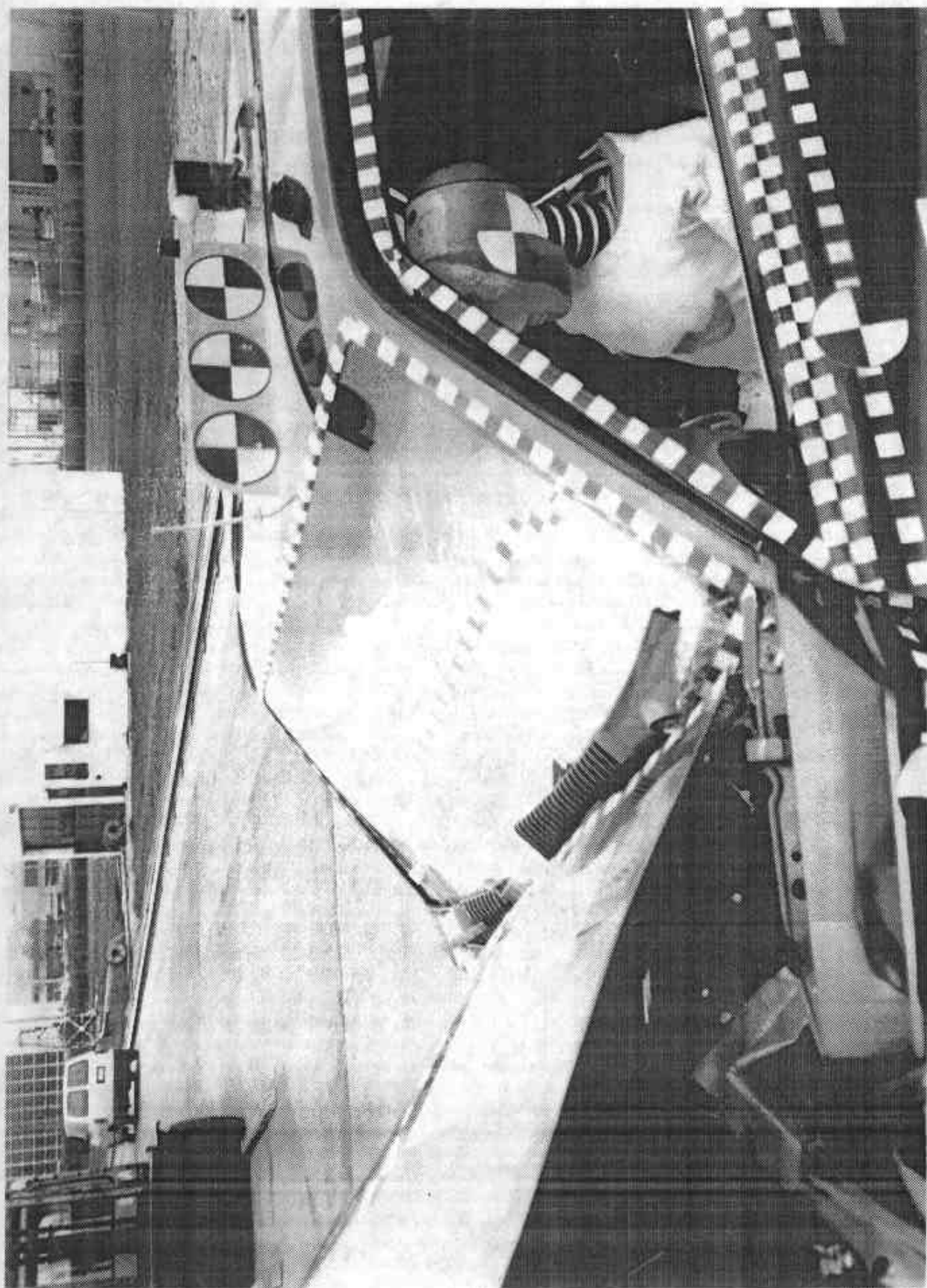


Figure A-13 POST-TEST WINDSHIELD VIEW

A-14

7776-19

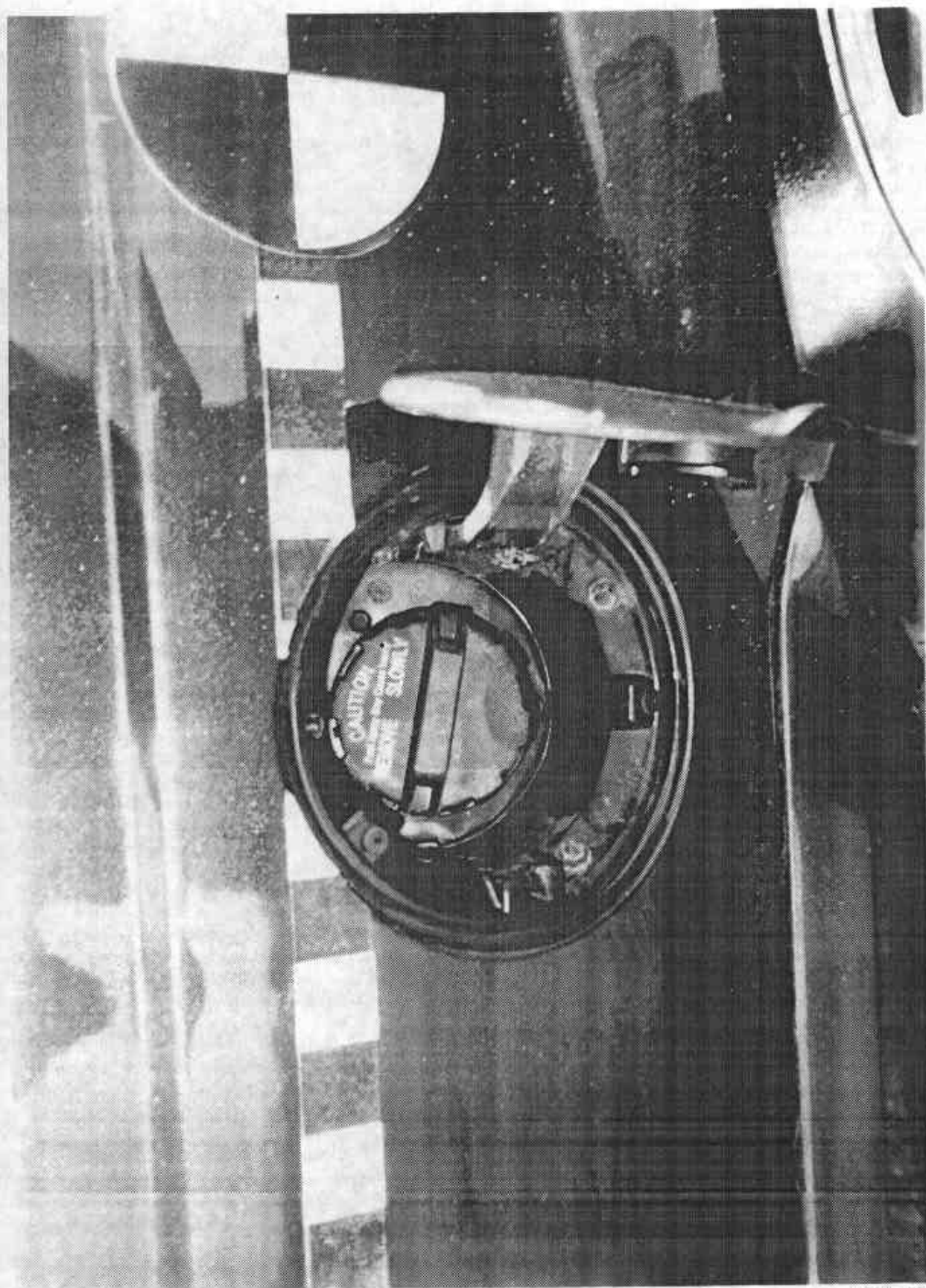


Figure A-15 FUEL CAP VIEW

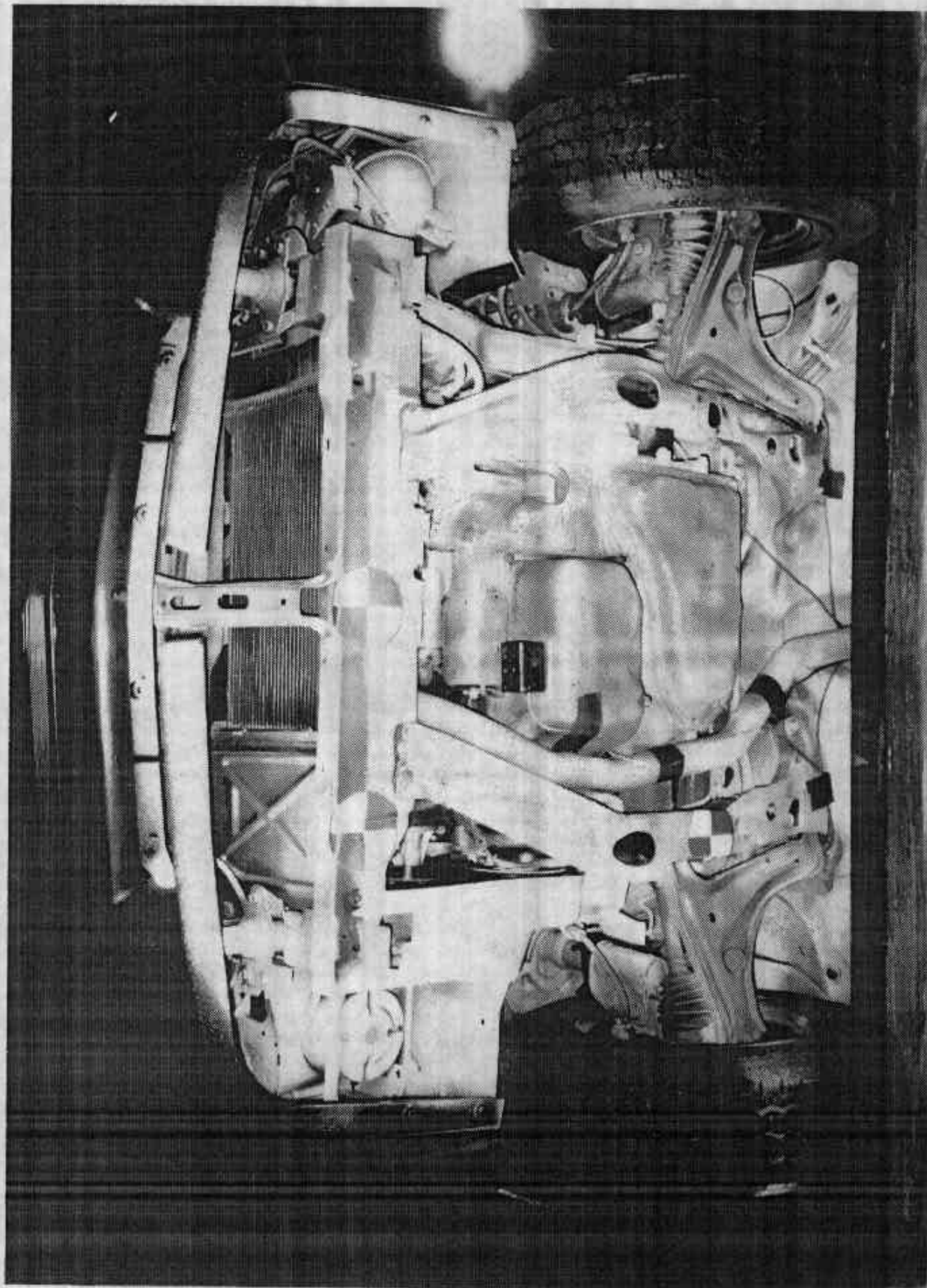


FIGURE A-16 PRE-TEST FRONT UNDERSIDE VIEW

A-17

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Figure A-17 POST-TEST FRONT UNDERBODY VIEW

A-18

7776-19

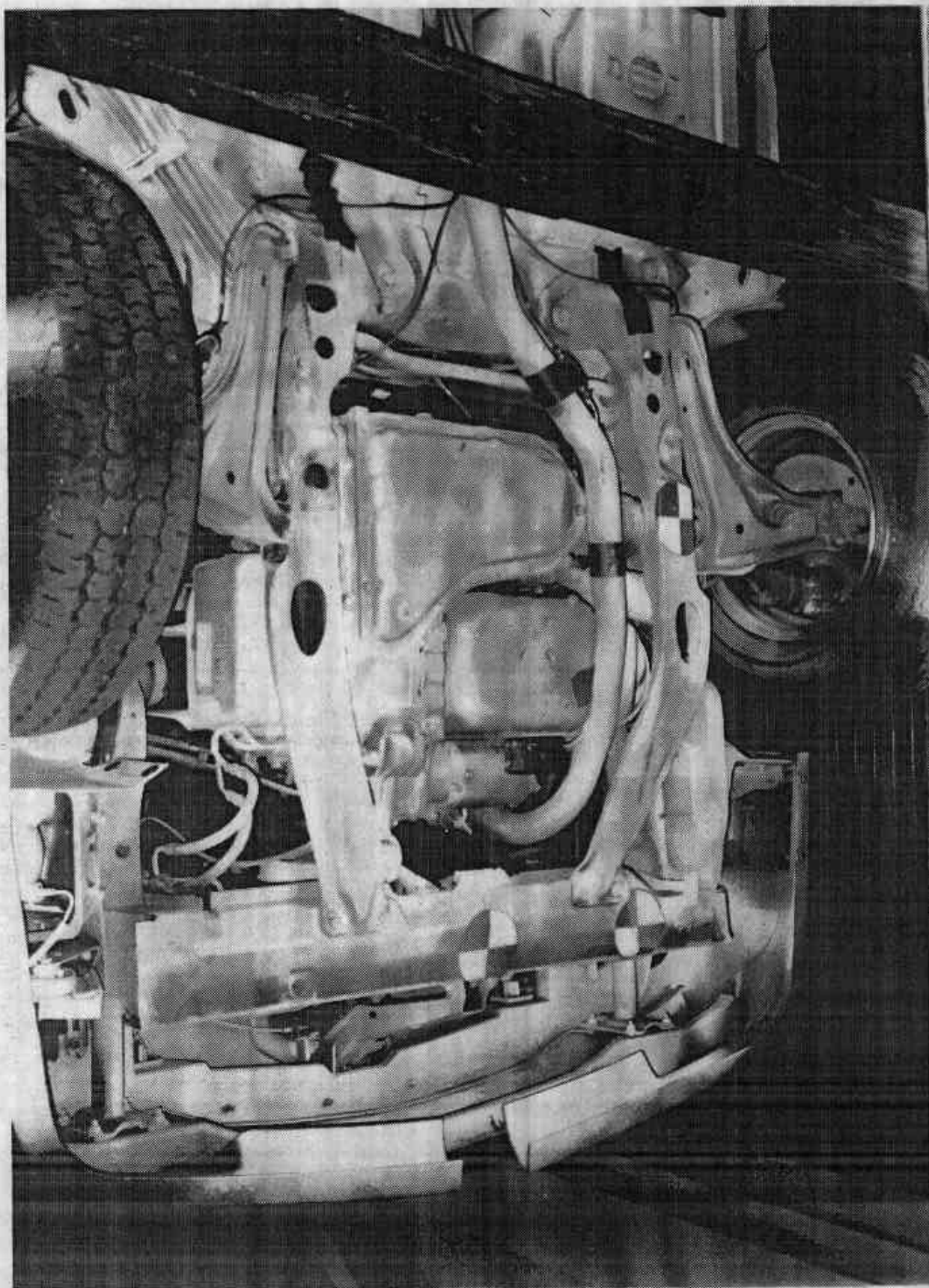


FIGURE A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW

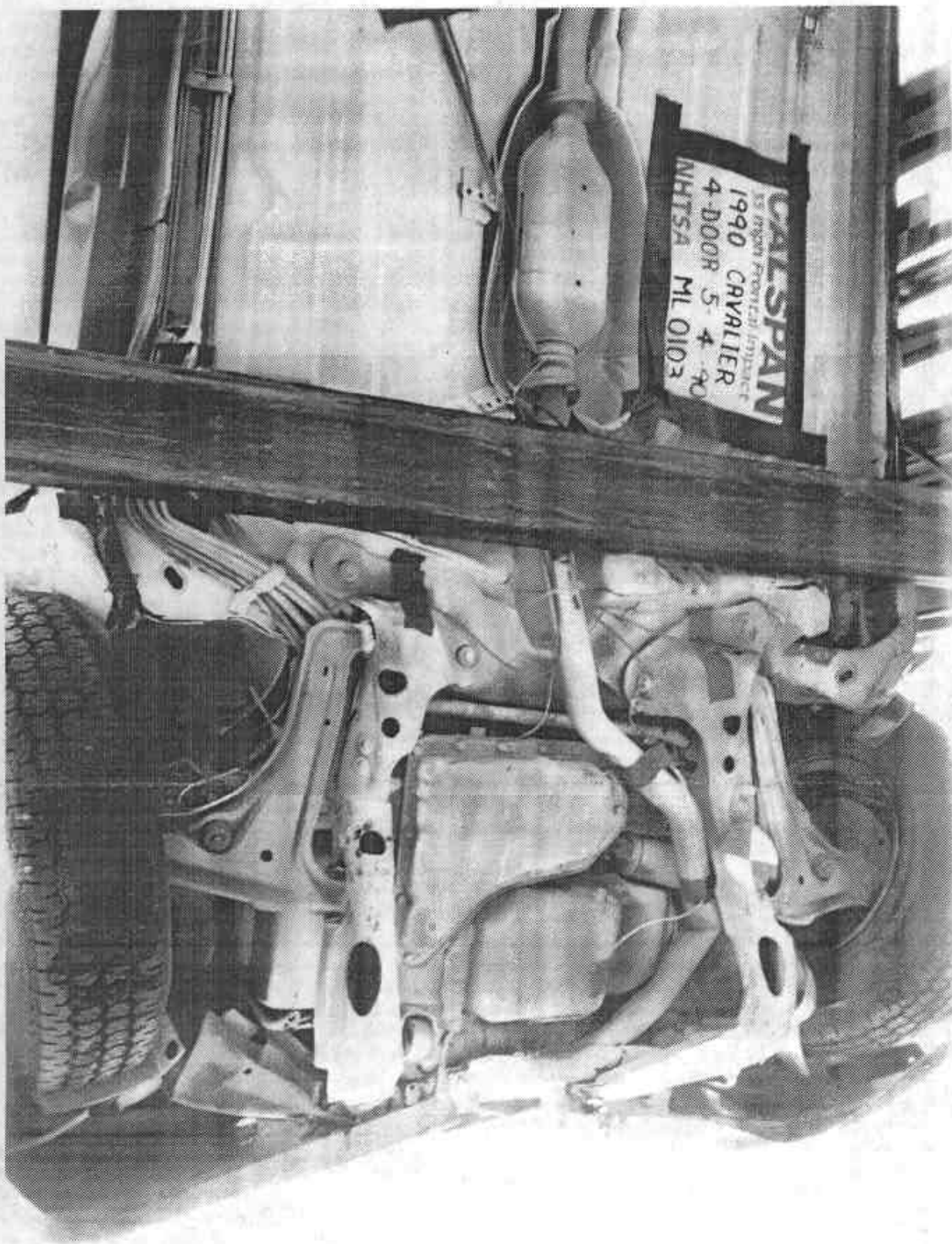


FIGURE A-19 POST-TEST FRONT SIDE UNDERBODY VIEW

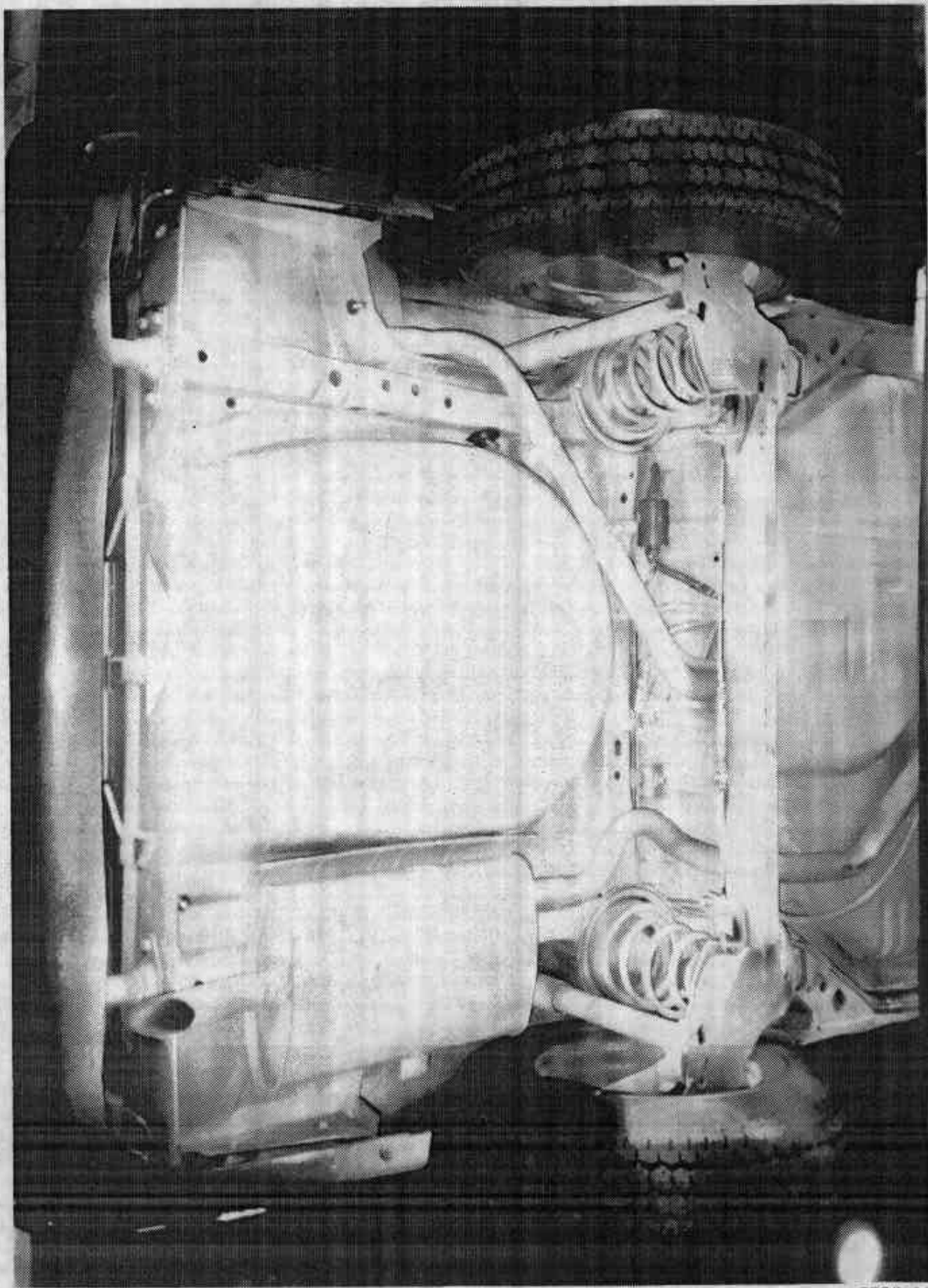


FIGURE A-20 PRE-TEST REAR UNDERBODY VIEW

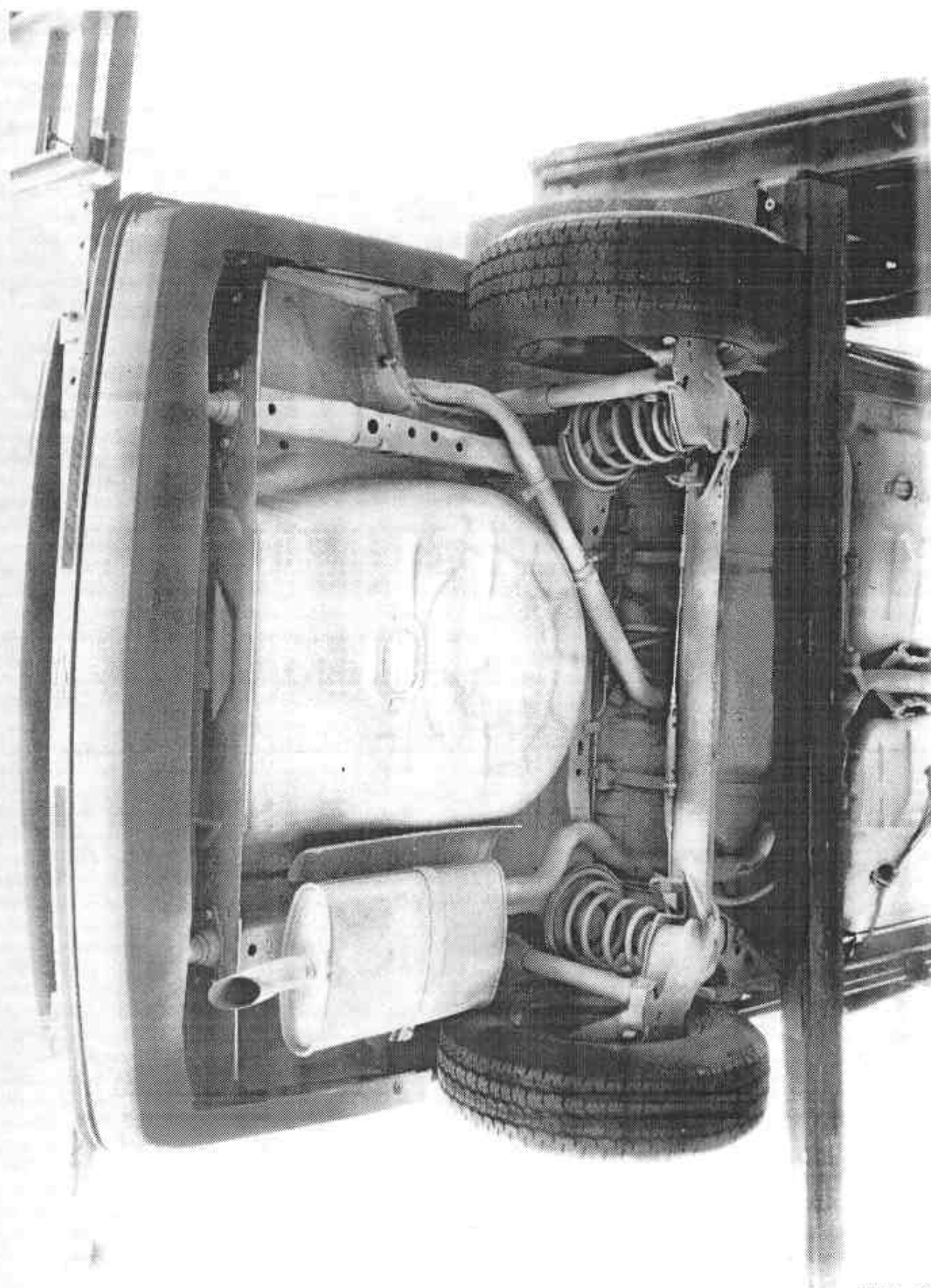


FIGURE A-21 POST-TEST REAR UNDERBODY VIEW

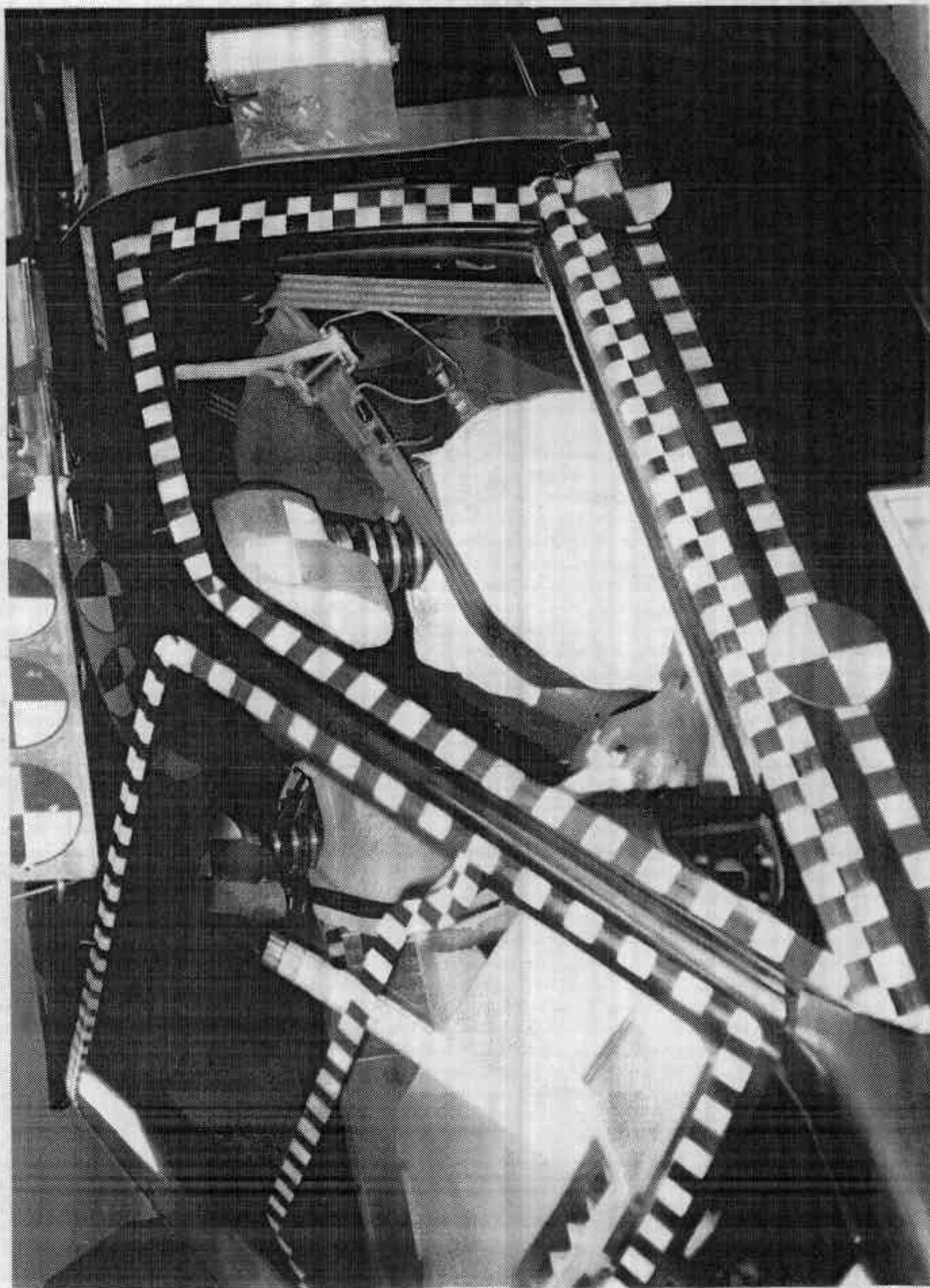


Figure A-22 PRE-TEST DRIVER POSITION VIEW

A-23

7776-19

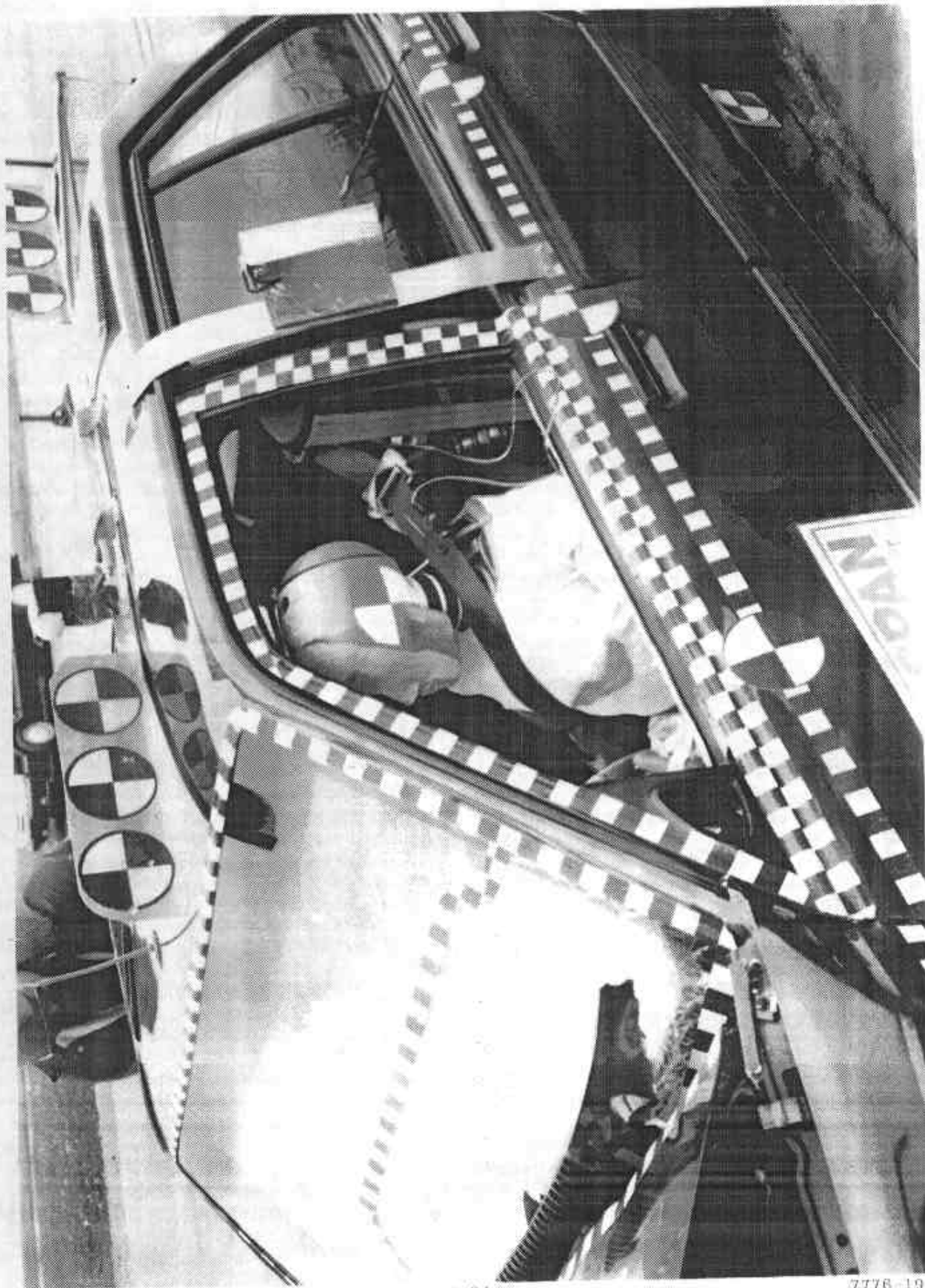


Figure A-23 POST-TEST DRIVER POSITION VIEW

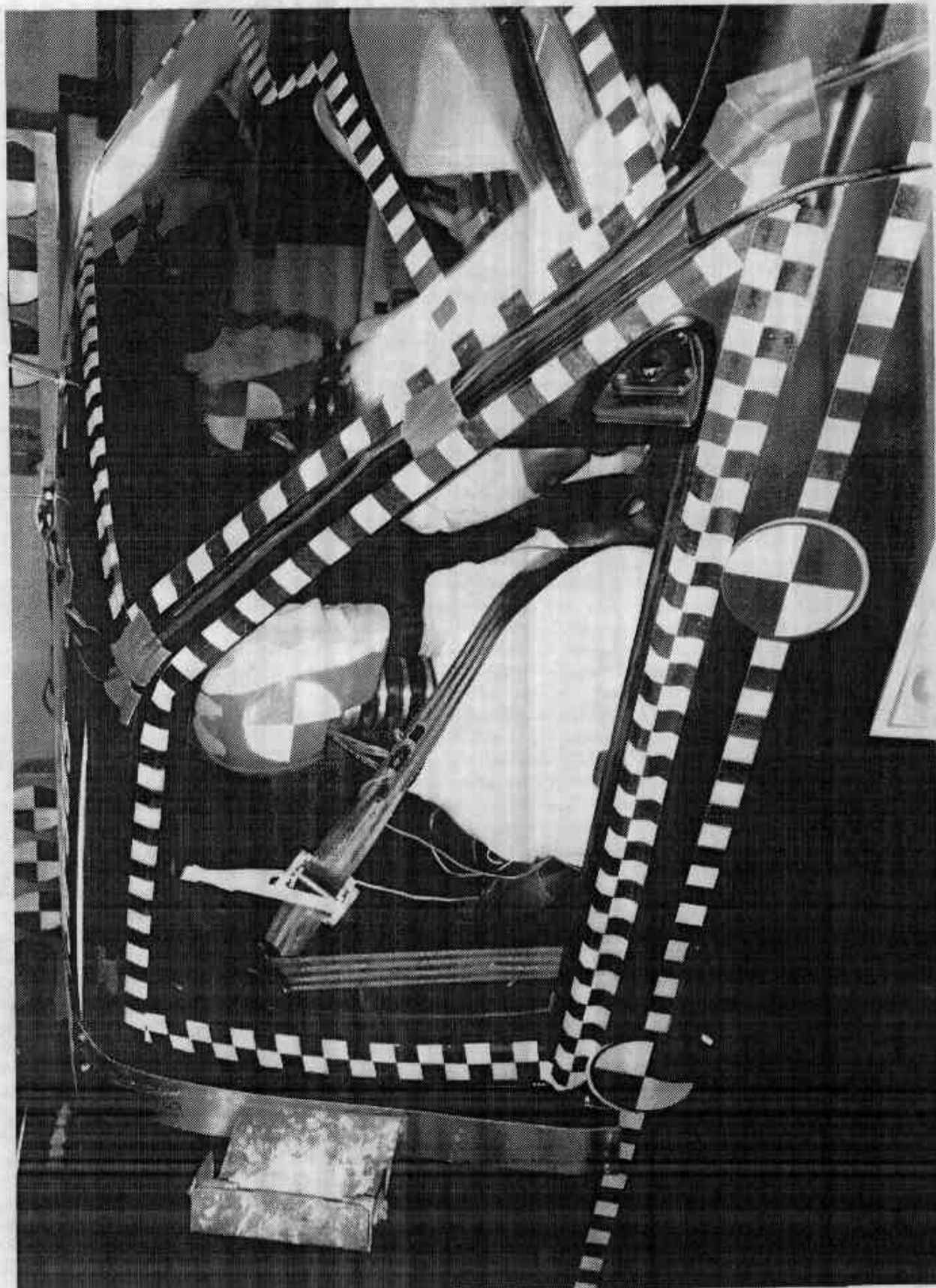


Figure A-24 PRE-TEST PASSENGER POSITION VIEW

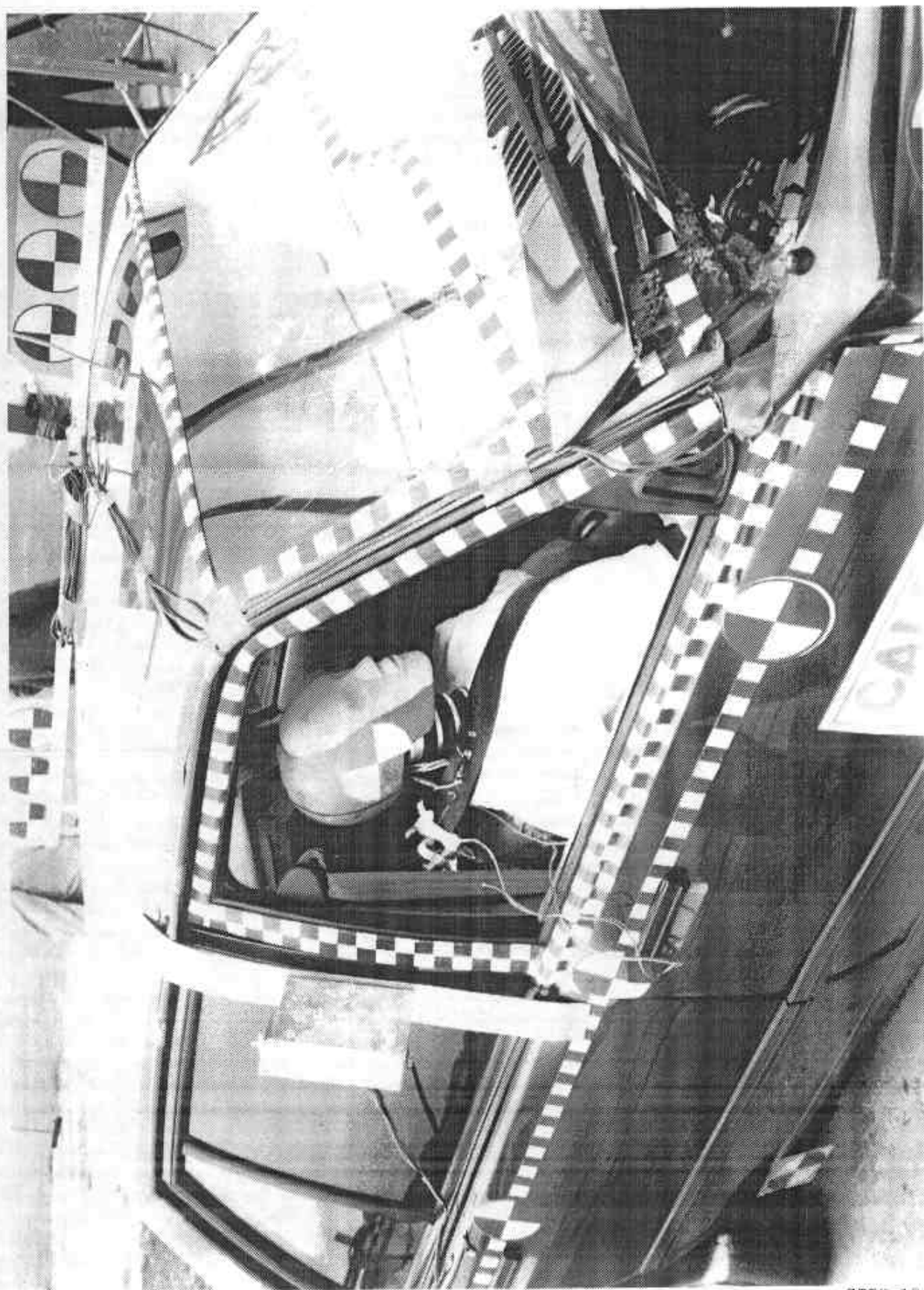


Figure A-25 POST-TEST PASSENGER POSITION VIEW

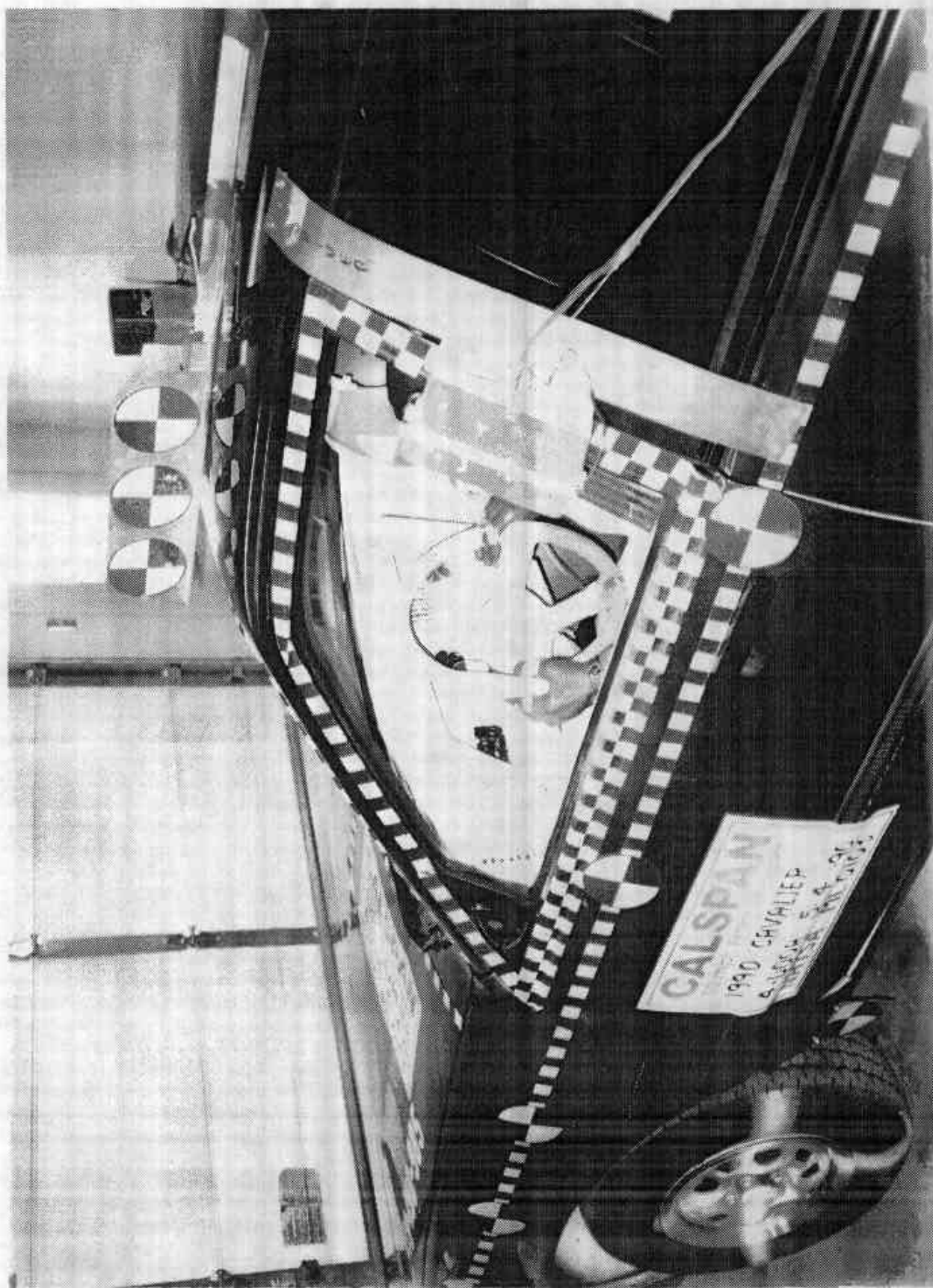


Figure A-20. PRE-TEST DRIVER AND INTERIOR VIEW

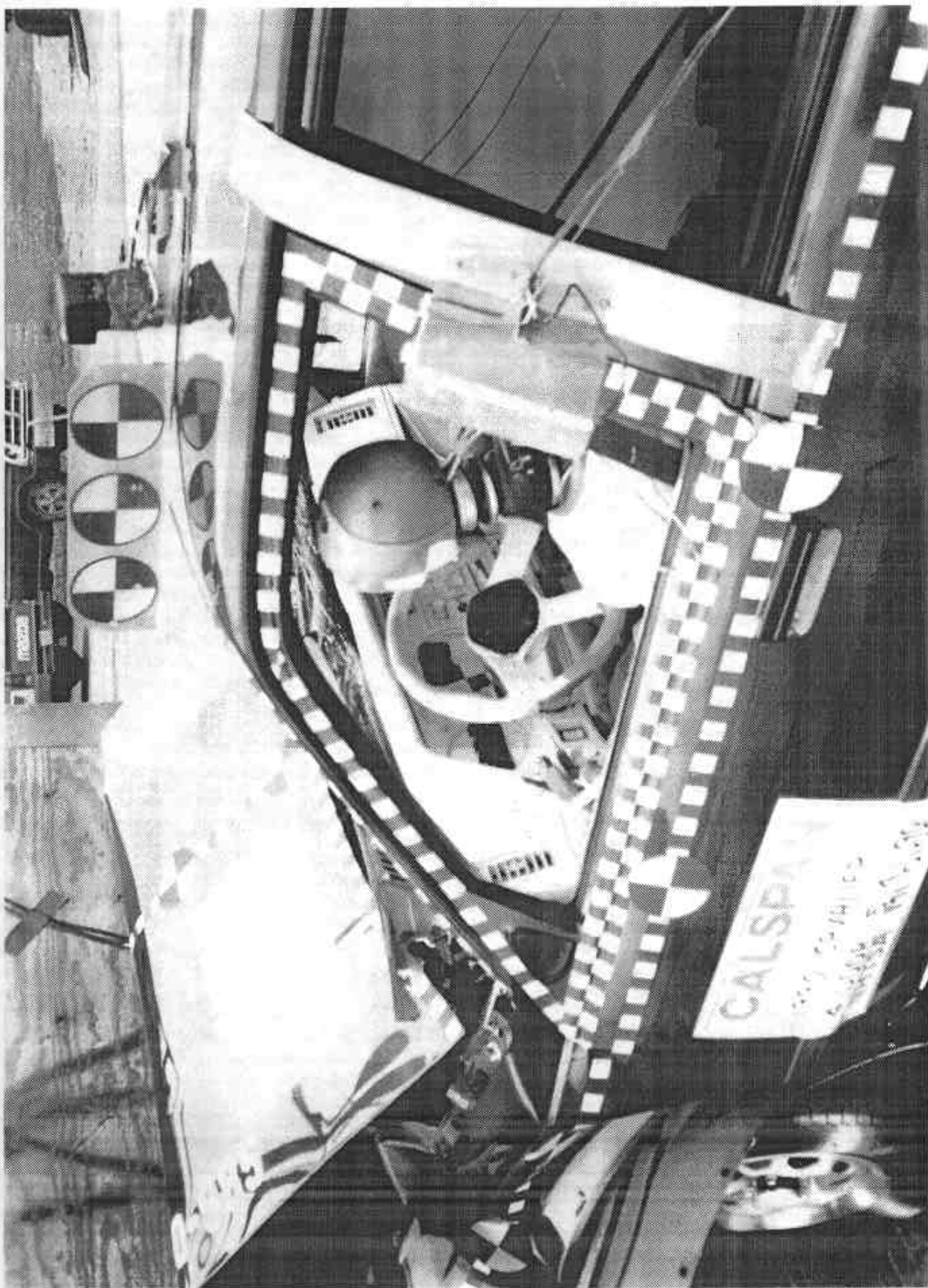


Figure A-27 POST-TEST DRIVER AND INTERIOR VIEW

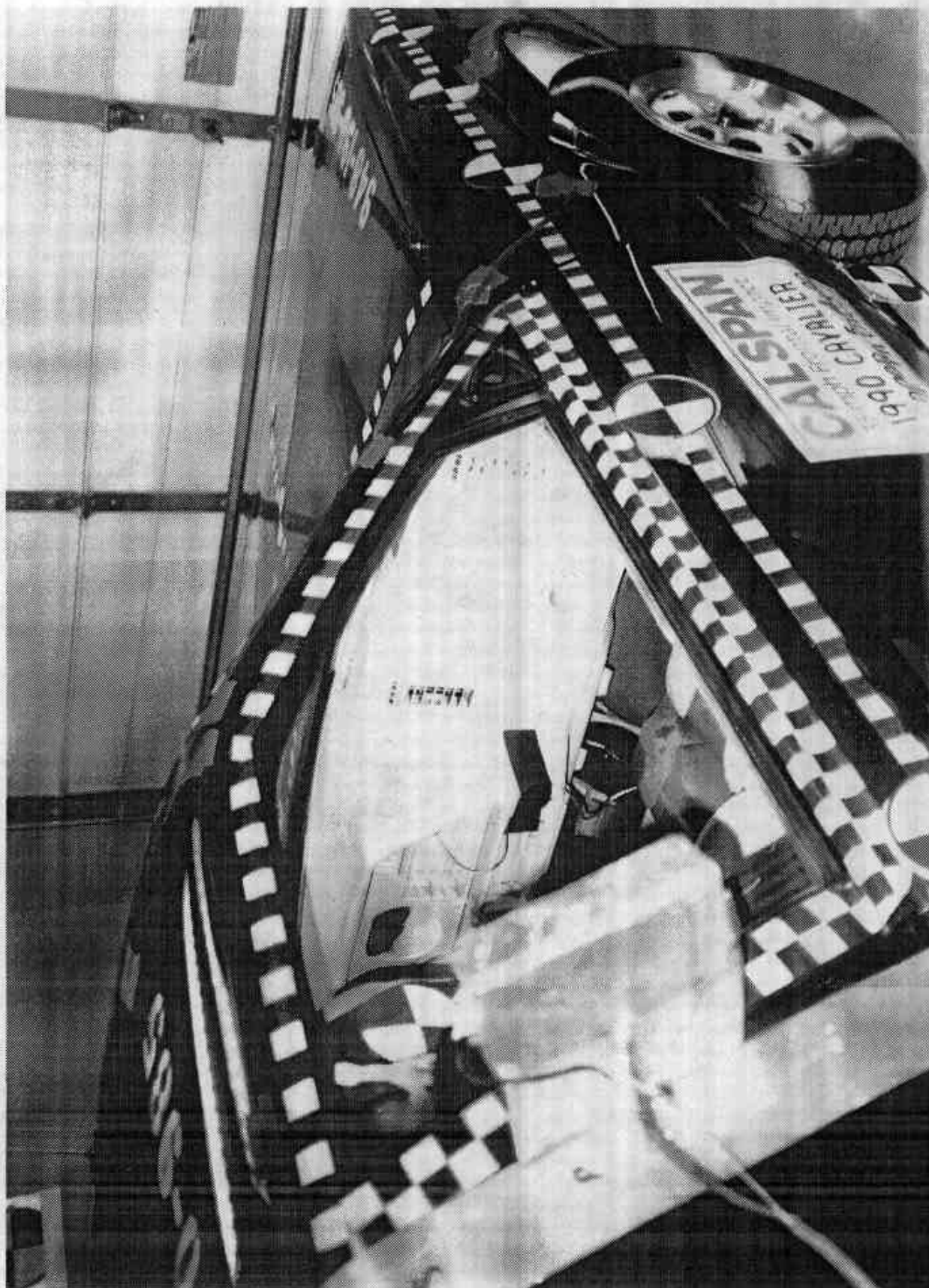


Figure A-28 PRE-TEST PASSENGER AND INTERIOR VIEW



Figure A-29 POST-TEST PASSENGER AND INTERIOR VIEW

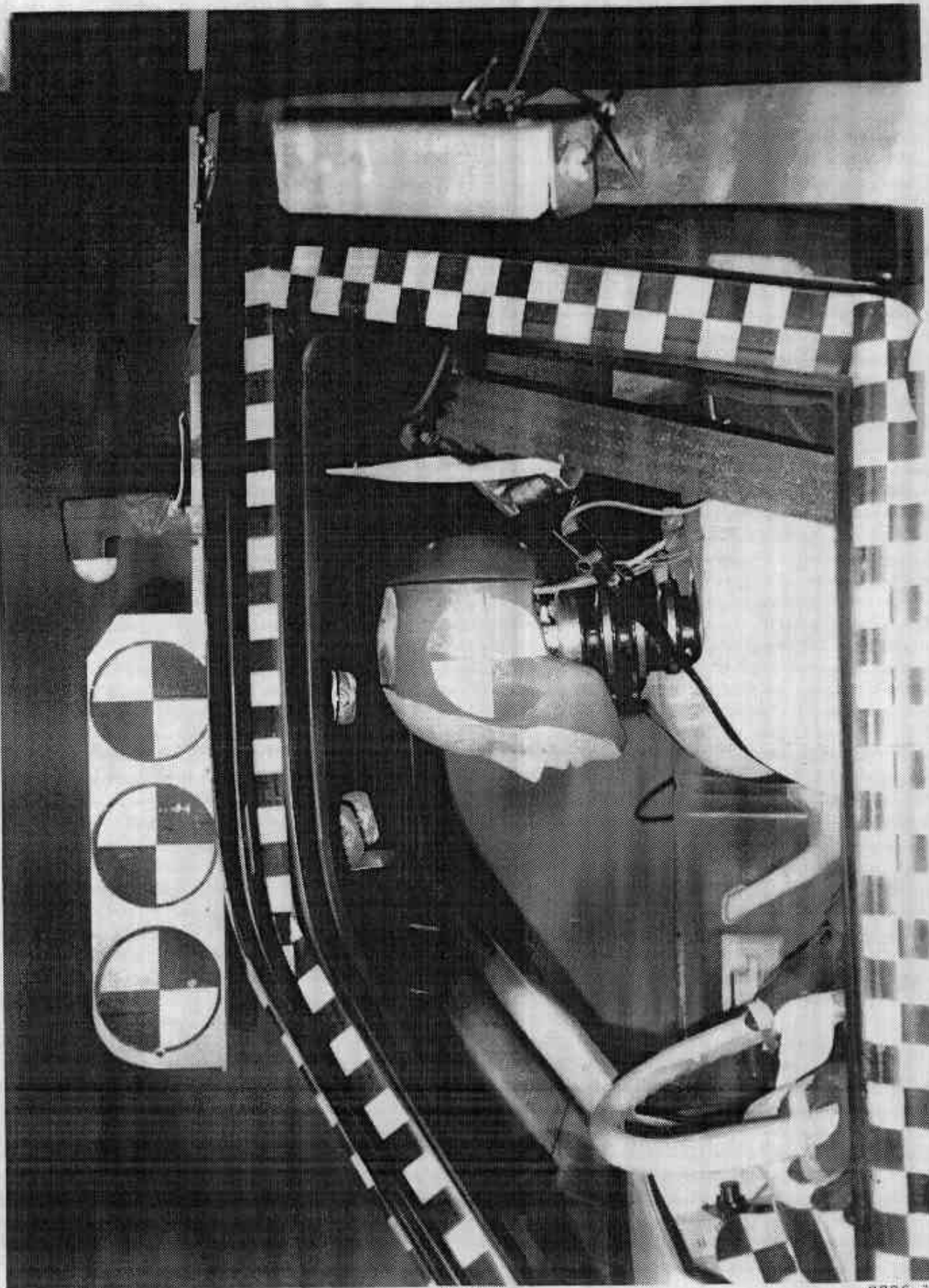


Figure A-30 PRE-TEST DRIVER HEAD TARGET



Figure A-31 PRE-TEST PASSENGER HEAD TARGET

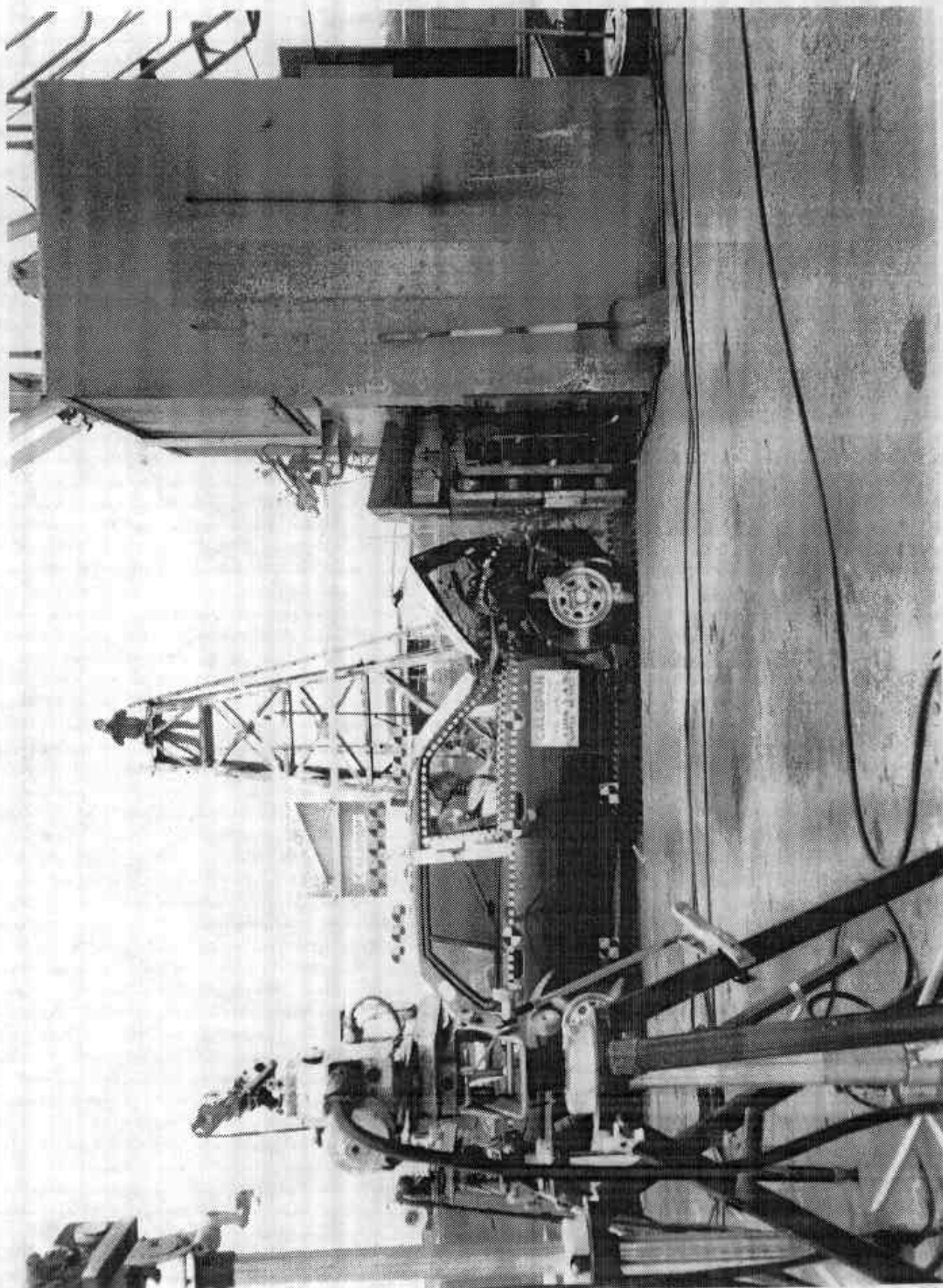


FIGURE A-32 IMPACT VIEW

A-33

7776-19

Appendix B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

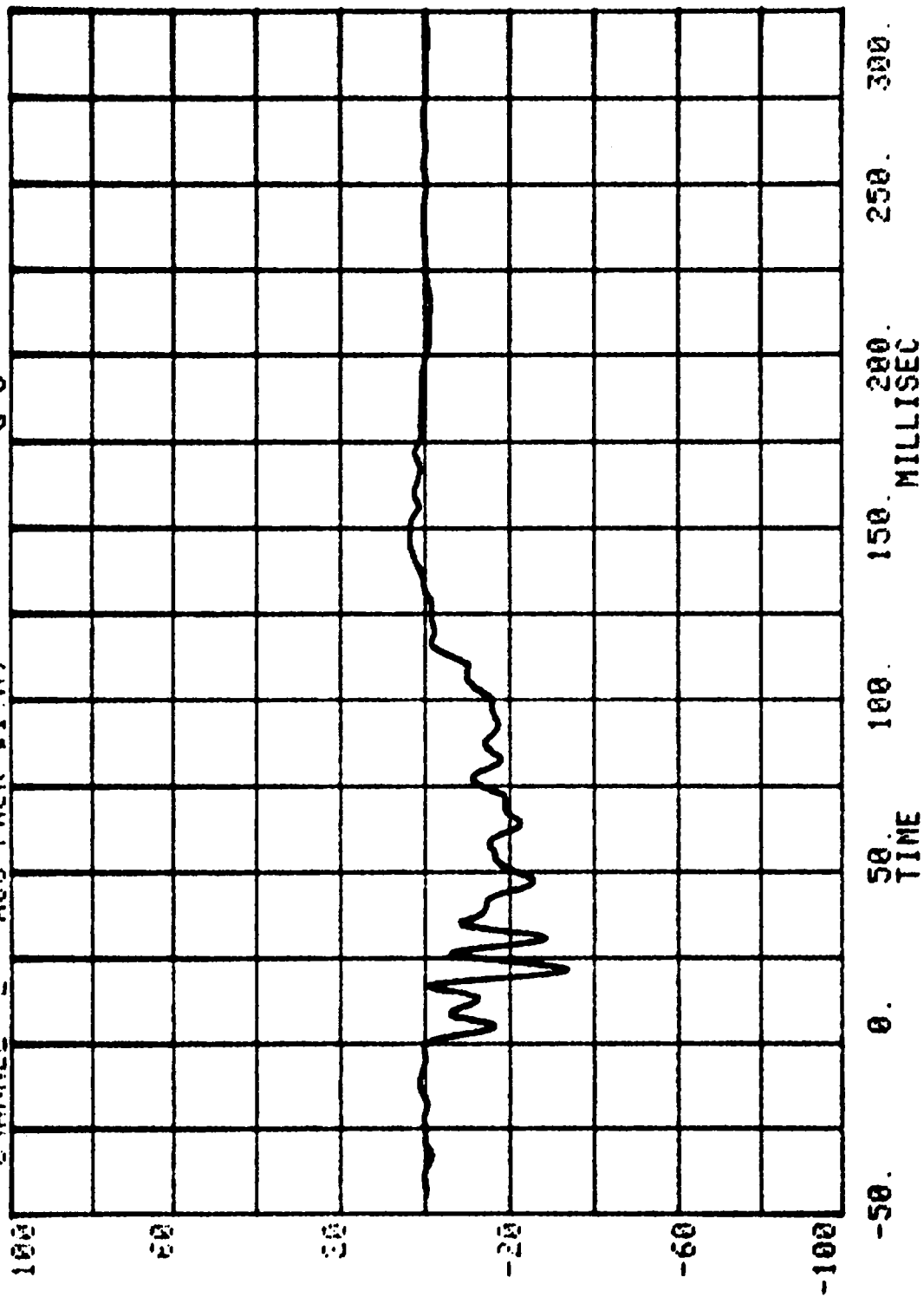
TEST NO. ML0103

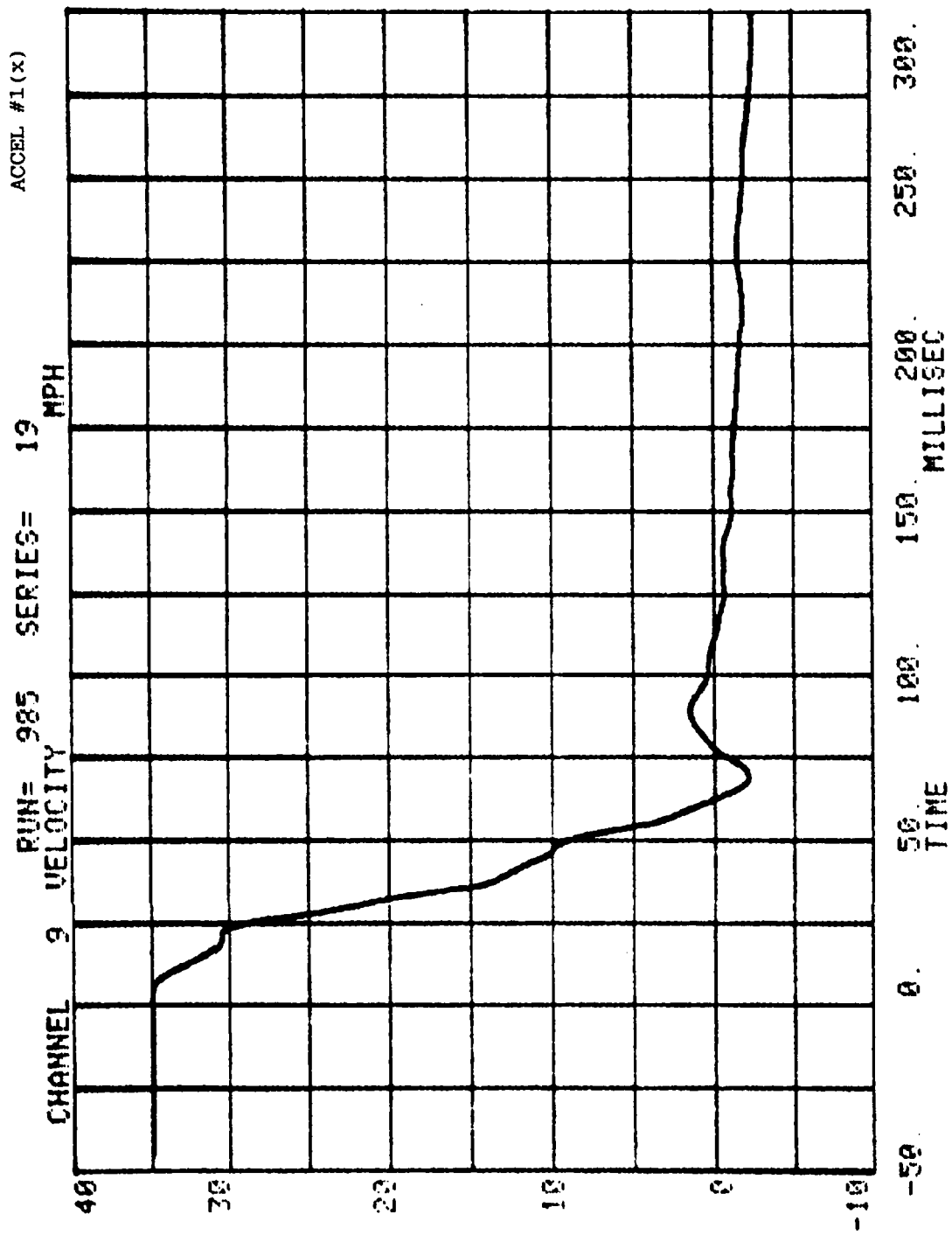
VEHICLE DATA

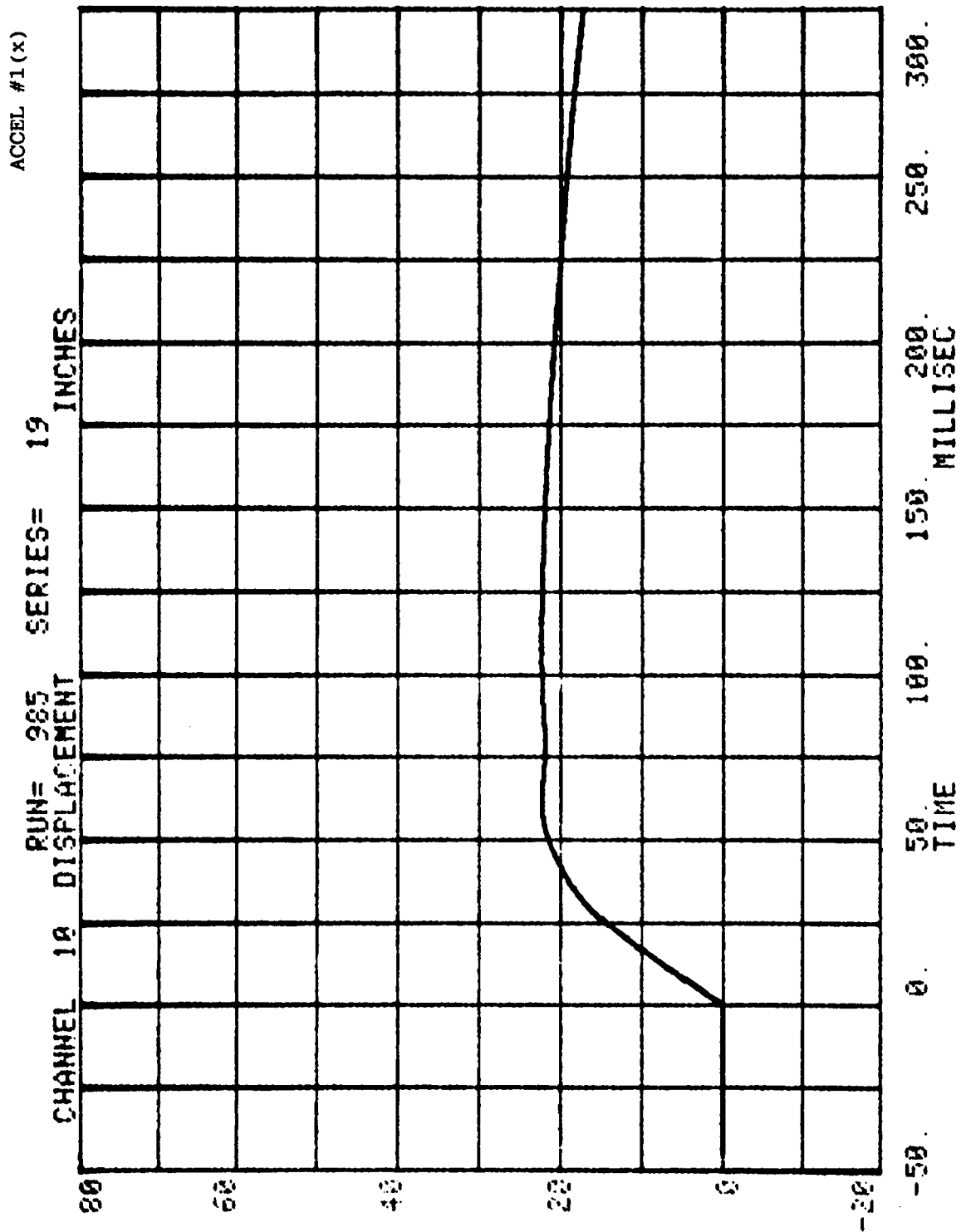
FILTER CHANNEL CLASS

60

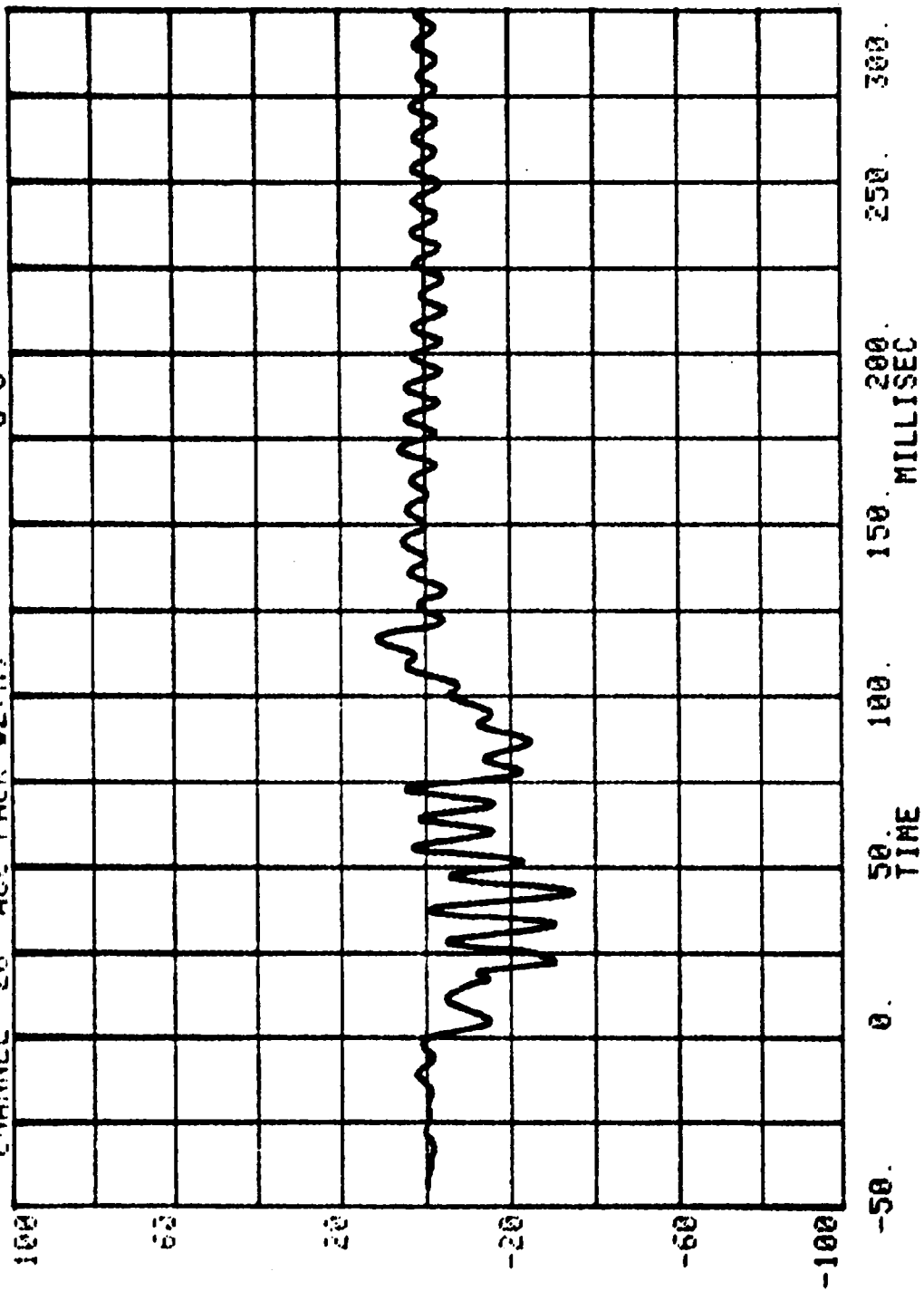
CHANNEL 27 ACC PACK #1(X) RUN= 385 SERIES= 19 G'S







CHANNEL 28 ACC PACK #2(X) RUN= 985 SERIES= 19 G'S



ACCEL #2 (x)

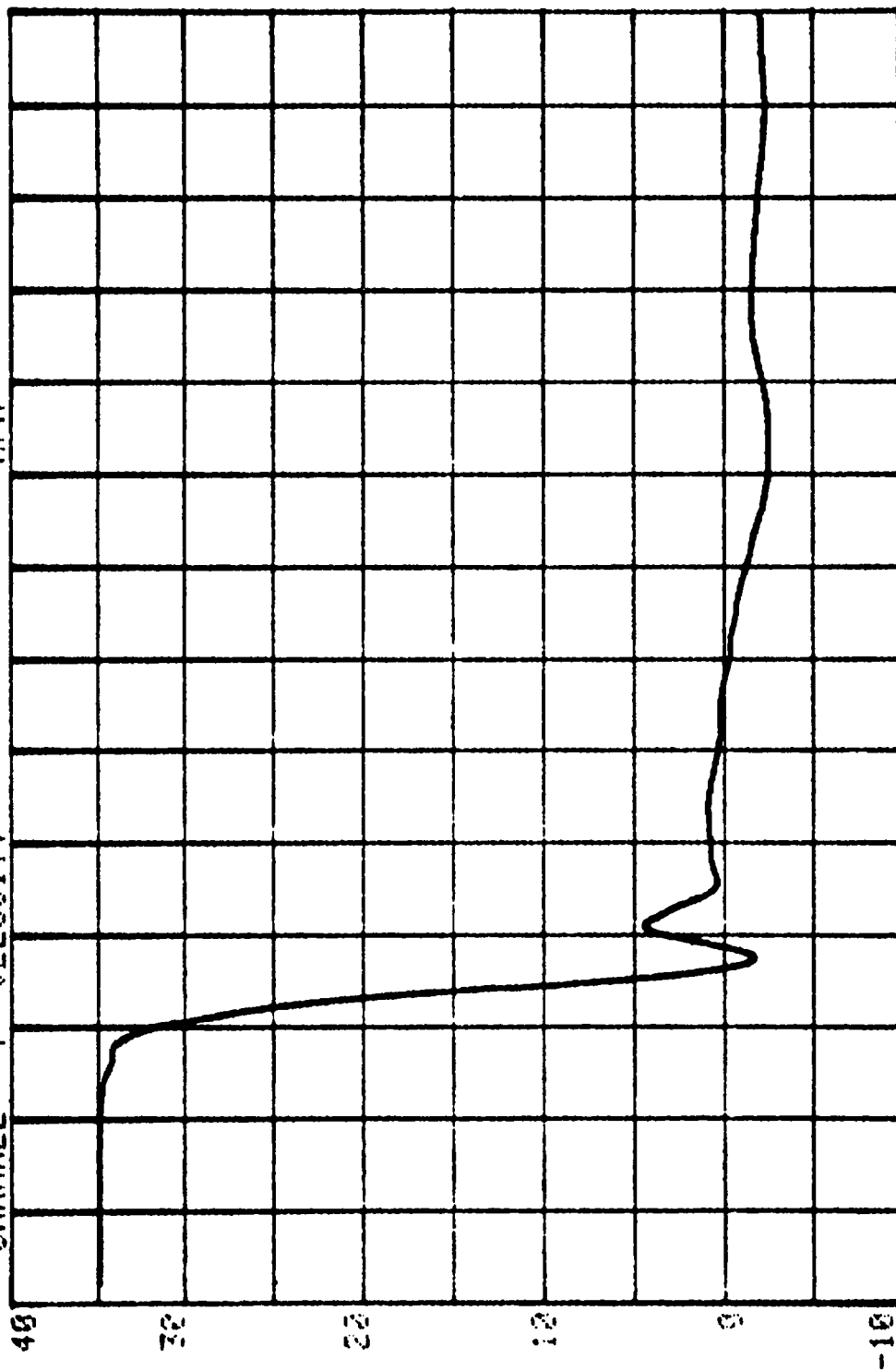
SERIES= 13

RUN= 965

MPH

VELOCITY

CHANNEL 7



TIME
MILLISEC

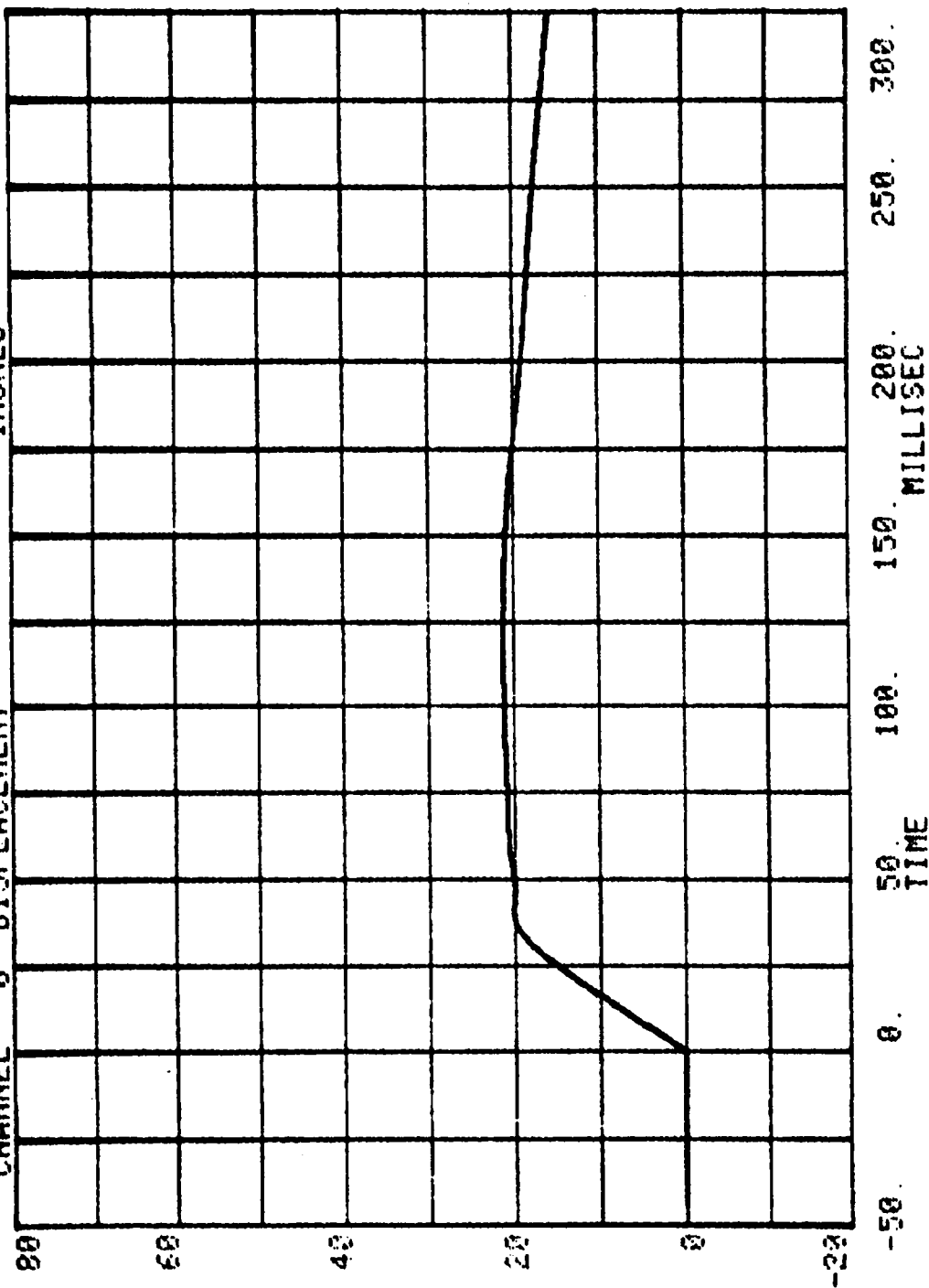
ACCEL #2 (x)

CHANNEL 3 DISPLACEMENT

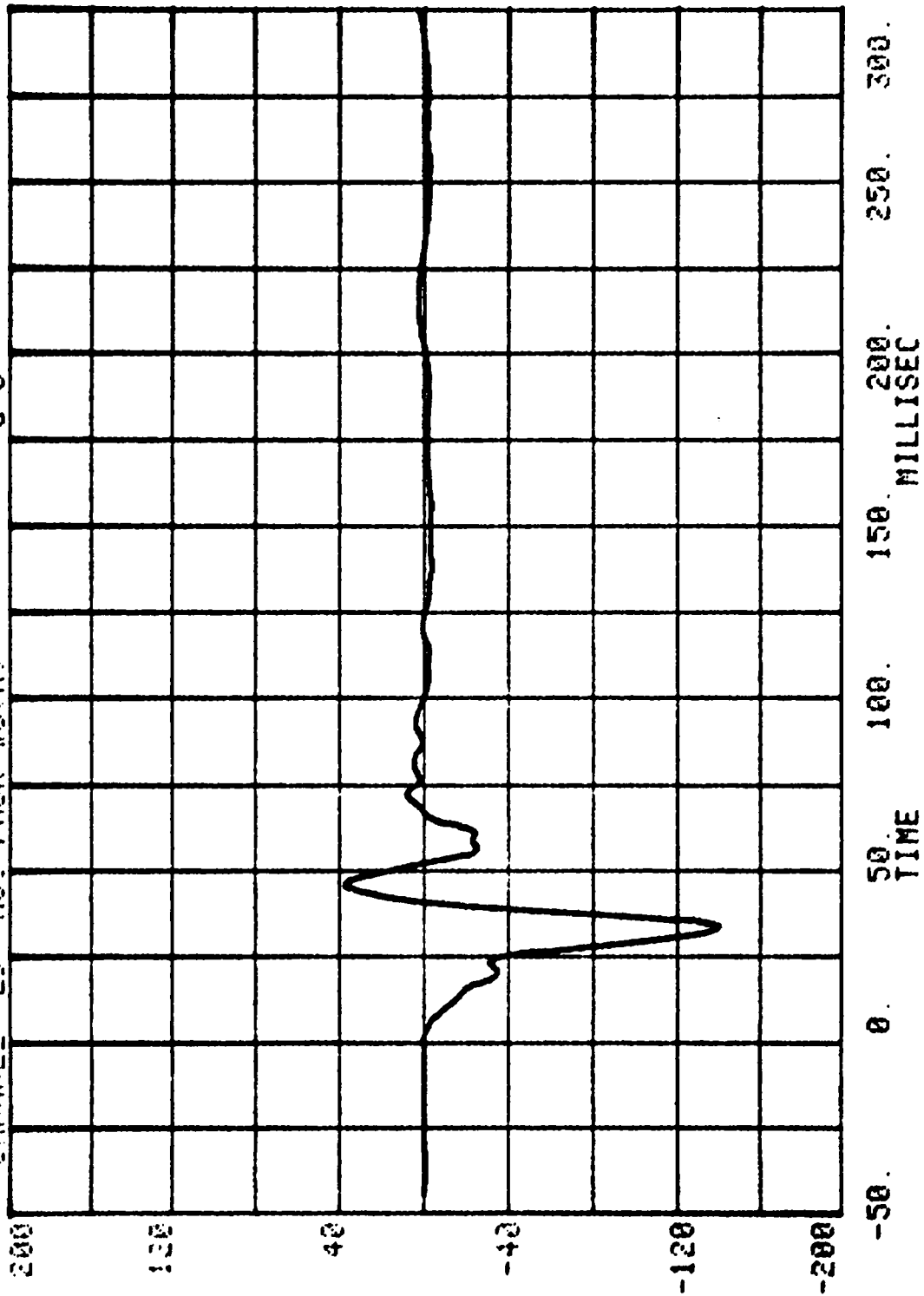
RUN= 985

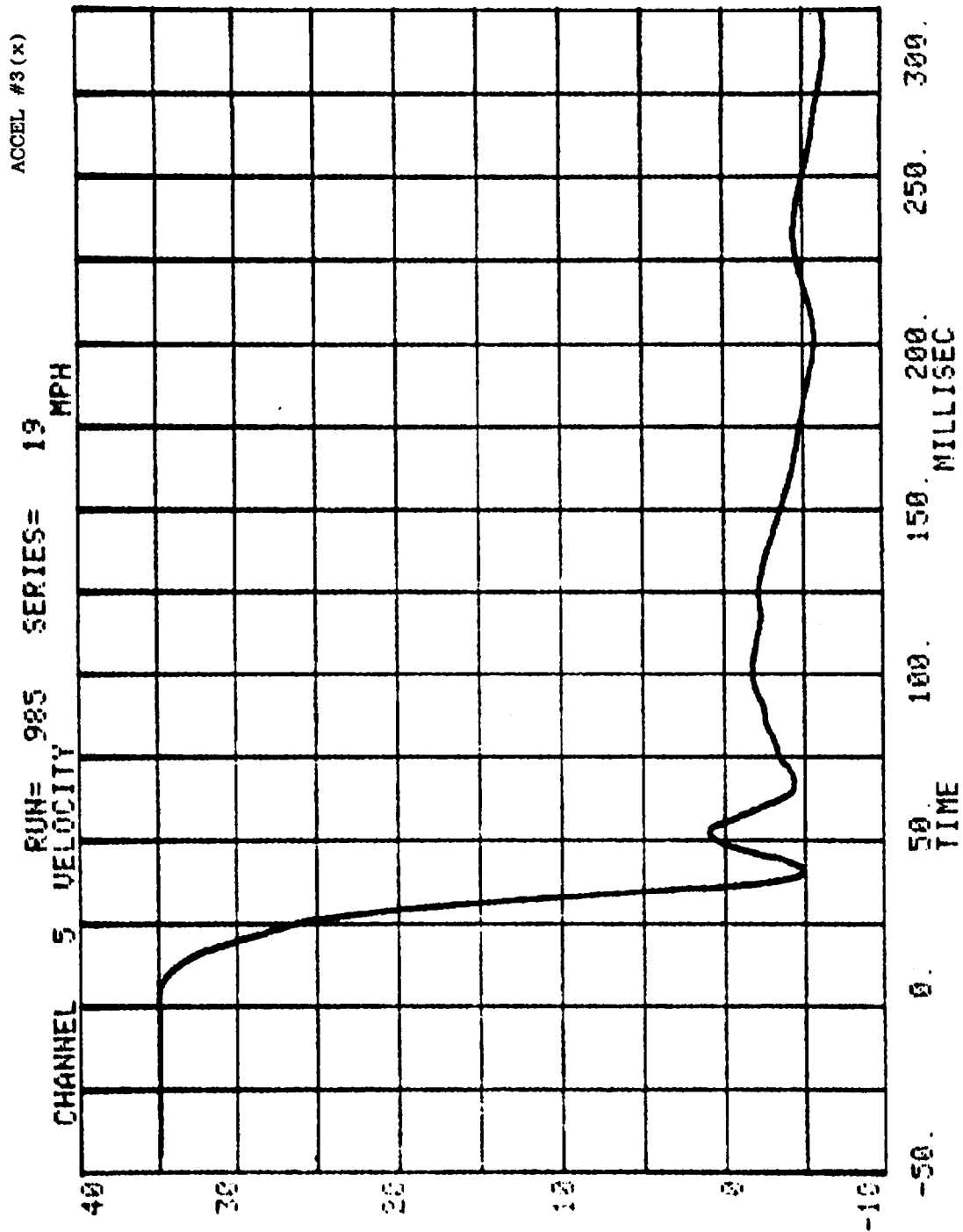
SERIES=

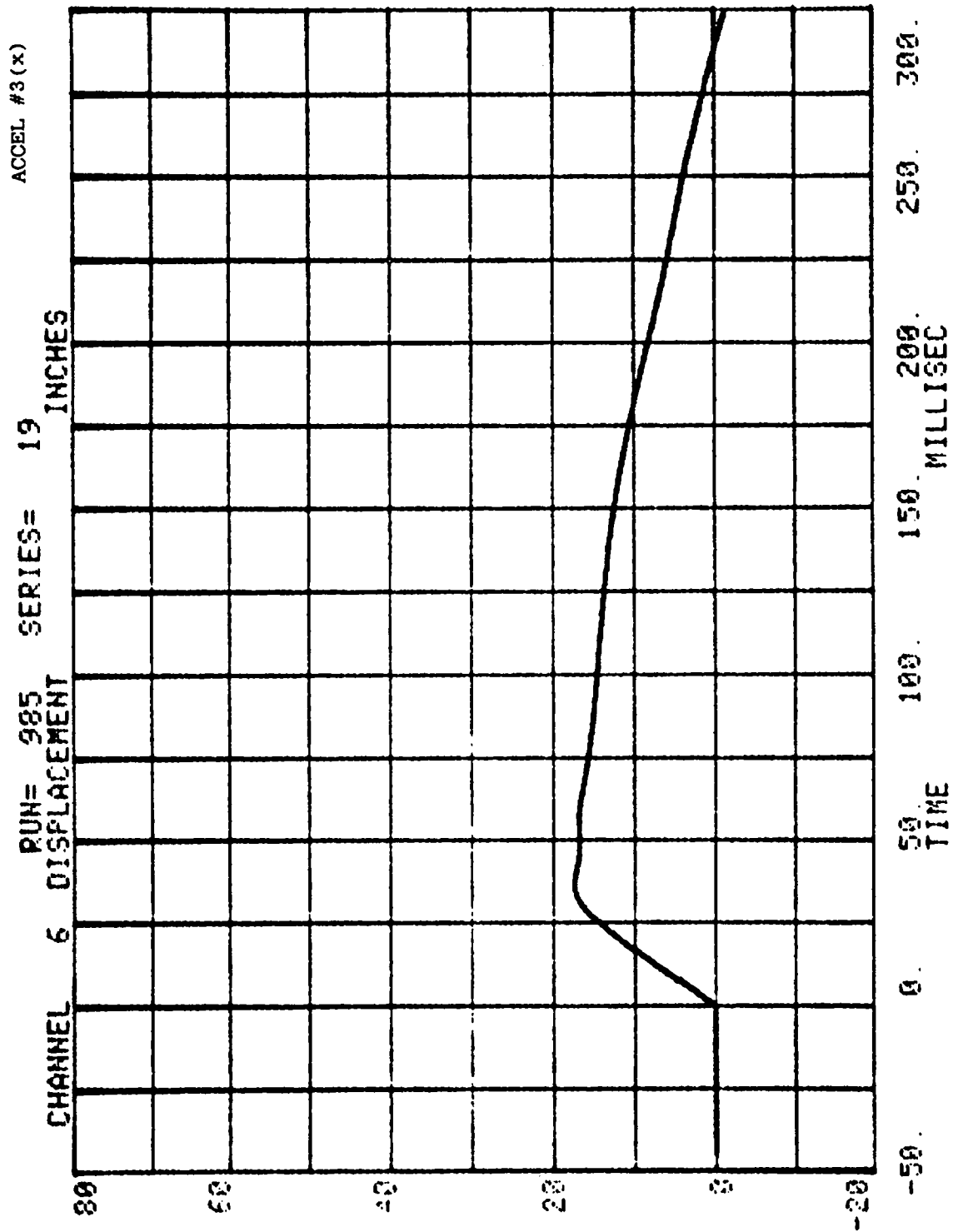
19 INCHES



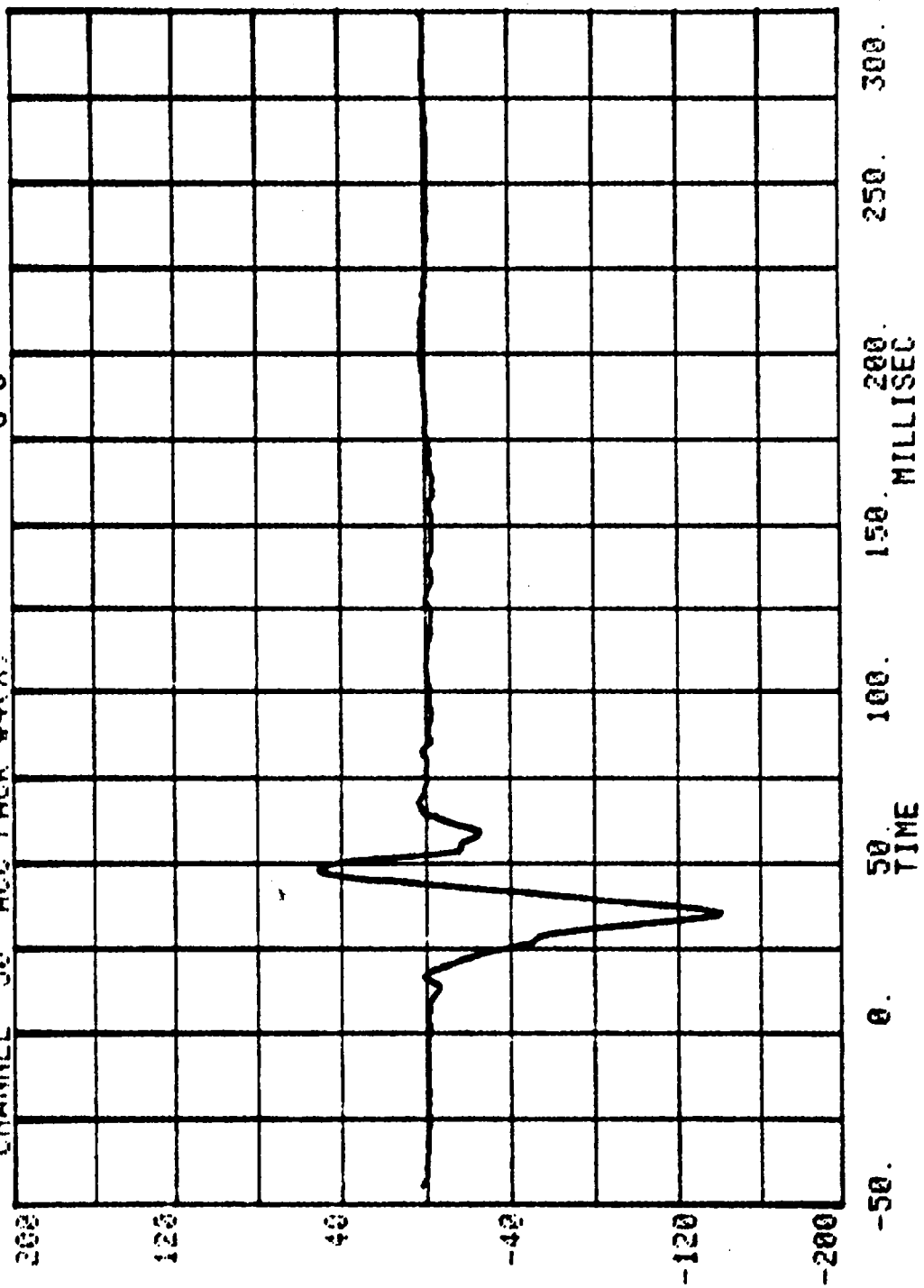
CHANNEL 23 ACC PACK #3(X) RUN= 985 SERIES= 19 G'S

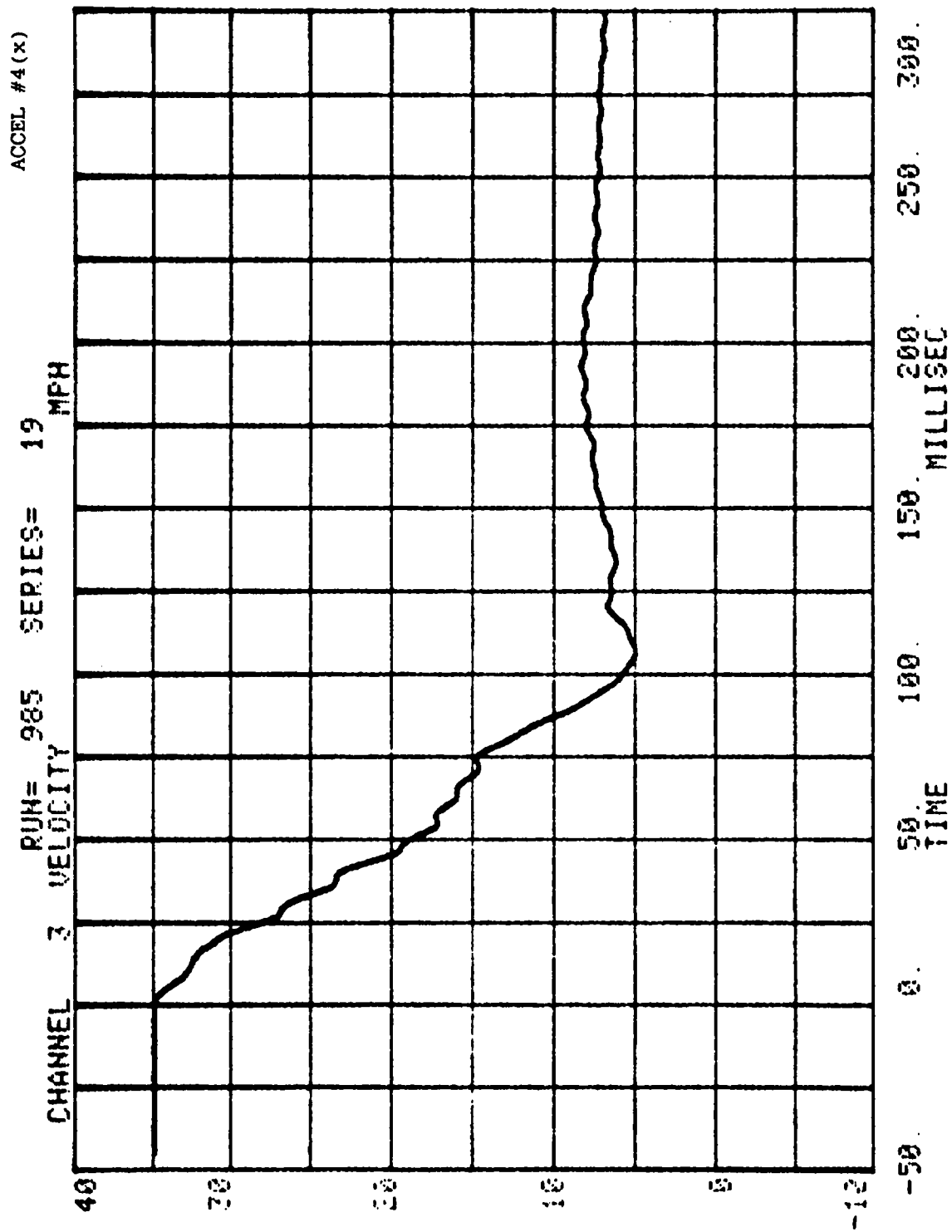






RUN= 985 SERIES= 19
CHANNEL 30 ACC PACK #4(X) G'S

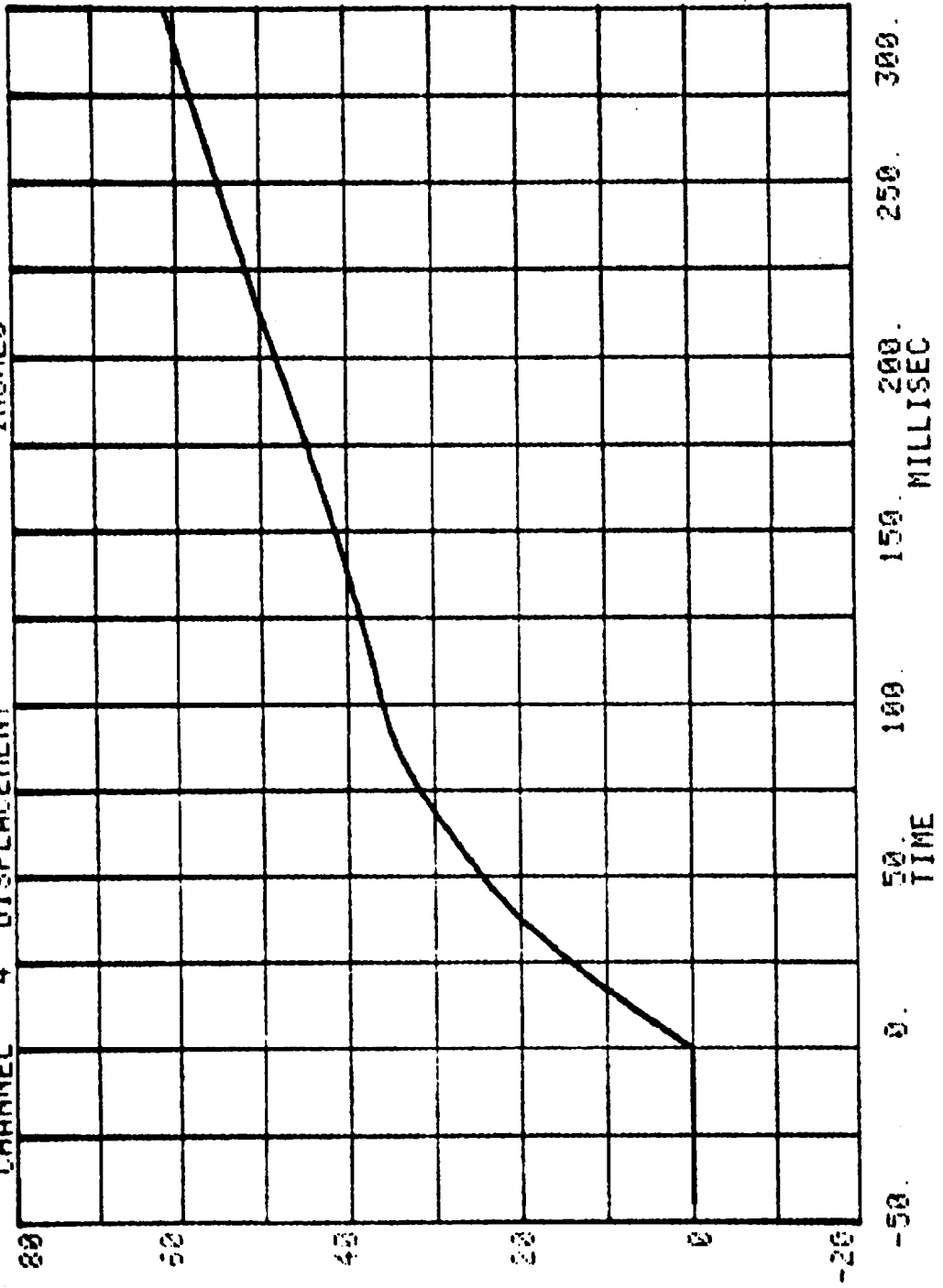




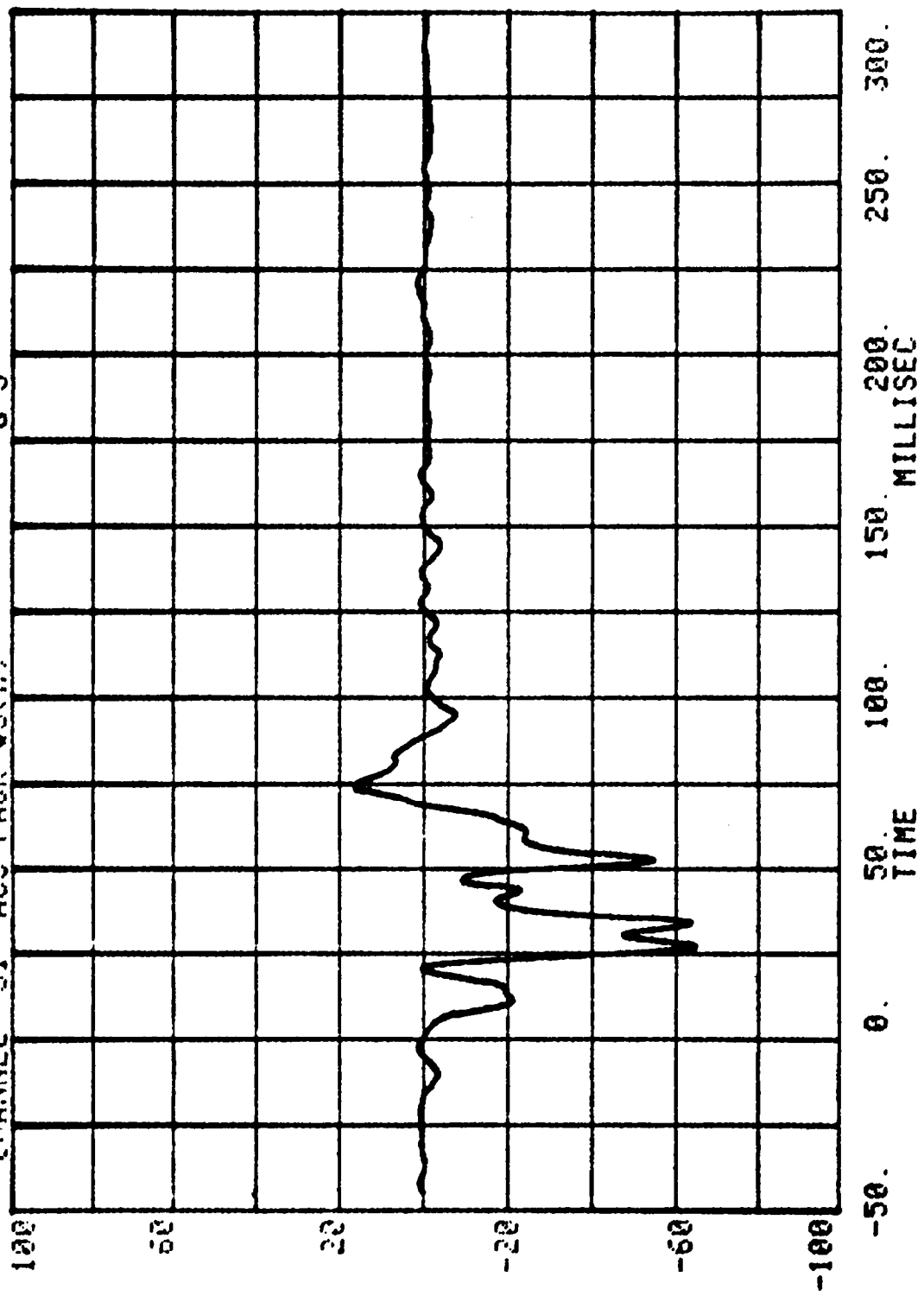
ACCEL #4 (x)

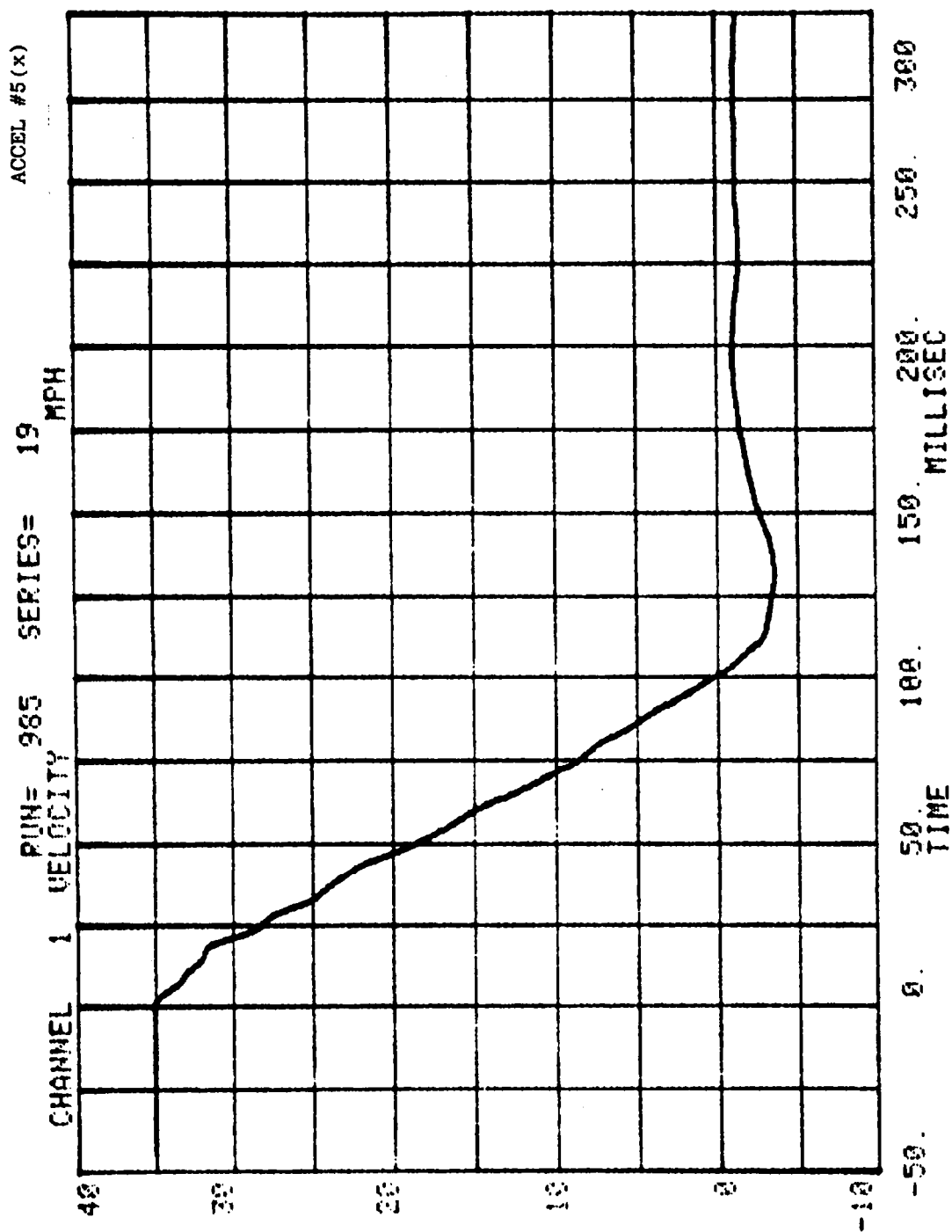
CHANNEL 4 DISPLACEMENT SERIES= 19 INCHES

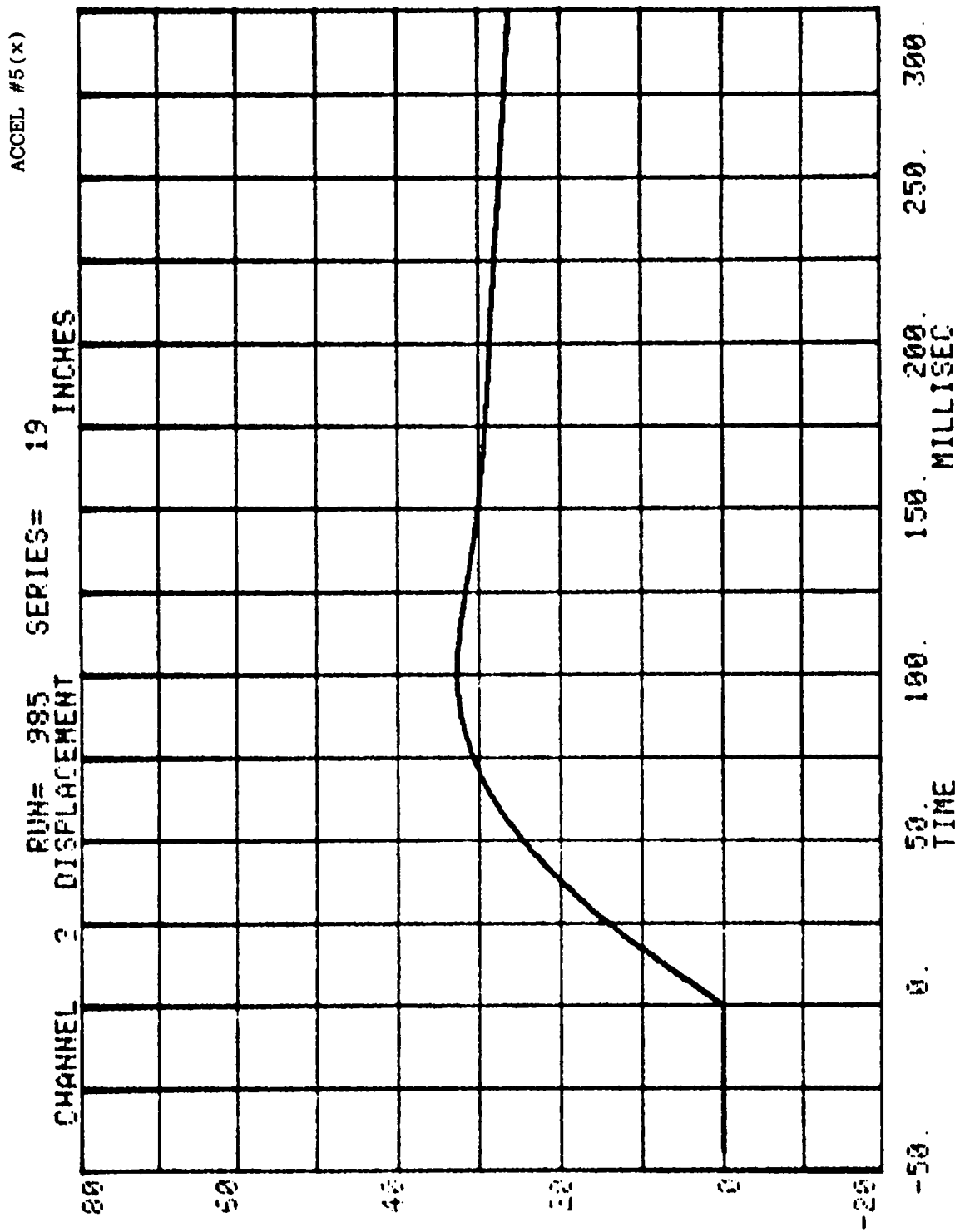
RUN= 985



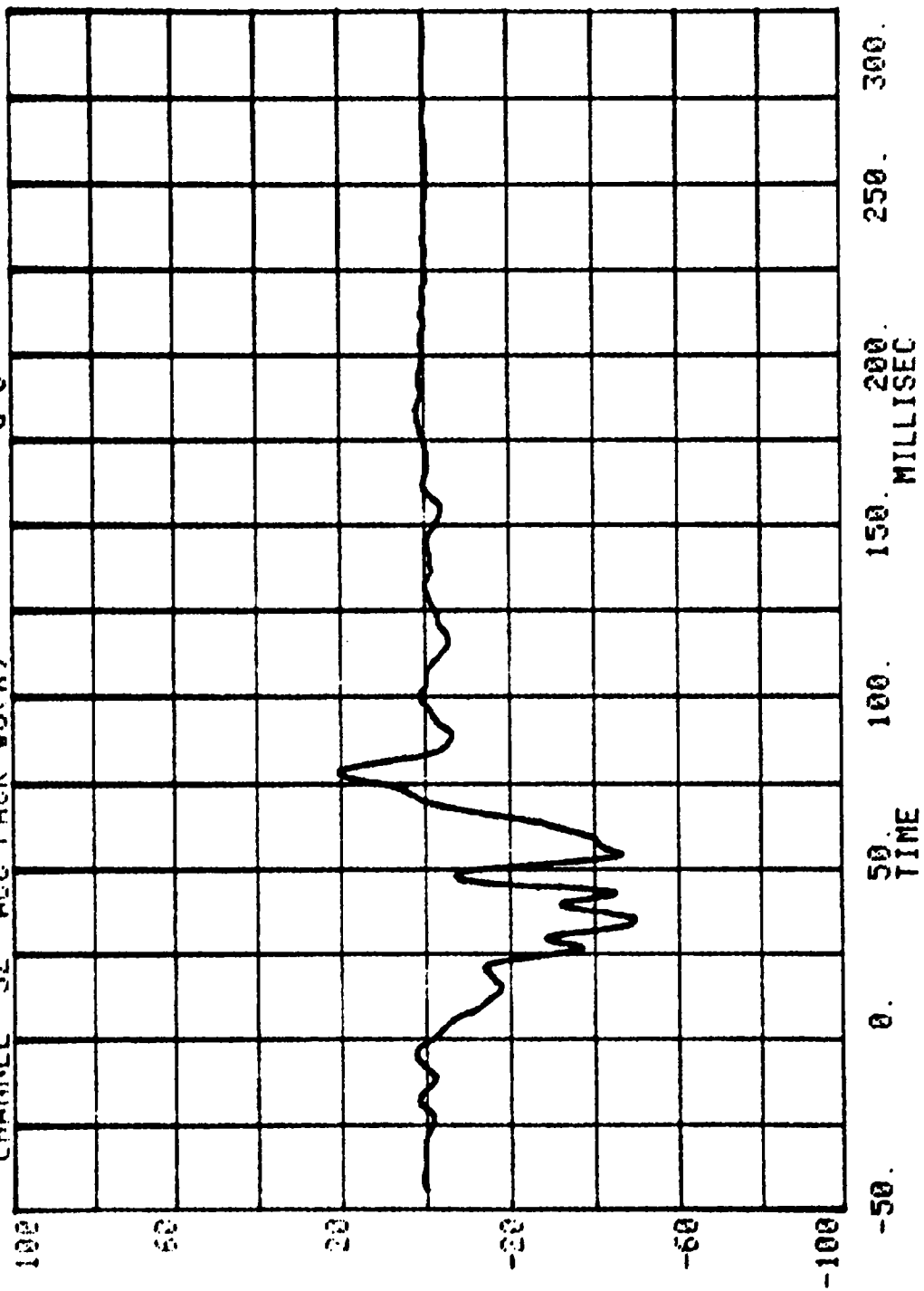
CHANNEL 31 ACC PACK #5(X) RUN= 985 SERIES= 19 G'S





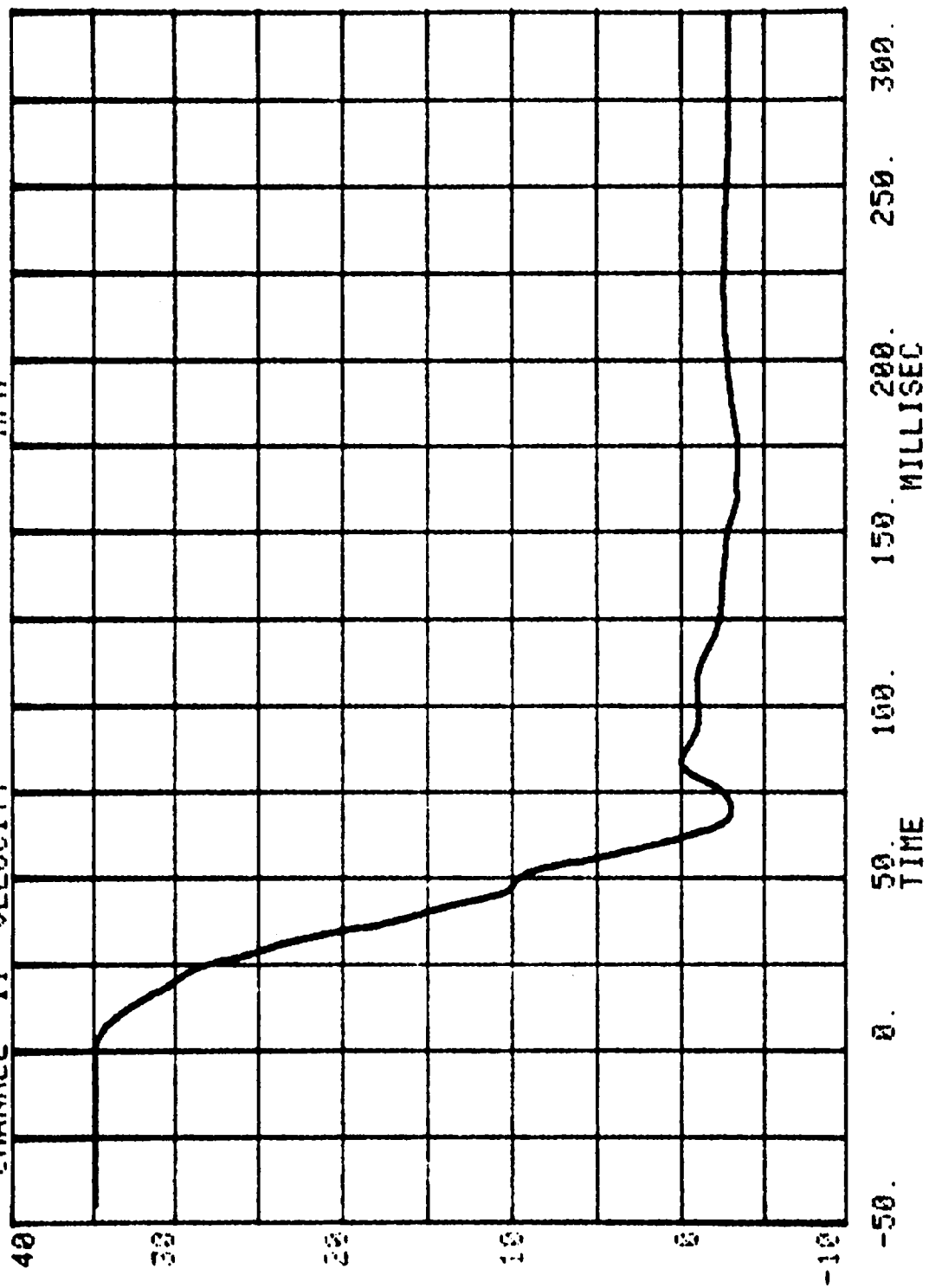


RUN= 985 SERIES= 19
CHANNEL 32 ACC PACK #6(X) G'S



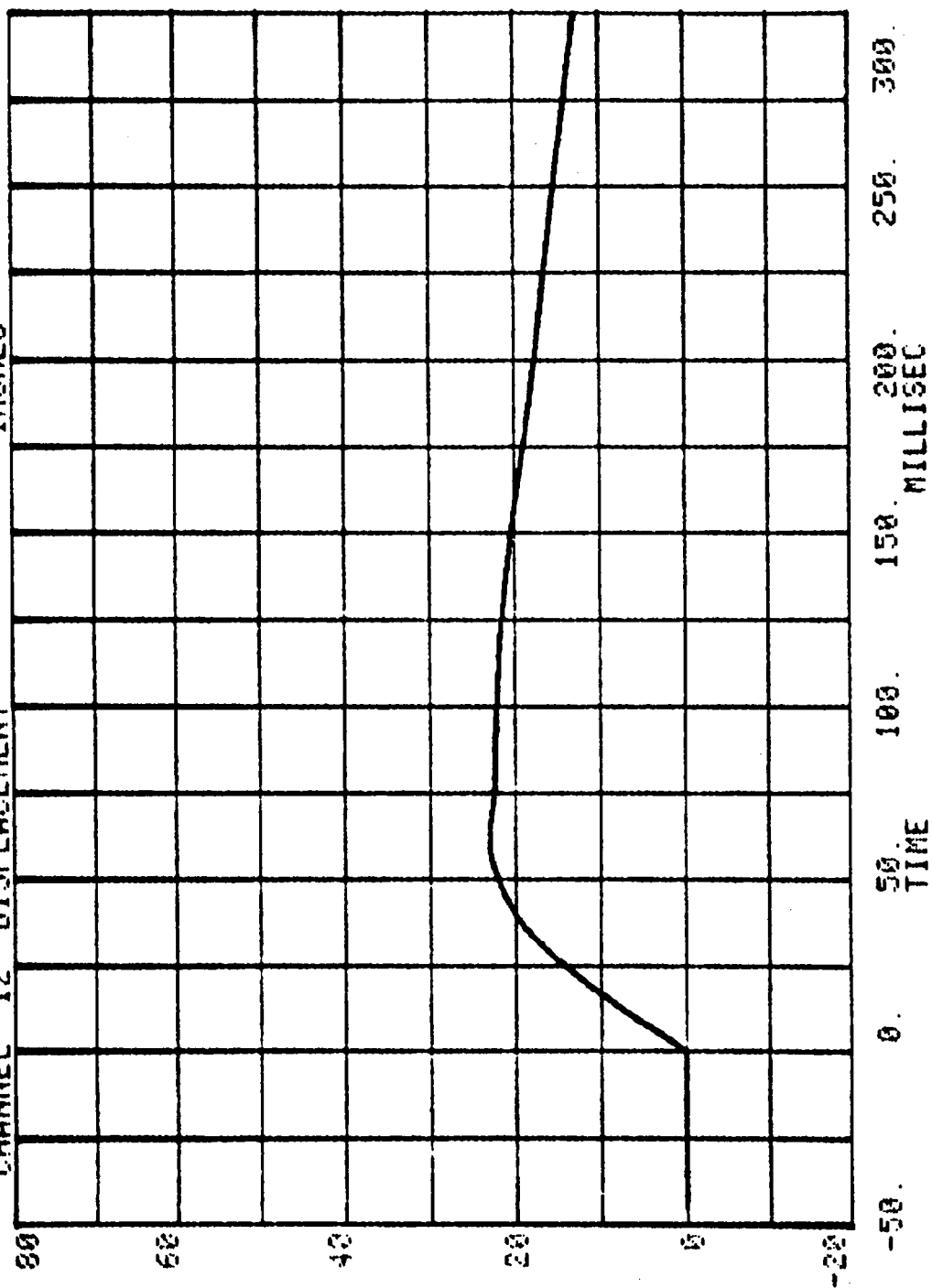
ACCEL #6 (x)

CHANNEL 11 VELOCITY
RUN= 985 SERIES= 19 MPH

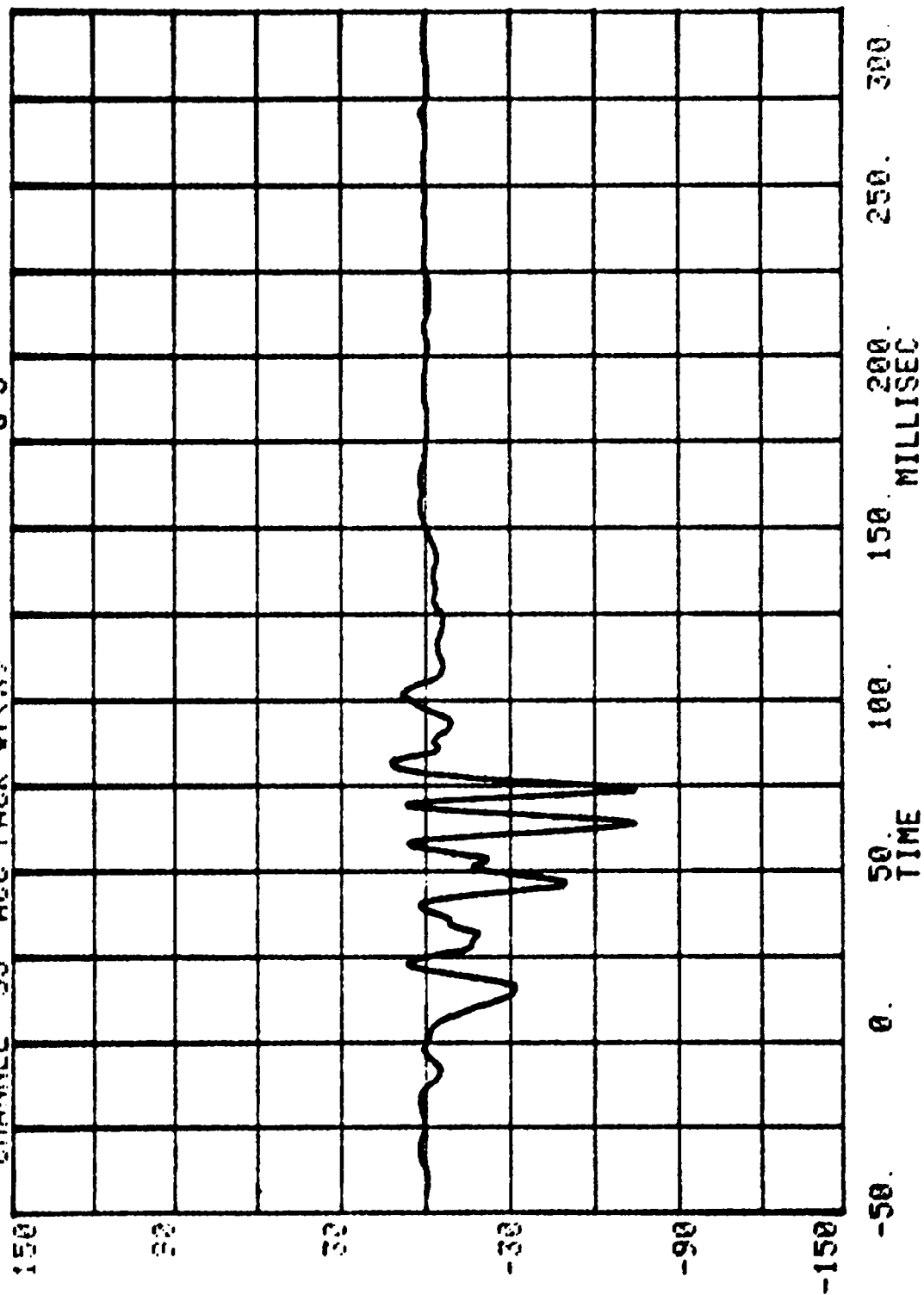


ACCEL #6(x)

RUN= 985 SERIES= 12 INCHES
CHANNEL 12 DISPLACEMENT

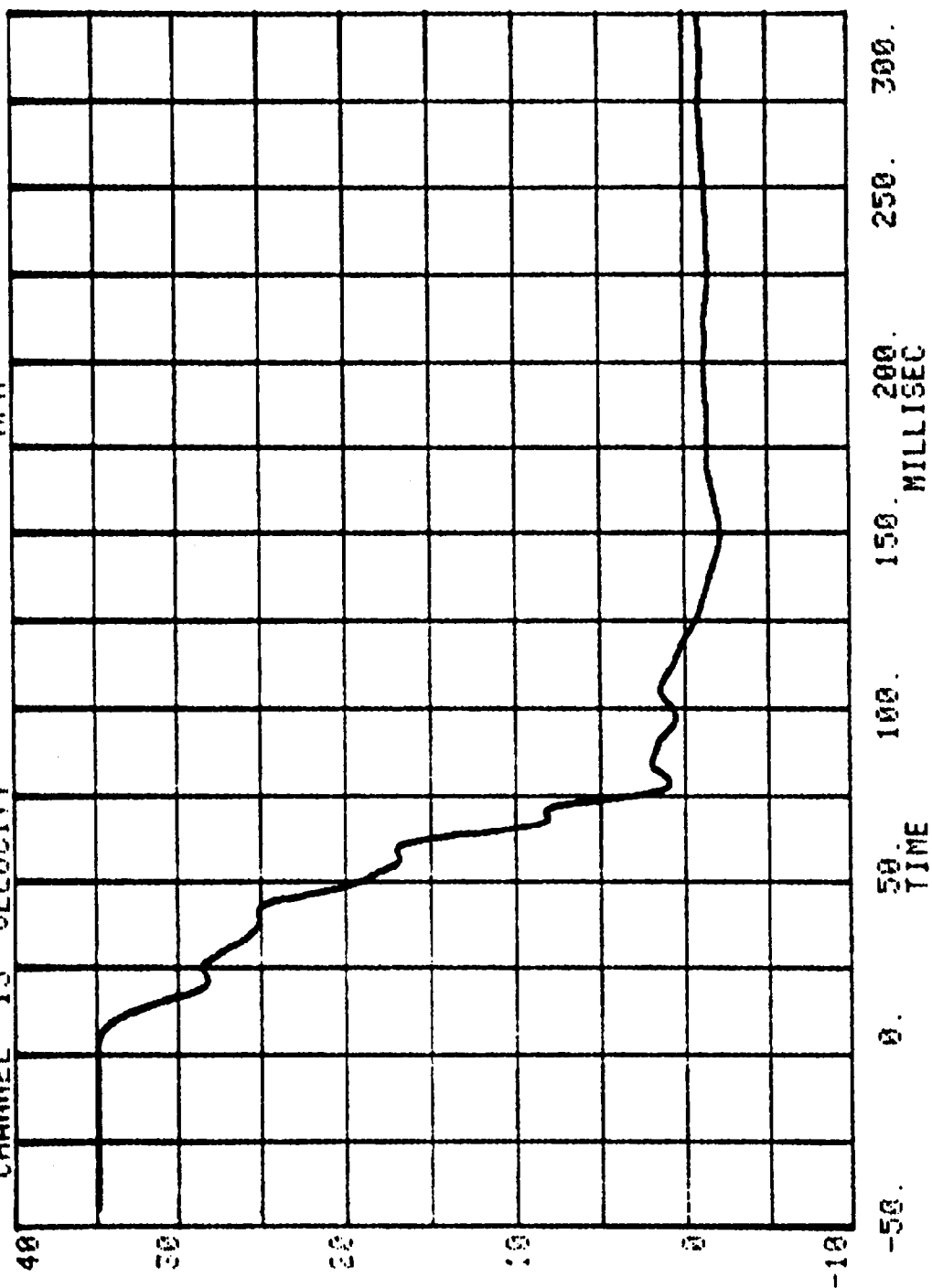


RUN= 985 SERIES= 19
CHANNEL 33 ACC PACK #7(X) G'S



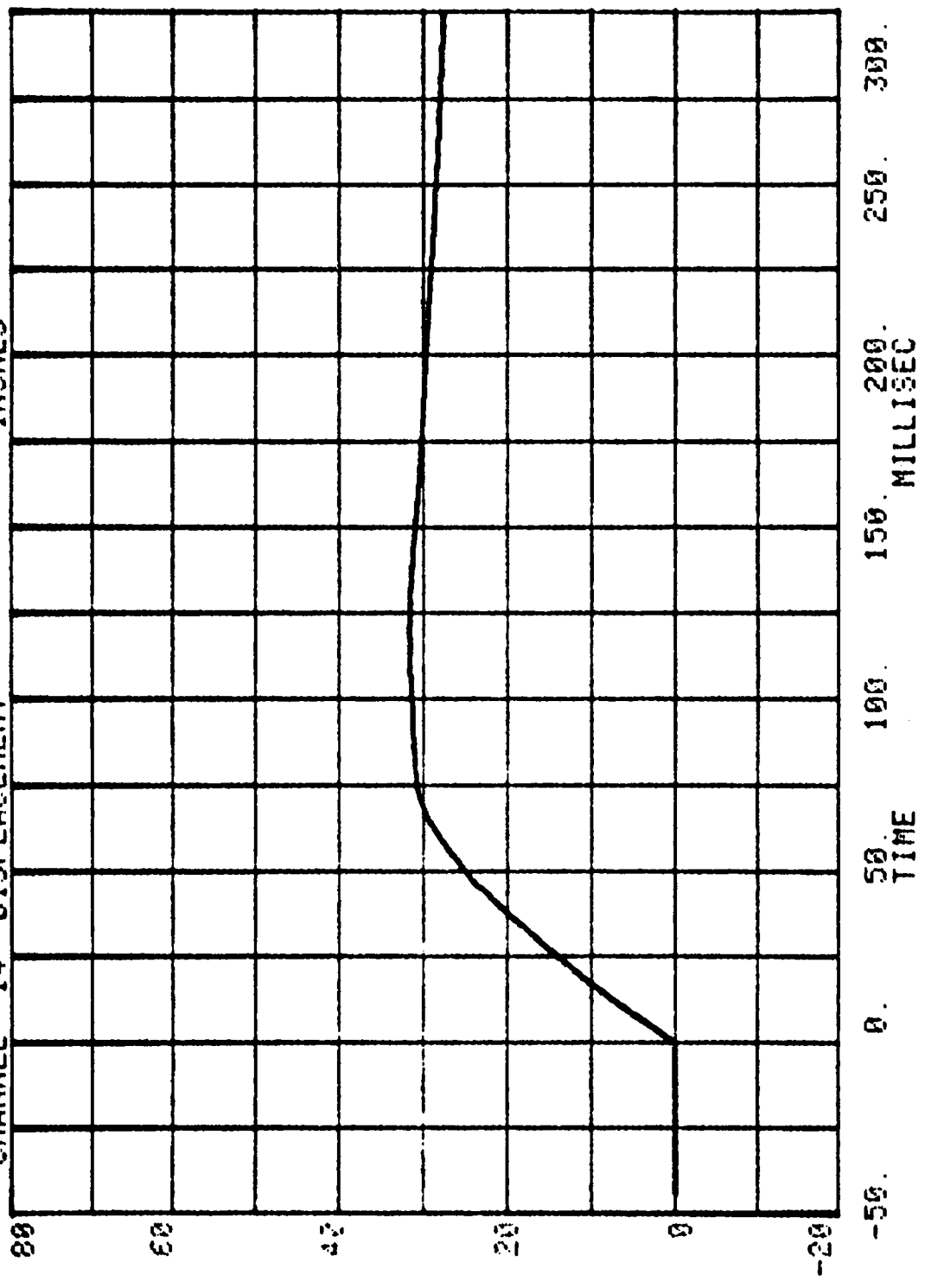
ACCEL #7 (x)

CHANNEL 13 VELOCITY
RUN= 985 SERIES= 19 MPH



ACCEL #7 (x)

RUN= 385
CHANNEL 14 DISPLACEMENT
SERIES= 13 INCHES



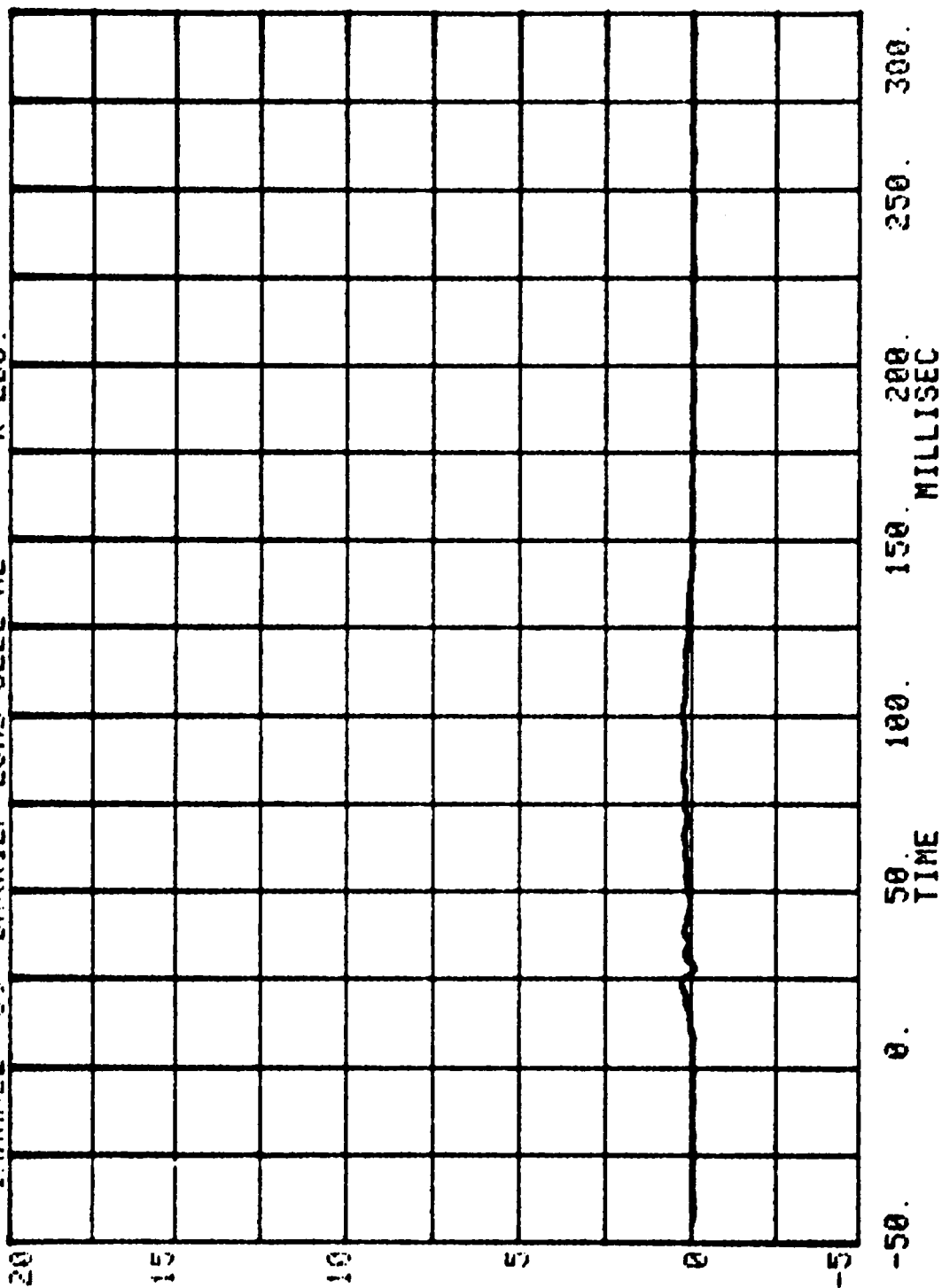
TEST NO. ML0103

LOAD CELL BARRIER DATA

FILTER CHANNEL CLASS

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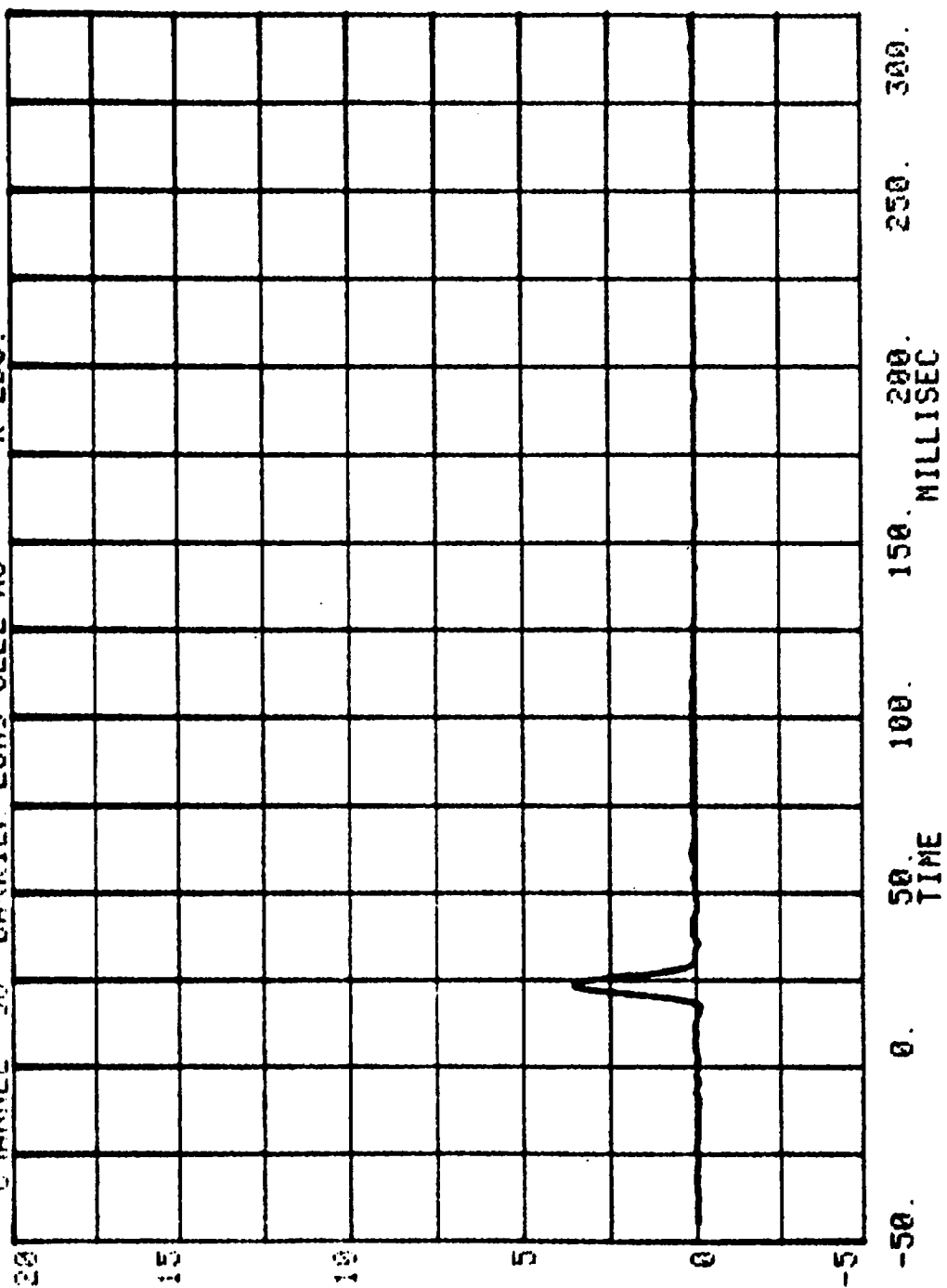
CHANNEL 35 BARRIEP LOAD CELL A2 RUN= 985 SERIES= 19 K LBS.



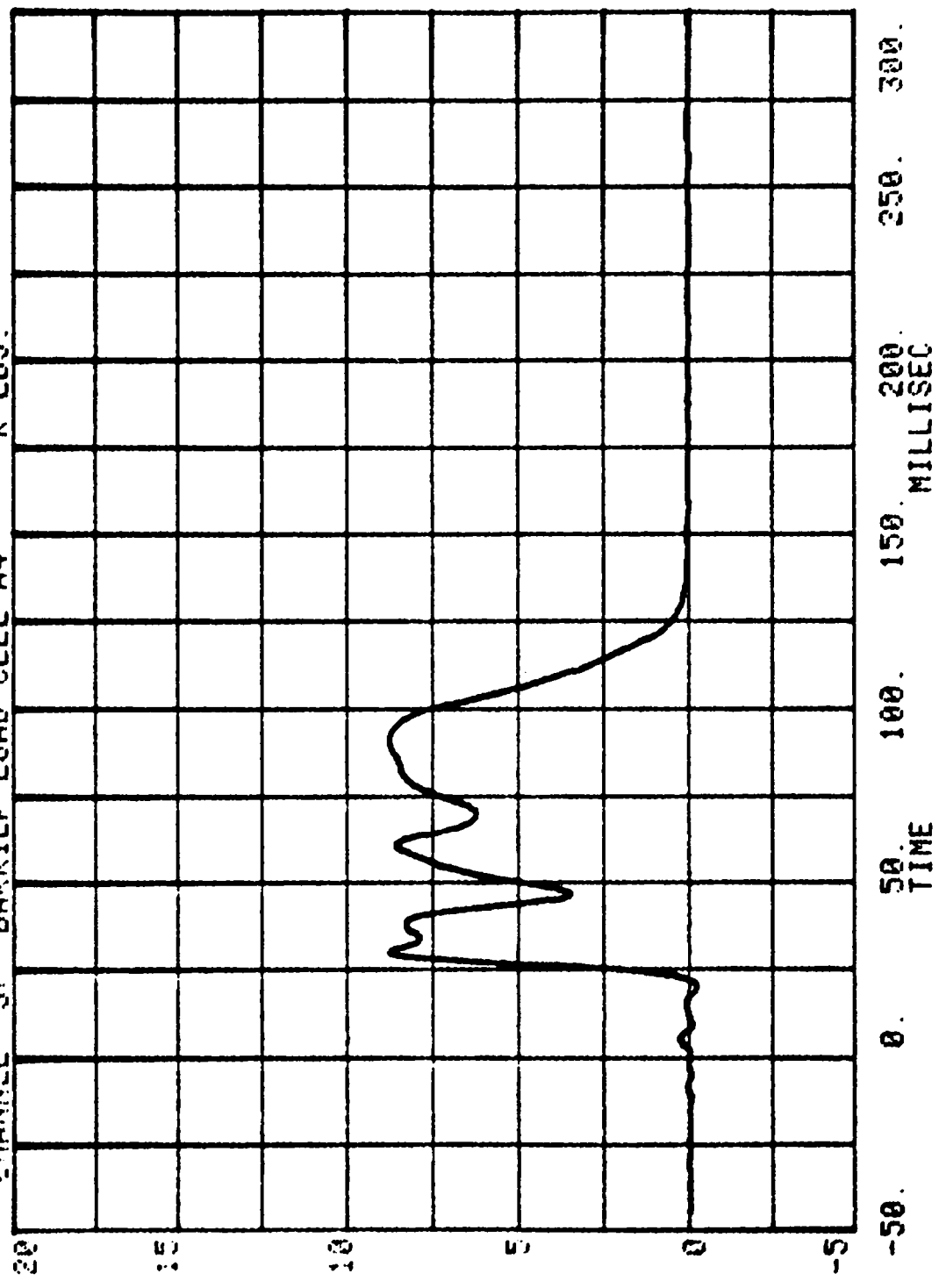
CHANNEL 36 BARRIER LOAD CELL A3

RUN= 985 SERIES= 19

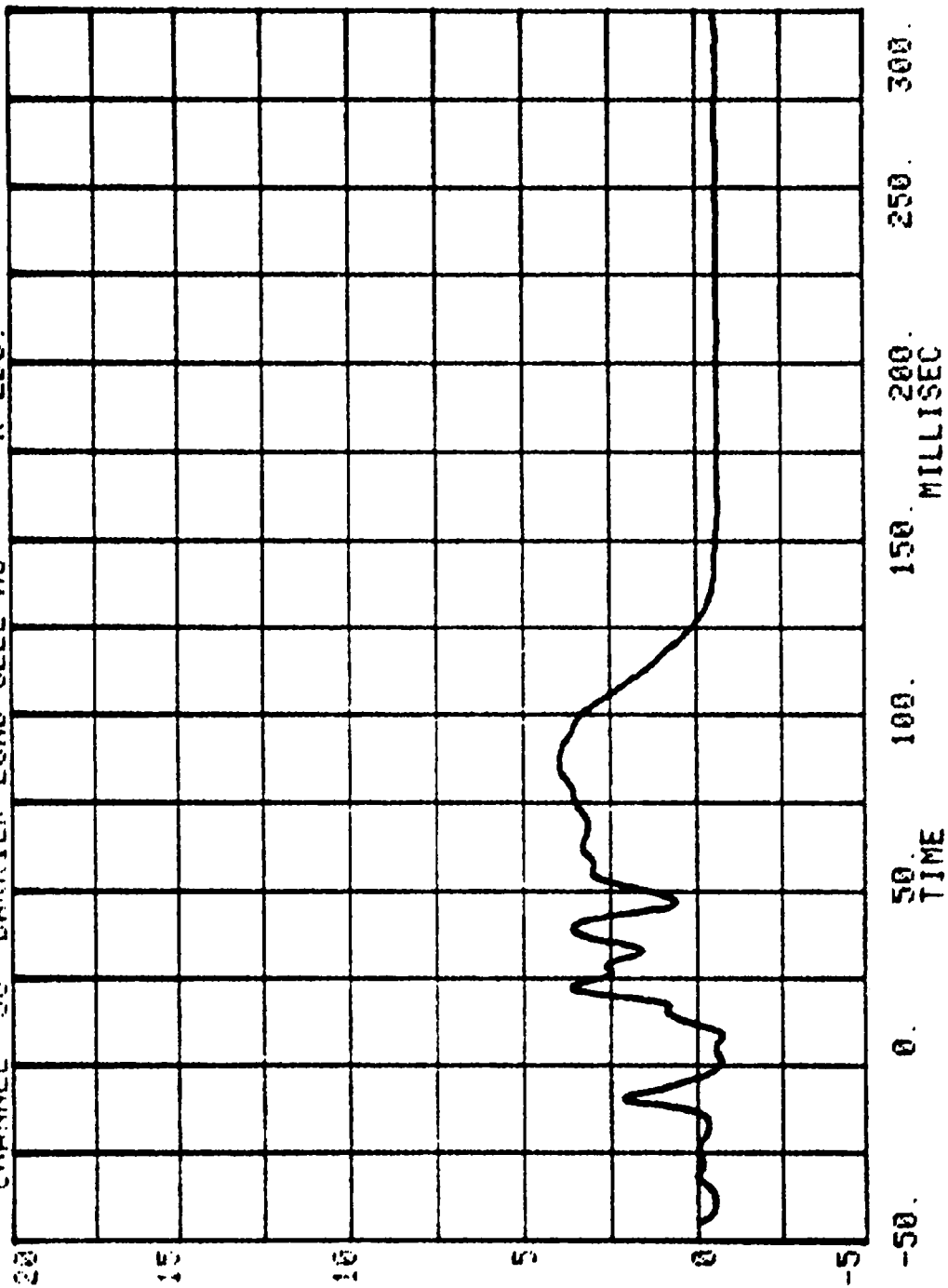
K LBS.



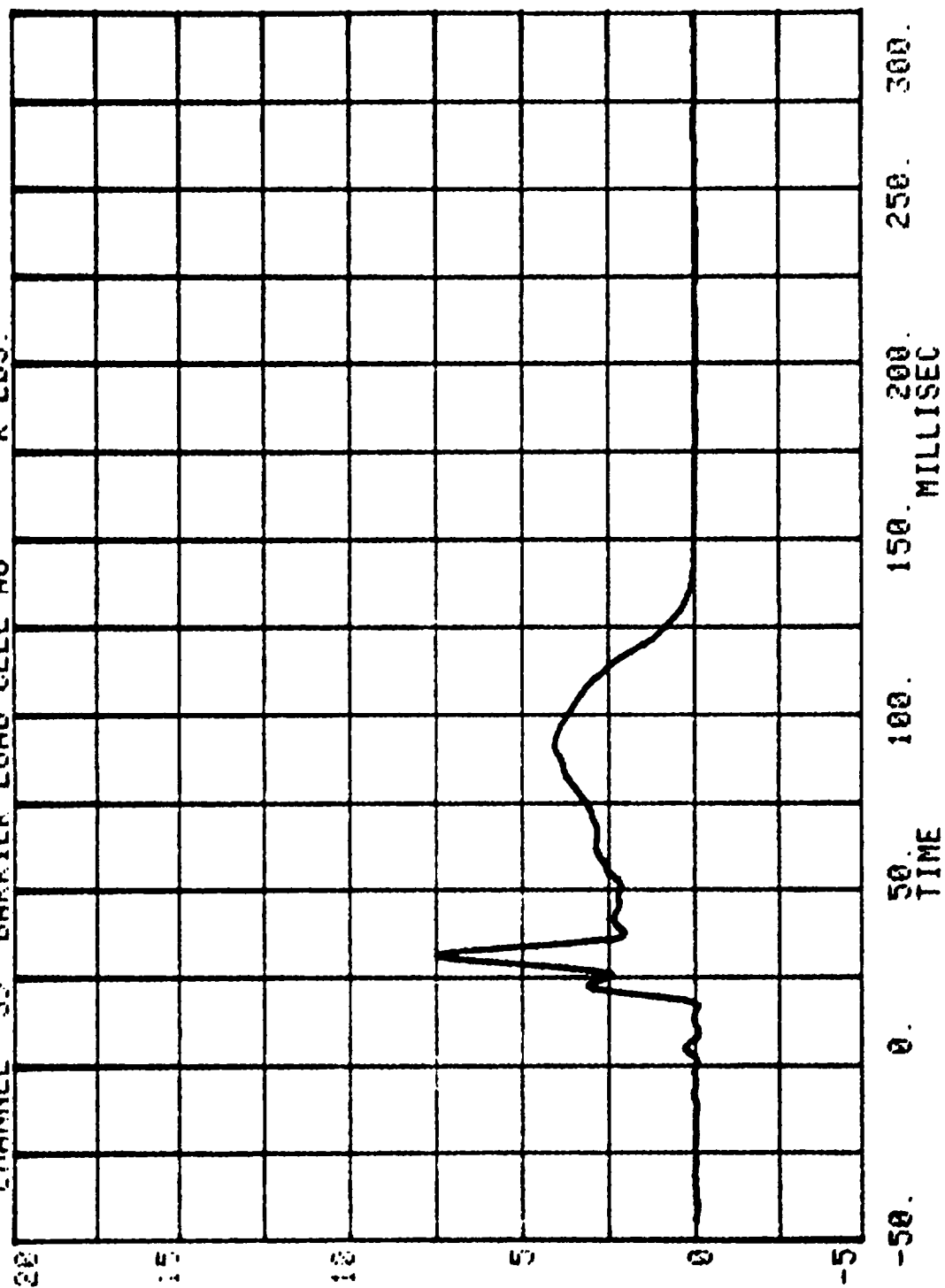
CHANNEL 37 RUN= 985 SERIES= 19 K LBS.



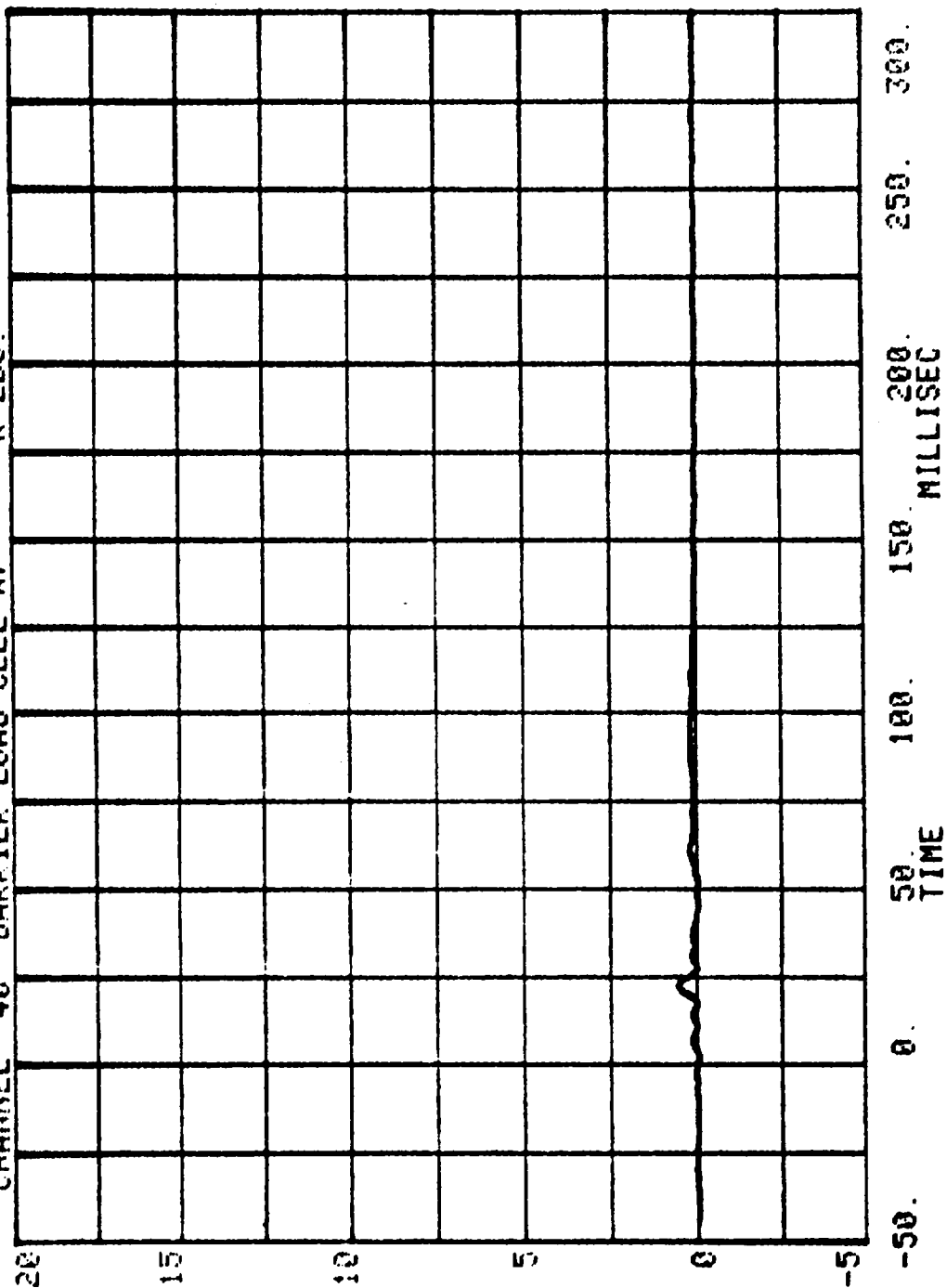
CHANNEL 38 BARRIER LOAD CELL A5 RUN= 985 SERIES= 19 K LBS.



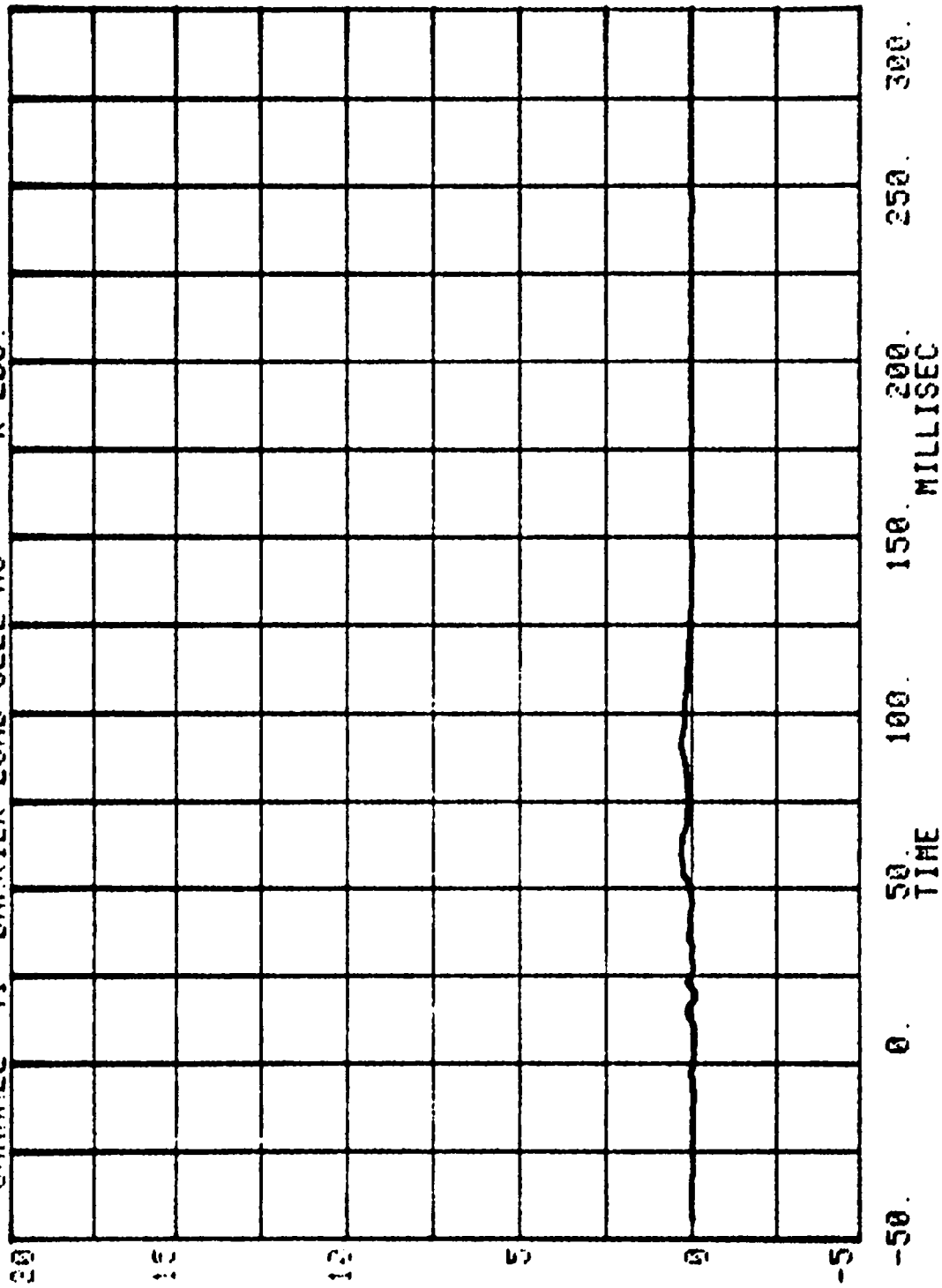
CHANNEL 39 RUN= 985 SERIES= 19
BARRIER LOAD CELL A6 K LBS.



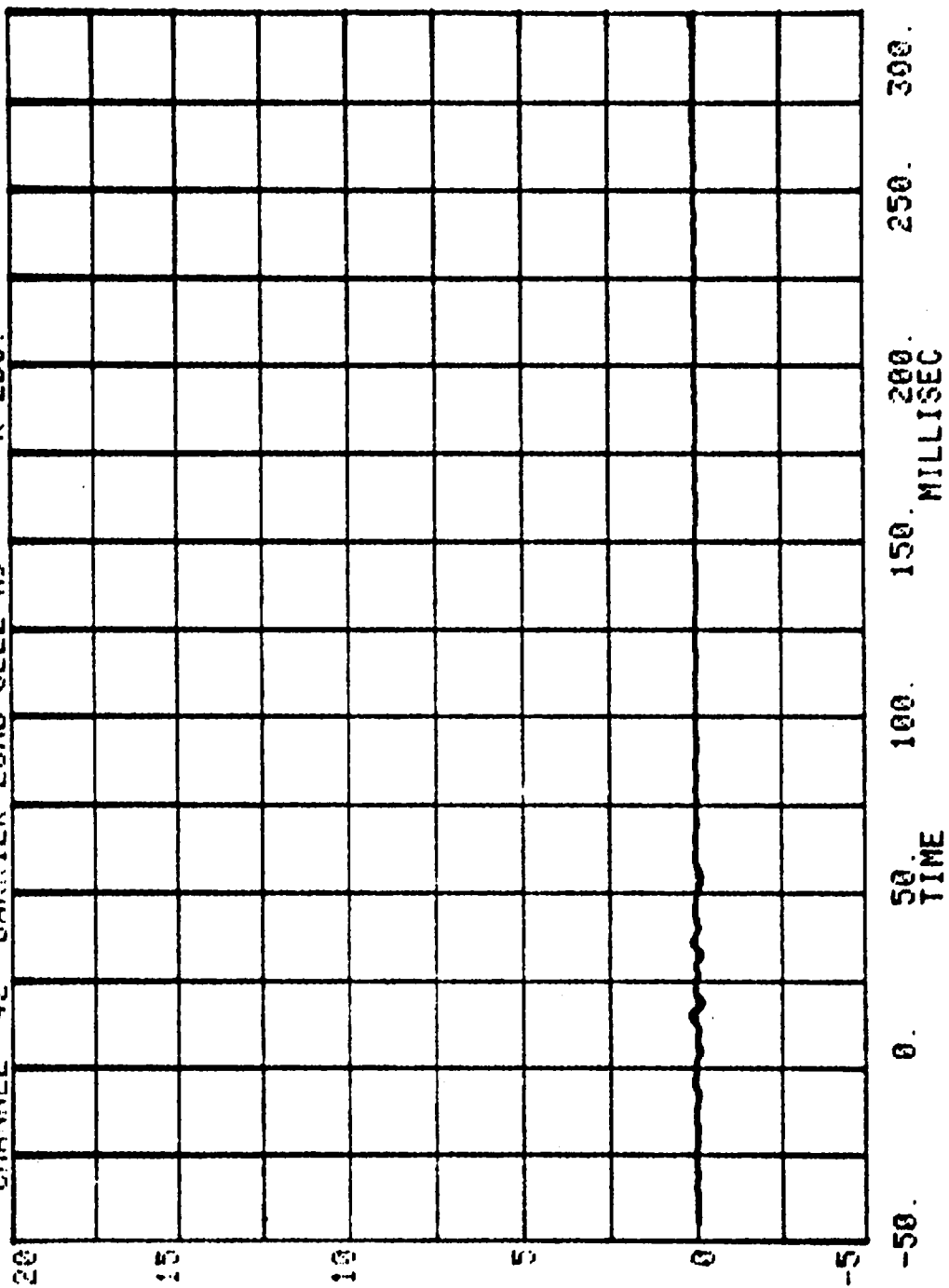
CHANNEL 40 BARRIER LOAD CELL A7 RUN= 985 SERIES= 19 K LBS.



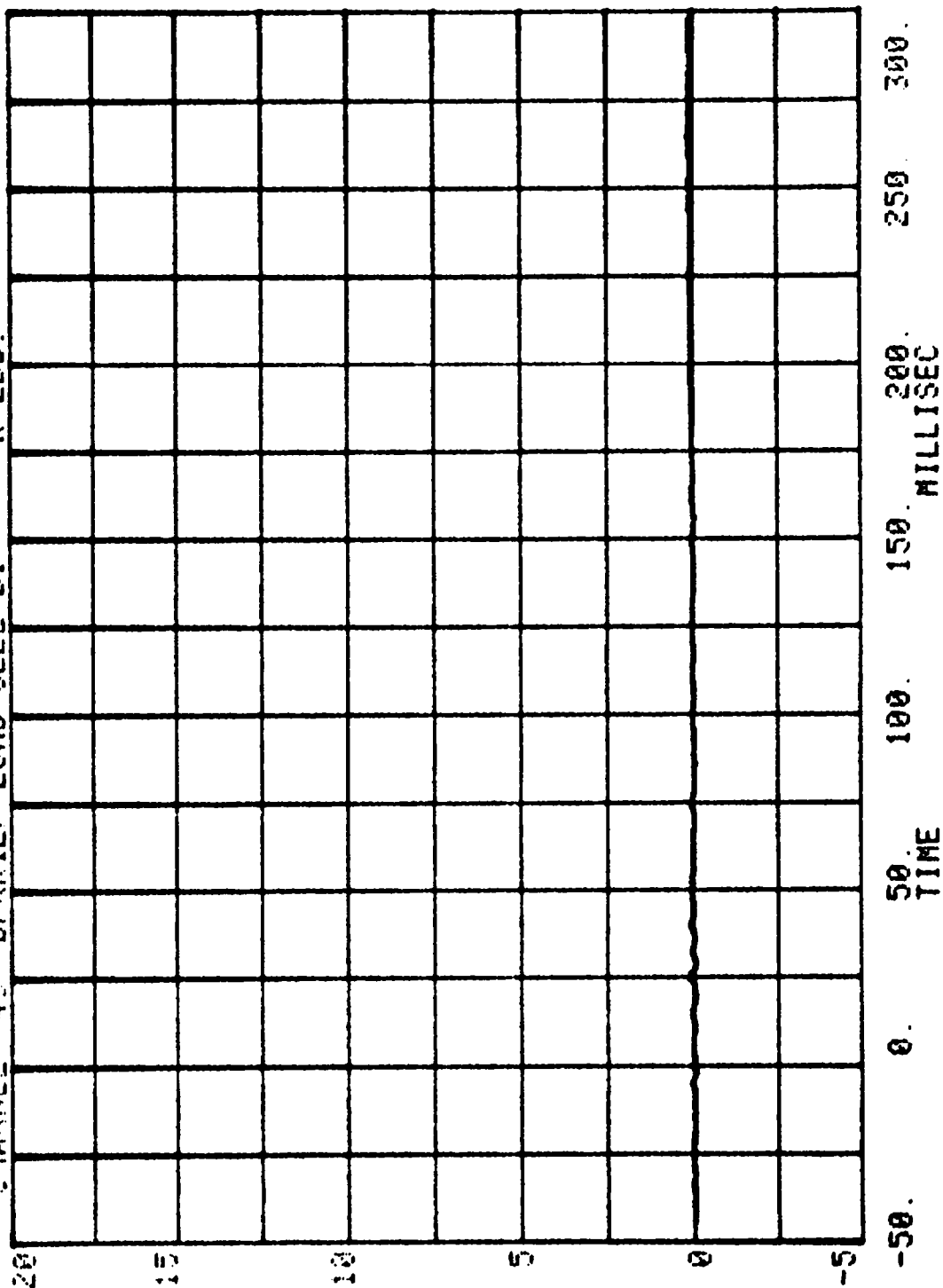
CHANNEL 41 BARRIER LOAD CELL AS RUN= 985 SERIES= 19 K LBS.

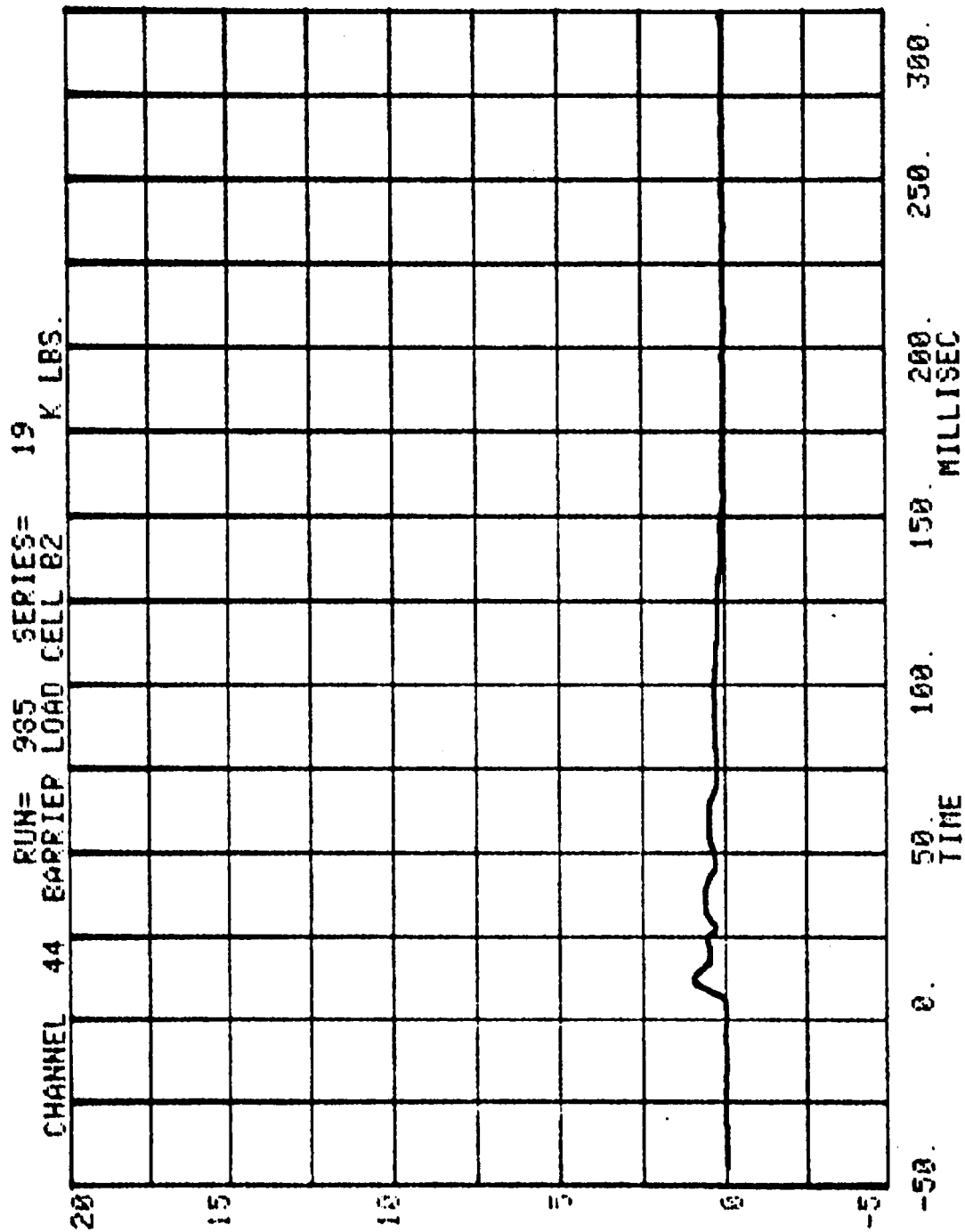


CHANNEL 42 BARRIER LOAD CELL A9 RUN= 985 SERIES= 19 K LBS.



CHANNEL 43 BARRIER LOAD CELL B1 RUN= 985 SERIES= 19 K LBS.

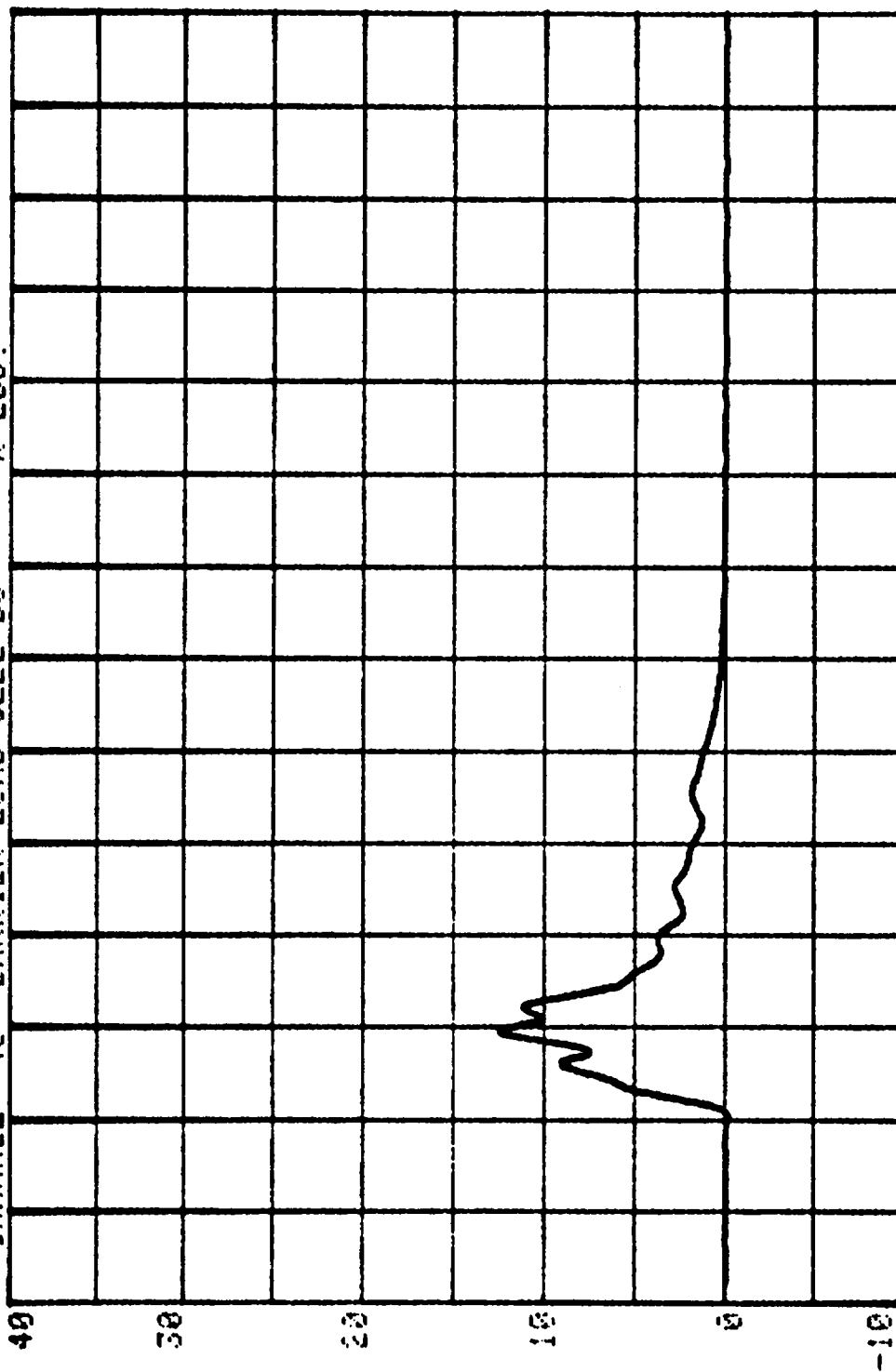




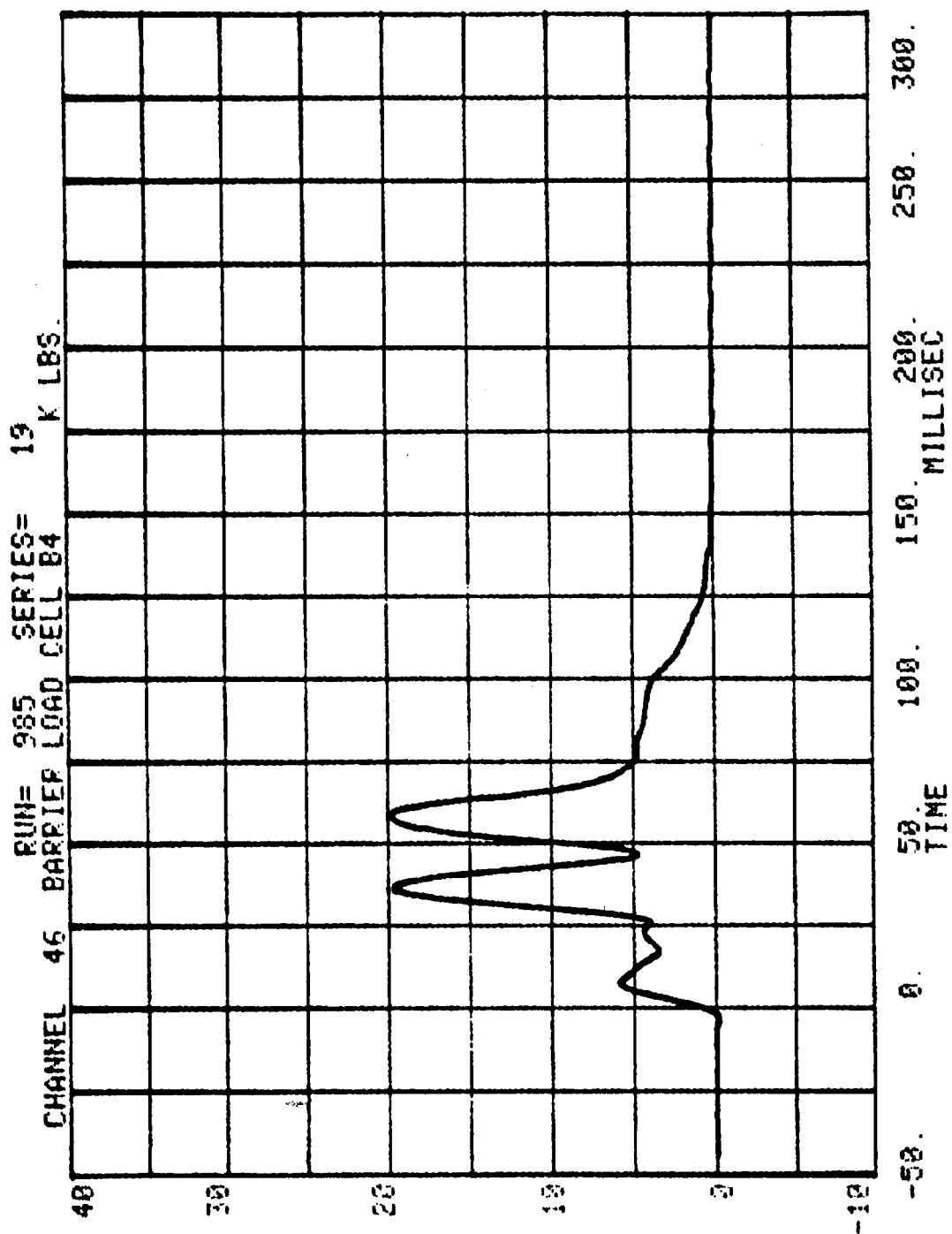
CHANNEL 45 BARrier LOAD CELL B3

RUN= 385 SERIES= 19

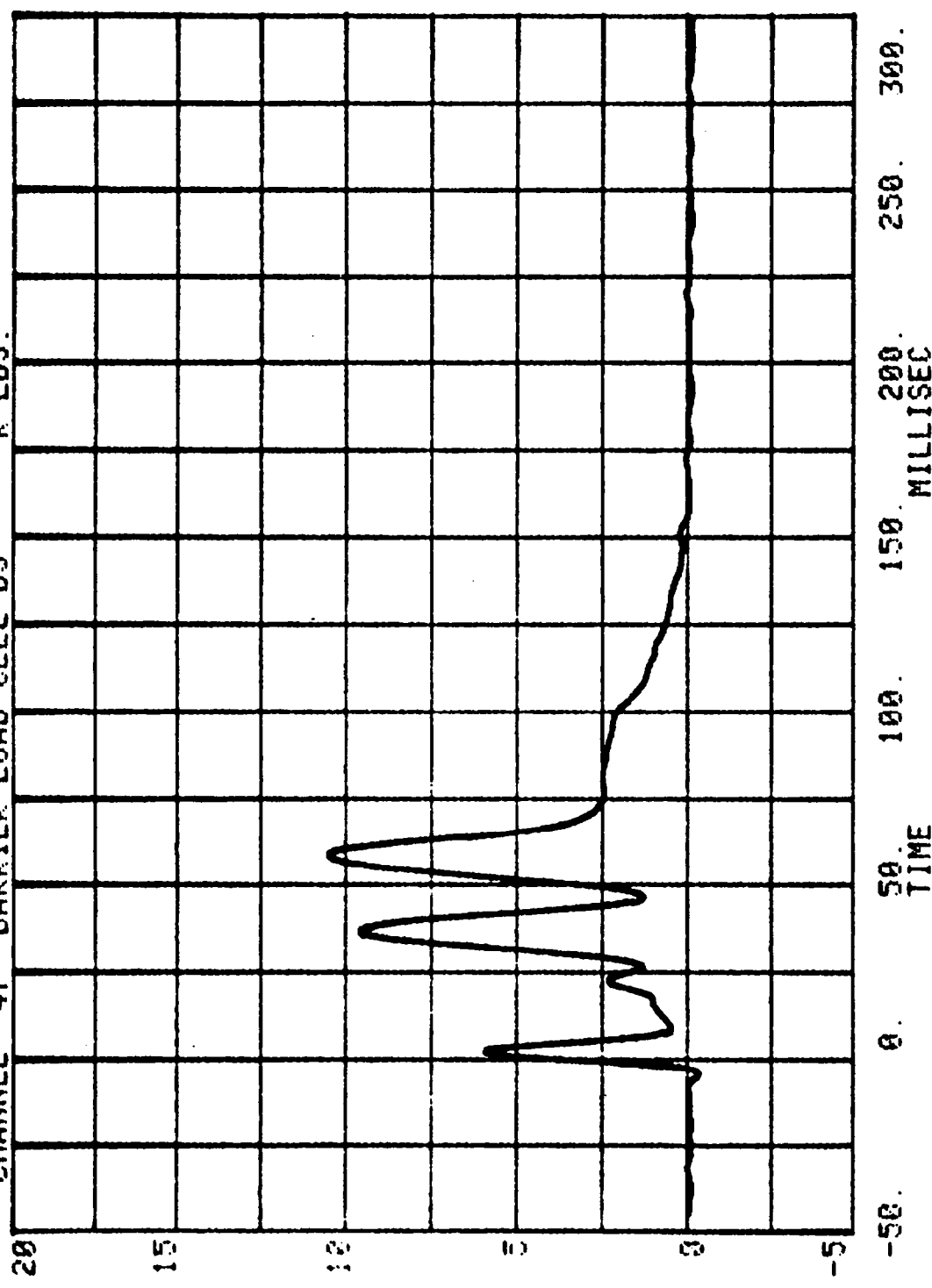
K LBS.

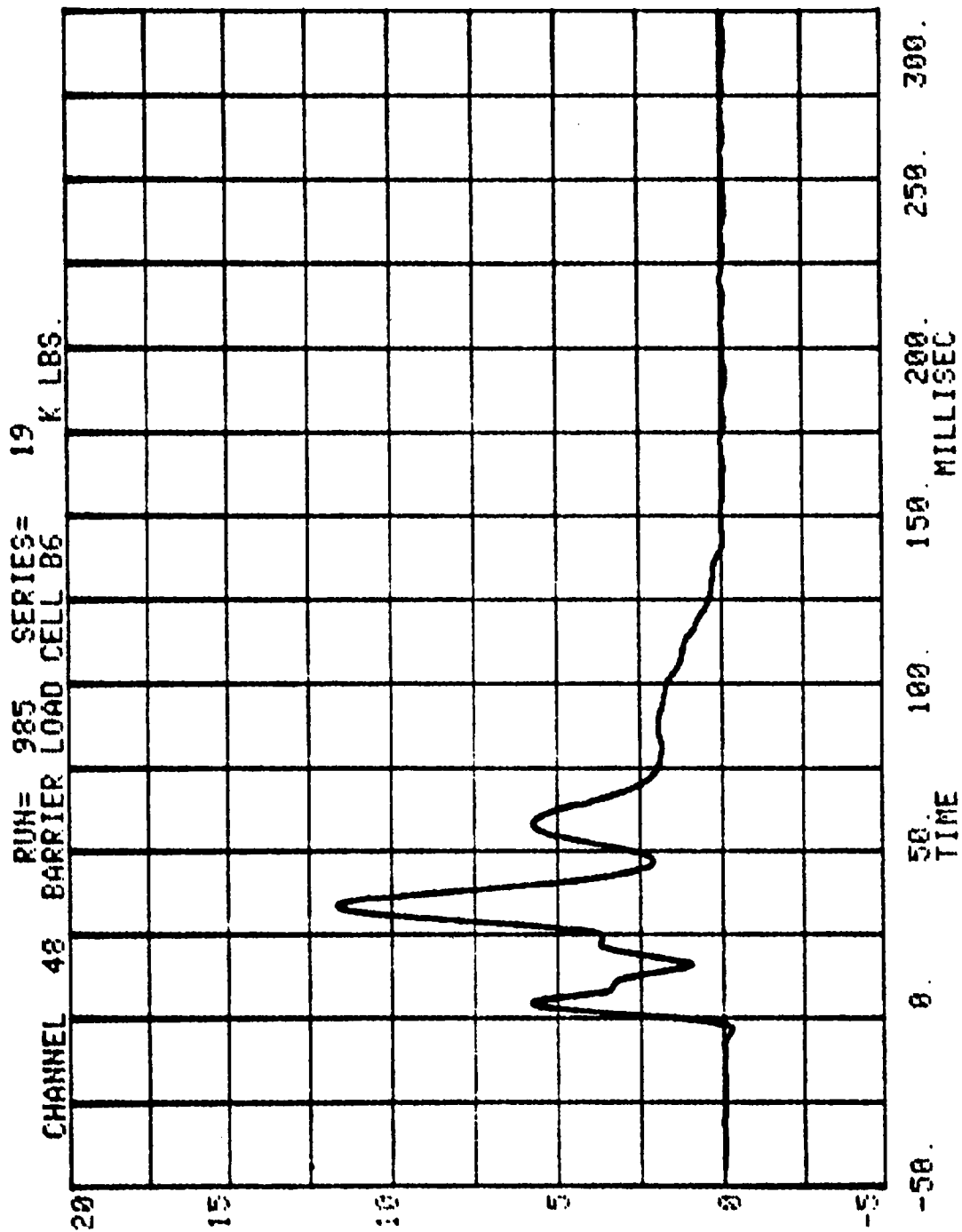


-50. 0. 50. 100. 150. 200. 250. 300.
TIME MILLISEC

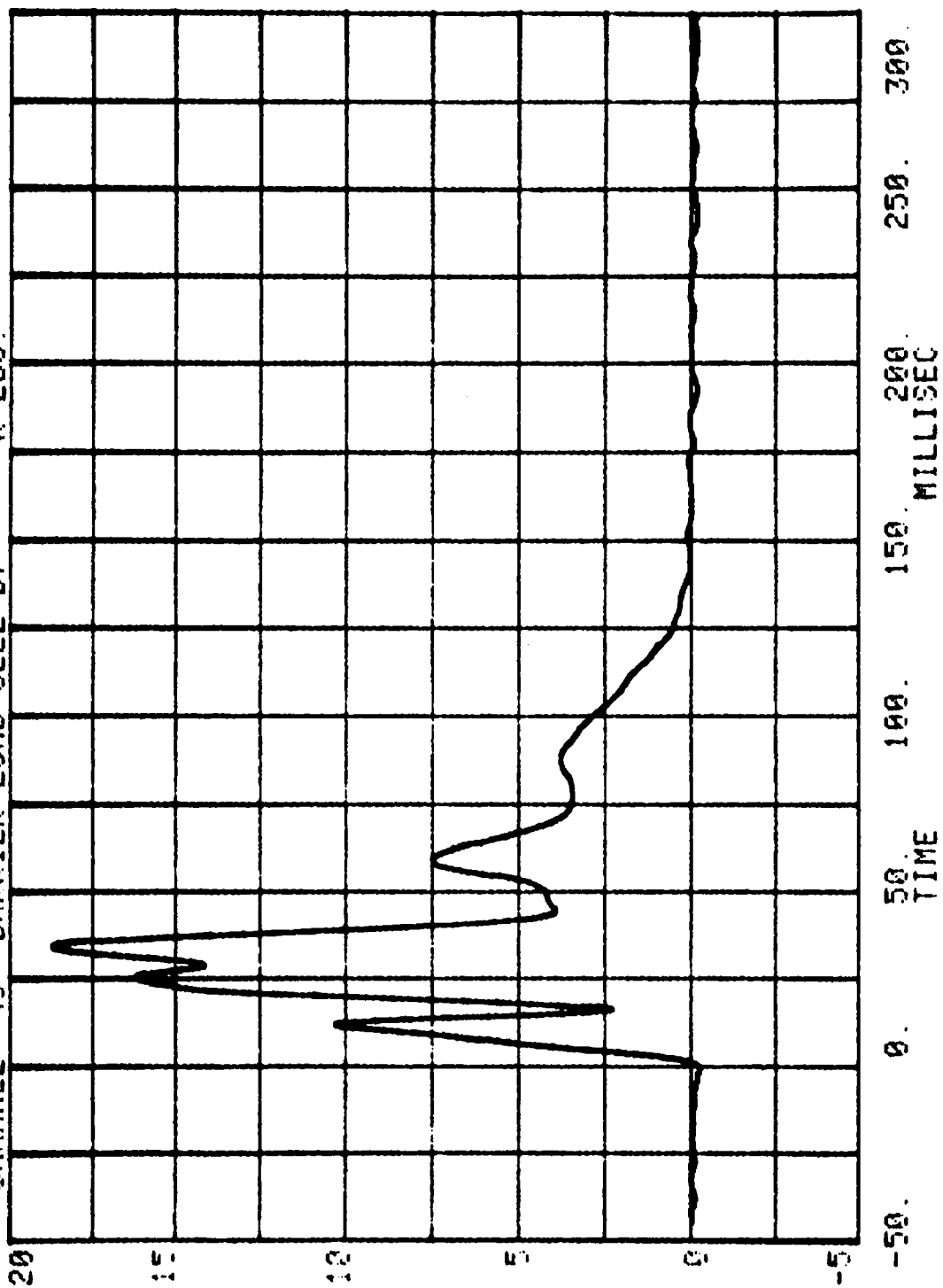


CHANNEL 47 BARRIER LOAD CELL B5 RUN= 985 SERIES= 19 K LBS.

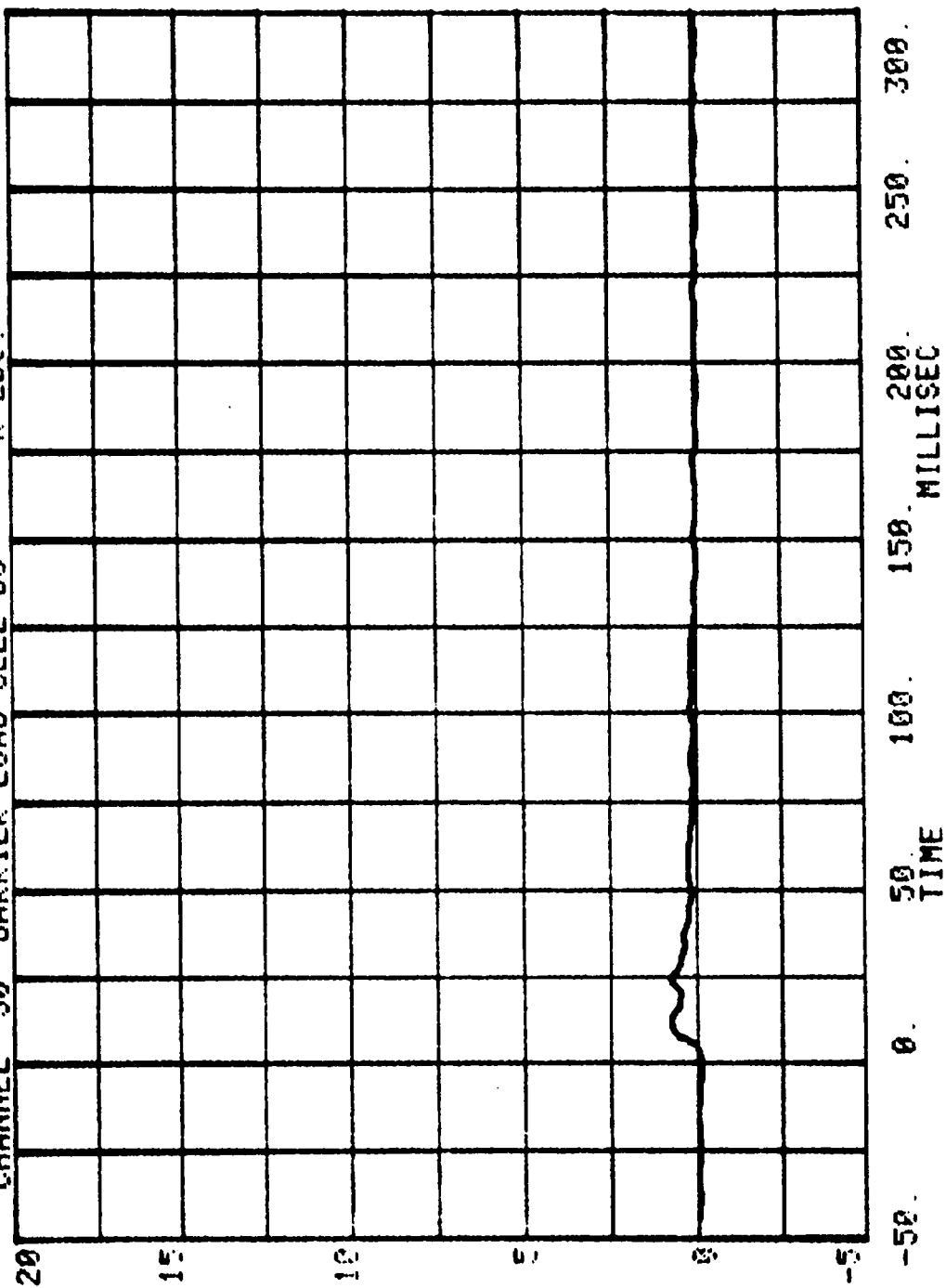




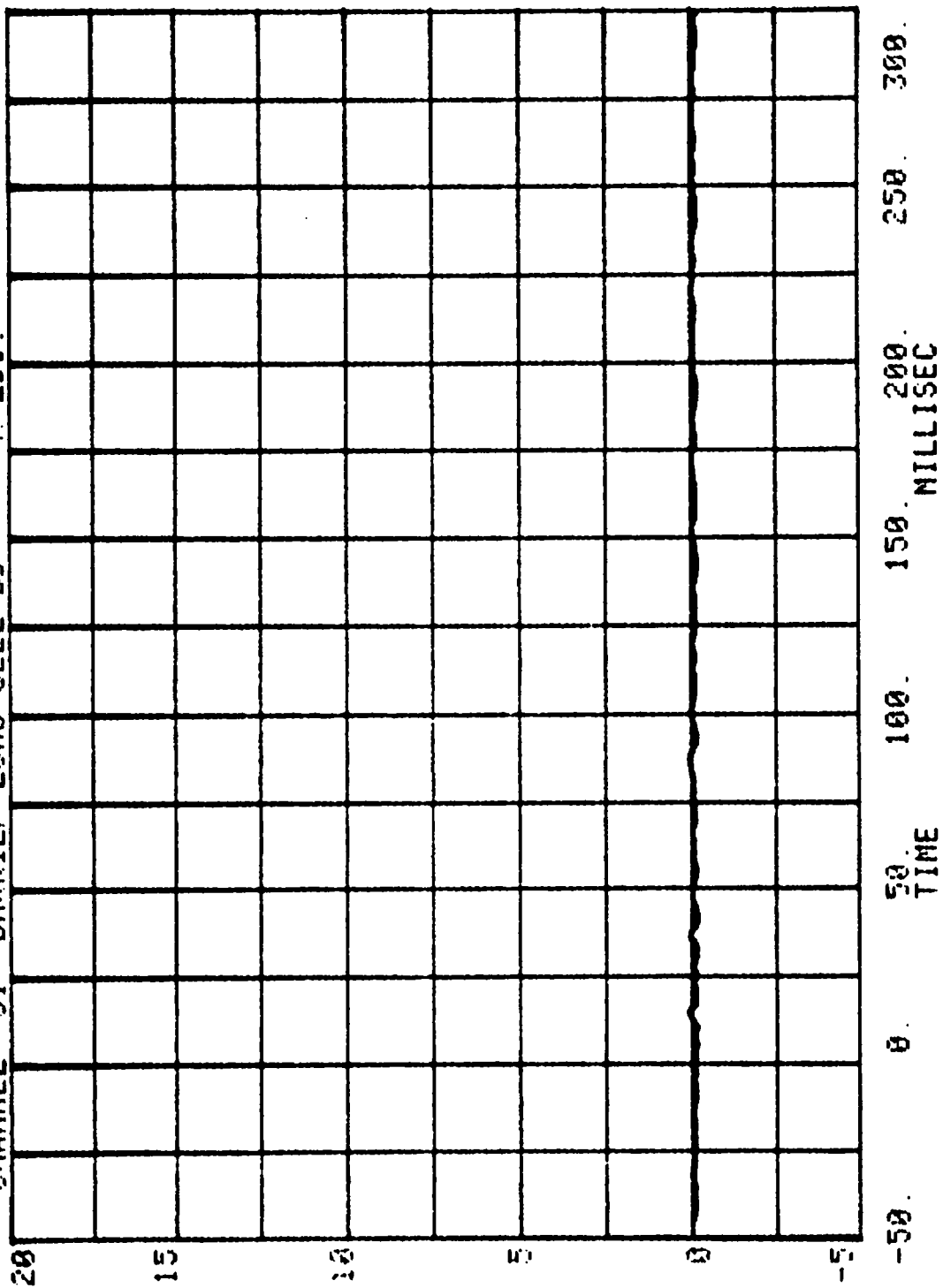
CHANNEL 49 RUN= 985 SERIES= 19 K LBS.
BARRIER LOAD CELL B7



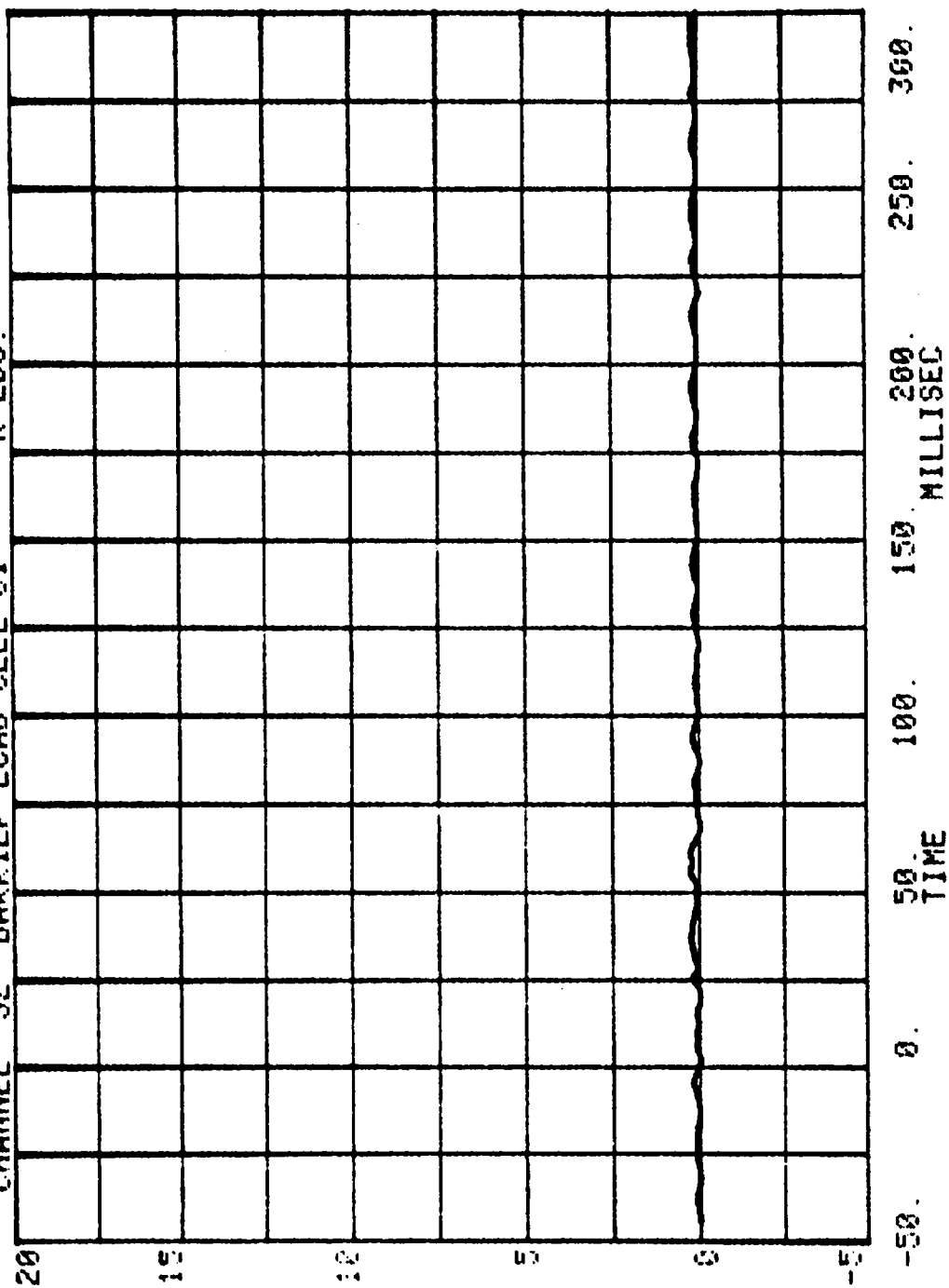
CHANNEL 50 BARRIER LOAD CELL B8
RUN= 985 SERIES= 19 K LBS.



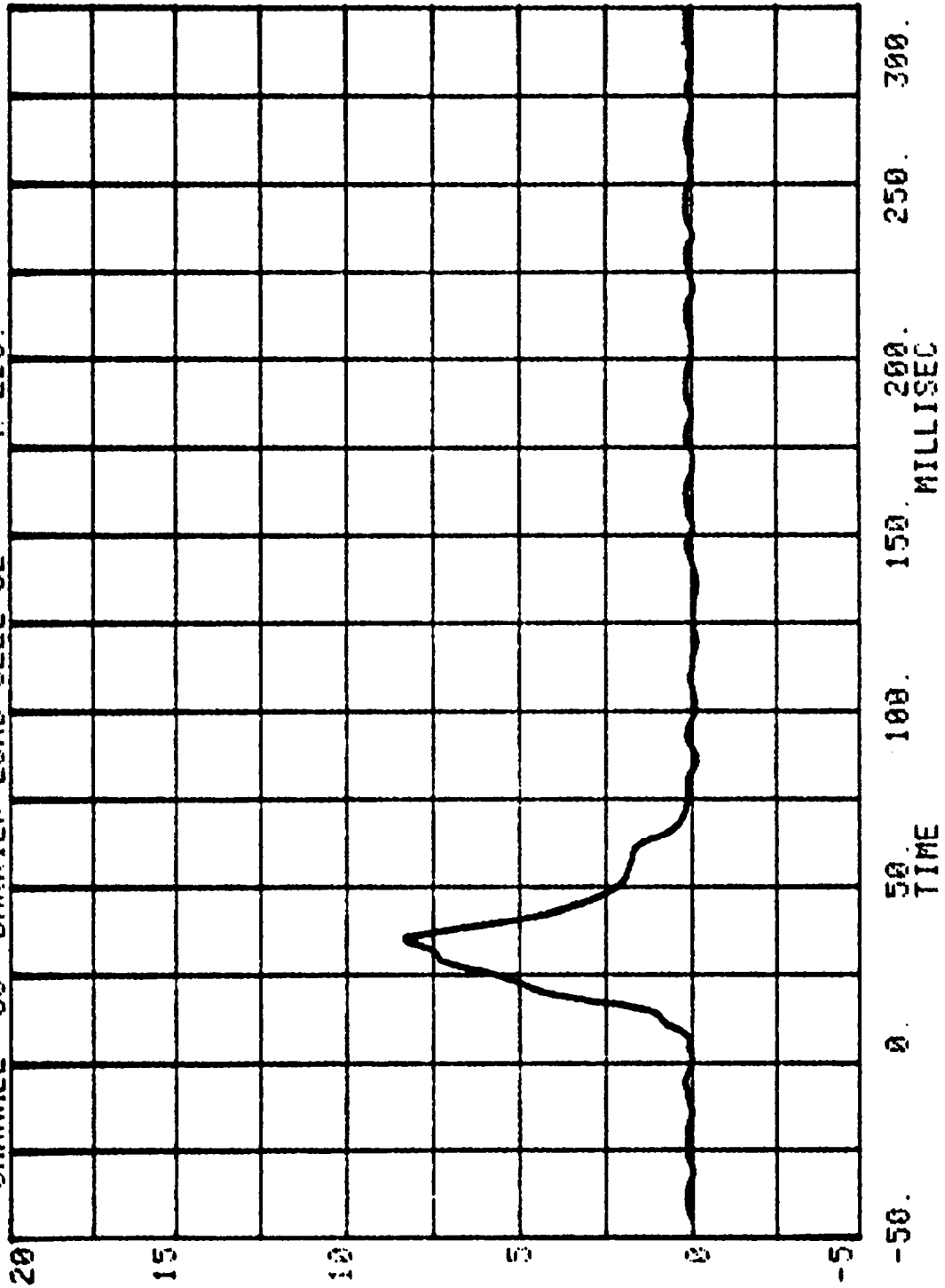
CHANNEL 51 BARRIER LOAD CELL B9 RUN= 385 SERIES= 19 K LBS.



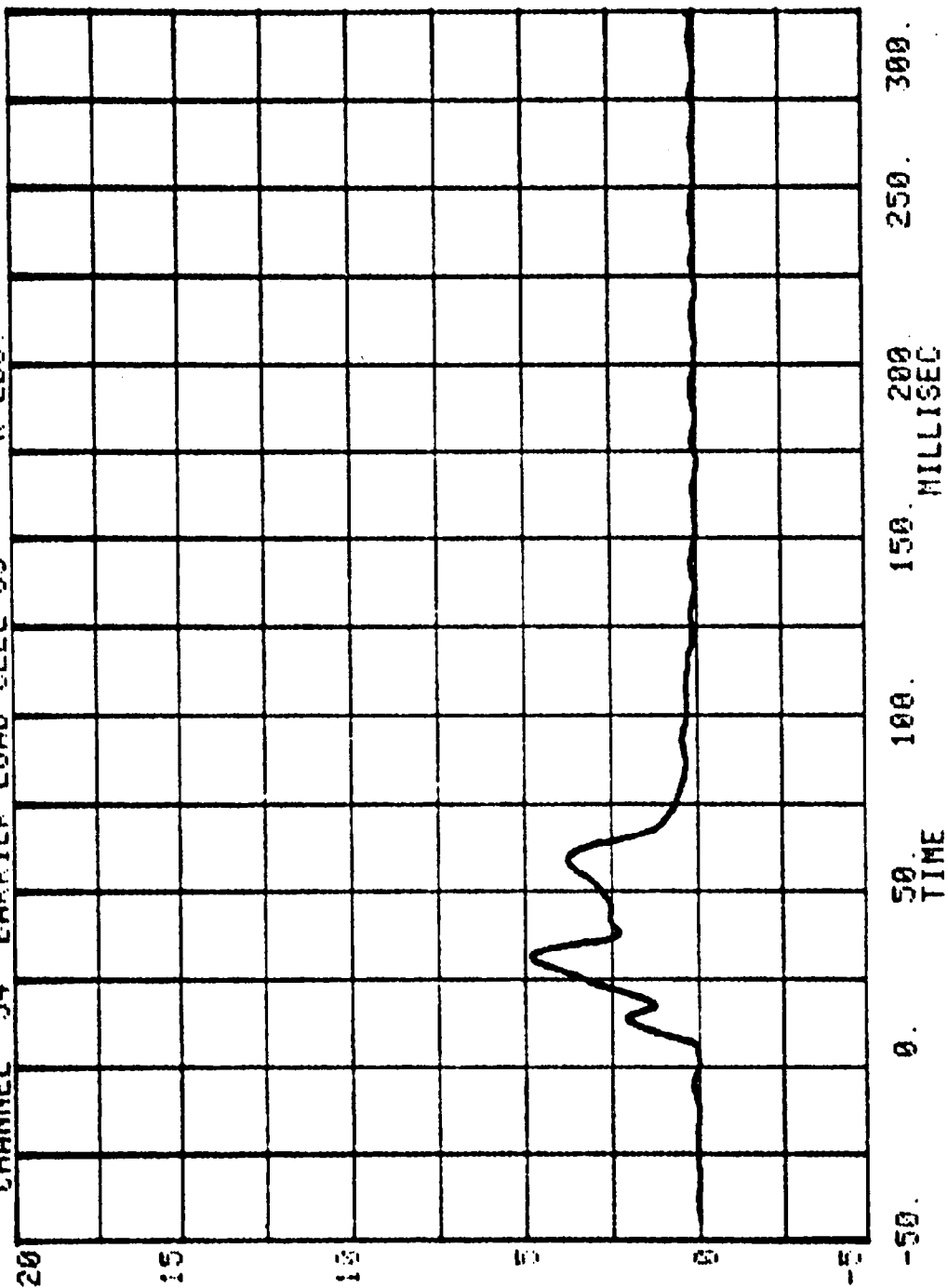
CHANNEL 52 BARRI EP LOAD CELL C1 RUN= 985 SERIES= 19 K LBS.



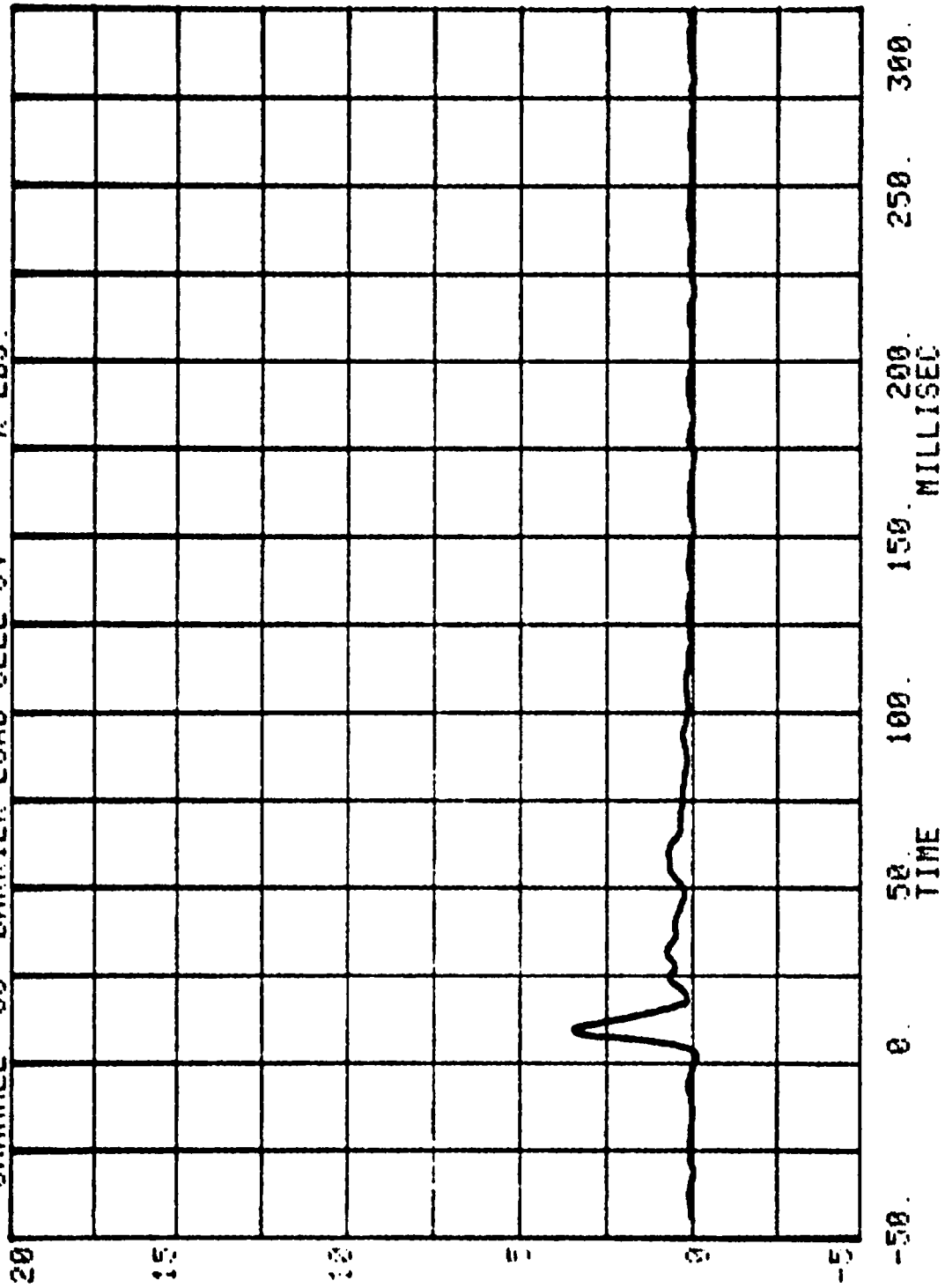
CHANNEL 53 BARRIER LOAD CELL C2 RUN= 985 SERIES= 19 K LBS.



CHANNEL 54 BARRIER LOAD CELL C3 RUN= 985 SERIES= 19 K LBS.



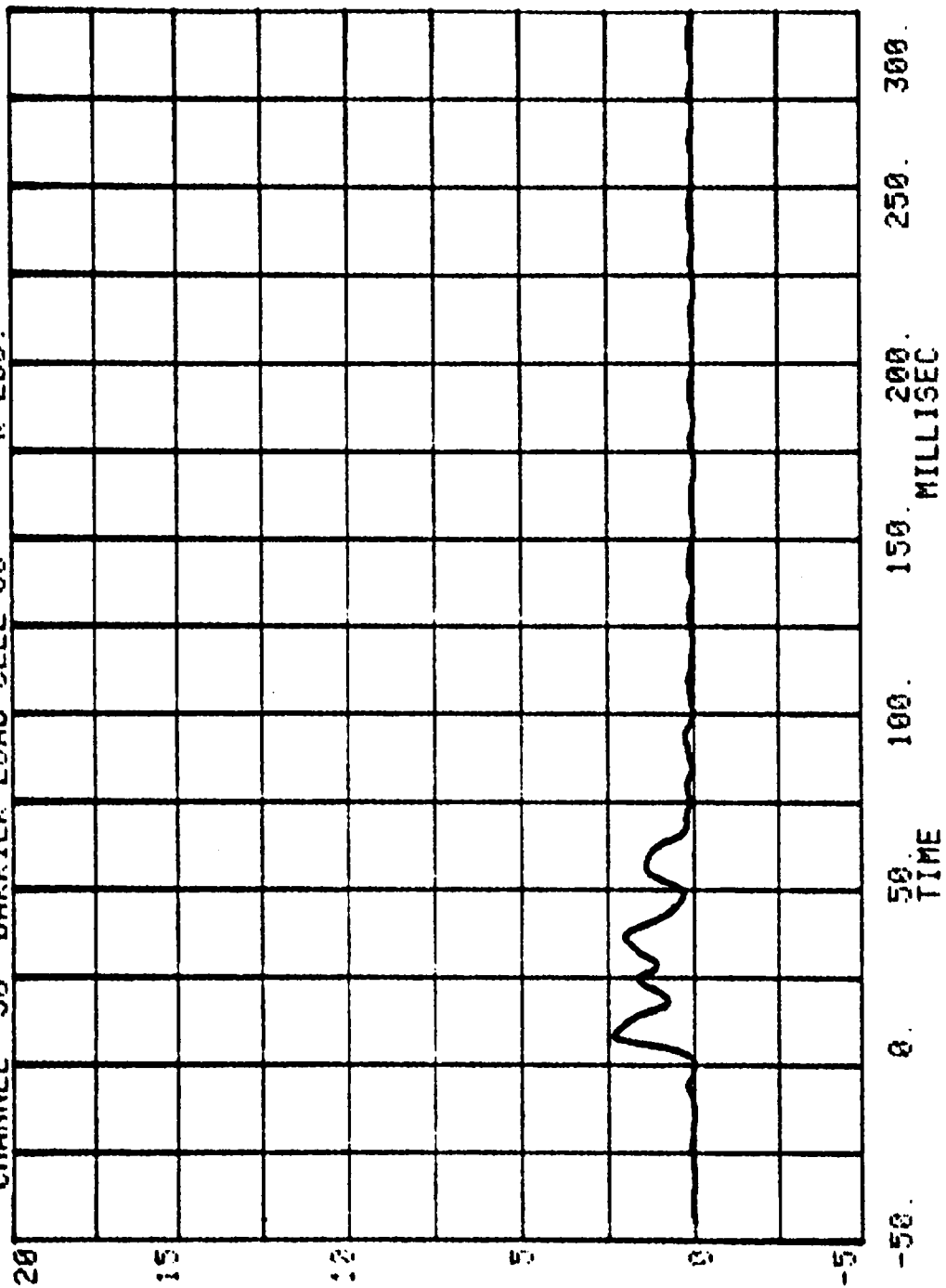
CHANNEL 55 RUN= 985 SERIES= 19 K LBS.
BARRIER LOAD CELL C4



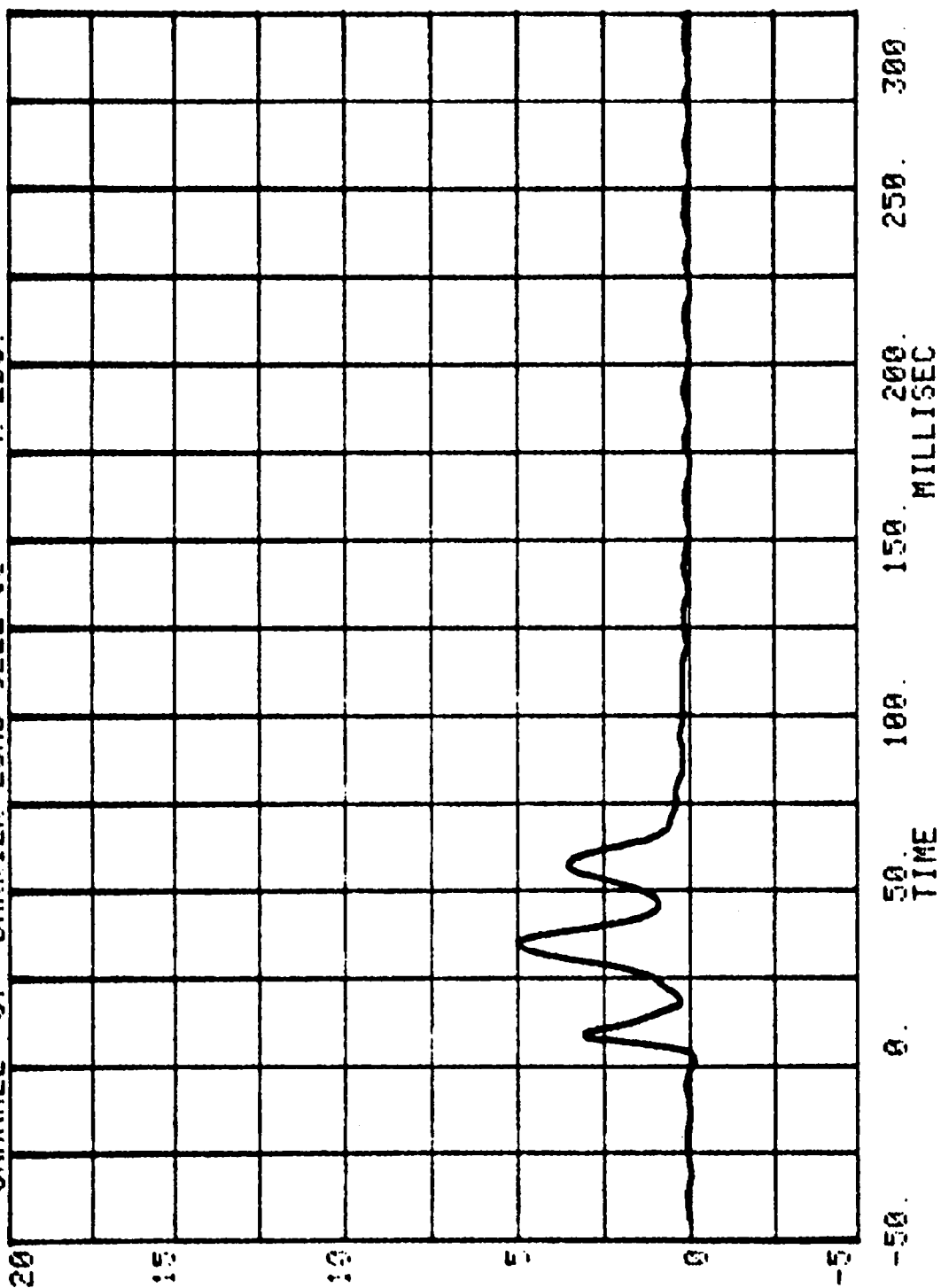
CHANNEL 56 BARRIER LOAD CELL C5

RUN= 985 SERIES= 19

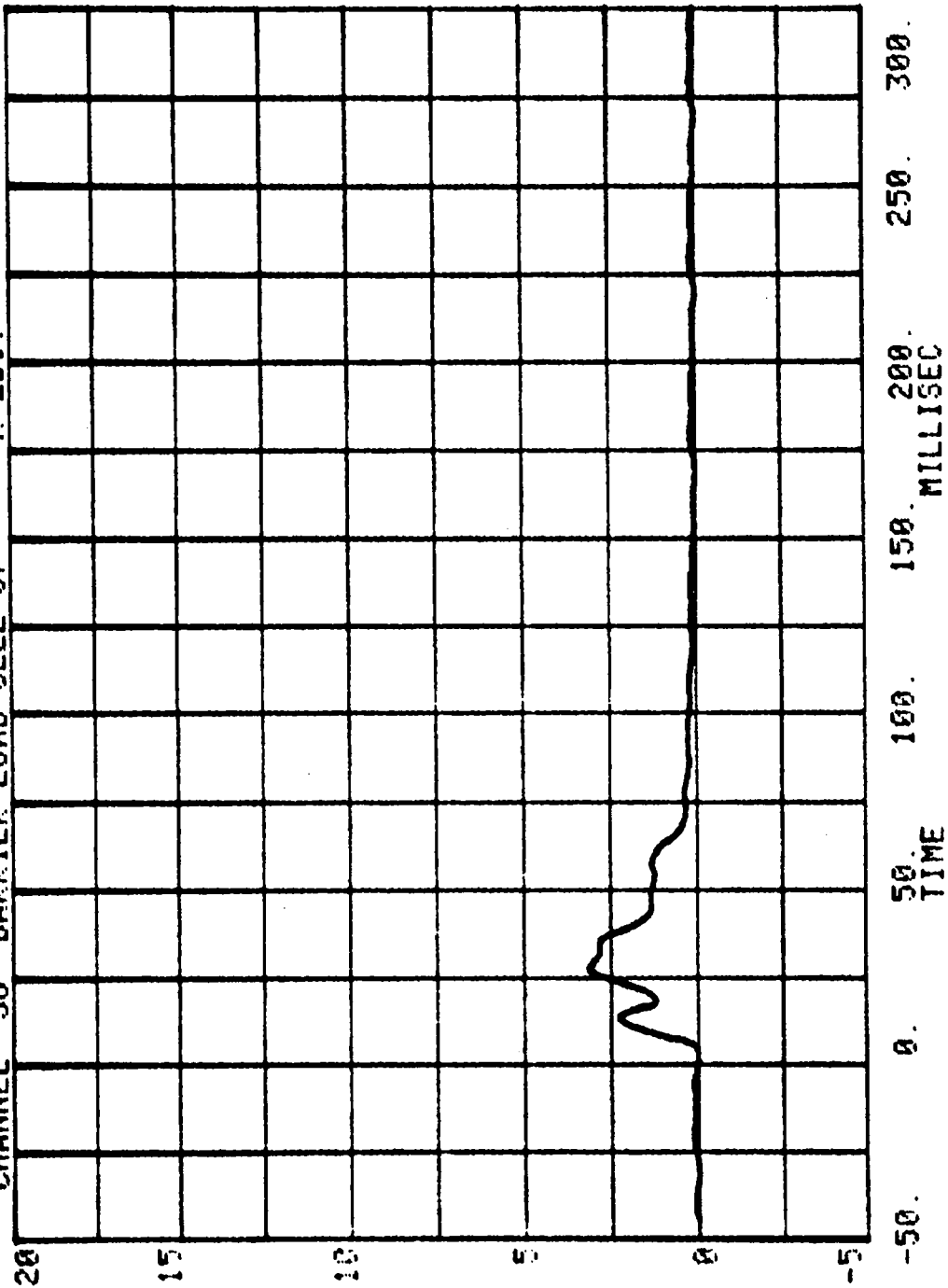
K LBS.



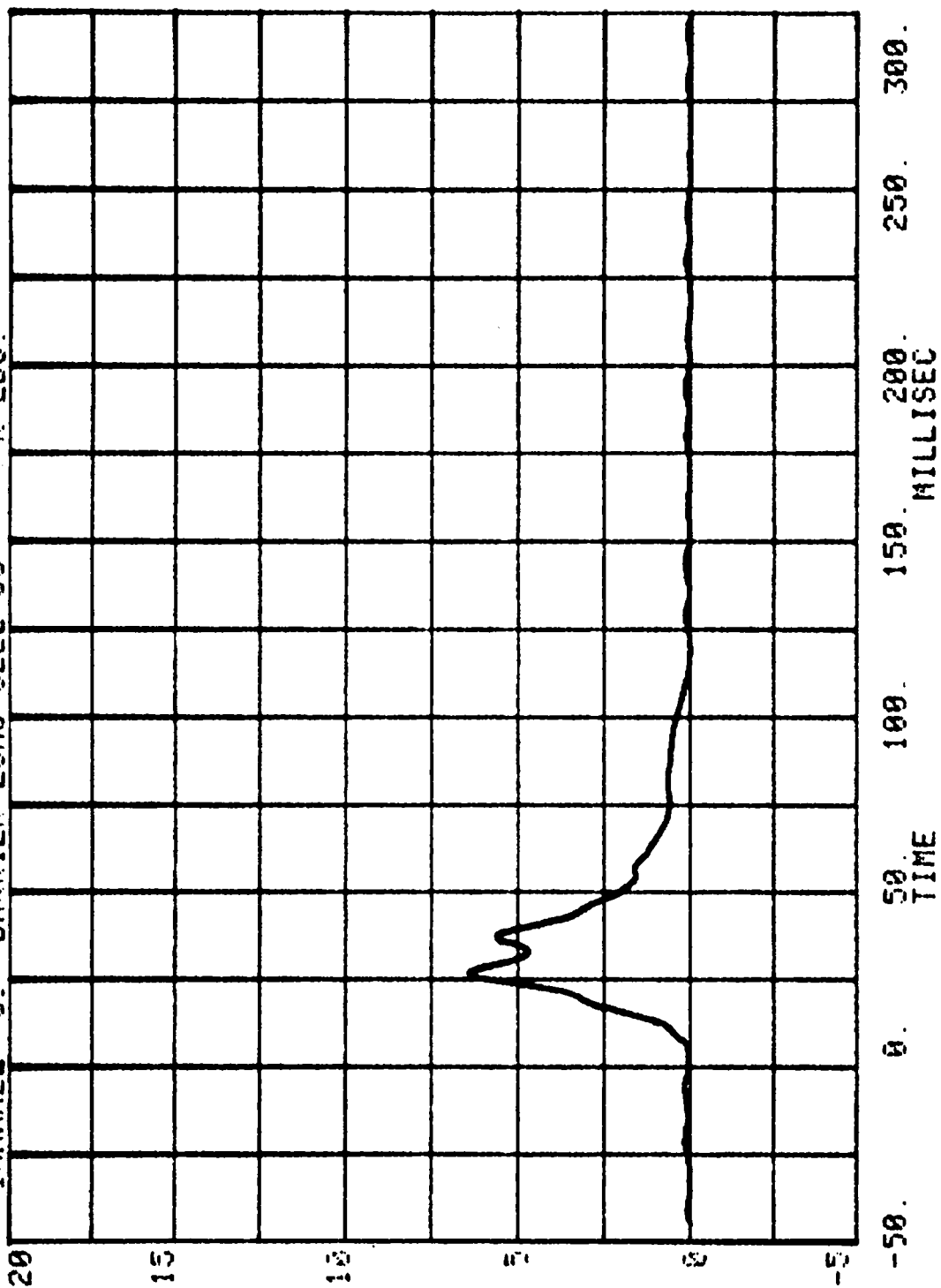
RUN= 985 SERIES= 19 K LBS.
CHANNEL 57 BARRIER LOAD CELL C6



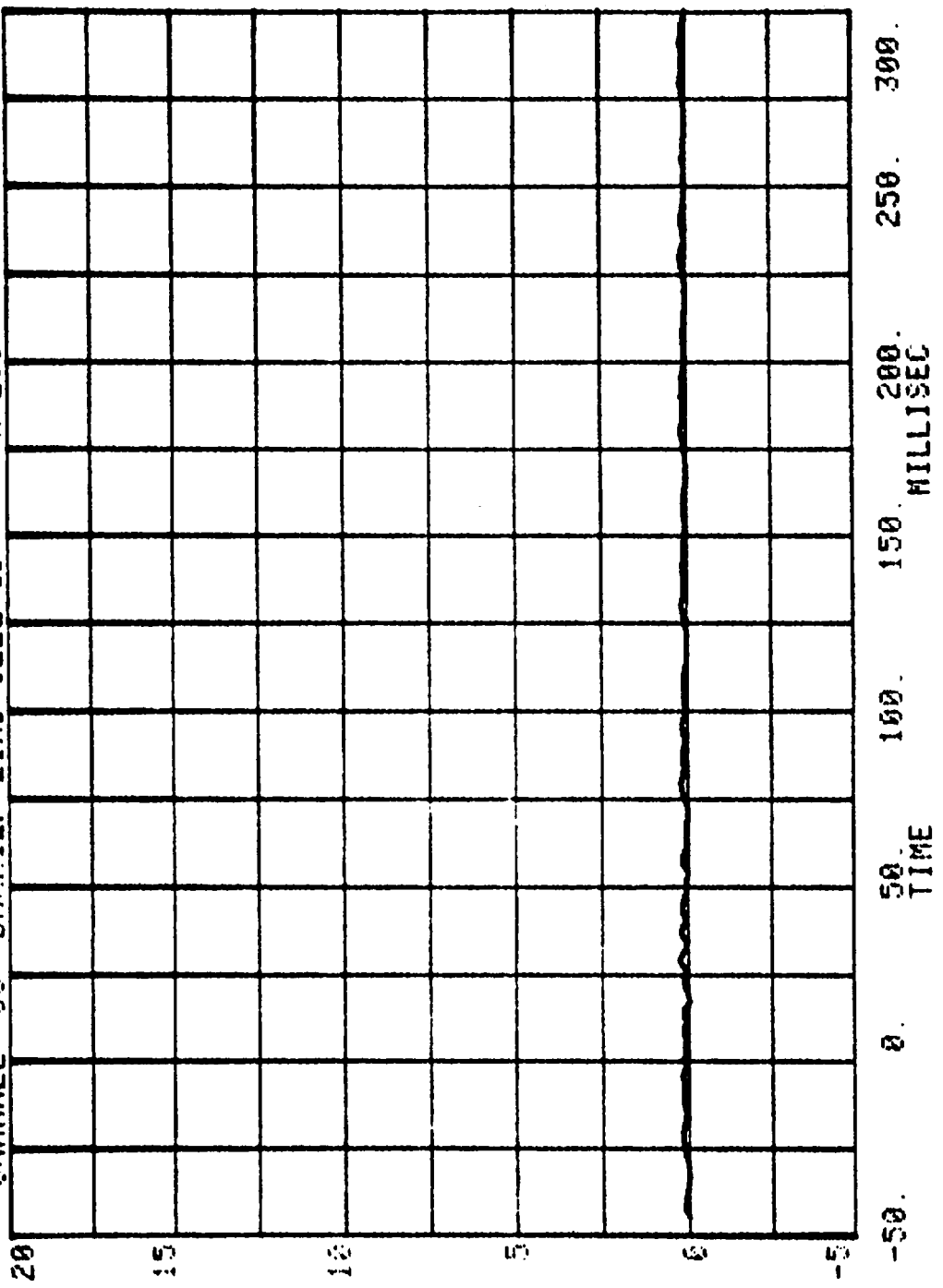
CHANNEL 58 BARRIER LOAD CELL C7 RUN= 985 SERIES= 19 K LBS.



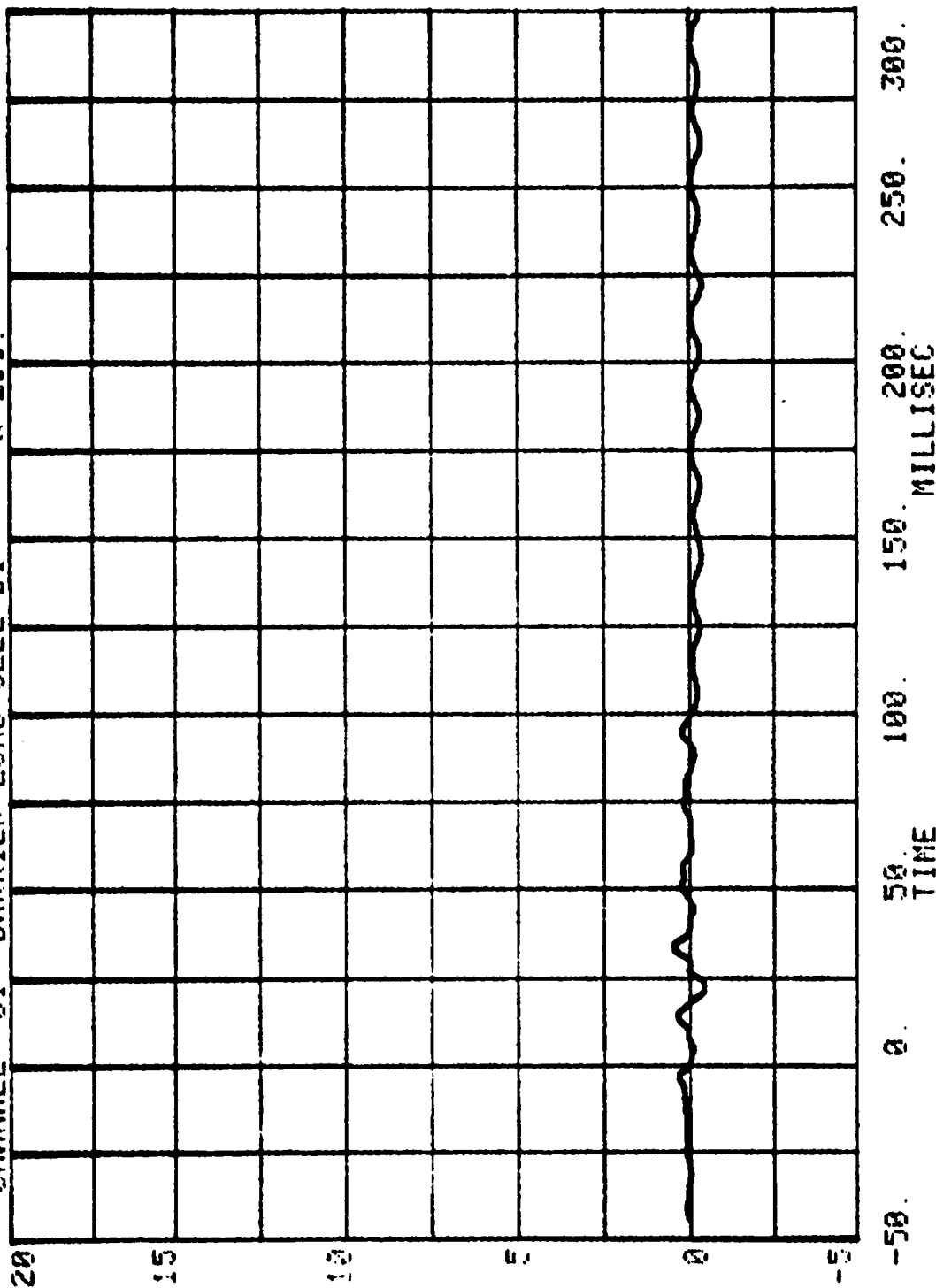
CHANNEL 53 BARRIER LOAD CELL C8
RUN= 985 SERIES= 19 K LBS.



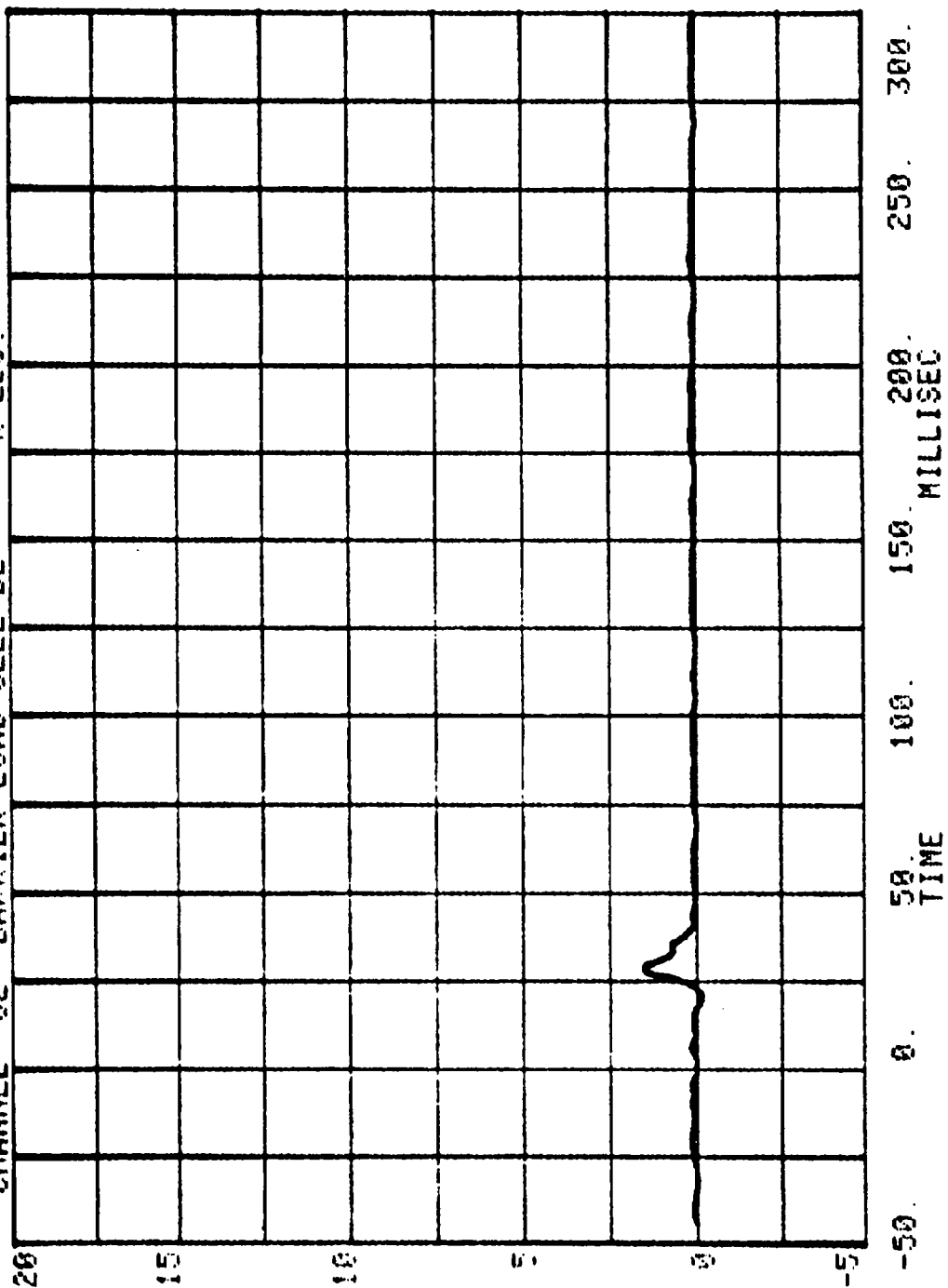
CHANNEL 60 BARRIER LOAD CELL C9 RUN= 985 SERIES= 19 K LBS.



CHANNEL 61 BARRIER LOAD CELL D1 RUN= 985 SERIES= 19 K LBS.

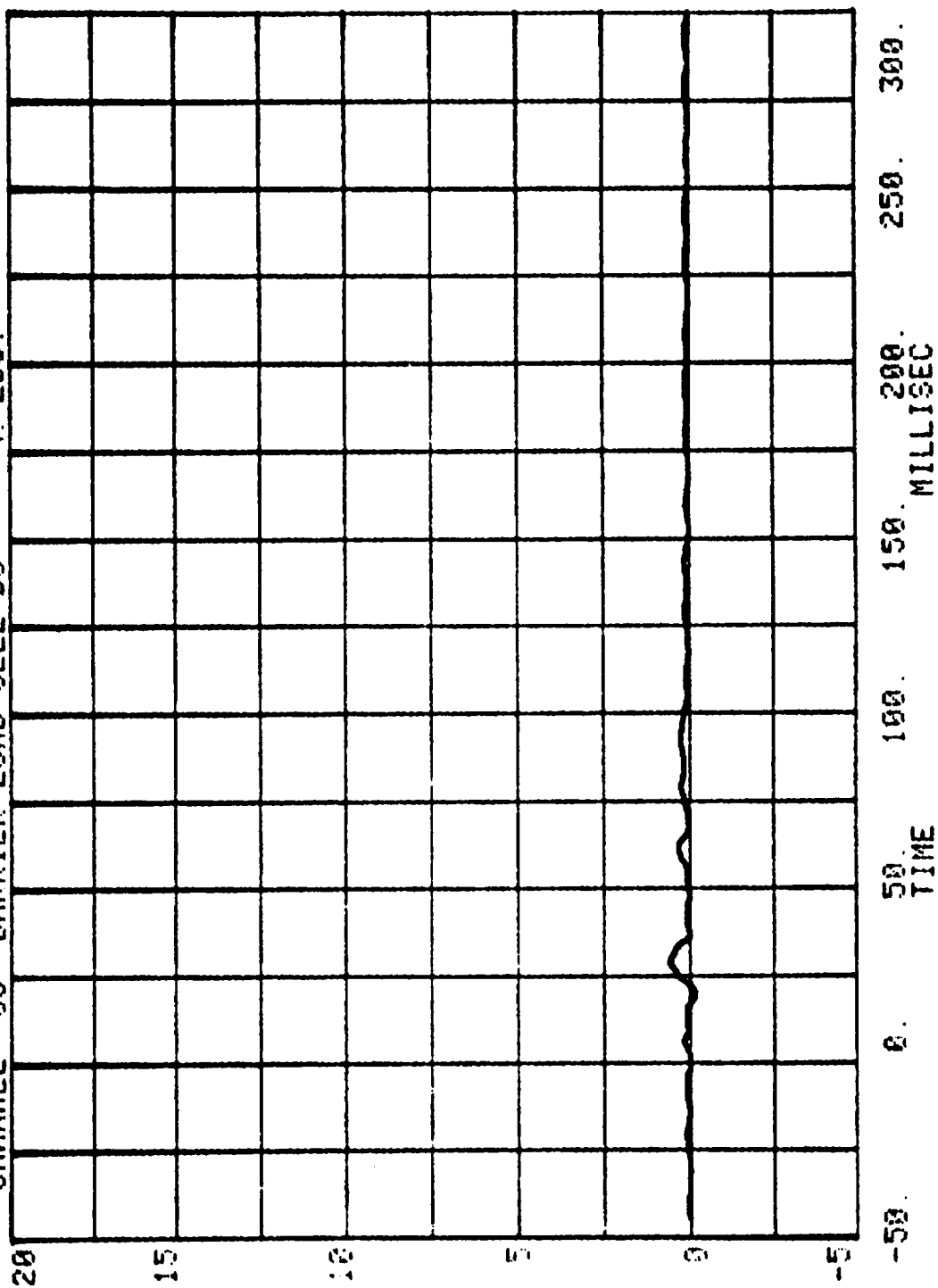


CHANNEL 62 BARRIER LOAD CELL D2 RUN= 985 SERIES= 19 K LBS.



CHANNEL 63 BARRIER LOAD CELL D3 19 K LBS.

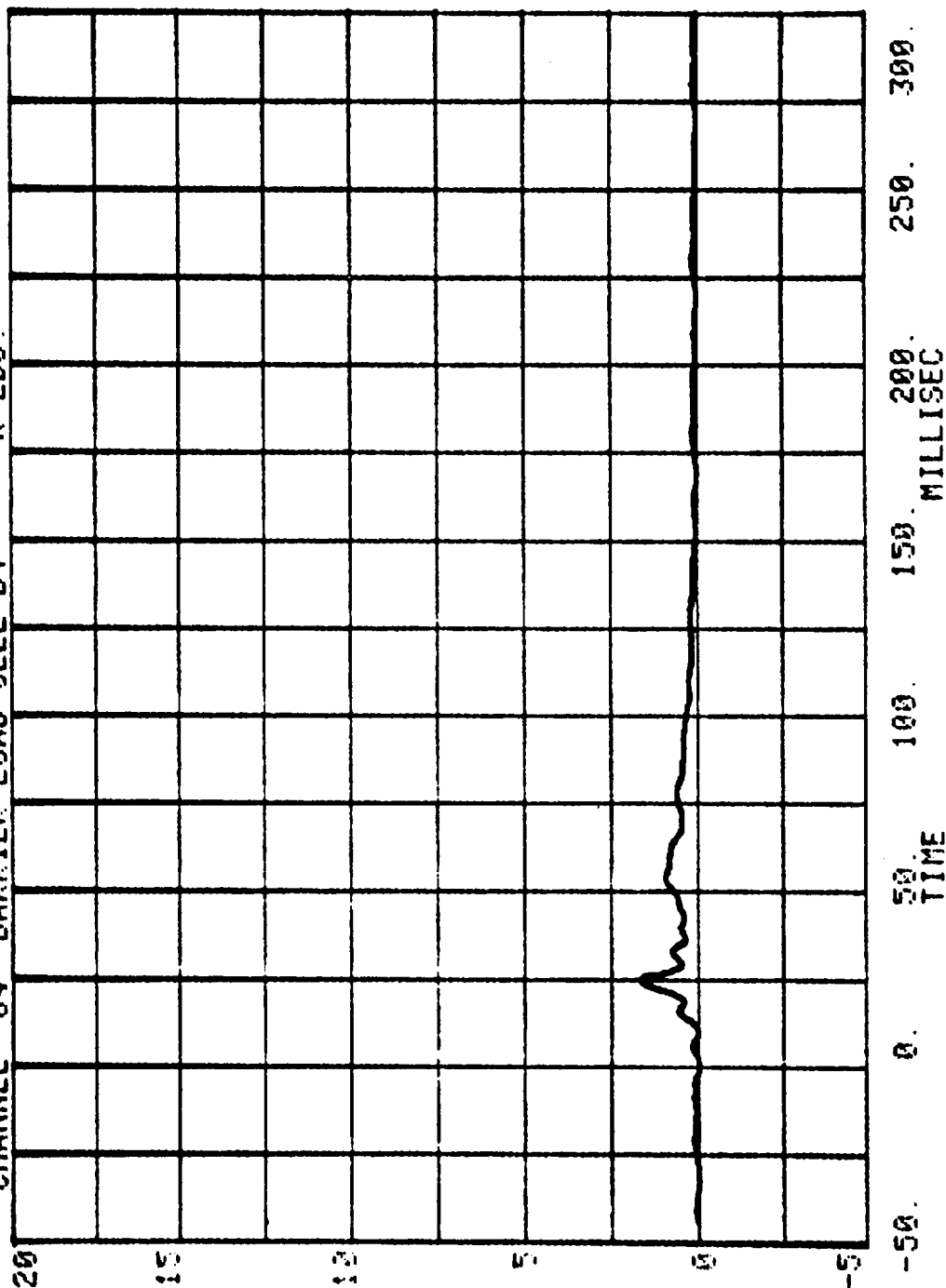
RUN= 985 SERIES=



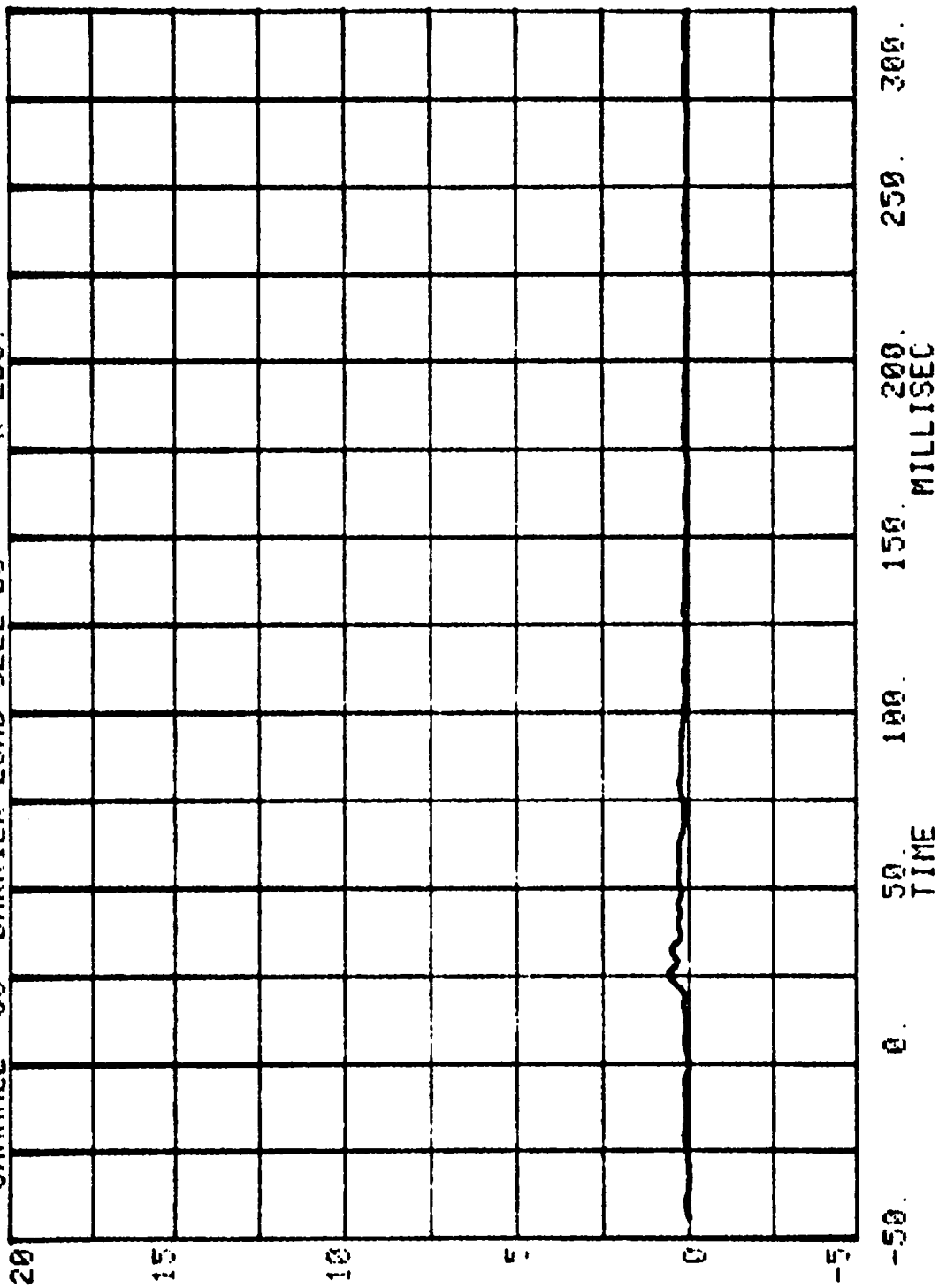
CHANNEL 64 BARRIER LOAD CELL D4

RUN= 985 SERIES= 13

K LBS.

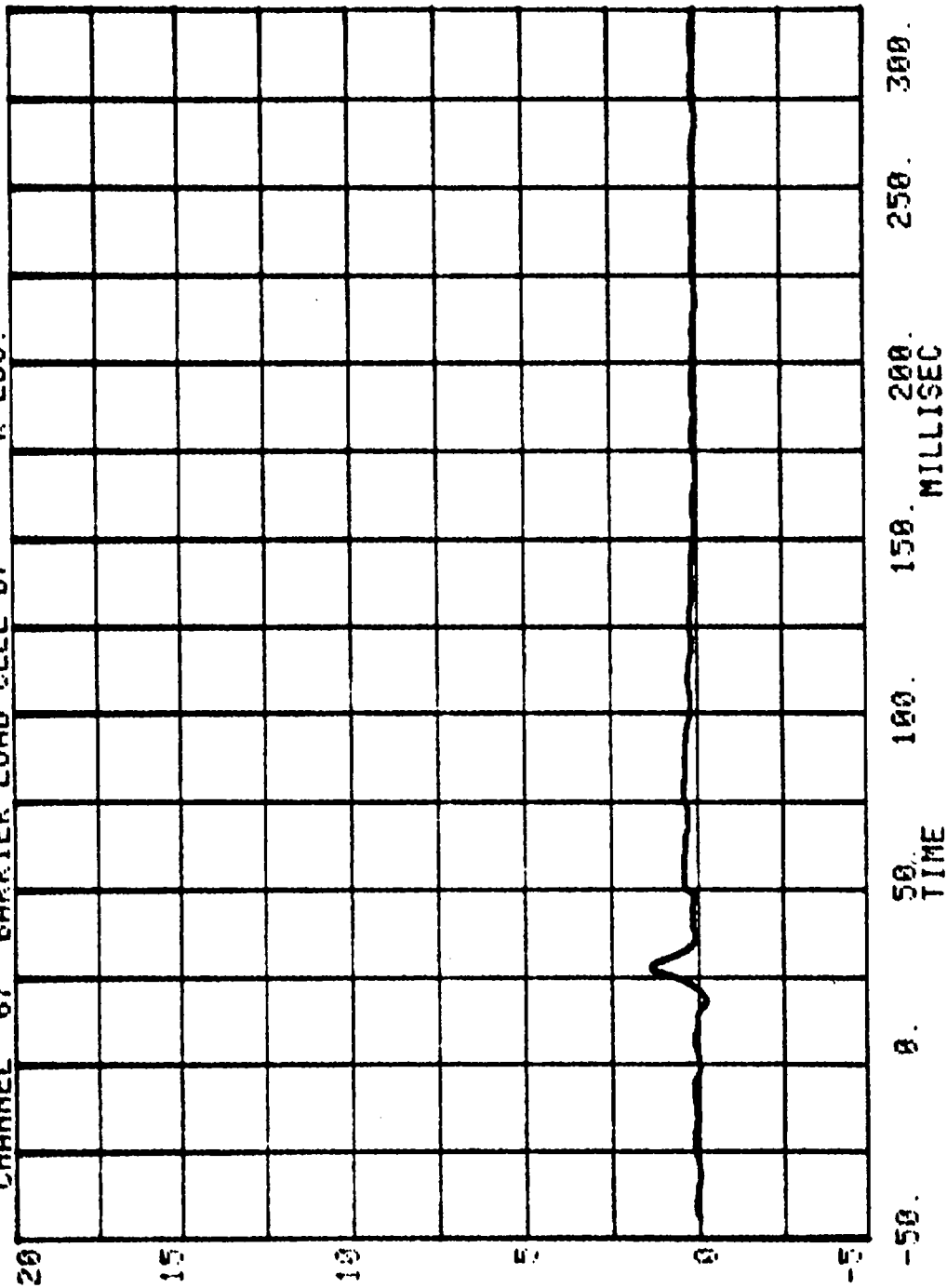


CHANNEL 66 BARRIER LOAD CELL 06 RUN= 985 SERIES= 19 K LBS.

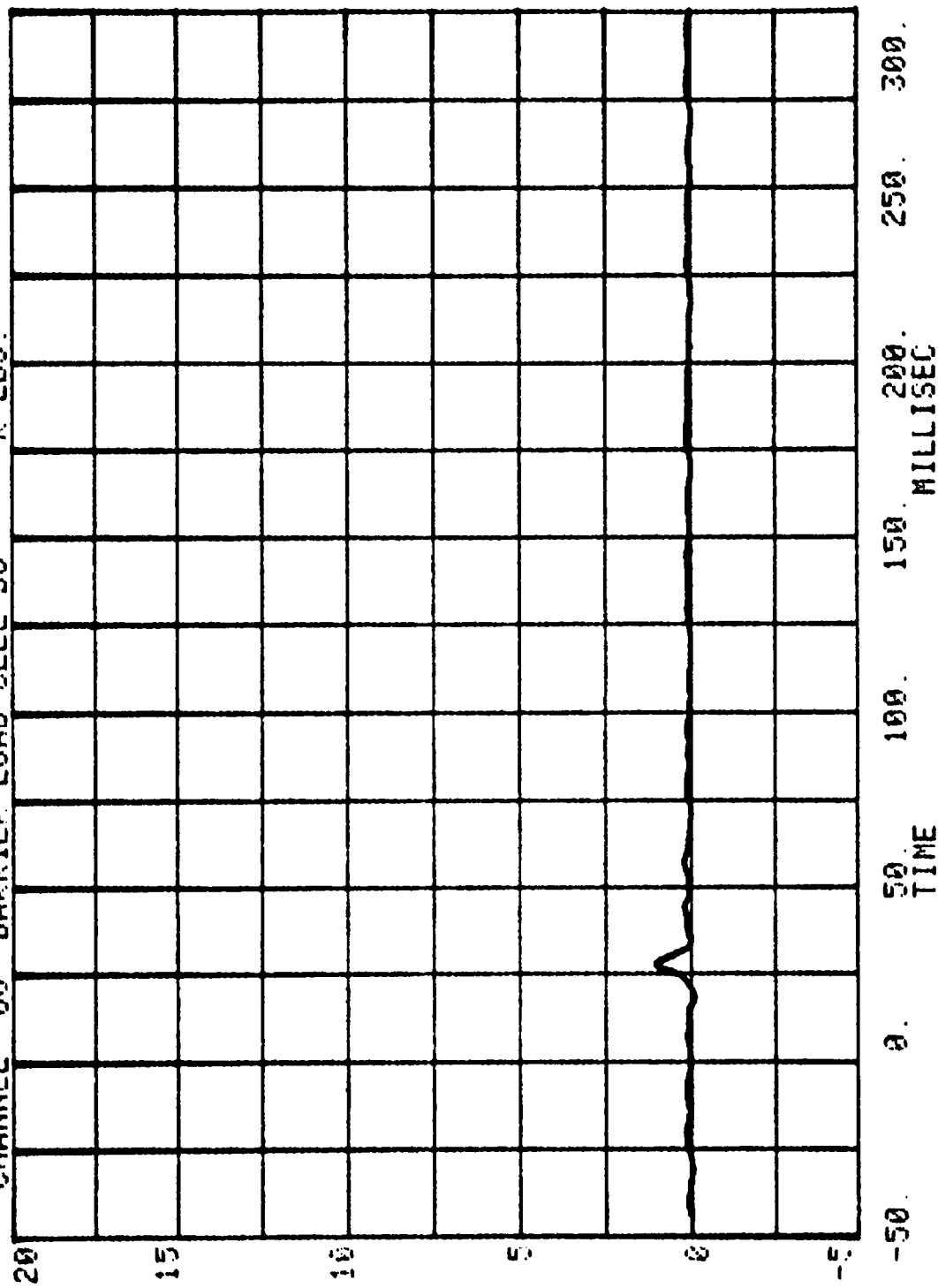


CHANNEL 67 BARRIER LOAD CELL 07 K LBS.

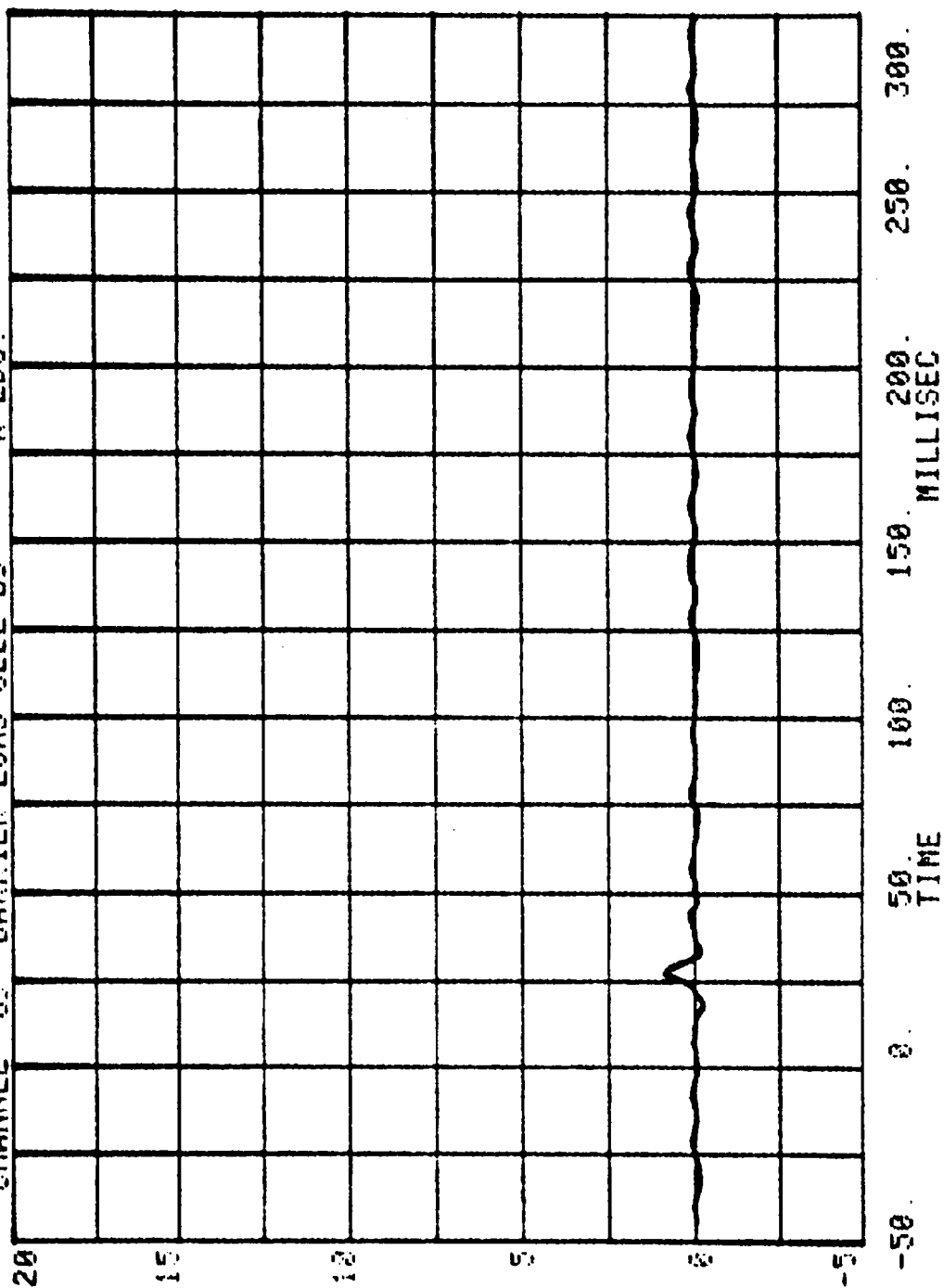
RUN= 985 SERIES= 19



CHANNEL 63 BARRIEP LOAD CELL D8 RUN= 985 SERIES= 19 K LBS.



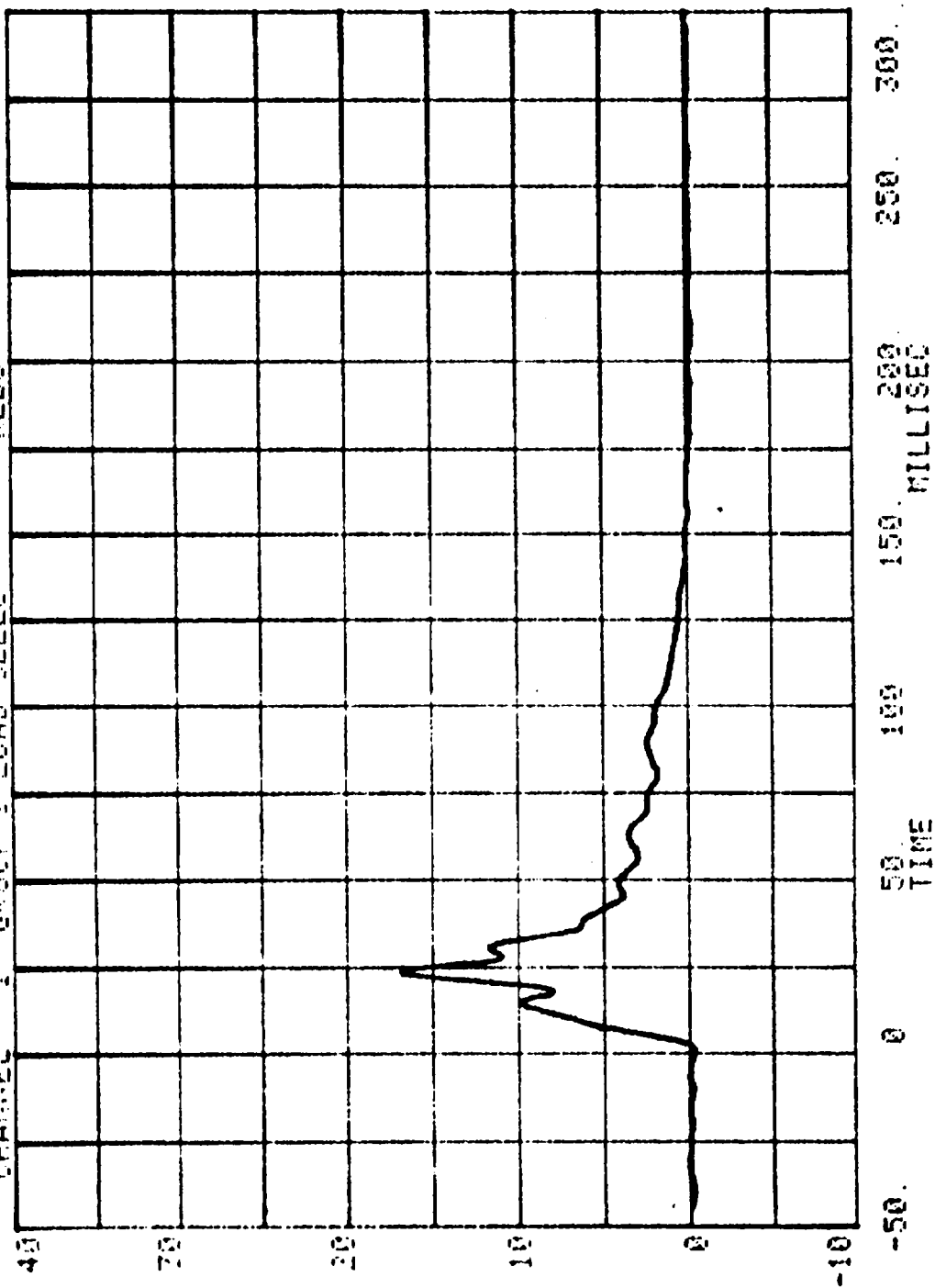
CHANNEL 62 BARRIER LOAD CELL D9 RUN= 985 SERIES= 19 K LBS.



NCAP TEST #19

FUN # 985		SERIES # 13			
CHAN	TITLE	MINIMUM/MAXIMUM	AT	TIME	
1	GROUP 1 LOAD CELLS	- 261 KLBs 16.925 KLBs		82 MS. 27.77 MS.	
2	GROUP 2 LOAD CELLS	- 739 KLBs 50.995 KLBs		-4.12 MS. 34.95 MS.	
3	GROUP 3 LOAD CELLS	- 457 KLBs 19.111 KLBs		242.10 MS. 34.42 MS.	
4	GROUP 4 LOAD CELLS	- 433 KLBs 14.124 KLBs		221.02 MS. 32.70 MS.	
5	GROUP 5 LOAD CELLS	- 167 KLBs 9.204 KLBs		1.35 MS. 2.15 MS.	
6	GROUP 6 LOAD CELLS	- 123 KLBs 12.918 KLBs		218.47 MS. 27.67 MS.	
7	TOTAL LOAD CELL SUM	- 293 KLBs 108.556 KLBs		221.47 MS. 33.60 MS.	

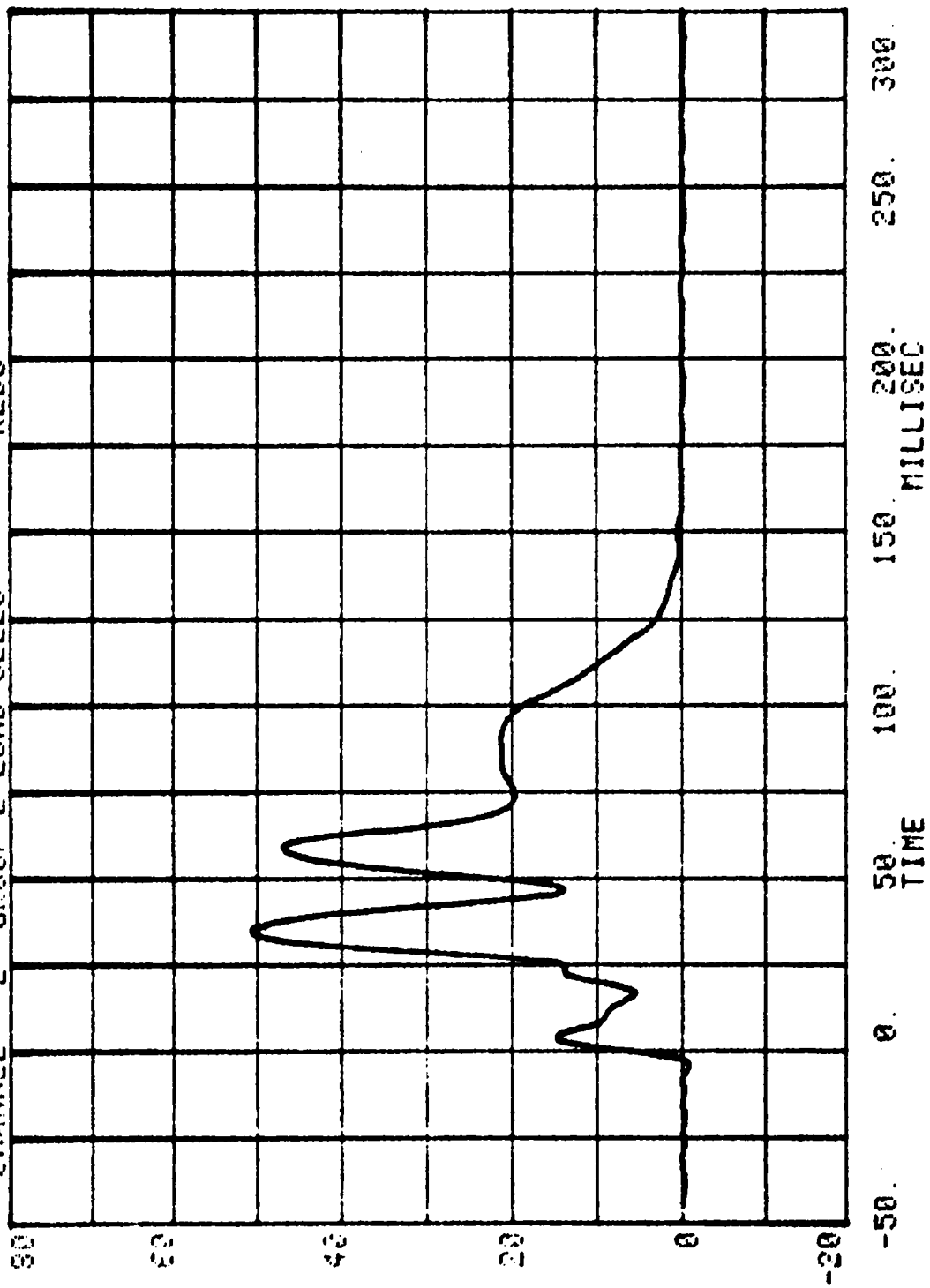
CHANNEL 1 GROUP 1 LOAD CELLS
RUN= 995 SERIES= 19
MLBS

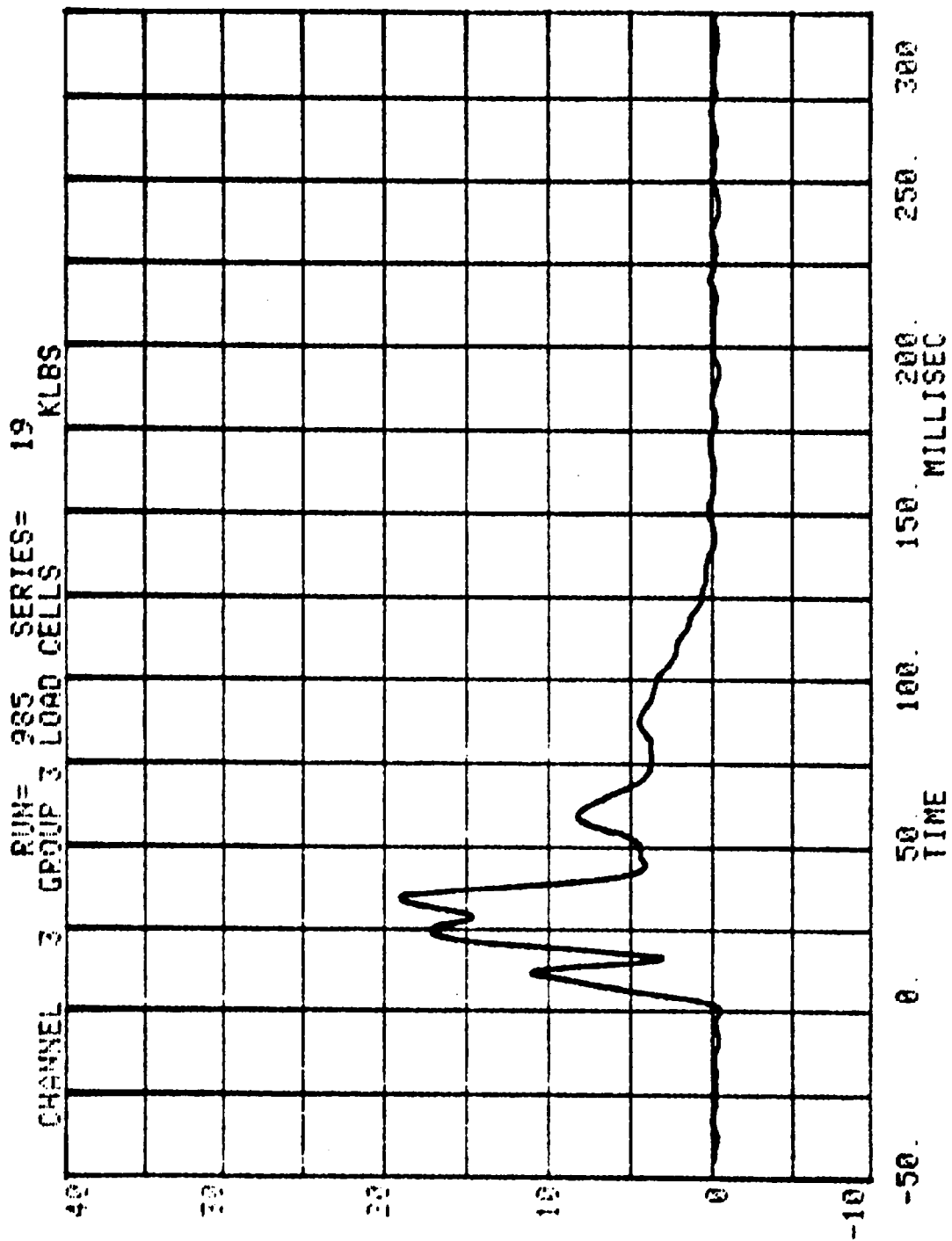


CHANNEL 2 GROUP 2 LOAD CELLS

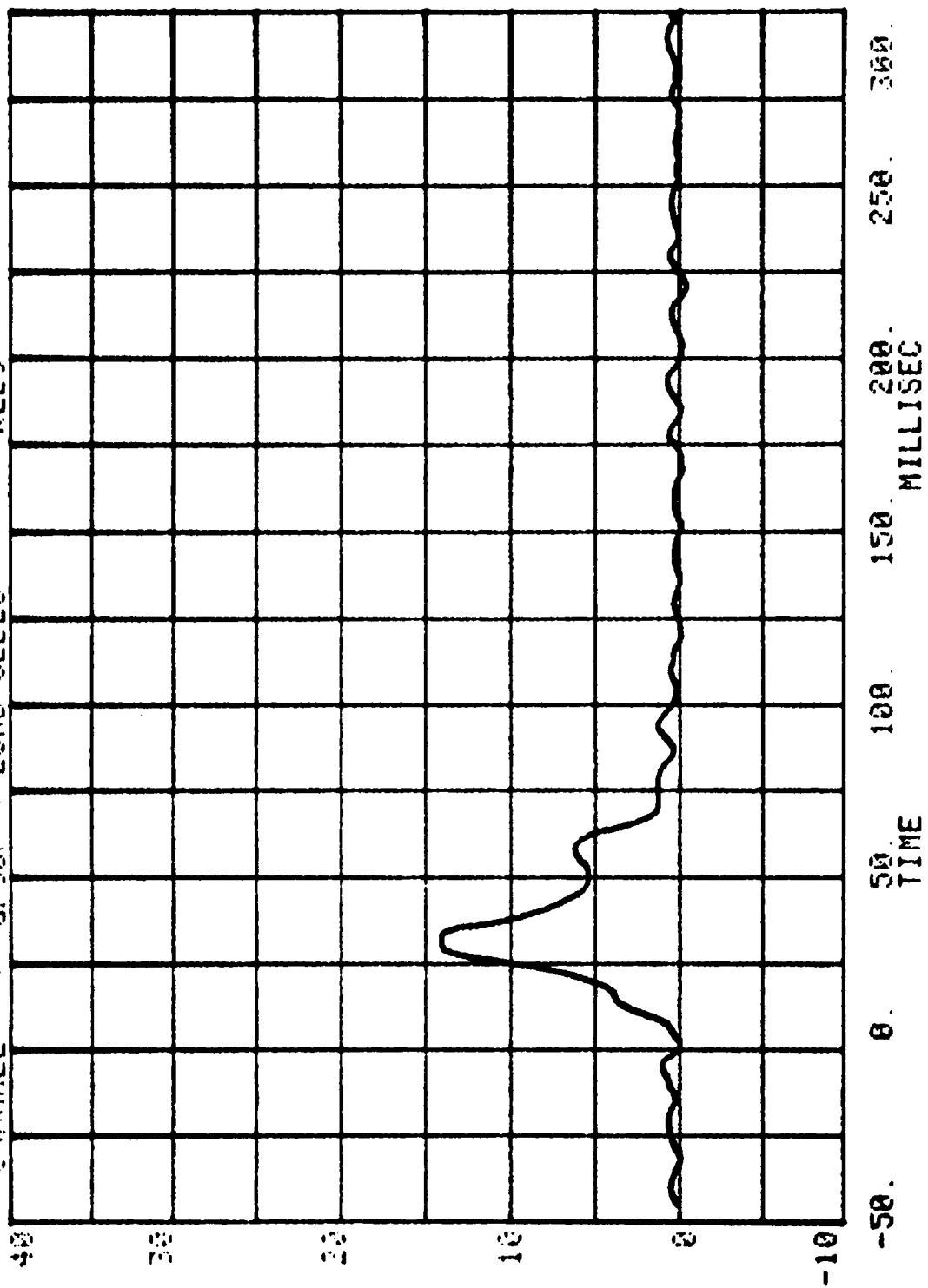
RUN= 985 SERIES= 19

KLBS

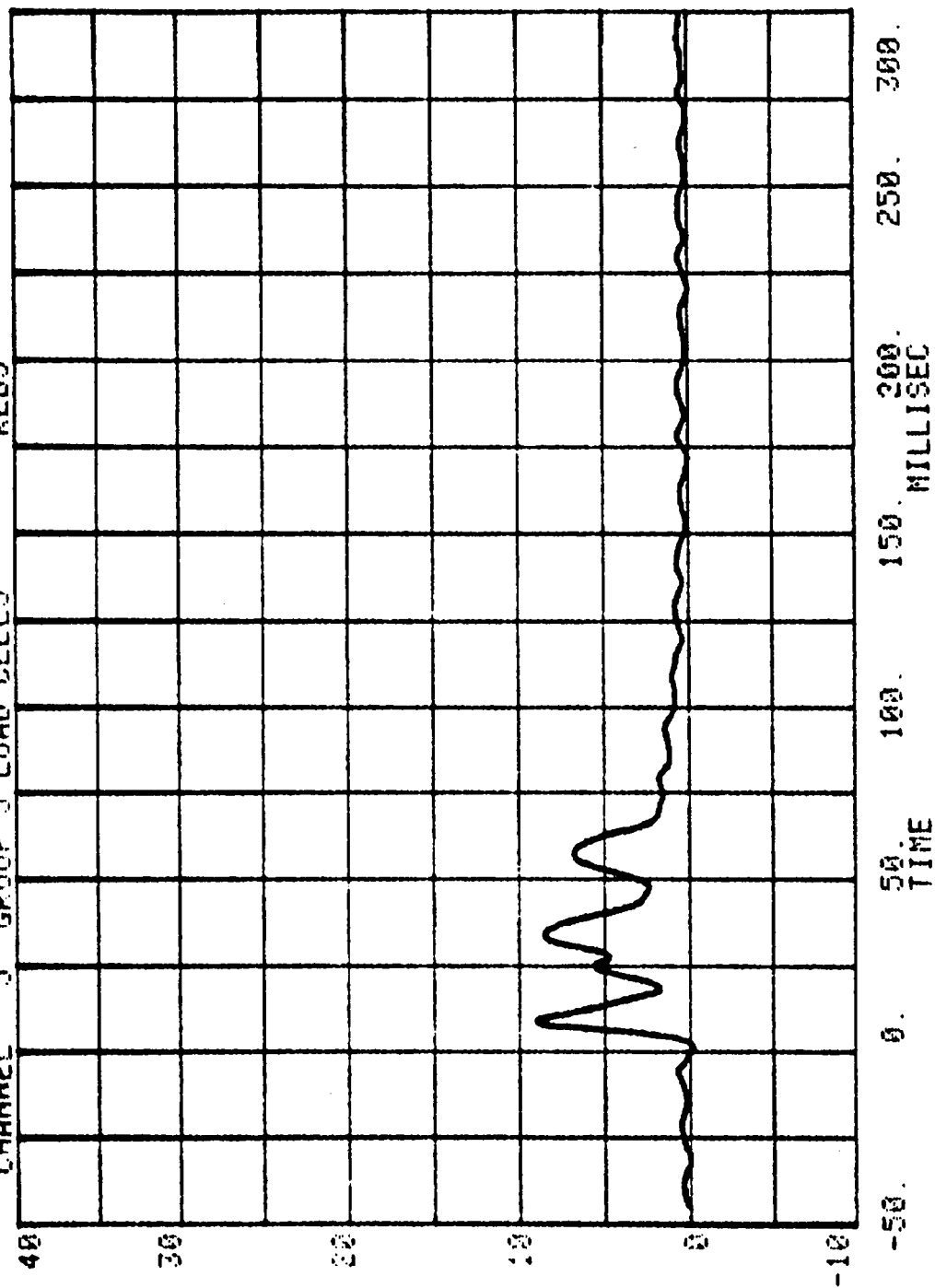




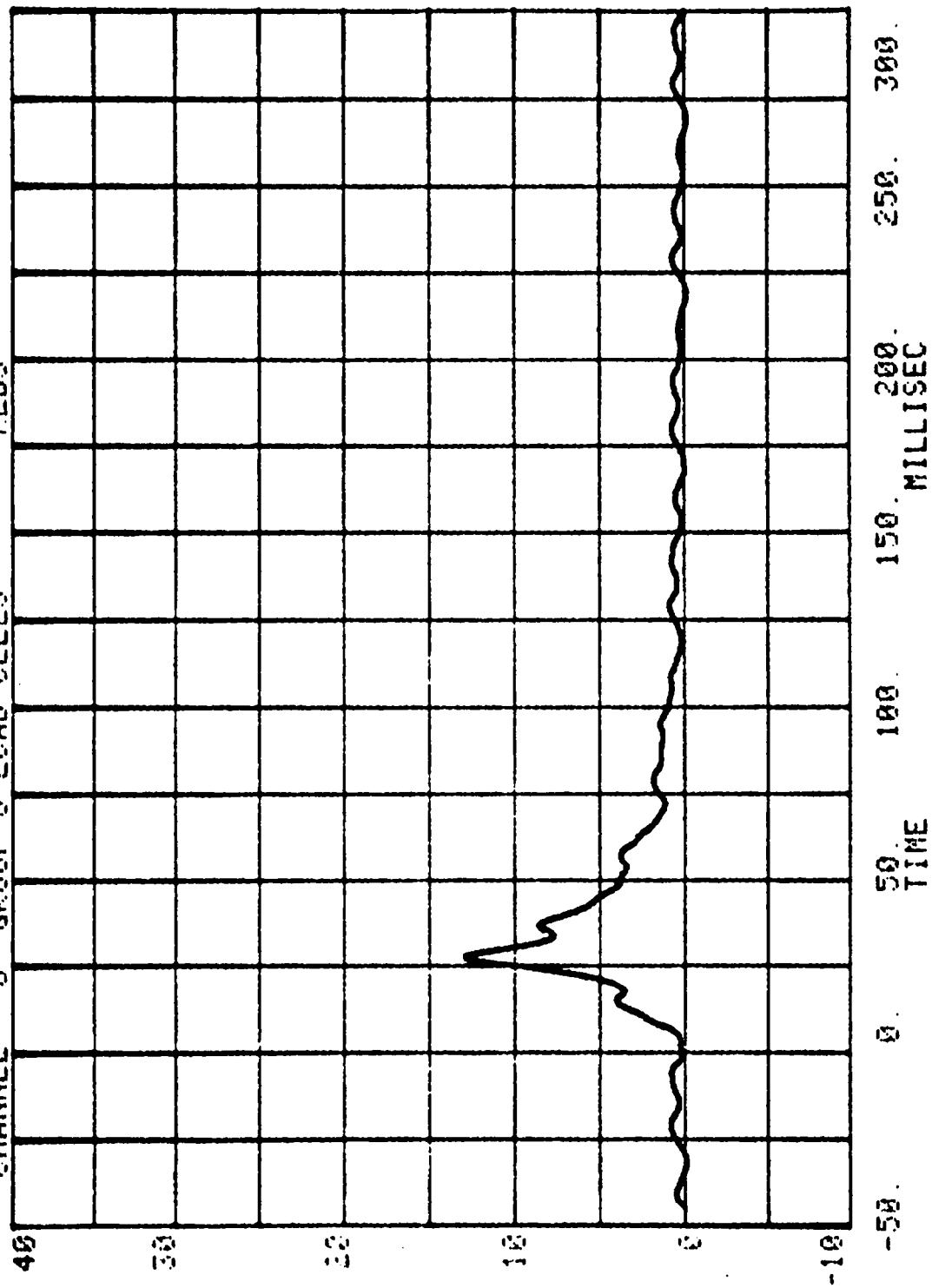
CHANNEL 4 GROUP 4 LOAD CELLS RUN= 985 SERIES= 19 KLS



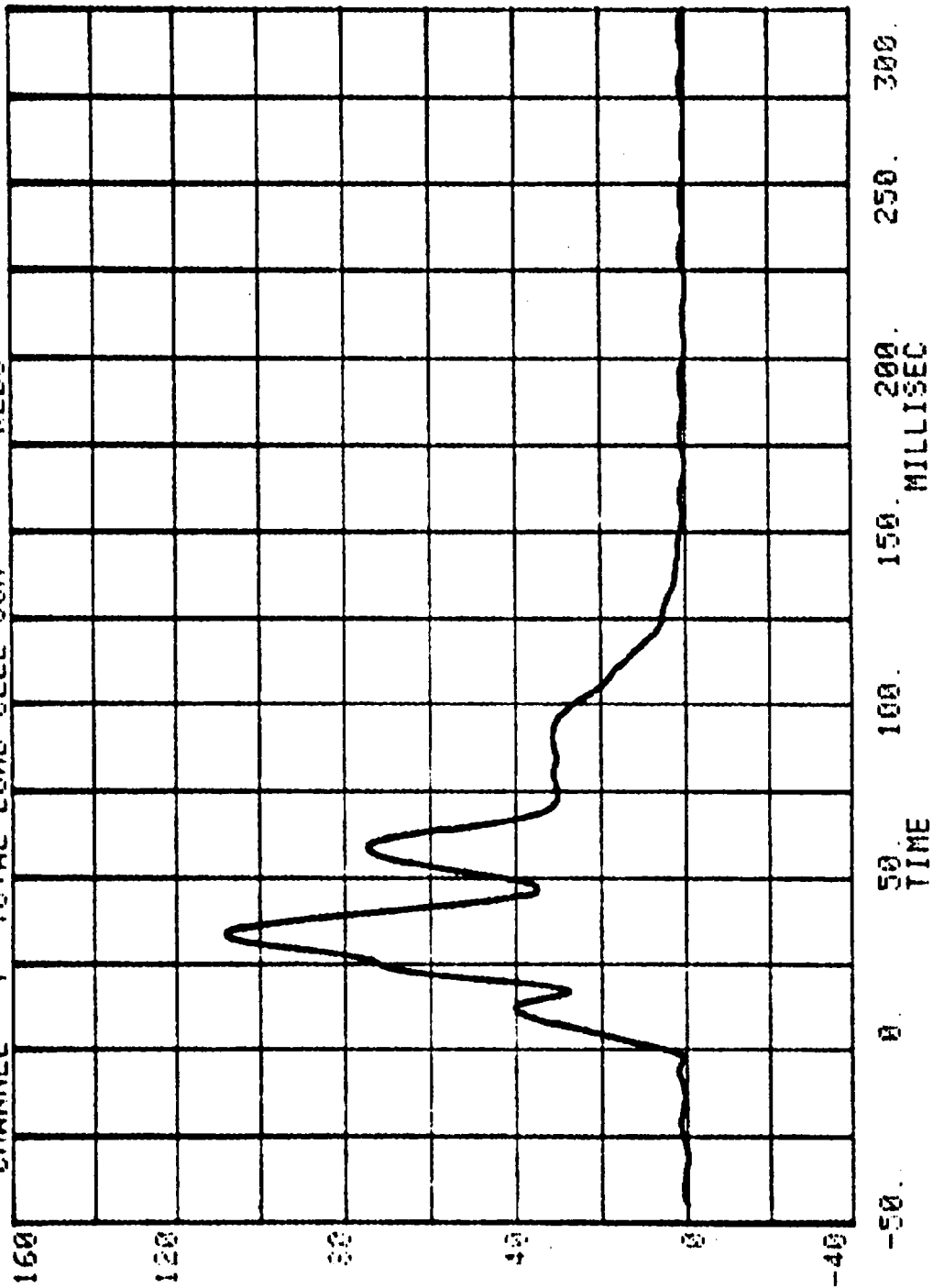
RUN= 985 SERIES= 19
CHANNEL 5 GROUP 5 LOAD CELLS KLBS



CHANNEL 6 GROUP 6 LOAD CELLS RUN= 985 SERIES= 19 KLBs



CHANNEL 7 TOTAL LOAD CELL SUM RUN= 985 SERIES= 19 KLBS



TEST NO. MLO103

DUMMY DATA

CLASS	FILTER CHANNEL
Head Accelerations	1000
Chest Accelerations	180
Femur Forces	600
Belt Loads	60

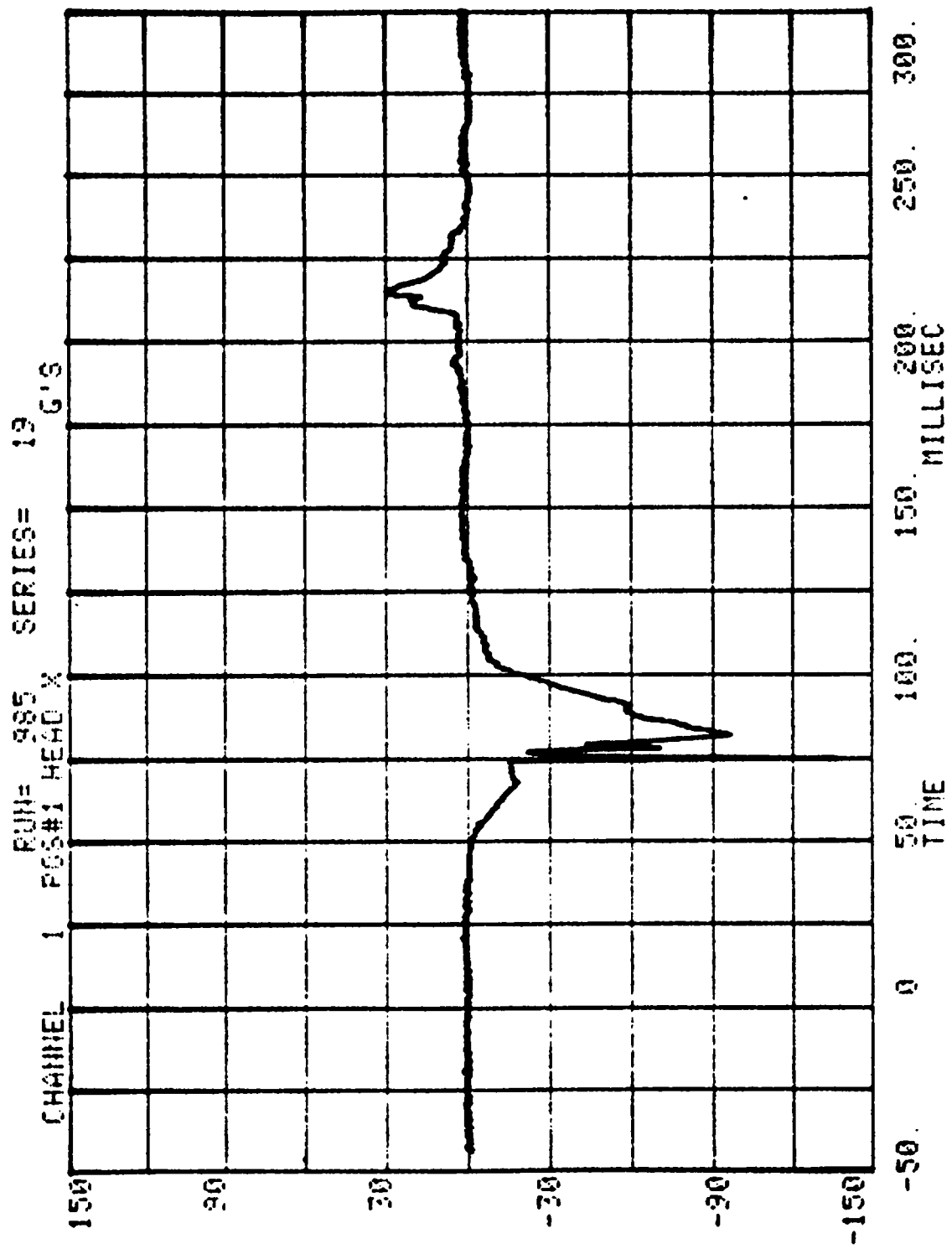
HEAD INJURY CRITERION
HEAD SEVERITY INDEX
30000 MAXIMUM DURATION

HEAD TEST #19

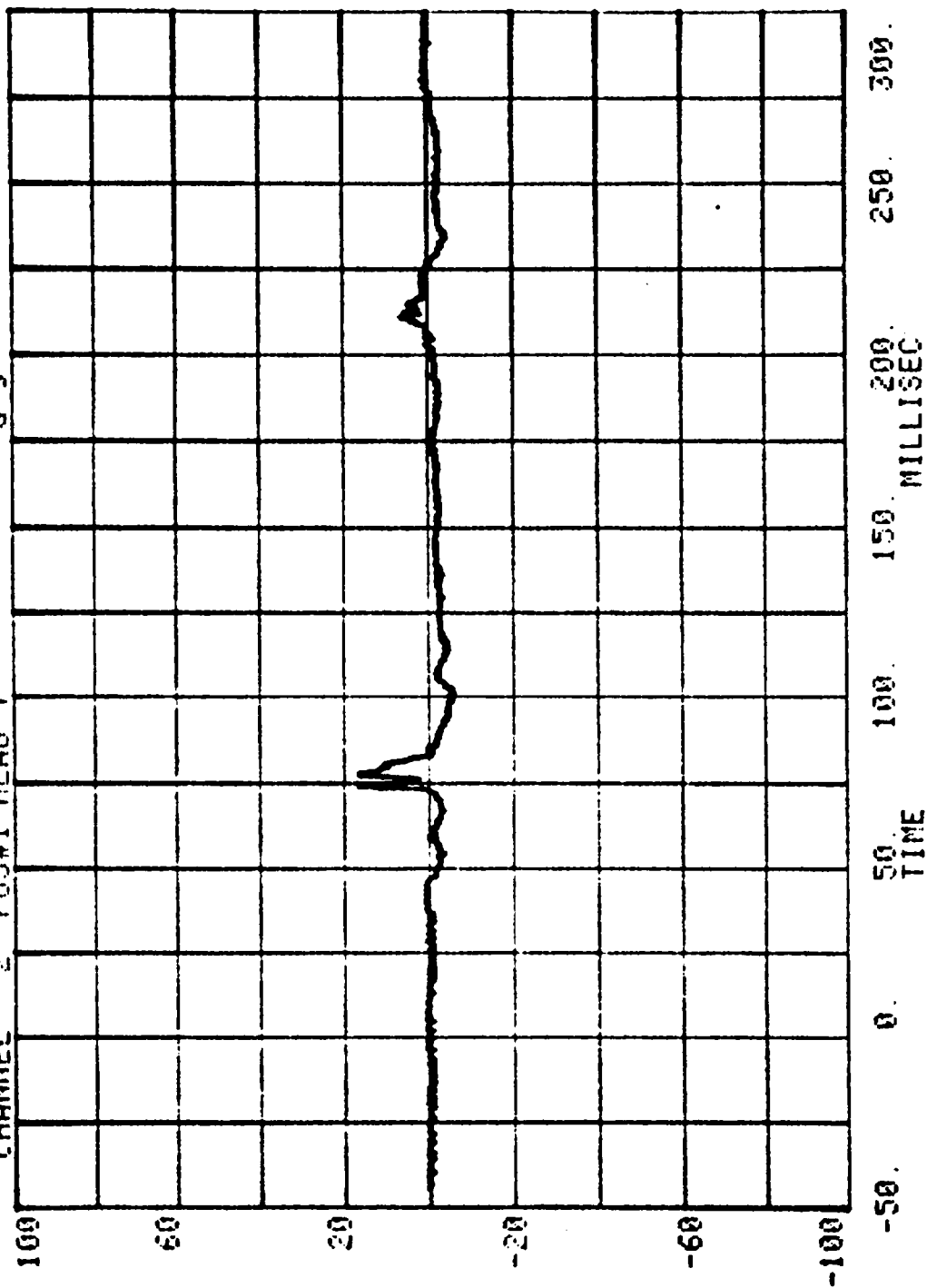
PIN= 985

POS #1 HEAD RESULTANT

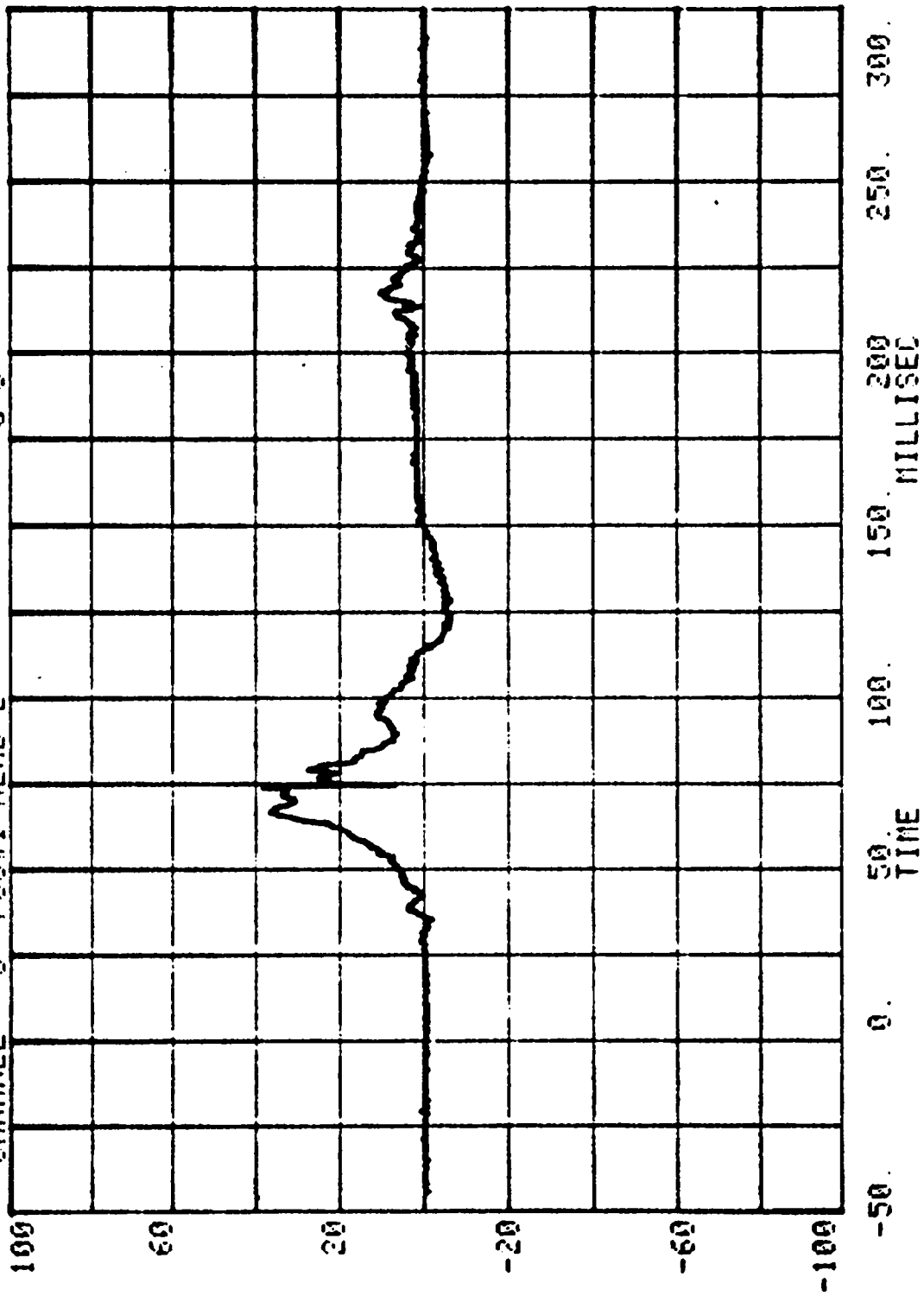
HIC= 770.1 FROM T1= .06517 TO T2= .09637
AVERAGE ACCELERATION BETWEEN T1 AND T2= 57.16'G
EVENT TIME= 300.0 MSEC
SEVERITY INDEX=1066.9



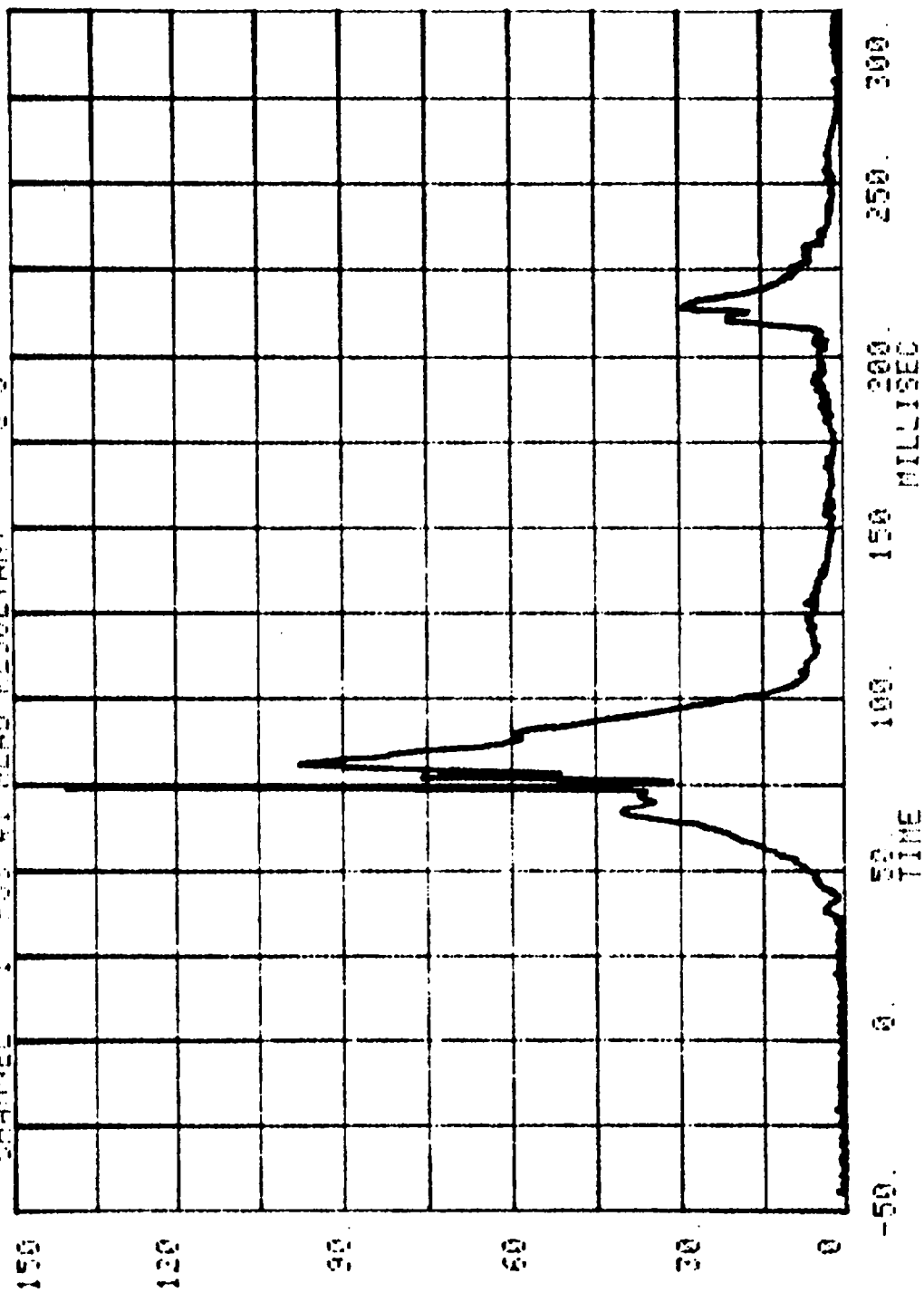
CHANNEL 2 POS#1 HEAD Y RUN= 985 SERIES= 19 G'S



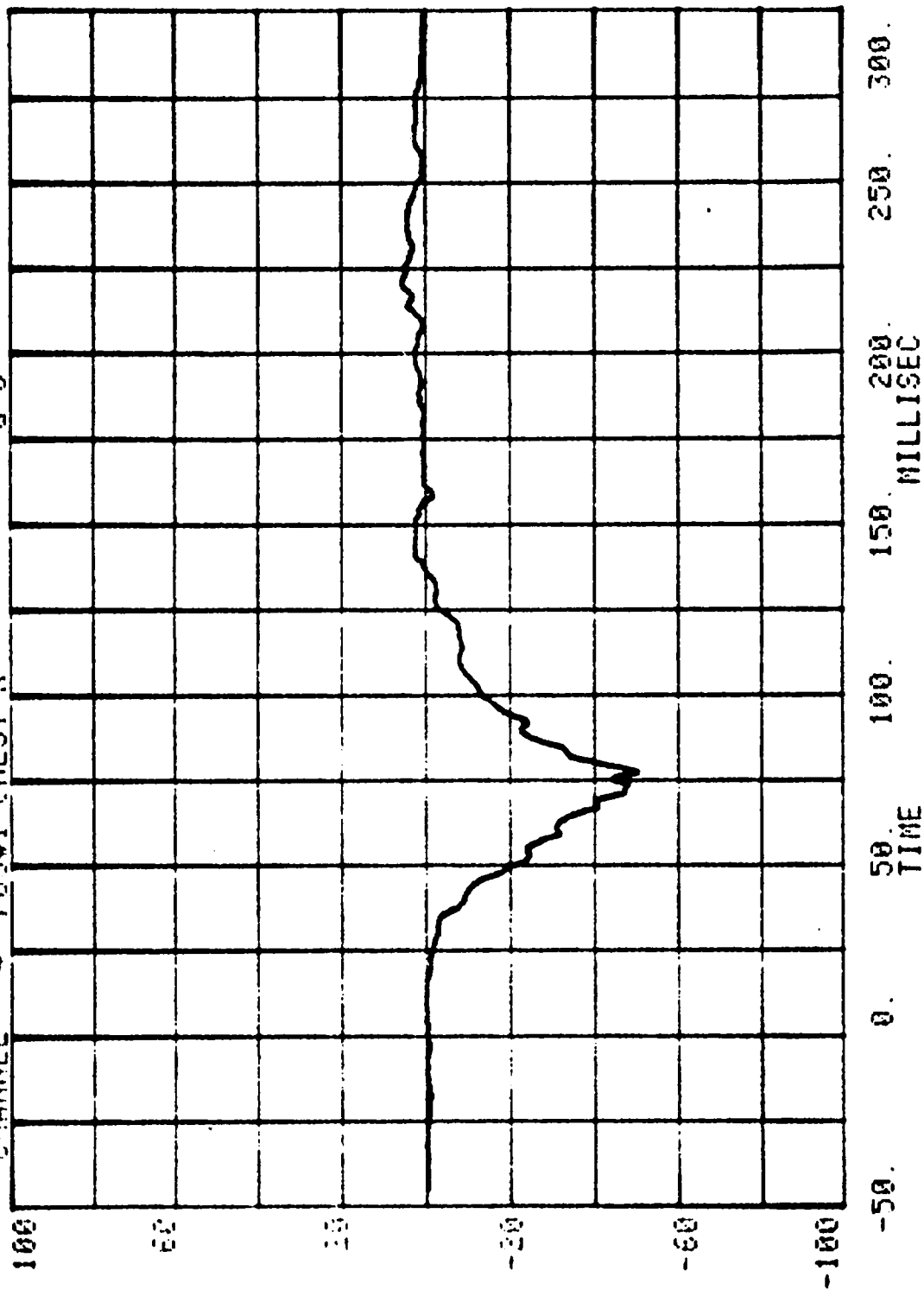
CHANNEL 3 POS#1 HEAD 2 RUN= 985 SERIES= 19 G'S



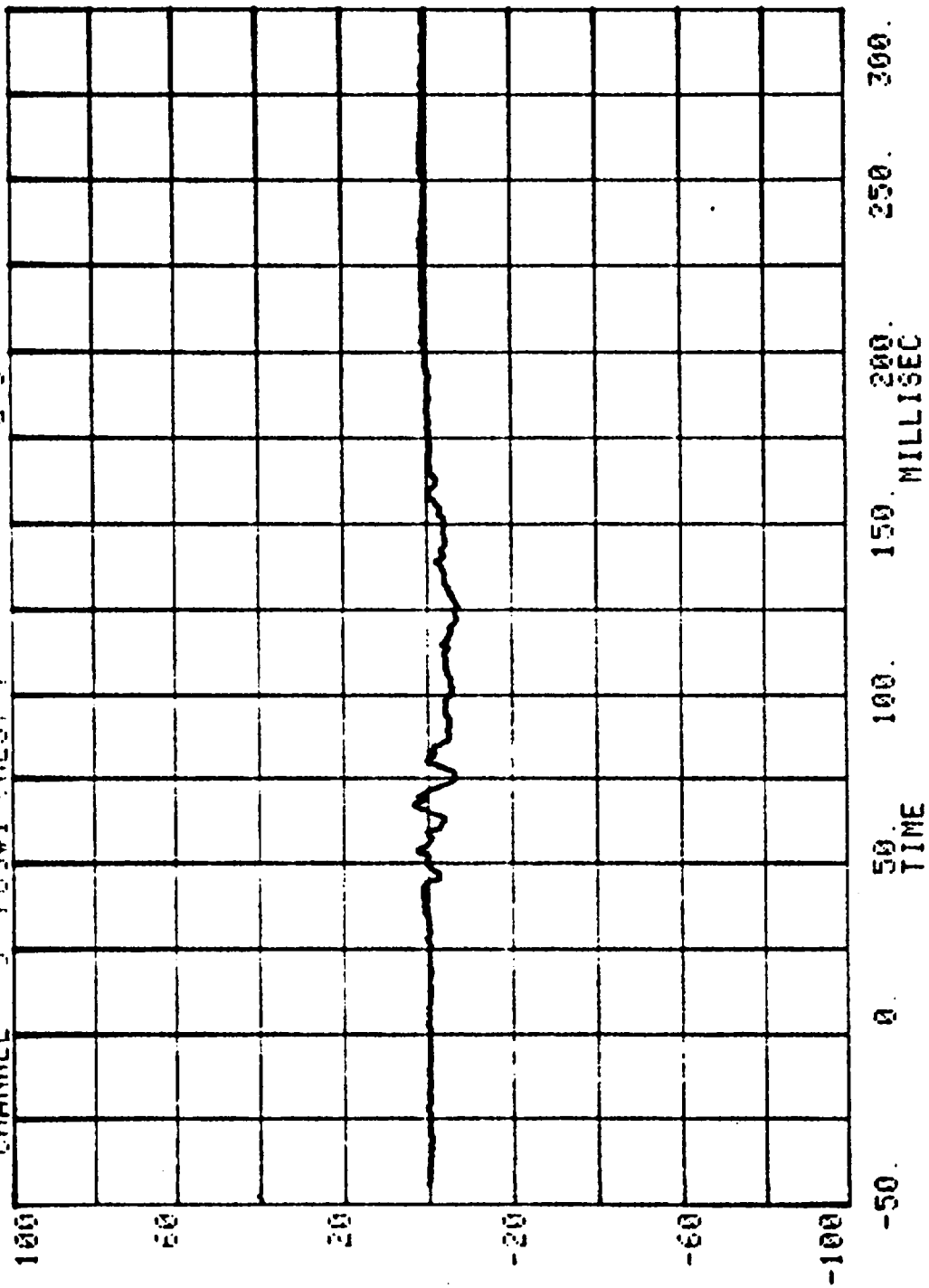
CHANNEL 1 500 #1 HEAD RESULTANT 19 0'S



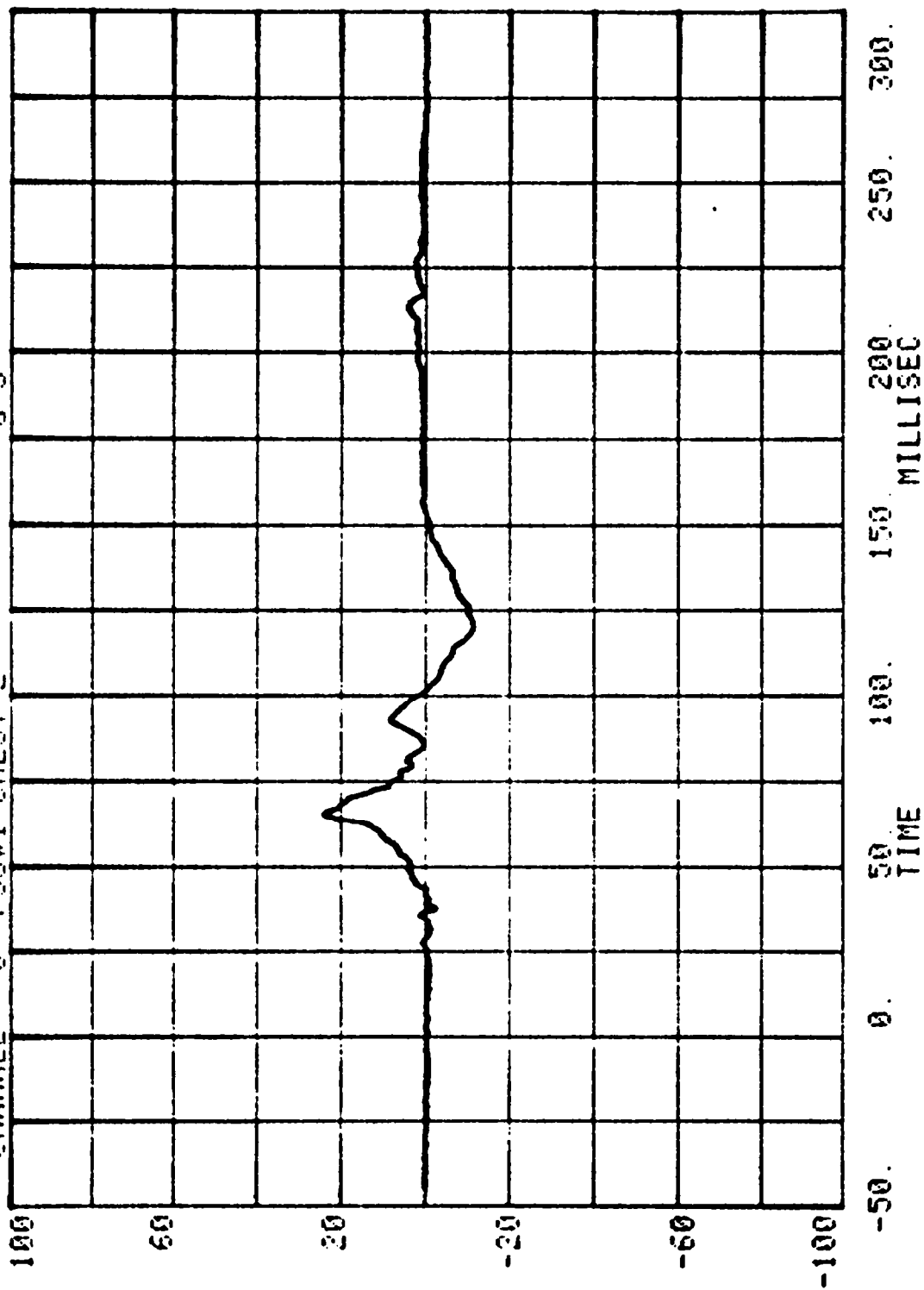
CHANNEL 4 POS#1 CHEST X RUN= 985 SERIES= 19 G'S



CHANNEL 5 POS#1 CHEST Y
RUN= 985 SERIES= 19 G'S

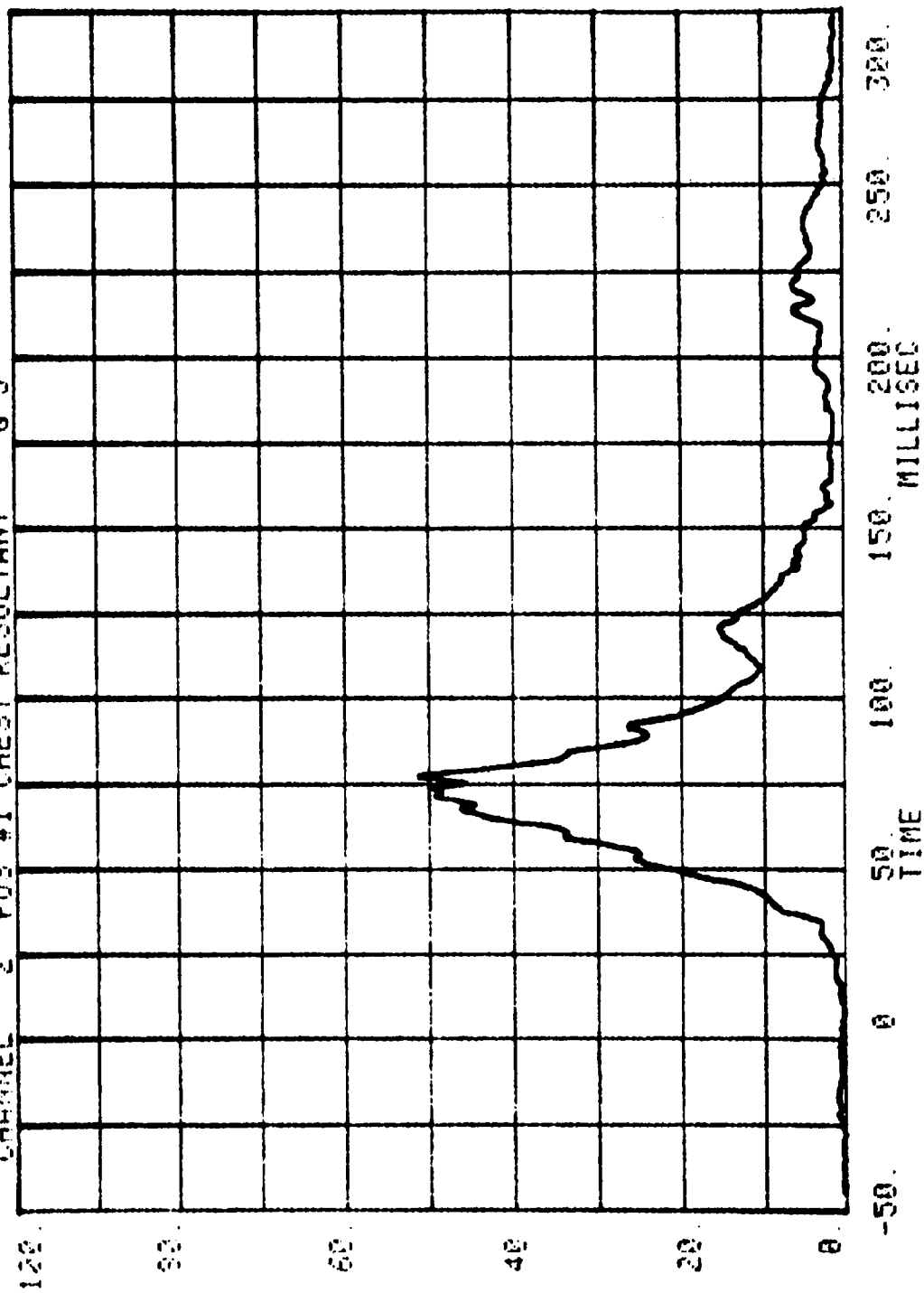


CHANNEL 6 POS#1 CHEST 2 SERIES= 19 G'S

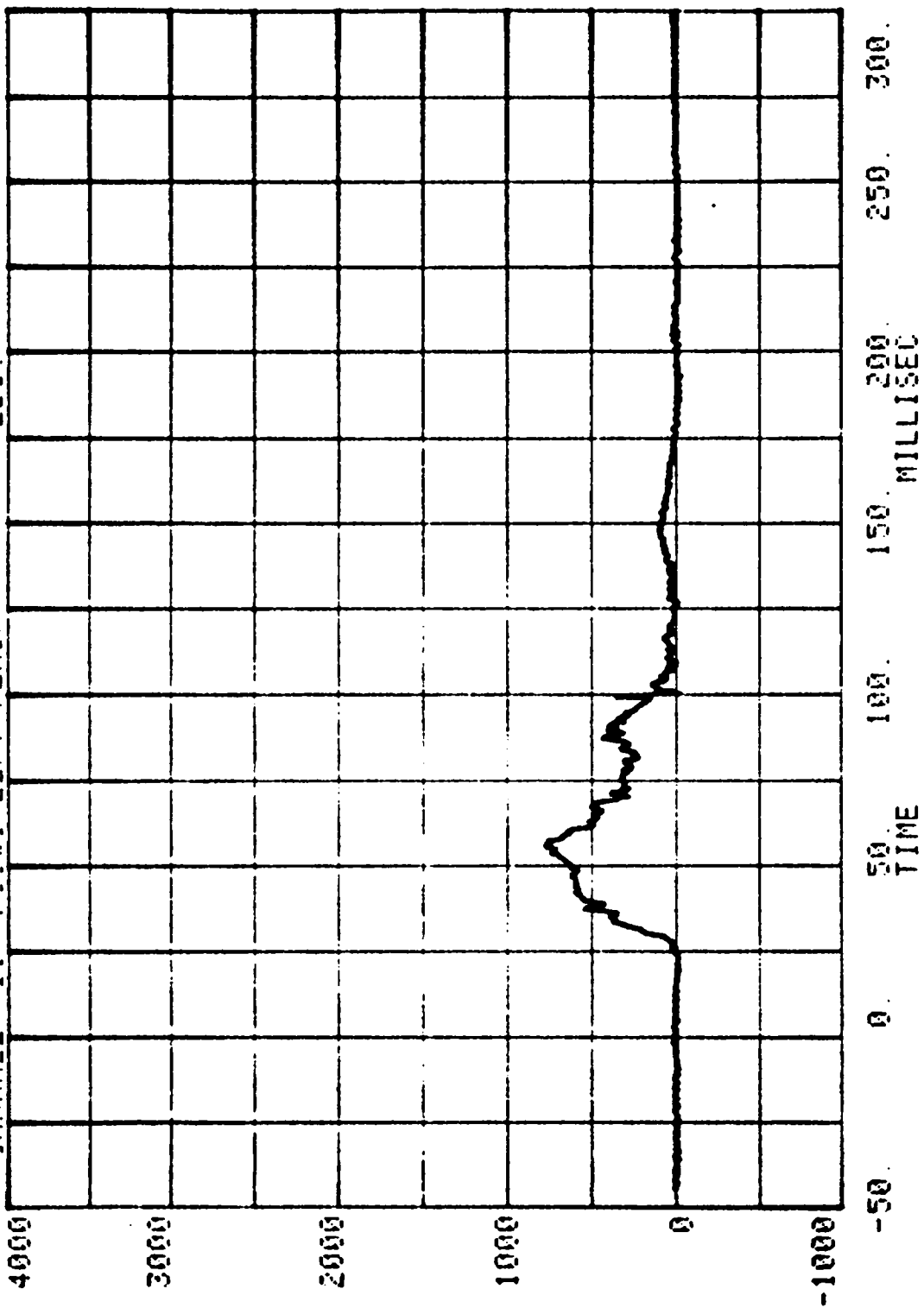


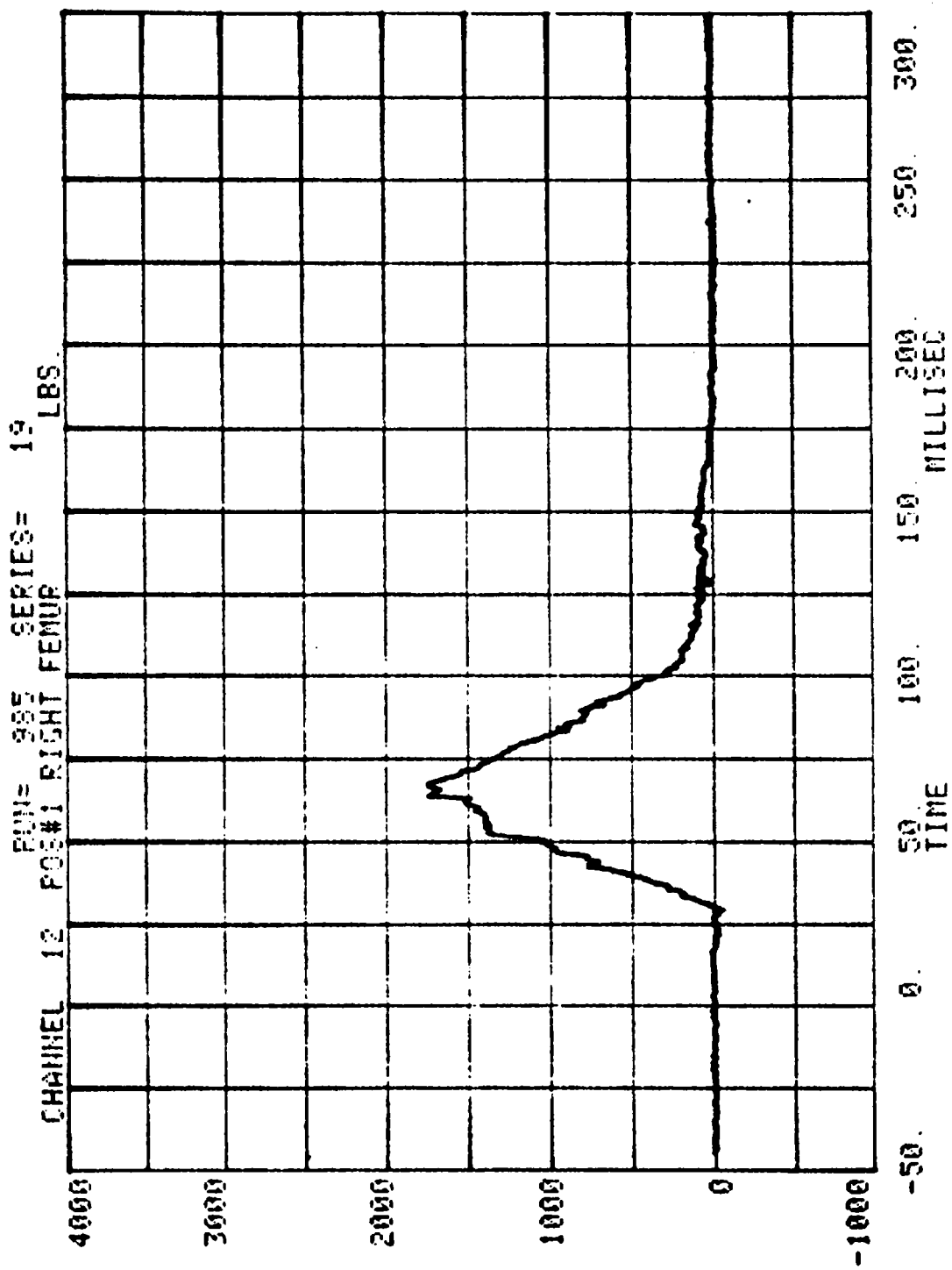
CHANNEL 2 POS #1 CHEST RESULTANT G'S

RUN= 985 SERIES= 19

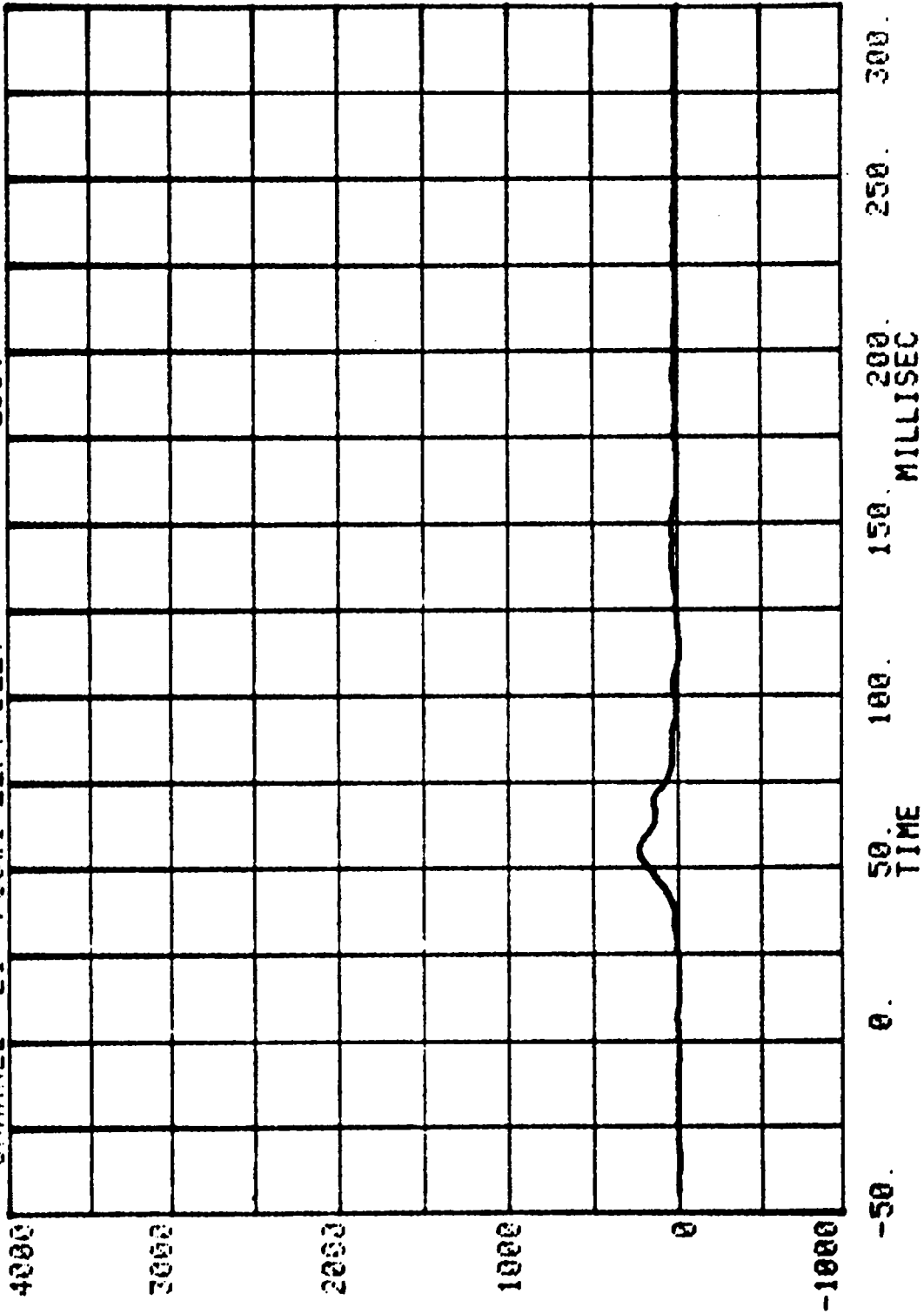


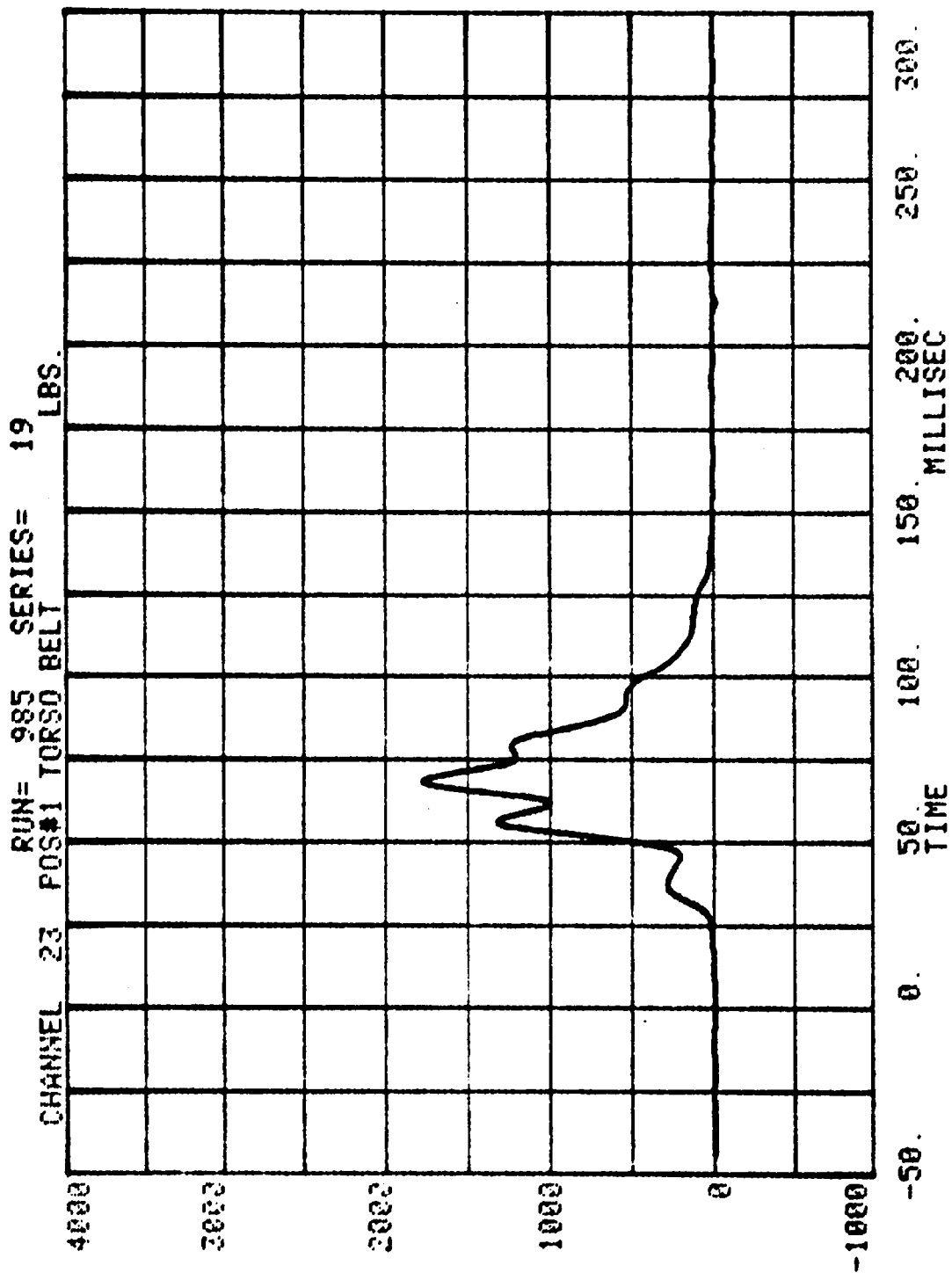
CHANNEL 11 POS#1 LEFT FEMUR
RUN= 995 SERIES= 19 LBS.





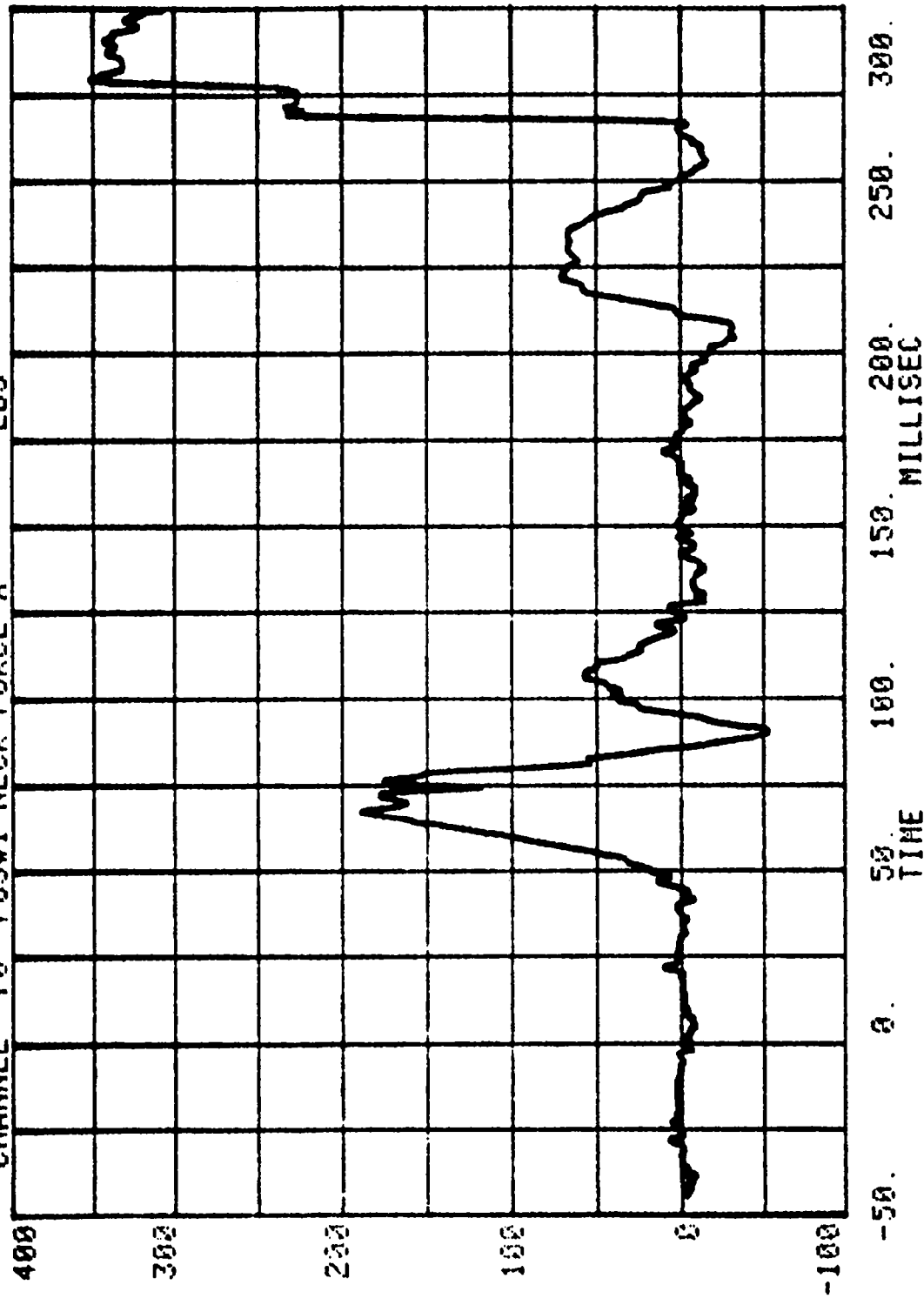
CHANNEL 21 POS#1 LEFT BELT
RUN= 985 SERIES= 19 LBS.





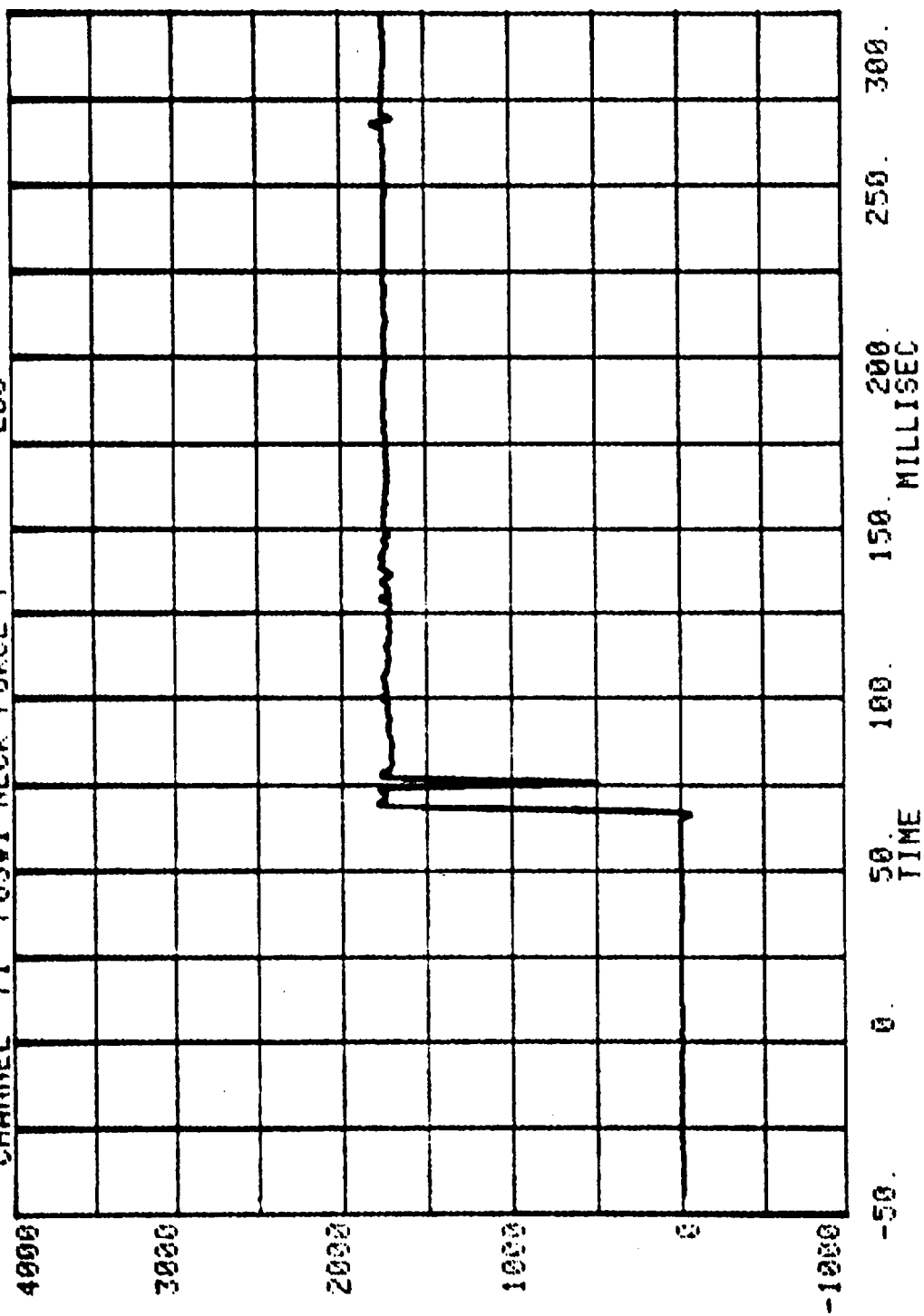
CHANNEL 70 POS#1 NECK FORCE X LBS

RUN= 985 SERIES= 19

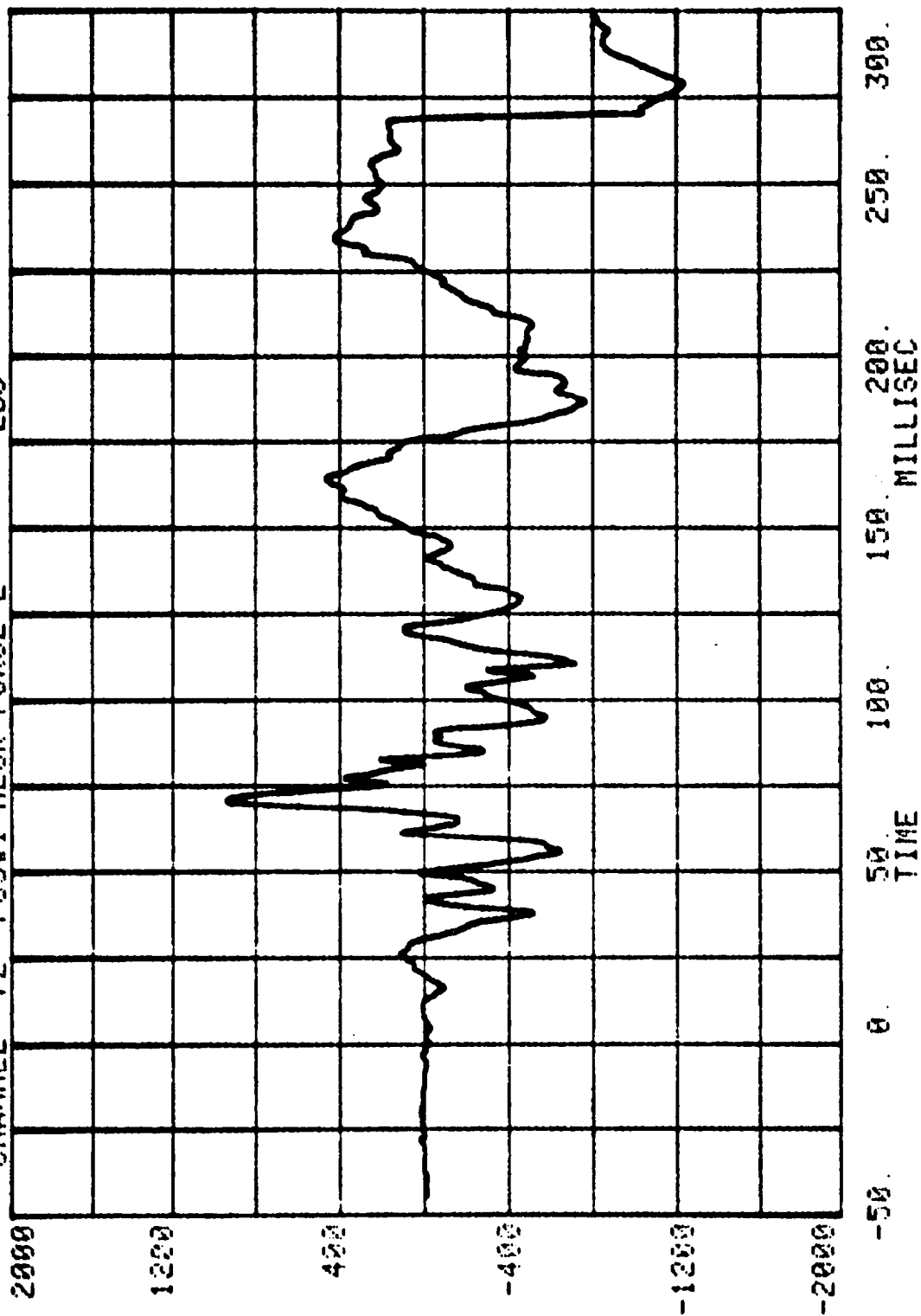


CHANNEL 71 POS#1 NECK FORCE Y LBS

RUN= 985 SERIES= 19

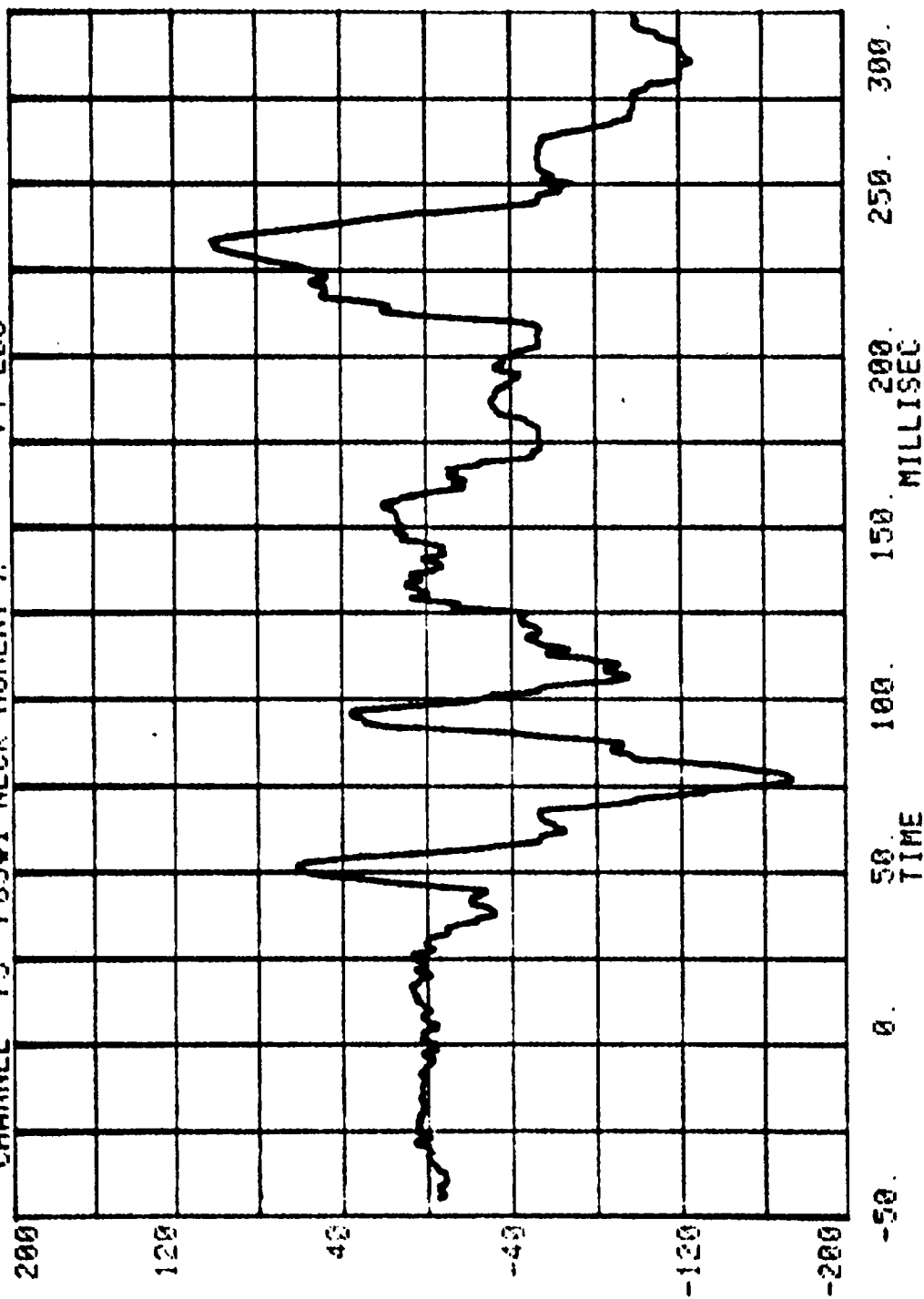


RUN= 985 SERIES= 19
CHANNEL 72 POS#1 NECK FORCE Z LBS



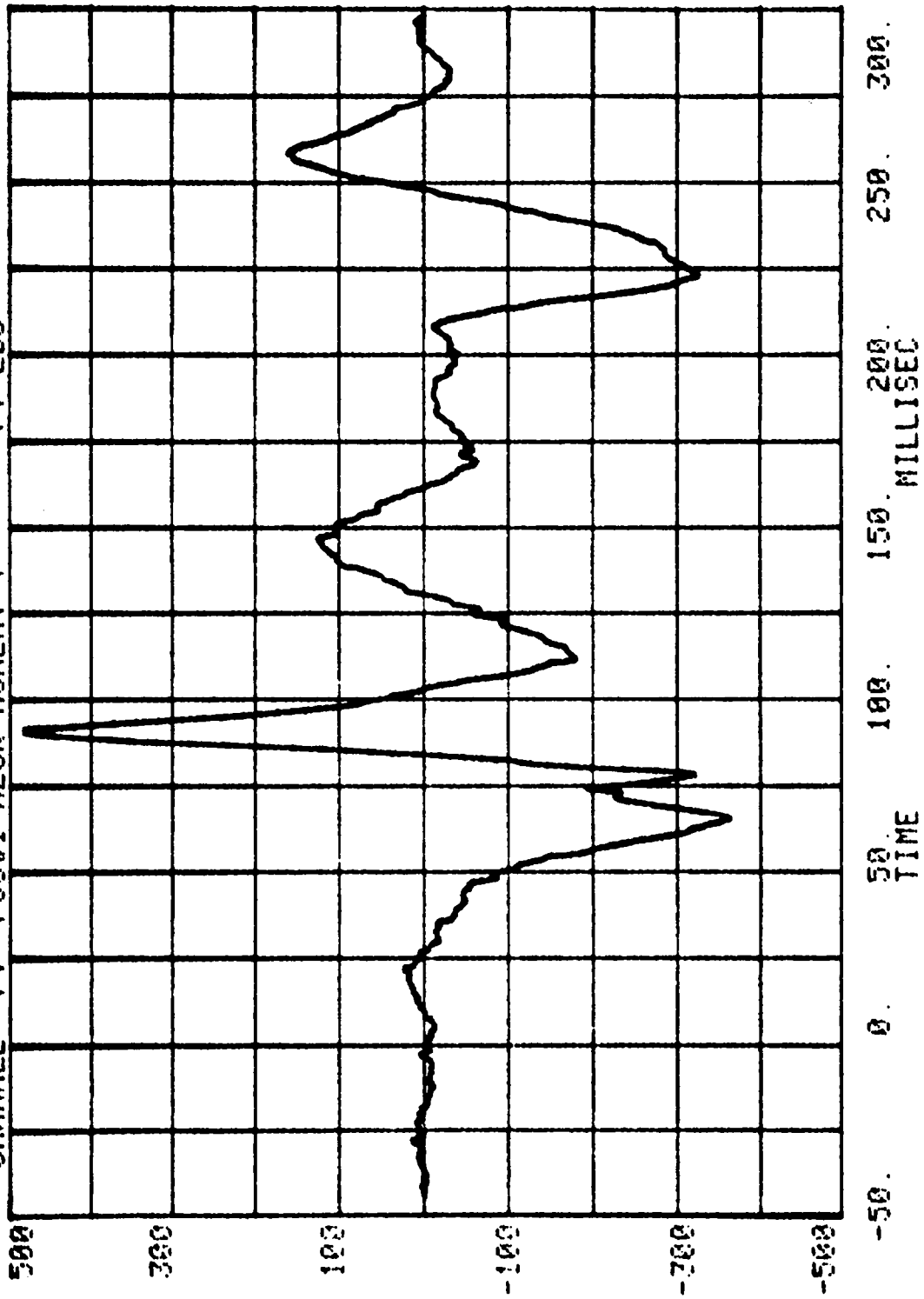
CHANNEL 73 POS#1 NECK MOMENT X FT-LBS

RUN= 985 SERIES= 19

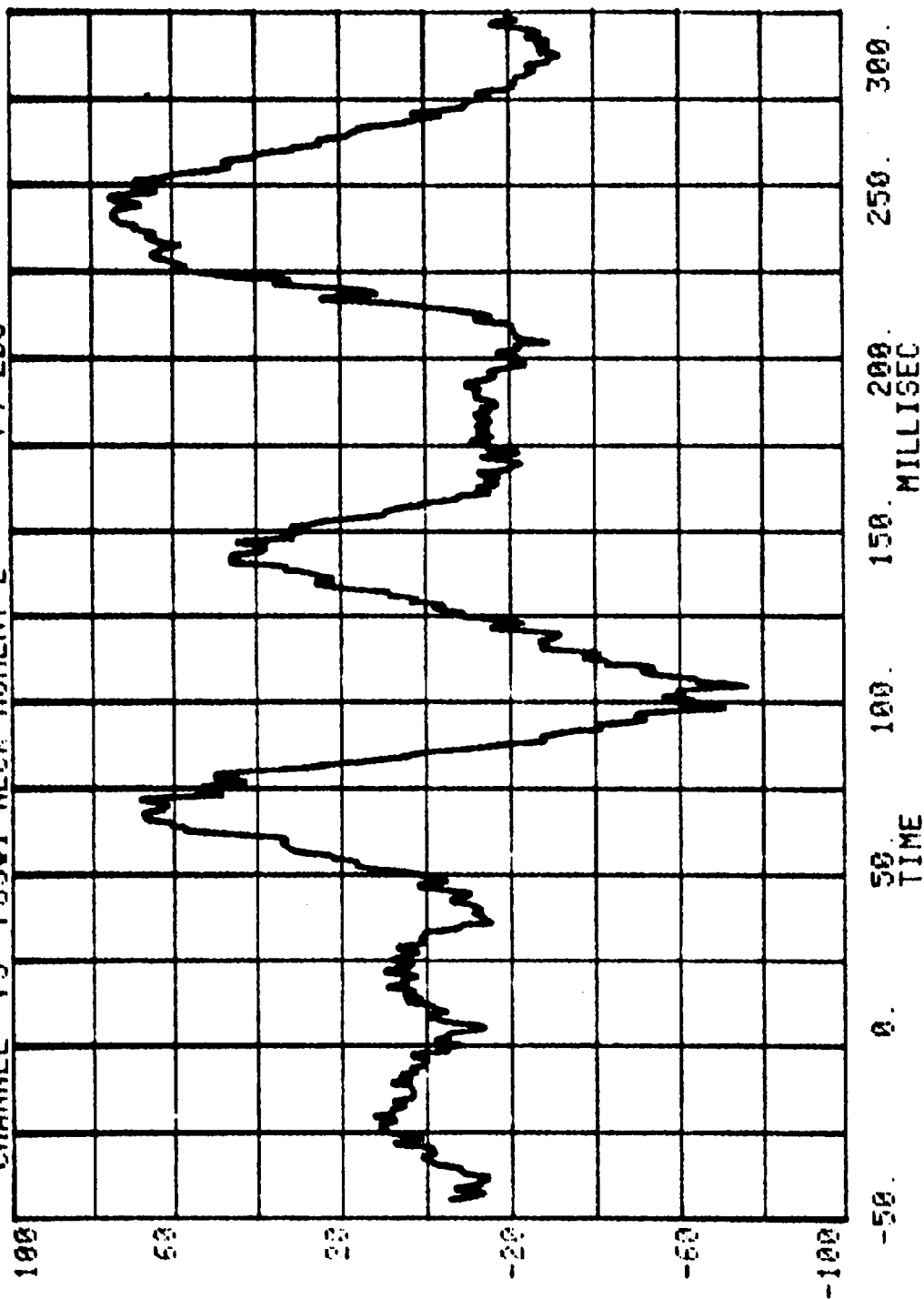


CHANNEL 74 POS#1 NECK MOMENT Y FT-LBS

RUN= 935 SERIES= 19

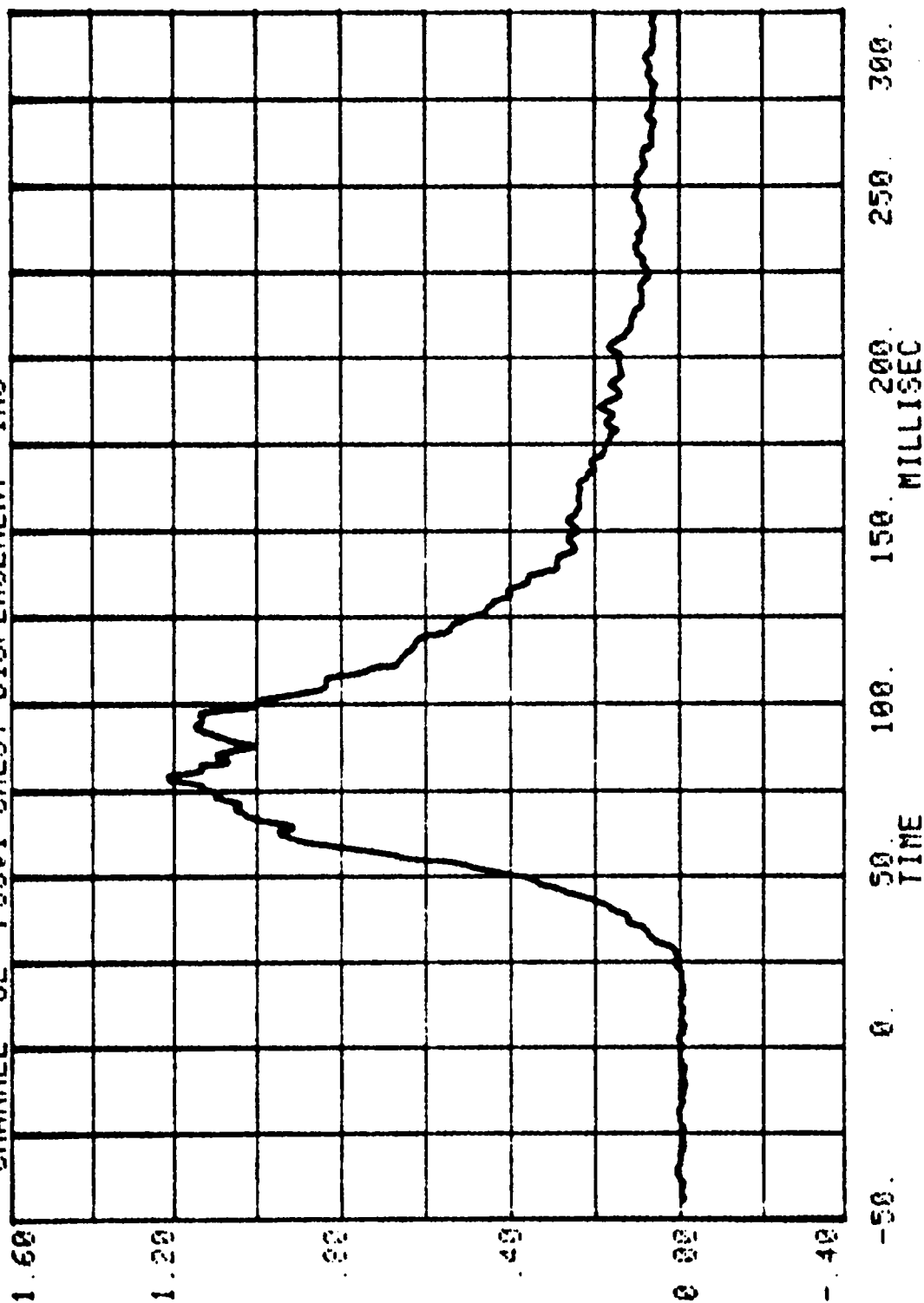


RUN= 985 SERIES= 19
CHANNEL 75 POS#1 NECK MOMENT Z FT-LBS



CHANNEL 82 POS#1 CHEST DISPLACEMENT INS

RUN= 985 SERIES= 19



HEAD INJURY CRITERION
HEAD SEVERITY INDEX
35MS MAXIMUM DURATION

NCAP TEST #19

PUN= 995

POS #2 HEAD RESULTANT

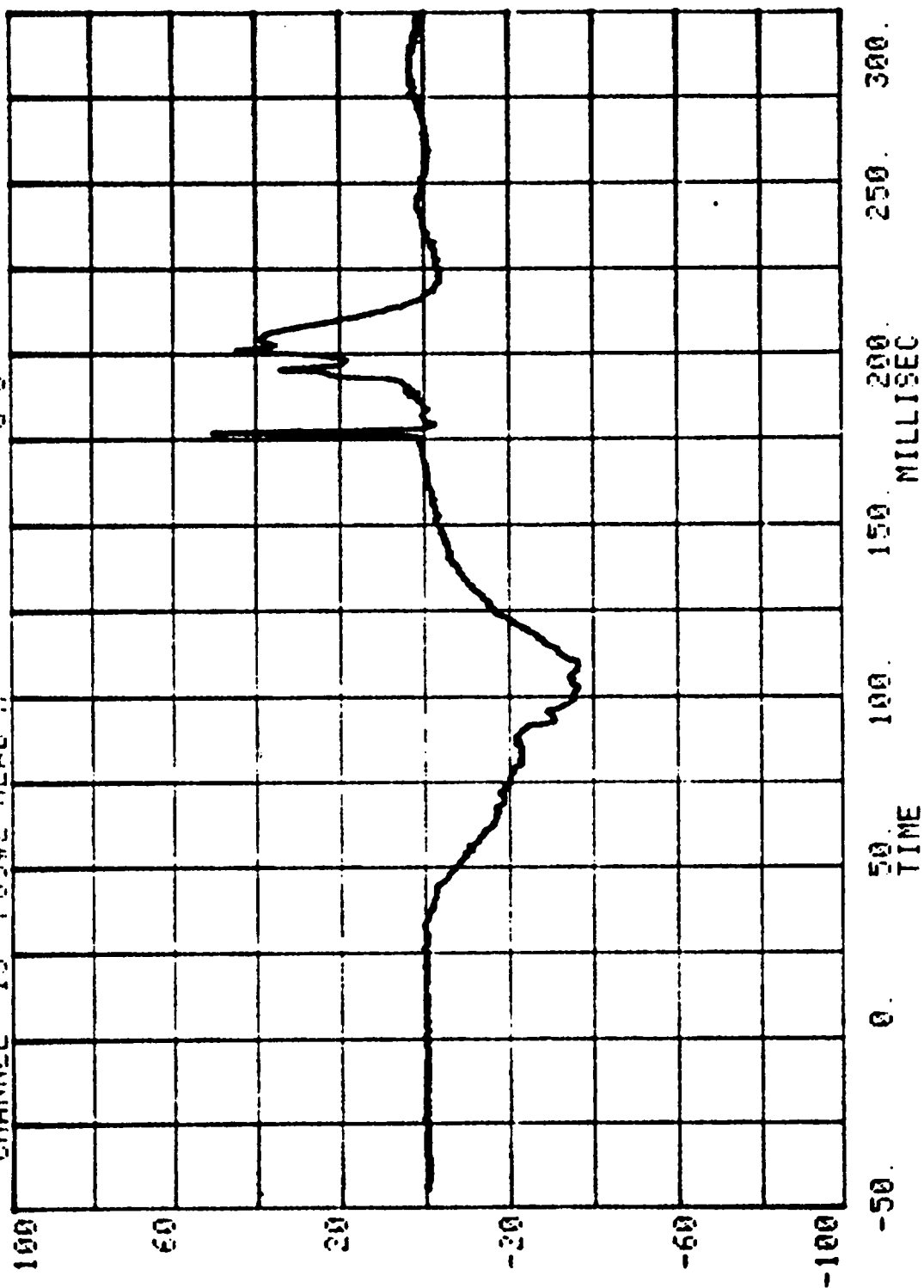
HIC= 485.3 FROM T1= .07275 TO T2= .10875

AVERAGE ACCELERATION BETWEEN T1 AND T2= 44.95'S

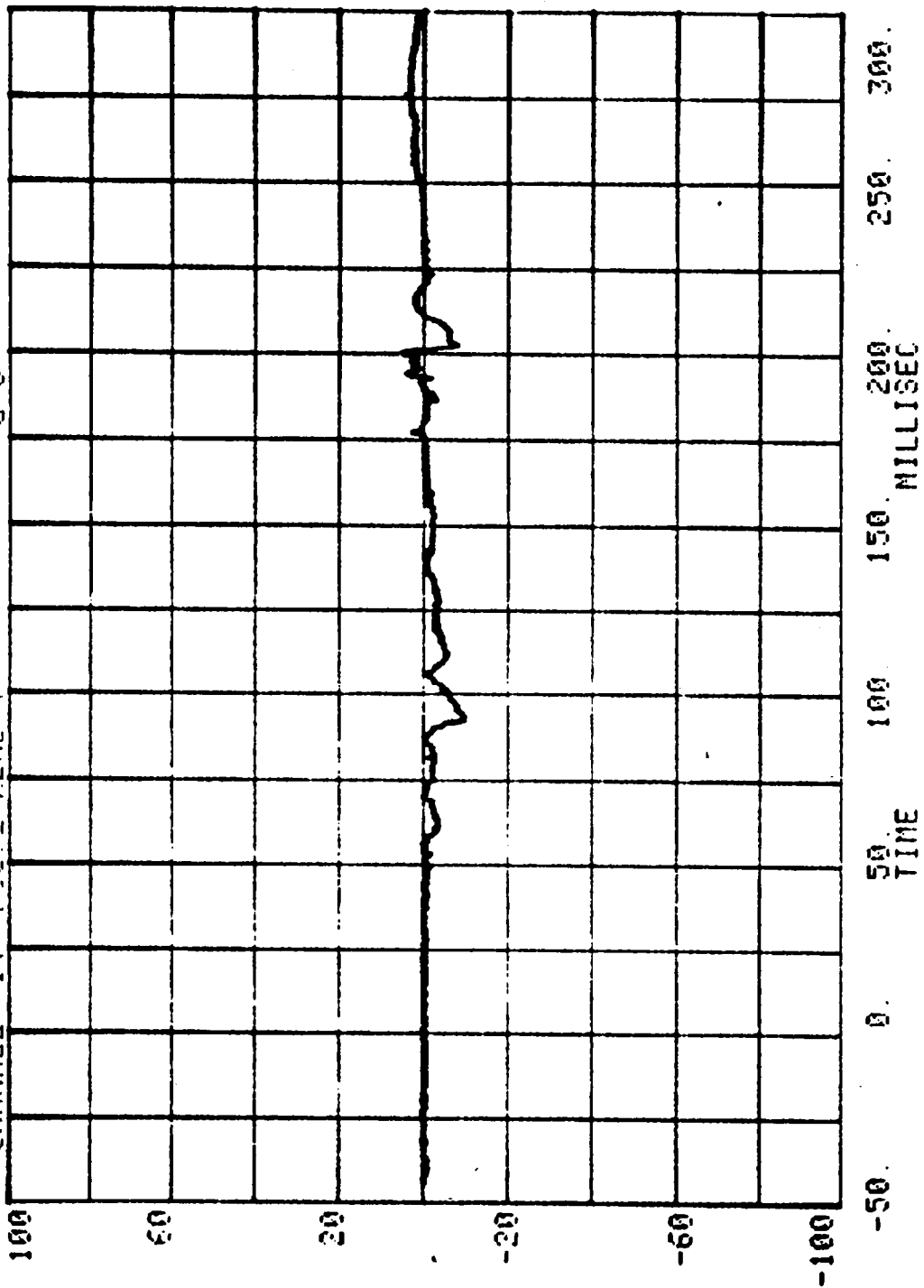
EVENT TIME= 300.0 MSEC

SEVERITY INDEX= 876.1

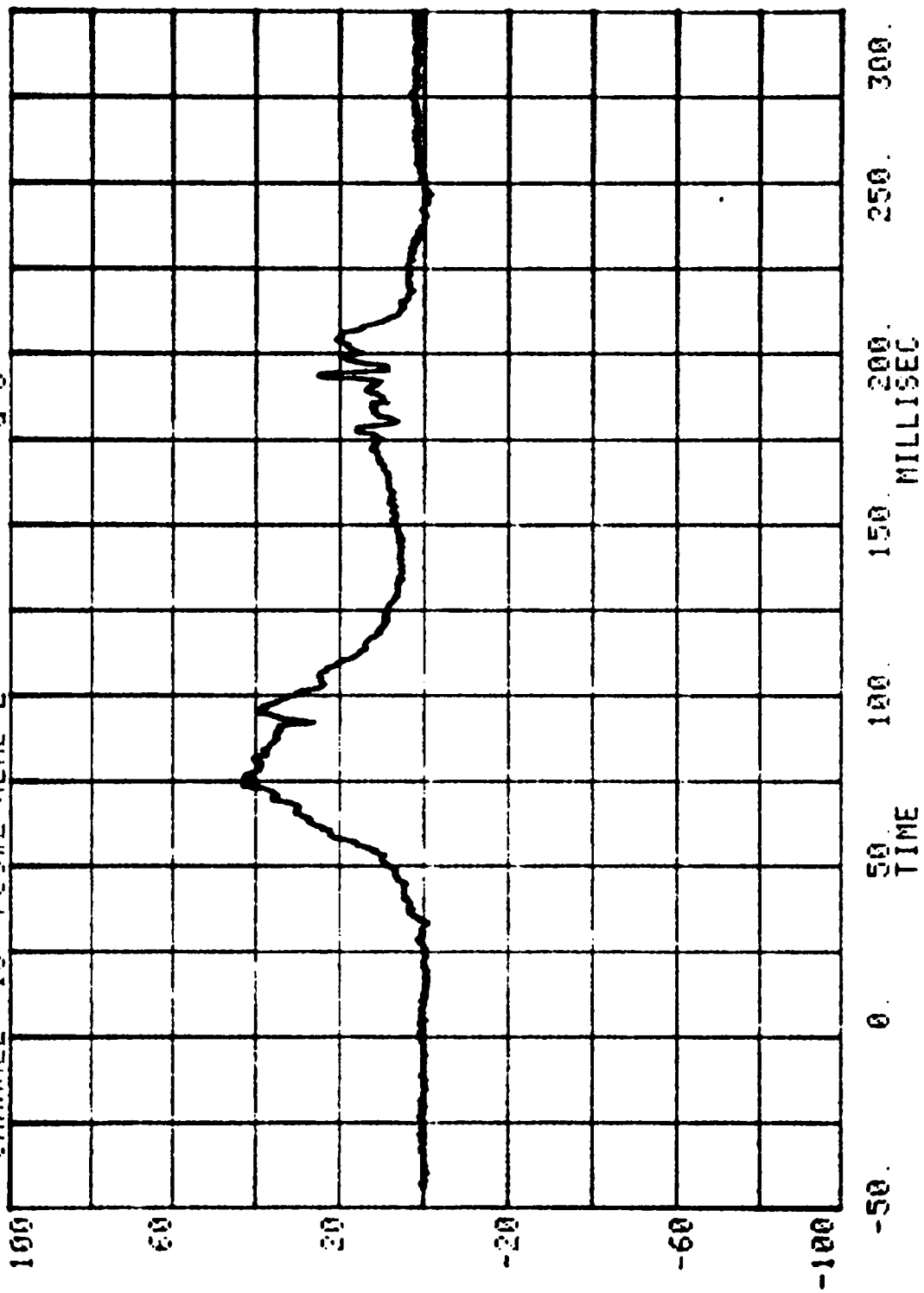
CHANNEL 13 RUN= 285 SERIES= 13 G'S
POS#2 HEAD 2



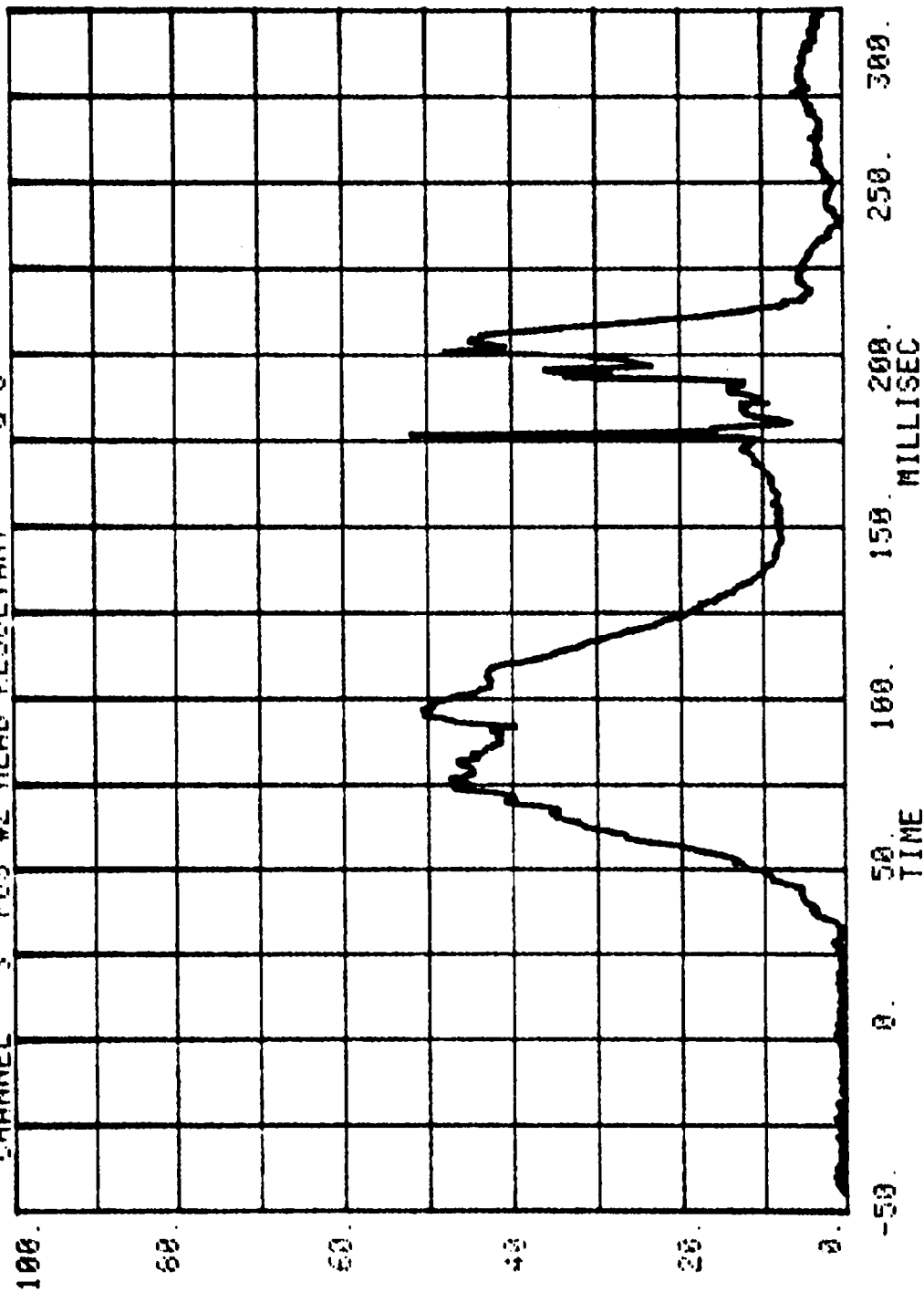
CHANNEL 14 POS#2 HEAD Y
FUH= 985 SERIES= 19 G'S



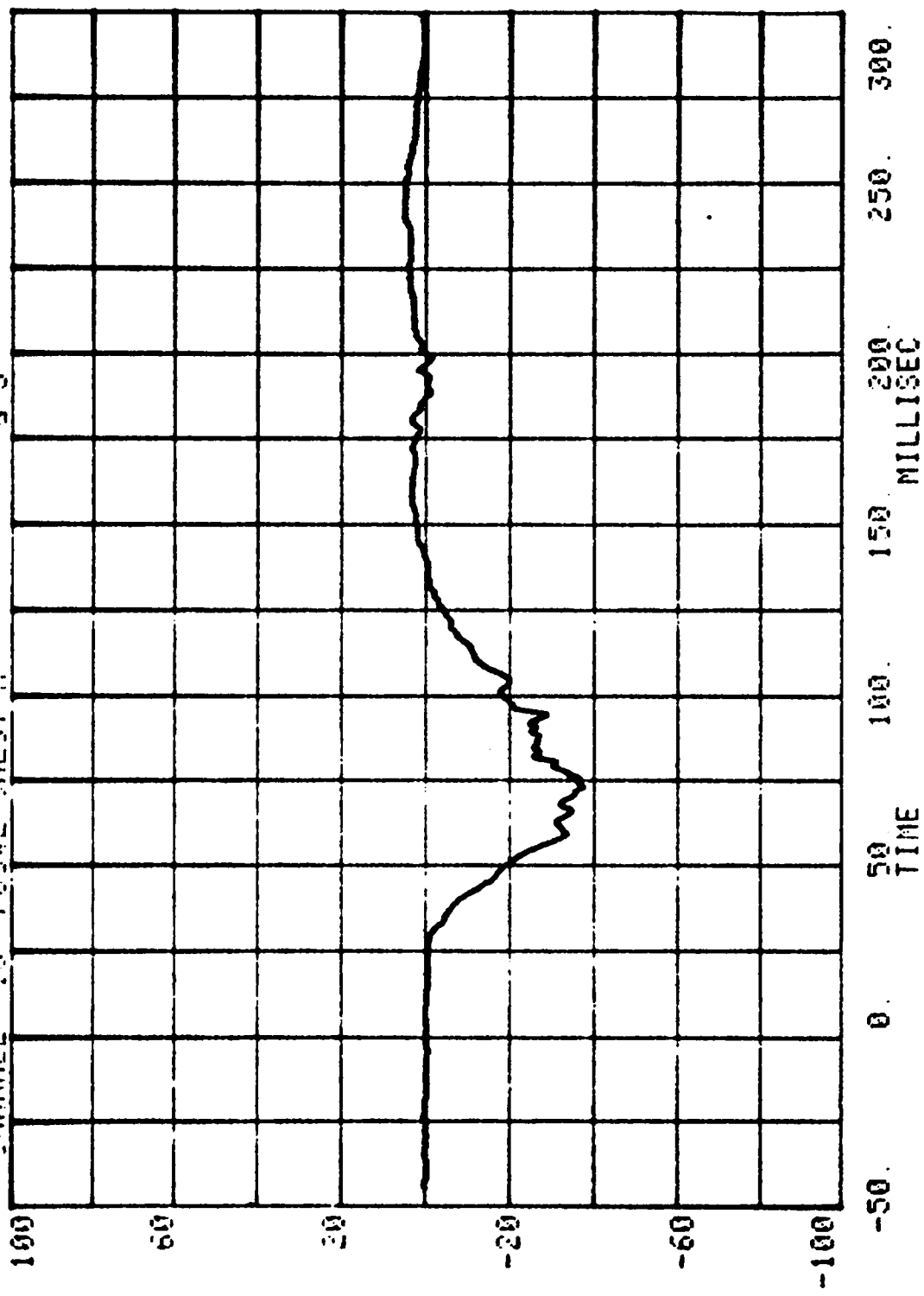
CHANNEL 15 RUN= 985 SERIES= 19 G'S
POS#2 HEAD 2

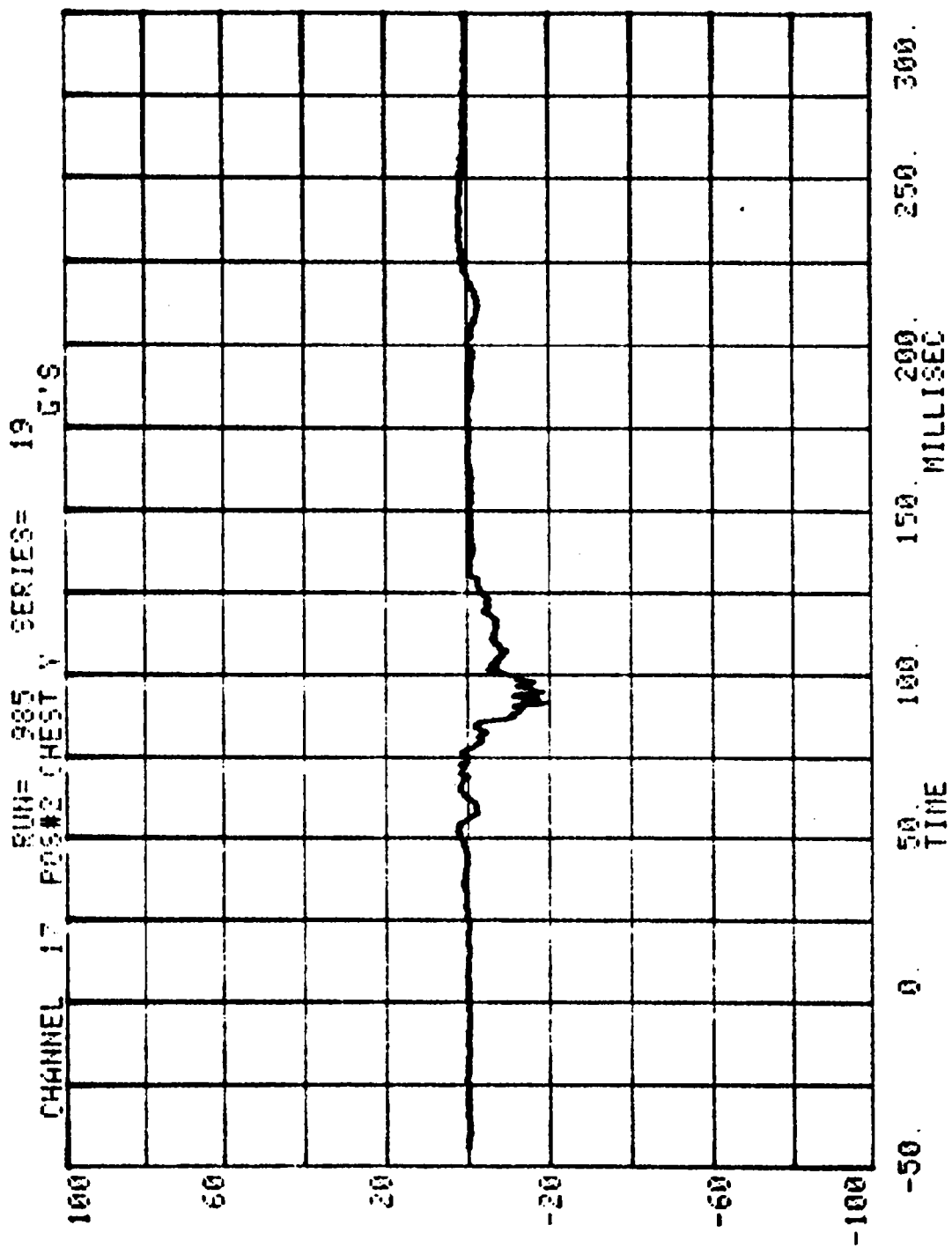


CHANNEL 3 POS #2 HEAD RESULTANT 19 G'S

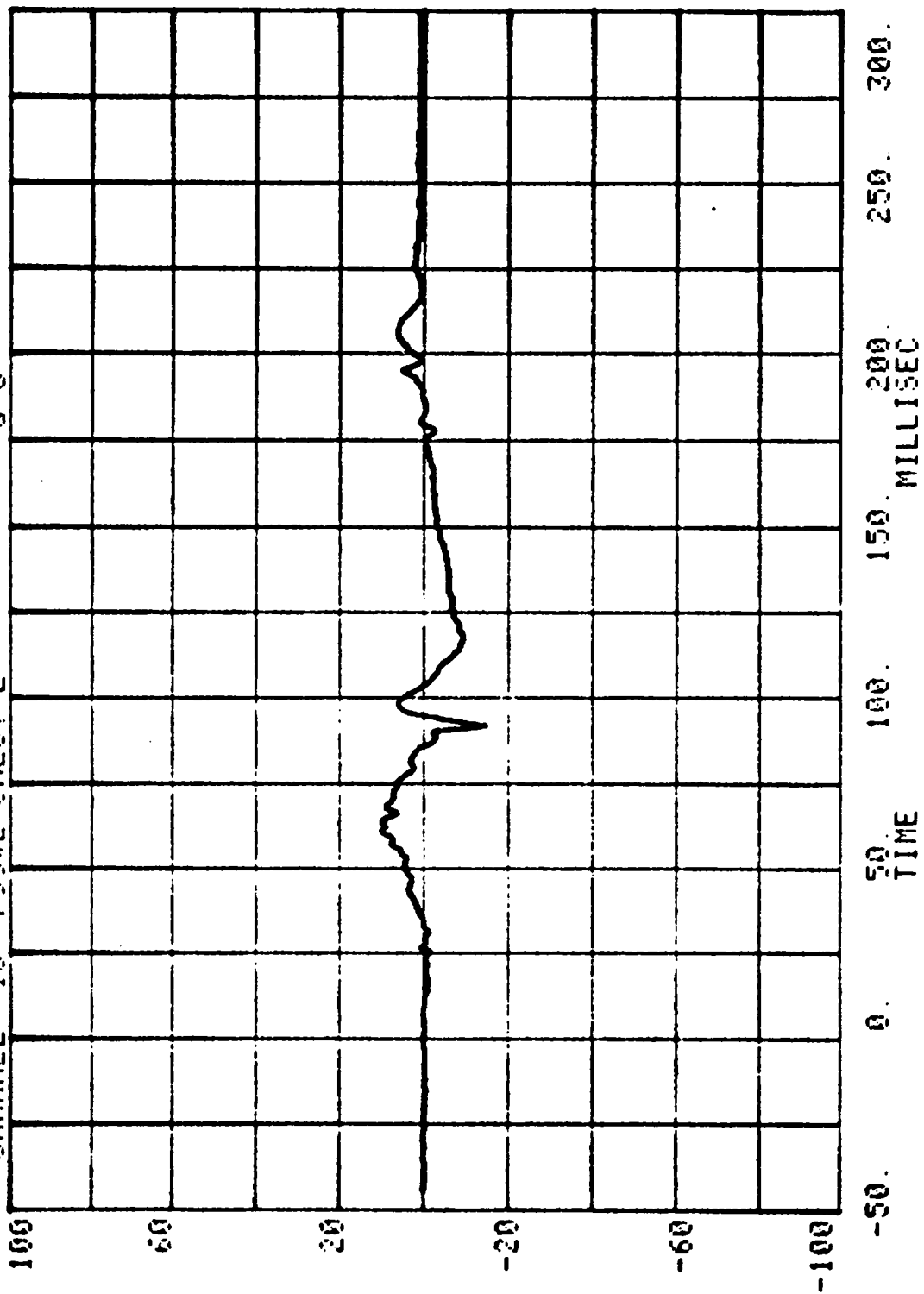


CHANNEL 15 RUN= 985 SERIES= 13 5'S





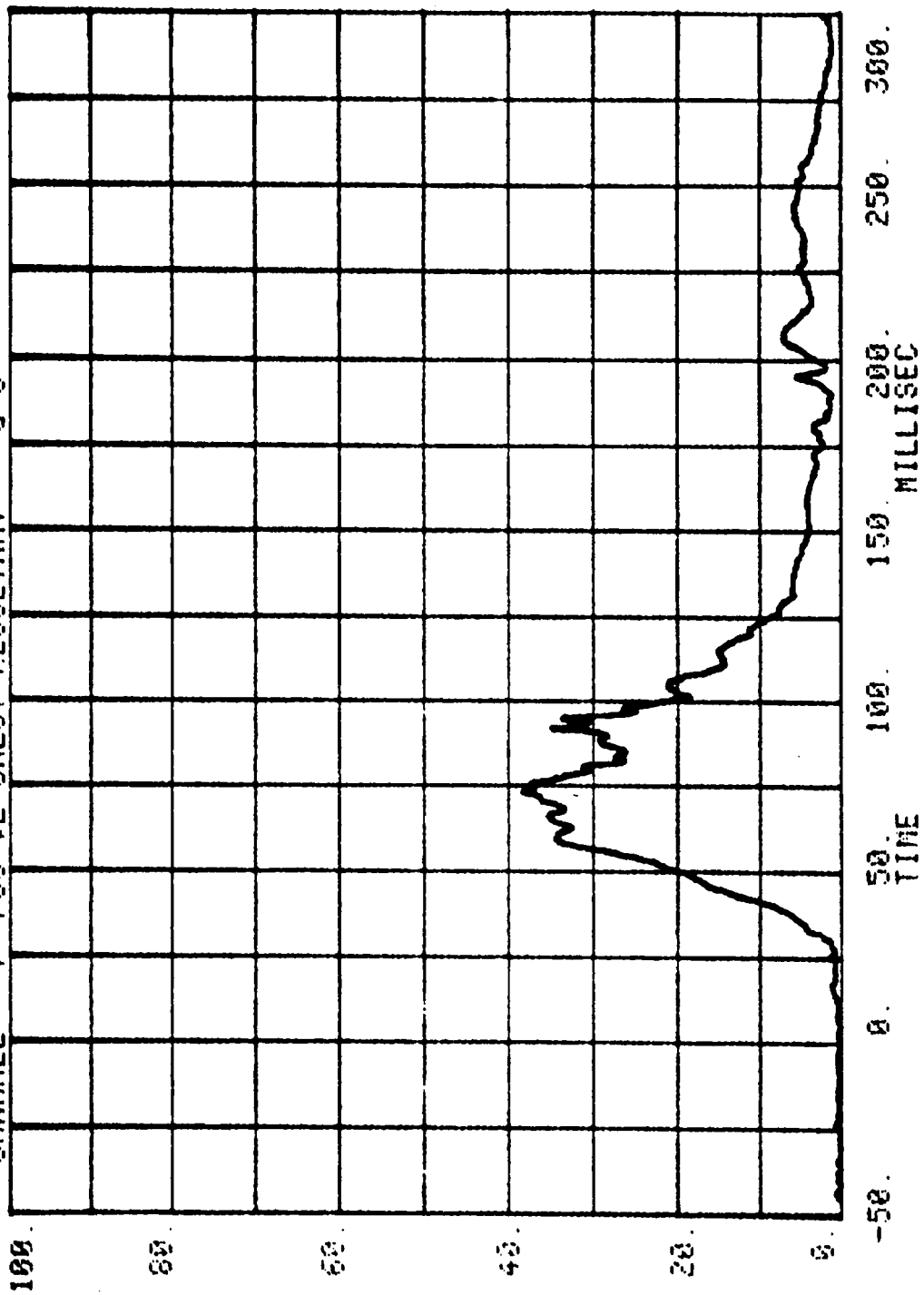
CHANNEL 18 RUN= 985 SERIES= 19
POS#2 CHEST 2 G'S



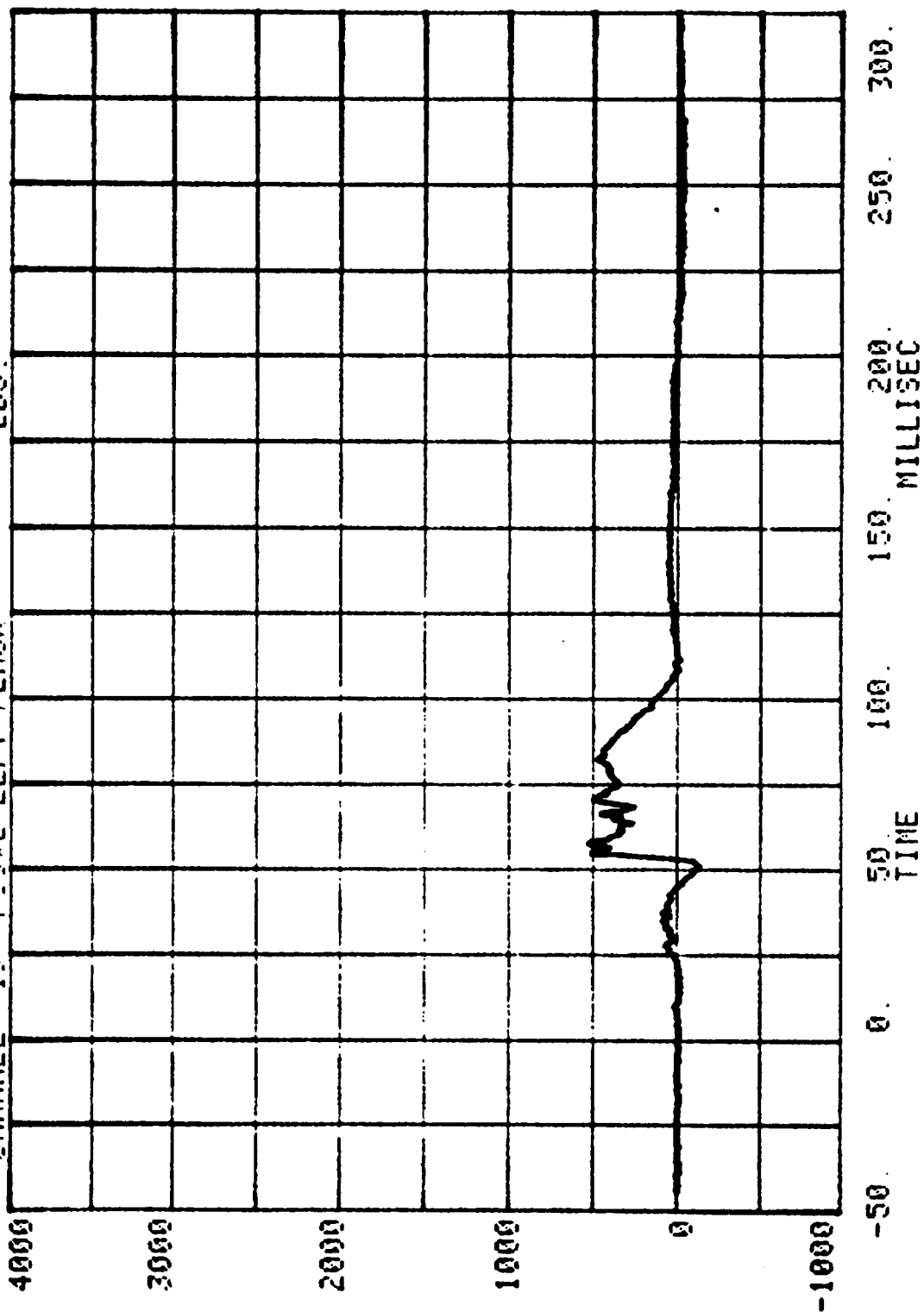
CHANNEL 4 POS #2 CHEST RESULTANT G'S

RUN= 285

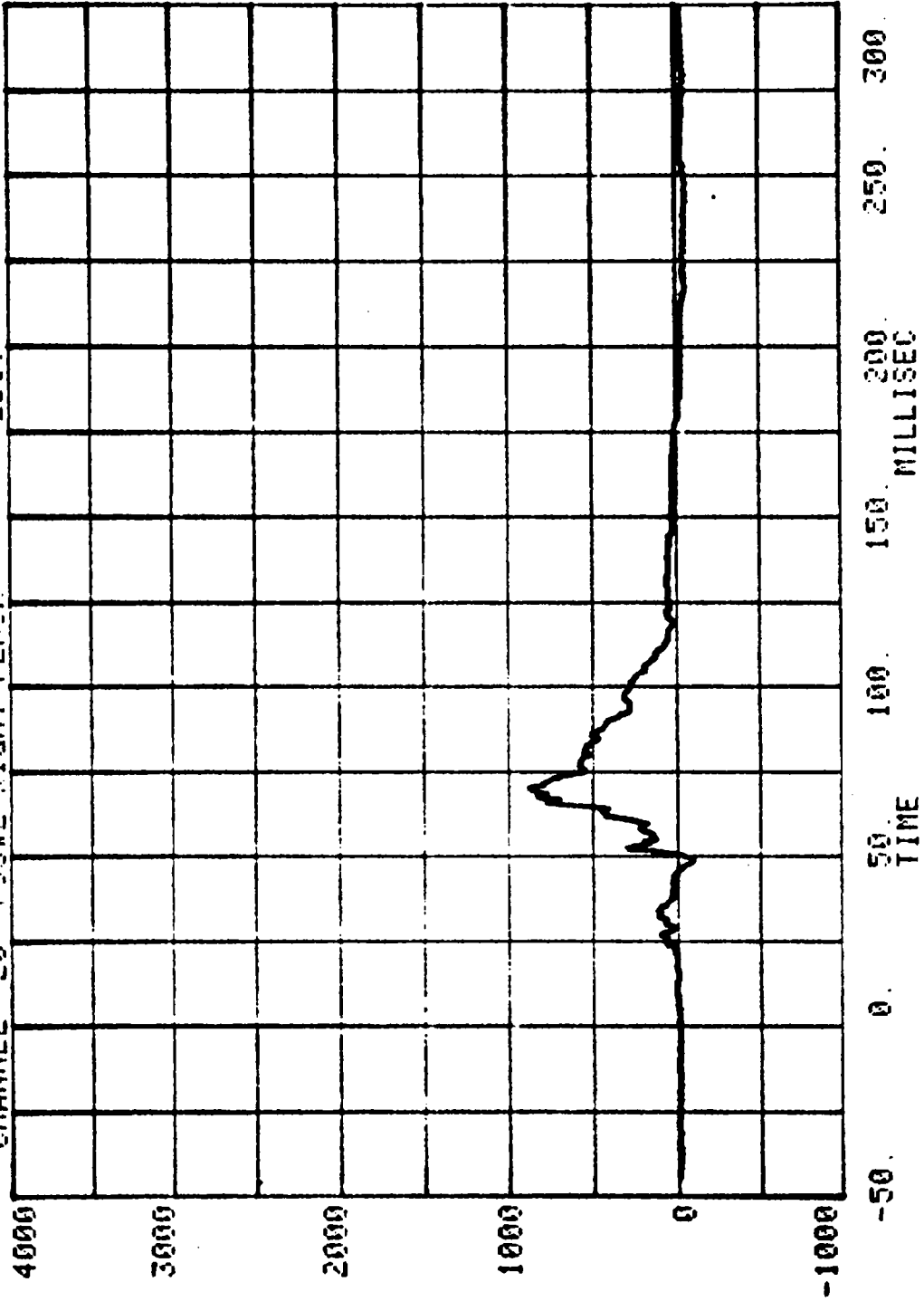
SERIES= 19



CHANNEL 19 POS#2 LEFT FEMUR RUH= 985 SERIES= 12 LBS.



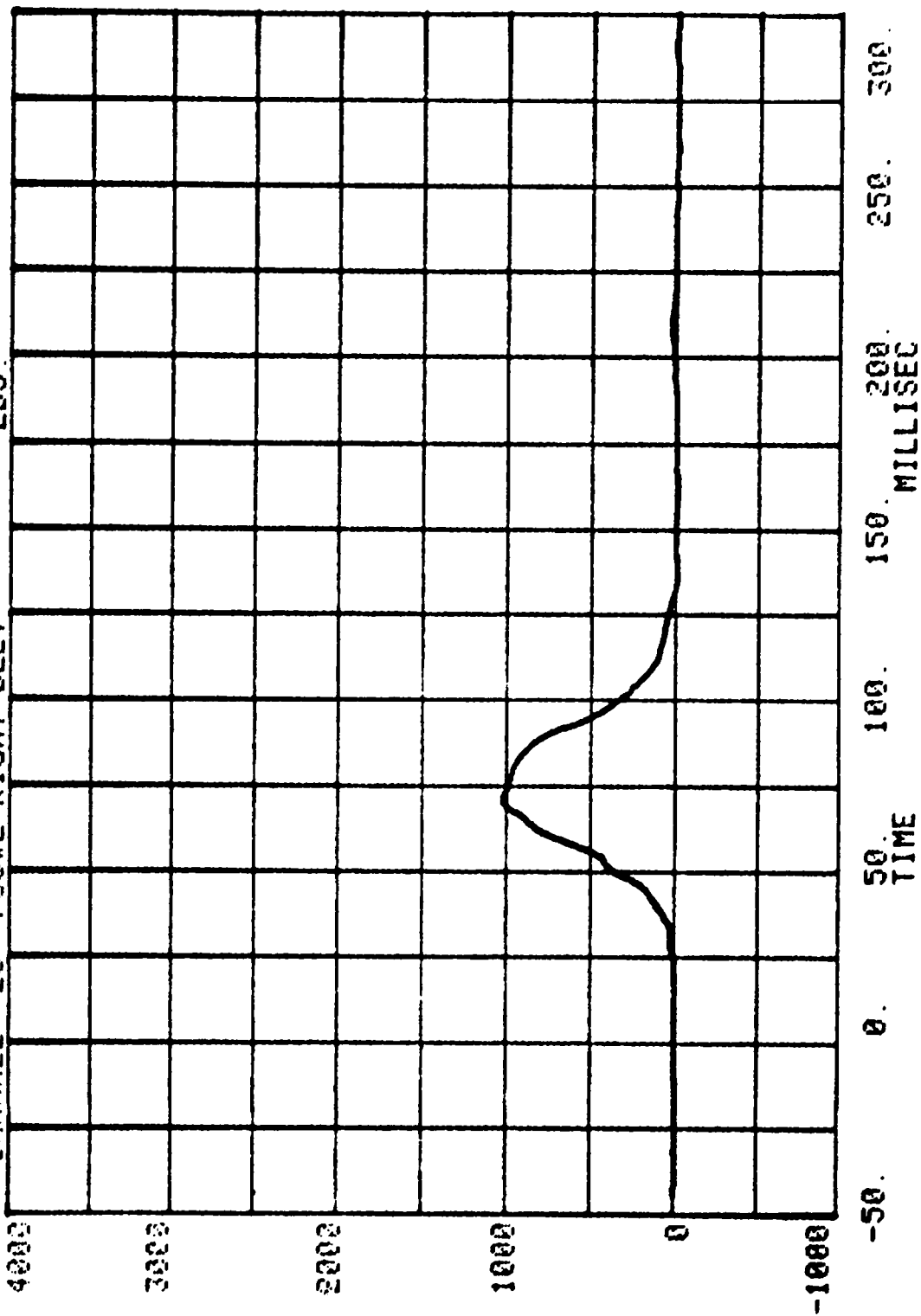
CHANNEL 20 POS#2 RIGHT FEMUR RUN= 985 SERIES= 19 LBS.



CHANNEL 25 POS#2 RIGHT BELT

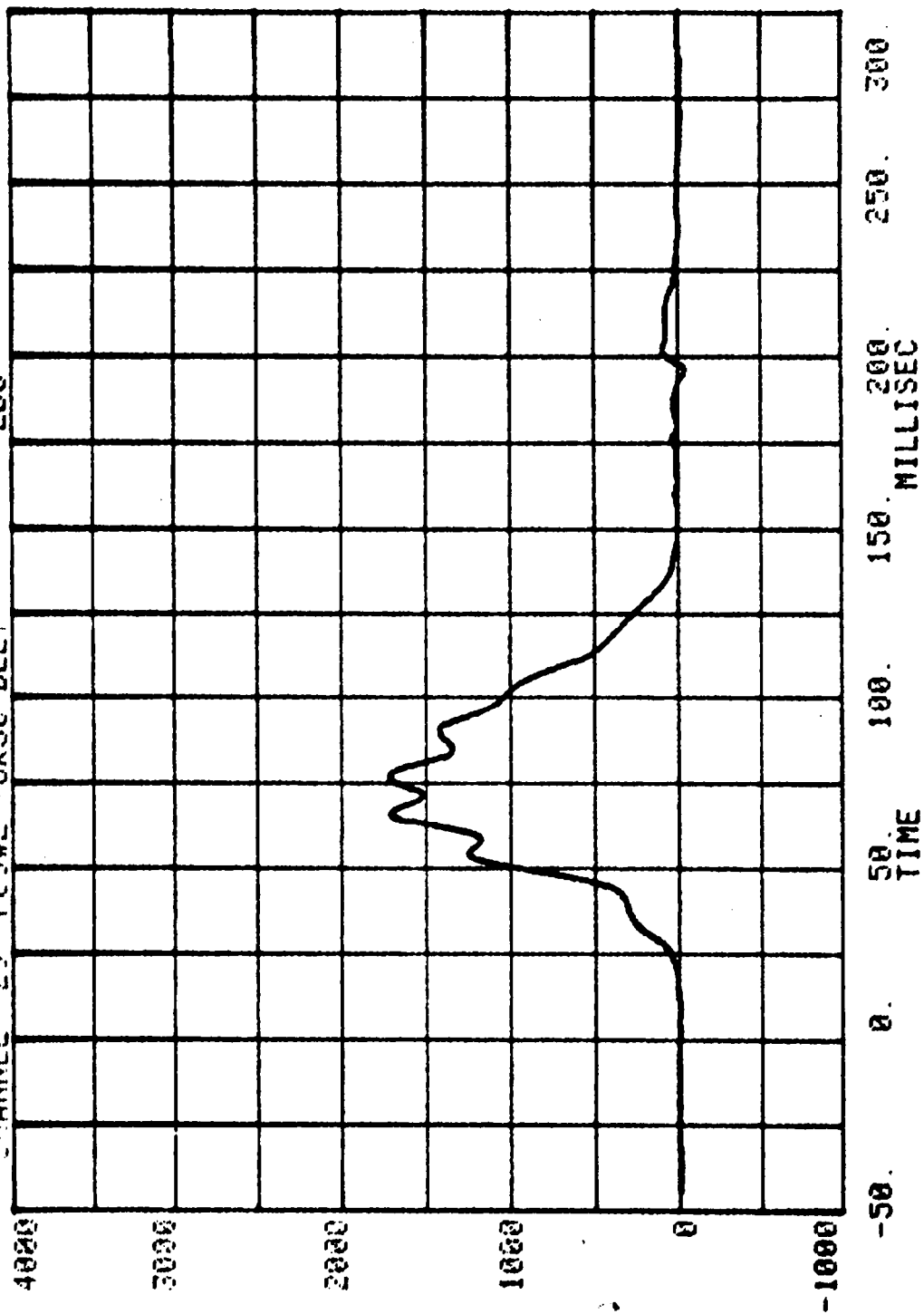
RUN= 985 SERIES= 19

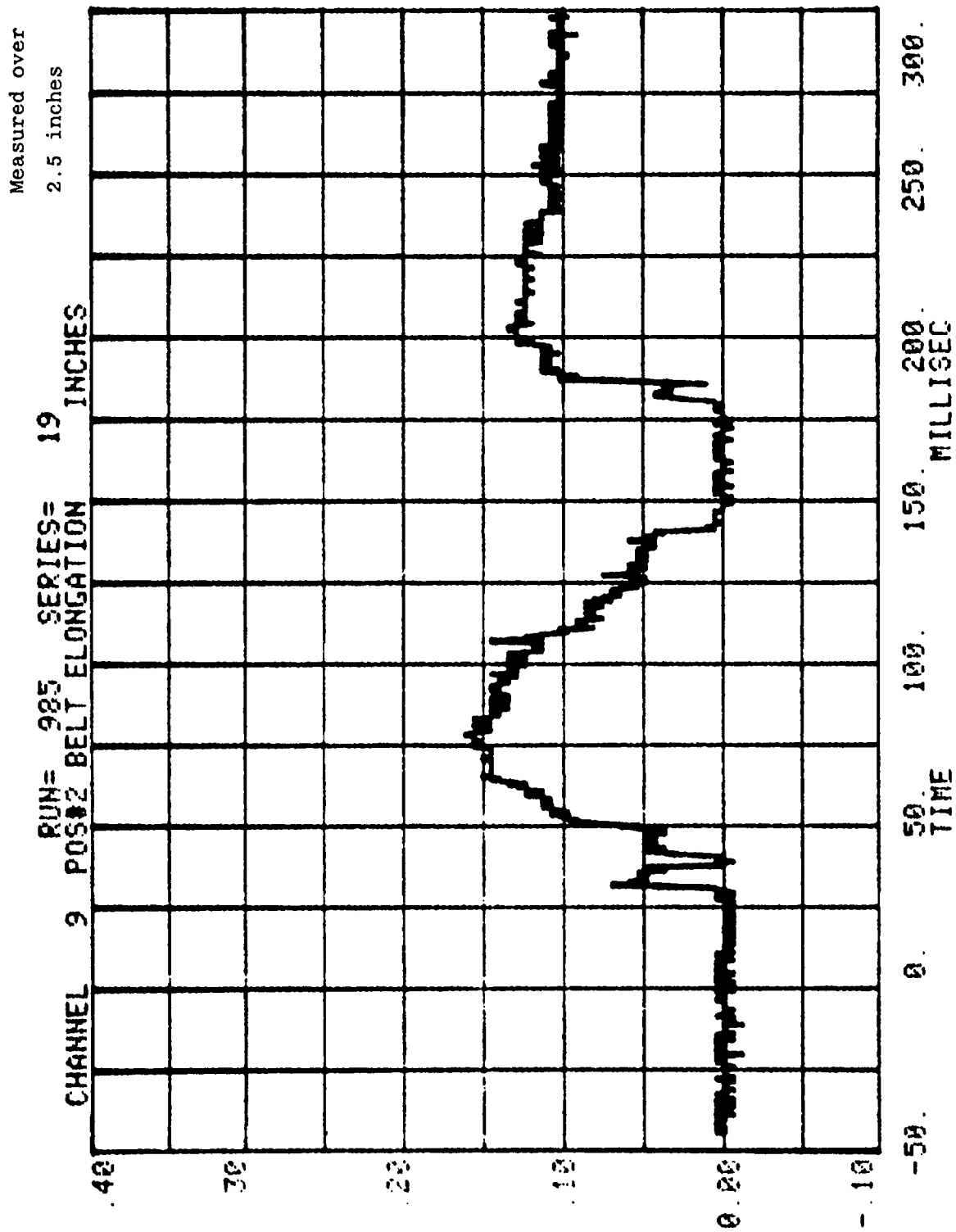
LBS.

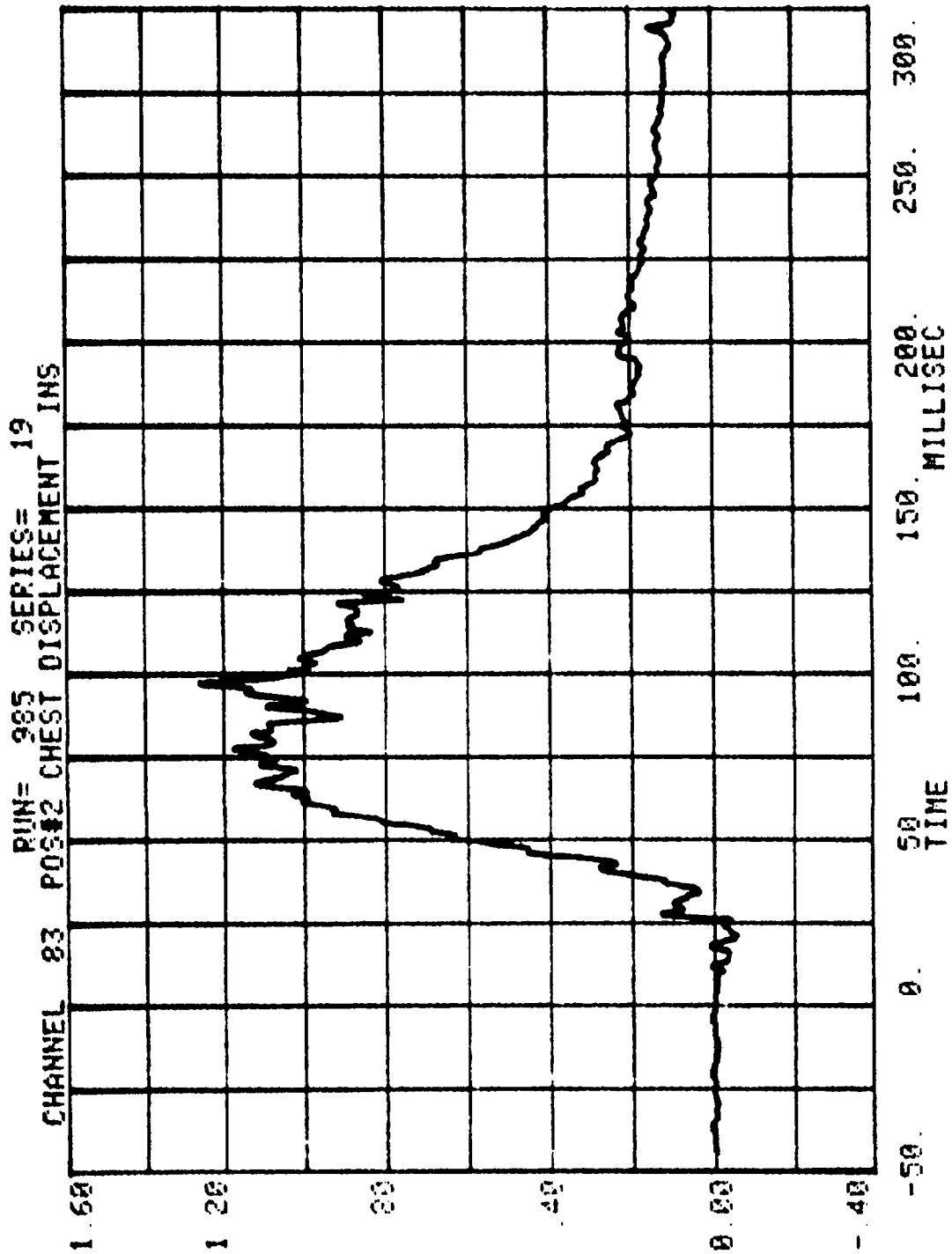


CHANNEL 25 POS#2 TORSO BELT LBS

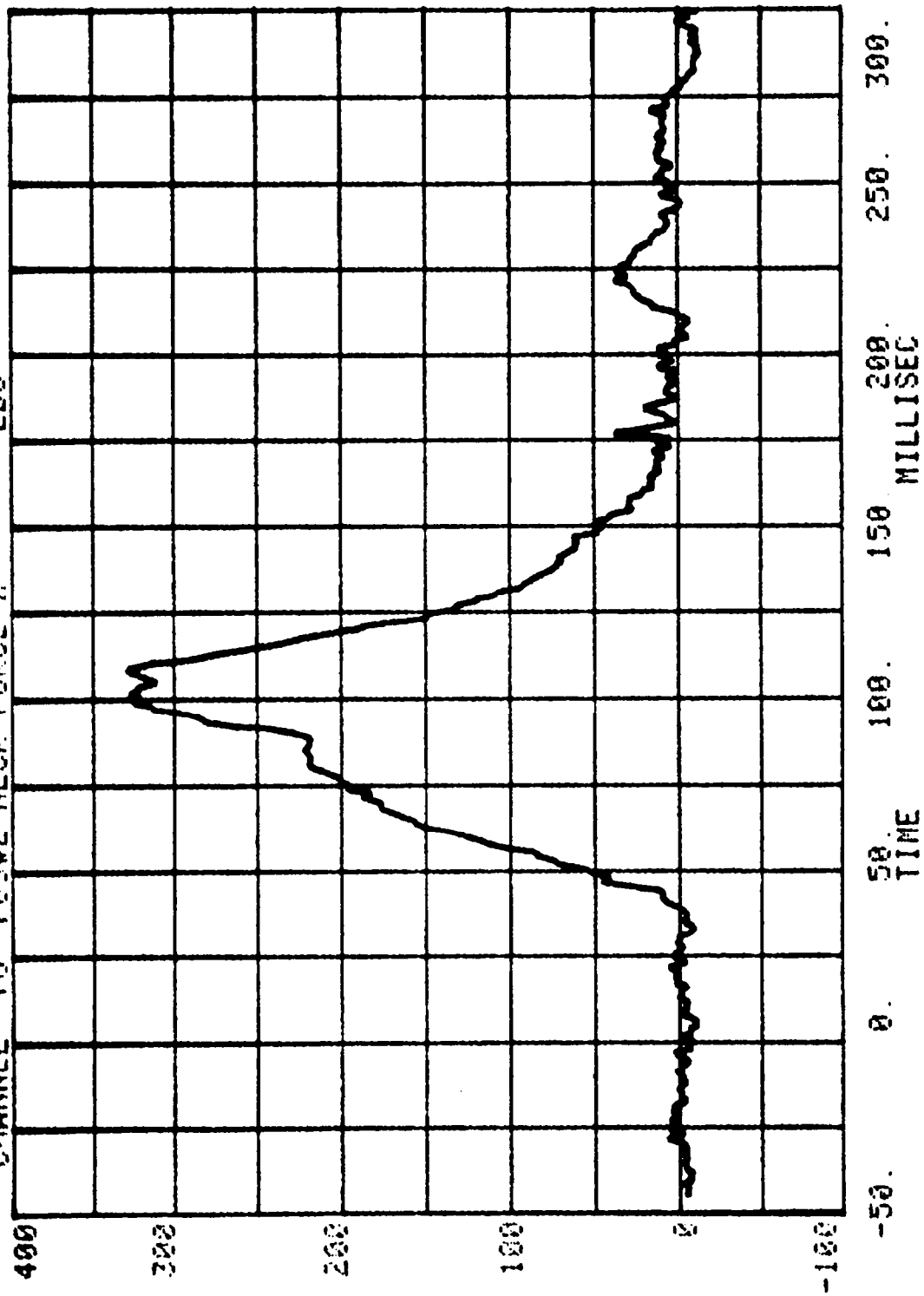
RUN= 985 SERIES= 19





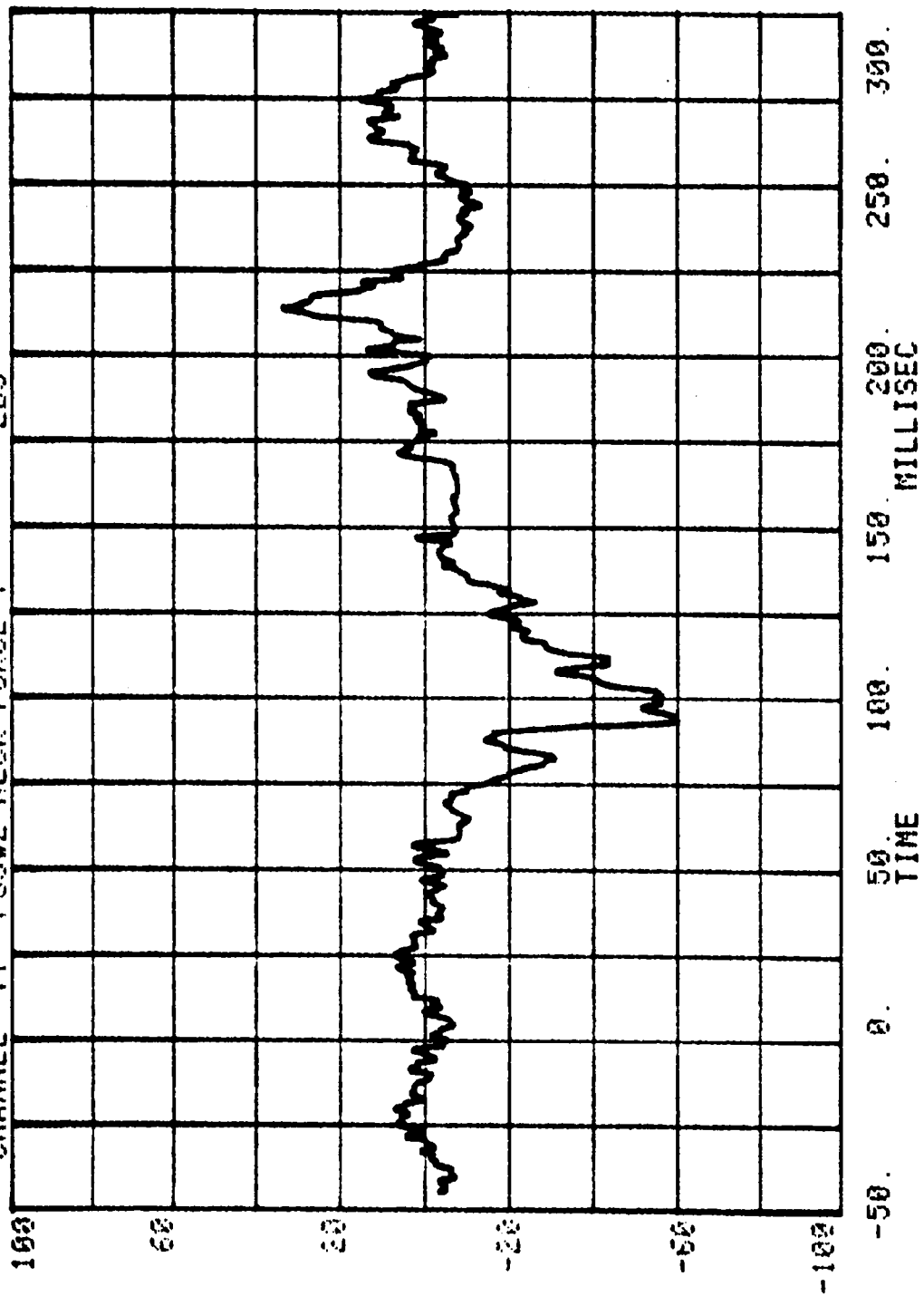


CHANNEL 76 PUN= 985 SERIES= 19 LBS
POS#2 HECK FORCE X

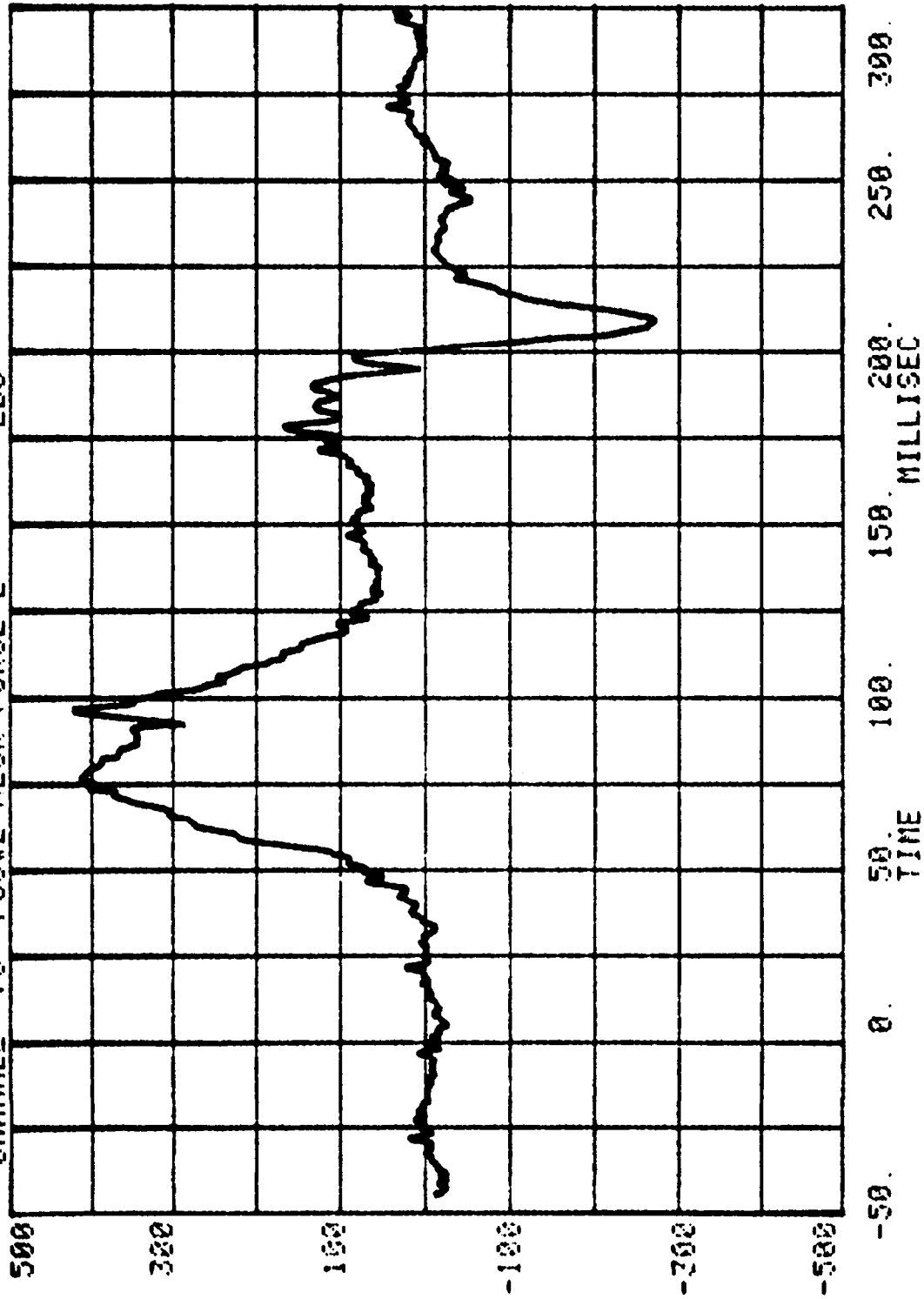


CHANNEL 77 POS#2 NECK FORCE Y LBS

RUN= 985 SERIES= 13

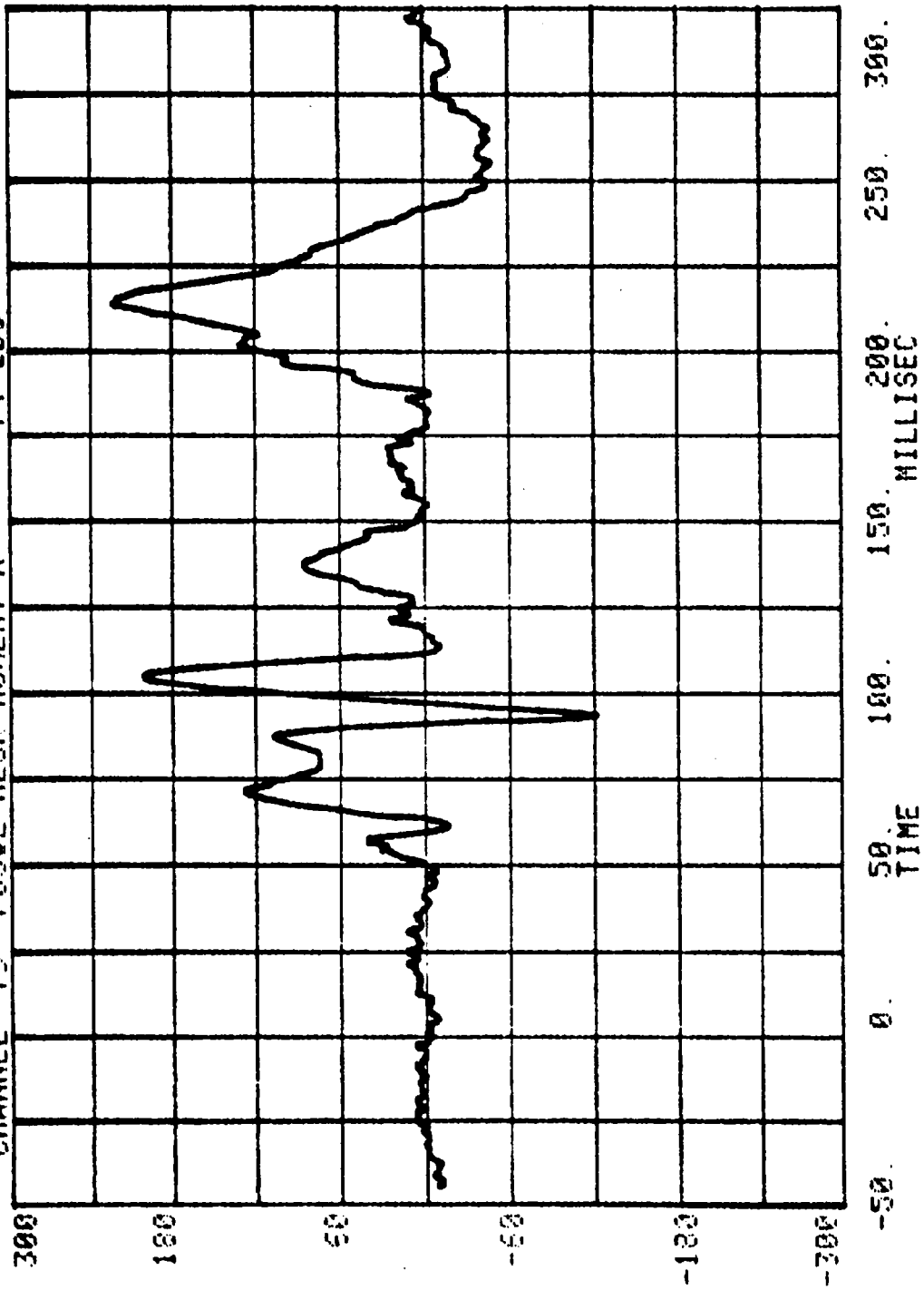


CHANNEL 73 POS#2 NECK FORCE Z LBS
RUN= 985 SERIES= 19



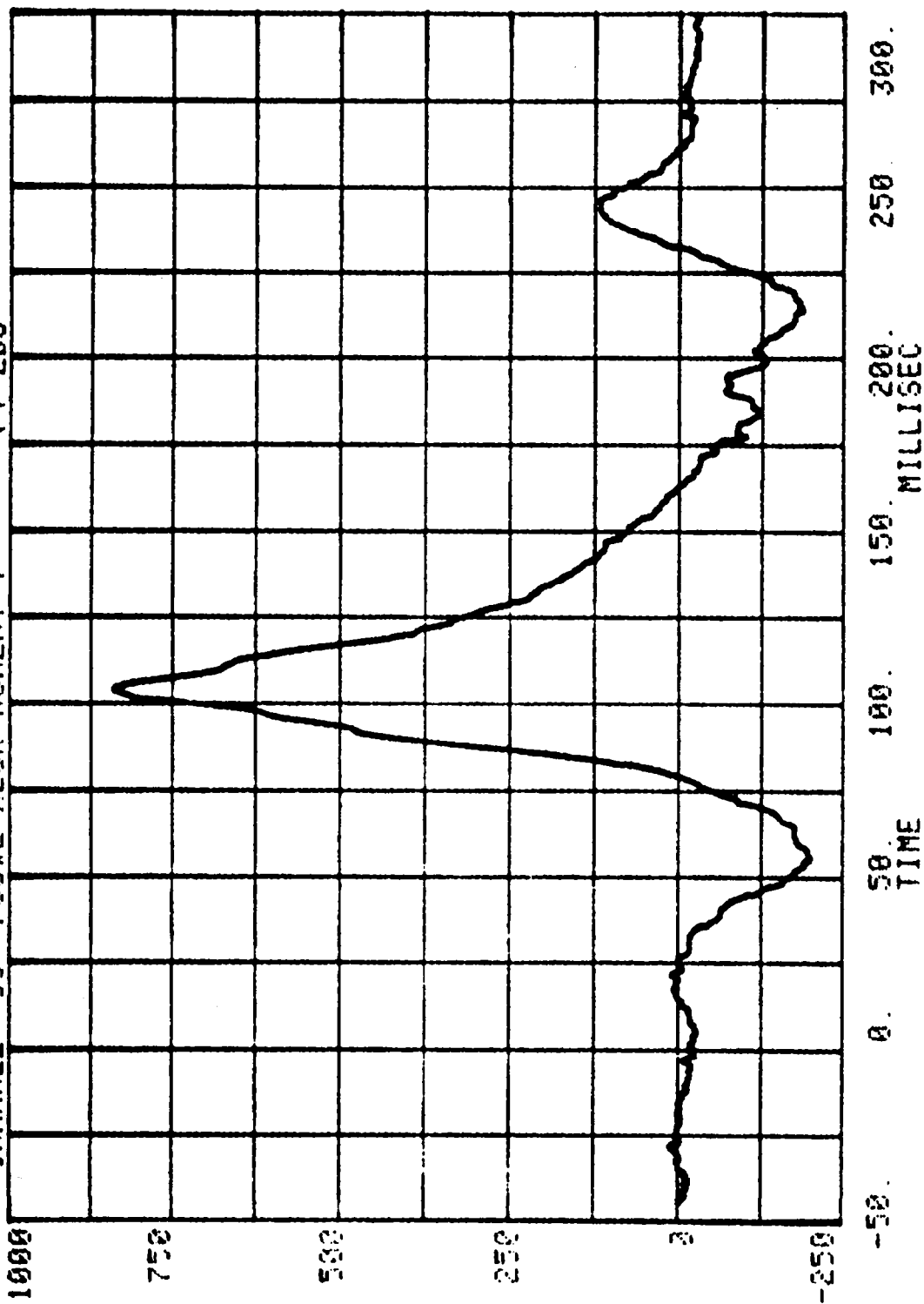
CHANNEL 79 POS#2 NECK MOMENT X FT-LBS

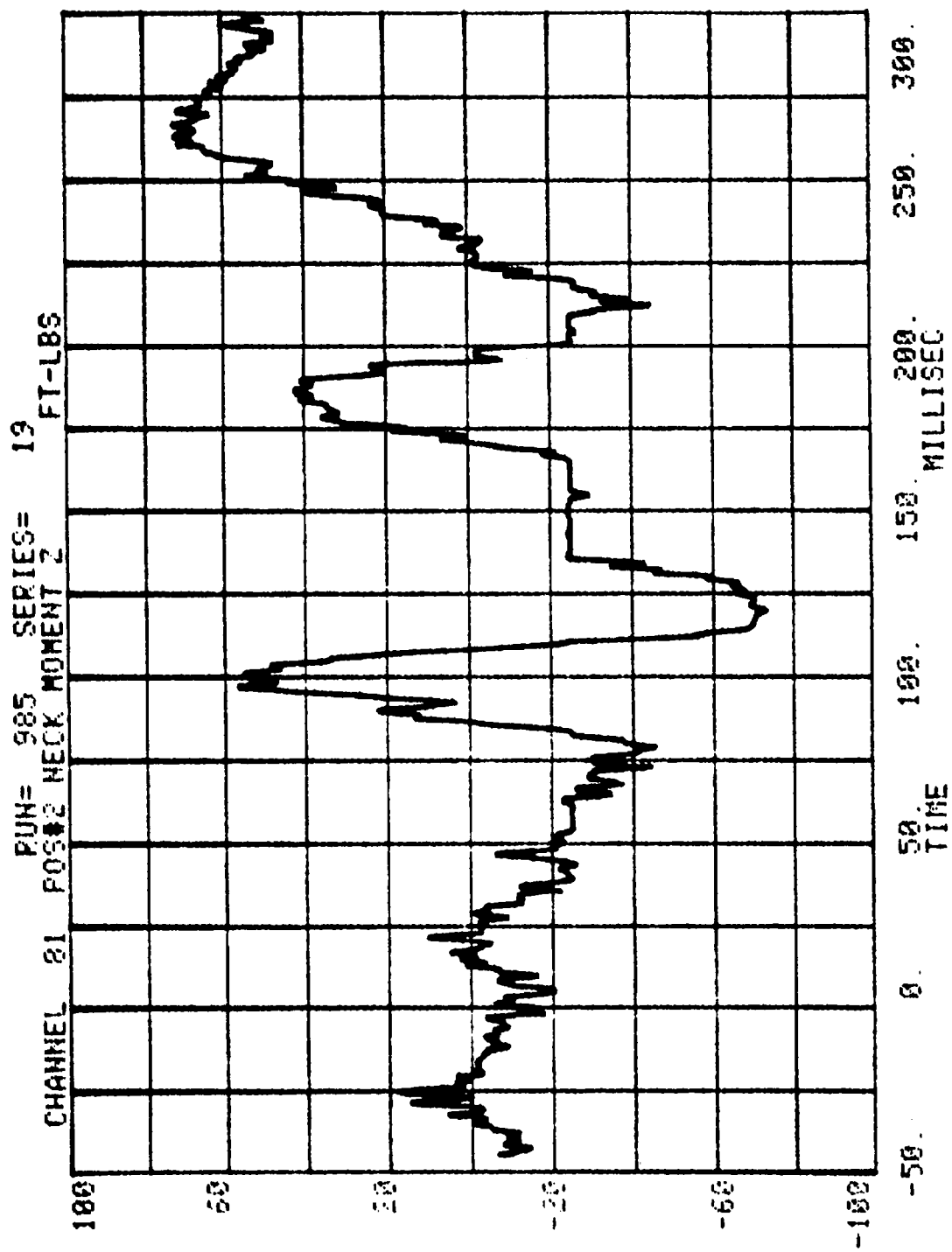
RUN= 985 SERIES= 19



CHANNEL 80 POS#2 NECK MOMENT Y FT-LBS

RUN= 995 SERIES= 19





Appendix C

DUMMY CERTIFICATION TESTS

Appendix C contains the results from certification tests performed on the 50th percentile male anthropomorphic 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.

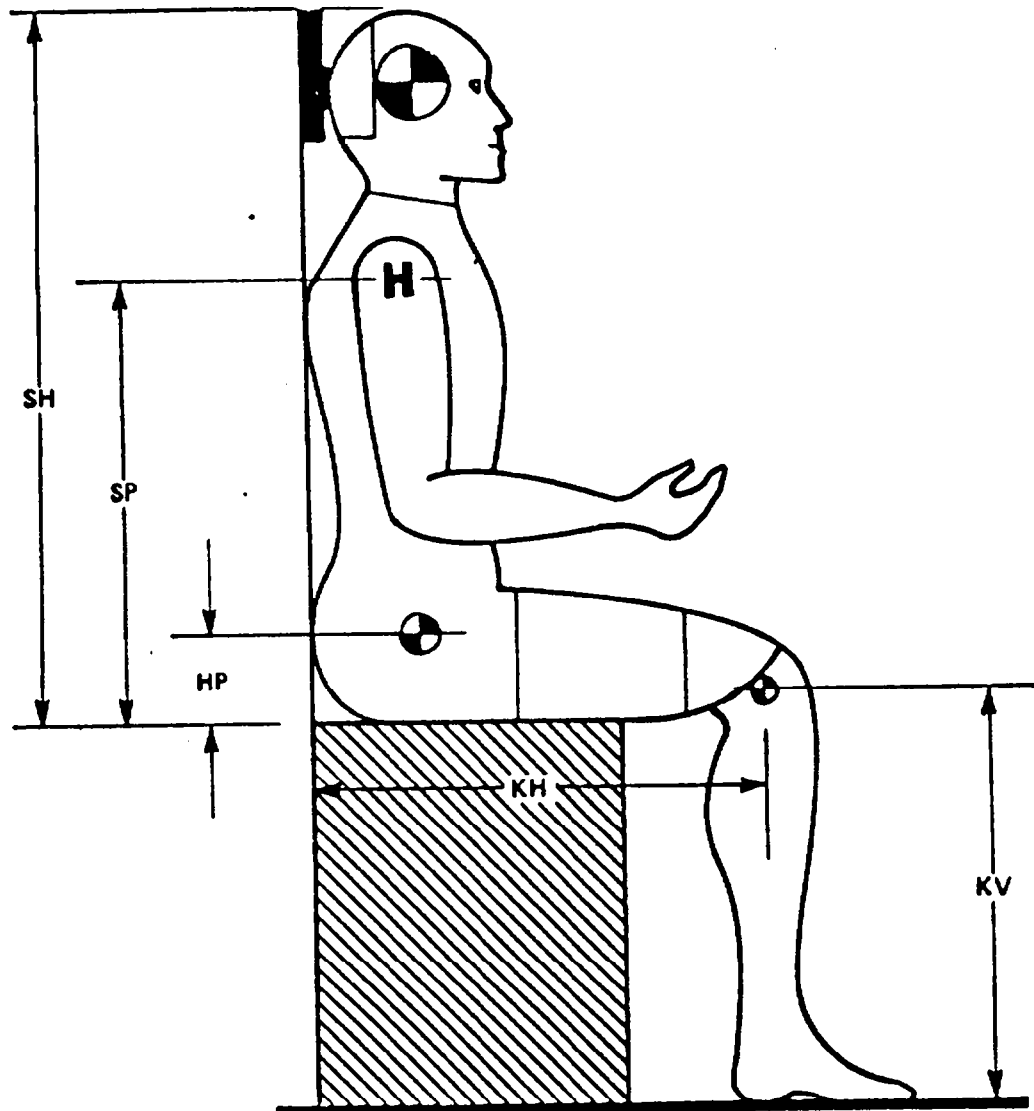
Dummy serial numbers and certification dates are:

<u>Serial No.</u>	<u>Completion Date</u>
45	04-16-90
150	04-17-90

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 No. 6525-V-1.

Figure 10
DUMMY CONFIGURATION DIMENSIONS



CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 4-16-90

6 AXIS NECK TRANSDUCER

CALSPAN

HY3 SN 45 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	71 DEG. F
RELATIVE HUMIDITY		10% - 70%	32 %
IMPACT VELOCITY		22.6 - 23.4 FPS	23.4 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	24.0 G
	20 MS	17.60 - 22.60 G	21.93 G
	30 MS	12.50 - 18.50 G	16.37 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	16.37 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	39.88 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	76.8 DEG.
	TIME	57 - 64 MS	58.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT.-LBS.	79.09 FT.-LBS.
	TIME	47 - 58 MS	54.25 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	113.88 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	99.25 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 4-16-90

6 AXIS NECK TRANSDUCER

CALSPAN

HY3 SN 45 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	71 DEG. F
RELATIVE HUMIDITY		10% - 70%	32 %
IMPACT VELOCITY		19.50 - 20.30 FPS	20.3 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	18.2 G
	20 MS	14.00 - 19.00 G	16.91 G
	30 MS	11.00 - 16.00 G	12.99 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	12.99 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	45.88 MS
D PLANE	MAX	81 - 106 DEG.	101.31 DEG.
ROTATION	TIME	72 - 82 MS	77 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-59.0/-39.0 FT.-LBS.	-57.84 FT.-LBS.
	TIME	65 - 79 MS	71.25 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	156.88 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	139.88 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 4-12-90

CALSPAN

HY3 SN 45 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	27 %
PENDULUM VELOCITY	21.6 - 22.4 FT/SEC	21.7 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 INCHES	2.51 INCHES
MAXIMUM RESISTIVE FORCE	1080 - 1245 POUNDS	1238 POUNDS
INTERNAL HYSTERESIS	69% - 85%	69 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 45

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	CH83	11-89	5-90
HY LATERAL--	ENDEVCO	CU62	11-89	5-90
HZ VERTICAL--	ENDEVCO	CM86	11-89	5-90
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A73	11-89	5-90
CY LATERAL--	ENDEVCO	CE06	11-89	5-90
CZ VERTICAL--	CEC	A44	11-89	5-90
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	74	12-89	6-90
RIGHT SIDE	GSE	1927	12-89	6-90
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	1-90	7-90
2. TEST PROBE ACCELEROMETER--	CEC	A161	1-90	7-90
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS- DUCER INC	20051	2-90	8-90
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	2-90	8-90
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	2-90	8-90

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 4-17-90

6 AXIS NECK TRANSDUCER

CALSPAN

HY3 SN 150 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY		10% - 70%	32 %
IMPACT VELOCITY		22.6 - 23.4 FPS	23.3 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	22.61 G
	20 MS	17.60 - 22.60 G	20.52 G
	30 MS	12.50 - 18.50 G	17.97 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	18.61 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	41.0 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	75.25 DEG.
	TIME	57 - 64 MS	59.88 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT.-LBS.	79.26 FT.-LBS.
	TIME	47 - 58 MS	53.38 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	117.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	98.25 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 4-17-90

6 AXIS NECK TRANSDUCER

CALSPAN

HY3 SN 150 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY		10% - 70%	32 %
IMPACT VELOCITY		19.50 - 20.30 FPS	20.3 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	17.25 G
	20 MS	14.00 - 19.00 G	16.91 G
	30 MS	11.00 - 16.00 G	13.59 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	13.59 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	45.5 MS
D PLANE	MAX	81 - 106 DEG.	94.52 DEG.
ROTATION	TIME	72 - 82 MS	75.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-59.0/-39.0 FT.-LBS.	-49.33 FT.-LBS.
	TIME	65 - 79 MS	70.25 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	155.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	129 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 4-12-90

CALSPAN

HY3 SN 150 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	26 %
PENDULUM VELOCITY	21.6 - 22.4 FT/SEC	21.7 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 INCHES	2.54 INCHES
MAXIMUM RESISTIVE FORCE	1080 - 1245 POUNDS	1229 POUNDS
INTERNAL HYSTERESIS	69% - 85%	76.1 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN ____IVAN MINKEWICZ____

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 150

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	CS75	1-90	7-90
HY LATERAL--	ENDEVCO	CY89	1-90	7-90
HZ VERTICAL--	ENDEVCO	CE76	1-90	7-90
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A129	3-90	9-90
CY LATERAL--	ENDEVCO	CN64	3-90	9-90
CZ VERTICAL--	CEC	A56	3-90	9-90
3. FEMUR LOAD CELLS				
RIGHT SIDE	GSE	311	12-89	6-90
LEFT SIDE	GSE	312	12-89	6-90
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	1-90	7-90
2. TEST PROBE ACCELEROMETER--	CEC	A161	1-90	7-90
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS- DUCER INC	20051	2-90	8-90
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	2-90	8-90
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	2-90	8-90

Appendix D

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

To raise the one-piece rear seat:

1. Lift the seatback until it locks in place. Push back and forth on the seatback to be sure it is locked in place.

■ Safety Belts— They're For Everyone

This part of the manual tells you how to use safety belts properly. It also tells you some things you should not do with safety belts.



220003

CAUTION

⚠ If you are ever in an accident and you're not wearing a safety belt, your injuries can be much worse. You could hit things inside the car or be ejected from it. You could be seriously hurt or killed. In the same accident, you might not be if you were buckled up.



Why You Should Wear Safety Belts

Nobody plans on being in an accident. You never know when an accident will happen. Some accidents are minor, but you could be in a serious one. A few accidents are so serious, such as being hit by a train, that even a safety belt won't help. But in many accidents people who wear safety belts can survive and sometimes walk away. Without safety belts they could be badly hurt or killed. After 25 years of safety belts in cars, the facts are clear. Buckling up does matter... a lot.

In many states and all provinces, the law requires the wearing of safety belts. Why? Because they work.

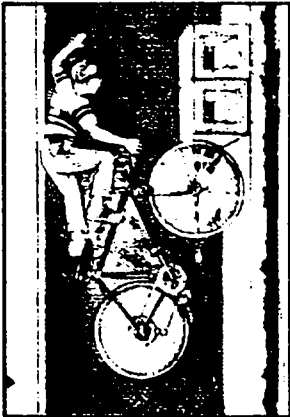
Seats & Safety Belts



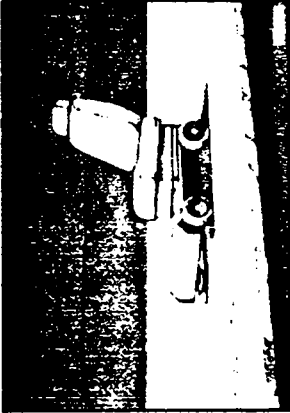
Why Safety Belts Work

When you're riding in or on anything, you're going as fast as it is.

1. For example, if the bike is going 10 mph, so is the child.



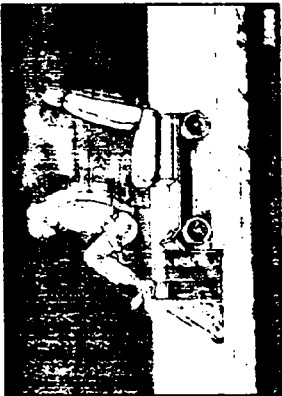
2. When the bike hits something, it stops. But the child keeps going!



3. Take a simple seat on wheels. Put a person on it.



4. Get it up to speed, then stop it. The person keeps going...



5. ... until something stops him.



7. It could be the instrument panel...



8. Or it could be the safety belts.



6. In a real car, it could be the windshield...

With safety belts, you slow down as the car does. You get more time to stop, and you stop over more distance. Also, your strongest bones take the force of stopping. That's why safety belts make such good sense.

Seats & Safety Belts

Here Are Questions Many People Ask About Safety Belts—and the Answers

Q: Won't I be trapped in the car after an accident if I'm wearing a safety belt?

A: You could be, whether you're wearing a safety belt or not. But you can easily unbuckle a safety belt, even if you're upside down. And your chance of being conscious during and after an accident, so you can unbuckle and get out, is much greater if you are belted.

Q: Why not just put air bags in cars so people won't have to wear safety belts?

A: "Air bags," or Supplemental Inflatable Restraint systems, are in some cars today and will be in more cars in the future. But they are supplemental systems only—so they work with safety belts, not instead of them. Every "air bag" system ever offered for sale has required the use of safety belts. They provide needed protection not only in frontal collisions, but especially for side collisions and other kinds of accidents.

Q: If I'm a good driver, and I never drive far from home, why should I wear safety belts?

A: You may be an excellent driver, but if you're involved in an accident—even one that isn't your fault—you and your passengers can be hurt. Being a good driver doesn't protect you from things beyond your control, or from bad drivers.

Most accidents occur within 25 miles (40 km) of home. And the greatest number of deaths and serious injuries occur at speeds less than 40 mph (64 km/h).

Safety belts are for everyone.

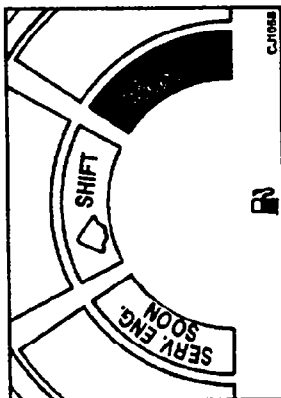
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Cars First Sold in Canada

Was your Chevrolet first sold, when new, in Canada? (If it was, a sticker on the driver's door will say "Conforms to all applicable Canada motor vehicle" etc.)

If your car was first sold in Canada, the rest of this safety belt information does not apply to your car.

To learn how to use the safety belts in your Chevrolet, please read the Owner's Manual Safety Belt Supplement. It comes with every new Chevrolet sold in Canada.



Safety Belt Warning Light

The fasten belts warning light on your instrument panel lights up when you turn the ignition to **Run** or **Start**. The light will stay on for a few seconds, and you'll also hear a buzzer or chime. It's your reminder to buckle up.

If the light ever comes on as you're driving, or stays on after you start your car, a retractor might not be working.

CAUTION

⚠ If your safety belt warning light ever stays on, have your Chevrolet serviced. If you don't have it fixed, you might not have the protection you need in an accident.

Adults and Safety Belts

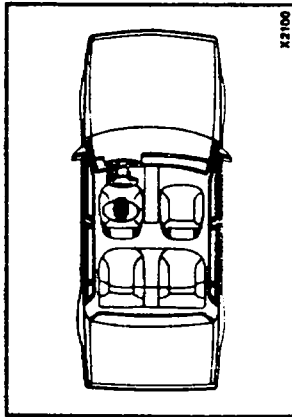
When Children Ride in Your Car

The following section is only for people of adult size. If children will be riding in your Chevrolet, also read *Children and Safety Belts* later in this section.

CAUTION

⚠ There are special things to know about safety belts for children. And there are different rules for infants, toddlers, and older children. Follow those rules for everyone's protection.

Seats & Safety Belts



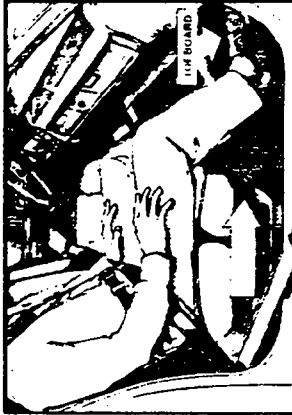
■ *Driver's Position*

The driver's position belt has an automatic lap-shoulder belt.



Automatic Lap-Shoulder Belt

This safety belt is called "automatic" because you don't have to buckle up when you get into the front seats of your car, and you don't have to unbuckle when you get out.



With the automatic belt, just get into your car and lock the door. Then adjust the seat so you can sit up straight. Move your seat far enough forward so that your feet touch the toeboard, which is the lower part of the firewall. This way you'll be less likely to slide under the lap belt in a crash.



The lap belt should be as low on the hips as possible. In an accident, this applies belt force to the pelvic bones, and it means you would be less likely to slide under the lap belt. If you slide under it, the belt would apply force to the abdomen, which could cause serious or even fatal injuries. The shoulder belt should go over the shoulder and across the chest. These parts of the body are best able to take belt restraining forces. The shoulder part of the belt locks only if there's a sudden stop or accident.



To unbuckle the automatic belt:
Just push the button on the buckle, and allow the belt to retract.

When you open the door, the belt should go back out of the way. Before you close the door, be sure the belt is out of the way. If you slam the door on it, you can damage both the belt and your car.

It's possible that an automatic belt could keep you from fully opening a door. That can happen if the door was slammed shut very hard. Just close the door all the way, then open it slowly. If that doesn't fix it, then your Chevrolet needs service.

We hope you will always keep your automatic belt buckled. However, you may need to unbuckle it in an emergency.

Seats & Safety Belts



Automatic Lap-Shoulder Belt

(CONT.)

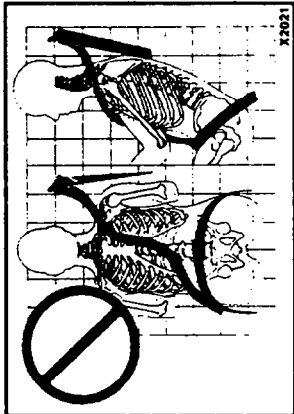
To reattach the automatic belt:

1. Close and lock the door.
2. Grasp the latch plate and pull the belt across you without getting it twisted.



3. Push the latch plate into the buckle until it clicks.

... 68

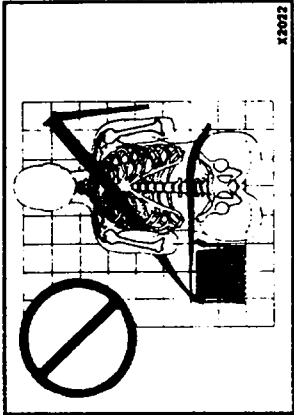


Q: What's wrong with this?

A: The shoulder belt is too loose. It won't give nearly as much protection this way.

CAUTION

! You can be seriously hurt if your shoulder belt is too loose. In an accident, you would move forward too far, which could significantly increase injury. The shoulder belt should fit against your body.

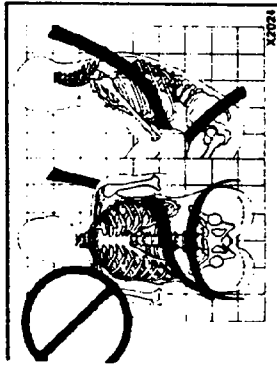


Q: What's wrong with this?

A: The belt is buckled in the wrong place.

CAUTION

! You can be seriously injured if your belt is buckled in the wrong place. In an accident, the belt would go up over your abdomen. The belt forces would be on your abdomen, not the pelvic bones. This could cause serious internal injuries. Be certain the belt is latched to the proper buckle—the one nearest to you.

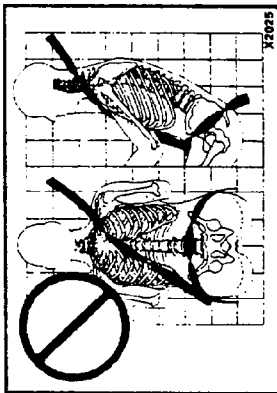


What's wrong with this?

The shoulder belt is worn under the arm. It should be worn over the shoulder at all times.

CAUTION

You can be seriously injured if you wear the shoulder belt under your arm. In an accident, the body would move forward too far, which would increase the chance of head and neck injury. Also, the belt would apply too much force to the ribs, which are not as strong as shoulder bones. This could severely injure internal organs like your liver or spleen.



Q: What's wrong with this?

A: The belt is twisted across the body.

CAUTION

You can be seriously injured by a twisted belt. In an accident, you wouldn't have the full width of the belt to take the impact forces. The twisted belt could badly cut or injure you. If a belt becomes so twisted that you cannot make it straight, ask your dealer to straighten it for you so it will work properly.



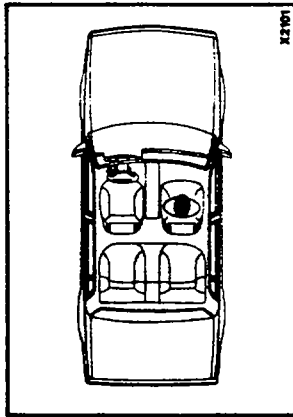
Q: What's wrong with this?

A: The belt is torn.

CAUTION

Torn or frayed belts may not protect you in an accident. They can rip apart under impact forces. If a belt is torn or ripped, replace it right away.

Seats & Safety Belts



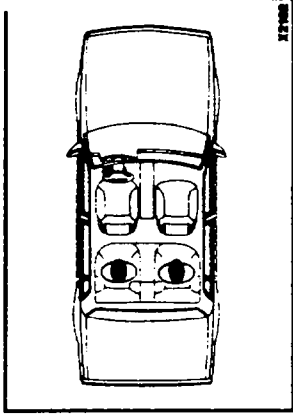
■ Passenger Belts

Right Front Passenger Position

The right front passenger has an automatic lap-shoulder belt. To see how it works, look at the explanation under *Automatic Lap-Shoulder Belt* earlier in this section.

Child Restraints

If you want to put a child restraint at the right front position, don't use the automatic lap-shoulder belt. You must detach it and use special hardware for the child restraint. Read *Children and Safety Belts* later in this section to learn about this special hardware.



Rear Safety Belts

It's very important for rear seat passengers to buckle up! Accident statistics show that unbelted people in the rear seat are hurt more often in accidents than those who were wearing safety belts.

Rear passengers who are not belted can be thrown out of the car in an accident. They can also strike others in the car who are belted.

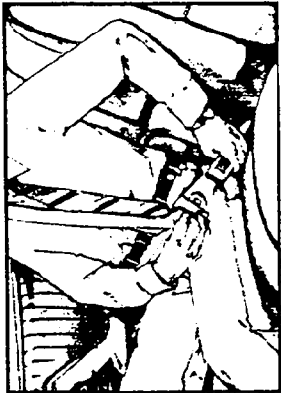
The positions next to the windows have lap-shoulder belts.

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To use rear lap-shoulder belts:

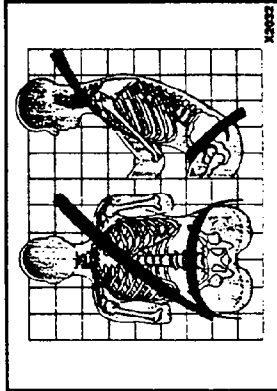
1. Grasp the latch plate and pull the belt across your body.



2. Push the latch into the buckle until it clicks. If the belt is not long enough, see *Safety Belt Extender* at the end of this safety belt section.



3. To unlatch the belt, just push the button on the buckle.



The lap part of the belt should fit low and snug below the hips, just touching the top of the thighs. In an accident, this would apply belt force to the pelvic bones, and it means you'll be less likely to slide under the lap belt. If you slide under it, the belt would apply force to the abdomen, which could cause serious or even fatal injuries. The shoulder belt should go over the shoulder and across the chest. These parts of the body are best able to take belt restraining forces.

Seats & Safety Belts



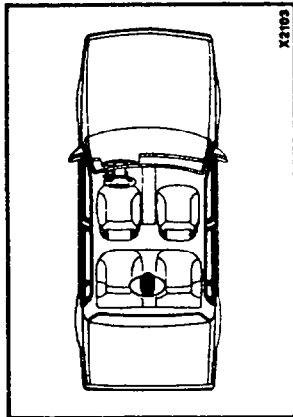
Rear Safety Belts (CONT.)

If the belt is too loose, pull up on the shoulder belt.

The shoulder part of the belt locks only if there's a sudden stop or accident.

CAUTION

 You can be seriously hurt if your shoulder belt is too loose. If it is too loose, you would move too far forward. If the shoulder belt should fit against your body.



Center Rear Lap Belt

The center position in the middle of the rear seat has a lap belt.



1. To make it longer, just tilt the latch buckle a little and pull it to adjust the length.