

REPORT NO. CAL-86-N19

NEW CAR ASSESSMENT PROGRAM (NCAP)

FRONTAL BARRIER IMPACT TEST

HYUNDAI MOTOR COMPANY

1986 Hyundai Excel

4-Door Sedan

NHTSA NO. MG0501

CALSPAN TEST NO. 7457-19

CALSPAN CORPORATION

ADVANCED TECHNOLOGY CENTER

P.O. BOX 400

BUFFALO, NEW YORK 14225

May 15, 1986



FINAL REPORT

Prepared for:

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OFFICE OF MARKET INCENTIVES

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16. Abstract A frontal load cell barrier test of a 1986 Hyundai Excel 4-Door Sedan was performed at the Calspan Corporation, Advanced Technology Center crash test facility in Buffalo, New York, on May 15, 1986. Impact speed was 34.8 mph, and the ambient temperature at the barrier face at the time of impact was 32°F. The maximum post-test vehicle crush was 21.0 inches. The test vehicle appeared to comply with the indicant requirements of the following Federal Motor Vehicle Safety Standard. 1. FMVSS No. 212, "Windshield Mounting" 2. FMVSS No. 219 (Partial), "Windshield Zone Intrusion" 3. FMVSS No. 301-75, "Fuel System Integrity" <u>Type of Restraint System</u> 3-point continuous webbing manual system at each front outboard seating position.					
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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	SUMMARY OF RESULTS FOR FMVSS NOS. 212, 219, & 301-75	3-1
4	OCCUPANT AND VEHICLE INFORMATION	4-1
APPENDIX A	PHOTOGRAPHS	A-1
APPENDIX B	VEHICLE, LOAD CELL BARRIER DATA 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	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 Positions 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 86 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 crashworthiness 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 MG0501

A load cell barrier consisting of 36 load cells was impacted by a 1986 Hyundai Excel 4-Door Sedan at a velocity of 34.8 mph. The test was performed at the Calspan Corporation Advanced Technology Center on May 15, 1986. 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. The driver ATD (Serial No. 1020) and the right-front passenger ATD (Serial No. 1019) were certified prior to the test. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 67 channels of data were recorded in six 14-channel FM tape recorders. Appendix B contains the vehicle, load cell barrier and dummy response data traces. Data from load cell C7 was lost. We are unable to provide this data as well as data for load cell group 6 and the data for total load cell sum.

The driver's head struck the steering wheel rim and hub; the HIC was 998.9. The maximum chest deceleration over 3 milliseconds was 73 g's and femur loads were 785 and 2248 pounds.

The right-front passenger HIC was 2662 and maximum chest deceleration over 3 milliseconds was 55 g's. Femur loads were 520 and 1597 pounds.

Table 1

GENERAL TEST AND VEHICLE DATA

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1986 Hyundai Excel 4 Door Sedan

NHTSA NO.: MG0501 VIN.: KMHLF21J4GU022189

BODY COLOR: Red DATE OF MANUFACTURE: February 1986

Engine: 4 cylinders; - C.I.D.; 1.5 Liters; - CC
x Gas; - Diesel; - Turbocharged
- Longitudinal; x Transverse

Transmission: 5 Speed x Manual; - Automatic; x Overdrive
Final Drive: x Front Wheel; - Rear Wheel; - Four Wheel

Date Received: 5/6/86 Odometer Reading: 64
x 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: GT-P155/80-13

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

Tires on Vehicle: GT-P155/80-13; Manufacturer: Goodyear

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. Knot

Vehicle Capacity Weight (VCW) = 816 lbs. (A)

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

Rated Cargo and Luggage Weight (RCLW) A-B = 66 lbs.

GVWR 3140 lbs. GAWR: Front 1610 lbs. Rear 1545 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 = <u>690</u> lbs.	Right Rear = <u>430</u> lbs.
Left Front = <u>700</u> lbs.	Left Rear = <u>450</u> lbs.
TOTAL FRONT WEIGHT = <u>1390</u> lbs. (<u>61</u> % of Total Vehicle Weight)	
TOTAL REAR WEIGHT = <u>880</u> lbs. (<u>39</u> % of Total Vehicle Weight)	
TOTAL DELIVERY WEIGHT = <u>2270</u> lbs.	

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (2270 lbs.)
 VCW = Vehicle Capacity Weight (816 lbs.)
 DSC = Designated Seating Capacity (5)
 RCLW = VCW - 150 (DSC) = 66 lbs.
 Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)
 Target Test Weight = 2664 lbs.

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

Right Front = <u>730</u> lbs.	Right Rear = <u>640</u> lbs.
Left Front = <u>740</u> lbs.	Left Rear = <u>600</u> lbs.
TOTAL FRONT WEIGHT = <u>1470</u> lbs. (<u>54</u> % of Total Vehicle Weight)	
TOTAL REAR WEIGHT = <u>1240</u> lbs. (<u>46</u> % of Total Vehicle Weight)	
TOTAL TEST WEIGHT = <u>2710</u> lbs.	
Weight of ballast secured in vehicle trunk area = <u>0</u> lbs.	

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude:	RF	<u>25.2</u>	LF	<u>25.2</u>	RR	<u>24.0</u>	LR	<u>24.0</u>
Test Attitude:	RF	<u>24.5</u>	LF	<u>25.0</u>	RR	<u>22.2</u>	LR	<u>22.5</u>
Wheel Base: <u>93.7</u> in.; C.G. = <u>43.6</u> 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: May 15, 1986 Time of Test: 12:00
 Ambient Temperature: 32° °F at impact area
 Temperature in Occupant Compartment: 70 °F.
 Windshield Molding Temperature: 72 °F.
 Required Impact Velocity Range: 34.5 to 35.5 mph
 Impact Velocity: primary = 34.8 mph, secondary = 34.8 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>164.1</u>	C _L	<u>167.0</u>	L	<u>163.8</u>
	Post-test	= R	<u>143.1</u>	C _L	<u>146.2</u>	L	<u>145.0</u>
	Crush	= R	<u>21.0</u>	C _L	<u>20.8</u>	L	<u>18.8</u>

Distance from front of test vehicle to point of impact:

R 11.0 C/L 10.5 L 11.0

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Rim</u>	<u>Dash</u>
Chest	<u>No contact</u>	<u>No contact</u>
Abdomen	<u>No contact</u>	<u>No contact</u>
Left Knee	<u>Dash</u>	<u>Dash</u>
Right Knee	<u>Dash</u>	<u>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>
Door Opening	<u>Not operable</u>	<u>Not operable</u>	<u>Operable</u>	<u>Operable</u>

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

Section 3

SUMMARY OF RESULTS OF FMVSS NOS. 212, 219 AND 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.:

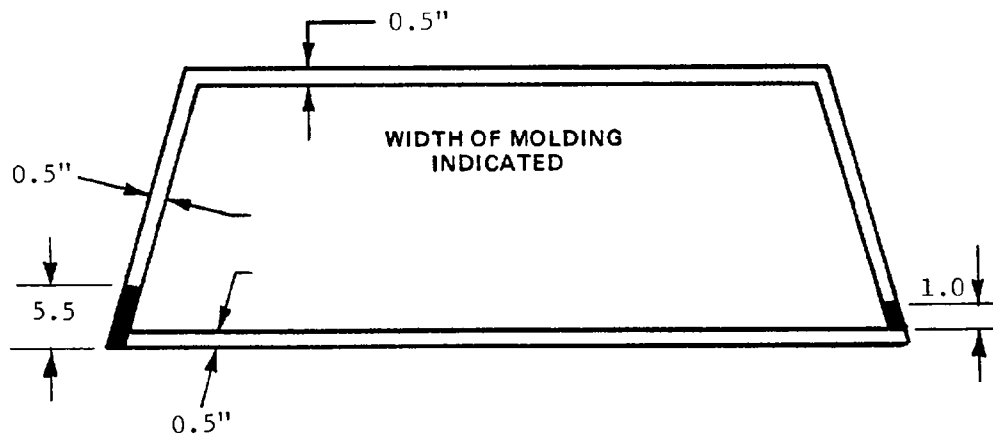
Windshield is bonded in place and covered with .5" molding.

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	76.0	71.5	94%
LEFT SIDE	76.0	75.0	99%
TOTAL	152.0	146.5	96%

AREA OF RETENTION FAILURE:



FRONT VIEW

FAILURE DETAILS:

Windshield lost some retention on both sides near the base. The right side of the windshield lost 5.5" of retention and the left side of the windshield lost 1.0" of retention. Both sides retained more than 75% of the windshield.

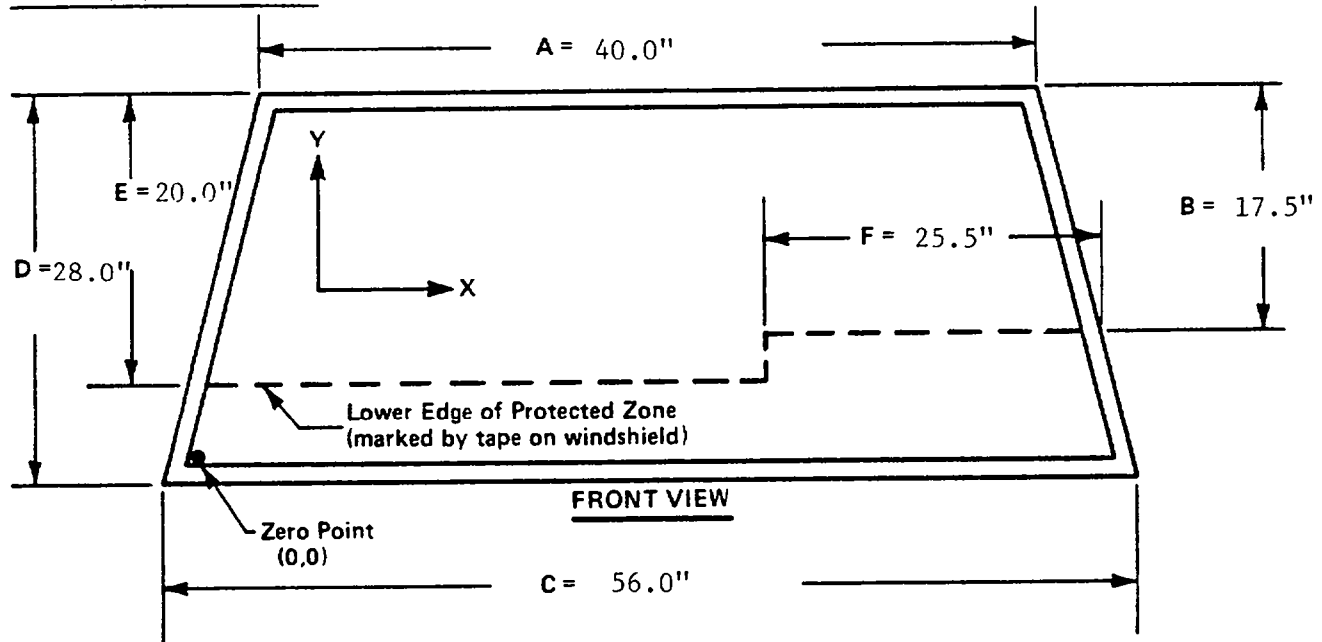
Figure 2

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. The locus of points is drawn on the inner surface of the windshield contacted by the sphere across the width of the instrument panel. From the outermost contactable points, extend the locus line horizontally to the edge 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 of this line onto the outer surface of the windshield.

FMVSS 219 TEST DATA:



DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":

(Show location of penetration on above sketch)

None

COORDINATES		
	X	Y
1.		
2.		
3.		
4.		

Figure 3

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

TEST VEHICLE NHTSA NO.: MG0501; TEST DATE: May 15, 1986

VEHICLE MAKE/MODEL/BODY STYLE: 1986 Hyundai Excel 4-Door Sedan

USABLE CAPACITY OF VEHICLE'S FUEL TANK: 10.6 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 purple 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:

9.8 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° =	<u>2</u> minutes,	<u>58</u> seconds
FMVSS 301-75 Position Hold Time =	<u>5</u> minutes,	<u>0</u> seconds
TOTAL	<u>7</u> minutes,	<u>58</u> seconds
Next Whole Minute Interval....	<u>8</u> minutes	

Figure 3

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

VEHICLE STATIC ROLLOVER DATA:

	First 5 Minutes FROM ONSET OF ROTATION	6th. Minute	7th. Minute	8th. 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.

Section 4
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

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)	-240	-11	56	209	-14	-18	-75	73
DUMMY (2)	-250	56	112	279	-54	22	13	55
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE - FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	785	2248
DUMMY (2)	520	1597
DUMMY (3)		
DUMMY (4)		

	MAXIMUM FORCE - SEAT BELTS LOADS (LBS)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
DUMMY (1)	1244	--	778
DUMMY (2)	1572	1025	--
DUMMY (3)			
DUMMY (4)			

	HEAD INJURY CRITERIA**			
	HIC	t ₁ (SEC)	t ₂ (SEC)	AVE. ACC. (g) t ₁ TO t ₂
DUMMY (1)	998.9	.06195	.09435	62.5
DUMMY (2)	2662.4	.08227	.09232	147.7
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

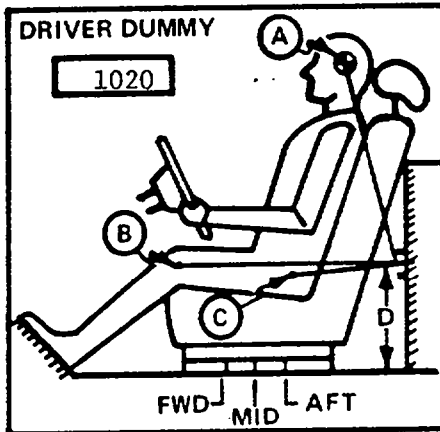
TEST NO.: MG0501

VEHICLE: 1986 Hyundai Excel 4-Door Sedan

SEAT TYPE:
☐ Bench
☒ Bucket
☐ Split Bench

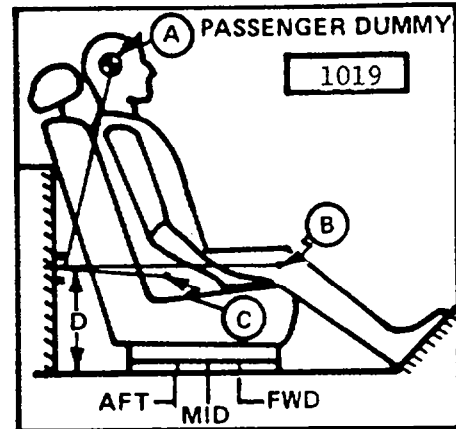
ADJUSTER TYPE:
☒ Manual
☐ Power

BUCKET SEAT BACK TYPE:
☐ Fixed
☒ Adjustable Reclining



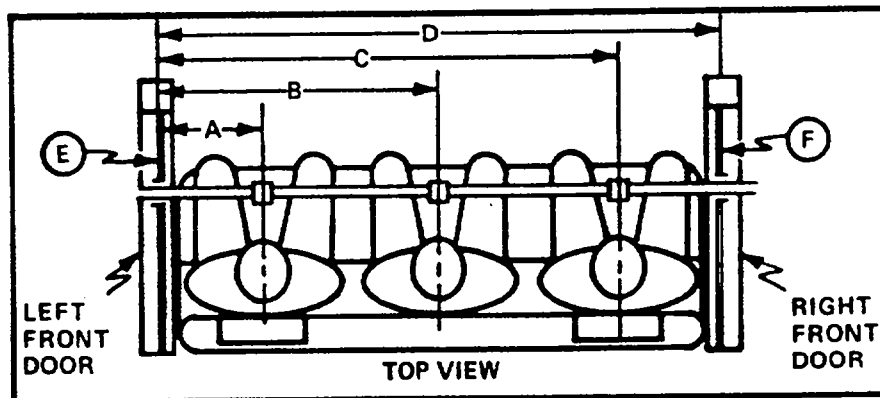
MEASUREMENT LOCATION

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



A = 21.7 in. 1 Degrees
 B = 22.0 in. 105 Degrees
 C = 8.4 in. 140 Degrees
 D = 13.7 in.

A = 22.0 in. 0 Degrees
 B = 21.6 in. 95 Degrees
 C = 7.3 in. 130 Degrees
 D = 13.7 in.



1020

1019

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)

11.2 in.
- in.
36.2 in.
47.2 in.
11.0 in.

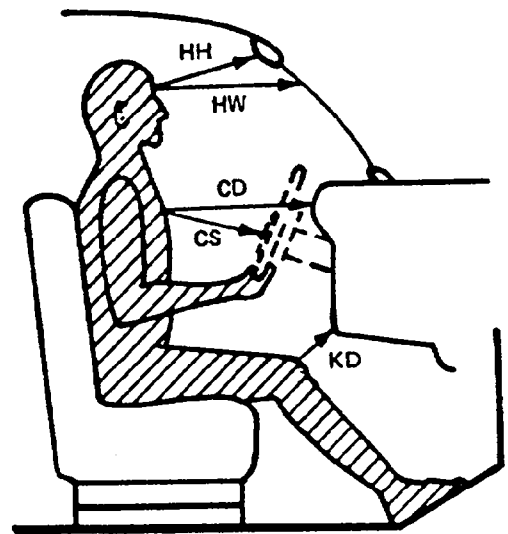
Figure 5

OCCUPANT CLEARANCE DIMENSIONS

	DRIVER	PASSENGER
HH	13.0	14.0
HW	19.0	19.0
CD	21.5	23.0
CS	13.9	--
KDL	4.9	4.2
KDR	5.2	5.2
SA	19°	19°
TA	24°	24°

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

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	4.8	4.9
HS	7.0	7.0
AD	3.5	4.0
HD	7.0	6.0
KK	10.5	8.5

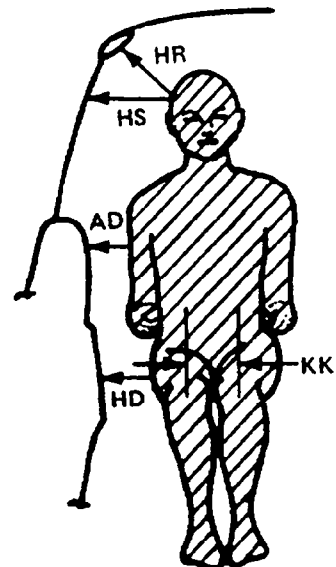
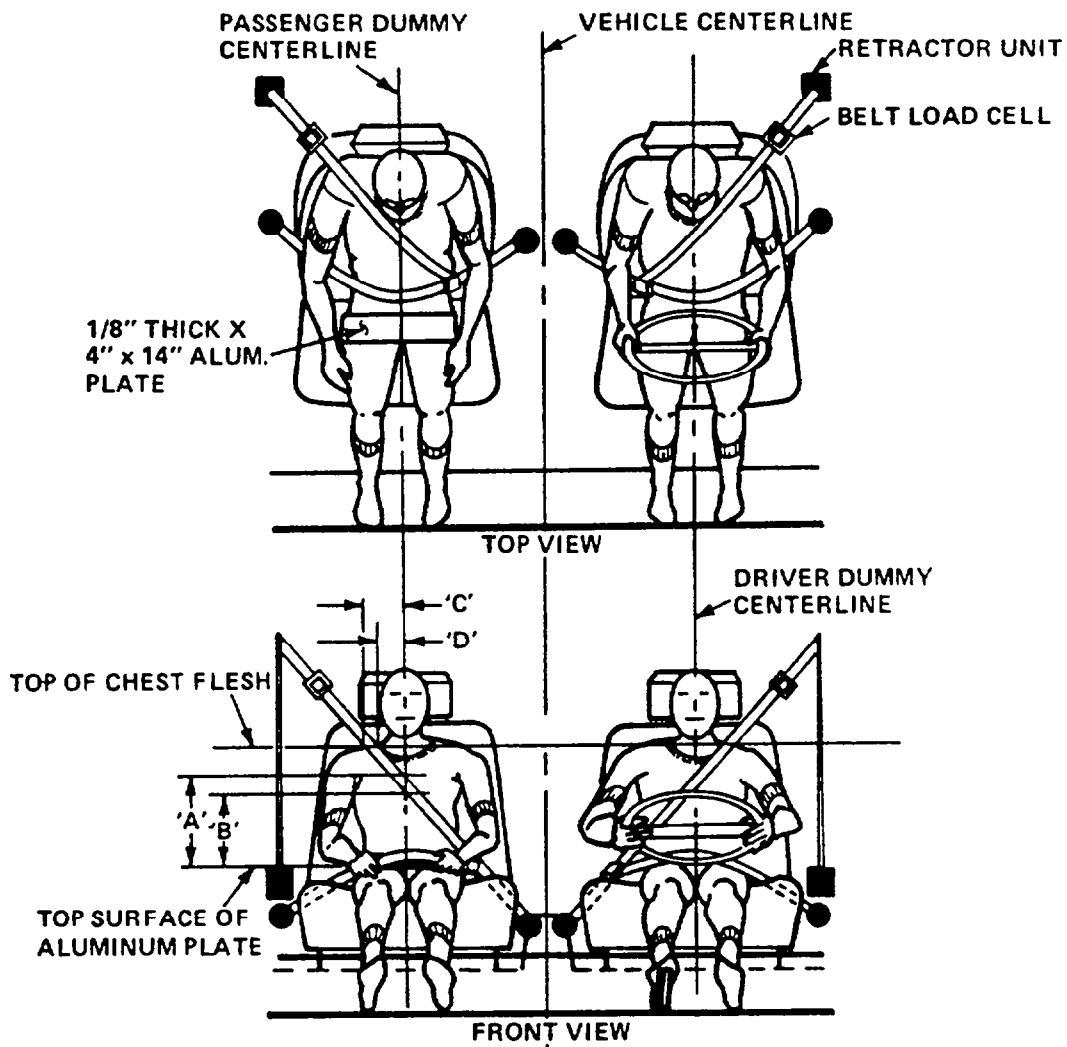


Figure 6

SEAT BELT POSITIONING DATA



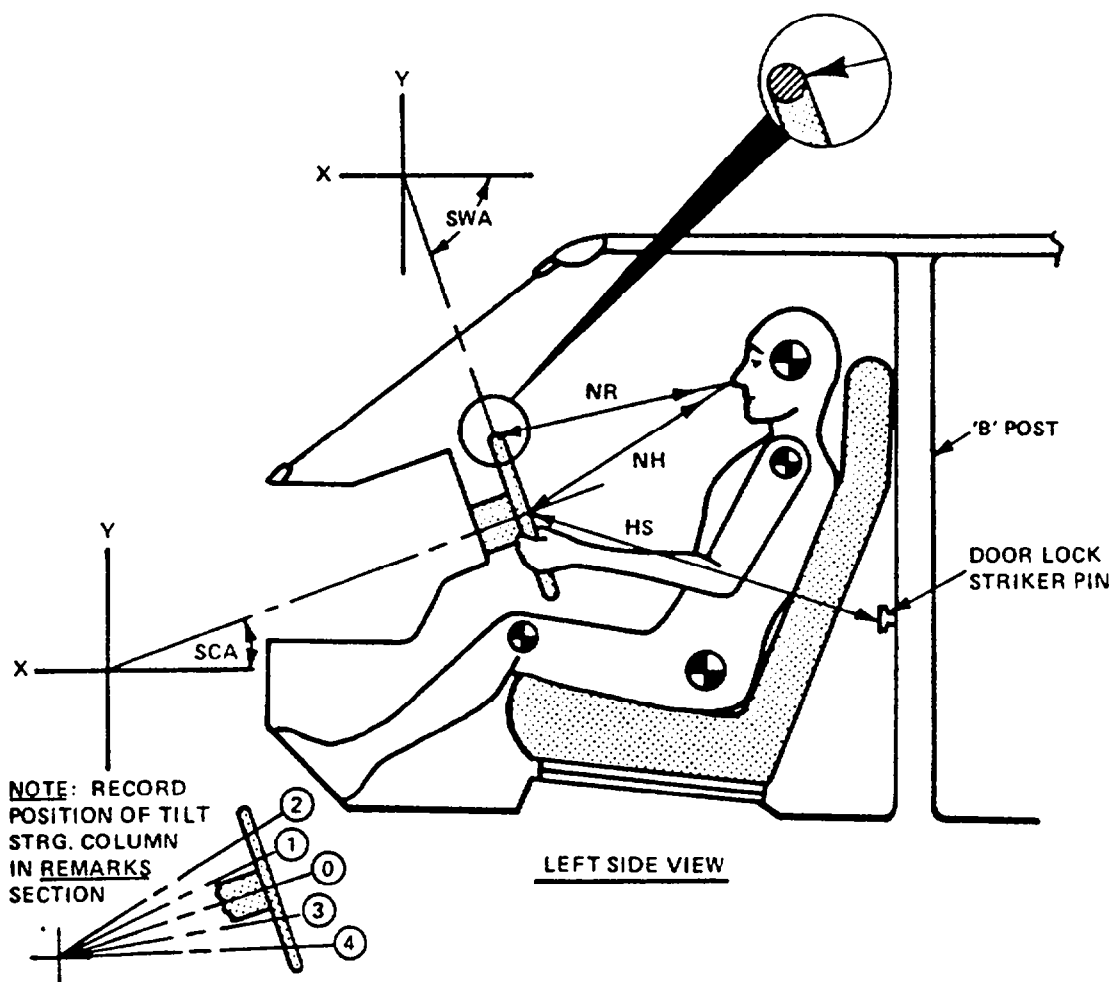
	DRIVER DUMMY (in.)	PASS. DUMMY (in.)
1. Dimension 'A'--alum. plate to belt upper edge on dummy centerline.	14.7	14.7
2. Dimension 'B'--alum. plate to belt lower edge on dummy centerline.	12.0	11.8
3. Dimension 'C'--dummy centerline to outer edge at chest flesh top	5.7	5.7
4. Dimension 'D'--dummy centerline to inner edge at chest flesh top	3.0	3.0
5. Lap belt tension (lbs.)	2.0	1.5
6. Shoulder belt tension (lbs.)	--	--

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>76.0"</u>	<u>75.0"</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>32.0"</u>	<u>32.0"</u>
Lap belt length as measured on Part 572 Dummy.	<u>34.0"</u>	<u>33.0"</u>
<u>BELT SPOOL-OFF DATA:</u>		
As determined by film analysis.	<u>5.0"</u>	<u>5.5"</u>
As determined mechanically.	<u>5.0"</u>	<u>4.5"</u>
As determined electronically.	<u>4.2"</u>	<u>3.8"</u>
<u>BELT STRETCH DATA:</u>		
Measured electronically between shoulder belt load cell and the "D" ring.	<u>1.2"/ft</u>	<u>1.3"/ft</u>
Measured Mechanically	<u>0.0"</u>	<u>0.0"</u>

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



	MEASUREMENTS
<u>NR</u> --Distance from tip of dummy's nose to top rear surface to steering wheel rim	17.5 Inches
<u>NH</u> --Distance from tip of dummy's nose to center of steering column hub	19.4 Inches
<u>HS</u> --Distance from center of steering column hub to the forward surface of the door lock striker pin	X = 19.5 Y = 16.0 Inches
<u>SCA</u> --Angle of steering column relative to the horizontal X axis	22 Degrees
<u>SWA</u> --Angle of steering wheel relative to the horizontal X axis	-65 Degrees

REMARKS CONCERNING ADJUSTABLE OR TILT STEERING COLUMN IF VEHICLE IS SO EQUIPPED:

Figure 8
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

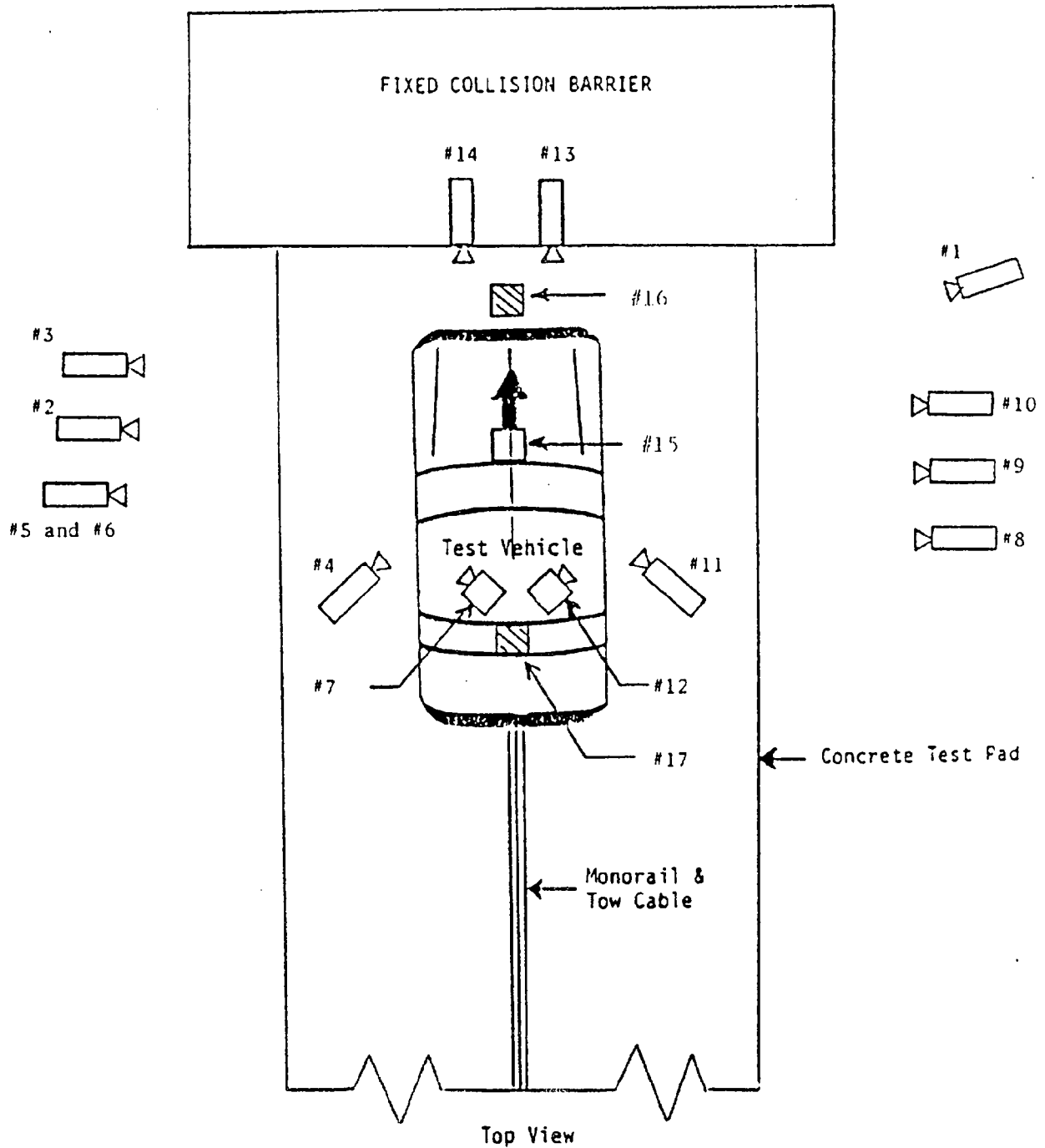


Table HIGH-SPEED CAMERA LOCATIONS

Vehicle 1986 Hyundai Excel 4-Door Sedan

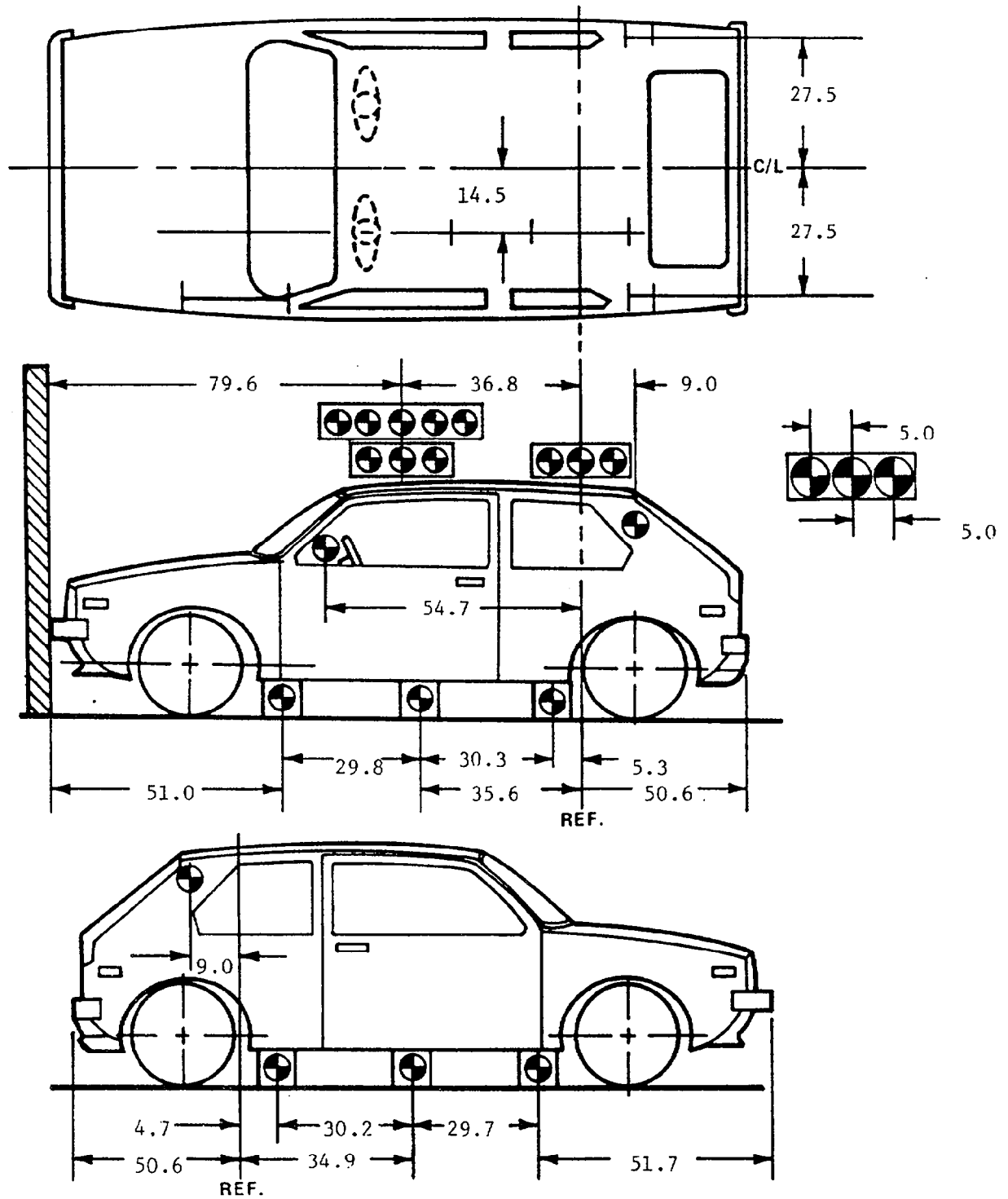
Test No. MG0501

CAMERA NO.	VIEW	CAMERA POSITIONS (in)			ANGLE ** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPE (fp)
		X	Y	Z				
1	Real-Time Camera	--	--	--	--	--	--	2
2	Overall Left Side	215	57	41	-5	--	13	53
3	Left Side View	205	37	50	-6	--	25	53
4	Driver and Interior View	101	124	70	-15	--	13	67
5	Steering Column (Bottom)	230	80	46	-5	213	25	54
6	Steering Column (Top)	230	80	70	-10	213	25	54
7	Left Belt	--	--	--	--	--	8	70
8	Overall Right Side	280	91	48	-6	--	13	80
9	Right Side View	270	79	47	-5	--	25	90
10	Right Passenger View	282	67	51	-4	265	35	80
11	Passenger and Interior View	101	124	72	-15	--	25	59
12	Right Belt	--	--	--	--	--	8	60
13	Passenger Front View	21	0	72	-38	103	13	54
14	Driver Front View	21	0	72	-38	103	13	59
15	Windshield View	0	0	126	-53	--	13	54
16	Pit View of Engine	0	36	-120	90	--	13	76
17	Pit View of Fuel Tank	0	130	-120	90	--	13	77

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

Figure 9

VEHICLE TARGET LOCATIONS



(DIMENSIONS IN INCHES)

Figure 10

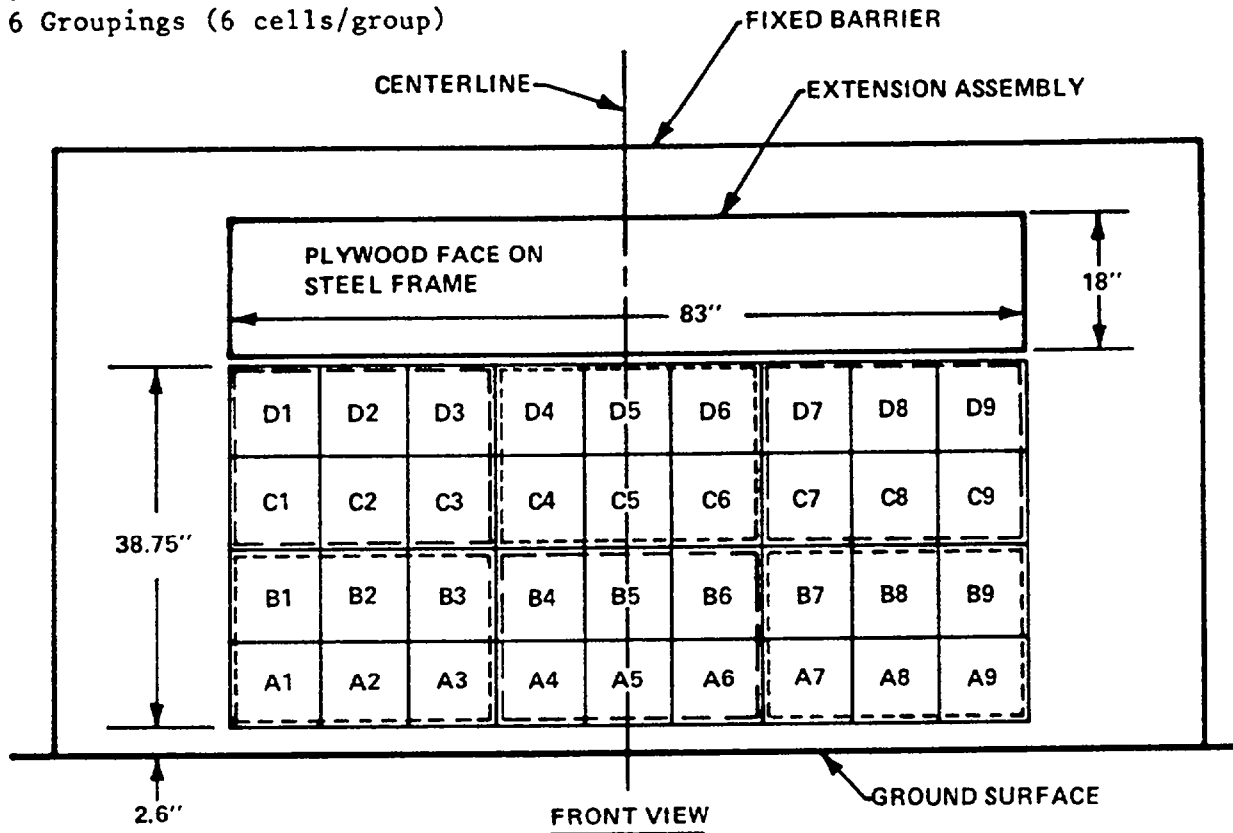
LOAD CELL LOCATIONS ON FIXED BARRIER

36 Load Cells

4 Rows

9 Columns

6 Groupings (6 cells/group)



6 GROUPS OF 6 LOAD CELLS EACH

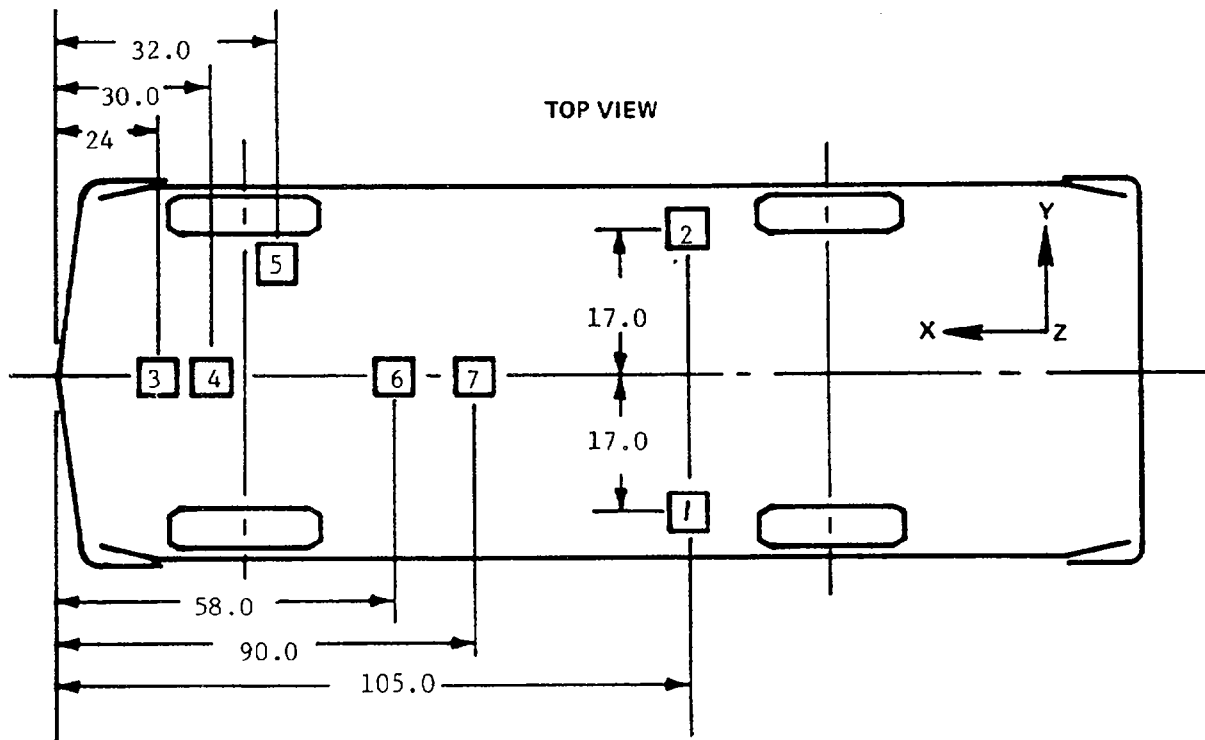
Group 4 C1 thru D3	Group 5 C4 thru D6	Group 6 C7 thru D9
Group 1 A1 thru B3	Group 2 A4 thru B6	Group 3 A7 thru B9

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 11

VEHICLE ACCELEROMETER LOCATIONS

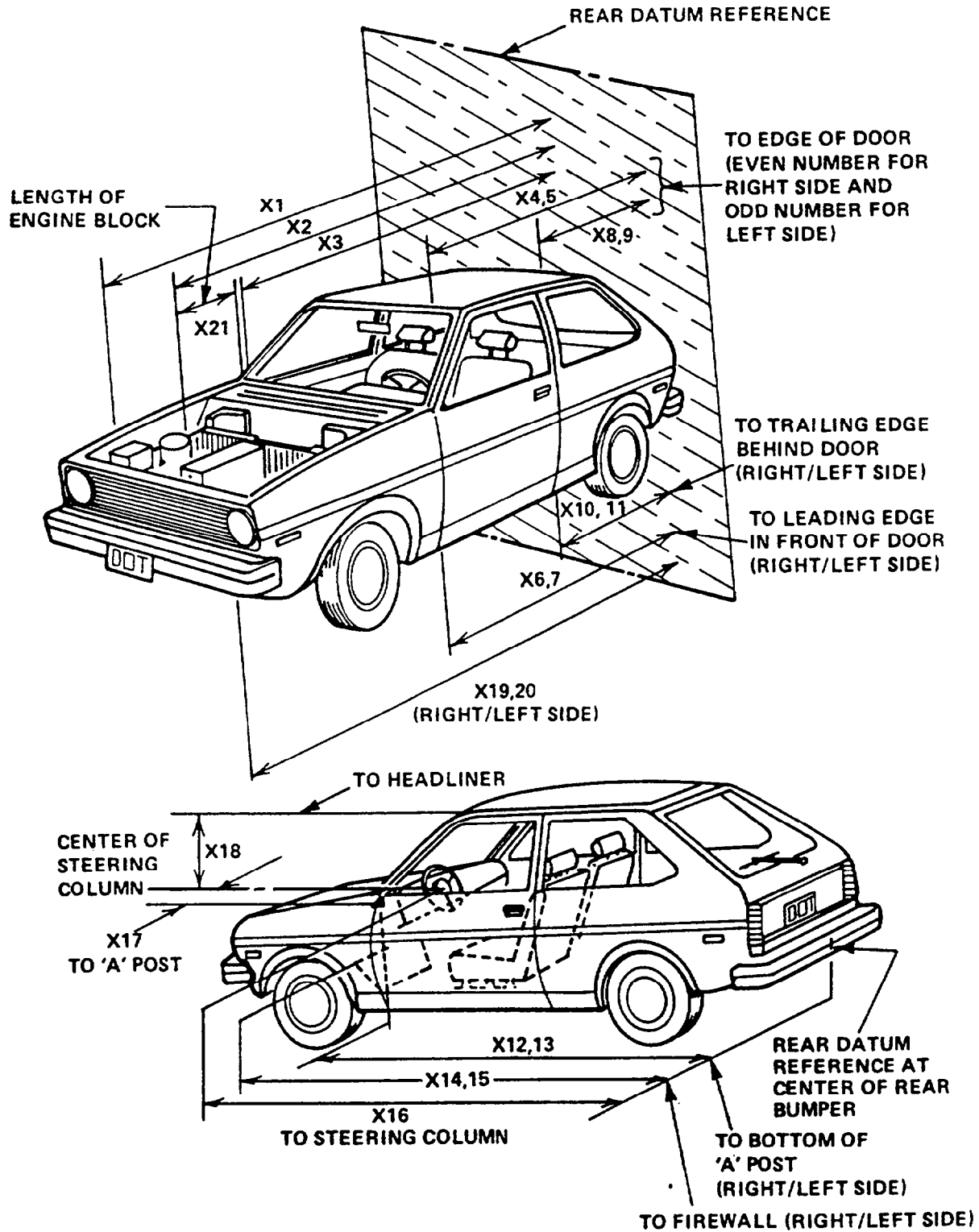


ACCELEROMETER NUMBER*	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Left Rear Seat Crossmember	X		
2	Right Rear Seat Crossmember	X		
3	Top of Engine	X		
4	Bottom of Engine	X		
5	Right Disc Brake Caliper	X		
6	Instrument Panel	X		
7	Center of Gravity (C/G)	X		

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

Figure 12

TEST VEHICLE MEASUREMENTS



Table

VEHICLE MEASUREMENTS

All Dimensions in Inches				
No.		Pre-Test	Post-Test	Difference
X1	Total Length of Vehicle at Centerline	167.0	146.2	20.8
X2	Rear Surface of Vehicle to Front of Engine	143.5	134.1	9.4
X3	Rear Surface of Vehicle to Firewall	124.5	121.0	3.5
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	115.0	114.2	.8
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	115.3	115.0	.3
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	114.2	113.2	1.0
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	114.5	114.1	.4
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	76.7	75.8	.9
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	77.0	77.0	0.0
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	78.0	77.1	.9
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	78.5	77.9	.6
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	114.5	112.9	1.6
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	115.0	114.2	.8
X14	Rear Surface of Vehicle to Firewall, Right Side	122.6	115.5	7.1
X15	Rear Surface of Vehicle to Firewall, Left Side	125.1	116.1	9.0
X16	Rear Surface of Vehicle to Steering Column	98.4	94.8	3.6
X17	Center of Steering Column to "A" Post	16.6	19.4	-2.8
X18	Center of Steering Column to Headliner	17.6	20.5	-2.9
X19	Rear Surface of Vehicle to Right Side of Front Bumper	164.1	143.1	21.0
X20	Rear Surface of Vehicle to Left Side of Front Bumper	163.8	145.0	18.8
X21	Length of Engine Block	14.7	14.7	0

Note: Measurements are not done in the same location as Accident Investigation measurements. Therefore, measurements may not be equal.

Table 6

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

VEHICLE MAKE/MODEL/BODY STYLE: 1986 Hyundai Excel 4-Door Sedan

VEH. NHTSA NO.: MG0501 ; VIN: KMHLF21J4GU022189

MODEL YEAR: 1986 ; BUILD DATE: February 1986 ; TEST DATE: May 15, 1986

VEH. SIZE CATEGORY: Sub-compact ; TEST WEIGHT: 2750

VEH. WHEELBASE: 93.7 ; FRONT OVERHANG: 33.5 ; OVERALL WIDTH: 63.2

ACCELEROMETER DATA:

LOCATION: 43.6 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: 34.8 ; TIME OF SEPARATION: 160.6

VELOCITY CHANGE: 37.7

COLLISION DEFORMATION CLASSIFICATION (CDC) CODE:

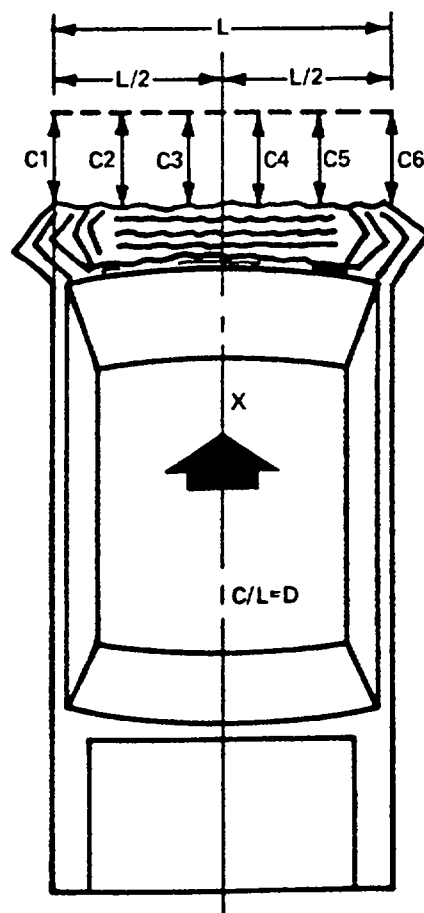
F (Frontal) 12 FDEW 3

CRUSH DEPTH DIMENSIONS:

C1 =	<u>18.9</u>	inches
C2 =	<u>20.0</u>	inches
C3 =	<u>20.6</u>	inches
C4 =	<u>20.8</u>	inches
C5 =	<u>20.4</u>	inches
C6 =	<u>20.1</u>	inches

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

LENGTH OF DAMAGED REGION: L = 56.5 inches



National Accident Sampling System — Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

NCI
1986 HYUNDAI EXCEL G.L. 4 Door H.T.

Complete When Applicable

End Damage	Side Damage
Undeformed end width <u>56.5</u> Corner shift: A1 _____ A2 _____ End shift at frame (CDC) (check one) <4 inches _____ ≥4 inches _____	Bowing: B1 _____ X1 _____ B2 _____ X2 _____ Bowing constant $\frac{X1 + X2}{2} = \underline{\hspace{2cm}}$

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 ₁	C ₂	C ₃	C ₄	C ₅	C ₆	±D
		Width** (CDC)	Max*** Crush								
1	Bumper	56.5	20.8	56.5	22.4	21.0	20.7	20.9	21.4	23.6	0
	Free/space		0		3.5	1.0	.1	.1	1.0	3.5	
1	Actual Crush	56.5	20.8	56.5	18.9	20.0	20.6	20.8	20.4	20.1	0

*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.

NCI

DAMAGE DESCRIPTION

Tire—Wheel Damage

a. Rotation physically
restrictedRF 1LF 1RR 2LR 2

b. Tire deflated

RF 1LF 2RR 2LR 2

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

TYPE OF TRANSMISSION

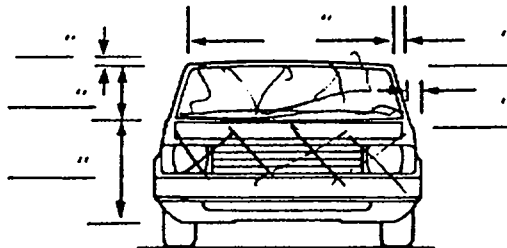
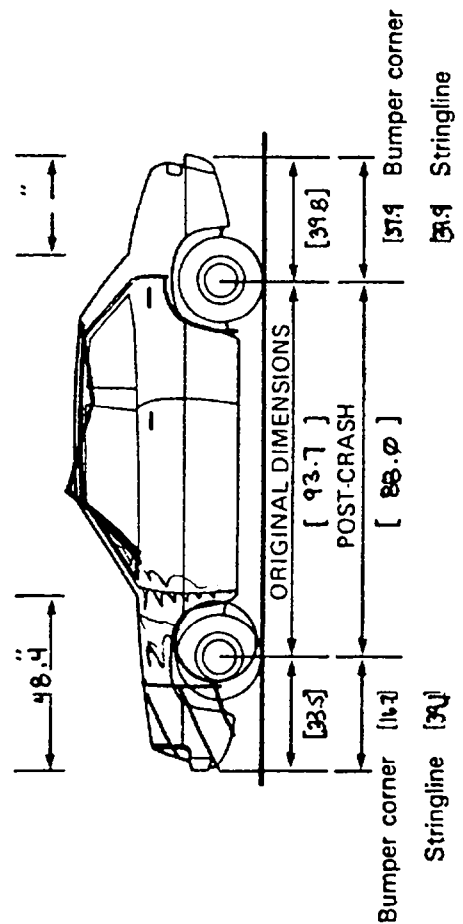
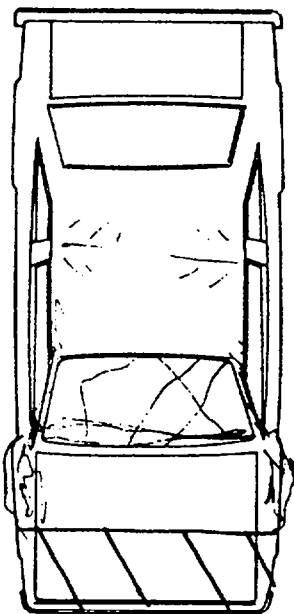
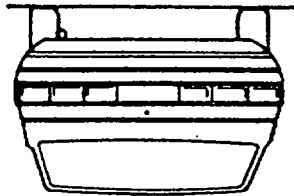
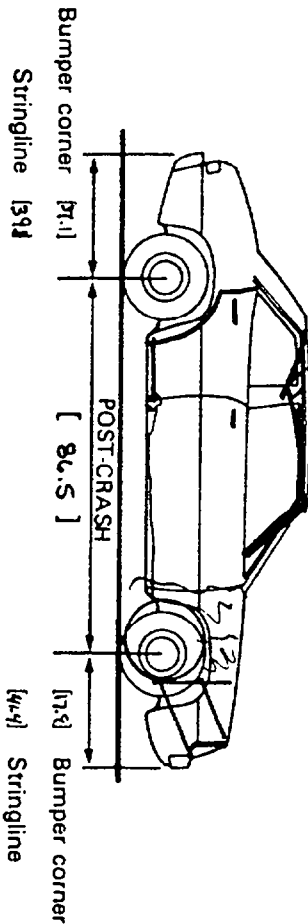
☒ Manual ☐ Automatic

Average Track: _____

Maximum Width: _____

Curb Weight: 2750Overall Length: 167.0Wheel Base: 93.7Engine Size: cyl. 4cyl
displ. _____

WHEEL STEER ANGLES

(For locked front wheels or displaced
rear axles only)RF $\pm$ 0 0°LF $\pm$ 0 1°RR $\pm$ N/A°LR $\pm$ N/A°Within $\pm$ 5 degrees1986 HYUNDAI EXCEL G.L.
4 Door HT

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

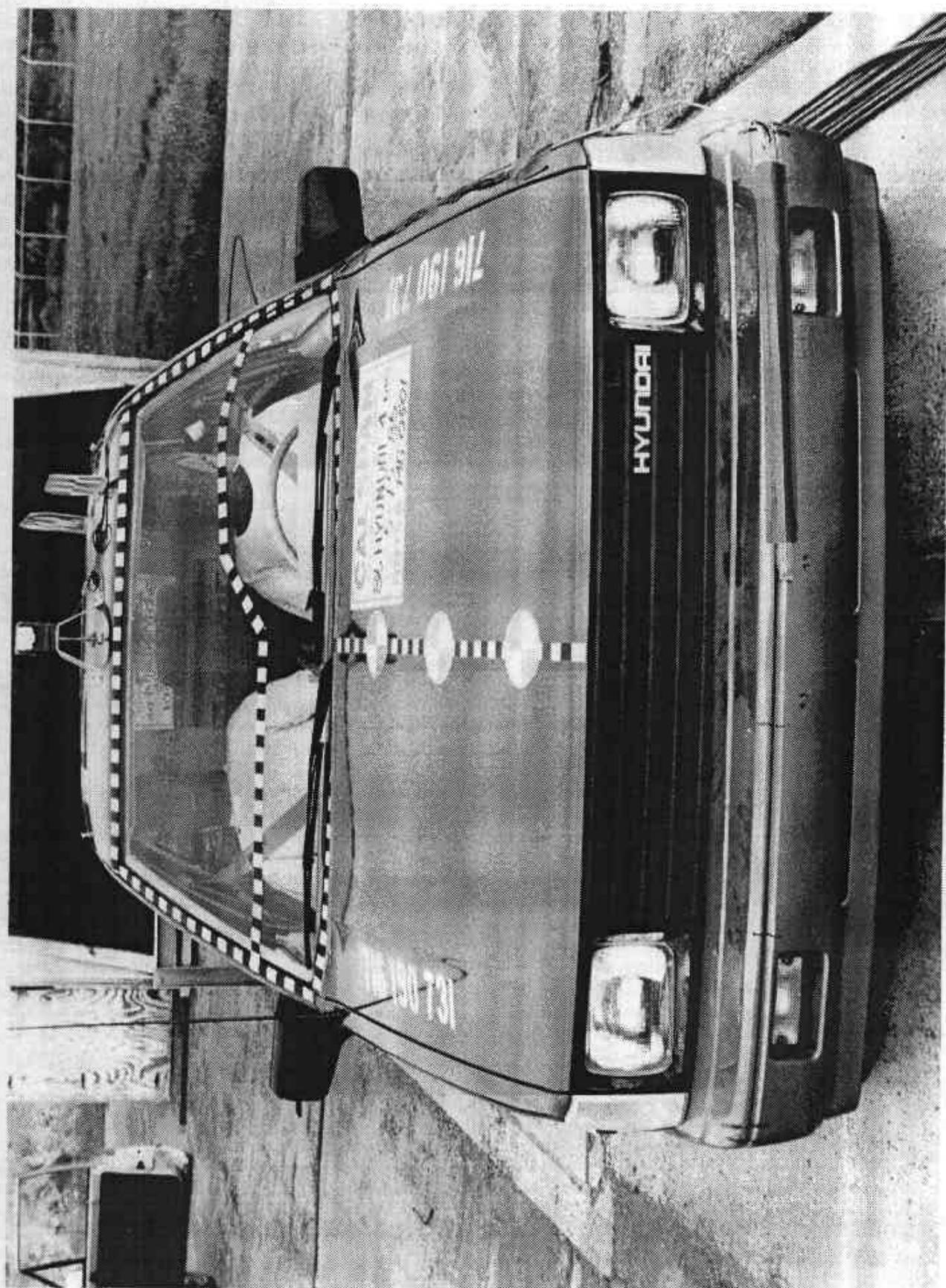


Figure A-1 PRE-TEST FRONT VIEW

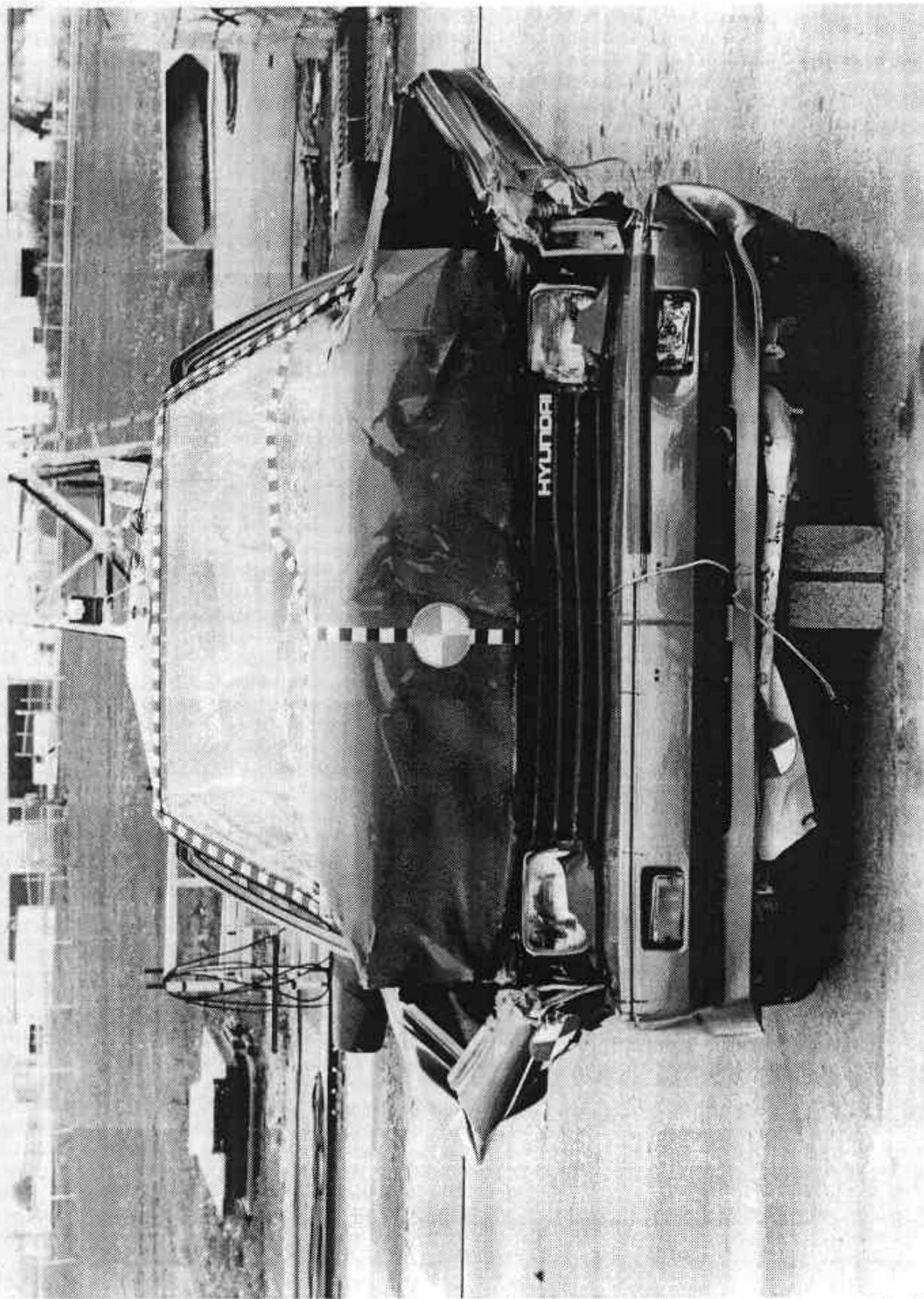


Figure A-2 POST-TEST FRONT VIEW

A-3

7457-19

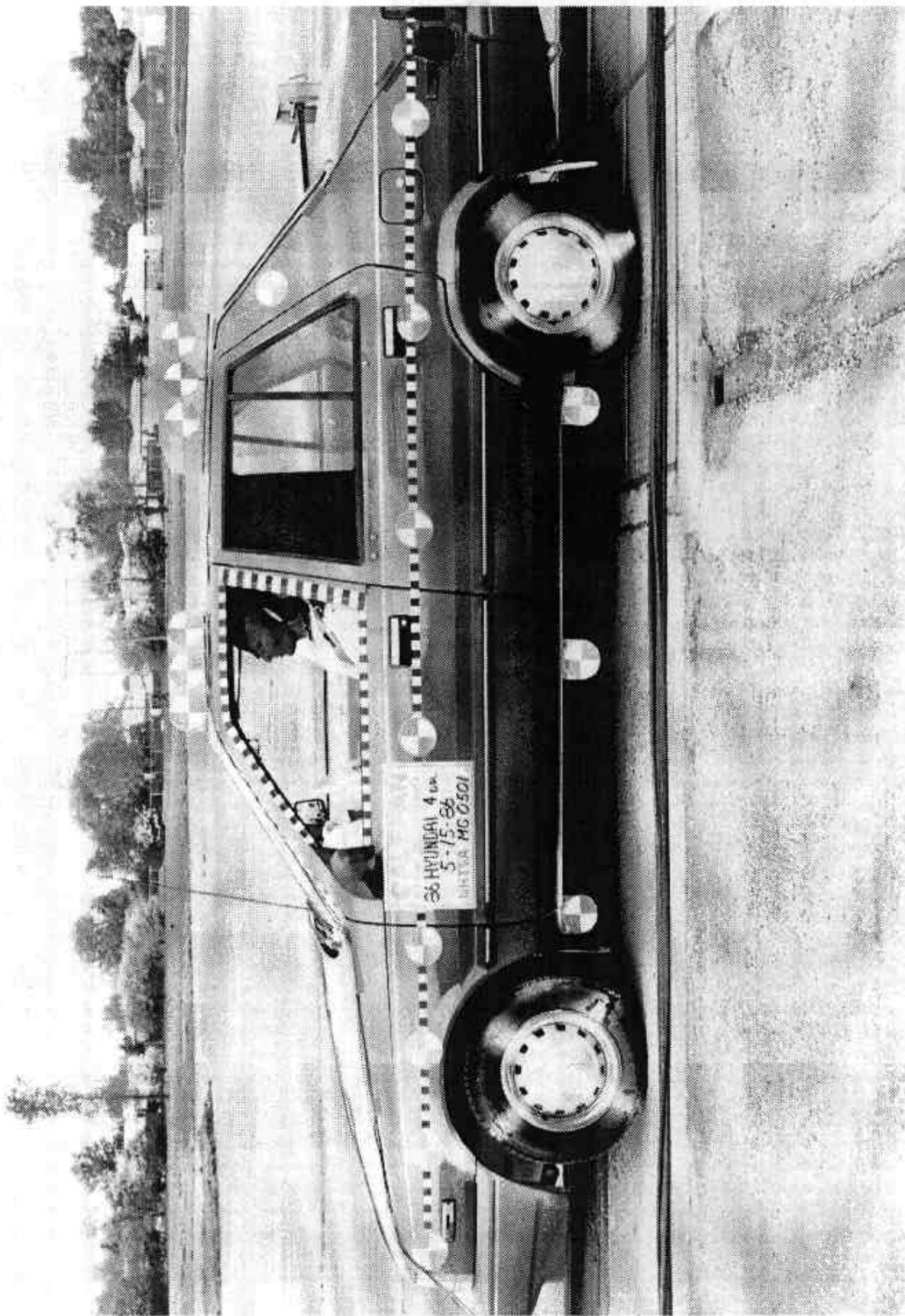


Figure A-3 PRE-TEST LEFT SIDE VIEW

A-4

7457-19

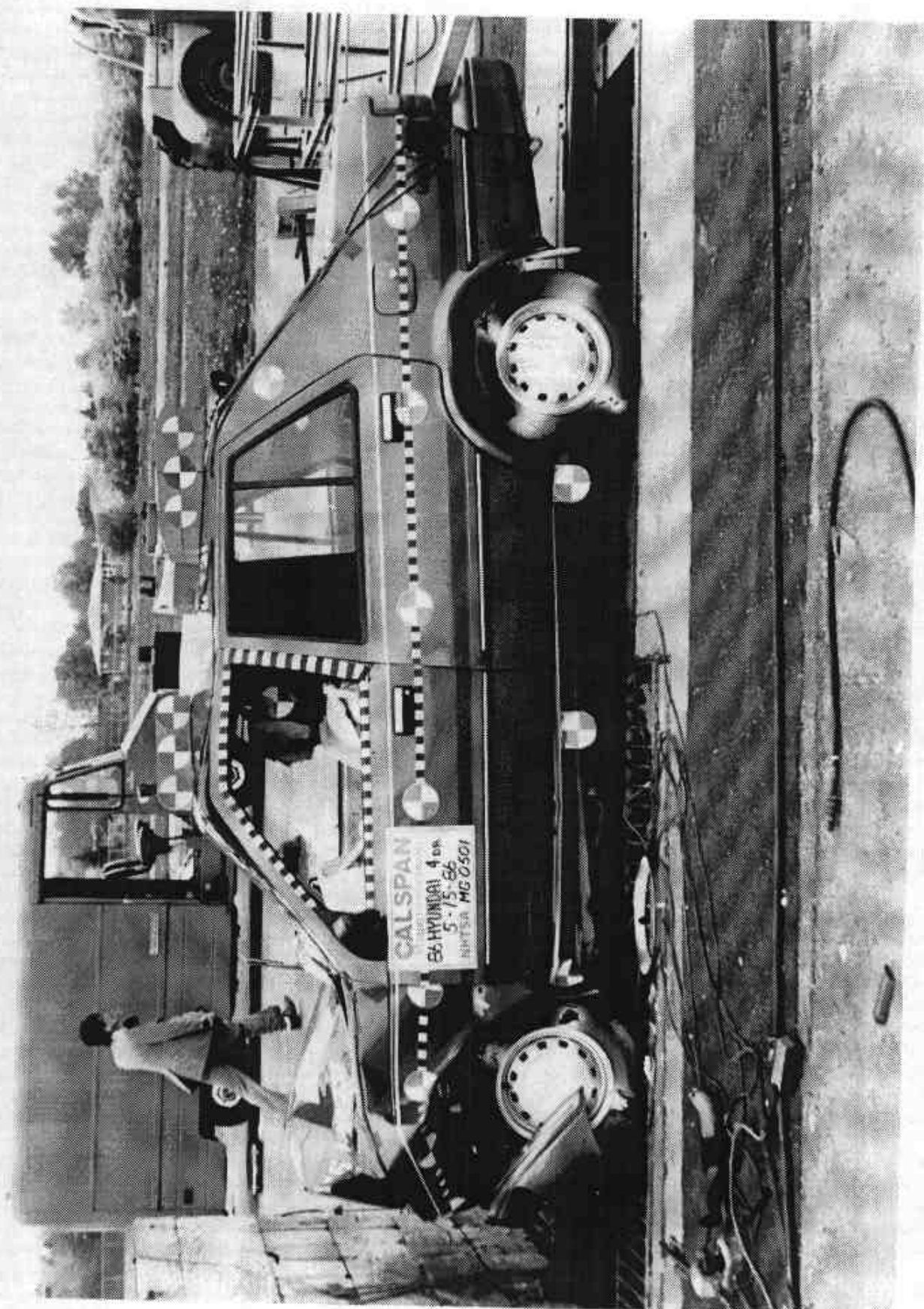


Figure A-4 POST-TEST LEFT SIDE VIEW

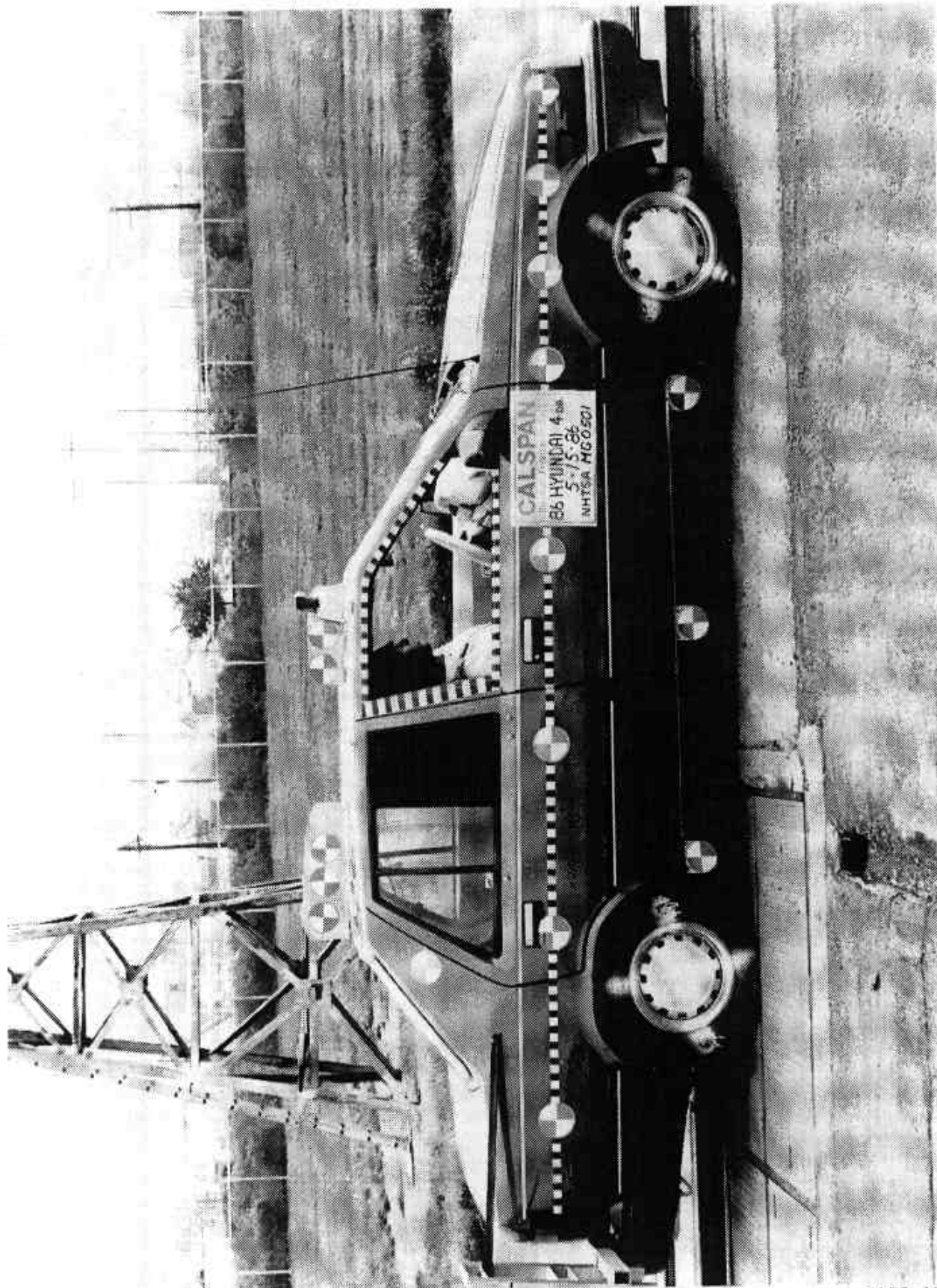


Figure A-5 PRE-TEST RIGHT SIDE VIEW

A-6

7457-19

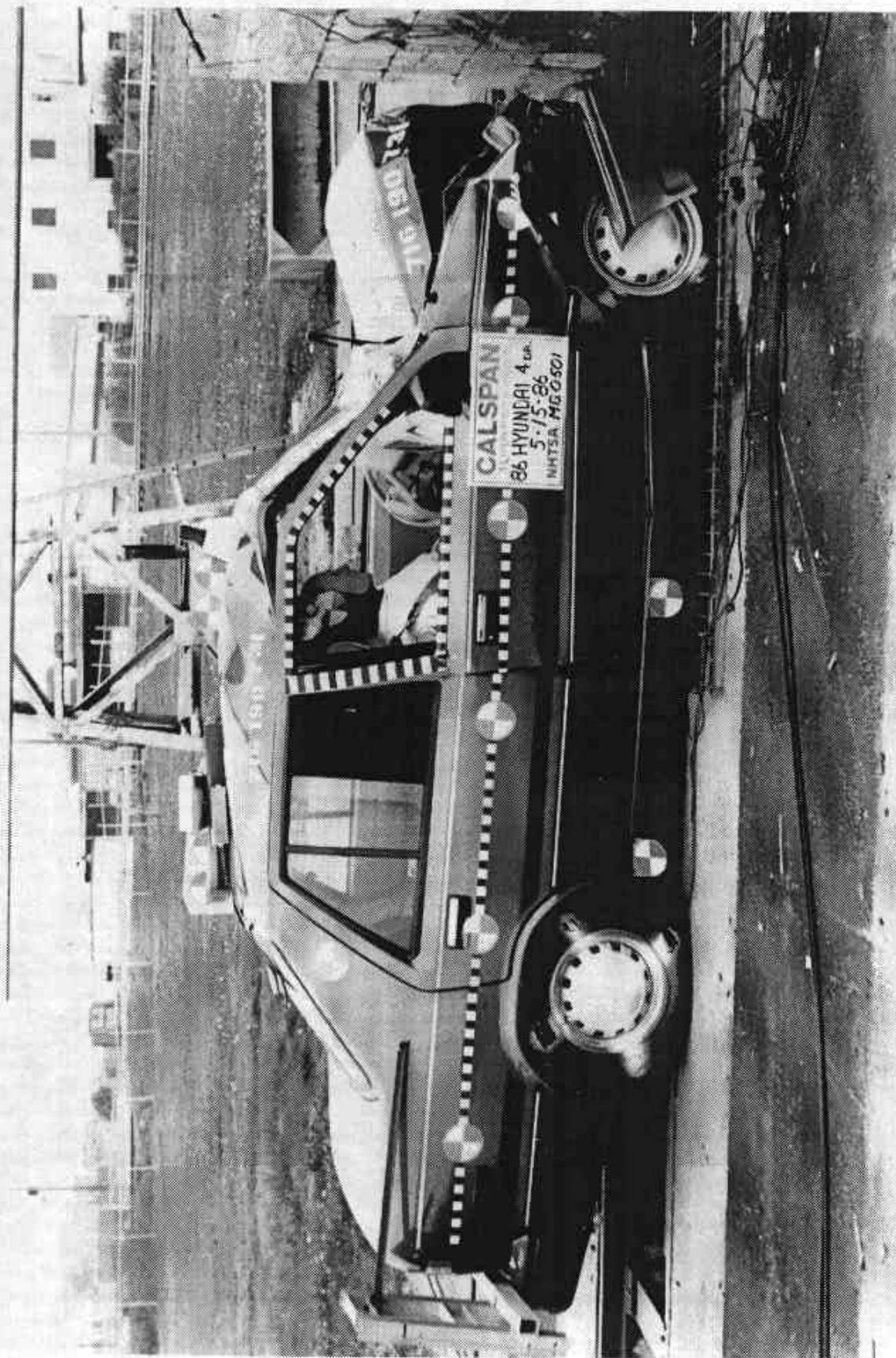


Figure A-6 POST-TEST RIGHT SIDE VIEW

A-7

7457-19

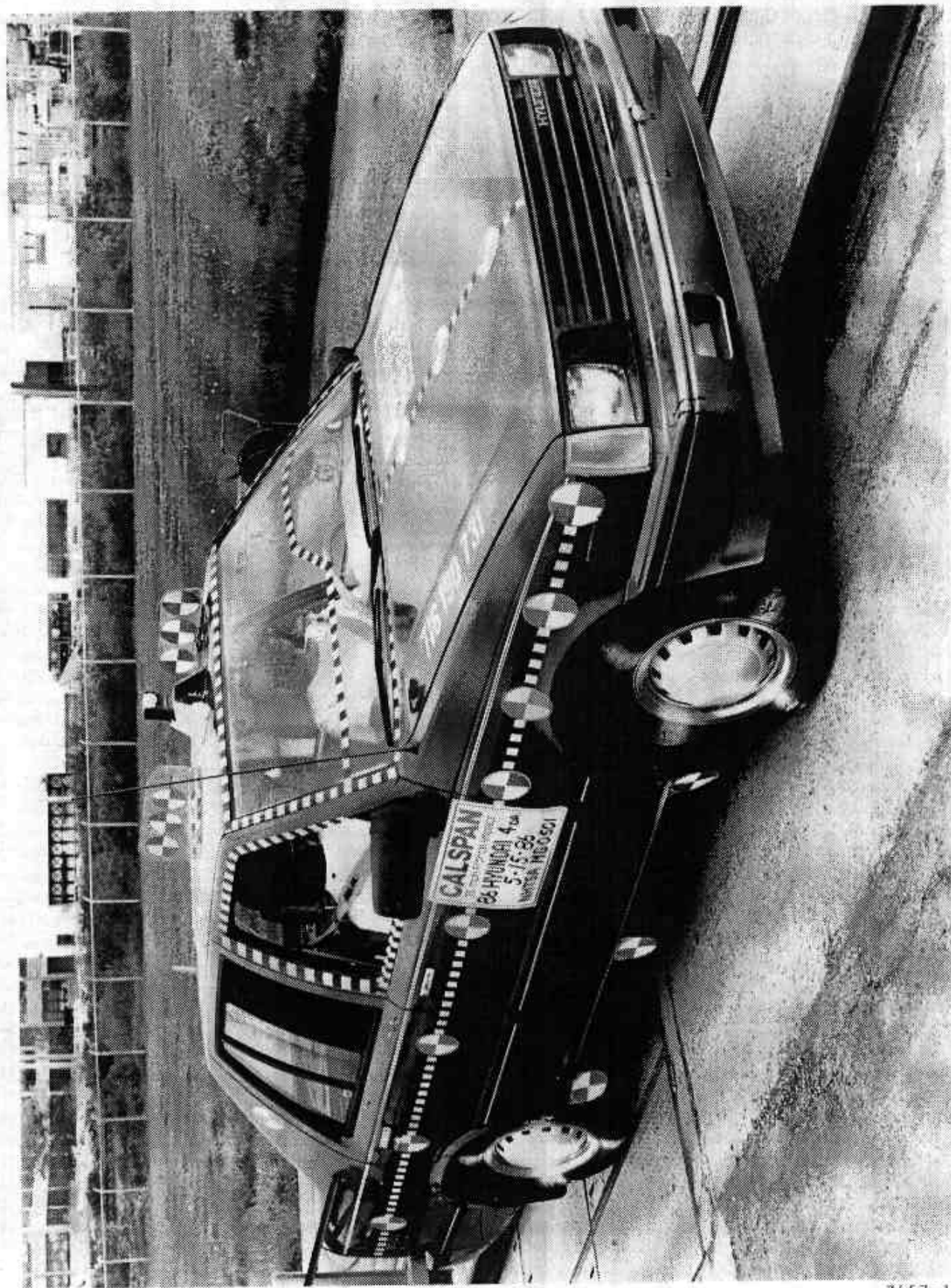


FIGURE A-7. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW



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



FIGURE A-9 PRE-TEST LEFT NEAR THREE-QUARTER VIEW

A-10

7457-19

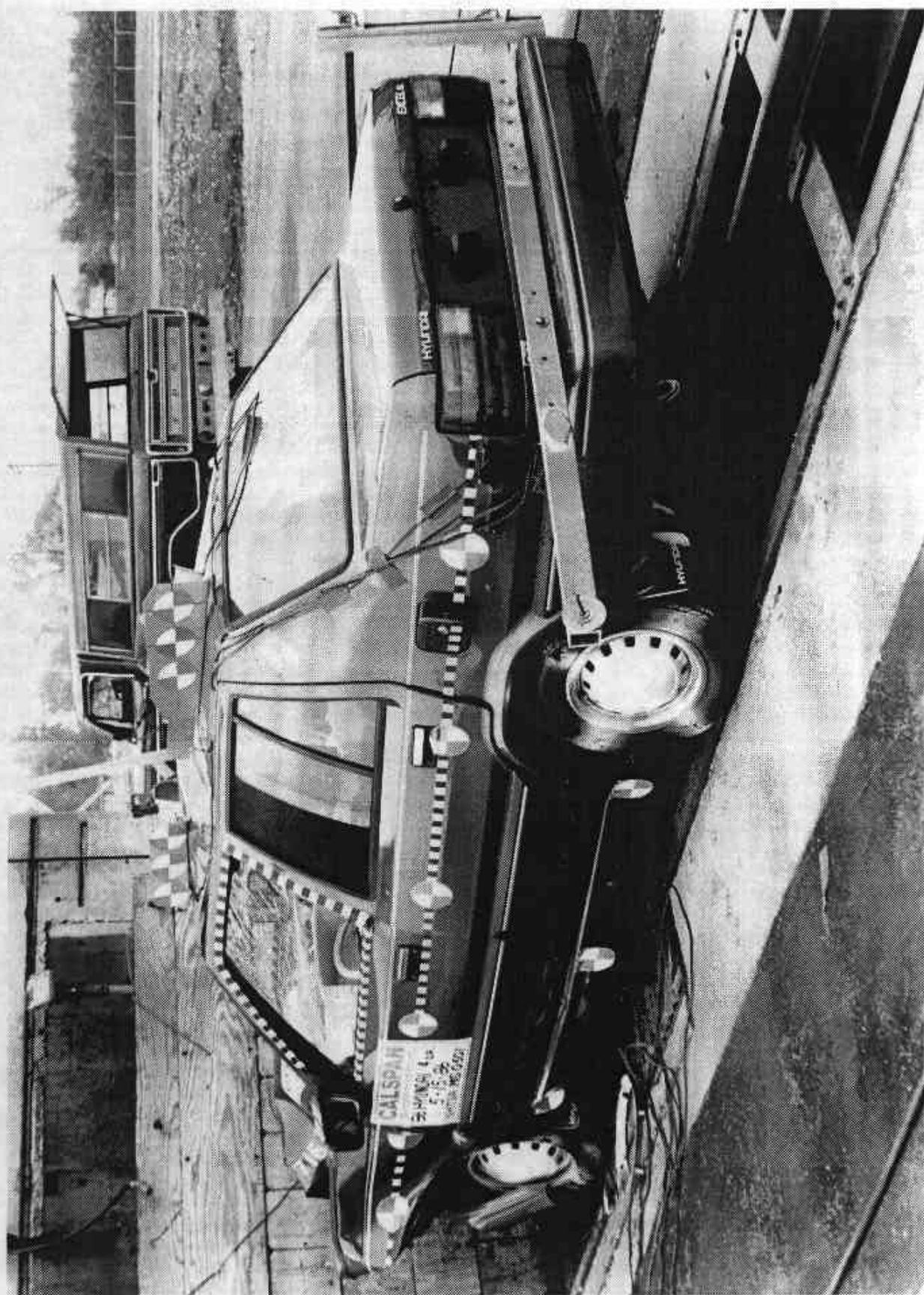


Figure A-19 POST-TEST LEFT REAR THREE-QUARTER VIEW

A-11

7457-19

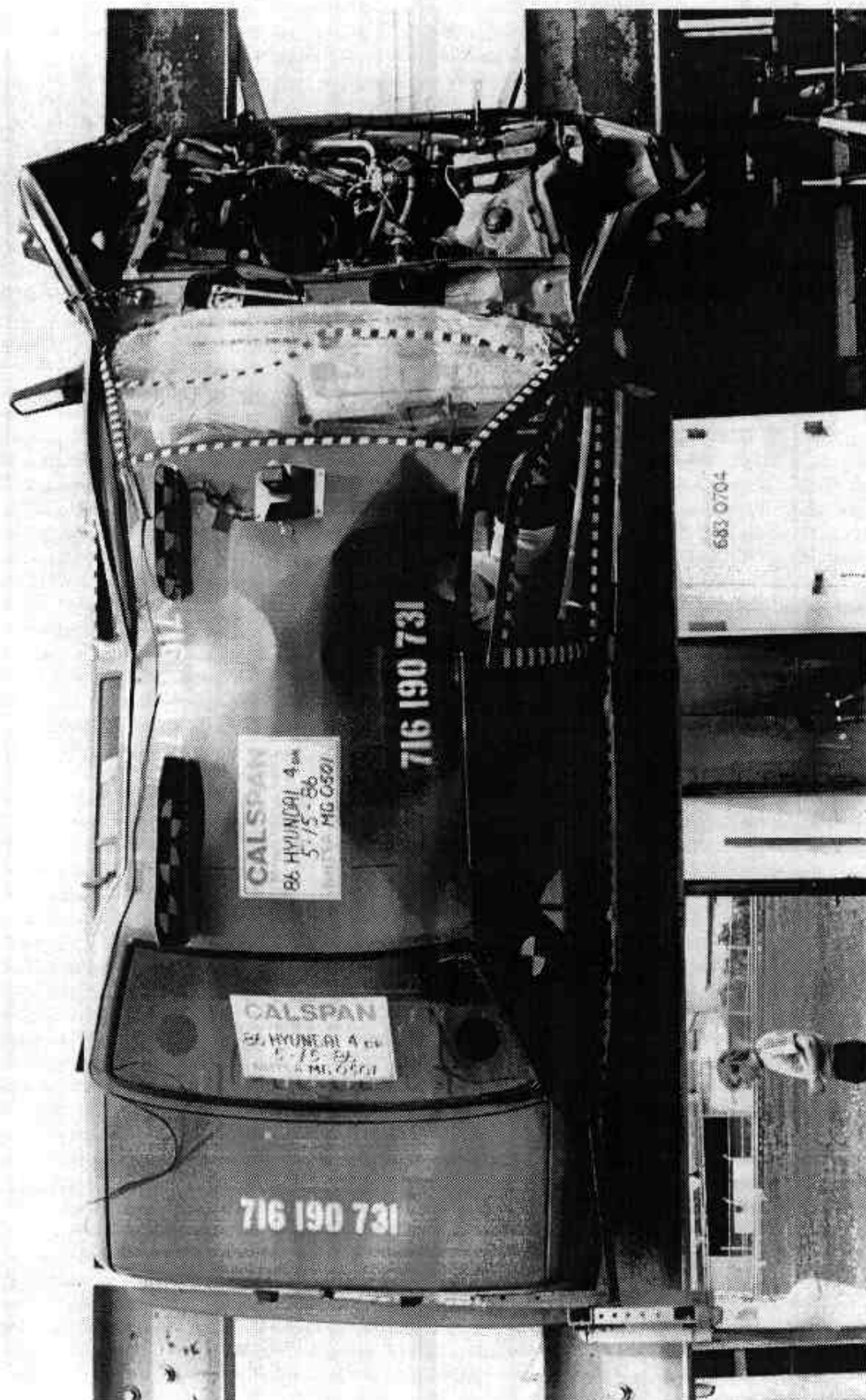


Figure A-11 POST-TEST TOP VIEW

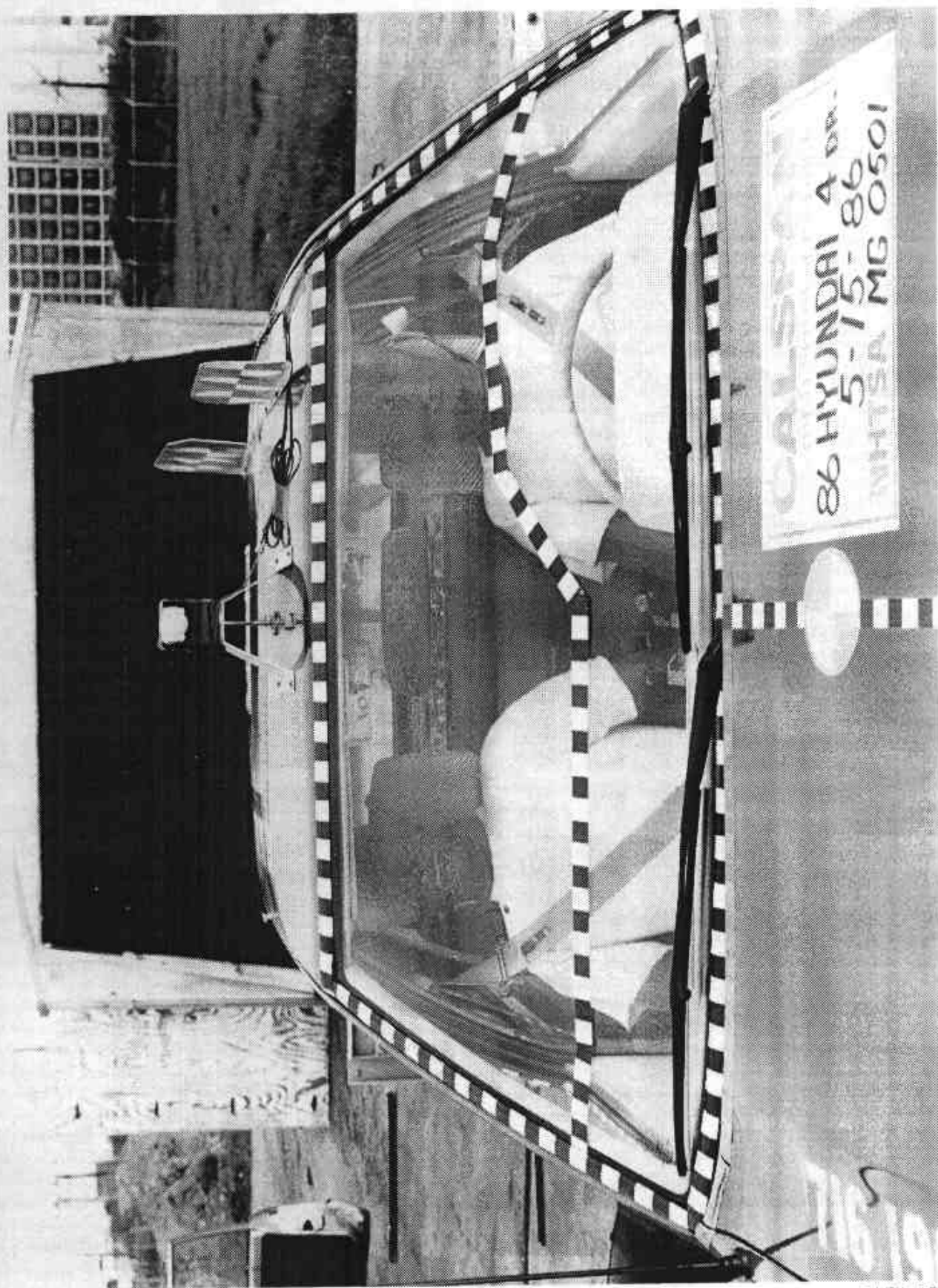


Figure A-12 PRE-TEST WINDSHIELD VIEW

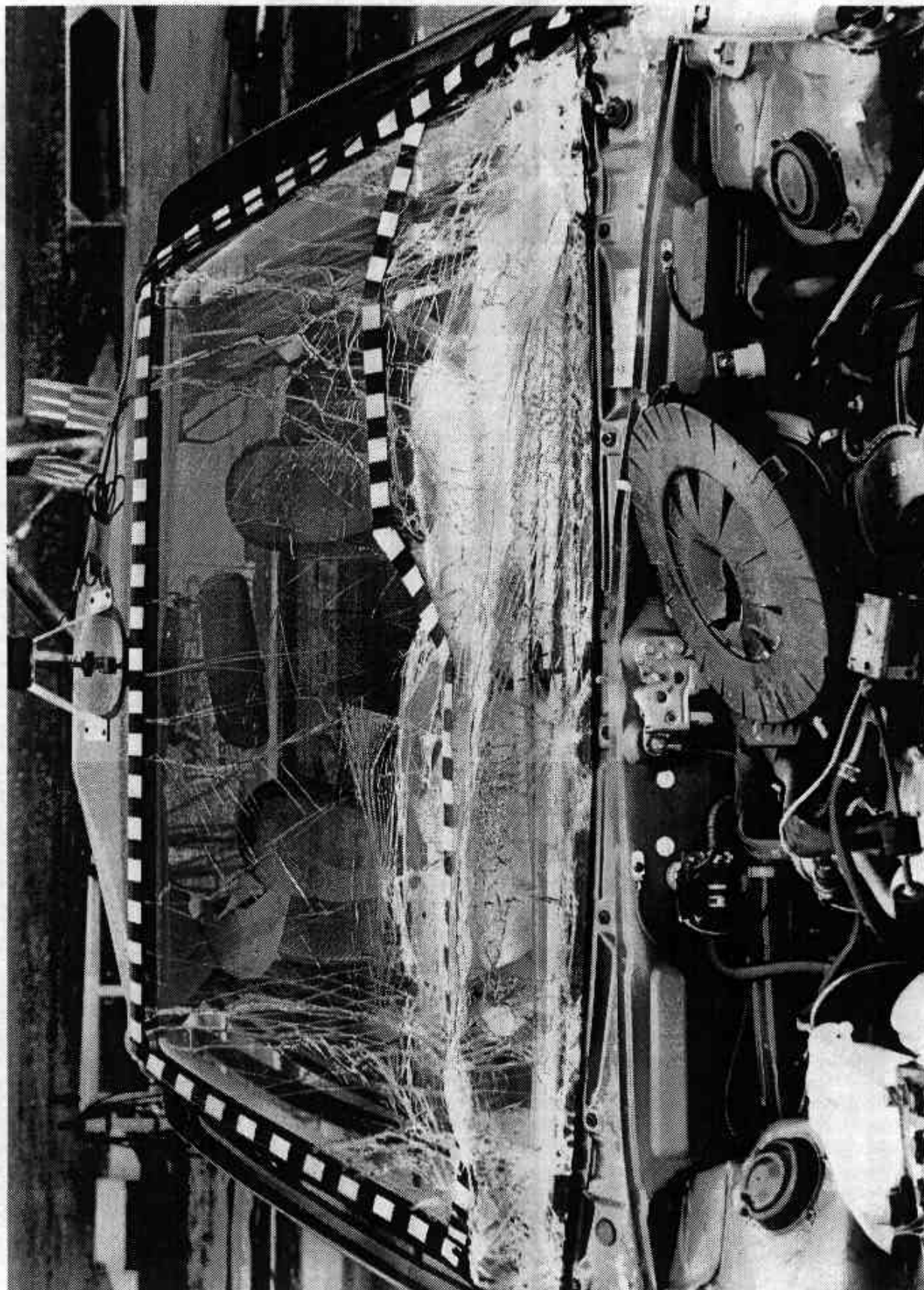


Figure A-13 POST-TEST WINDSHIELD VIEW

A-14

7457-19

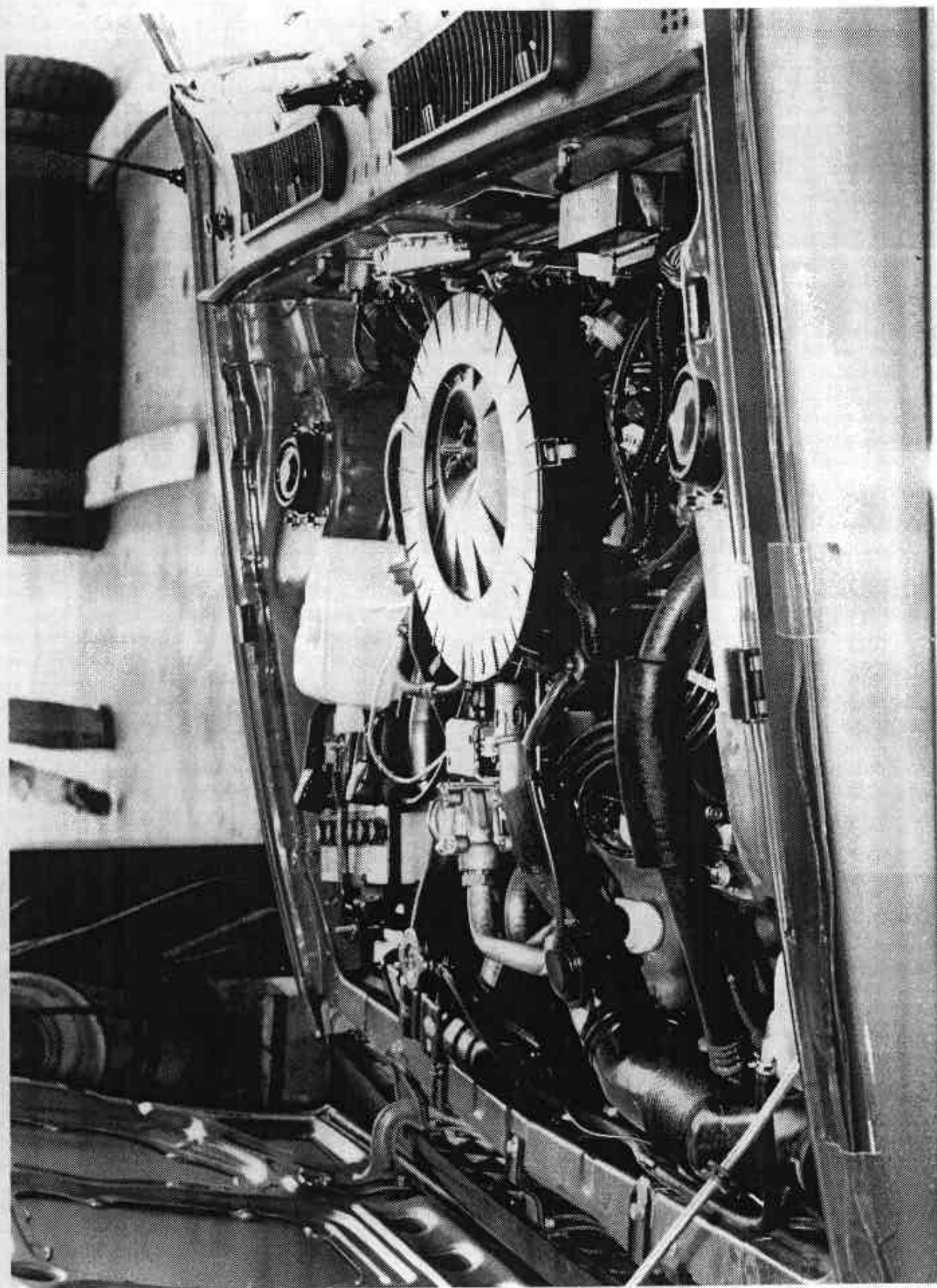


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-15

7457-19

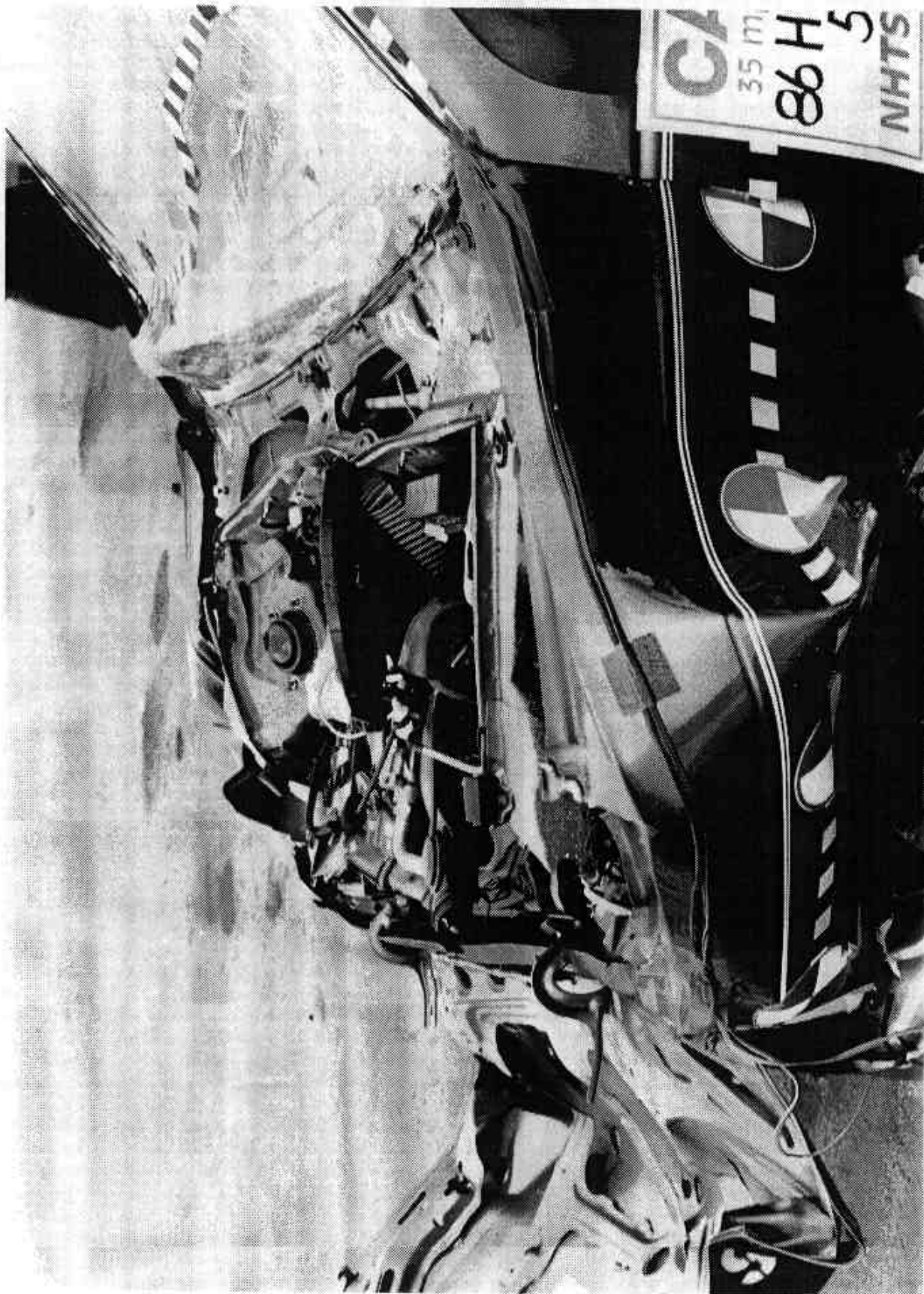


Figure A-15 POST-TEST ENGINE COMPARTMENT VIEW

A-16

7457-19

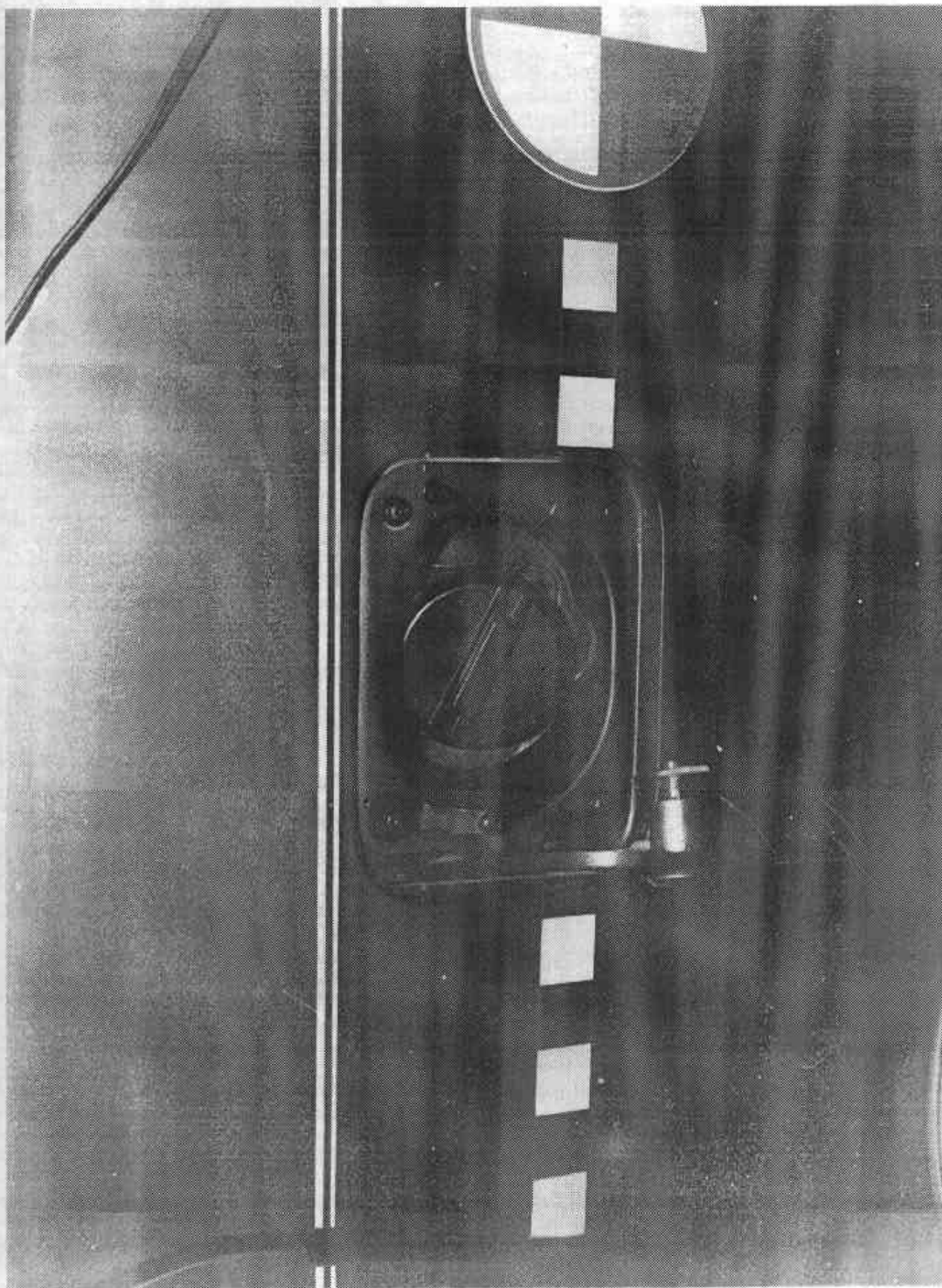


Figure A-16 PRE-TEST FUEL FILTER CAP VIEW

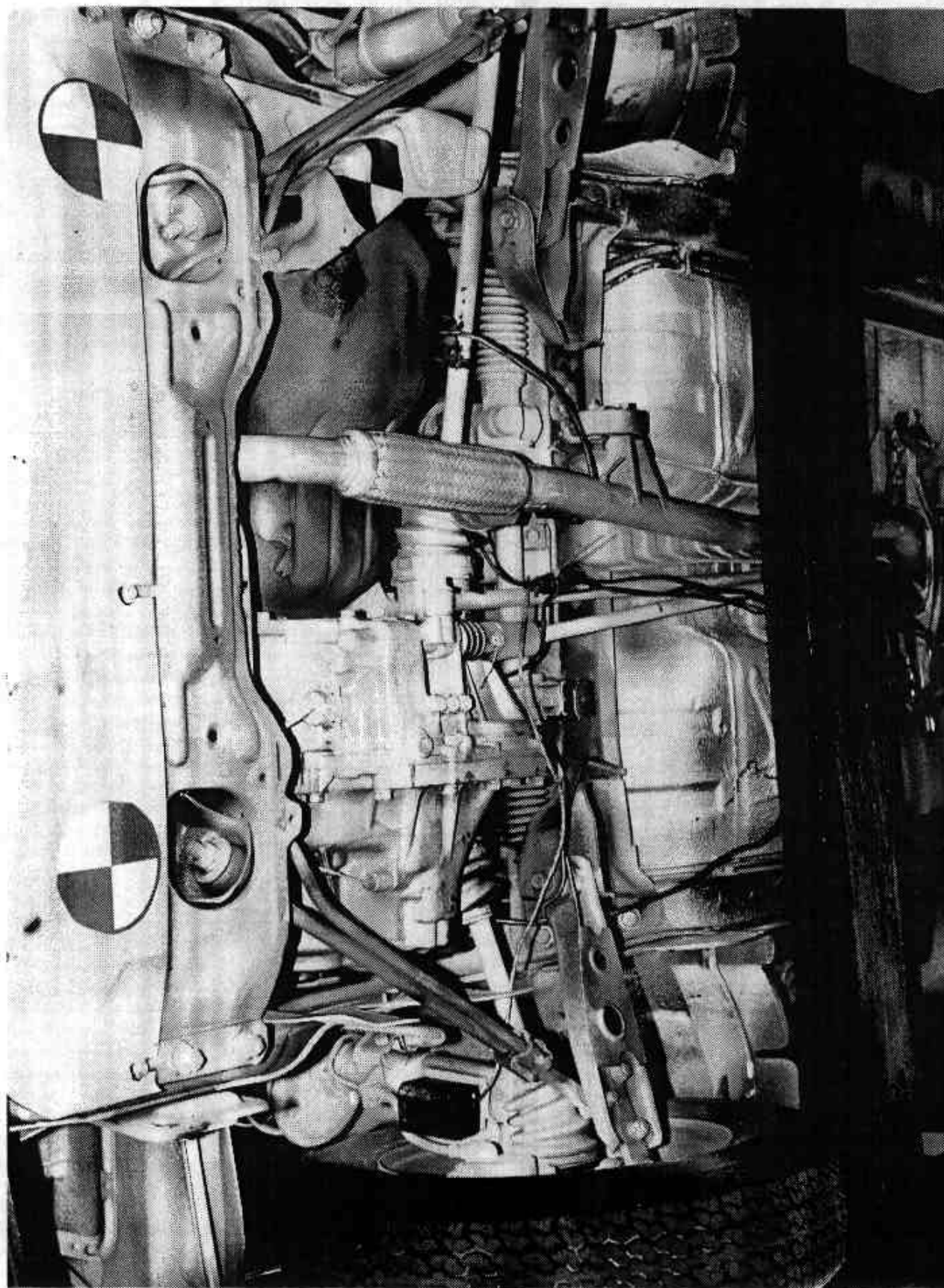


Figure A-17 PRE-TEST FRONT UNDERBODY VIEW

A-18

7457-19

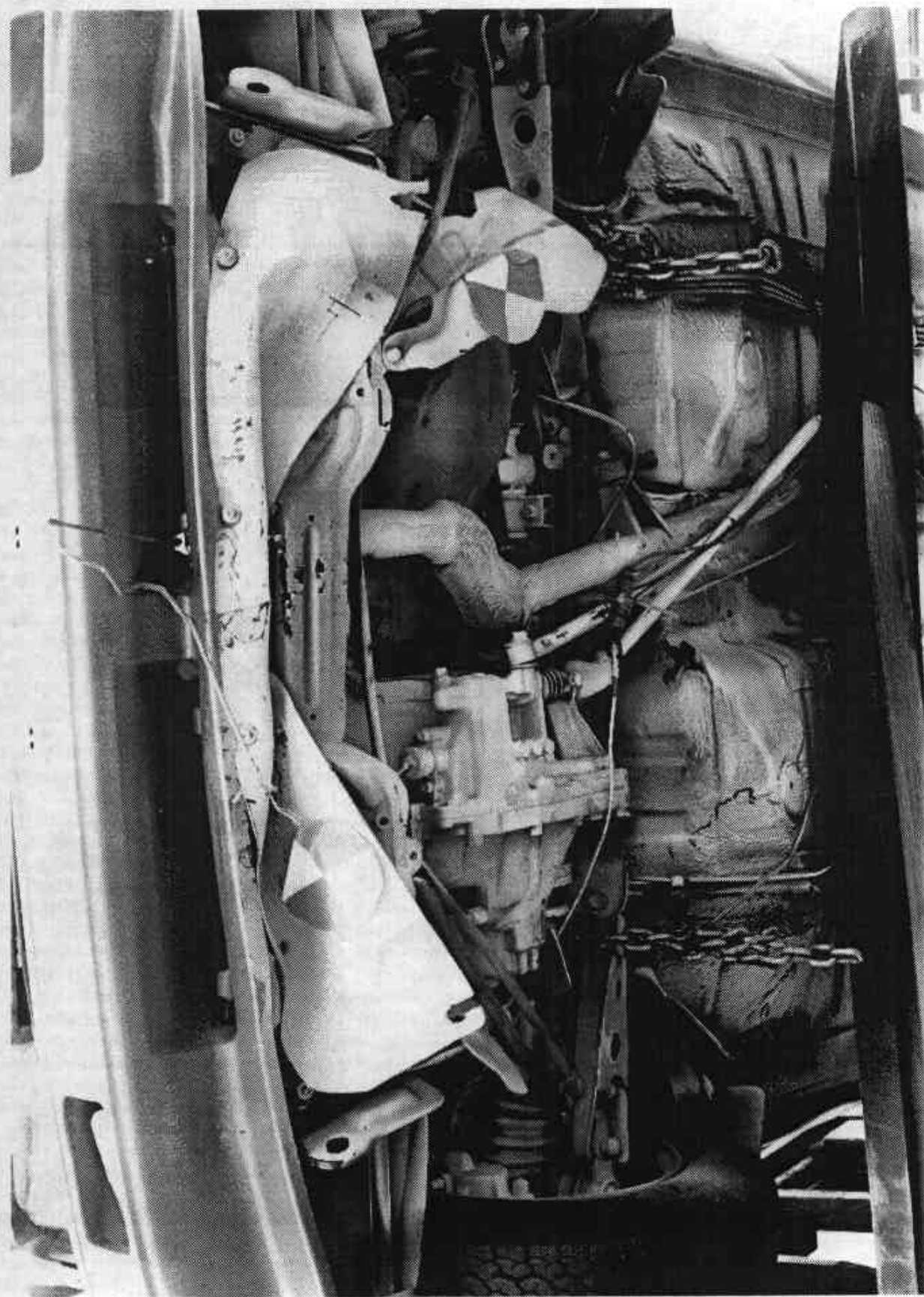


Figure A-18 POST-TEST FRONT UNDERBODY VIEW

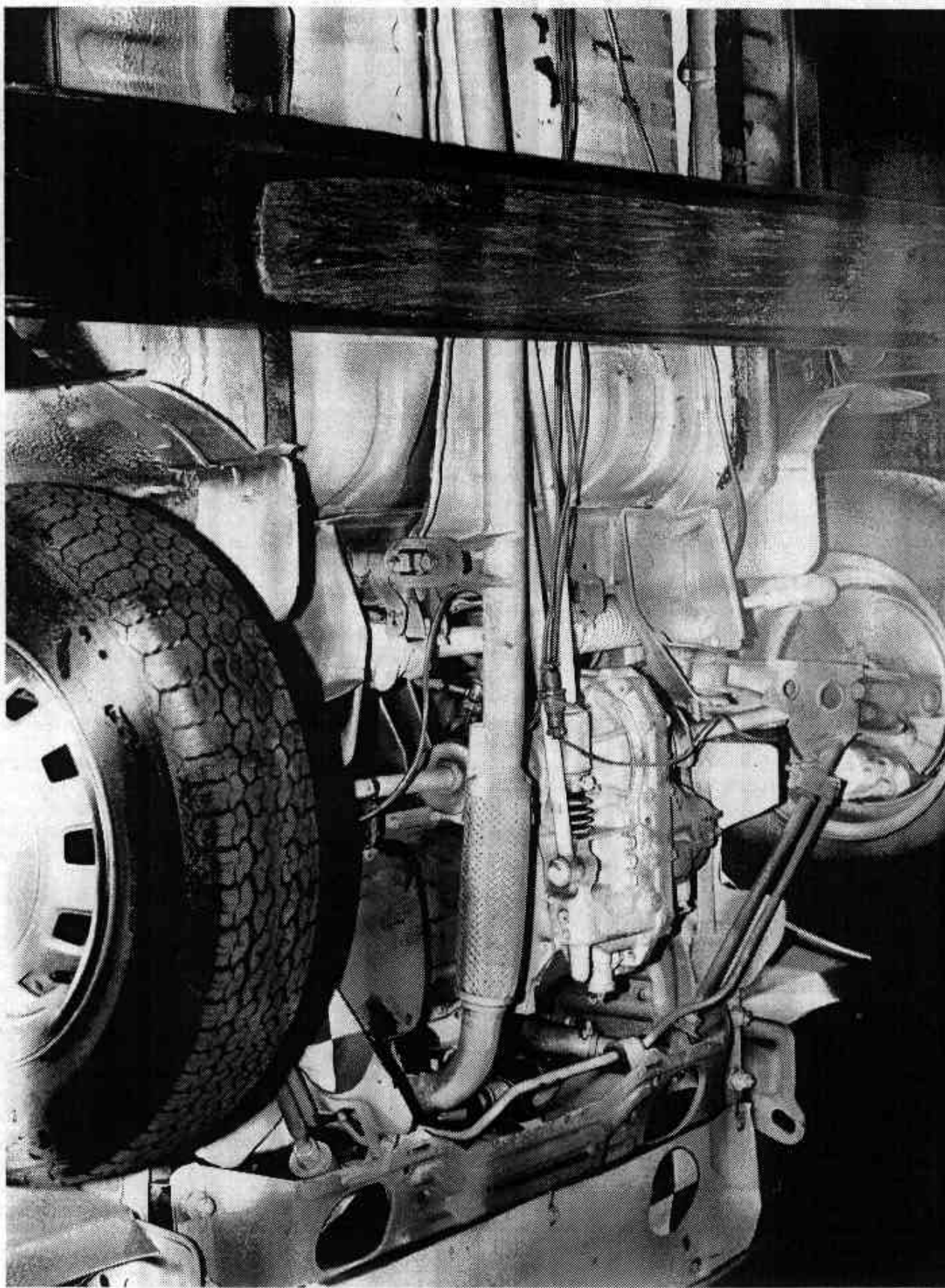


Figure A-19 PRE-TEST FRONT SIDE UNDERBODY VIEW

A-20

7457-19

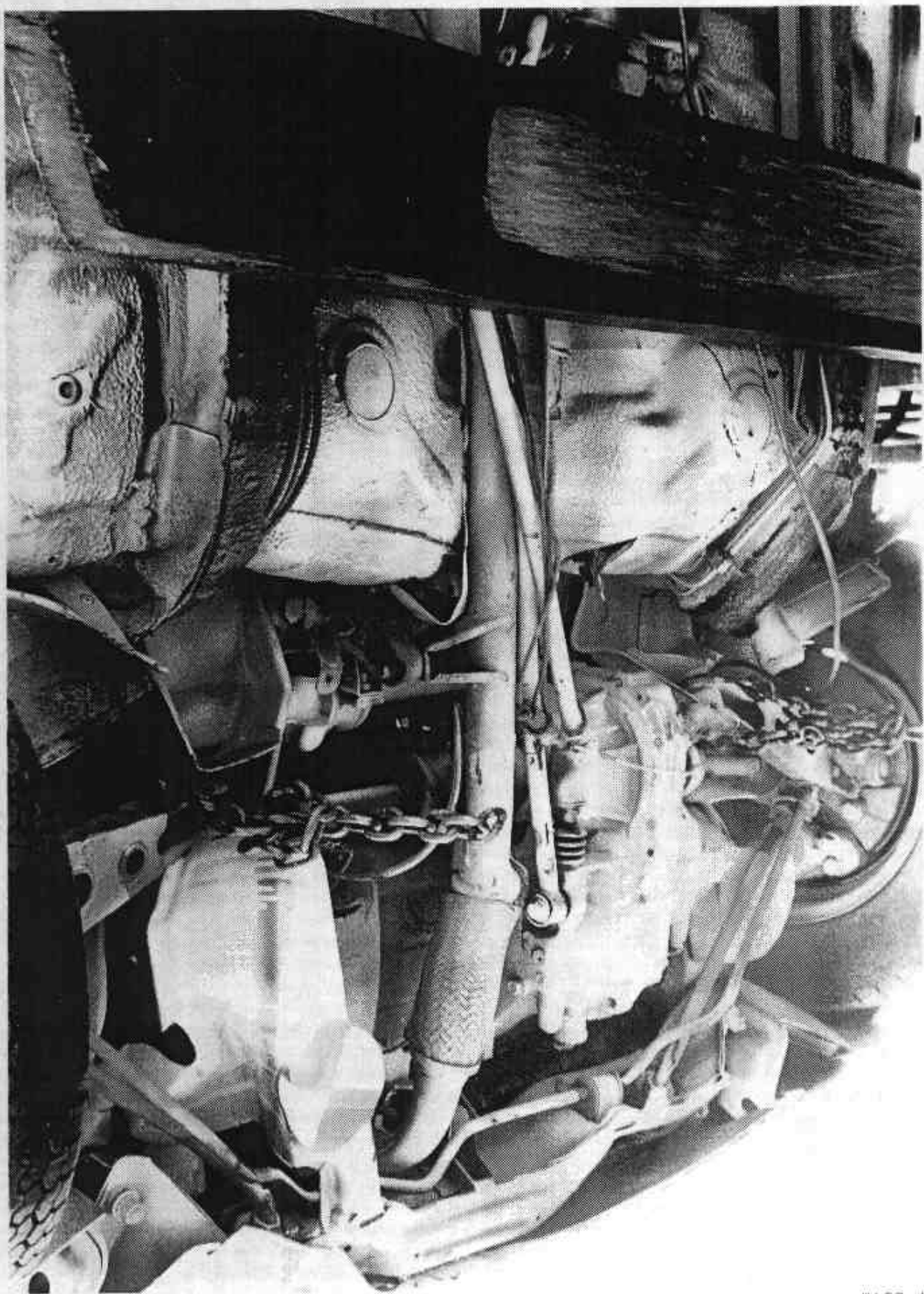


Figure A-20 POST-TEST FRONT SIDE UNDERBODY VIEW

A-21

7457-19

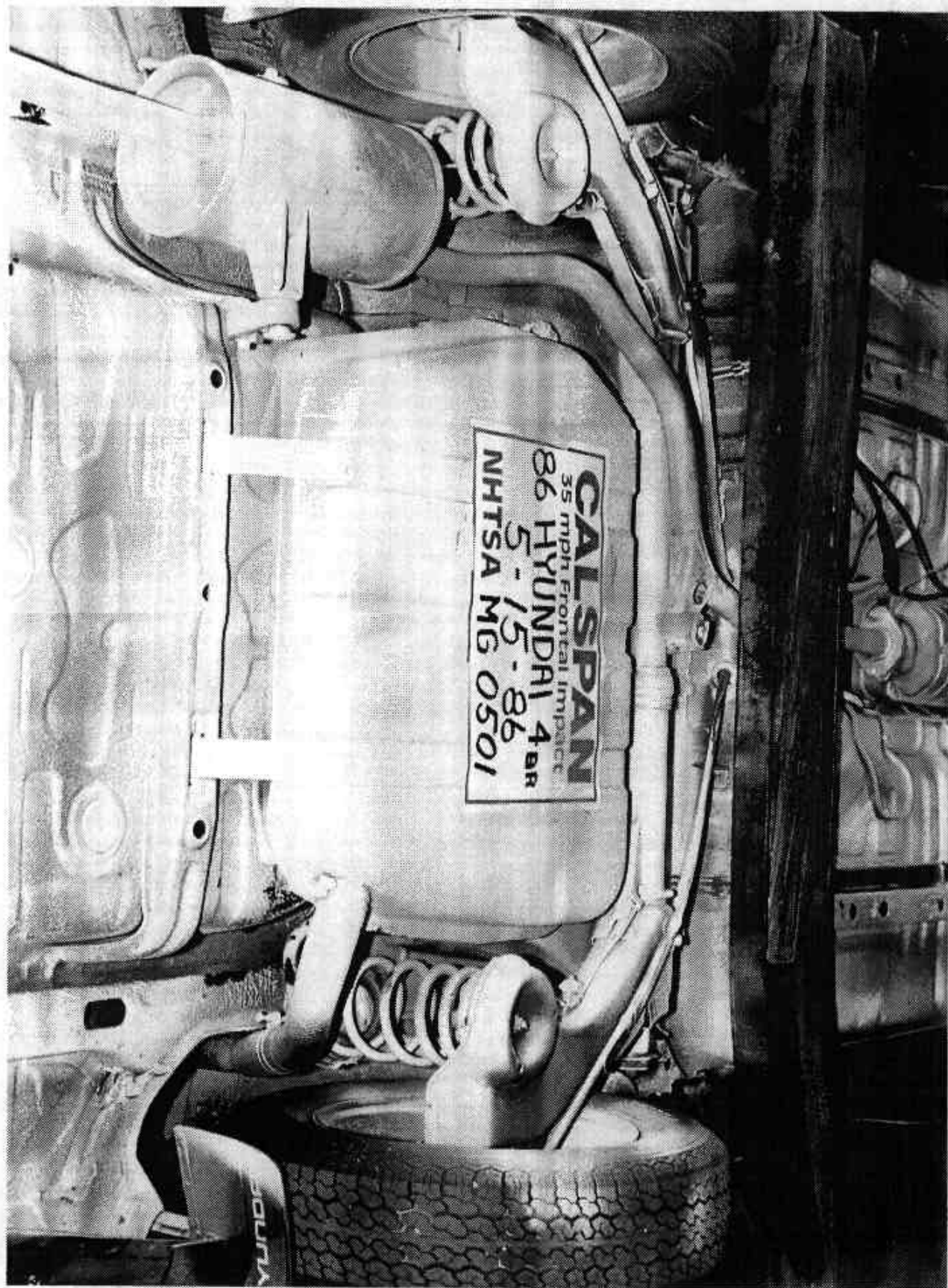


Figure A-21 PRE-TEST REAR UNDERBODY VIEW

A-22

7457-19

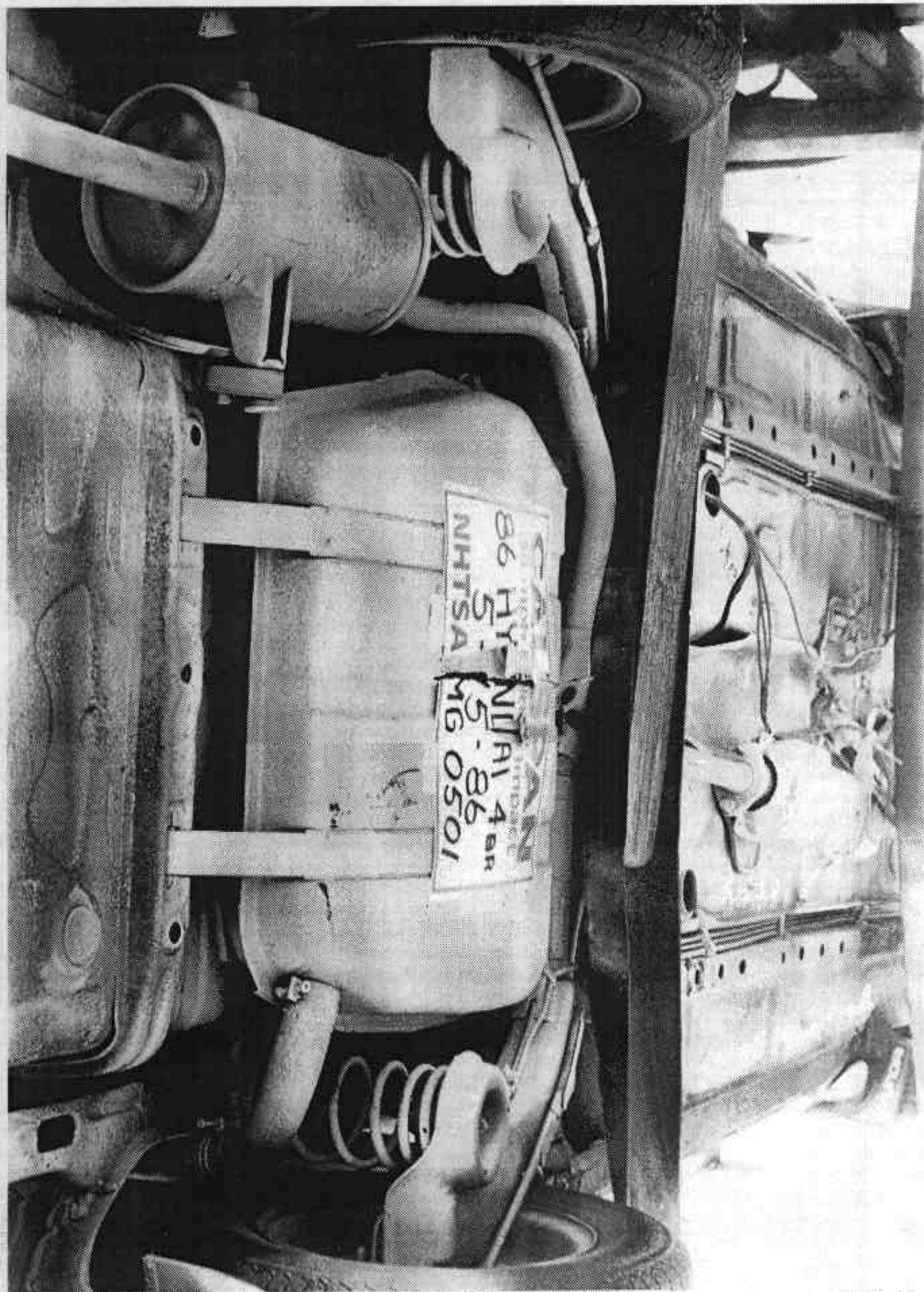


Figure A-22 POST-TEST REAR UNDERBODY VIEW

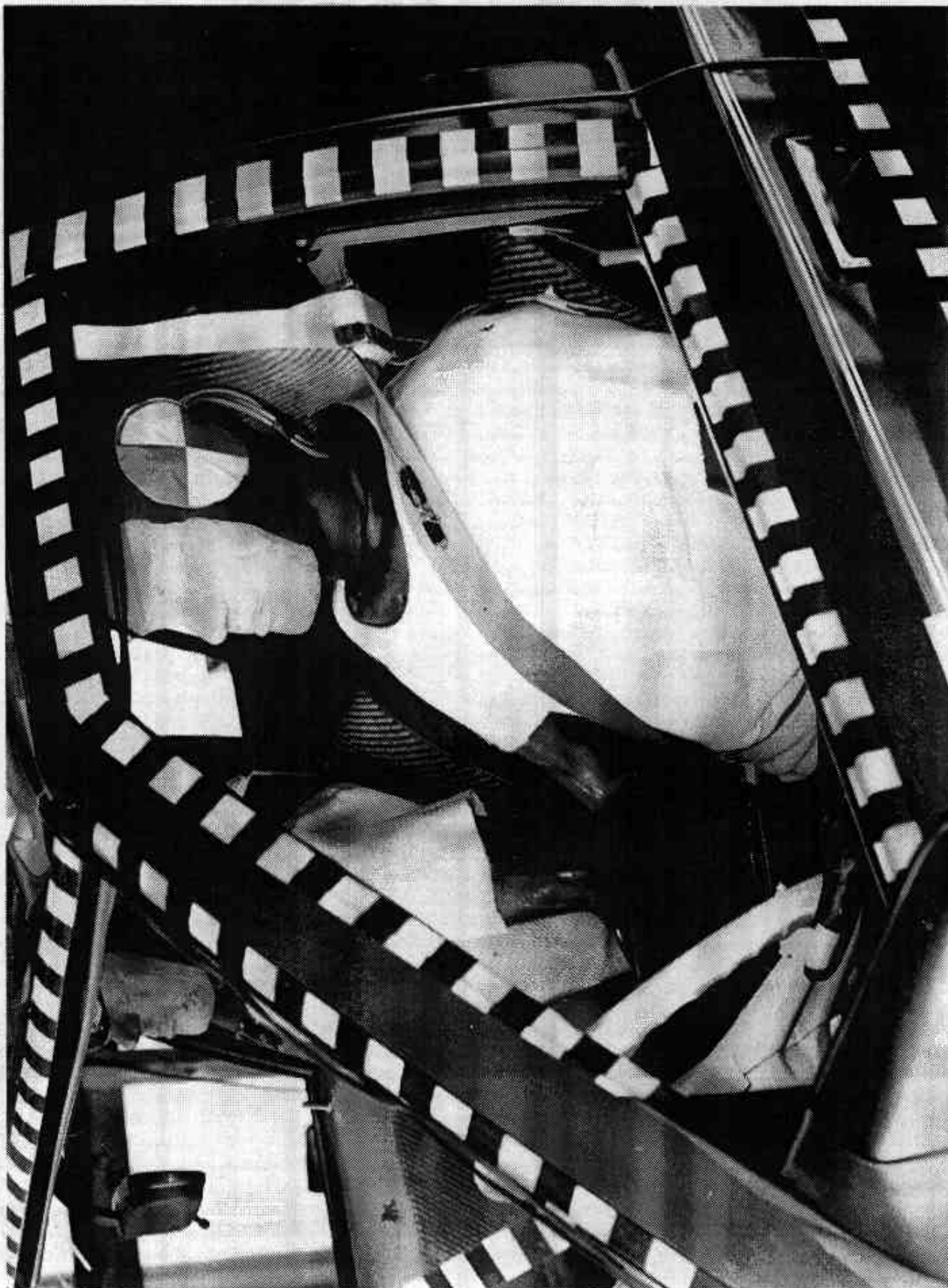


Figure A-23 PRE-TEST DRIVER POSITION VIEW

A-24

7457-19



Figure A-24 POST-TEST DRIVER POSITION VIEW

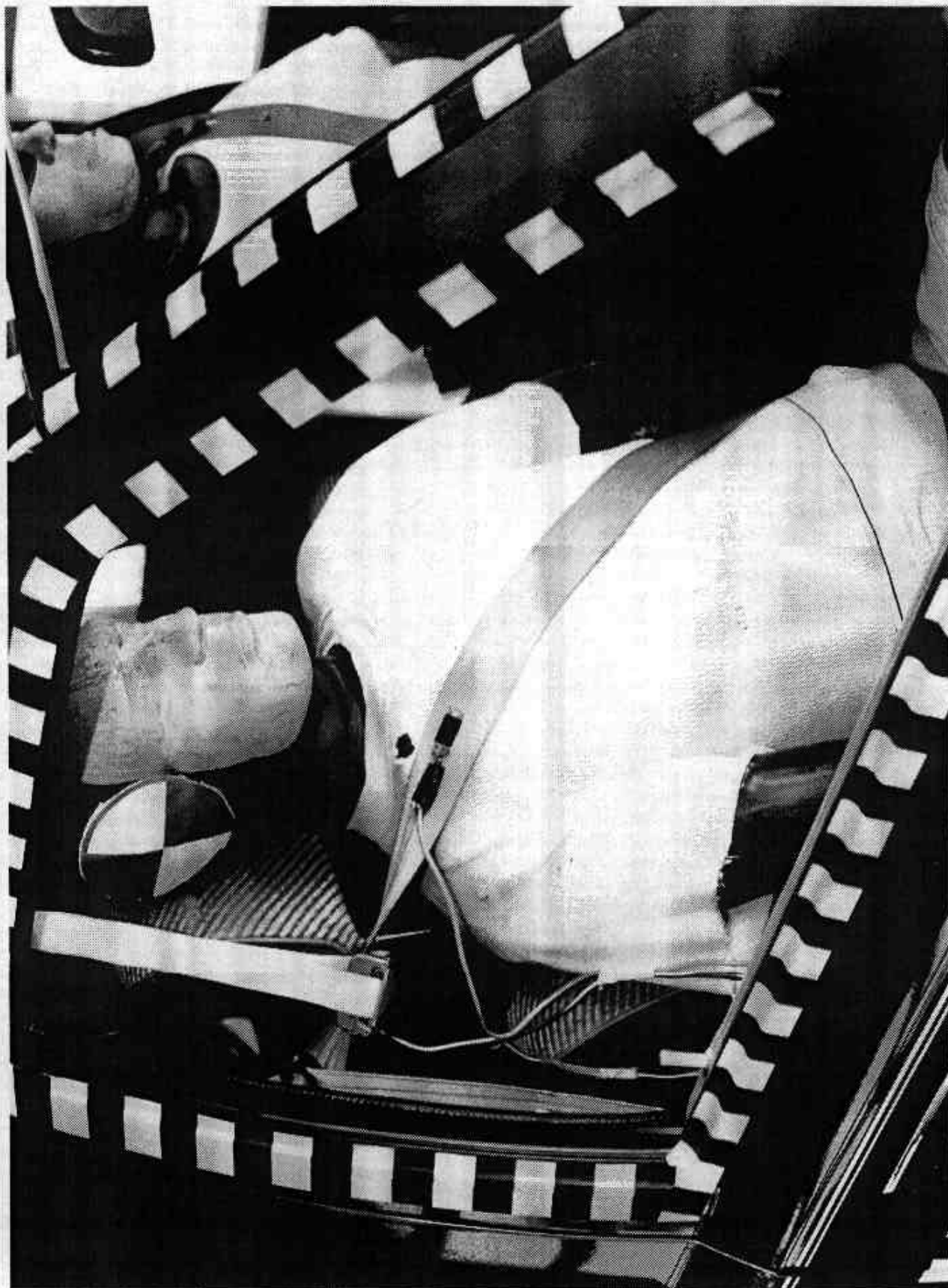


Figure A-25 PRE-TEST PASSENGER POSITION VIEW

A-26

7457-19



Figure A-26 POST-TEST PASSENGER POSITION VIEW

A-27

7457-19

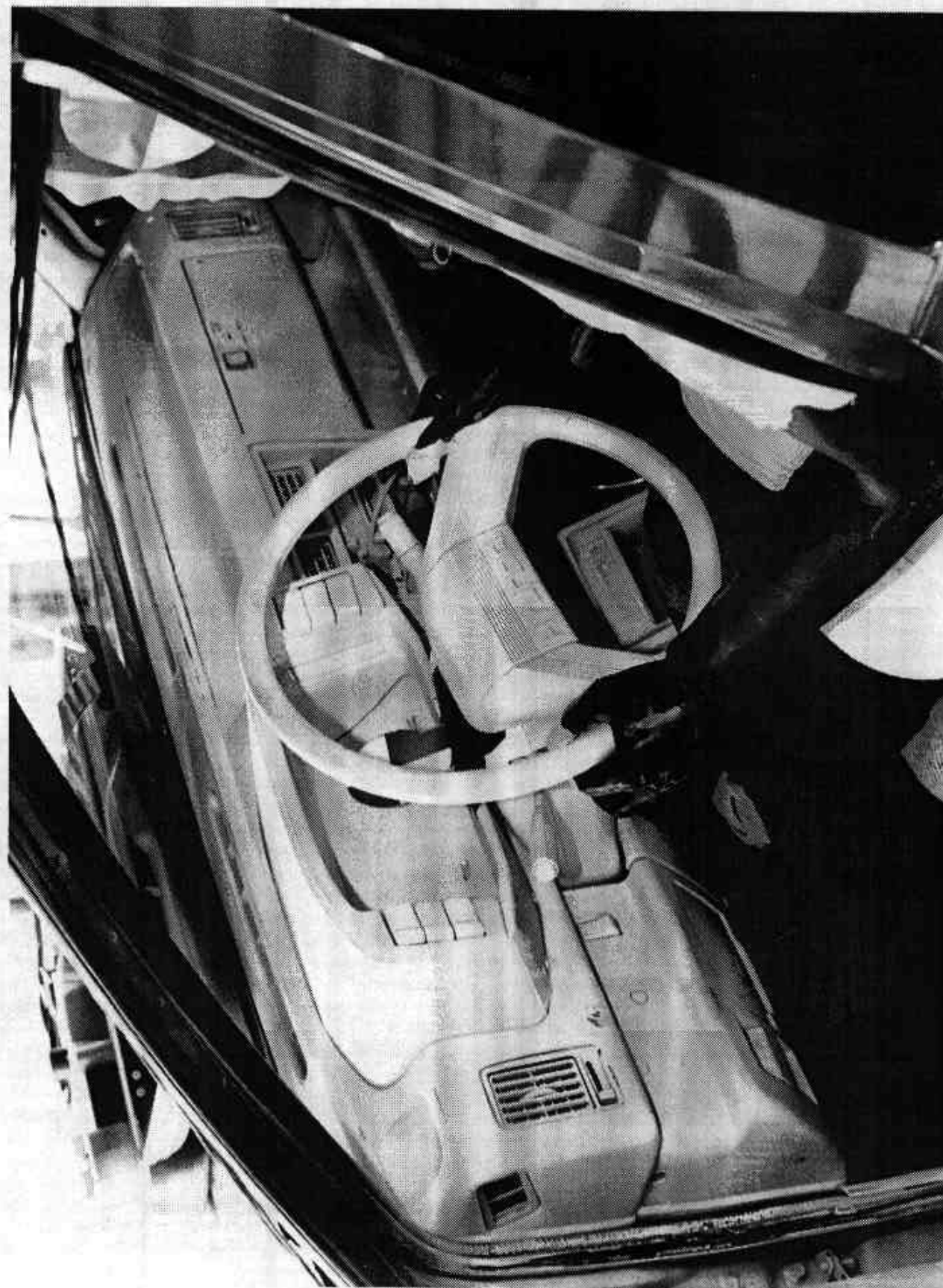


Figure A-27 PRE-TEST DRIVER AND INTERIOR VIEW

A-28

7457-19

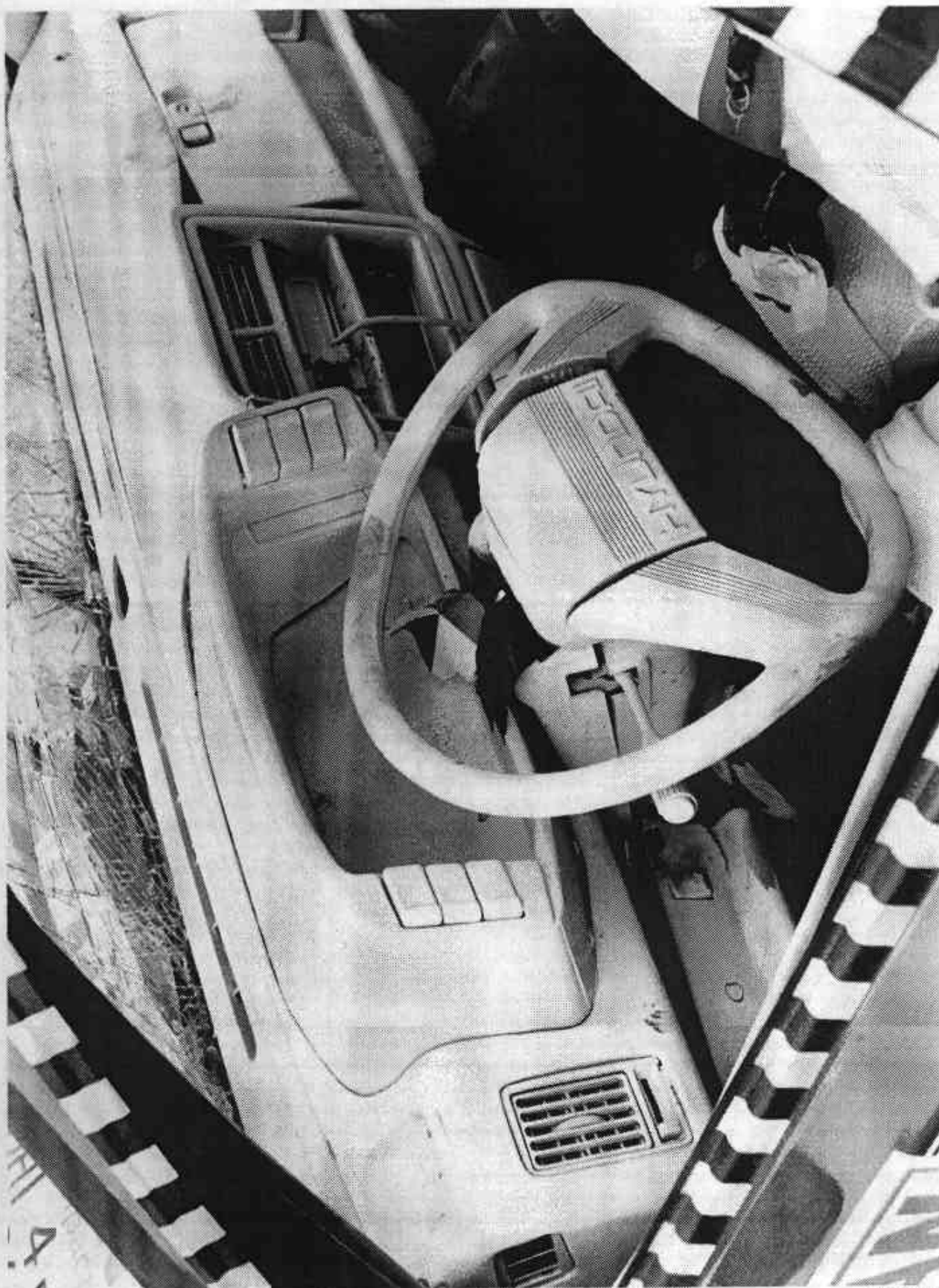


Figure A-28 POST-TEST DRIVER AND INTERIOR VIEW

A-29

7457-19

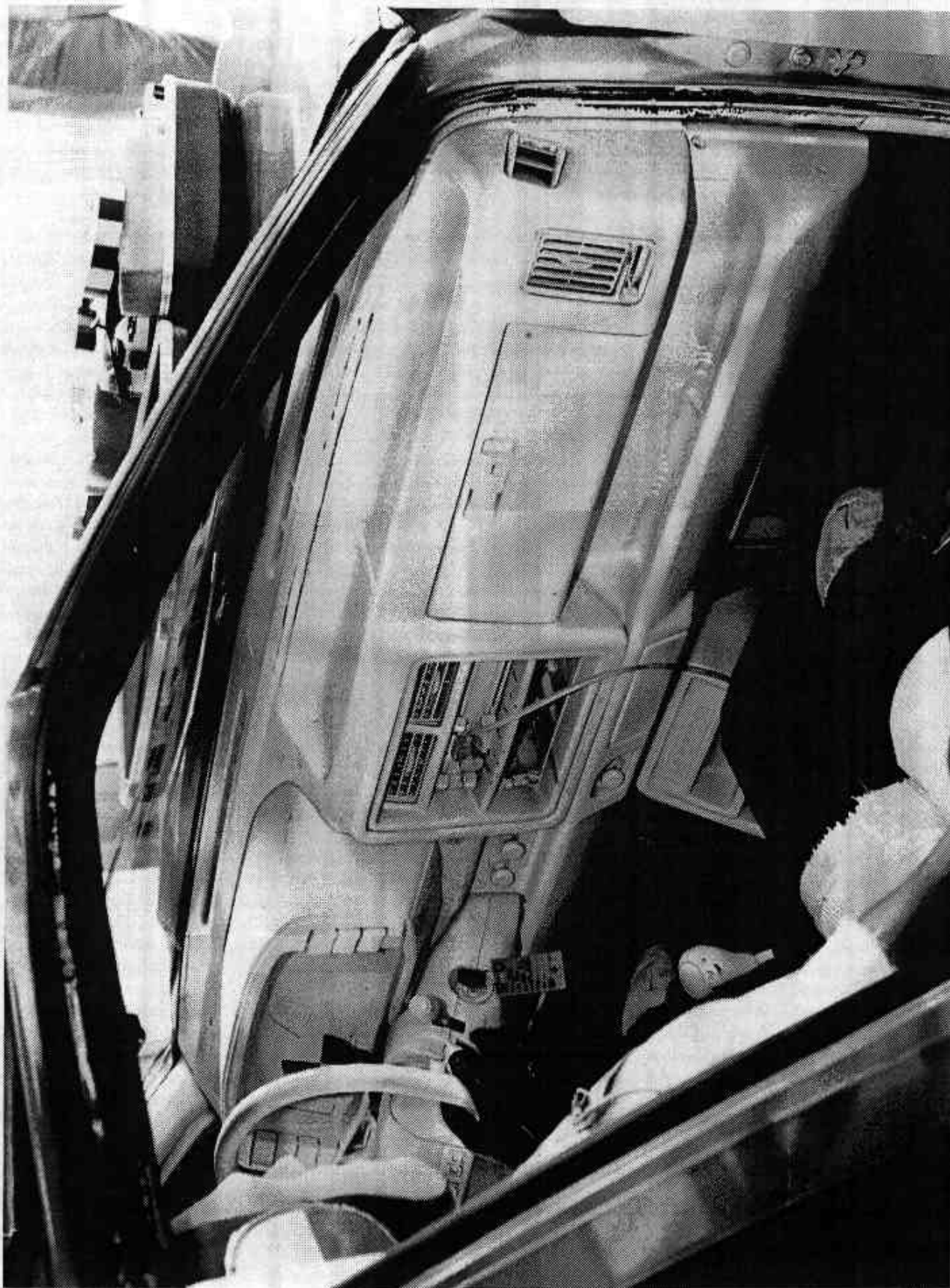


Figure A-29 PRE-TEST PASSENGER AND INTERIOR VIEW

A-30

7457-19

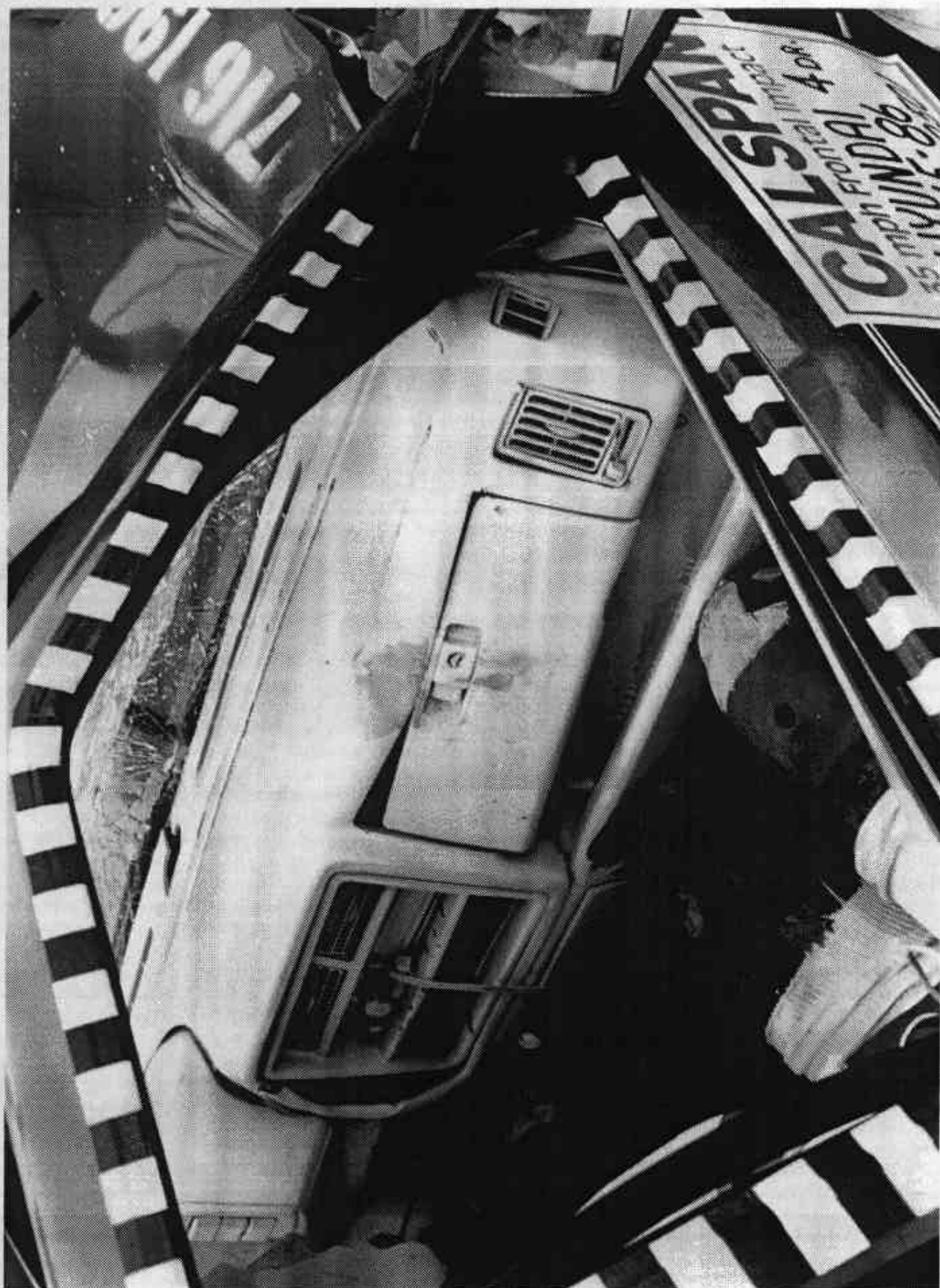


Figure A-30 POST-TEST PASSENGER AND INTERIOR VIEW

A-31

7457-19

APPENDIX B

VEHICLE, DUMMY RESPONSE DATA AND LOAD CELL BARRIER DATA

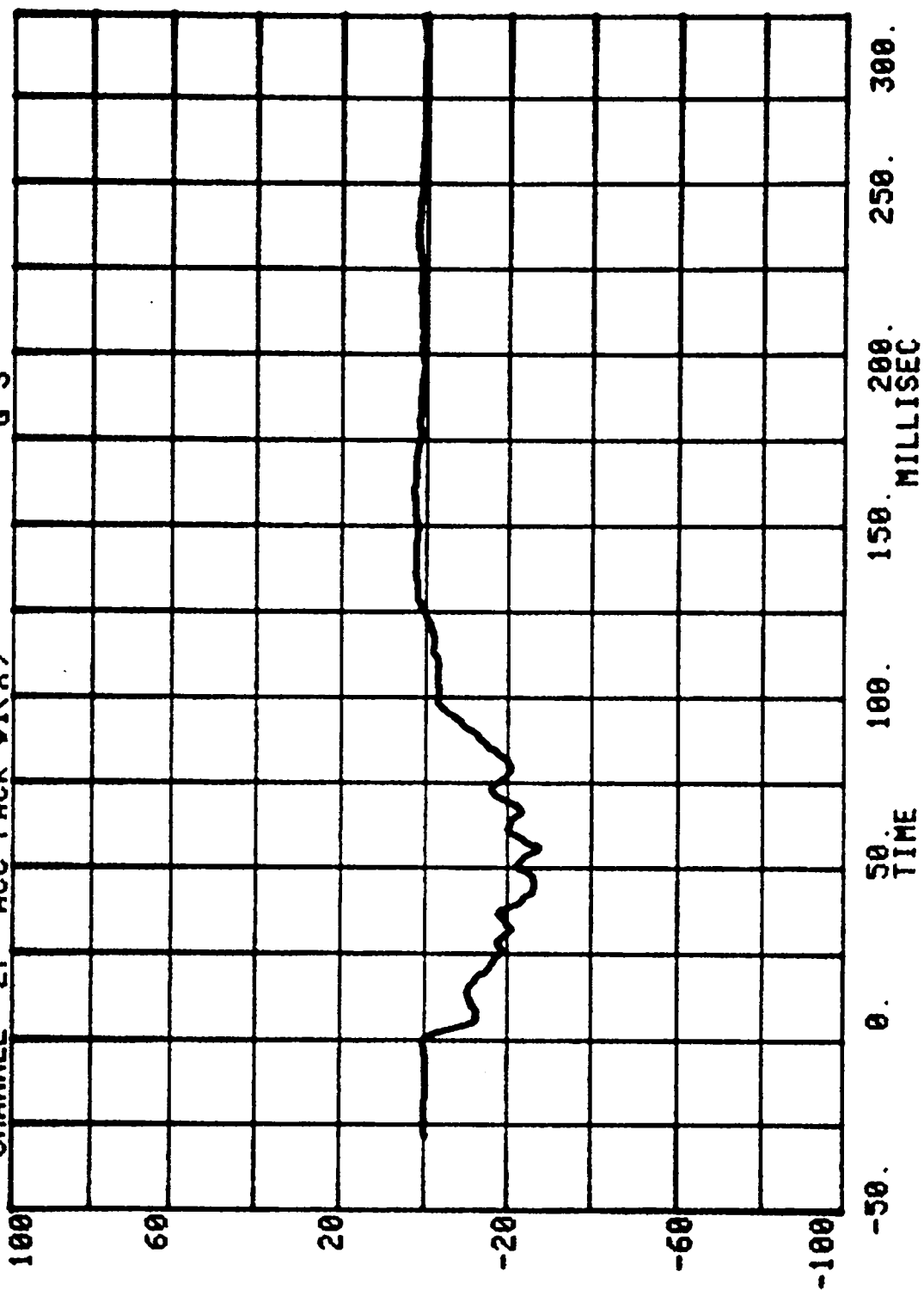
TEST NO. MG0501

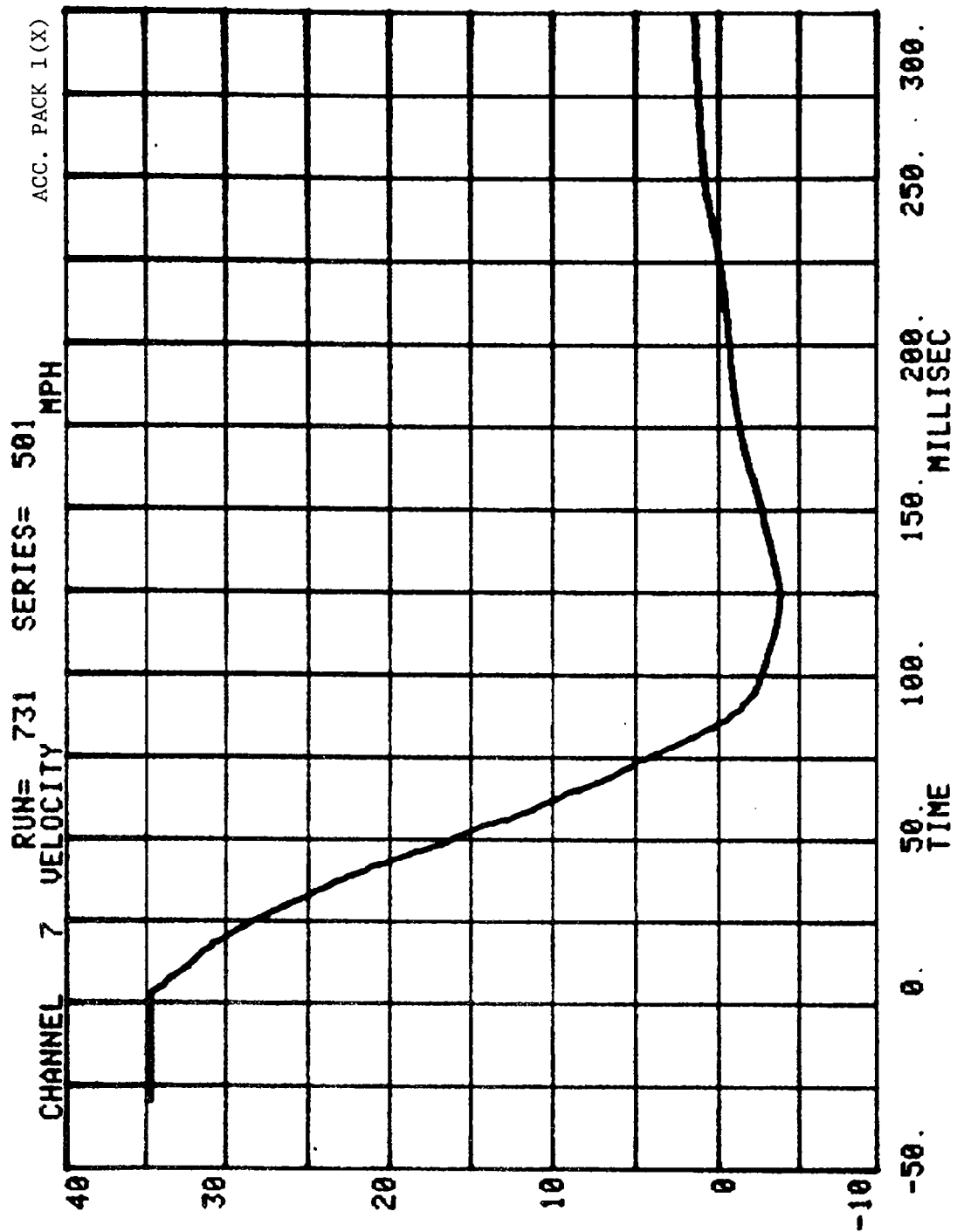
VEHICLE DATA

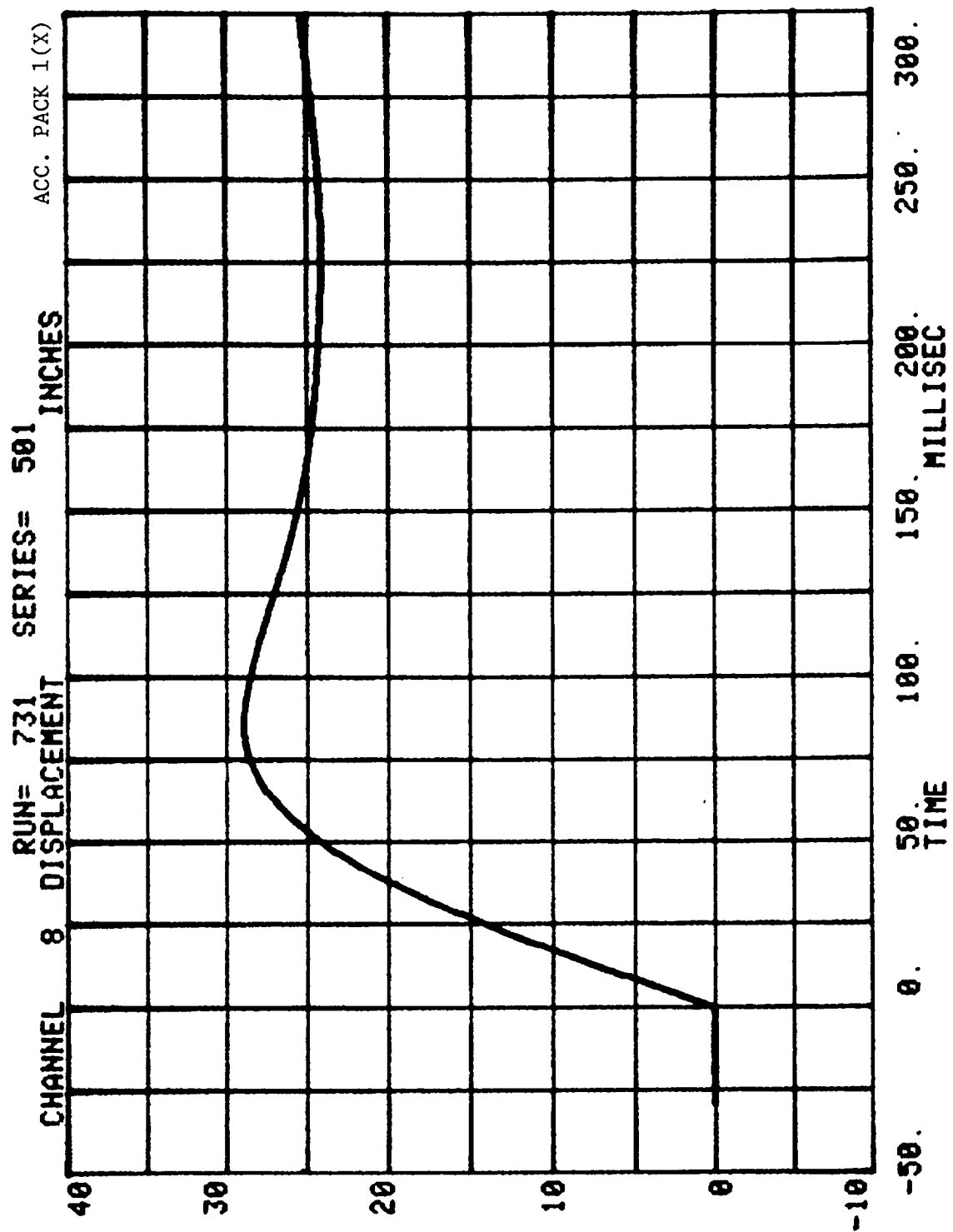
FILTER CHANNEL CLASS

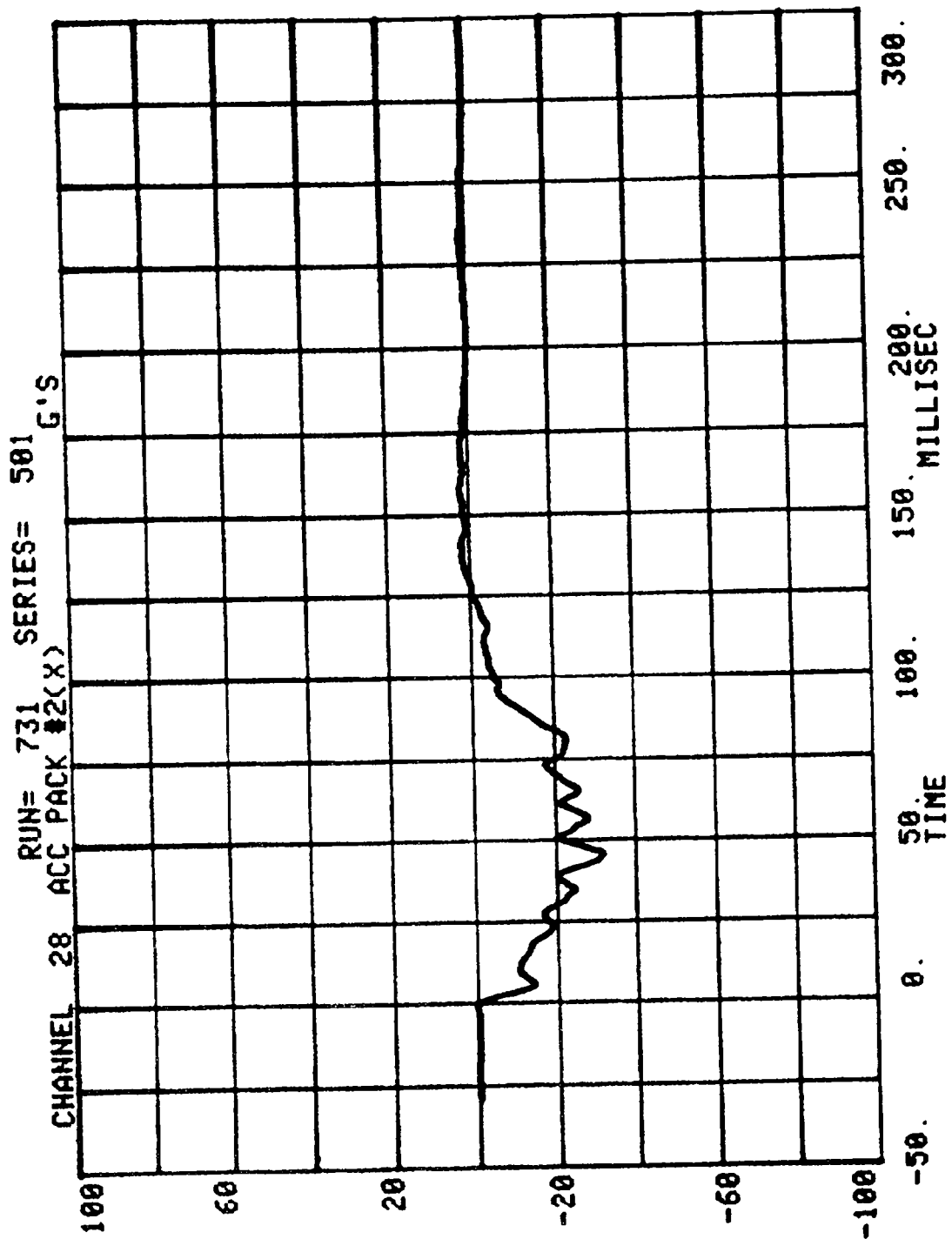
60

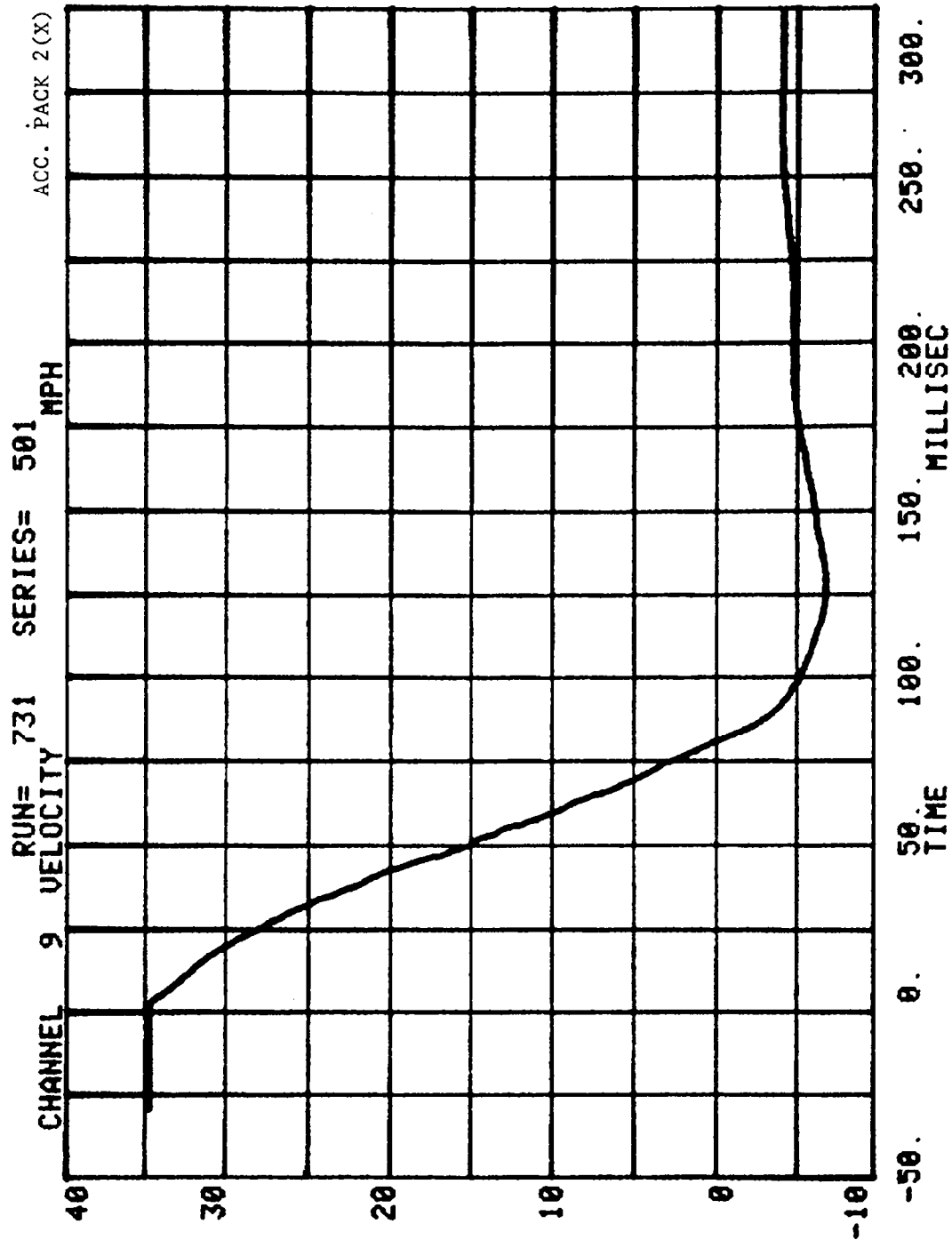
CHANNEL 27 ACC PACK #1(X) RUN= 731 SERIES= 501 G'S

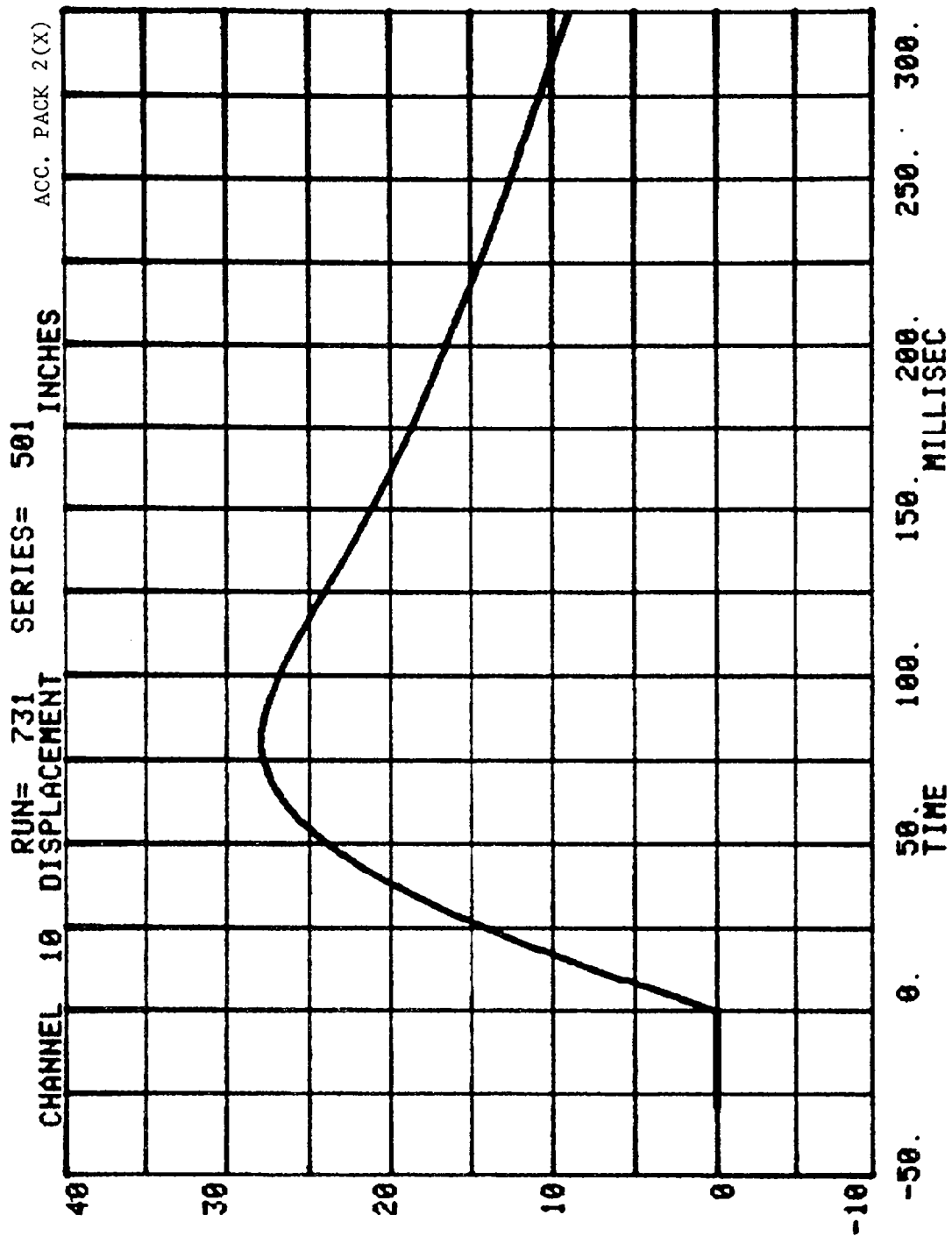


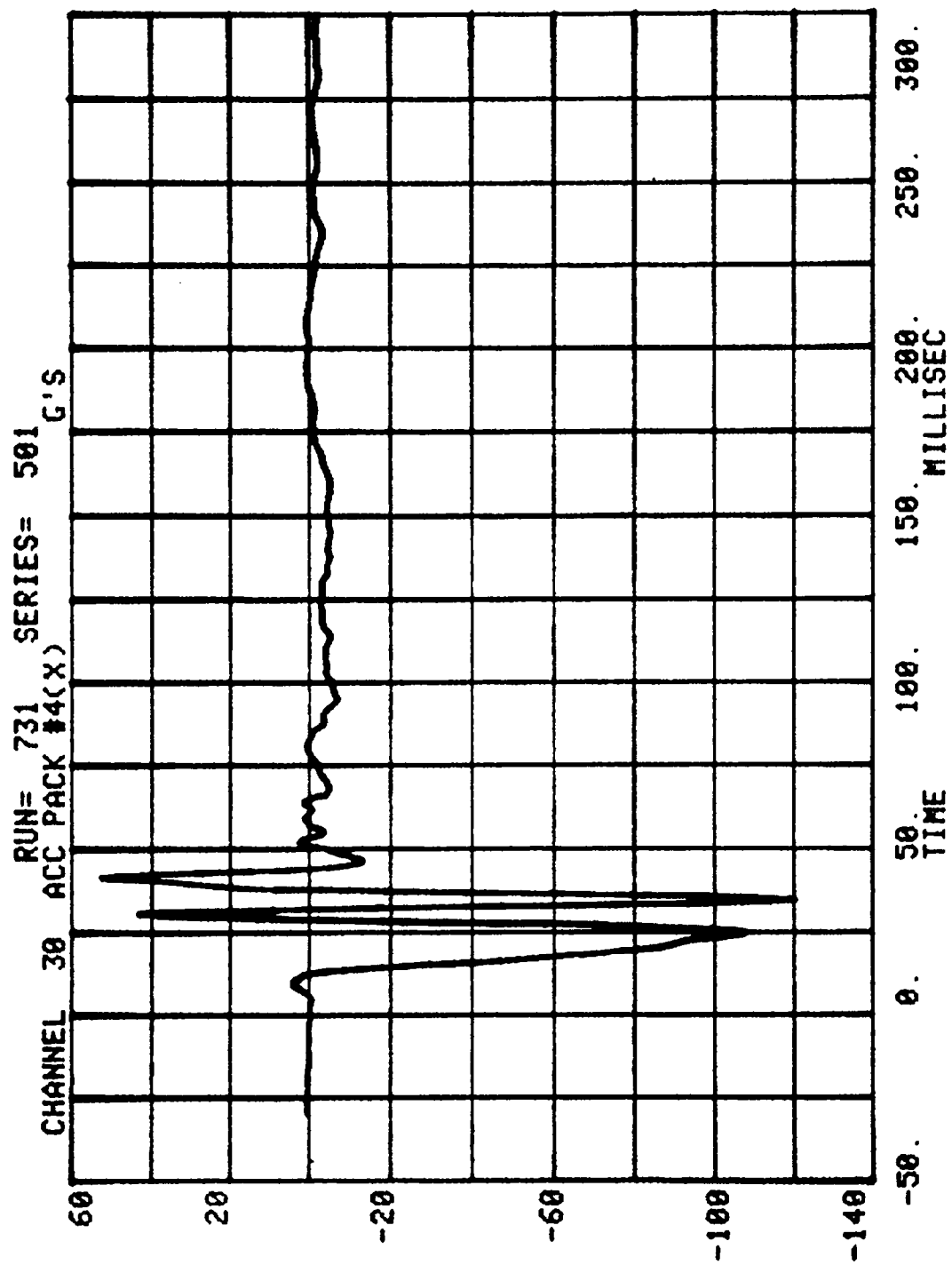


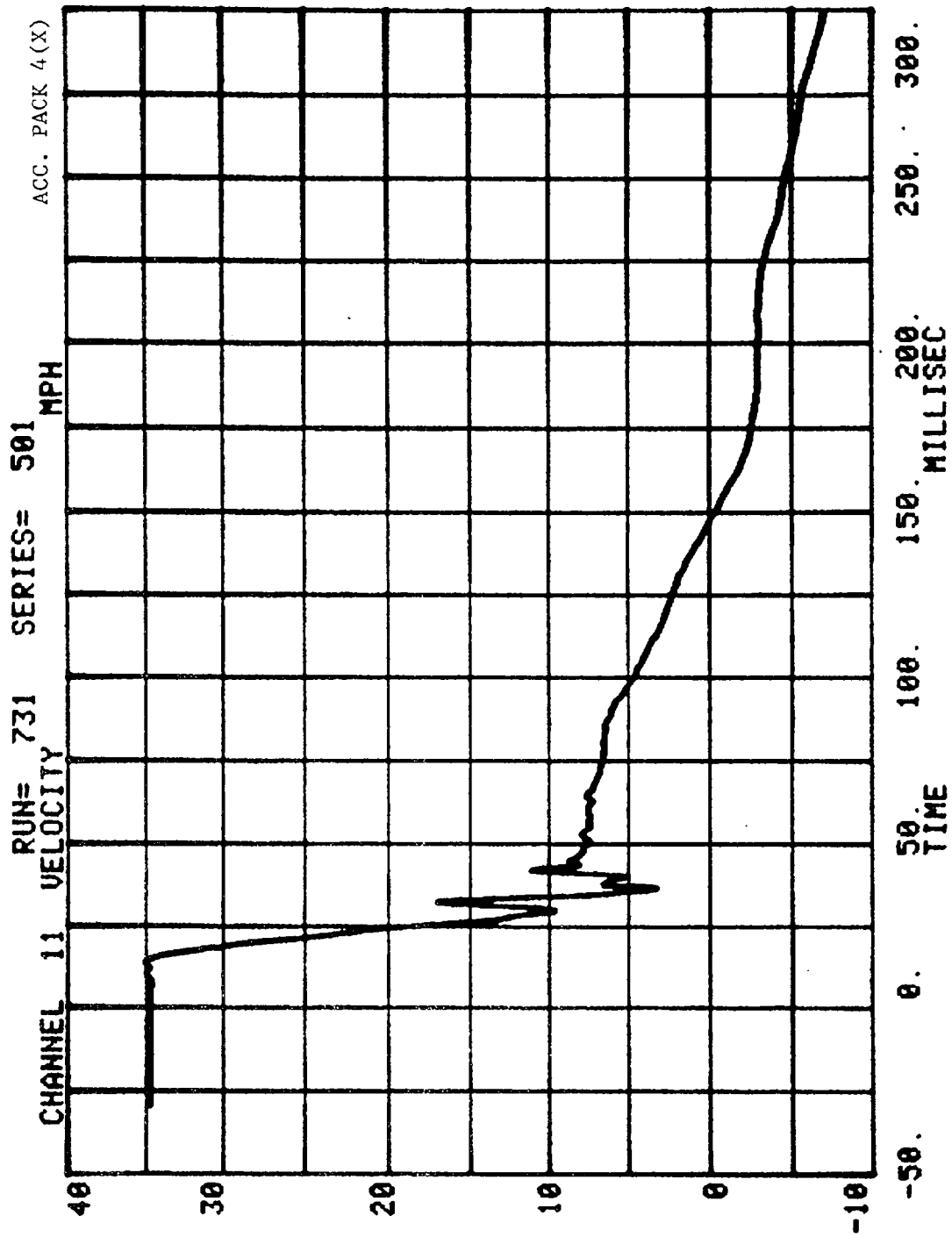












HYUNDAI

FOR IMMEDIATE RELEASE:
July 31, 1986

FOR INFORMATION CONTACT:
Ted Kade (714) 890-6237

HYUNDAI ANNOUNCES SEAT BELT IMPROVEMENT

Garden Grove, Calif., July 31, 1986 -- Hyundai Motor America today announced an improved front seat belt system for the subcompact Excel.

The new system locks up faster during sudden deceleration, such as would occur during a collision, thus providing an increased safety margin for front seat occupants.

Hyundai began installation of the new system on April 25 and all Excels currently on the market include the production change. There is no added charge for the new belt system.

The Company stressed, however, that while the new belt system is an improvement, the one previously used also meets or exceeds all applicable federal motor vehicle safety standards.

Hyundai is installing the new system as part of the Company's commitment to product refinement. The Company will continually assess its products and make changes that are appropriate and which add to the value received by the consumer.

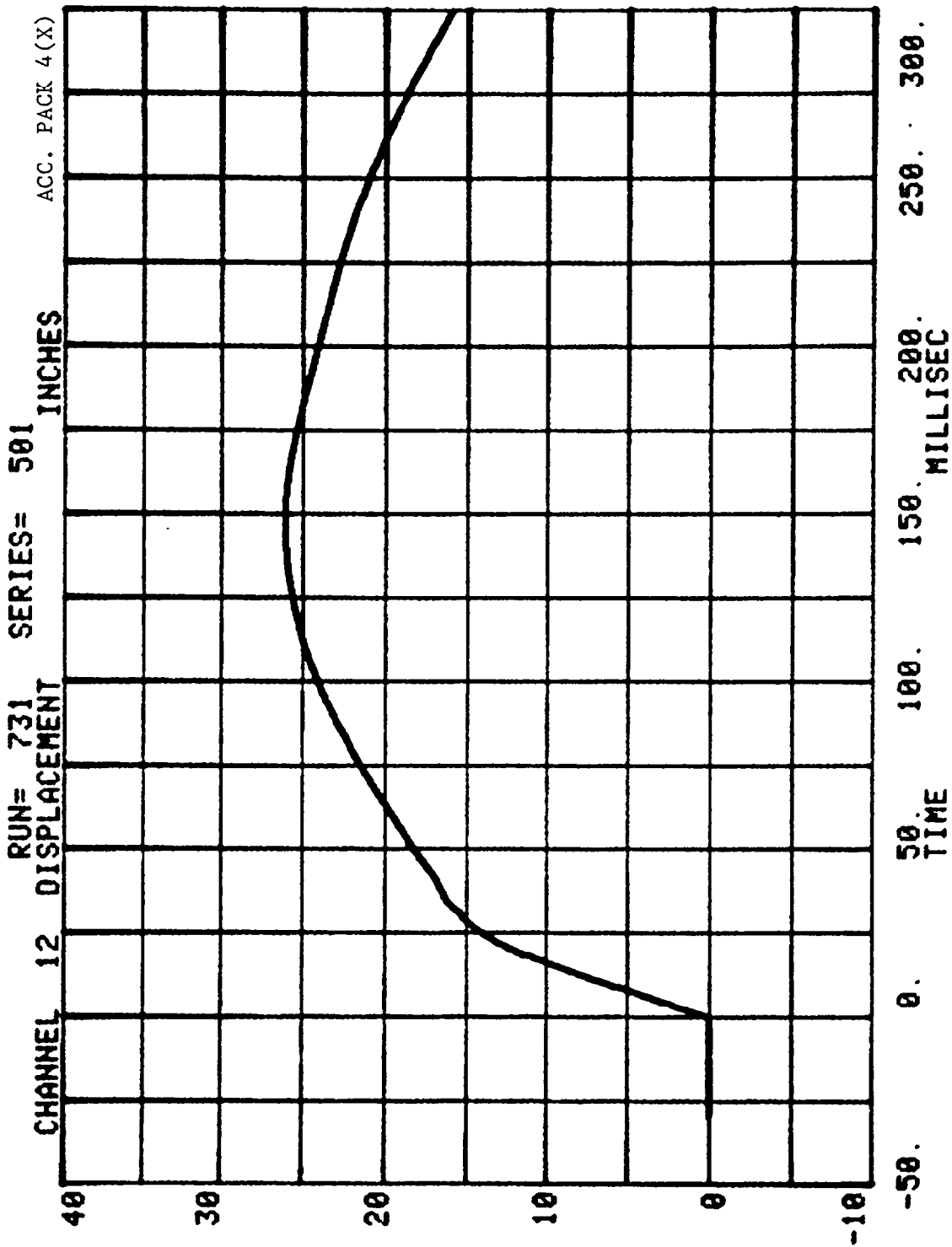
In addition to meeting the federal crash tests which are conducted at 30 mph, Hyundai also tested the new system at 35 mph. That higher speed is used in the experimental New Car Assessment Program (NCAP) conducted by the National Highway Traffic Safety Administration (NHTSA). Federal law, however, does not require auto manufacturers to meet this experimental standard.

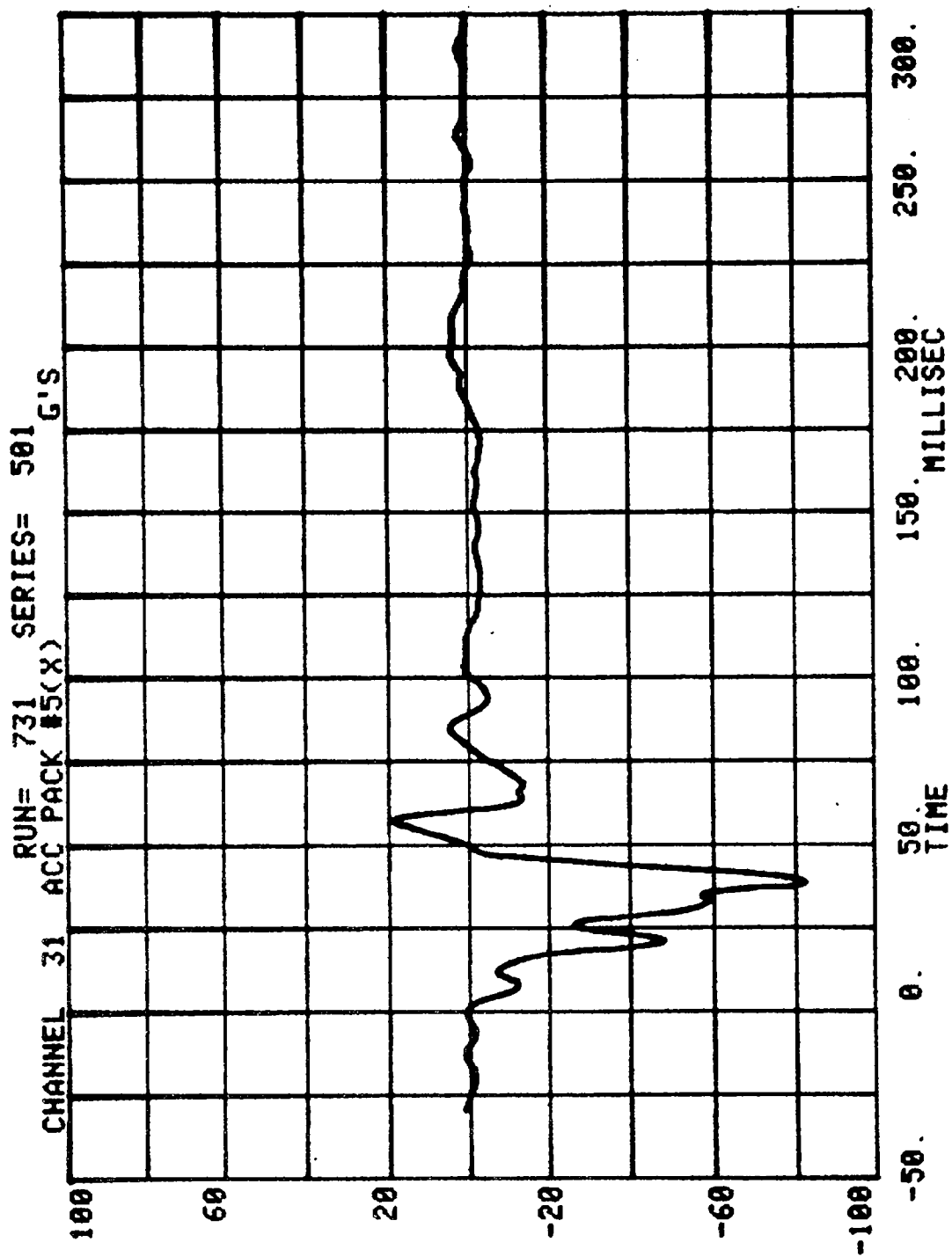
In 35 mph tests conducted by Hyundai using the new system and following the procedure prescribed by NHTSA, the Excel easily met the guidelines for sustained head injuries.

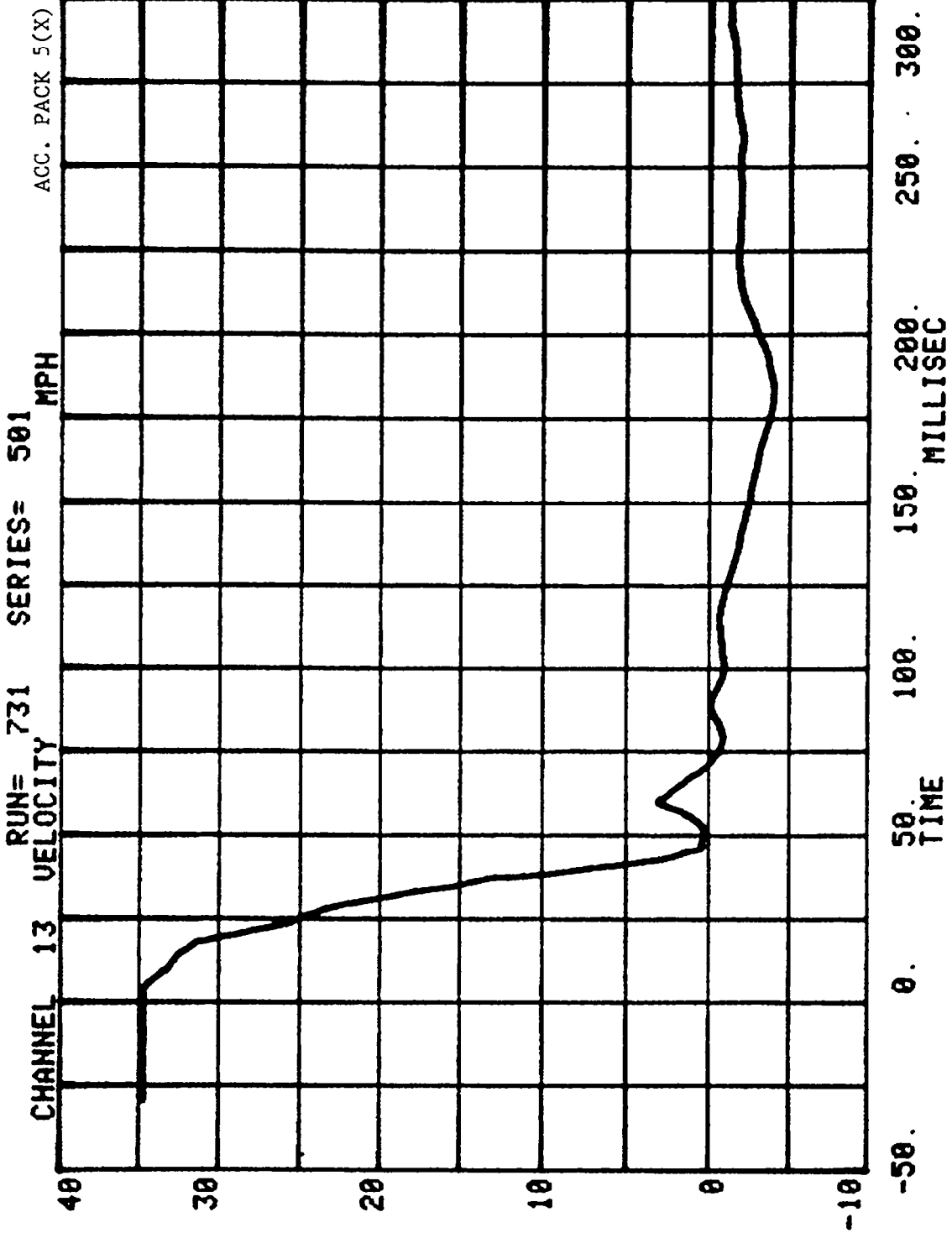
Even at the increased speed of 35 mph, the "driver" dummy in the tests conducted by the Company had a head injury criterion (HIC) factor of 608 and the "passenger" dummy had a factor of 909, well below the maximum allowable standard of 1000.

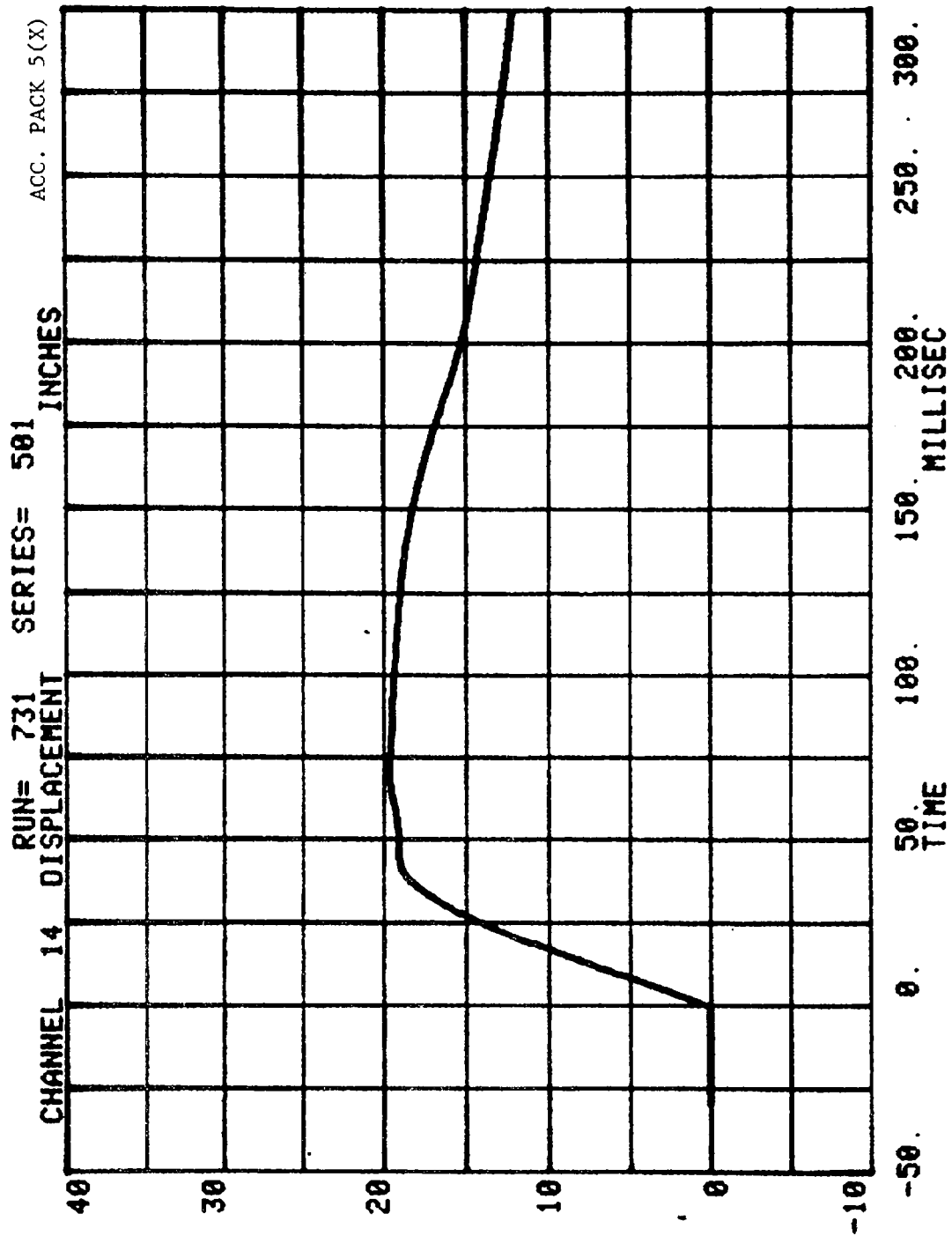
These numbers were achieved even though a 35 mph crash is one-third more severe than the 30 mph speed used by the federal government in its official certification testing.

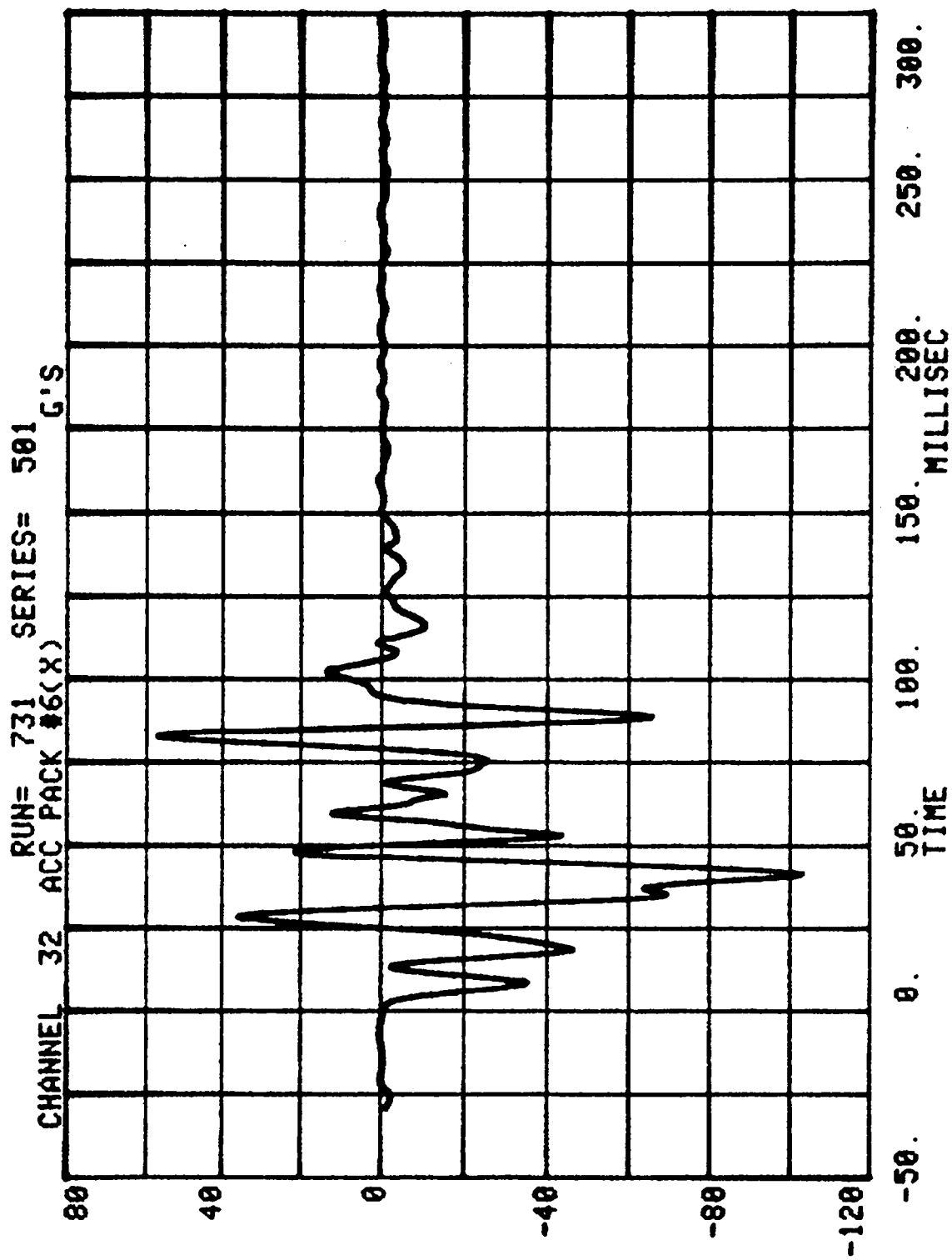
Hyundai also noted that small differences in test dummy placement and safety belt position can and do produce large variations in the recorded results.

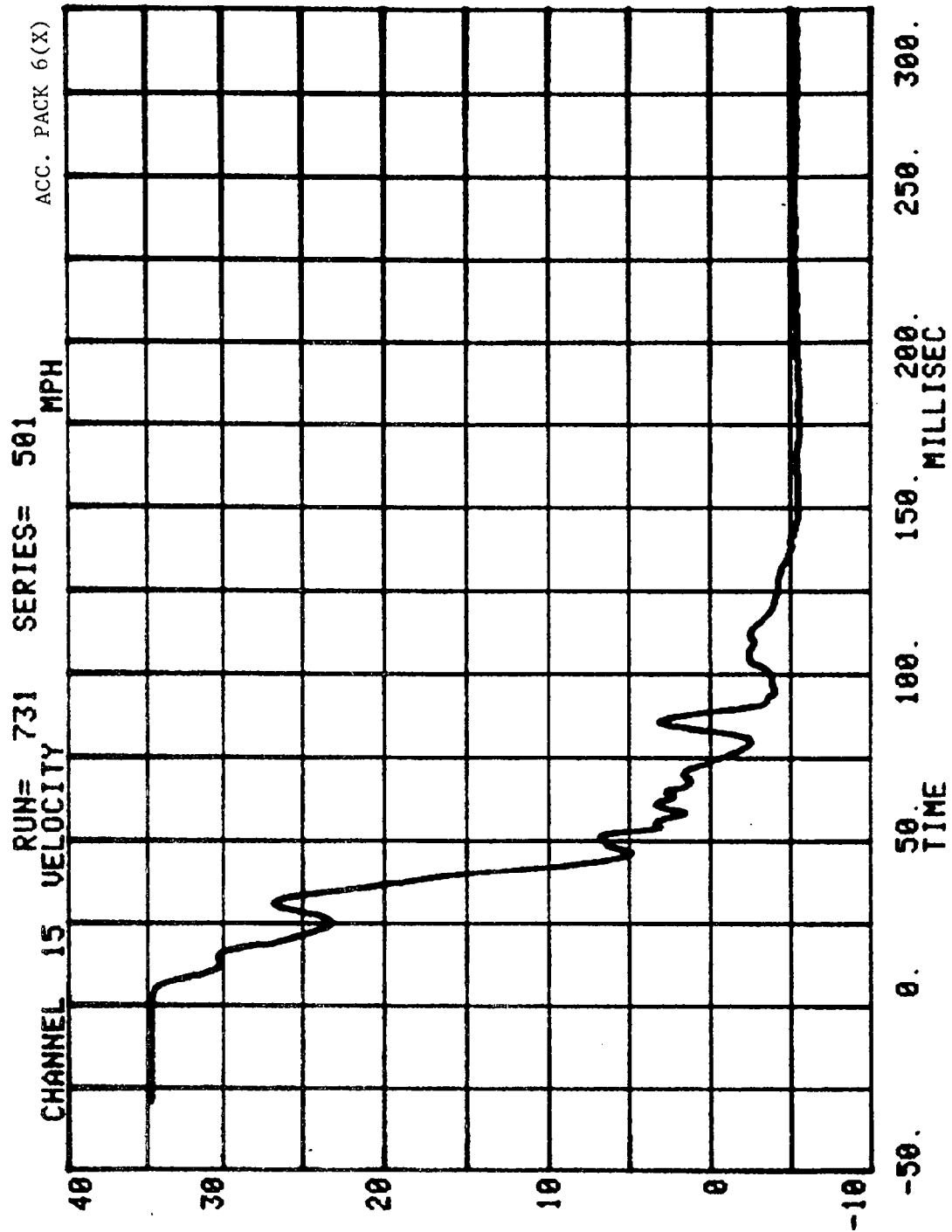


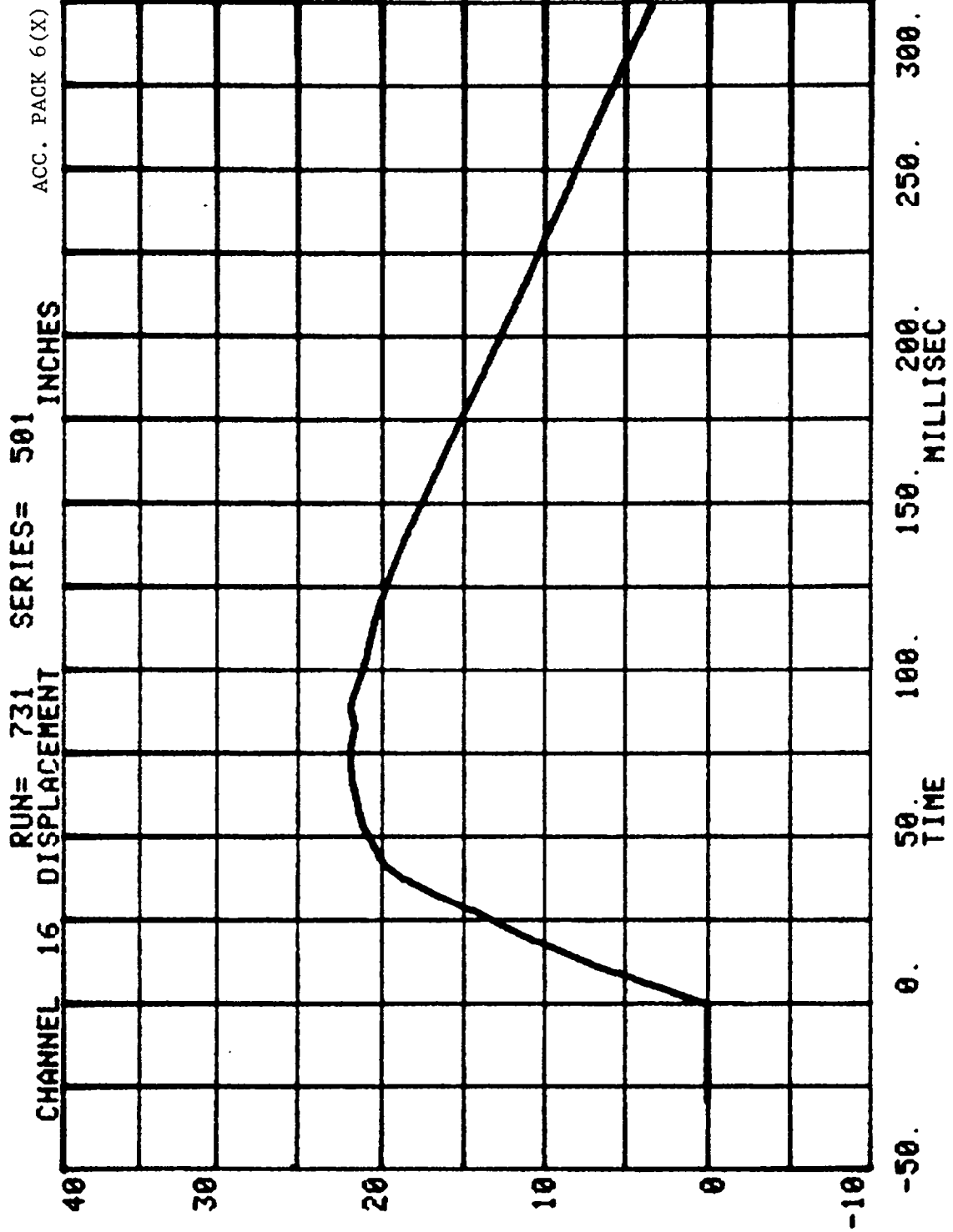


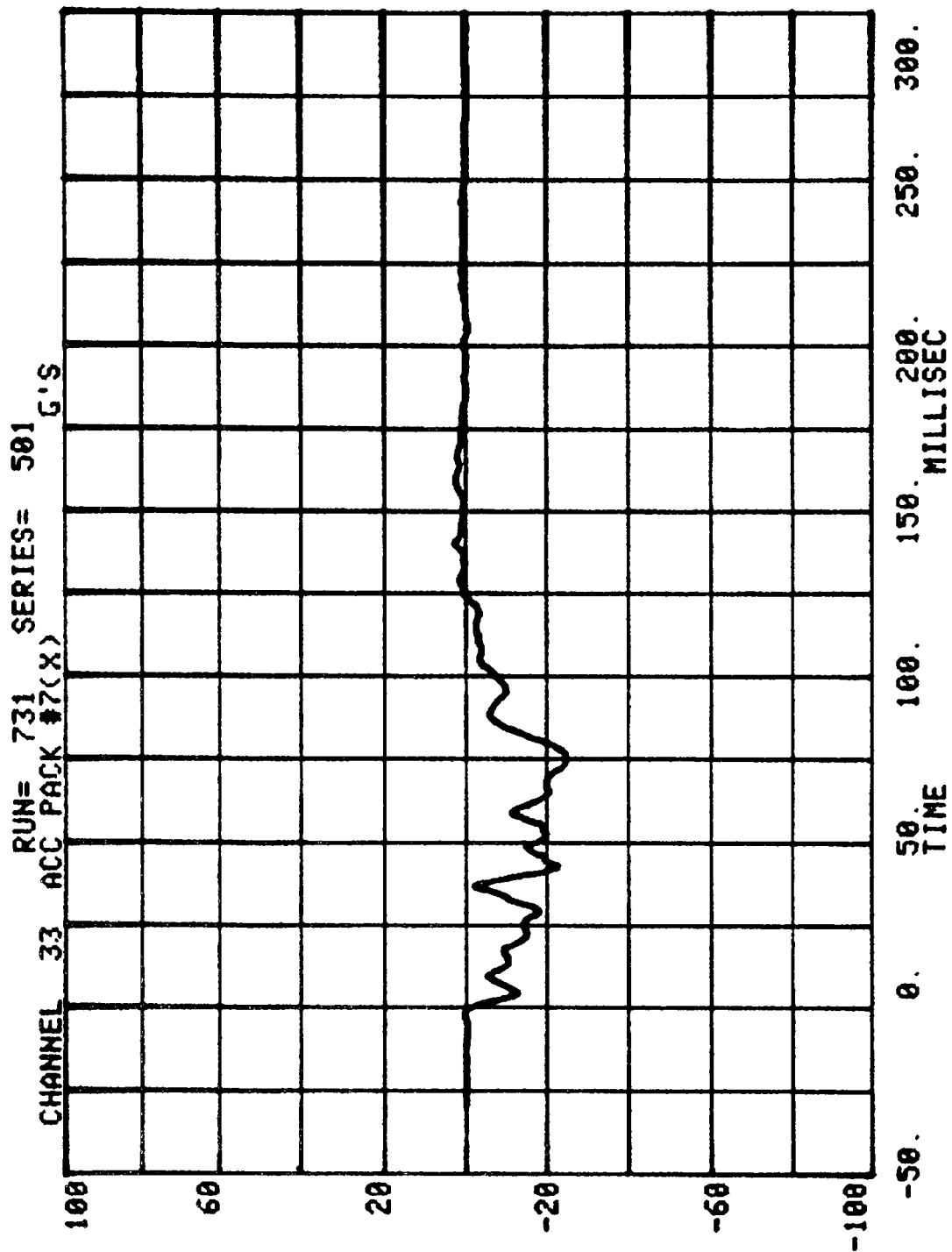


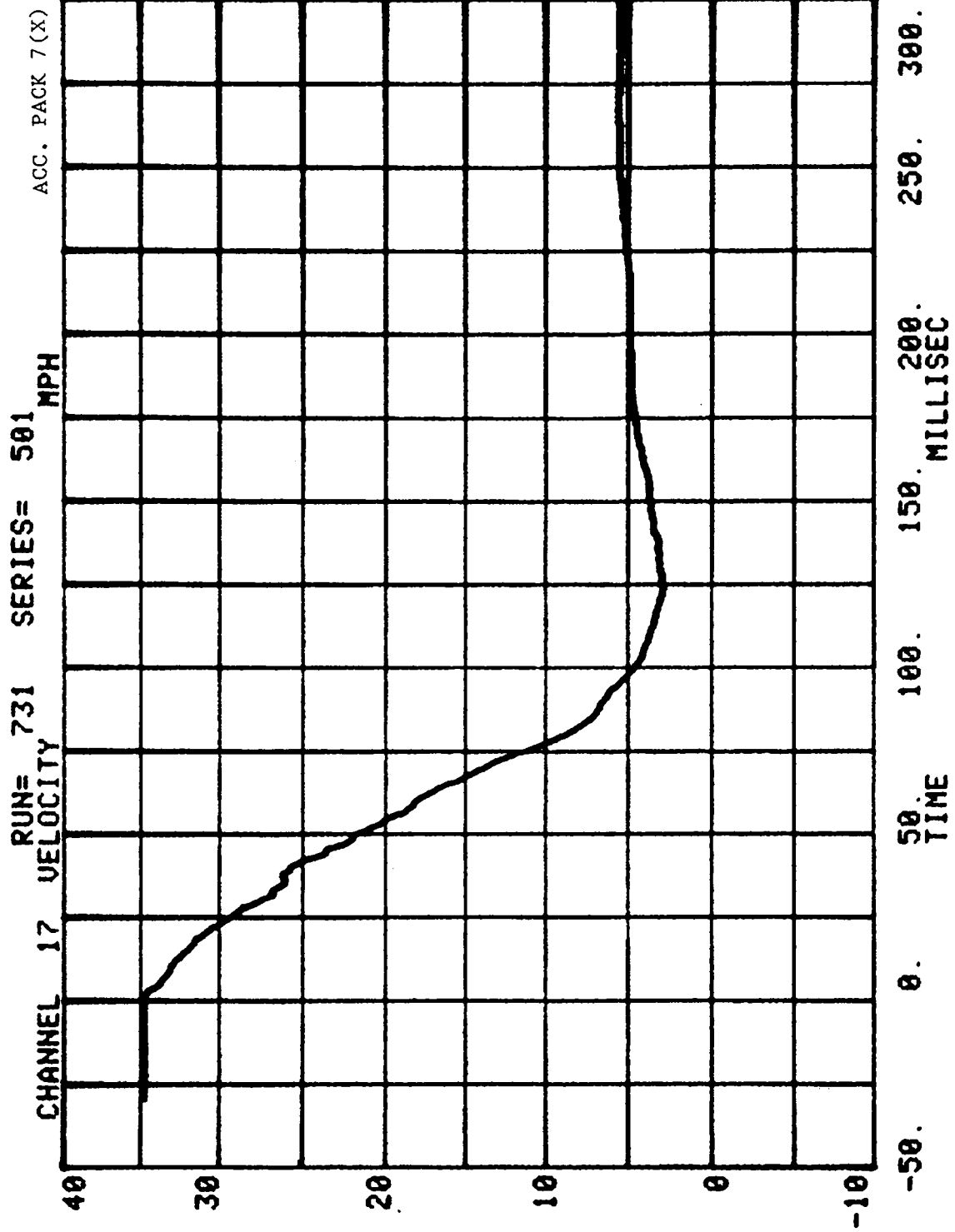


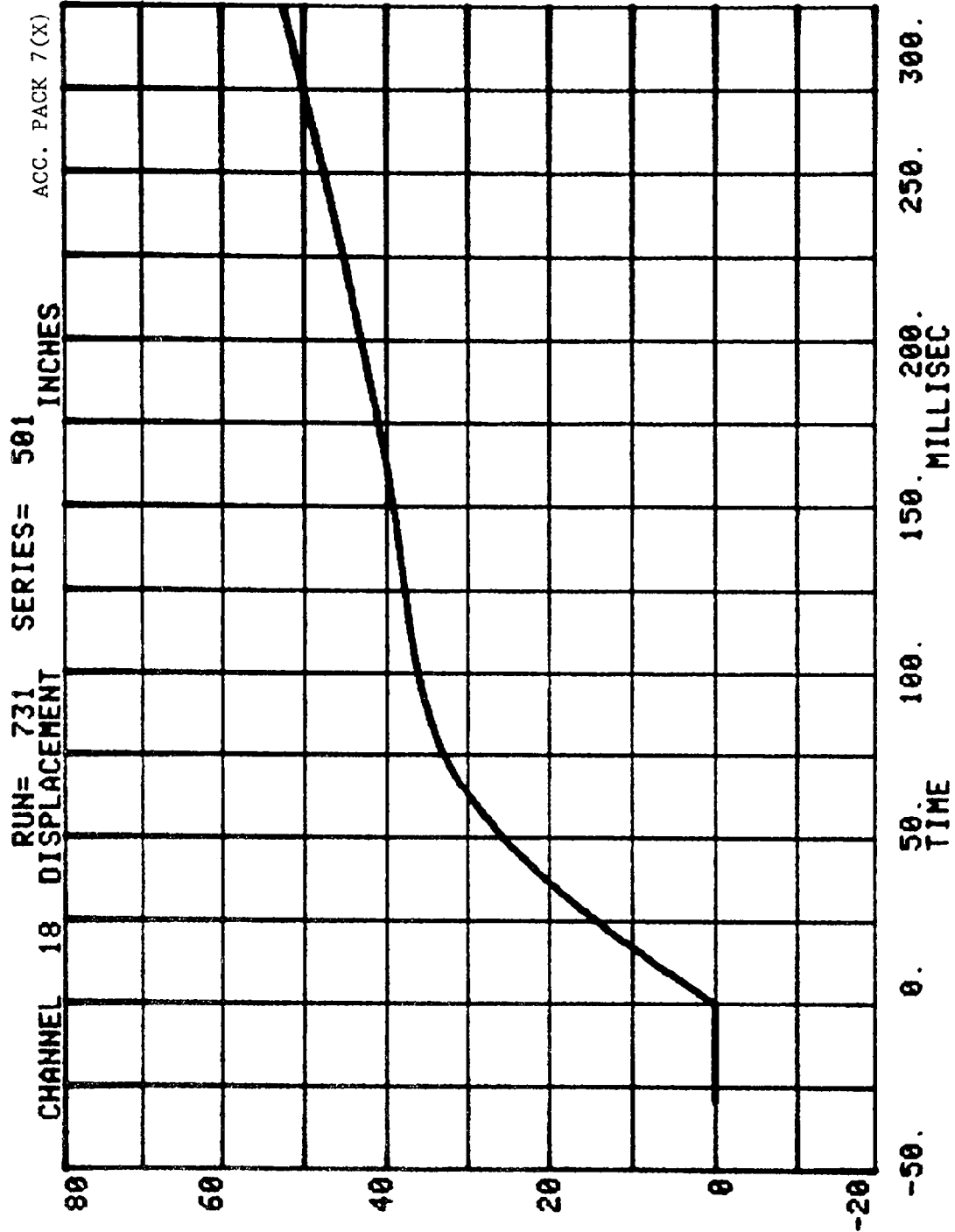










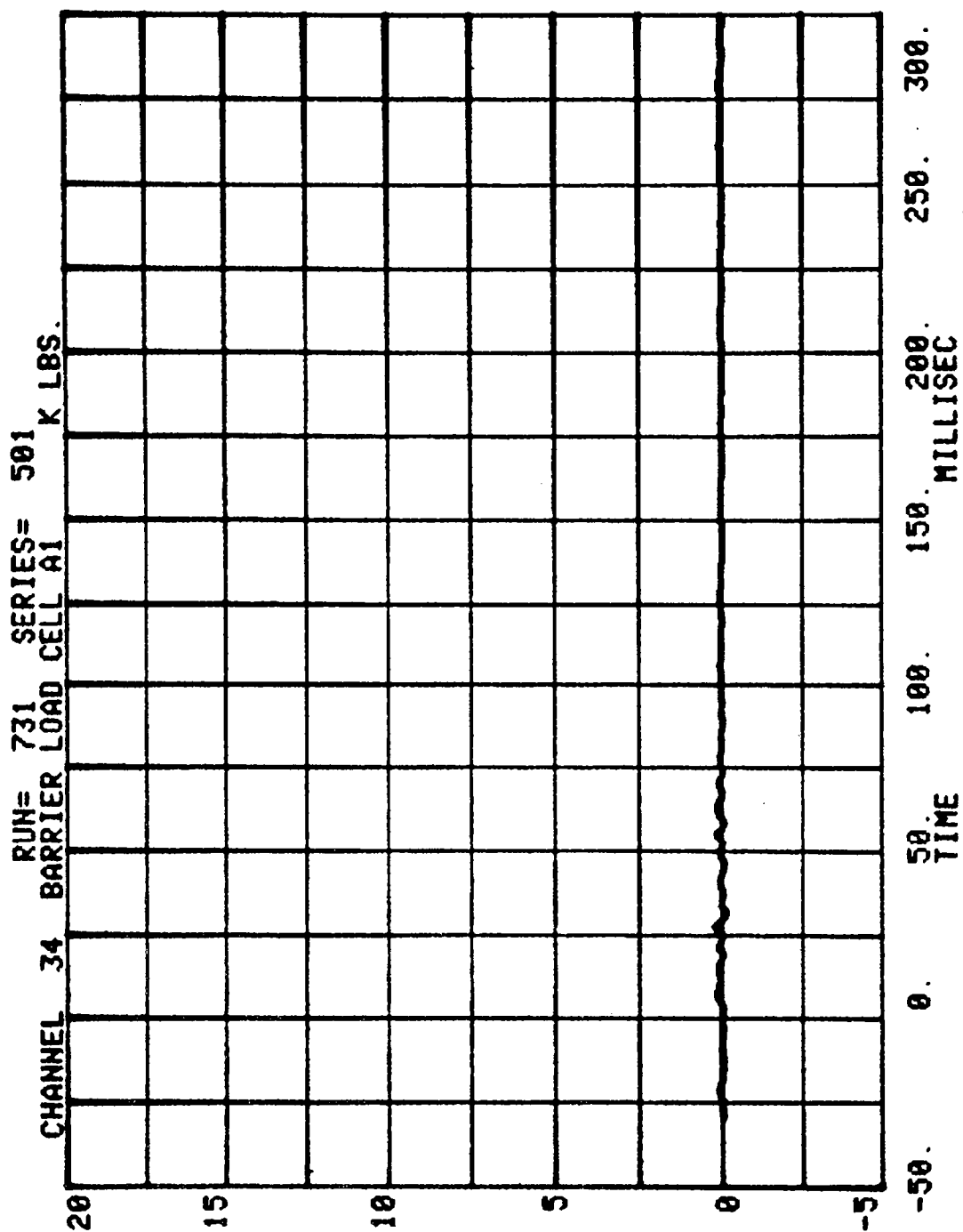


TEST NO. MG0501

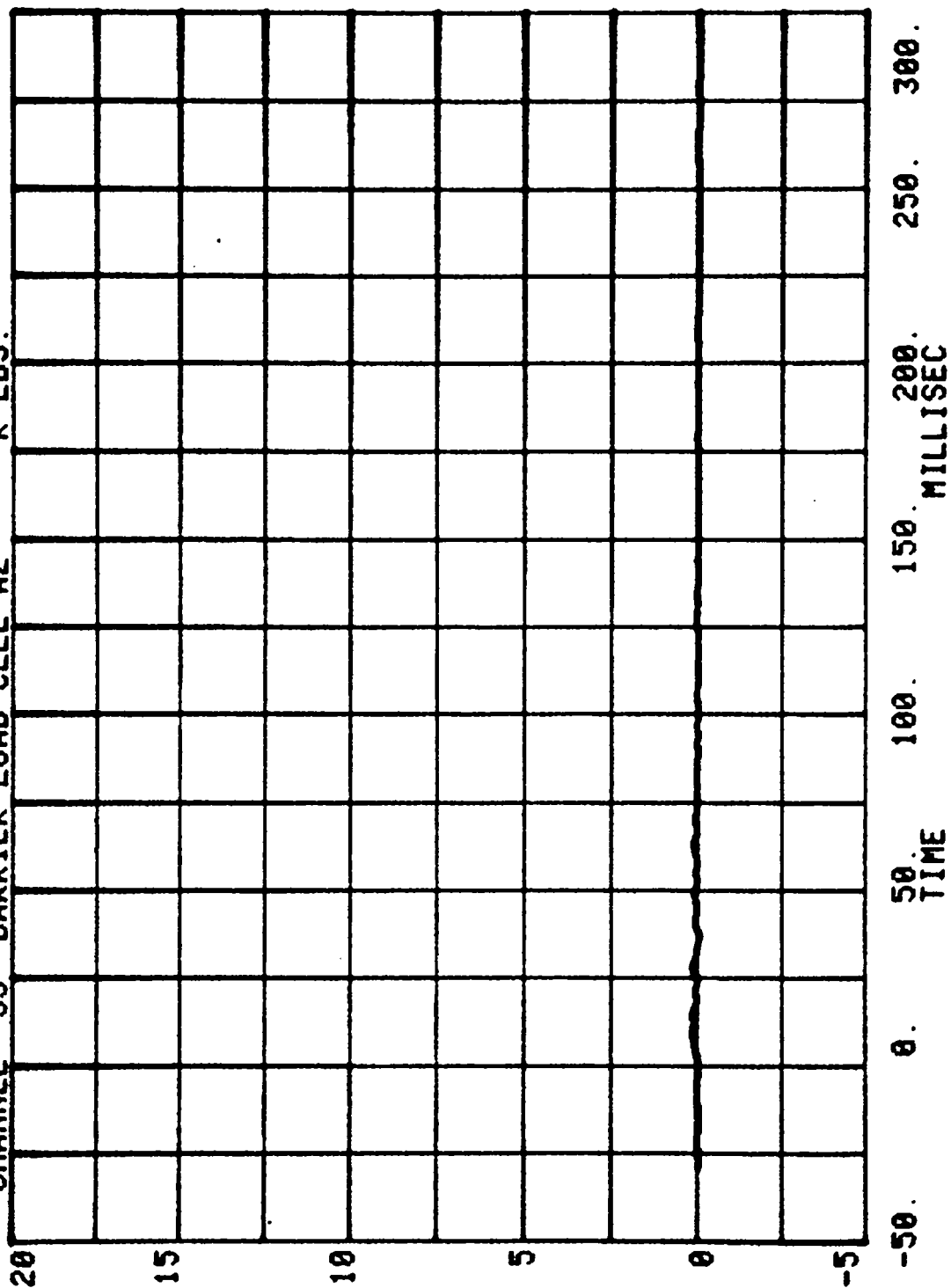
LOAD CELL BARRIER DATA

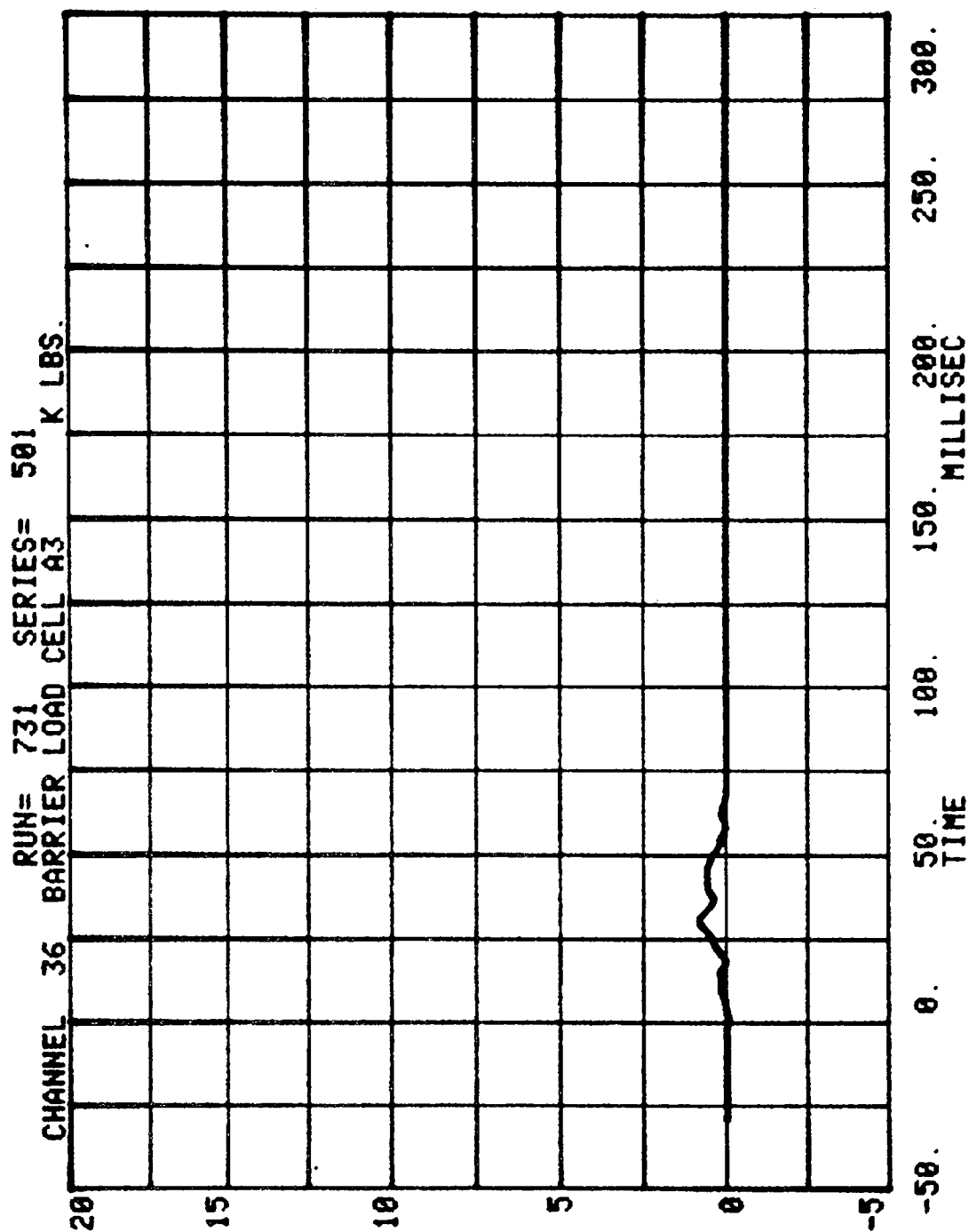
FILTER CHANNEL CLASS

60

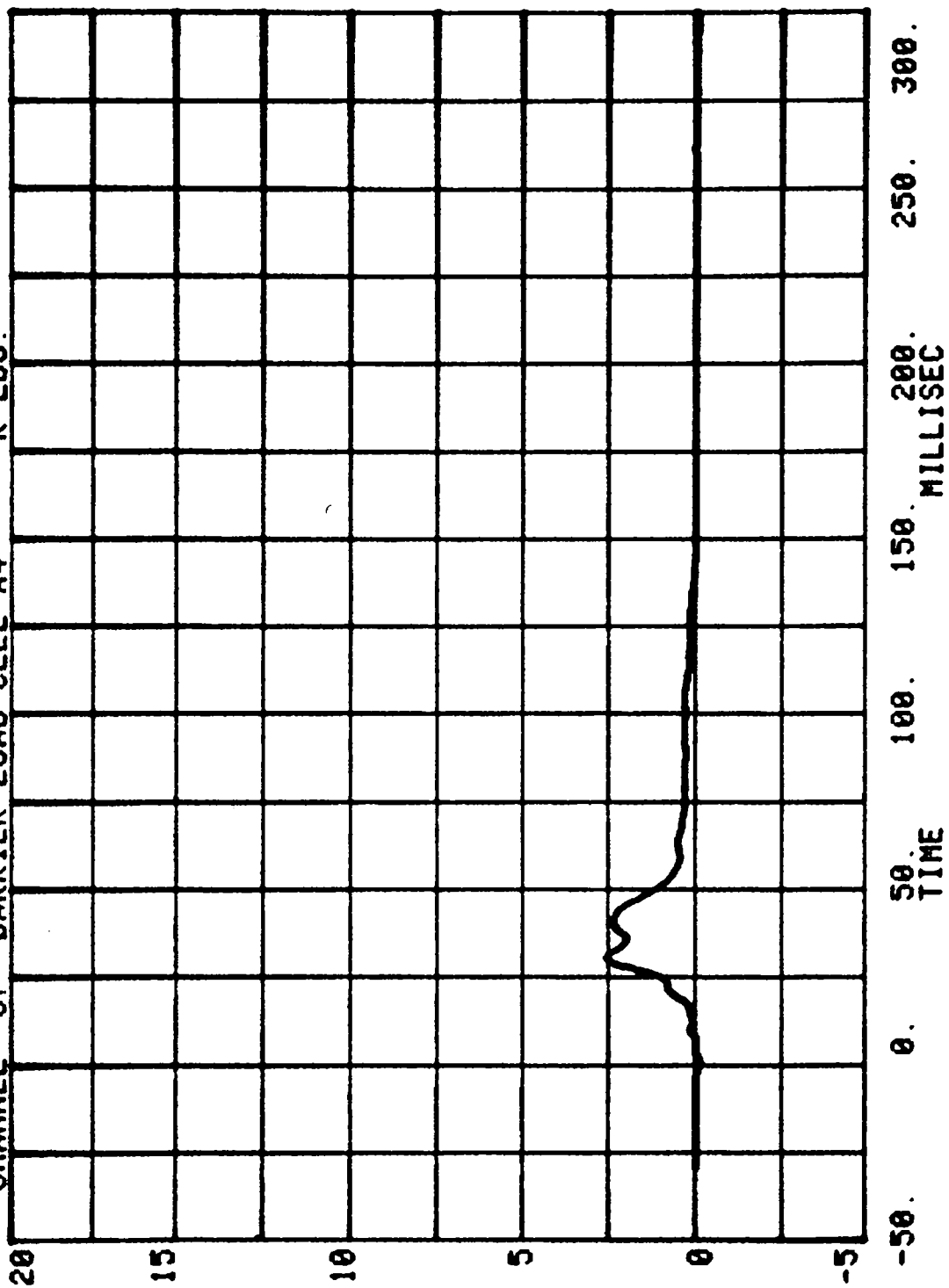


CHANNEL 35 BARRIER LOAD CELL A2 RUN= 731 SERIES= 501 K LBS.

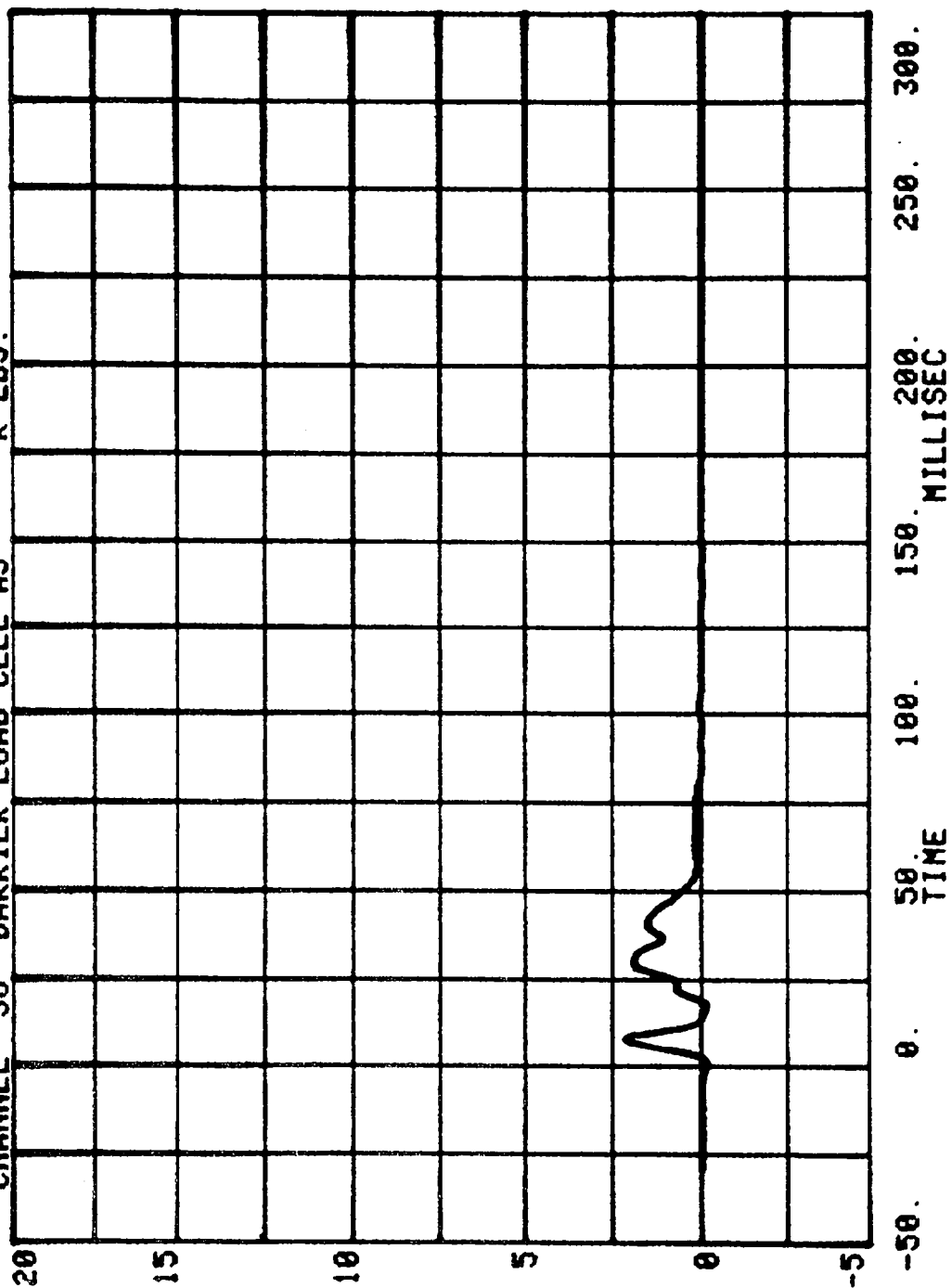




CHANNEL 37 RUN= 731 SERIES= 501 K LBS.
BARRIER LOAD CELL A4

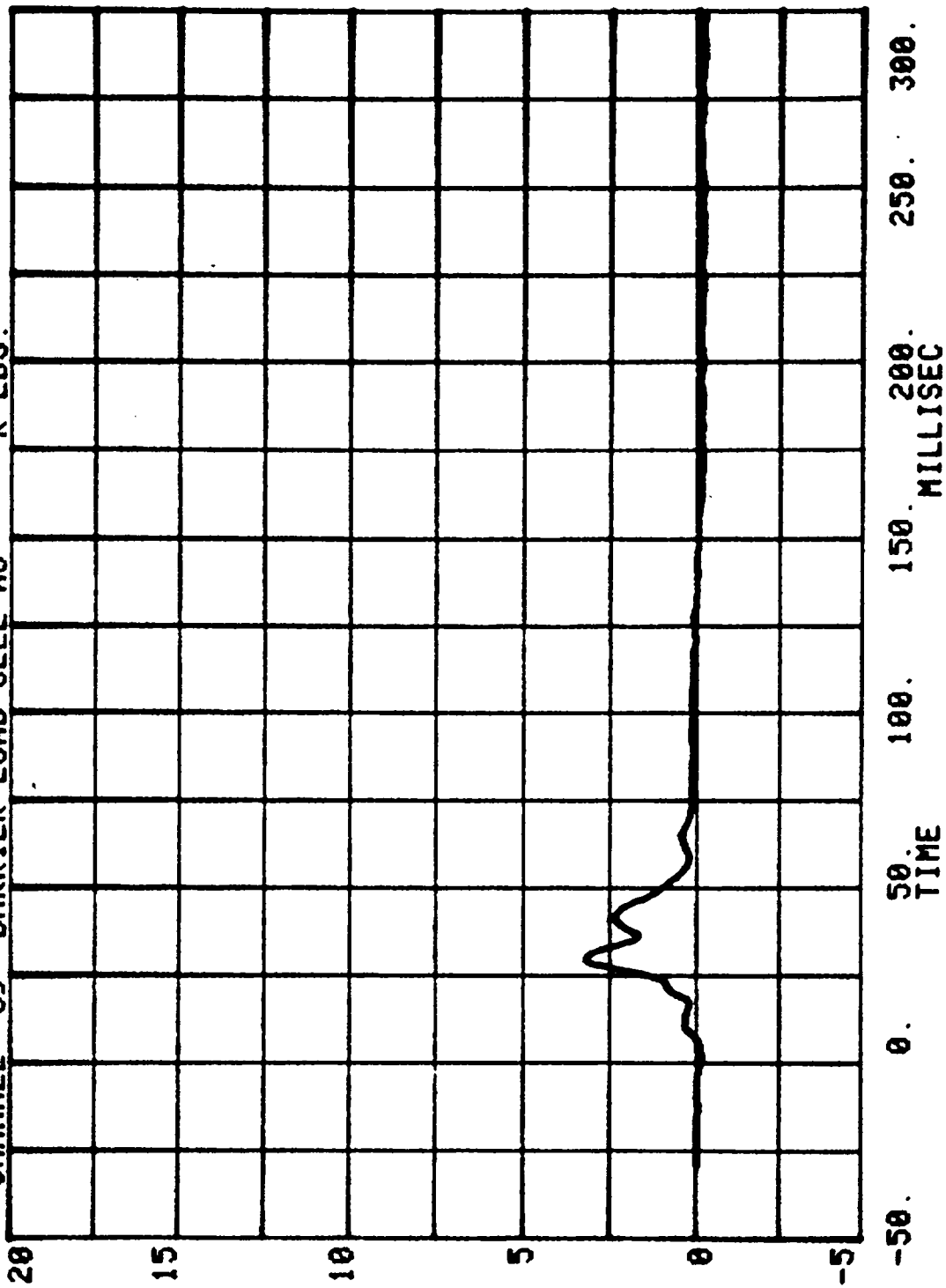


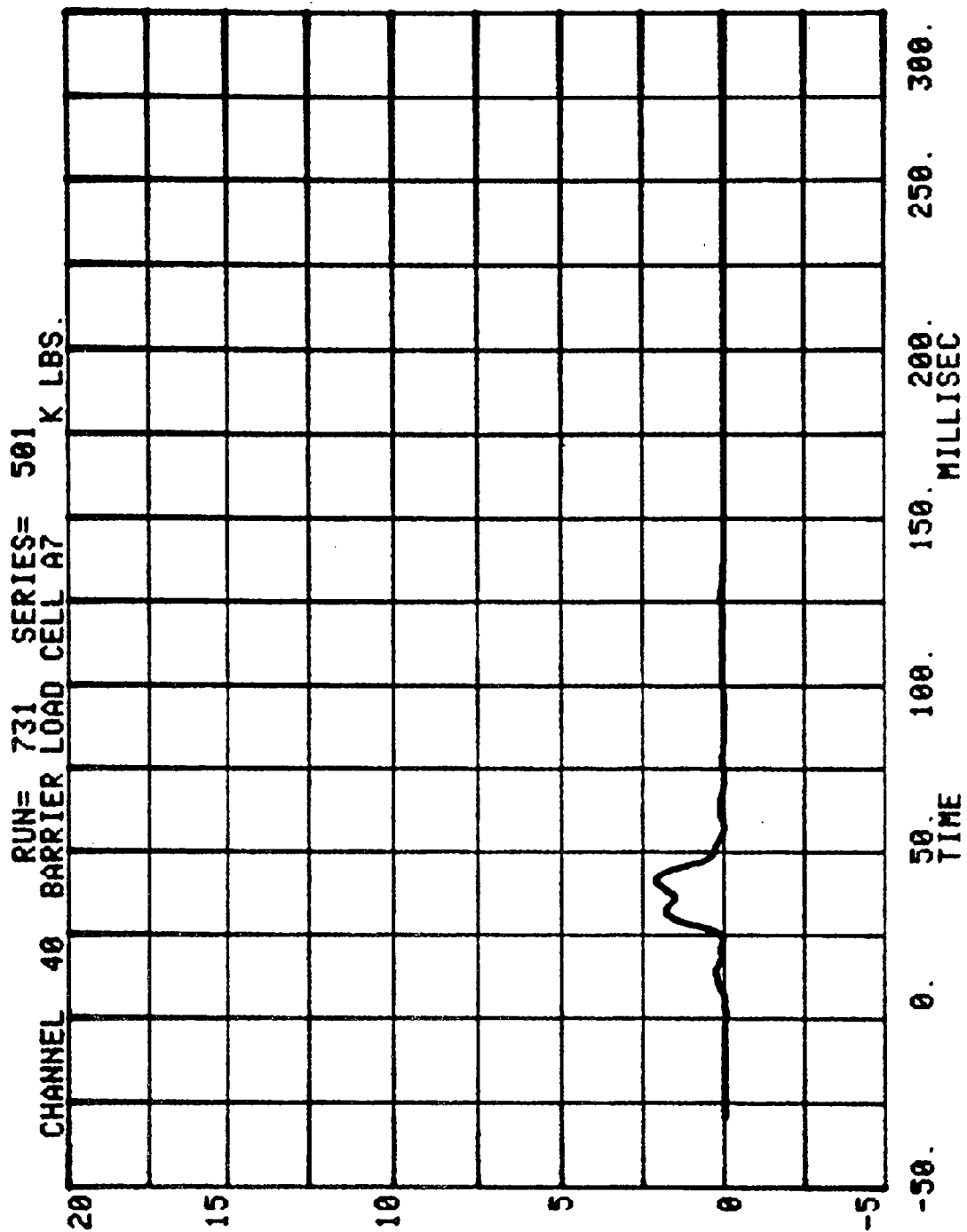
CHANNEL 38 BARRIER LOAD CELL A5 RUN= 731 SERIES= 501 K LBS.



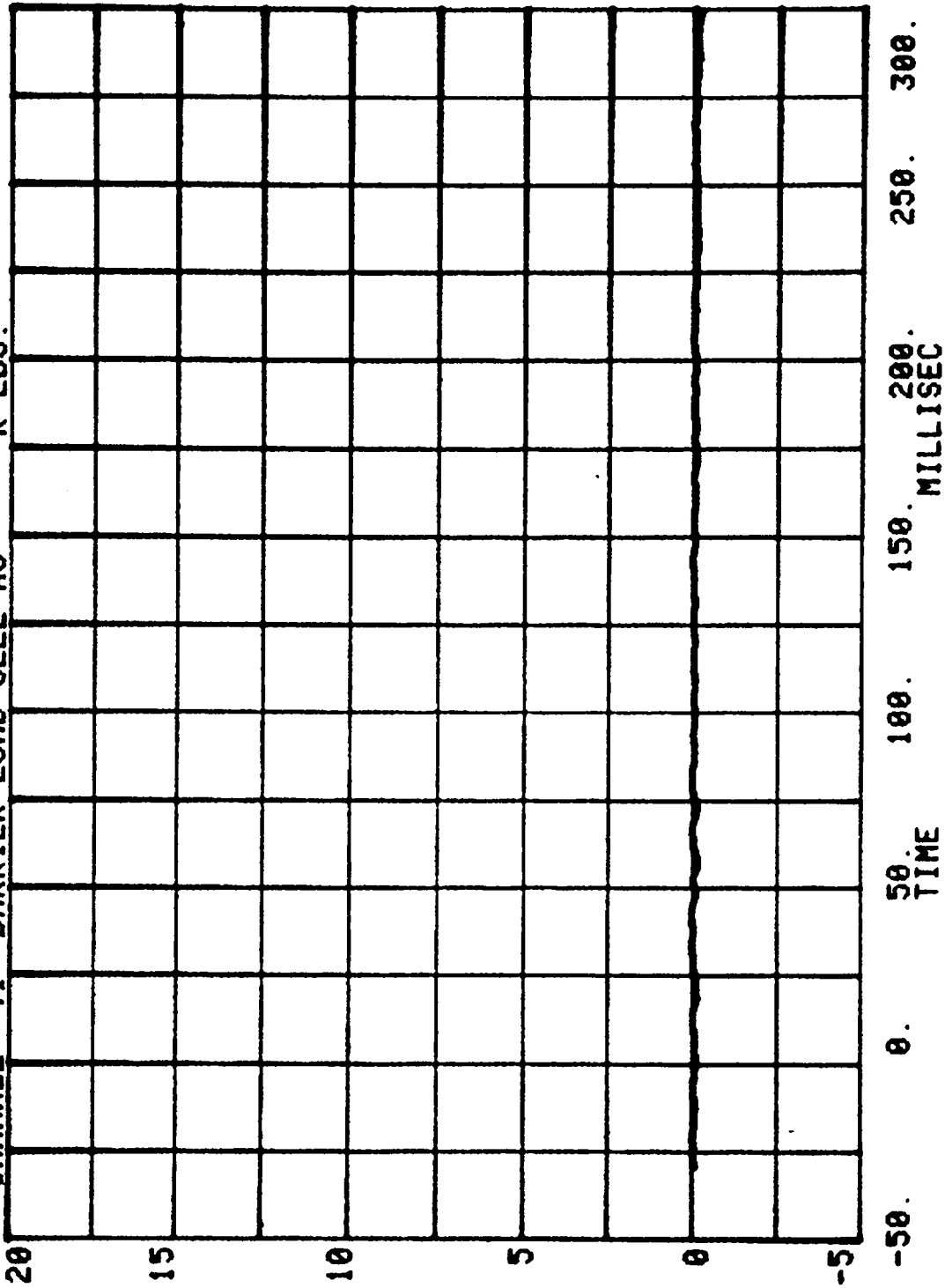
CHANNEL 39 BARRIER LOAD CELL A6 K LBS.

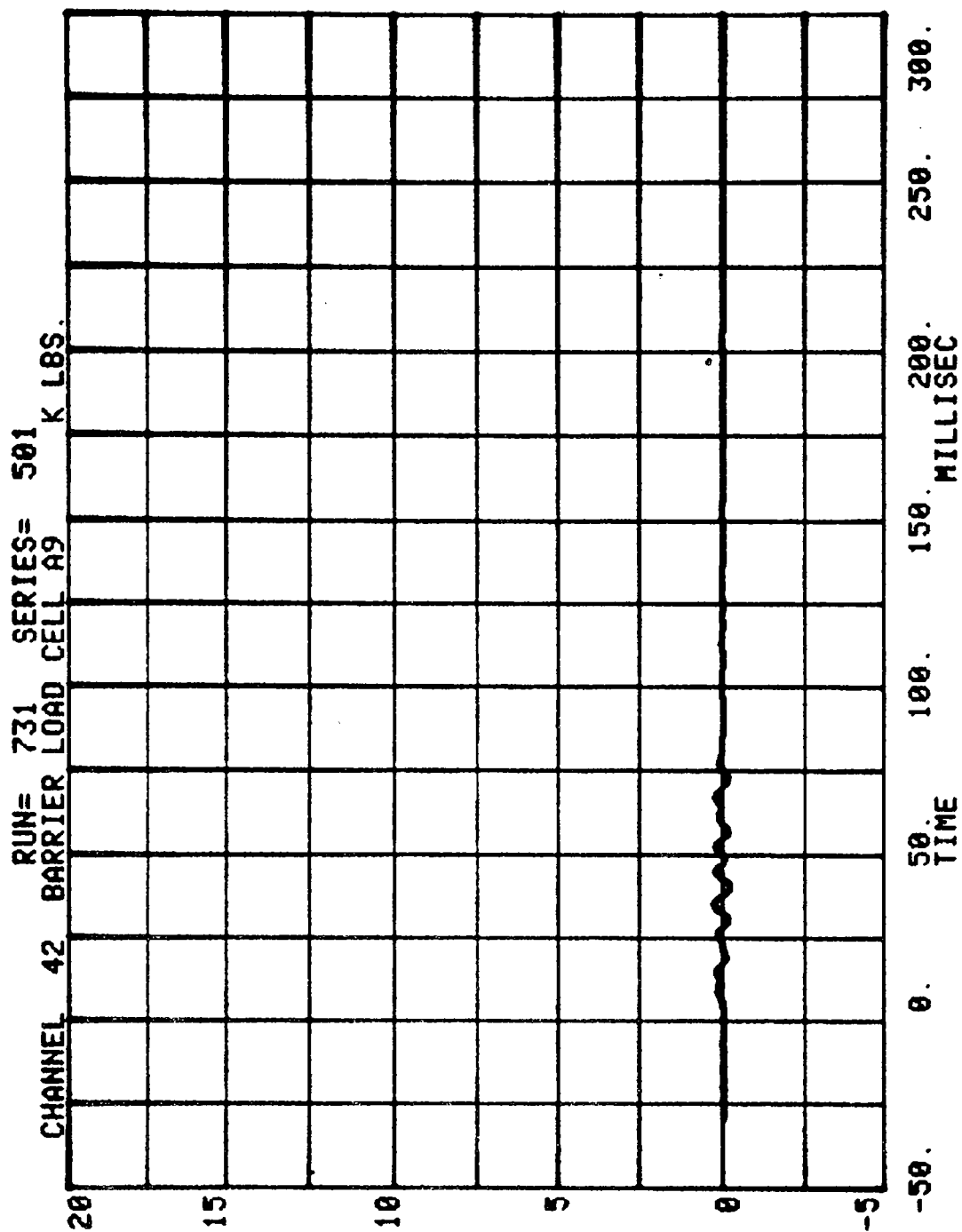
RUN= 731 SERIES= 501



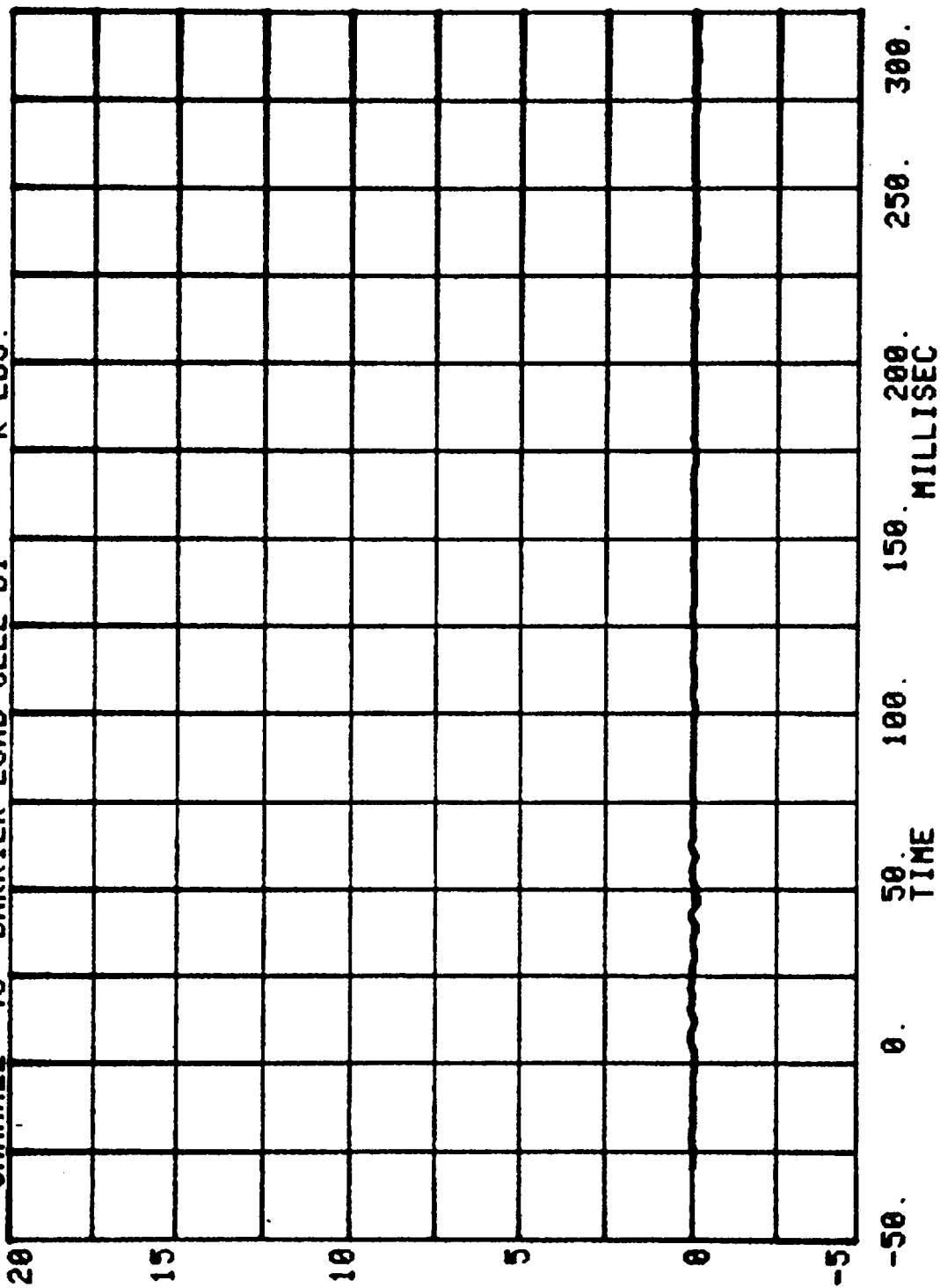


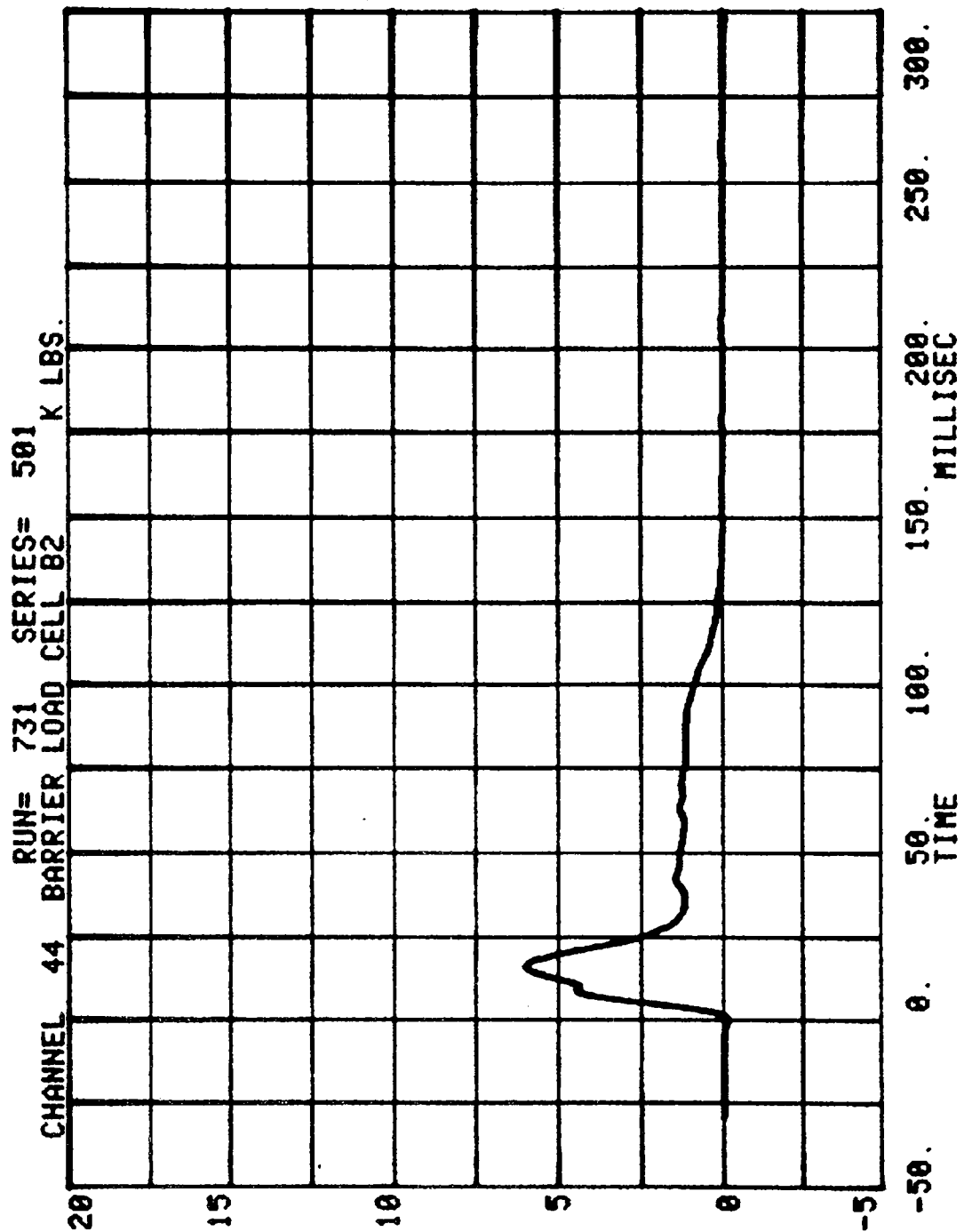
CHANNEL 41 BARRIER LOAD CELL A8 RUN= 731 SERIES= 501 K LBS.





CHANNEL 43 BARRIER LOAD CELL B1 RUN= 731 SERIES= 501 K LBS.

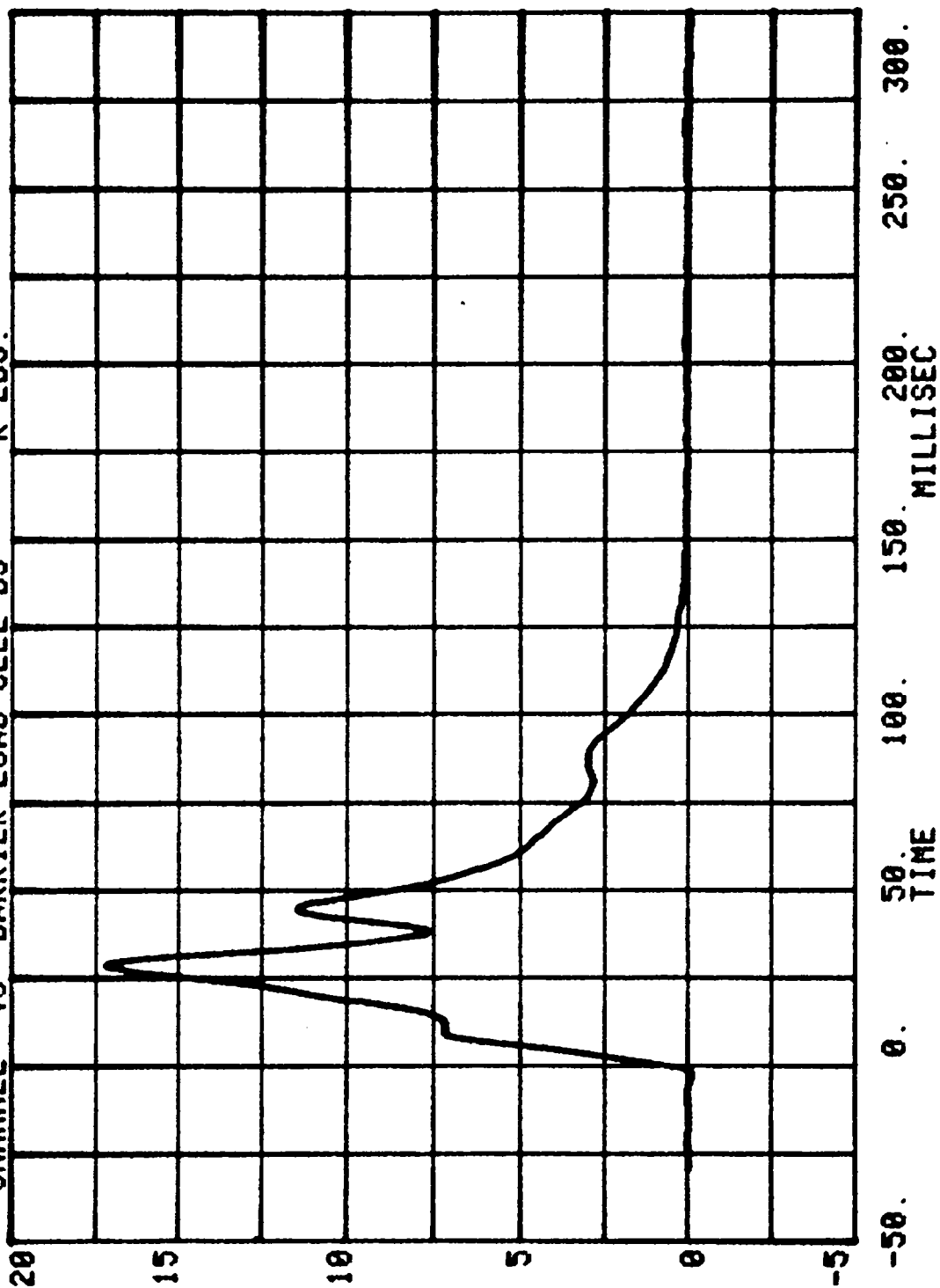


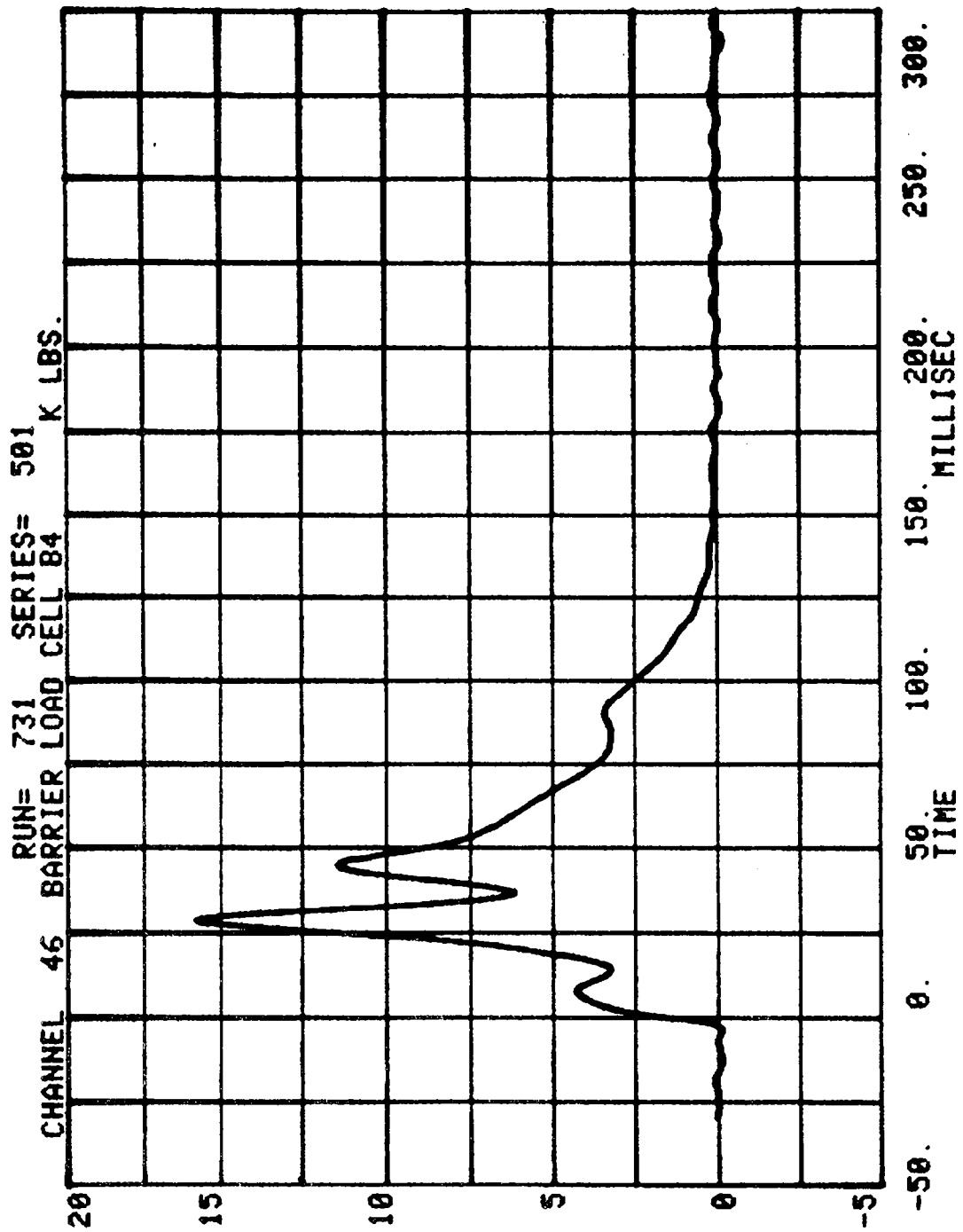


CHANNEL 45 BARrier LOAD CELL B3

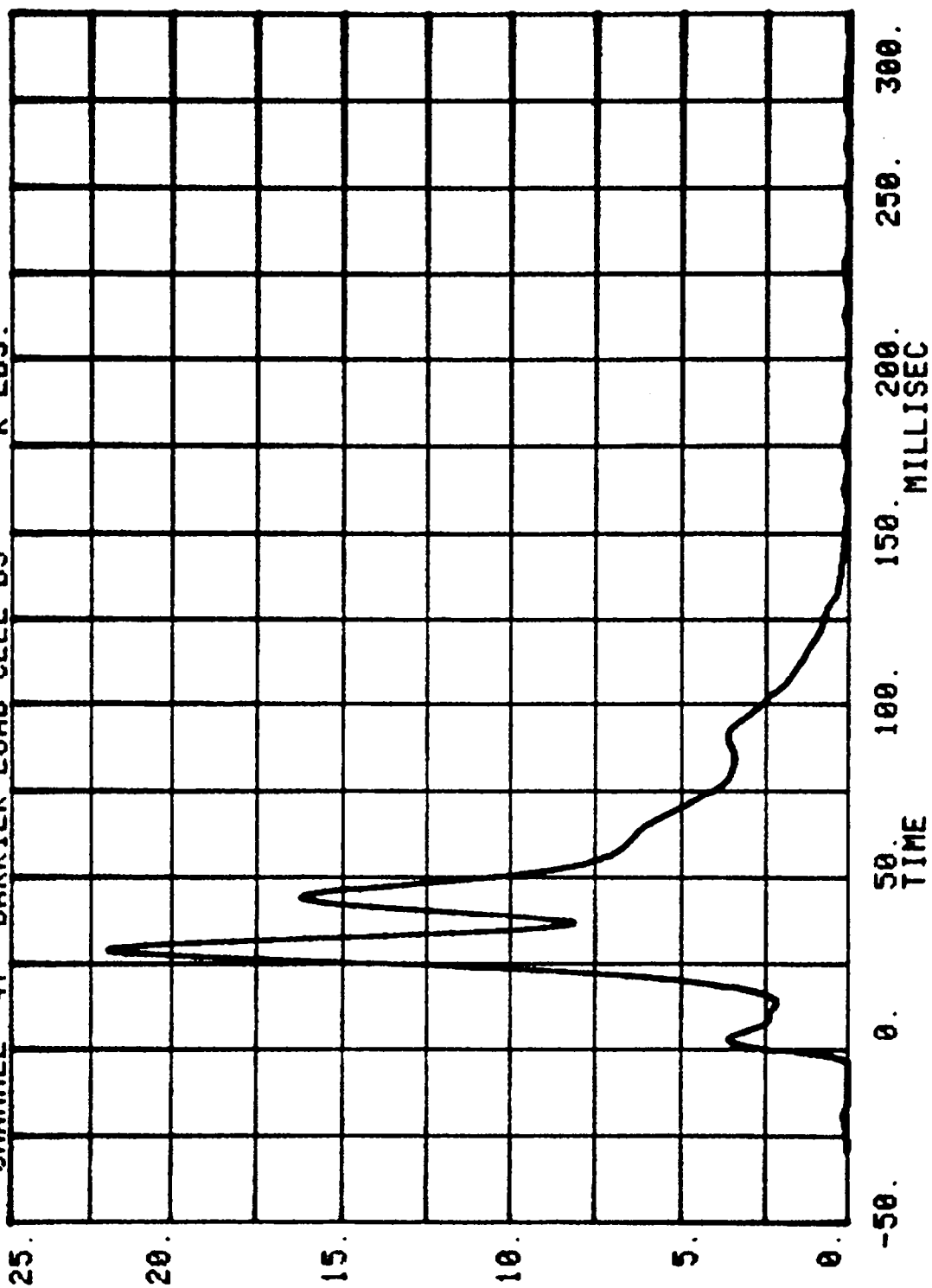
RUN= 731 SERIES= 501

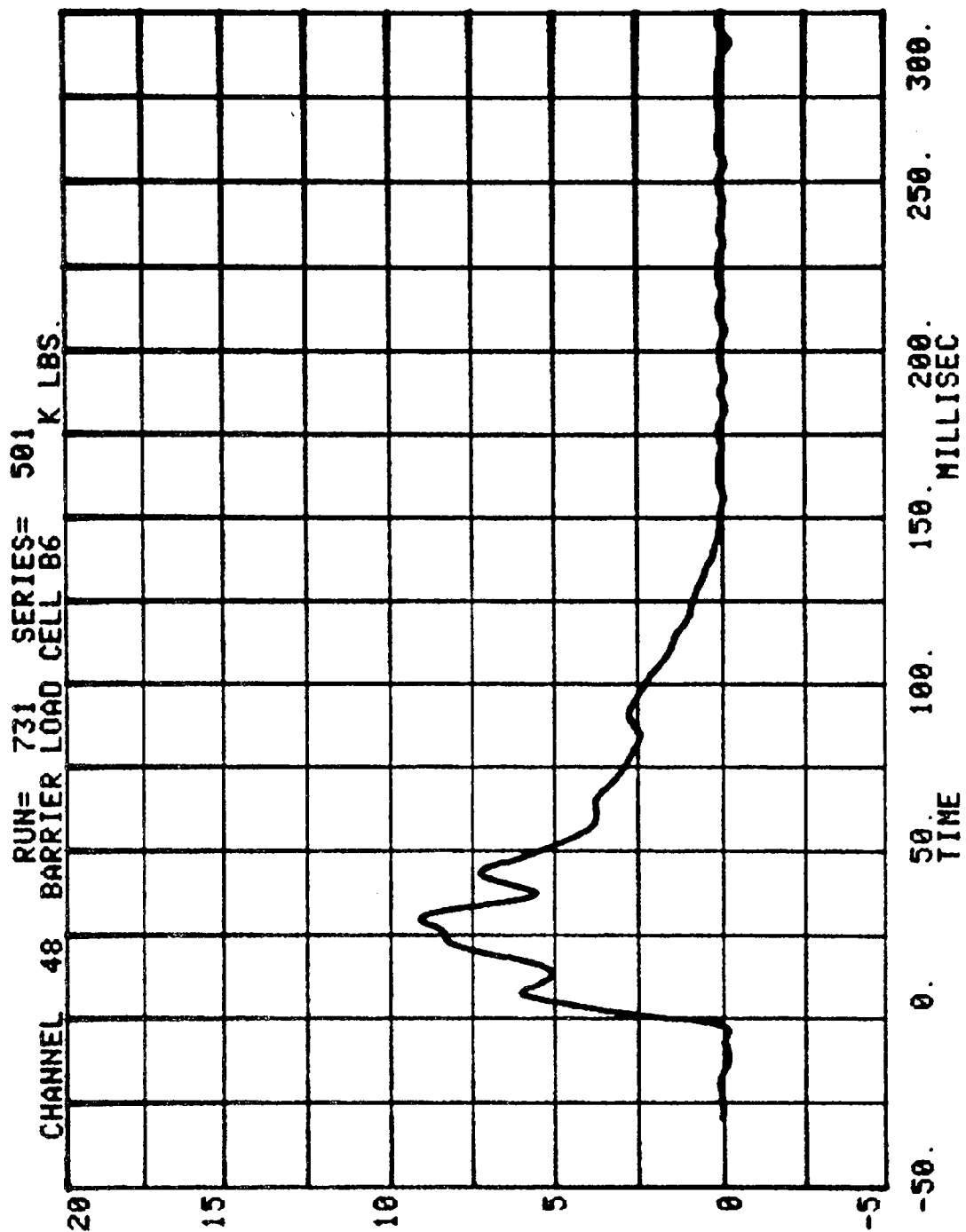
K LBS.



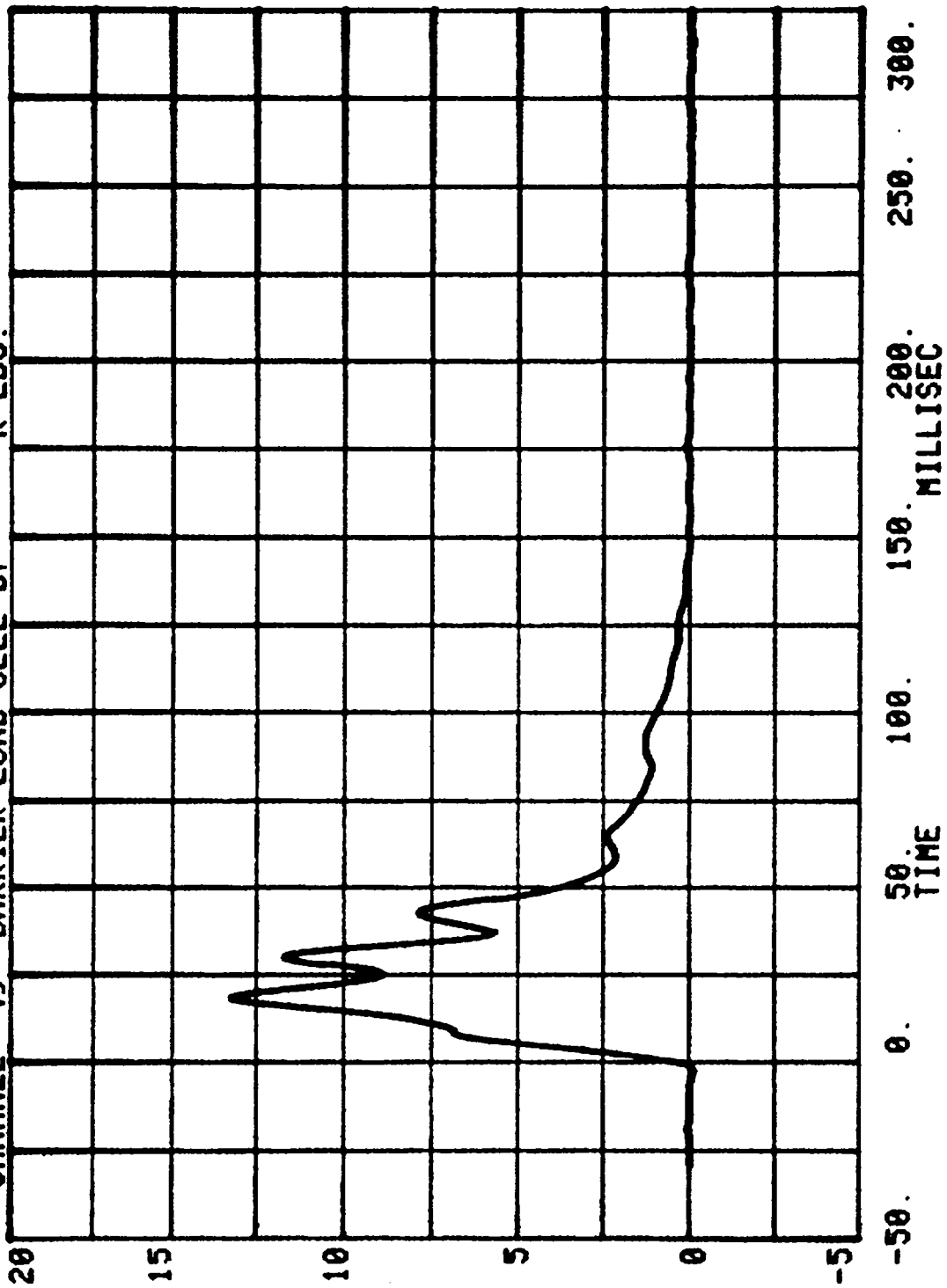


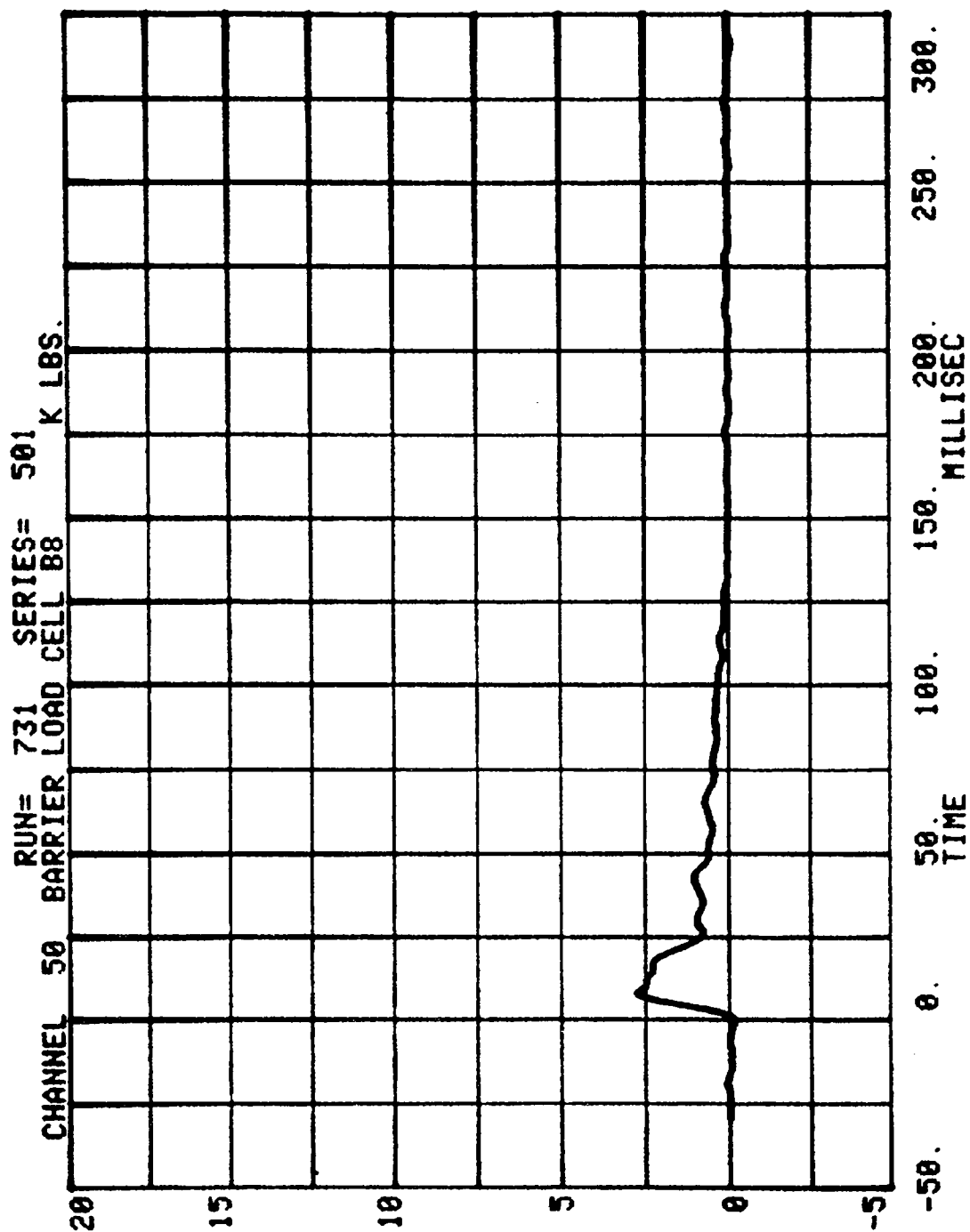
CHANNEL 47 RUN= 731 SERIES= 501 K LBS.
BARRIER LOAD CELL B5



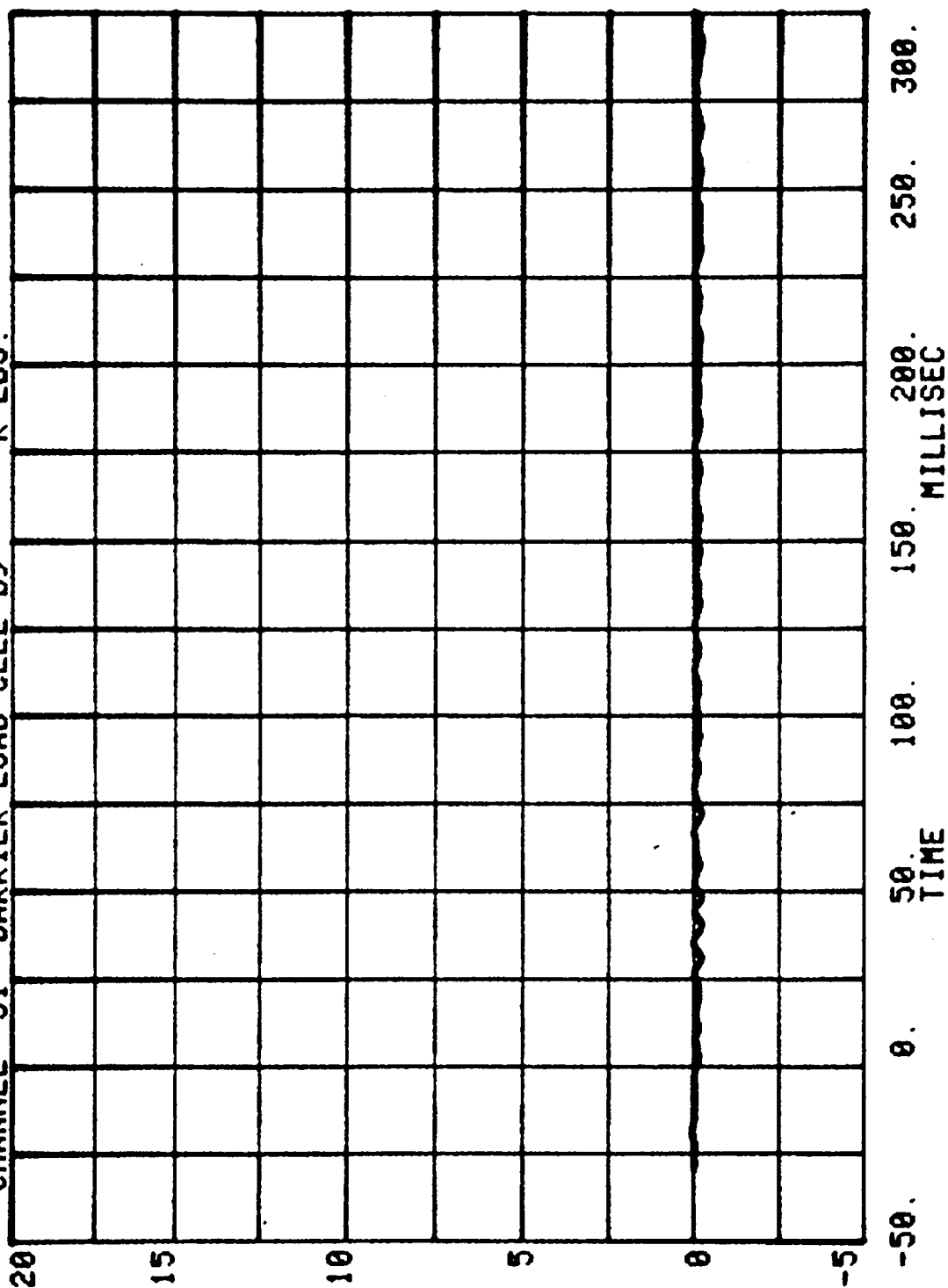


CHANNEL 49 RUN= 731 SERIES= 501 K LBS.
BARRIER LOAD CELL B7

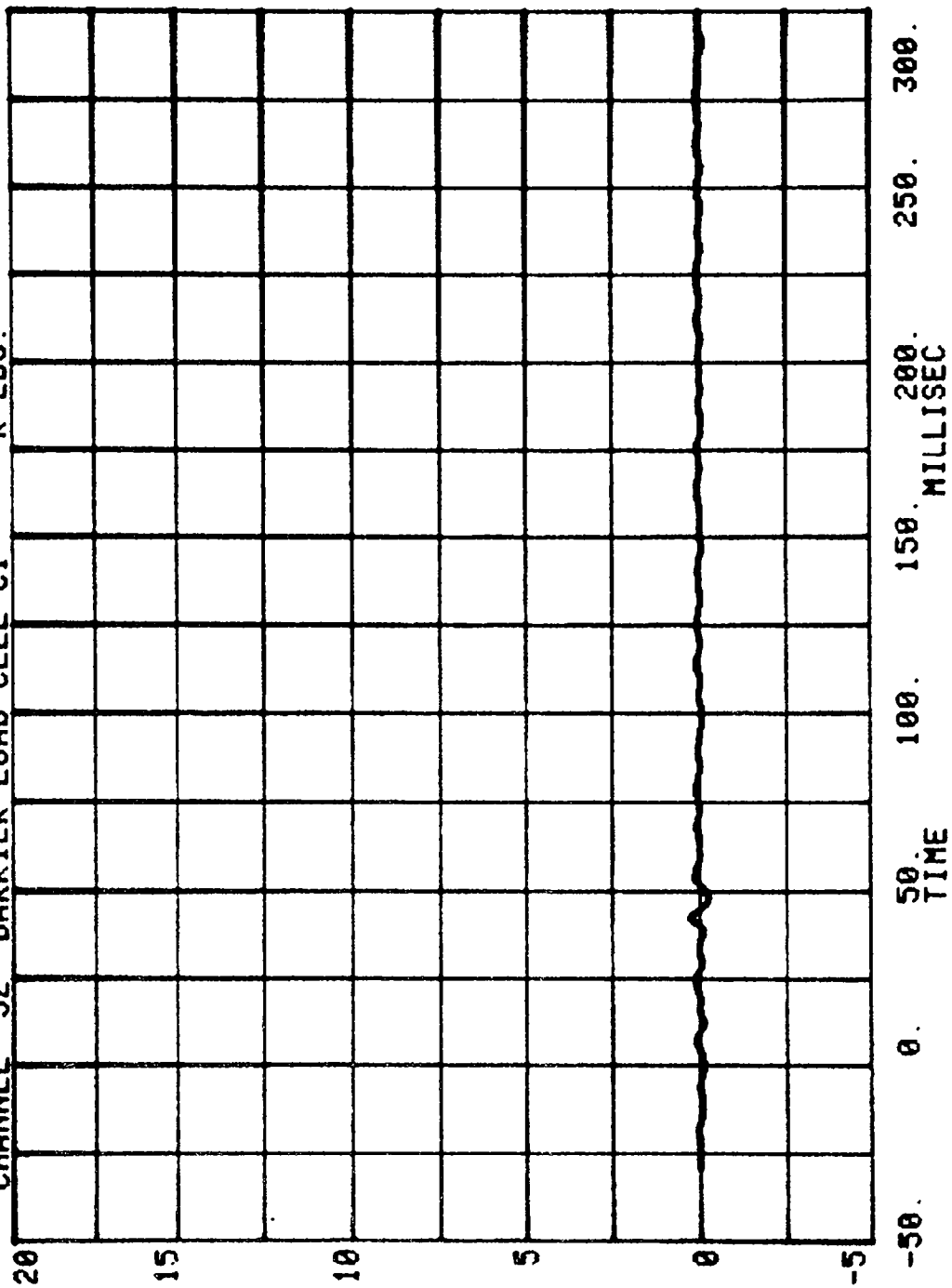




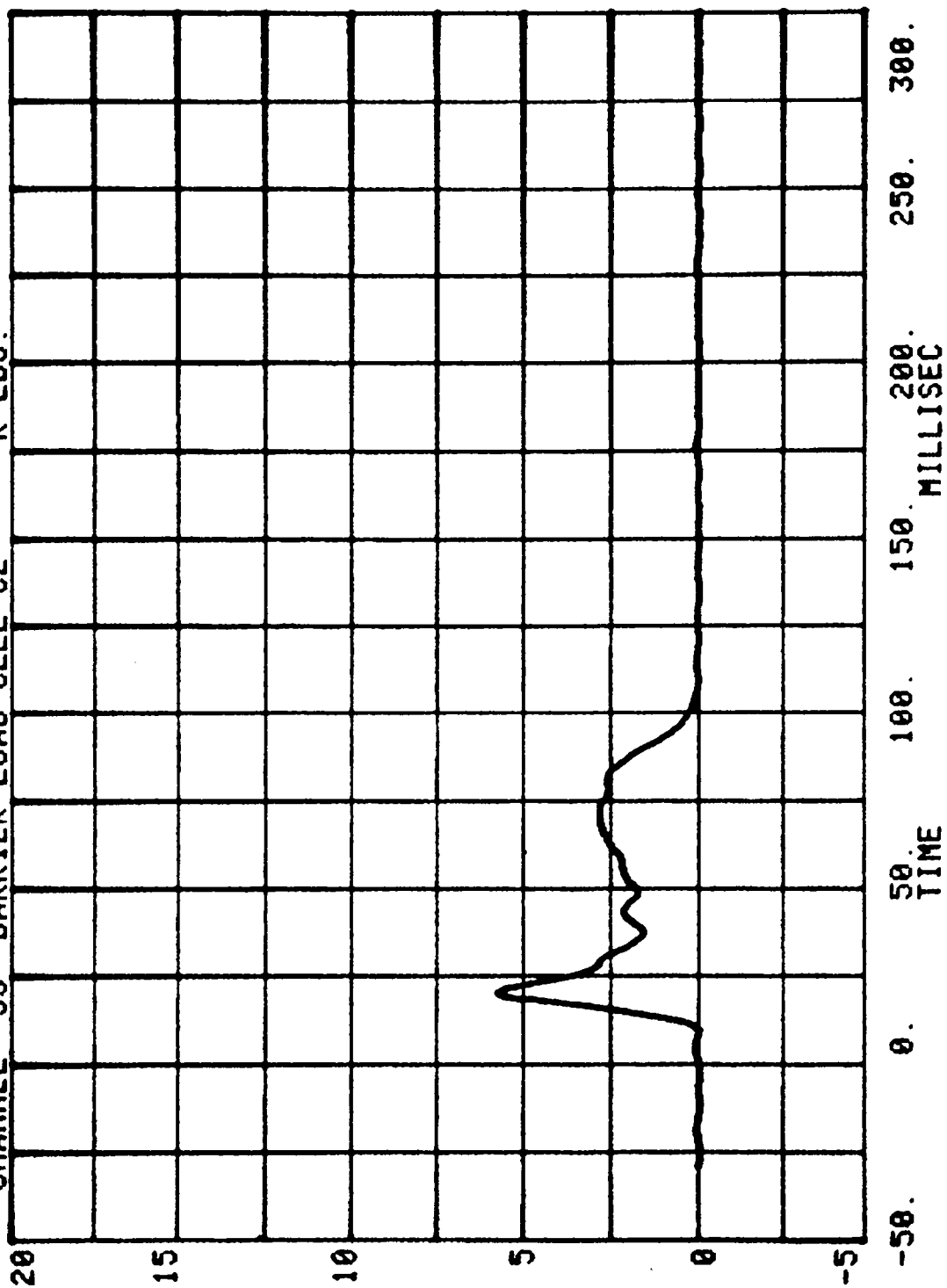
CHANNEL 51 BARRIER LOAD CELL B9 RUN= 731 SERIES= 501 K LBS.

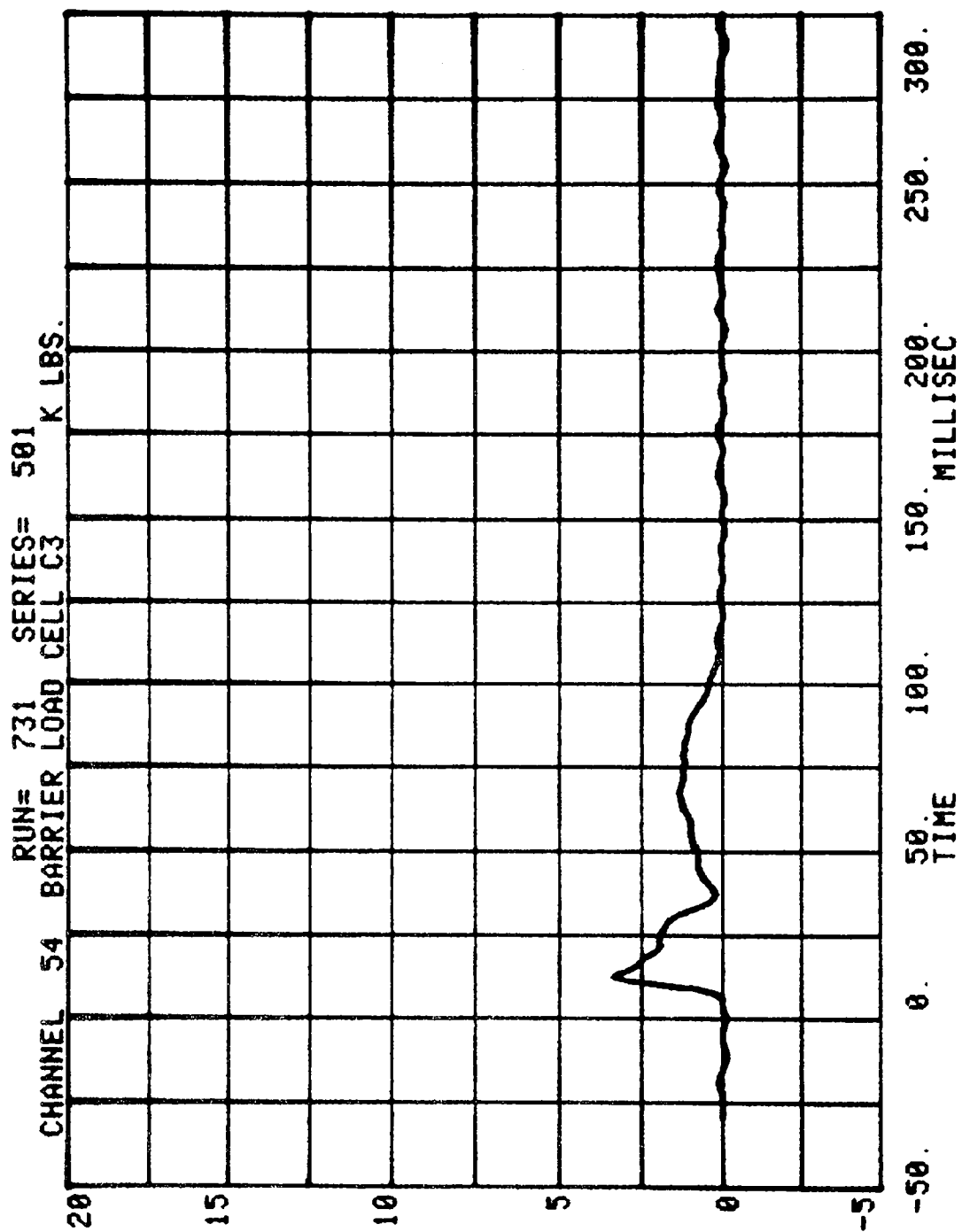


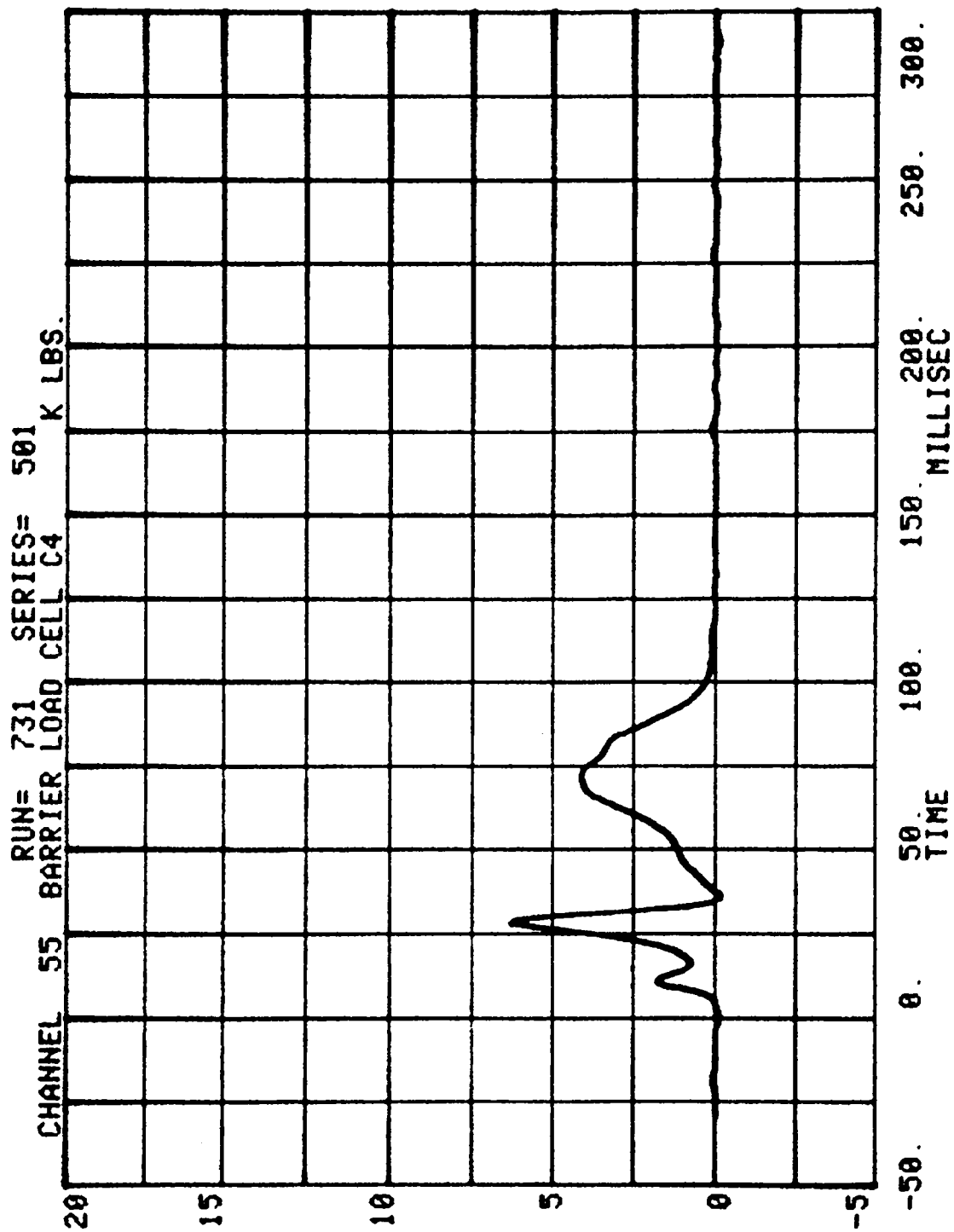
CHANNEL 52 RUN= 731 SERIES= 501 K LBS.
BARRIER LOAD CELL C1



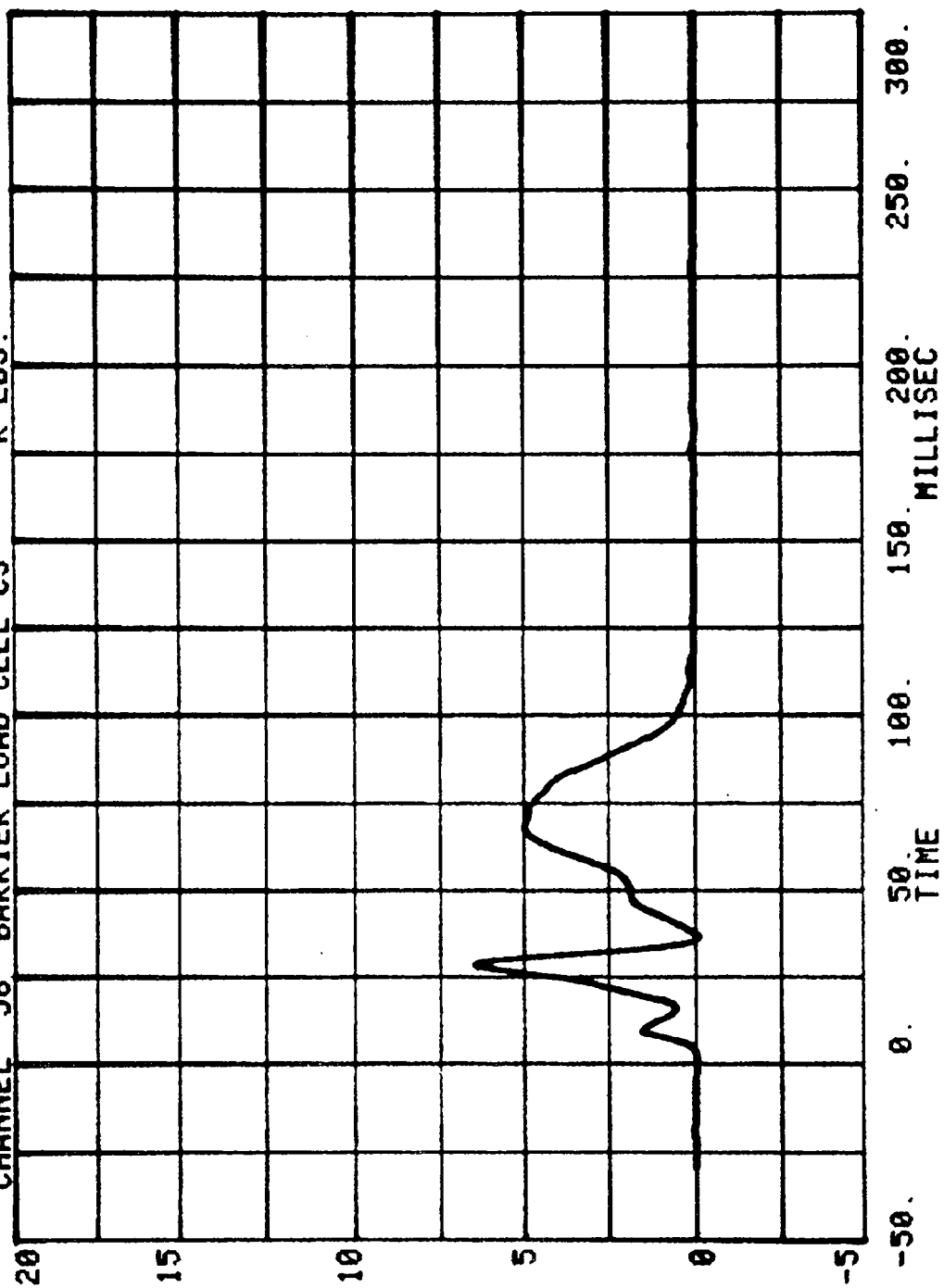
CHANNEL 53 BARRIER LOAD CELL C2 RUN= 731 SERIES= 501 K LBS.

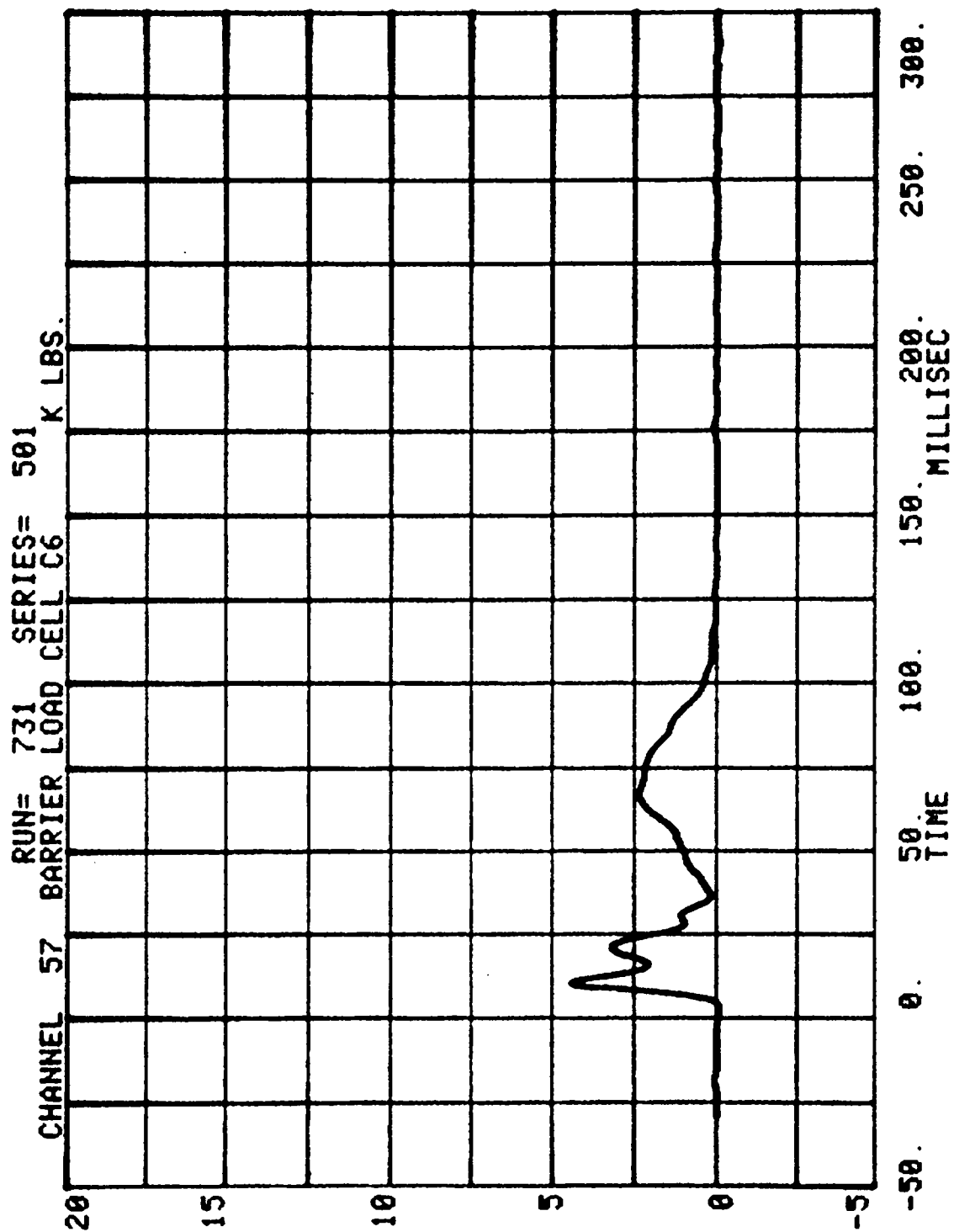


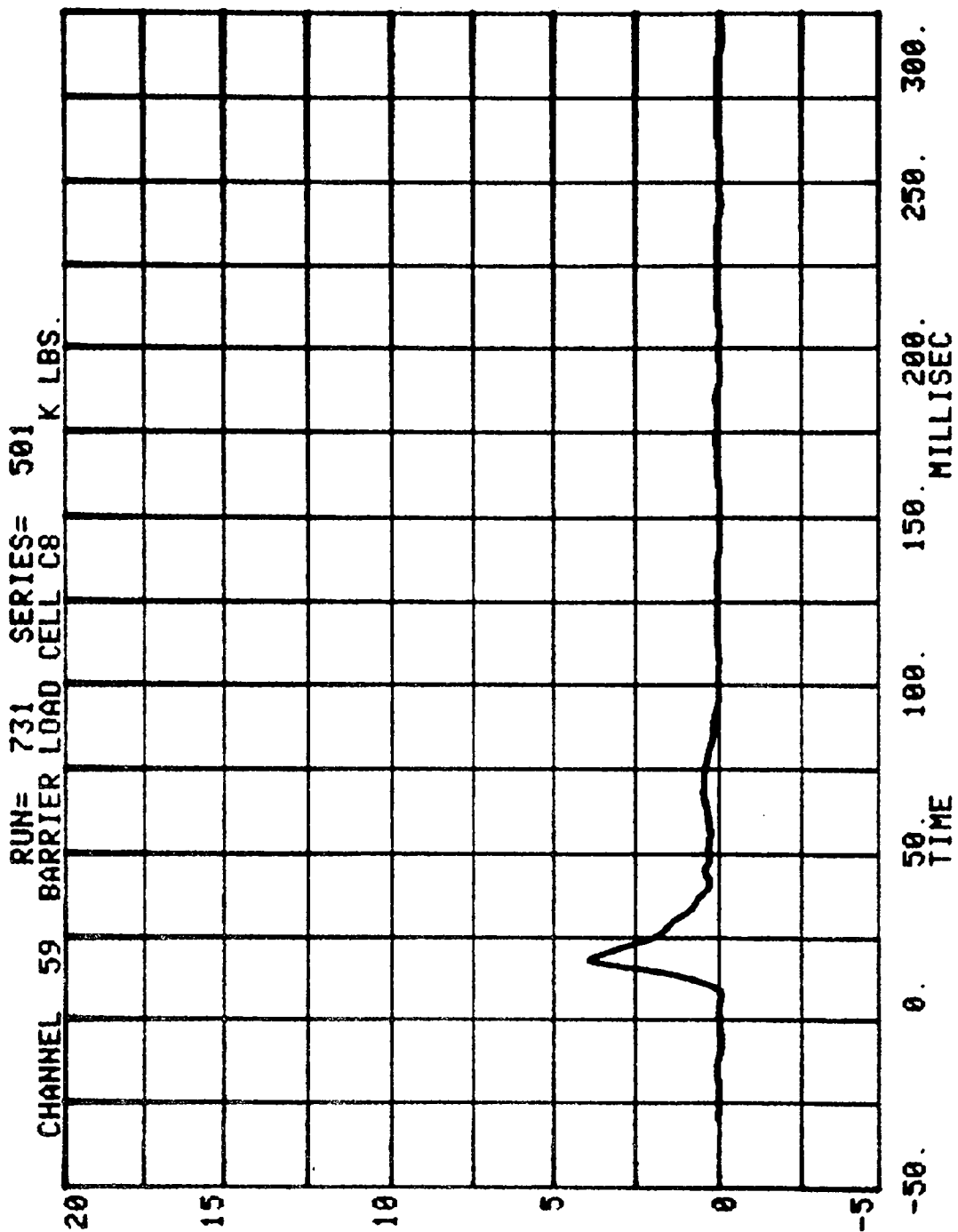




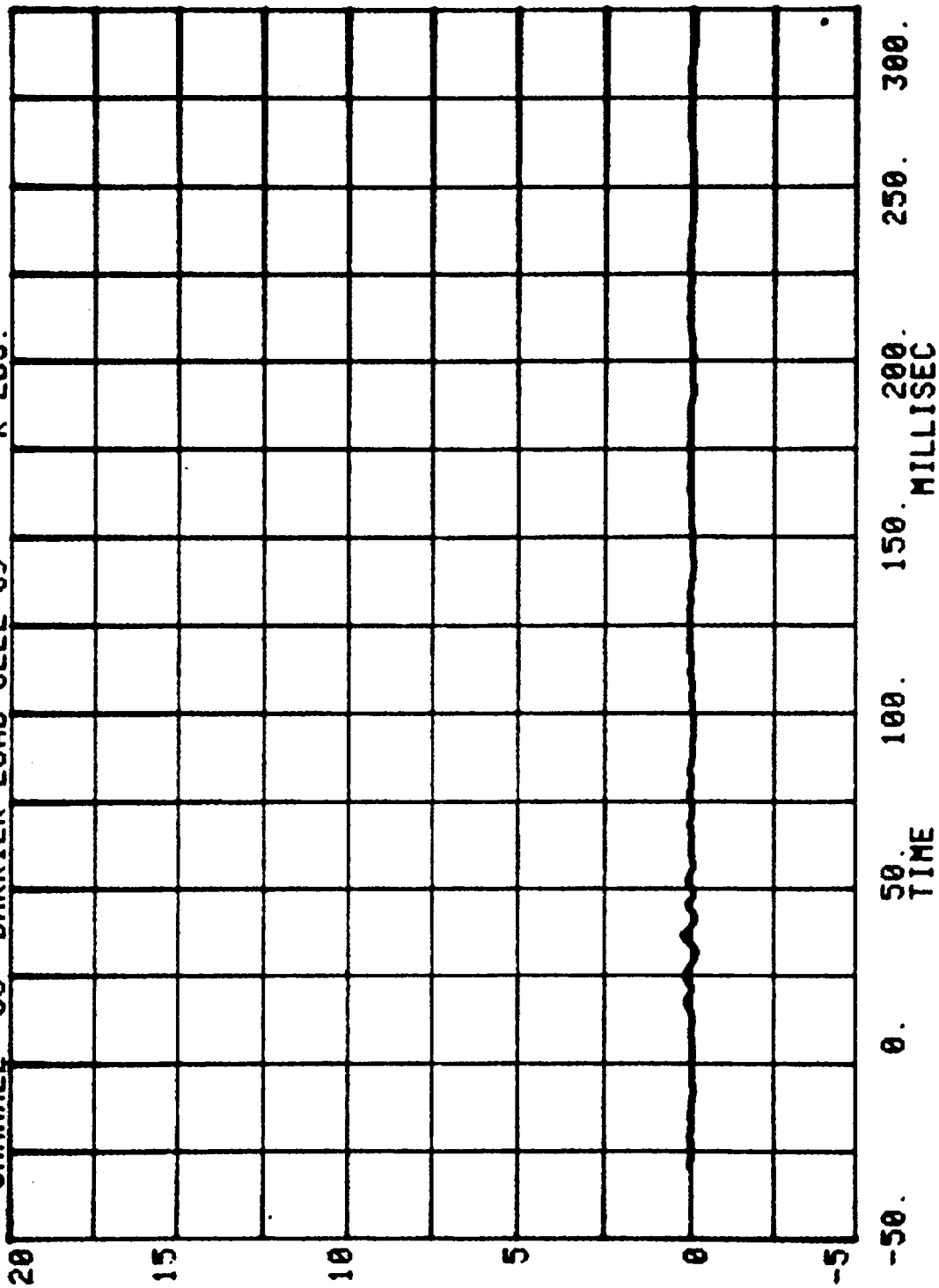
CHANNEL 56 BARRIER LOAD CELL C5 RUN= 731 SERIES= 501 K LBS.

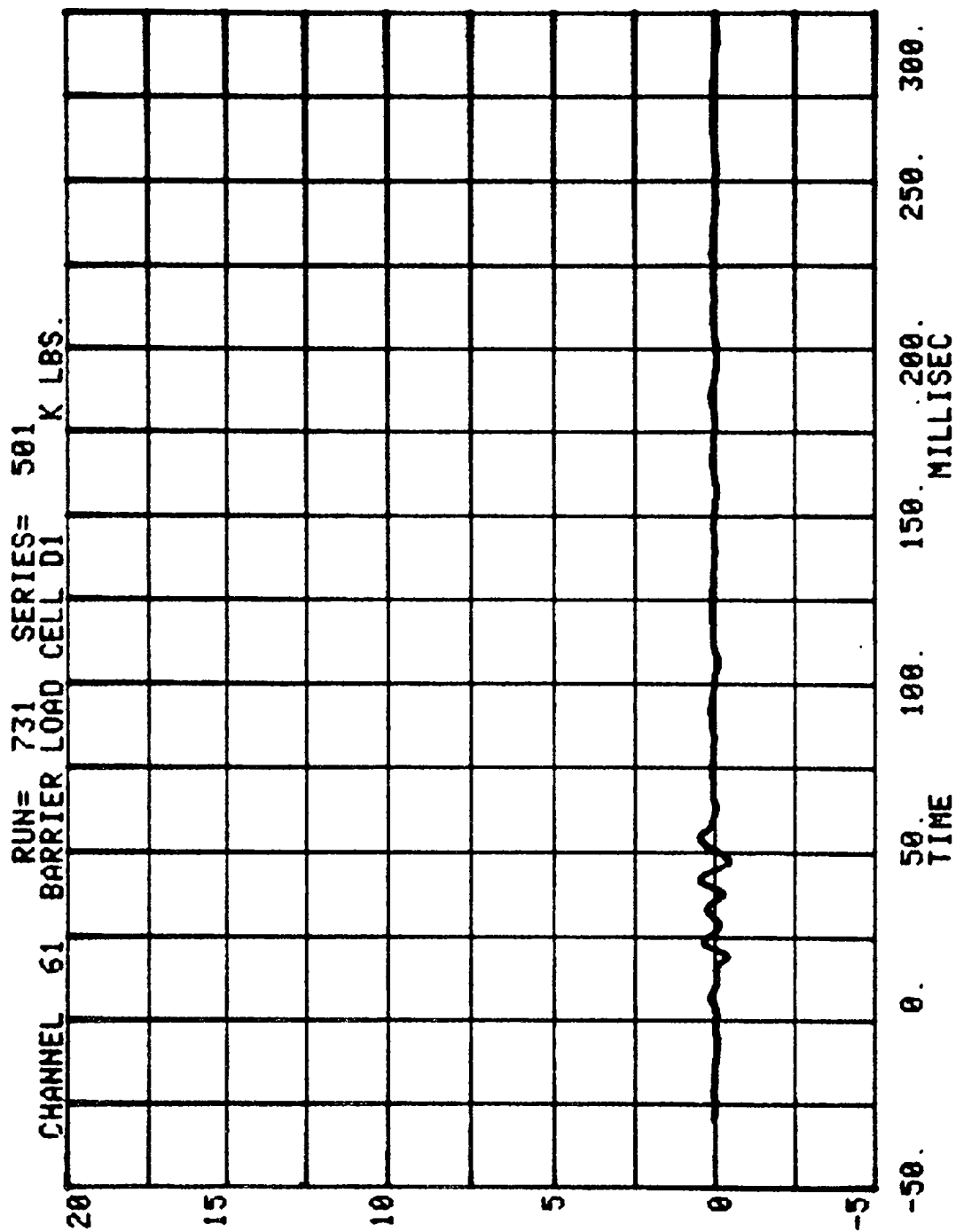




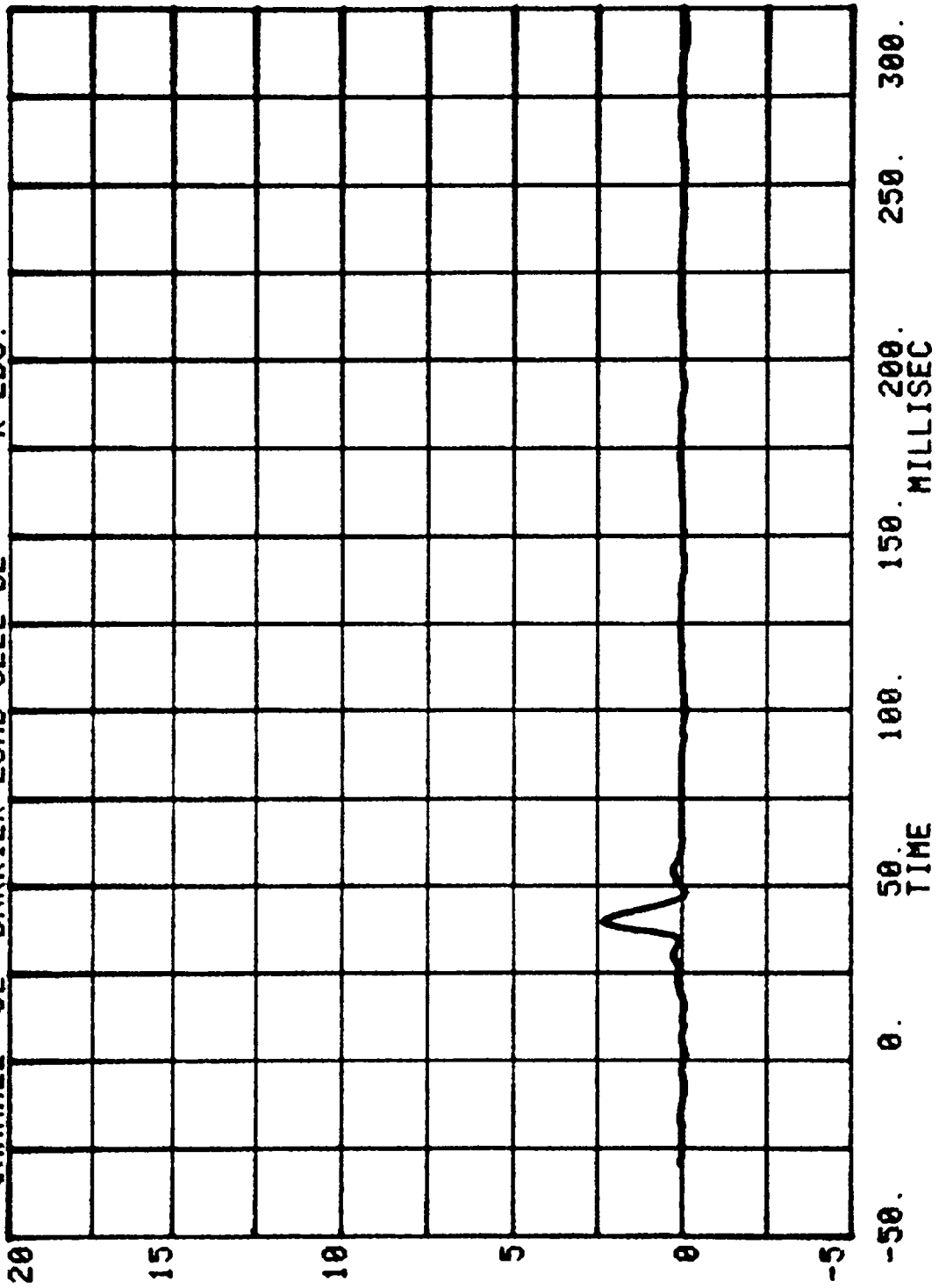


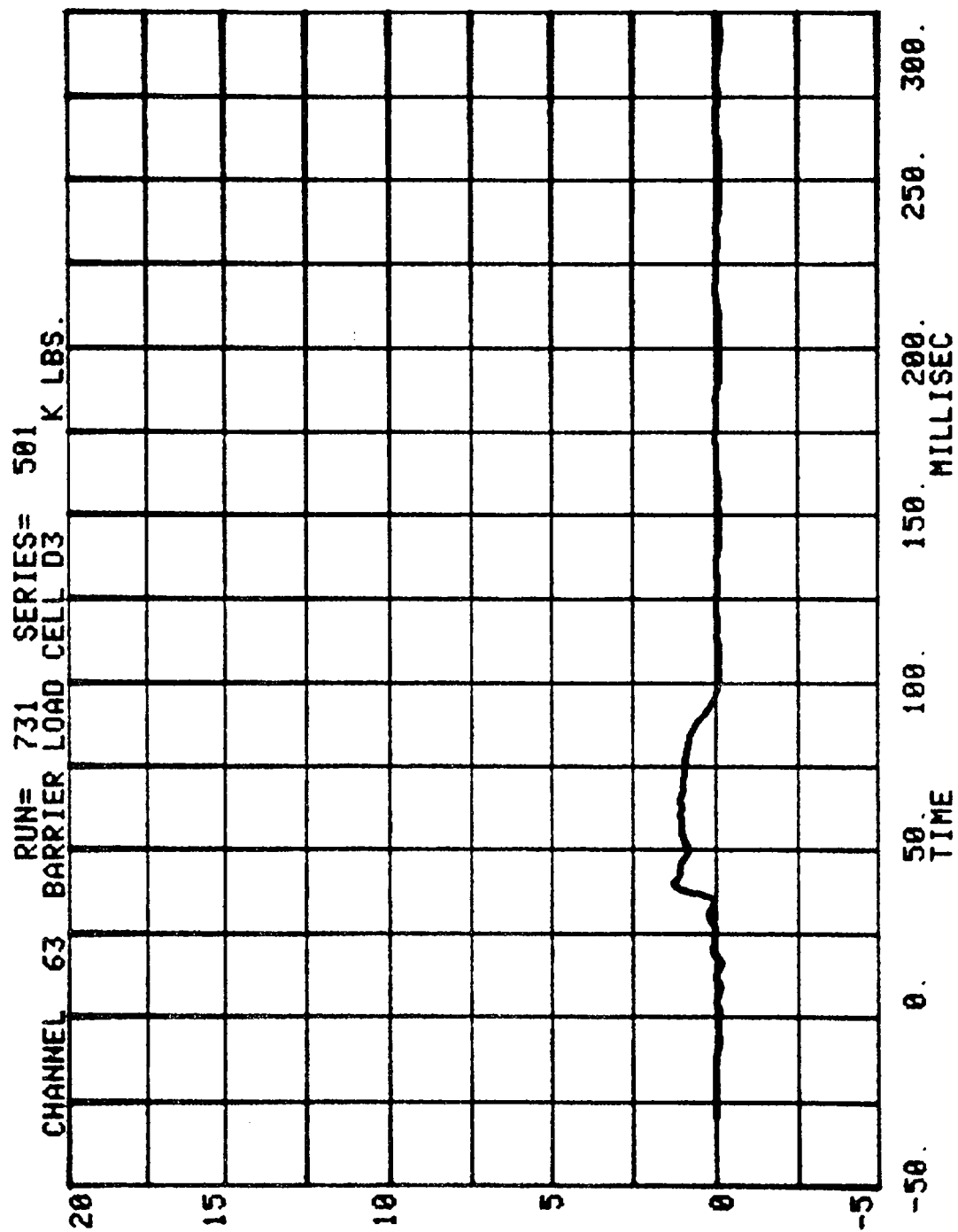
RUN= 731 SERIES= 501
CHANNEL 60 BARRIER LOAD CELL C9 K LBS.



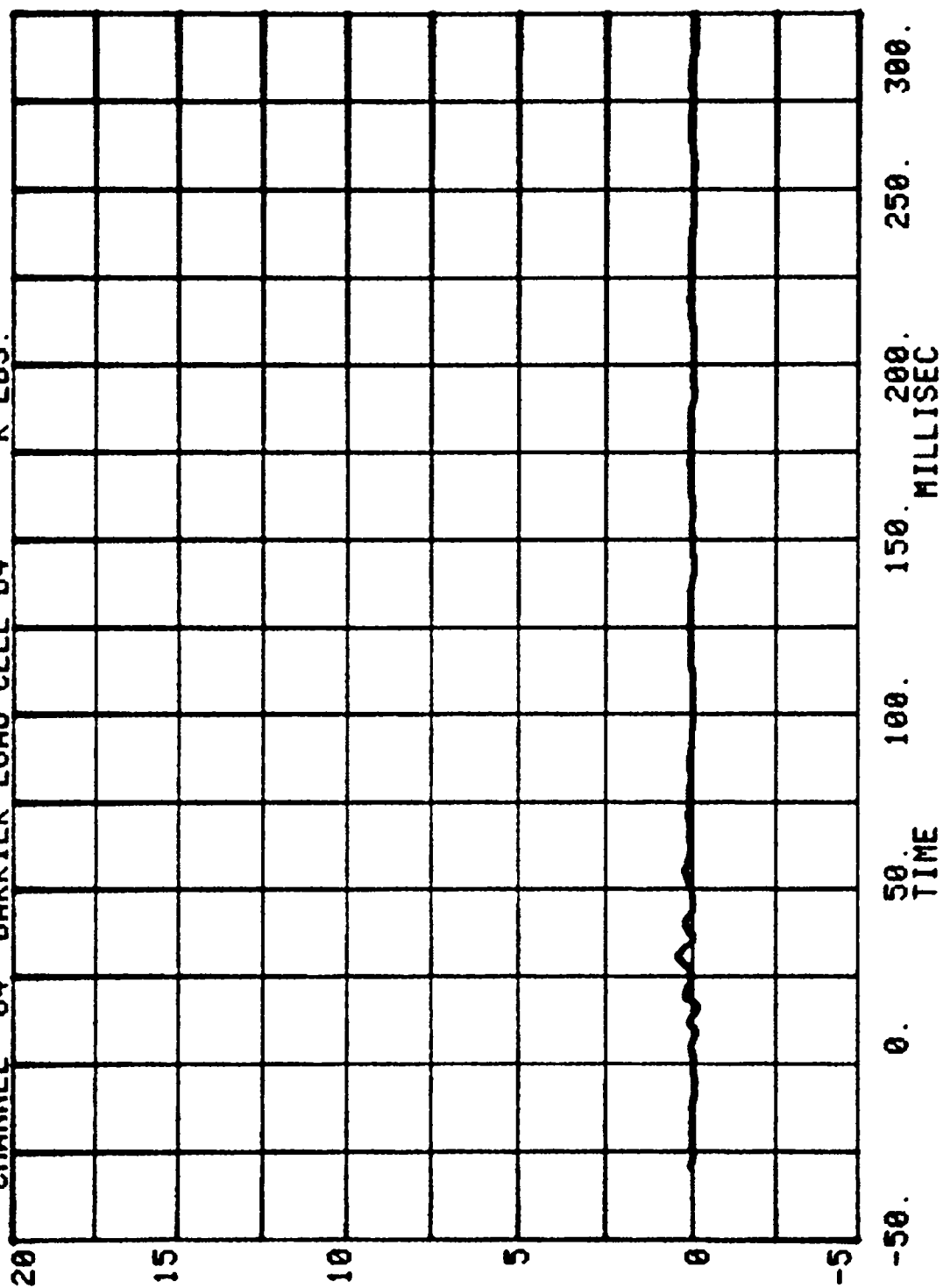


CHANNEL 62 BARRIER LOAD CELL D2 RUN= 731 SERIES= 501 K LBS.



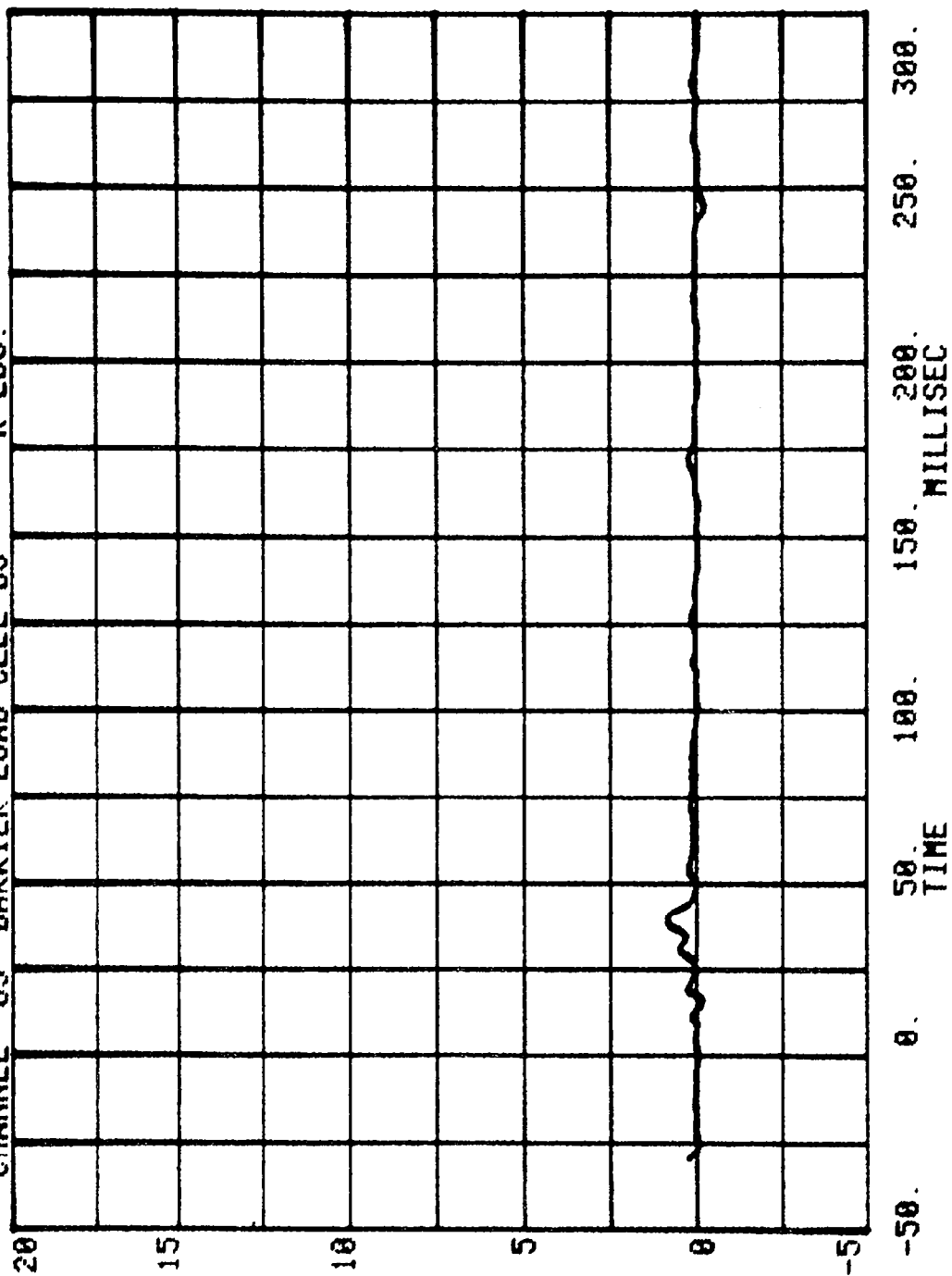


RUN= 731 SERIES= 501
CHANNEL 64 BARRIER LOAD CELL D4 K LBS.



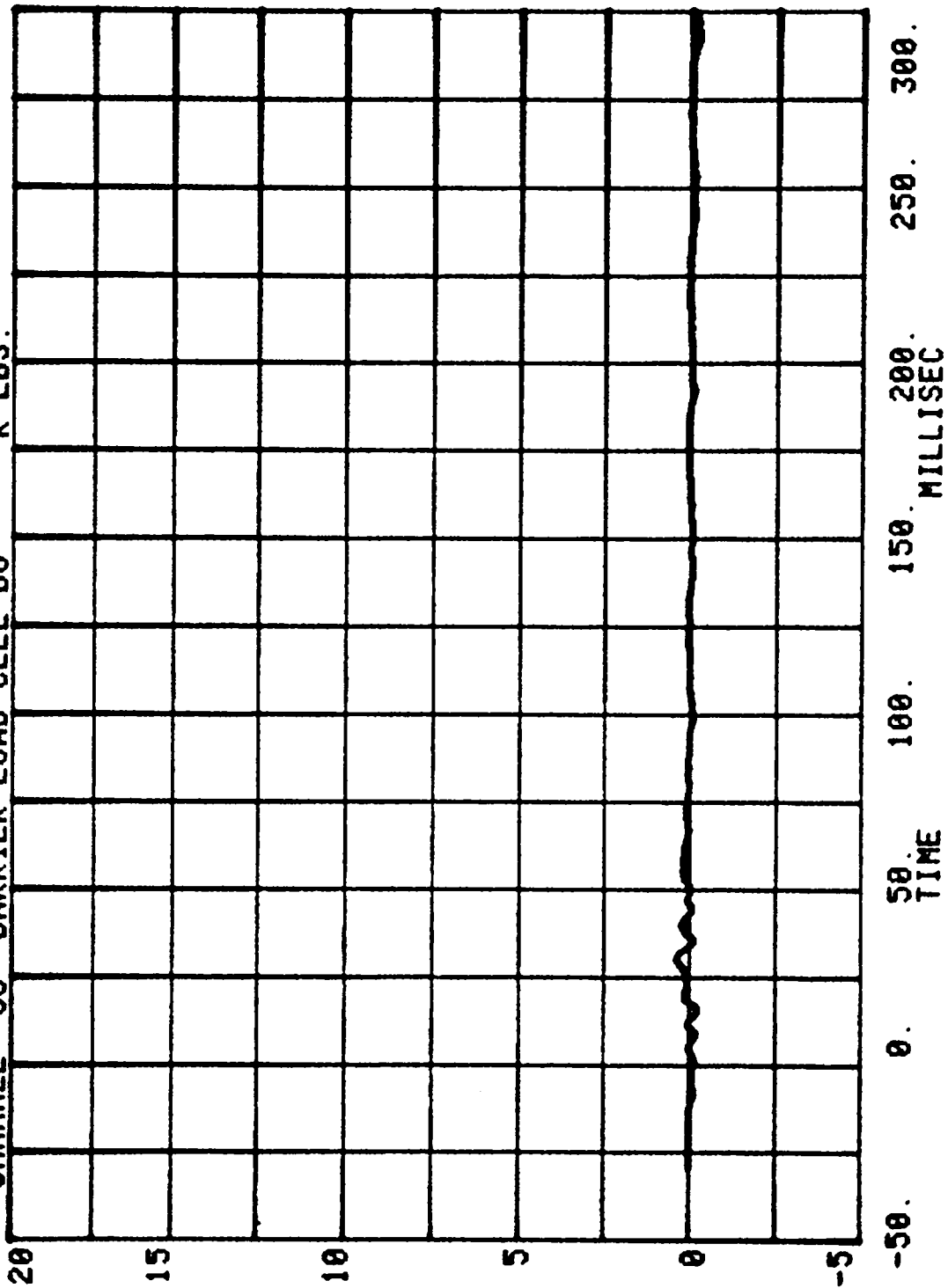
CHANNEL 65 BARRIER LOAD CELL D5 K LBS.

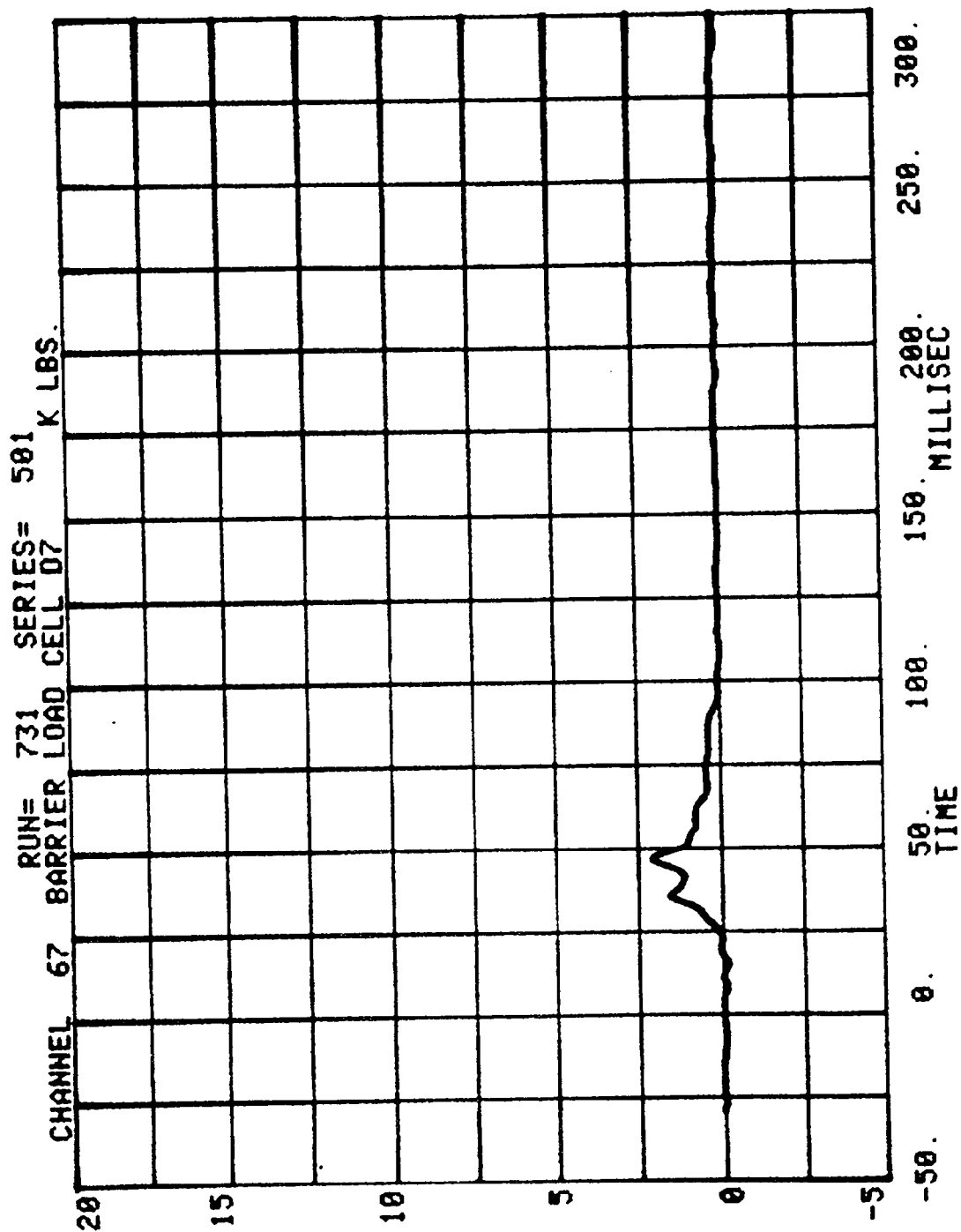
RUN= 731 SERIES= 501



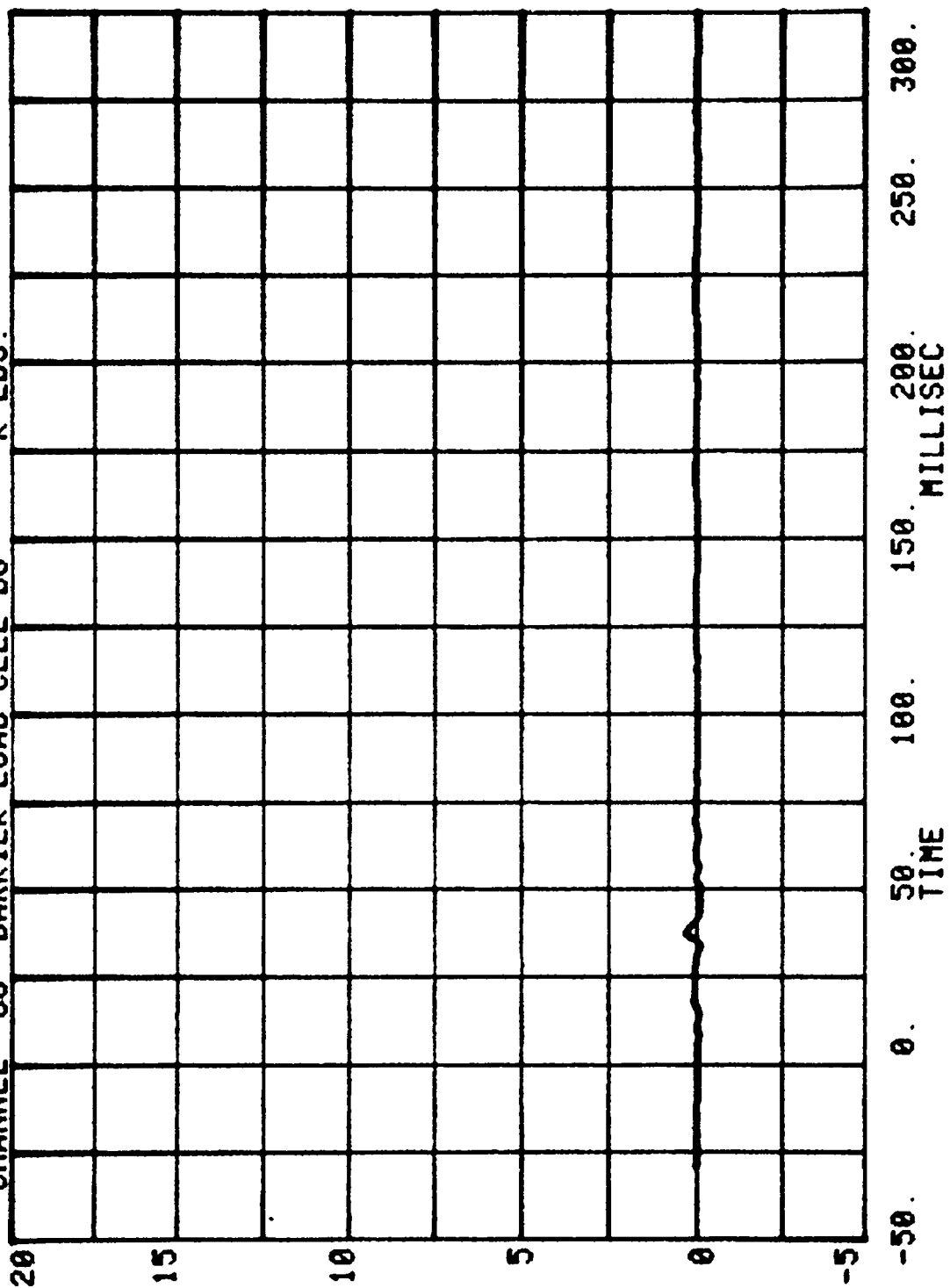
CHANNEL 66 BARRIER LOAD CELL D6 K LBS.

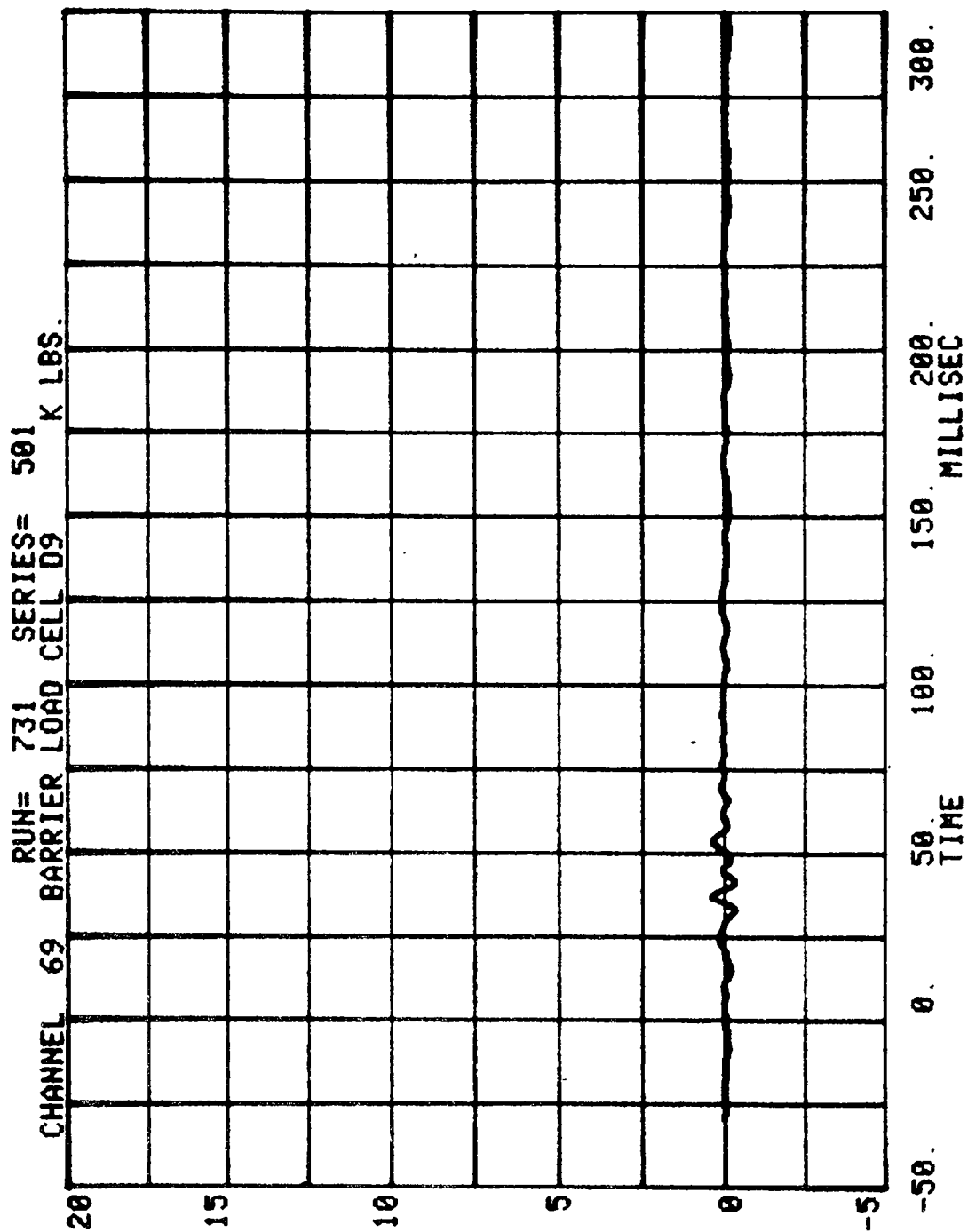
RUN= 731 SERIES= 501





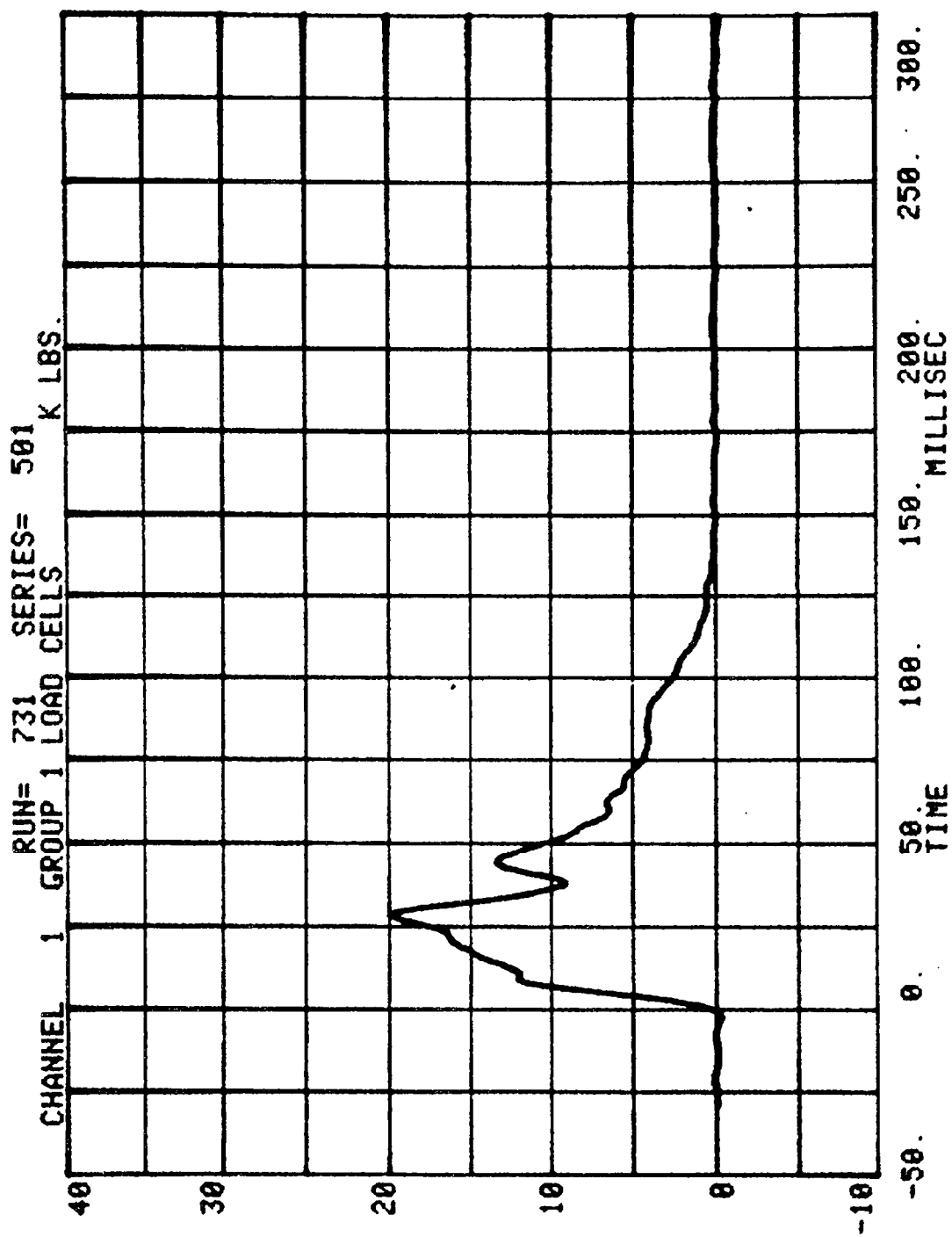
CHANNEL 68 BARRIER LOAD CELL D8 RUN= 731 SERIES= 501 K LBS.



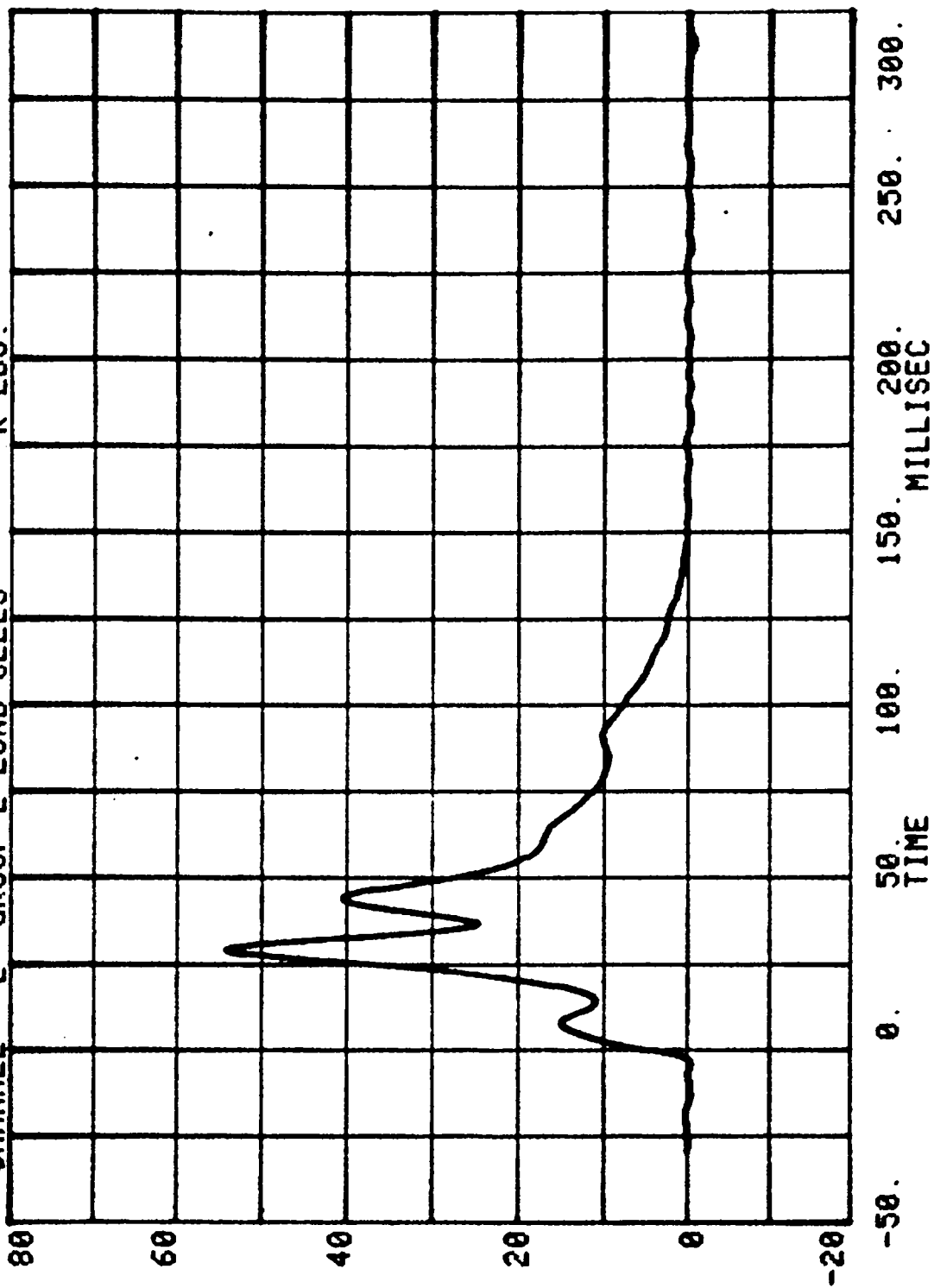


NEW CAR ASSESSMENT BARRIER TESTS - 1986

RUN # 731		SERIES # 501	
CHAN	TITLE	MINIMUM	MAXIMUM
1 GROUP	1 LOAD CELLS	-.243	19.941 K LBS.
2 GROUP	2 LOAD CELLS	-.682	54.238 K LBS.
3 GROUP	3 LOAD CELLS	-.413	15.275 K LBS.
4 GROUP	4 LOAD CELLS	-.491	7.751 K LBS.
5 GROUP	5 LOAD CELLS	-.446	14.499 K LBS.



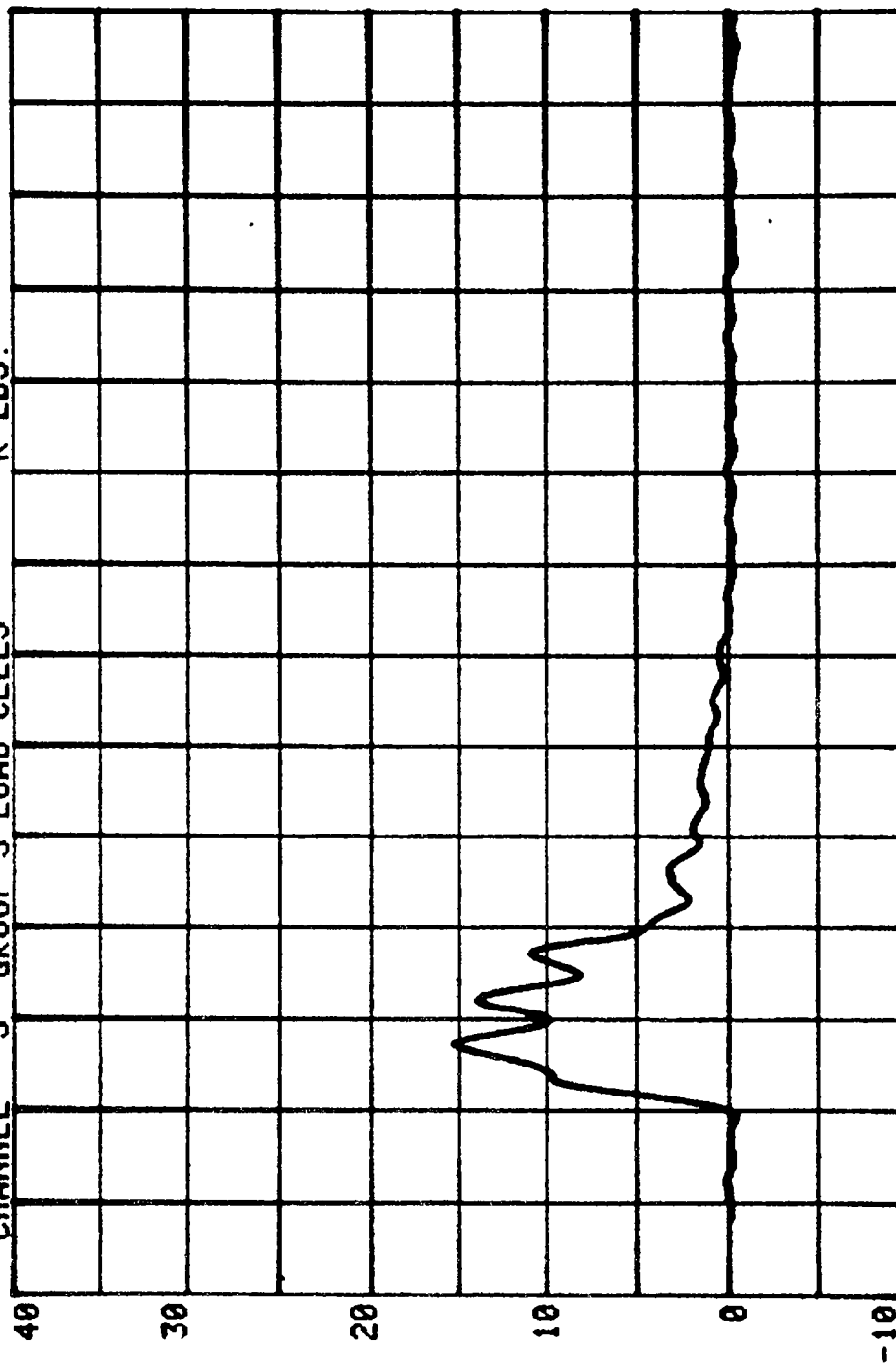
CHANNEL 2 GROUP 2 LOAD CELLS RUN= 731 SERIES= 501 K LBS.



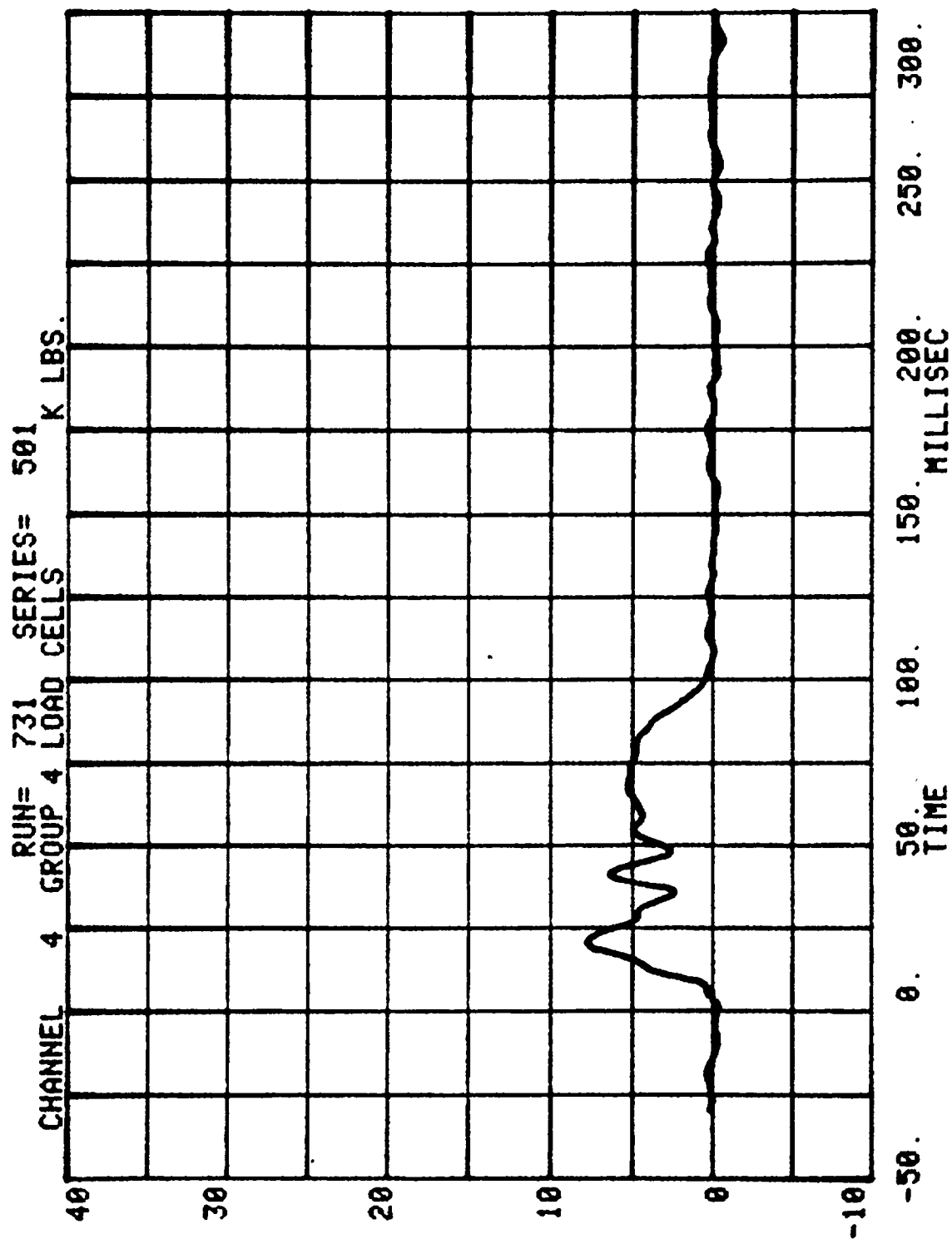
CHANNEL 3 GROUP 3 LOAD CELLS

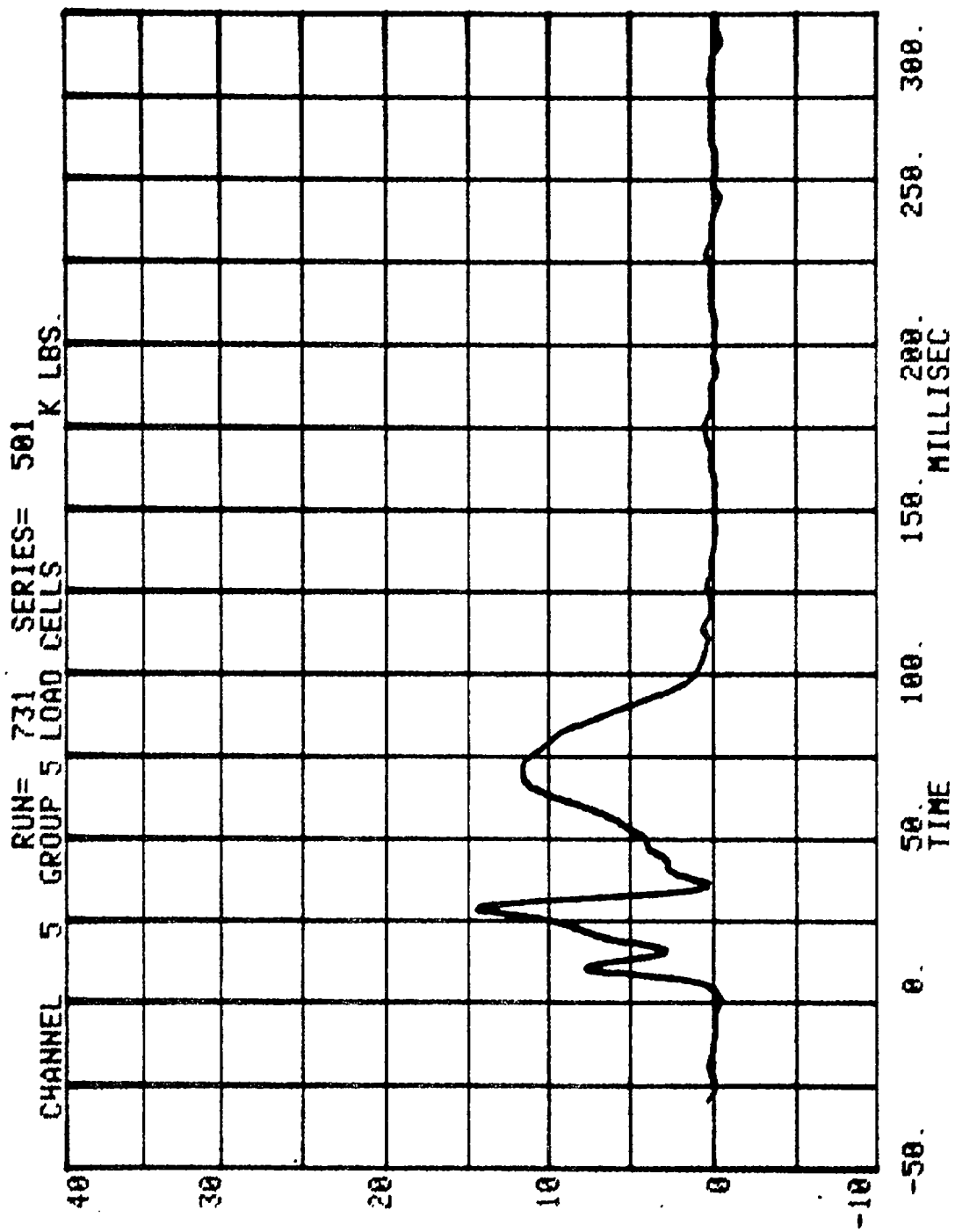
RUN= 731 SERIES= 581

K LBS.



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





TEST NO. MG0501

DUMMY DATA

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

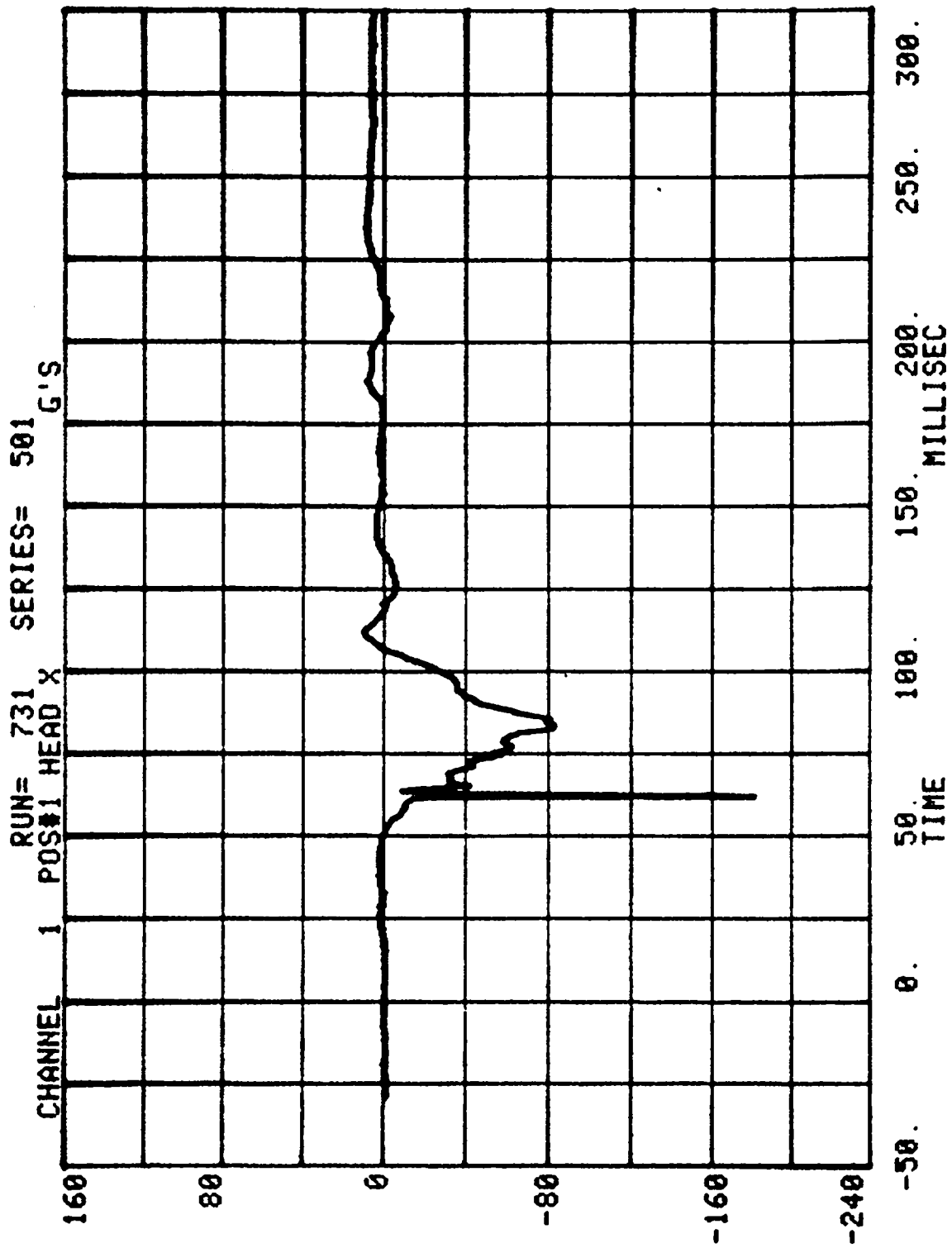
HEAD INJURY CRITERION
HEAD SEVERITY INDEX

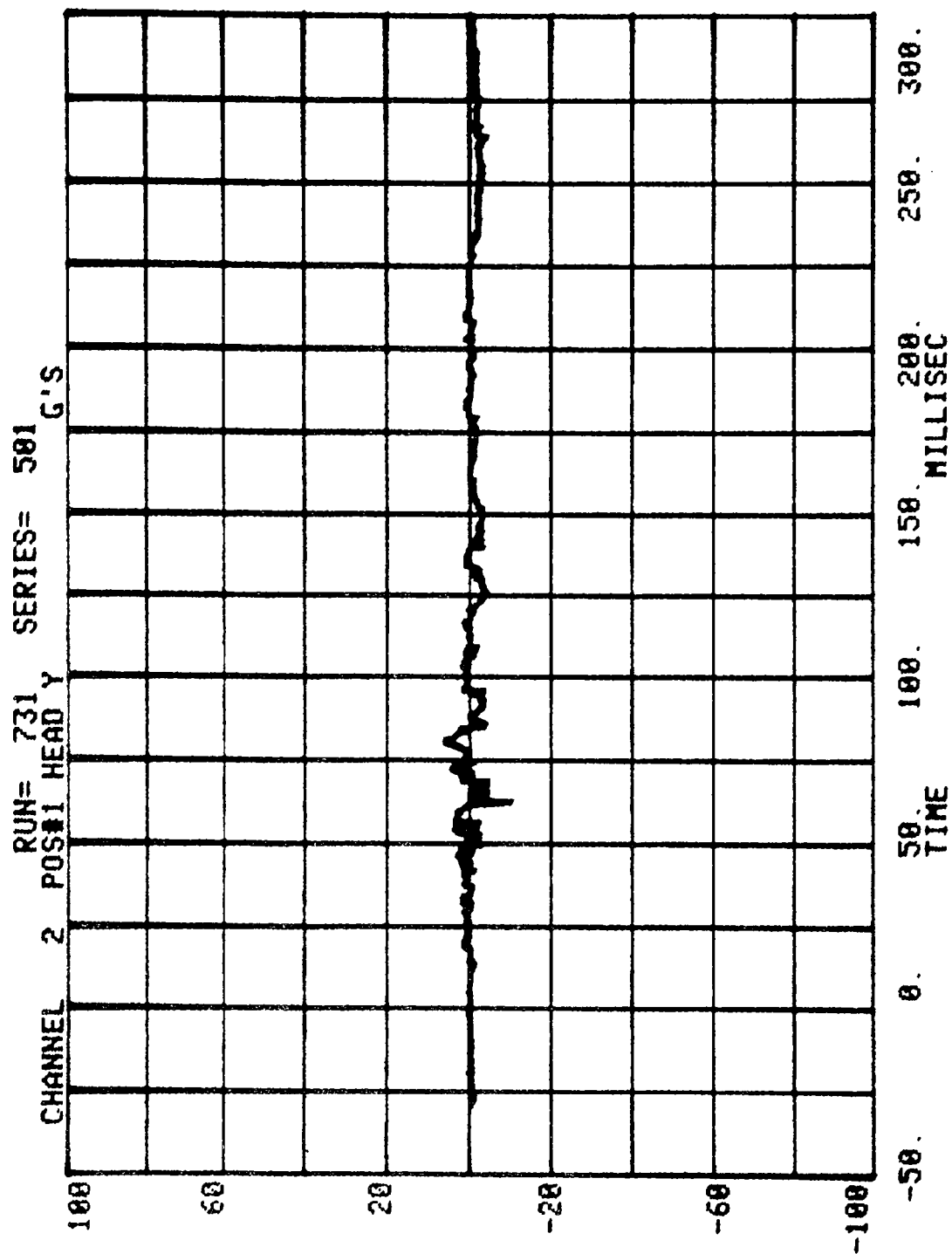
NEW CAR ASSESSMENT BARRIER TESTS - 1986

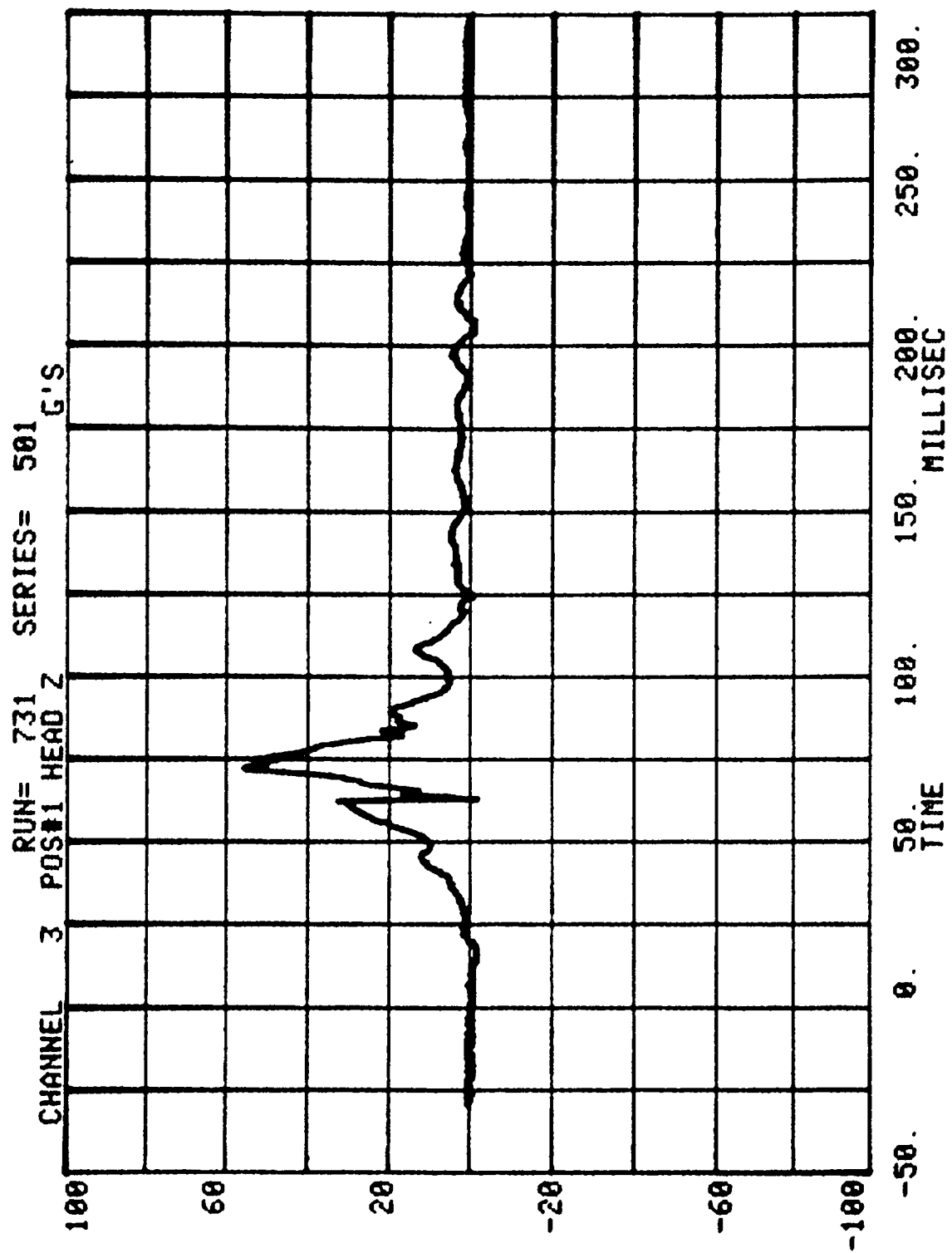
RUN= 731

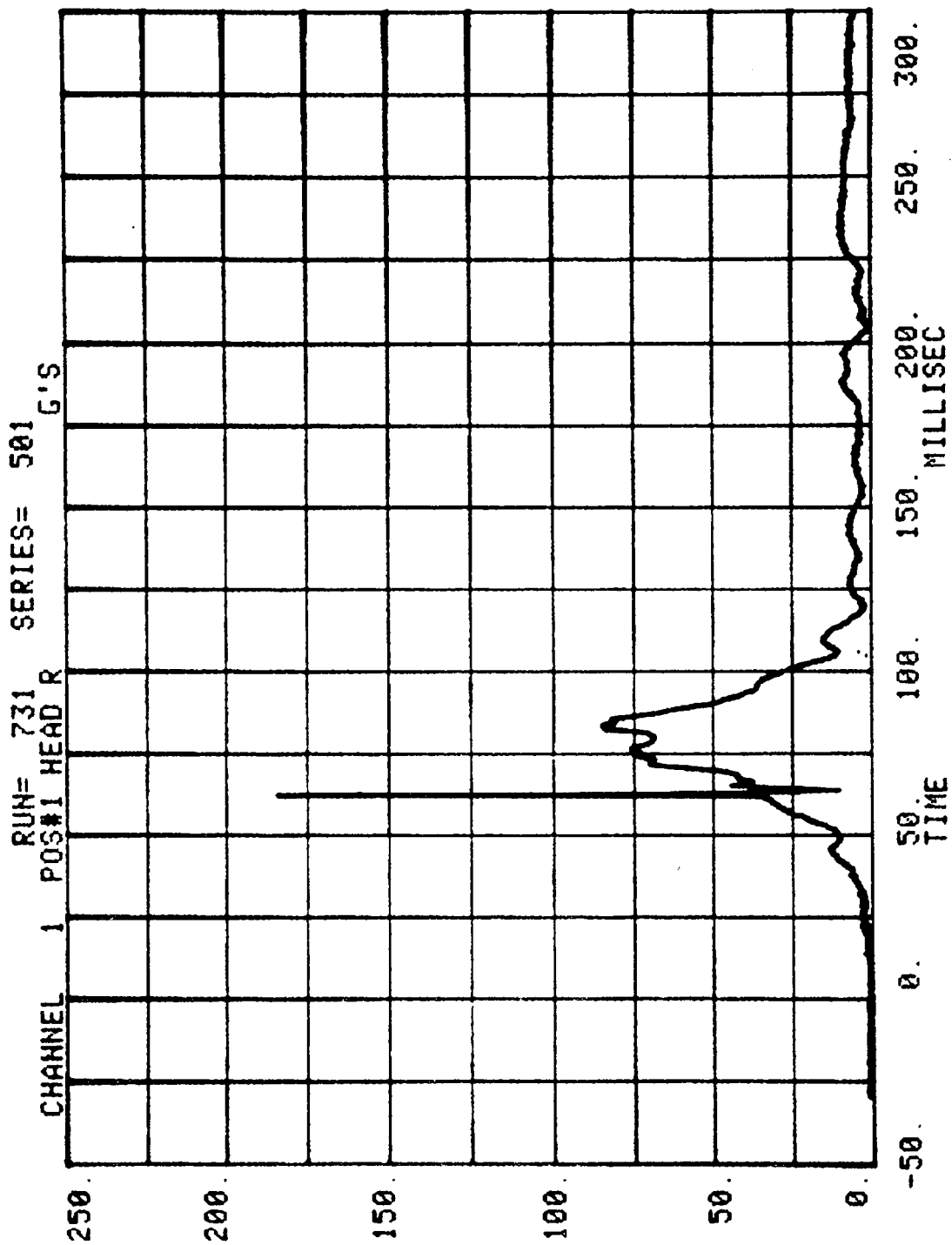
POS#1 HEAD R

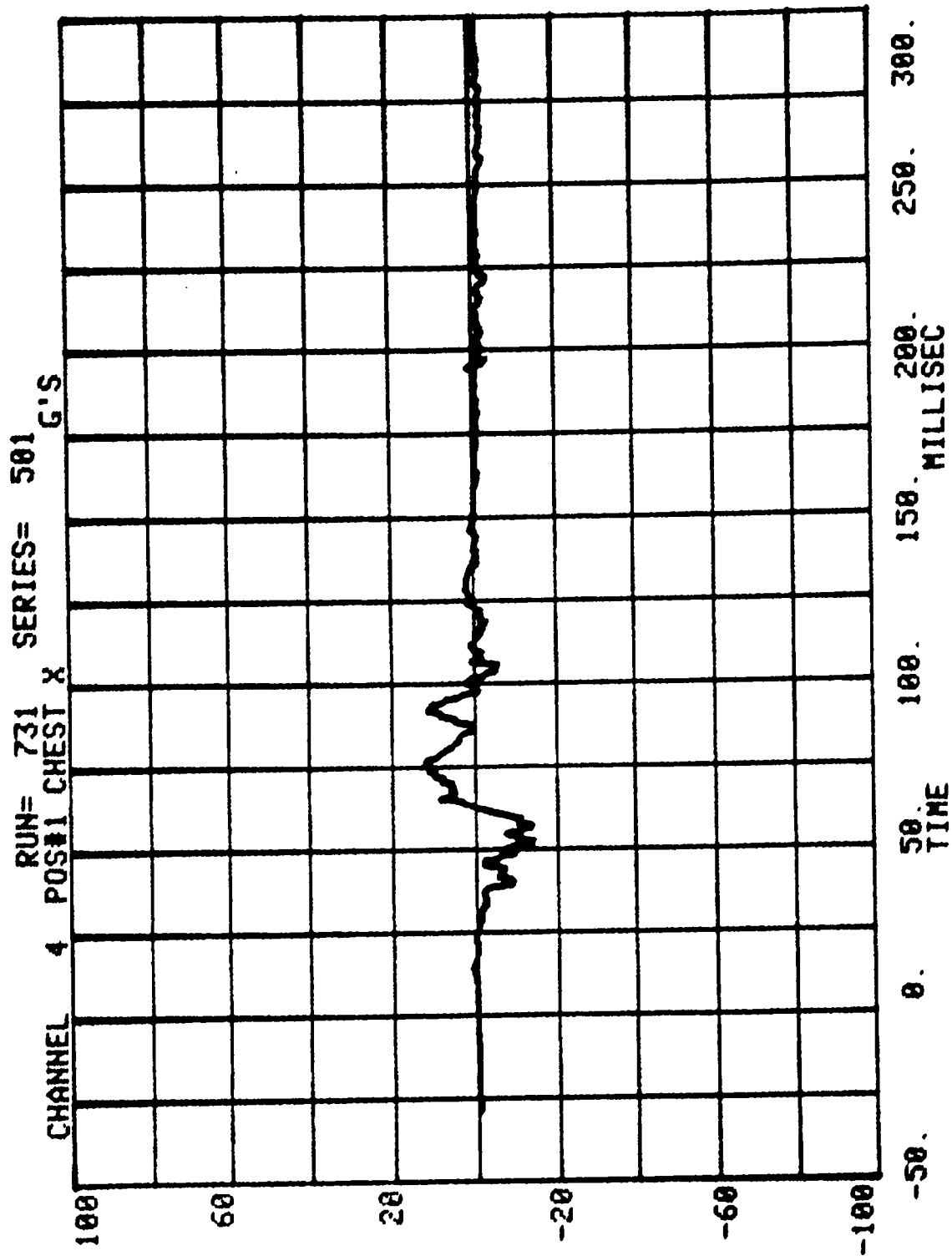
HIC= 998.9 FROM T1= .06195 TO T2= .09435
AVERAGE ACCELERATION BETWEEN T1 AND T2= 62.5G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX=1415.3

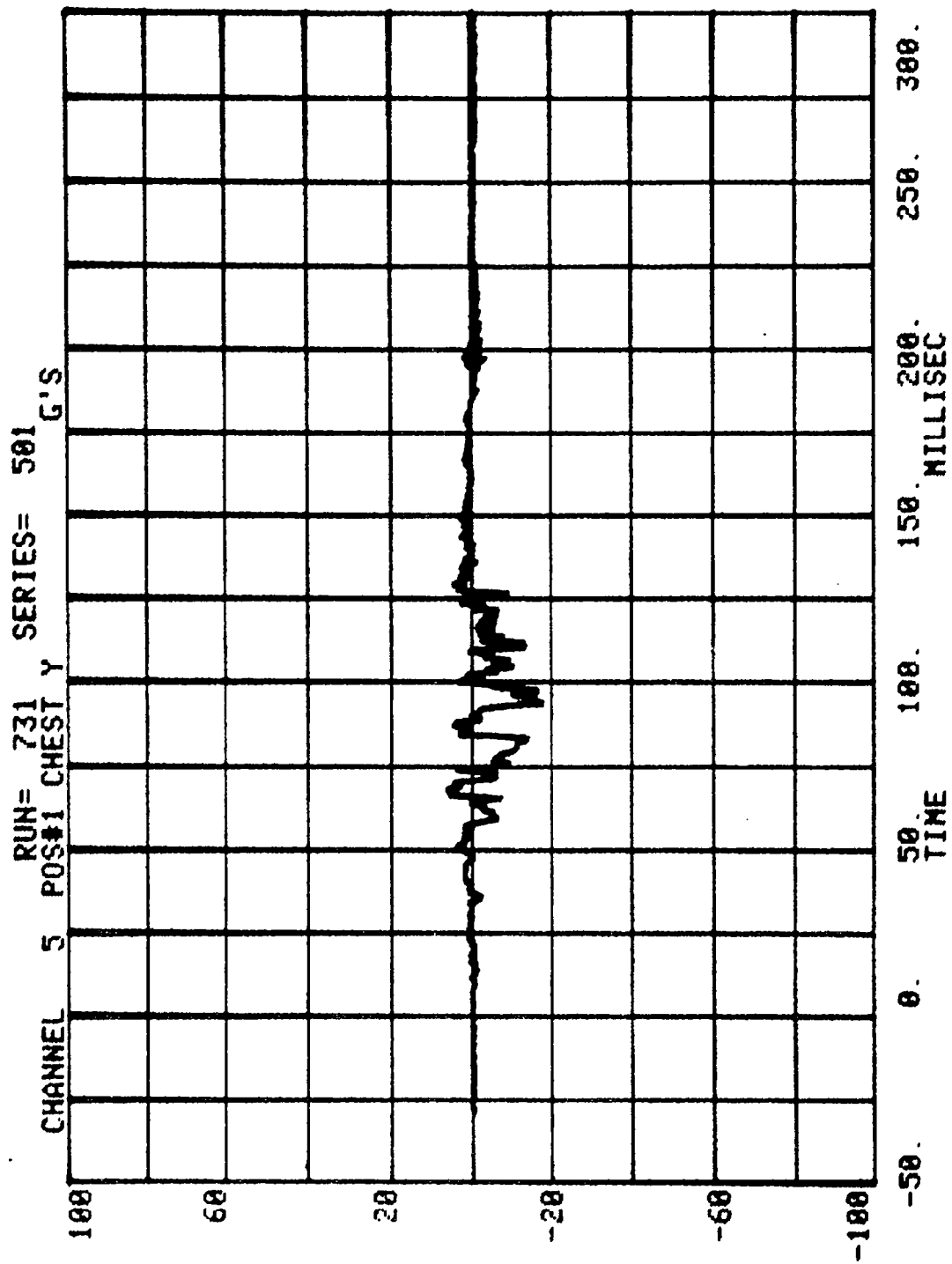


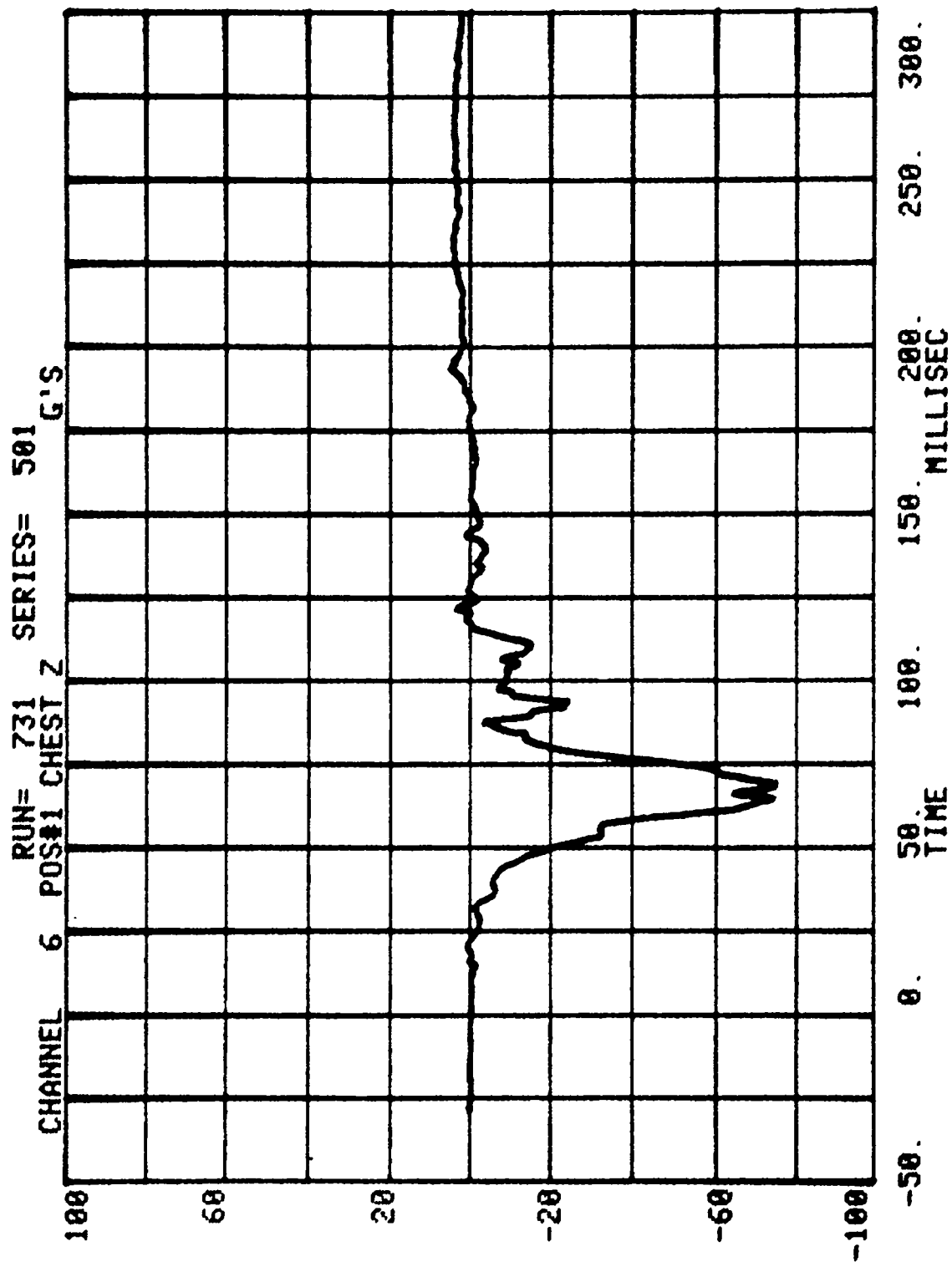


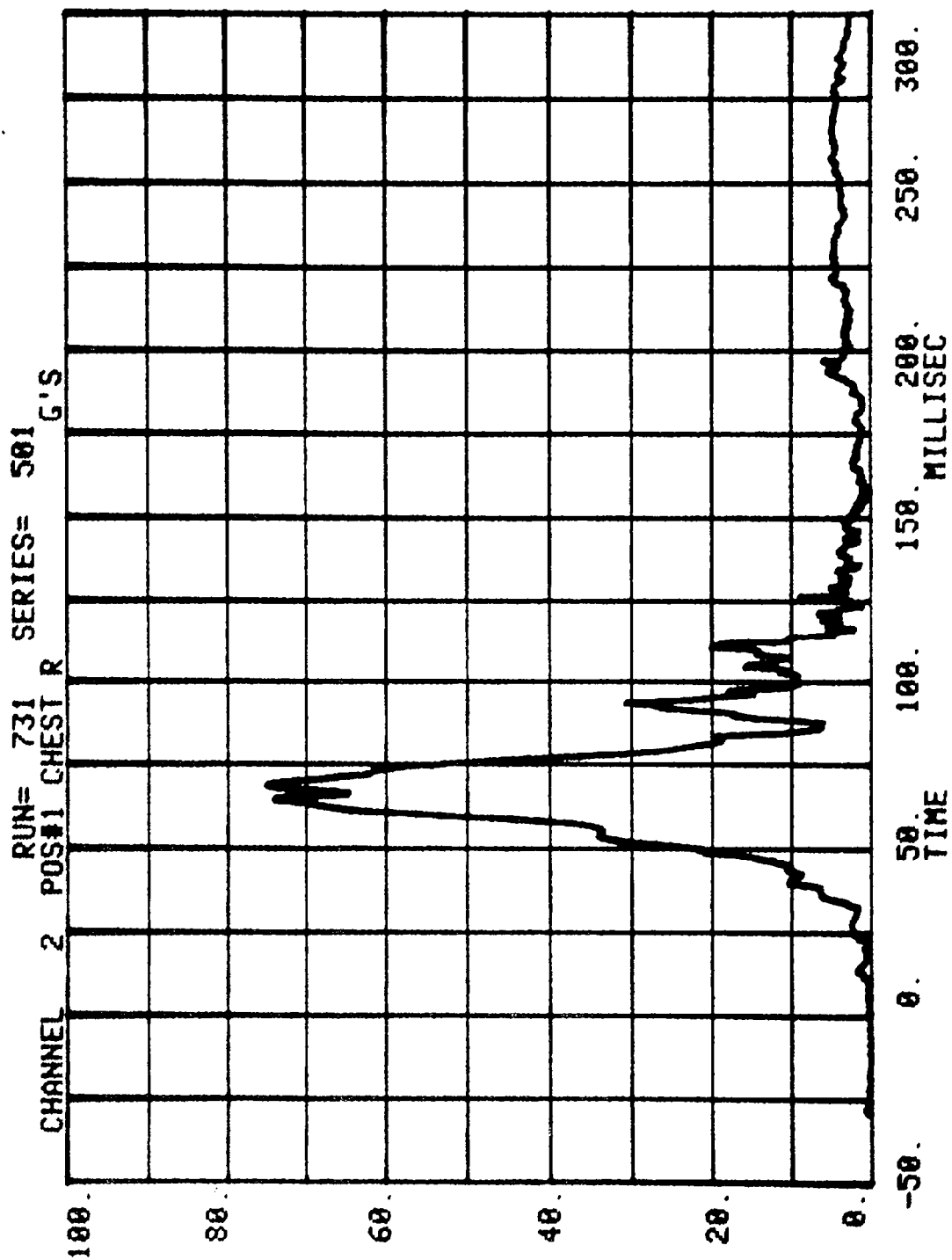


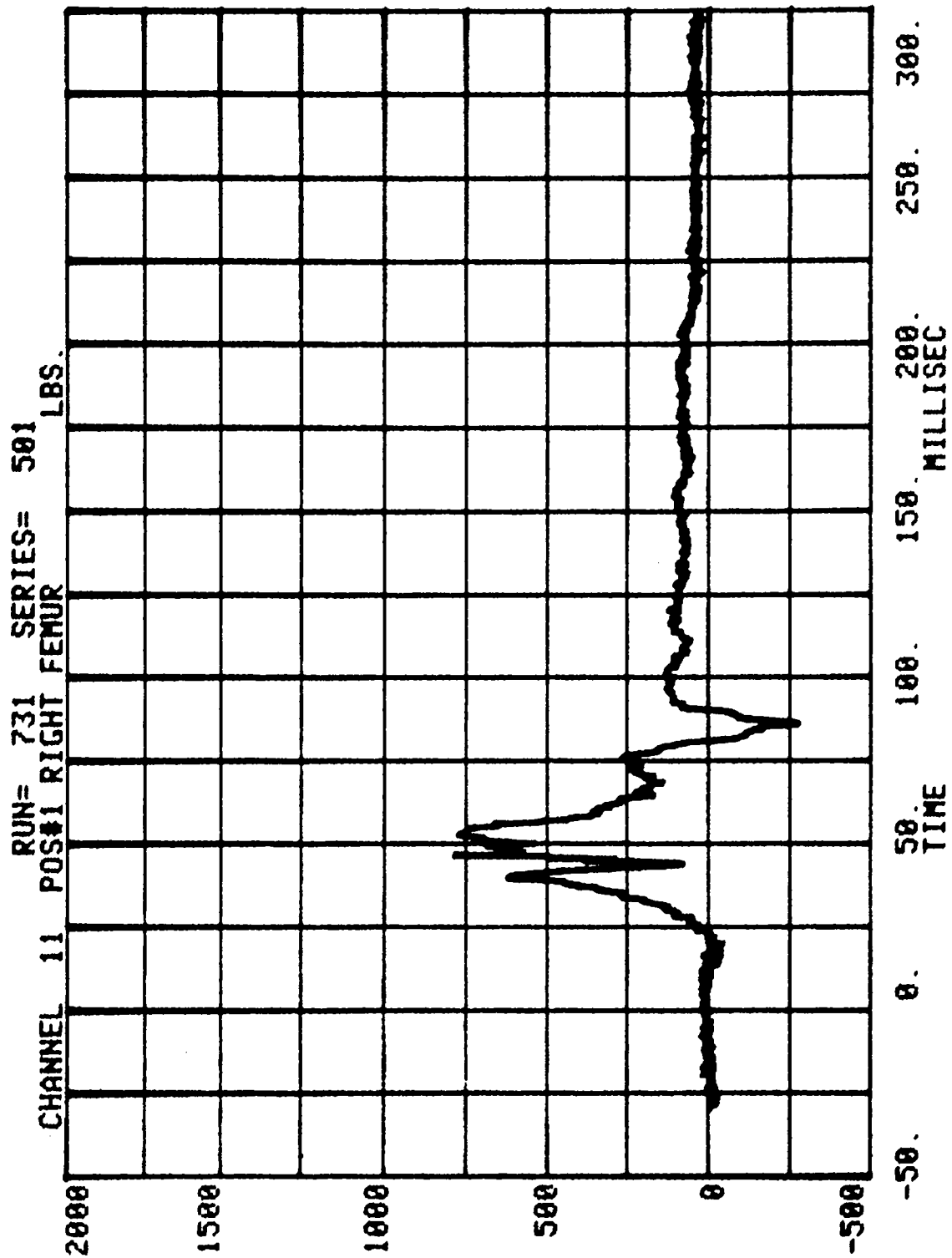


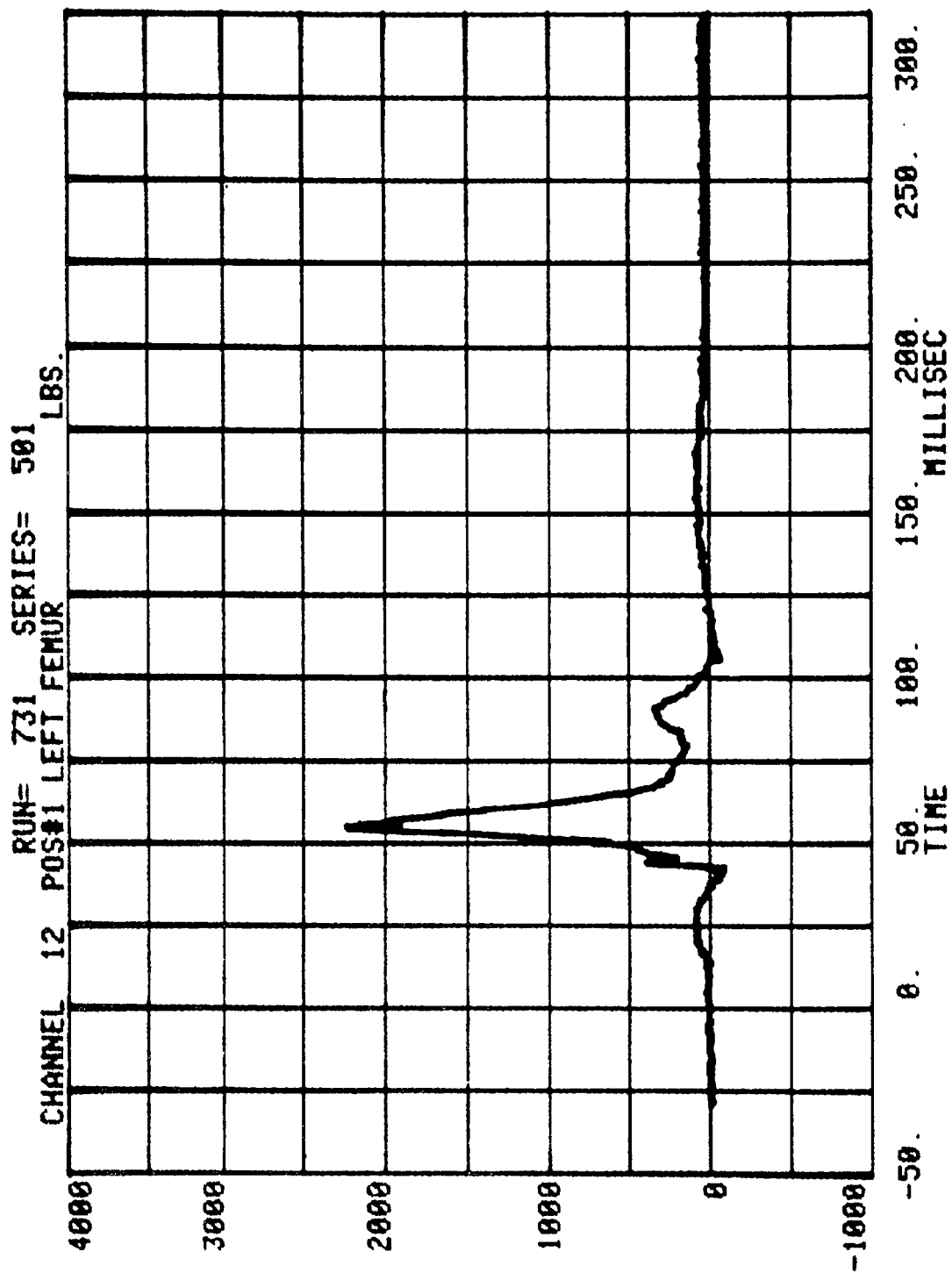


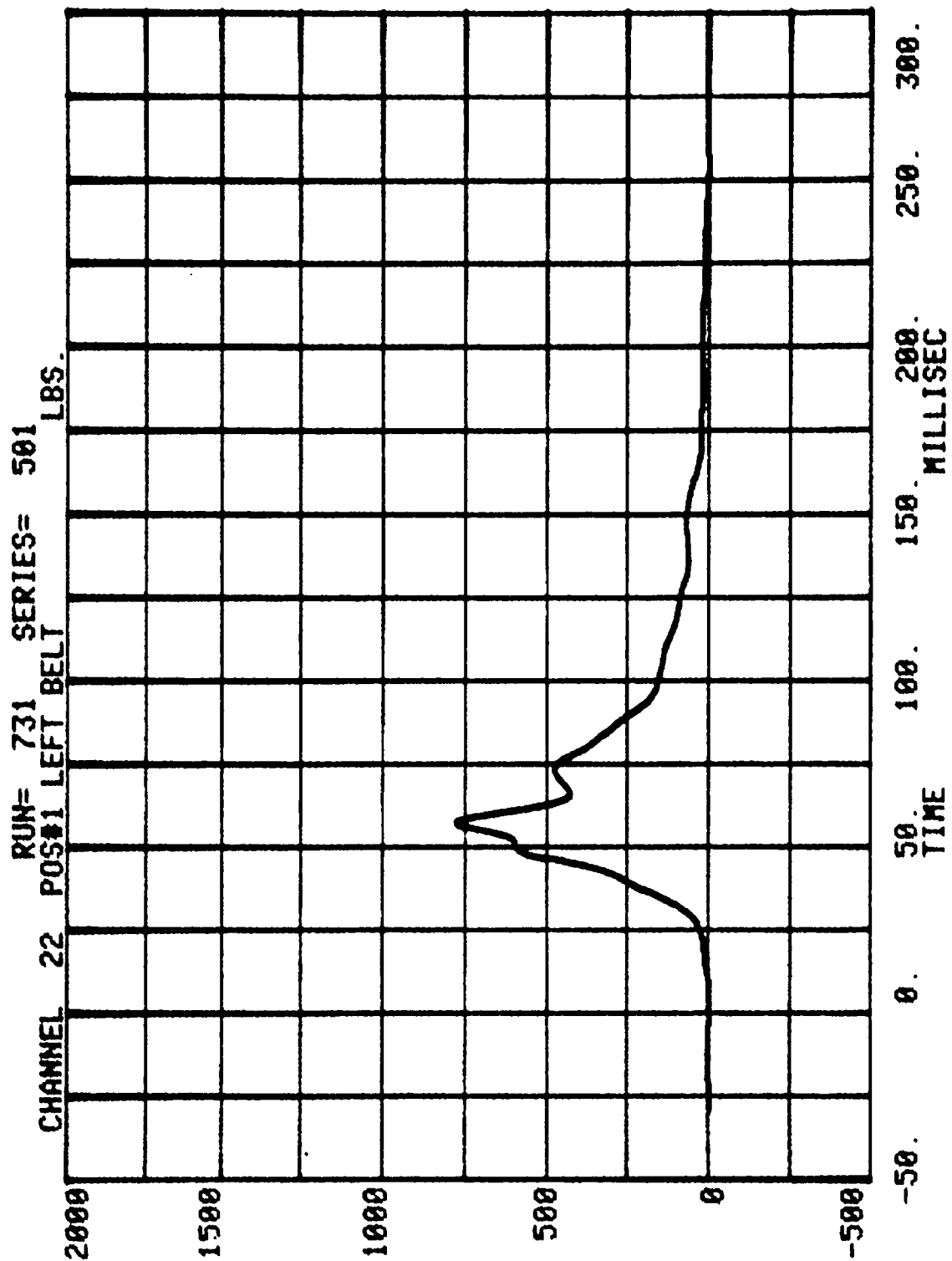


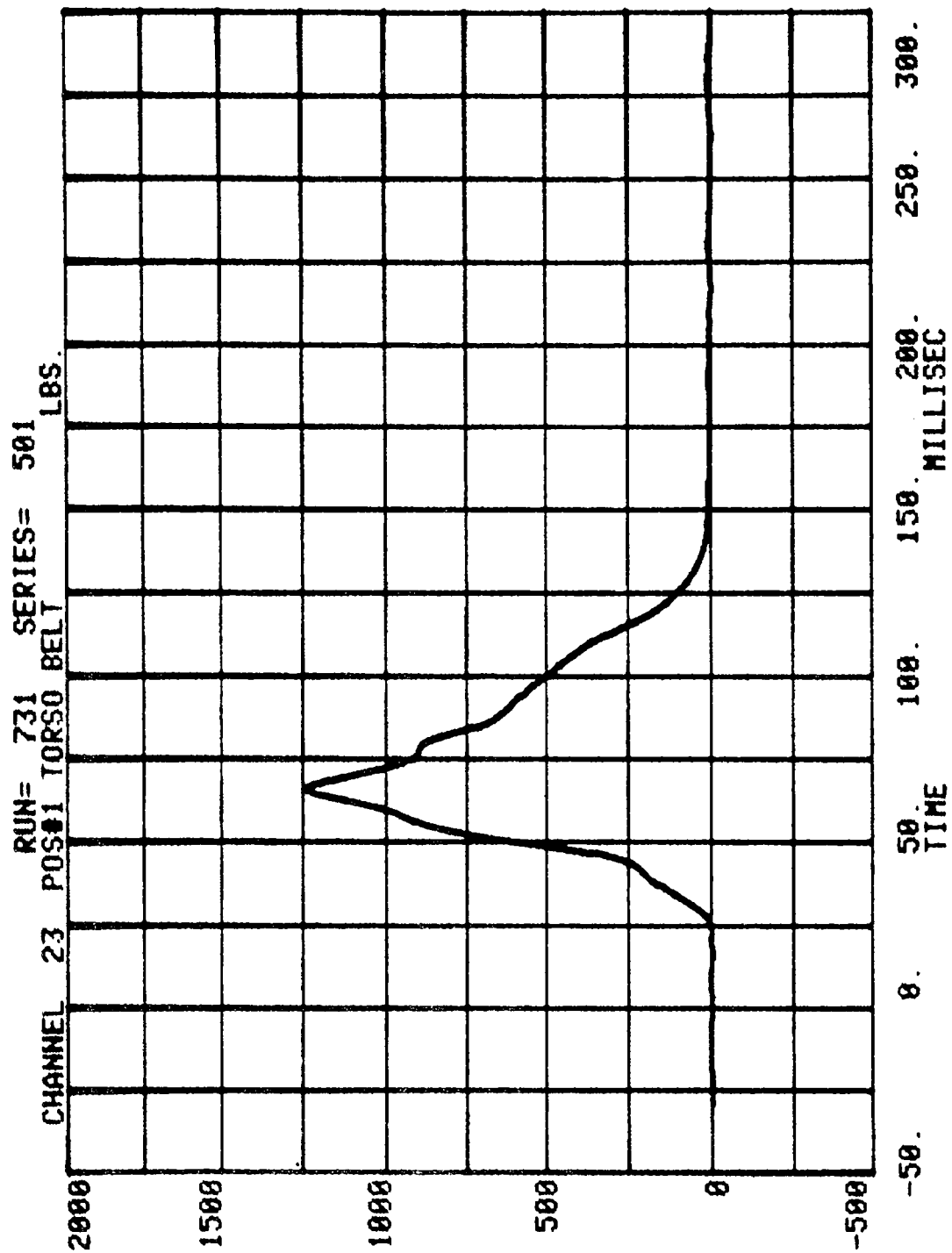






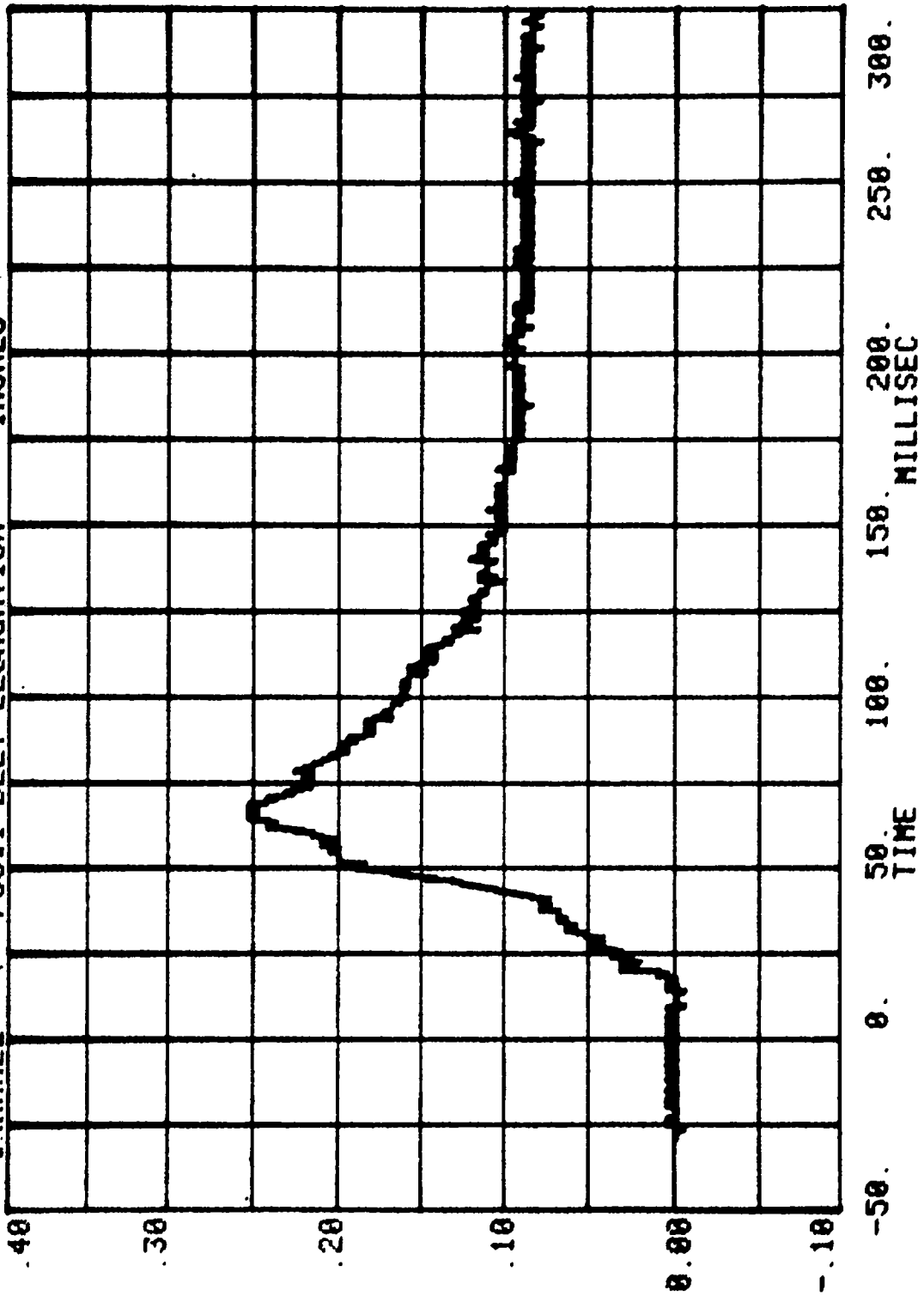




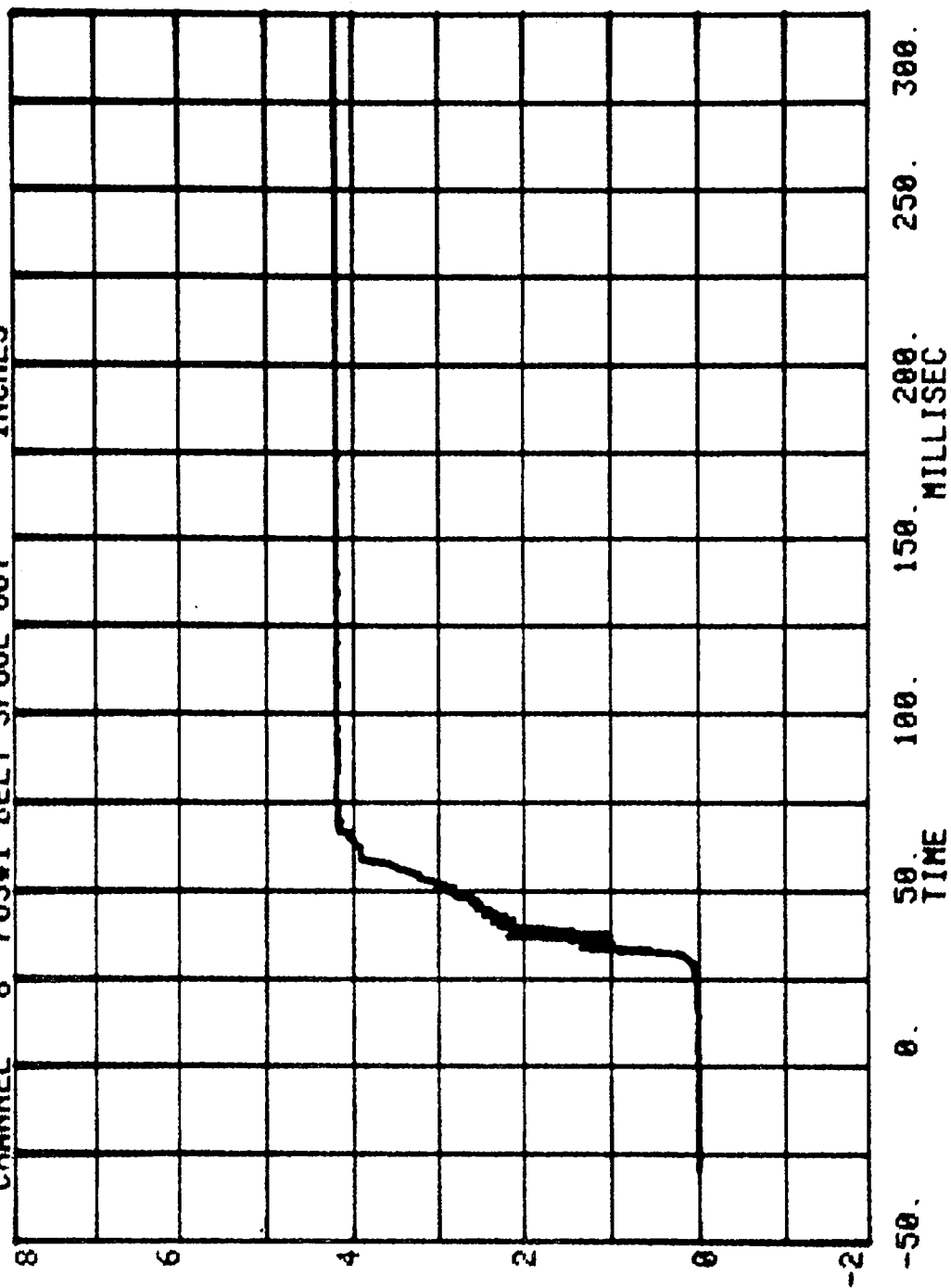


MEASURED OVER 2.5"

CHANNEL 7 POS#1 BELT ELONGATION SERIES= 501 INCHES



RUN= 731 SERIES= 501
CHANNEL 8 POS#1 BELT SPOOL OUT INCHES



HEAD INJURY CRITERION
HEAD SEVERITY INDEX

NEW CAR ASSESSMENT BARRIER TESTS - 1986

RUN= 731

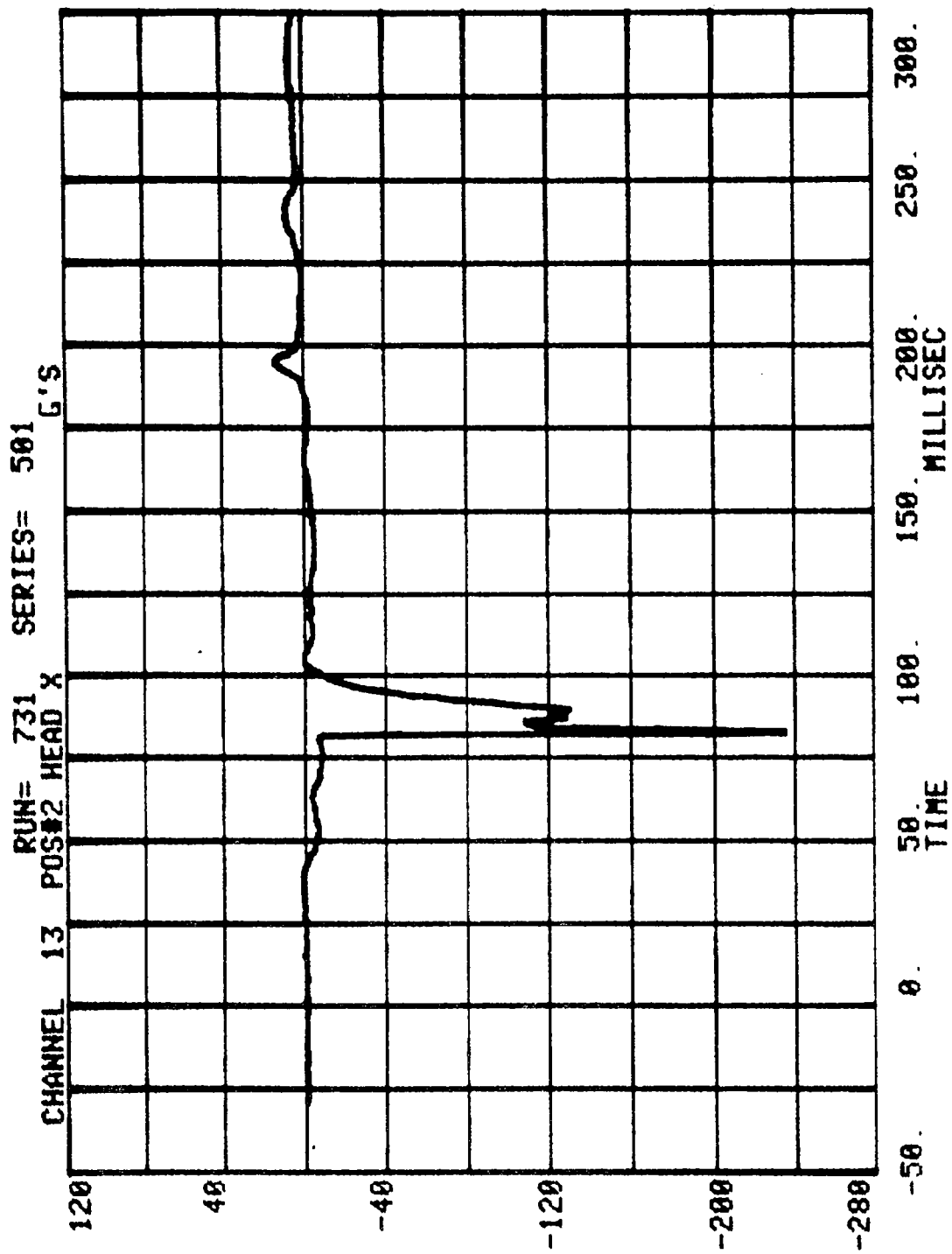
POS#2 HEAD R

HIC=2662.4 FROM T1= .03227 TO T2= .09232

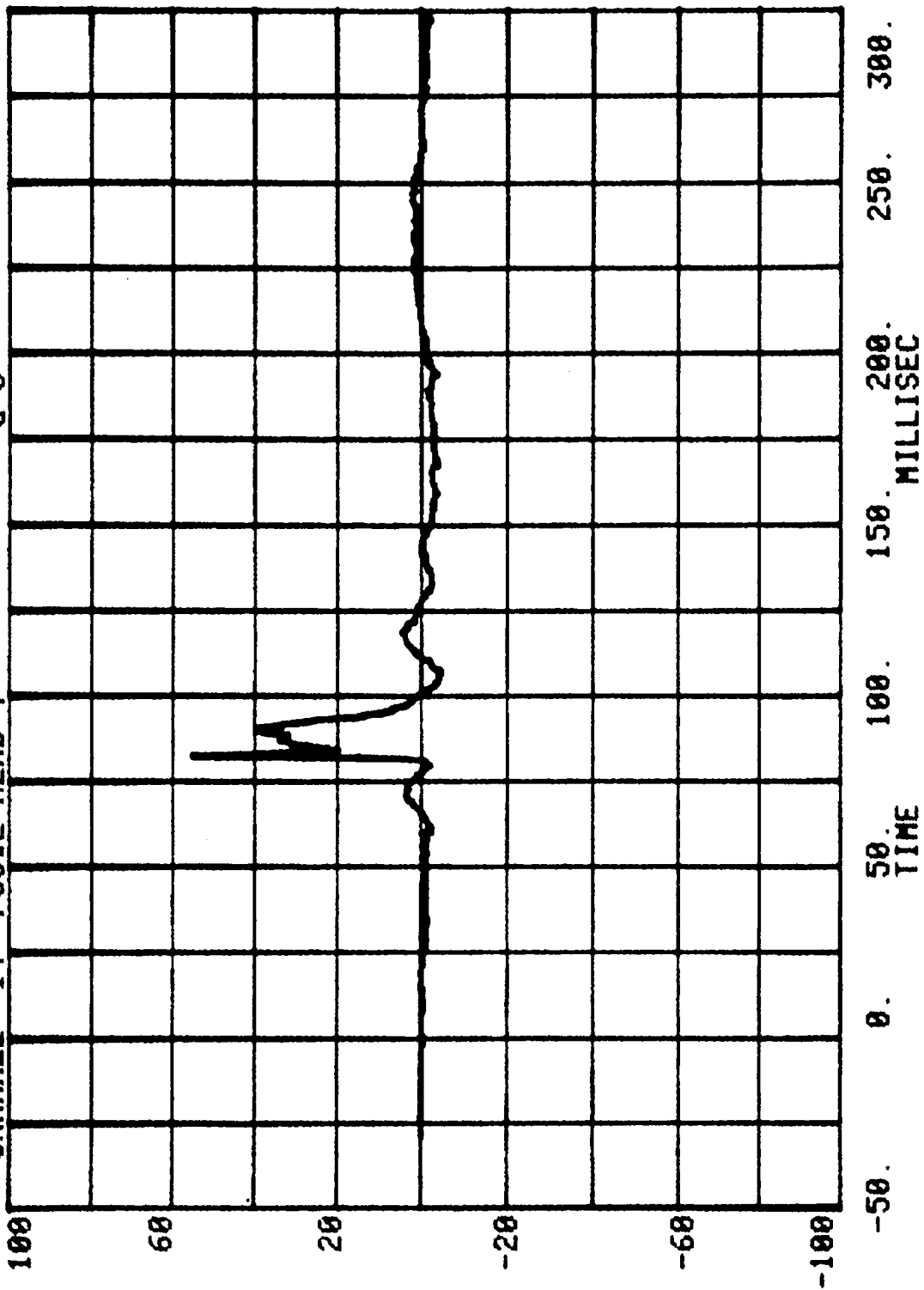
AVERAGE ACCELERATION BETWEEN T1 AND T2= 147.7G'S

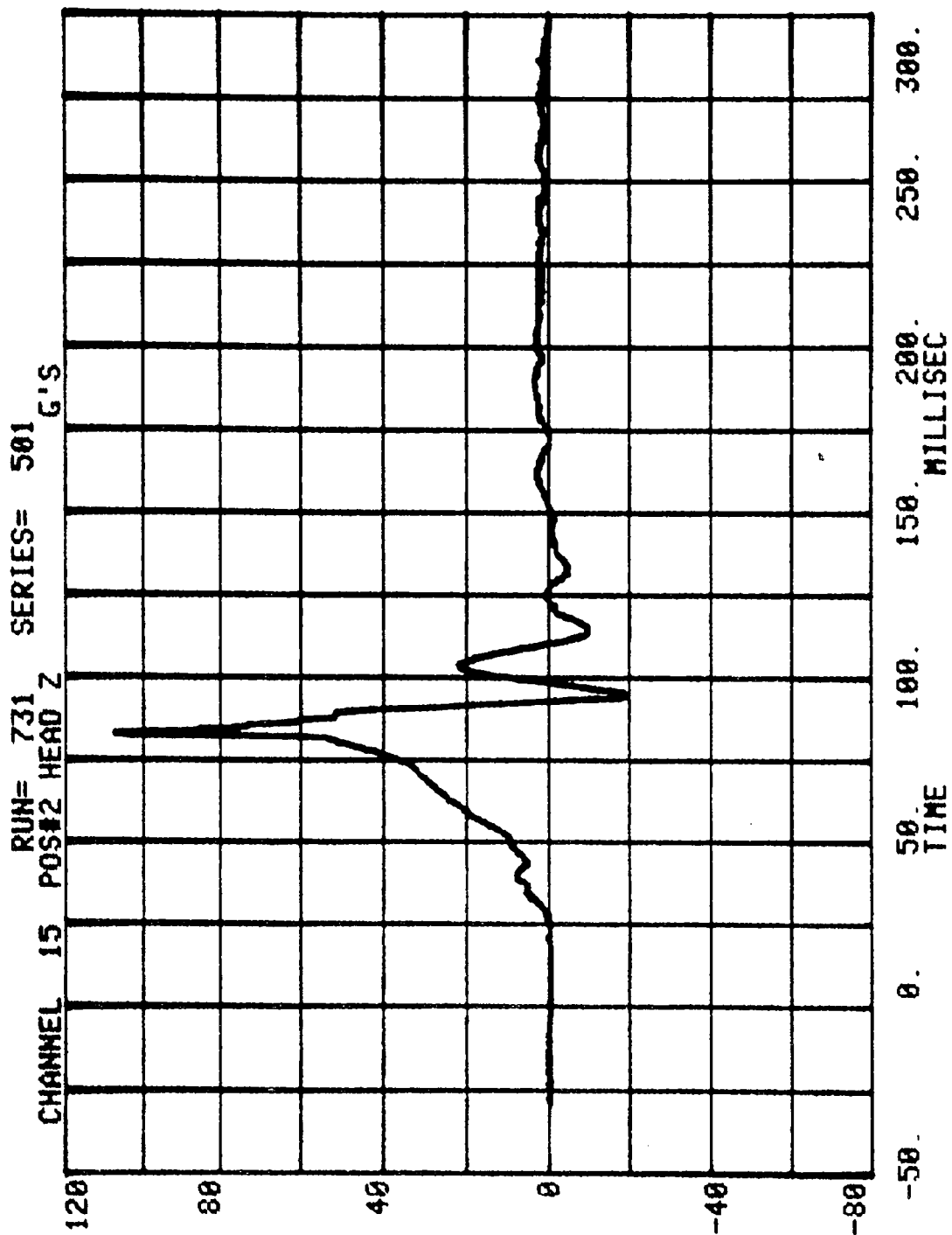
EVENT TIME= 300.0 MSEC

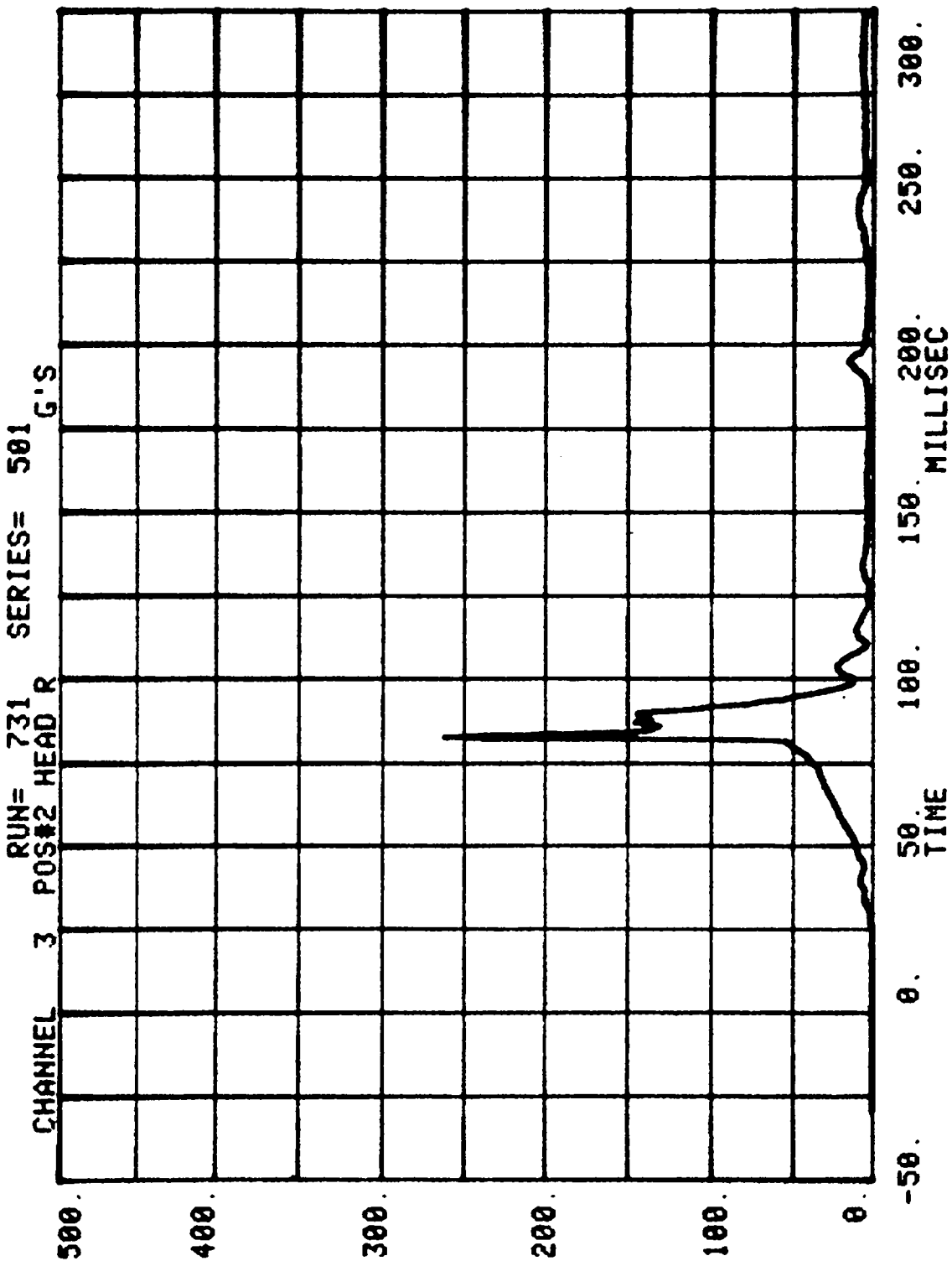
SEVERITY INDEX=3400.9

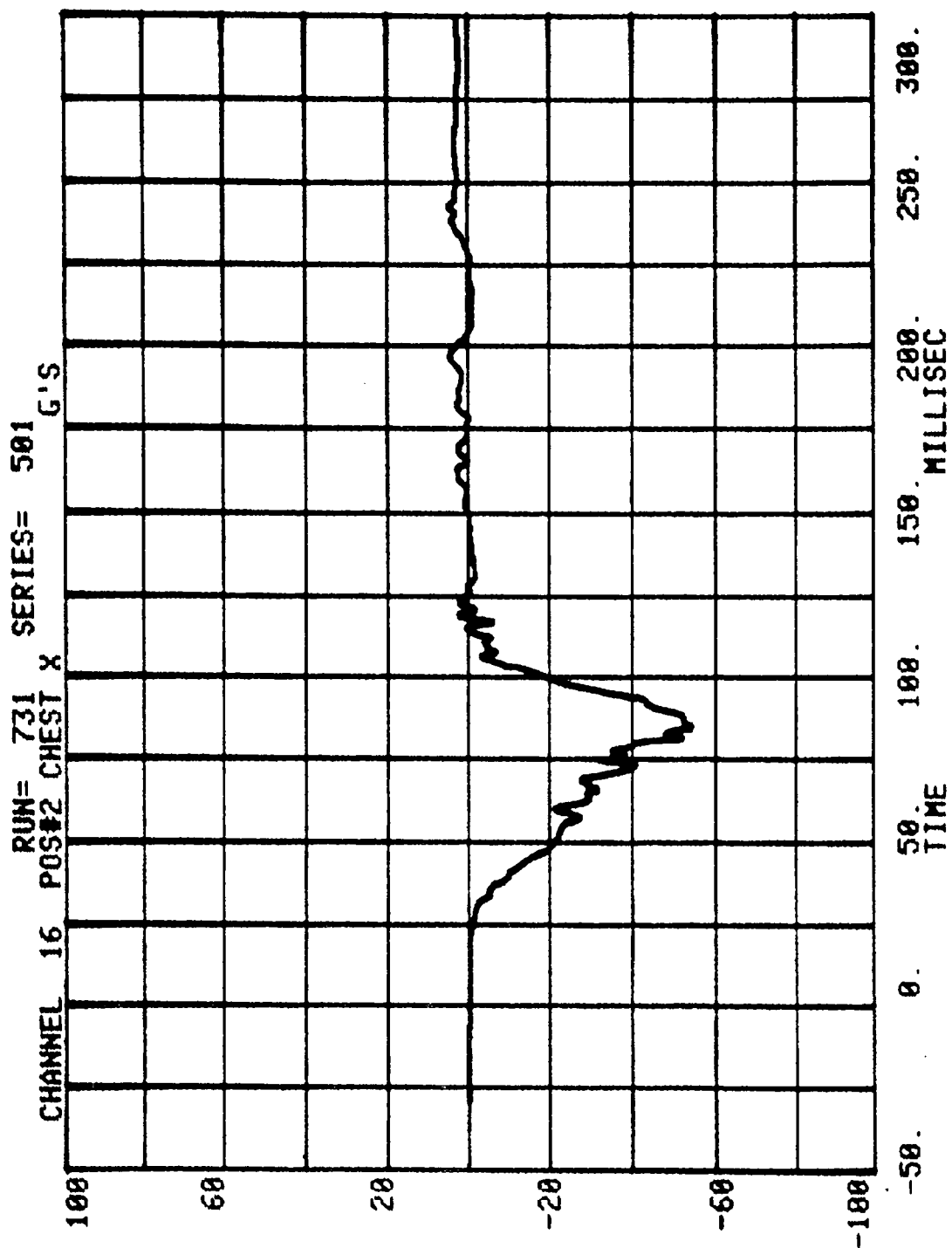


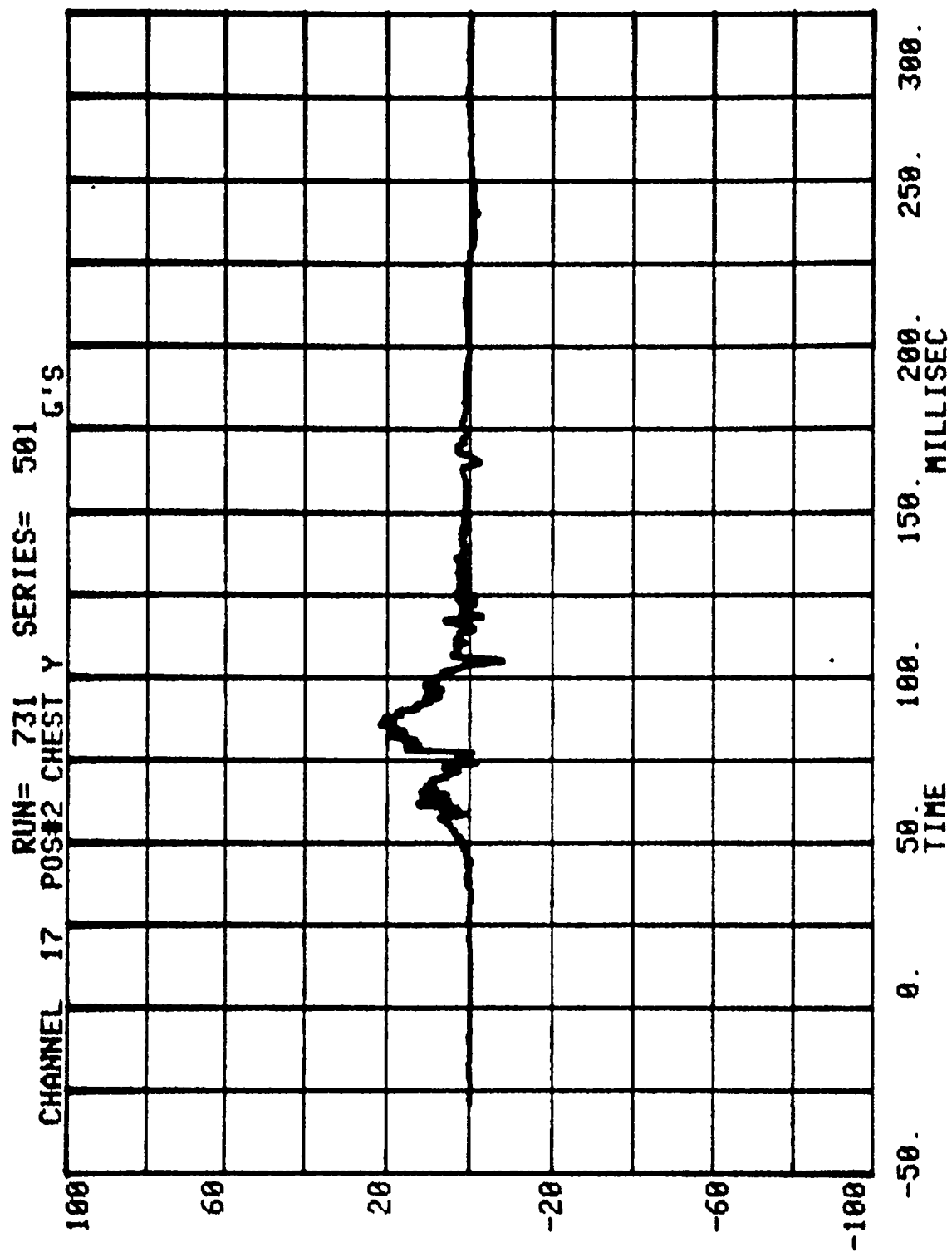
CHANNEL 14 POS#2 HEAD Y RUN= 731 SERIES= 501 G'S

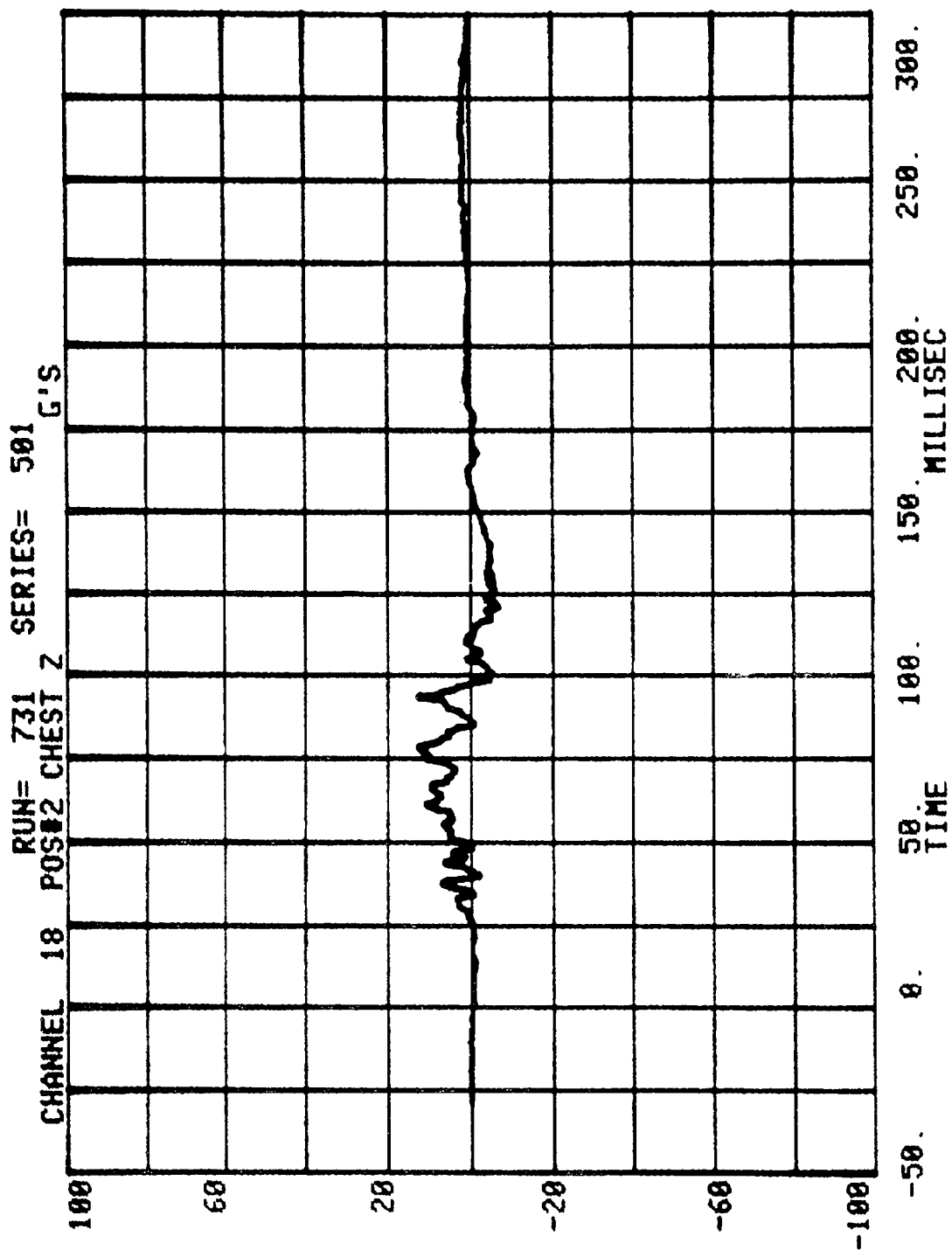


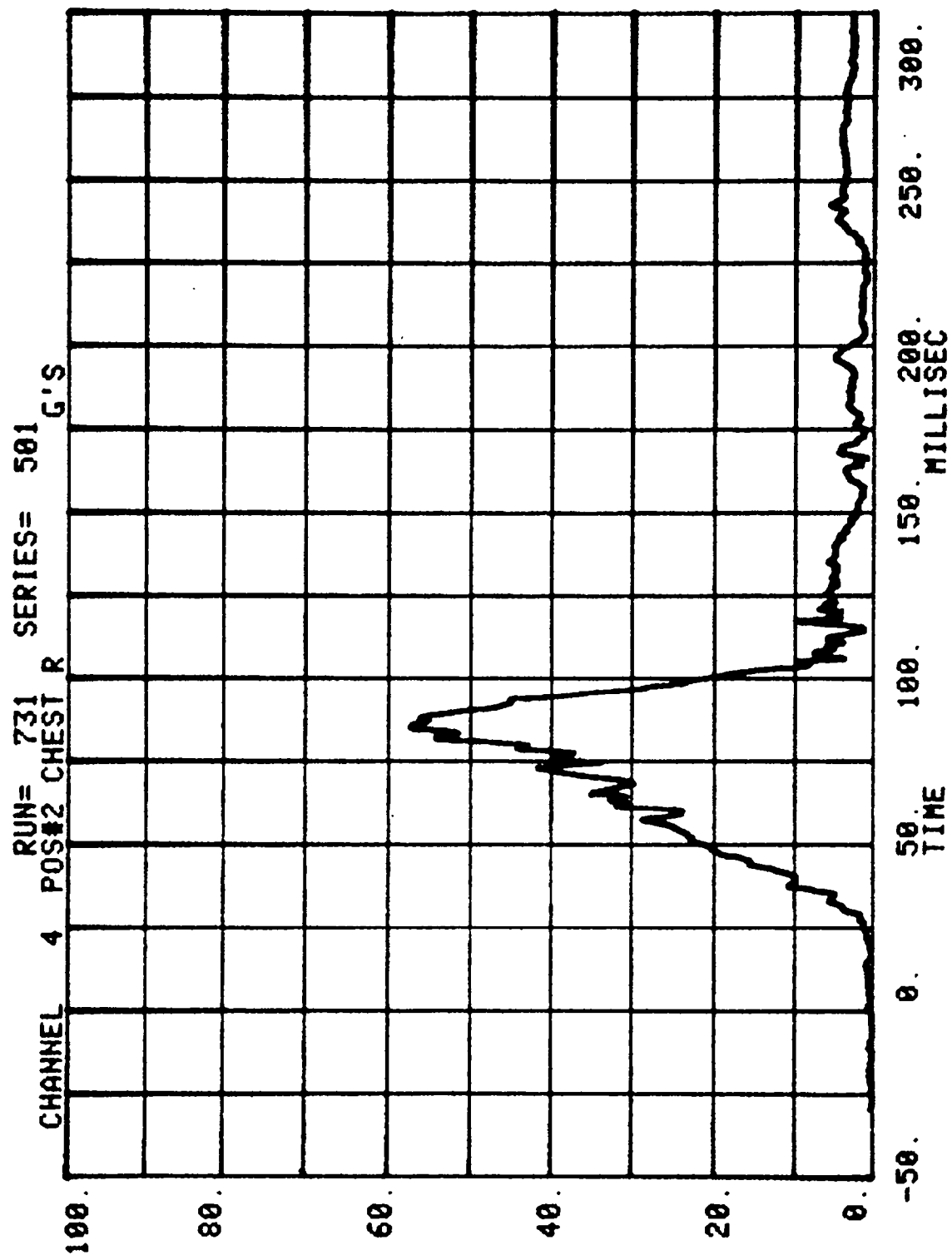


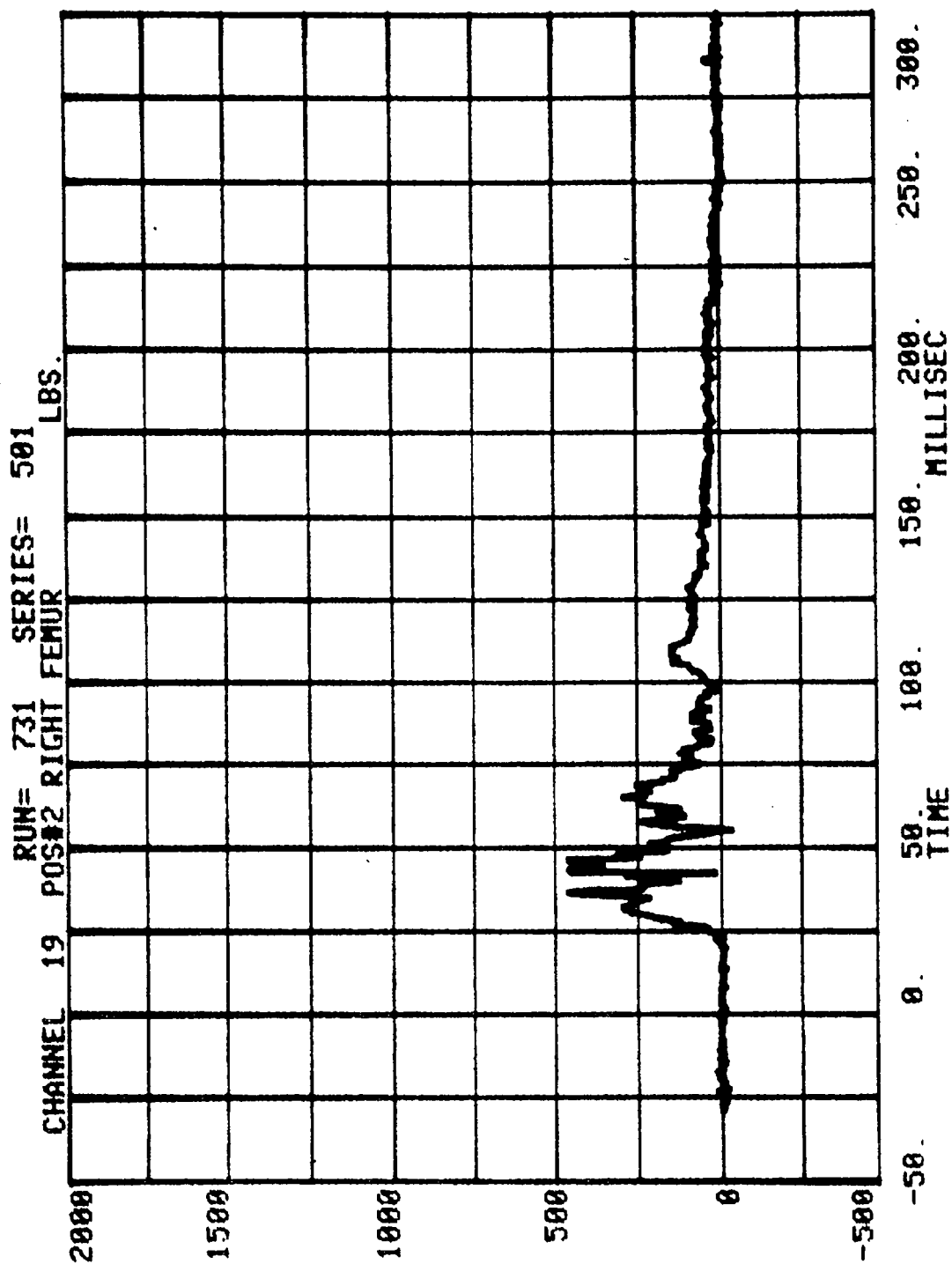


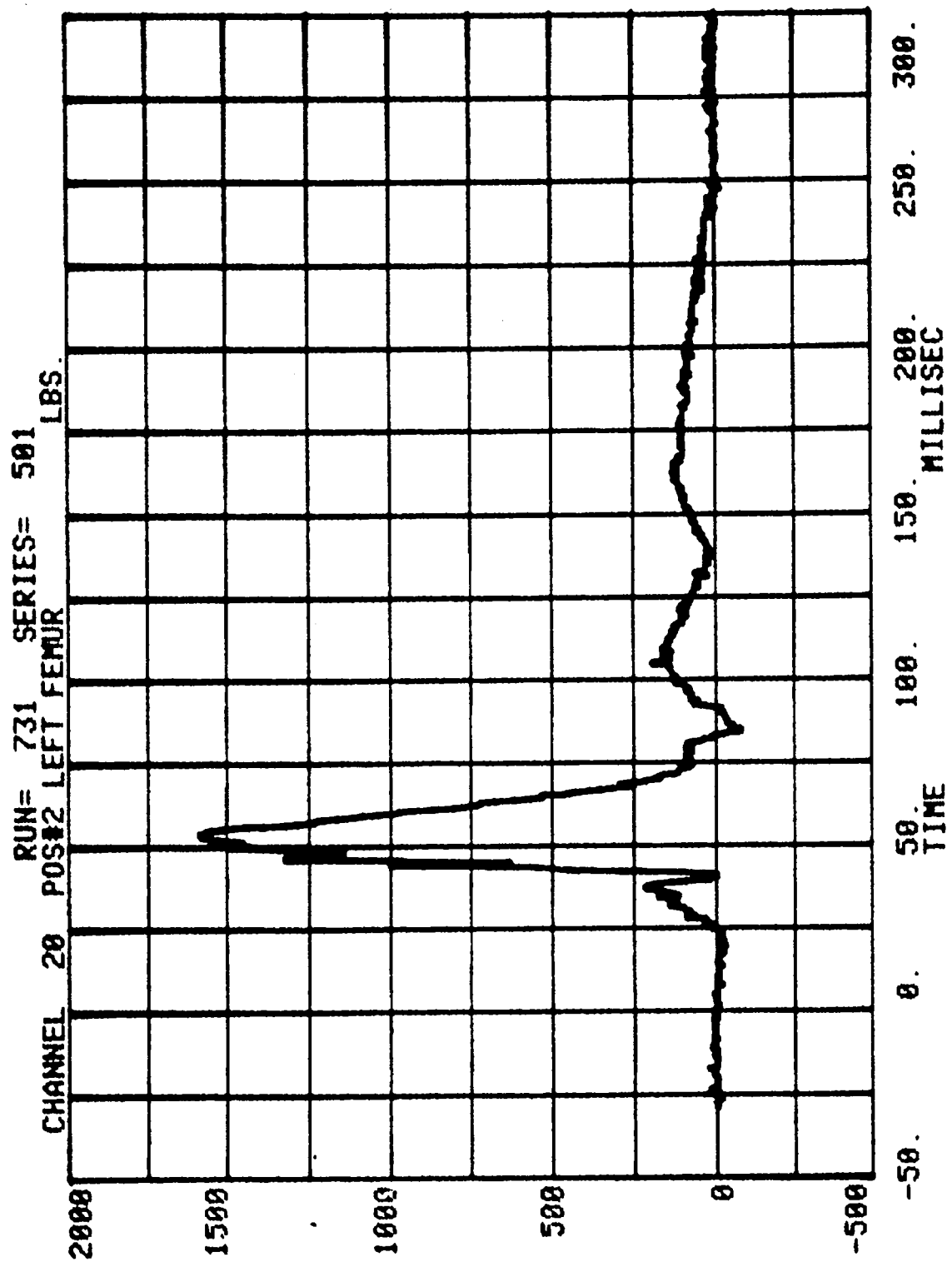


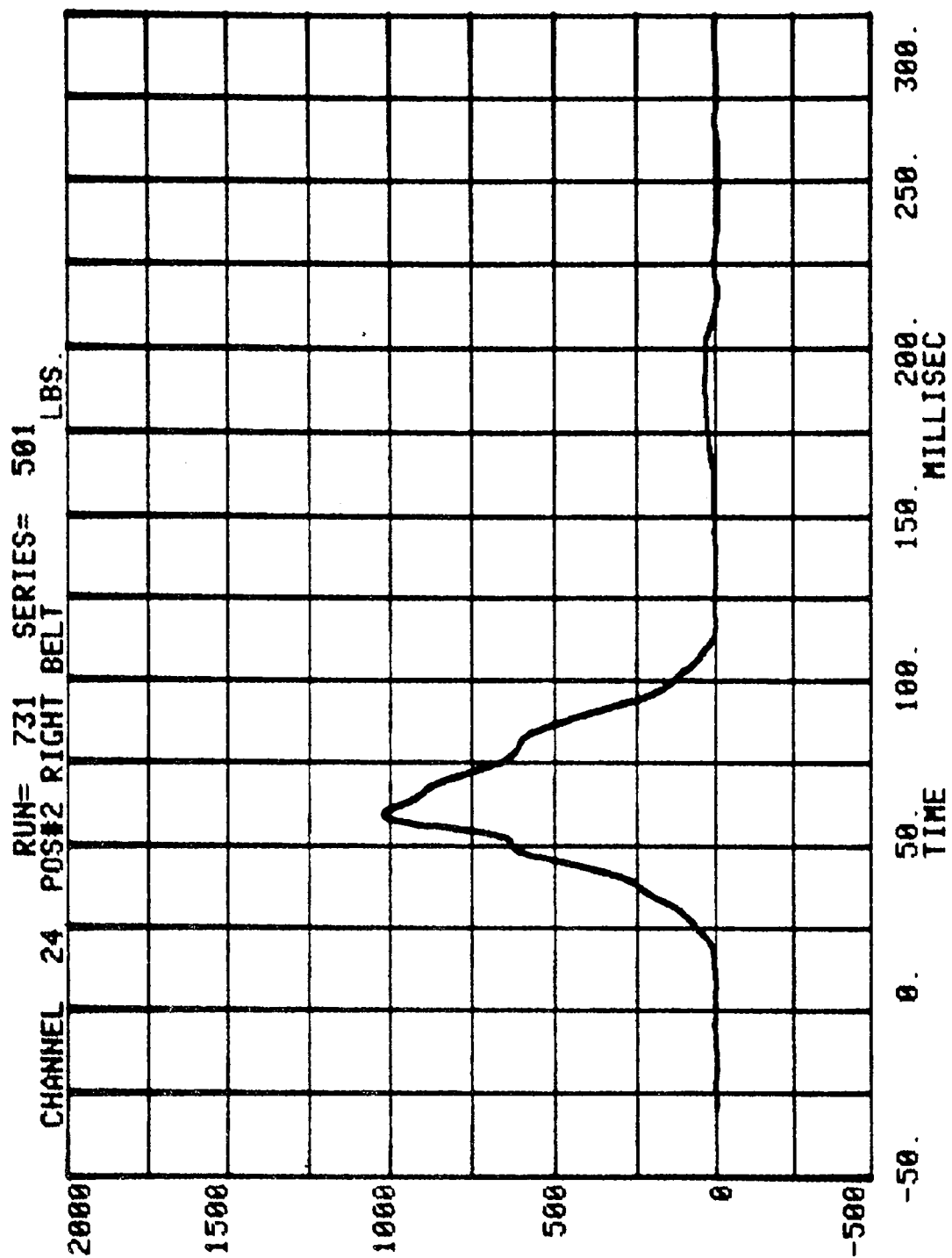


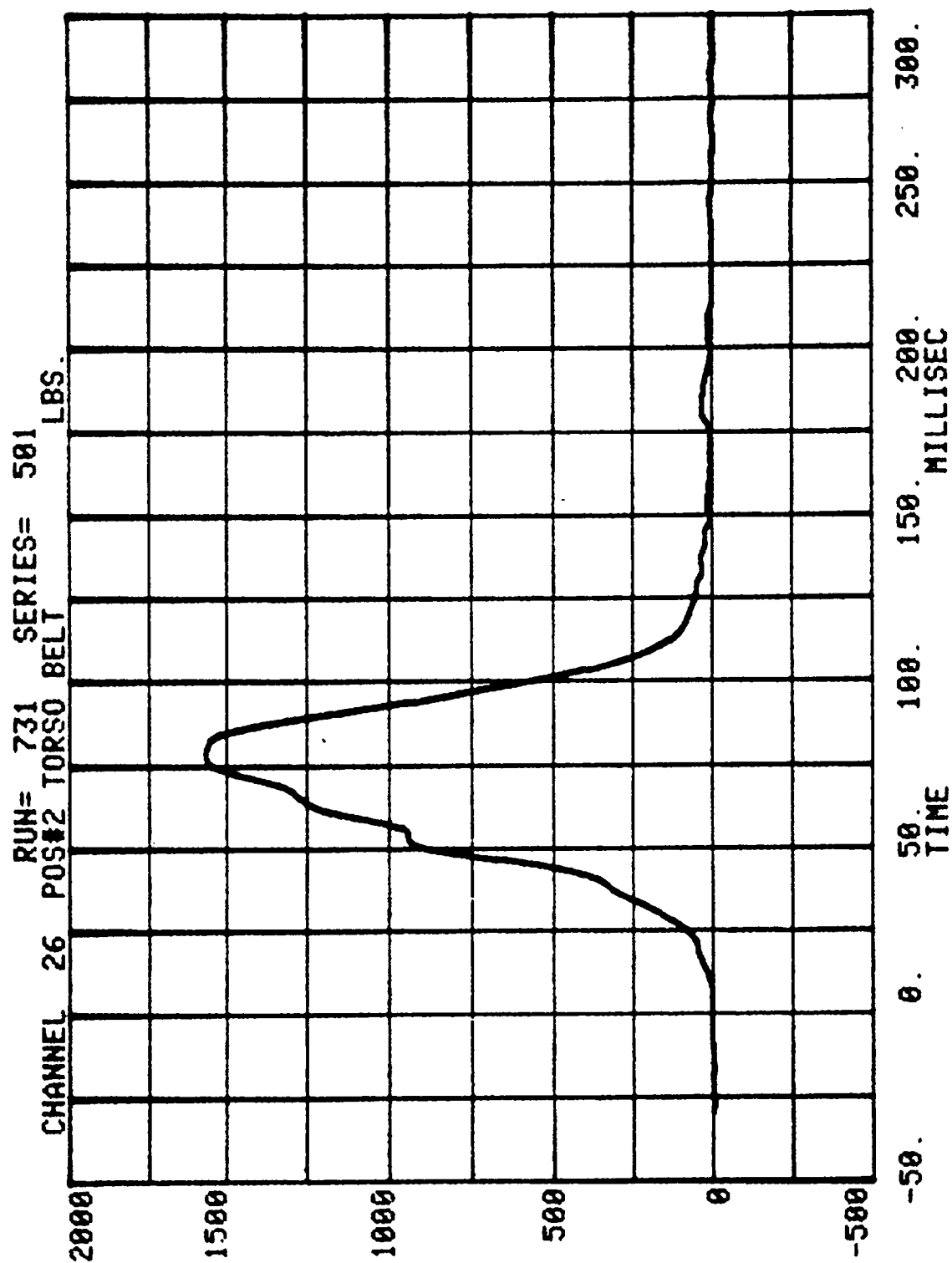


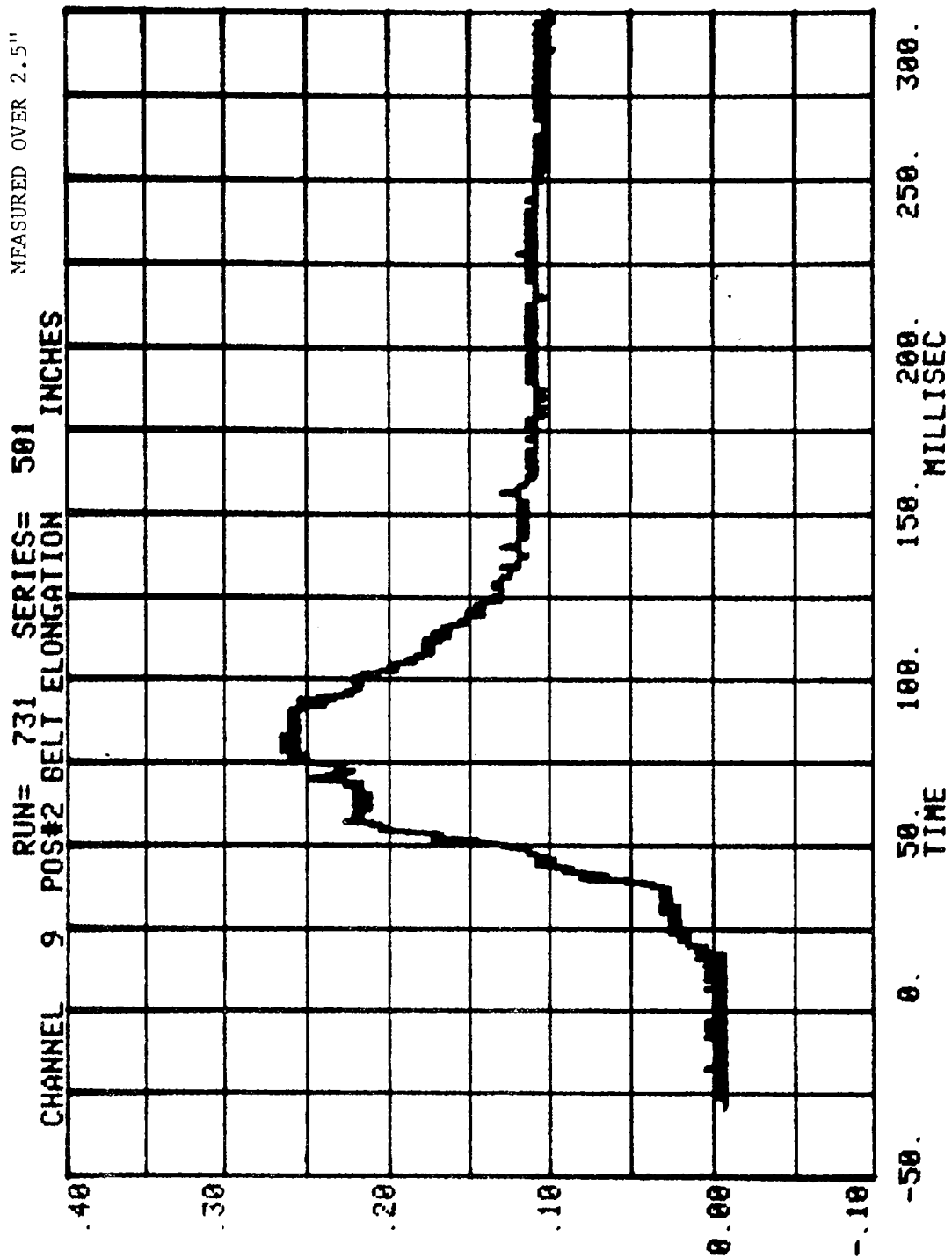








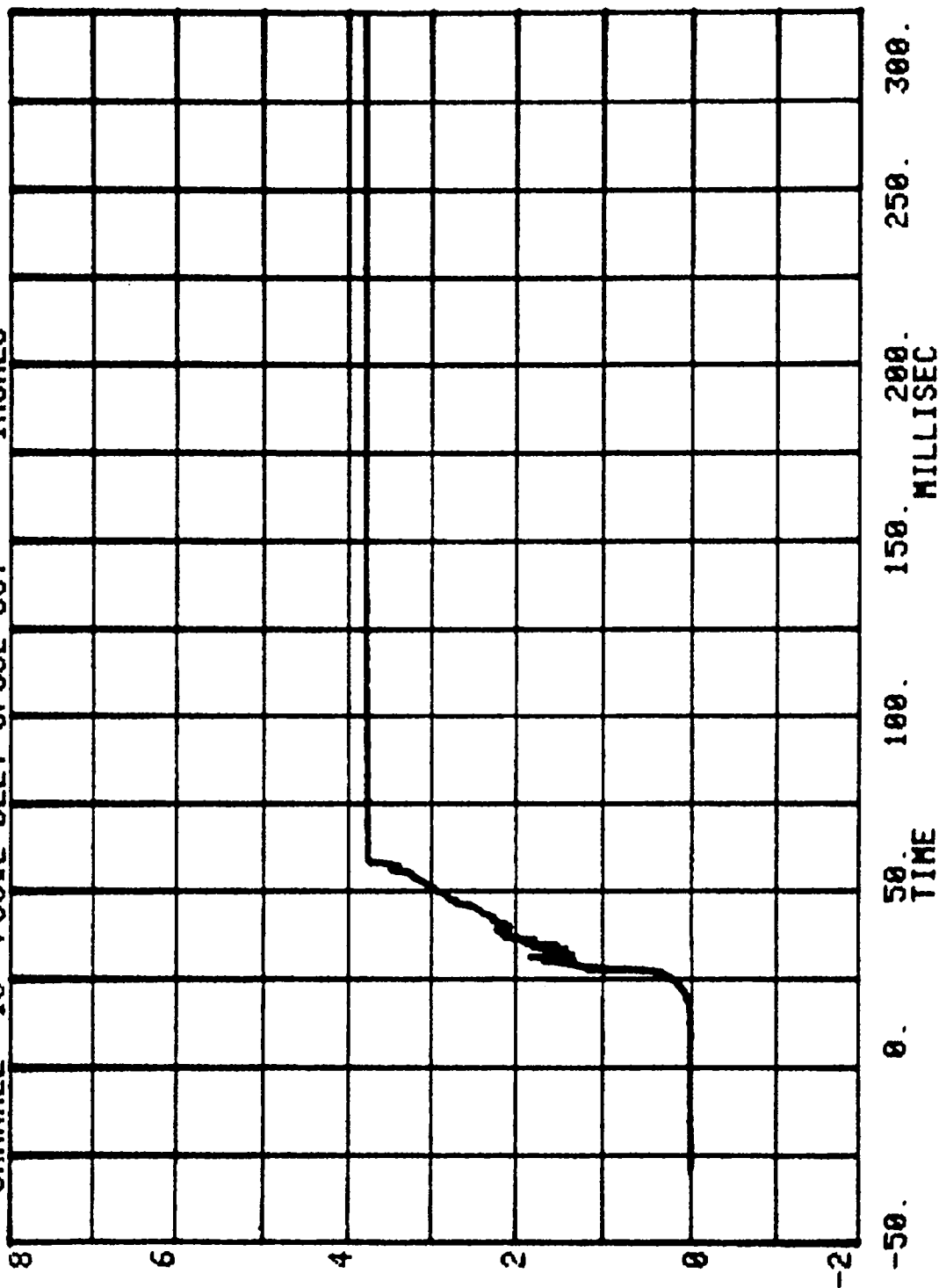




CHANNEL 10 POS#2 BELT SPOOL OUT

RUN= 731 SERIES= 501

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>
1019	5-6-86
1020	5-6-86

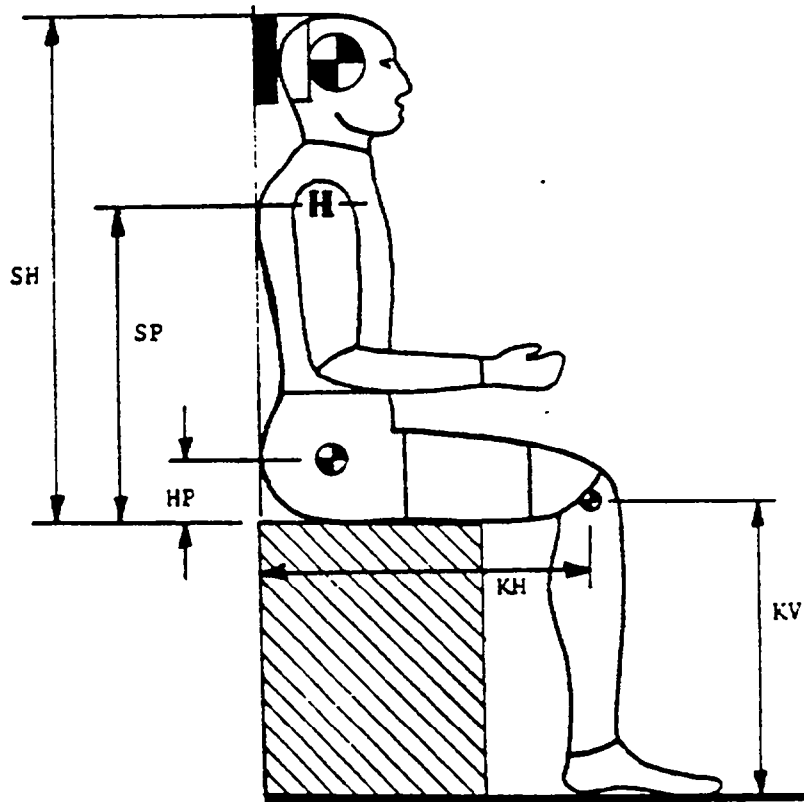
Electronic Test Equipment

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.: 1019

I. CONFIGURATION VERIFICATION DATA:



	P. 572 SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
DATE OF CONFIGURATION VERIFICATION		5-6-86	
VERIFICATION NUMBER FOR DUMMY*		4	
SH - Seated Height- - - - -	35.6 to 35.8"	35.7"	
SP - Shoulder Pivot Height- - -	21.8 to 22.4"	22.1"	
HP - Hip Pivot Height - - - - -	3.9" ref.	3.9"	
KH - Knee Pivot from back line- -	20.1 to 20.7"	20.4"	
KV - Knee Pivot from floor- - -	19.3 to 19.9"	19.6"	
SW - Shoulder Width - - - - -	17.8 to 18.4"	18.1"	
HW - Hip Width- - - - -	14.0 to 15.4"	14.8"	

TECHNICIAN'S NAME: DWH

* 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.: 1019

TECHNICIAN'S NAME: DWH

		PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION-----		5-6-86	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY*-----		4	
VERIF. LAB. TEMPERATURE (66 to 78°F Range)-----		68-76 °F.	°F.
VERIF. LAB. HUMIDITY (10 to 70% Range)		30-48 %	%
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST--			
a. Peak Resultant Accel.-	210 to 260G	247g	
b. Peak Lateral Accel.-	≤ - 10G	6g	
c. Time above 100G- - -	0.9 to 1.5ms	1.38 ms	
2. NECK BENDING TEST--			
a. Pendulum Speed - - -	21.5 to 25.5 fps	23.4 fps	
b. Pend. Avg. Decel. over t ₃ - t ₂	20 to 24G	23.5g	
c. Peak Resultant Head Acceleration - - - -	26G max.	23.5g	
d. Pendulum Decel.(t ₂ -t ₁)	≤ - 3ms	2.5 ms	
e. Pendulum Decel.(t ₃ -t ₂)	25 to 30 ms	27 ms	
f. Pendulum Decel.(t ₄ -t ₃)	≤ - 10ms	6 ms	
g. Max. Head Rotation -	63 to 73°	68°	
h. Chordal Displacement-- Head Rotation Angle-			
0°	Time- -2 to 2 ms	0.0ms	
	Displ.- -.5 to .5"	0.0"	
30°	Time- 25.6 to 34.4ms	30.2ms	
	Displ.- 2.1 to 3.1"	3.0"	
60°	Time- 40.3 to 51.7ms	46.5ms	
	Displ.- 4.3 to 5.3"	5.2"	
Maximum (68 °)	Time- 53.2 to 66.8ms	61.5ms	
	Displ.- 5.0 to 6.0"	5.7"	

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

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.:

TECHNICIAN'S NAME: DWH

TEST PARAMETER		SPECIFICATION	Pre-Test (if required)	Post-Test (if required)
2. NECK BENDING TEST.... <u>Continued:</u>				
h. Chordal Displacement:				
Head Rotation Angle--				
60°	Time	67.0 to 83.0 ms	74 ms	
	Displ.	4.3 to 5.3 in.	5.0"	
30°	Time	85.4 to 104.6 ms	93 ms	
	Displ.	2.1 to 3.1 in.	2.7"	
0°	Time	101.0 to 123.0 ms	107.7 ms	
	Displ.	-.5 to 0.5 in.	0.0"	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ .5" - - - -		23 to 36 lbs.	28 lbs	
b. Force @ .75" - - - -		36 to 50 lbs.	44 lbs	
c. Force @ 1.0" - - - -		50 to 63 lbs.	60.5 lbs	
d. Force @ 1.5" - - - -		73 to 88 lbs.	83 lbs	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - -		22 to 34 lbs.	29.5 lbs	
b. Force @ 30° - - - -		34 to 46 lbs.	36.5 lbs	
c. Force @ 40° - - - -		46 to 58 lbs.	47.5 lbs	
d. Return Angle - - - -		12° maximum	8.5°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed- - -	21.78-22.22 fps	21.85 fps		
(2) Peak Deflection- -	1.7" maximum	1.48"		
(3) Peak Resistive Force- - - - -	2250 lbs. maximum	2111.5		
(4) Internal Hysteresis - - -	50 to 70%	59.3%		
b. Low Speed				
(1) Probe Speed- - -	13.86-14.14 fps	13.89 fps		
(2) Peak Deflection- -	1.1" maximum	.96"		
(3) Peak Resistive Force- - - - -	1450 lbs. maximum	1261 lb		
(4) Internal Hyster. - -	50 to 70%	54.5%		

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

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.: 1019

TECHNICIAN'S NAME: DWH

TEST PARAMETER	SPECIFICATION	Pre-Test (if required)	Post-Test (if required)
6. KNEE IMPACT TESTS:			
a. Right Side--			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.97 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1910 lb	
(3) Time Above 1000g-	1.7 ms minimum	1.96 ms	
b. Left Side--			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.97 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1870 lb	
(3) Time Above 1000g-	1.7 ms minimum	2.0 ms	

REMARKS:

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 1019

CALIB. SEQ. NOS. FOR DUMMY: 4

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

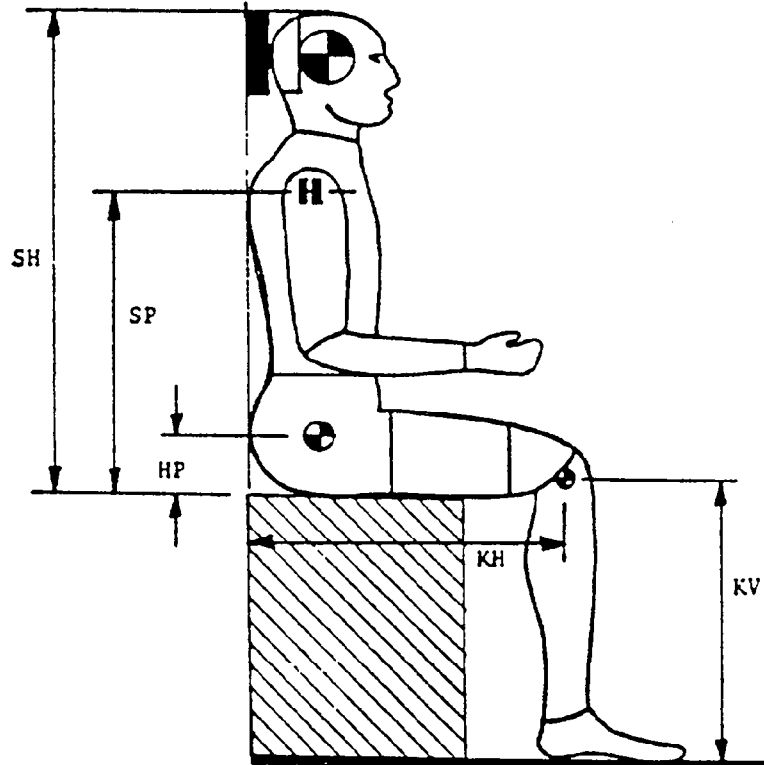
5. Abdominal Compression
Test Displacement Gauge

MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
--	-	--	--
Endevco	CL60	4/86	10/86
Endevco	CG34	4/86	10/86
Endevco	CN24	4/86	10/86
--	--	--	--
CEC	A129 18341	4/86	10/86
Endevco	CN64	4/86	10/86
CEC	A56 22705	4/86	10/86
GSE	311	4/86	10/86
GSE	312	4/86	10/86
CEC	18259 A128	4/86	10/86
CEC	17815	4/86	10/86
Transducer Inc.	20051	4/86	10/86
BLH	72952	4/86	10/86
CIC	567-11	4/86	10/86

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NO.: 1020

I. CONFIGURATION VERIFICATION DATA:



	P. 572 SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
DATE OF CONFIGURATION VERIFICATION		5-6-86	
VERIFICATION NUMBER FOR DUMMY *		4	
SH - Seated Height- - - - -	35.6 to 35.8"	35.7	
SP - Shoulder Pivot Height- - -	21.8 to 22.4"	21.9	
HP - Hip Pivot Height - - - - -	3.9" ref.	3.9	
KH - Knee Pivot from back line- -	20.1 to 20.7"	21.3	
KV - Knee Pivot from floor- - -	19.3 to 19.9"	19.7	
SW - Shoulder Width - - - - -	17.8 to 18.4"	18.2	
HW - Hip Width- - - - -	14.0 to 15.4"	14.6	

TECHNICIAN'S NAME: DWH

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

II. PERFORMANCE VERIFICATION DATA:

NHTSA DUMMY I.D. NO.:

TECHNICIAN'S NAME: DWH

		PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION-----		5-6-85	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY*-----		4	
VERIF. LAB. TEMPERATURE (66 to 78°F Range)-----		68-76 °F.	°F.
VERIF. LAB. HUMIDITY (10 to 70% Range)		30-48 %	%
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST--			
a. Peak Resultant Accel.-	210 to 260G	223 g	
b. Peak Lateral Accel.- -	≤ - 10G	7 g	
c. Time above 100G- - - -	0.9 to 1.5ms	1.16 ms	
2. NECK BENDING TEST--			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	23.7 fps	
b. Pend. Avg. Decel. over t ₃ - t ₂	20 to 24G	23.5 g	
c. Peak Resultant Head Acceleration - - - - -	26G max.	24.6 g	
d. Pendulum Decel.(t ₂ -t ₁)	≤ - 3ms	3 ms	
e. Pendulum Decel.(t ₃ -t ₂)	25 to 30 ms	26.5 ms	
f. Pendulum Decel.(t ₄ -t ₃)	≤ - 10ms	6.5 ms	
g. Max. Head Rotation - -	63 to 73°	69°	
h. Chordal Displacement-- 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"	2.9"	
60°	Time- - 40.3 to 51.7ms	45.0 ms	
	Displ.- 4.3 to 5.3"	5.1"	
Maximum	Time- - 53.2 to 66.8ms	61.5 ms	
(69 °)	Displ.- 5.0 to 6.0"	5.7"	

*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: DWH

TEST PARAMETER		SPECIFICATION	Pre-Test (if required)	Post-Test (if required)
2. NECK BENDING TEST....				
<u>Continued:</u>				
h. Chordal Displacement:				
Head Rotation Angle--				
60°	Time	67.0 to 83.0 ms	63.5 ms	
	Displ.	4.3 to 5.3 in.	5.0"	
30°	Time	85.4 to 104.6 ms	91.5 ms	
	Displ.	2.1 to 3.1 in.	2.5"	
0°	Time	101.0 to 123.0 ms	106 ms	
	Displ.	-.5 to 0.5 in.	0.0"	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ .5" - - - - -		23 to 36 lbs.	26.3 lbs	
b. Force @ .75" - - - - -		36 to 50 lbs.	41.6 lbs	
c. Force @ 1.0" - - - - -		50 to 63 lbs.	58.0 lbs	
d. Force @ 1.5" - - - - -		73 to 88 lbs.	84.0 lbs	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - - -		22 to 34 lbs.	31.5 lbs	
b. Force @ 30° - - - - -		34 to 46 lbs.	42.0 lbs	
c. Force @ 40° - - - - -		46 to 58 lbs.	52.0 lbs	
d. Return Angle - - - - -		12° maximum	8.5°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed- - - - -		21.78-22.22 fps	22.07 fps	
(2) Peak Deflection- - - - -		1.7" maximum	1.59"	
(3) Peak Resistive Force- - - - -		2250 lbs. maximum	2137 lbs	
(4) Internal Hysteresis - - - - -		50 to 70%	60.7%	
b. Low Speed				
(1) Probe Speed- - - - -		13.86-14.14 fps	13.91	
(2) Peak Deflection- - - - -		1.1" maximum	.95"	
(3) Peak Resistive Force- - - - -		1450 lbs. maximum	1236 lbs	
(4) Internal Hyster. - - - - -		50 to 70%	55.4%	

II. PERFORMANCE VERIFICATION DATA (Continued)

NHTSA DUMMY I.D. NO.: 1020

TECHNICIAN'S NAME: DWH

TEST PARAMETER	SPECIFICATION	Pre-Test (if required)	Post-Test (if required)
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side--			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.04 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1990#	
(3) Time Above 1000#-	1.7 ms minimum	1.9 ms	
b. Left Side--			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.84 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1950#	
(3) Time Above 1000#-	1.7 ms minimum	2.0 ms	

REMARKS:

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 1020

CALIB. SEQ. NOS. FOR DUMMY: 4

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 NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
---	---	---	---
Endevco	CS70	4/86	10/86
Endevco	CH35	4/86	10/86
Endevco	CU88	4/86	10/86
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CEC	A84 25189	4/86	10/86
Endevco	CY71	4/86	10/86
CEC	A86 25188	4/86	10/86
GSE	551	4/86	10/86
GSE	552	4/86	10/86
CEC	18259 A128	4/86	10/86
CEC	17815	4/86	10/86
Transducer Inc.	20051	4/86	10/86
BLH	72952	4/86	10/86
CTC	567-11	4/86	10/86

APPENDIX D

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

FEATURES OF YOUR HYUNDAI EXCEL

SEAT BELT PRECAUTIONS

All occupants of the vehicle should wear their seat belts at all times. Indeed, your state's laws may require that some or all occupants of the vehicle use seat belts. The possibility of injury or the severity of injury in an accident will be decreased if this elementary safety precaution is observed. In addition, the following recommendations are made.

Baby or Small Child

Some states require the use of child restraint systems for babies and small children. Whether this is required by law or not, it is strongly recommended that a child restraint seat or infant restraint system be used for babies or small children weighing less than 40 pounds. Information about the use of such restraints is included in the 10, 11 pages

Larger Children

It is recommended that larger children occupy the rear seat and wear their seat belts. If the child is in the front seat, it should be securely restrained by the seat belt. Under no circumstances should the child be allowed to stand or kneel on the seat.

Pregnant Women

The use of a seat belt is recommended for pregnant women to lessen the chance of injury in an accident. If a seat belt is used, it should be placed as low and snugly as possible on the hips, not across the abdomen. For specific recommendations, consult a physician.

Injured Person

A seat belt should be used when an injured person is being transported. When this is necessary, you should consult a physician for recommendations.

One Person Per Belt

Two people (including children) should never attempt to use a single seat belt. This could increase the severity of injuries in case of an accident.

Do not Lie Down

For maximum effectiveness, all passengers should be sitting up and the front seats should be in an upright position. A seat belt cannot operate properly if the person is lying down in the rear seat or if the front seat is at or near the fully reclined position.

CARE OF SEAT BELTS

Seat belt systems should never be disassembled or modified. In addition, care should be taken to assure that seat belts and belt hardware are not damaged by seat hinges, doors or other abuse.

Periodic Inspection

It is recommended that all seat belts be inspected periodically for wear or damage of any kind. Parts of the system that are damaged should be replaced as soon as possible.

Keep Belts Clean and Dry

Seat belts should be kept clean and dry. If belts become dirty, they can be cleaned using a mild soap solution and warm water. Bleach, dye, strong detergents or abrasives should not be used because they may damage and weaken the fabric.

When to Replace Seat Belts

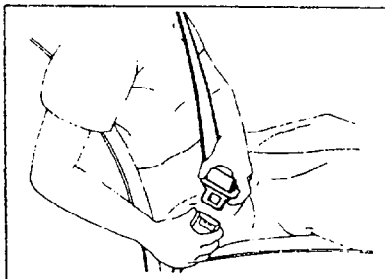
The entire seat belt assembly or assemblies should be replaced if the vehicle has been involved in an accident. This should be done even if no damage is visible.

Additional questions concerning seat belt operation should be directed to your Hyundai Dealer.

SEAT BELTS (3-Point Type)

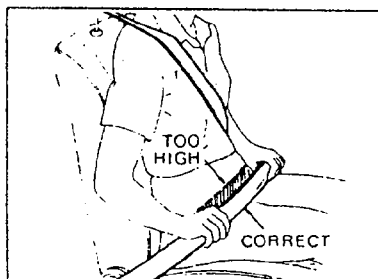
When fastening your seat belt, draw it out in one continuous motion and insert the metal tab into the buckle. If this motion is interrupted, the belt will lock and you won't be able to pull it out any further. If this happens, allow the belt to retract and try again. There will be an audible "click" when the tab locks into the buckle.

The seat belt automatically adjusts to the proper length. If you lean forward in a slow, easy motion, the belt will extend and let you move around. If there is a sudden stop or impact, however, the belt will lock into position. It will also lock if you try to lean forward too quickly.



Adjusting Your Seat Belt

You should place the belt as low as possible on your hips not on your waist. If located too high on your body the chances of sliding out from under it and being injured are increased. Do not put the shoulder belt under your arm or place your arms in such a position that they rest under the belt.



To Release the Seat Belt

The seat belt is released by pressing the release button in the locking buckle. When it is released, the belt should automatically draw back into the retractor. If this does not happen, check the belt to be sure it is not twisted, then try again.

