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REPORT NO. CAL-87-N10

NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST

CHRYSLER CORPORATION

1987 DODGE SHADOW

2-DOOR HATCHBACK

NHTSA NO. MH0301

CALSPAN TEST NO. 7556-10

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APRIL 23, 1987

FINAL REPORT

Prepared for:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF MARKET INCENTIVES
400 SEVENTH STREET, S.W.
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16. Abstract

A frontal load cell barrier test of a 1987 Dodge Shadow 2-door Hatchback was performed at the Calspan Corporation, Advanced Technology Center crash test facility in Buffalo, New York, on April 23, 1987.

Impact speed was 34.7 mph, and the ambient temperature at the barrier face at the time of impact was 67°F. The maximum post-test vehicle crush was 25.7 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" (94.9 percent retention)
2. FMVSS No. 219 (Partial), "Windshield Zone Intrusion"
3. FMVSS No. 301-75, "Fuel System Integrity"

Type of Restraint System 3-point continuous webbing manual system at each front outboard seating position.

17. Key Words **35 mph Frontal Barrier Impact Test** **New Car Assessment Program (NCAP)** **FMVSS 212 Indicant Testing** **FMVSS 219 (Partial) Indicant Testing** **FMVSS 301-75 Indicant Testing**	18. Distribution Statement **Copies of this report are available from:** **Technical Reference Division** **National Highway Traffic Safety Admin.** **Nassif Building, Room 5108** **400 Seventh St., S.W., Washington, DC 20590**		
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Section 1

PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY 87 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 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 MH0301

A load cell barrier consisting of 36 load cells was impacted by a 1987 Dodge Shadow 2-door Hatchback at a velocity of 34.7 mph. The test was performed at the Calspan Corporation Advanced Technology Center on April 23, 1987. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

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

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

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

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

The driver's head struck the steering wheel rim and hub and the HIC was 1488. The maximum chest deceleration over 3 milliseconds was 49 g's and femur loads were 748 and 1003 pounds.

The right front passenger's head struck the dash panel and his HIC was 653. The maximum chest deceleration over 3 milliseconds was 36 g's and femur loads were 486 and 529 pounds.

Table 1

GENERAL TEST AND VEHICLE DATA

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1987 Dodge Shadow 2-Door Hatchback

NHTSA NO.: MH0301 VIN.: 1B3BS44DXHN416239

BODY COLOR: Silver DATE OF MANUFACTURE: 1/87

Engine: 4 cylinders; - C.I.D.; 2.2 Liters; - CC
x Gas; - Diesel; - Turbocharged
- Longitudinal; x Transverse

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

Date Received: 2/27/87 Odometer Reading: 28
- 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: 185/70R14

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

Tires on Vehicle: P185/70R14; 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) = 865 lbs. (A)

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

Rated Cargo and Luggage Weight (RCLW) A-B = 115 lbs.

GVWR 3569 lbs. GAWR: Front 1911 lbs. Rear 1733 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 = 780 lbs. Right Rear = 490 lbs.

Left Front = 790 lbs. Left Rear = 490 lbs.

TOTAL FRONT WEIGHT = 1570 lbs. (61.6 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 980 lbs. (38.4 % of Total Vehicle Weight)

TOTAL DELIVERY WEIGHT = 2550 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (2550 lbs.)

VCW = Vehicle Capacity Weight (865 lbs.)

DSC = Designated Seating Capacity (5)

RCLW = VCW - 150 (DSC) = 115 lbs.

Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)

Target Test Weight = 2993 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 122 POUNDS CARGO:

Right Front = 830 lbs. Right Rear = 670 lbs.

Left Front = 830 lbs. Left Rear = 670 lbs.

TOTAL FRONT WEIGHT = 1660 lbs. (55.3 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 1340 lbs. (44.7 % of Total Vehicle Weight)

TOTAL TEST WEIGHT = 3000 lbs.

Weight of ballast secured in vehicle trunk area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude: RF 26.3 LF 26.6 RR 26.2 LR 26.1

Test Attitude: RF 25.9 LF 26.1 RR 24.1 LR 24.1

Wheel Base: 97.0 in.; C.G. = 43.3 in. rearward of front wheel C/L

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Angle: 0 o

Date of Test: 4/23/87 Time of Test: 1120

Ambient Temperature: 67 °F at impact area

Temperature in Occupant Compartment: 71 °F.

Windshield Molding Temperature: 71 °F.

Required Impact Velocity Range: 34.5 to 35.5 mph

Impact Velocity: primary = 34.7 mph, secondary = 34.6 mph

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

VEHICLE REBOUND AND CRUSH (inches):

Vehicle Length:	Pre-test	= R	168.0	C_L	171.8	L	167.8
	Post-test	= R	145.0	C_L	146.1	L	143.6
	Crush	= R	23.0	C_L	25.7	L	24.2

Distance from front of test vehicle to point of impact:

R 22.3 C/L 22.3 L 22.7

VISIBLE DUMMY CONTACT POINTS:

	Driver	Passenger
Head	Upper steering wheel rim and hub	dash panel
Chest	Lower steering wheel rim	None
Abdomen	None	None
Left Knee	Dash Panel	Glove Compartment door
Right Knee	Dash Panel	Glove Compartment door

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

	Front	
	Left	Right
Door Opening	Tools Required	Operable

	Front	
Seat Movement	Left	Right
Seat Back Failure	None	None
Seat Shift (in.)	None	None

Glazing Damage

Backlight/Windshield Windshield has stress cracks and 8.0 inches retention loss (Figure A-13)

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.:

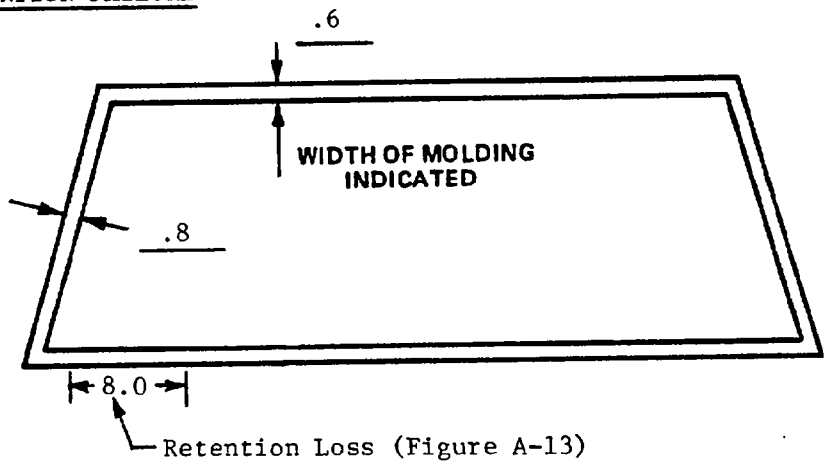
Windshield is bonded in place and has a rubber molding along the top and sides

FMVSS 212 REQUIREMENTS: **The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery mesurement 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 PREIPHERY		
	PRE-TEST (in.)	POST-TEST (in.)	PERCENT RETENTION
RIGHT SIDE	78.75	70.75	89.8
LEFT SIDE	78.75	78.75	100.0
TOTAL	157.5	149.5	94.9

AREA OF RETENTION FAILURE:



FRONT VIEW

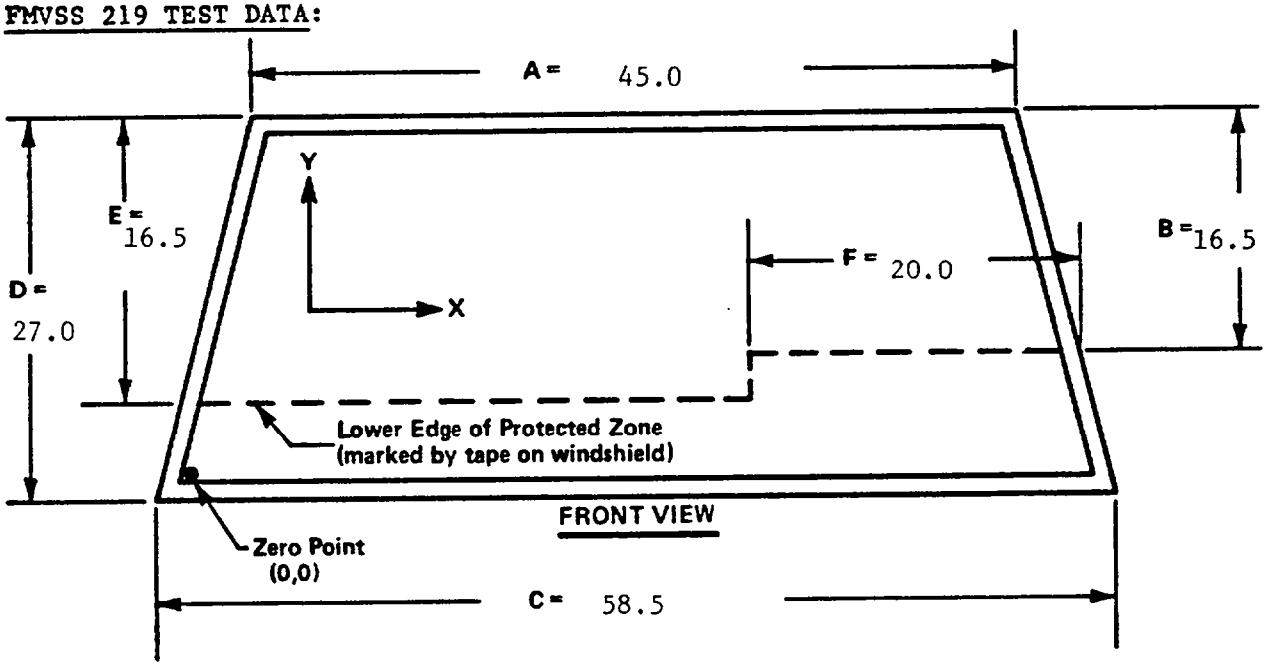
Figure 2

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 edges of the windshield, and then draw a line on the inner surface of the windshield below and 1/2" distant from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection 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.: MH0301 ; TEST DATE: 4/23/87

VEHICLE MAKE/MODEL/BODY STYLE: 1987 Dodge Shadow 2-Door Hatchback

USABLE CAPACITY OF VEHICLE'S FUEL TANK: 14 Gallons (figure furnished by vehicle manufacturer)

TEST REQUIREMENTS:

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

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

13.0 Gallons which is 93 % of the Stated USABLE CAPACITY.

SOLVENT SPILLAGE MEASUREMENT AFTER 35 MPH FRONTAL BARRIER IMPACT TEST:

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

SOLVENT SPILLAGE DETAILS:

NONE

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

Time reqd. for machine to rotate 90°	=	2 minutes,	57	seconds
FMVSS 301-75 Position Hold Time	=	5 minutes,	00	seconds
TOTAL	=	7 minutes,	57	seconds
Next Whole Minute Interval....	=	8 minutes		

Figure 3

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

VEHICLE STATIC ROLLOVER DATA:

	First 5 Minutes 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
3. Test Vehicle Measurements

Table 2

DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G")							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DUMMY (1)	-219	-88	102	233	-51	-18	-25	49
DUMMY (2)	-57	-40	70	93	-37	26	-13	36
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE - FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	748	1003
DUMMY (2)	486	529
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)	1700	-	883
DUMMY (2)	1656	1085	-
DUMMY (3)			
DUMMY (4)			

	HEAD INJURY CRITERIA**			
		36 Millisecond Max.		AVE. ACC. (g)
	HIC	t_1 (SEC)	t_2 (SEC)	t_1 TO t_2
DUMMY (1)	1488	.07395	.09315	90
DUMMY (2)	653	.09150	.11587	59
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

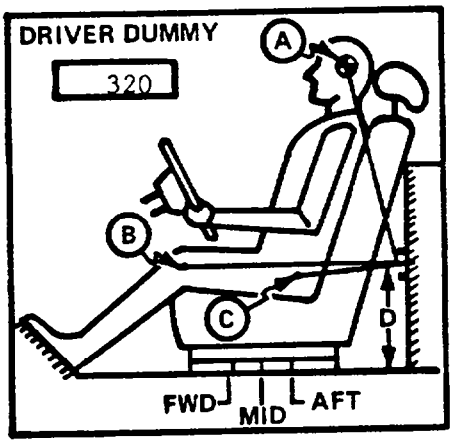
TEST NO.: MH0301

VEHICLE: 1987 Dodge Shadow 2-dr Hatchback

SEAT TYPE:
- ____ Bench
- x Bucket
- ____ Split Bench

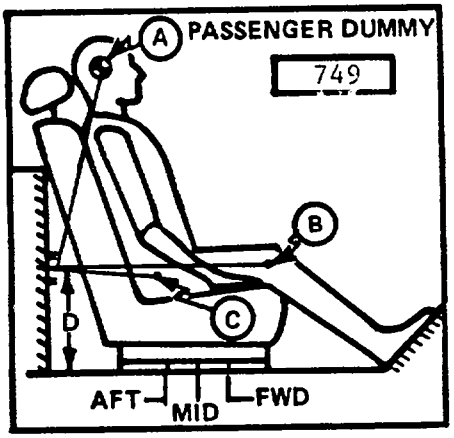
ADJUSTER TYPE:
- x Manual
- ____ Power

BUCKET SEAT BACK TYPE:
- ____ Fixed
- x Adjustable Reclining



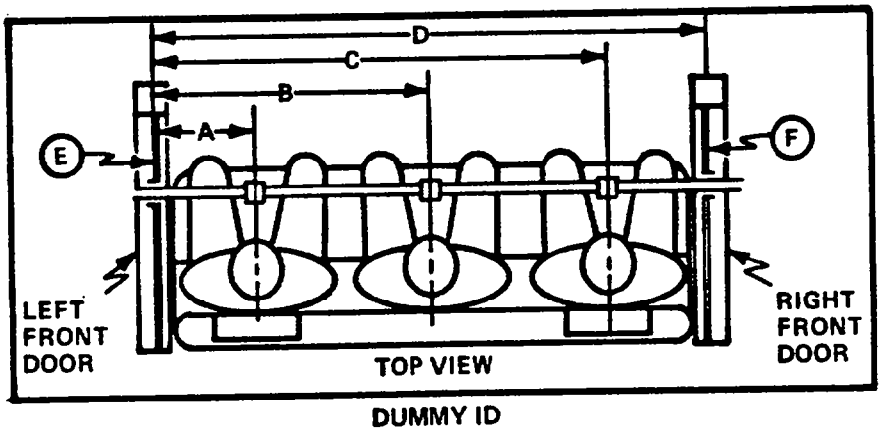
MEASUREMENT LOCATION

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



A =	26.1	in.	35	Degrees
B =	36.5	in.	95	Degrees
C =	20.8	in.	108	Degrees
D =	14.2	in.		

A =	26.7	in.	35	Degrees
B =	36.8	in.	92	Degrees
C =	21.7	in.	105	Degrees
D =	14.2	in.		

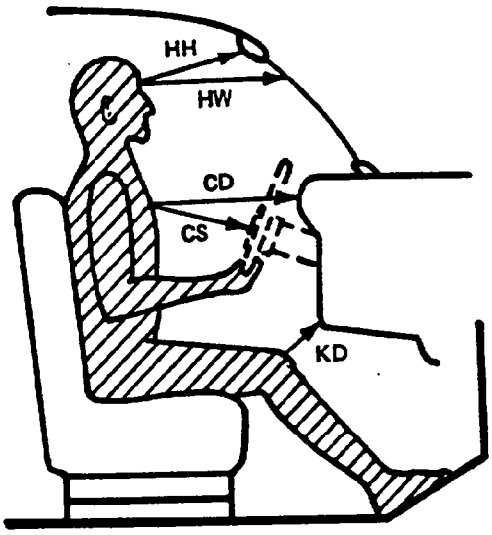


	DUMMY ID 320	DUMMY ID 749
A = Left Door to Driver Centerline	12.2 in.	
B = Left Door to Center Passenger Centerline	- in.	
C = Left Door to Right Passenger Centerline	38.2 in.	
D = Left Door to Right Door	50.5 in.	
E, F = Window Glass Height (Right and Left Must Be Equal)	11.9 in.	

Figure 5

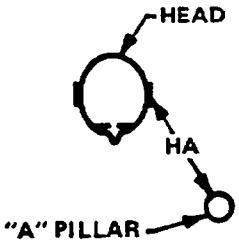
OCCUPANT CLEARANCE DIMENSIONS

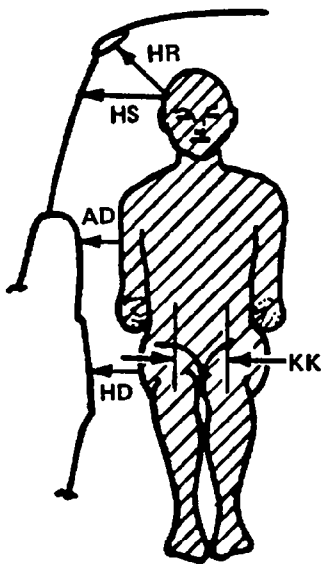
	DRIVER	PASSENGER
HH	13.7	14.1
HW	19.2	19.3
CD	20.0	22.0
CS	12.6	-
KDL	6.7	5.0
KDR	6.5	5.4
SA	6th notch	6th notch
TA	25°	25°



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

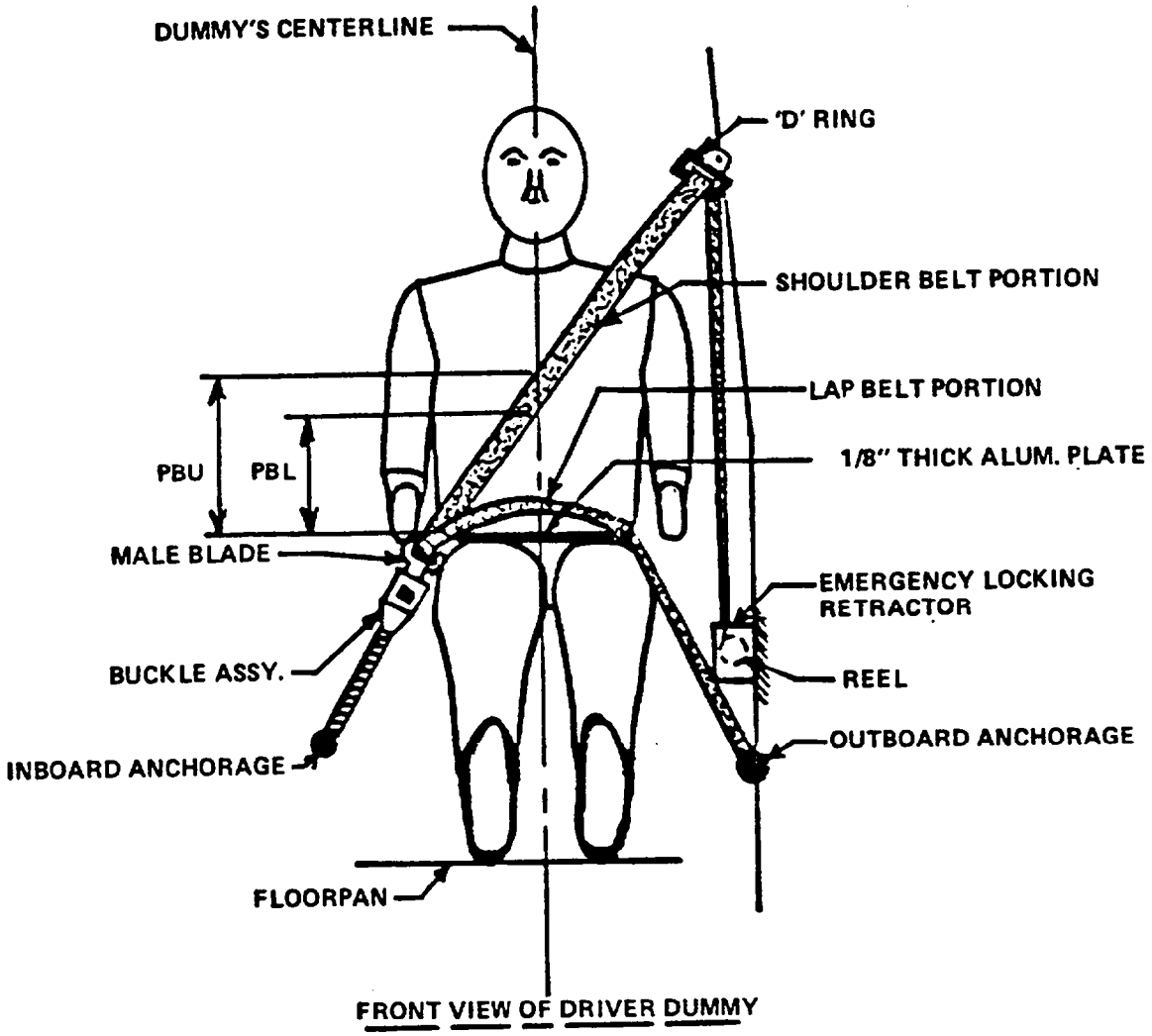




	DRIVER	PASSENGER
HR	5.5	5.6
HS	9.1	9.2
AD	3.9	5.0
HD	7.8	6.9
KK	11.2	8.5
HA	19.0	18.8

Figure 6

SEAT BELT POSITIONING DATA



	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
PBU -- Top surface of alum. plate to upper edge	14.0	14.0
PBL -- Top surface of alum. plate to belt lower edge	10.6	10.5
LAP BELT TENSION	-	-
SHOULDER BELT TENSION	2.0 lb	2.0 lb

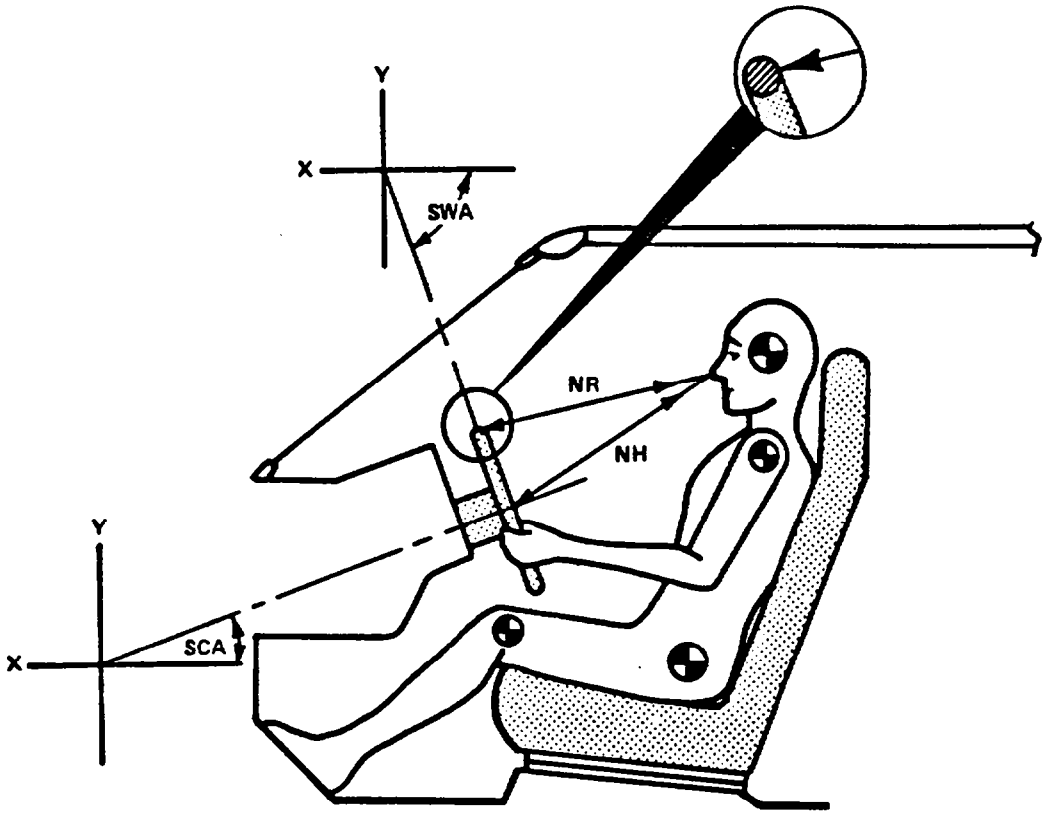
Table 3

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

	Driver	Passenger
BELT LENGTH DATA:		
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems.	93.5	93.5
Should belt length as measured on Part 572 Dummy.	38.0	38.0
Lap belt length as measured on Part 572 Dummy.	31.5	31.5
BELT SPOOL-OFF DATA:		
As determined by film analysis.	4.5	3.2
As determined mechanically.	4.0	3.5
As determined electronically.	3.7	3.4
BELT STRETCH DATA:		
Measured electronically between shoulder belt load cell and the "D" ring.	1.9 in per ft	.9 in per ft
Measured Mechanically	0	0

Figure 7

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



LEFT SIDE VIEW

	MEASUREMENTS	
NR -- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim	17.2	Inches
NH -- Distance from tip of dummy's nose to center of steering column hub	18.5	Inches
SCA -- Angle of steering column relative to the horizontal X axis	25	Degrees
SWA -- Angle of steering wheel relative to the horizontal X axis	-65	Degrees

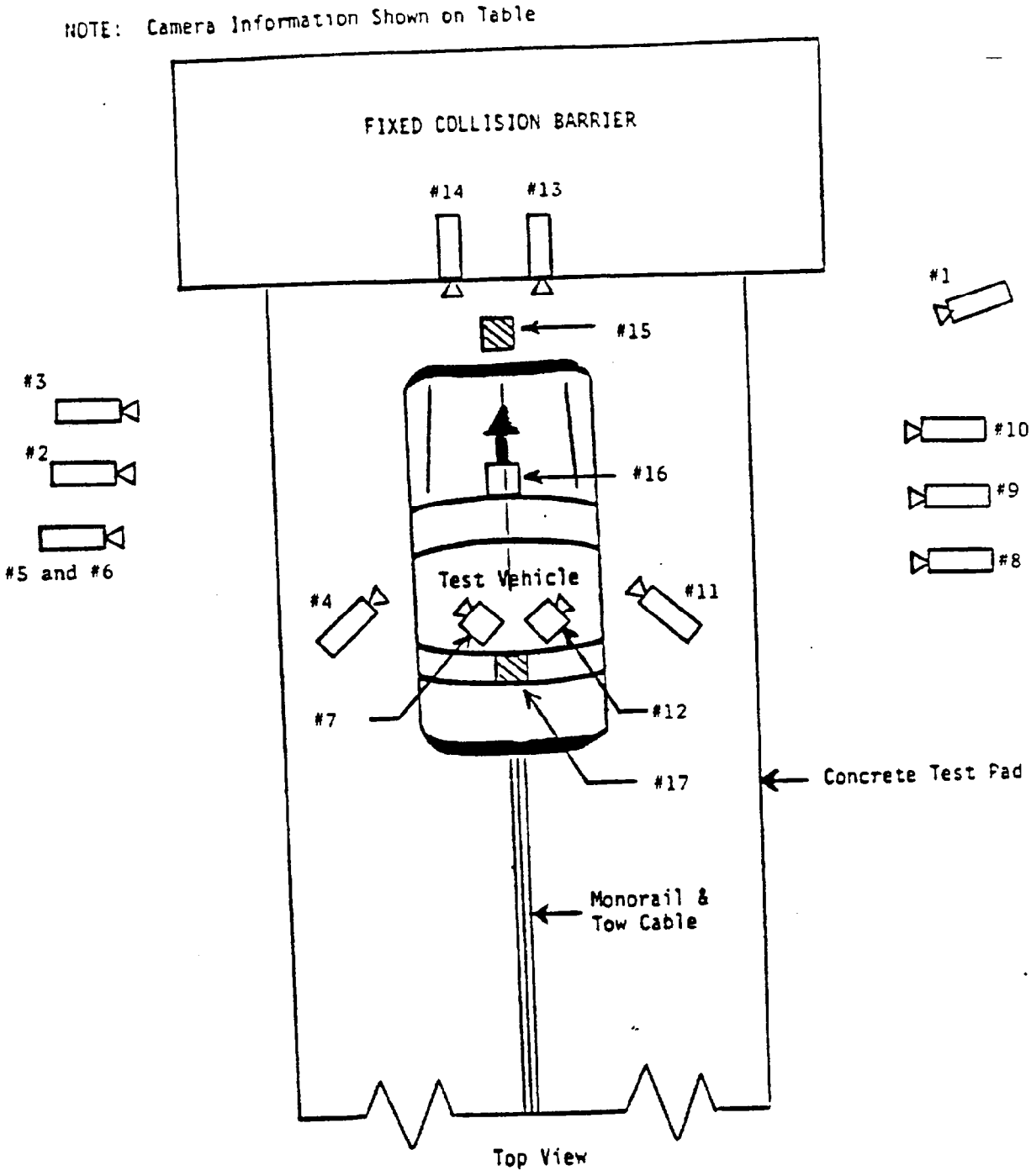


Figure 8

CAMERA POSITIONS FOR FRONTAL IMPACTS

Table 4
HIGH-SPEED CAMERA LOCATIONS

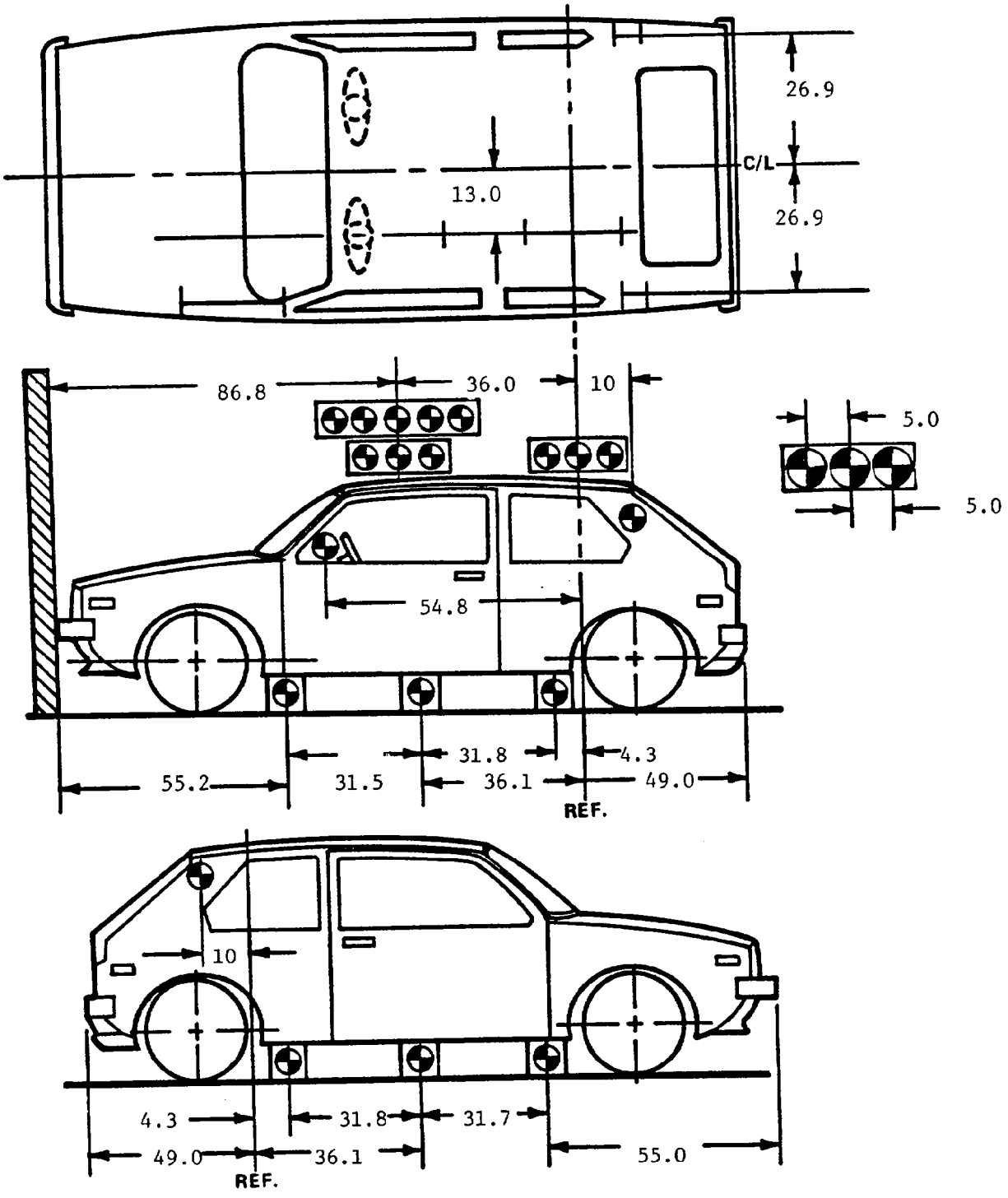
Test No. MH0301 Vehicle 1987 Dodge Shadow 2-Door Hatchback

CAMERA NO.	VIEW	CAMERA POSITIONS (in)* X	Y	Z	ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
1	Real-Time Camera	-	-	-	-	-	-	24
2	Overall Left Side	262	45	42	-2	-	13	525
3	Left Side View	251	40	43	-5	-	25	525
4	Driver and Interior View	105	114	70	-16	-	13	650
5	Steering Column (Bottom)	240	78	52	-6	224	25	540
6	Steering Column (Top)	240	78	77	-13	224	25	525
7	Left Belt	-	-	-	-	-	8	No Timing
8	Overall Right Side	246	47	43	-1	-	13	790
9	Right Side View	260	70	44	-4	-	25	750
10	Right Passenger View	276	86	42	-3	260	35	No Timing
11	Passenger & Interior View	87	101	66	-15	-	25	590
12	Right Belt	-	-	-	-	-	8	No Timing
13	Passenger Front View	24	0	72	-40	-	13	550
14	Driver Front View	24	0	72	-40	-	13	580
15	Windshield View	0	0	126	-55	-	13	540
16	Pit View of Engine	0	32	-120	90	-	13	740
17	Pit View of Fuel Tank	0	63	-120	90	-	13	770

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

Figure 9

VEHICLE TARGET LOCATIONS



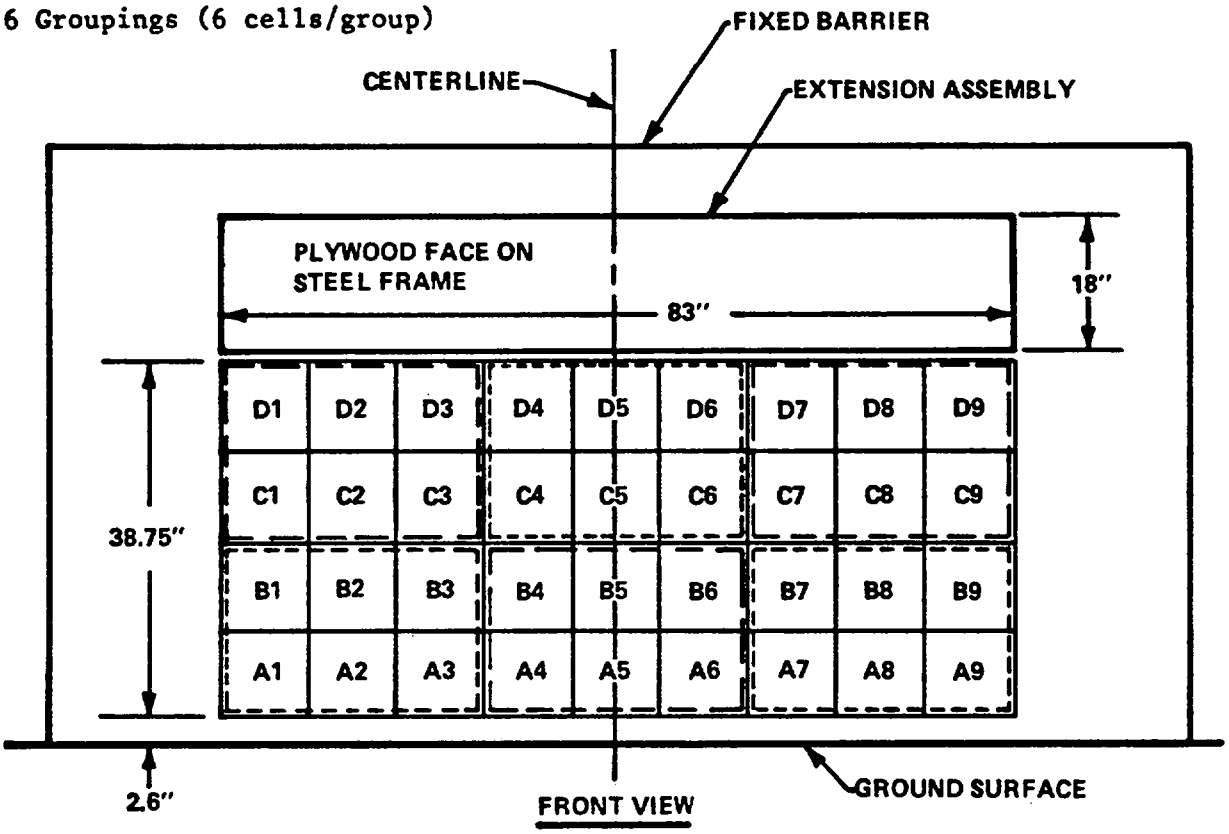
(DIMENSIONS IN INCHES)

7556-10

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

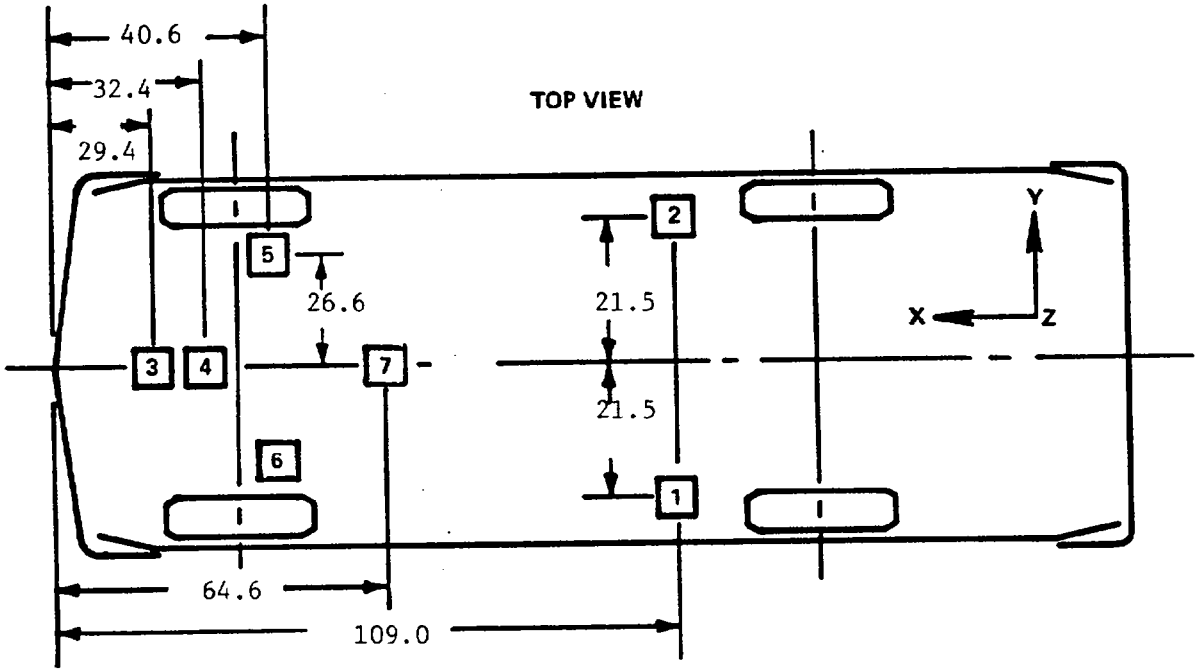
Group 4 C1 thru D3	Group 5 C4 thru D6	Group 6 C7 thru D9
Group 1 A1 thru B3	Group 2 A4 thru B6	Group 3 A7 thru B9

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



Engine accelerometer No. 3 and 4 experienced cut wires approximately 30 milliseconds into crash event.

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	Left Disc Brake Caliper	x		
7	Instrument Panel	x		

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

Figure 12

TEST VEHICLE MEASUREMENTS

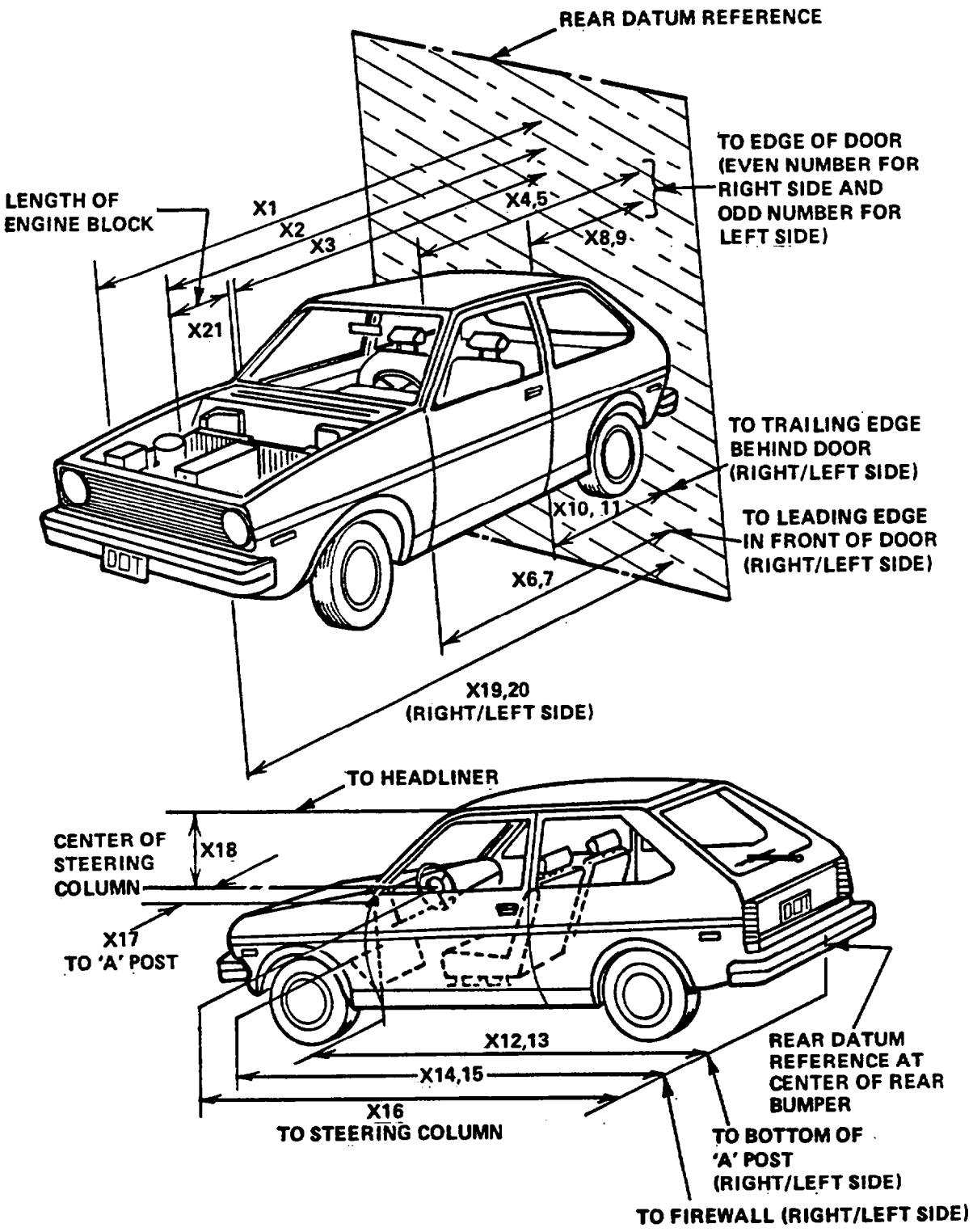


Table 5

VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	171.8	146.1	25.7
X2	Rear Surface of Vehicle to Front of Engine	143.7	136.5	7.2
X3	Rear Surface of Vehicle to Firewall	126.1	120.8	5.3
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	114.6	113.6	1.0
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	113.5	112.5	1.0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	113.3	113.0	.3
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	112.9	112.4	.5
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	62.9	62.5	.4
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	62.5	62.0	.5
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	62.0	61.4	.6
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	61.0	60.5	.5
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	113.5	113.0	.5
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	113.0	112.5	.5
X14	Rear Surface of Vehicle to Firewall, Right Side	122.7	114.8	7.9
X15	Rear Surface of Vehicle to Firewall, Left Side	123.3	115.5	7.8
X16	Rear Surface of Vehicle to Steering Column	95.4	92.2	3.2
X17	Center of Steering Column to "A" Post	16.5	14.7	1.8
X18	Center of Steering Column to Headliner	17.1	14.2	2.9
X19	Rear Surface of Vehicle to Right Side of Front Bumper	168.0	145.0	23.0
X20	Rear Surface of Vehicle to Left Side of Front Bumper	167.8	143.6	24.2
X21	Length of Engine Block	17.0	17.0	0.0

Appendix A

PHOTOGRAPHS

Figure A-1 PRE-TEST FRONT VIEW

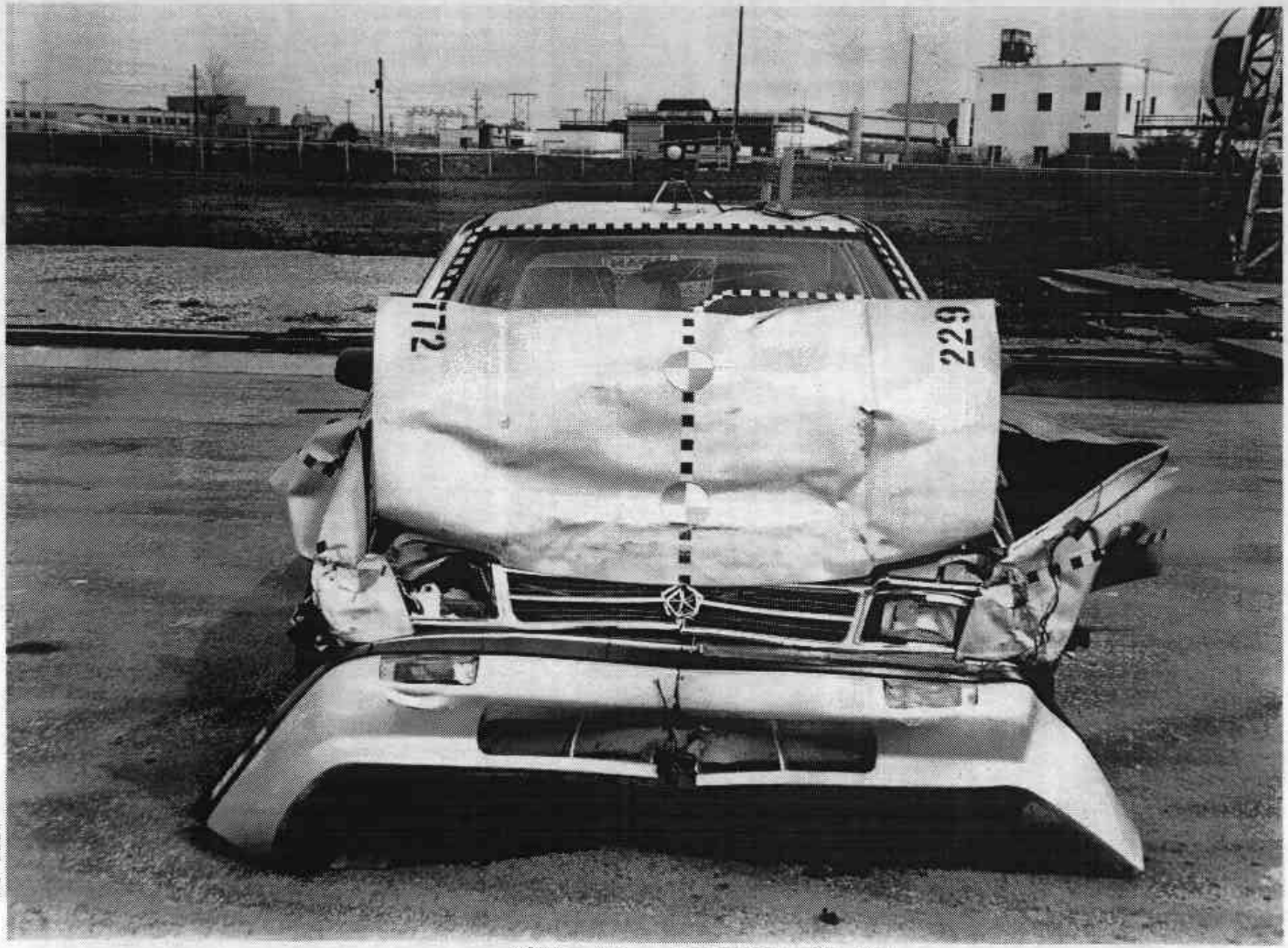


Figure A-2 POST-TEST FRONT VIEW

Figure A-3 PRE-TEST LEFT SIDE VIEW

Figure A-4 POST-TEST LEFT SIDE VIEW

Figure A-5 PRE-TEST RIGHT SIDE VIEW

Figure A-6 POST-TEST RIGHT SIDE VIEW

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

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

7556-10

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

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

Figure A-11 TOP VIEW

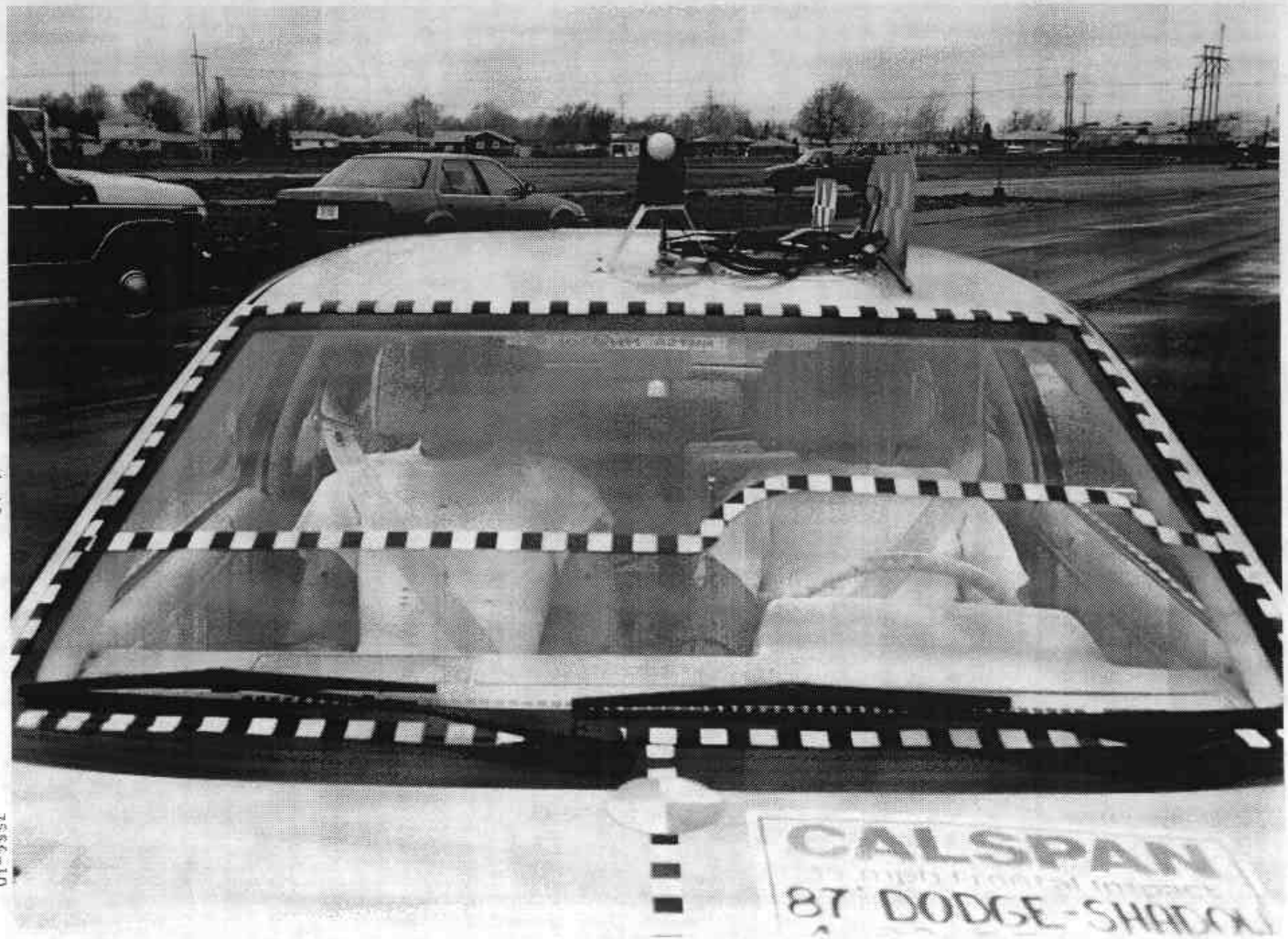


Figure A-12 PRE-TEST WINDSHIELD VIEW

7556-10

Figure A-13 POST-REST WINDSHIELD VIEW

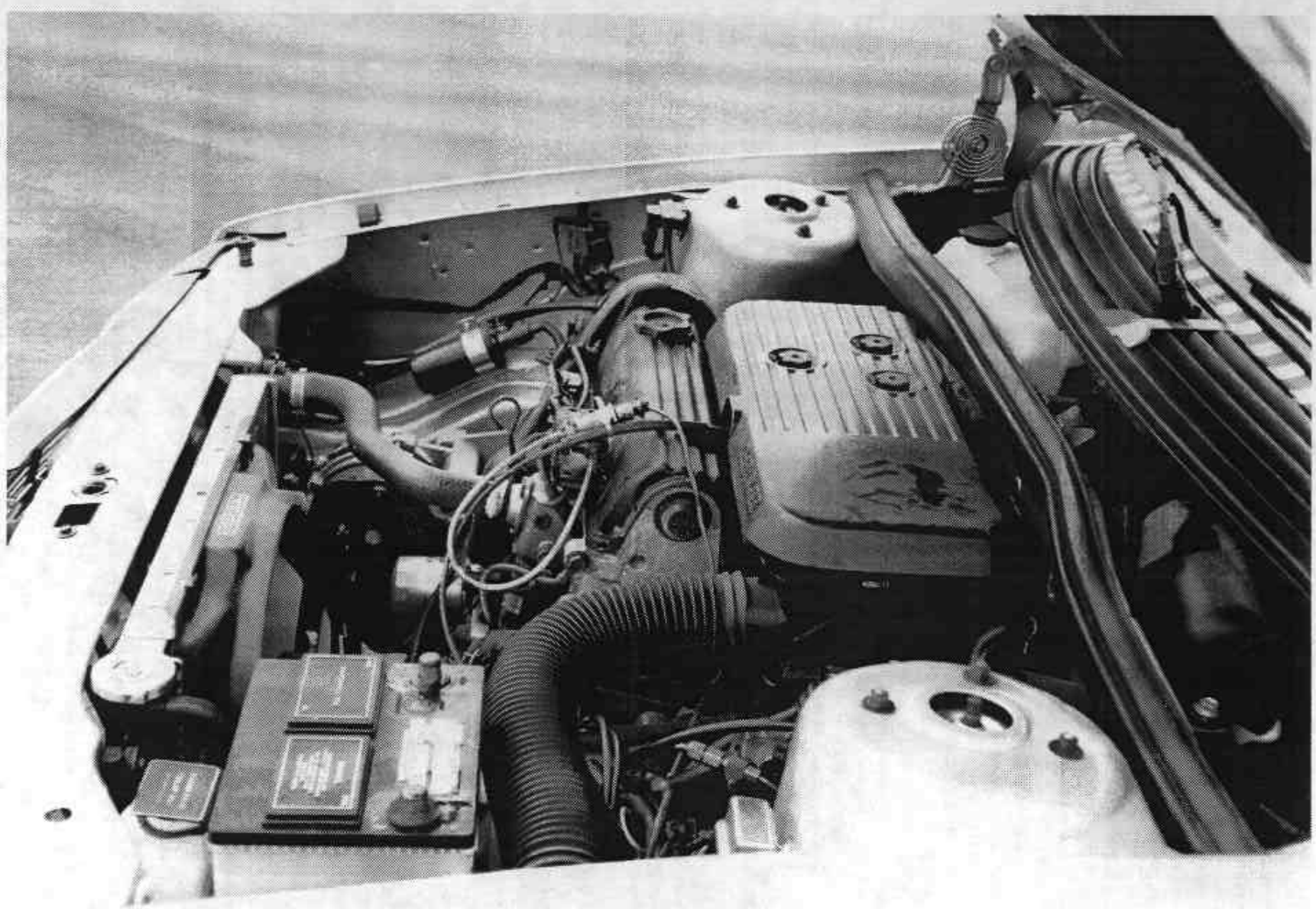


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

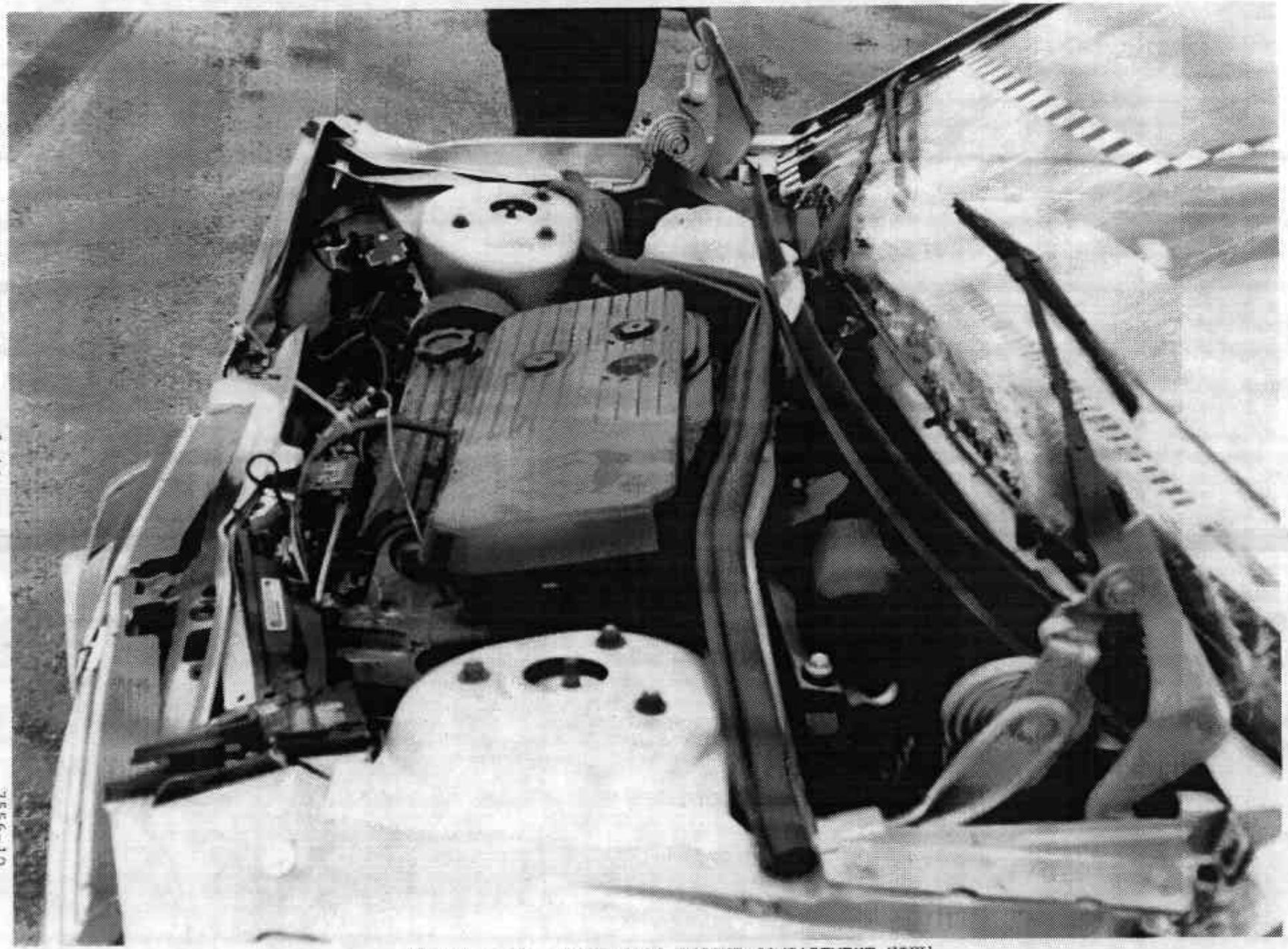


Figure A-15 POST-TEST ENGINE COMPARTMENT VIEW

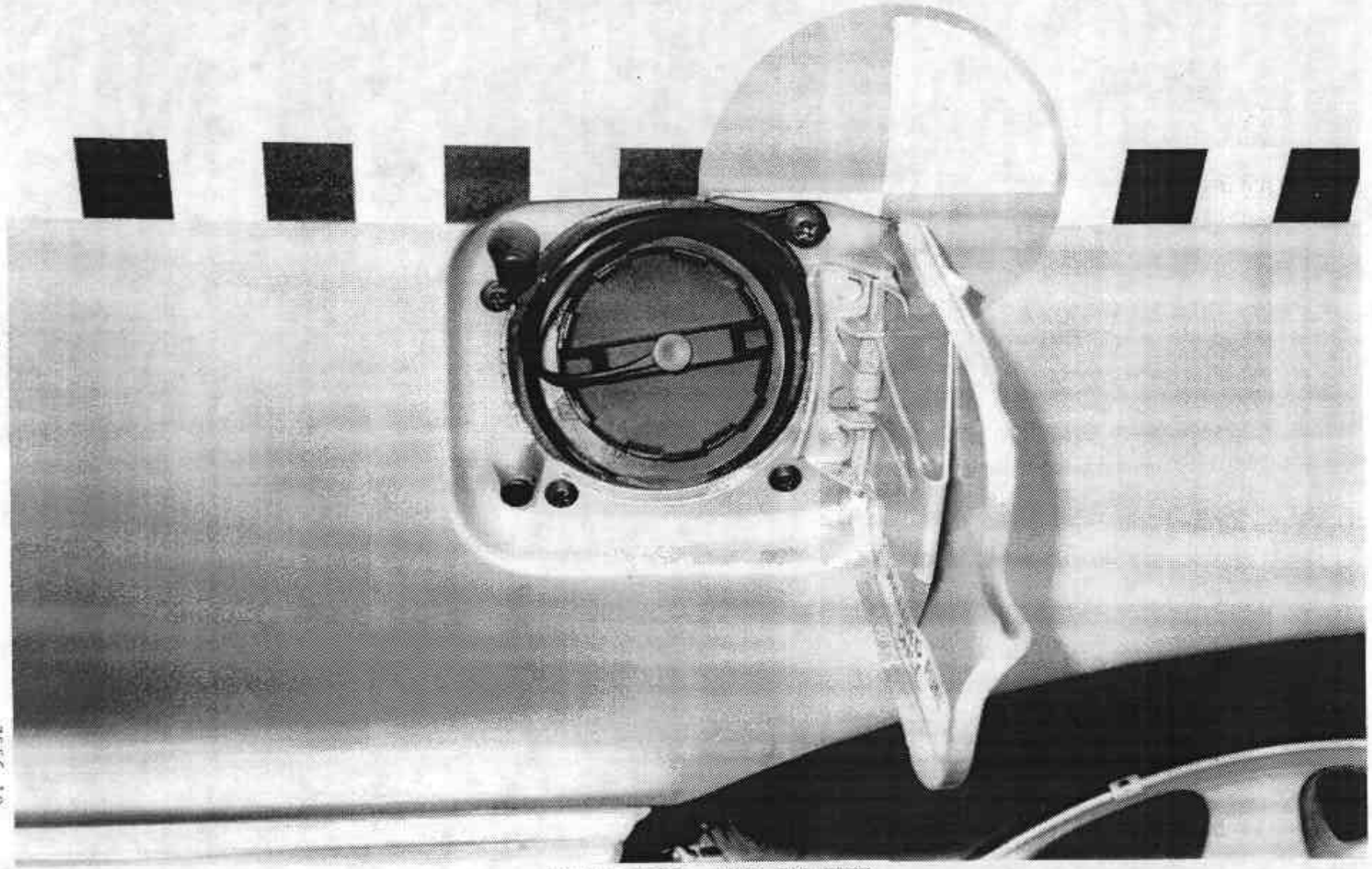


Figure A-16 FUEL CAP VIEW

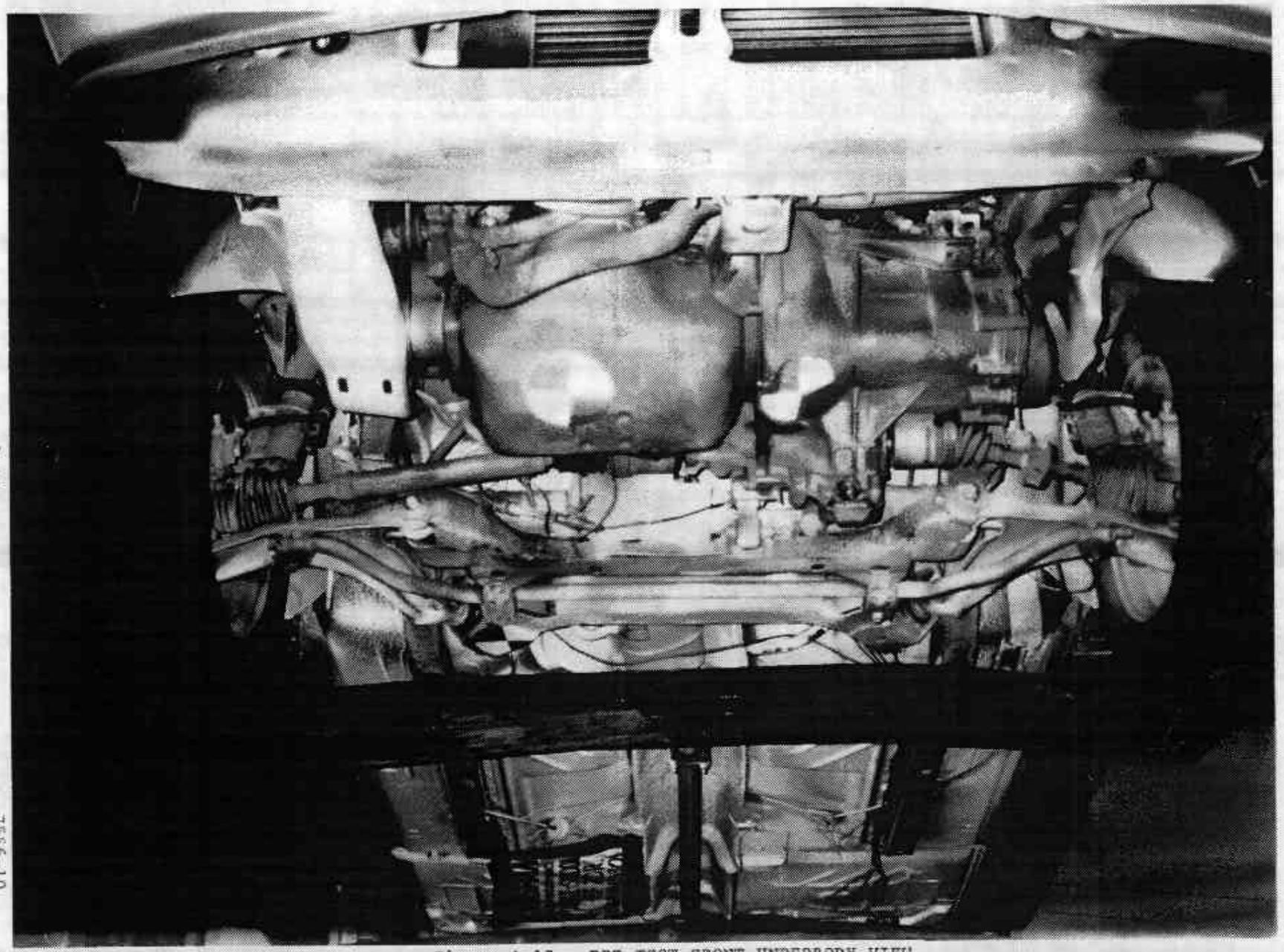


Figure A-17 PRE-TEST FRONT UNDERBODY VIEW

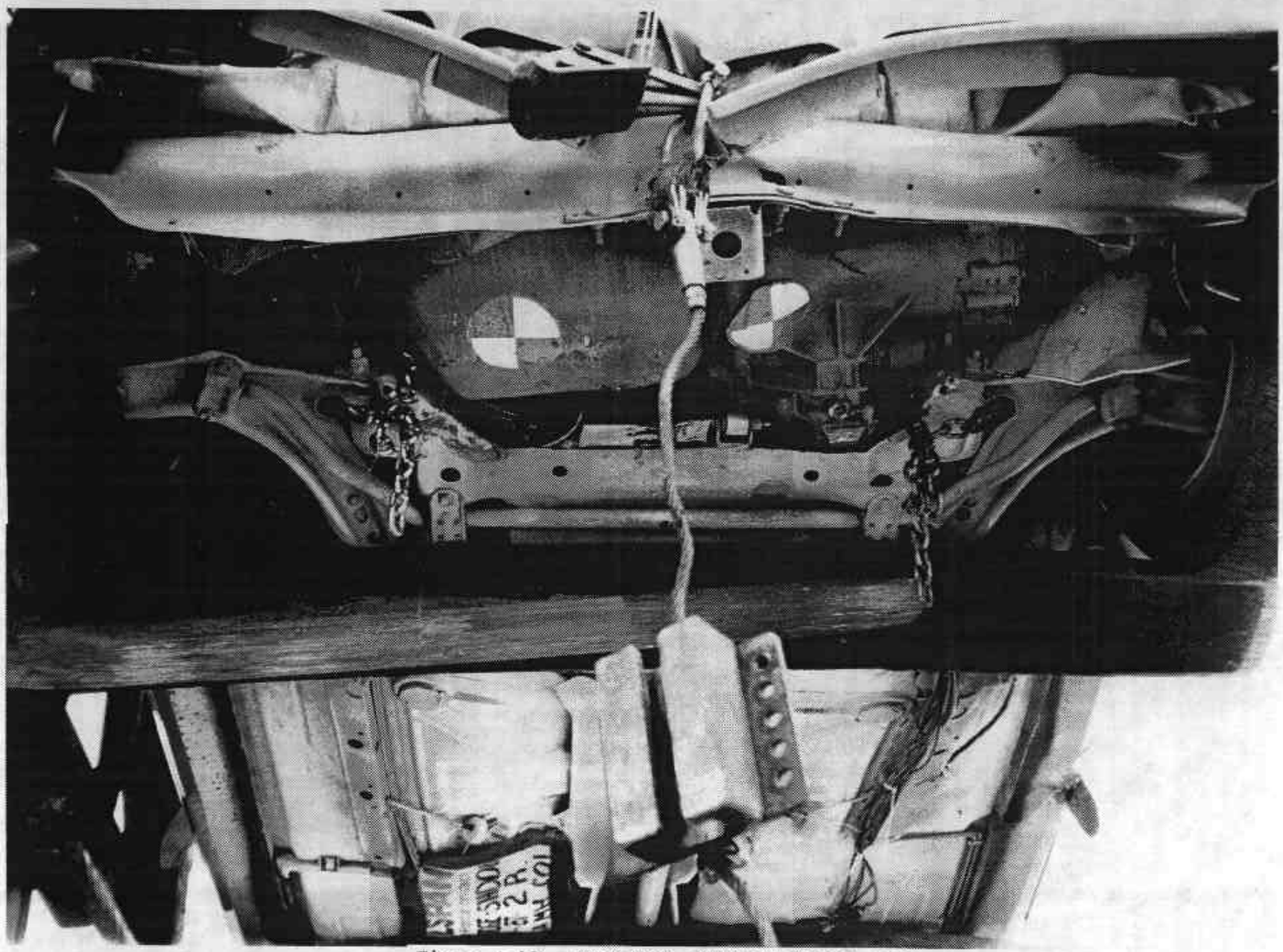


Figure A-18 POST-TEST FRONT UNDERBODY VIEW

7556-10

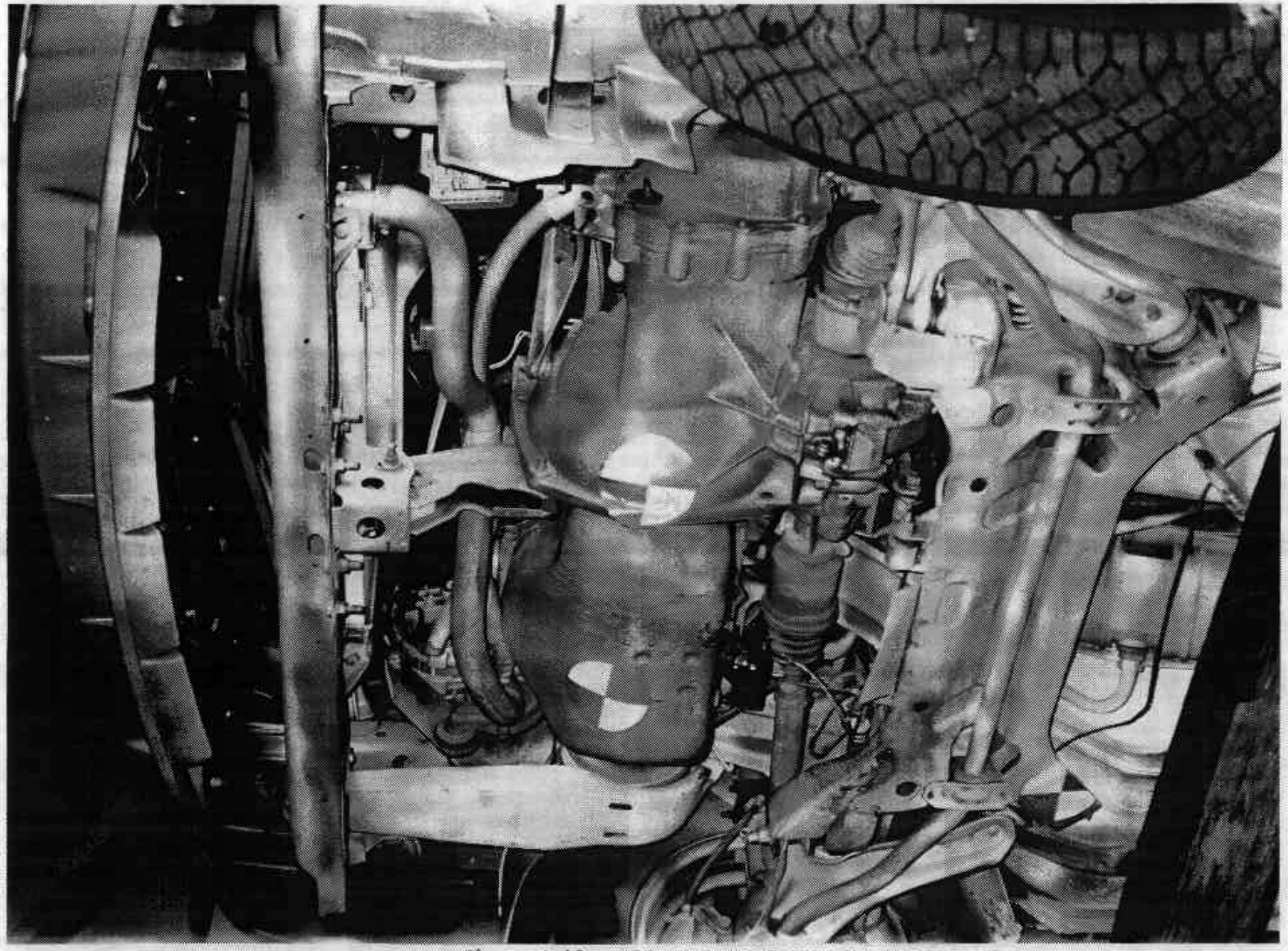


Figure A-19 PRE-TEST FRONT-SIDE UNDERBODY VIEW

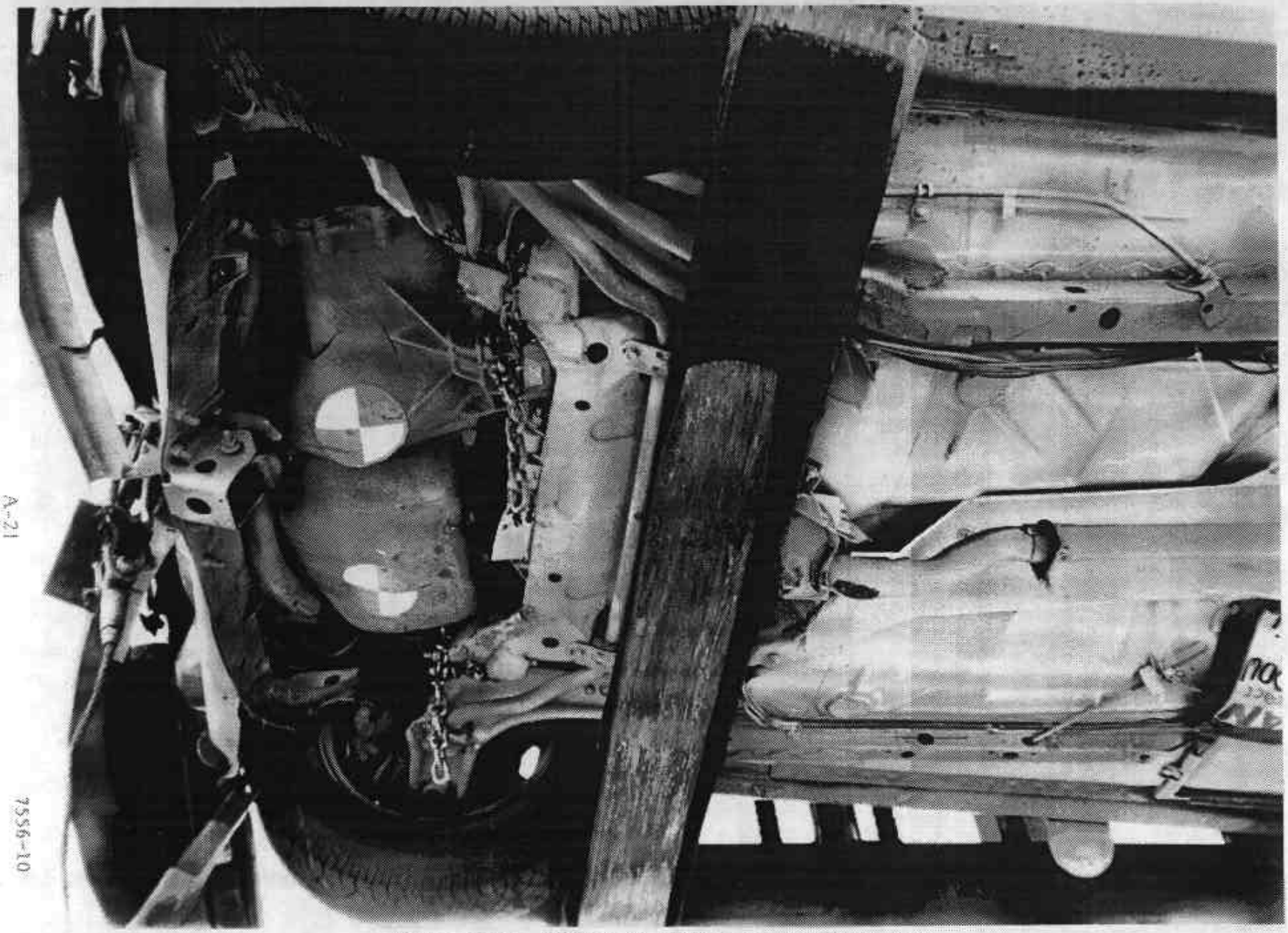


Figure A-20 POST-TEST FRONT-SIDE UNDERBODY VIEW

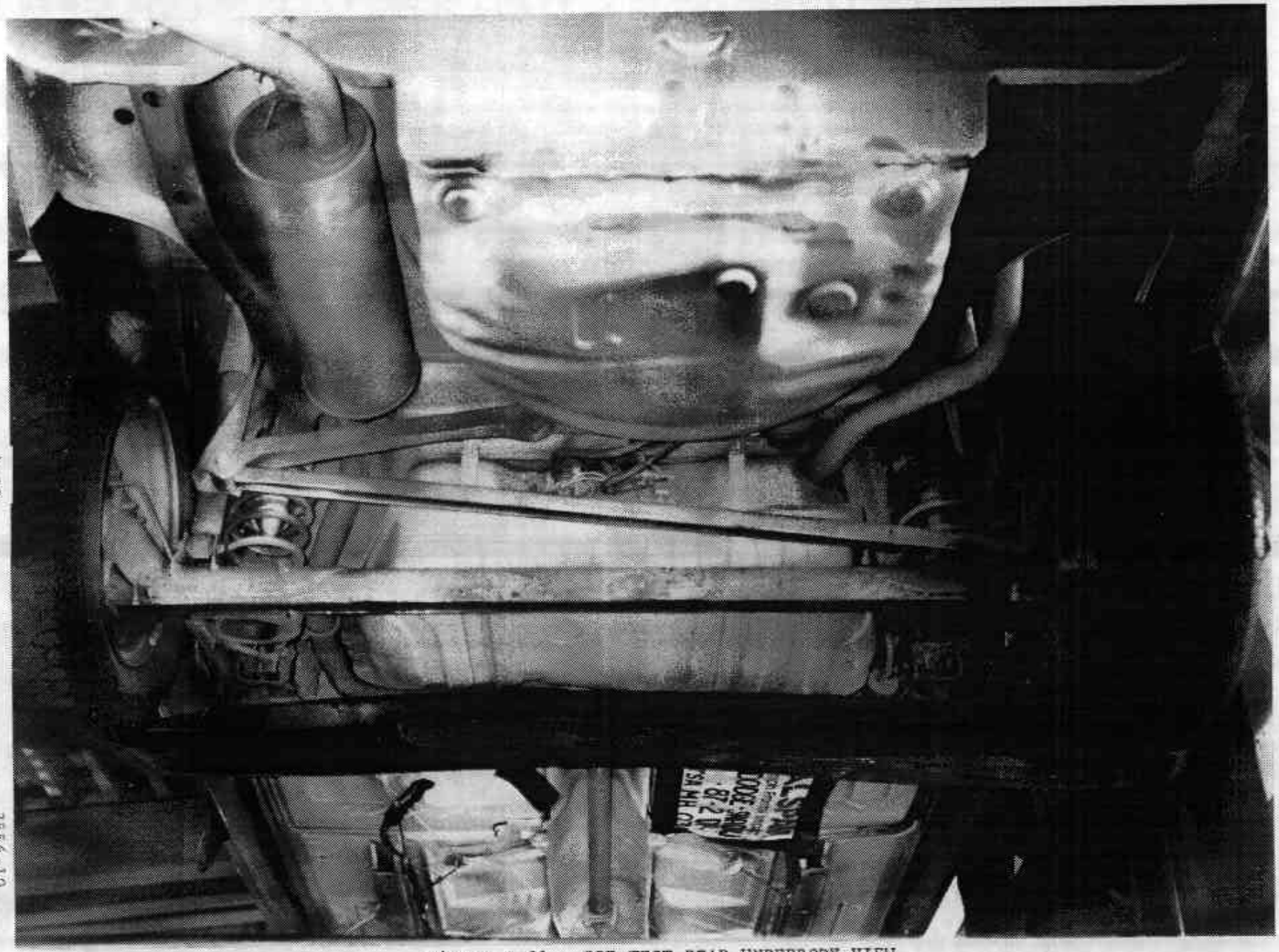


Figure A-21 PRE-TEST REAR UNDERBODY VIEW

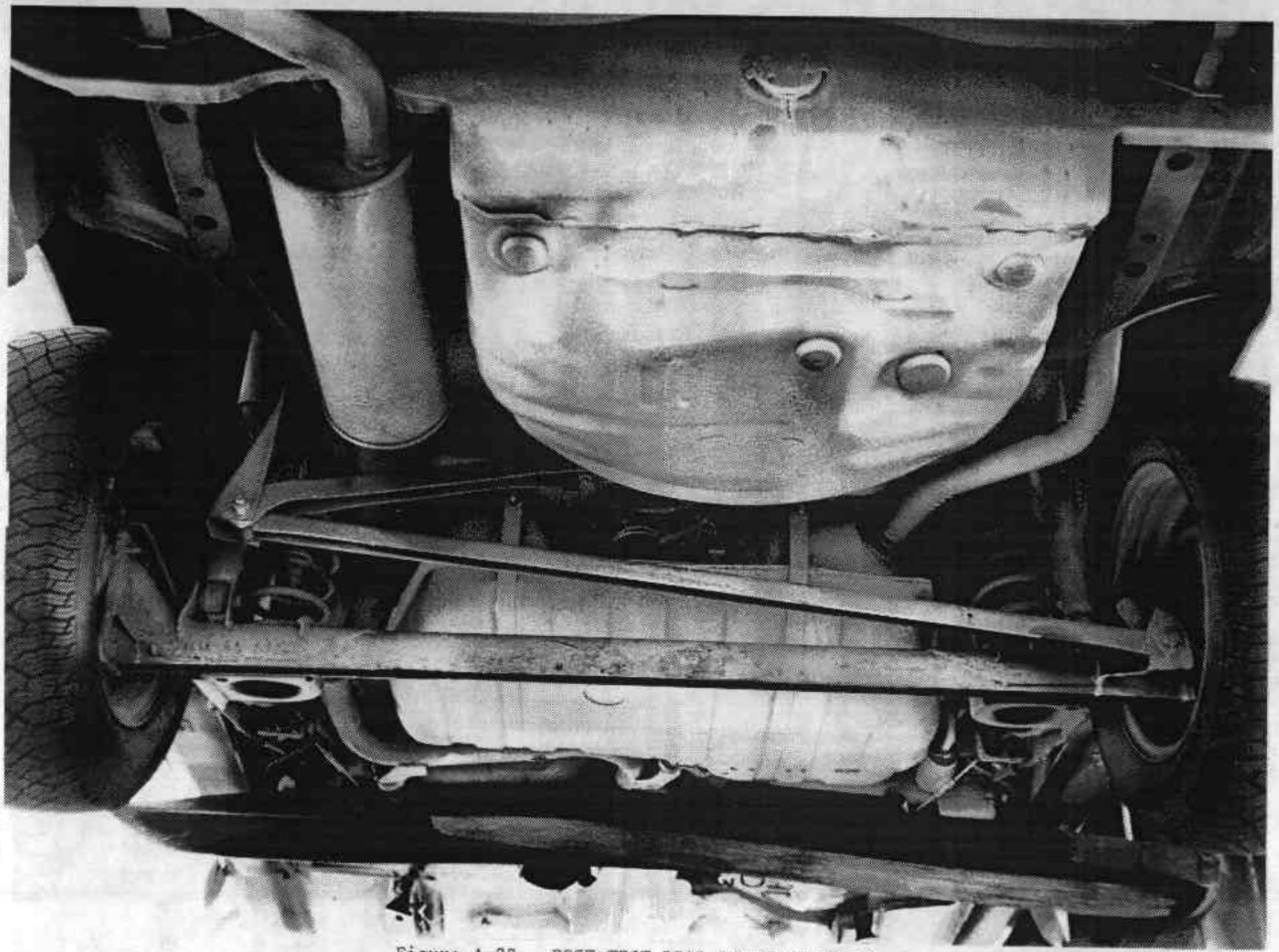


Figure A-22 POST-TEST REAR UNDERBODY VIEW

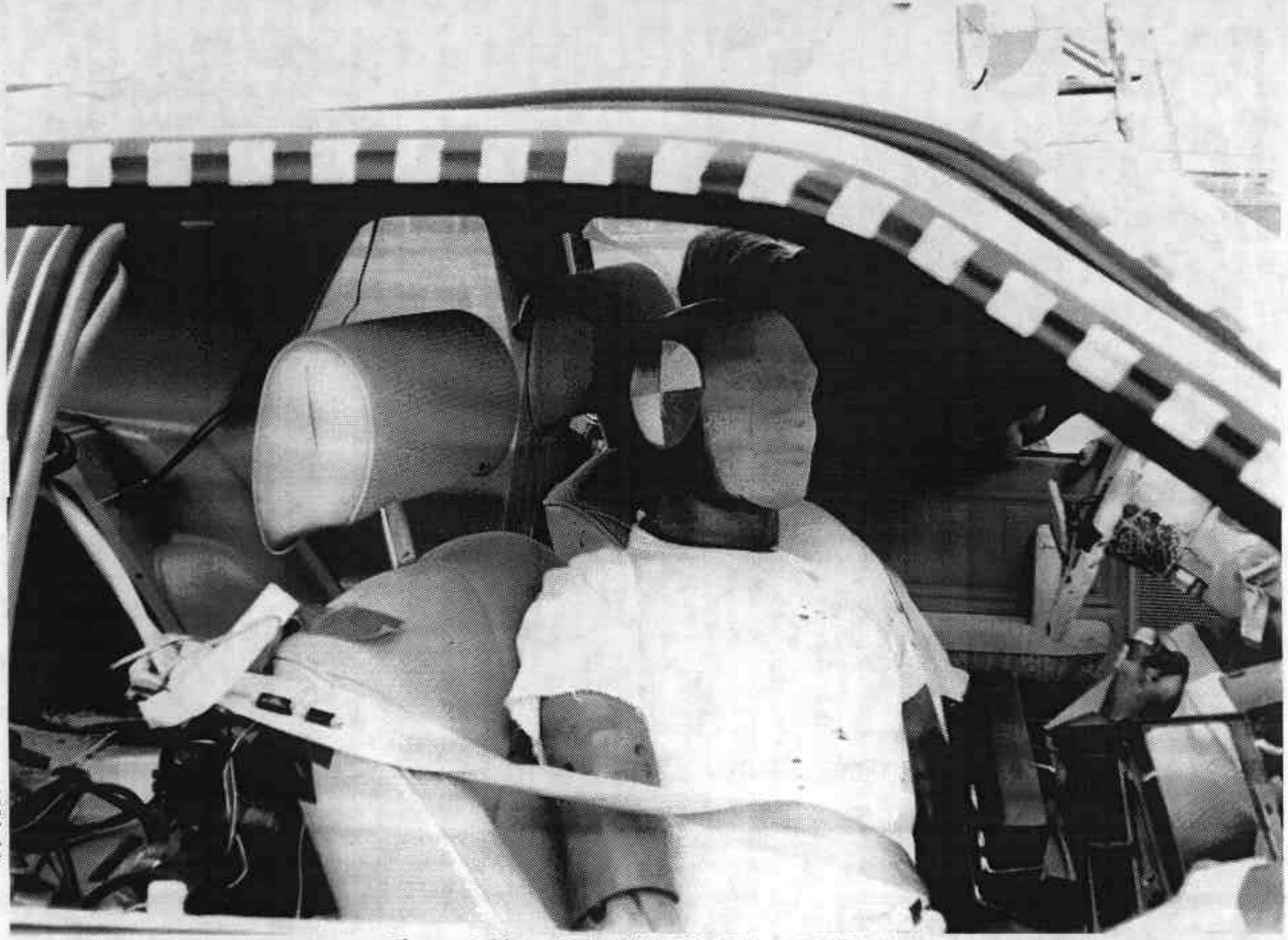
Figure A-23 PRE-TEST DRIVER POSITION VIEW

7556-10

Figure A-24 POST-TEST DRIVER POSITION VIEW

Figure A-25 PRE-TEST PASSENGER POSITION VIEW

7556-10



A-27

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Figure A-26 POST-TEST PASSENGER POSITION VIEW

Figure A-27 PRE-TEST DRIVER AND INTERIOR VIEW

Figure A-28 POST-TEST DRIVER AND INTERIOR VIEW

Figure A-29 PRE-TEST PASSENGER AND INTERIOR VIEW

Figure A-30 POST-TEST PASSENGER AND INTERIOR VIEW

Appendix B

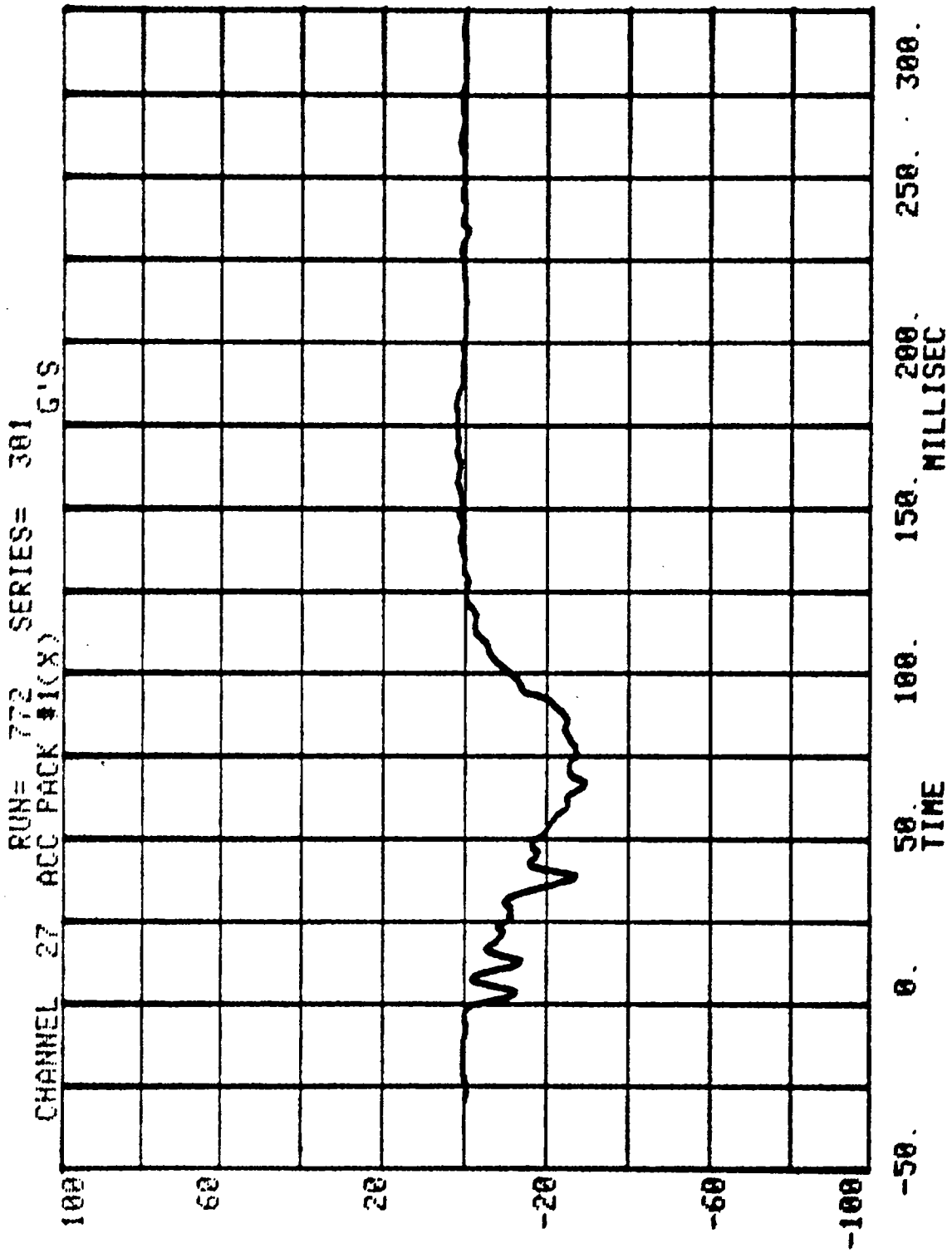
VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

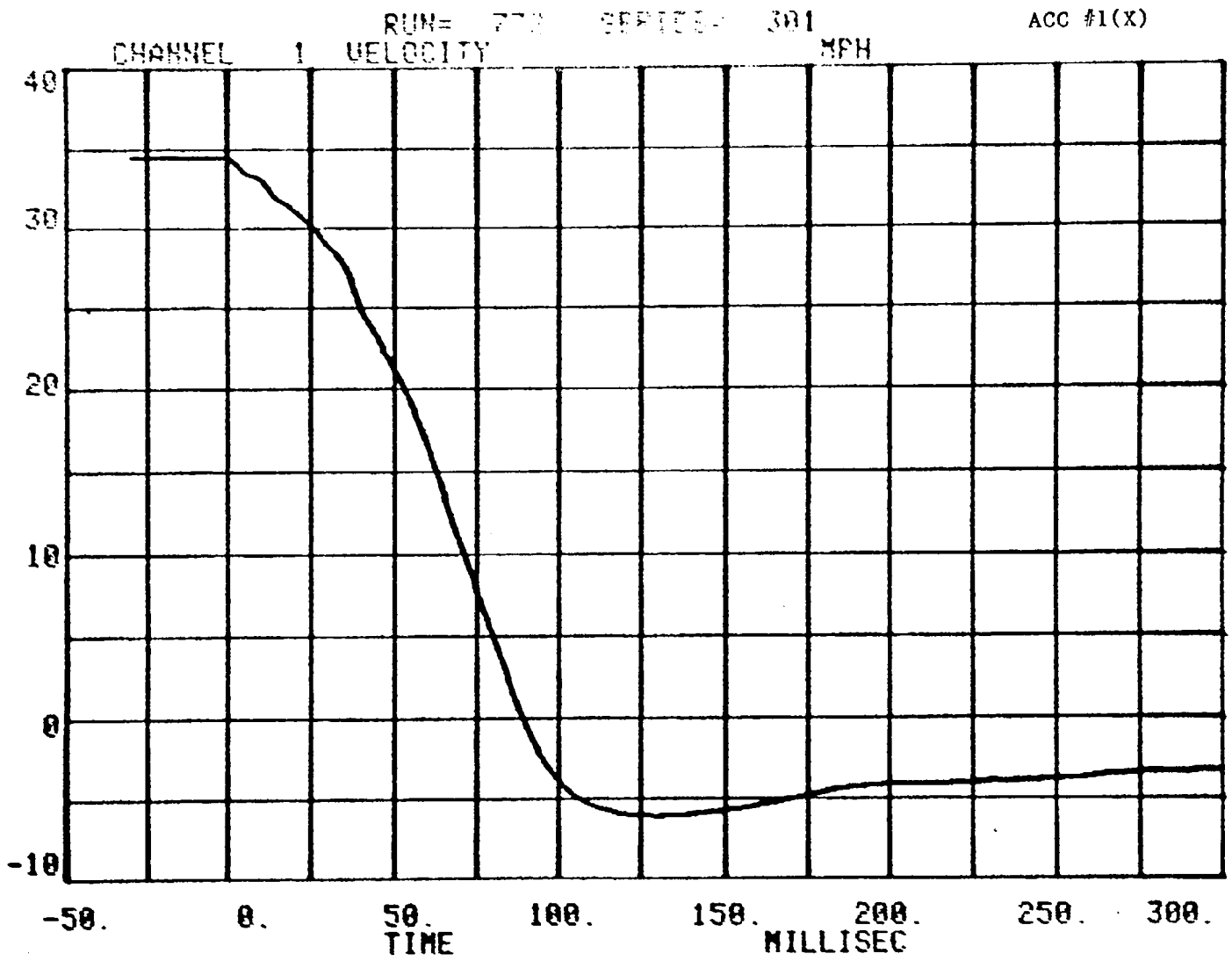
TEST NO. MH0301

VEHICLE DATA

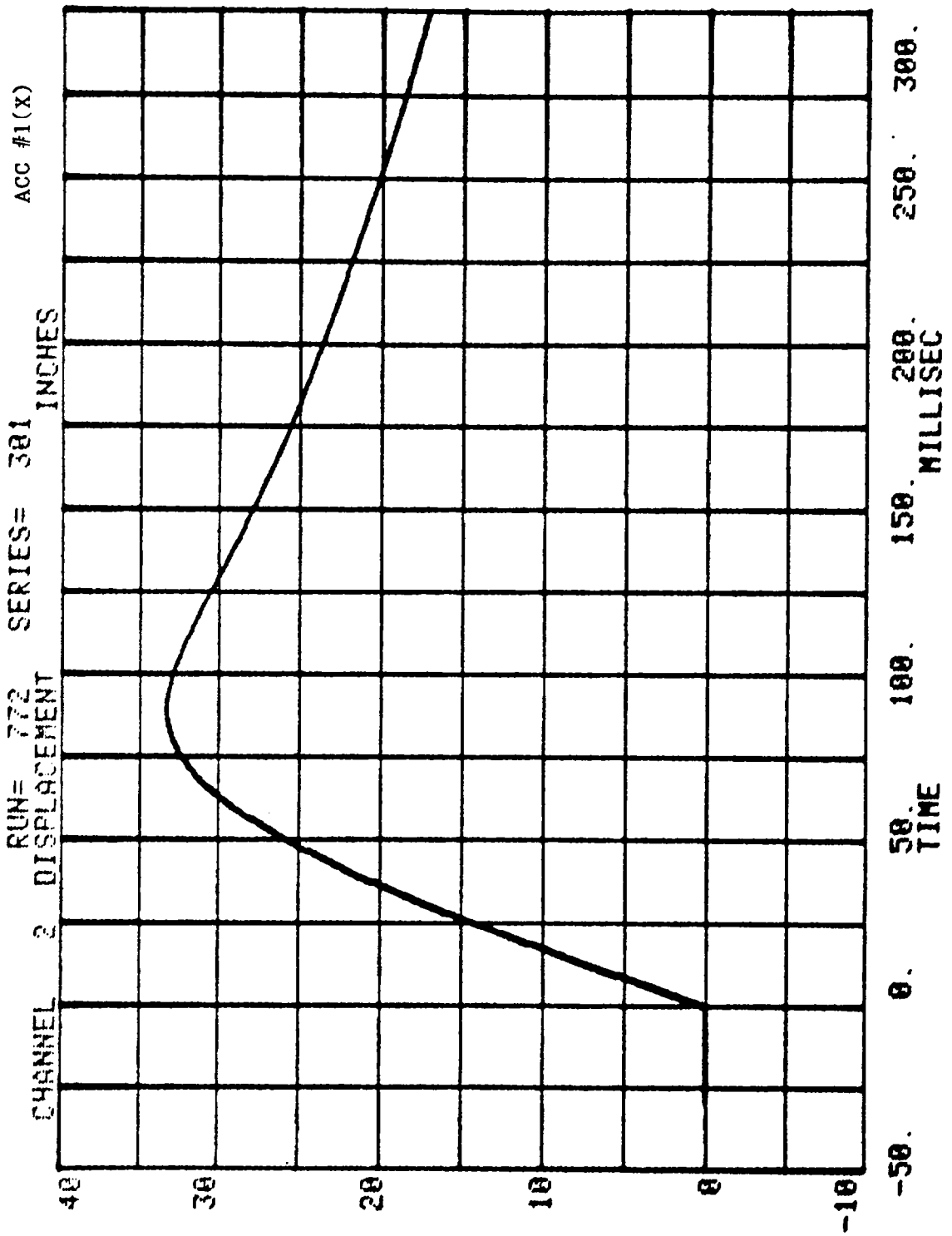
FILTER CHANNEL CLASS

60

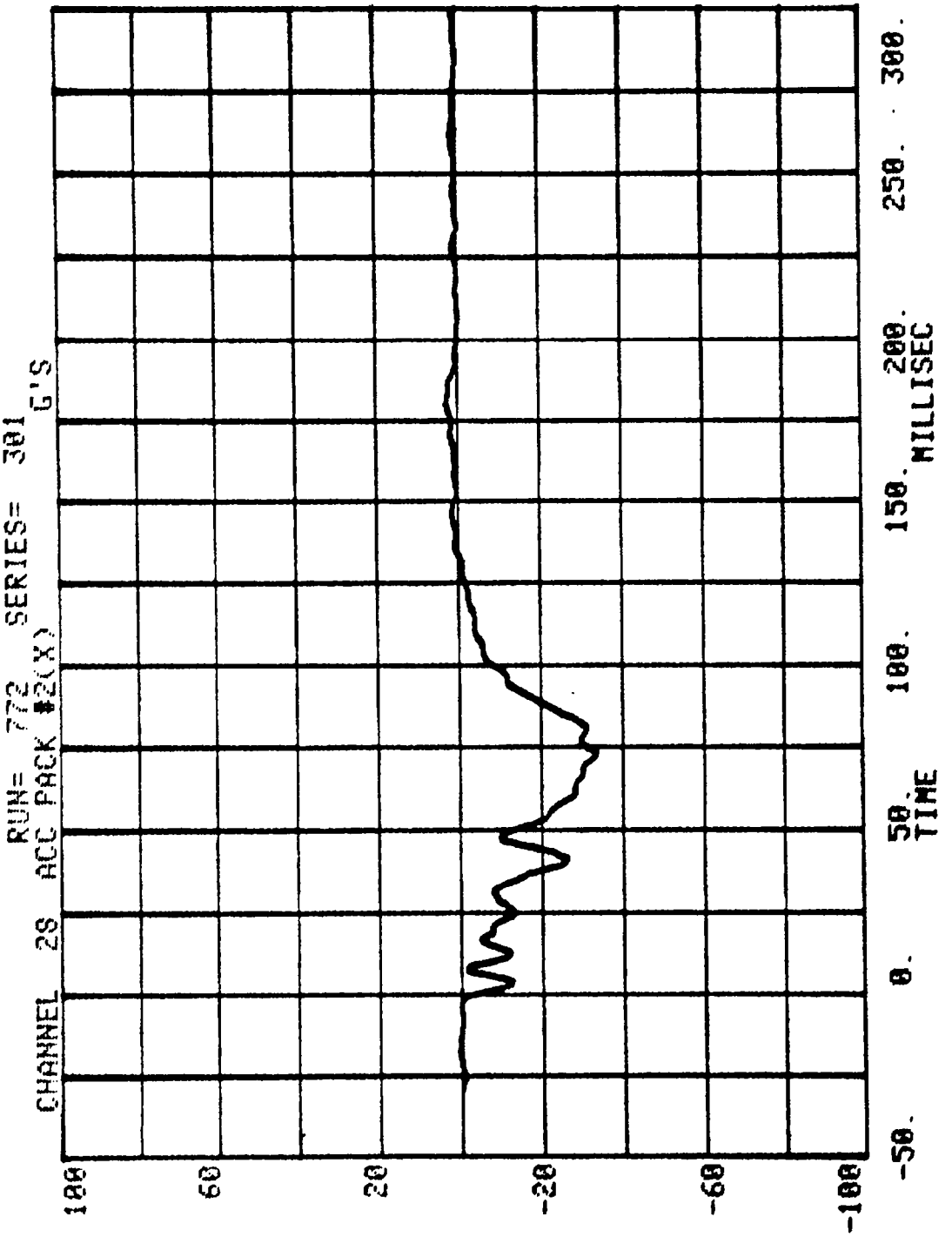

CHANNEL 27 ACC PACK #1(X)
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

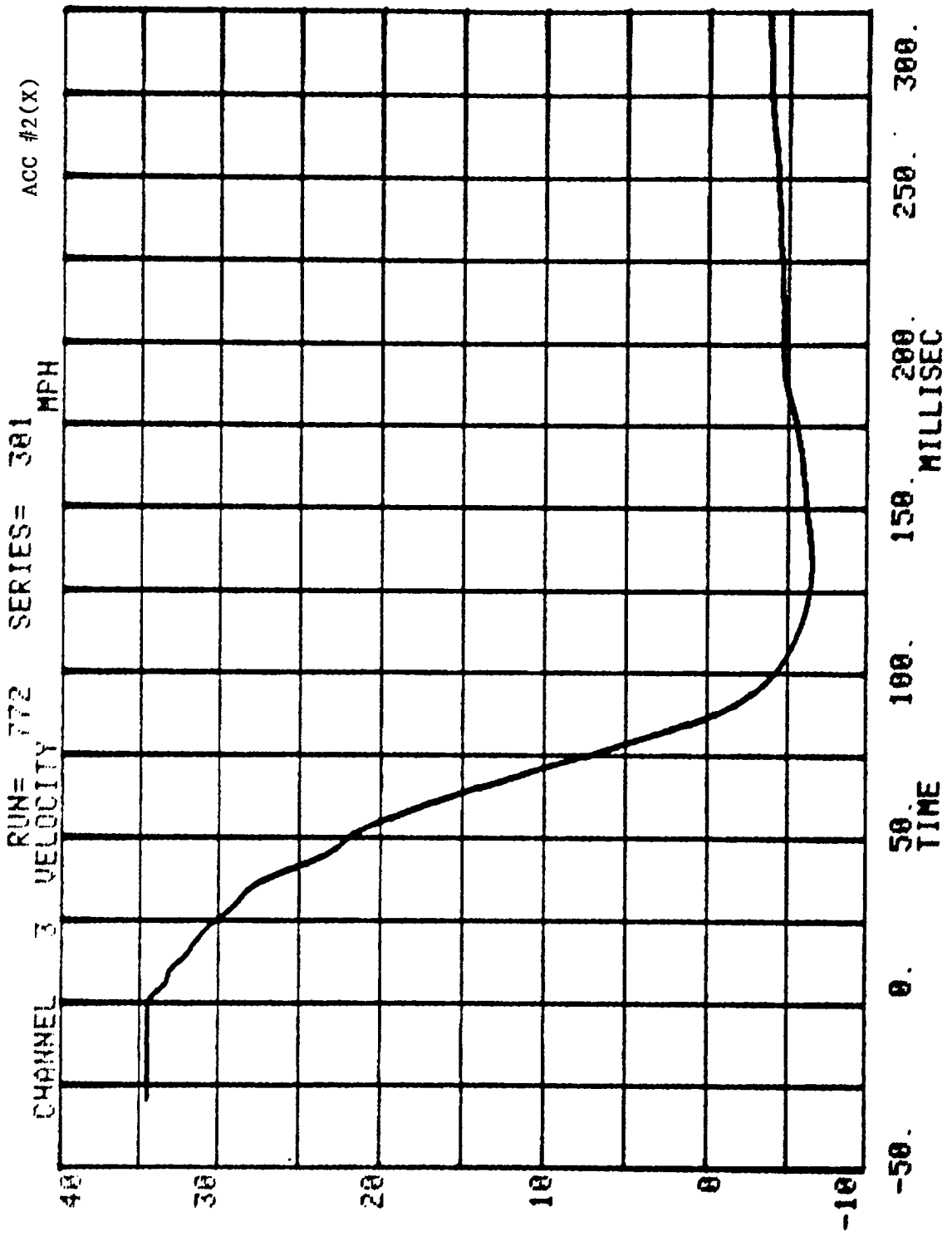

RUN= 77? SERIES- 301
ACC #1(X)
CHANNEL 1 VELOCITY
MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

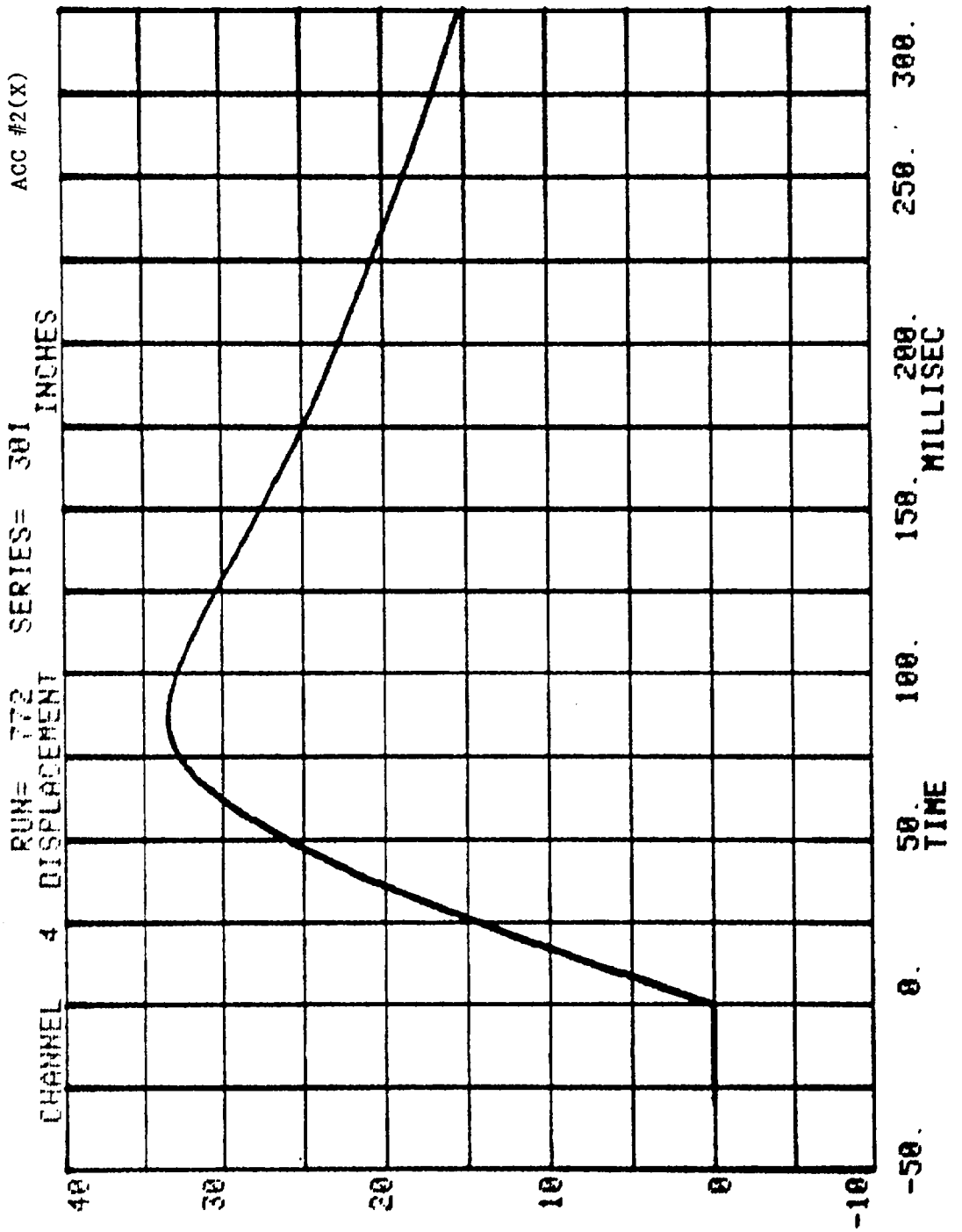

CHANNEL 2 DISPLACEMENT
RUN= 772 SERIES= 301 INCHES
ACC #1(X)
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

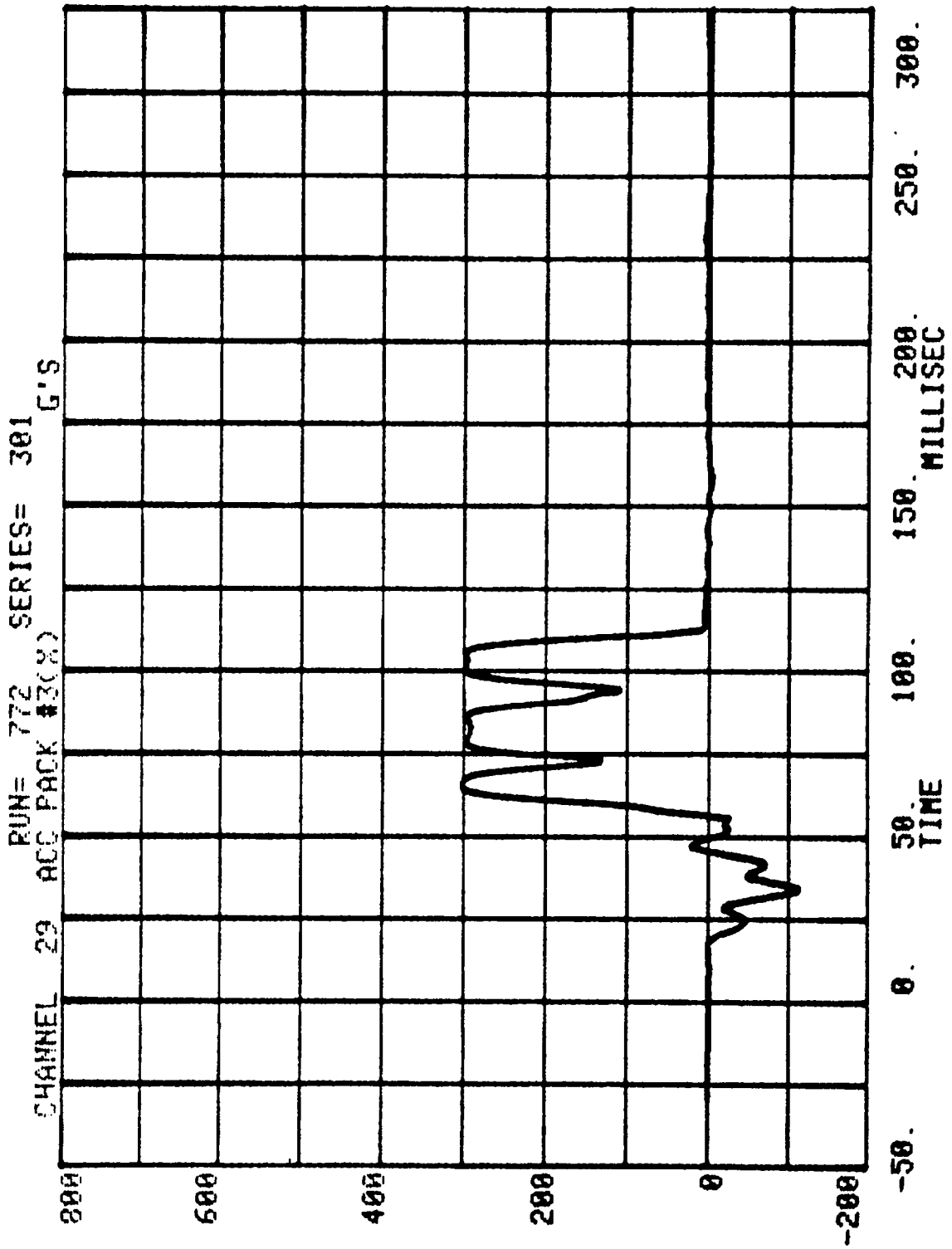

CHANNEL 2S ACC PACK #2(X)
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


ACC #2(X)
CHANNEL 3 VELOCITY
RUN= 772 SERIES= 381 MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

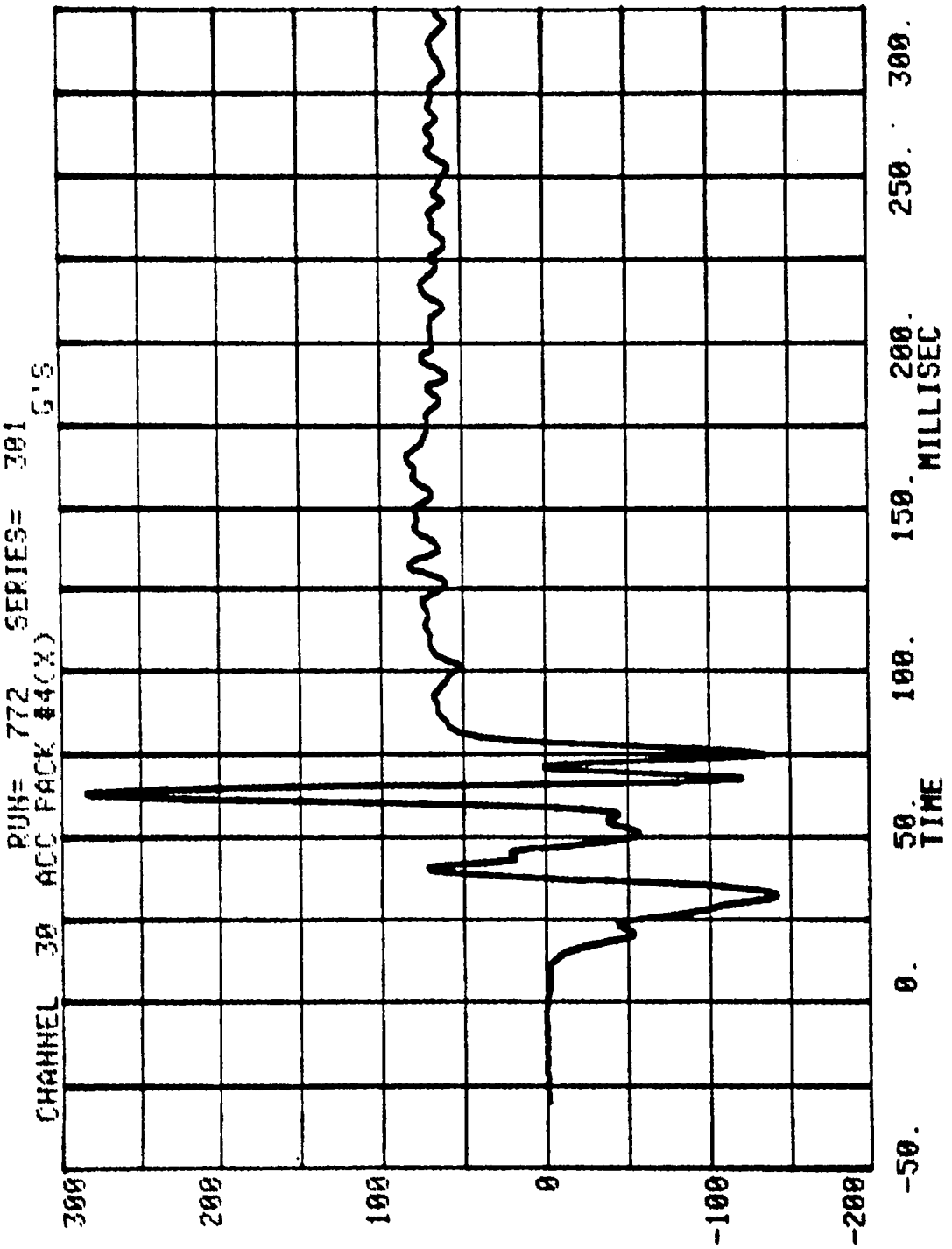
7556-10


ACC #2(X)
RUN= 772 SERIES= 301
CHANNEL 4 DISPLACEMENT INCHES
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME MILLISEC

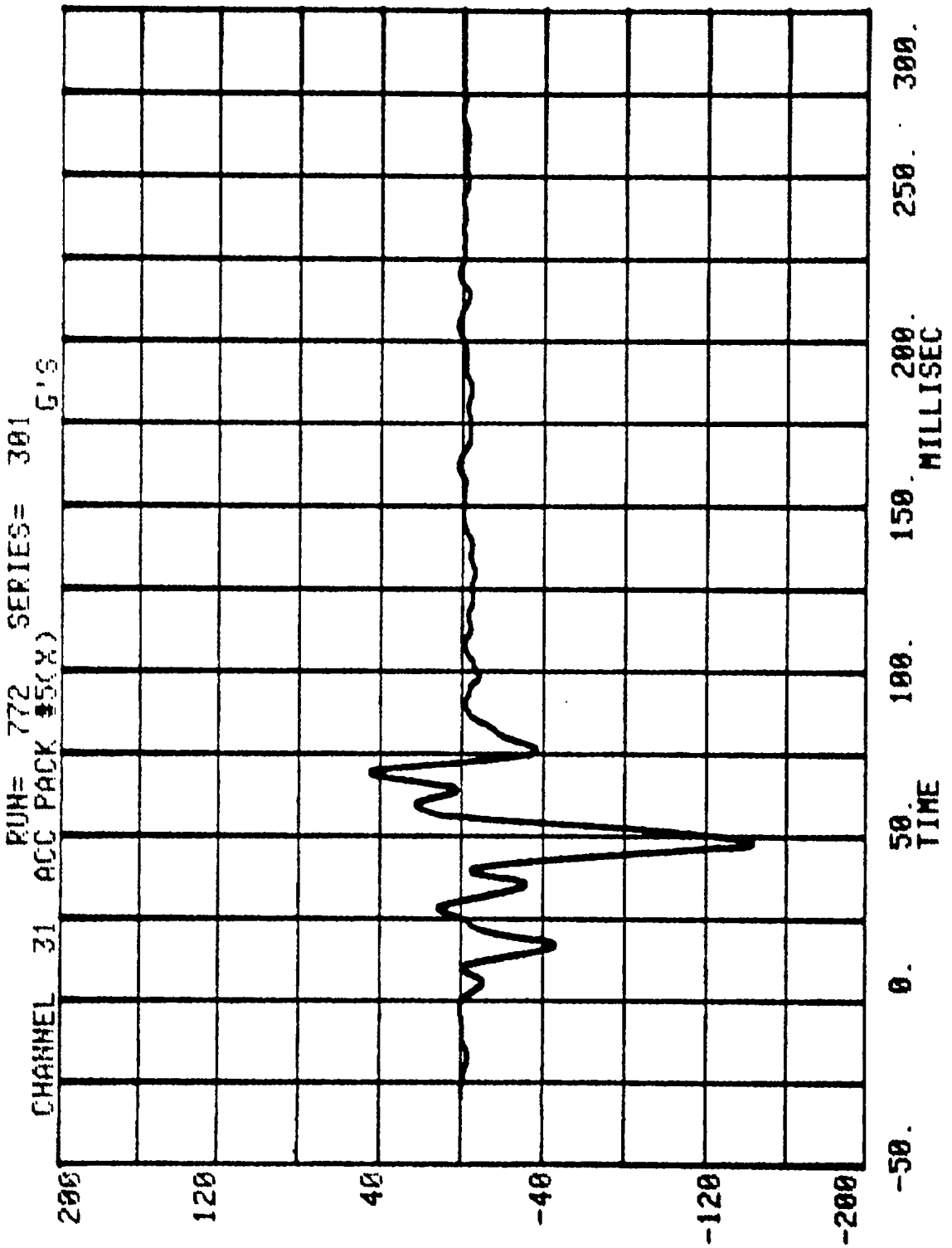
7556-10

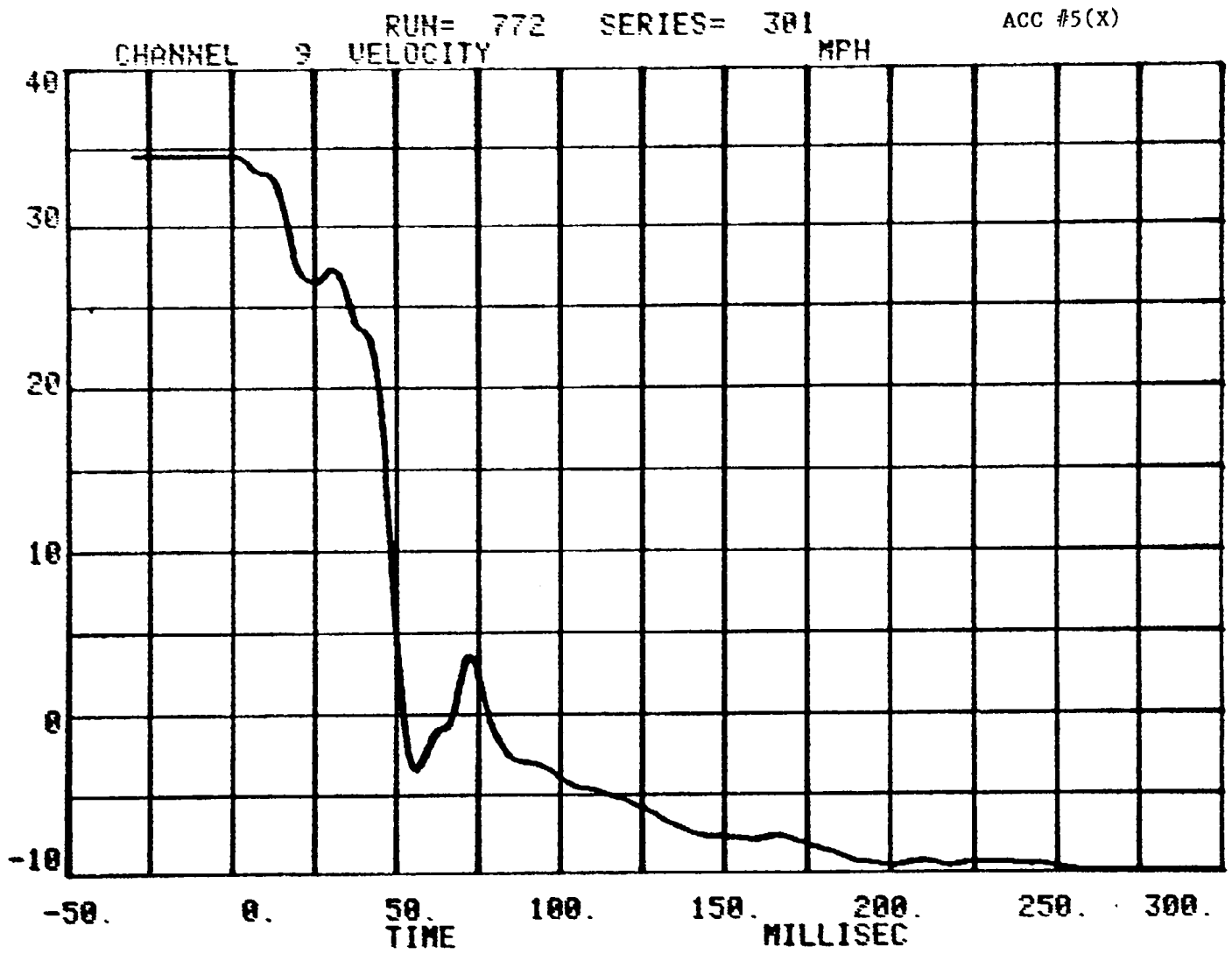

CHANNEL 29 ACC PACK #3(X)
RUN= 772 SERIES= 301
G'S
200
600
400
200
0
-200
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

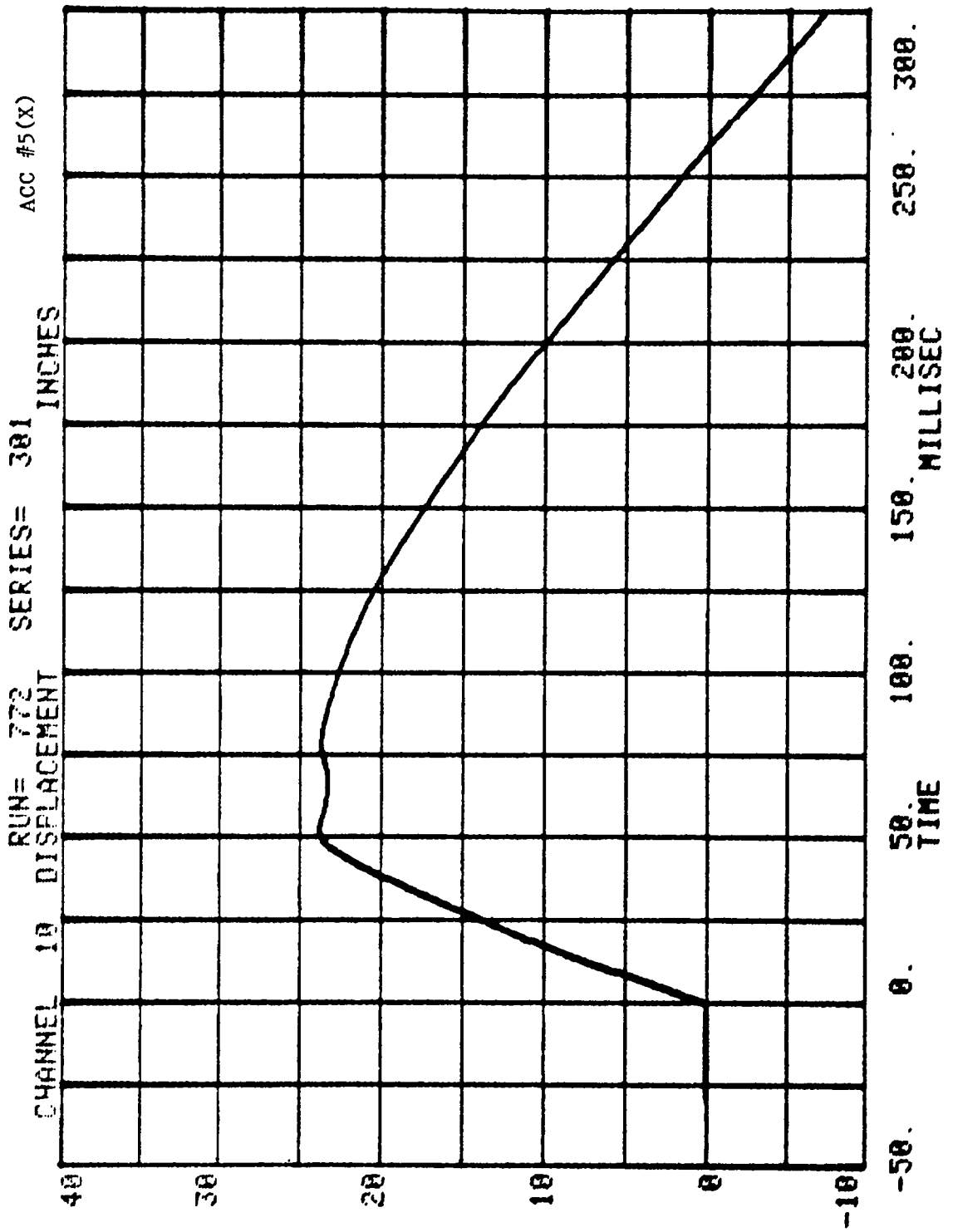

CHANNEL 30 ACC PACK #4(X)
RUN= 772 SERIES= 201
G'S
300
200
100
0
-100
-200
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


CHANNEL 31 ACC PACK #5(X)
RUN= 772 SERIES= 301
G'S
200
120
40
-40
-120
-200
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


RUN= 772 SERIES= 301
ACC #5(X)
CHANNEL 9 VELOCITY
MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


CHANNEL 10 DISPLACEMENT
RUN= 772 SERIES= 301
ACC #5(X)
INCHES
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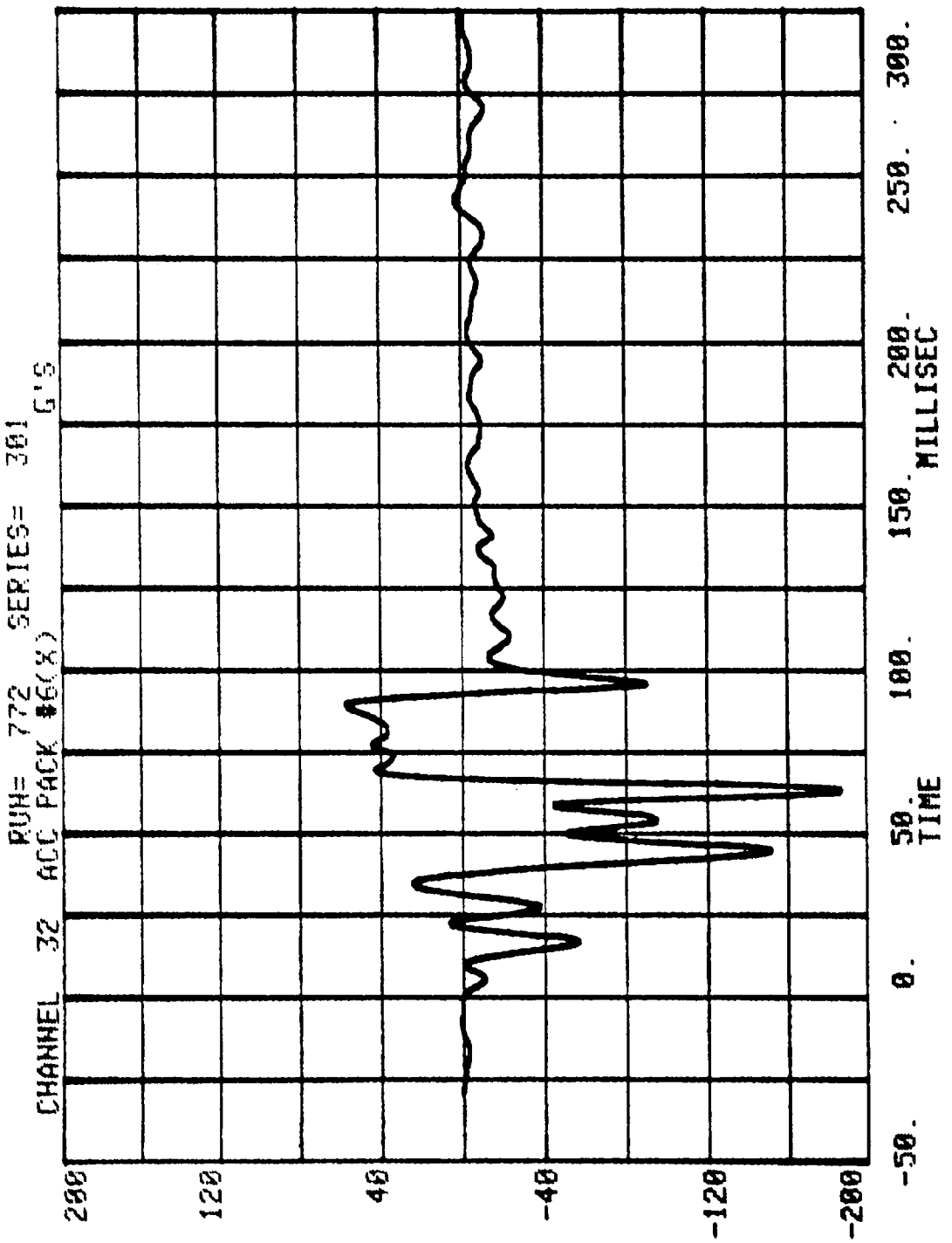
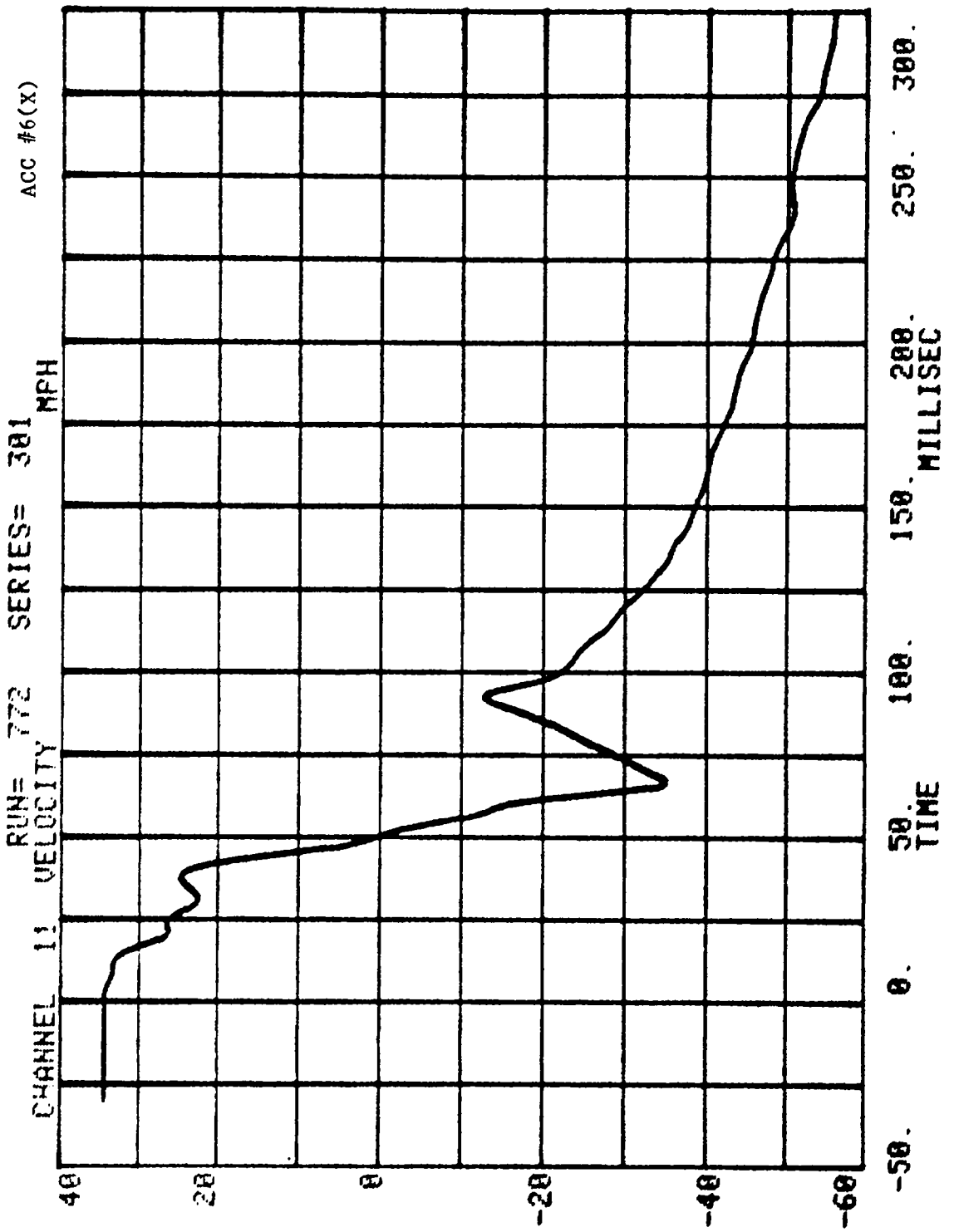
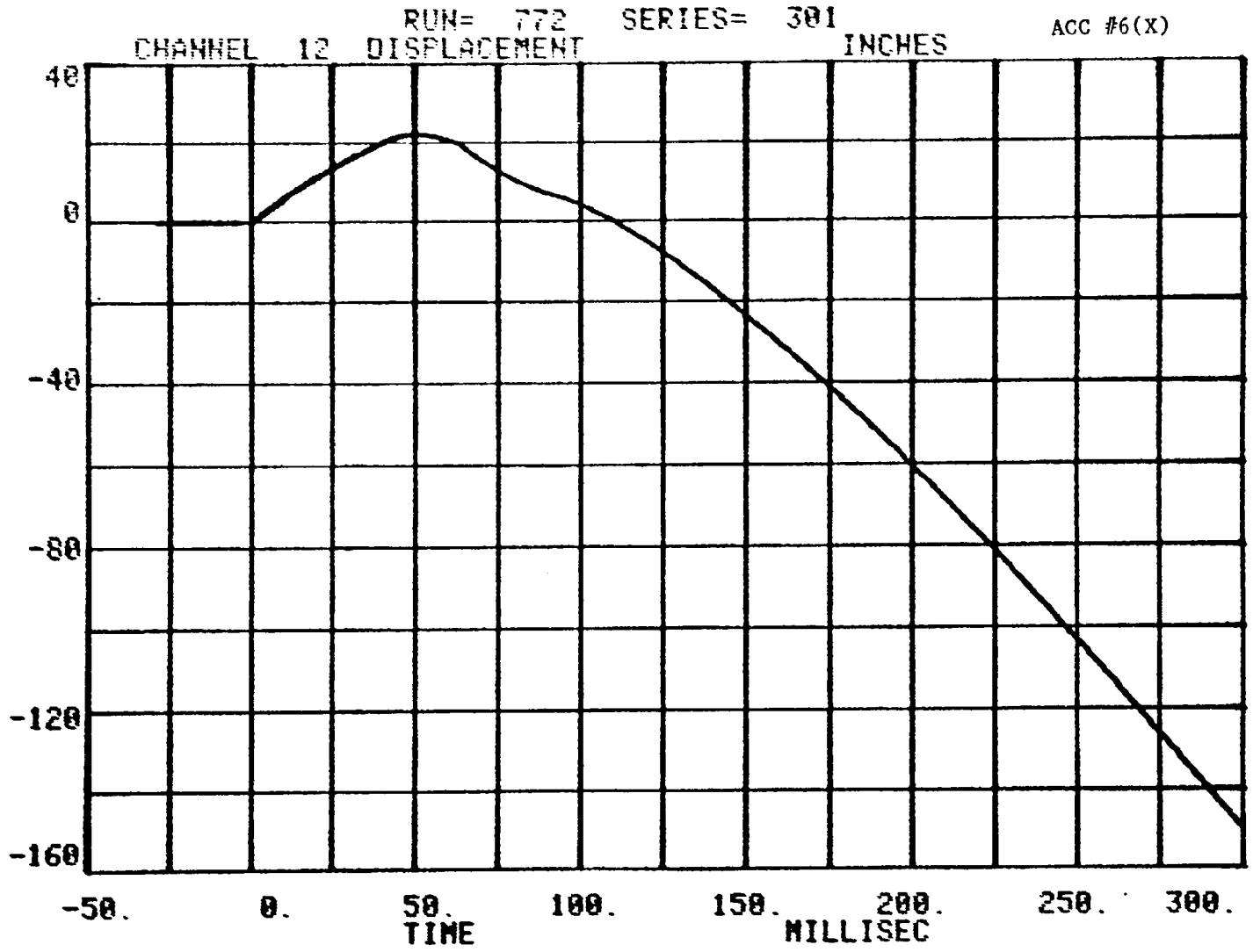
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

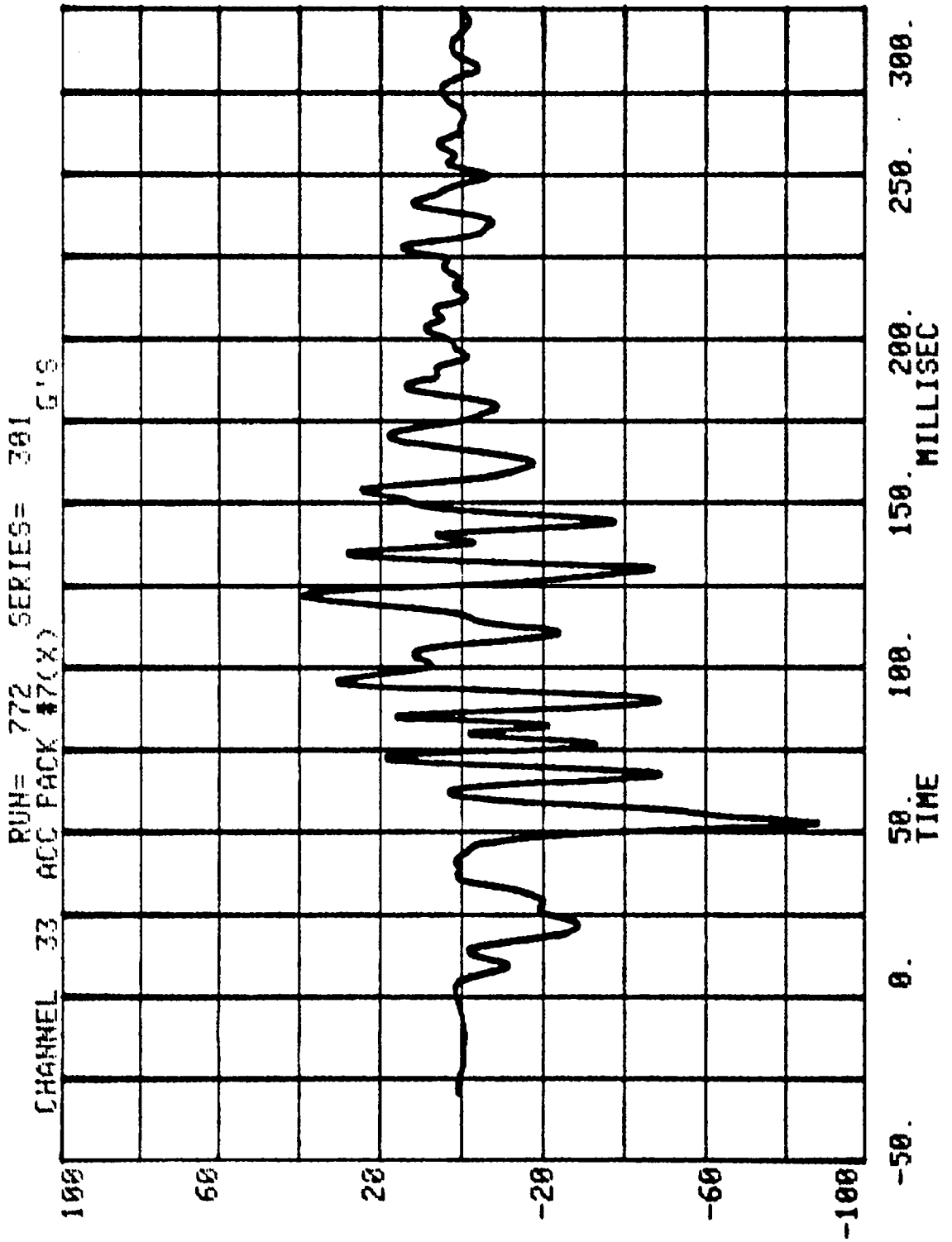

CHANNEL 32 ACC PACK #6(X)
RUN= 772 SERIES= 301
G'S
200
120
40
-40
-120
-200
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

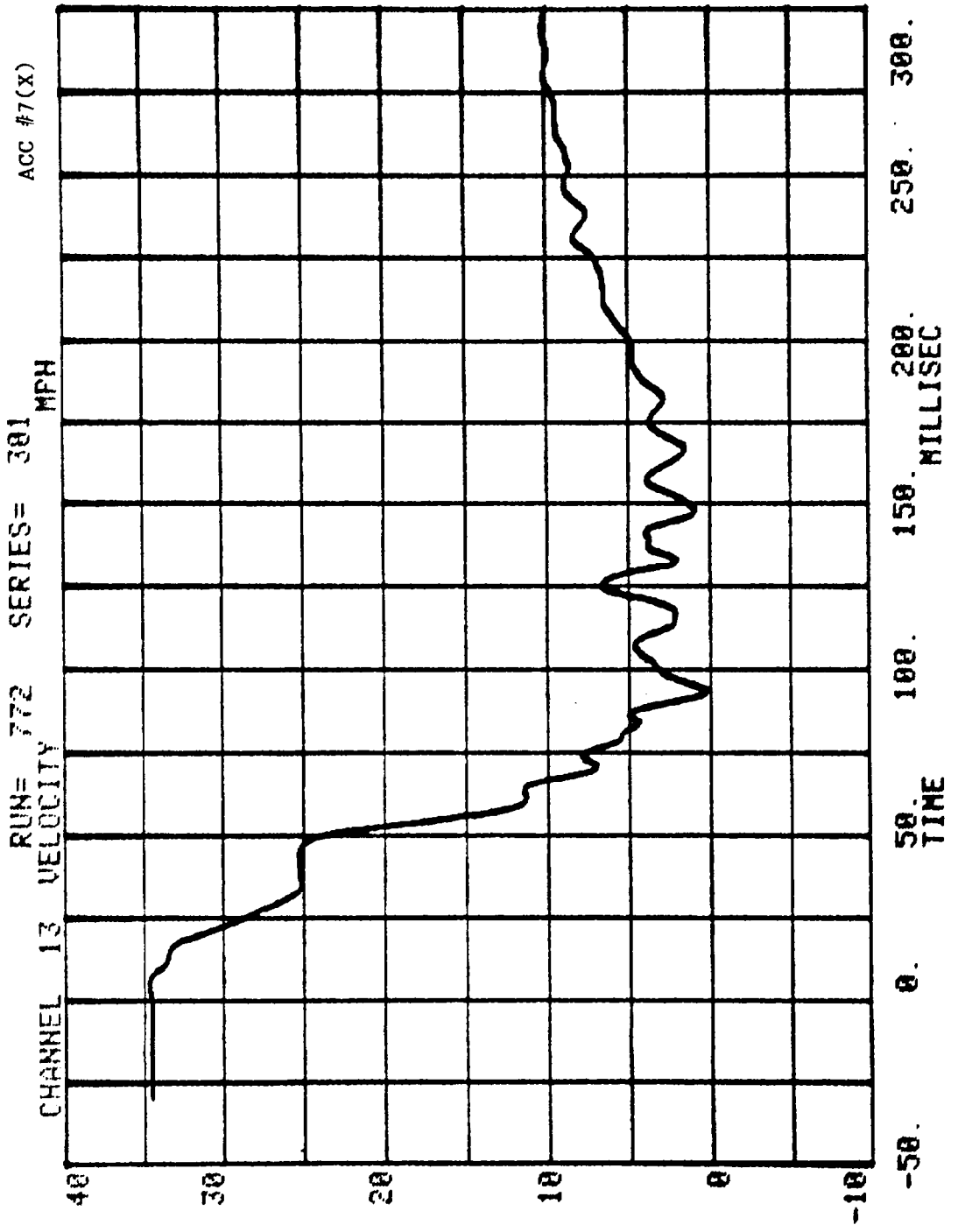

ACC #6(X)
CHANNEL 11 VELOCITY
RUN= 772 SERIES= 301
MPH
40
20
0
-20
-40
-60
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


RUN= 772 SERIES= 301
ACC #6(X)
CHANNEL 12 DISPLACEMENT
INCHES
40
0
-40
-80
-120
-160
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

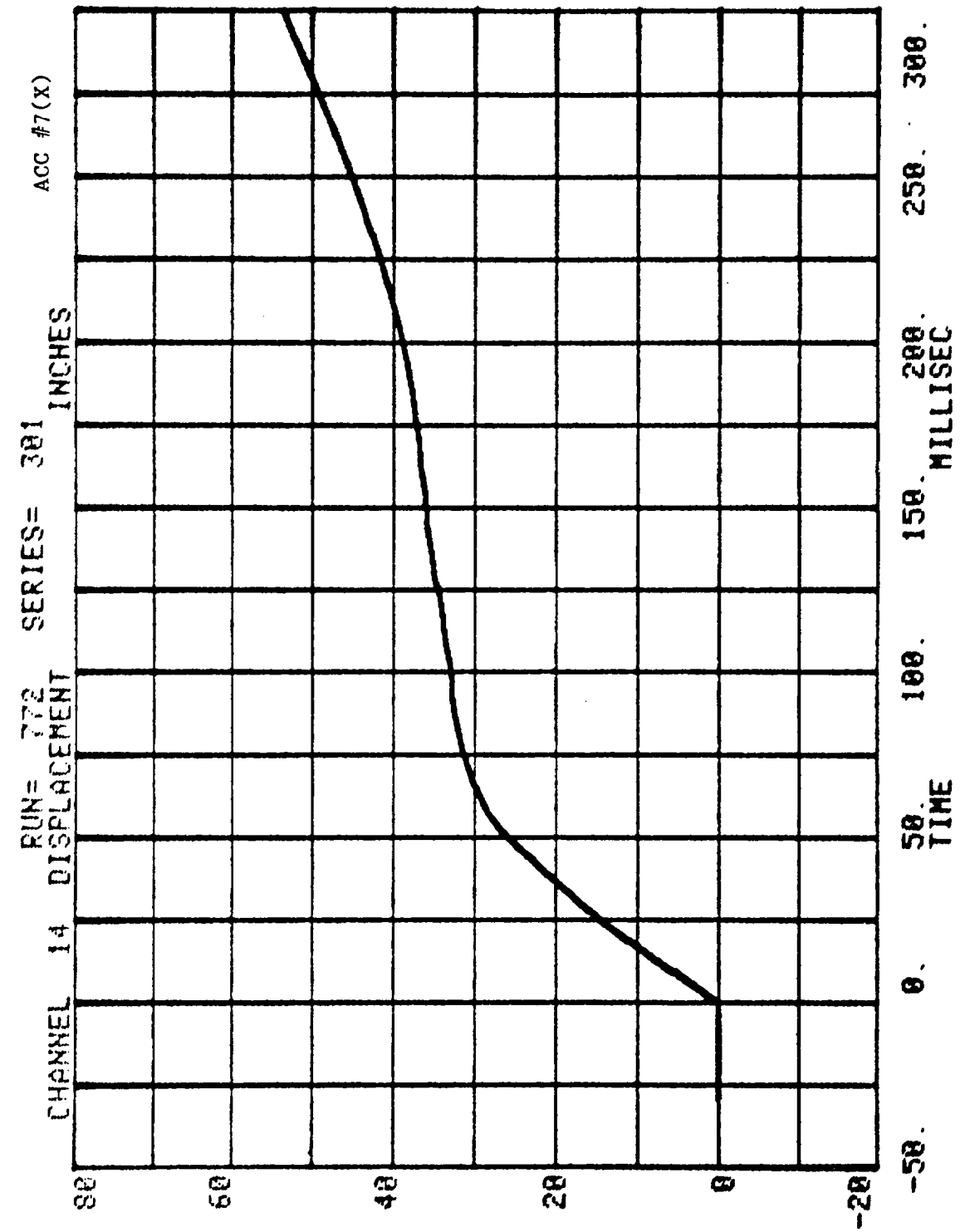
7556-10


CHANNEL 33 ACC PACK #7(X)
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


ACC #7(X)
CHANNEL 13 VELOCITY
RUN= 772 SERIES= 301 MPH
40
30
20
10
0
-10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

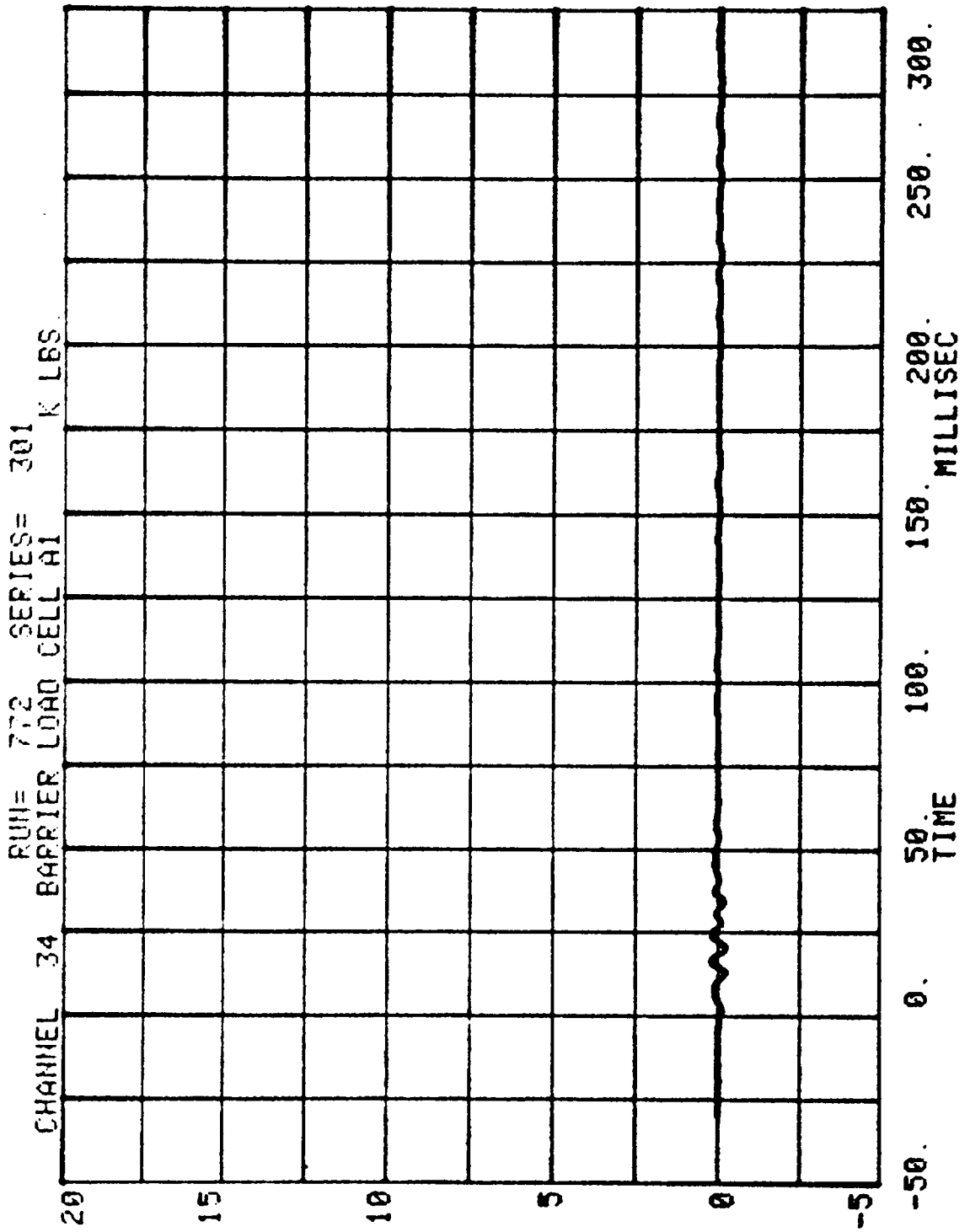

CHANNEL 14 DISPLACEMENT
RUN= 772 SERIES= 301 INCHES
ACC #7(X)
80
60
40
20
0
-20
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

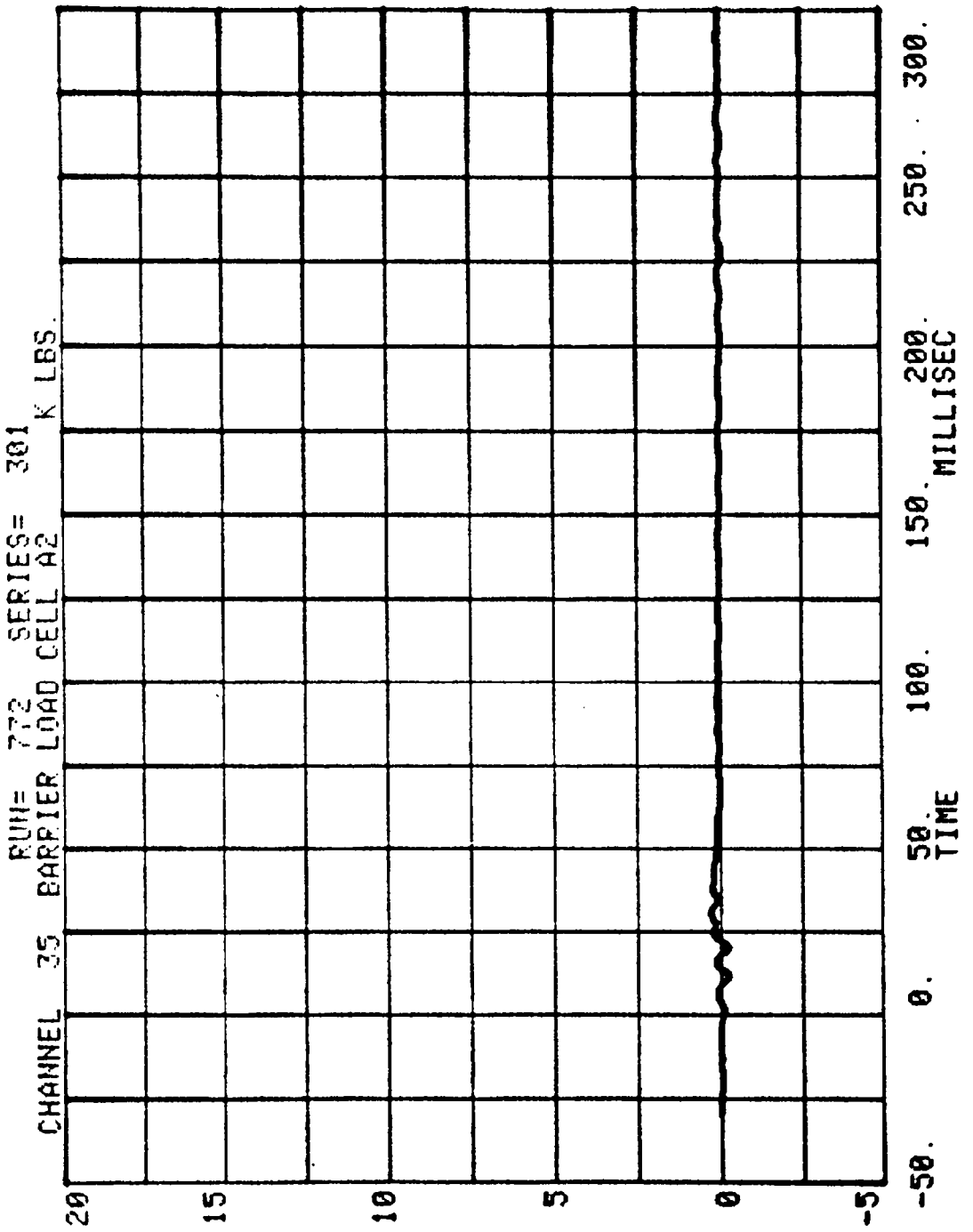
TEST NO. MH0301

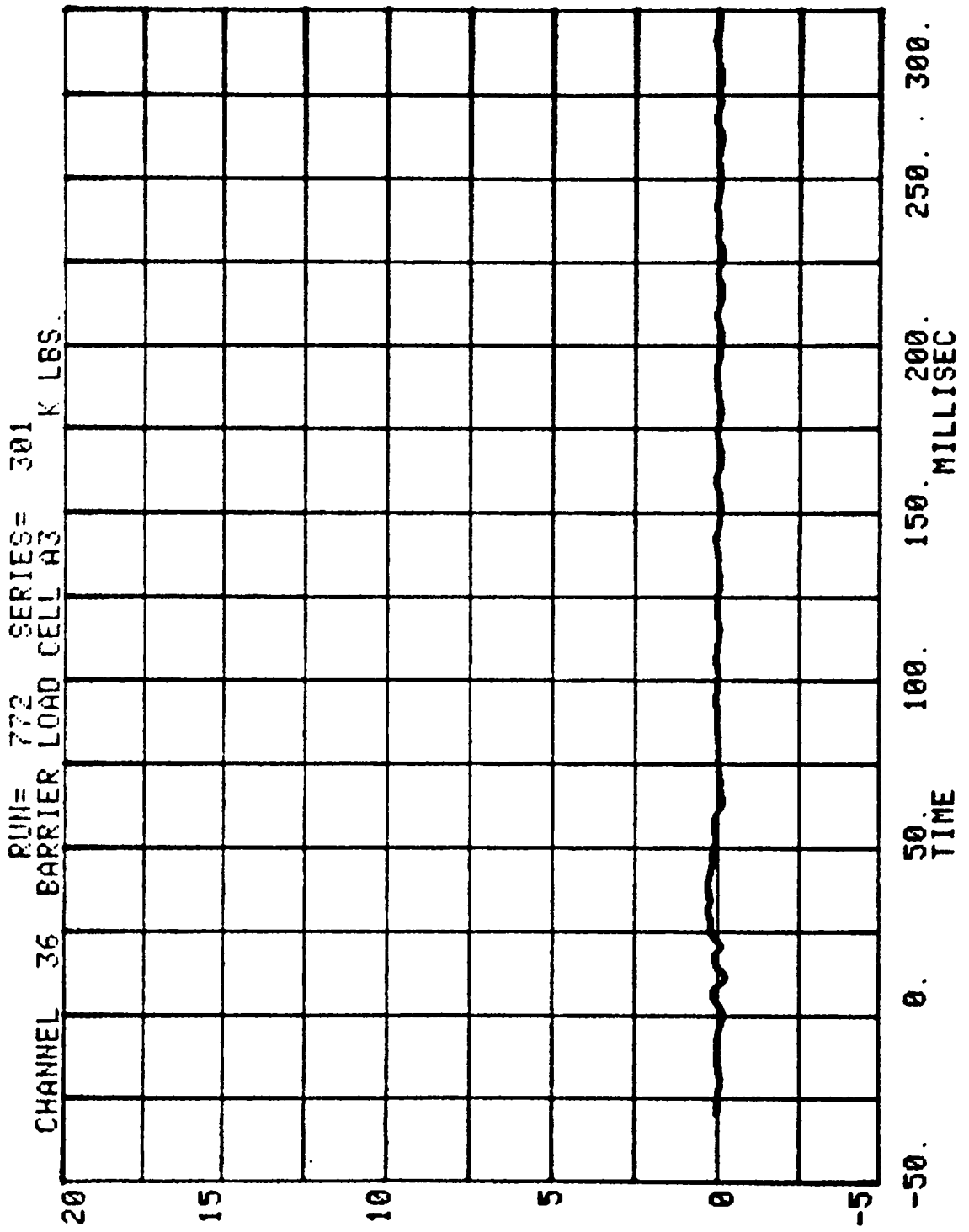
LOAD CELL BARRIER DATA

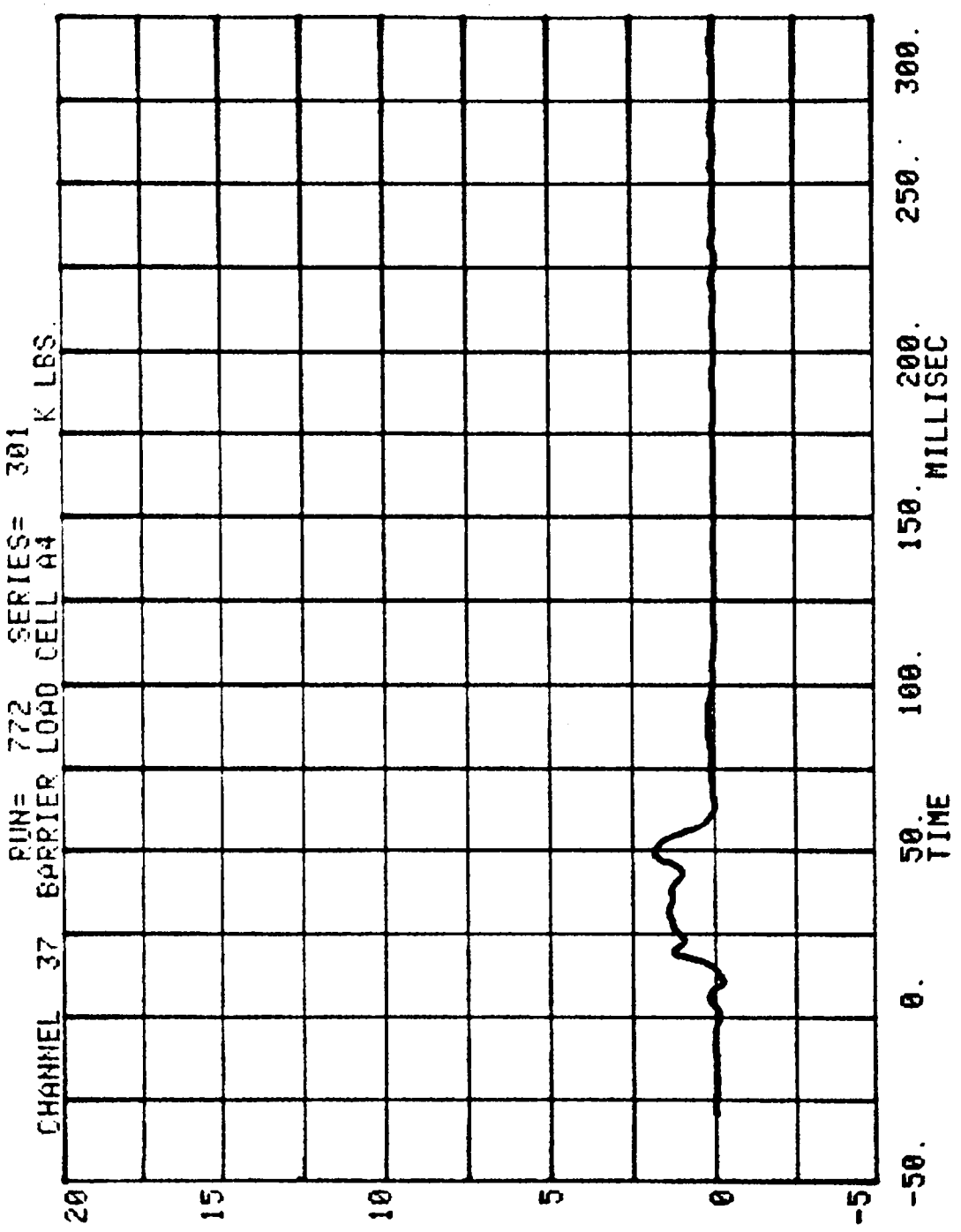
FILTER CHANNEL CLASS

60

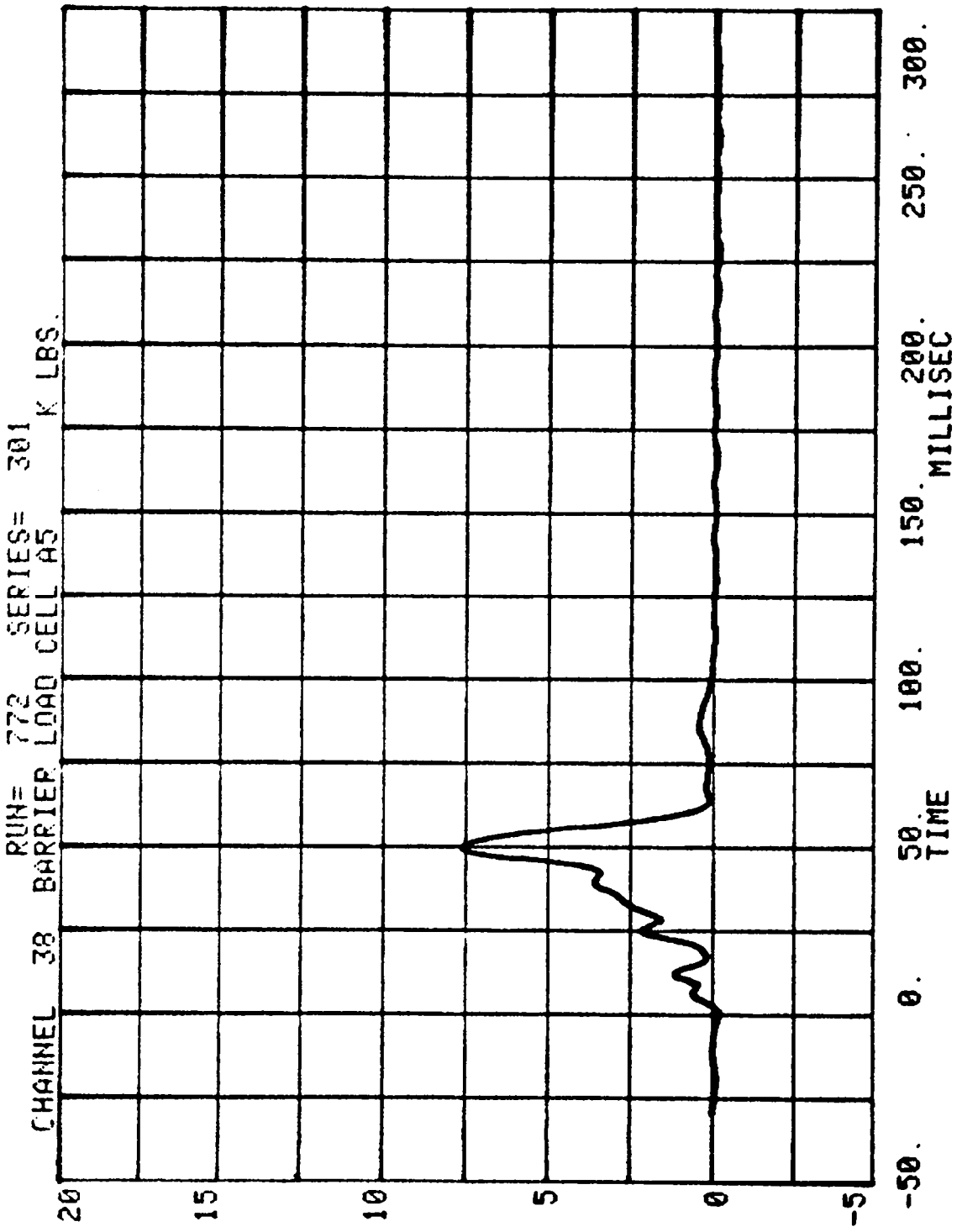

CHANNEL 34 BARRIER LOAD CELL A1
RUN= 772 SERIES= 301
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

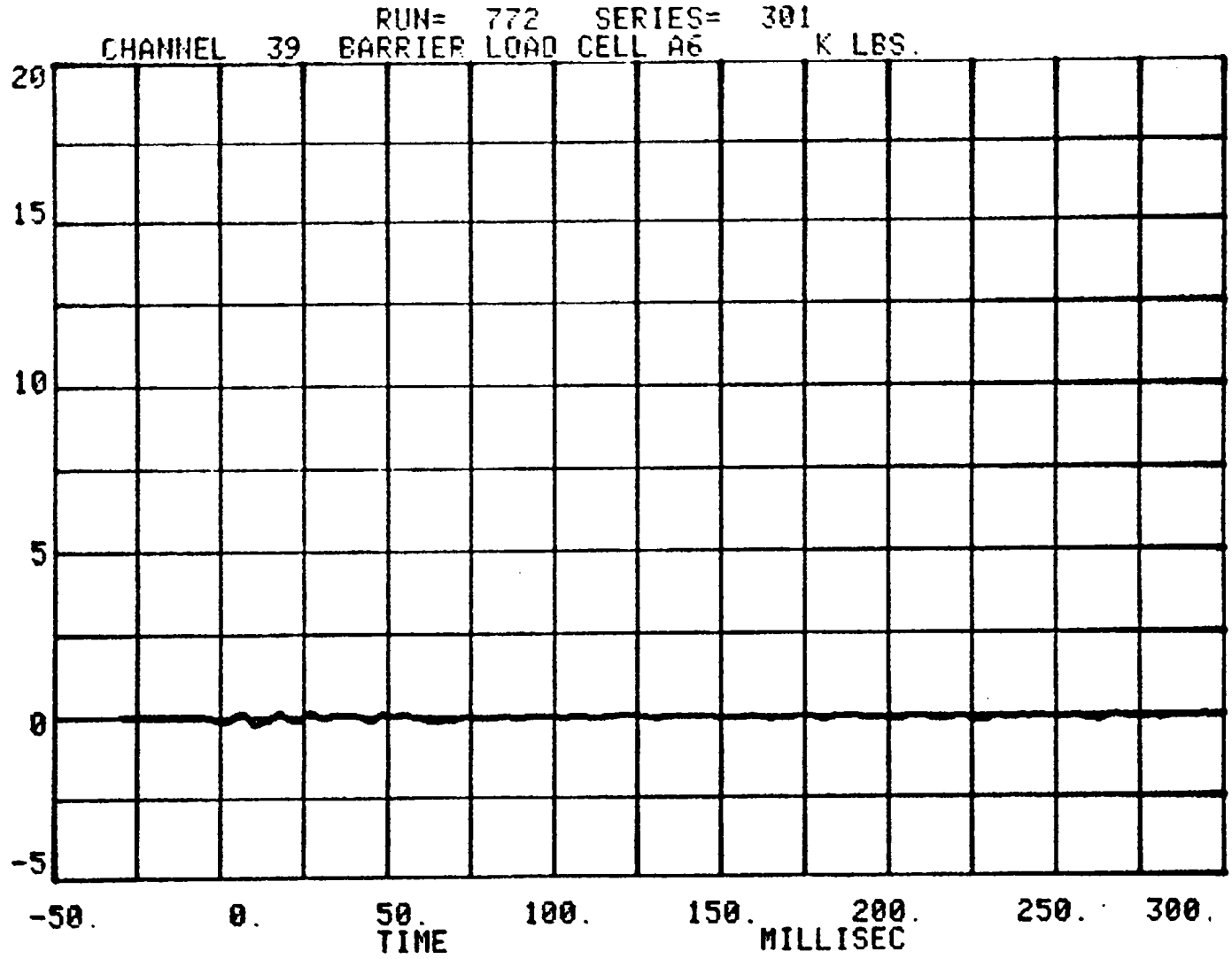

CHANNEL 35 BARRIER LOAD CELL A2
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 36 BARRIER LOAD CELL A3
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

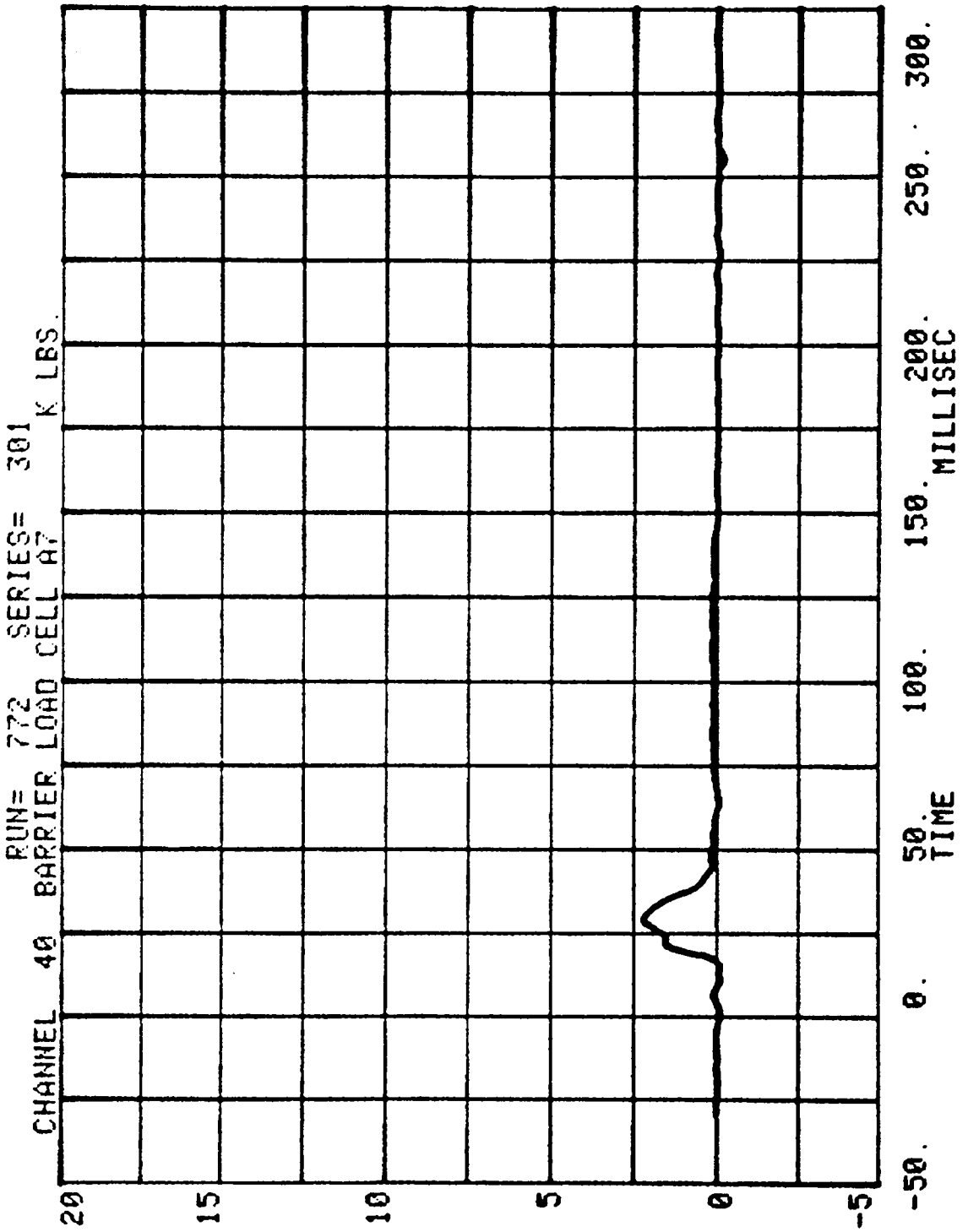

CHANNEL 37
RUN= 772
BARRIER LOAD CELL A4
SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

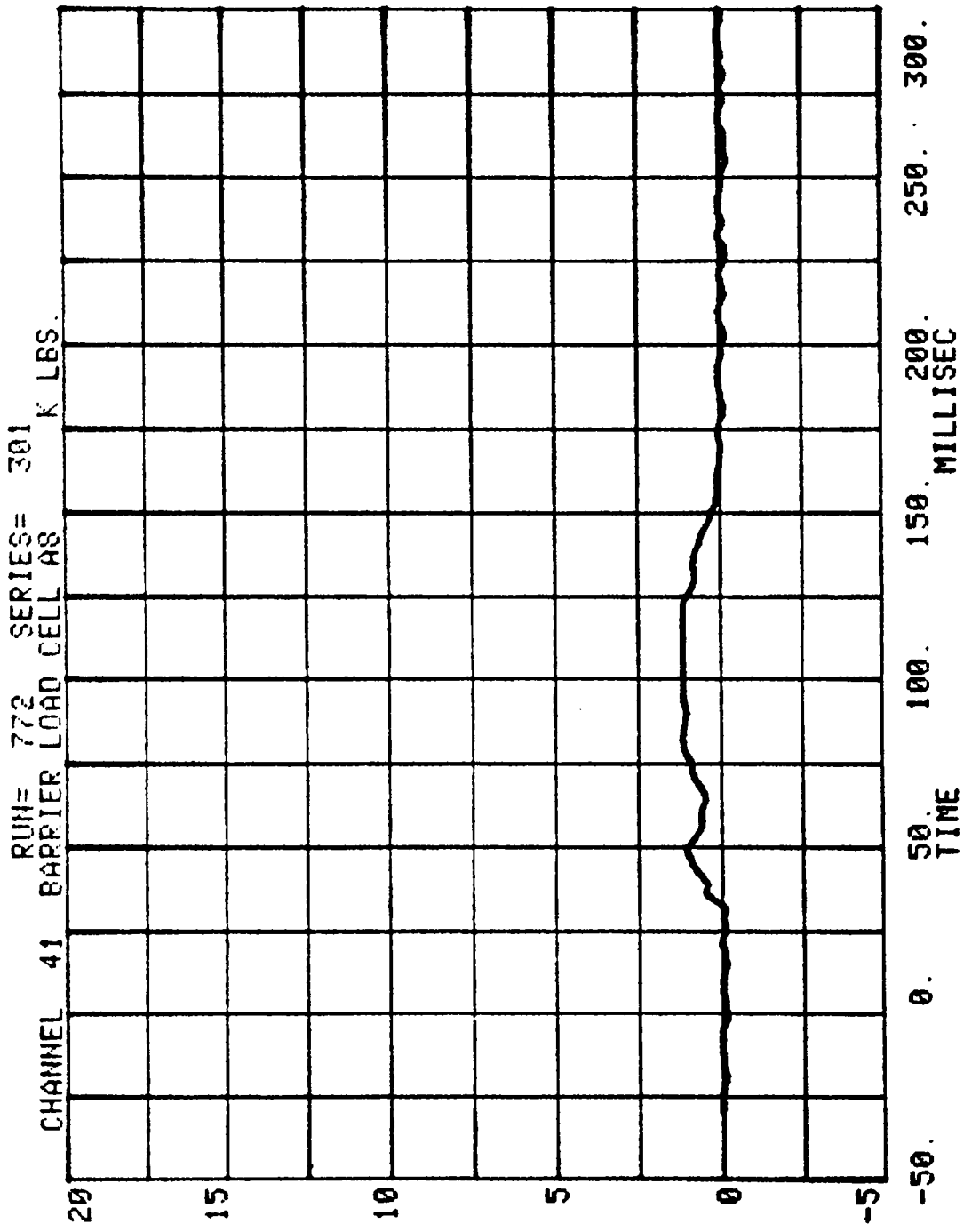
7556-10


CHANNEL 38 BARRIER LOAD CELL A5
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

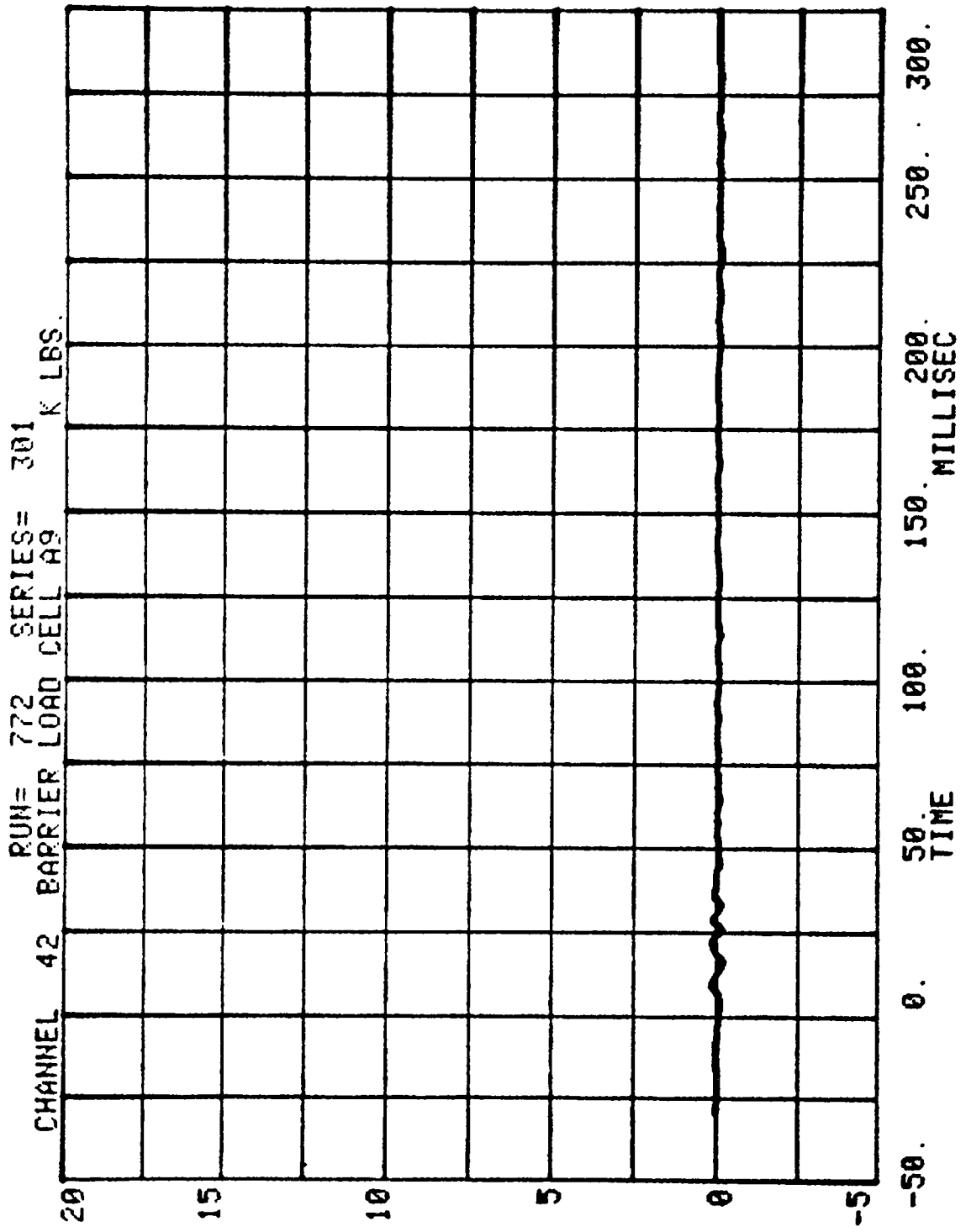

RUN= 772 SERIES= 301
CHANNEL 39 BARRIER LOAD CELL A6
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

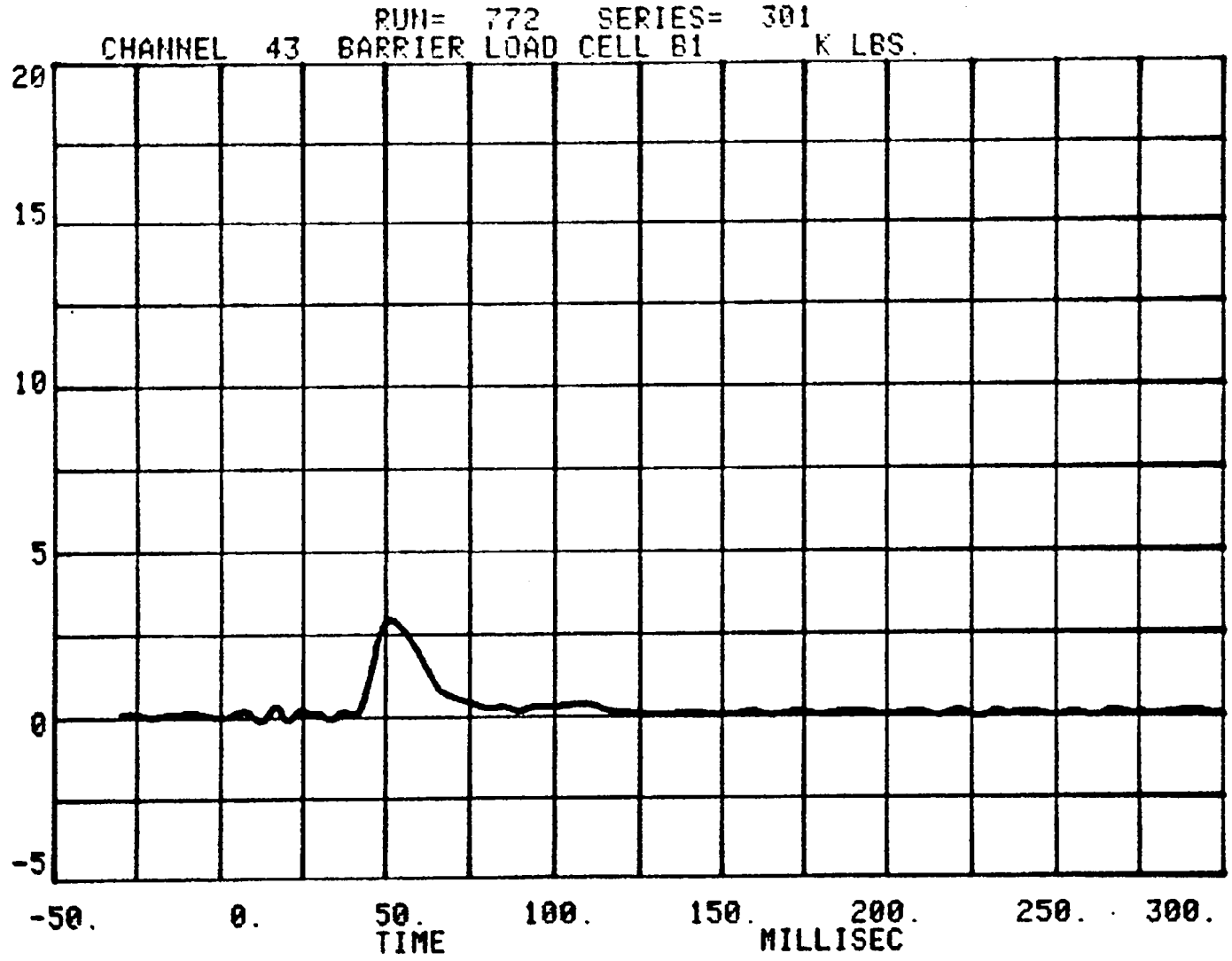
7556-10


CHANNEL 40 BARRIER LOAD CELL A7
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

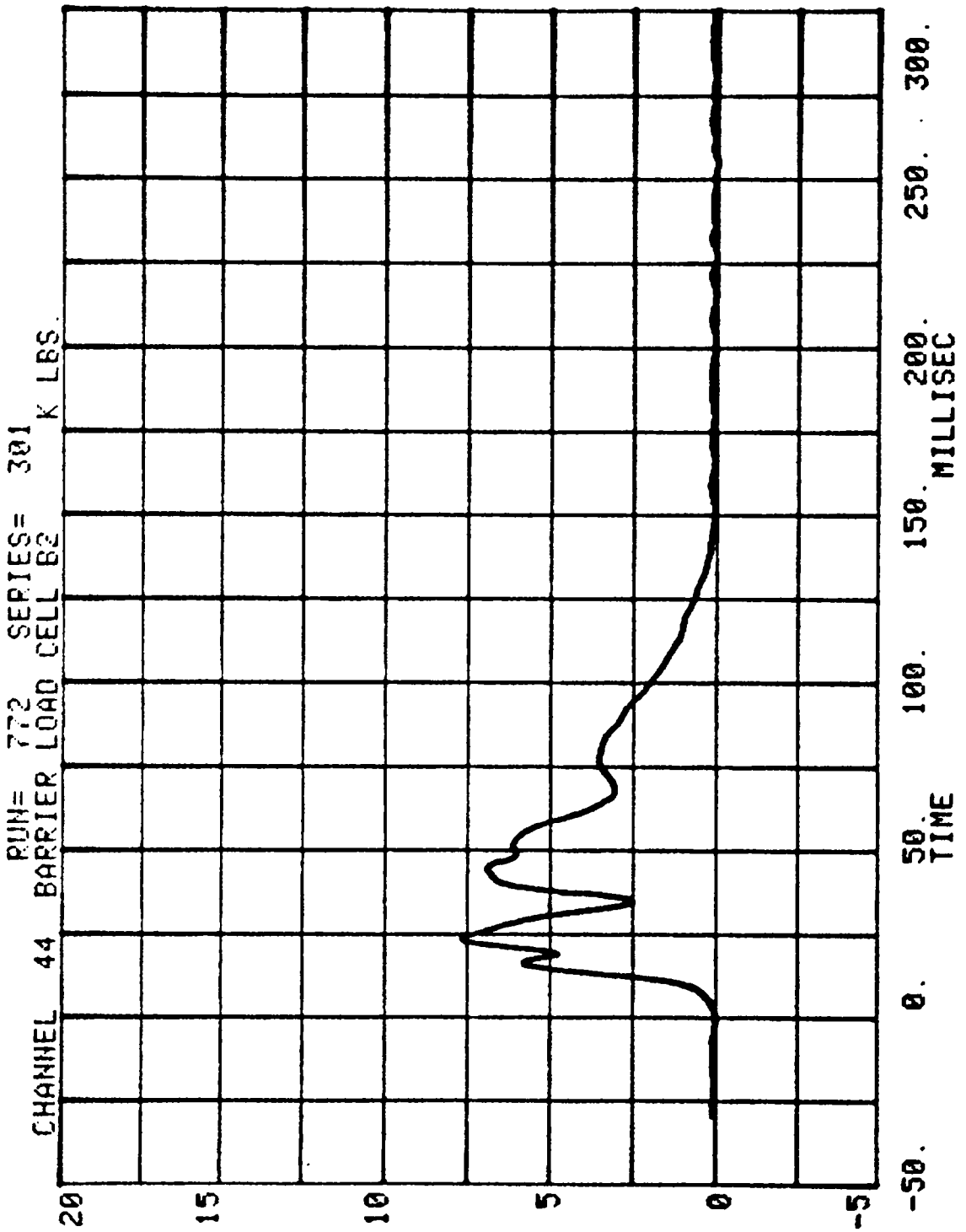

CHANNEL 41 BARRIER LOAD CELL AS
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

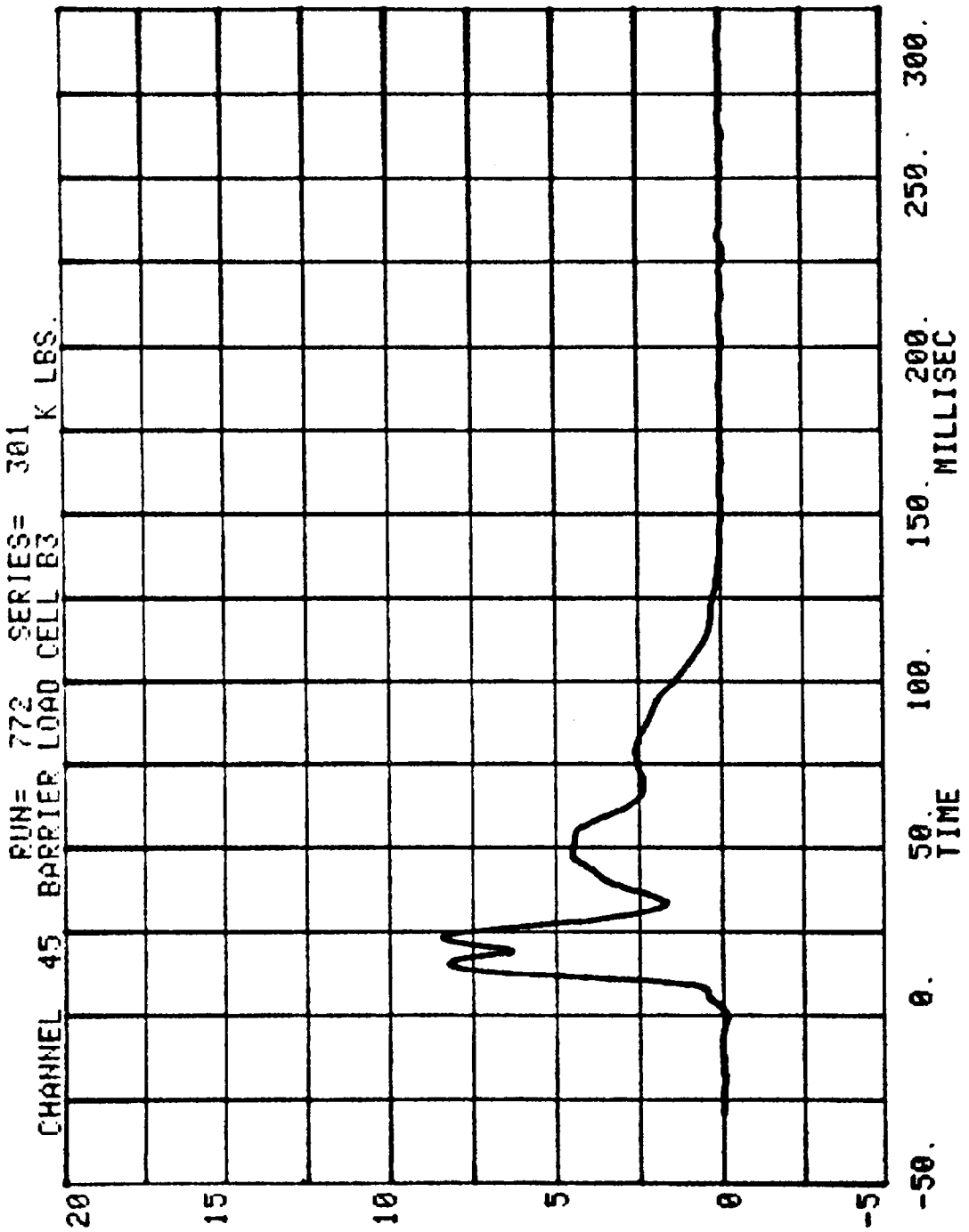
7556-10

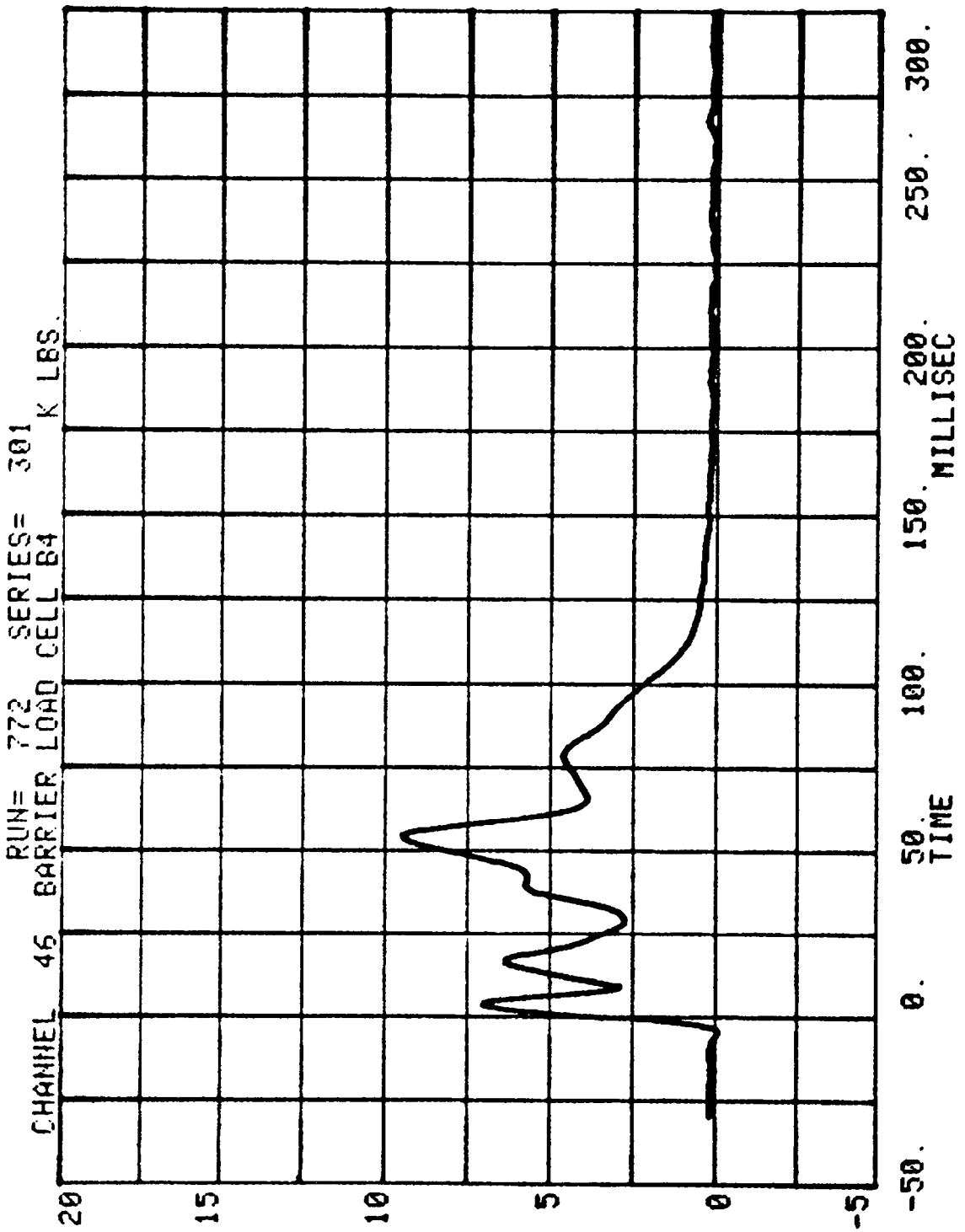

CHANNEL 42
RUN= 772
BARRIER LOAD CELL A9
SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

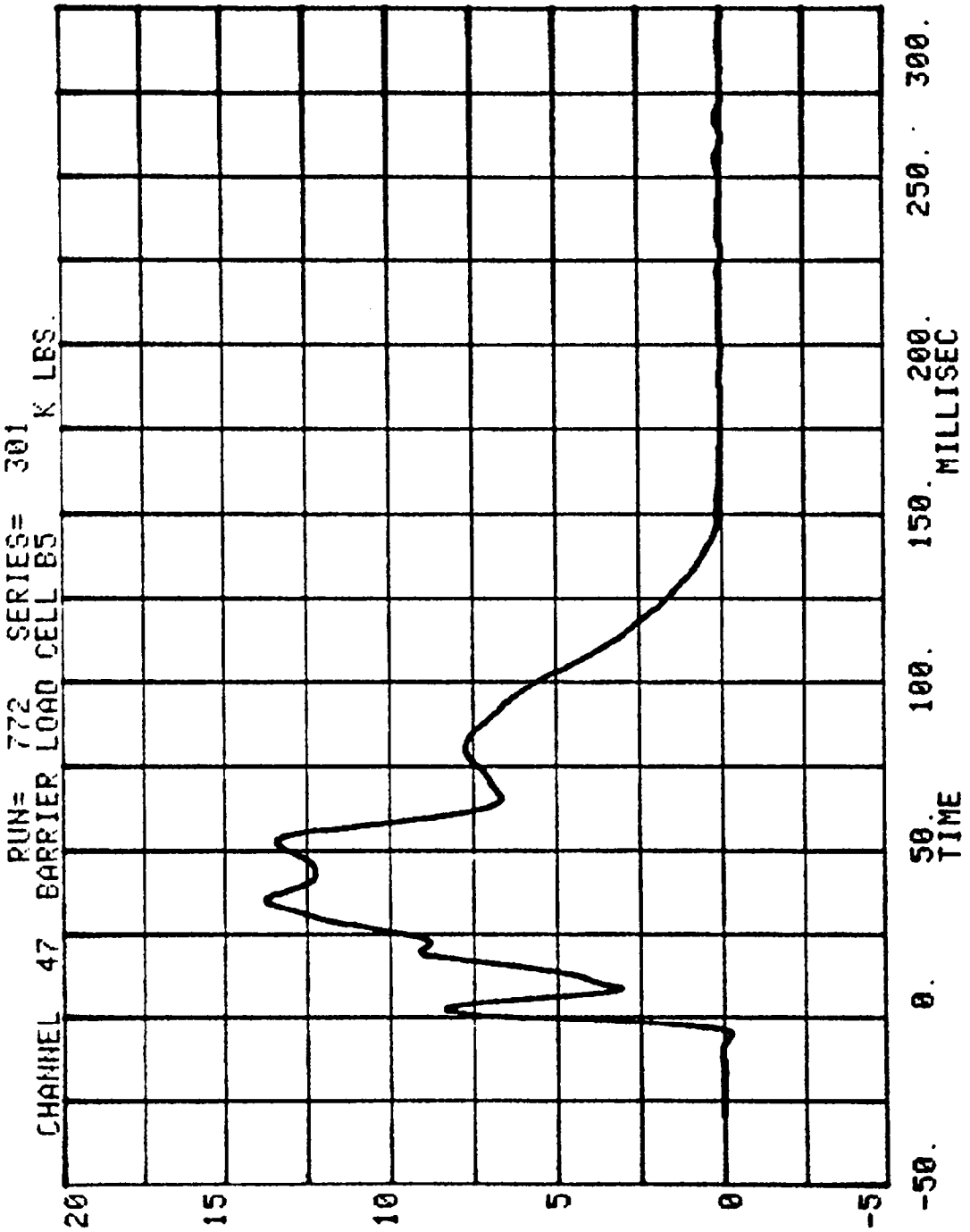

RUN= 772 SERIES= 301
CHANNEL 43 BARRIER LOAD CELL B1 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

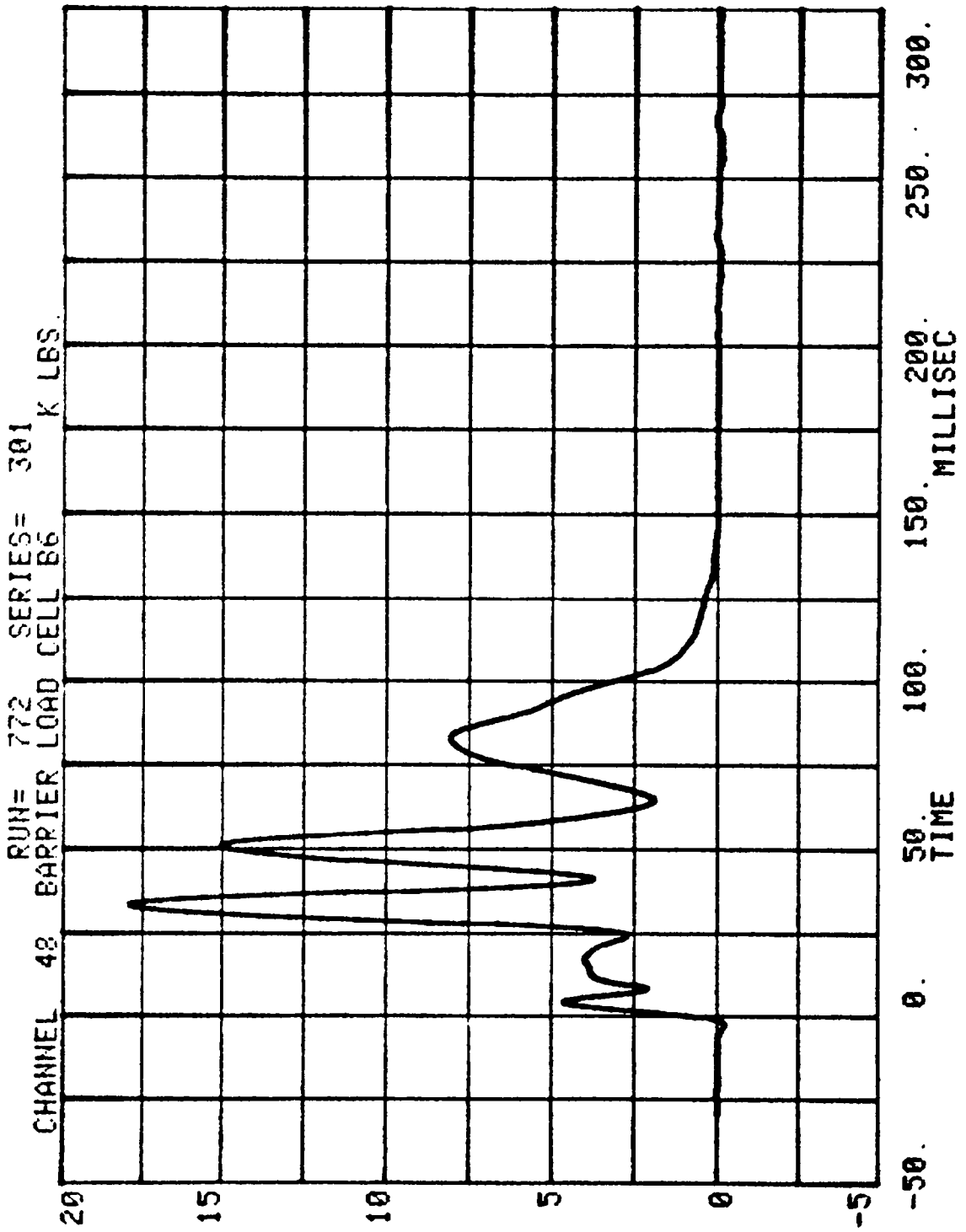
7556-10

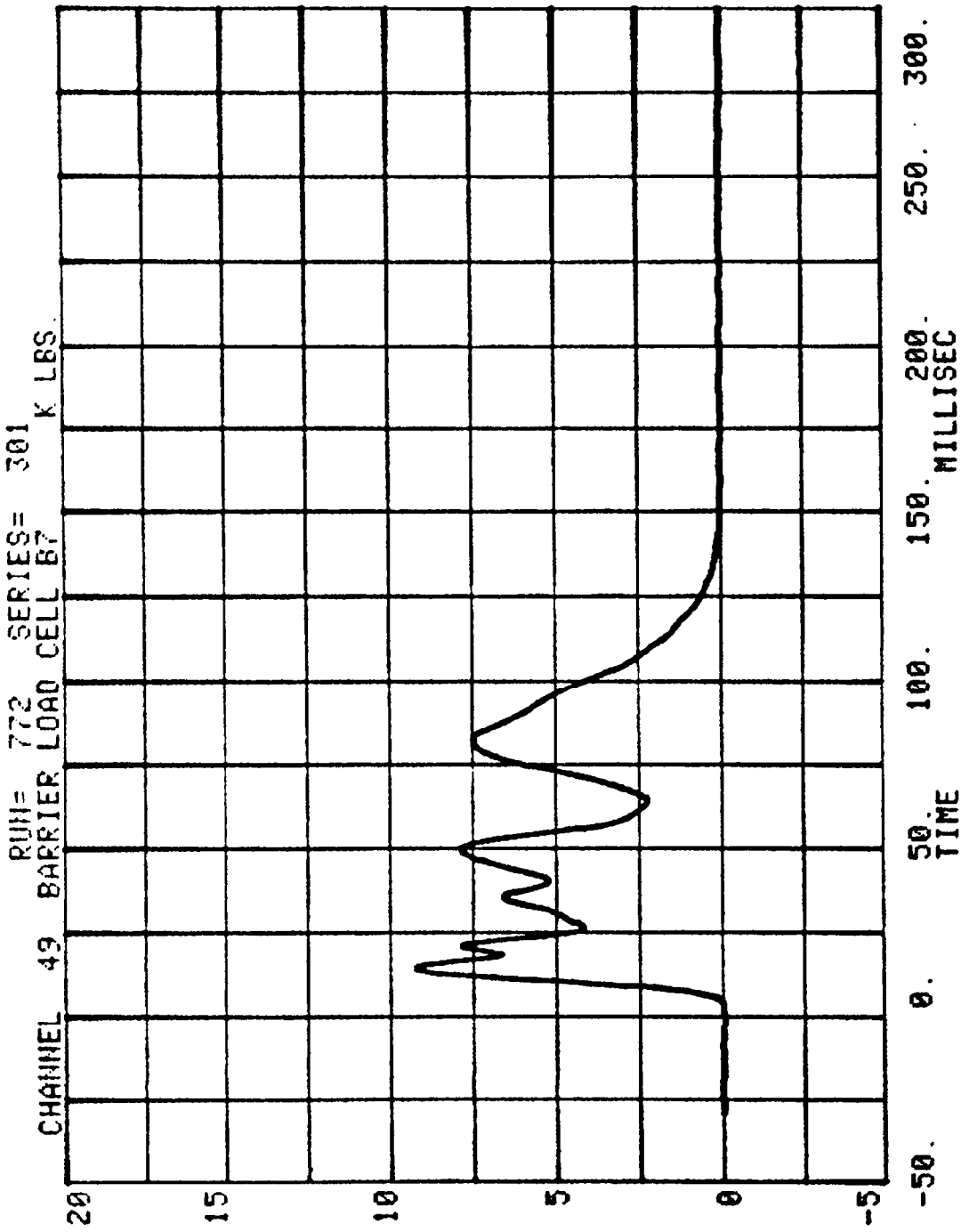

CHANNEL 44
RUN= 772
BARRIER LOAD CELL B2
SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

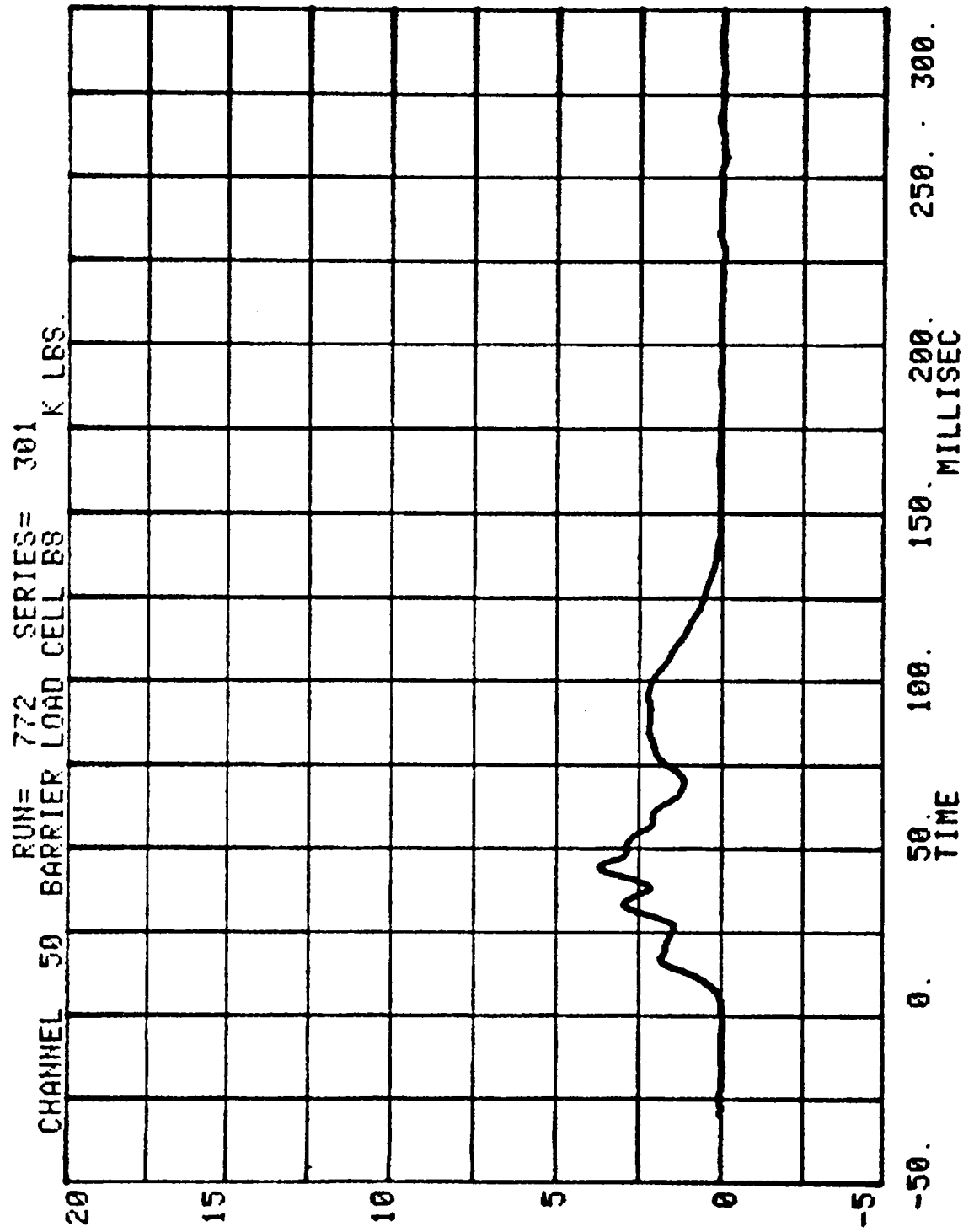

CHANNEL 45 BARRIER LOAD CELL B3
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

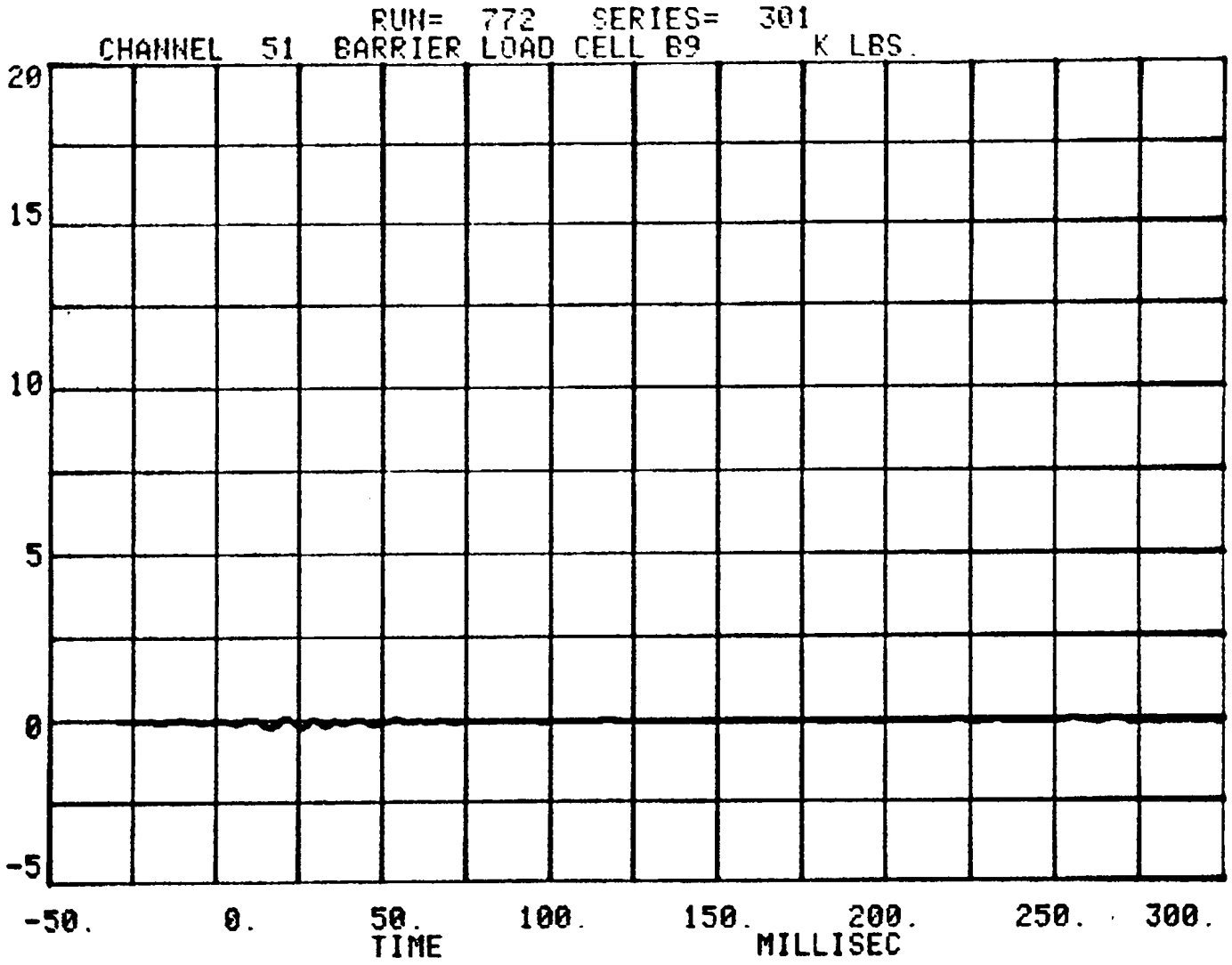

CHANNEL 46 BARRIER LOAD CELL B4
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

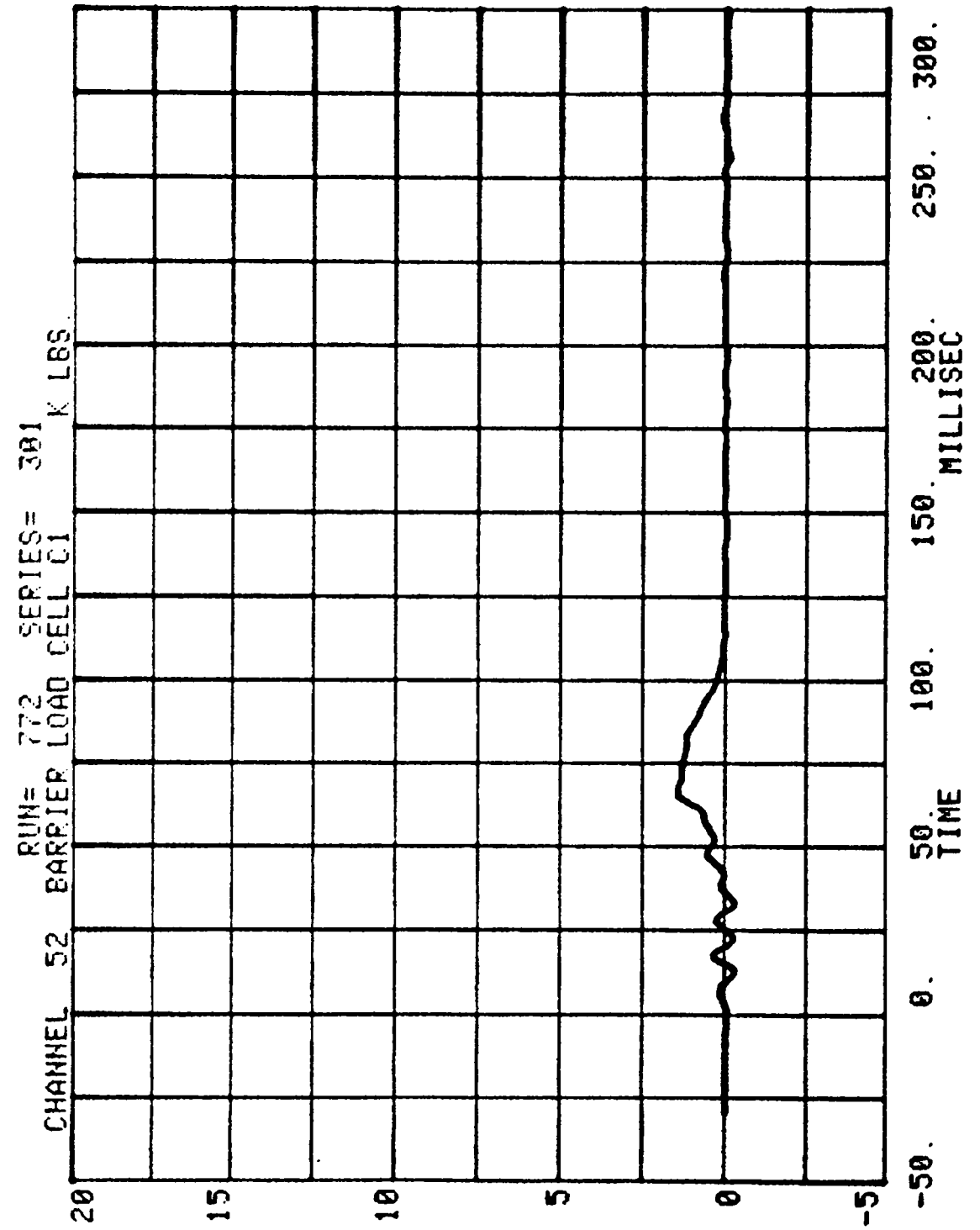

CHANNEL 47 BARRIER LOAD CELL B5
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

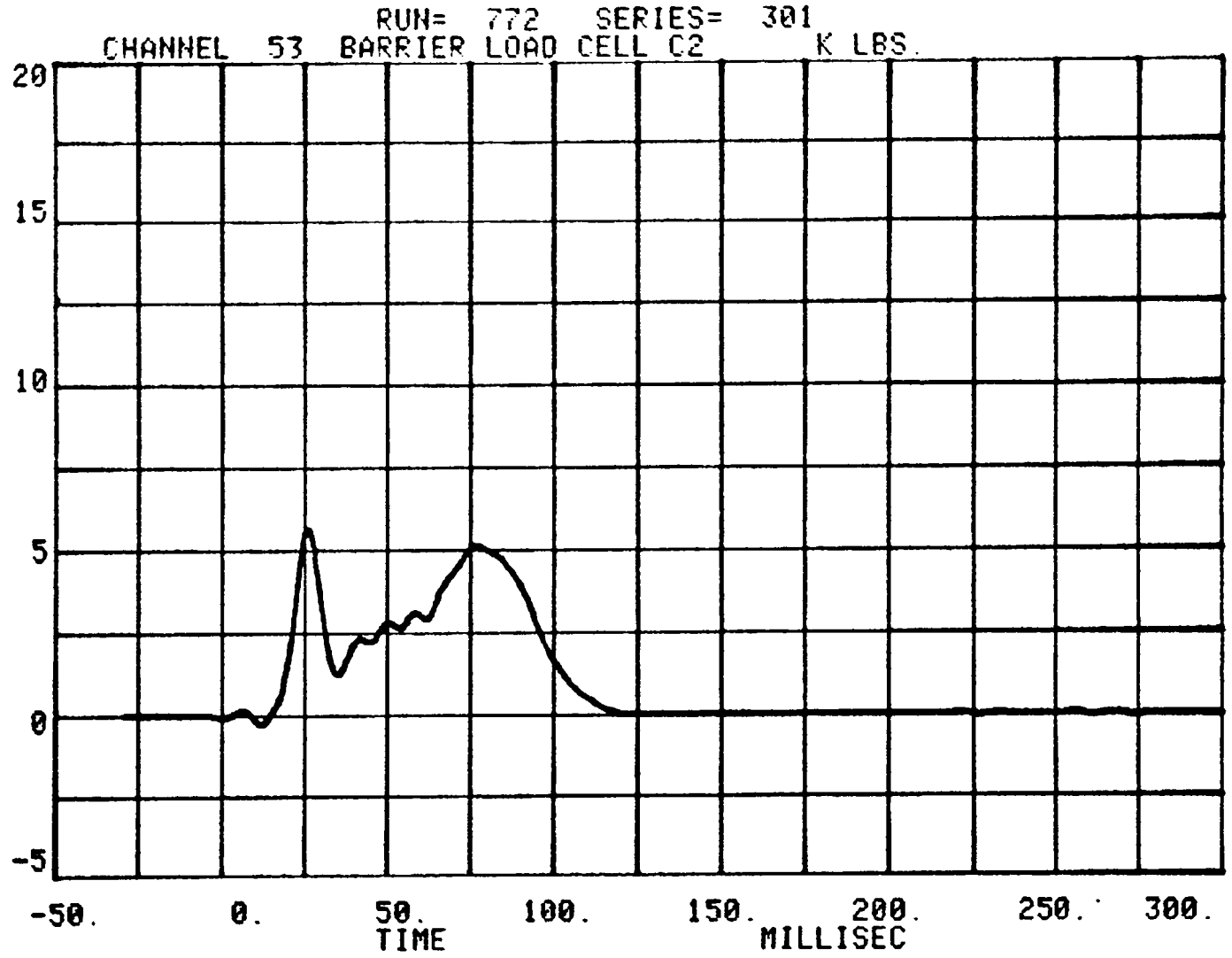

CHANNEL 48
RUN= 772 SERIES= 301
BARRIER LOAD CELL B6
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

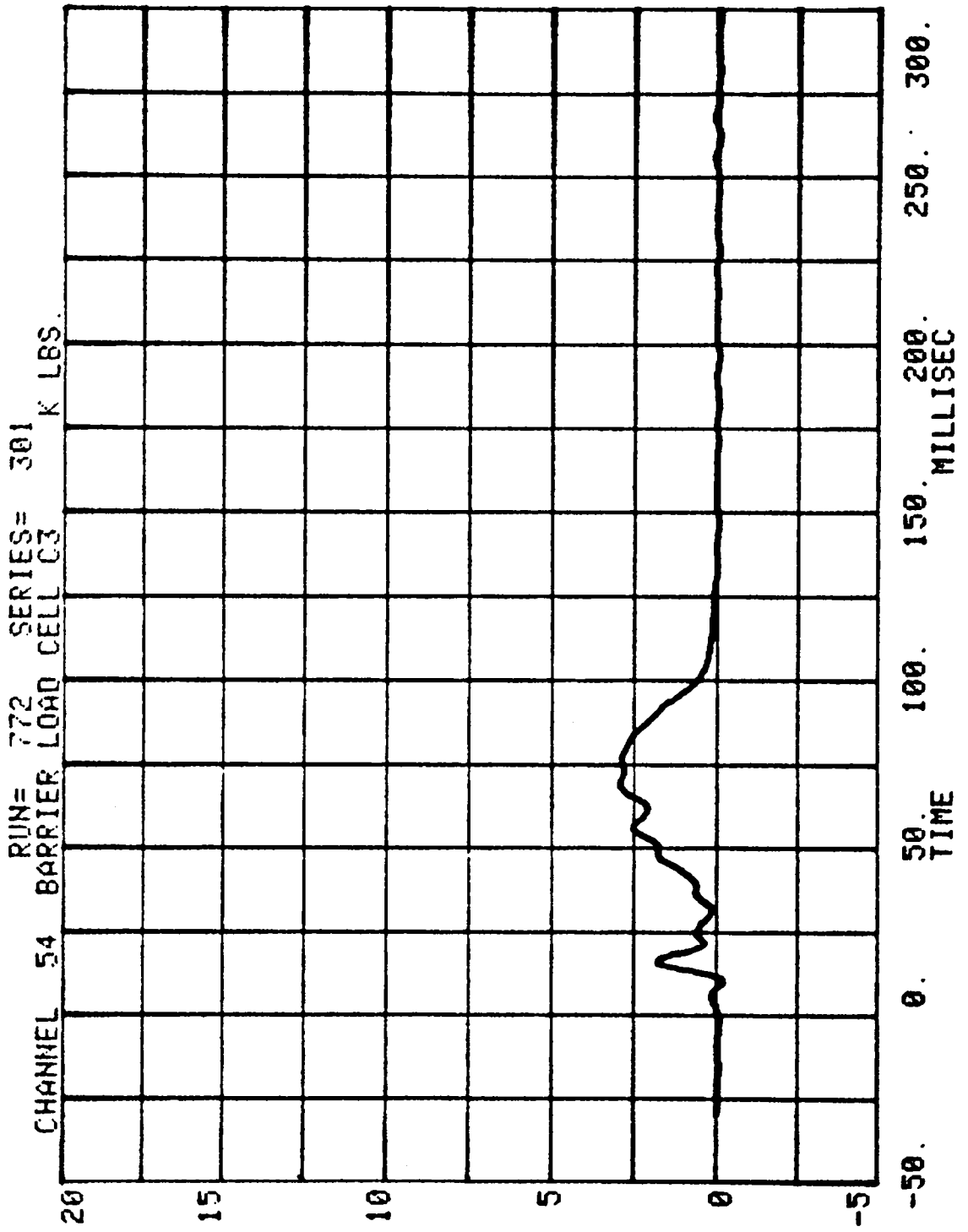

CHANNEL 49 BARRIER LOAD CELL B7
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

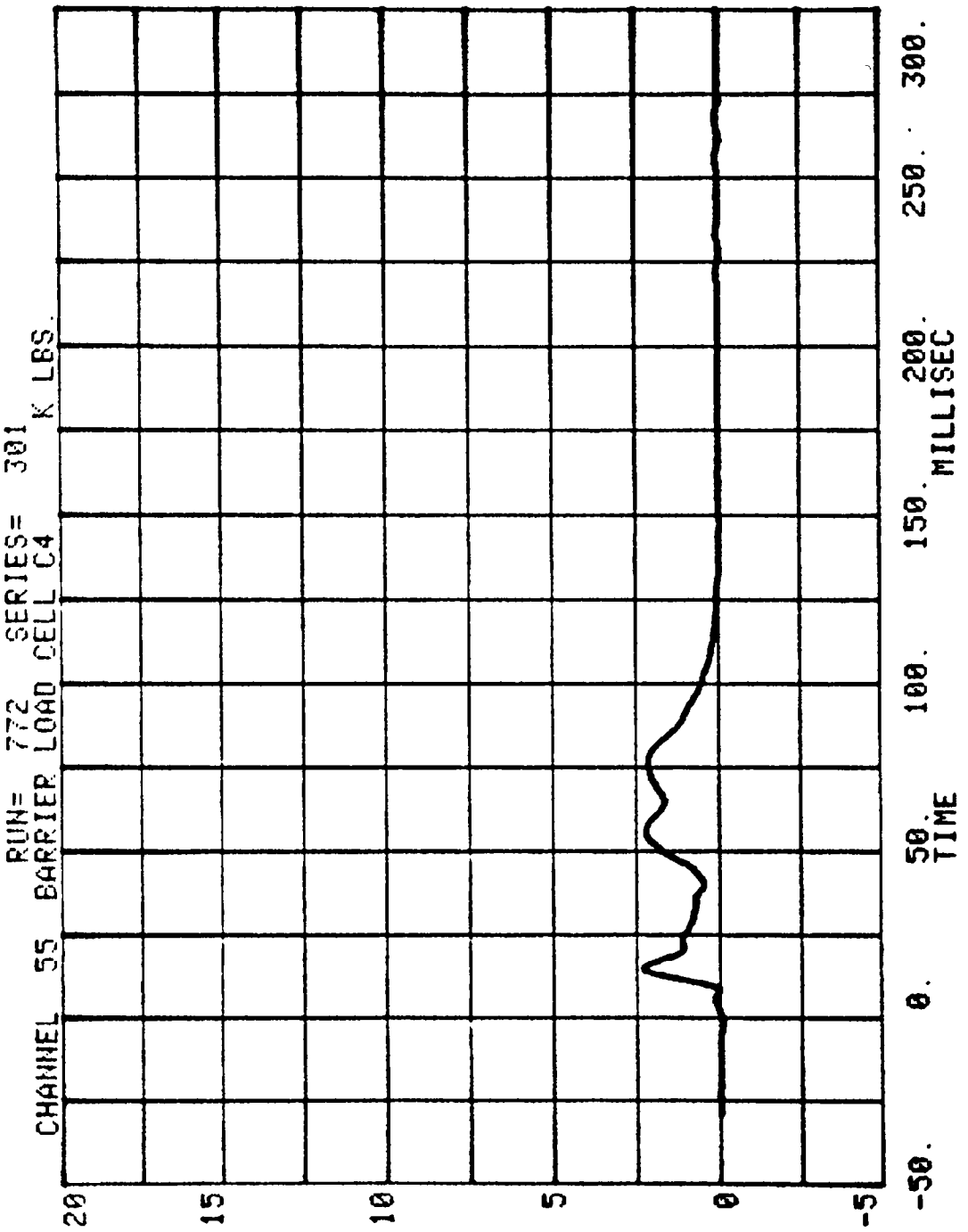

CHANNEL 50 BARRIER LOAD CELL 88
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


RUN= 772 SERIES= 301
CHANNEL 51 BARRIER LOAD CELL B9
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

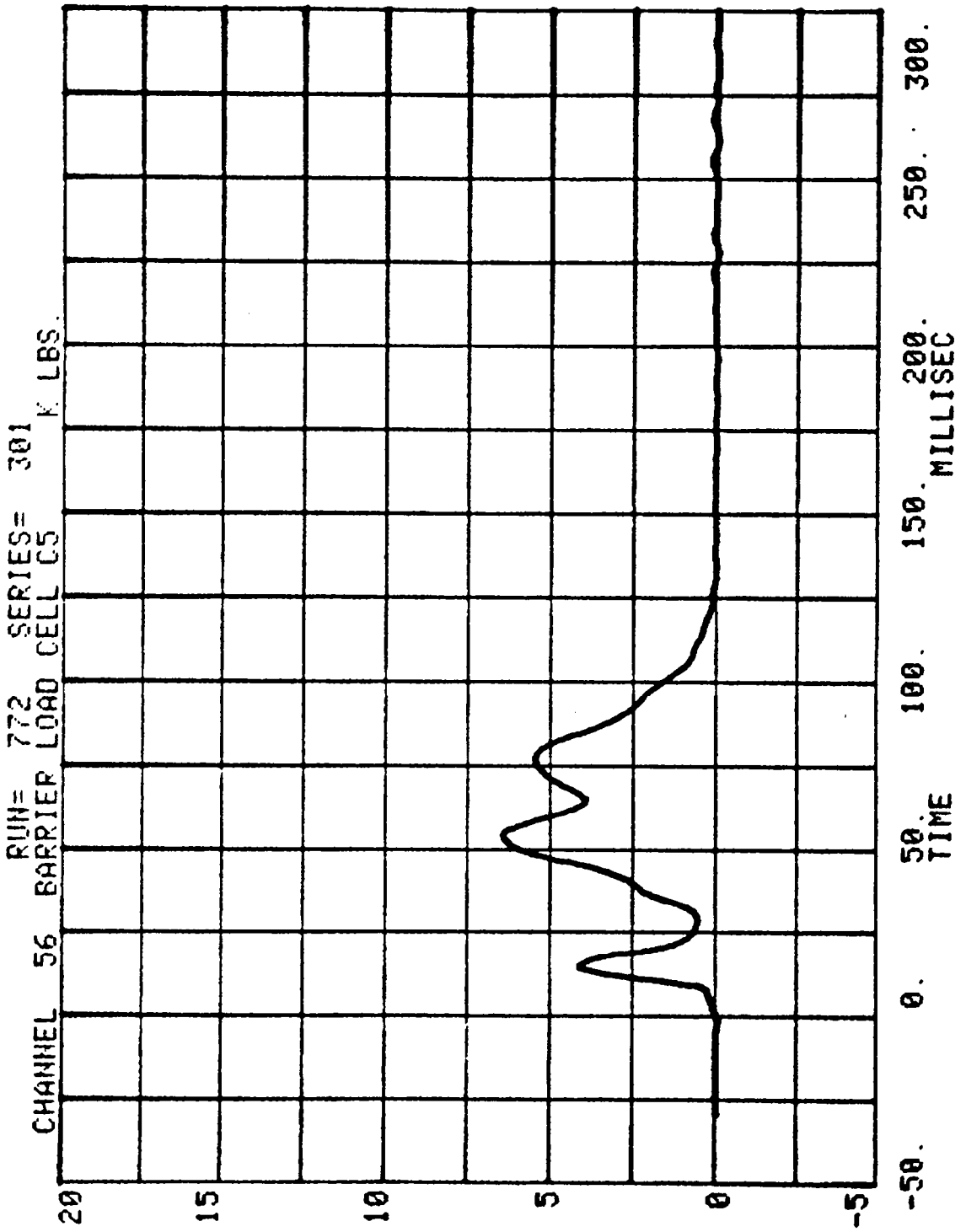

CHANNEL 52 BARRIER LOAD CELL C1
RUN= 772 SERIES= 301
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

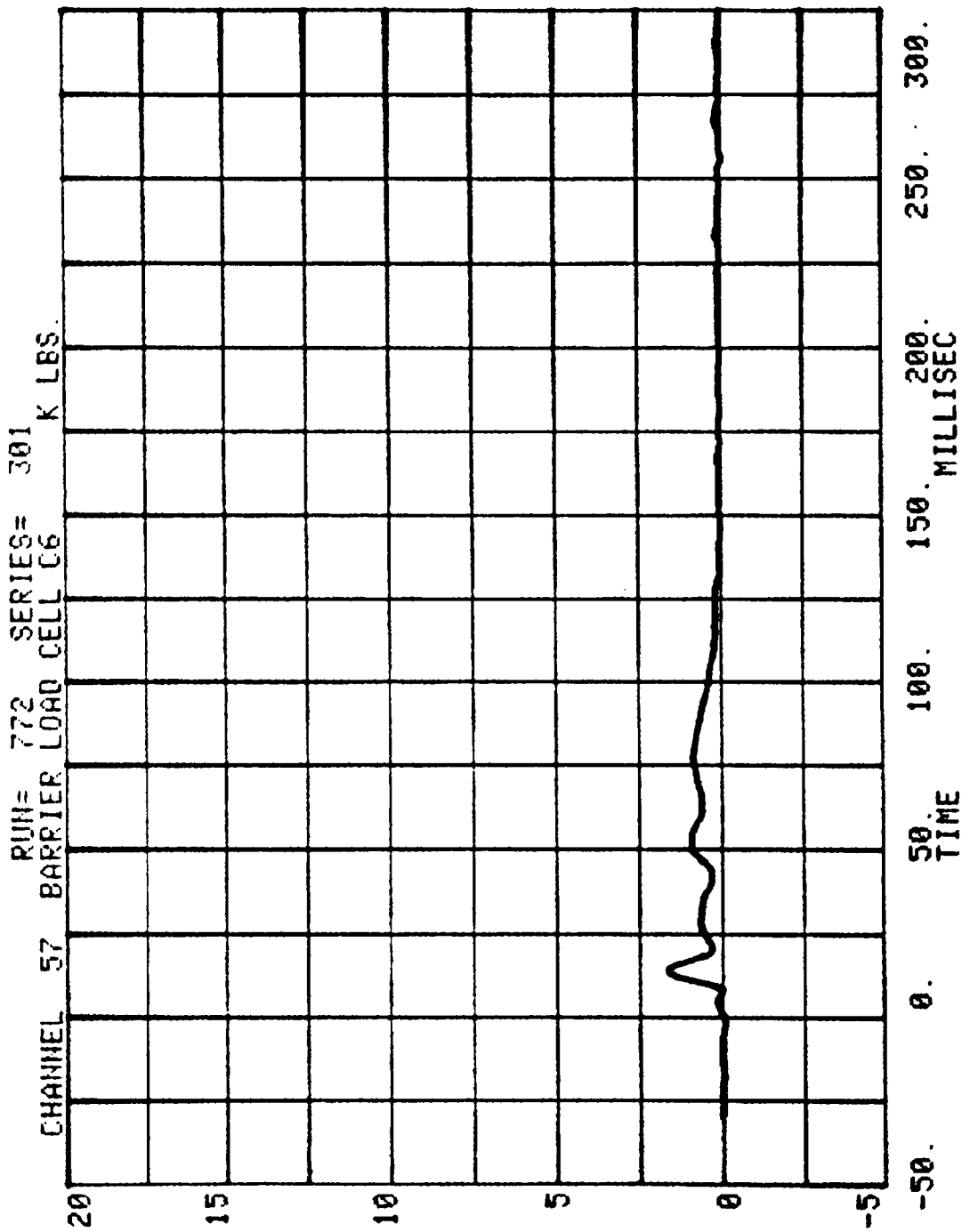

RUN= 772 SERIES= 301
CHANNEL 53 BARRIER LOAD CELL C2
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

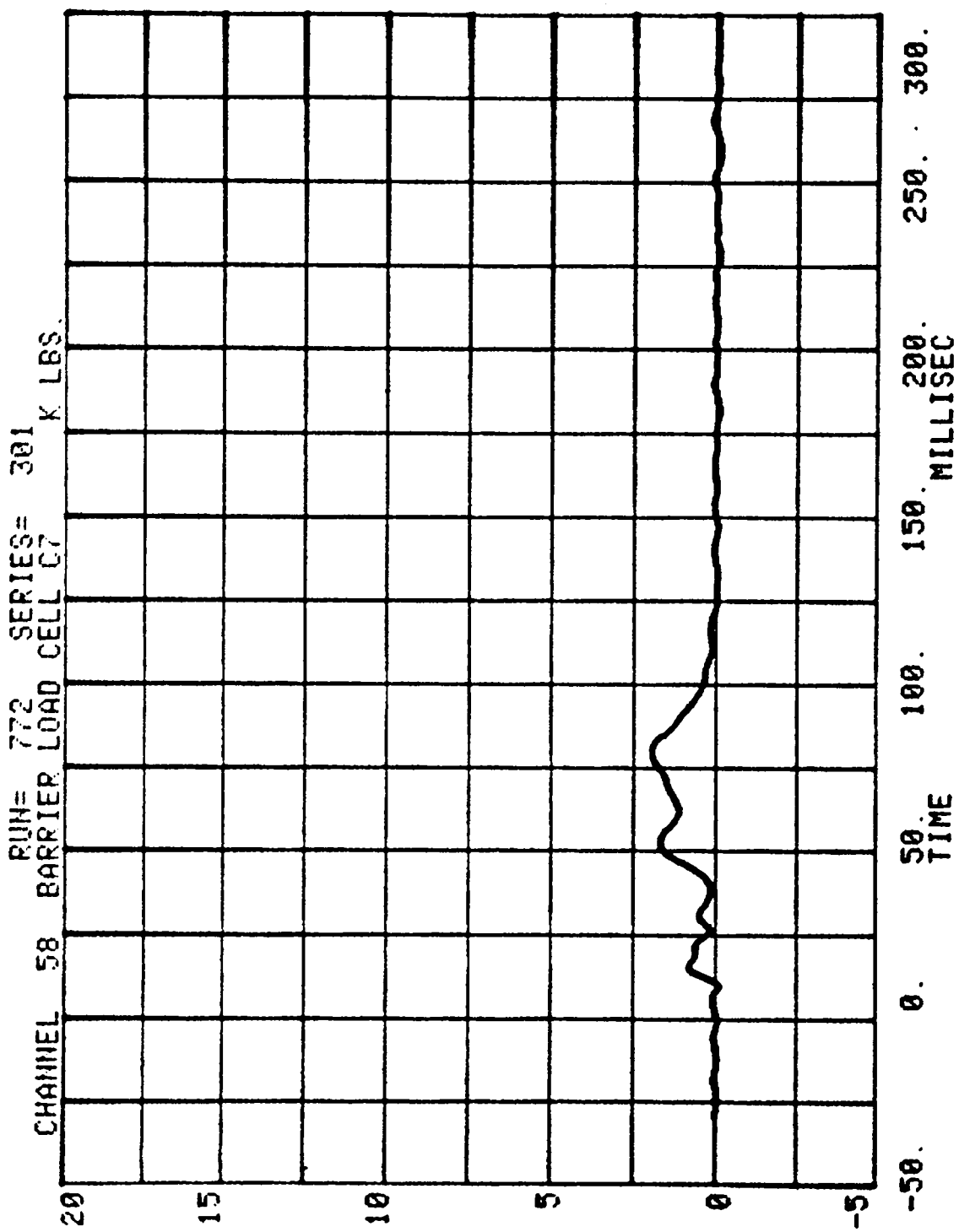

CHANNEL 54 BARRIER LOAD CELL C3
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 55 BARRIER LOAD CELL C4
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

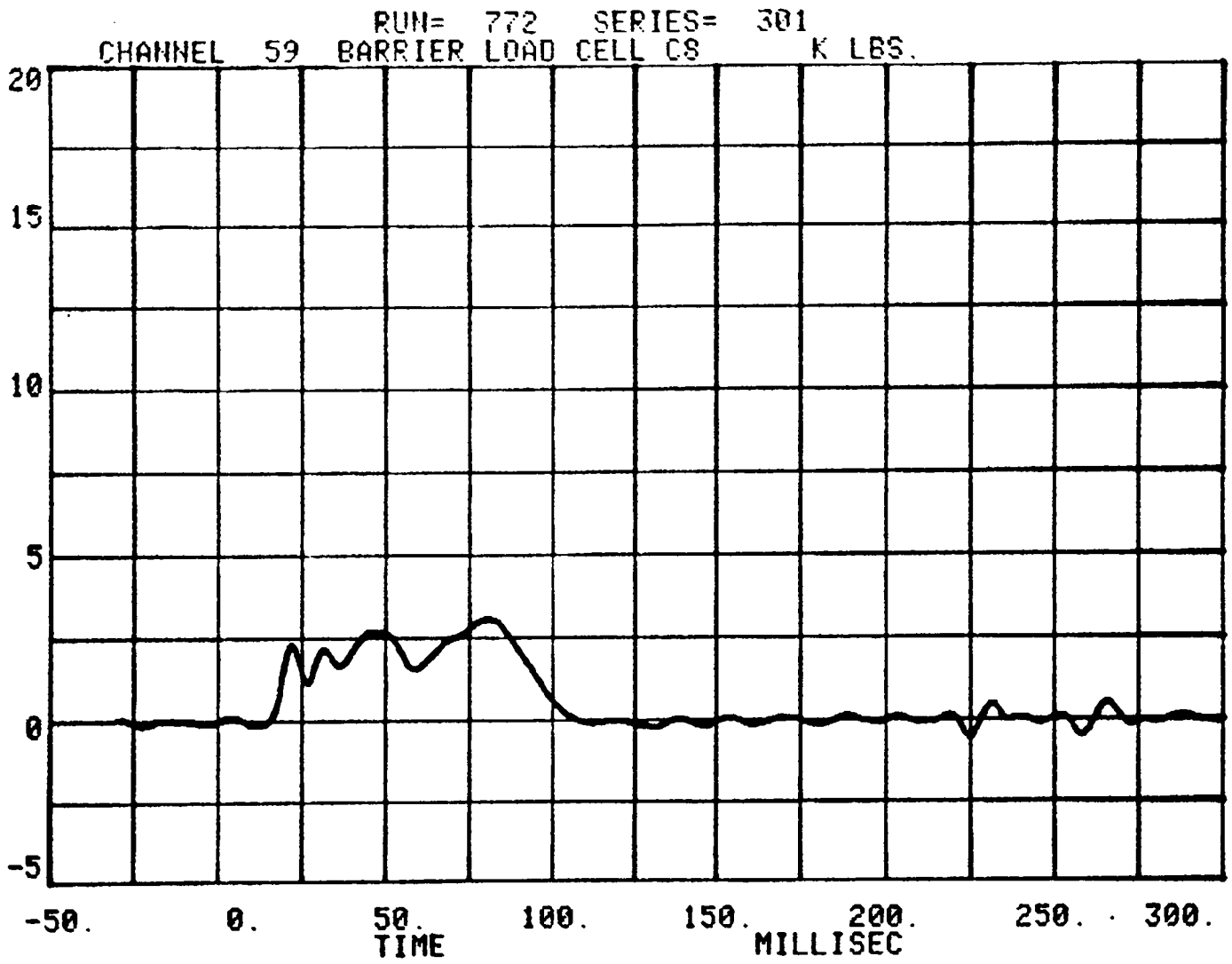
7556-10


CHANNEL 56 BARRIER LOAD CELL C5
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

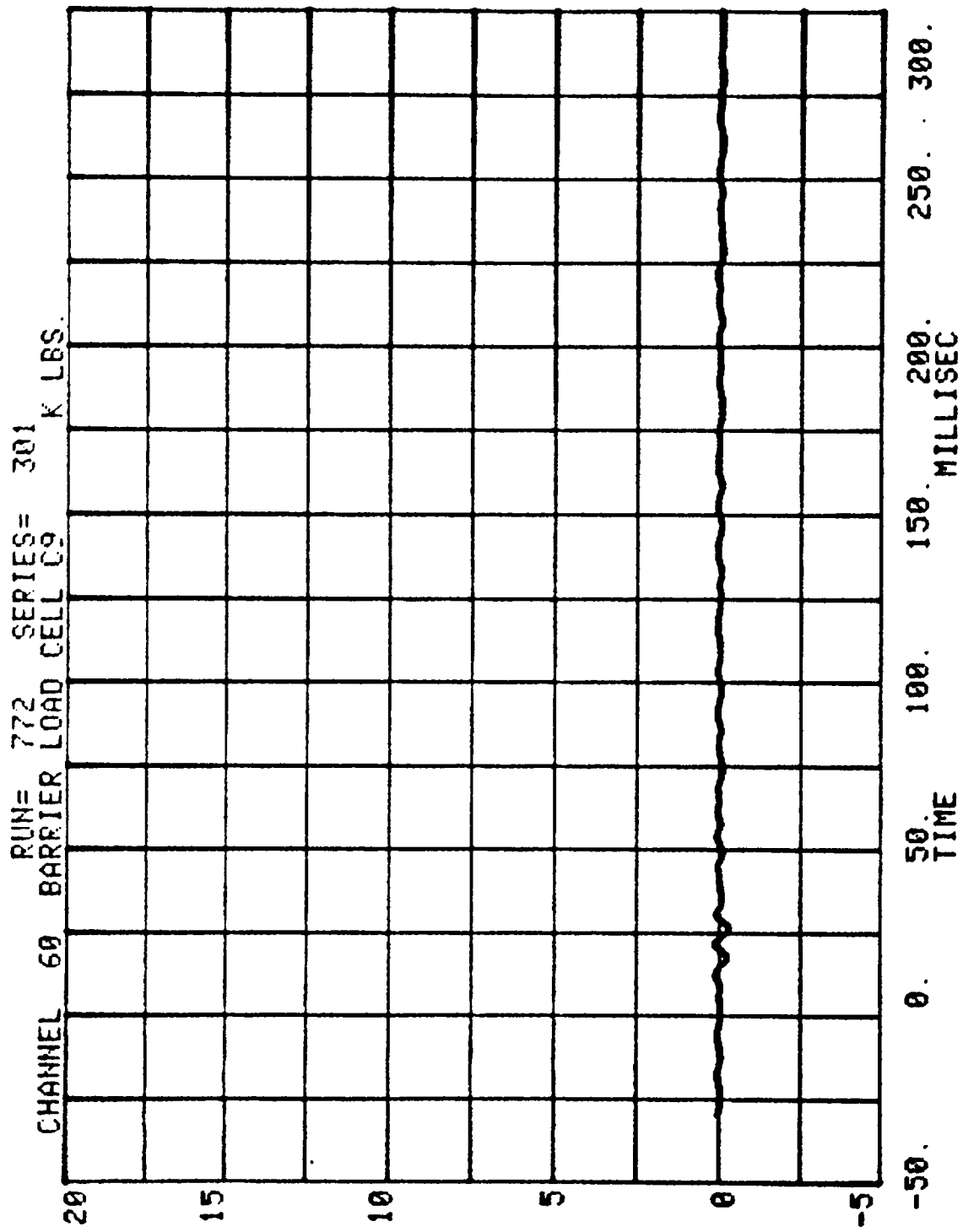

CHANNEL 57 BARRIER LOAD CELL C6
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

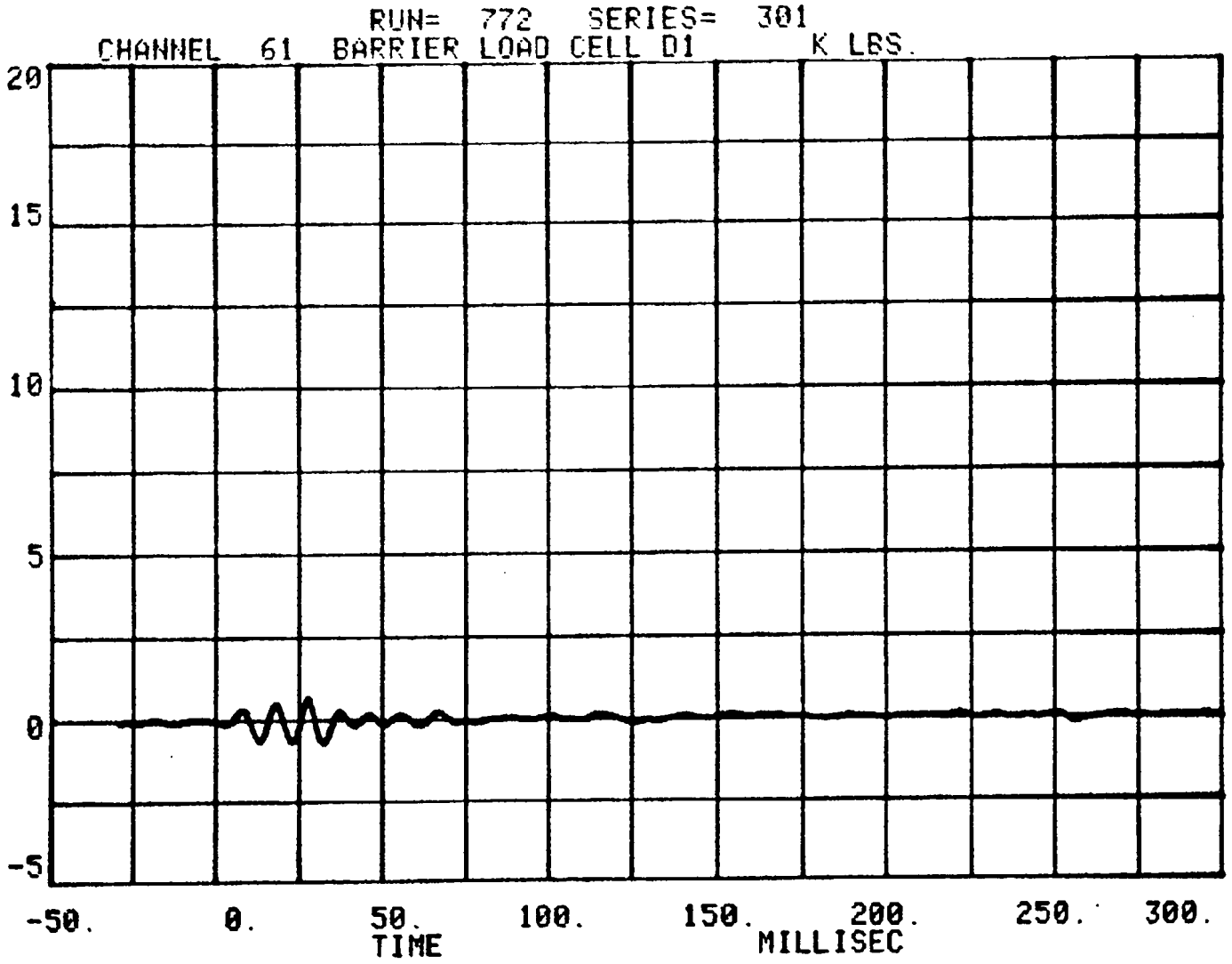

CHANNEL 58
RUN= 772
BARRIER LOAD CELL C7
SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

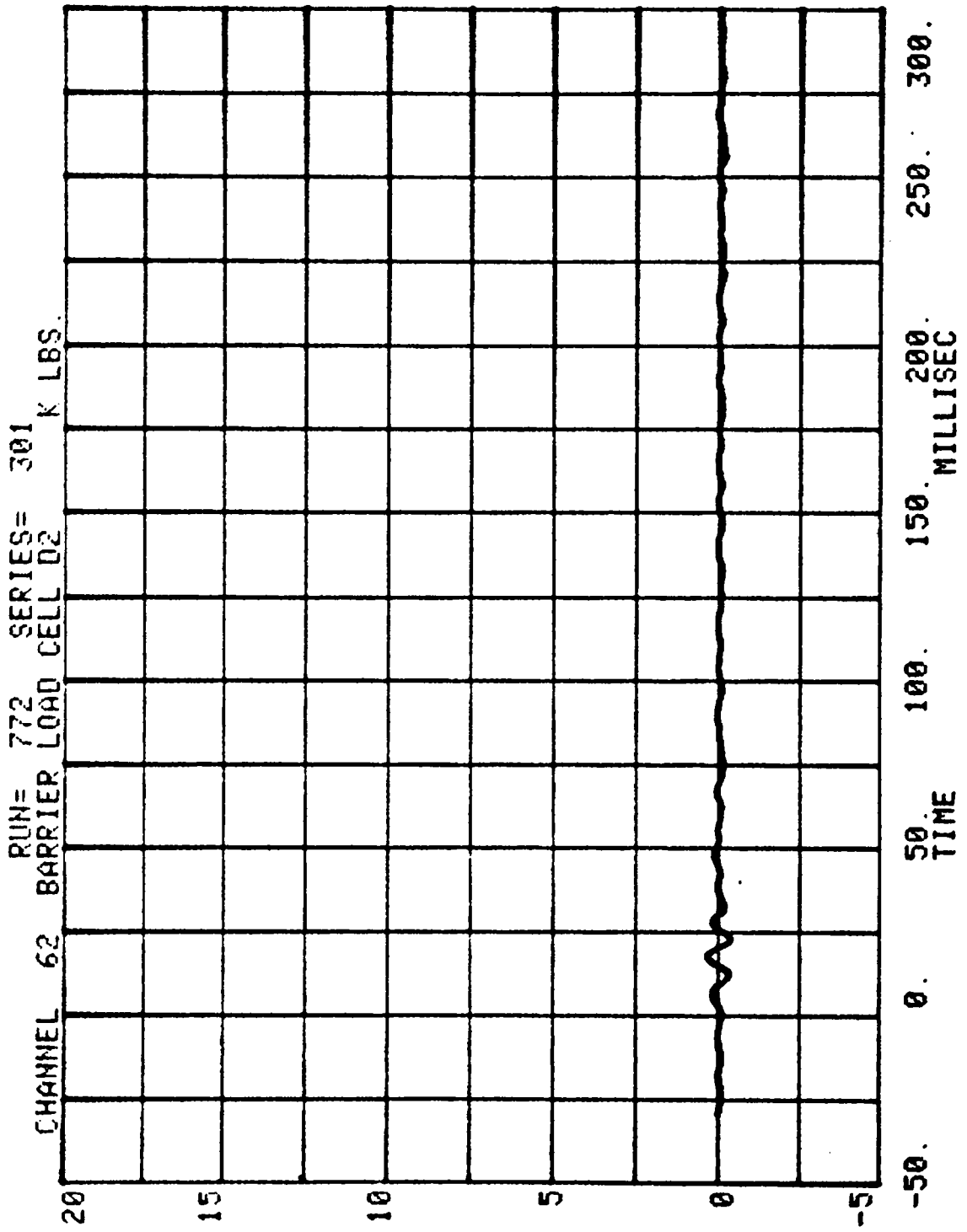

RUN= 772 SERIES= 301
CHANNEL 59 BARRIER LOAD CELL CS K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

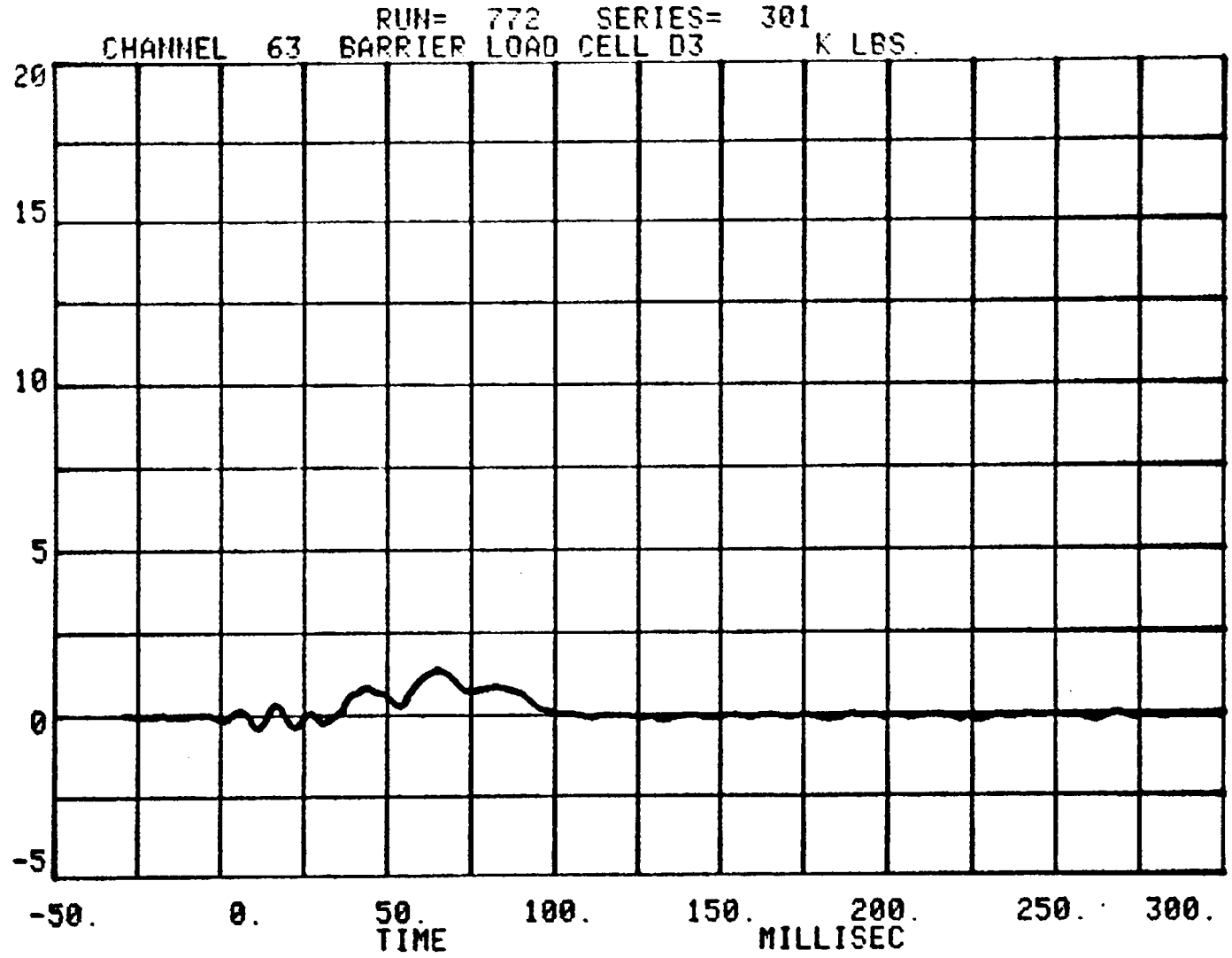
7556-10


CHANNEL 60 BARRIER LOAD CELL C9
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

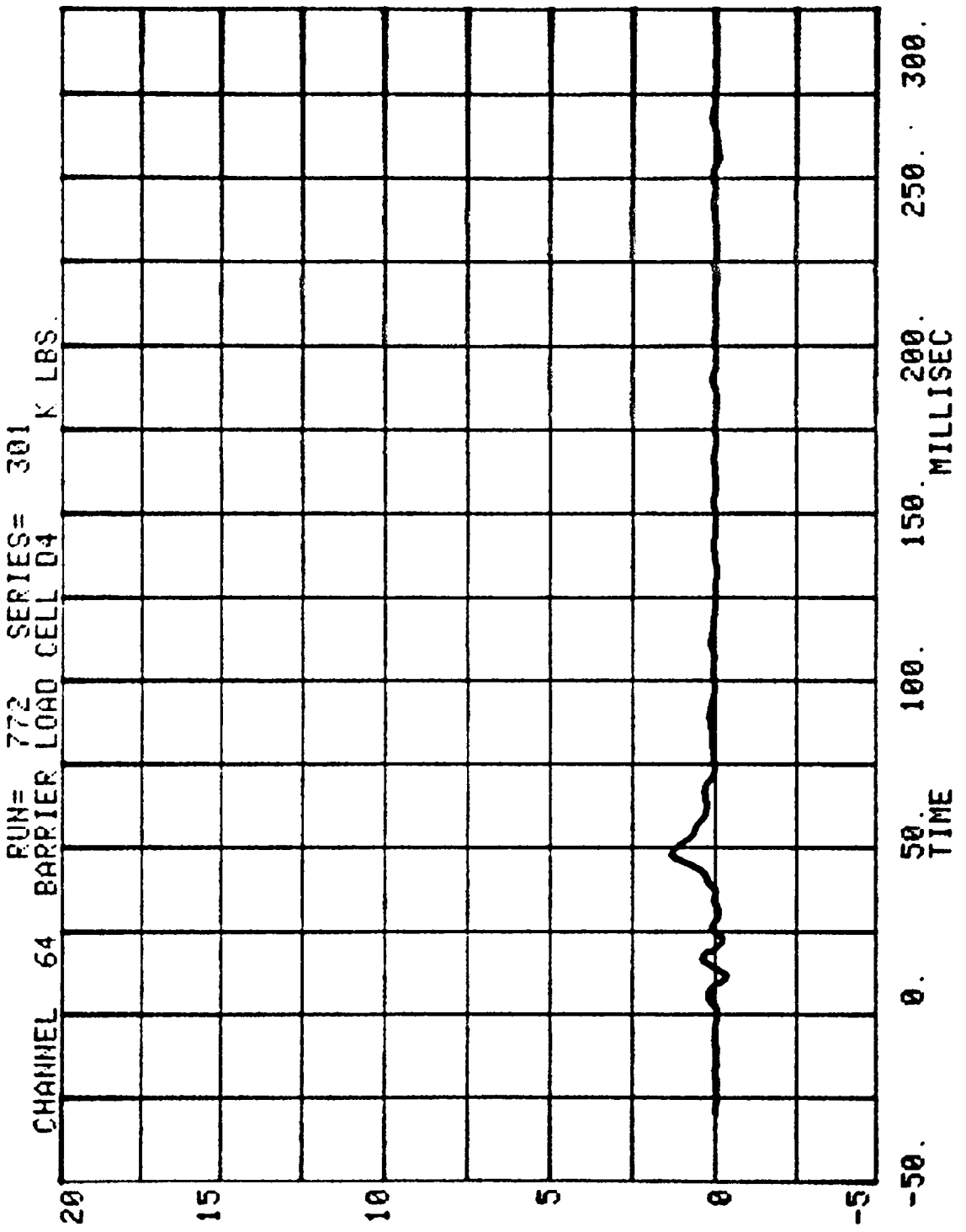

RUN= 772 SERIES= 301
CHANNEL 61 BARRIER LOAD CELL D1 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

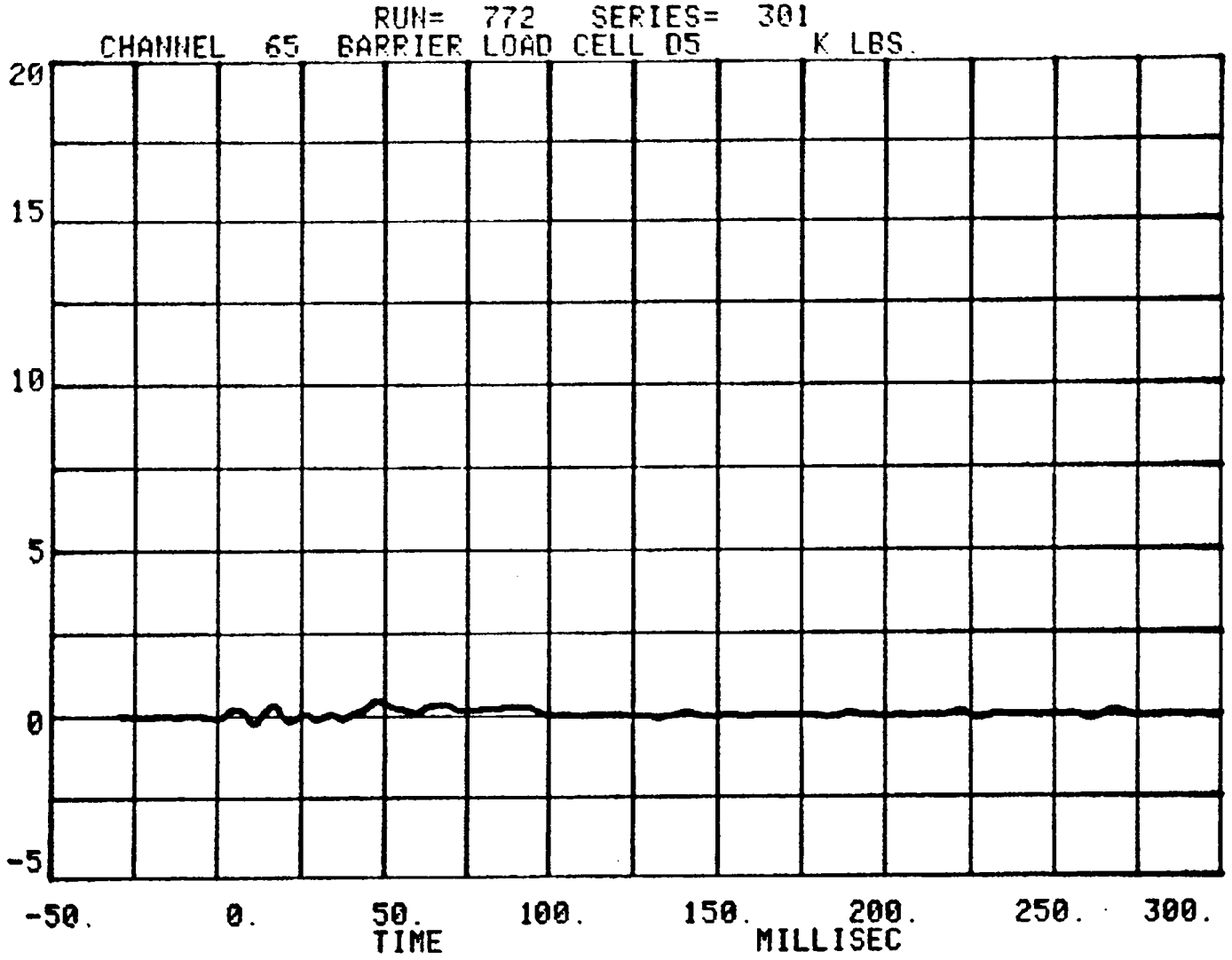

CHANNEL 62 BARRIER LOAD CELL 02
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

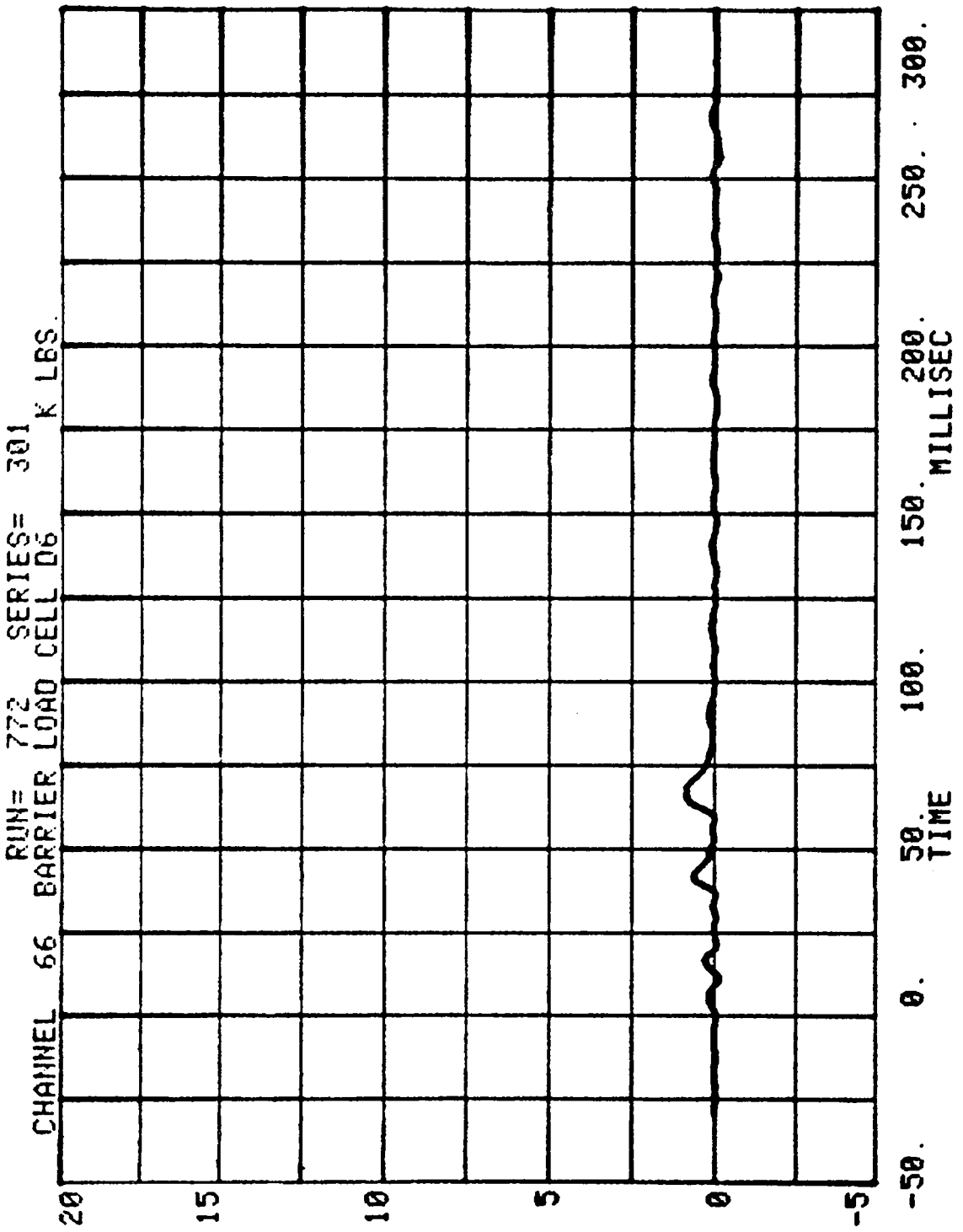

RUN= 772 SERIES= 301
CHANNEL 63 BARRIER LOAD CELL D3
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

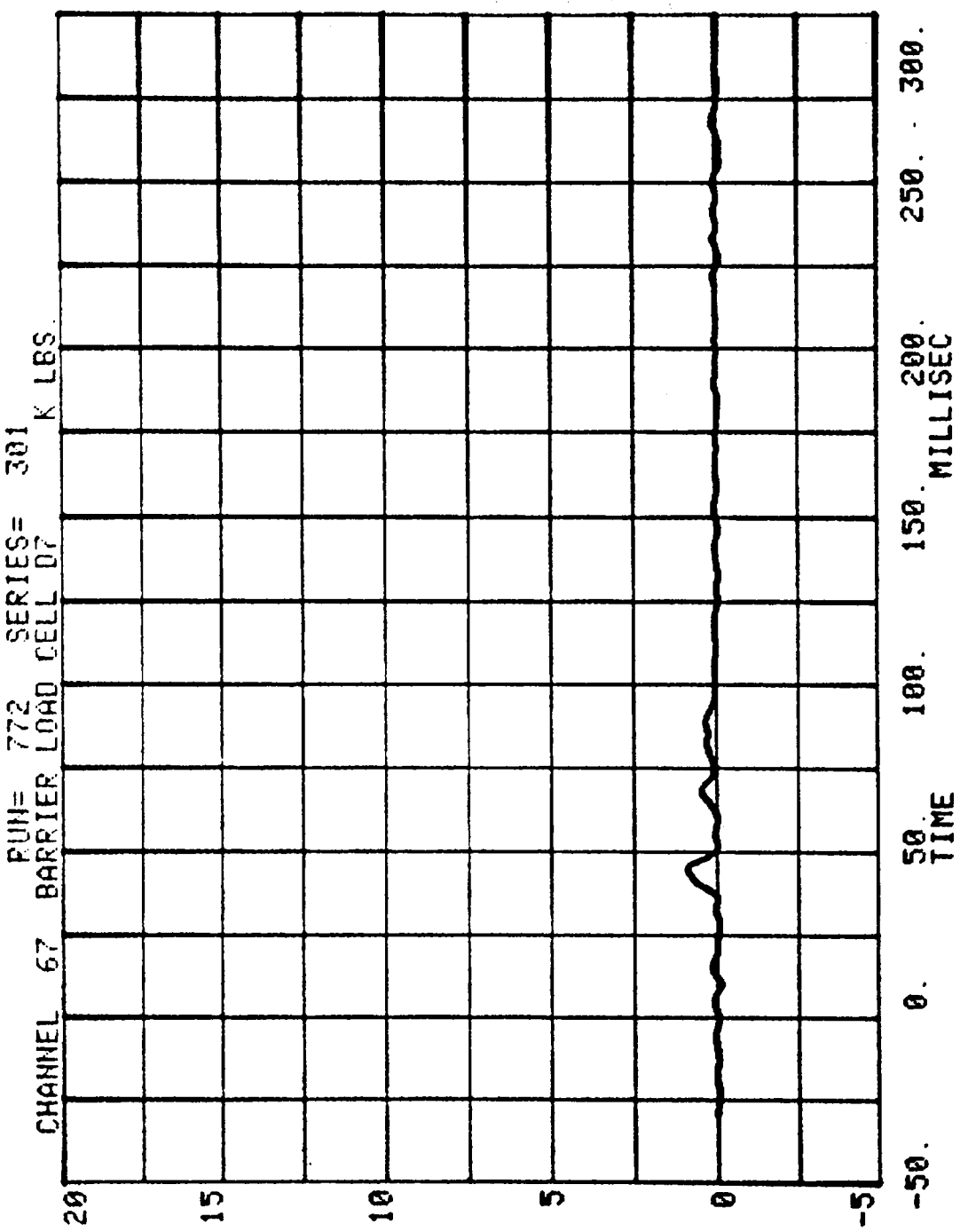
7556-10


CHANNEL 64 BARRIER LOAD CELL 04
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

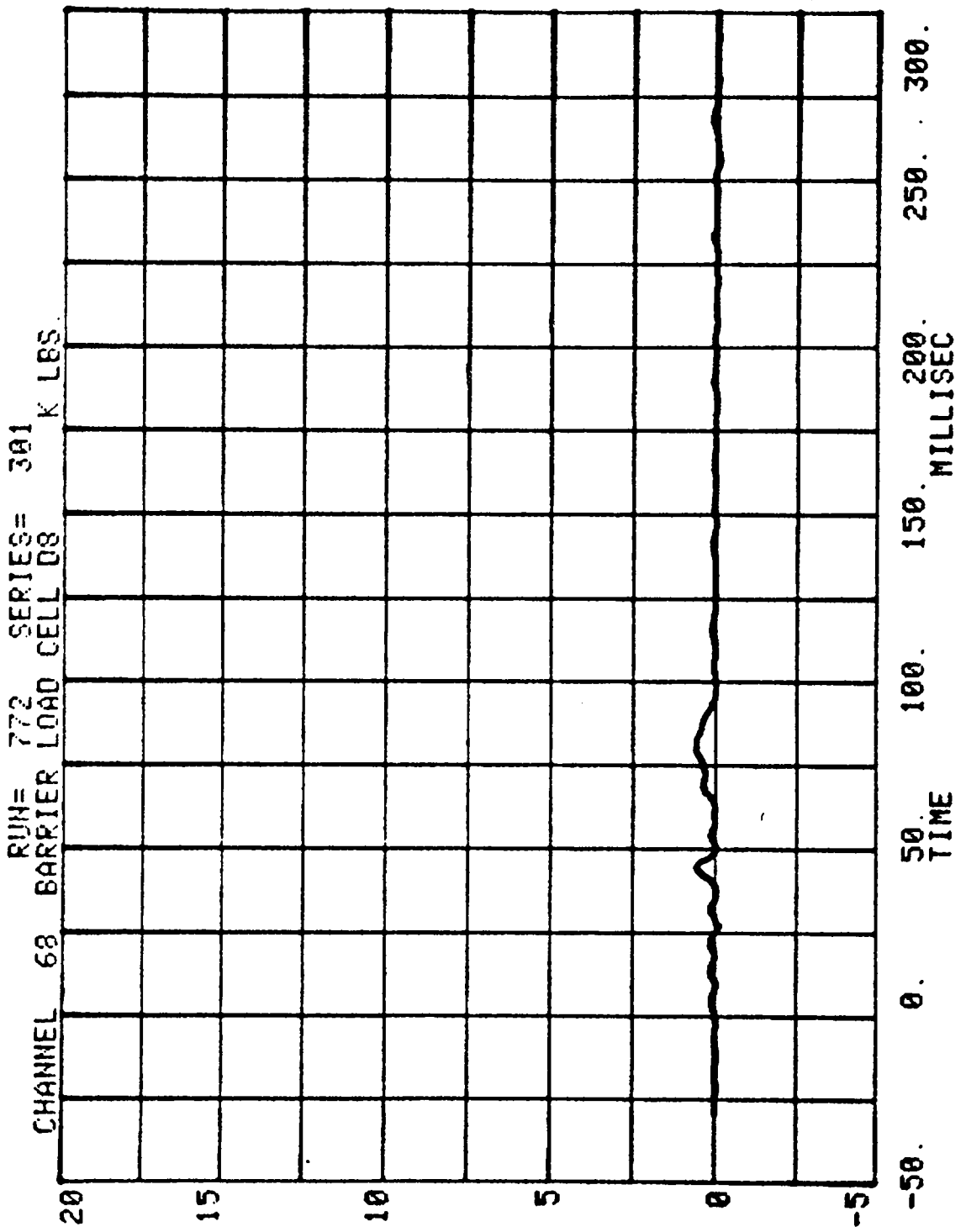
7556-10

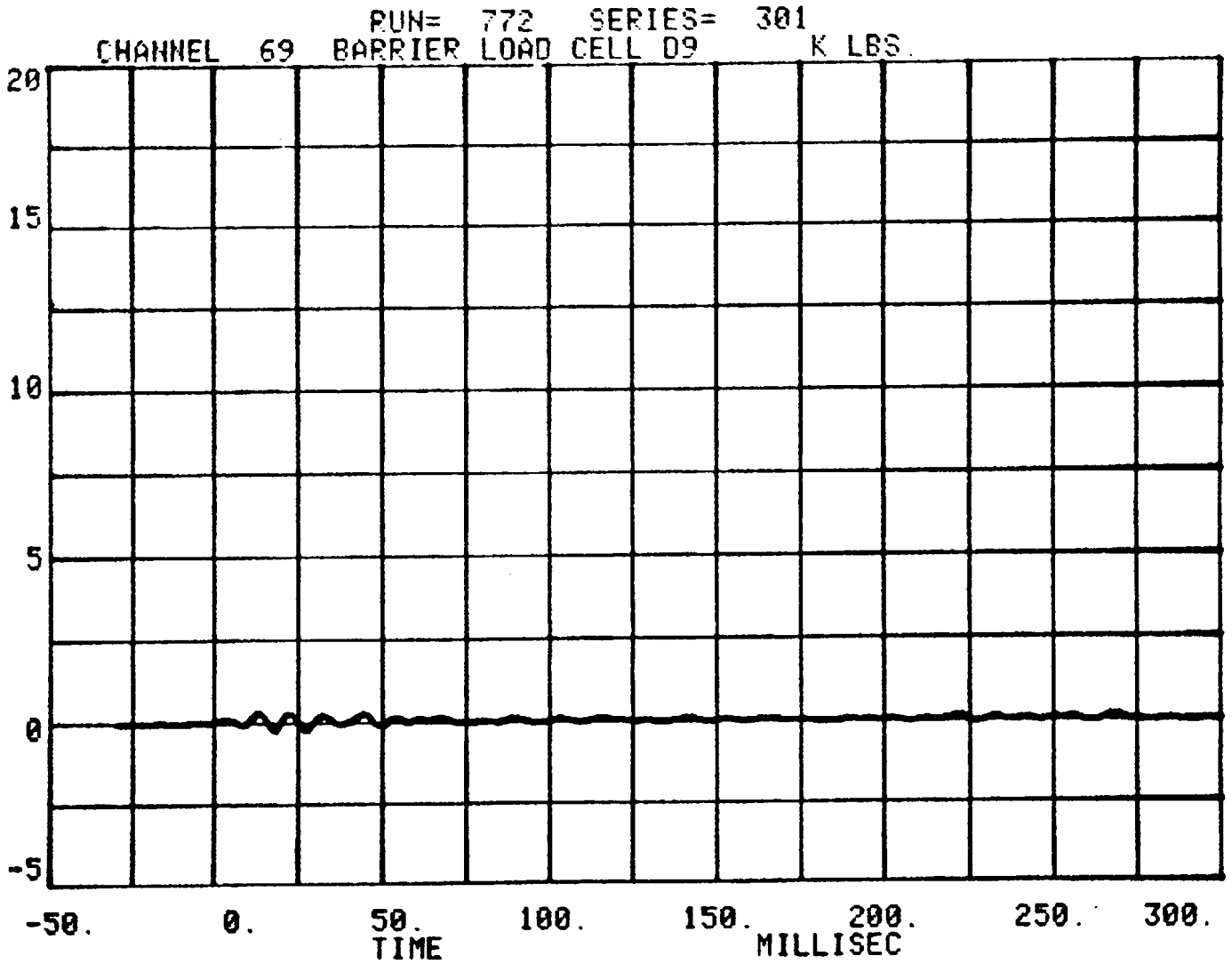

RUN= 772 SERIES= 301
CHANNEL 65 BARRIER LOAD CELL 05 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 66 BARRIER LOAD CELL 06
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 67
RUN= 772 SERIES= 301
BARRIER LOAD CELL 07
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


CHANNEL 68 BARRIER LOAD CELL 08
RUN= 772 SERIES= 301
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

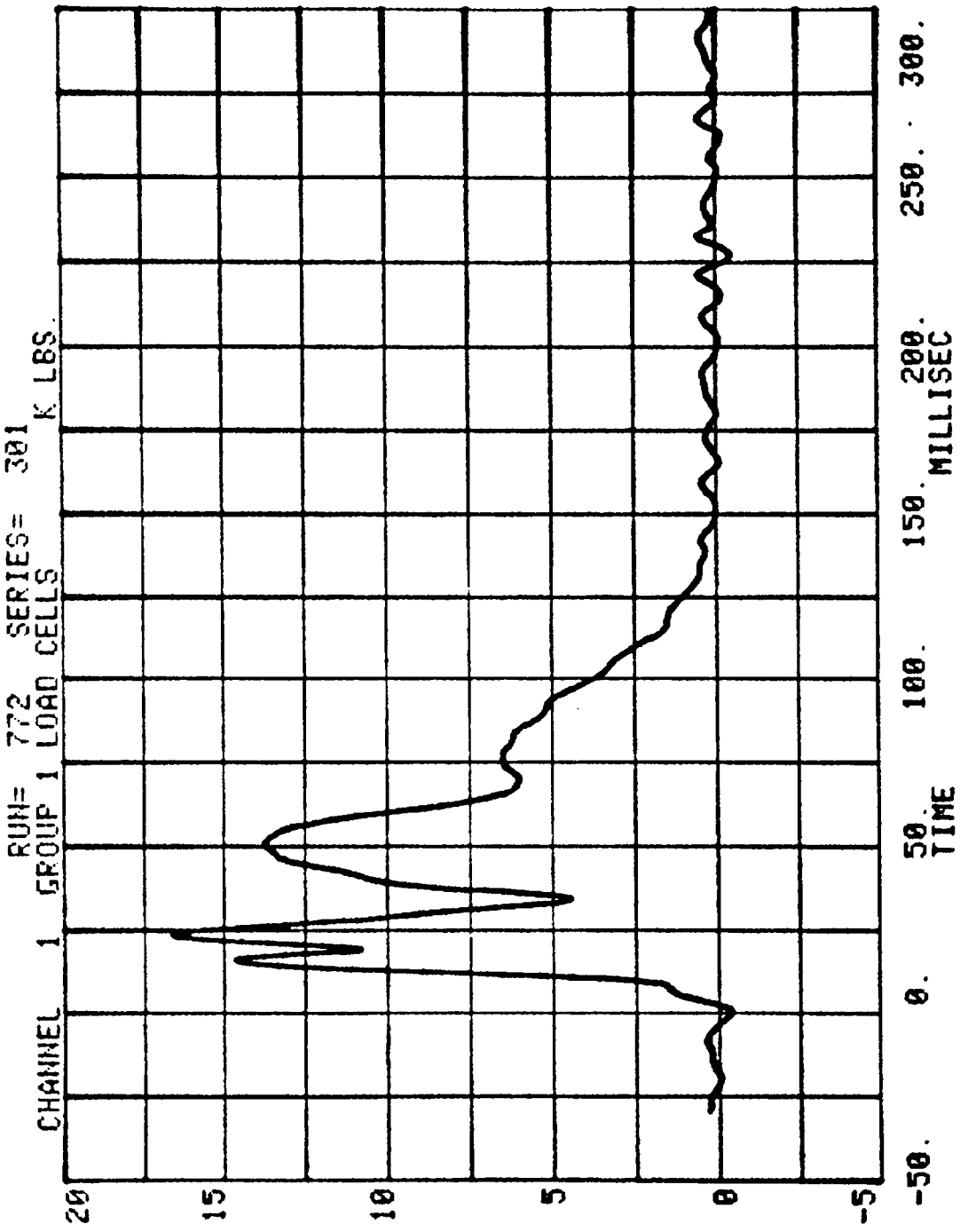

RUN= 772 SERIES= 301
CHANNEL 69 BARRIER LOAD CELL D9 K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

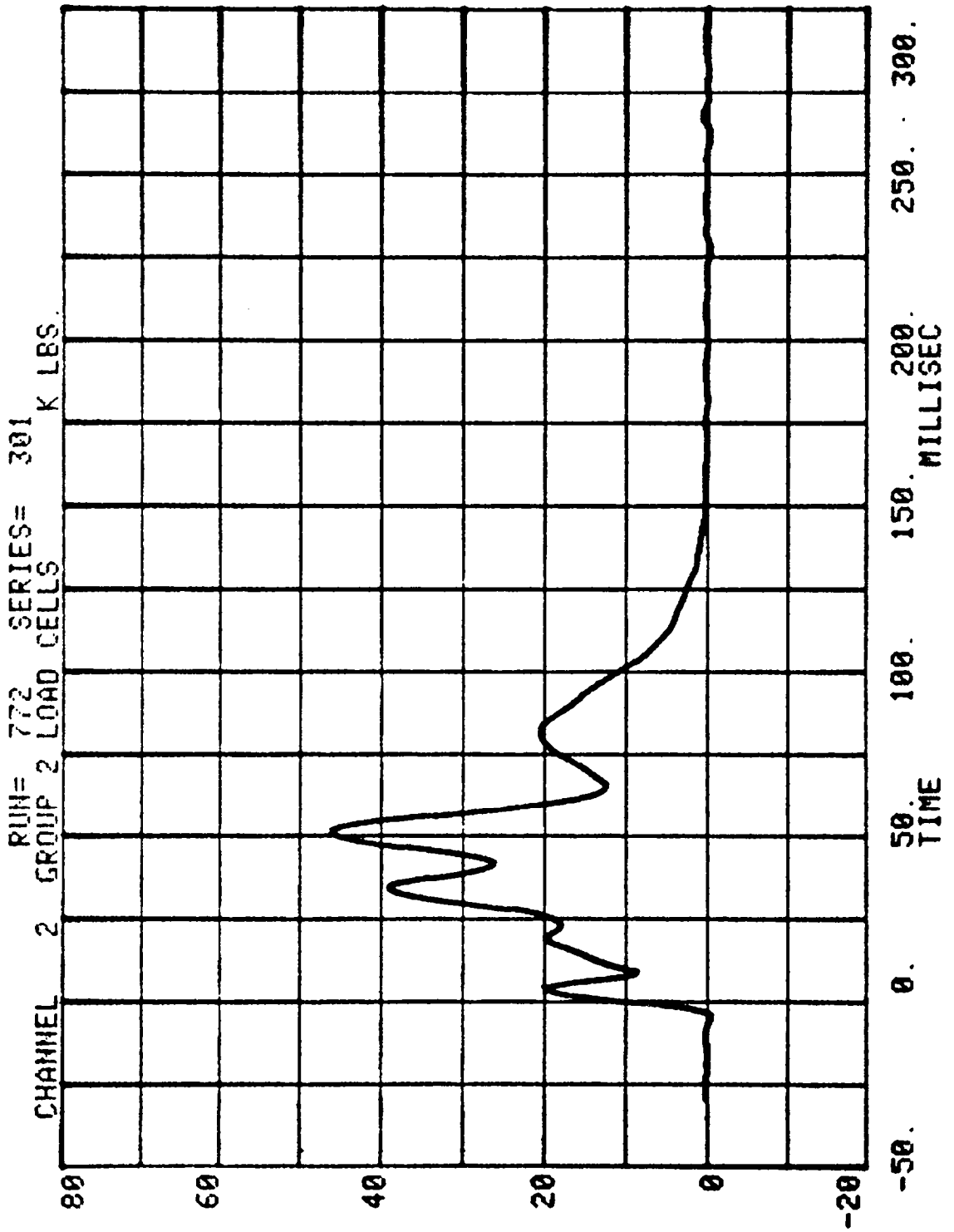
NEW CAP ASSESSMENT BARRIER TESTS - 1987

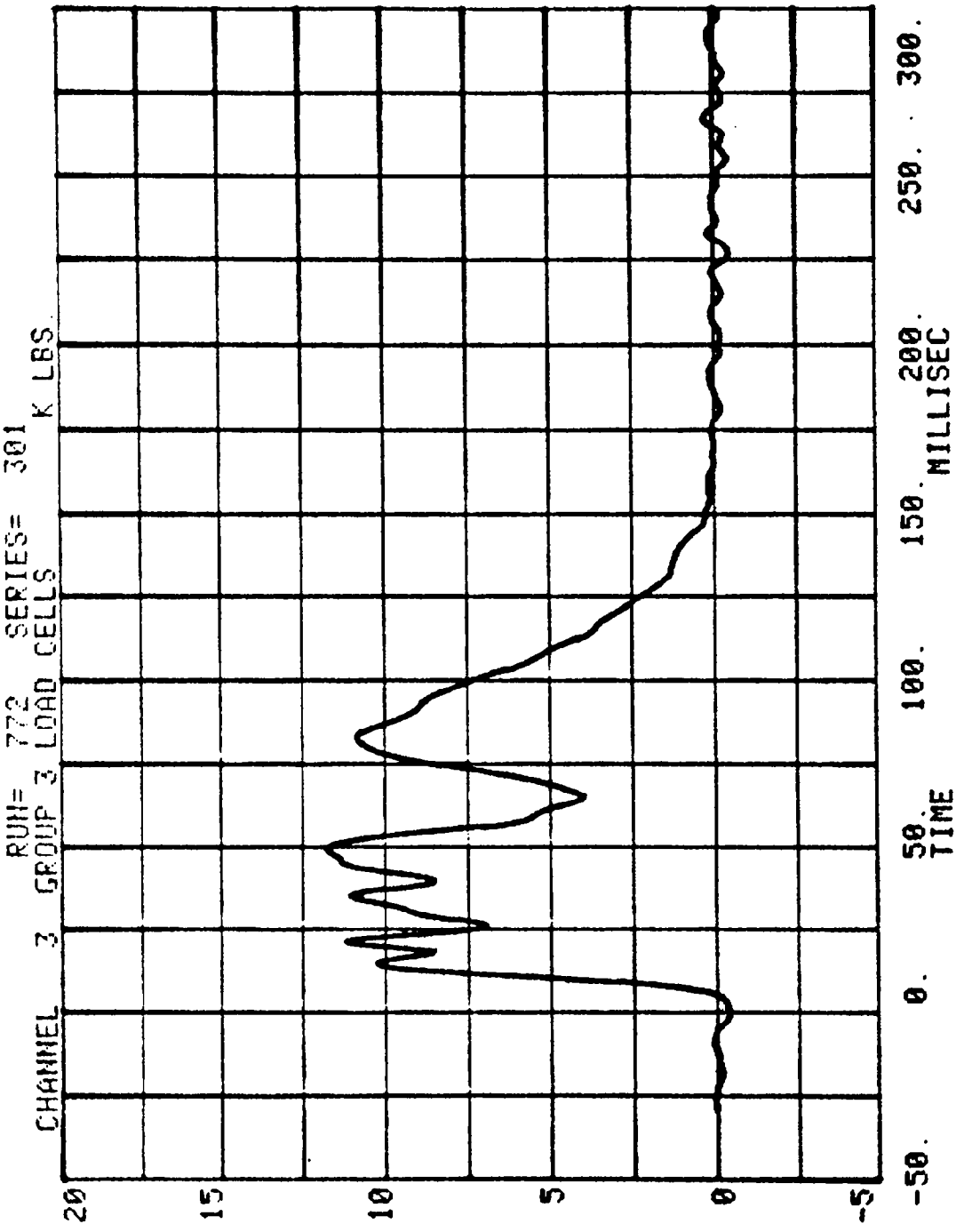
RUN # 772 SERIES # 301

CHAN	TITLE	MINIMUM	MAXIMUM
1	GROUP 1 LOAD CELLS	-.432	16.680 K LBS.
2	GROUP 2 LOAD CELLS	-.419	46.216 K LBS.
3	GROUP 3 LOAD CELLS	-.470	11.779 K LBS.
4	GROUP 4 LOAD CELLS	-1.479	9.844 K LBS.
5	GROUP 5 LOAD CELLS	-.431	10.392 K LBS.
6	GROUP 6 LOAD CELLS	-.704	5.871 K LBS.
7	TOTAL LOAD CELL SUM	-2.671	91.235 K LBS.

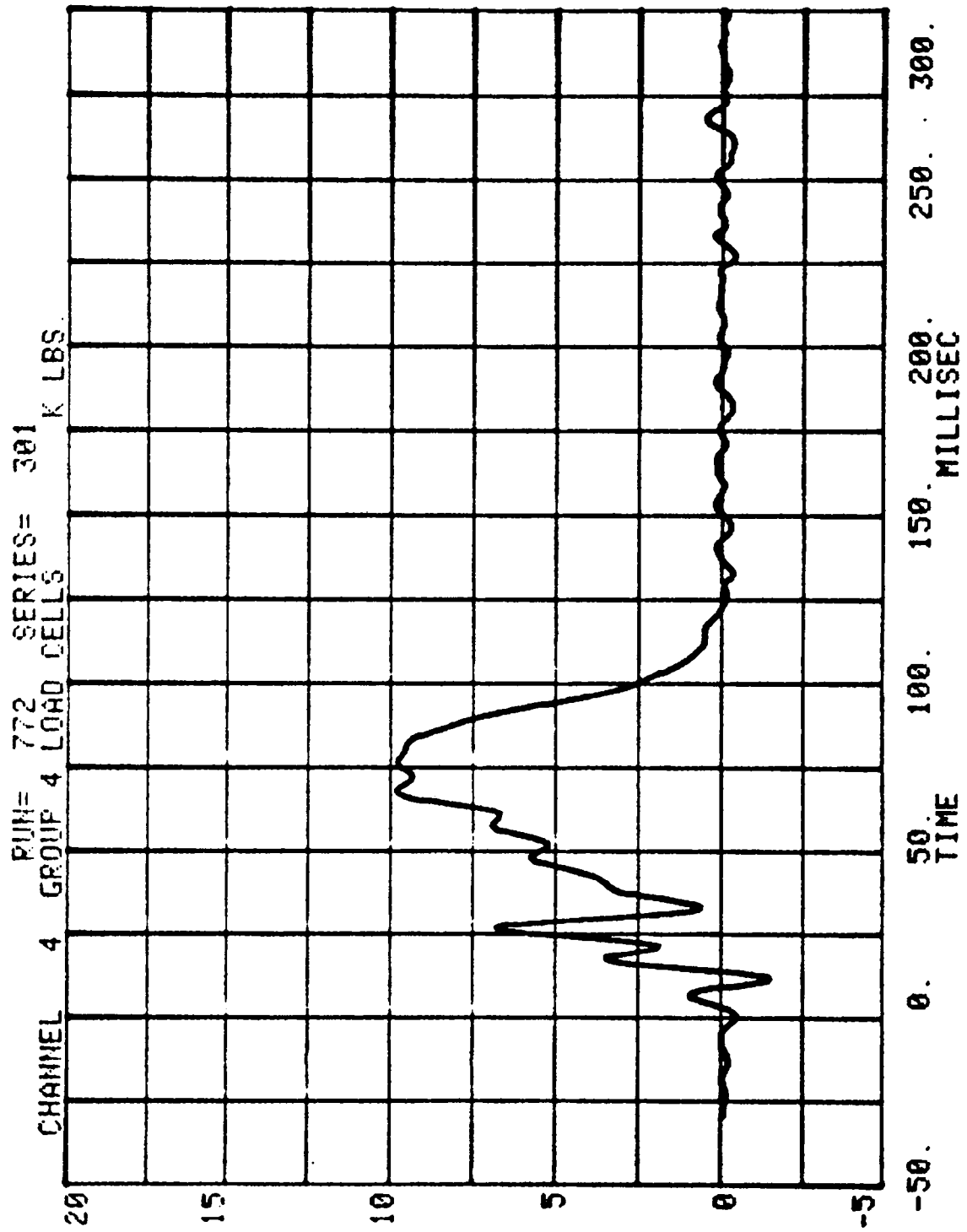

CHANNEL 1 GROUP 1 LOAD CELLS
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

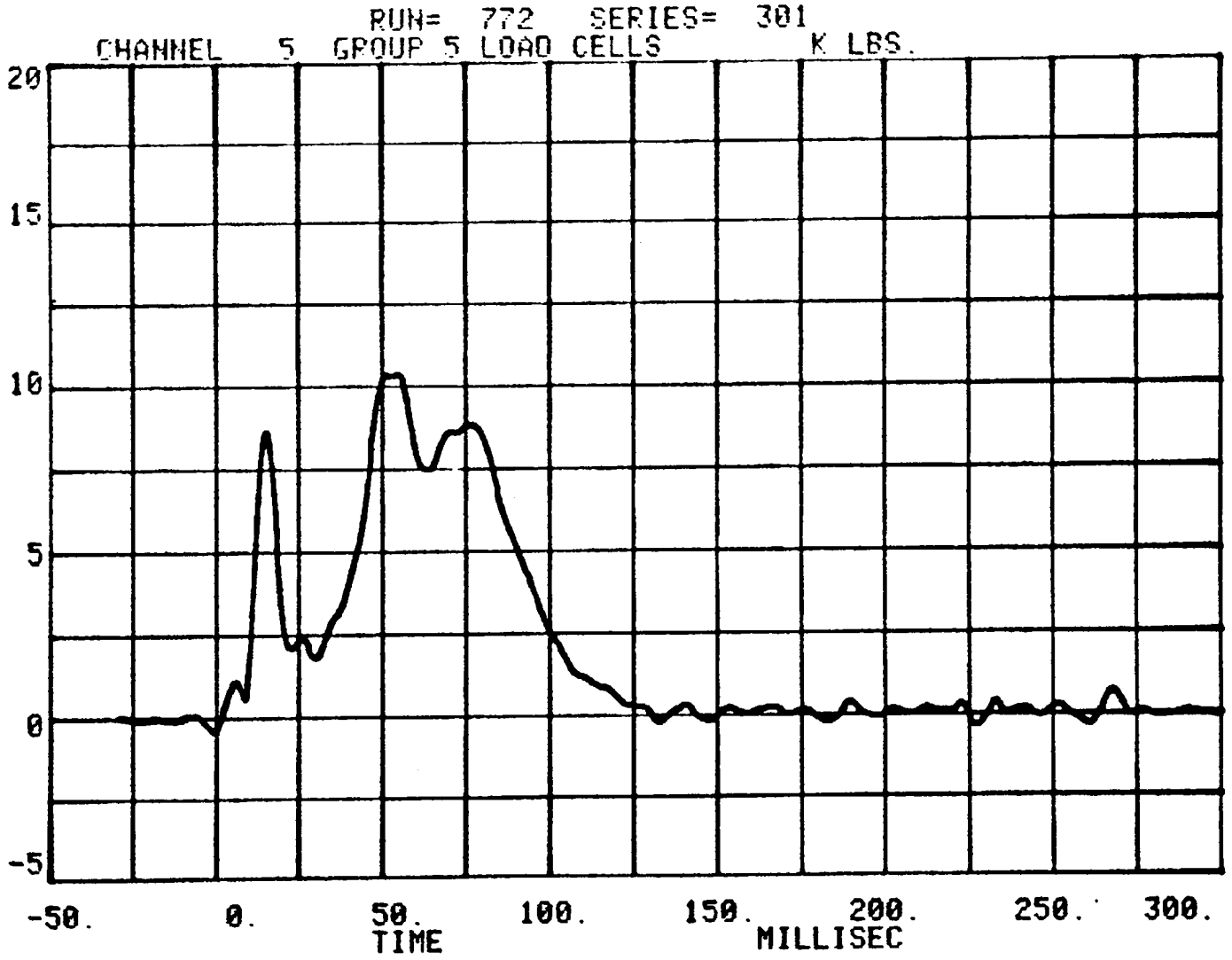
7556-10

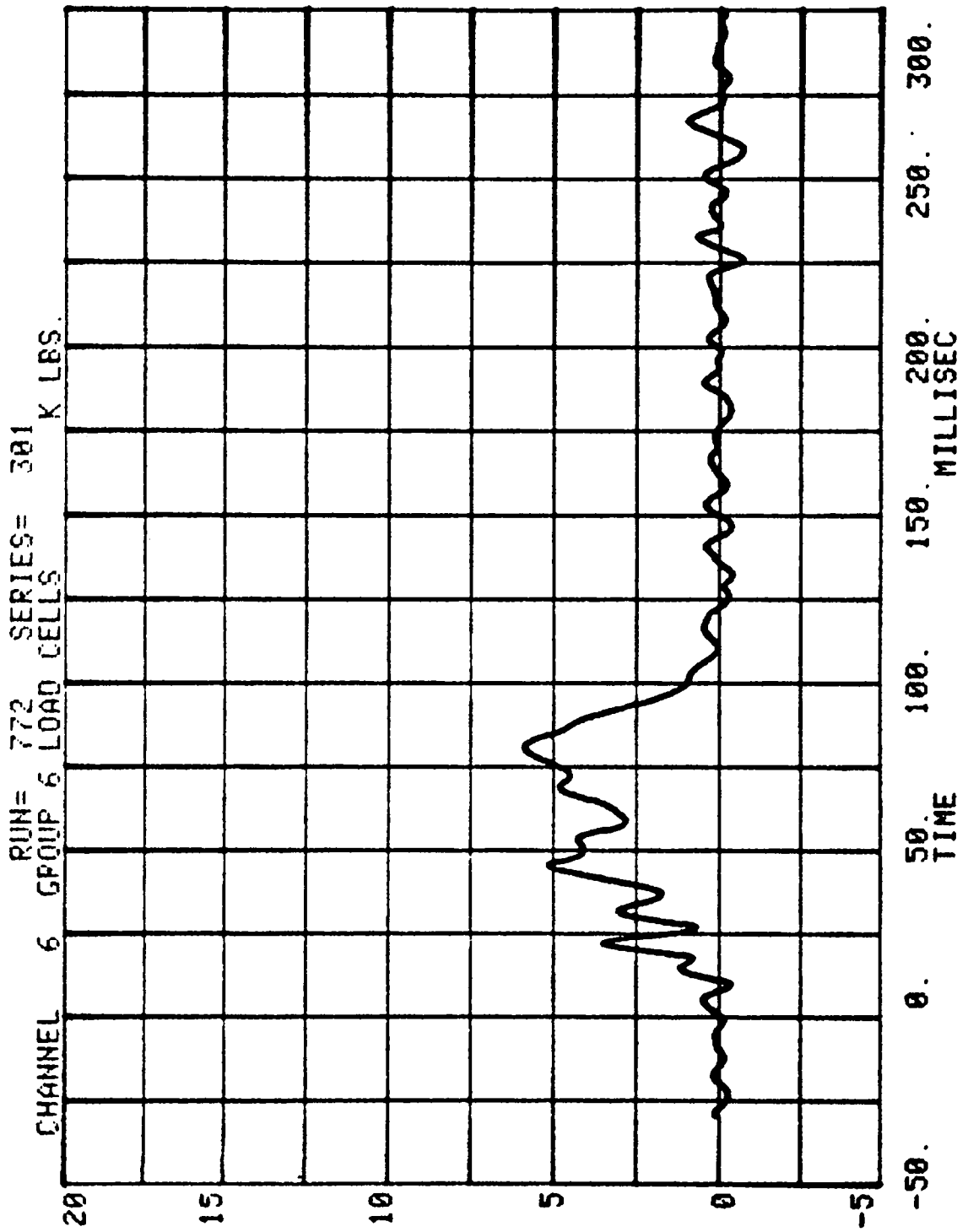

CHANNEL 2 GROUP 2 LOAD CELLS
RUN= 772 SERIES= 301
K LBS.
80
60
40
20
0
-20
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 3 GROUP 3 LOAD CELLS
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

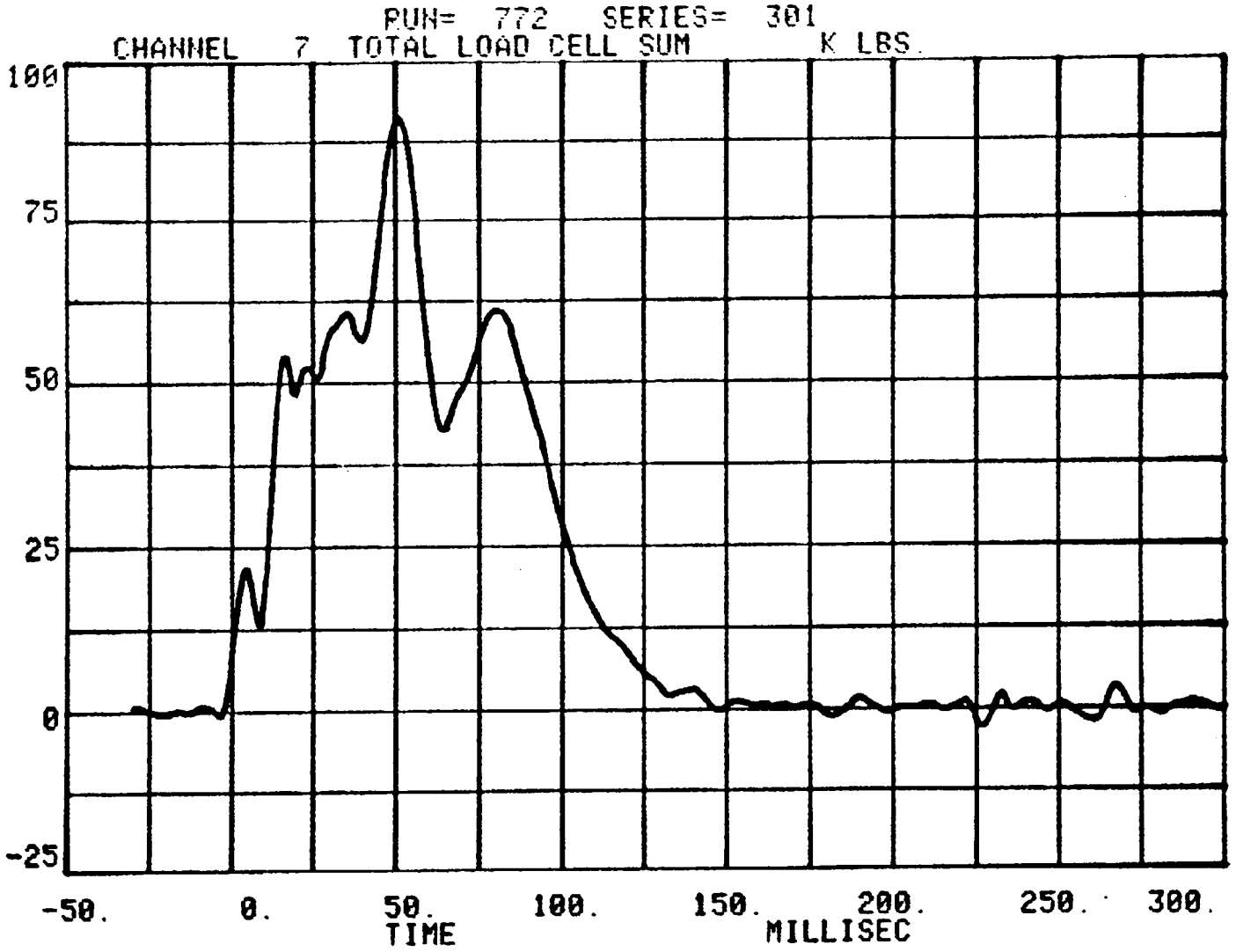
7556-10


CHANNEL 4
GROUP 4
RUN= 772
LOAD CELLS
SERIES= 301
K LBS
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


RUN= 772 SERIES= 301
CHANNEL 5 GROUP 5 LOAD CELLS
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 6 GROUP 6 LOAD CELLS
RUN= 772 SERIES= 301
K LBS.
20
15
10
5
0
-5
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


RUN= 772 SERIES= 301
CHANNEL 7 TOTAL LOAD CELL SUM K LBS.
100
75
50
25
0
-25
-50.
0.
50.
100.
150.
200.
250.
300.
TIME MILLISEC

7556-10

TEST NO. MH0301

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 - 1987

RUN= 772

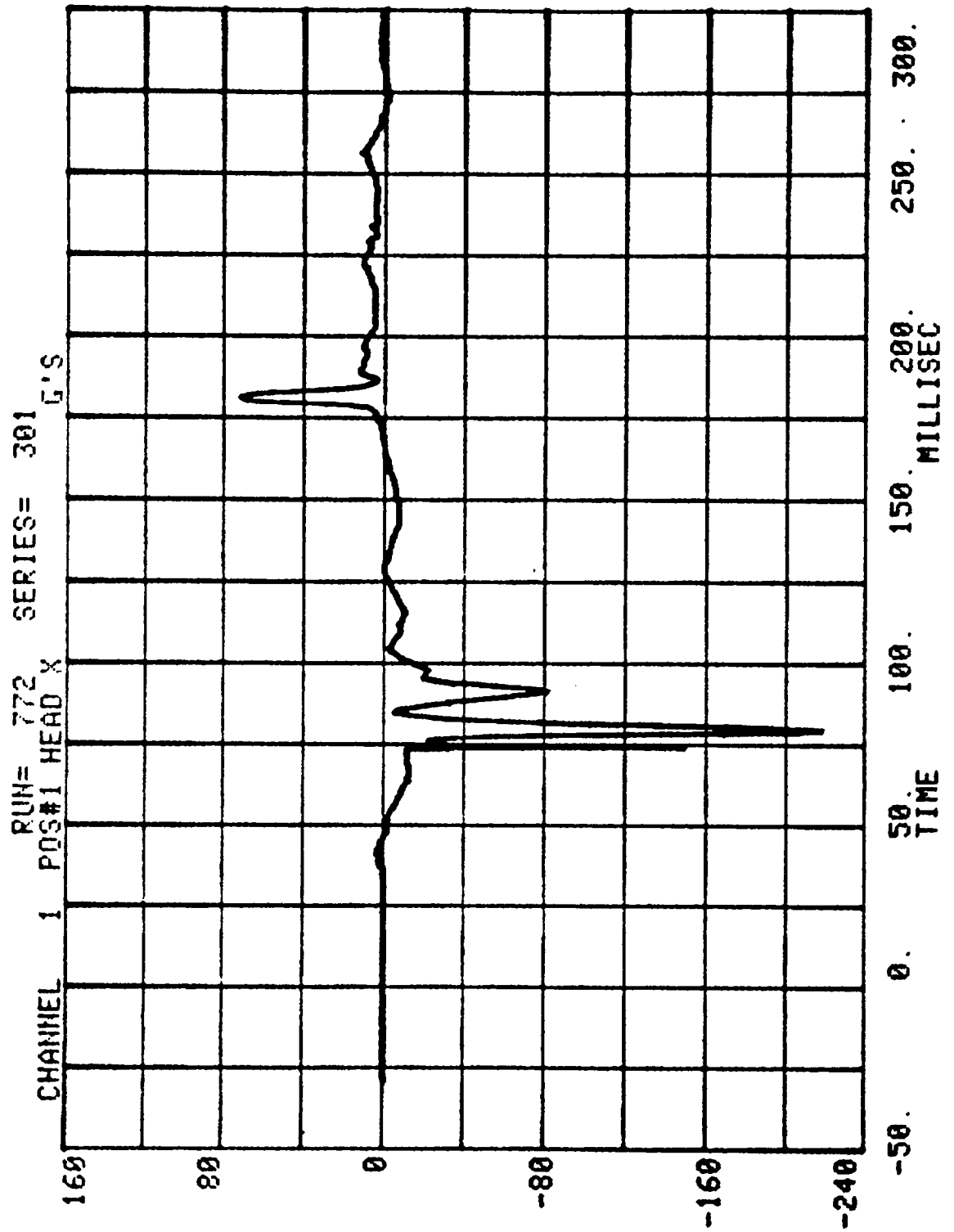
POS#1 HEAD R

HIC=1488.4 FROM T1= .07395 TO T2= .09315

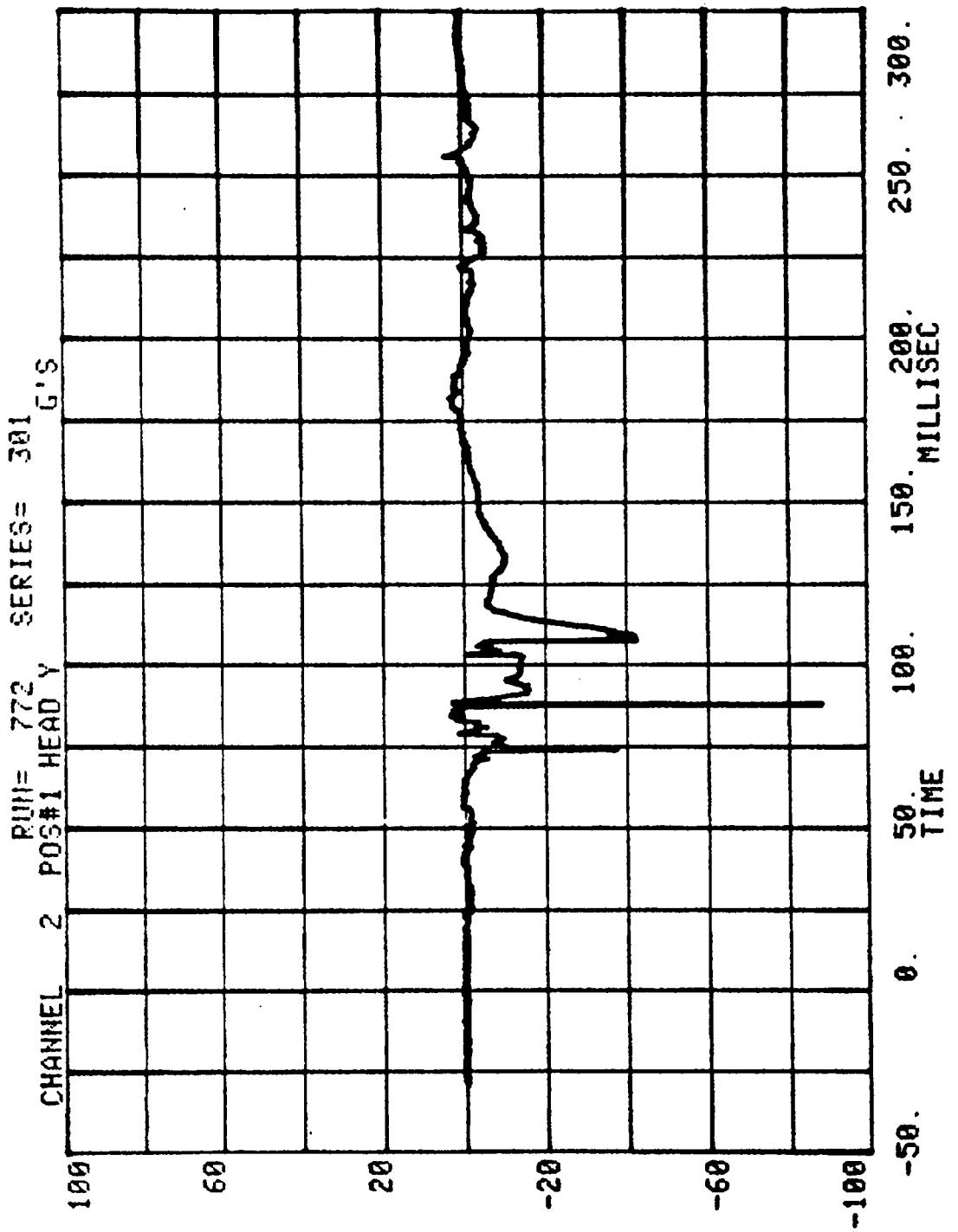
AVERAGE ACCELERATION BETWEEN T1 AND T2= 90.3G'S

EVENT TIME= 300.0 MSEC

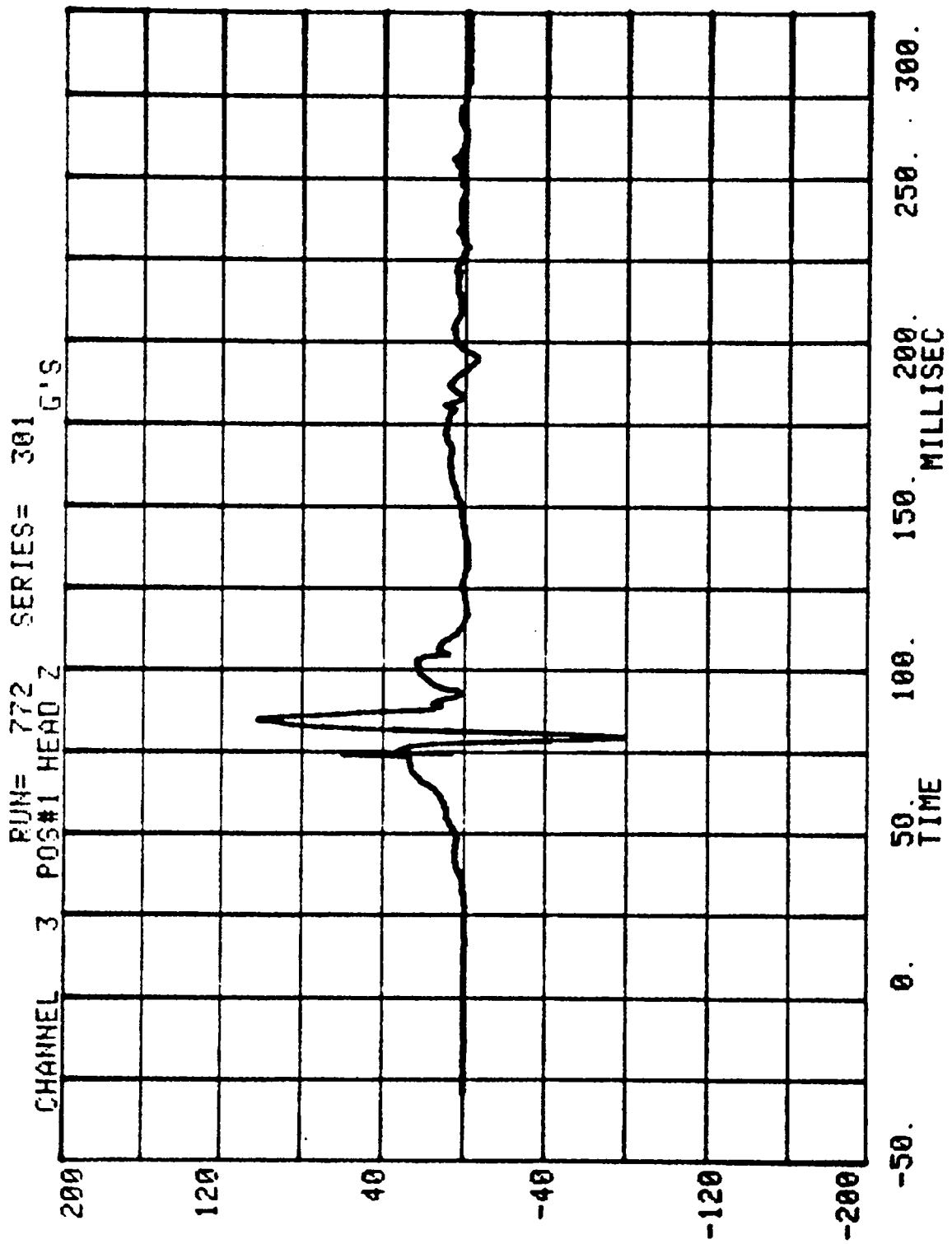
SEVERITY INDEX=2727.1

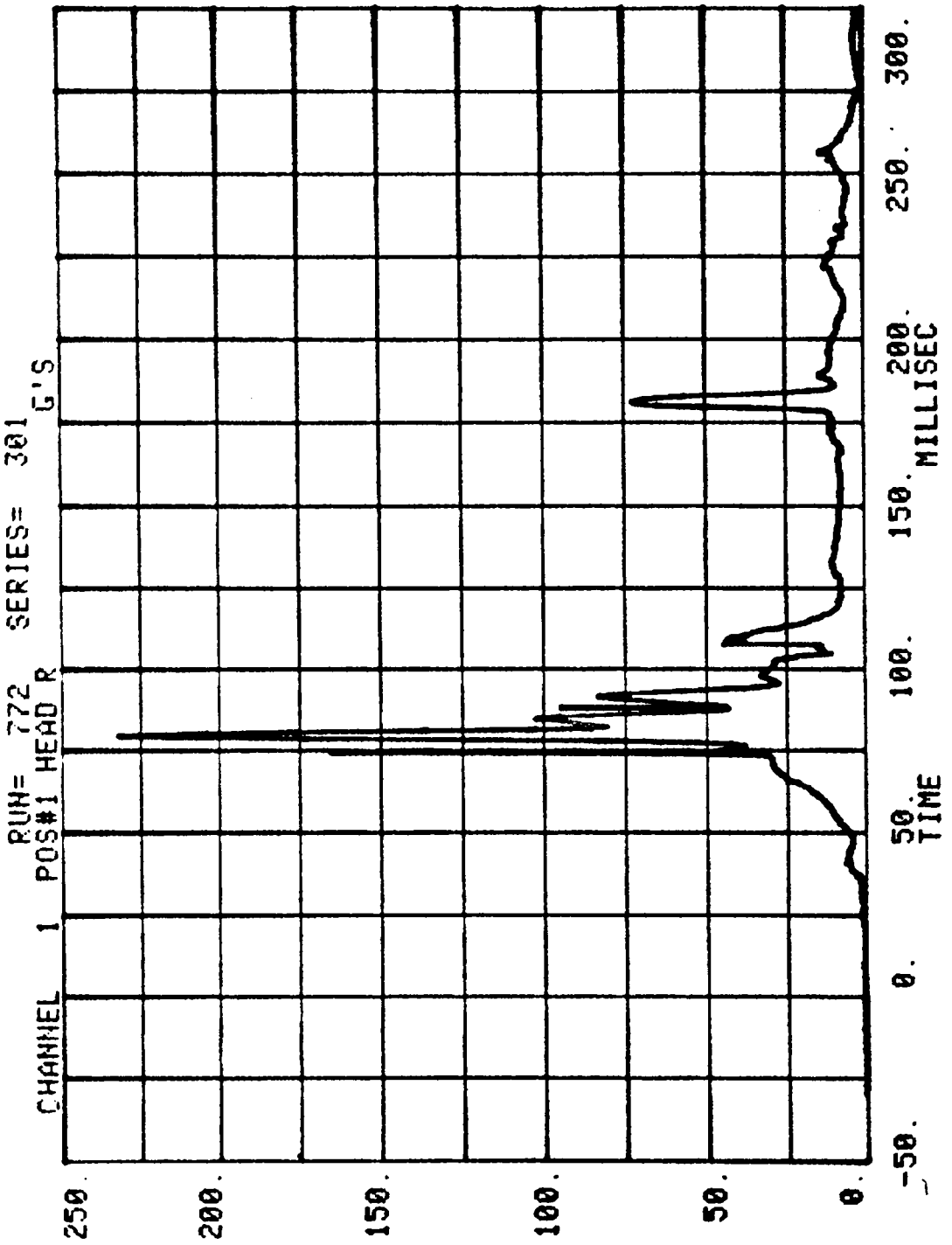

CHANNEL 1 POS#1 HEAD X
RUN= 772 SERIES= 301
G'S
160
80
0
-80
-160
-240
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

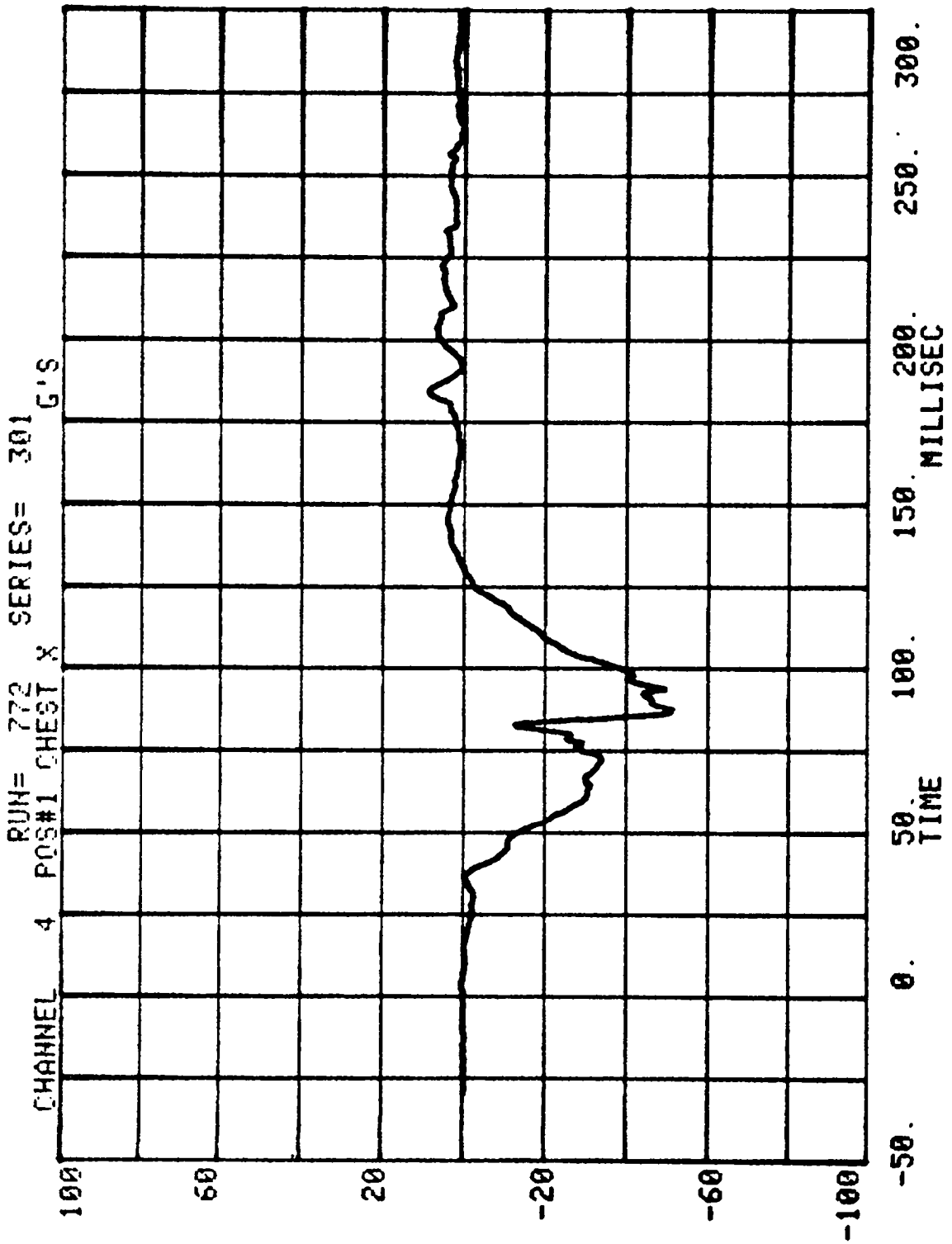

CHANNEL 2 POS#1 HEAD Y
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

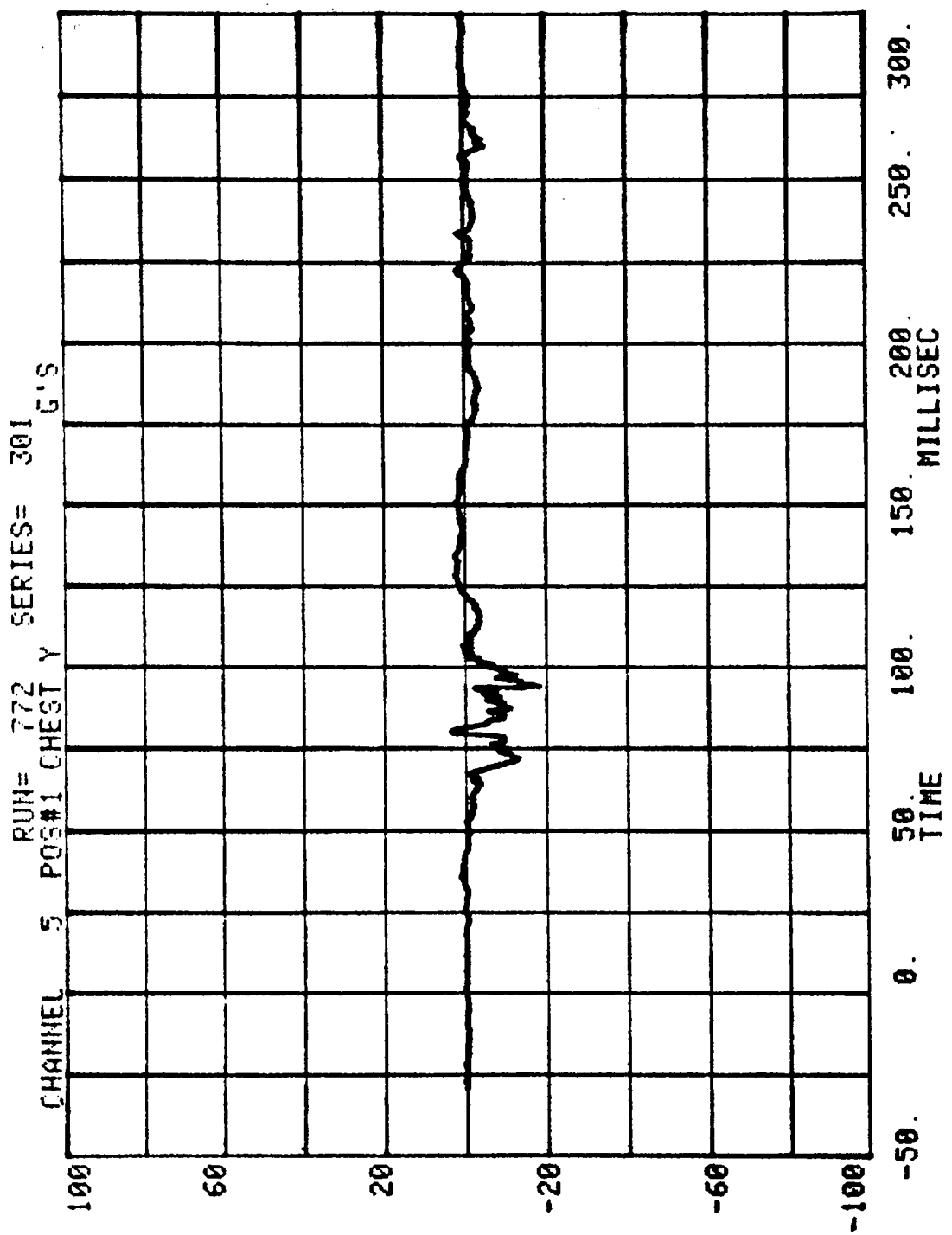

CHANNEL 3 POS#1 HEAD 2
RUN= 772 SERIES= 301
G'S
200
120
40
-40
-120
-200
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 1 POS#1 HEAD R
RUN= 772 SERIES= 301
G'S
250.
200.
150.
100.
50.
0.
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

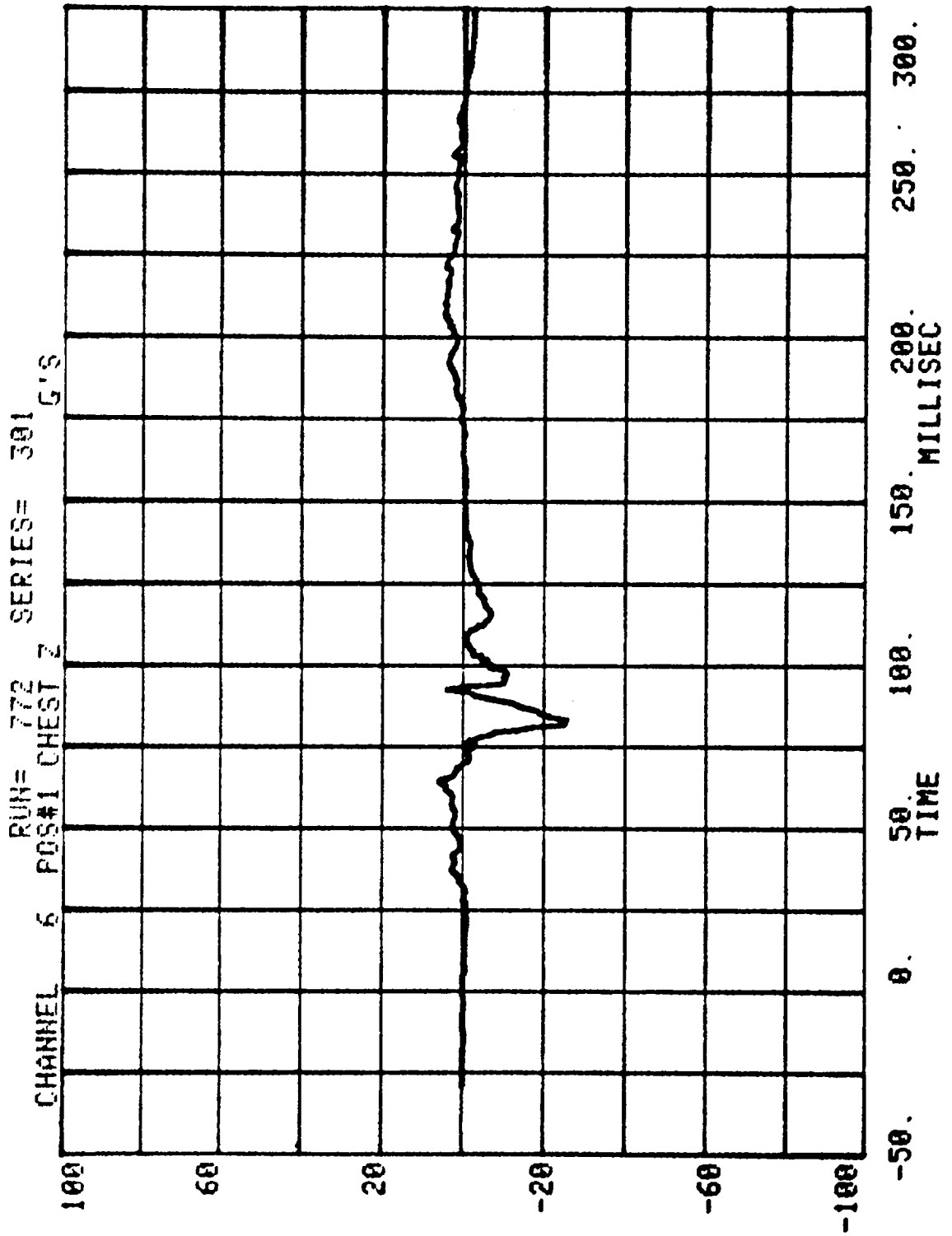
7556-10

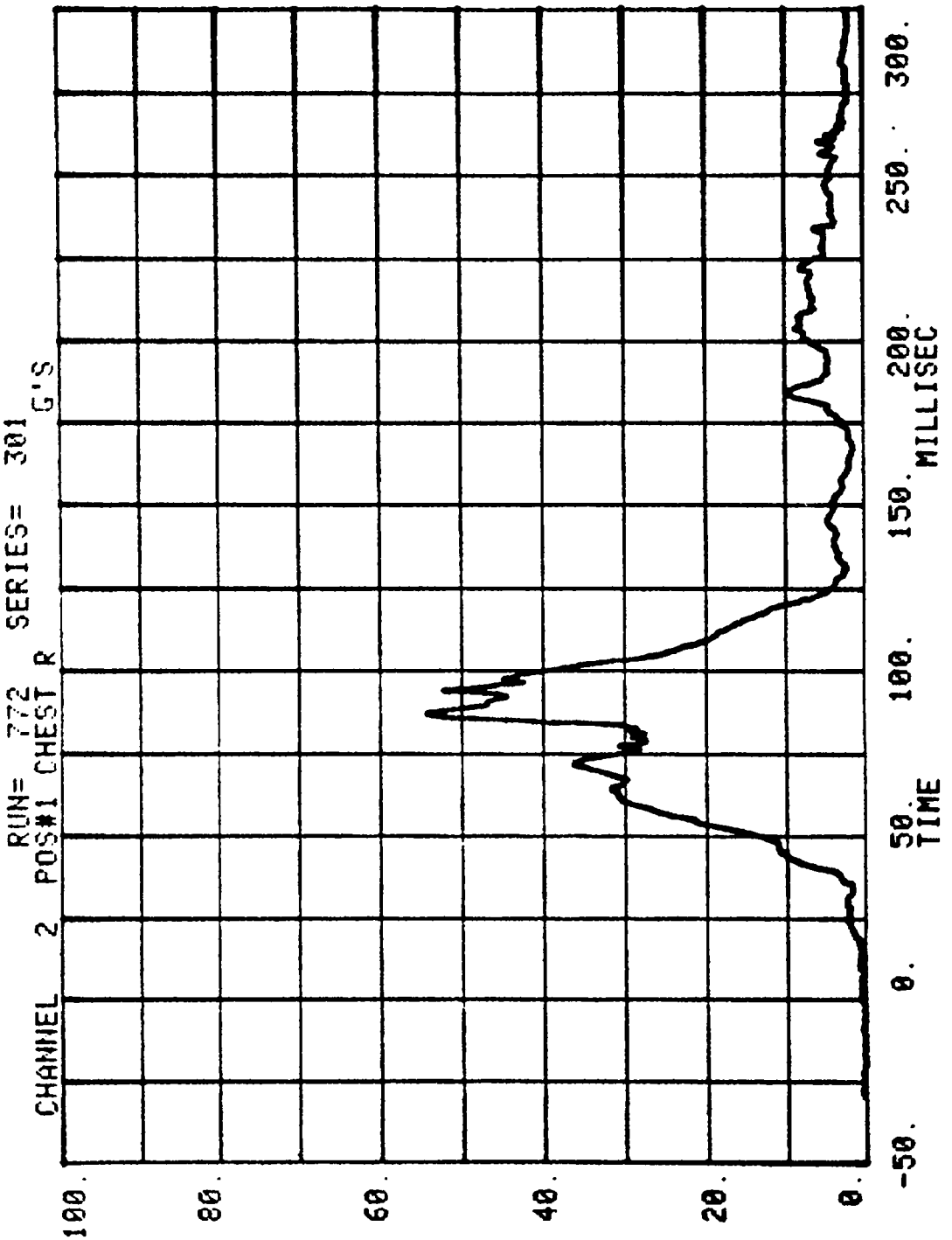

CHANNEL 4 RUN= 772 SERIES= 301
POS#1 CHEST X G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

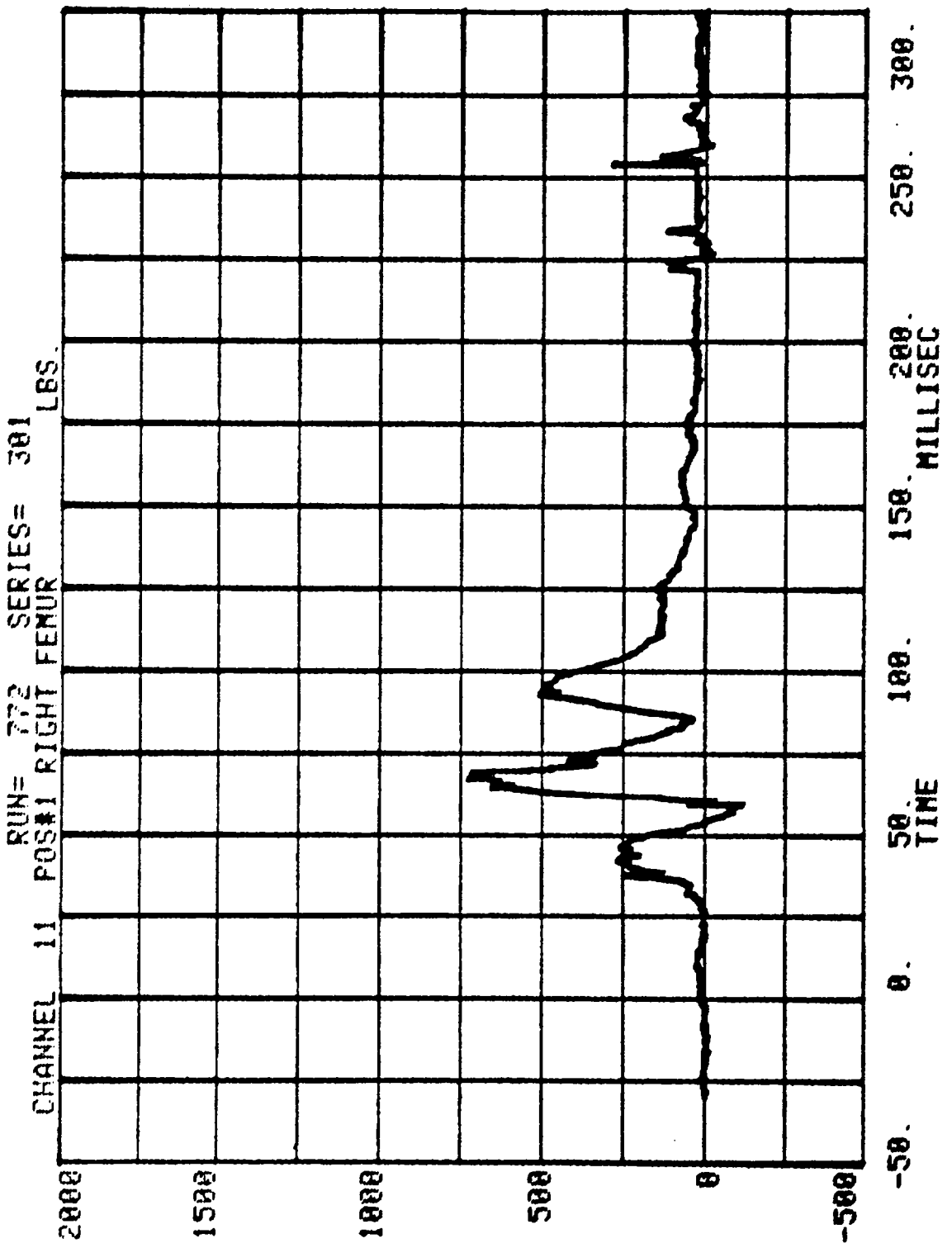

CHANNEL 5 POS#1 CHEST Y
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

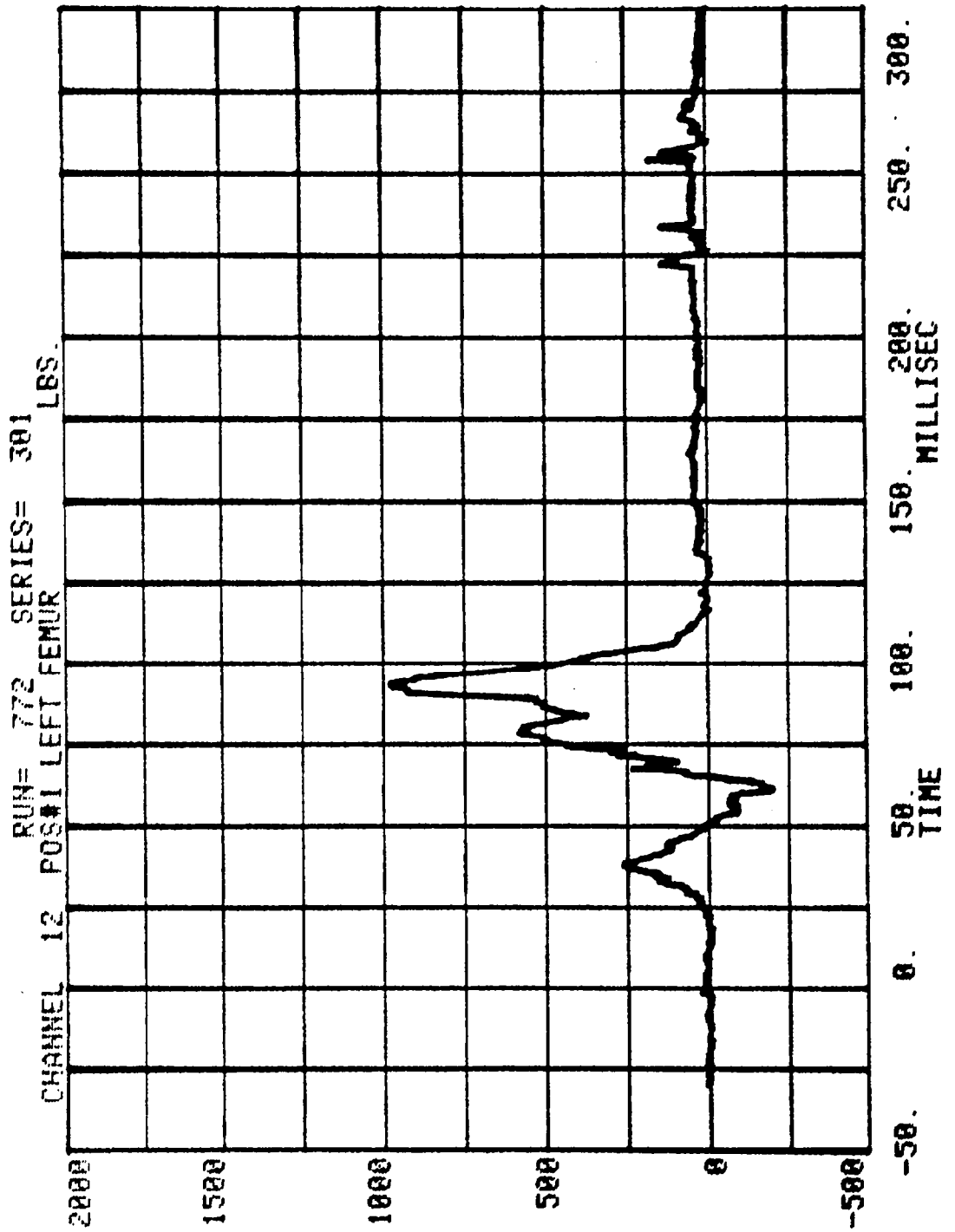
7556-10


CHANNEL 6 POS#1 CHEST Z
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

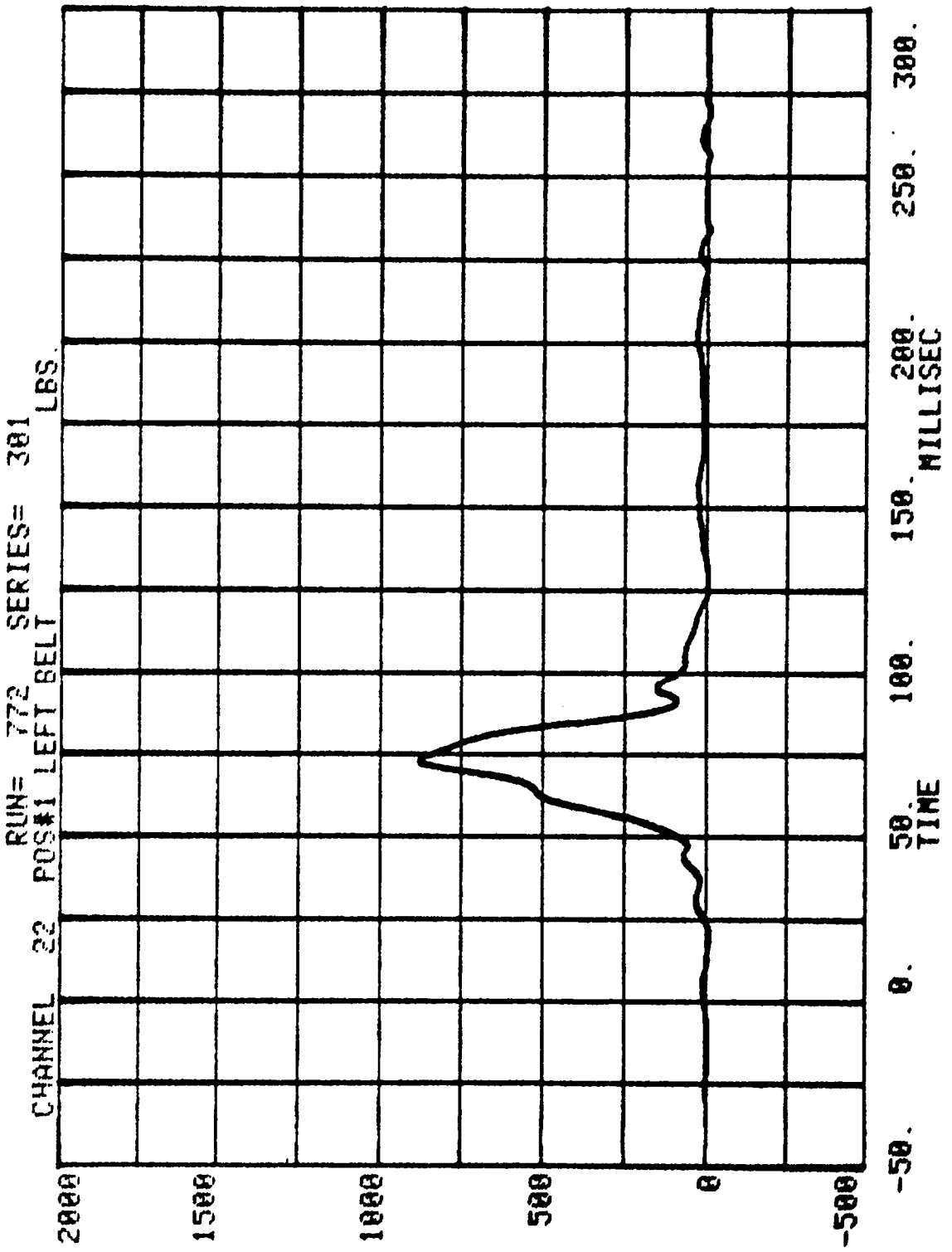

CHANNEL 2 POS#1 CHEST R
RUN= 772 SERIES= 301
G'S
100.
80.
60.
40.
20.
0.
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

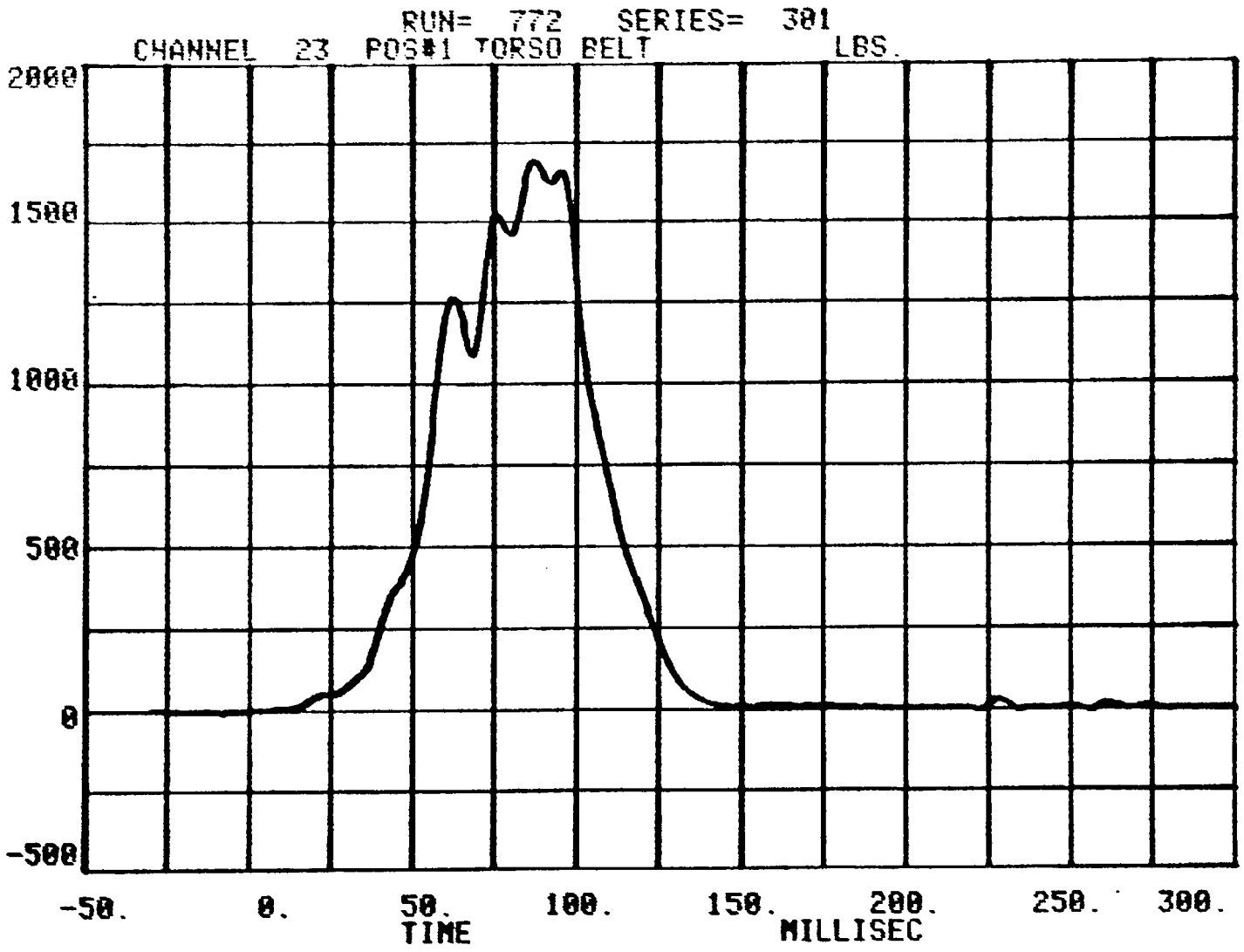

CHANNEL 11 POS#1 RIGHT FEMUR
RUN= 772 SERIES= 301
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

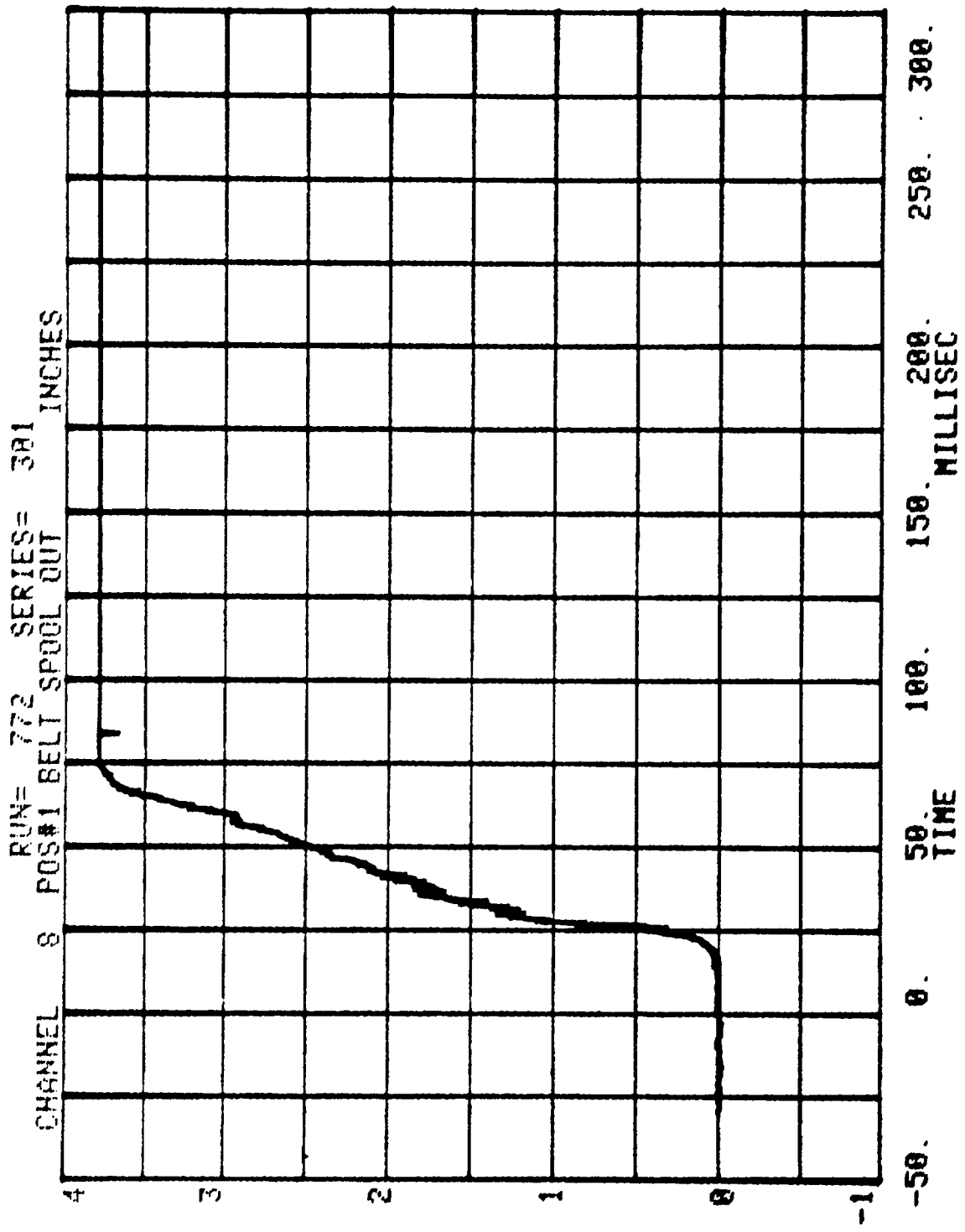

CHANNEL 12 POS#1 LEFT FEMUR
RUN= 772 SERIES= 301
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

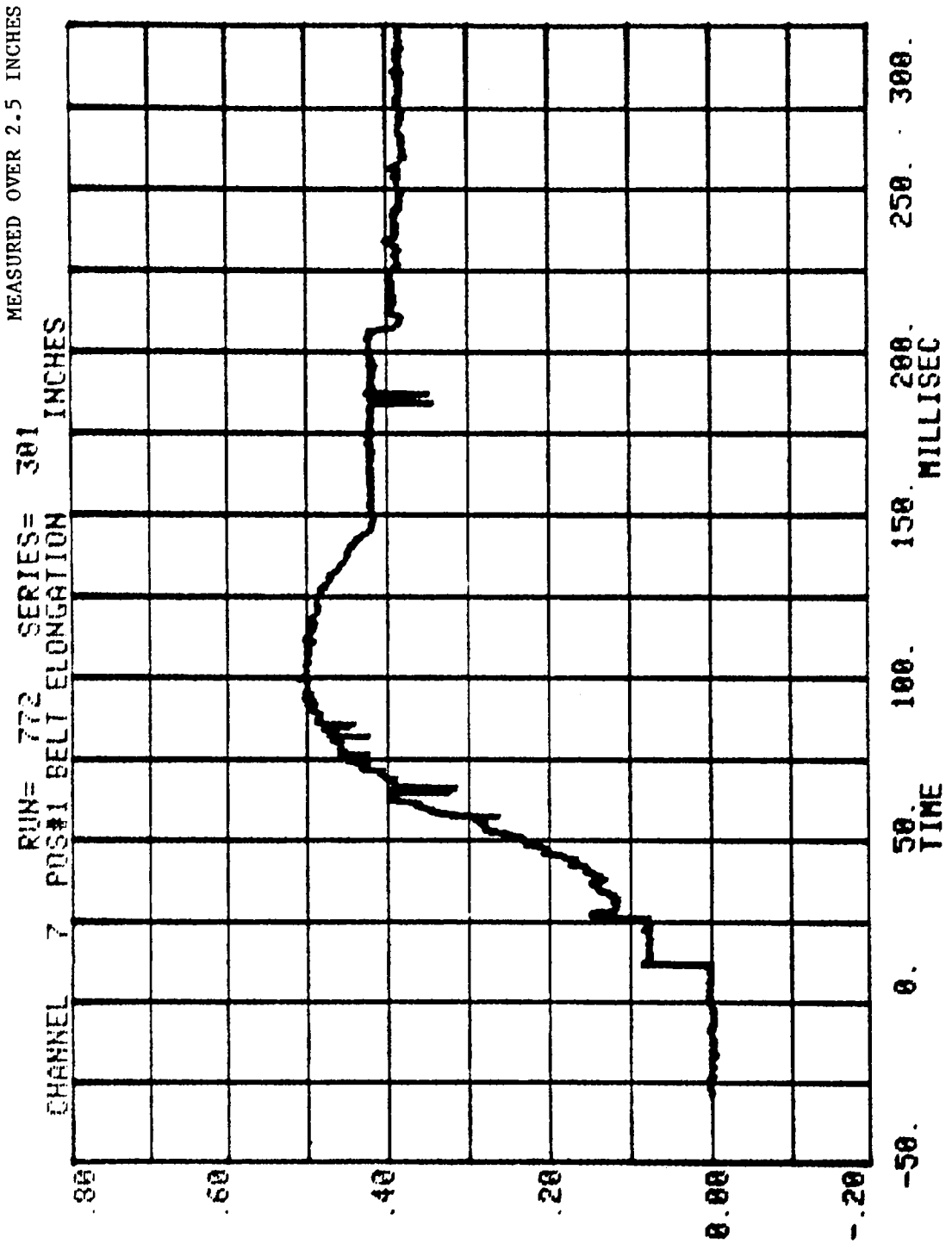
7556-10


CHANNEL 22 POS#1 LEFT BELT
RUN= 772 SERIES= 301
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


RUN= 772 SERIES= 301
CHANNEL 23 POS#1 TORSO BELT LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 8 POS#1 BELT SPOOL OUT
RUN= 772 SERIES= 381
INCHES
4
3
2
1
0
-1
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


MEASURED OVER 2.5 INCHES
CHANNEL 7 POS#1 BELT ELONGATION
RUN= 772 SERIES= 301
INCHES
.80
.60
.40
.20
0.00
-.20
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

NEW CAR ASSESSMENT BARRIER TESTS - 1987

RUN= 772

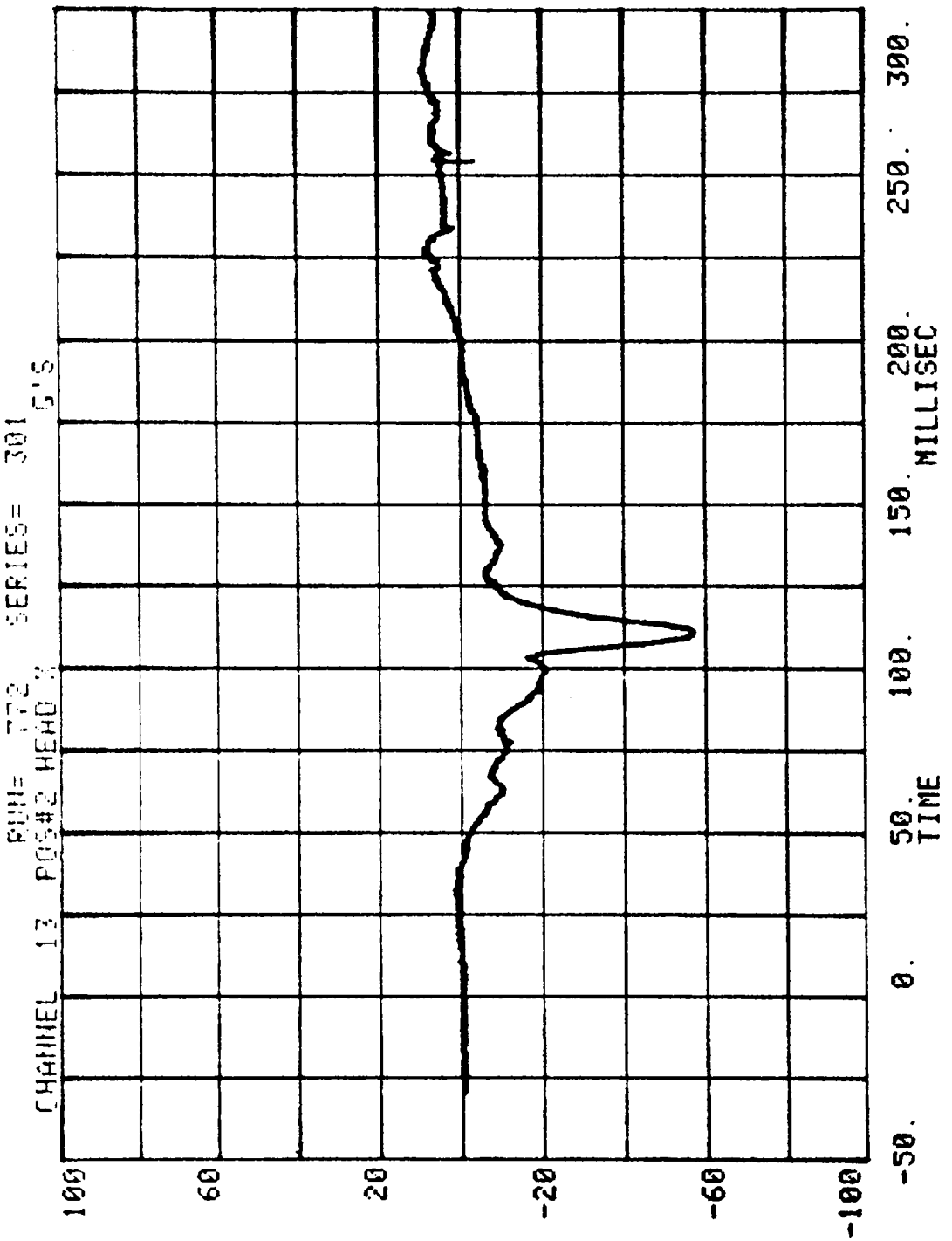
POS#2 HEAD R

HIC= 652.8 FROM T1= .09150 TO T2= .11587

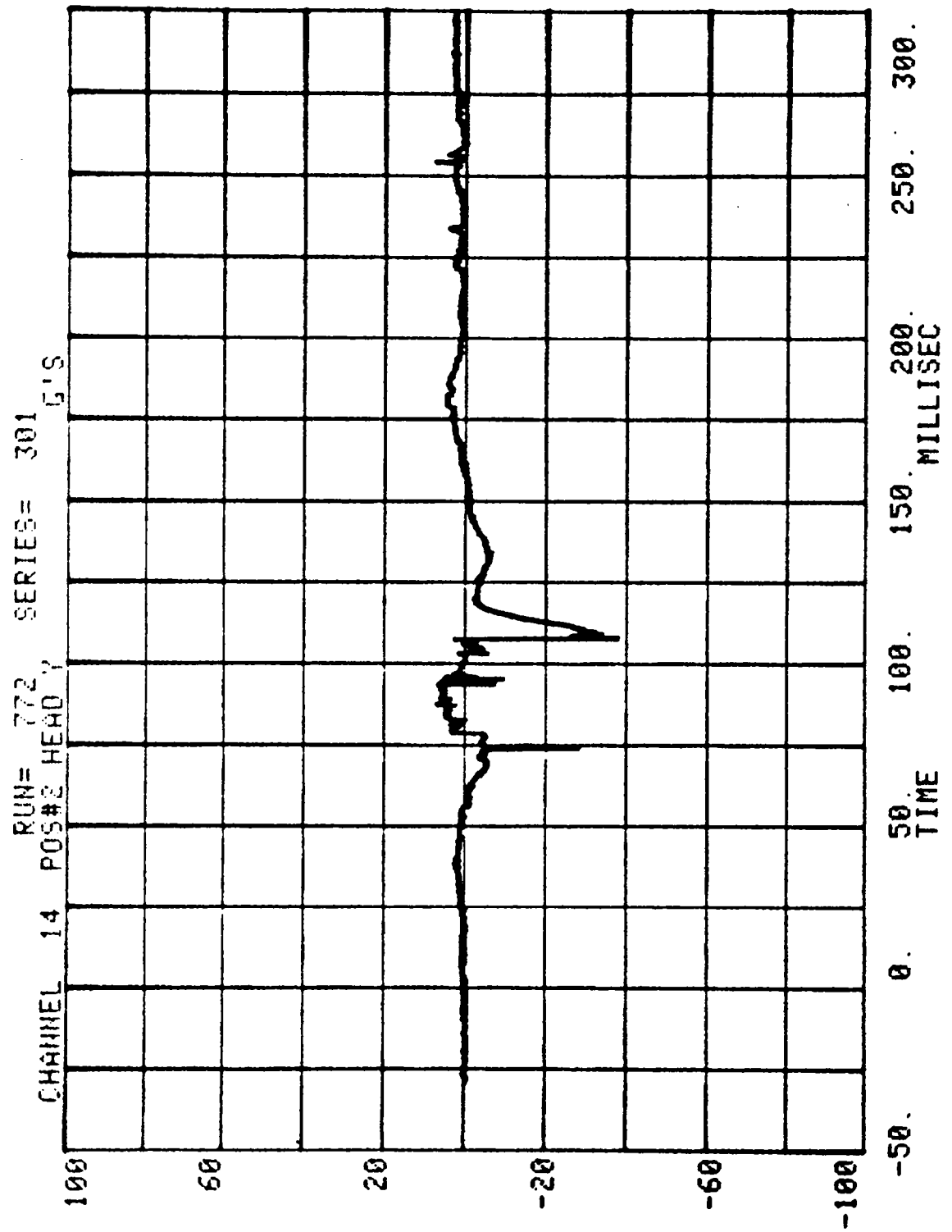
AVERAGE ACCELERATION BETWEEN T1 AND T2= 59.0G'S

EVENT TIME= 300.0 MSEC

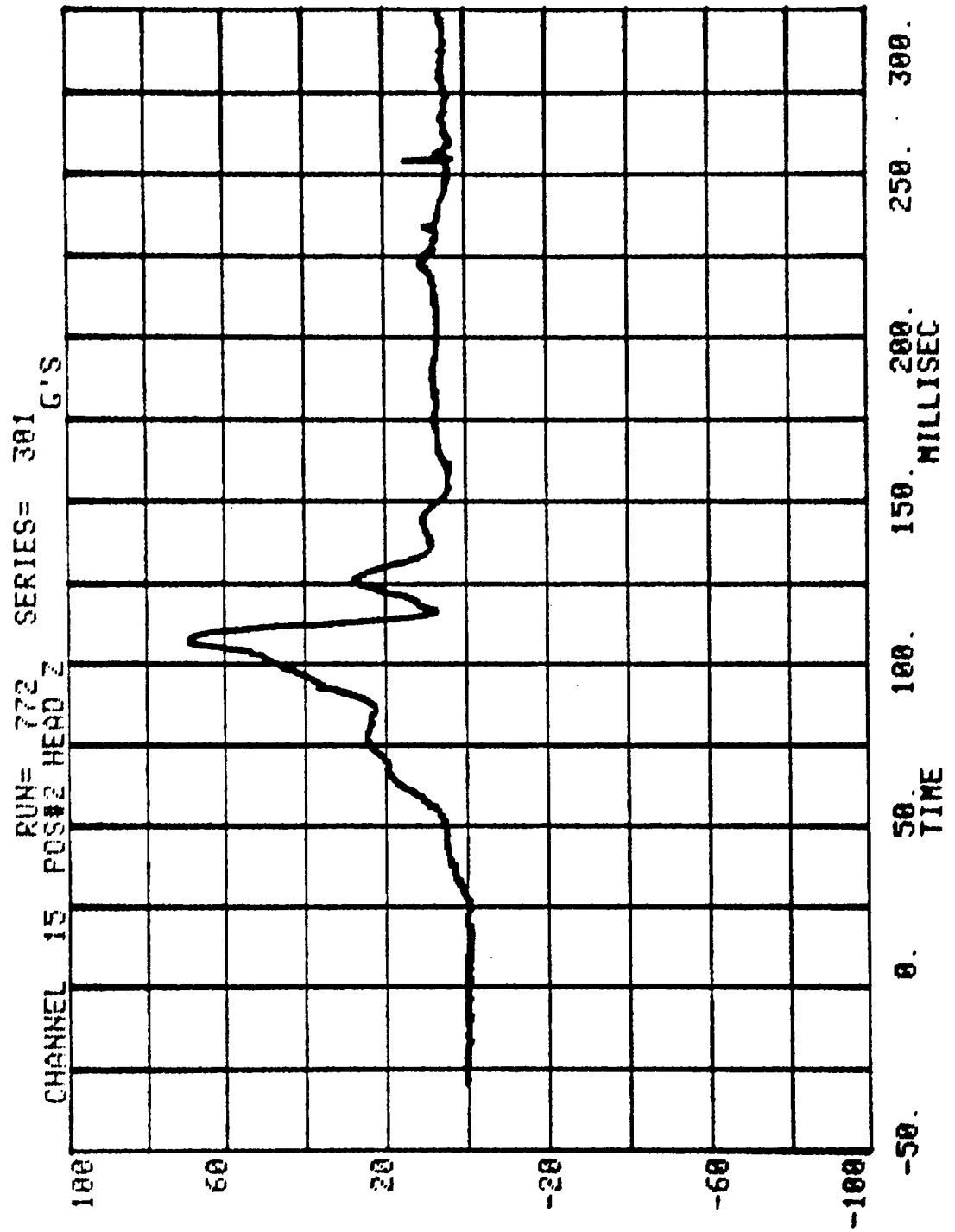
SEVERITY INDEX= 961.3


CHANNEL 13 POS#2 HEAD 2
RUN= 772 SERIES= 301 5'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

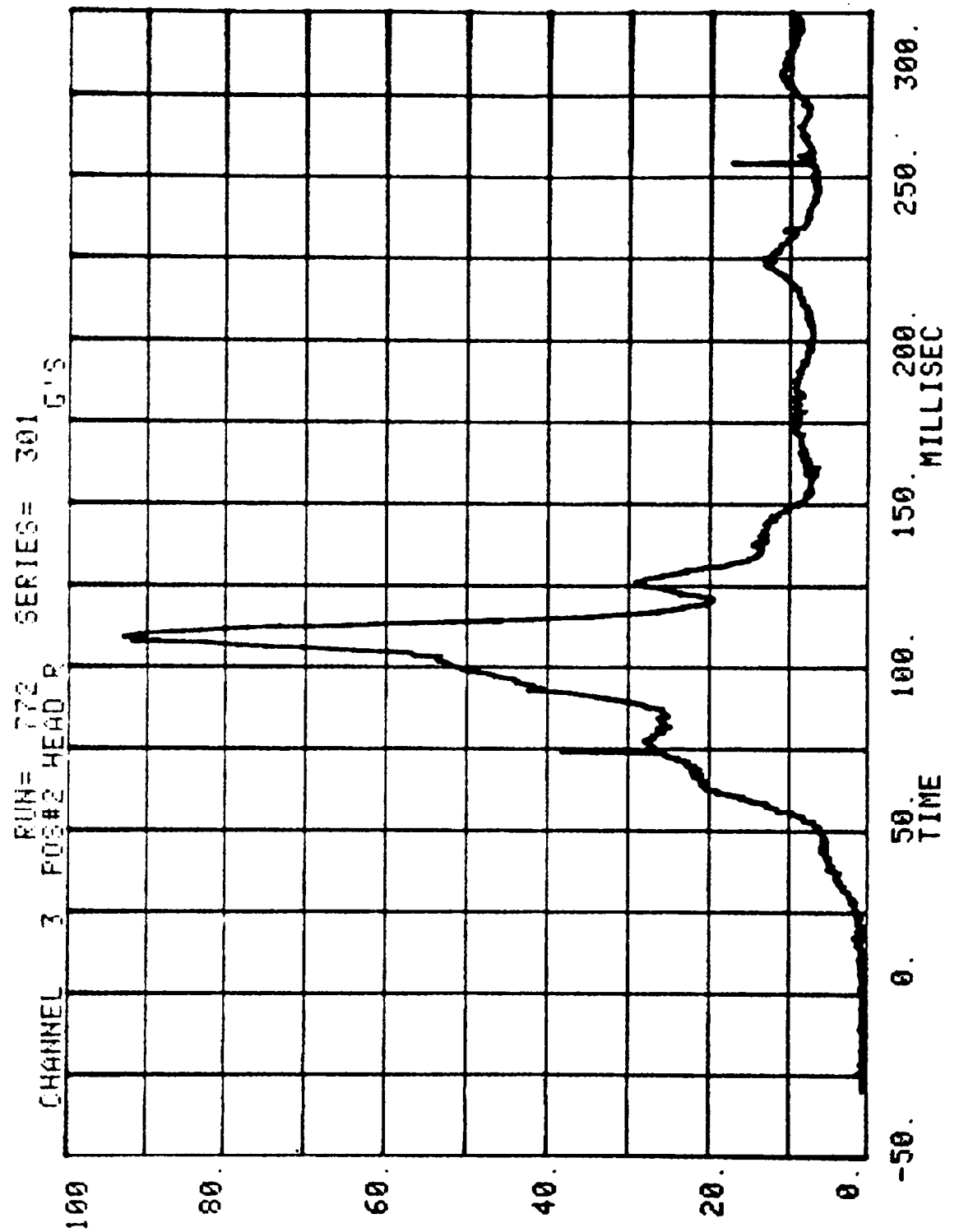
7556-10


CHANNEL 14 POS#2 HEAD Y
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

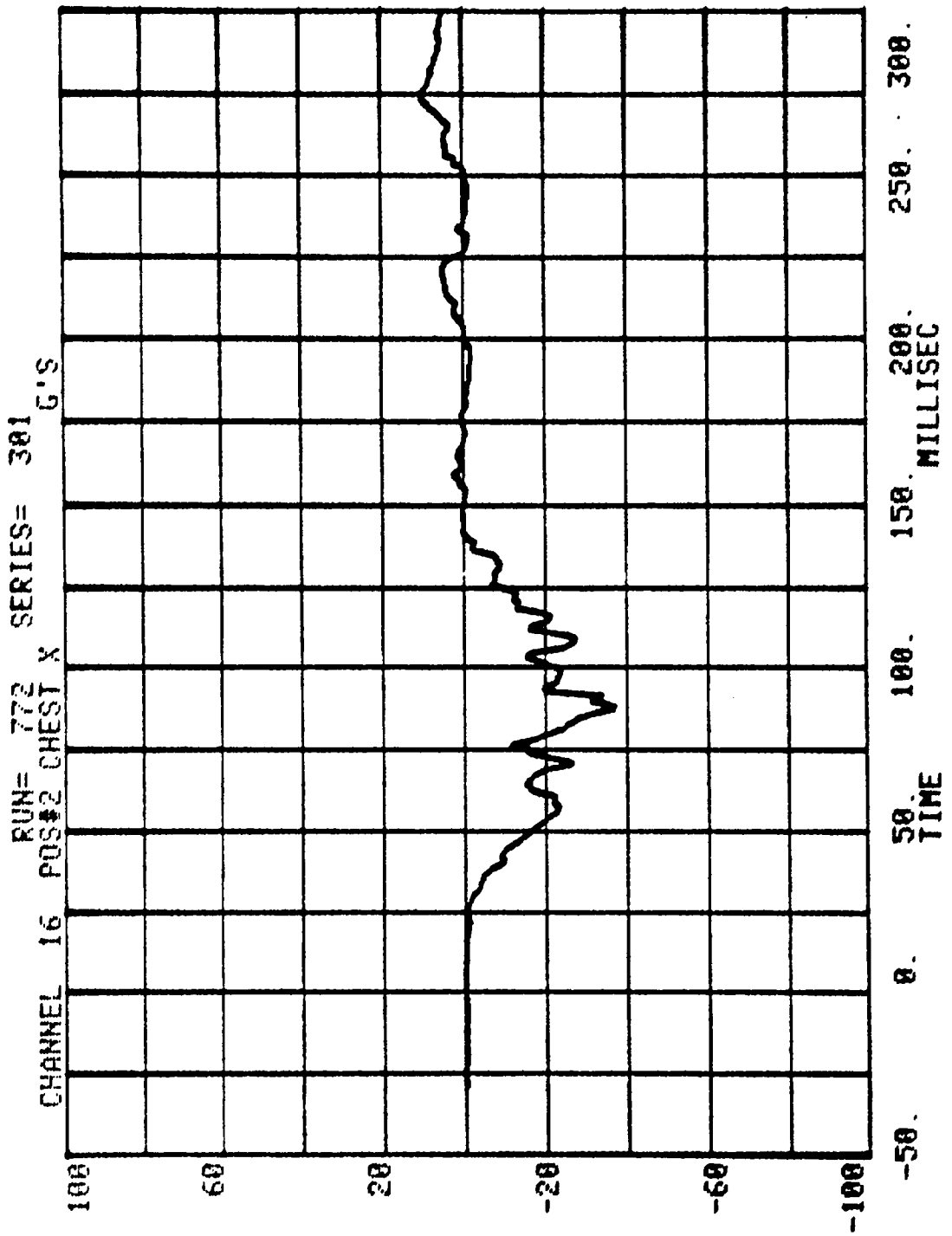
7556-10


CHANNEL 15 POS#2 HEAD 2
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

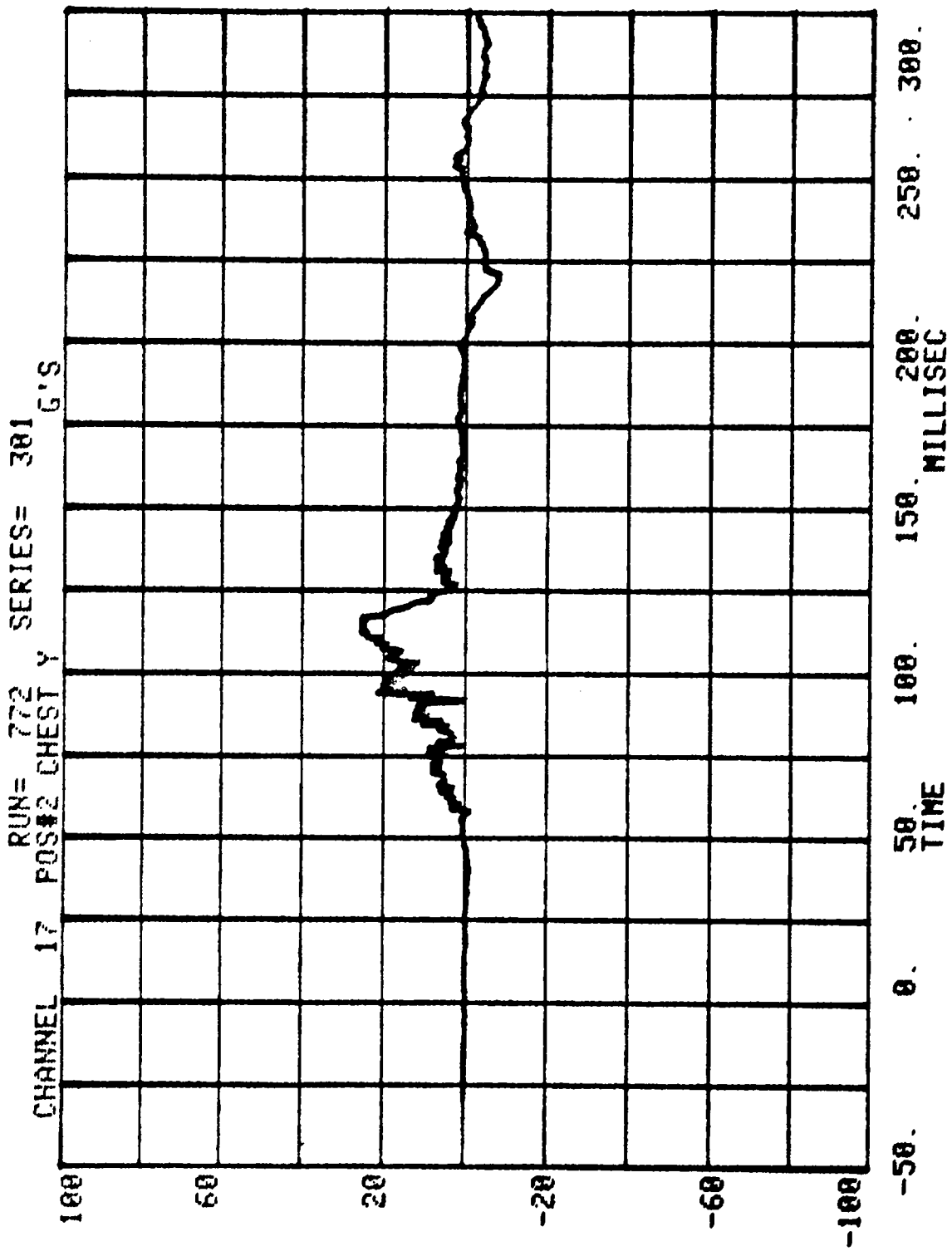
7556-10

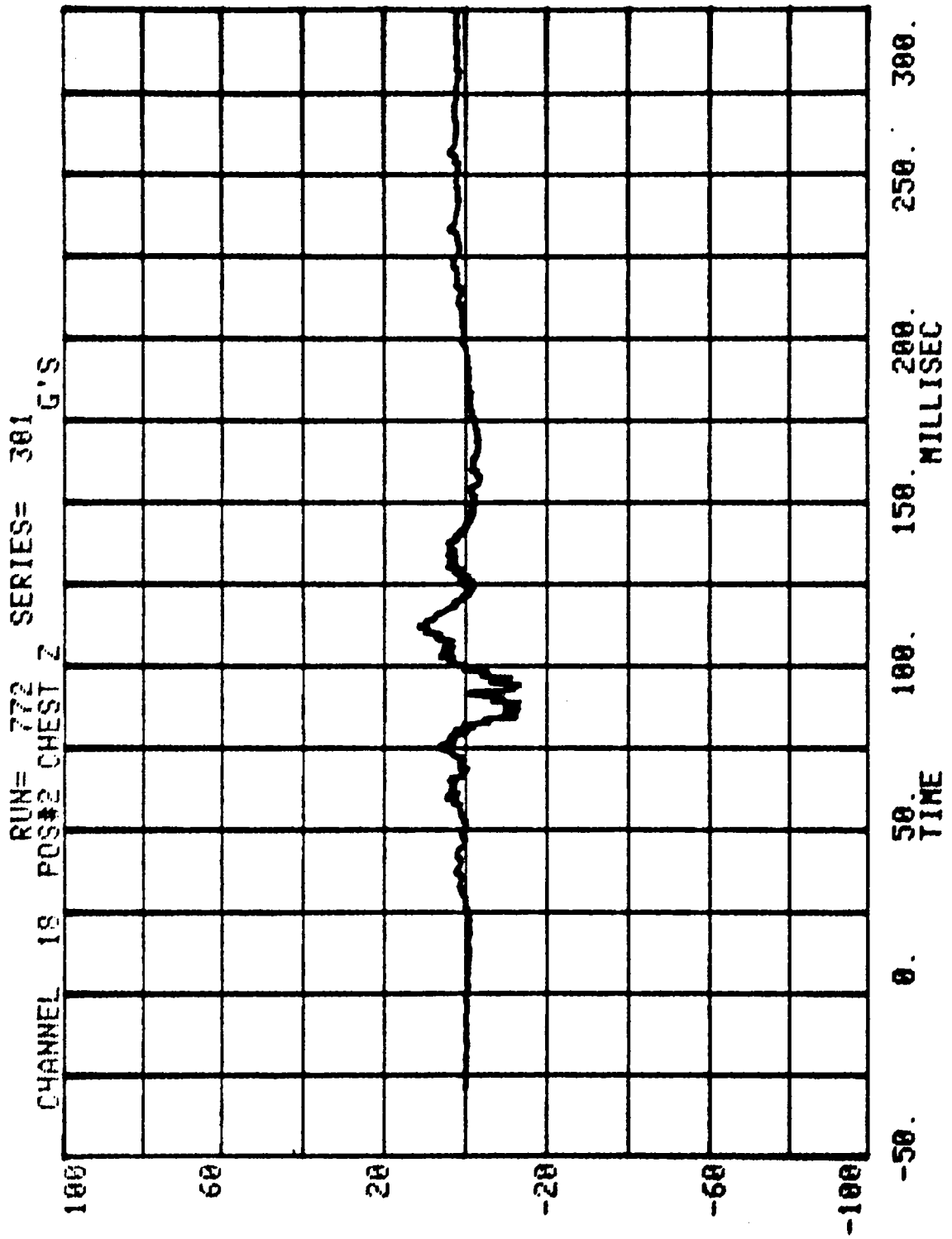

CHANNEL 3 POS#2 HEAD R RUN= 772 SERIES= 301 G'S
100
80.
60.
40.
20.
0.
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

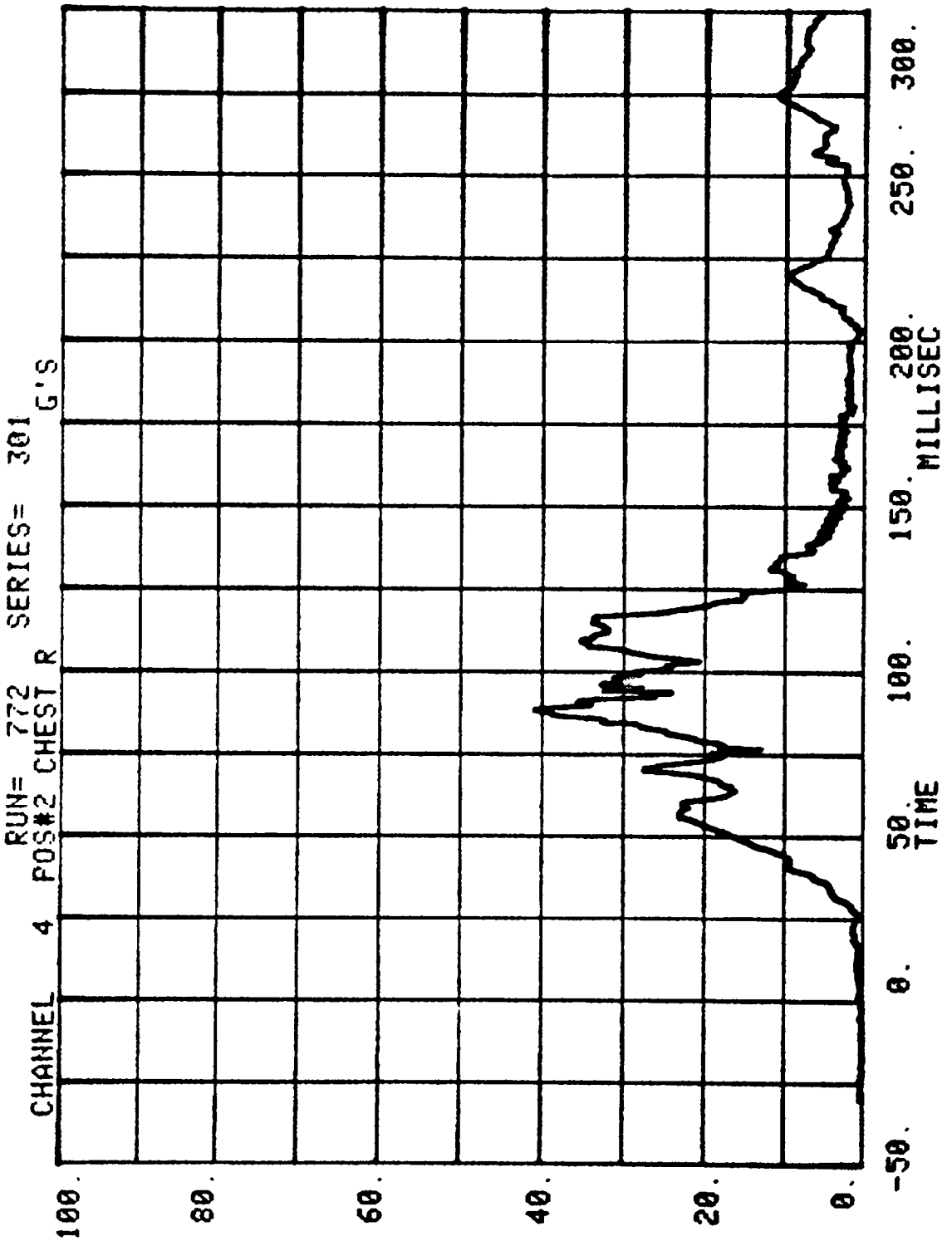

CHANNEL 16 POS#2 CHEST X
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

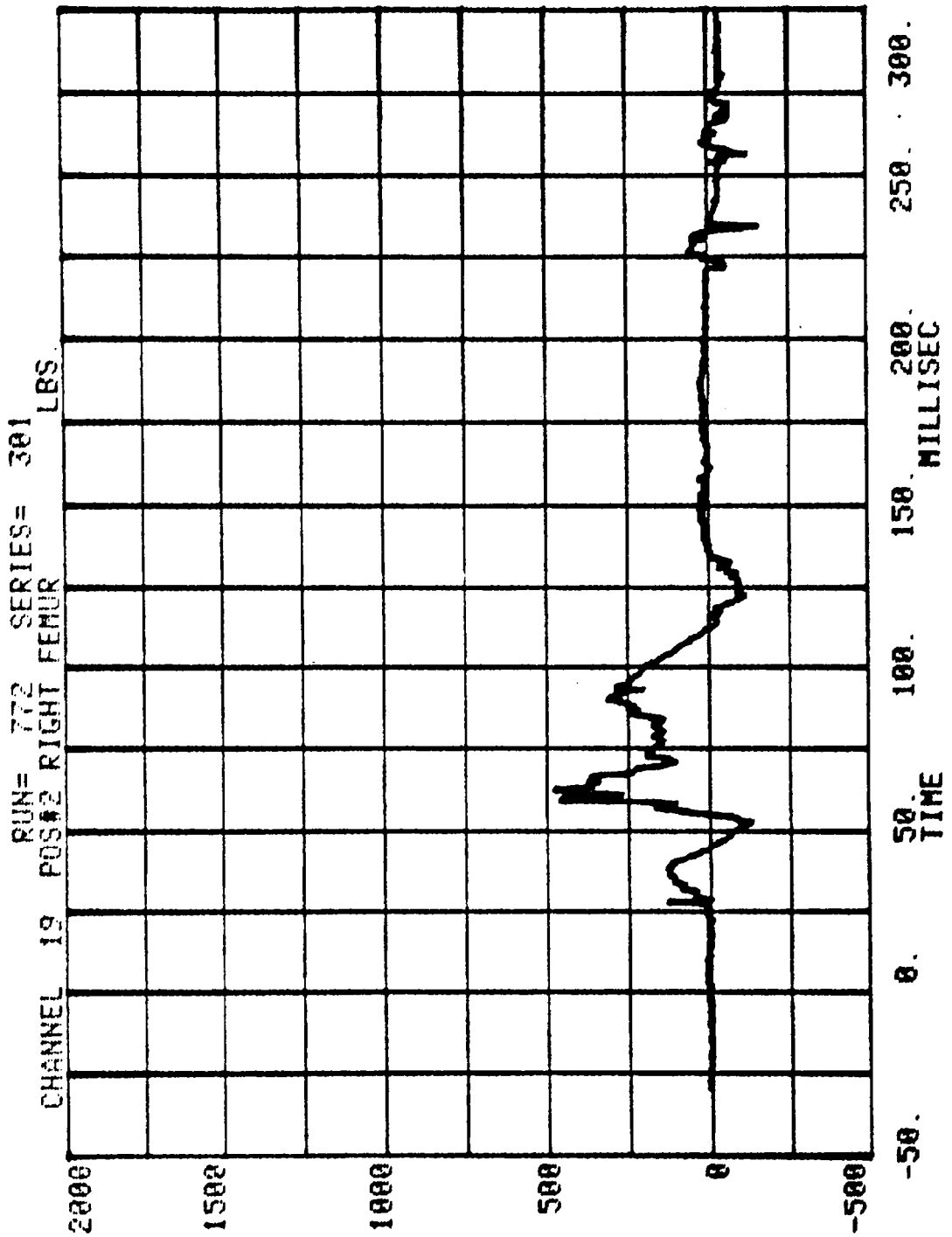

CHANNEL 17 POS#2 CHEST Y
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC


CHANNEL 18 POS#2 CHEST Z
RUN= 772 SERIES= 301
G'S
100
60
20
-20
-60
-100
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

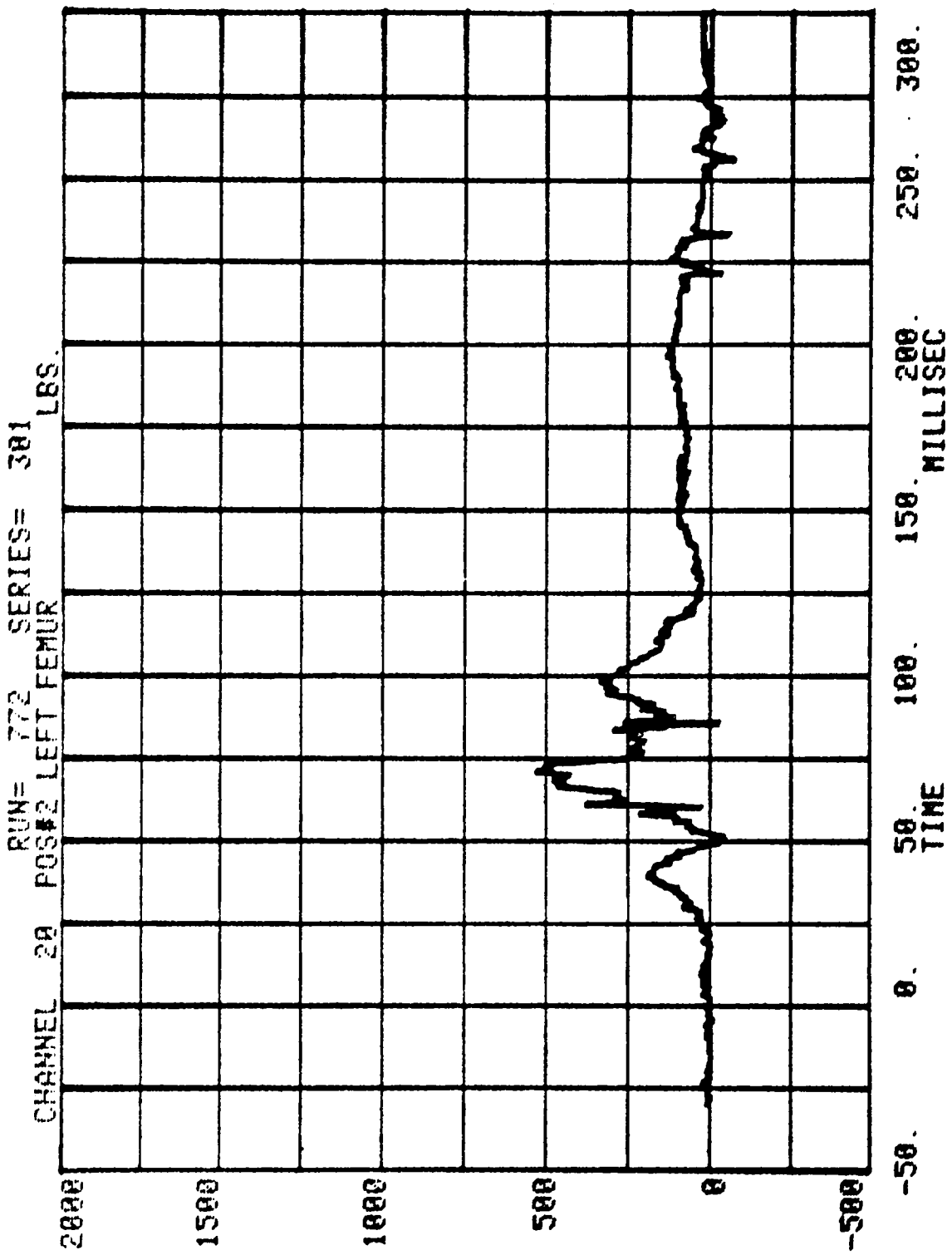
7556-10


CHANNEL 4 RUN= 772 SERIES= 301
POS#2 CHEST R
G'S
100.
80.
60.
40.
20.
0.
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

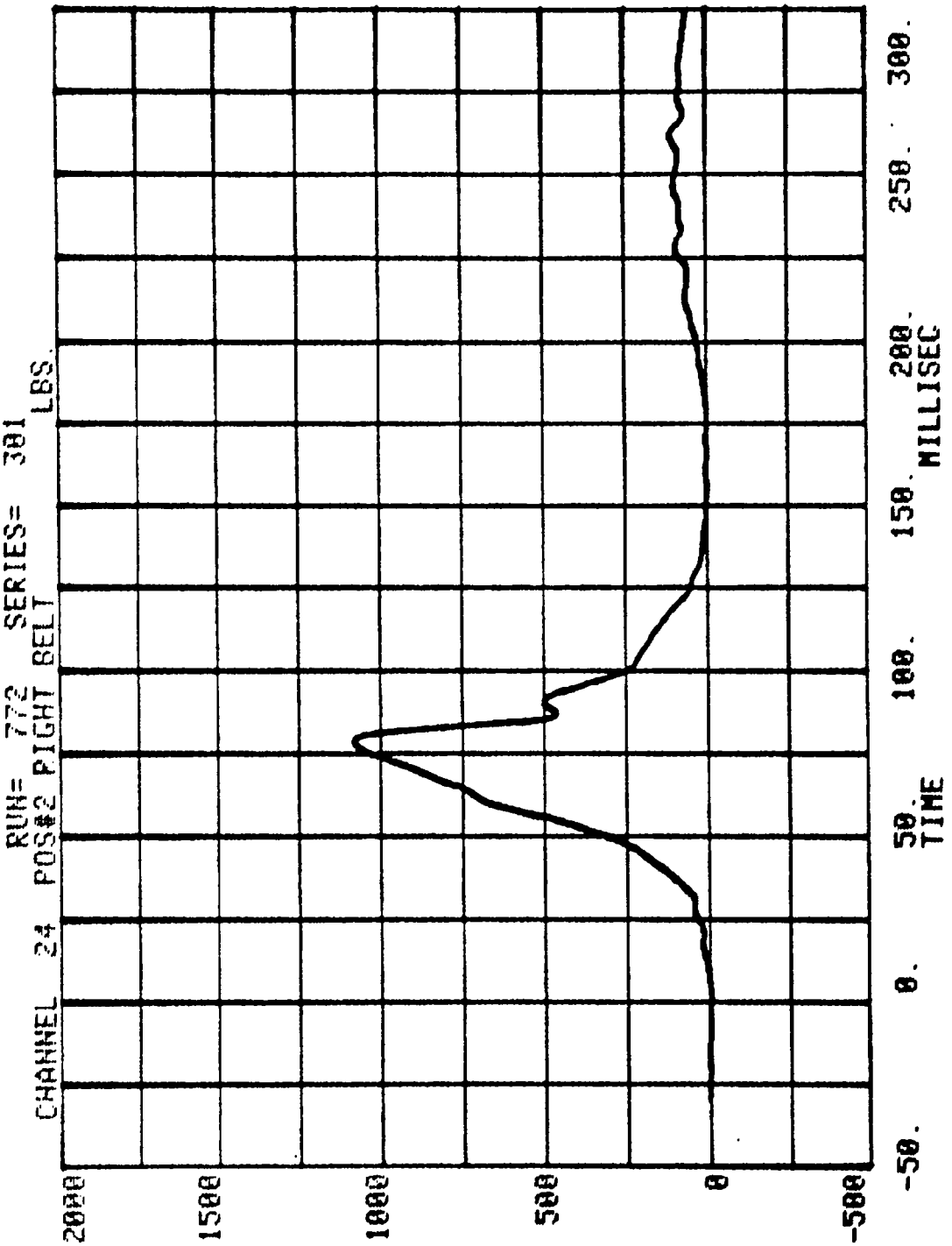
7556-10


CHANNEL 19
RUN= 772
POS#2 RIGHT FEMUR
SERIES= 301
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

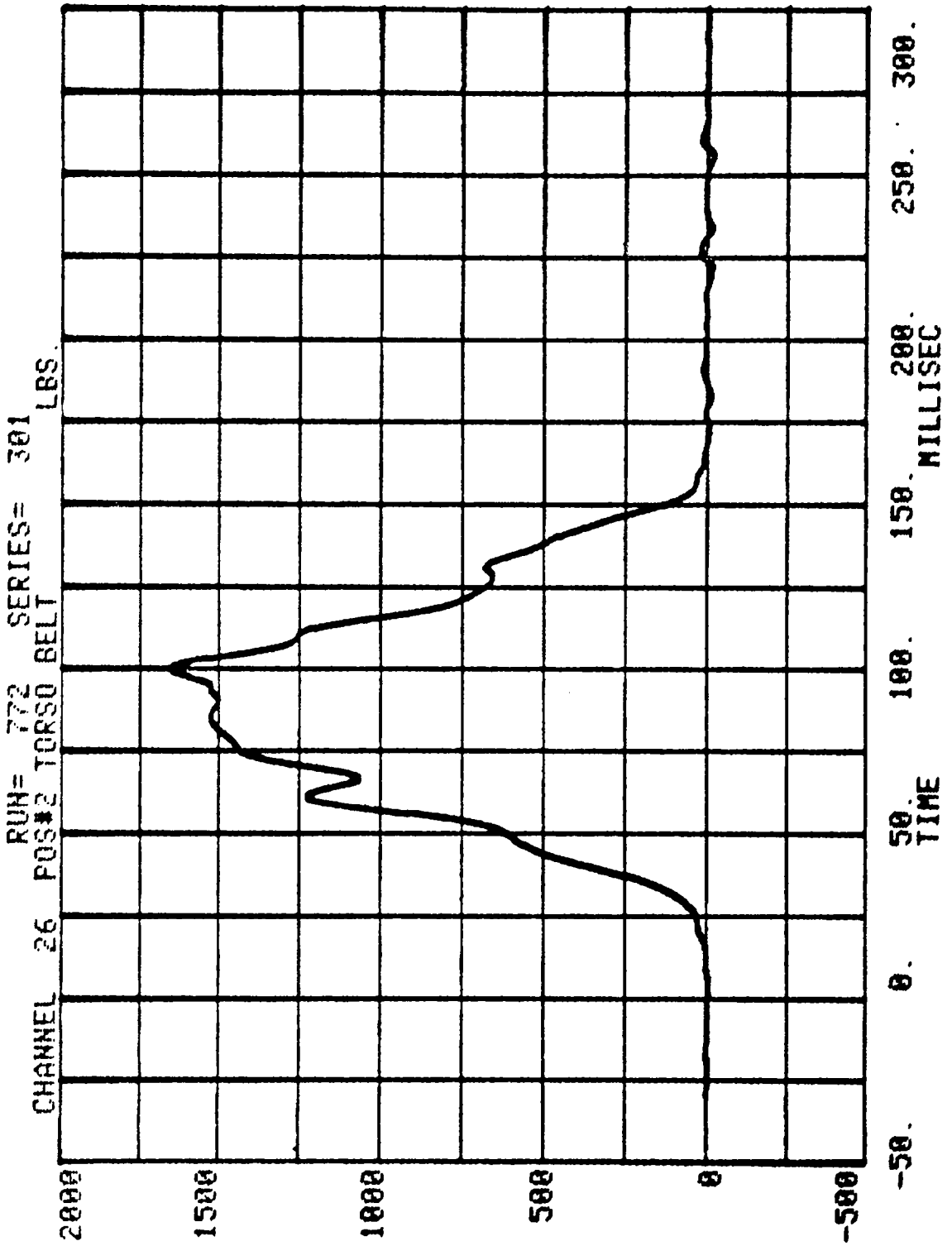
7556-10


CHANNEL 20 POS#2 LEFT FEMUR
RUN= 772 SERIES= 301
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

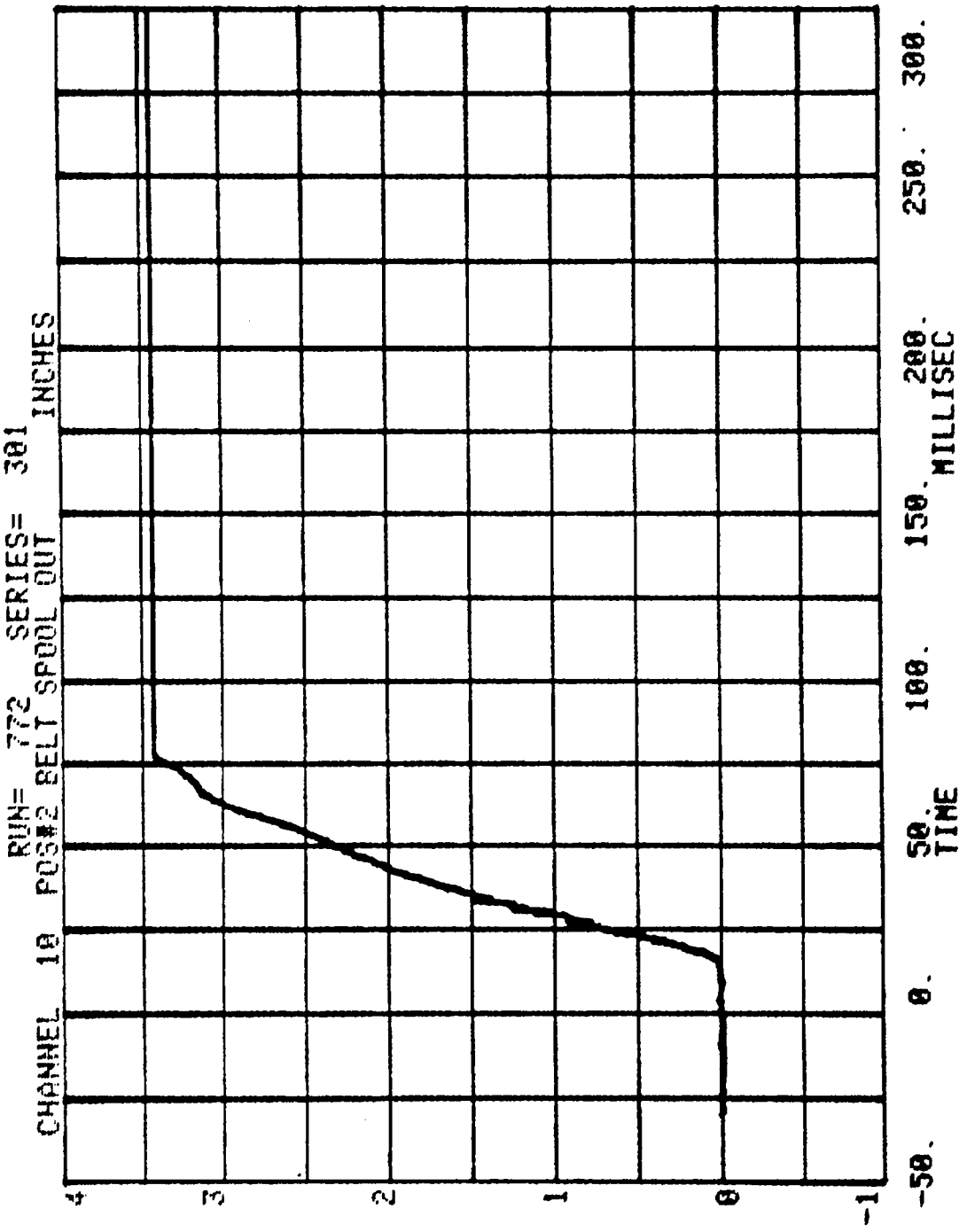
7556-10


CHANNEL 24 RUN= 772 SERIES= 301
POS#2 RIGHT BELT
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

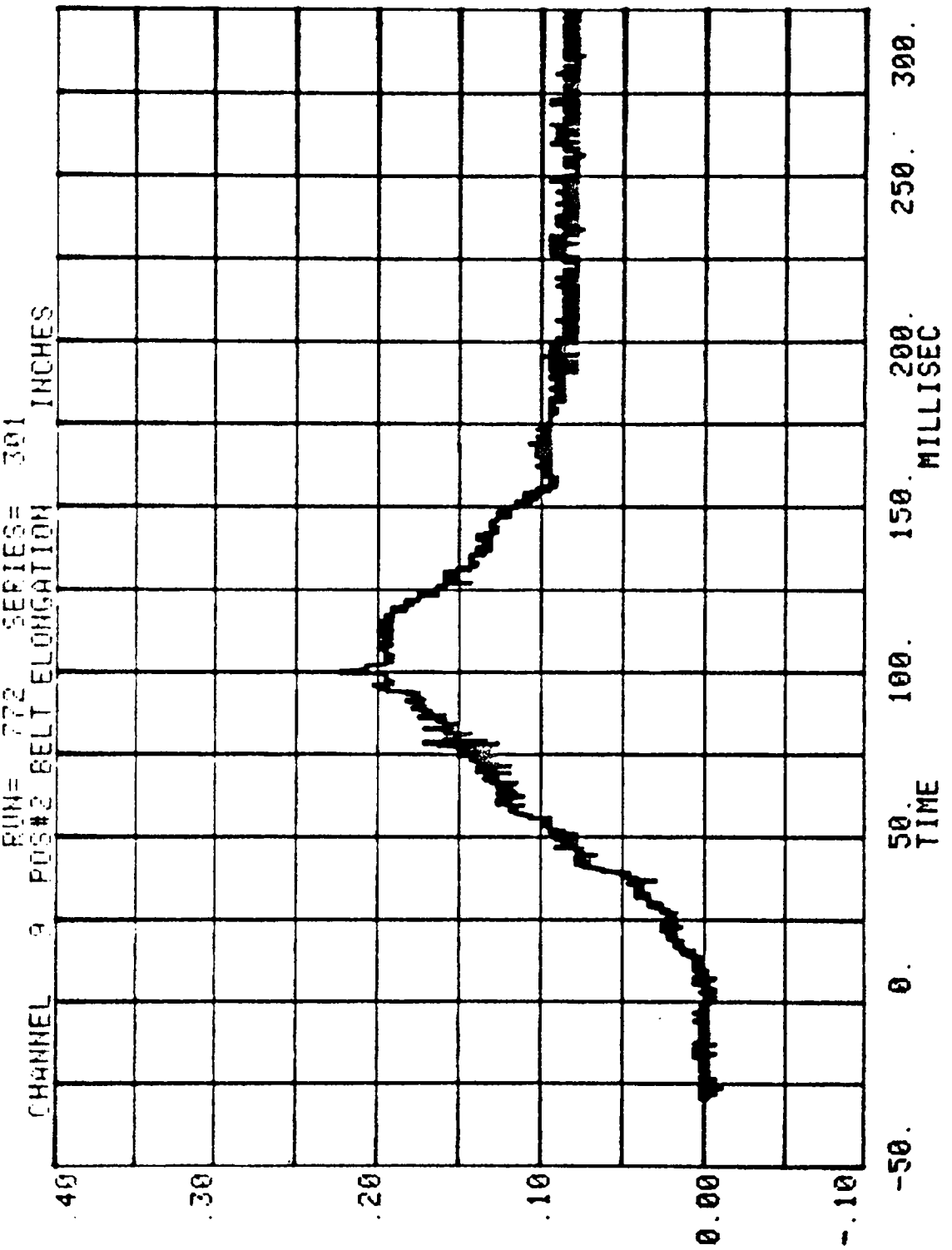
7556-10


CHANNEL 26 POS#2 TORSO BELT
RUN= 772 SERIES= 301
LBS.
2000
1500
1000
500
0
-500
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


CHANNEL 10 POS#2 BELT SPOOL OUT
RUN= 772 SERIES= 301
INCHES
4
3
2
1
0
-1
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10


CHANNEL 3 POS#2 BELT ELONGATION
RUN= 772 SERIES= 301
INCHES
.40
.30
.20
.10
0.00
-.10
-50.
0.
50.
100.
150.
200.
250.
300.
TIME
MILLISEC

7556-10

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 the Appendix.

Dummy serial numbers and certification dates are:

Serial No.	Completion Date
320	3/18/87
749	4/7/87

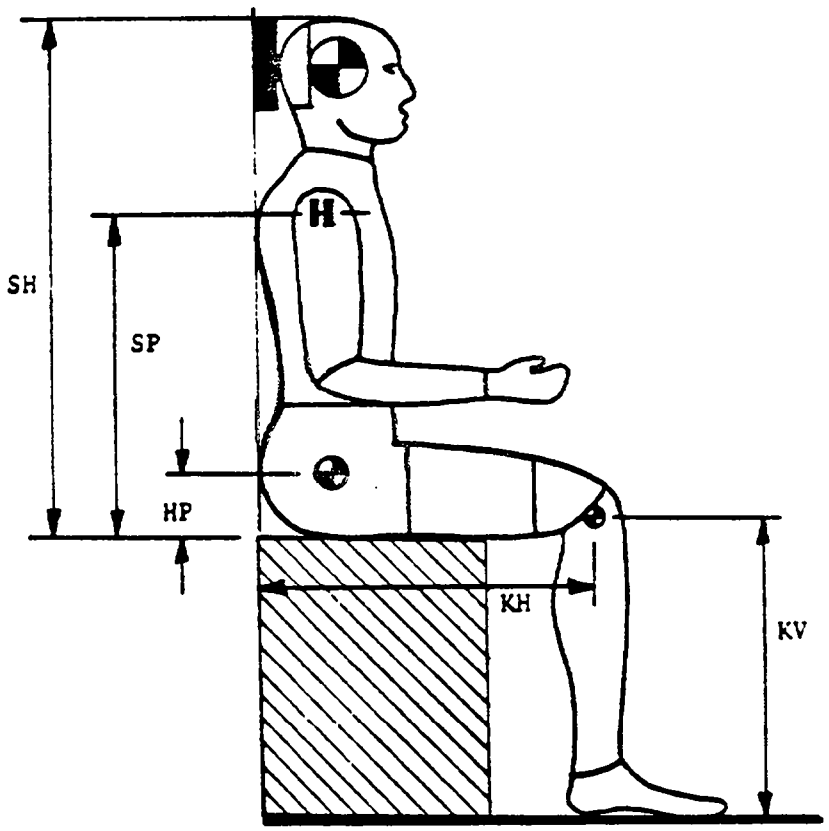
Electronic Test Equipment

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.: 320

I. CONFIGURATION VERIFICATION DATA:



	P.572 SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
DATE OF CONFIGURATION VERIFICATION		3/18/87	
VERIFICATION NUMBER FOR DUMMY*		2	
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"	19.5"	
SW - Shoulder Width - - - - - - -	17.8 to 18.4"	18.1"	
HW - Hip Width- - - - - - - - - -	14.0 to 15.4"	14.8"	

TECHNICIAN'S NAME: D. W. Hess

* 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.: 320

TECHNICIAN'S NAME: D. W. Hess

			PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION----------			3/18/87	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY*------			2	
VERIF. LAB. TEMPERATURE (66 to 78°F Range)-----			70-73 °F.	°F.
VERIF. LAB. HUMIDITY (10 to 70% Range)			24-45 %	%
TEST PARAMETER		SPECIFICATION		
1. HEAD DROP TEST--				
a. Peak Resultant Accel.-		210 to 260G	260 g	
b. Peak Lateral Accel.- -		≤ - 10G	9 g	
c. Time above 100G- - - -		0.9 to 1.5ms	1.04 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	24 g	
c. Peak Resultant Head Acceleration - - - - -		26G max.	24 g	
d. Pendulum Decel.(t_2-t_1)		≤ - 3ms	2 ms	
e. Pendulum Decel.(t_3-t_2)		25 to 30 ms	28.5 ms	
f. Pendulum Decel.(t_4-t_3)		≤ - 10ms	3 ms	
g. Max. Head Rotation - -		63 to 73°	68°	
h. Chordal Displacement-- Head Rotation Angle-				
0°	Time- -	-2 to 2 ms	0.0 ms	
	Displ.-	-.5 to .5"	0.0"	
30°	Time- -	25.6 to 34.4ms	28 ms	
	Displ.-	2.1 to 3.1"	2.8"	
60°	Time- -	40.3 to 51.7ms	42 ms	
	Displ.-	4.3 to 5.3"	5.0"	
Maximum (68°)	Time- -	53.2 to 66.8ms	54 ms	
	Displ.-	5.0 to 6.0"	5.6"	

*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.: 320

TECHNICIAN'S NAME: D. W. Hess

TEST PARAMETER		SPECIFICATION	Pre-Test (if required)	Post-Test (if required)
2. NECK BENDING TEST.... Continued:				
h. Chordal Displacement:				
Head Rotation Angle--				
60°	Time	67.0 to 83.0 ms	67.0 ms	
	Displ.	4.3 to 5.3 in.	5.1"	
30°	Time	85.4 to 104.6 ms	86 ms	
	Displ.	2.1 to 3.1 in.	2.3"	
0°	Time	101.0 to 123.0 ms	101 ms	
	Displ.	-.5 to 0.5 in.	0.0"	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ .5" - - - - -		23 to 36 lbs.	23.5 lbs.	
b. Force @ .75" - - - - -		36 to 50 lbs.	38.5 lbs.	
c. Force @ 1.0" - - - - -		50 to 63 lbs.	57.5 lbs.	
d. Force @ 1.3" - - - - -		73 to 88 lbs.	88 lbs.	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - - -		22 to 34 lbs.	31 lbs.	
b. Force @ 30° - - - - -		34 to 46 lbs.	38.5 lbs.	
c. Force @ 40° - - - - -		46 to 58 lbs.	49 lbs.	
d. Return Angle - - - - -		12° maximum	6°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed- - -		21.78-22.22 fps	21.89 fps	
(2) Peak Deflection-		1.7" maximum	1.58"	
(3) Peak Resistive Force- - - - - -		2250 lbs. maximum	2028 lbs.	
(4) Internal Hysteresis - - -		50 to 70%	56.6%	
b. Low Speed				
(1) Probe Speed- - -		13.86-14.14 fps	14.13 fps	
(2) Peak Deflection-		1.1" maximum	.6"	
(3) Peak Resistive Force- - - - - -		1450 lbs. maximum	1274 lbs.	
(4) Internal Hyster.		50 to 70%	63.5%	

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

II. PERFORMANCE VERIFICATION DATA (Continued) NHTSA DUMMY I.D. NO.: 320

TECHNICIAN'S NAME: D. W. Hess

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	7.03 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2125 lbs.	
(3) Time Above 1000#-	1.7 ms minimum	1.8 ms	
b. Left Side--			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.93 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2000 lbs.	
(3) Time Above 1000#-	1.7 ms minimum	1.72 ms	

REMARKS:

INSTRUMENT CALIBRATION INFORMATION

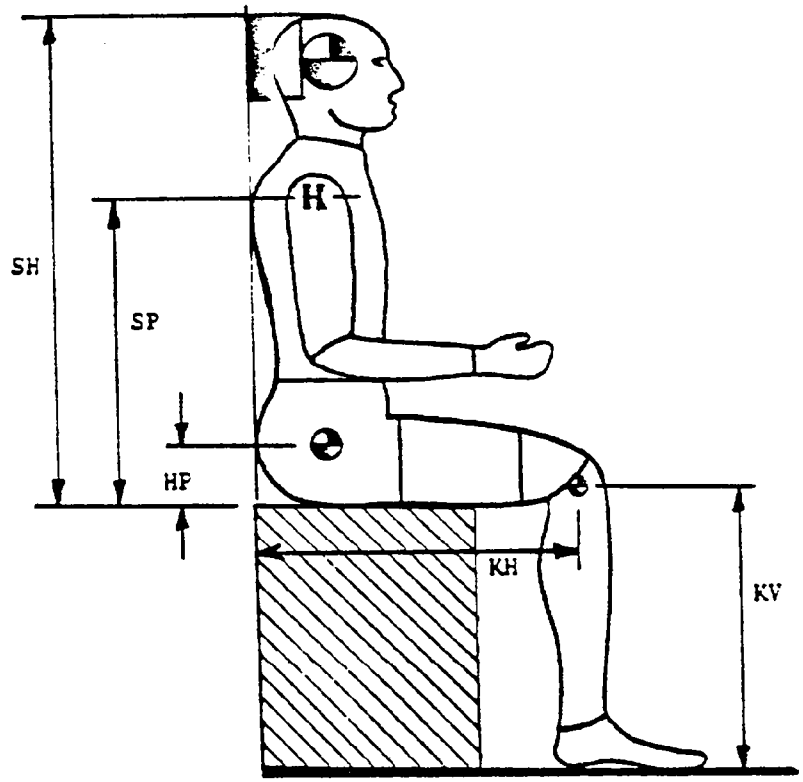
ITSA DUMMY ID NO. 320 CALIB. SEQ. NOS. FOR DUMMY: 2

DUMMY INSTRUMENTS:	MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. Head Accelerometers --				
a. Triaxial unit - - - - -	NA	------	------	------
b. Uniaxial units				
(1) Longitudinal (A_x) -	Endevco	CJ22	2-87	8-87
(2) Lateral (A_y) - - -		CS41		
(3) Vertical (A_z) - - -		CH31		
2. Chest Accelerometers -- (Vehicle Crash Test Usage)				
a. Triaxial unit - - - - -	NA			
b. Uniaxial units				
(1) Longitudinal (A_x) -	CEC	A73		
(2) Lateral (A_y) - - -	Endevco	CE06		
(3) Vertical (A_z) - - -	CEC	A44		
3. Chest Potentiometer - - -	NA	------	-------	------
4. Femur Load Cells --				
a. Right Side - - - - - -	GSE	549	2-87	8-87
b. Left Side - - - - - -	"	548	2-87	8-87
CALIB. LAB. INSTRUMENTS:				
1. Pendulum Accelerometer - - -	CED	18259	2-87	8-87
2. Test Probe Accelerometer - - -	"	17815	2-87	8-87
3. Lumbar Flexion Test Push Force Gauge - - - - - - - - -	Transducer Inc.	20051	2-87	8-87
4. Abdominal Compression Test Force Gauge - - - - - - - - -	BLH	72952	2-87	8-87
5. Abdominal Compression Test Displacement Gauge - - - - -	CIC	567-11	2-87	8-87

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NO.: 749

I. CONFIGURATION VERIFICATION DATA:



	P.572 SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
DATE OF CONFIGURATION VERIFICATION		4/7/87	
VERIFICATION NUMBER FOR DUMMY*		2	
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"	14.7"	

TECHNICIAN'S NAME: D. W. Hess

* 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.: 749

TECHNICIAN'S NAME: D. W. Hess

			PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION----------			4/7/87	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY*------			2	
VERIF. LAB. TEMPERATURE (66 to 78°F Range)-----			70-74 °F.	°F.
VERIF. LAB. HUMIDITY (10 to 70% Range)			35-48 %	%
TEST PARAMETER		SPECIFICATION		
1. HEAD DROP TEST--				
a. Peak Resultant Accel.-		210 to 260G	235 g	
b. Peak Lateral Accel.- -		≤ - 10G	2 g	
c. Time above 100G- - - -		0.9 to 1.5ms	1.12 ms	
2. NECK BENDING TEST--				
a. Pendulum Speed - - - -		21.5 to 25.5 fps	21.58 fps	
b. Pend. Avg. Decel. over $t_3 - t_2$		20 to 24G	23 g	
c. Peak Resultant Head Acceleration - - - - -		26G max.	24 g	
d. Pendulum Decel.(t_2-t_1)		≤ - 3ms	2 ms	
e. Pendulum Decel.(t_3-t_2)		25 to 30 ms	27 ms	
f. Pendulum Decel.(t_4-t_3)		≤ - 10ms	3 ms	
g. Max. Head Rotation - -		63 to 73°	72°	
h. Chordal Displacement--				
Head Rotation Angle-				
0°	Time- -	-2 to 2 ms	0.0 ms	
	Displ.-	-.5 to .5"	0.0"	
30°	Time- -	25.6 to 34.4ms	28.5 ms	
	Displ.-	2.1 to 3.1"	3.1"	
60°	Time- -	40.3 to 51.7ms	42.7 ms	
	Displ.-	4.3 to 5.3"	5.1"	
Maximum	Time- -	53.2 to 66.8ms	57 ms	
(72 °)	Displ.-	5.0 to 6.0"	5.9"	

*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.: 749

TECHNICIAN'S NAME: D. W. Hess

TEST PARAMETER		SPECIFICATION	Pre-Test (if required)	Post-Test (if required)
2. NECK BENDING TEST.... Continued:				
h. Chordal Displacement:				
Head Rotation Angle--				
60°	Time	67.0 to 83.0 ms	77 ms	
	Displ.	4.3 to 5.3 in.	4.8"	
30°	Time	85.4 to 104.6 ms	94 ms	
	Displ.	2.1 to 3.1 in.	2.5"	
0°	Time	101.0 to 123.0 ms	108.5 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.	42.5 lbs.	
c. Force @ 1.0" - - - - -		50 to 63 lbs.	57.5 lbs.	
d. Force @ 1.3" - - - - -		73 to 88 lbs.	82 lbs.	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - - -		22 to 34 lbs.	32 lbs.	
b. Force @ 30° - - - - -		34 to 46 lbs.	42.5 lbs.	
c. Force @ 40° - - - - -		46 to 58 lbs.	54 lbs.	
d. Return Angle - - - - -		12° maximum	5°	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed- - -		21.78-22.22 fps	22.04 fps	
(2) Peak Deflection-		1.7" maximum	1.42"	
(3) Peak Resistive Force- - - - -		2250 lbs. maximum	2184 lbs.	
(4) Internal Hysteresis - - -		50 to 70%	62.6%	
b. Low Speed				
(1) Probe Speed- - -		13.86-14.14 fps	13.95 fps	
(2) Peak Deflection-		1.1" maximum	.96"	
(3) Peak Resistive Force- - - - -		1450 lbs. maximum	1300 lbs.	
(4) Internal Hyster.		50 to 70%	59.7%	

II. PERFORMANCE VERIFICATION DATA (Continued) NHTSA DUMMY I.D. NO.: 749

TECHNICIAN'S NAME: D. W. Hess

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	6.98 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	1995 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.71 ms	
b. Left Side--			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.00 fps	
(2) Maximum Force - -	1850 to 2500 lbs.	2130 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.9 ms	

REMARKS:

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 749 CALIB. SEQ. NOS. FOR DUMMY: 2

	MANUFACTURER	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
A. DUMMY INSTRUMENTS:				
1. Head Accelerometers --				
a. Triaxial unit - - - - -	NA	------	------	------
b. Uniaxial units				
(1) Longitudinal (A_x) -	Endevco	CK54	2-87	8-87
(2) Lateral (A_y) - - -	"	CK78	2-87	8-87
(3) Vertical (A_z) - - -	"	CD75	2-87	8-87
2. Chest Accelerometers -- (Vehicle Crash Test Usage)				
a. Triaxial unit - - - - -	NA	------	------	------
b. Uniaxial units				
(1) Longitudinal (A_x) -	CEC	A52	2-87	8-87
(2) Lateral (A_y) - - -	Endevco	CL65	2-87	8-87
(3) Vertical (A_z) - - -	CEC	A90	2-87	8-87
3. Chest Potentiometer - - -	NA	------	------	------
4. Femur Load Cells --				
a. Right Side - - - - - -	GSE	77	2-87	8-87
b. Left Side - - - - - -	"	76	2-87	8-87
B. CALIB. LAB. INSTRUMENTS:				
1. Pendulum Accelerometer - - -	CED	18259	2-87	8-87
2. Test Probe Accelerometer - - -	"	17815	2-87	8-87
3. Lumbar Flexion Test Push Force Gauge - - - - - - - - -	Transducer Inc.	20051	2-87	8-87
4. Abdominal Compression Test Force Gauge - - - - - - - - -	BLH	72952	2-87	8-87
5. Abdominal Compression Test Displacement Gauge - - - - -	CIC	567-11	2-87	8-87

APPENDIX D

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

SAFETY BELTS

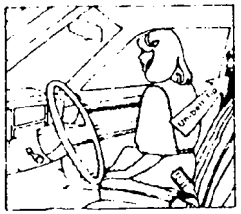
Always use the safety belts. The chance of a serious injury is greatly reduced when the belts are properly used.

Safety belts provide protection against being thrown from the vehicle as well as reducing the risk of an injury caused by striking the interior of the vehicle.

Front Seats

The "UNIBELT", or single continuous-belt restraint system, is installed for the driver and front seat passenger. The unibelt system incorporates an inertia sensitive belt webbing retractor which is designed to lock (i.e., prevent belt travel) *only during very sudden stops or impacts.* This feature allows the shoulder belt to move freely with the wearer under normal conditions. *The retractor will not lock by jerking or pulling the webbing rapidly by hand.*

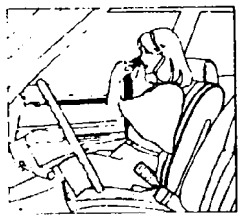
UNIBELT OPERATING INSTRUCTIONS



1

1. Enter the vehicle and close the door. Sit well back and erect and adjust the seat. Note the metal tip of the unibelt in its stowed position.

2. Grasp the metal tip and slide it up the webbing as far as necessary to go around your lap as you pull out the webbing. A couple of tries and this will become an automatic one handed operation.

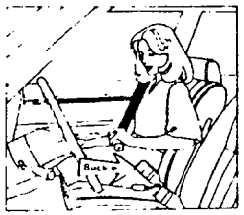


2

3. As you pull the webbing across your lap and over your shoulder, move the metal tip toward the buckle.

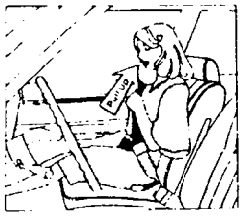
Insert the tip into the buckle until a "click" is heard.

Do not wear the shoulder belt under your arm or otherwise out of position. Such use could increase the chance and/or severity of injury in an accident.



3

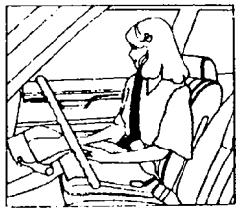
4. Position the lap belt with the upper edge of the belt drawn across the thighs and snug against the hips. Slack will automatically be removed due to tension created by the retractor. If a snug fit in the lap belt portion is desired, pull up on the shoulder belt as shown. *A snug belt reduces the risk of sliding under the belt in a collision.*



4

5. On 2-Door models only, if the shoulder belt feels too tight, move your shoulder forward slightly, or withdraw an inch or less of webbing by giving a slight tug on the belt.

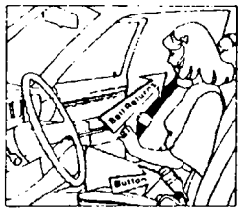
The belt will retain the small amount of slack necessary for comfort when you return to your normal seating position. If the belt is still too tight, pull out 6 to 8 inches of webbing, let it return to your chest and repeat the above motion.



5

CAUTION: *The amount of slack in the shoulder belt should be kept to a minimum. Too much slack could reduce the amount of protection because the belt may not be able to properly restrain you in an accident.*

The shoulder belt will allow unrestricted movement of the upper body under normal conditions. Extreme movements will probably require resetting the slack in the shoulder belt. The belt will lock in the event of an accident.



6

6. To release the belt, push the red button marked "Press" on the buckle. The belt will automatically retract to its stowed position.

If needed, slide the tip down the webbing to allow the belt to fully retract.