

DOT0004

REPORT NO. 6525-V-2

NEW CAR ASSESSMENT AND STANDARDS

ENFORCEMENT INDICANT TESTING

FMVSS NOS. 212, 219 AND 301-75

General Motors Corporation
1980 Chevrolet Citation 5-Door Hatchback
NHTSA 308-T2-431

CALSPAN CORPORATION
ADVANCED TECHNOLOGY CENTER
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June 7, 1979

FINAL REPORT

Prepared For

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Enforcement

Office of Vehicle Safety Compliance
2100 Second Street, S. W., Transpoint Building
Washington, D. C. 20590

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FINAL REPORT ACCEPTED BY:

Contract Technical Manager

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16. Abstract A frontal barrier test of a 1980 Chevrolet Citation, 5-Door Hatchback, was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department facility for the New Car Assessment and Standards Enforcement Indicant Testing of FMVSS 212 - Windshield Mounting; FMVSS 219 - Windshield Zone Intrusion; and FMVSS No. 301 - Fuel Standard Integrity for the Office of Vehicle Safety Compliance, the Office of Automotive Ratings and for Research and Development. The impact speed was 48.0 mph. Post vehicle crush was 40.3". The test vehicle was in noncompliance with FMVSS No. 212 - Windshield Retention (68.8%). The test vehicle was in noncompliance with FMVSS 301-75 - Fuel System Integrity. FMVSS 219 - Windshield Zone Intrusion - was not tested at the instruction of the Contract Technical Manager. Both Driver (1) and Passenger (2) exceeded FMVSS 208 Injury Criteria on Head and Chest.		
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SECTION 1

PURPOSE AND TEST PROCEDURE

PURPOSE: The purpose of this test was to determine whether the subject vehicle (a 1980 Chevrolet Citation 5-door hatchback) meets the requirements of FMVSS Nos. 212, 219 and 301-75 at a higher test speed and also to obtain structural and dummy information for Research and Development and the Office of Automotive Ratings of the NHTSA. This test is part of the New Car Assessment Program B.O.A., Task 2, sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract DOT-HS-8-01938.

TEST PROCEDURE: The Calspan Corporation, Advanced Technology Center, Transportation Research Department Test Procedure for the New Car Assessment Crash Tests submitted to, and approved by, the Contract Technical Manager (CTM) contains the specific procedures used to perform this test.

With the exception of a higher test speed, this procedure is not in conflict with any portion of FMVSS Procedures issued by the Office of Standards Enforcement and the Amendments in effect as noted by the applicable contract.

SECTION 2

SUMMARY OF RESULTS OF BARRIER TEST

Table 1

CRASH TEST SUMMARY

TEST NO. 308-T2-431 PROJECT: NEW CAR ASSESSMENT PROGRAM

DATE: 6-7-79 TIME: 15:17 TEMP: 85°F

VEHICLE Chevrolet Citation 5-Door Hatchback

TEST WEIGHT (lbs) 3130

IMPACT ANGLE (deg)* 0

IMPACT VELOCITY (mph)** 48.0

MAX. CRUSH (in) 40.3

MAX. INTRUSION (in) 21.2

DUMMIES

TYPE HYBRID II, PART 572

LOCATION LF(1), RF(2)

RESTRAINT PRODUCTION 3-POINT SYSTEM

NUMBER OF DATA CHANNELS 31

NUMBER OF HIGH SPEED CAMERAS 7 + 1 Real Time

*With respect to tow track Centerline

**Speed trap measurement ($\pm$.05% accuracy)

GENERAL COMMENTS

- (1) The hood of the test vehicle buckled and intruded into the area that would have been the protected zone of the windshield, if the FMVSS 219 styrofoam had been applied. It was omitted by instruction of the CTM.
- (2) The test vehicle did not comply with FMVSS No. 212 - Windshield Retention - and FMVSS No. 301-75 - Fuel Integrity.
 - Windshield Retention was 68.8%.
 - Fuel leakage was exceeded on the rollover test between 0° - 90° due to a break in filler tube to fuel tank.
- (3) Neither driver nor passenger doors were operable after impact.
- (4) Data on left femur of RFP was lost due to a cut wire.

Table 2
VEHICLE TEST WEIGHTS AS TESTED

Left Front	990	lbs	Left Rear	635	lbs
Right Front	910	lbs	Right Rear	605	lbs
Total Front	1900	lbs	Total Rear	1240	lbs

Total Weight = 1900 lbs + 1240 lbs = 3140 lbs

Wheel Base = 105 inches

$$Cg_{F.W.} = \frac{1240 \text{ lbs} \cdot 105 \text{ inches}}{3140 \text{ lbs}} = 41.46 \text{ inches}$$

CALCULATED FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
UDW = Unloaded Delivered Weight (2680 lbs)
VCW = Vehicle Capacity Weight (895 lbs)
DSC = Designated Seating Capacity (5)

$$RCLW = VCW - 150 (DSC)$$

$$RCLW = 895 - 150(5) = 145 \text{ lbs}$$

$$TEST \text{ WEIGHT} = UDW + RCLW + \text{No. of DUMMIES} \times 164 \text{ lbs.}$$

$$TEST \text{ WEIGHT} = 2680 \text{ lbs} + 145 \text{ lbs} + 2 (164 \text{ lbs})$$

$$TEST \text{ WEIGHT} = 3153 \text{ lbs}$$

Table 3

DUMMY INJURY CRITERIA VALUES

48 mph

	MAXIMUM ACCELERATION ("G") *											
	HEAD				CHEST				PELVIS			
	X	Y	Z	R	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	-288	-11.5	-80	315	-86	-17	-28	94.5				
DUMMY (2)	-150	21	116	160	-59	28	35	61				
DUMMY (3)												
DUMMY (4)												

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	3080	2800
DUMMY (2)	969	--
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)	1750		
DUMMY (2)	1580		
DUMMY (3)			
DUMMY (4)			

	HEAD INJURY CRITERIA**				SEVERITY INDEX	
	HIC	t ₁ (SEC)	t ₂ (SEC)	AVE. ACC. (g) t ₁ TO t ₂	HEAD	CHEST
DUMMY (1)	4167	.0639	.06810	240.0	6217	
DUMMY (2)	2433	.0777	.0861	153.0	3284	
DUMMY (3)						
DUMMY (4)						

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

FIGURE 1

PRE-TEST AND POST-TEST MEASUREMENT POINTS

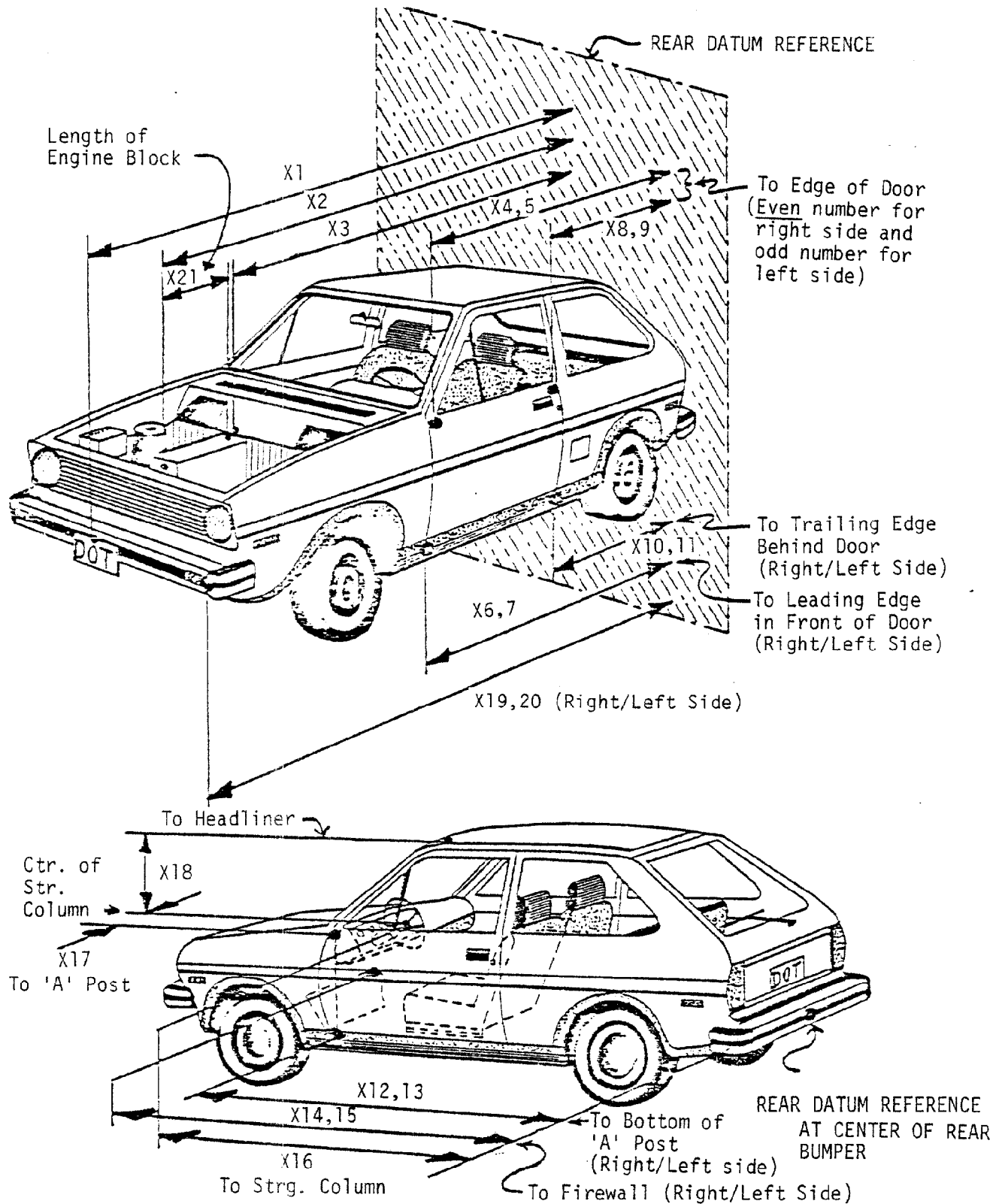
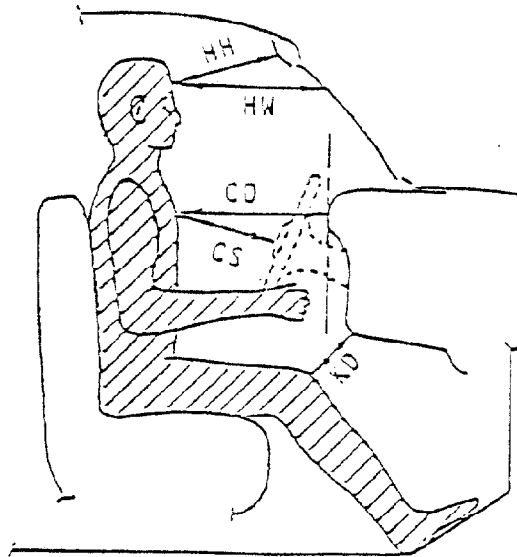


Table 4

NO.	TYPE OF MEASUREMENT	ALL DIMENSIONS IN INCHES	
		PRE-TEST	POST-TEST
X1	Total Length of Vehicle at Centerline	177.6	136.7
X2	Rear Surface of Vehicle to Front of Engine	160.1	131
X3	Rear Surface of Vehicle to Firewall	133.1	112.9
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	122.5	111.2
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	122.5	111.2
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	121.4	110
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	121.4	107.2
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	80.6	79
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	80.7	80
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	82.2	80.2
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	82.4	81.7
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	120.9	109.1
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	120.9	107.2
X14	Rear Surface of Vehicle to Firewall - Right Side	133.1	111.9
X15	Rear Surface of Vehicle to Firewall - Left Side	133	113.6
X16	Rear Surface of Vehicle to Steering Column	104.9	96.1
X17	Center of Steering Column to "A" Post	15.5	15.4
X18	Center of Steering Column to Headliner	16	20.5
X19	Rear Surface of Vehicle to Right Side of Front Bumper	175.1	134.5
X20	Rear Surface of Vehicle to Left Side of Front Bumper	174.4	134.5
X21	Length of Engine Block	18.9	17.2

	<u>DRIVER</u>	<u>PASS</u>
HH	14	14.5
HW	18.9	18.7
CD	23.7	26.7
CS	15.2	
KDL	5.7	8.2
KDR	6.5	8.6



HR	6.5	6.5
HS	8.2	8.5
AD	4.7	6.2
HD	7.2	7.9

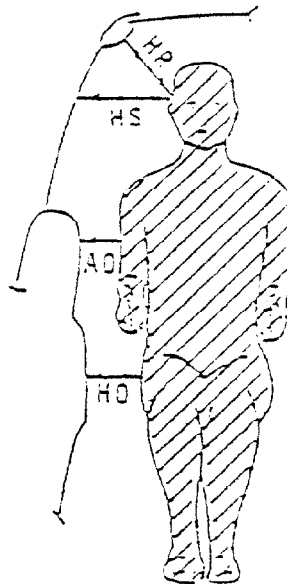


FIGURE 2 OCCUPANT CLEARANCE DIMENSIONS

FIGURE 3
CAMERA POSITIONS FOR FRONTAL/OBLIQUE IMPACTS

Note: Camera information shown in Table 5 on next page.

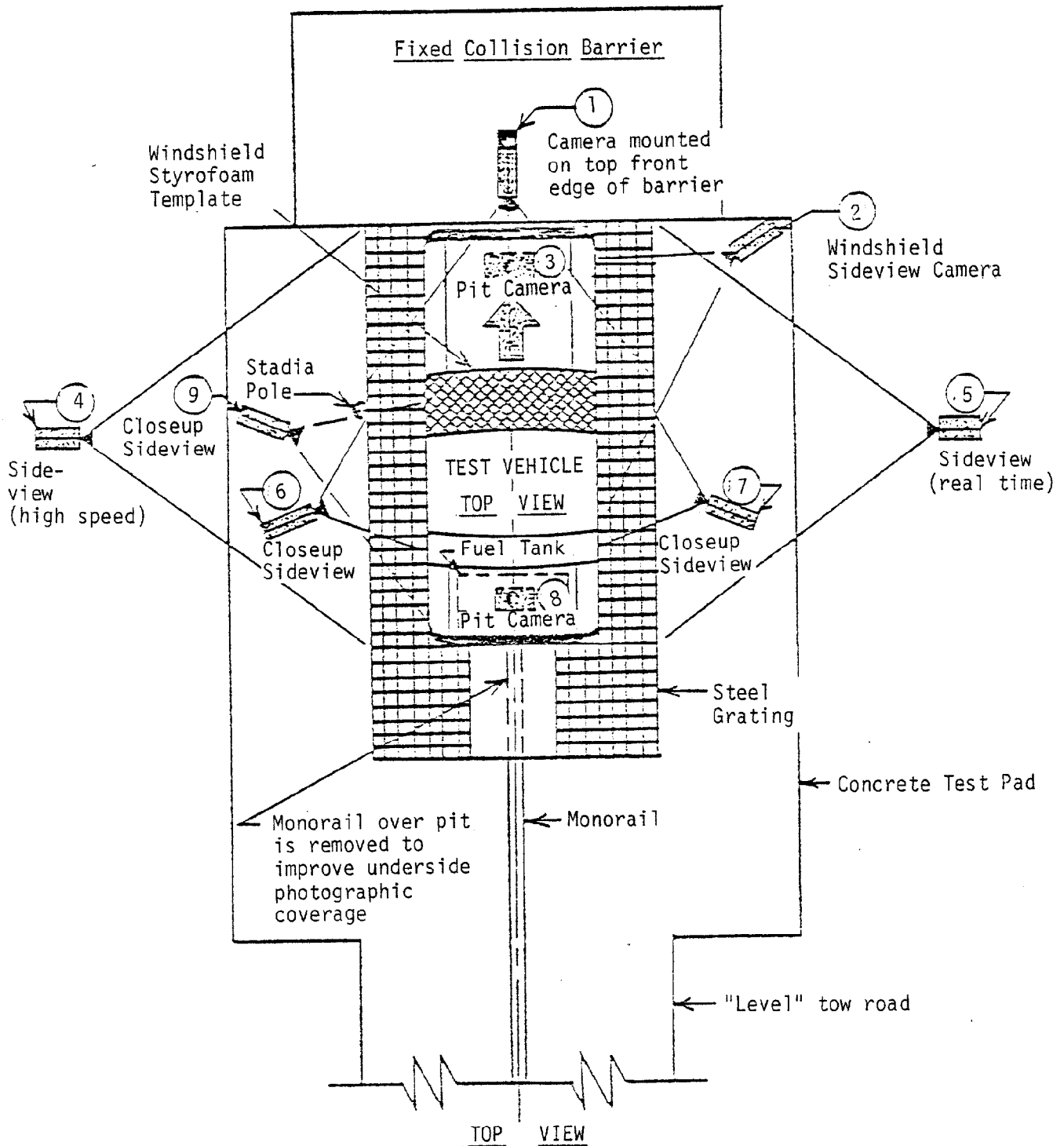


Table 5
HIGH SPEED CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	BARRIER FACE	PHOTOSONIC	8 MM	525
2	TOWER	PHOTOSONIC	13 MM	--
3	PIT FRONT	PHOTOSONIC	25 MM	550
4	NORTH WIDE	PHOTOSONIC	13 MM	1000
5	SOUTH WIDE	REAL TIME	---	24
6	NORTH OCCUPANT	PHOTOSONIC	35 MM	500
7	SOUTH OCCUPANT	PHOTOSONIC	35 MM	250
8	PIT REAR	PHOTOSONIC	25 MM	500

NOTE: (24 fps) REAL TIME MOVIE FILM COVERAGE OF PRE-CRASH, POST-CRASH
AND CRASH EVENT SPLICED AT START AND END OF FILM.

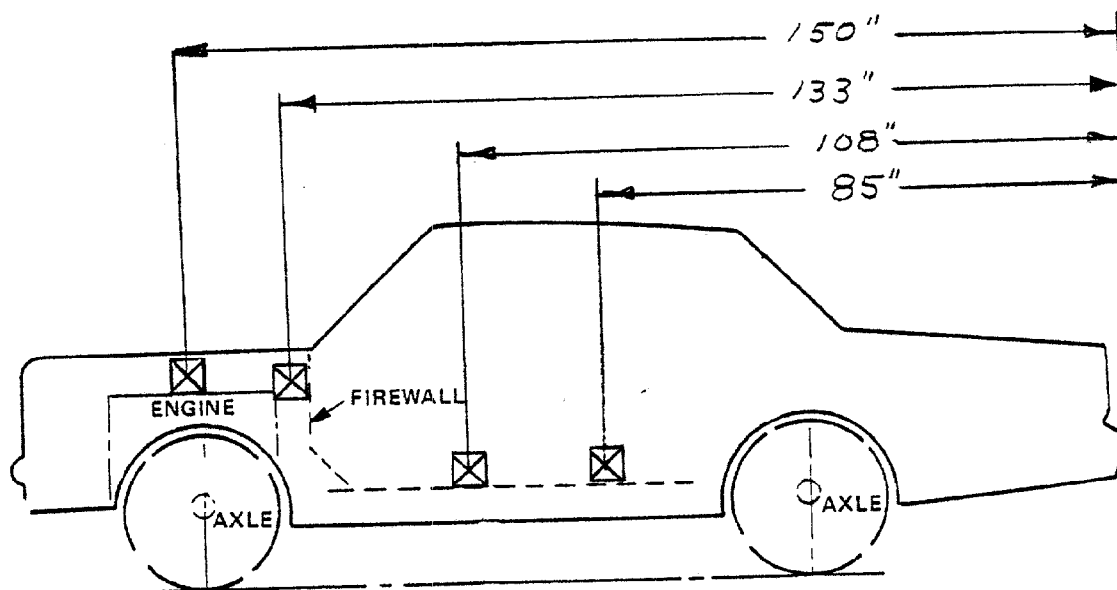
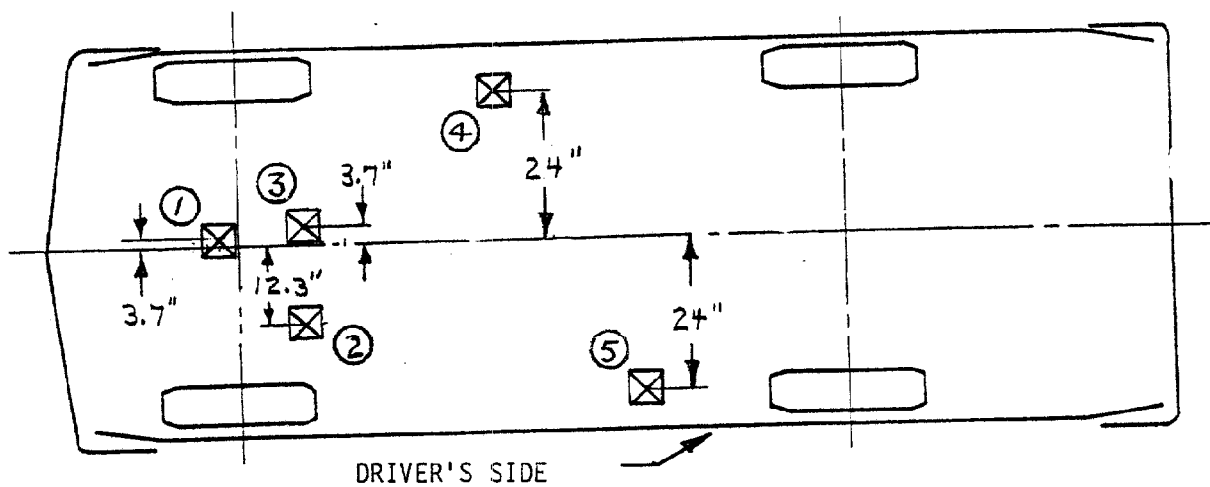


FIGURE 4 VEHICLE ACCELEROMETER LOCATIONS

SECTION 3

SUMMARY OF RESULTS OF FMVSS NOS. 212, 219 AND 301-75

- Summary of Test Conditions
- Post Impact Data
- Windshield Zone Intrusion, FMVSS 219
- Protected Zone
- Summary of FMVSS Data
- Fuel System Integrity Post-Impact

SUMMARY OF TEST CONDITIONS

Vehicle Manufacturer: GENERAL MOTORS

Make/Model: CITATION 1XX68

Body Style: 5 Door Hatchback; Model Year: 1980

VIN: 1X687 AT107739; Build Date: March 1979

NHTSA No.: 301-T2-431; Color: WHITE/BLACK

Engine Data: 6 cylinders; 28 LTR in³/cc displacement.

Transmission Data: 3 speed () Manual/ (X) Automatic

Date Vehicle Received by Laboratory: 6-4-79

Dealer's Name & Address: J. K. J. CHEVROLET VIENNA VA.

Vehicle Manufactured By: GENERAL MOTORS

Date of Manufacture: March 1979; VIN: 1X687A107739
GVWR: 3583 lbs.; GAWR: Front = 1947 lbs.; Rear = 1636 lbs.

Vehicle Load: FRONT REAR
Up to Capacity 2 6 psi 2 6 psi

RECOMMENDED TIRE SIZE: P185/80R 13	LOAD RANGE: B <u>C</u> D
---------------------------------------	-----------------------------

Type of Seats -	X	Bench
		Bucket
		Split Bench

Number of Occupants =

2
3
5

 Front
(Designated Seating Capacity) Rear
Total

CARGO LOAD = 145 lbs.
TOTAL = 189 lbs.

Right Front =

8	5	0
---	---	---

 lbs.

Right Rear =

	4	7	0
--	---	---	---

 lbs.

Left Front =

	8	7	0
--	---	---	---

 lbs.

Left Rear =

	4	9	0
--	---	---	---

 lbs.

TOTAL FRONT WEIGHT = 1720 lbs. (64.2 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 960 lbs. (35.8 % of Total Vehicle Weight)

TOTAL DELV. WEIGHT = 2680 lbs.

Right Front =

	9	1	0
--	---	---	---

 lbs.

Right Rear = 605 lbs.

Left Front =

	9	9	0
--	---	---	---

 lbs.

Left Rear = 63.5 lbs.

TOTAL FRONT WEIGHT = 1900 lbs. (60.5 % of Total Vehicle Weight)

TOTAL REAR WEIGHT = 1240 lbs. (39.5 % of Total Vehicle Weight)

TOTAL TEST WEIGHT =

3	1	4	0
---	---	---	---

 lbs.

Weight of ballast secured in vehicle trunk area = 000 lbs.

Date of Test: 6-7-79; Time of Test: 1517 ~~hr~~/pm

Ambient Temperature: 85 °F at impact area.

Temp. In Occ. Compart.: 82 °F.: W/Shld. Mldg. Temp.: 92 °F.

Table 6 - continued

VEHICLE ATTITUDE: (all dimensions in inches)

Delivered Attitude: RF 26-5/16 LF 26-3/8; RR 26-3/4; LR 26-1/2

Test Attitude: RF 25-5/8; LF 25-3/4; RR 24-3/8; LR 24-3/8

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 26 psi

Rear = 26 psi

Recommended Tire Size: 185/80R13

Load Range: C

Tires on Vehicle: B. F. GOODRICH P185/80R13

Is Spare Tire a "Space Saver": YES (yes/no)

Is Spare Tire standard equipment: YES (yes/no)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent #2; Spec. Grav.: 0.764

Kinematic Viscosity: 0.96 CENTISTOKES

Spill Point Volume: 14.15 Gallons (SPV)

Test Volume: 12.81 Gallons (90 to 91% of SPV)

Fuel System Capacity (data from Owner's Manual): 14 gal.

Details of fuel system:

Electric Fuel Pump: Yes; X No; Fuel Injection: Yes; X No

Does electric fuel pump operate with ignition switch "on" and the engine not operating: Yes; No

VEHICLE REBOUND AND CRUSH:

Overall Length of Test Vehicle: Pre-Test = R175.2/L174.5 inches

CRUSH=R 40.7 /L 40.0

Post-Test= R134.5/L134.5 inches

FOR FRONTAL IMPACTS, distance from front of test vehicle to the barrier after impact = 13.8 inches

*With entire fuel system filled from fuel tank through carburetor bowl.

Table 7

POST IMPACT DATA - STDS. 219 & 301

DATA SHEET

- TYPE OF TEST: ☒ Frontal (90°) Impact
 - ☐ Oblique (___°) Impact on ☐ Left (Driver's) Side
 - ☐ Right Side
 - ☐ Lateral or Side Impact on ☐ Left (Driver's) Side
 - ☐ Right Side
 - ☐ Rear Impact

● DATE OF TEST: 6-7-79 ; TIME: 1517 ; TEMP.: 85 °F.

● VEH. NHTSA NO.: 308-T2-431 ; VIN: 1X687A1107739

● REQUIRED VEH. VELOCITY RANGE: 47.5 to 48.5 mph

● IMPACT VELOCITY: (traps within 5 feet of impact event)

Trap #1 = 48.01 mph; Trap #2 = 48.03 mph

Distance from the vehicle's front bumper to the barrier face
 entering the vehicle velocity measurement device = 64 inch.
 exiting the vehicle velocity measurement device = 24 inch.

● VEH. STATIC CRUSH: (for Frontal and Rear Impacts Only)

Driver's Side = 40.0 in.; Passenger's Side = 40.7 in.

Average = 40.35 inches

Crush Details:

● VEH. STATIC CRUSH: (for Side Impacts Only)

Amount of Crush = _____ inches on _____ side

Crush Details:

● VEH. REBOUND: (from rigid barrier only)

Driver's Side = 13.2 inches; Pass. Side = 14.4 inches

Average = 13.8 inches

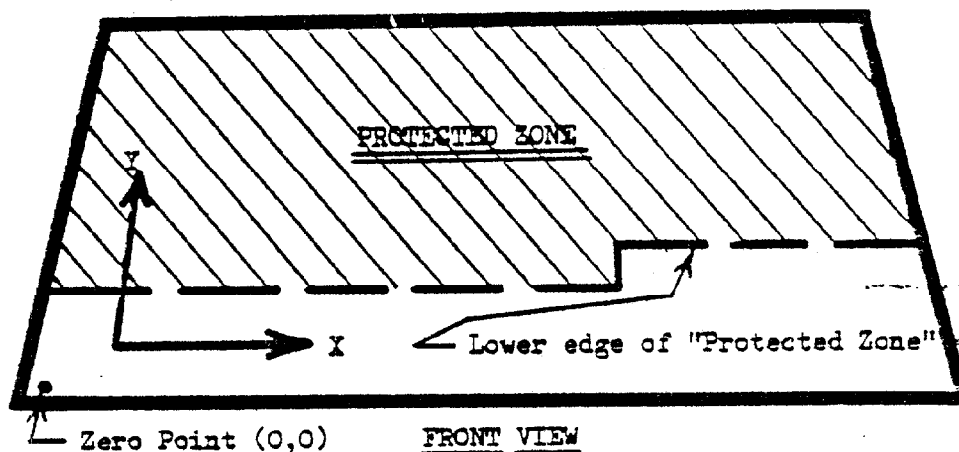
● REMARKS:

FIGURE 5

WINDSHIELD ZONE INTRUSION, FMVSS 219

DATA SHEET

THIS STANDARD WAS NOT TESTED.



With the zero coordinate for the X-Y grid located at the lower right corner (passenger side) of the windshield, record the following positions:

- (A) The area that the "Protected Zone" template was penetrated more than .25 inches by a vehicle component other than one which is normally in contact with the windshield.

Coordinates

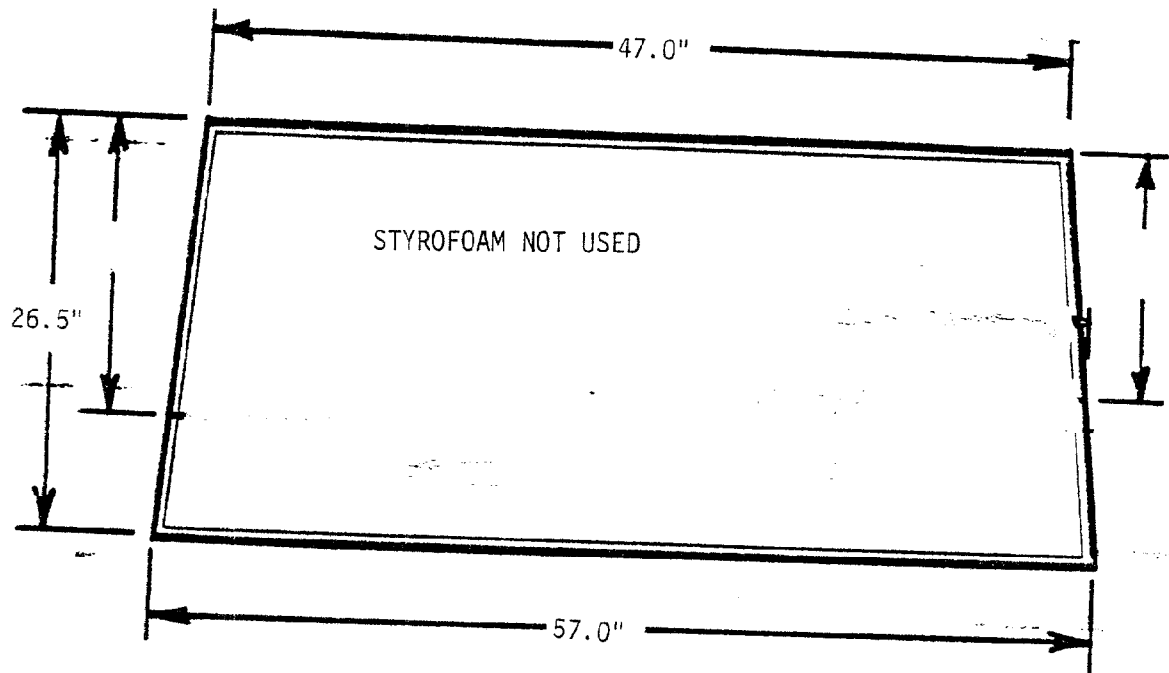
X	Y

- (B) The area beneath the "Protected Zone" that the inner surface of the windshield was penetrated by a vehicle component.

Coordinates

X	Y

FIGURE 6 PROTECTED ZONE



FRONT VIEW OF WINDSHIELD

Provide all dimensions necessary to reproduce the protected zone.

Method of adhering styrofoam to the windshield:

NONE USED

FIGURE 7 SUMMARY OF FMVSS 212 DATA

Details of windshield mounting (method of retention, type of trim, etc.):

The windshield is bonded in place and has a chrome trim piece around the perimeter of the window.

	WINDSHIELD PERIPHERY		
	PRETEST	POST TEST	
RIGHT SIDE	78.5	51	68.8% Retention
LEFT SIDE	78.5	57	
TOTAL	157.0	108	

The standard requires that POST TEST be a minimum of 75 percent of the PRETEST total periphery measurement for vehicles not equipped with occupant passive restraints and 50 percent for each side of the windshield for vehicles which are equipped with occupant passive restraints.

AREA OF RETENTION FAILURE:

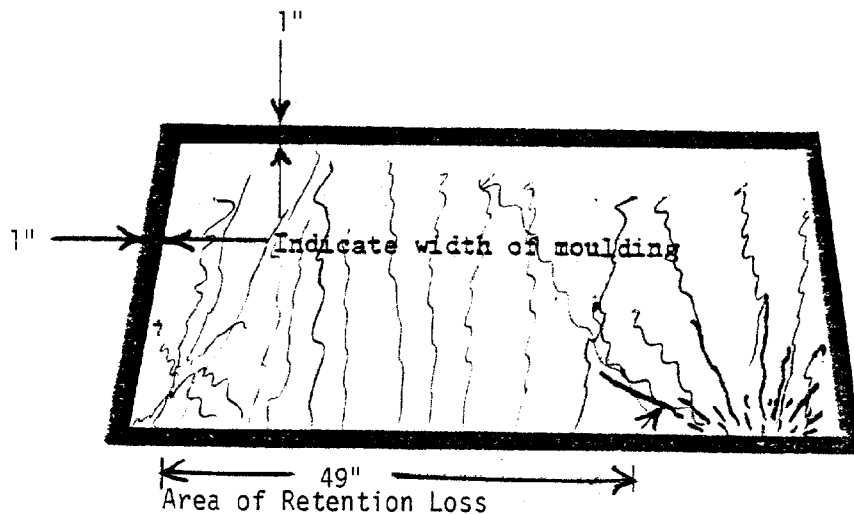


Table 8

**"FUEL SYSTEM INTEGRITY" POST-IMPACT
TEST DATA, FMVSS No. 301-75**

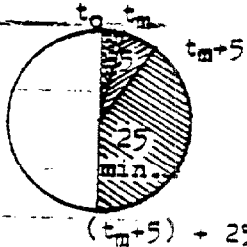
TEST VEHICLE NHTSA NO.: 3 0 8 T 2 4 3 1; TEST DATE: 6-7-79

VEH. MFR./MAKE/MODEL: 1980 CHEVROLET CITATION

Test vehicle fuel tank filled to 90-91% of capacity with Stoddard Solvent and with electric fuel pump operating (if it will operate without engine operation. Part 572 test dummies located at each front designated seating position.

- A. TEST VEHICLE IMPACT TYPE:** ☒ Frontal (48 mph)
☐ Oblique (30 mph) with ____° barrier face first contacting ____ (driver/passenger) side.
☐ Rear Moving Barrier (30 mph)
☐ Lateral Moving Barrier (20 mph)

FUEL SPILLAGE MEASUREMENT - - -



1. From impact until vehicle motion ceases - - - - -
2. For 5 minute period after veh. motion ceases. - - -
3. For next 25 minutes - - -

ACTUAL	MAX. ALLOW.
0	1 oz.
0	5 oz.
0	1 oz./1 min.

B. TEST VEHICLE STATIC ROLLOVER:

TEST INFORMATION WILL BE ADDED TO THE FOLLOWING STATIC ROLLOVER DATA SHEETS:

- (1) FIGURE 10A - Rollover data for 0° to 90° test phase.
- (2) FIGURE 10B - Rollover data for 90° to 180° test phase.
- (3) FIGURE 10C - Rollover data for 180° to 270° test phase.
- (4) FIGURE 10D - Rollover data for 270° to 360° test phase.

C. SOLVENT SPILLAGE DETAILS:

Exceeded FMVSS No. 301-75 on rollover for 0° to 90° test phase.

Table 8A

VEH. NETSA ID NO.:

3 0

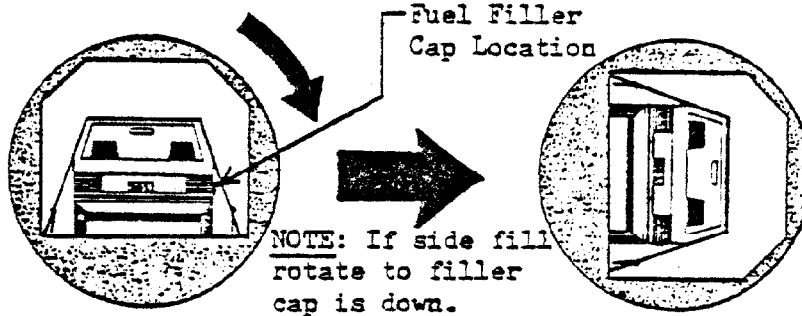
8	T	2	4	3	1
---	---	---	---	---	---

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEETTEST PHASE:

0

 °

90

 °


37 Min.

I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:
 Rollover Fixture 90° Rotation Time - - =

2

 minutes,

5

7

 seconds
 (Spec. Range = 1 to 3 minutes)

 FMVSS 301-75 Position Hold Time - - - =

5

 minutes,

0

0

 seconds

 TOTAL - - - - - =

7

 minutes,

5

7

 seconds

 Next Whole Minute Interval - - - - - =

8

 minutes
II. FMVSS 301-75 REQUIREMENTS:

(1) Time Period--

First 5 min. FROM onset of rotation	6th. min.	7th. min.	8th. min. if reqd.
-------------------------------------	-----------	-----------	-----------------------

(2) Maximum Allowable Solvent Spillage--

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

11.5 oz	--	--	--
---------	----	----	----

NOTE: Record spillage
for whole minute
intervals only as
determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

Exceeded maximum allowable solvent spillage

Table 8B

VEH. NETSA ID NO.:

3 0

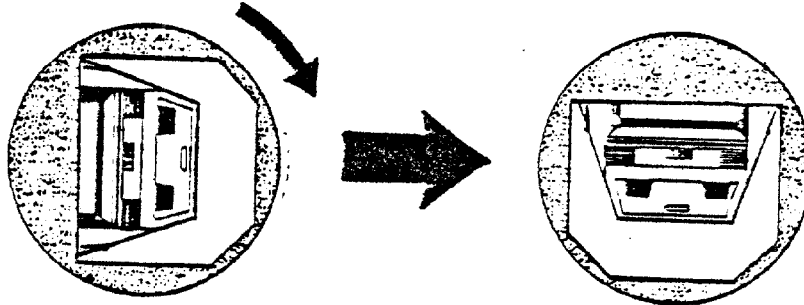
8	T	2	4	3	1
---	---	---	---	---	---

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE:

90°

180°



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time - - = minutes, seconds
(Spec. Range = 1 to 3 minutes)

FMVSS 301-75 Position Hold Time - - - = minutes, seconds

TOTAL - - - - - = minutes, seconds

Next Whole Minute Interval - - - - - = minutes

II. FMVSS 301-75 REQUIREMENTS:

(1) Time Period--

First 5 min. FROM onset of rotation	6th. min.	7th. min.	8th. min. if reqd.
-------------------------------------	-----------	-----------	-----------------------

(2) Maximum Allowable Solvent Spillage--

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

--	--	--	--

NOTE: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

NOT PERFORMED.

Table 8C

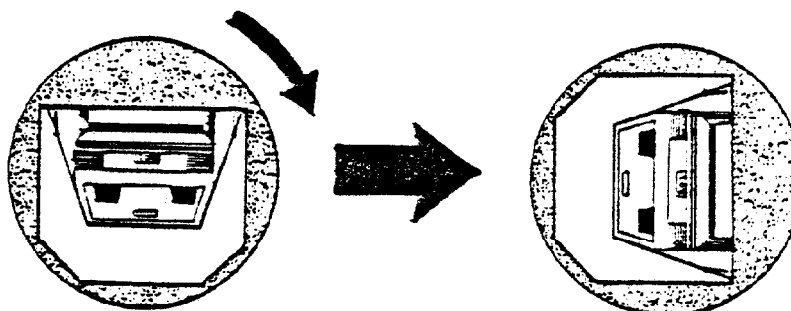
VEH. NHTSA ID NO.:

3 0 8 T 2 4 3 1

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEETTEST PHASE:

180°

270°

I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time - - = minutes, seconds
 (Spec. Range = 1 to 3 minutes)

FMVSS 301-75 Position Hold Time - - - = minutes, seconds

TOTAL - - - - - = minutes, seconds

Next Whole Minute Interval - - - - - = minutes

II. FMVSS 301-75 REQUIREMENTS:

(1) Time Period--

First 5 min. FROM onset of rotation	6th. min.	7th. min.	8th. min. if reqd.

(2) Maximum Allowable Solvent Spillage--

5 ounces	1 ounce	1 ounce	1 ounce

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

--	--	--	--

NOTE: Record spillage
for whole minute
intervals only as
determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

NOT PERFORMED.

Table 8D

VEH. NHTSA ID NO.:

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

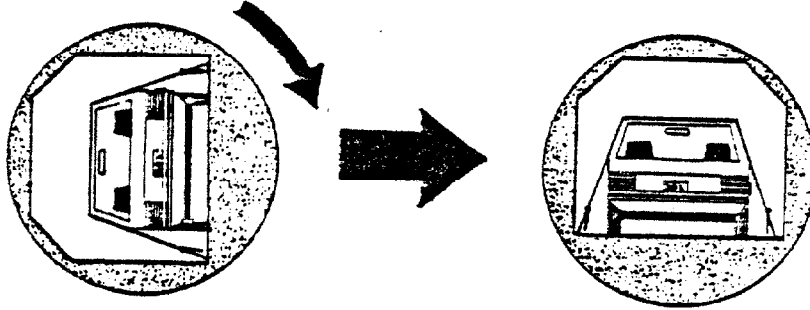
3 0

8	T	2	4	3	1
---	---	---	---	---	---

TEST PHASE:

270°

360°

I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:
 Rollover Fixture 90° Rotation Time - - = minutes, seconds
 (Spec. Range = 1 to 3 minutes)

 FMVSS 301-75 Position Hold Time - - - = 5 minutes, 0 0 seconds

 TOTAL - - - - - = minutes, seconds

 Next Whole Minute Interval - - - - - = minutes
II. FMVSS 301-75 REQUIREMENTS:

(1) Time Period--

First 5 min. FROM onset of rotation	6th. min.	7th. min.	8th. min. if reqd.
-------------------------------------	-----------	-----------	-----------------------

(2) Maximum Allowable Solvent Spillage--

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

--	--	--	--

NOTE: Record spillage
for whole minute
intervals only as
determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

NOT PERFORMED

APPENDIX A
STILL PHOTOGRAPHS

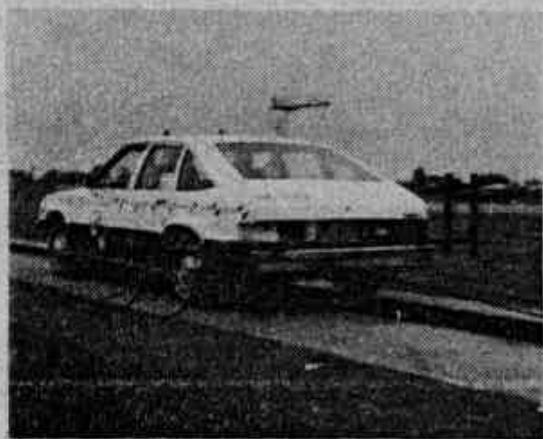


FIGURE 1A FULL FRONT, SIDE, REAR AND THREE-QUARTER EXTERIOR VIEW

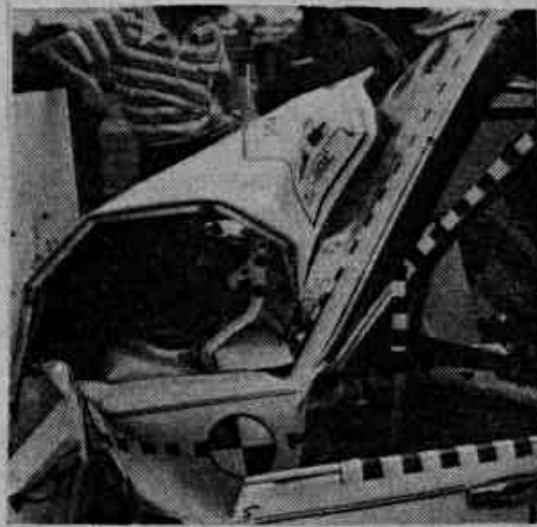
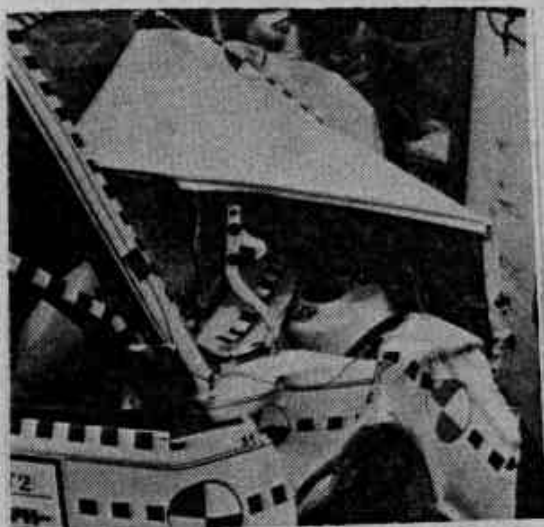
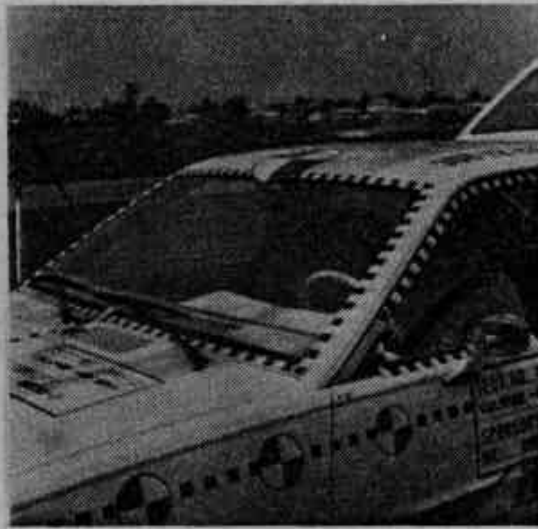
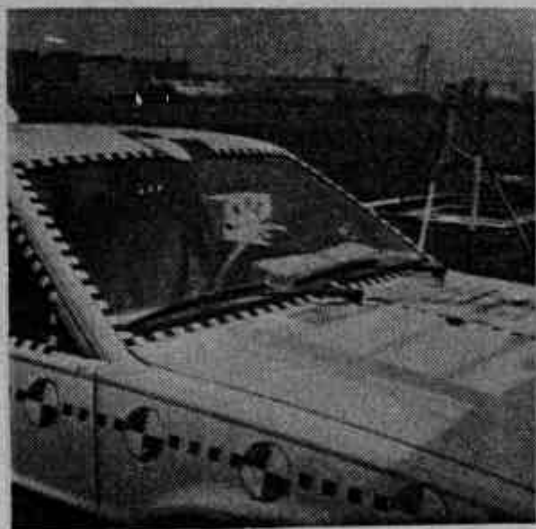


FIGURE 2A PRE- AND POST-TEST VIEW OF WINDSHIELD



FIGURE 3A PRE- AND POST-TEST VIEW OF SIDE

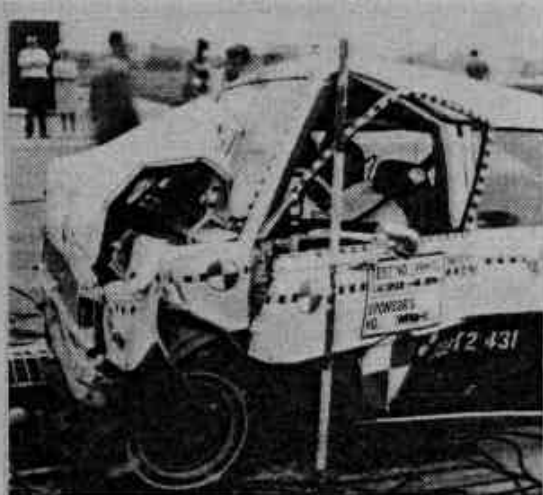
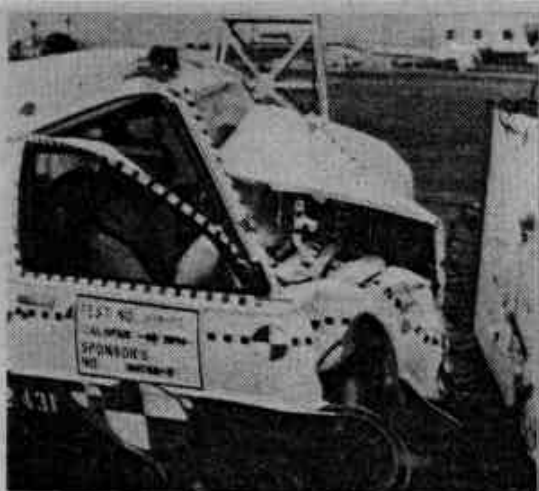


FIGURE 4A PRE-AND POST-TEST VIEW FRONT SIDE

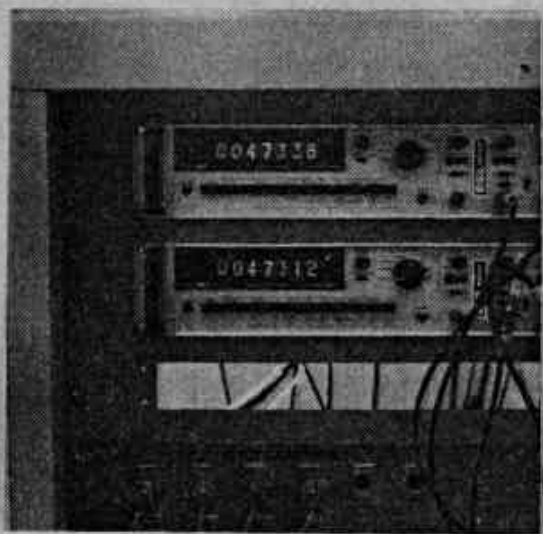
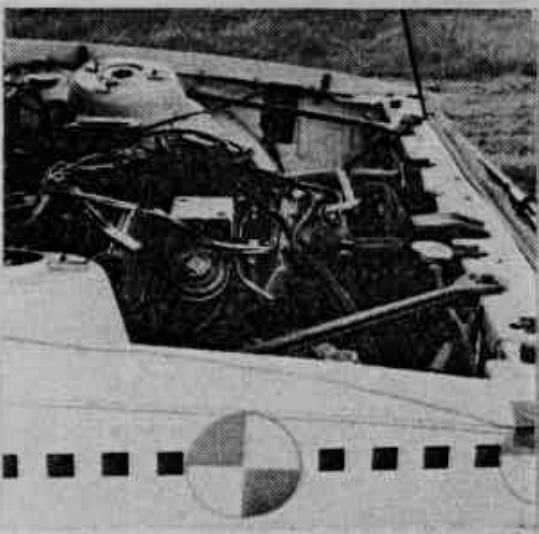


FIGURE 5A ENGINE BLOCK ACCELEROMETER

VELOCITY TRAP COUNTER DISPLAY

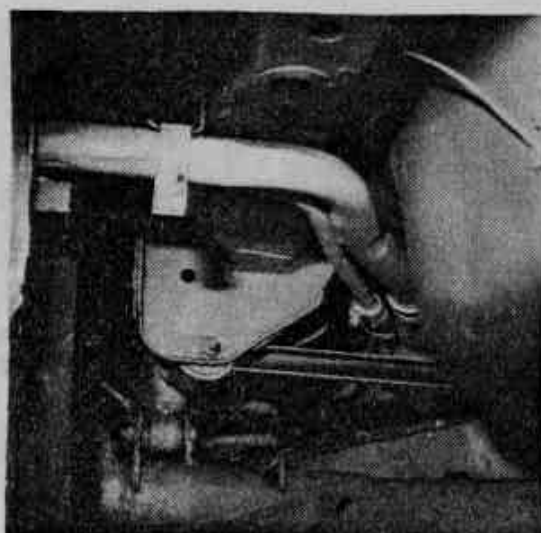
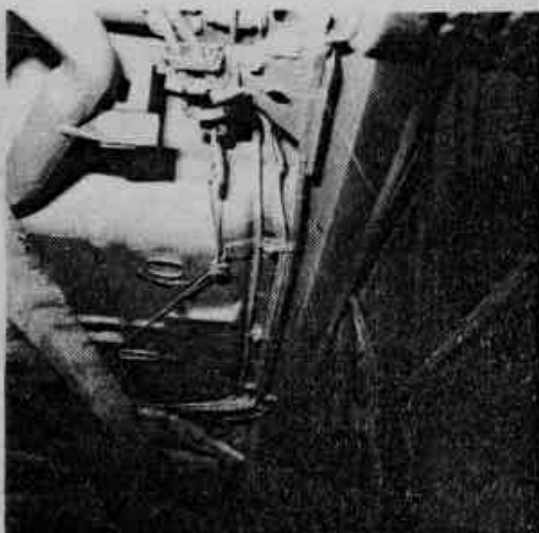
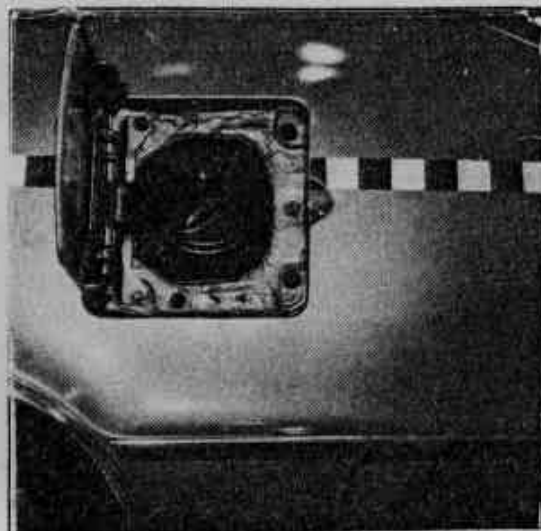


FIGURE 6A FUEL/VAPOR LINES AND FILLER PIPE

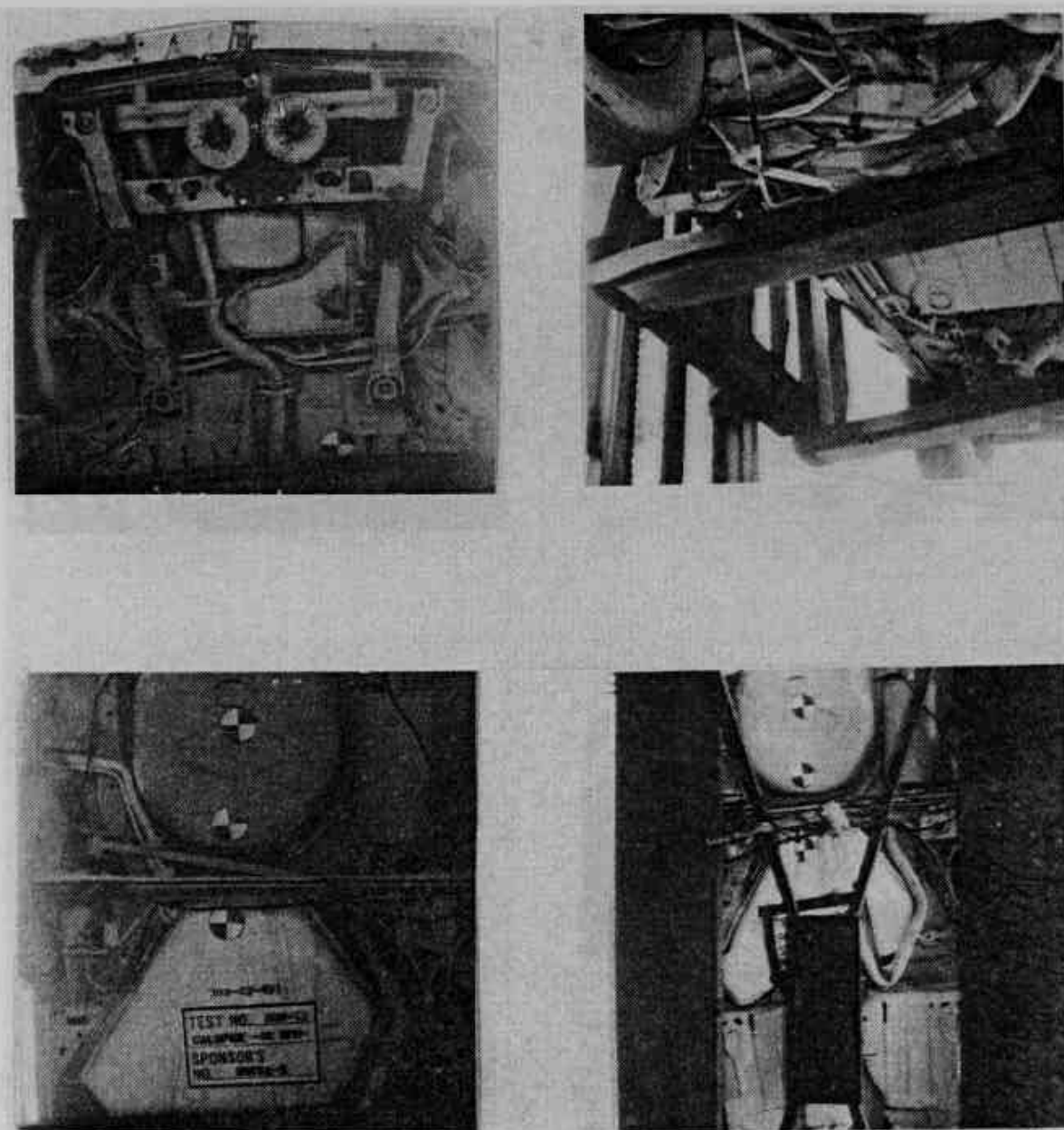


FIGURE 7A PRE- AND POST-TEST VIEW OF UNDERBODY

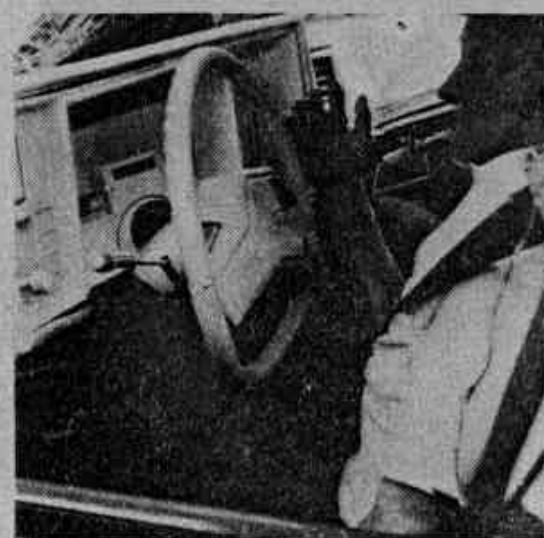


FIGURE 8A PRE- AND POST-TEST DRIVER AND PASSENGER POSITION

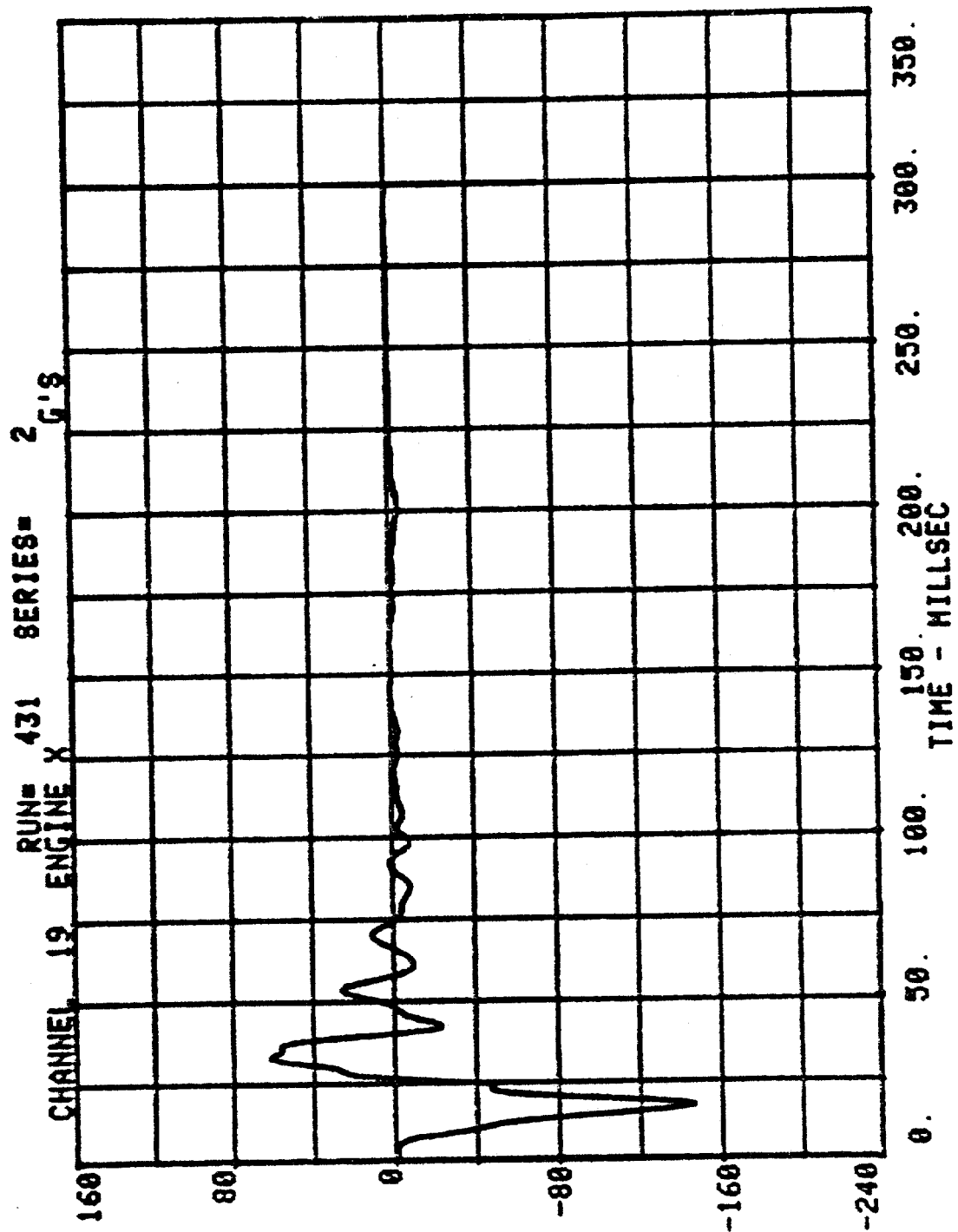
APPENDIX B
VEHICLE AND DUMMY RESPONSE DATA

TEST NO. 301-T2-431
1980 CHEVROLET CITATION
VEHICLE DATA

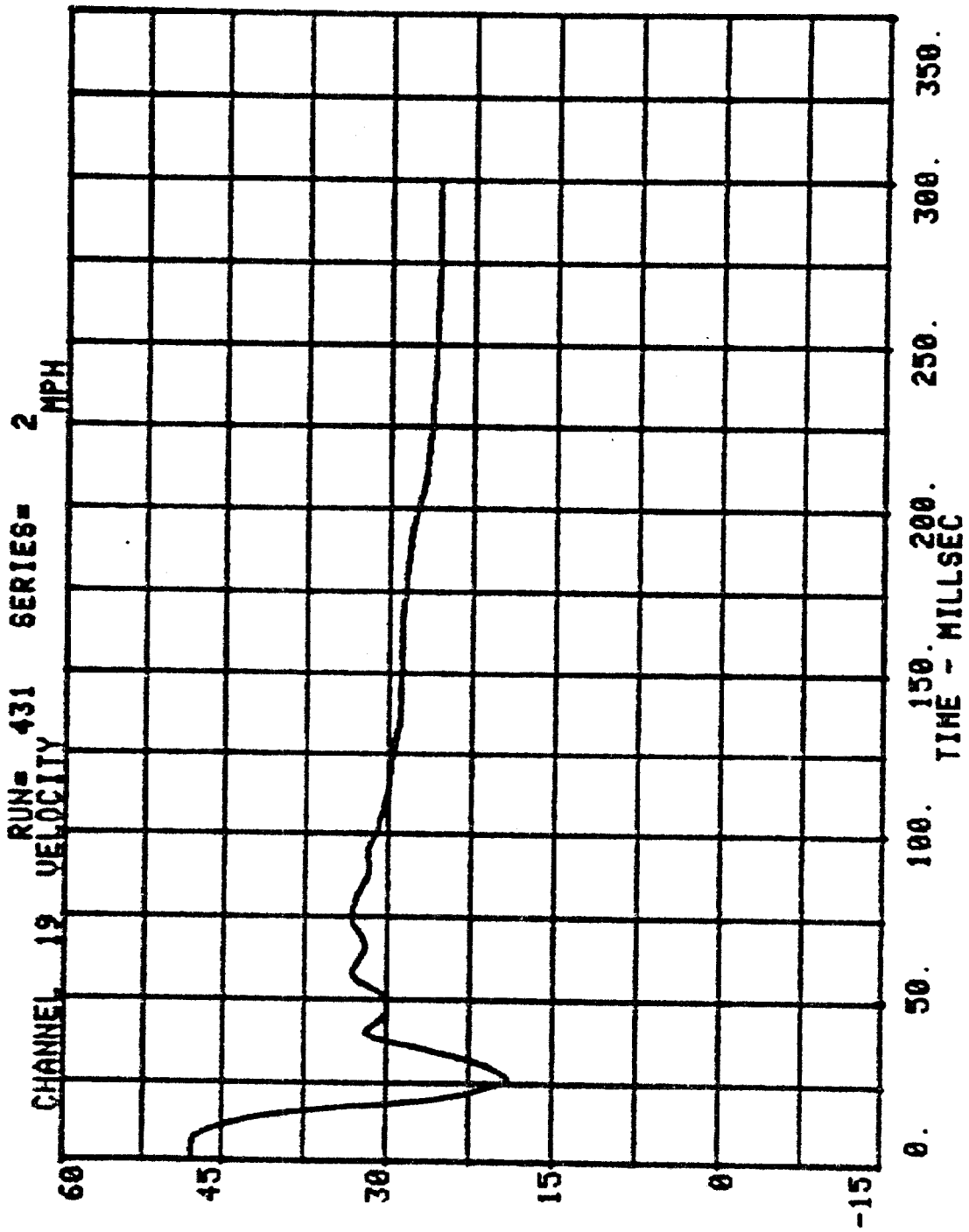
FILTER CHANNEL CLASS

VEHICLE DATA

60



ENGINE X



ENGINE X

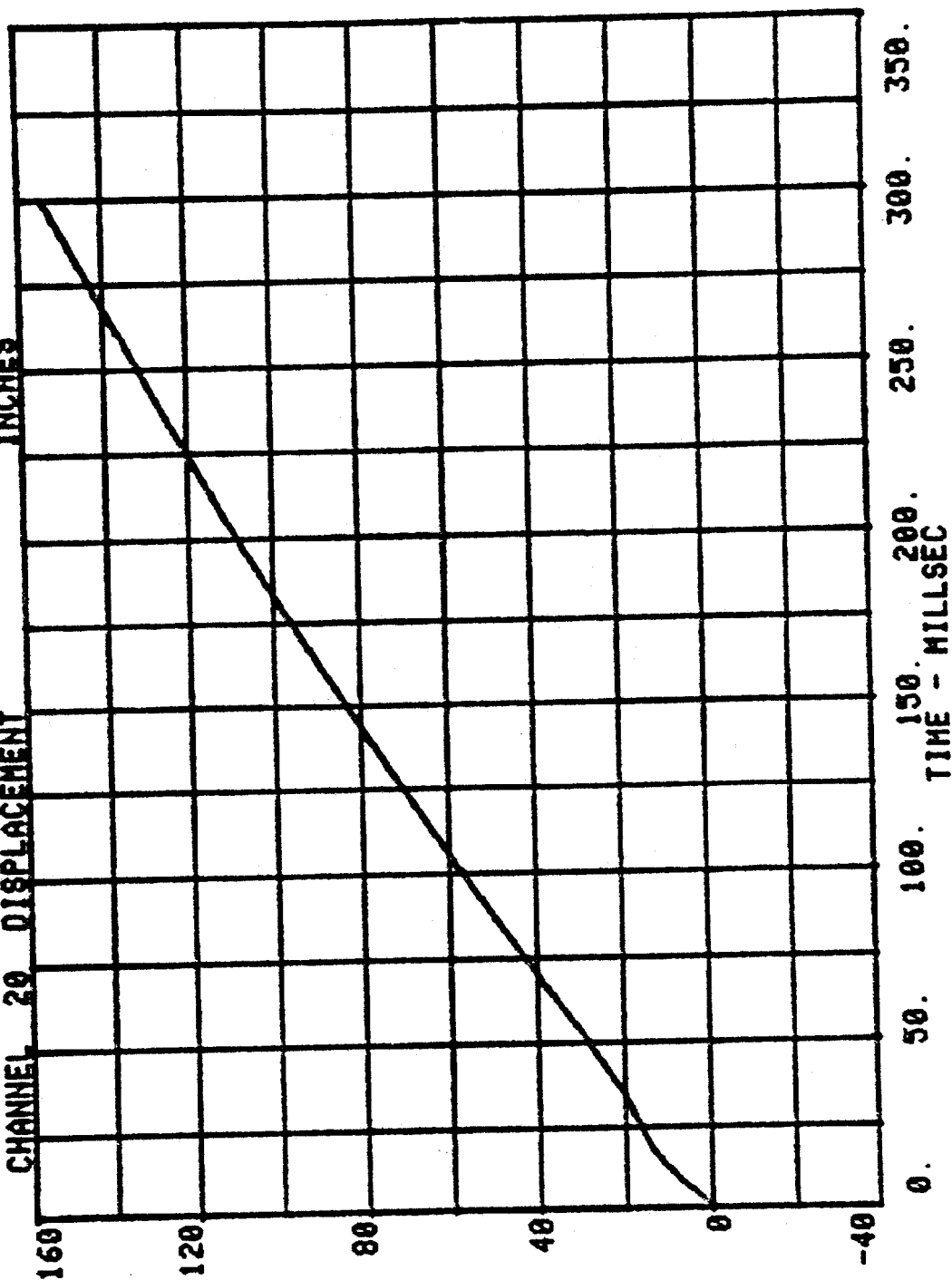
CHANNEL 20 DISPLACEMENT

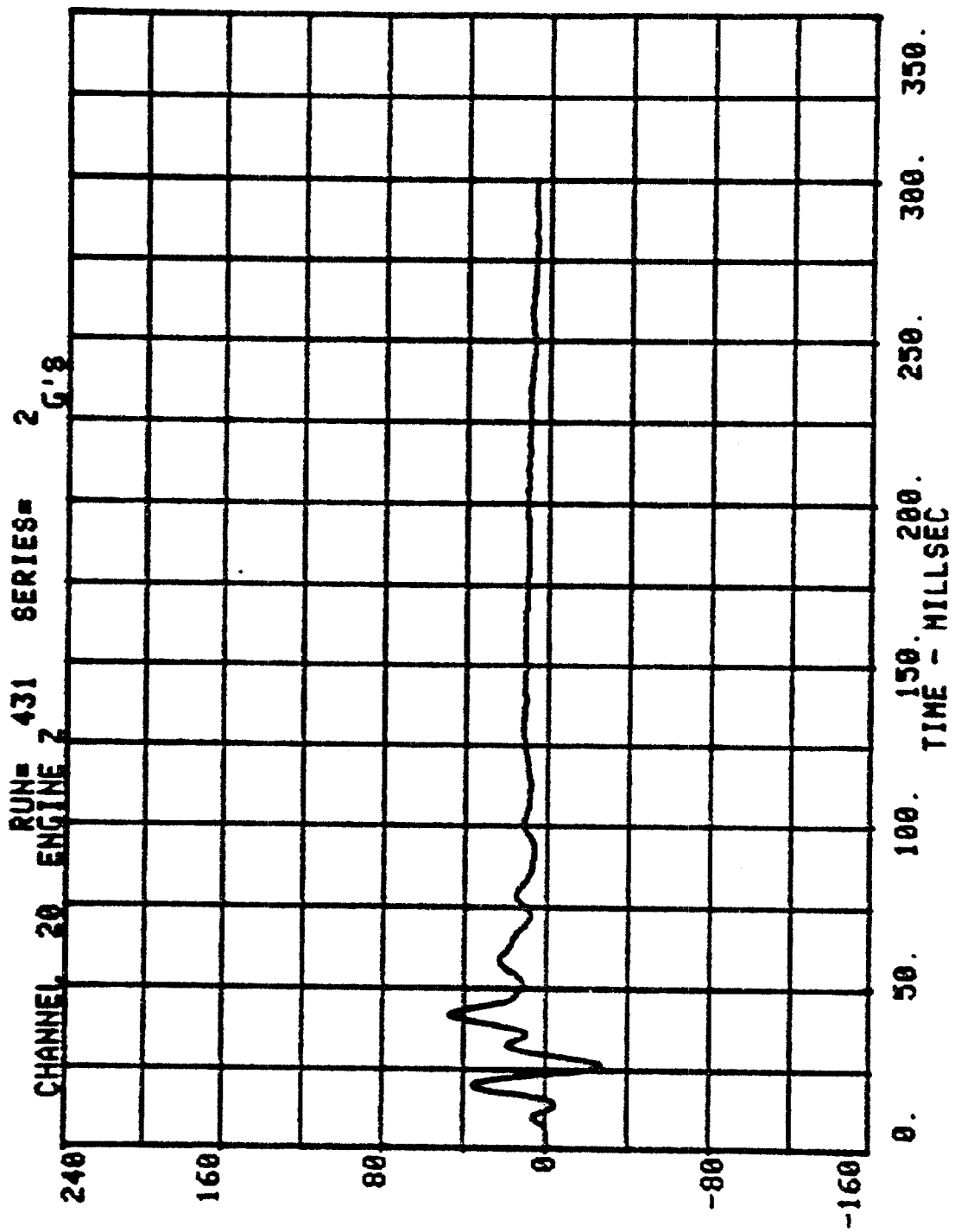
RUN= 431

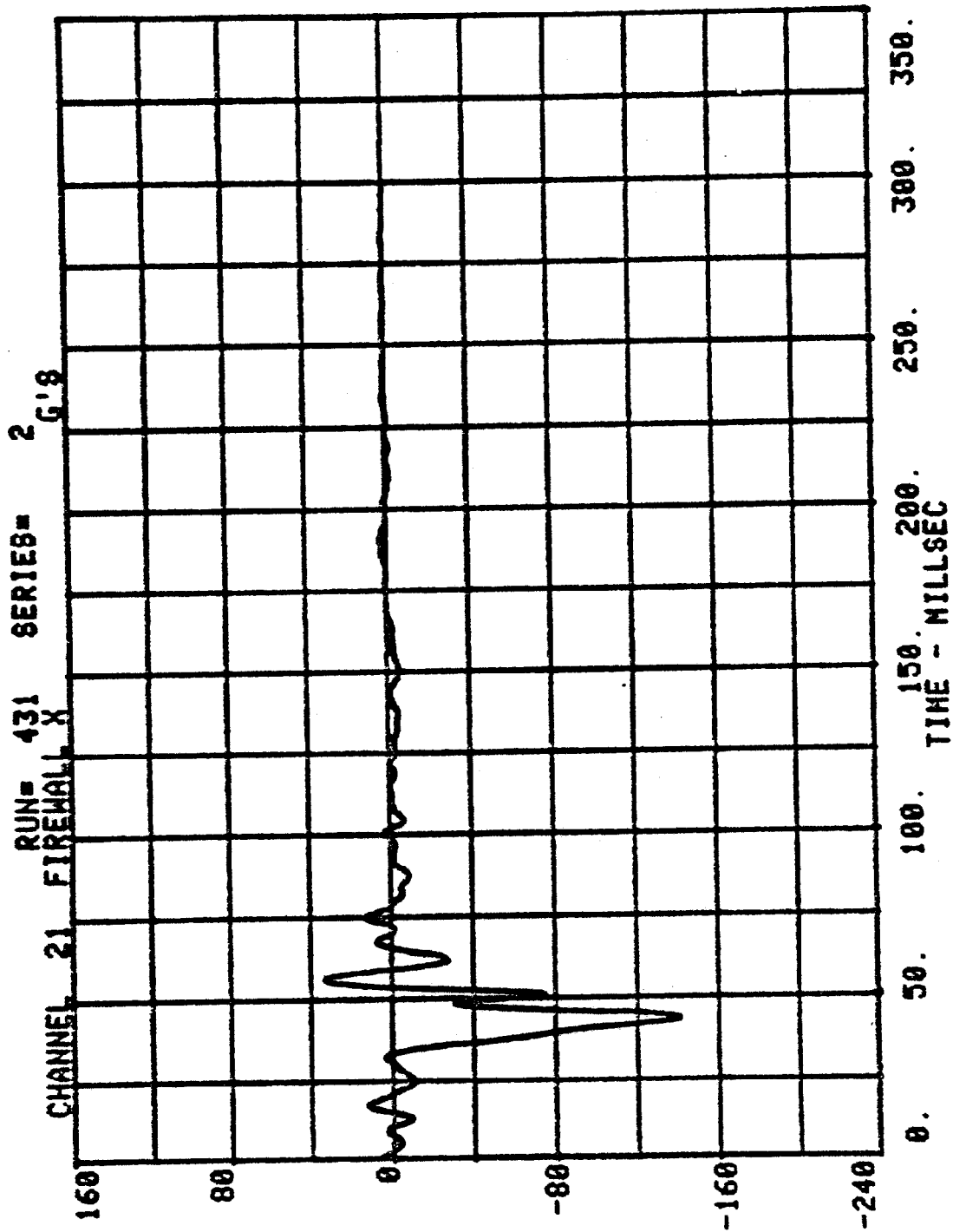
SERIES=

2

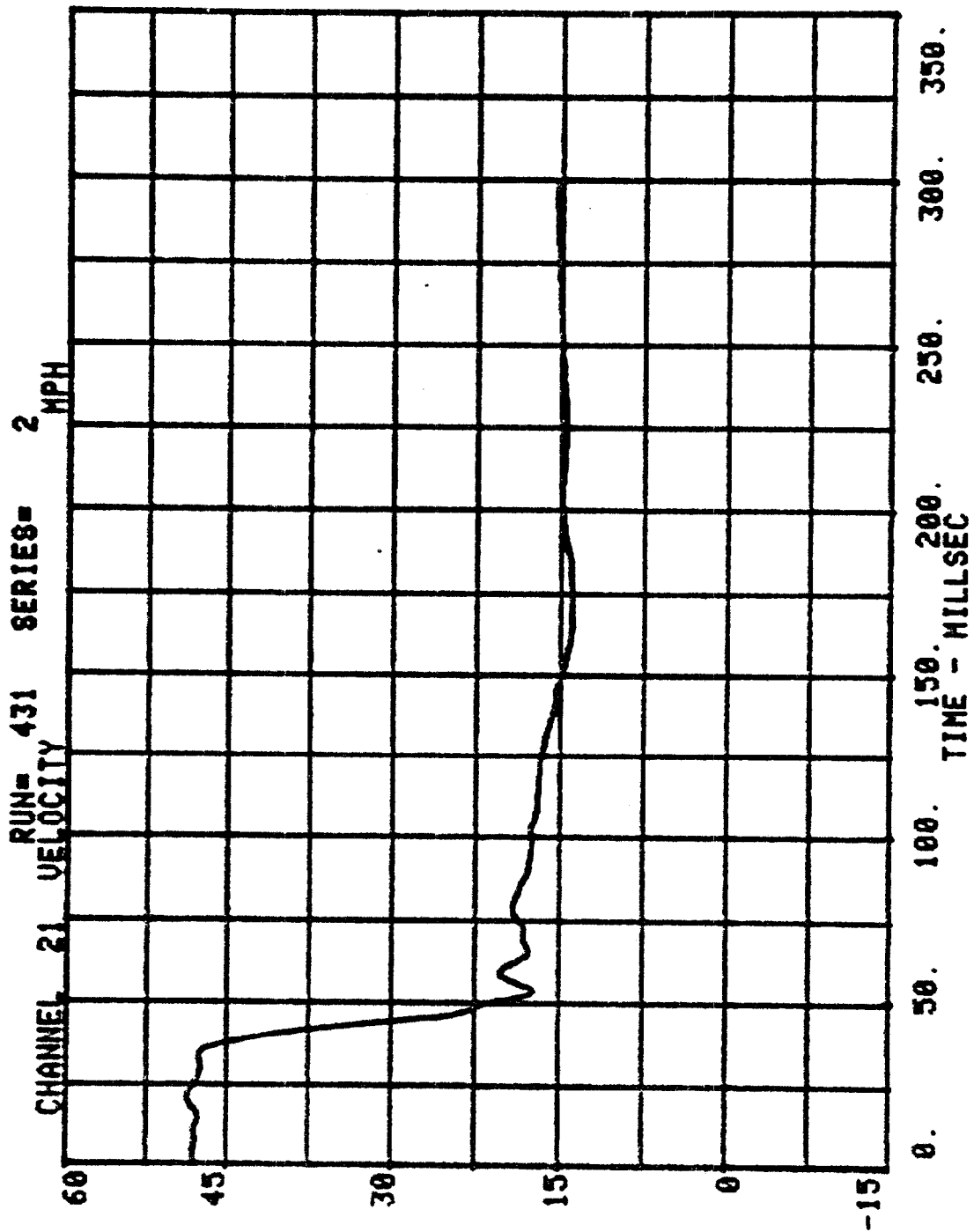
INCHES





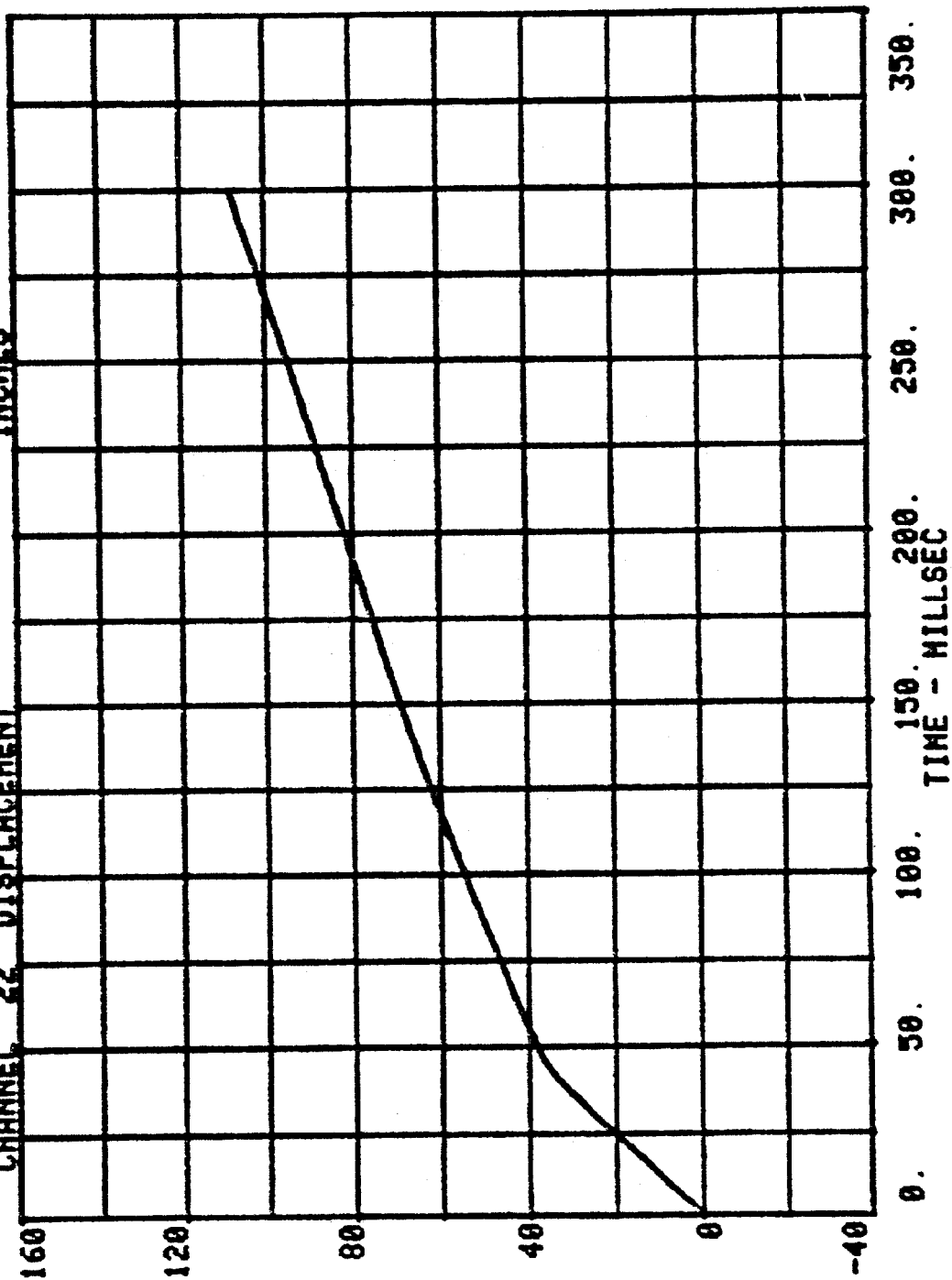


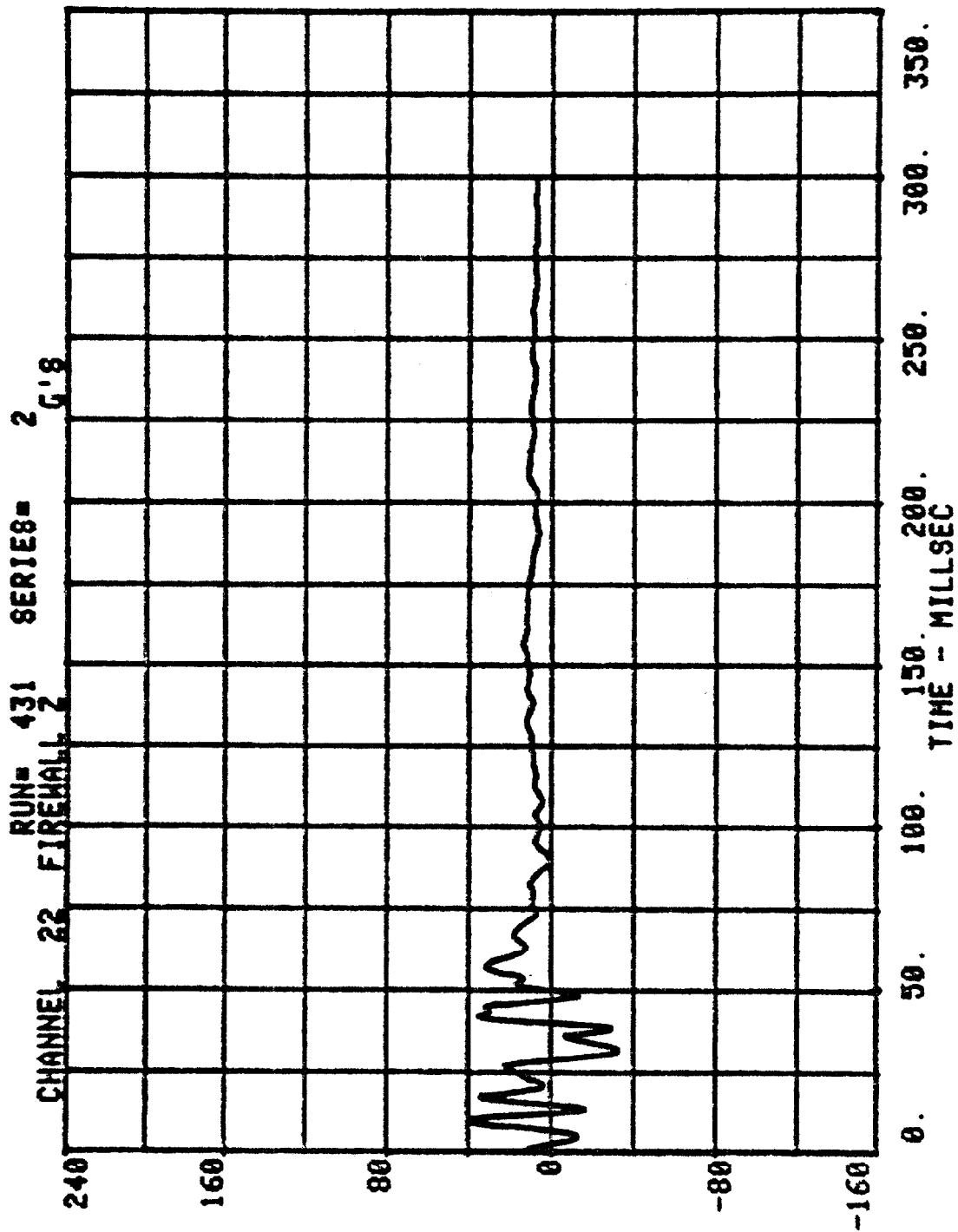
FIREWALL X



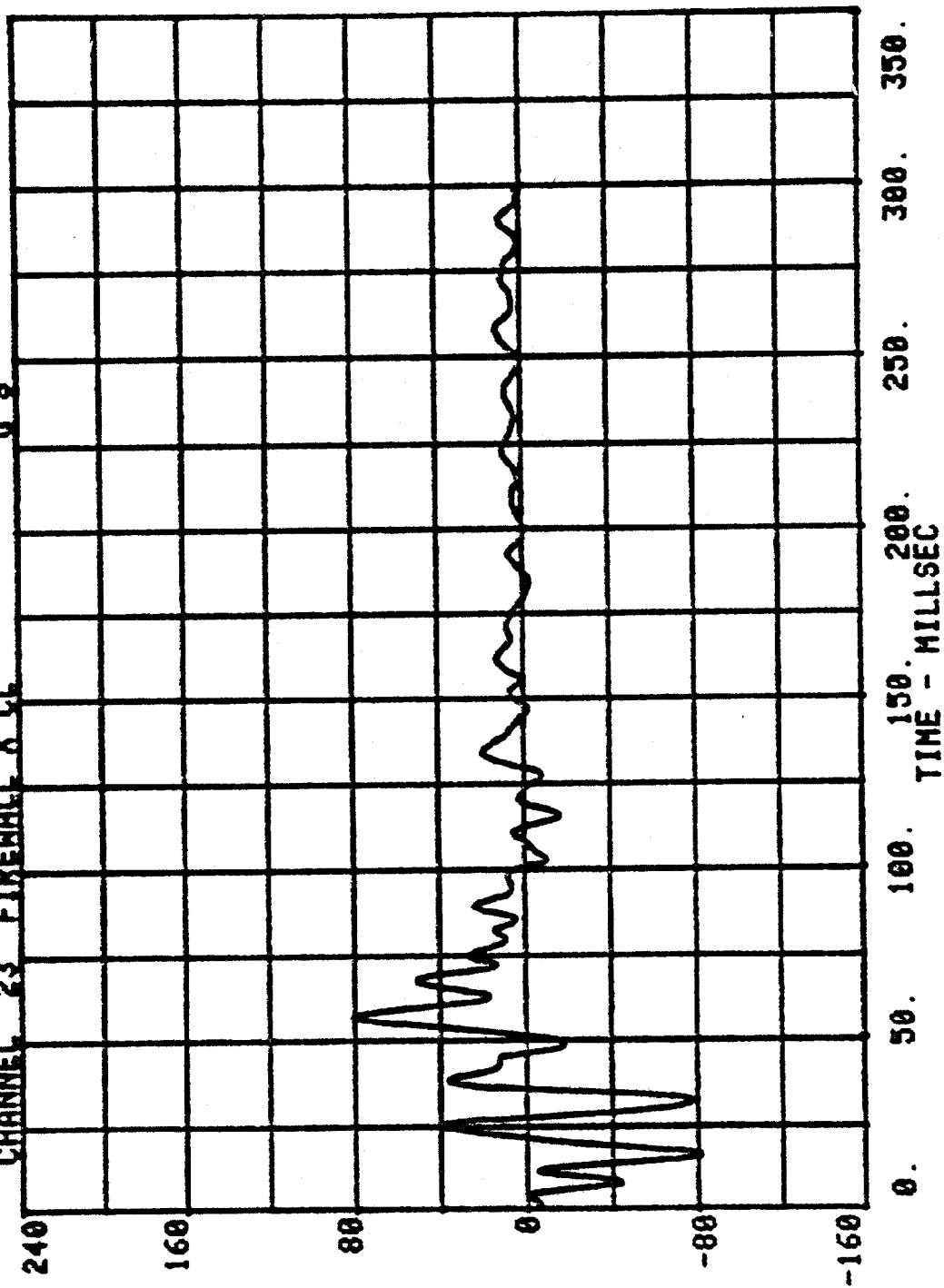
FIREWALL X

CHANNEL 22 DISPLACEMENT RUN= 431 SERIES= 2 INCHES

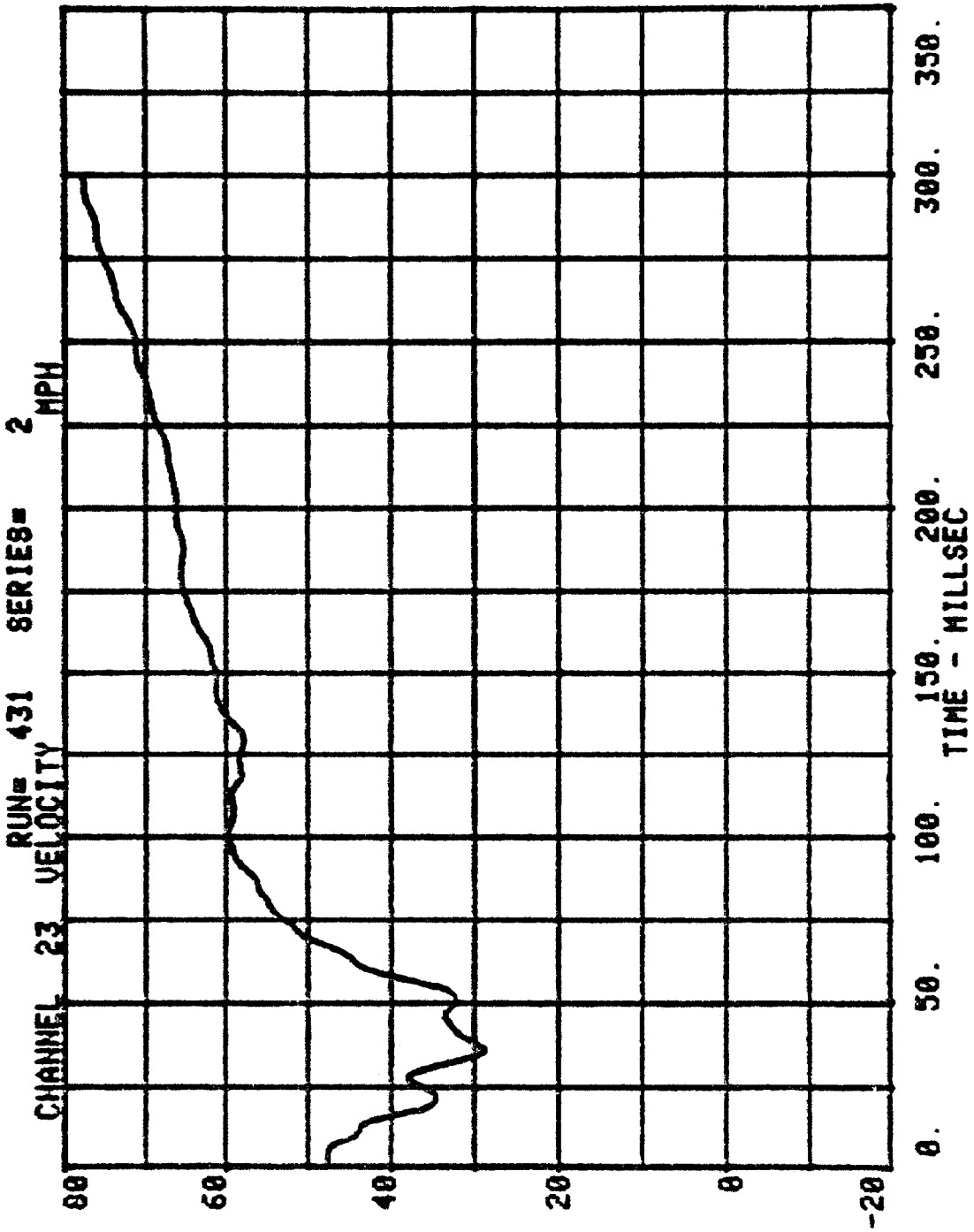




CHANNEL 23 FIREBALL X CL RUN# 431 SERIES# 2 G'8

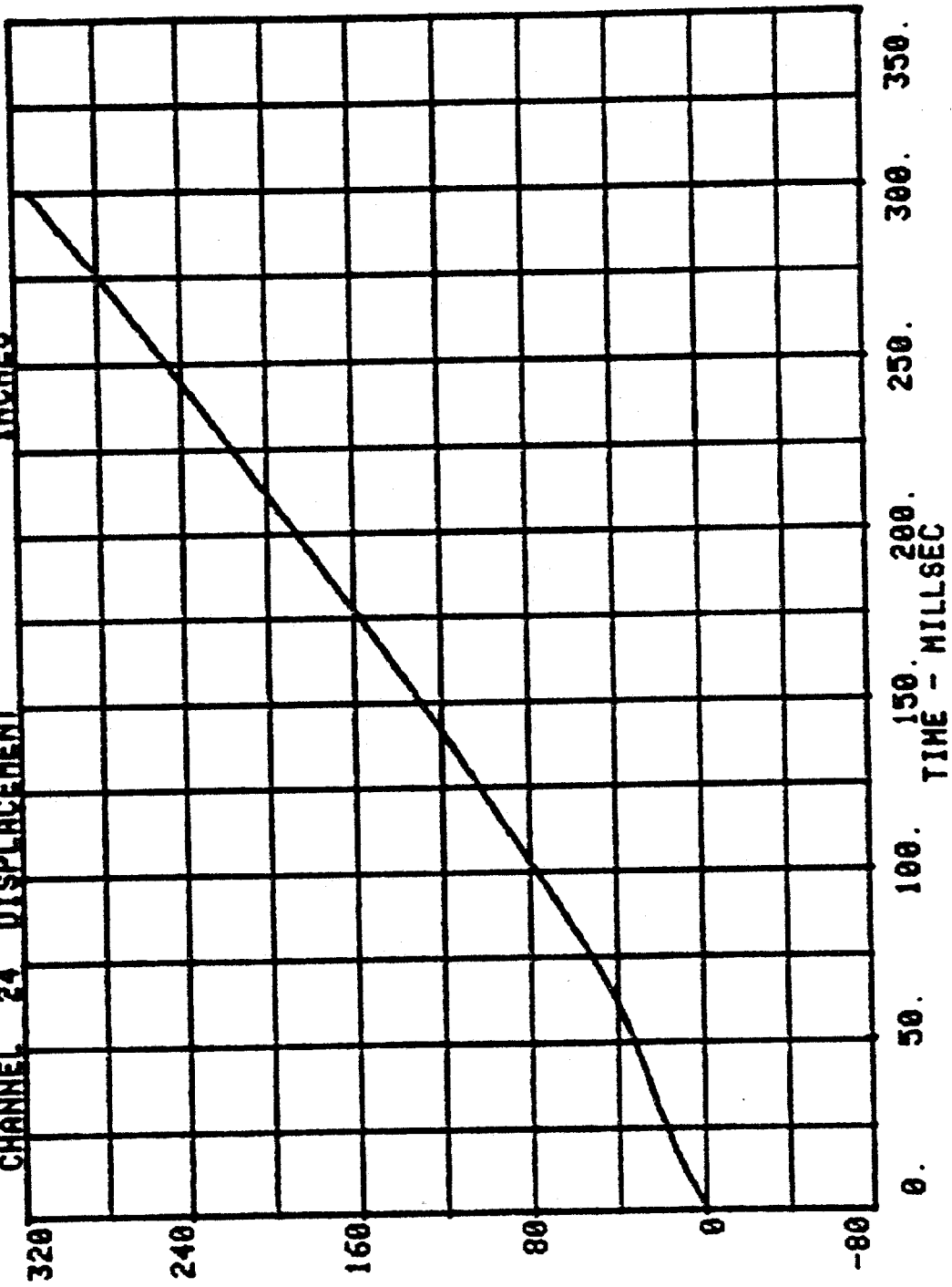


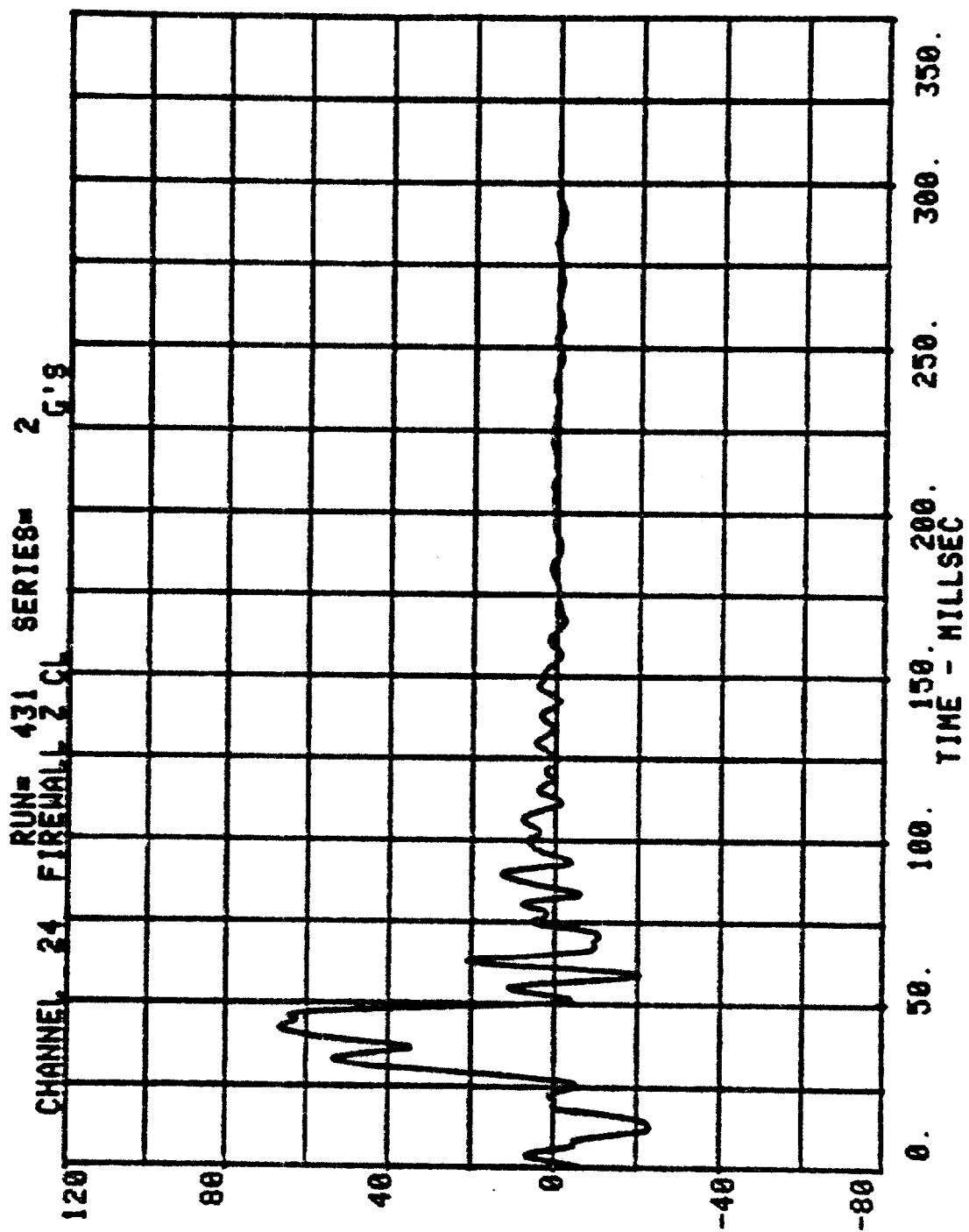
FIREWALL CL

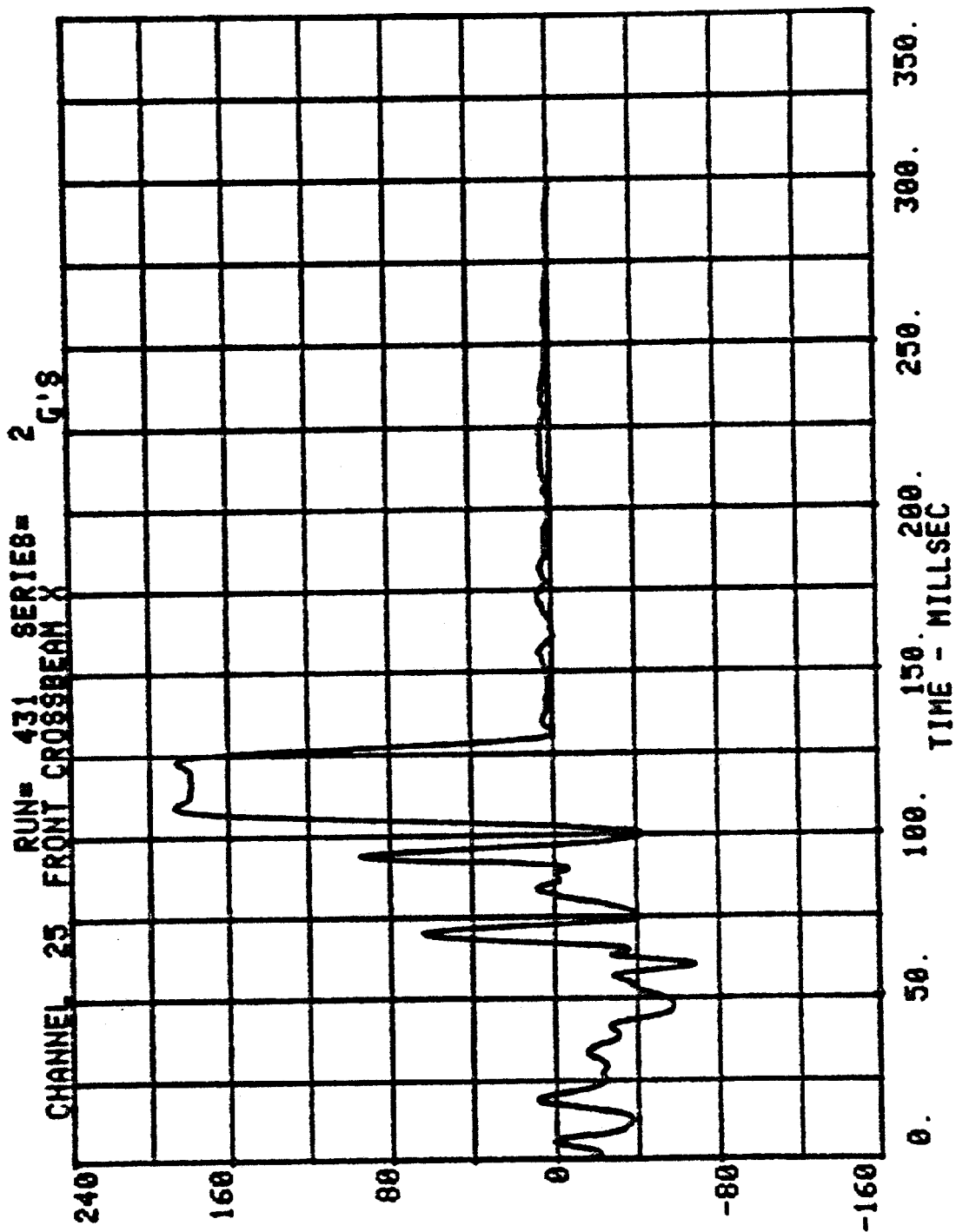


FIREWALL CL

CHANNEL 24 DISPLACEMENT RUN= 431 SERIES= 2 INCHES







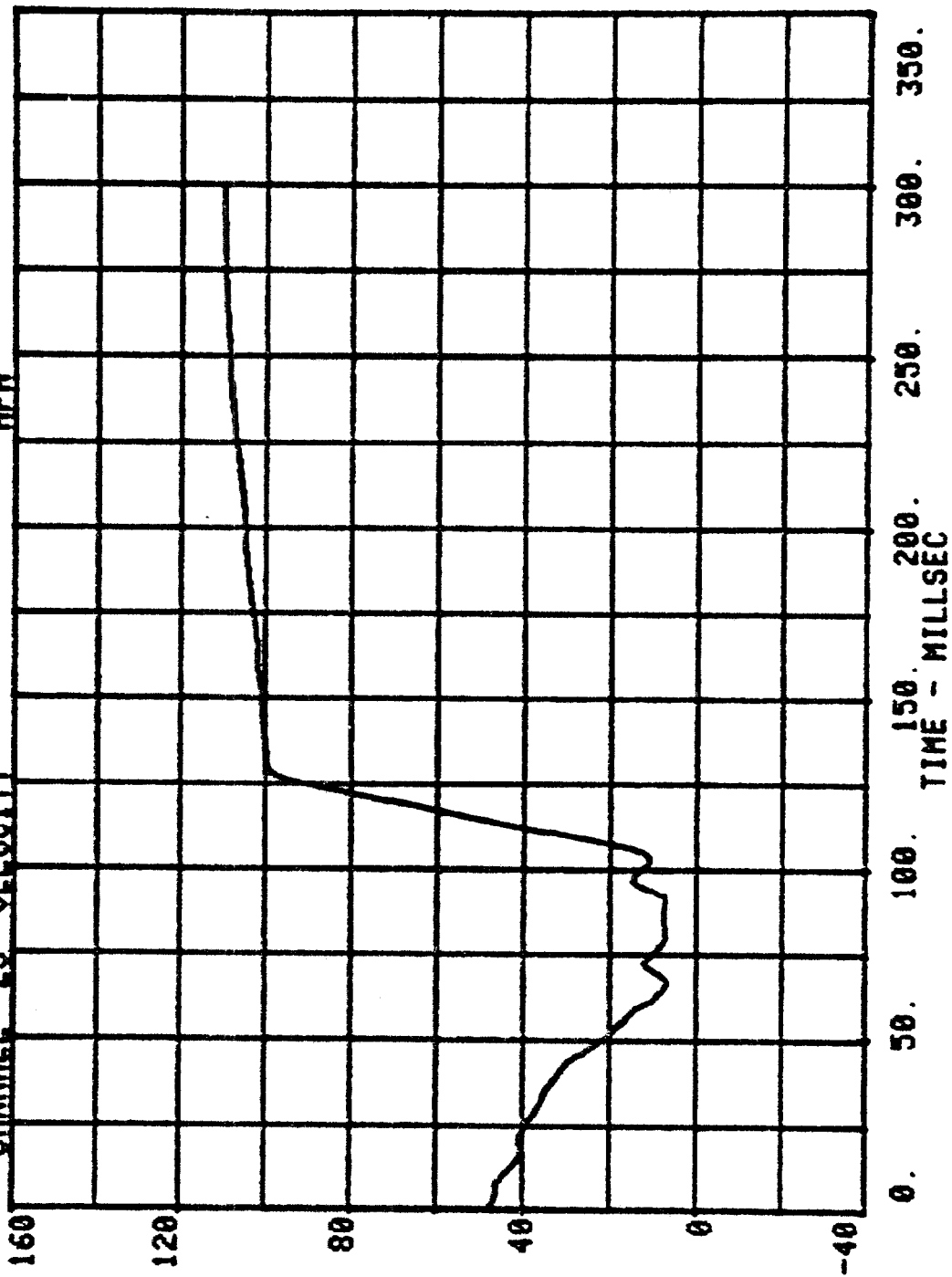
FRONT CROSS BEAM X

CHANNEL 25 VELOCITY

RUN= 431

SERIE8=

2 MPH



FRONT CROSS BEAM X

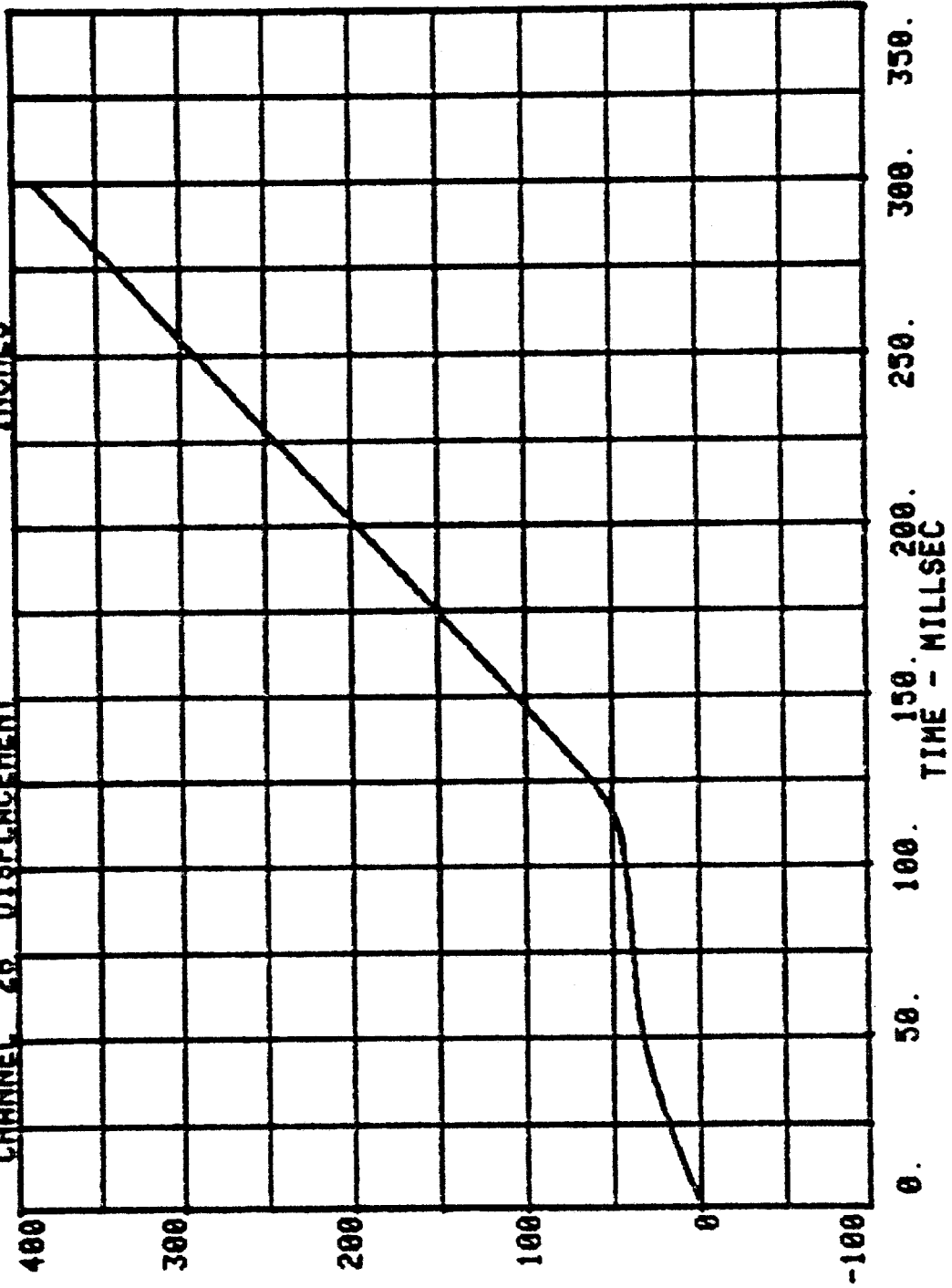
CHANNEL 20 DISPLACEMENT

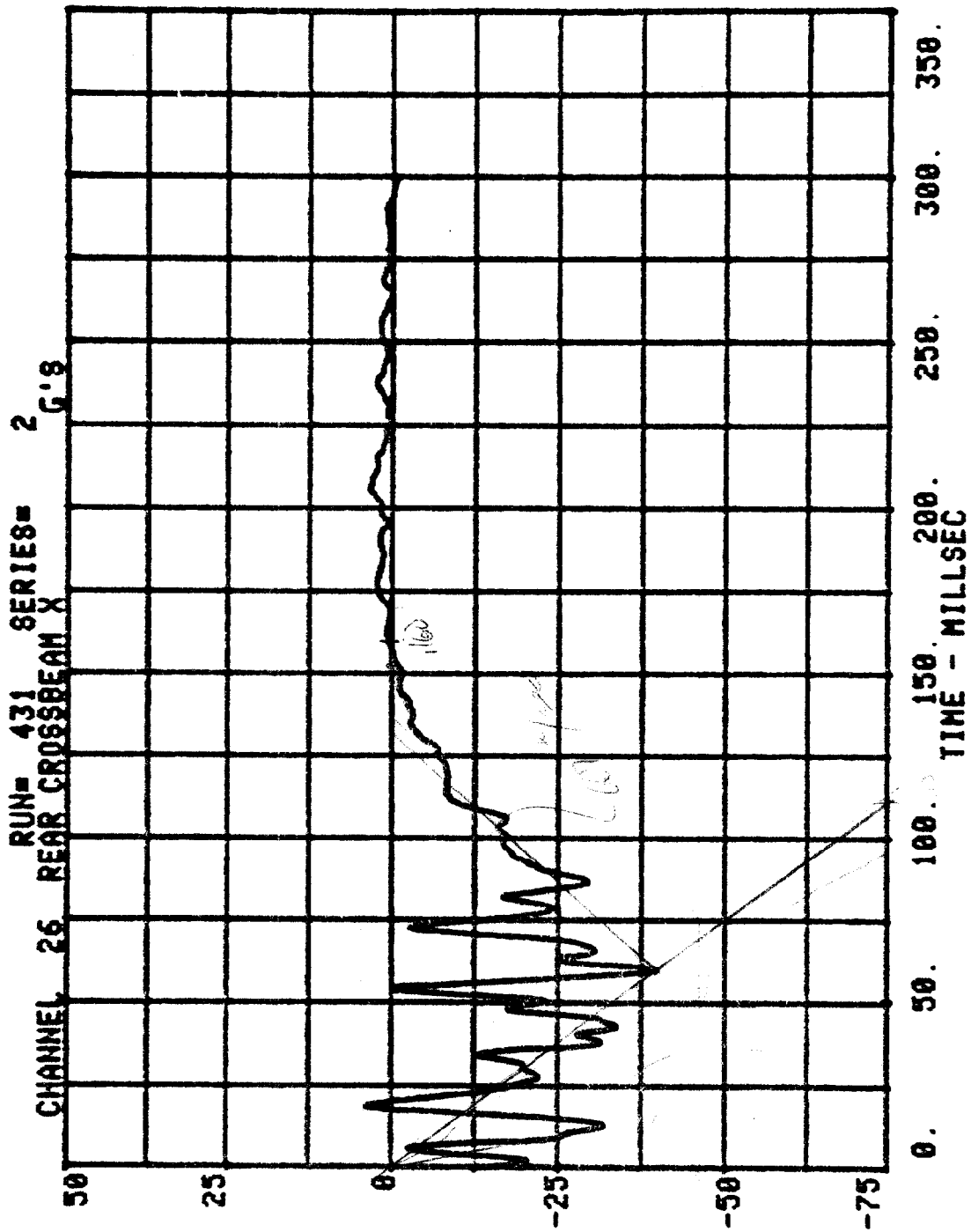
RUN= 431

SERIES=

2

INCHES

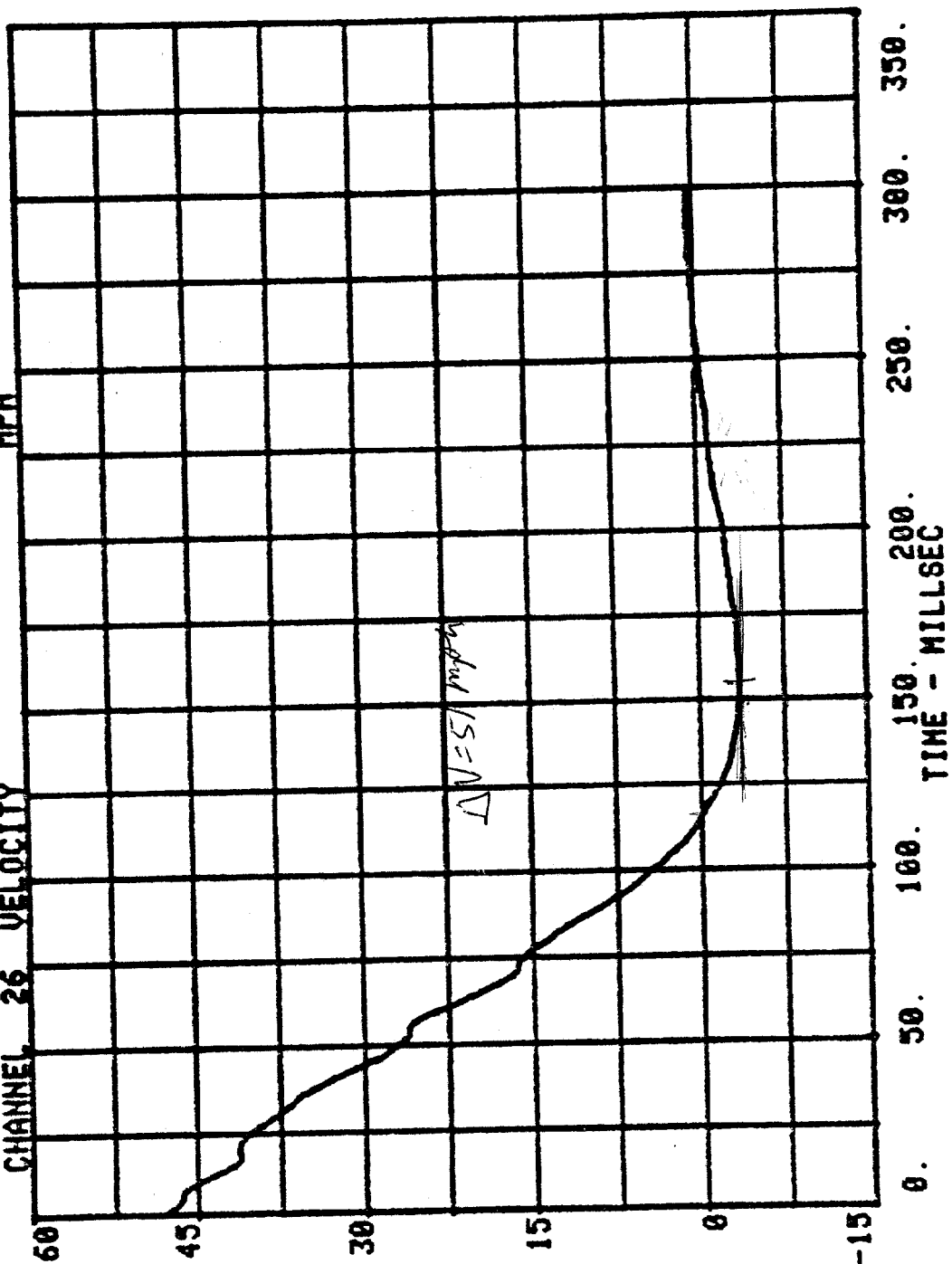




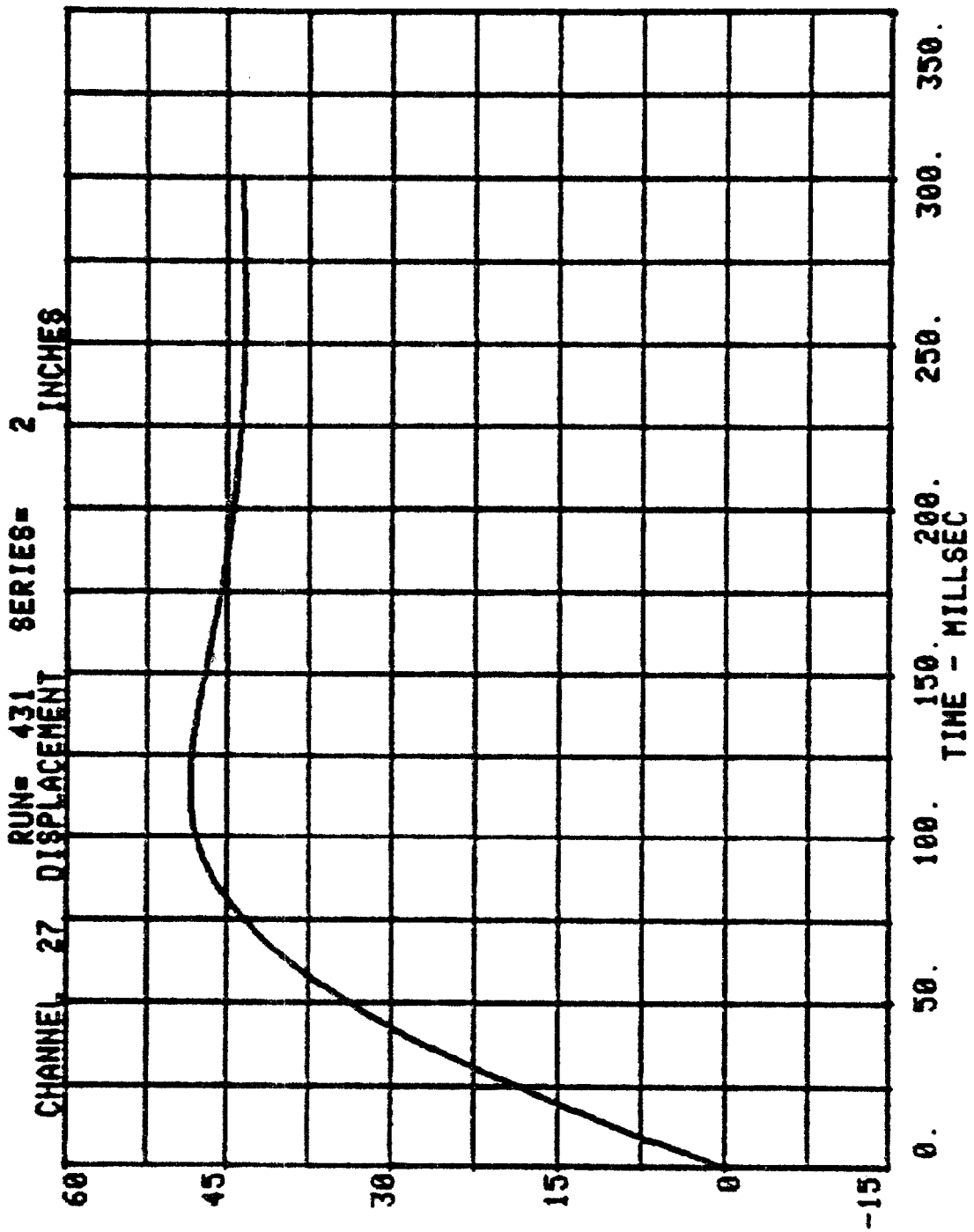
REAR CROSS BEAM X

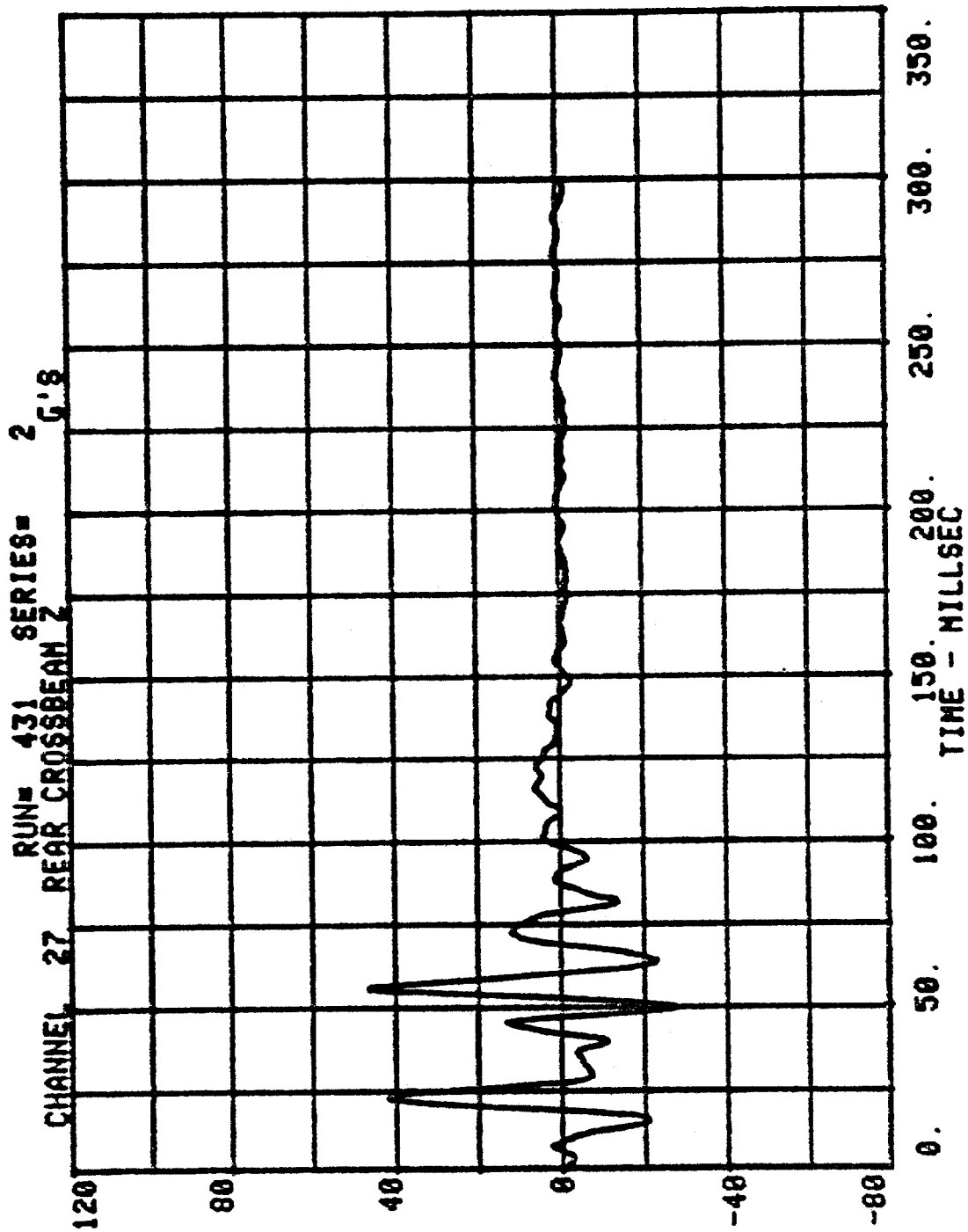
CHANNEL 26 VELOCITY

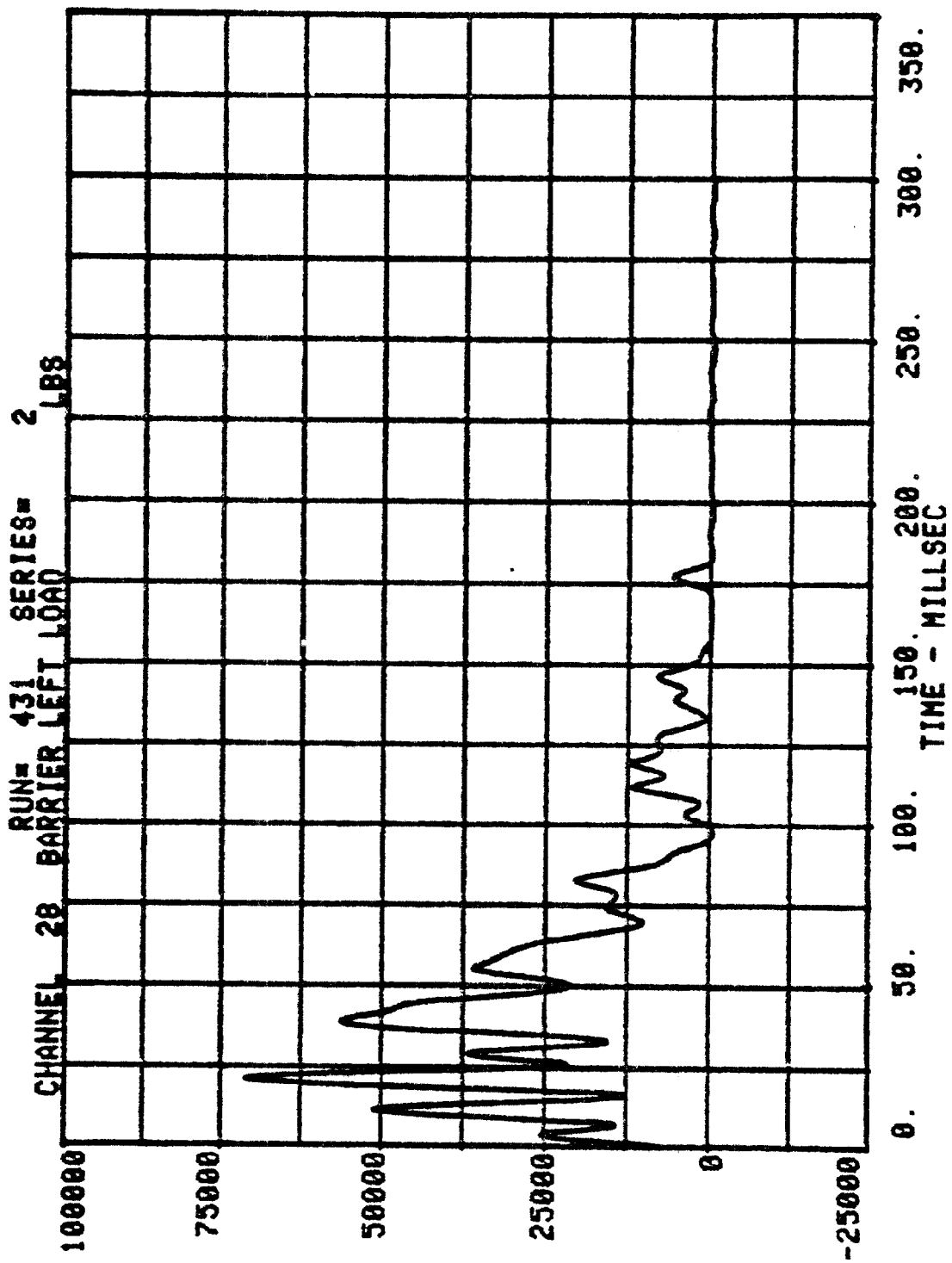
RUN= 431 SERIES= 2 MPH



REAR CROSS BEAM X



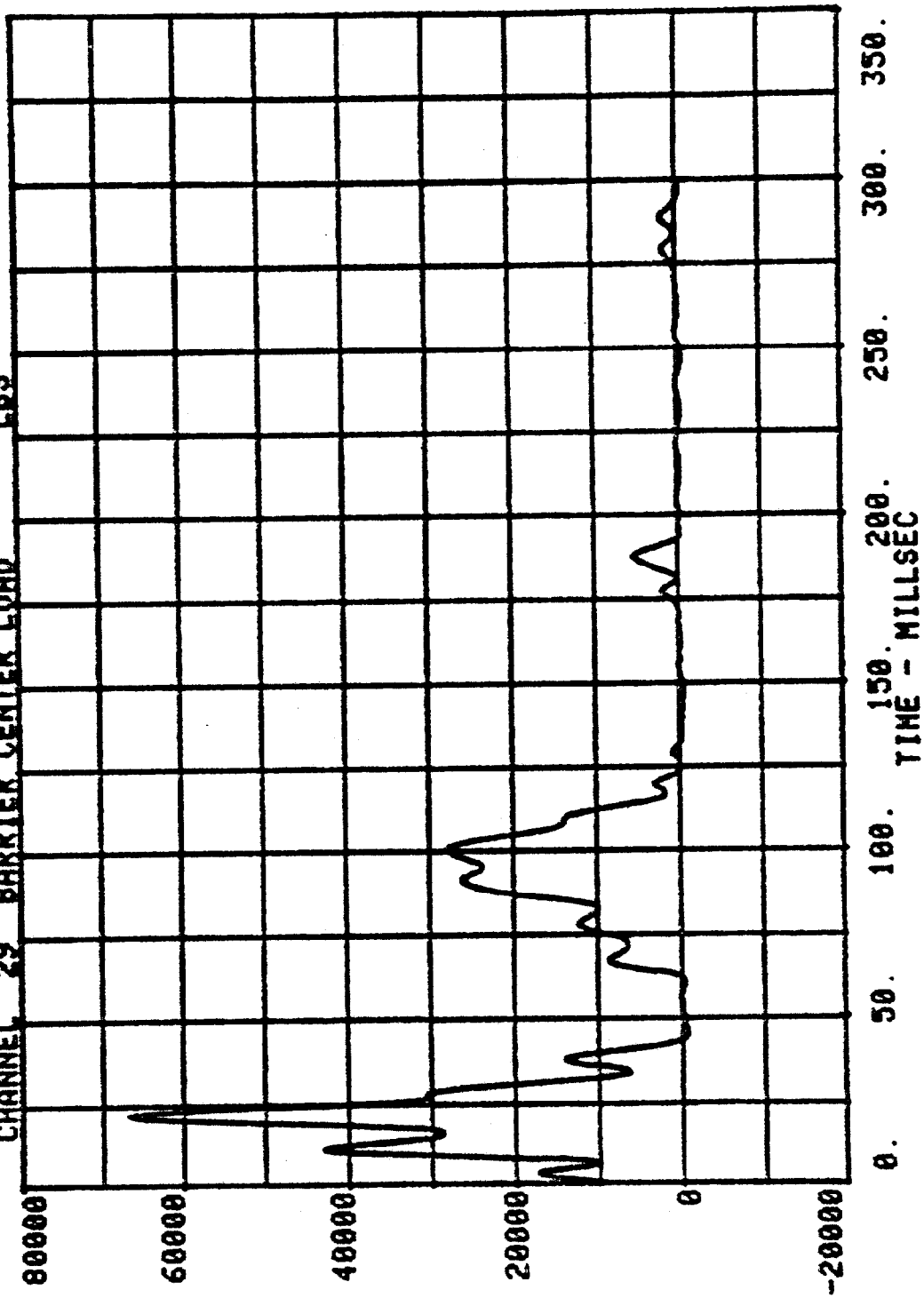


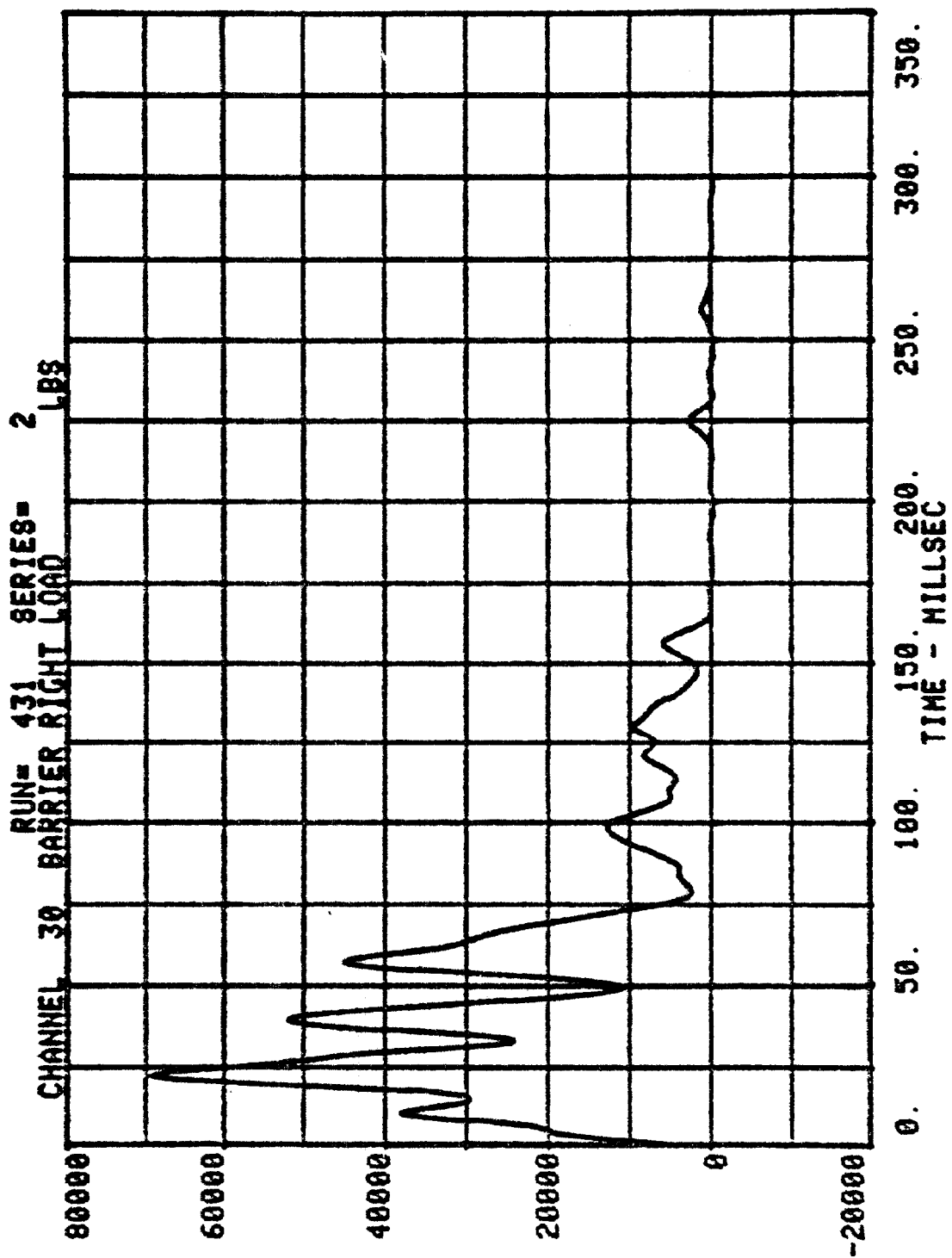


CHANNEL 22 BARrier CENTER LOAD

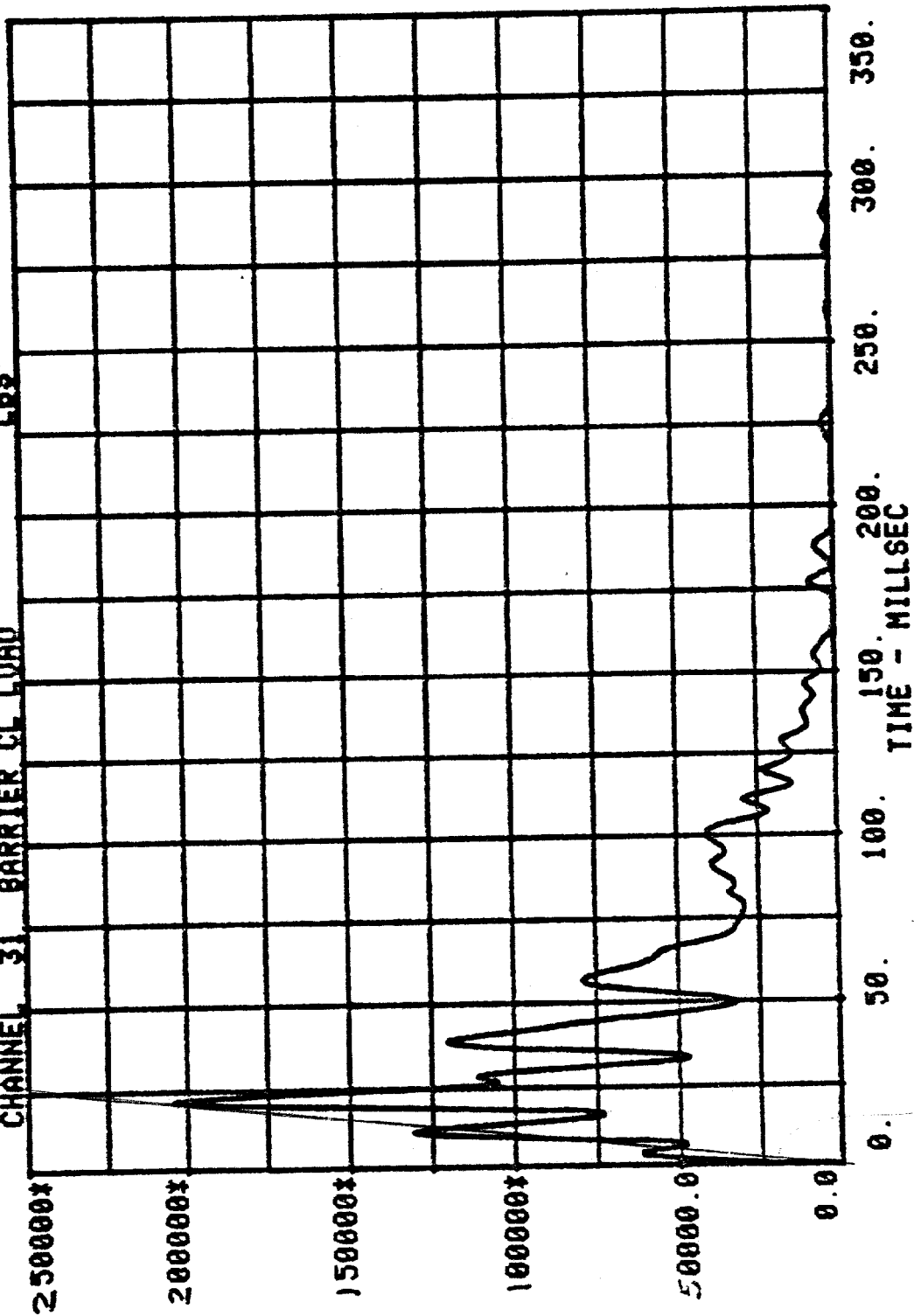
RUN= 431 SERIES= 2

LBS





CHANNEL 31 RUN= 431 SERIES= 2 LBS
BARRIER CL LOAD



✓ 1990 1991

**HEAD INJURY CRITERION
HEAD SEVERITY INDEX**

CITATION

RUN= 431

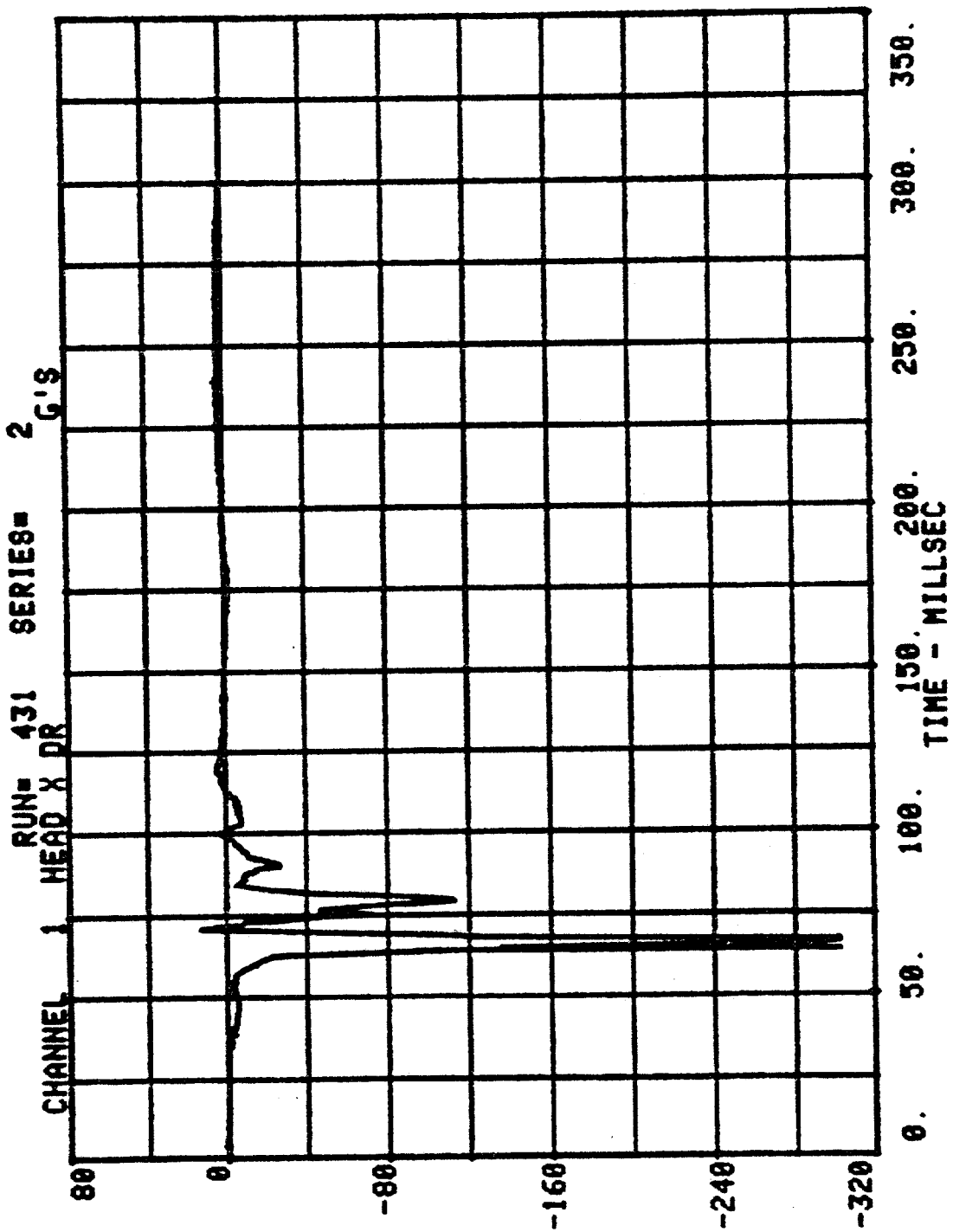
HEAD RESULTANT DR

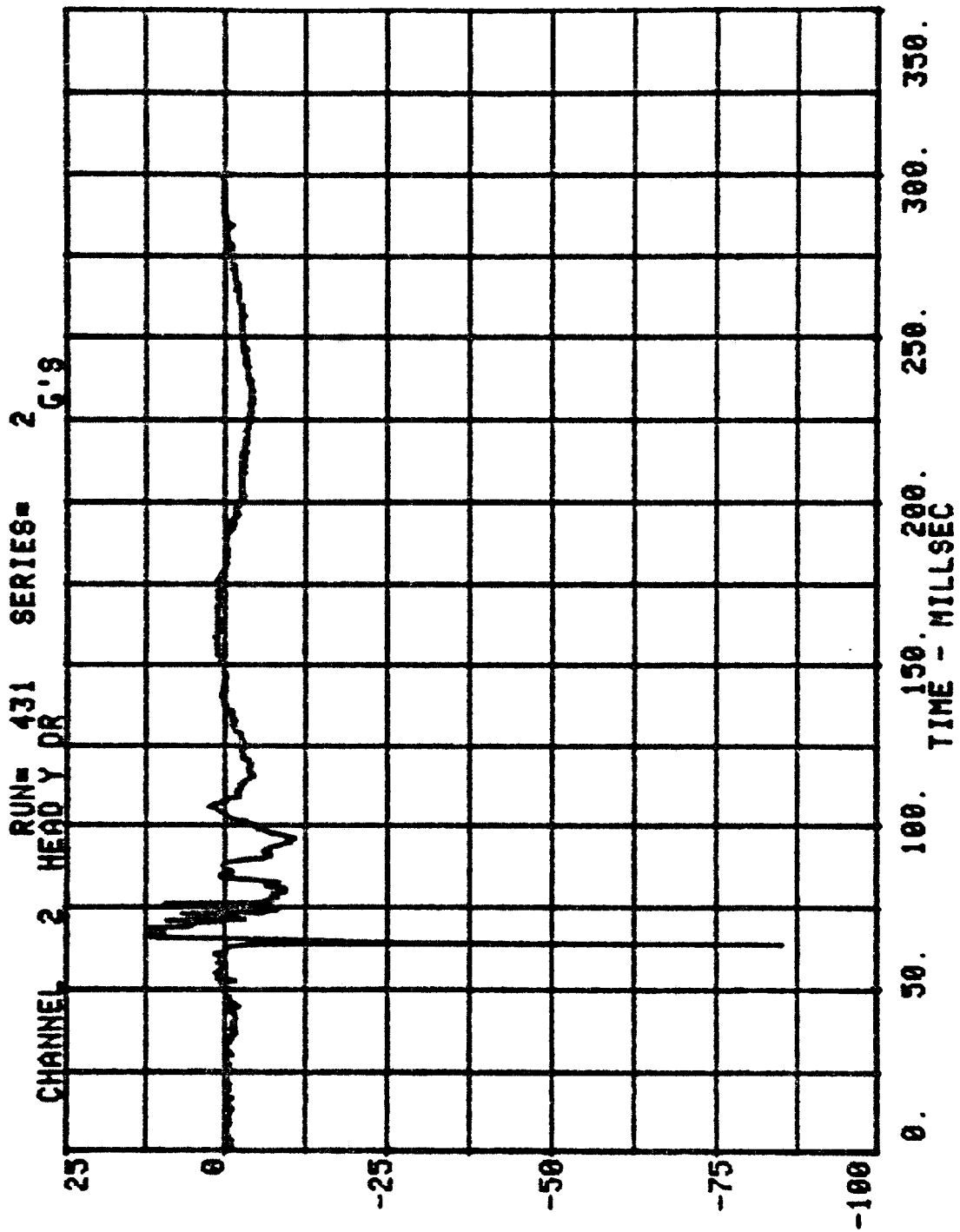
HIC=4167.2 FROM T1= .06390 TO T2= .06810

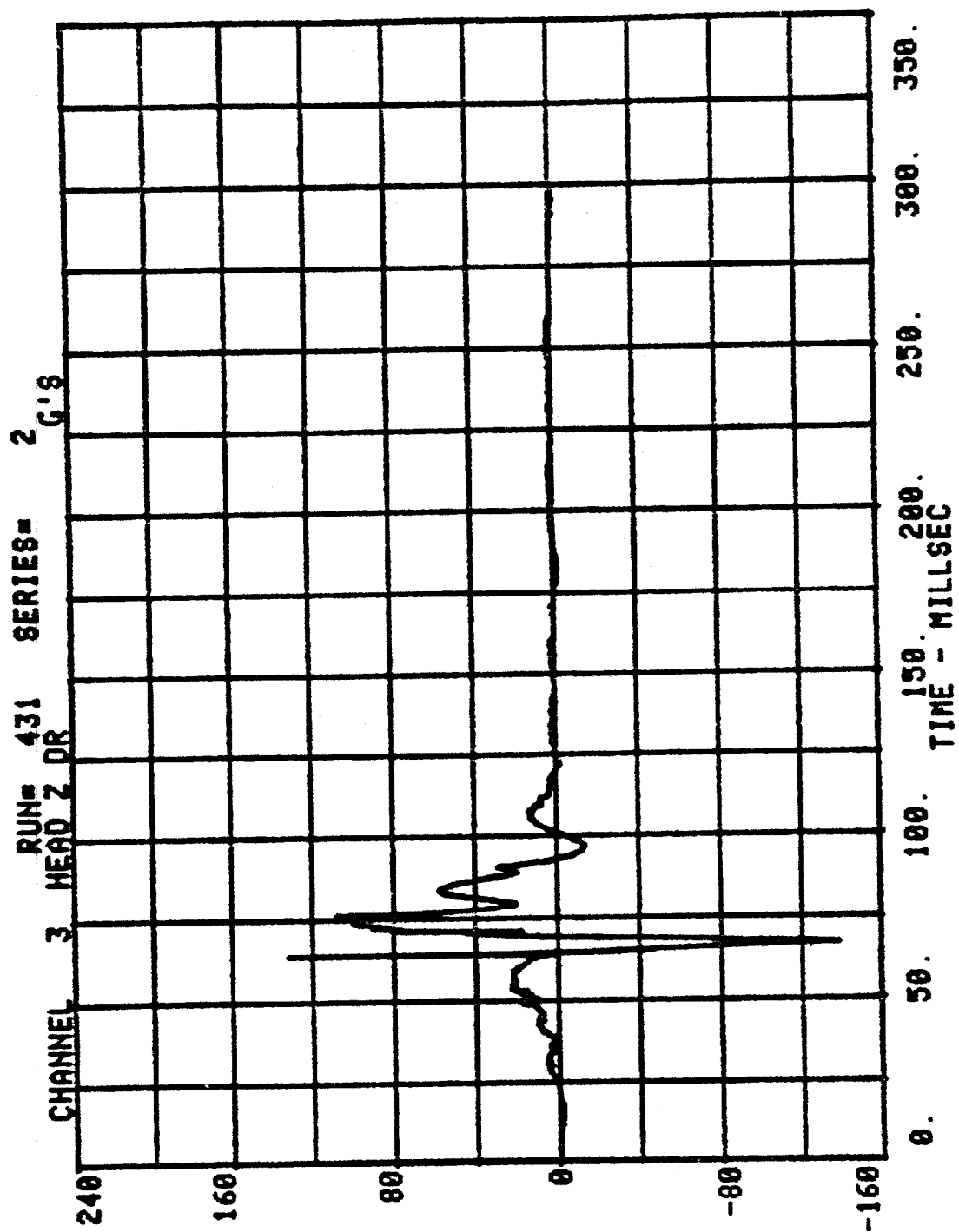
AVERAGE ACCELERATION BETWEEN T1 AND T2= 250.4G'S

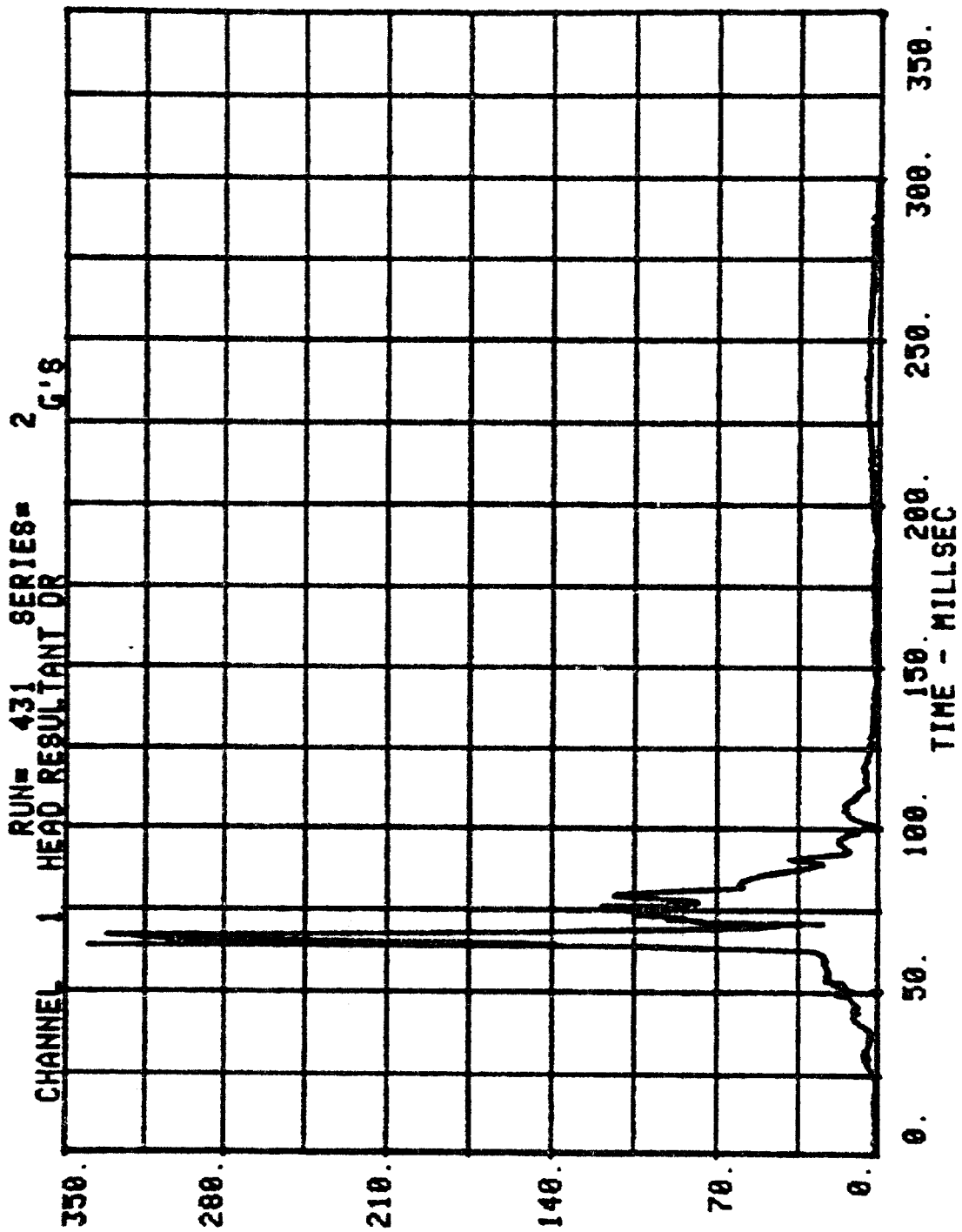
EVENT TIME= 300.0 MSEC

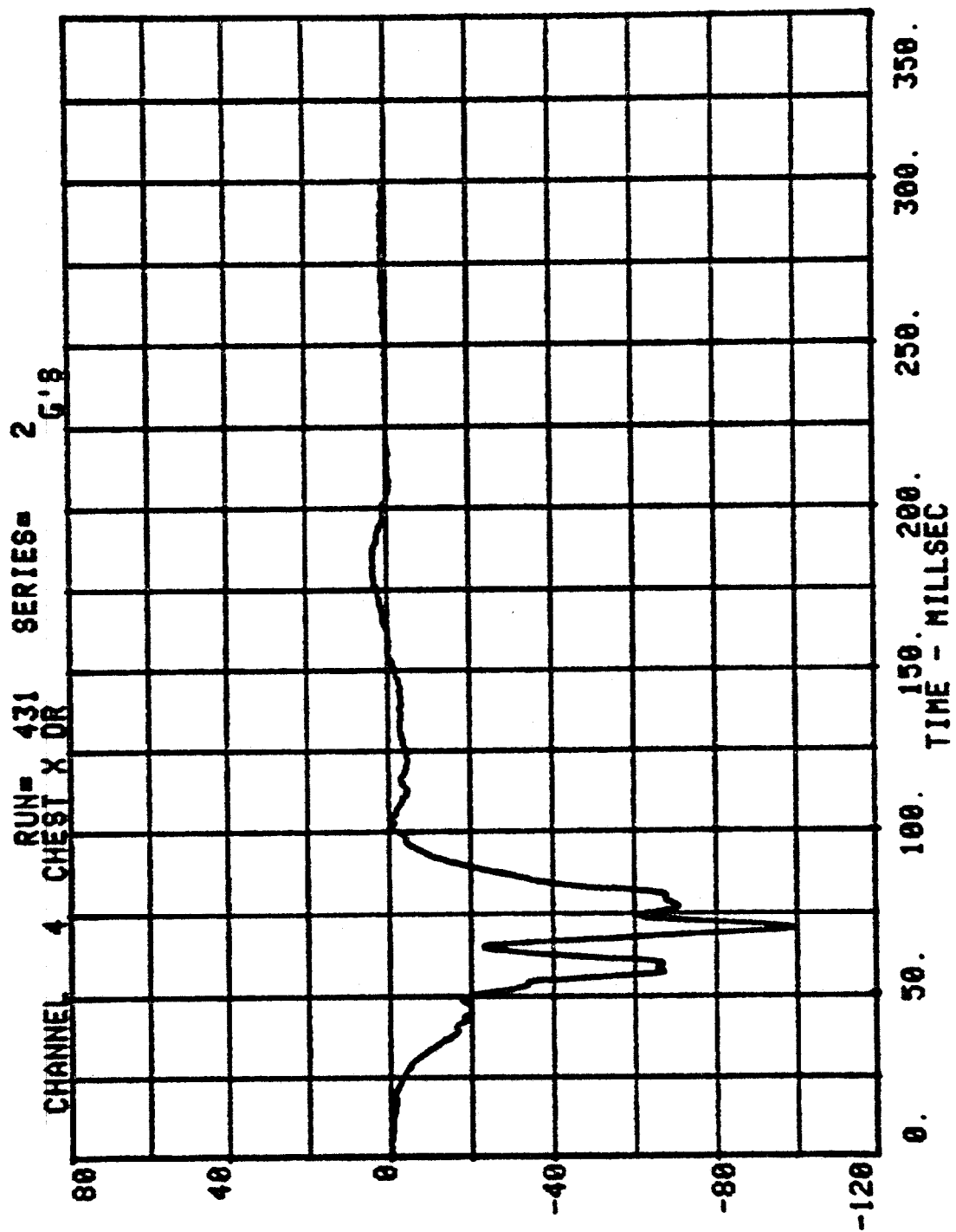
SEVERITY INDEX=6217.5

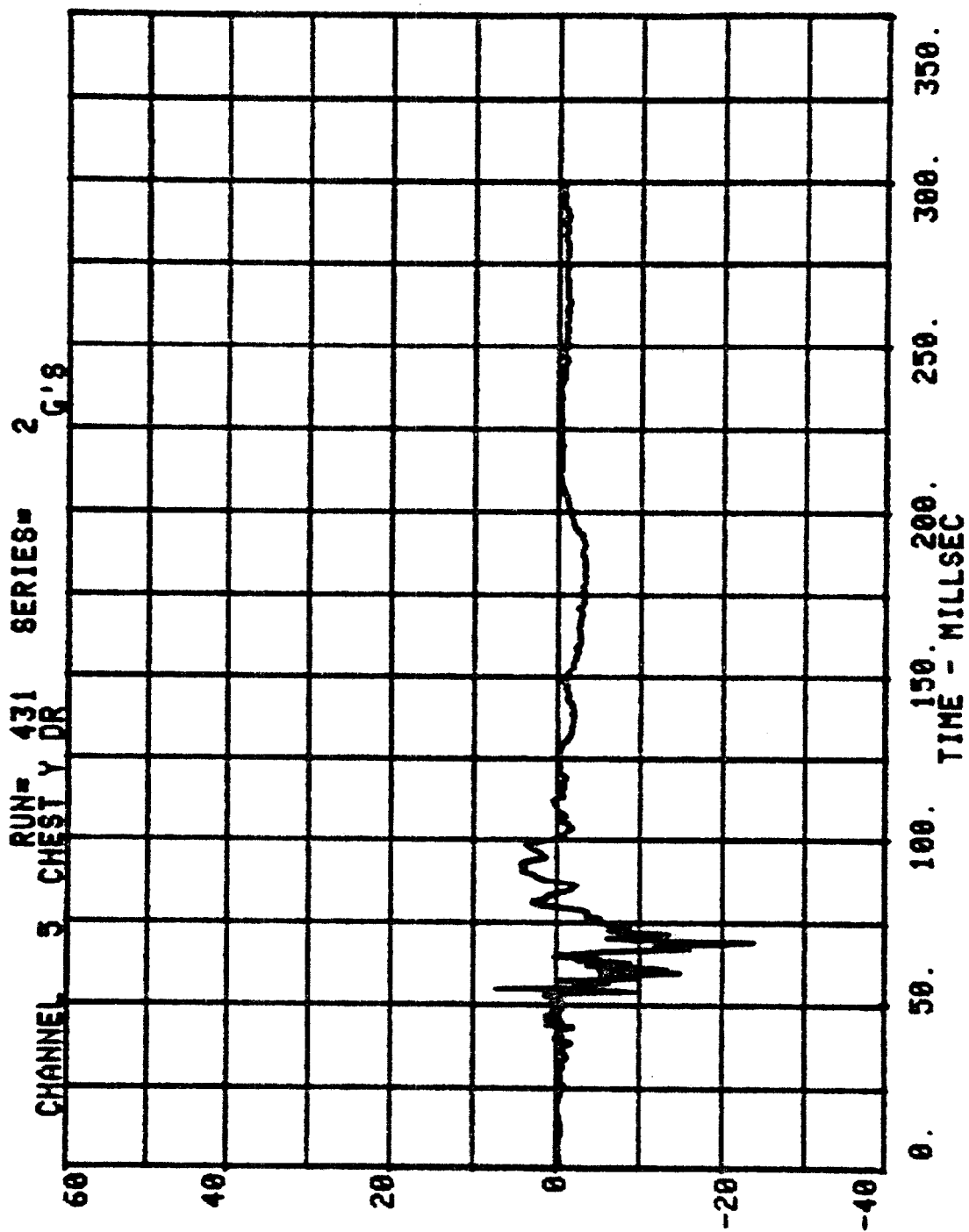


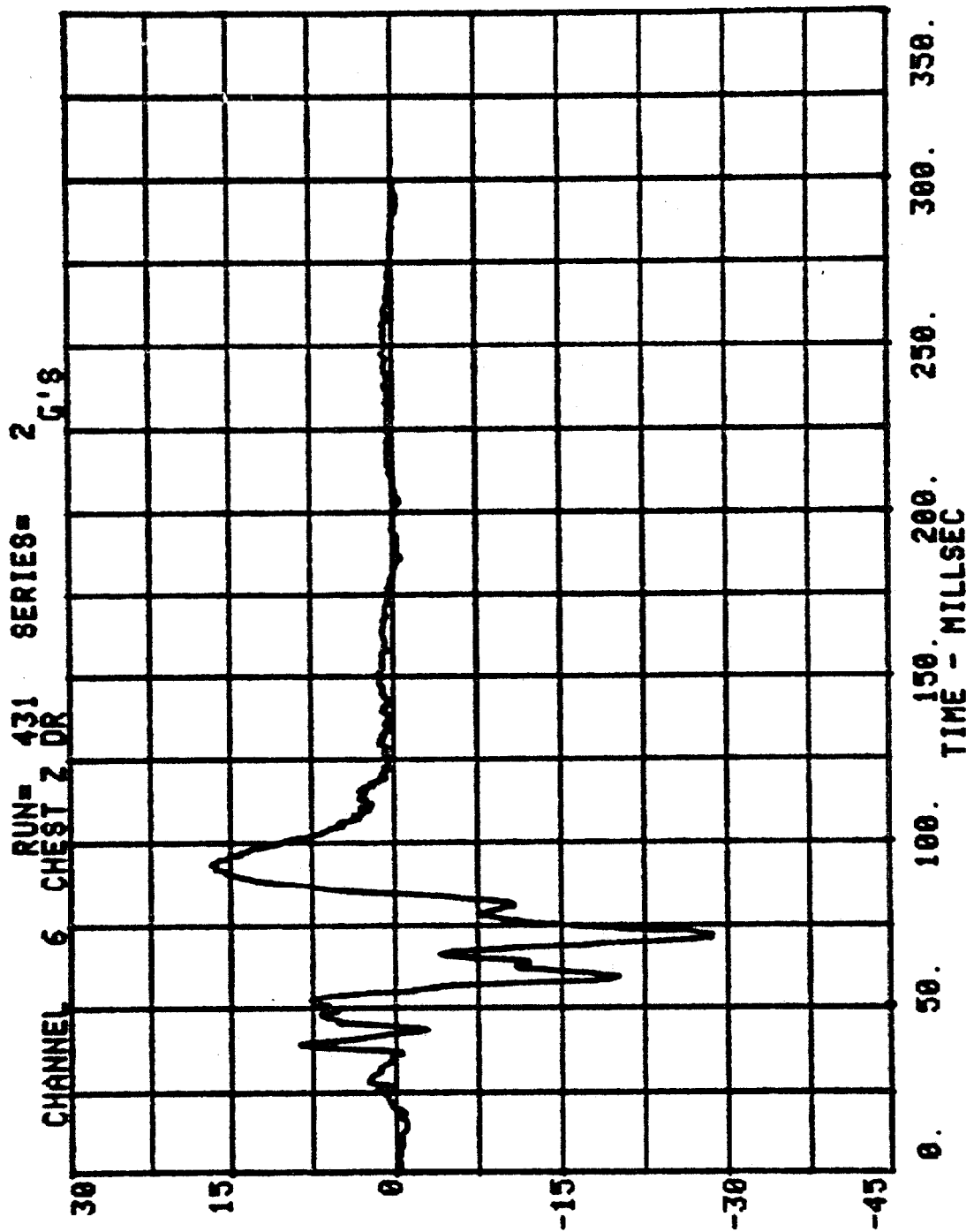


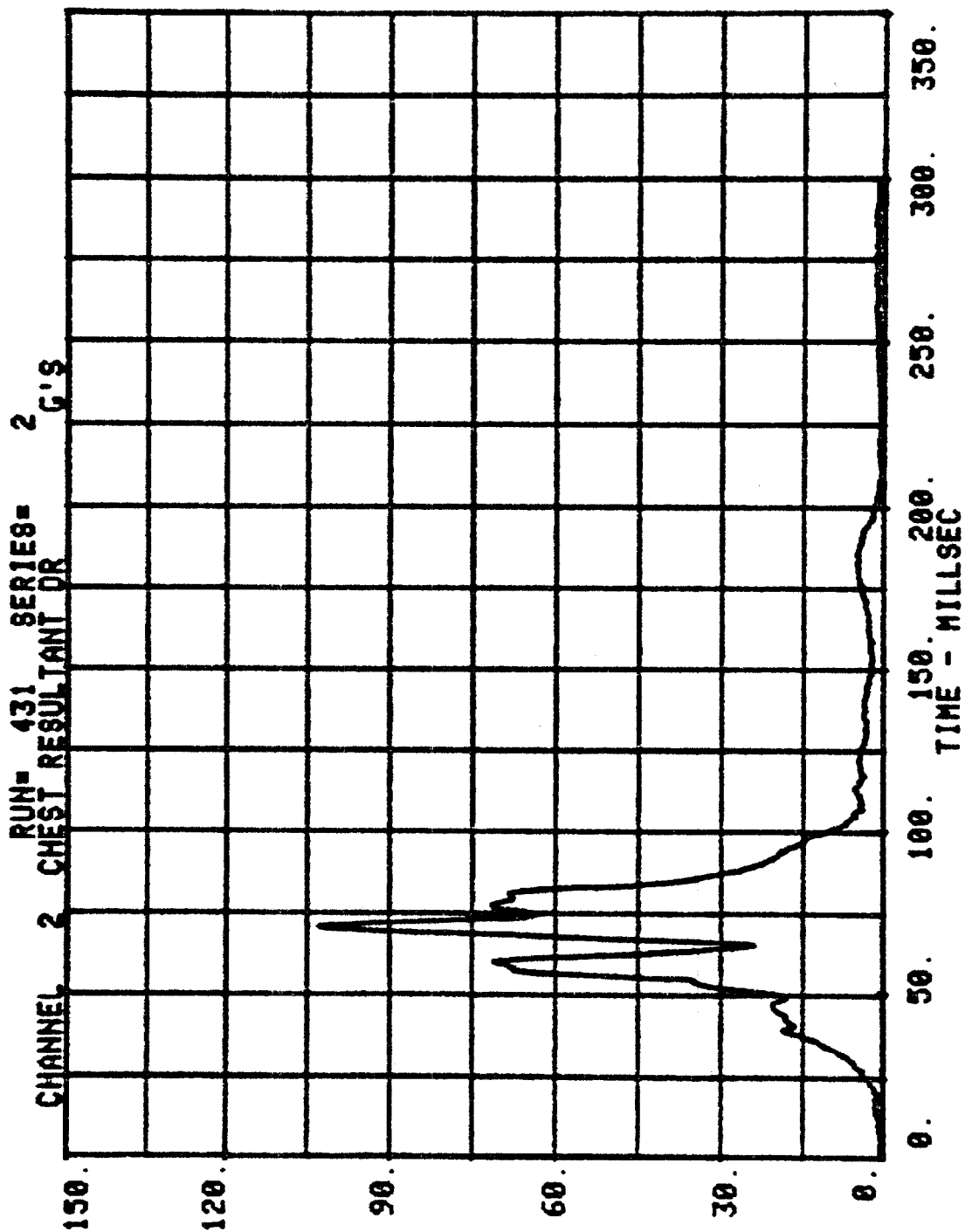


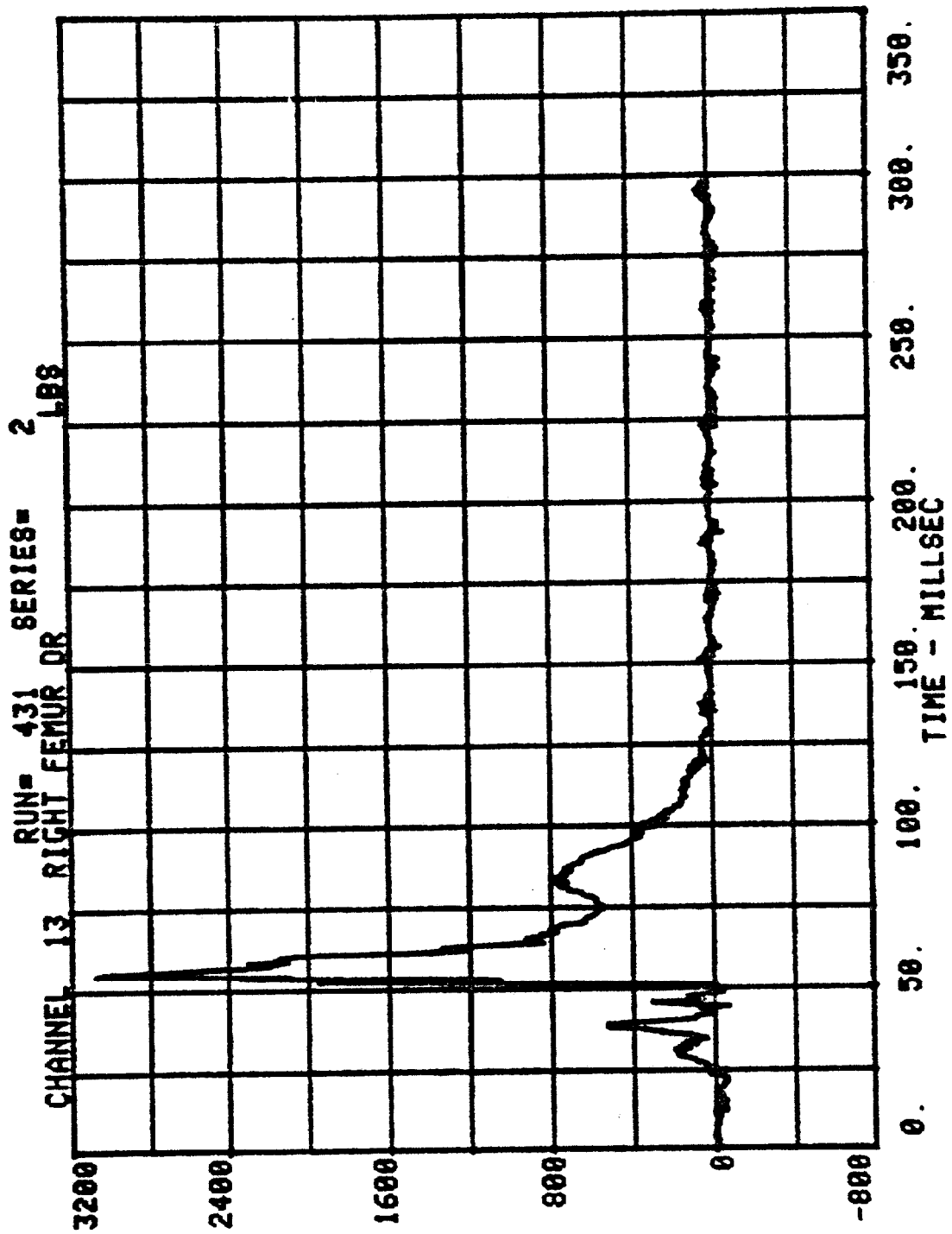


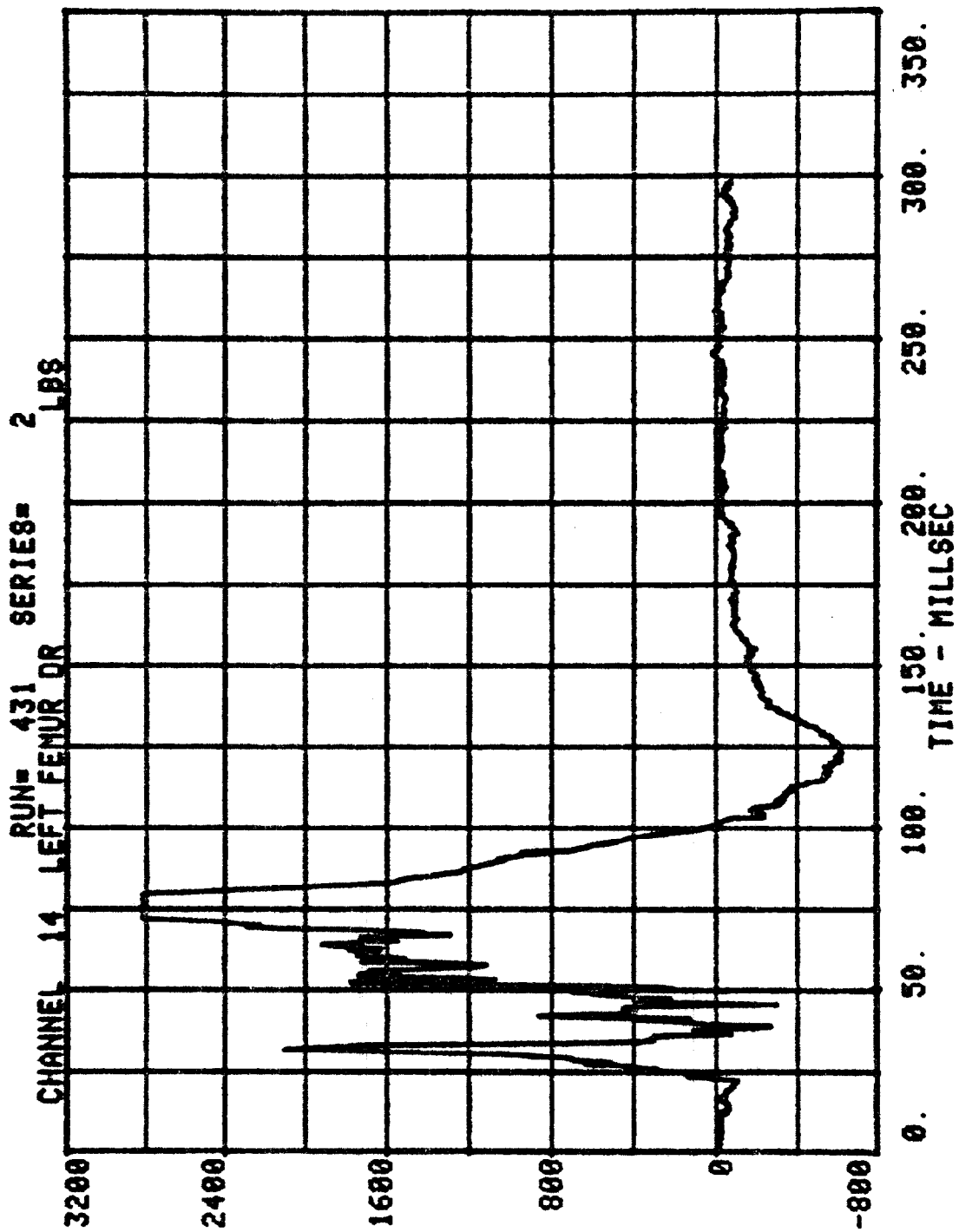


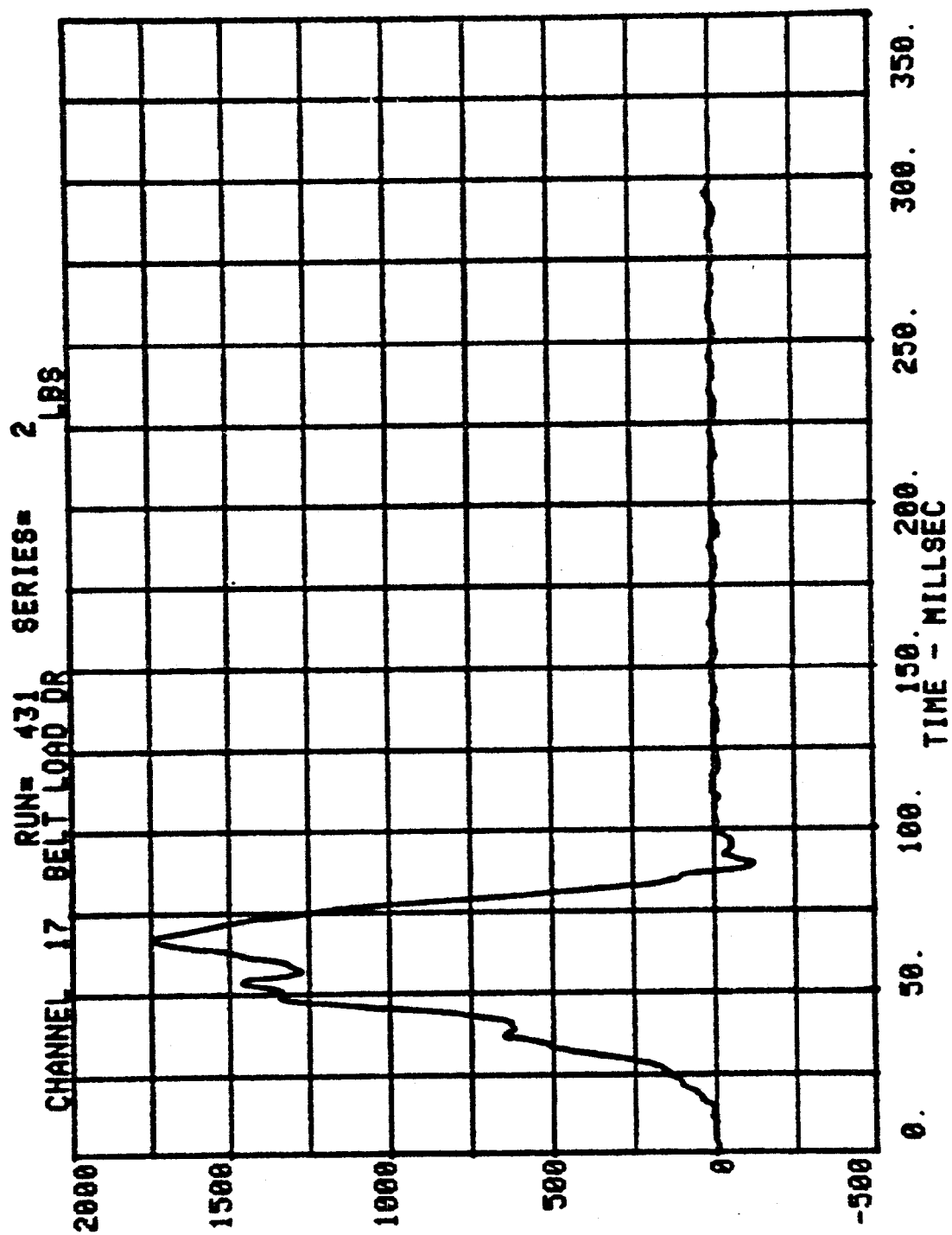












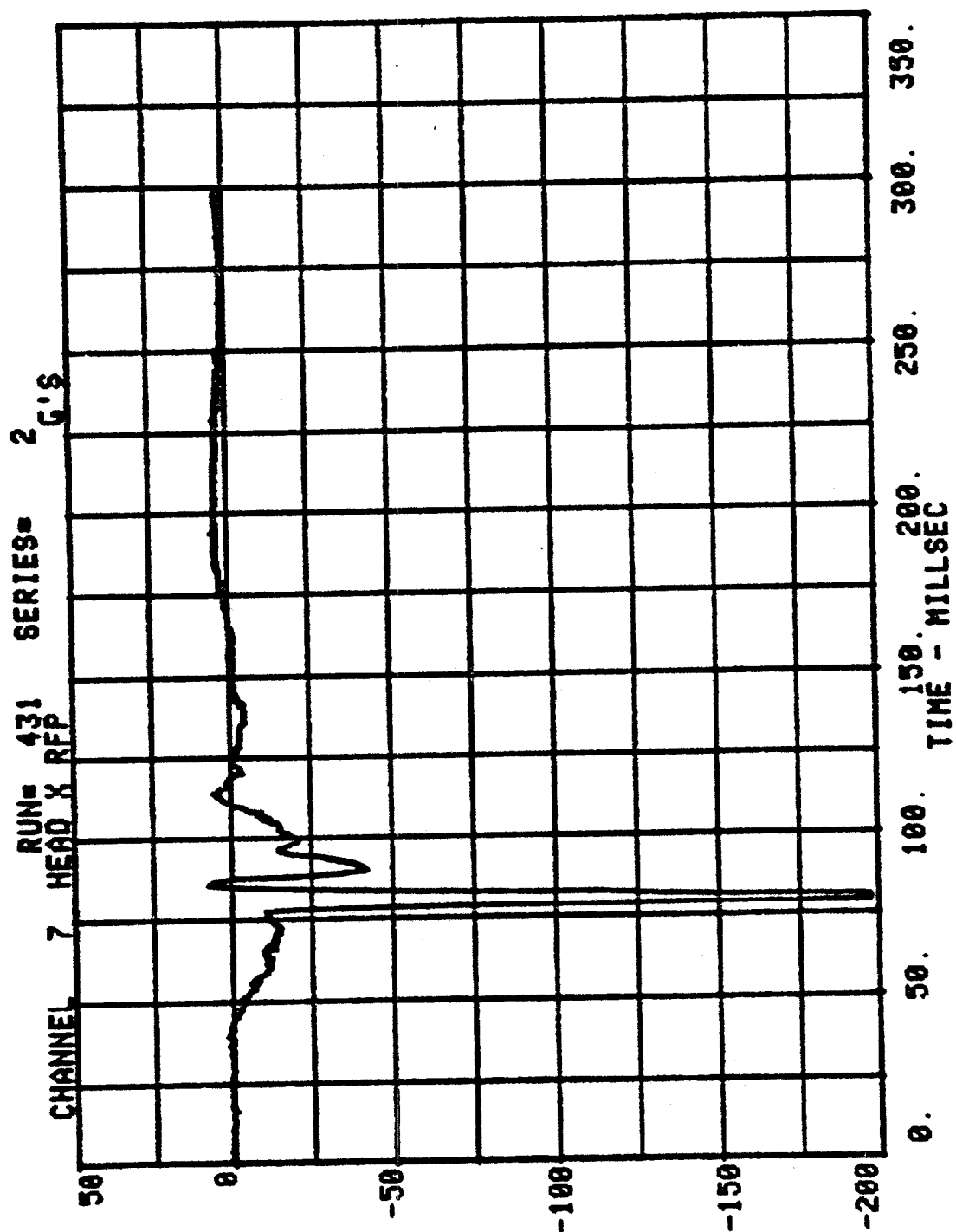
HEAD INJURY CRITERION
HEAD SEVERITY INDEX

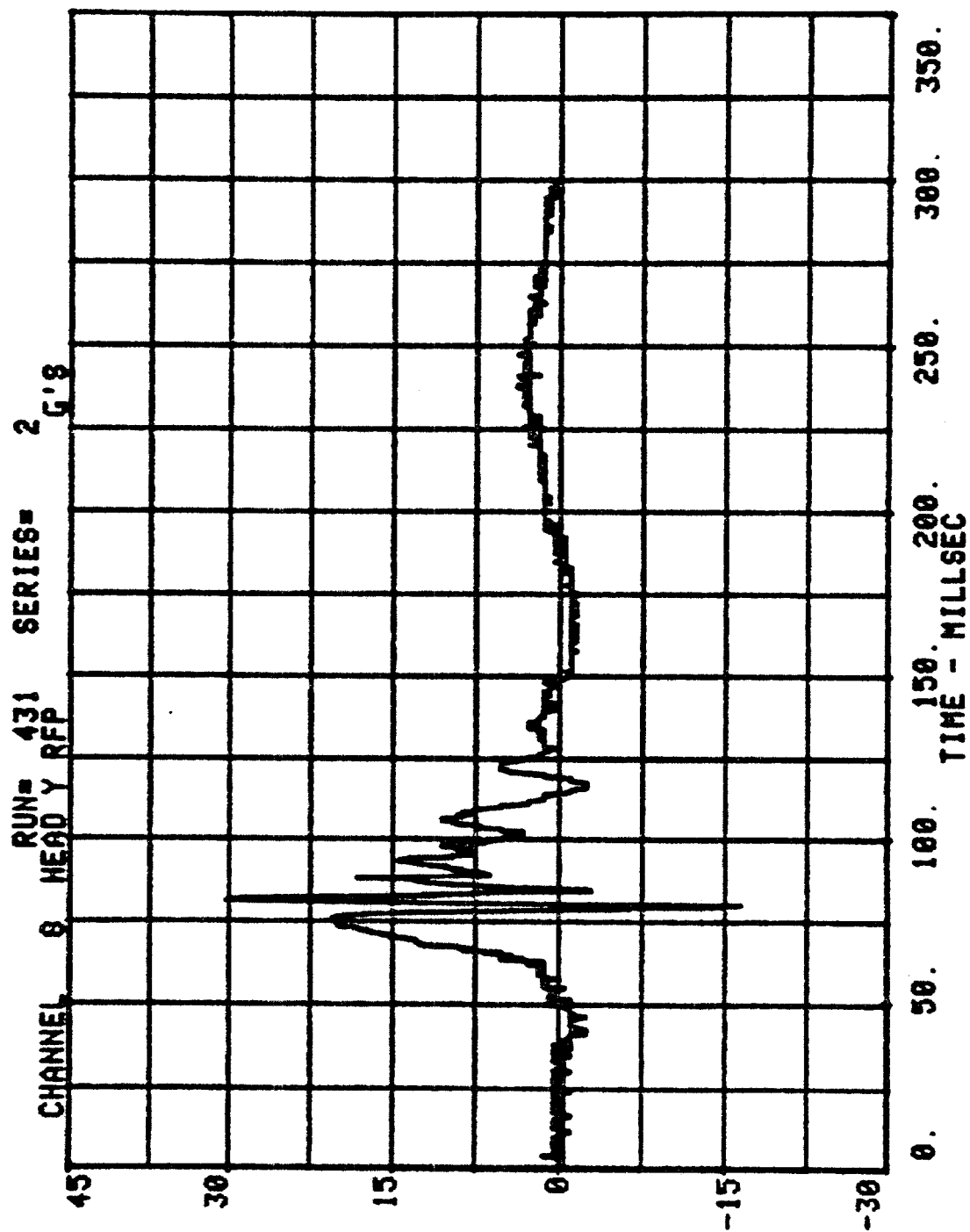
CITATION

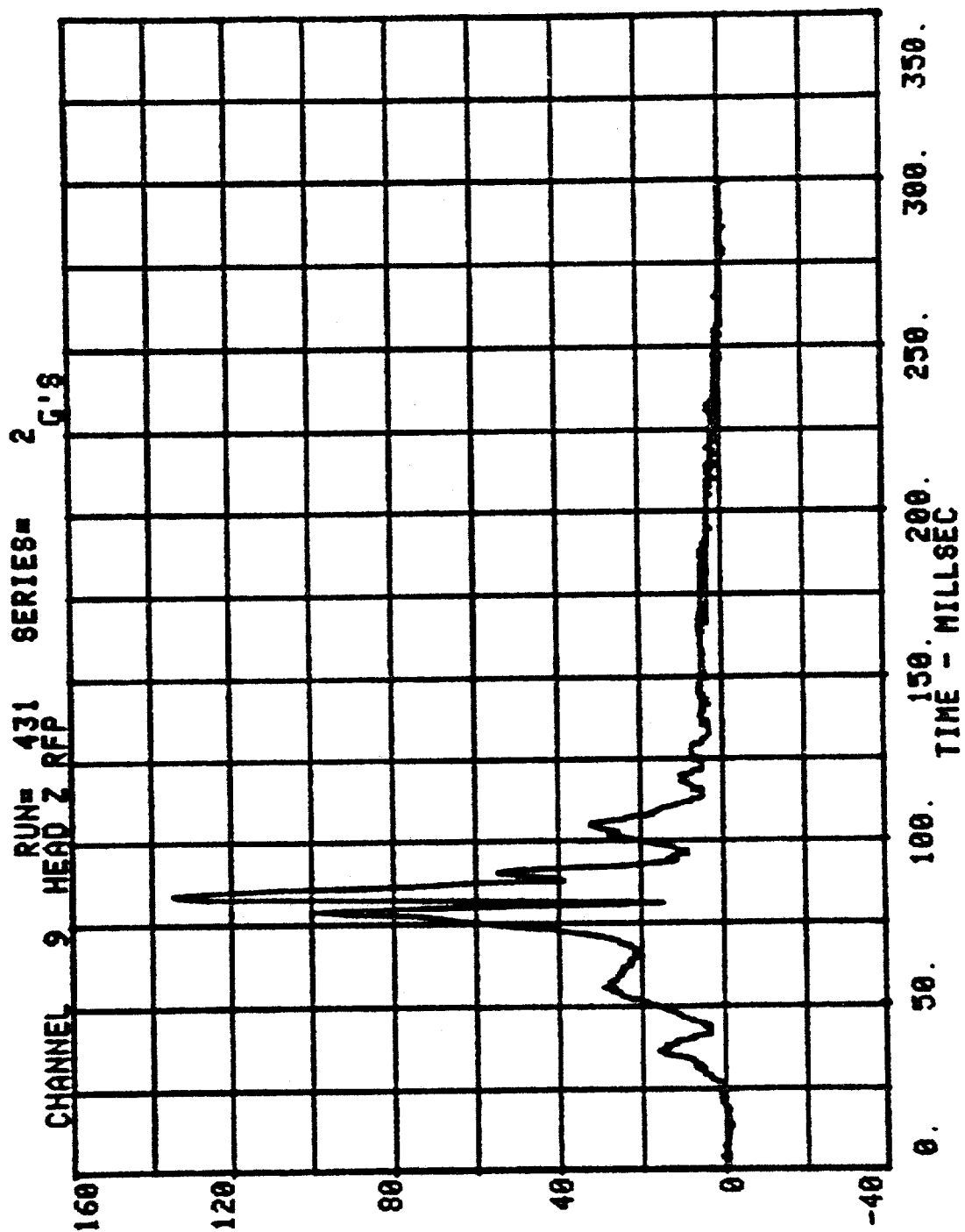
RUN= 431

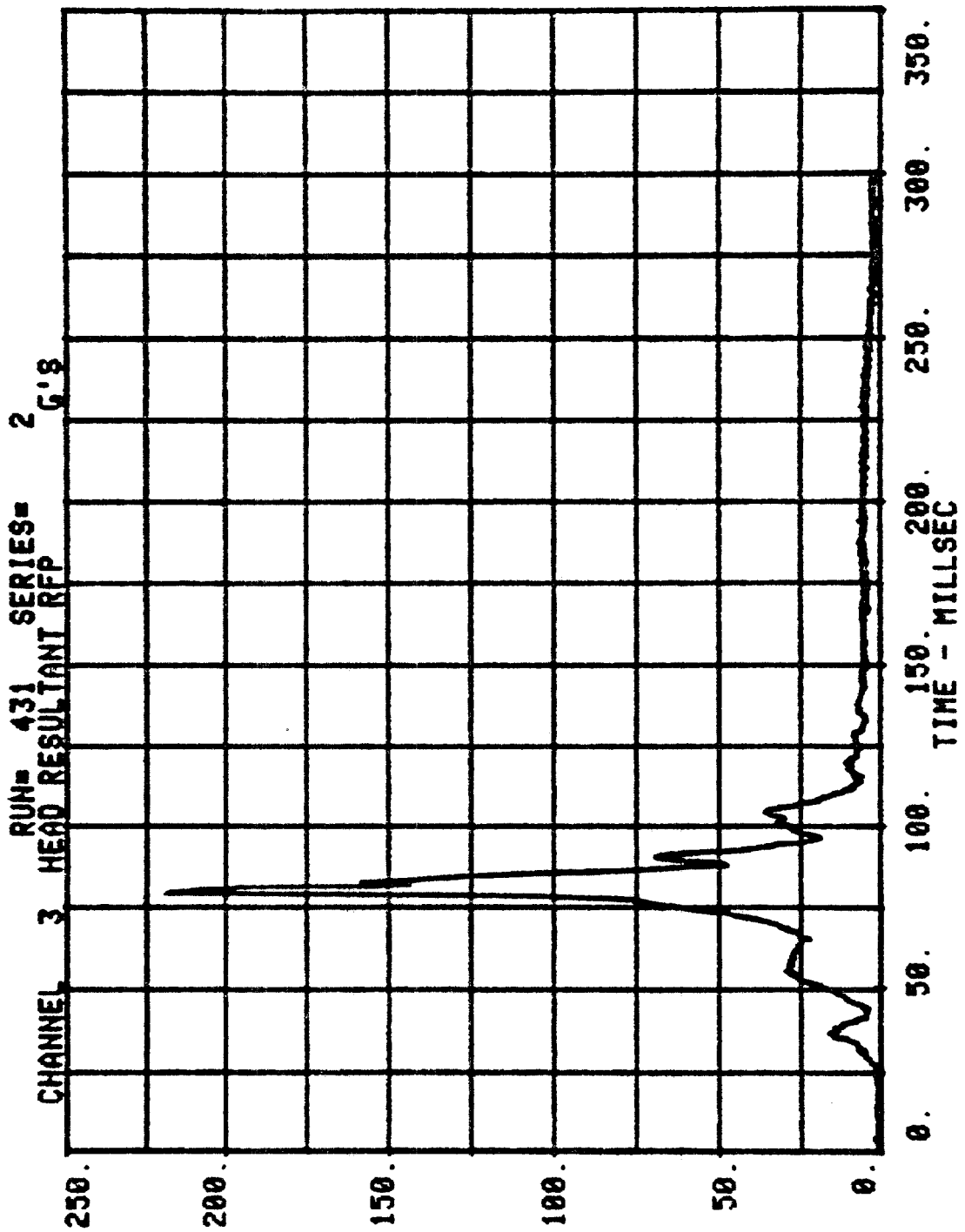
HEAD RESULTANT RFP

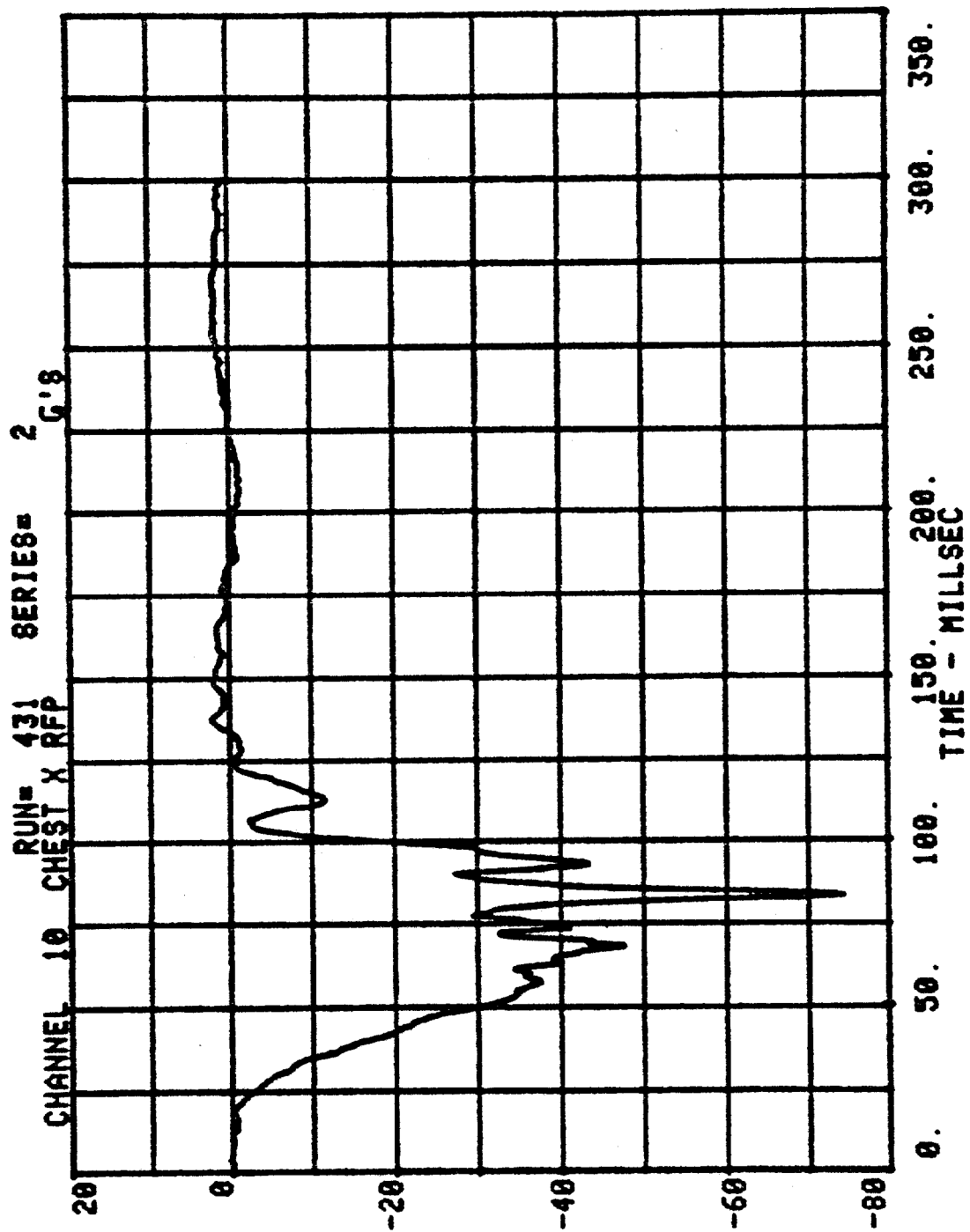
HIC=2433.4 FROM T1= .07770 TO T2= .08610
AVERAGE ACCELERATION BETWEEN T1 AND T2= 153.0G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX=3284.4

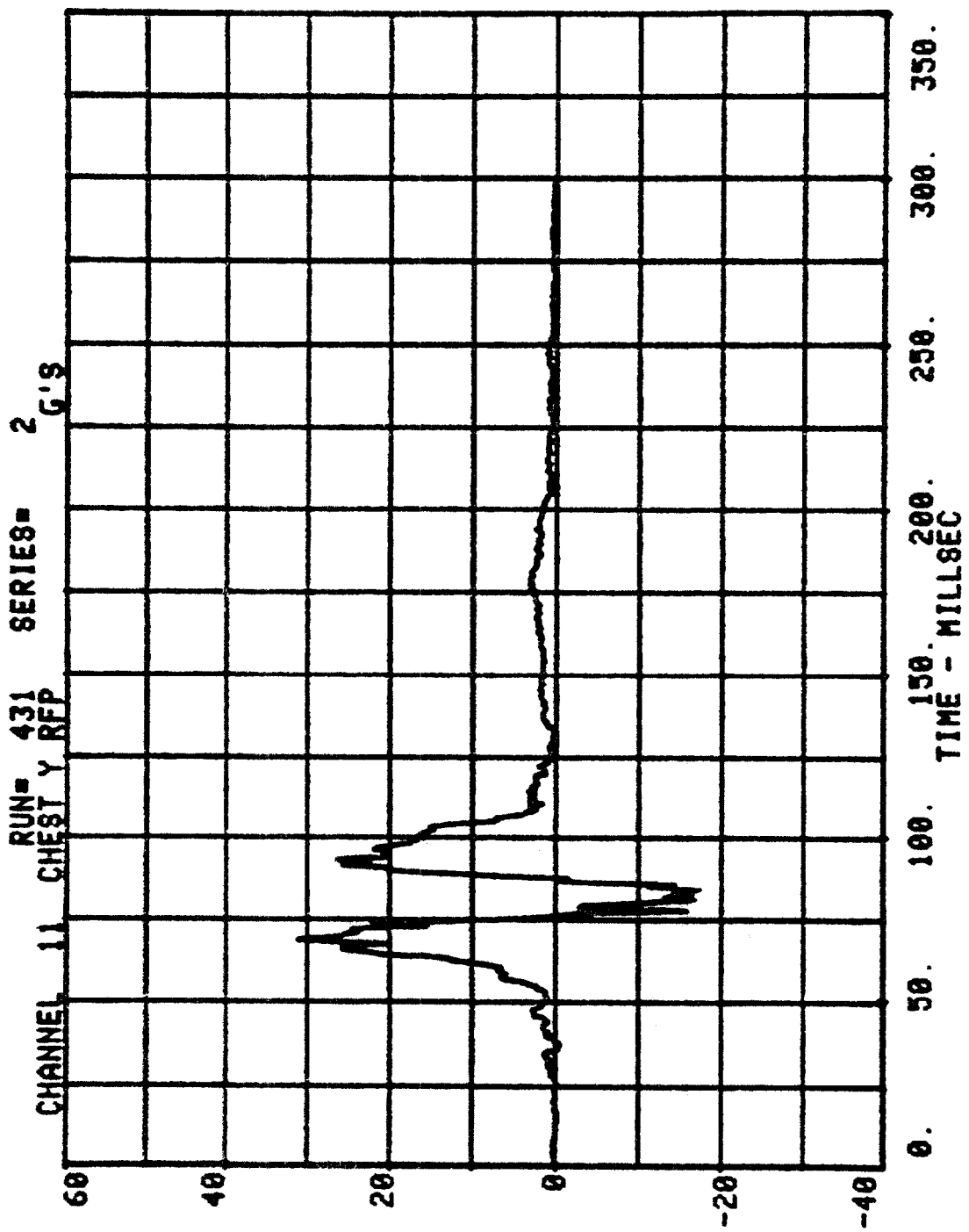


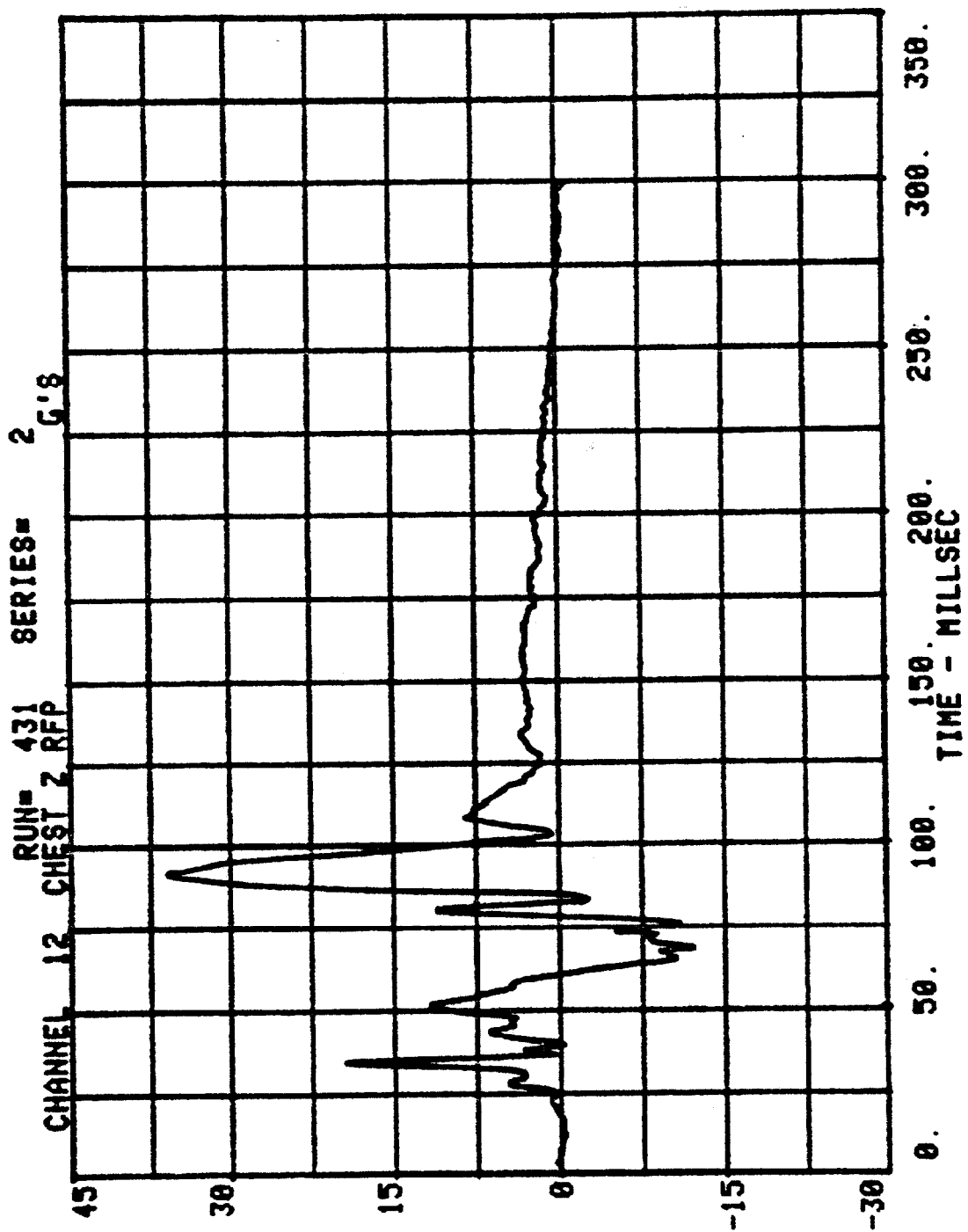




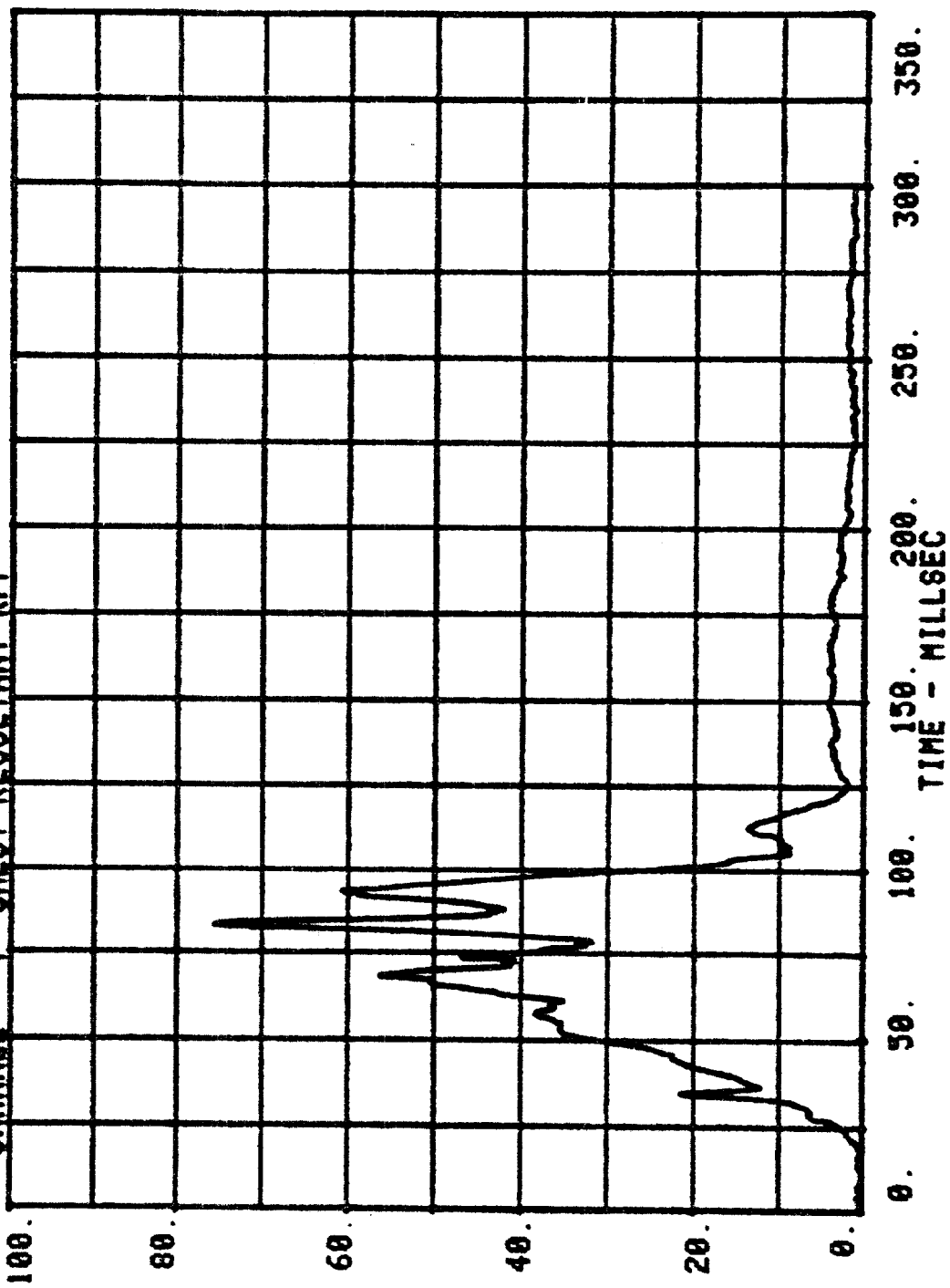


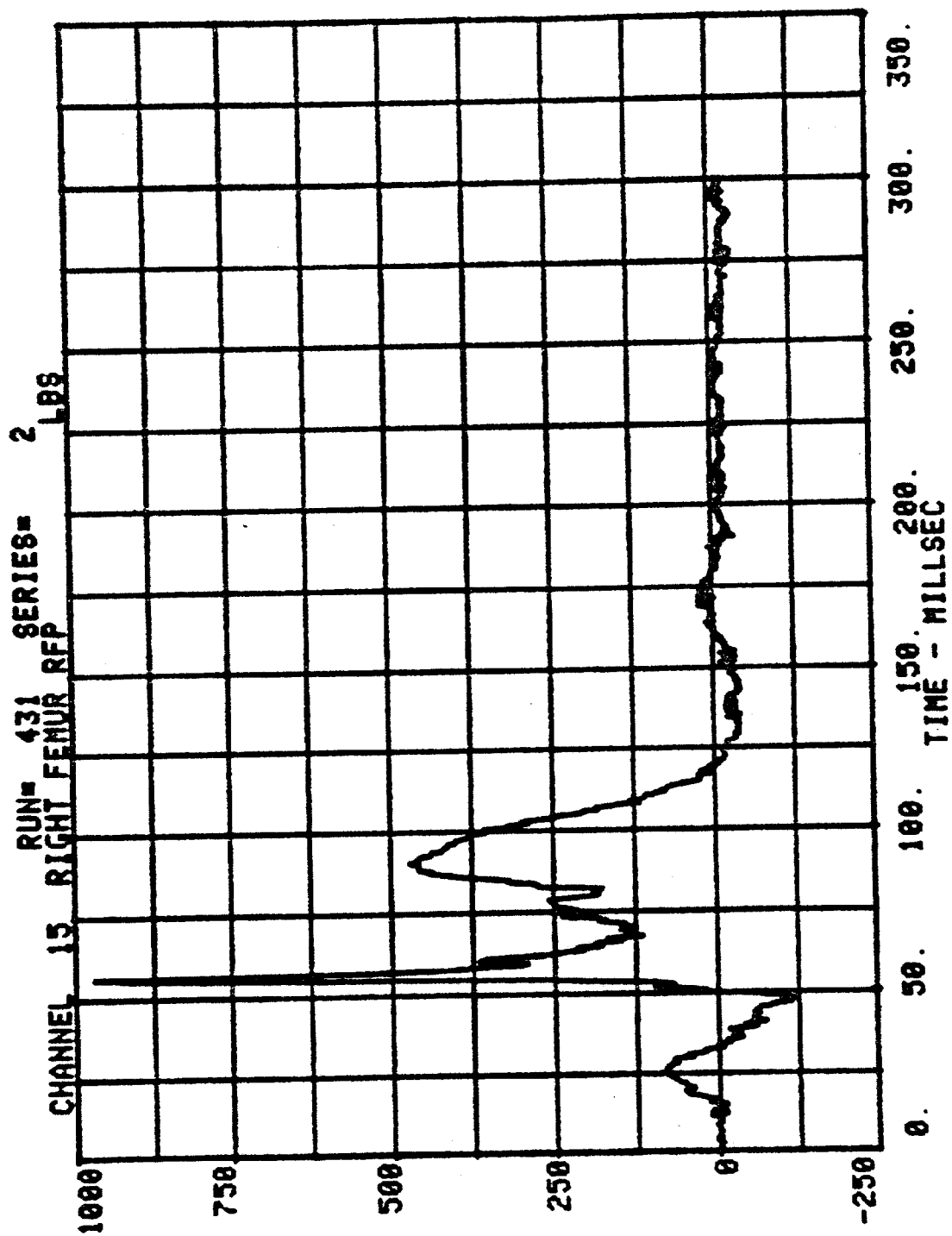


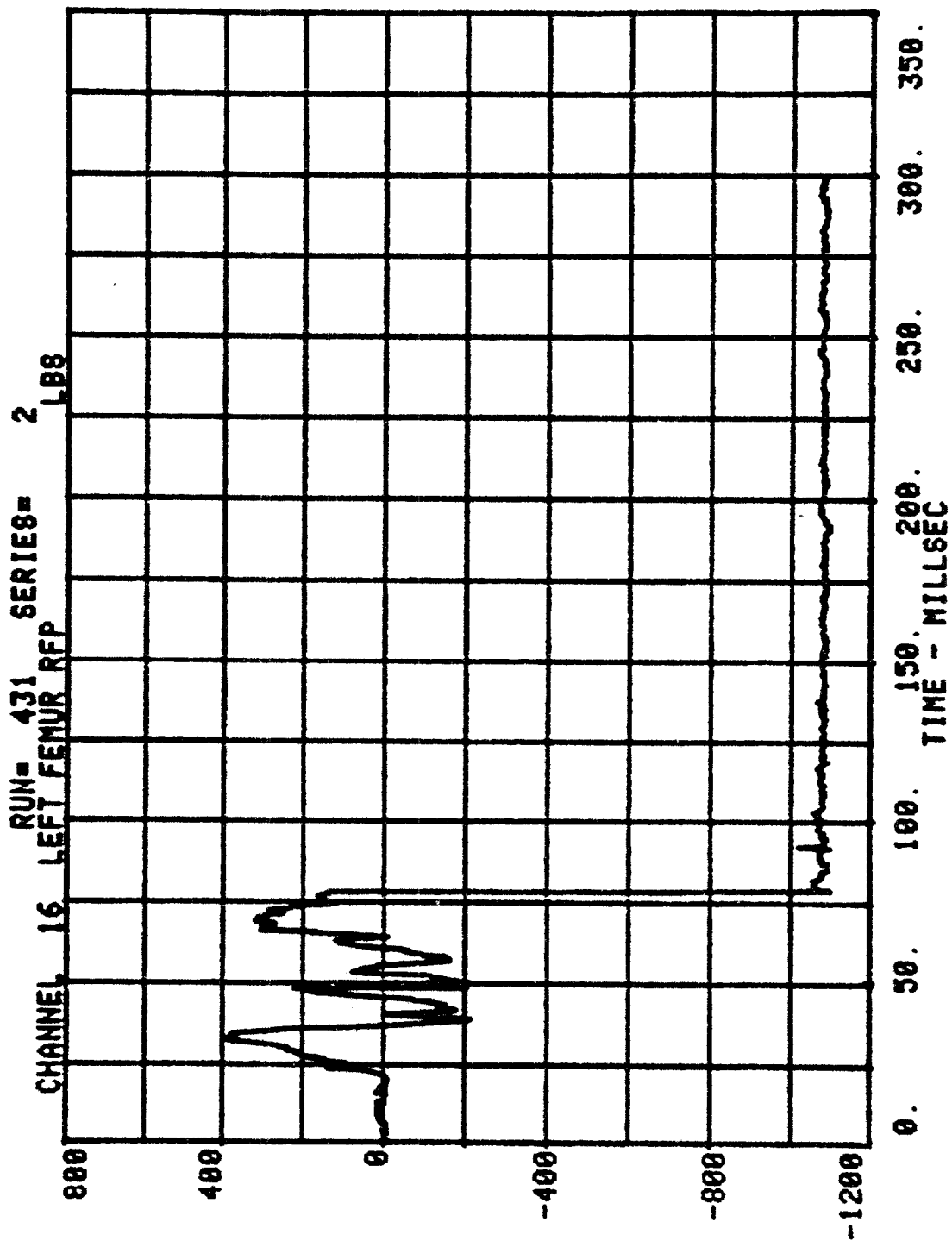


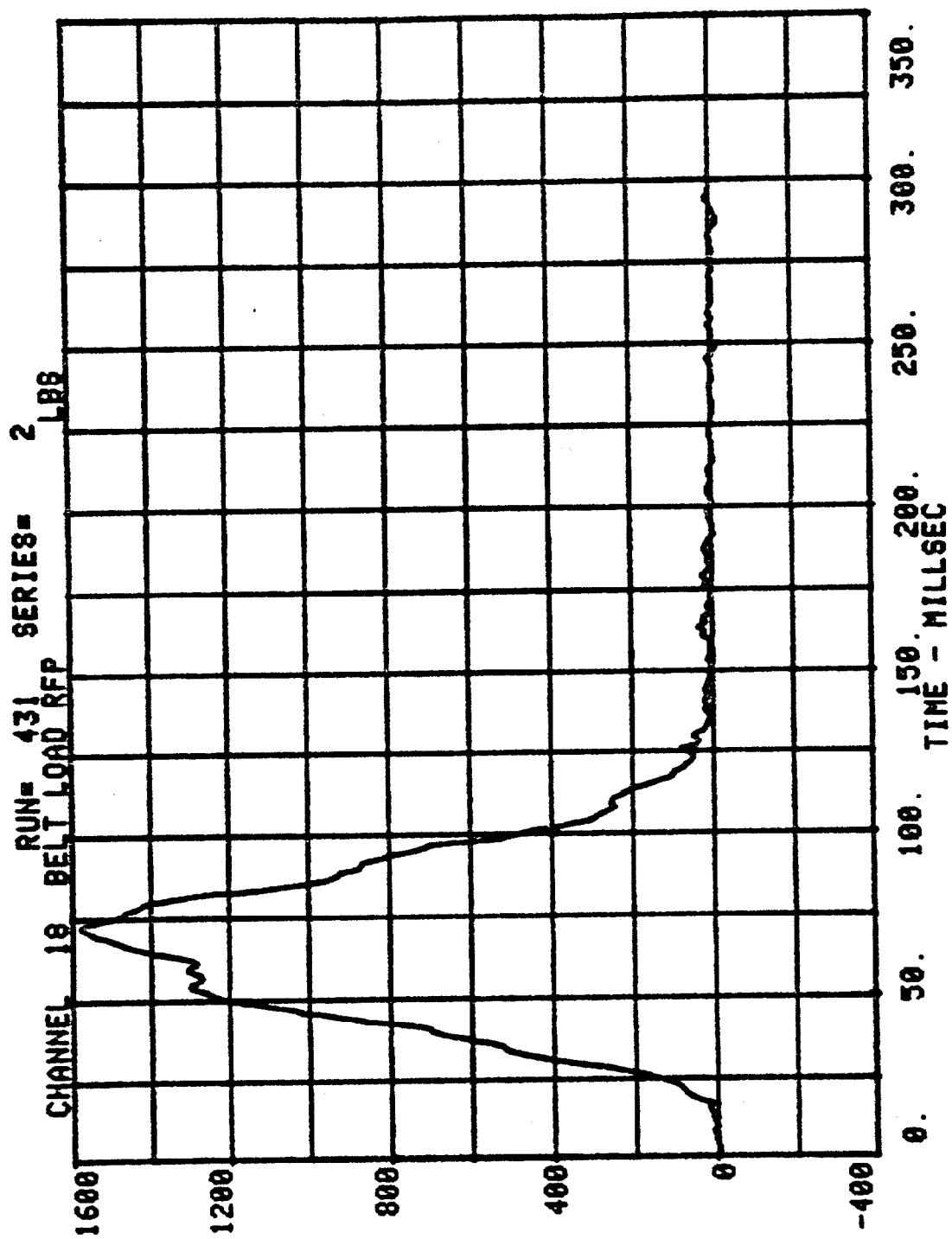


CHANNEL 4 RUN= 431 SERIES= 2
CHEST RESULTANT RFP









APPENDIX C
DUMMY CERTIFICATION TESTS

This test report contains results from certification tests performed on Alderson Research Laboratories Model ATD 30034, 50th percentile anthropomorphic test dummies, Serial Nos. 319, 320, which were completed on June 1, 1979. 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, Vol. 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 is presented in the following tables, Table 1C through 8C along with the Part 572 requirements.

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

1	8	2
---	---	---

LABORATORY TECHNICIAN: FRED JULIANO

APPROVED BY: Bruce D. Smith

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		6-5-79	
Calibration Sequential Number for Dummy - - - -		1	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		72	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		64	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	237.6	
b. Peak Lateral Accel. - -	≤10G	8	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.3	
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	24.35	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	21	
c. Peak Resultant Head Acceleration - - - -	26G maximum	23.2	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1.5	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	25	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	9	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	117	
h. Max. Head Rotation - -	63 to 73°	63°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0
	Displ.	-.5 to .5 in	0
30°	Time	25.6 to 34.4 ms	28
	Displ.	2.1 to 3.1 in.	2.75
60°	Time	40.3 to 51.7 ms	47
	Displ.	4.3 to 5.3 in.	5.25
Maximum (°)	Time	53.2 to 66.8 ms	55
	Displ.	5.0 to 6.0 in.	5.85

Continued

P, 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

1	8	2
---	---	---

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST Continued				
i. Chordal Displacement:				
Head Rotation Angle --				
60°	Time	67.0 to 83.0 ms	68	
	Displ.	4.3 to 5.3 in.	5.2	
30°	Time	85.4 to 104.6 ms	90	
	Displ.	2.1 to 3.1 in.	2.55	
0°	Time	101.0 to 123.0 ms	111.5	
	Displ.	-.5 to 0.5 in.	.08	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - - -		50 to 63 lbs.	52.5	
b. Force @ 1.3" - - - - -		73 to 80 lbs.	75.0	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - - -		22 to 34 lbs.	27.5	
b. Force @ 30° - - - - -		34 to 46 lbs.	40	
c. Force @ 40° - - - - -		46 to 58 lbs.	50	
d. Return Angle - - - - -		12° maximum	9.5	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - - - - -		21.78-22.22 fps	22.0	
(2) Peak Deflection - - - - -		1.7" maximum	1.5	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	2030	
(4) Internal Hysteresis - - - - -		50 to 70%	61%	
b. Low Speed				
(1) Probe Speed - - - - -		13.86-14.14 fps	13.9	
(2) Peak Deflection - - - - -		1.1" maximum	1.0"	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1295	
(4) Internal Hysteresis - - - - -		50 to 7%	61%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

1	8	2
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TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.02	
(2) Maximum Force - -	1850 to 2500 lbs	2025	
(3) Time Above 1000#	1.7 ms minimum	2.0	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.89	
(2) Maximum Force - -	1850 to 2500 lbs.	2000	
(3) Time Above 1000#	1.7 ms minimum	1.9	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1	8	2
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CALIB. SEQ. NOS. FOR DUMMY: _____ & _____

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	CP30	1-79	
ENDEVCO	CK09	1-79	
ENDEVCO	CL79	1-79	
BELL HOWELL	22704	1-79	
ENDEVCO	CT01	1-79	
BELL HOWELL	22707	12-78	
OHMITE	JAIN 200P	6-79	
GSE	77	1-79	
GSE	76	1-79	
BELL HOWELL	17547	2-79	
BELL HOWELL	16928	1-79	
BLH ELECTRONICS	72952	6-79	
BLH ELECTRONICS	72952	6-79	
BOURNS	108	6-79	
C-6		6525-V-2	

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY I.D. NO.:

1	8	3
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LABORATORY TECHNICIAN: _____

APPROVED BY: _____

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		6-5-79	
Calibration Sequential Number for Dummy - - -		2	
Temperature in Lab. (Spec. = 66 to 78°F) - - -		72°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		69%	
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST:			
a. Peak Resultant Accel. -	210 to 260G	232	
b. Peak Lateral Accel. - -	≤10G	5	
c. Time above 100G - - -	0.9 to 1.5 ms	1.2	
2. NECK BENDING TEST:			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	24.08	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - -	20 to 24G	22	
c. Peak Resultant Head Acceleration - - - -	26G maximum	22	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	2	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	25	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	7	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	115	
h. Max. Head Rotation - -	63 to 73°	65°	
i. Chordal Displacement:			
Head Rotation Angle - -			
0°	Time	-2 to 2 ms	0
	Displ.	-.5 to .5 in	0
30°	Time	25.6 to 34.4 ms	27
	Displ.	2.1 to 3.1 in.	2.7
60°	Time	40.3 to 51.7 ms	44
	Displ.	4.3 to 5.3 in.	4.95
Maximum (°)	Time	53.2 to 66.8 ms	56
	Displ.	5.0 to 6.0 in.	5.45

Continued

P, 572 DUMMY CALIBRATION TEST DATA Continued:

Dummy I.D. No.:

1	8	3
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TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. <u>NECK BENDING TEST</u> <u>Continued</u>			
i. Chordal Displacement:			
Head Rotation Angle --			
60°	Time	67.0 to 83.0 ms	68
	Displ.	4.3 to 5.3 in.	5.0
30°	Time	85.4 to 104.6 ms	90
	Displ.	2.1 to 3.1 in.	2.5
0°	Time	101.0 to 123.0 ms	107
	Displ.	-.5 to 0.5 in.	.15
3. <u>ABDOMINAL COMPRESSION TEST:</u> (Preload = 10 pounds)			
a. Force @ 1" - - - -	50 to 63 lbs.	55	
b. Force @ 1.3" - - - -	73 to 80 lbs.	80	
4. <u>LUMBAR FLEXION TEST:</u>			
a. Force @ 20° - - - -	22 to 34 lbs.	30	
b. Force @ 30° - - - -	34 to 46 lbs.	40.5	
c. Force @ 40° - - - -	46 to 58 lbs.	54.0	
d. Return Angle - - - -	12° maximum		
5. <u>CHEST IMPACT TESTS:</u>			
a. High Speed			
(1) Probe Speed - -	21.78-22.22 fps	21.9	
(2) Peak Deflection -	1.7" maximum	1.35"	
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	2034	
(4) Internal Hysteresis - - - -	50 to 70%	64%	
b. Low Speed			
(1) Probe Speed - - -	13.86-14.14 fps	14.0	
(2) Peak Deflection -	1.1" maximum	95"	
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1349	
(4) Internal Hysteresis- - - -	50 to 7%	63%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

Dummy I.D. No.:

1	8	3
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TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. KNEE IMPACT TESTS:			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.03	
(2) Maximum Force - -	1850 to 2500 lbs	1950	
(3) Time Above 1000#	1.7 ms minimum	2.0	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	6.98	
(2) Maximum Force - -	1850 to 2500 lbs.	2175	
(3) Time Above 1000#	1.7 ms minimum	2.0	

INSTRUMENT CALIBRATION INFORMATION

DUMMY I.D. NO.:

1	8	3
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CALIB. SEQ. NOS. FOR DUMMY: _____ & _____

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
	CS70		
ENDEVCO		1-79	
ENDEVCO	CS27	1-79	
	CU88		
ENDEVCO		1-79	
BELL & HOWELL	A49	12-78	
ENDEVCO	CH31	1-79	
BELL & HOWELL	A73	1-79	
OHMITE	JAIN 200P	6-79	
D. J. INSTR.	1926	1-79	
D. J. INSTR.	1707	1-79	
BELL & HOWELL	17547	2-79	
BELL & HOWELL	16928	1-79	
BLH ELECTRONICS	72952	6-79	
BLH ELECTRONICS	72952	6-79	
BOURNS	108	6-79	
C-10			6525-V-2

Electronic Test Equipment

The complement of signal conditioning recording and display equipment used in conjunction with dummy certification testing is shown in Figure 8.

- Data Acquisition - Sangamo Mod 3500 14 channel FM Tape Transport (recording Speed: 60 in/sec).
- Data Reduction - Brush Mark 260 6-channel recorder or Pace X-Y plotter.
- Signal Conditioning - Calspan designed and fabricated bridge amplifiers providing gain, balance, and shunt calibration of all sensor inputs.
- Computational Equipment - Calspan designed and fabricated analog computer consisting of operational amplifiers in circuit configurations providing continuous computation of acceleration vector magnitude and Severity Index relationships.
- Signal Filtering - Calspan designed and fabricated second order active filters (6 channels) with selectable frequency responses consistent with SAE J211b Class 60, 180, 600, and 1000 requirements. Filters are compensated for 32:1 real time expansion resulting from data recording at 60 in/sec and playback at 1-7/8 in/sec.
- Real Time Reference - Tektronix Time Mark Generator; 1 and 10 millisecond is synchronously recorded with all certification data and reproduced at playback on all strip chart records.

- The data acquisition, reproduction, and time reference equipment is maintained by Calspan's Equipment and Standards Laboratory (ESL), which is an NBS traceable calibration facility. Other special purpose equipment is maintained by qualified test facility personnel using support equipment maintained and standardized by all ESL.

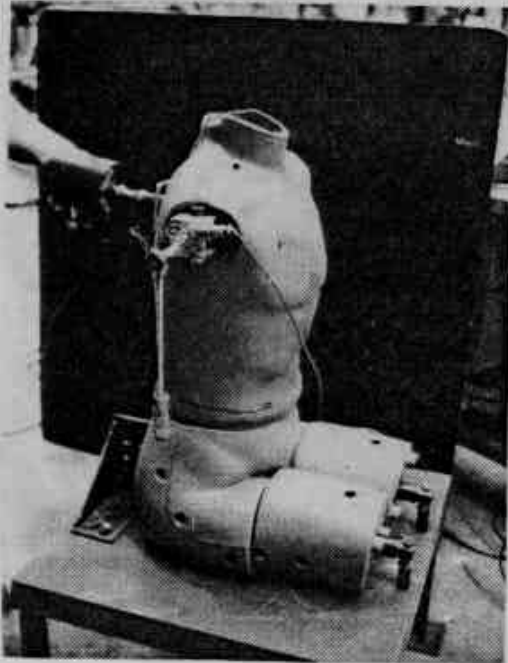


FIGURE C-1

LUMBAR SPINE FLEXION TEST APPARATUS

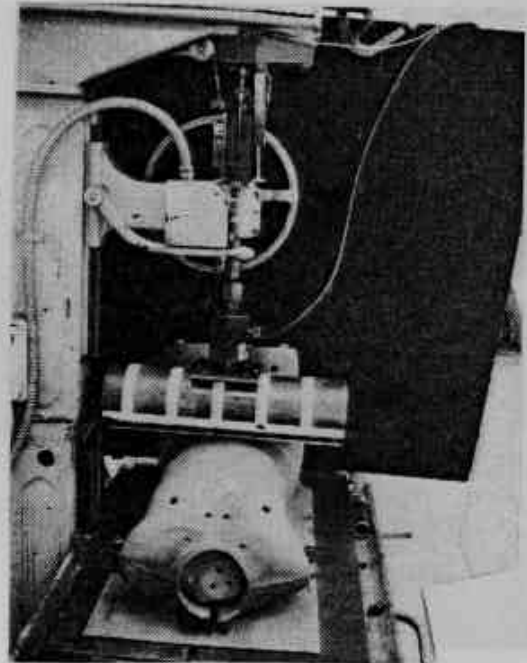


FIGURE C-2

ABDOMEN PRESS TEST APPARATUS

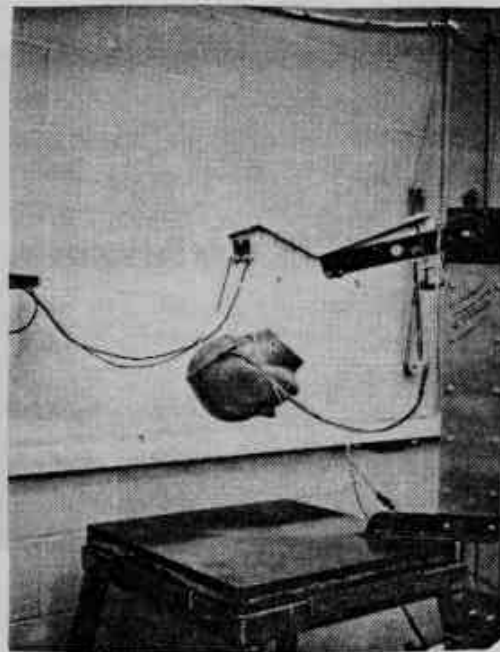


FIGURE C-3

HEAD DROP TEST APPARATUS

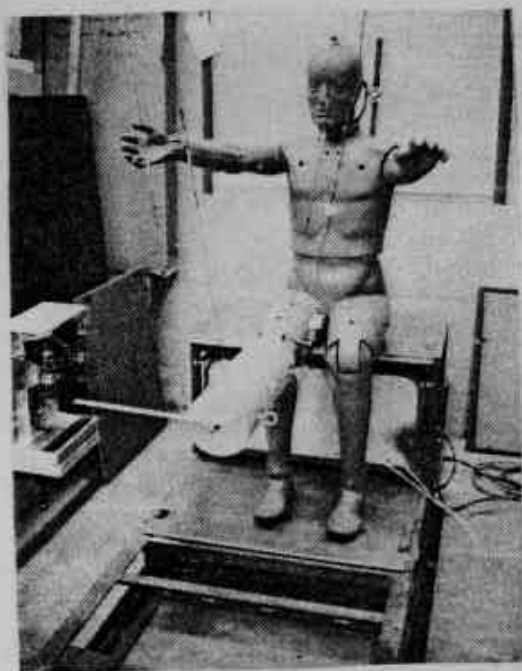


FIGURE C-4
KNEE IMPACT TEST APPARATUS

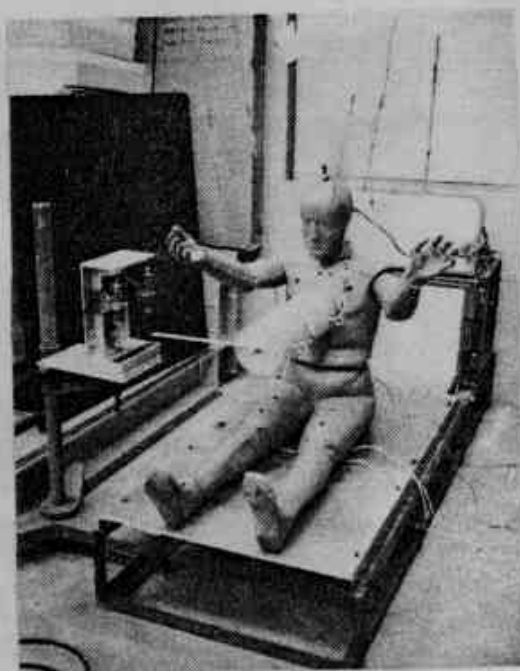


FIGURE C-5
THORAX IMPACT TEST APPARATUS

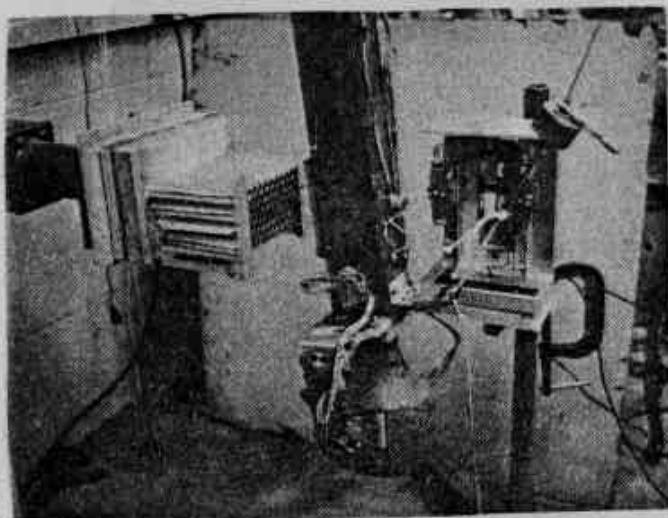


Figure C-6
NECK IMPACT TEST APPARATUS

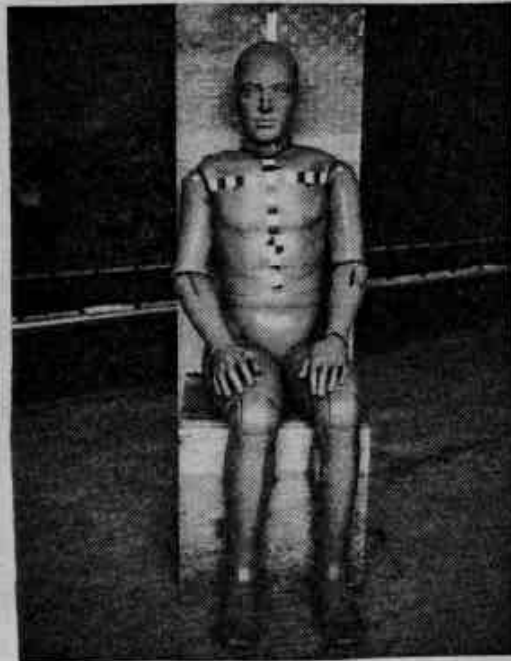


FIGURE C-7



FIGURE C-7
PART 572 TEST DUMMY
FRONT & SIDE VIEW

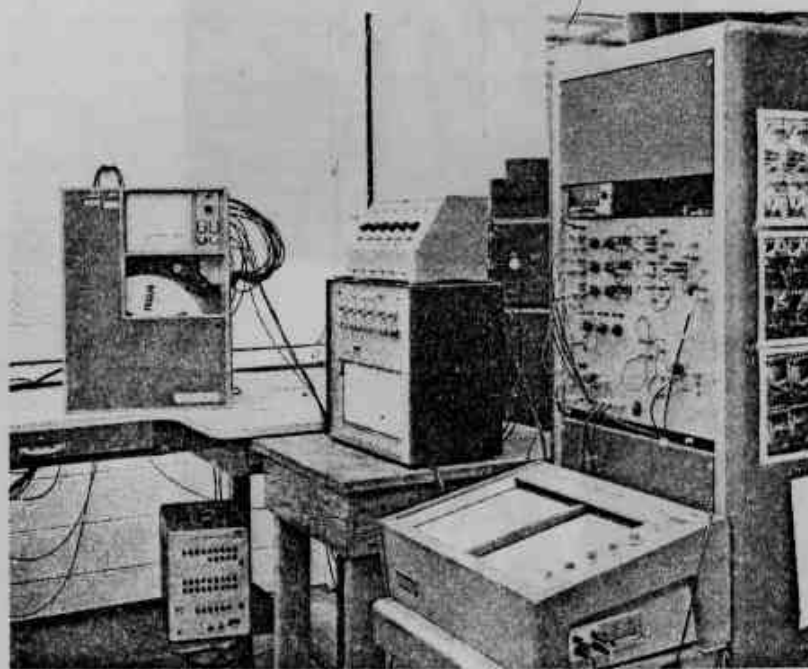


Figure C-8. ELECTRONIC TEST EQUIPMENT