

NEW CAR ASSESSMENT AND STANDARDS
ENFORCEMENT INDICANT TESTING
FMVSS NOS. 212, 219 AND 301-75

AMERICAN MOTORS CORPORATION
1980 AMC Concord 2-Door
NHTSA 308-29-470

CALSPAN CORPORATION
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October 15, 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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16. Abstract A frontal barrier test of a 1980 AMC Concord 2-door was performed at Calspan Corporation, Advanced Technology Center, Transportation Research Department facility for the New Car Assessment and Standards Enforcement Inducant Testing of FMVSS 212 - Windshield Mounting; FMVSS 219 - Windshield Zone Intrusion; FMVSS No. 301 - Fuel System Integrity for the Office of Vehicle Safety Compliance, the Office of Automotive Ratings and for Research and Development. The impact speed was 34.7 mph. The post-test vehicle crush was 20.8 inches. Intrusion of firewall into compartment was 3.0 inches. Test vehicle complied in all respects with following: 1. FMVSS 212 - Windshield Retention. 2. FMVSS 219 - Windshield Intrusion. 3. FMVSS 301-75 - Fuel System Integrity, FMVSS 208 injury criteria were exceeded by the following dummy occupants: Driver - Head and Chest Right Front Passenger - Head 6-Year Old-Size Rear Seat Passenger - 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 AMC Concord 2-door) meets the requirements of FMVSS Nos. 212, 219 and 301-75 at a higher test speed and also to obtain structural information and dummy injury criteria values 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 Standard Enforcement and the amendments in effect as noted by the applicable contract.

SUMMARY OF TEST NUMBER 29

A frontal barrier crash test was performed on a 1980 AMC Concord 2-door sedan at an impact velocity of 34.7 mph. Pre- and post-test photographs of the vehicle and occupants can be viewed in Appendix A and Table 1 presents pertinent crash test information.

The vehicle occupants included a 50th percentile Part 572 driver wearing a production 3-point belt, a 50th percentile Part 572 right front passenger also restrained with a 3-point belt and a lap-belted Anderson VIP-6C 6-year old-size ATD right rear seat passenger.

Both 50th percentile ATD's were fully instrumented (head, chest and femurs) and the 6-year old size ATD with head and chest triaxial accelerometers. Certification data and photographs of the test setup are found in Appendix C.

Injury criteria values are presented in Table 3, and Appendix B contains dummy response data traces along with vehicle acceleration data traces.

Maximum firewall intrusion into the occupant compartment was 3.0 inches and maximum crush of the test vehicle was 20.8 inches.

Post-test observations are summarized in General Comments, page 2-3.

Table 1

CRASH TEST SUMMARYTEST NO. 308-29-470PROJECT: NEW CAR ASSESSMENT PROGRAMDATE: 10/15/79TIME: 1150TEMP: 50⁰FVEHICLE American Motors Concord 2-Door SedanTEST WEIGHT (lbs) 3700IMPACT ANGLE (deg)* 0IMPACT VELOCITY (mph)** 34.7 mphMAX. CRUSH (in) 20.8"MAX. INTRUSION (in) 3.0"

DUMMIES

TYPE	<u>HYBRID II, PART 572</u>	<u>HYBRID II, PART 572</u>	<u>ALDERSON VIP - 6C</u> <u>6-YEAR OLD SIZE</u>
LOCATION	<u>LF(1)</u>	<u>RF(2)</u>	<u>RR(3)</u>
RESTRAINT	<u>Production 3-Point</u> <u>Belt System</u>	<u>Production 3-Point</u> <u>Belt System</u>	<u>Lap Belt</u>
NUMBER OF DATA CHANNELS	<u>42</u>		
NUMBER OF HIGH SPEED CAMERAS	<u>9 + 1 Real Time</u>		

*With respect to tow track Centerline

**Speed trap measurement (± .05% accuracy)

GENERAL COMMENTS

The 1980 American Motors Concord 2-door sedan involved in a frontal barrier crash at a velocity of 34.7 mph complied with FMVSS Nos. 212 - Windshield Mounting; 219 - Windshield Zone Intrusion and 301-75 - Fuel System Integrity. There was 100% retention of the windshield, no intrusion into the protected zone and no fuel leakage after impact or any phase of the rollover test.

All of the occupants exceeded the FMVSS 208 - Injury Criteria HIC number limit of 1000. Both the driver and the 6 year-old size ATD also exceeded the Chest Resultant Acceleration limit of 60 g. The right front passenger's head struck the instrument panel. The driver's head and chest contacted the steering wheel. Deformation of the steering wheel can be seen in Figures A-14 and A-15.

The 6-year old-size ATD appeared to have significant forward motion even though he was lap belted. As the right front seat stroked forward on impact, his head struck the back of this seat and he slid down. His head was apparently jammed into this position when the front seat rebounded (see Figure A-18).

Other observations:

- After impact, both the driver and passenger doors could be opened; however, the driver door window, which was in the down position, had completely shattered.
- The windshield has a few stress cracks on the right side of the vehicle.
- All tires remained inflated.

Table 2

VEHICLE TEST WEIGHTS AS TESTED

Left Front 1000 lbs
Right Front 1000 lbs
TOTAL FRONT 2000 lbs

Left Rear 840 lbs
Right Front 860 lbs
TOTAL REAR 1700 lbs

Total Weight = $\frac{2000 + 1700}{1} = 3700$ lbs

Wheel Base = $\frac{108.5}{1}$ inches

Cg_{F.W.} = $\frac{1700 \text{ lbs} \times 108.5 \text{ inches}}{3700 \text{ lbs}} = 49.8$ inches

CALCULATION FOR TEST WEIGHT

RCLW = Rated Cargo and Luggage Weight
UDW = Unloaded Delivered Weight ($\frac{3130}{1}$ lbs)
VCW = Vehicle Capacity Weight ($\frac{775}{1}$ lbs)
DSC = Designated Seating Capacity ($\frac{4}{1}$)

RCLW = VCW - 150 (DSC)

RCLW = $\frac{775}{1} - 150 (4) = 175$ lbs

TEST WEIGHT = UDW + RCLW + (No. Dummies x 164 lbs) + wt. 6-Year Old-Size Dummy

TEST WEIGHT = $\frac{3130}{1}$ lbs + $\frac{175}{1}$ lbs + 2 (164 lbs) + 48

TEST WEIGHT = $\frac{3681}{1}$ lbs

DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G") *											
	HEAD				CHEST				PELVIS			
	X	Y	Z	R	X	Y	Z	R	X	Y	Z	R
DUMMY (1)	-60	10	73.5	94	-57.7	-10	20	61				
DUMMY (2)	-42	38.5	75.4	79	-33	24.6	16.3	39				
DUMMY (3)	-103	-70	135	157	-35	24	52.6	64				
DUMMY (4)												

	MAXIMUM FORCE-FEMUR LOAD (LBS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	910	1300
DUMMY (2)	337	375
DUMMY (3)		
DUMMY (4)		

	MAXIMUM FORCE-SEAT BELTS LOADS (LBS)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP BELT LOAD	
DUMMY (1)	1925	2000	
DUMMY (2)	2360	1500	
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)	1077.8	.0558	.0975	58.2	1452.9	
DUMMY (2)	1457.2	.0624	.1188	58.2	1800.2	
DUMMY (3)	4025.3	.0708	.1317	84.7	6415.6	
DUMMY (4)						

*DEFINED AS EXCEEDING 0.003 SEC. DURATION

**AS DEFINED IN FMVSS NO. 208

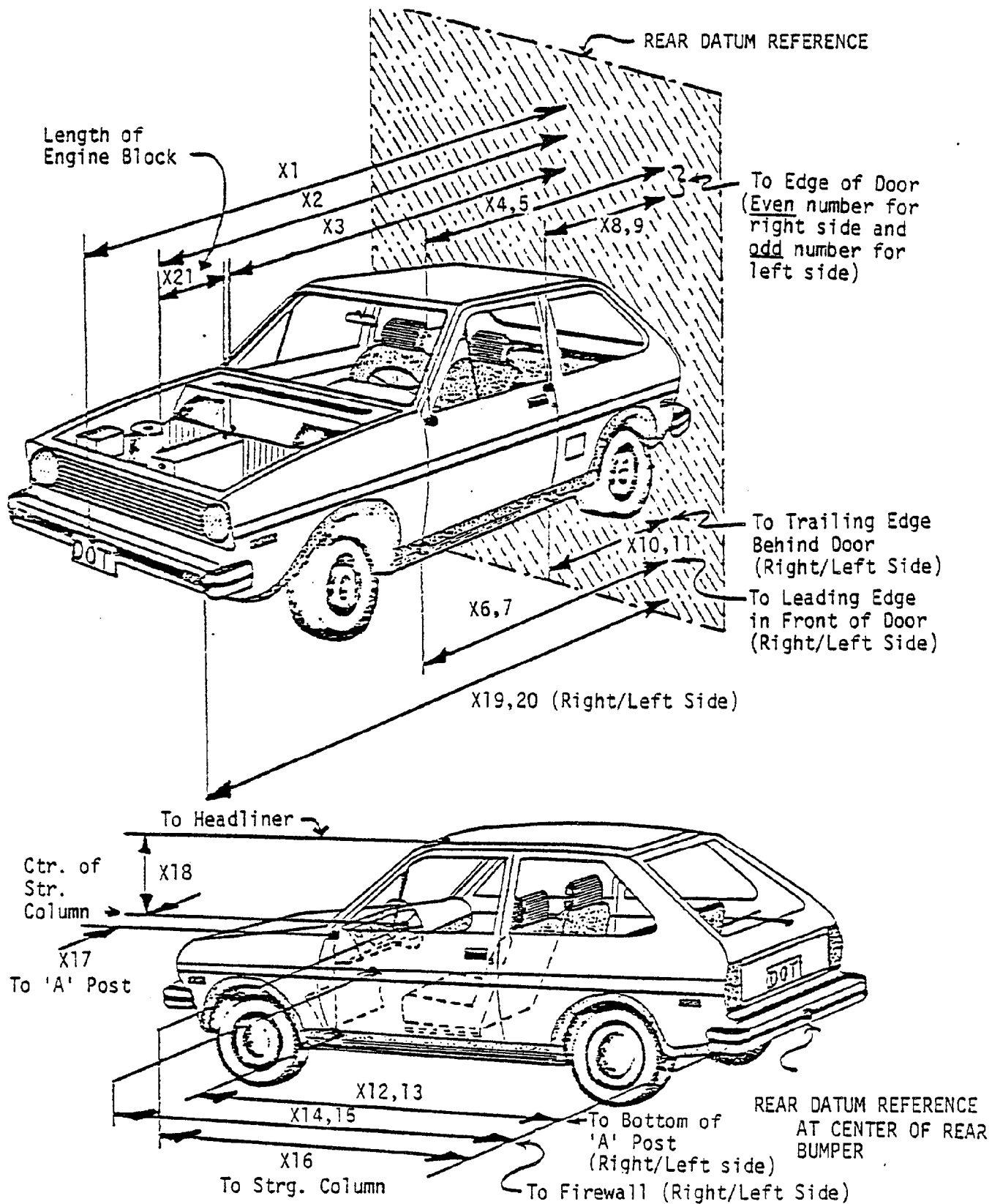


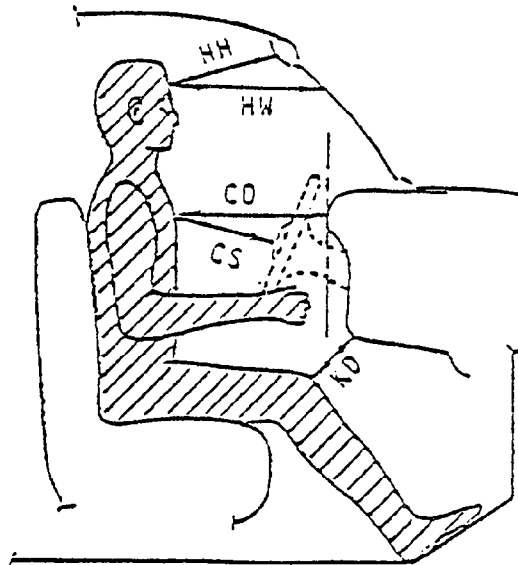
Figure 1 PRE-TEST AND POST-TEST MEASUREMENT POINTS

VEHICLE MEASUREMENTS

All Dimensions in inches

NO.		Pre-Test	Post-Test
X1	Total Length of Vehicle at Centerline	185.9	166.4
X2	Rear Surface of Vehicle to Front of Engine	164.5	159.0
X3	Rear Surface of Vehicle to Firewall	136.1	134.8
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	129.5	129.7
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	129.5	130.0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	129.1	128.1
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	129.1	128.4
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	79.0	79.2
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	79.0	79.2
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	79.6	78.5
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	79.5	78.9
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	125.9	125.3
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	125.9	125.3
X14	Rear Surface of Vehicle to Firewall - Right Side	136.9	134.0
X15	Rear Surface of Vehicle to Firewall - Left Side	137.6	134.6
X16	Rear Surface of Vehicle to Steering Column	109.5	108.4
X17	Center of Steering Column to "A" Post	15.3	19.2
X18	Center of Steering Column to Headliner	16.9	14.3
X19	Rear Surface of Vehicle to Right Side of Front Bumper	184.8	165.1
X20	Rear Surface of Vehicle to Left Side of Front Bumper	184.9	164.1
X21	Length of Engine Block	28.0	28.0
X??	DASH TO REAR DECK	83.0	81.3

	<u>DRIVER</u>	<u>PASS</u>
HH	13.7	13.2
HW	20.0	20.0
CD	24.0	24.2
CS	15.7	N/A
KDL	11.0	10.7
KDR	10.6	11.0



HR	6.6	6.2
HS	8.5	8.1
AD	4.2	4.9
HD	7.8	8.2

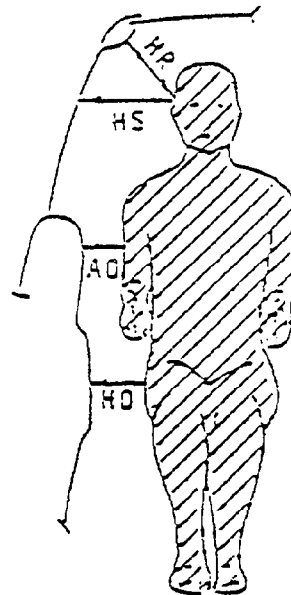


Figure 2 OCCUPANT CLEARANCE DIMENSIONS

Note: Camera information shown in Table 5.

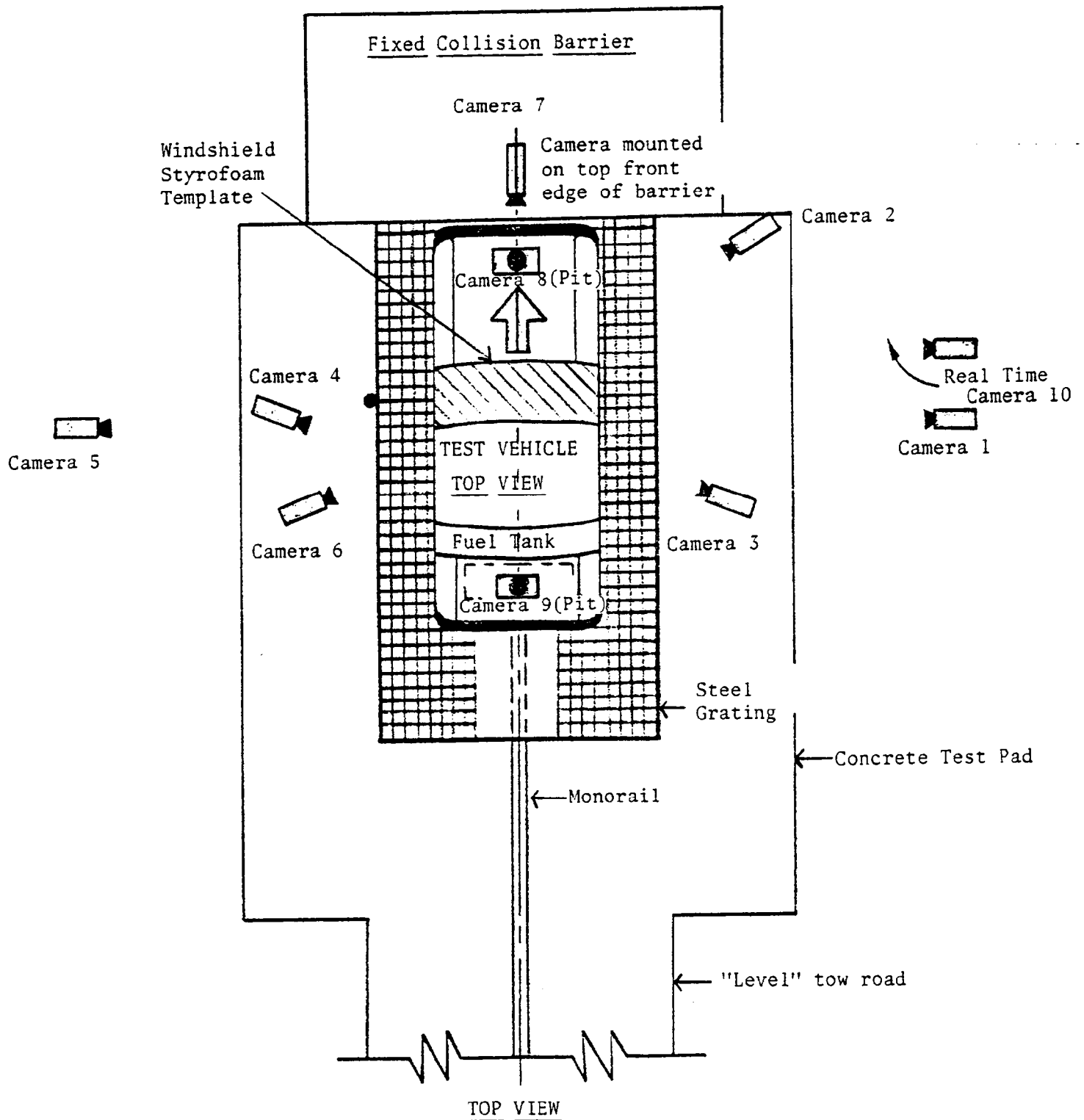


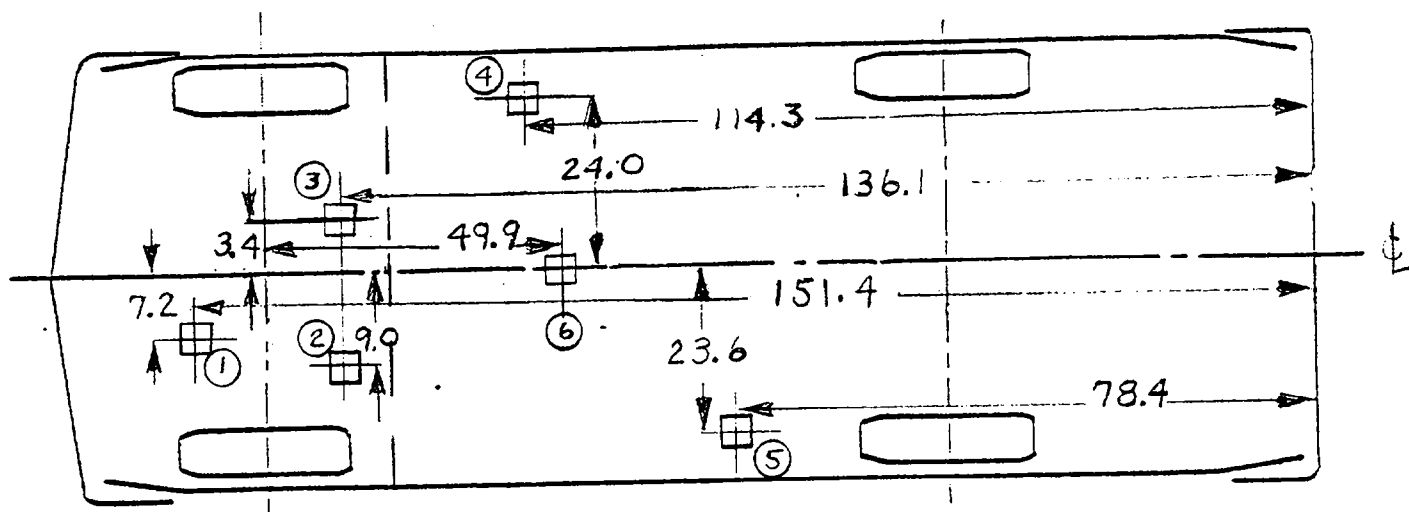
Figure 3 CAMERA POSITIONS FOR FRONTAL IMPACTS

Table 5
HIGH SPEED CAMERA INFORMATION
 (Test 308-29-470)
 AMC Concord Frontal

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)
1	SOUTH WIDE	HYCAM	13 mm	825
2	SOUTH WINDSHIELD	FASTEX	50 mm	1100
3	SOUTH DUMMY	FASTEX	50 mm	1100
4	NORTH DUMMY	FASTEX	50 mm	1450
5 (1)	NORTH WIDE	FASTEX	35 mm	--
6	NORTH REAR	FASTEX	50 mm	1400
7	BARRIER FACE	PHOTOSONICS	8 mm	850
8	PIT FRONT	PHOTOSONICS	13 mm	1000
9	PIT REAR	PHOTOSONICS	13 mm	500
10	SOUTH WIDE	REAL TIME	--	24

(24 fps) real time movie film coverage of pre-crash, post-crash and crash event spliced at start and end of film.

(1) Film damaged in processing.



ACCELEROMETER NUMBER *	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Engine	X		X
2	Firewall above Steering Column	X		X
3	Firewall at Vehicle Centerline	X		X
4	Front Seat "Crossbeam"	X		
5	Rear Seat "Crossbeam"	X		X
6	CG	X	X	X

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

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

Table 6
SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION

Vehicle Manufacturer American Motors Corporation
Make/Model Concord DC 2-Door Sedan
Body Style 2-Door Model Year 1979
VIN AOA065C108206 Build Date July 1979
NHTSA No. 308-29-470 Color Maroon
Engine Data: 6 cylinders 258 in³/ displacement
Transmission Data: 3 speed () Manual (☒) Automatic
Date Vehicle Received by Laboratory September 21, 1979
Dealer's Name & Address Sheridan Amherst Motors, 3900 Sheridan Drive, Buffalo, N. Y.

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR 'B' POST

Vehicle Manufactured by American Motors Corporation
Date of Manufacture July 1979 VIN AOA065C108206
GVRW 4142 lbs GAWR: Front 2156 lbs Rear 2008 lbs

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.

Vehicle Load (up to capacity) - Front 24 psi
Rear 24 psi
Recommended Tire Size D78-14 Load Range: ☒ B ☐ C ☐ D
Vehicle Capacity: Types of Seats ☐ Bench ☒ Bucket ☐ Split Bench
Number of Occupants (Designated Seating Capacity): 2 Front
2 Rear
4 TOTAL
Cargo Load = 175 lbs
TOTAL = 775 lbs

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

Right Front = 880 lbs Right Rear = 680 lbs
Left Front = 920 lbs Left Rear = 650 lbs
TOTAL FRONT WEIGHT = 1800 lbs (57.5 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1330 lbs (42.5 % of Total Vehicle Weight)
TOTAL DELV. WEIGHT = 3130 lbs

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 194 lbs CARGO

Right Front = 1000 lbs Right Rear = 860 lbs
Left Front = 1000 lbs Left Rear = 840 lbs
TOTAL FRONT WEIGHT = 2000 lbs (54.0 % of Total Vehicle Weight)
TOTAL REAR WEIGHT = 1700 lbs (46.0 % of Total Vehicle Weight)
TOTAL TEST WEIGHT = 3700 lbs
Weight of ballast secured in vehicle trunk area = 0 lbs

Table 6
SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS

Date of Test October 15, 1979 Time of Test 1150 am/pm
Ambient Temperature 50 °F at impact area
Temperature in Occupant Compartment 64 °F
Windshield Molding Temperature 52 °F

VEHICLE ATTITUDE (all dimensions in inches)

Delivered Attitude: RF 27-7/8" LF 27-7/8" RR 28" LR 28"
Test Attitude: RF 27.1 LF 27.2 RR 26.1 LR 26

VEHICLE TIRE DATA

Recommended Cold Tire Pressure: Front = 24 psi Rear = 24 psi
Recommended Tire Size D78-14 Load Range B
Tires on Vehicle D78-14
Is Spare Tire a "Space Saver" X yes no
Is Spare Tire Standard Equipment X yes no

TEST FLUID DATA

Test Fluid Type: Red Stoddard Solvent #2 Spec. Grav.: 0.764
Kinematic Viscosity 0.96 Centistokes
Spill Point Volume* 22.5 gal (SPV)
Test Volume 20.3 gal (90 to 91% of SPV)
Fuel System Capacity (data from Owner's Manual) 22 gal
Details of fuel system Fuel tank is strapped under trunk area with
filler tube and cap located in the back center of the vehicle above the
bumper.
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 X No

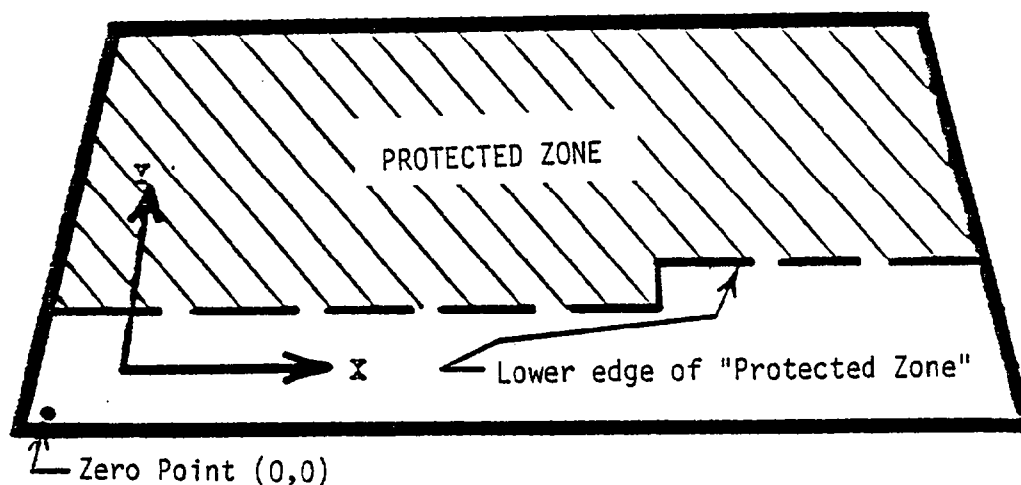
VEHICLE REBOUND AND CRUSH

Overall Length of Test Vehicle: Pre-Test = R 184.8 / L 184.9 inches
Post-Test = R 165.1 / L 164.1 inches
Crush = R 19.7 / L 20.8
FOR FRONTAL IMPACTS, distance from front of test vehicle to the barrier
after impact = 12.6 inches

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

DATA SHEET

6525-Y-29



FRONT VIEW

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

- (1) 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.

None

Coordinates	
X	Y

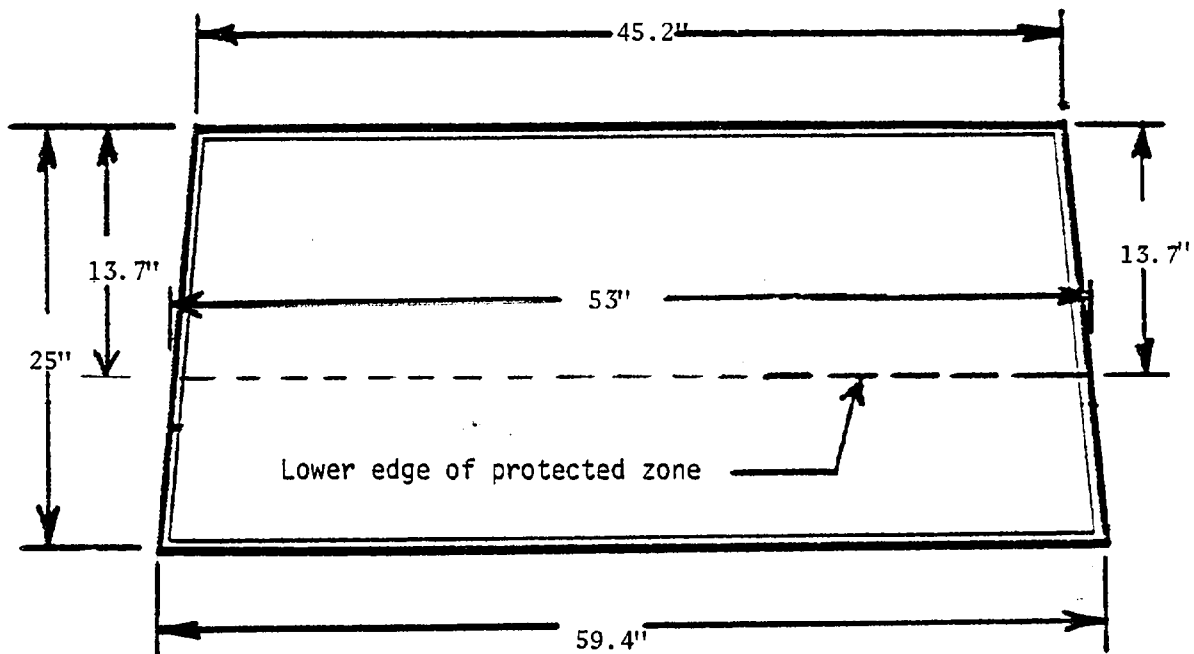
- (2) The area beneath the "Protected Zone" that the inner surface of the windshield was penetrated by a vehicle component.

None

Coordinates	
X	Y

- (3) Record any windshield retention clips or brackets used to insure that the windshield would not disengage from the body.

Figure 5 WINDSHIELD ZONE INTRUSION, FMVSS 219 - DATA SHEET



FRONT VIEW OF WINDSHIELD

Provide all dimensions necessary to reproduce the protected zone.

Method of adhering styrofoam to the windshield:

RTV adhesive applied to windshield surface and to back side of
 styrofoam which was then clamped in place until dry.

Figure 6 PROTECTED ZONE

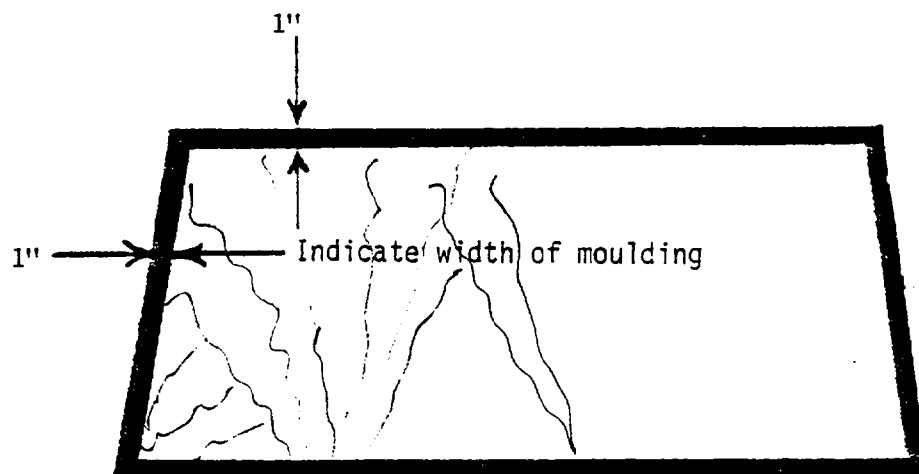
Details of windshield mounting (method of retention, type of trim, etc.):

Windshield is bonded in place and has a one inch chrome piece around the
perimeter of the window

	Windshield Periphery		
	Pre-Test	Post-Test	Retention %
Right Side	77.3	77.3	100%
Left Side	77.3	77.3	100%
TOTAL	154.6	154.6	100%

The standard requires that Post-Test be a minimum of 75 percent of the Pre-Test total periphery measurement for vehicle 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



FRONT VIEW

Figure 7 SUMMARY OF FMVSS 212 DATA

Table 8

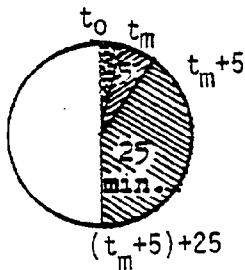
TEST VEHICLE NHTSA NO. 308-29-470 Test Date October 15, 1979
Vehicle Manufacture/Make/Model American Motor Concord 2-Door Sedan

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.

TEST VEHICLE IMPACT TYPE

- X Frontal (35 mph)
 Oblique (30 mph) with ° barrier face first contacting
 driver passenger side
 Rear Moving Barrier (35 mph)
 Lateral Moving Barrier (20 mph)

FUEL SPILLAGE MEASUREMENT



	Actual	Max. Allow.
From impact until vehicle motion ceases	0	1 oz
For 5 min. period after vehicle motion ceases	0	5 oz
For next 25 min.	0	1 oz/1 min

TEST VEHICLE STATIC ROLLOVER

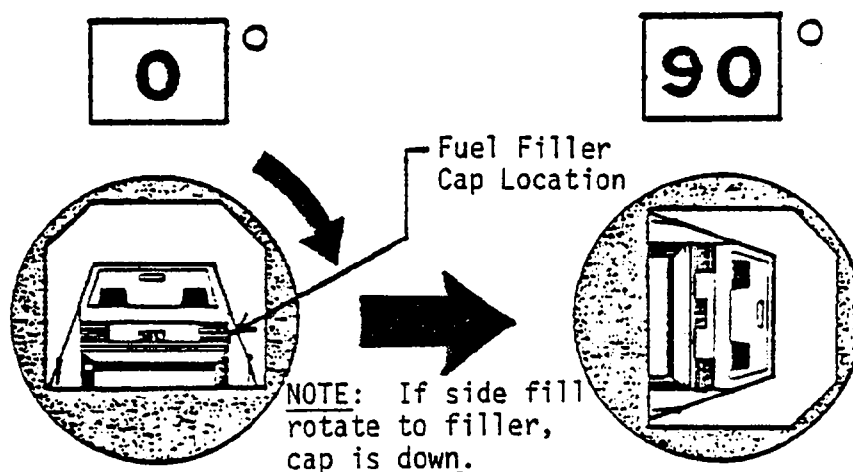
Test information will be added to the following static rollover data sheets

- (1) Figure 8A - Rollover data for 0° to 90° test phase
- (2) Figure 8B - Rollover data for 90° to 180° test phase
- (3) Figure 8C - Rollover data for 180° to 270° test phase
- (4) Figure 8D - Rollover data for 270° to 360° test phase

SOLVENT SPILLAGE DETAILS

NONE

Table 8A
FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASEDETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time = 2 minutes 56 seconds
 (Spec. Range = 1 to 3 min.)

FMVSS 301-75 Position Hold Time = 5 minutes 00 seconds

TOTAL = 7 minutes 56 seconds

Next Whole Minute Interval = 0 minutes

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. <u>from</u> onset of rotation	6th min.	7th min.	8th min. if reqd.
--	----------	----------	-------------------

Maximum Allowable Solvent Spillage

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

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0
---	---	---	---

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

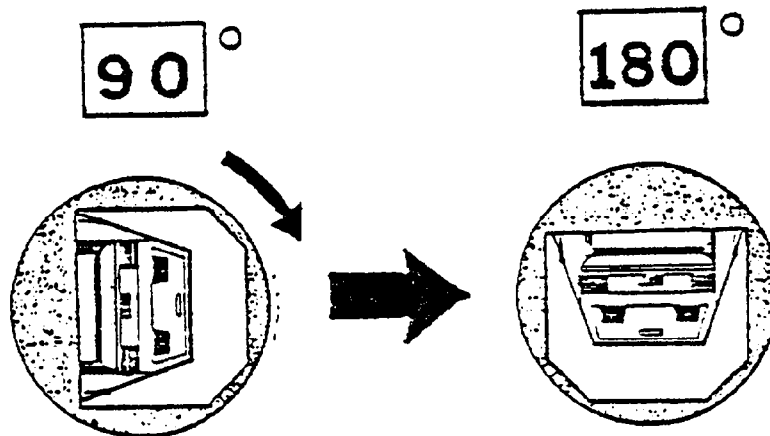
SOLVENT SPILLAGE LOCATION(S)

None

Table 8B

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE



DETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time = 2 minutes 57 seconds
 (Spec. Range = 1 to 3 min.)
 FMVSS 301-75 Position Hold Time = 5 minutes 00 seconds
 TOTAL = 7 minutes 57 seconds
 Next Whole Minute Interval = 8 minutes

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. <u>from</u> onset of rotation	6th min.	7th min.	8th min. if reqd.
--	----------	----------	-------------------

Maximum Allowable Solvent Spillage

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

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0
---	---	---	---

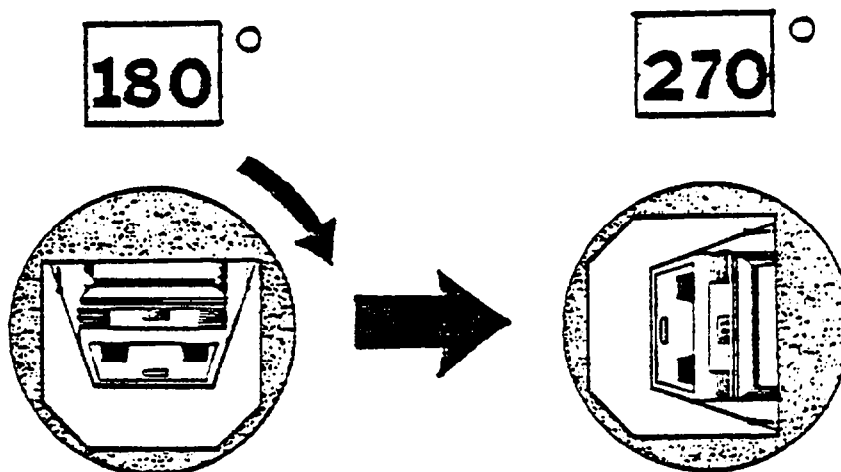
NOTE: Record spillage for whole minute intervals only as determined above.

SOLVENT SPILLAGE LOCATION(S)

NONE

Table 8C
FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEET

TEST PHASE



DETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time = 2 minutes 59 seconds
(Spec. Range = 1 to 3 min.)
FMVSS 301-75 Position Hold Time = 5 minutes 00 seconds
TOTAL = 7 minutes 59 seconds
Next Whole Minute Interval = 8 minutes

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. <u>from</u> onset of rotation	6th min.	7th min.	8th min. if reqd.
--	----------	----------	-------------------

Maximum Allowable Solvent Spillage

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

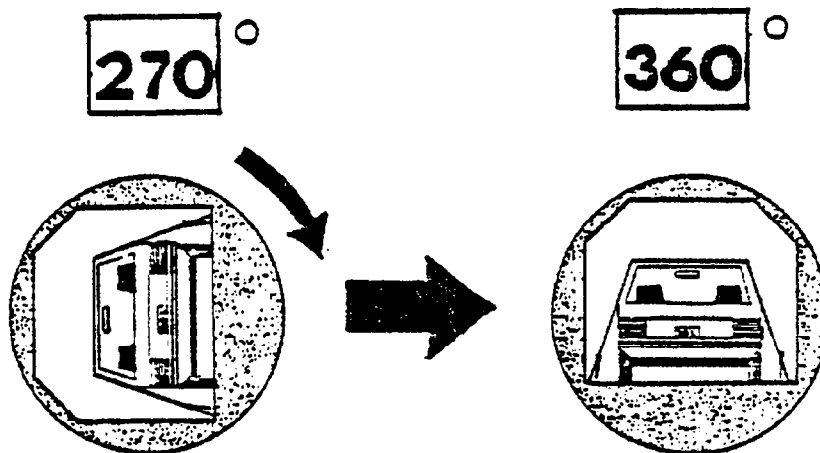
ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0
---	---	---	---

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

SOLVENT SPILLAGE LOCATION(S)

NONE

FMVSS NO. 301-75 STATIC ROLLOVER DATA SHEETTEST PHASEDETERMINATION OF SOLVENT COLLECTION TIME PERIOD

Rollover Fixture 90° Rotation Time = 2 minutes 58 seconds
(Spec. Range = 1 to 3 min.)
FMVSS 301-75 Position Hold Time = 5 minutes 00 seconds
TOTAL = 2 minutes 58 seconds
Next Whole Minute Interval = 8 minutes

FMVSS 301-75 REQUIREMENTS

Time Period

First 5 min. <u>from</u> onset of rotation	6th min.	7th min.	8th min. if reqd.
--	----------	----------	-------------------

Maximum Allowable Solvent Spillage

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

ACTUAL TEST VEHICLE SOLVENT SPILLAGE

0	0	0	0
---	---	---	---

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

SOLVENT SPILLAGE LOCATION(S)

NONE

APPENDIX A
STILL PHOTOGRAPHS

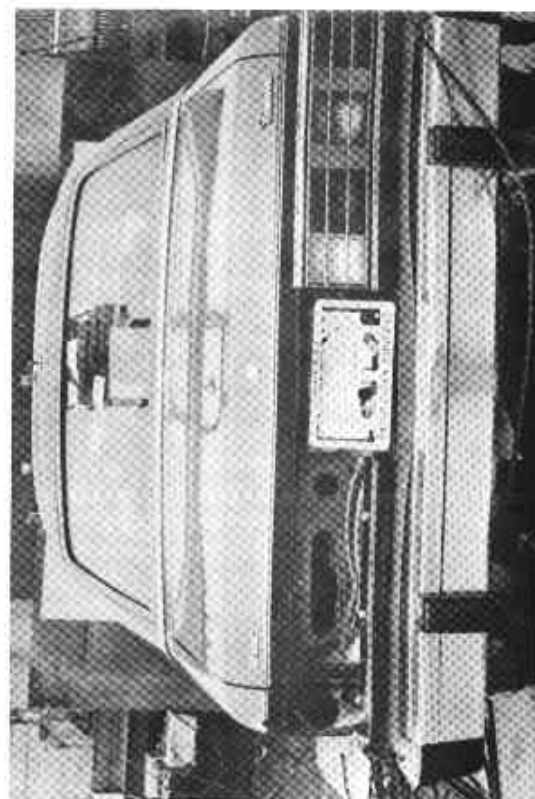
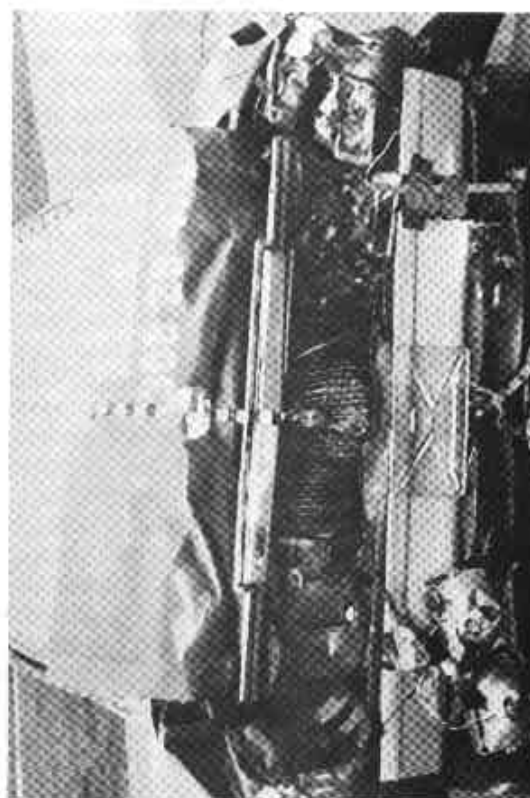
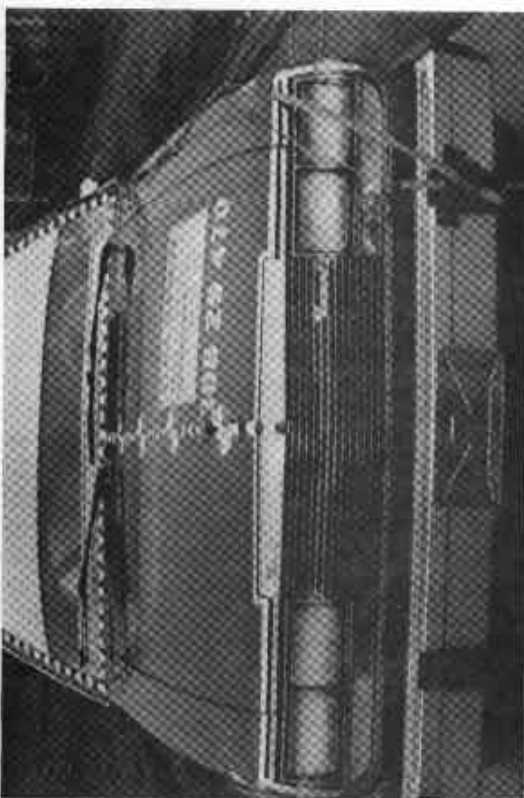


FIGURE A-1 PRE- AND POST-TEST VIEWS OF FRONT AND REAR EXTERIOR

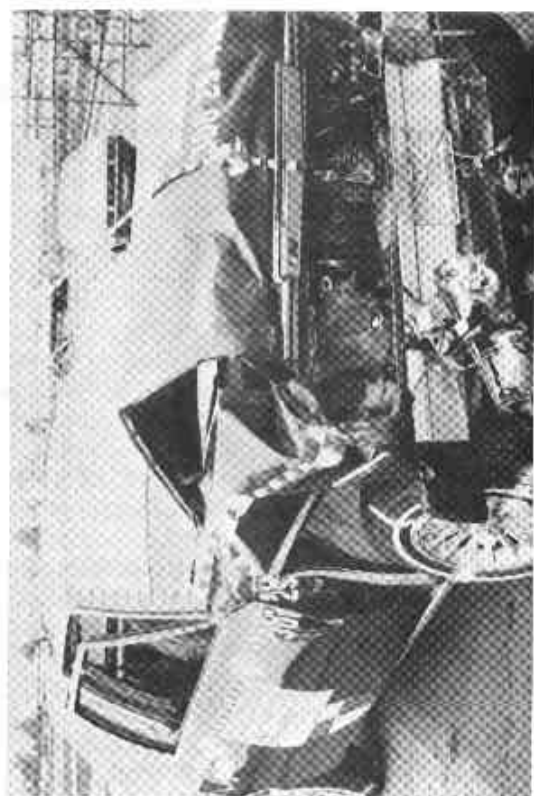
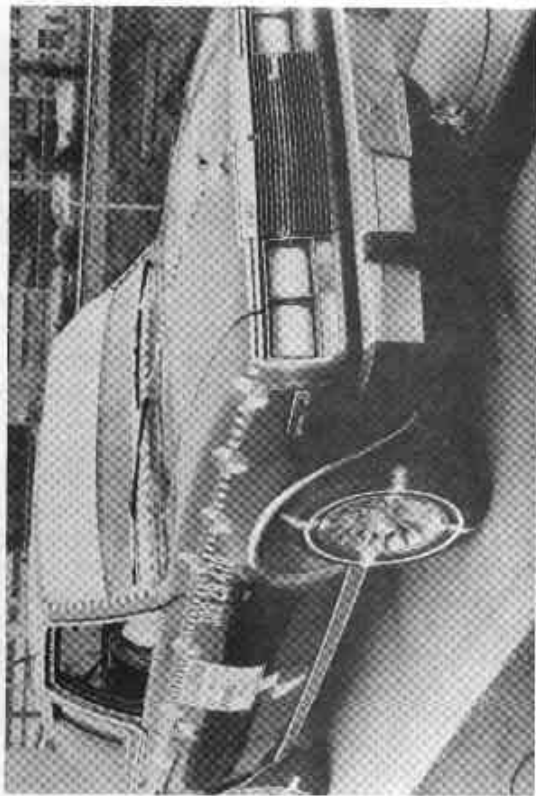
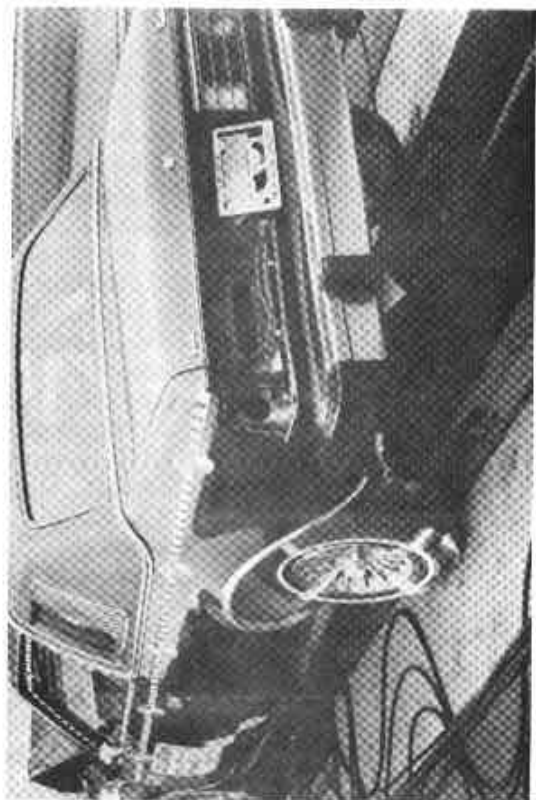
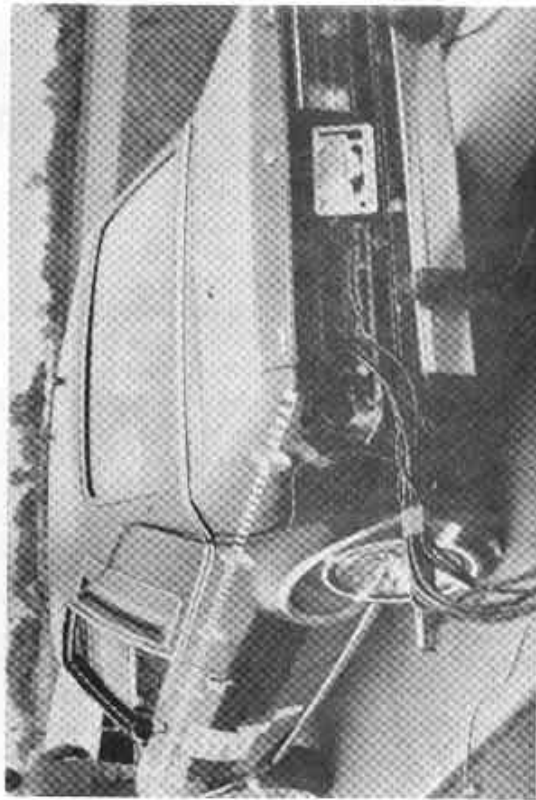


FIGURE A-2 PRE- AND POST-TEST VIEWS OF FRONT AND REAR THREE-QUARTER

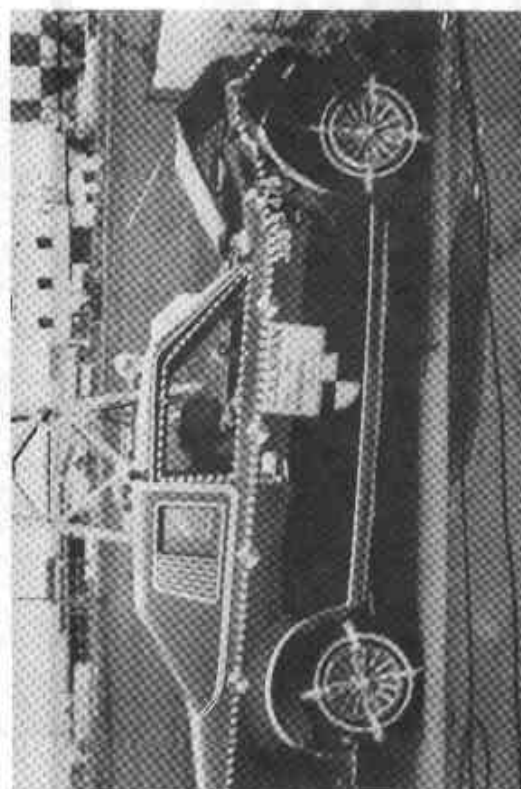
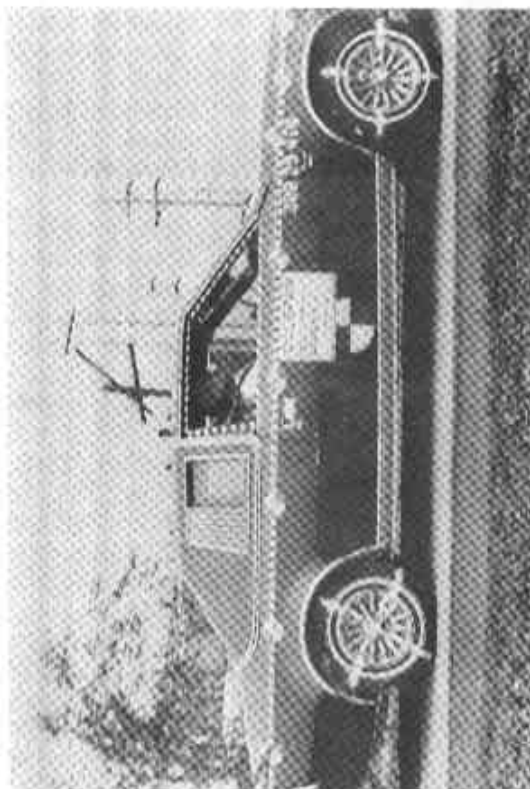
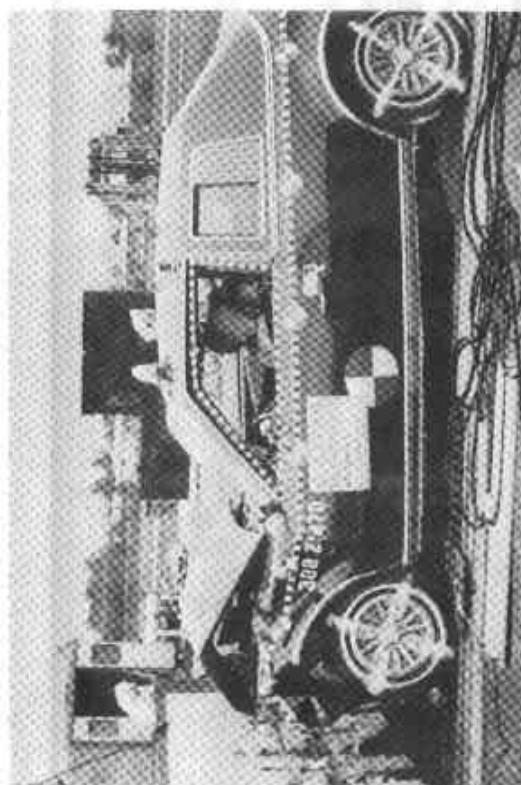
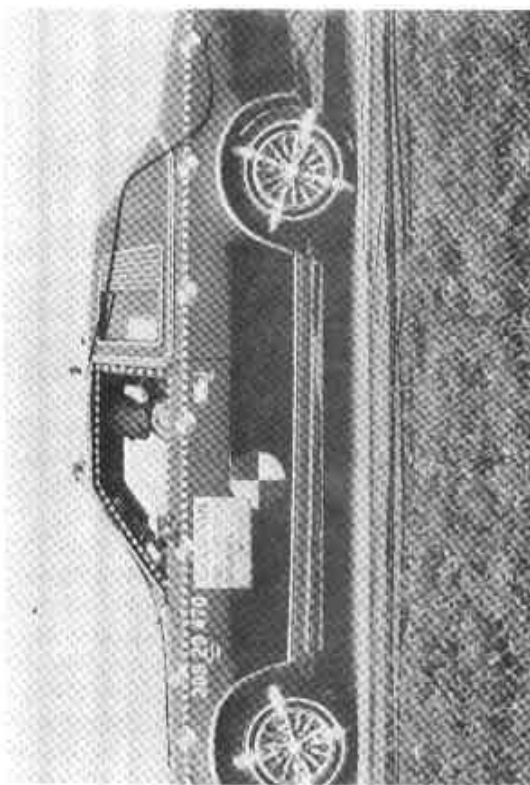


FIGURE A-3 PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT SIDE

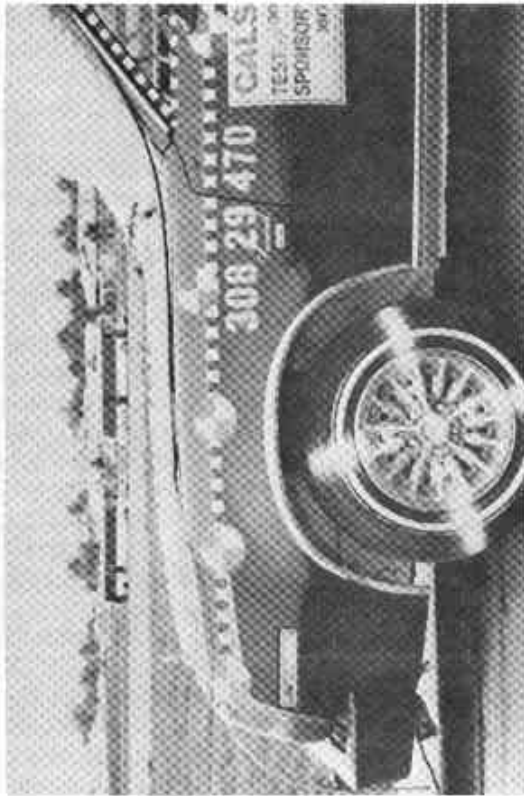
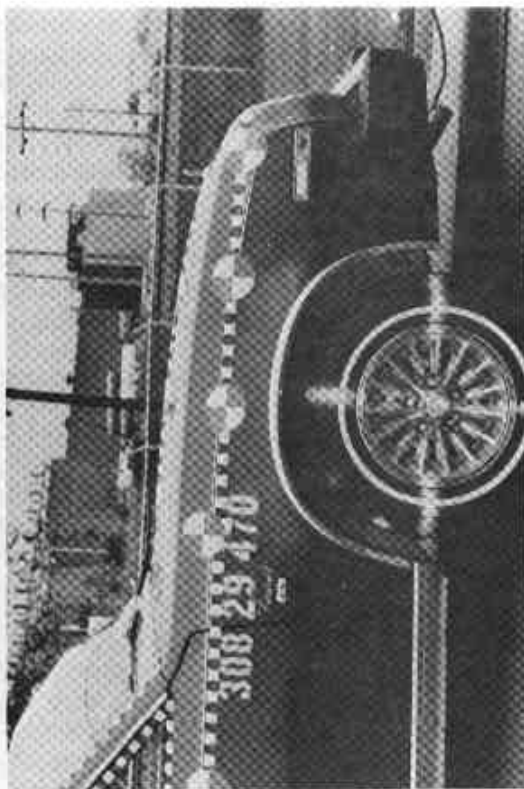


FIGURE A-4 PRE- AND POST-TEST VIEWS OF RIGHT AND LEFT FRONT QUARTER

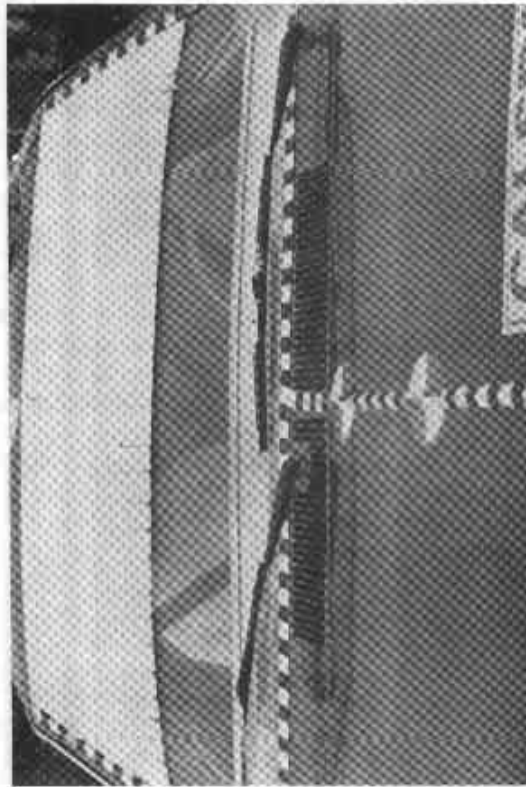


FIGURE A-5 VIEW OF WINDSHIELD AND STYROFOAM PROTECTED AREA

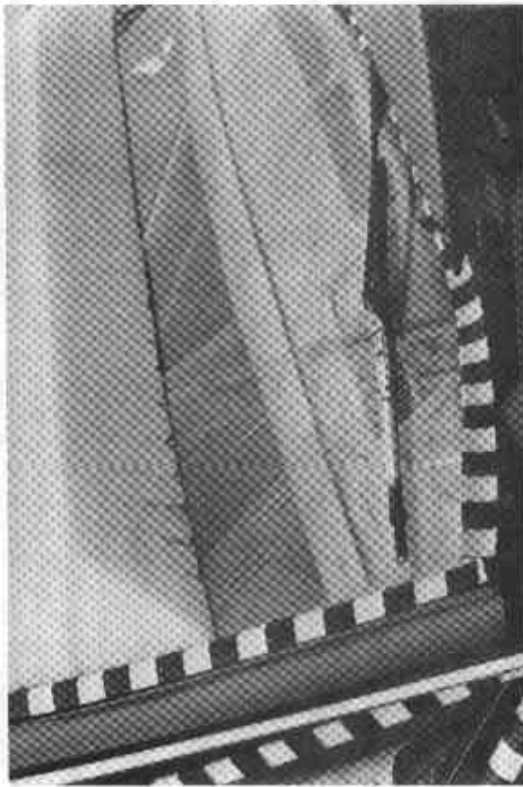


FIGURE A-6 POST-TEST VIEW OF WINDSHIELD CRACKS

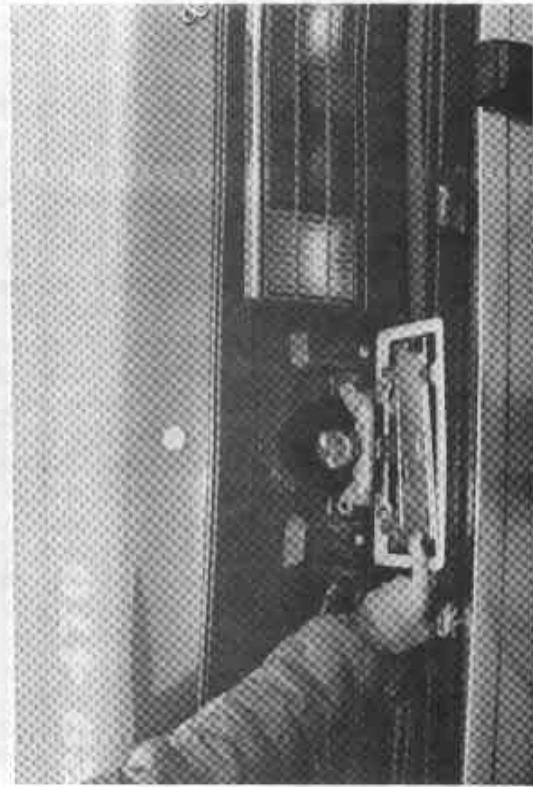


FIGURE A-7 FILLER TUBE AND CAP

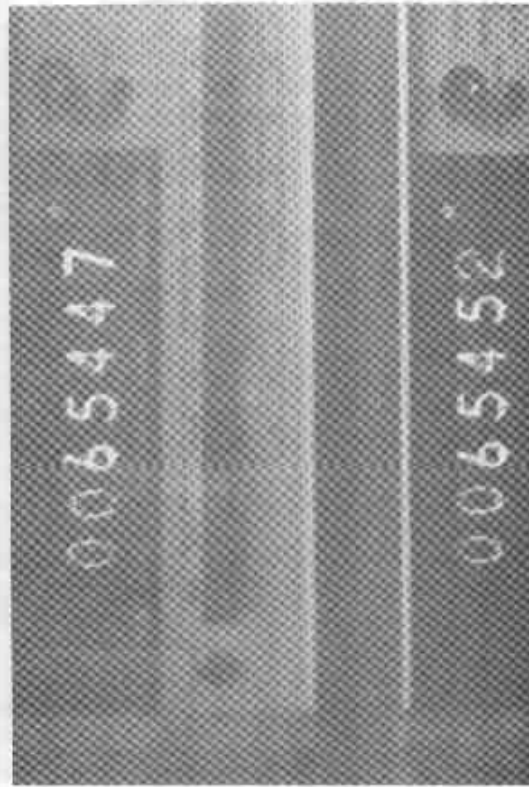


FIGURE A-8 VELOCITY TRAP COUNTER DISPLAY

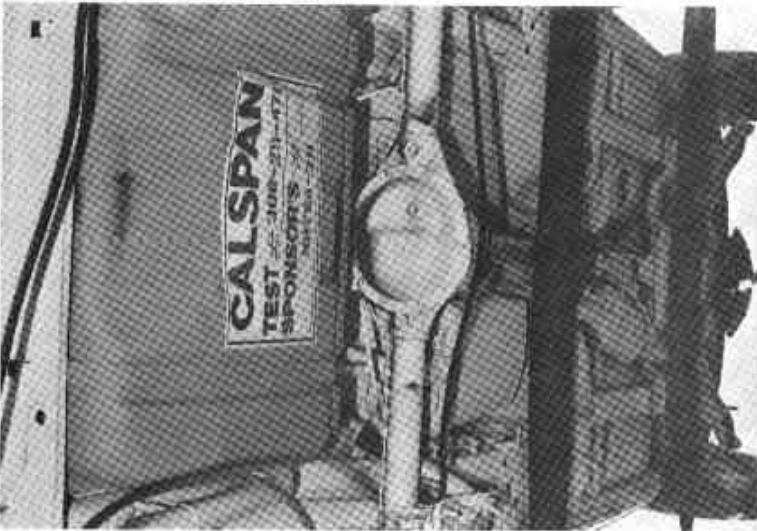


FIGURE A-9 PRE-TEST VIEW OF REAR UNDERBODY

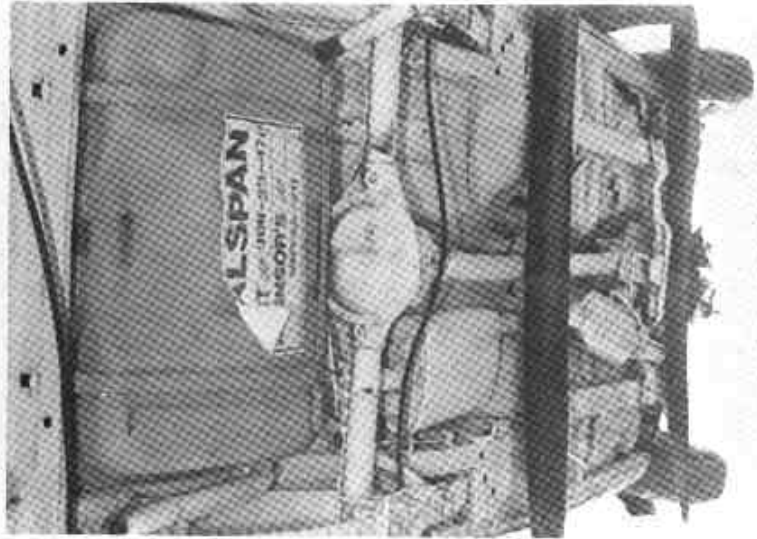


FIGURE A-10 POST-TEST VIEW OF REAR UNDERBODY

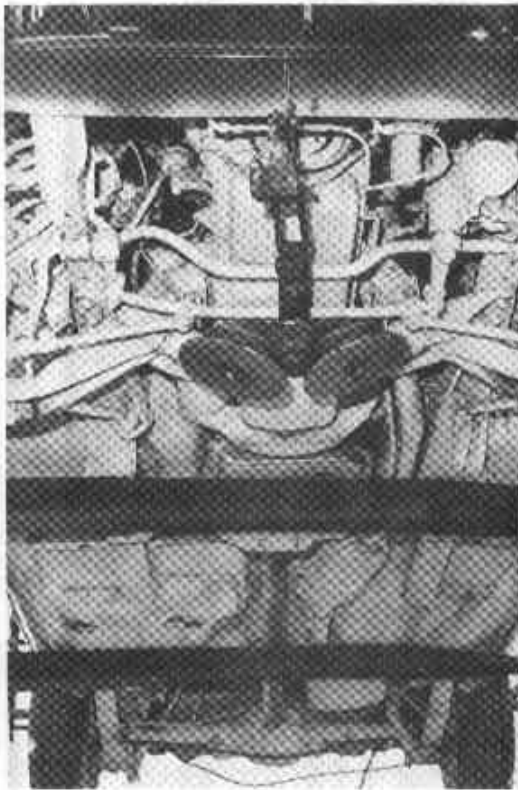


FIGURE A-11 PRE-TEST VIEWS OF FRONT UNDERBODY

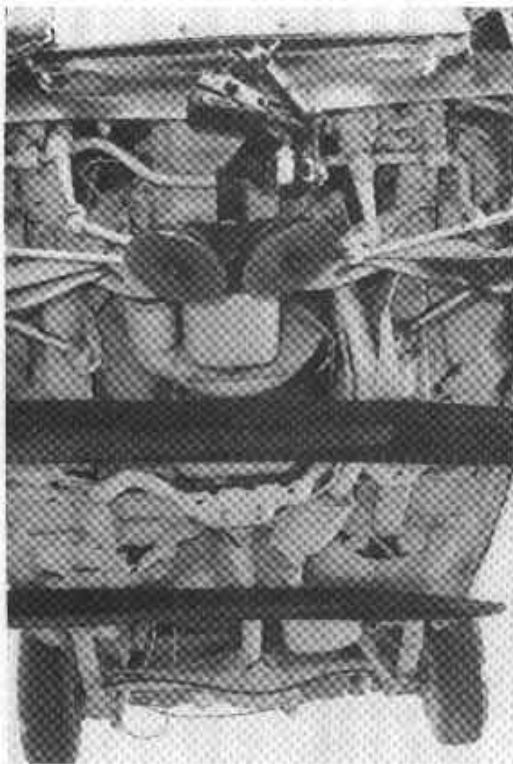


FIGURE A-12 POST-TEST VIEWS OF FRONT UNDERBODY



FIGURE A-13 PRE-TEST VIEW OF DRIVER POSITION



FIGURE A-14 POST-TEST VIEW OF STEERING WHEEL AND DASH PANEL



FIGURE A-15 POST-TEST VIEW OF DRIVER POSITION

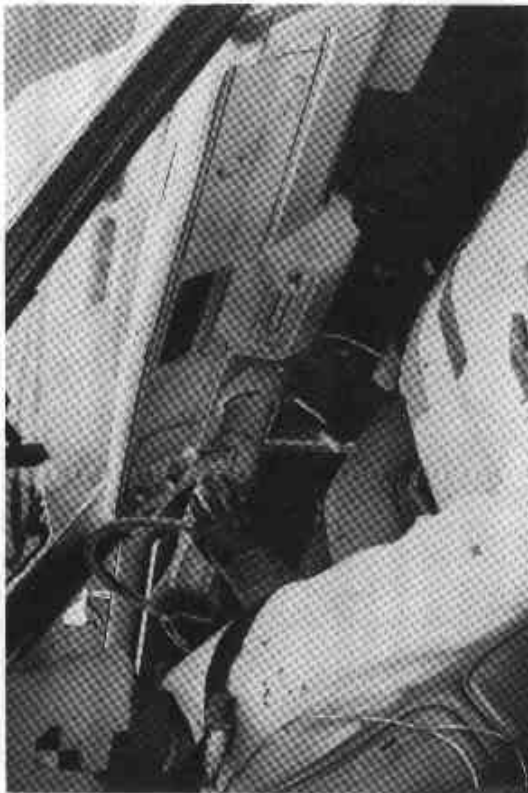


FIGURE A-16 PRE-TEST VIEW OF PASSENGER POSITION



FIGURE A-17 POST-TEST VIEWS OF PASSENGER POSITION



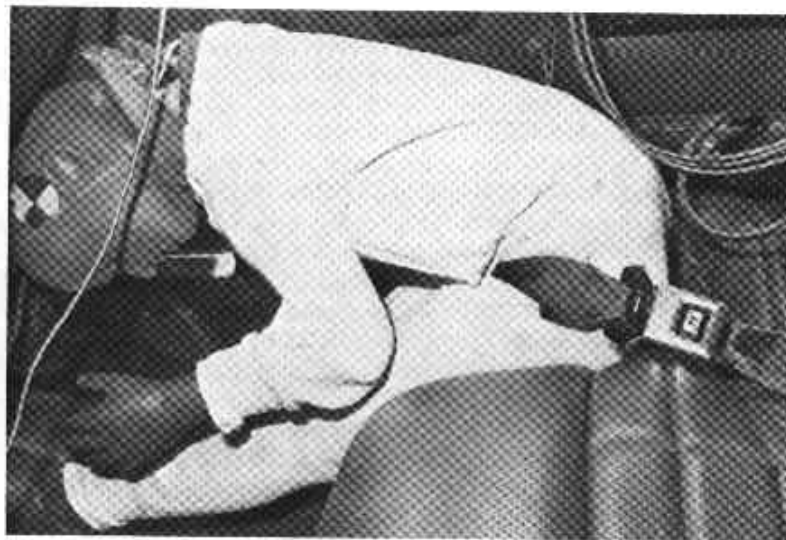


FIGURE A-18 PRE- AND POST-TEST VIEWS OF REAR SEAT 6-YEAR OLD CHILD DUMMY

APPENDIX B

VEHICLE AND DUMMY RESPONSE DATA

TEST NO. 308-29-470

1980 AMC CONCORD

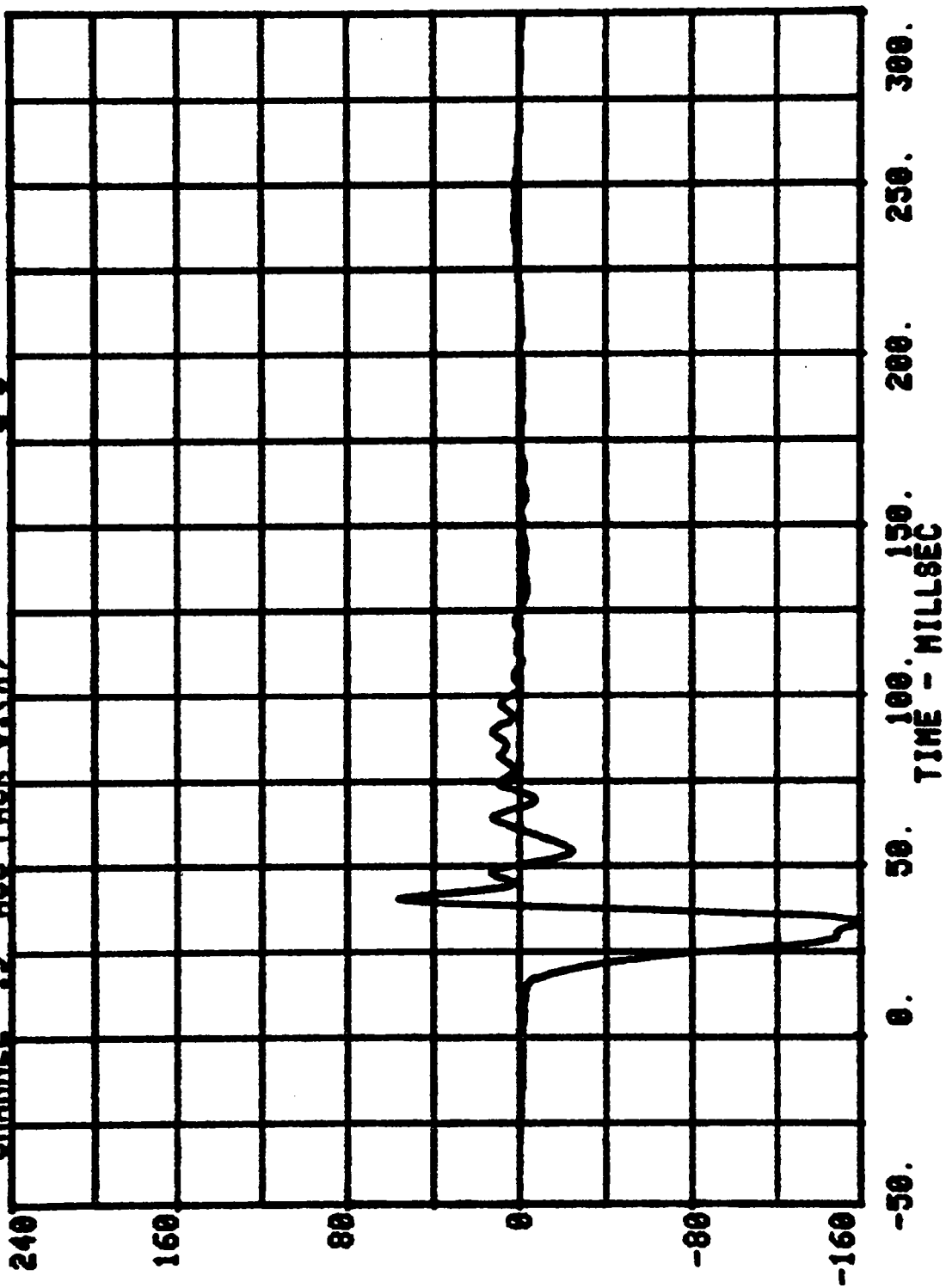
VEHICLE DATA

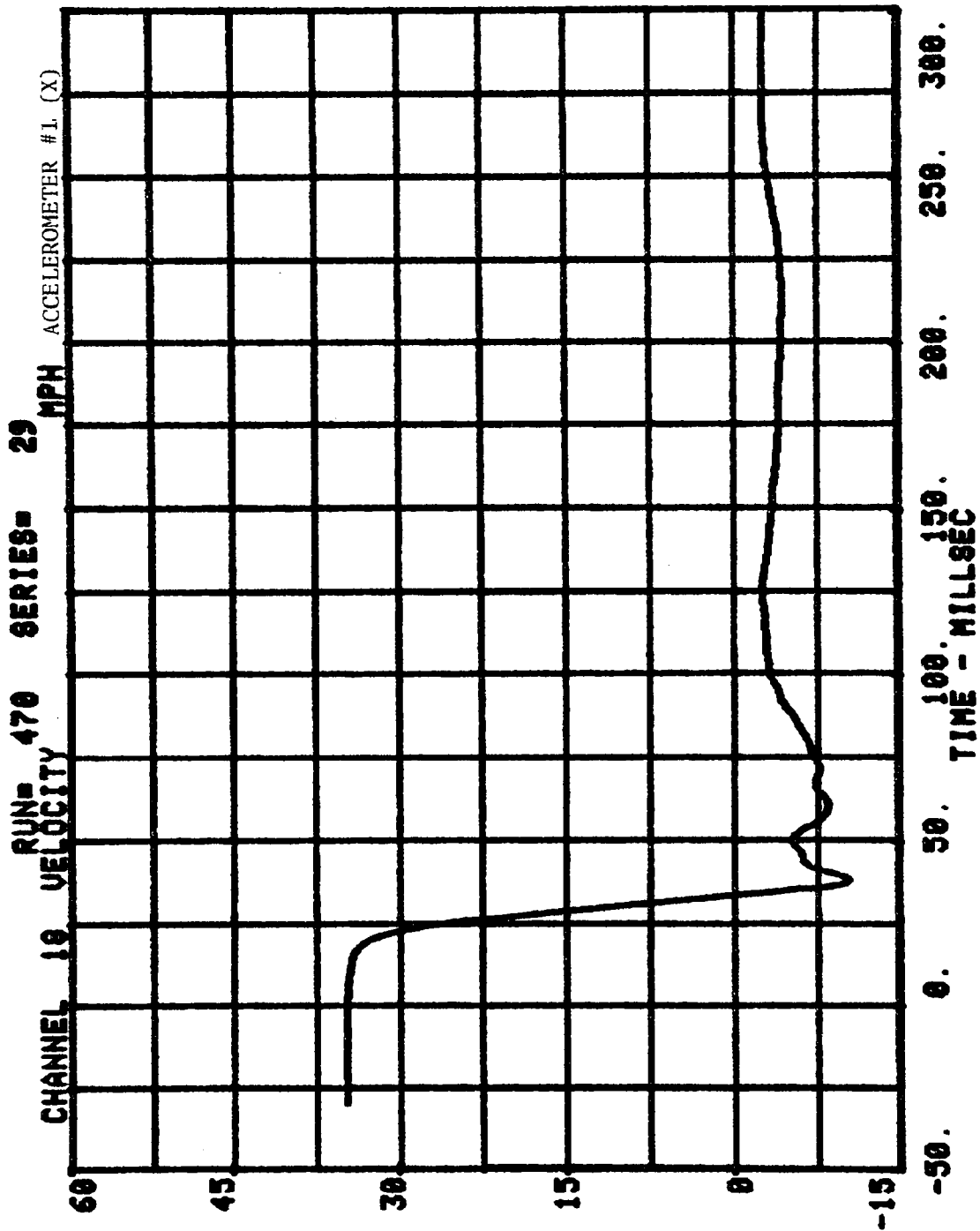
VEHICLE DATA

FILTER CHANNEL CLASS

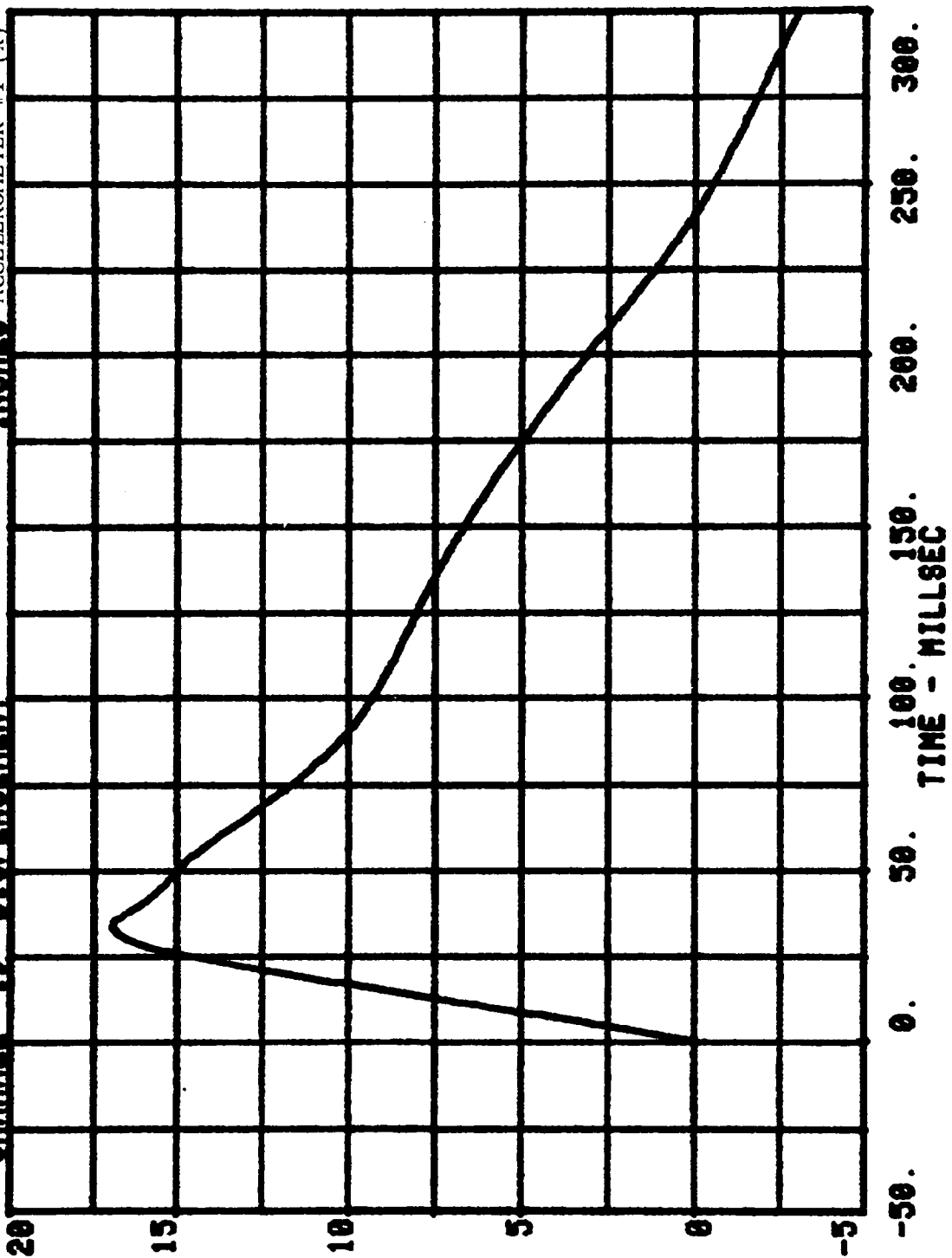
60

RUN= 470 SERIES= 29 G'S
CHANNEL 12 ACC PACK (1X)

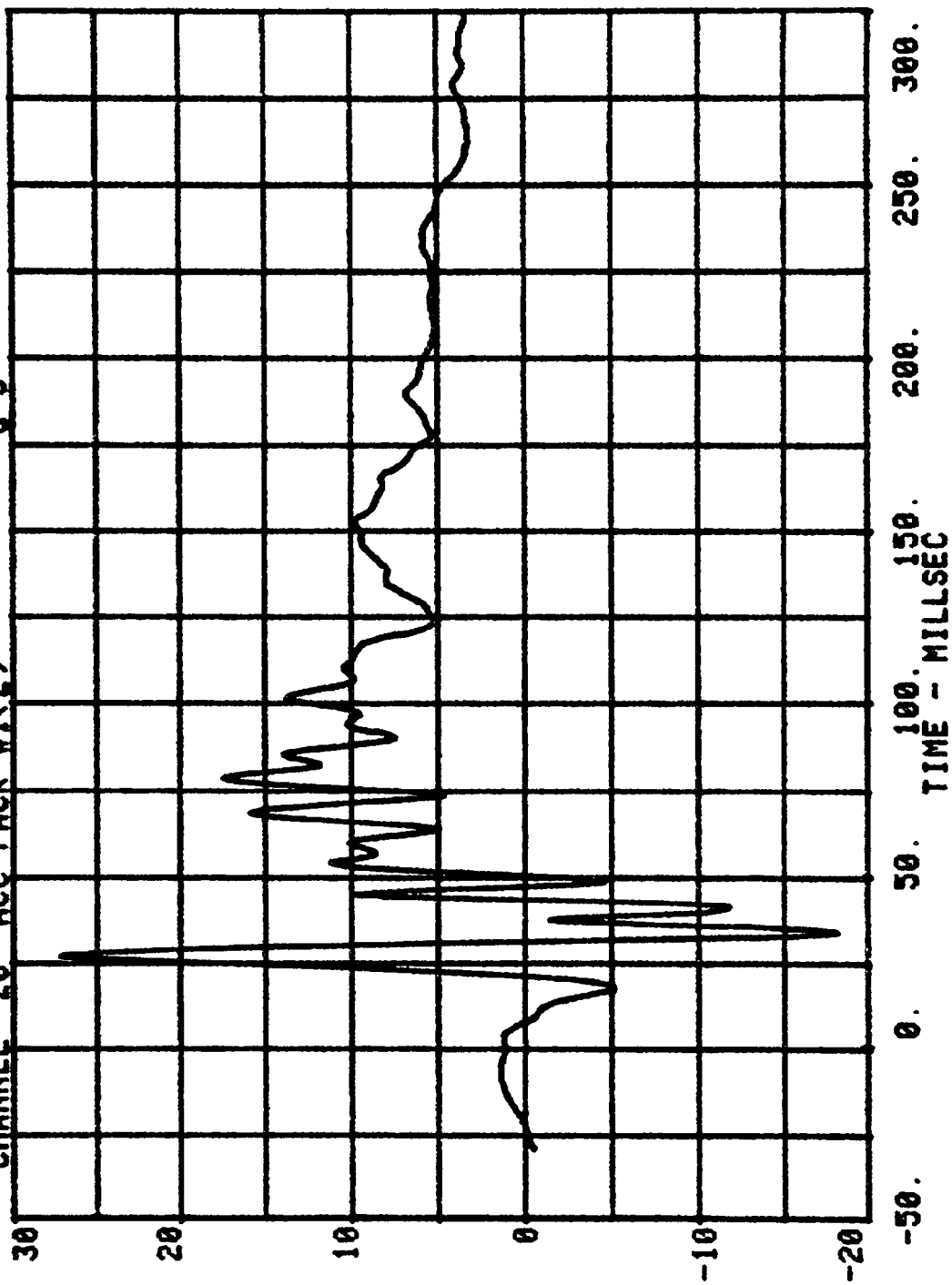




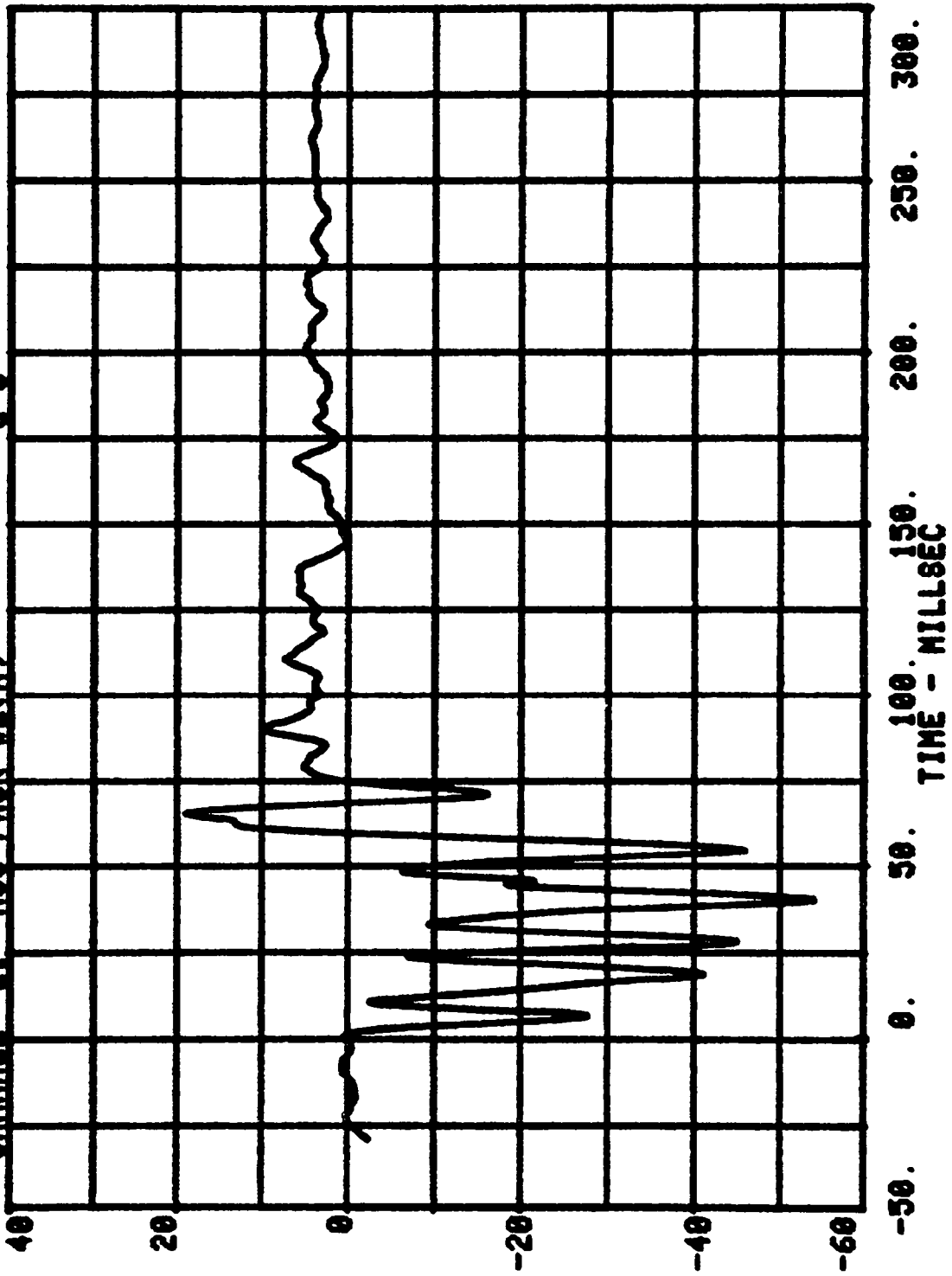
RUN= 470 SERIES= 29
CHANNEL 19 DISPLACEMENT INCHES ACCELEROMETER #1 (X)

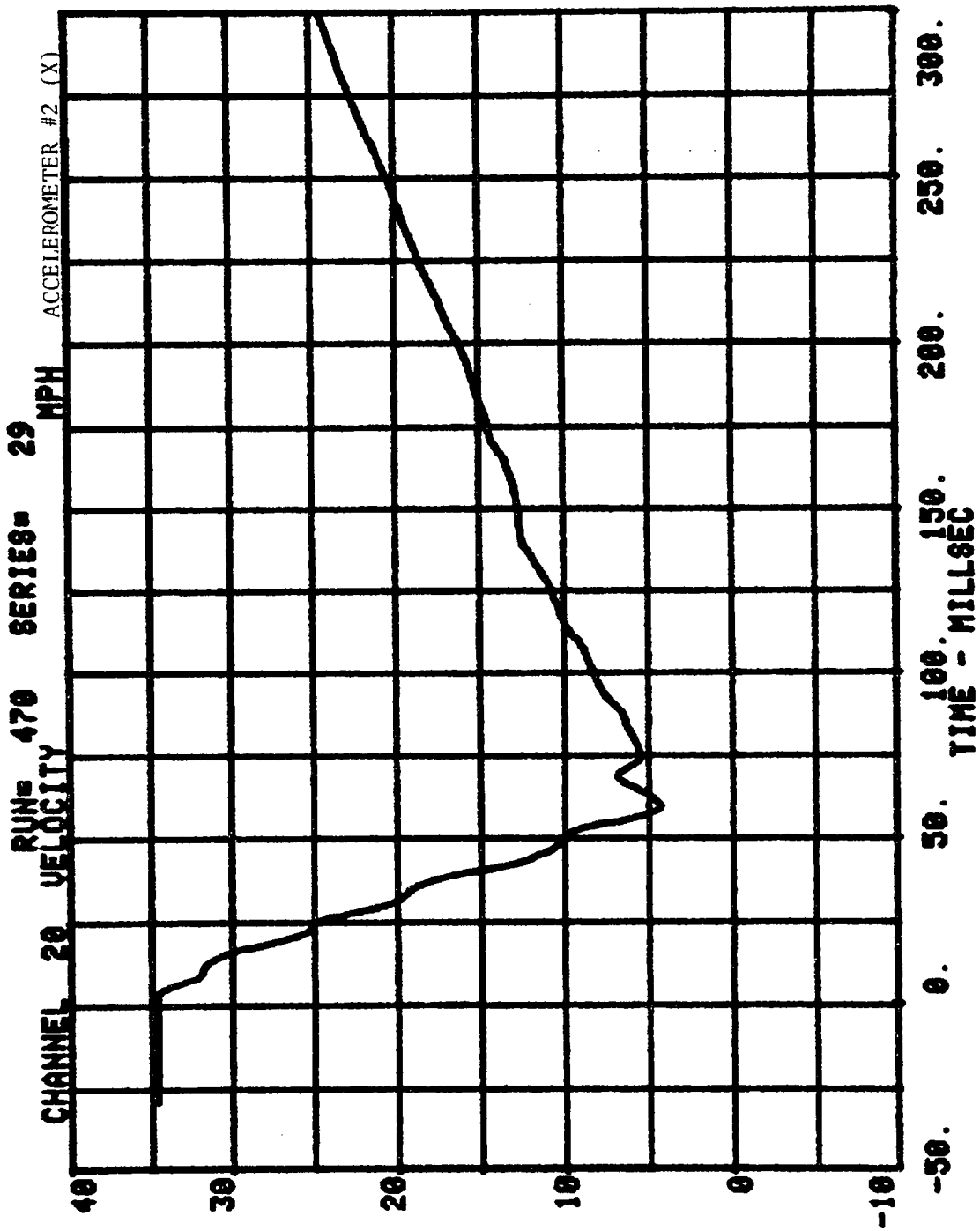


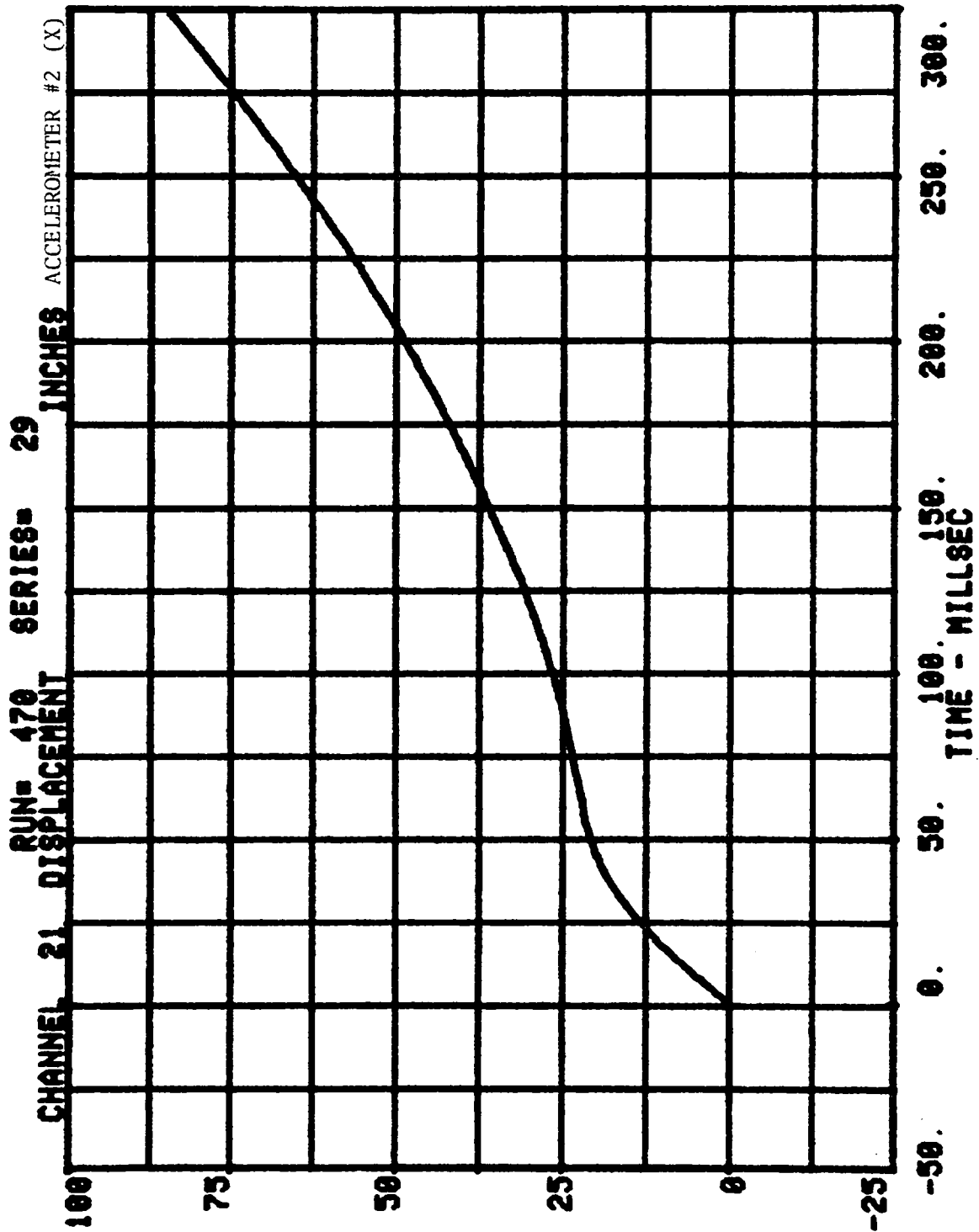
CHANNEL 20 ACC PACK #1(Z) RUN= 470 SERIES= 29 G'S



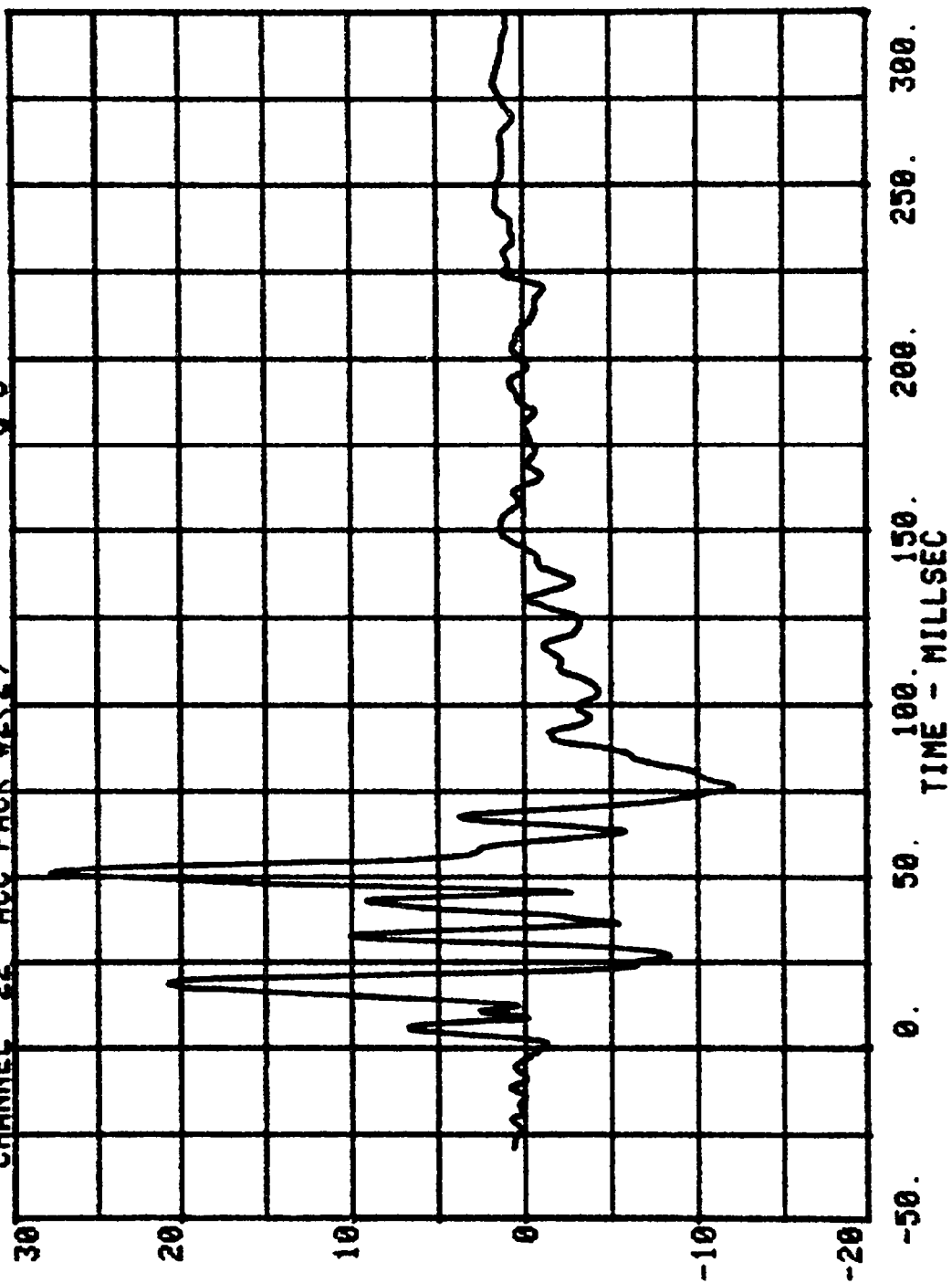
CHANNEL 21 ACC PACK #2(X) RUN= 470 SERIES= 29 G'S



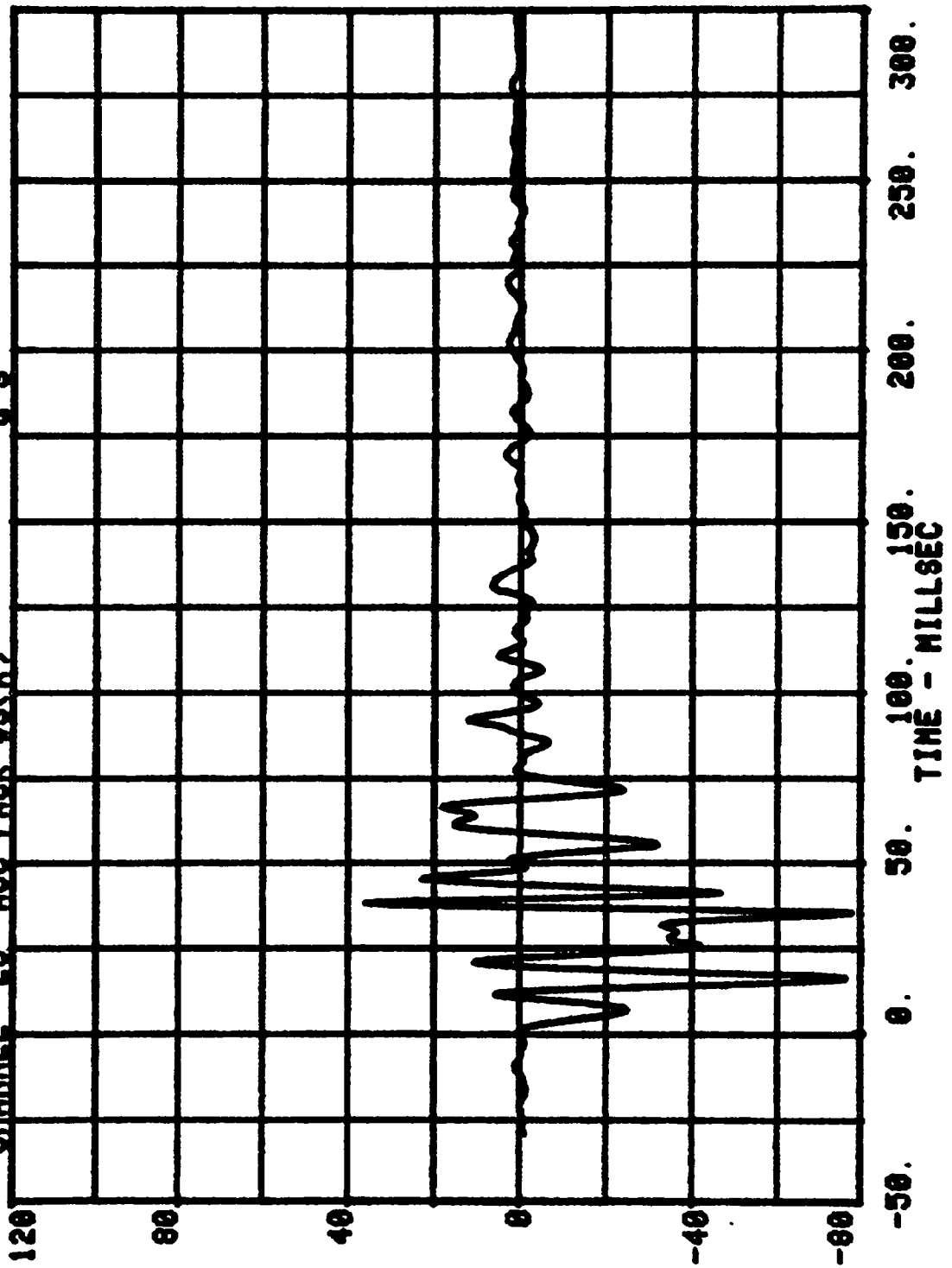


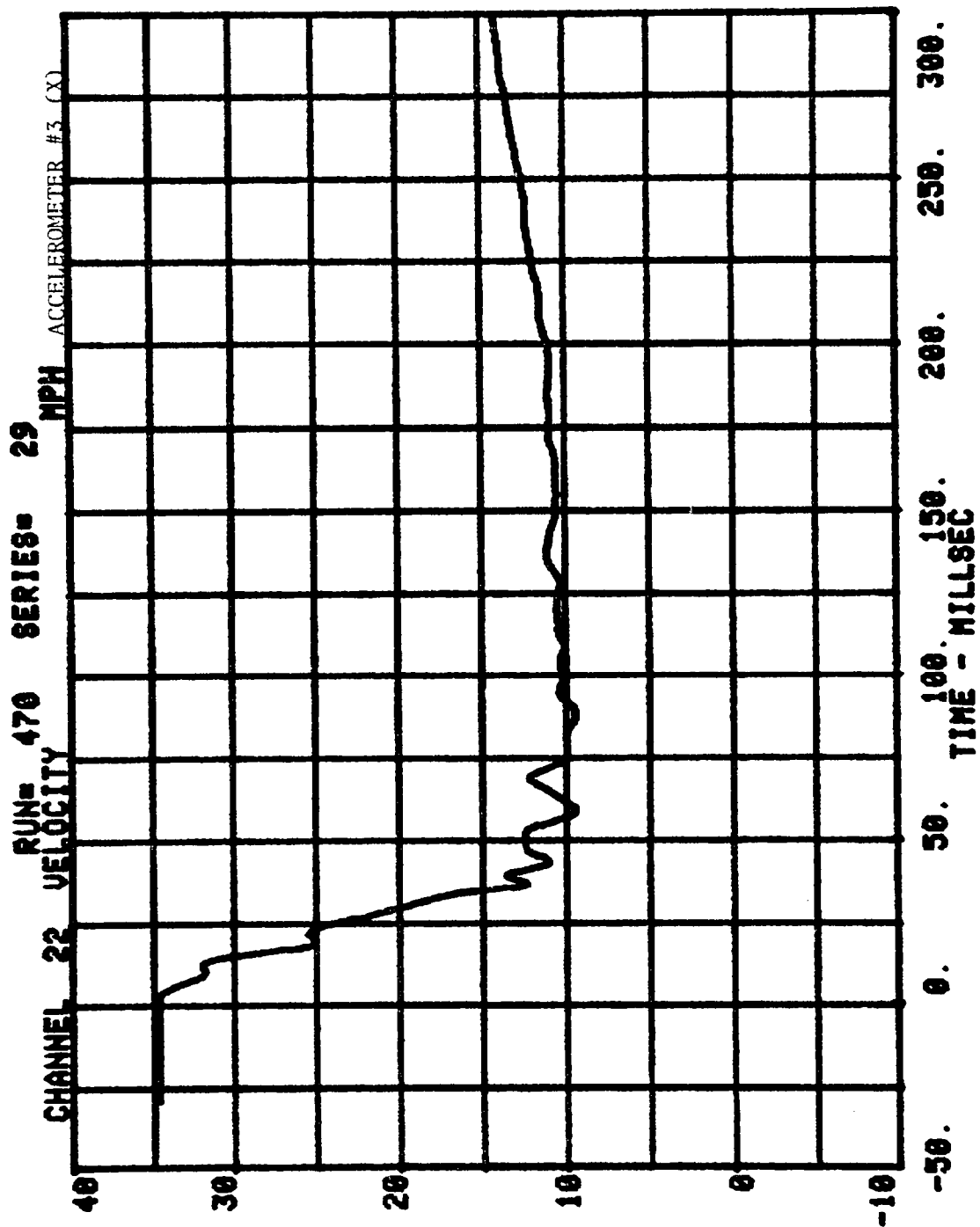


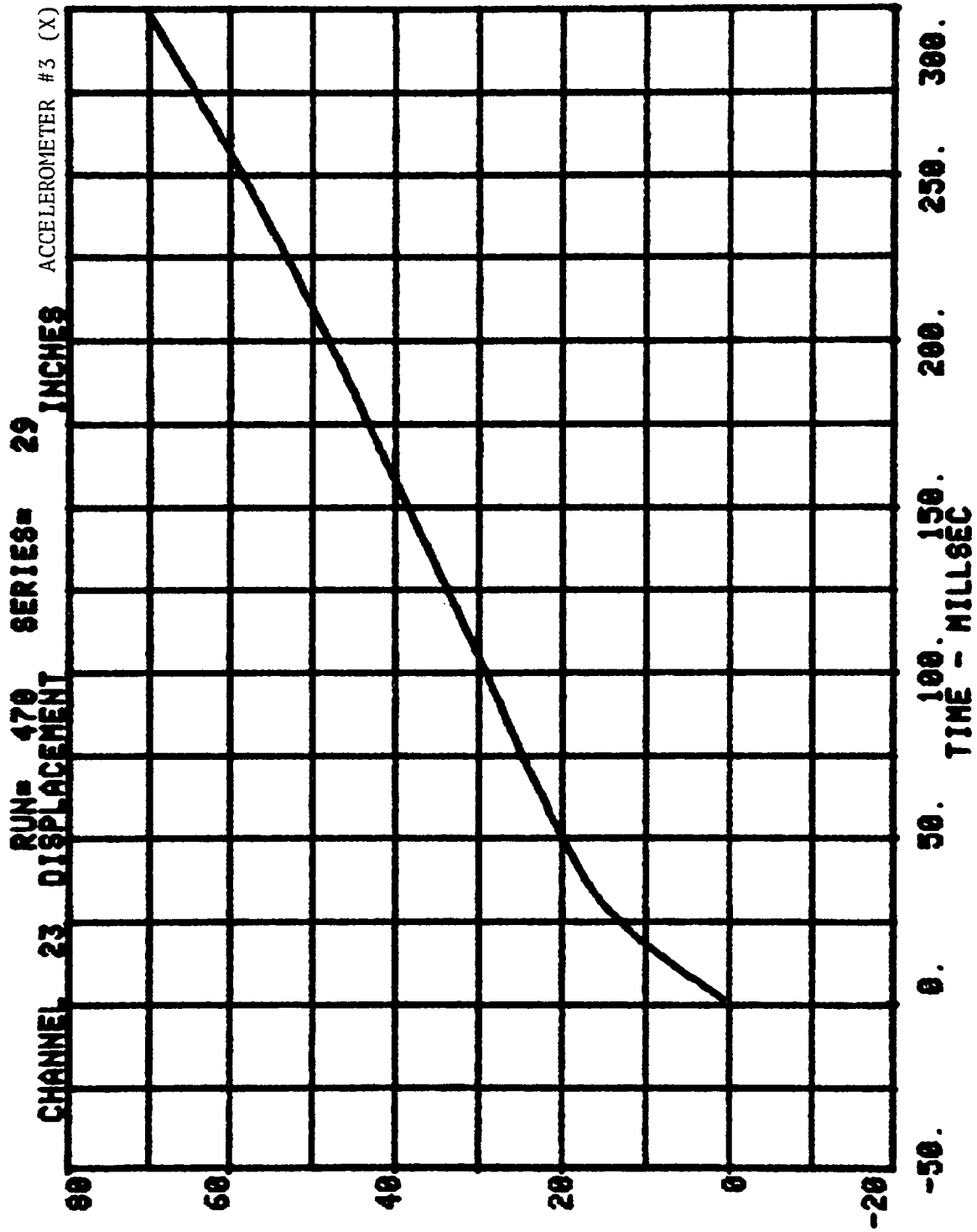
CHANNEL 22 ACC PACK #2(Z) RUN= 470 SERIES= 29 5'8

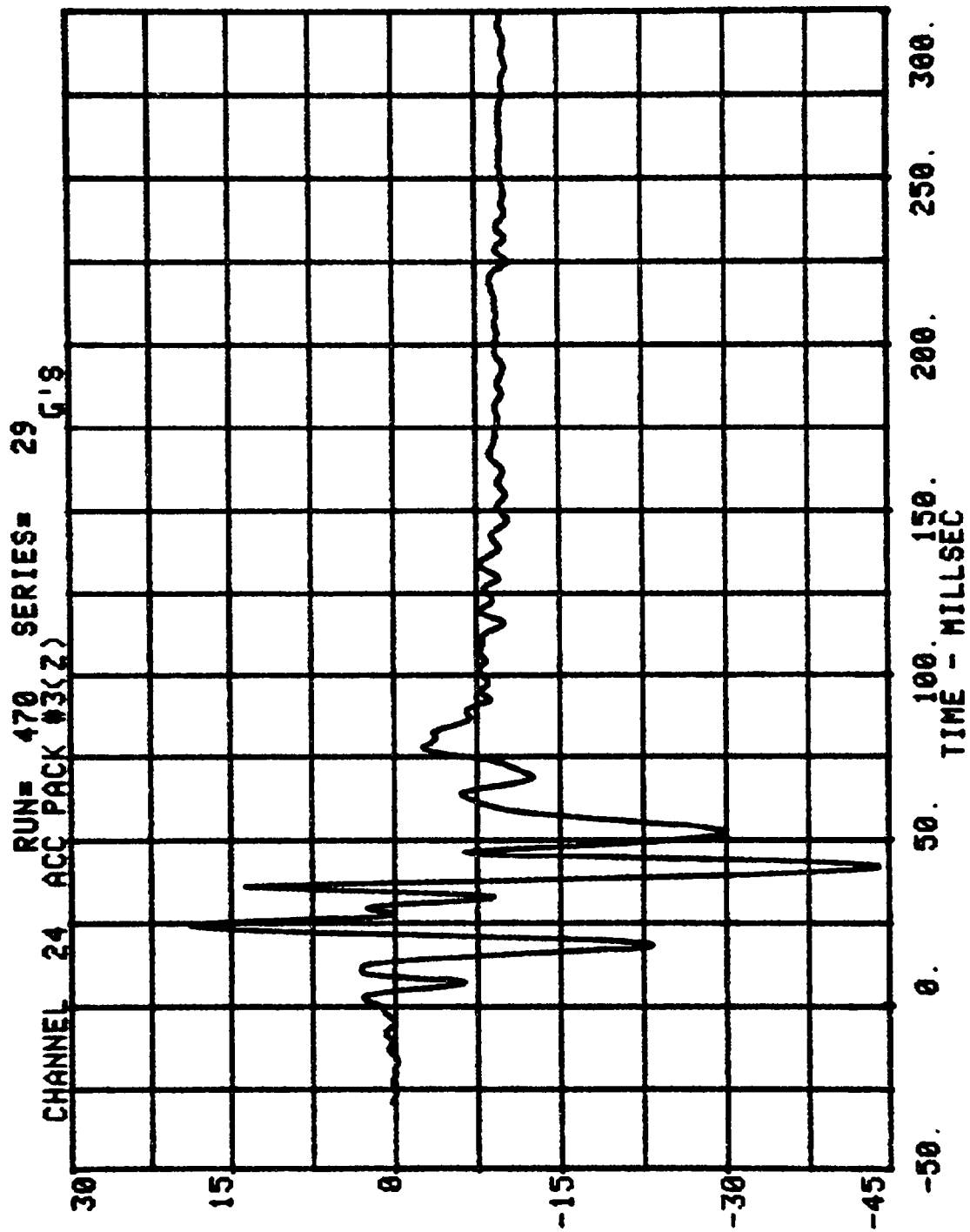


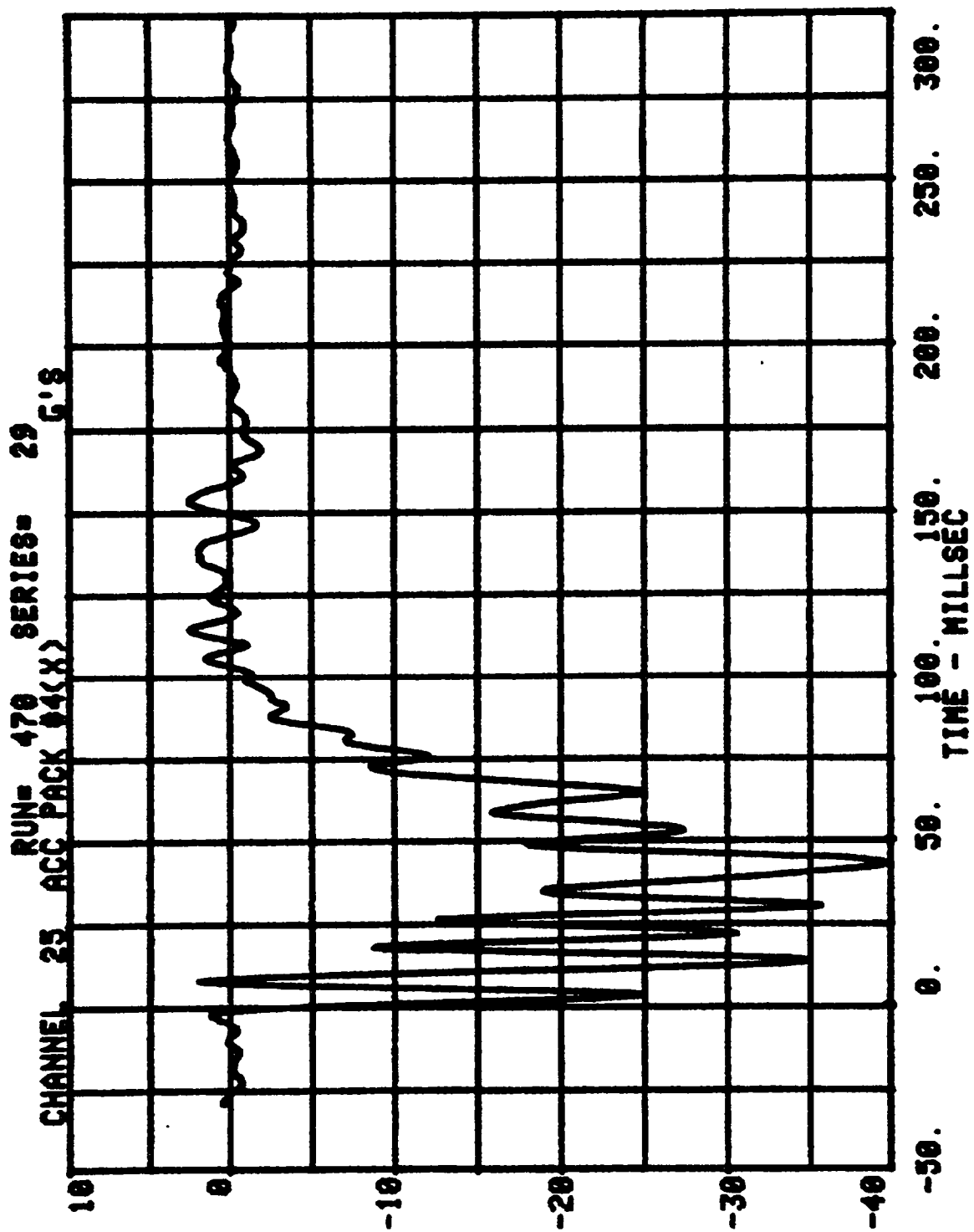
CHANNEL 23 ACC PACK #3(X) RUN= 470 SERIES= 29 G'S

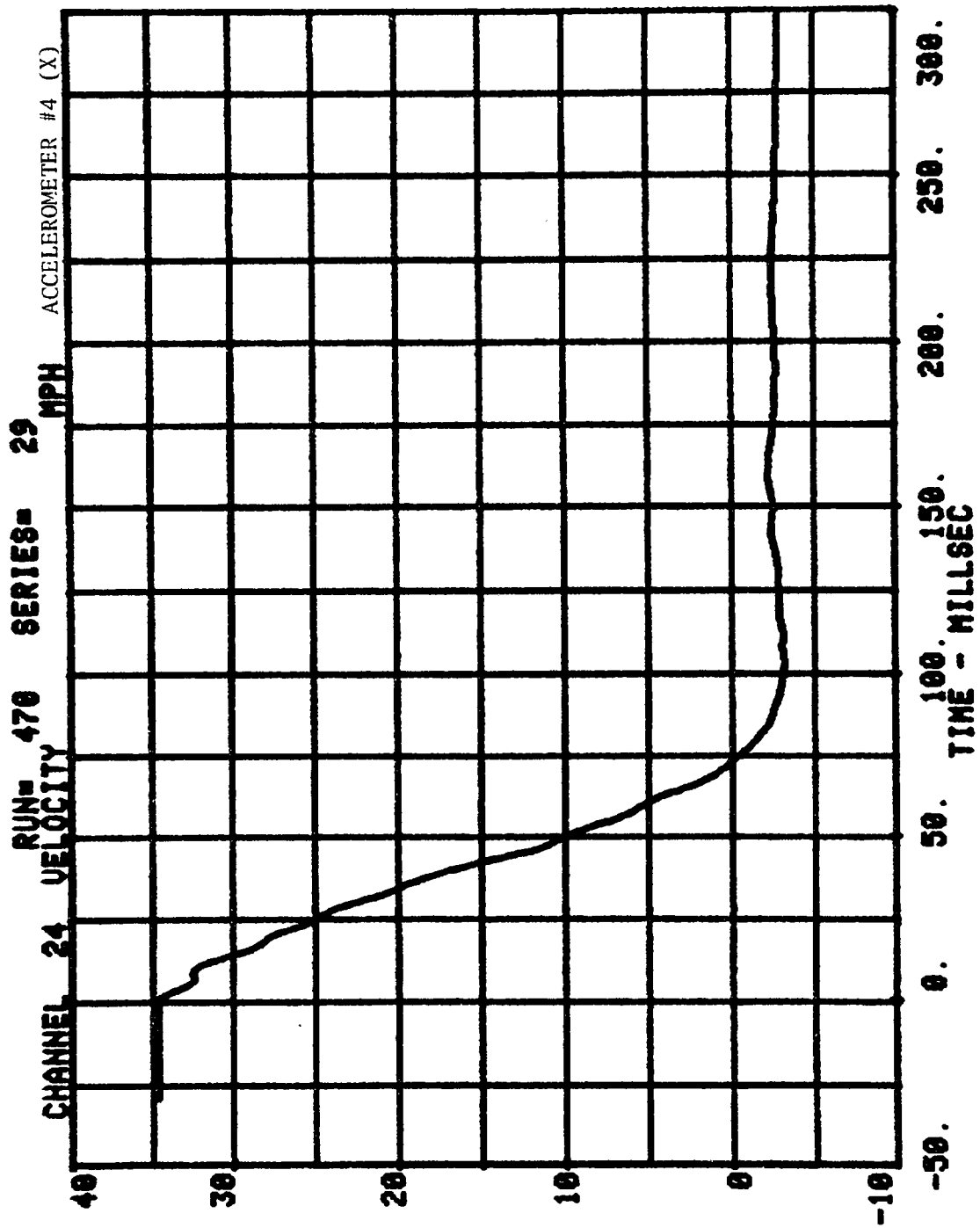


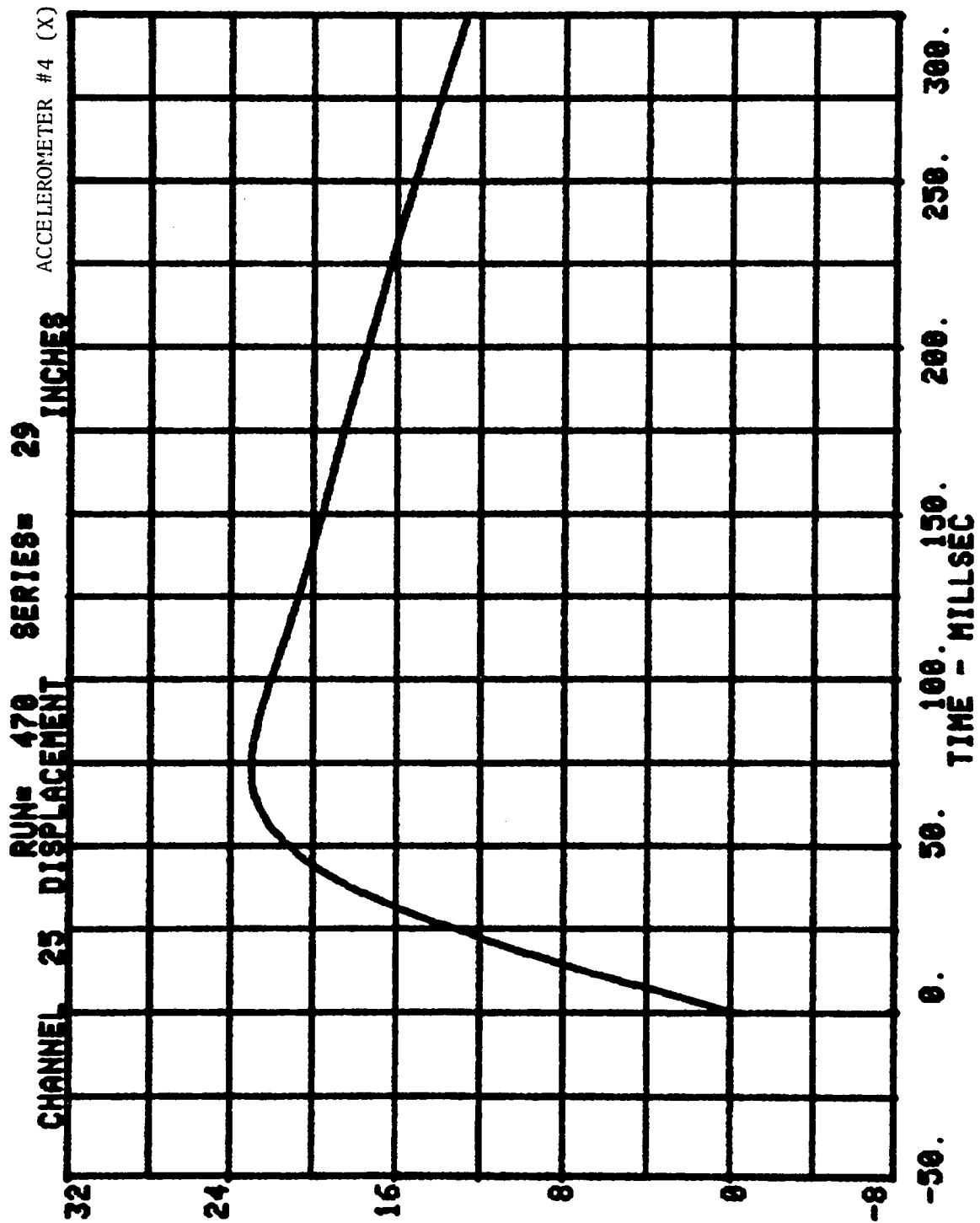




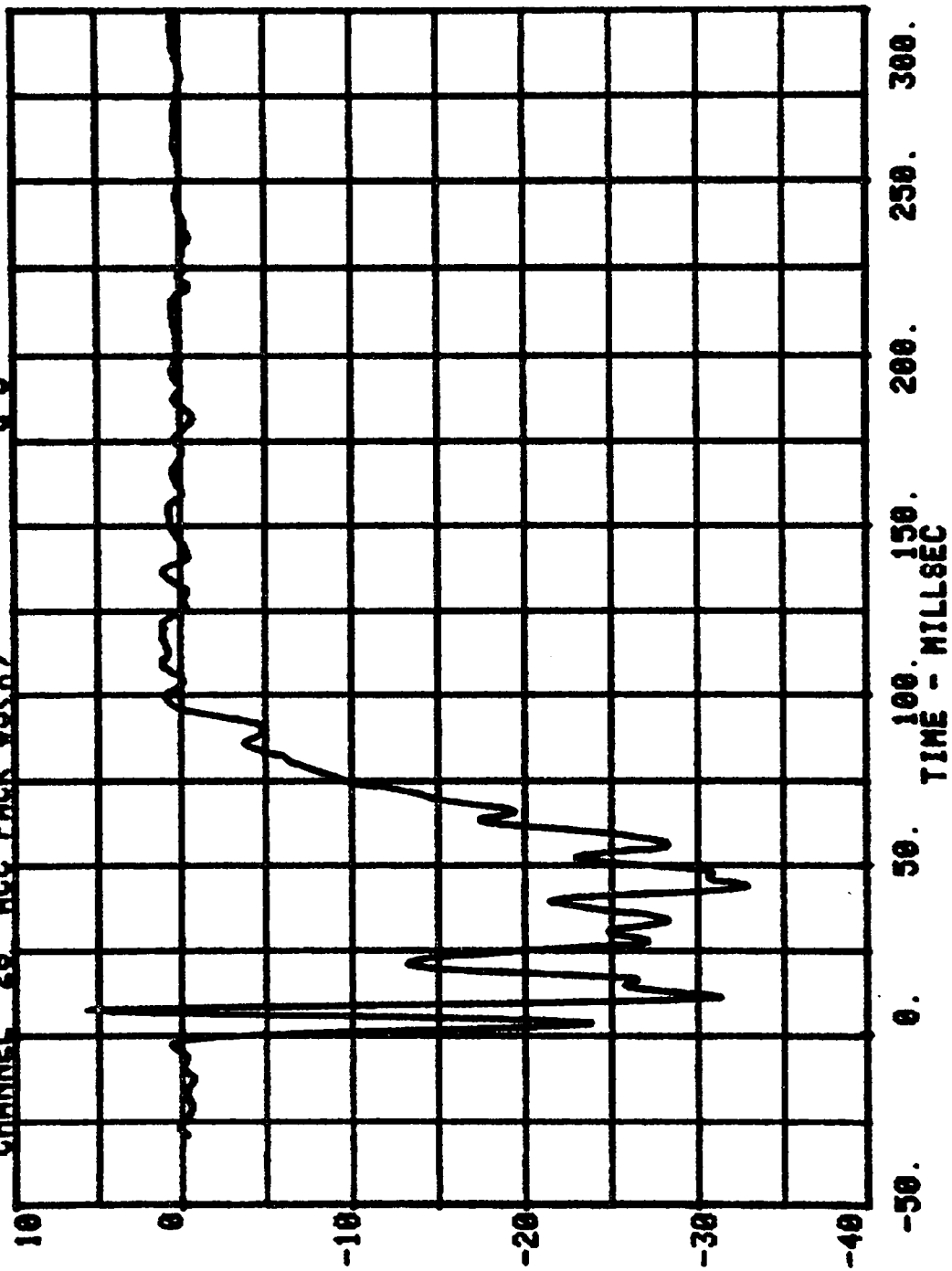


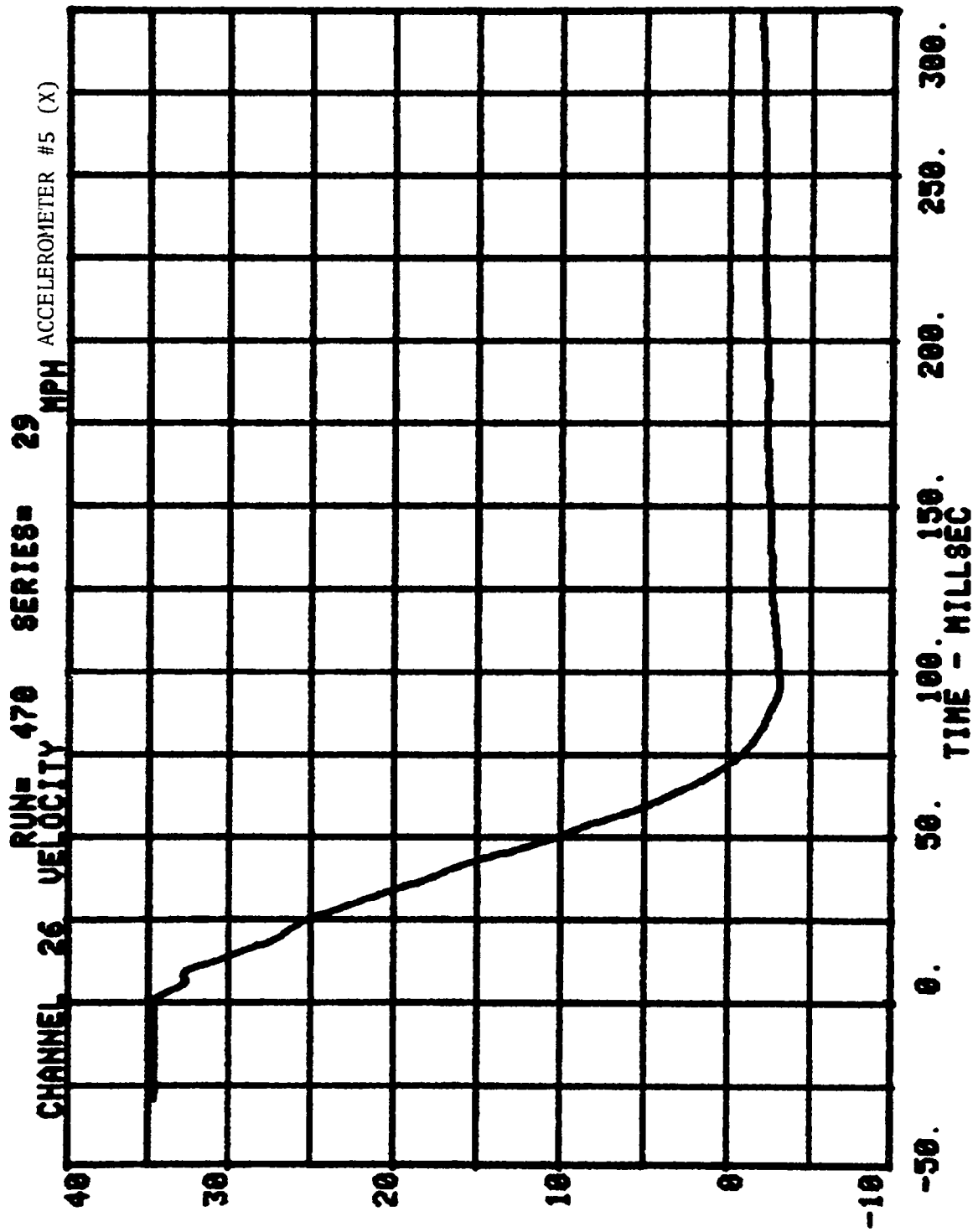


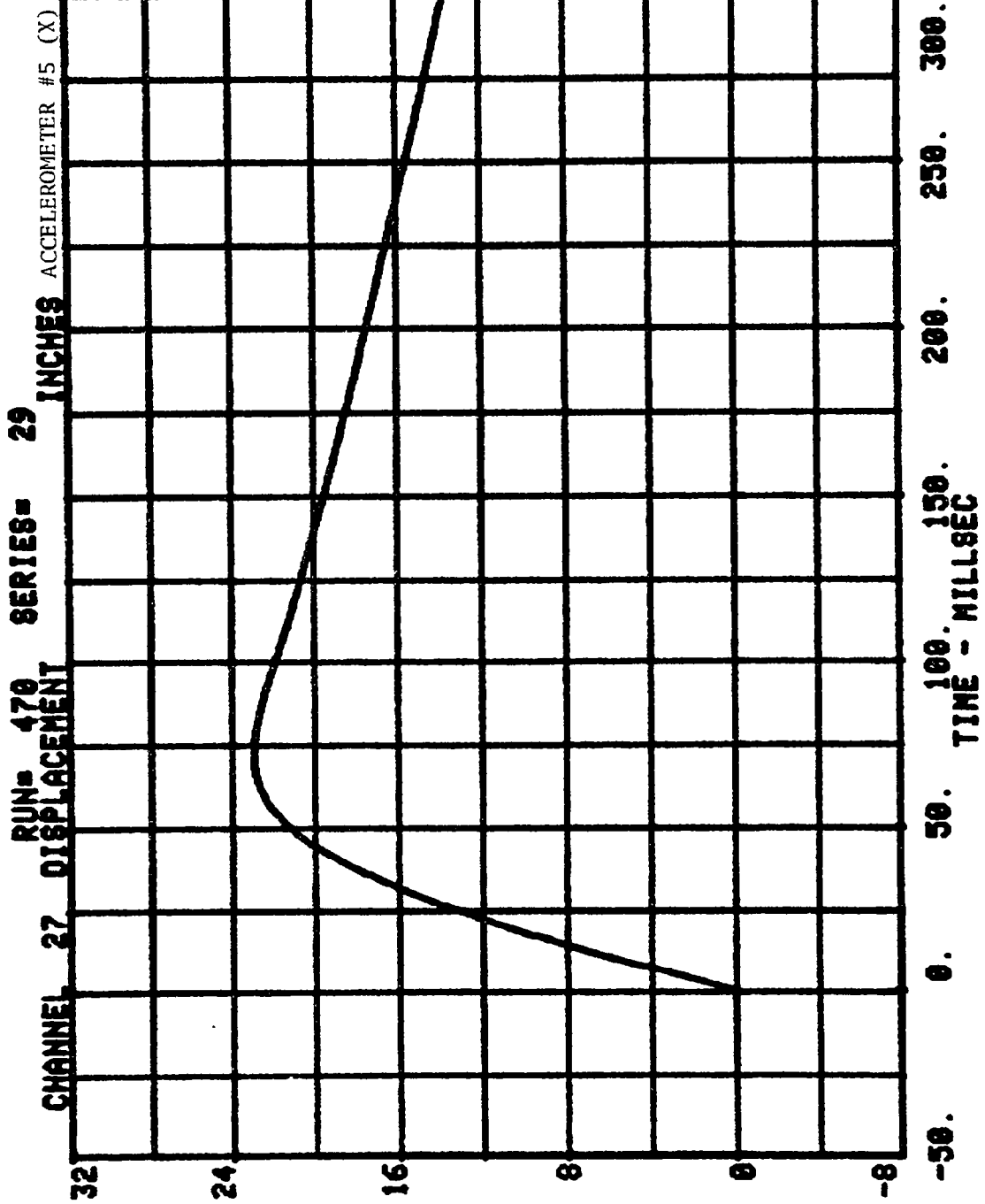


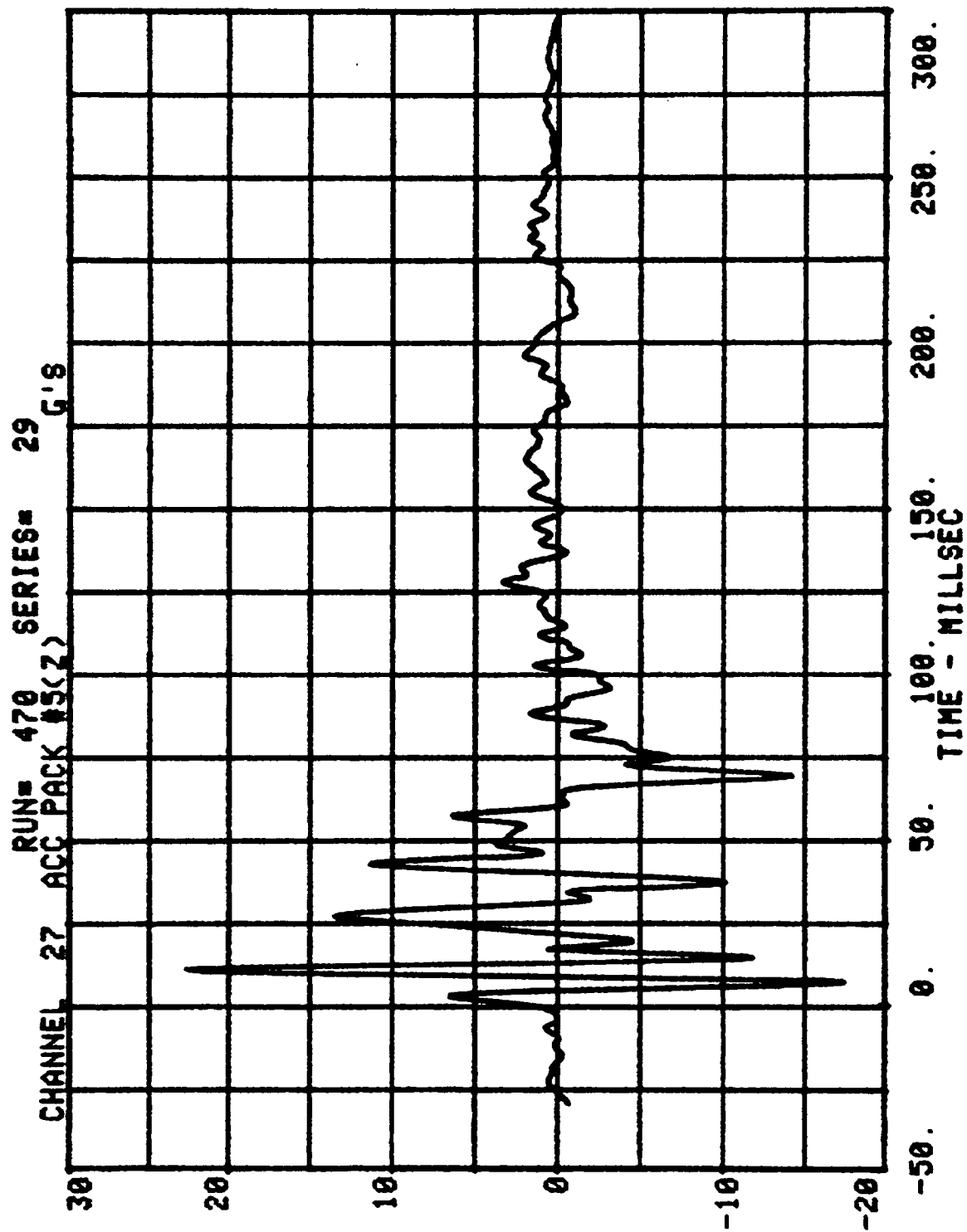


CHANNEL 26 ACC PACK #3(X) RUN= 470 SERIES= 29 G'8

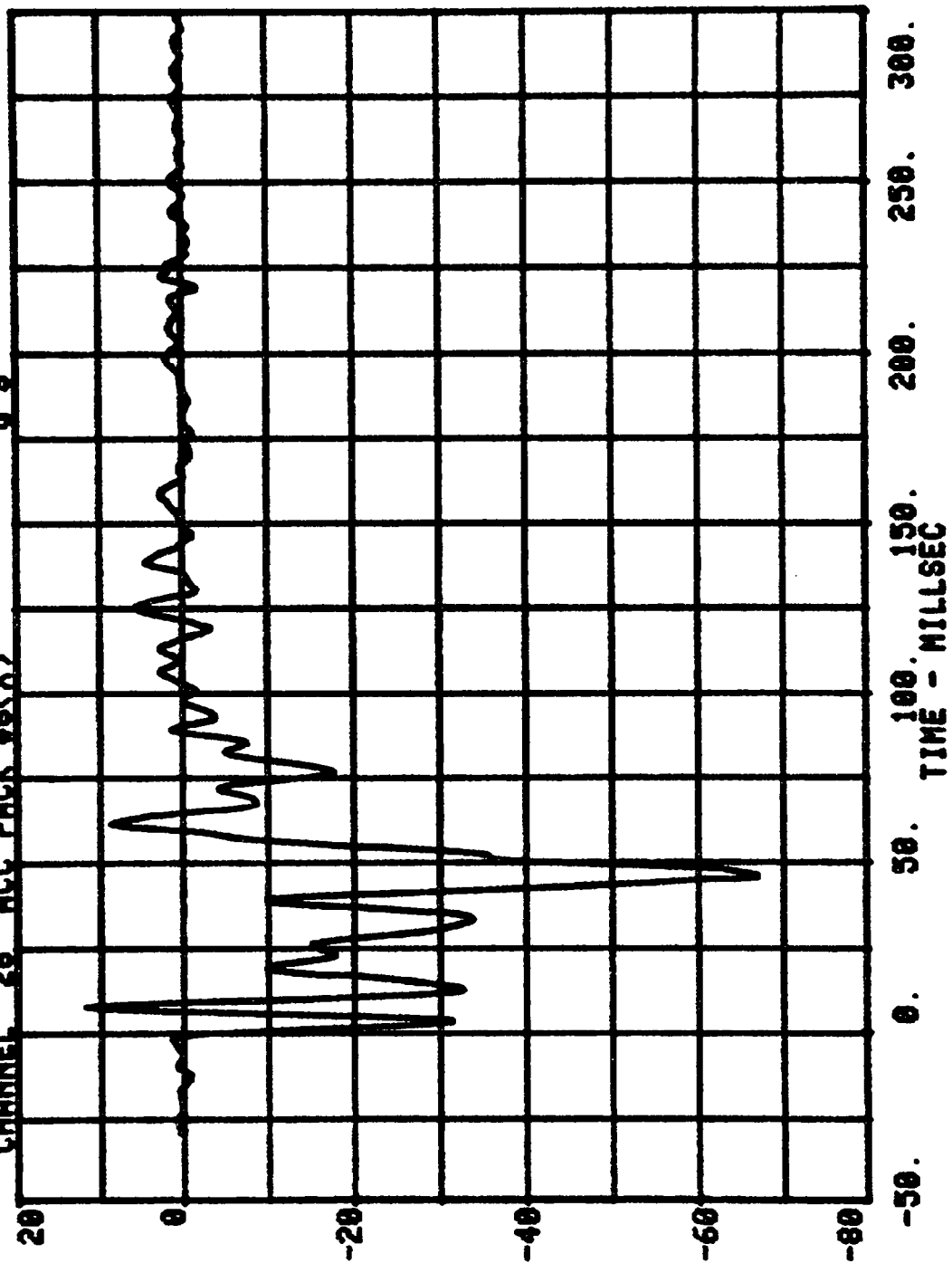


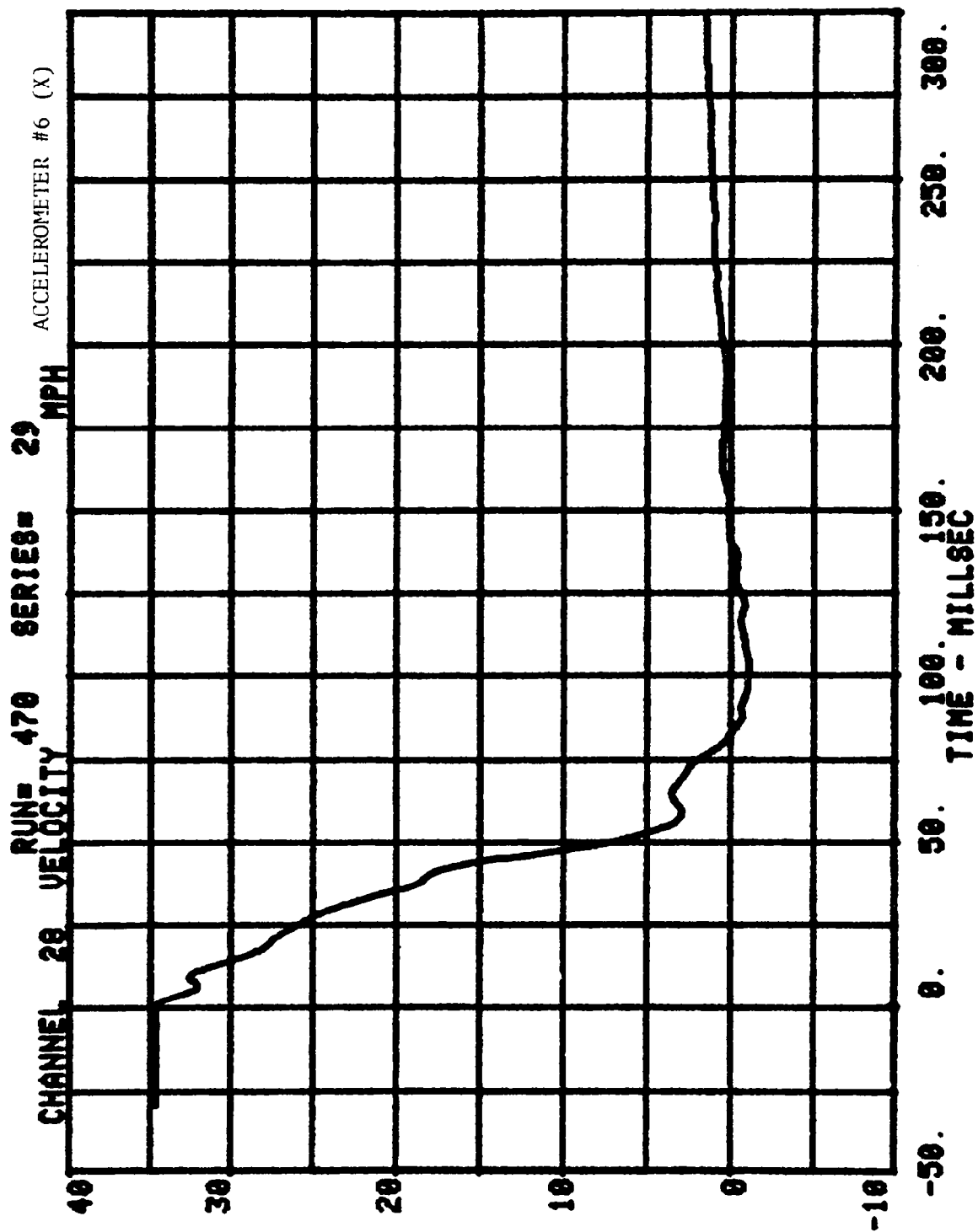


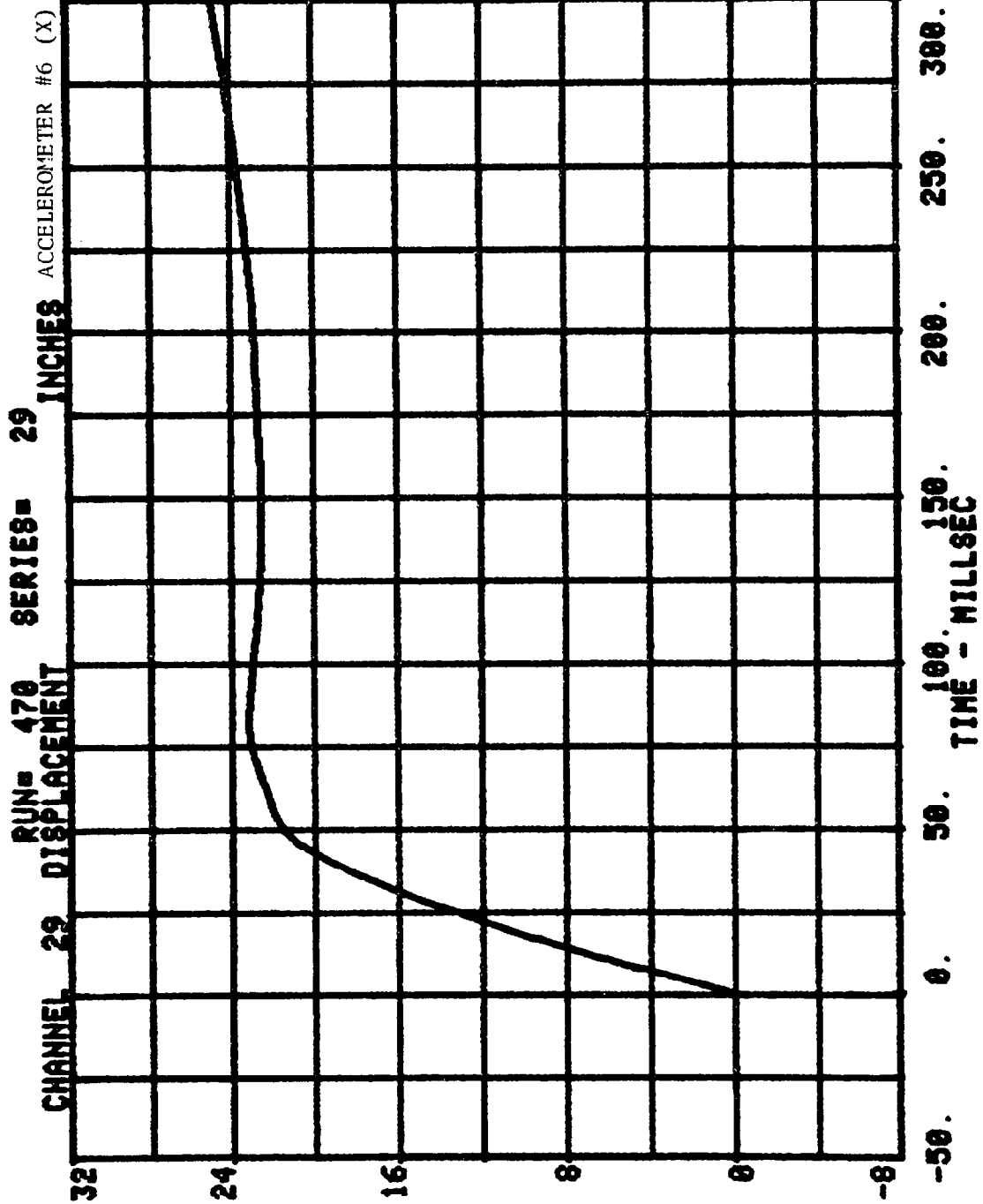




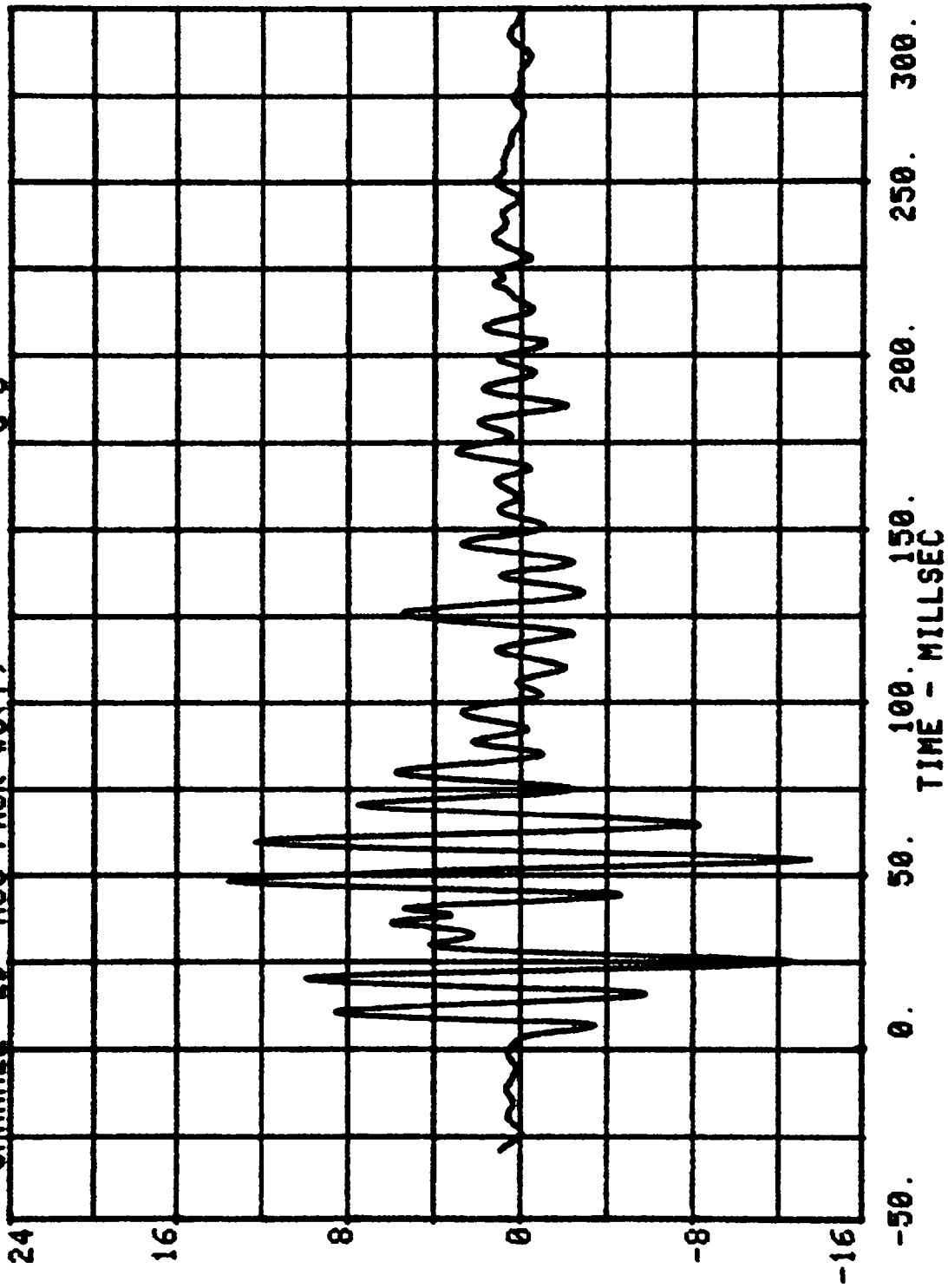
CHANNEL 20 ACC PACK #6(X) RUN= 470 SERIES= 29 G'S



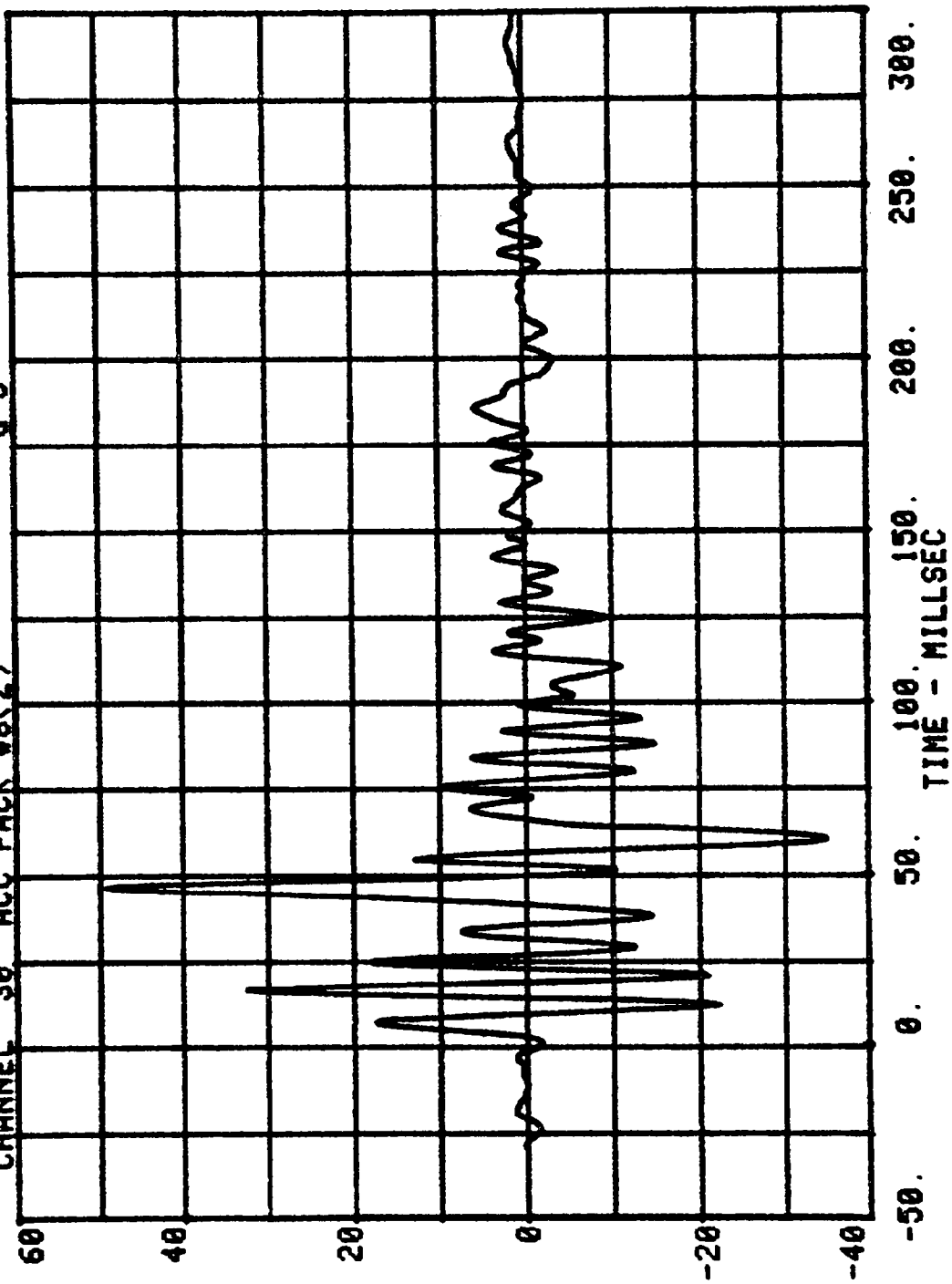


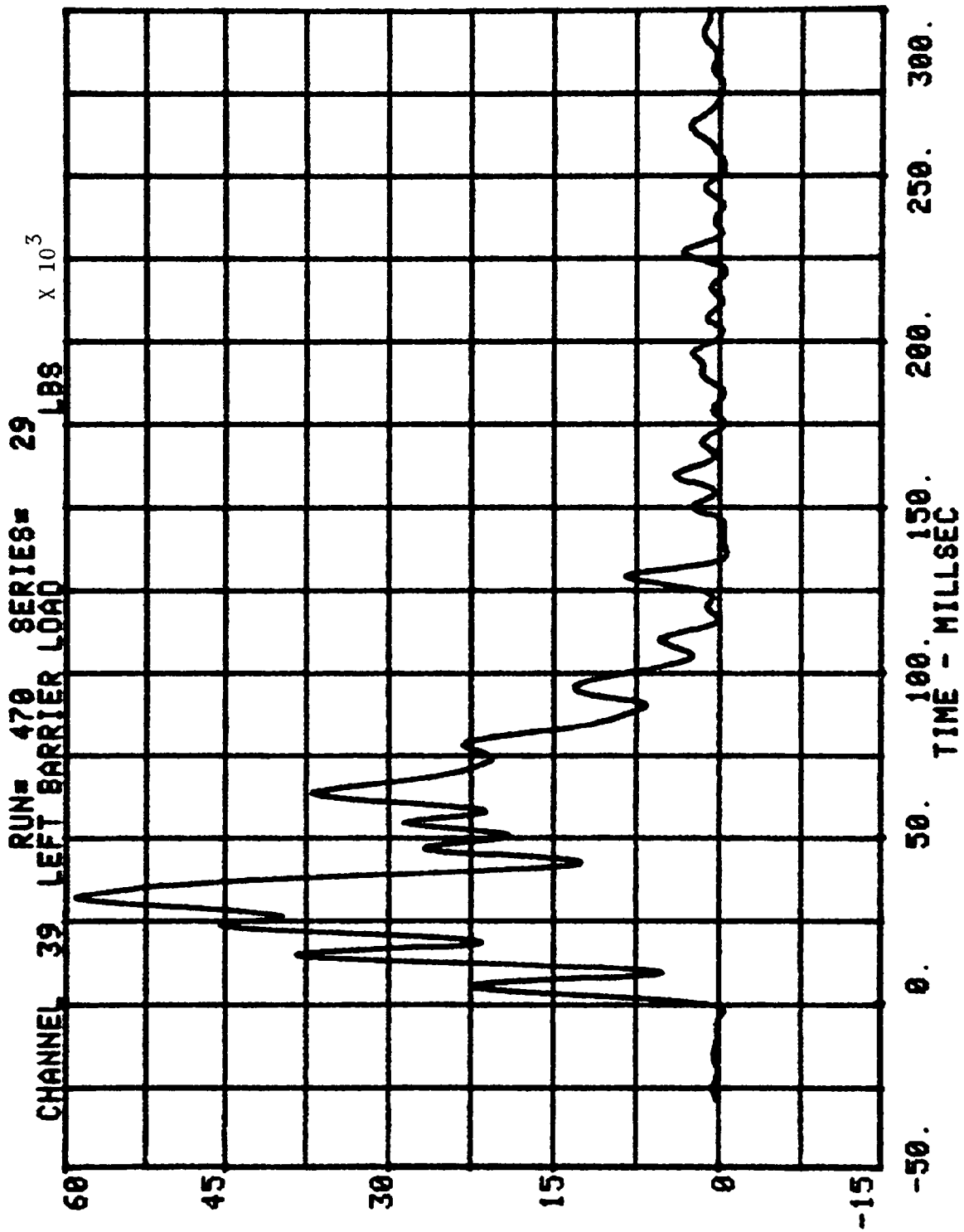


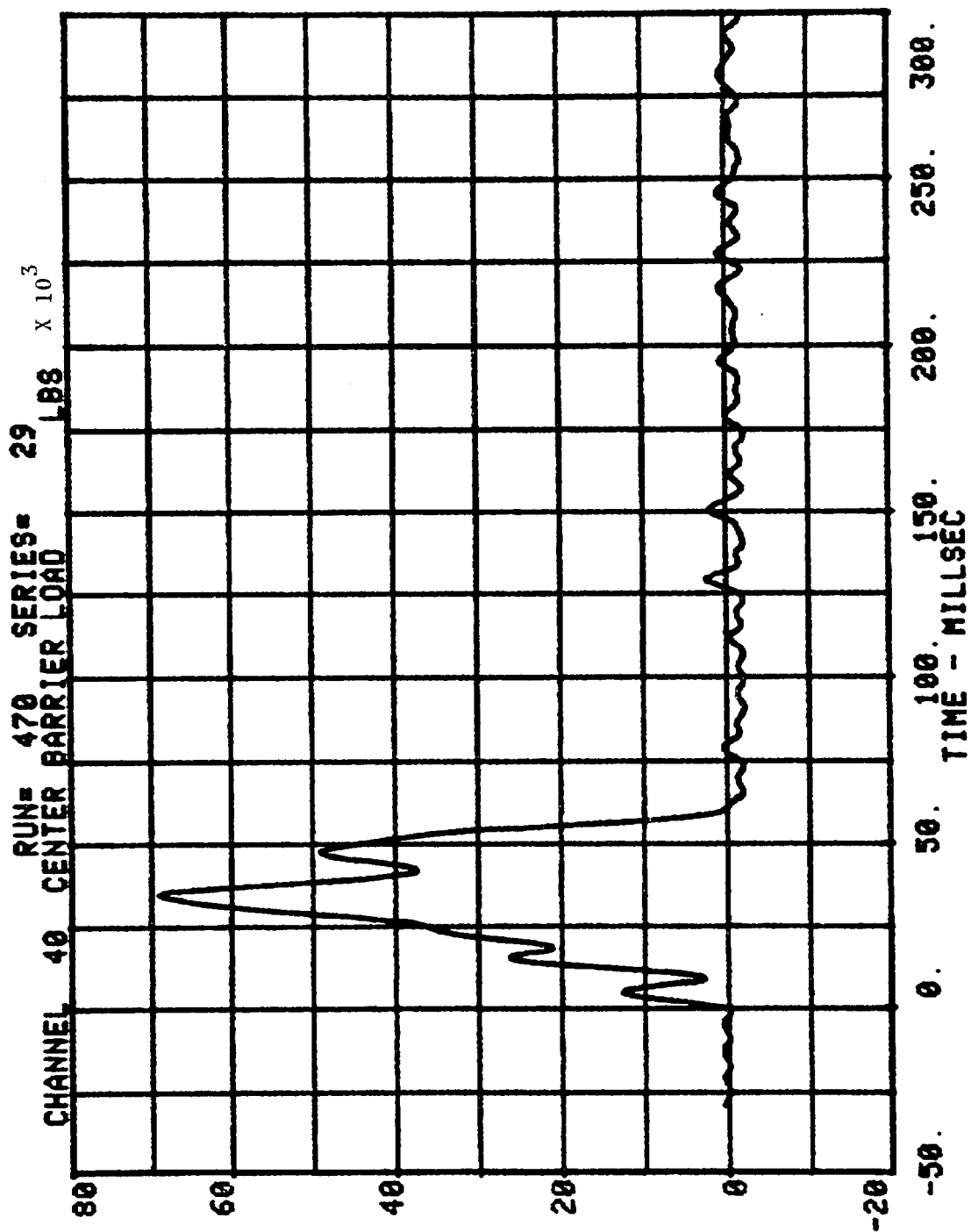
CHANNEL 29 ACC PACK #6(Y) RUN= 470 SERIES= 29 G'S



CHANNEL 30 ACC PACK #6(Z) RUN= 470 SERIES= 29 G'S



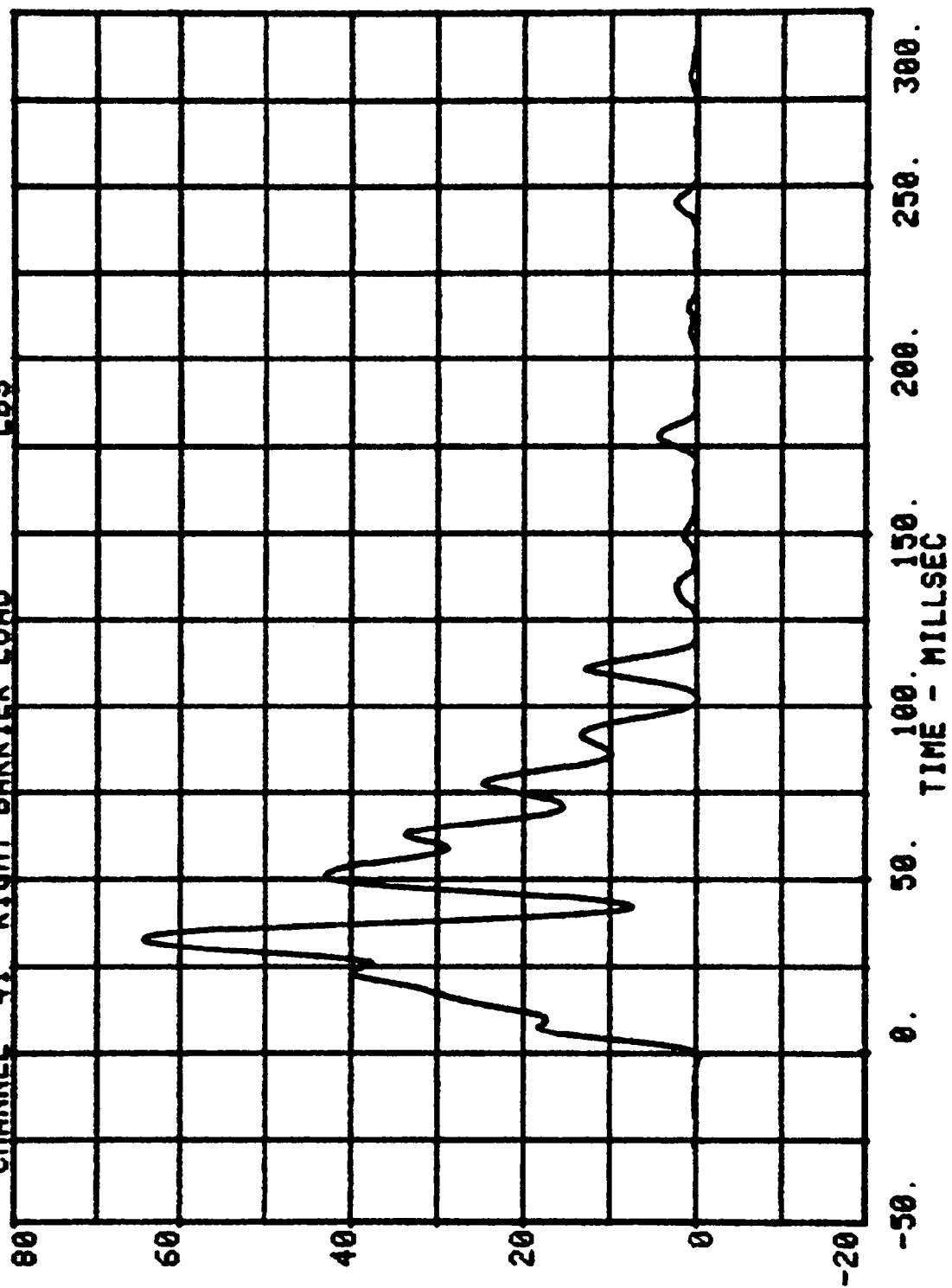


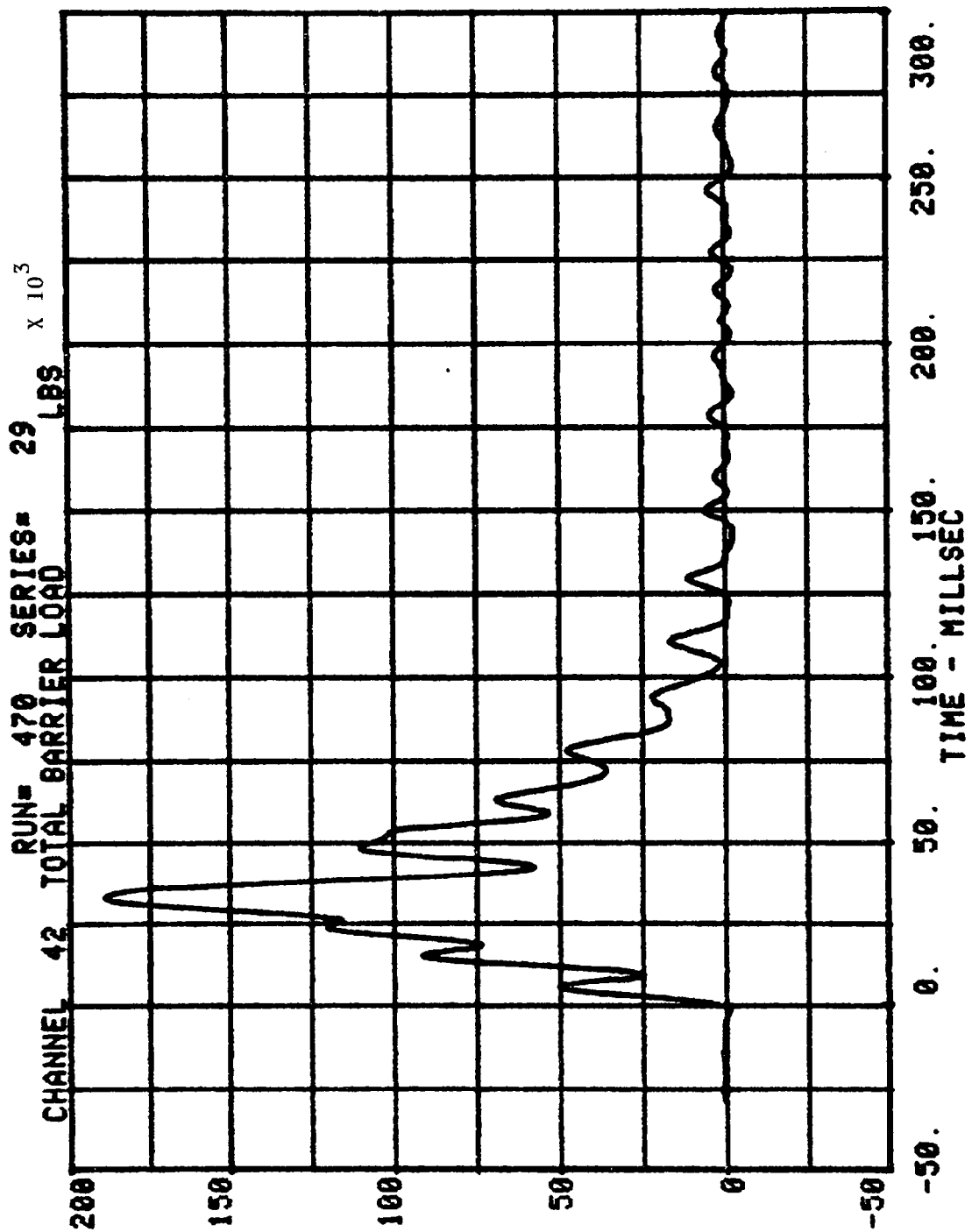


CHANNEL 41 RIGHT BARRIER LOAD

RUN= 470 SERIES= 29

LB X 10³





TEST NO. 308-29-470

1980 AMC CONCORD

DUMMY DATA

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

HEAD INJURY CRITERION
HEAD SEVERITY INDEX

BOA #29 AMC CONCORD BARRIER TEST

RUN= 470

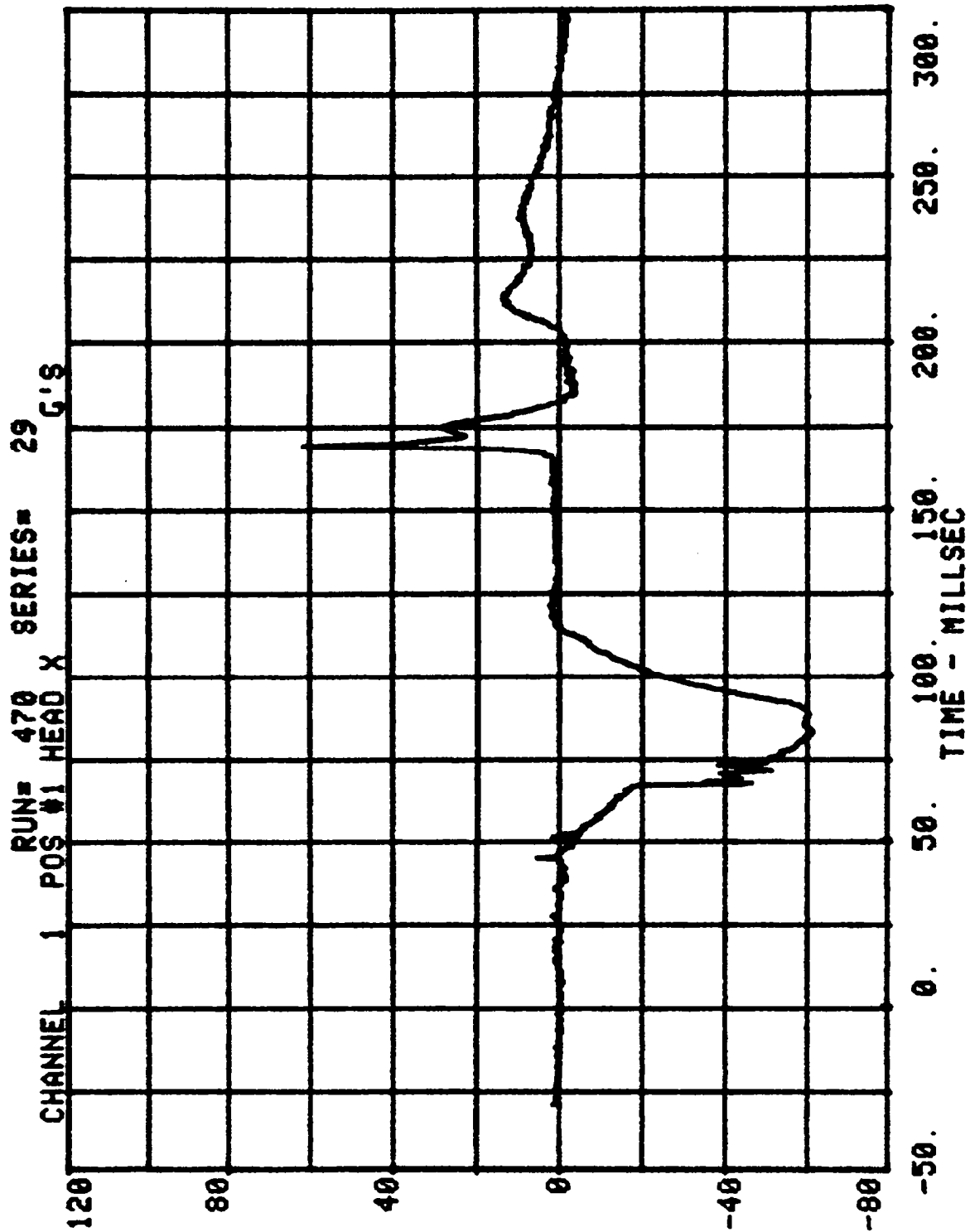
POS #1 HEAD RESULTANT

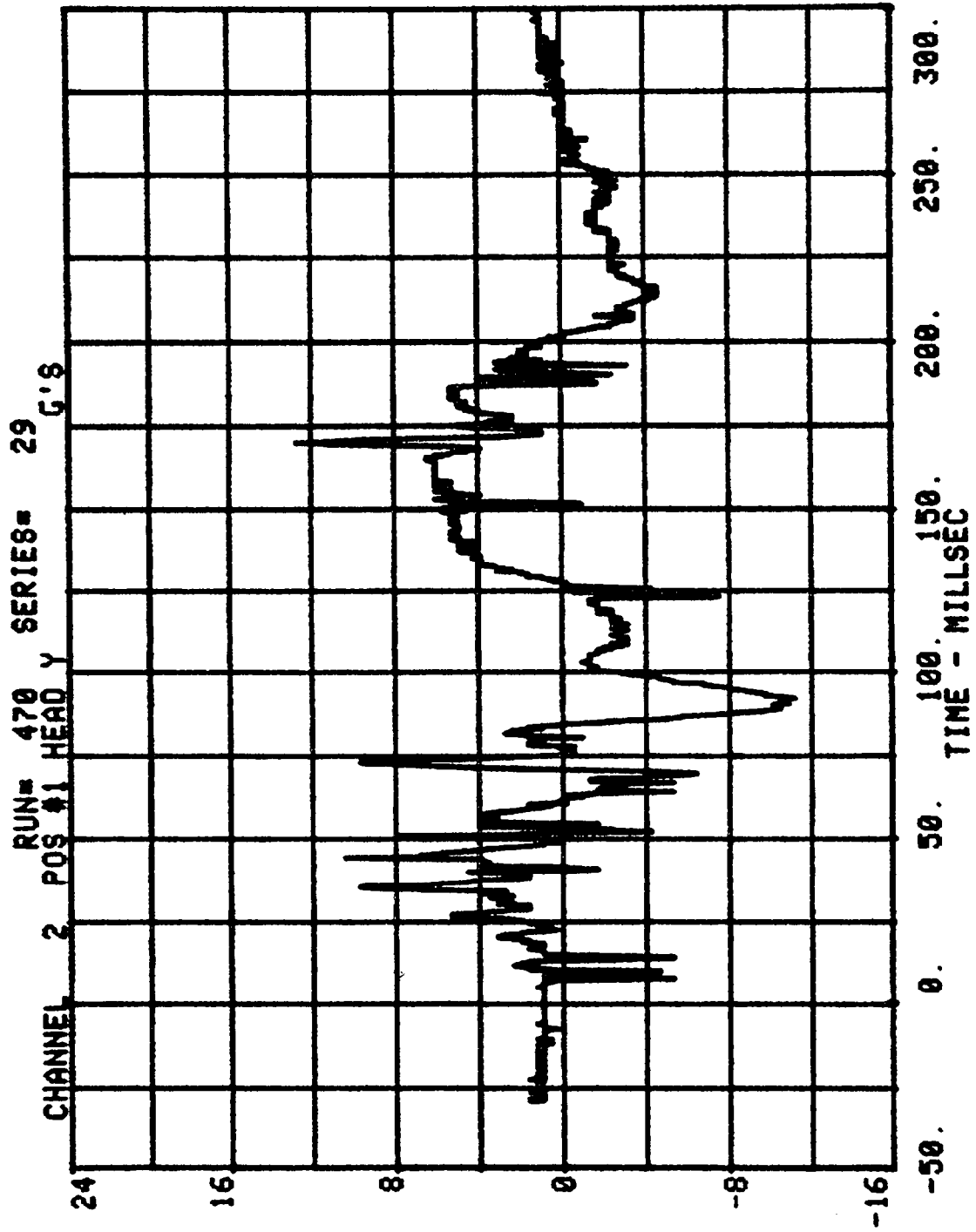
HIC=1077.8 FROM T1= .05580 TO T2= .09750

AVERAGE ACCELERATION BETWEEN T1 AND T2= 58.2G'S

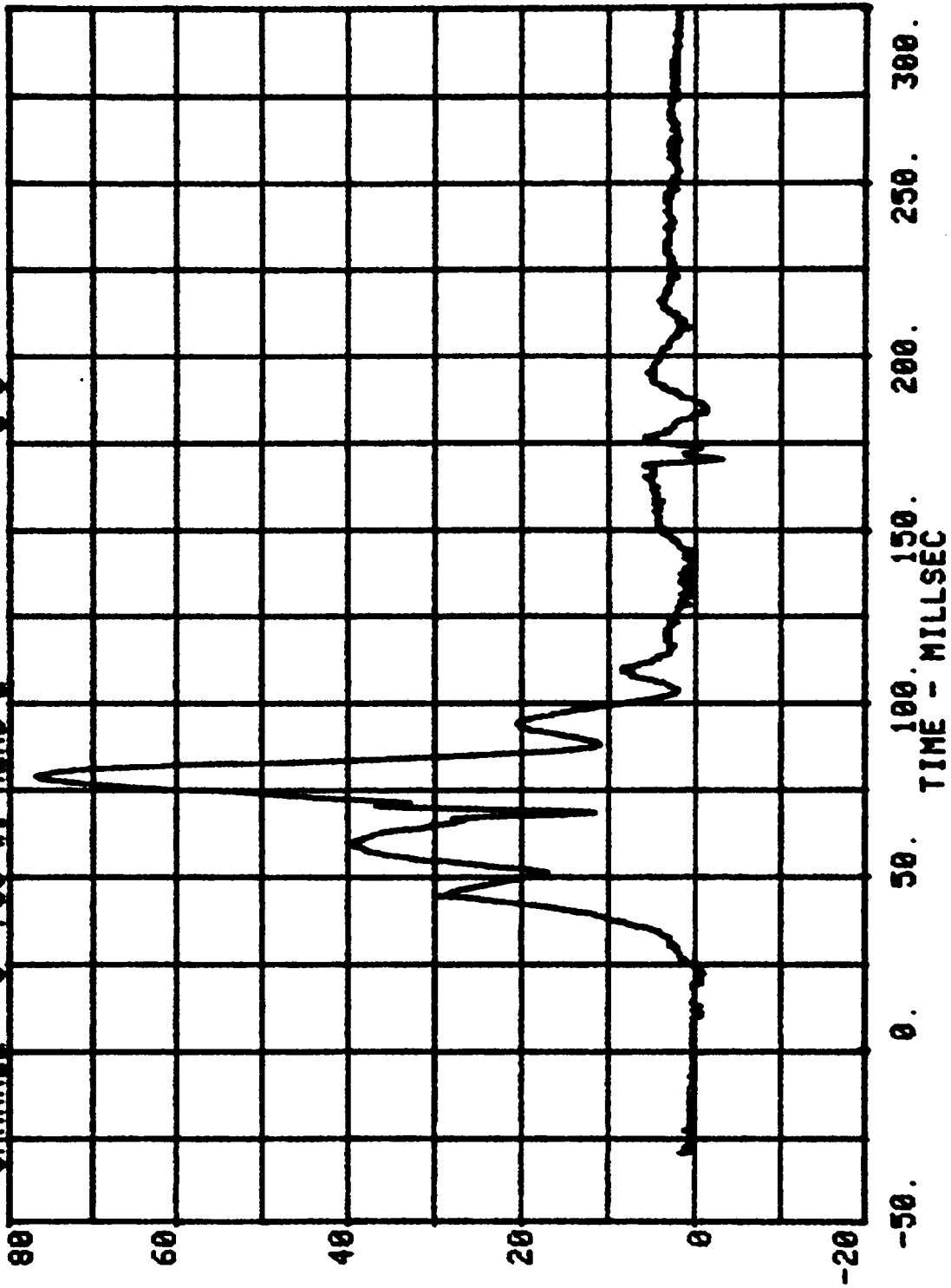
EVENT TIME= 300.0 MSEC

SEVERITY INDEX=1452.9

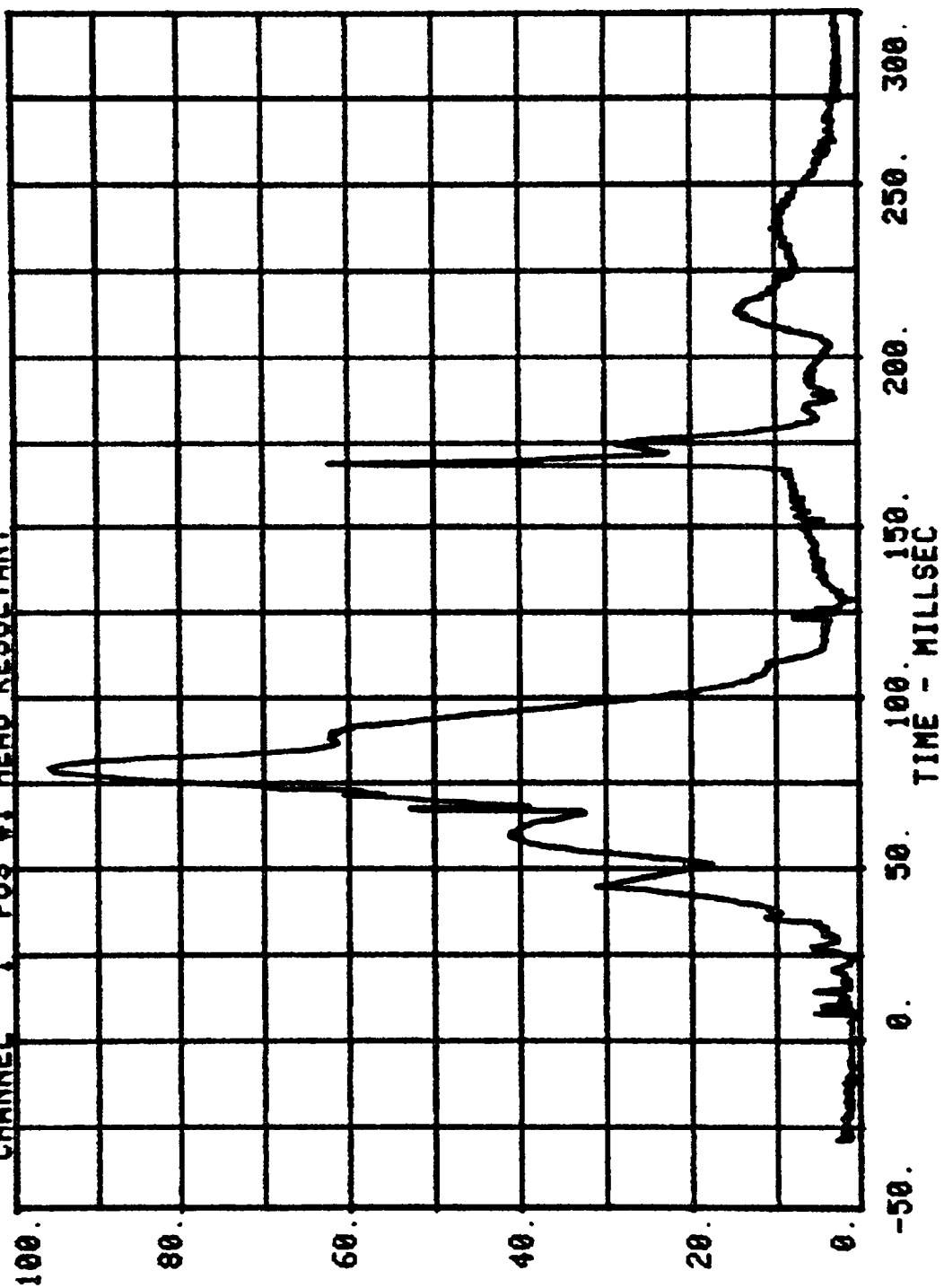


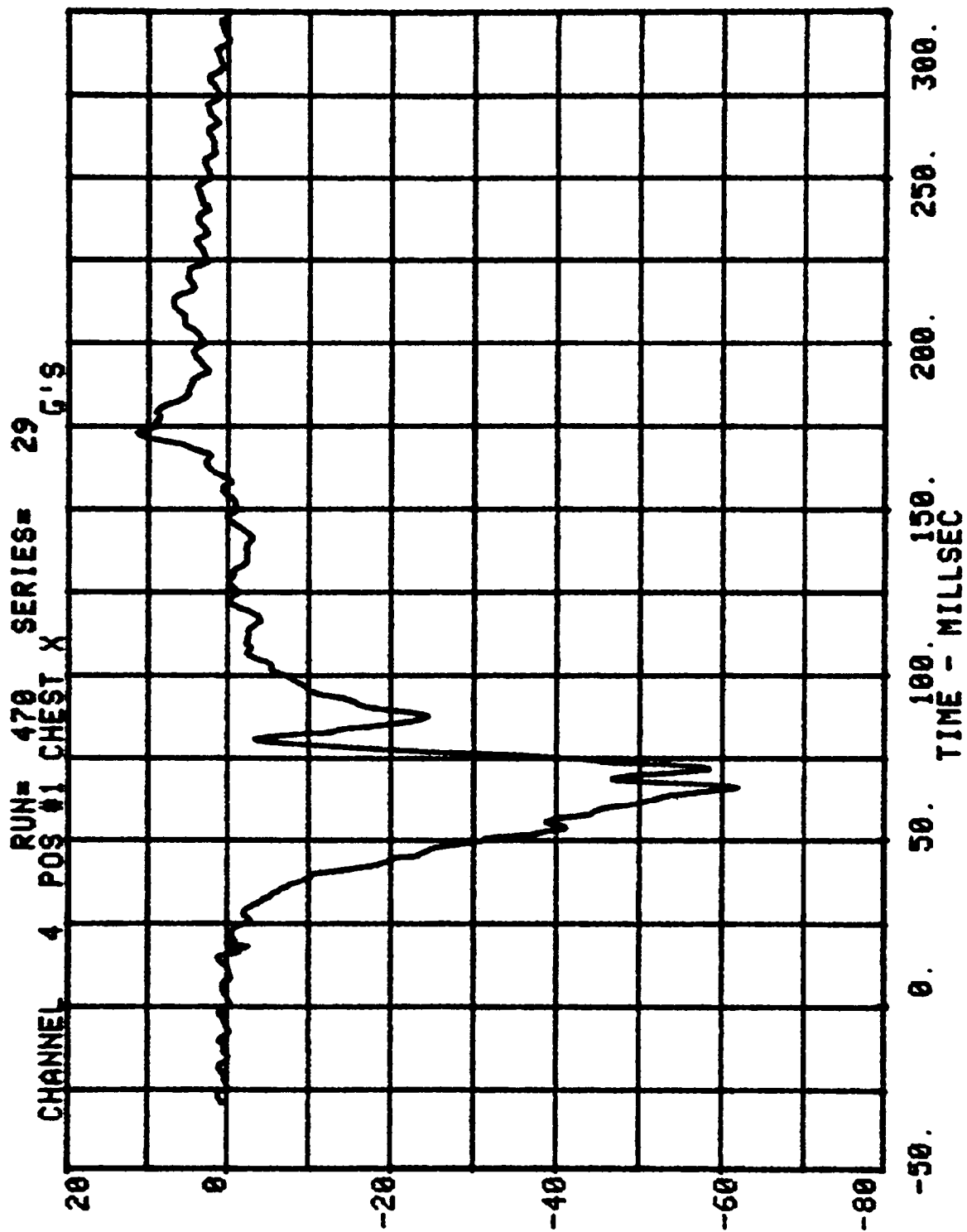


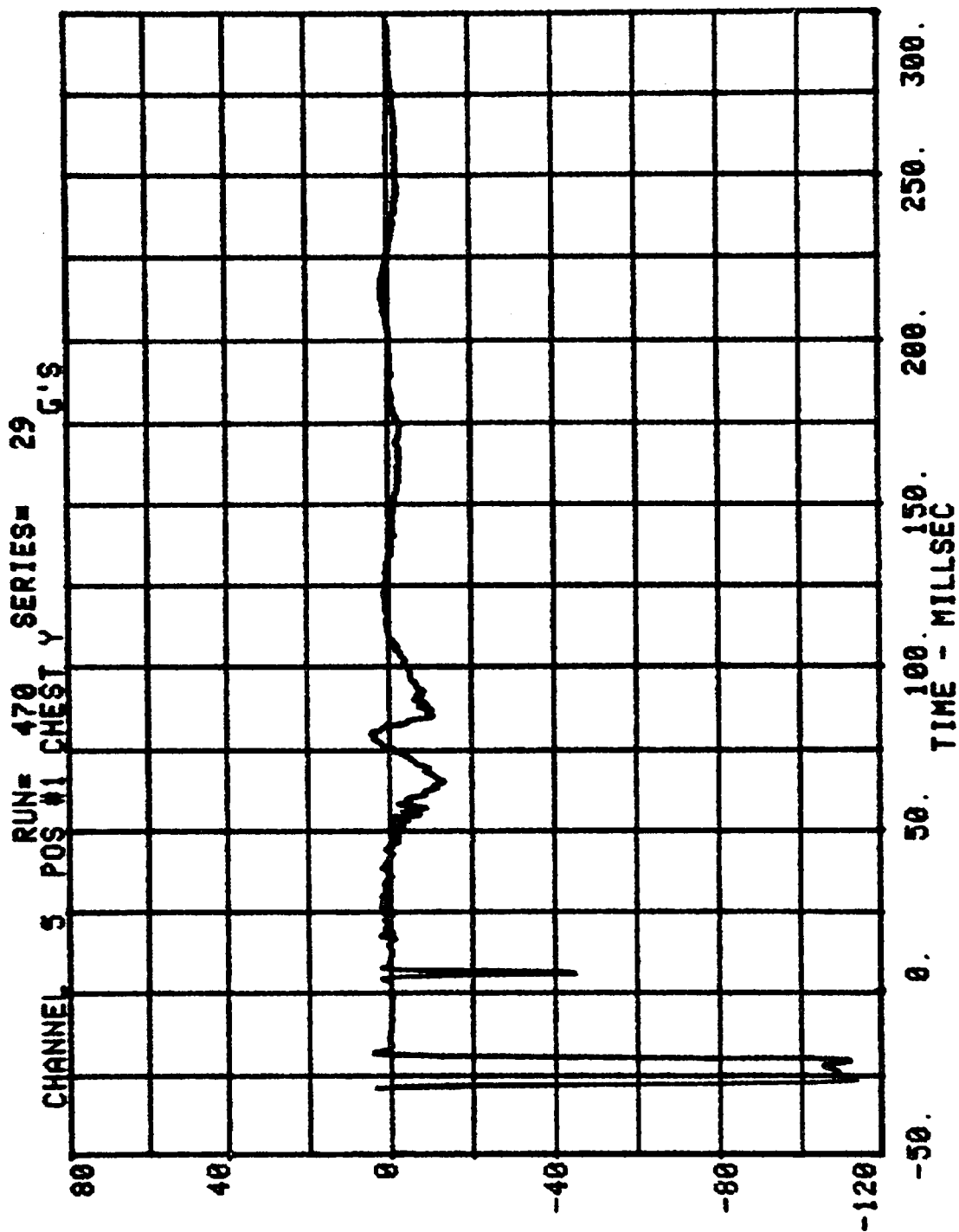
CHANNEL 3 POS #1 HEAD 2 RUN= 470 SERIES= 29 6'8

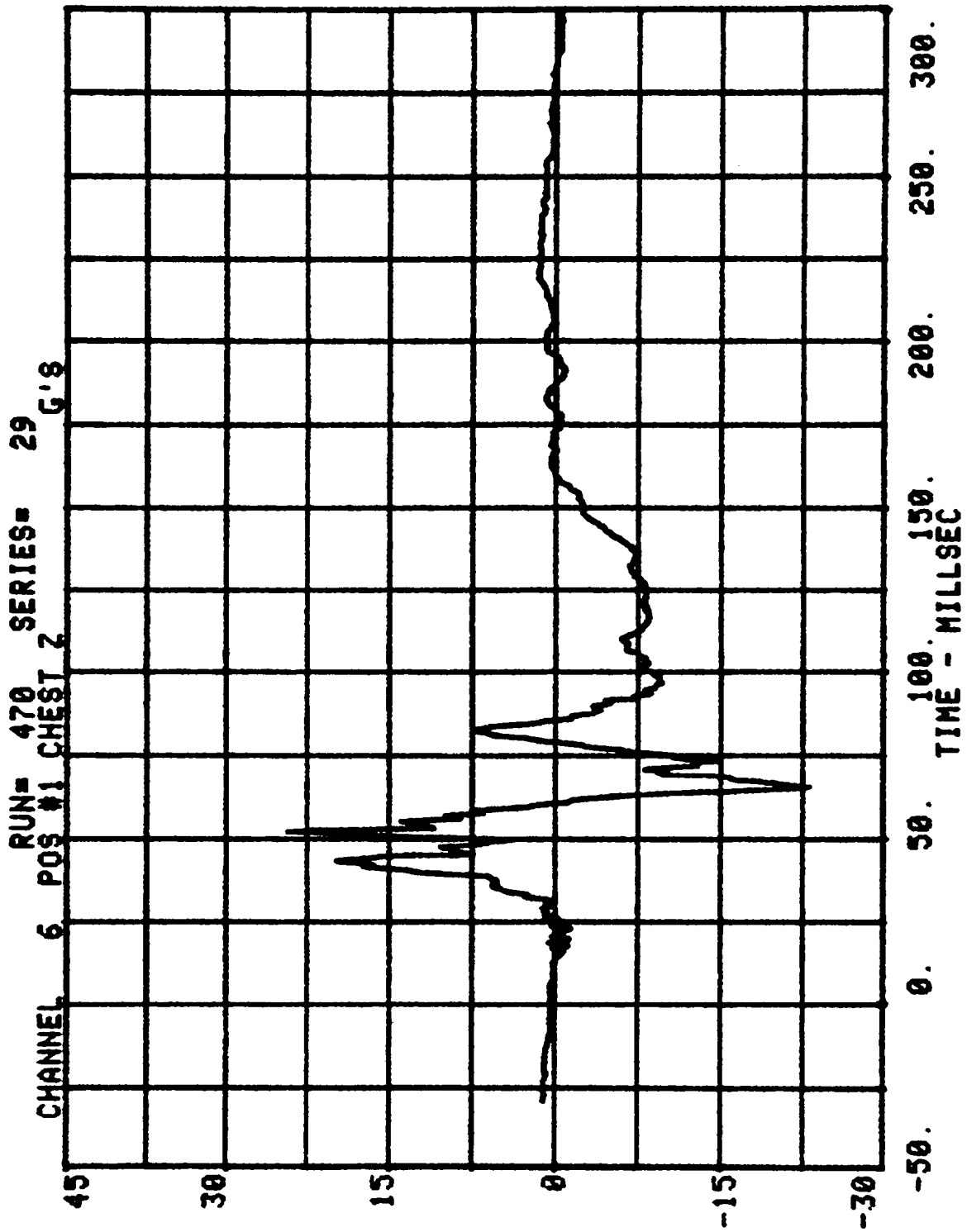


CHANNEL 1 POS #1 HEAD RESULTant RUN= 470 SERIES= 29

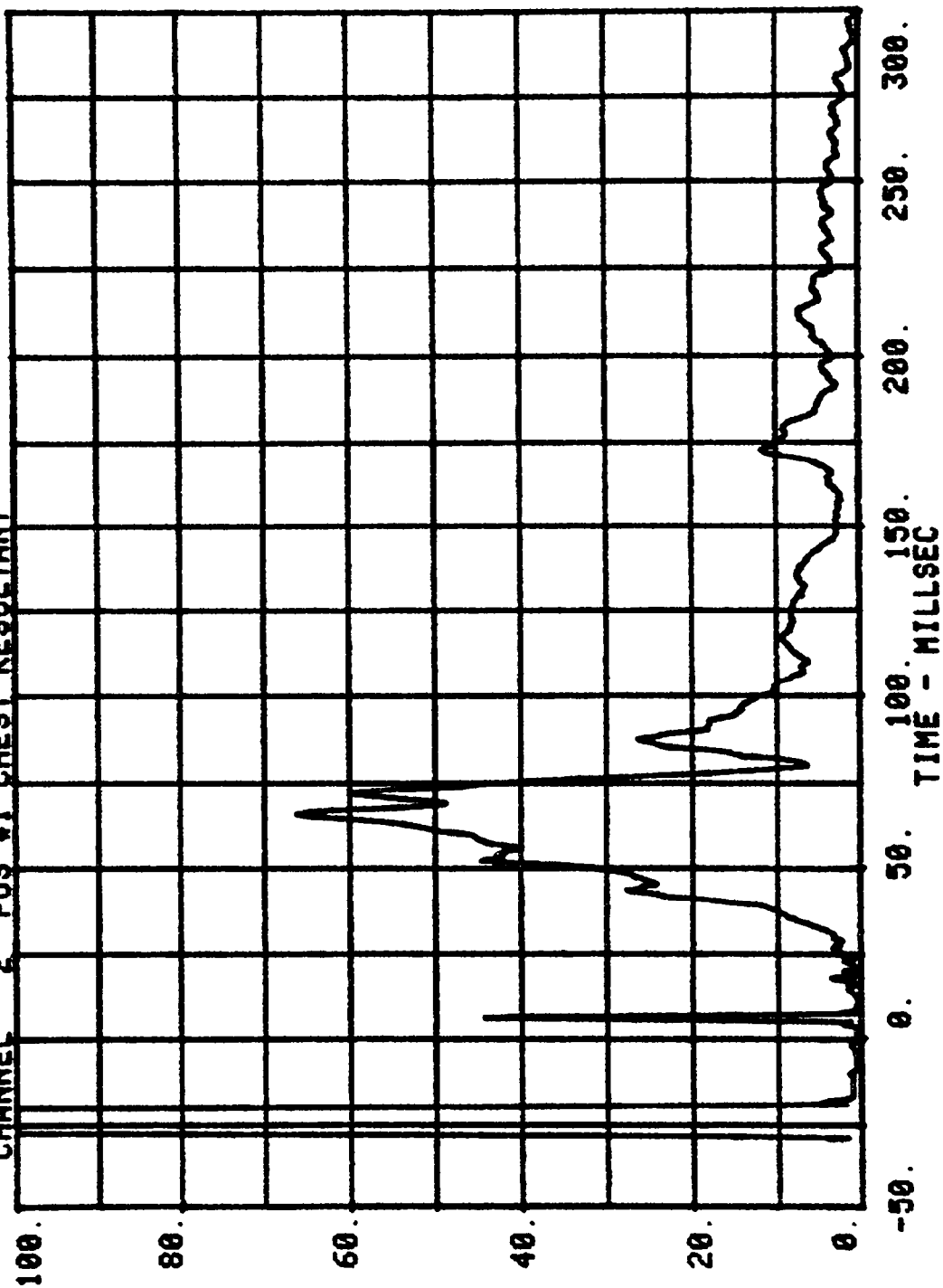




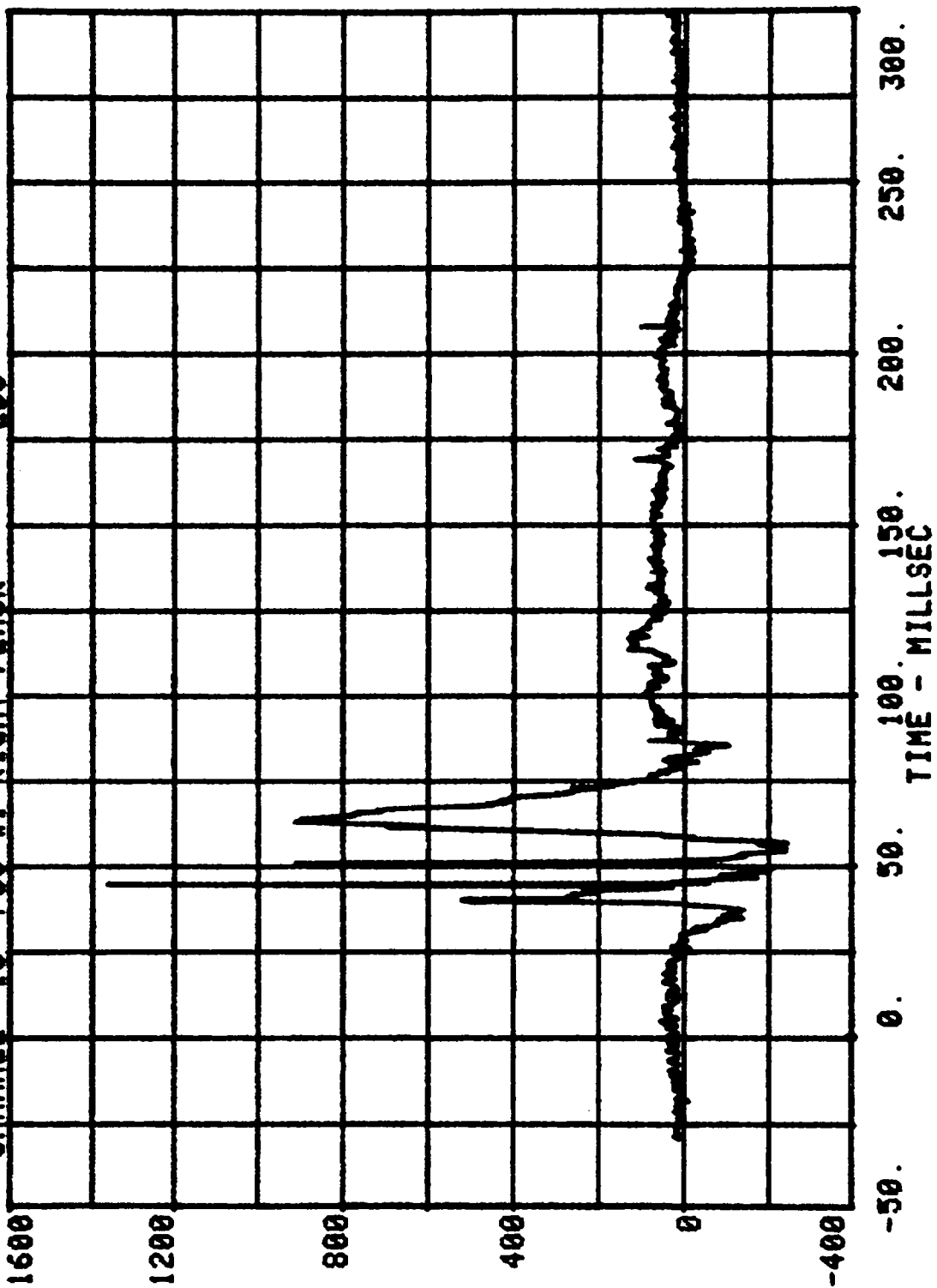




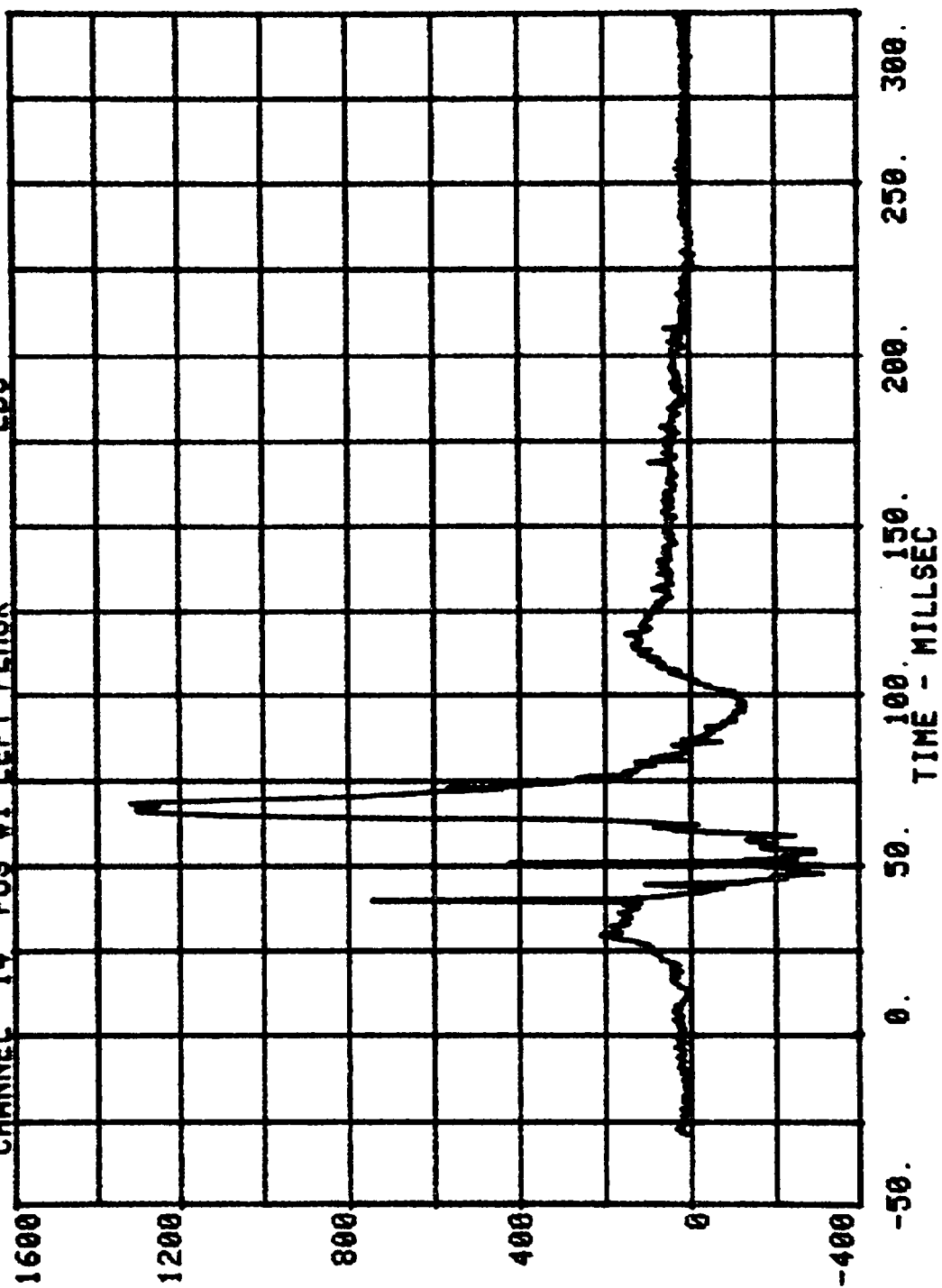
CHANNEL 2 POS #1 CHEST RESULTANT RUN= 470 SERIES= 29

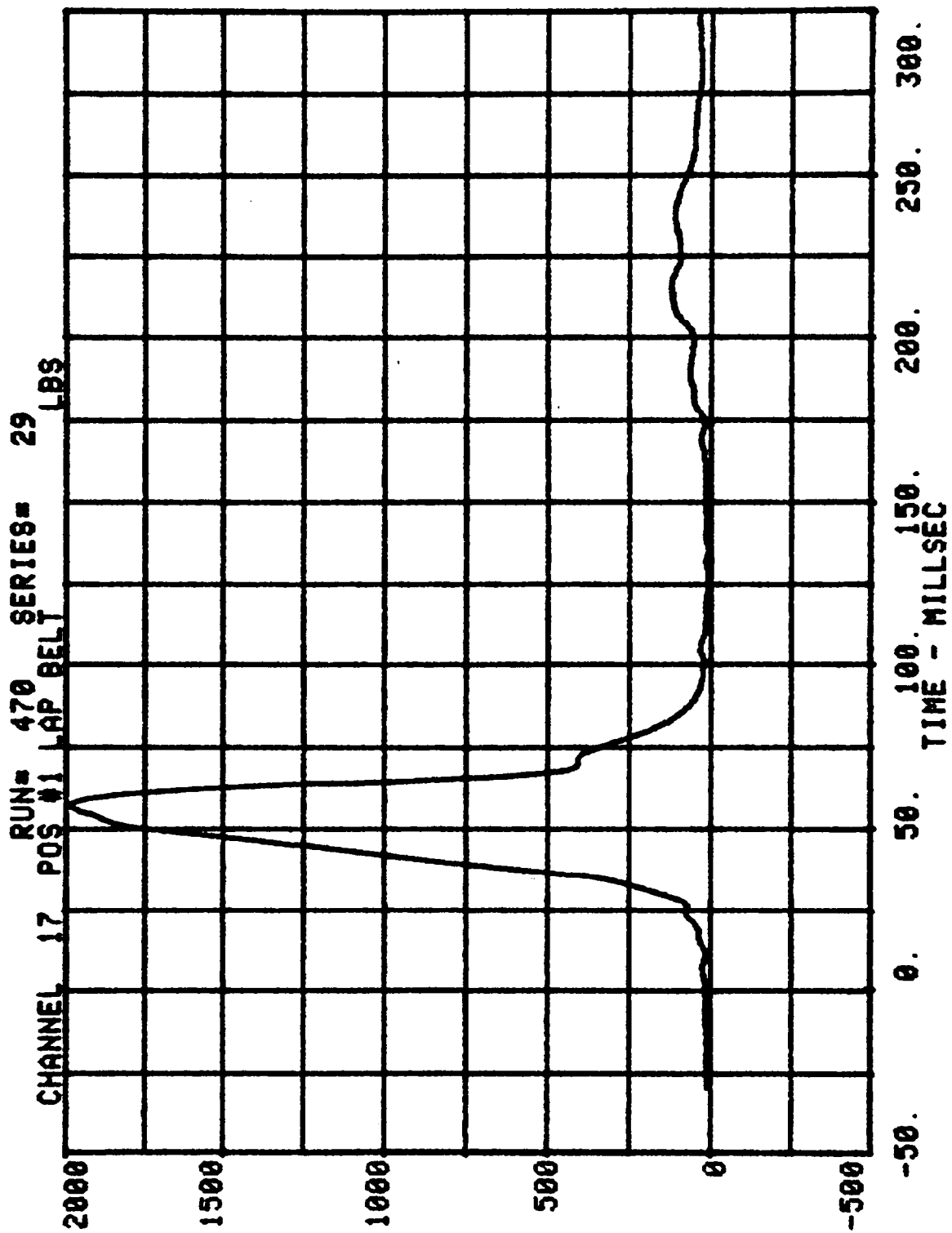


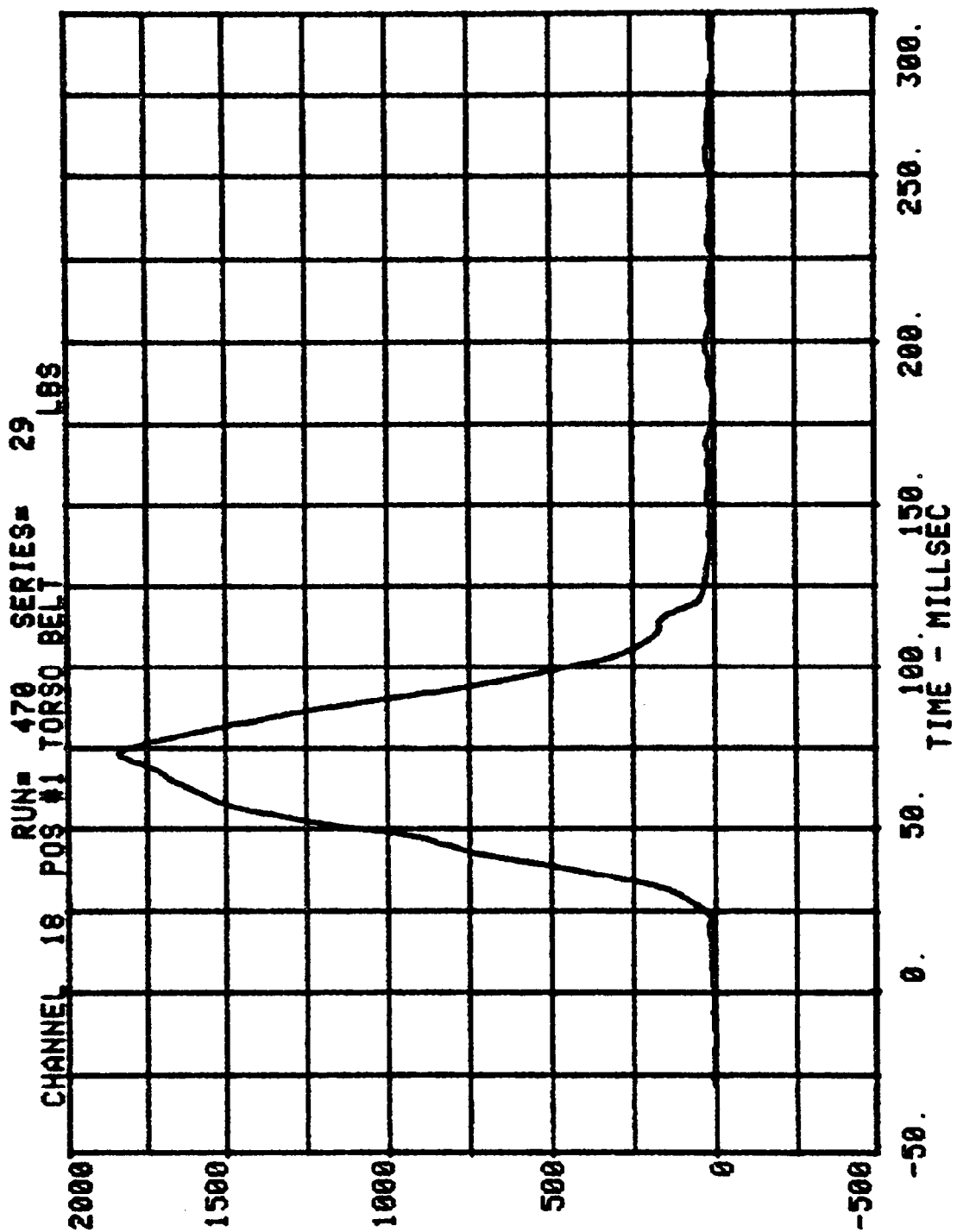
RUN= 470 SERIES= 29
CHANNEL 13 POS #1 RIGHT FEMUR LBS



CHANNEL 14 POS #1 LEFT FEMUR RUN= 470 SERIES= 29 LBS







HEAD INJURY CRITERION
HEAD SEVERITY INDEX

BOA #29 AMC CONCORD BARRIER TEST

RUN= 470

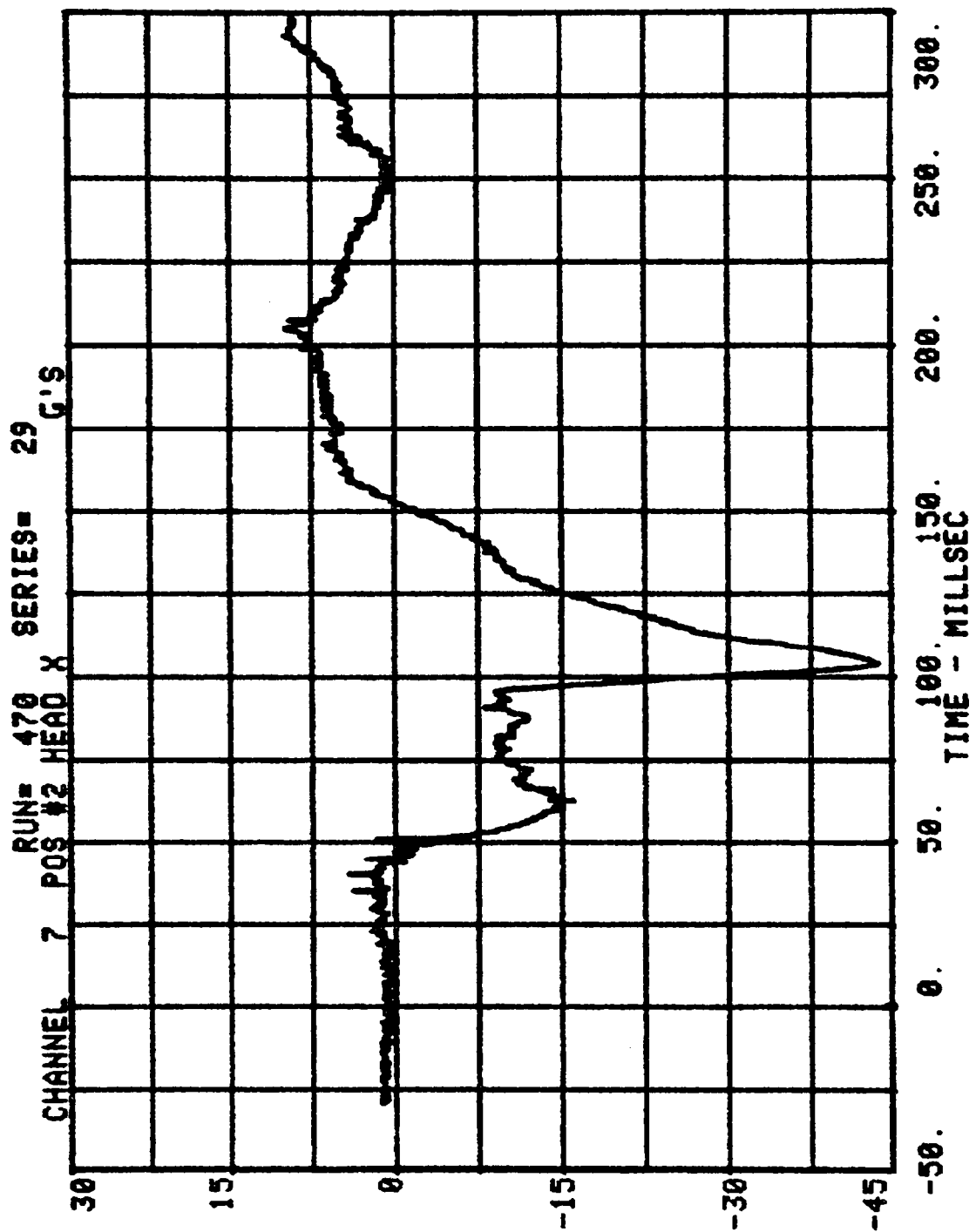
POS #2 HEAD RESULTANT

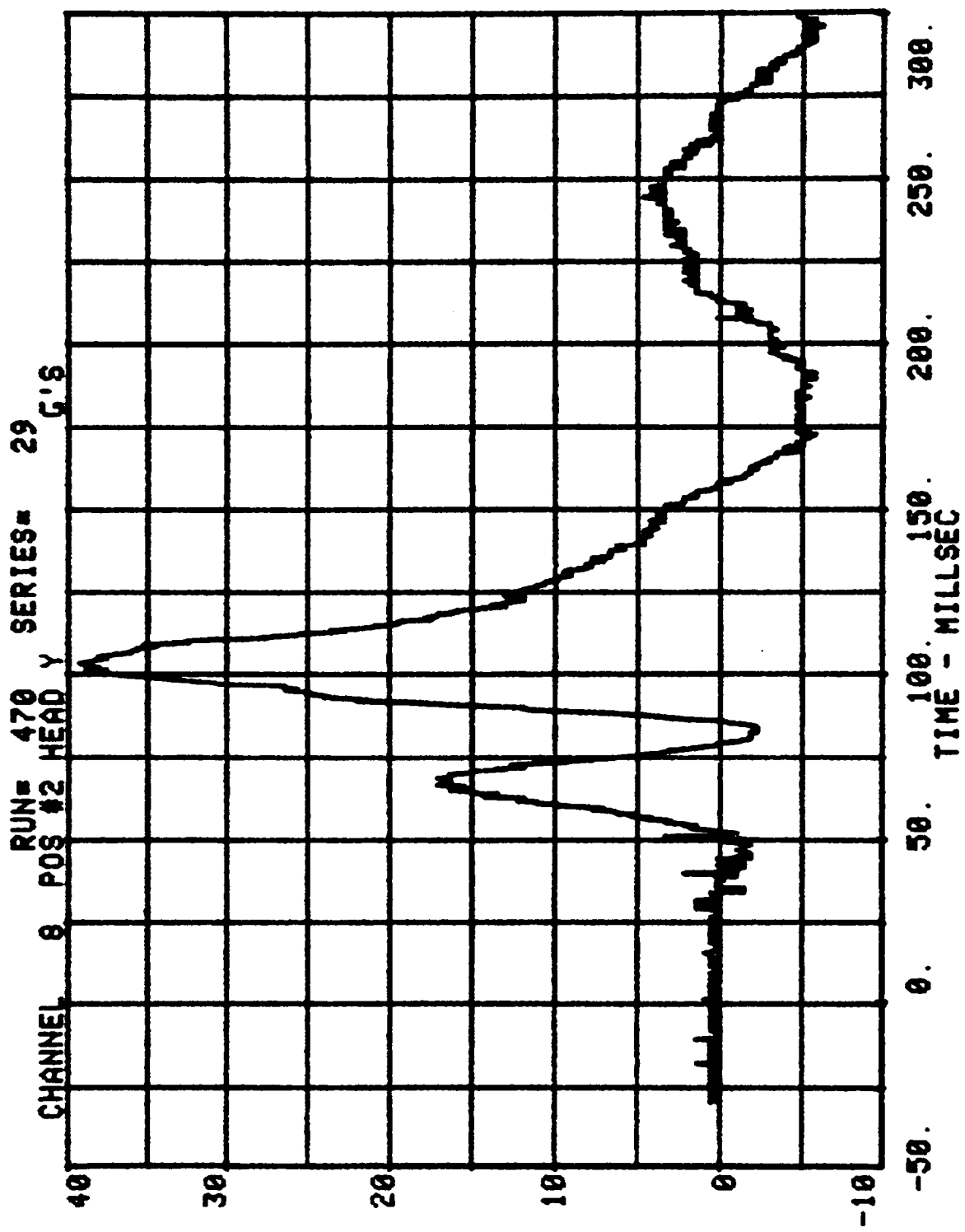
HIC=1457.2 FROM T1= .06240 TO T2= .11880

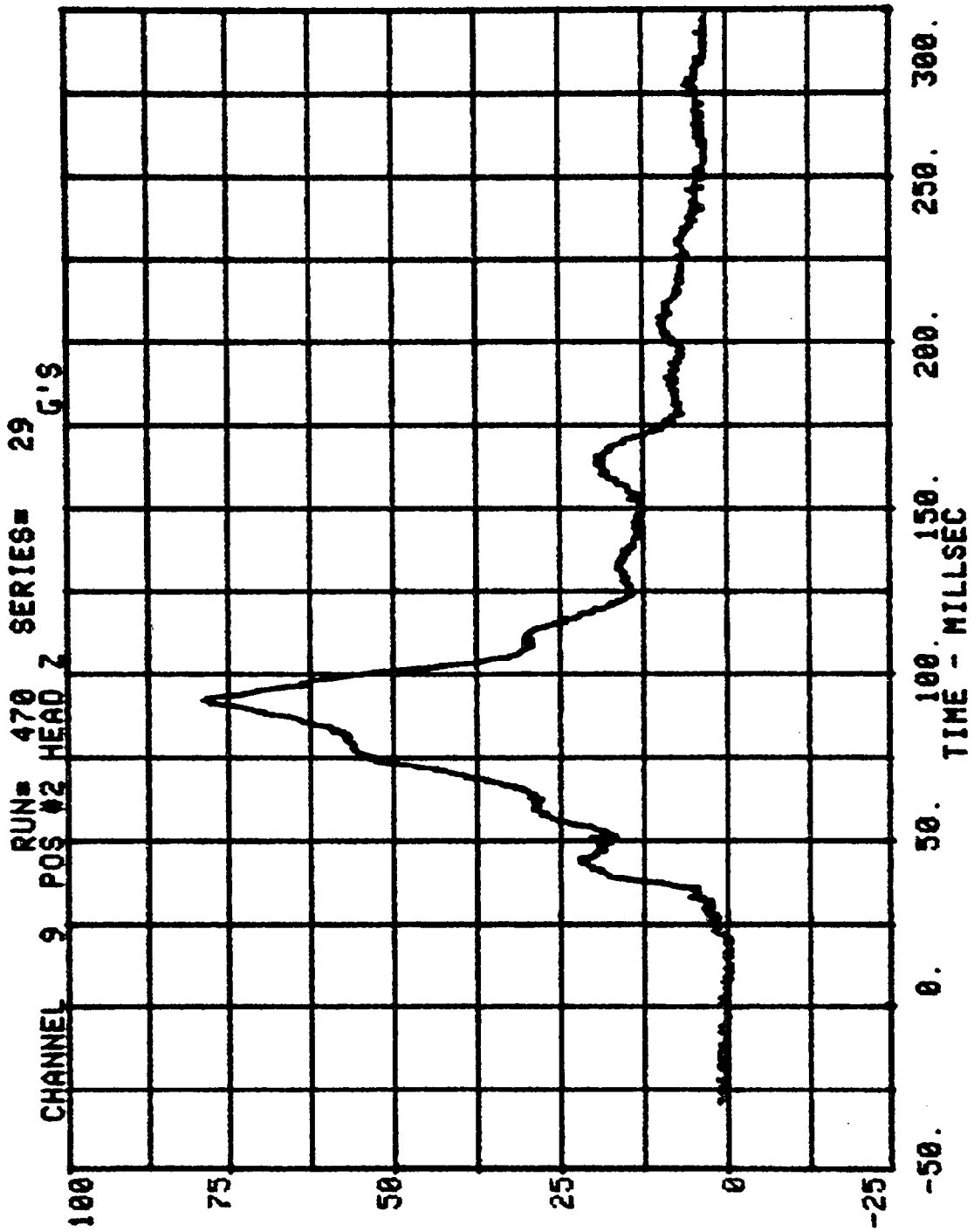
AVERAGE ACCELERATION BETWEEN T1 AND T2= 58.2G'S

EVENT TIME= 300.0 MSEC

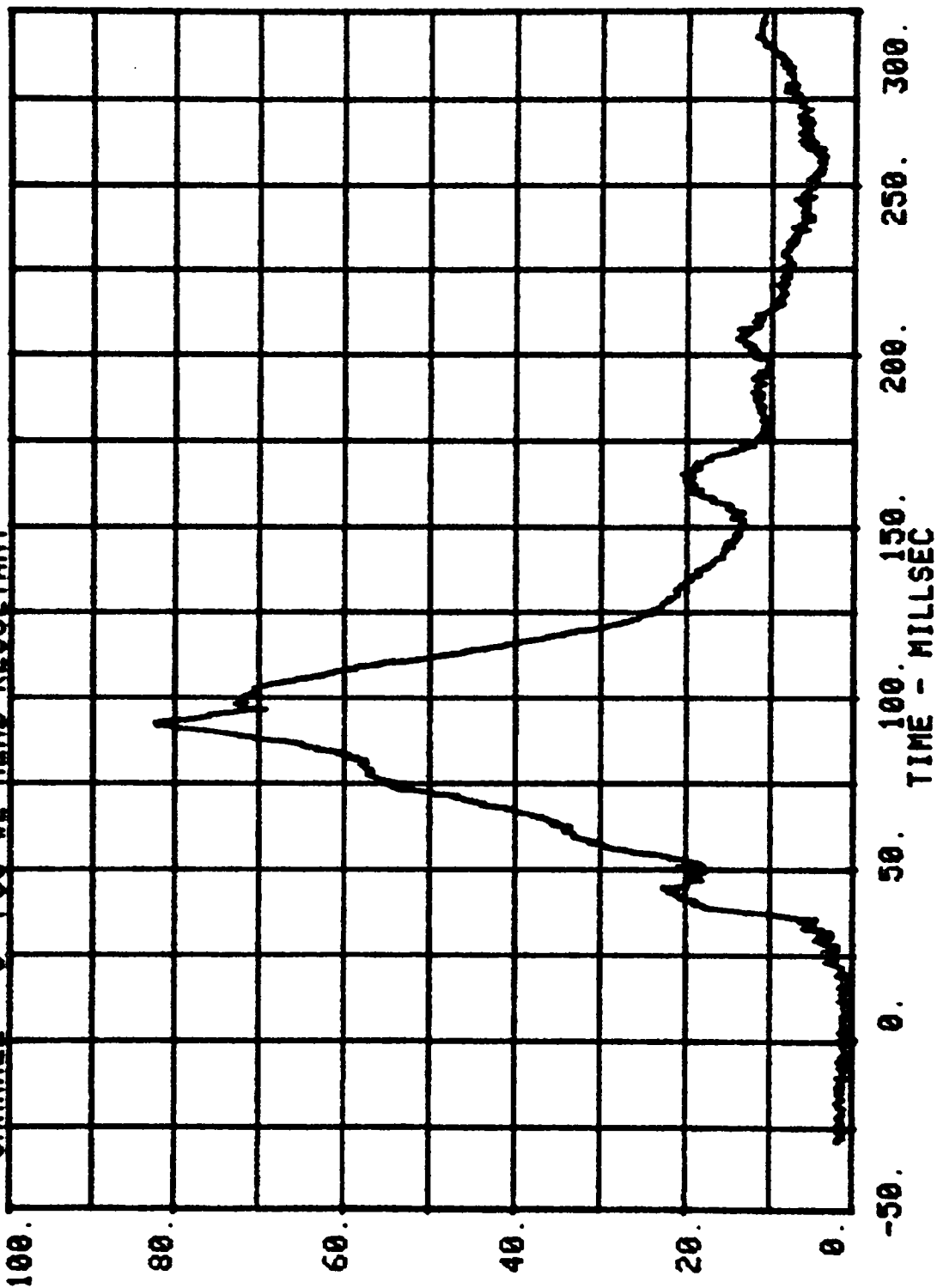
SEVERITY INDEX=1800.2



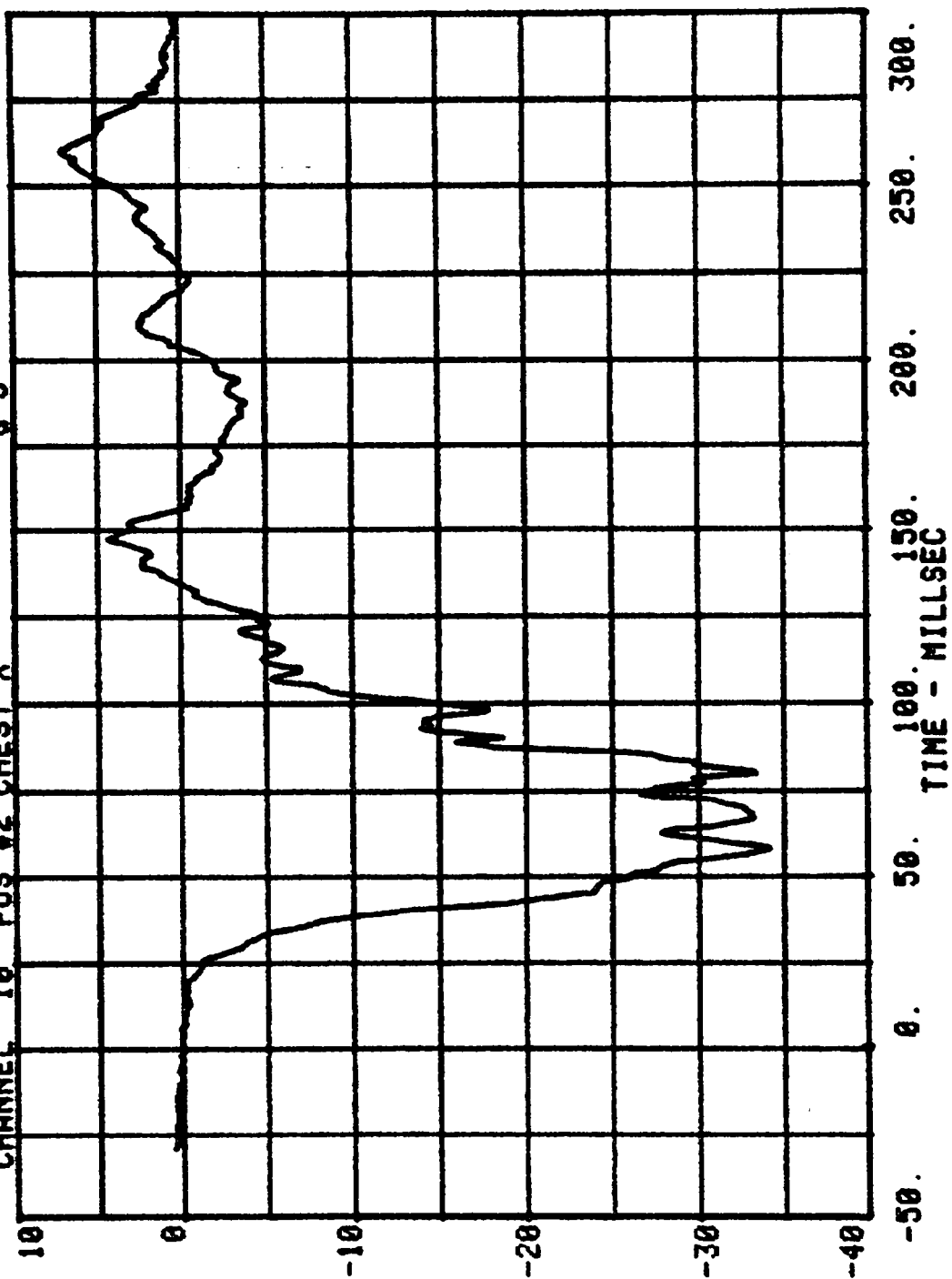


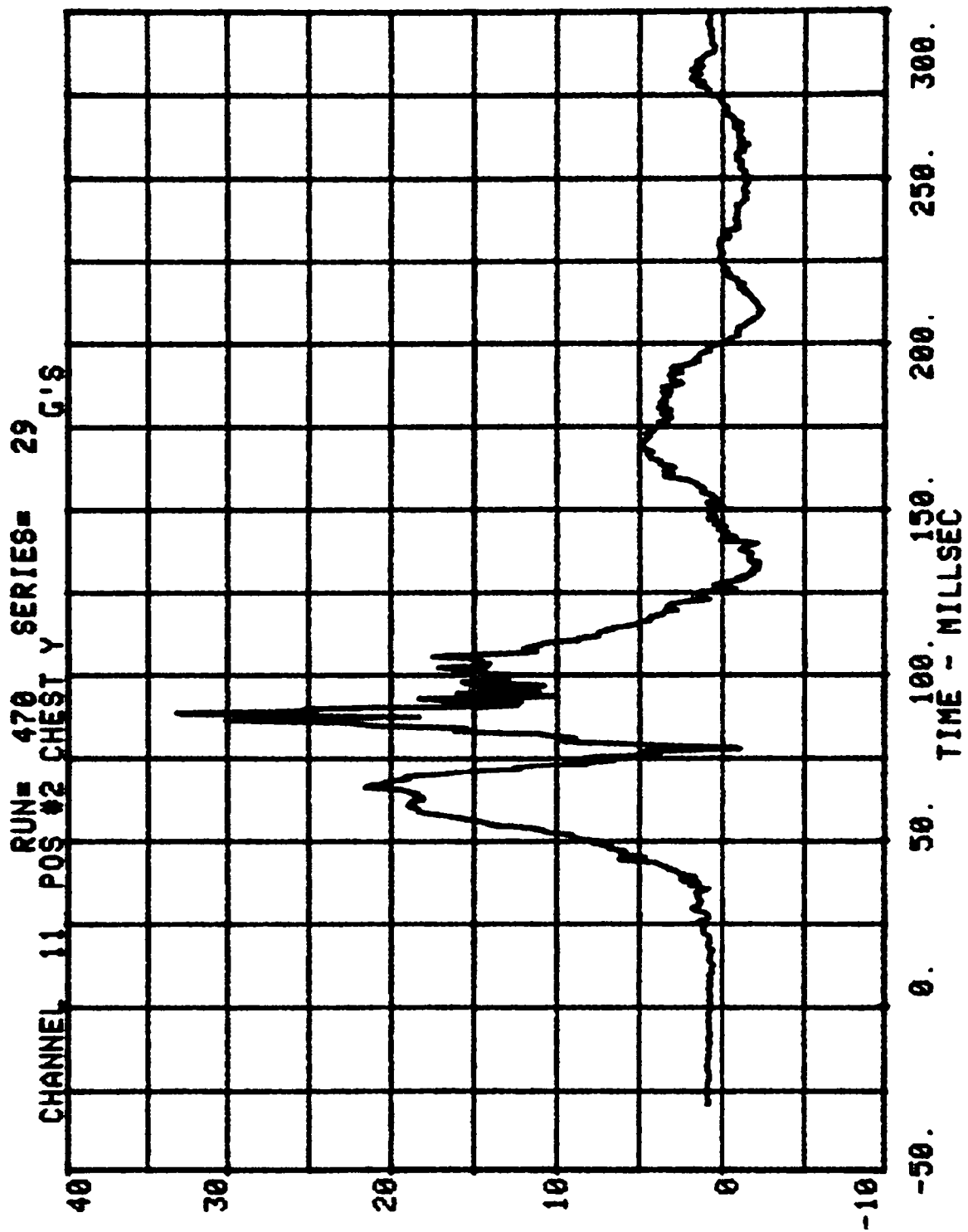


CHANNEL 3 POS #2 HEAD RESULTant RUN# 470 SERIES# 29

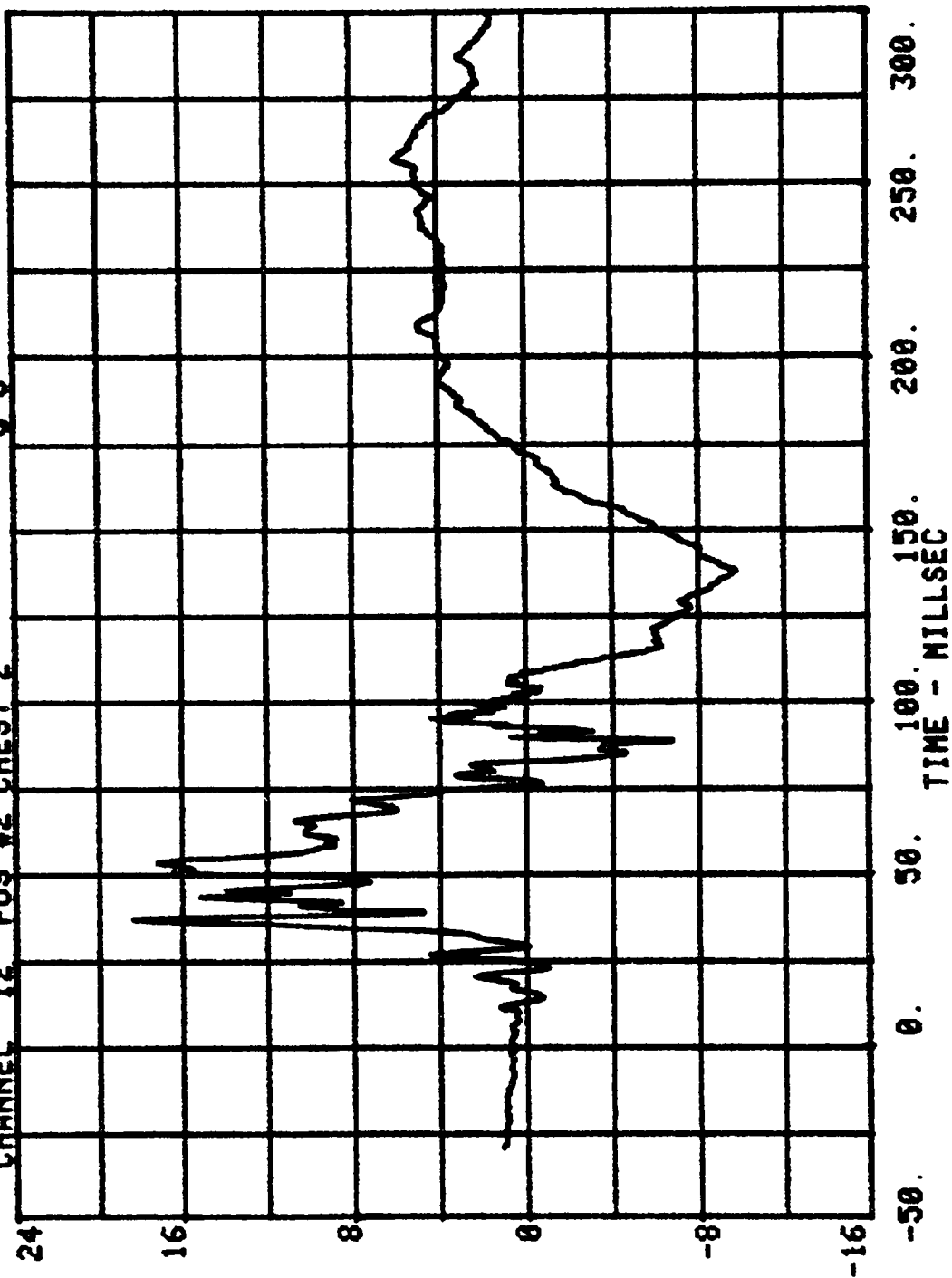


CHANNEL 10 POS #2 CHEST X
RUN# 470 SERIES# 29 G'S

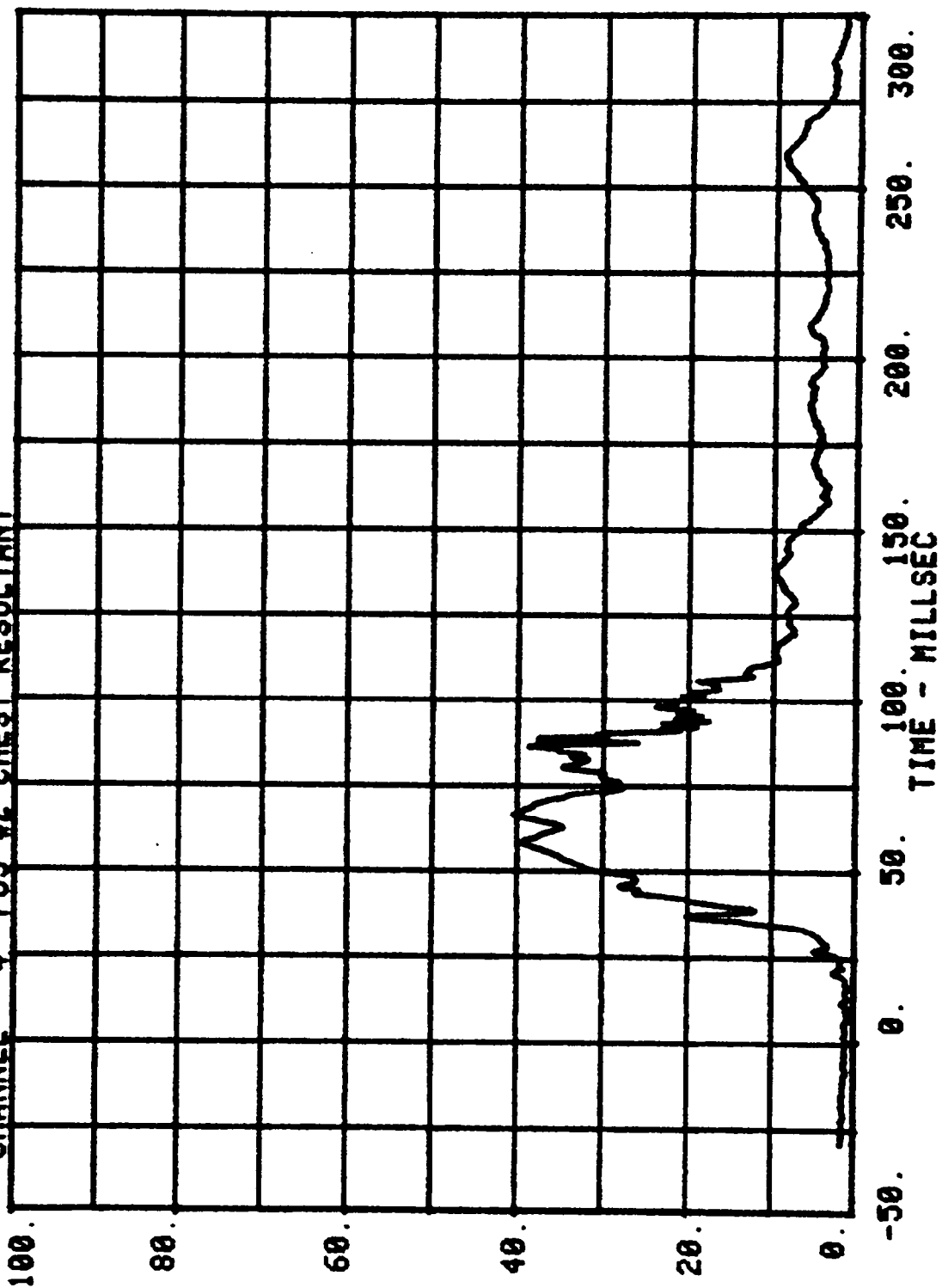


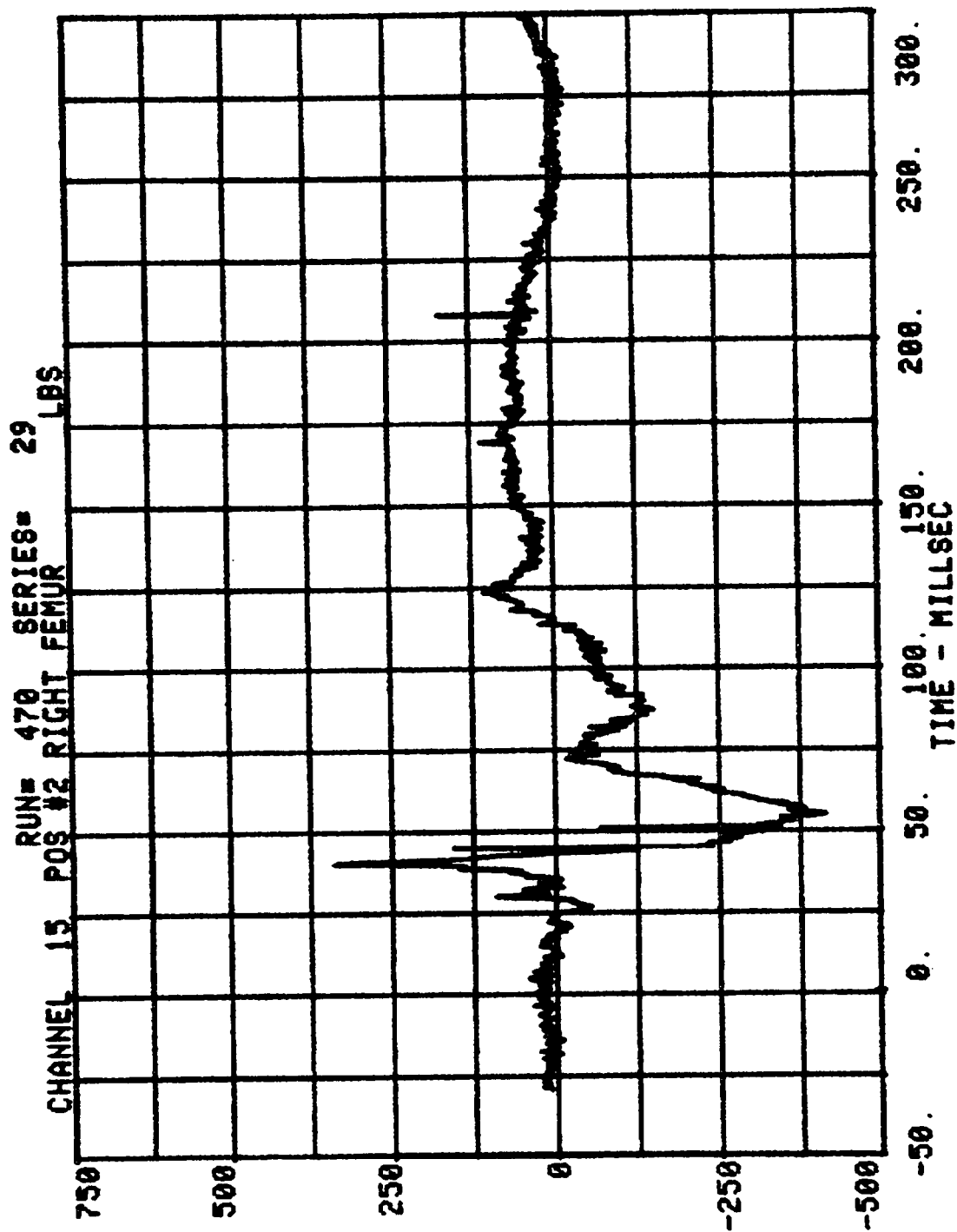


CHANNEL 12 POS #2 CHEST Z 29 G'S



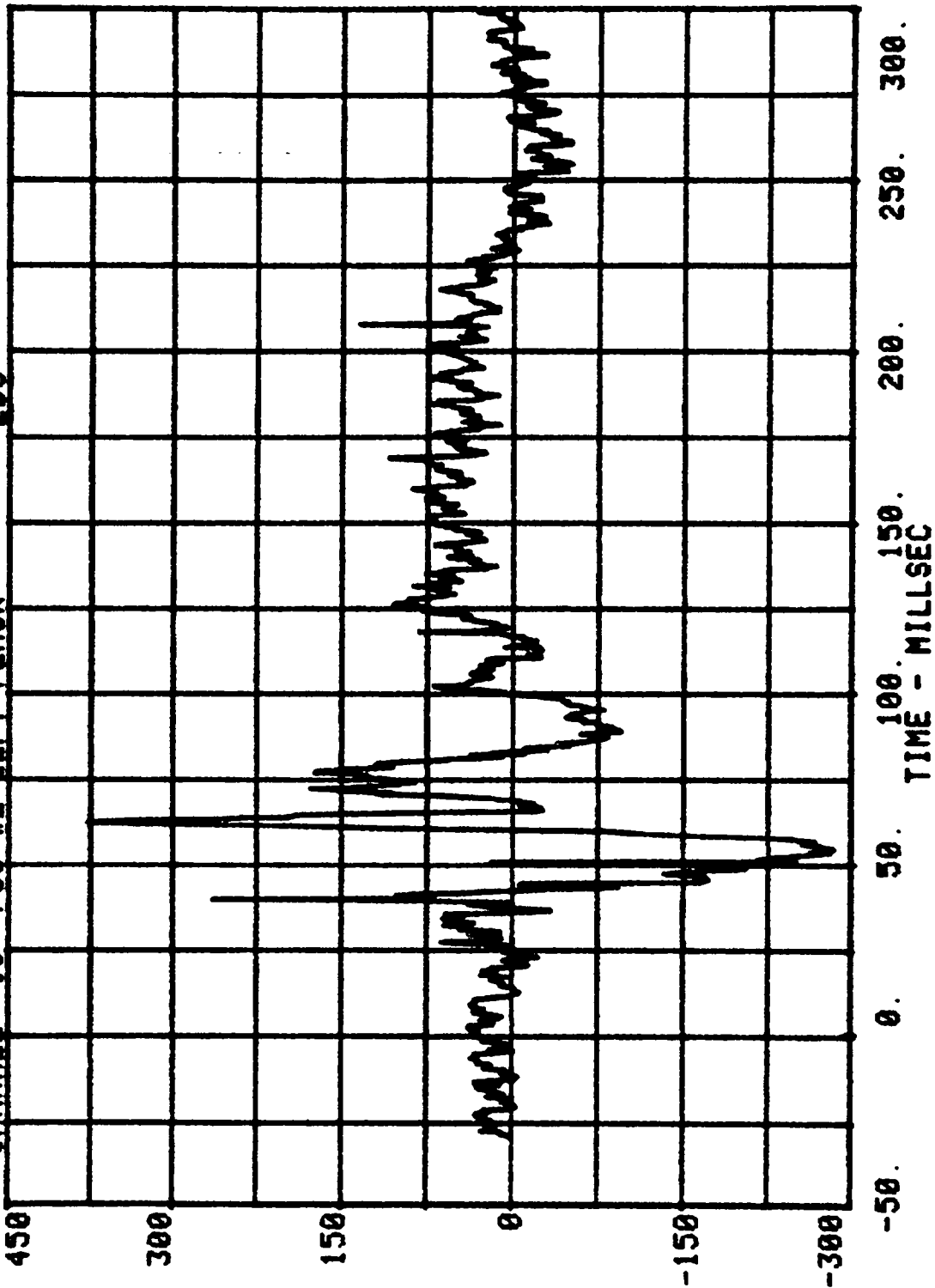
CHANNEL 4 POS #2 CHEST RESULTANT RUN= 470 SERIES= 29



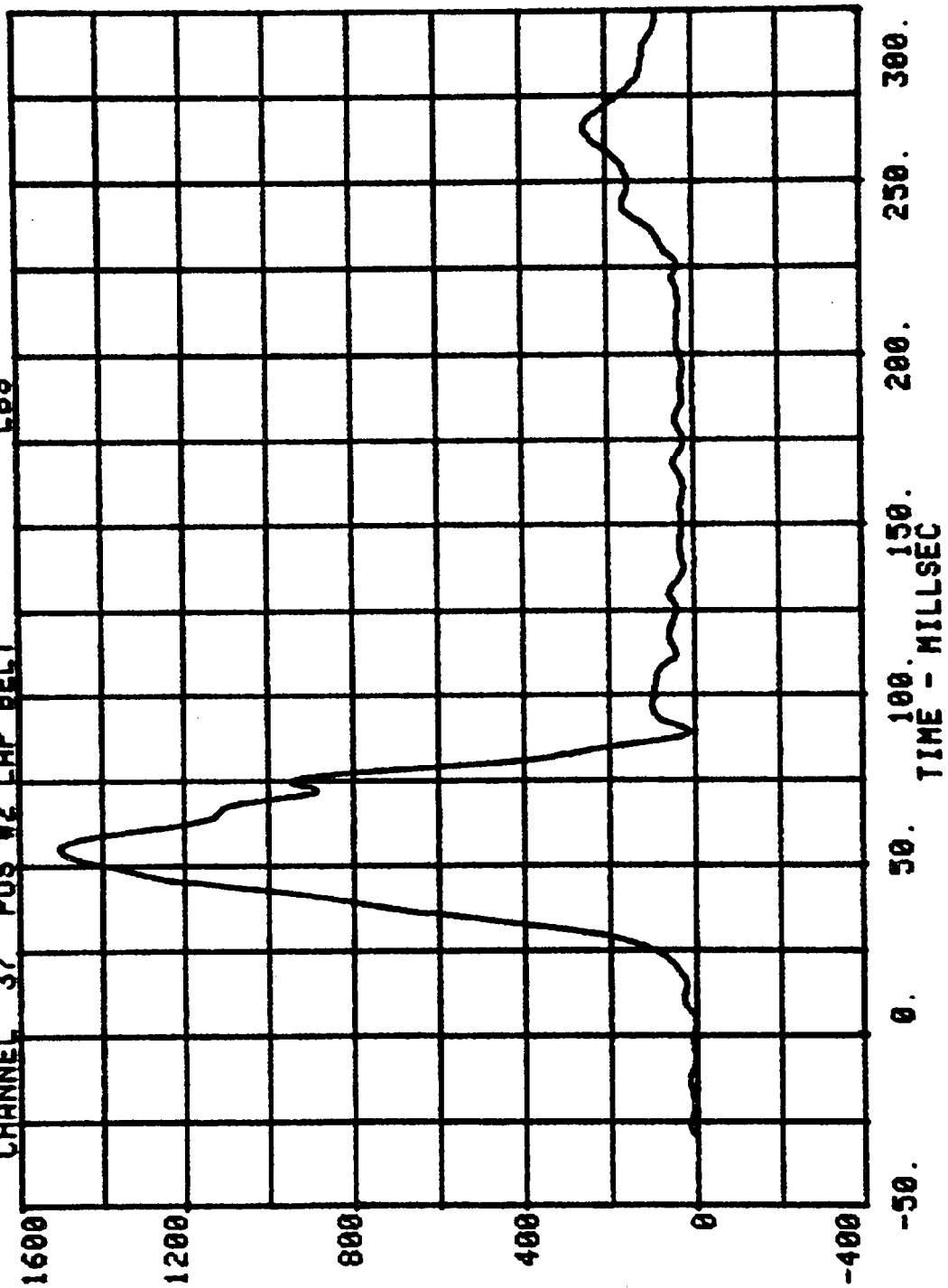


CHANNEL 16 POS #2 LEFT FEMUR LBS

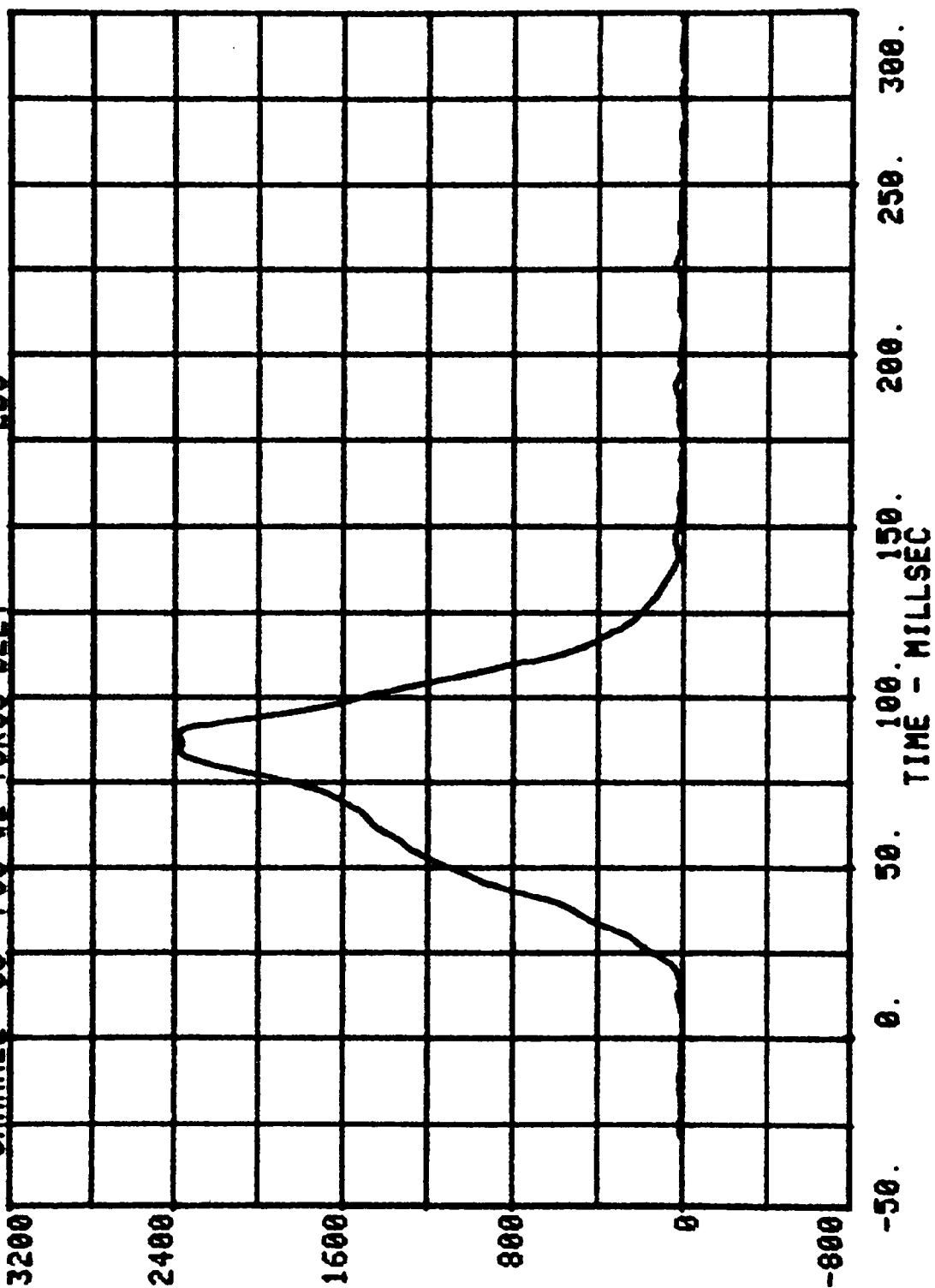
RUN= 470 SERIES= 29



CHANNEL 37 RUN= 470 SERIES= 29 L88
POS #2 LAP BELT



CHANNEL 38 POS #2 TORSO BELT
RUN= 470 SERIES= 29 LBB



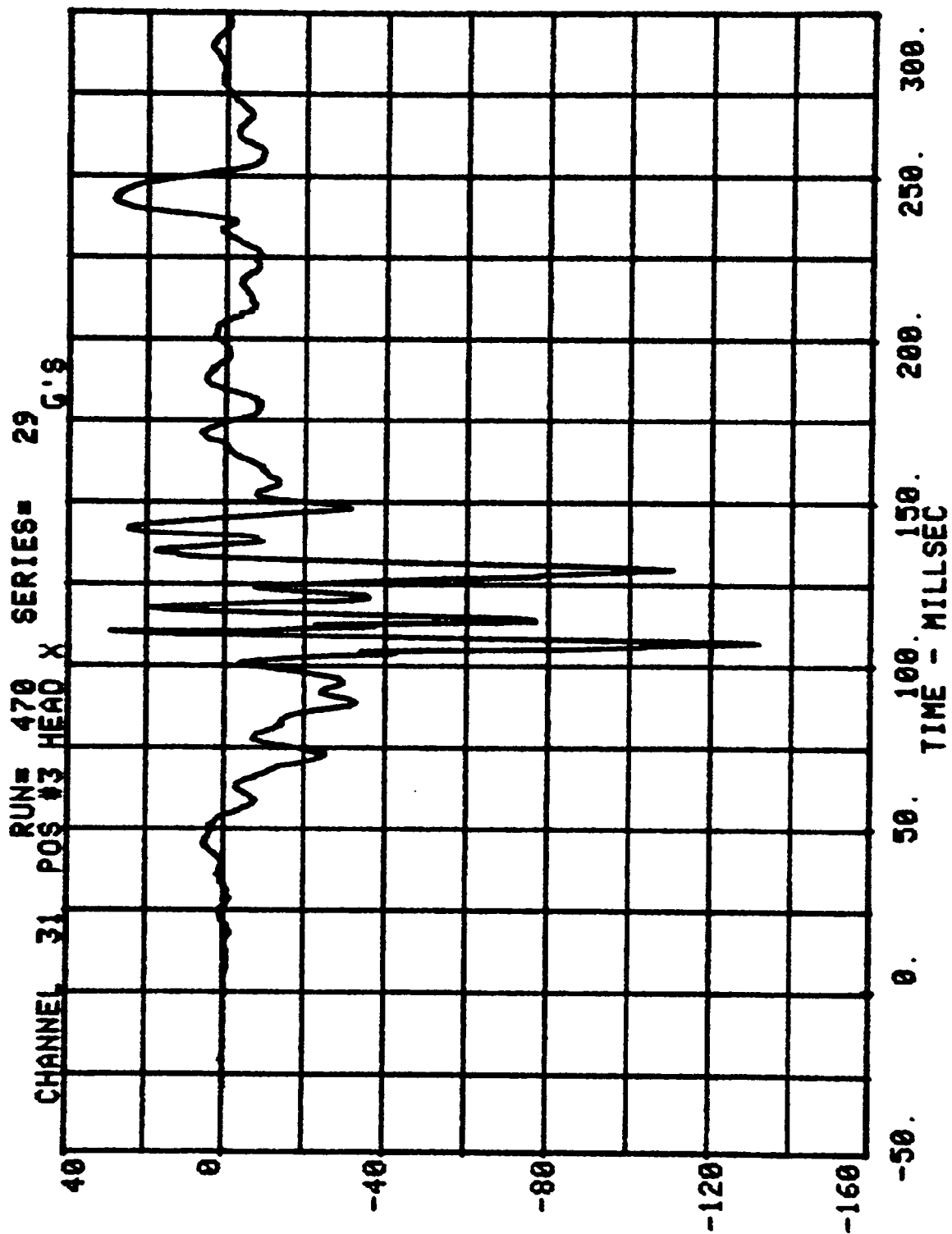
HEAD INJURY CRITERION
HEAD SEVERITY INDEX

BOA #29 AMC CONCORD BARRIER TEST

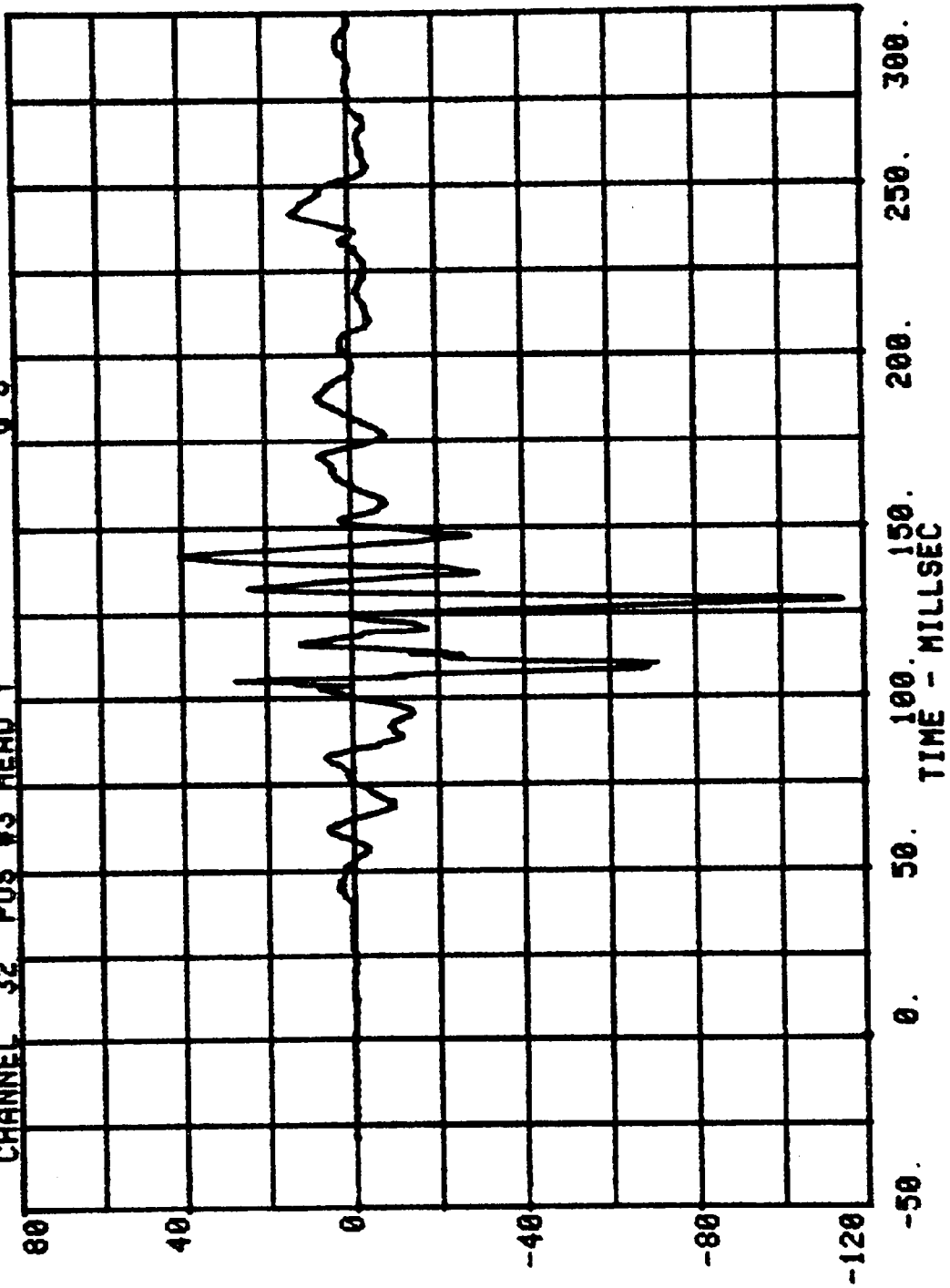
RUN= 470

POS #3 HEAD RESULTANT

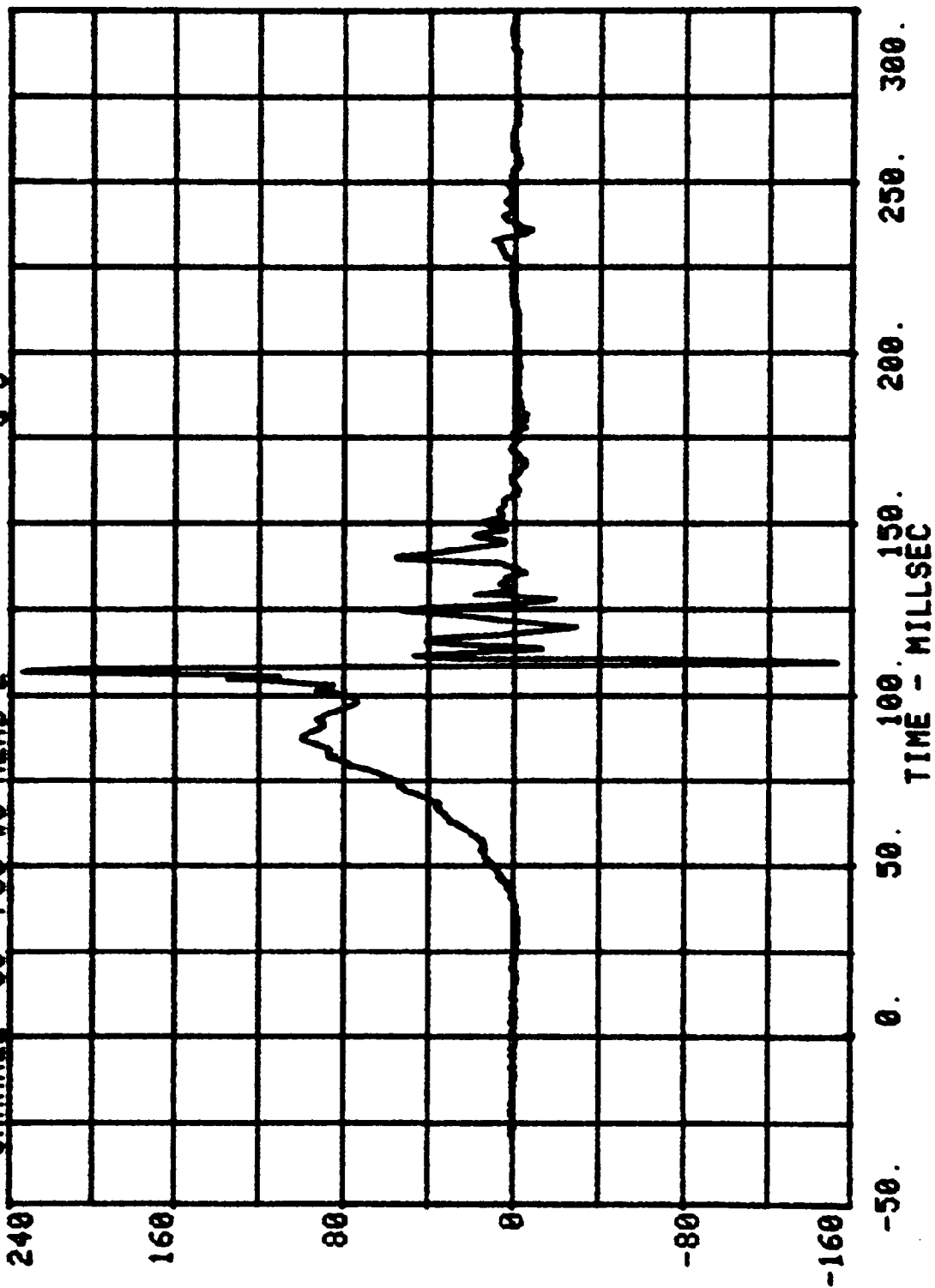
HIC=4025.3 FROM T1= .07080 TO T2= .13170
AVERAGE ACCELERATION BETWEEN T1 AND T2= 84.7G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX=6415.6



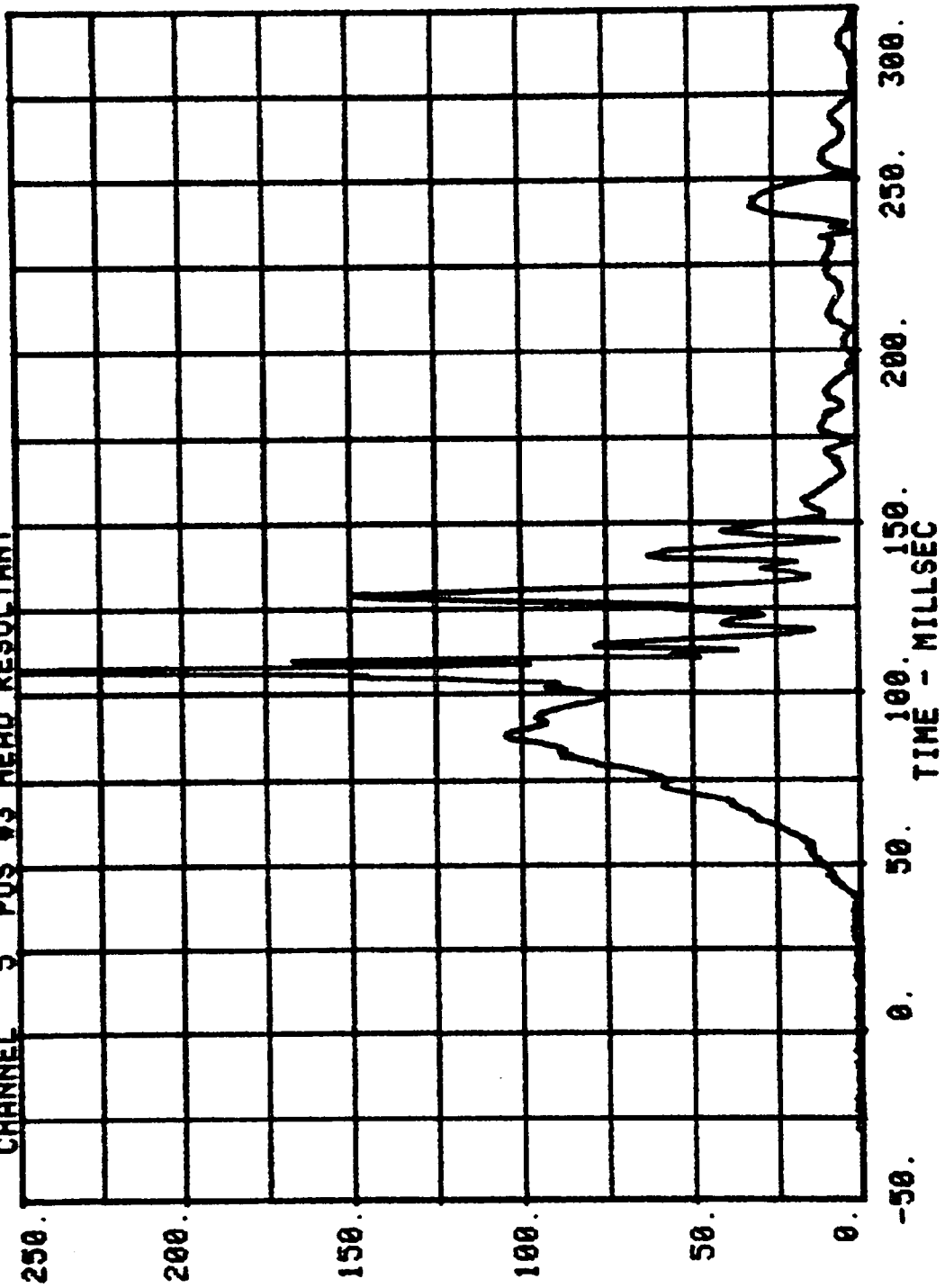
CHANNEL 32 RUN= 470 SERIES= 29
POS #3 HEAD Y G'S

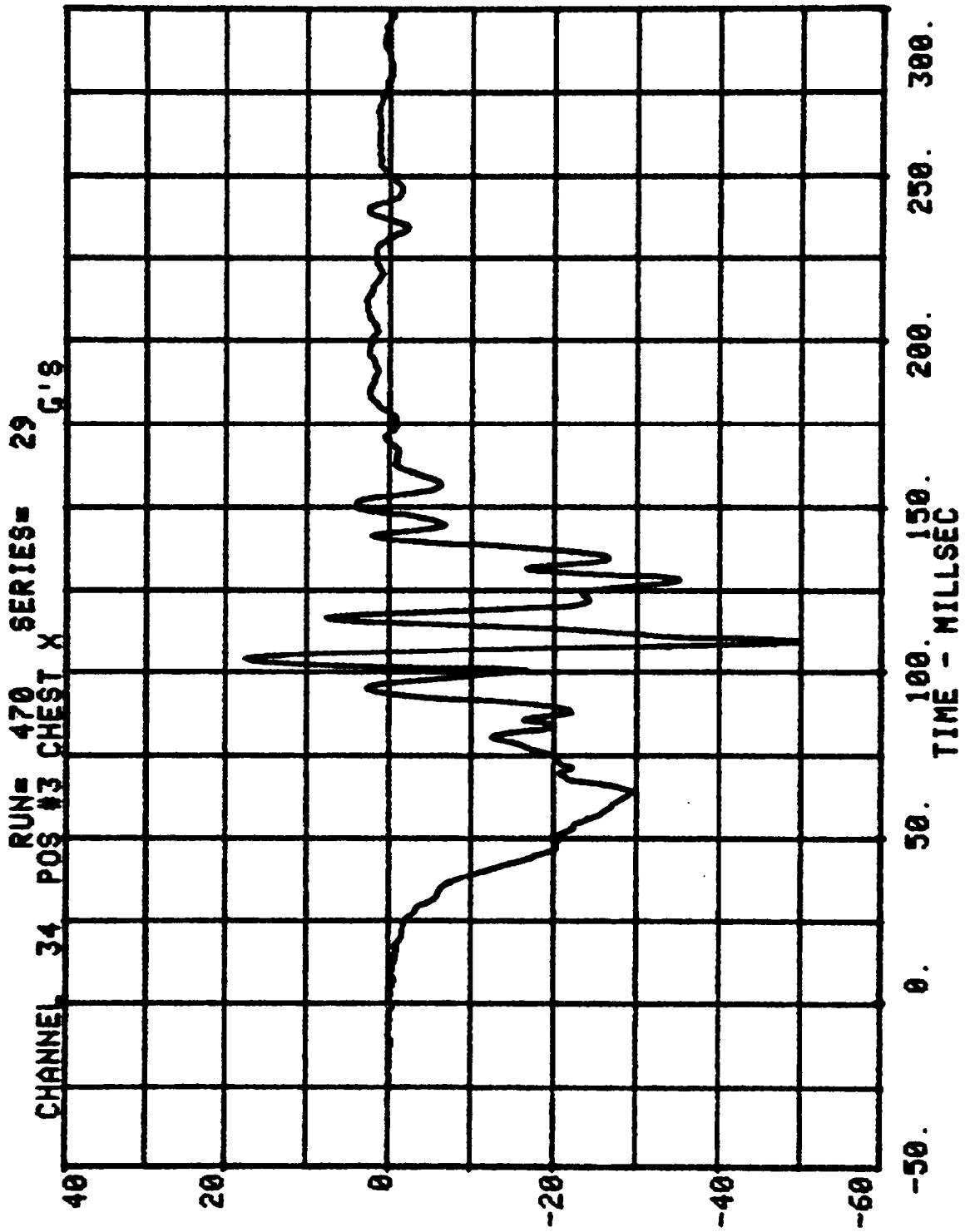


CHANNEL 33 RUN= 470 POS #3 HEAD 2 SERIES= 29 G'S

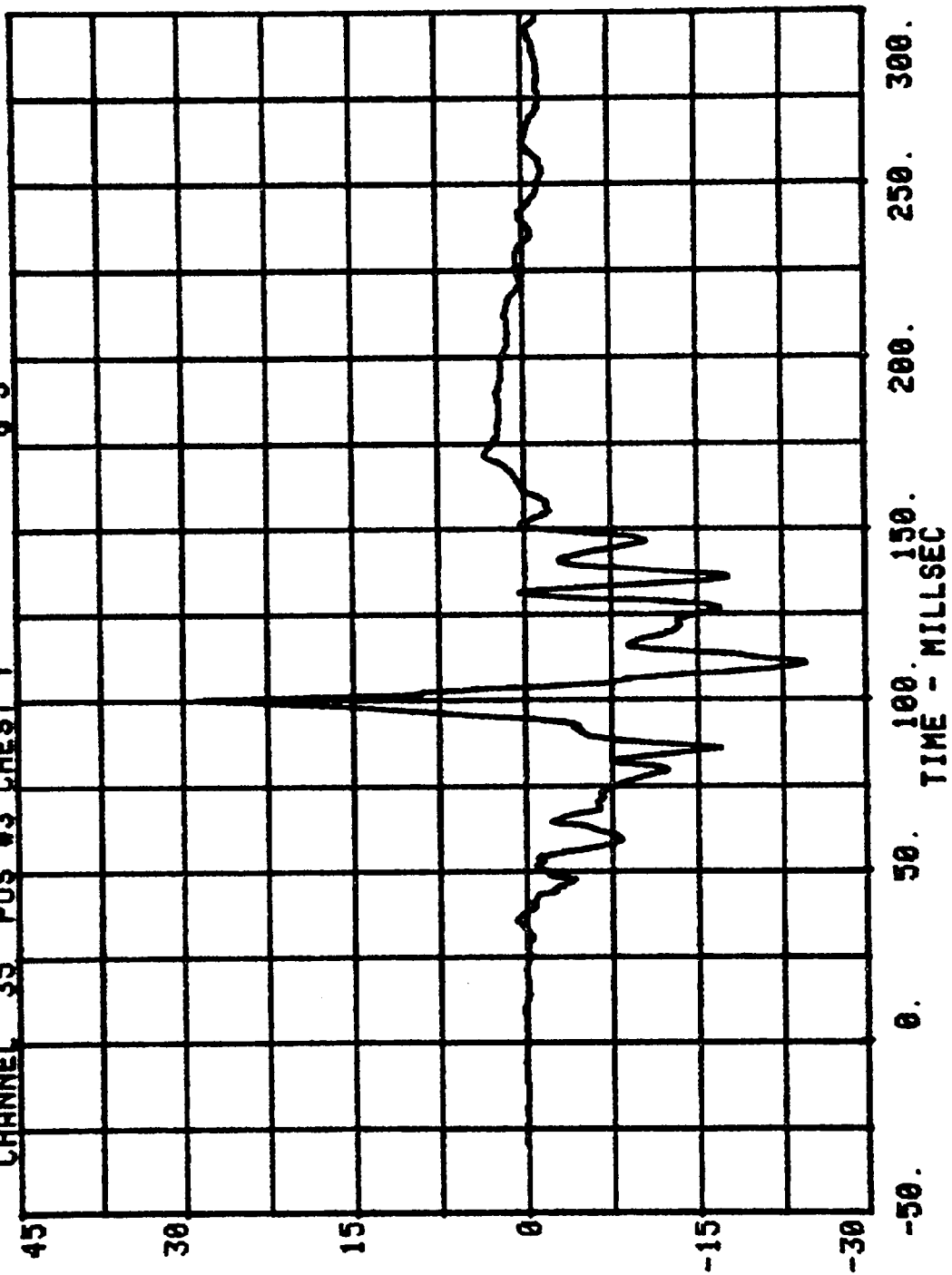


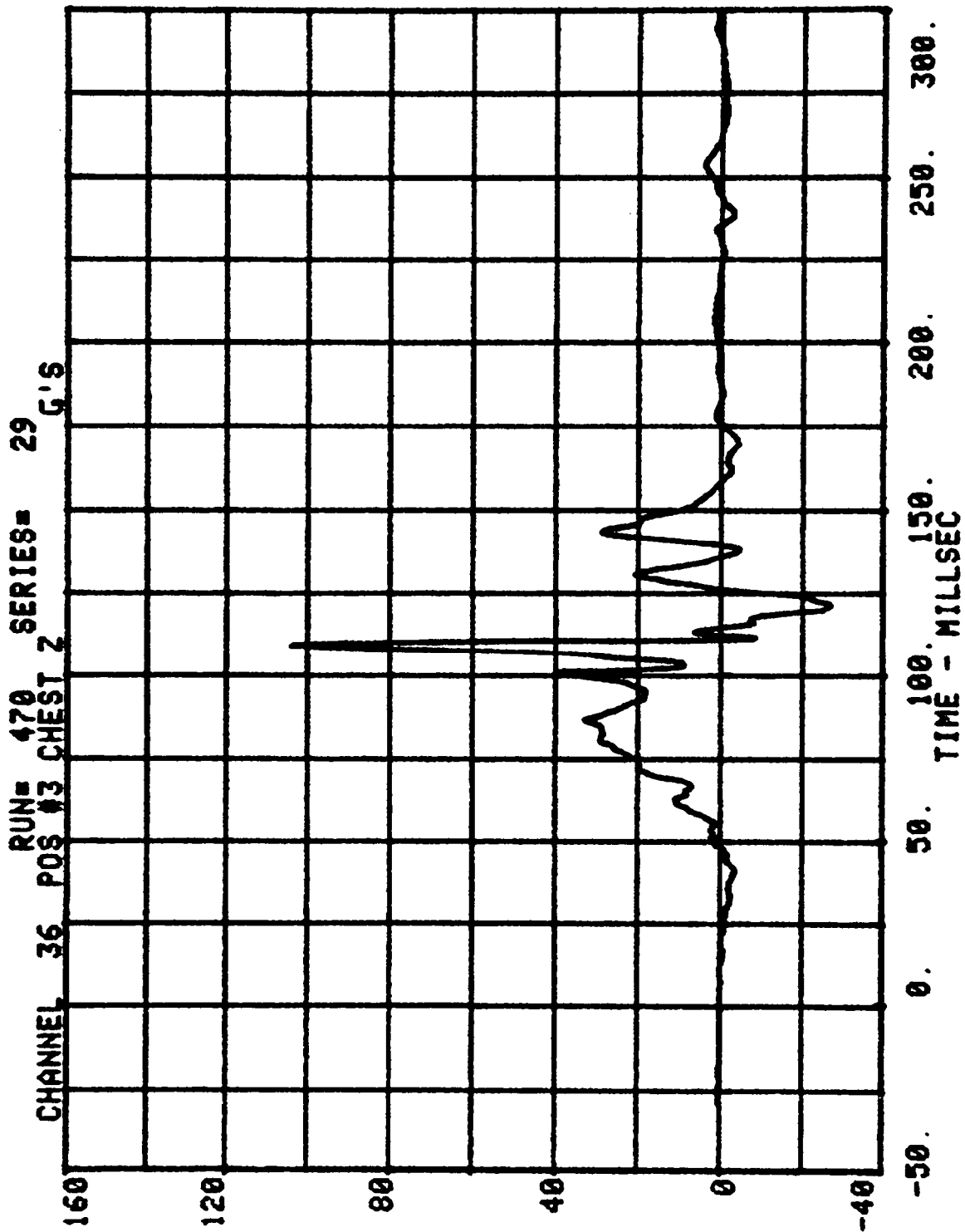
CHANNEL 5 POS #3 HEAD RESULTANT RUN# 470 SERIES# 29



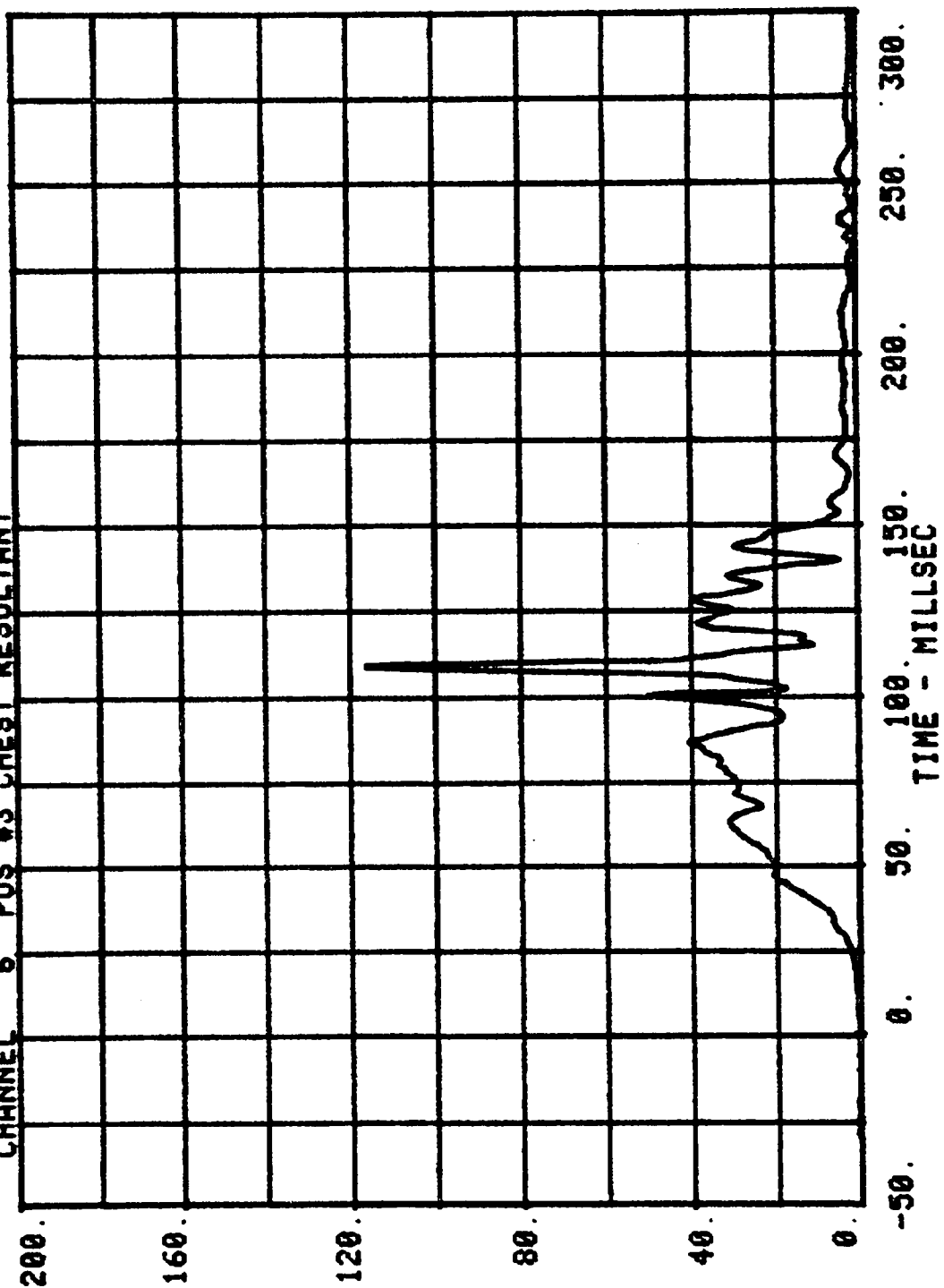


CHANNEL 35 RUN= 470 POS #3 CHEST Y SERIES= 29 G'S





CHANNEL 6 POS #3 CHEST RESULTANT RUN= 470 SERIES= 29



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. 111, 320, which were completed on September 27, 1979. The results indicated 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 ID NO. 111

LABORATORY TECHNICIAN: Fred Juliano and Gary Gestwick

APPROVED BY: _____

APPROVED BY: _____		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		9/21 - 9/27/79	
Calibration Sequential Number for Dummy - - -		4	
Temperature in Lab. (Spec. = 66 to 78°F) - - -		66 - 68	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		59 - 68	
TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	235	
b. Peak Lateral Accel. - -	≤10G	4	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.15	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	22.28	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	23	
c. Peak Resultant Head Acceleration - - - -	26G maximum	19	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	25	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	8	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	113	
h. Max. Head Rotation - -	63 to 73°	63.5	
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	28.5
	Displ.	2.1 to 3.1 in.	2.65
60°	Time	40.3 to 51.7 ms	48.5
	Displ.	4.3 to 5.3 in.	5.10
Maximum	Time	53.2 to 66.8 ms	58
(°)	Displ.	5.0 to 6.0 in.	5.30

Continued

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. NECK BENDING TEST			
<u>Continued</u>			
i. Chordal Displacement:			
Head Rotation Angle --			
60°	Time	67.0 to 83.0 ms	67
	Displ.	4.3 to 5.3 in.	5.05
30°	Time	85.4 to 104.6 ms	91
	Displ.	2.1 to 3.1 in.	2.35
0°	Time	101.0 to 123.0 ms	107
	Displ.	-.5 to 0.5 in.	.20
3. ABDOMINAL COMPRESSION TEST:			
(Preload = 10 pounds)			
a. Force @ 1" - - - -	50 to 63 lbs.	56	
b. Force @ 1.3" - - - -	73 to 80 lbs.	88	
4. LUMBAR FLEXION TEST:			
a. Force @ 20° - - - -	22 to 34 lbs.	26	
b. Force @ 30° - - - -	34 to 46 lbs.	37	
c. Force @ 40° - - - -	46 to 58 lbs.	51	
d. Return Angle - - - -	12° maximum	7	
5. CHEST IMPACT TESTS:			
a. High Speed		66° - 52%	
(1) Probe Speed - -	21.78-22.22 fps	21.88	
(2) Peak Deflection -	1.7" maximum	1.7	
(3) Peak Resistive Force - - - - -	2250 lbs. maximum	1942.5	
(4) Internal Hysteresis - - - -	50 to 70%	55%	
b. Low Speed			
(1) Probe Speed - - -	13.86-14.14 fps	13.87	
(2) Peak Deflection -	1.1" maximum	1.05	
(3) Peak Resistive Force - - - - -	1450 lbs. maximum	1217.3	
(4) Internal Hysteresis - - - -	50 to 7%	51%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

NHTSA DUMMY ID NO. 111

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.01	
(2) Maximum Force - -	1850 to 2500 lbs	1850	
(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.	1900	
(3) Time Above 1000#	1.7 ms minimum	1.9	

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 111

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	CL60	1/79	1/80
ENDEVCO	CG34	1/79	1/80
ENDEVCO	CK11	1/79	1/80
CEC	18118	4/79	1/80
ENDEVCO	AA07	4/79	1/80
CEC	22292	4/79	1/80
HUMANOID SPECIAL		8/79	1/80
GSE	312	1/79	1/80
GSE	311	1/79	1/80
CEC	17547	2/79	1/80
CEC	16928	1/79	1/80
BLH	73141	8/79	1/80
BLH	72952	8/79	1/80
CIC	567-11	8/79	1/80

P.572 DUMMY CALIBRATION TEST DATA

NHTSA DUMMY ID NO. 320

LABORATORY TECHNICIAN: Fred Juliano

APPROVED BY: _____

APPROVED BY: _____		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration - - - - -		9/21 - 9/27/79	
Calibration Sequential Number for Dummy - - - -		6	
Temperature in Lab. (Spec. = 66 to 78°F) - - - -		66° - 70°	
Relative Humidity in Lab. (Spec. = 10 to 70%) -		54 - 68	
TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel. -	210 to 260G	220	
b. Peak Lateral Accel. - -	≤10G	5	
c. Time above 100G - - - -	0.9 to 1.5 ms	1.1	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed - - - -	21.5 to 25.5 fps	22.32	
b. Pendulum Avg. Decel. (over $t_3 - t_2$) - - - -	20 to 24G	23	
c. Peak Resultant Head Acceleration - - - -	26G maximum	19	
d. Pendulum Decel. ($t_2 - t_1$)	≤3 ms	1	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	25	
f. Pendulum Decel. ($t_4 - t_3$)	≤10 ms	5	
g. Pendulum Direction Reversal Time - - - -	≥123 ms	120	
h. Max. Head Rotation - -	63 to 73°	69.5	
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.	3.05
60°	Time	40.3 to 51.7 ms	42.5
	Displ.	4.3 to 5.3 in.	5.20
Maximum (°)	Time	53.2 to 66.8 ms	59
	Displ.	5.0 to 6.0 in.	6

Continued

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	74	
	Displ.	4.3 to 5.3 in.	5.25	
30°	Time	85.4 to 104.6 ms	93.5	
	Displ.	2.1 to 3.1 in.	2.80	
0°	Time	101.0 to 123.0 ms	109	
	Displ.	-.5 to 0.5 in.	.25	
3. ABDOMINAL COMPRESSION TEST:				
(Preload = 10 pounds)				
a. Force @ 1" - - - -		50 to 63 lbs.	51	
b. Force @ 1.3" - - - -		73 to 88 lbs.	76	
4. LUMBAR FLEXION TEST:				
a. Force @ 20° - - - -		22 to 34 lbs.	27	
b. Force @ 30° - - - -		34 to 46 lbs.	37.5	
c. Force @ 40° - - - -		46 to 58 lbs.	48	
d. Return Angle - - -		12° maximum	7	
5. CHEST IMPACT TESTS:				
a. High Speed				
(1) Probe Speed - -		21.78-22.22 fps	21.95	
(2) Peak Deflection -		1.7" maximum	1.3	
(3) Peak Resistive Force - - - - -		2250 lbs. maximum	1864.8	
(4) Internal Hysteresis - - - -		50 to 70%	68%	
b. Low Speed				
(1) Probe Speed - - -		13.86-14.14 fps	13.88	
(2) Peak Deflection -		1.1" maximum	.95	
(3) Peak Resistive Force - - - - -		1450 lbs. maximum	1243.2	
(4) Internal Hysteresis- - - -		50 to 70%	52%	

P.572 DUMMY CALIBRATION TEST DATAContinued:

NHTSA DUMMY ID NO. 111

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.02	
(2) Maximum Force - -	1850 to 2500 lbs	2200	
(3) Time Above 1000#	1.7 ms minimum	1.8	
b. Left Side --			
(1) Probe Speed - - -	6.76 to 7.04 fps	7.02	
(2) Maximum Force - -	1850 to 2500 lbs.	1875	
(3) Time Above 1000#	1.7 ms minimum	1.8	

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NO. 320

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	CS70	1/79	1/80
ENDEVCO	CS27	1/79	1/80
ENDEVCO	CU88	1/79	1/80
CEC	22704	12/78	1/80
ENDEVCO	CH31	1/79	1/80
CEC	22960	1/79	1/80
HUMANOID SPECIAL		8/79	1/80
GSE	77	1/79	1/80
GSE	76	1/79	1/80
CEC	17547	2/79	1/80
CEC	16928	1/79	1/80
BLH	73141	8/79	1/80
BLH	72952	8/79	1/80
CIC	567-11	8/79	1/80
C-10		6525-V-29	

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 six 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 (six 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.

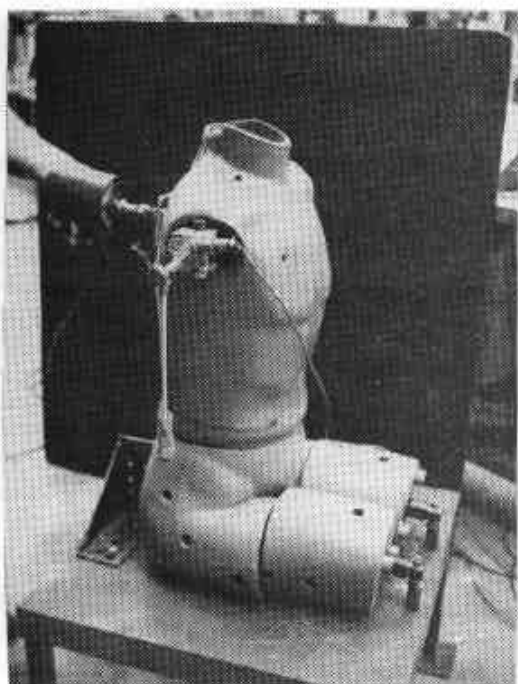


FIGURE C-1

LUMBAR SPINE FLEXION TEST APPARATUS

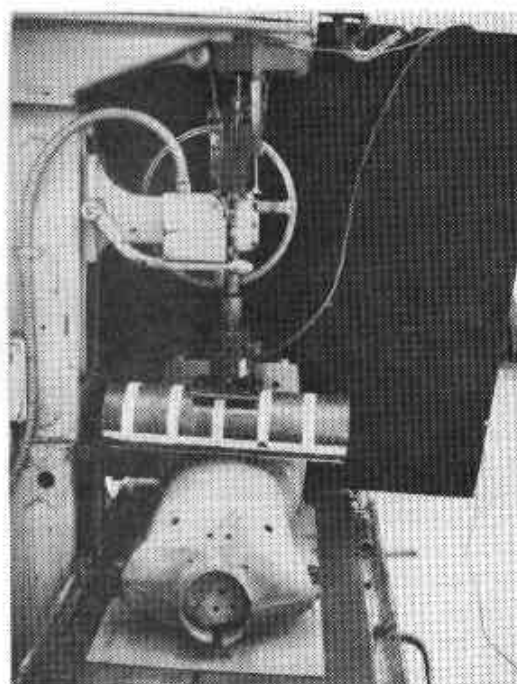


FIGURE C-2

ABDOMEN PRESS TEST APPARATUS

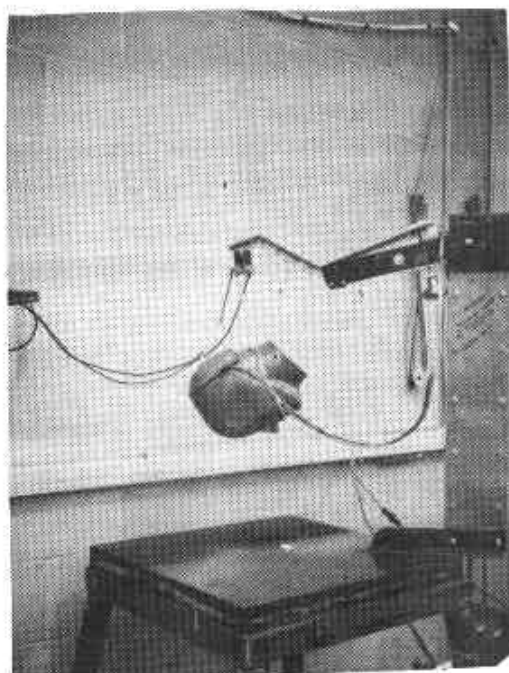


FIGURE C-3

HEAD DROP TEST APPARATUS

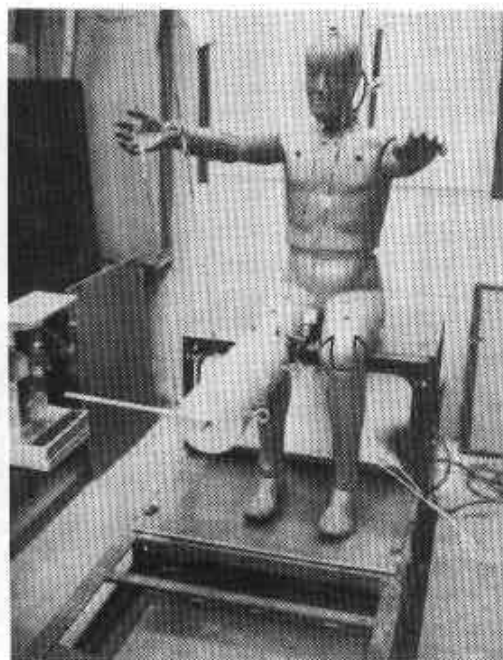


FIGURE C-4
KNEE IMPACT TEST APPARATUS

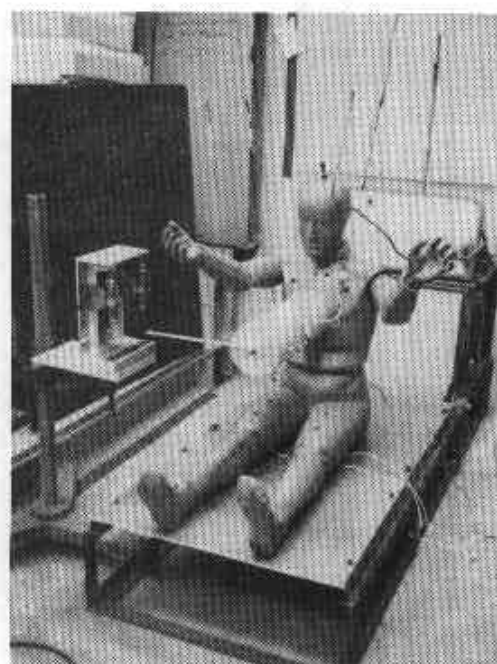


FIGURE C-5
THORAX IMPACT TEST APPARATUS

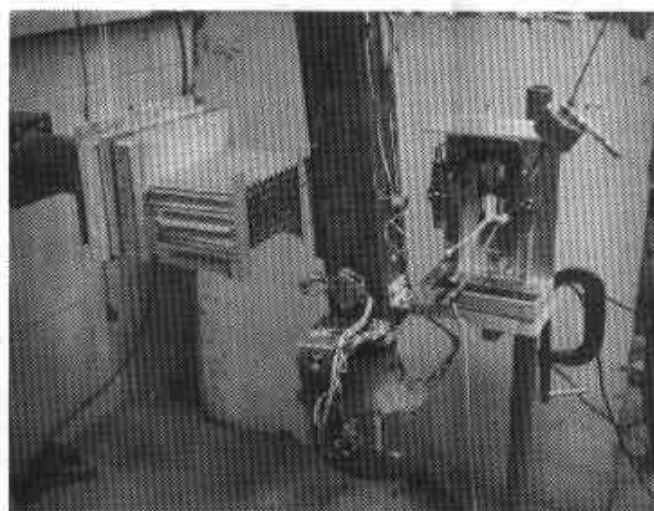


Figure C-6
NECK IMPACT TEST APPARATUS



FIGURE C-7

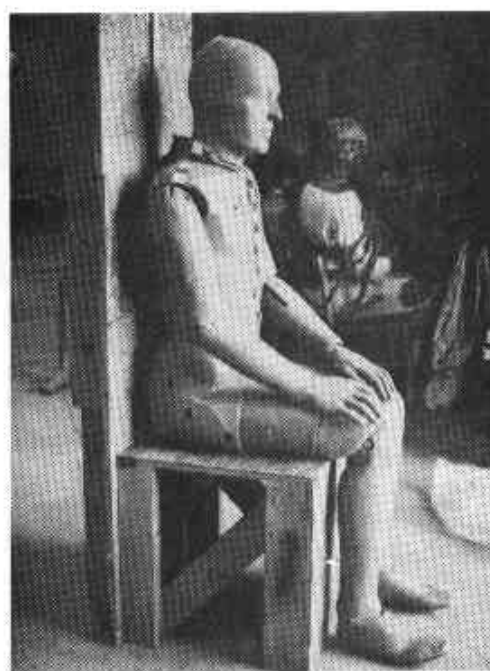


FIGURE C-7
PART 572 TEST DUMMY
FRONT & SIDE VIEW

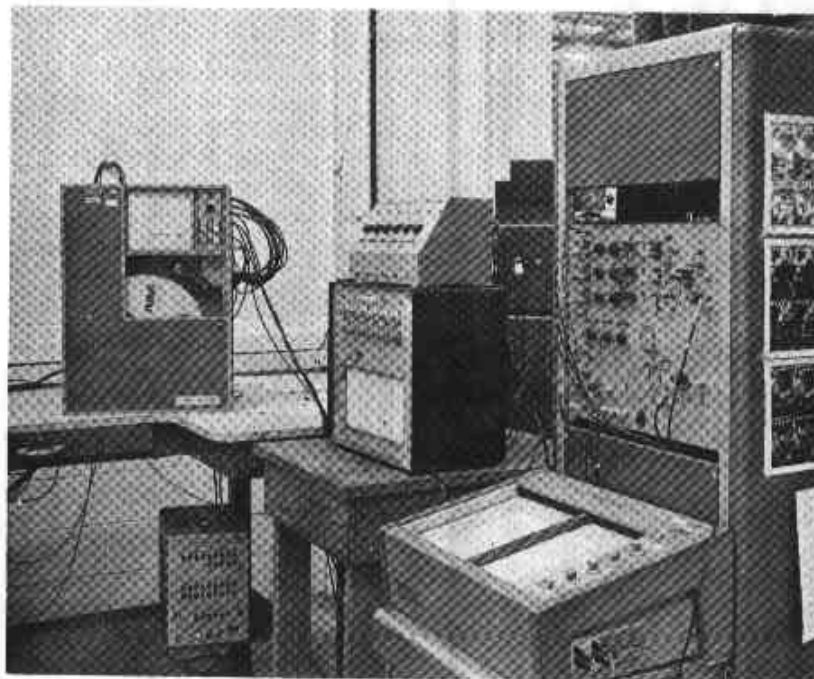


Figure C-8 ELECTRONIC TEST EQUIPMENT