

**SIDE IMPACT PROTECTION
IN PRODUCTION VEHICLES**

**MDB-TO-CAR SIDE IMPACT TEST OF
A 26° CRABBED MOVING DEFORMABLE BARRIER
TO A 1988 FORD F-150
AT 33.5 MPH**

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JANUARY 1989

TEST REPORT

Prepared Under Contract No. DTNH22-87-C-07168

For

**U.S. DEPARTMENT OF TRANSPORTATION
National Highway Traffic Safety Administration
Office of Crashworthiness Research
400 Seventh Street, S.W.
Washington, DC 20590**

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16. Abstract This test report documents a crash test to evaluate side impact protection. Testing was conducted on a 1988 Ford F-150 pickup at the Mobility Systems and Equipment Company Test Facility, Mira Loma, California. The test vehicle was impacted on the left side by a moving deformable barrier, crabbled to 26°, at 33.5 mph. The test was a simulation of a 90° intersection collision with the striking vehicle traveling at 30 mph and the struck vehicle traveling at 15 mph. Occupant response of one side impact dummy was measured. The dummy was located in driver's designated seating position. The test date was October 28, 1988.					
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METRIC CONVERSION FACTORS

APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL WHEN YOU KNOW MULTIPLY BY TO FIND SYMBOL

LENGTH

in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km

AREA

in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.6	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha

MASS (weight)

oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons(2000 lb)	0.9	tonnes	t

VOLUME

tsp	teaspoons	5	milliliters	ml
tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³

TEMPERATURE (exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL WHEN YOU KNOW MULTIPLY BY TO FIND SYMBOL

LENGTH

m	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi

AREA

cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares(10,000m ²)	2.5	acres	

MASS (weight)

g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000kg)	1.1	short tons	

VOLUME

ml	milliliters	8.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m ³	cubic meters	36	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³

TEMPERATURE (exact)

°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F
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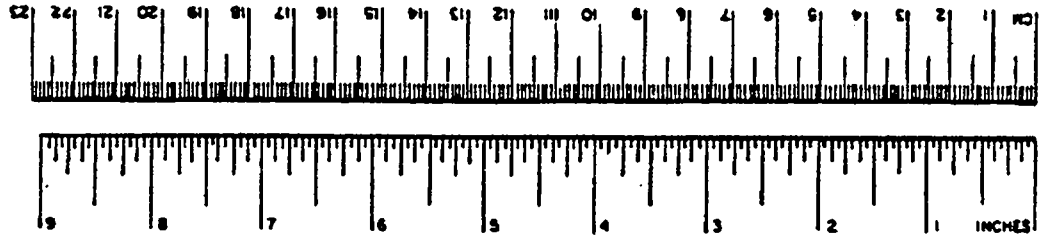


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SECTION 1

PURPOSE AND INTRODUCTION

This testing program is an investigation and evaluation of side impact protection in production light trucks and vans. The test is specifically intended to simulate a 90° intersection collision with the striking vehicle moving at 30 mph and the struck vehicle traveling at 15 mph. This is accomplished by towing a Moving Deformable Barrier (MDB) crabbed at a 26° angle into the struck test vehicle which is placed in a stationary position. The velocity of the MDB is to be 33.5 $\pm$ 0.5 mph.

The subject vehicle for this test was a 1988 Ford F-150 Pickup. The test was performed on 28 October 1988 at an actual impact speed of 33.4 mph. The leading left-hand edge of the MDB contacted the test vehicle 39.0 inches forward of the midpoint between the axles.

Section 2 contains a general test summary and vehicle information data sheets. Section 3 contains the test results. Appendix A contains pretest and posttest vehicle and dummy photographs and Appendix B contains data plots for transducers. Appendix C contains side impact dummy certification data and Appendix D has the side impact dummy positioning procedure.

SECTION 2

TEST SUMMARY AND VEHICLE INFORMATION

The 1988 Ford F-150 Pickup, Test No. 1, was tested on 28 October 1988. General test vehicle information and pretest conditions are given in Tables 2-1 and 2-2. A crash test summary is shown in Table 2-3. The vehicle was instrumented with 10 accelerometer channels and two onboard high-speed movie cameras. Accelerometer locations and peak values are shown in Table 2-4. All pretest measurements were made detailing the left side vehicle profile. The impact point was marked on the vehicle 37 inches forward of the midpoint of the wheelbase.

One side impact anthropomorphic dummy (SID) was placed in the vehicle's driver seat and positioned using the side impact dummy seating procedure (Appendix D). SID position measurements are shown in Table 2-5. The SID was instrumented with 12 accelerometers and one displacement transducer. A summary of the SID accelerometer data is given in Table 2-6. Colored chalk was applied to the SID's head, left shoulder, left hip and his knees to help determine dummy contact points during the test.

The MDB was crabbed at 26° and instrumented with five (5) accelerometers and two (2) high-speed movie cameras. A general crash test summary and accelerometer locations with peak values for the MDB are shown in Tables 2-7 and 2-8.

Additional film coverage of the test was also provided by two (2) overhead and two (2) ground high-speed movie cameras and one real-time camera. Camera locations are given in Table 2-9. A total of 26 channels of information were recorded on two (2) FM data tapes.

TABLE 2-1 TEST VEHICLE DATA

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1988/FORD/F-150 CUSTOM/PICKUP TRUCK
 VEHICLE NHTSA NO.: TEST 01 VIN: 1FDTF15Y4JPA93991
 VEHICLE BODY COLOR: BEIGE; MONTH & YEAR OF MANUFACTURE: 02/88
 ENGINE: Cyl.: C.I.D. 4.9 Liters; Placement: X Longitudinal; Lateral
8 Gas; X Diesel; Turbocharged
 TRANSMISSION: 5 Speed; Manual; Automatic; X Overdrive
 FINAL DRIVE: Front Wheel Drive; X Rear Wheel Drive; Four Wheel Drive
 DATE VEHICLE AVAILABLE FOR SIDE IMPACT TESTING:
 ODOMETER READING: 21 miles; OPTIONS: A/C; X P/S; P/Wdo;
 Tilt Whl.; Cruise Control

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): 35 psi Front; 41 psi Rear
 Recommended Tire Size: P235/75R15XL
 Tires On Vehicle: P235/75R15; Manufacturer: General

Number Of Occupants: 3 Front; Rear; 3rd Seat; 3 TOTAL
 Type Of Front Seats: Bucket; X Bench; Split Bench
 Type Of Front Seat Back: X Fixed; Adjustable With Lever/ Rotating Knob

Vehicle Maximum Capacity Loading = 1347* lb (A)
 No. Of Occupants x 150 lb - - - = 450 lb (B)
 Cargo Capacity (A - B) - - - - = 897 lb
 *GVWR - Delivered Weight

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Right Front = <u>1129</u> lb	TOTAL FRONT = <u>2302</u> lb (<u>56.1%</u> of TOTAL)
Left Front = <u>1173</u> lb	
Right Rear = <u>889</u> lb	TOTAL REAR = <u>1801</u> lb (<u>43.9%</u> of TOTAL)
Left Rear = <u>912</u> lb	
TOTAL WEIGHT = <u>4103</u> lb	

TABLE 2-1 TEST VEHICLE DATA (Cont'd)

CALCULATION OF TEST VEHICLE TARGET WEIGHT:

Total Test Vehicle Delivered Weight With Maximum Fluids	=	<u>4103</u>	lb
Maximum Cargo Carrying Capacity Of Test Vehicles*	=	<u>300</u>	lb
Weight Of Two P.572 Dummies (1 x 174 lb)	=	<u>174</u>	lb
TEST VEHICLE TARGET WEIGHT	=	<u>4577</u>	lb

* 300 lb for light trucks and MPVs

ACTUAL WEIGHT OF TEST VEHICLE WITH 1 DUMMY AND CARGO:

Right Front	=	<u>1197</u>	lb	
Left Front	=	<u>1347</u>	lb	TOTAL FRONT = <u>2543</u> lb (55.6% of TOTAL)
Right Rear	=	<u>954</u>	lb	
Left Rear	=	<u>1080</u>	lb	TOTAL REAR = <u>2034</u> lb (44.4% of TOTAL)
TOTAL WEIGHT	=	<u>4577</u>	lb	(which includes <u>300</u> lb of cargo ballast weight)

TEST VEHICLE ATTITUDE:

As Delivered — Right Front	=	<u>32.3</u>	in	Ready For Test — Right Front	=	<u>31.6</u>	in
Left Front	=	<u>32.0</u>	in	Left Front	=	<u>31.4</u>	in
Right Rear	=	<u>35.1</u>	in	Right Rear	=	<u>34.4</u>	in
Left Rear	=	<u>35.6</u>	in	Left Rear	=	<u>34.3</u>	in
Test Vehicle Wheelbase:		<u>133.0</u>	in;	C.G. =	<u>59.1</u>	in rearward of front wheel centerline	

TOTAL VEHICLE LENGTH:

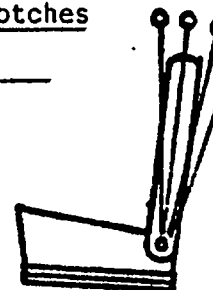
Right Side	=	<u>213.2</u>	in
Left Side	=	<u>213.2</u>	in
Centerline	=	<u>216.0</u>	in

TABLE 2-2 PRETEST CONDITIONS

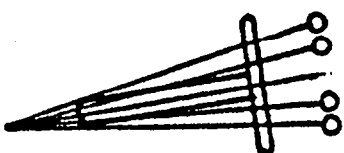
VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1988/FORD/F-150 CUSTOM/PICKUP
 VEH. NHTSA NO. N/A; TEST DATE: 10/28/88
 FRONT SEAT CUSHION PLACEMENT: Midpoint of forward/aft travel (7th notch rearward)
 TOTAL NUMBER OF ADJUSTMENT POSITIONS OR DETENTS: 12 notches
 FRONT SEAT BACK ADJUSTMENT POSITION: Not Adjustable

(latch position, knob rotations, etc.)

TORSO ANGLE: 25°



ADJUSTABLE STEERING COLUMN POSITION:

X Not Applicable  Midpoint of swing

WINDOW POSITIONS: Left Front — closed
 Left Rear — N/A
 Right Front — open
 Right Rear — N/A

NOTE: Window will be in closed position on struck side of test vehicle and in open position on opposite side.

AMOUNT OF STODDARD SOLVENT IN FUEL TANK: Front Standard Tank 17.5 Gal
 Rear Optional Tank 17.0 Gal
 (92 to 94% of USABLE CAPACITY)

LOCATION OF IMPACT POINT ON TEST VEHICLE SIDE TO BE IMPACTED:

Wheelbase = 133.0 in

Impact point is 29.5 inches rearward of front axle centerline (which is 37 inches forward of the wheelbase midpoint).

TABLE 2-3 CRASH TEST SUMMARY FOR TEST VEHICLE

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1988/FORD/F-150 CUSTOM/PICKUP
 VEH. NHTSA NO. N/A; VIN: 1FTDF15Y4JPA93991
 TEST DATE: 10/28/88 BUILD DATE: 02/88

OVERALL LENGTH = 216.0 inches; OVERALL WIDTH = 75.5 inches

TEST WEIGHT: Left Front = 1346 lb; Left Rear = 1080 lb
 Right Front = 1197 lb; Right Rear = 954 lb
 SUBTOTALS - - - Front = 2543 lb Rear = 2034 lb
 TOTAL VEHICLE WEIGHT - - - - - 4577 lb

WHEELBASE = 133.0 inches

LONGITUDINAL C.G. FROM CENTER OF FRONT AXLE = 59.1 inches

IMPACT ANGLE WITH RESPECT TO IMPACTOR = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 (18.2" above ground) = 25.4 inches
2. LEVEL 2 (36.1" above ground) = 22.3 inches
3. LEVEL 3 (33.6" above ground) = 22.2 inches
4. LEVEL 4 (49.0" above ground) = 15.6 inches
5. LEVEL 5 (67.5" above ground) = 9.3 inches

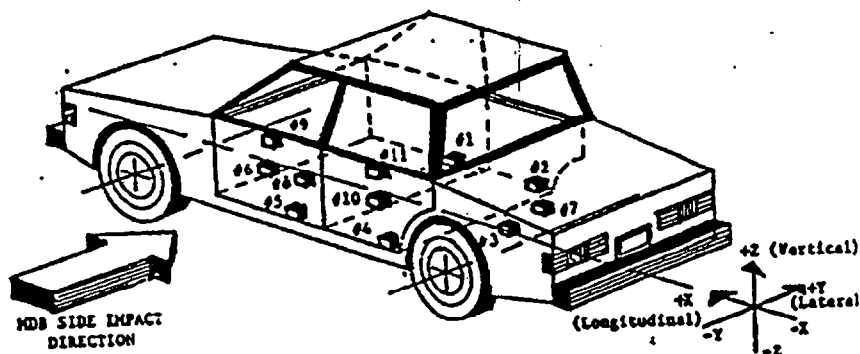
MAXIMUM POSTTEST INTRUSION = 25.4 inches

<u>OCCUPANTS:</u>	<u>DRIVER</u>	<u>LEFT REAR</u>
TYPE OF DUMMY - - - -	SID	N/A
RESTRAINT USED- - - -	None	N/A

INSTRUMENTATION:

NUMBER OF DATA CHANNELS = 26
 NUMBER OF CAMERAS: ONBOARD = 4 High-speed
 OFFBOARD = 4 High-speed

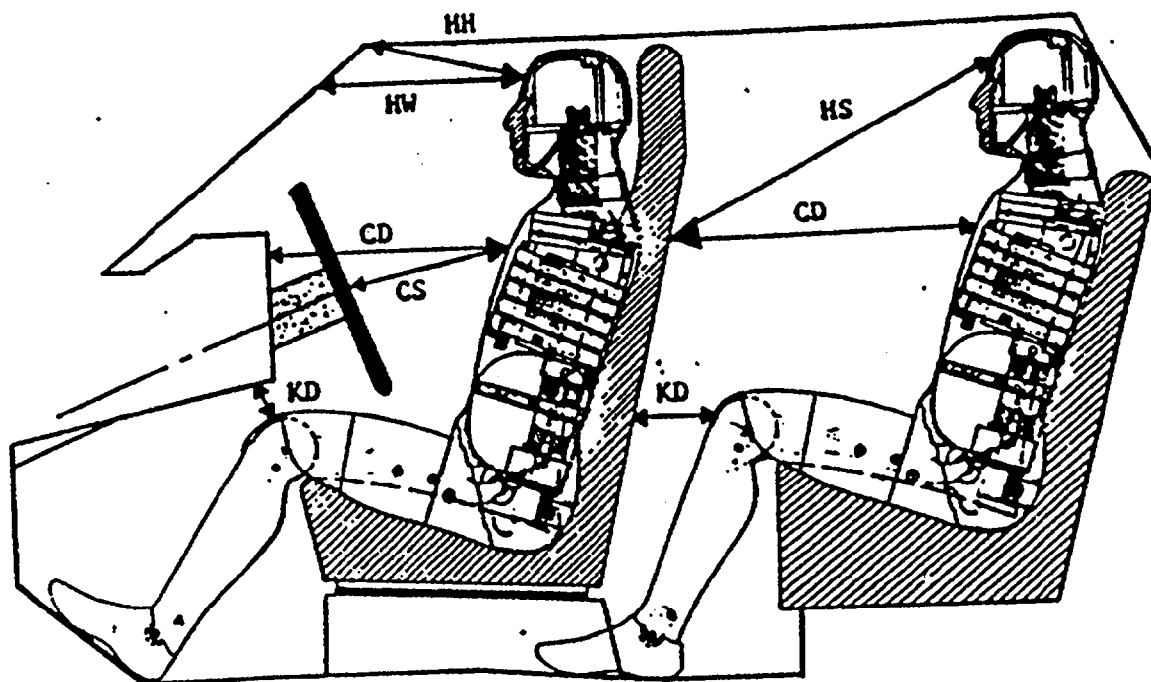
TABLE 2-4 TEST VEHICLE ACCELOMETER LOCATIONS AND DATA SUMMARY

TEST VEHICLE: FORD F150 CUSTOM PICKUPNHTSA NO.: N/ATEST DATE: 10/28/88

ACCEL. NO.	LOCATION	COORDINATES(")			LONG. (X) POS. / NEG.		LAT. (Y) POS. / NEG.		VERT. (Z) POS. / NEG.		RESULTANT POS. / NEG.	
		X*	Y*	Z*	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	Right Side Sill At Front Seat	153.9	+26.5	20.0	+14.4	35.4	+22.3	35.4	-36.8	30.3	+38.3	30.4
2	Right Side Sill At Rear Seat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Right Floorpan Above Axle	51.0	0.0	30.2	-11.6	22.5	+28.2	32.6	+31.6	22.6	+37.2	32.9
4	Left Side Sill At Rear Seat	NA	NA	NA			NA	NA				
5	Left Side Sill At Front Seat	152.0	-26.5	20.0			+127.2	26.6				
6	Left Front Door on Centerline	138.1	-34.0	37.2			+124.8	13.1				
7	Right Rear Occ. Compartment	NA	NA	NA	NA	NA						
8	Midrear of Left Front Door	122.6	-34.0	139.5	-109.6	16.4						
9	Left Front Door Upper Centerline	132.3	-34.0	44.6	+101.5	9.1						
10	Midrear of Left Rear Door	NA	NA	NA			NA	NA				
11	Left Rear Door Upper Centerline	NA	NA	NA			NA	NA				

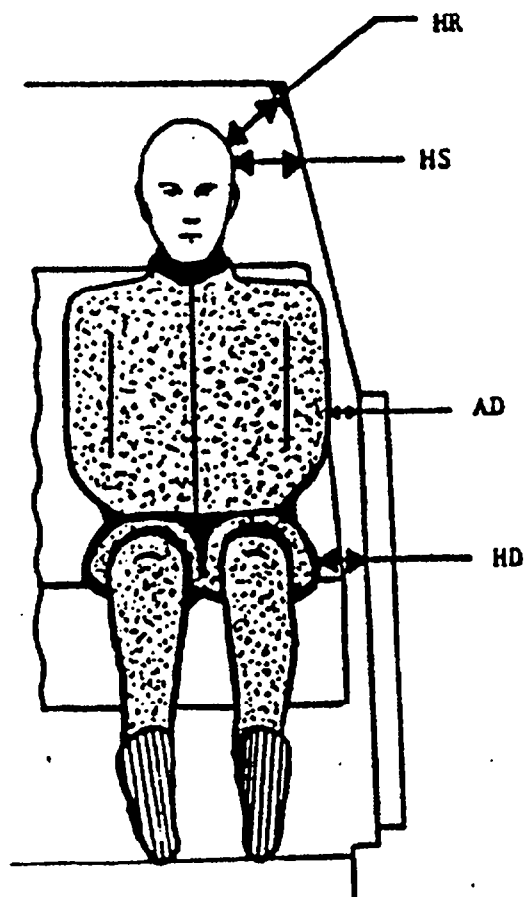
* Reference: X - Rear Bumper (+ Forward)
 Y - Vehicle Centerline (+ To Right)
 Z - Ground Level (+ Up)

TABLE 2-5 SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS



	DRIVER ID # 137	REAR PASSENGER ID # N/A
HH	16.3 in	_____ in
HW	21.2 in	_____ in
HS	_____ in	NA in
CD	20.7 in	NA in
CS	11.0 in	_____ in
KDL	5.4 in	NA in
KDR	5.6 in	NA in

TABLE 2-5 SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS (Cont'd)



	DRIVER ID # 137	REAR PASSENGER ID # N/A
HR	6.9 in	NA in
HS	10.7 in	NA in
AD	6.3 in	NA in
HD	6.4 in	NA in

TABLE 2-6 SIDE IMPACT DUMMY (SID) TEST DATA SUMMARY

TEST DATE: 10/28/88

	FRONT DUMMY — ID # 137				REAR DUMMY — ID # NA			
	POS. DIRECT.		NEG. DIRECT.		POS. DIRECT.		NEG. DIRECT.	
	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
HEAD ACCELERATIONS:								
Longitudinal — X	3.8	48.7	-11.6	184.3	NA	NA	NA	NA
Lateral — Y	14.2	63.3	-12.3	48.3	NA	NA	NA	NA
Vertical — Z	10.1	65.7	-31.2	62.6	NA	NA	NA	NA
RESULTANT — R	33.2	62.6	0.1	13.3	NA	NA	NA	NA
HIC —————*	54.96				NA	NA	NA	NA
RIB ACCELERATIONS:								
1. Upper Rib Lateral Y*	47.5	51.9	-3.3	57.5	NA	NA	NA	NA
2. Upper Rib Lateral Y*	47.9	51.9	-4.1	57.5	NA	NA	NA	NA
1. Lower Rib Lateral Y*	50.6	50.0	-6.7	77.5	NA	NA	NA	NA
2. Lower Rib Lateral Y*	50.6	50.0	-6.2	77.5	NA	NA	NA	NA
SPINE ACCELERATIONS:								
1. Upper Lateral Y*	28.9	57.5	-5.6	238.8	NA	NA	NA	NA
2. Upper Lateral Y*	26.6	57.5	-5.8	238.1	NA	NA	NA	NA
1. Lower Lateral Y*	51.1	51.3	-8.1	71.9	NA	NA	NA	NA
2. Lower Lateral Y*	48.9	51.3	-9.7	71.9	NA	NA	NA	NA
PELVIS ACCELERATIONS:								
Lateral Y*	52.7	45.6	-4.6	187.5	NA	NA	NA	NA
RIB DEFLECTION:	0.11	44.5	-1.30	131.4	NA	NA	NA	NA

Data Required (other data to be used by R & D)

REFERENCE: Positive Direction — Longitudinal (X) = forward
 Lateral (Y) = to right
 Vertical (Z) = up

Positive Direction — Longitudinal (X) = rearward
 Lateral (Y) = to left
 Vertical (Z) = down

TABLE 2-7 CRASH TEST SUMMARY FOR SIDE IMPACTOR

TYPE OF TEST: 30/15 90° IMPACT TEST DATE 10/28/88
NHTSA NO. FOR TARGET VEHICLE: NA
POSITION OF IMPACTOR (MDB) ON MONORAIL: CRABBED 26° TO RIGHT (CLOCKWISE)

MDB DETAILS: Overall Width of Framework Carriage = 49.35 in.
Overall Length of MDB = 162 in. (Including honeycomb impact face)
Wheelbase of Framework Carriage = 102 in.
Tread of Framework Carriage (Front & Rear) = 72 in.
C.G. location rearward of front axle = 50 in.
MDB Weight — Left Front = 1123 lb; Left Rear = 884 lb
Right Front = 1127 lb; Right Rear = 896 lb
SUBTOTAL: Front = 2200 lb; Rear = 1780 lb
TOTAL MDB WEIGHT = 3980 lb
IMPACT ANGLE (MDB C/L to Target Vehicle C/L) = 90° (blank)
IMPACT SPEED = 33.4 MPH

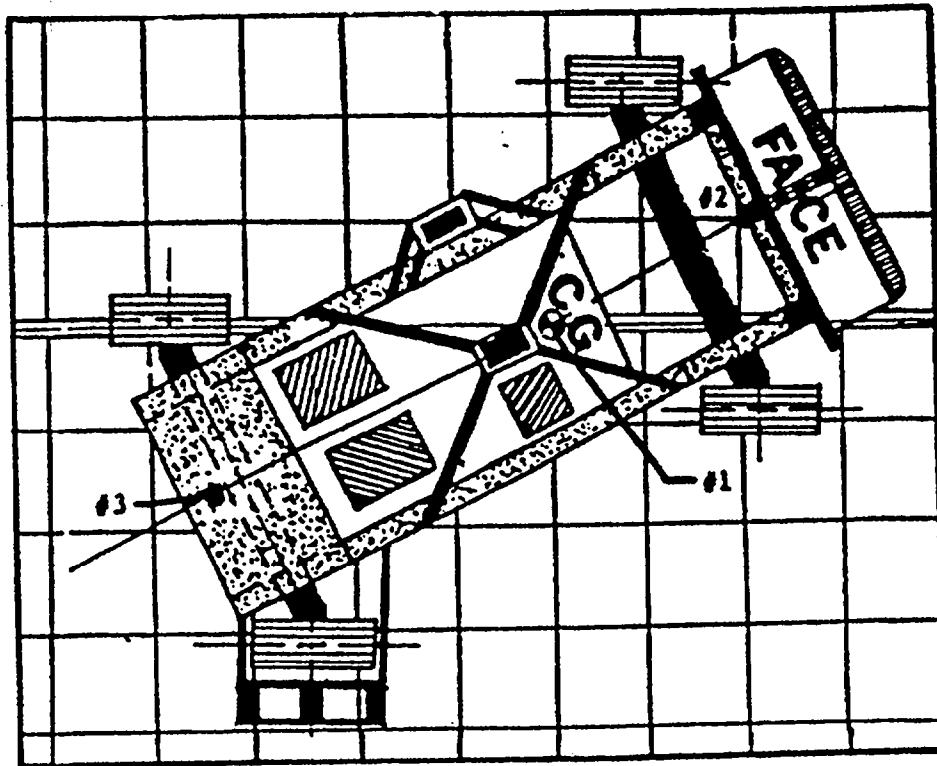
MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

1. ROW A at bumper level = 0.1 in.
2. ROW B at mid-stack level = 4.0 in.
3. ROW C at top of stack level = 4.8 in.

INSTRUMENTATION:

Number of MDB Data Channels = 5 accelerometer channels

TABLE 2-8 MOVING DEFORMABLE BARRIER (MDB) ACCELEROMETER LOCATIONS AND SAMPLE DATA SUMMARY



ACCEL. NO.	LOCATION	Coordinates			POS. DIRECT.		NEG. DIRECT.	
		X*	Y*	Z*	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	MDB Center of Gravity							
	Longitudinal X				1.8	229.7	-12.0	47.2
	Lateral Y				1.0	228.4	-4.2	49.3
	Vertical Z	56.4	0.0	12.0	4.8	55.6	-6.8	33.6
	Resultant R				13.4	46.7	-0.1	220.6
2	Front Frame Member Longitudinal X	121.4	0.0	9.8	2.5	195.8	-12.1	38.6
3	Rear Frame Member Longitudinal X	2.5	0.0	14.0	No Data	No Data	No Data	No Data

*Reference: X - Rearmost Frame Point (+ Forward)
Y - Centerline of MDB (+ Right)
Z - ground Level (+Up)

TABLE 2-9 HIGH-SPEED CAMERA LOCATIONS AND DATA

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	COORDINATES (in)		
					X*	Y*	Z*
1	Overhead view of test vehicle dynamics	Fastex	8	600	0	0	252
2	Overhead Closeup view of impact plane	Fastex	8	600	0	0	252
3	MDB Onboard Closeup view of Impact point	Himac	25	600	-88	18	49
4	MDB Onboard view of driver dummy kinematics	Fastex	13	600	-118	33	80
5	Overhead view of test Level—Overall View	Photo-sonic	25	600	-18	648	39
6	Left Side Ground Level—Overall View	Fastex	17	600	0	-208	48
7	Test Vehicle Onboard-driver dummy front view kinematics	Fastex	8	600	64	24	51
8	Test Vehicle Onboard-driver dummy side view kinematics	Fastex	8	600	-32	84	51
9	Test Vehicle Onboard-pass. dummy side view kinematics	NA	NA	NA	NA	NA	NA

NOTE: Real time (24 fps) film coverage of pre-test test, and post-test events included in final print

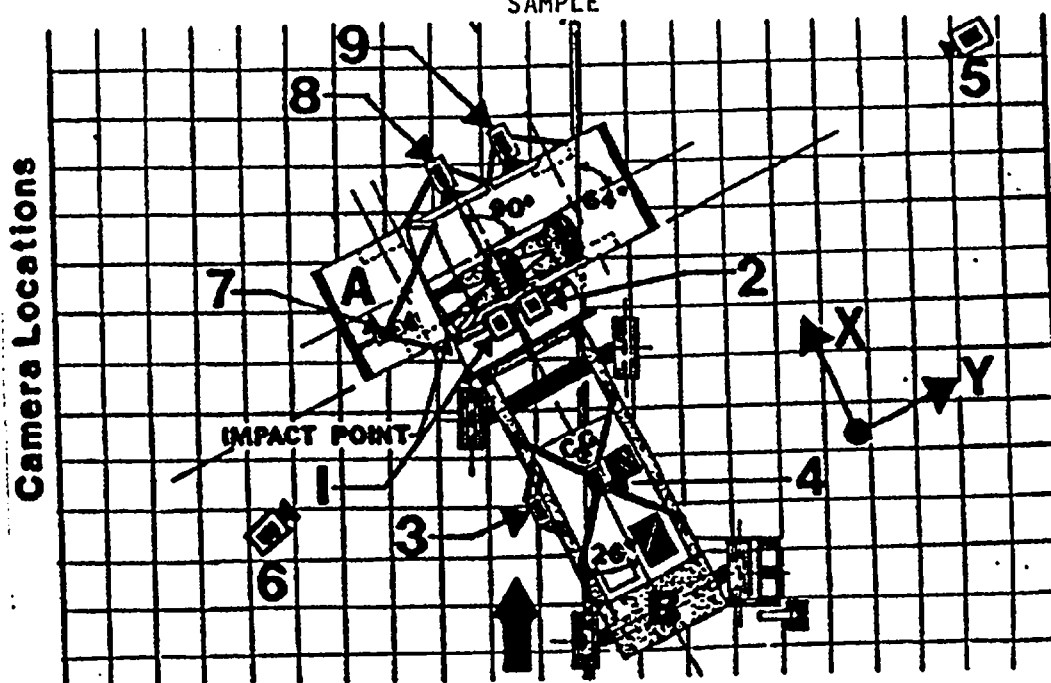
* Reference (from point of impact

+X = Forward

+Y = To Right

+Z = Upward

SAMPLE



ANGLES INDICATED ARE HYPOTHETICAL

SECTION 3

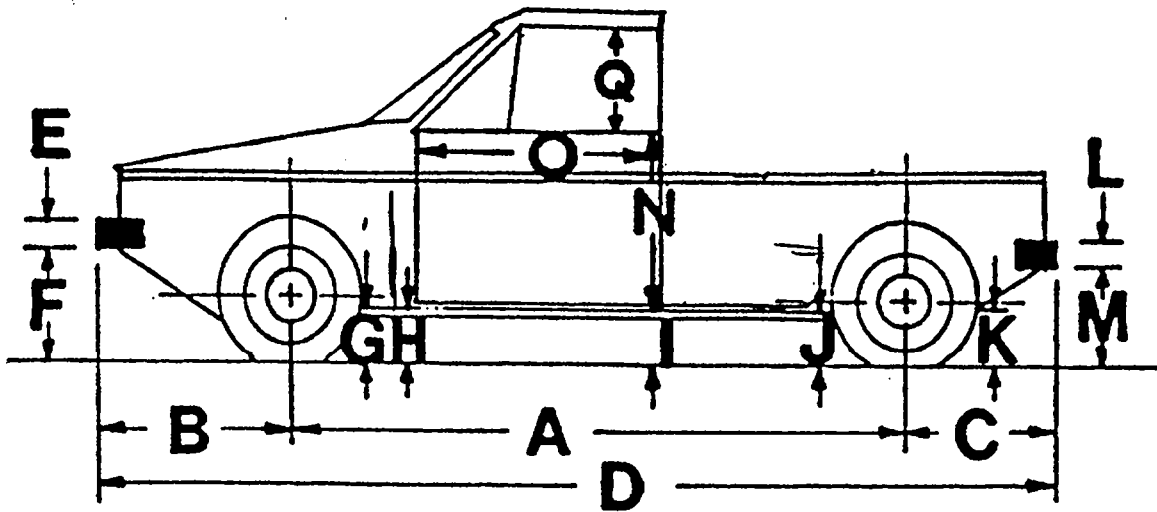
TEST RESULTS

The 1988 Ford F-150 Pickup was impacted at 33.4 mph by the 26° crabbed MDB on 28 October 1988. The MDB's left edge contacted the test vehicle 2.0 inches forward of the impact line. The test vehicle was spun around counterclockwise, the lighter back end of the vehicle pivoting around the heavier front. The vehicle driver side door and bed were crushed inwards a maximum of 25.4 inches. Pretest and posttest vehicle dimensions are shown in Tables 3-1 to 3-5.

The SID impacted the driver door with the left knee, hip and shoulder. The neck and body were rotated far enough by the impact force to allow the SID head to go through the driver side window. The SID head did not contact the aluminum barrier or any objects during this action. The SID then rotated to its left while being thrown across the cab interior. It appeared that the top of the SID head slightly impacted the cab ceiling. The SID ended up sitting in the passenger position facing forward. SID contact is documented in Table 3-6.

The MDB impacted the test vehicle and was stopped by the remote brake system to prevent a second impact. The aluminum deformable barrier received minor damage with a maximum crush of 4.8 inches on the upper right-hand corner. The crush details for the MDB are given in Table 3-7.

TABLE 3-1 PRE AND POSTTEST MEASUREMENTS



NOTE: All dimensions are in inches

	PRETEST	POSTTEST	CHANGE
A	133.0	128.4	4.6
B	29.0	30.0	-1.0
C	51.1	52.1	-1.0
D	213.1	210.5	2.6
E	10.3	10.3	0.0
F	15.8	13.5	2.3
G	16.4	16.2	0.2
H	17.2	18.0	-0.8
I	18.2	19.7	-1.5
J	18.6	22.0	-3.4
K	20.8	21.1	-0.3
L	7.3	7.3	0.0
M	19.2	17.2	2.0
N	31.0	29.0	2.0
O	42.8	40.8	2.0
P	N/A	N/A	N/A
Q	18.6	18.0	0.6

TABLE 3-2 VEHICLE SIDE MEASUREMENT

TEST VEHICLE NHTSA NO.: TEST #01

LEVEL 5 @ Window Top	67.5	in
LEVEL 4 @ Window Sill	49.0	in
LEVEL 3 @ Mid Door	33.6	in
LEVEL 2 @ Occupant H-Point	36.1	in
LEVEL 1 @ Axle Centerline Height	18.2	in
(or Sill Top Height)		

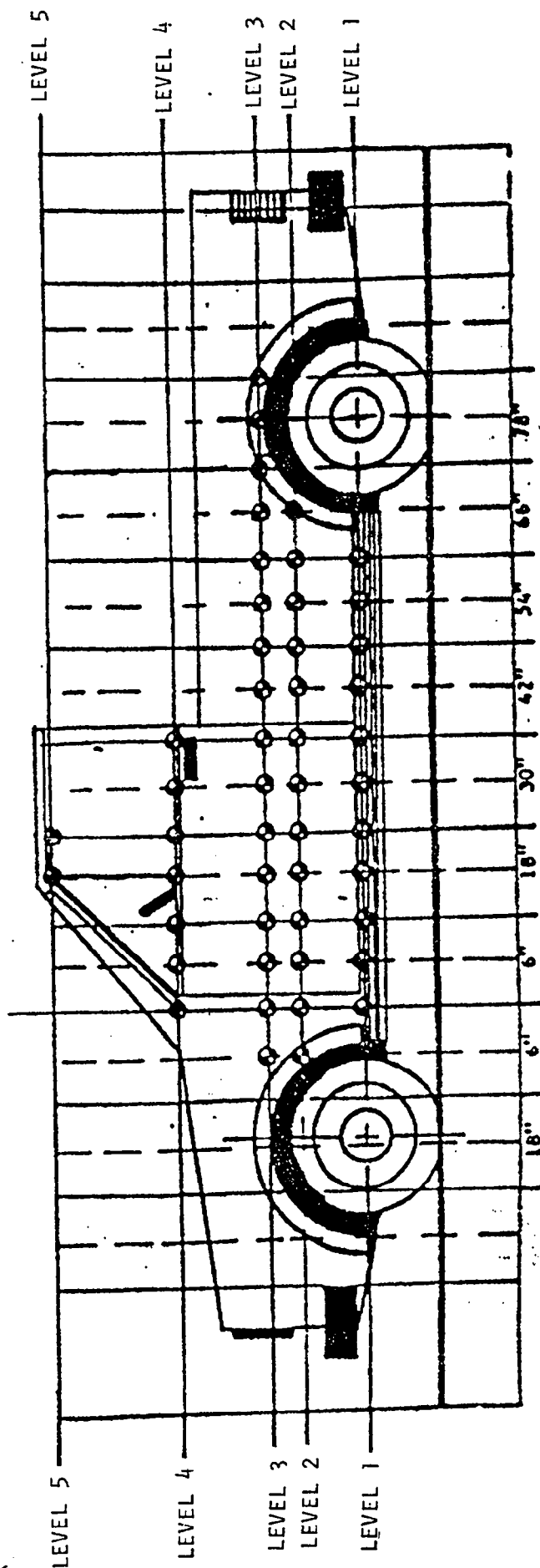


TABLE 3-3 TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE* AND STATIC CRUSH DATA

TEST DATE			IMPACT POINT														
LOCATION:	HEIGHT (in)	PROFILES/CRUSH	6"	0"	6"	12"	18"	24"	30"	36"	42"	48"	54"	60"	66"	72"	
1. Window Top	67.5	Posttest- - - - Pretest - - - - Static Crush- -	NA NA NA	NA NA NA	NA NA NA	NA NA NA	24.2 16.5 8.1	24.5 16.5 8.0	25.4 16.1 9.3	25.3 16.1 9.2	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	
2. Window Sill	49.0	Posttest- - - - Pretest - - - - Static Crush- -	NA NA NA	22.4 10.8 11.6	24.3 11.0 13.3	26.0 11.0 15.0	26.2 11.1 15.1	26.9 11.3 15.6	25.8 11.3 15.4	26.0 11.7 14.3	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	NA NA NA	
3. Mid-Door	33.6	Posttest- - - - Pretest - - - - Static Crush- -	18.0 8.0 10.0	20.8 8.1 12.7	29.7 8.1 21.6	29.4 8.1 21.3	29.1 8.1 21.0	29.0 8.3 20.7	28.4 8.3 20.1	29.2 8.5 20.7	28.7 8.7 20.0	29.2 9.0 20.2	31.2 9.0 22.2	30.5 9.1 21.4	29.2 9.1 20.1	22.6 9.1 13.5	
4. H-Point	36.1	Posttest- - - - Pretest - - - - Static Crush- -	18.8 8.1 10.7	20.5 8.2 12.3	28.7 8.1 20.6	29.0 8.1 20.9	29.5 8.2 21.3	29.3 8.3 21.0	28.8 8.3 20.5	28.4 8.5 19.9	29.0 8.7 20.3	30.3 9.0 21.3	31.4 9.1 22.3	31.2 9.1 22.1	29.0 9.1 19.9	18.4 9.2 9.2	
5. Axle Centerline	18.2	Posttest- - - - Pretest - - - - Static Crush- -	20.2 9.8 10.2	23.6 9.9 13.7	28.2 9.9 18.3	30.2 10.0 20.2	30.5 10.1 20.4	31.3 10.2 21.1	33.0 10.3 22.7	32.0 10.4 21.6	32.8 10.4 22.4	36.0 10.6 25.4	35.8 10.8 25.0	36.0 10.9 25.1	36.2 11.2 25.0	30.8 11.3 19.5	

*Reference Plane is parallel to and 48 inches from test vehicle longitudinal centerline

TABLE 3-4 A PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 1 - AXLE CENTERLINE 18.2' ABOVE GROUND LEVEL

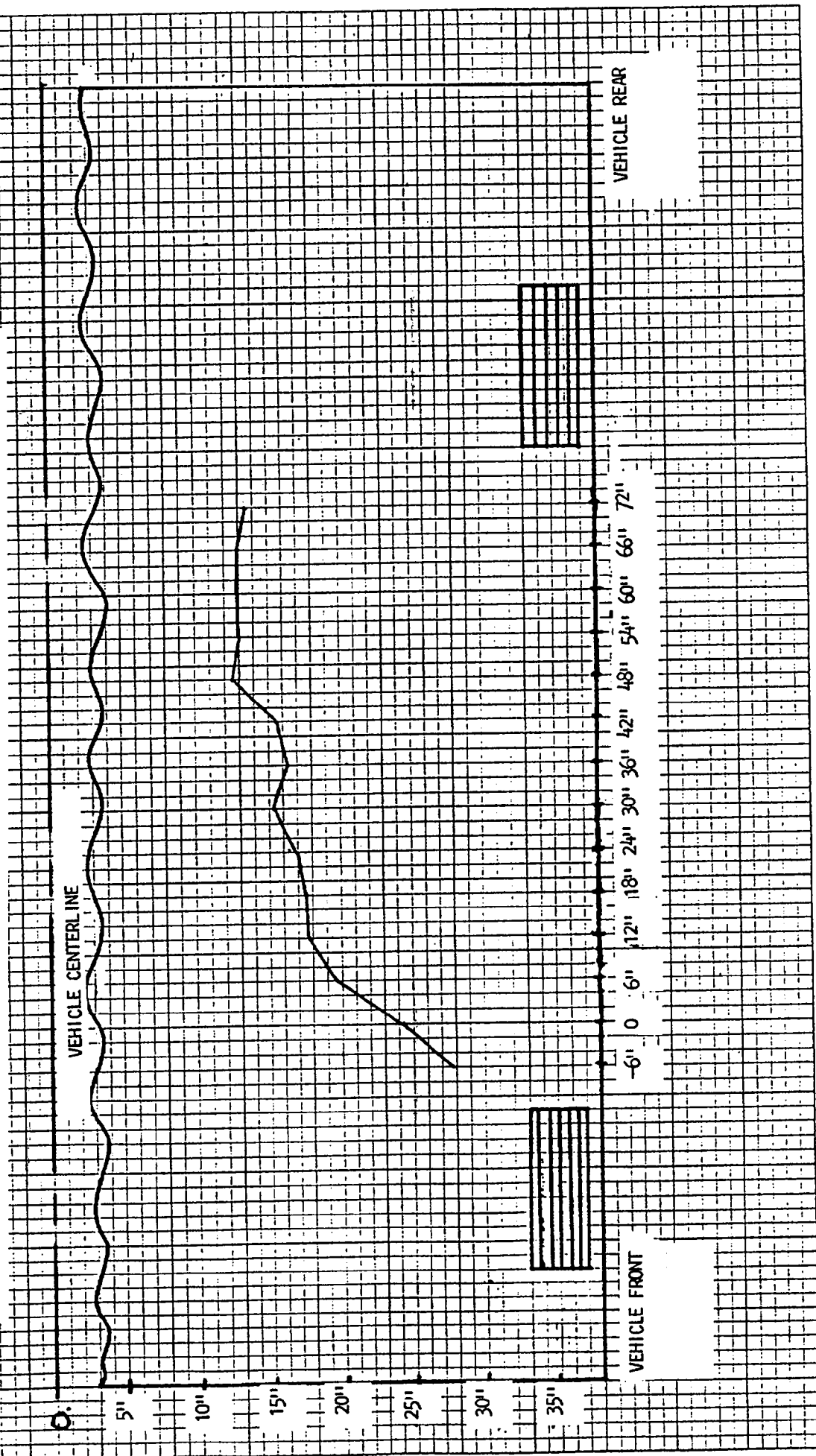


TABLE 3-4 B PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 2 - H-POINT 36.1" ABOVE GROUND LEVEL

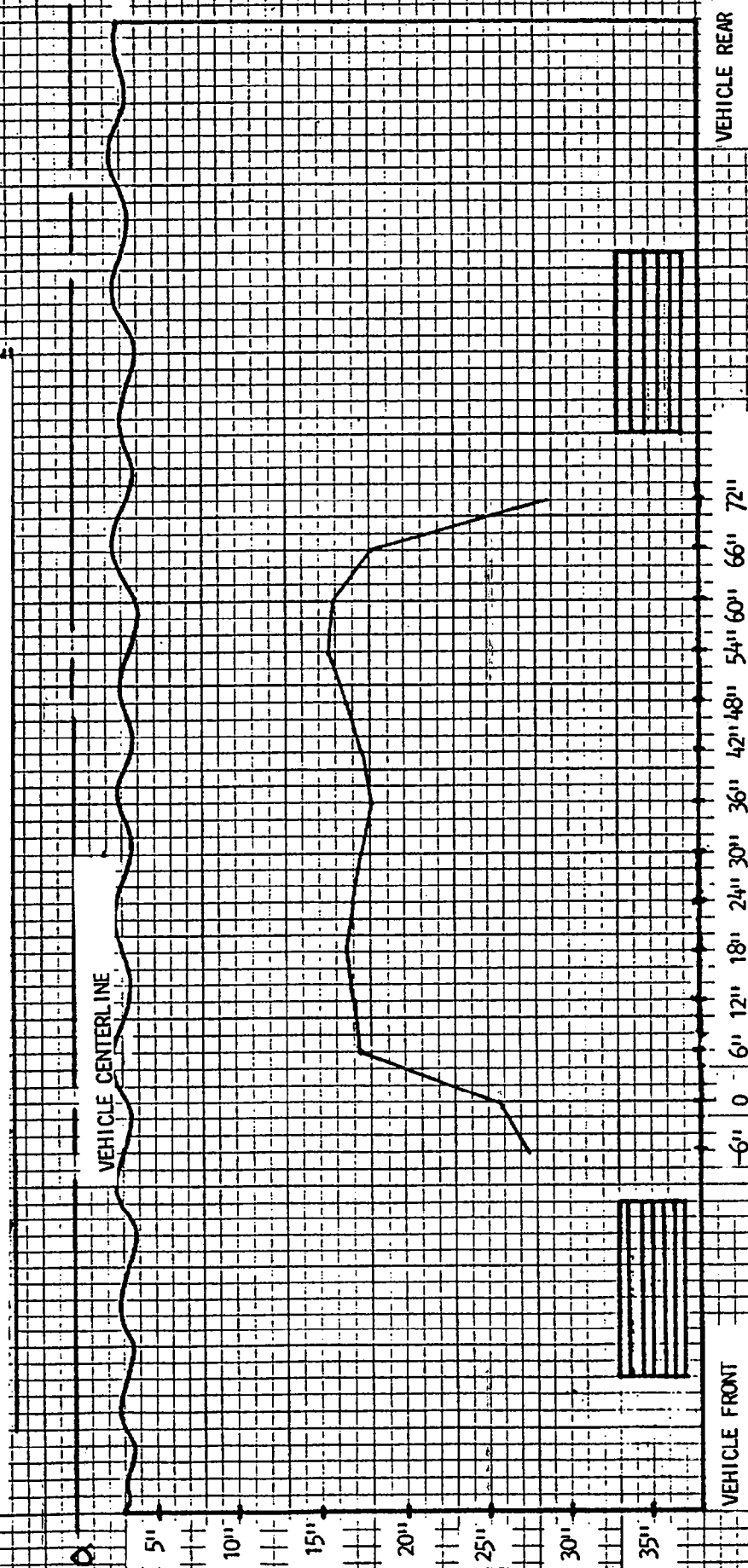


TABLE 3-4 C PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 3 - MID DOOR 33.6" ABOVE GROUND LEVEL

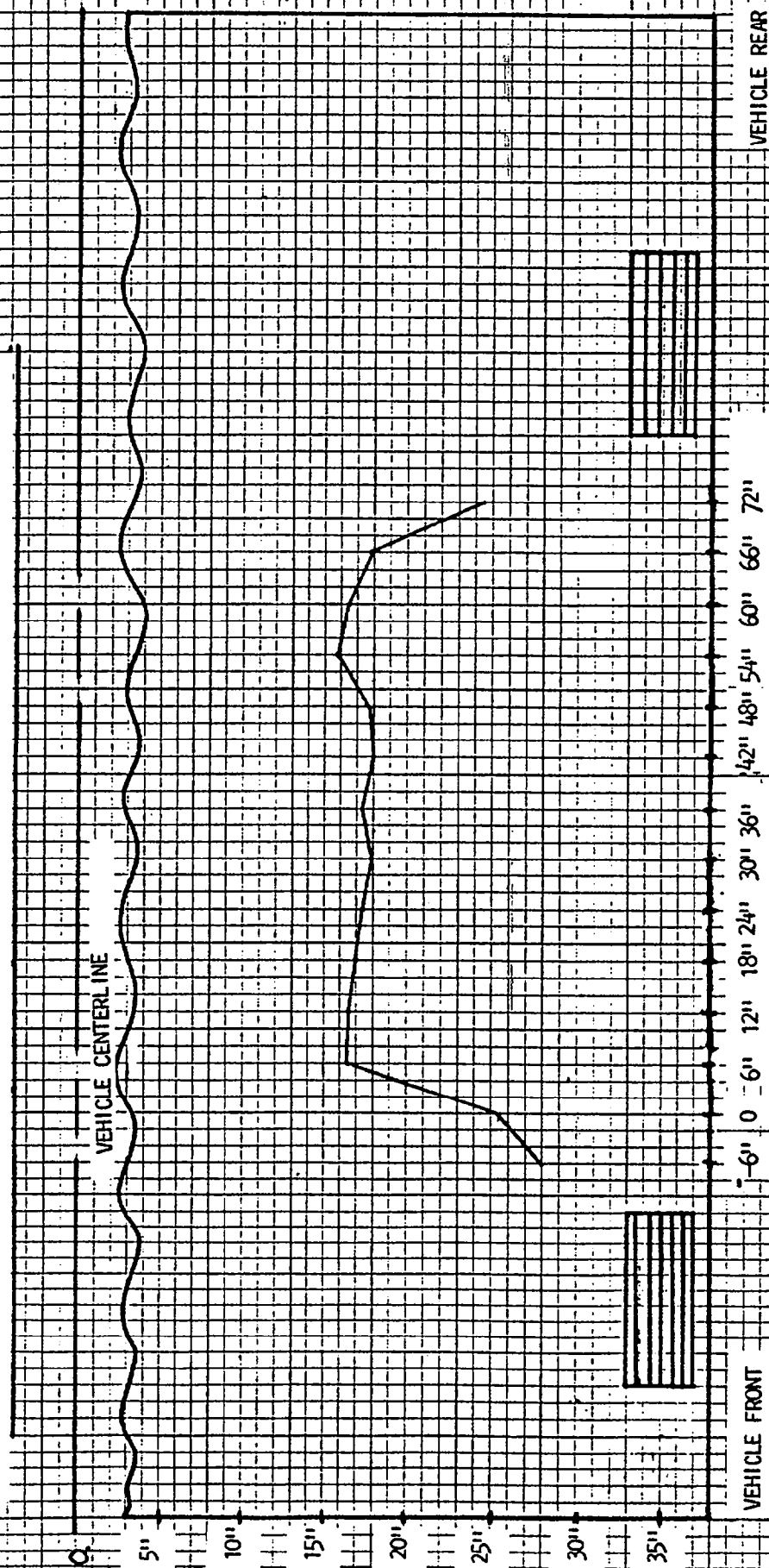


TABLE 3-4 D PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 4 - WINDOW SILL 49.0' ABOVE GROUND LEVEL

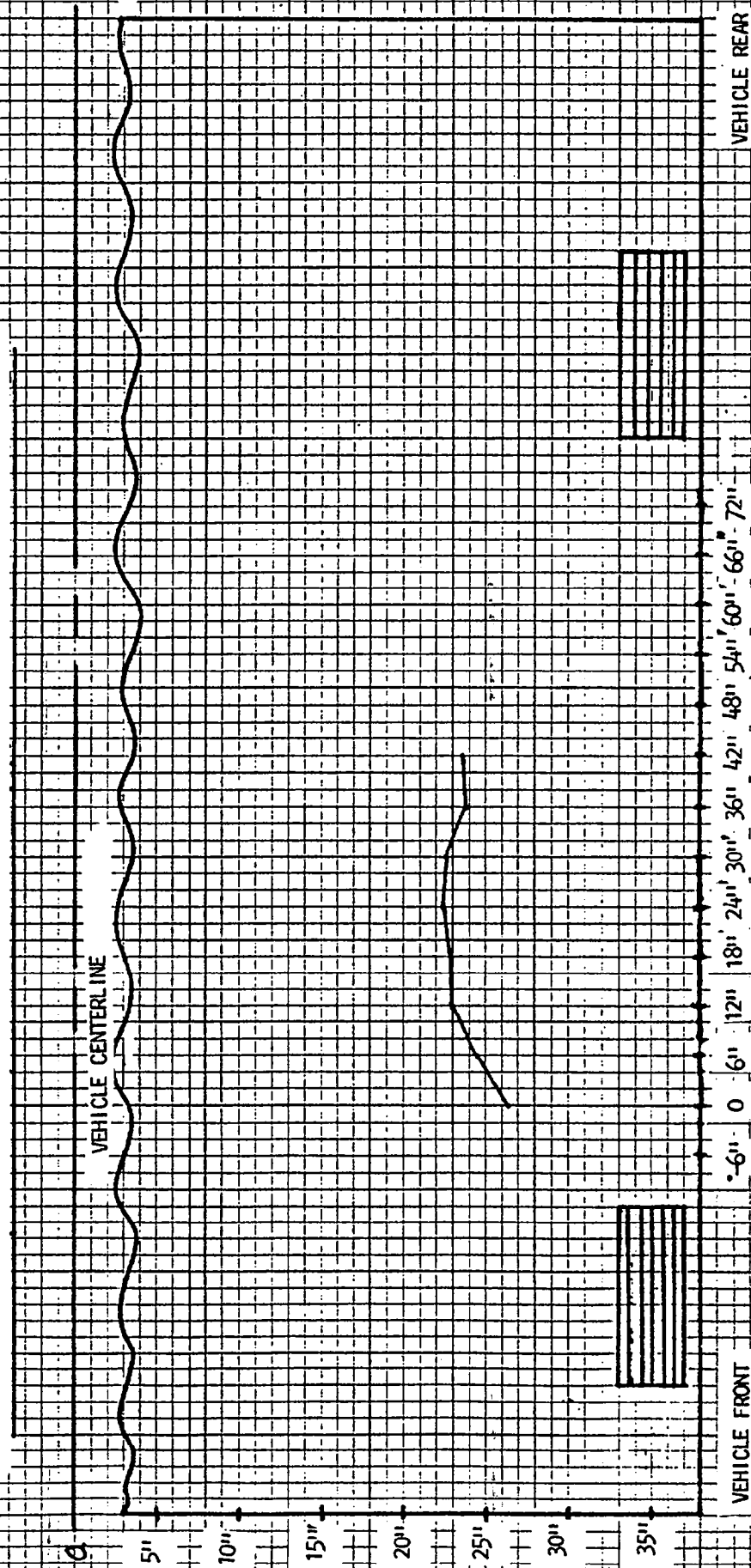


TABLE 3-4 E PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 5 - WINDOW TOP 67.5" ABOVE GROUND LEVEL

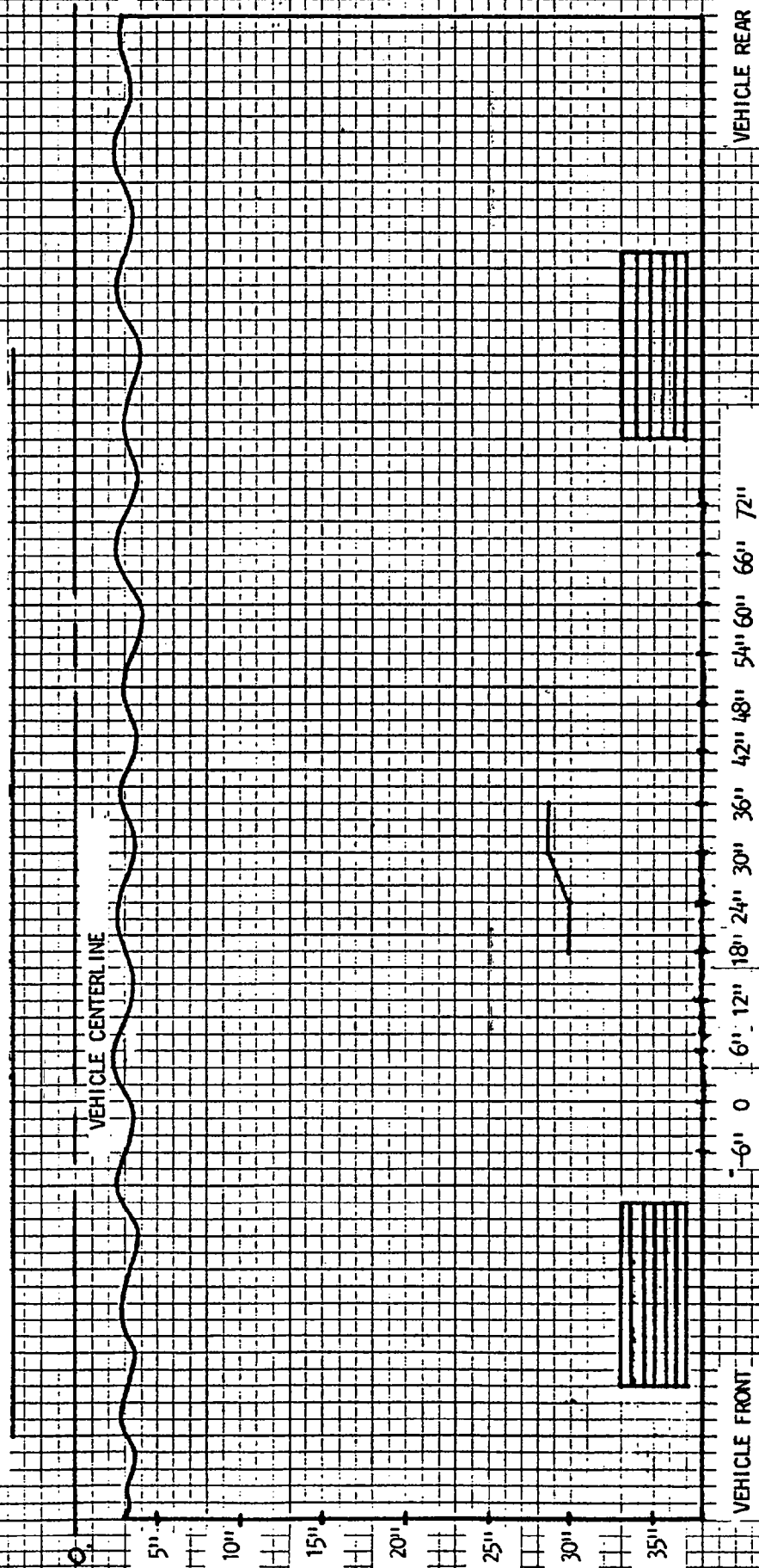


TABLE 3-5 TEST VEHICLE MEASUREMENTS

NO.	MEASUREMENT DESCRIPTION	Pre-Test (in.)	Post-Test (in.)	Diff. (in.)
X1	Total Length of Test Vehicle at Centerline	216.0	213.8	2.2
X2	Rear Surface of Vehicle to Front of Engine	193.7	191.5	2.2
X3	Rear Surface of Vehicle to Firewall	163.8	160.2	3.6
X4	Rear Surface to Upr. Leading Edge of Right Door	156.0	159.0	3.0
X5	Rear Surface to Upr. Leading Edge of Left Door	156.0	149.0	7.0
X6	Rear Surface to Lwr. Leading Edge of Right Door	155.0	157.2	-2.2
X7	Rear Surface to Lwr. Leading Edge of Left Door	155.0	145.5	9.5
X8	Rear Surface to Upr. Trailing Edge of Right Door	112.7	116.5	-3.8
X9	Rear Surface to Upr. Trailing Edge of Left Door	112.6	109.0	3.6
X10	Rear Surface to Lwr. Trailing Edge of Right Door	112.1	115.1	-3.0
X11	Rear Surface to Lwr. Trailing Edge of Left Door	112.2	108.2	4.0
X12	Rear Surface to Bottom 'A' Post on Right Side	153.8	156.0	-2.2
X13	Rear Surface to Bottom 'A' Post on Left Side	153.8	148.0	15.8
X14	Rear Surface to Firewall on Right Side	165.9	169.5	-3.6
X15	Rear Surface to Firewall on Left Side	166.8	164.0	2.8
X16	Rear Surface to Steering Column	139.7	140.5	-0.8
X17	Center of Steering Column to 'A' Post	17.0	13.0	4.0
X18	Center Steering Column to Headlining	20.2	20.2	0.0
X19	Rear Surface to Right Side of Front Bumper	213.1	212.5	0.6
X20	Rear Surface to Left Side of Front Bumper	213.1	212.5	0.6
X21	Length of Engine Block	30.0	30.0	0.0
X22	Strg. Whl. Hub C/L to W/Shld. Header Interior Moulding	19.0	19.0	0.0
X23	Strg. Whl. Hub C/L to Rr. Wdo. Upper Int. Trim Moulding	33.7	33.7	0.0

TABLE 3-6 POSTTEST OBSERVATIONS

TEST VEHICLE: 1988 FORD F-150 ; NHTSA NO.: N/A

VISIBLE DUMMY CONTACT POINT:	FRONT SID	REAR SID
HEAD - - - - -	<u>Cab Ceiling</u>	<u>N/A</u>
CHEST - - - - -	<u>Left Door</u>	<u>N/A</u>
ABDOMEN - - - - -	<u>Left Door</u>	<u>N/A</u>
LEFT KNEE - - - - -	<u>Left Door</u>	<u>N/A</u>
RIGHT KNEE - - - - -	<u>None</u>	<u>N/A</u>

DOOR OPENING:	LEFT SIDE	RIGHT SIDE
FRONT - - - - -	<u>Needed Tools to Open</u>	<u>N/A</u>
REAR - - - - -	<u>N/A</u>	<u>N/A</u>

SEAT MOVEMENT:

None

GLAZING DAMAGE:

Minor cracking of windshield only, no separation.

OTHER NOTABLE IMPACT EFFECTS:

- o Slight separation at top of left side "B" pillar at the top where it is attached to cab.
- o There is no structural damage further inwards than the left frame rail.
- o No fuel tank damage or leakage was detected.

TABLE 3-7 EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

DISTANCE RIGHT OF CENTER																	DISTANCE LEFT OF CENTER**																
LOCATION	HEIGHT at CL*	32"	28"	24"	20"	16"	12"	8"	4"	0"	4"	8"	12"	16"	20"	24"	28"	32"															
Top of Stack Level	32" 40"	4.8	3.5	1.0	0.3	0.0	0.4	0.7	1.2	0.5	0.0	0.0	0.0	0.2	1.2	1.0	1.5	2.8															
Mid-Stack Level	22"	4.0	3.3	0.0	0.0	0.0	0.7	0.5	0.7	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5															
Bumper Level	17"	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0															

* Heights measured above ground level.

** Impact Side

APPENDIX A
PHOTOGRAPHIC COVERAGE

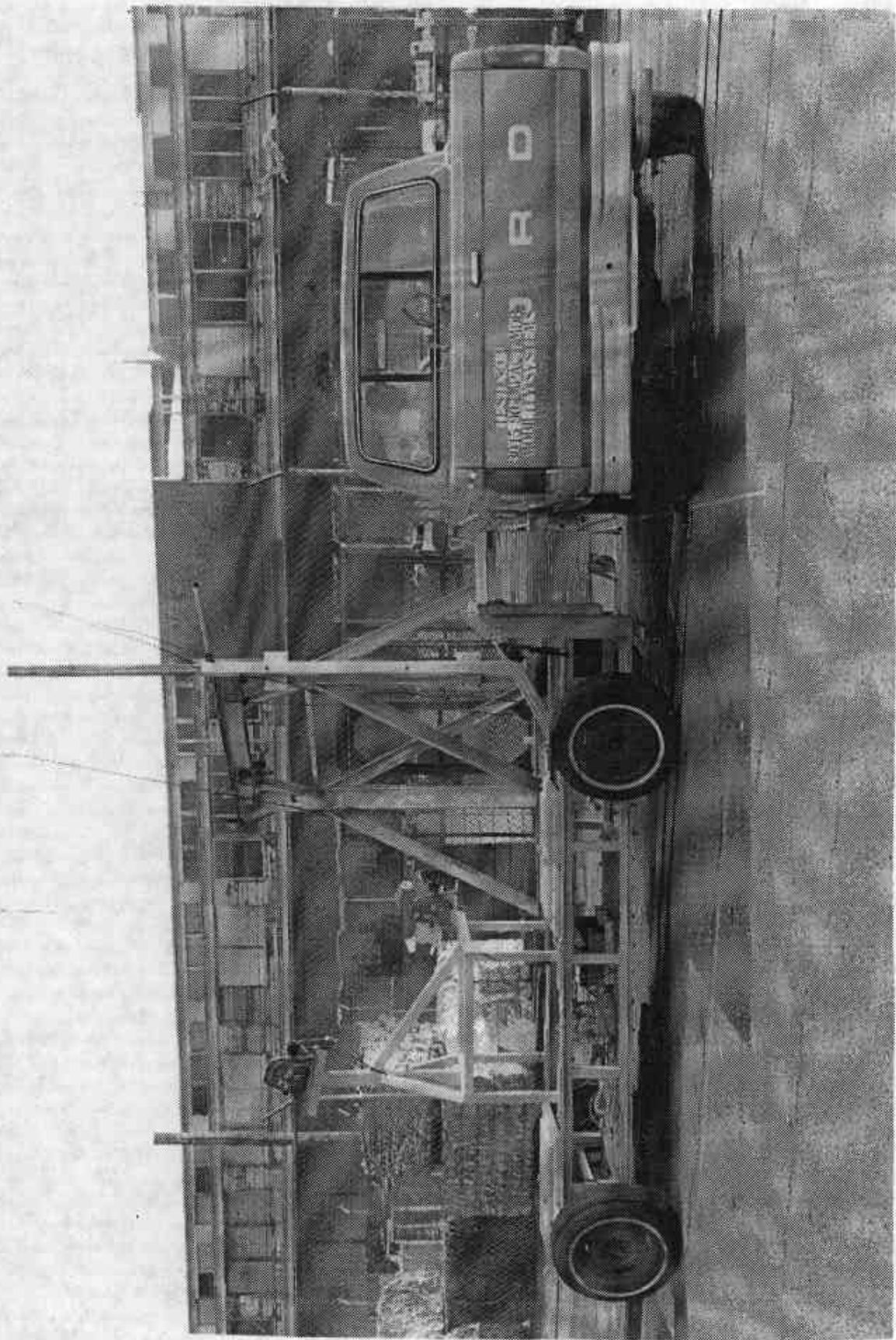


FIGURE A-1 HDB AT TEST VEHICLE, OVERALL VIEW PRETEST

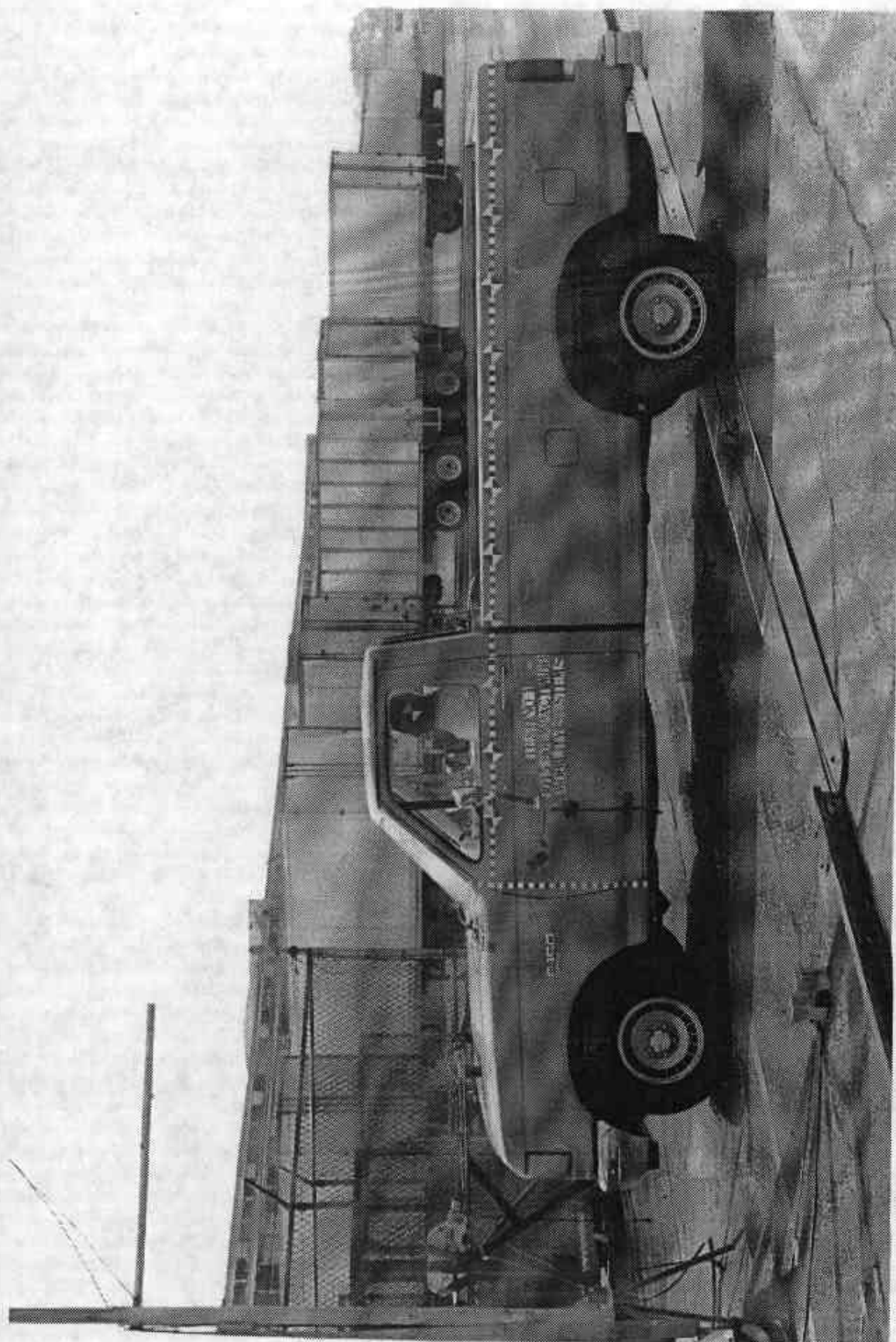


FIGURE A-2 TEST VEHICLE, LEFT SIDE VIEW - PRETEST

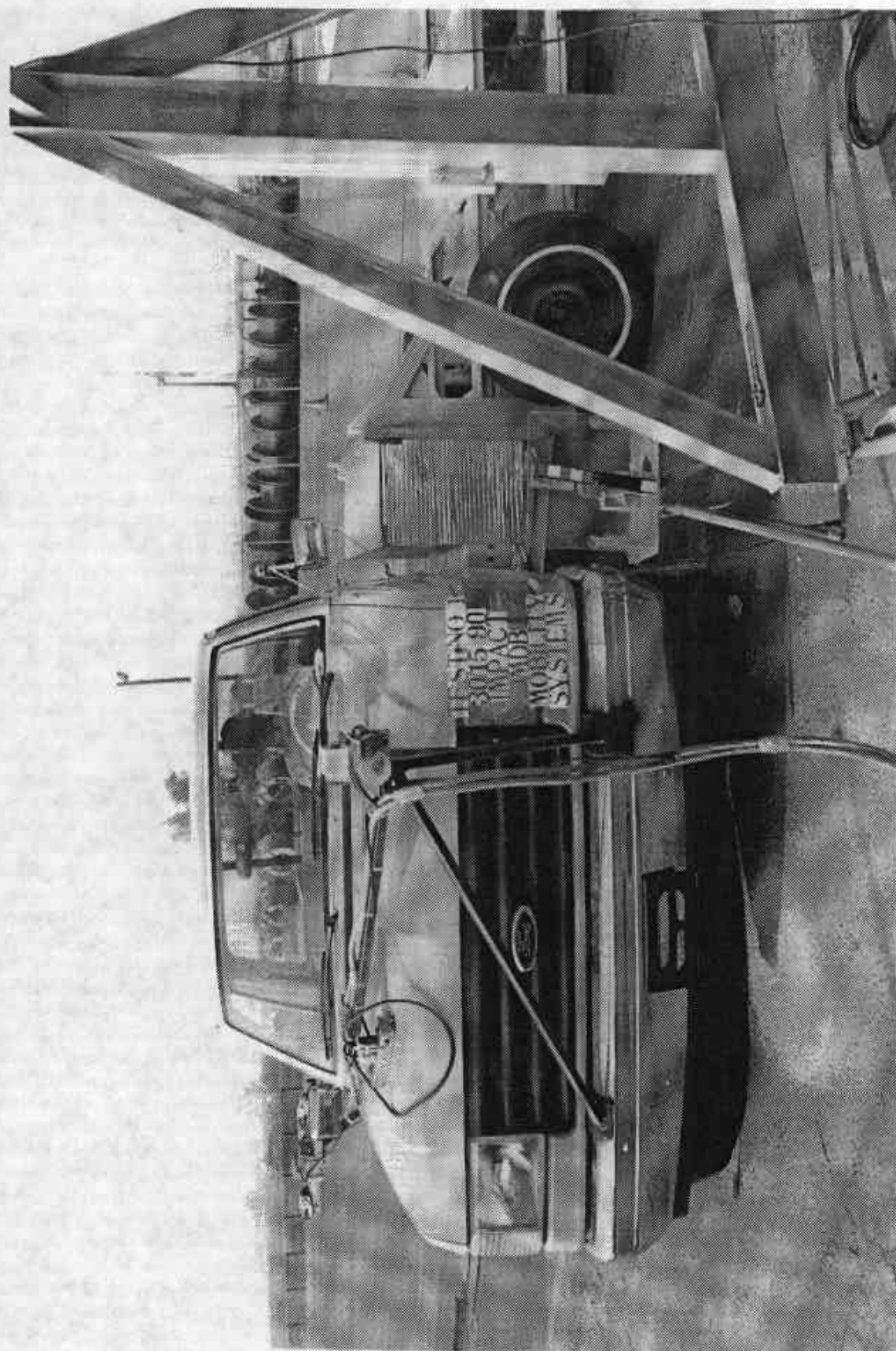


FIGURE A-3 TEST VEHICLE AND MDB, FRONT VIEW -PRETEST

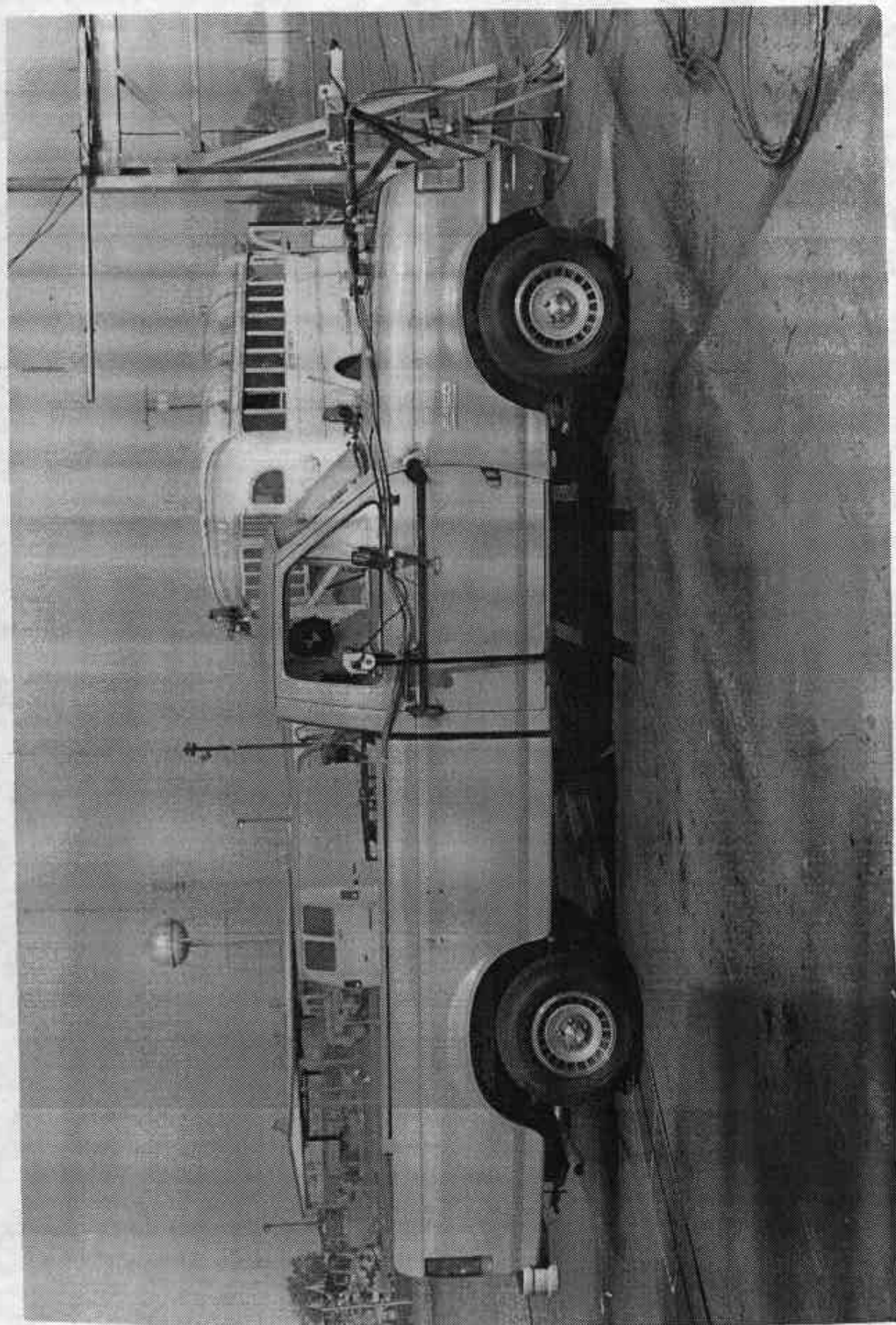


FIGURE A-4 TEST VEHICLE, RIGHT SIDE VIEW - PRETEST



FIGURE A-5 TEST VEHICLE AND MDB, OVERHEAD VIEW - PRETEST



FIGURE A-6 TEST VEHICLE, DRIVER SIDE DOOR, PRETEST



FIGURE A-7 SID IN DRIVER POSITION - PRETEST

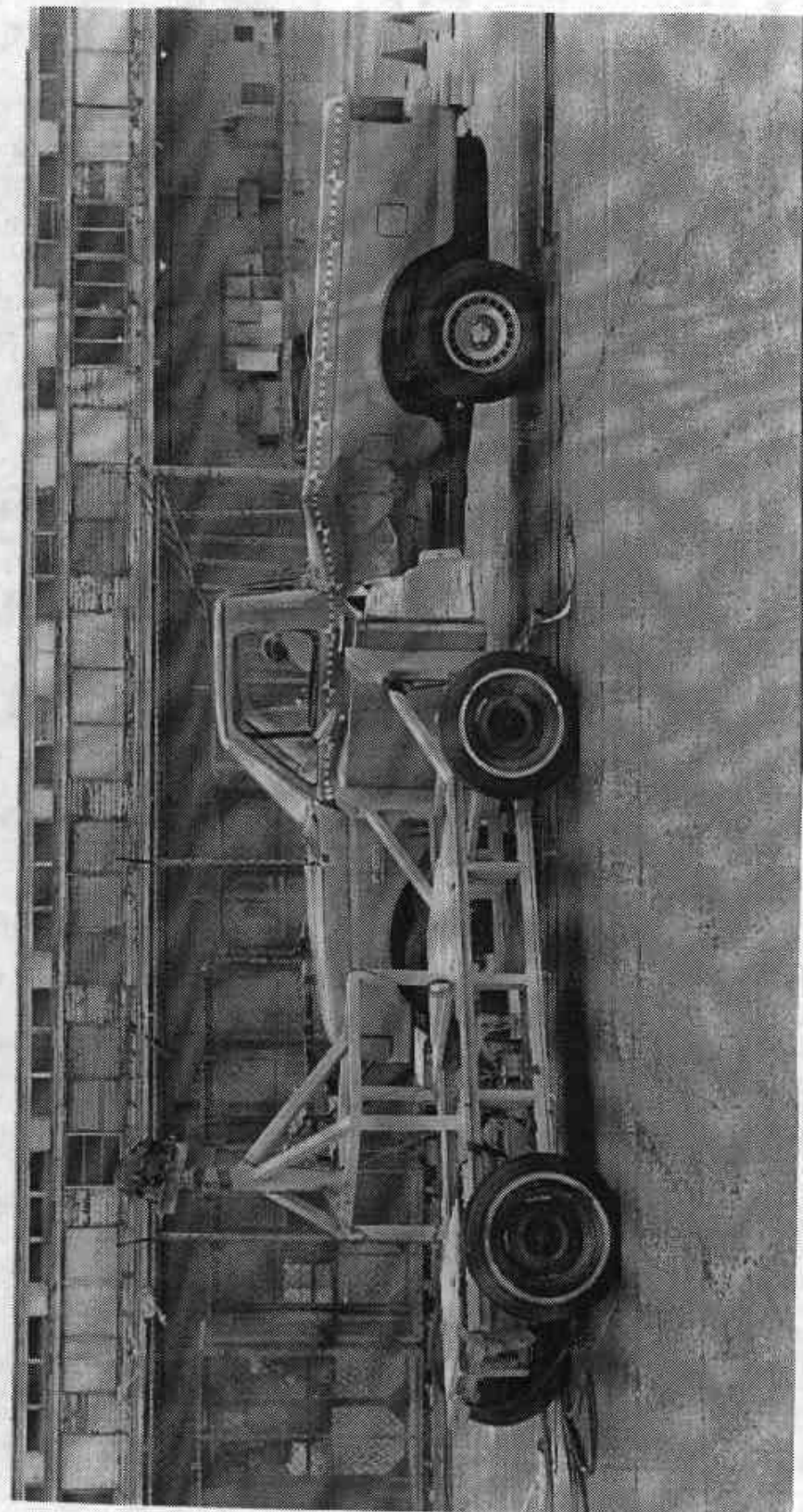


FIGURE A-8 MDB AND TEST VEHICLE, OVERALL VIEW - POSTTEST

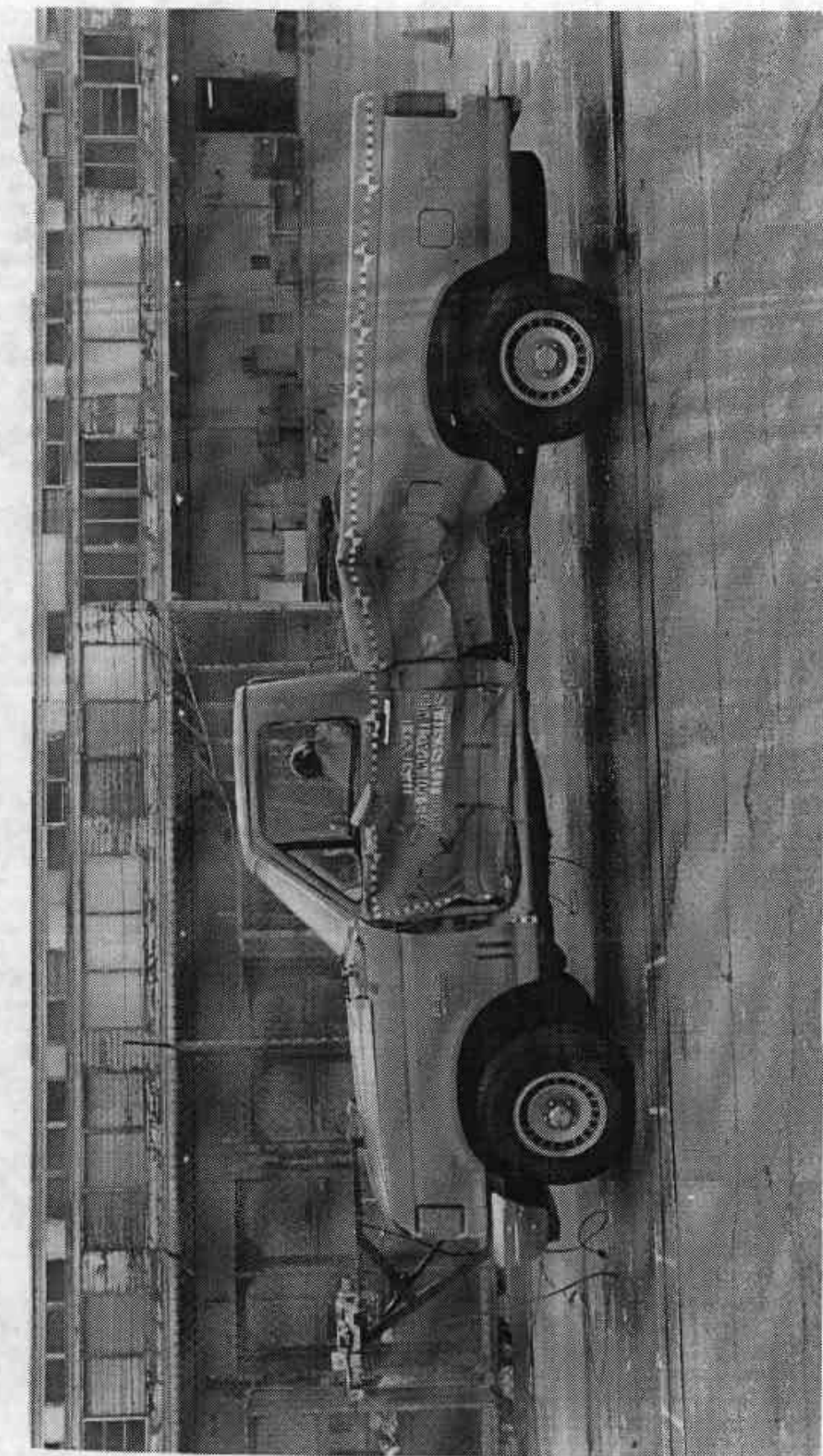


FIGURE A-9 TEST VEHICLE, LEFT SIDE VIEW - POSTTEST



FIGURE A-10 TEST VEHICLE AND MDB, FRONT VIEW -POSTTEST

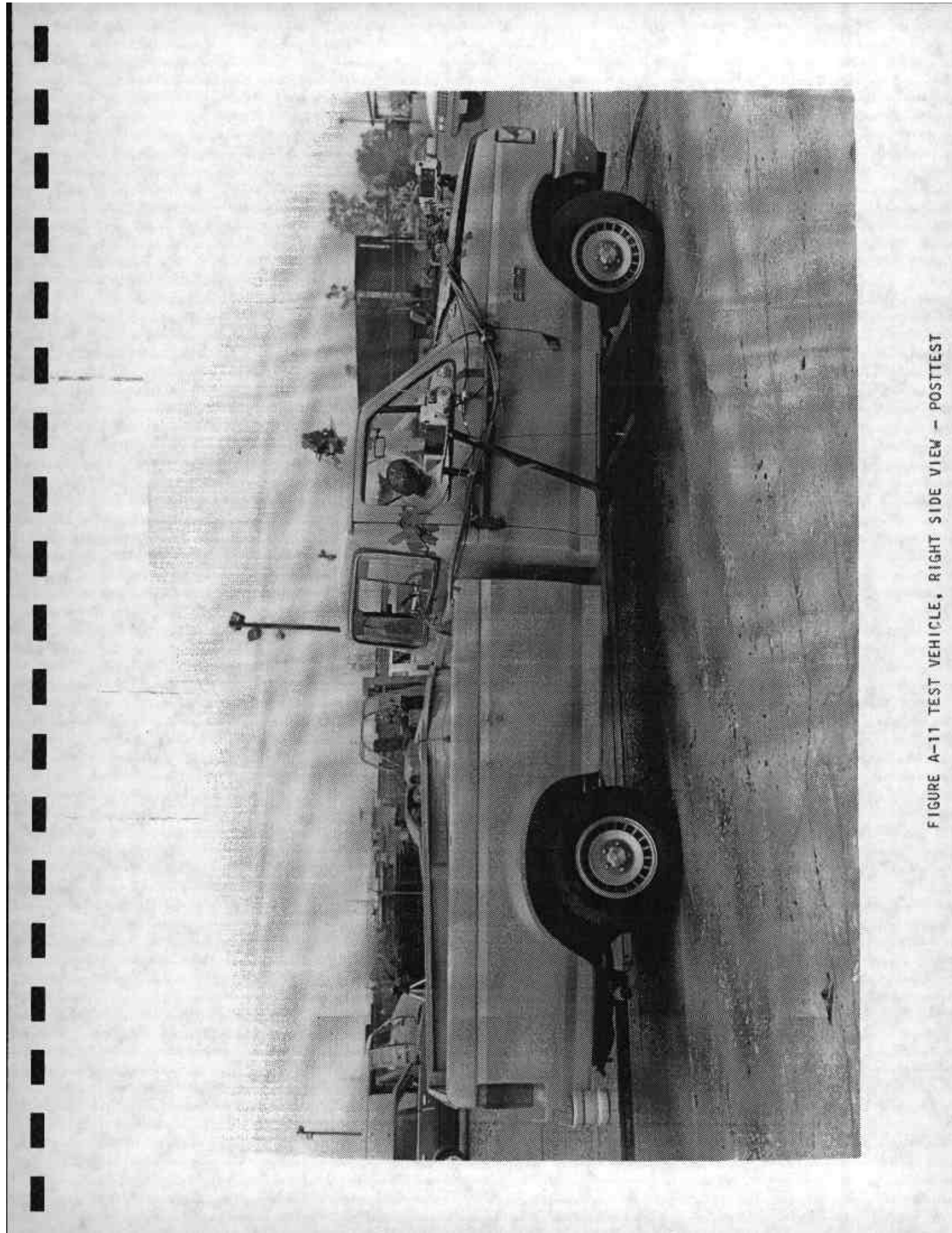


FIGURE A-11 TEST VEHICLE, RIGHT SIDE VIEW - POSTTEST



FIGURE A-12 MDB AND TEST VEHICLE, REAR VIEW - POSTTEST



FIGURE A-13 SID FINAL POSITION - POSTTEST

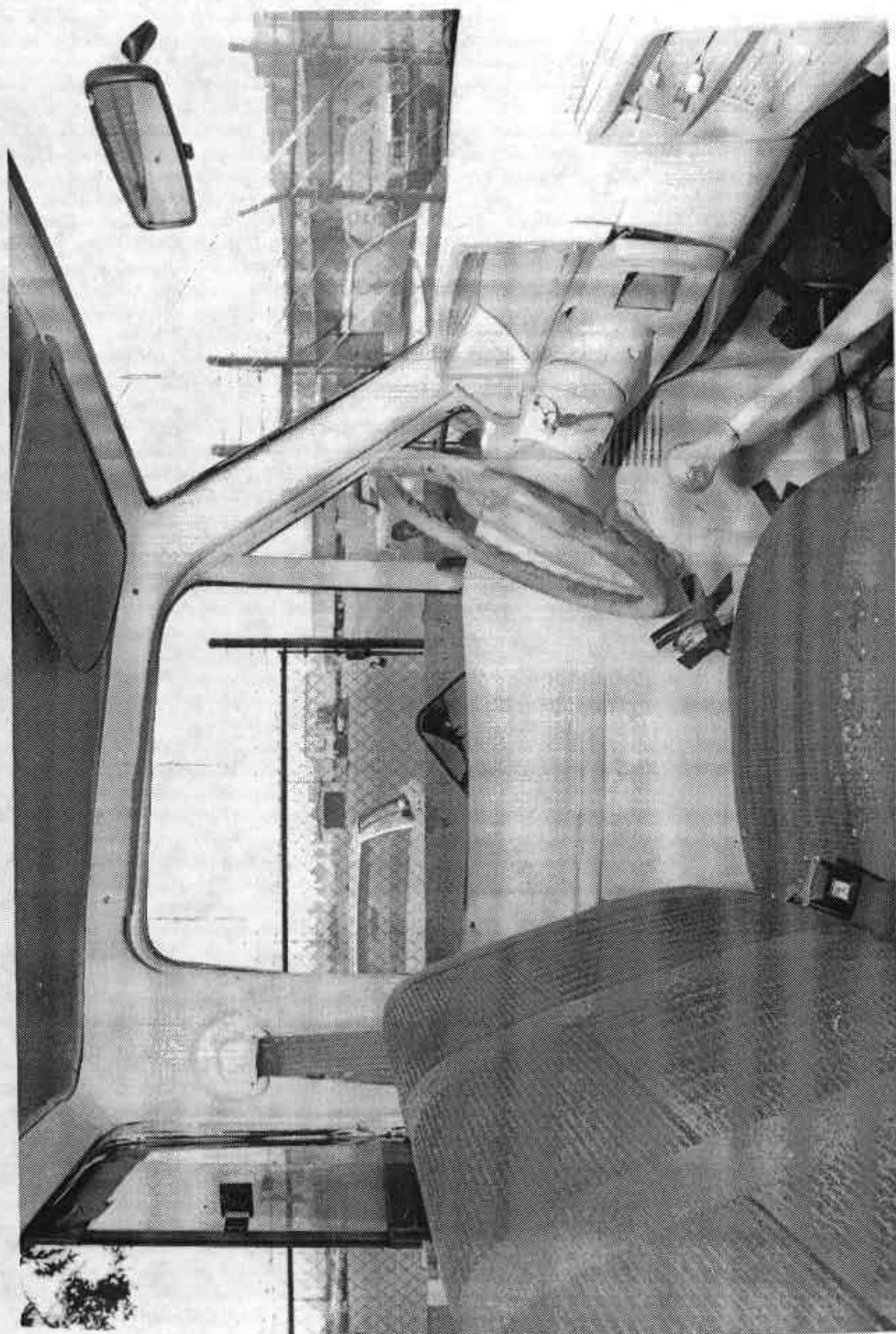


FIGURE A-14 OCCUPANT COMPARTMENT INTERIOR - POSTTEST

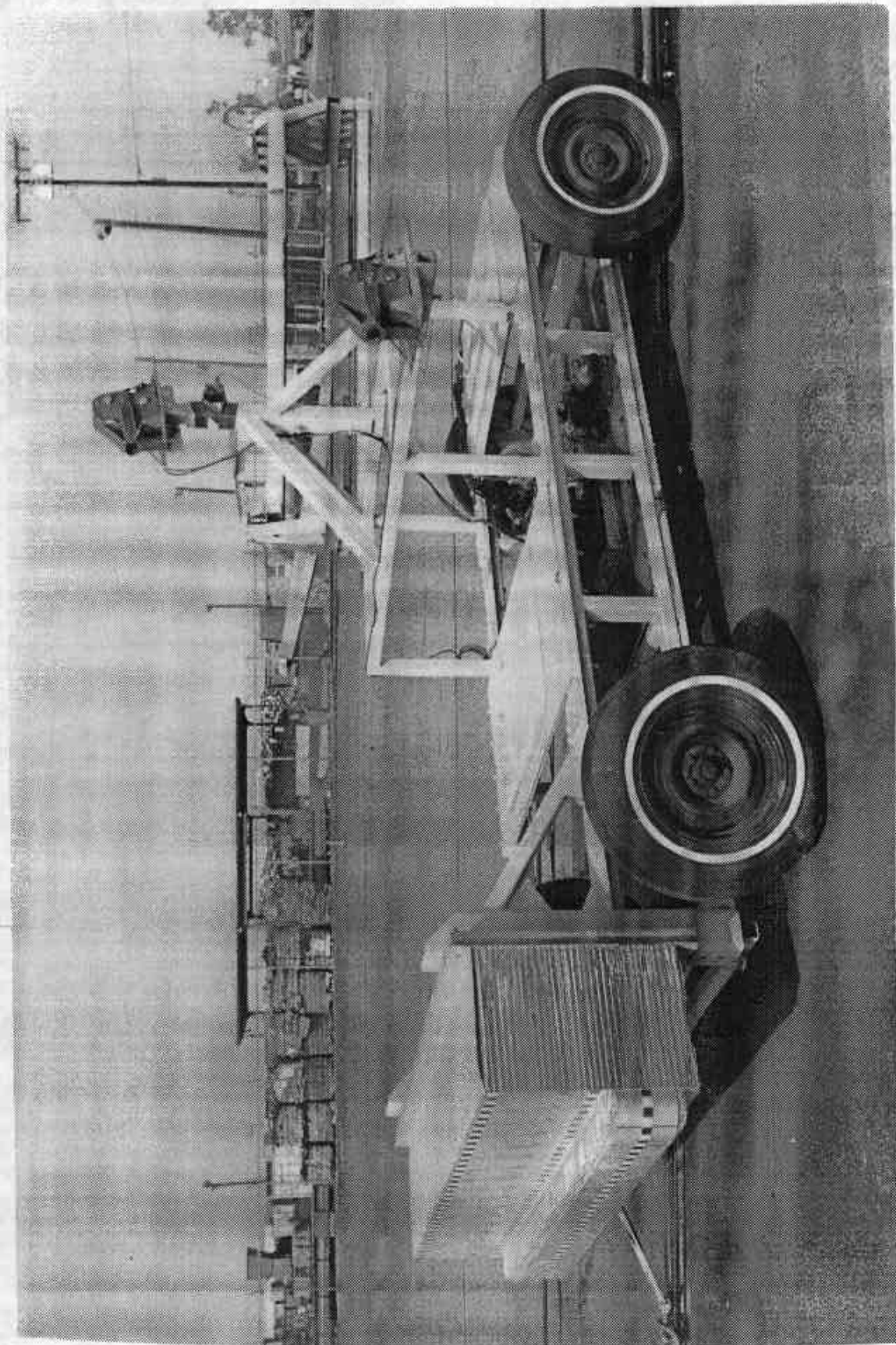


FIGURE A-15 MDB, VIEW NO. 1 -- PRETEST

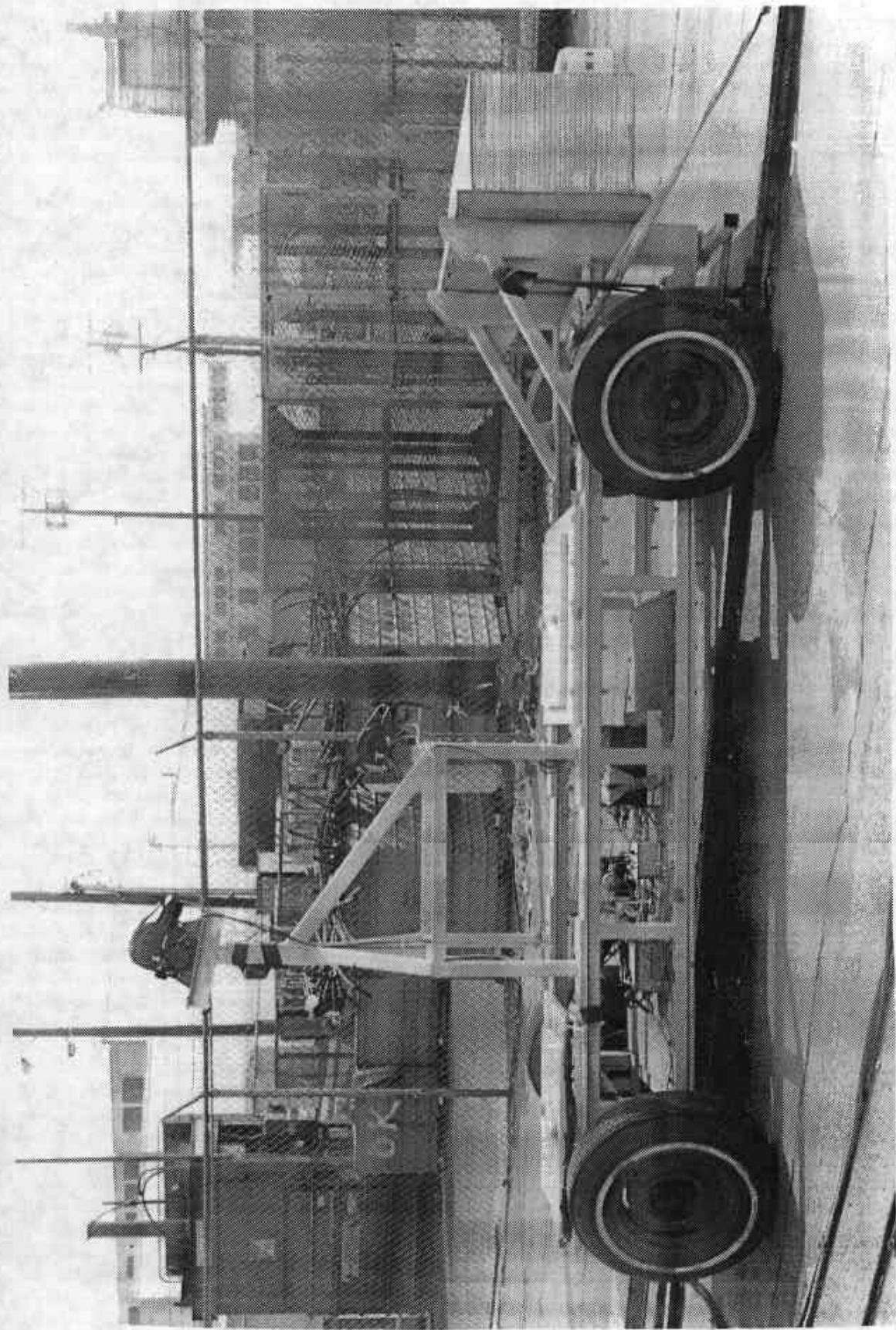


FIGURE A-16 MDB. VIEW NO. 2 -- PRETEST

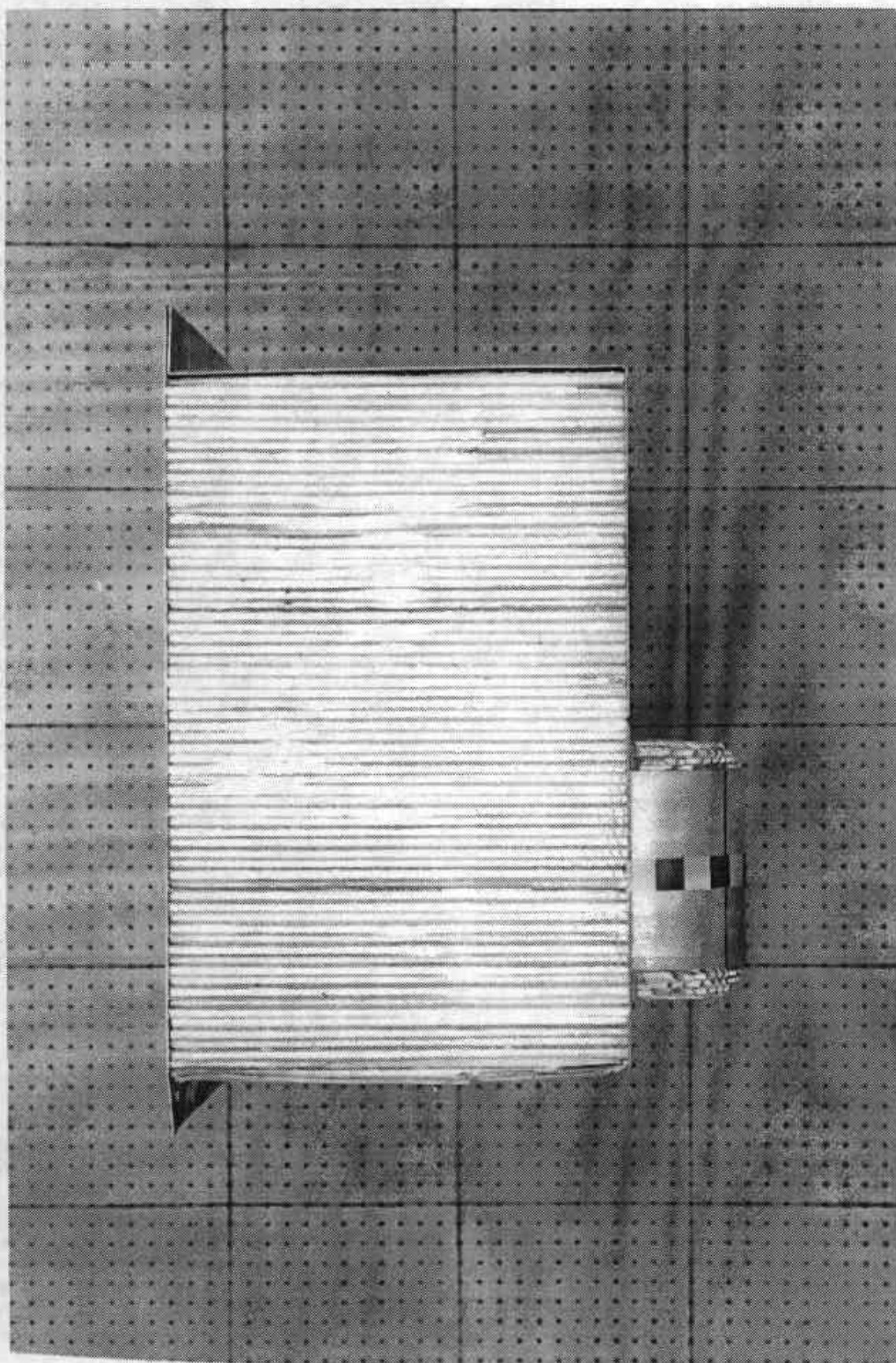


FIGURE A-17 MDB FACE, VIEW NO. 1 - PRETEST

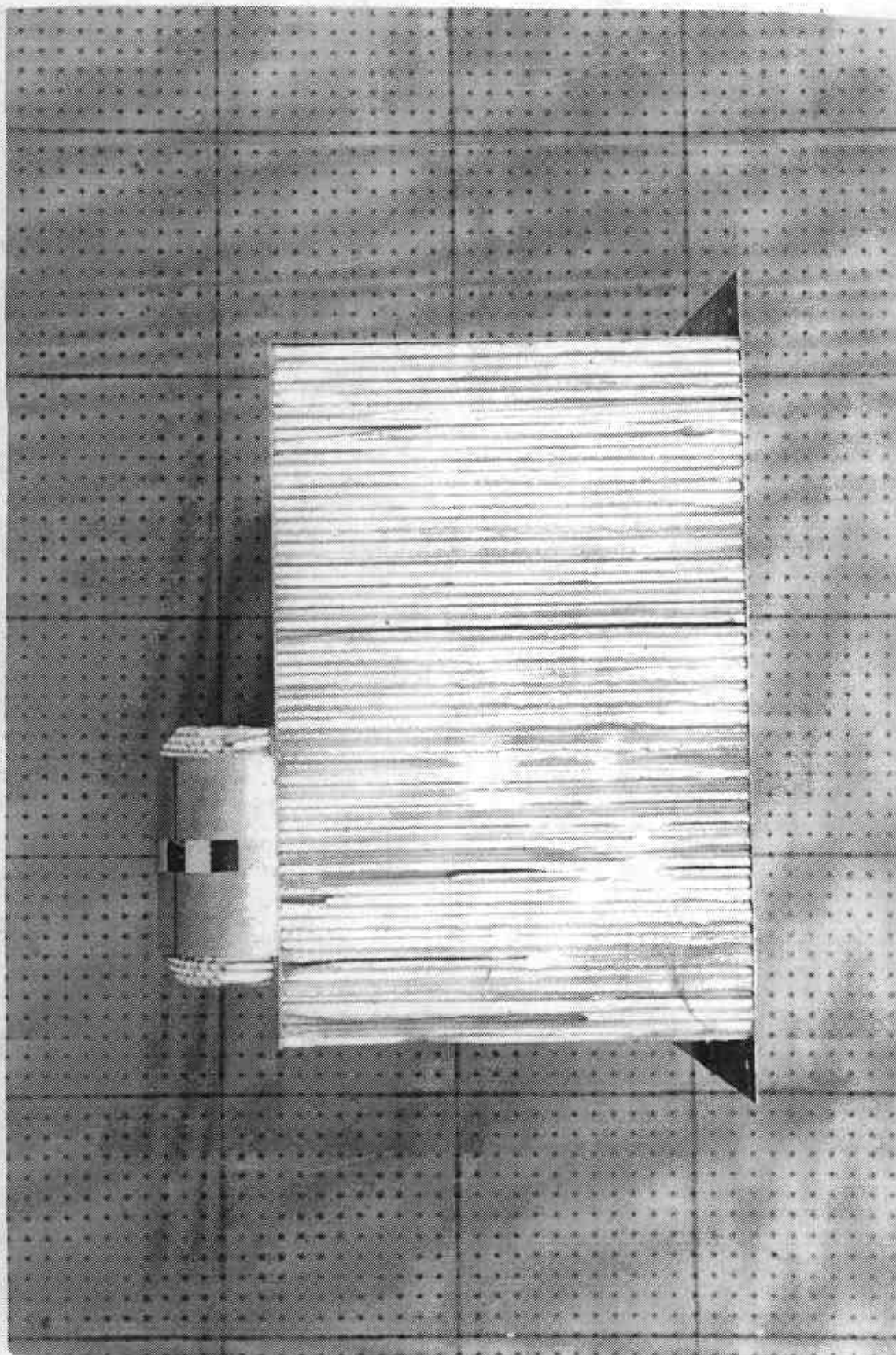


FIGURE A-18 MDB FACE, VIEW NO. 2 - PRETEST

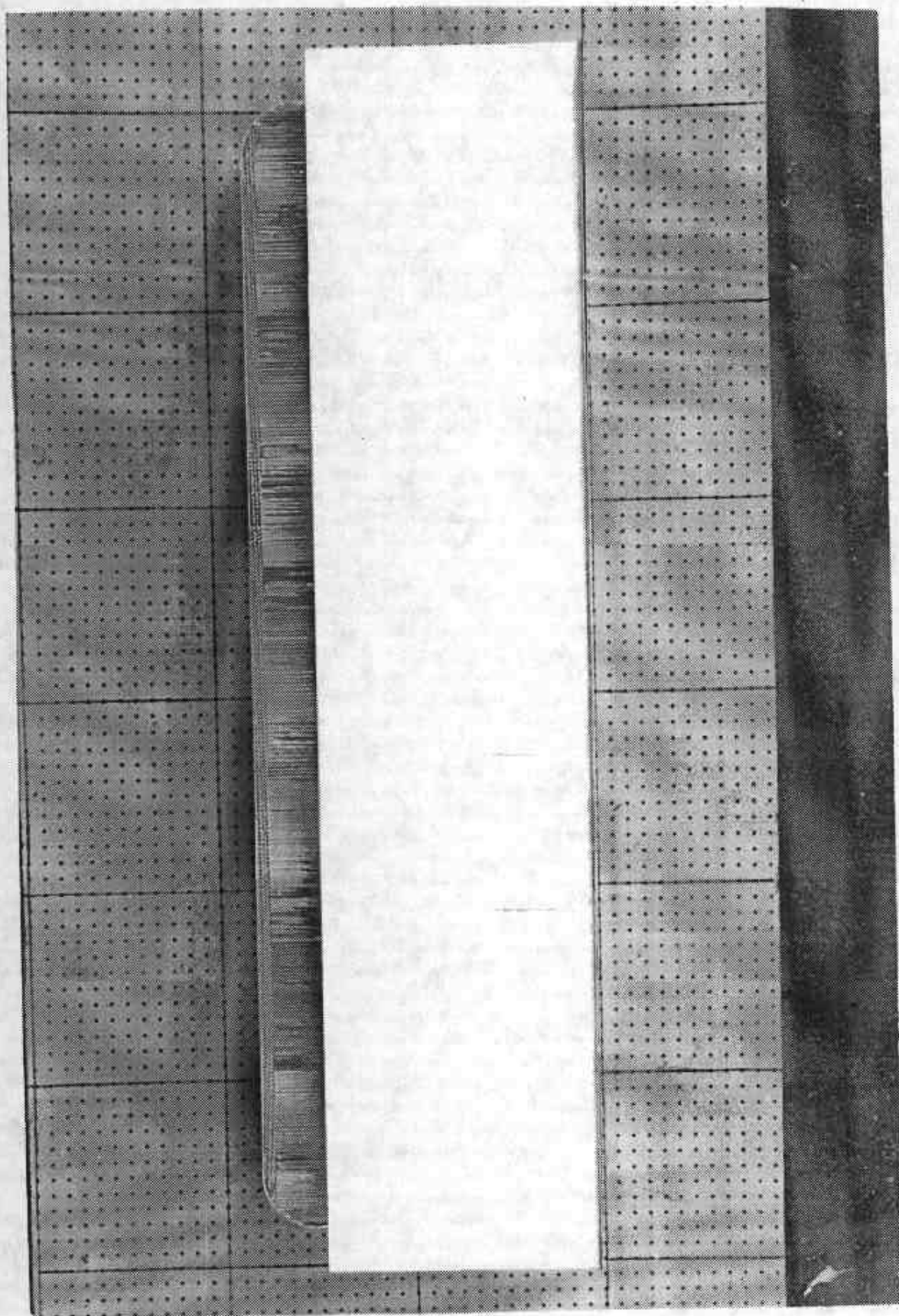


FIGURE A-19 MDB FACE, VIEW NO. 3 - PRETEST

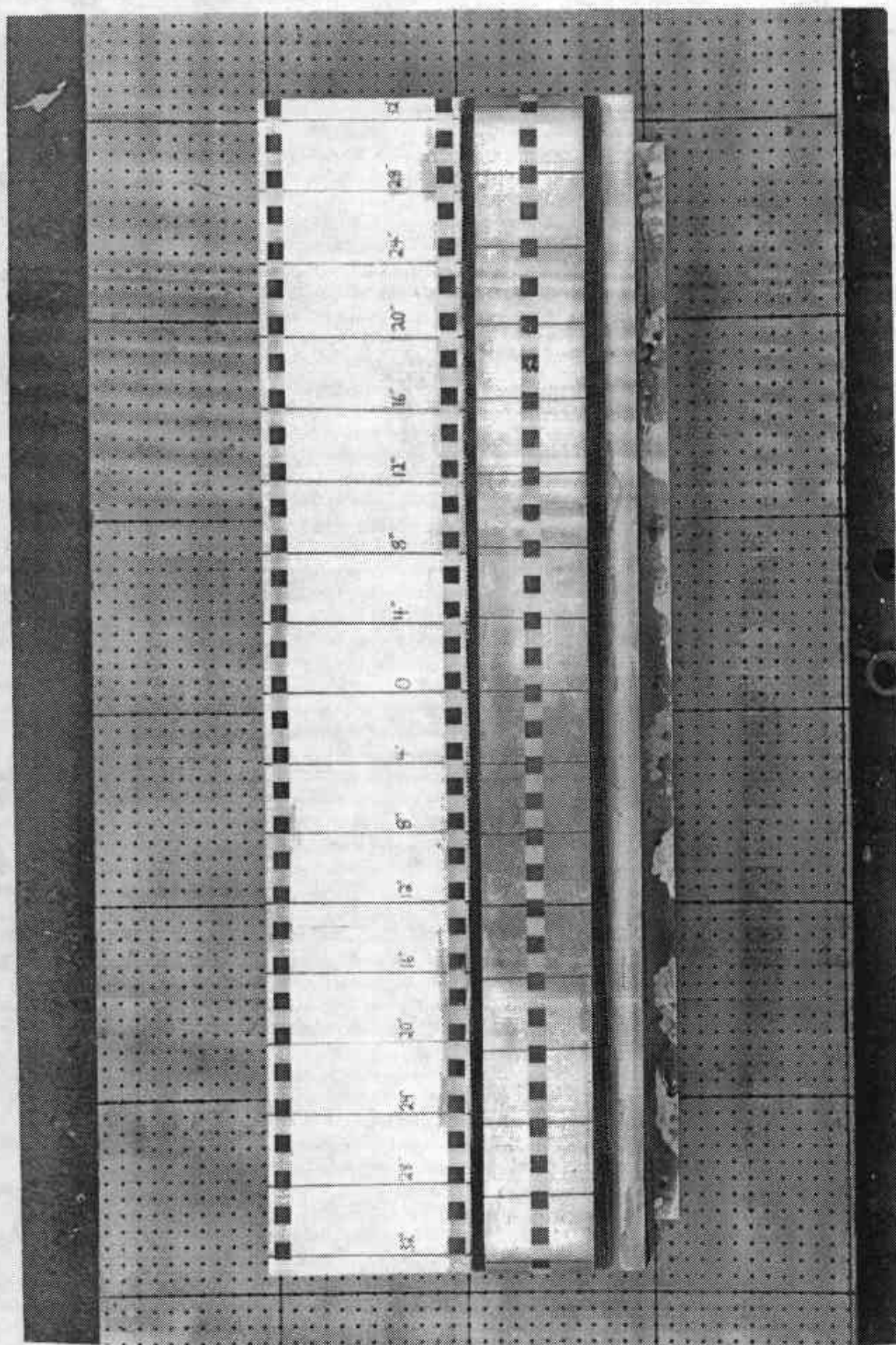


FIGURE A-20 MDB FACE, VIEW NO. 4 - PRETEST

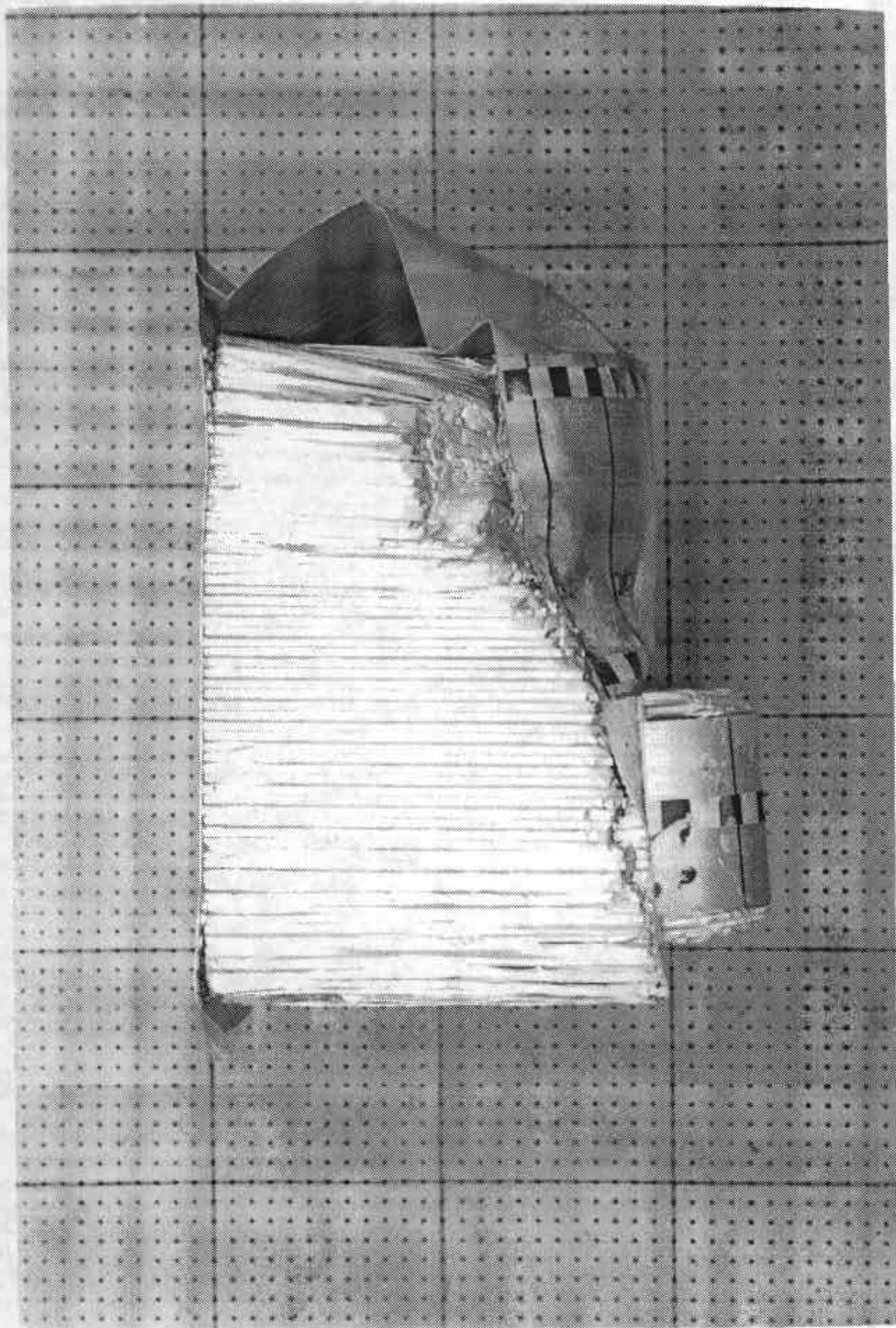


FIGURE A-21 MDB FACE VIEW NO. 1 - POSTTEST



FIGURE A-22 MDB FACE VIEW NO 2 - POSTTEST

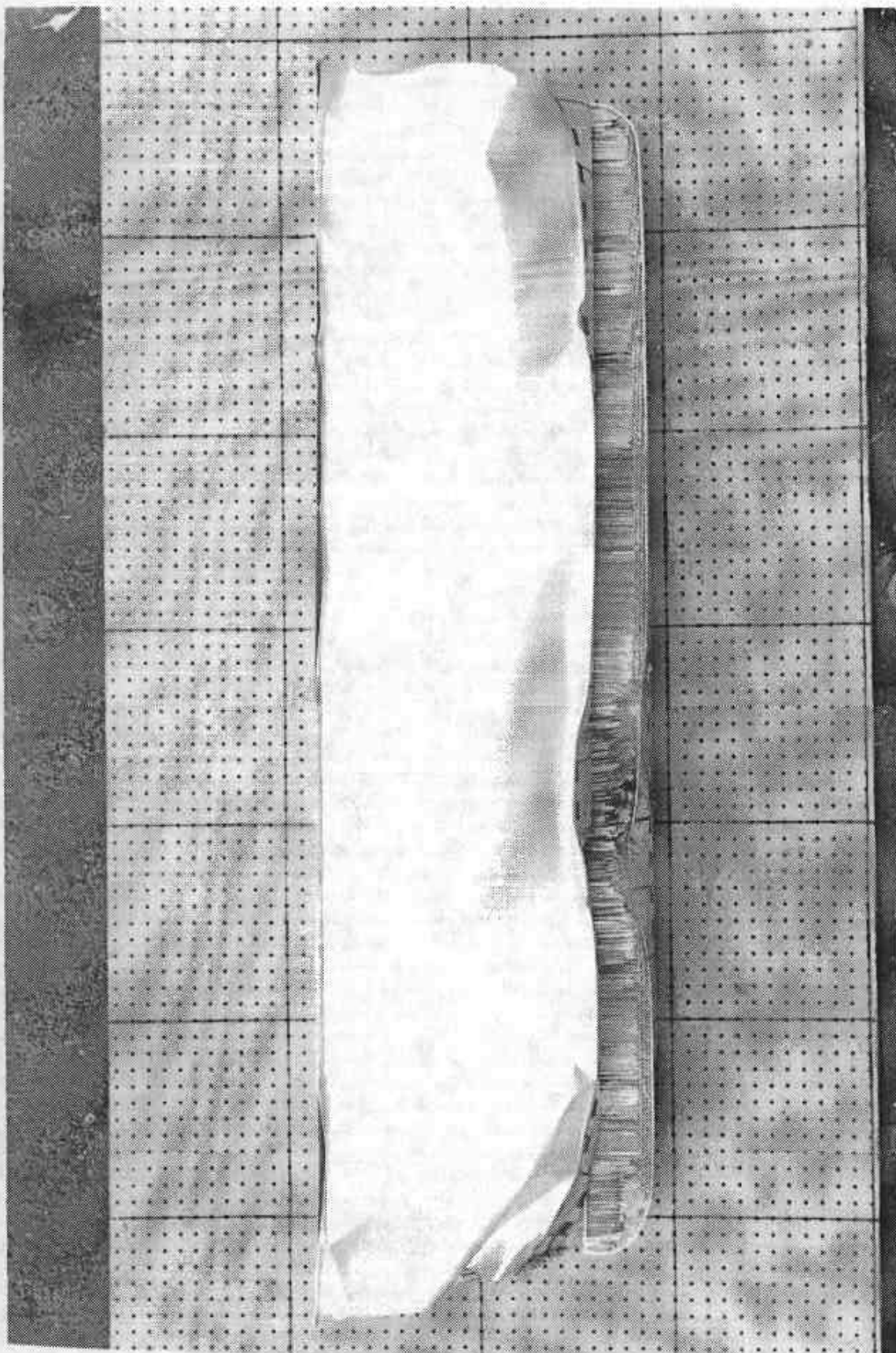


FIGURE A-23 MDB FACE, VIEW NO. 3 - POSTTEST

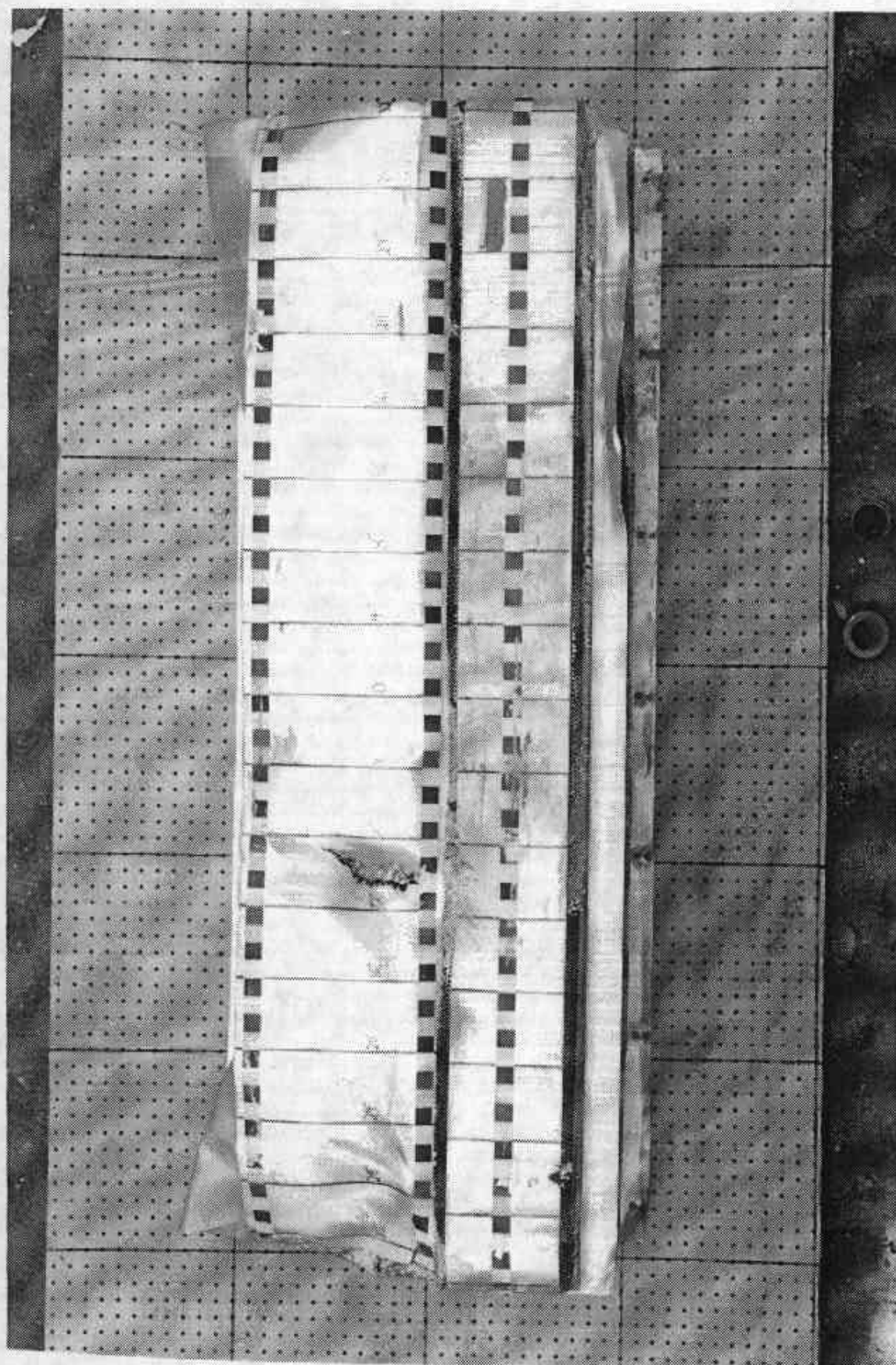
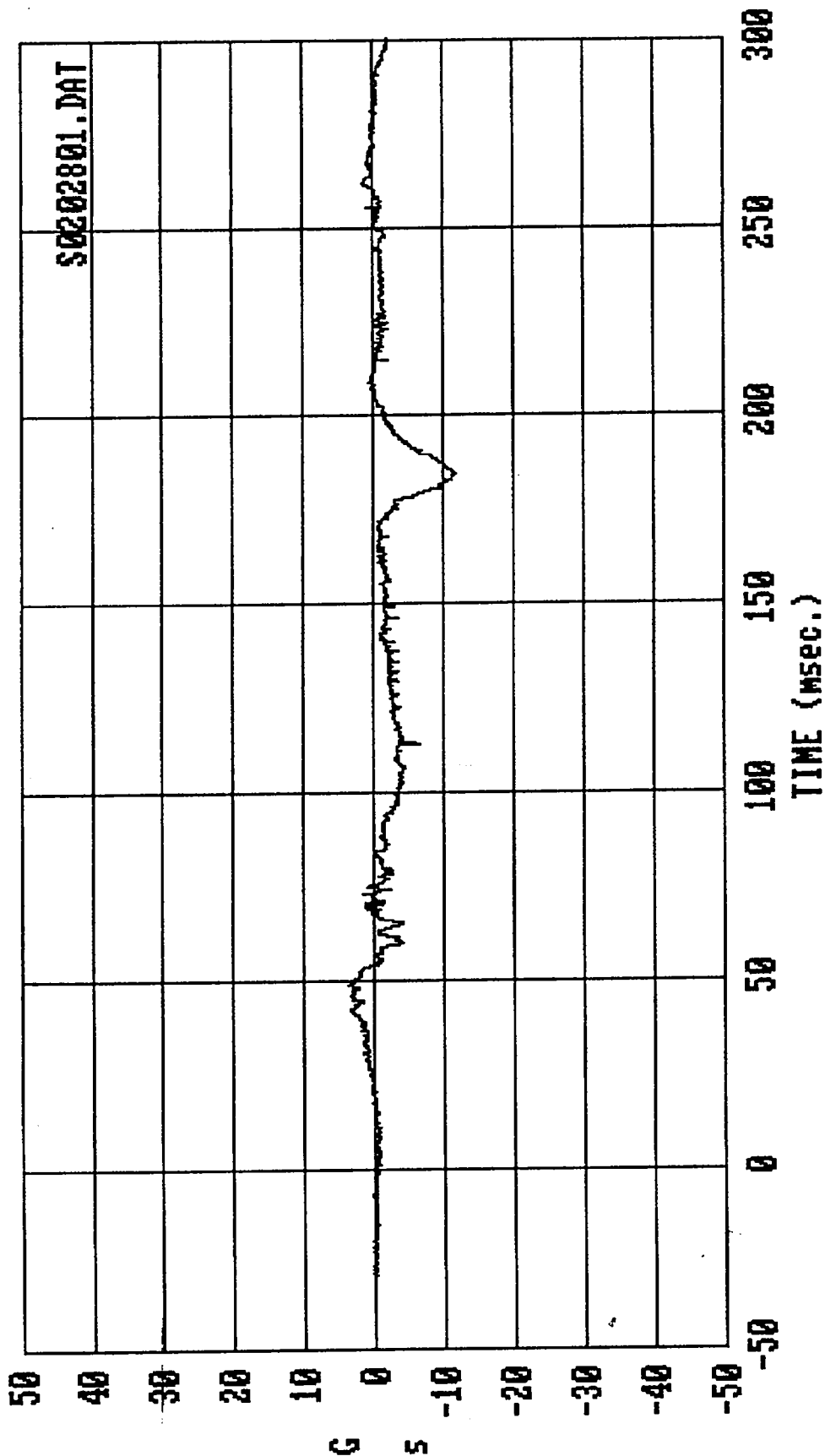
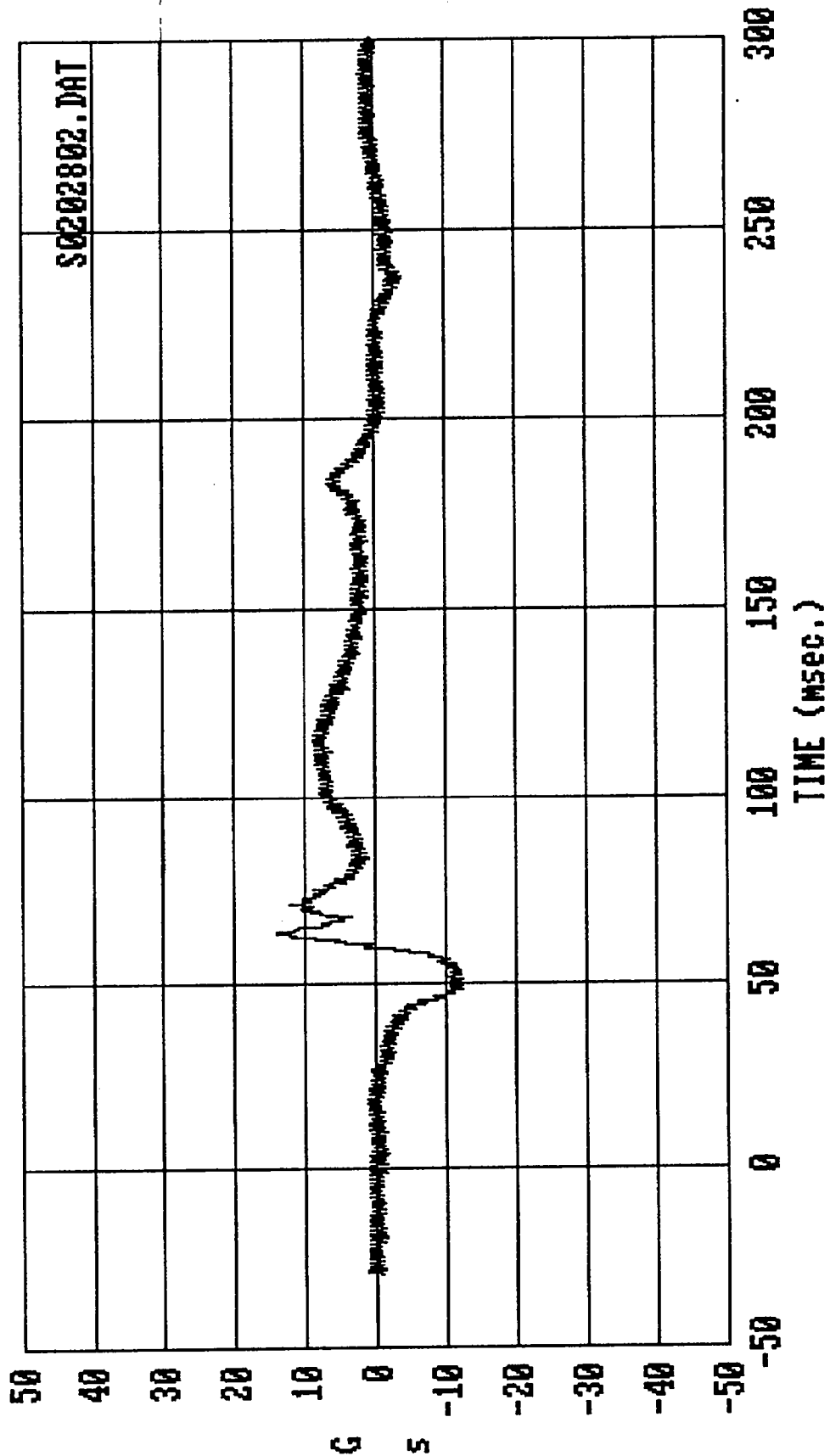


FIGURE A-24 MDB FACE, VIEW NO. 4 - POSTTEST

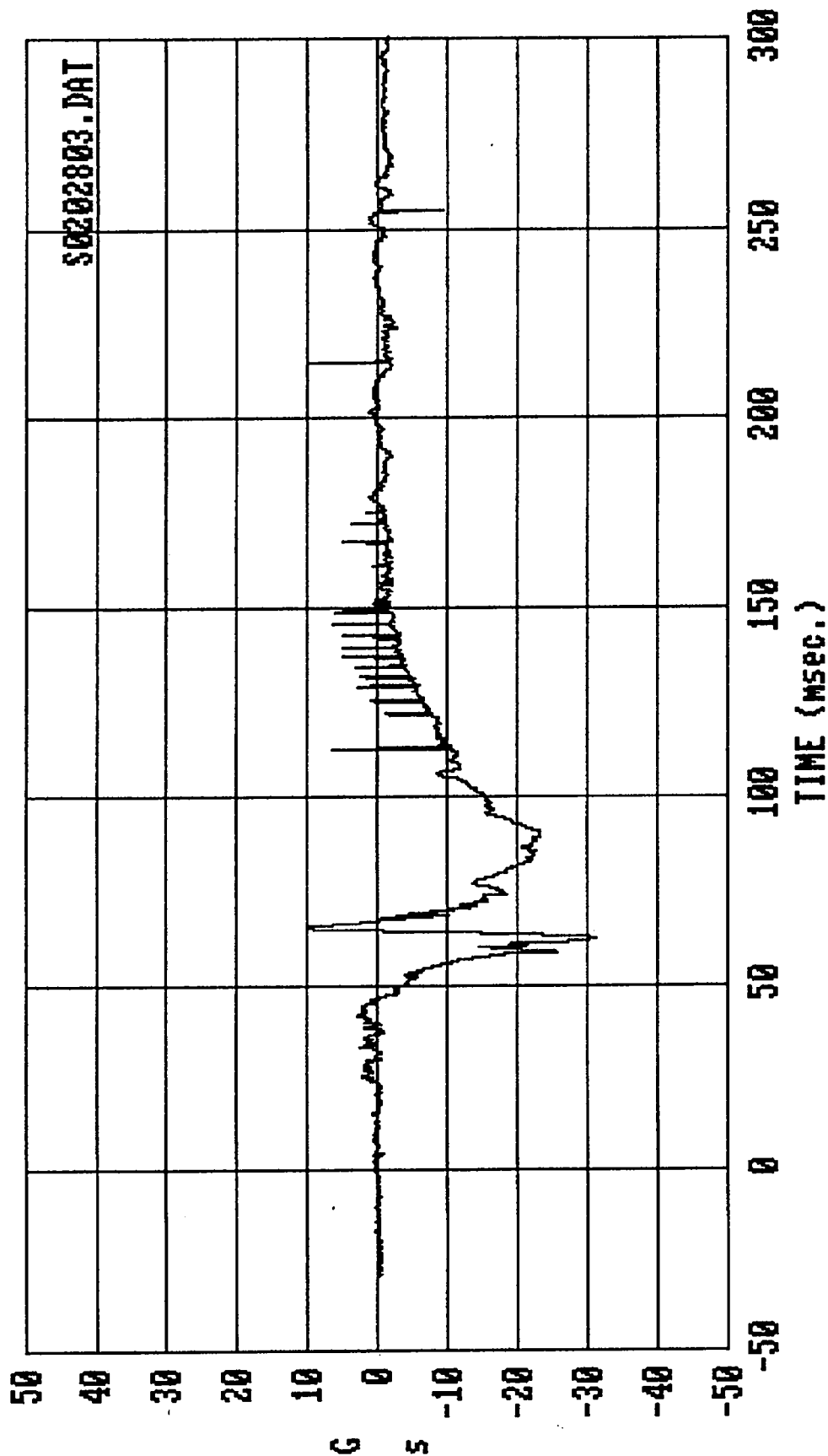
APPENDIX B
DATA PLOTS



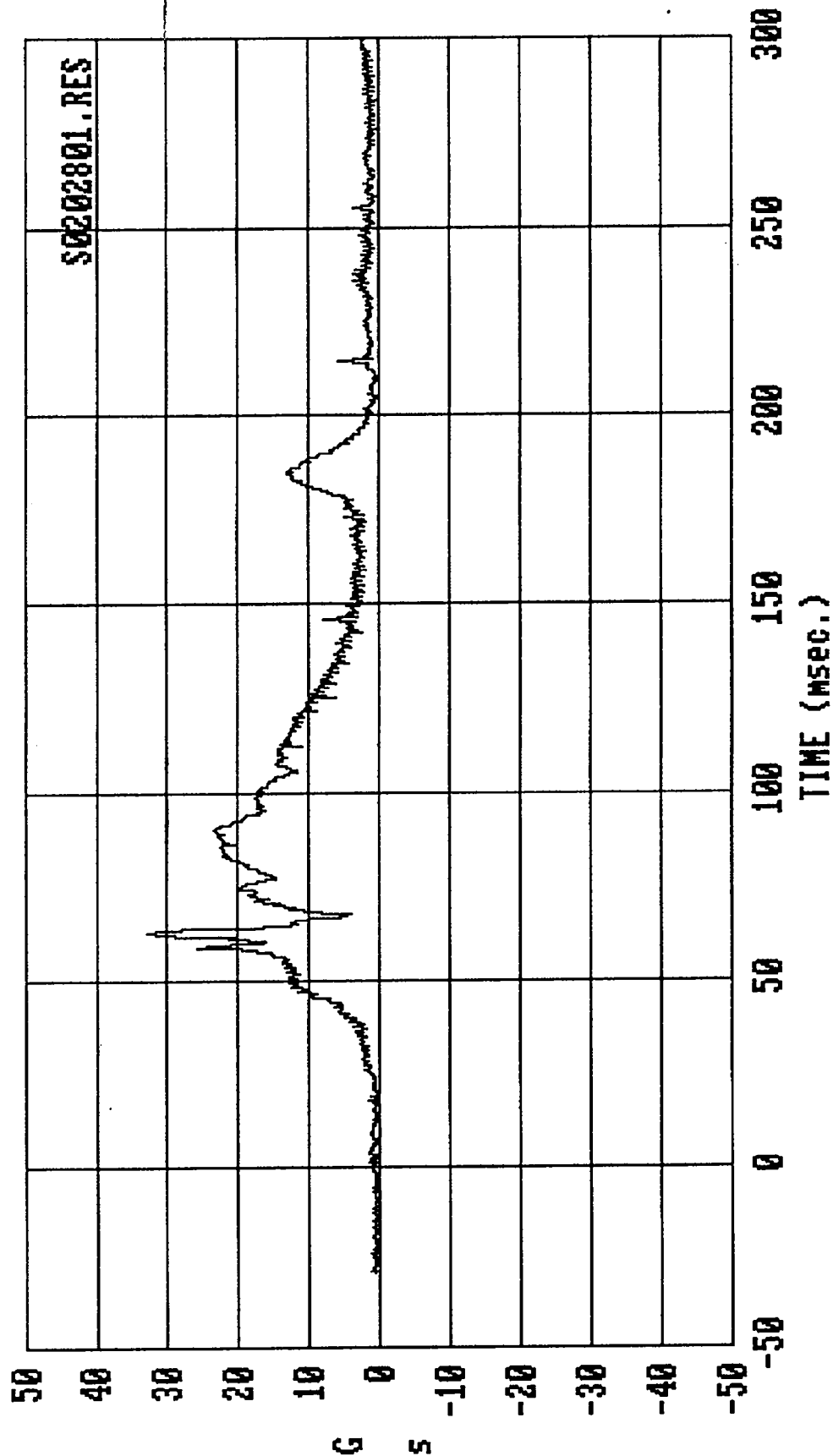
Filter: SAE CLASS 1000 Max = 3.7986 Min = -11.581
MSE 10/28/88 -- 1988 Ford F-150 : Driver Head acceleration, X-axis



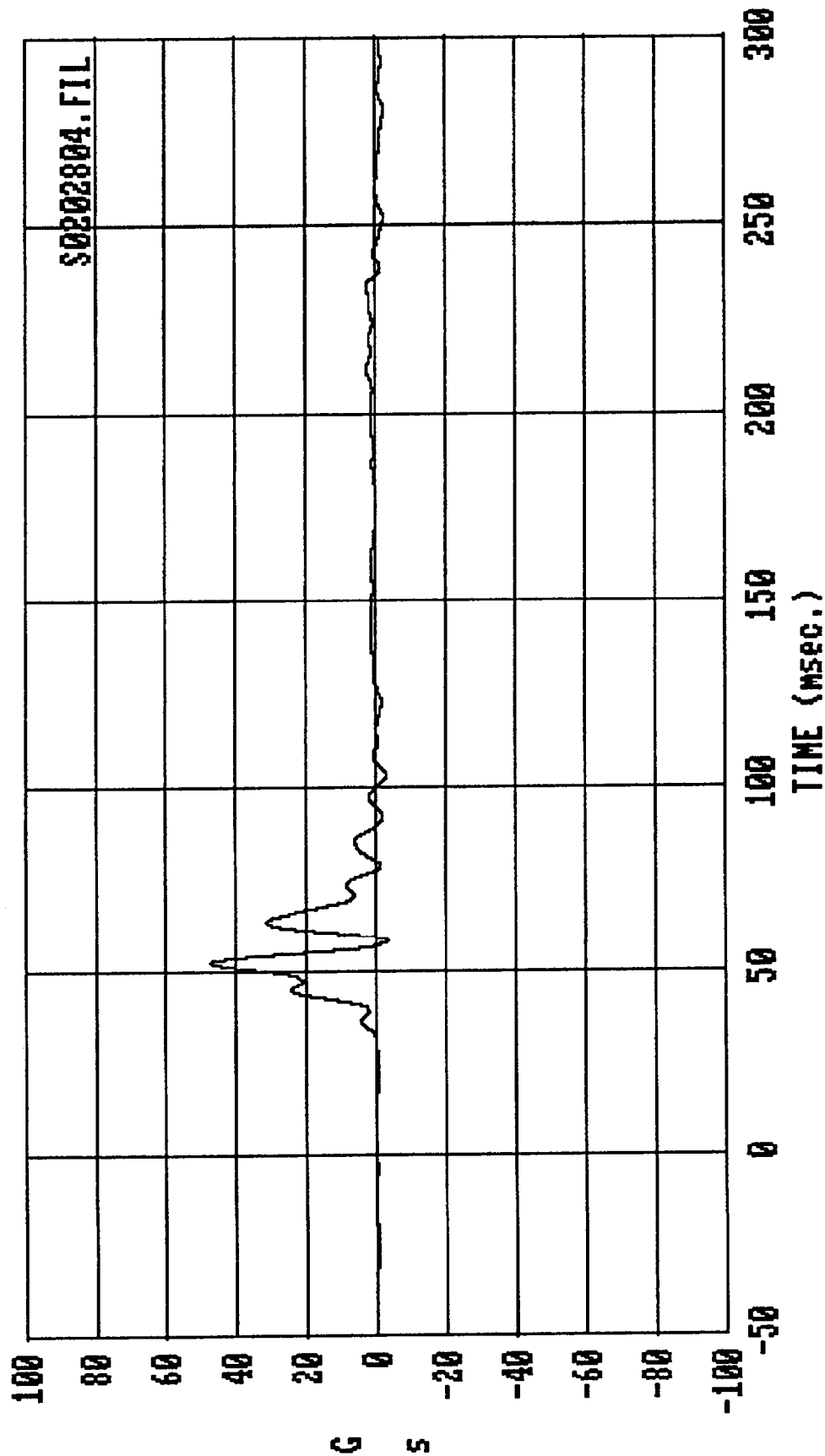
Filter: SAE CLASS 1000 Max = 14.177 Min = -12.270
 MSE 10/28/88 -- 1988 Ford F-150 : Driver Head acceleration, Y-axis



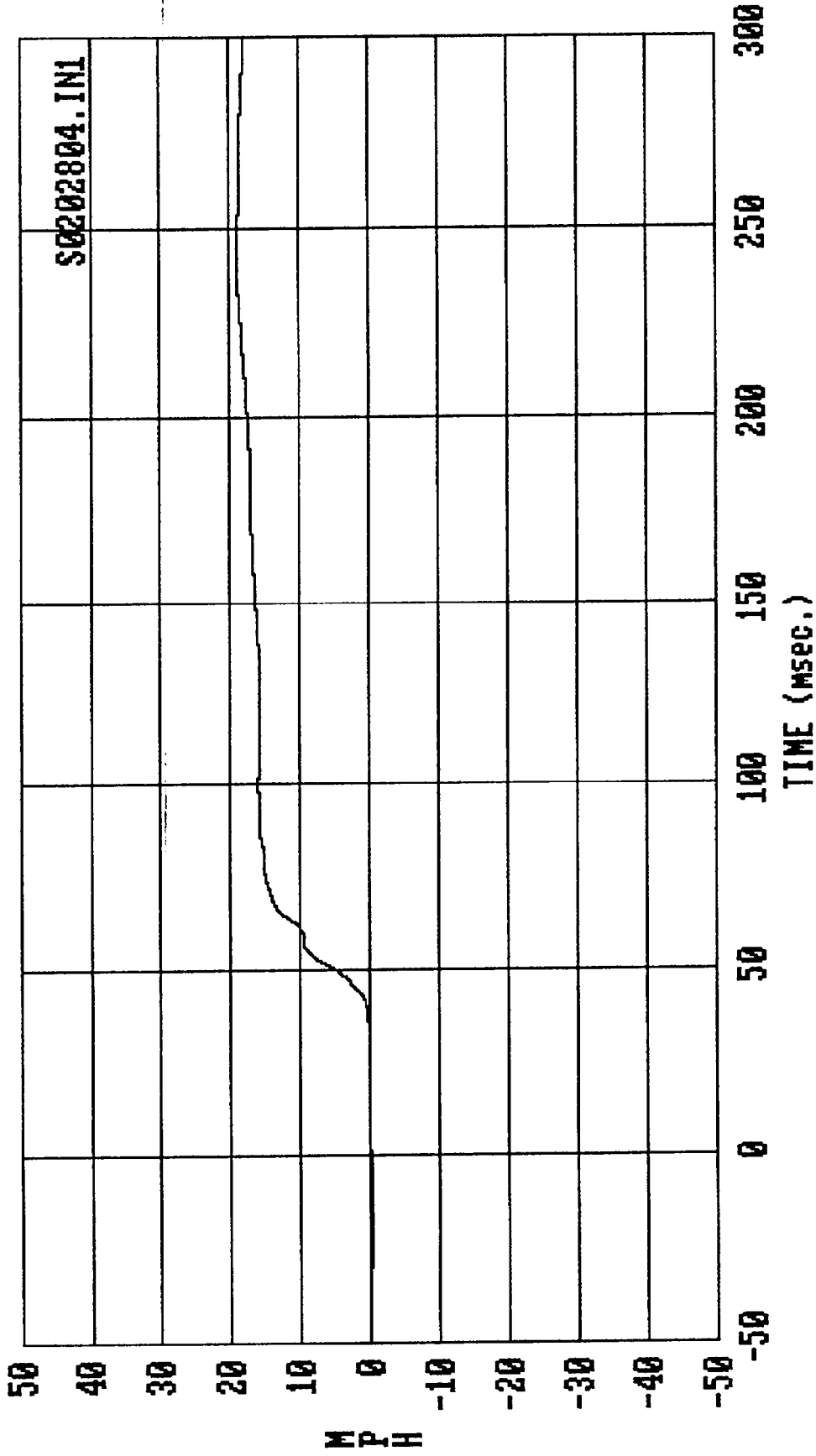
Filter: SAE CLASS 1000 Max = 10.117 Min = -31.181
 MSE 10/28/88 -- 1988 Ford F-150 : Driver Head acceleration, Z-axis



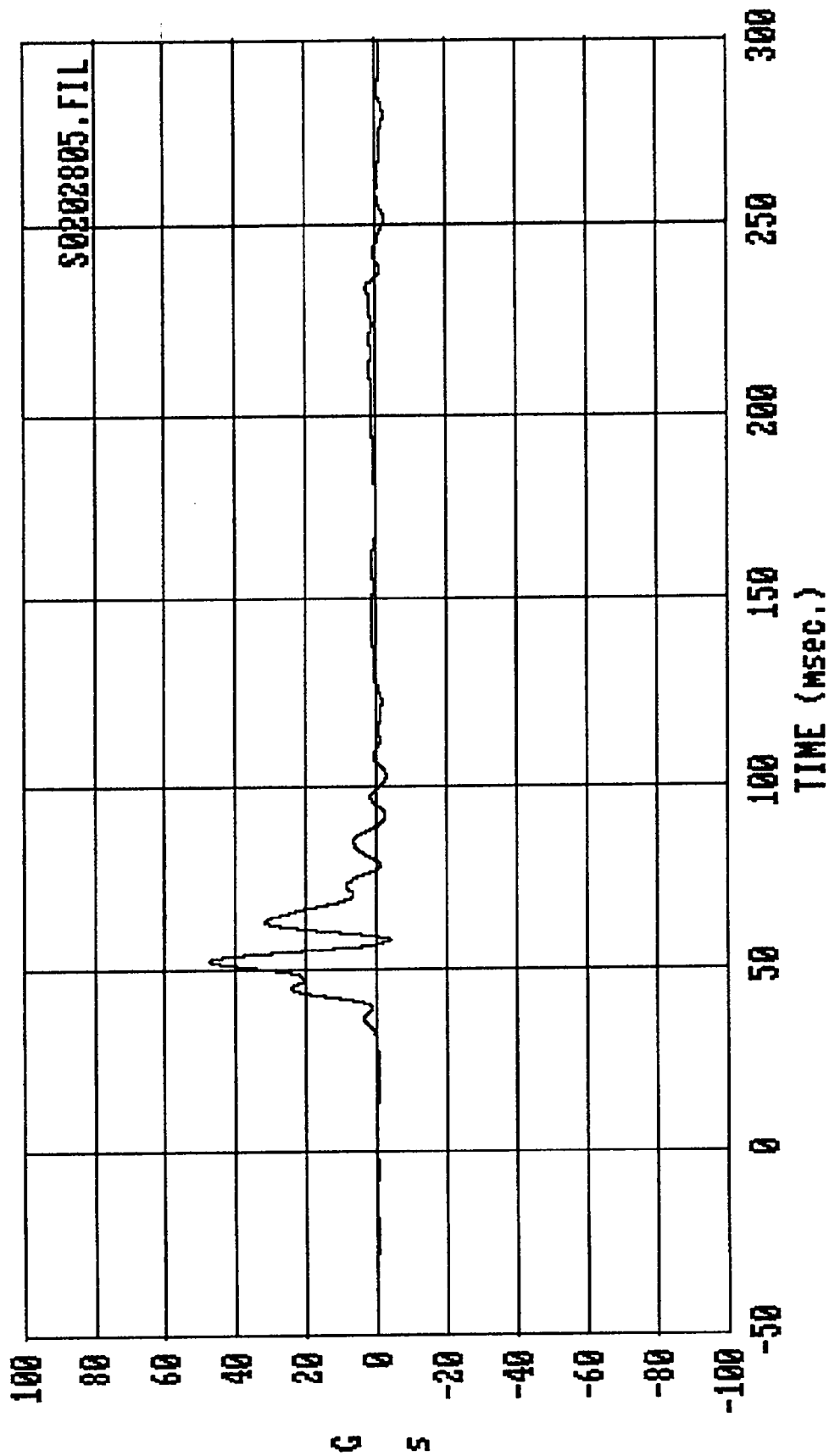
Filter: SAE CLASS 1000 Max = 33.234 Min = .14400
MSE 10/28/88 -- 1988 Ford F-150 : Driver Head resultant acceleration



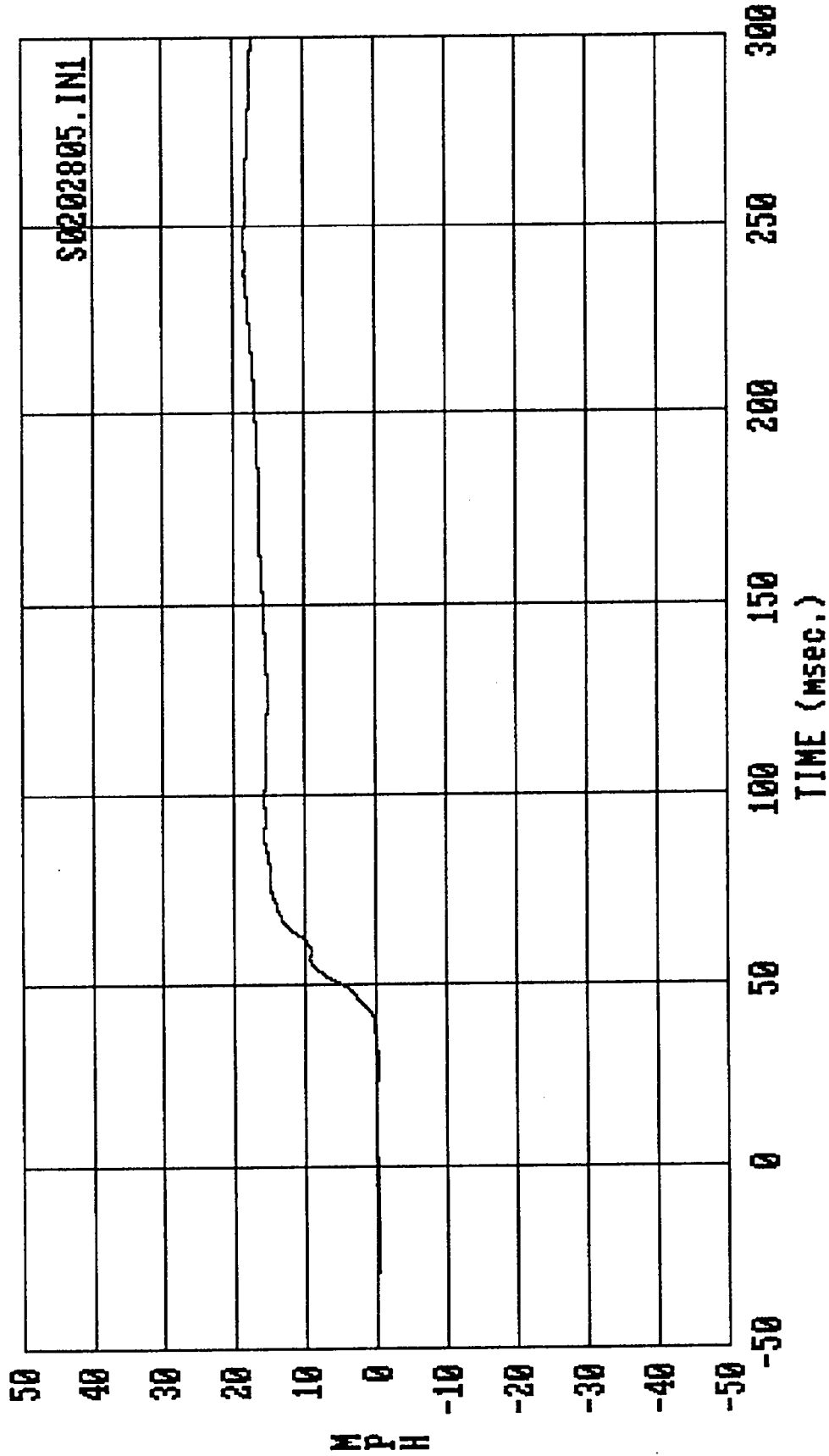
Filter: FIR 100 Max = 47.463 Min = -3.2746
 MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Rib acc., Y-axis (Primary)



Filter: FIR 100 Max = 19.059 Min = .52798E-02
 MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Rib delt ψ , Y-ax. (Primary)

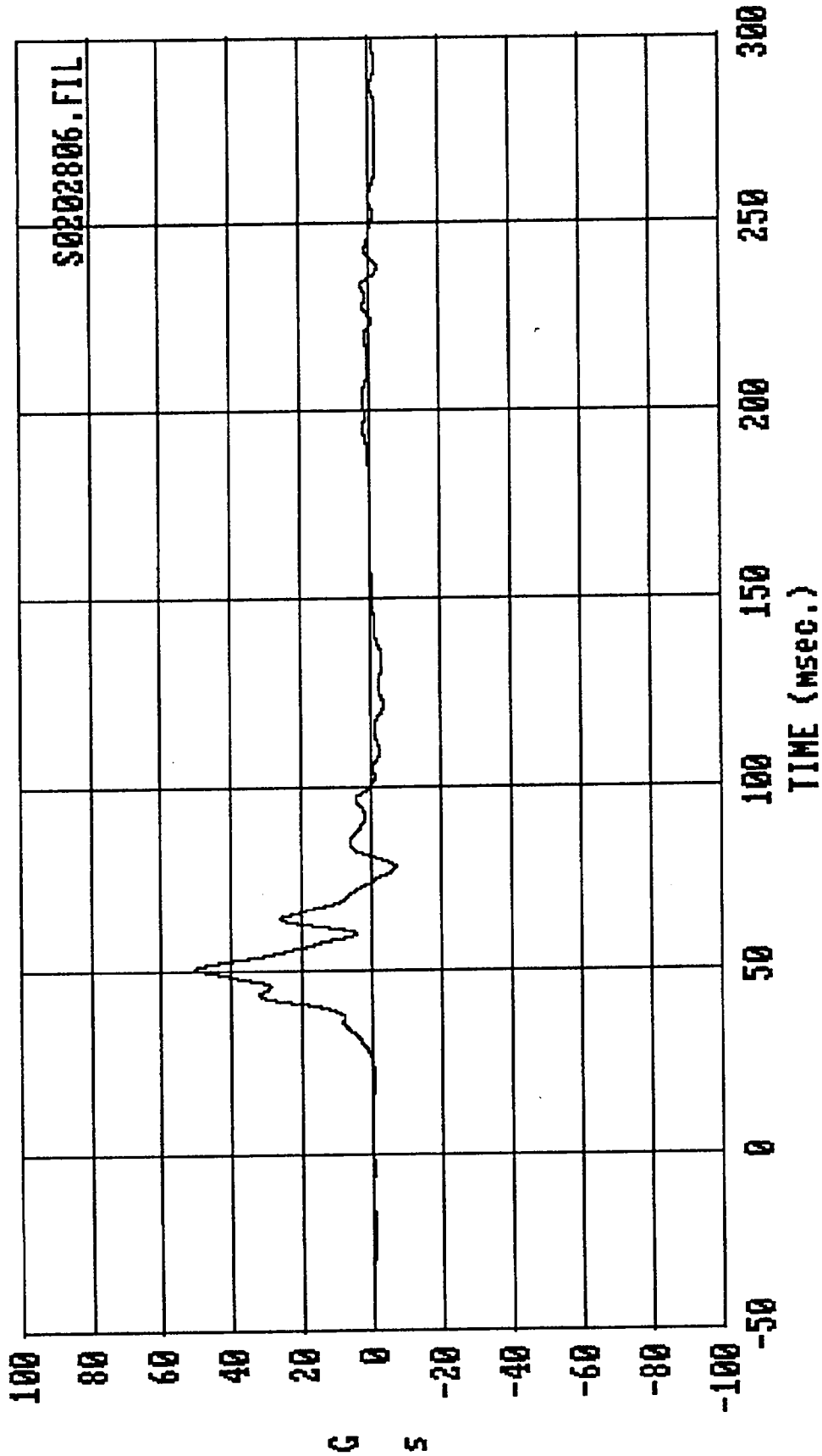


Filter: FIR 100 Max = 47.926 Min = -4.1379
MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Rib acc., Y-axis (Second)

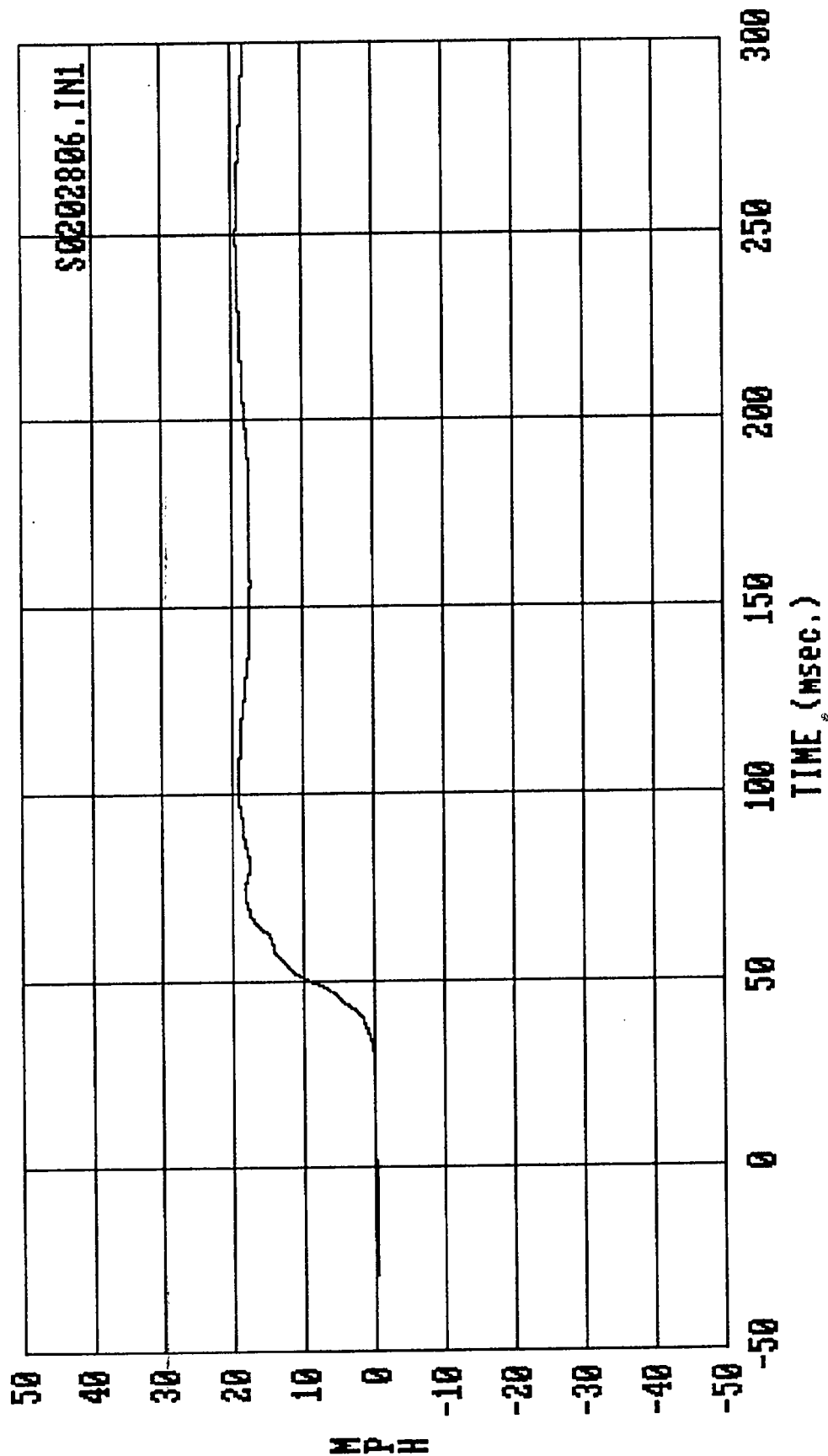


Filter: FIR 100 Max = 18.583 Min = -.16898E-01

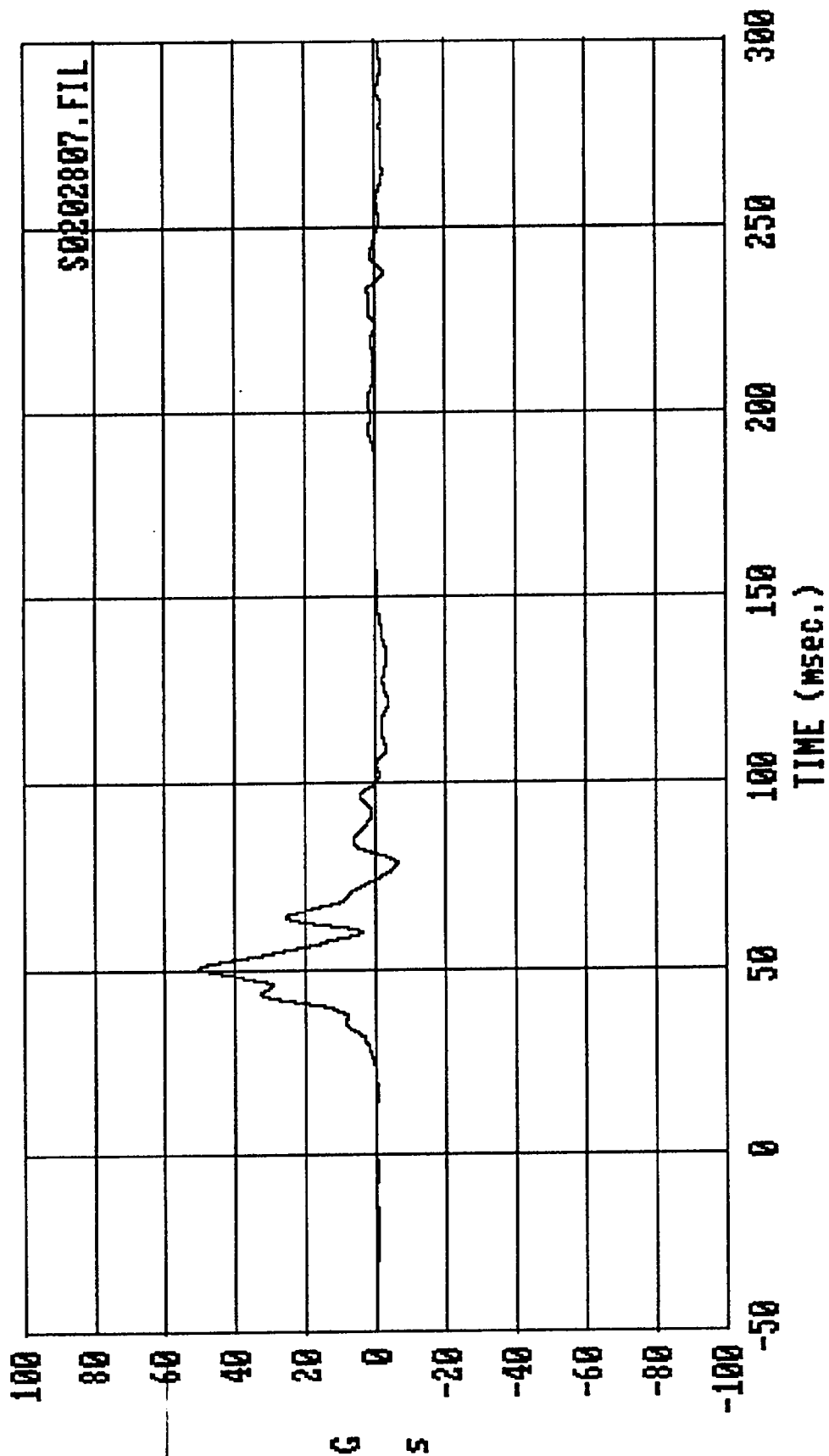
MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Rib delt V, Y-ax.(Second)



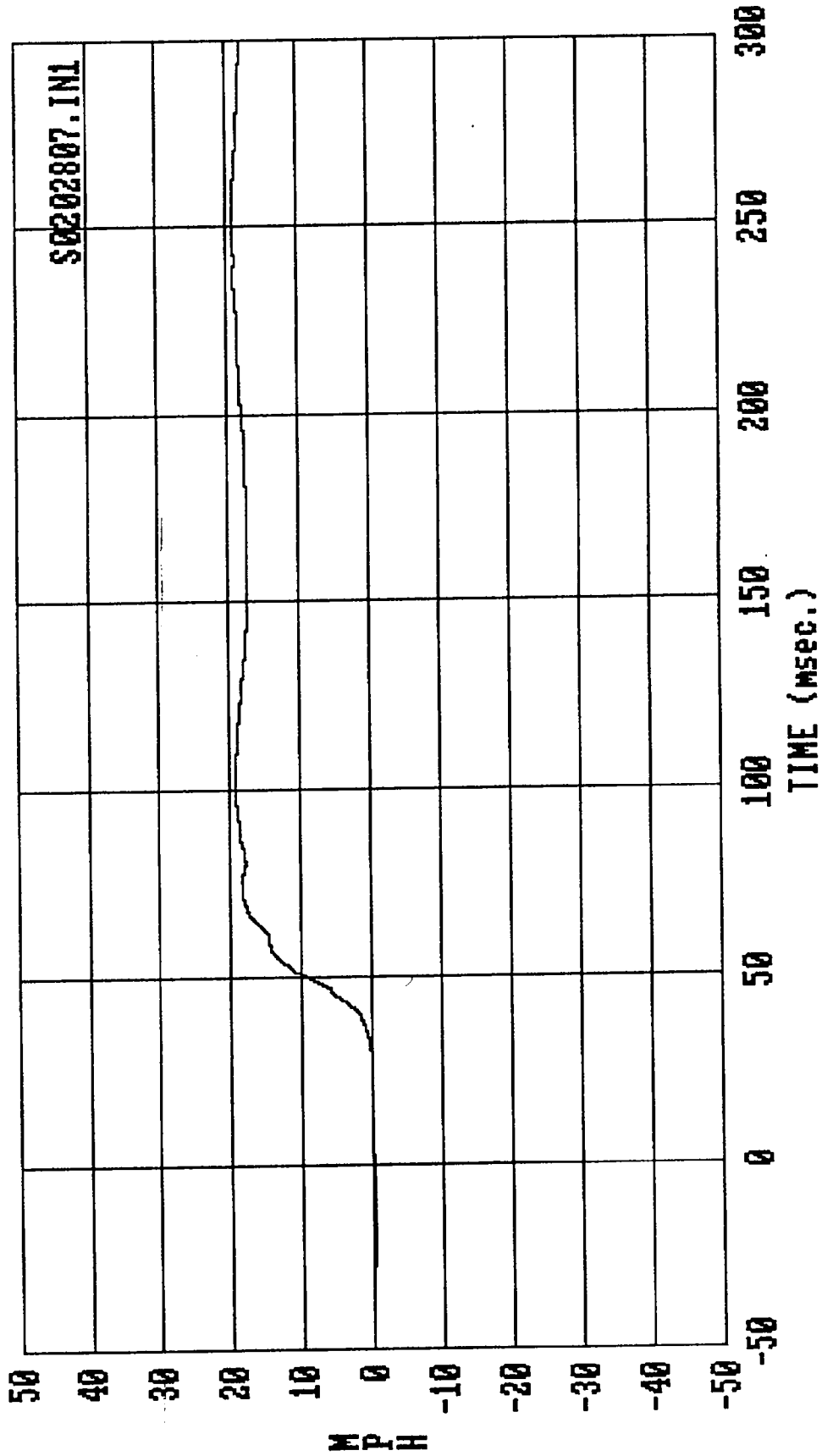
Filter: FIR 100 Max = 50.565 Min = -6.6920
 MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Rib acc., Y-axis (Primary)



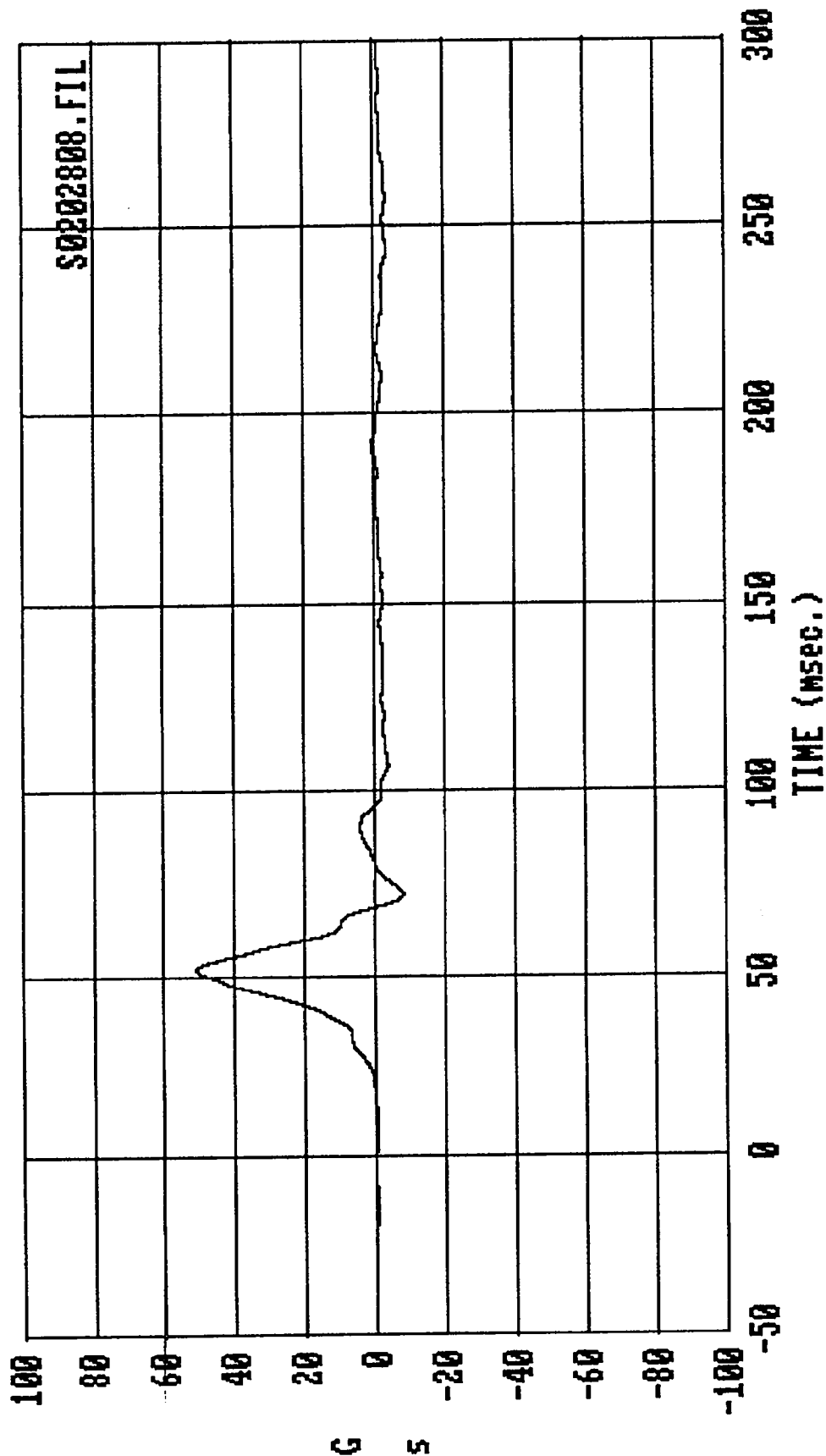
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MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Rib delt V, Y-ax.(Primary)



Filter: FIR 100 Max = 50.609 Min = -6.1621
MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Rib acc., Y-axis (Second)



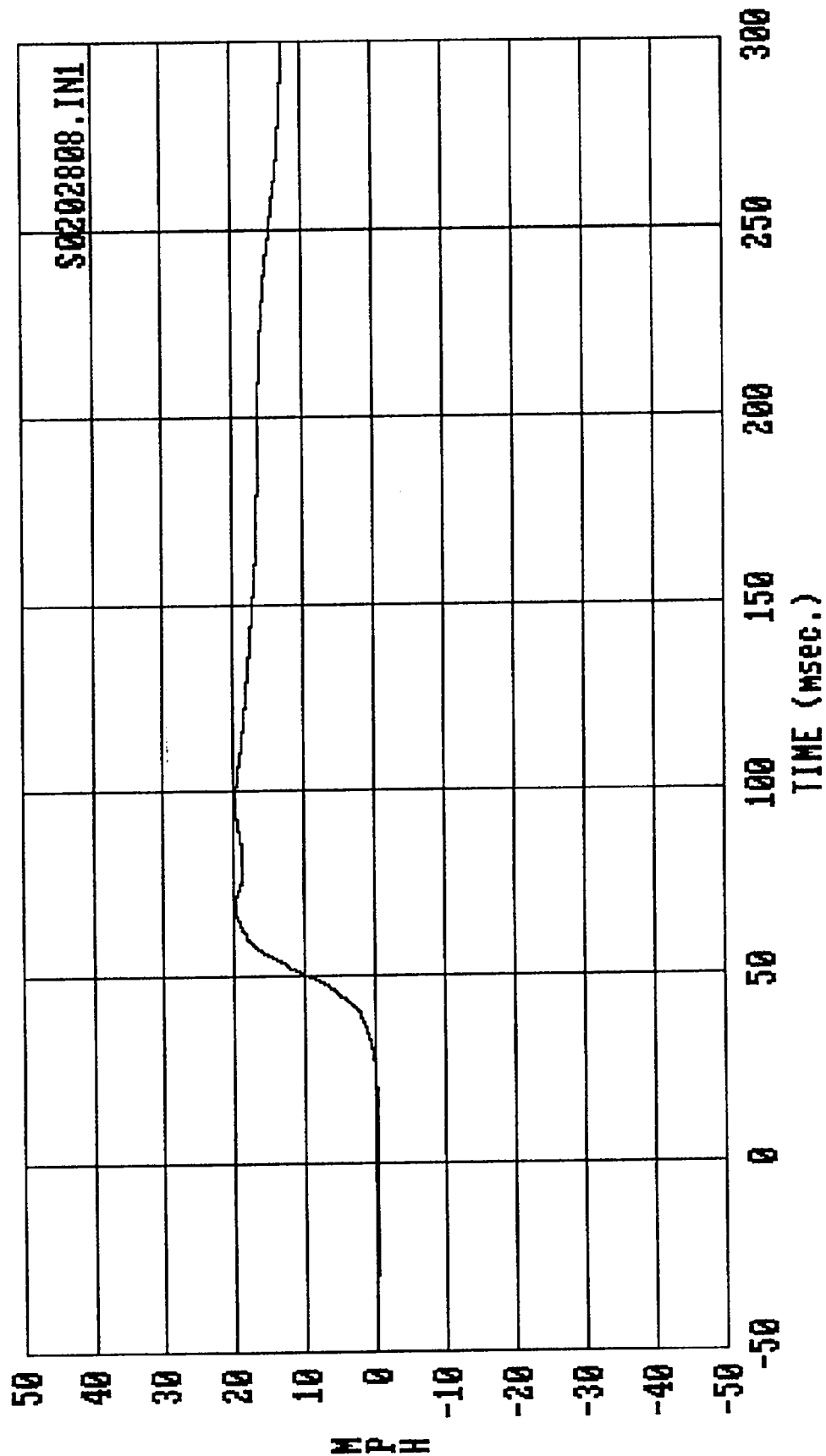
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MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Rib delt U, Y-ax.(Second)



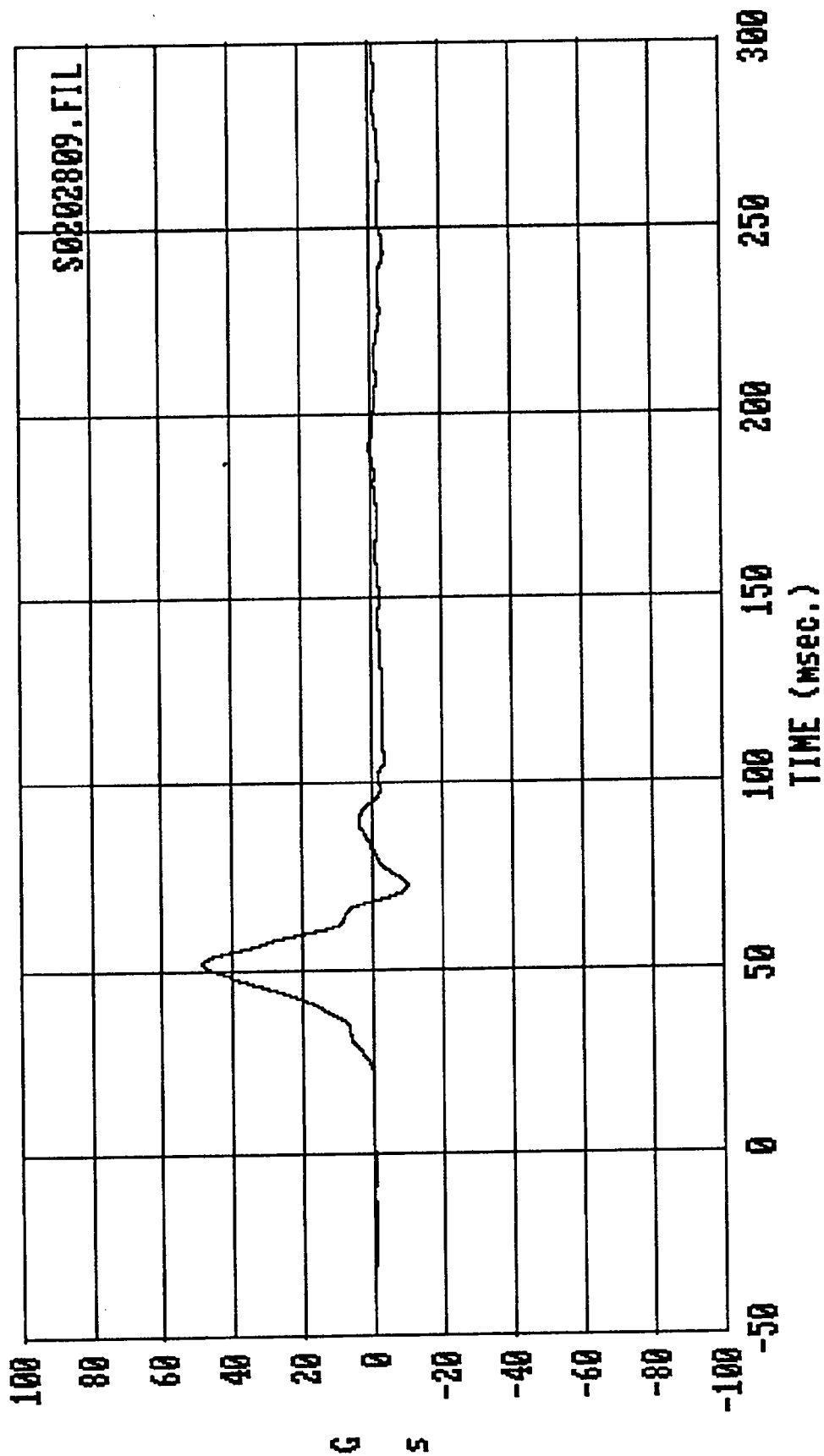
Filter: FIR 100

Max = 51.118 Min = -8.0958

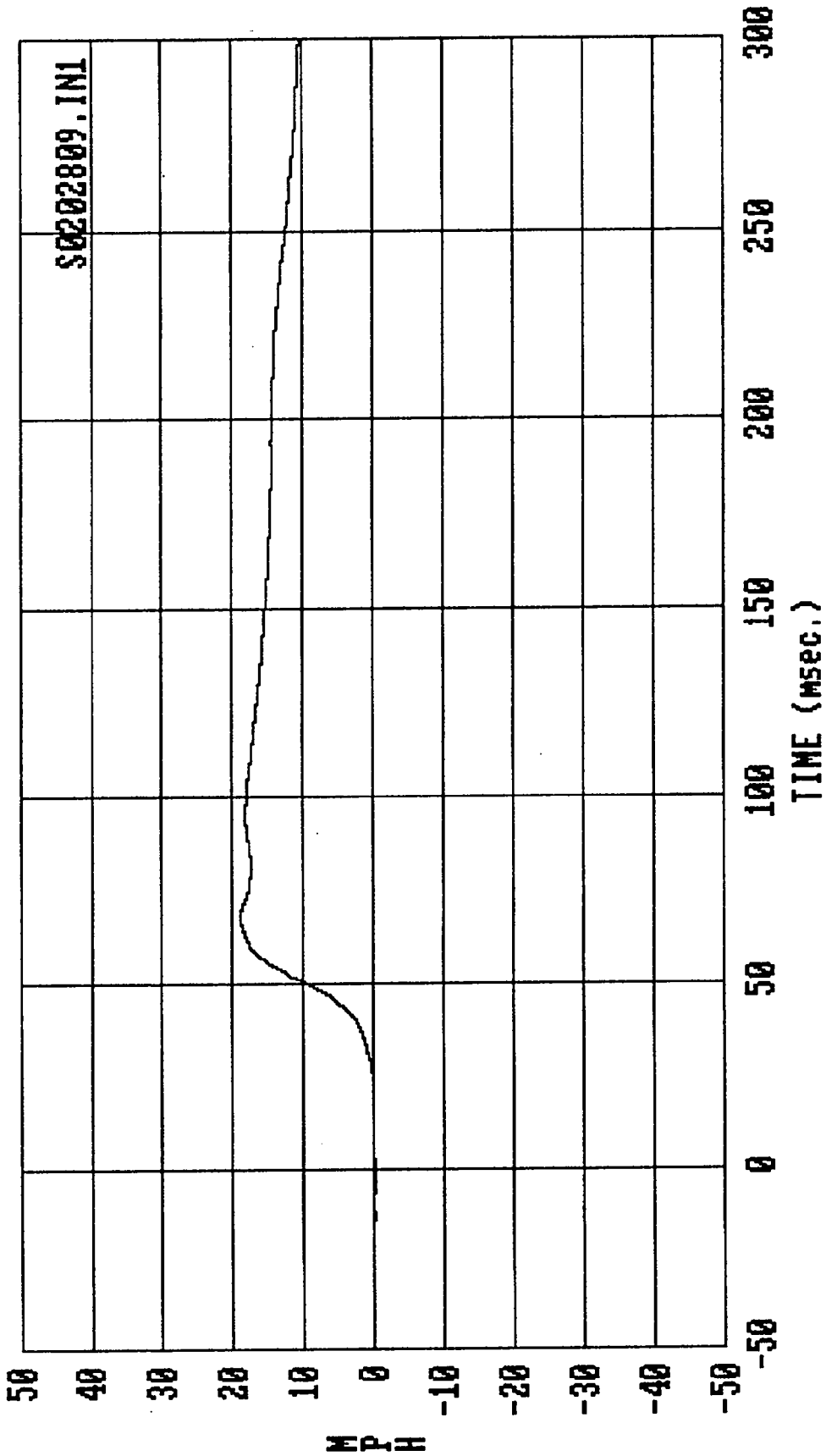
MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Spine acc., Y-ax.(Primary)



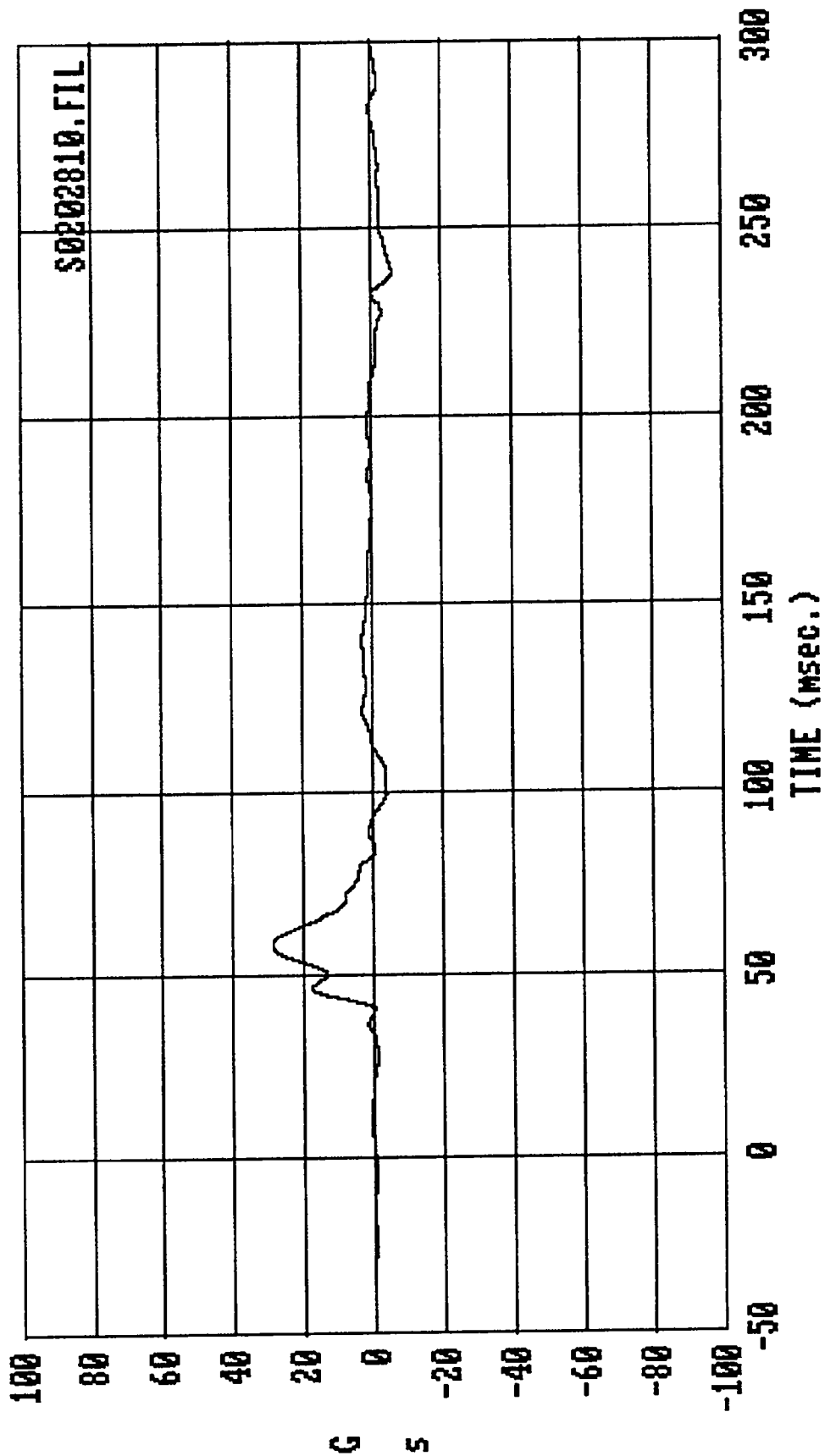
Filter: FIR 100 Max = 19.968 Min = -.38913E-01
 MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Spine delt U, Y-ax(Primary)



Filter: FIR 100 Max = 48.926 Min = -9.7437
MSE 10/28/88 -- 1988 Ford F-150 : Driver Lower Spine acc., Y-ax. (Second)



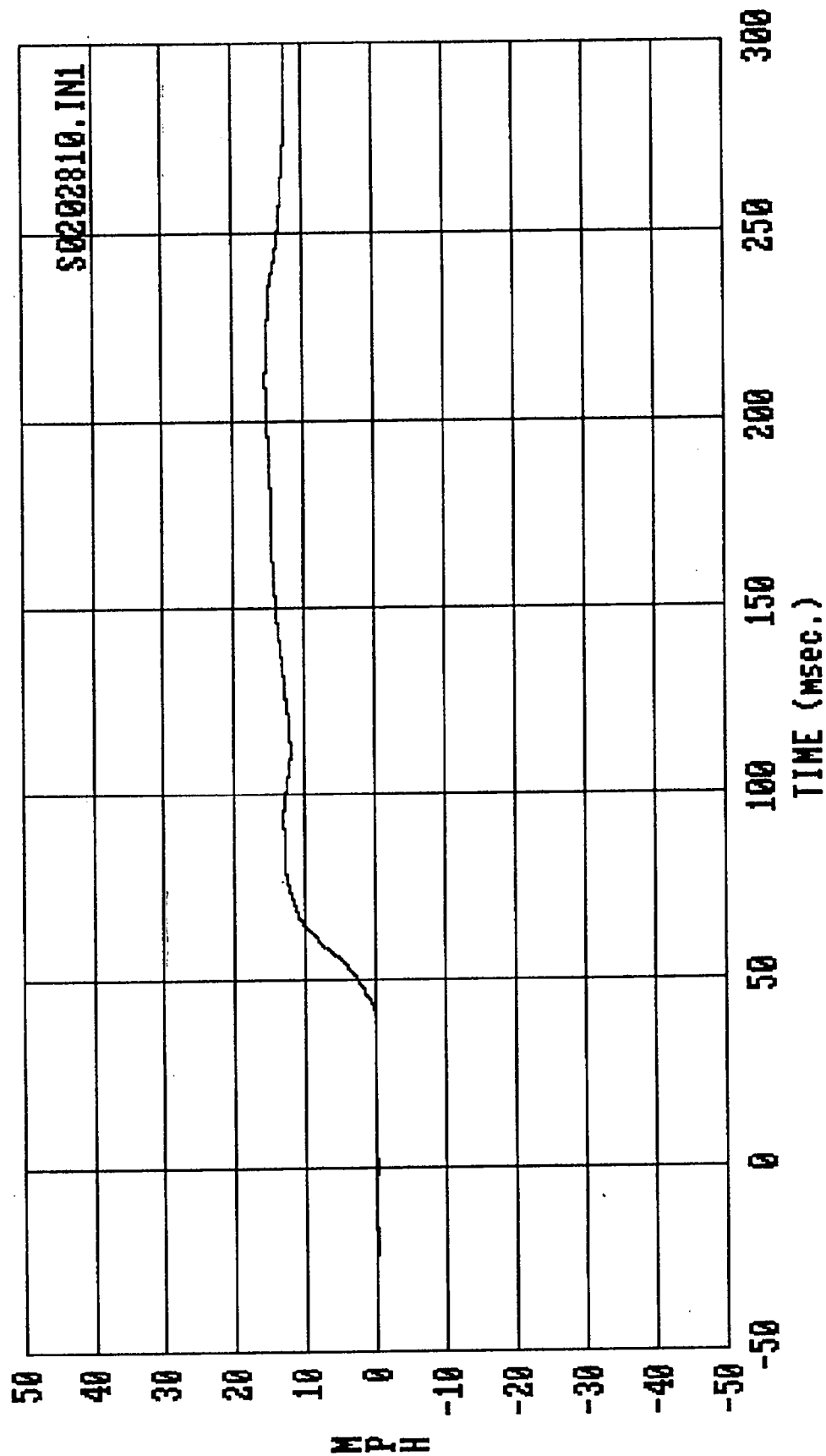
Filter: FIR 100 Max = 18.998 Min = .24754E-03
MSE 10/28/88 -- 1988 Ford F-150 ; Driver Lower Spine delt U,Y-ax (Second)



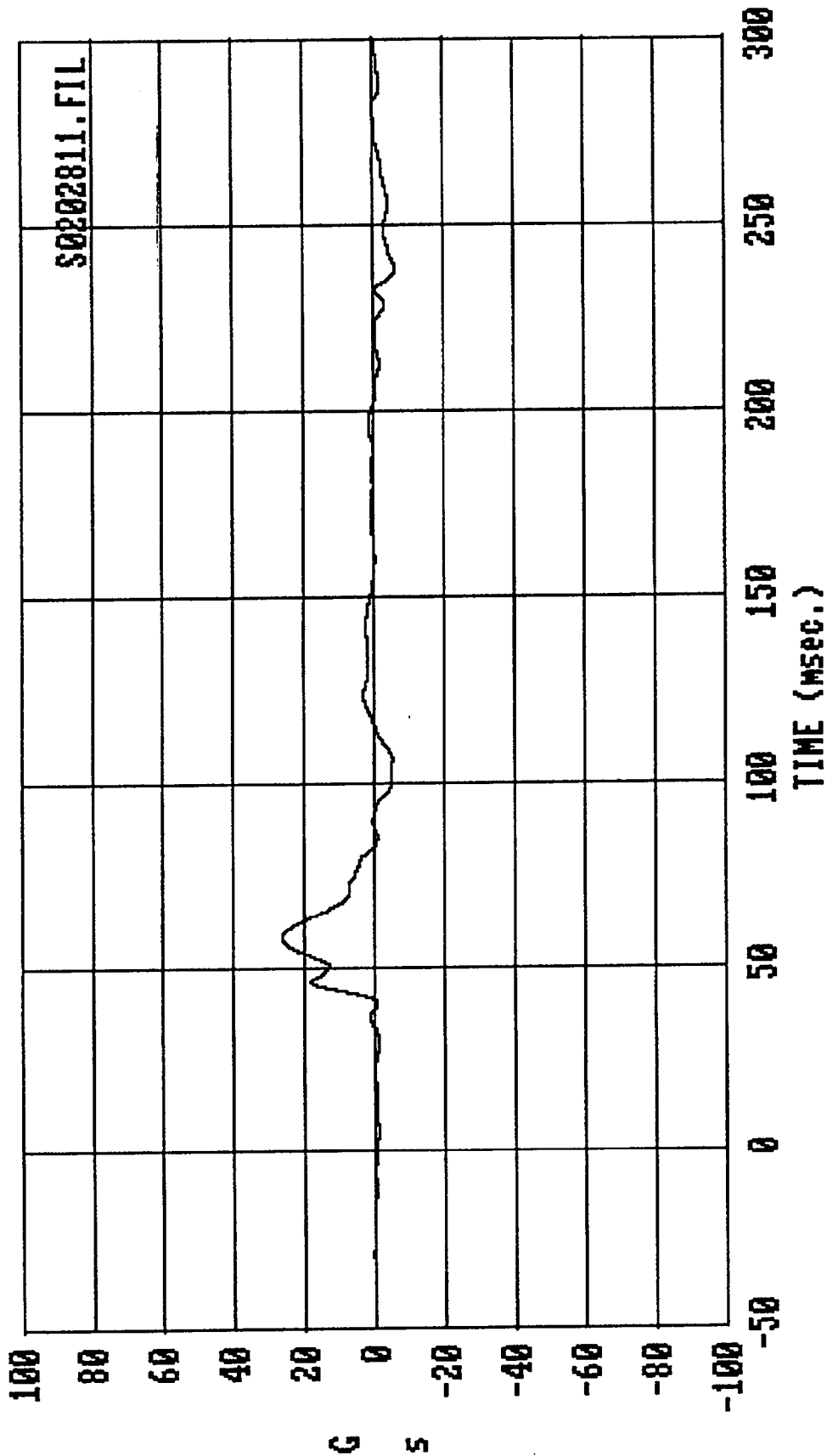
Filter: FIR 100

Max = 28.927 Min = -5.5871

MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Spine acc., Y-ax.(Primary)

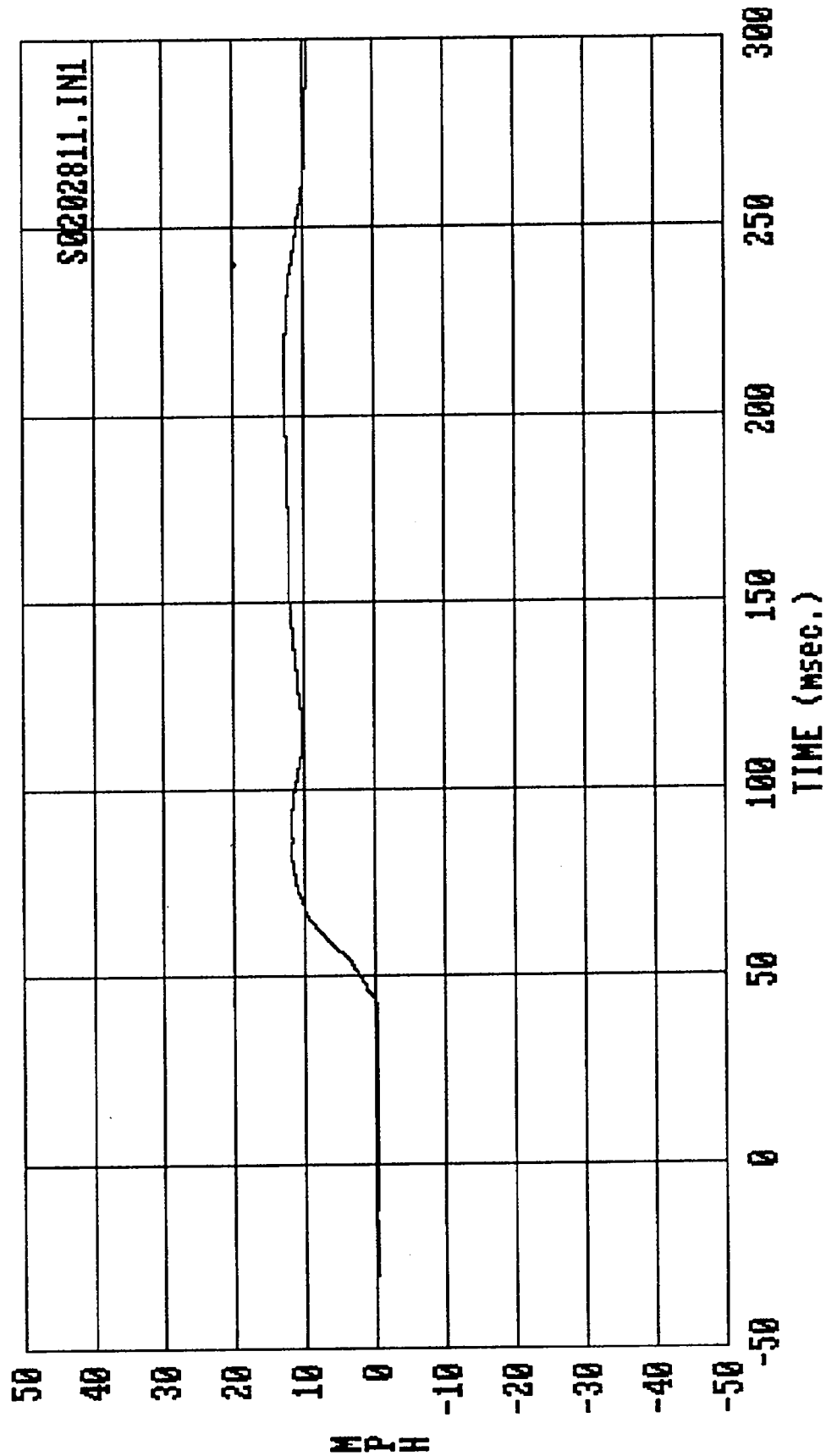


Filter: FIR 100 Max = 15.512 Min = .49911E-03
MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Spine delt U, Y-ax(Primary)



Filter: FIR 100 Max = 26.600 Min = -5.8562

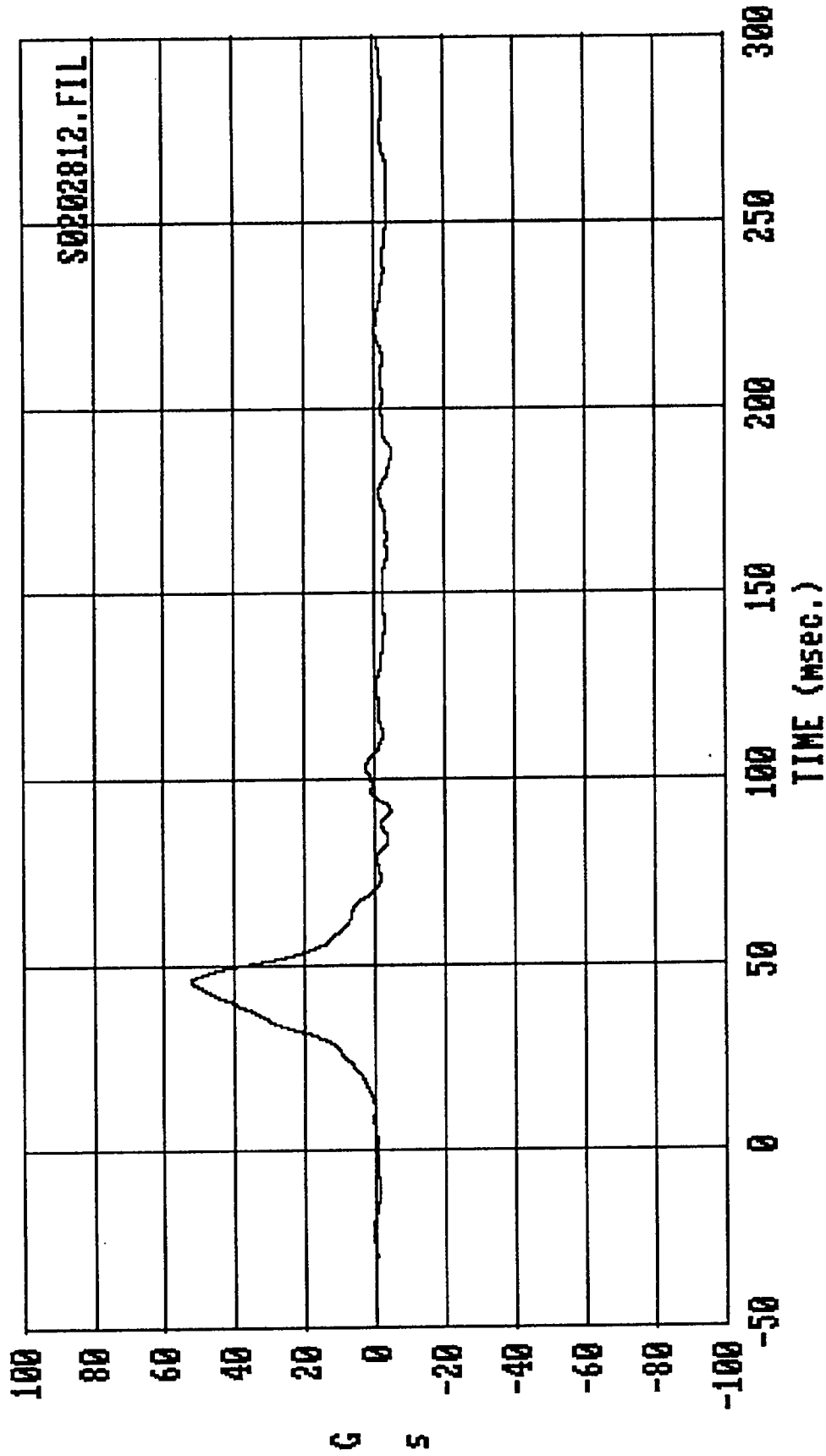
MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Spine acc., Y-ax. (Second)



Filter: FIR 100

Max = 12.984 Min = -.23374

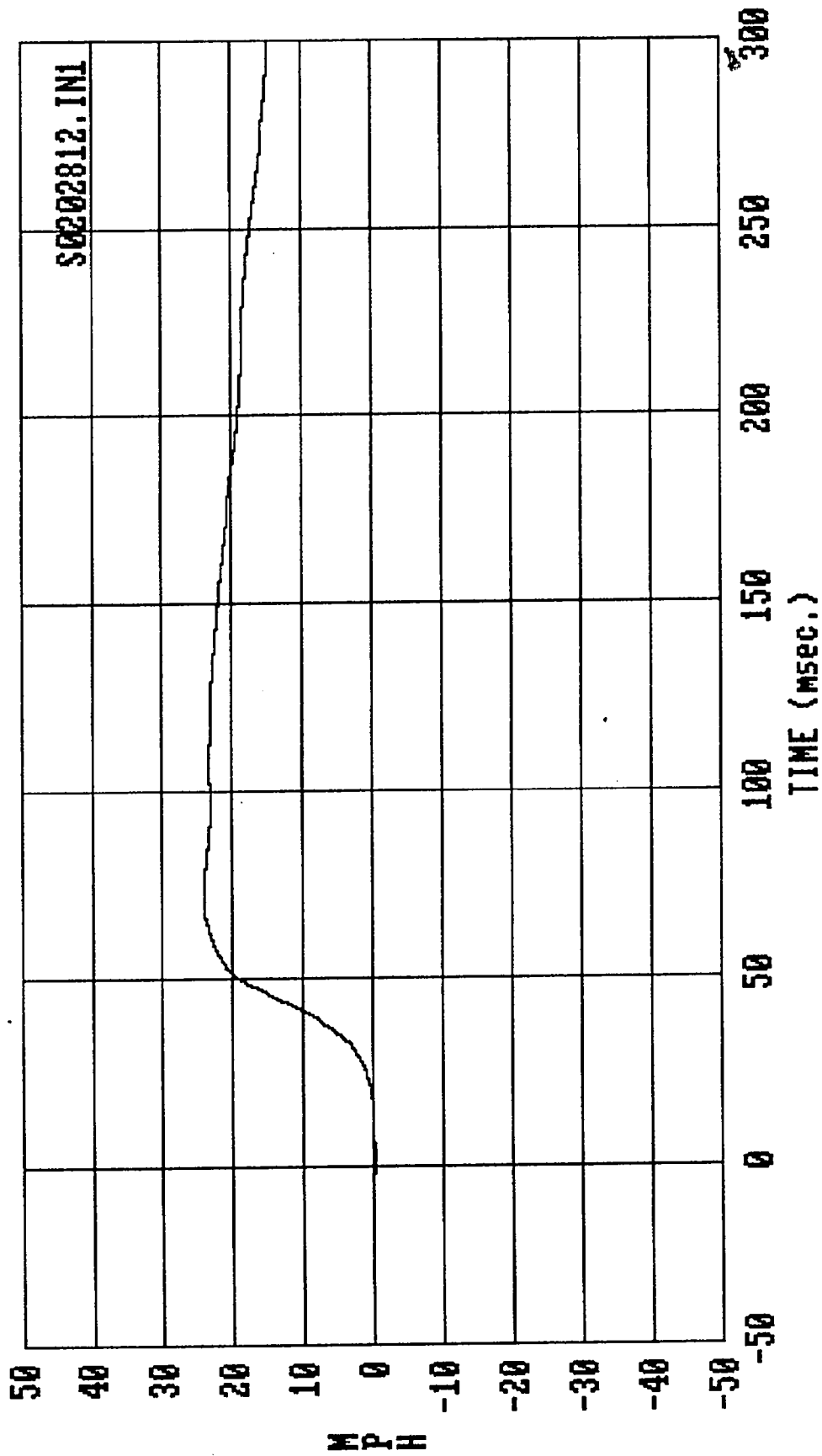
MSE 10/28/88 -- 1988 Ford F-150 : Driver Upper Spine delt U,Y-ax (Second)



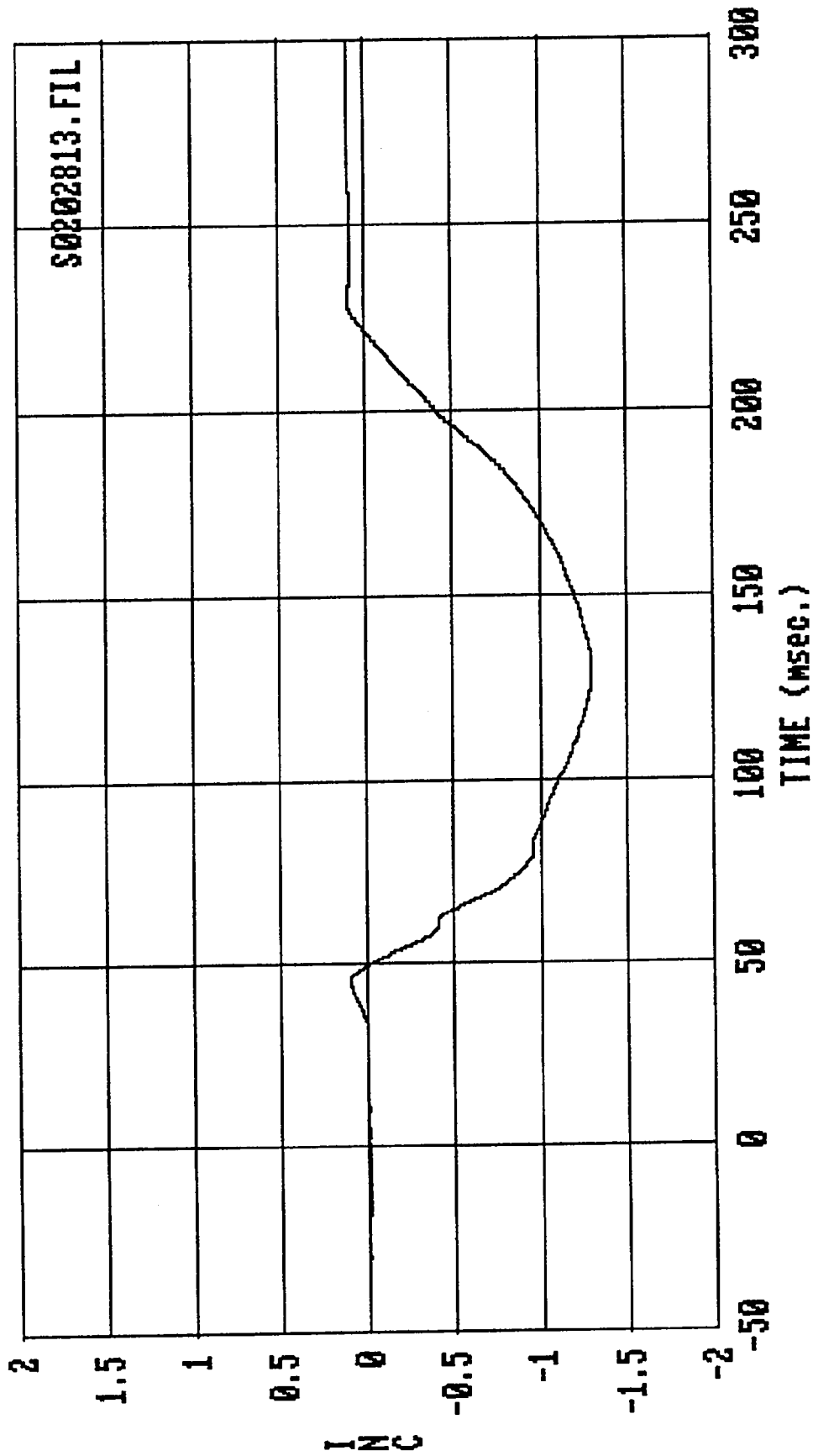
Filter: FIR 100

Max = 52.741 Min = -4.5995

MSE 10/28/88 -- 1988 Ford F-150 : Driver Pelvis acceleration, Y-axis

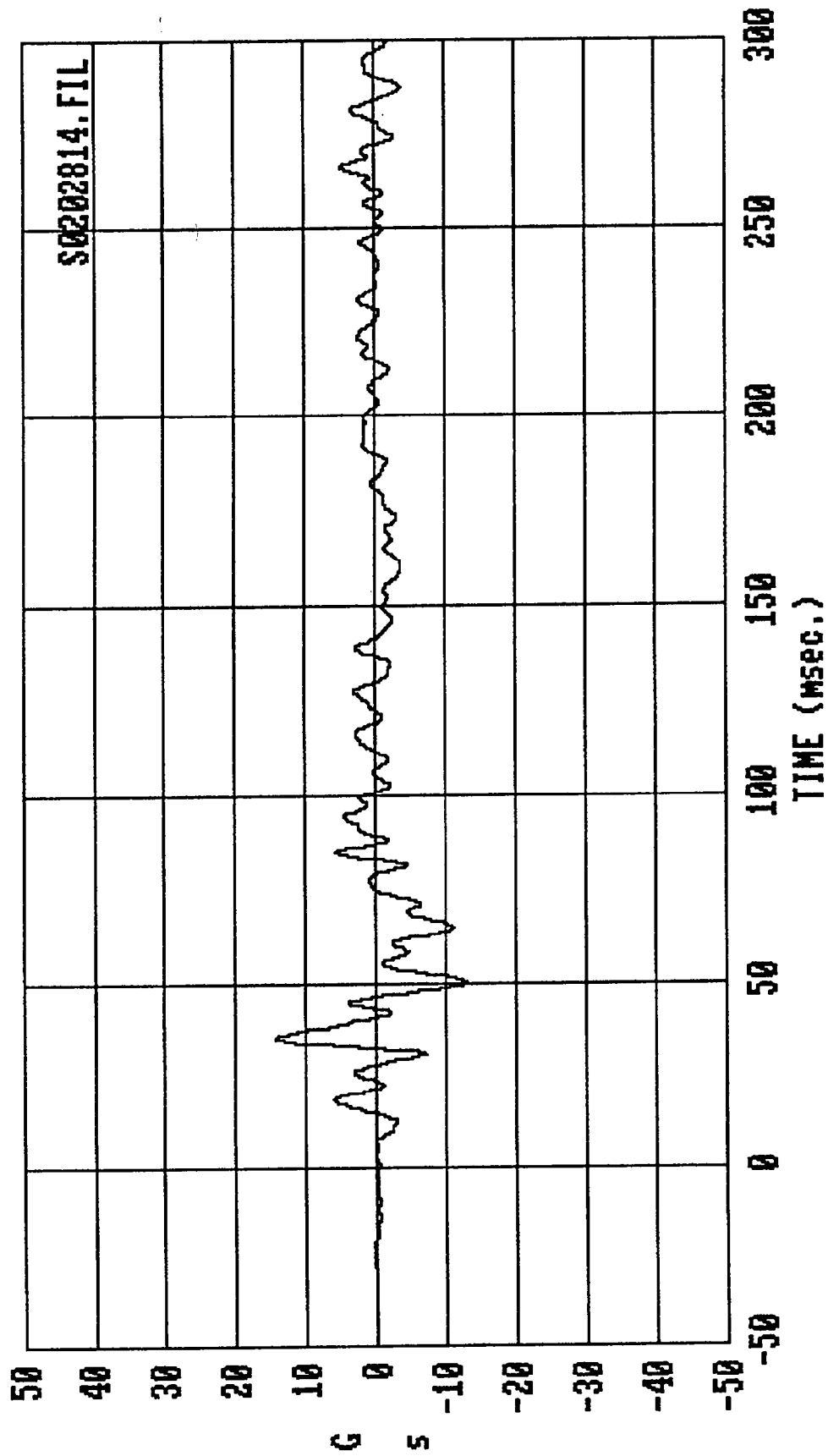


Filter: FIR 100 Max = 24.162 Min = -.55407E-02
MSE 10/28/88 -- 1988 Ford F-150 : Driver Pelvis delta V, Y-axis



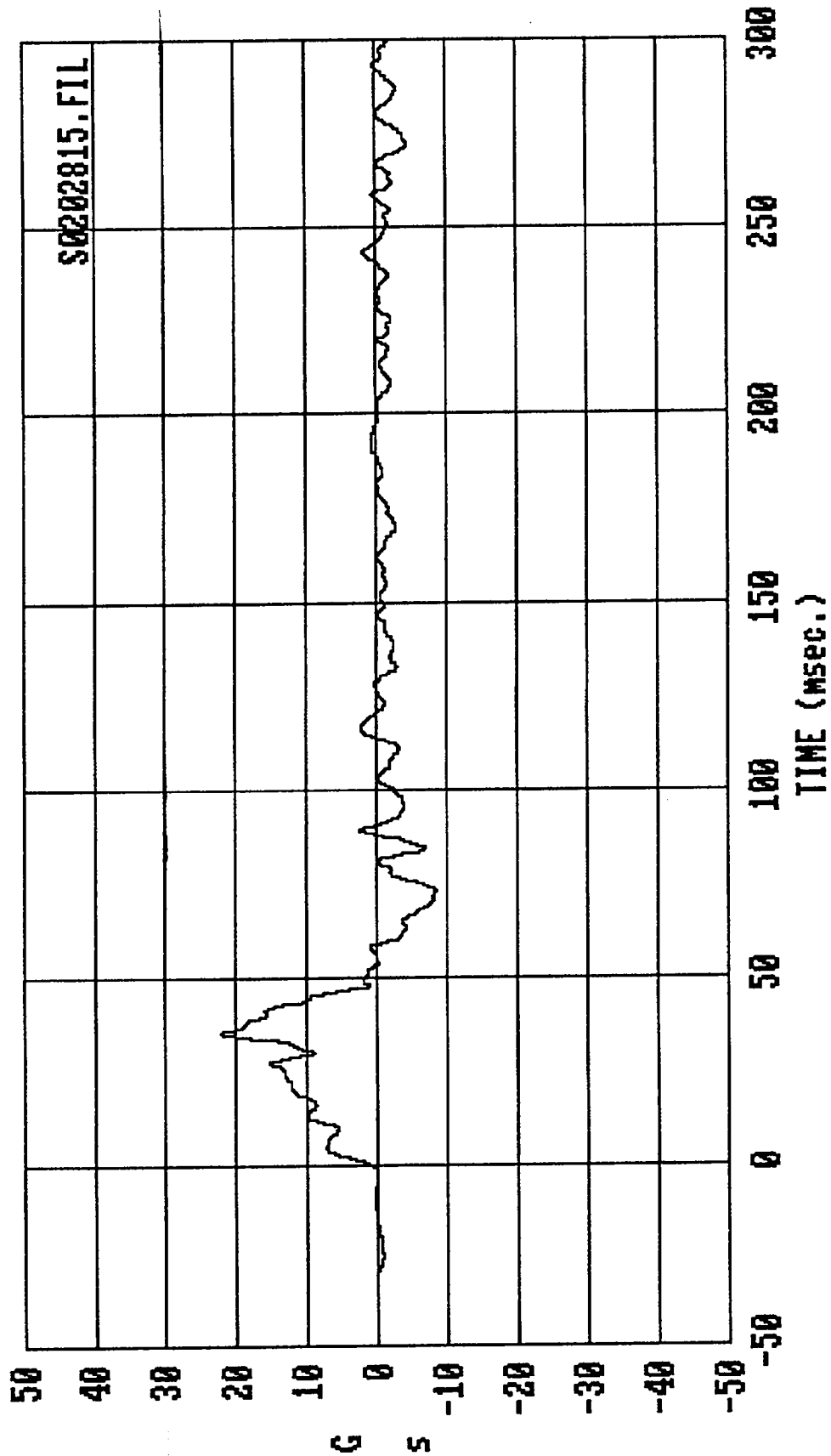
Filter: SAE CLASS 180 Max = .10878 Min = -1.2991

MSE 10/28/88 -- 1988 Ford F-150 : Driver Chest disp. (Compression is -)



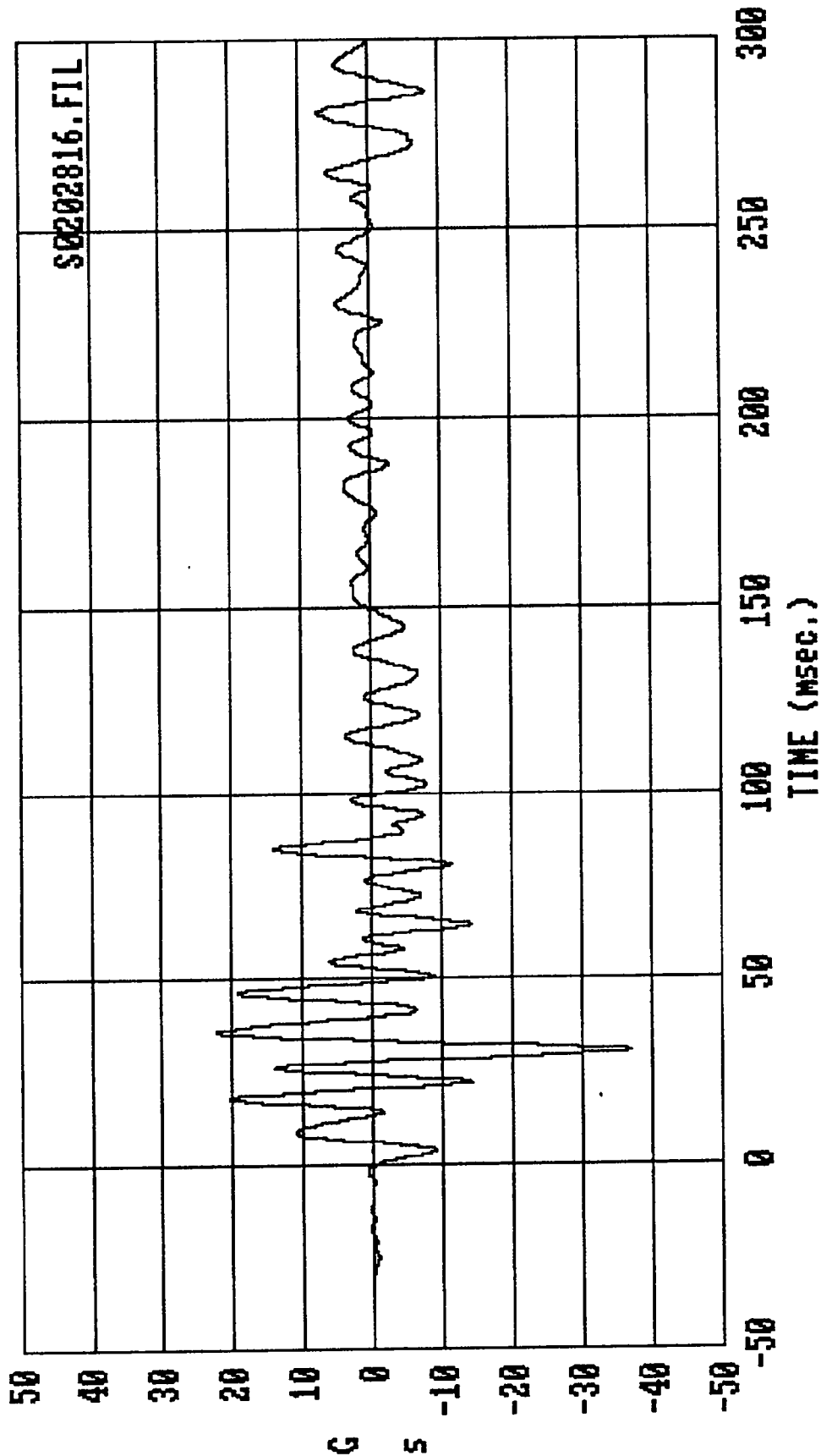
Filter: SAE CLASS 60 Max = 14.359 Min = -12.835

MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Right Sill, X-axis



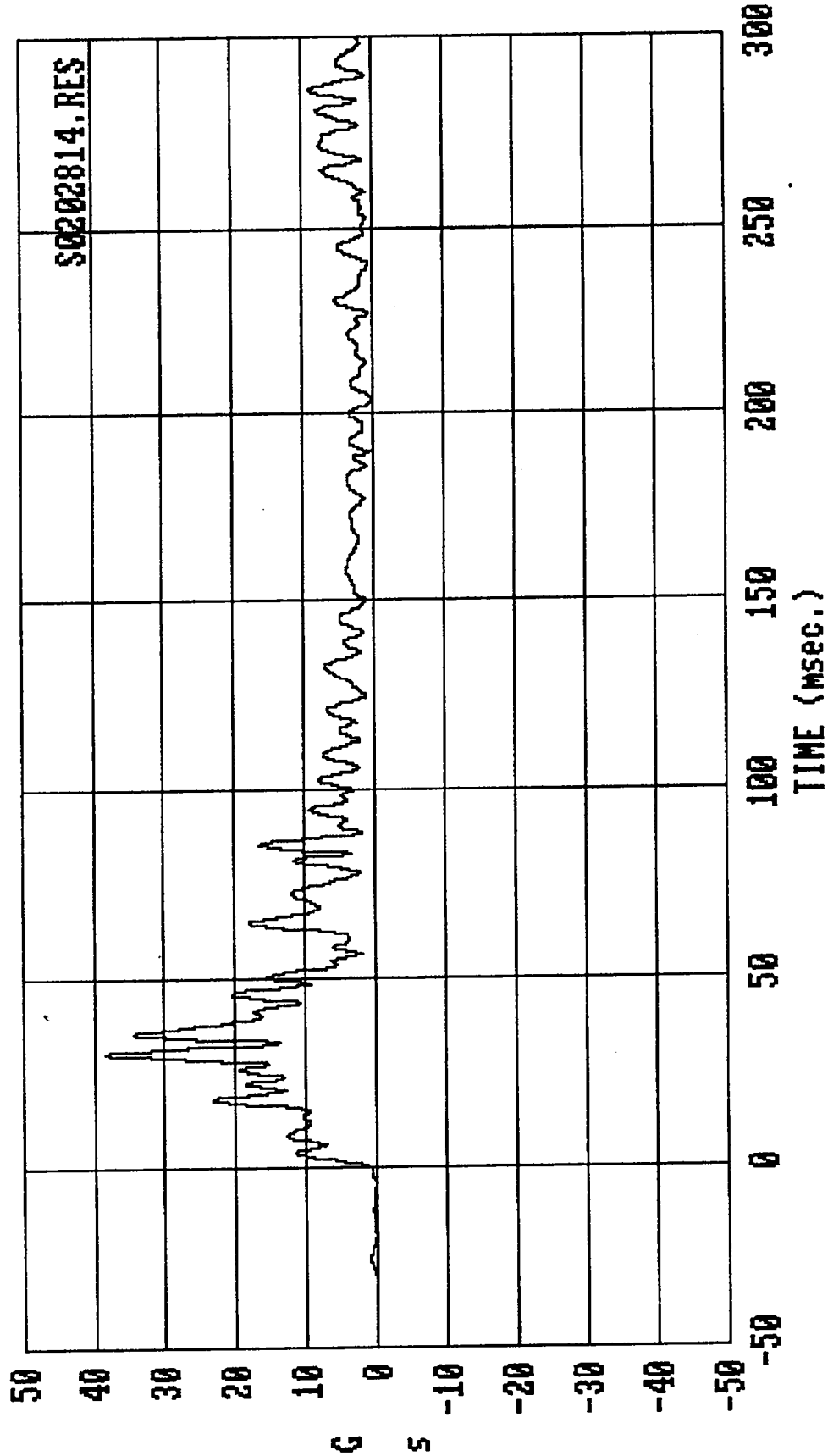
Filter: SAE CLASS 60 Max = 22.269 Min = -8.3228

MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Right Sill, Y-axis



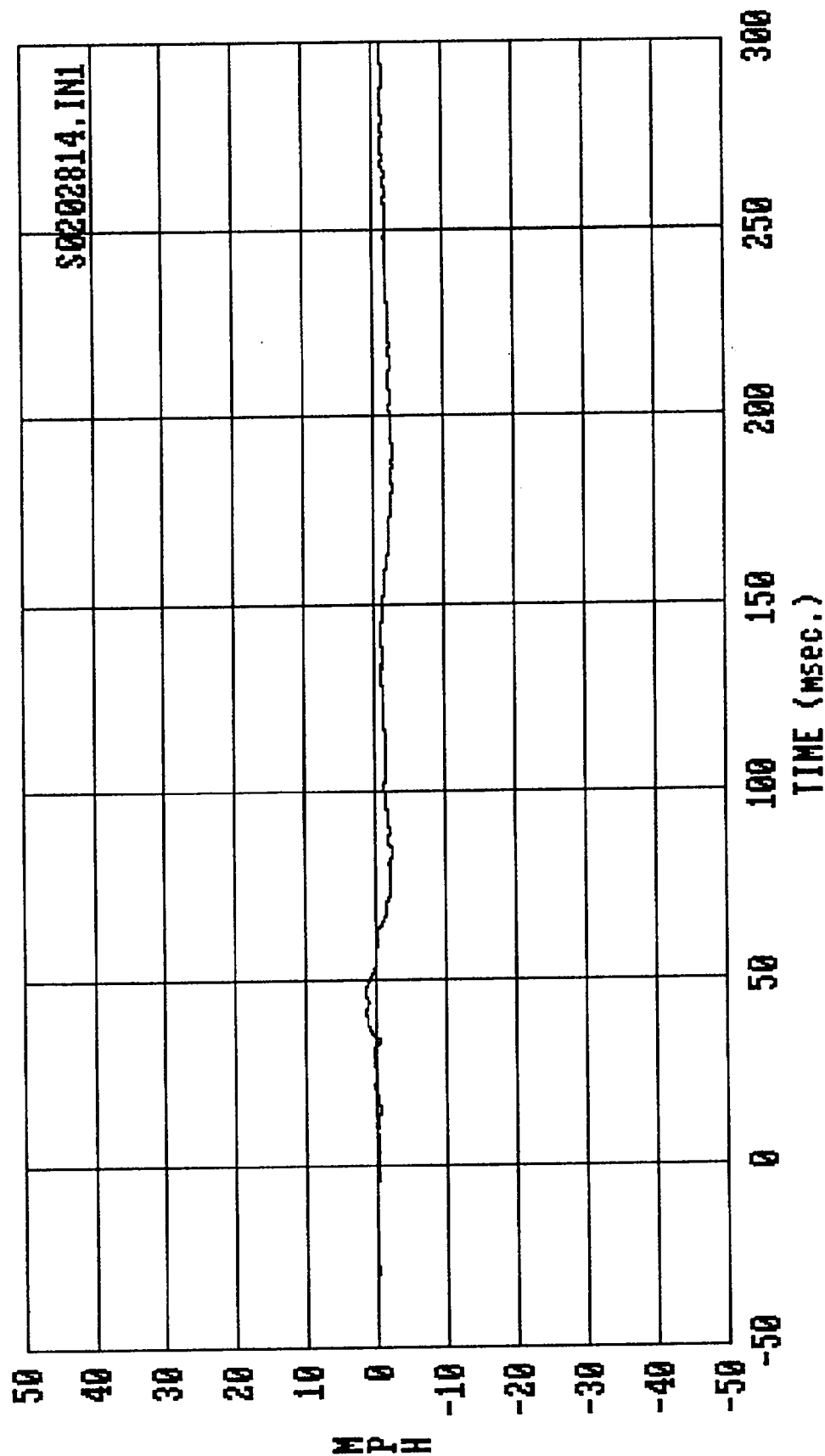
Filter: SAE CLASS 60 Max = 22.265 Min = -36.779

MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Right Sill, Z-axis



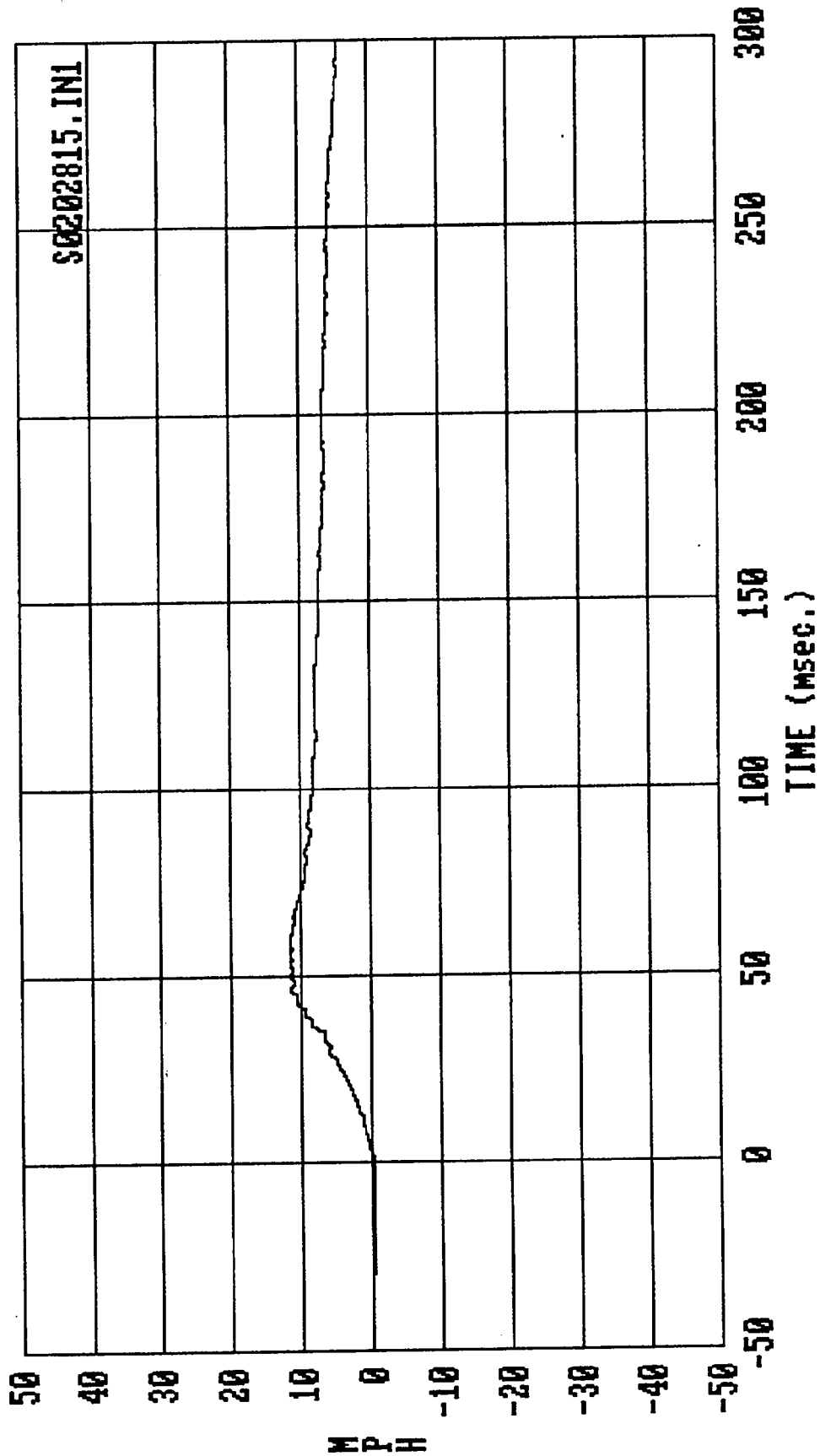
Filter: SAE CLASS 60 Max = 38.298 Min = .31934

MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Right Sill, resultant accel.

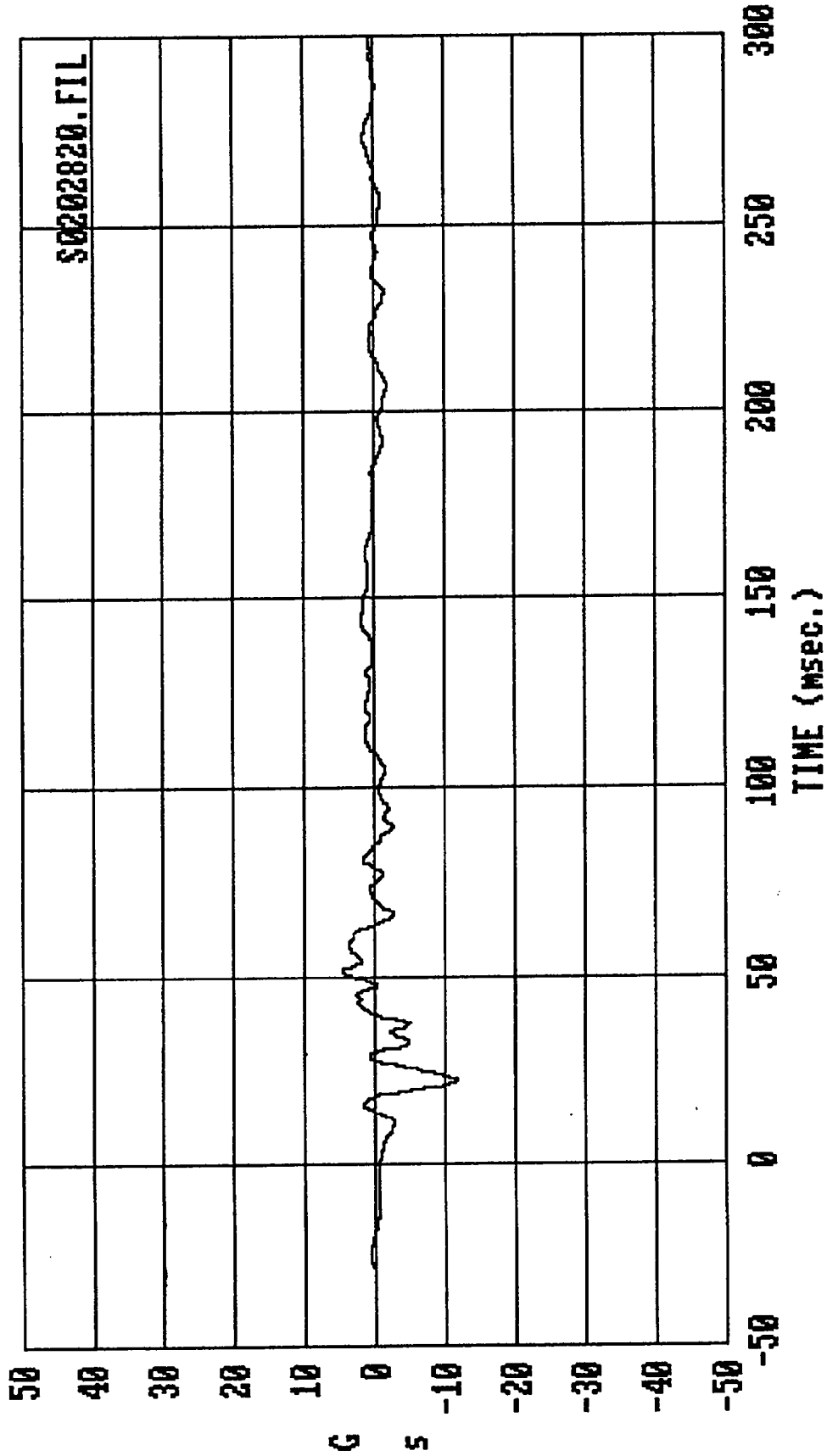


Filter: SAE CLASS 180 Max = 1.7548 Min = -2.5912

MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Right Sill delta V, X-axis

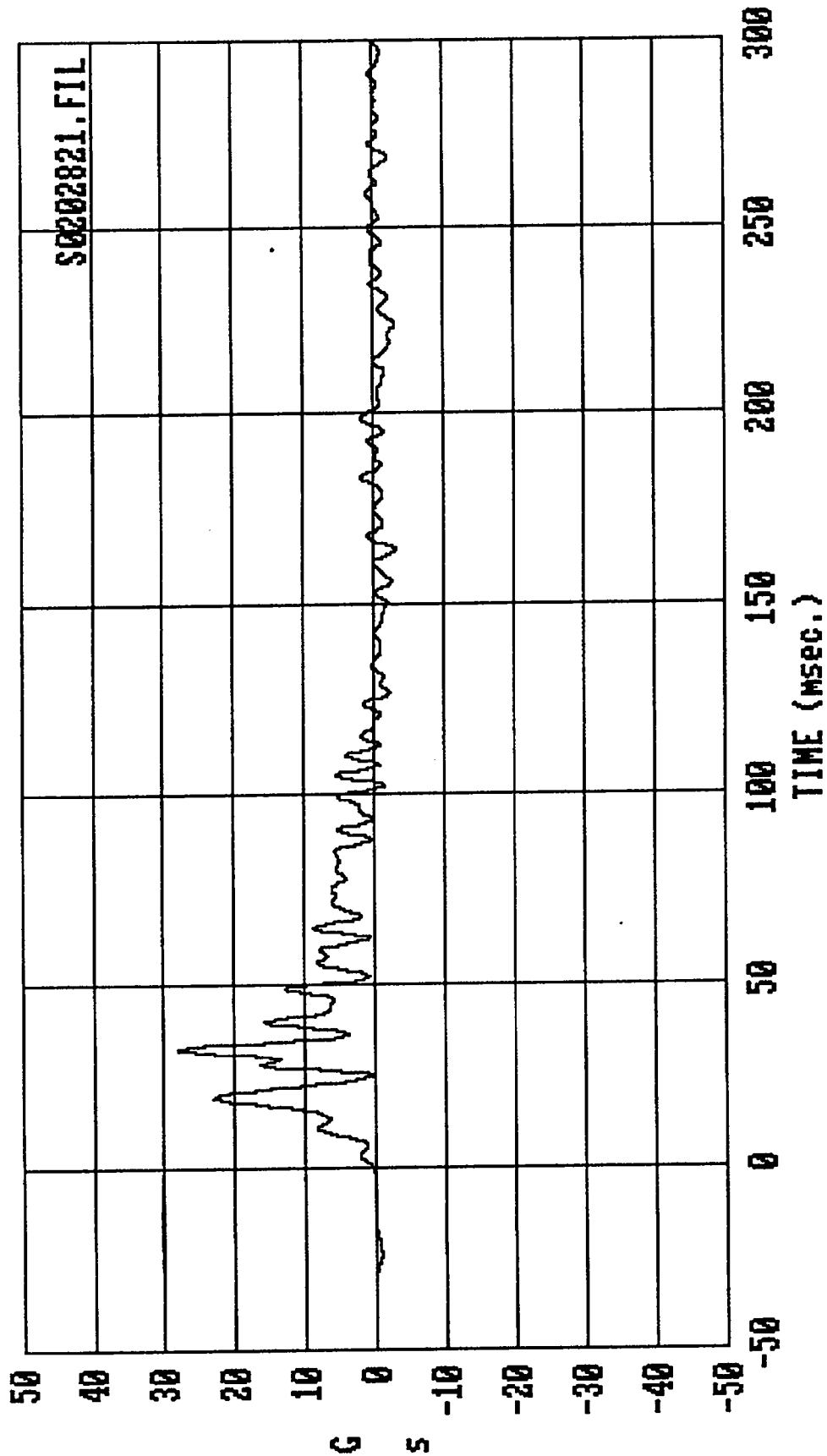


Filter: SAE CLASS 180 Max = 11.779 Min = -.88680E-03
 MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Right Sill delta V, Y-axis

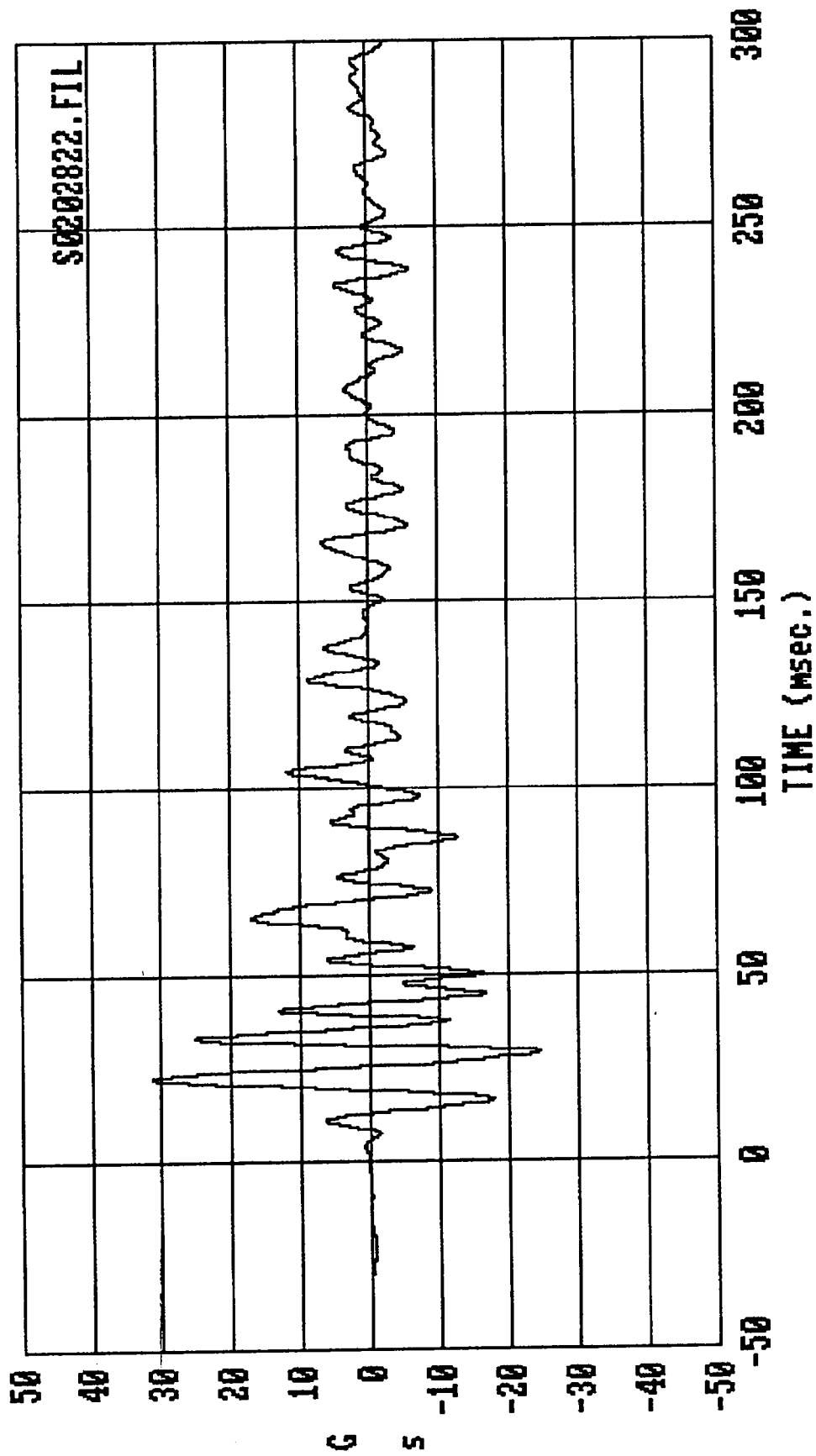


Filter: SAE CLASS 60 Max = 4.7216 Min = -11.551

MSE 10/28/88 -- 1988 Ford F-150 : Rear Floor above axle, X-axis

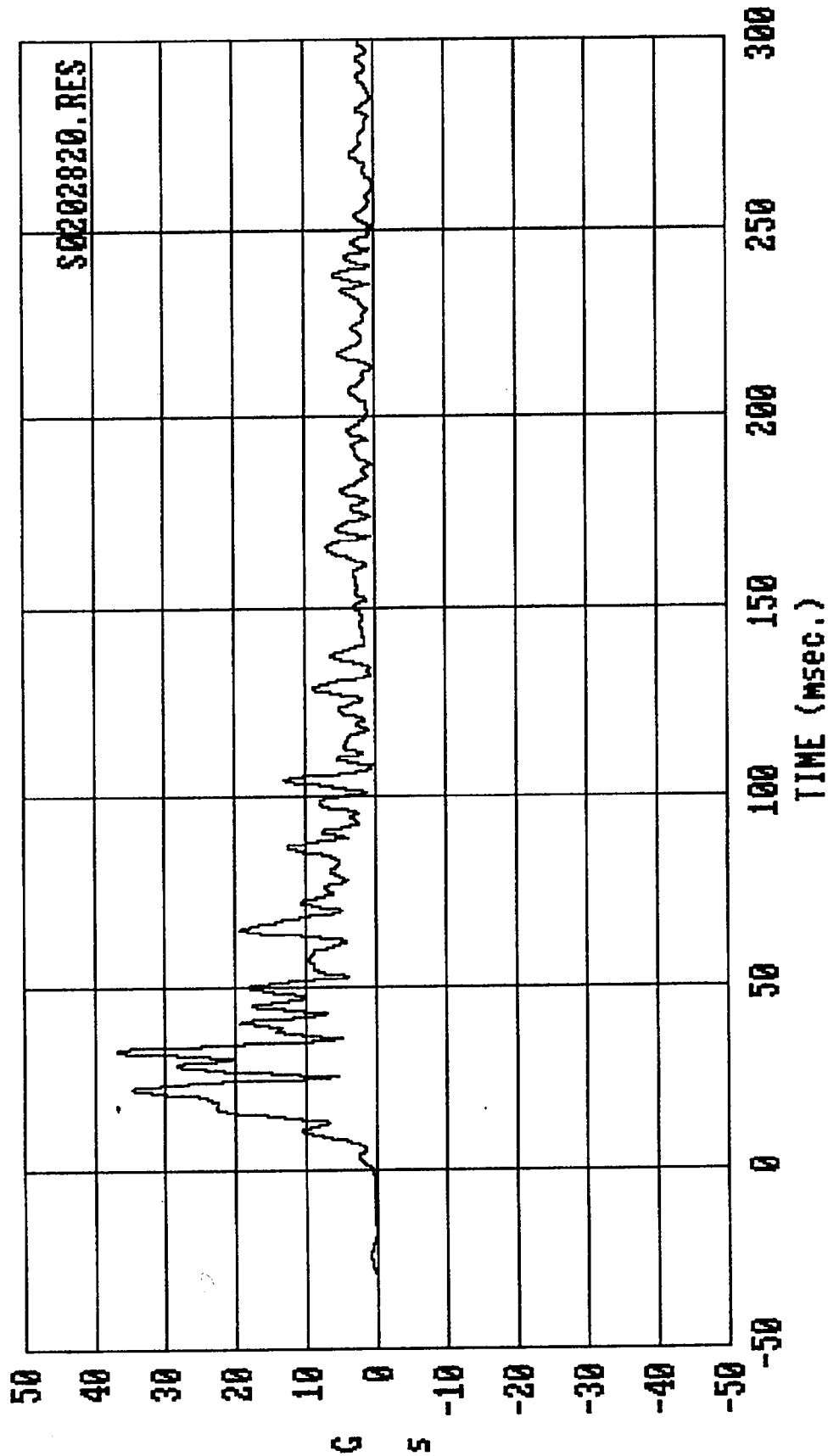


Filter: SAE CLASS 60 Max = 28.210 Min = -3.1809
 MSE 10/28/88 -- 1988 Ford F-150 : Rear Floor above axle, Y-axis



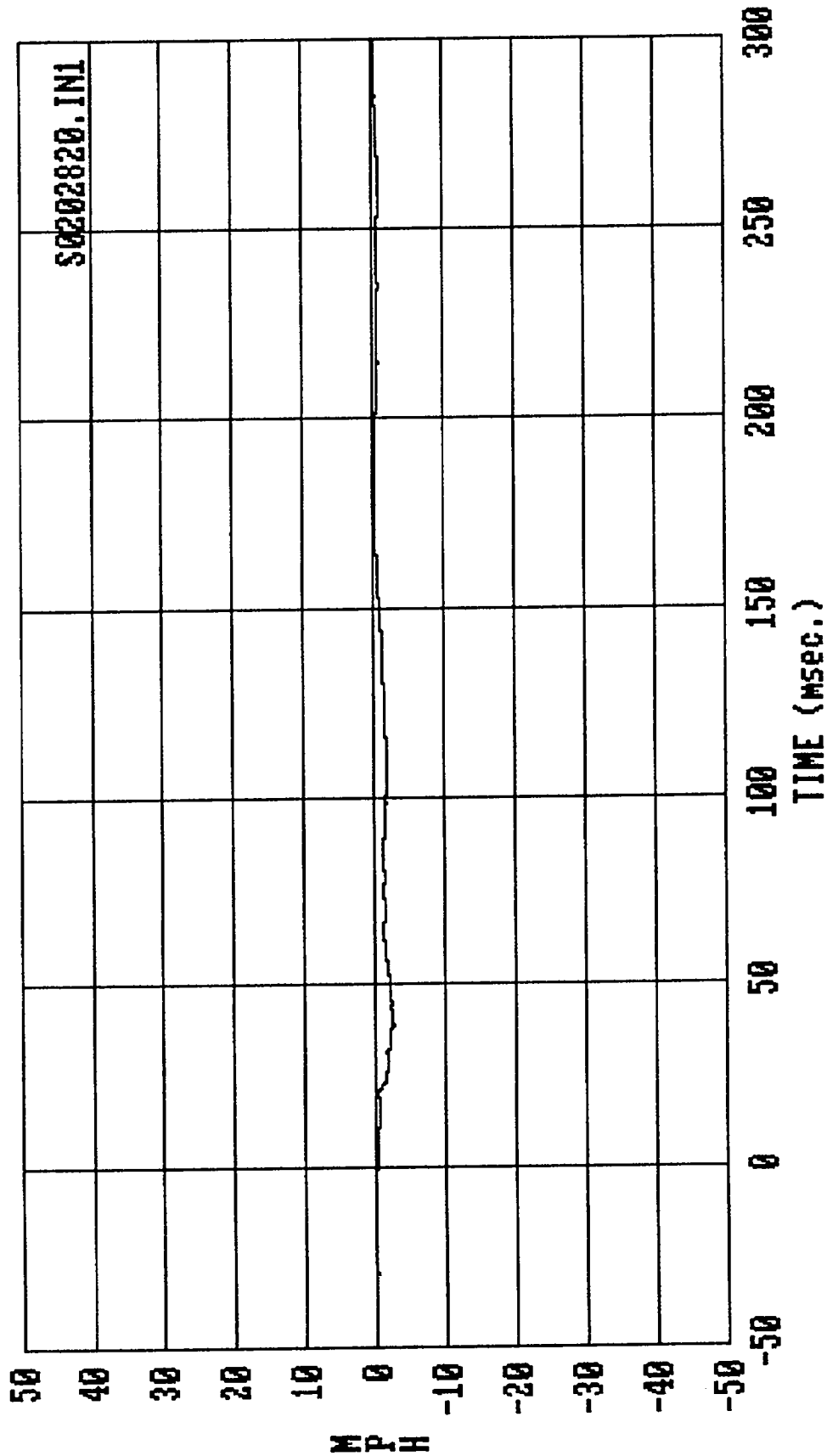
Filter: SAE CLASS 60 Max = 31.635 Min = -24.551

MSE 10/28/88 -- 1988 Ford F-150 : Rear Floor above axle, Z-axis



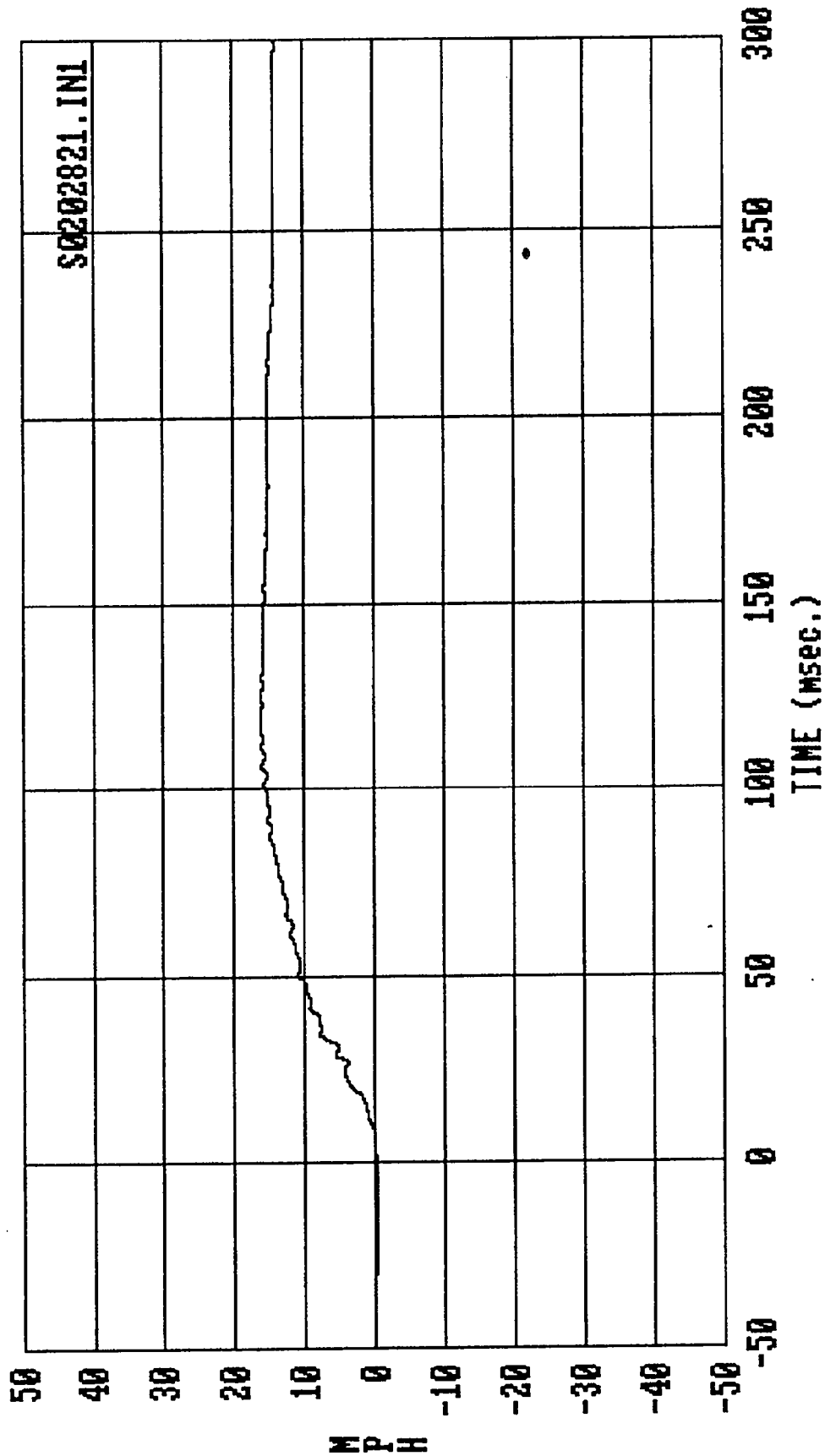
Filter: SAE CLASS 60 Max = 37.192 Min = .11978

MSE 10/28/88 -- 1988 Ford F-150 : Rear Floor above axle, resultant accel.

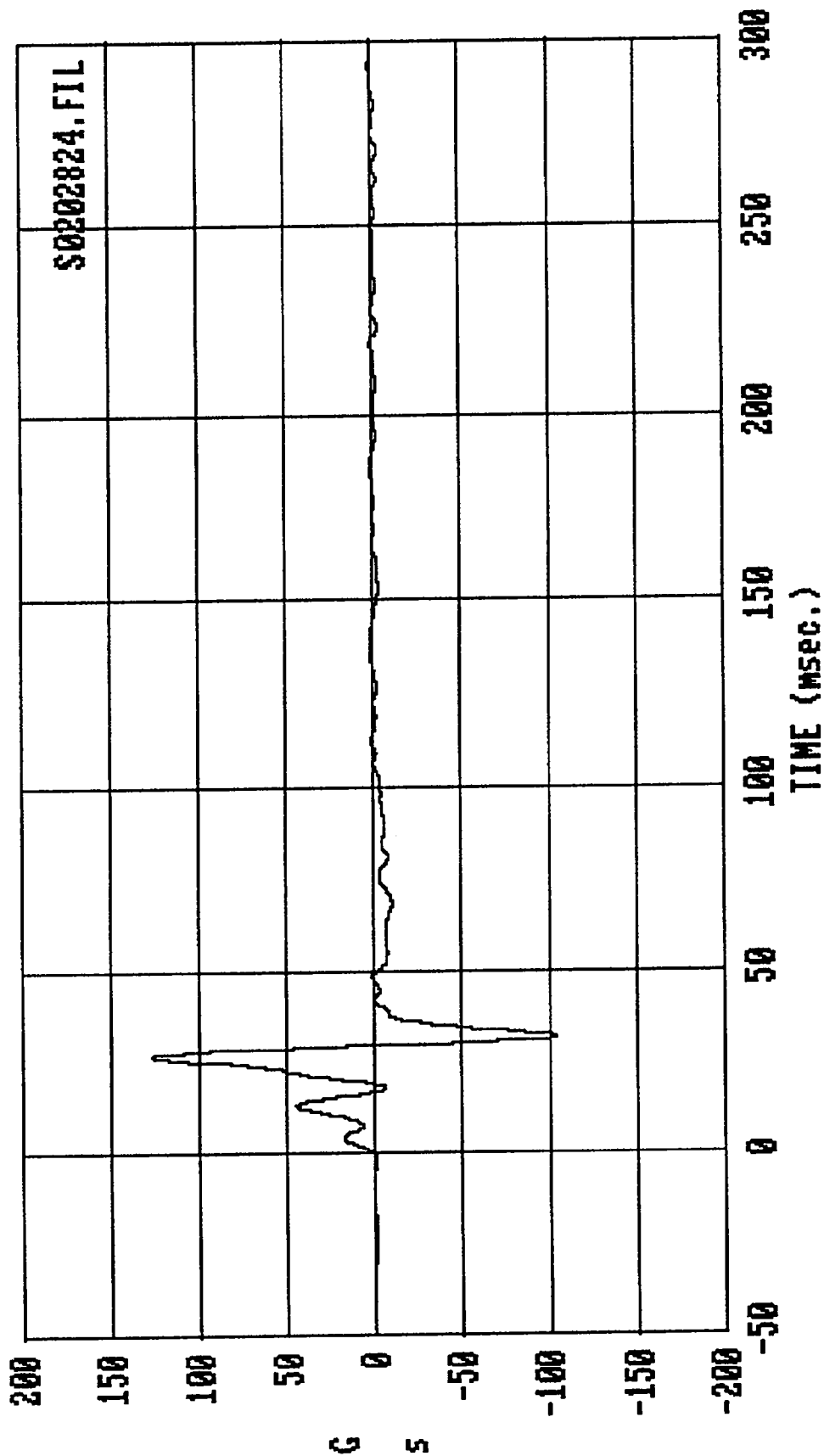


Filter: SAE CLASS 180 Max = .10000E-09Min = -2.5212

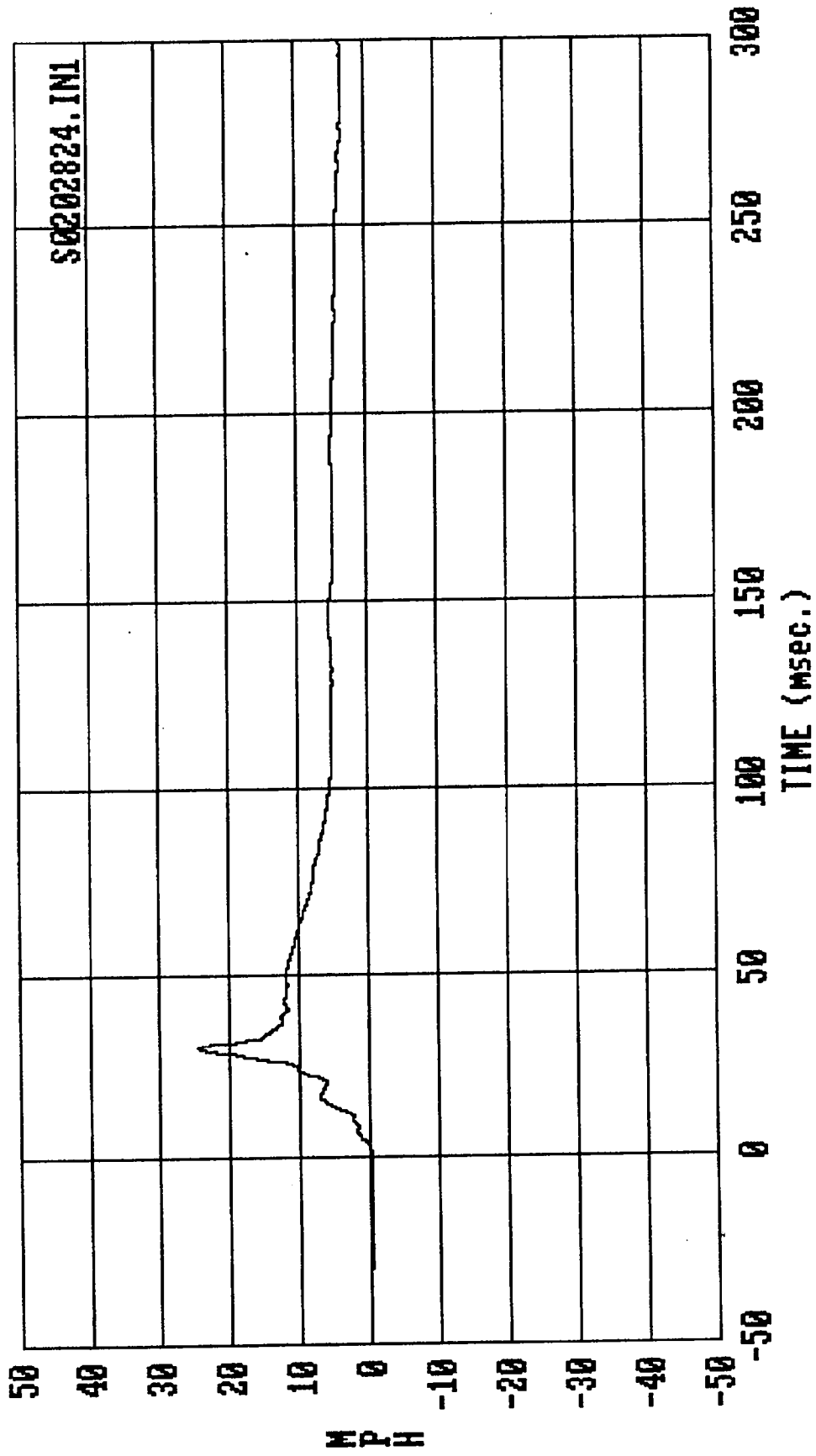
MSE 10/28/88 -- 1988 Ford F-150 : Rear Floor above axle delta V, X-axis



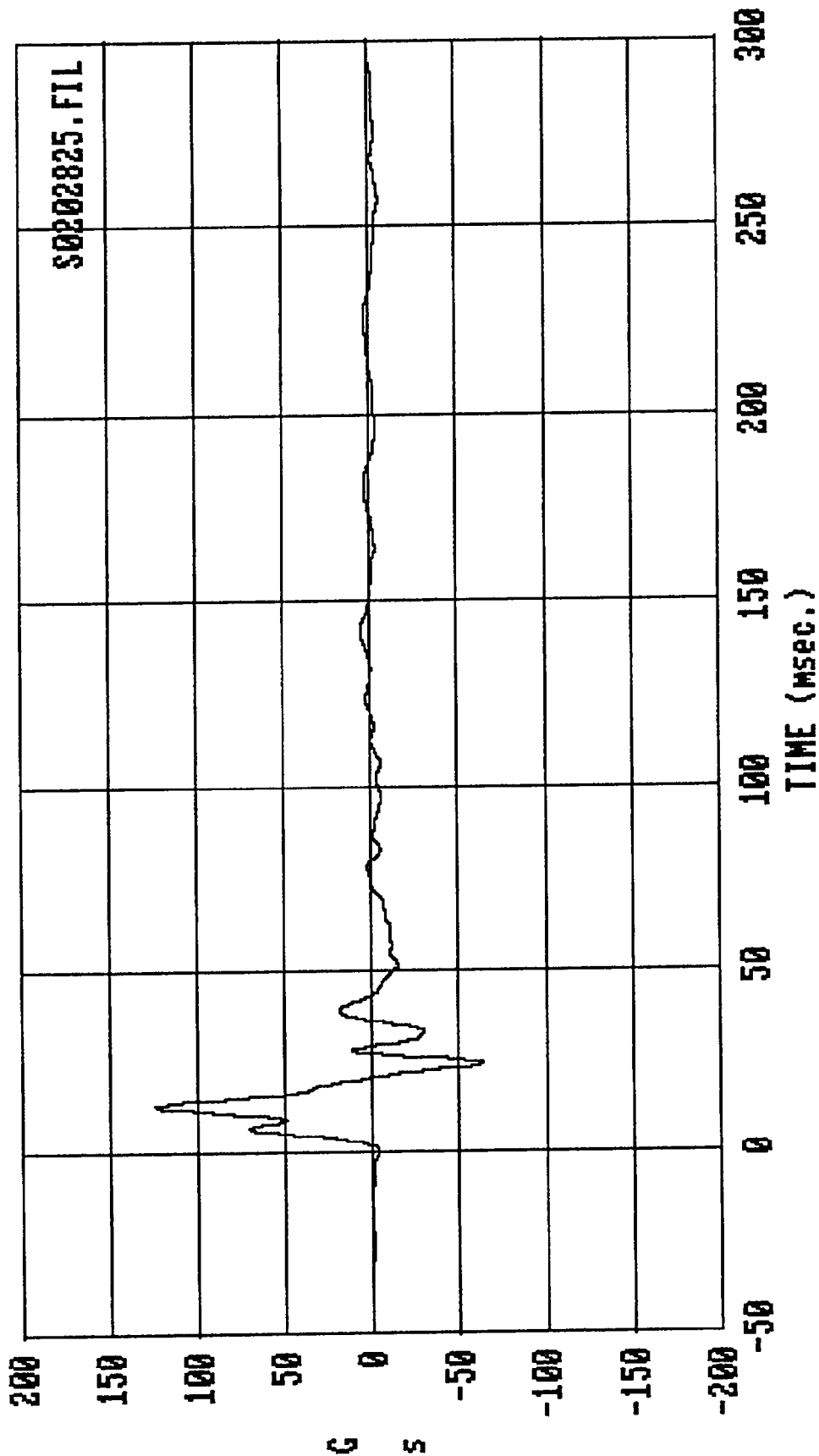
Filter: SAE CLASS 180 Max = 16.390 Min = .20321E-03
MSE 10/28/88 -- 1988 Ford F-150 : Rear Floor above axle delta U, Y-axis



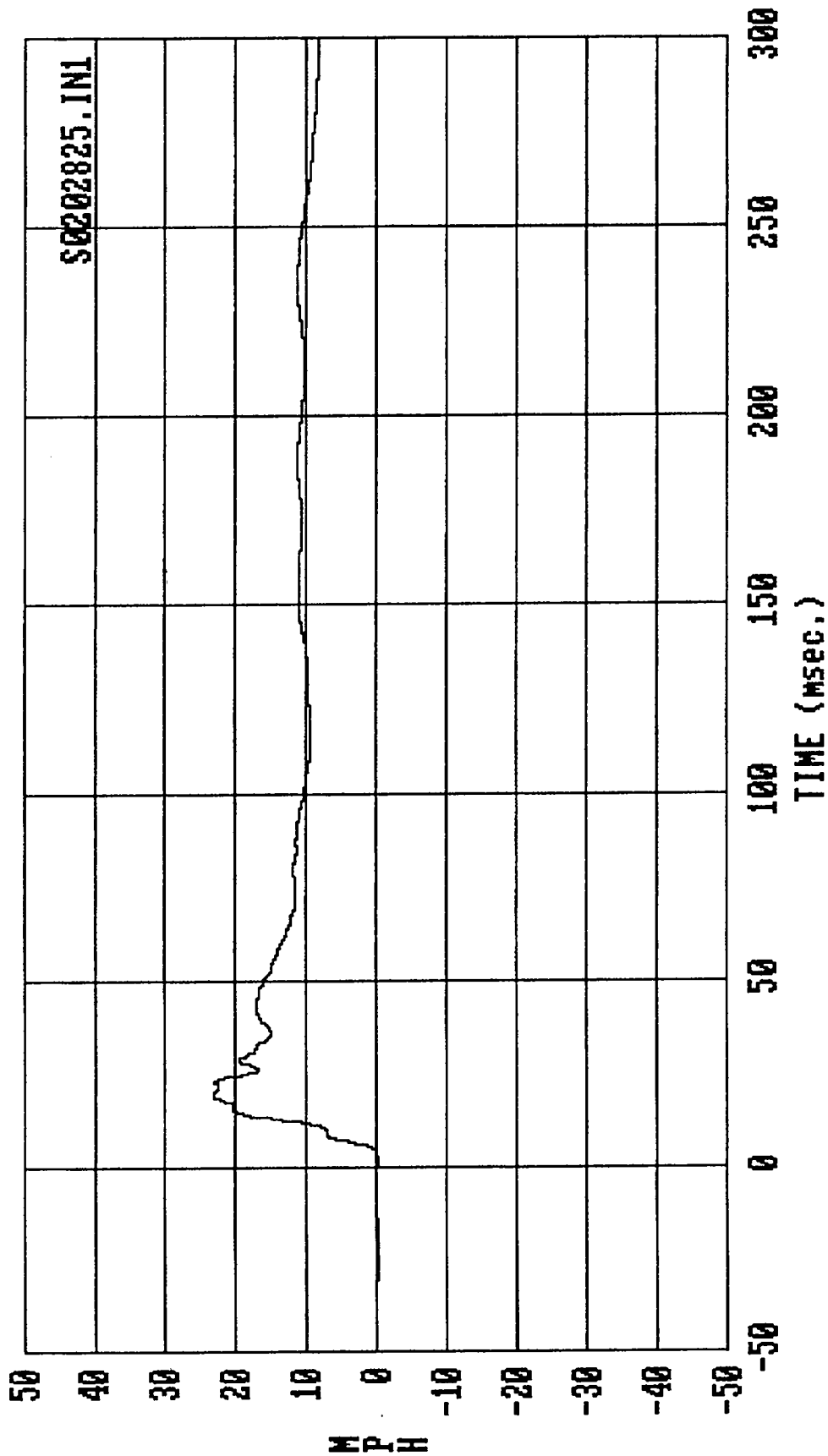
Filter: SAE CLASS 60 Max = 127.17 Min = -104.60
MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Left Sill, Y-axis



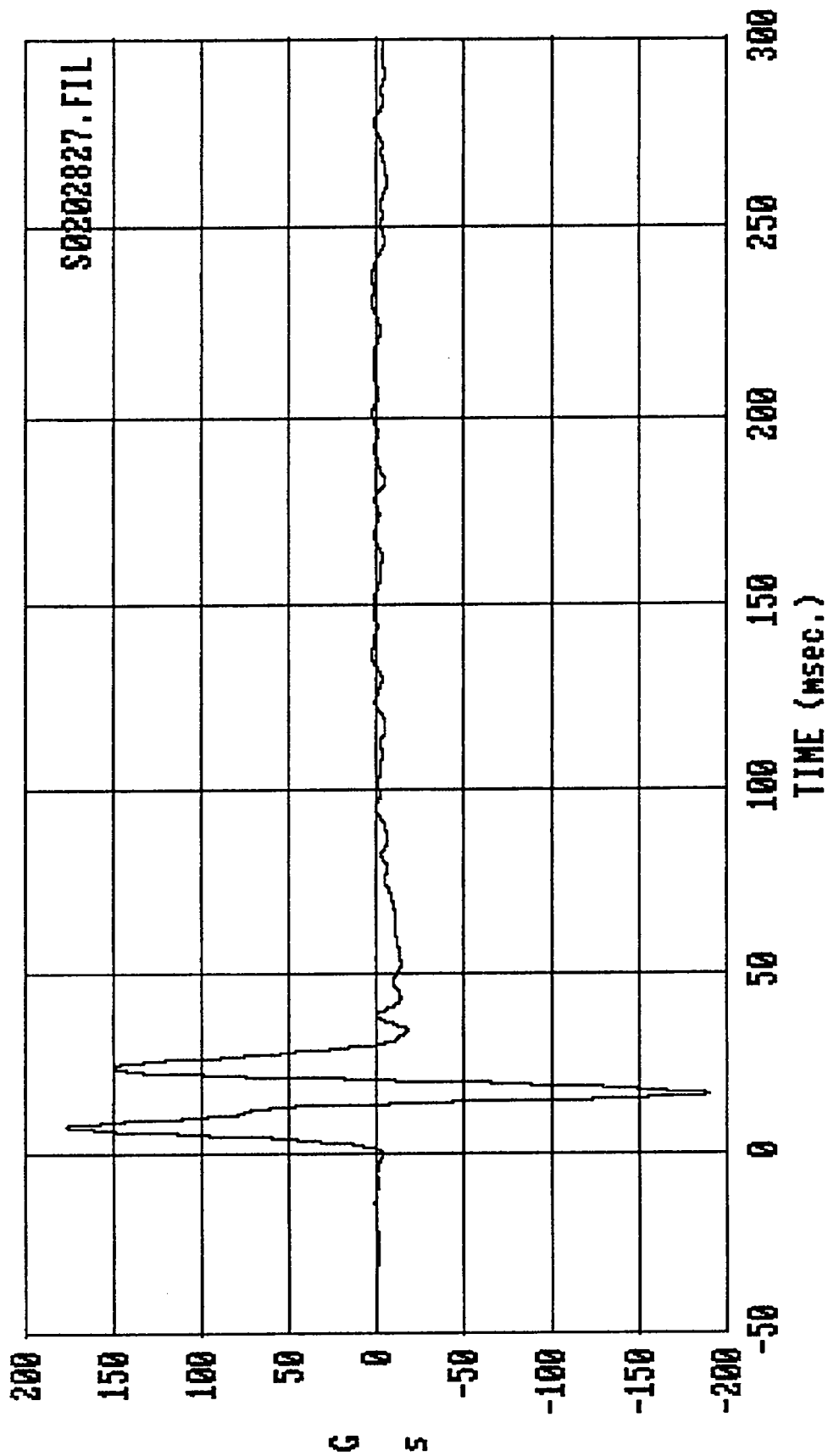
Filter: SAE CLASS 180 Max = 24.670 Min = .25025E-03
MSE 10/28/88 -- 1988 Ford F-150 : Front Seat Left Sill delta U, Y-axis



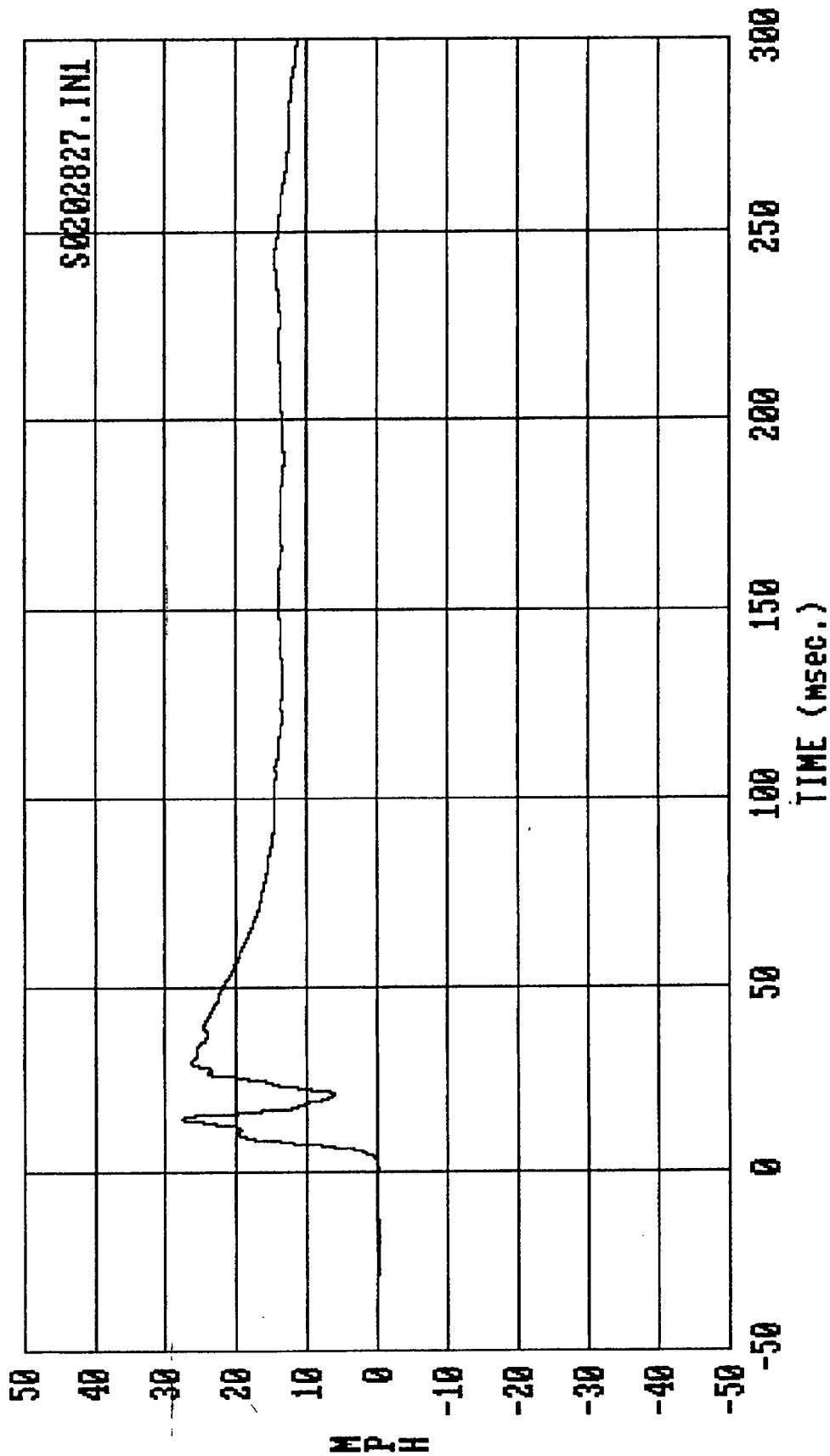
Filter: SAE CLASS 60 Max = 124.84 Min = -63.698
MSE 10/28/88 -- 1988 Ford F-150 : Left Front Door centerline, Y-axis



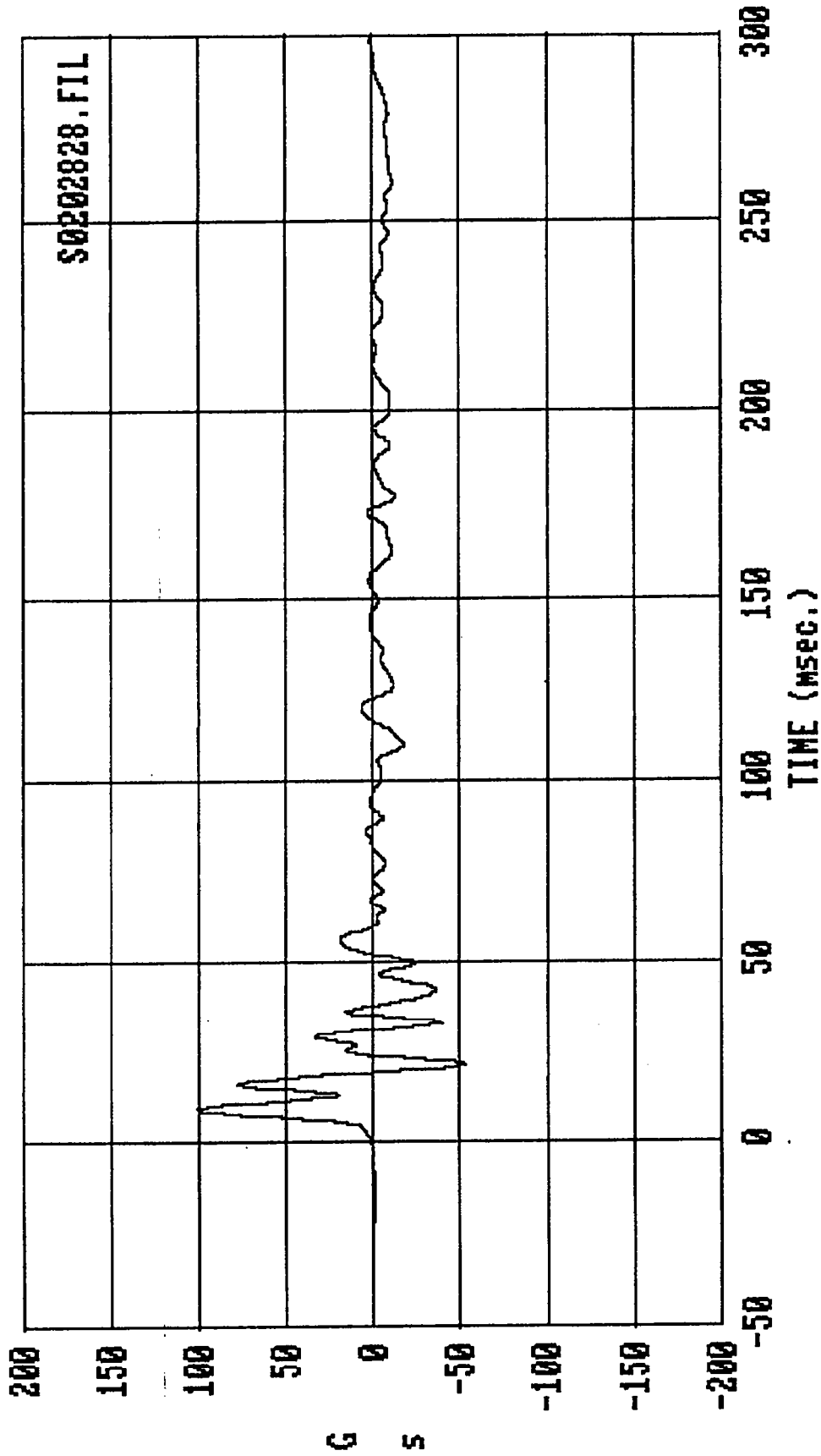
Filter: SAE CLASS 180 Max = 23.236 Min = -.63151E-01
 MSE 10/28/88 -- 1988 Ford F-150 : Left Front Door C/L delta V, Y-axis



Filter: SAE CLASS 60 Max = 176.36 Min = -190.58
MSE 10/28/88 -- 1988 Ford F-150 : Left Front Door mid-rear, Y-axis

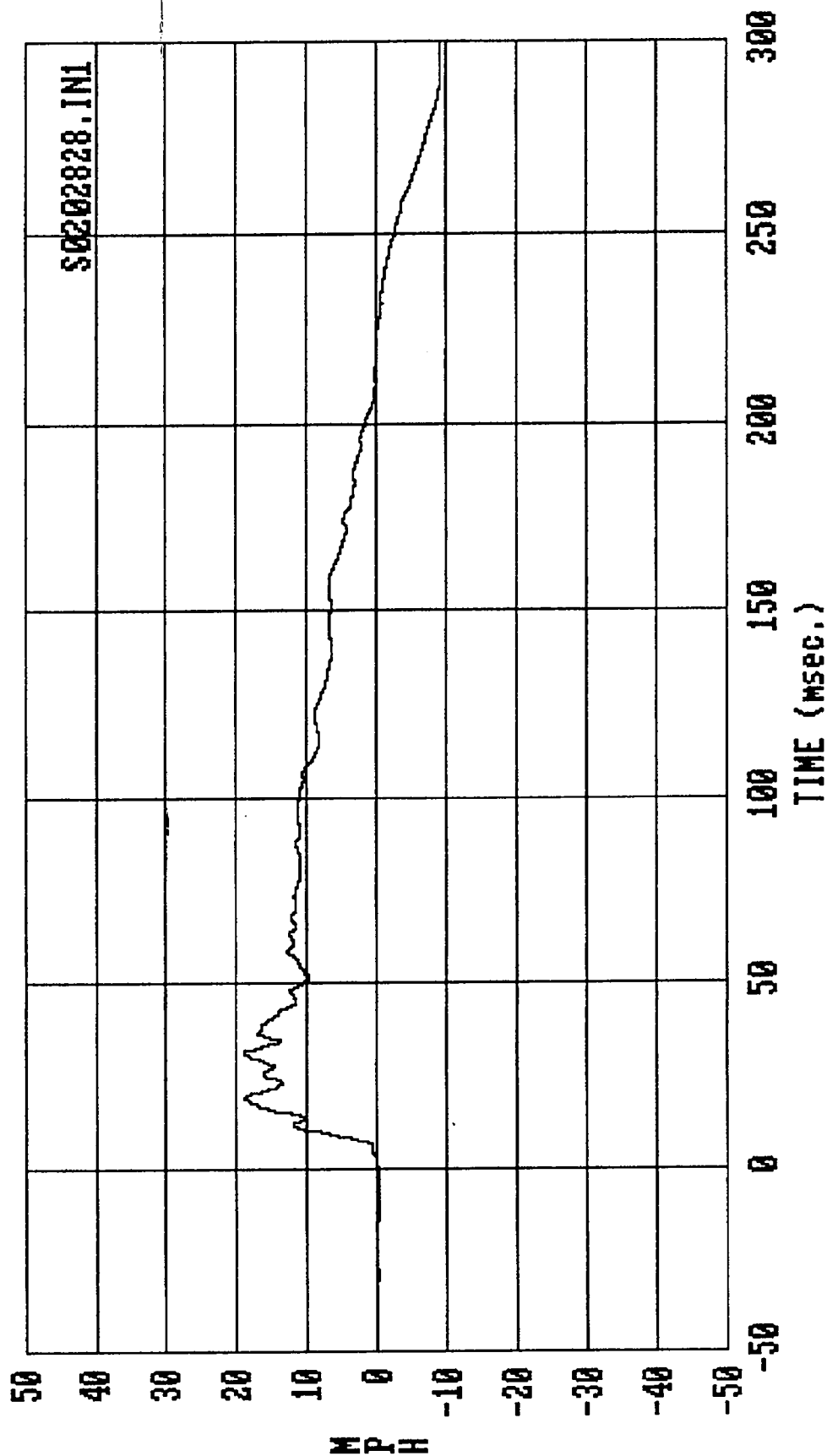


Filter: SAE CLASS 180 Max = 27.720 Min = -.21028E-02
MSE 10/28/88 -- 1988 Ford F-150 : Lft Frnt Door mid-rear delta V, Y-axis



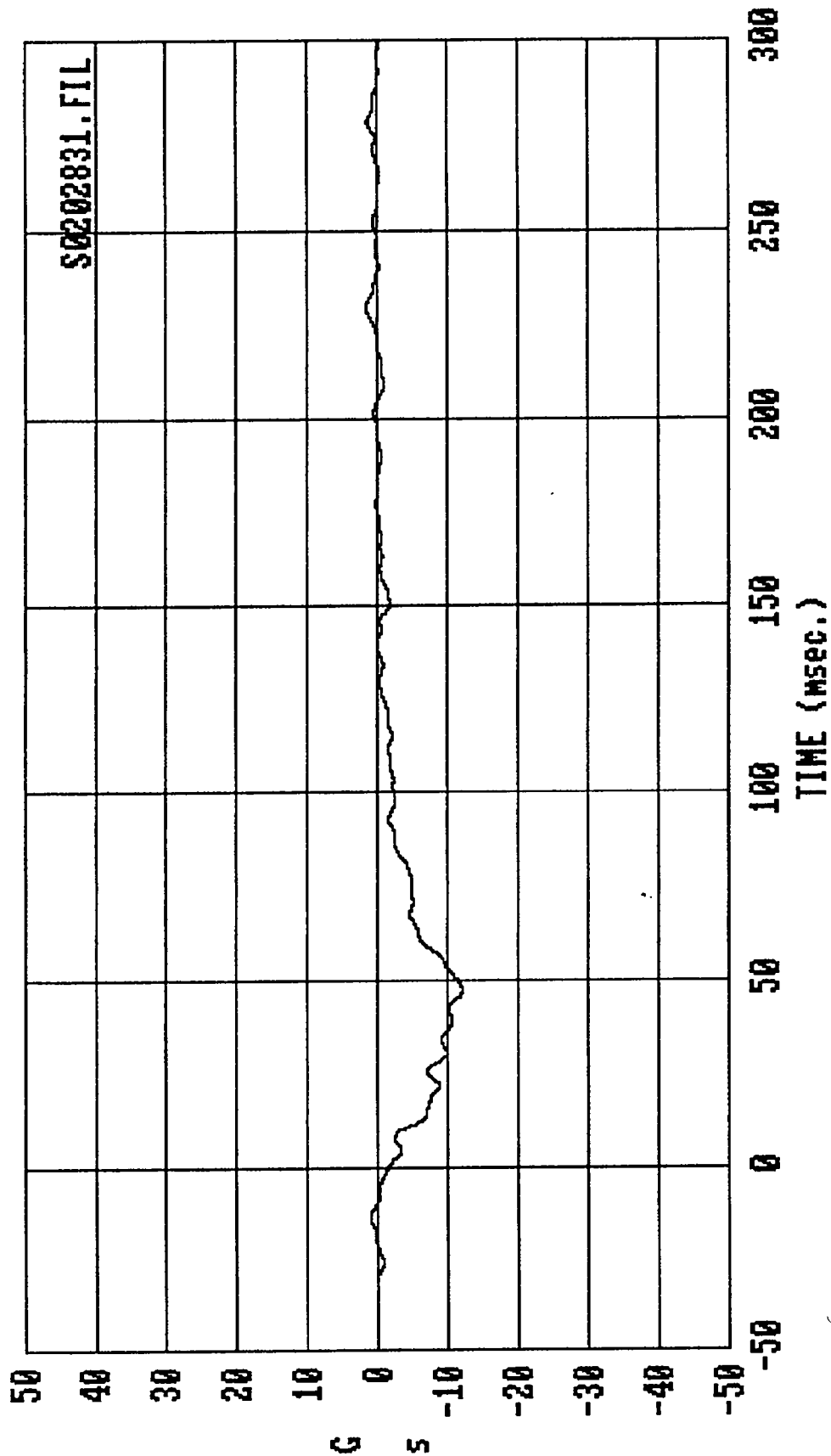
Filter: SAE CLASS 60 Max = 101.46 Min = -52.974

MSE 10/28/88 -- 1988 Ford F-150 : Left Front Door upper centerline, Y-axis



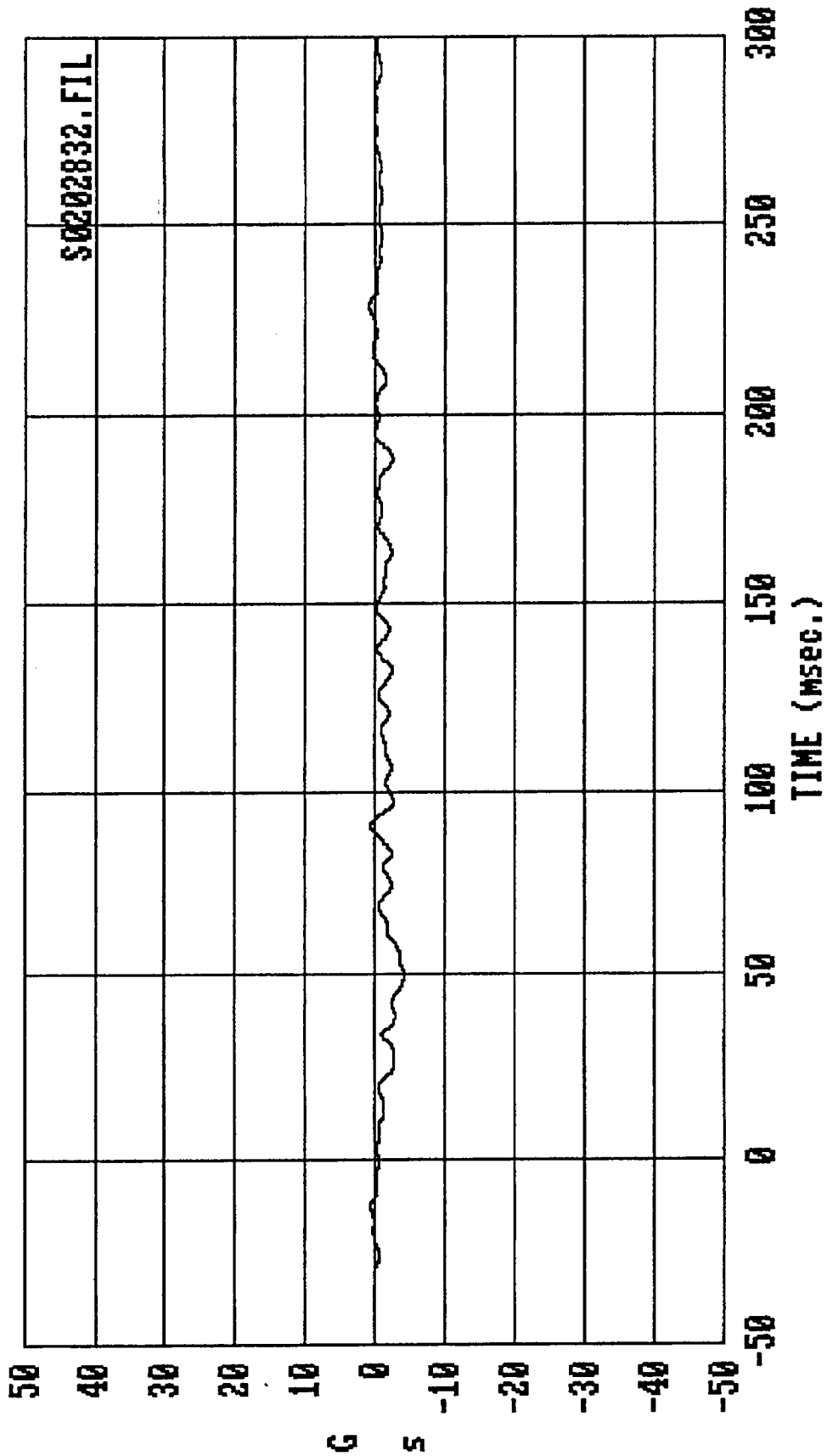
Filter: SAE CLASS 180 Max = 19.066 Min = -9.0159

MSE 10/28/88 -- 1988 Ford F-150 : Lft Frnt Door uppr C/L delta U, Y-axis



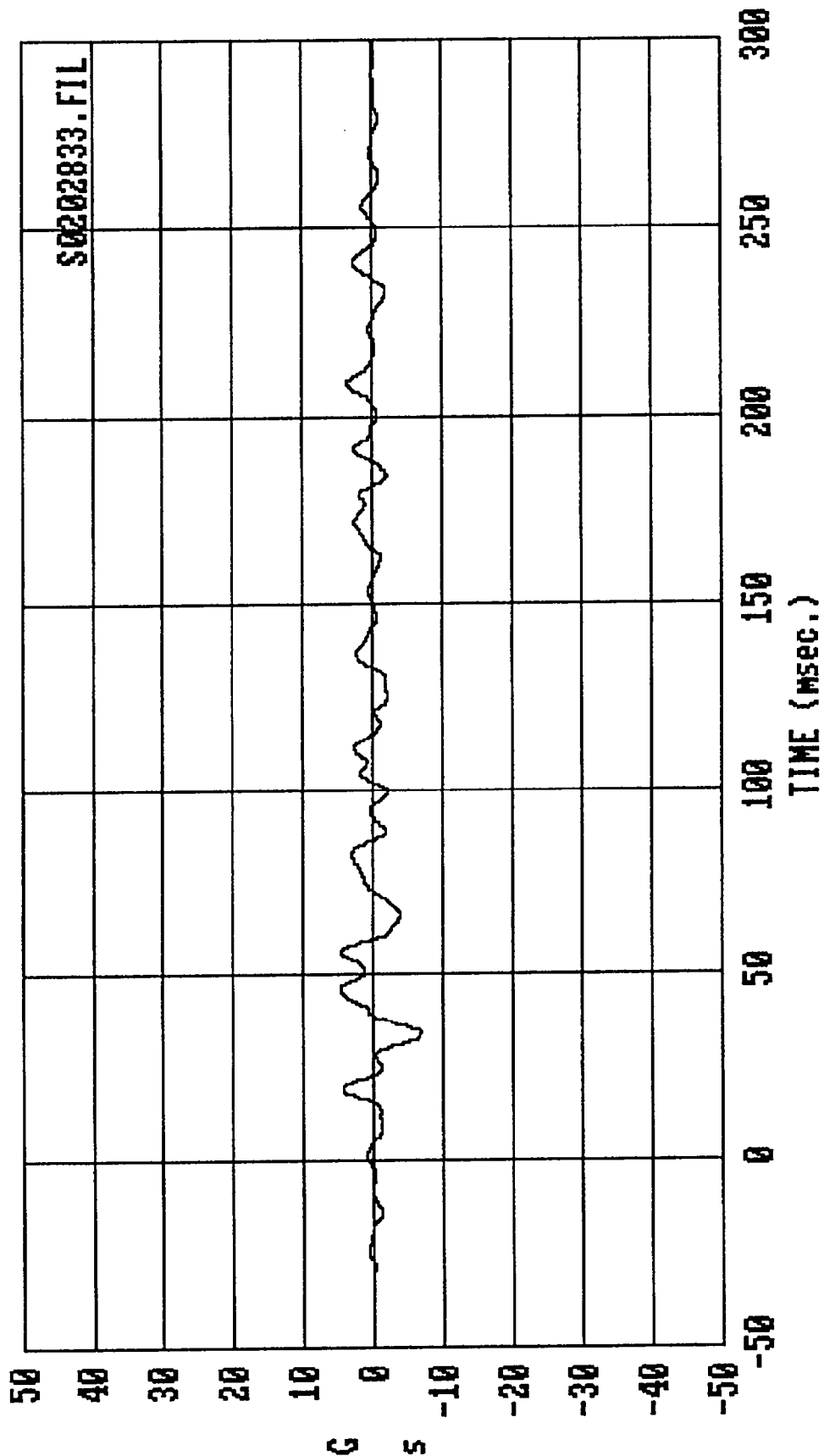
Filter: SAE CLASS 60 Max = 1.7792 Min = -12.006

MSE 10/28/88 -- 1988 Ford F-150 : Moving Deformable Barrier C/G, X-axis

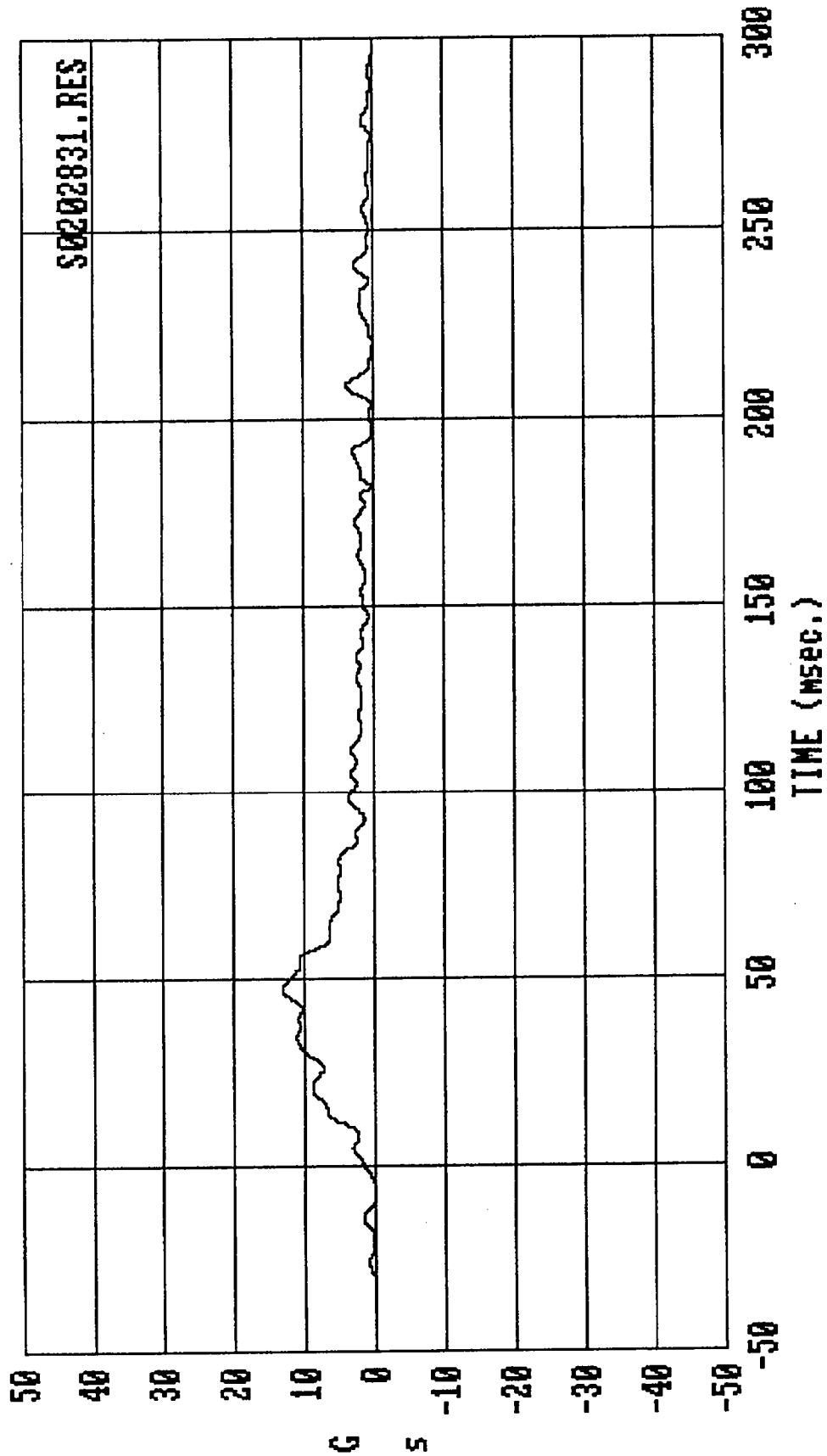


Filter: SAE CLASS 60 Max = 1.0531 Min = -4.2035

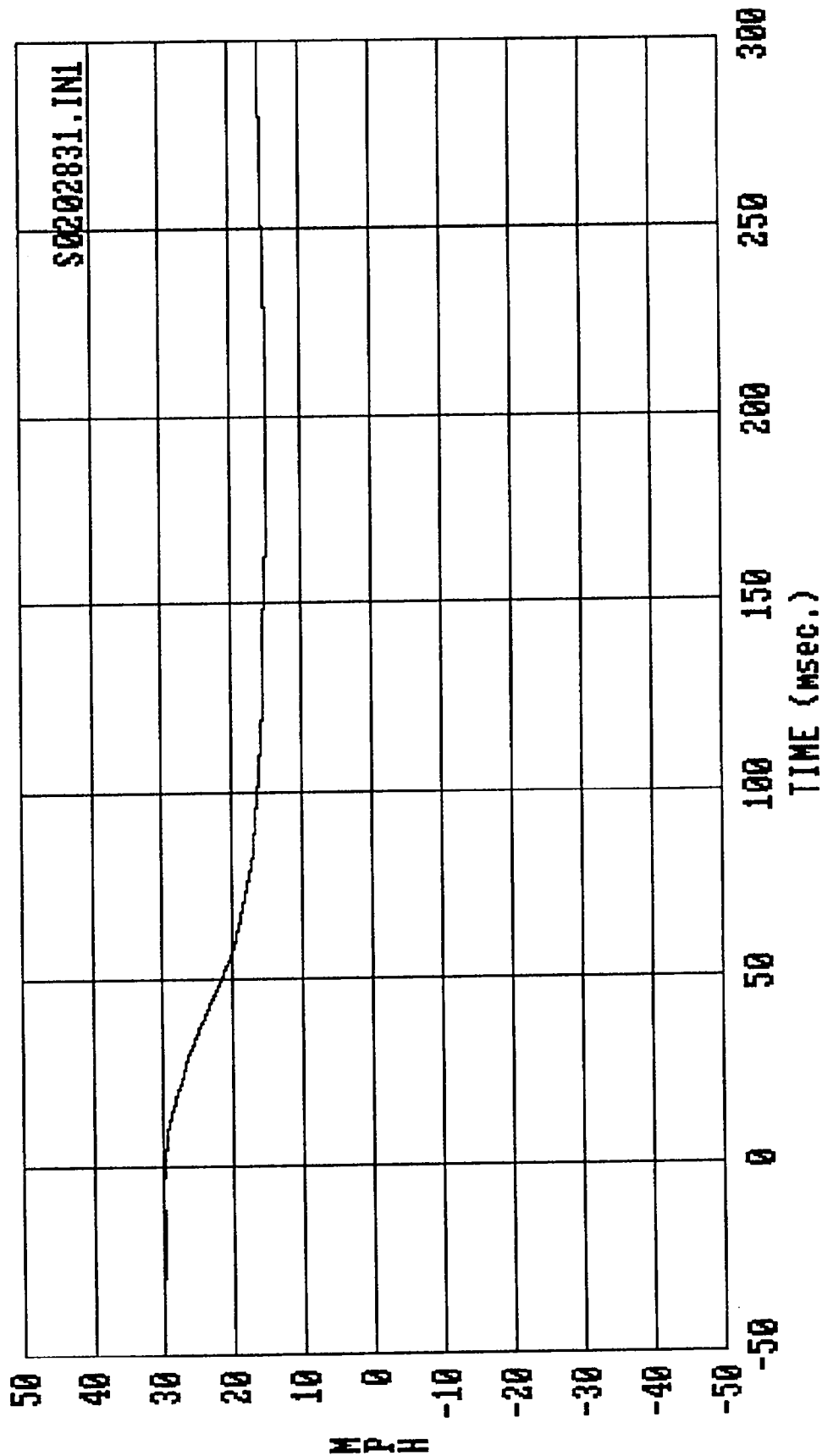
MSE 10/28/88 -- 1988 Ford F-150 : Moving Deformable Barrier C/G, Y-axis



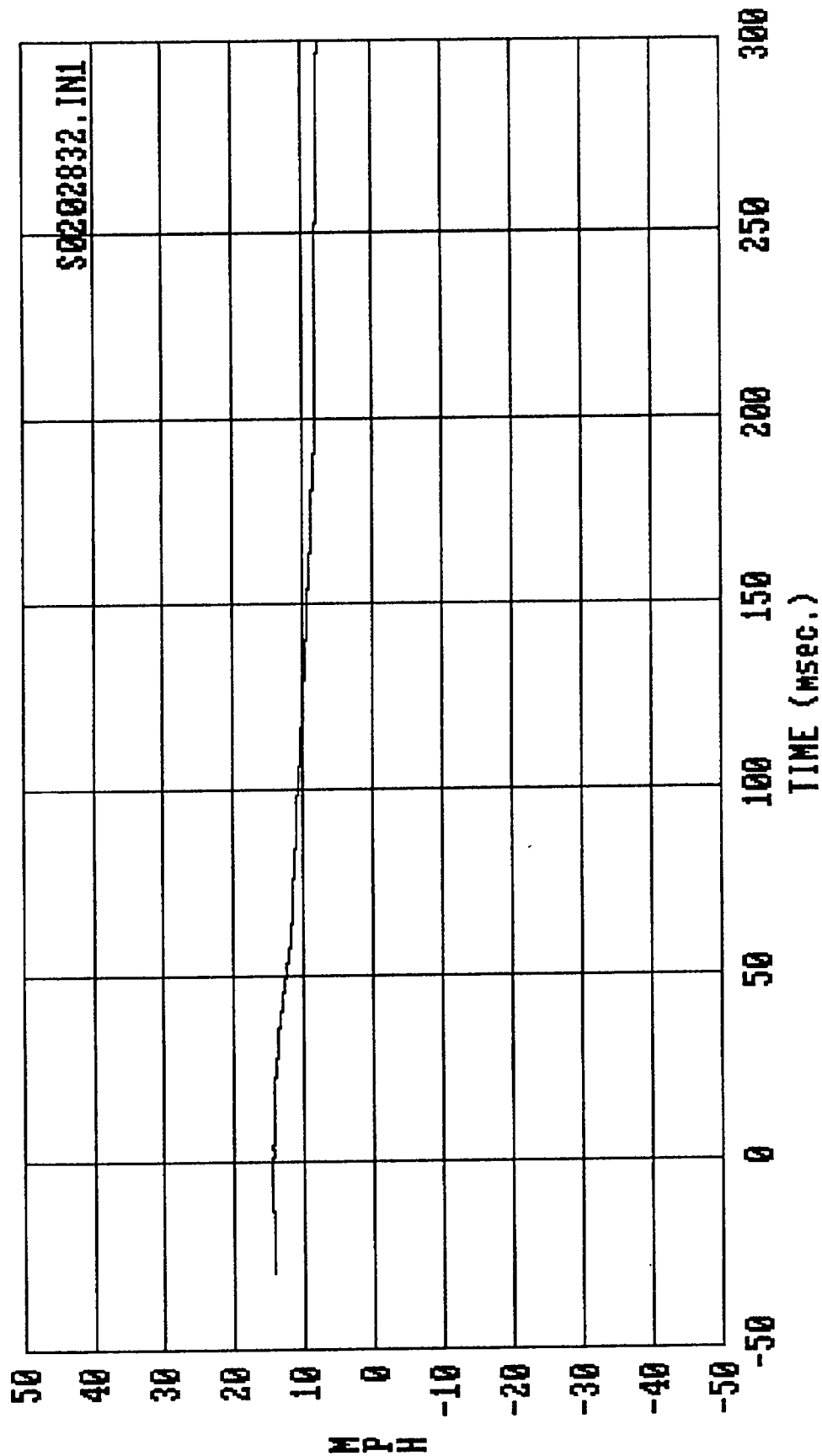
Filter: SAE CLASS 60 Max = 4.8409 Min = -6.7646
MSE 10/28/88 -- 1988 Ford F-150 : Moving Deformable Barrier C/G, Z-axis



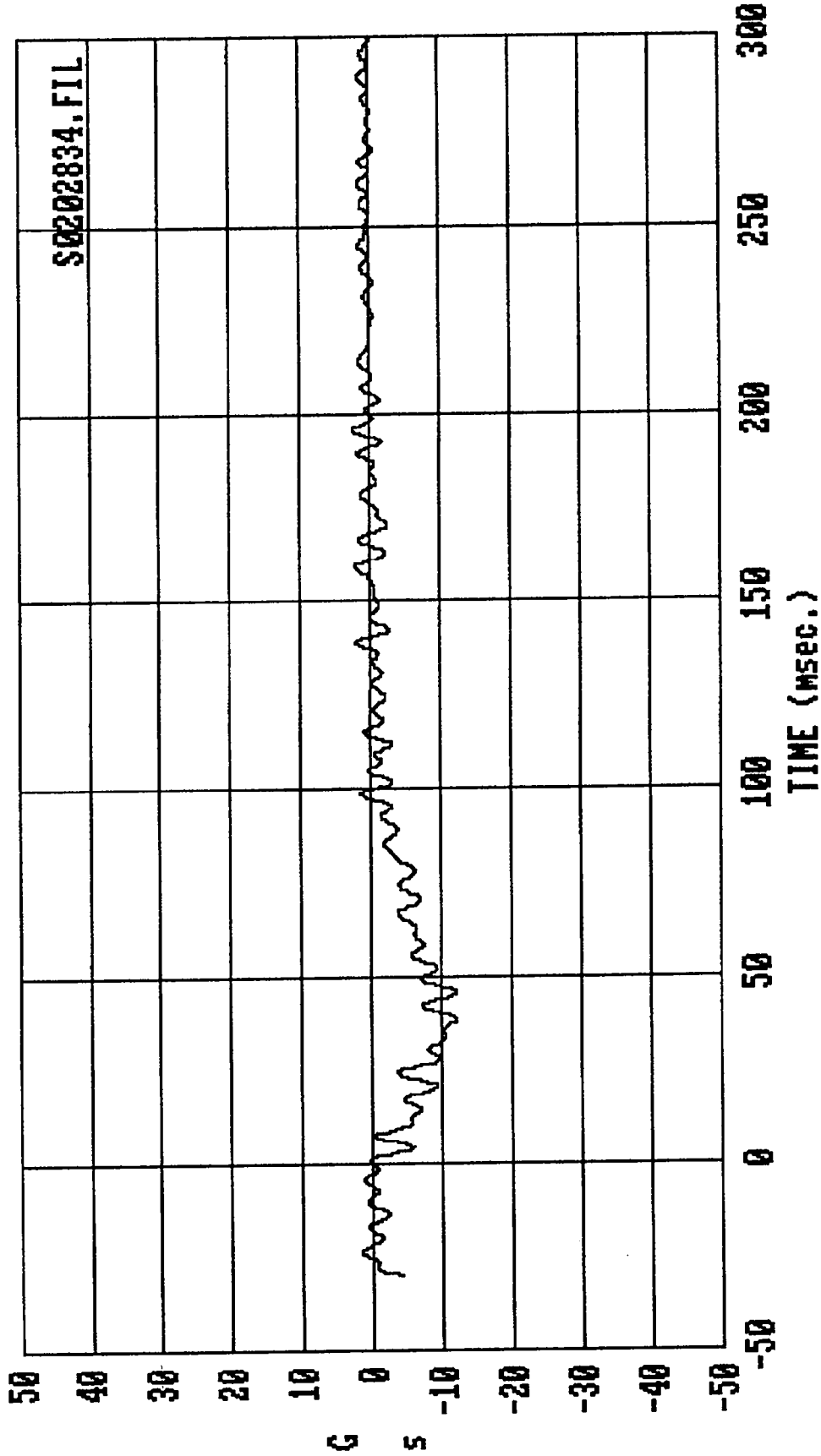
Filter: SAE CLASS 60 Max = 13.354 Min = .14368
MSE 10/28/88 -- 1988 Ford F-150 : MDB C/G resultant acceleration



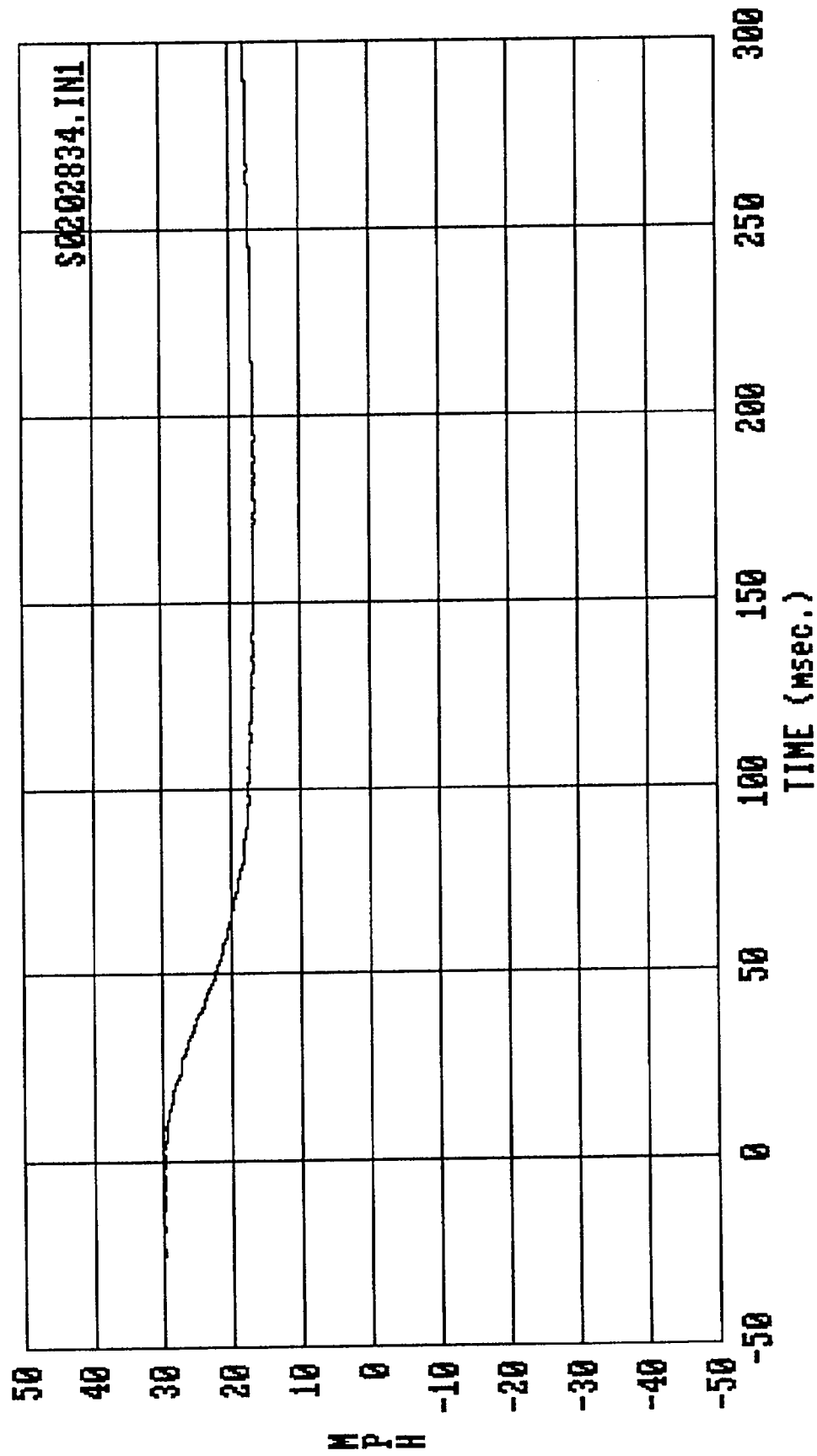
Filter: SAE CLASS 180 Max = 29.997 Min = 15.049
 MSE 10/28/88 -- 1988 Ford F-150 : Moving Barrier C/G delta U, X-axis



Filter: SAE CLASS 180 Max = 14.614 Min = 7.8903
MSE 10/28/88 -- 1988 Ford F-150 : Moving Barrier C/G delta U, Y-axis

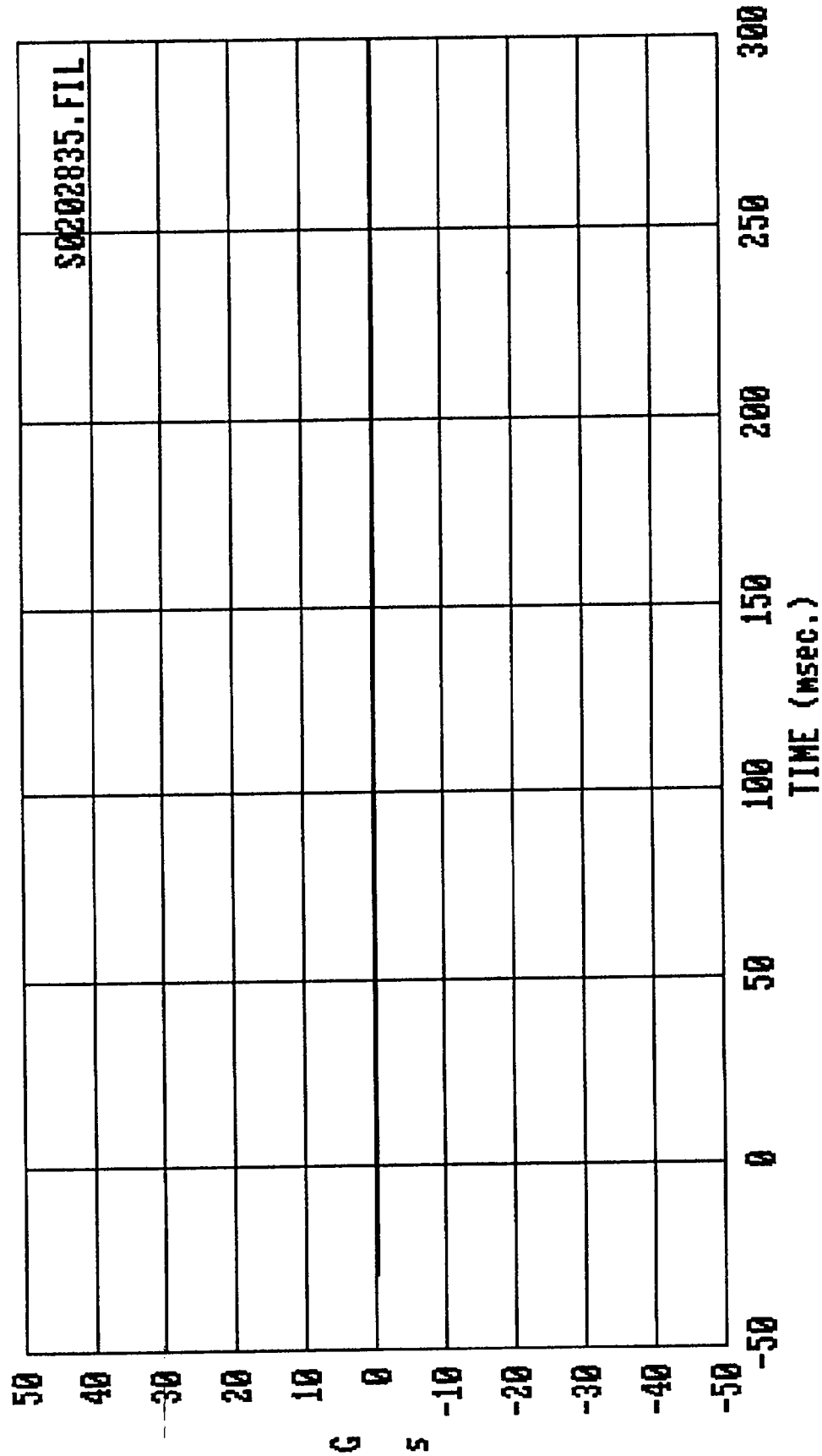


Filter: SAE CLASS 60 Max = 2.4844 Min = -12.140
 MSE 10/28/88 -- 1988 Ford F-150 : Moving Deform. Barrier Front, X-axis



Filter: SAE CLASS 180 Max = 30.184 Min = 16.631

MSE 10/28/88 -- 1988 Ford F-150 : Moving Barrier Front delta V, X-axis



Filter: SAE CLASS 60 Max = .00000 Min = .00000

MSE 10/28/88 -- 1988 Ford F-150 : Mov. Def. Barr. Rear, X-axis (No data)

APPENDIX C
SID CERTIFICATION DATA

SID IMPACT CALIBRATION SUMMARY SHEET

S.I.D. I.D. NO. : 137

LABORATORY TECHNICIAN: MARK WALKER

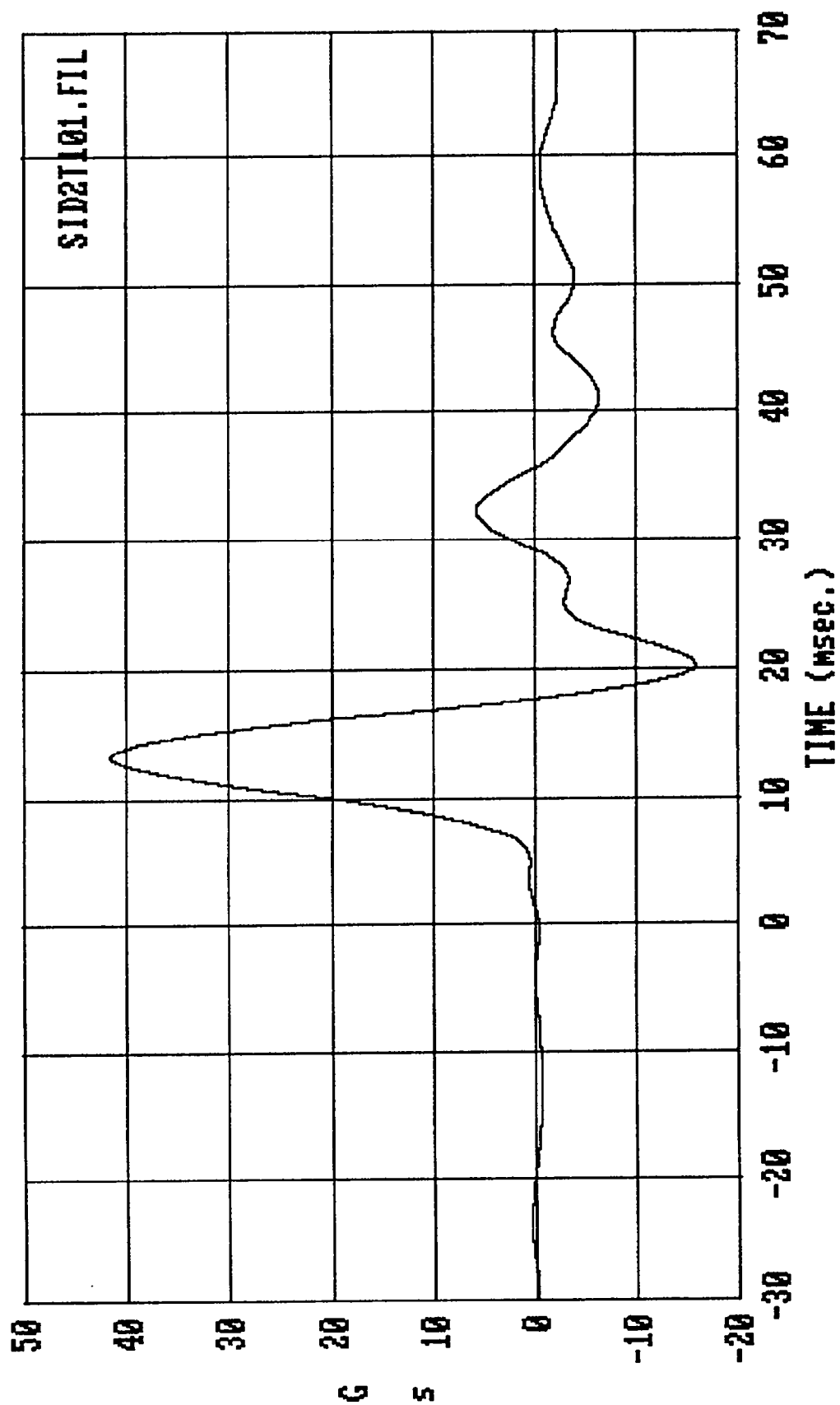
Sheet No. 1 of 3		Pretest Calibration	Posttest Calibration
Date of SID Calibration - - - - -		10/21/88	
Calibration Sequential Number for Dummy		2	3
Temperature min Lab. (Spec. = 66 to 78° F) - - -		70	
Relative Humidity in Lab. (Spec. = 10 to 70%)		70	
TEST PARAMETER	SPECIFICATION		
1. NECK BENDING TEST:			
a. Pendulum Speed - - -	21.5 to 25.5 fps	23.07	
b. Pendulum Avg. Decel (over t3 - t2) - - - -	20 to 24G	24.00	
c. Peak Resultant Head Acceleration- - - - -	26G maximum	24.98	
d. Pendulum Decel. (t2-t1)	3 ms	0.9	
e. Pendulum Decel. (t2-t2)	25 to 30 ms	27.8	
f. Pendulum Decel. (t2-t3)	10 ms	8.0	
g. Pendulum Direction Reversal Time - - - -	123 ms	—	
h. Max. Head Rotation- -	63 to 73°	63.77	
i. Chordal Displacement:			
Head Rotation Angle -			
0° Time	-2 to 2 ms	0.0	
Displ.	.5 to .5 in	0.048	
30° Time	25.6 to 34.4 ms	33.0	
Displ.	2.1 to 3.1 in.	33.0	
Time	40.3 to 51.7 ms	51.0	
60° Displ.	4.3 to 5.3 in	4.43	
Maximum Time	53.2 to 66.8 ms	56.0	
(°) Displ.	5.0 to 6.0	5.0	
2. NECK BENDING TEST			
continued:			
i. Chordal Displacement:			
Head Rotation angle-			
0° Time	67.0 to 83.0 ms	6.7	
Displ.	4.3 to 5.3 in.	4.47	
30° Time	85.4 to 104.6 ms	86.5	
Displ.	2.1 to 3.1 in.	2.16	
Time	101.0 to 123.0 ms	105.5	
60° Displ.	-.5 to 0.5 in.	0.41	

SID IMPACT CALIBRATION SUMMARY SHEET (Continued)

S.I.D. I.D. NO. : 137

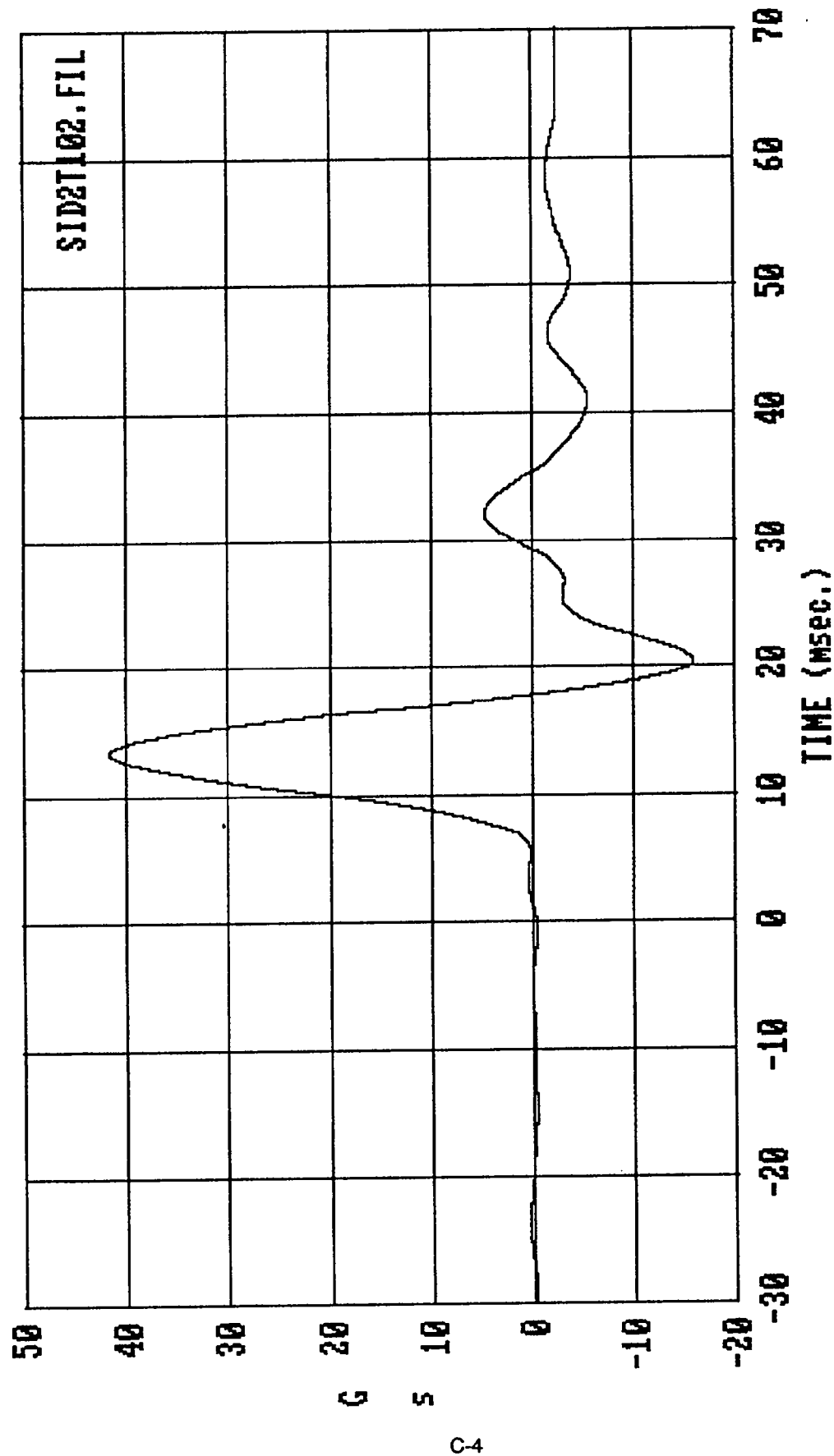
LABORATORY TECHNICIAN: MARK WALKER

Sheet No. 2 of 3 TEST PARAMETER	SPECIFICATION	Pretest	Posttest
3. ABSOMINAL COMPRESSION TEST (Preload = 10 pounds)			
a. Force @ .5" - - - -	23 - 36 lbs.	25.0	
b. Force @ .75" - - - -	36 - 50 lbs.	45.0	
c. Force @ 1.0" - - - -	50 - 63 lbs.	61.0	
d. Force @ 1.3" - - - -	73 - 88 lbs.	81.0	
4. LUMBAR FLEXION TEST:			
a. Force @ 20° - - - -	22 to 34 lbs	23.0	
b. Force @ 30° - - - -	34 to 46 lbs	43.0	
c. Force @ 40° - - - -	46 to 58 lbs	52.0	
d. Return Angle - - - -	12 maximum	10.0	
5. THORAX IMPACT TEST:			
a. Upper Rib accel. - - -	Primary 37 - 46g's Sec	41.679 41.747	
b. Lower Rib accel. - - -	Primary 37 - 46g's Sec	41.064 41.033	
c. Lower Spine accel - -	Primary 15 - 22 g's Sec	21.464 20.342	
6. PELVIC IMPACT TEST:			
Pelvic accel. - - - -	40 - 60g's	58.287	



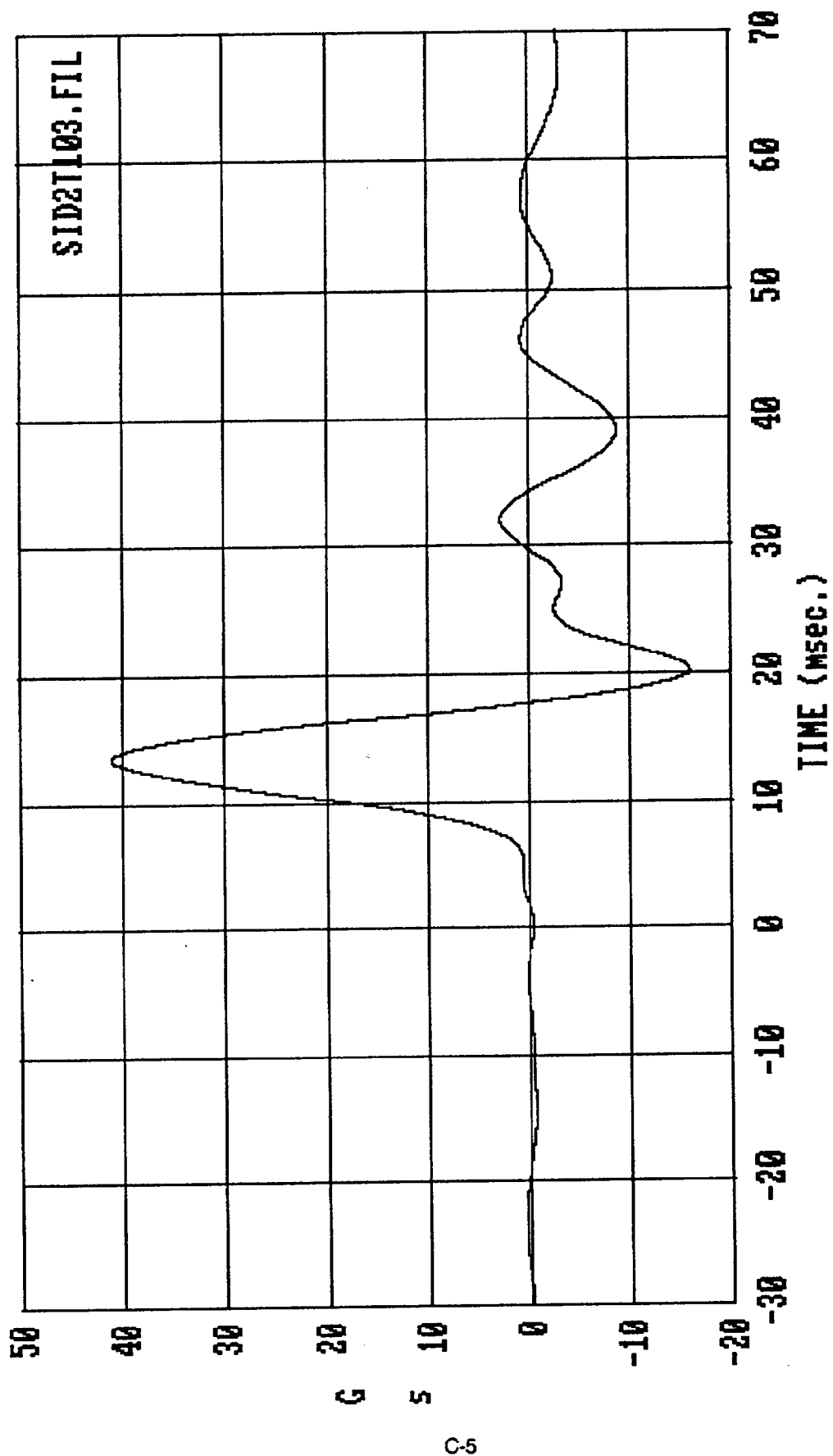
Max = 41.679 Min = -15.855

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Upper Rib acc. primary, Y-axis (FIR)



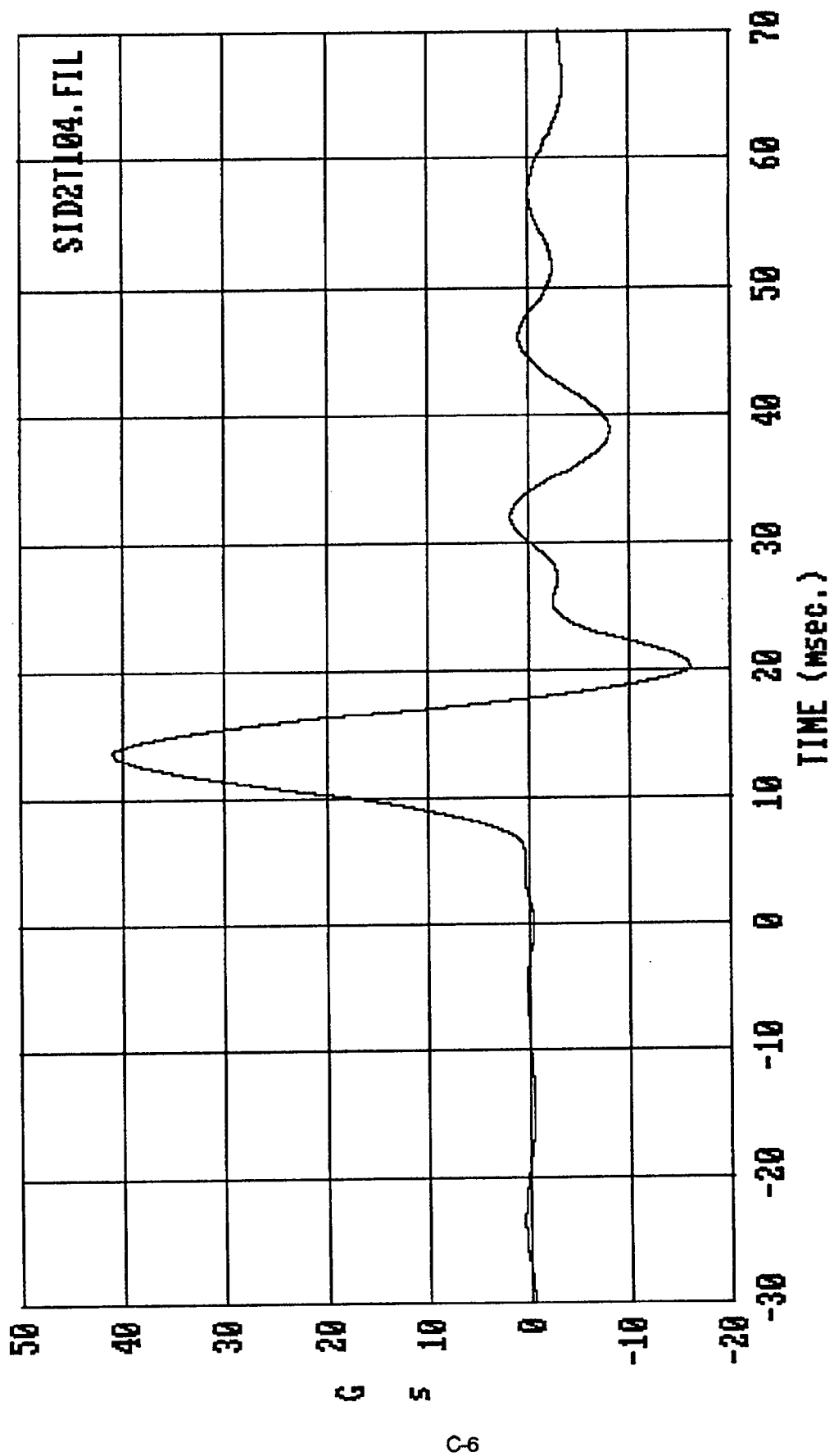
Max = 41.747 Min = -15.832

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Upper Rib acc. secondary, Y-axis (FIR)



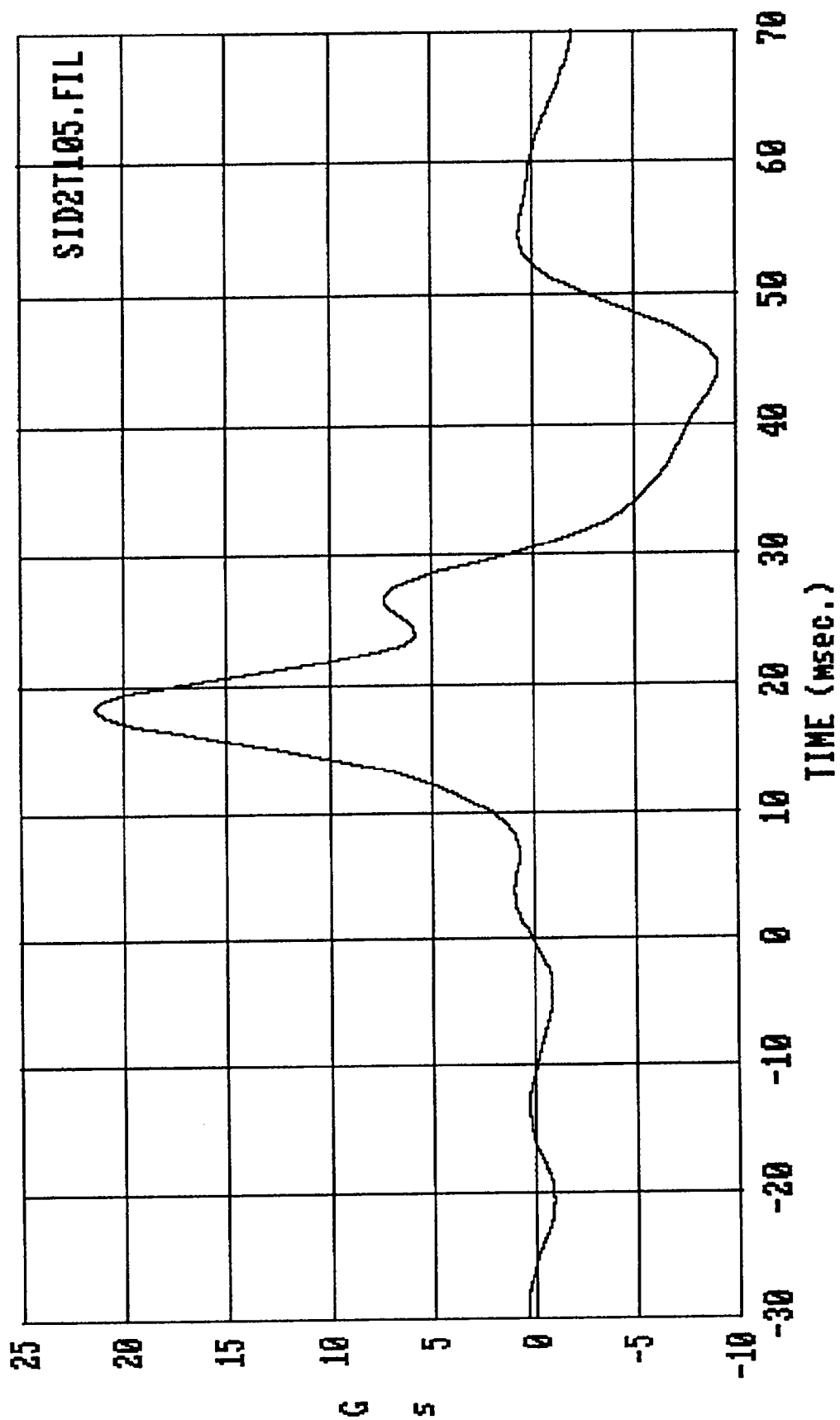
Max = 41.064 Min = -15.903

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Lower Rib acc. primary, Y-axis (FIR)



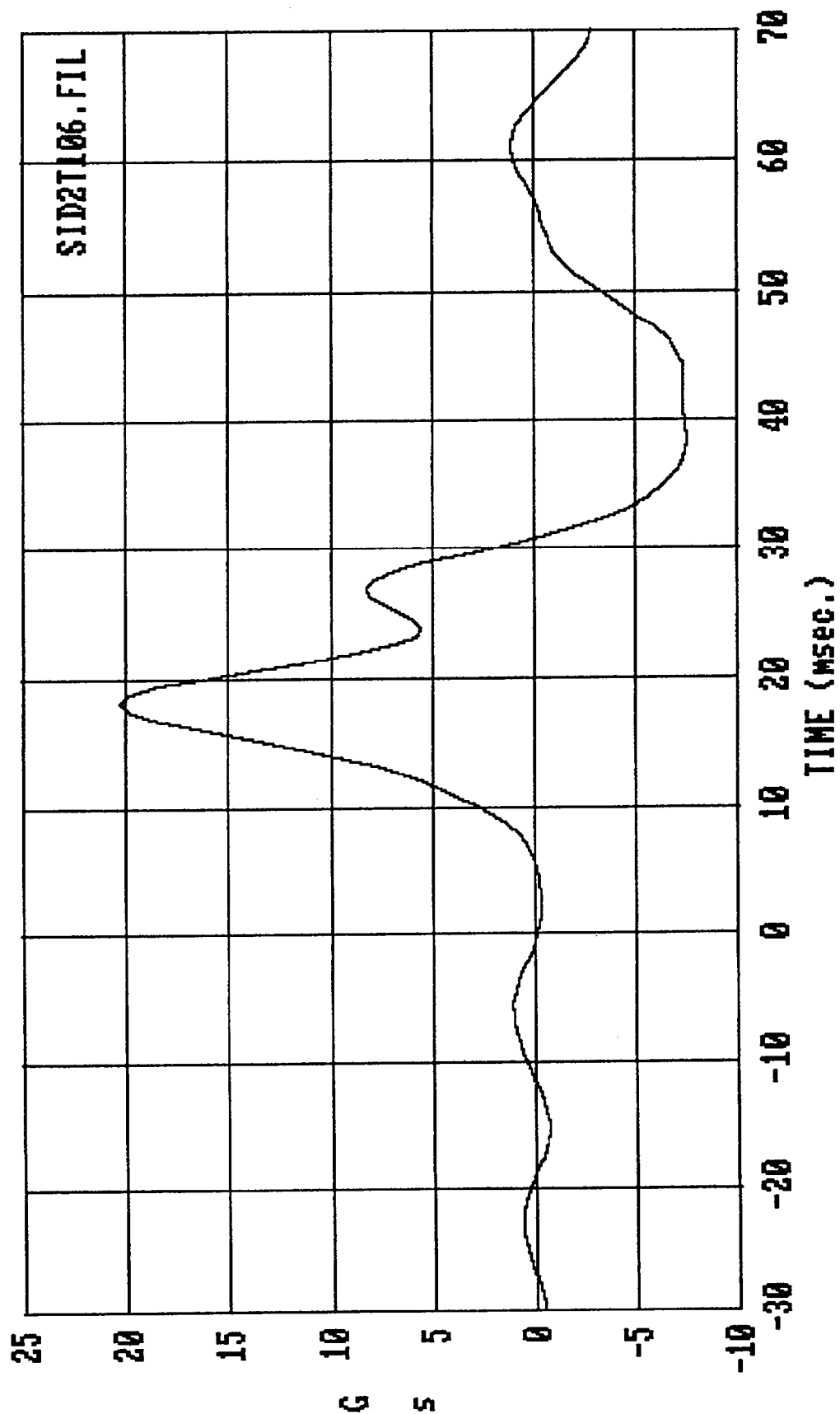
Max = 41.033 Min = -15.933

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Lower Rib acc. secondary, Y-axis (FIR)



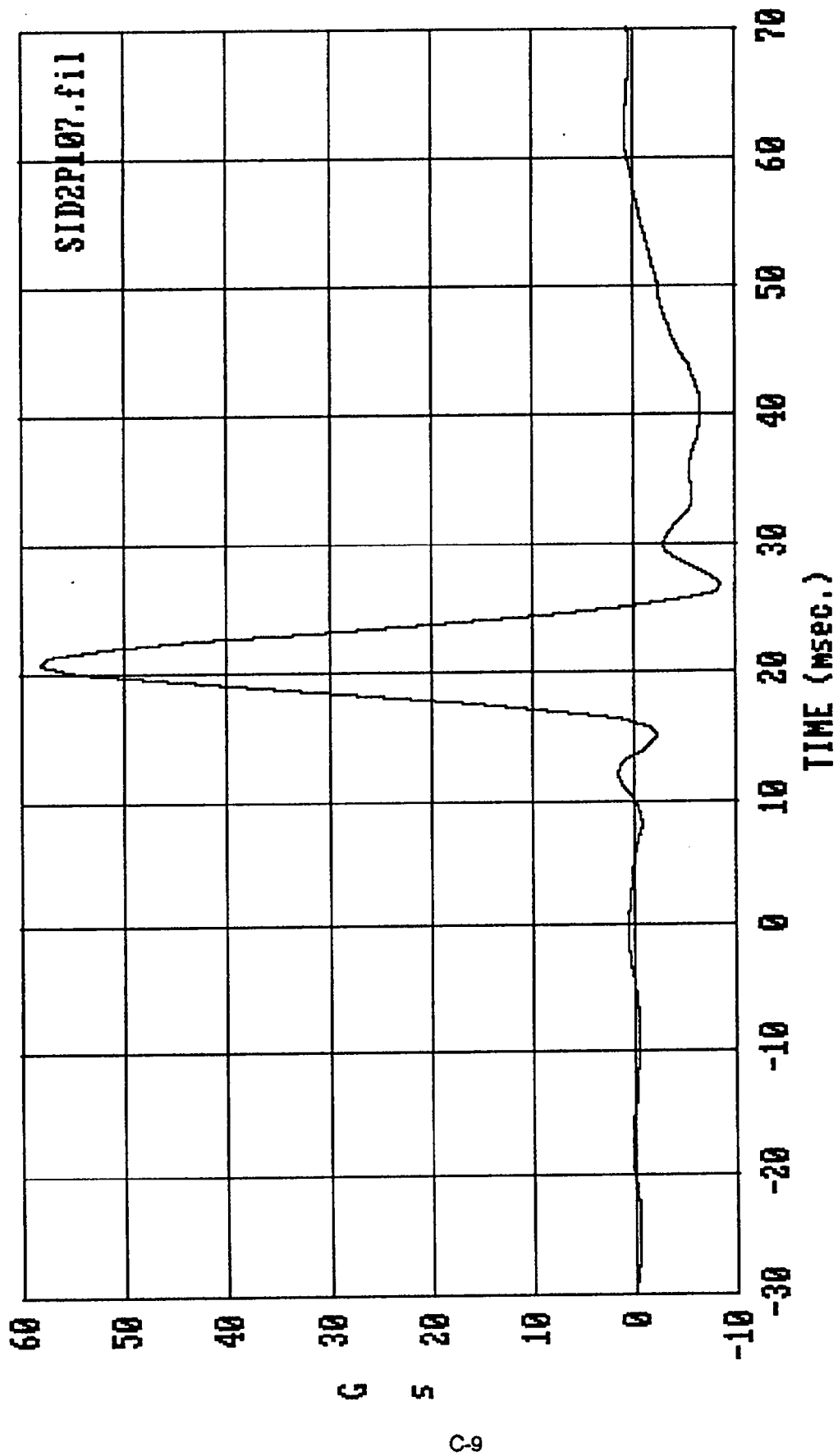
Max = 21.464 Min = -9.0541

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Lower Spine acc. primary, Y-axis (FIR)



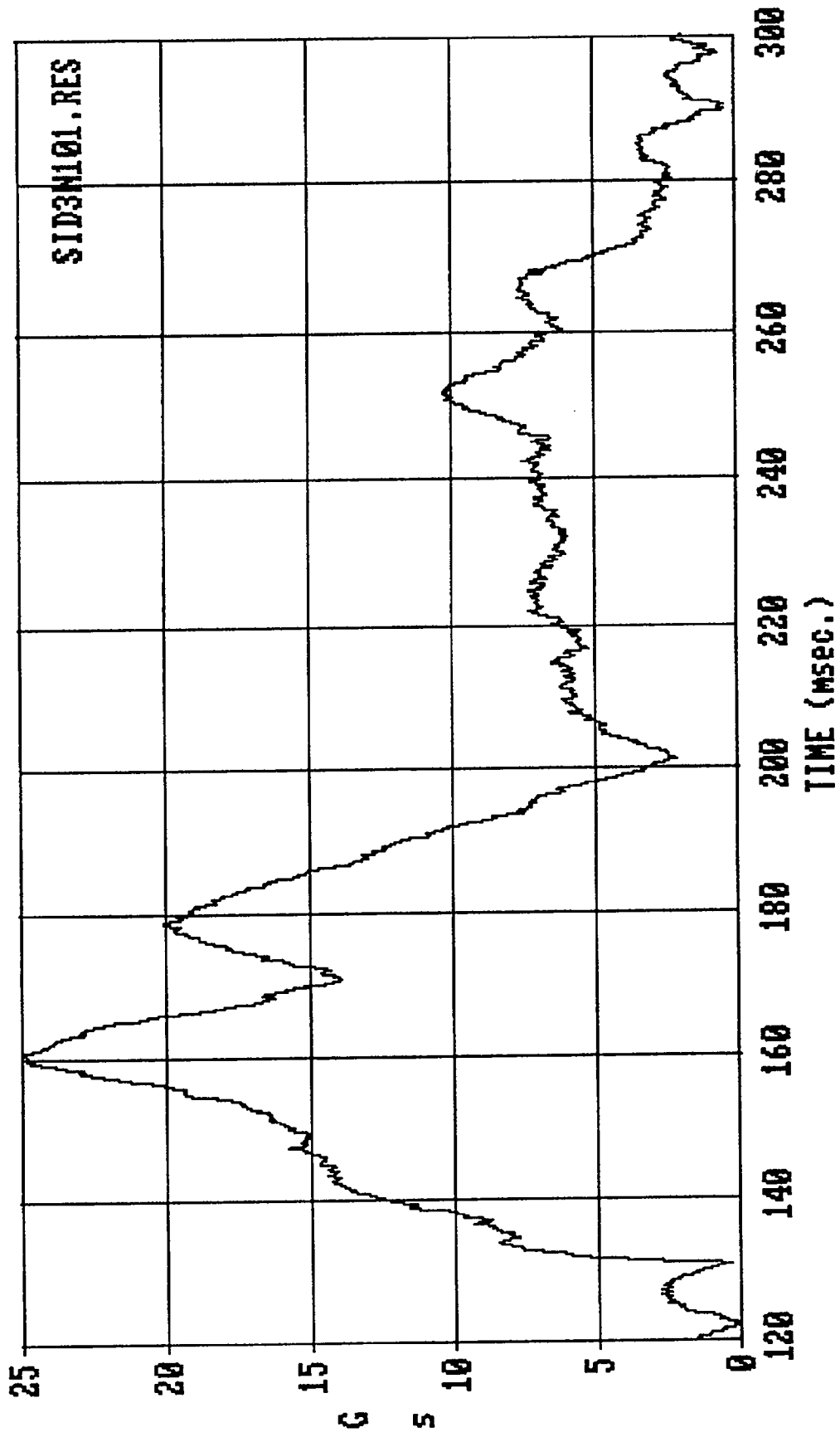
Max = 20.342 Min = -7.4395

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Lower Spine acc. secondary, Y-axis (FIR)



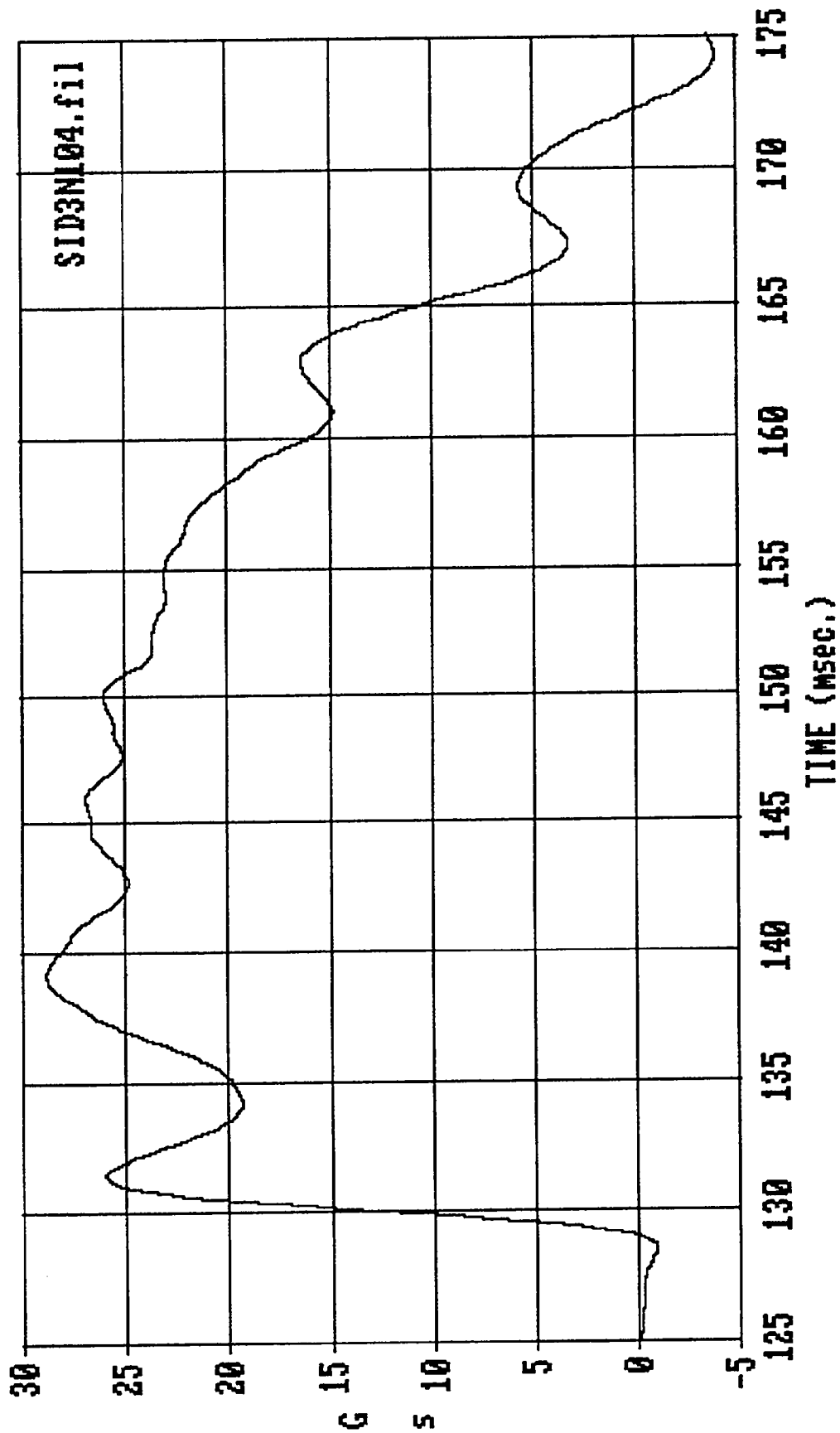
Max = 58.287 Min = -8.3967

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Pelvis acceleration, Y-axis (FIR)



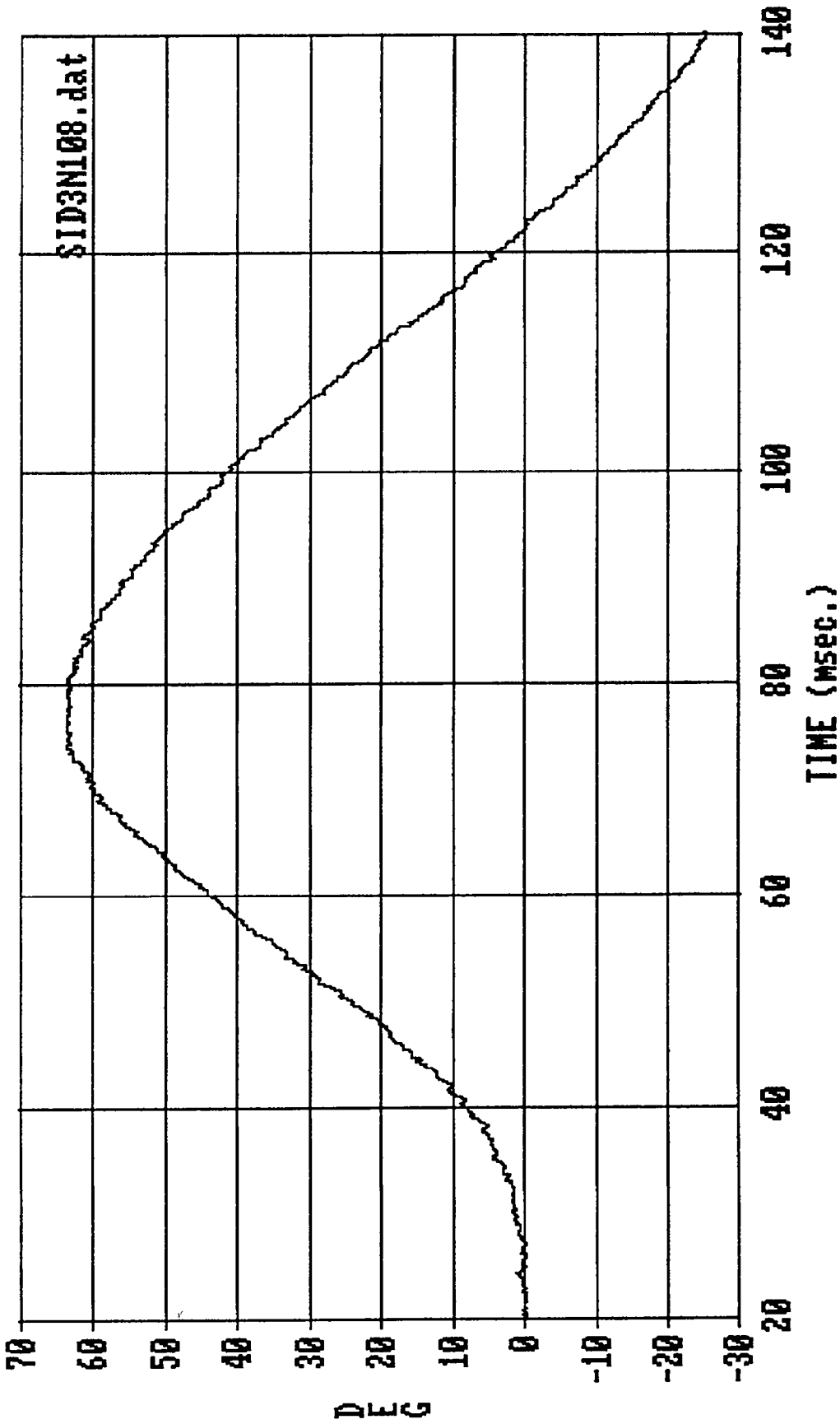
Max = 24.984 Min = .00000

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Neck Bend Resultant Head accel.



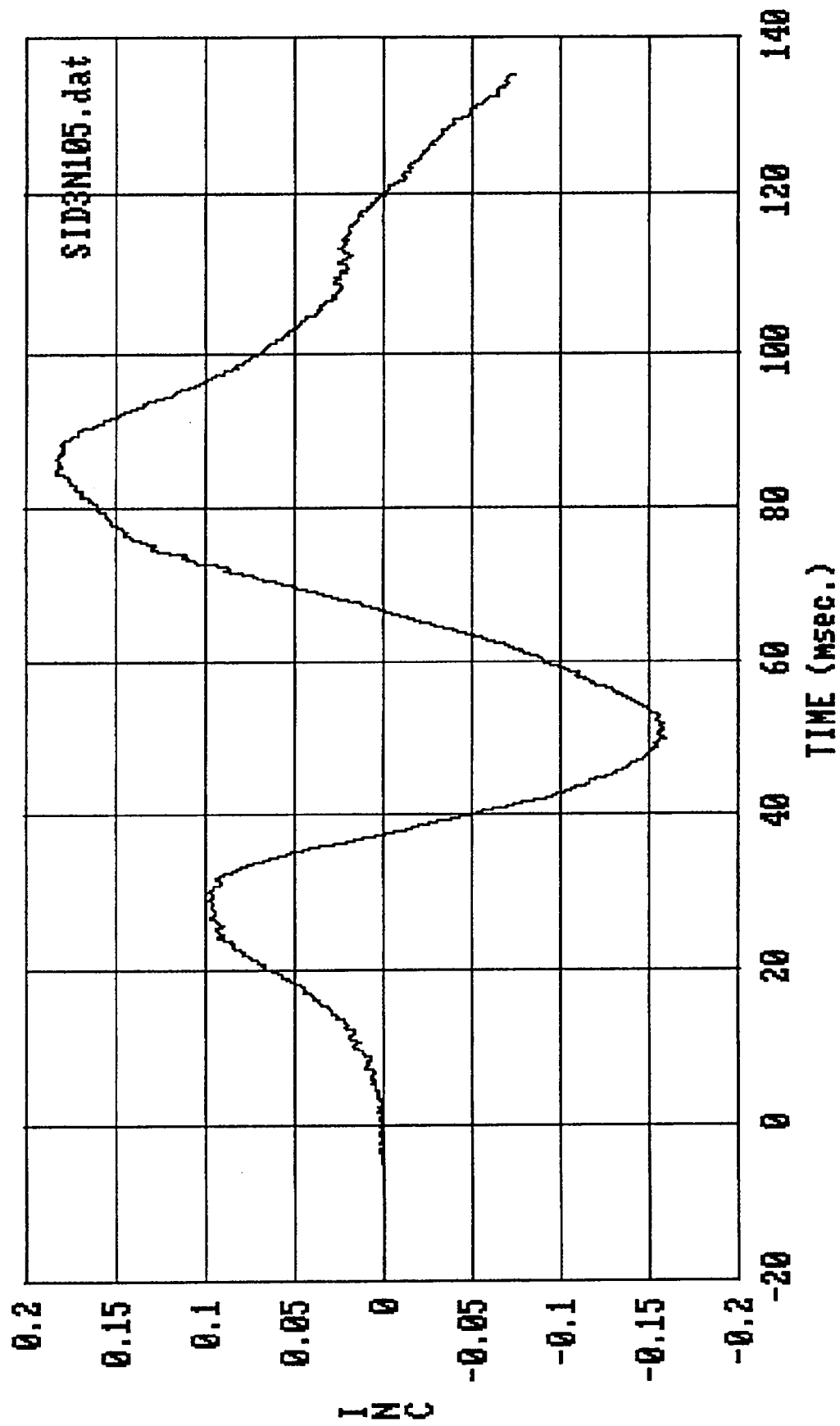
Max = 28.886 Min = -7.7987

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Neck Bend Pendulum accel.



Max = 63.767 Min = -32.223

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Neck Bend Total Head Rotation



Max = .18367 Min = -.15878

MSE 10/21/88 -- SID CAL SEQUENCE 2 : Neck Bend Chordal Displacement

APPENDIX D
SID POSITIONING PROCEDURE

SIDE IMPACT DUMMY SEATING PROCEDURE

1. Seat Positioning

- A. Place seat at the longitudinal midpoint of fore to aft adjustment (forward most locking position to rear most locking position). If no locking position is available at mid-travel, use the position immediately rearward of mid-travel.
- B. If the seat back angle is adjustable, place it in the manufacturer's stated nominal design location. If not specified, set it at the first detent rearward of 25°.
- C. Adjustable head restraints are set such that the top surface of the restraint is level with the c.g. of the dummy's head.
- D. If the seat is equipped with adjustable side or lumbar supports, they are set in their "released" or full back positions.
- E. All other seat adjustments are positioned to their mid-travel locations. If locking positions are not available at these mid-points, use the position immediately rearward, down, left, or clockwise of mid-travel. Clockwise is defined looking rear to front or left to right relative to the vehicle. This also applies to adjustable steering columns.

2. H-point Determination

- A. The SAE three-dimensional H-point machine (SAE J826 APR80 - 50th percentile male configuration) is used to locate the H-point for each surrogate (see Appendix A).

B. The H-point machine is positioned on the seat as follows:

1. Bucket or Contoured Seats - The H-point machine is centered on the bucket or contour such that its midsagittal plane is vertical and longitudinal.

2. Bench Seats

- a. Driver position - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.
- b. Outboard passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and the same distance from the longitudinal vehicle centerline as that for the driver position.
- c. Center passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical and contains the longitudinal vehicle centerline.

C. Locate the H-point position using the steps outlined in sections 4 through 6 of SAE Standard J826 APR80, unless otherwise specified in section 1 or 2 of this document. Record the coordinates of this point, relative to the vehicle, for use in section 4 of this document.

3. Test Dummies

A. All NHTSA side impact crash test use the NHTSA Side Impact Dummy (SID) as the surrogate(s), unless otherwise specified by the COTR.

- B. All dummy joints are inspected for mobility prior to each test usage and reset to hold between 1 and 2 g's. This amount just barely restrains the weight of the individual limb when it is extended horizontally.
- C. Each test dummy is clothed in form-fitting cotton stretch underwear with short sleeves and mid-calf length pants. Each foot of each dummy is equipped with a size 11EE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S-13192 and weighs 1.25 + 0.2 pounds. All the above items are supplied by the contractor.

4. Initial Dummy Placement

The SID dummy(s) is placed in the vehicle seat with its pelvis positioned such that a lateral line passing through the dummy H-point is perpendicular to the longitudinal centerplane of the vehicle.

- A. Bucket or Contoured Seats. The dummy is centered on the bucket or contoured seat such that its midsagittal plane is vertical and longitudinal. The legs are positioned as follows, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible.
 - 1. Driver position placement - The right foot of the dummy is placed on the undepressed accelerator pedal, with the heel resting on the floorpan as far forward as possible. The left knee is positioned such that the distance from the outer surface of the knee pivot bolt to the dummy's midsagittal plane is 6 inches.

2. Passenger positions placement - The knees of the dummy are initially set 11 1/2" apart, measured between the outer surfaces of the knee pivot bolt heads. If a center tunnel prevents this, place the feet on either side of the tunnel.

B. Bench Seats.

1. Driver position placement - The dummy is placed in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.
2. Outboard passenger positions - The dummy is placed in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical, longitudinal, and the same distance from the vehicle centerline as that for the driver position.
3. Center passenger positions - The dummy is positioned in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical and contains the vehicle centerline.

5. Initial Dummy Positioning

A. H-point Positioning.

1. With the dummy laterally positioned as in section 4, insert the pelvis angle indicator bar in the hole provided above, and to the rear of the dummy H-point. Position the longitudinal pelvis angle between 23° and 25° to the horizontal. This may be accomplished by

raising the legs or flexing the upper torso forward and allowing the pelvis to rotate. The lateral pelvis angle is to be horizontal.

2. Apply sufficient force on the lower torso in a horizontal and vertical direction to place the dummy H-point at the coordinates obtained in section 2.
 3. If the H-point cannot be placed at the desired coordinates, adjust the pelvis angle within the 2° band and reposition to the coordinates. After repositioning the H-point, any deviation from the desired coordinates is recorded and used to indicate actual H-point locations. This deviation is not to exceed 1/2".
- B. Upper Torso Positioning. The dummy's upper torso should rest against the seat back. If not, adjust the upper torso, maintaining the H-point location and pelvis angle, so that the dummy's back rests against the seat back. If this cannot be done, modify the H-point location and/or pelvis angle within the allowable bands until the back rests against the seat.

6. Final Dummy Positioning

- A. Driver Position. Without inducing pelvis or torso movement, the dummy's right foot is placed on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. If possible within these constraints, the dummy's thighs should be in contact with the seatpan.

- B. Front Passenger Positions. Without inducing pelvis or torso movement, place the dummy's feet on the vehicle's toeboard with the heel resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible such that the heels rest on the floorpan.
- C. Rear Passenger Positions. Without inducing pelvis or torso movement, the feet are placed flat on the floorpan and beneath the front seat as far forward as possible without front seat interference. If necessary, change the distance between the knees as required to place the feet beneath the seat. Record the new distance.
- D. Vehicles with wheelhouse projections in the passenger compartment. The foot(feet) in question is placed in the well of the floorpan/toeboard and not on the wheelhouse projection. This is done by twisting the foot at the ankle, maintaining the upper and lower leg positions outlined in section 4. If this does not resolve the situation, move the leg of the foot in question just enough to achieve the correct position, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible. Record the new distance between the knees.
- F. Prior to conducting the test, the dummy position is visually checked. The dummy is to be properly positioned laterally with its midsagittal plane vertical and longitudinal, and the upper torso resting against the seat back. The H-point and pelvis angle are to be within the specified ranges and the foot, knee, and leg placements are to be as outlined.

The COTR is to be satisfied with the final dummy position and any deviations from this procedure are to be approved by the COTR.

- G. The final dummy position is recorded. These measurements are to include, but not be limited to, pelvis and head angles as well as actual H-point and head c.g. locations relative to the vehicle. The straight line distance from the H-point to the center of the outer ankle bolt is also recorded for one of the legs (eg. left H-point to left ankle bolt).