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SIDE IMPACT PROTECTION IN PRODUCTION VEHICLES

MDB-TO-CAR SIDE IMPACT TEST OF A 26' CRABBED MOVING DEFORMABLE BARRIER TO A 1988 NISSAN PICKUP AT 33.5 MPH

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FEBRUARY 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 Nissan 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, crabbed 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 November 09, 1988.

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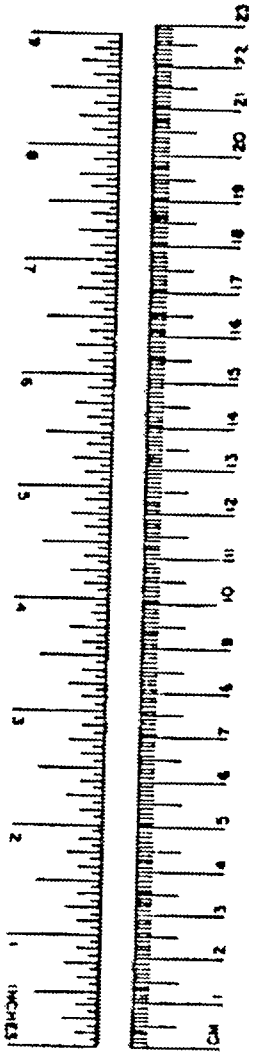
METRIC CONVERSION FACTORS

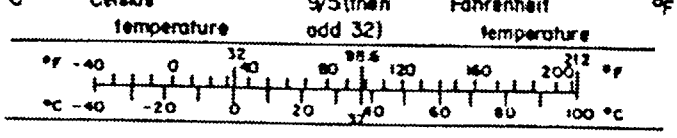
APPROXIMATE CONVERSIONS FROM METRIC MEASURES

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



APPROXIMATE CONVERSIONS FROM METRIC MEASURES

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
mm	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 (10,000 m^2)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	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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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 Nissan Pickup. The test was performed on 09 November 1988 at an actual impact speed of 33.2 mph. The leading left-hand edge of the MDB contacted the test vehicle 34.0 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 Nissan Pickup, Test No. 2, was tested on 09 November 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/NISSAN/NL-XEV/PICKUP

VEHICLE NHTSA NO.: TEST 02 VIN: 1N6ND11S7JC320137

VEHICLE BODY COLOR: WHITE ; MONTH & YEAR OF MANUFACTURE: 11/87

ENGINE: Cyl.;145.8 C.I.D. ____ Liters; Placement; X Longitudinal; __ Lateral

X Gas; ___ Diesel; ___ Turbocharged

TRANSMISSION: 4 Speed; X Manual; ___ Automatic; ___ Overdrive

FINAL DRIVE: ___ Front Wheel Drive; X Rear Wheel Drive; ___ Four Wheel Drive

DATE VEHICLE AVAILABLE FOR SIDE IMPACT TESTING: JULY 1988

ODOMETER READING: 48 miles; OPTIONS: ___ A/C; ___ P/S; ___ P/Wdo; _____

___ Tilt Whl.; ___ Cruise Control

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): 26 psi Front; 34 psi Rear

Recommended Tire Size: P185/75R14

Tires On Vehicle: P185/75R14 ; Manufacturer: Goodyear

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 = 1191* lb (A)

No. Of Occupants x 150 lb - - - = 450 lb (B)

Cargo Capacity (A - B)- - - - - = 741 lb

*GVWR - Delivered Weight

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Right Front = 773 lb

Left Front = 742 lb

Right Rear = 630 lb

Left Rear = 664 lb

TOTAL WEIGHT = 2809 lb

TOTAL FRONT = 1515 lb (53.9% of TOTAL)

TOTAL REAR = 1294 lb (46.1% of TOTAL)

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

CALCULATION OF TEST VEHICLE TARGET WEIGHT:

Total Test Vehicle Delivered Weight With Maximum Fluids = 2809 lb
Maximum Cargo Carrying Capacity Of Test Vehicles* - - - = 300 lb
Weight Of Two P.572 Dummies (1 x 164 lb)- - - - - - - - = 174 lb
TEST VEHICLE TARGET WEIGHT- - - - - - - = 3283 lb

* 300 lb for light trucks and MPVs

ACTUAL WEIGHT OF TEST VEHICLE WITH 1 DUMMY AND CARGO:

Right Front = 872 lb
Left Front = 897 lb — TOTAL FRONT = 1769 lb (53.9% of TOTAL)
Right Rear = 684 lb
Left Rear = 830 lb — TOTAL REAR = 1514 lb (46.1% of TOTAL)
TOTAL WEIGHT = 3283 lb (which includes 100 lb of cargo ballast weight)

TEST VEHICLE ATTITUDE:

As Delivered		Ready For Test	
Right Front	29.4 in	Right Front	28.3 in
Left Front	29.3 in	Left Front	28.5 in
Right Rear	30.5 in	Right Rear	28.7 in
Left Rear	30.4 in	Left Rear	29.0 in

Test Vehicle Wheelbase: 104.4 in; C.G. = 48.1 in rearward of front wheel centerline

TOTAL VEHICLE LENGTH:

Right Side = 178.5 in
Left Side = 178.5 in
Centerline = 180.3 in

TABLE 2-2 PRETEST CONDITIONS

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1988/NISSAN/NL-XEV/PICKUP

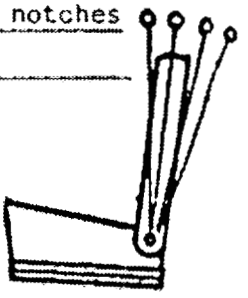
VEH. NHTSA NO. TEST 02 ; TEST DATE: 11/09/88

FRONT SEAT CUSHION PLACEMENT: Midpoint of forward/aft travel(6th notch rearward

TOTAL NUMBER OF ADJUSTMENT POSITIONS OR DETENTS: 13 notches

FRONT SEAT BACK ADJUSTMENT POSITION: Not Adjustable

(latch position, knob rotations, etc.)



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 19.75 Gal
Rear Optional Tank N/A Gal
(92 to 94% of USABLE CAPACITY)

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

Wheelbase = 104.4 in
Impact point is 15.2 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/NISSAN/XEV/PICKUP

VEH. NHTSA NO. N/A ; VIN: 1N6ND11S7JC320137

TEST DATE: 11/09/88 BUILD DATE: 11/87

OVERALL LENGTH = 180.3 inches; OVERALL WIDTH = 65.0 inches

TEST WEIGHT: Left Front = 897 lb; Left Rear = 830 lb

Right Front = 872 lb; Right Rear = 684 lb

SUBTOTALS - - - Front = 1769 lb Rear = 1514 lb

TOTAL VEHICLE WEIGHT - - - - - - - - - - - - - - = 3283 lb

WHEELBASE = 104.4 inches

LONGITUDINAL C.G. FROM CENTER OF FRONT AXLE = 48.1 inches

IMPACT ANGLE WITH RESPECT TO IMPACTOR = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

			Right	Crush
1.	LEVEL 1 (16.0" above ground) = 1.2 inches		15	24
2.	LEVEL 2 (27.5" above ground) = 10.4 inches		27.2	17.5
3.	LEVEL 3 (30.3" above ground) = 14.5 inches		27.5	17.5
4.	LEVEL 4 (43.4" above ground) = 14.5 inches		29.2	10.4
5.	LEVEL 5 (59.6" above ground) = 8.4 inches		30.8	1.2

MAXIMUM POSTTEST INTRUSION = 14.5 inches

OCCUPANTS:	DRIVER	LEFT REAR
TYPE OF DUMMY - - - -	SID	N/A
RESTRAINT USED- - - -	None (Manual Belts)	N/A (Manual Belts)

INSTRUMENTATION:

NUMBER OF DATA CHANNELS = 28

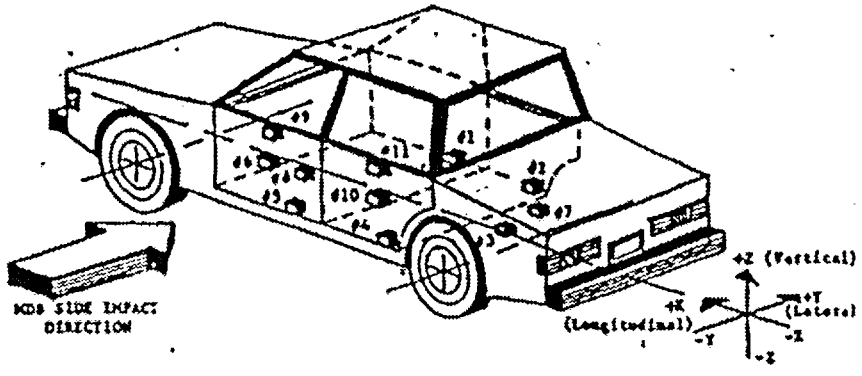
NUMBER OF CAMERAS: ONBOARD = 4 High-speed

OFFBOARD = 4 High-speed, 1 Real-time

TABLE 2-4 TEST VEHICLE ACCELOMETER LOCATIONS AND DATA SUMMARY

TEST VEHICLE: NISSAN NL-XEV PICKUP NHTSA NO.: N/A

TEST DATE: 11/09/88

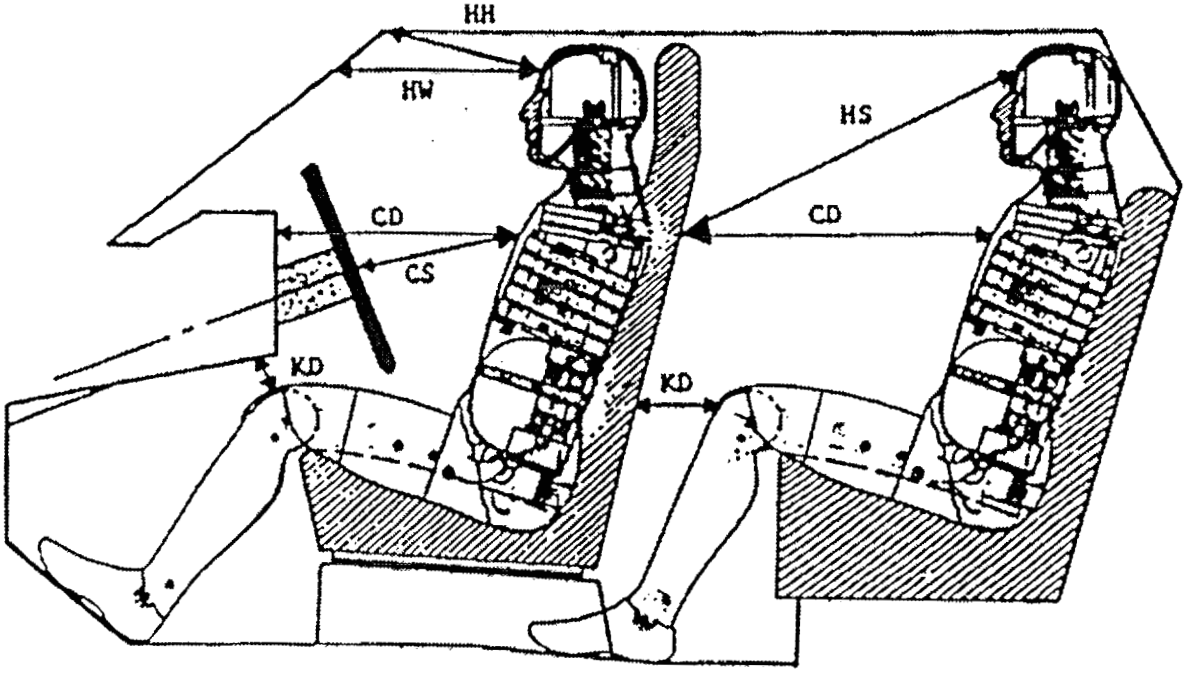


ACCEL. NO.	LOCATION	COORDINATES(")			LONG. (X) POS. / NEG.		LAT. (Y) POS./ NEG.		VERT. (Z) POS./ NEG.		RESULTANT POS./ NEG	
		X*	Y*	Z*	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	Right Side Sill At Front Seat	90.5	24.5	16.3	-7.0	52.0	28.8	18.4	26.8	23.2	33.5	23.4
2	Right Side Sill At Rear Seat	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
3	Right Floorpan Above Axle	46.5	0.0	25.8	-9.0	12.0	36.2	7.0	-10.1	38.6	37.5	7.1
4	Left Side Sill At Rear Seat	NA	NA	NA			NA	NA				
5	Left Side Sill At Front Seat	101.5	-24.8	16.0			51.9	19.8				
6	Left Front Door on Centerline	112.0	-29.7	29.2			249.7	7.0				
7	Right Rear Occ. Compartment	NA	NA	NA	NA	NA						
8	Midrear of Left Front Door	91.2	-30.0	29.2			178.2	5.6				
9	Left Front Door Upper Centerline	108.9	-30.0	37.9			147.1	13.2				
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)

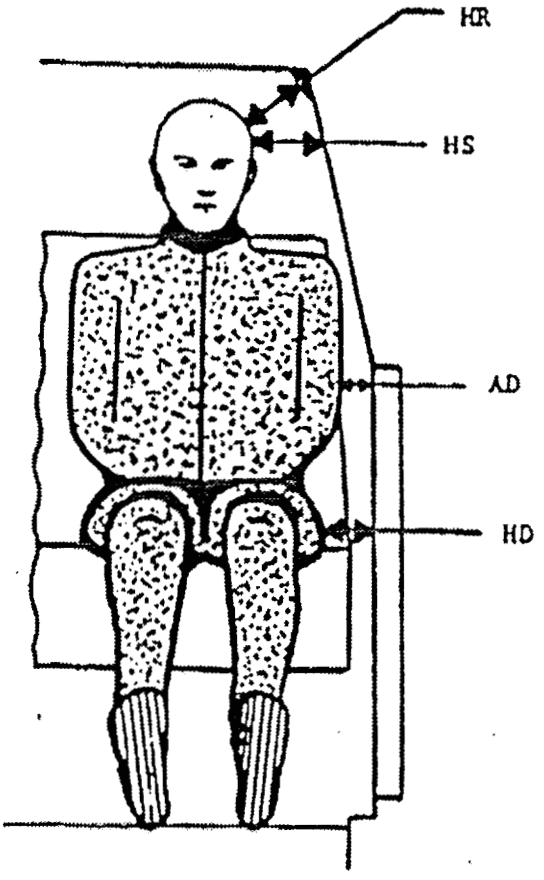
Rear floor above axle
See 15.31

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



	DRIVER ID # 137	REAR PASSENGER ID # N/A
HH	14.0 in	NA in
HW	19.9 in	NA in
HS	N/A in	NA in
CD	21.7 in	NA in
CS	12.1 in	NA in
KDL	5.7 in	NA in
KDR	6.0 in	NA in

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



	DRIVER ID # 137	REAR PASSENGER ID # N/A
HR	6.2 in	NA in
HS	9.6 in	NA in
AD	3.7 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. MAX (g)	DIRECT. TIME (msec)	NEG. MAX (g)	DIRECT. TIME (msec)	POS. MAX (g)	DIRECT. TIME (msec)	NEG. MAX (g)	DIRECT. TIME (msec)
HEAD ACCELERATIONS:								
Longitudinal --- X	33.3	299.9	-37.0	89.2	NA	NA	NA	NA
Lateral ------- Y	35.1	48.0	-12.8	36.0	NA	NA	NA	NA
Vertical ------ Z	3.7	24.8	-46.3	62.2	NA	NA	NA	NA
RESULTANT ----- R	46.5	62.2	0.0	0.0	NA	NA	NA	NA
HIC ----------*	233.26				NA	NA	NA	NA
RIB ACCELERATIONS:								
1. Upper Rib Lateral Y*	93.4	34.4	-13.4	71.9	NA	NA	NA	NA
2. Upper Rib Lateral Y*	83.8	35.0	-10.8	82.5	NA	NA	NA	NA
1. Lower Rib Lateral Y*	96.3	35.6	-14.9	59.4	NA	NA	NA	NA
2. Lower Rib Lateral Y*	97.5	35.6	-14.6	59.4	NA	NA	NA	NA
SPINE ACCELERATIONS:								
1. Upper Lateral Y*	110.6	40.6	-46.4	61.9	NA	NA	NA	NA
2. Upper Lateral Y*	107.6	40.6	-65.4	61.9	NA	NA	NA	NA
1. Lower Lateral Y*	97.3	38.1	-23.1	64.4	NA	NA	NA	NA
2. Lower Lateral Y*	93.7	38.1	-23.2	64.4	NA	NA	NA	NA
PELVIS ACCELERATIONS:								
Lateral Y*	158.5	28.7	-4.1	142.5	NA	NA	NA	NA
RIB DEFLECTION:	0.1	172.4	-1.7 in	83.9	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 IMPACT (MDB) TEST DATE 11/09/88

NHTSA NO. FOR TARGET VEHICLE: NA

POSITION OF IMPACTOR (MDB) ON MONORAIL: CRABBED 26°

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 = 1077 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 = 33.21 MPH

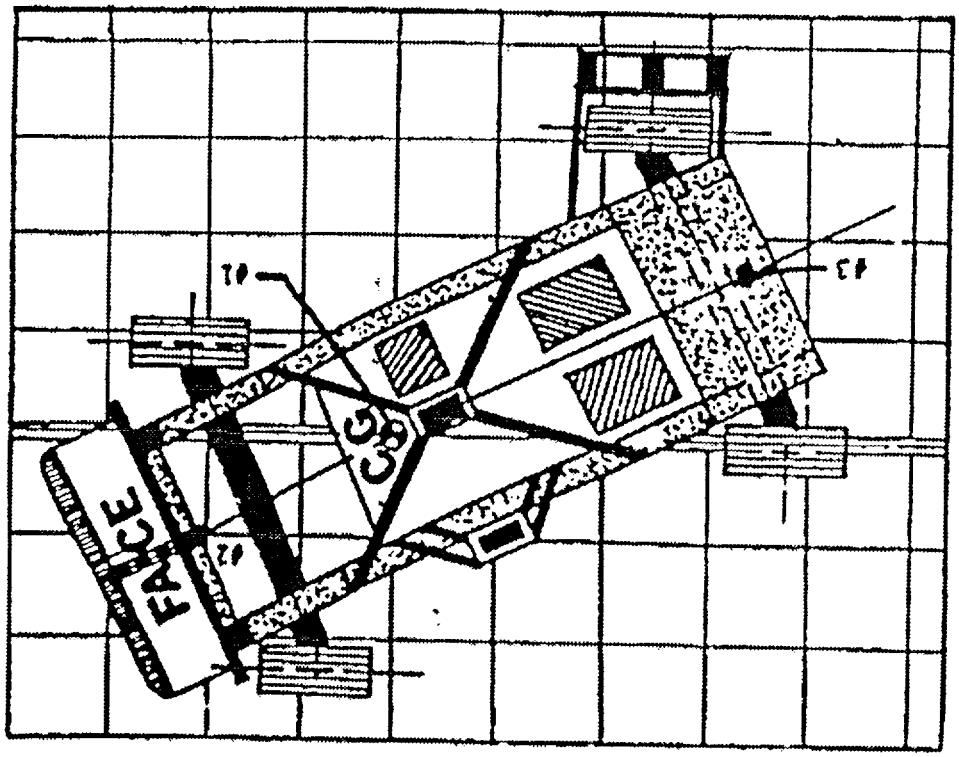
MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

1. ROW A at bumper level = 4.3 in.
2. ROW B at mid-stack level = 2.0 in.
3. ROW C at top of stack level = 5.3 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 X*	Y*	Z*	POS. MAX (g)	DIRECT TIME (msec)	NEG. MAX (g)	DIRECT TIME (msec)
1	MDB Center of Gravity							
	Longitudinal X				0.1	150.3	-11.6	39.5
	Lateral Y				1.2	162.7	-5.3	45.1
	Vertical Z	56.4	0.0	12.0	8.6	23.6	-4.9	18.1
	Resultant R				0.4	262.4	13.6	23.7
2	Front Frame Member Longitudinal X	121.4	0.0	9.8	5.8	173.5	-17.5	28.4
3	Rear Frame Member Longitudinal X	2.5	0.0	14.0	2.0	292.4	-11.0	26.8

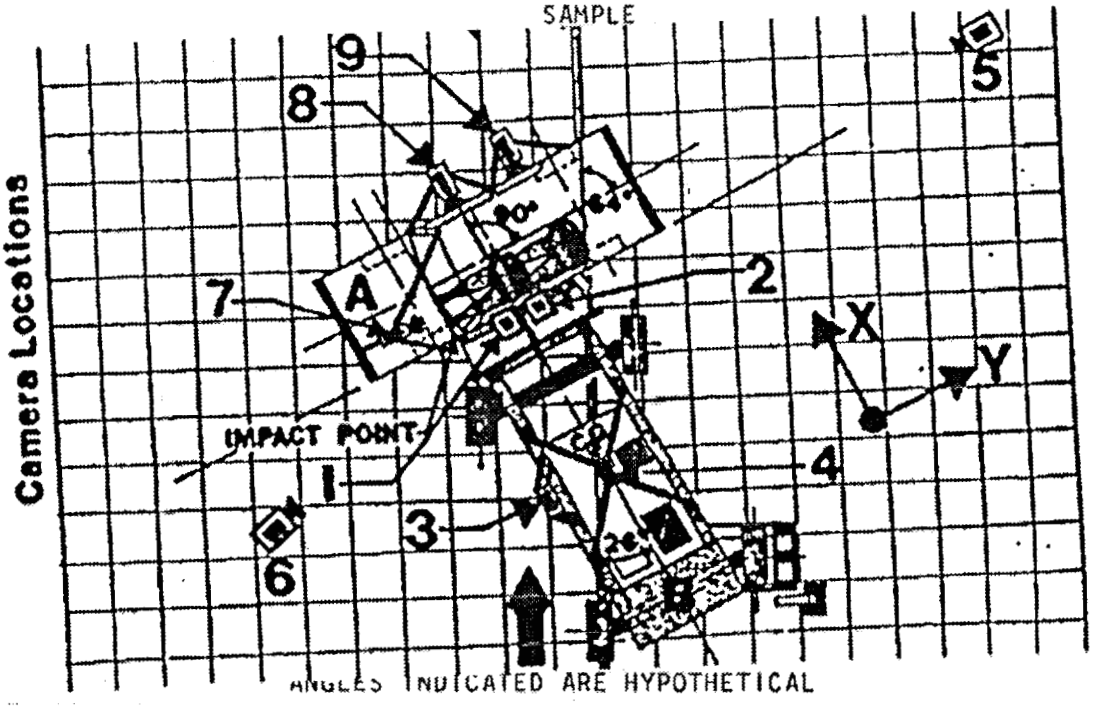
*Reference: X - Rearmost Frame Point (+ Forward)
Y - Centerline of MDB (+ Right)
Z - ground Level (+Up)

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	16	600	0	18	252
2	Overhead Closeup view of impact plane	Fastex	28	600	0	38	252
3	MDB Onboard Closeup view of impact point	Himac	16	600	-88.2	18	49.3
4	MDB Onboard view of driver dummy kinematics	Himac	16	600	-117.9	33	80.5
5	Overhead view of test Level--Overall View	Fastex	13	600	-18	54	39
6	Left Side Ground Level--Overall View	Photo-sonic	16	600	0	-208	48
7	Test Vehicle Onboard-driver dummy front view kinematics	Fastex sonic	16	600	45	18	53
8	Test Vehicle Onboard-driver dummy side view kinematics	Fastex	16	600	-36	85	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



SECTION 3

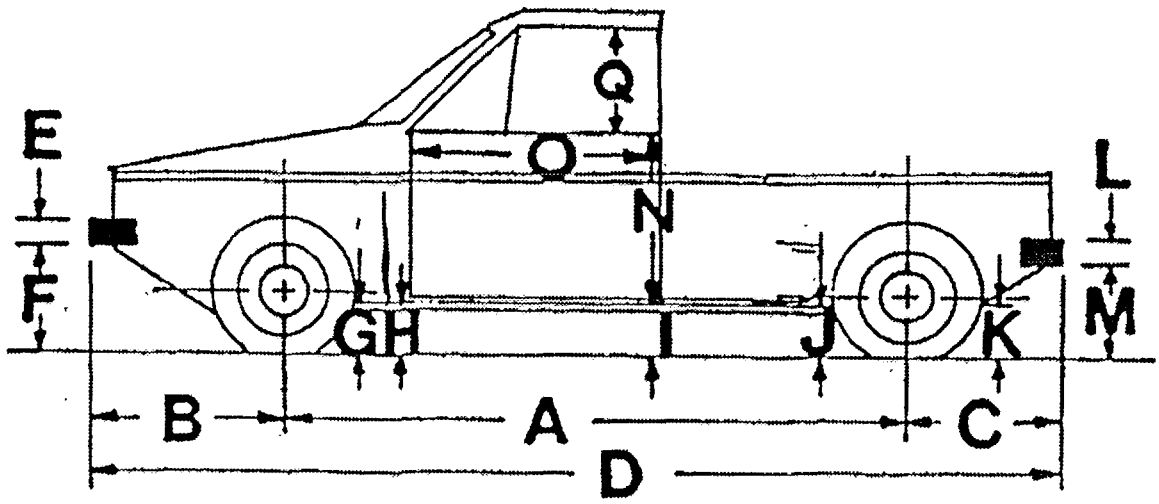
TEST RESULTS

The 1988 Nissan Pickup was impacted at 33.2 mph by the 26° crabbed MDB on 09 November 1988. The MDB's left edge contacted the test vehicle 3.0 inches rearward 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 14.5 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 contacted the aluminum barrier 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 in two places. The SID ended up sitting in the passenger position facing towards the driver side with his back up against the passenger door. 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 5.3 inches on the upper left-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	104.4	106.9	0.0
B	27.9	27.3	0.6
C	46.5	48.2	-1.7
D	178.5	178.0	0.5
E	7.0	7.0	0.0
F	16.3	15.6	0.7
G	11.1	12.2	-1.1
H	14.9	16.7	-1.8
I	15.6	19.9	-4.3
J	13.8	17.2	-3.4
K	17.2	19.8	-2.6
L	6.1	6.1	0.0
M	16.7	19.1	-2.4
N	25.7	21.5	4.2
O	46.1	44.3	1.8
P	N/A	N/A	N/A
Q	17.3	17.0	0.3

TABLE 3-2 VEHICLE SIDE MEASUREMENT

TEST VEHICLE NHTSA NO.: TEST #02

LEVEL 5 @	Window Top	57.8	in
LEVEL 4 @	Window Sill	39.6	in
LEVEL 3 @	Mid Door	27.5	in
LEVEL 2 @	Occupant H-Point	27.1	in
LEVEL 1 @	Axle Centerline Height (or Sill Top Height)	15.0	in

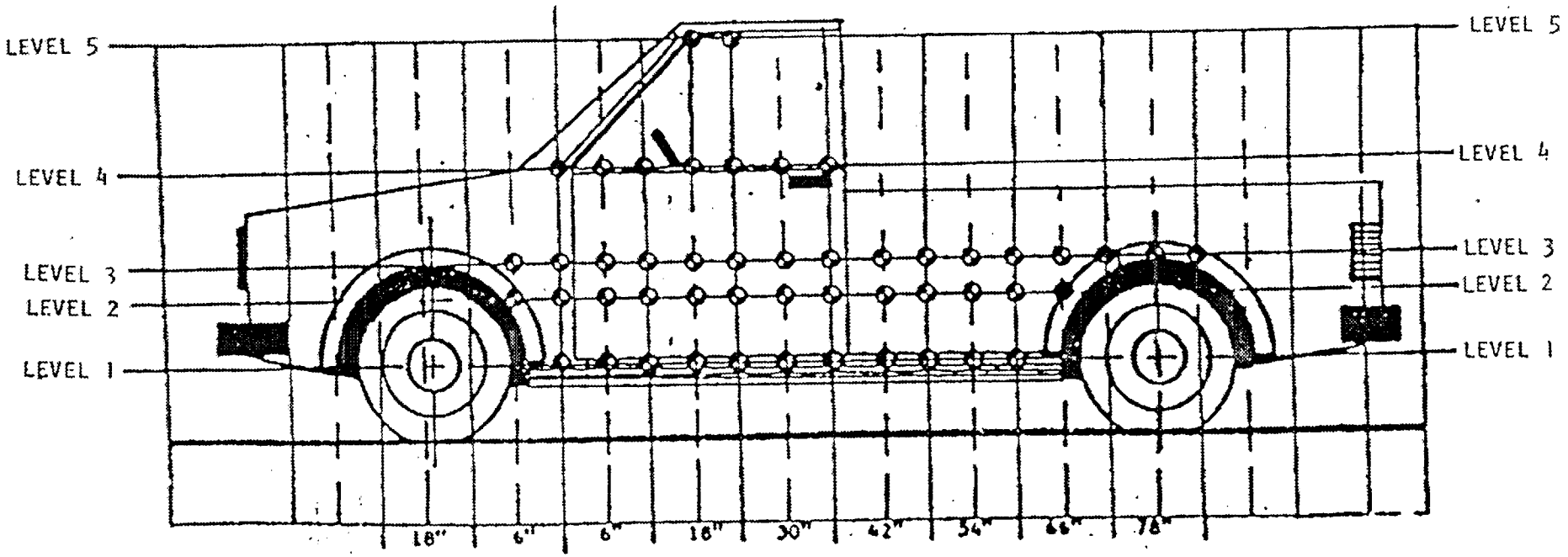


TABLE 3-3 TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE* AND STATIC CRUSH DATA

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	57.8	Posttest- - - -	NA	NA	NA	NA	22.5	23.3	23.3	23.6	23.9	23.9	NA	NA	NA	NA
		Pretest - - - -	NA	NA	NA	NA	22.4	22.6	22.6	22.6	22.7	22.7	NA	NA	NA	NA
		Static Crush- -	NA	NA	NA	NA	0.1	0.7	1.0	0.7	1.2	1.2	NA	NA	NA	NA
2. Window Sill	39.6	Posttest- - - -	17.5	17.8	20.0	23.1	25.0	25.8	25.5	25.3	25.3	24.8	22.8	26.0	27.3	26.8
		Pretest - - - -	17.5	17.3	17.3	17.1	17.1	17.0	16.9	16.9	16.9	16.9	16.9	16.9	16.9	16.9
		Static Crush- -	0.0	0.5	2.7	6.0	7.9	8.8	8.6	8.4	8.4	7.9	6.9	9.1	10.4	9.9
3. Mid-Door	27.5	Posttest- - - -	NA	16.1	22.5	29.5	30.0	30.1	29.9	29.4	28.9	28.7	29.4	29.4	28.4	28.7
		Pretest - - - -	NA	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6
		Static Crush- -	NA	0.5	6.9	13.9	14.4	14.5	14.3	13.8	13.3	13.1	13.8	13.8	12.8	13.1
4. H-Point	27.2	Posttest- - - -	NA	16.1	22.5	29.5	30.0	30.1	29.9	29.4	28.9	28.7	29.4	29.4	28.4	28.7
		Pretest - - - -	NA	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.6	15.5
		Static Crush- -	NA	0.5	6.9	13.9	14.4	14.5	14.3	13.8	13.3	13.1	13.8	13.8	12.8	20.0
5. Axle Centerline	15.0	Posttest- - - -	NA	19.0	19.5	19.8	20.8	21.0	21.5	21.8	22.3	22.0	26.3	26.0	26.0	26.0
		Pretest - - - -	NA	18.0	18.1	17.8	17.8	17.8	17.8	17.8	17.9	17.9	17.9	17.9	17.9	17.9
		Static Crush- -	NA	1.0	1.5	2.0	3.0	3.2	3.7	4.0	4.4	4.1	8.4	8.1	8.1	8.1

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

TABLE 3–4A PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 1 – WINDOW TOP – 57.8" ABOVE GROUND LEVEL

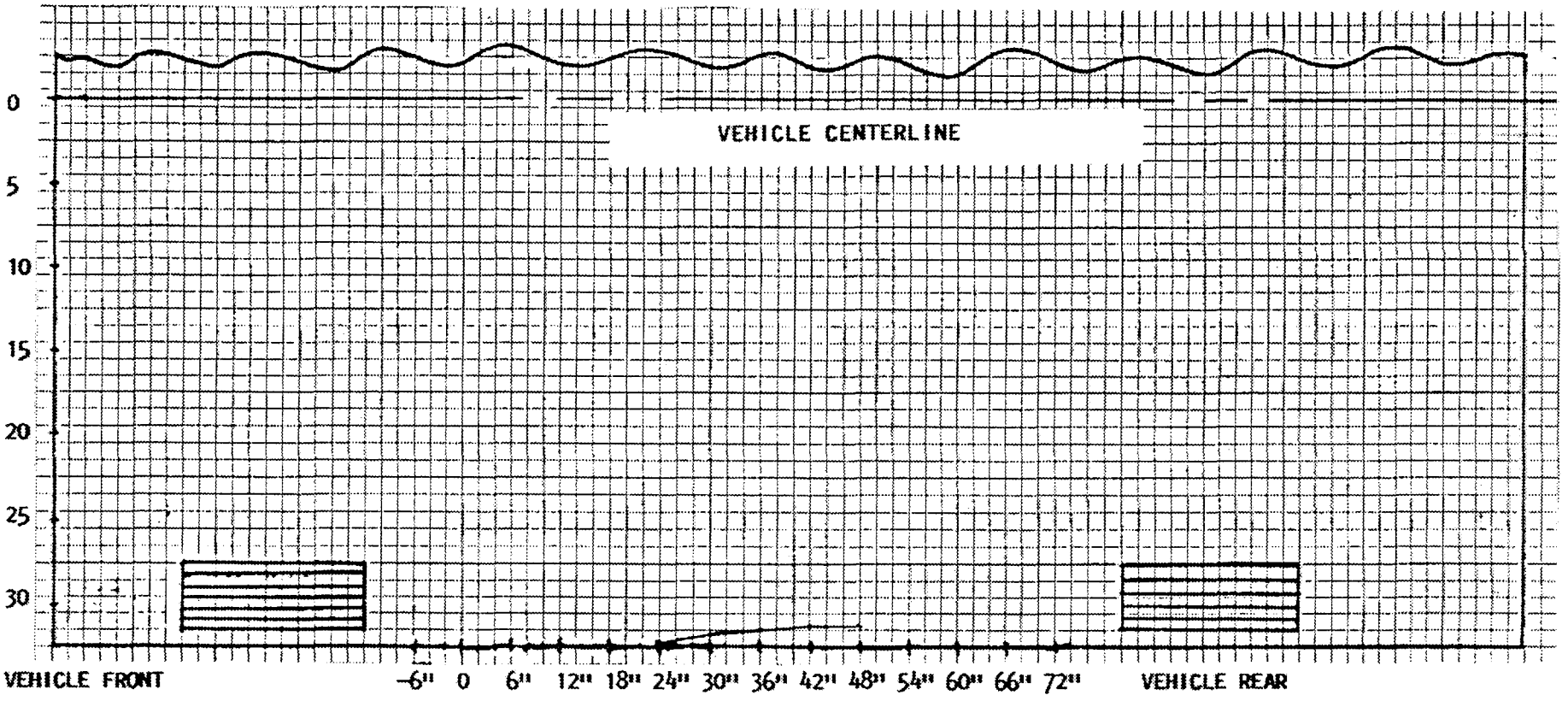


TABLE 3-4B PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 2 – WINDOW SILL – 39.6" ABOVE GROUND LEVEL

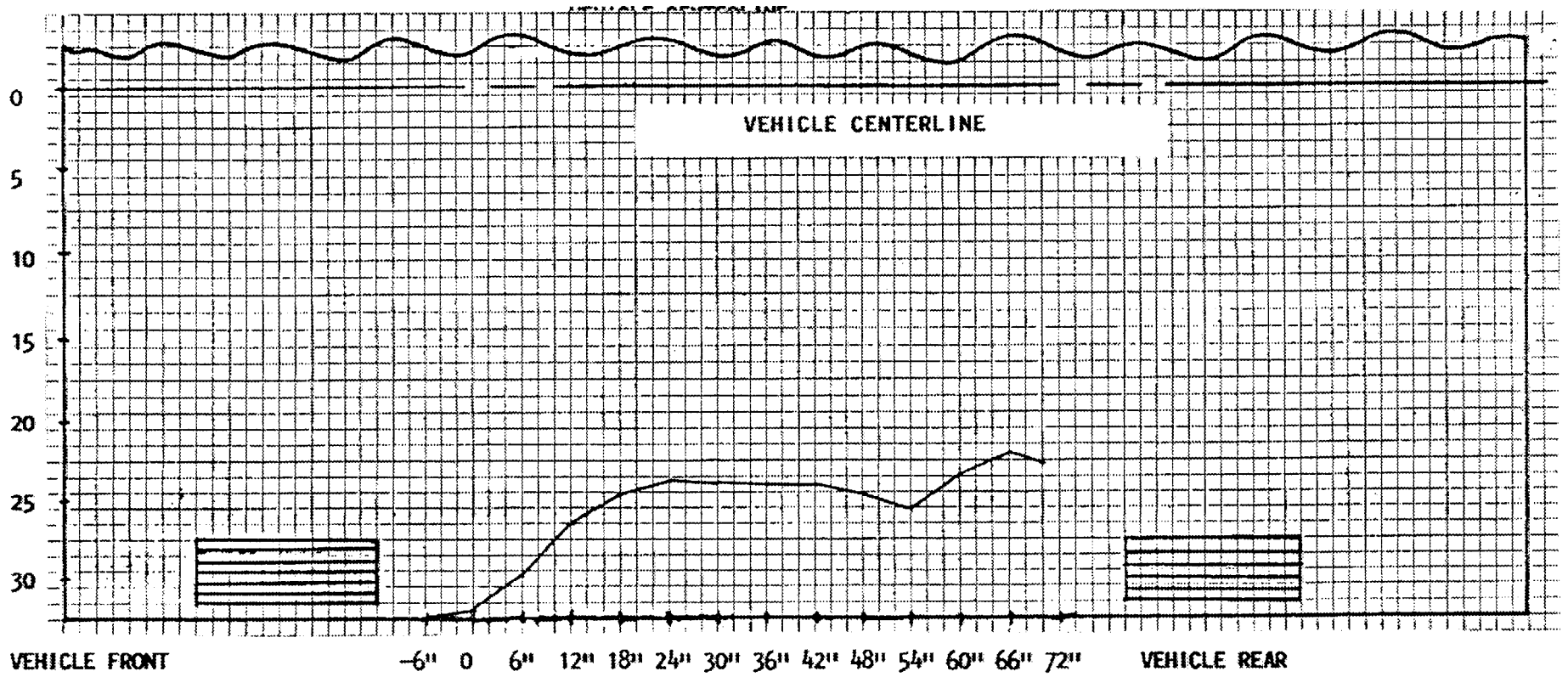


TABLE 3-4C PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 3 - MID DOOR - 27.5" ABOVE GROUND LEVEL

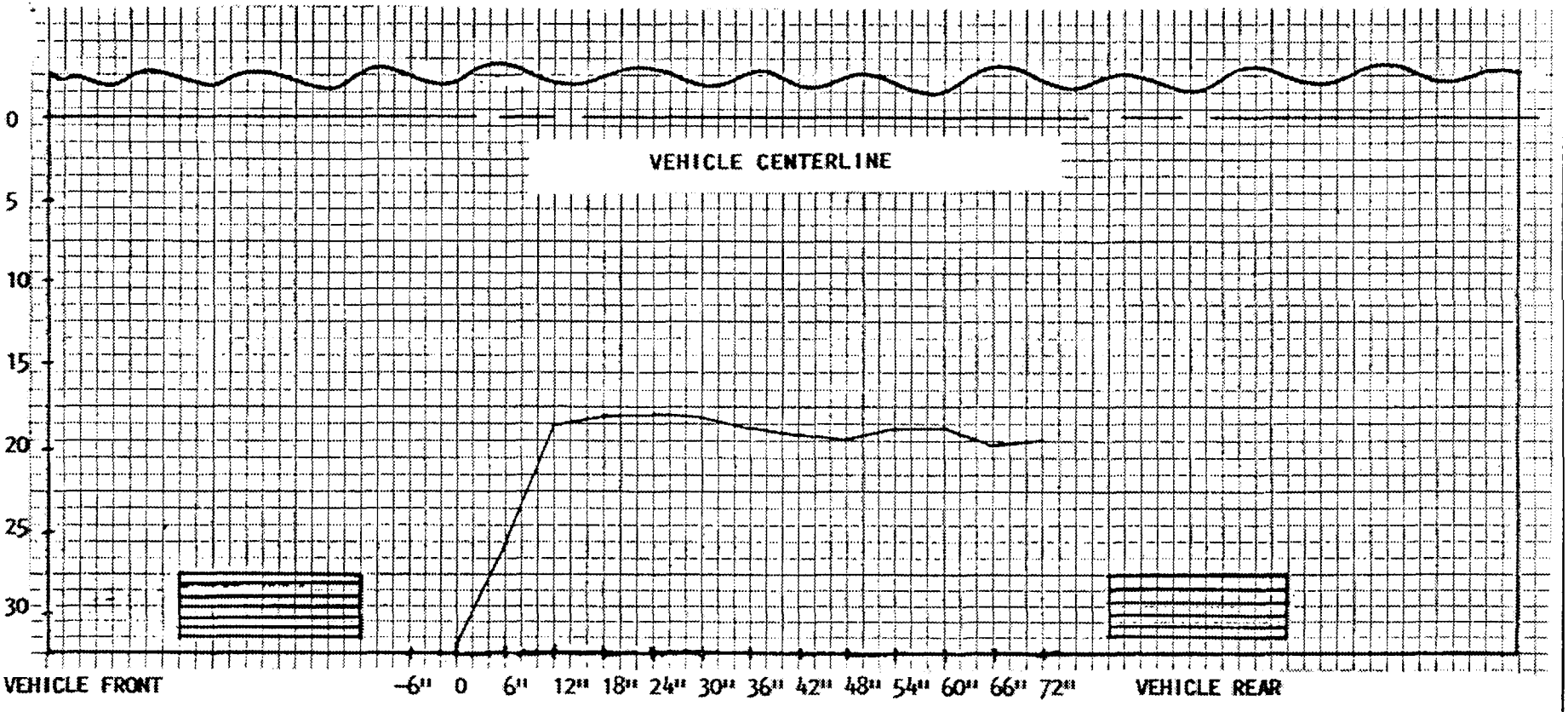


TABLE 3-40 PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 4 - H POINT - 27.2" ABOVE GROUND LEVEL

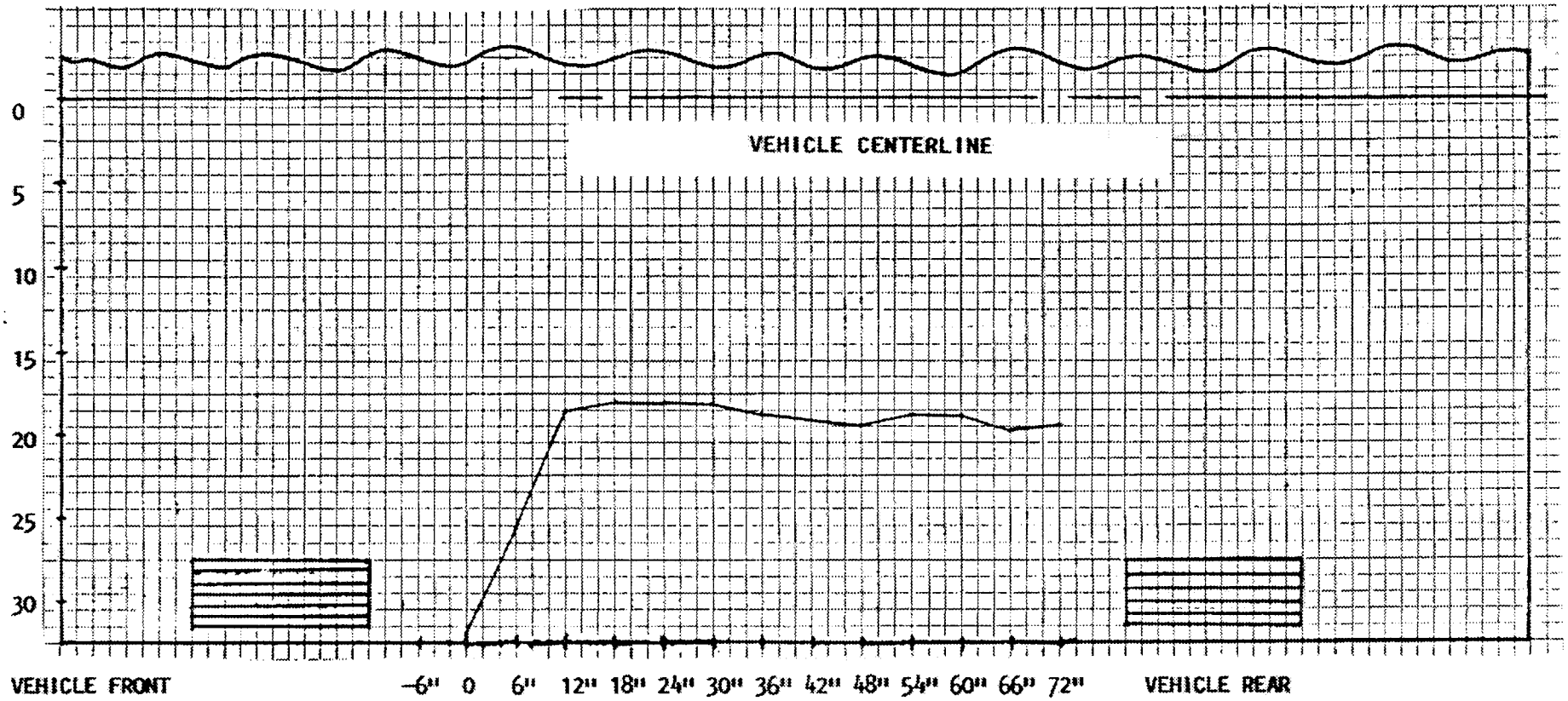


TABLE 3-4E PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 5 - AXLE CENTERLINE - 15.0" ABOVE GROUND LEVEL

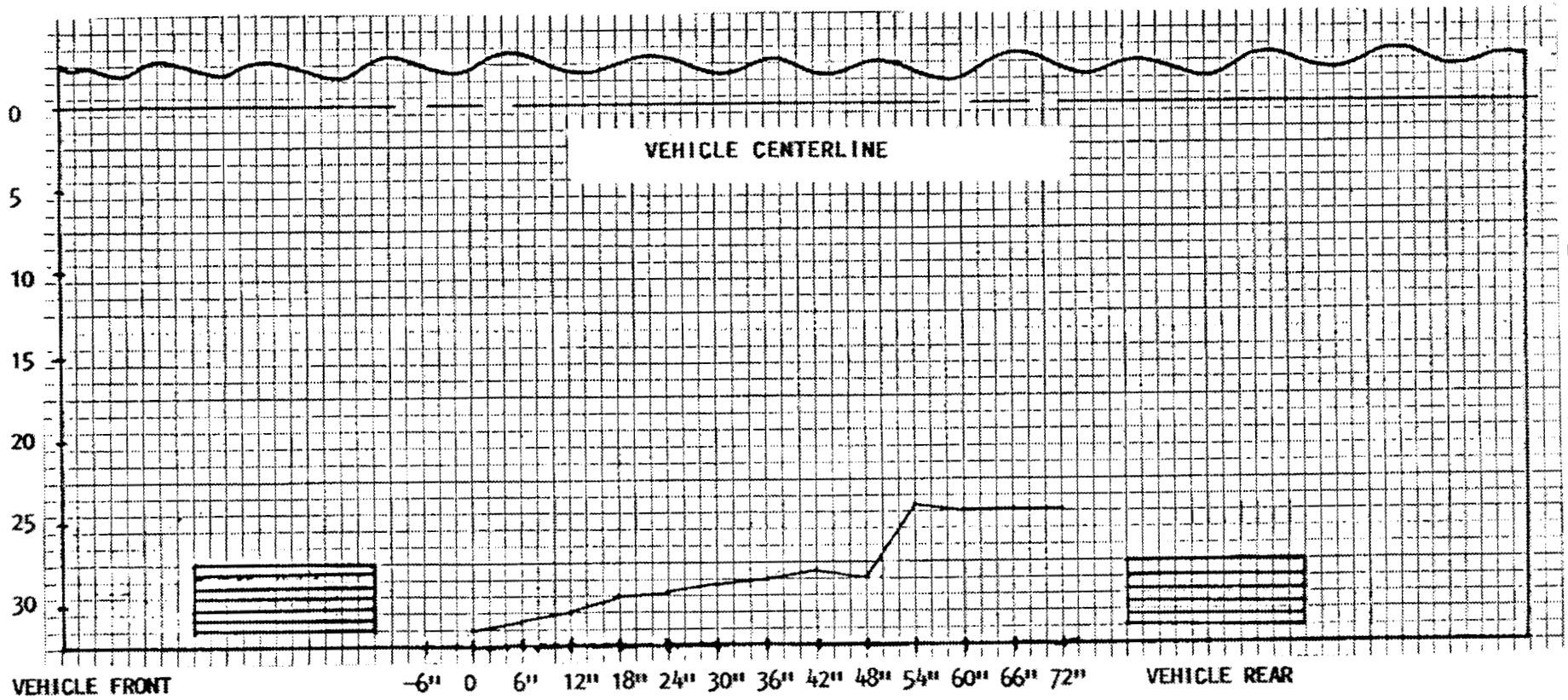


TABLE 3-5 TEST VEHICLE MEASURMENTS

NO.	MEASUREMENT DESCRIPTION	Pre-Test (in.)	Post-Test (in.)	Diff. (in.)
X1	Total Length of Test Vehicle at Centerline	180.0	180.0	0.0
X2	Rear Surface of Vehicle to Front of Engine	161.0	161.0	0.0
X3	Rear Surface of Vehicle to Firewall	142.5	142.5	0.0
X4	Rear Surface to Upr. Leading Edge of Right Door	133.2	133.2	0.0
X5	Rear Surface to Upr. Leading Edge of Left Door	133.2	129.2	4.0
X6	Rear Surface to Lwr. Leading Edge of Right Door	132.8	132.8	0.0
X7	Rear Surface to Lwr. Leading Edge of Left Door	132.8	128.5	4.3
X8	Rear Surface to Upr. Trailing Edge of Right Door	87.5	87.5	0.0
X9	Rear Surface to Upr. Trailing Edge of Left Door	87.5	86.2	1.3
X10	Rear Surface to Lwr. Trailing Edge of Right Door	87.0	86.2	-0.2
X11	Rear Surface to Lwr. Trailing Edge of Left Door	87.0	86.7	0.3
X12	Rear Surface to Bottom 'A' Post on Right Side	130.0	130.0	0.0
X13	Rear Surface to Bottom 'A' Post on Left Side	130.0	129.2	0.8
X14	Rear Surface to Firewall on Right Side	142.2	140.7	1.5
X15	Rear Surface to Firewall on Left Side	142.2	140.7	1.5
X16	Rear Surface to Steering Column	115.3	114.5	0.8
X17	Center of Steering Column to 'A' Post	15.2	16.5	-1.3
X18	Center Steering Column to Headlining	19.0	18.0	1.0
X19	Rear Surface to Right Side of Front Bumper	178.5	178.2	0.3
X20	Rear Surface to Left Side of Front Bumper	178.5	178.0	0.5
X21	Length of Engine Block	17.2	17.2	0.0
X22	Strg. Whl. Hub C/L to W/Shld. Header Interior Moulding	17.8	16.5	1.3
X23	Strg. Whl. Hub C/L to Rr. Wdo. Upper Int. Trim Moulding	34.5	35.5	-1.0

TABLE 3-6 POSTTEST OBSERVATIONS

TEST VEHICLE: 1988 NISSAN NL-XEV PICKUP; NHTSA NO.: N/A

VISIBLE DUMMY CONTACT POINT:	FRONT SID	REAR SID
HEAD	MDB & Cab Ceiling	N/A
CHEST	None	N/A
ABDOMEN	None	N/A
LEFT KNEE	Driver Door	N/A
RIGHT KNEE	None	N/A

DOOR OPENING:	LEFT SIDE	RIGHT SIDE
FRONT	Needed Tools to Open	N/A
REAR	N/A	N/A

SEAT MOVEMENT:

None

GLAZING DAMAGE:

Minor cracking of windshield only, no separation.

OTHER NOTABLE IMPACT EFFECTS:

- No fuel tank damage or leakage was detected.
- The body cab and bed were pushed inwards up to the left frame rail.
- Right rear tire was flattened during the impact event.

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"	1.5	0.3	0.5	0.7	1.7	2.7	2.0	1.0	0.5	0.6	0.4	0.4	0.5	0.6	1.5	3.5	5.3
Mid-Stack Level	22"	2.0	1.7	1.5	1.3	0.7	0.5	0.3	0.3	0.1	0.1	0.3	0.4	0.4	0.4	0.5	0.6	1.0
Bumper Level	17"	4.3	3.9	3.0	2.9	2.7	2.4	1.6	1.4	1.3	1.1	1.0	1.0	0.9	0.9	0.7	1.1	2.3

* Heights measured above ground level.

** Impact Side

APPENDIX A
PHOTOGRAPHIC COVERAGE

FIGURE A-1 MDB 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

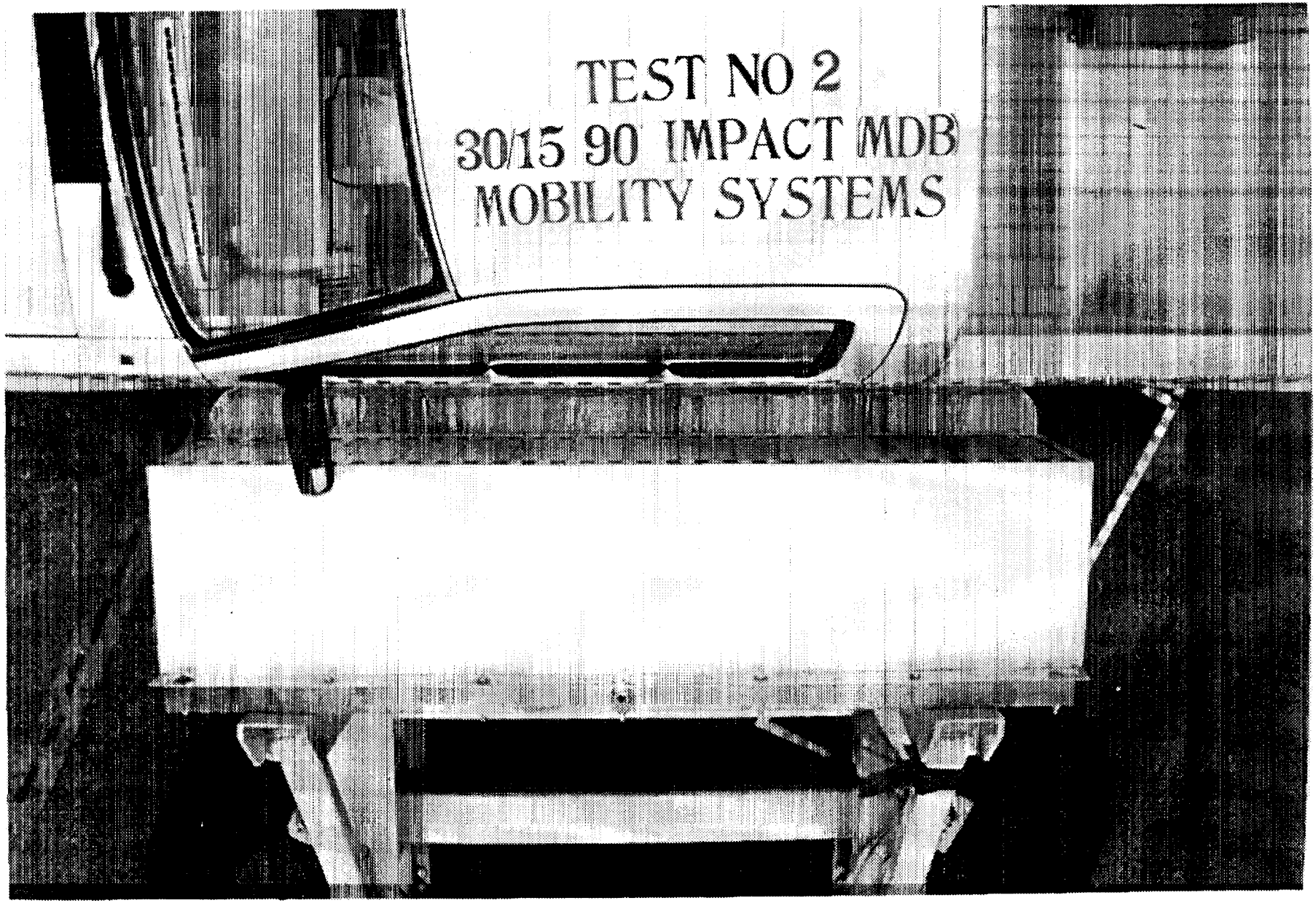


FIGURE A-5 TEST VEHICLE AND MDB, OVERHEAD VIEW - PRETEST

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

FIGURE A-7 SID IN DRIVER POSITION - PRETEST

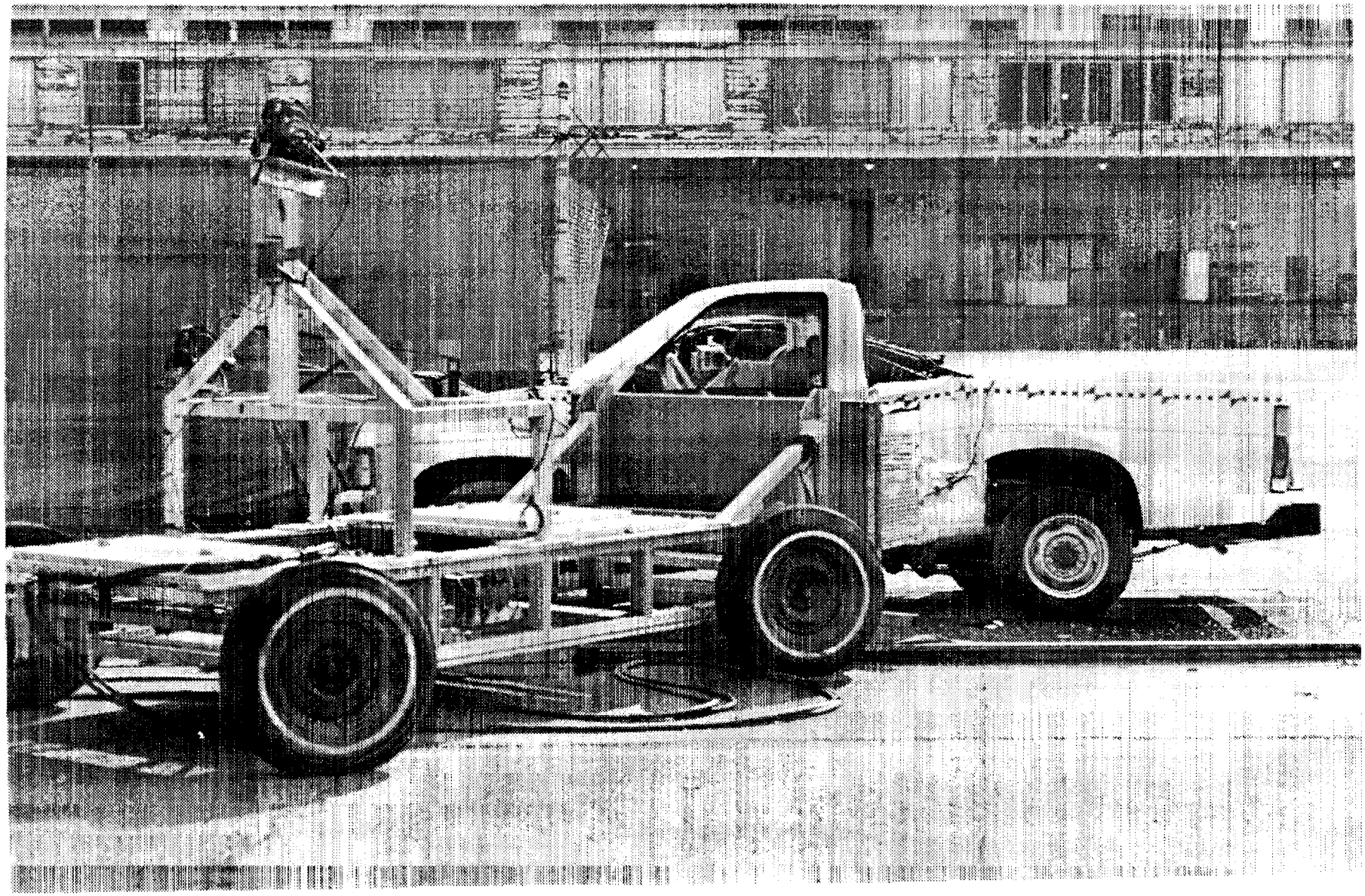


FIGURE A-8 MDB AND TEST VEHICLE, OVERALL VIEW - POSTTEST

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

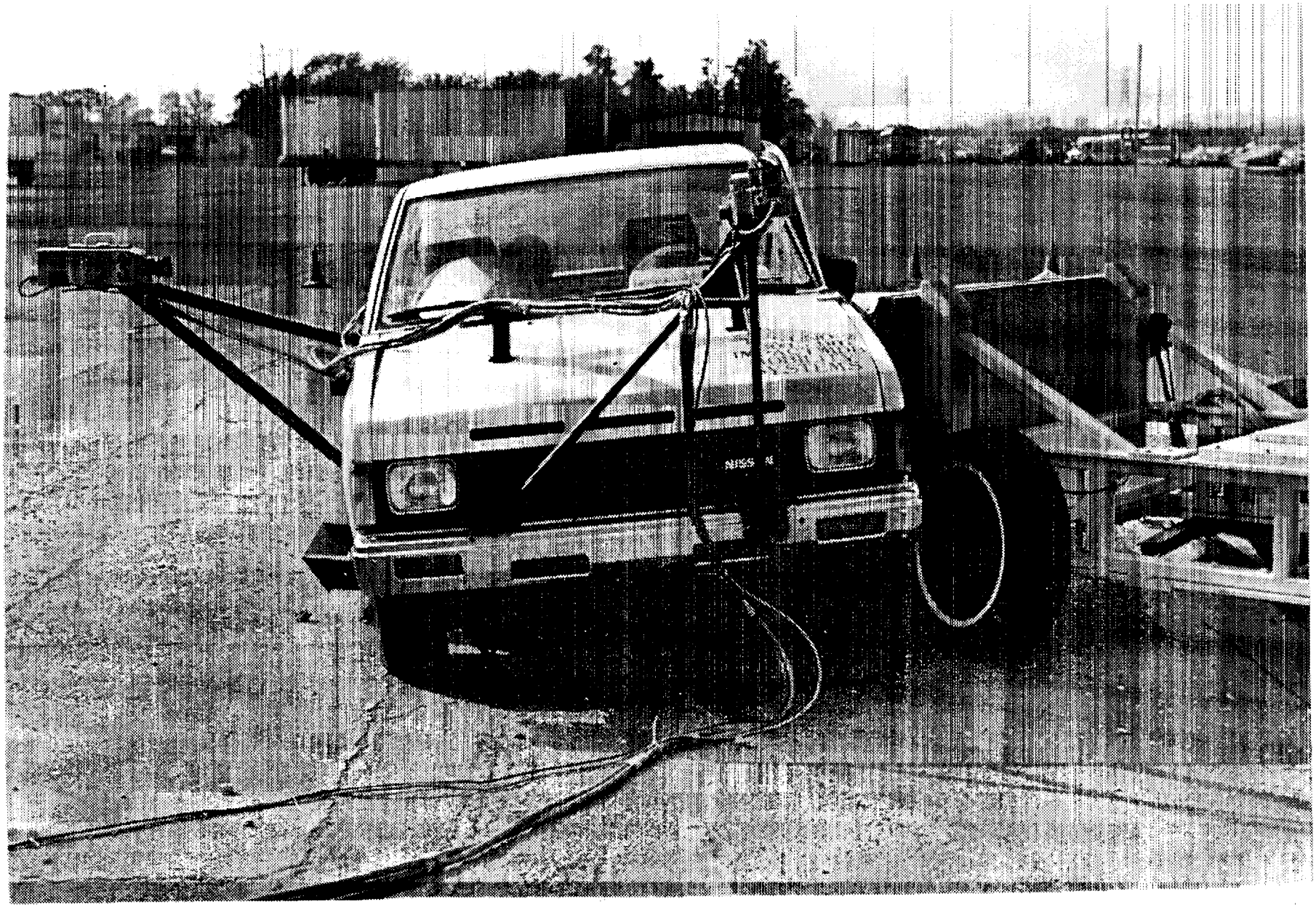


FIGURE A-10 TEST VEHICLE AND MDB, FRONT VIEW -POSTTEST

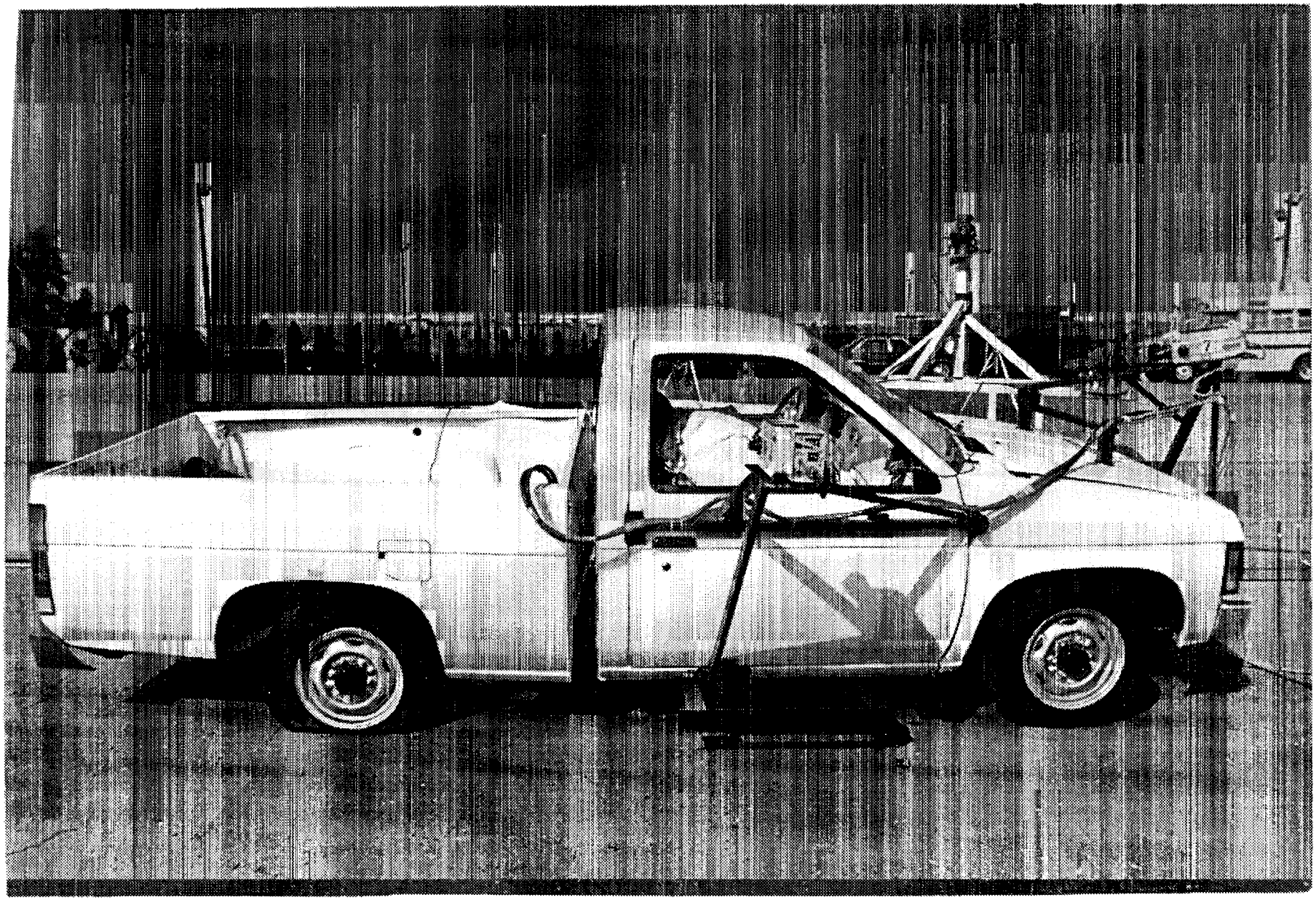


FIGURE A-11 TEST VEHICLE, RIGHT SIDE VIEW - POSTTEST

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

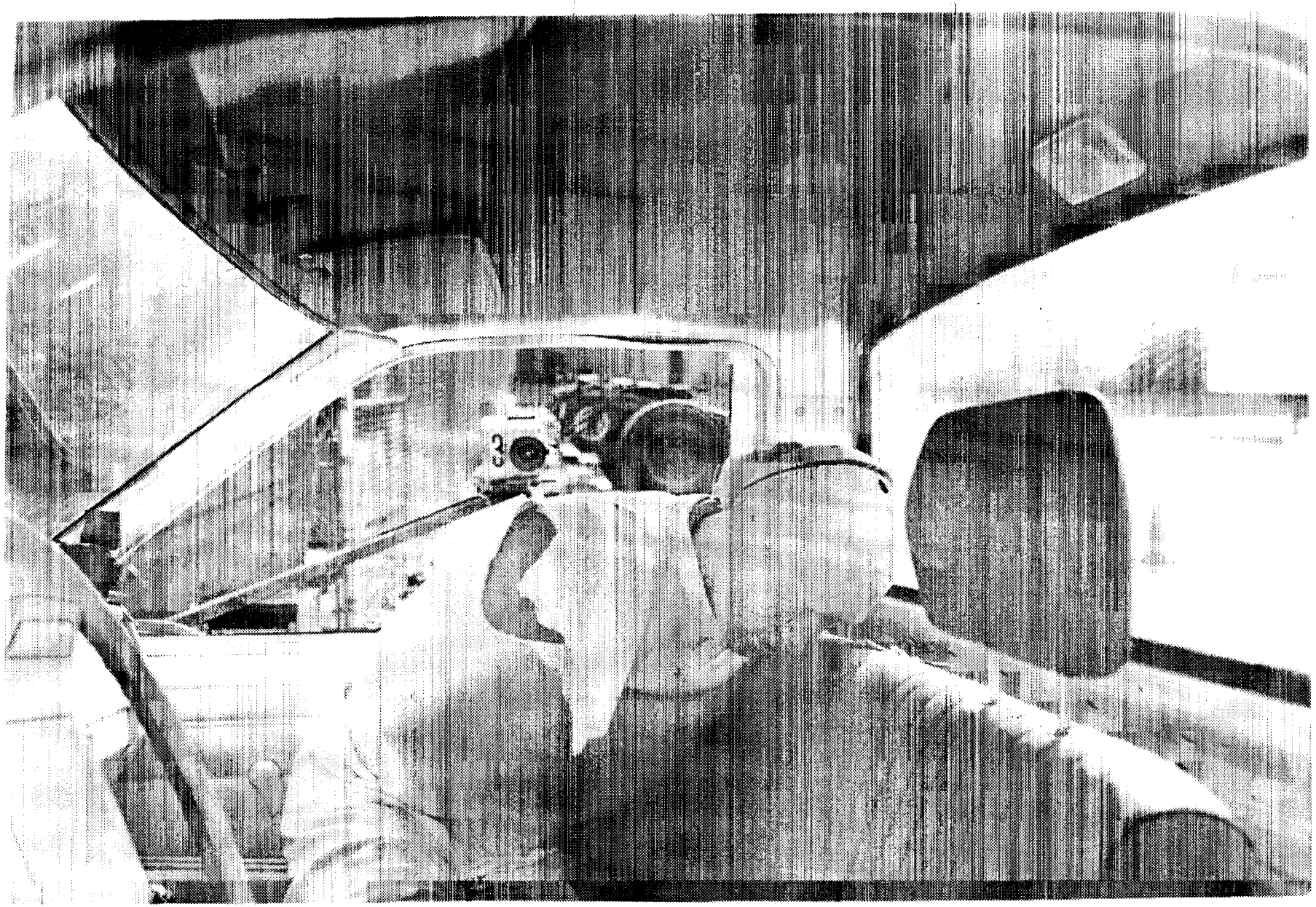


FIGURE A-13 SID FINAL POSITION - POSTTEST

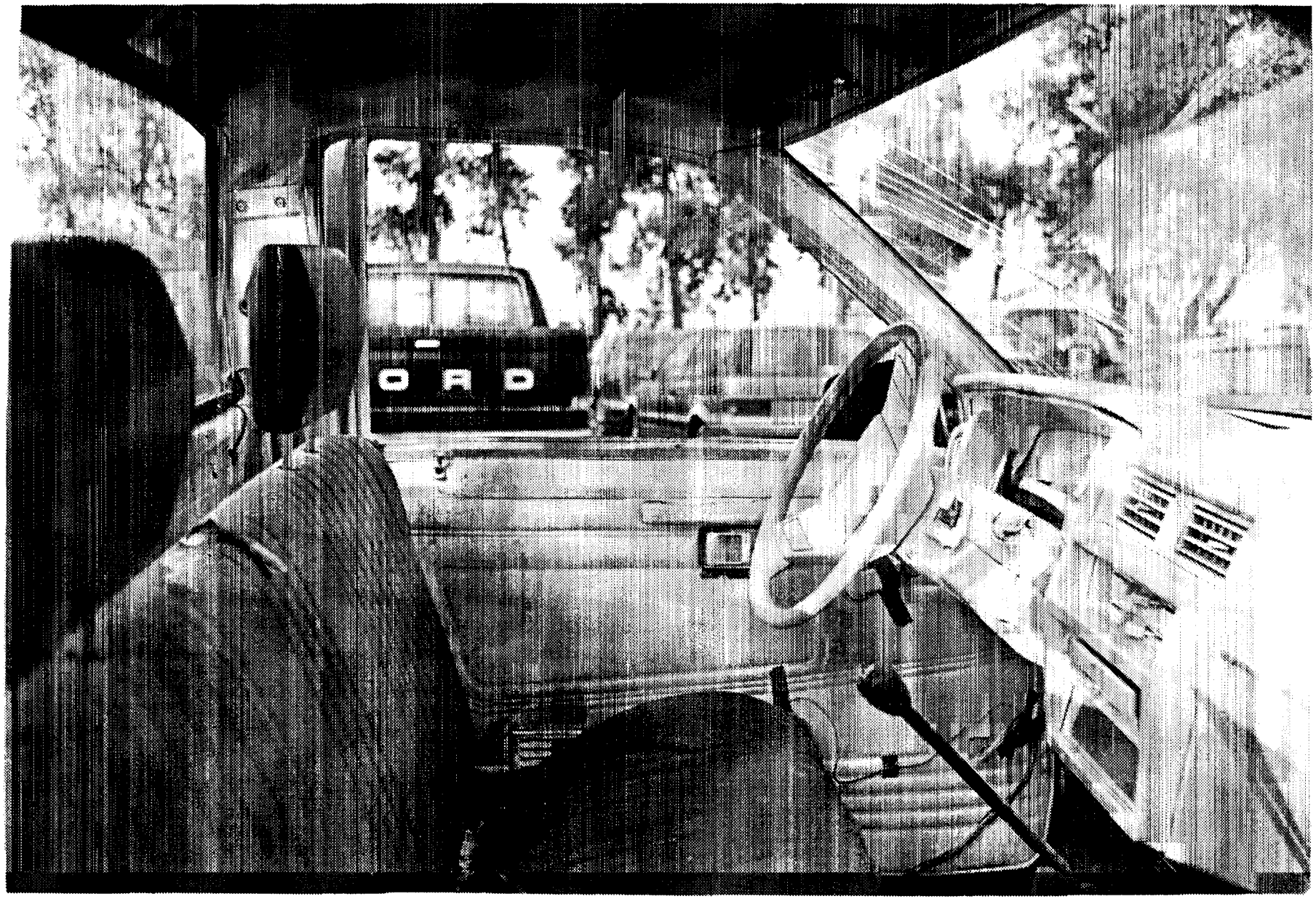


FIGURE A-14 OCCUPANT COMPARTMENT INTERIOR - POSTTEST

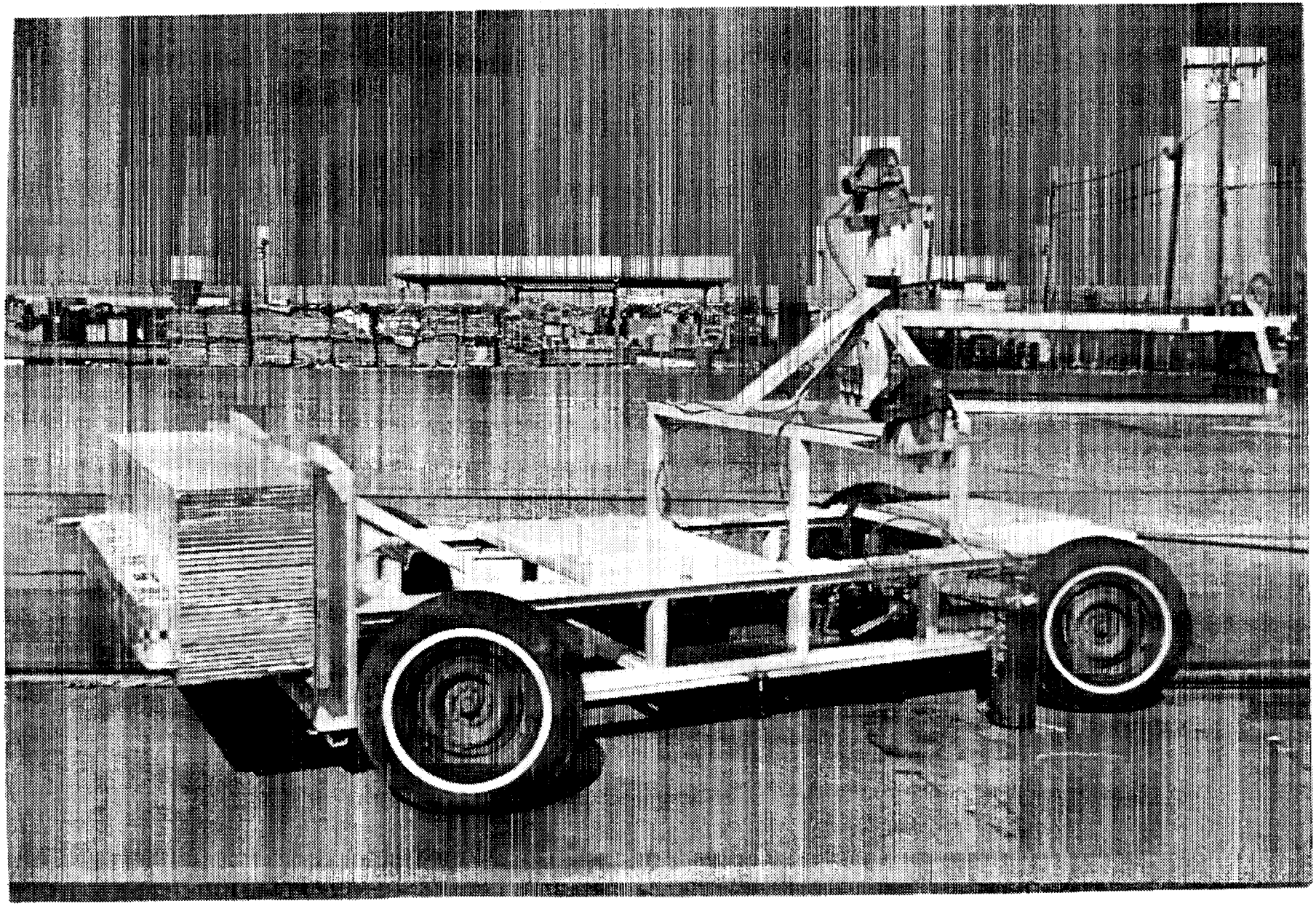


FIGURE A-15 MDB, VIEW NO. 1 - PRETEST

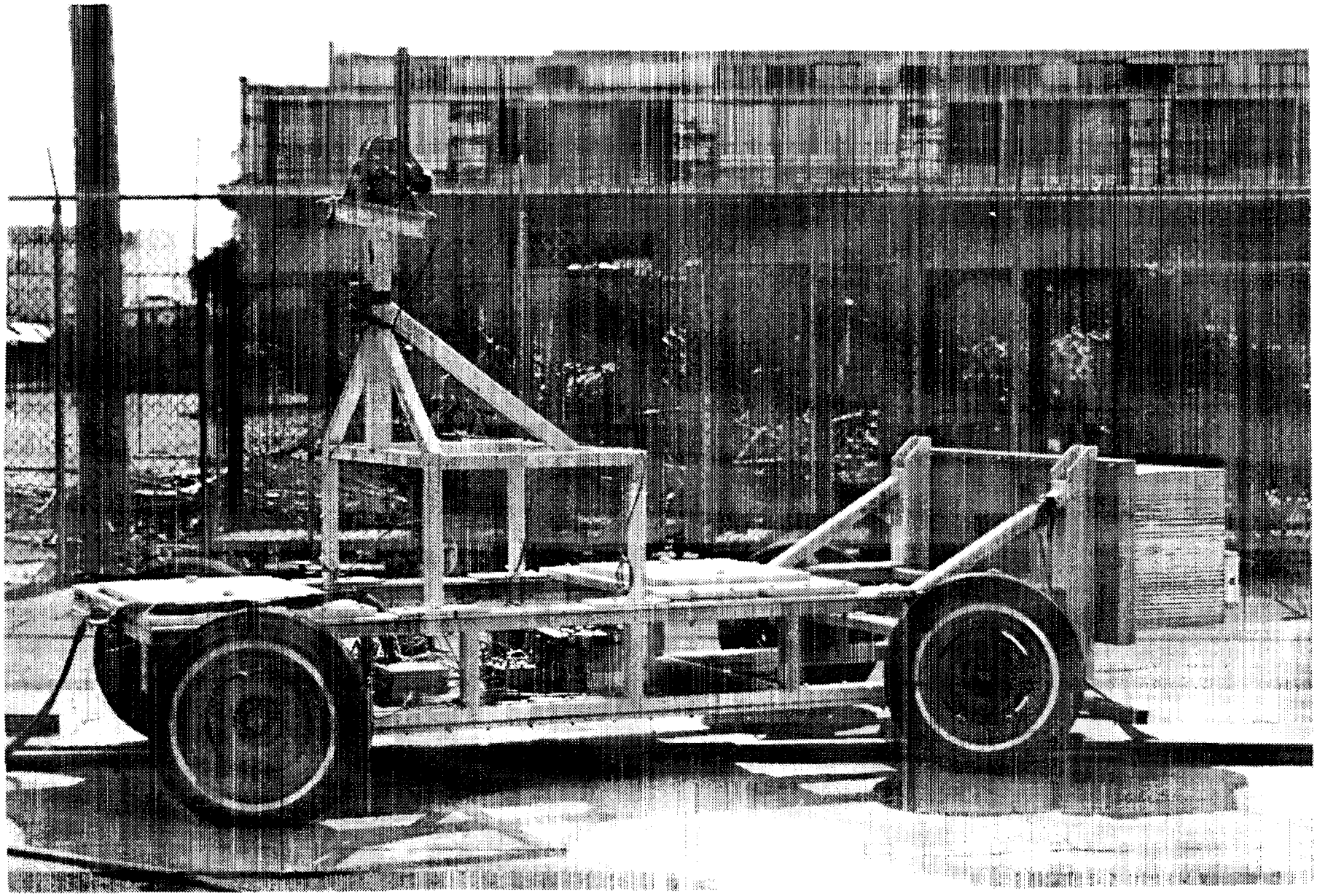


FIGURE A-16 MDB, VIEW NO. 2 - PRETEST

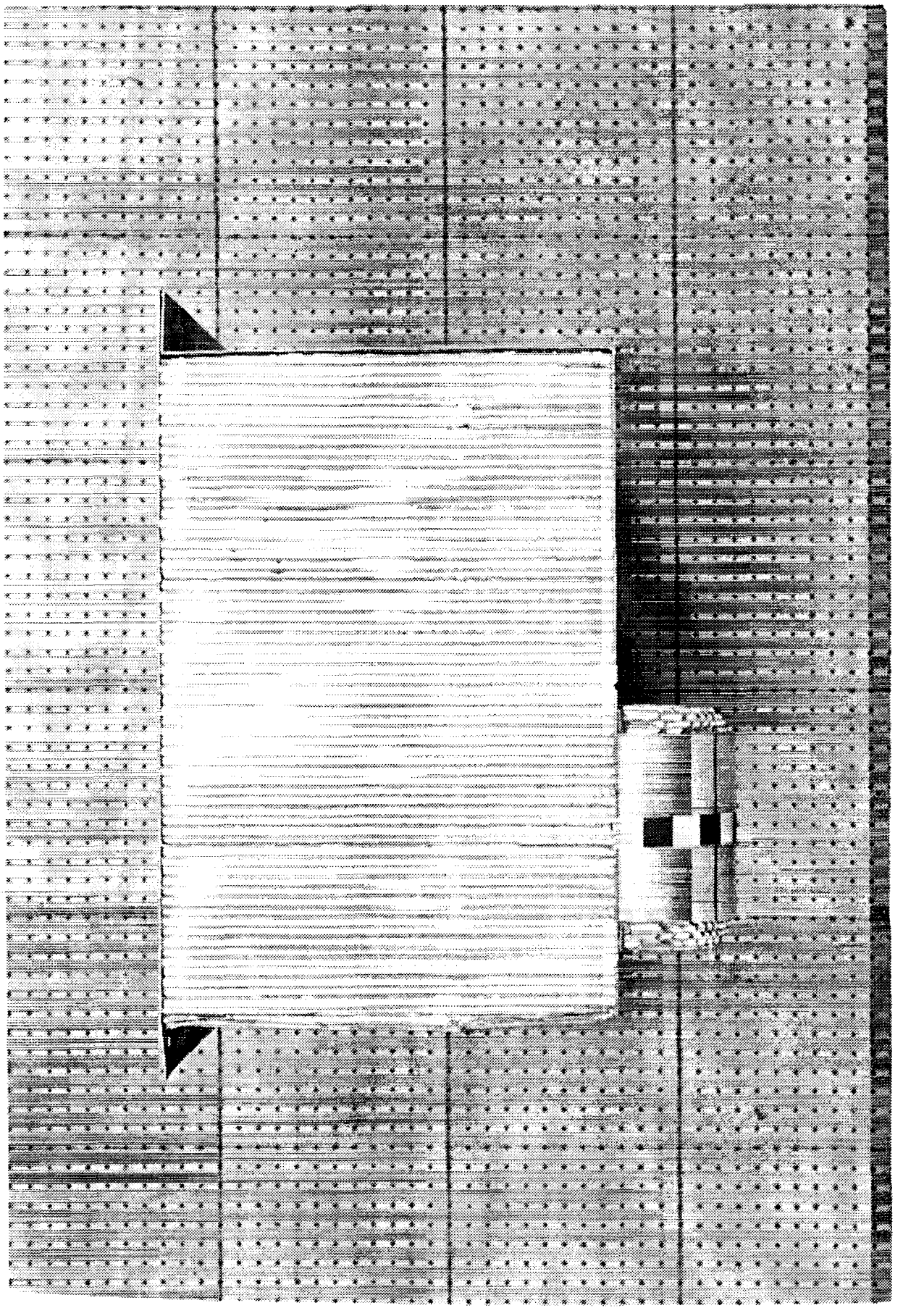


FIGURE A-17 MDB FACE, VIEW NO. 1 - PRETEST

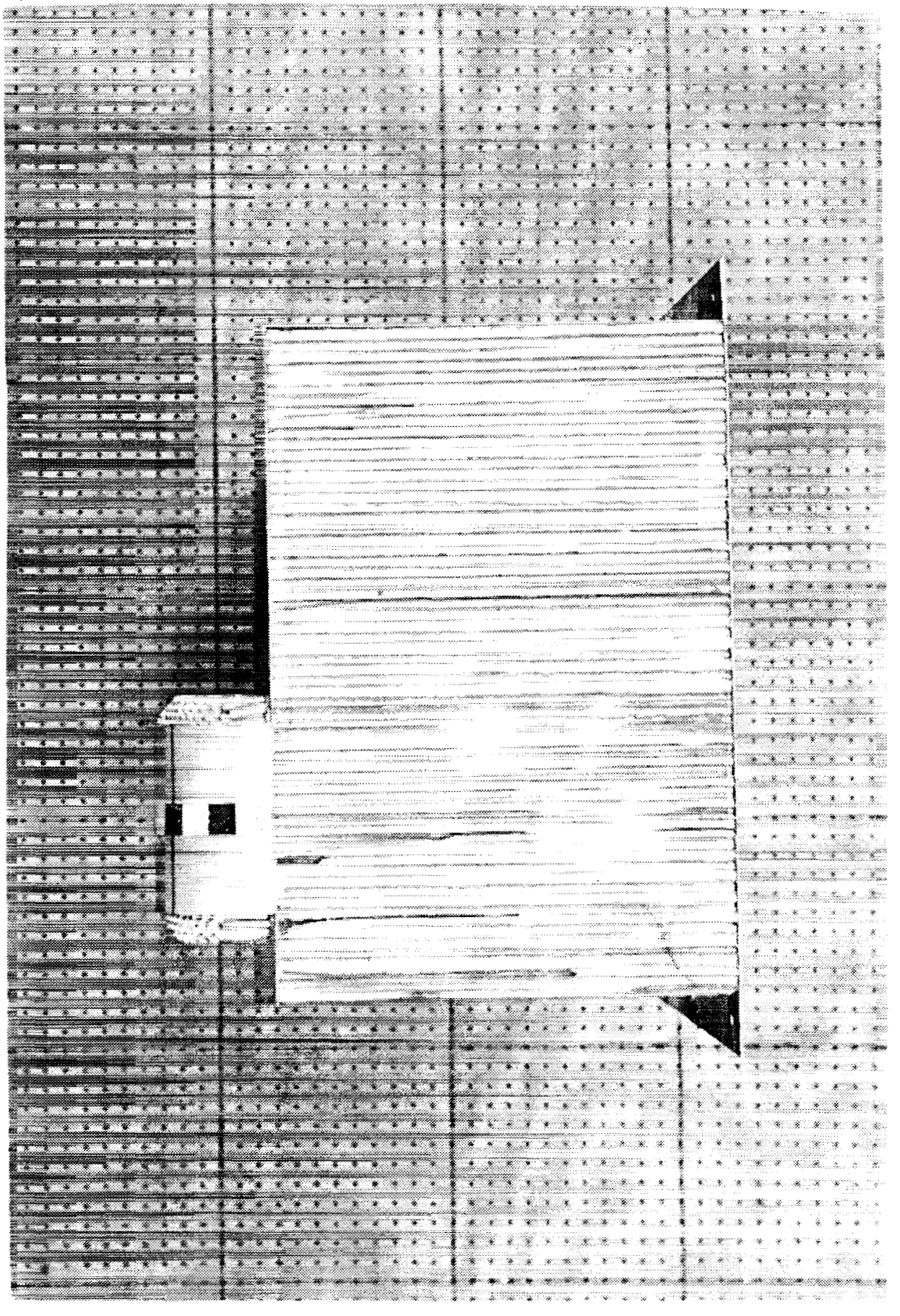


FIGURE A-18 MDB FACE, VIEW NO. 2 - PRETEST

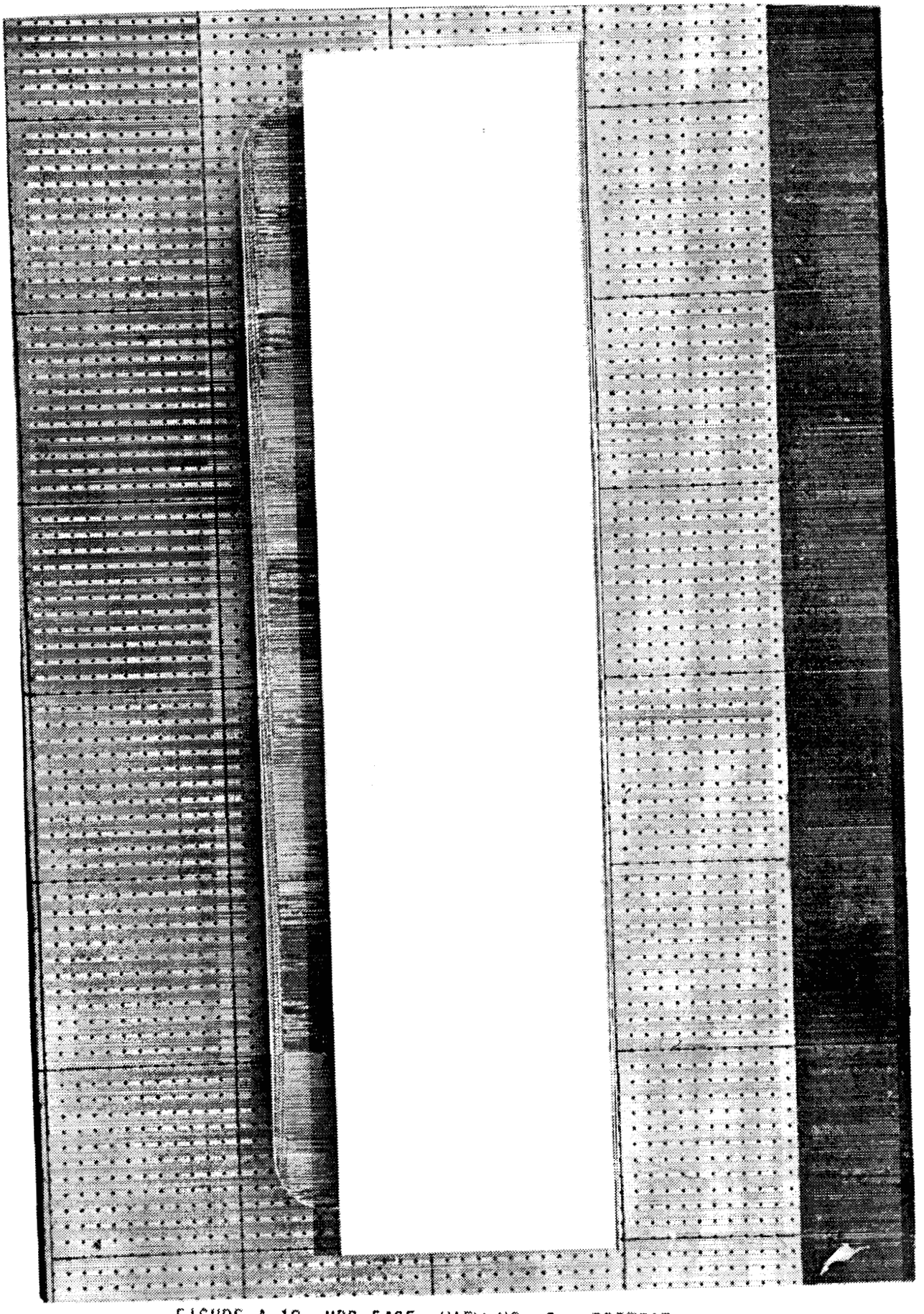


FIGURE A-19 MDB FACE, VIEW NO. 3 - PRETEST

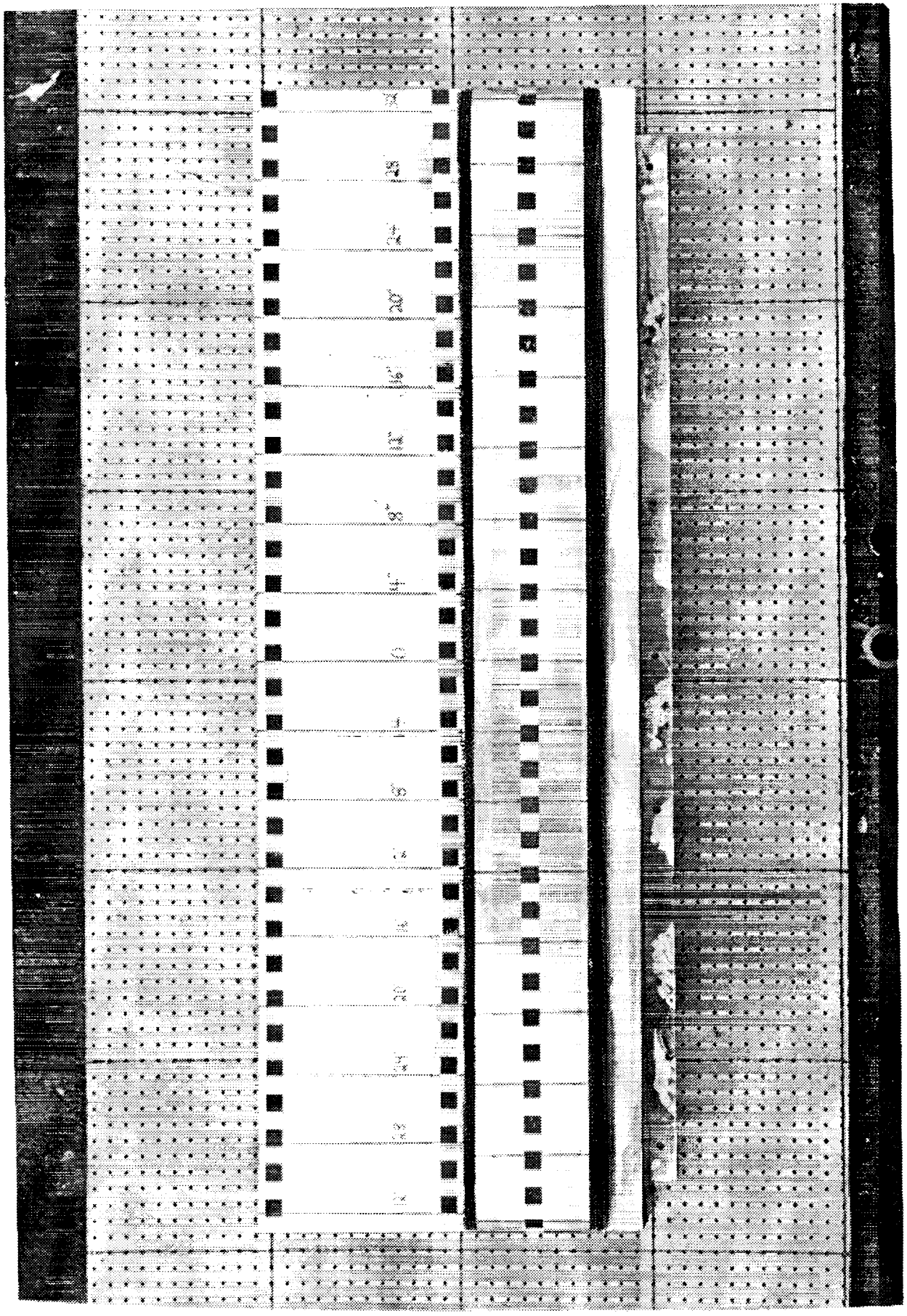


FIGURE A-20 MDB FACE, VIEW NO. 4 - PRETEST

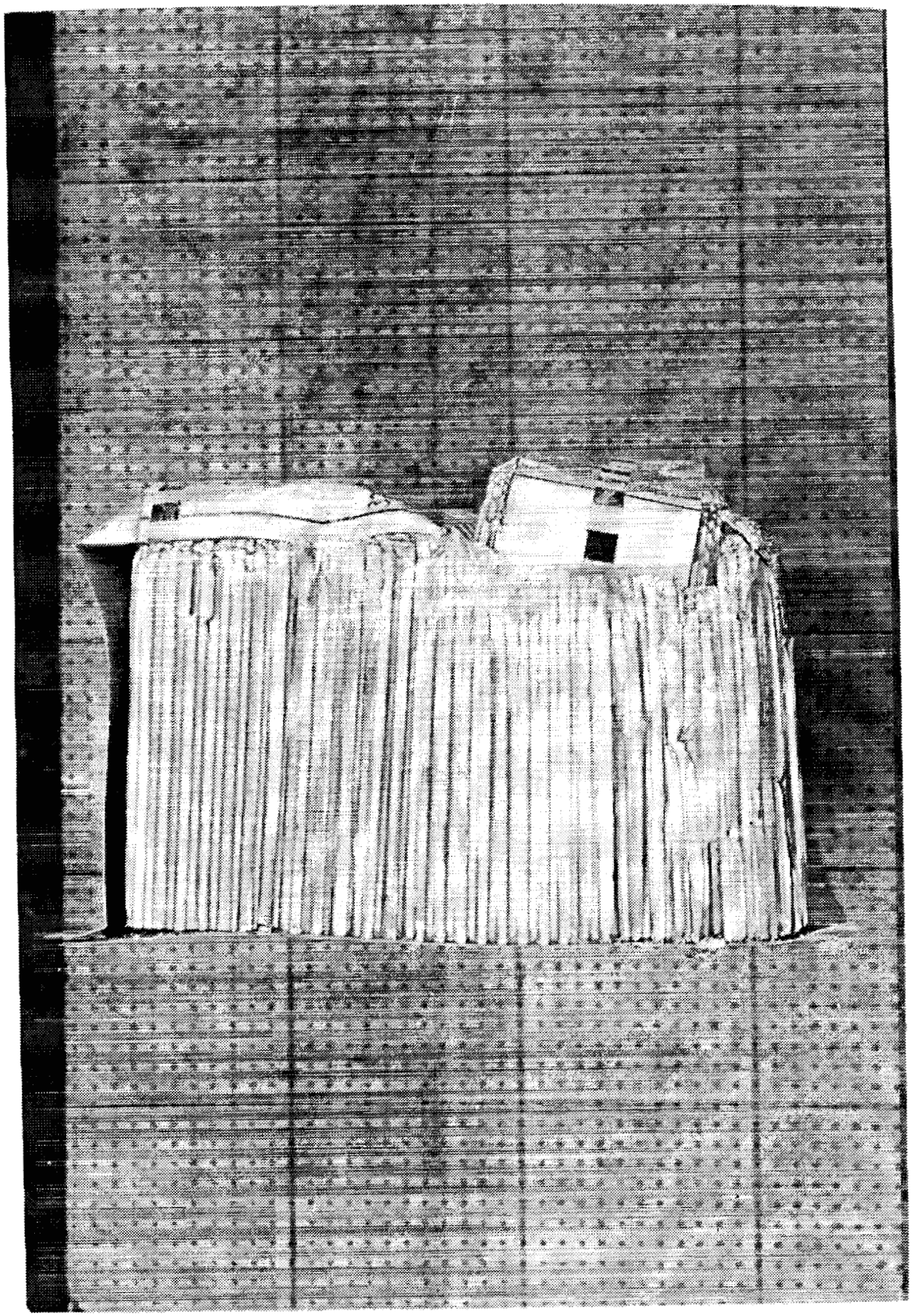


FIGURE A-21 MDB FACE VIEW NO. 1 - POSTTEST

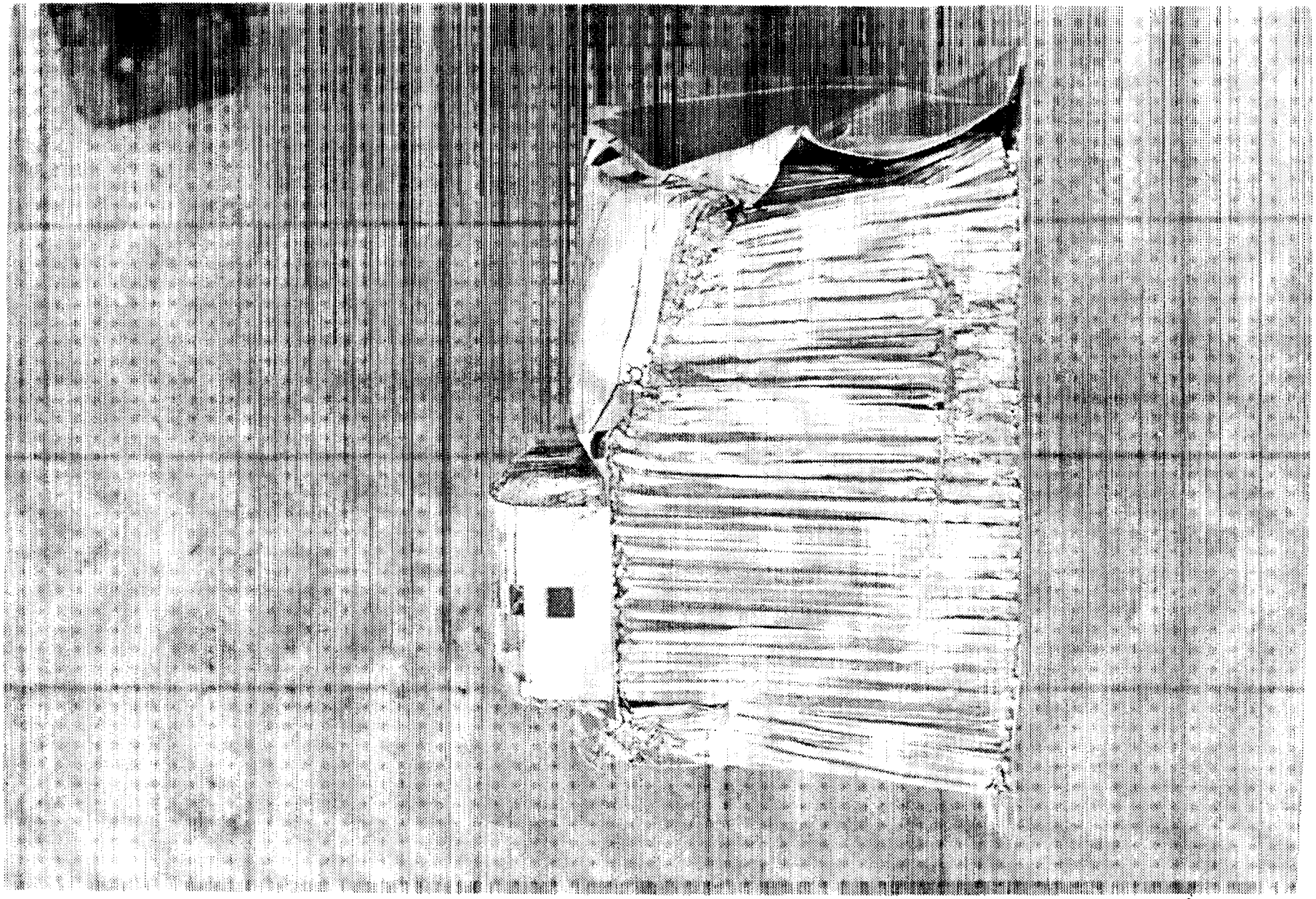


FIGURE A-22 MDB FACE VIEW NO 2 - POSTTEST

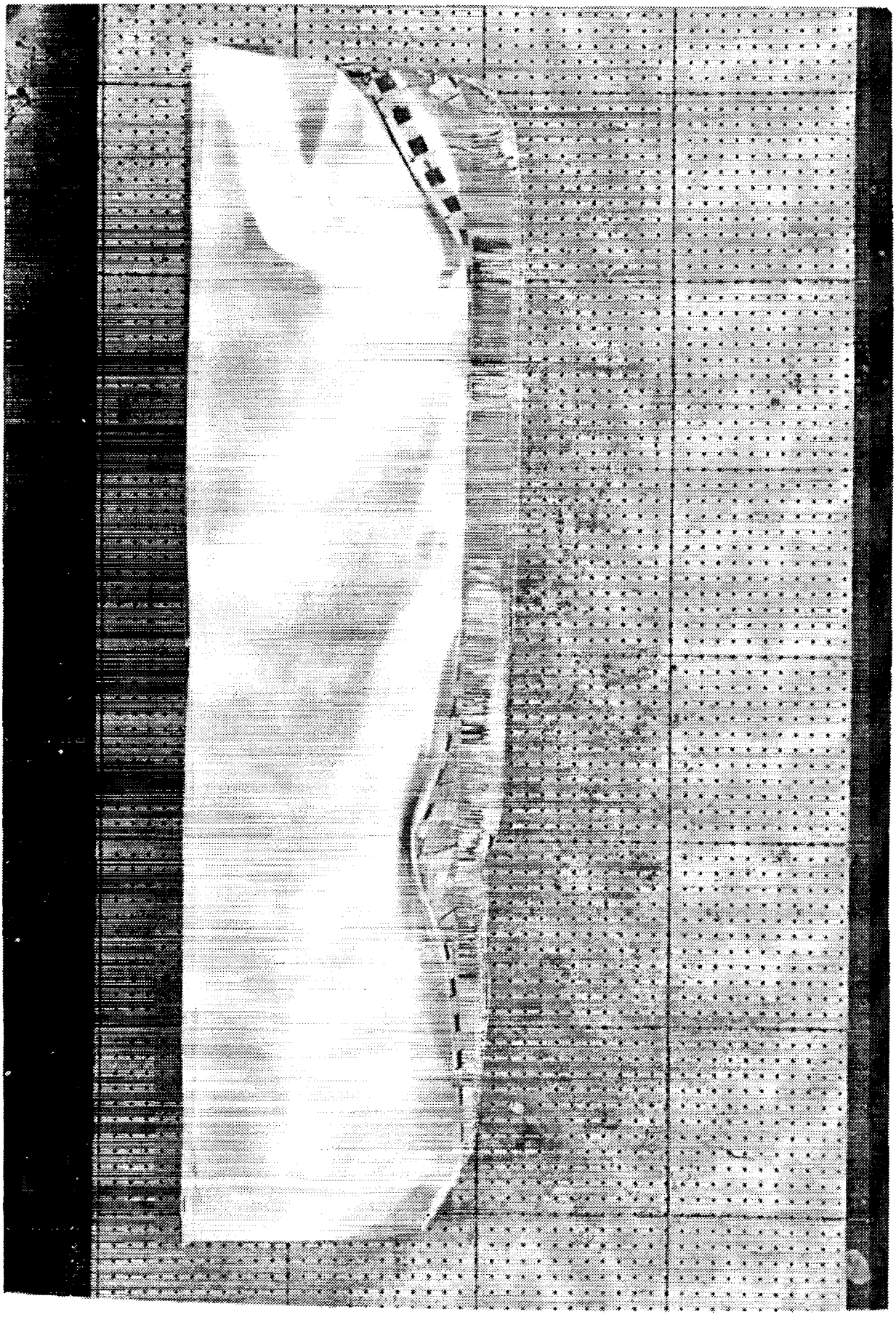


FIGURE A-23 MDB FACE, VIEW NO. 3 - POSTTEST

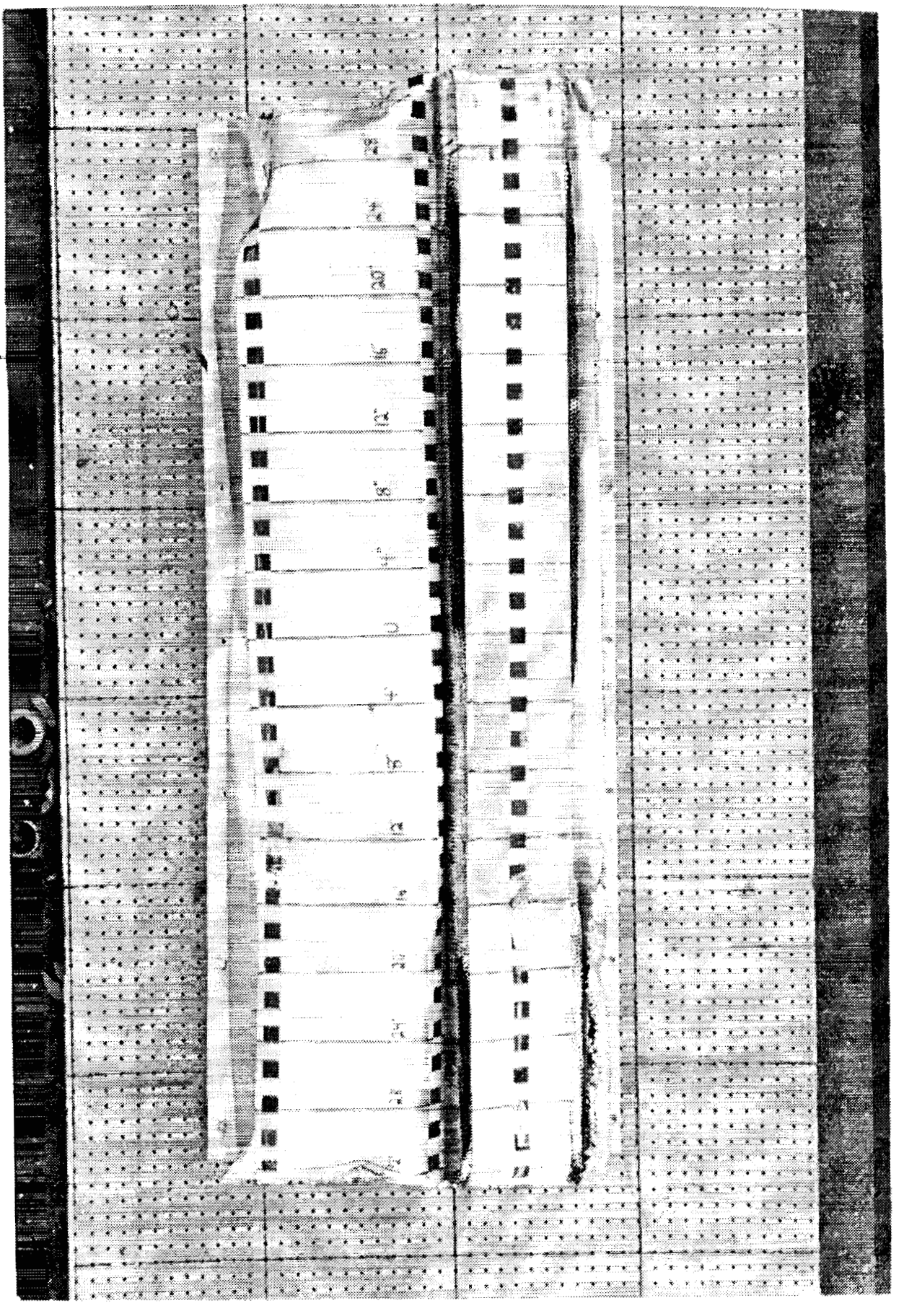
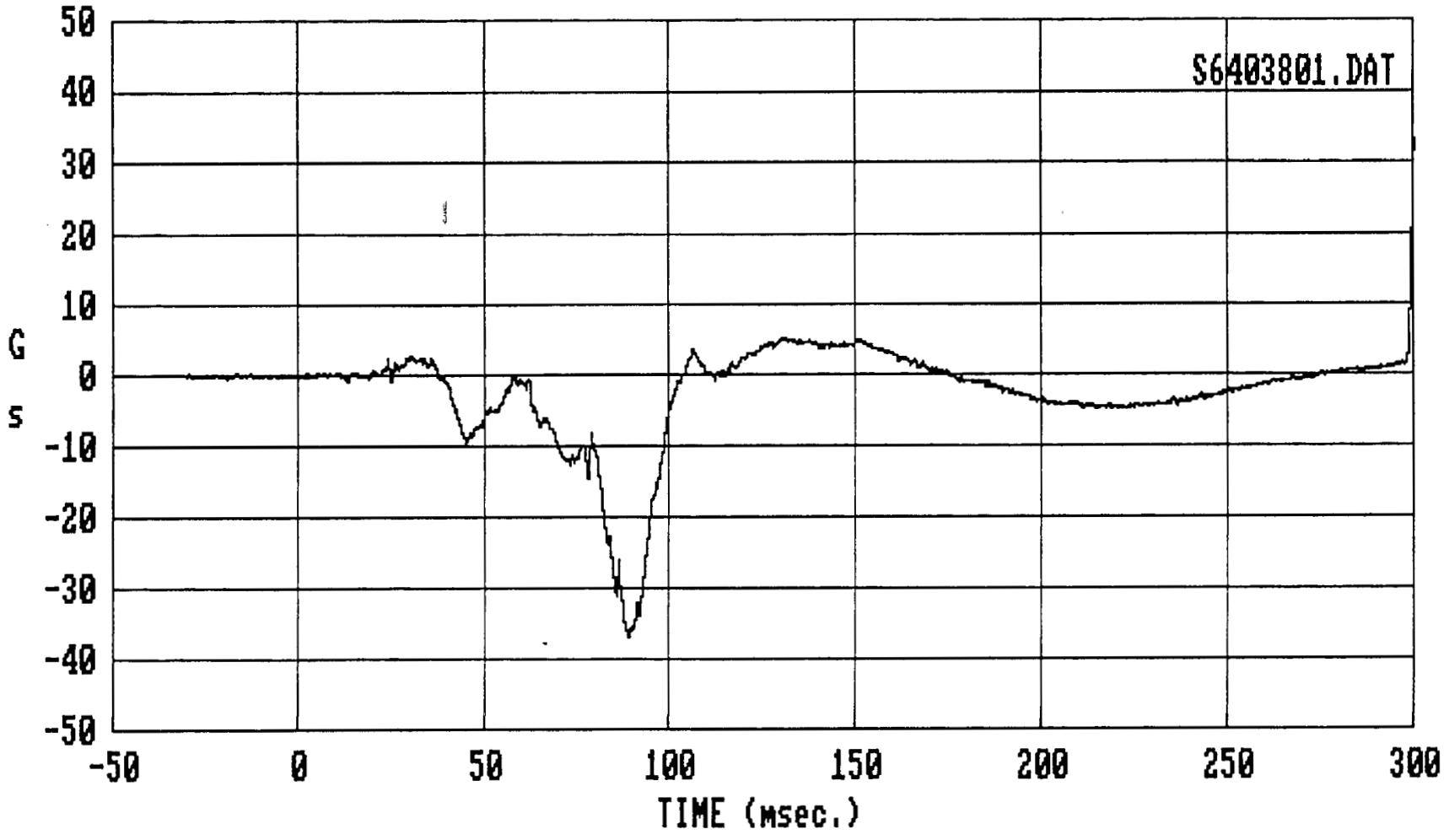


FIGURE A-24 MDB FACE, VIEW NO. 4 - POSTTEST

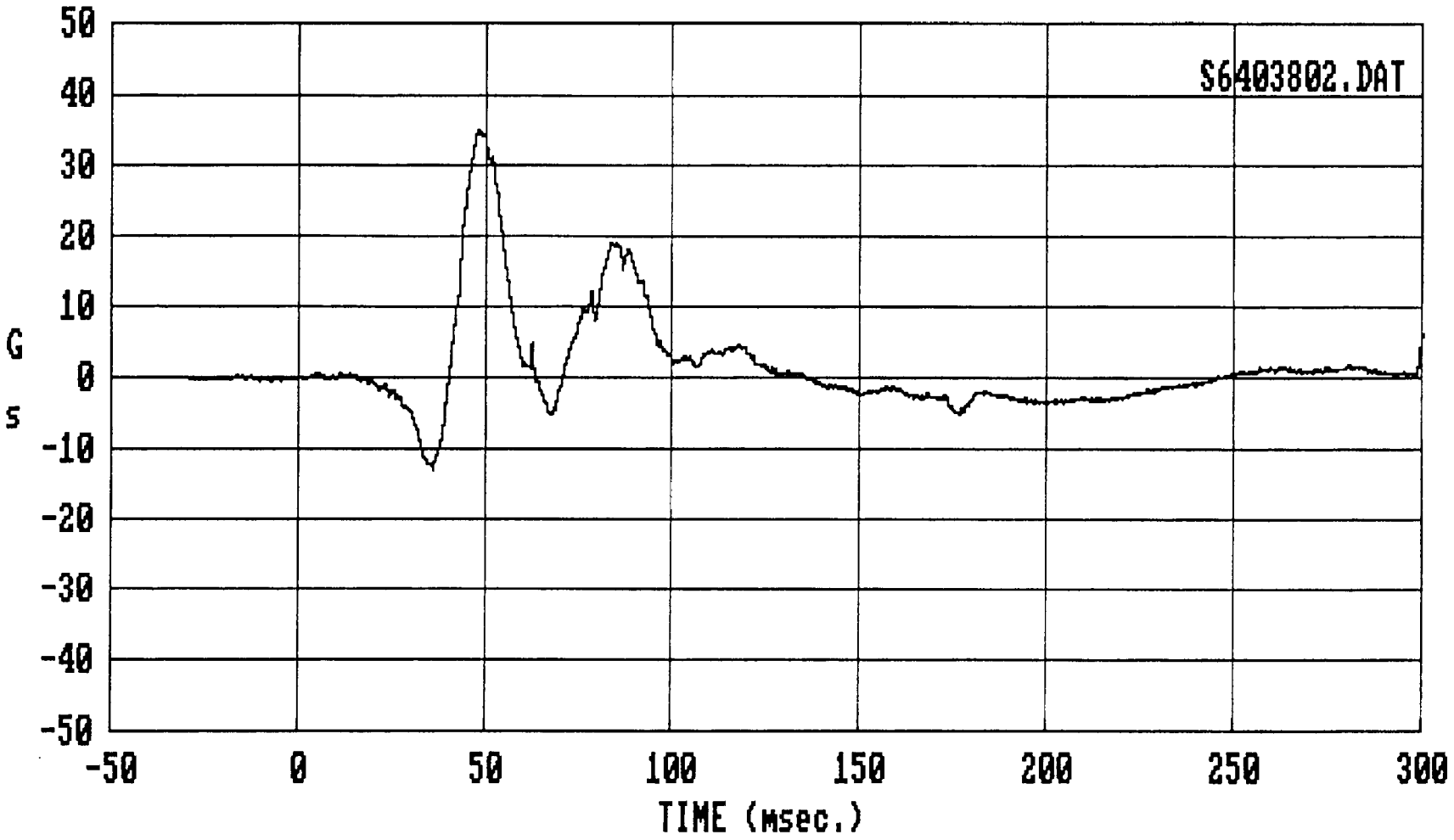
APPENDIX B

DATA PLOTS



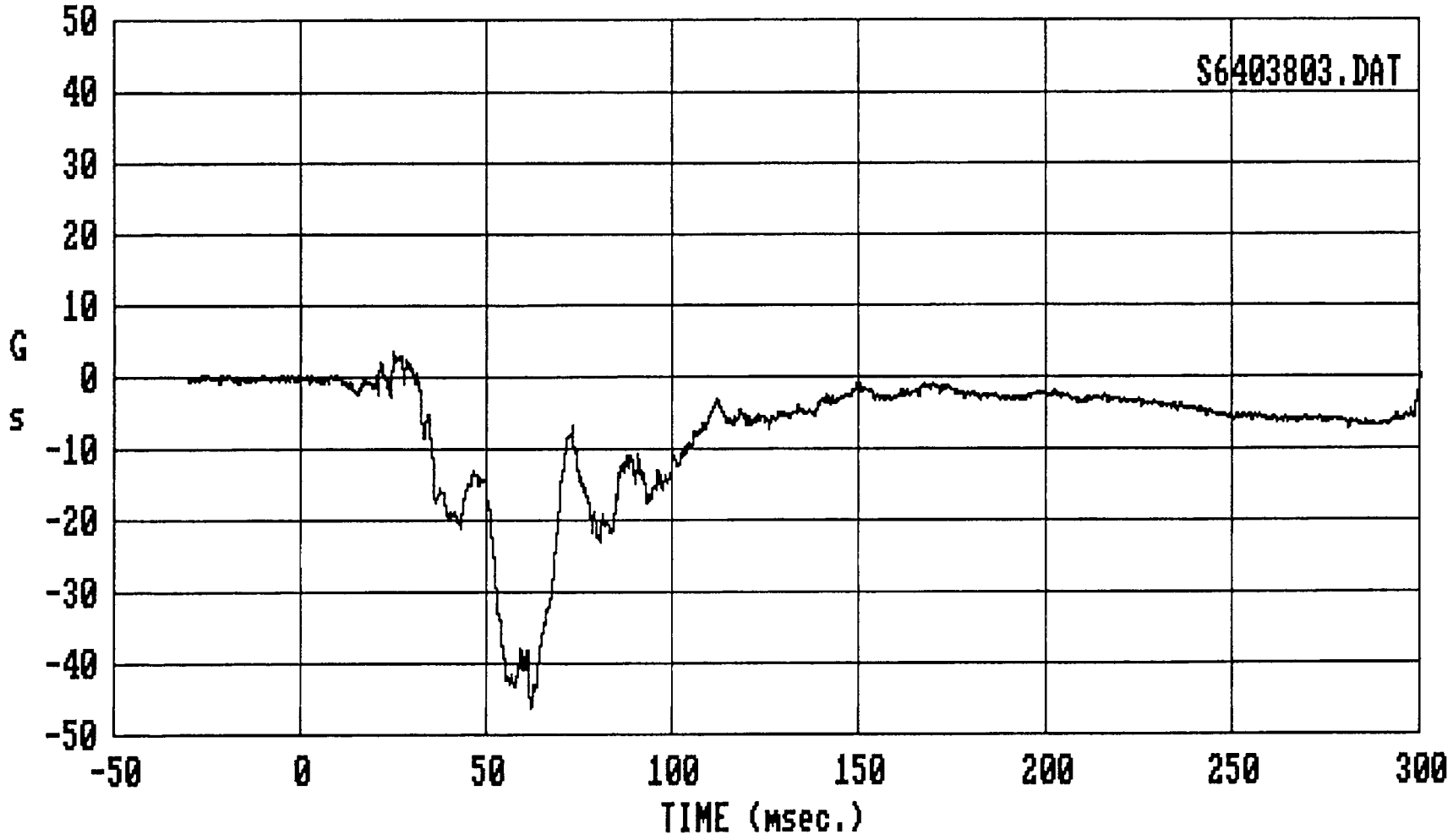
Filter: SAE CLASS 1000 Max = 33.257 Min = -37.022

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Head acceleration, X-axis



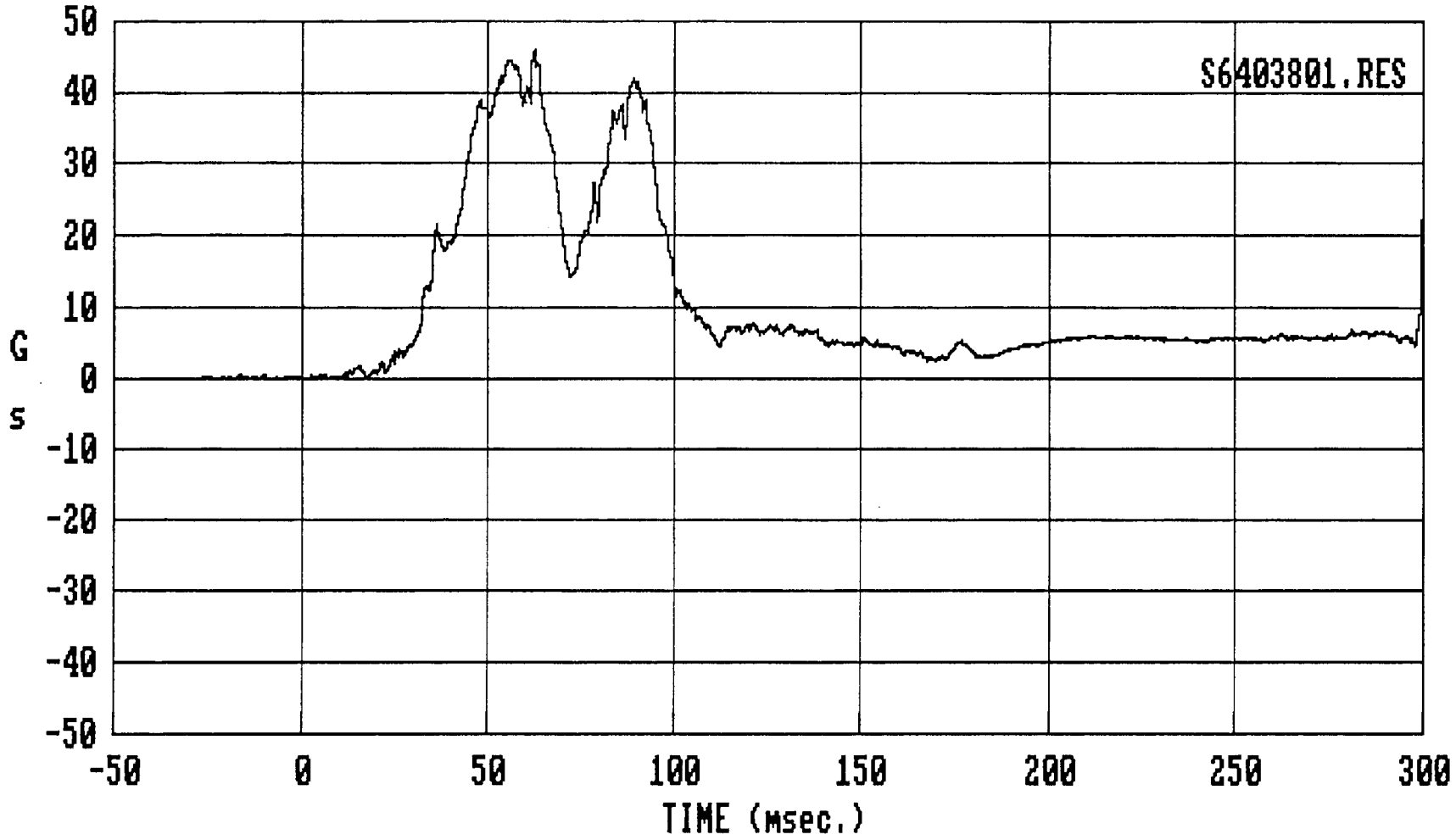
Filter: SAE CLASS 1000 Max = 35.097 Min = -12.826

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Head acceleration, Y-axis



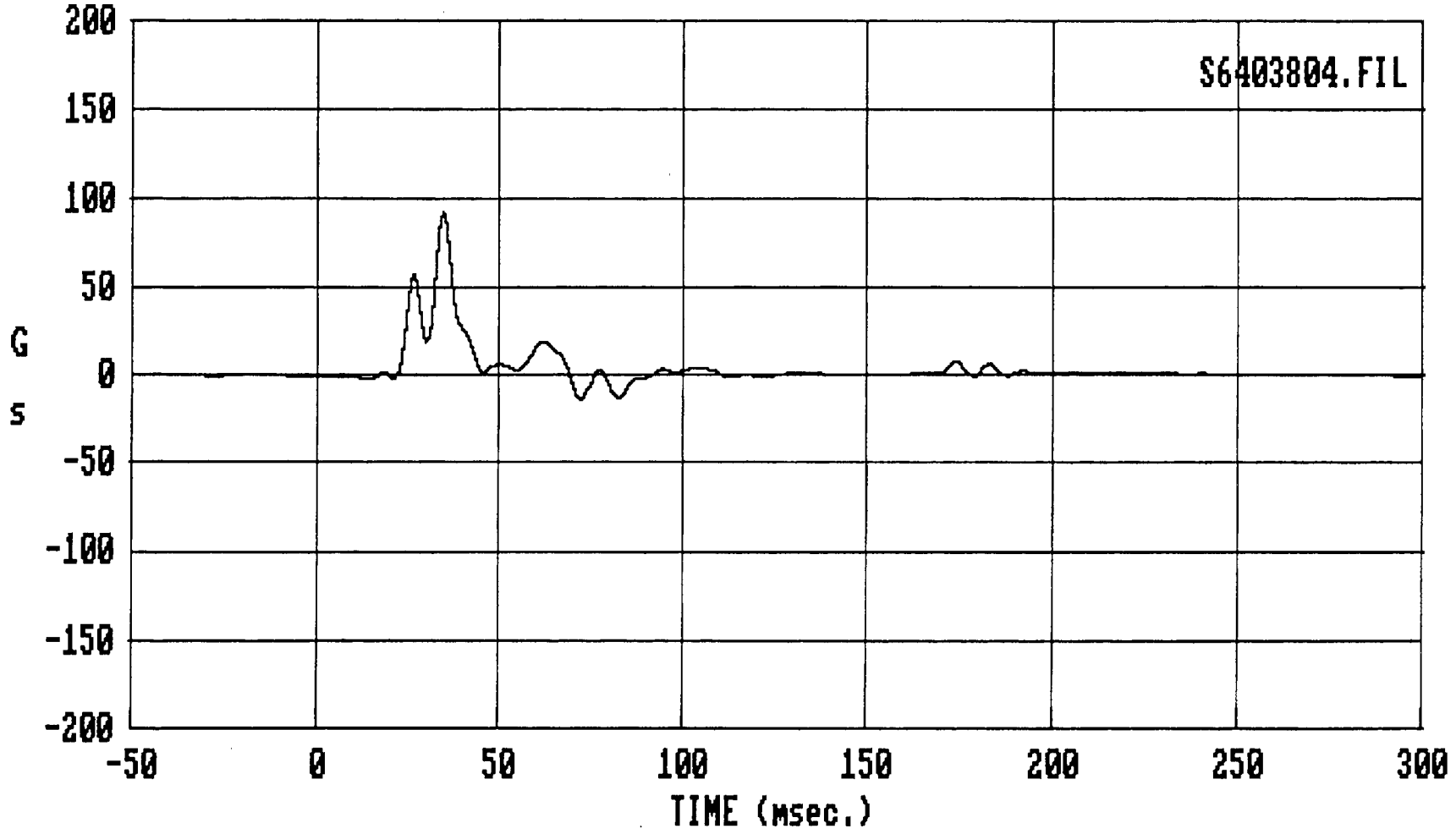
Filter: SAE CLASS 1000 Max = 3.7092 Min = -46.281

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Head acceleration, Z-axis



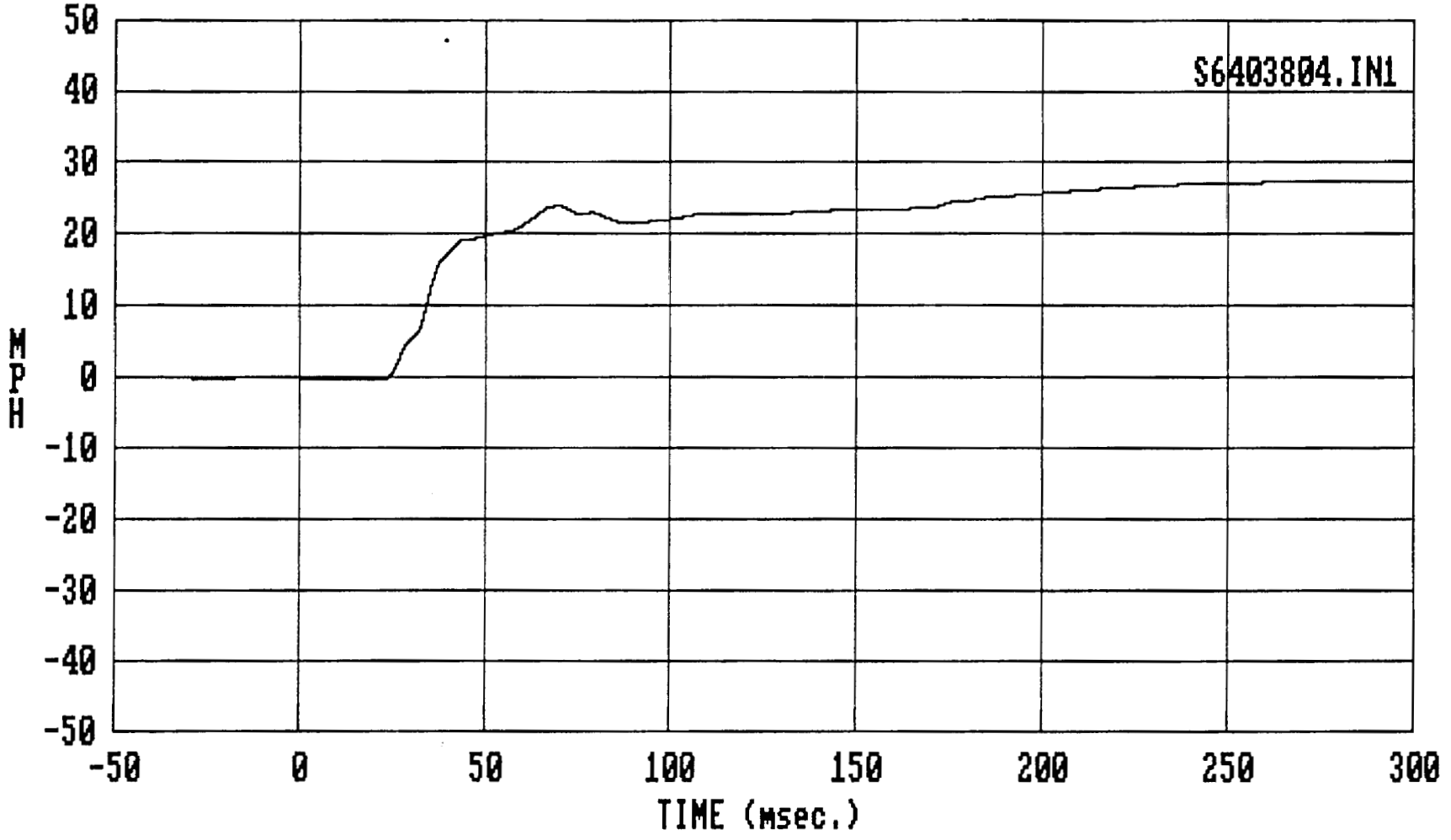
Filter: SAE CLASS 1000 Max = 46.468 Min = .58963E-01

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Head resultant acceleration



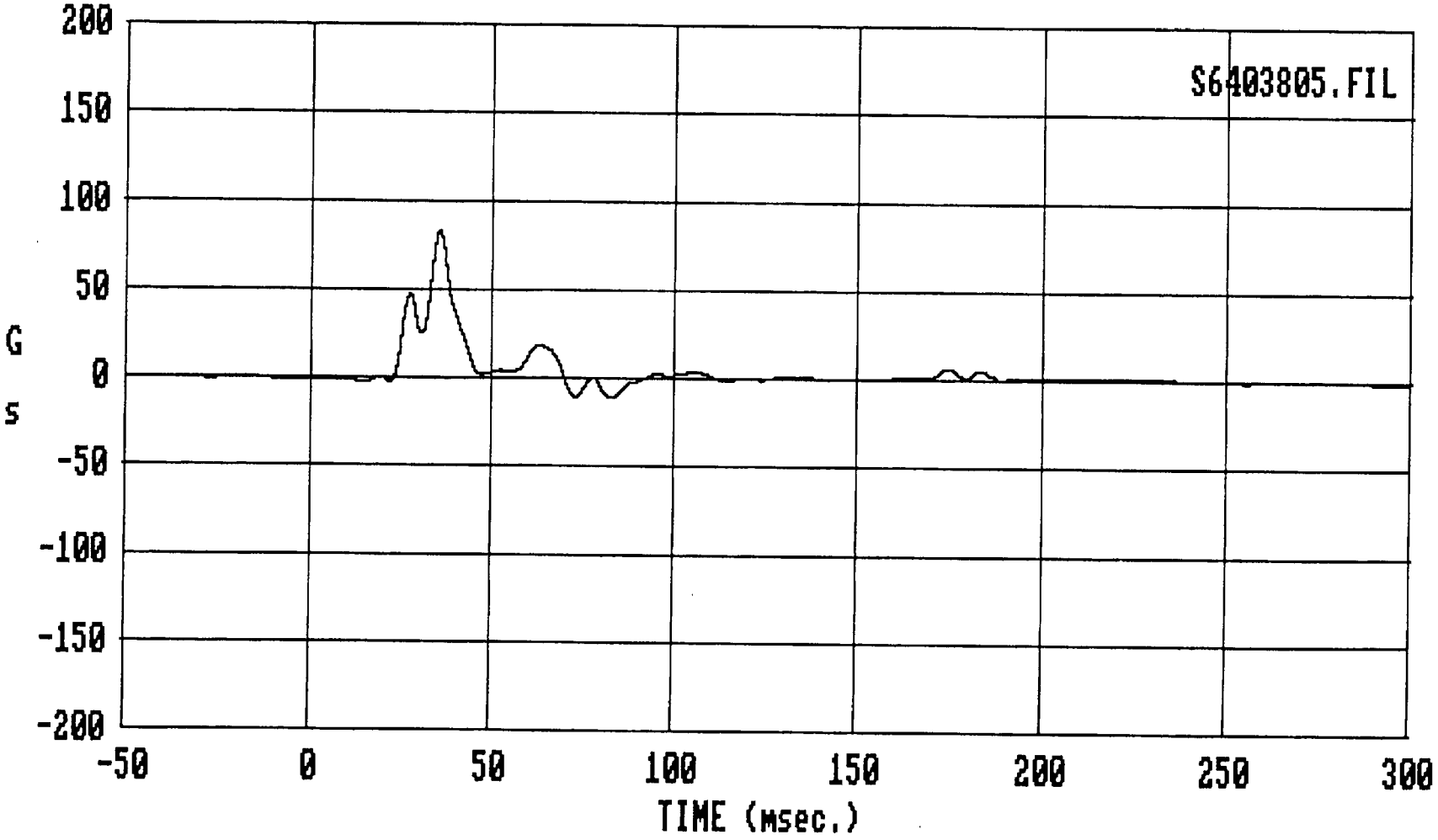
Filter: FIR 100 Max = 93.436 Min = -13.411

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Rib acc., Y-axis (Primary)



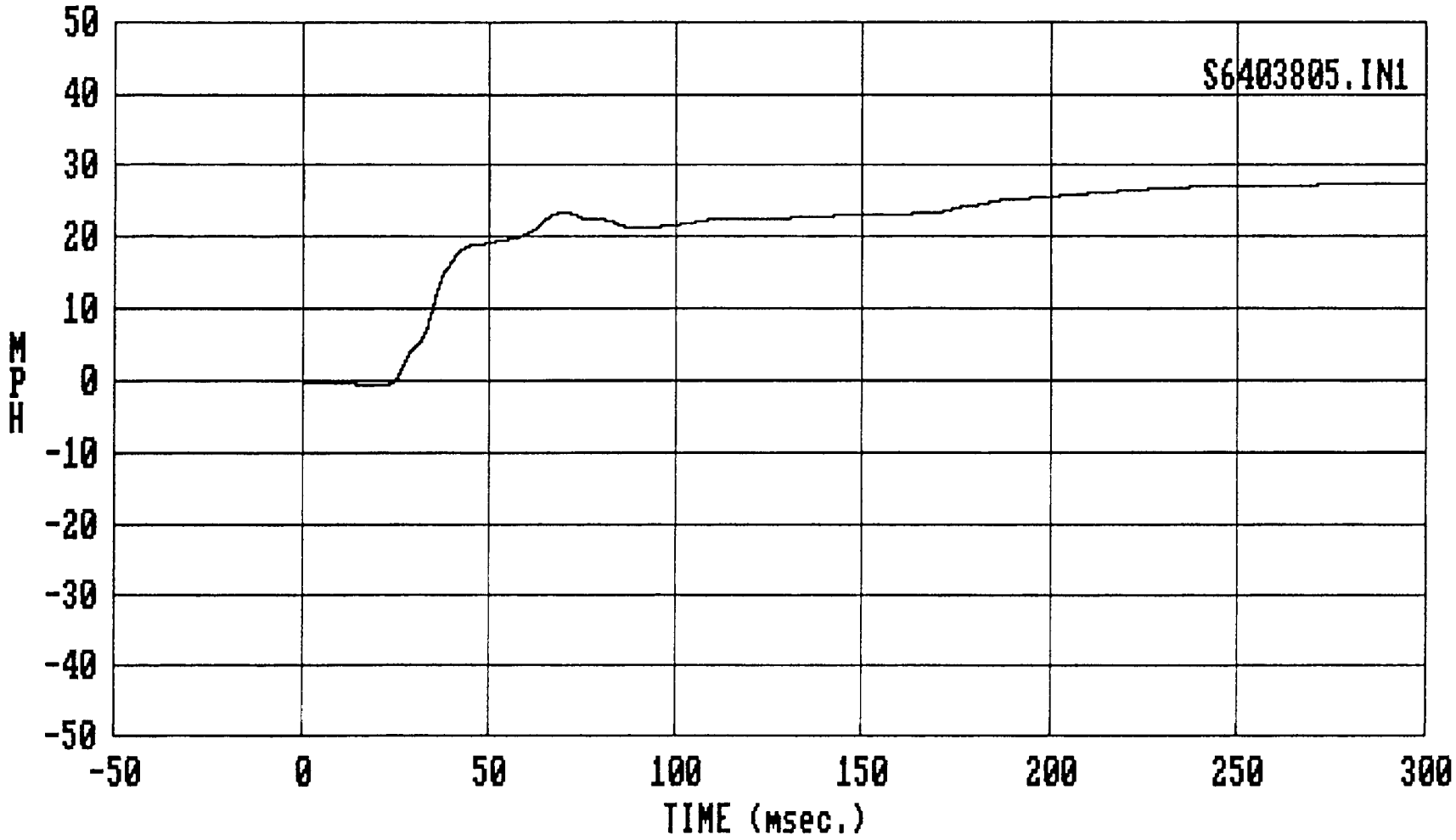
Filter: FIR 100 Max = 27.653 Min = -.28169

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Rib delt V, Y-ax.(Primary)



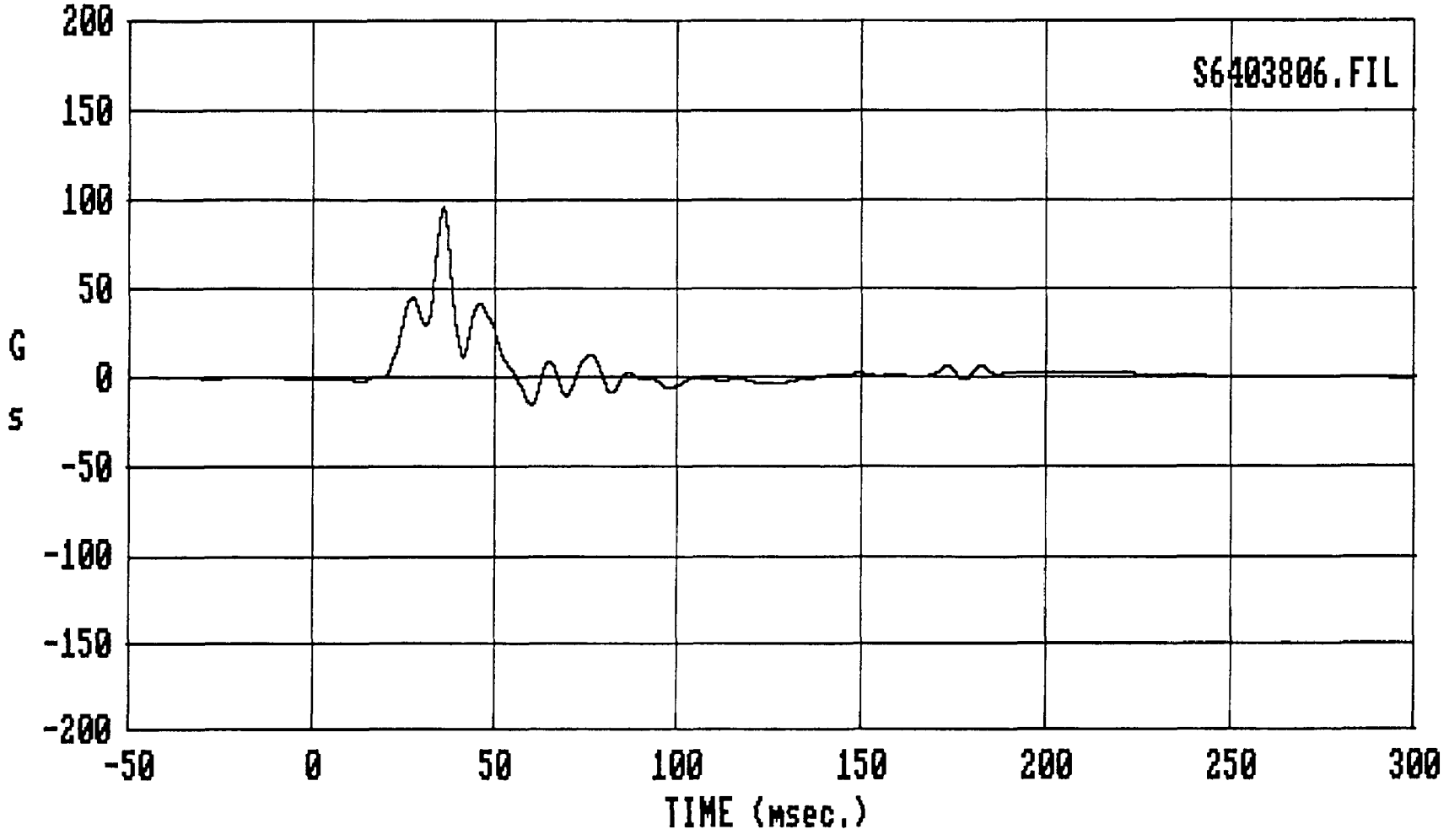
Filter: FIR 100 Max = 83.853 Min = -10.826

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Rib acc., Y-axis (Second)



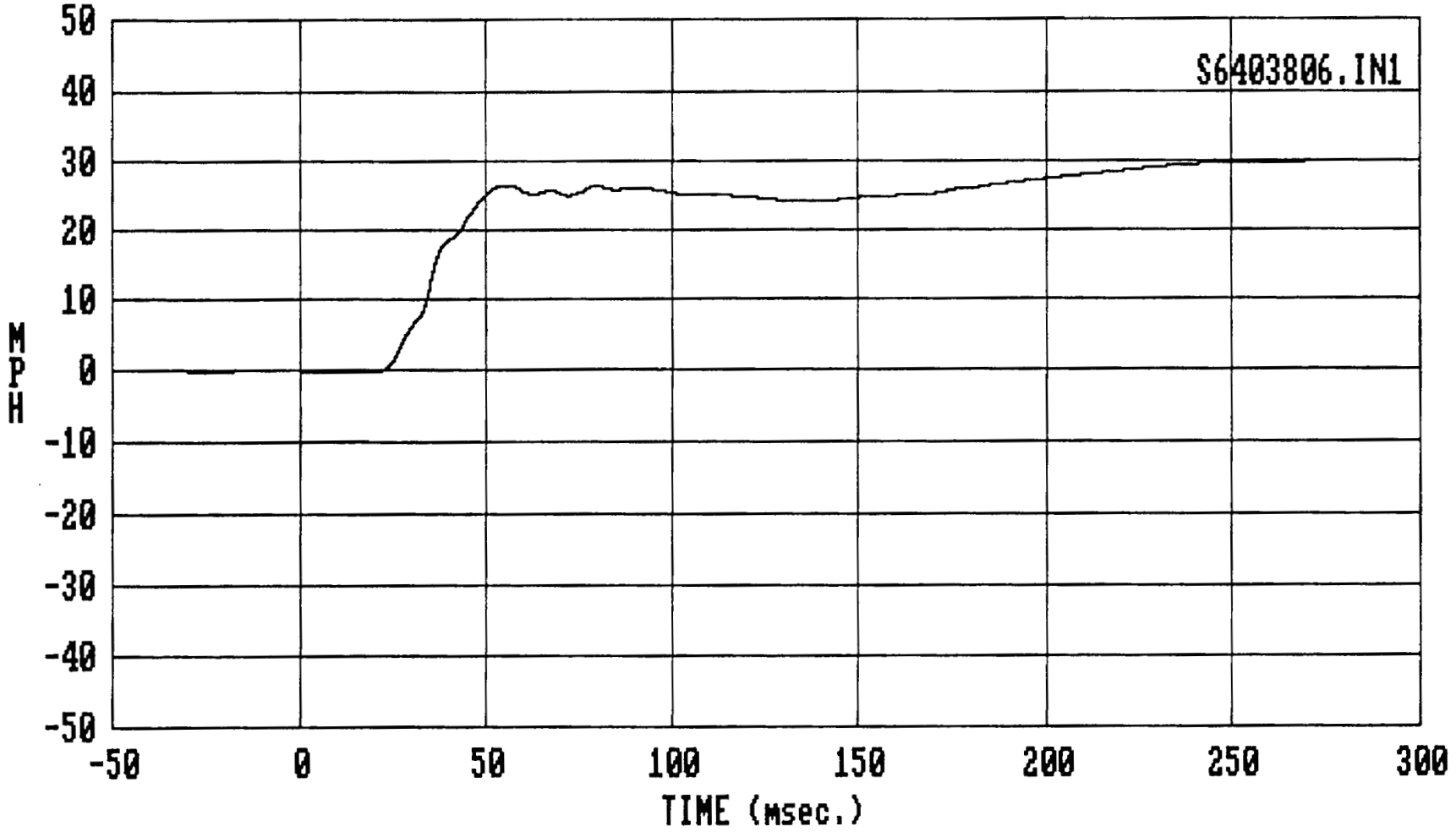
Filter: FIR 100 Max = 27.543 Min = -.36328

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Rib delt V, Y-ax.(Second)



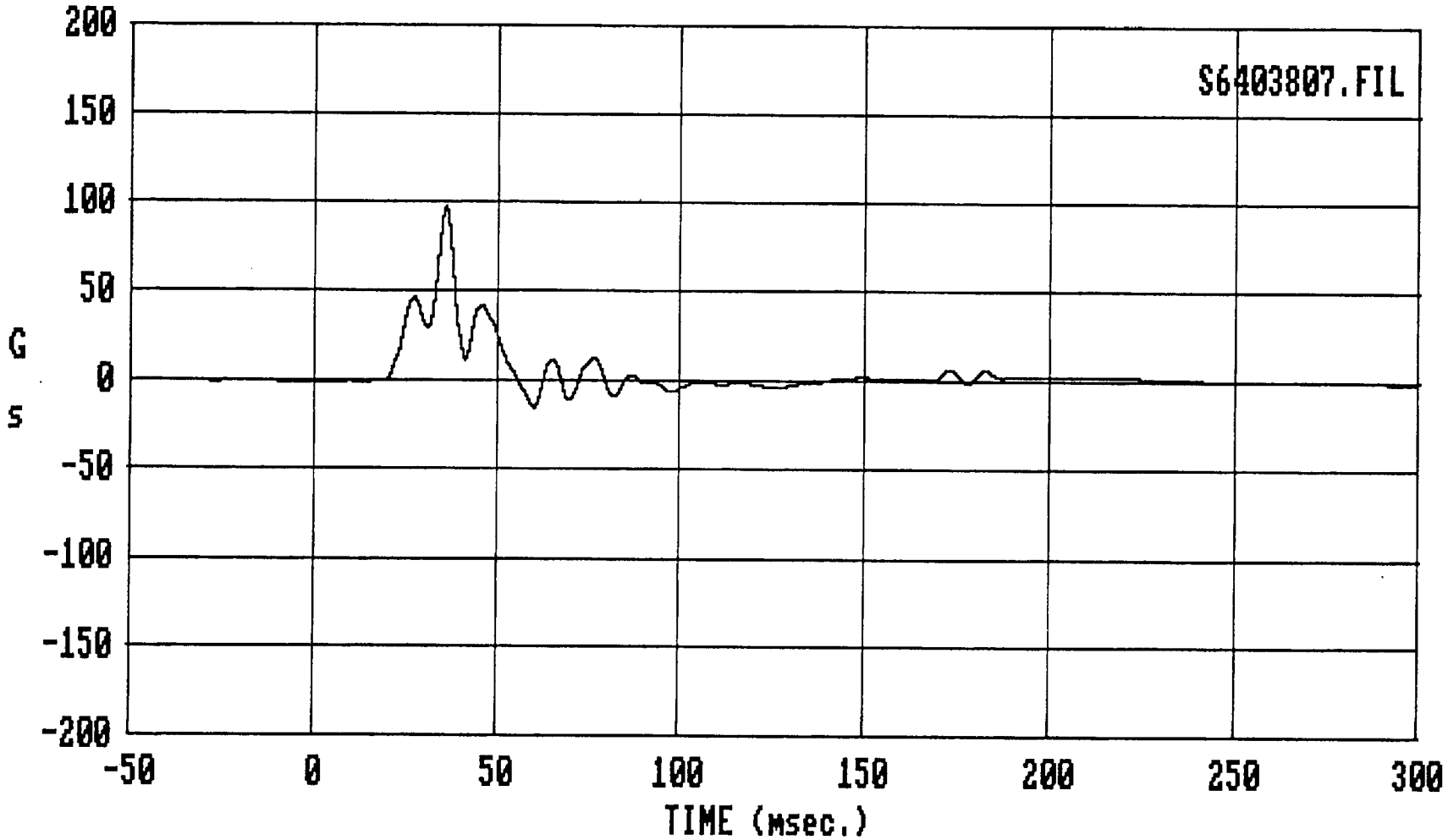
Filter: FIR 100 Max = 96.259 Min = -14.932

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Rib acc., Y-axis (Primary)



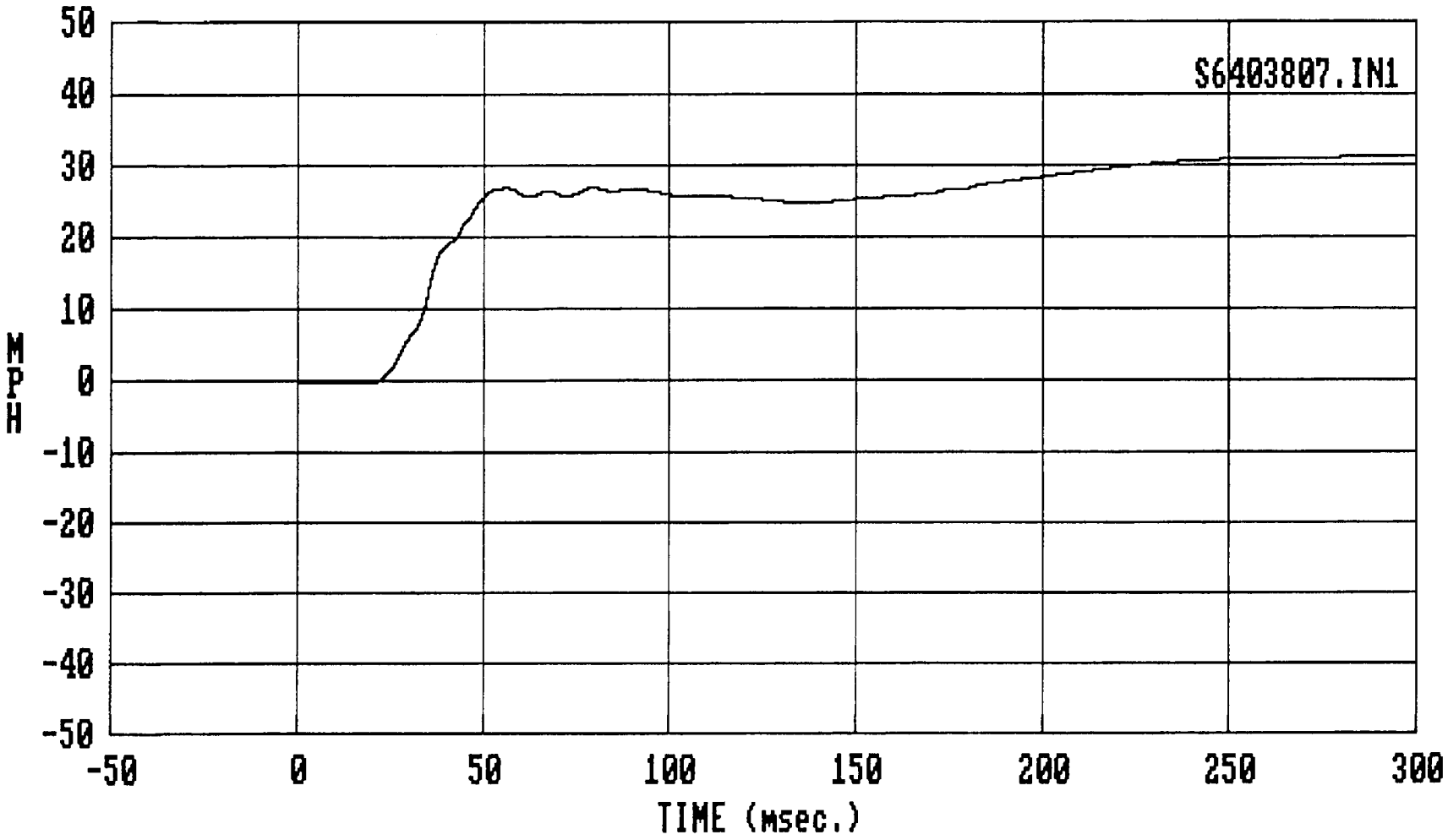
Filter: FIR 100 Max = 30.385 Min = -.23408

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Rib delt V, Y-ax.(Primary)



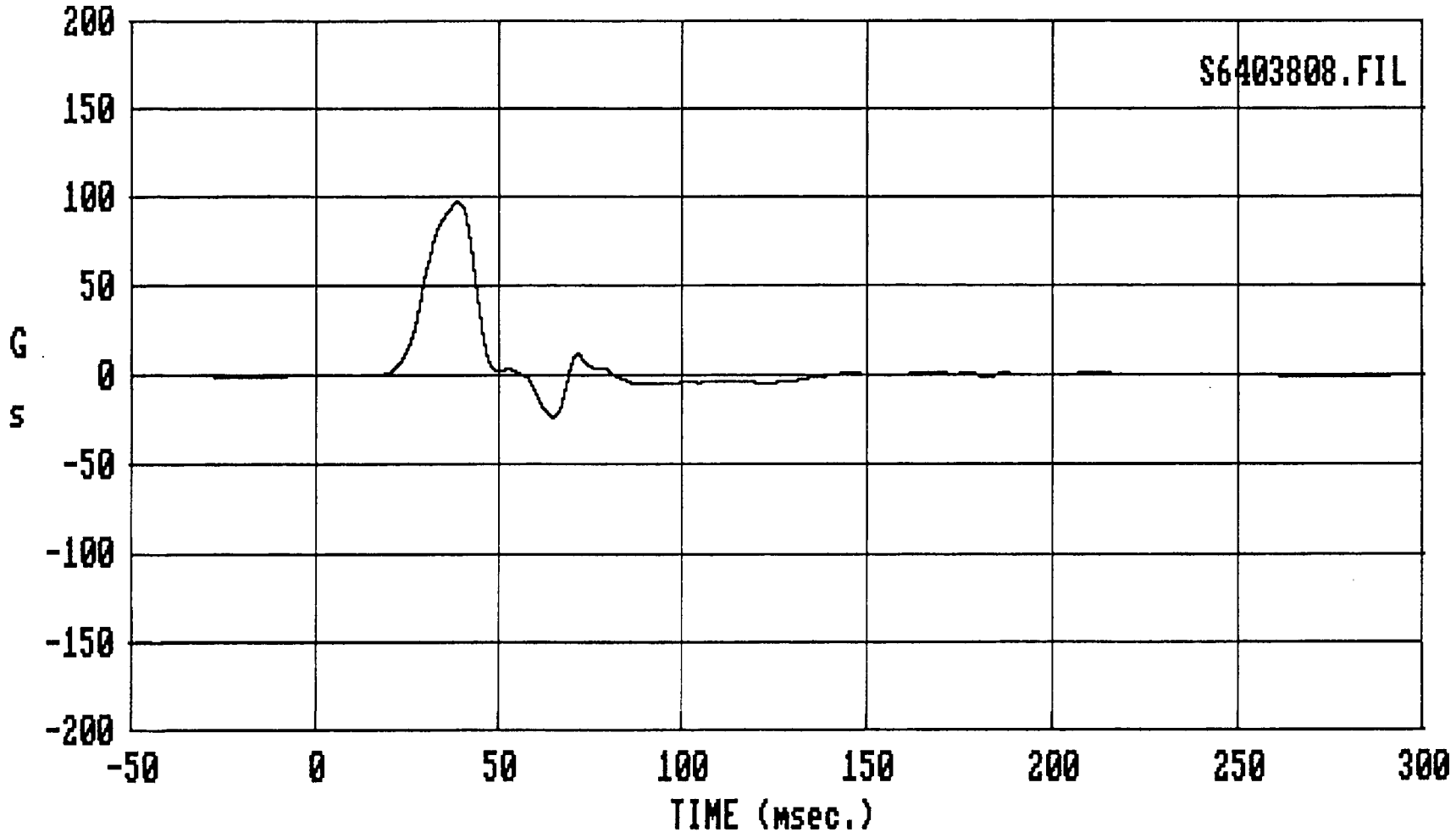
Filter: FIR 100 Max = 97.542 Min = -14.581

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Rib acc., Y-axis (Second)



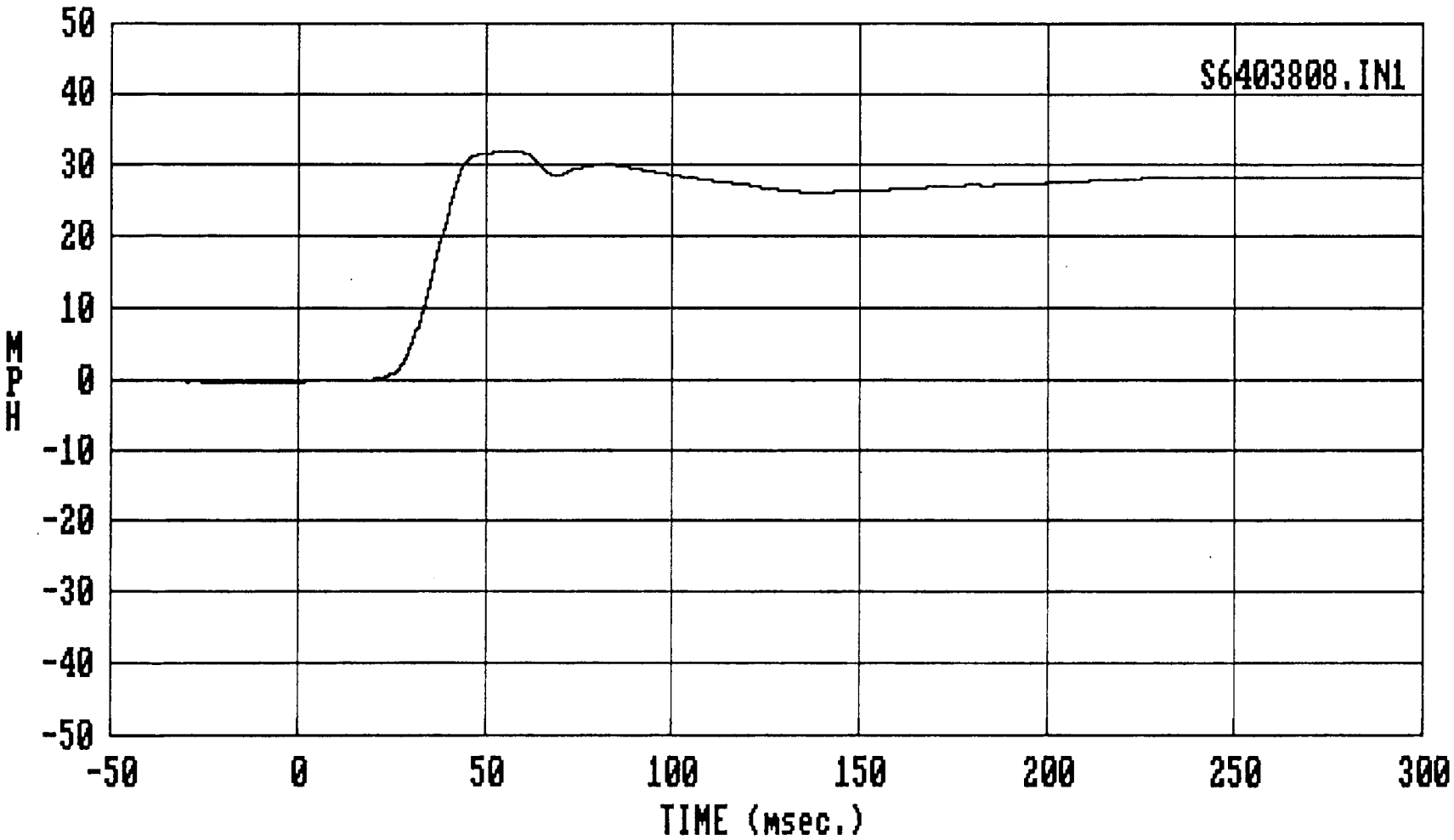
Filter: FIR 100 Max = 31.445 Min = -.10763

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Rib delt V, Y-ax.(Second)



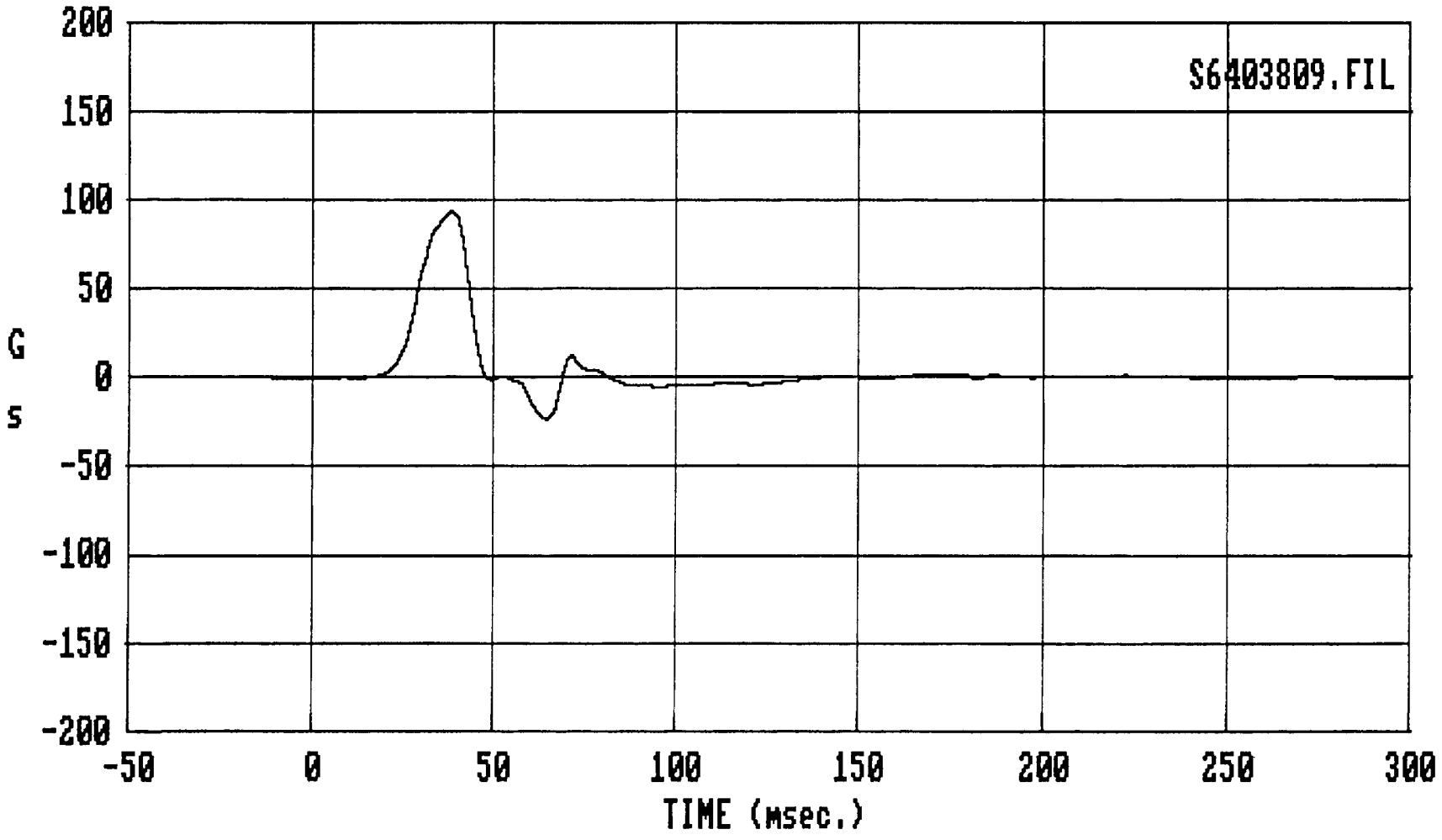
Filter: FIR 100 Max = 97.323 Min = -23.073

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Spine acc., Y-ax (Primary)



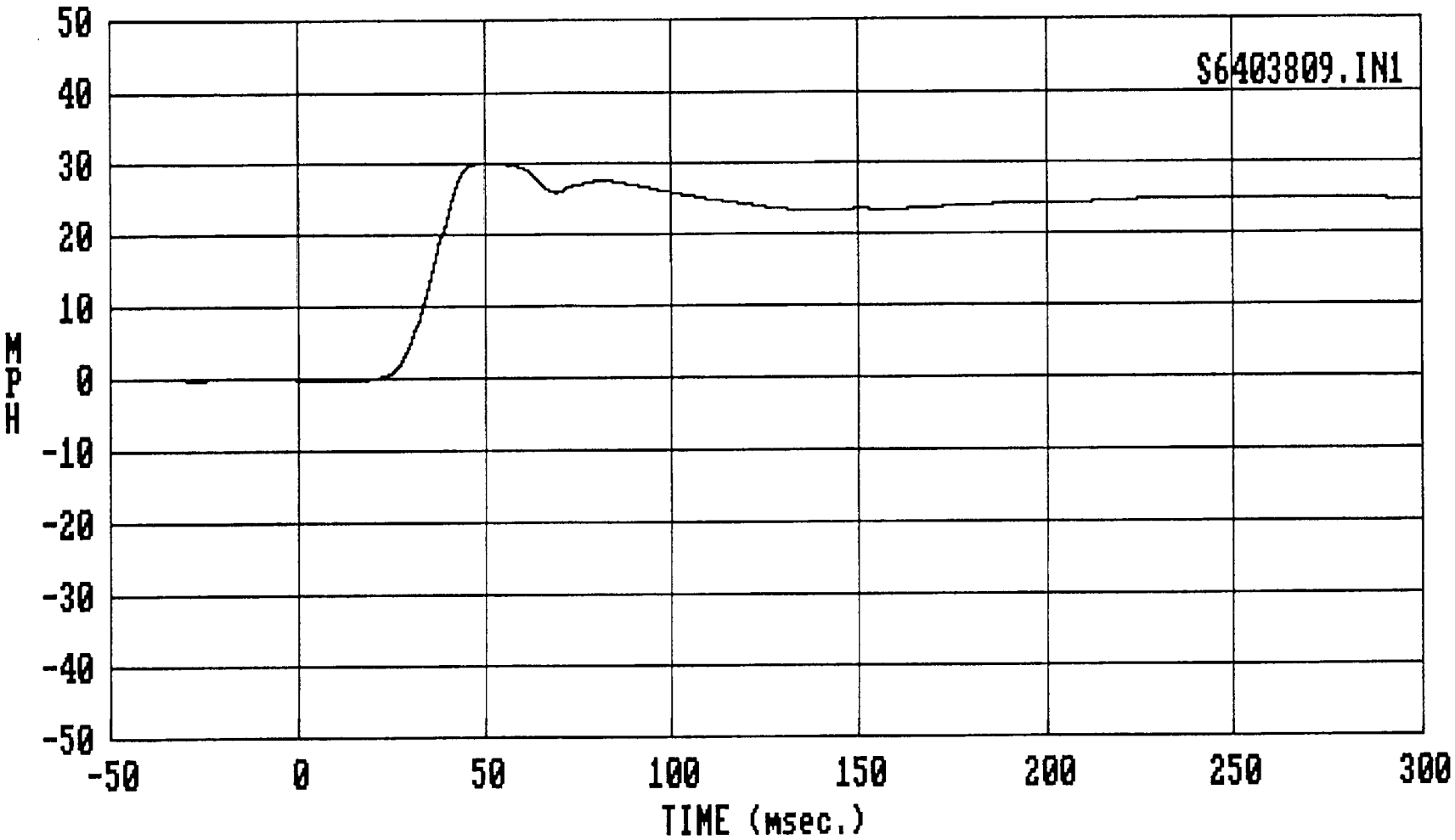
Filter: FIR 100 Max = 32.203 Min = .00000

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Spine delt V,Y-ax(Primary)



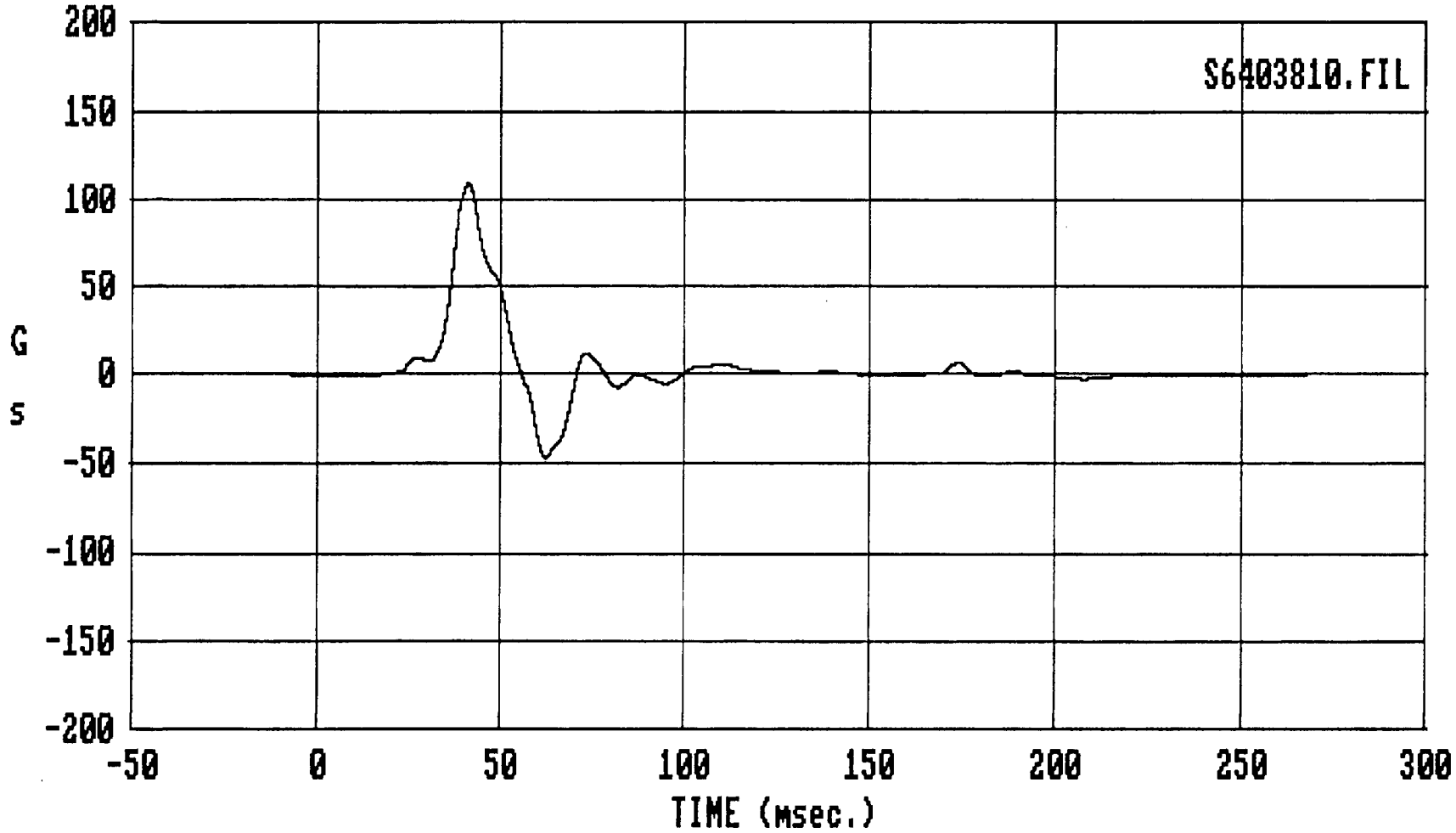
Filter: FIR 100 Max = 93.741 Min = -23.250

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Spine acc., Y-ax (Second)



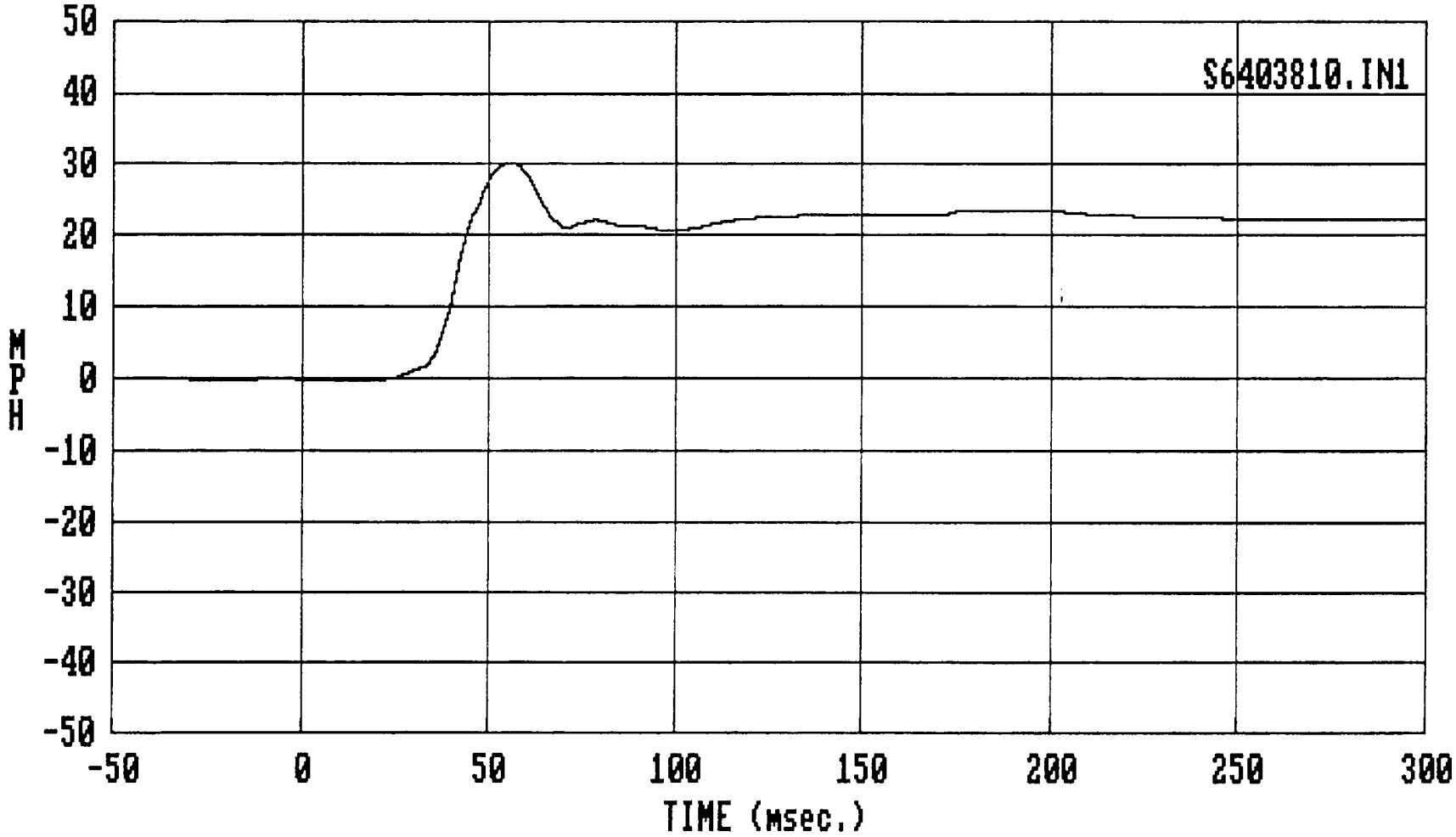
Filter: FIR 100 Max = 30.140 Min = -.52456E-01

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Lower Spine delt V,Y-ax (Second)



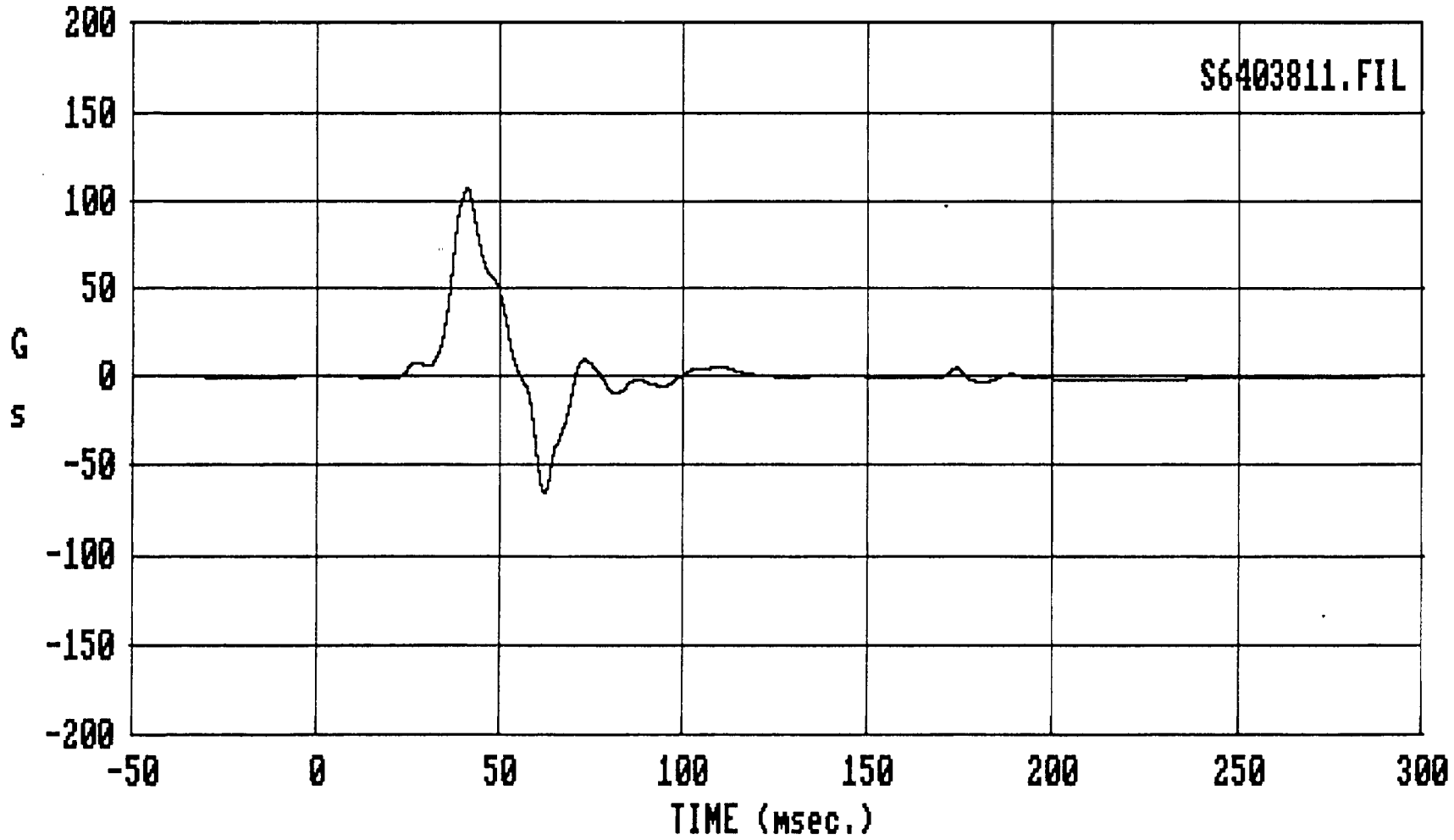
Filter: FIR 100 Max = 110.55 Min = -46.357

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Spine acc., Y-ax (Primary)



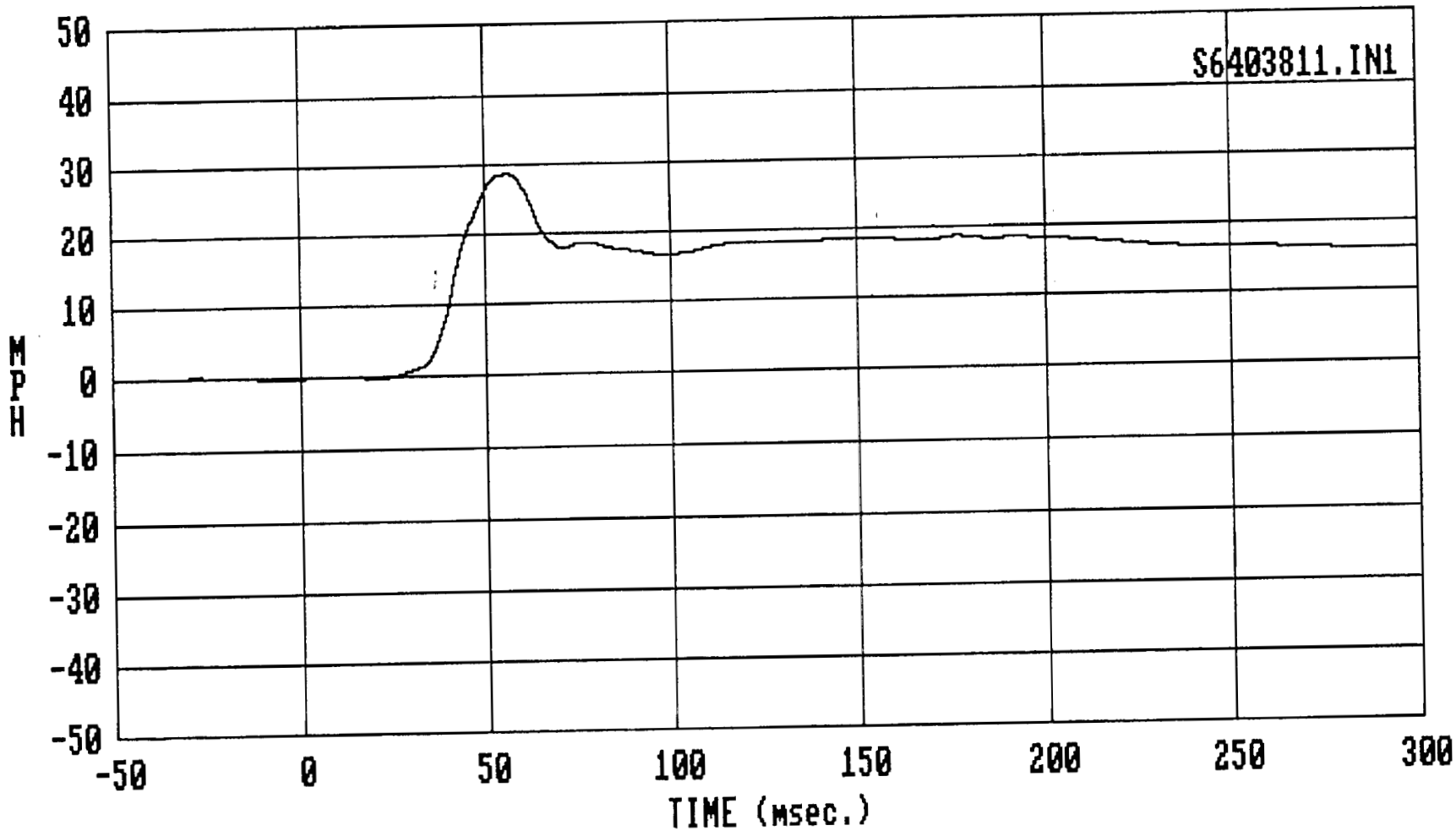
Filter: FIR 100 Max = 30.332 Min = -.64321E-01

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Spine delt V,Y-ax(Primary)



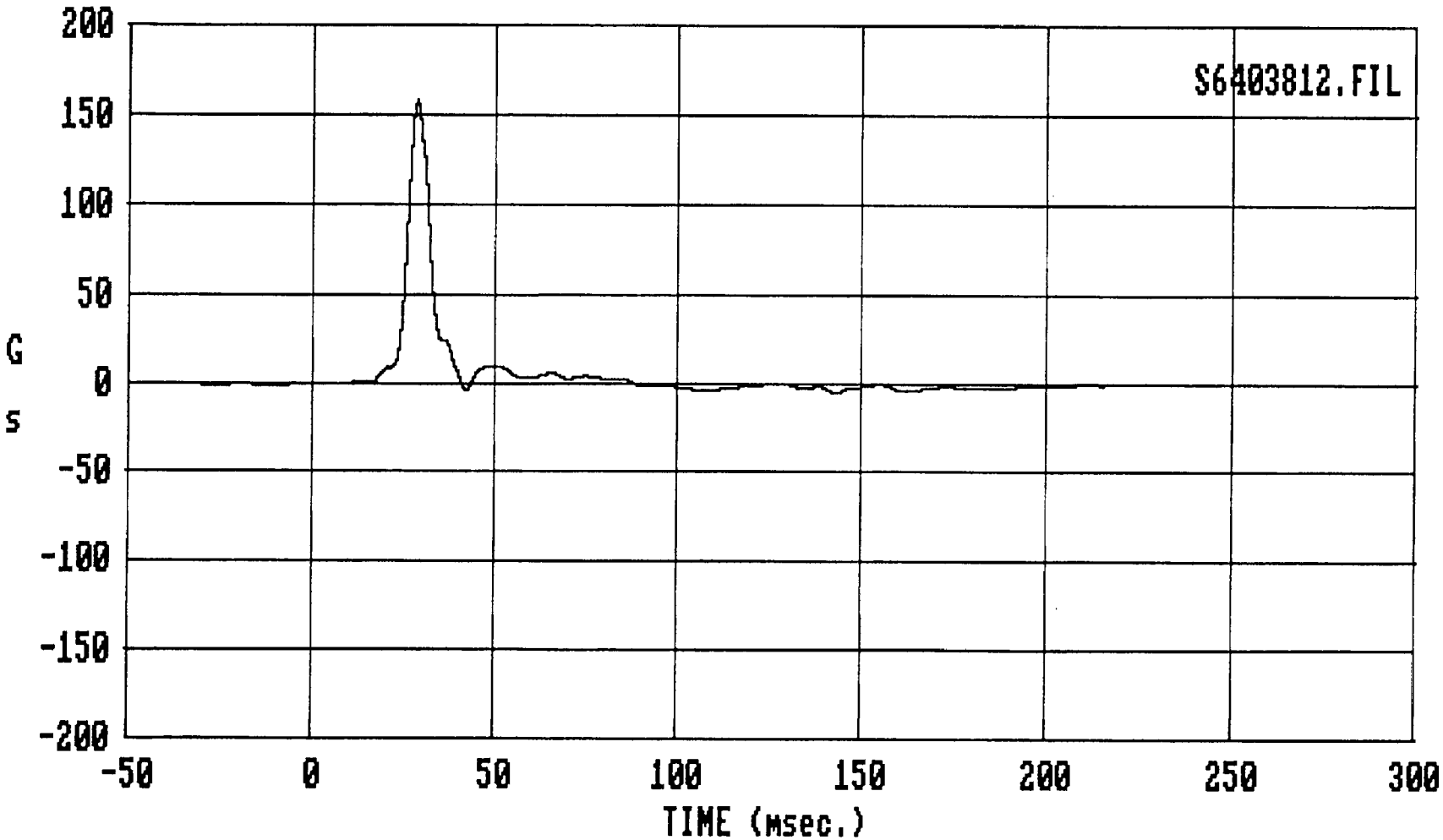
Filter: FIR 100 Max = 107.65 Min = -65.429

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Spine acc., Y-ax (Second)



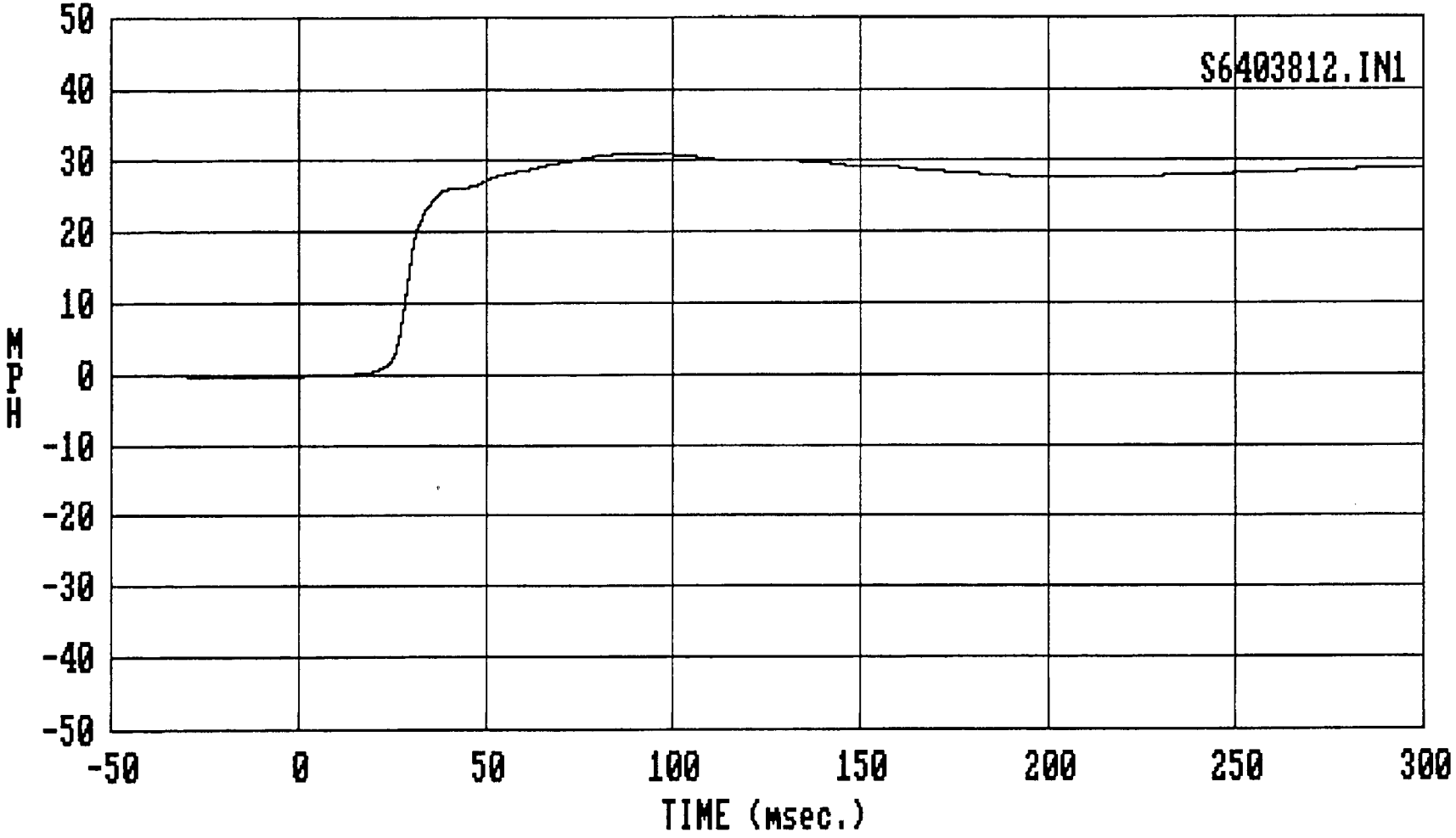
Filter: FIR 100 Max = 28.898 Min = -.26409E-01

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Upper Spine delt V,Y-ax (Second)



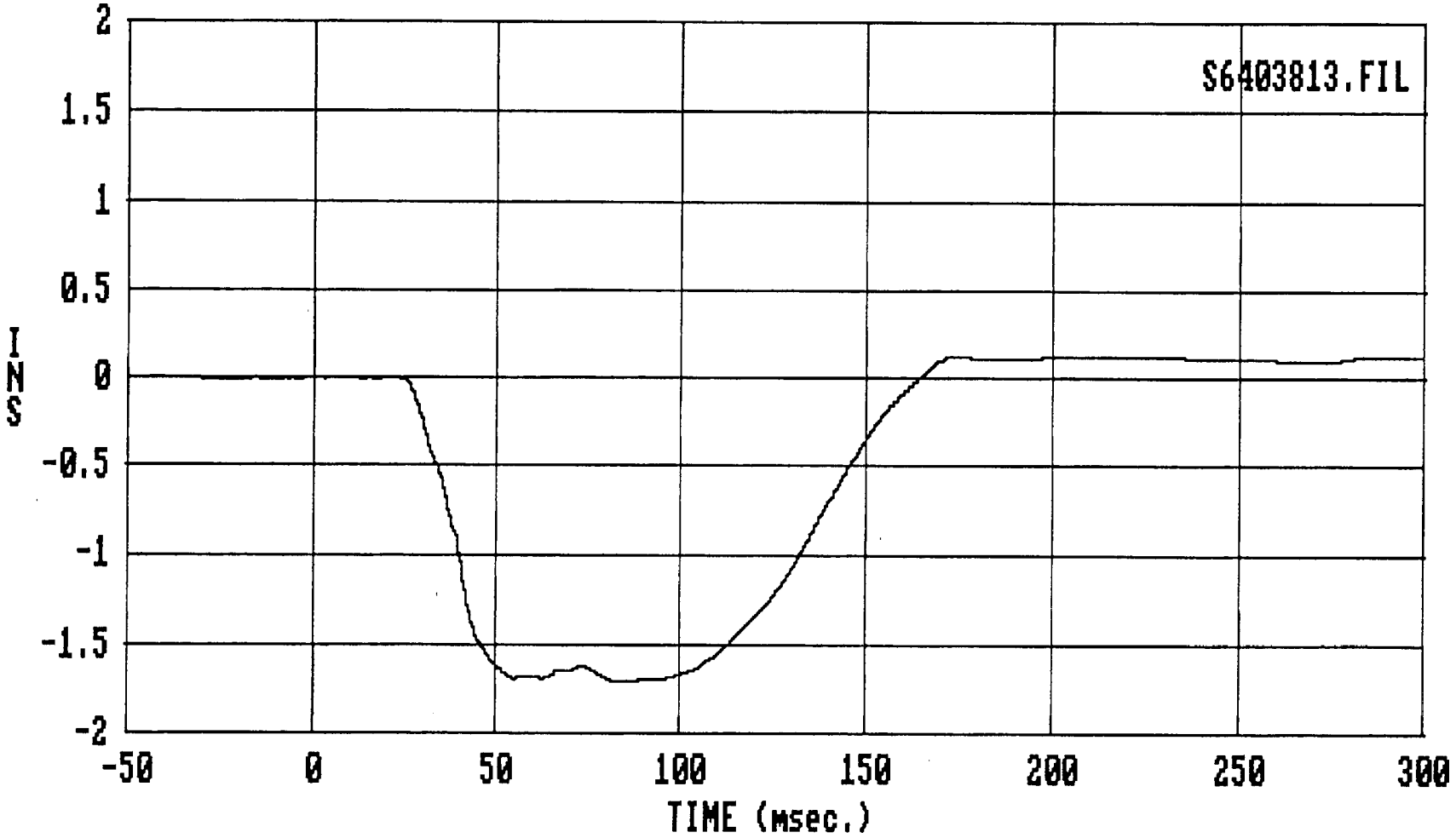
Filter: FIR 100 Max = 158.50 Min = -4.0940

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Pelvis acceleration, Y-axis



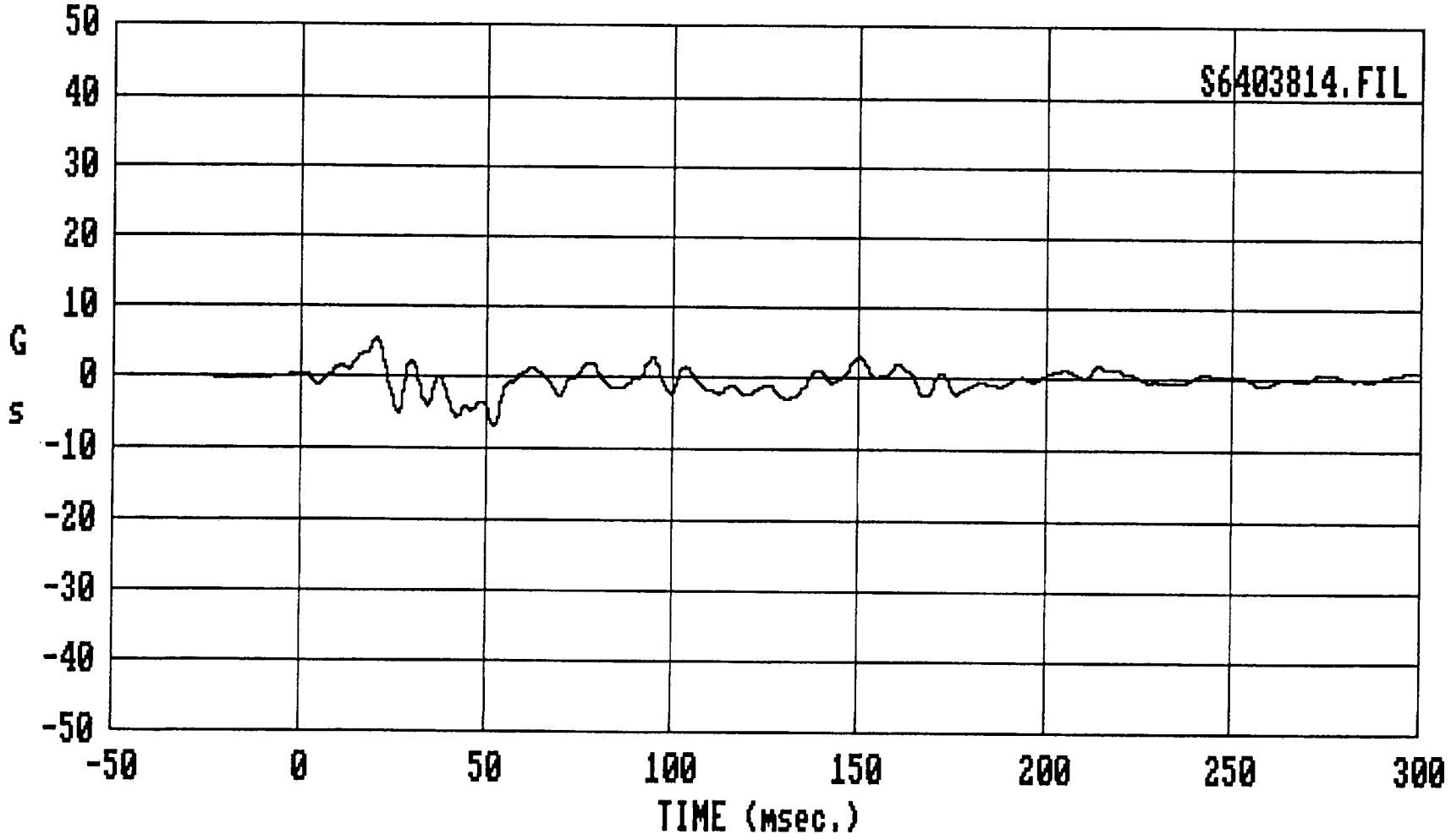
Filter: FIR 100 Max = 31.195 Min = .00000

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Pelvis delta V, Y-axis



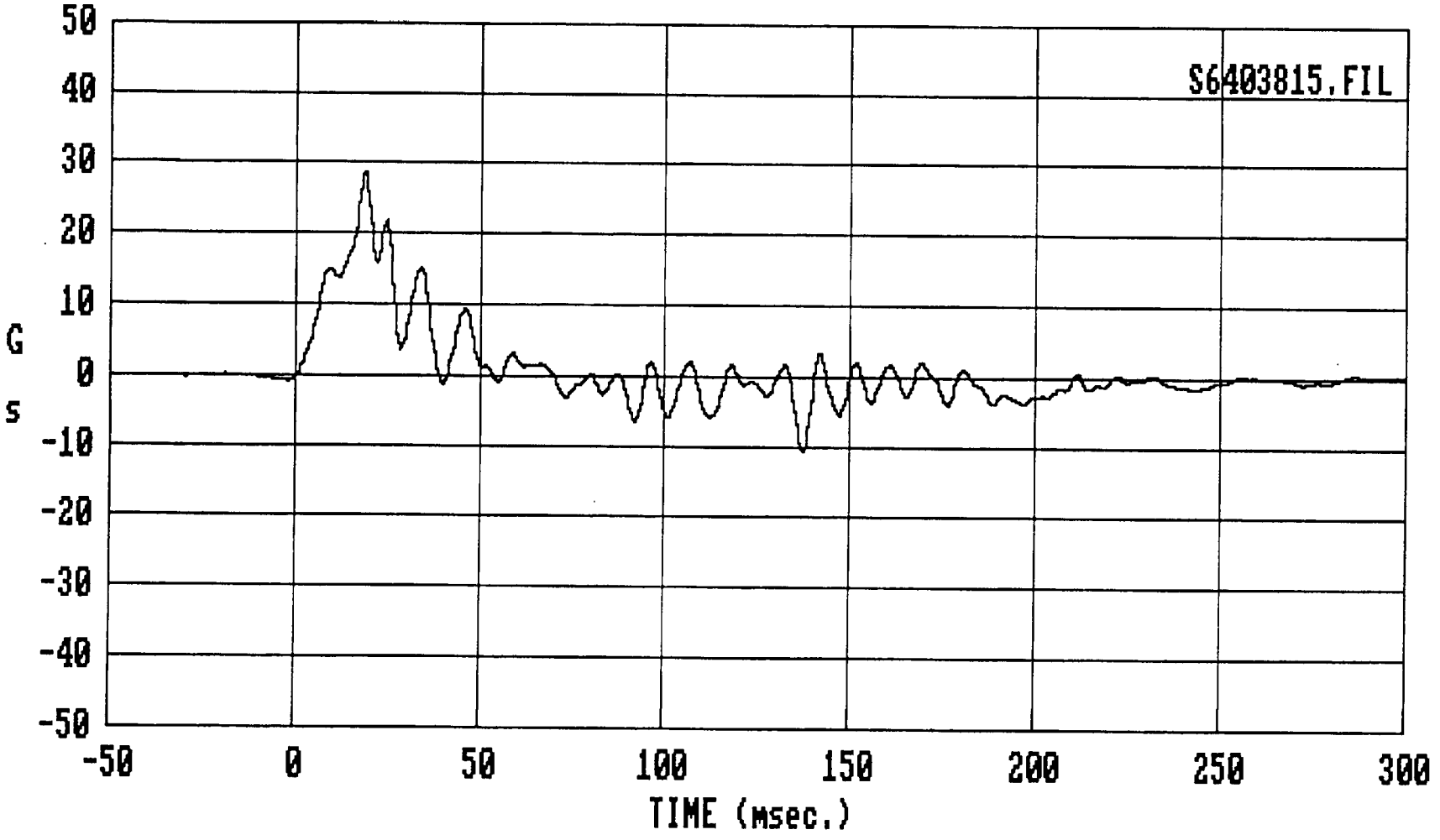
Filter: SAE CLASS 180 Max = .13138 Min = -1.7050

MSE 11/09/88 -- 1988 Nissan Pickup : Driver Chest disp. (Compression is -)



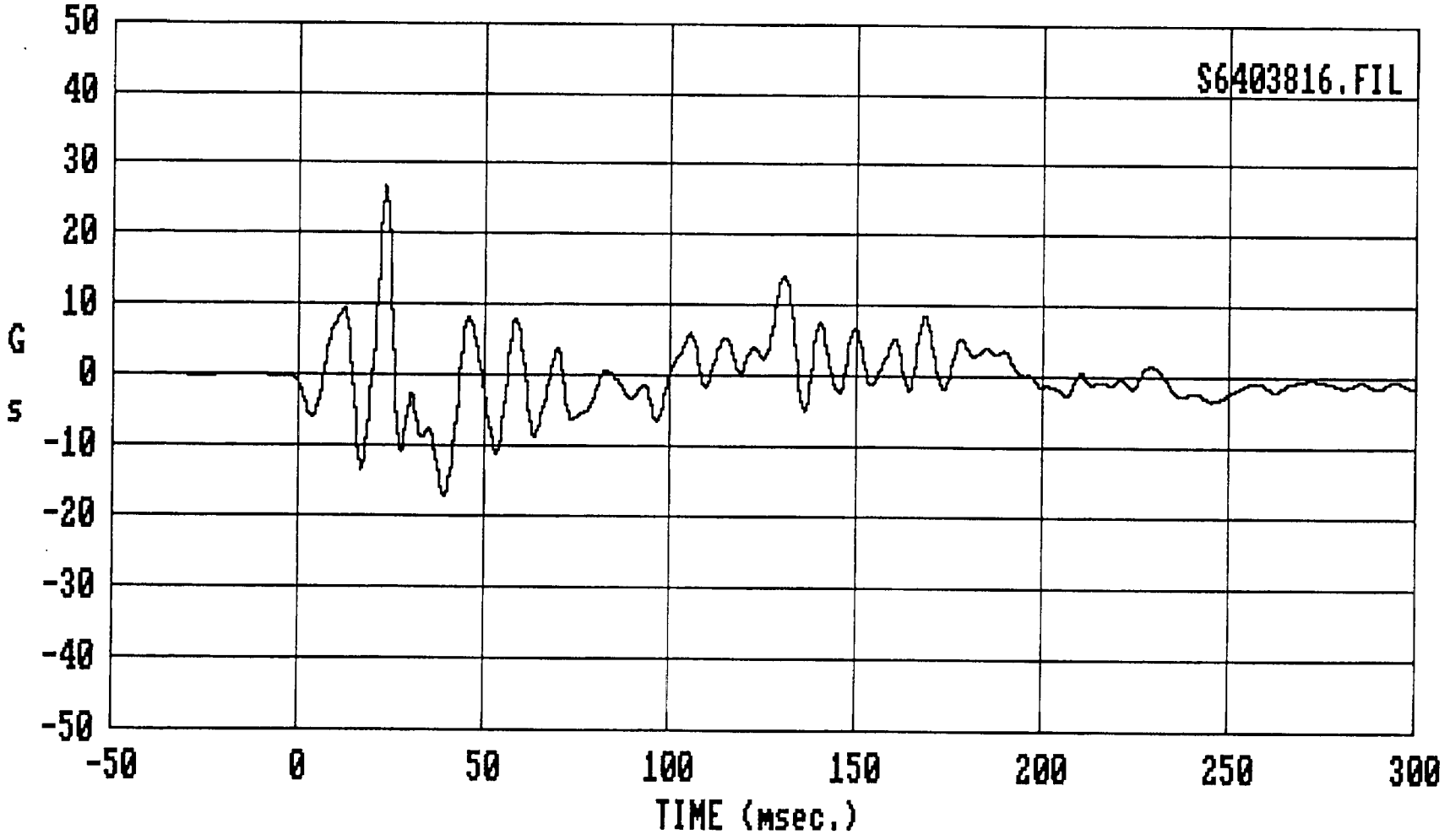
Filter: SAE CLASS 60 Max = 5.7207 Min = -6.9581

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Right Sill, X-axis



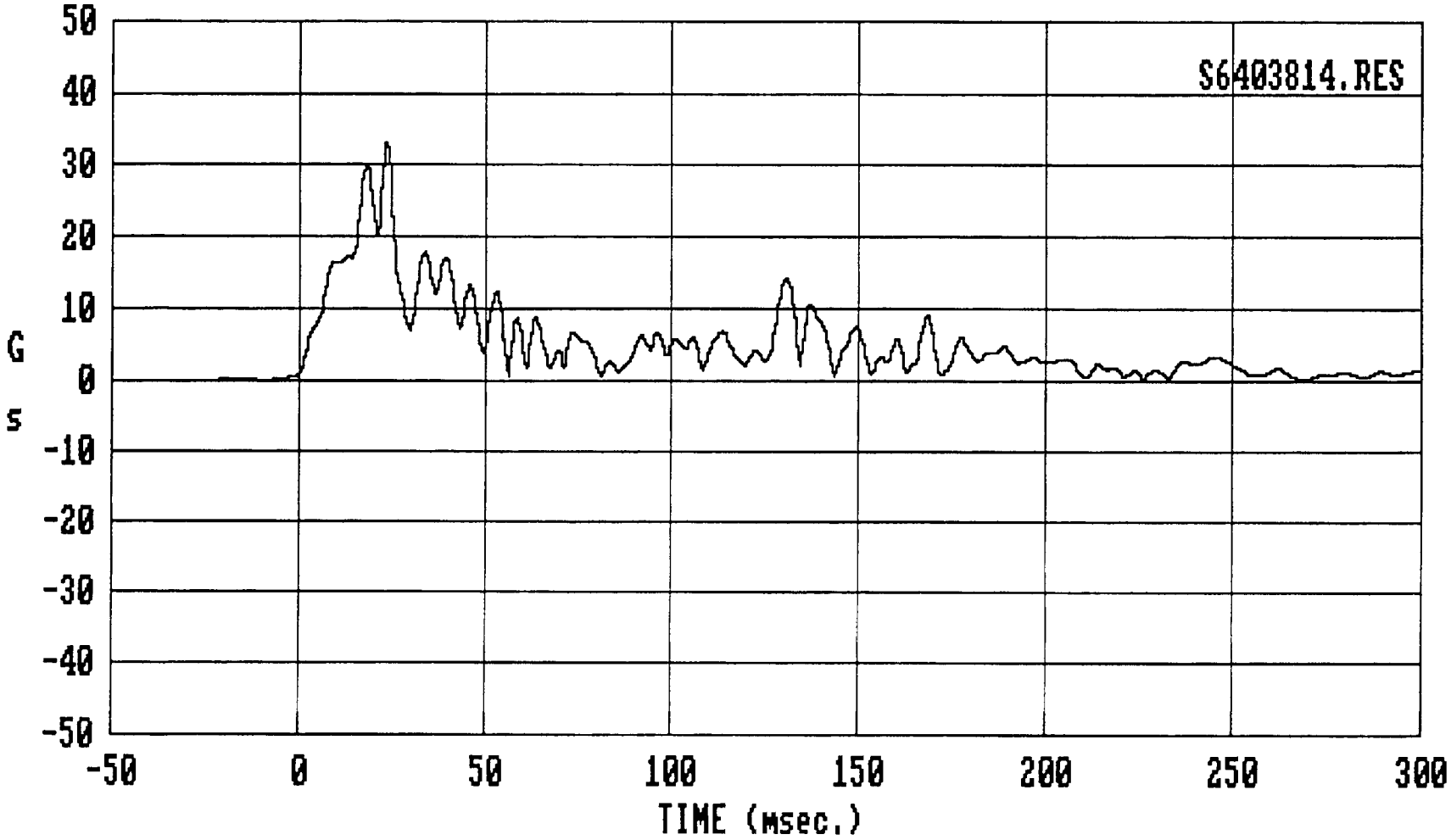
Filter: SAE CLASS 60 Max = 28.823 Min = -10.530

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Right Sill, Y-axis



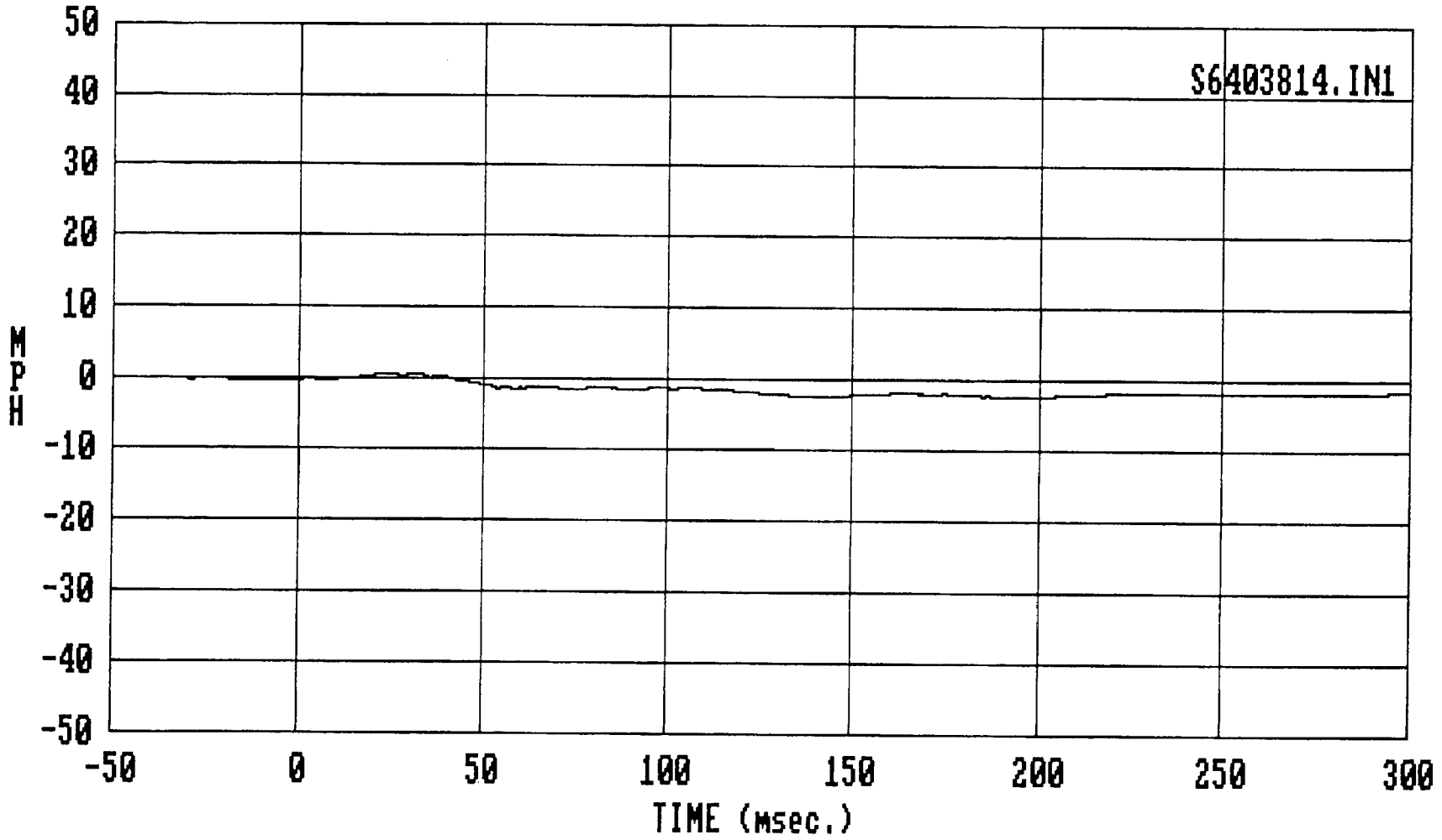
Filter: SAE CLASS 60 Max = 26.815 Min = -17.121

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Right Sill, Z-axis



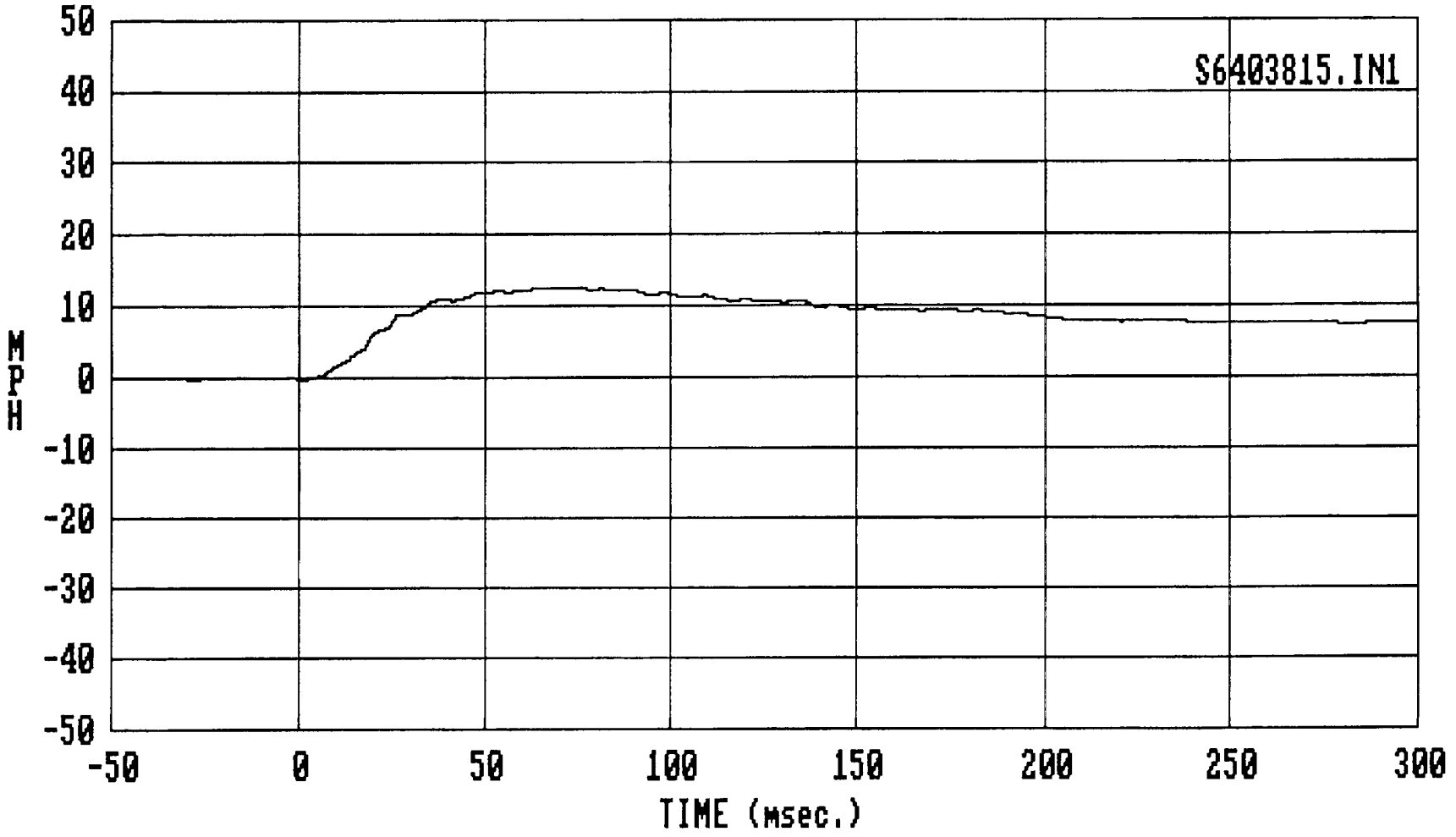
Filter: SAE CLASS 60 Max = 33.471 Min = .27079

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Right Sill, resultant accel.



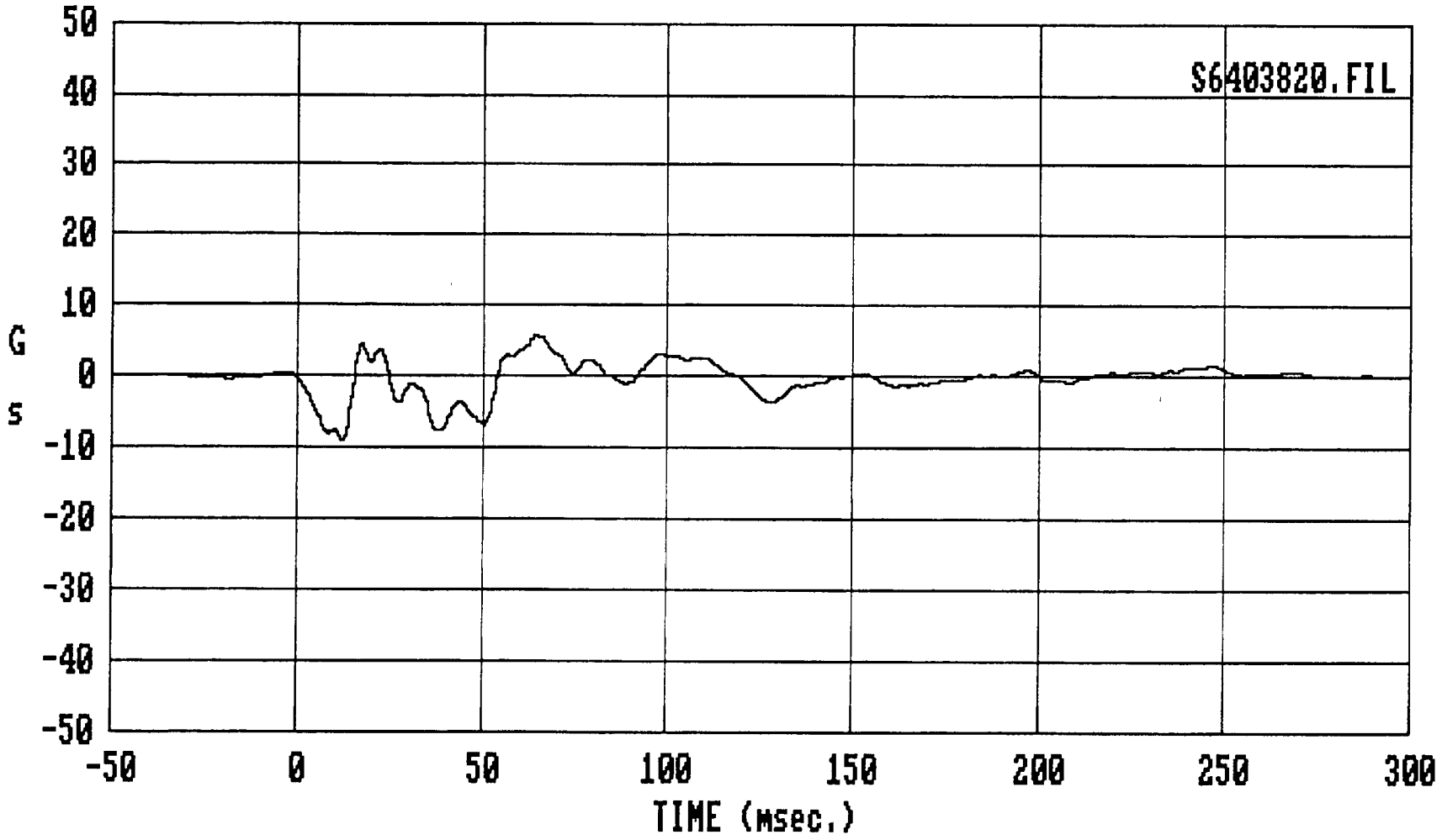
Filter: SAE CLASS 180 Max = .88387 Min = -2.3353

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Right Sill delta V, X-axis



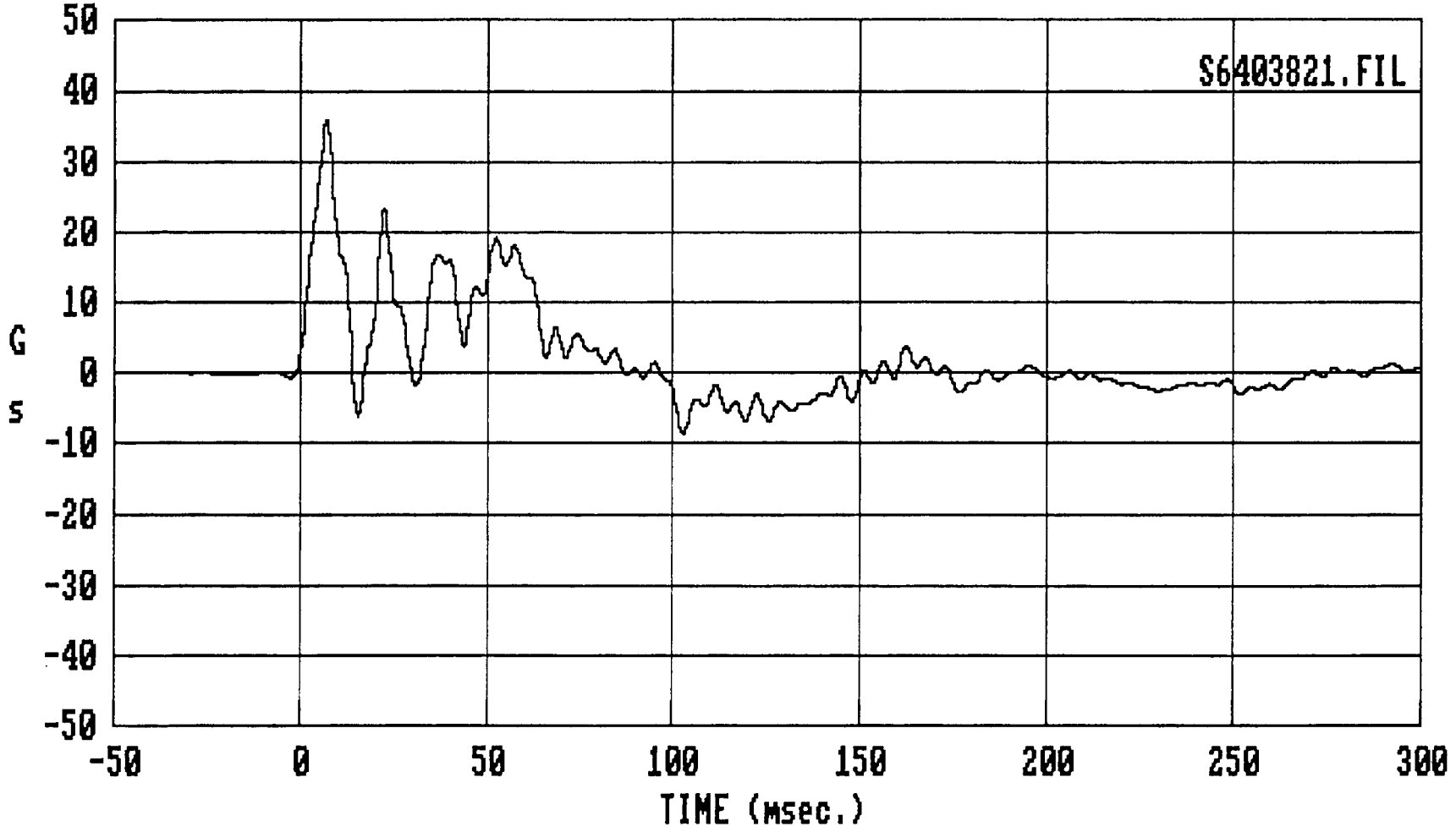
Filter: SAE CLASS 180 Max = 12.754 Min = -.88208E-02

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Right Sill delta V, Y-axis



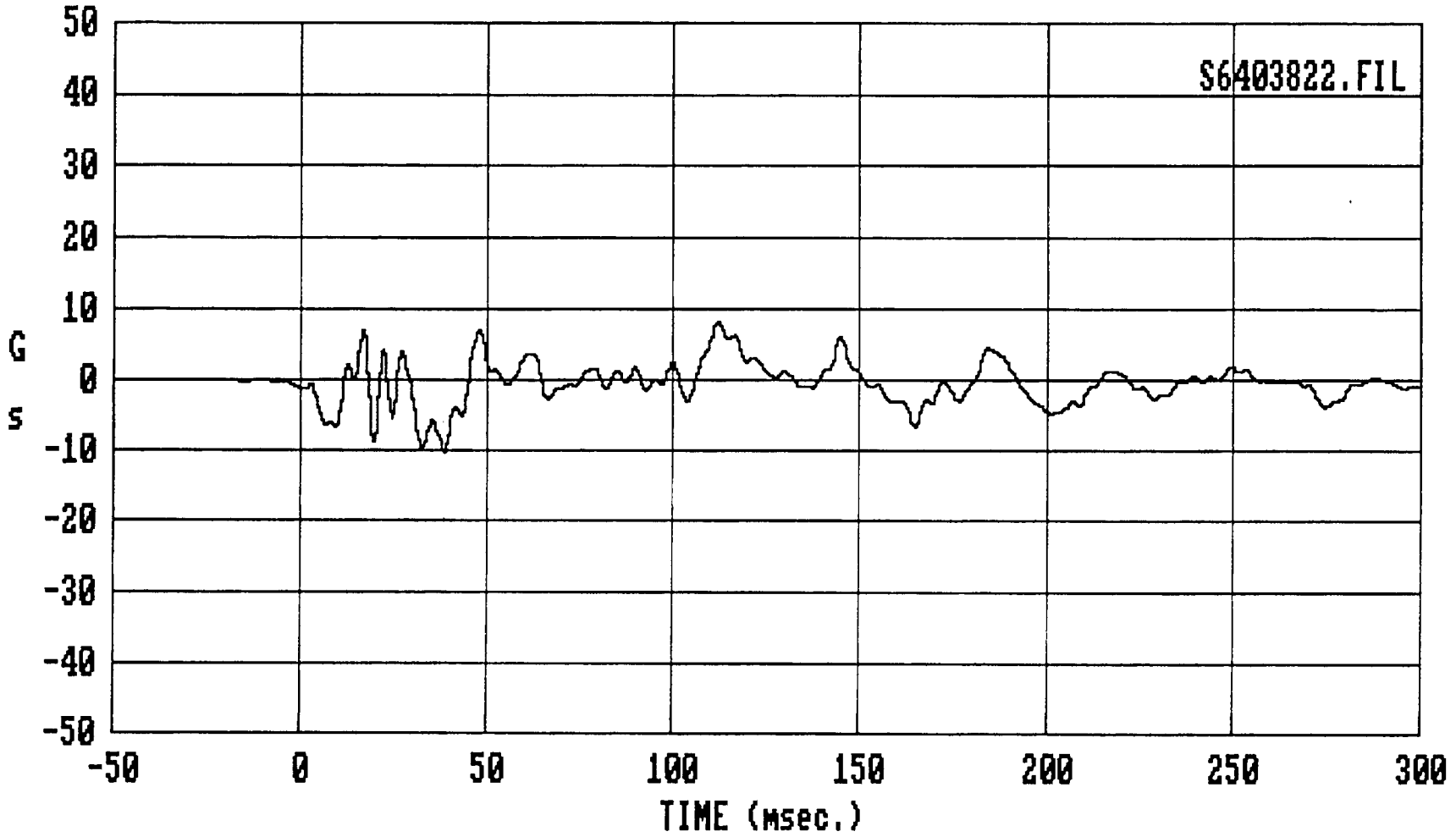
Filter: SAE CLASS 60 Max = 5.8605 Min = -9.0025

MSE 11/09/88 -- 1988 Nissan Pickup : Rear Floor above axle, X-axis



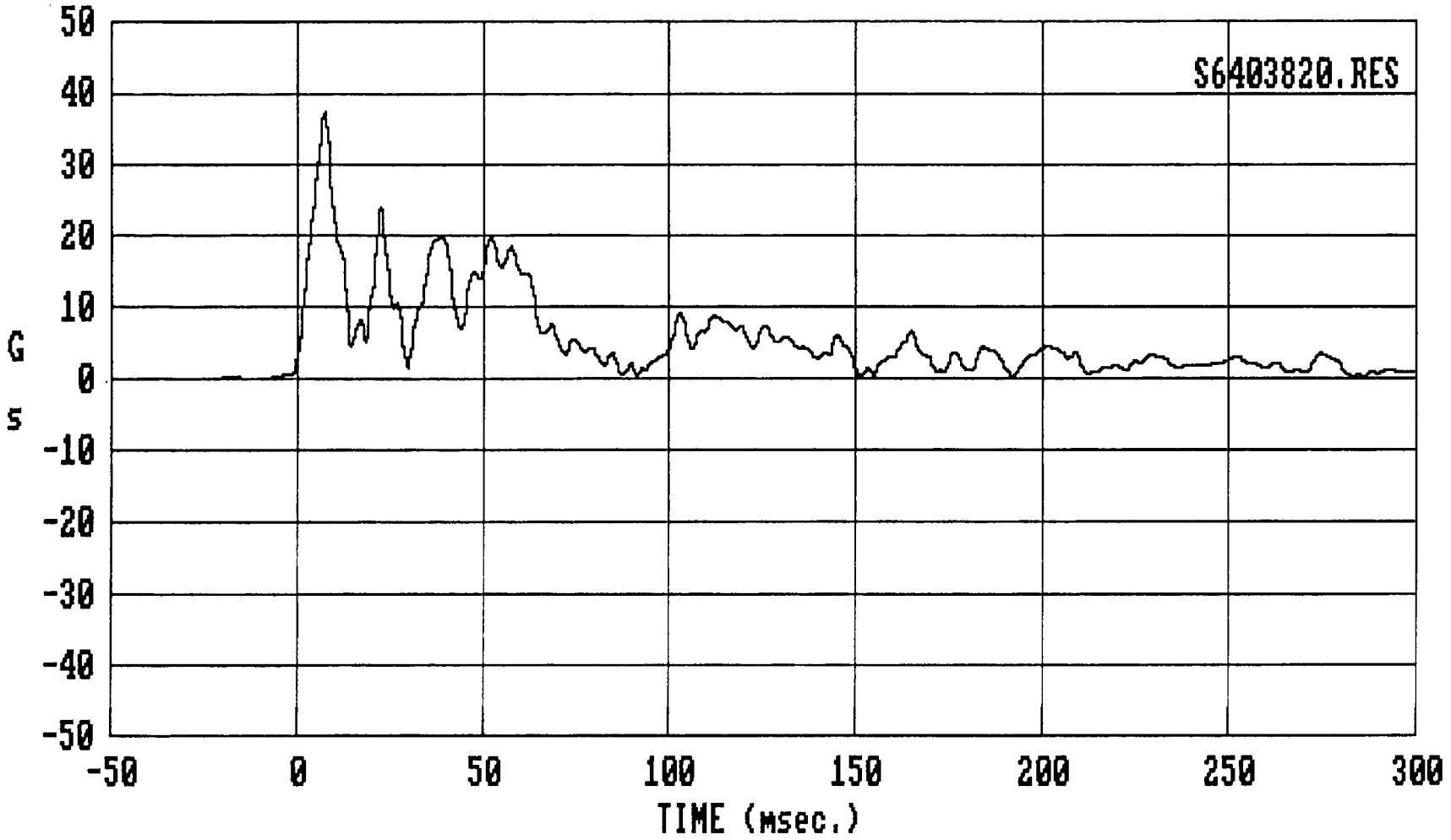
Filter: SAE CLASS 60 Max = 36.218 Min = -8.6046

MSE 11/09/88 -- 1988 Nissan Pickup : Rear Floor above axle, Y-axis



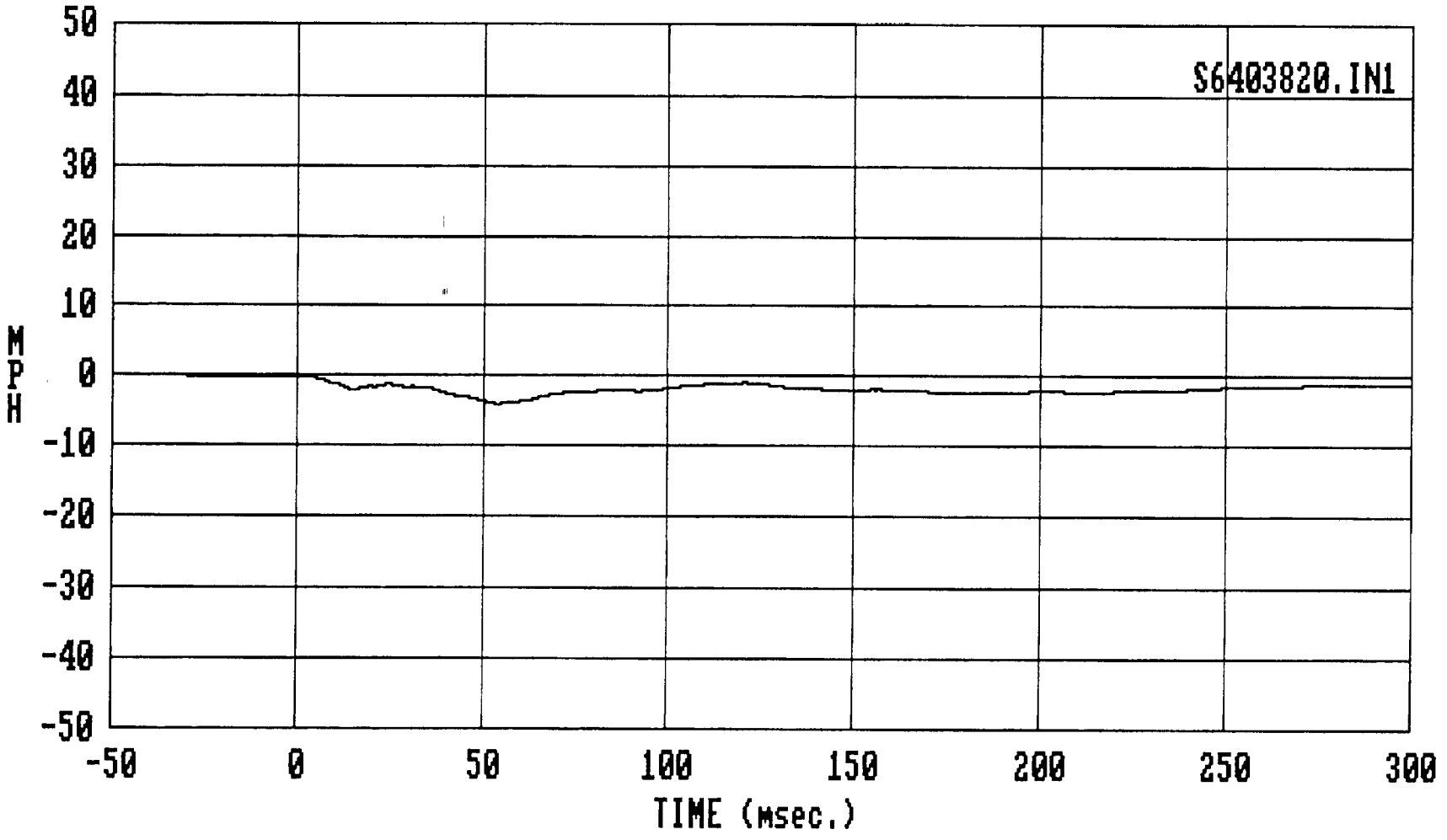
Filter: SAE CLASS 60 Max = 8.4629 Min = -10.132

MSE 11/09/88 -- 1988 Nissan Pickup : Rear Floor above axle, Z-axis



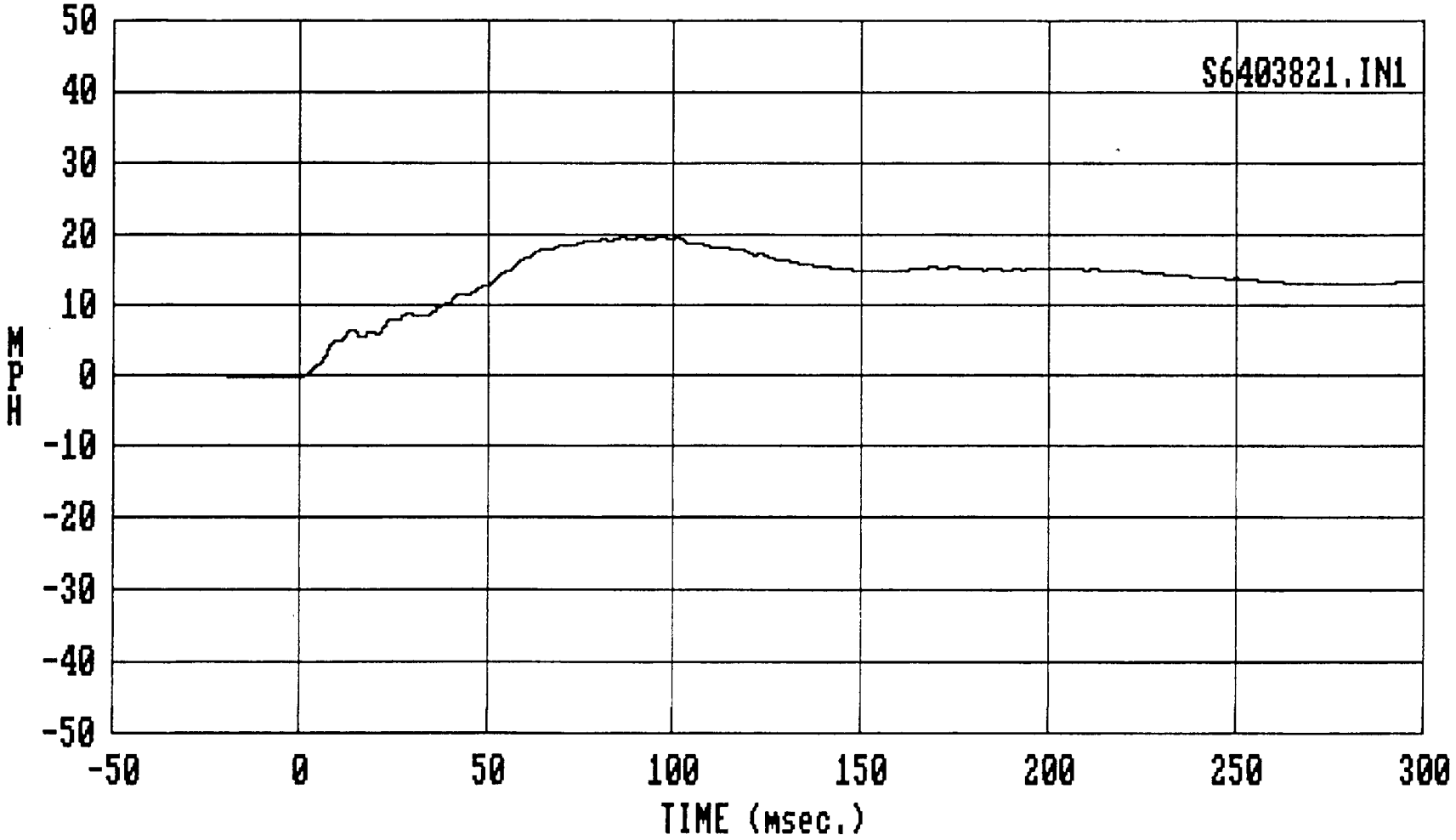
Filter: SAE CLASS 60 Max = 37.471 Min = .28620

MSE 11/09/88 -- 1988 Nissan Pickup : Rear Floor above axle, resultant accel.



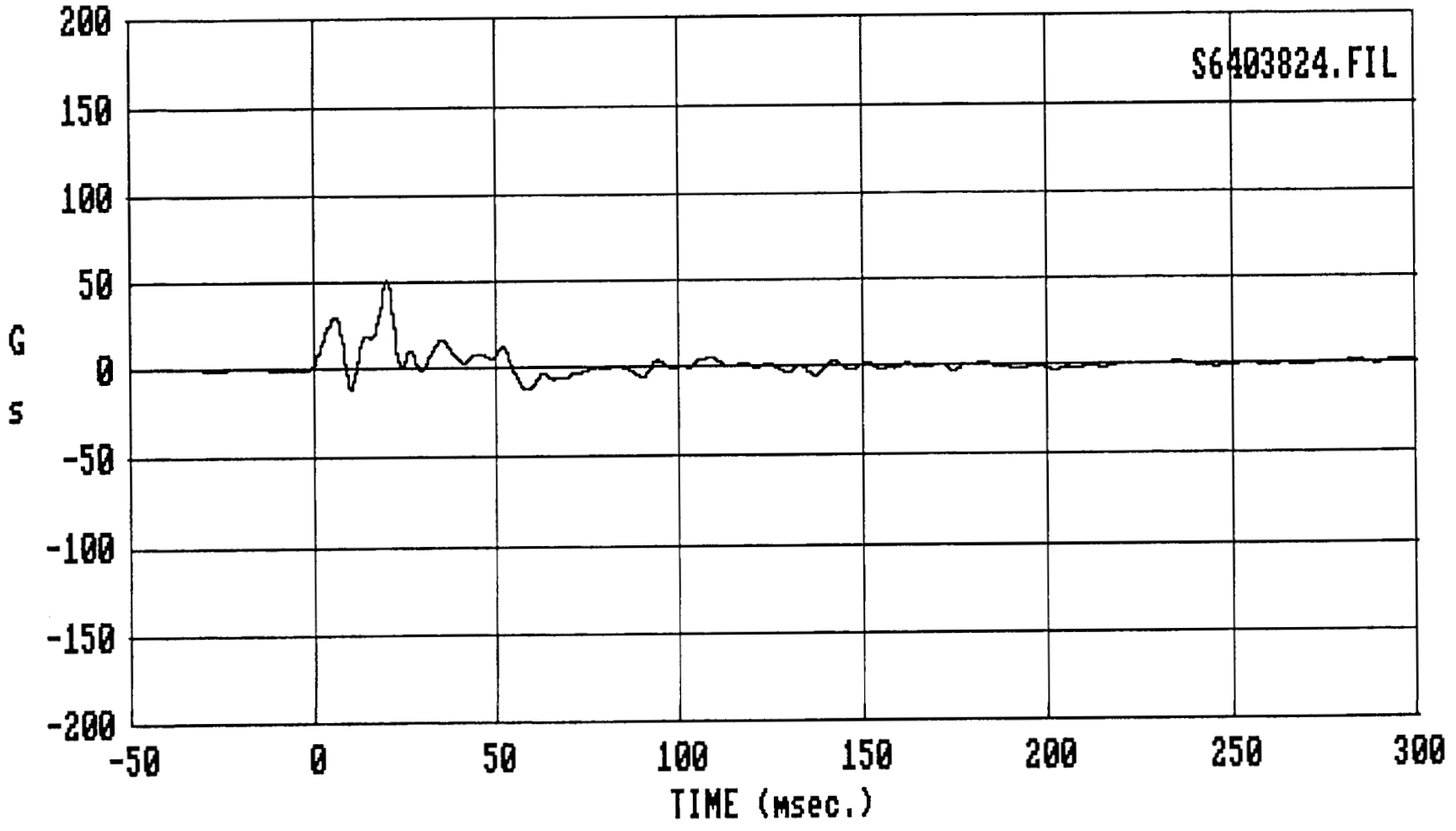
Filter: SAE CLASS 180 Max = .62073E-03Min = -3.9891

MSE 11/09/88 -- 1988 Nissan Pickup : Rear Floor above axle delta V, X-axis



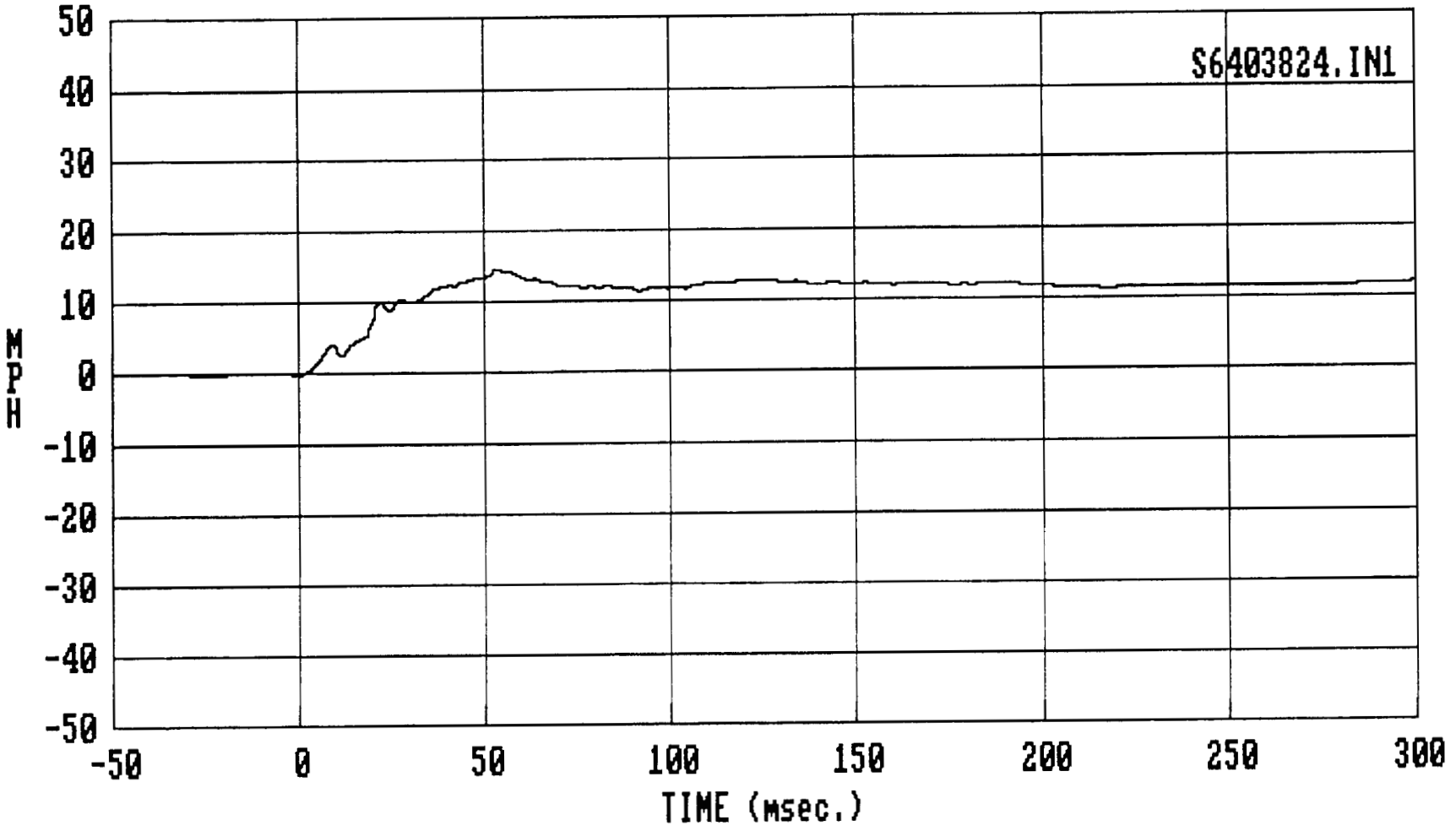
Filter: SAE CLASS 180 Max = 19.869 Min = -.20786E-02

MSE 11/09/88 -- 1988 Nissan Pickup : Rear Floor above axle delta V, Y-axis



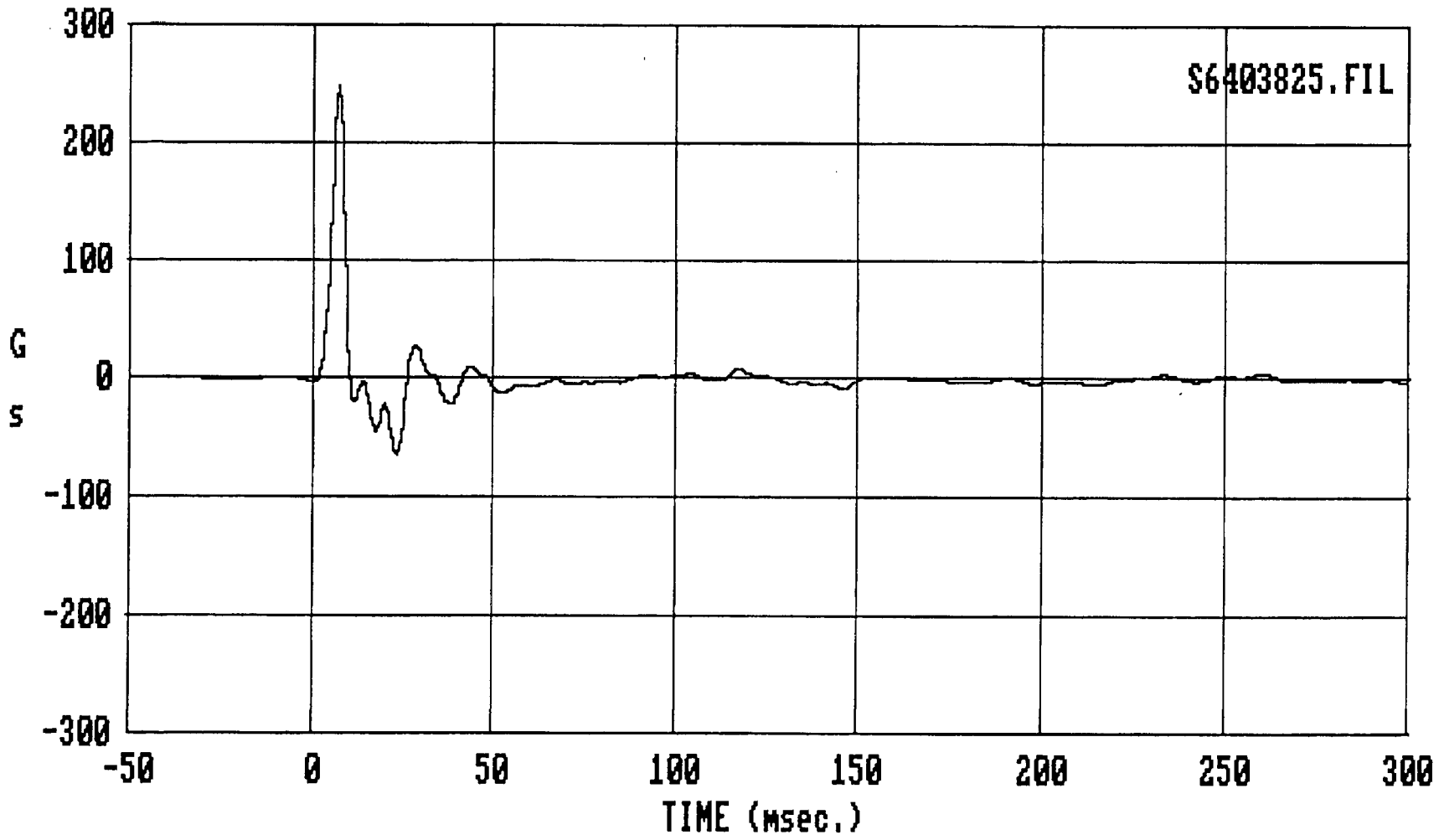
Filter: SAE CLASS 60 Max = 51.913 Min = -11.904

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Left Sill, Y-axis



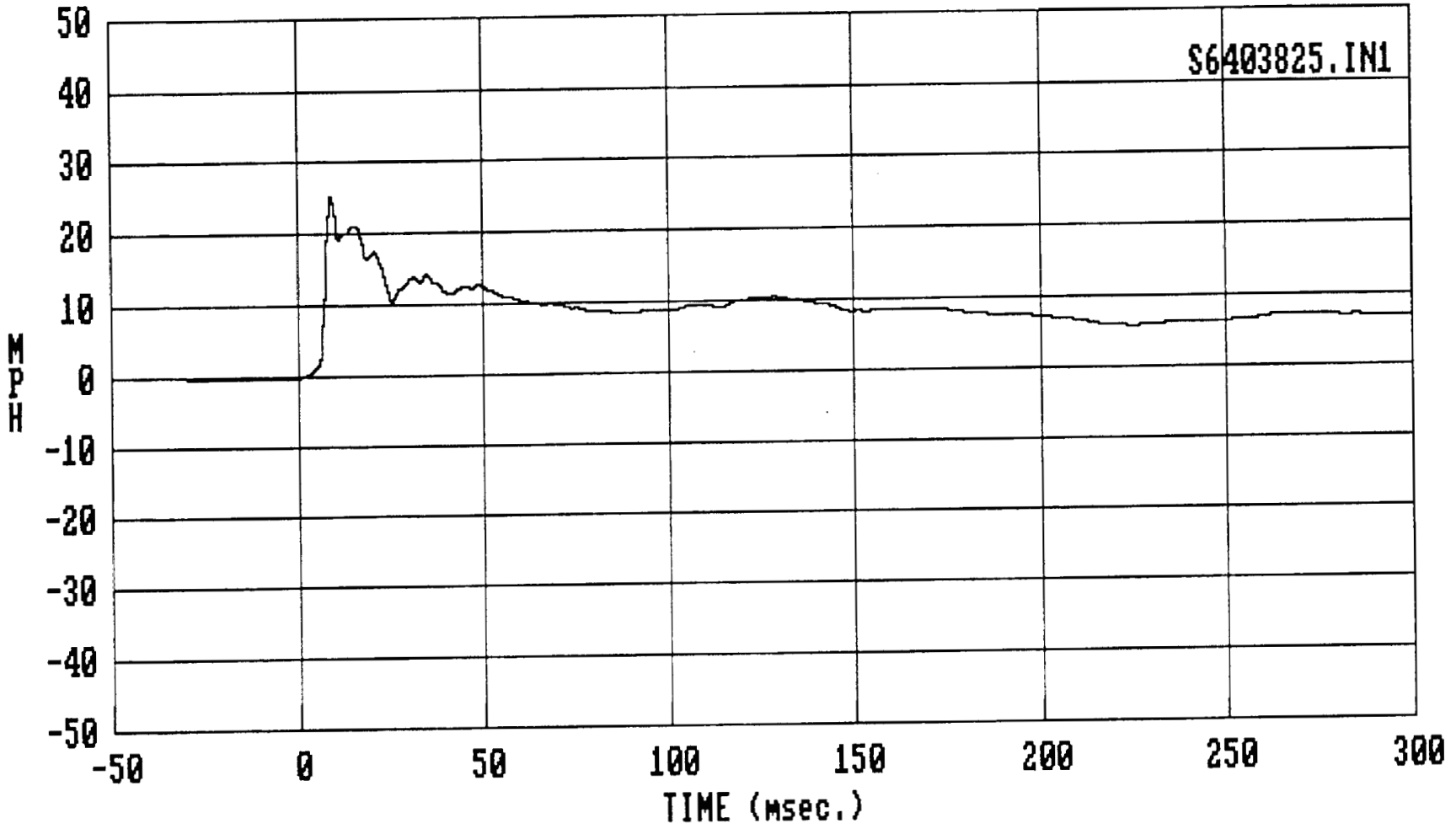
Filter: SAE CLASS 180 Max = 14.820 Min = -.10718E-02

MSE 11/09/88 -- 1988 Nissan Pickup : Front Seat Left Sill delta V, Y-axis



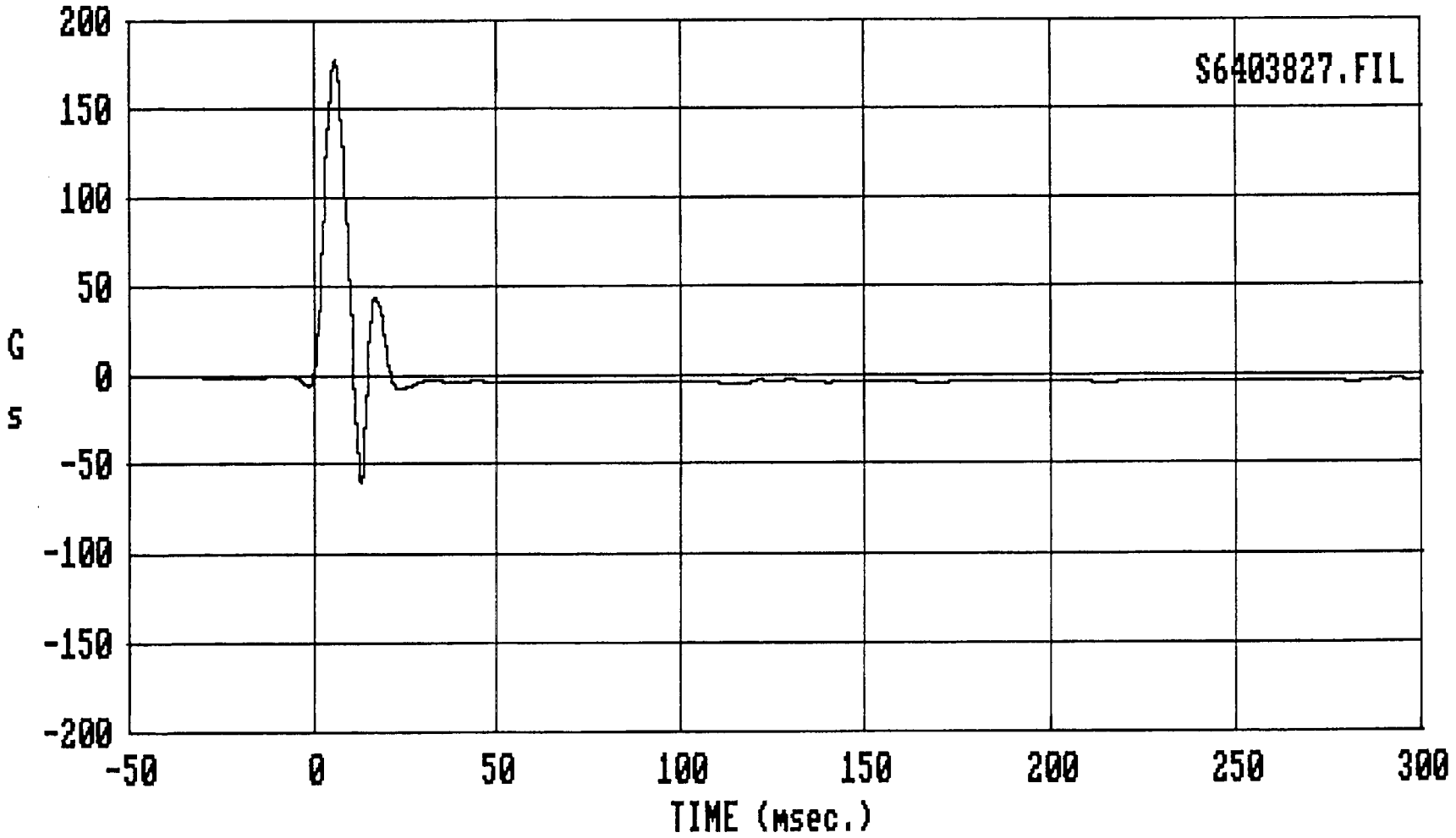
Filter: SAE CLASS 60 Max = 249.67 Min = -65.331

MSE 11/09/88 -- 1988 Nissan Pickup : Left Front Door centerline, Y-axis



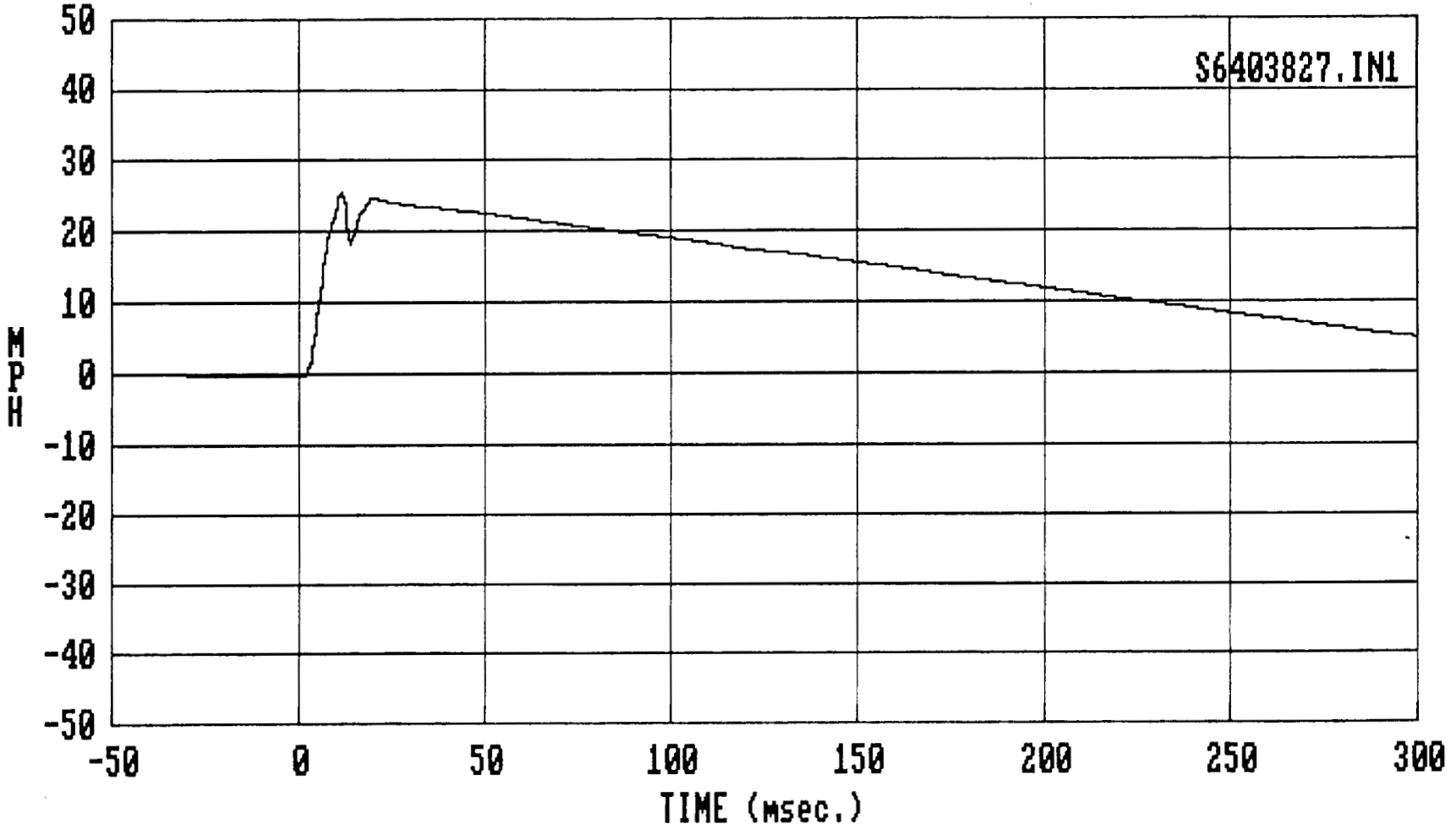
Filter: SAE CLASS 180 Max = 25.370 Min = .00000

MSE 11/09/88 -- 1988 Nissan Pickup : Left Front Door C/L delta V, Y-axis



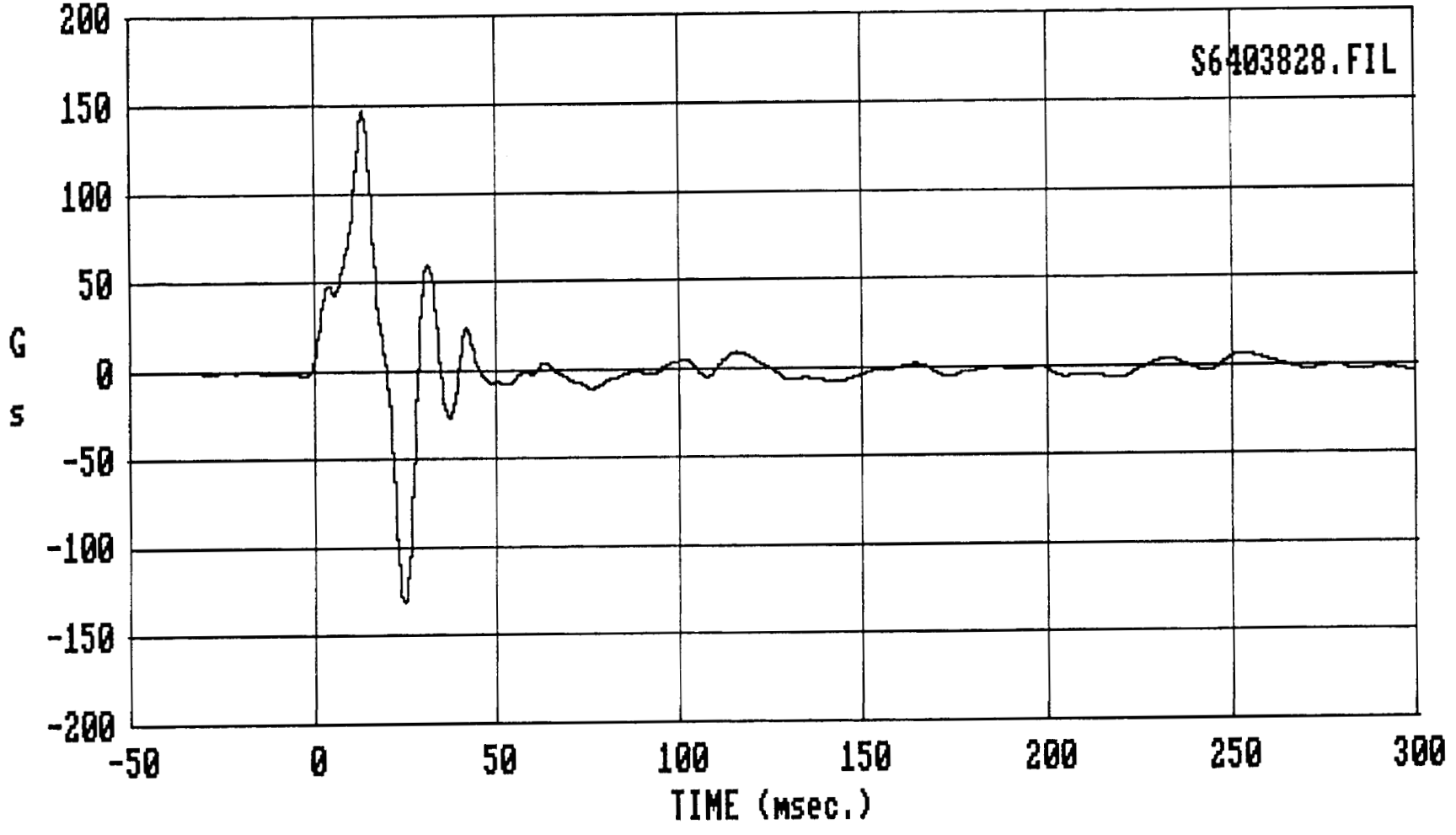
Filter: SAE CLASS 60 Max = 178.25 Min = -60.675

MSE 11/09/88 -- 1988 Nissan Pickup : Left Front Door mid-rear, Y-axis



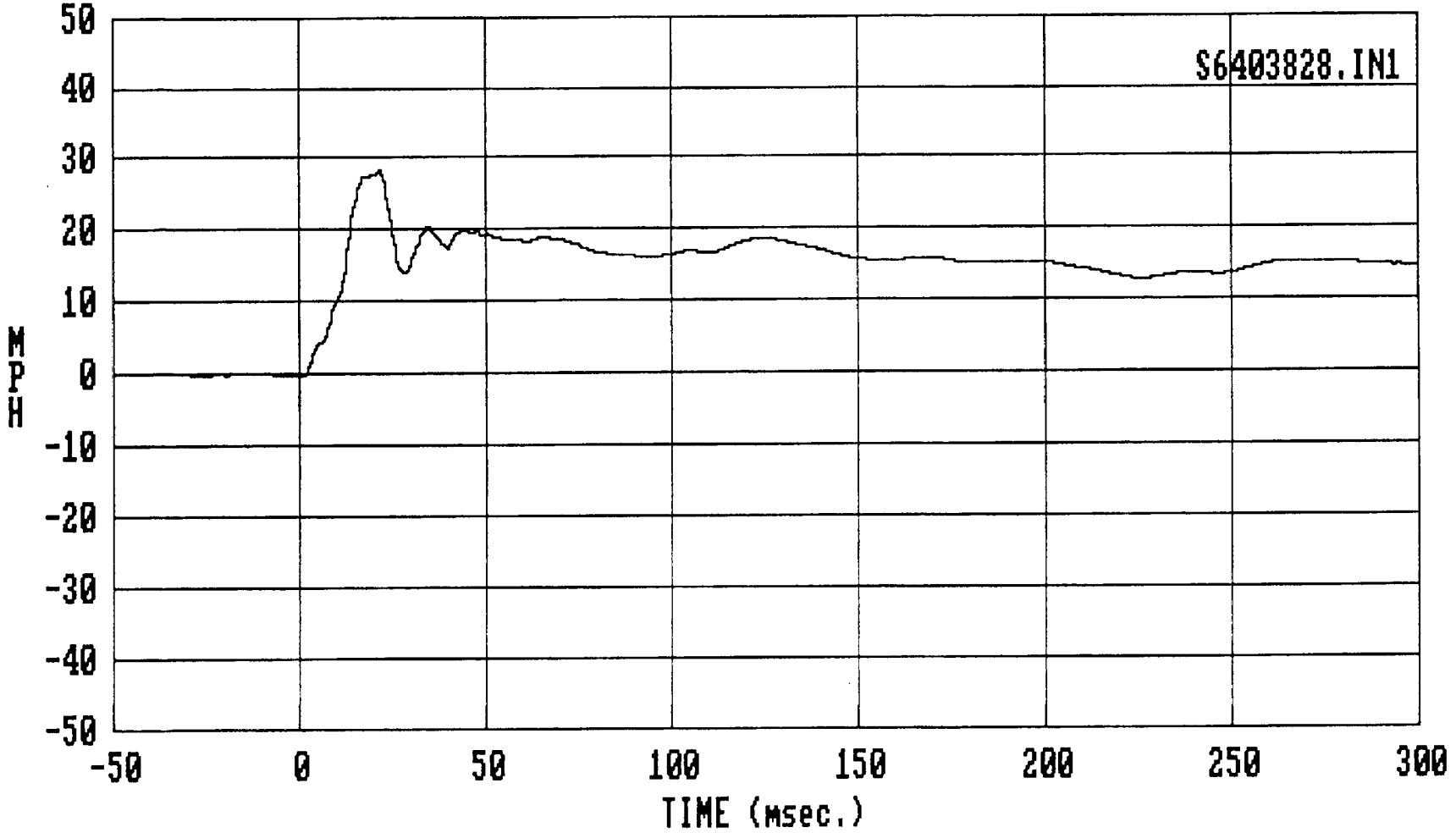
Filter: SAE CLASS 180 Max = 25.602 Min = -.13832E-01

MSE 11/09/88 -- 1988 Nissan Pickup : Lft Frnt Door mid-rear delta V, Y-axis



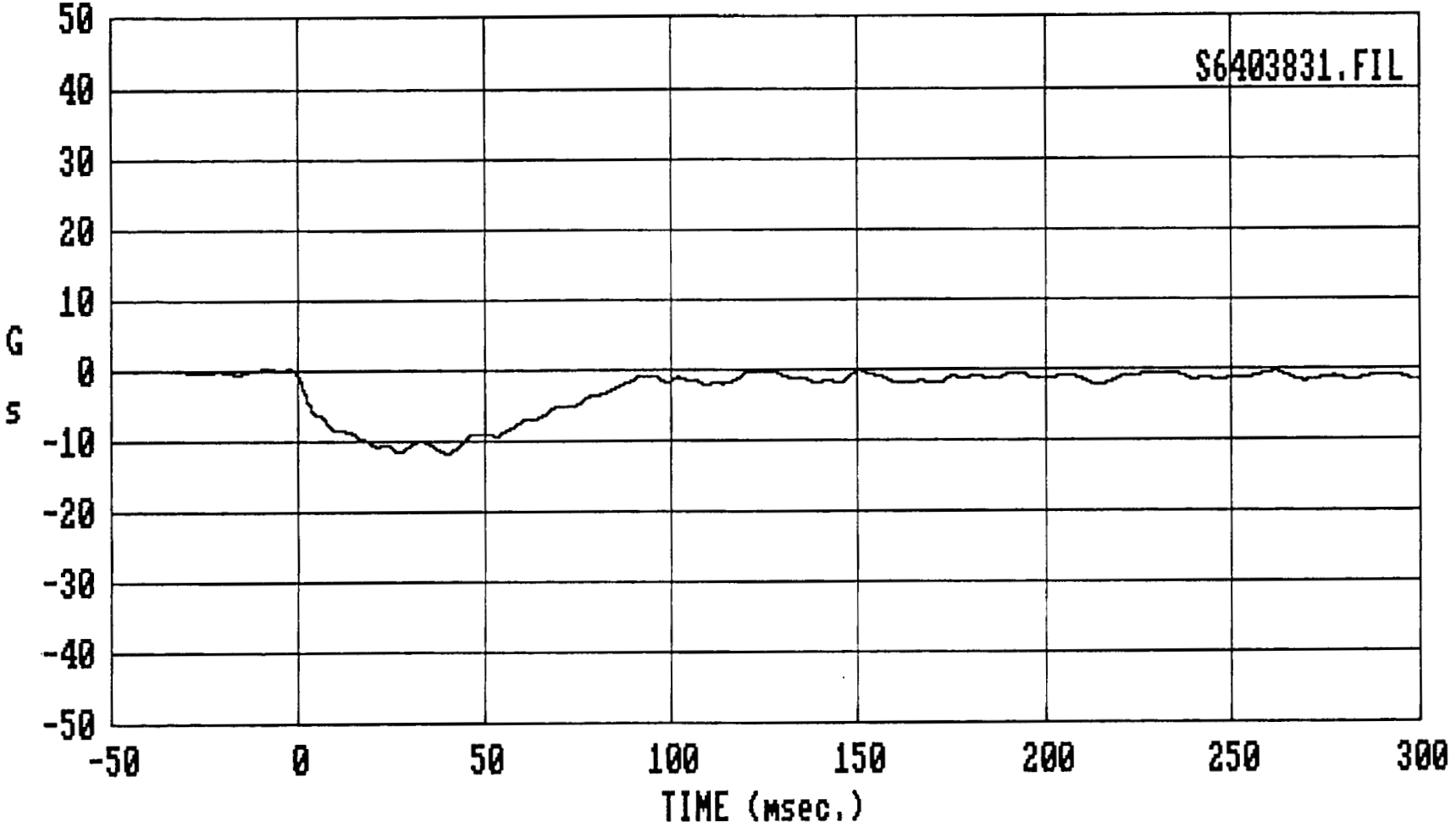
Filter: SAE CLASS 60 Max = 147.07 Min = -131.78

MSE 11/09/88 -- 1988 Nissan Pickup : Left Front Door upper centerline,Y-axis



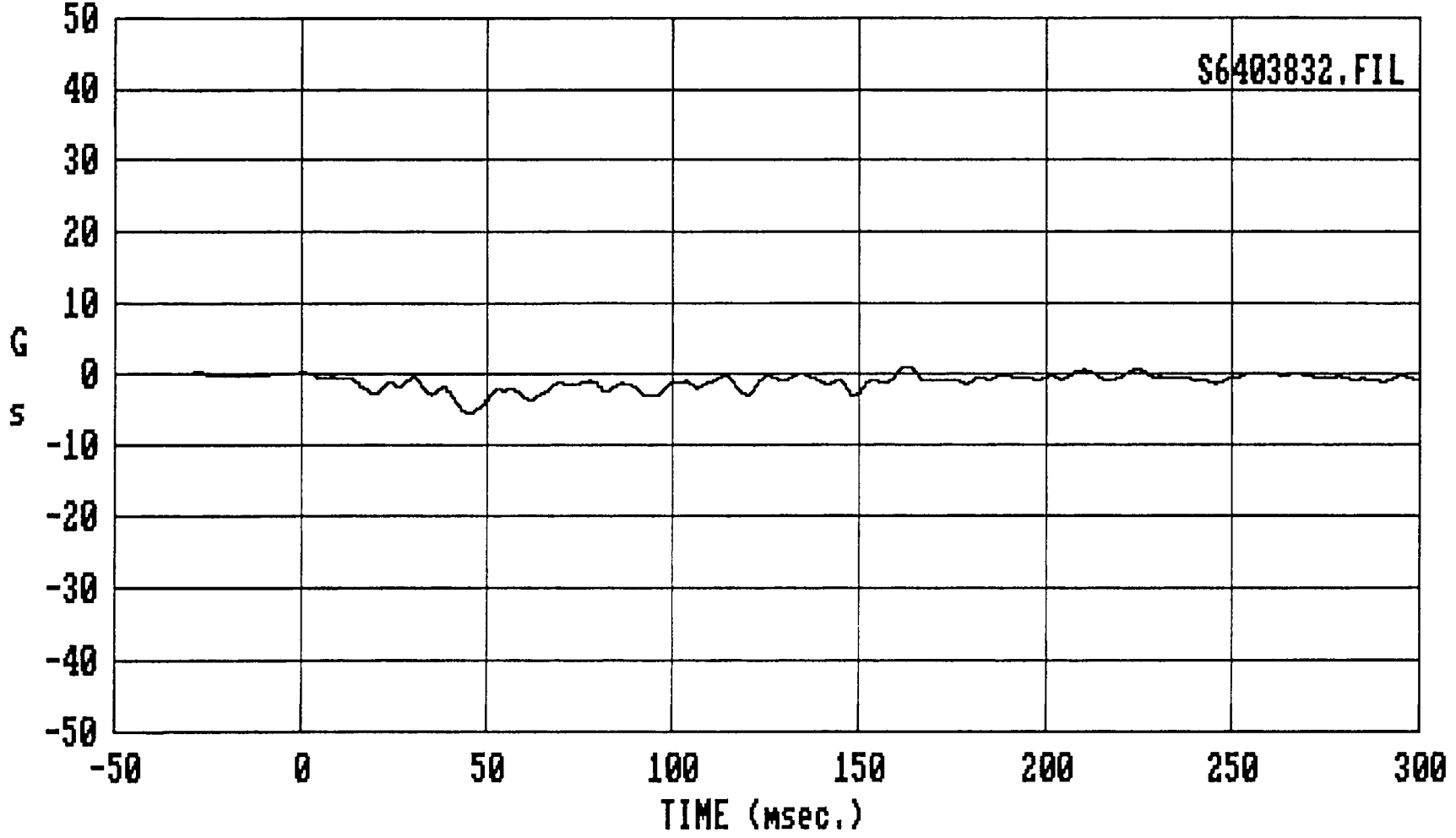
Filter: SAE CLASS 180 Max = 28.491 Min = -.23956E-01

MSE 11/09/88 -- 1988 Nissan Pickup : Lft Frnt Door uppr C/L delta V, Y-axis



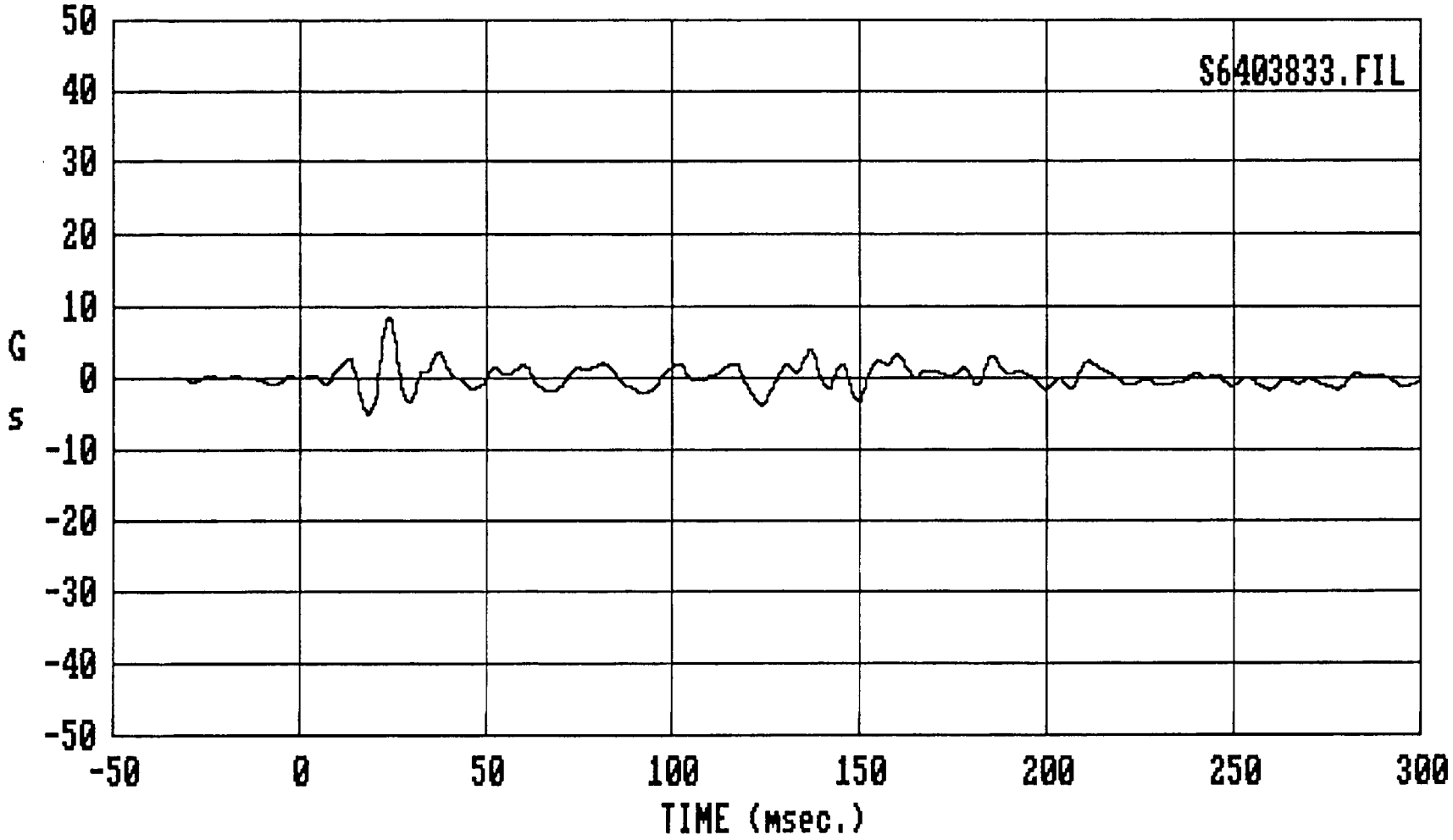
Filter: SAE CLASS 60 Max = .11029 Min = -11.622

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Deformable Barrier C/G, X-axis



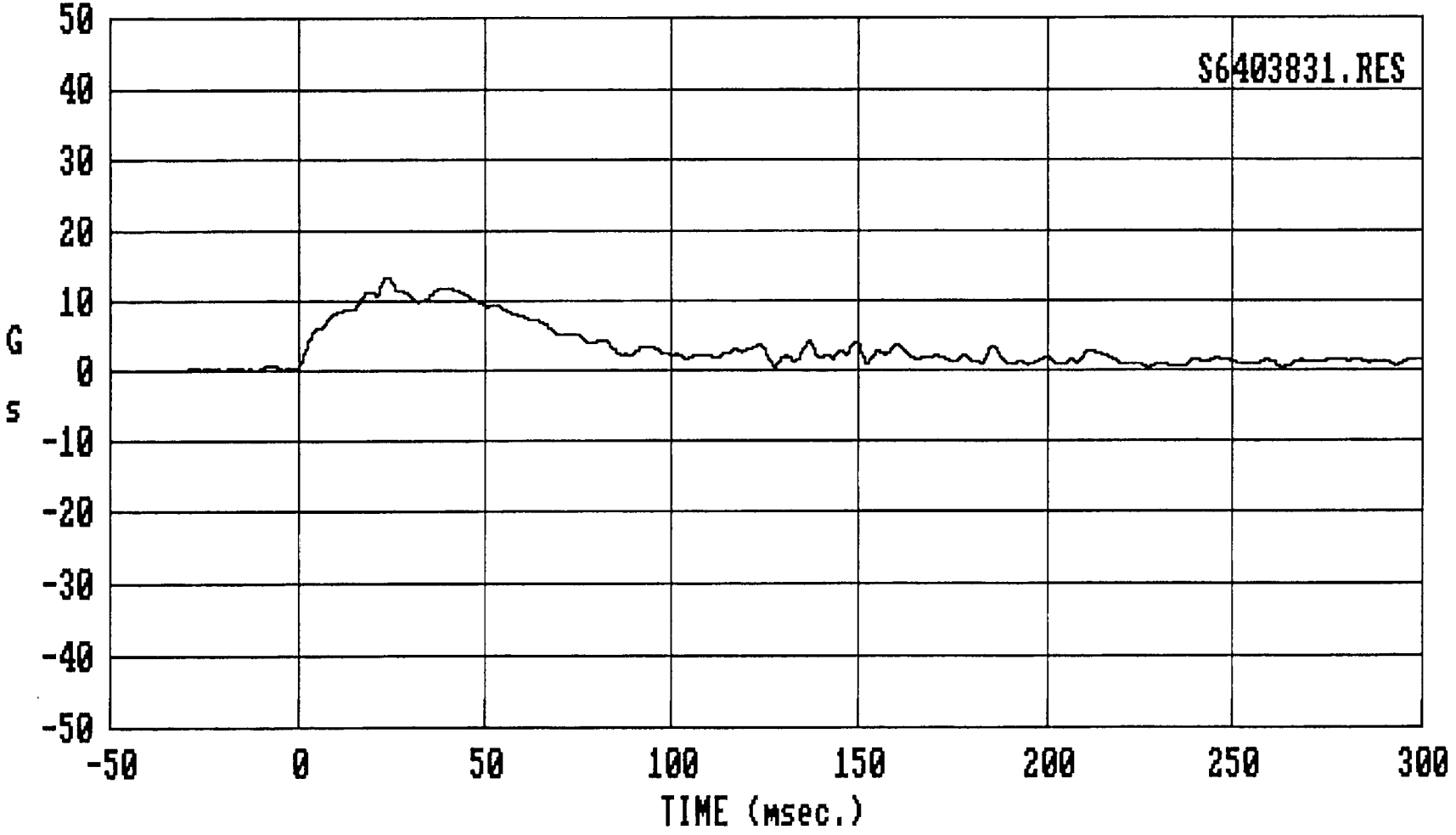
Filter: SAE CLASS 60 Max = 1.1841 Min = -5.3046

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Deformable Barrier C/G, Y-axis



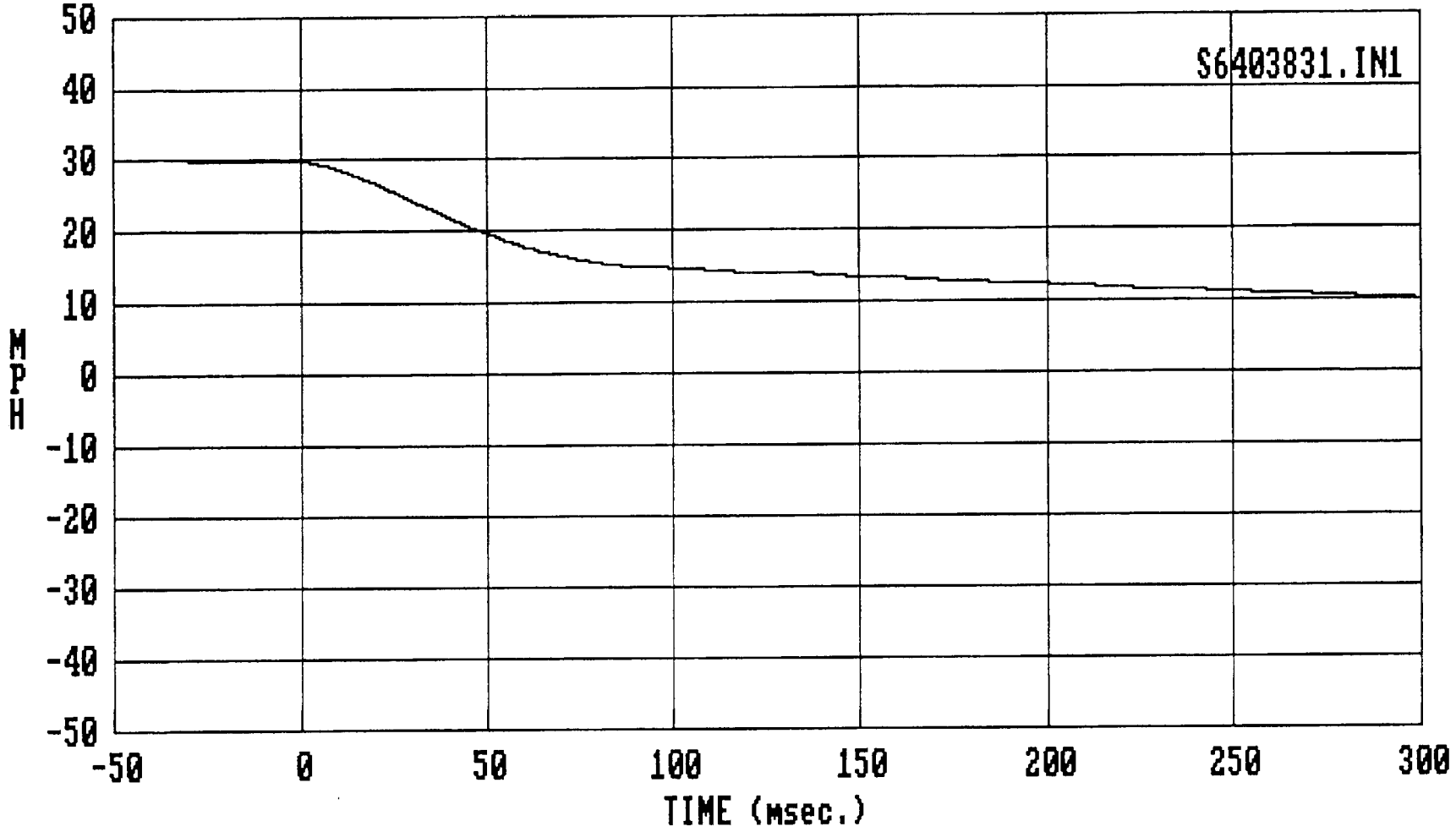
Filter: SAE CLASS 60 Max = 8.6271 Min = -4.8956

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Deformable Barrier C/G, Z-axis



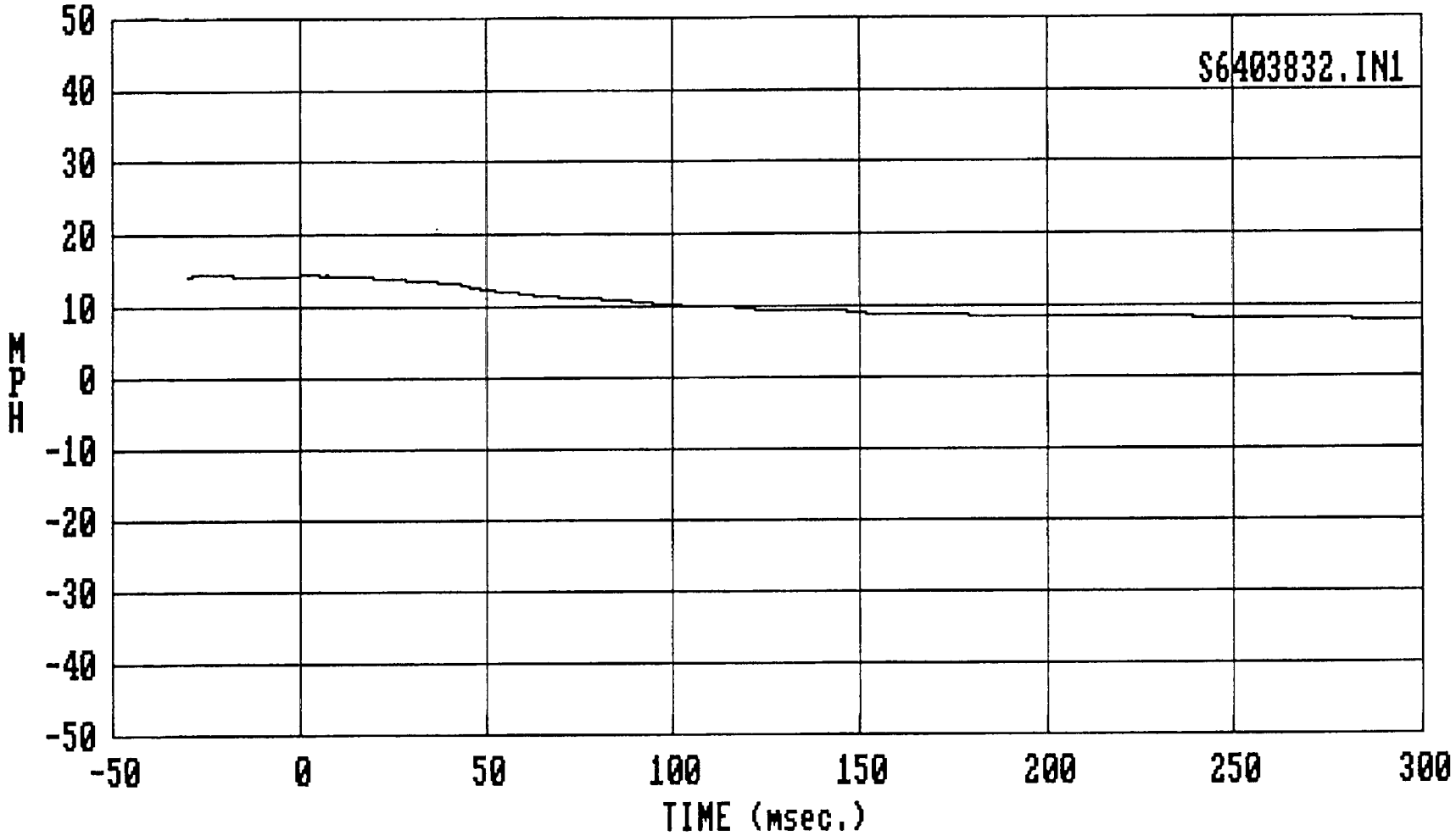
Filter: SAE CLASS 60 Max = 13.634 Min = .44797

MSE 11/09/88 -- 1988 Nissan Pickup : MDB C/G resultant acceleration



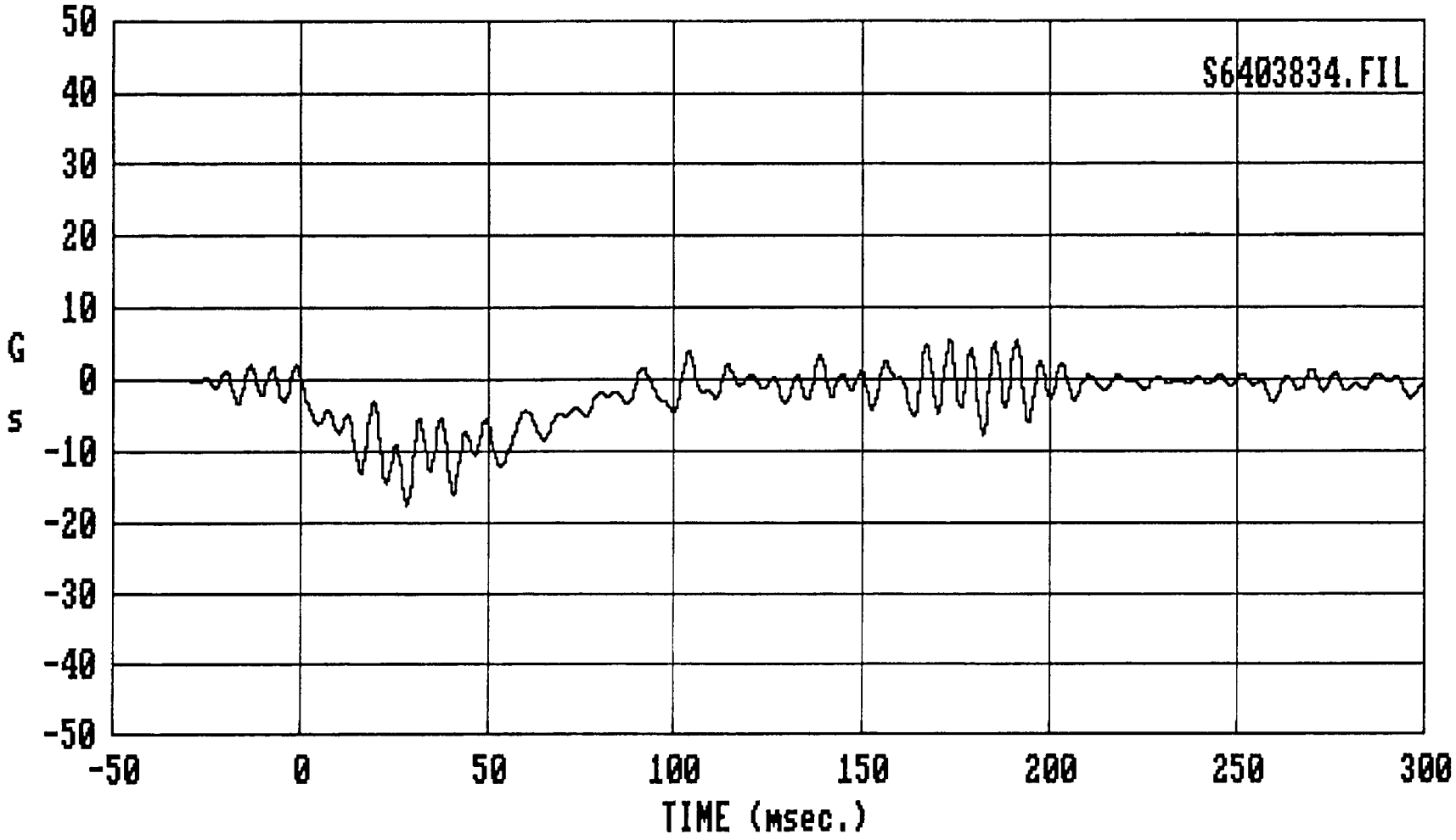
Filter: SAE CLASS 180 Max = 29.905 Min = 10.258

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Barrier C/G delta V, X-axis



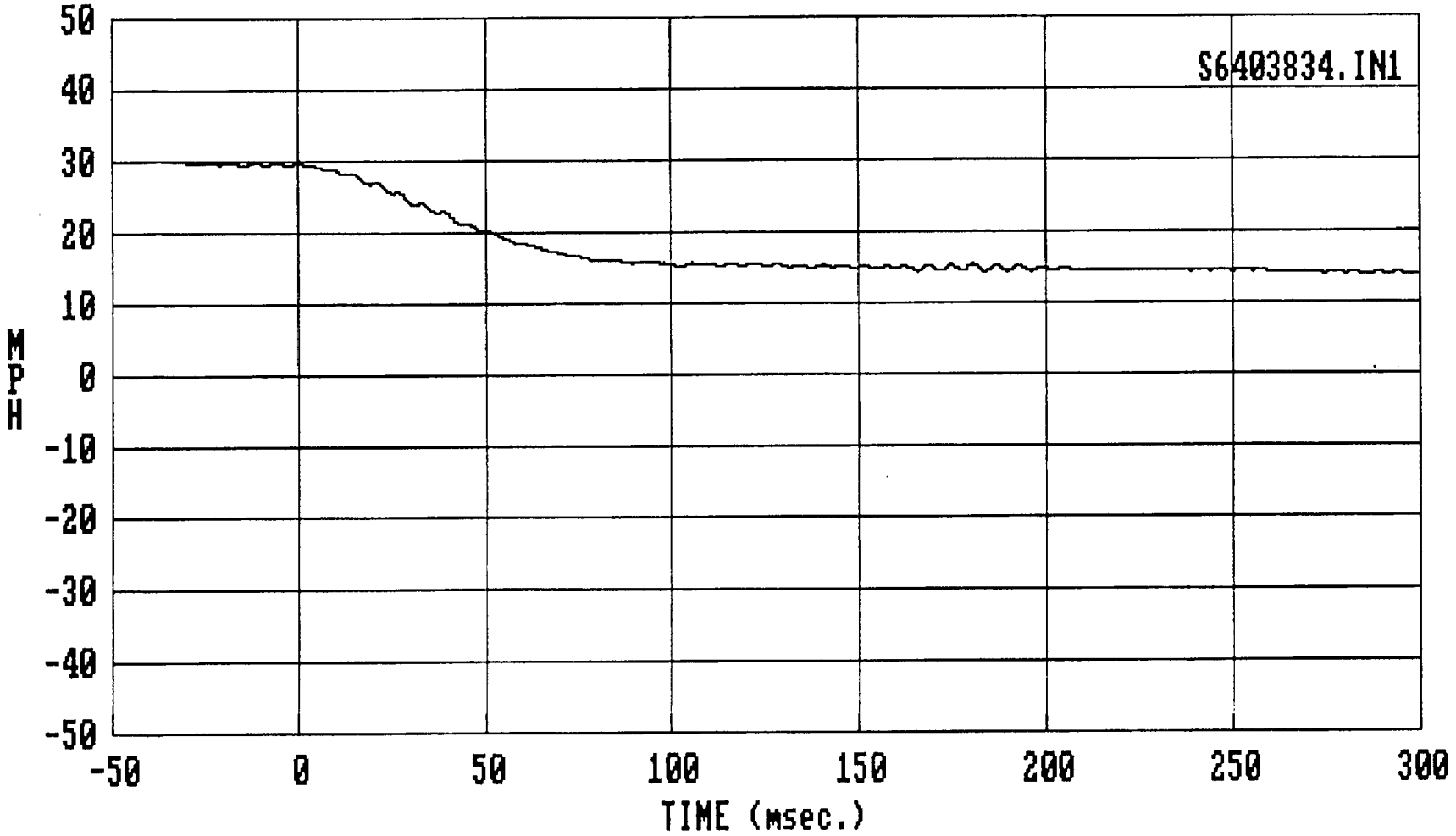
Filter: SAE CLASS 180 Max = 14.641 Min = 7.9349

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Barrier C/G delta V, Y-axis



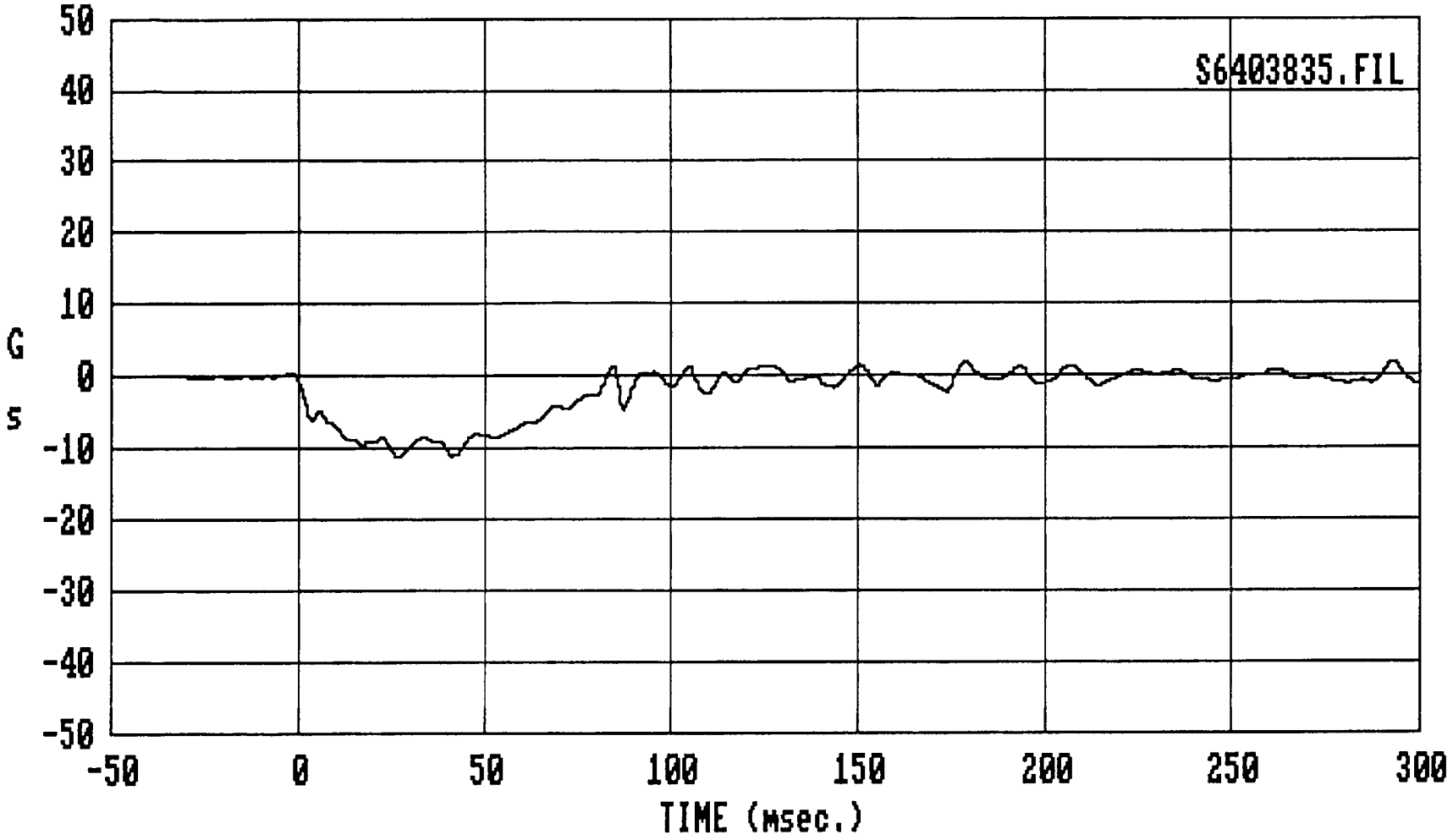
Filter: SAE CLASS 60 Max = 5.7675 Min = -17.465

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Deform. Barrier Front, X-axis



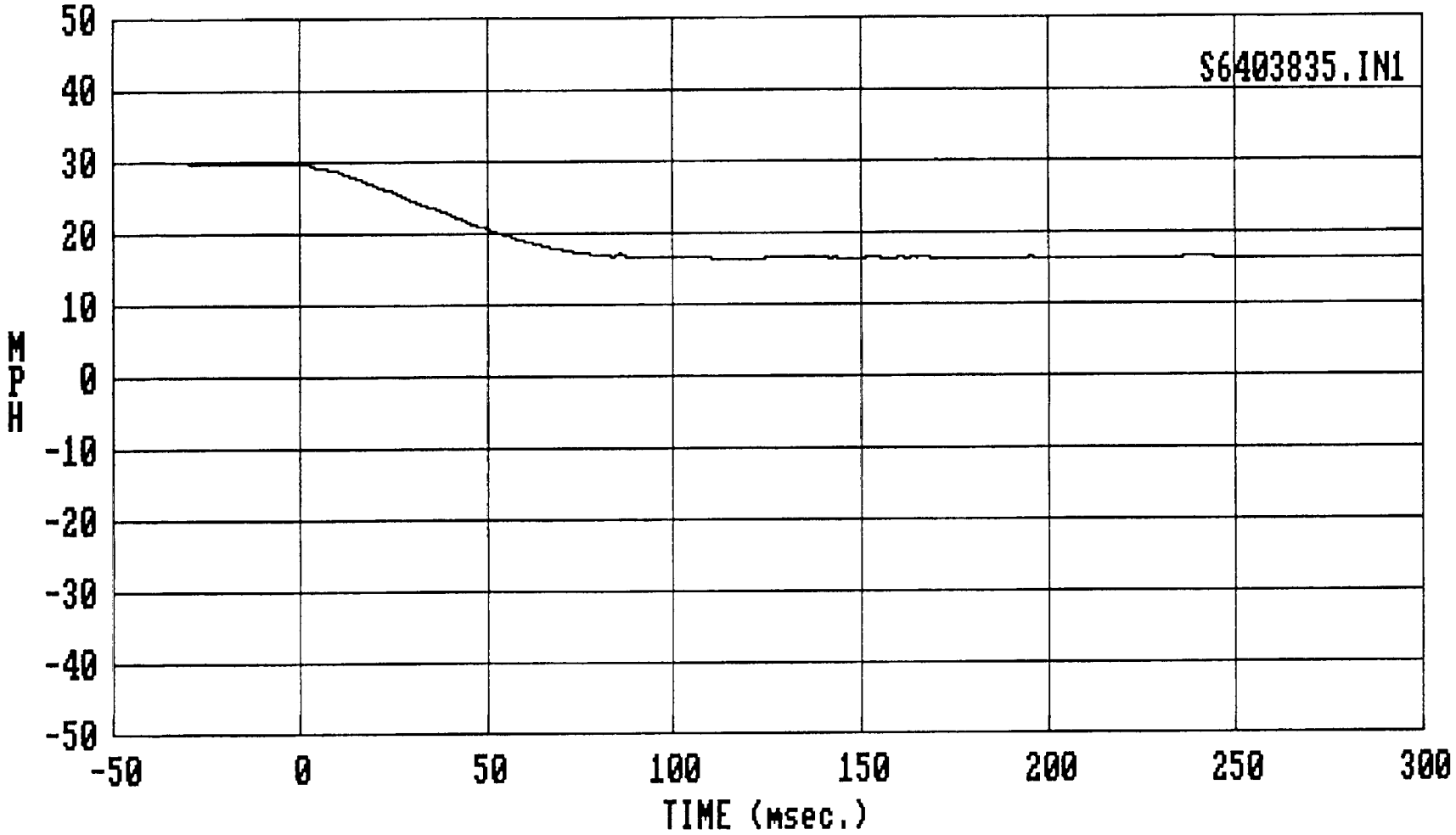
Filter: SAE CLASS 180 Max = 29.897 Min = 14.055

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Barrier Front delta V, X-axis



Filter: SAE CLASS 60 Max = 2.0408 Min = -11.050

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Deform. Barrier Rear, X-axis



Filter: SAE CLASS 180 Max = 29.900 Min = 16.430

MSE 11/09/88 -- 1988 Nissan Pickup : Moving Barrier Rear delta V, X-axis

APPENDIX C

SID CERTIFICATION DATA

SID IMPACT CALIBRATION SUMMARY SHEET

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

LABORATORY TECHNICIAN: MARK WALKER

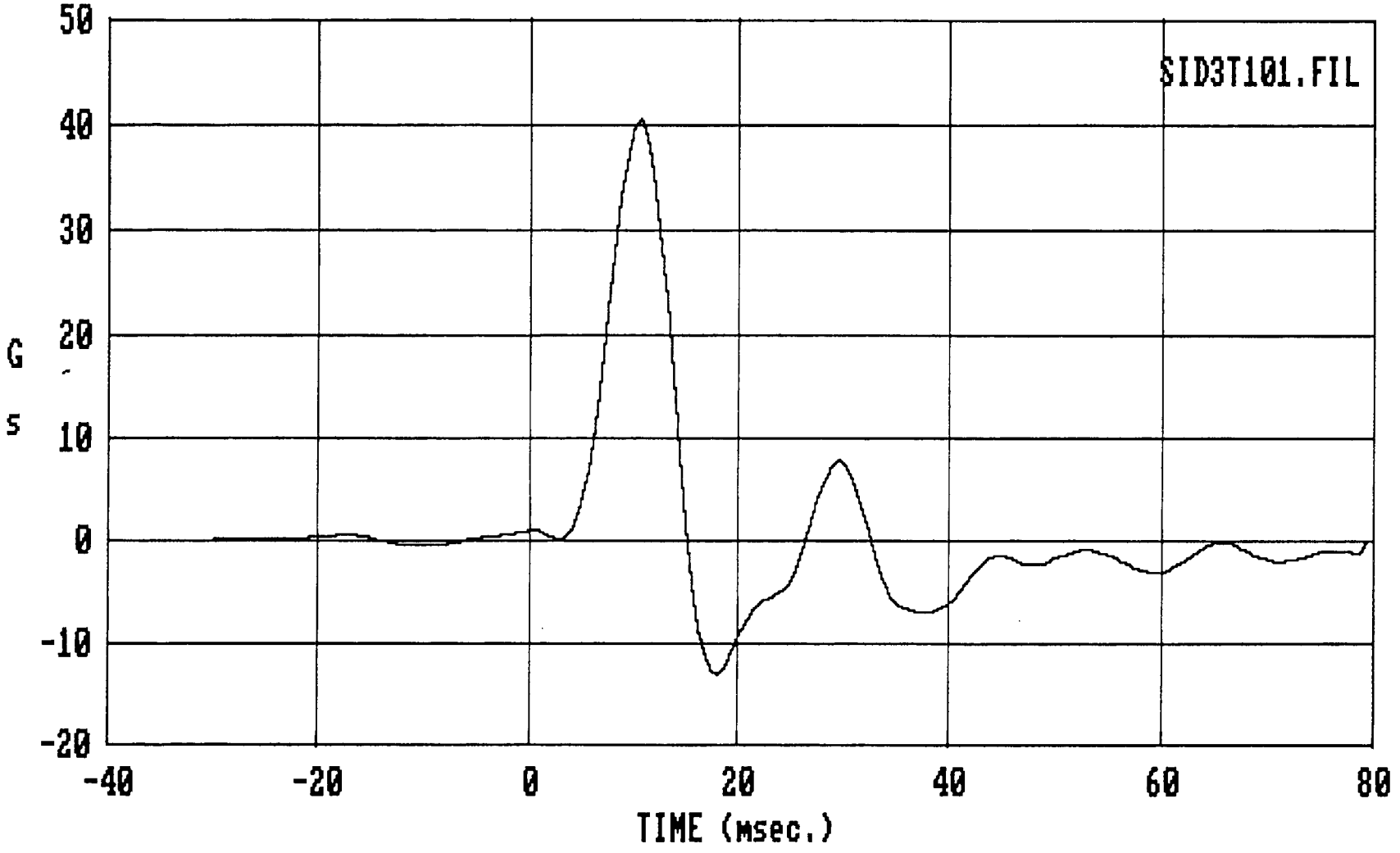
Sheet No. 1 of 3			Pretest Calibration	Posttest Calibration
Date of SID Calibration - - - - - - - - - - - - - - -			11/04/88	
Calibration Sequential Number for Dummy			3	
Temperature min Lab. (Spec. =66 to 78' F) - - - -			70	
Relative Humidity i n Lab. (Spec. = 10 tp 70%)			20	
TEST PARAMETER		**SPECIFICATION**		
1. NECK BENDING TEST:				
a. Pendulum Speed - - -		21.5 to 25.5 fps	22.1	
b. Pendulum Avg. Decel (over t3 - t2) - - - - -		20 to 24G	23.5	
c. Peak Resultant Head Acceleration- - - - -		26G maximum	25.93	
d. Pendulum Decel. (t2-t1)		‹3 ms	1.2	
e. Pendulum Decel. (t2-t2)		25 to 30 ms	28.4	
f. Pendulum Decel. (t2-t3)		‹0 ms	8.4	
g. Pendulum Direction Reversal Time - - - - -		›123 ms	---	
h. Max. Head Rotation- -		63 to 73'	66.8'	
i. Chordal Displacement: Head Rotation Angle -				
0'	Time	-2 to 2 ms	0.0	
	Displ.	.5 to .5 in	0.18	
30'	Time	25.6 to 34.4 ms	32.8	
	Displ.	2.1 to 3.1 in.	2.59	
	Time	40.3 to 51.7 ms	50.2	
60'	Displ.	4.3 to 5.3 in	4.63	
Maximum	Time	53.2 to 66.8 ms	61.8	
(')	Displ.	5.0 to 6.0	5.10	
2. NECK BENDING TEST continued:				
i. Chordal Displacement: Head Rotation angle-				
0'	Time	67.0 to 83.0 ms	73.4	
	Displ.	4.3 to 5.3 in.	4.75	
30'	Time	85.4 to 104.6 ms	93.7	
	Displ.	2.1 to 3.1 in.	2.35	
	Time	101.0 to 123.0 ms	109.4	
60'	Displ.	-.5 to 0.5 in.	0.12	

SID IMPACT CALIBRATION SUMMARY SHEET (Continued)

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

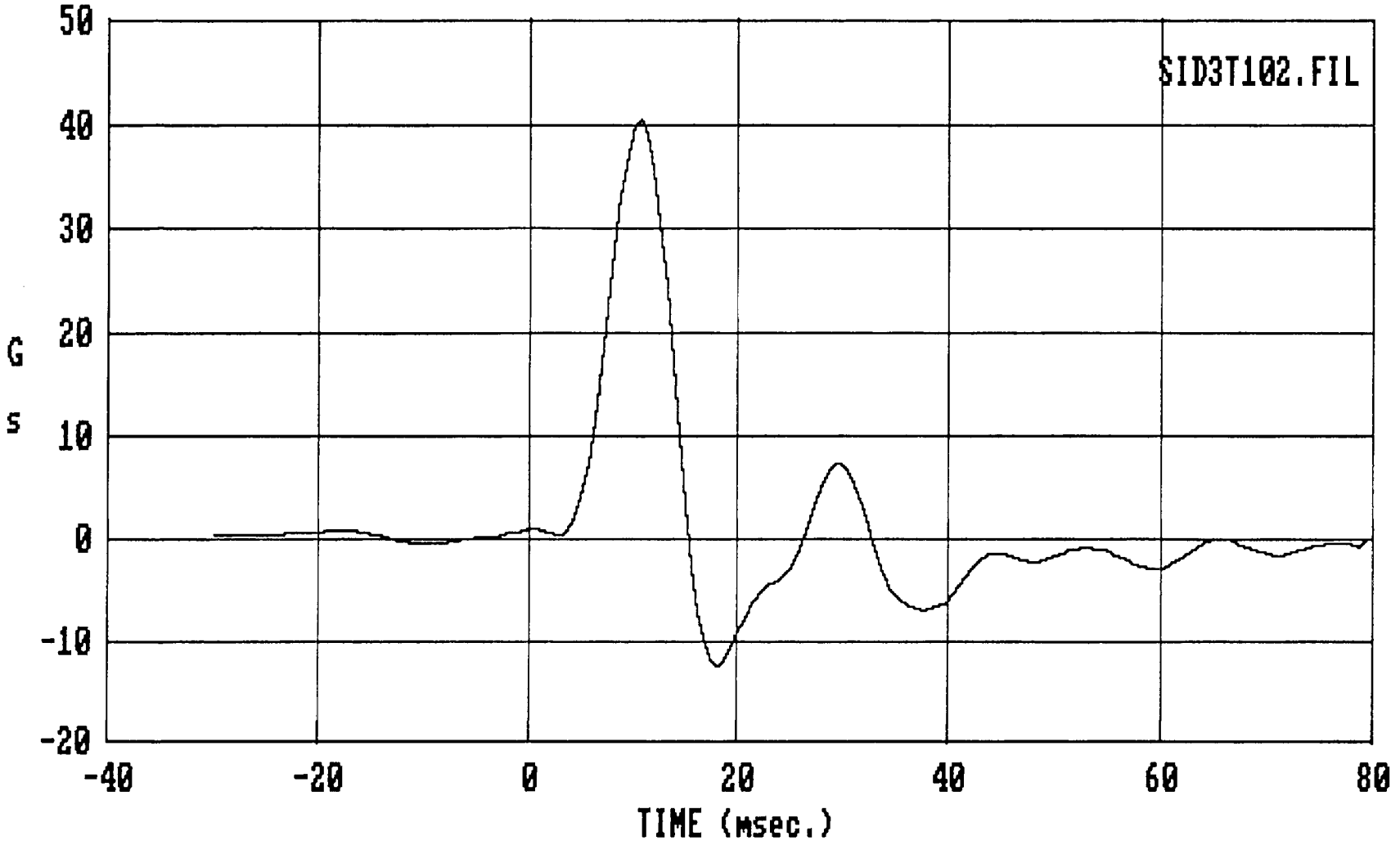
LABORATORY TECHNICIAN: MARK WALKER

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.	42.0	
c. Force @ 1.0"- - - - -	50 - 63 lbs	61.5	
d. Force @ 1.3"- - - - -	73 - 88 lbs.	80.0	
4. LUMBAR FLEXION TEST:			
a. Force @ 20' - - - -	22 to 34 lbs	31.0	
b. Force @ 30' - - - -	34 to 46 lbs	45.0	
c. Force @ 40' - - - - -	46 to 58 lbs	56.0	
d. Return Angle - - - -	12 maximum	9.0'	
5. THORAX IMPACT TEST:			
	Primary	40.693	
a. Upper Rib accel.- - -	37 - 46g`s Sec	40.697	
	Primary	37.907	
b. Lower Rib accel.- - -	37 - 46g`s Sec	38.042	
	Primary	21.272	
c. Lower Spine accel - -	15 -22 g`s Sec	20.675	
6. PELVIC IMPACT TEST:			
Pelvic accel. - - - -	40 - 60g`s	59.508	



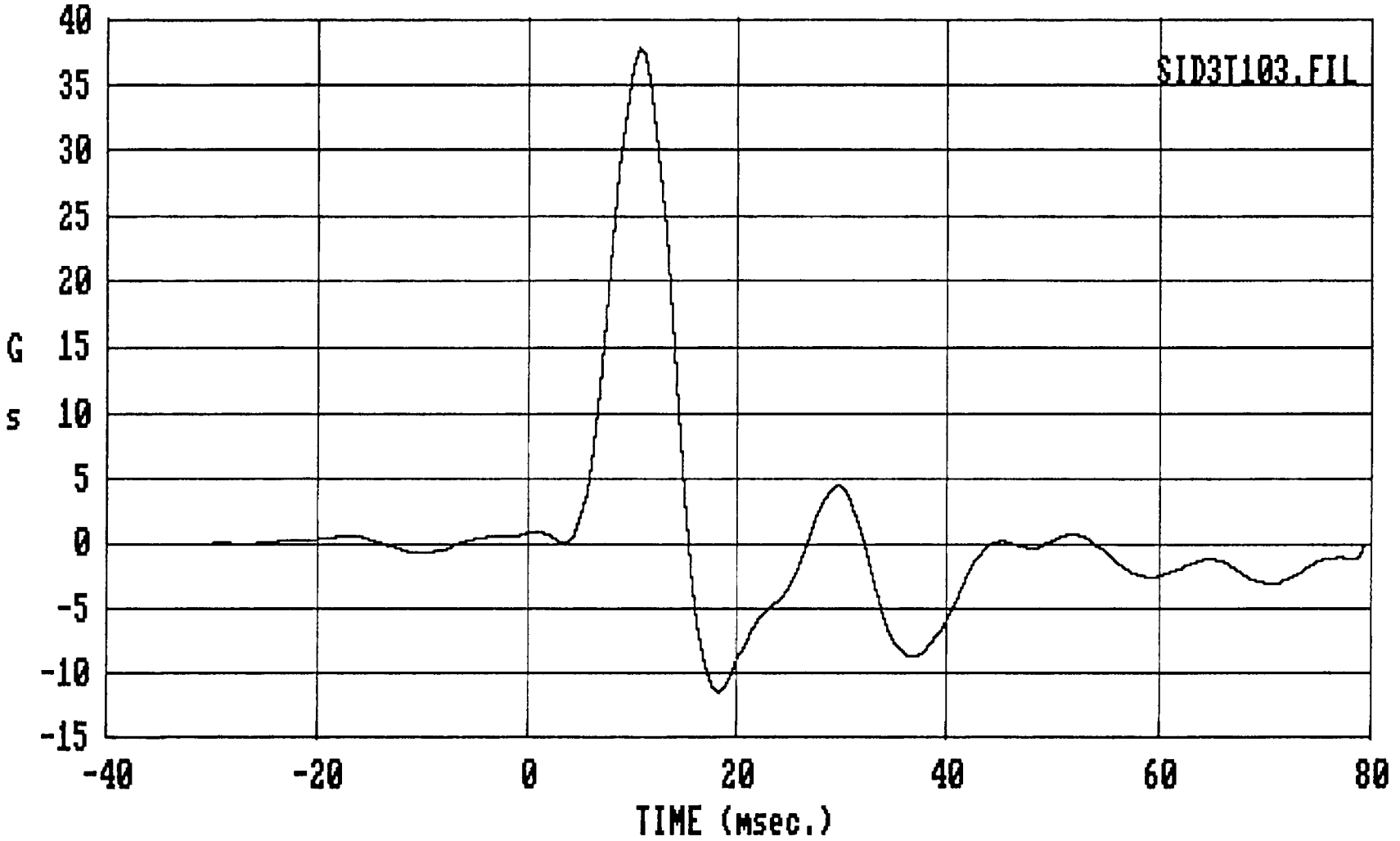
Max = 40.693 Min = -12.847

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Upper Rib acc. primary, Y-axis (FIR)



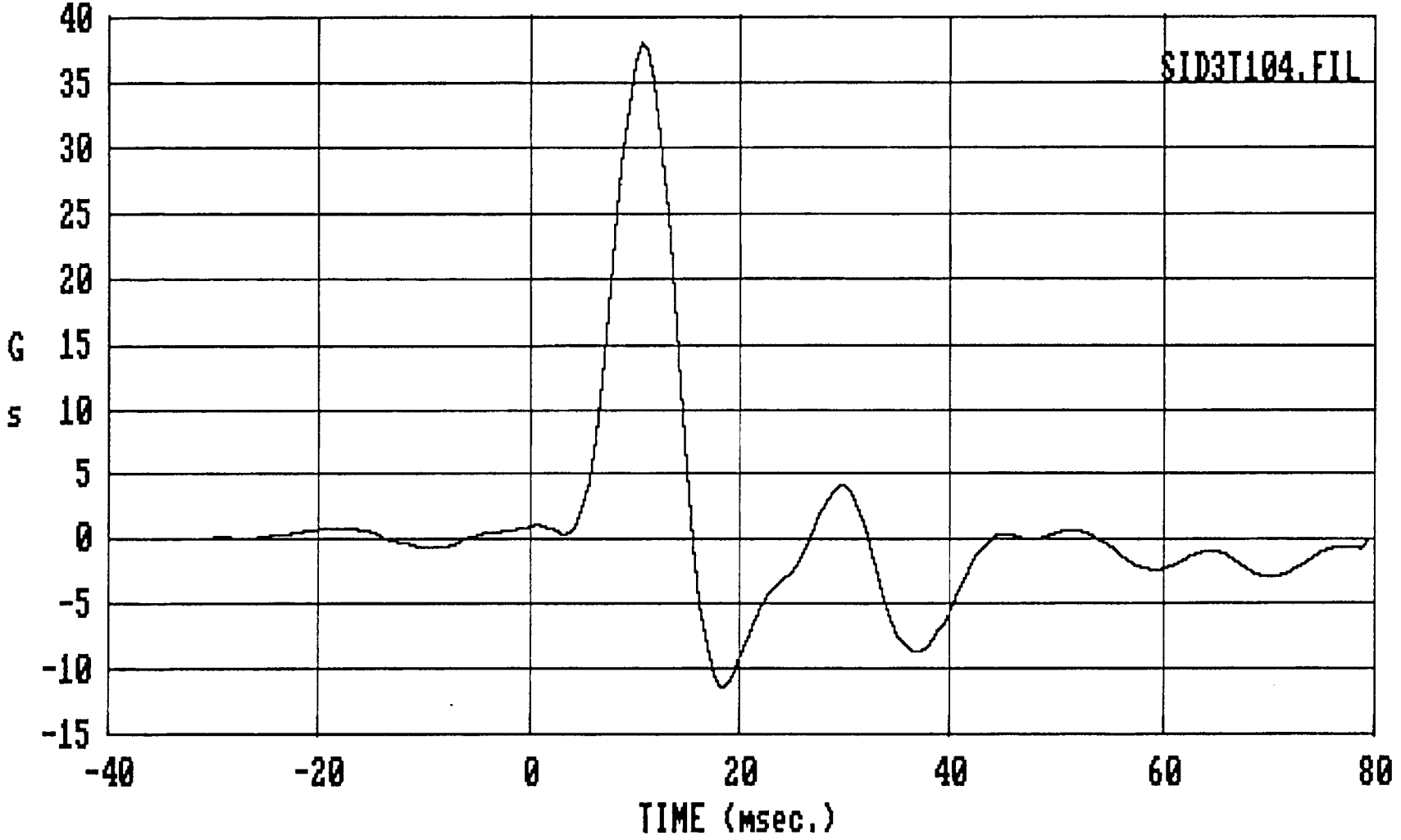
Max = 40.697 Min = -12.312

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Upper Rib acc. secondary, Y-axis (FIR)



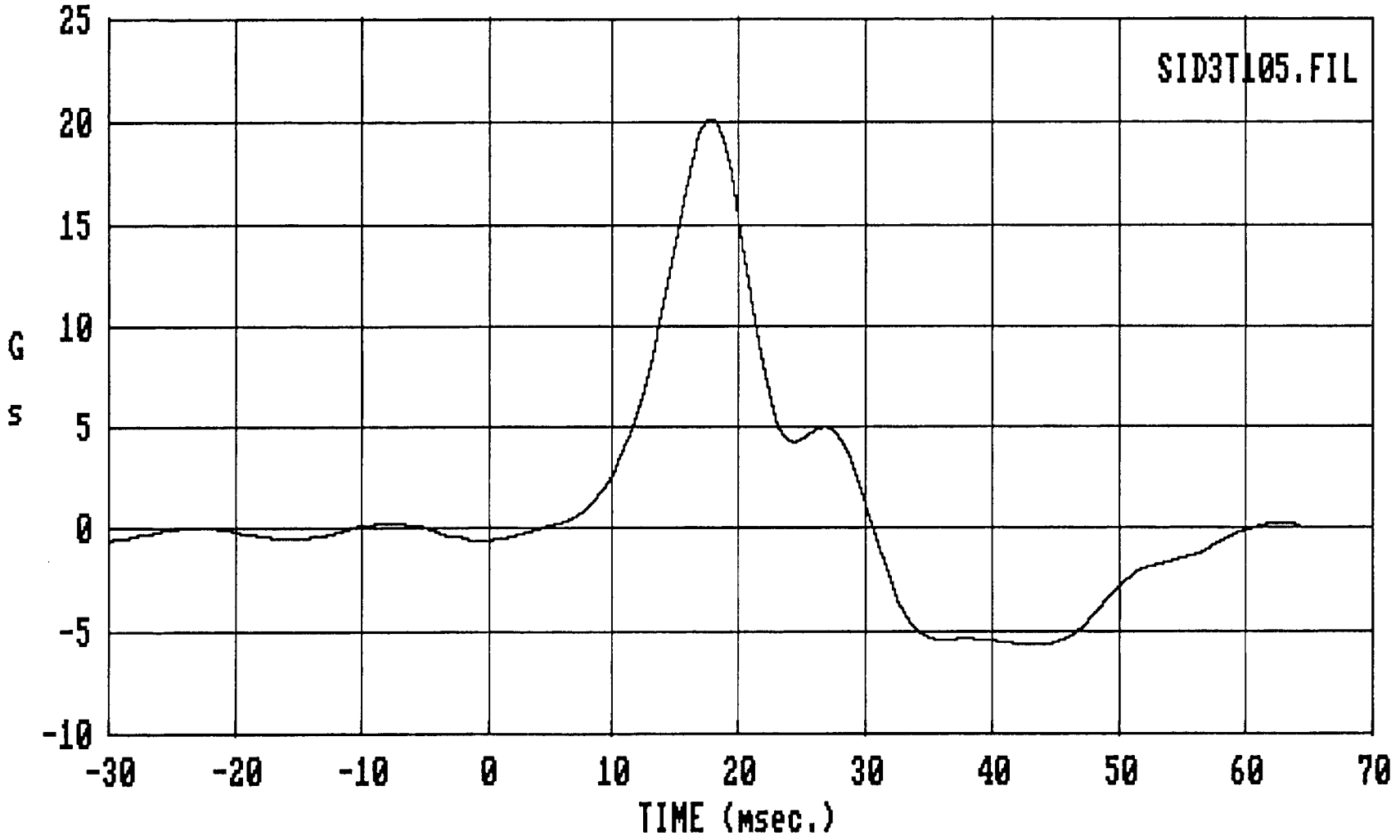
Max = 37.907 Min = -11.457

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Lower Rib acc. primary, Y-axis (FIR)



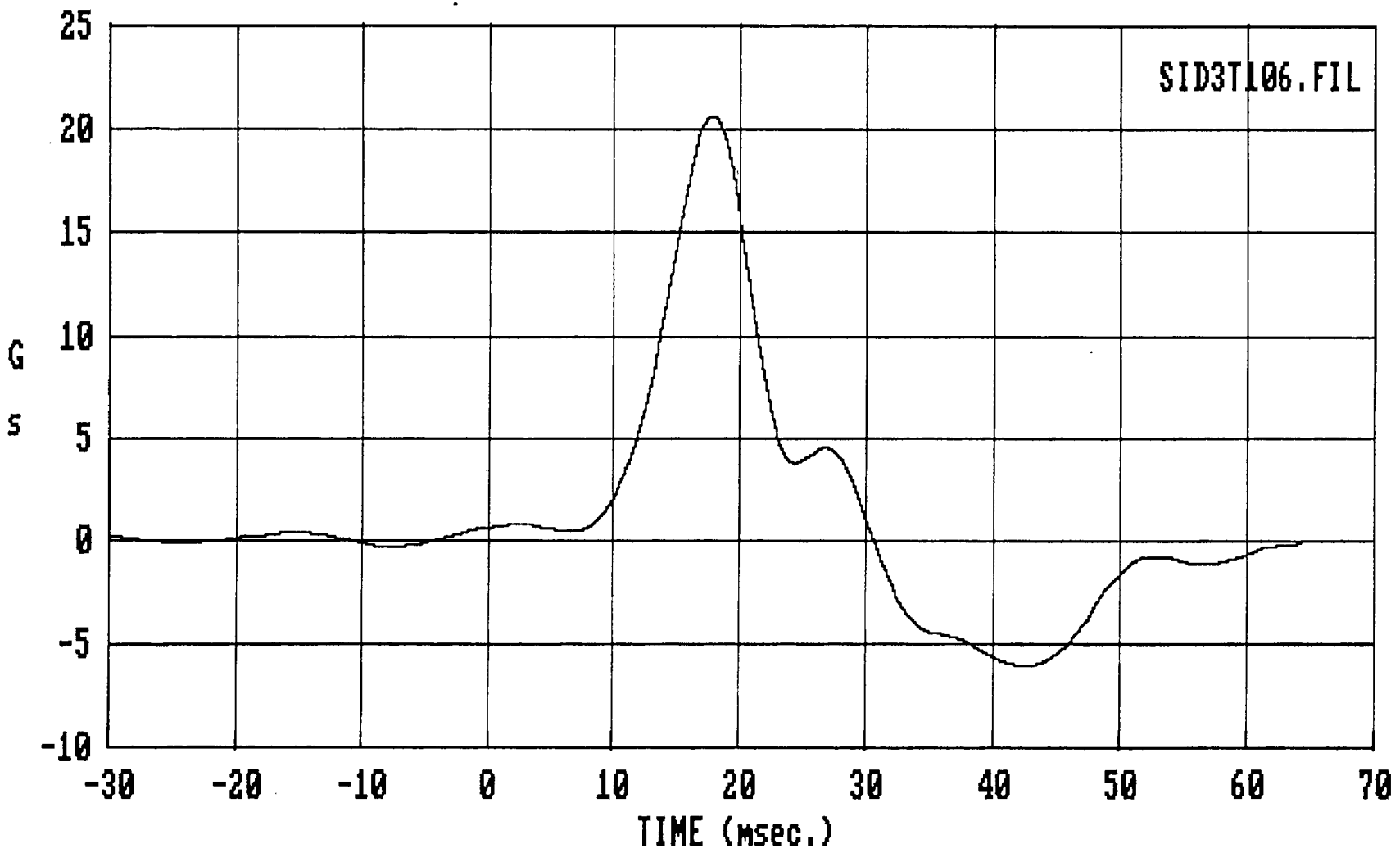
Max = 38.042 Min = -11.295

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Lower Rib acc. secondary, Y-axis (FIR)



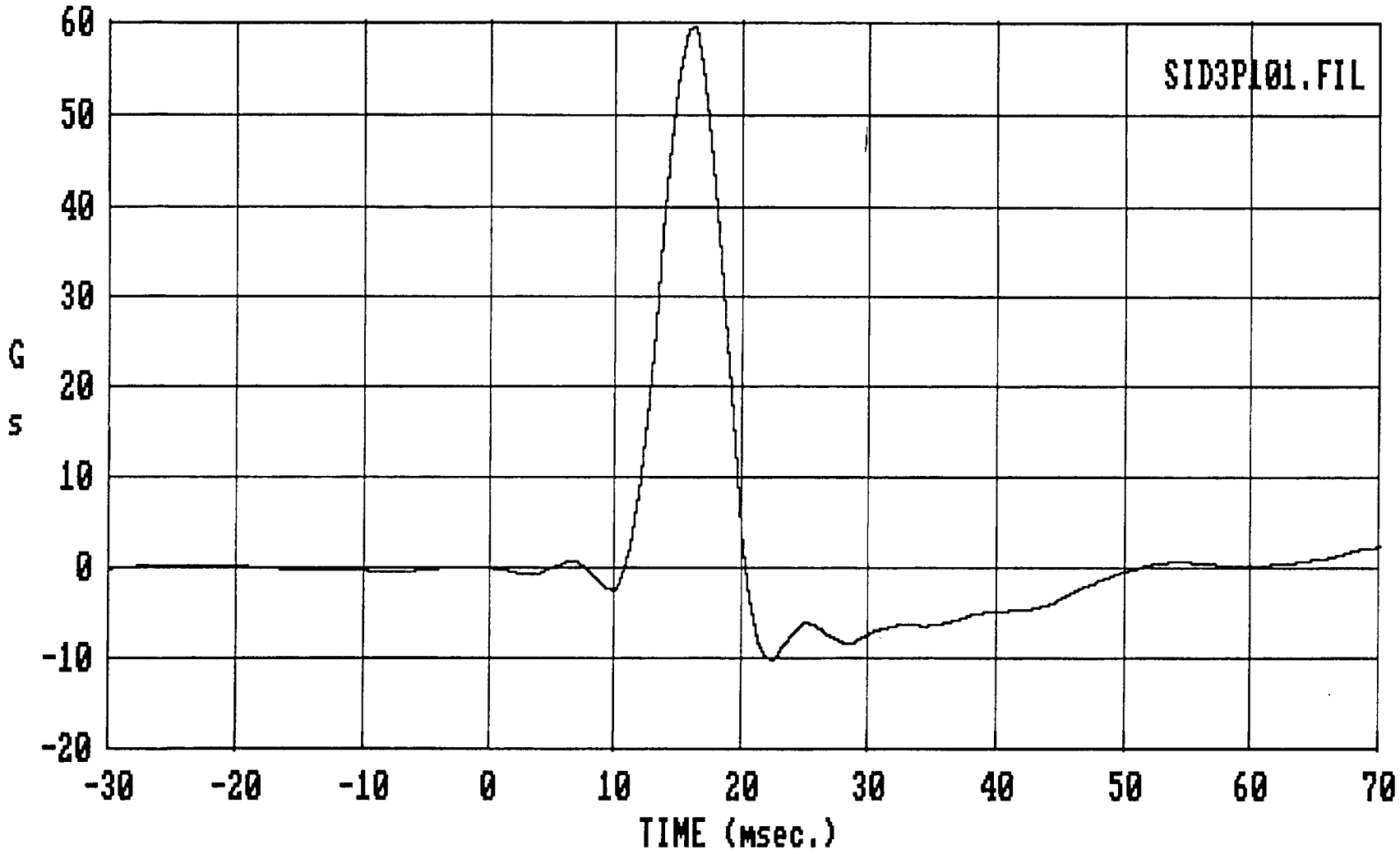
Max = 20.172 Min = -5.5429

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Lower Spine acc. primary, Y-axis (FIR)



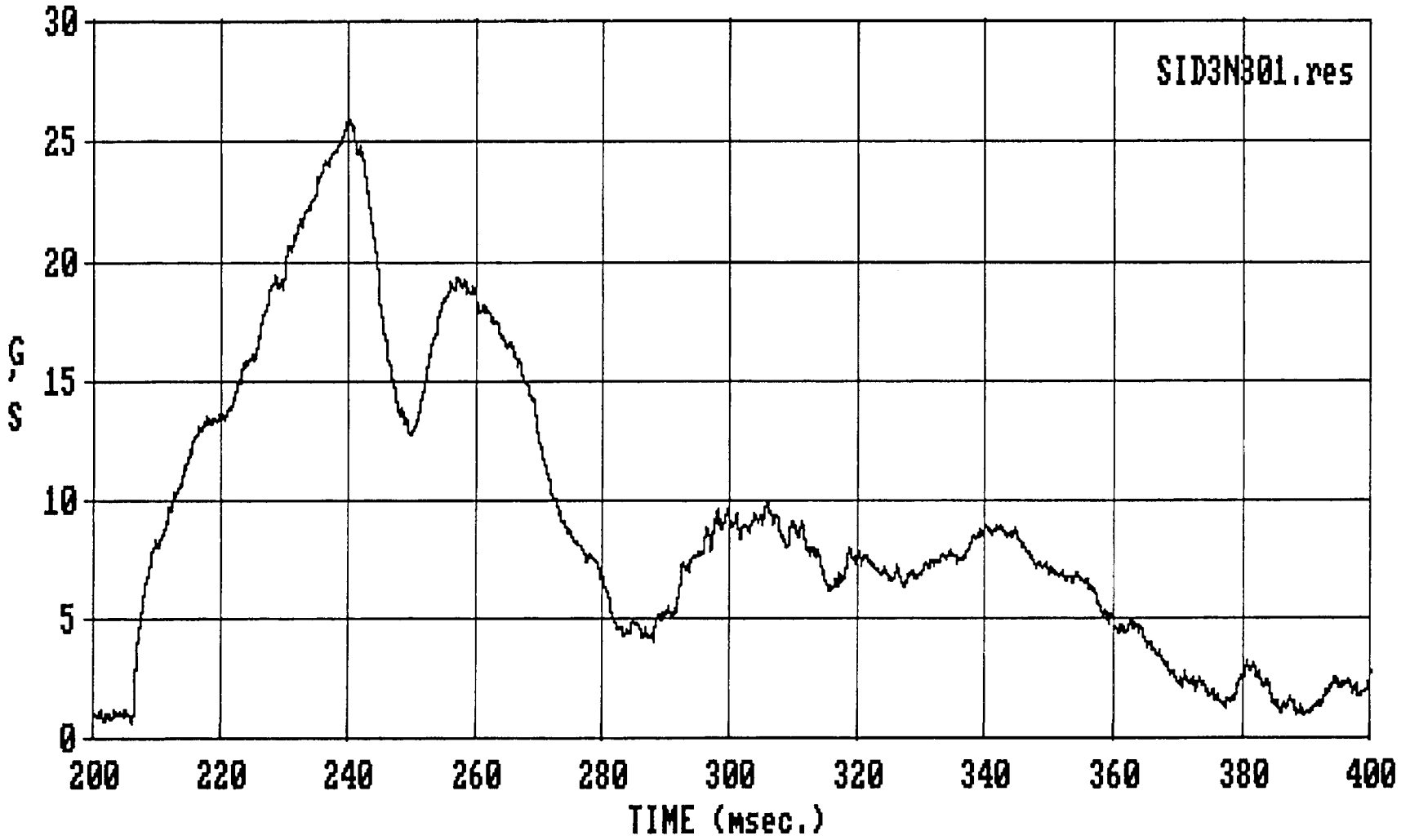
Max = 20.675 Min = -5.9651

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Lower Spine acc. secondary, Y-axis (FIR)



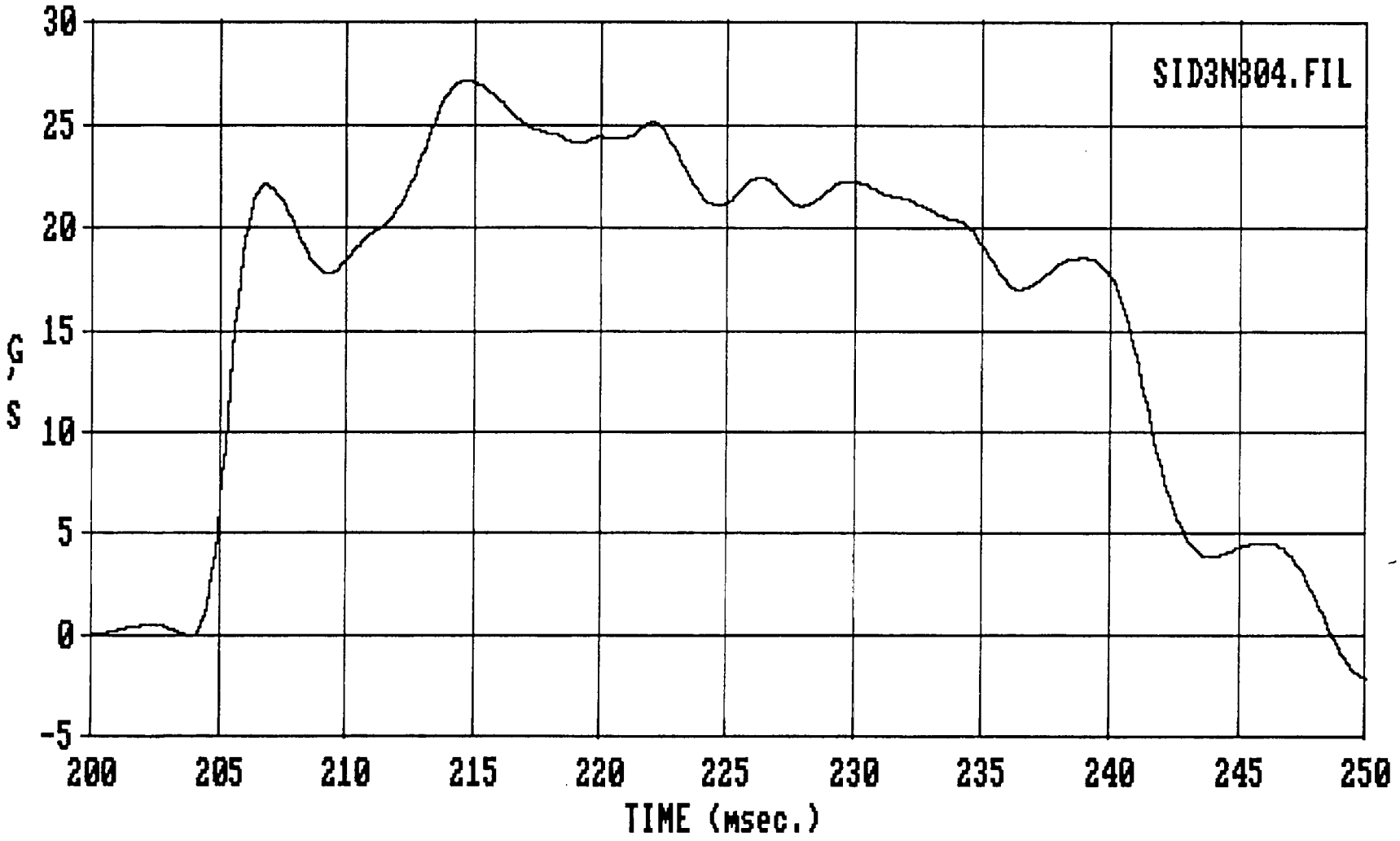
Max = 59.508 Min = -10.014

MSE 11/04/88 -- SID CAL SEQUENCE 3 : Pelvis acceleration, Y-axis (FIR)



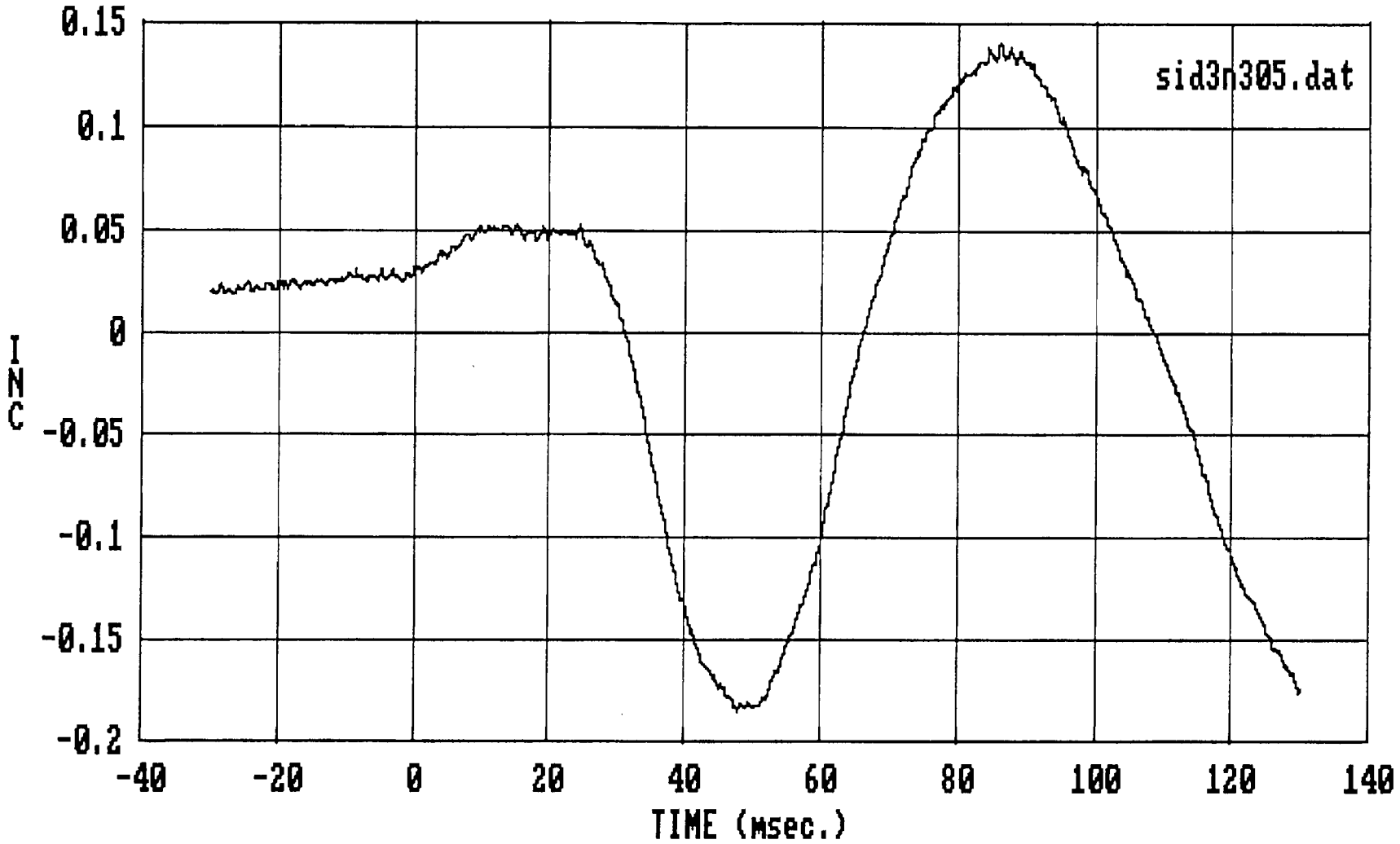
Max = 25.925 Min = .00000

MSE 11/05/88 -- SID CAL SEQUENCE 3 : Neck Bend Resultant Head accel.



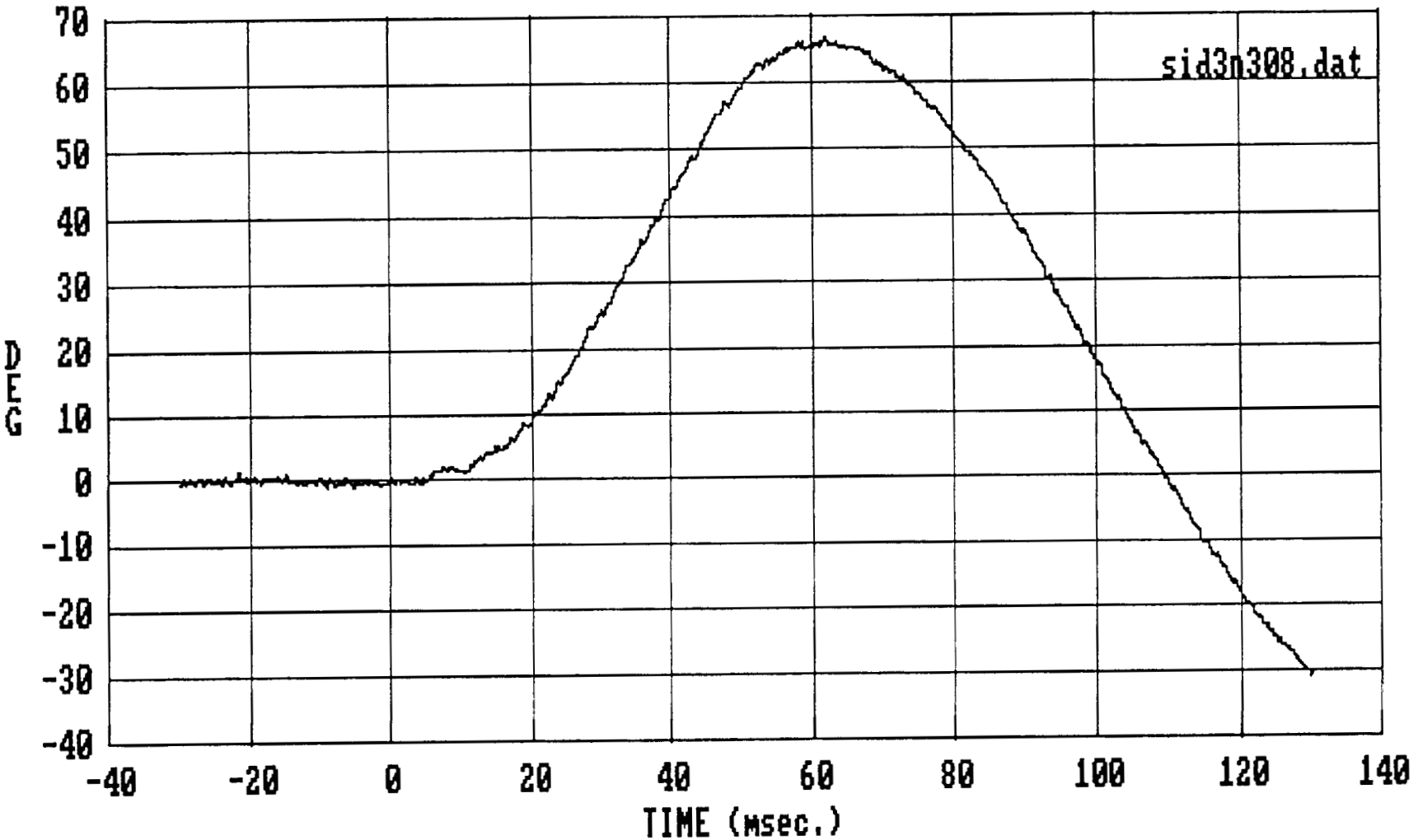
Max = 27.170 Min = -6.6567

MSE 11/05/88 -- SID CAL SEQUENCE 3 : Neck Bend Pendulum accel.



Max = .14088 Min = -.19610

MSE 11/05/88 -- SID CAL SEQUENCE 3 : Neck Bend Chordal Displacement



Max = 66.797 Min = -38.615

MSE 11/05/88 -- SID CAL SEQUENCE 3 : Neck Bend Total Head Rotation

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).