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SIDE IMPACT PROTECTION IN PRODUCTION VEHICLES

MDB-TO-VEHICLE SIDE IMPACT TEST OF A 27° CRABBED MOVING DEFORMABLE BARRIER TO A 1989 COLT VISTA AT 33.5 MPH

MOBILITY SYSTEMS AND EQUIPMENT COMPANY
9920 LA CIENEGA BOULEVARD SUITE 708
INGLEWOOD, CALIFORNIA 90301

15 NOVEMBER 1991

TEST REPORT

Prepared Under Contract No. DTNH22-87-C-07168, D.O. #2

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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PREPARED BY: Dr. Anil V. Khadilkar/Mr. Mike Brown/Mr. Patrick Puzzuto

APPROVED BY: _____
Dr. Anil V. Khadilkar/Mr. George J. Adams, P.E.

DATE: _____

FINAL REPORT ACCEPTED BY:

_____
Contracting Officer's Technical Representative
Office of Crashworthiness Research

_____
Date

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DR. ANIL V. KHADILKAR/MR. MIKE BROWN/MR. PATRICK PUZZUTO

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MOBILITY SYSTEMS AND EQUIPMENT COMPANY
9920 LA CIENEGA BOULEVARD, SUITE 708
INGLEWOOD, CALIFORNIA 90301

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16. Abstract

This test report documents a crash test to evaluate Side Impact Protection. Testing was conducted on a 1989 Colt Vista at Mobility Systems and Equipment Company Test Facility, San Bernardino, California. The test vehicle was impacted on the left side by a moving deformable barrier, crabbed to 27°, 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 two side impact dummies was measured. The dummies were located in driver's designated seating position and rear seat at left outboard seating position.

The test date was October 25, 1991.

	Driver	Passenger
Head Injury Criterion		
Thoracic Trauma Index		
Pelvic Acceleration		

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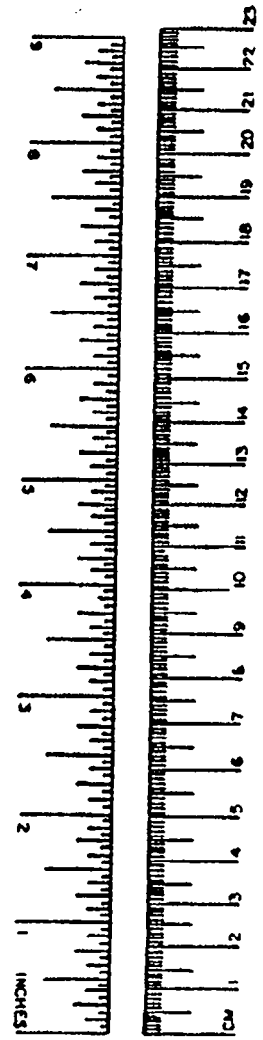
METRIC CONVERSION FACTORS

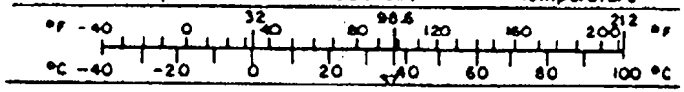
APPROXIMATE CONVERSIONS FROM METRIC MEASURES

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(2000lb)	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 ME

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND
	LENGTH		
mm	millimeters	0.04	inches
cm	centimeters	0.4	inches
m	meters	3.3	feet
m	meters	1.1	yards
km	kilometers	0.6	miles
	AREA		
cm^2	square centimeters	0.16	square inches
m^2	square meters	1.2	square yards
km^2	square kilometers	0.4	square miles
ha	hectares($10,000m^2$)	2.5	acres
	MASS (weight)		
g	grams	0.035	ounces
kg	kilograms	2.2	pounds
t	tonnes (1000kg)	1.1	short tons
	VOLUME		
ml	milliliters	8.03	fluid ounces
l	liters	2.1	pints
l	liters	1.06	quarts
l	liters	0.26	gallons
m^3	cubic meters	36	cubic feet
m^3	cubic meters	1.3	cubic yards
	TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature



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SECTION 1

PURPOSE AND INTRODUCTION

This testing program is a part of an investigation and evaluation of side impact protection in production light trucks and vans. The test is specifically intended to simulate a 90 deg. intersection collision with the striking vehicle moving at 30 mph. This is accomplished by towing a Moving Deformable Barrier (MDB) crabbed at a 27 degree 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 1989 Colt Vista. The test was performed on October 25, 1991 at an actual impact speed of 33.79 mph. The leading left-hand edge of the MDB contacted the test vehicle 36.25 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 1989 Colt Vista, Test No. 6, was tested on 25 October 1991. 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 17 accelerometer channels and three 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.

Two side impact anthropomorphic dummies (SID) were placed in the vehicle and positioned using the side impact dummy seating procedure (Appendix D). SID position measurements are shown in Table 2-5. The SIDs were instrumented with 12 accelerometers and one displacement transducer. A summary of the SID accelerometer data is given in Table 2-6. Lap and shoulder seat belts were equipped with load cells for both SIDs. 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 27° 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 52 channels of information was recorded on three (3) FM data tape recorders.

TABLE 2-1 TEST VEHICLE DATA

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1989/COLT VISTA

VEHICLE NHTSA NO.: RK0302 VIN: JP3BG39V7KZ055256

VEHICLE BODY COLOR: MAUVE ; MONTH & YEAR OF MANUFACTURE: 03/89

ENGINE: Cyl.; 4 ~~C.I.D.~~ Displacement 2 ? Liters; Placement;
N/A Longitudinal; X Lateral X Gas; N/A Diesel; N/A Turbocharged

TRANSMISSION: 3 Speed; N/A Manual; X Automatic; N/A Overdrive

FINAL DRIVE: X Front Wheel Drive; N/A Rear Wheel Drive; N/A
Four Wheel Drive N/A

DATE VEHICLE AVAILABLE FOR SIDE IMPACT TESTING: 09/24/91

ODOMETER READING: 13298.8 miles; OPTIONS: X A/C; X P/S; N/A P/Wdo;
N/A Tilt Whl.; N/A Cruise Control

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): 32 psi Front; 32 psi Rear

Recommended Tire Size: P165/80 R13

Tires On Vehicle: P165/80 R13; Manufacturer: YOKOHAMA

Number Of Occupants: 2 Front; 3 Rear; 2 3rd Seat; 7 TOTAL

Type Of Front Seats: X Bucket; N/A Bench; N/A Split Bench

Type Of Front Seat Back: N/A Fixed; X Adjustable With X Lever
N/A Rotating Knob

Vehicle Maximum Capacity Loading = 1161 lb (A)

No. Of Occupants x 150 lb - - - = 1050 lb (B)

Cargo Capacity (A - B)- - - - - = 111 lb
*GVWR - Delivered Weight

TEST VEHICLE DELIVERED WEIGHT WITH MAXIMUM FLUIDS:

Right Front = 812 lb

Left Front = 852 lb

Right Rear = 582 lb

Left Rear = 539 lb

TOTAL WEIGHT = 2785 lb

TOTAL FRONT = 1664 lb (59.7% of TOTAL)

TOTAL REAR = 1121 lb (40.3% of TOTAL)

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

CALCULATION OF TEST VEHICLE TARGET WEIGHT:

Total Test Vehicle Delivered Weight With Maximum Fluids = 2785 lb

Maximum Cargo Carrying Capacity Of Test Vehicles* - - - = 300 lb

Weight Of Two P.572 Dummies (2 x 174 lb)- - - - - - - - = 348 lb

TEST VEHICLE TARGET WEIGHT- - - - - - - = 3433 lb

* 300 lb for light trucks and MPVs

ACTUAL WEIGHT OF TEST VEHICLE WITH 2 DUMMIES CARGO:

Right Front = 951 lb

Left Front = 996 lb TOTAL FRONT = 1947 lb (57.0% of TOTAL)

Right Rear = 756 lb

Left Rear = 710 lb TOTAL REAR = 1466 lb (43.0% of TOTAL)

TOTAL WEIGHT = 3413 lb (which includes 100 lb of cargo ballast weigh

TEST VEHICLE ATTITUDE:

As Delivered -----Right Front = 25.94 in

Left Front = 25.50 in

Right Rear = 25.38 in

Left Rear = 25.00 in

Test Vehicle Wheelbase: 103.5 in; C.G.=-41.7 in rearward of front wheel centerline

Ready For Test -- Right Front = 25.00 in

Left Front = 24.50 in

Right Rear = 23.82 in

Left Rear = 23.50 in

TOTAL VEHICLE LENGTH:

Right Side = 177.75 in

Left Side = 177.75 in

Centerline = 177.00 in

TABLE 2-2 PRETEST CONDITIONS

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1989/COLT VISTA

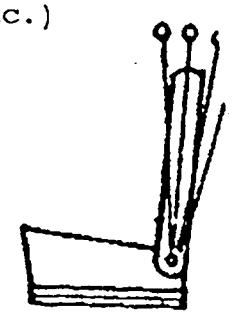
VEH. NHTSA NO. RK0302 ; TEST DATE: 10/25/91

RONT SEAT CUSHION PLACEMENT: Midpoint of forward/aft travel

TOTAL NUMBER OF ADJUSTMENT POSITIONS OR DETENTS: 11 notches

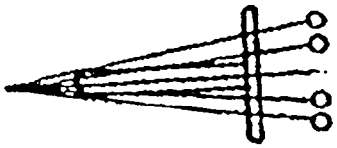
FRONT SEAT BACK ADJUSTMENT POSITION: 25°

(latch position, knob rotations, etc.)



TORSO ANGLE 25°

ADJUSTABLE STEERING COLUMN POSITION:



Midpoint of swing

_X_ Not Applicable

WINDOW POSITIONS: Left Front -- closed
Left Rear --- closed
Right Front - open
Right Rear -- open

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 12.25 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 = 103.05 in
Impact point is 14.75 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: 1989/COLT VISTA

VEH. NHTSA NO. RK0302 ; VIN: JP3BG39V7KZ055256

TEST DATE: 10/25/91 BUILD DATE: 03/89

OVERALL LENGTH = 177.75 inches; OVERALL WIDTH = 60.00 inches

TEST WEIGHT: Left Front = 996 lb; Left Rear = 710 lb

Right Front = 951 lb; Right Rear = 756 lb

SUBTOTALS - - - Front = 1947 lb Rear = 1466 lb

TOTAL VEHICLE WEIGHT - - - - - - - - - - - - - - 3413 lb

WHEELBASE = 103.5 inches

LONGITUDINAL C.G. FROM CENTER OF FRONT AXLE = -41.7 inches

IMPACT ANGLE WITH RESPECT TO IMPACTOR = 90 degrees

MAXIMUM EXTERIOR STATIC CRUSH:

1. LEVEL 1 (11.0" above ground) = 6.375 inches
2. LEVEL 2 (23.6" above ground) = 12.08 inches
3. LEVEL 3 (24.3" above ground) = 12.75 inches
4. LEVEL 4 (37.8" above ground) = 10.04 inches
5. LEVEL 5 (53.1" above ground) = +20.06 inches

MAXIMUM POSTTEST INTRUSION = 12.8 inches

OCCUPANTS:	PASSENGER	RIGHT REAR
TYPE OF DUMMY - - - -	SID S/N ?	SID
RESTRAINT USED- - - -	LAP & SHOULDER	LAP & SHOULDER

INSTRUMENTATION:

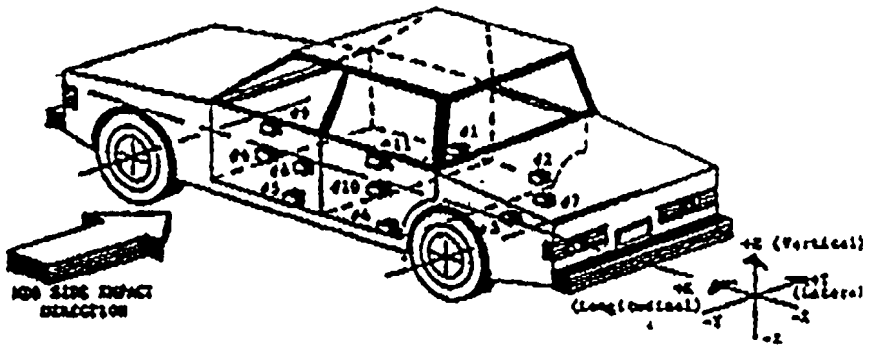
NUMBER OF DATA CHANNELS = 47

NUMBER OF CAMERAS: ONBOARD = 3 High-speed

OFFBOARD = 4 High-speed, 1 Real-time

TABLE 2-4 TEST VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST VEHICLE: 1989 COLT VISTA NHTSA NO.: RK0302 TEST DATE: 10/25/91

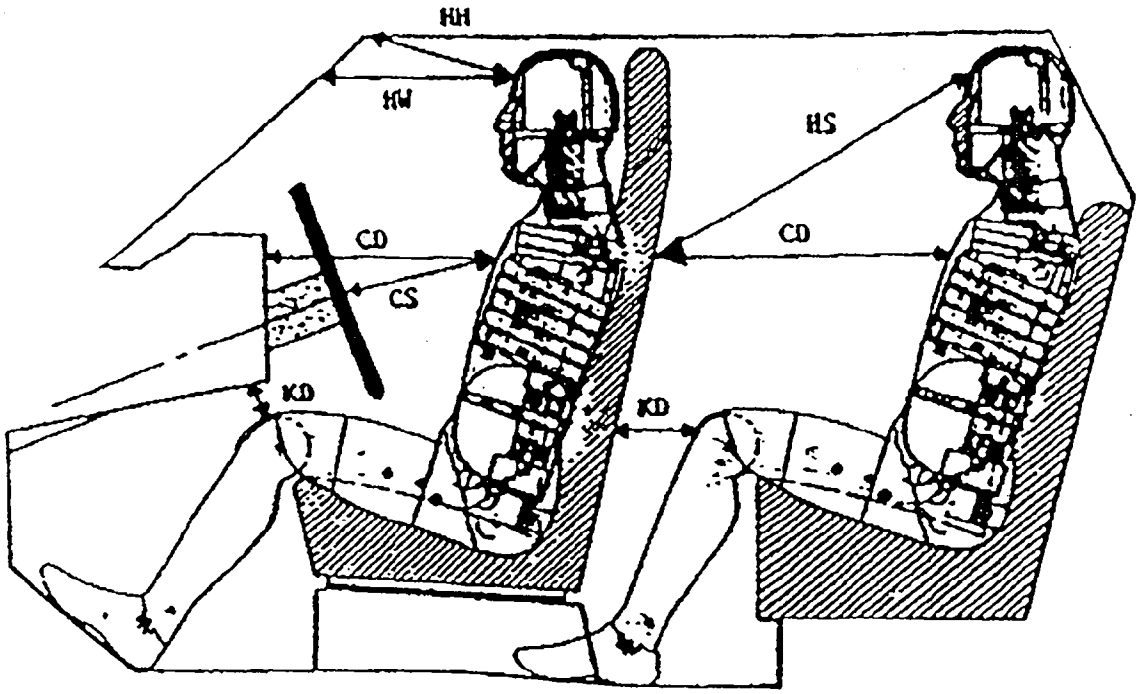


ACCEL. NO.	LOCATION	COORDINATES (")			LONG. (X) POS. / NEG.		LAT. (Y) POS./ NEG.		VERT. (Z) POS. / NEG.		RESULTANT POS./ NEG	
		X*	Y*	Z*	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	Right Side Sill At Front Seat	+111	+24.0	+ 8.5	4.78	17.20	14.17	19.60	6.79	25.00	15.1	18.40
2	Right Side Sill At Rear Seat	+ 79	+24.0	+ 9.5	6.42	13.30	21.23	20.30	11.30	24.60	24.1	19.90
3	Rear Floorpan Above Axle	+ 34	0.0	+21.5	9.08	34.70	30.67	37.70	5.51	50.50	31.5	37.60
4	Left Side Sill At Rear Seat	+ 81	-26.0	+ 9.0	////	// ///	50.51	14.10	/////	// ///	////	/////
5	Left Side Sill At Front Seat	+111	-24.0	+ 8.5	////	// ///	22.70	2.10	/// /	// ///	////	////
6	Left Front Door on Centerline	+102	-27.0	23.8	////	/////	202.20	4.20	// /	// ///	////	/////
7	Right Rear Occ. Compartment	+ 81	+15.5	+ 8.5	8.47	5.30	/////	//////	// //	// ///	////	/////
8	Midrear of Left Front Door	88.5	-27.0	24.0	////	/////	192.75	3.40	// //	// ///	////	/////
9	Left Front Door Upper Centerline	102.0	-27.0	36.0	////	/////	148.41	9.00	// //	// ///	////	/////
10	Midrear of Left Rear Door	+ 69	-27.5	24.3	////	/////	109.18	1.20	// //	// ///	////	/////
11	Left Rear Door Upper Centerline	+ 69	-27.5	37.3	////	/////	93.78	9.80	// //	// ///	////	/////

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

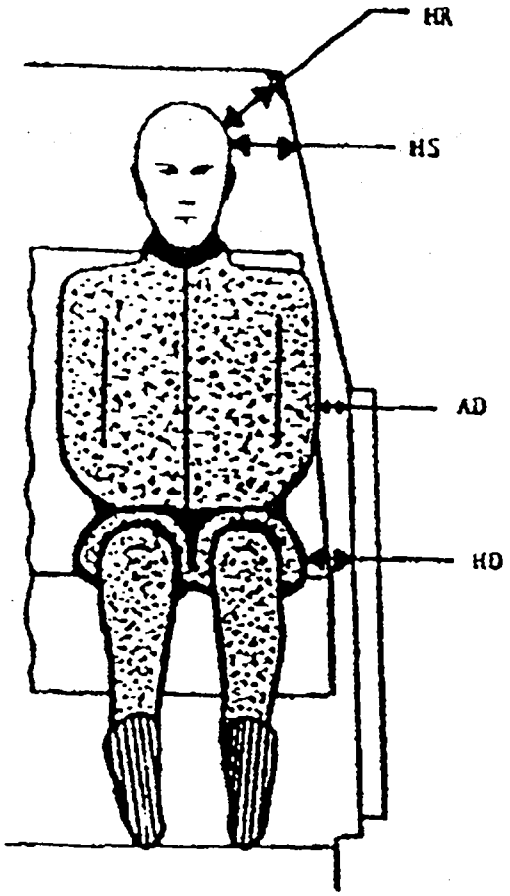
TABLE 2-5 SIDE IMPACT DUMMY (SID) LONGITUDINAL CLEARANCE DIMENSIONS

1989 Colt Vista



	FRONT PASSENGER ID # 319	REAR PASSENGER ID # 137
HH	22.5 in	NA in
HW	30.5 in	NA in
HS	NA in	24.00 in
CD	31.5 in	14.00 in
CS	18.5 in	NA in
KDL (LEFT)	6.0 in	1.00 in
KDR (RIGHT)	2.0 in	0.75 in

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



	FRONT PASSENGER ID # 319	REAR PASSENGER ID # 137
HR	7.5 in	7.5 in
HS	8.8 in	10.0 in
AD	3.0 in	4.0 in
HD	6.0 in	6.0 in

1989 COLT VISTA, RK0302

TABLE 2-6 SIDE IMPACT DUMMY (SID) TEST DATA SUMMARY
1989 COLT VISTA, RK0302

TEST DATE: 10/25/91

	FRONT DUMMY -- ID # 319				REAR DUMMY -- ID # 137			
	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	13.62	60.90	54.26	48.20	9.0	206.70	58.65	56.60
Lateral -------- Y	143.54	45.70	14.40	156.40	108.3	56.70	16.11	35.60
Vertical ------- Z	42.63	50.00	21.55	45.60	69.5	59.90	14.89	70.90
RESULTANT ------ R	150.27	45.70	0.00	4.70	124.2	56.70	0.11	1.20
HIC ----------* (Time Interval)				637.43			629.9	
RIB ACCELERATIONS:								
1.Upper Rib Lateral Y*	75.15	30.63	26.79	60.00	85.91	38.13	49.0	59.38
2.Upper Rib Lateral Y*	74.03	30.63	26.71	60.00	84.59	38.13	49.5	59.38
1.Lower Rib Lateral Y*	115.03	26.88	14.67	70.00	108.7	33.13	27.00	50.00
2.Lower Rib Lateral Y*	115.52	26.88	14.84	70.00	109.0	33.13	28.87	50.00
SPINE ACCELERATIONS:								
1.Upper Spine Lateral Y*	99.28	26.25	16.64	71.88	96.55	32.50	3.07	50.00
2.Upper Spine Lateral Y*	99.98	26.25	16.46	71.88	99.05	32.50	30.22	50.63
1.Lower Spine Lateral Y*	102.07	30.00	28.26	60.00	113.3	36.25	38.92	58.75
2.Lower Spine Lateral Y*	102.25	30.00	28.83	60.00	115.7	36.35	36.28	58.13
PELVIS ACCELERATIONS: Lateral Y*	69.12	28.13	17.31	86.21	108.4	26.88	17.22	66.88
RIB DEFLECTION: Lateral	2.00	58.40	0.00	11.00	1.71	65.10	0.40	97.60

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

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

Negative Direction -- Longitudinal (X) = rearward
Lateral (Y) = to left
Vertical (Z) = up

Thoracic Trauma Index

TABLE 2-7 CRASH TEST SUMMARY FOR SIDE IMPACTOR

TYPE OF TEST: 90 DEG., 30 MPH/15MPH SIMULATION TEST DATE 10/25/91

NHTSA NO. FOR TARGET VEHICLE: RK0302 ; VEHICLE: 1989 COLT VISTA

POSITION OF IMPACTOR (MDB) ON MONORAIL: CRABBED 27° 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 = 44.5 in.

MDB Weight -- Left Front = 1013 lb; Left Rear = 442 lb

Right Front = 638 lb; Right Rear = 838 lb

SUBTOTAL: Front = 1651 lb; Rear = 1280 lb

TOTAL MDB WEIGHT = 2931 lb

IMPACT ANGLE (MDB C/L to Target Vehicle C/L) = 90°

IMPACT SPEED = 33.79 MPH

MAXIMUM STATIC CRUSH OF HONEYCOMB IMPACT FACE:

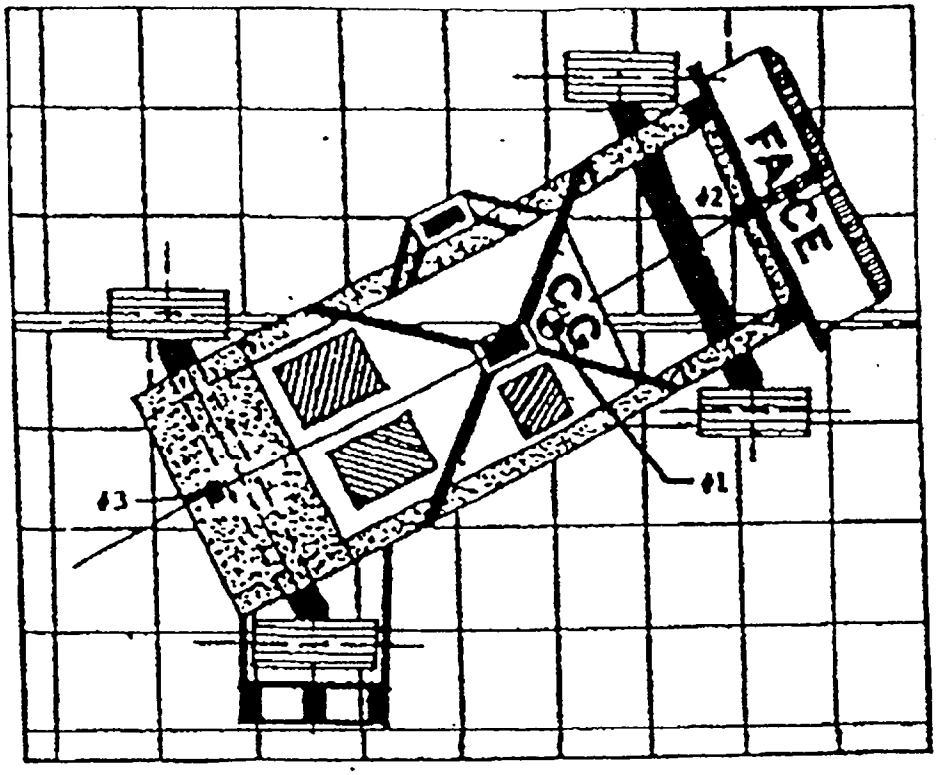
1. ROW A at bumper level = 4.00 in.
2. ROW B at mid-stack level = 1.75 in.
3. ROW C at top of stack level = 3.00 in.

INSTRUMENTATION:

Number of MDB Data Channels = 5 accelerometer channels

Number of Onboard Cameras ——

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



1989 COLT VISTA, RK0302

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	74.0	0.0	14.0	93.8	9.80	91.6	25.10
	Lateral Y				2.5	106.90	17.7	39.10
	Vertical Z				8.9	40.90	4.1	71.20
	Resultant R				20.5	45.90	0.2	96.50
2	Front Frame Member Longitudinal X	131.0	0.0	26.5	1.6	152.20	14.6	57.10
3	Rear Frame Member Longitudinal X	13.0	0.0	17.0	1.5	151.30	15.8	37.60

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

TABLE 2-9 HIGH-SPEED CAMERA LOCATIONS AND DATA

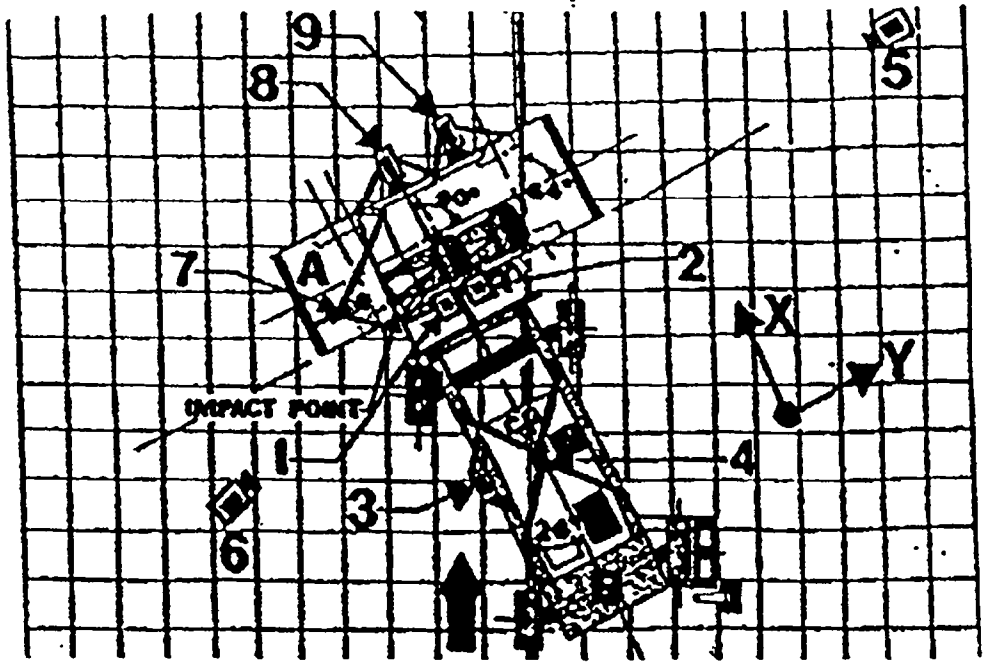
CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	COORDINATES (in) X*	Y*	Z*
1	Overhead view of test vehicle dynamics	Fastex	28	600	0	60	252
2	Overhead Closeup view of impact plane	Fastex	16	600	20	35	252
3	MDB Onboard Closeup view of impact point	Himac	28	600	-121	0	29.5
4	MDB Onboard view of driver dummy kinematics	Himac	16	600	-150	37	54
5	Overhead view of test Level--Overall View	Fastex	50	600	1294	2534	48
6	Left Side Ground Level--Overall View	Fastex	28	600	00	312	24
7	Test Vehicle Onboard-driver dummy front view kinematics	Fastex	16	600	-13	50	+51
8	Test Vehicle Onboard-pass. dummy side view kinematics	Fastex	16	600	+91	-28	+49
9	Test Vehicle Onboard-pass. dummy side view kinematics	Fastex	16	600	+91	-61	+49

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

* Reference (from point of impact
+X = Forward
+Y = To Right
+Z = Upward

SAMPLE

1989 COLT VISTA, RK0302



ANGLES INDICATED ARE HYPOTHETICAL

SECTION 3

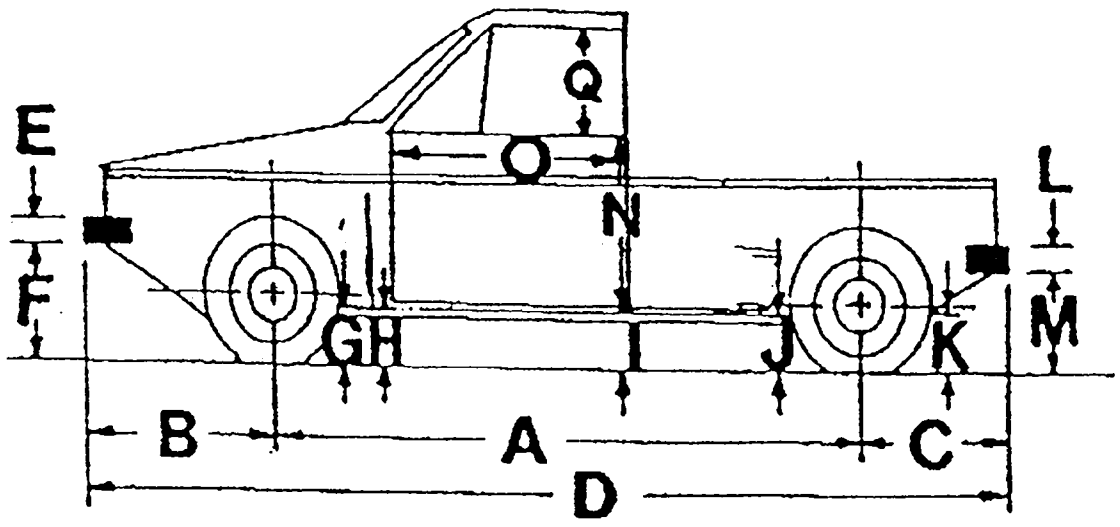
TEST RESULTS

The 1989 Colt Vista was impacted at 33.79 mph by the 27° crabbed MDB on 25 October 1991. The MDB's left edge contacted the test vehicle 0.75 inches rearward of the impact line. The test vehicle spun around counterclockwise and pushed back due to impact with barrier. The vehicle driver side doors were crushed inwards a maximum of 12.75 inches. Pretest and posttest vehicle dimensions are shown in Tables 3-1 to 3-5.

The MDB impacted the 1989 Colt Vista at a height that was above the sill. As a result, the MDB created extensive deformation to both left side doors and "B" pillar. The doors on the 1989 Colt Vista contacted the SIDs at the lower and mid torso before the SIDs began to move. The contact to the lower and mid torso, started the SIDs heads to rotate in the counterclockwise direction. The front SIDs head impacted the seat belt anchor bolt on the "B" pillar. The passenger SIDs head impacted the virticle metal brace between the two side windows. Both SIDs then rebounded in a rotating clock wise motion. The seat belts haulted any further motion. Both SIDs ended up sitting in an upright position and facing forward.

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 4.0 inches on the lower right-hand corner. The MDB face wedged into the 1989 Colt Vista and had to be pried out. The honey comb MDB face separated from the 26 degree crabed sled at the mounting bolts. The crush details for the MDB are given in Table 3-7.

TABLE 3-1 PRE AND POSTTEST MEASUREMENTS
1989 COLT VISTA, RK0302



NOTE: All dimensions are in inches

	PRETEST	POSTTEST	CHANGE
A	103.0	101.75	1.25
B	35.25	34.75	0.5
C	38.25	39.25	1.0
D	177.0	175.75	1.25
E	4.75	4.75	0.0
F	14.125	14.75	0.625
G	8.0	8.5	0.5
H	8.0	8.5	0.5
I	8.5	11.0	2.5
J	9.0	10.25	1.25
K	10.625	10.5	0.125
L	4.75	4.75	0.0
M	16.75	16.5	0.25
N	28.0	24.0	4.0
O	40.0	38.5	1.5
P	N/A	N/A	N/A
Q	16.5	16.0	0.5

TABLE 3-2 VEHICLE SIDE MEASUREMENT

TEST VEHICLE NHTSA NO.: RK0302 TEST VEHICLE 1989 COLT VISTA

LEVEL 5 @	Window Top - - - - - - - -	53.125	in
LEVEL 4 @	Window Sill - - - - - - - -	37.75	in
LEVEL 3 @	Mid Door- - - - - - - - - -	24.25	in
LEVEL 2 @	Occupant H-Point- - - - -	23.625	in
LEVEL 1 @	Axle Centerline Height- -	11.0	in
	(or Sill Top Height)		

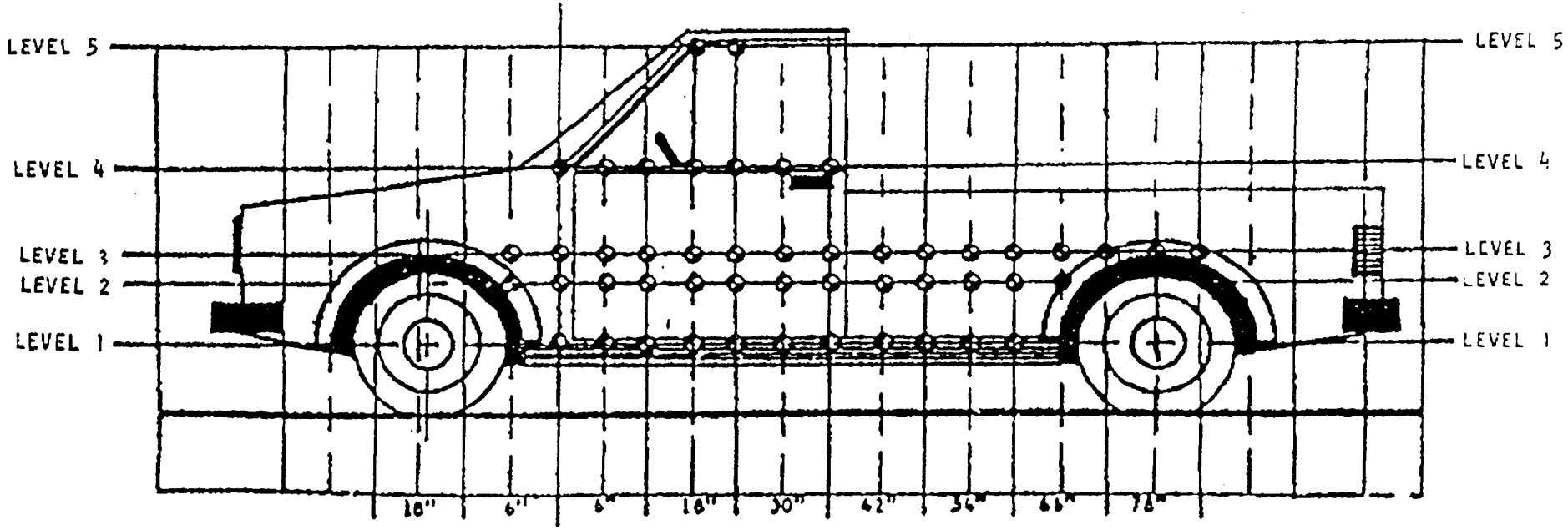


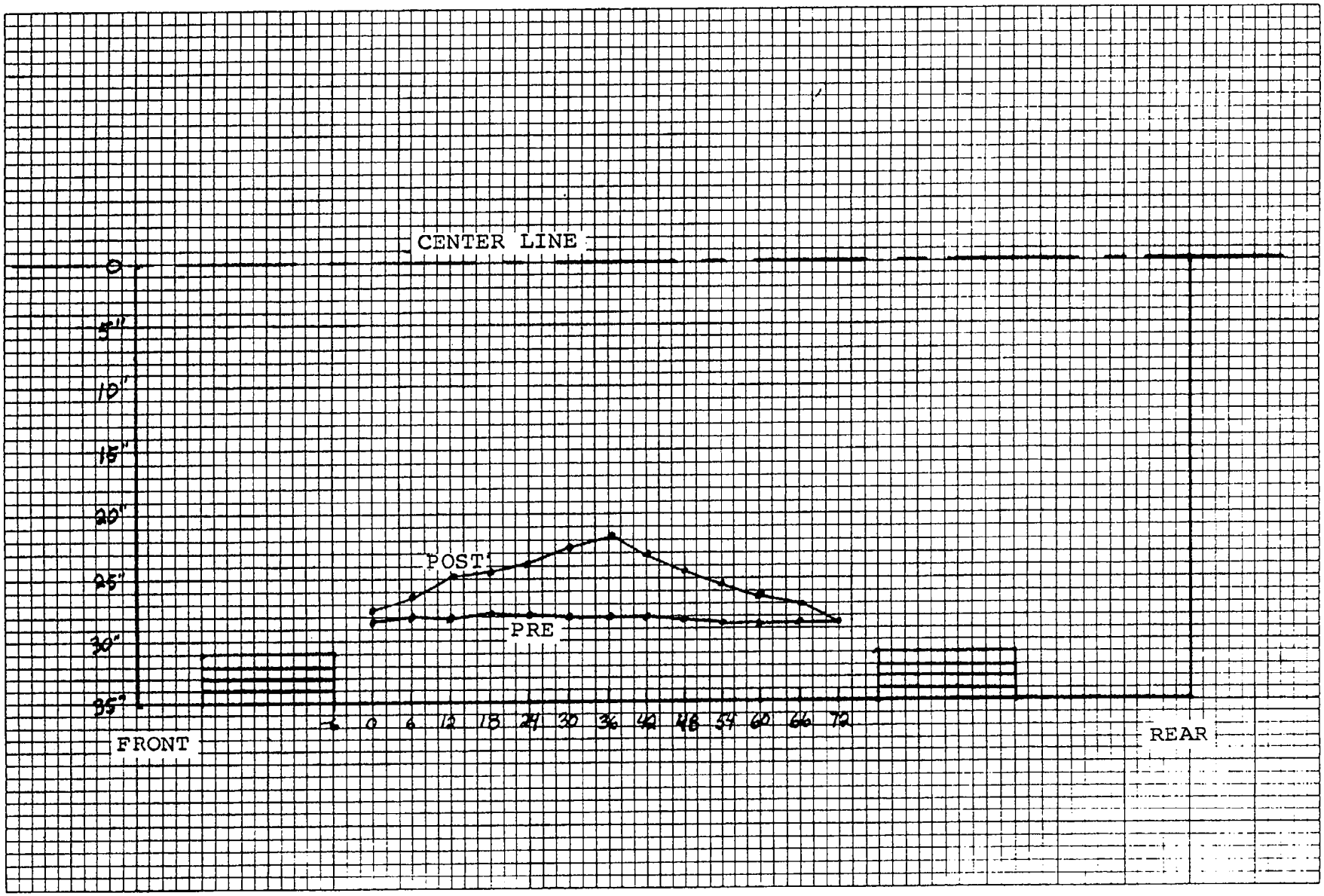
TABLE 3-3 TEST VEHICLE EXTERIOR PROFILES FROM REFERENCE PLANE* AND STATIC CRUSH DATA

1989 COLT VISTA, RK0302

TEST DATE		IMPACT POINT													
			FORWARD/REARWARD												
LOCATION:	HEIGHT (in)	PROFILES/ CRUSH	6"	0"	6"	12"	18"	24"	30"	36"	42"	48"	54"	60"	66"	7
1.Window Top	53.125	Posttest- - -	NA	NA	NA	NA	36.1	36.8	37.4	37.9	39.0	38.3	37.3	36.4	35.4	38
		Pretest - - -	NA	NA	NA	NA	37.3	38.3	38.1	38.0	37.5	37.8	37.8	37.8	37.5	37
		Static Crush-	NA	NA	NA	NA	-1.1	-1.1	-0.8	-0.1	+1.5	+0.5	-0.5	-1.3	-2.1	+1
2.Window Sill	37.75	Posttest- - -	33.3	34.4	34.5	38.6	41.3	41.4	41.8	42.0	43.0	42.8	42.5	42.0	40.8	36
		Pretest - - -	33.5	33.3	33.1	33.0	32.8	32.6	32.6	32.6	32.6	32.4	32.3	32.0	32.0	32
		Static Crush-	-0.3	+1.2	+1.4	+5.6	8.5	8.8	9.1	7.4	10.4	10.4	10.3	10.0	8.8	4
3.Mid-Door	24.25	Posttest- - -	30.3	34.0	38.0	41.9	41.8	41.8	41.7	41.6	42.4	42.4	42.3	42.0	42.3	40
		Pretest - - -	30.1	30.3	30.0	30.0	30.0	30.0	29.8	29.8	30.0	30.0	30.0	30.0	30.0	29
		Static Crush-	0.1	3.8	0.8	11.9	11.8	11.9	11.9	11.8	12.6	12.6	12.7	12.5	12.8	11
4.H-Point	23.625	Posttest- - -	30.3	34.0	38.0	41.9	41.8	41.8	41.7	41.6	42.4	42.4	42.3	42.0	42.3	40
		Pretest - - -	29.9	30.1	30.1	30.0	30.0	30.0	29.8	30.0	30.0	29.6	30.0	30.0	30.0	30
		Static Crush-	0.4	3.9	7.9	11.9	11.8	11.8	11.9	11.9	12.7	12.8	12.8	12.5	12.8	11
5.Axle Centerline	11.0	Posttest- - -	NA	32.8	33.8	32.1	32.5	36.3	37.8	38.4	36.9	35.8	34.5	33.8	33.0	31
		Pretest - - -	NA	31.5	32.0	32.0	32.1	32.1	32.0	32.0	32.0	31.8	31.5	31.5	31.5	31
		Static Crush-	NA	1.3	1.8	3.1	3.4	4.1	5.8	6.4	4.9	4.0	3.0	2.3	1.5	0

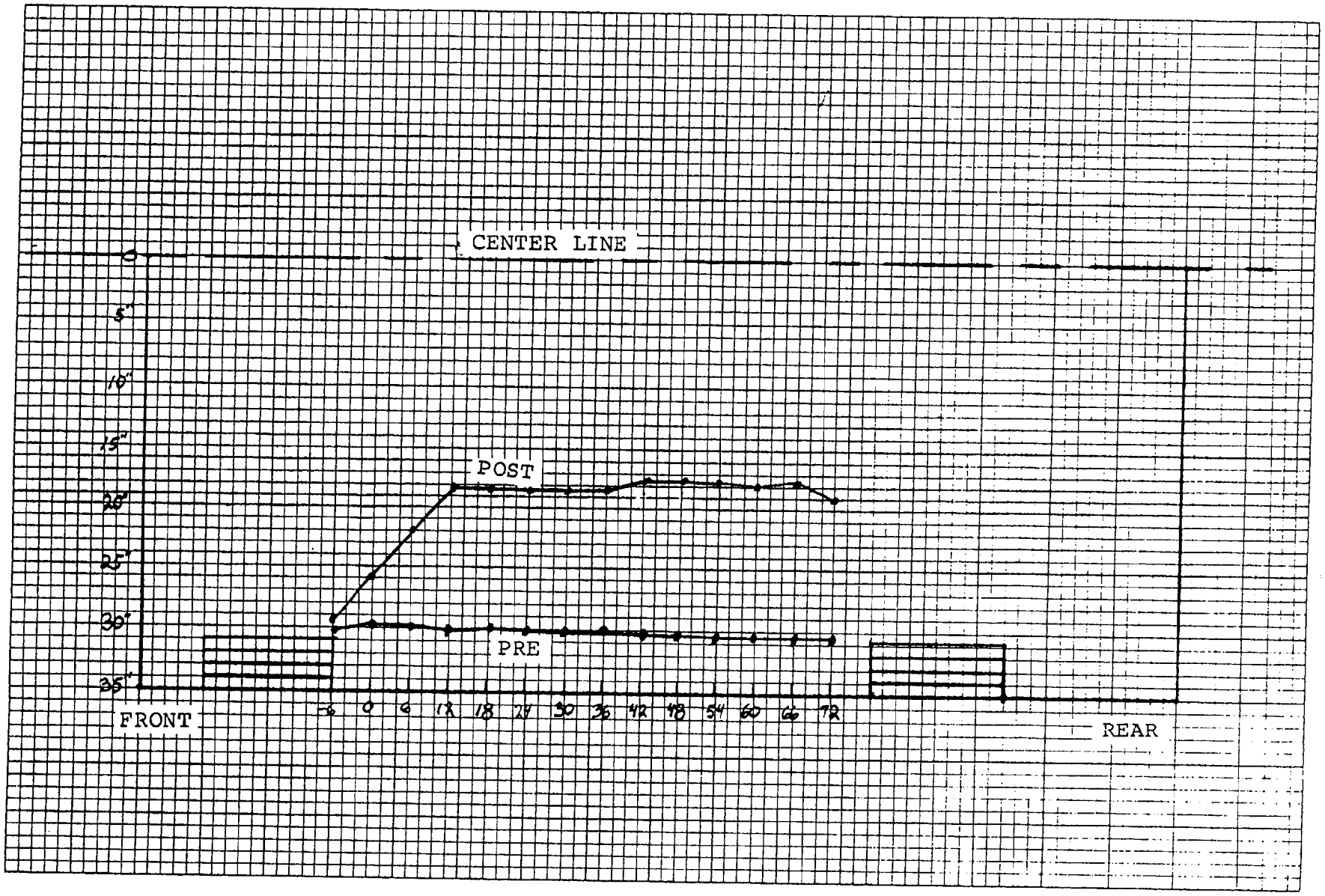
*Reference Plane is parallel to and 48 inches from test vehicle longitudinal centerline.
**Measured from ground.
***Impact point.

FIGURE 3-4A PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 1
AXLE CENTERLINE 11.0" ABOVE GROUND LEVEL



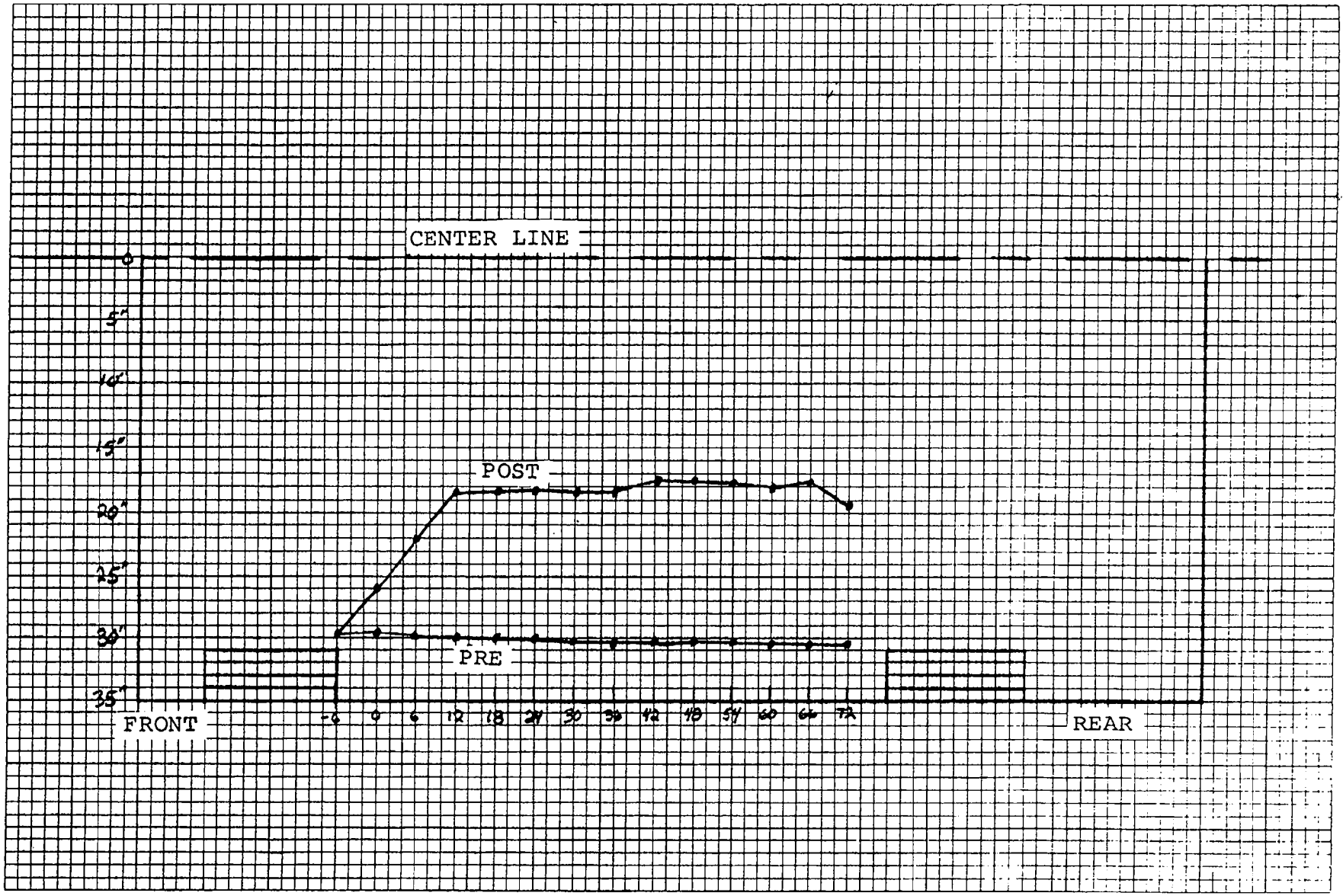
1989 COLT VISTA, RK0302

FIGURE 3-4B PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 2
H-POINT 23.6" ABOVE GROUND LEVEL



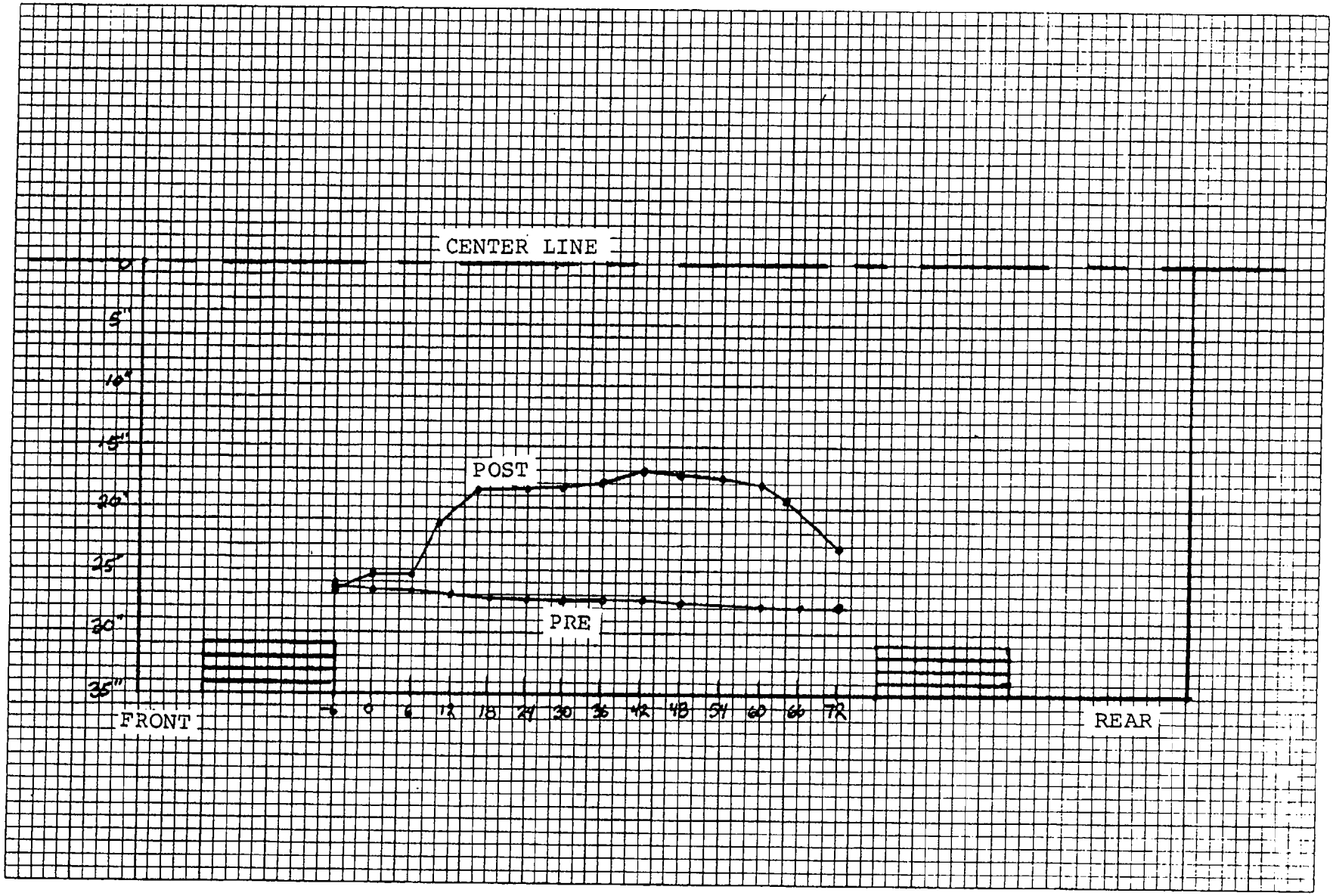
1989 COLT VISTA, RK0302

FIGURE 3-4C PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 3
MID DOOR 24.3" ABOVE GROUND LEVEL



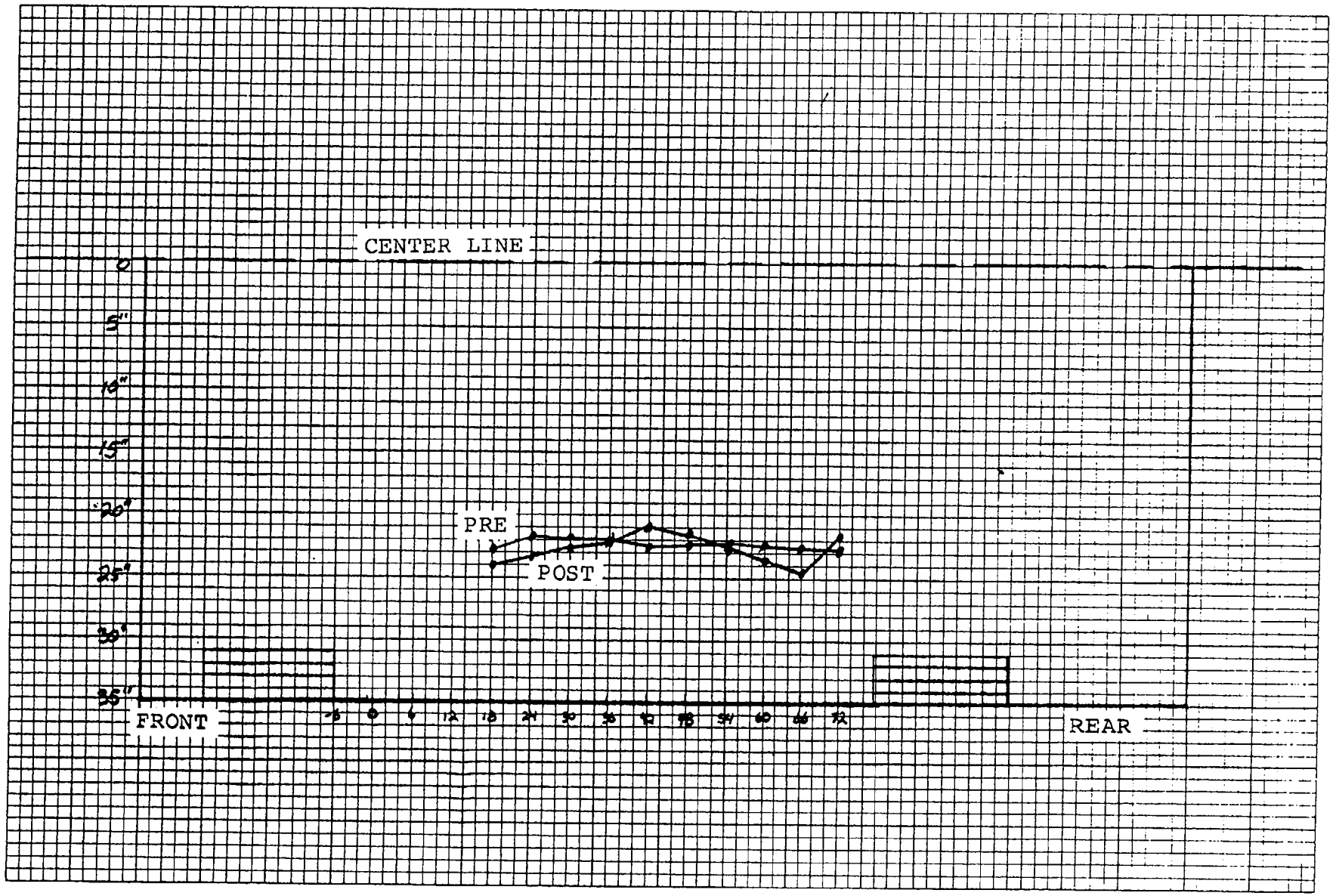
1989 COLT VISTA, RK0302

FIGURE 3-4D PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 4
WINDOW SILL 37.8" ABOVE GROUND LEVEL



1989 COLT VISTA, RK0302

FIGURE 3-4E PRE AND POSTTEST EXTERIOR PROFILE AT LEVEL 5
WINDOW TOP 53.1" ABOVE GROUND LEVEL



1989 COLT VISTA, RK0302

TABLE 3-5 TEST VEHICLE MEASUREMENTS

1989 COLT VISTA, RK0302

NO.	MEASUREMENT DESCRIPTION	Pre-Test (in.)	Post-Test (in.)	Diff. (in.)
X1	Total Length of Test Vehicle at Centerline	177.0	175.8	1.2
X2	Rear Surface of Vehicle to Front of Engine	159.0	157.8	1.2
X3	Rear Surface of Vehicle to Firewall	134.0	132.8	1.2
X4	Rear Surface to Upr. Leading Edge of Right Door	106.0	106.0	0.0
X5	Rear Surface to Upr. Leading Edge of Left Door	106.0	106.0	0.0
X6	Rear Surface to Lwr. Leading Edge of Right Door	124.6	125.0	0.4
X7	Rear Surface to Lwr. Leading Edge of Left Door	124.9	122.5	1.4
X8	Rear Surface to Upr. Trailing Edge of Right Door	87.0	87.0	0.0
X9	Rear Surface to Upr. Trailing Edge of Left Door	87.0	86.5	0.5
X10	Rear Surface to Lwr. Trailing Edge of Right Door	87.6	87.8	0.2
X11	Rear Surface to Lwr. Trailing Edge of Left Door	87.8	86.5	1.3
X12	Rear Surface to Bottom "A" Post on Right Side	125.0	125.0	0.0
X13	Rear Surface to Bottom "A" Post on Left Side	125.0	120.3	4.7
X14	Rear Surface to Firewall on Right Side	128.0	128.0	0.0
X15	Rear Surface to Firewall on Left Side	128.0	125.5	2.5
X16	Rear Surface to Steering Column	111.0	108.5	2.5
X17	Center of Steering Column to "A" Post	20.5	19.0	1.5
X18	Center Steering Column to Headlining	19.0	19.5	0.5
X19	Rear Surface to Right Side of Front Bumper	174.8	175.5	0.7
X20	Rear Surface to Left Side of Front Bumper	174.8	173.0	1.8
X21	Length of Engine Block	19.0	19.0	0.0
X22	Strg. Whl. Hub C/L to W/Shld. Header Interior Moulding	22.0	19.5	2.5
X23	Strg. Whl. Hub C/L to Rr.Wdo. Upper Int. Trim Moulding	40.3	37.5	2.8

TABLE 3-6 POSTTEST OBSERVATIONS

TEST VEHICLE: 1989 COLT VISTA ; NHTSA NO.: RK0302

VISIBLE DUMMY CONTACT POINT:	FRONT SID	REAR SID
HEAD	Seat Belt Anchor at "B" pillar	Vertical Metal Brace
CHEST	"B" Pillar	Door
ABDOMEN	"B" Pillar, Door	Arm Rest
LEFT KNEE	Door	Door
RIGHT KNEE	N/A	N/A

DOOR OPENING:	LEFT SIDE	RIGHT SIDE
FRONT	No	No
REAR	No	No

SEAT MOVEMENT:

Seats displaced to the right from the door impacting them.

GLAZING DAMAGE:

Passenger and drivers side windows shattered upon impact.

OTHER NOTABLE IMPACT EFFECTS:

None.

TABLE 3-7 EXTERIOR STATIC CRUSH FOR SIDE IMPACTOR

1989 COLT VISTA, RK0302

		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"	3.0	1.0	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	3.0
Mid-Stack Level	22"	1.7	1.7	1.5	1.3	1.0	0.8	0.8	0.5	0.5	0.5	0.5	0.3	0.3	0.0	0.0	0.0	0.0
Bumper Level	17"	4.0	3.4	3.4	3.5	3.3	2.8	2.5	2.5	2.3	2.3	2.0	1.8	1.8	1.5	1.5	1.3	1.8

* 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

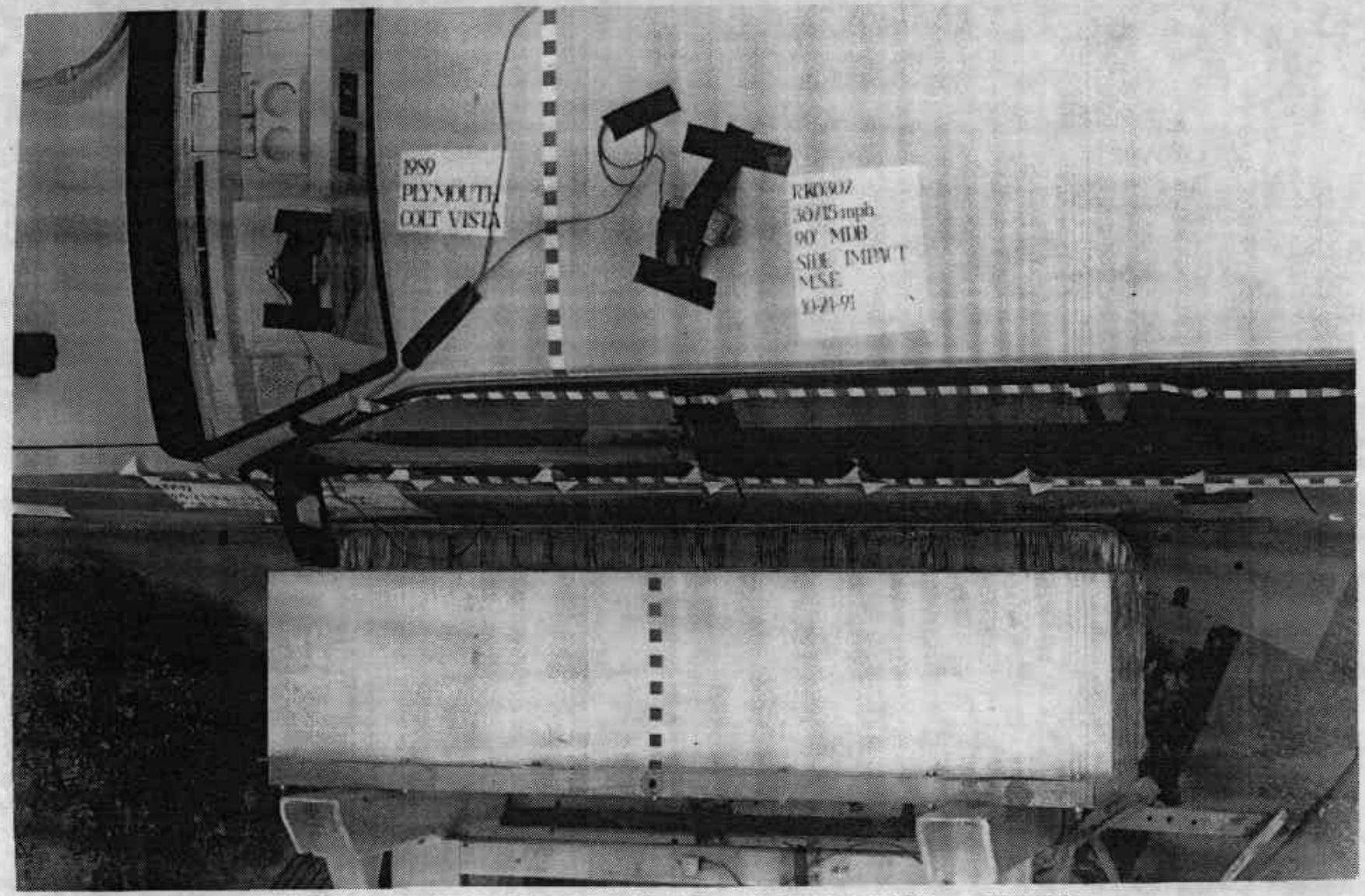


FIGURE A-5 TEST VEHICLE AND MDB, OVERHEAD VIEW - PRETEST

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

FIGURE A-7 SID IN DRIVER POSITION - PRETEST

FIGURE A-8 TEST VEHICLE, REAR PASSENGER DOOR - PRETEST

FIGURE A-9 SID IN PASSENGER POSITION - PRETEST

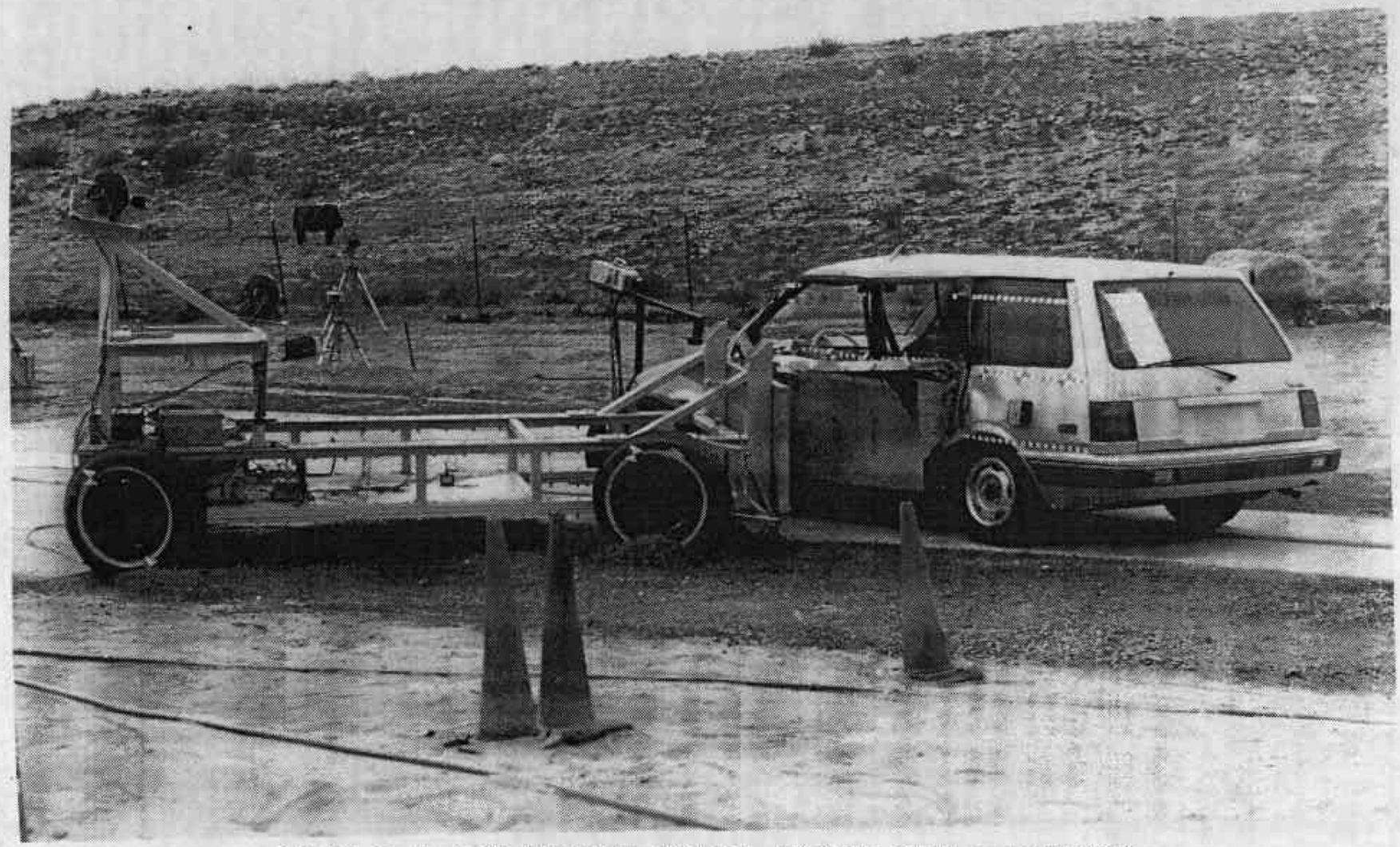


FIGURE A-10 MDB AND TEST VEHICLE, OVERALL VIEW - POSTTEST

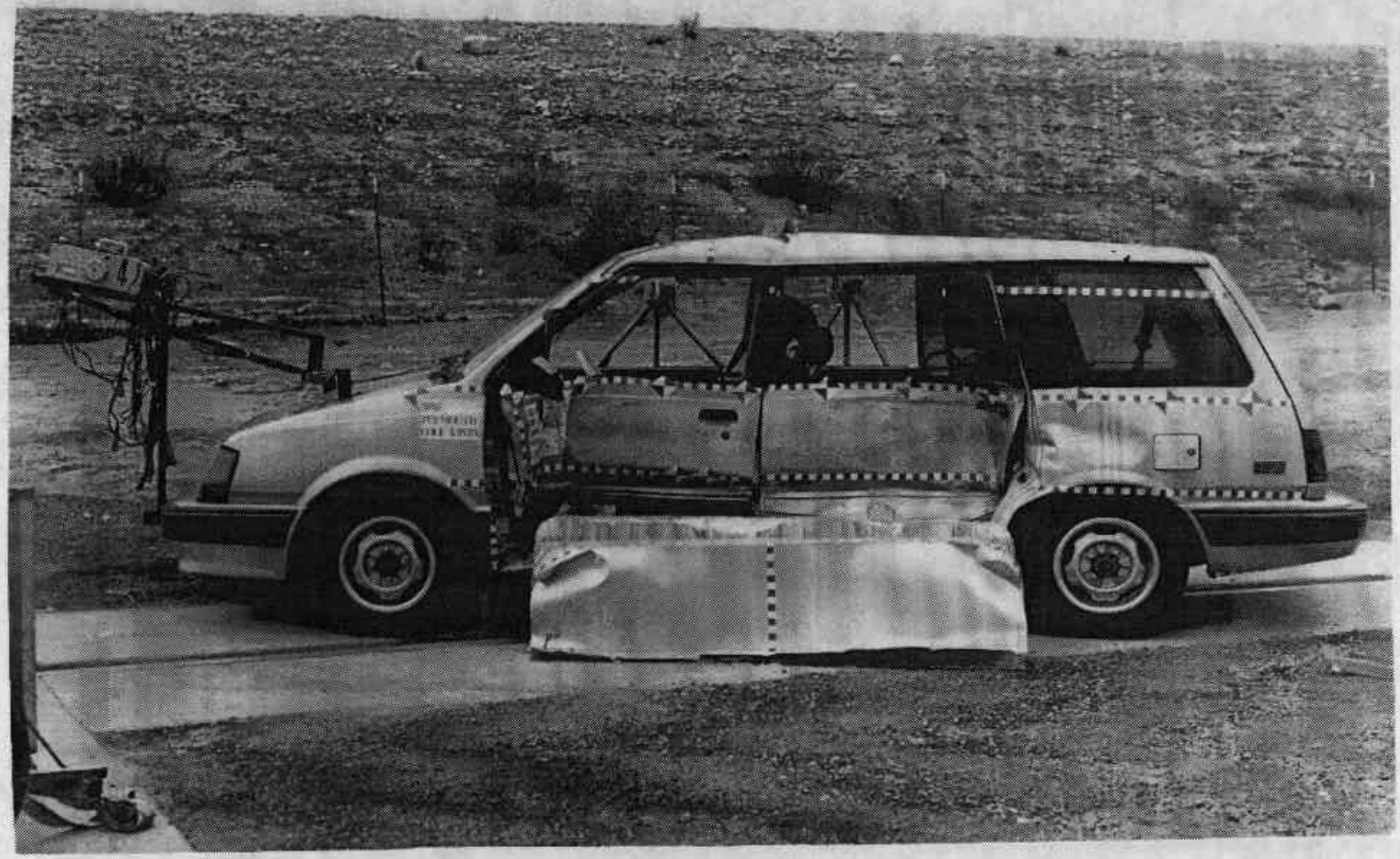


FIGURE A-11 TEST VEHICLE, LEFT SIDE VIEW - POSTTEST

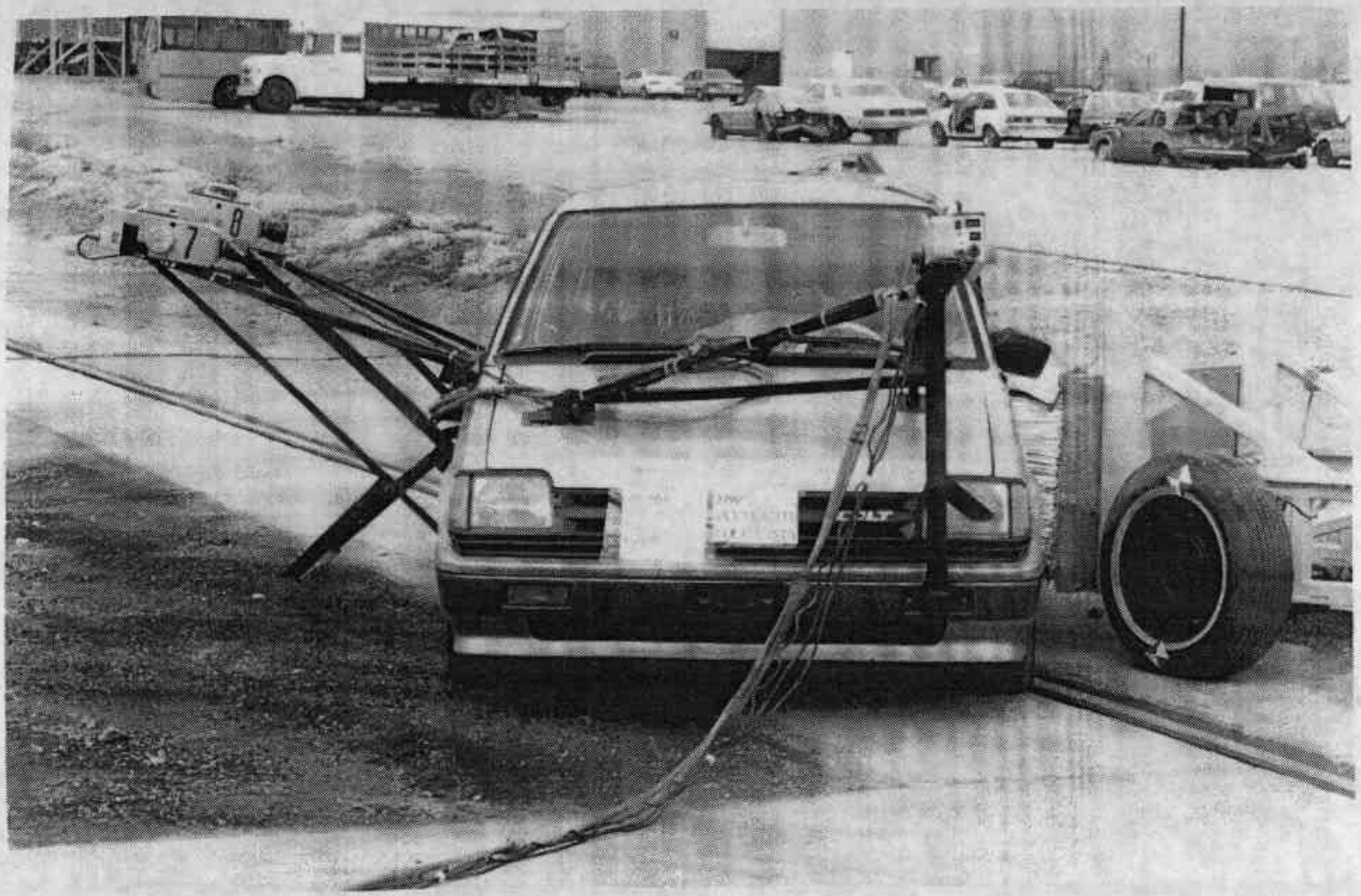


FIGURE A-12 TEST VEHICLE AND MDB, FRONT VIEW - POSTTEST

FIGURE A-13 TEST VEHICLE, RIGHT SIDE VIEW - POSTTEST

FIGURE A-14 MDB AND TEST VEHICLE, REAR VIEW - POSTTEST

FIGURE A-15 DRIVER FINAL POSITION - POSTTEST

FIGURE A-16 DRIVER POSITION INTERIOR - POSTTEST

FIGURE A-17 PASSENGER FINAL POSITION - POSTTEST

FIGURE A-18 PASSENGER POSITION INTERIOR - POSTTEST

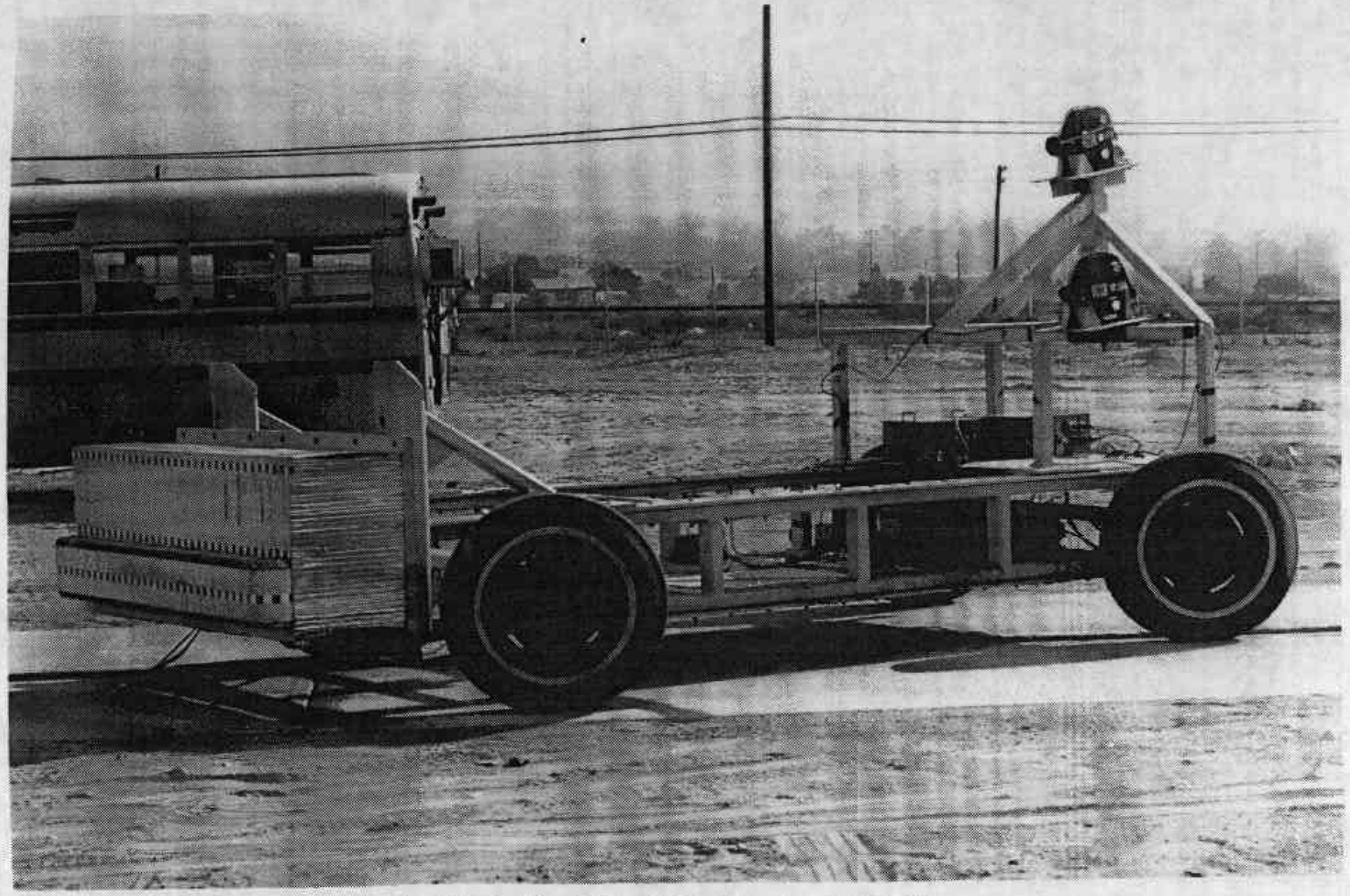


FIGURE A-13 MDB, VIEW NO. 1 - PRETEST

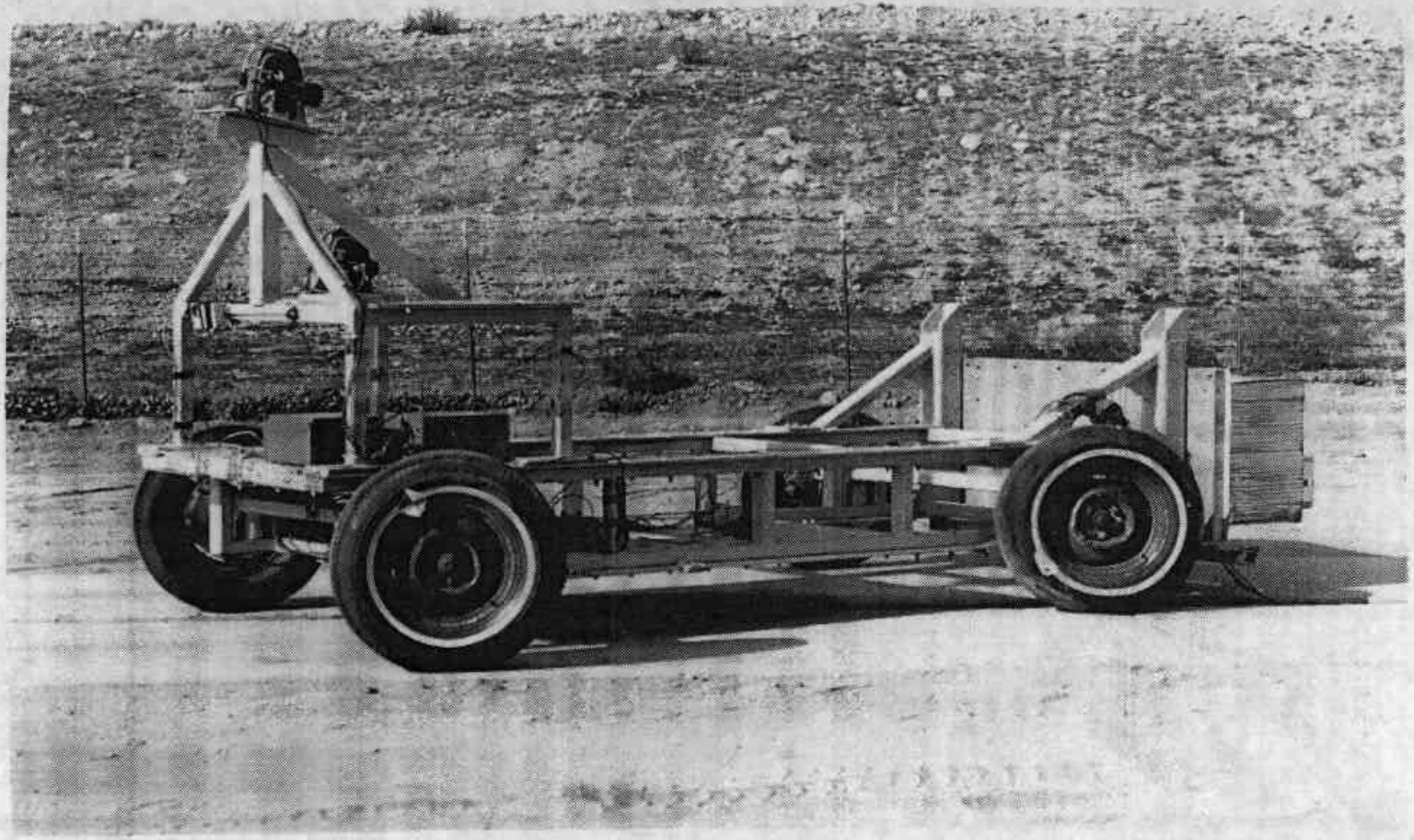


FIGURE A-23 MDB, VIEW NO. 2 - PRETEST

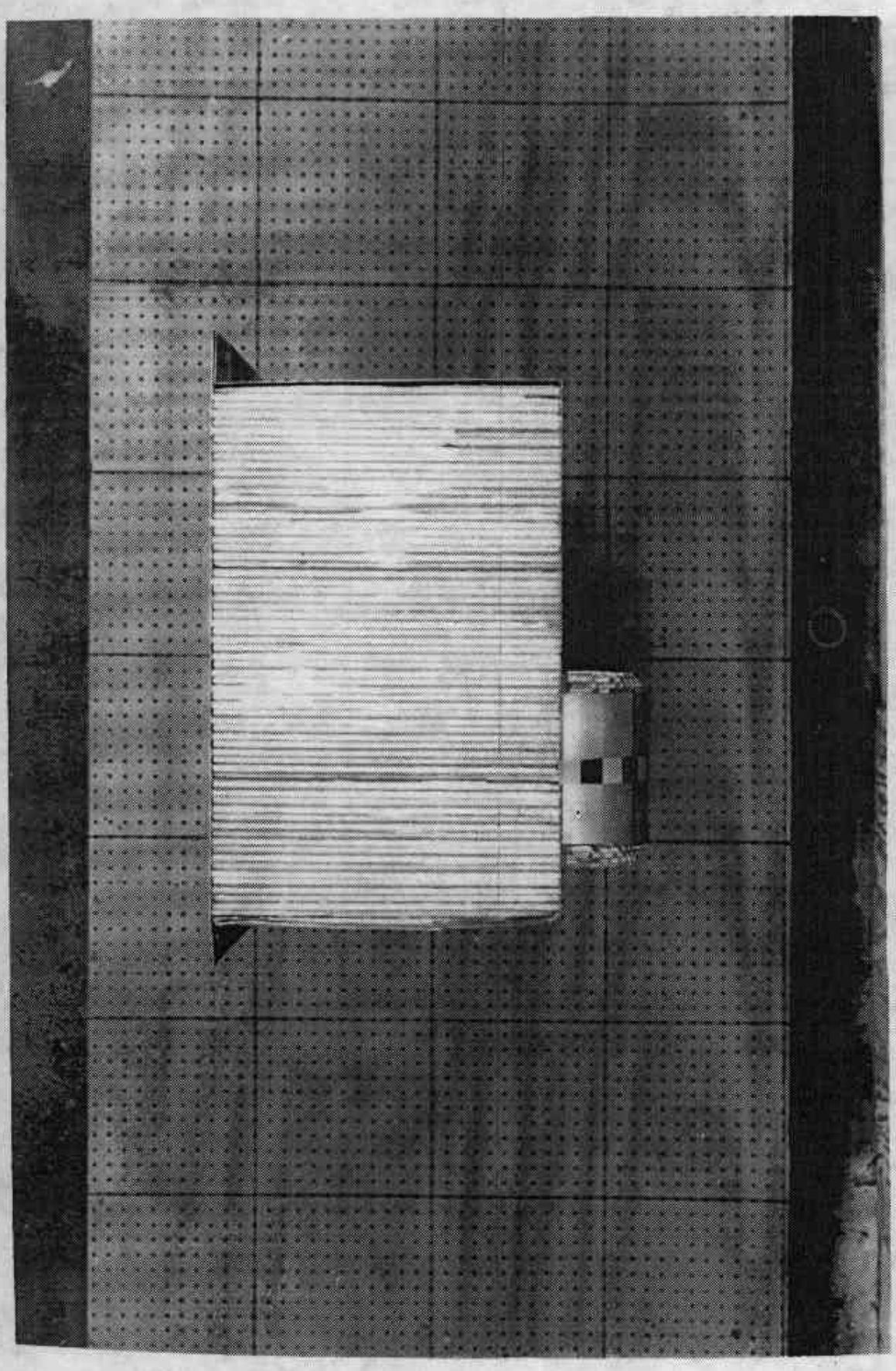


FIGURE A-21 MDB FACE, VIEW NO. 1 - PRETEST

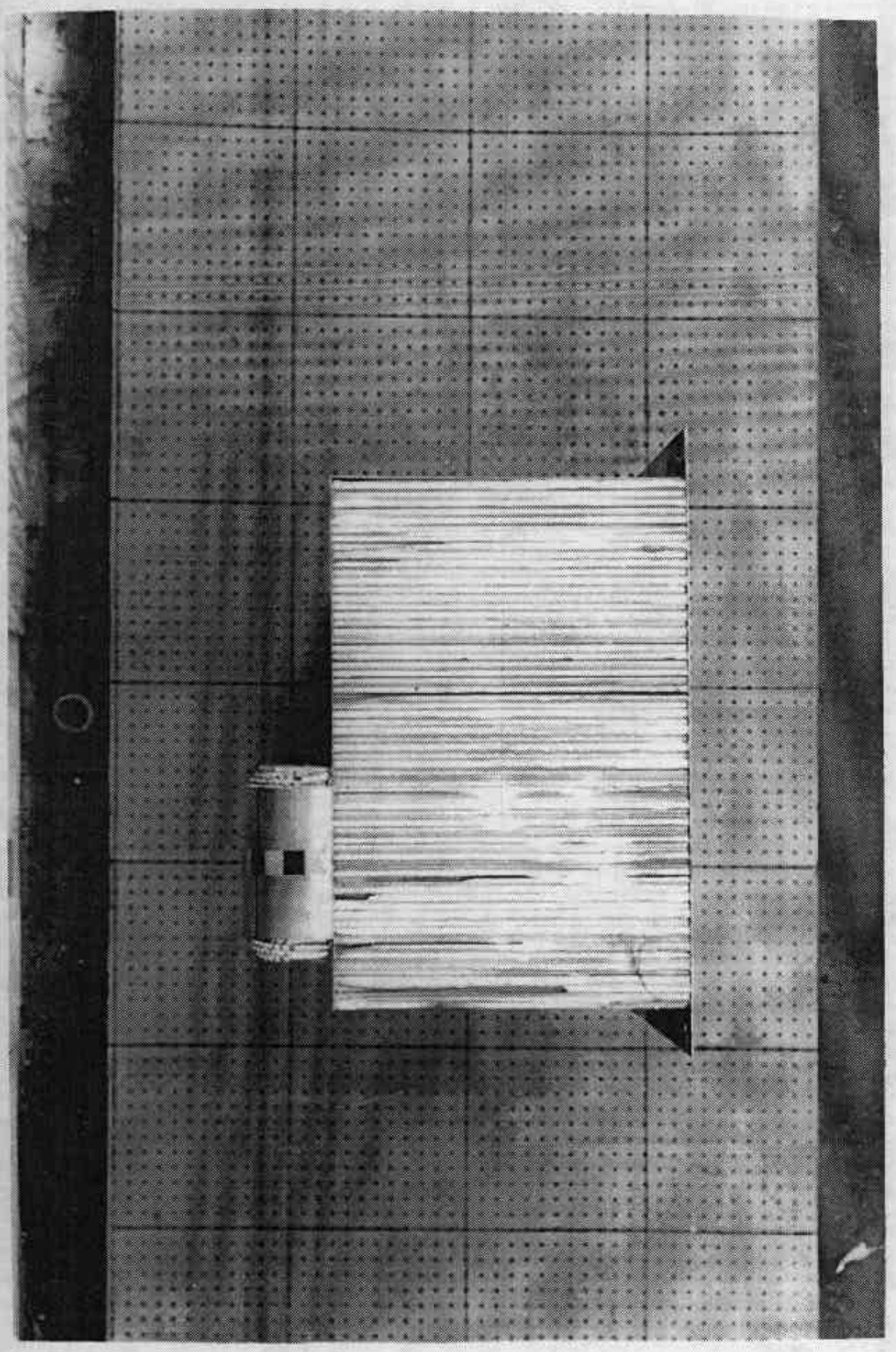


FIGURE A-22 MDB FACE, VIEW NO. 2 - PRETEST

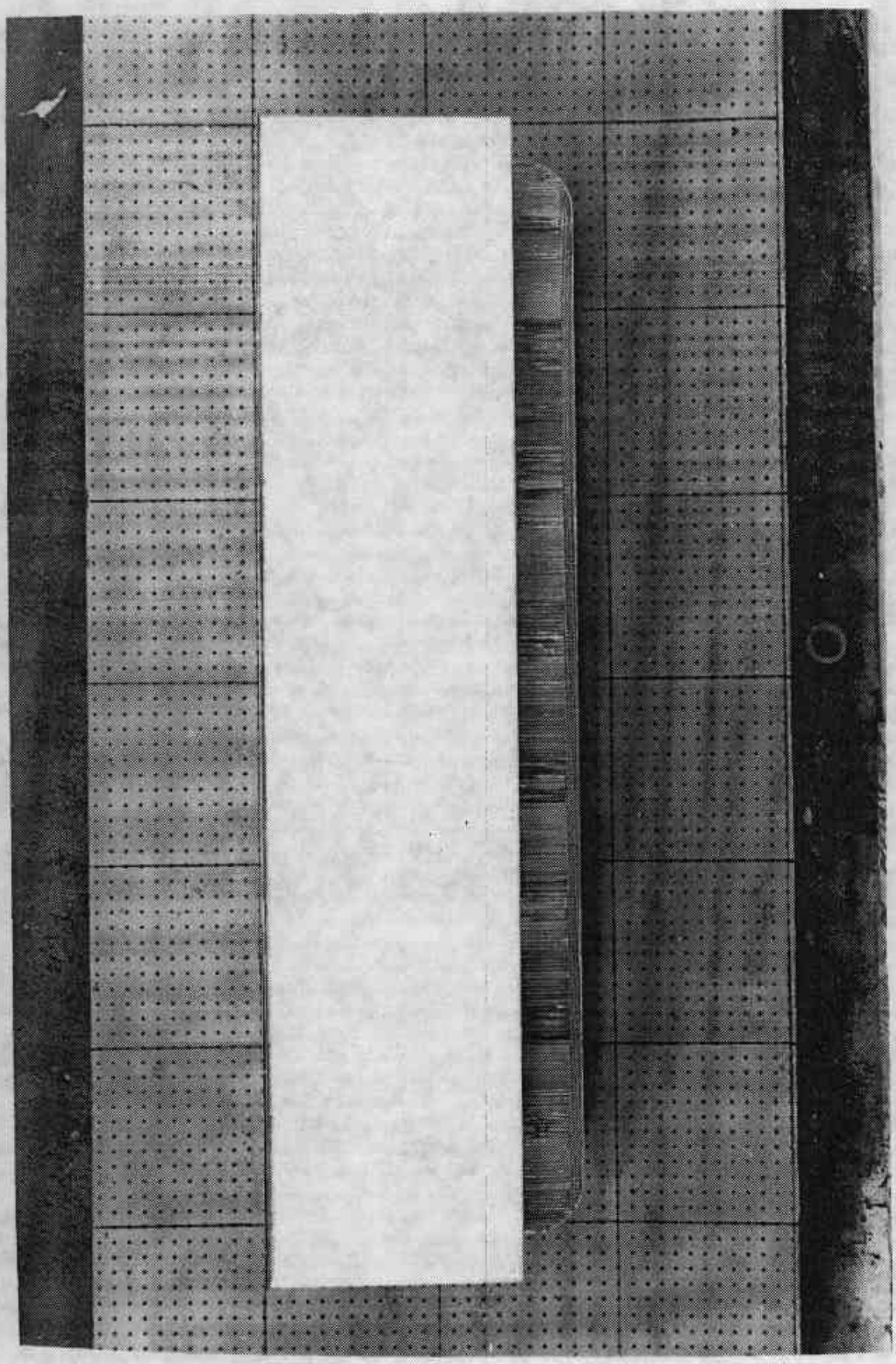


FIGURE A-23 MDB FACE, VIEW NO. 3 - PRETEST

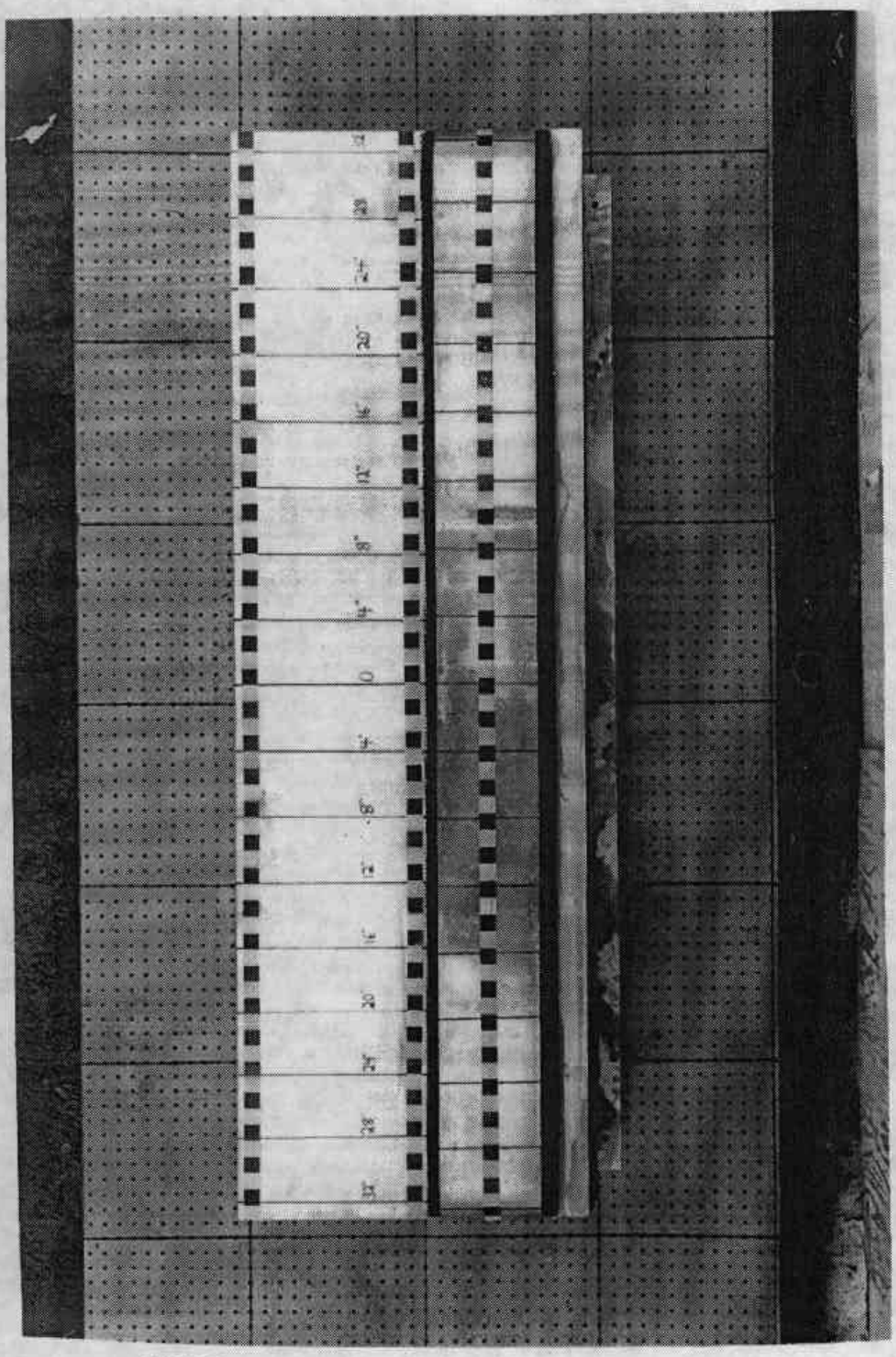


FIGURE A-24 MDB FACE, VIEW NO. 4 - PRETEST

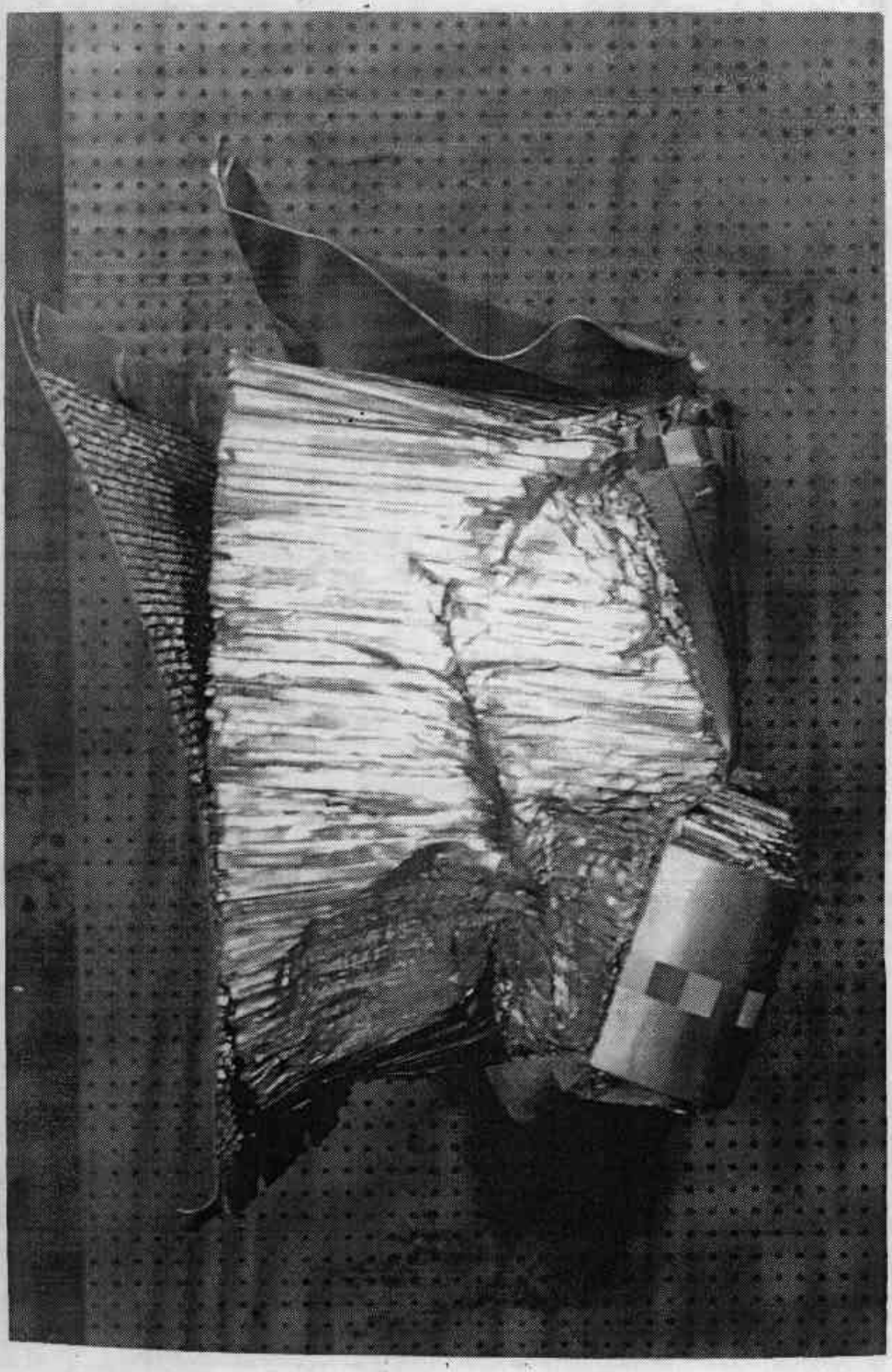


FIGURE A-25 MDB FACE, VIEW NO. 1 - POSTTEST

FIGURE A-26 MDB FACE, VIEW NO. 2 - POSTTEST

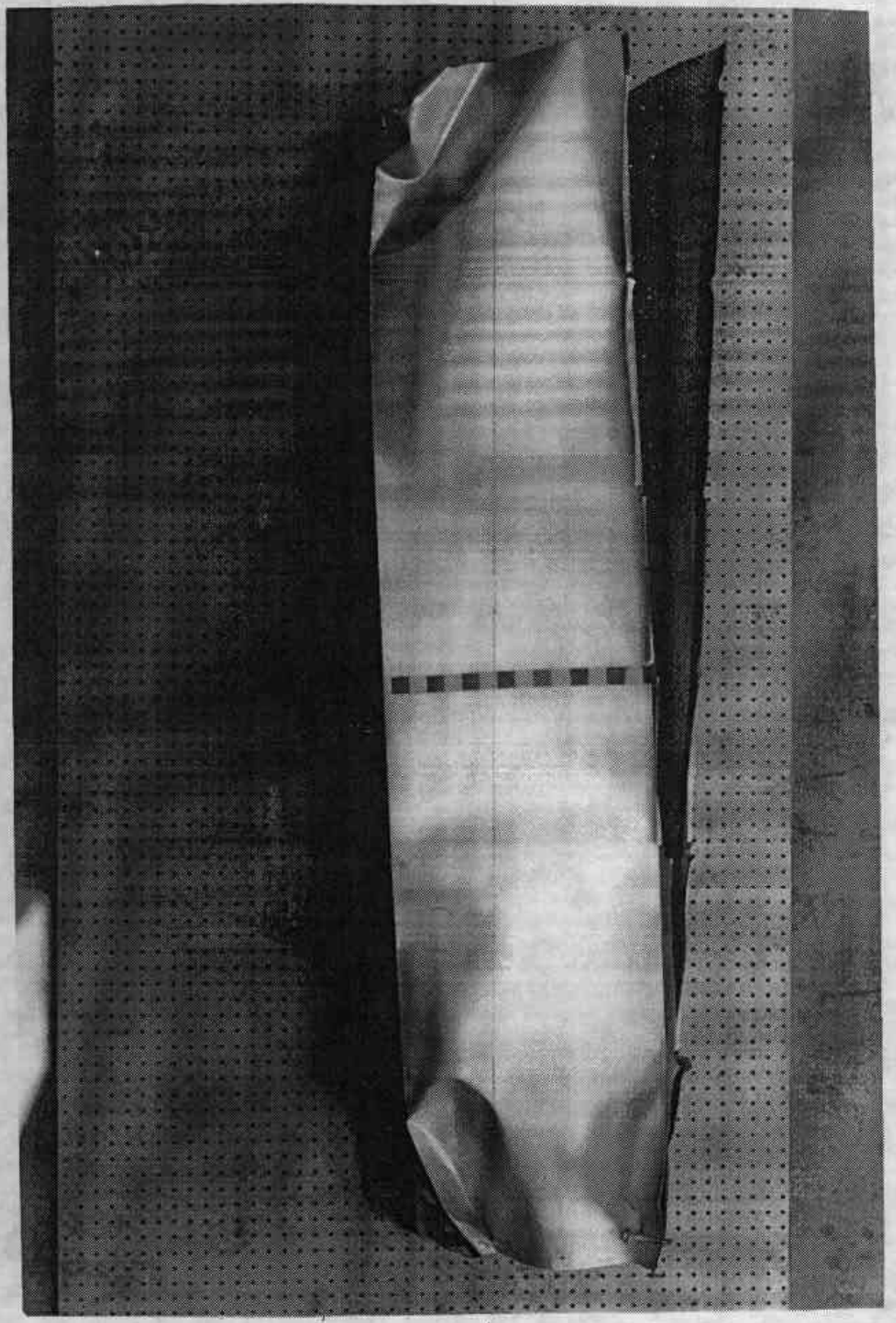


FIGURE A-27 MDB FACE, VIEW NO. 3 - POSTTEST

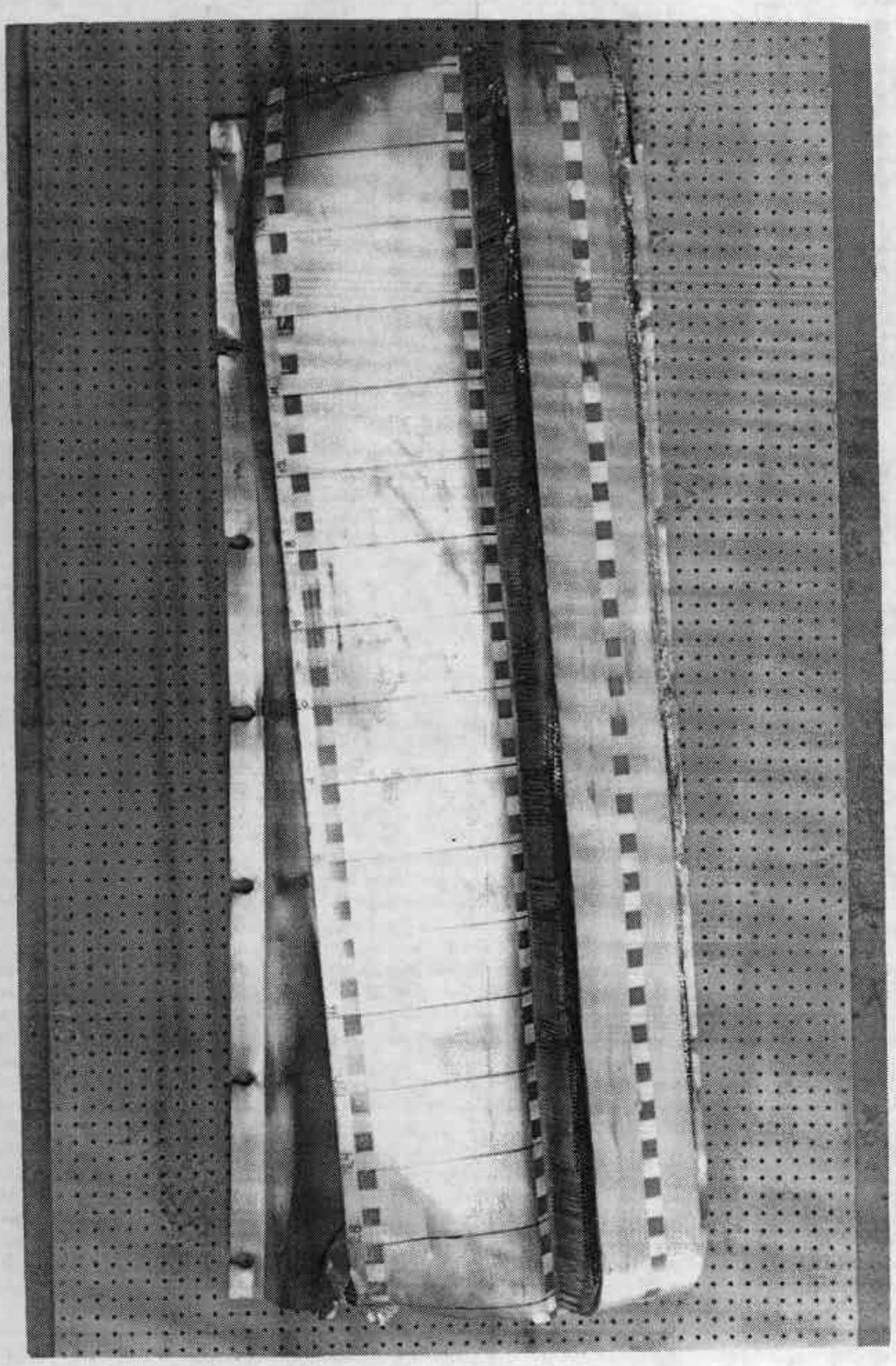
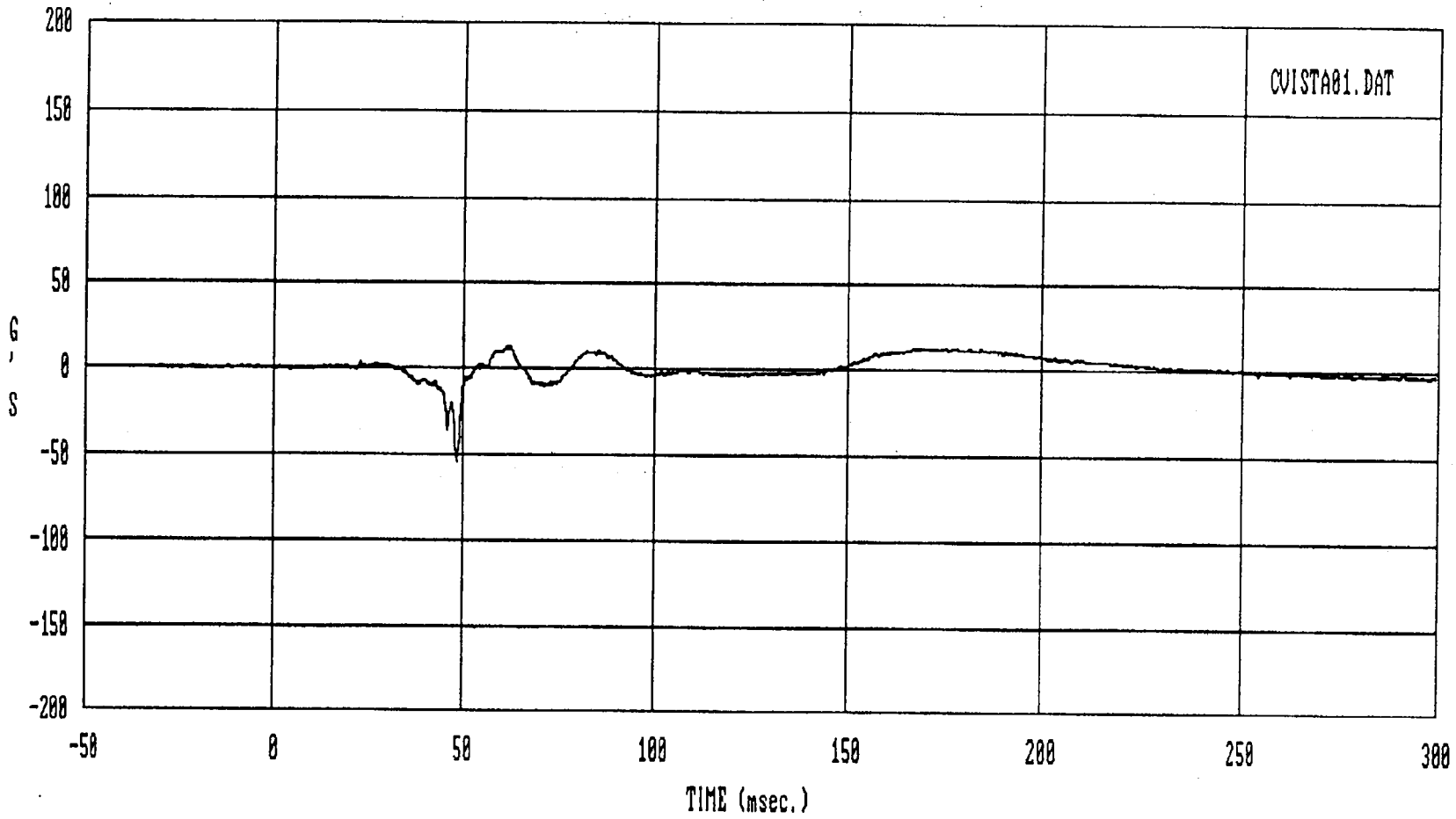


FIGURE A-28 MDB FACE, VIEW NO. 4 - POSTTEST

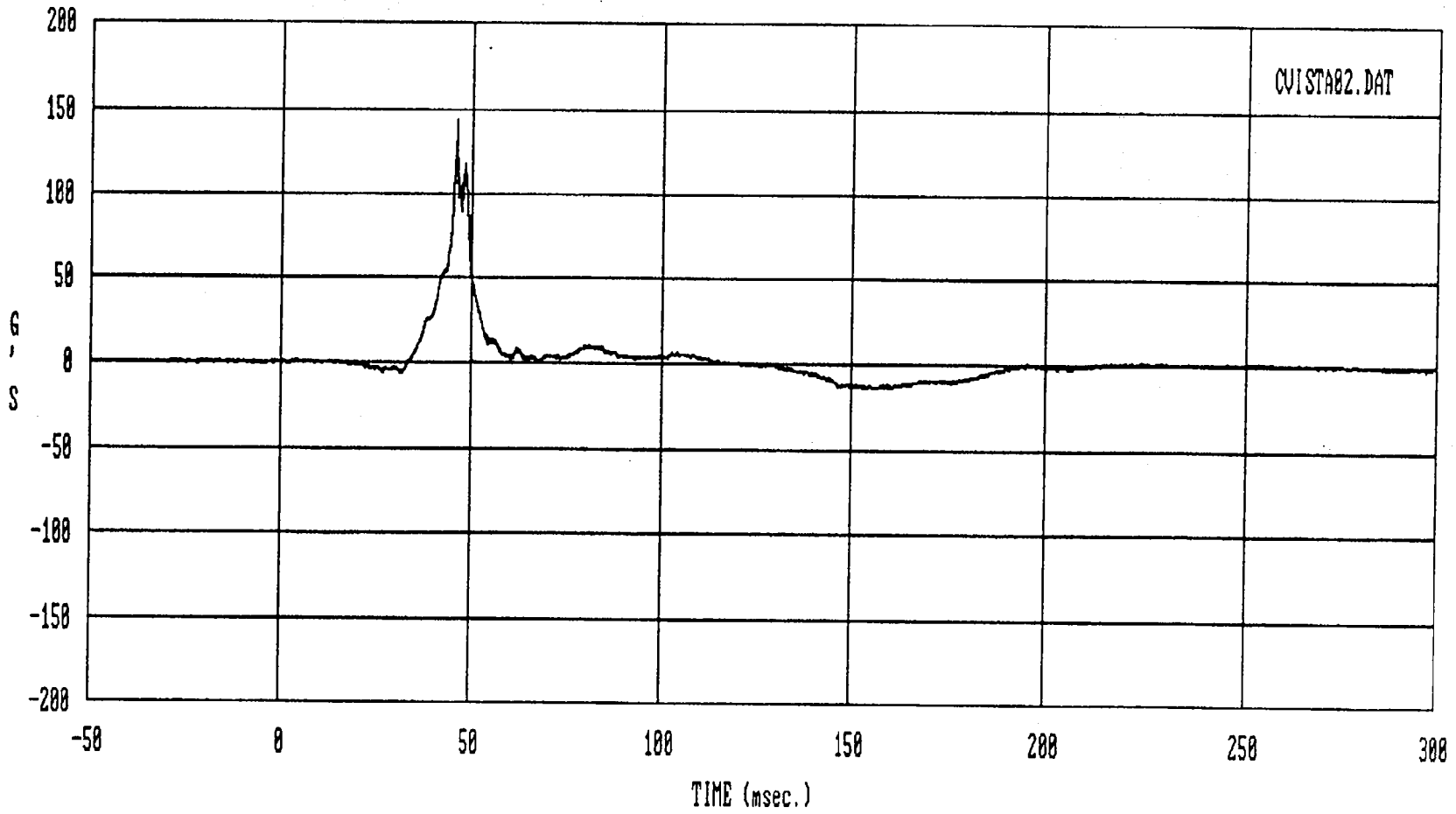
APPENDIX B

DATA PLOTS



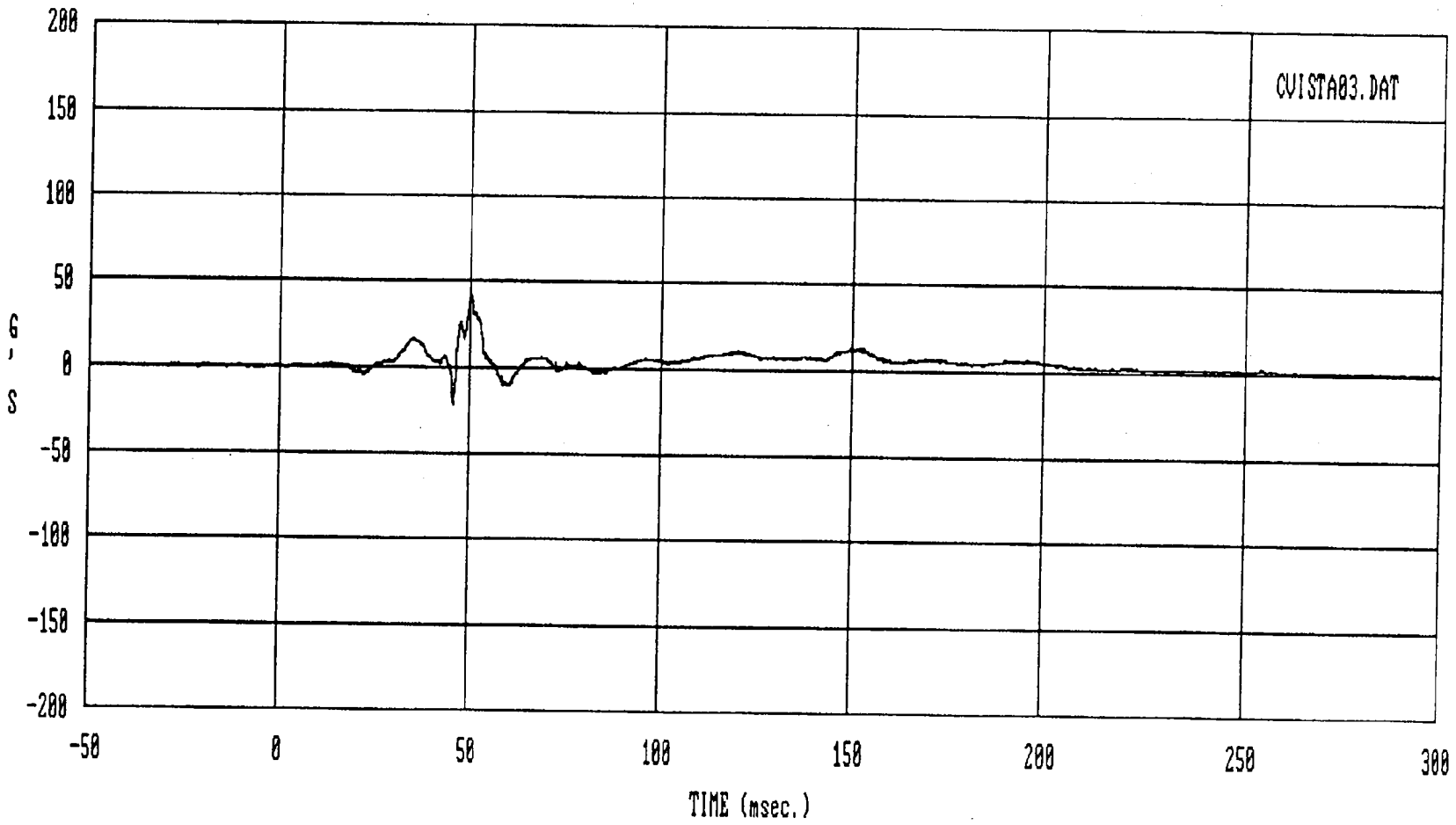
Curve: Driver Head acceleration -- X axis Filter: SAE CLASS 1000 Max = 13.620 Min = -54.258

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



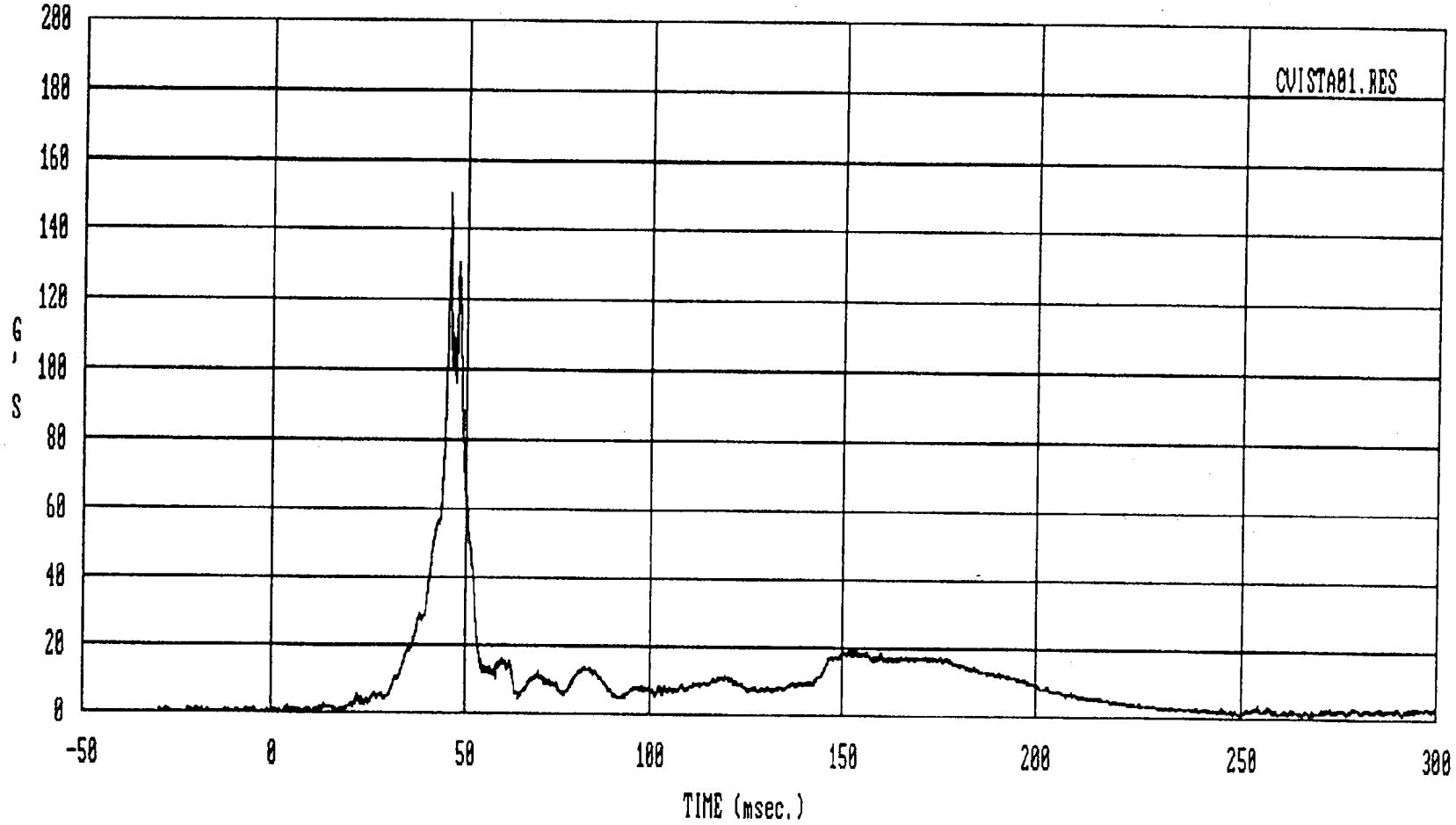
Curve: Driver Head acceleration -- Y axis Filter: SAE CLASS 1000 Max = 143.54 Min = -14.484

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



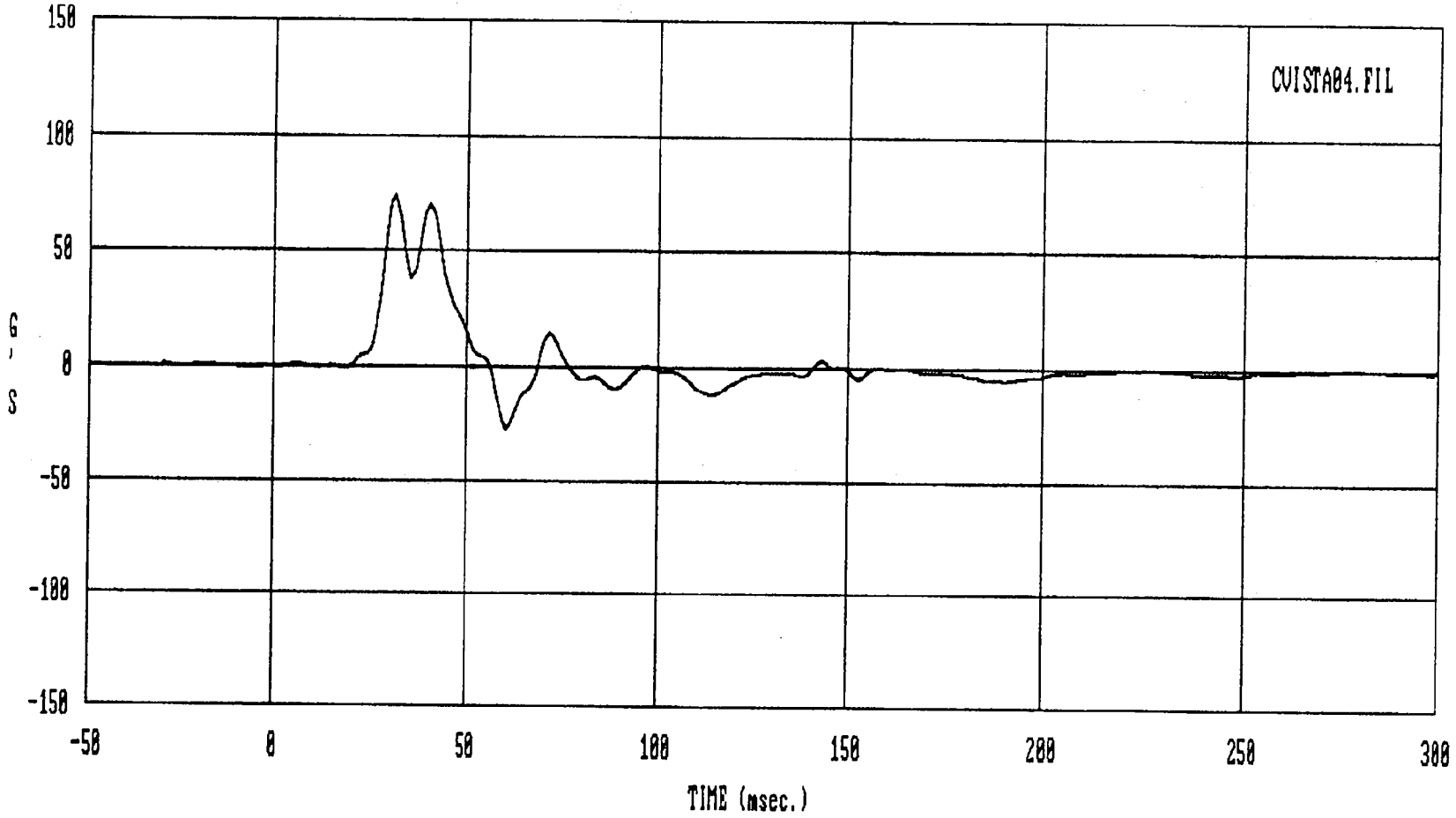
Curve: Driver Head acceleration -- Z axis Filter: SAE CLASS 1000 Max = 42.628 Min = -21.552

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



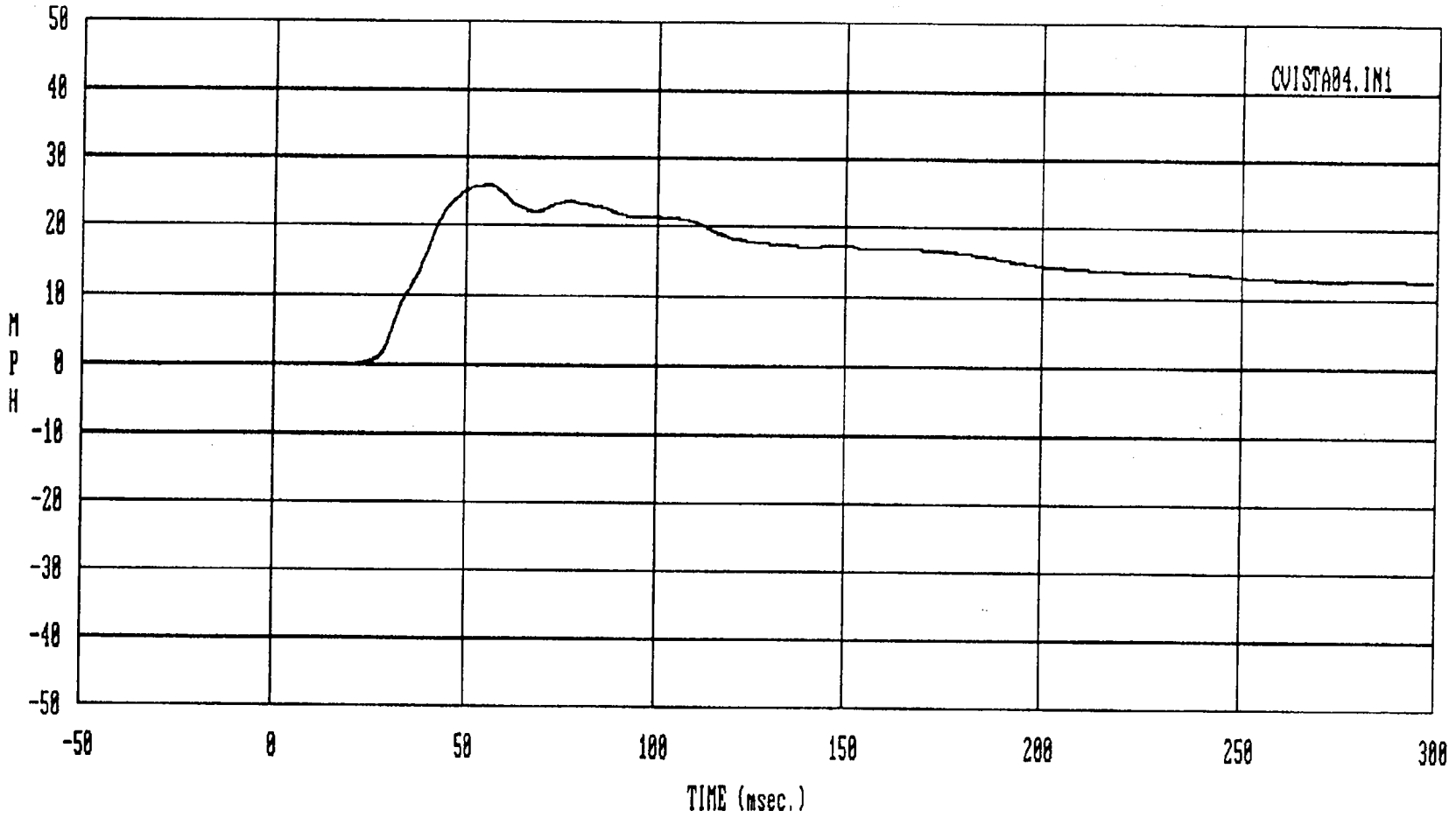
Curve: Driver head resultant acceleration Filter: SAE CLASS 1000 Max = 150.27 Min = .00000

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



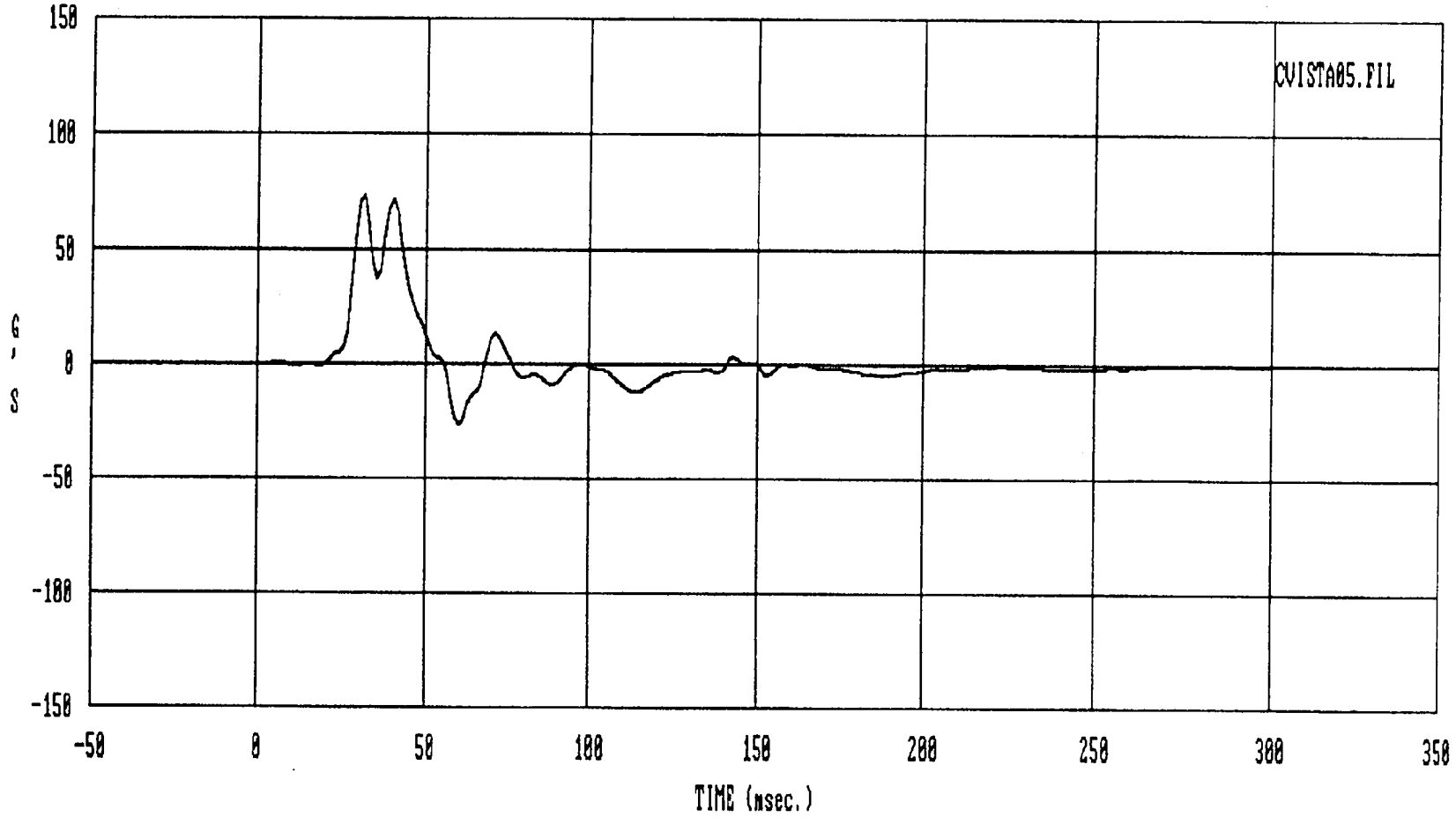
Curve: Driver upper spine acceleration -- Primary Filter: FIR 100 Max = 75.152 Min = -26.788

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



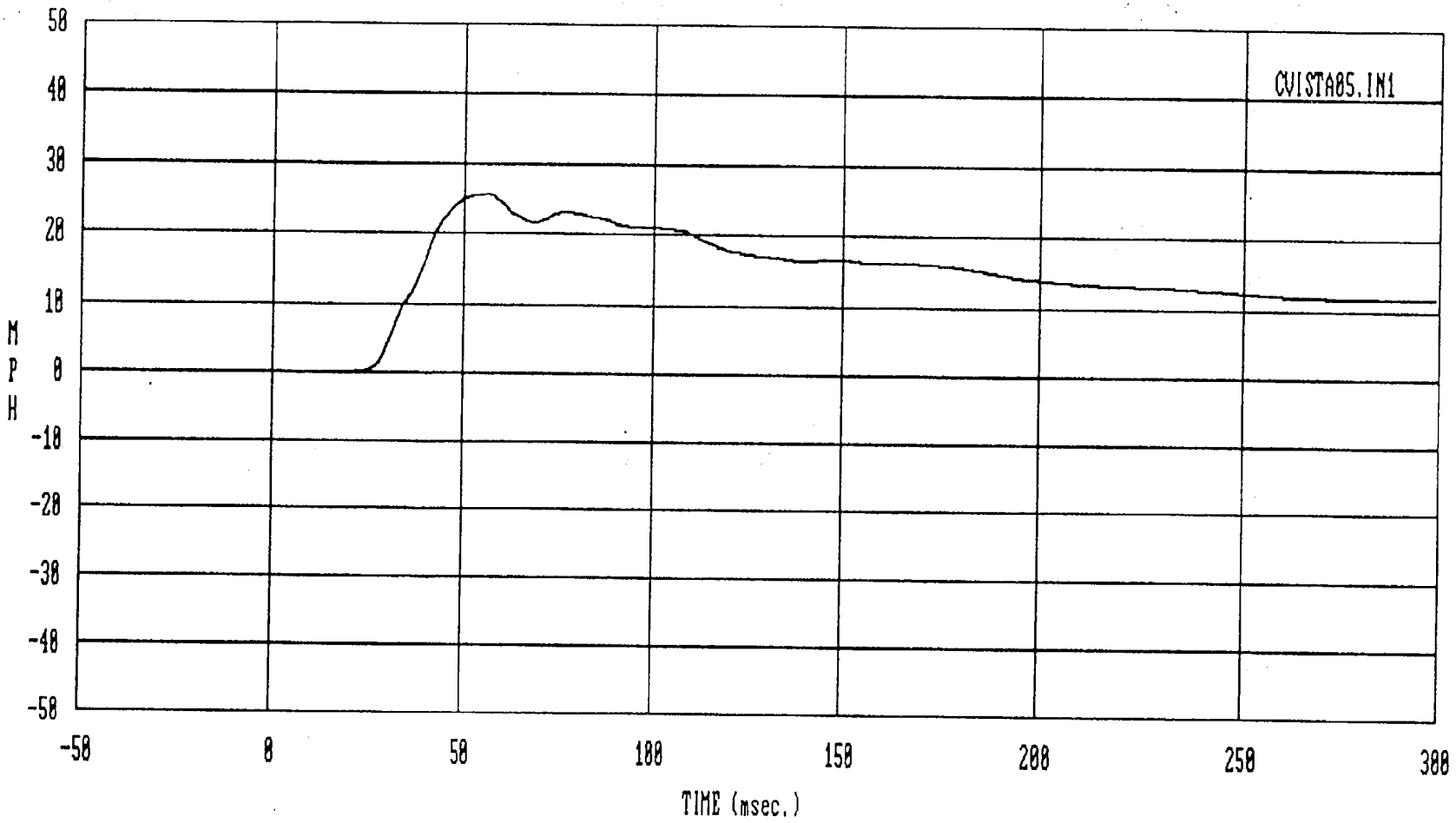
Curve: Driver upper spine delta V — Primary Filter: FIR 100 Max = 25.916 Min = -.13839E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



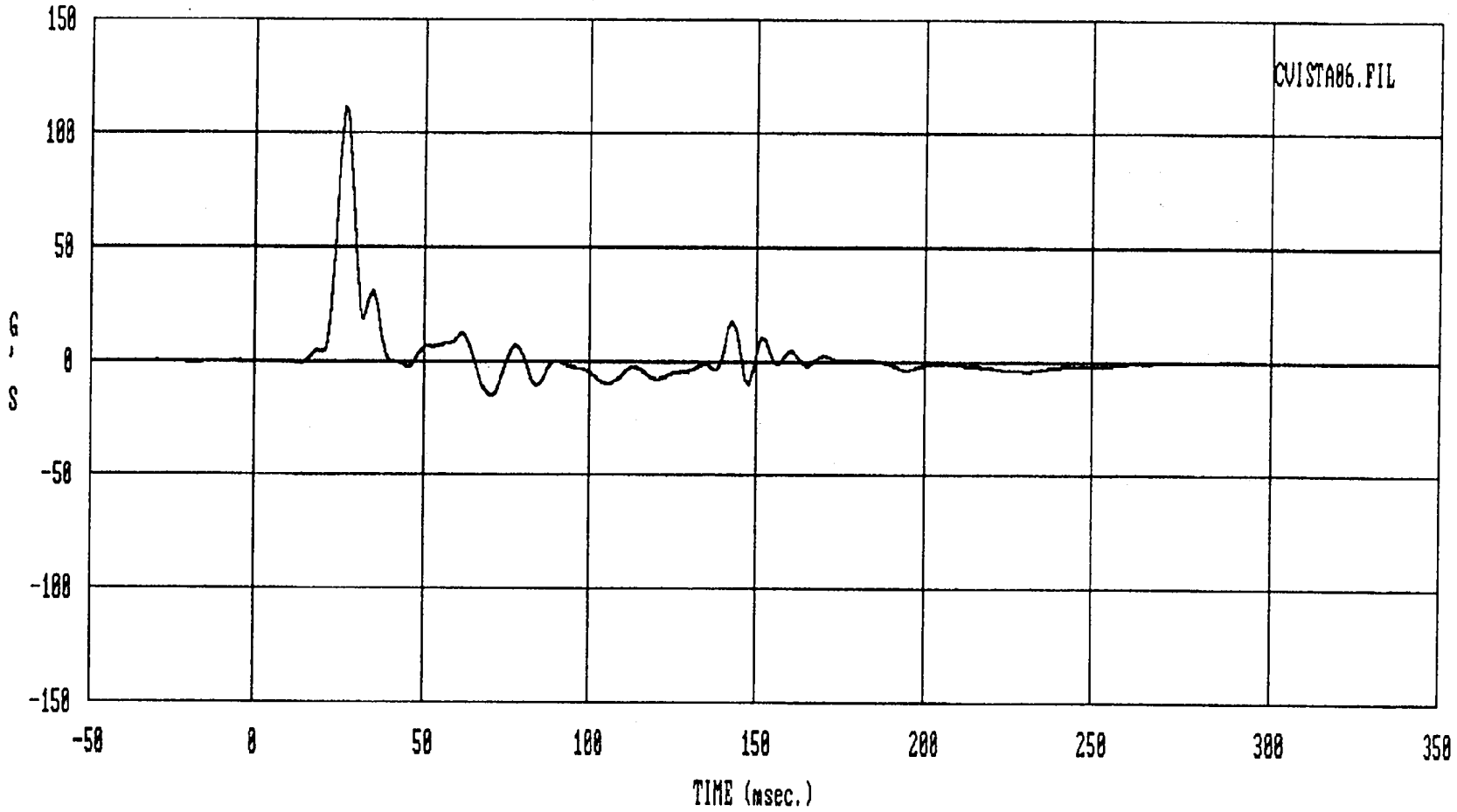
Curve: Driver upper spine acceleration — Redundant Filter: FIR 100 Max = 74.827 Min = -26.711

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



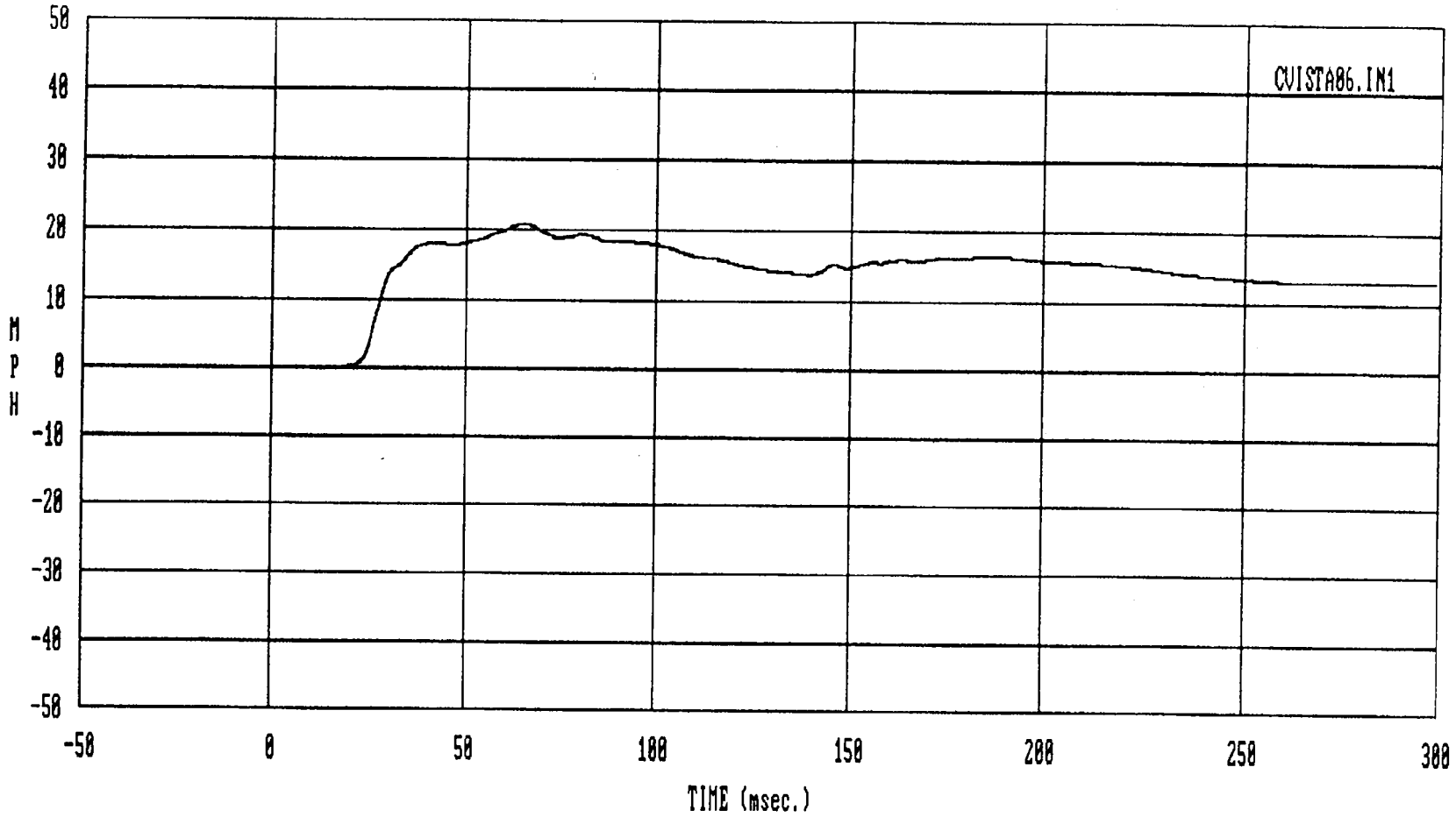
Curve: Driver upper spine delta V -- Redundant Filter: FIR 100 Max = 25.716 Min = -.76364E-02

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



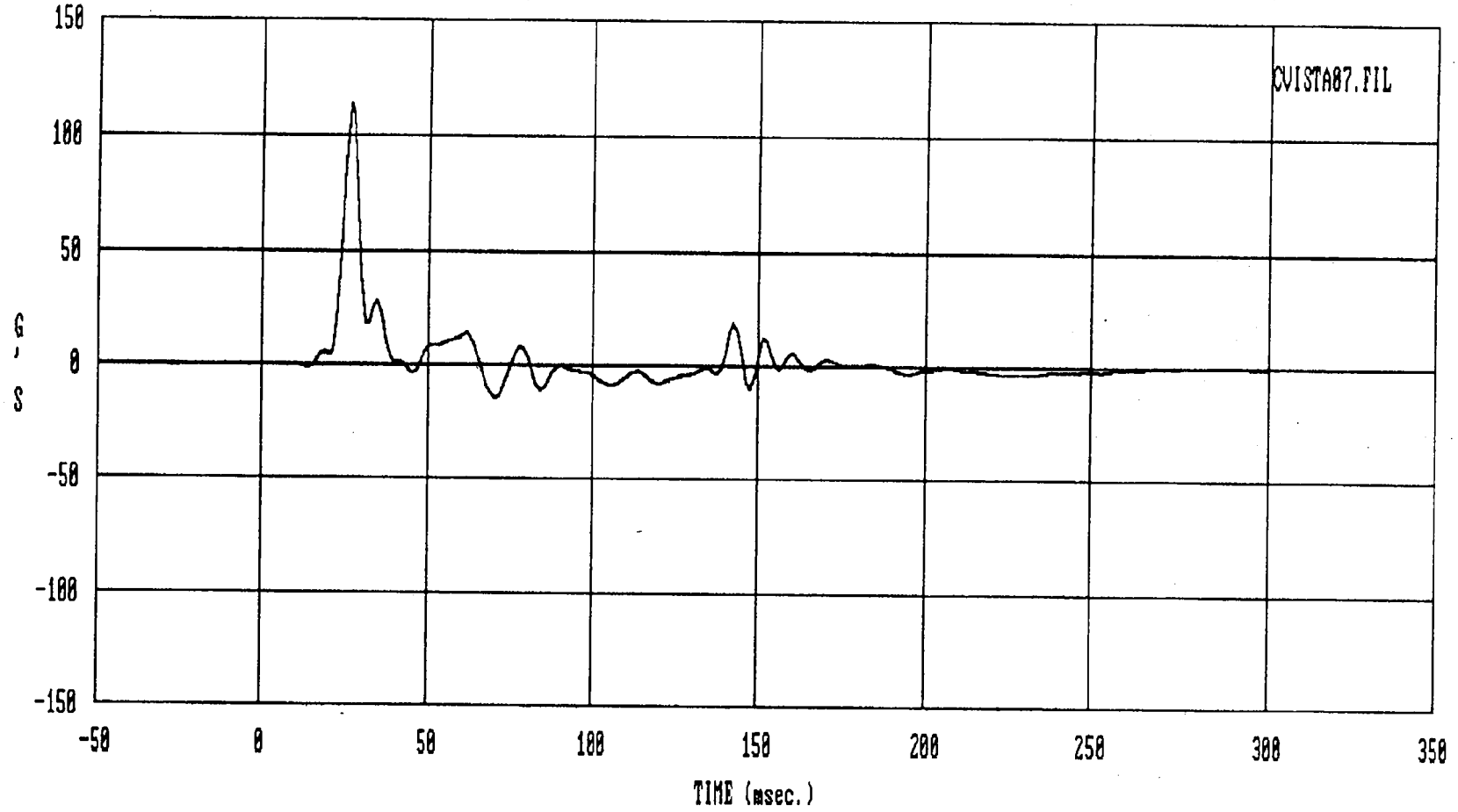
Curve: Driver upper rib acceleration — Primary Filter: FIR 100 Max = 115.83 Min = -14.671

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



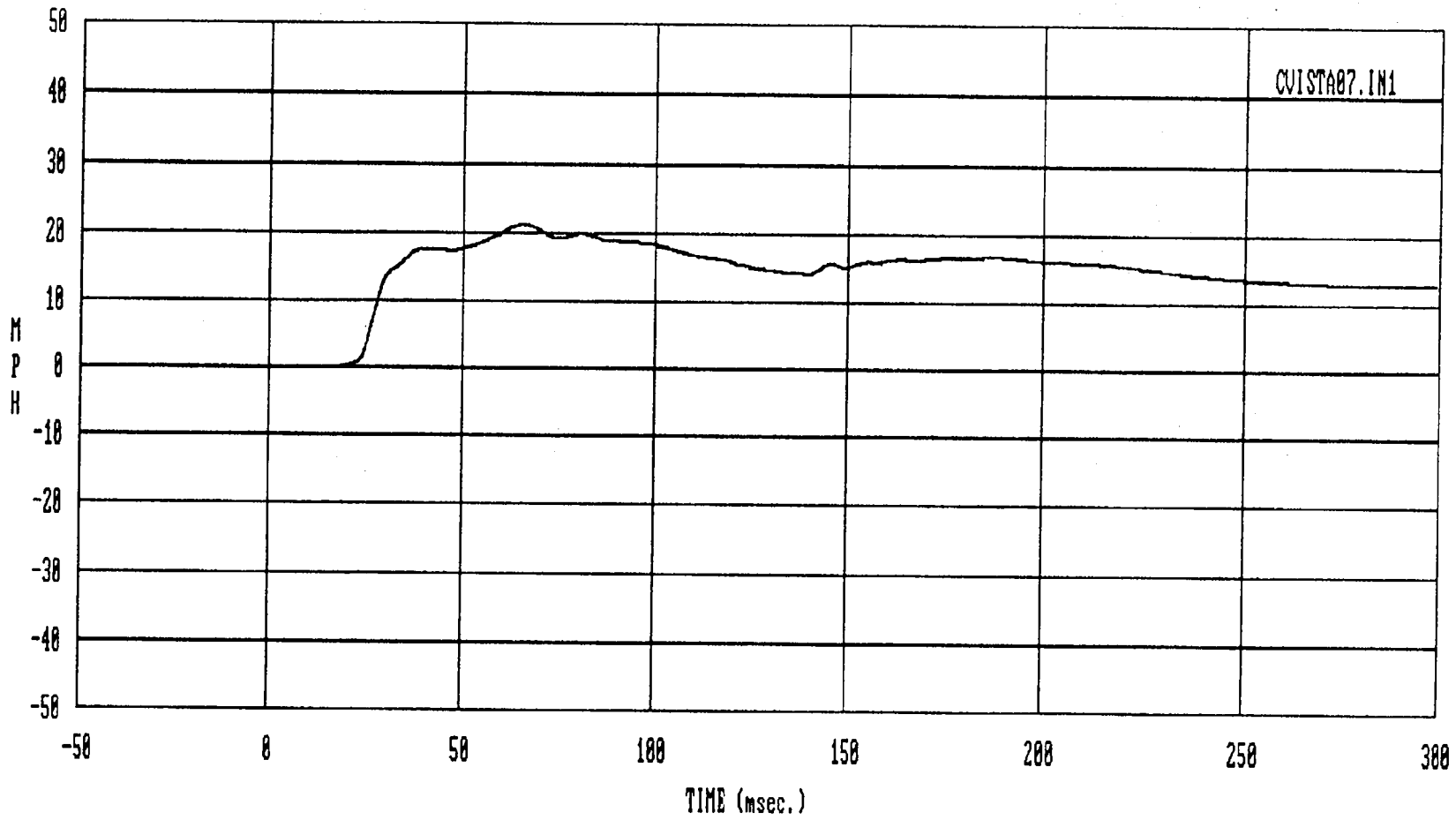
Curve: Driver upper rib delta V -- Primary Filter: FIR 100 Max = 28.911 Min = -.36000E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



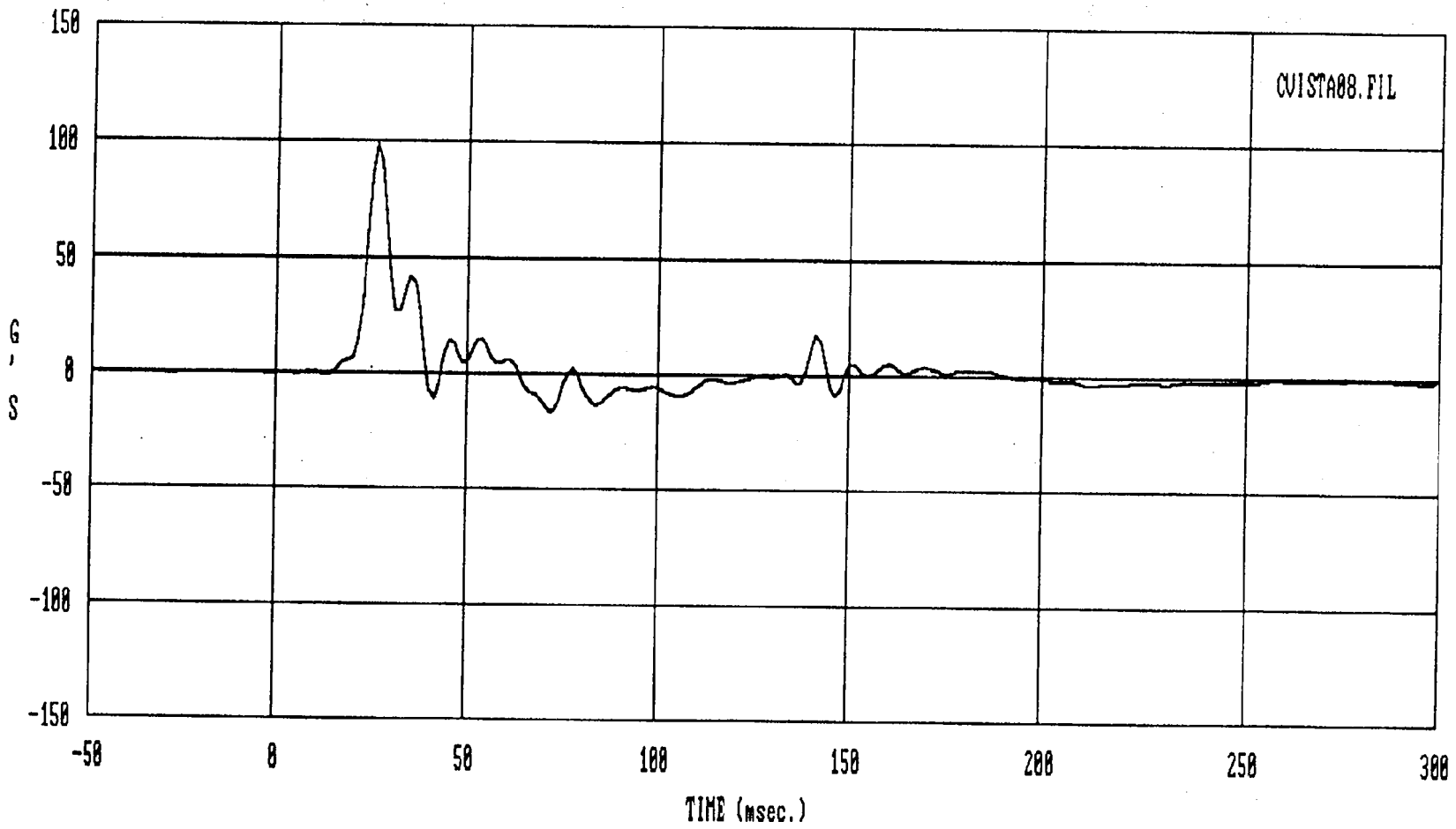
Curve: Driver upper rib acceleration -- Redundant Filter: FIR 100 Max = 115.52 Min = -14.844

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



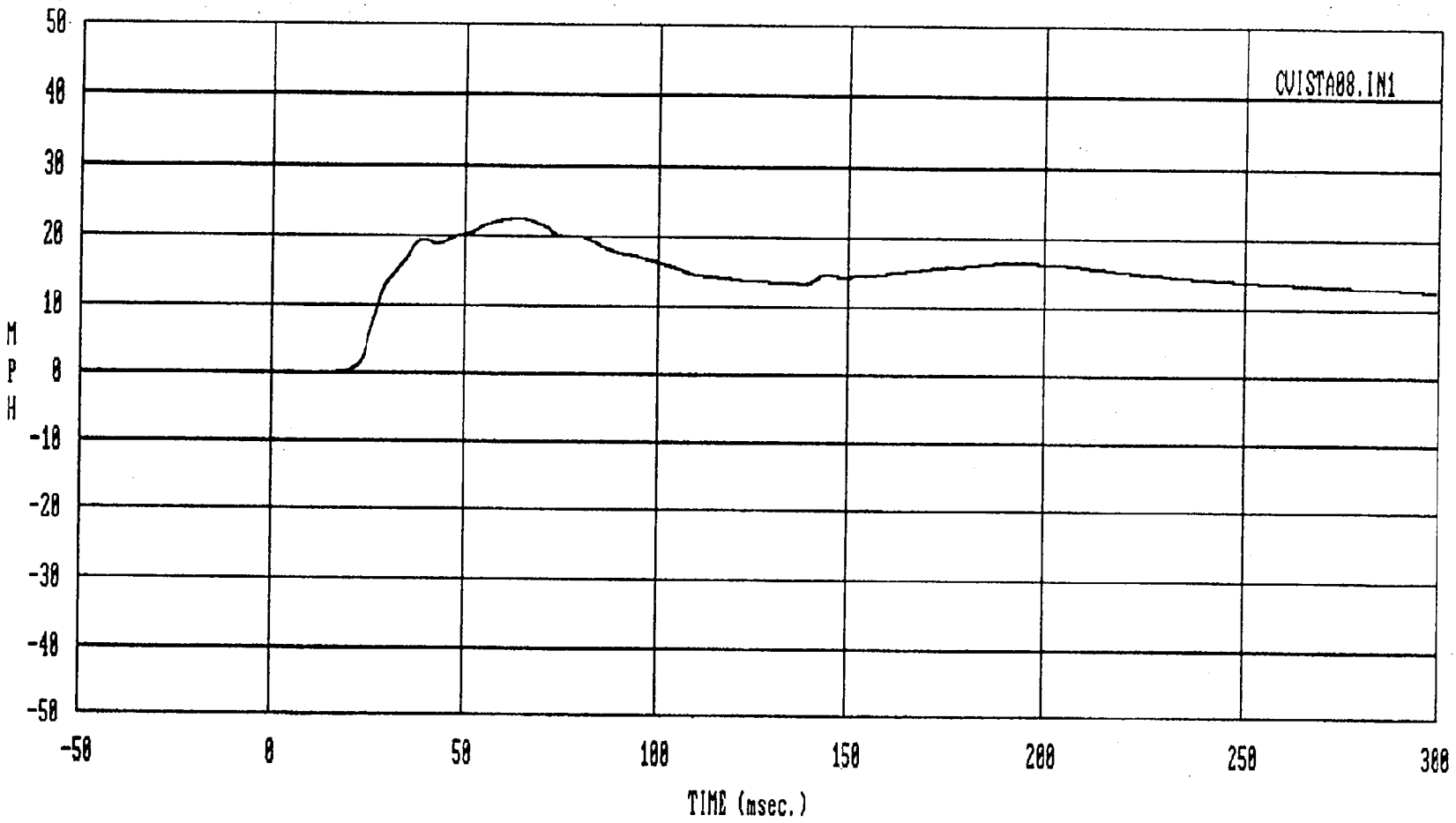
Curve: Driver upper rib delta V -- Redundant Filter: FIR 100 Max = 21.279 Min = -.24677E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



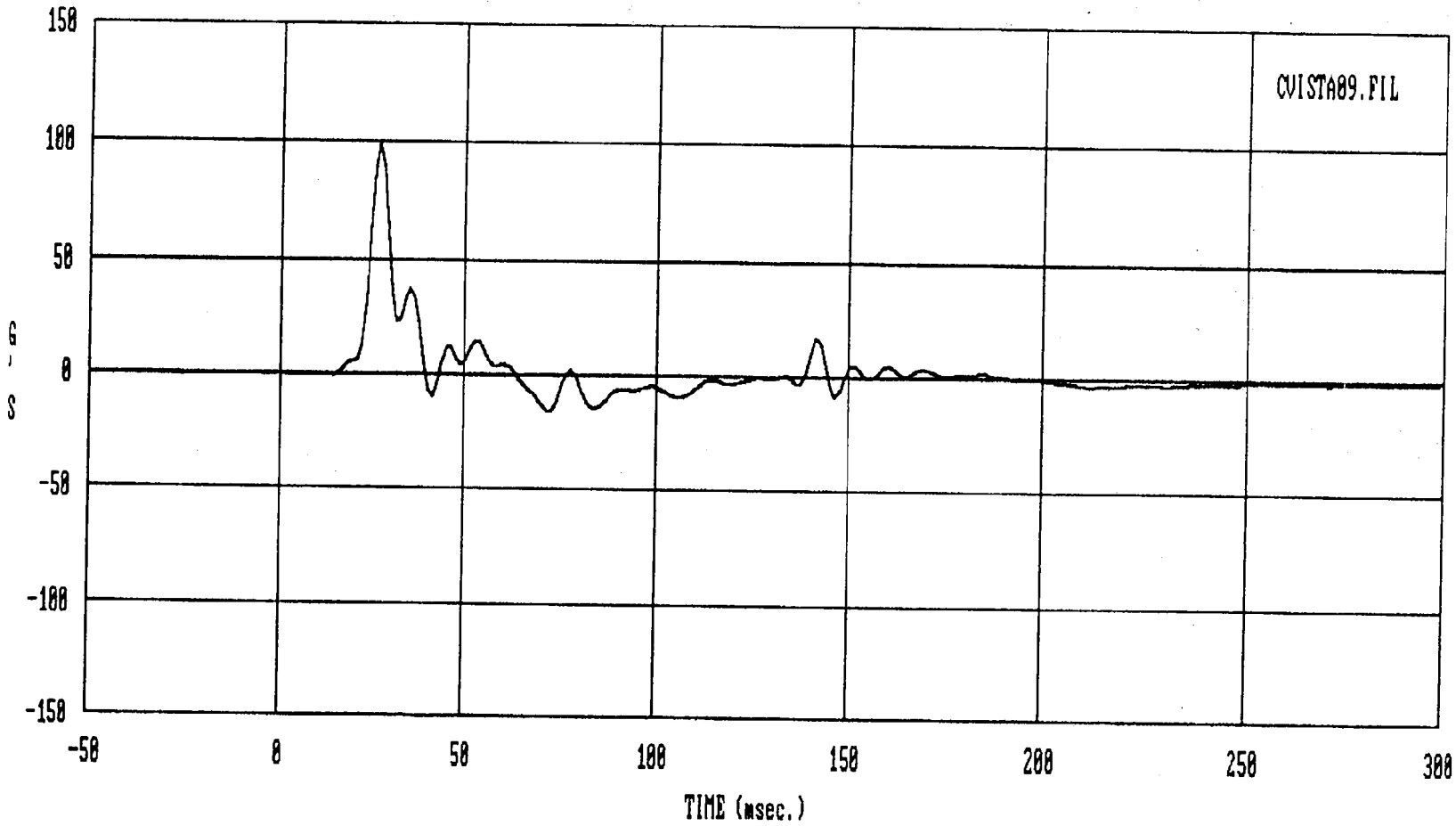
Curve: Driver lower rib acceleration -- Primary Filter: FIR 100 Max = 99.280 Min = -16.638

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



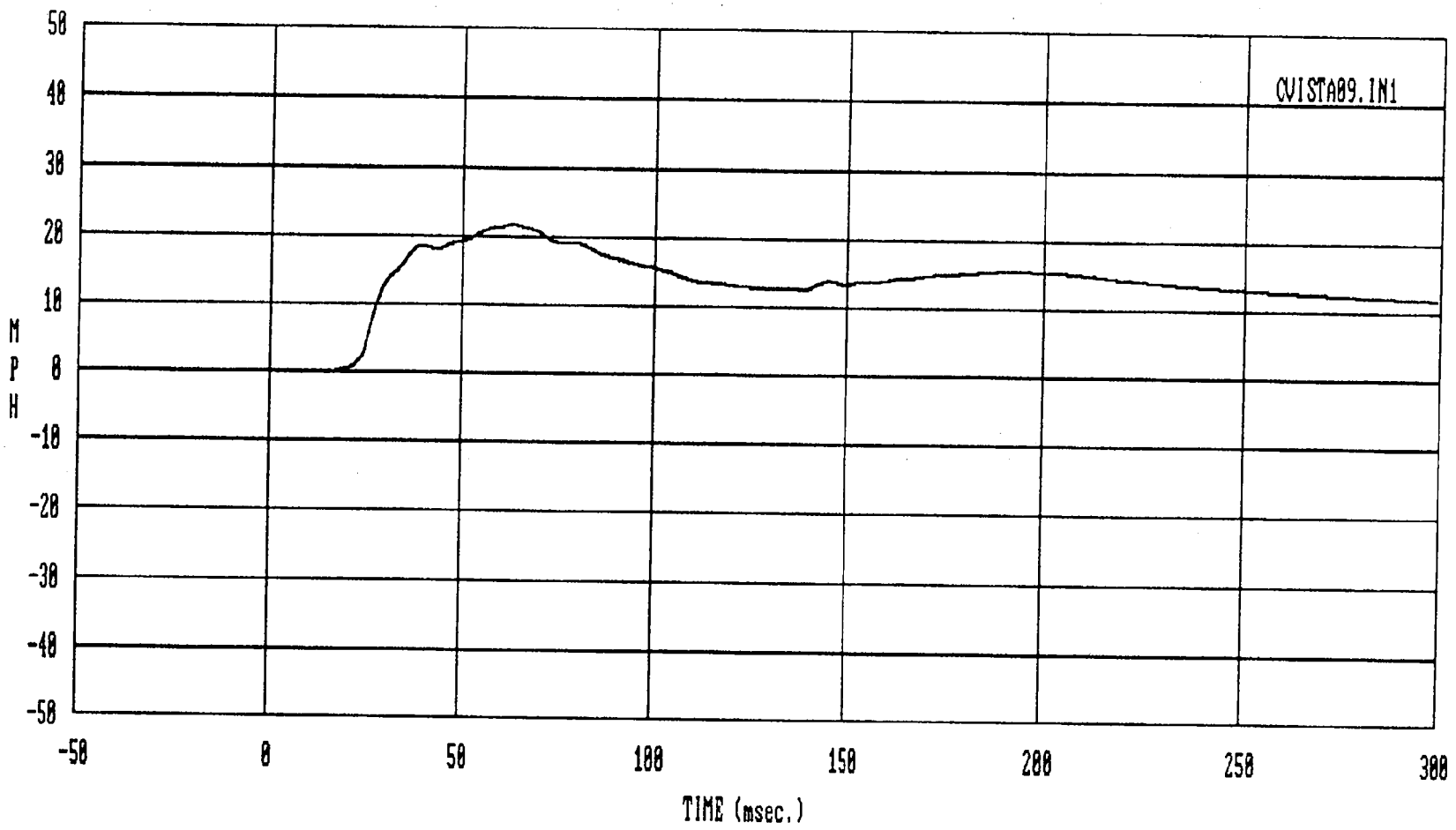
Curve: Driver lower rib delta V -- Primary Filter: FIR 100 Max = 22.657 Min = -.23290E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



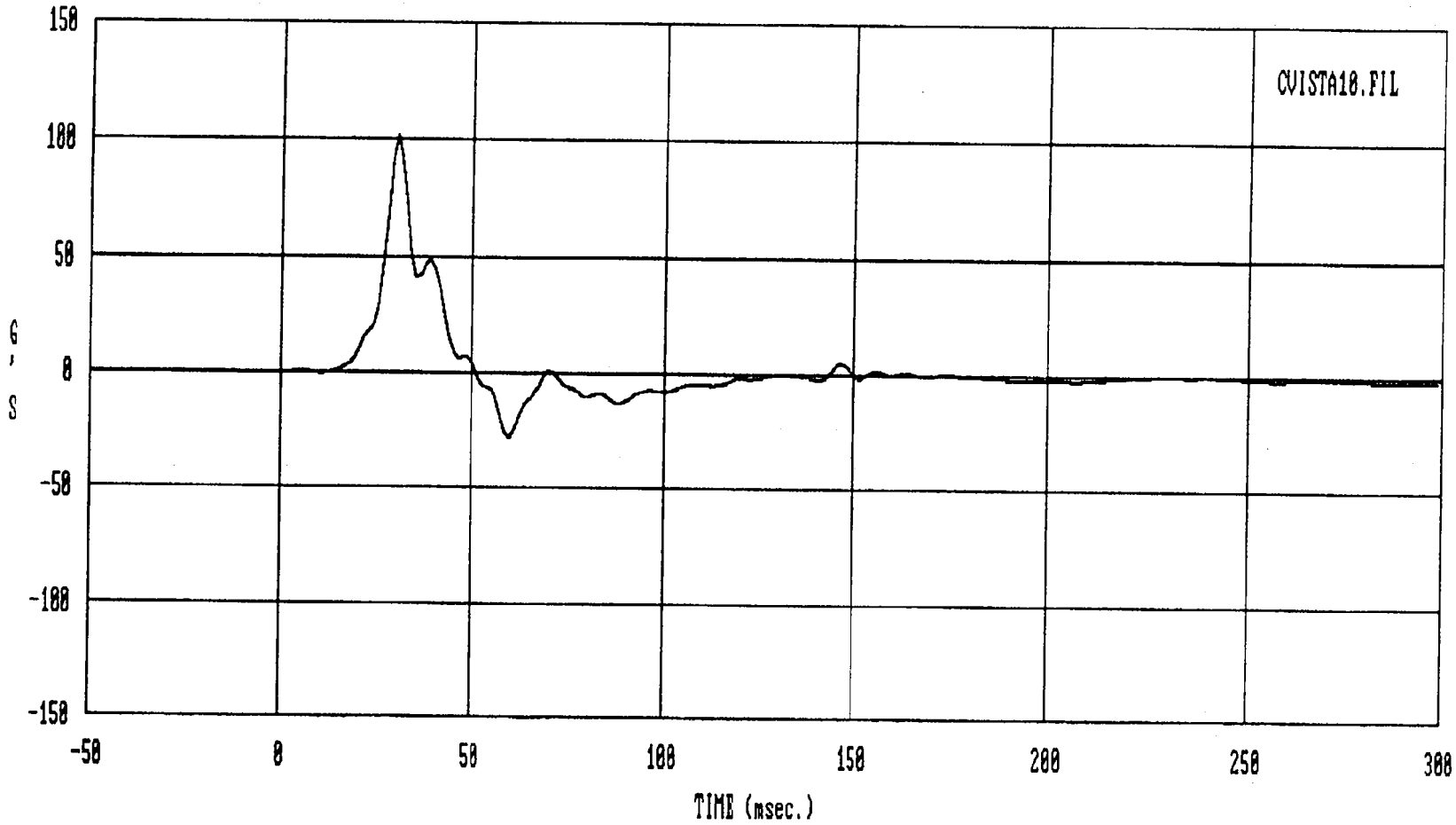
Curve: Driver lower rib acceleration -- Redundant Filter: FIR 100 Max = 99.983 Min = -16.461

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



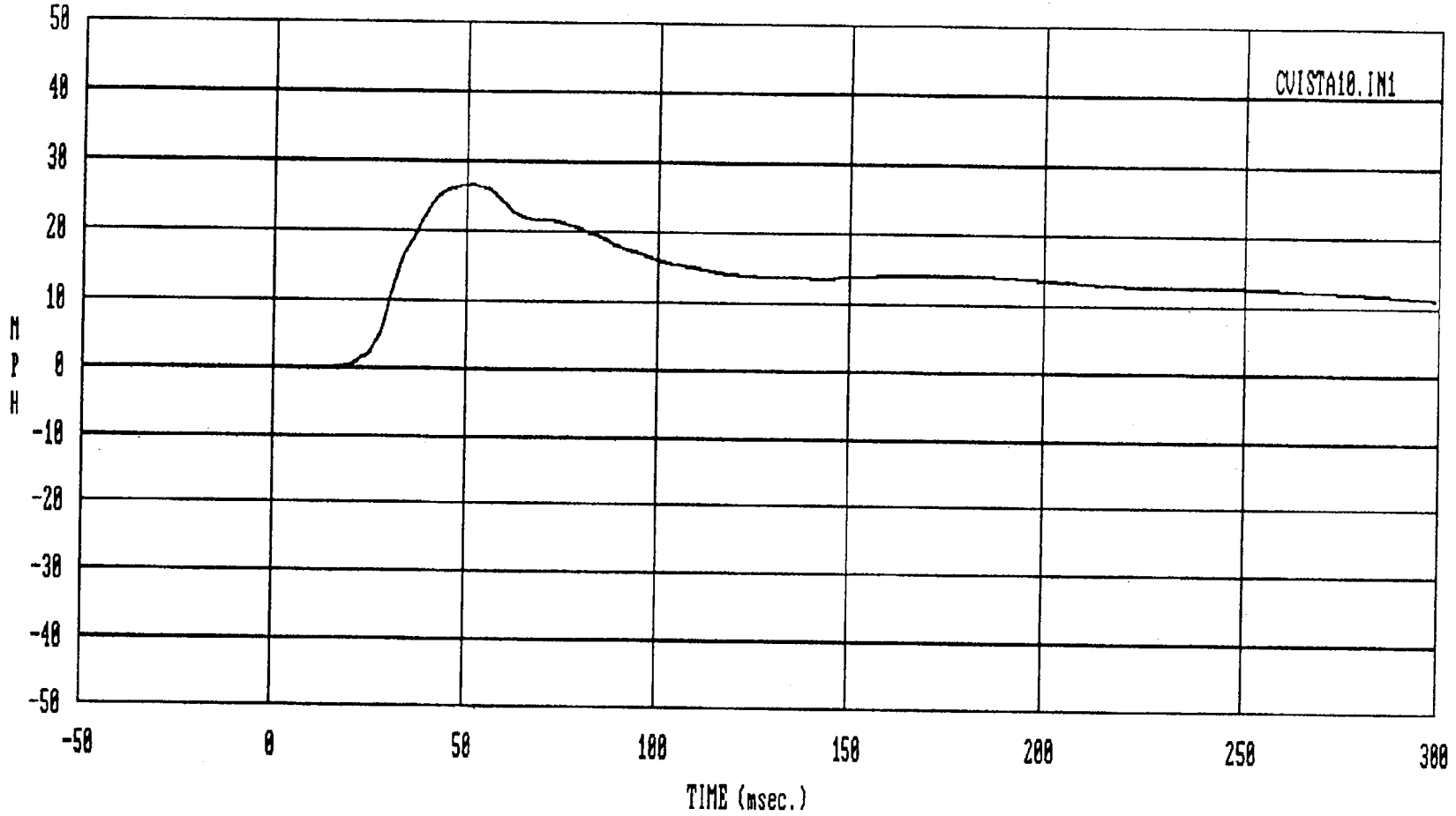
Curve: Driver lower rib delta V — Redundant Filter: FIR 100 Max = 21.736 Min = .23858E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



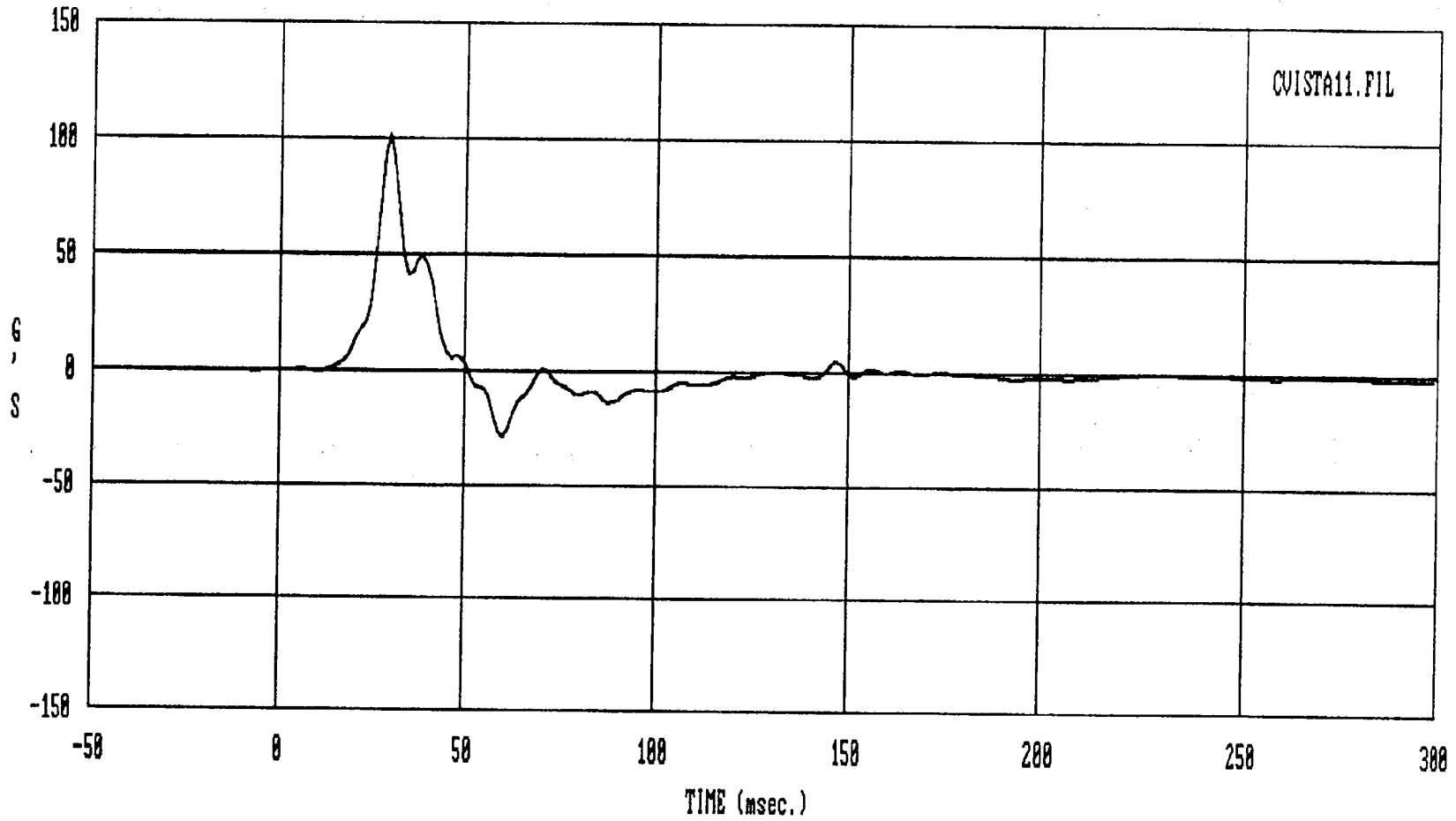
Curve: Driver lower spine acceleration -- Primary Filter: PIR 100 Max = 102.87 Min = -28.255

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



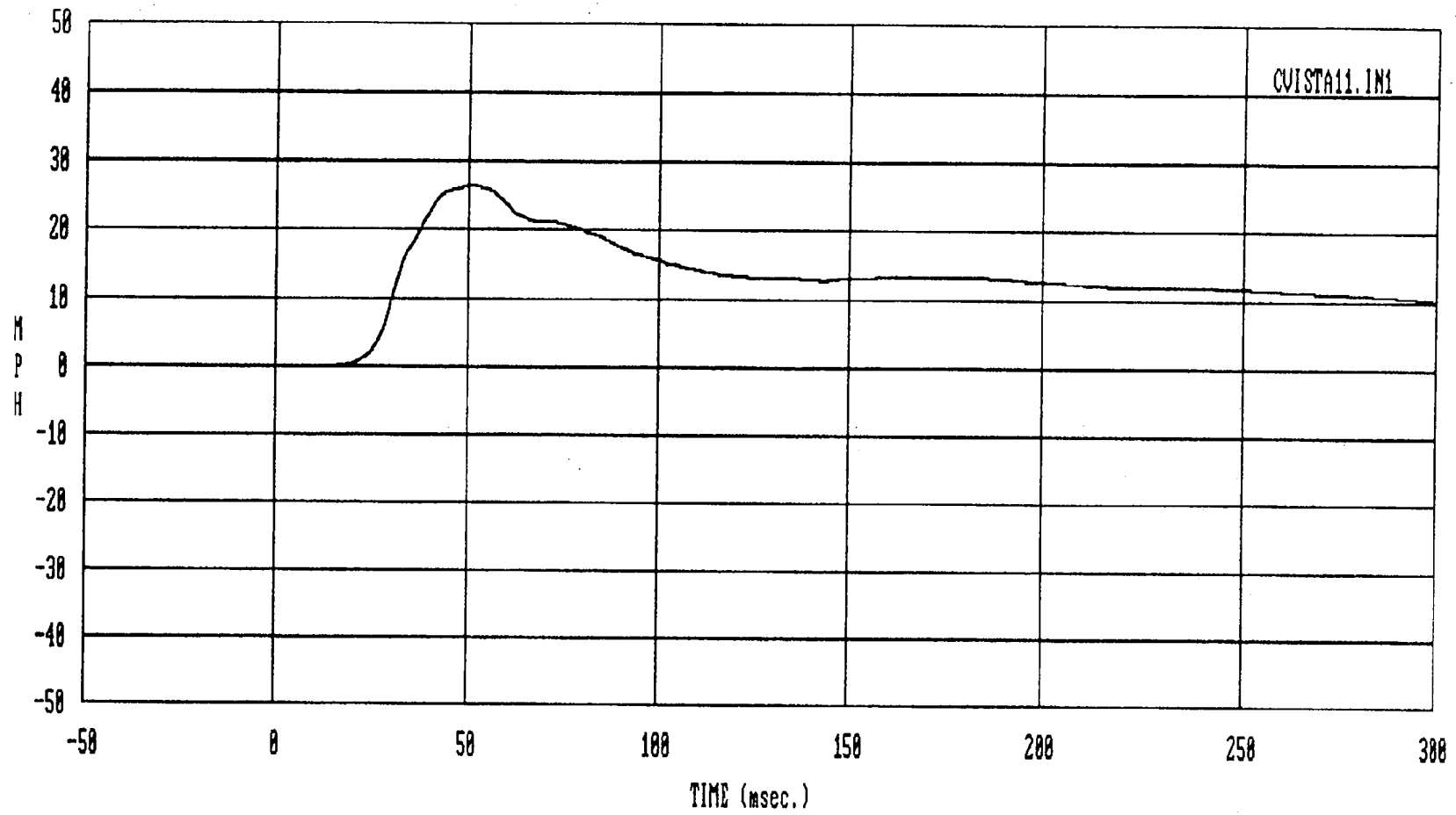
Curve: Driver lower spine delta V -- Primary Filter: FIR 100 Max = 26.637 Min = .32118E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



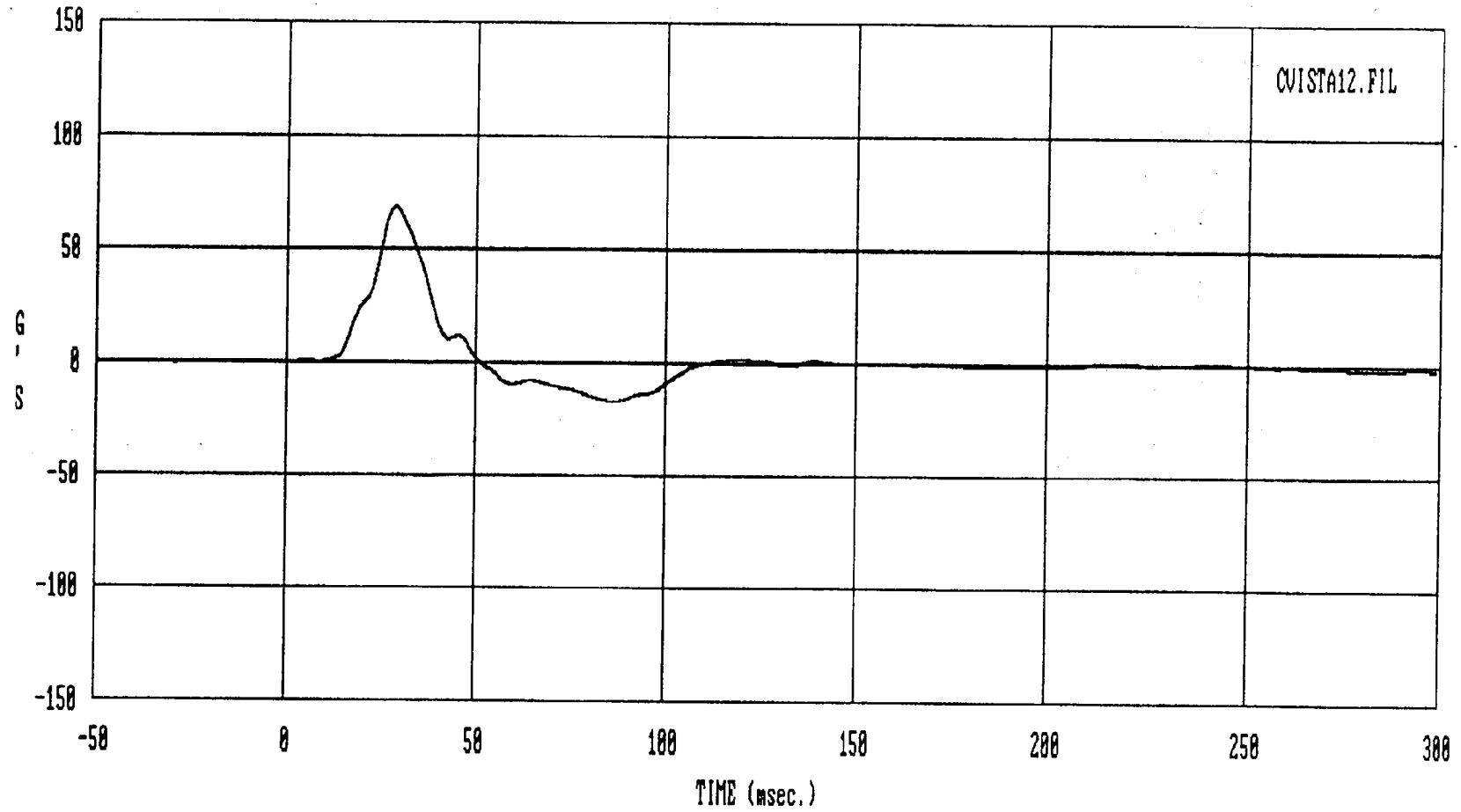
Curve: Driver lower spine acceleration — Redundant Filter: FIR 100 Max = 102.25 Min = -28.834

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



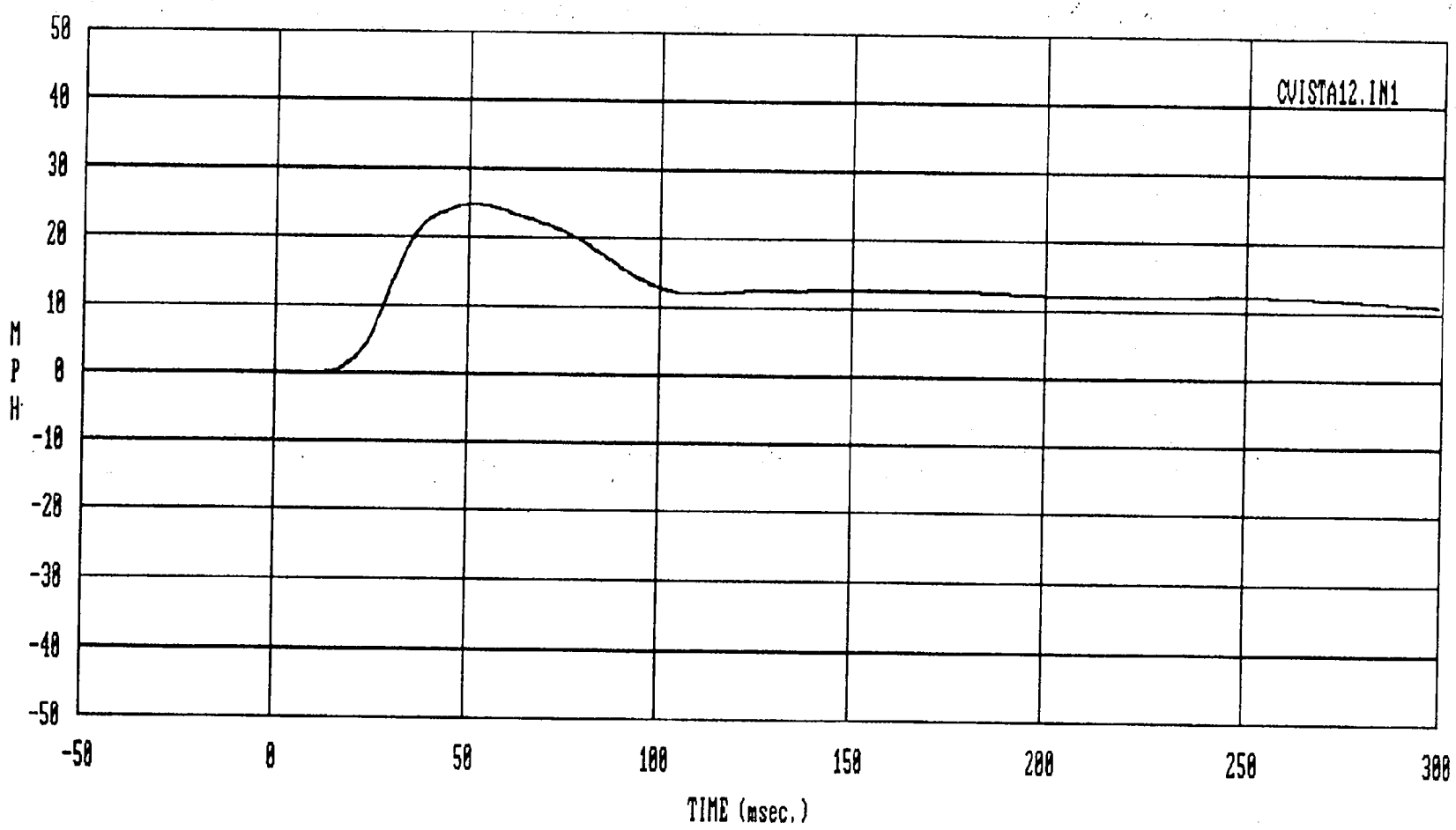
Curve: Driver lower spine delta V -- Redundant Filter: FIR 100 Max = 26.457 Min = -.18377E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



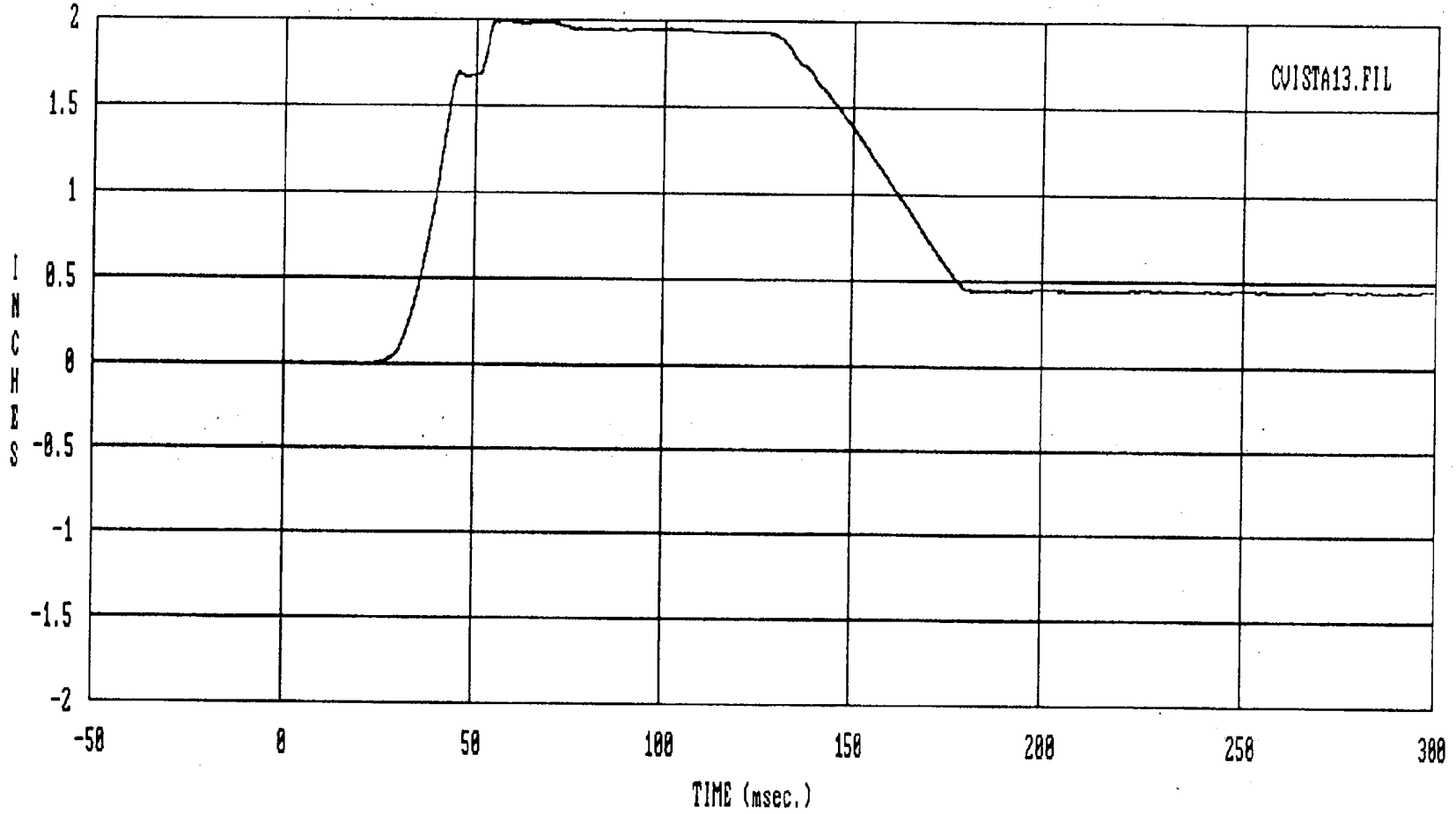
Curve: Driver pelvis acceleration Filter: FIR 100 Max = 69.122 Min = -17.305

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



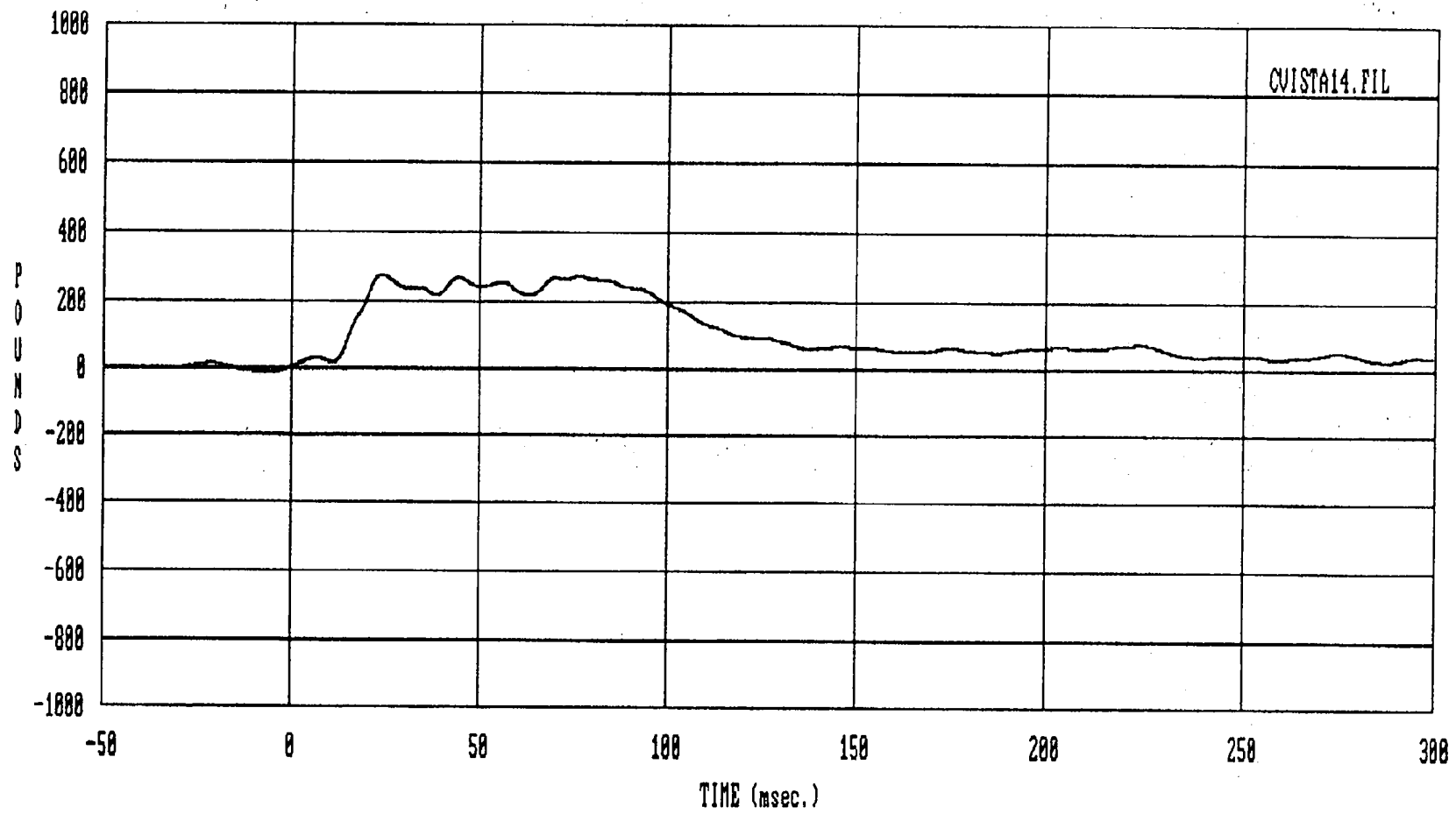
Curve: Driver pelvis delta V Filter: FIR 100 Max = 24.933 Min = 11.865

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



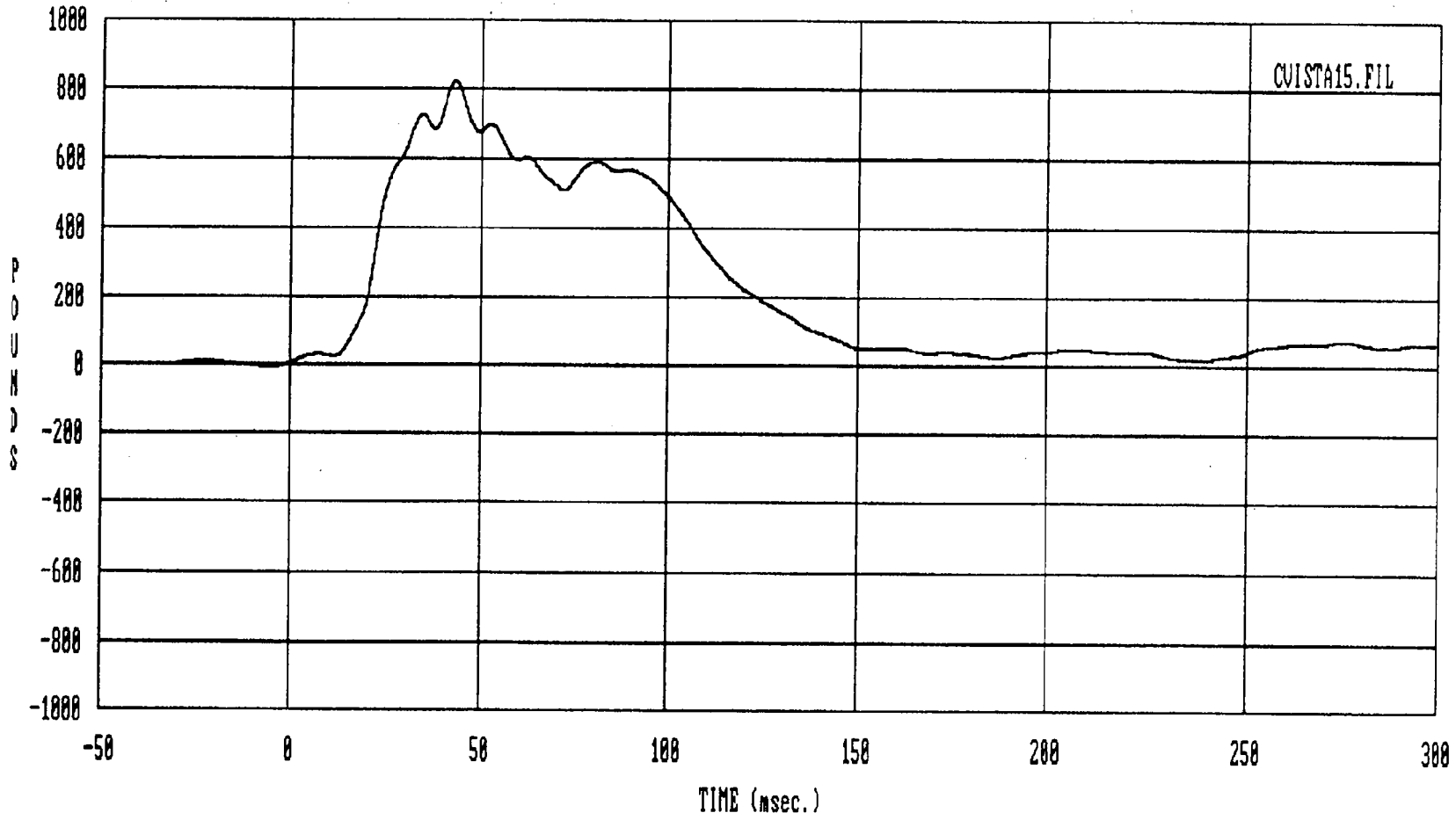
Curve: Driver rib deflection Filter: SAE CLASS 180 Max = 1.9959 Min = -.11576E-02

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



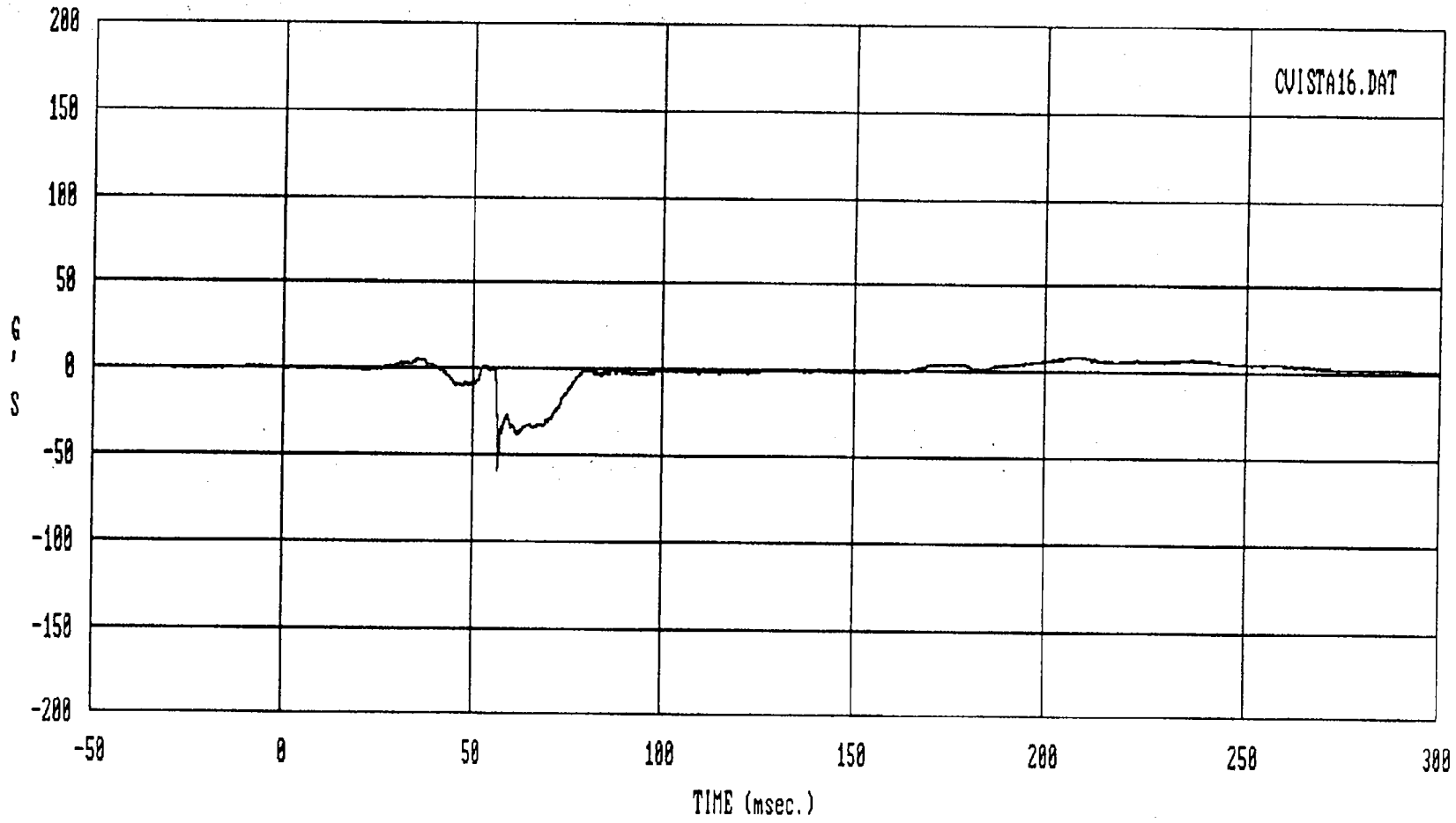
Curve: Driver lap belt load Filter: SAE CLASS 60 Max = 278.19 Min = 19.589

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



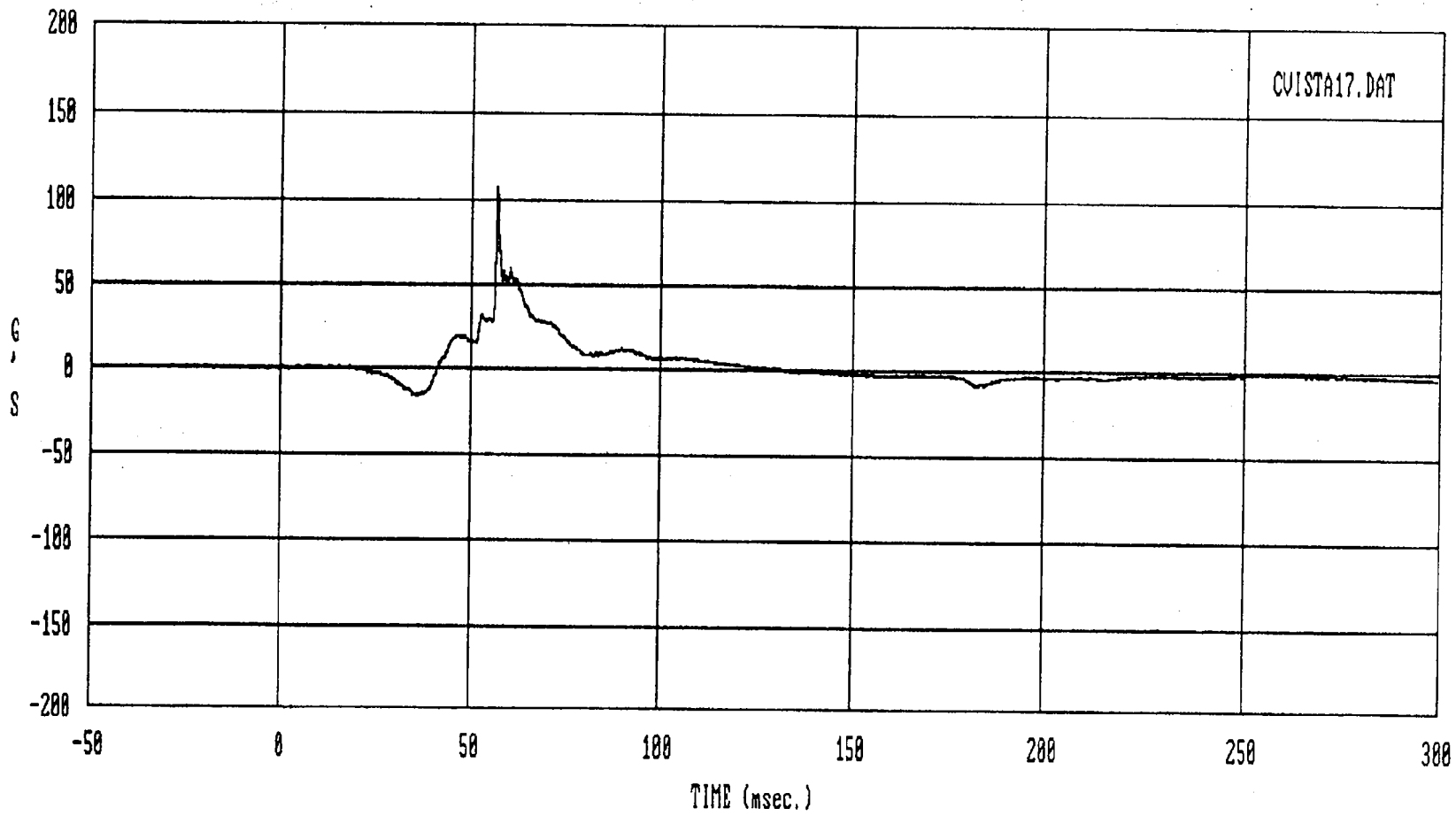
Curve: Driver shoulder belt load Filter: SAE CLASS 60 Max = 825.23 Min = 18.312

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



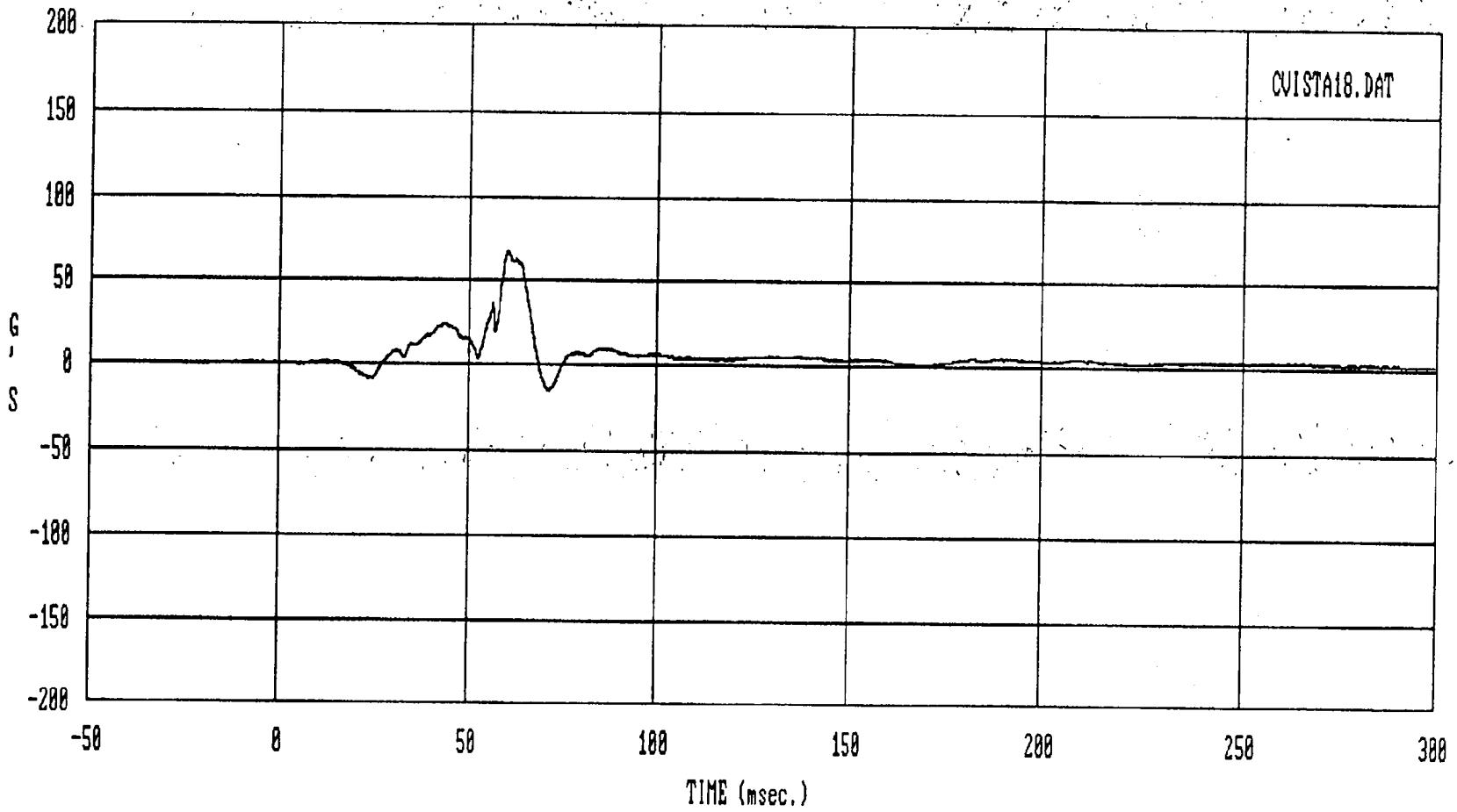
Curve: Passenger Head acceleration -- X axis Filter: SAE CLASS 1000 Max = 8.9539 Min = -58.648

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



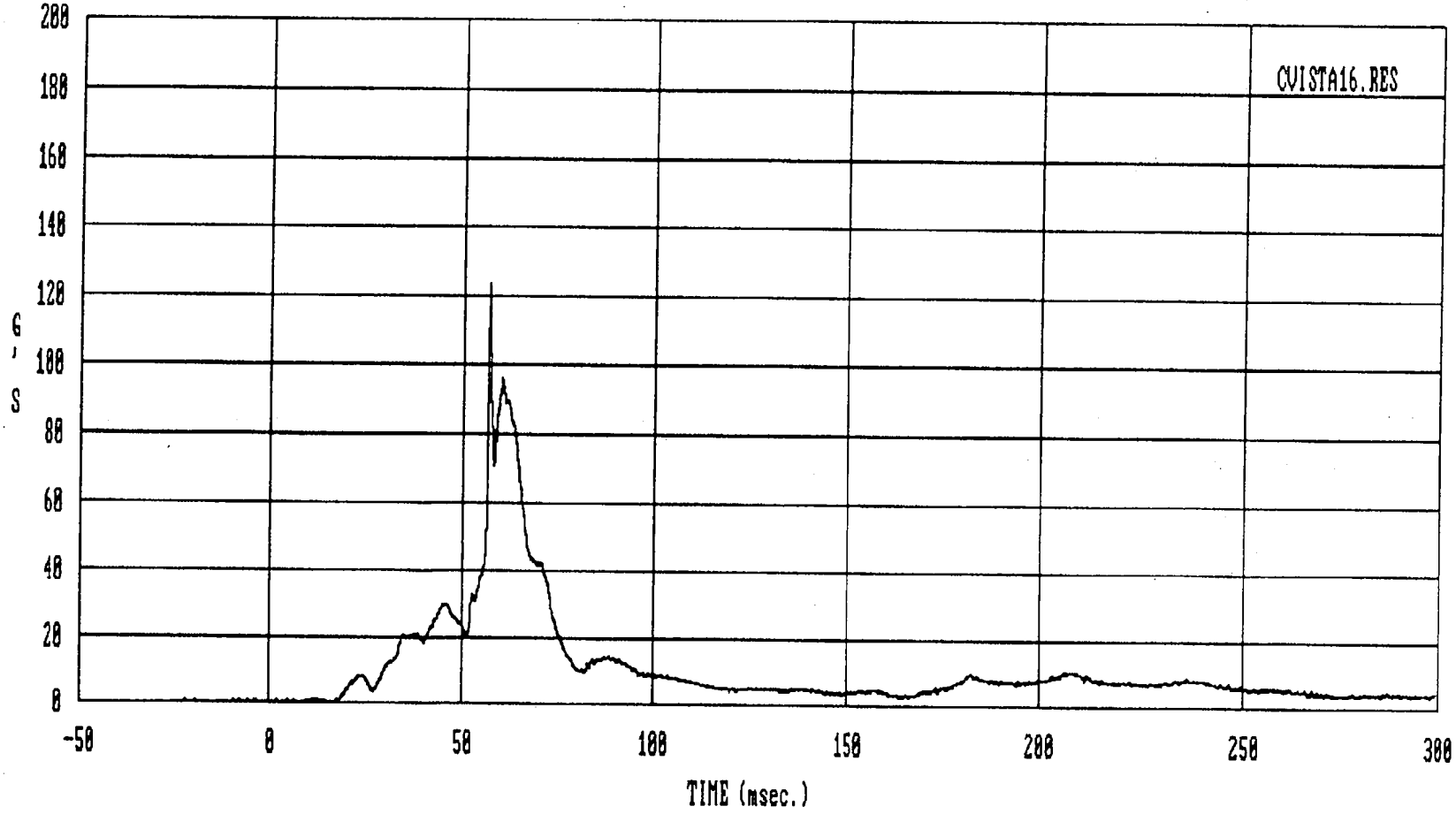
Curve: Passenger Head acceleration -- Y axis Filter: SAE CLASS 1000 Max = 108.25 Min = -16.111

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



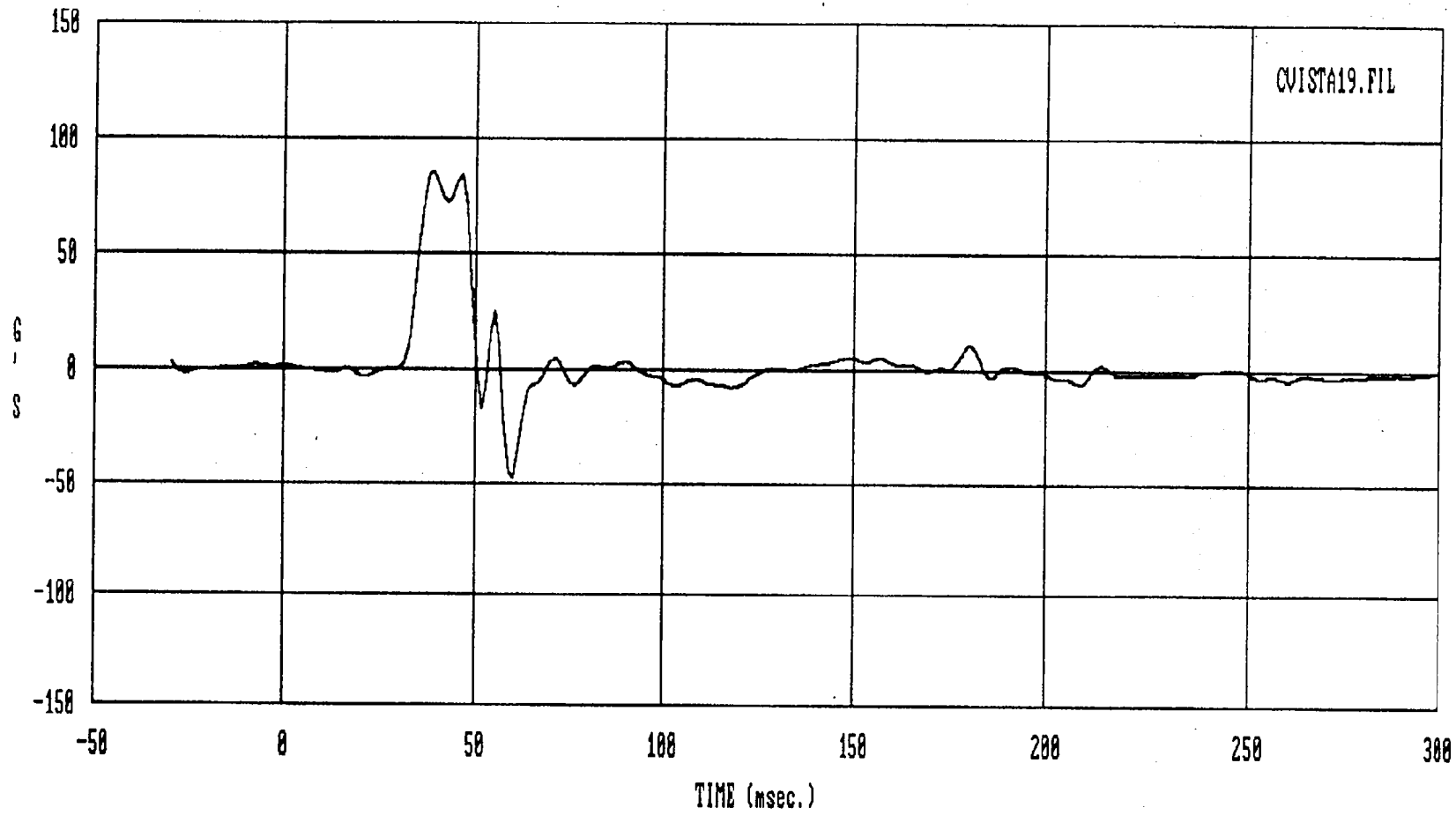
Curve: Passenger Head acceleration -- Z axis Filter: SAE CLASS 1000 Max = 69.503 Min = -14.893

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



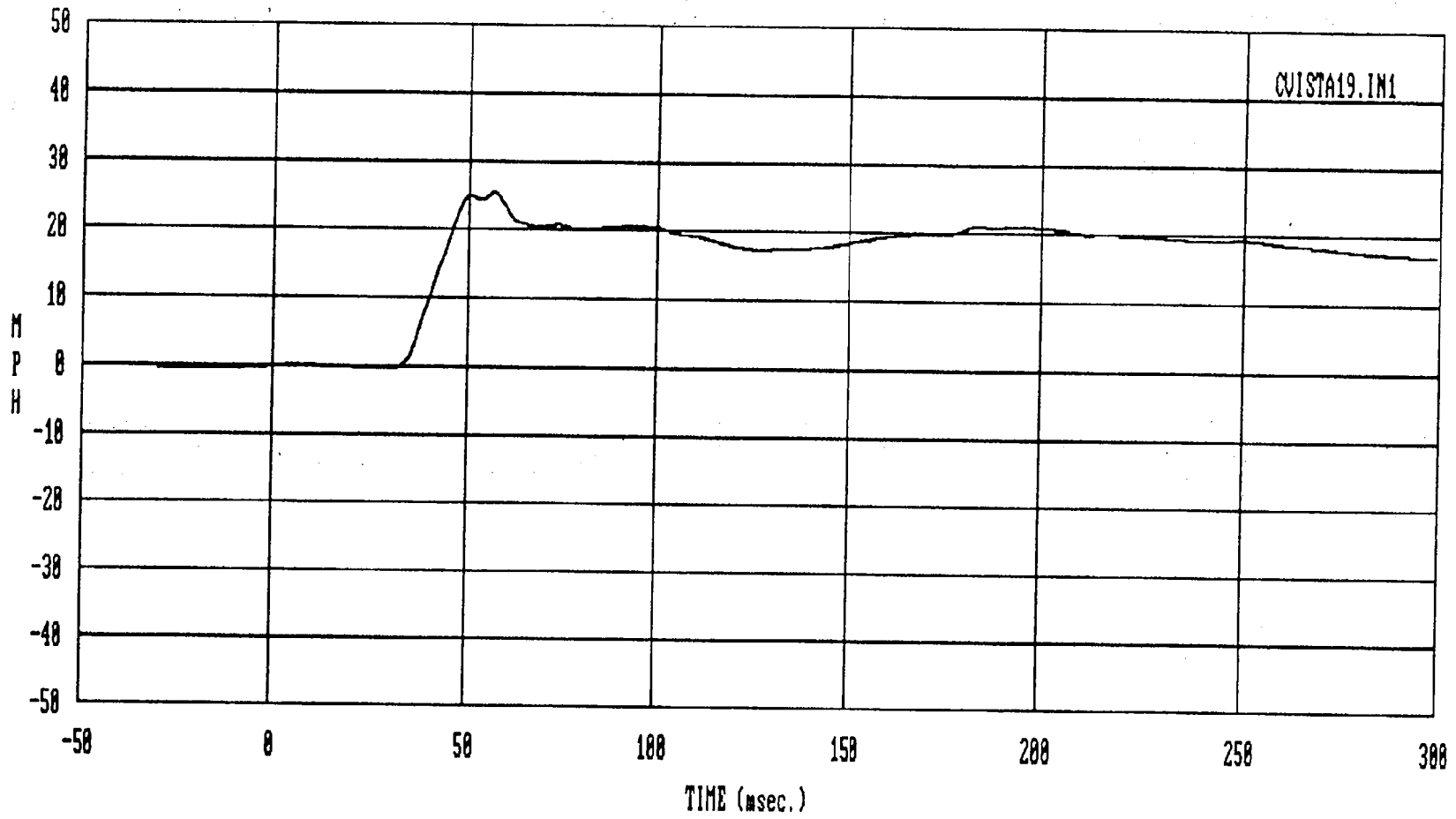
Curve: Passenger head resultant acceleration Filter: SAE CLASS 1000 Max = 124.22 Min = .10530

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



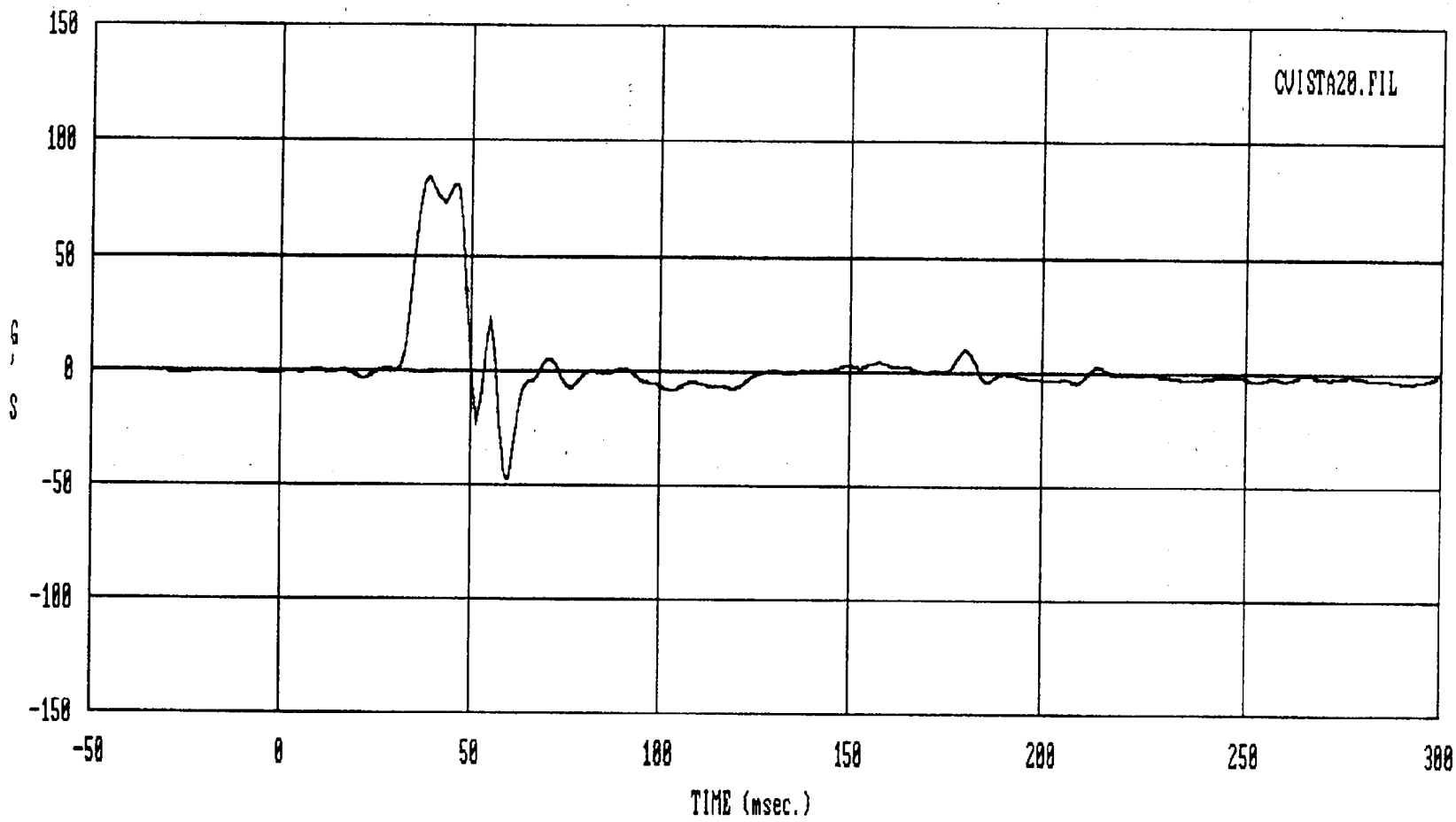
Curve: Passenger upper spine acceleration -- Primary Filter: FIR 100 Max = 85.913 Min = -49.303

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



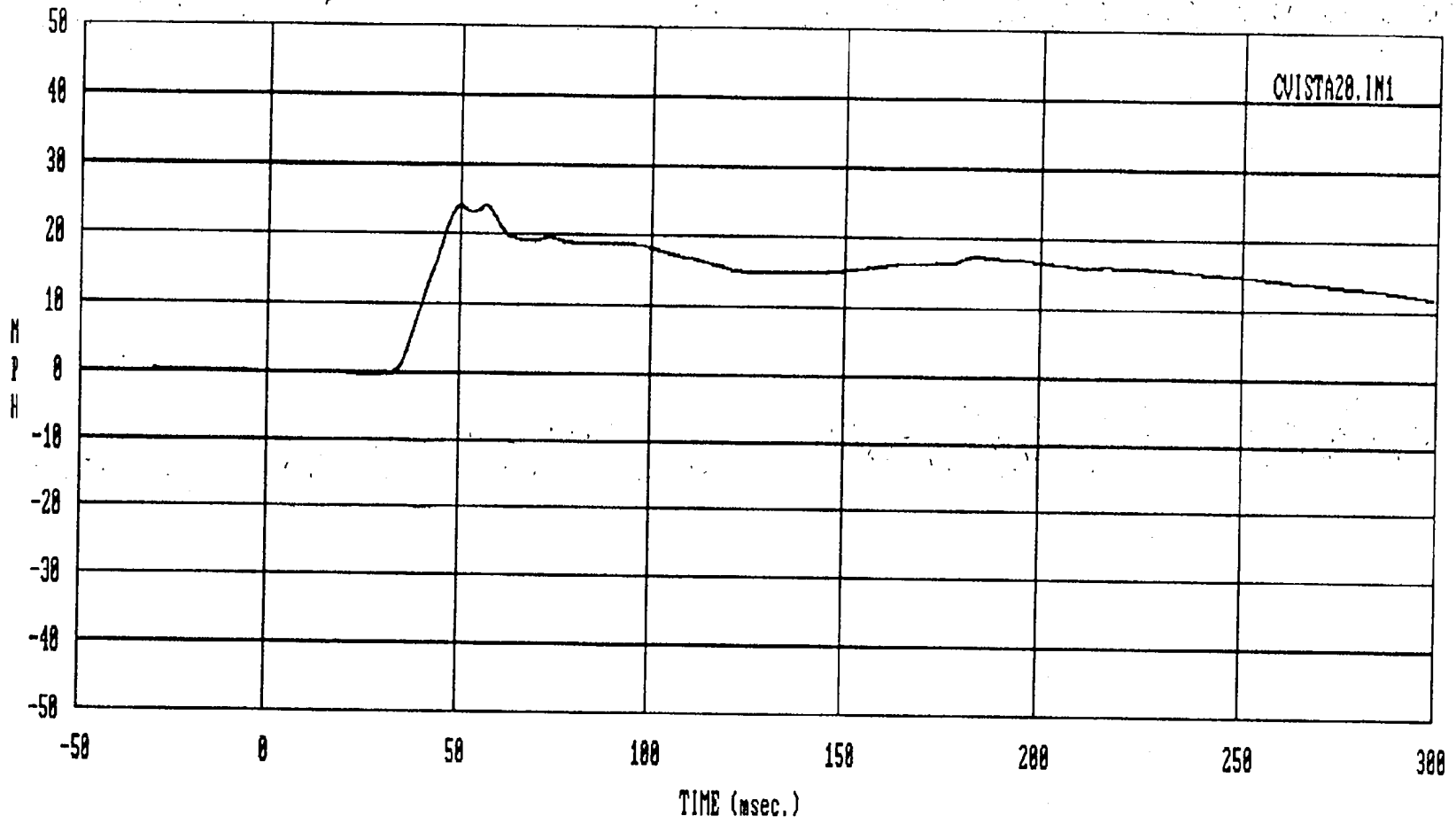
Curve: Passenger upper spine delta V -- Primary Filter: FIR 100 Max = 25.568 Min = -.26125

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



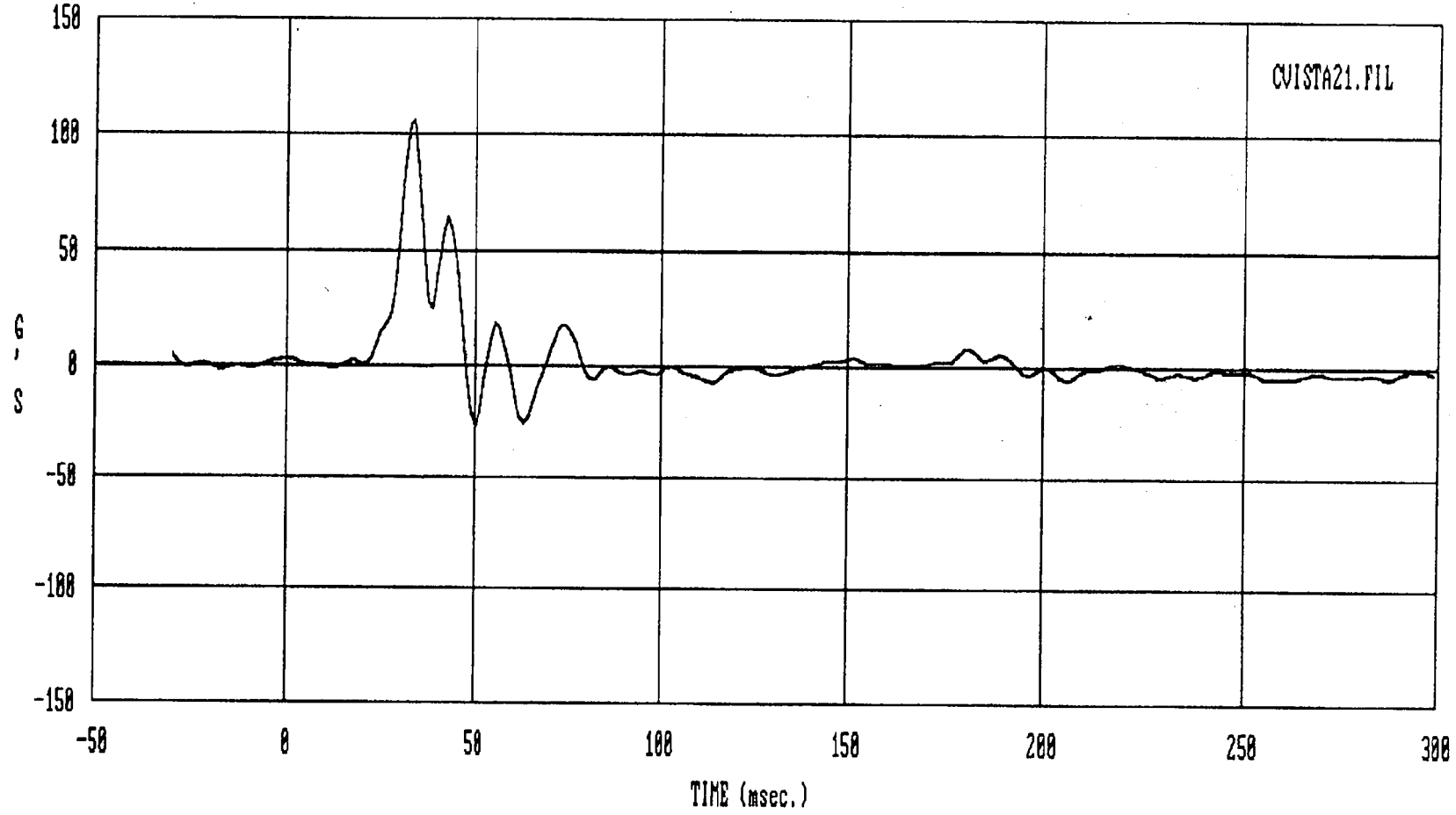
Curve: Passenger upper spine acceleration — Redundant Filter: FIR 100 Max = 84.590 Min = -49.518

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



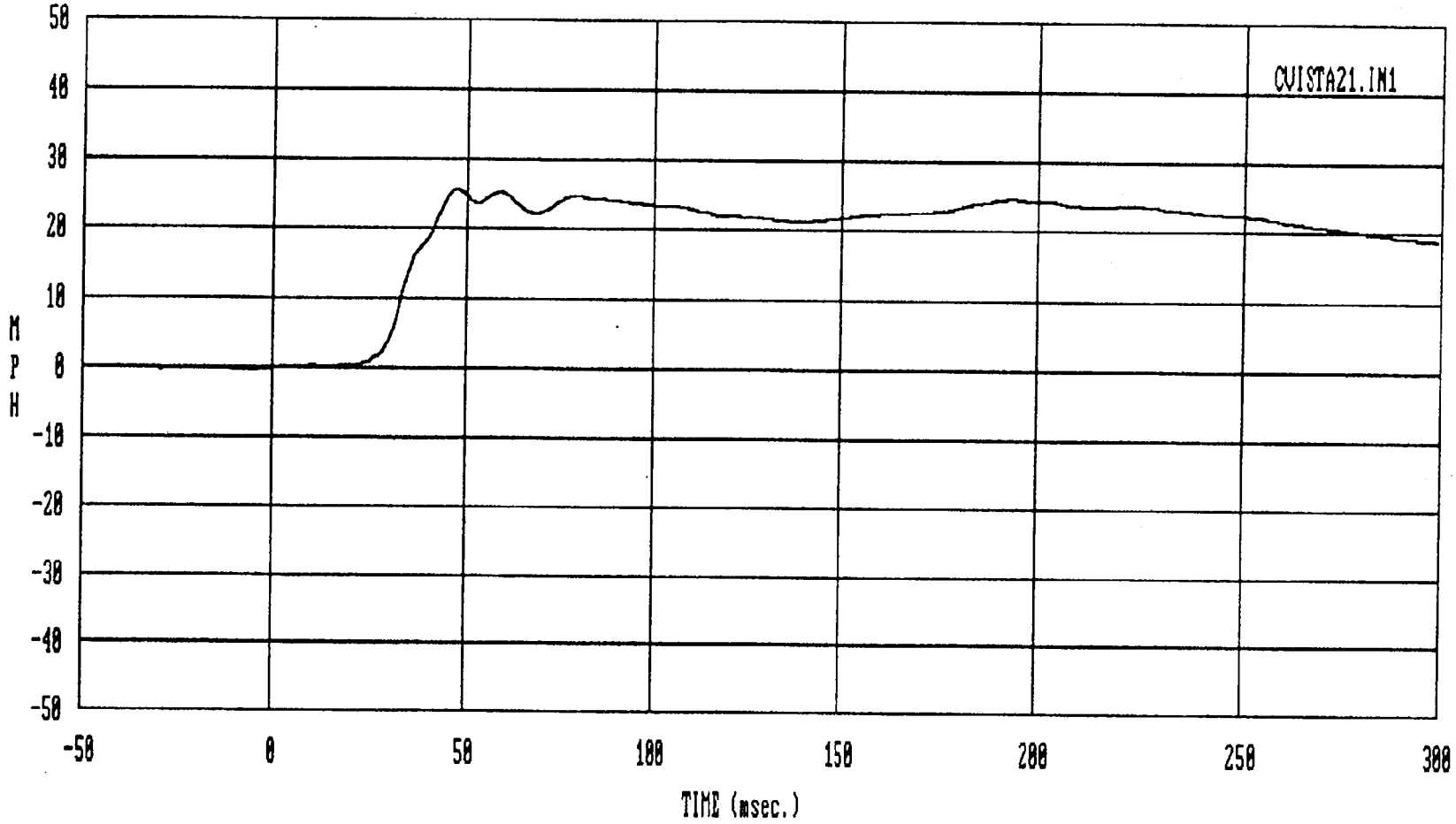
Curve: Passenger upper spine delta V — Redundant Filter: FIR 100 Max = 24.179 Min = -.35047

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



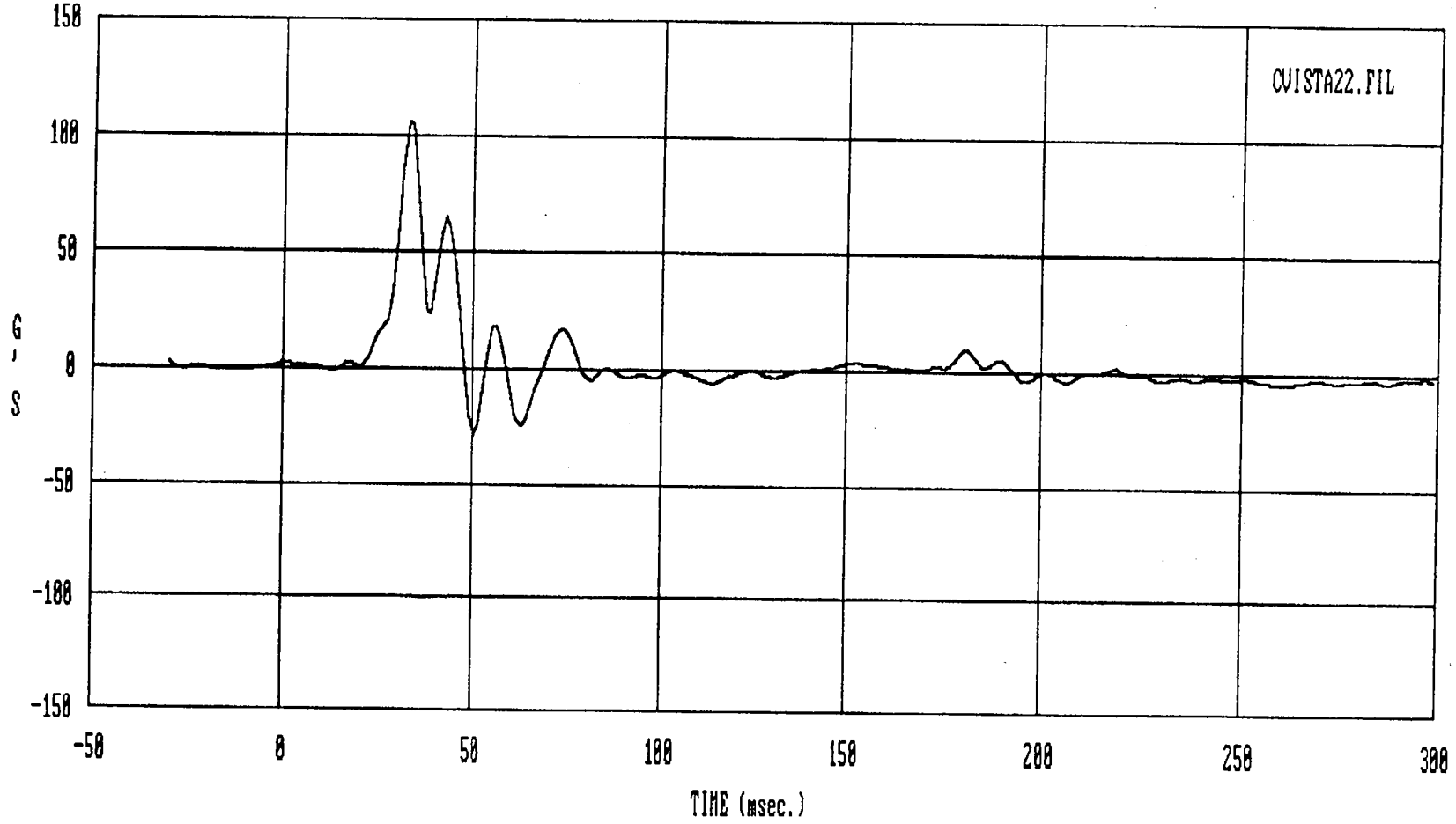
Curve: Passenger upper rib acceleration — Primary Filter: FIR 100 Max = 100.69 Min = -27.002

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



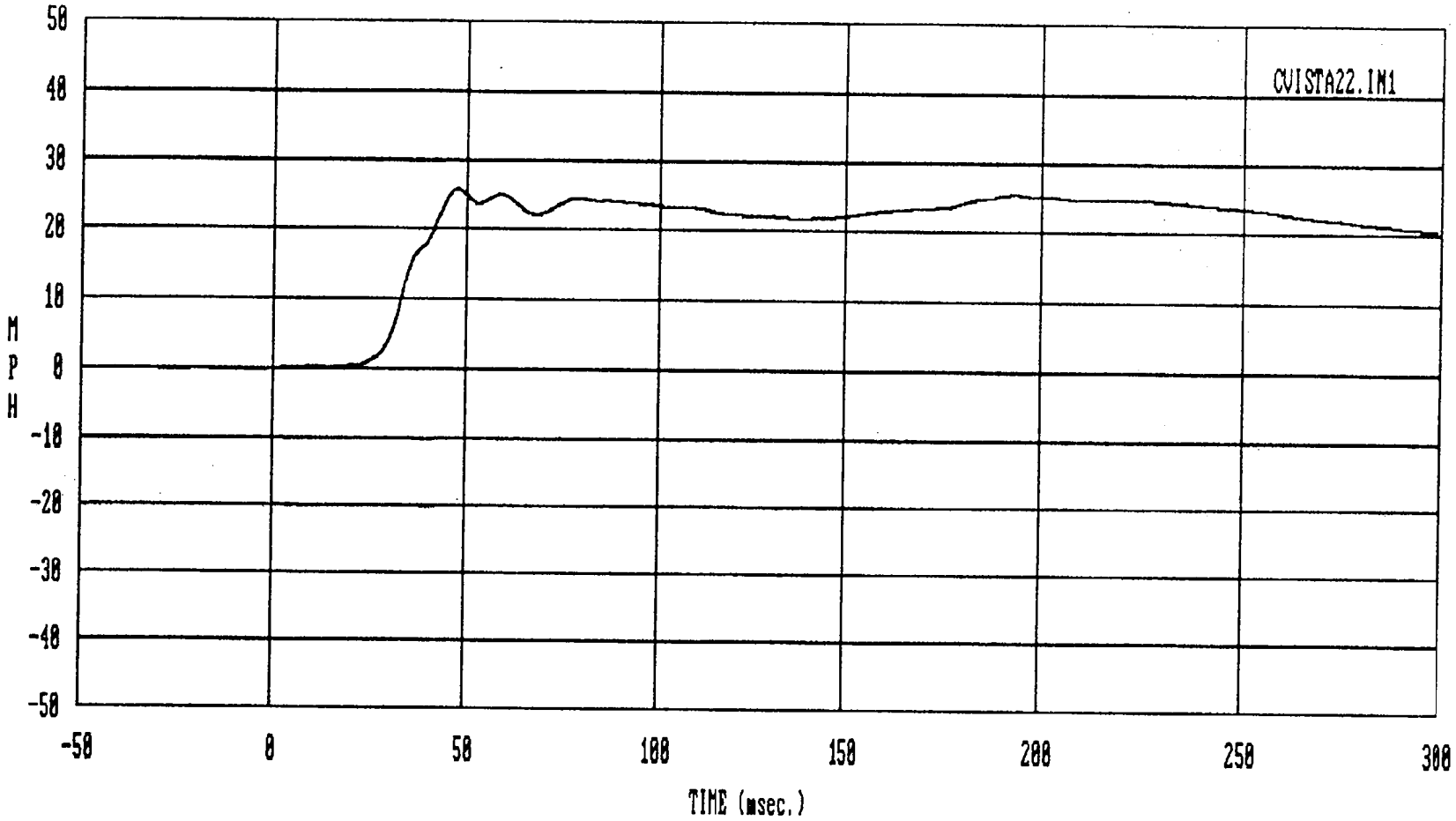
Curve: Passenger upper rib delta V — Primary Filter: FIR 100 Max = 25.740 Min = .23591

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



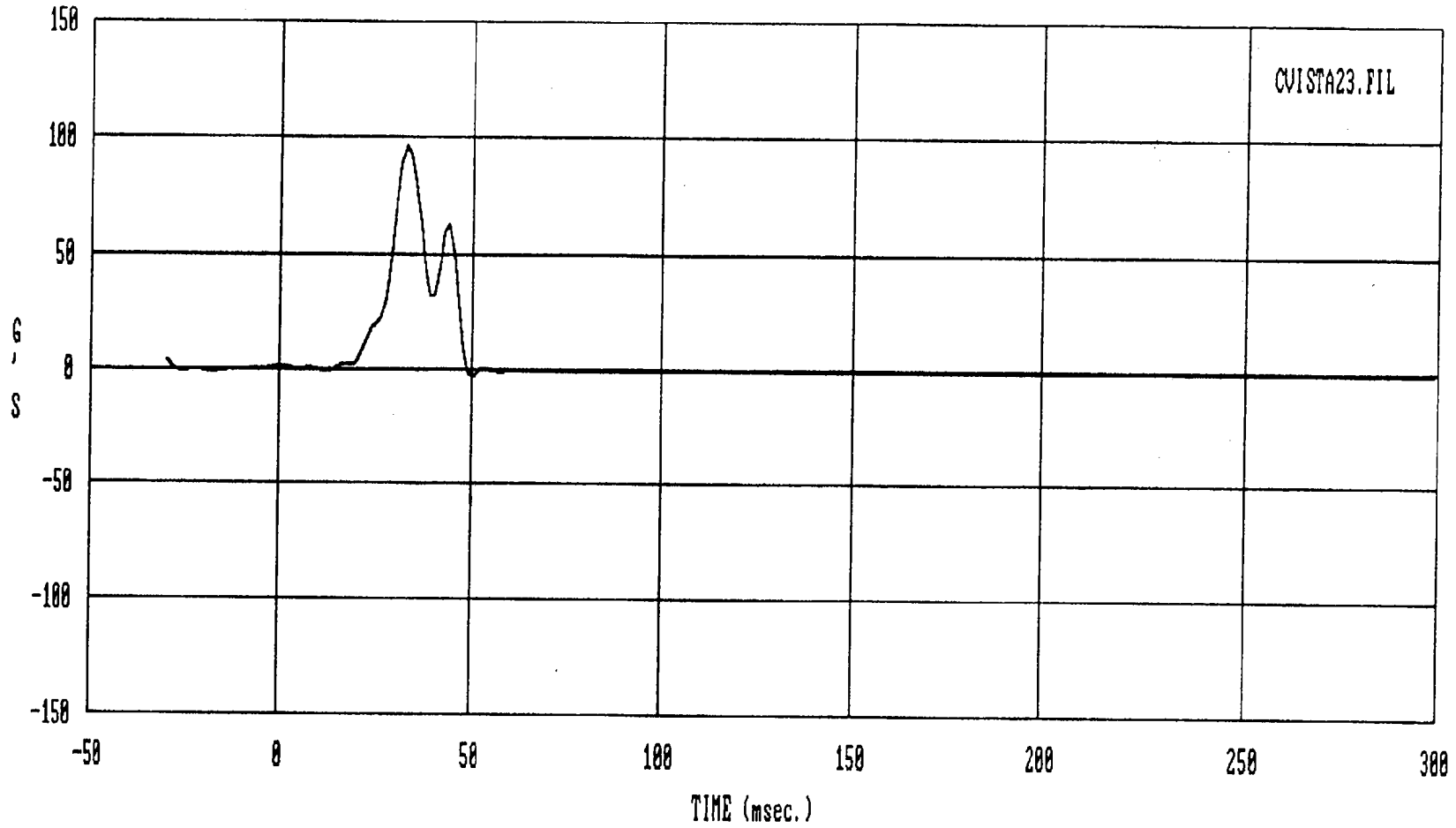
Curve: Passenger upper rib acceleration -- Redundant Filter: FIR 100 Max = 108.96 Min = -28.873

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



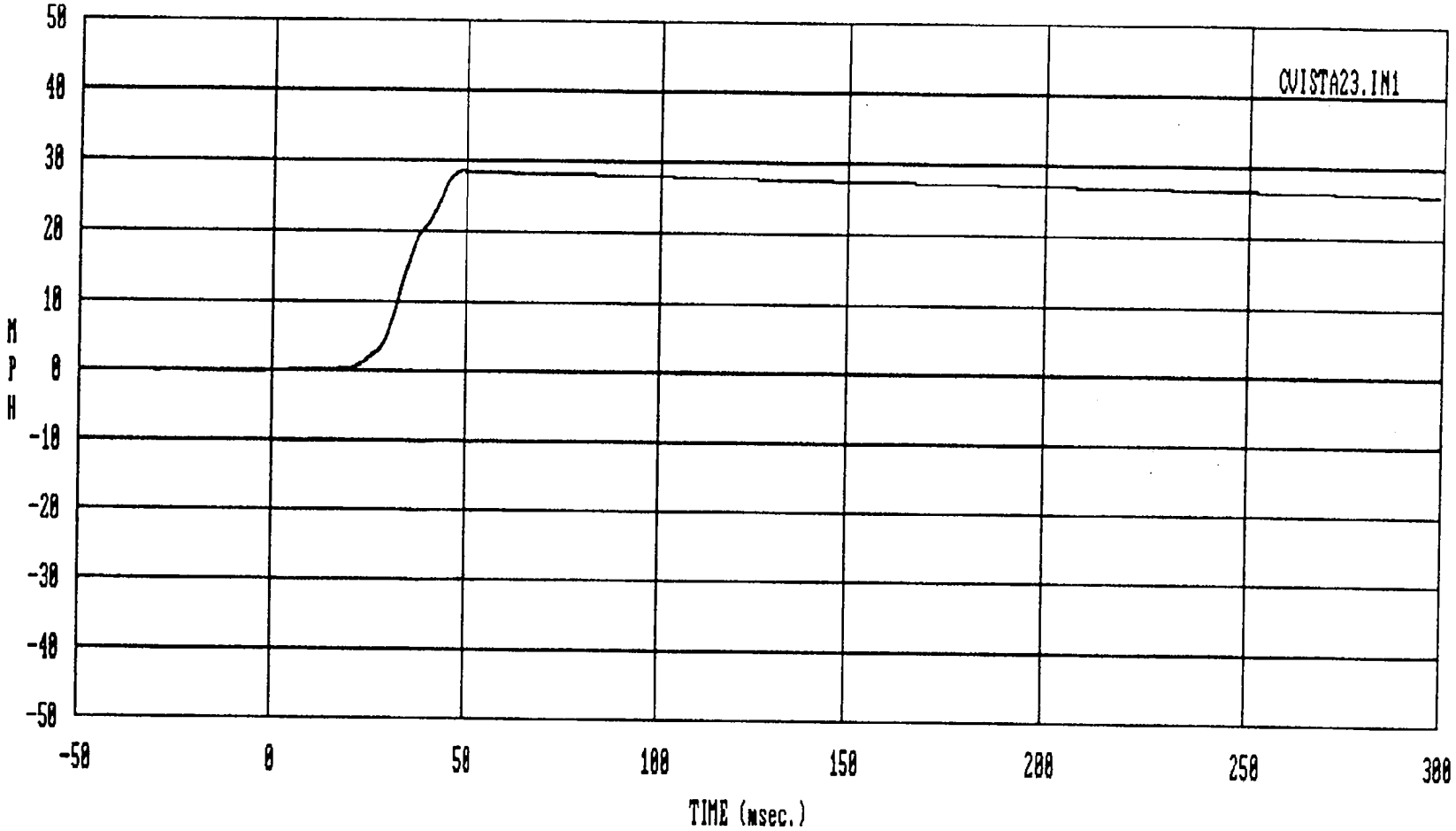
Curve: Passenger upper rib delta V — Redundant Filter: FIR 100 Max = 25.869 Min = .29046

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



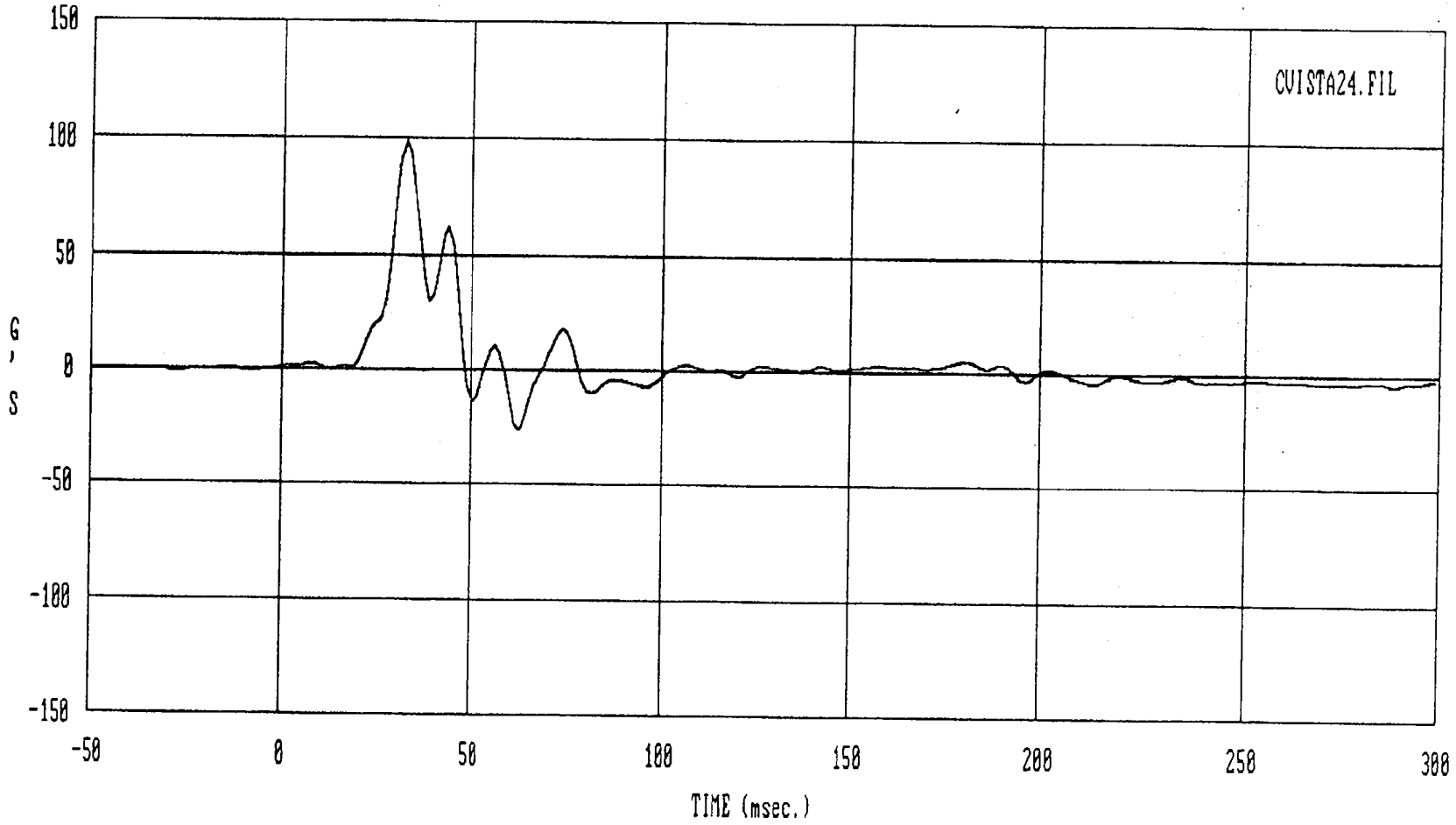
Curve: Passenger lower rib acceleration -- Primary Filter: FIR 100 Max = 96.553 Min = -3.8729

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



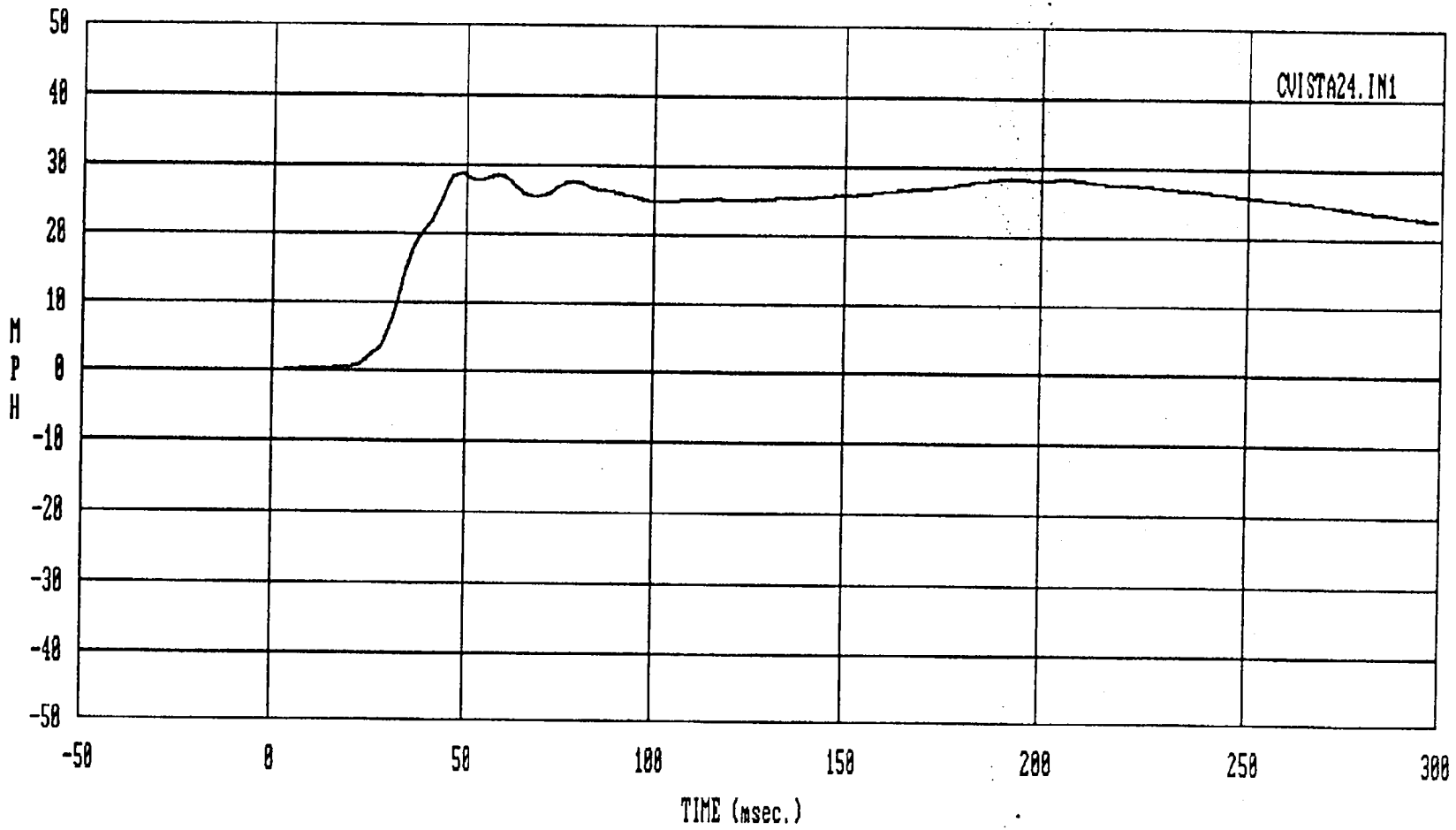
Curve: Passenger lower rib delta V — Primary Filter: FIR 100 Max = 28.600 Min = .15928

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



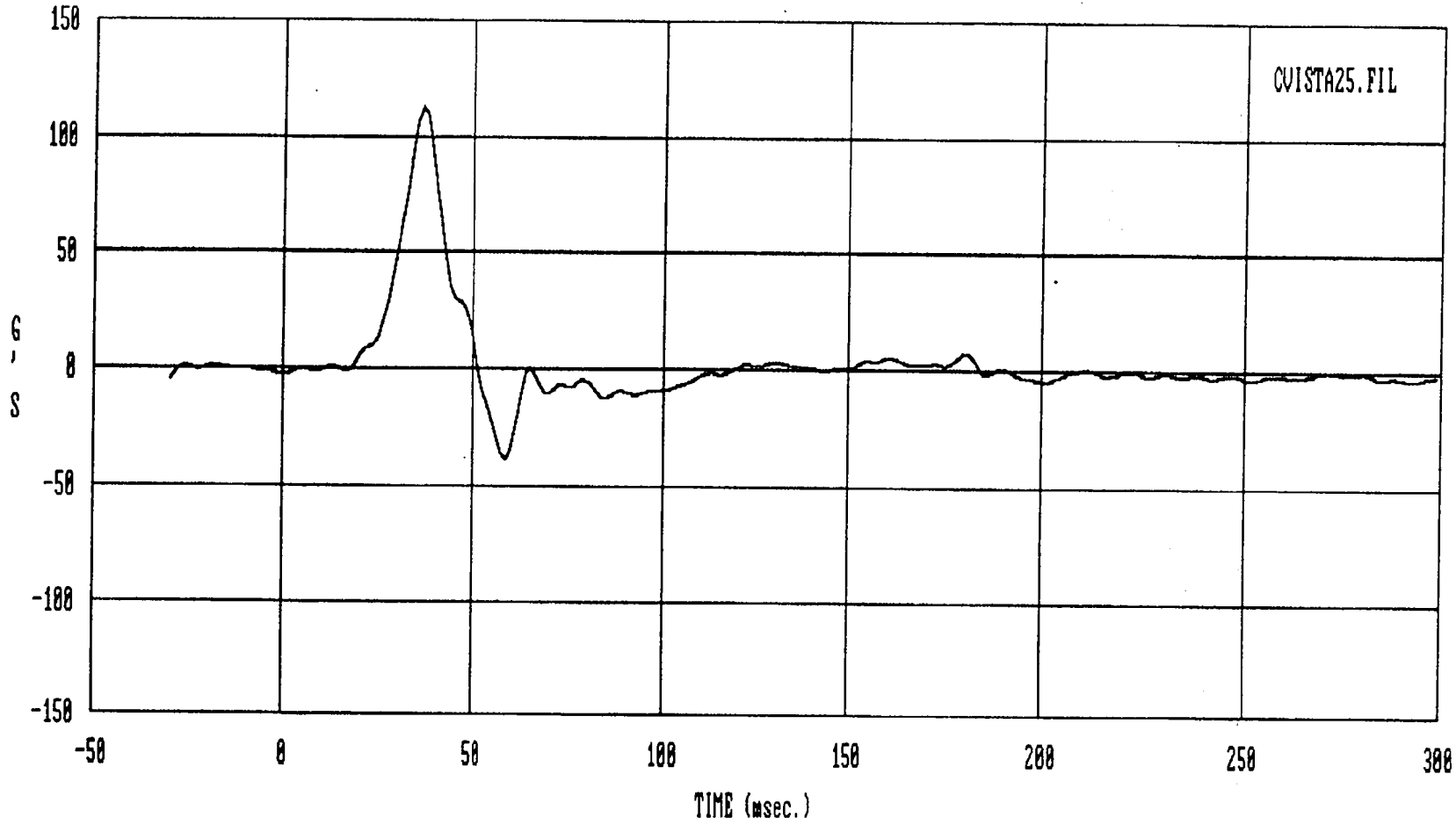
Curve: Passenger lower rib acceleration -- Redundant Filter: FIR 100 Max = 99.037 Min = -26.318

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



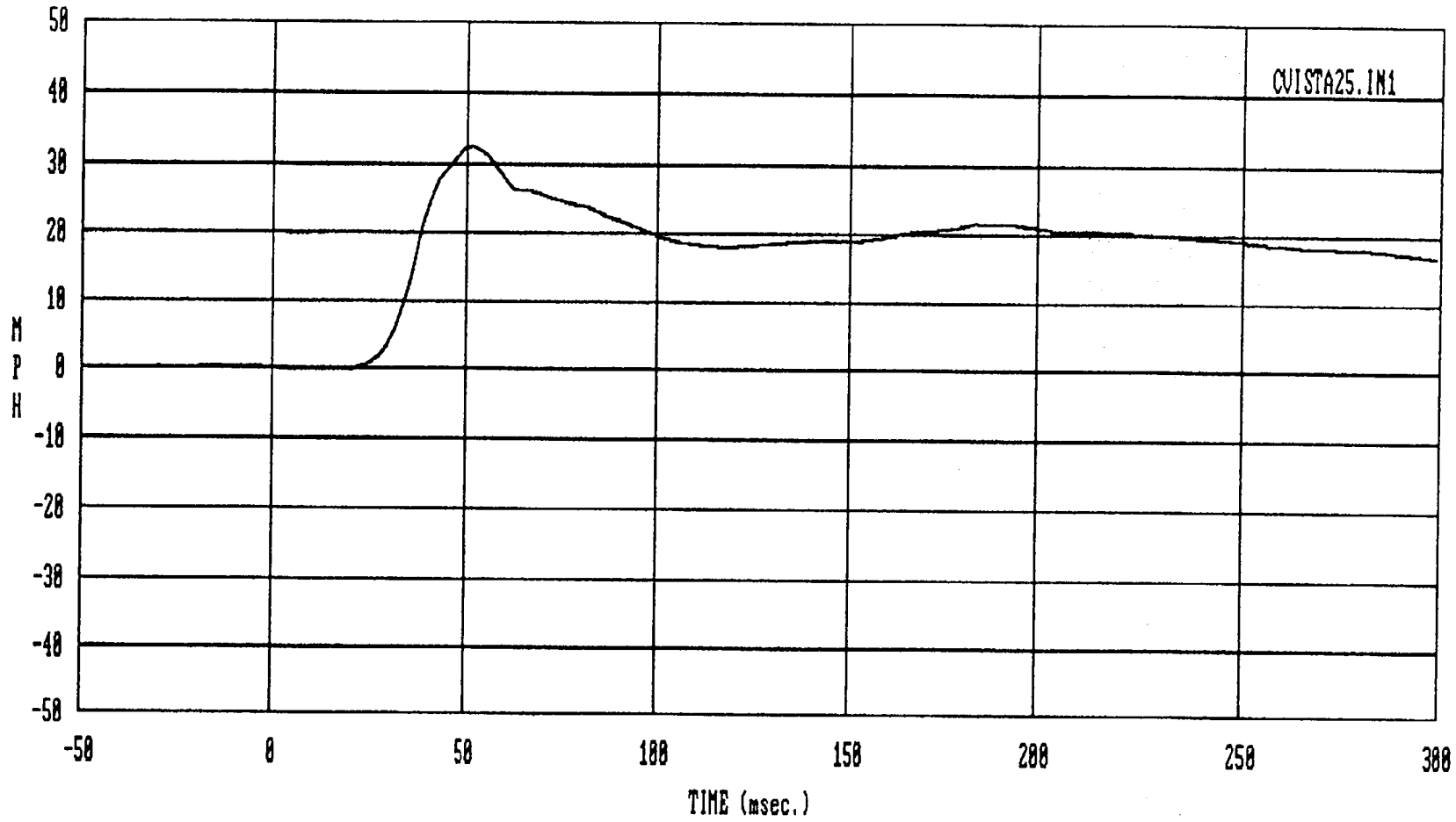
Curve: Passenger lower rib delta V — Redundant Filter: FIR 100 Max = 28.852 Min = .46157

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



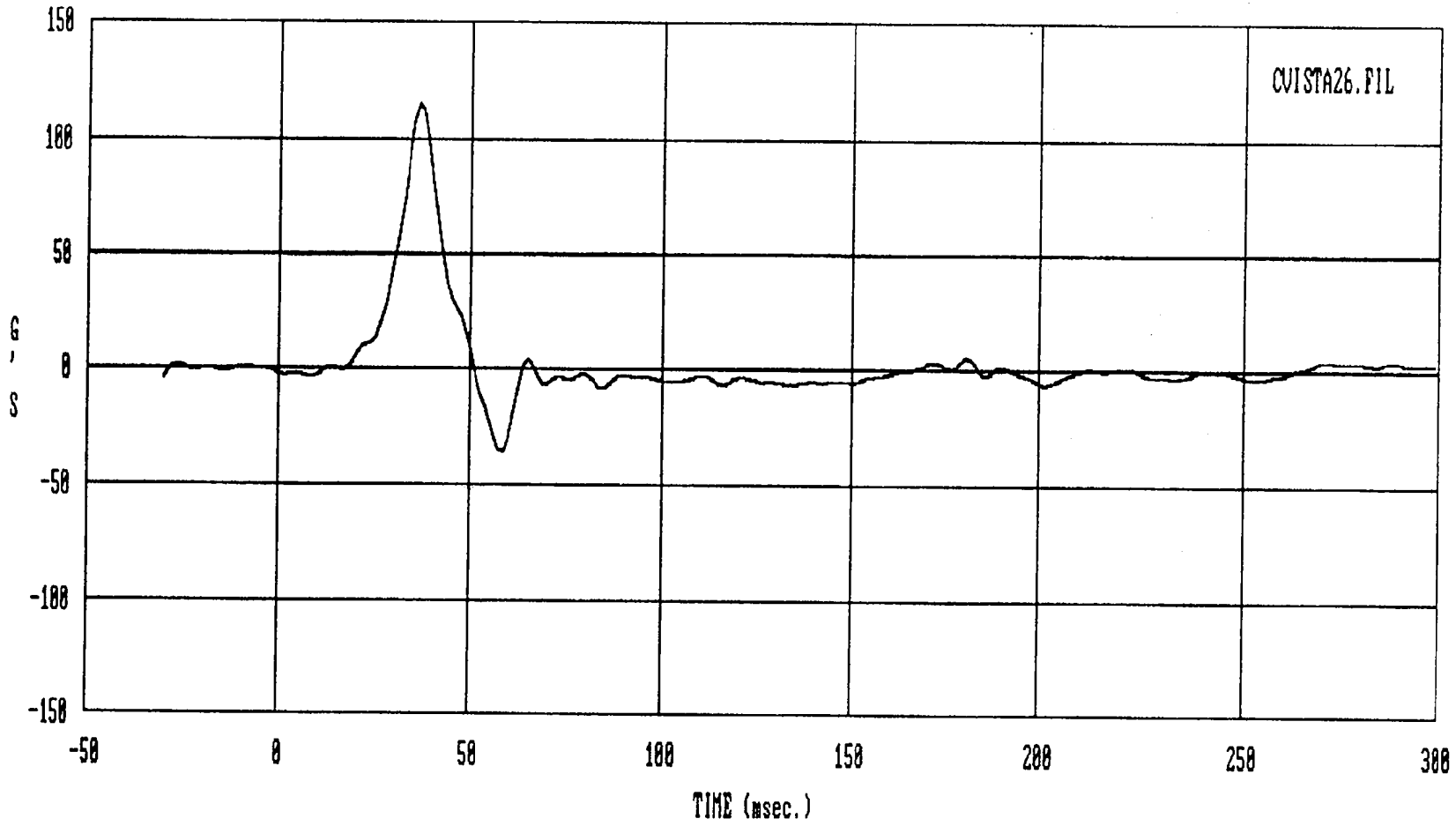
Curve: Passenger lower spine acceleration -- Primary Filter: FIR 100 Max = 113.27 Min = -38.919

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



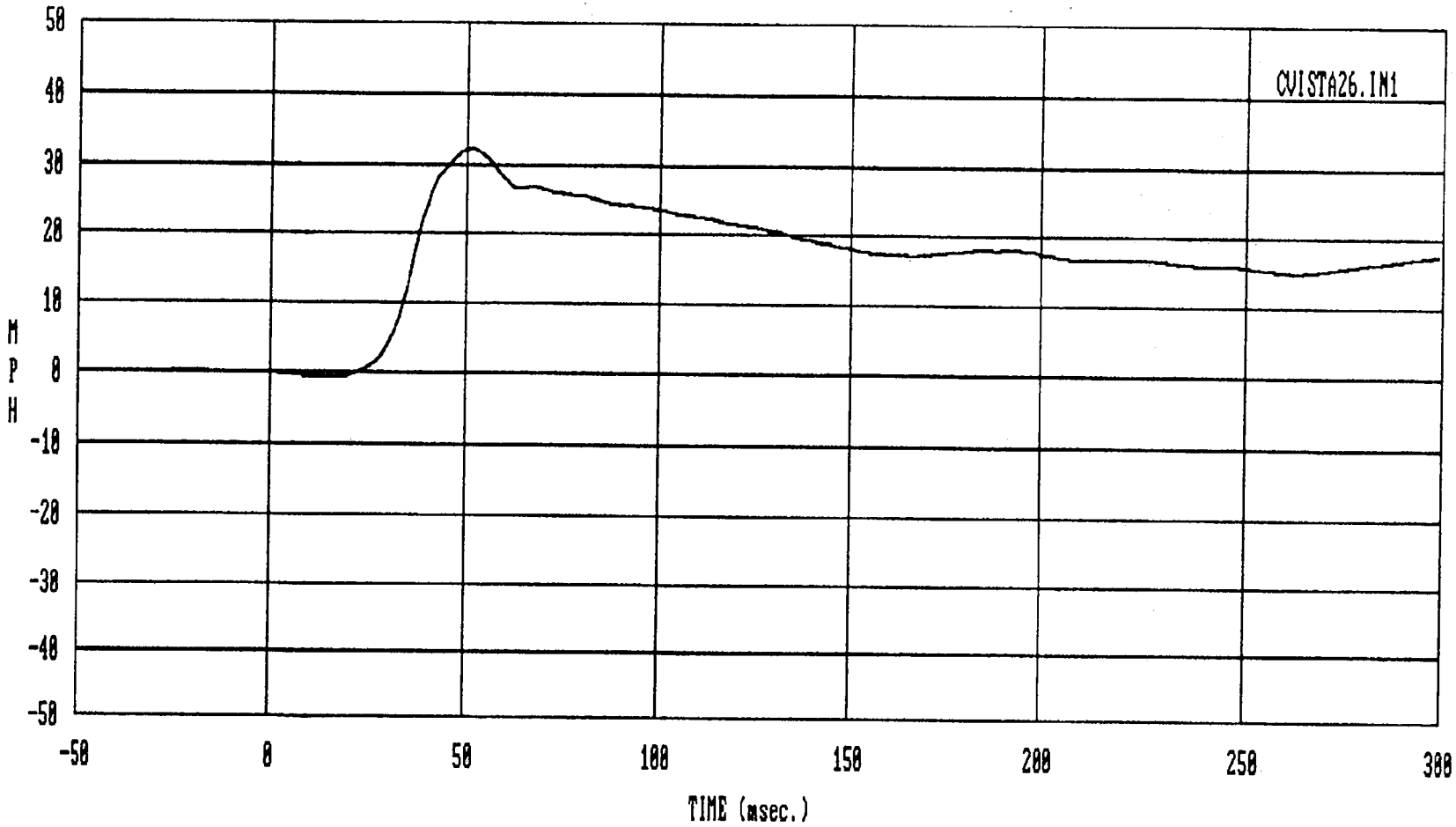
Curve: Passenger lower spine delta V — Primary Filter: FIR 100 Max = 32.576 Min = -.26295

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



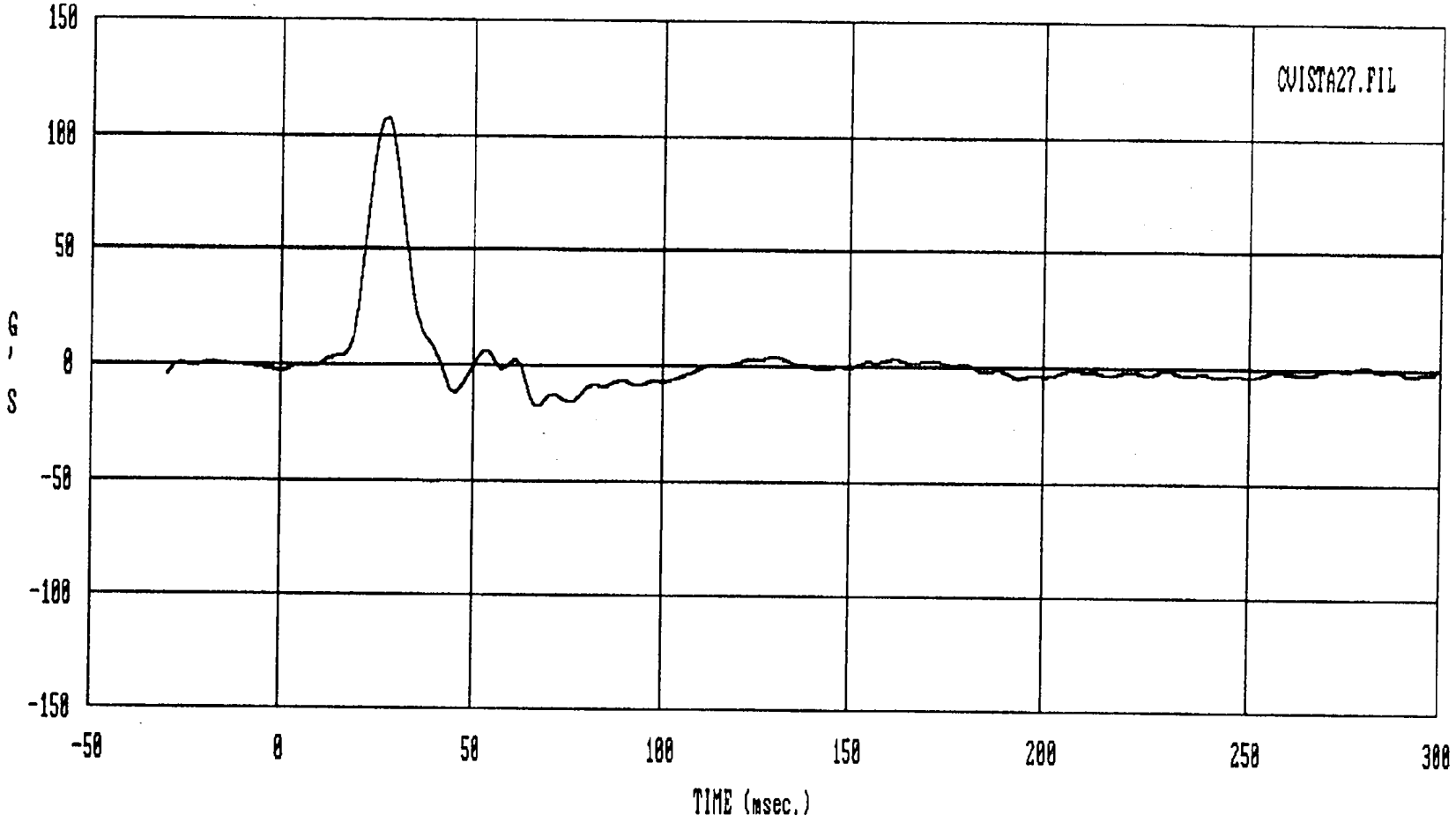
Curve: Passenger lower spine acceleration -- Redundant Filter: FIR 100 Max = 115.71 Min = -36.282

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



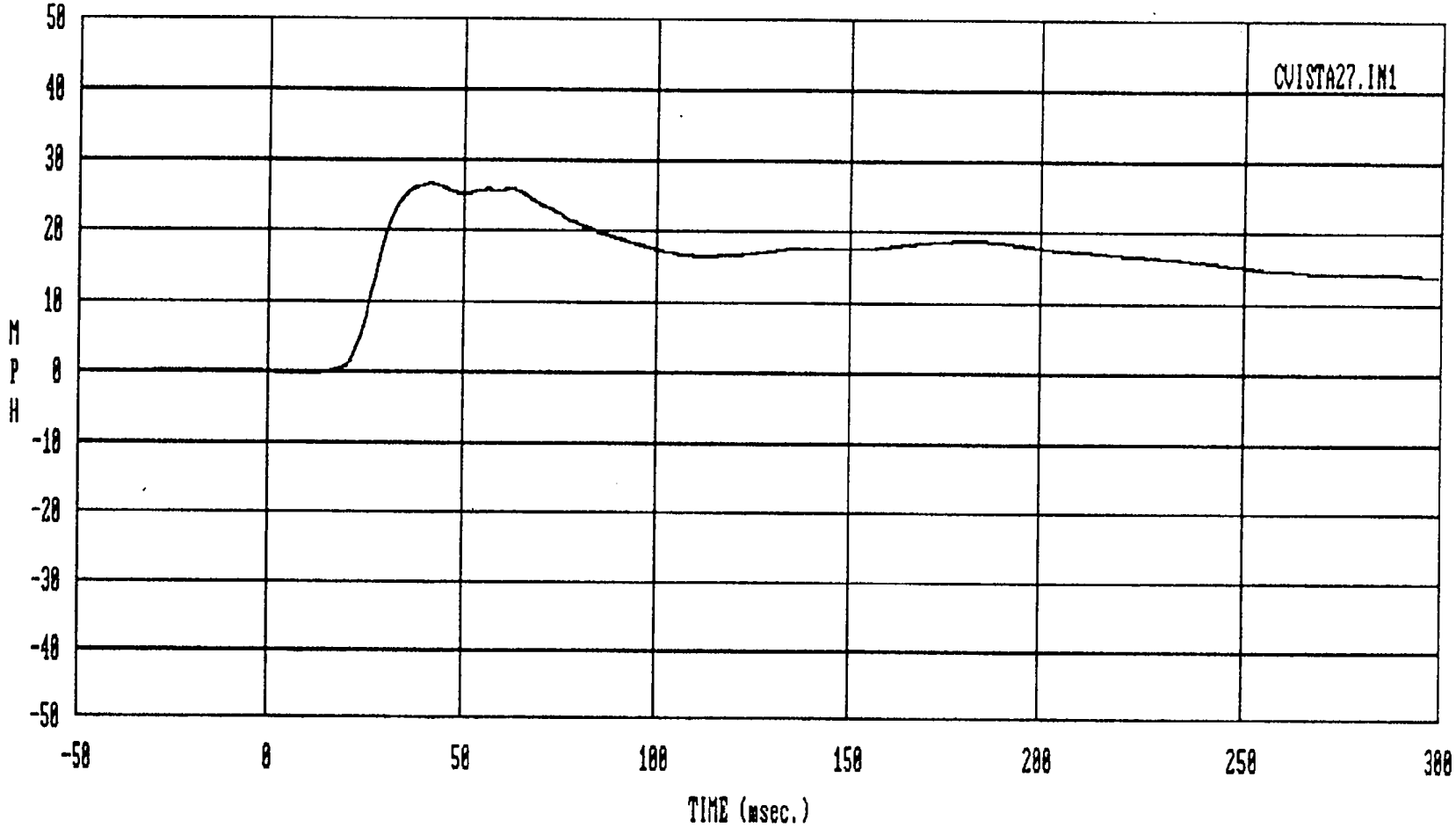
Curve: Passenger lower spine delta V — Redundant Filter: FIR 100 Max = 32.382 Min = -.64863

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



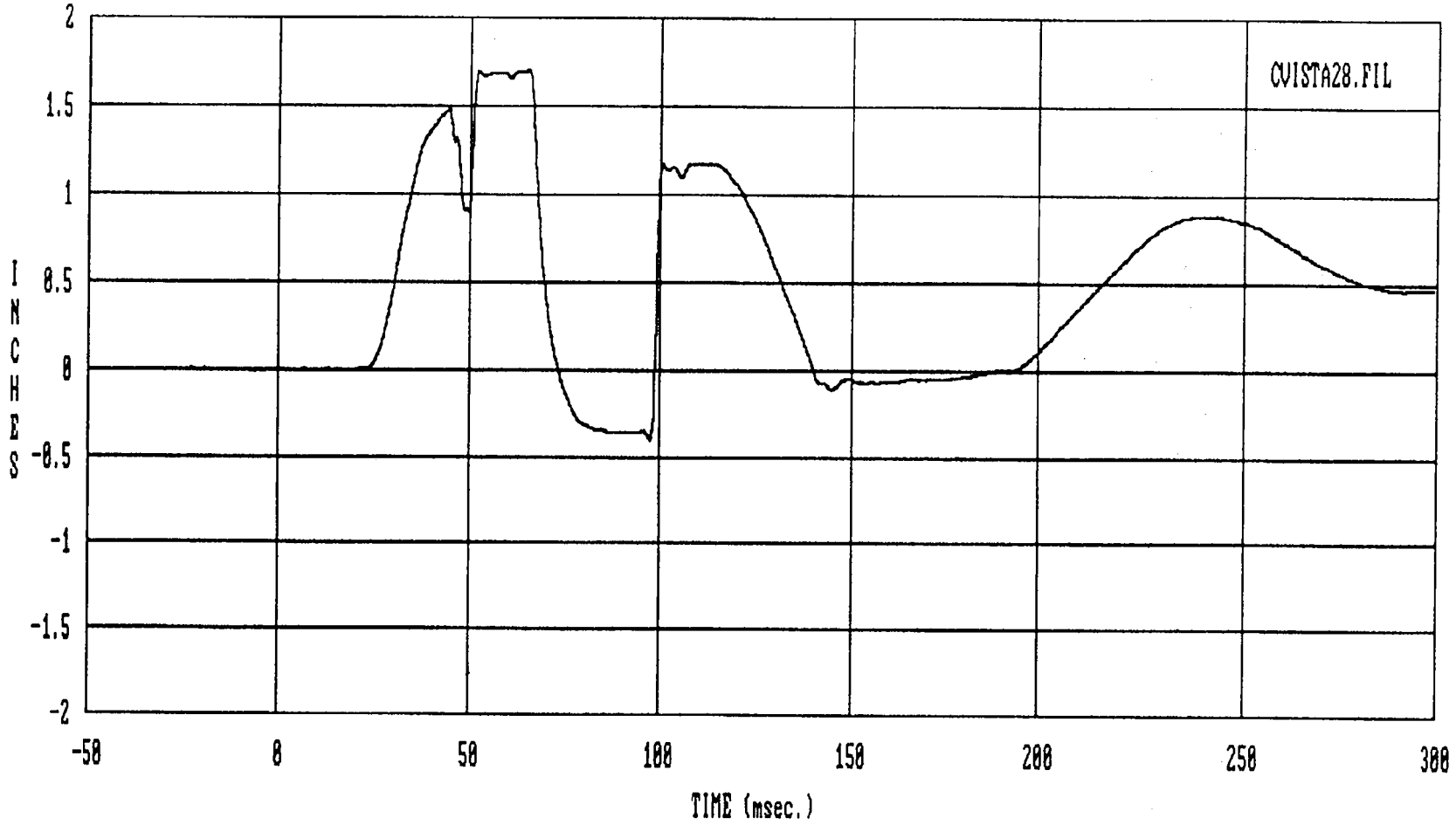
Curve: Passenger pelvis acceleration Filter: FIR 100 Max = 108.37 Min = -17.220

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



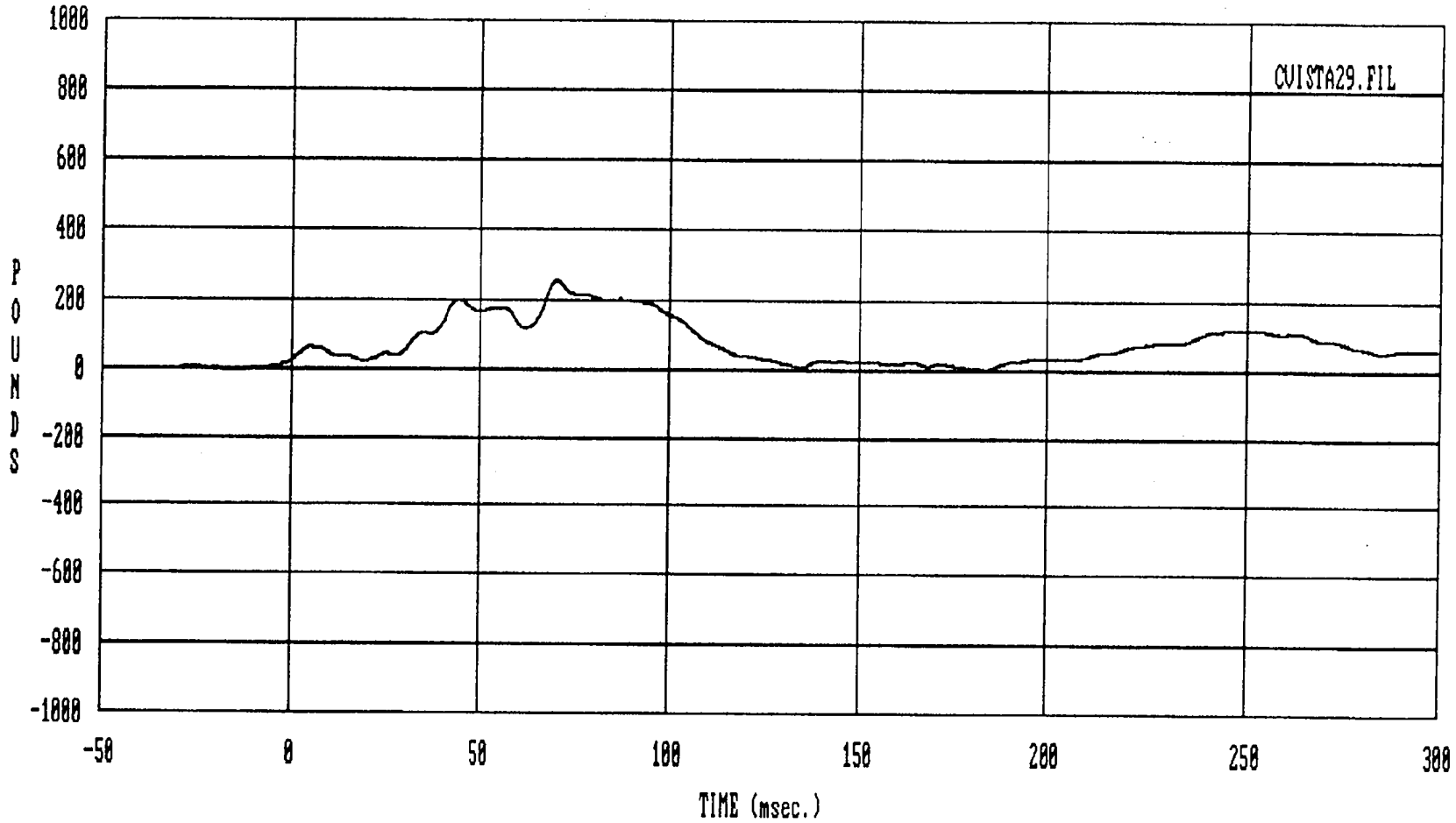
Curve: Passenger pelvis delta V Filter: FIR 100 Max = 26.638 Min = -.19583

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



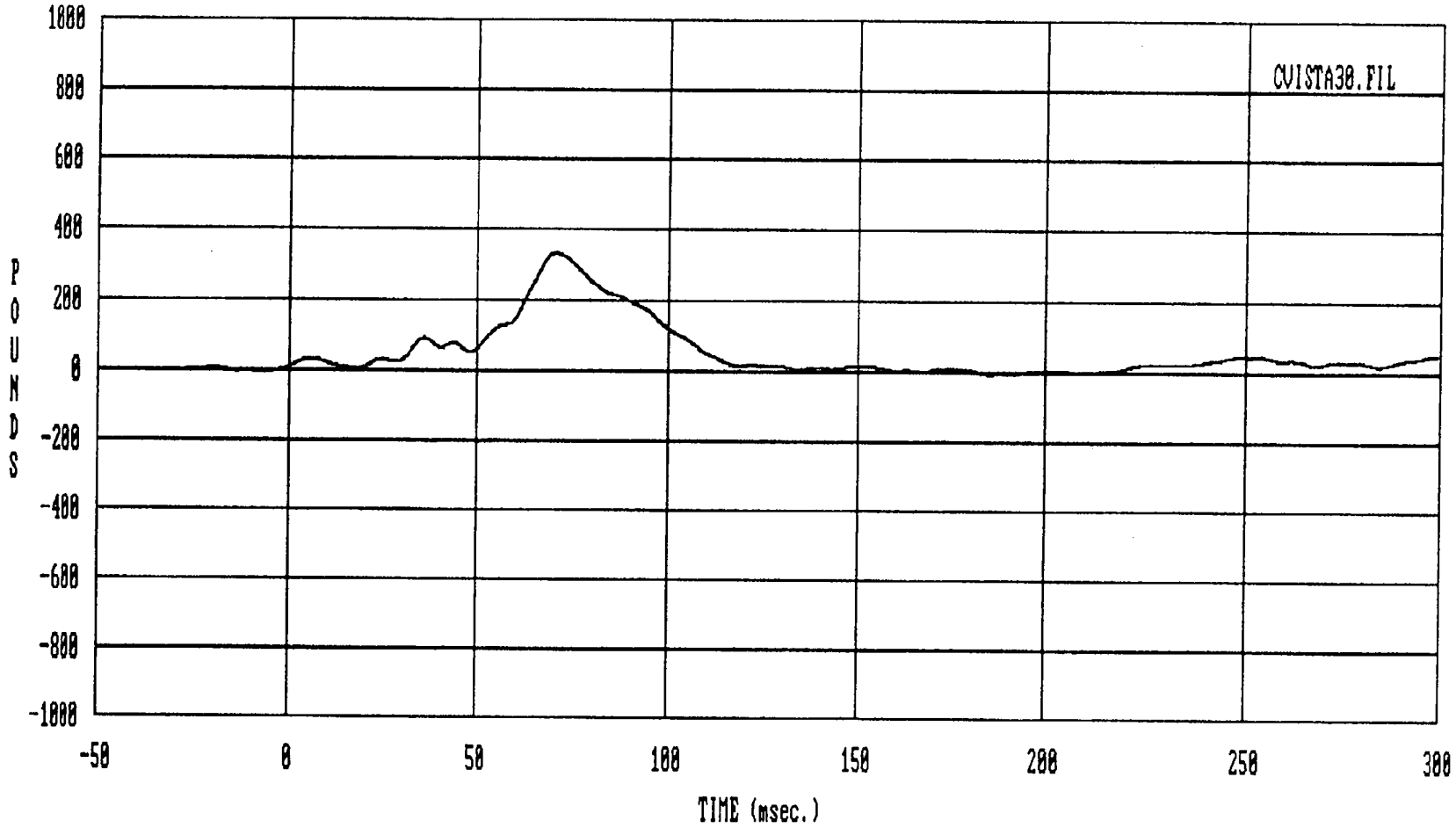
Curve: Passenger rib deflection Filter: SAE CLASS 180 Max = 1.7068 Min = -.39832

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



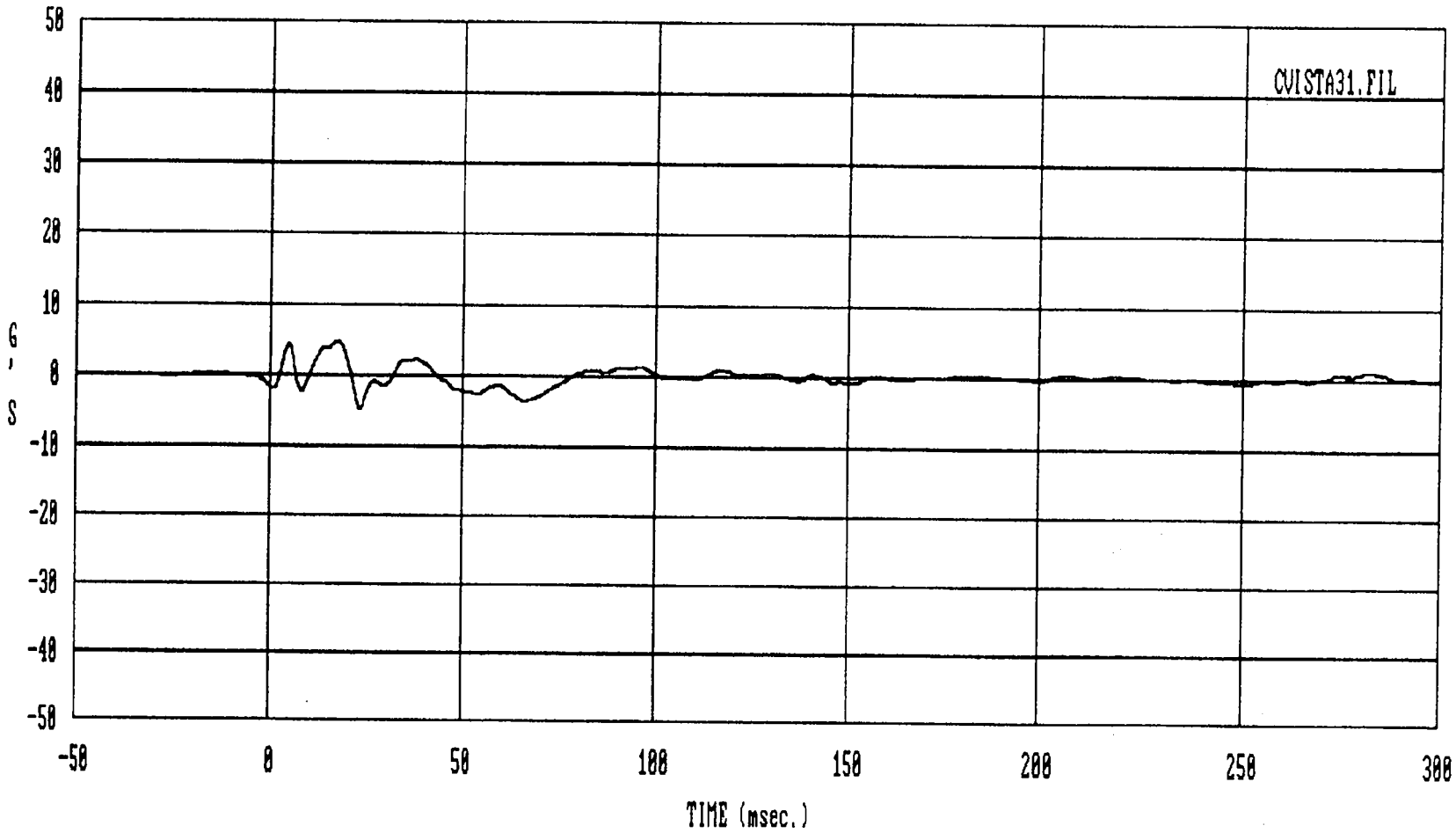
Curve: Passenger lap belt load Filter: SAE CLASS 60 Max = 257.93 Min = 4.6497

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



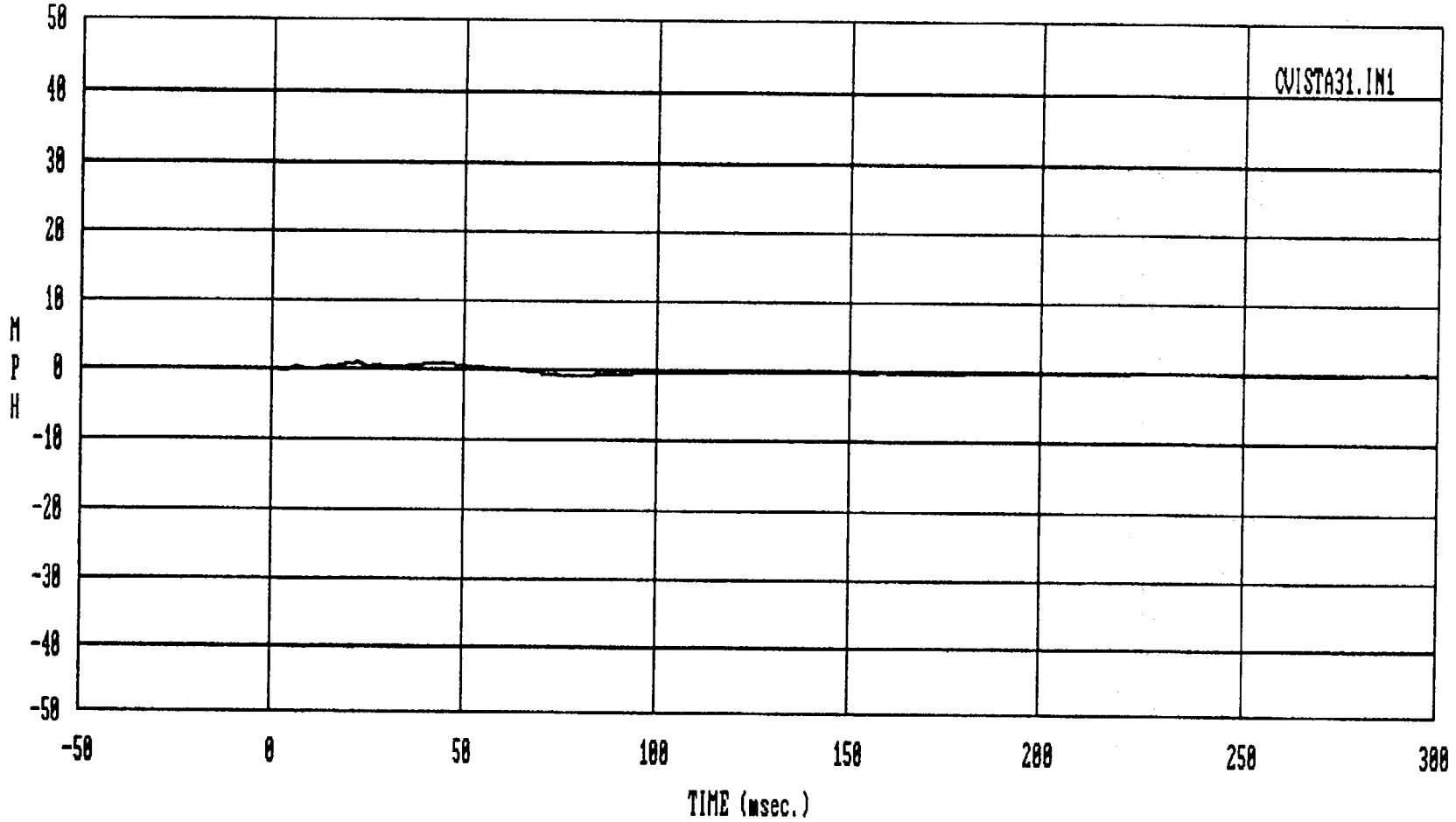
Curve: Passenger shoulder belt load Filter: SAE CLASS 60 Max = 333.15 Min = -6.0140

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



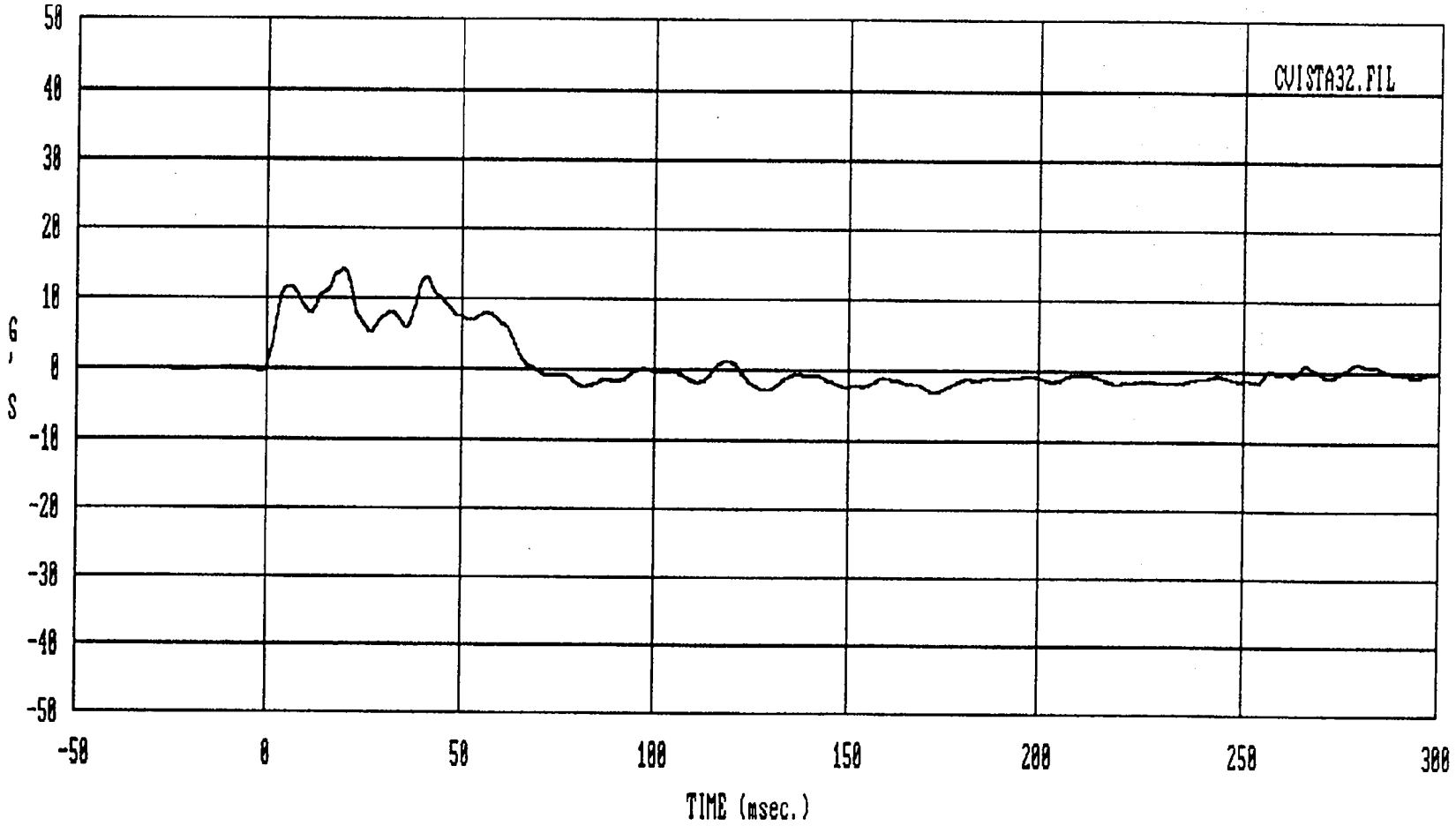
Curve: Front seat right sill acceleration -- X axis Filter: SAE CLASS 60 Max = 4.7756 Min = -4.7267

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



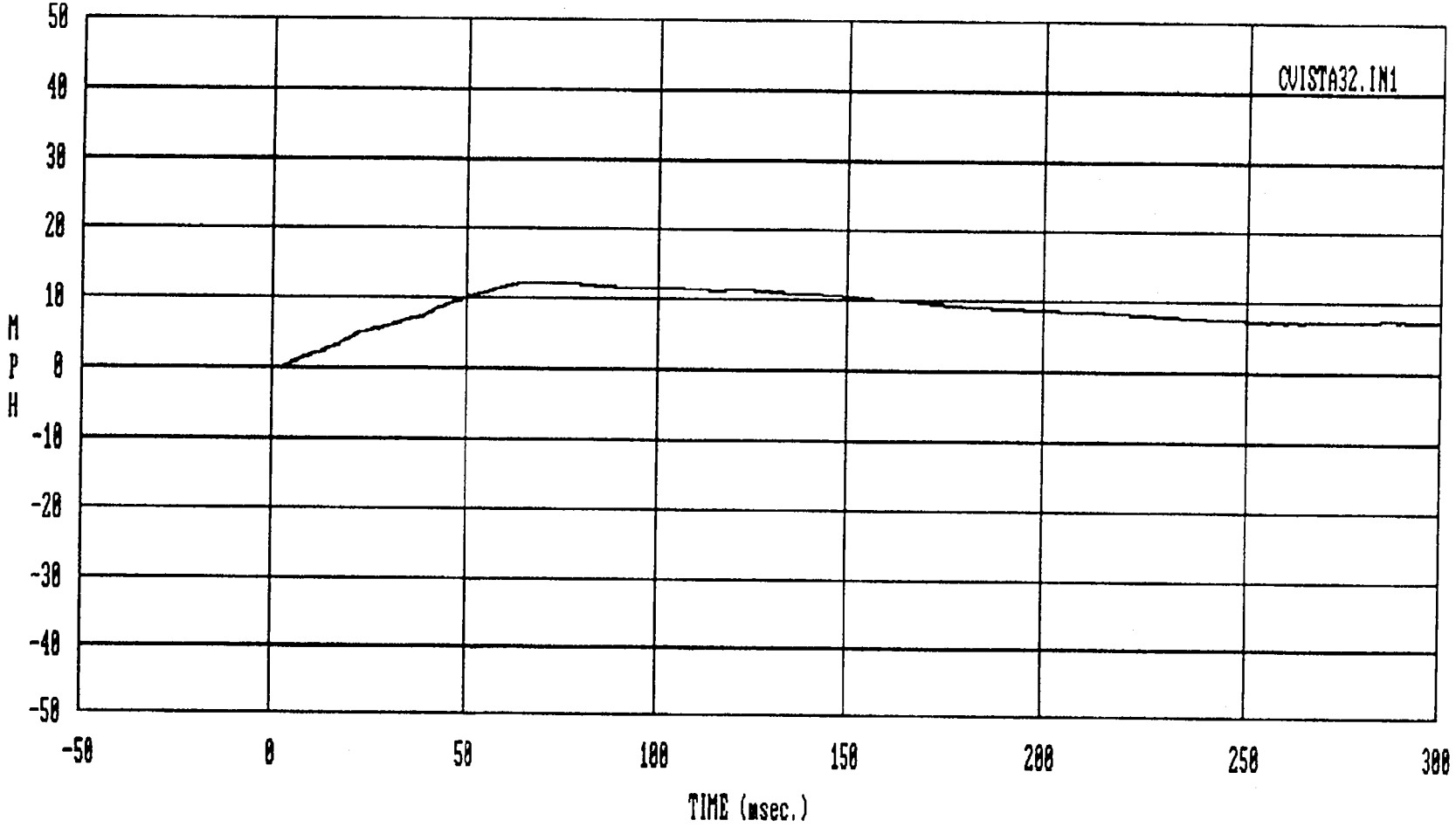
Curve: Front seat right sill delta V -- X axis Filter: SAE CLASS 180 Max = .92454 Min = -.75826

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



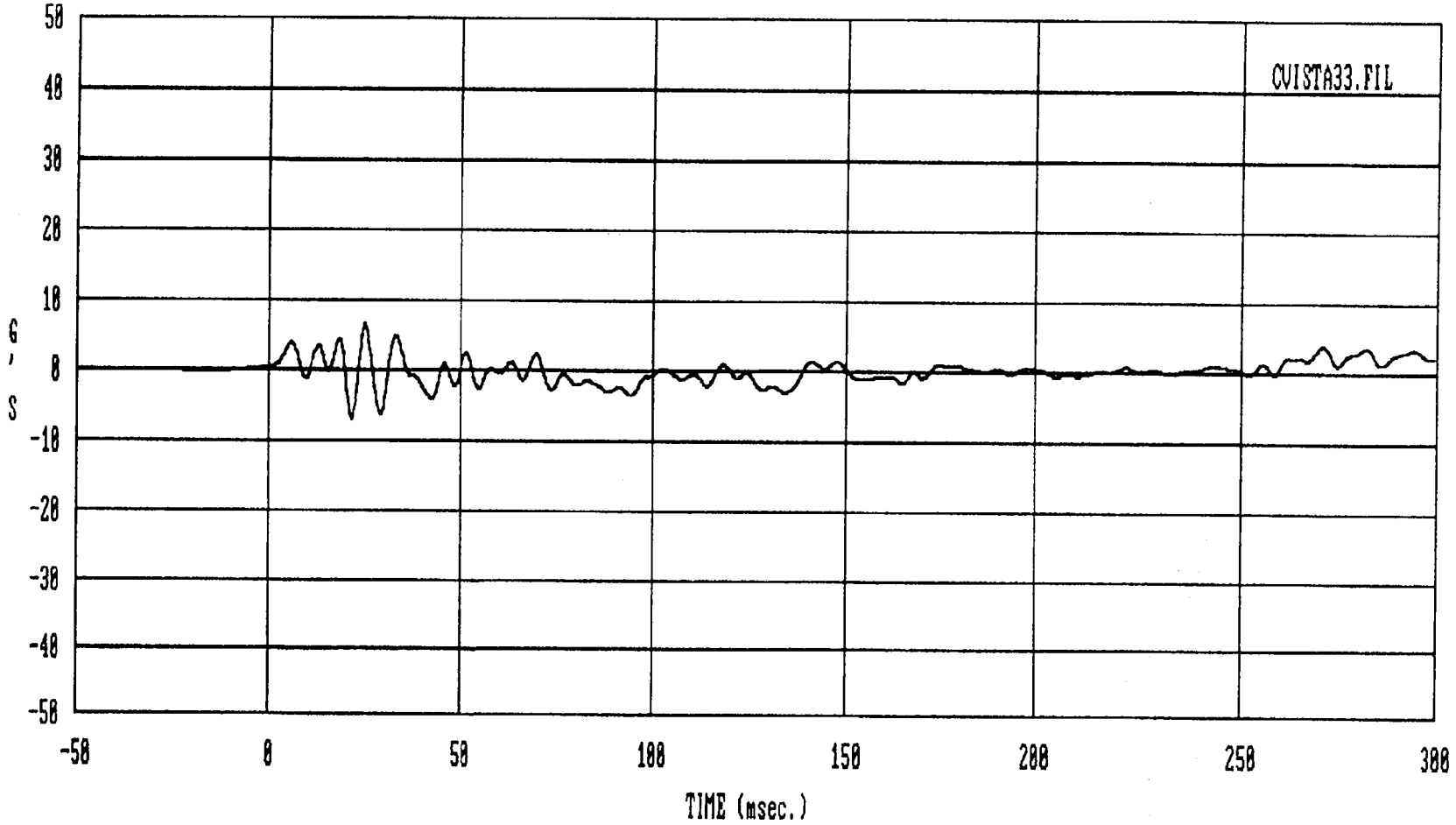
Curve: Front seat right sill acceleration — Y axis Filter: SAE CLASS 60 Max = 14.169 Min = -2.9557

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



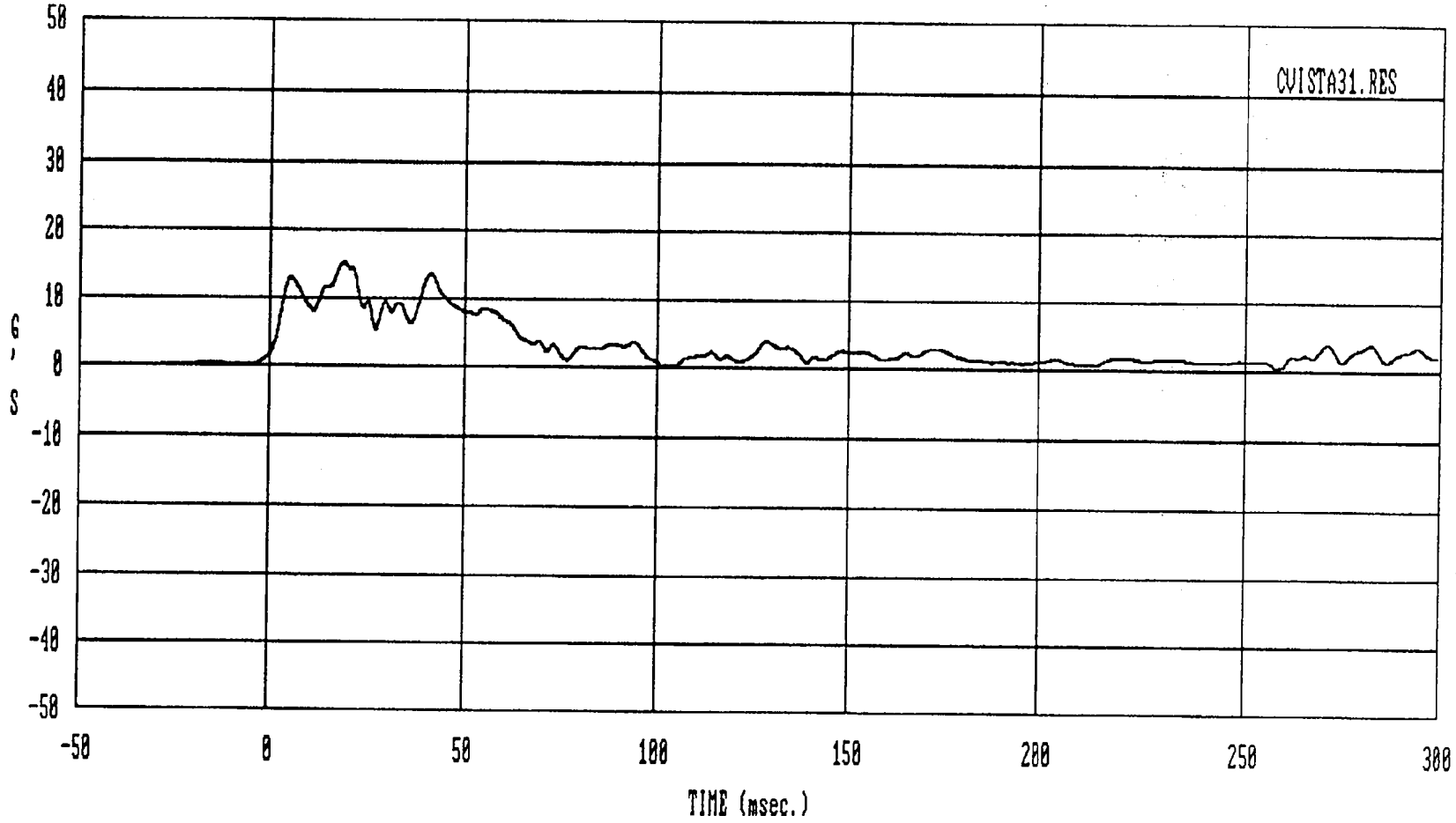
Curve: Front seat right sill delta V -- Y axis Filter: SAE CLASS 180 Max = 12.298 Min = -.14126E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



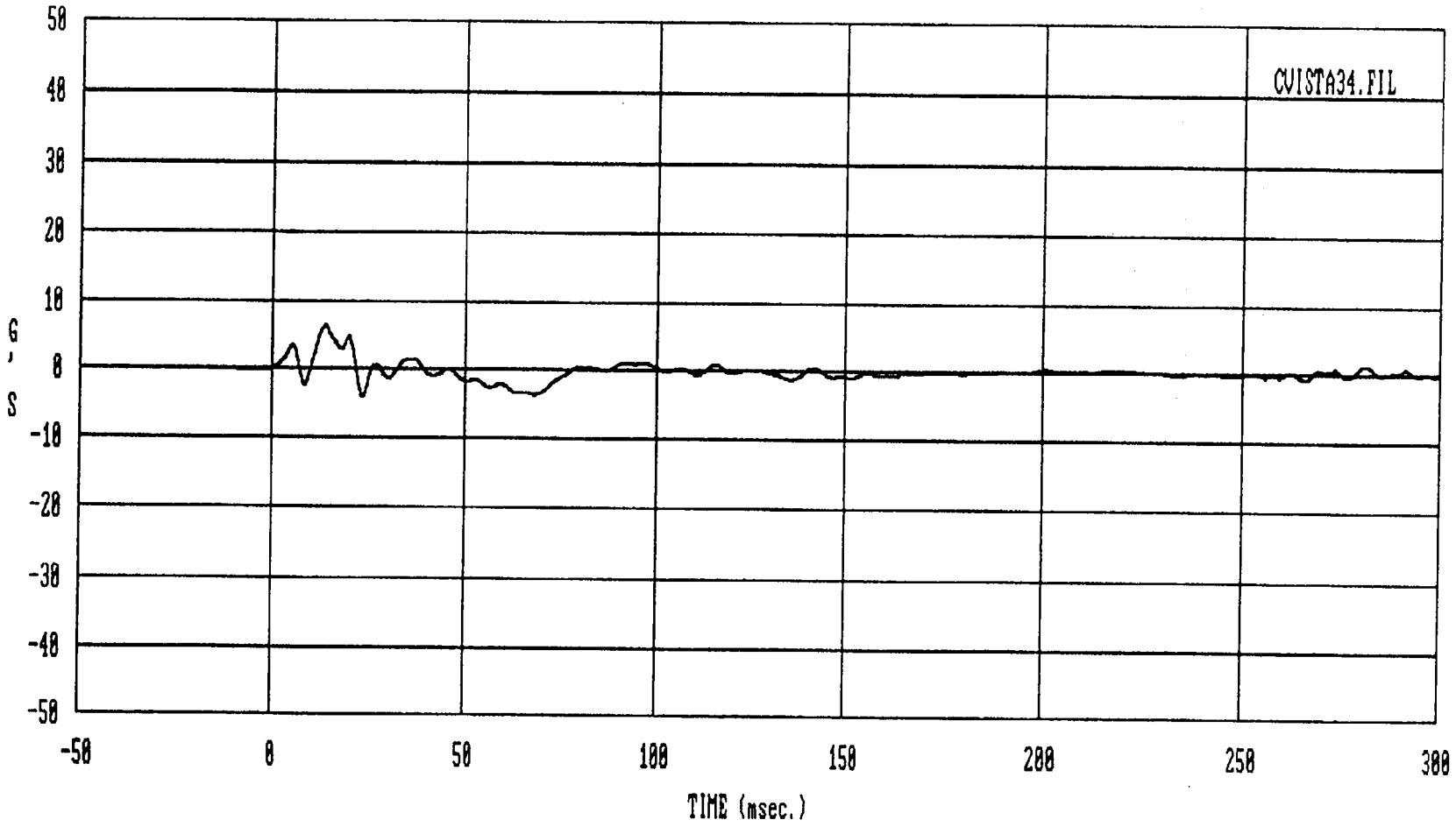
Curve: Front seat right sill acceleration — Z axis Filter: SAE CLASS 60 Max = 6.7916 Min = -6.8382

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



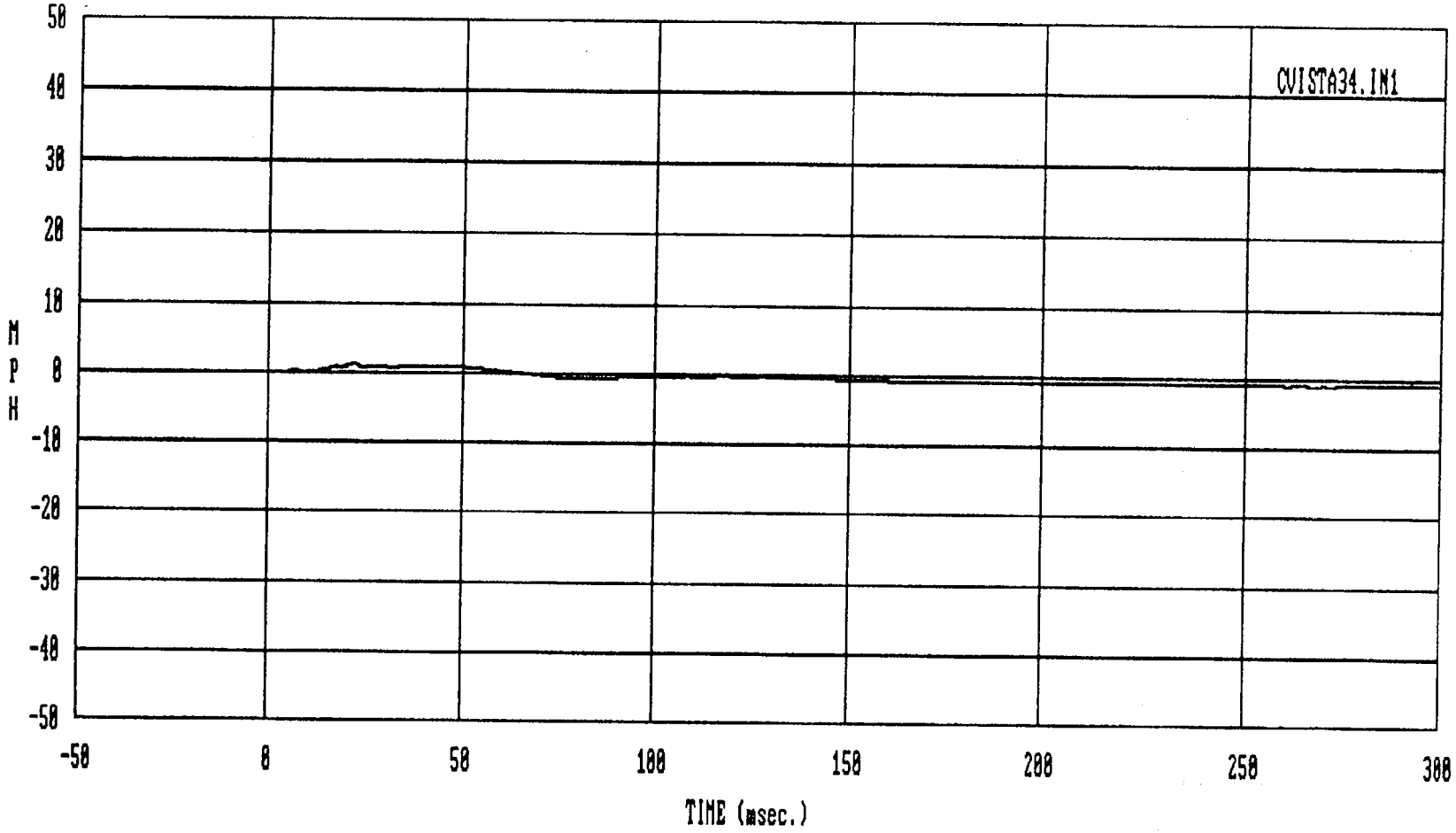
Curve: Front seat right sill resultant acceleration Filter: SAE CLASS 60 Max = 15.122 Min = .28768

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



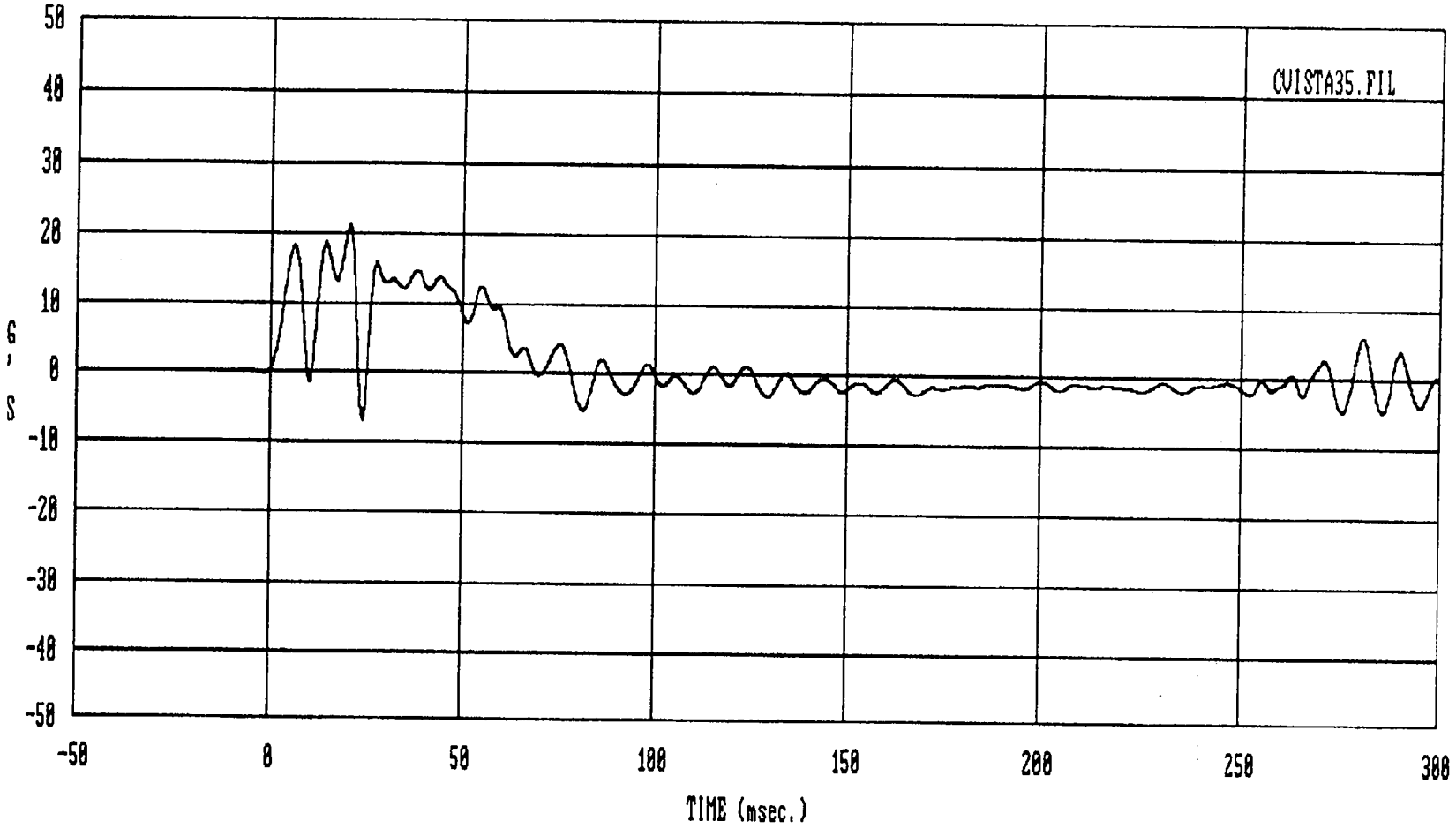
Curve: Rear seat right sill acceleration — X axis Filter: SAE CLASS 60 Max = 6.4152 Min = -4.1946

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



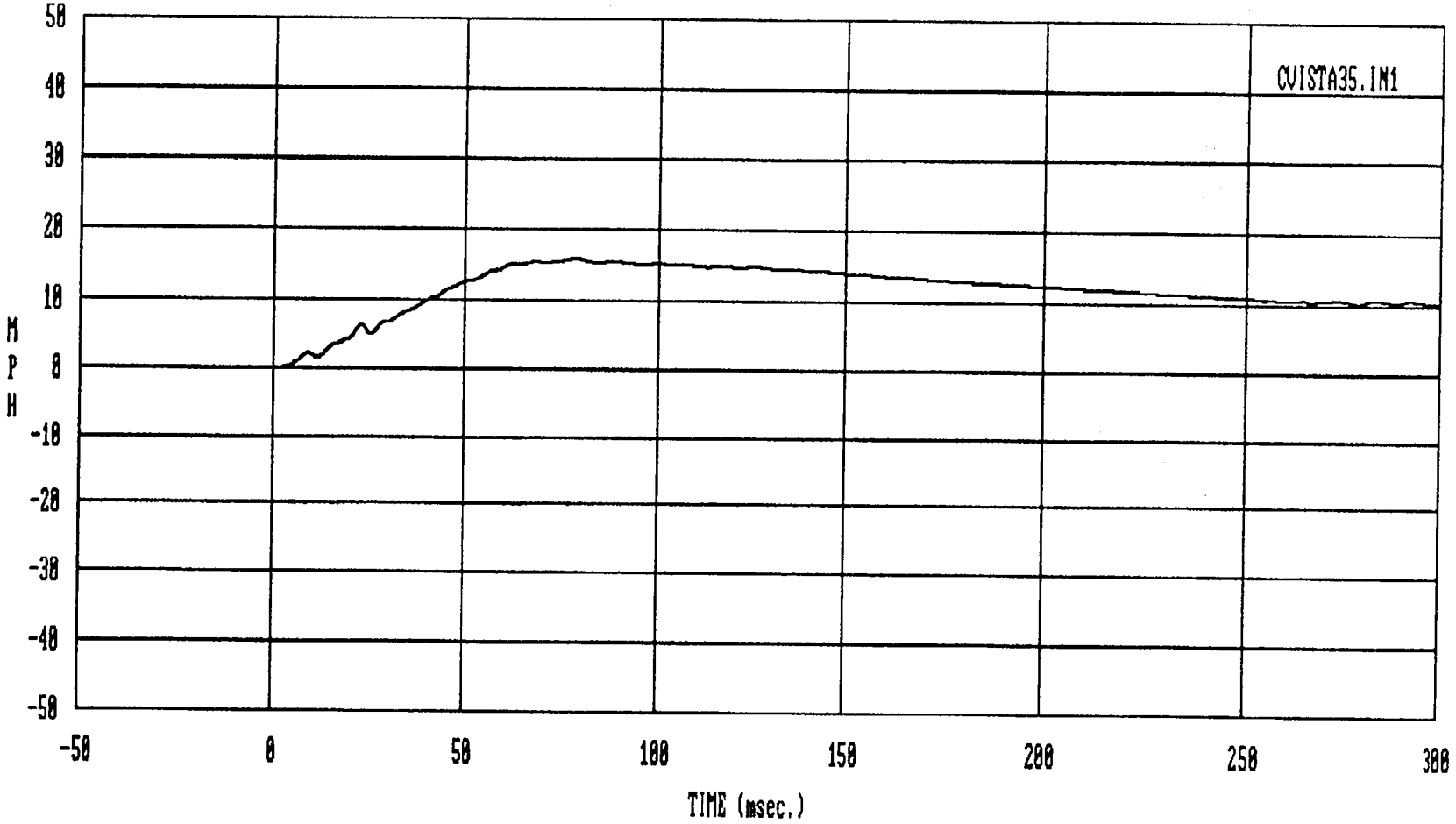
Curve: Rear seat right sill delta V -- X axis Filter: SAE CLASS 180 Max = 1.3318 Min = -.95321

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



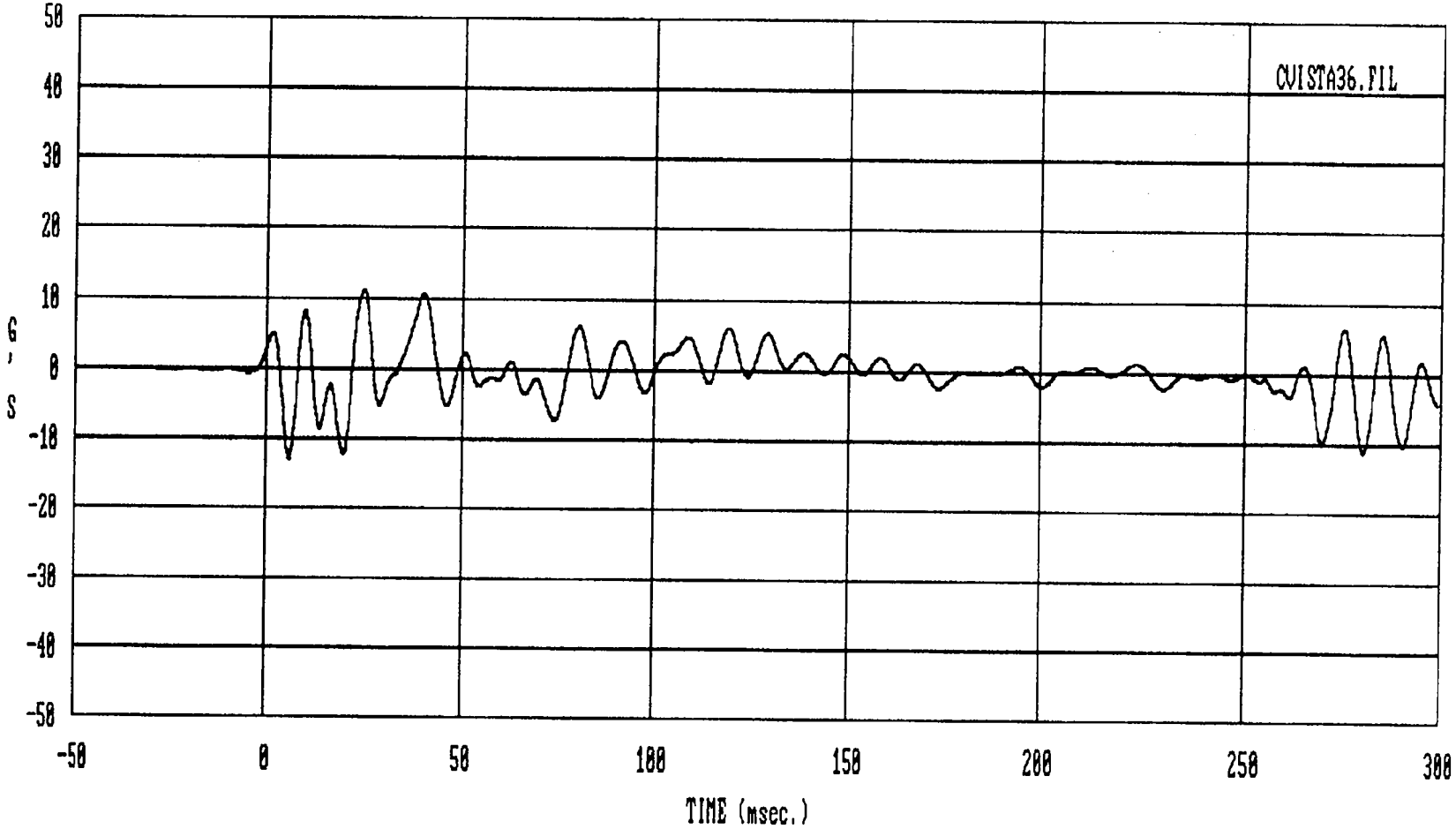
Curve: Rear seat right sill acceleration -- Y axis Filter: SAE CLASS 60 Max = 21.234 Min = -6.7943

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



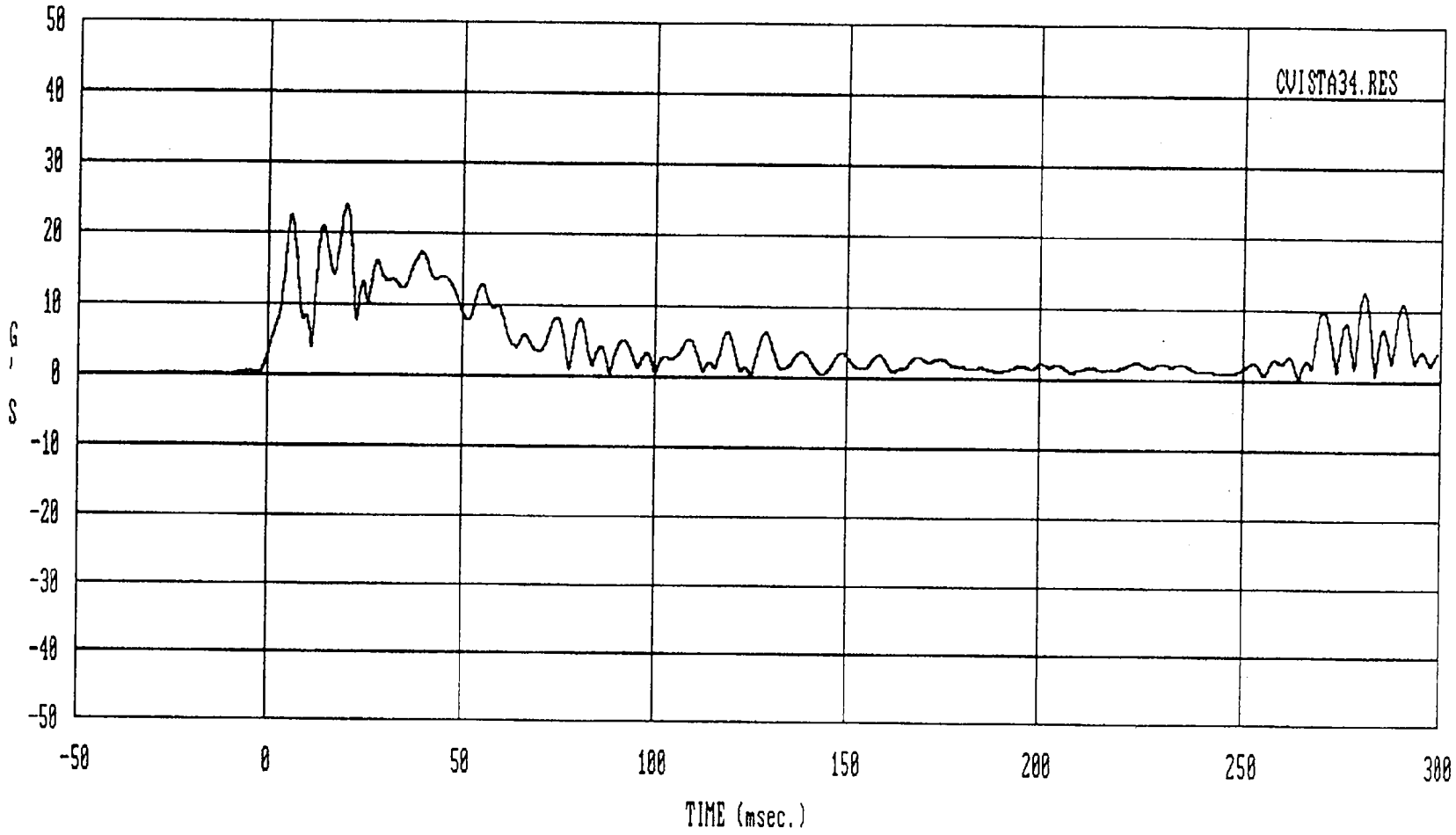
Curve: Rear seat right sill delta V — Y axis Filter: SAE CLASS 180 Max = 15.879 Min = 1.7257

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



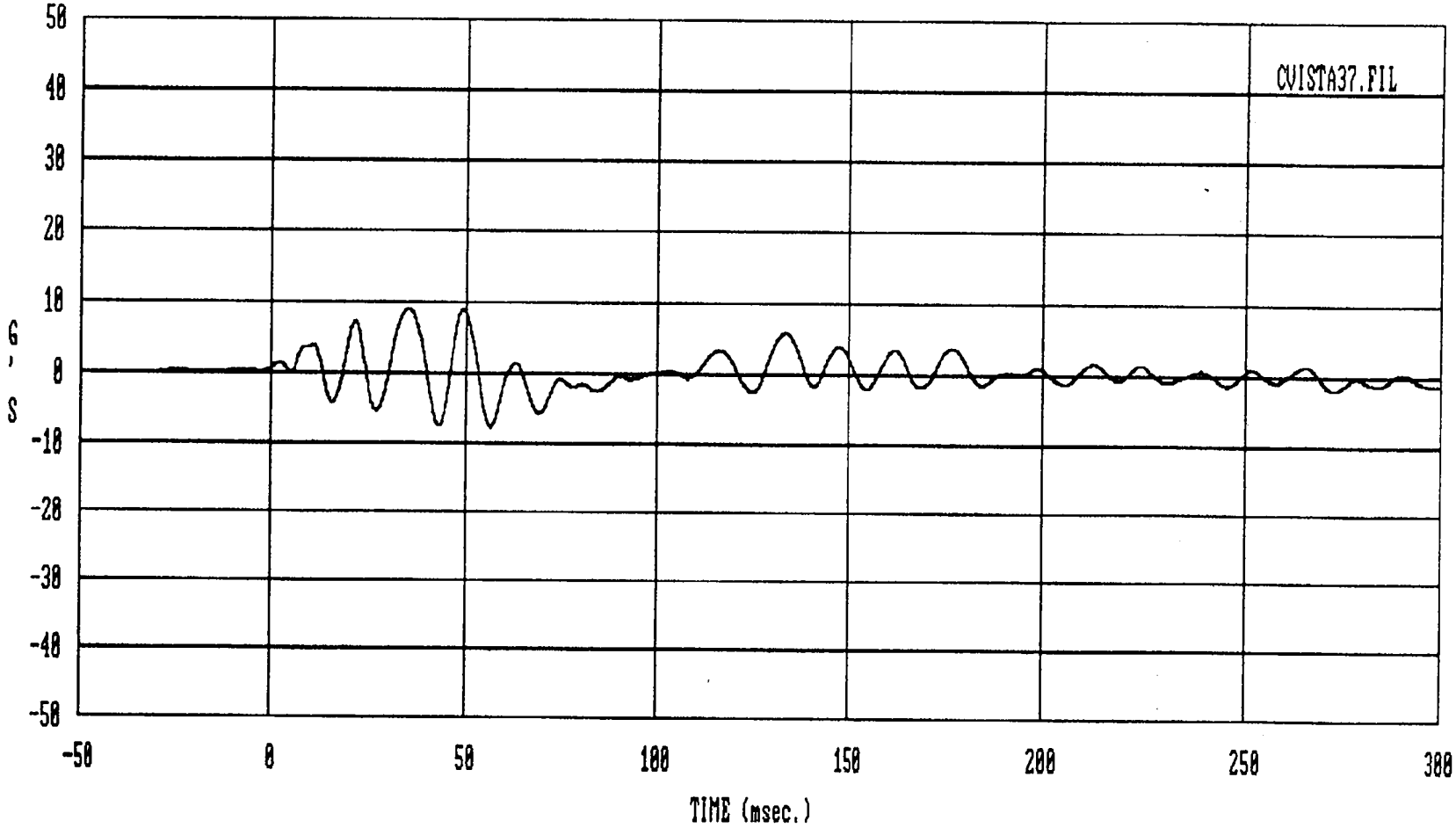
Curve: Rear seat right sill acceleration — Z axis Filter: SAE CLASS 60 Max = 11.295 Min = -12.887

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



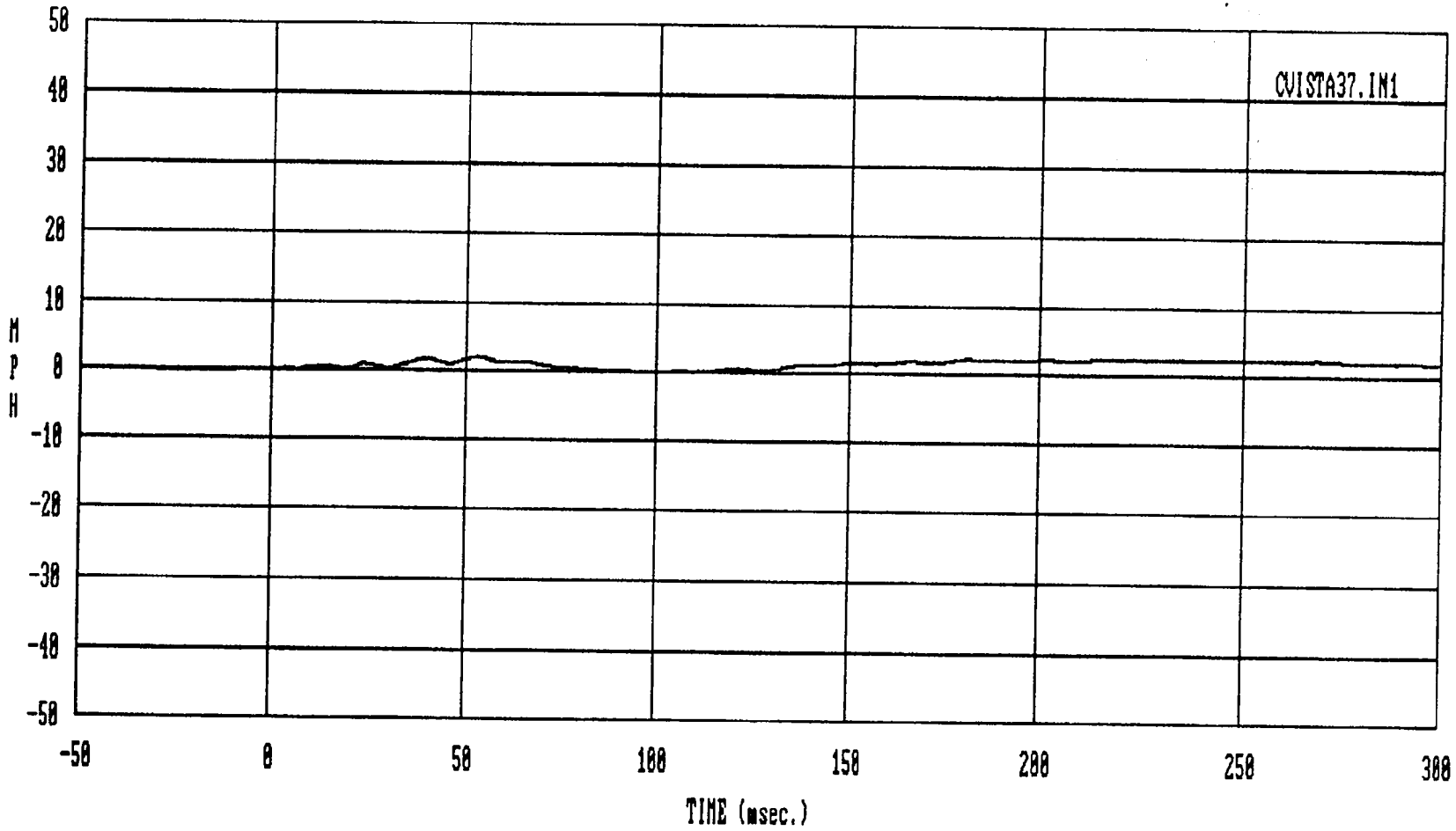
Curve: Rear seat right sill resultant acceleration Filter: SAE CLASS 60 Max = 24.130 Min = .23629

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



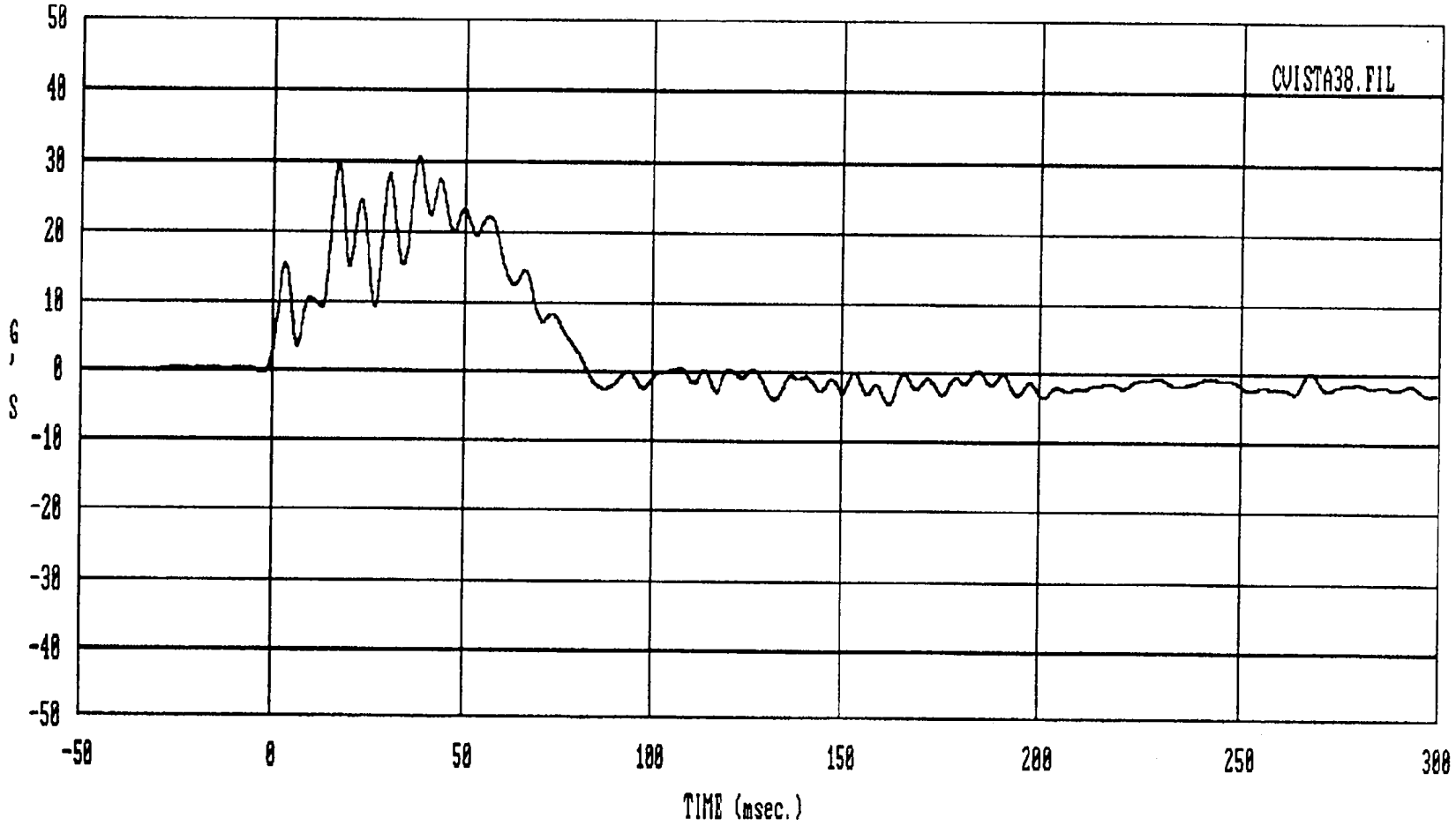
Curve: Rear floor above axle acceleration — X axis Filter: SAE CLASS 60 Max = 9.0794 Min = -7.6076

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



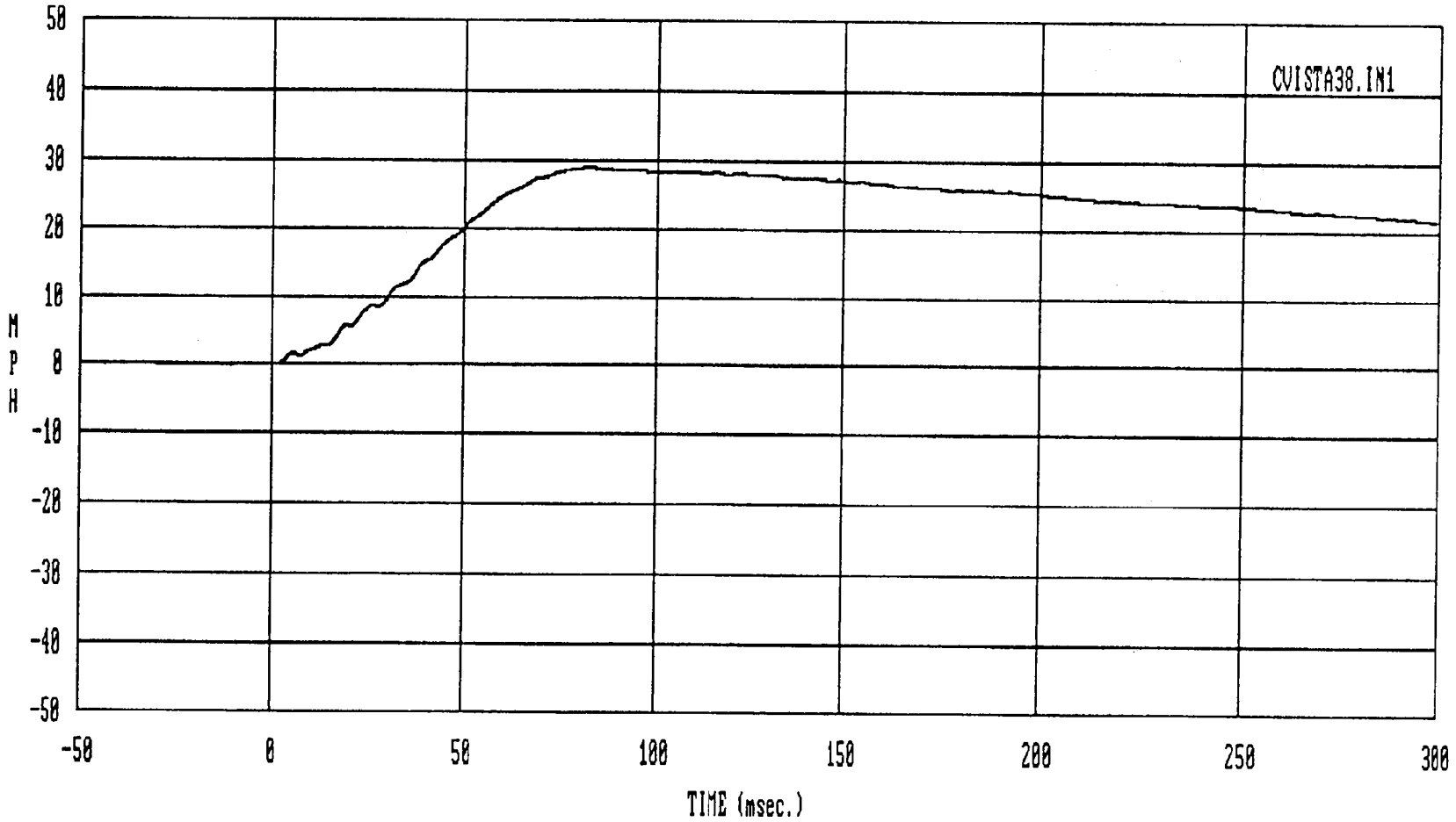
Curve: Rear floor above axle delta V — X axis Filter: SAE CLASS 180 Max = 2.4798 Min = .25887E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



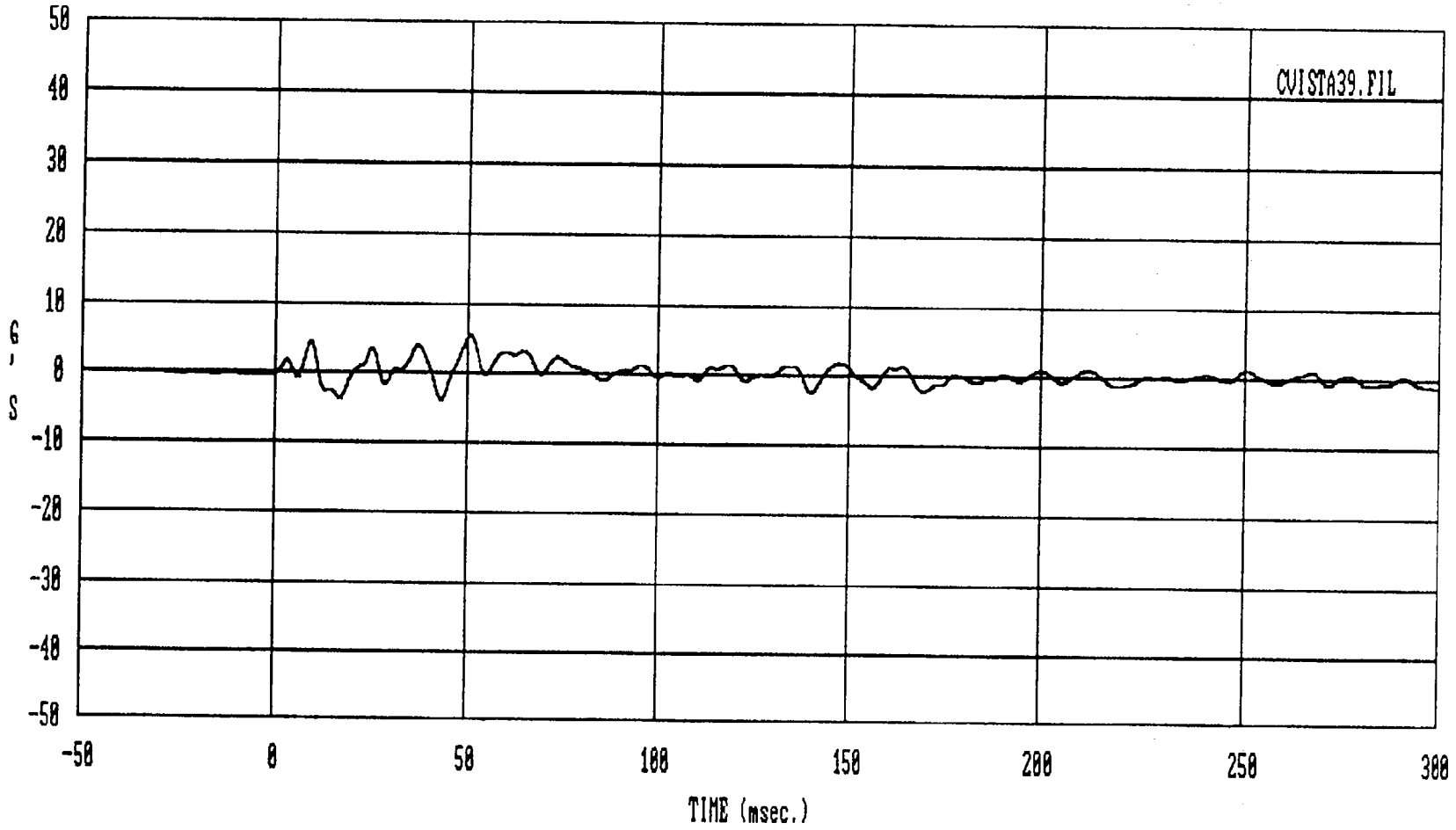
Curve: Rear floor above axle acceleration -- Y axis Filter: SAE CLASS 60 Max = 38.665 Min = -4.5533

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



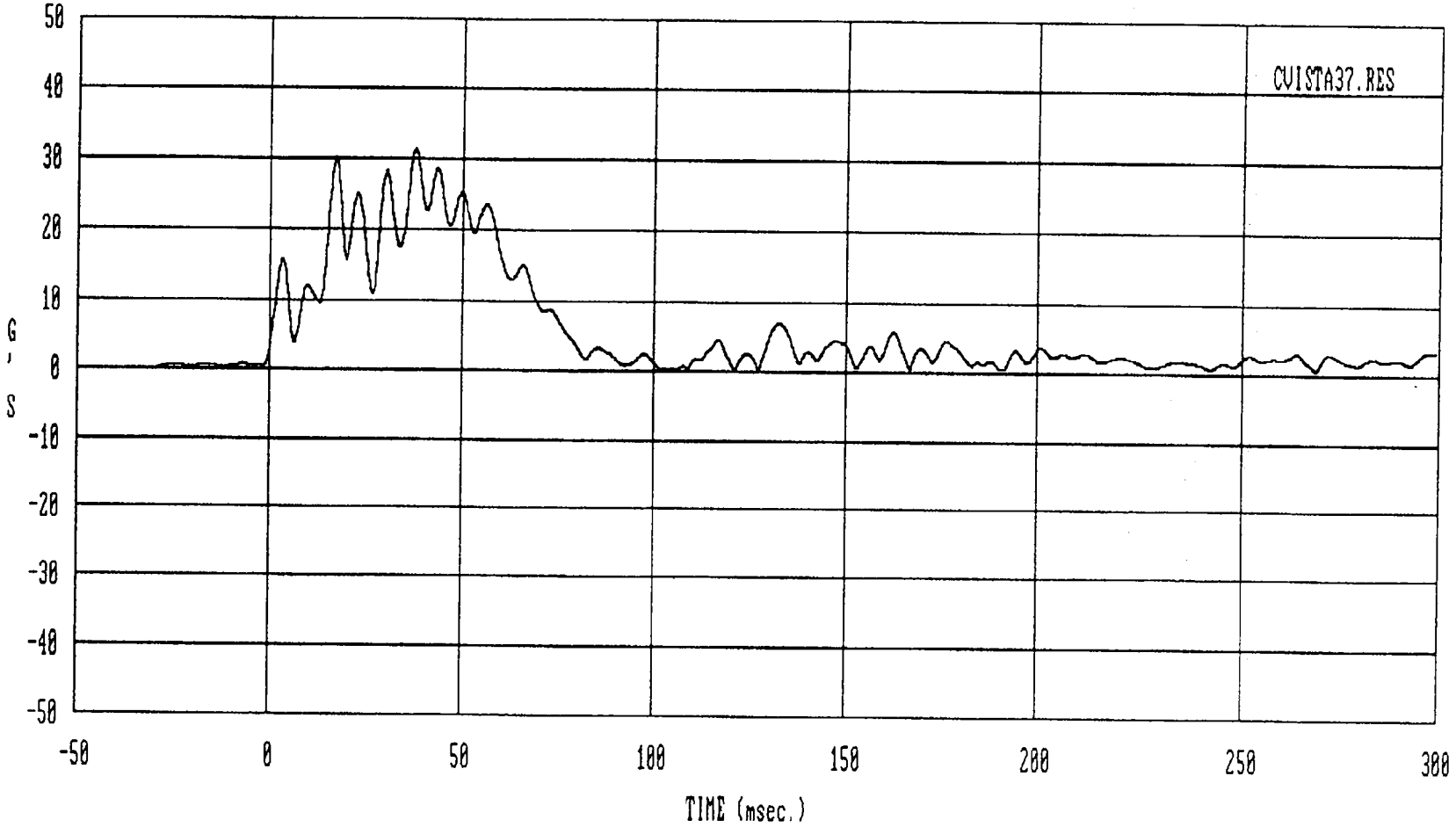
Curve: Rear floor above axle delta V -- Y axis Filter: SAE CLASS 180 Max = 29.837 Min = -.45846E-02

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



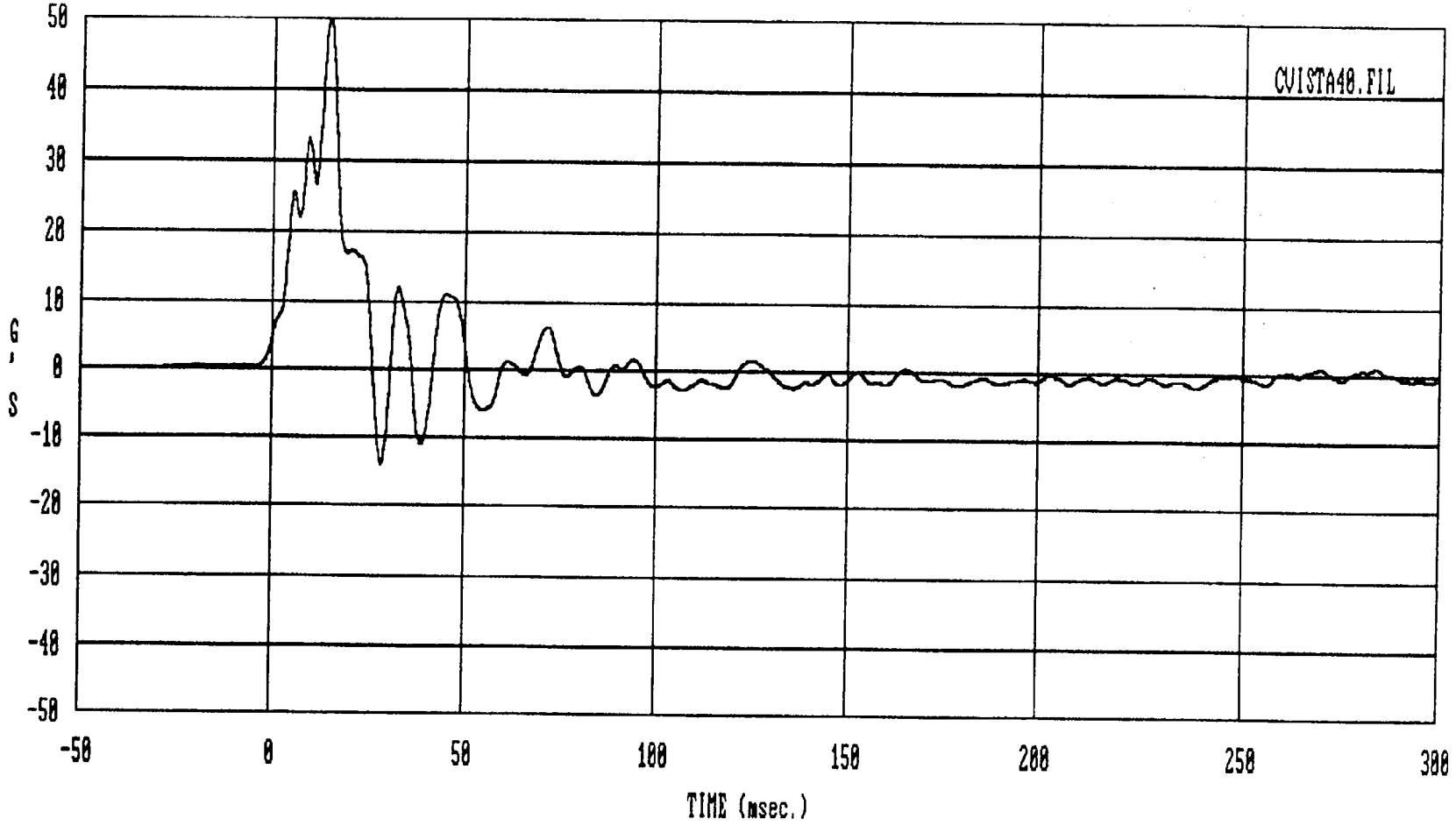
Curve: Rear floor above axle acceleration — Z axis Filter: SAE CLASS 60 Max = 5.5114 Min = -3.8704

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



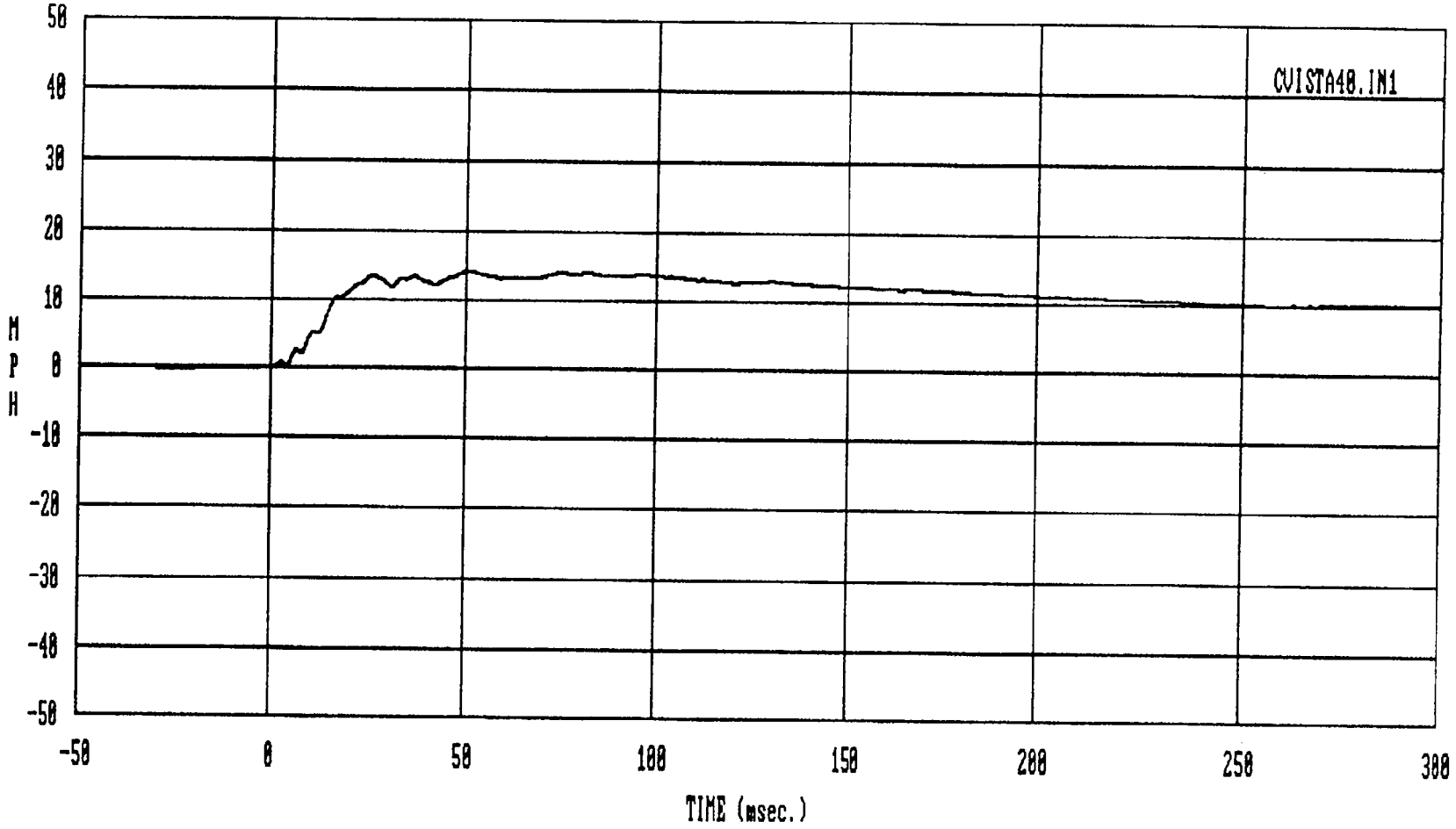
Curve: Rear floor above axle resultant acceleration Filter: SAE CLASS 60 Max = 31.453 Min = .89077E-01

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



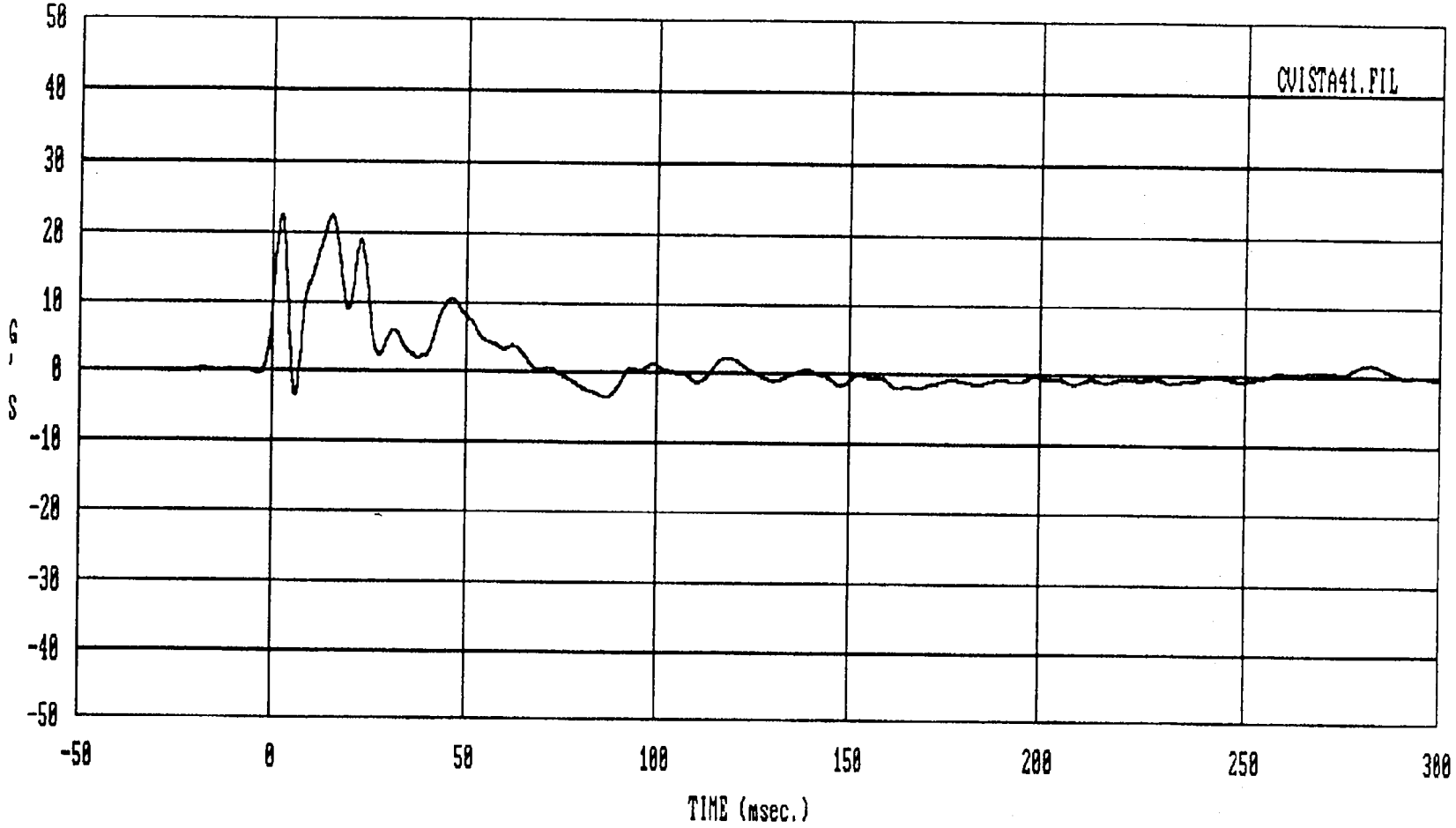
Curve: Rear seat left sill acceleration — Y axis Filter: SAE CLASS 60 Max = 50.551 Min = -13.891

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



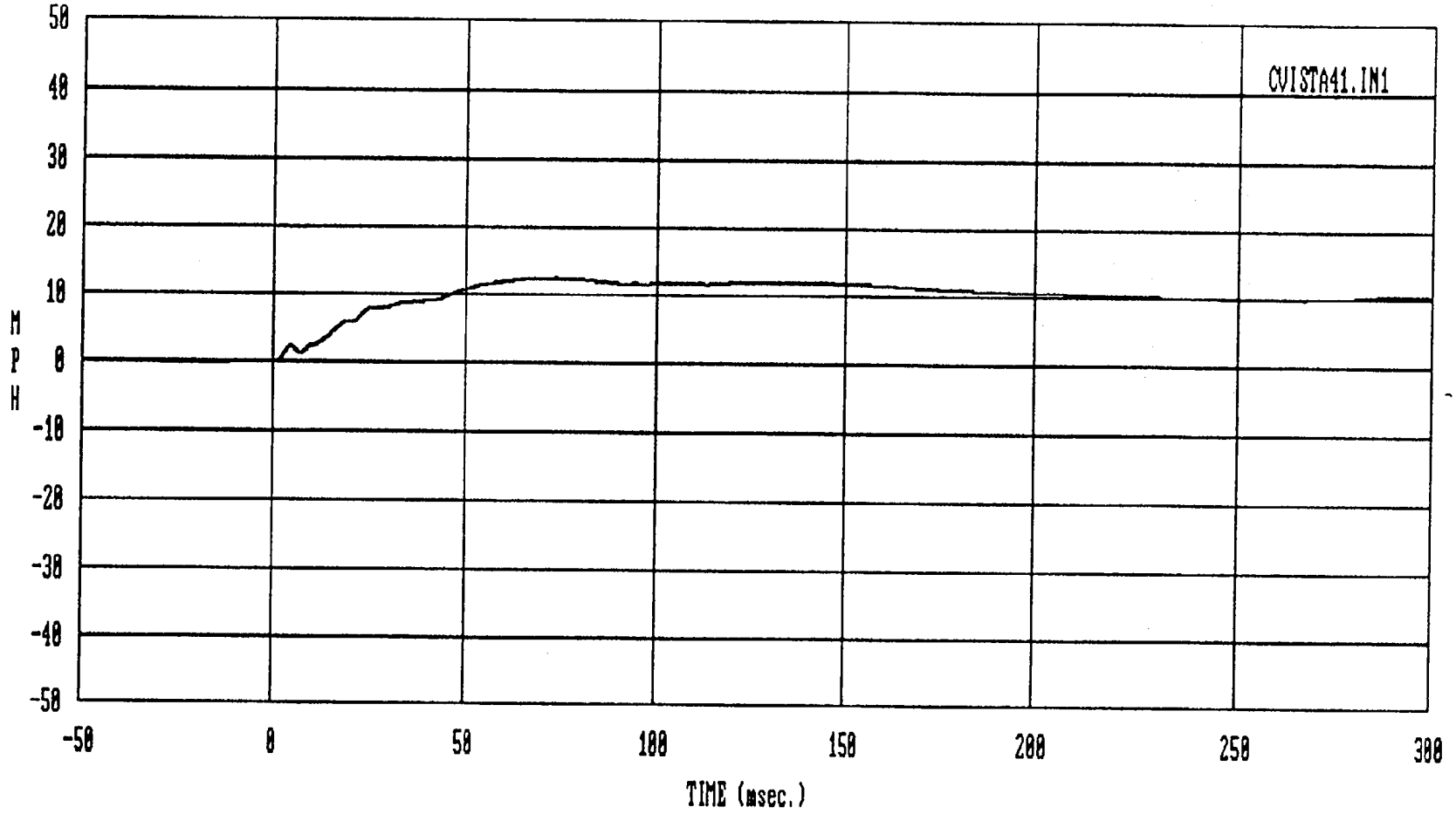
Curve: Rear seat left sill delta V — Y axis Filter: SAE CLASS 180 Max = 14.226 Min = .22837

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



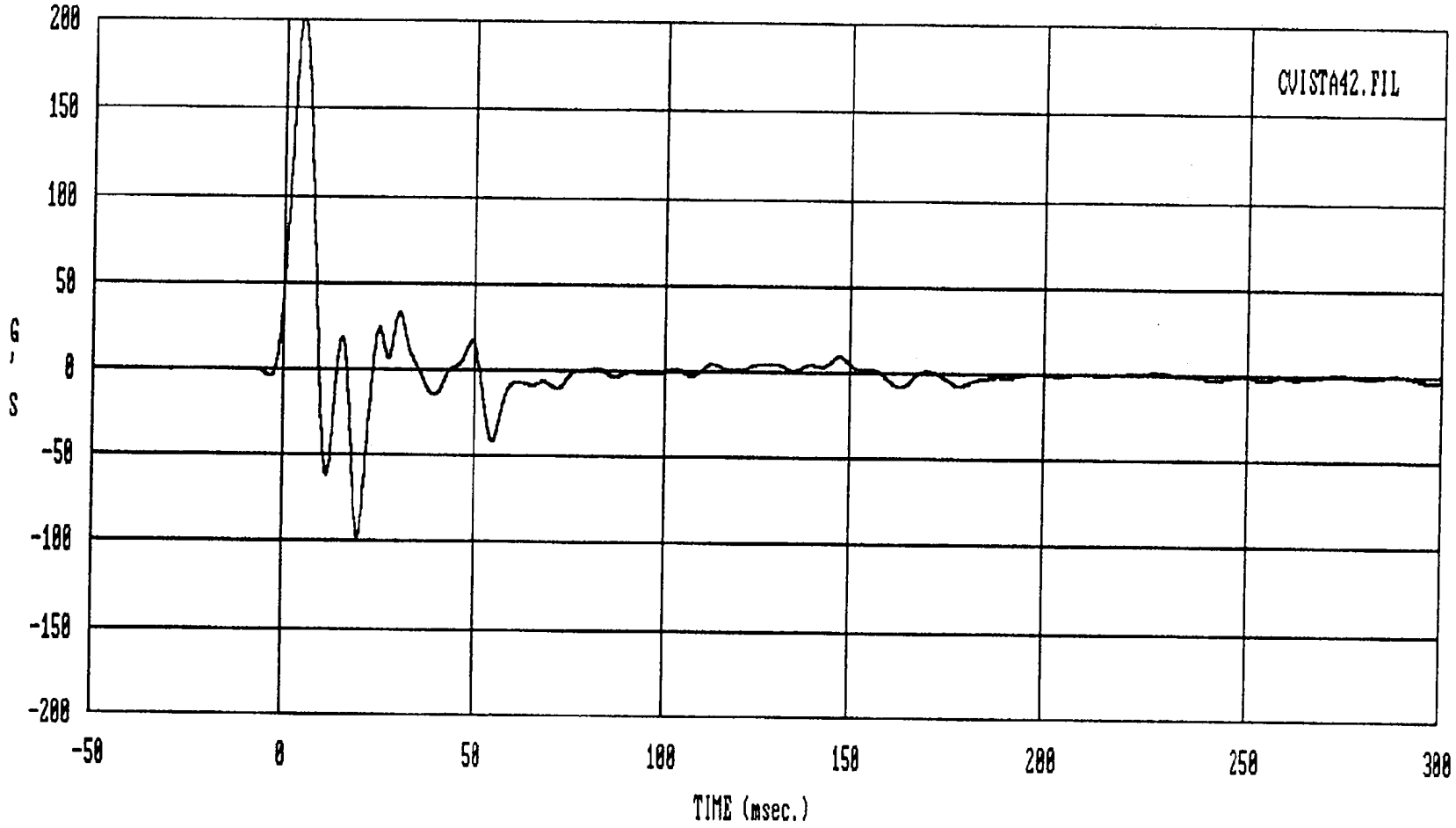
Curve: Front seat left Sill acceleration — Y axis Filter: SAE CLASS 60 Max = 22.673 Min = -3.5689

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



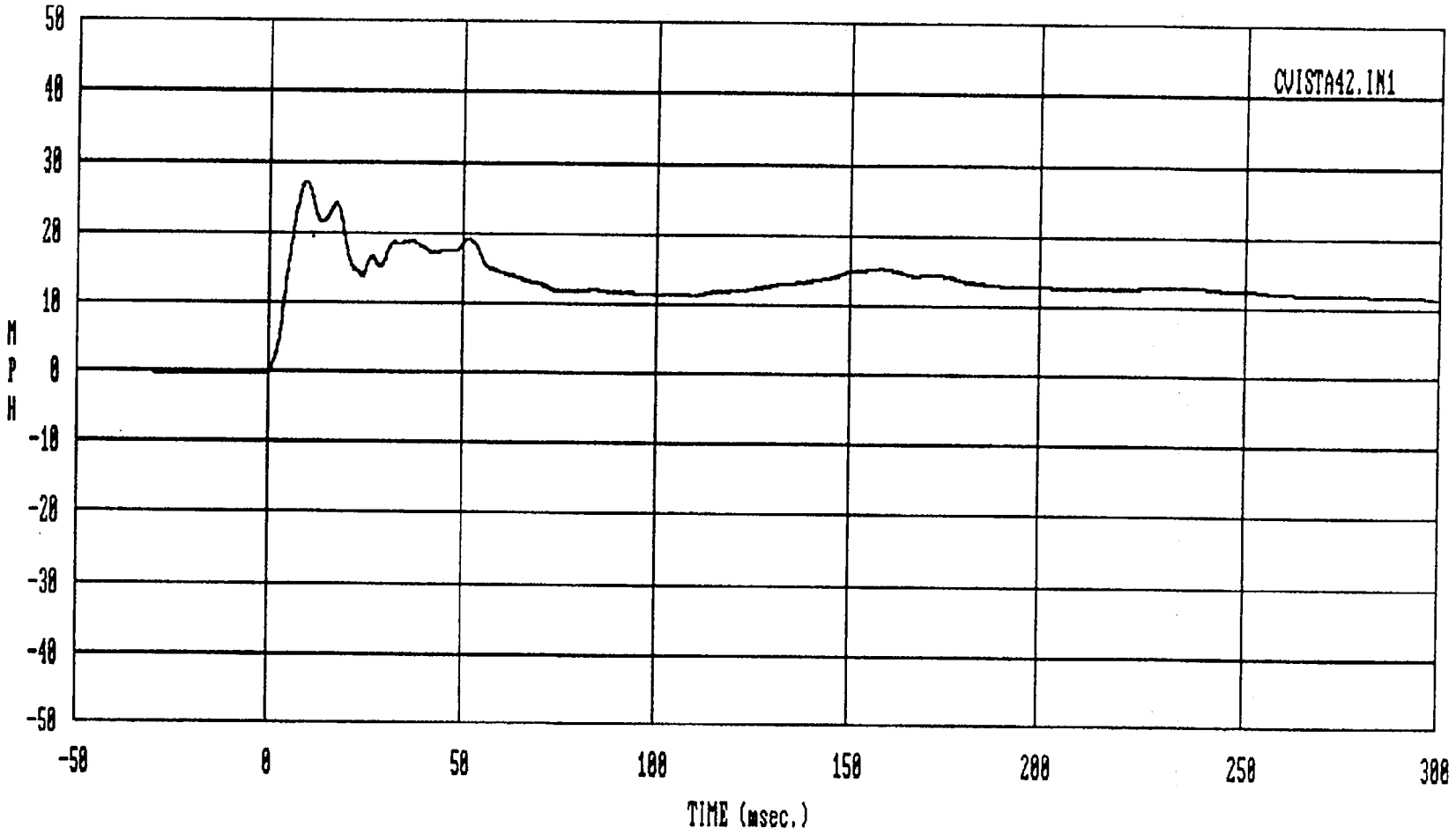
Curve: Front seat left Sill delta V — Y axis Filter: SAE CLASS 180 Max = 12.485 Min = 1.2645

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



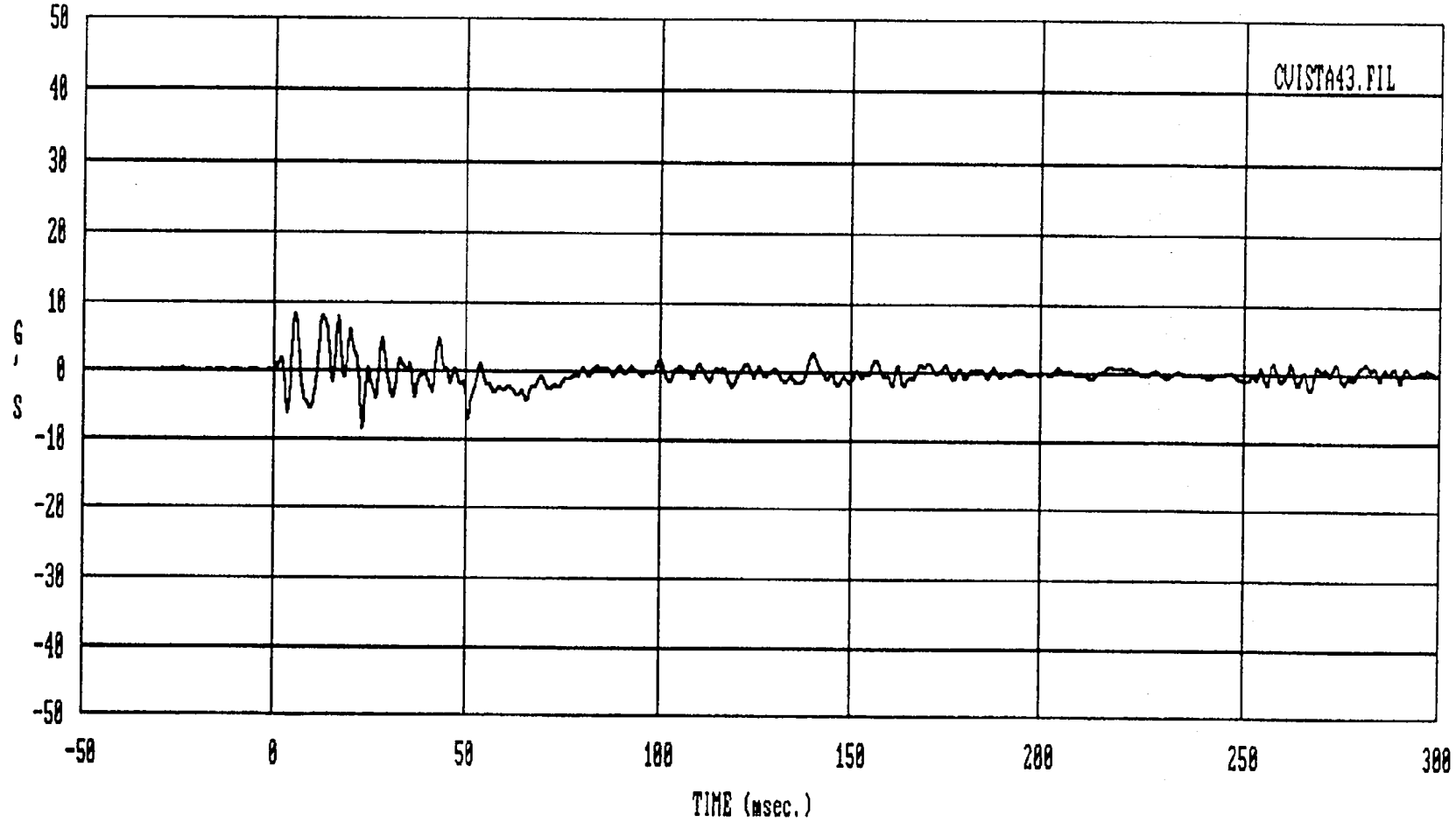
Curve: Left front door at centerline -- Y axis Filter: SAE CLASS 60 Max = 282.22 Min = -97.389

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



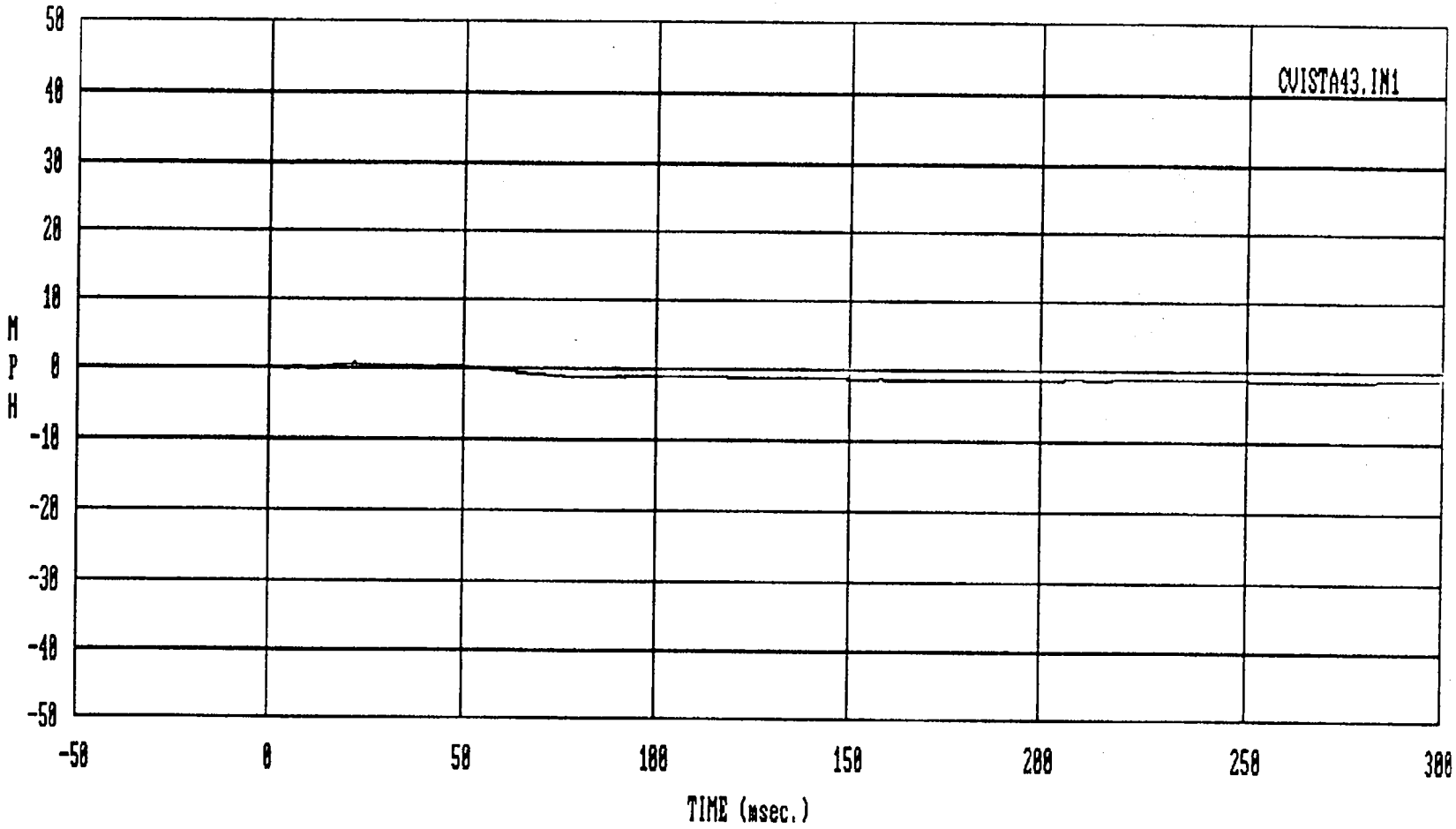
Curve: Left front door at centerline — Y axis Filter: SAE CLASS 180 Max = 27.481 Min = 11.414

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



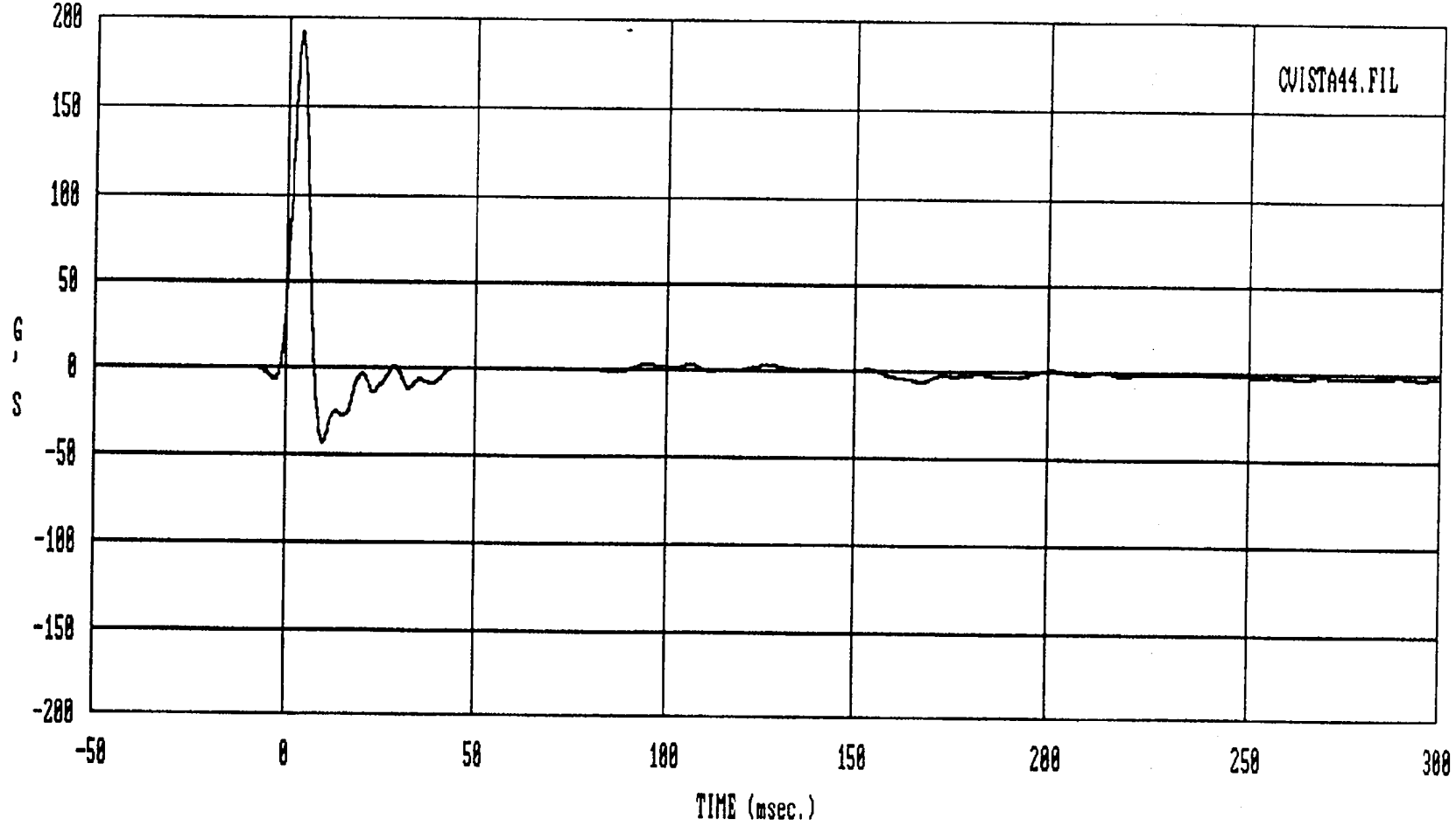
Curve: Right rear occupant compartment -- X axis Filter: SAE CLASS 60 Max = 8.4652 Min = -8.3725

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



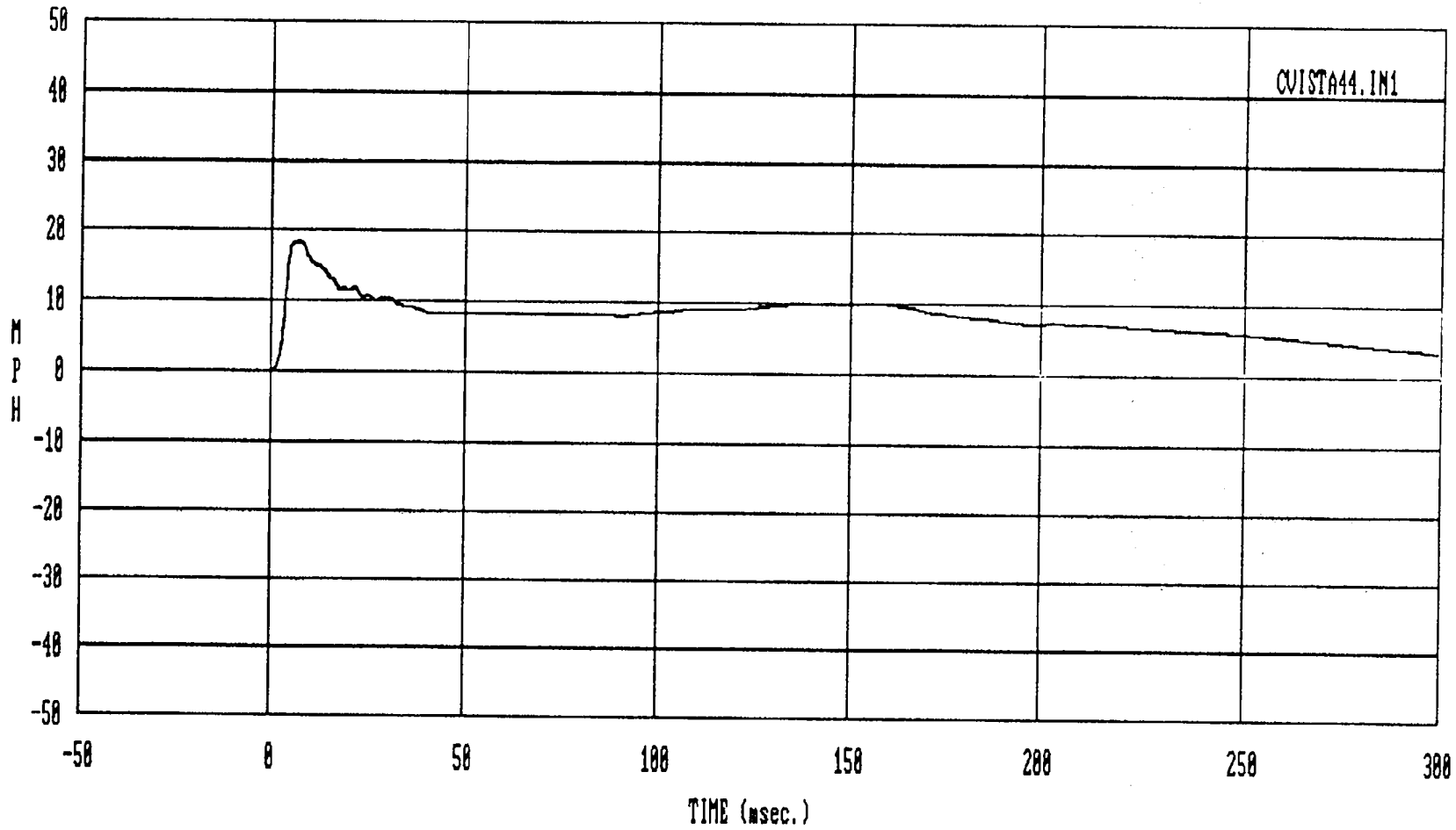
Curve: Right rear occupant compartment — X axis Filter: SAE CLASS 180 Max = .71837 Min = -1.4129

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



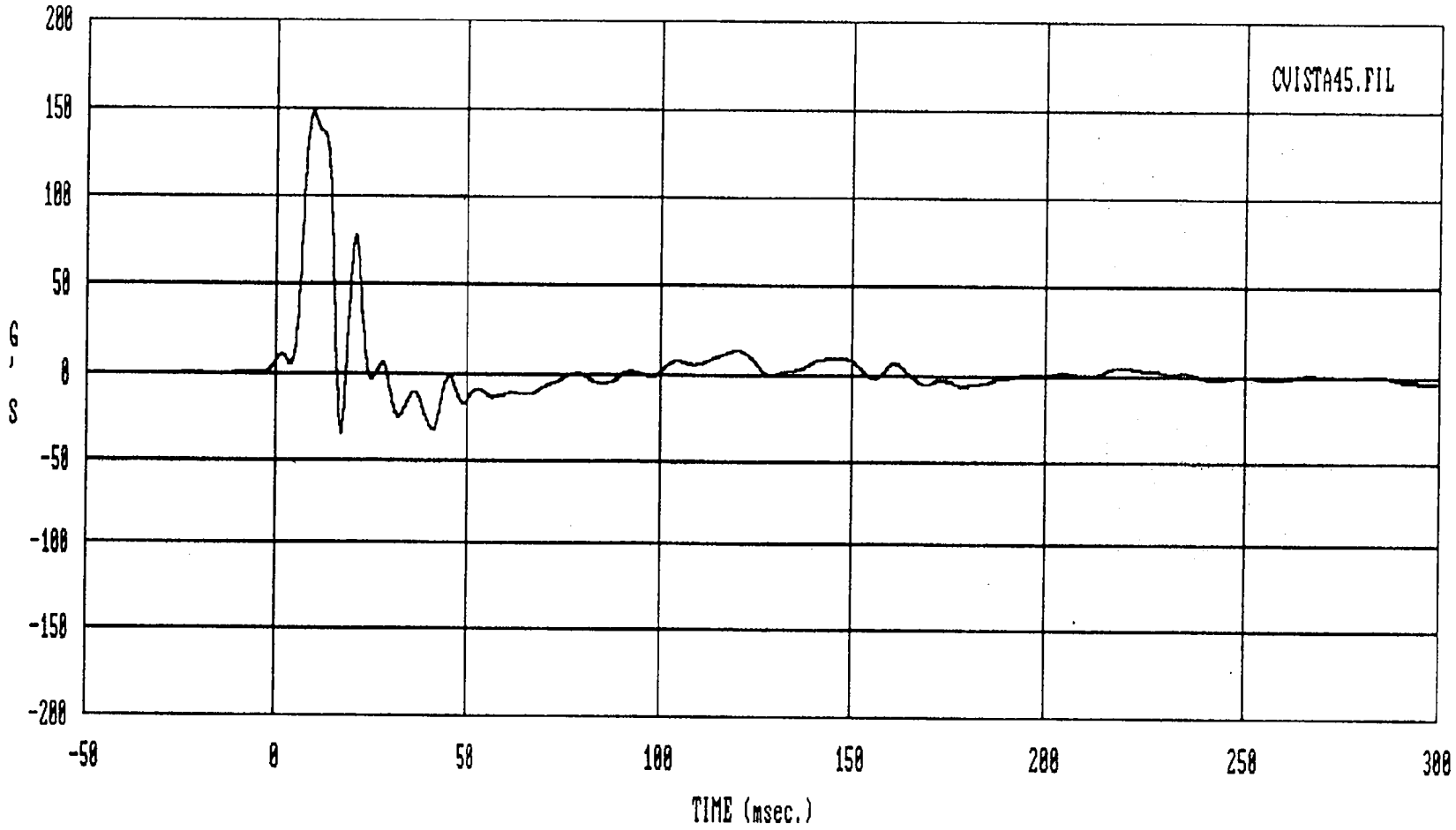
Curve: Left front door at mid-rear — Y axis Filter: SAE CLASS 60 Max = 192.75 Min = -43.136

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



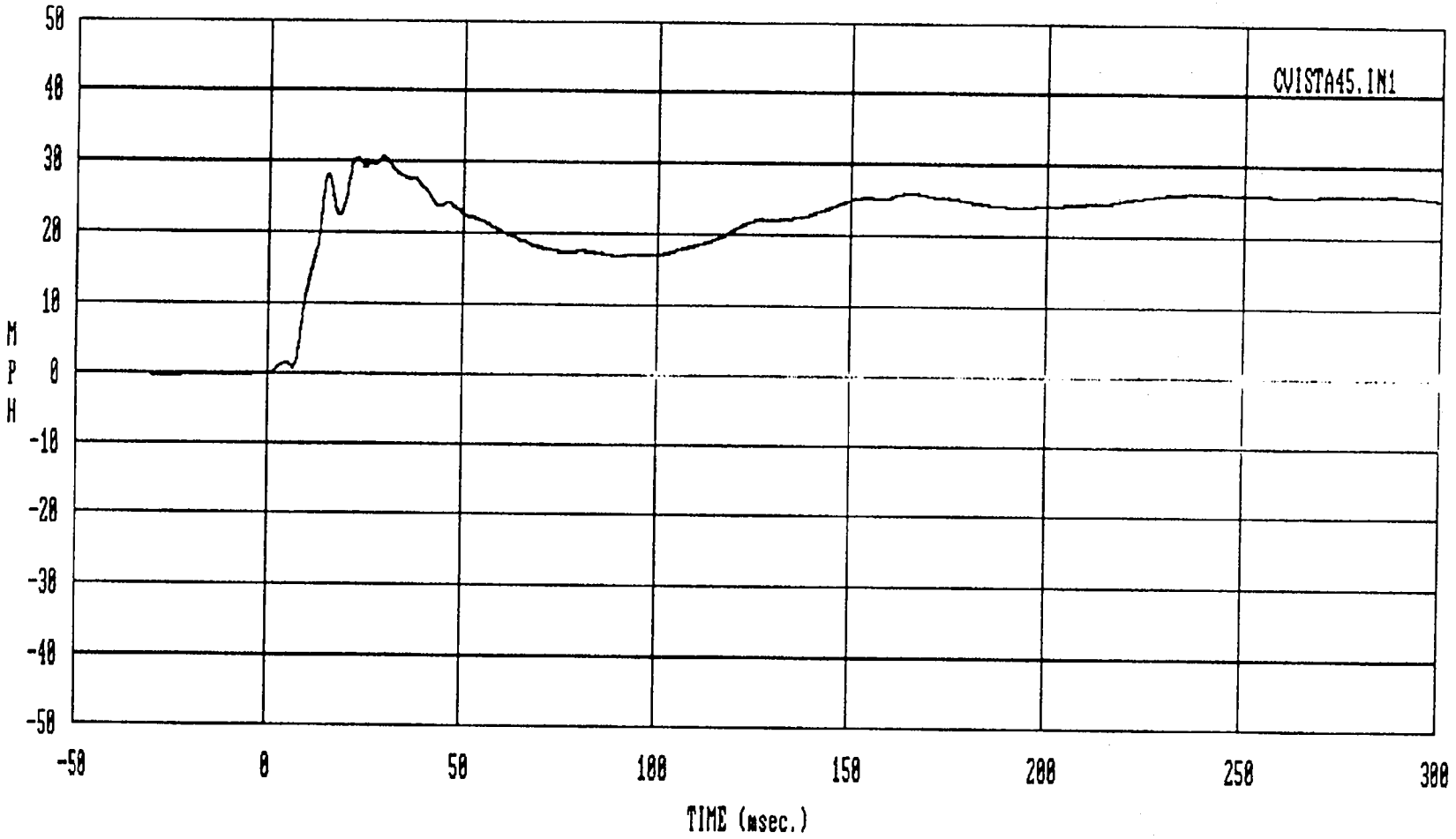
Curve: Left front door at mid-rear — Y axis Filter: SAE CLASS 180 Max = 18.380 Min = 3.5548

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



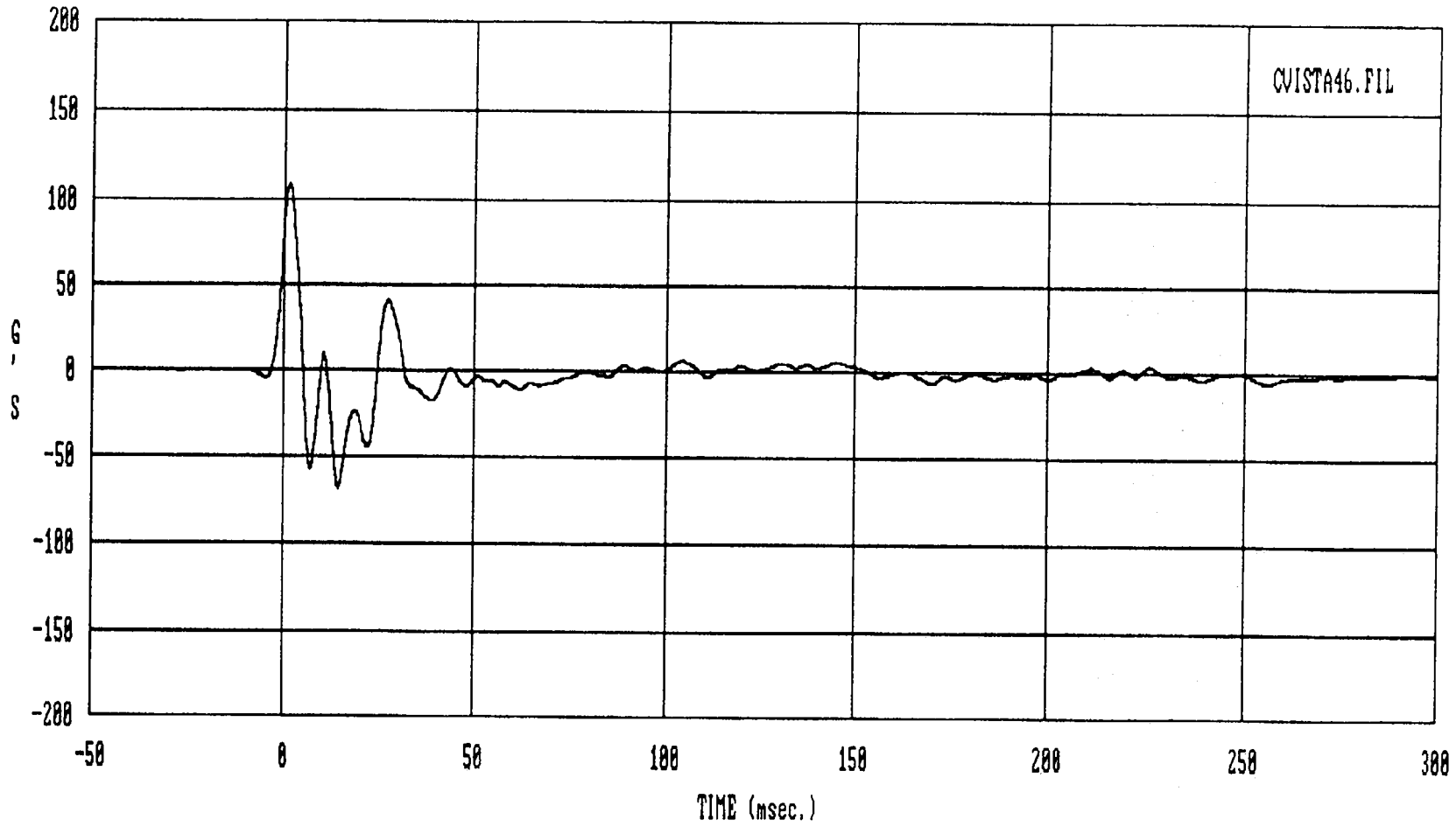
Curve: Left front door at upper centerline -- Y axis Filter: SAE CLASS 60 Max = 148.41 Min = -34.384

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



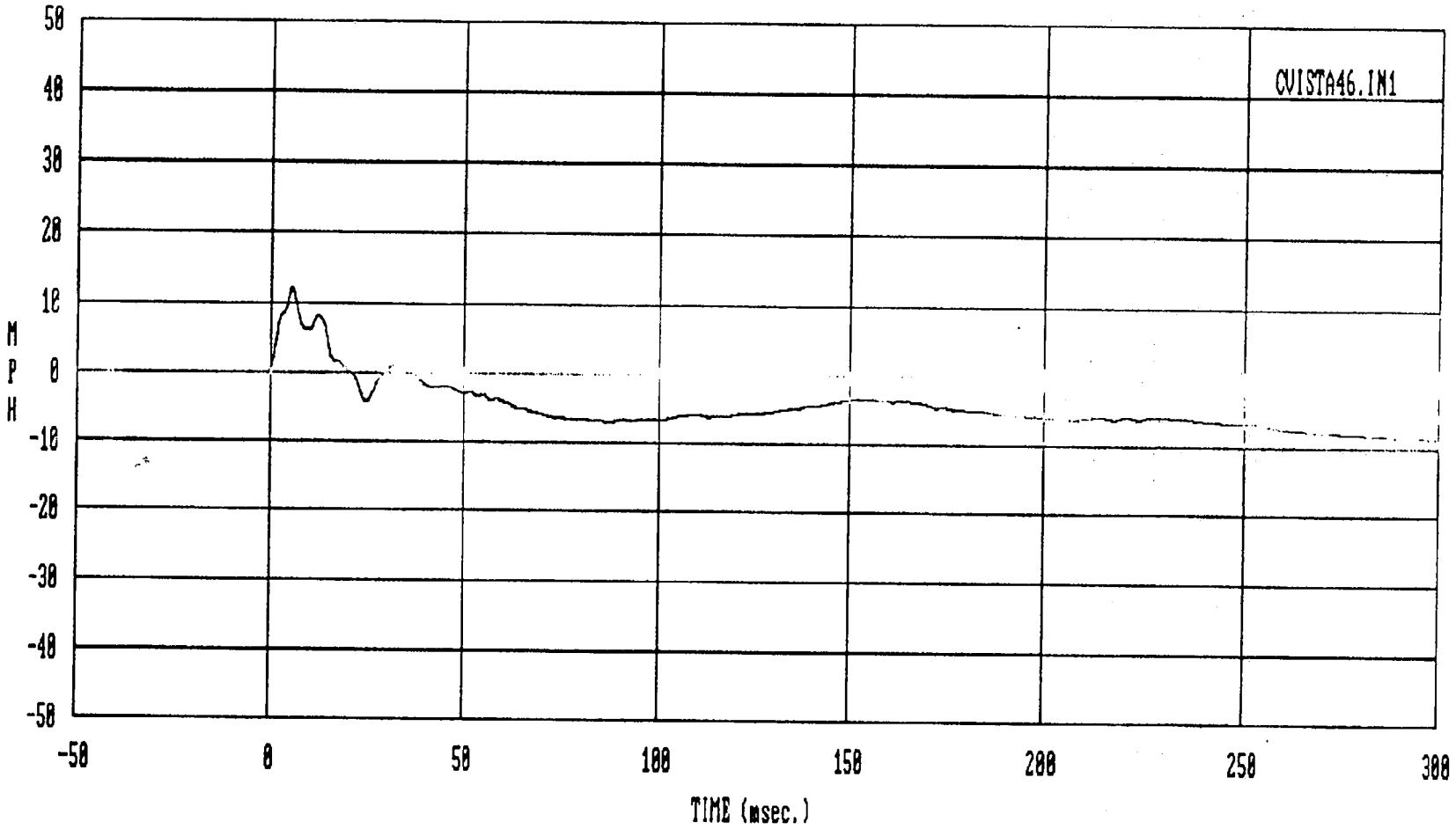
Curve: Left front door at upper centerline -- Y axis Filter: SAE CLASS 180 Max = 30.613 Min = .83808

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



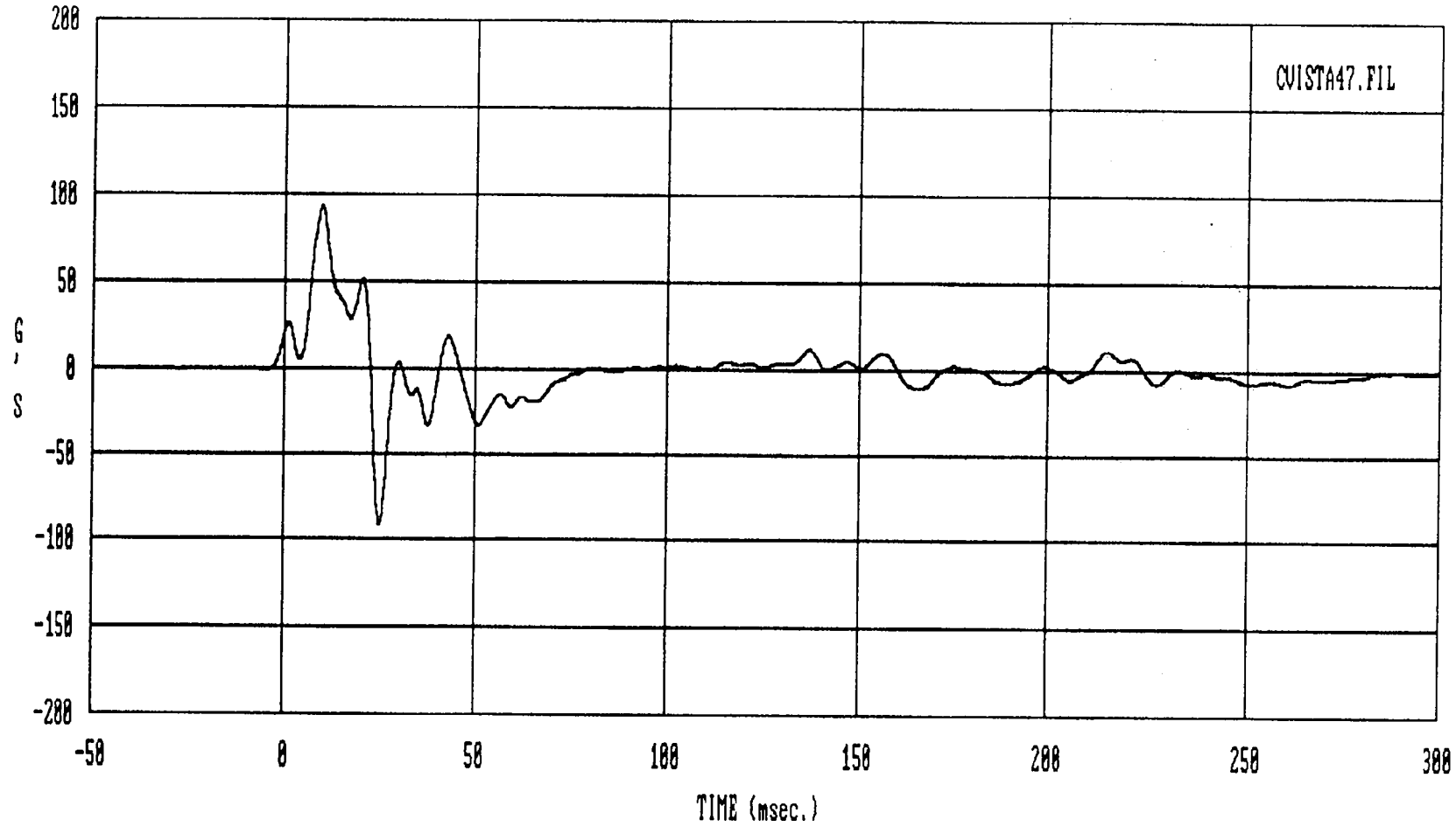
Curve: Left rear door at mid-rear -- Y axis Filter: SAE CLASS 60 Max = 109.18 Min = -68.212

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



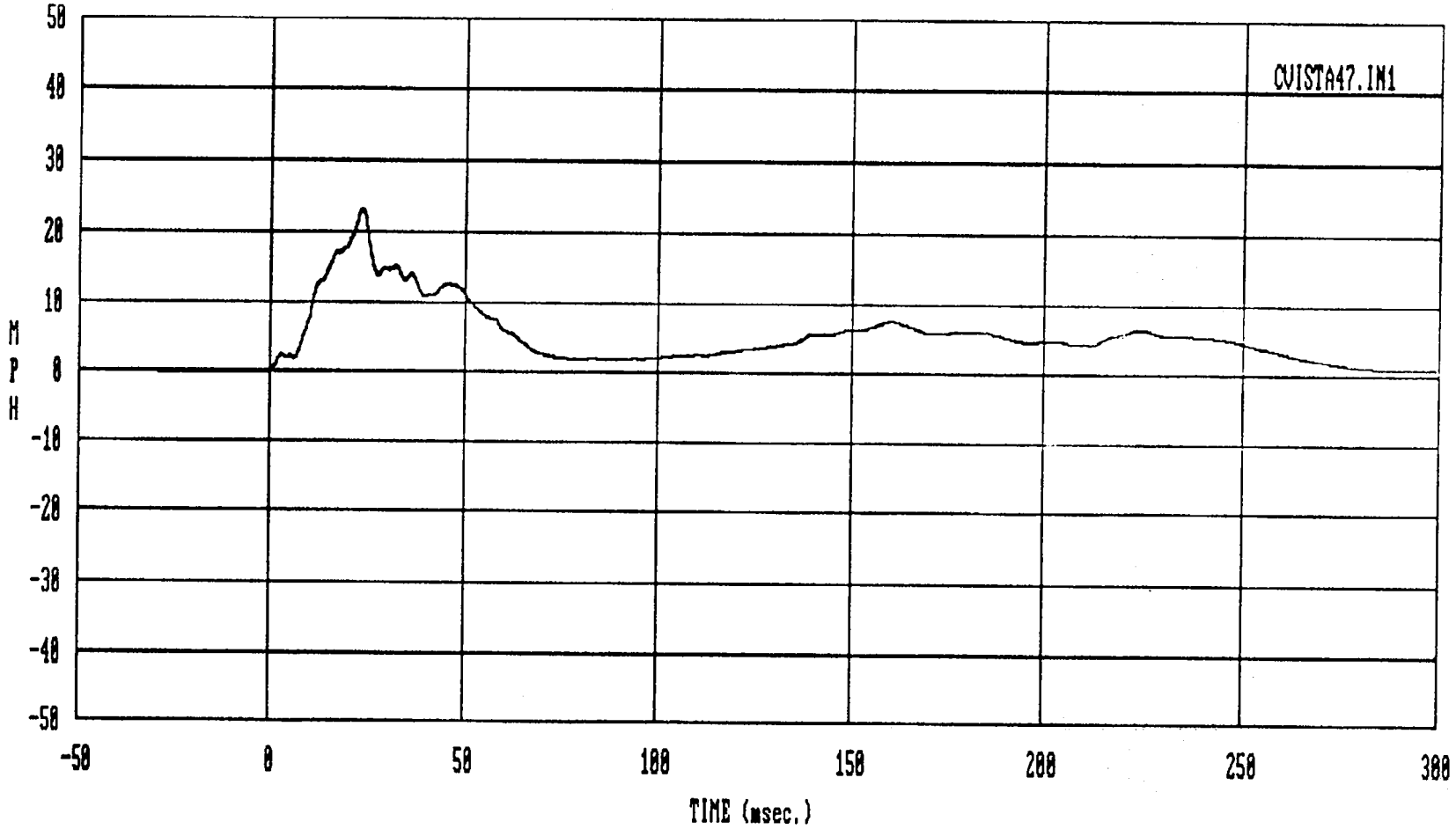
Curve: Left rear door at mid-rear — Y axis Filter: SAE CLASS 180 Max = 12.197 Min = -8.6266

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



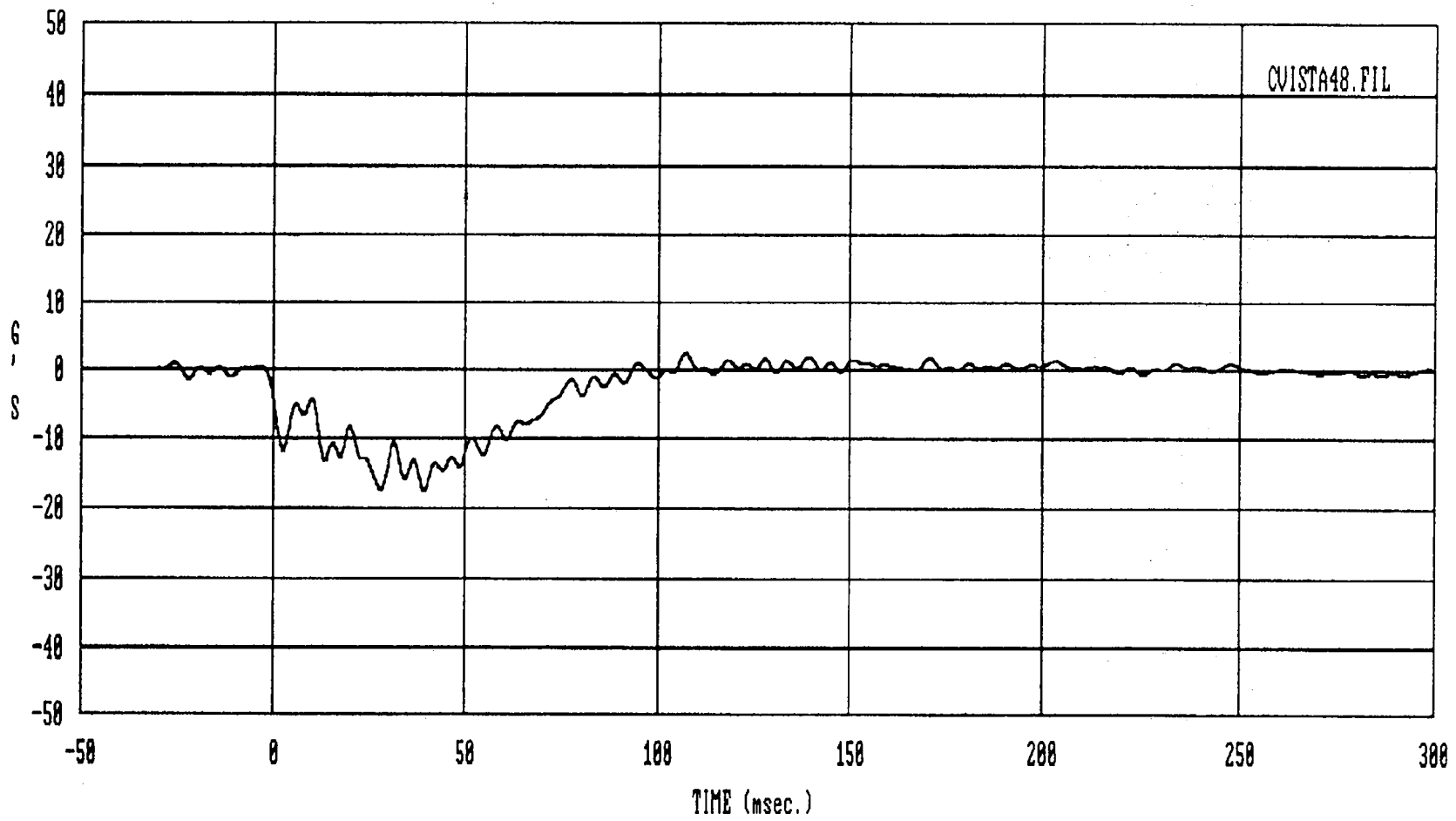
Curve: Left rear door at upper centerline — Y axis Filter: SAE CLASS 60 Max = 93.775 Min = -91.634

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



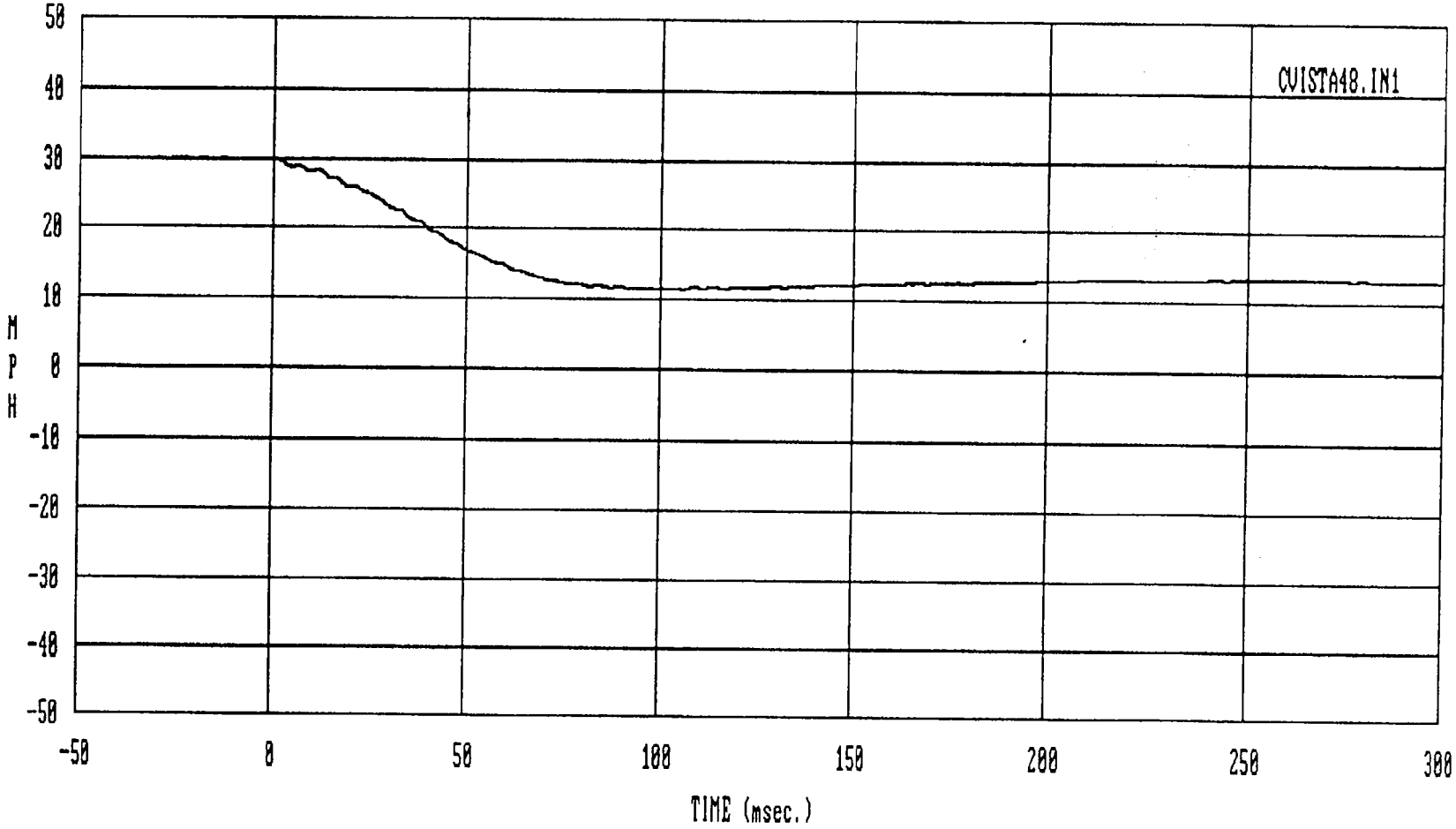
Curve: Left rear door at upper centerline — Y axis Filter: SAE CLASS 180 Max = 23.474 Min = .91487

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



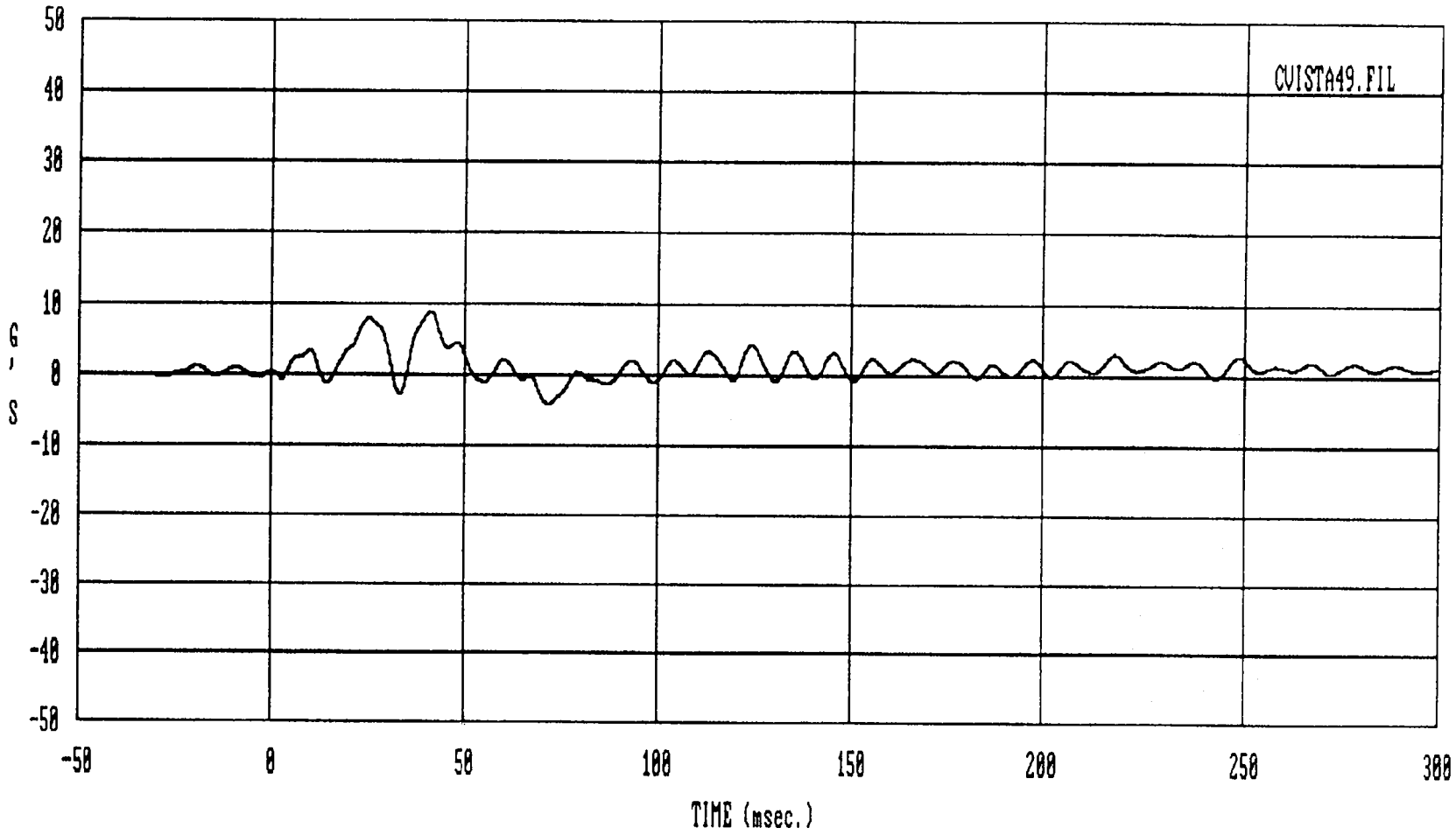
Curve: M.D.B. C/G acceleration -- X axis Filter: SAE CLASS 60 Max = 2.4660 Min = -17.739

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



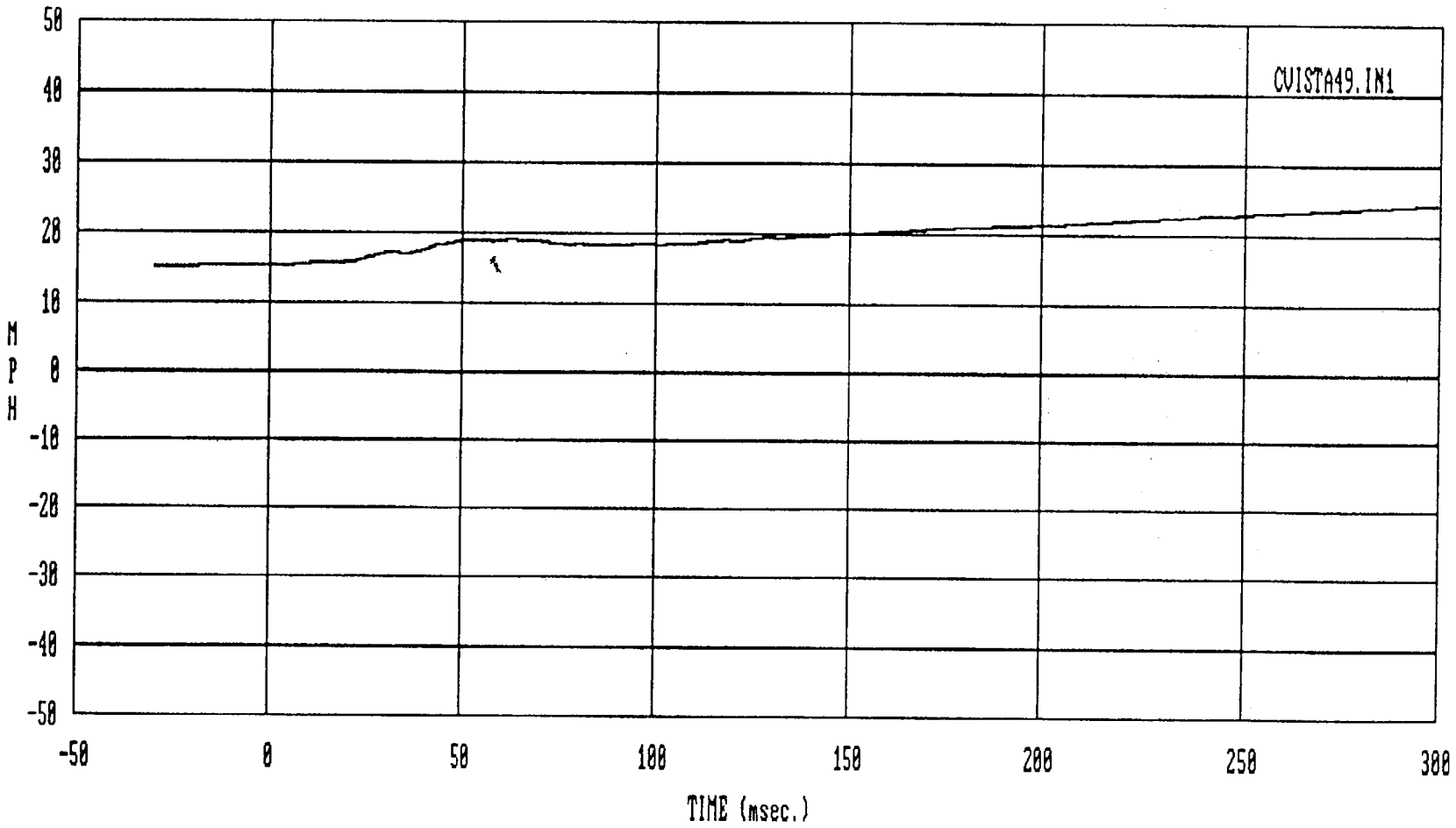
Curve: M.D.B. C/G delta V — X axis Filter: SAE CLASS 180 Max = 30.098 Min = 11.478

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



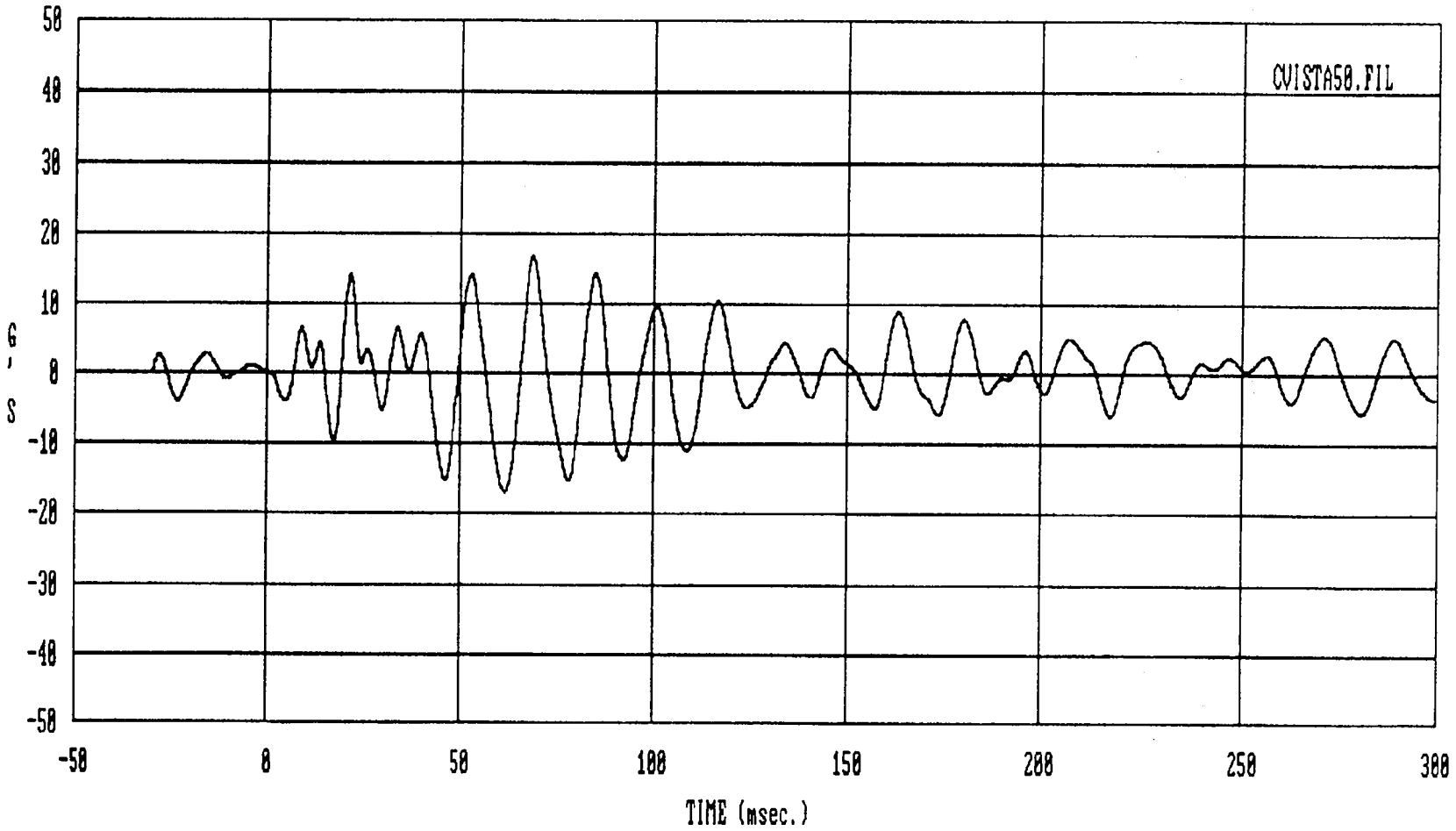
Curve: M.D.B. C/G acceleration -- Y axis Filter: SAE CLASS 60 Max = 8.9208 Min = -4.8589

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



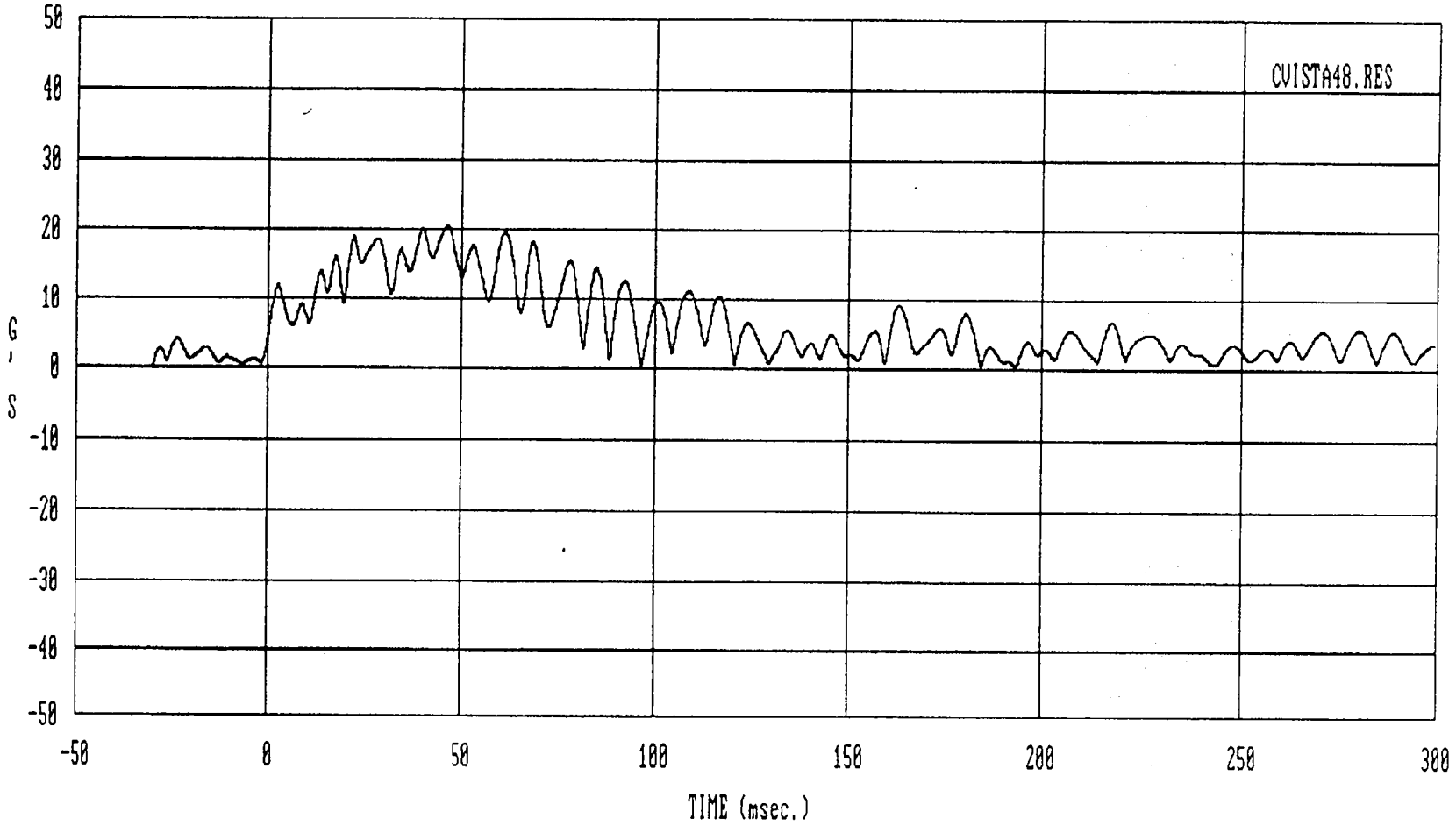
Curve: M.D.B. C/G delta V -- Y axis Filter: SAE CLASS 180 Max = 24.430 Min = 15.275

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



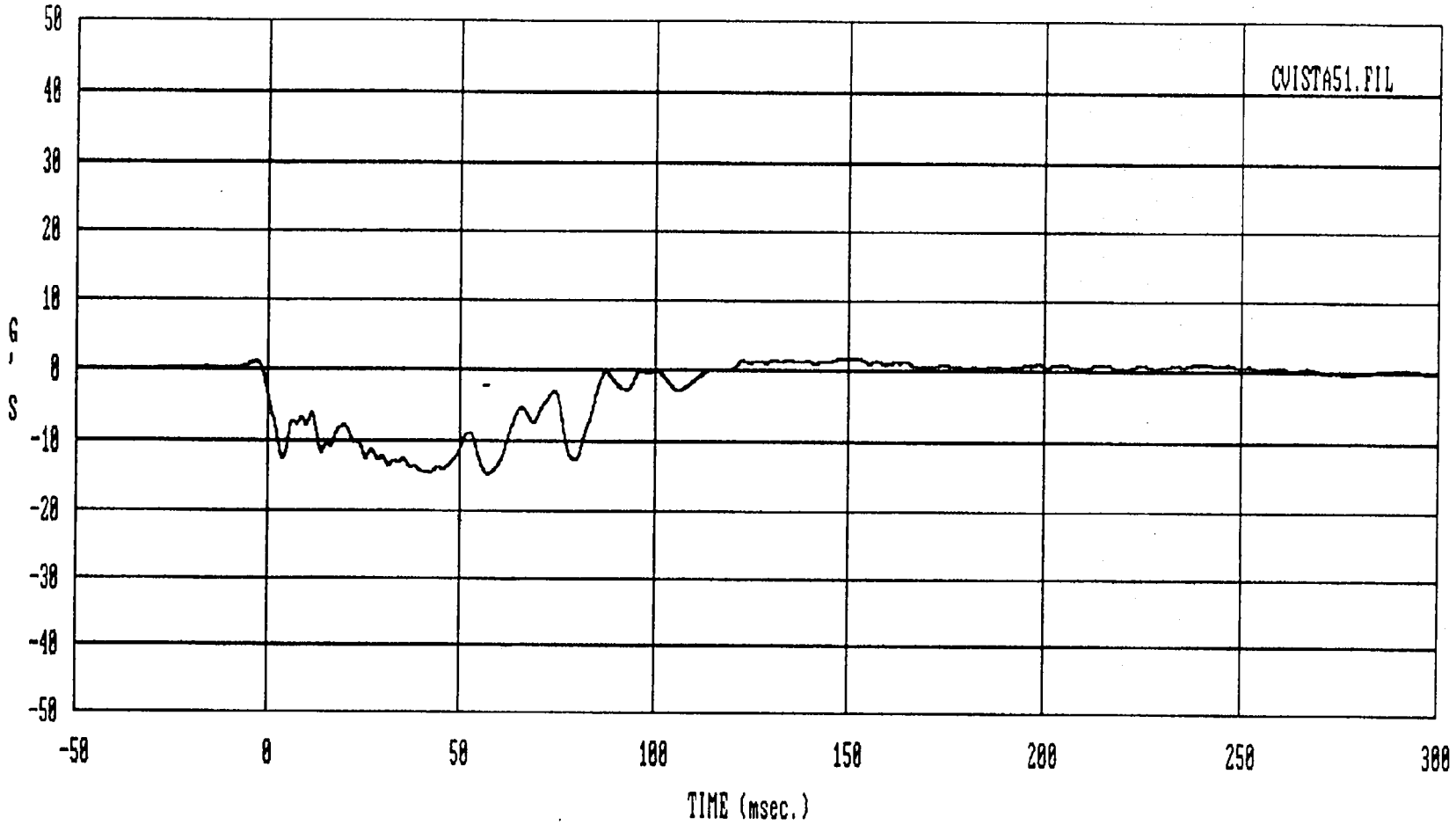
Curve: M.D.B. C/G acceleration -- Z axis Filter: SAE CLASS 60 Max = 16.826 Min = -16.999

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



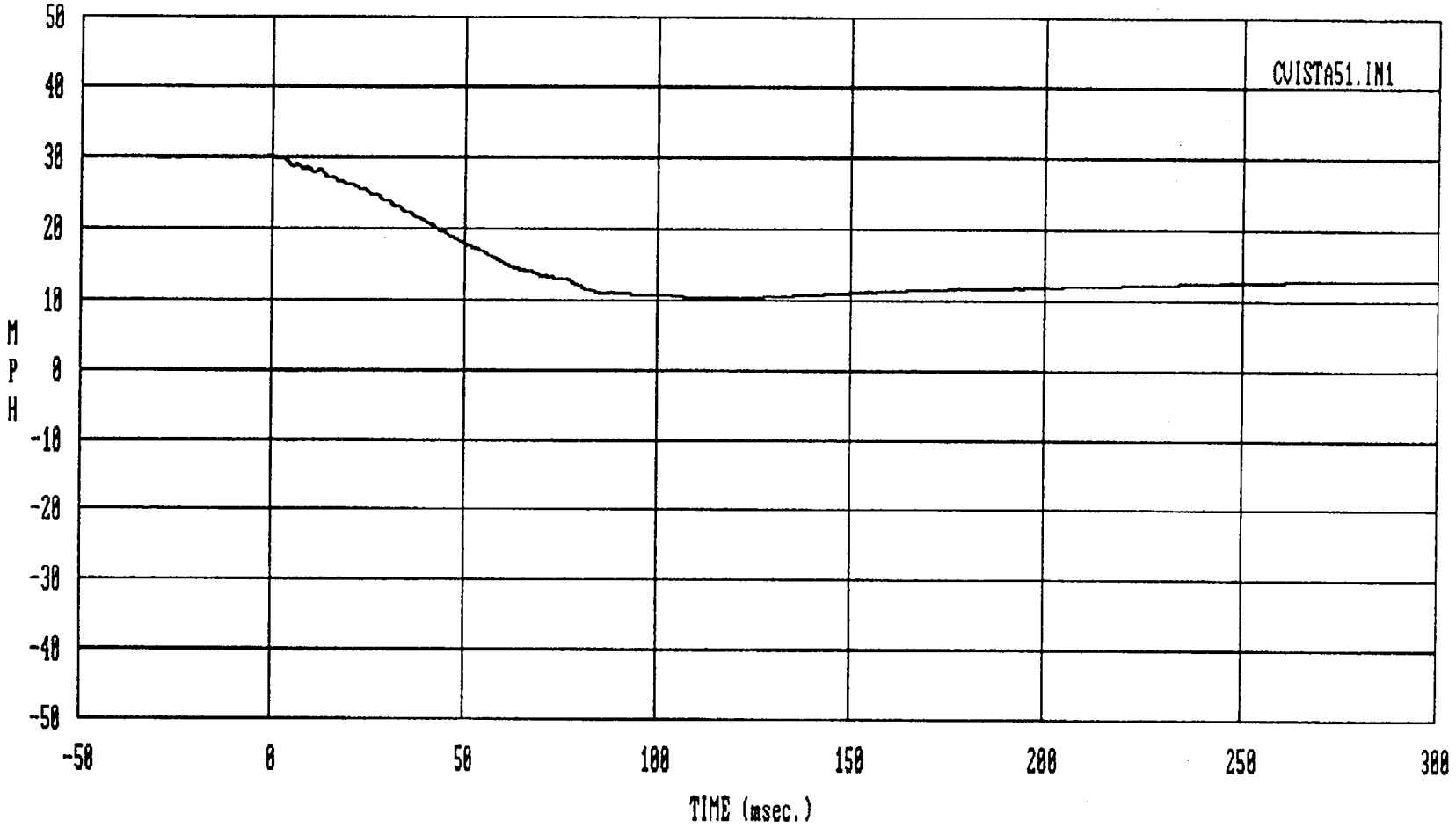
Curve: M.D.B. C/G resultant acceleration Filter: SAE CLASS 60 Max = 20.457 Min = .15597

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



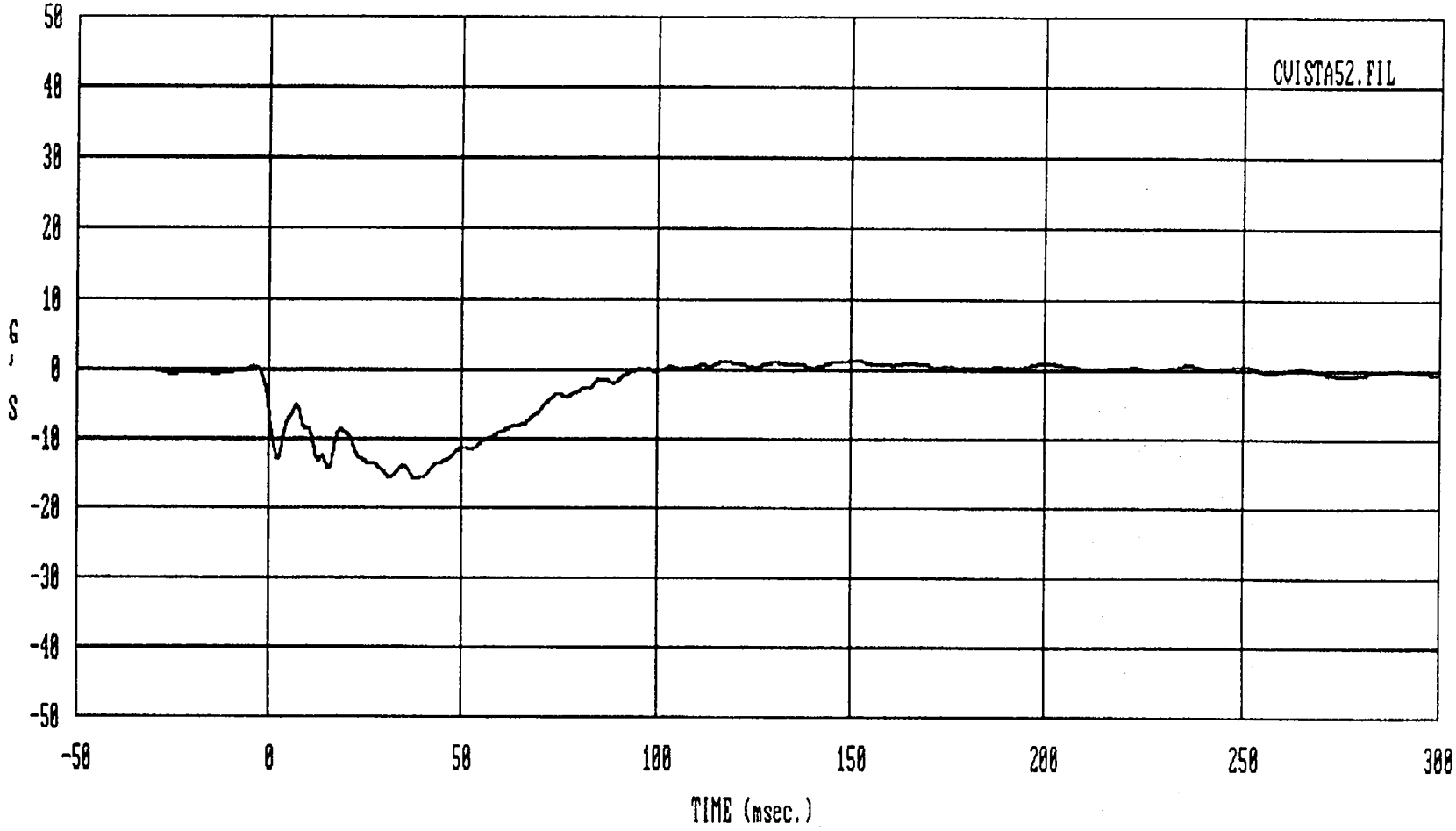
Curve: M.D.B. front frame acceleration -- X axis Filter: SAE CLASS 60 Max = 1.6124 Min = -14.624

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



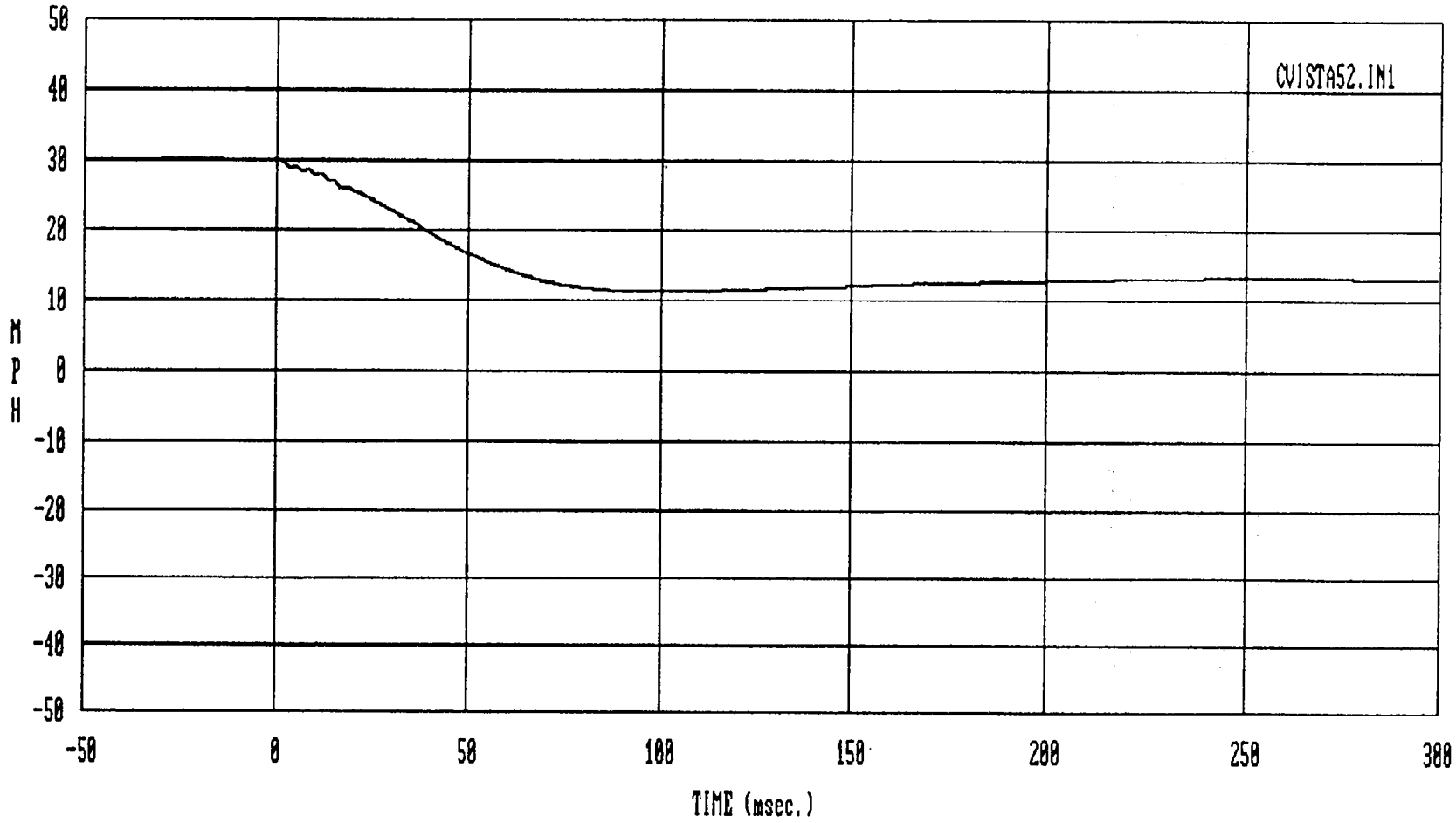
Curve: M.D.B. front frame delta V -- X axis Filter: SAE CLASS 180 Max = 30.084 Min = 10.312

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



Curve: M.D.B. rear frame acceleration -- X axis Filter: SAE CLASS 60 Max = 1.4878 Min = -15.778

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista



Curve: M.D.B. rear frame delta V -- X axis Filter: SAE CLASS 180 Max = 30.097 Min = 11.305

MSE Date: 10/25/91 Program: 1991 Side Impact Vehicle: 1989 Plymouth Colt Vista

APPENDIX C

SID CERTIFICATION DATA

SID IMPACT CALIBRATION SUMMARY SHEET

S.I.D. I.D. NO. : 319
LABORATORY TECHNICIAN: PATRICK PUZZUTO

Sheet No. 1 of 3			Pretest Calibration	Posttest Calibration
Date of SID Calibration - - - - - - - - - - - -				
Calibration Sequential Number for Dummy				
Temperature min Lab. (Spec. =66 to 78′ F) - -				
Relative Humidity i n Lab. (Spec. = 10 tp 70%)				
TEST PARAMETER		SPECIFICATION		
1. NECK BENDING TEST:				
a. Pendulum Speed - - -		21.5 to 25.5 fps		
b. Pendulum Avg. Decel (over t3 - t2) - - - -		20 to 24G		
c. Peak Resultant Head Acceleration- - - - -		26G maximum		
d. Pendulum Decel. (t2-t1)		3 ms		
e. Pendulum Decel. (t2-t2)		25 to 30 ms		
f. Pendulum Decel. (t2-t3)		10 ms		
g. Pendulum Direction Reversal Time - - - -		123 ms		
h. Max. Head Rotation- -		63 to 73′		
i. Chordal Displacement: Head Rotation Angle -			N/A	
0′	Time	-2 to 2 ms		
	Displ.	.5 to .5 in		
30′	Time	25.6 to 34.4 ms		
	Displ.	2.1 to 3.1 in.		
	Time	40.3 to 51.7 ms		
60′	Displ.	4.3 to 5.3 in		
Maximum	Time	53.2 to 66.8 ms		
(′)	Displ.	5.0 to 6.0		
2. NECK BENDING TEST continued:				
i. Chordal Displacement: Head Angle: --				
0′	Time	67.0 to 83.0 ms		
	Displ.	4.3 to 5.3 in.		
30′	Time	85.4 to 104.6 ms		
	Displ.	2.1 to 3.1 in.		
	Time	101.0 to 123.0 ms		
60′	Displ.	-.5 to 0.5 in.		

SID IMPACT CALIBRATION SUMMARY SHEET (Continued)

S.I.D. I.D. NO. : 319
LABORATORY TECHNICAN: PATRICK PUZZUTO

Sheet No. 2 of 3 TEST PARAMETER	SPECIFICATION	Pretest	Posttest
3. ABSOMINAL COMPRESSION TEST (Preload = 10 pounds) a. Force @ .5" - - - - b. Force @ .75"- - - - c. Force @ 1.0"- - - - - d. Force @ 1.3"- - - - -	 23 - 36 lbs. 36 - 50 lbs. 50 - 63 lbs 73 - 88 lbs.	 N/A	
4. LUMBAR FLEXION TEST: a. Force @ 20' - - - - b. Force @ 30' - - - - c. Force @ 40' - - - - - d. Return Angle - - - -	 22 to 34 lbs 34 to 46 lbs 46 to 58 lbs 12 maximum deg. max.		
5. THORAX IMPACT TEST: a. Upper Rib accel.- - - b. Lower Rib accel.- - - c. Lower Spine accel - -	 Primary 37 - 46g's Sec Primary 37 - 46g's Sec Primary 15 -22 g's Sec	 45.16 45.08 41.83 42.10 20.39 20.18	
6. PELVIC IMPACT TEST: Pelvic accel. - - - -	40 - 60g's	53.38	

SID IMPACT CALIBRATION SUMMARY SHEET

S.I.D. I.D. NO. : 137
LABORATORY TECHNICAN: PATRICK PUZZUTO

Sheet No. 3 of 3 TEST PARAMETER	SPECIFICATION	Pretest	Posttest
3. ABSOMINAL COMPRESSION TEST (Preload = 10 pounds) a. Force @ .5" - - - - b. Force @ .75"- - - - c. Force @ 1.0"- - - - - d. Force @ 1.3"- - - - -	 23 - 36 lbs. 36 - 50 lbs. 50 - 63 lbs 73 - 88 lbs.	 N/A	
4. LUMBAR FLEXION TEST: 14.15 ft/sec a. Force @ 20' - - - - b. Force @ 30' - - - - c. Force @ 40' - - - - - d. Return Angle - - - -	 22 to 34 lbs 34 to 46 lbs 46 to 58 lbs 12 maximum		
5. THORAX IMPACT TEST: 14.1 ft/sec a. Upper Rib accel.- - - b. Lower Rib accel.- - - c. Lower Spine accel - -	 Primary 37 - 46g's Sec Primary 37 - 46g's Sec Primary 15 -22 g's Sec	 41.15 41.37 39.02 39.48 18.93 19.20	
6. PELVIC IMPACT TEST: Pelvic accel. - - - -	40 - 60g's	58.11	

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 underpressed 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 underpressed 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).