

REPORT NUMBER: CAL-93-N04

V1765

NEW CAR ASSESSMENT PROGRAM (NCAP)  
FRONTAL BARRIER IMPACT TEST

GENERAL MOTORS CORPORATION  
1993 PONTIAC GRAND AM  
4-DOOR SEDAN

NHTSA NUMBER: MP0100

CALSPAN TEST NUMBER: 8048-2

OCTOBER 13, 1992

CALSPAN CORPORATION  
ADVANCED TECHNOLOGY CENTER  
P.O. BOX 400  
BUFFALO, NEW YORK 14225



FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation  
National Highway Traffic Safety Administration  
Office of Market Incentives  
400 Seventh Street, S.W.  
Room No. 5313 (NRM-20)  
Washington, DC 20590

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared: Michael J. Kilgallon  
Michael J. Kilgallon, Project Engineer

Approved: Walter E. Levan  
Walter E. Levan, Program Manager  
Transportation Research/  
Physical Sciences Department

FINAL REPORT ACCEPTED BY:

Stuart Jay Seigel

Manager, New Car Assessment Program (NCAP)

Date of Report Acceptance

Stuart Jay Seigel For  
CHAW

Contracting Officer's Tech. Rep. (COTR)

DEC 23 1992

Date of Report Acceptance

**TECHNICAL REPORT STANDARD TITLE PAGE**

1. Report No. CAL-93-N04		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle NHTSA New Car Assessment Program (NCAP) Frontal Barrier Impact Test of a 1993 Pontiac Grand Am 4-Door Sedan				5. Report Date October 13, 1992	
				6. Performing Organization Code CAL	
7. Author(s) Michael J. Kilgallon, Project Engineer Walter E. Levan, Program Manager				8. Performing Organization Report No. 8048-2	
9. Performing Organization Name and Address Calspan Advanced Technology Center P.O. Box 400 Buffalo, New York 14225				10. Work Unit No. 251-020-1222	
				11. Contract or Grant No. DTNH22-90-D-02121	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Market Incentives (NRM-20) 400 Seventh Street, S.W., Washington, DC 20590				13. Type of Report and Period Covered Final Report October 1992	
				14. Sponsoring Agency Code DOT/NHTSA/RM/OMI	
15. Supplementary Notes					
16. Abstract  A frontal load cell barrier test of a 1993 Pontiac Grand Am 4-Door Sedan was performed at Calspan Advanced Technology Center crash test facility in Buffalo, New York, on October 13, 1992.  The impact velocity was 56.0 kph and the temperature at the barrier face was 15°C. The maximum post-test vehicle crush was 564 mm. The test vehicle was equipped with a 3-point automatic belt system at each of the front outboard seating positions.  With regard to FMVSS 208 "Occupant Crash Protection," injury criteria, both the driver and passenger dummies appear to exceed the maximum specified HIC values.					
17. Key Words Frontal Barrier Impact Test New Car Assessment Program (NCAP)				18. Distribution Statement <u>Copies of this report are available from:</u> Technical Reference Division National Highway Traffic Safety Admin. Nassif Building, Room 5108 400 Seventh St., S.W., Washington, DC 20590	
19. Security Classif. (of this report) UNCLASSIFIED		20. Security Classif. (of this page) UNCLASSIFIED		21. No. of Pages	22. Price

TABLE OF CONTENTS

<u>Section</u>		<u>Page No.</u>
1	PURPOSE AND TEST PROCEDURE	1-1
2	SUMMARY OF FRONTAL BARRIER IMPACT TEST	2-1
3	OCCUPANT AND VEHICLE INFORMATION	3-1
APPENDIX A	PHOTOGRAPHS	A-1
APPENDIX B	VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA	B-1
APPENDIX C	PART 572E DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION TESTS	C-1
APPENDIX D	DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION	D-1
APPENDIX E	VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS	E-1

LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1	Dummy Measurements for Front Seat Passengers	3-4
2	Camera Positions for Frontal Impacts	3-7
3	Vehicle Target Locations	3-9
4	Load Cell Locations on Fixed Barrier	3-10
5	Vehicle Accelerometer Locations	3-11
6	Test Vehicle Measurements	3-12
7	Dummy Configuration Dimensions	C-3

LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
1	General Test and Vehicle Data	2-2
2	Dummy Injury Criteria Values	3-2
3	Hybrid III Neck and Chest Data Sheet	3-3
4	Front Seat Occupant Measurement Table	3-5
5	Seat Belt Performance Assessment Test Data	3-6
6	High Speed Camera Locations	3-8
7	Vehicle Measurements	3-13
8	Accident Investigation Division Data	3-14

Section 1  
PURPOSE AND TEST PROCEDURE

This 56.3 kph frontal barrier impact test is part of the Composite FY 92 Vehicle Barrier Impact Testing Program sponsored by the National Highway Traffic Safety Administration (NHTSA) under Contract No. DTNH22-90-D-02121. The purpose of this test was to obtain vehicle crashworthiness and occupant restraint system performance data for an impact speed in excess of the current 48.3 kph requirements.

The 56.3 kph frontal barrier impact test was conducted in accordance with the Office of Market Incentives (OMI) Laboratory Indicant Test procedure.

## Section 2

### SUMMARY OF TEST NUMBER MPO100

A load cell barrier consisting of 36 load cells was impacted by a 1993 Pontiac Grand Am 4-Door Sedan at a velocity of 56.0 kph. The test was performed at the Calspan Corporation Advanced Technology Center on October 13, 1992. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by one real-time camera and 16 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 50th percentile male anthropomorphic test devices (ATDs), were placed in the driver and right-front passenger seating positions according to dummy placement instructions specified in the Laboratory Indicant Test Procedure.

Both ATDs were fully instrumented with head and chest triaxial accelerometers and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver ATD (Serial No. 45) and the right-front passenger ATD (Serial No. 150) were used in two previous tests (MPO300 and MNO110). Injury criteria were not exceeded in either test. Certification details, along with instrumentation calibration data, are found in Appendix C and D.

The 83 channels of data were recorded on a P.C. based data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces. Accelerometer #5(X)--right disc brake caliber--did not record accurately.

The driver's head struck the steering wheel rim and hub; the HIC was 1459.3. The maximum chest deceleration over 3 milliseconds was 50.9 g's. The maximum chest displacement was 39.4 mm. Femur forces were -4198.7 newtons on the left femur and -4687.6 newtons on the right femur.

The right front passenger's HIC was 1093.2. Maximum chest deceleration over 3 milliseconds was 49.7 g's and maximum chest deflection was 40.0 mm. Femur loads were -3312.7 newtons on the left and -3698.1 newtons on the right.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1993 Pontiac Grand Am 4-Door Sedan

NHTSA Test No.: MP0100 VIN.: 1G2NE5430PM503088

Body Color: White

Engine: 4 Cylinders; - C.I.D.; 2.3 Liters; - CC

X Gas; - Diesel; - Turbocharged

- Longitudinal; X Transverse

Transmission: 3 Speed; - Manual; X Automatic; - Overdrive

Final Drive: X Front Wheel; - Rear Wheel; - Four Wheel

Date Received: 9/14/92 Odometer Reading: 18

X A/C; X P/S; X P/B; - P/wdo;

X Tilt Wheel - P/seats; X Cruise Control

Type of Occupant Restraint: 3-point automatic restraint device

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 241 kPa, Rear 241 kPa

Recommended Tire Size: P/185/75R14

Recommended Cold Tire Pressure: Front 241 kPa, Rear 241 kPa

Tires on Vehicle: P185/75R14; Manufacturer: Michelin

Number of Occupants: 2 Front; 3 Rear; - 3rd Seat; 5 TOTAL

Type of Front Seats: X Bucket; - Bench; - Split Bench

Type of Front Seat Back: - Fixed; X Adj. With X Lever - Rot. Knob

Vehicle Capacity Weight (VCW) = 400 kgs (A)

No. of Occupants x 68 kgs = 340 kgs (B)

Rated Cargo and Luggage

Weight (RCLW) A-B = 60 kgs

GVWR 1712 kgs GAWR: Front 951 kgs Rear 761 kgs

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

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

Right Front = 417 kgs                      Right Rear = 222 kgs  
 Left Front = 417 kgs                      Left Rear = 227 kgs  
 TOTAL FRONT WEIGHT = 834 kgs    (65 % of Total Vehicle Weight)  
 TOTAL REAR WEIGHT = 449 kgs    (35 % of Total Vehicle Weight)  
 TOTAL DELIVERED WEIGHT = 1283 kgs

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (1283 kgs)  
 VCW = Vehicle Capacity Weight (400 kgs)  
 DSC = Designated Seating Capacity (5)  
 RCLW = VCW - 68 (DSC) = 60 kgs  
 Target Test Weight = UDW + RCLW + (2 dummies x 78 kgs/dummy)  
 Target Test Weight = 1499 kgs

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 48 KILOGRAMS CARGO:

Right Front = 426 kgs                      Right Rear = 290 kgs  
 Left Front = 431 kgs                      Left Rear = 340 kgs  
 TOTAL FRONT WEIGHT = 857 kgs    (58 % of Total Vehicle Weight)  
 TOTAL REAR WEIGHT = 630 kgs    (42 % of Total Vehicle Weight)  
 TOTAL TEST WEIGHT = 1487 kgs  
 Weight of ballast secured in vehicle trunk area = 0 kgs

VEHICLE ATTITUDE (all dimensions in millimeters):

Delivered Attitude: RF 704    LF 704    RR 717    LR 717  
 Test Attitude:            RF 680    LF 678    RR 658    LR 654  
 Wheel Base: 2626 mm.; C.G. = 1103 mm. rearward of front wheel C/L  
 Remarks: 53 liters of stoddard solution was placed in the fuel tank

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Impact Angle: 0°  
 Date of Test: October 13, 1992 Time of Test: 14:25  
 Ambient Temperature: 15 °C at impact area  
 Temperature in Occupant Compartment: 21 °C  
 Windshield Molding Temperature: 21 °C  
 Required Impact Velocity Range: 55.5 to 57.1 kph  
 Impact Velocity: primary = 56.0 kph, secondary = 55.8 kph  
 Distance From Front Bumper to Barrier Face When  
     Entering Speed Trap: 1320 mm  
     Exiting Speed Trap: 304 mm

VEHICLE REBOUND AND CRUSH:

Vehicle Length: Pre-test = R 4602 mm C<sub>L</sub> 4750 mm L 4608 mm  
                   Post-test = R 4140 mm C<sub>L</sub> 4186 mm L 4074 mm  
                   Crush = R 462 mm C<sub>L</sub> 564 mm L 534 mm

Distance from front of test vehicle to point of impact:

R 233 mm C<sub>L</sub> 173 mm L 262 mm

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Steering Upper Rim and Hub</u>	<u>Upper Dash Panel</u>
Chest	<u>Lower Rim</u>	<u>None</u>
Abdomen	<u>Lower Rim</u>	<u>None</u>
Left Knee	<u>Lower Dash Panel</u>	<u>Glove Compartment Door</u>
Right Knee	<u>Lower Dash Panel</u>	<u>Glove Compartment Door</u>

Table 1  
GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Door Opening	<u>operable</u>	<u>operable</u>	—	—
	<u>Front</u>		<u>Rear</u>	
<u>Seat Movement</u>	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Seat Back Failure	<u>none</u>	<u>none</u>	—	—
Seat Shift (mm)	<u>0.0</u>	<u>0.0</u>	—	—
<u>Glazing Damage</u>				
Backlight/Windshield	<u>The windshield sustained stress fractures but</u> <u>remained intact</u>			
Other Notable Impact Effects:	<u>None</u>			



Section 3  
OMI FINAL DATA

Occupant and Vehicle Information

I. OMI DATA

1. Dummy Injury Criteria Data Summary
2. Dummy Positioning Data
3. Seat Belt Performance Assessment Data
4. Camera Locations
5. Vehicle Target Locations

II. OVR DATA

1. Load Cell Barrier Data
2. Vehicle Accelerometer Data
3. Test Vehicle Measurements

Table 2

DUMMY INJURY CRITERIA VALUESNHTSA No.: MP0100 Vehicle: 1993 Pontiac Grand Am 4-Door Sedan

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-207.7	-31.4	66.2	207.8
Position #2 - Passenger	-126.0	11.7	54.4	126.4

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-57.7	9.9	14.4	50.9
Position #2 - Passenger	50.1	6.7	-19.1	49.7

The maximum chest resultant acceleration is defined as the maximum acceleration which exceeds 0.003 seconds in duration.

	MAXIMUM FORCE - FEMUR LOAD (nwt)	
	LEFT FEMUR	RIGHT FEMUR
Position #1 - Driver	-4198.7	-4687.6
Position #2 - Passenger	-3312.7	-3698.1

	MAXIMUM FORCE - SEAT BELT LOADS (nwt)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	8209.0	-	2146.7
Position #2 - Passenger	9190.7	4479.2	-

	HEAD INJURY CRITERIA (HIC)			
	HIC	t <sub>1</sub> (SEC)	t <sub>2</sub> (SEC)	Average Acceleration t <sub>1</sub> TO t <sub>2</sub>
Position #1 - Driver	1459.3	0.07356	0.08112	130.1
Position #2 - Passenger	1093.2	0.07344	0.1044	65.9

HIC is as defined in FMVSS 208. The maximum time interval from t<sub>1</sub> to t<sub>2</sub> is 36 milliseconds.

Table 3  
HYBRID III NECK AND CHEST DATA SHEET

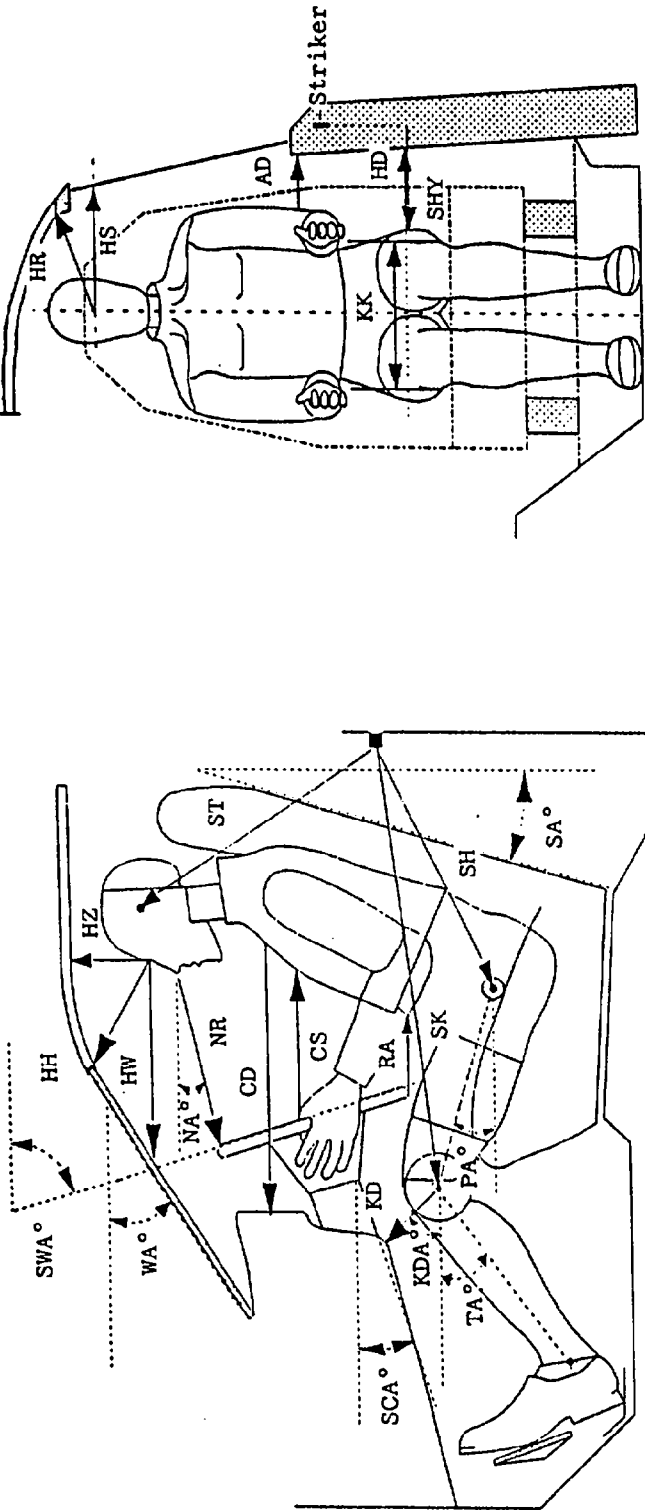
Vehicle Year/Make/Model/Body Style: 1993 Pontiac Grand Am 4-Door Sedan

Vehicle NHTSA No.: MP0100 Test Date: October 13, 1992

MAXIMUM VALUES	DRIVER DUMMY ID #45	PASSENGER DUMMY ID #150
Neck Load X (nwt)	848.8	1365.4
Neck Load Y (nwt)	219.9	269.4
Neck Load Z (nwt)	4956.1	2450.8
Neck Moment X (nwt-m)	-20.4	-24.3
Neck Moment Y (nwt-m)	-40.2	-32.8
Neck Moment Z (nwt-m)	-19.1	-7.8
Chest Deflection X (mm)	39.4	40.0
Time of Max. Occurrence (msec)	85.9	93.8

NOTE: All values listed must be occurring during primary impact event.

Figure 1  
DUMMY MEASUREMENTS FOR FRONT SEAT PASSENGERS

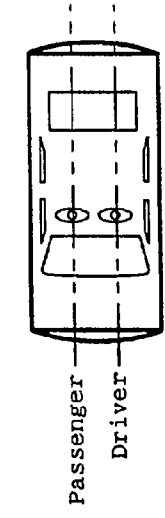


- HH - Head to Header
- HW - Head to Windshield
- HZ - Head to Roof
- NR - Nose to Rim
- CS - Steering Wheel to Chest
- CD - Chest to Dash
- RA - Rime to Abdomen
- KDL/KDR - Knee to Dash
- KDA - Knee to Dash Angle
- SH - Striker to H-Point

- SK - Striker to Knee
- ST - Striker to Head
- NA - Nose to Rim Angle
- TA - Tibial Angle
- PA - Pelvic Angle
- SA - Seat Back Angle
- SCA - Steering Column Angle
- SWA - Steering Wheel Angle
- WA - Windshield Angle

- HR - Head to Side Header
- HS - Head to Side Window
- AD - Arm to Door
- HD - H-Point to Door
- SHY - Striker to H-Point (Y Dir.)
- KK - Knee to Knee

Vertical Longitudinal Planes



Vertical Transverse Plane

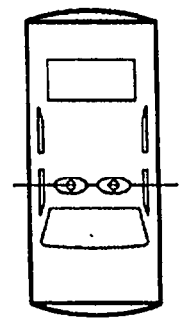


Table 4  
FRONT SEAT OCCUPANT MEASUREMENTS

	DRIVER (Serial #45)	PASS (Serial #150)
WA°	26°	N/A
SWA°	3rd notch 62°	N/A
SCA°	28°	N/A
SA°	20.5°	20.5°
HZ	173	155
HH	280	288
HW	565	535
HR	180	177
NR	386 Angle 11°	N/A
CD	489	490
CS	320	N/A
RA	200	N/A
KDL	168 Angle (KDA) 45°	130
KDR	126 Angle (KDA) 40°	130 Angle (KDA) 35°
PA°	25°	25°
TA°	43°	40°
KK	280	280
ST	573 Angle 75°	518 Angle 79°
SK	594 Angle 0°	592 Angle 5°
SH	229 Angle 43°	224 Angle 34°
SHY	205	215
HS	325	325
HD	110	95
AD	105	105

All dimensions are in millimeters

Table 5  
SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

SHOULDER BELT SPOOL-OFF DATA:

As determined by film analysis.	<u>63 mm</u>	<u>71 mm</u>
As determined mechanically.	<u>61 mm</u>	<u>63 mm</u>

BELT STRETCH DATA:

Measured electronically between shoulder belt load cell and the "D" ring.	<u>55 mm/m</u>	<u>88 mm/m</u>
Measured mechanically	<u>0 mm/m</u>	<u>0 mm/m</u>

Figure 2  
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

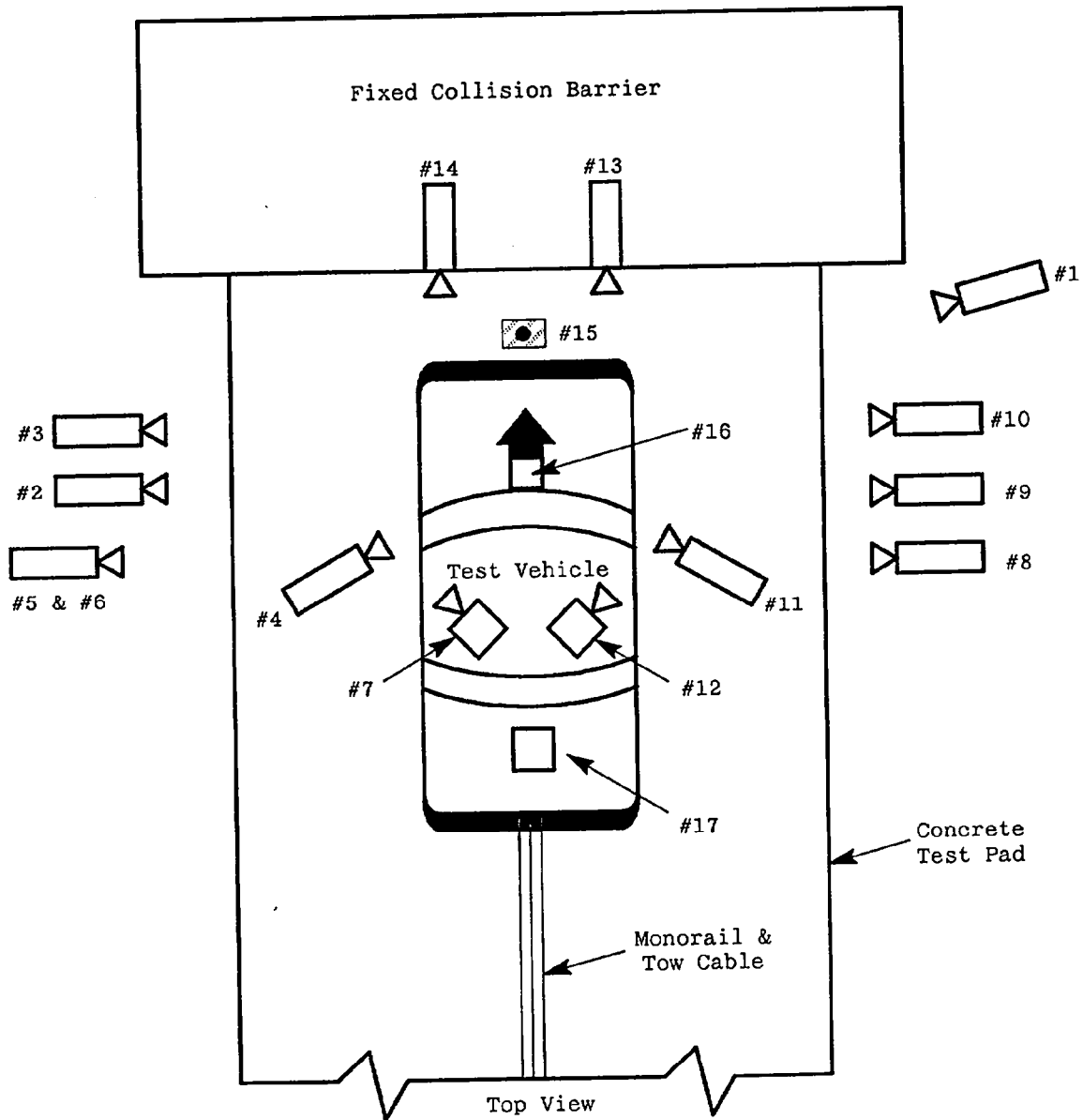


Table 6

HIGH-SPEED CAMERA LOCATIONS

Test No. MPO100 Vehicle: 1993 Pontiac Grand Am 4-Door Sedan

CAMERA NO.	VIEW	CAMERA POSITIONS (mm)*			ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Camera	-	-	-	-	-	24	
2	Overall Left Side	6324	1575	1067	-4	5922	550	
3	Left Side View	8204	1118	1041	-3	7802	610	
4	Driver and Interior View	2946	2718	1676	-17	2544	570	
5	Steering Column (Bottom)	7112	1905	1168	-4	6710	590	
6	Steering Column (Top)	7112	1905	1778	-9	6710	570	
7	Left Belt	-	-	-	-	-	530	
8	Overall Right Side	6147	1676	1067	-2	5745	570	
9	Right Side View	8153	1219	1041	-3	7751	620	
10	Right Passenger View	7976	1880	1473	-5	7574	560	
11	Passenger and Interior View	2667	2743	1626	-17	2265	570	
12	Right Belt	-	-	-	-	-	N/A	
13	Passenger Front View	610	-127	1778	-38	-	630	
14	Driver Front View	610	-127	1778	-33	-	650	
15	Windshield View	0	0	3048	-48	-	600	
16	Pit View of Engine	0	1092	-3048	90	-	650	
17	Pit View of Fuel Tank	0	3276	-3048	90	-	800	

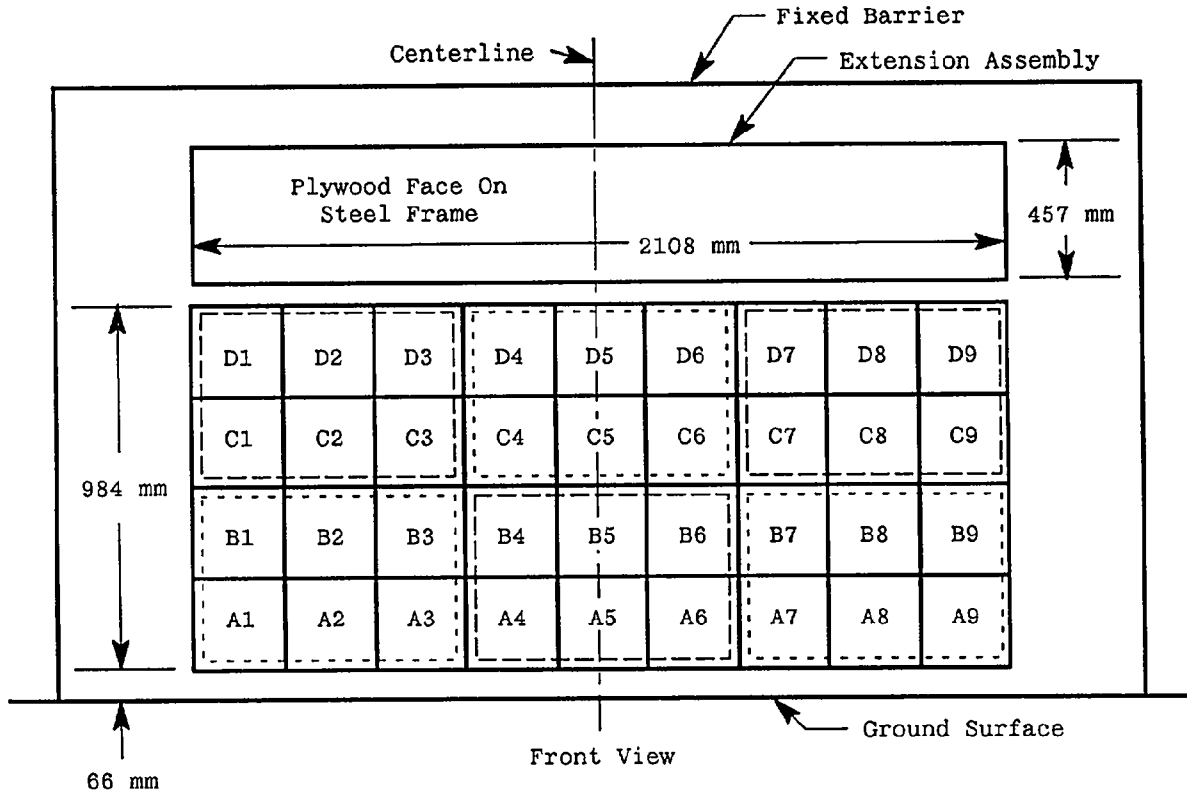
\*X = film plane to monorail centerline  
 Y = film plane to impact location  
 Z = film plan to ground  
 \*\* = referenced to horizontal plane



Figure 4

LOAD CELL LOCATIONS ON FIXED BARRIER

- 36 Load Cells
- 4 Rows
- 9 Columns
- 6 Groupings (6 cells/group)



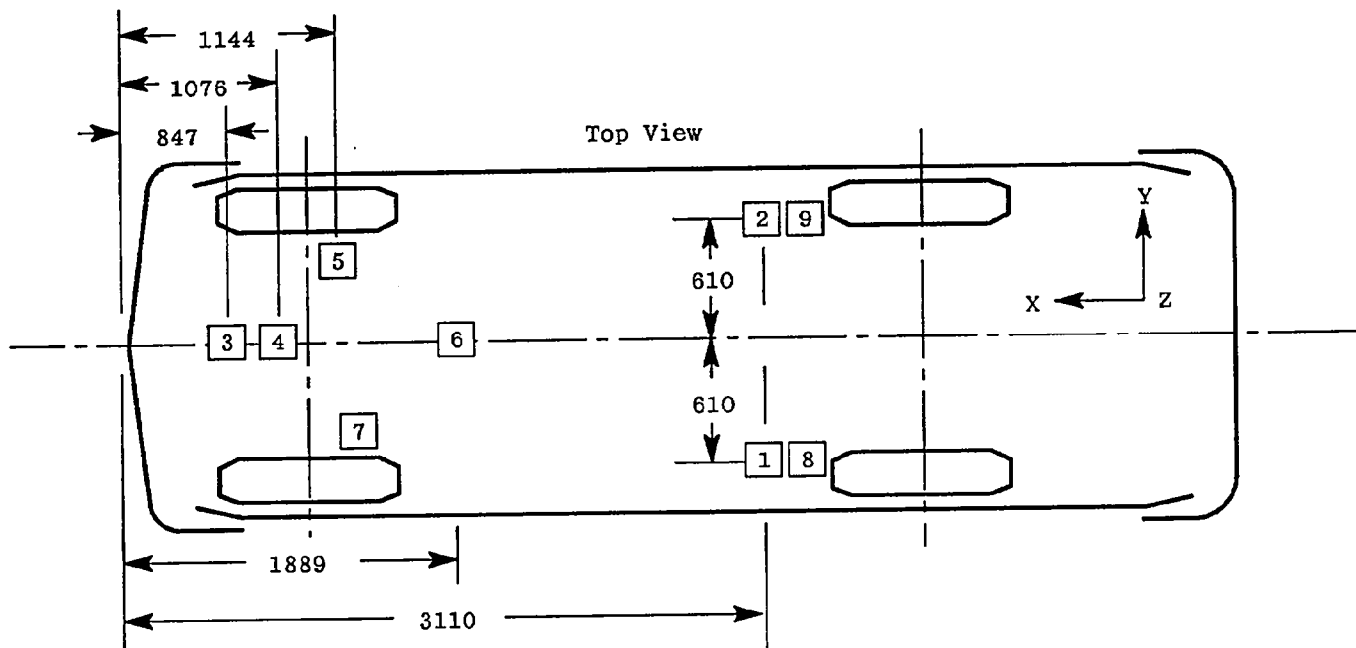
6 GROUPS OF 6 LOAD CELLS EACH

Group 4 C1 thru D3	Group 5 C4 thru D6	Group 6 C7 thru D9
Group 1 A1 thru B3	Group 2 A4 thru B6	Group 3 A7 thru B9

The following data is presented in Appendix B:

- (1) Data from 36 individual load cells
- (2) Total or Sum of 36 individual load cells
- (3) Data from 6 Groupings shown above (6 cells/group)

Figure 5  
VEHICLE ACCELEROMETER LOCATIONS



All dimensions are in millimeters

ACCELEROMETER NUMBER*	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Left Rear Seat Crossmember	✓		
2	Right Rear Seat Crossmember	✓		
3	Top of Engine	✓		
4	Bottom of Engine	✓		
5	Right Disc Brake Caliper	✓		
6	Left Disc Brake Caliper	✓		
7	Instrument Panel	✓		
8	Left Rear Seat Crossmember	✓		
9	Right Rear Seat Crossmember	✓		

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

Figure 6

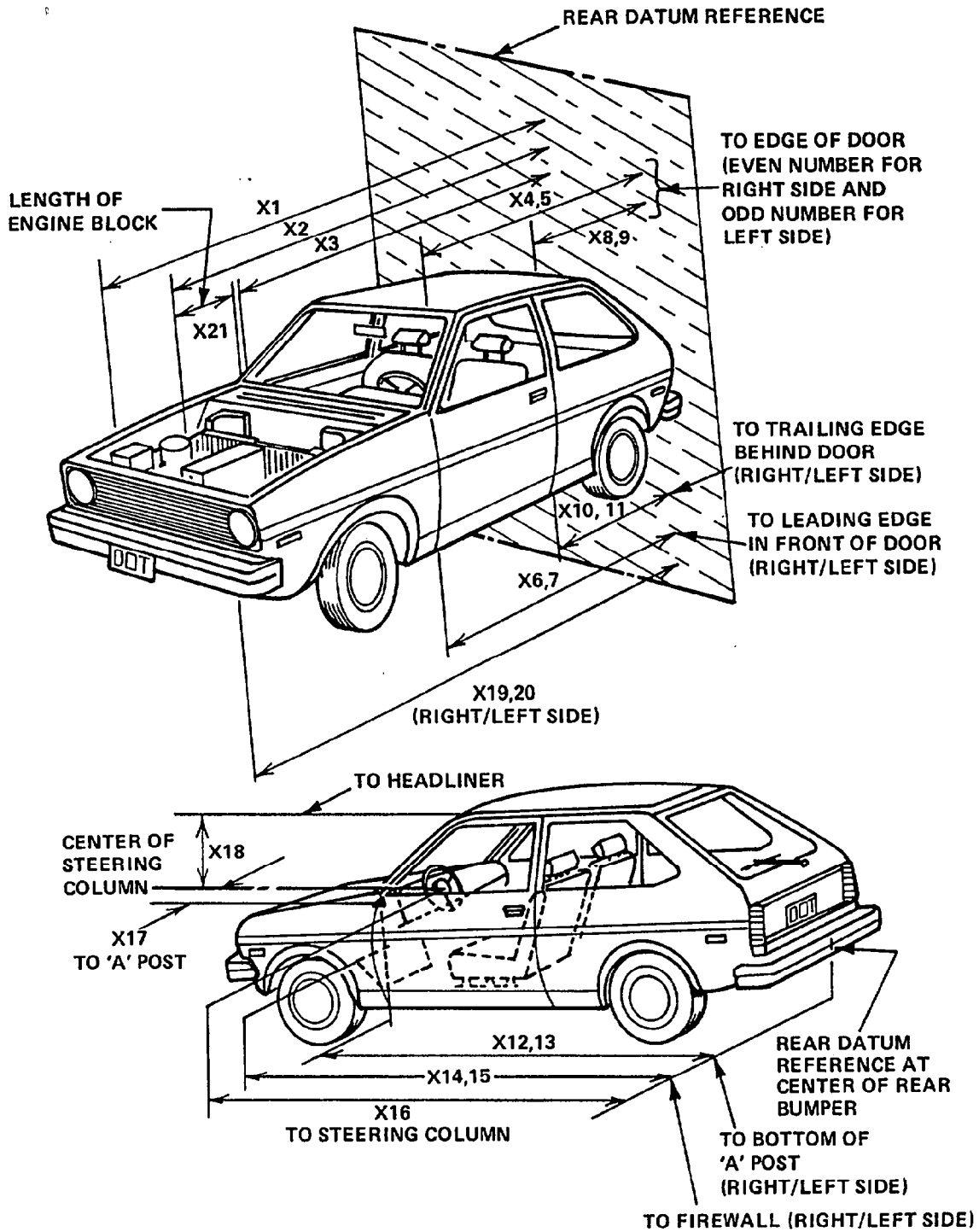


Table 7

## VEHICLE MEASUREMENTS

No.		All Dimensions in Millimeters		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	4750	4186	564
X2	Rear Surface of Vehicle to Front of Engine	3967	3647	320
X3	Rear Surface of Vehicle to Firewall	3447	3378	69
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	3162	3162	0
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	3160	3137	23
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	3160	3137	23
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	3157	3134	23
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	2123	2131	-8
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	2121	2121	0
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	2167	2154	13
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	2164	2146	18
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	3185	N/A	-
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	3195	N/A	-
X14	Rear Surface of Vehicle to Firewall, Right Side	3454	3358	96
X15	Rear Surface of Vehicle to Firewall, Left Side	3447	3371	76
X16	Rear Surface of Vehicle to Steering Column	2751	2731	20
X17	Center of Steering Column to "A" Post	419	465	-46
X18	Center of Steering Column to Headliner	419	318	101
X19	Rear Surface of Vehicle to Right Side of Front Bumper	4602	4140	462
X20	Rear Surface of Vehicle to Left Side of Front Bumper	4608	4074	534
X21	Length of Engine Block	381	381	0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	2870	2807	63
CD	Rear Surface of Vehicle to Center of Dash Panel	2896	2852	44
LD	Rear Surface of Vehicle to Left Side of Dash Panel	2855	2840	15

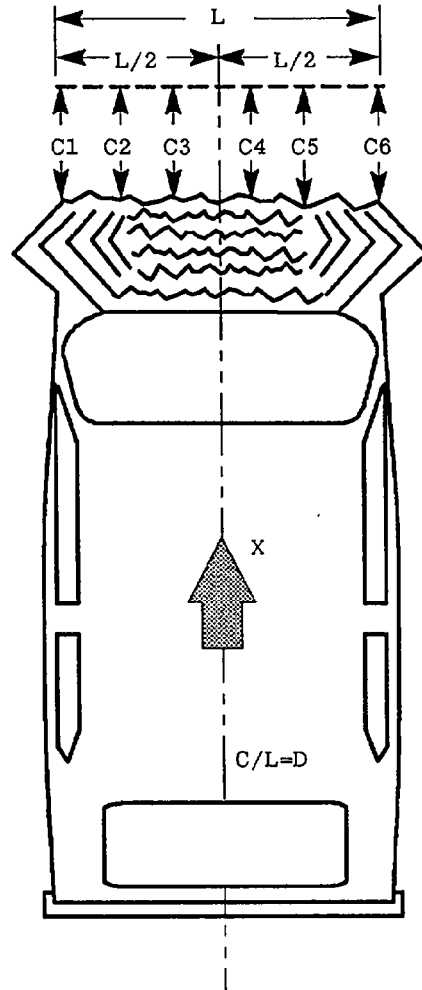
Table 8  
 ACCIDENT INVESTIGATION DIVISION DATA  
 FOR 35 MPH FRONTAL BARRIER IMPACT

Vehicle Make/Model/Body Style: Pontiac Grand Am 4-Door Sedan  
 Vehicle NHTSA No.: MP0100 ; Vin: 1G2NE5430PM503088  
 Model Year: 1993 ; Test Date: October 13, 1992  
 Vehicle Size Category: Mid Size ; Test Weight: 1488 kgs  
 Vehicle Wheelbase: 2626 mm; Front Overhang: 1466 mm; Overall Width: 1742 mm  
 Collision Deformation Classification (CDC) Code: 12FDEW2

Crush Depth C1= 348 mm  
 Dimensions: C2= 569 mm  
 C3= 571 mm  
 C4= 564 mm  
 C5= 564 mm  
 C6= 455 mm

Midpoint of Damage: D= Vehicle Centerline (Longitud.)

Length of Damaged Region: L= 1354 mm

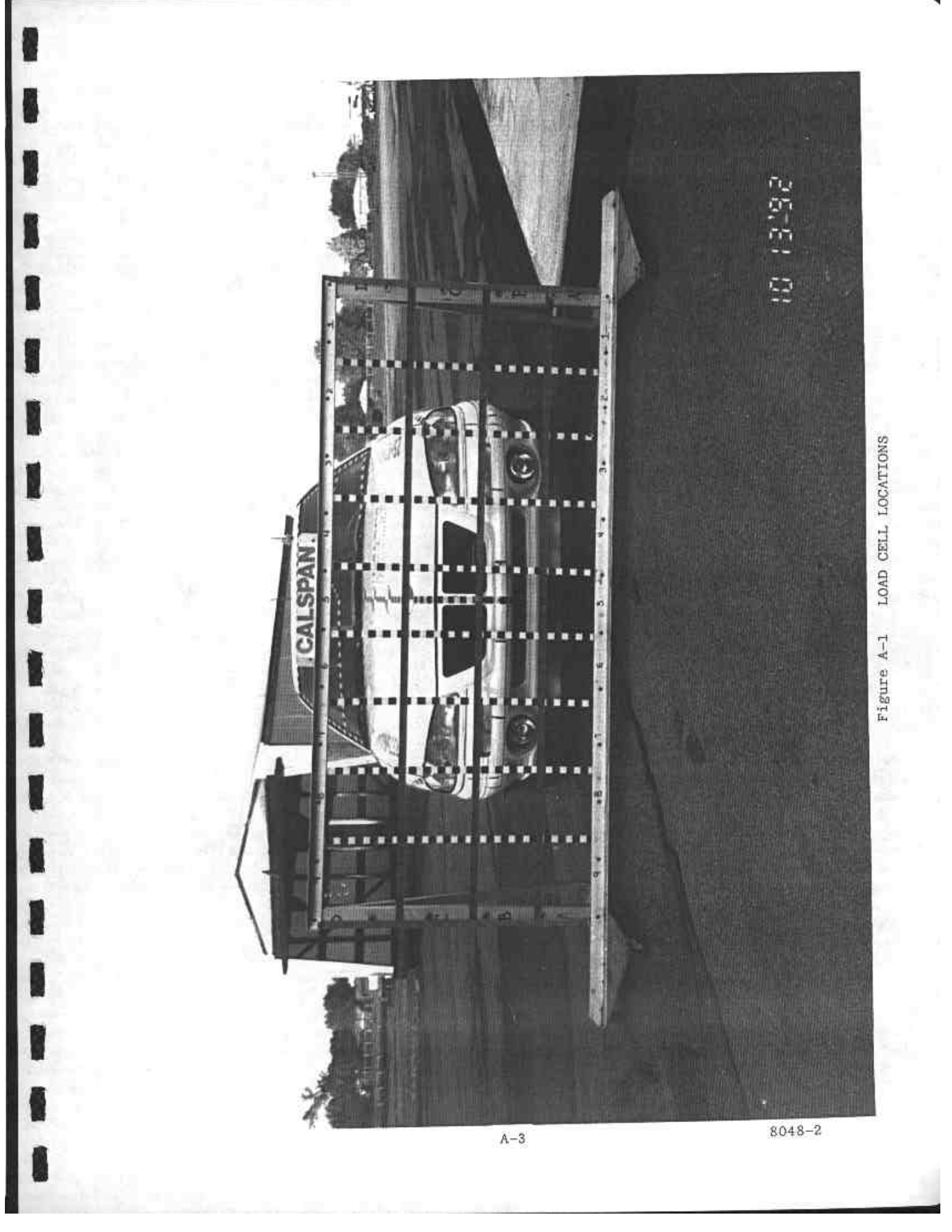


Appendix A

PHOTOGRAPHS

PHOTOGRAPHS

<u>Figure</u>	<u>Title</u>	<u>Page</u>
A-1	LOAD CELL LOCATIONS .....	A-3
A-2	PRE-TEST FRONT VIEW .....	A-4
A-3	POST TEST FRONT VIEW .....	A-5
A-4	PRE-TEST LEFT SIDE VIEW .....	A-6
A-5	POST TEST LEFT SIDE VIEW .....	A-7
A-6	PRE-TEST RIGHT SIDE VIEW .....	A-8
A-7	POST-TEST RIGHT SIDE VIEW .....	A-9
A-8	PRE-TEST RIGHT FRONT THREE-QUARTER VIEW .....	A-10
A-9	POST-TEST RIGHT FRONT THREE-QUARTER VIEW .....	A-11
A-10	PRE-TEST LEFT REAR THREE-QUARTER VIEW .....	A-12
A-11	POST-TEST LEFT REAR THREE-QUARTER VIEW .....	A-13
A-12	PRE-TEST WINDSHIELD VIEW .....	A-14
A-13	POST-TEST WINDSHIELD VIEW .....	A-15
A-14	PRE-TEST ENGINE COMPARTMENT VIEW .....	A-16
A-15	FUEL CAP VIEW .....	A-17
A-16	PRE-TEST FRONT UNDERBODY VIEW .....	A-18
A-17	POST-TEST FRONT UNDERBODY VIEW .....	A-19
A-18	PRE-TEST FRONT SIDE UNDERBODY VIEW .....	A-20
A-19	POST-TEST FRONT SIDE UNDERBODY VIEW .....	A-21
A-20	PRE-TEST REAR UNDERBODY VIEW .....	A-22
A-21	POST-TEST REAR UNDERBODY VIEW .....	A-23
A-22	PRE-TEST DRIVER POSITION VIEW .....	A-24
A-23	POST-TEST DRIVER POSITION VIEW .....	A-25
A-24	PRE-TEST PASSENGER POSITION VIEW .....	A-26
A-25	POST-TEST PASSENGER POSITION VIEW .....	A-27
A-26	PRE-TEST DRIVER AND INTERIOR VIEW .....	A-28
A-27	POST-TEST DRIVER AND INTERIOR VIEW .....	A-29
A-28	PRE-TEST PASSENGER AND INTERIOR VIEW .....	A-30
A-29	POST-TEST PASSENGER AND INTERIOR VIEW .....	A-31
A-30	IMPACT VIEW .....	A-34



10 13 92

Figure A-1 LOAD CELL LOCATIONS

A-3

8048-2



Figure A-2 PRE-TEST FRONT VIEW



Figure A-3 POST TEST FRONT VIEW

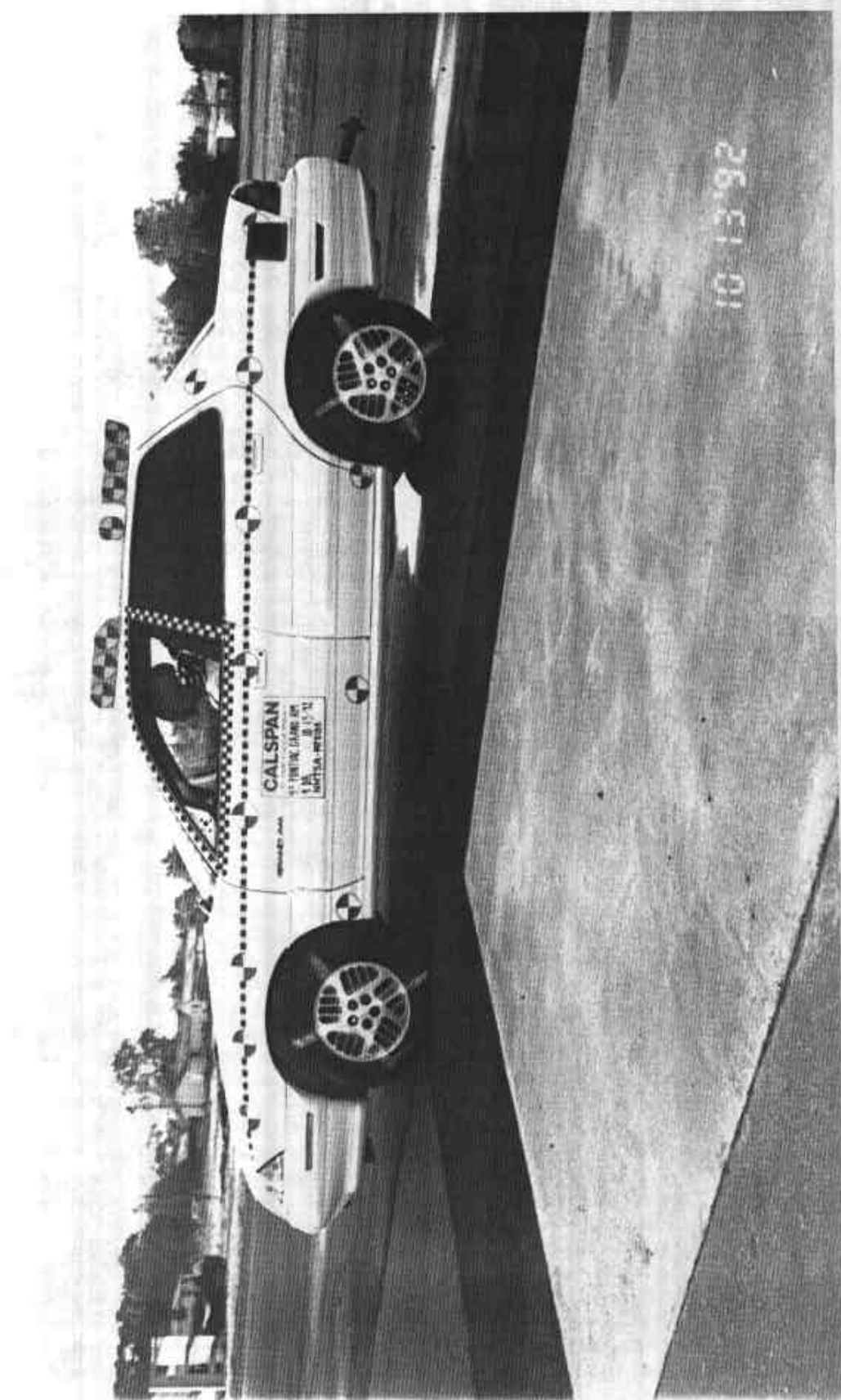


Figure A-4 PRE-TEST LEFT SIDE VIEW

A-6

8048-2



Figure A-5 POST TEST LEFT SIDE VIEW

A-7

8048-2

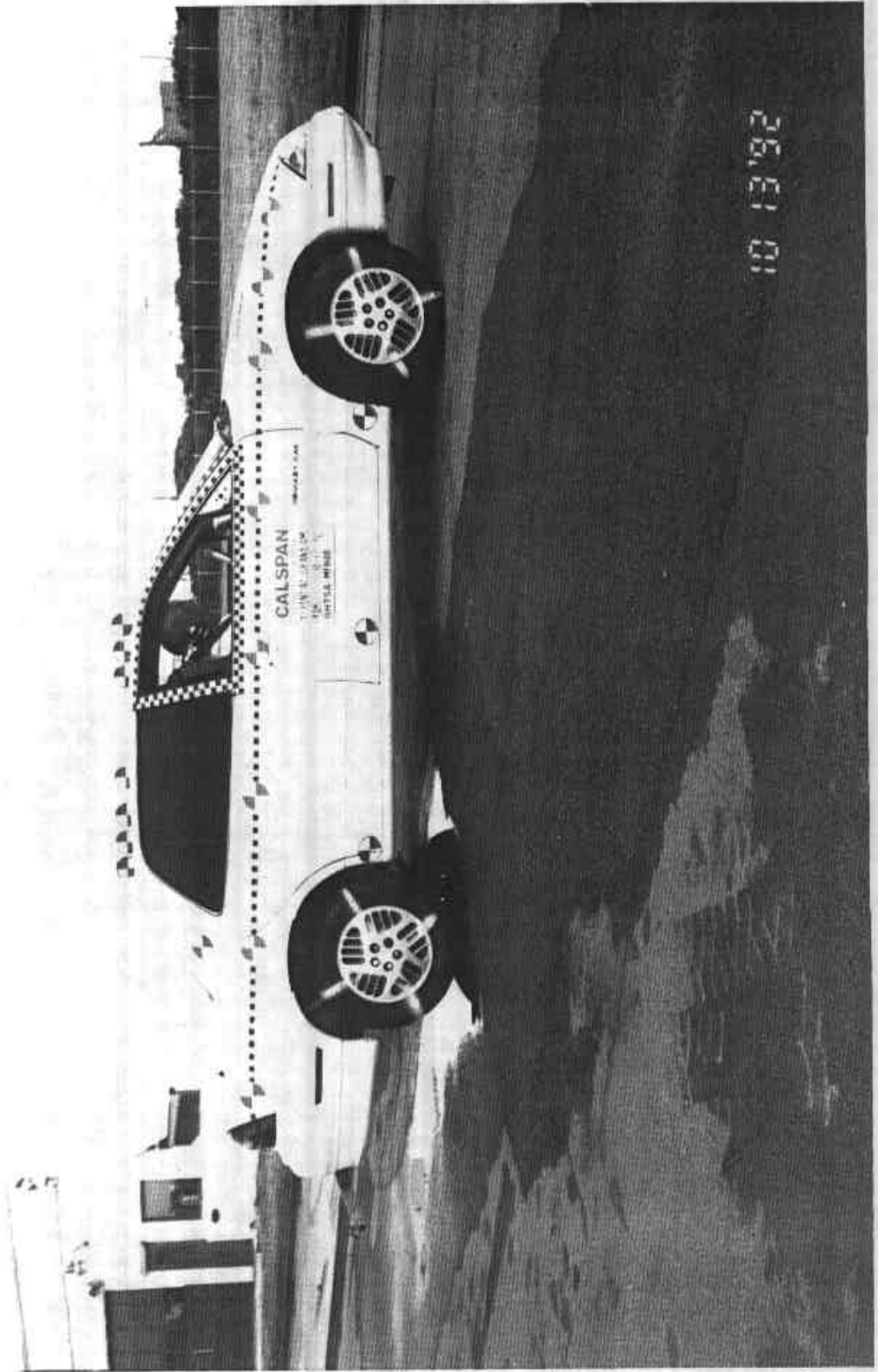
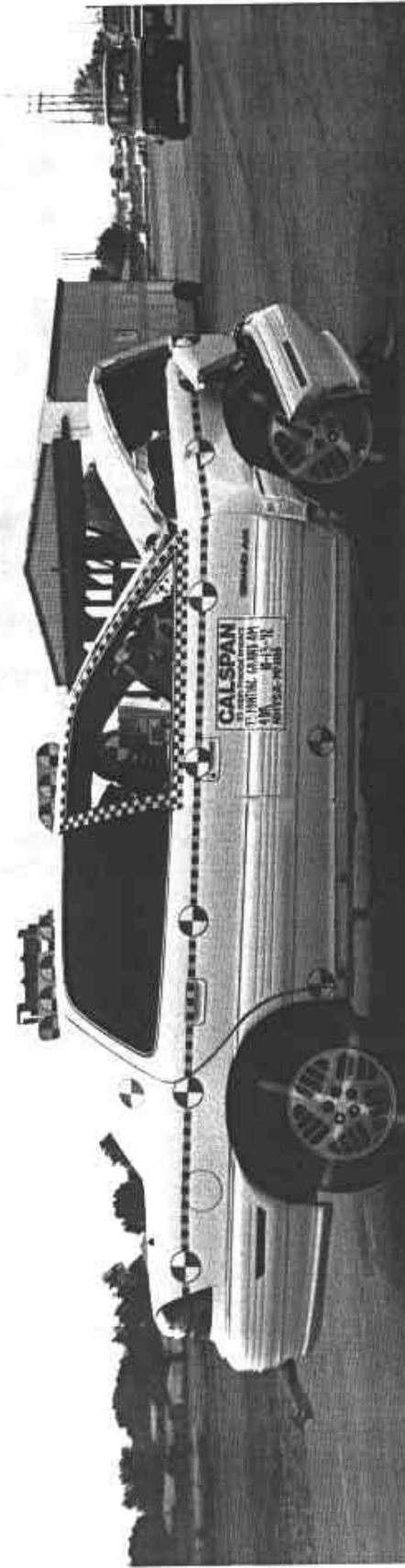


Figure A-6 PRE-TEST RIGHT SIDE VIEW

A-8

8048-2



26.61.00

Figure A-7 POST-TEST RIGHT SIDE VIEW

A-9

8048-2



Figure A-8 PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

A-10

8048-2



08 13 '92

Figure A-9 POST-TEST RIGHT FRONT THREE-QUARTER VIEW

A-11

8048-2

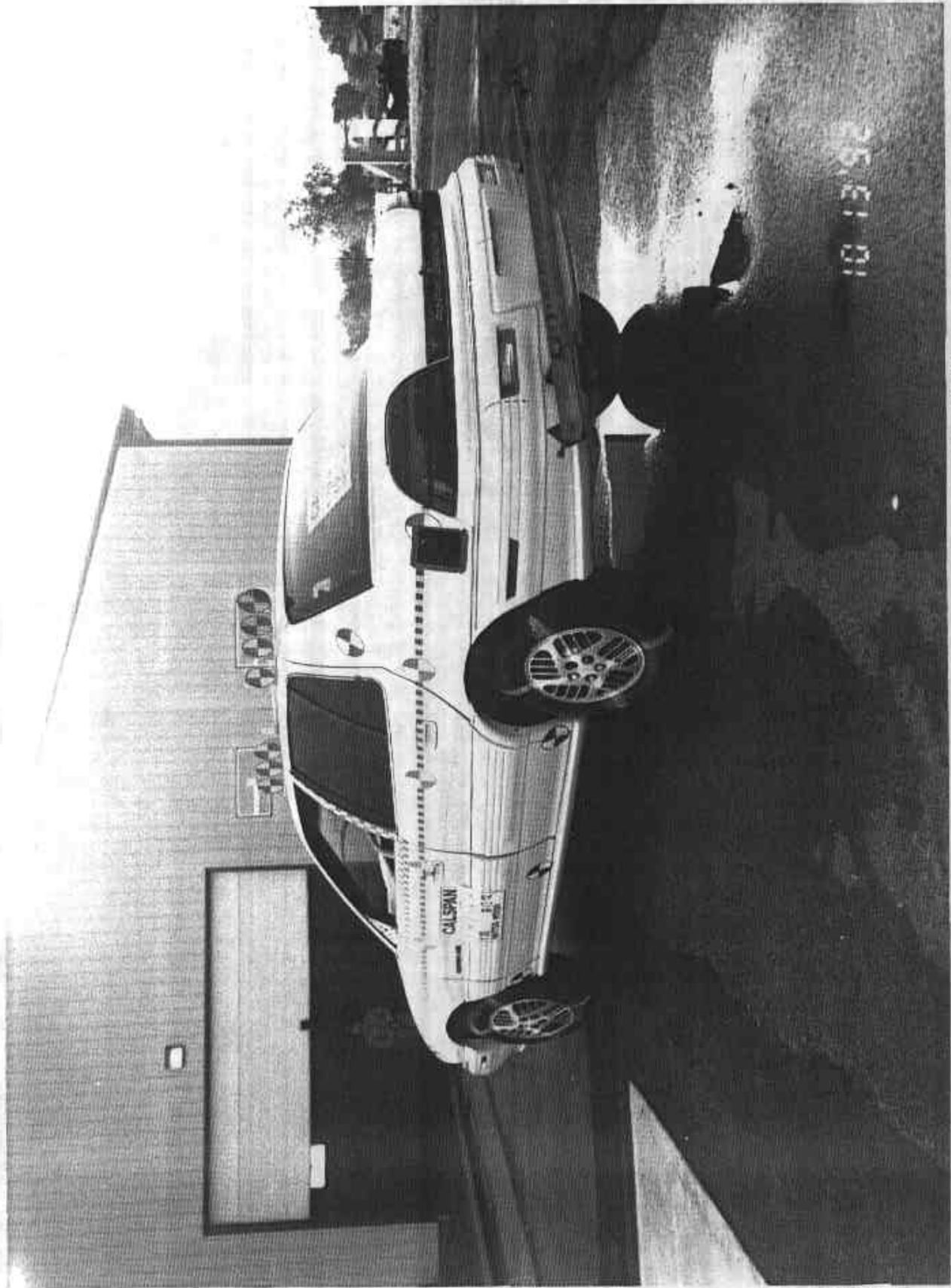


Figure A-10 PRE-TEST LEFT REAR THREE-QUARTER VIEW

A-12

8048-2

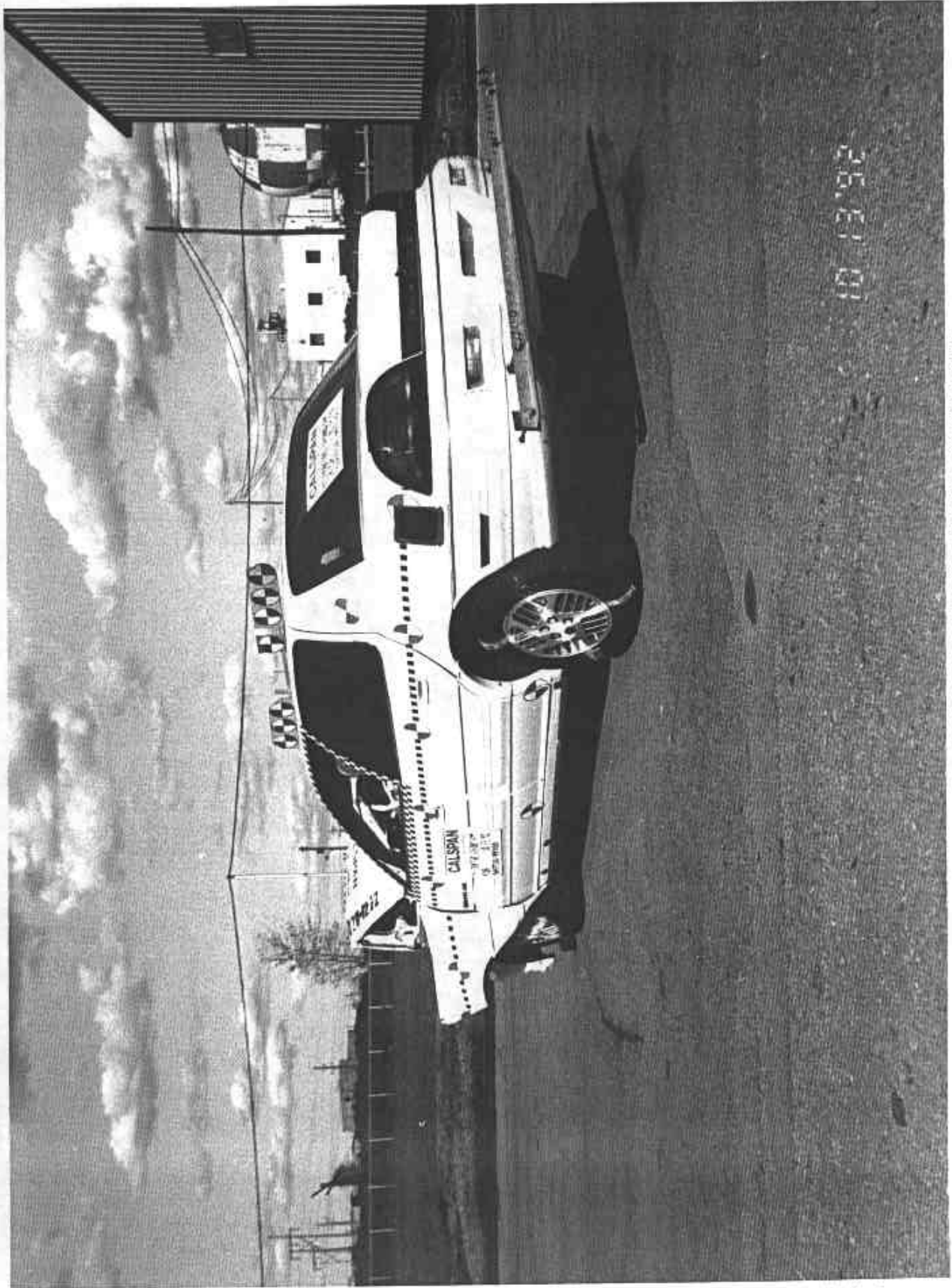
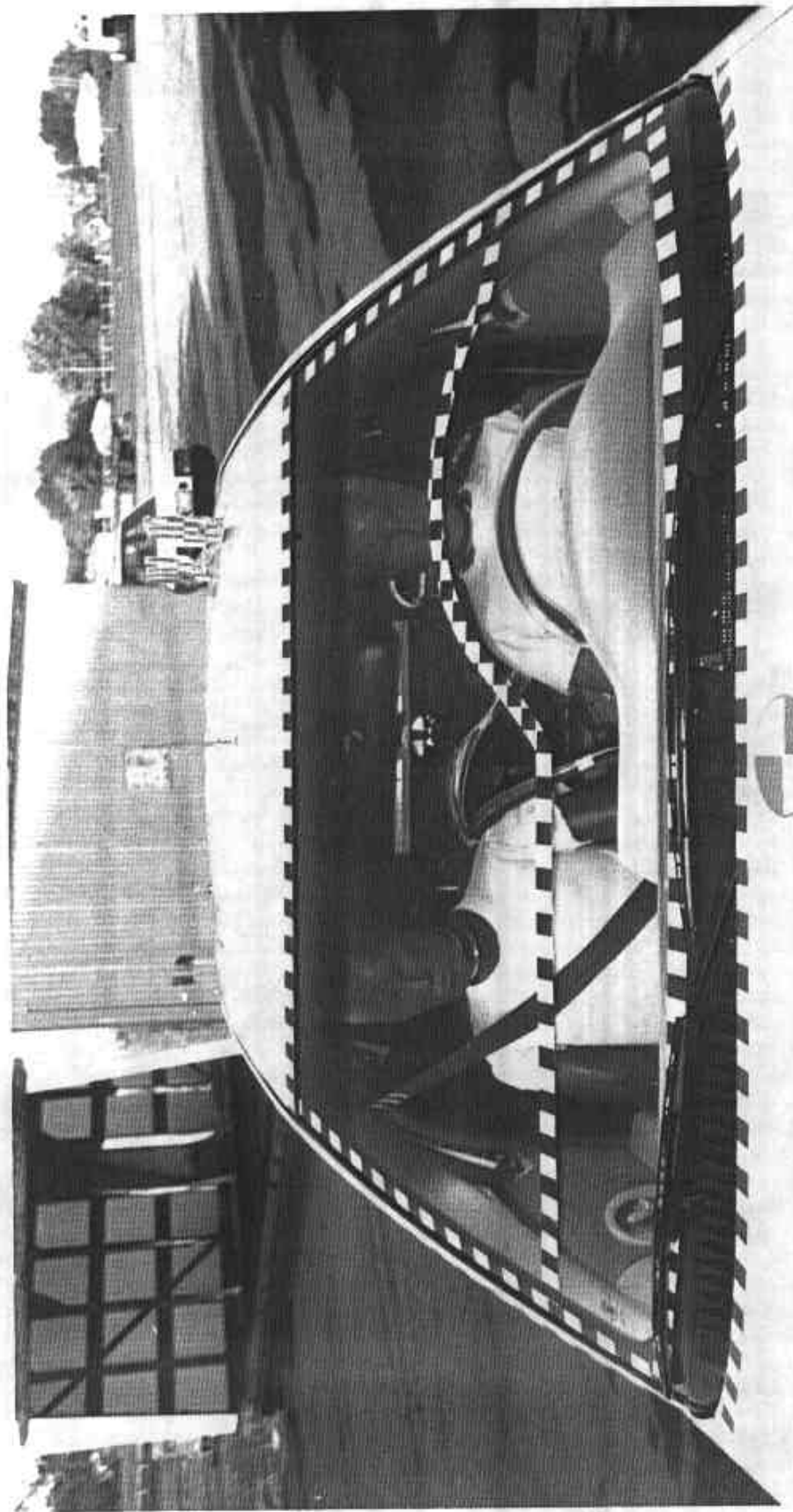


Figure A-11 POST-TEST LEFT REAR THREE-QUARTER VIEW

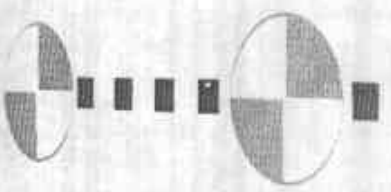
A-13

8048-2



200

**CALSPAN**  
39 mph Frontal Impact  
**'13 PONTIAC, GRAND**



251

Figure A-12 PRE-TEST WINDSHIELD VIEW

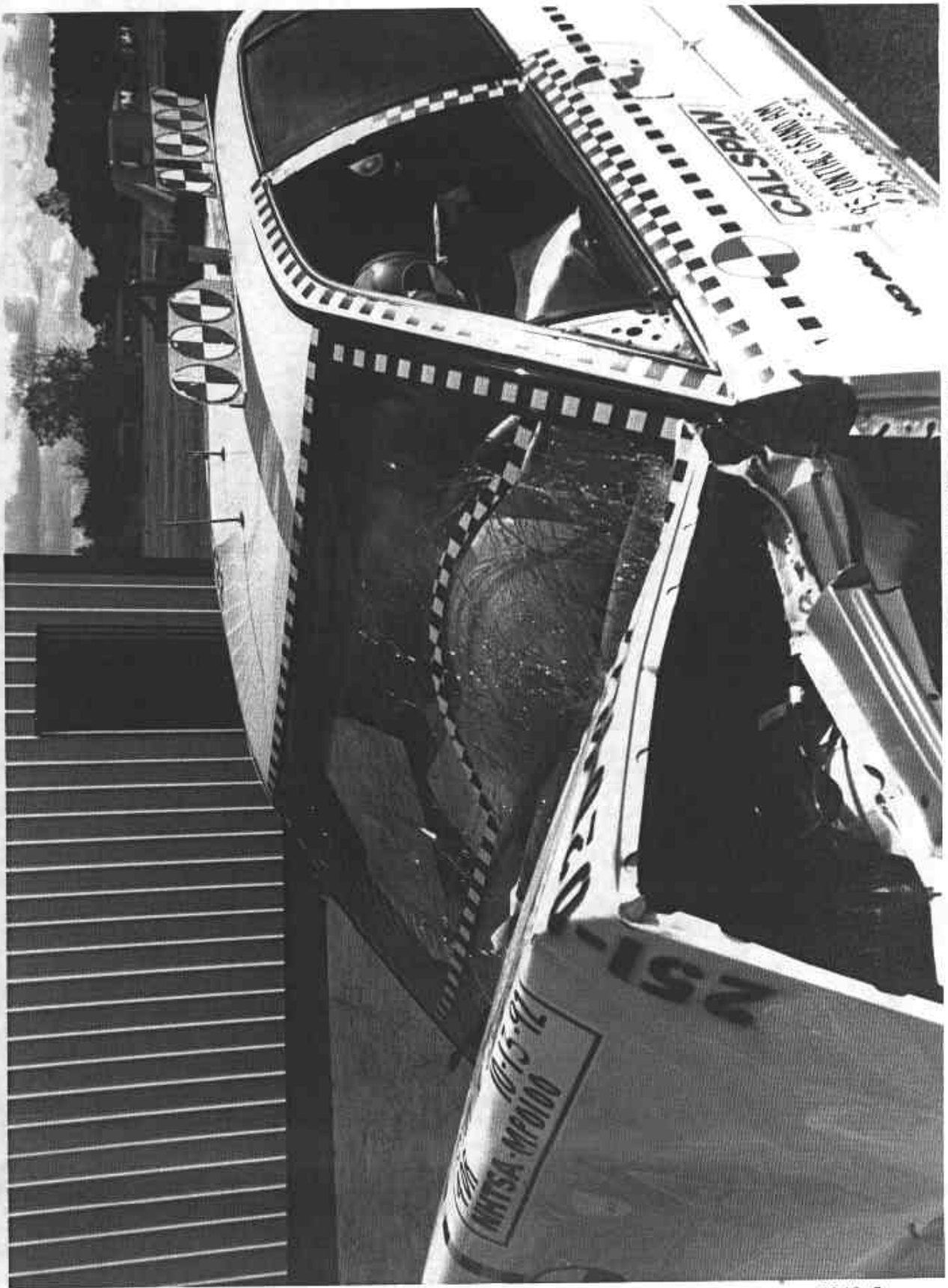


Figure A-13 POST-TEST WINDSHIELD VIEW

A-15

8048-2

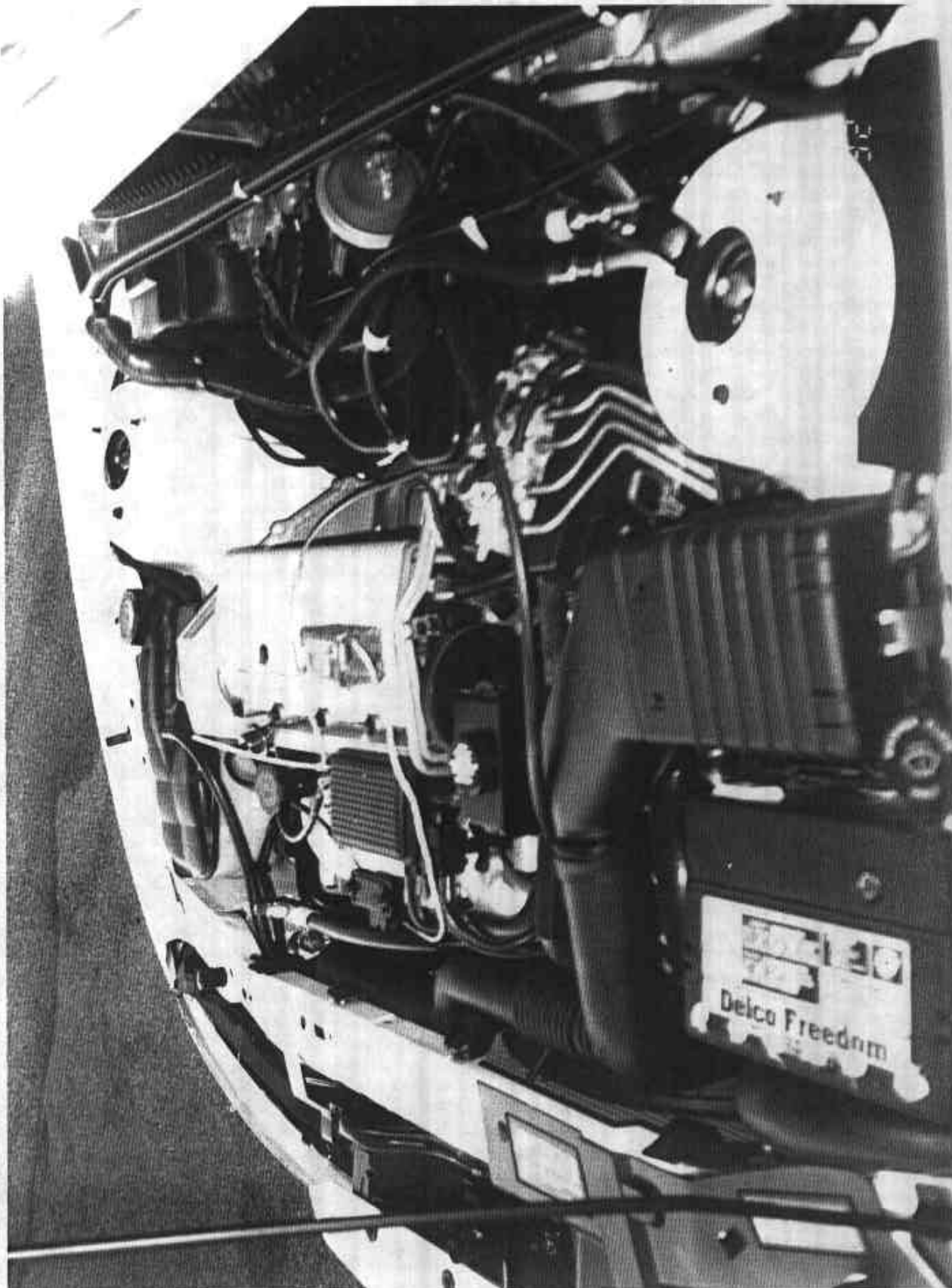


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-16

8048-2

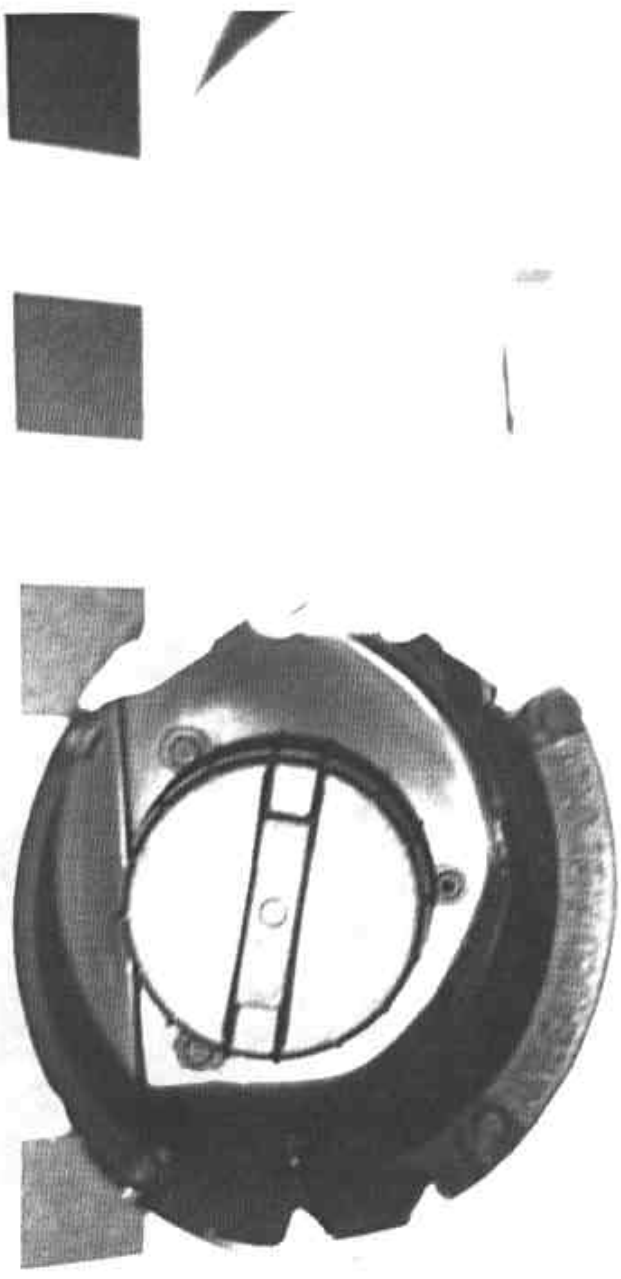


FIGURE A-15 FUEL CAP VIEW

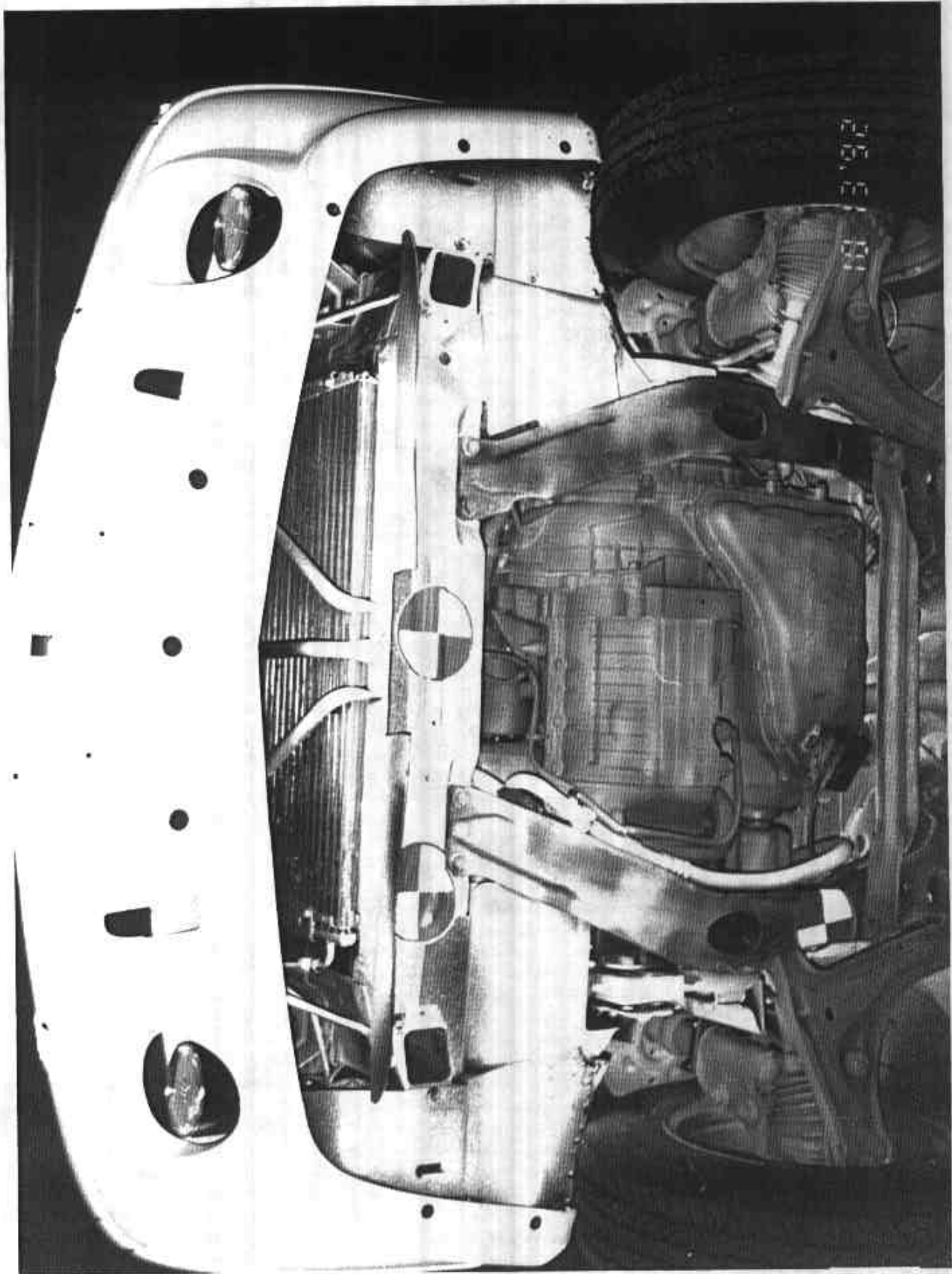


Figure A-16 PRE-TEST FRONT UNDERBODY VIEW

A-18

8048-2



Figure A-17 POST-TEST FRONT UNDERBODY VIEW

A-19

8048-2

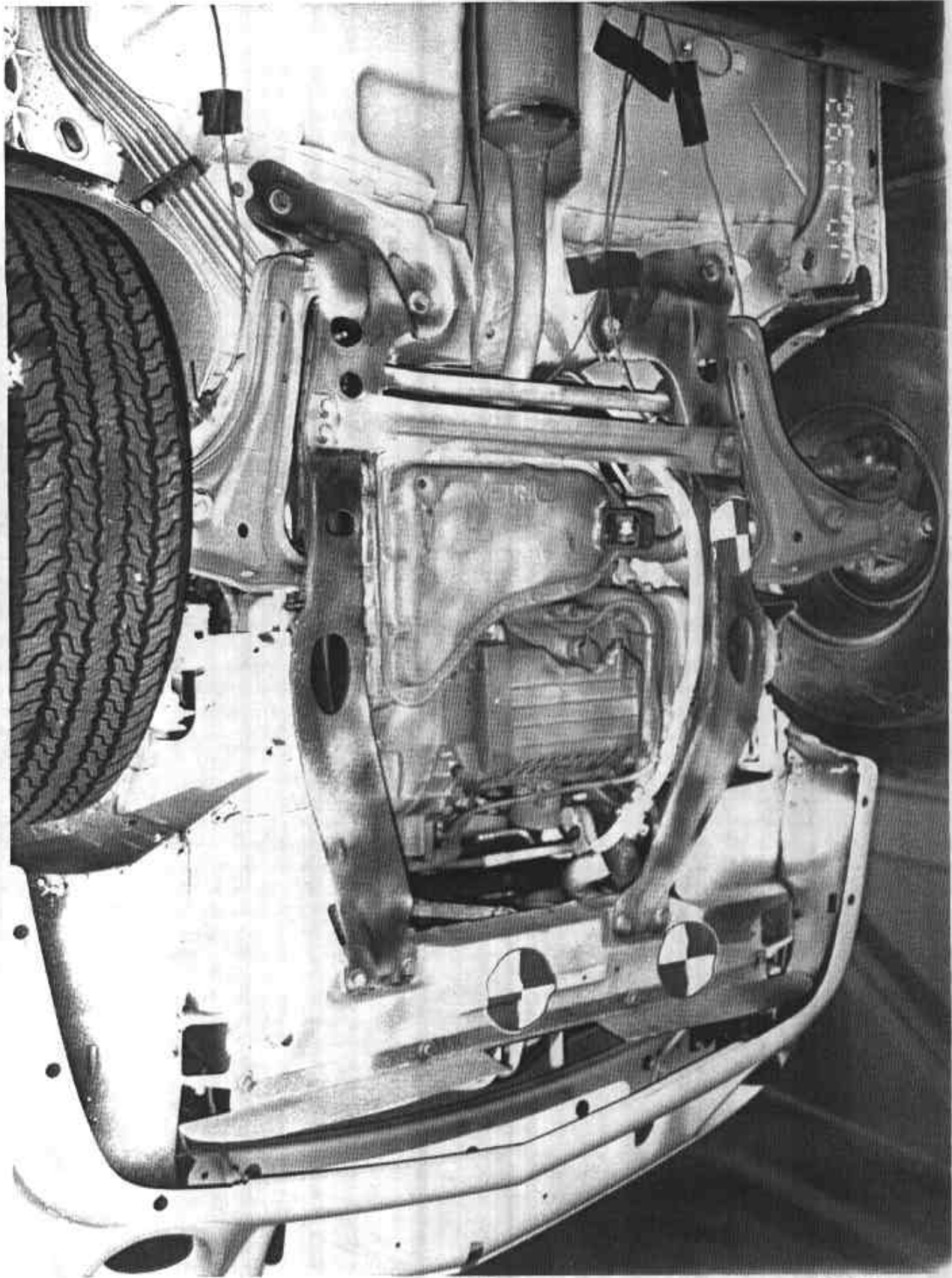


Figure A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW

A-20

8048-2

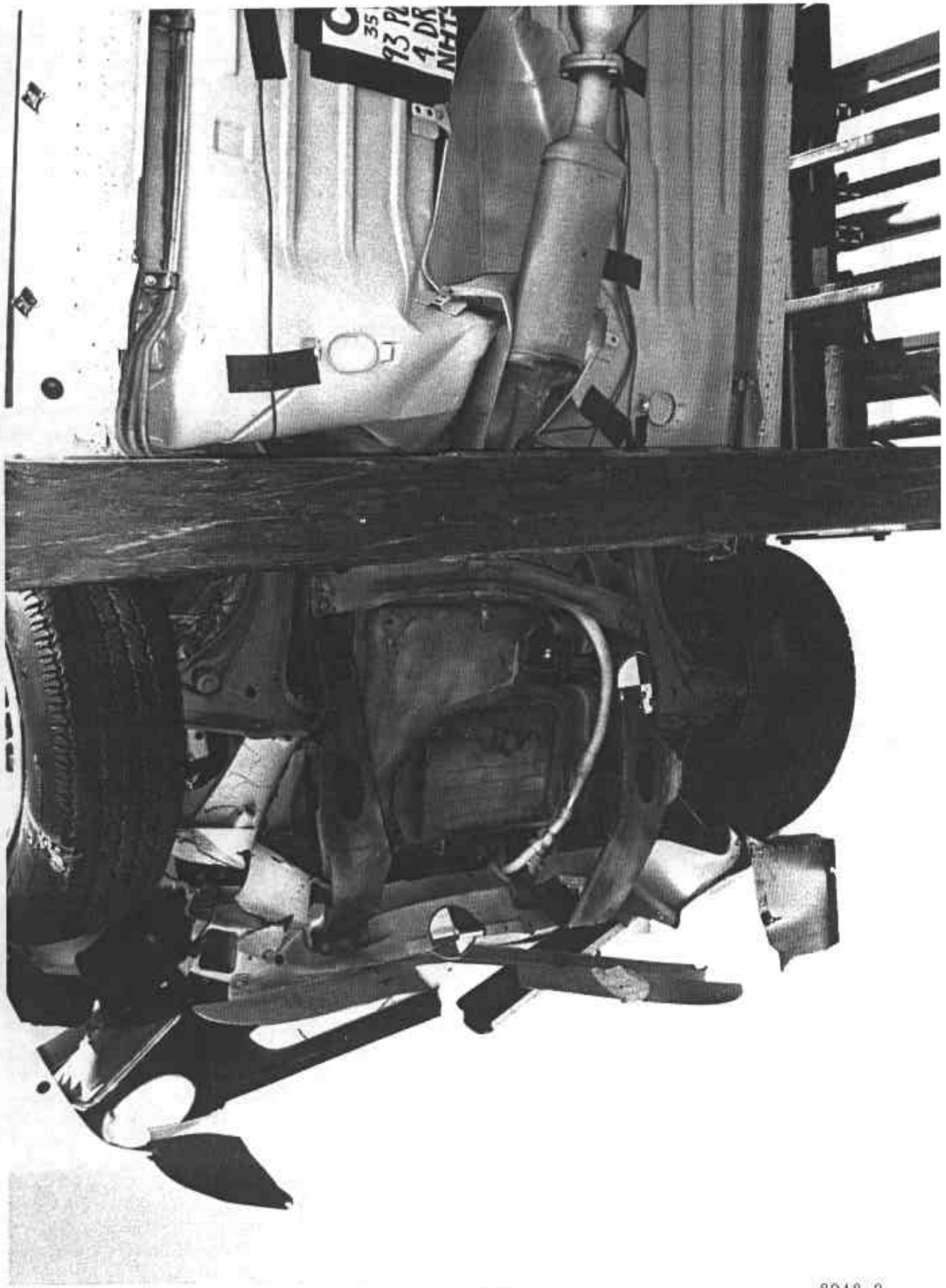


Figure A-19 POST-TEST FRONT SIDE UNDERBODY VIEW

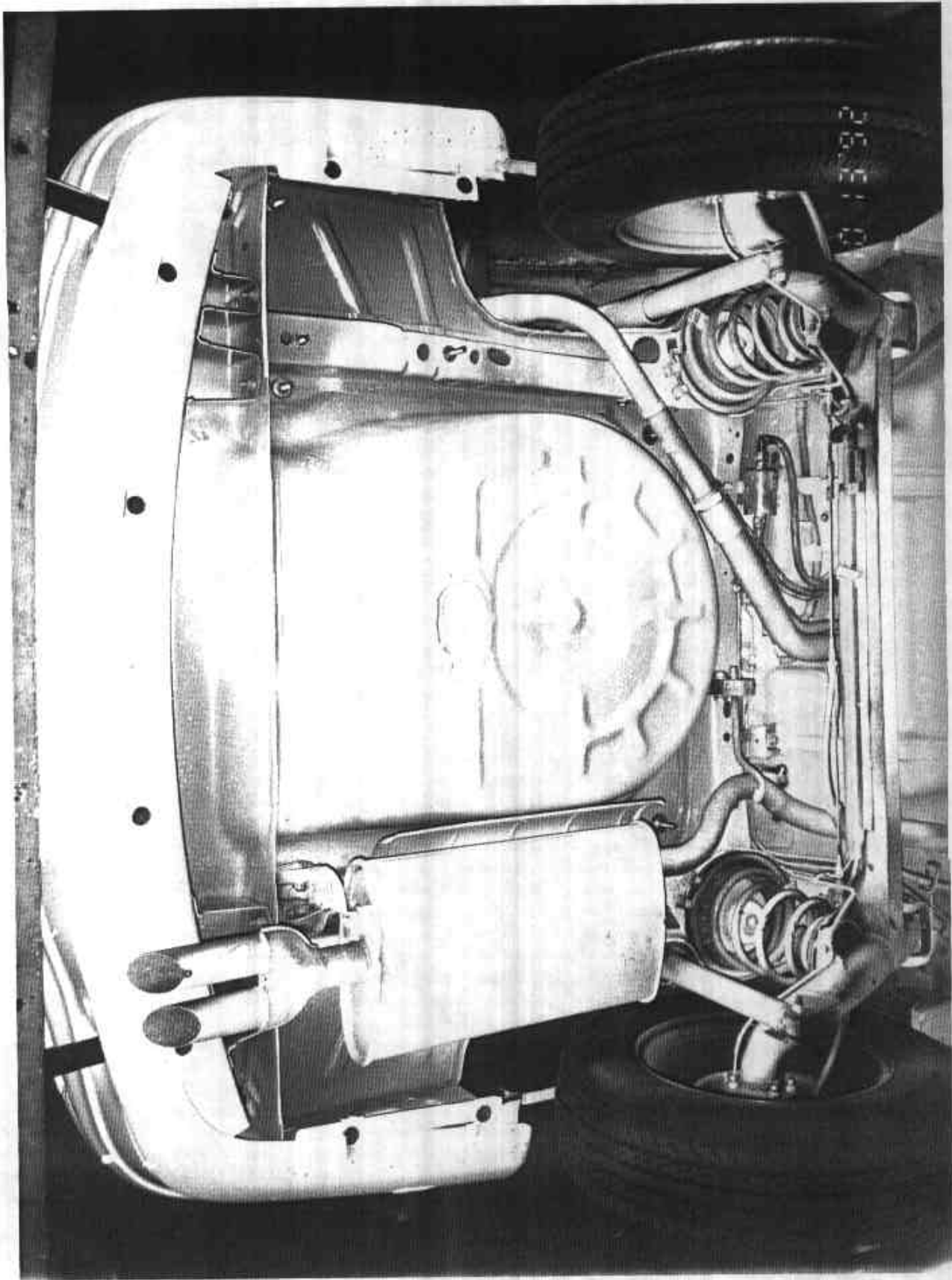


Figure A-20 PRE-TEST REAR UNDERBODY VIEW

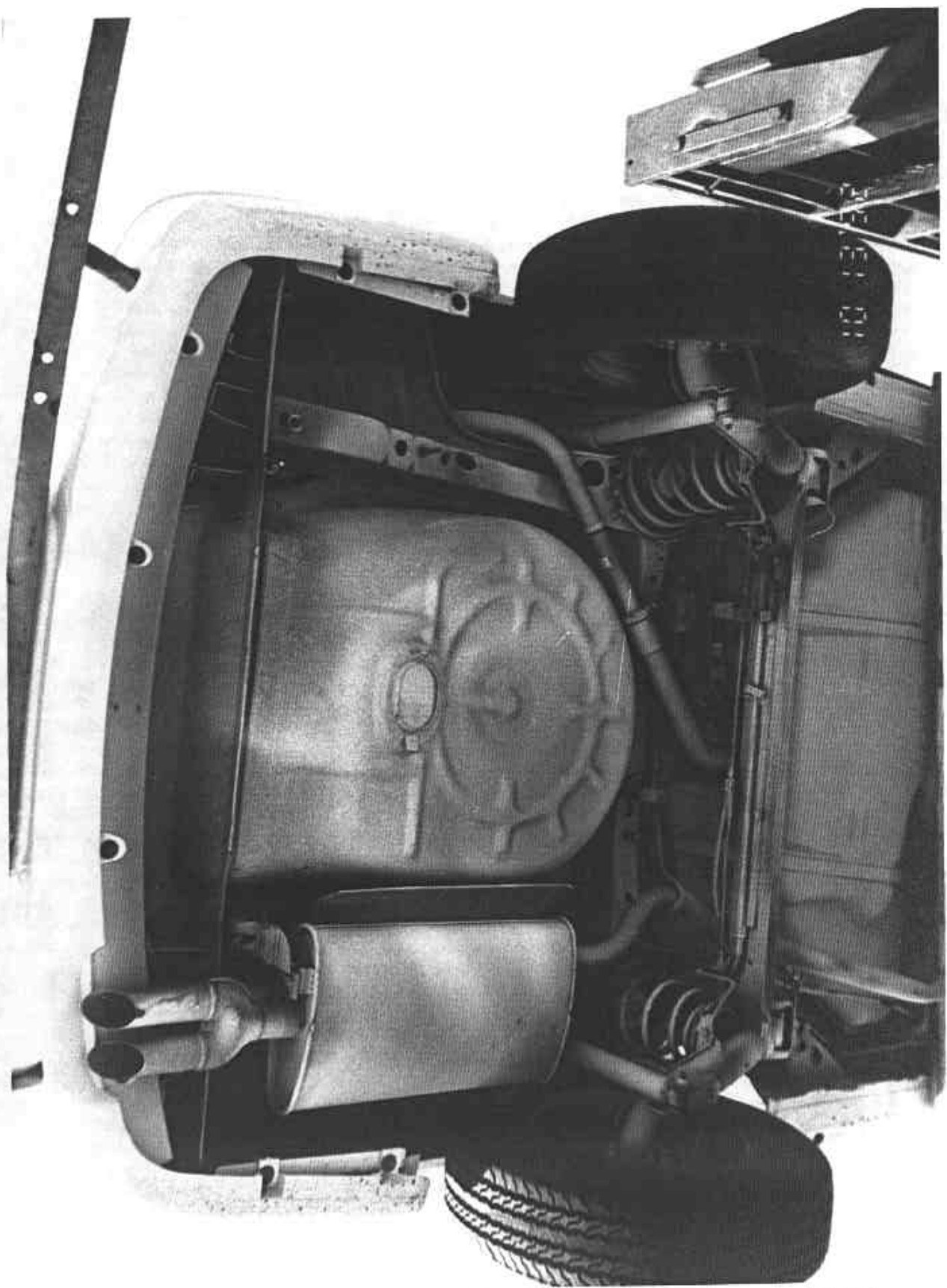


Figure A-21 POST-TEST REAR UNDERBODY VIEW

A-23

8048-2.



Figure A-22 PRE-TEST DRIVER POSITION VIEW

A-24

8048-2



Figure A-23 POST-TEST DRIVER POSITION VIEW

A-25

8048-2

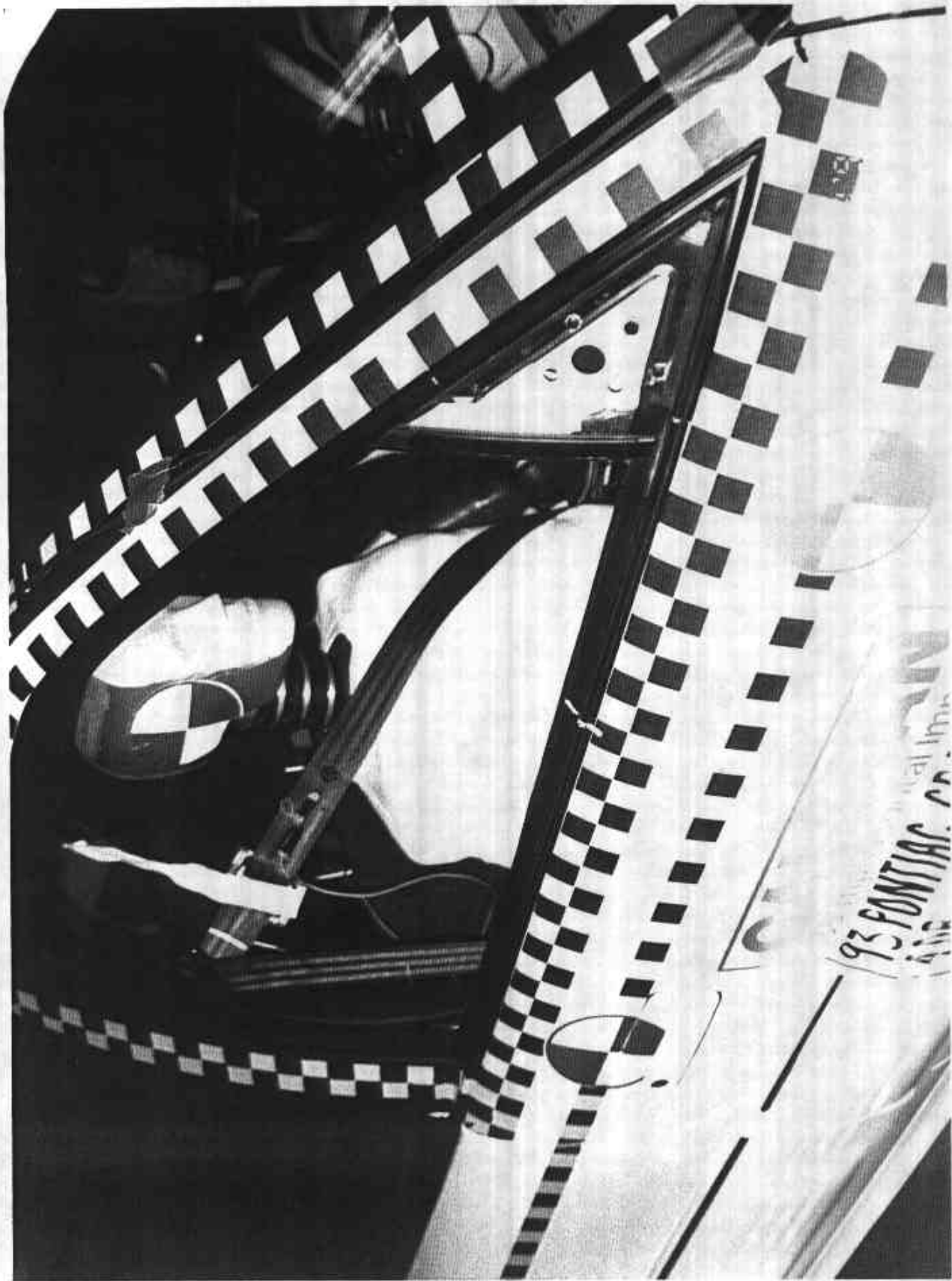


Figure A-24 PRE-TEST PASSENGER POSITION VIEW

A-26

8048-2



Figure A-25 POST-TEST PASSENGER POSITION VIEW

A-27

8048-2



Figure A-26 PRE-TEST DRIVER AND INTERIOR VIEW

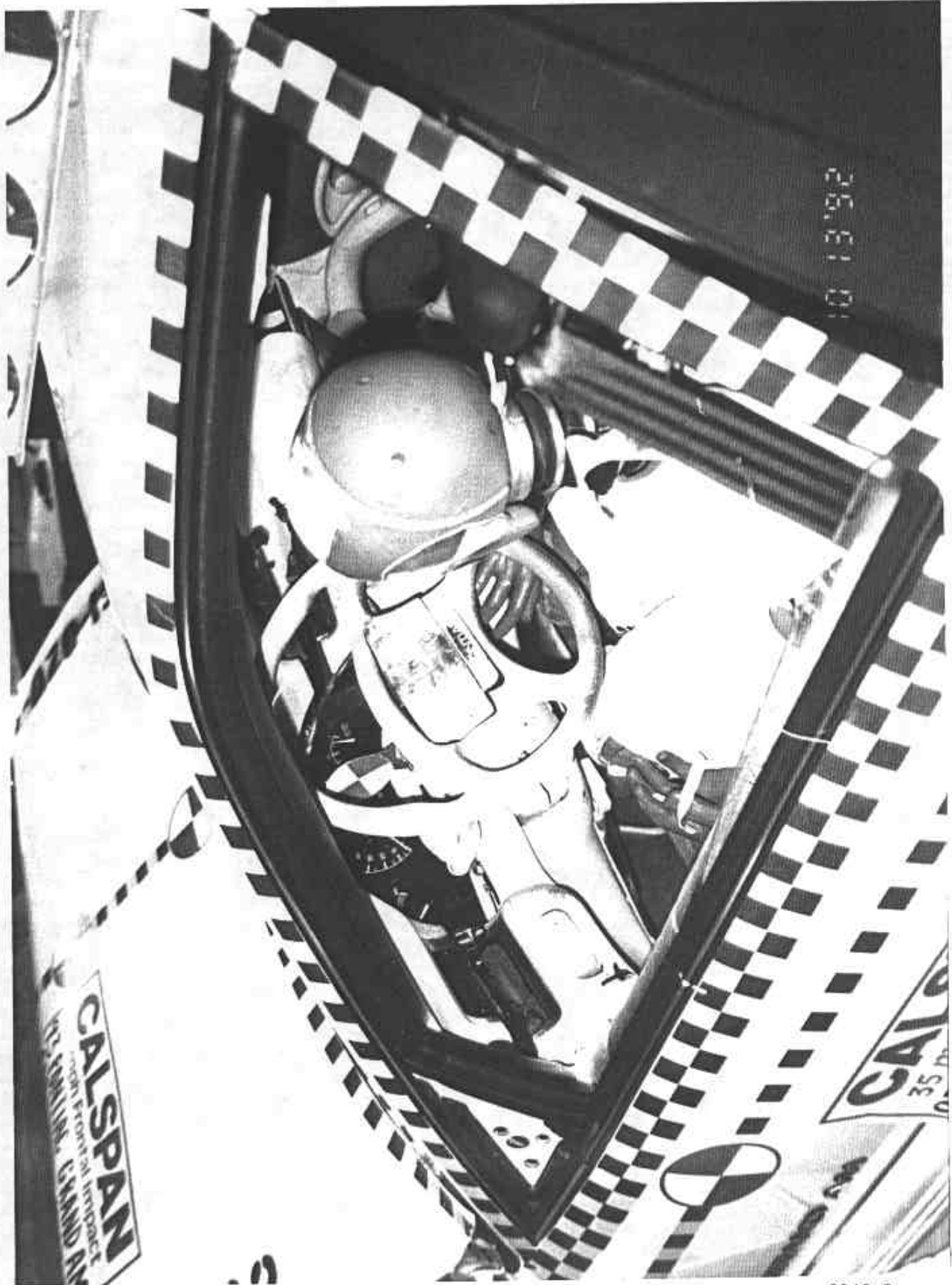


Figure A-27 POST-TEST DRIVER AND INTERIOR VIEW



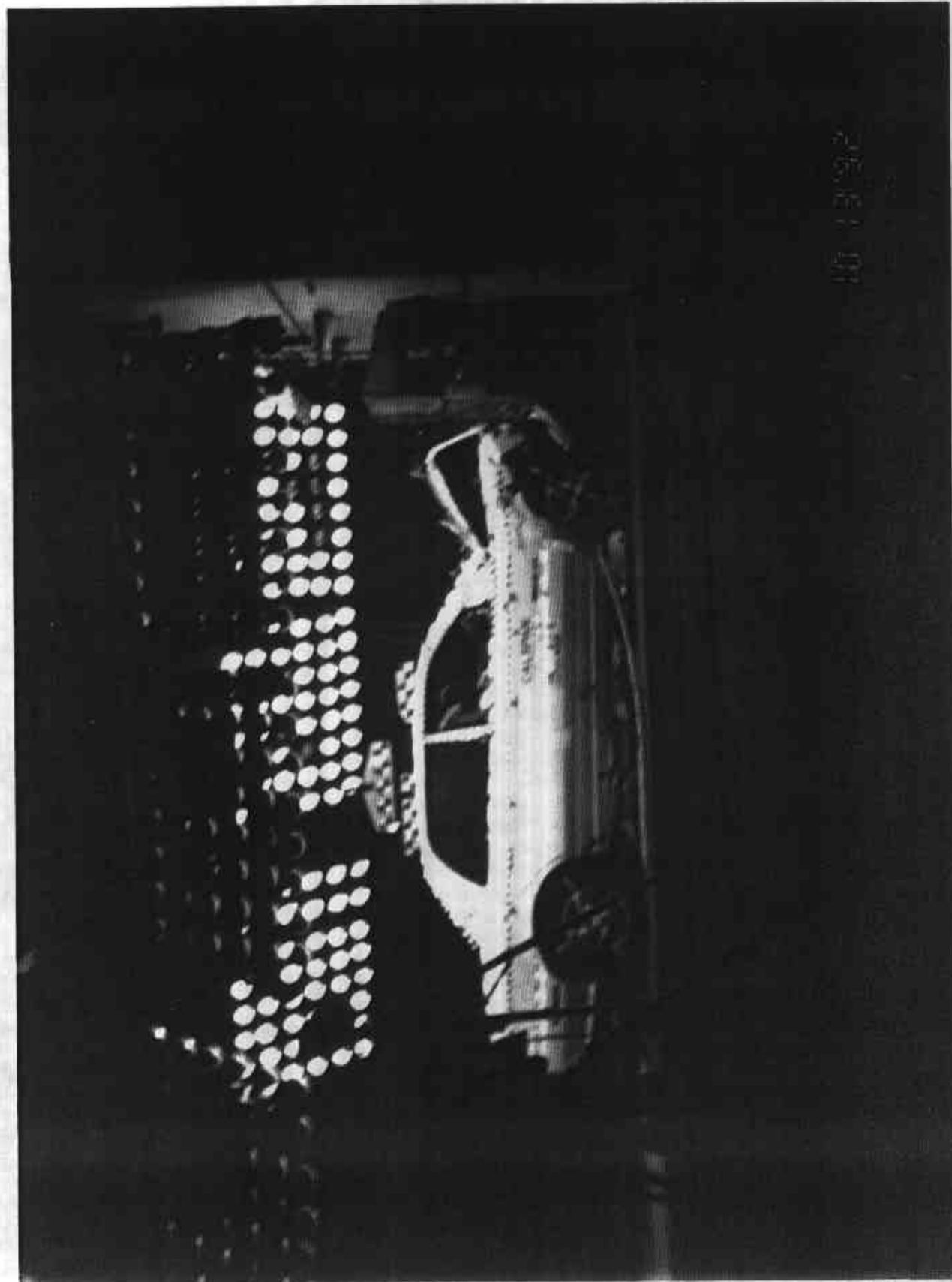
Figure A-28 PRE-TEST PASSENGER AND INTERIOR VIEW



Figure A-29 POST-TEST PASSENGER AND INTERIOR VIEW

A-31

8048-2



10 13 92

Figure A-30 IMPACT VIEW

Appendix B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

TEST NO. MP0100

VEHICLE DATA

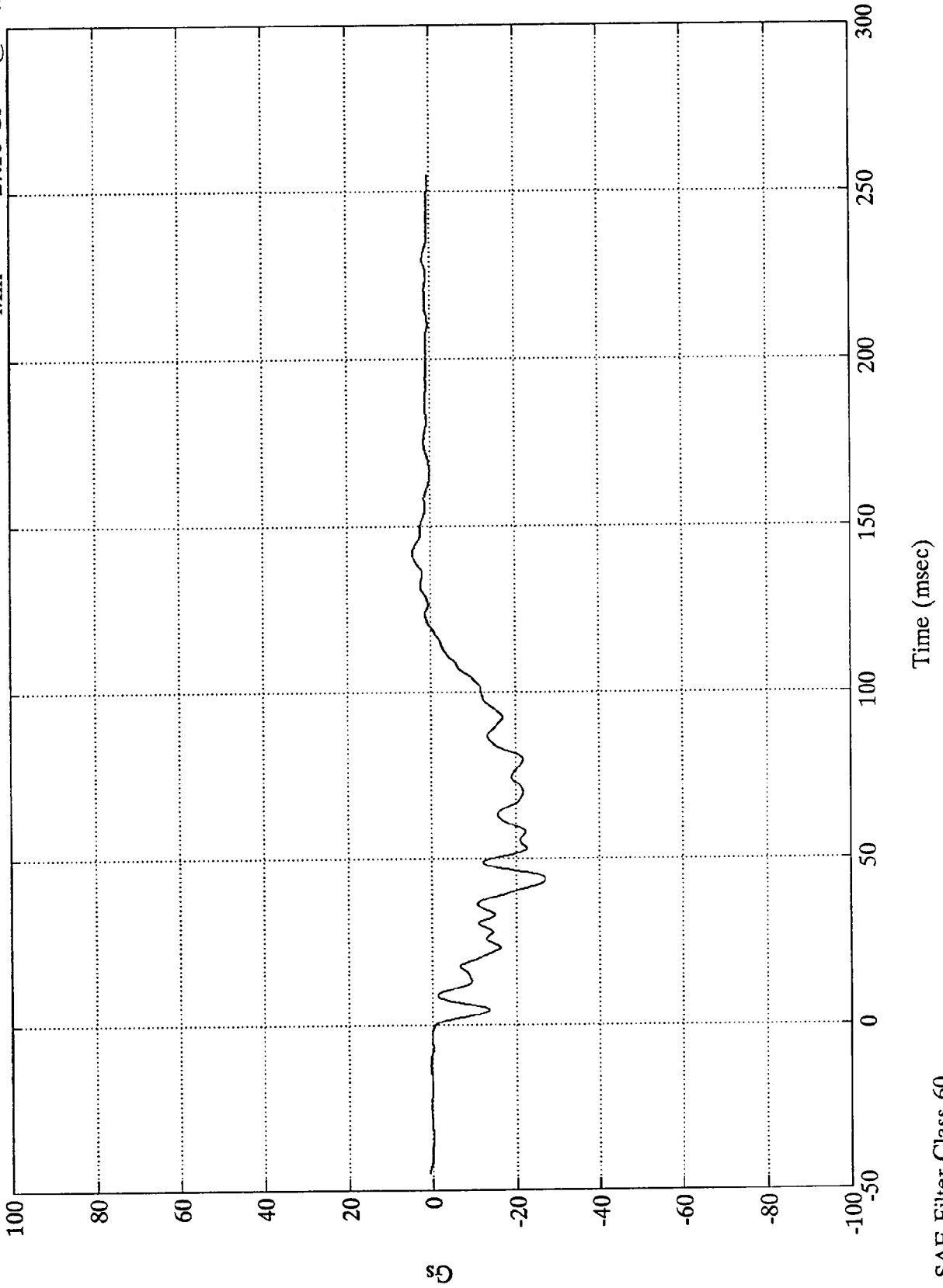
FILTER CHANNEL CLASS

60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Max = 4.39 Gs @ 141.96 msec  
Min = -27.10 Gs @ 43.91 msec

Acc. #1(x)



50

B-3

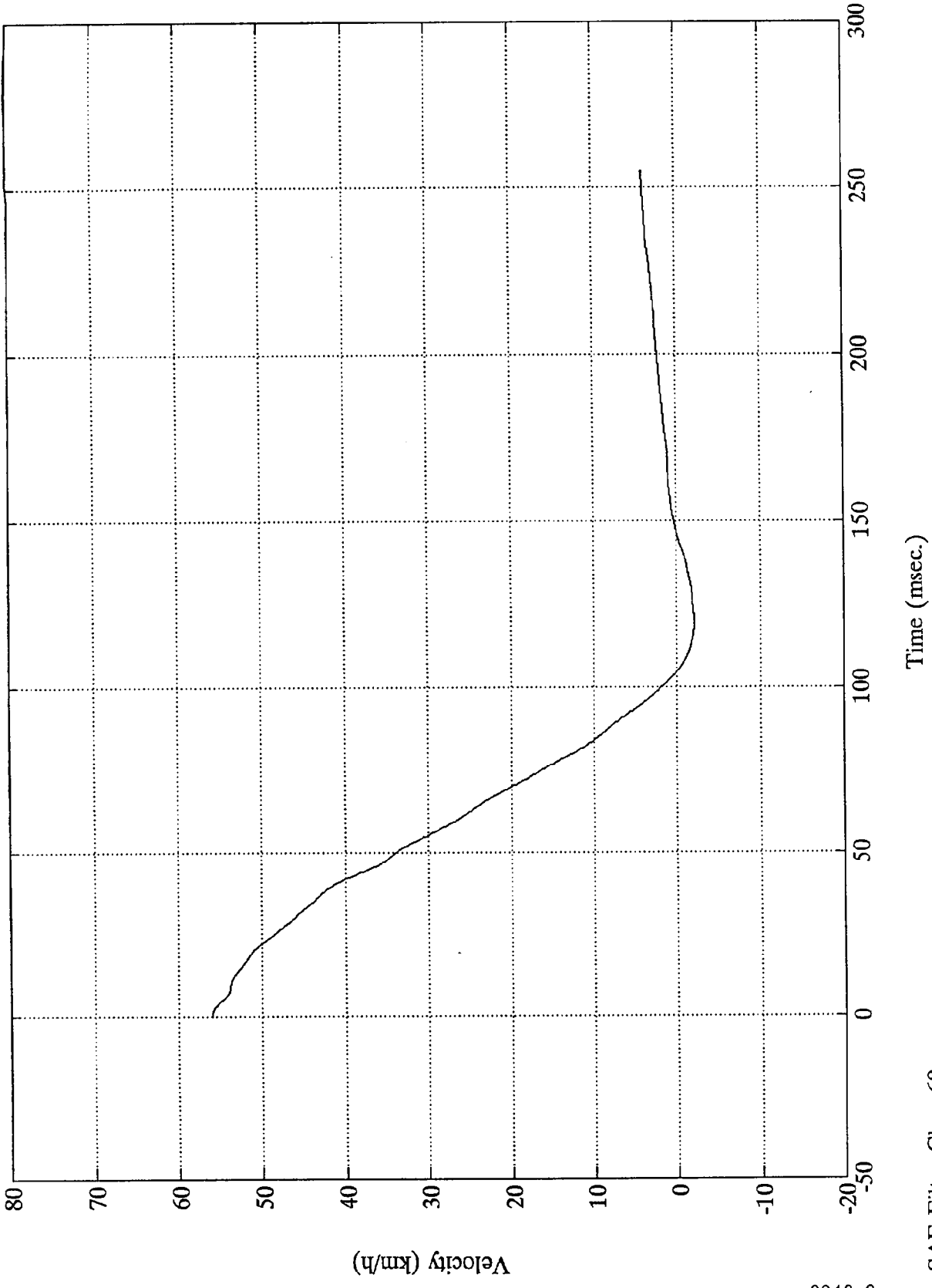
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #1(x)

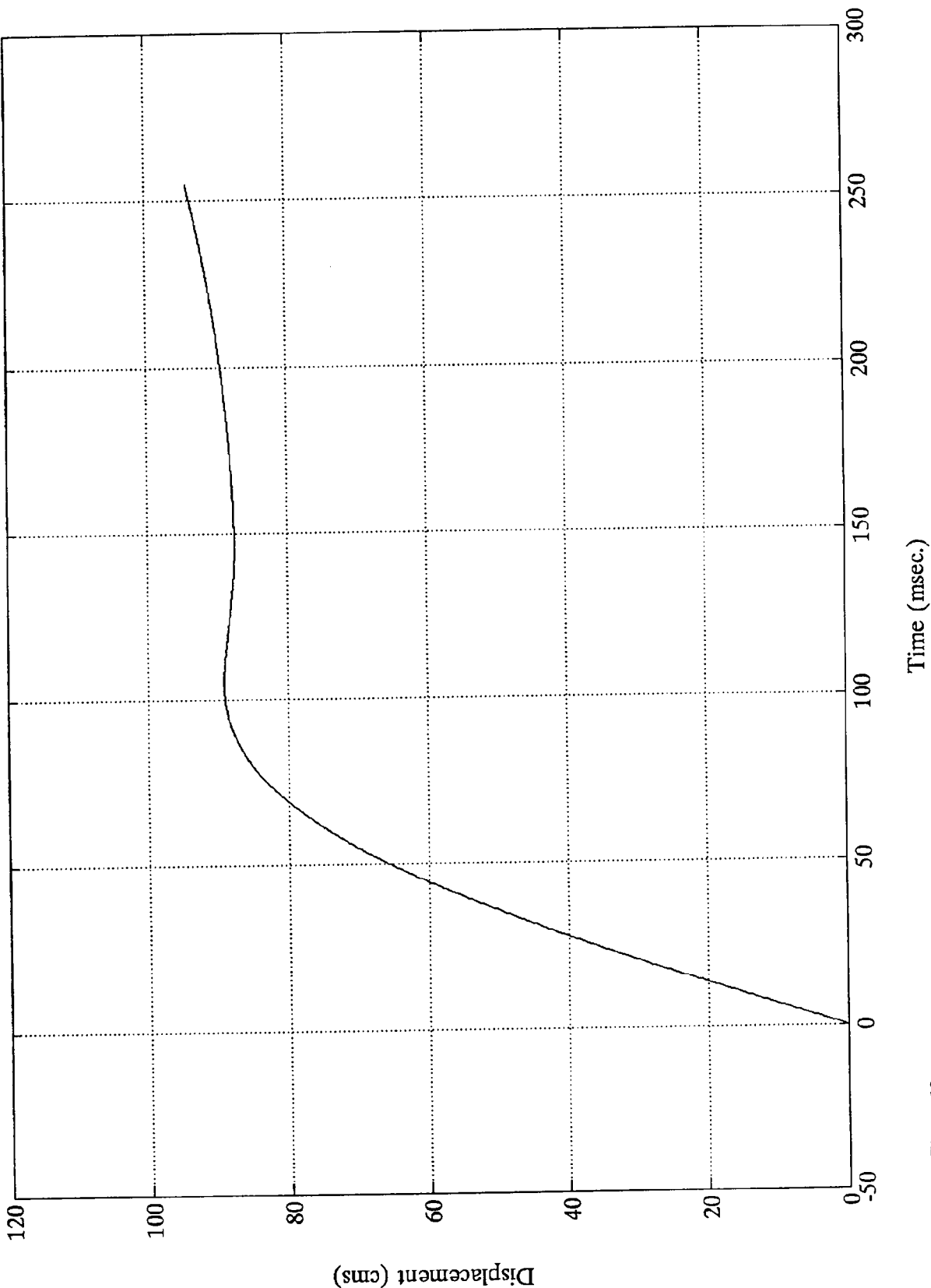
Max = 56.00 km/h @ -0.00 msec  
Min = -2.10 km/h @ 119.76 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #1(x)

Max = 94.13 cms @ 254.88 msec  
Min = 0.00 cms @ -0.00 msec

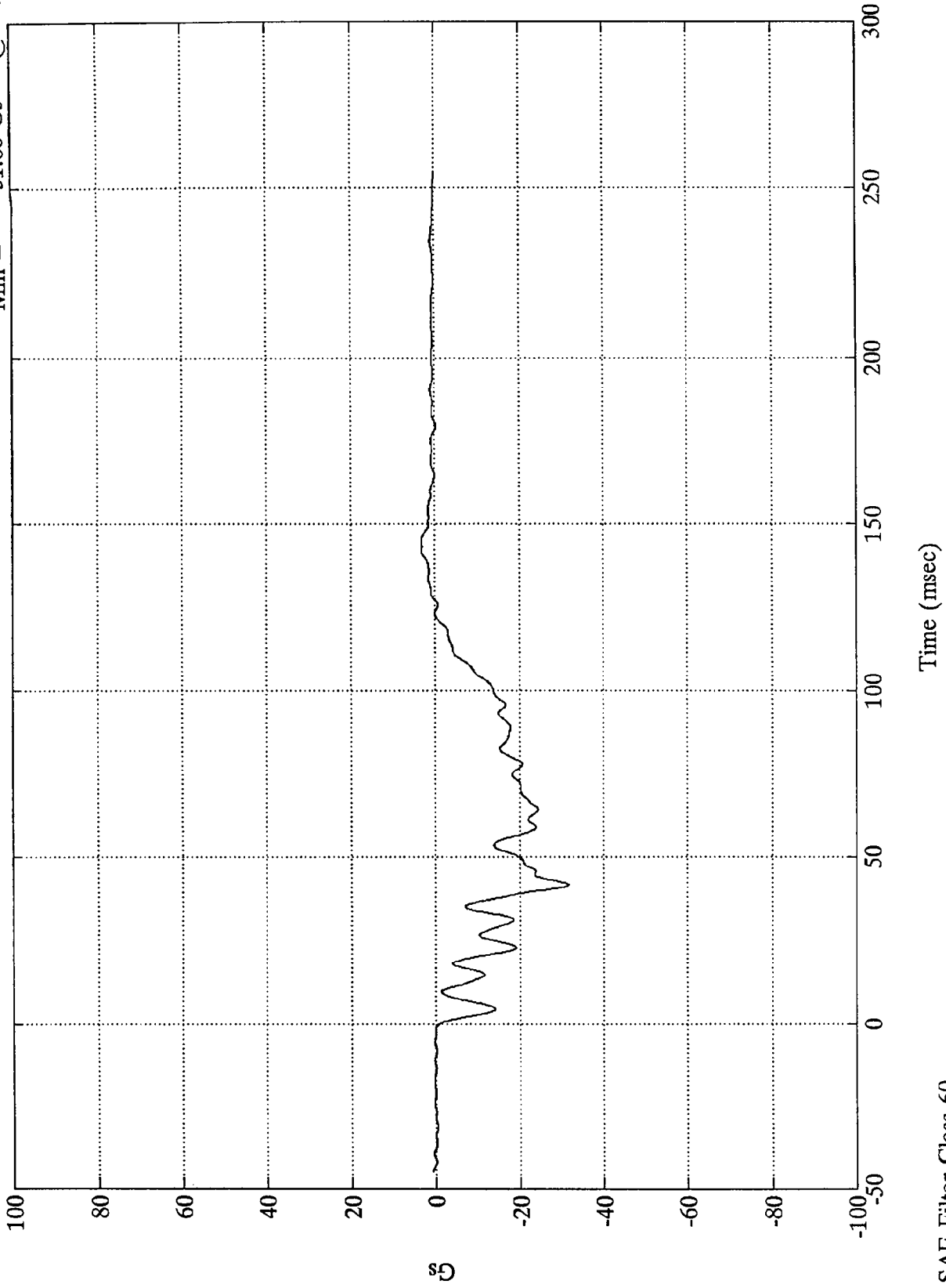


SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #2(x)

Max = 3.19 Gs @ 142.08 msec  
Min = -31.66 Gs @ 41.40 msec



95

B-6

8048-2

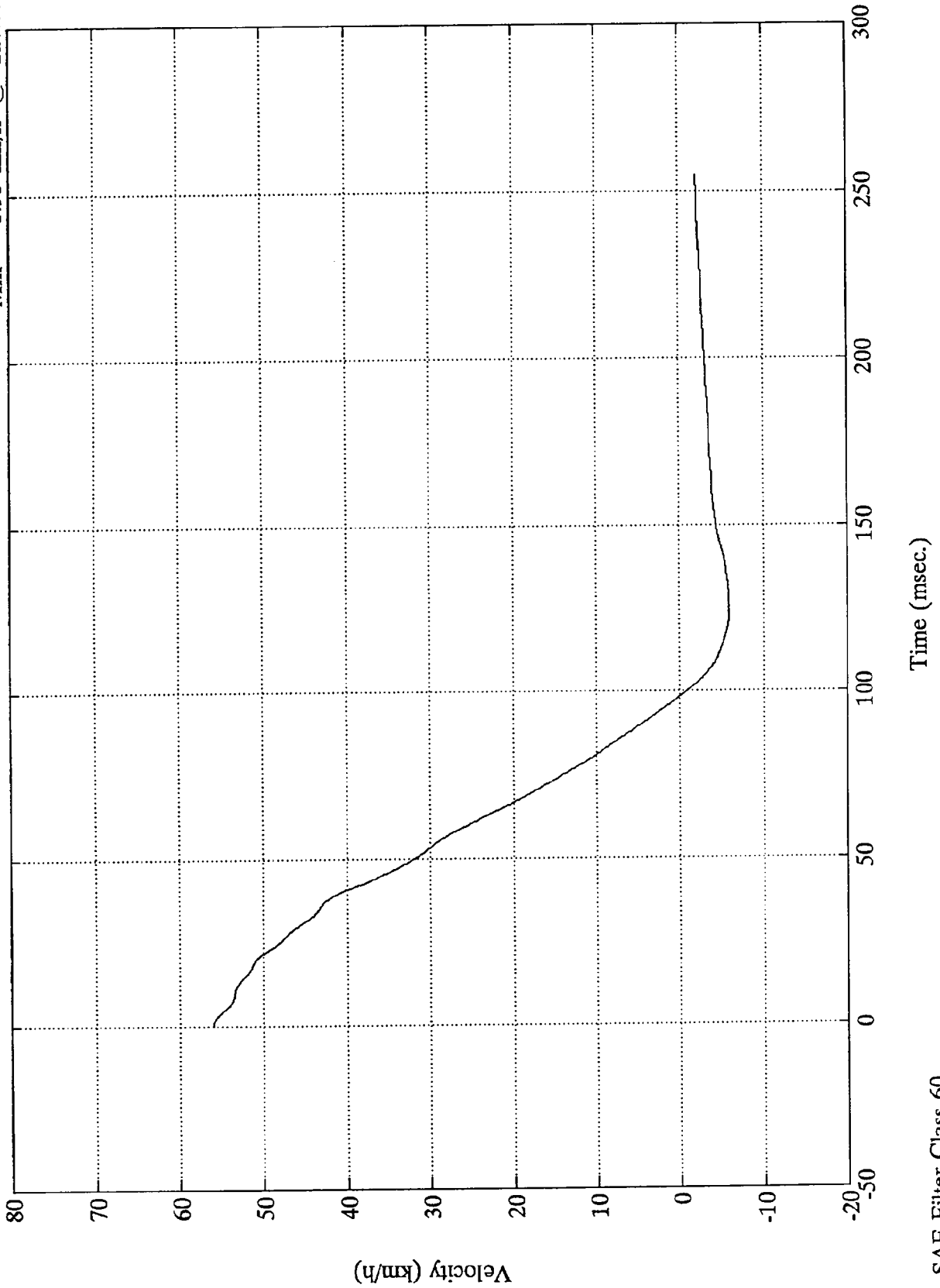
SAE Filter Class 60

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #2(x)

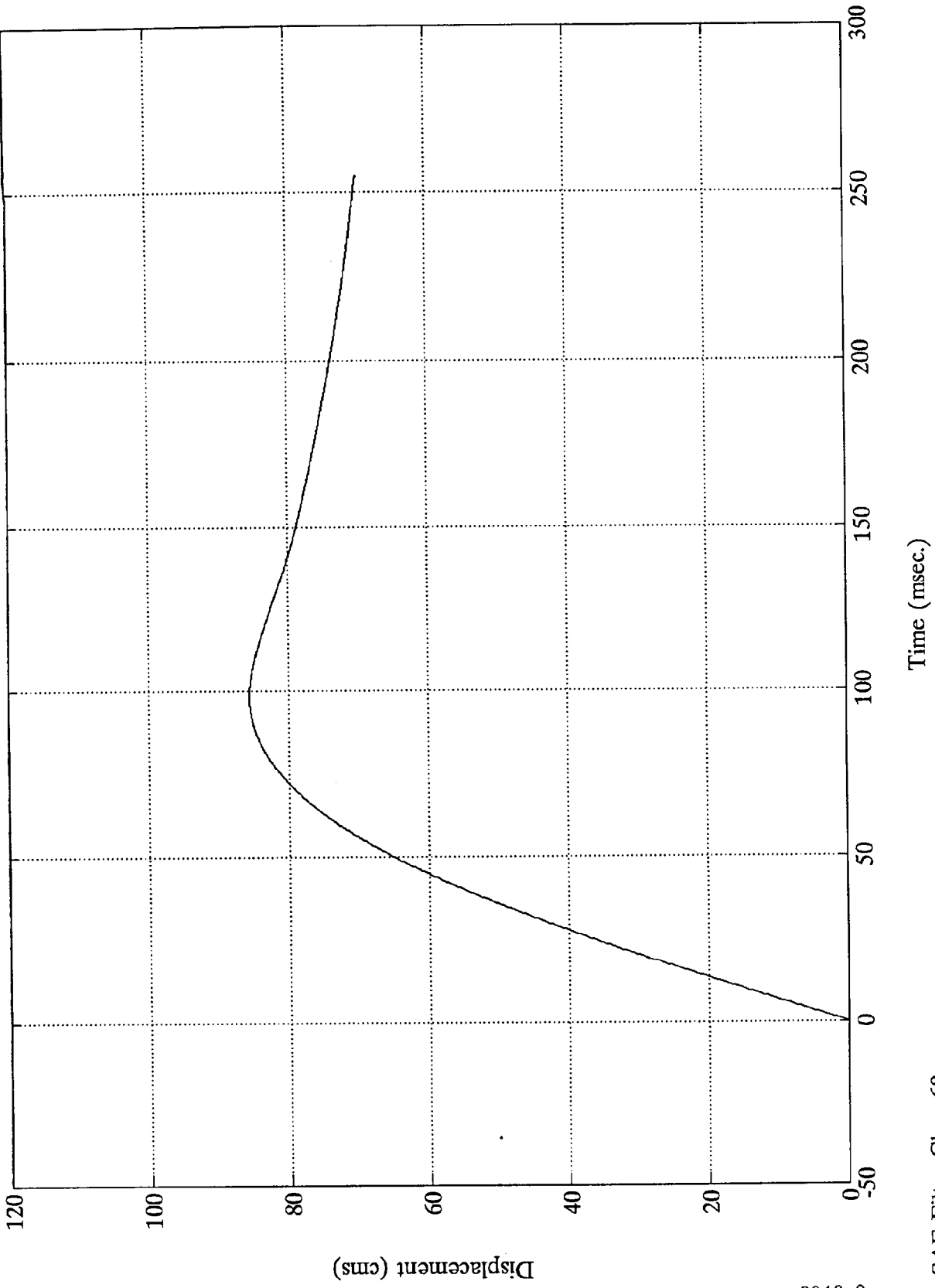
Max = 56.00 km/h @ -0.00 msec  
Min = -5.93 km/h @ 127.68 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #2(x)

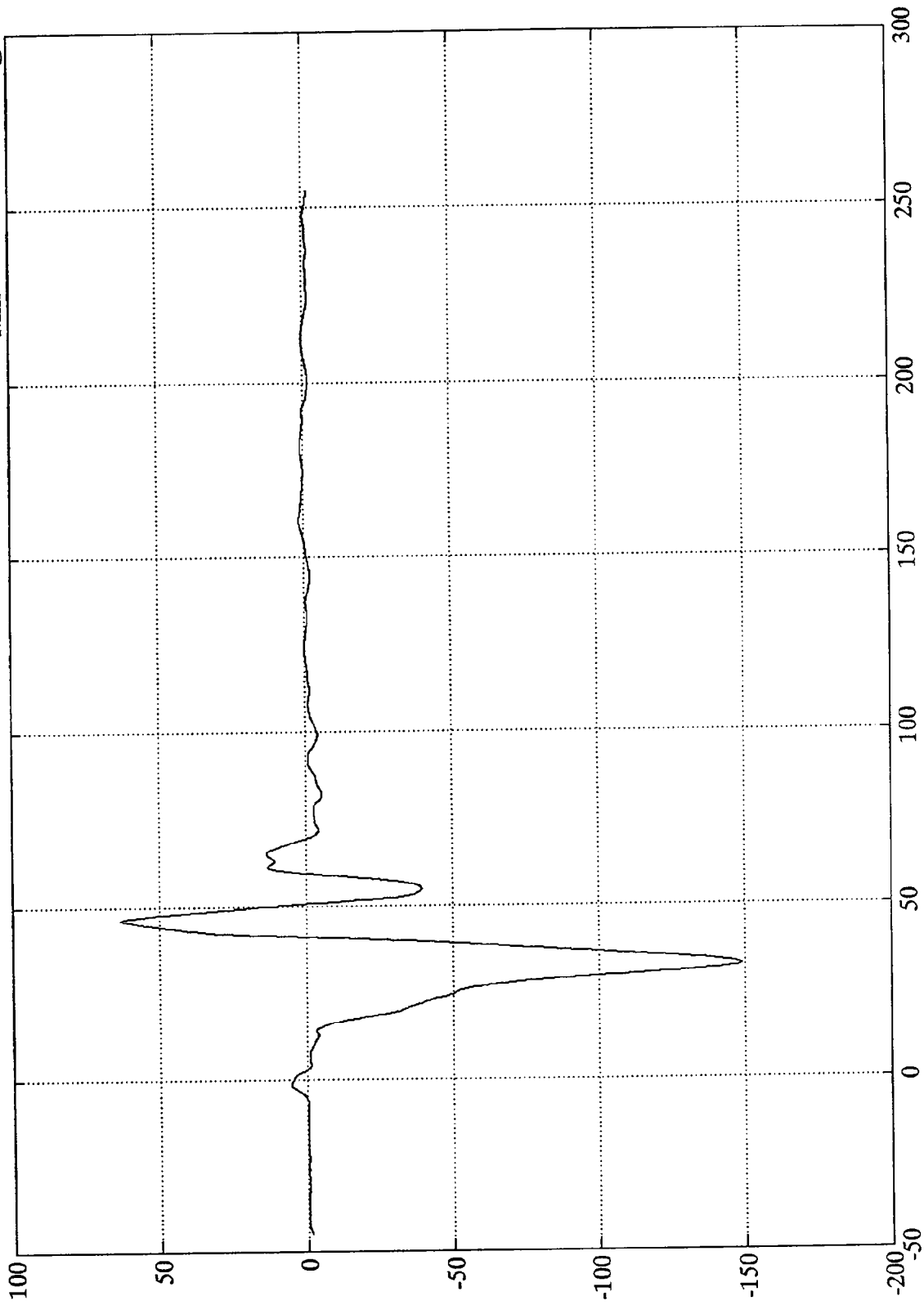
Max = 85.65 cms @ 99.36 msec  
Min = 0.00 cms @ -0.00 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #3(x)

Max = 63.36 Gs @ 46.20 msec  
Min = -148.91 Gs @ 32.63 msec



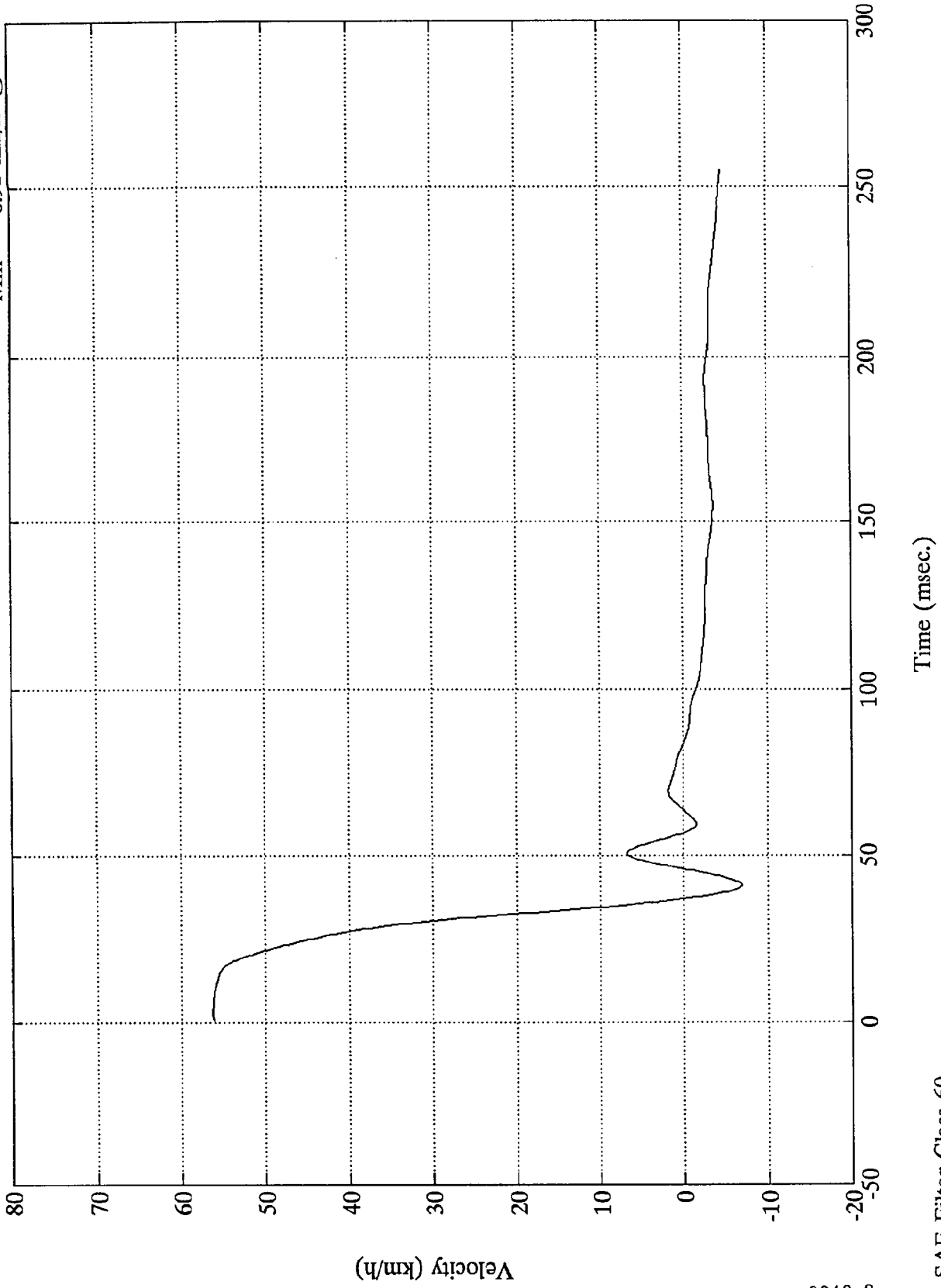
Time (msec)

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #3(x)

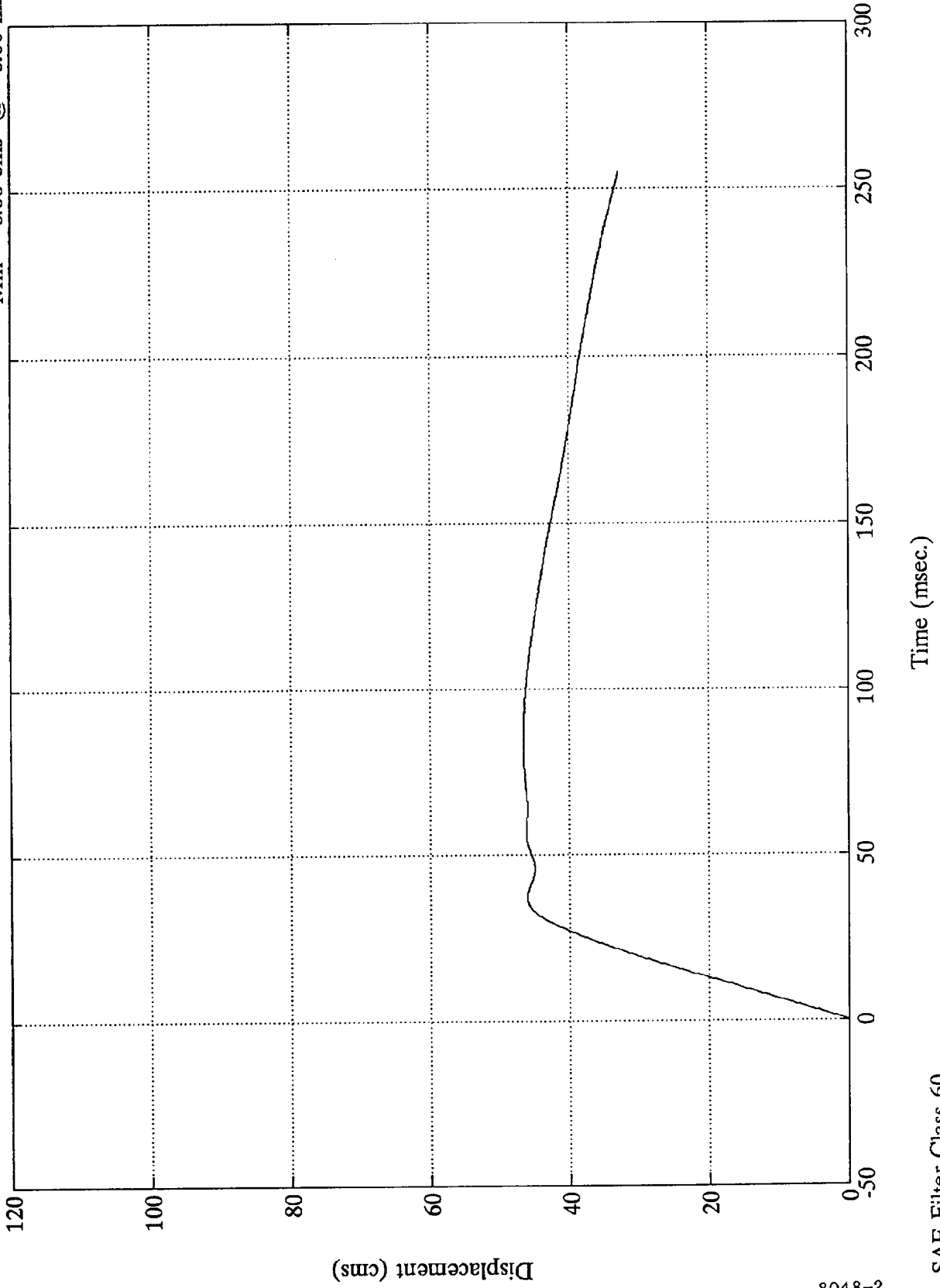
Max = 56.29 km/h @ 3.36 msec  
Min = -6.91 km/h @ 41.04 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #3(x)

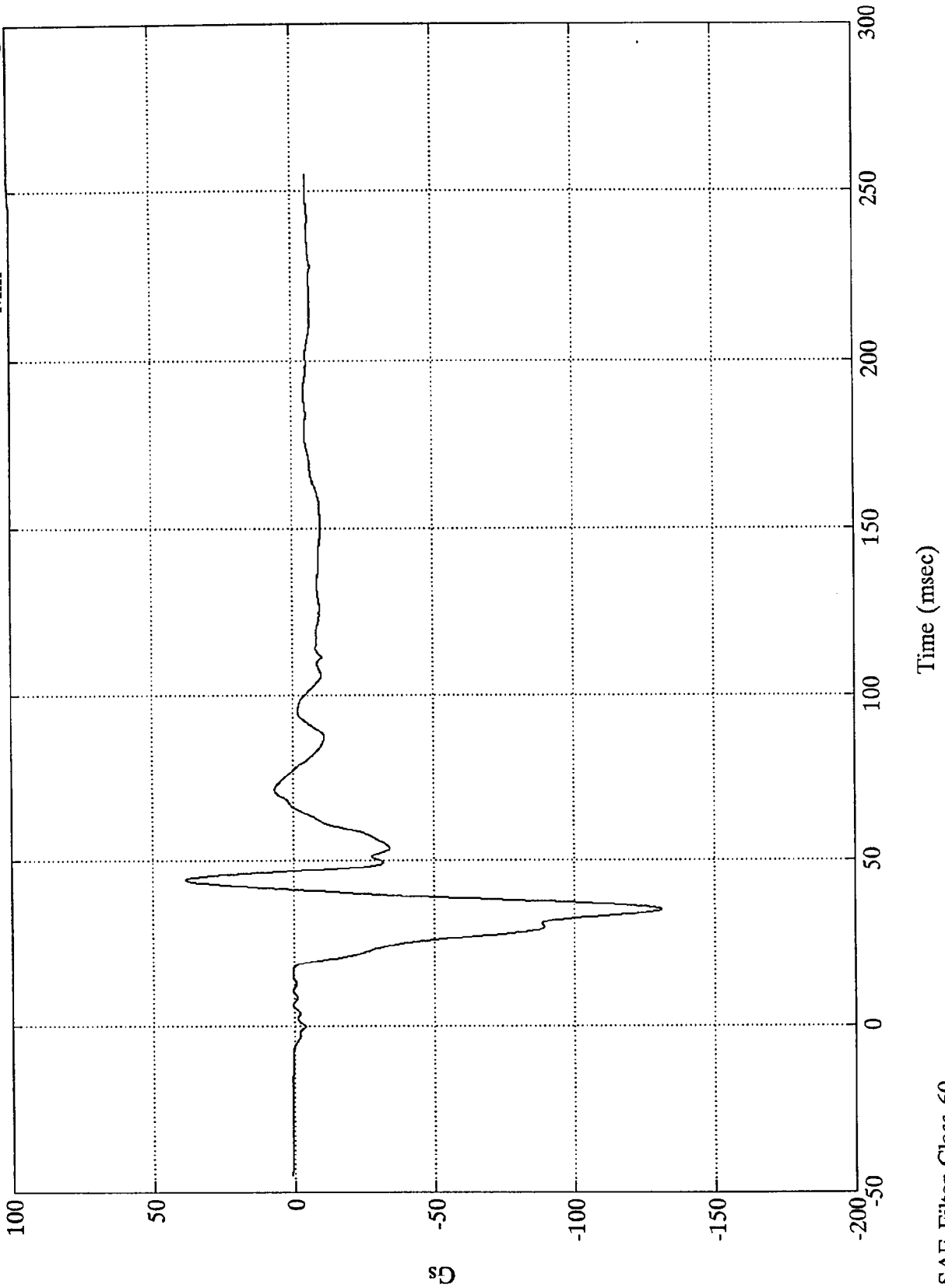
Max = 46.63 cms @ 86.88 msec  
Min = 0.00 cms @ -0.00 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #4(x)

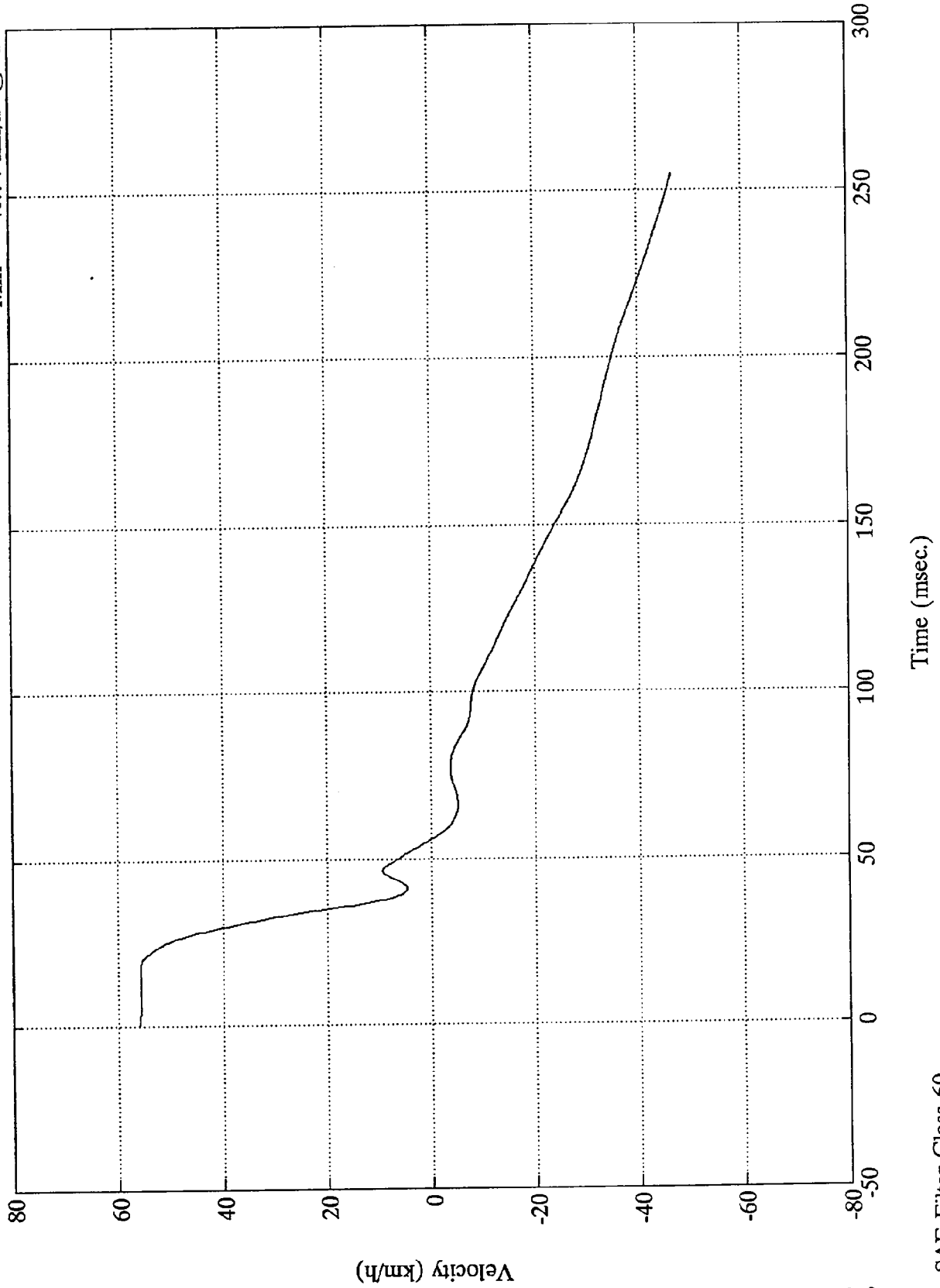
Max = 38.39 Gs @ 43.91 msec  
Min = -131.02 Gs @ 34.91 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #4(x)

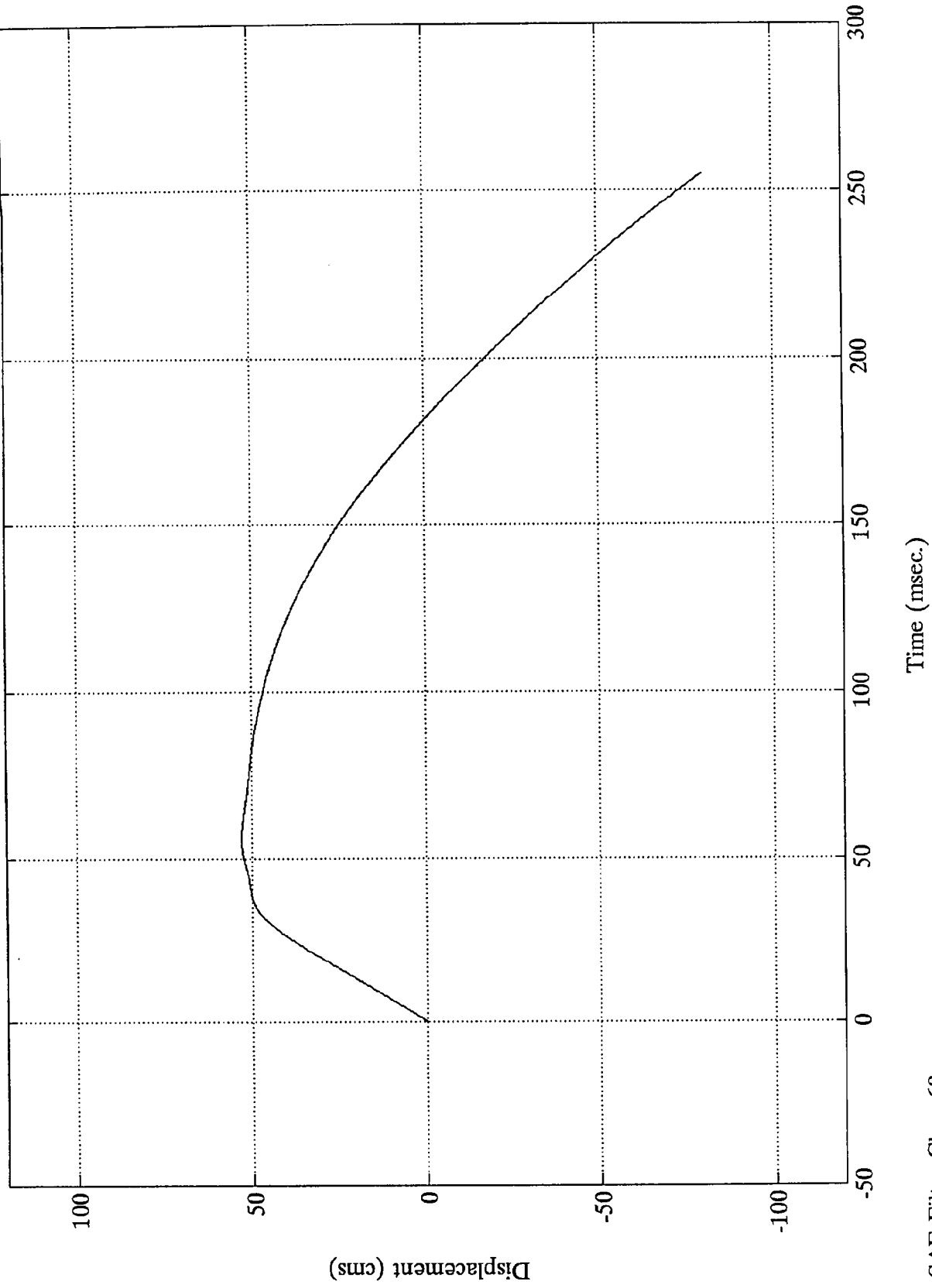
Max = 56.00 km/h @ -0.00 msec  
Min = -46.74 km/h @ 254.88 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #4(x)

Max = 52.88 cms @ 57.12 msec  
Min = -80.16 cms @ 254.88 msec

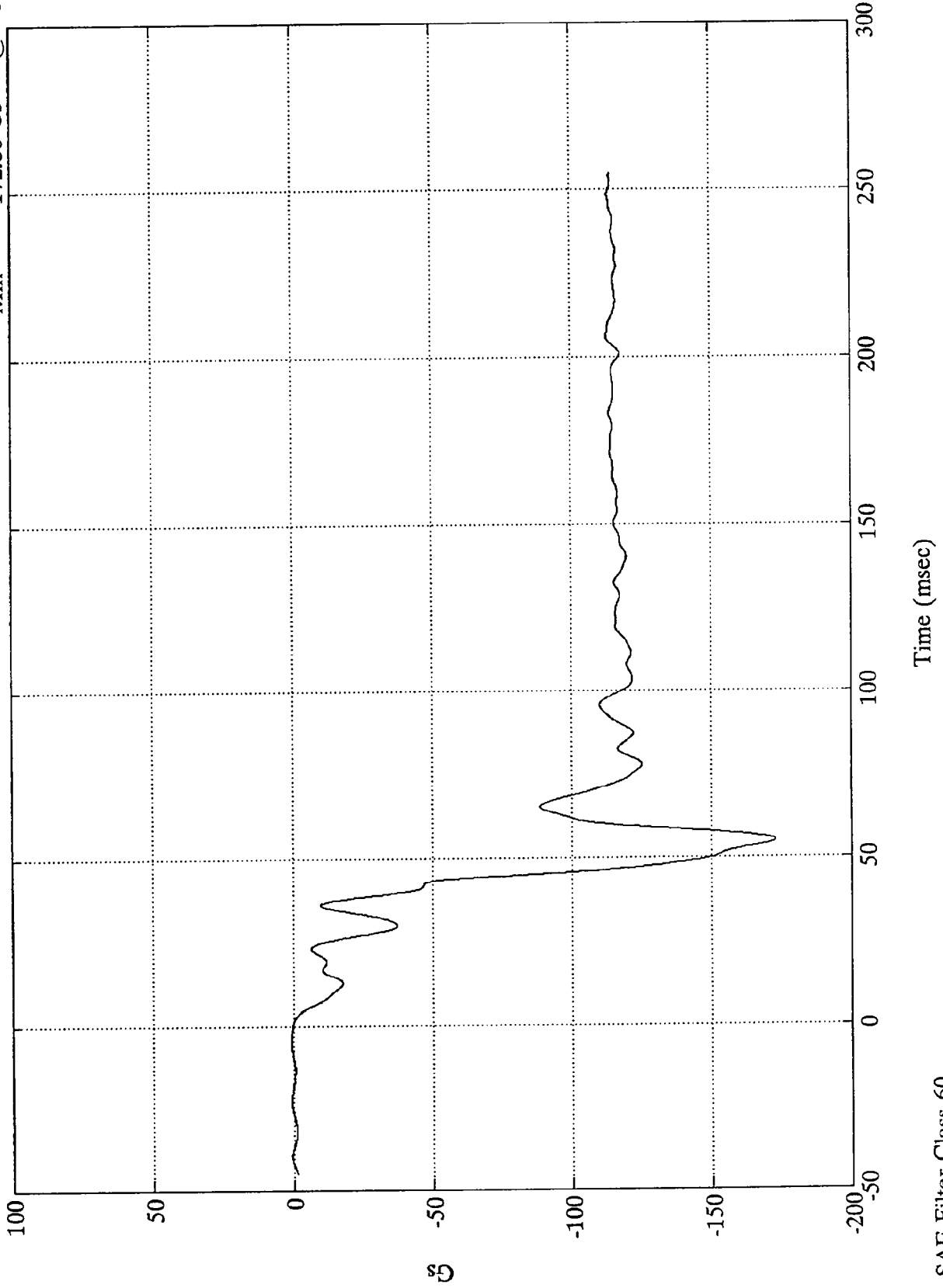


SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #5(x)

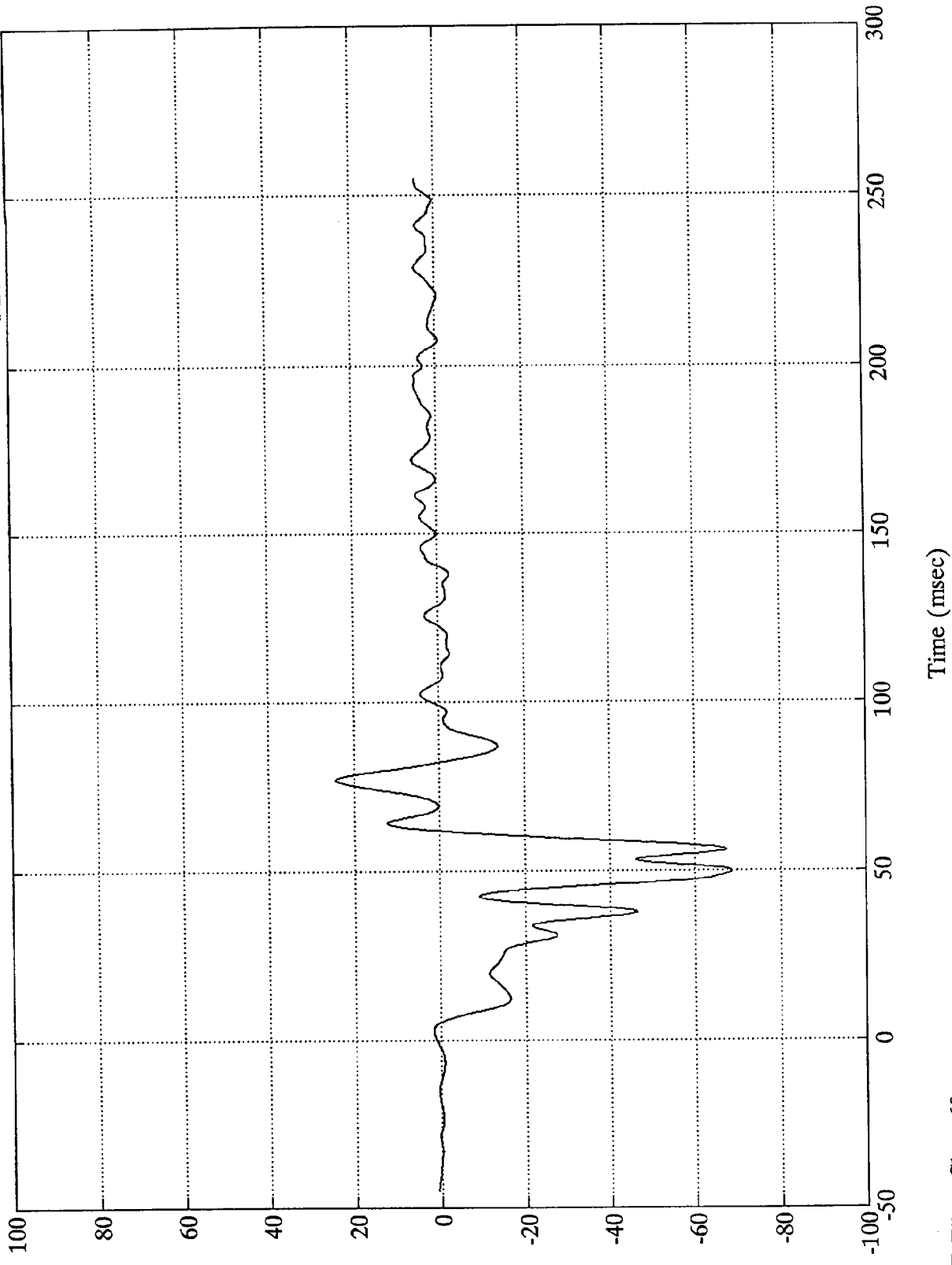
Max = .77 Gs @ -22.80 msec  
Min = -172.80 Gs @ 55.08 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Max = 24.35 Gs @ 76.92 msec  
Min = -68.69 Gs @ 49.92 msec

Acc. #6(x)



SD  
B-16

8048-2

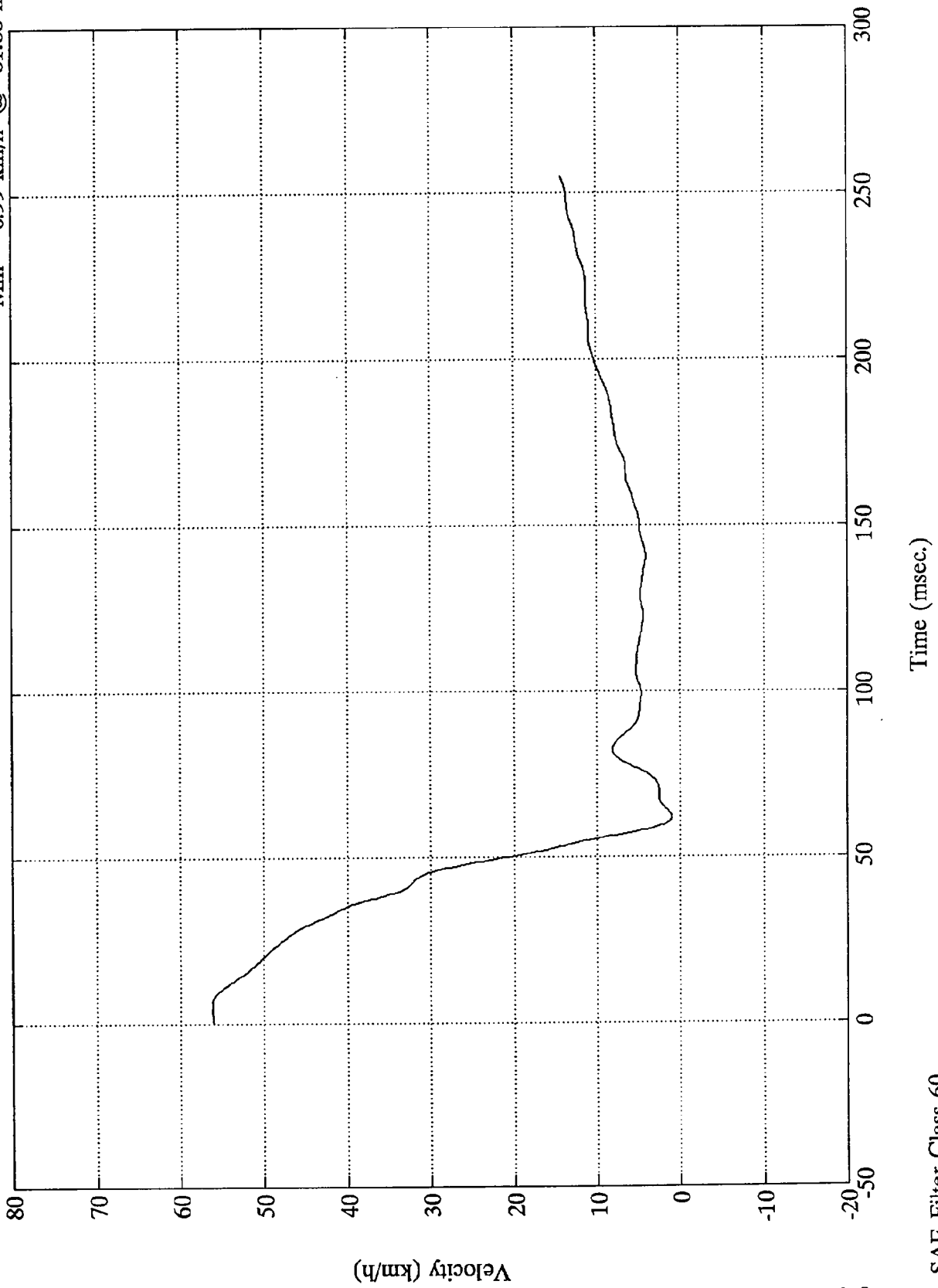
SAE Filter Class 60

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #6(x)

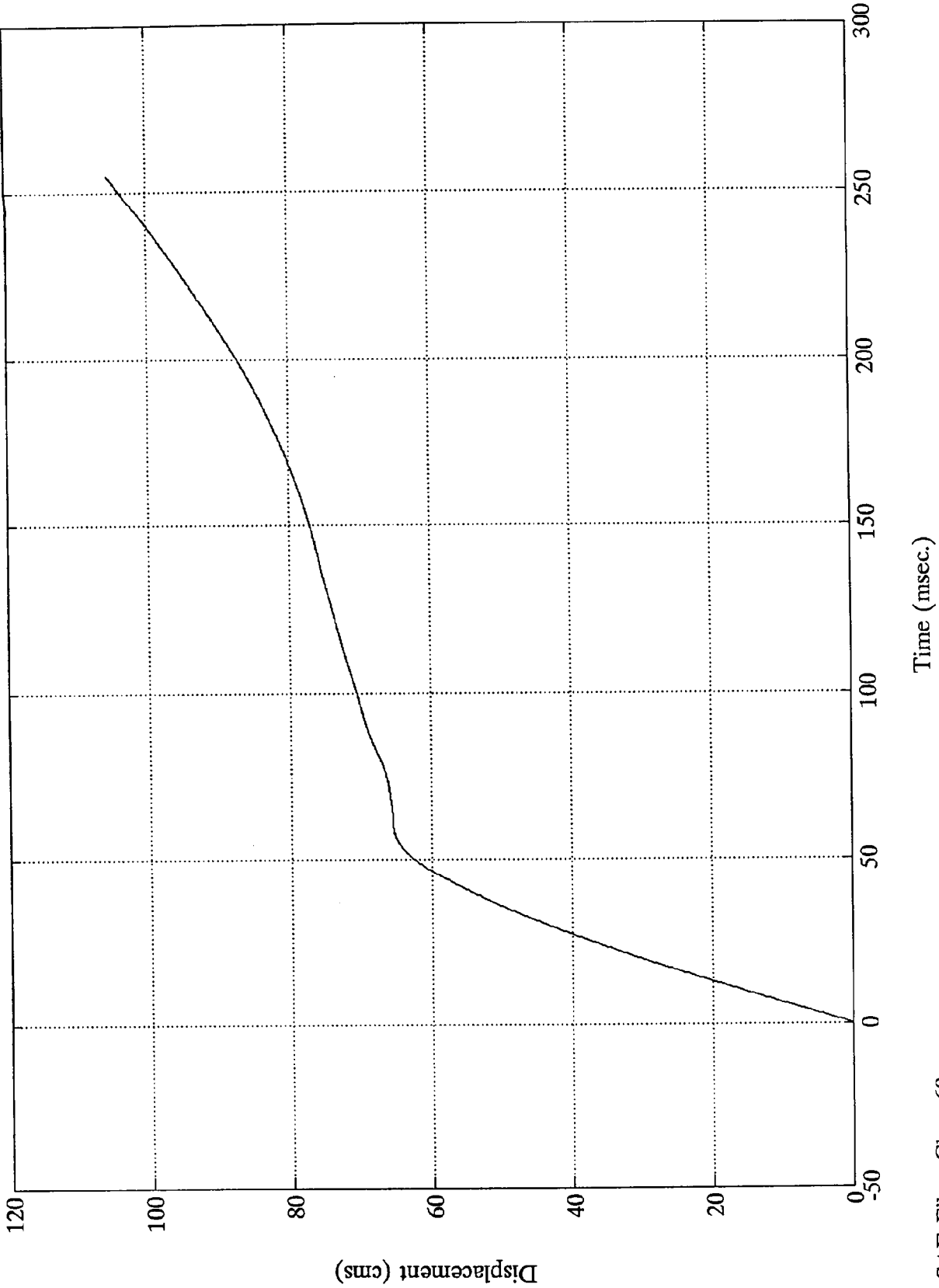
Max = 56.25 km/h @ 5.76 msec  
Min = 0.99 km/h @ 61.68 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #6(x)

Max = 105.54 cms @ 254.88 msec  
Min = 0.00 cms @ -0.00 msec

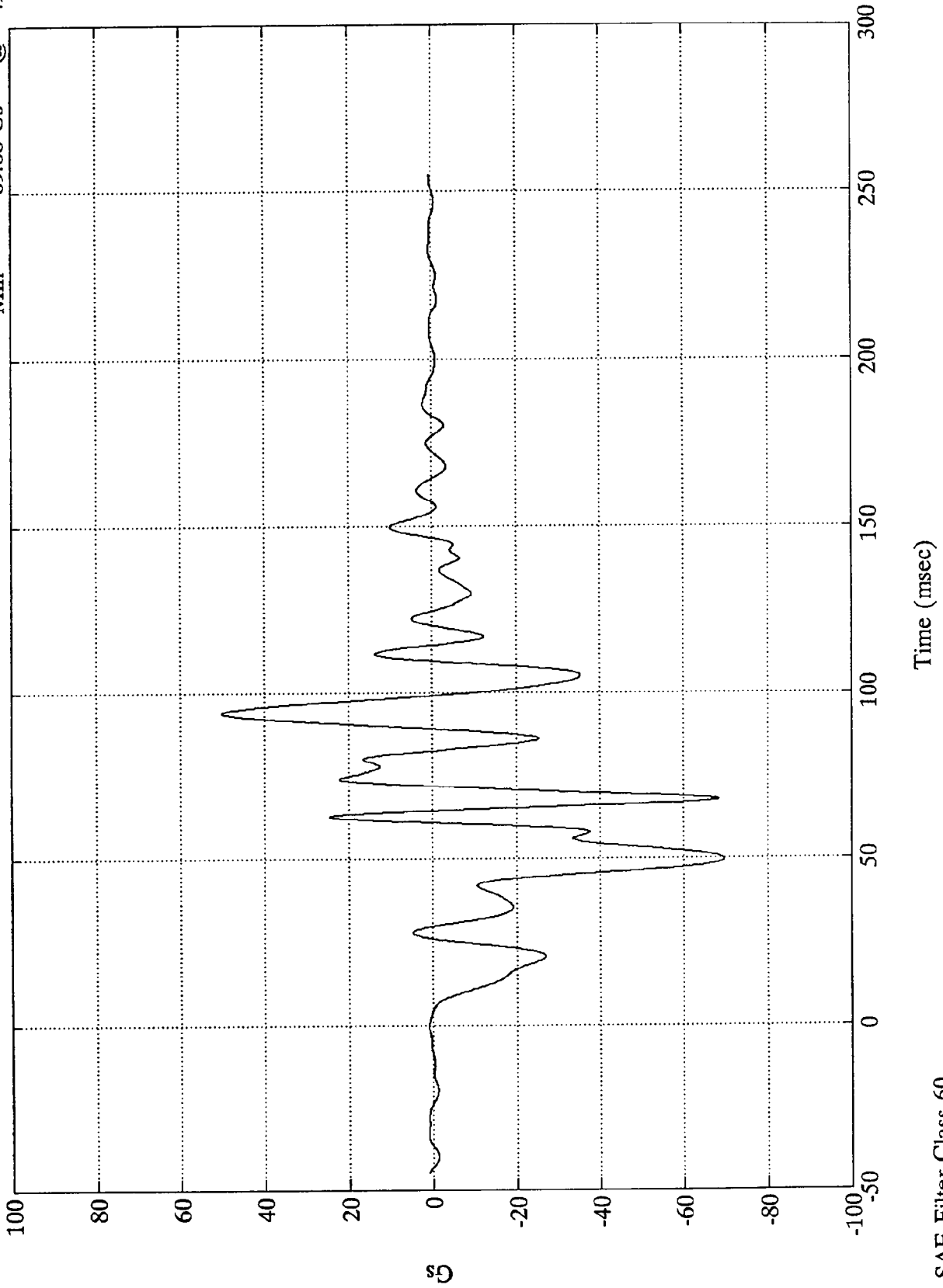


SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #7(x)

Max = 50.17 Gs @ 93.84 msec  
Min = -69.66 Gs @ 49.68 msec



50

B-19

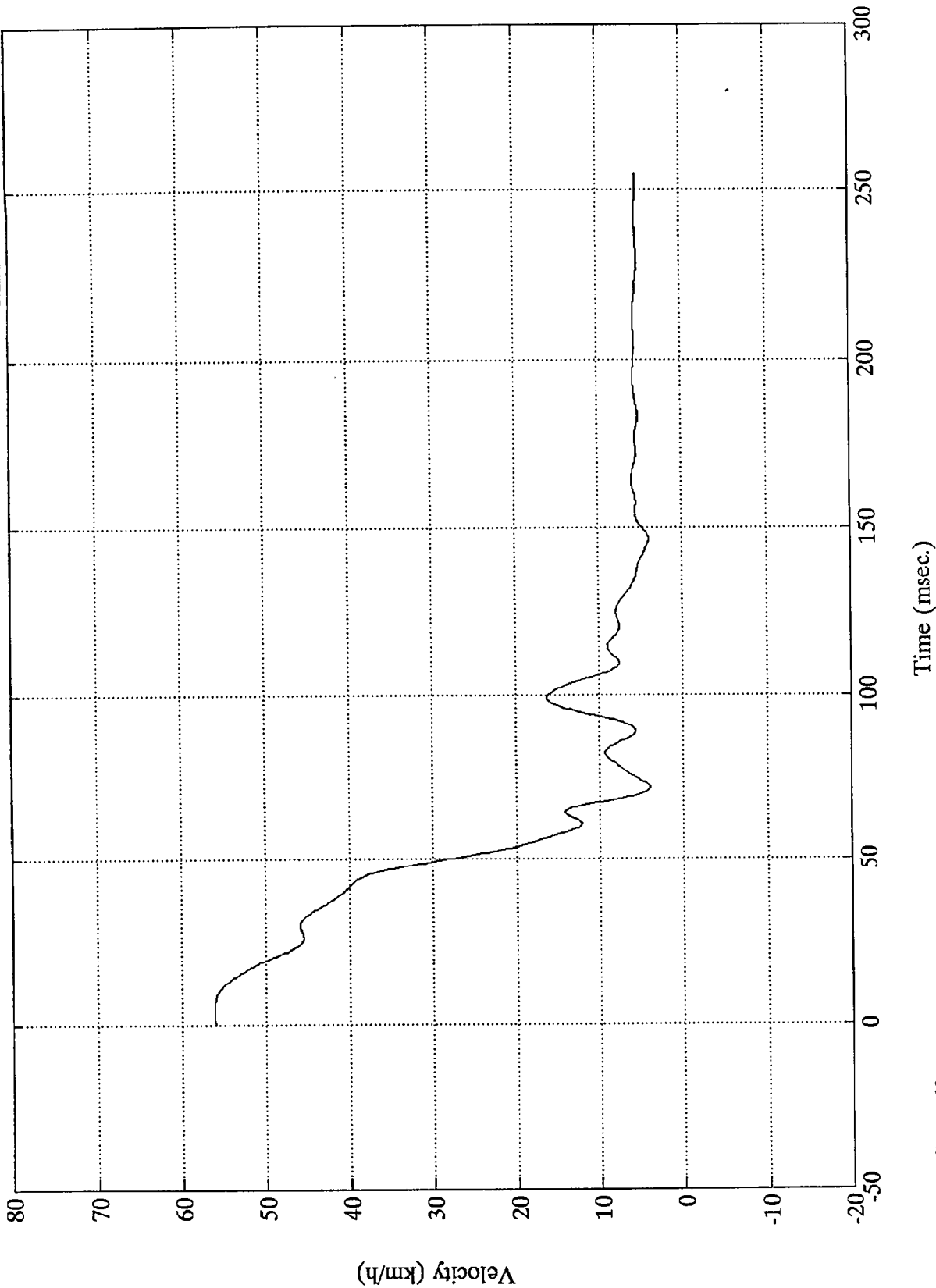
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #7(x)

Max = 56.07 km/h @ 5.28 msec  
Min = 3.96 km/h @ 146.64 msec

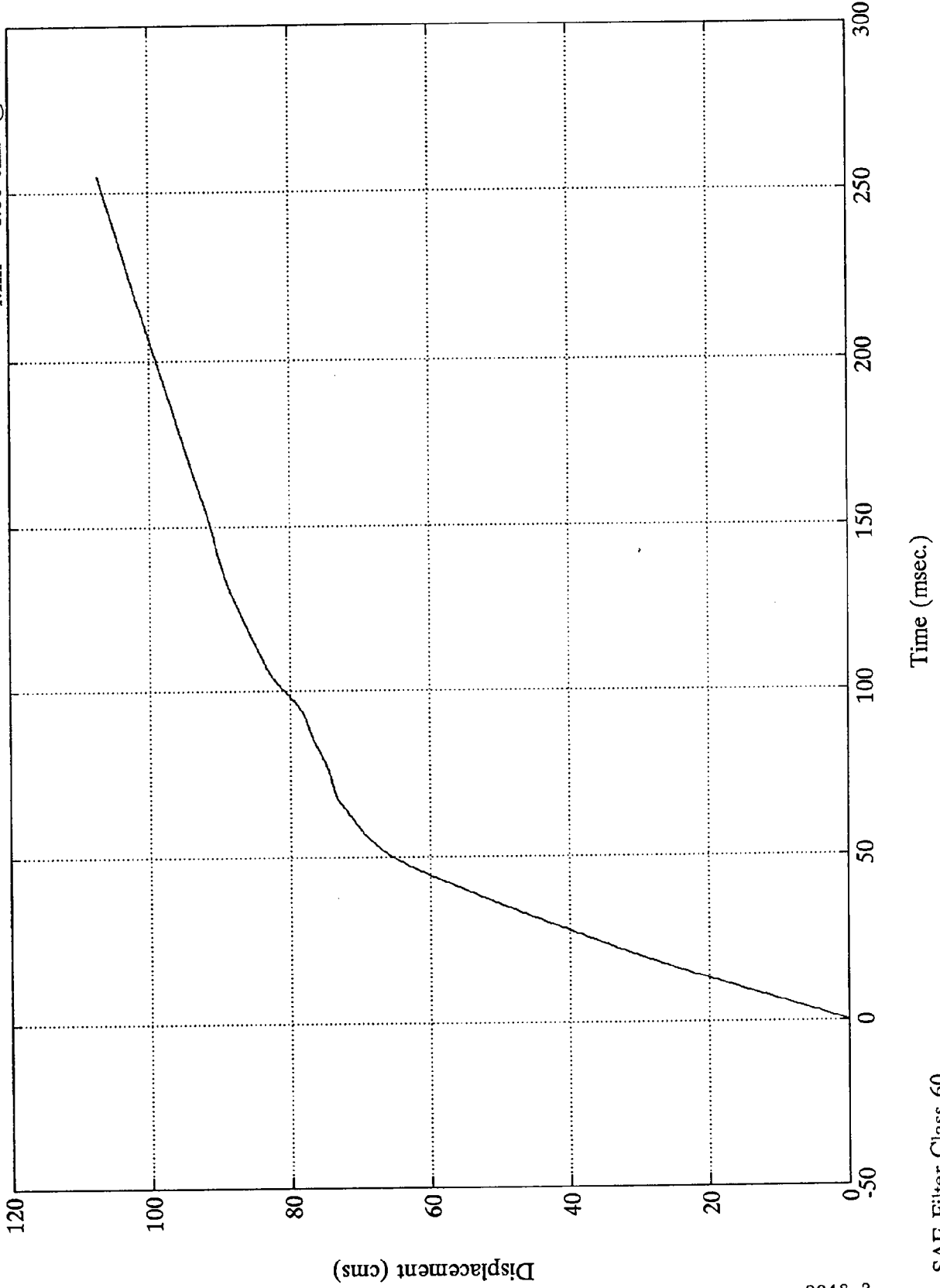


SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #7(x)

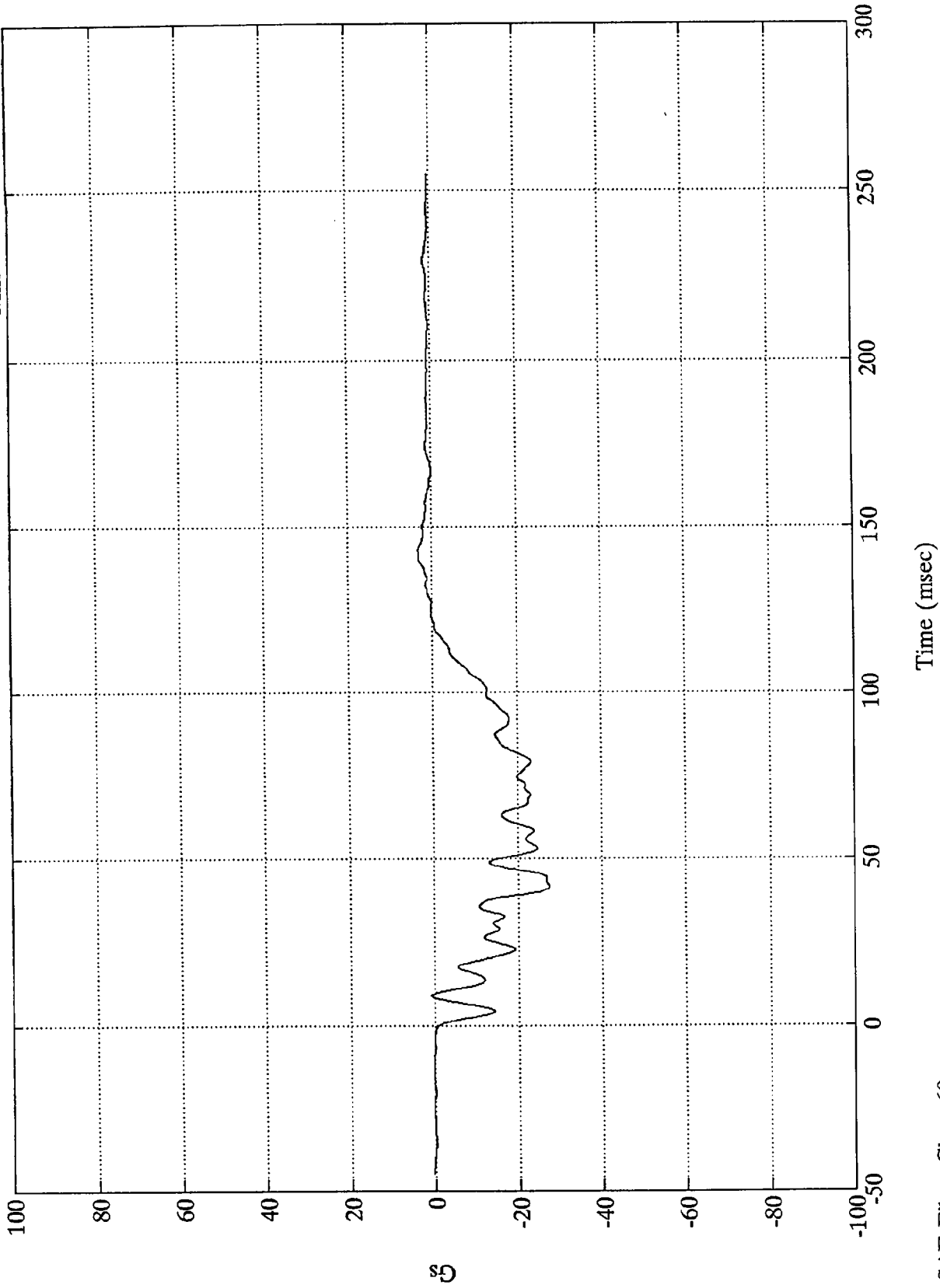
Max = 107.24 cms @ 254.88 msec  
Min = 0.00 cms @ -0.00 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Max = 3.28 Gs @ 143.04 msec  
Min = -27.49 Gs @ 41.40 msec

Acc. #8(x)



85  
B-22

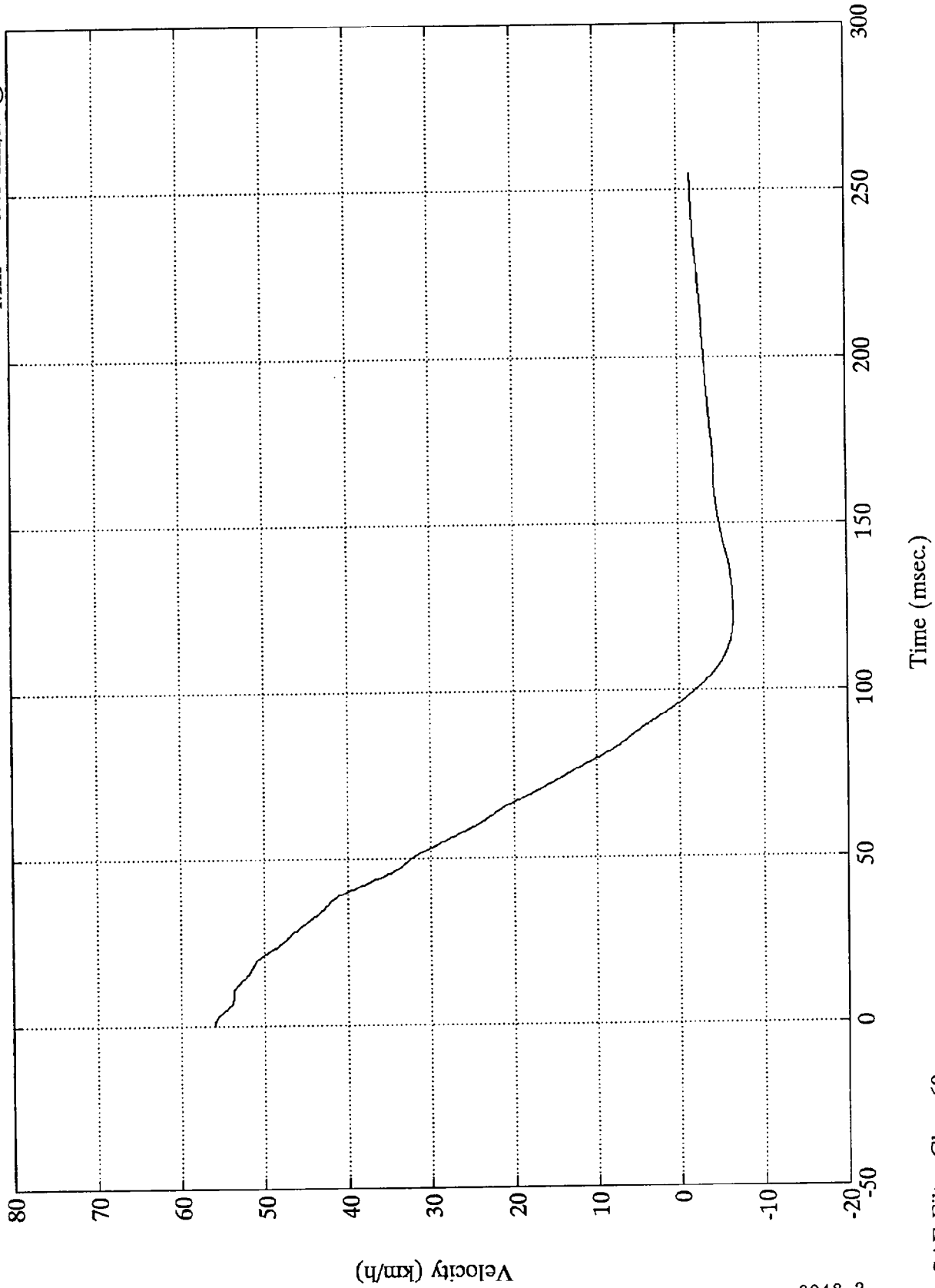
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #8(x)

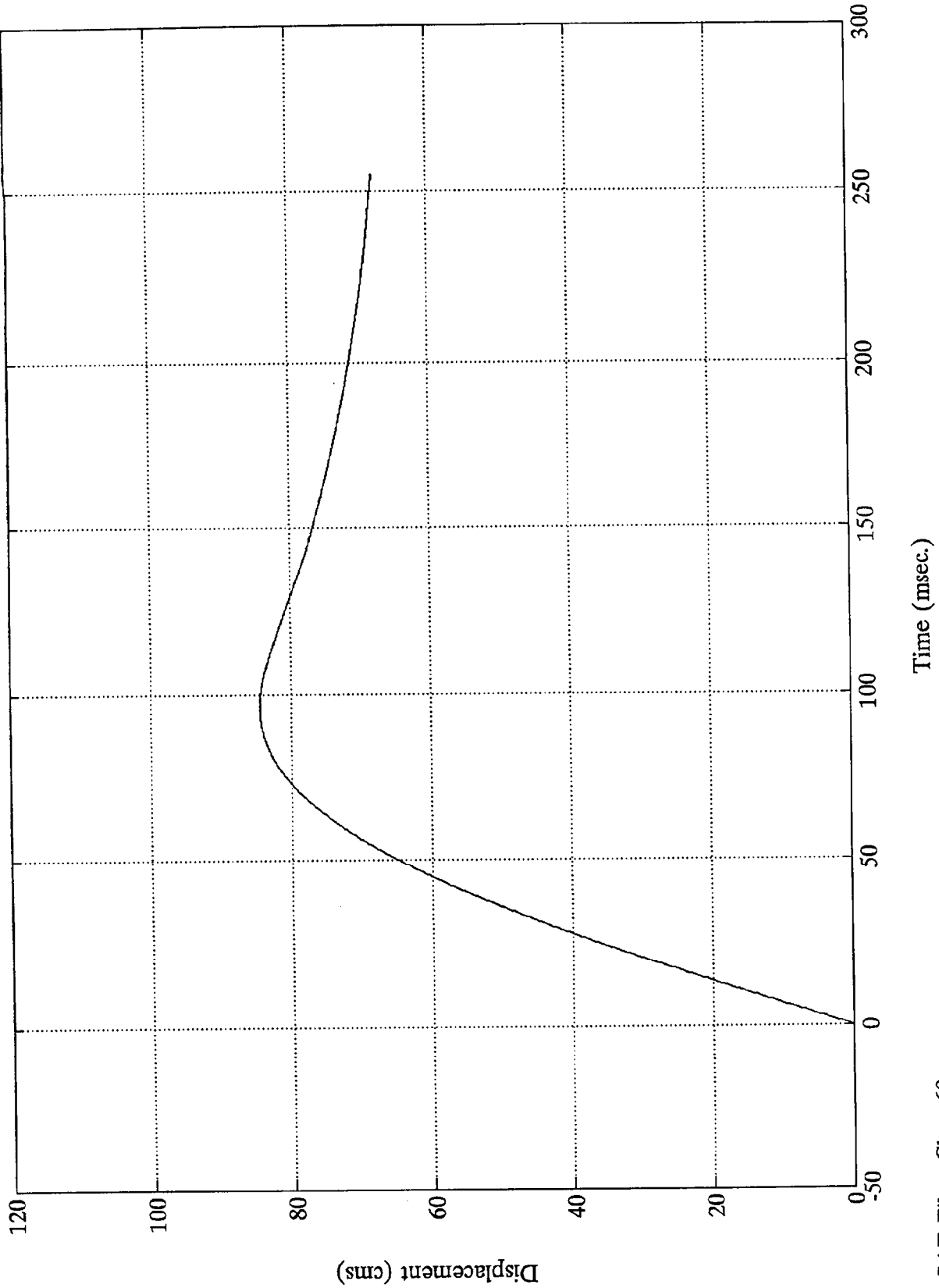
Max = 56.00 km/h @ -0.00 msec  
Min = -6.43 km/h @ 122.16 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #8(x)

Max = 84.51 cms @ 97.44 msec  
Min = 0.00 cms @ -0.00 msec



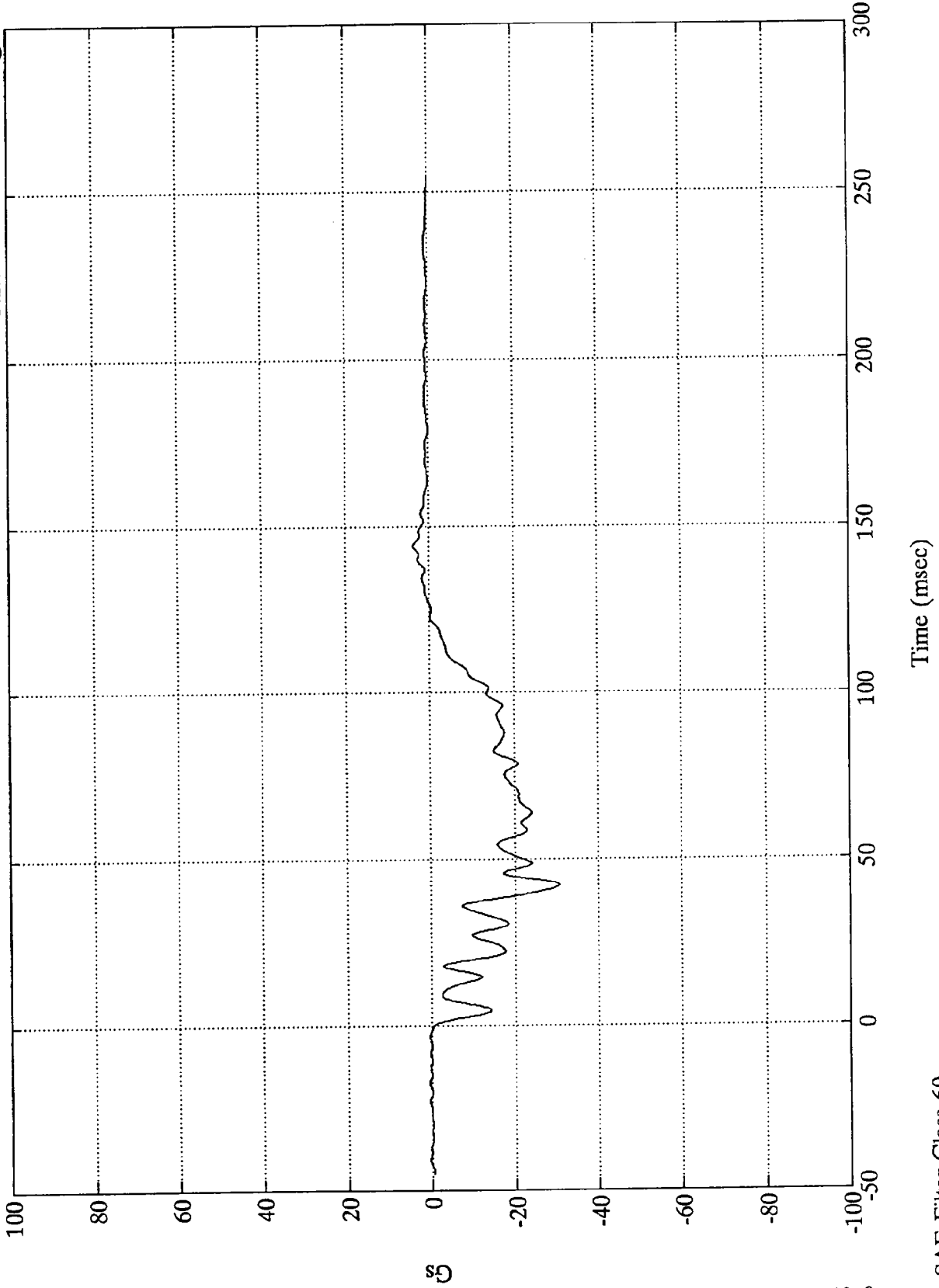
SAE Filter Class 60

8048-2

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #9(x)

Max = 3.77 Gs @ 144.24 msec  
Min = -30.75 Gs @ 42.11 msec



80  
B-25

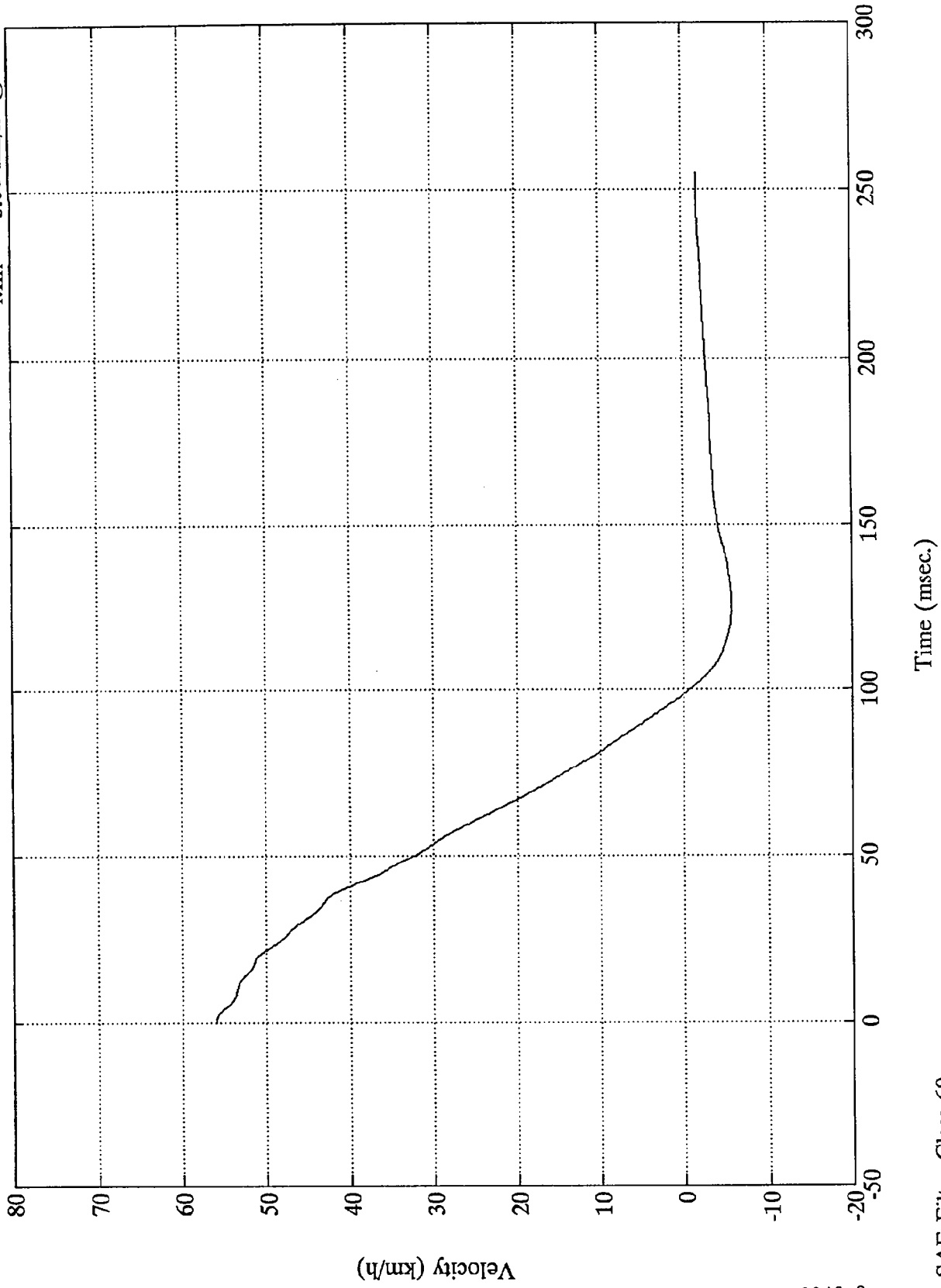
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #9(x)

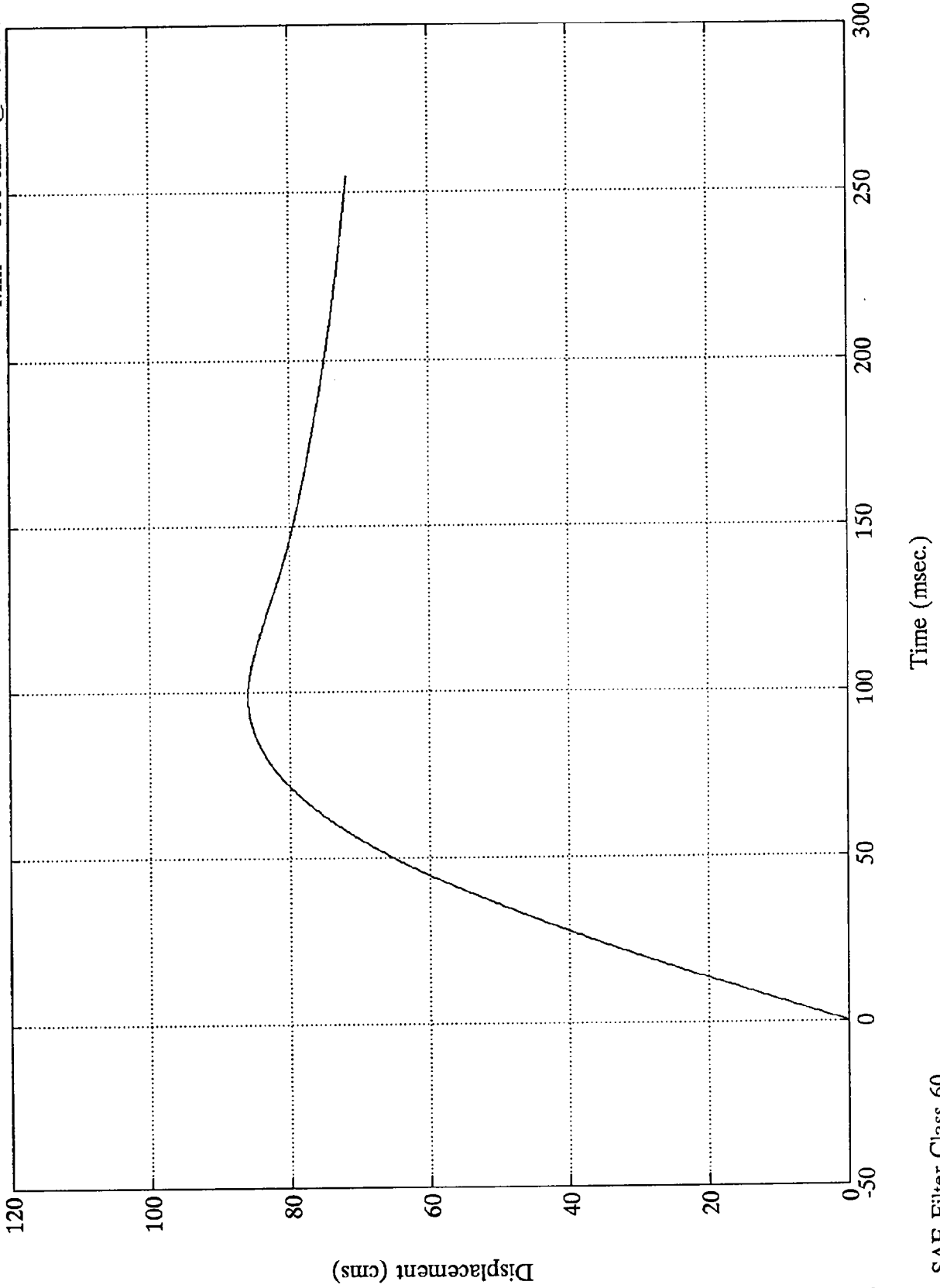
Max = 56.00 km/h @ -0.00 msec  
Min = -5.66 km/h @ 126.96 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Acc. #9(x)

Max = 86.06 cms @ 99.12 msec  
Min = 0.00 cms @ -0.00 msec



SAE Filter Class 60

TEST NO. MP0100

LOAD CELL BARRIER DATA

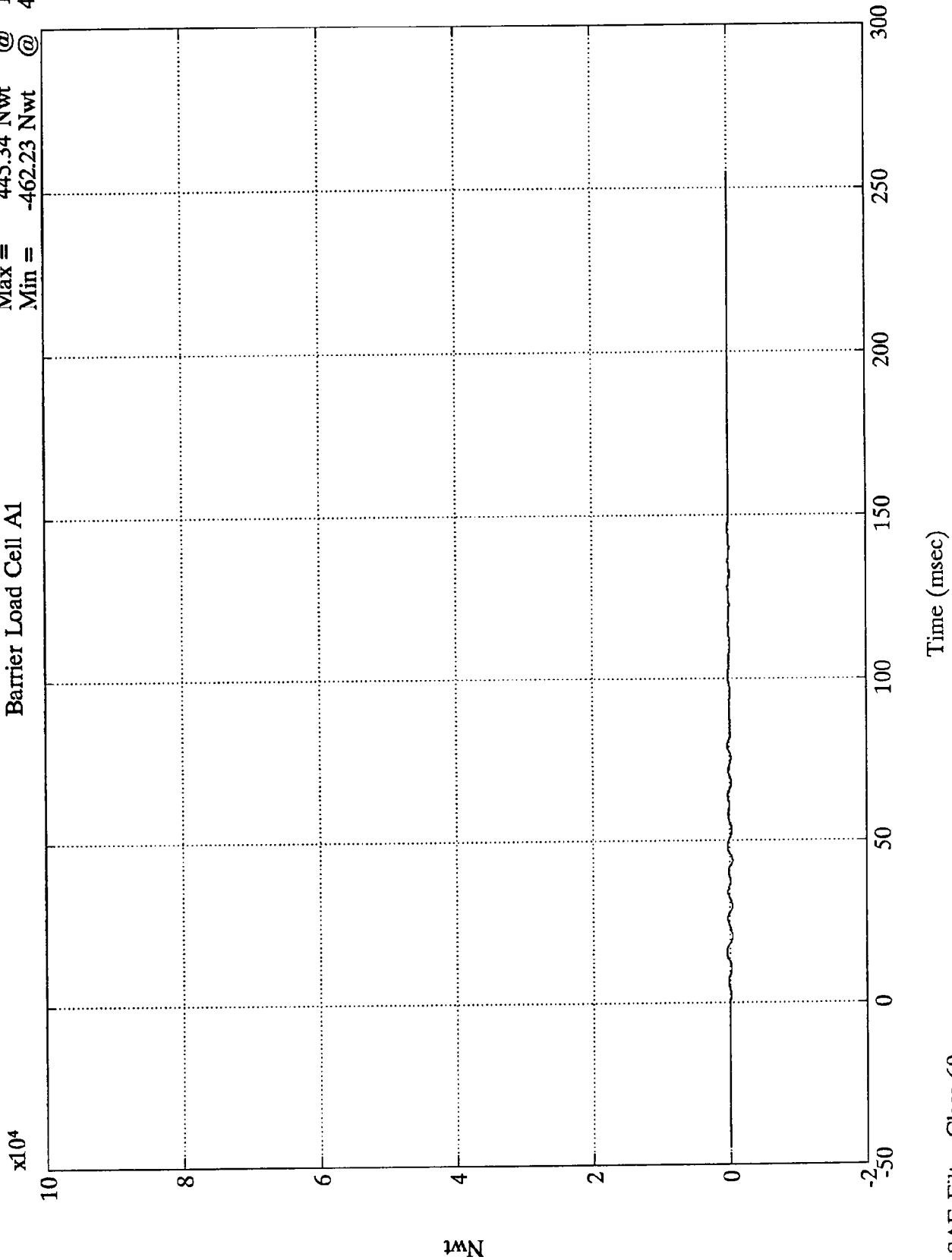
FILTER CHANNEL CLASS

60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A1

Max = 445.34 Nwt @ 15.59 msec  
Min = -462.23 Nwt @ 43.91 msec



1MN

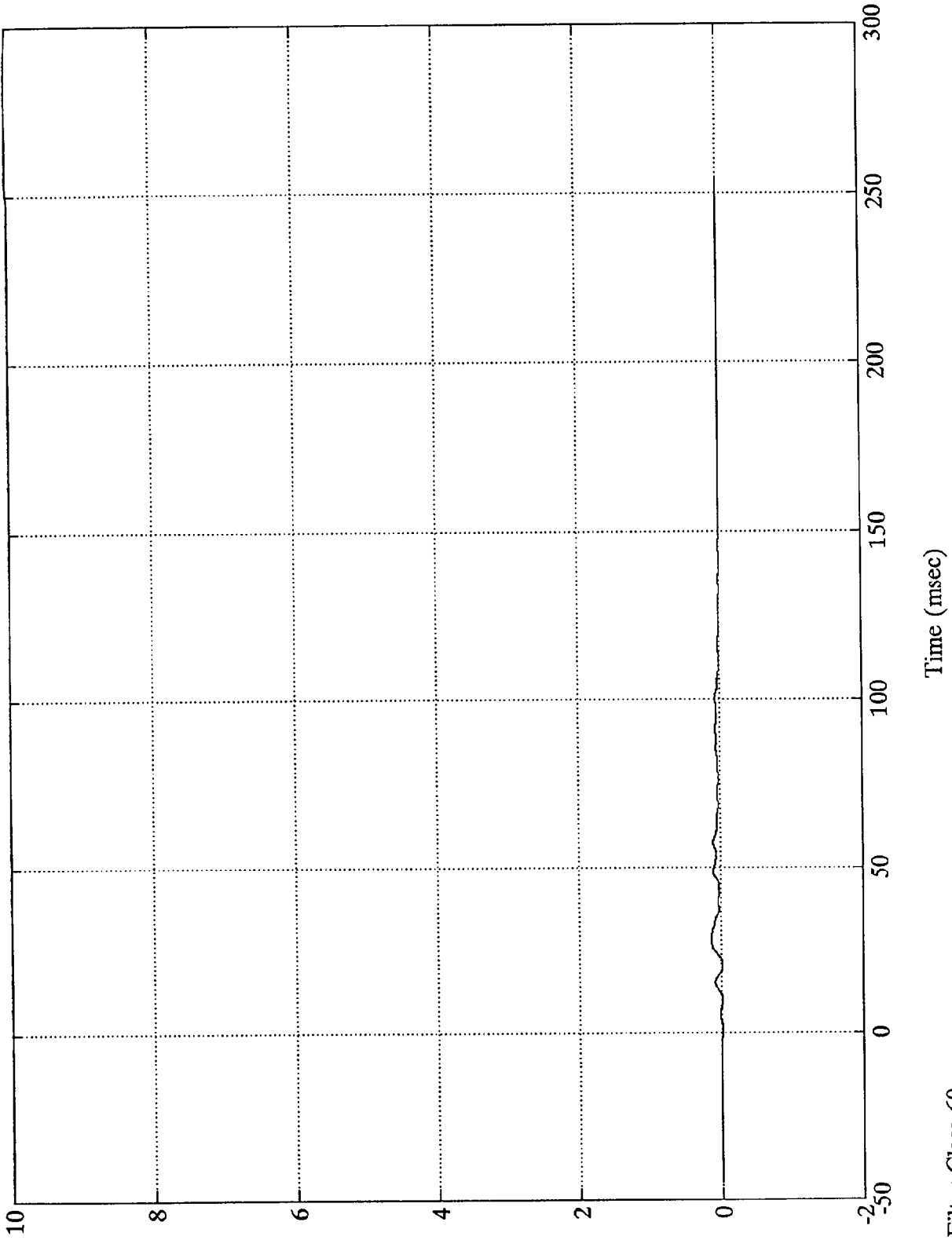
B-29

8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

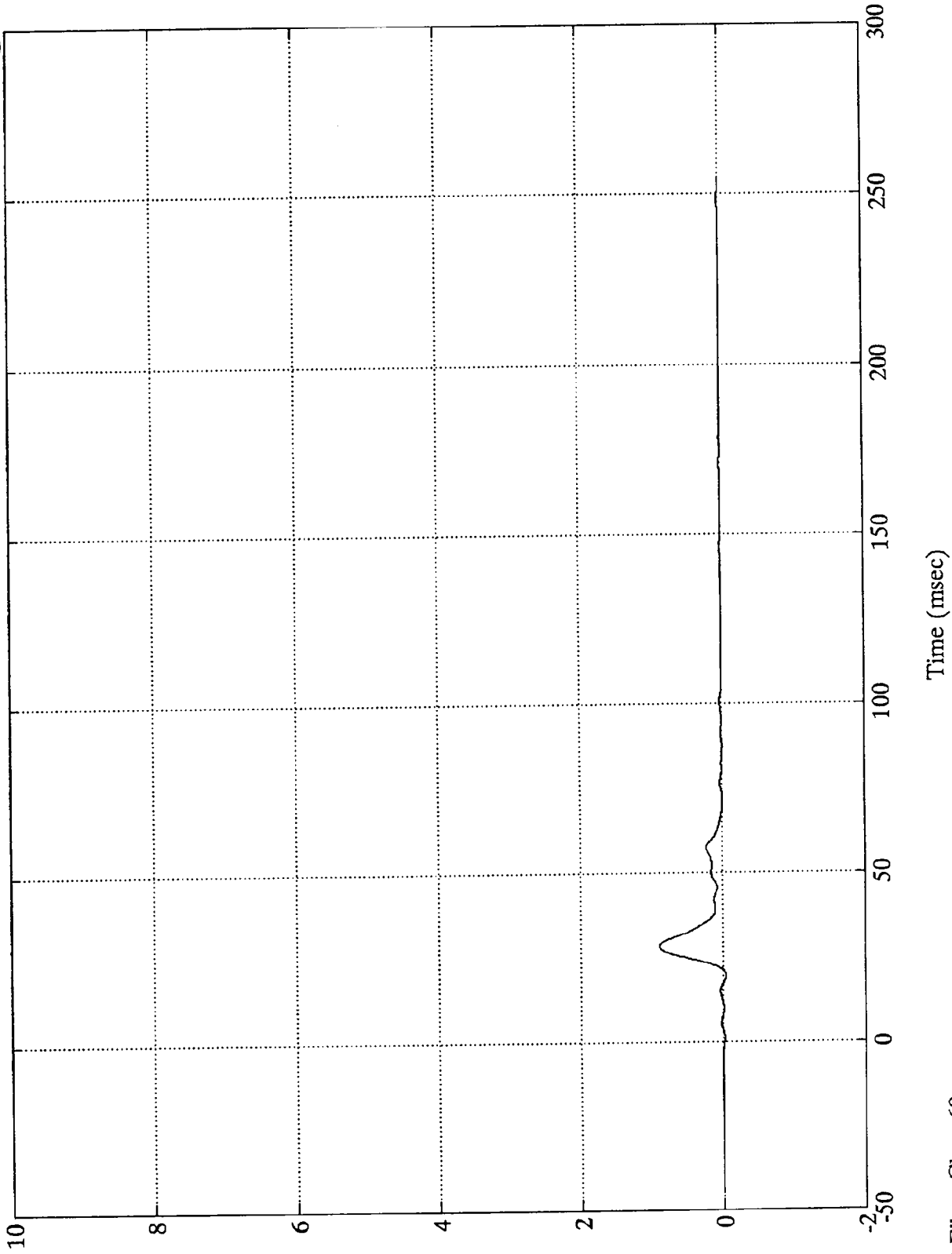
Barrier Load Cell A2  
Max = 1327.11 Nwt @ 27.23 msec  
Min = -159.49 Nwt @ 9.71 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A3

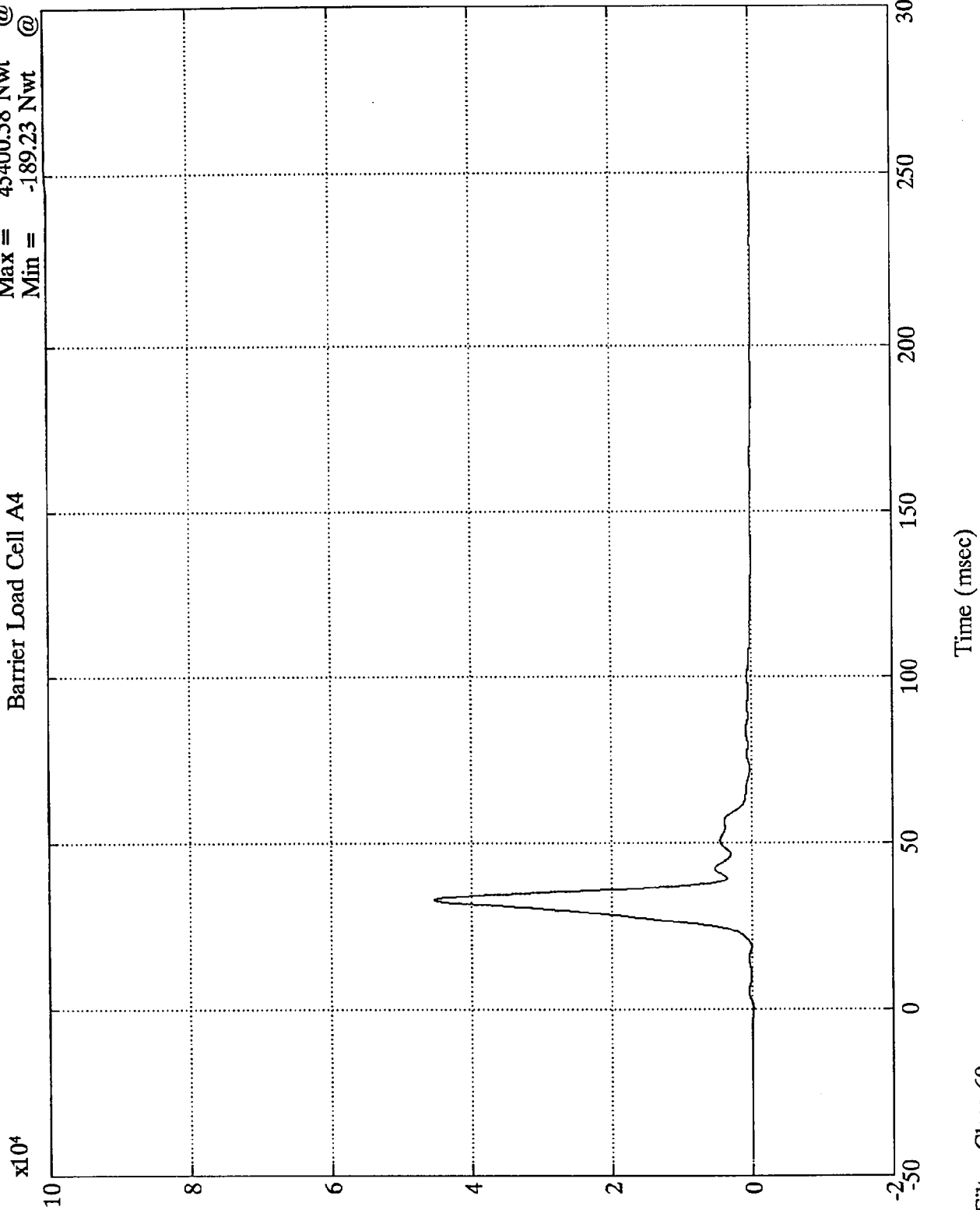
Max = 8876.38 Nwt @ 28.31 msec  
Min = -399.44 Nwt @ 19.43 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A4

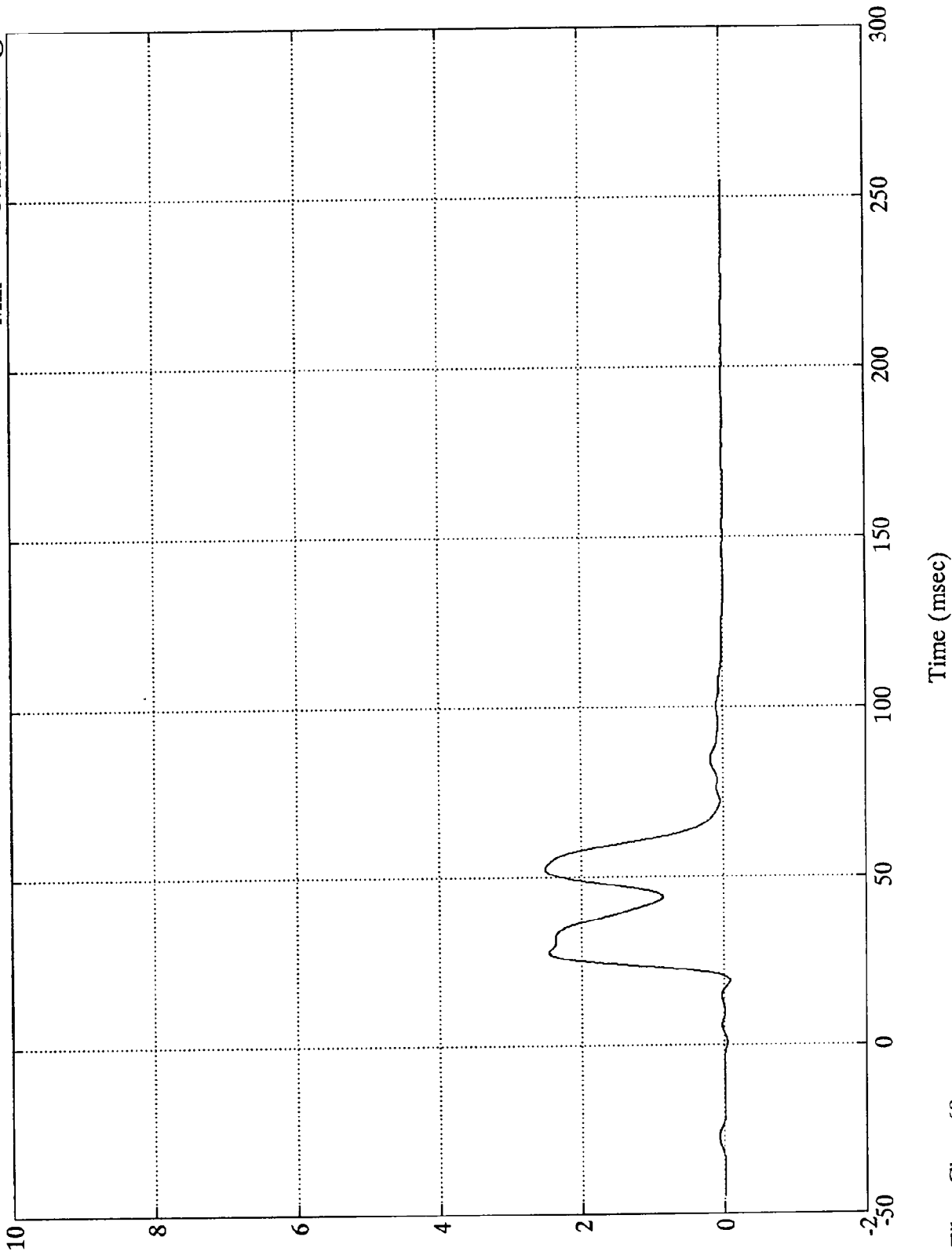
Max = 45400.58 Nwt @ 32.88 msec  
Min = -189.23 Nwt @ -0.00 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell A5

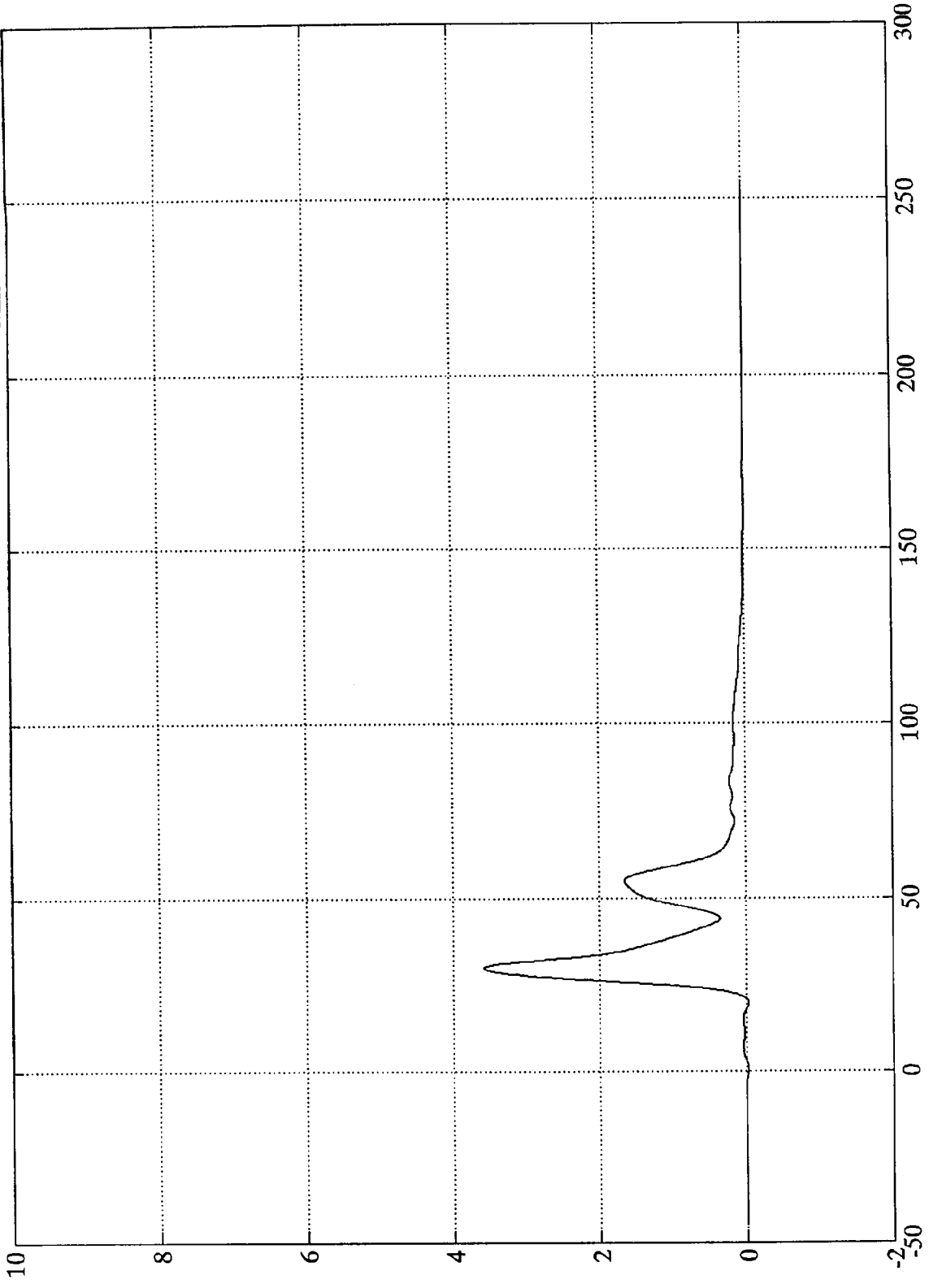
Max = 25149.32 Nwt @ 52.44 msec  
Min = -871.18 Nwt @ 18.95 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A6

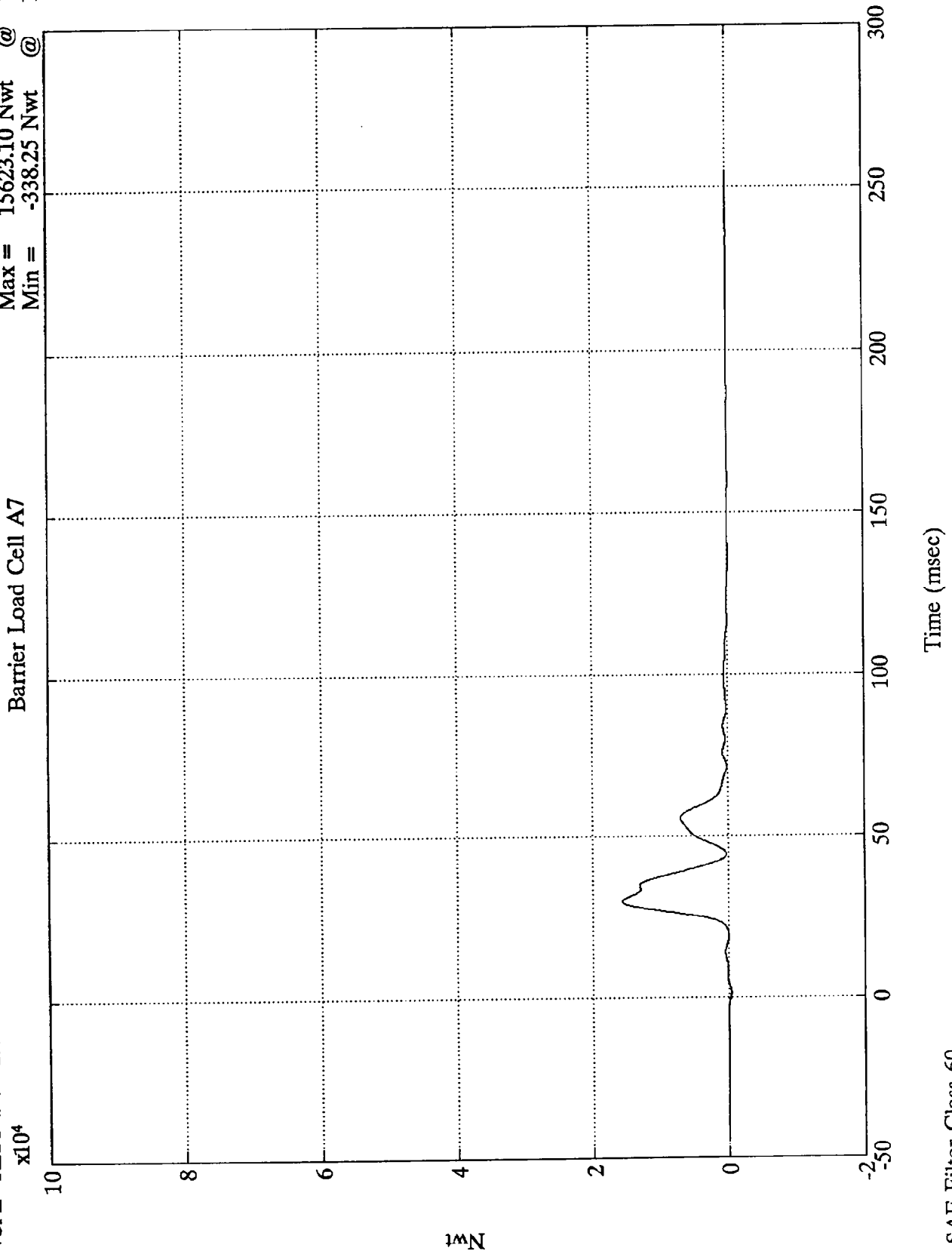
Max = 35847.36 Nwt @ 30.00 msec  
Min = -303.42 Nwt @ 19.79 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A7

Max = 15623.10 Nwt @ 29.88 msec  
Min = -338.25 Nwt @ 1.43 msec



B-35

8048-2

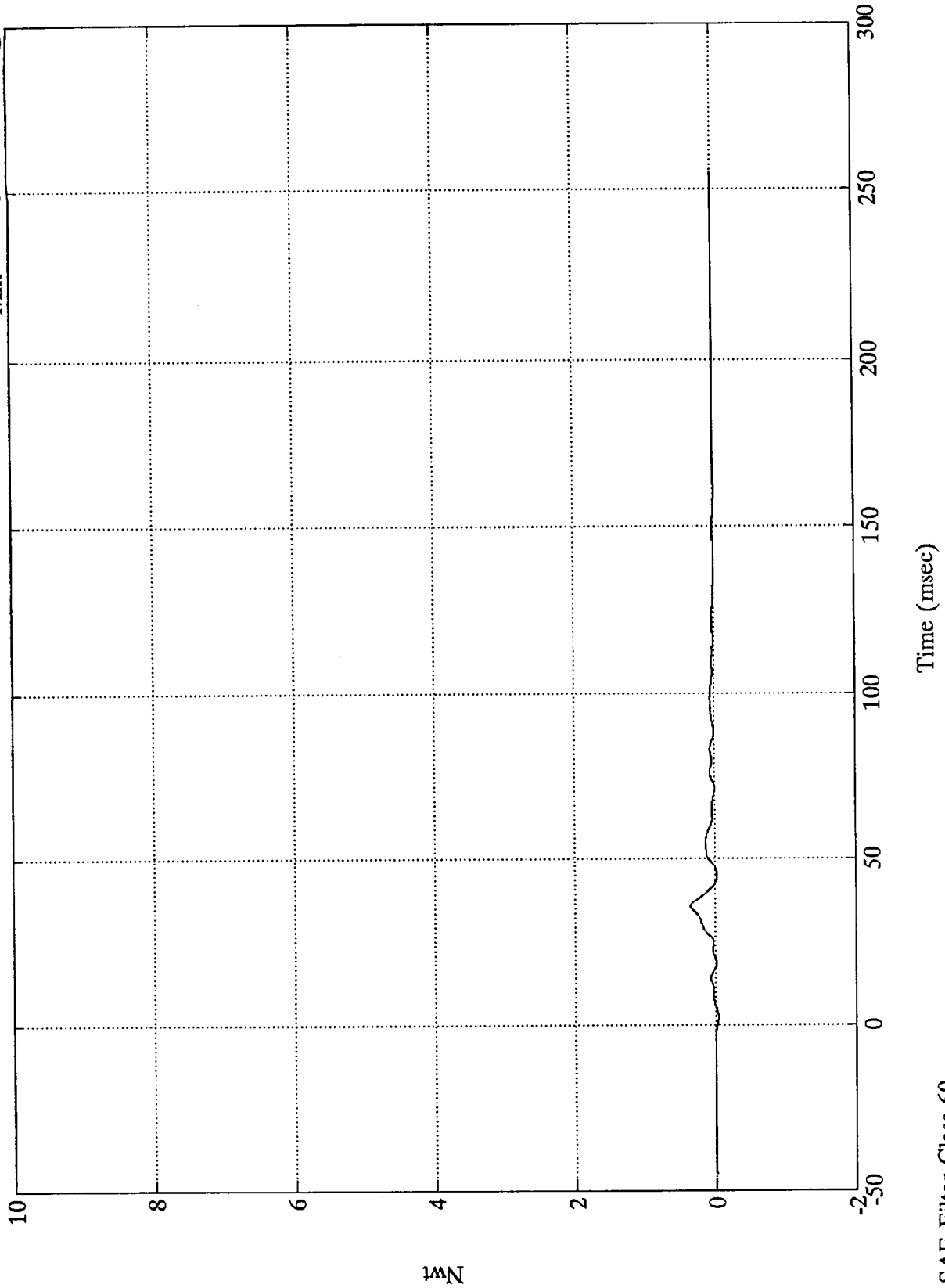
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A8

Max = 3575.19 Nwt @  
Min = -339.09 Nwt @

35.63 msec  
2.15 msec



1N

B-36

8048-2

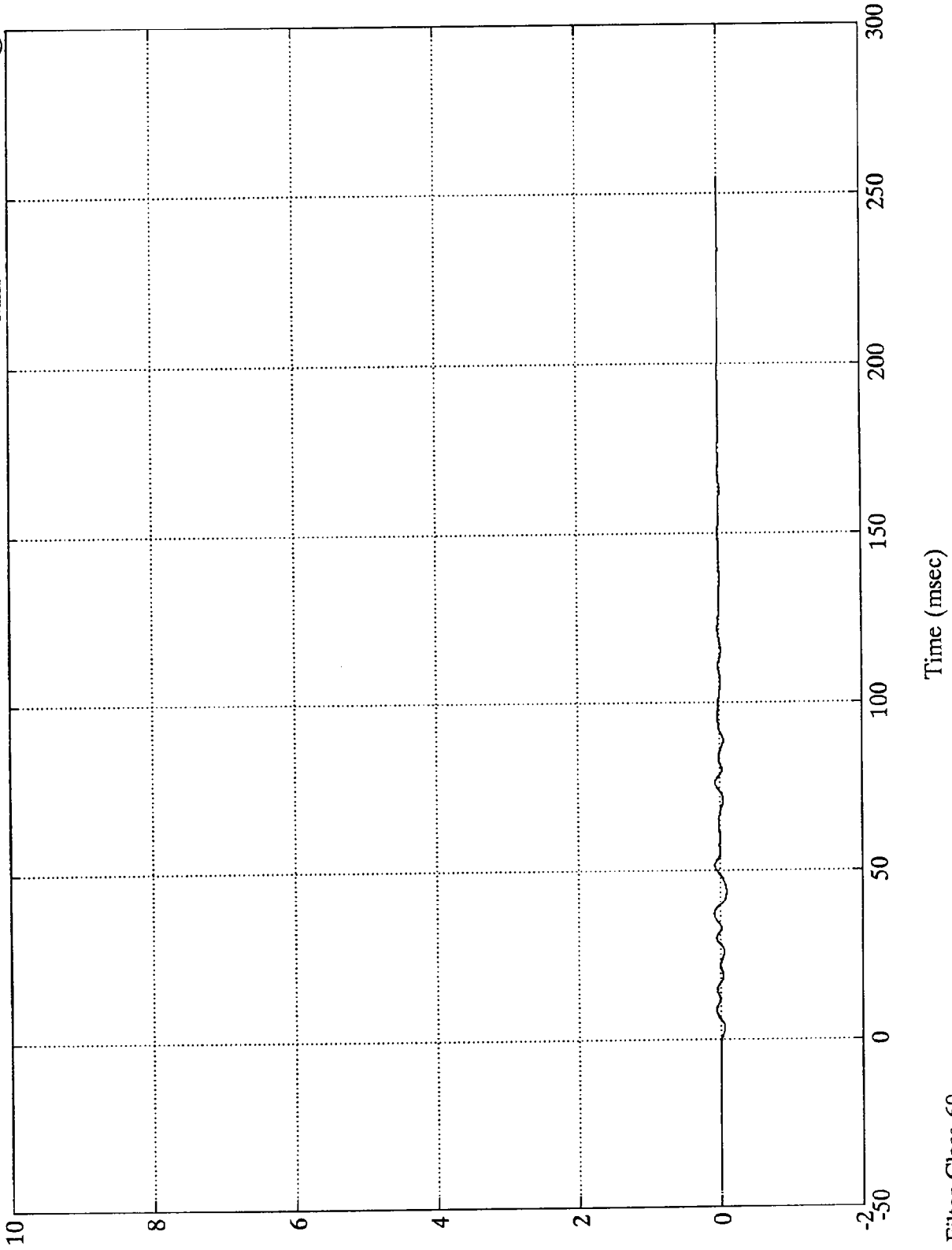
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell A9

Max = 888.81 Nwt @ 37.08 msec  
Min = -873.29 Nwt @ 43.79 msec

x10<sup>4</sup>



10N  
B-37

8048-2

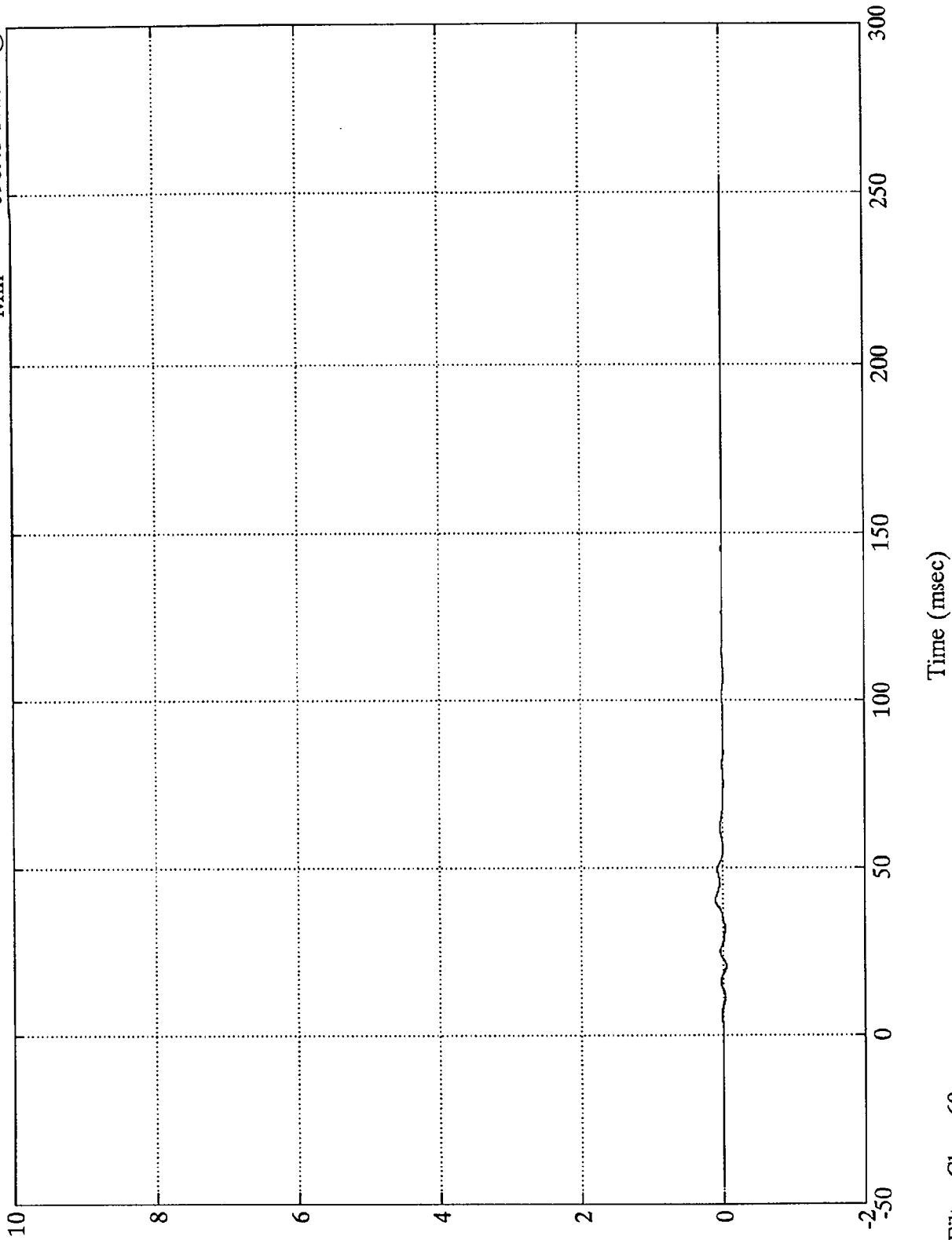
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

$\times 10^4$

Barrier Load Cell B1

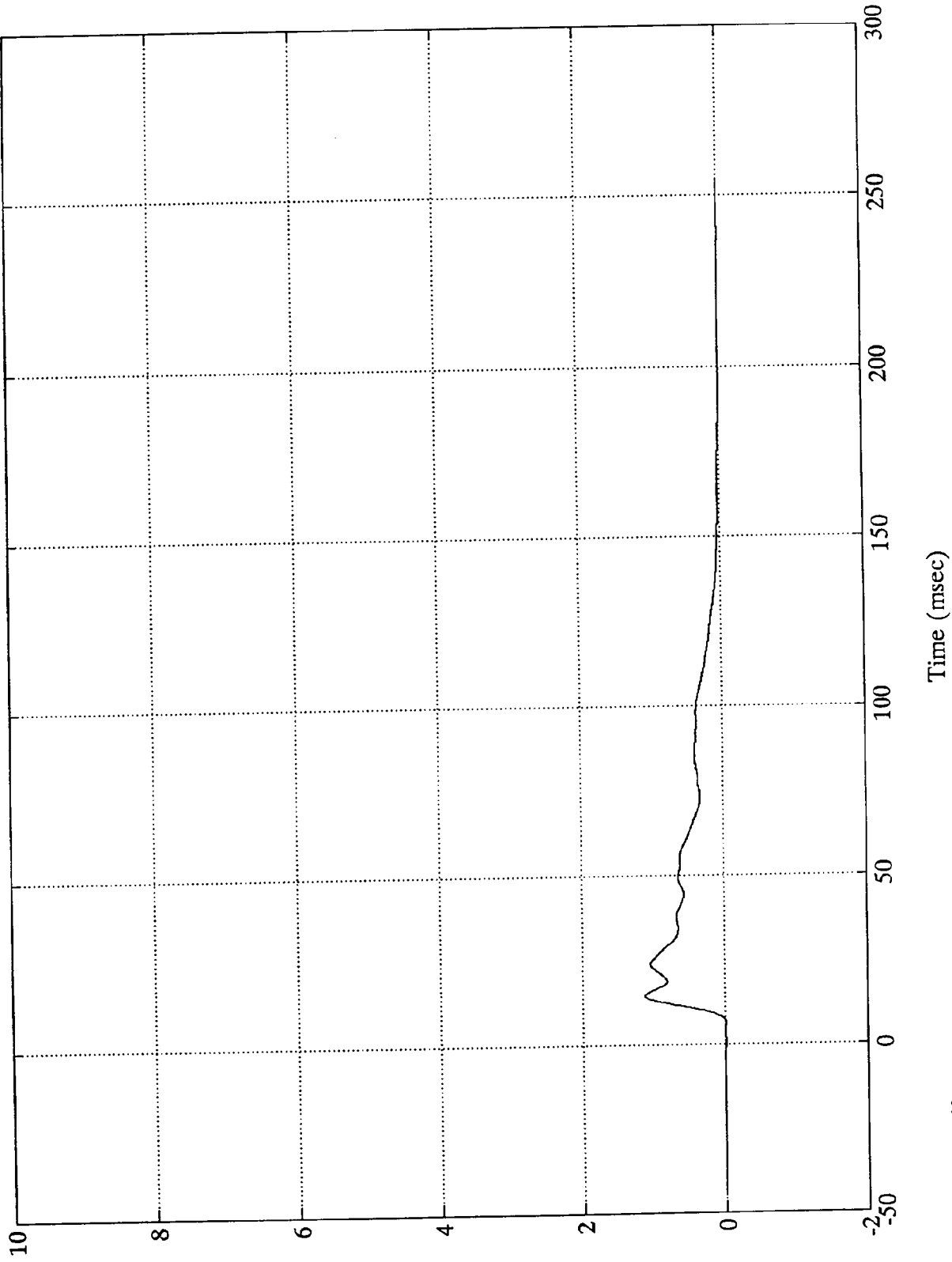
Max = 1085.86 Nwt @ 40.31 msec  
Min = -390.45 Nwt @ 20.63 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell B2

Max = 11295.11 Nwt @ 14.51 msec  
Min = -87.01 Nwt @ 0.47 msec



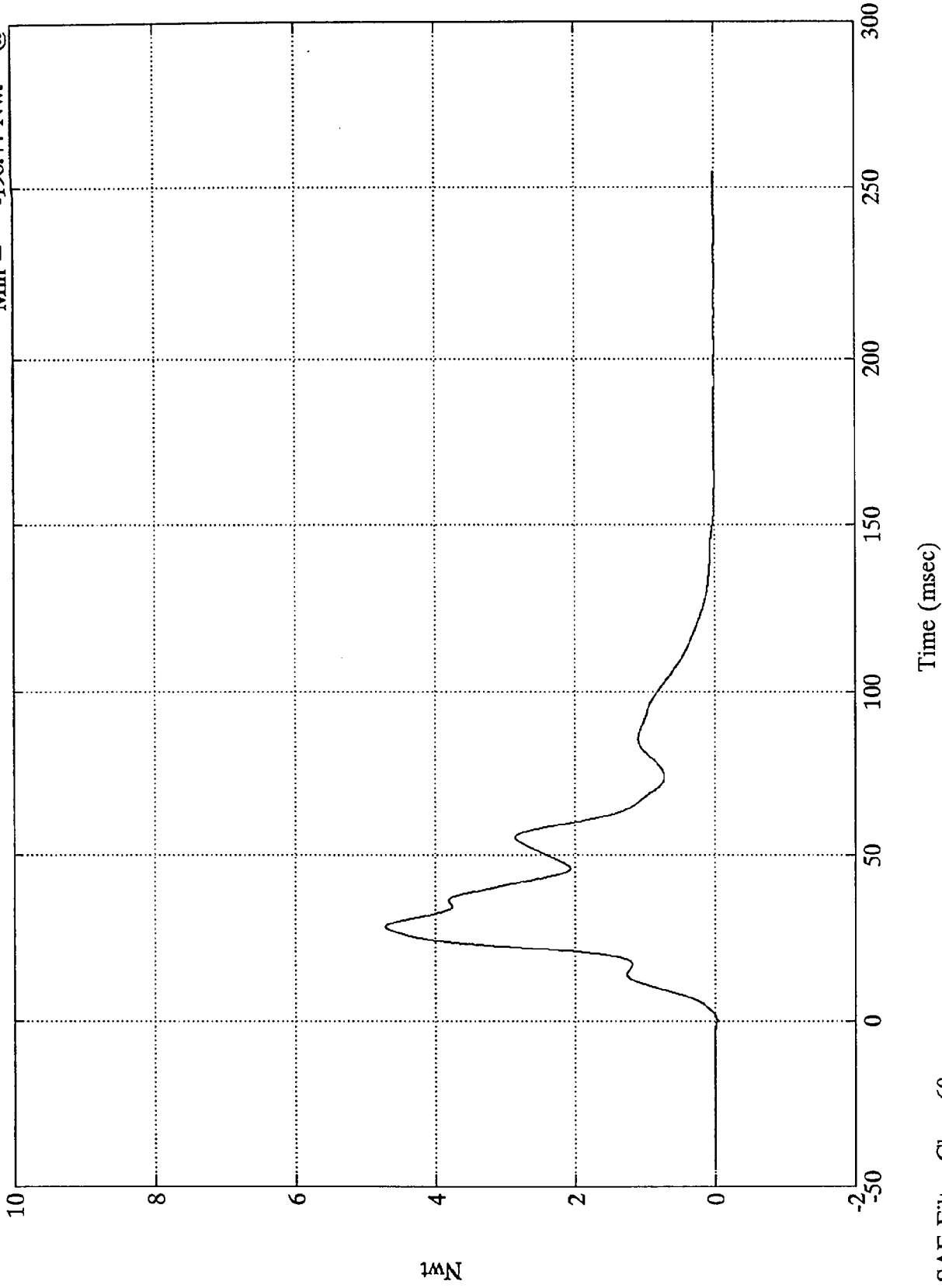
Nwt  
B-39

8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell B3  
Max = 47200.85 Nwt @ 28.55 msec  
Min = -198.44 Nwt @ -0.00 msec



1MN  
B-40

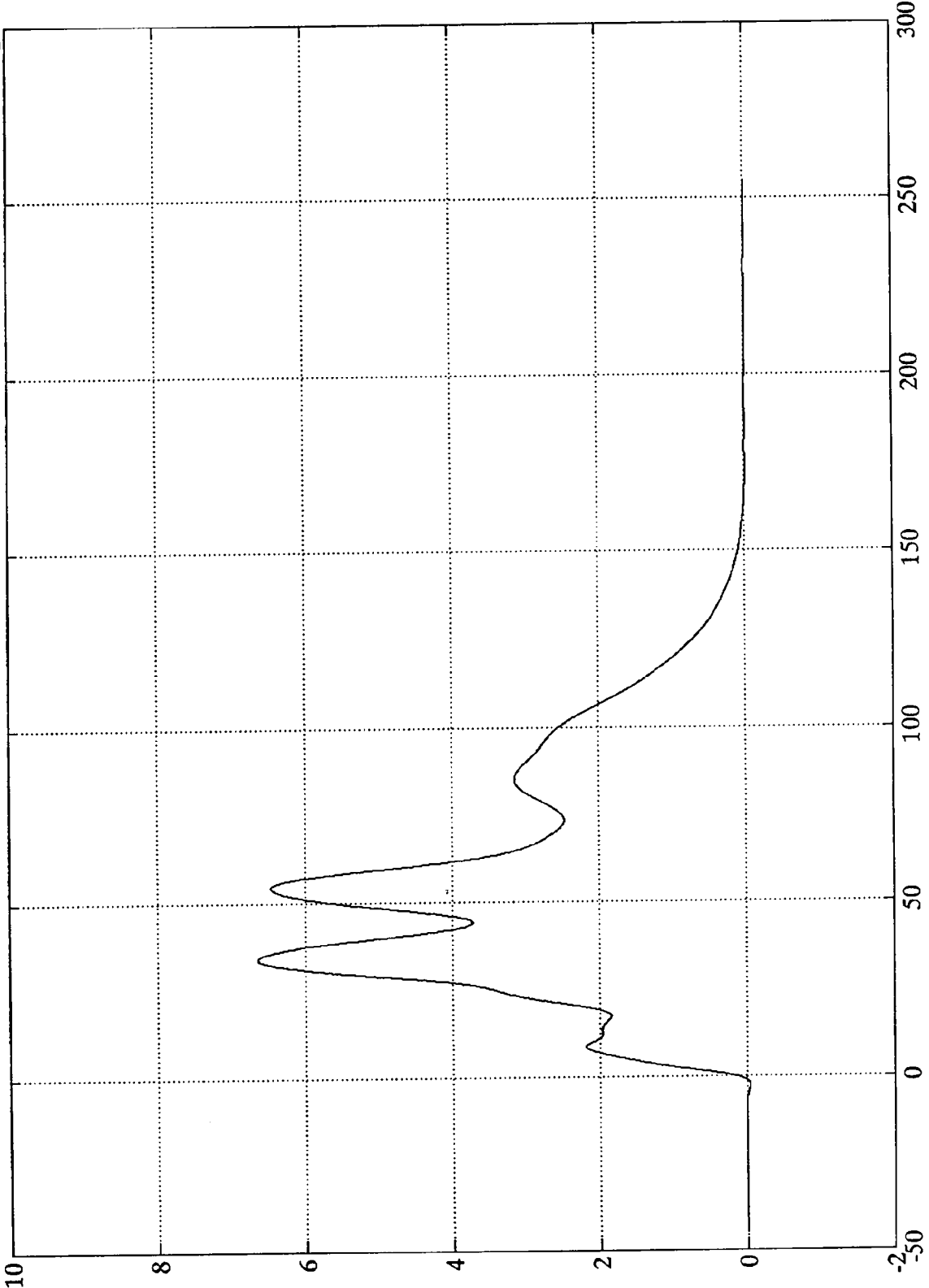
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell B4

Max = 66496.32 Nwt @ 33.95 msec  
Min = -429.13 Nwt @ -2.64 msec



1N  
B-41

8048-2

Time (msec)

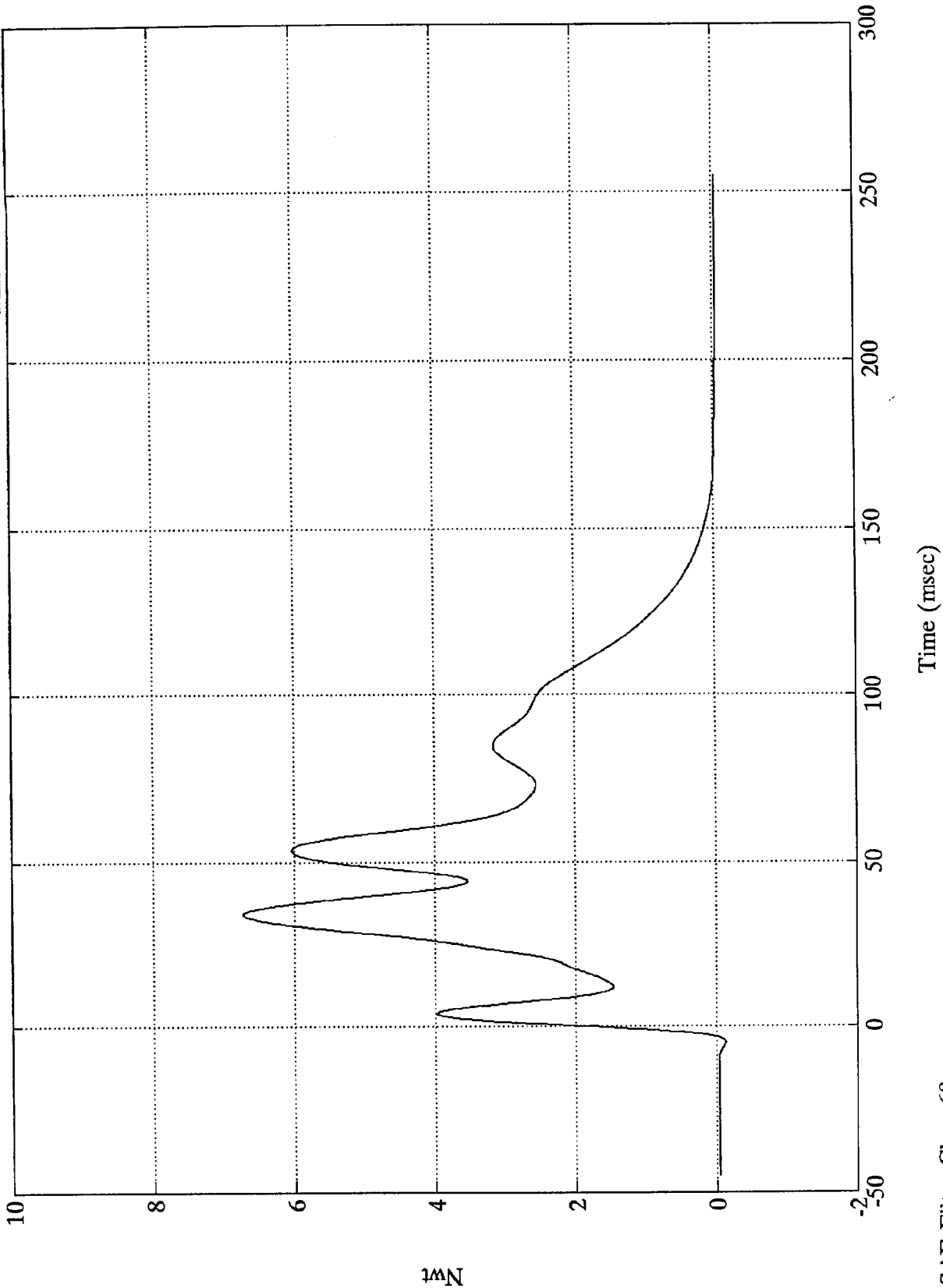
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

$\times 10^4$

Barrier Load Cell B5

Max = 67315.05 Nwt @ 33.95 msec  
Min = -1281.84 Nwt @ -4.92 msec



1Nwt  
B-42

8048-2

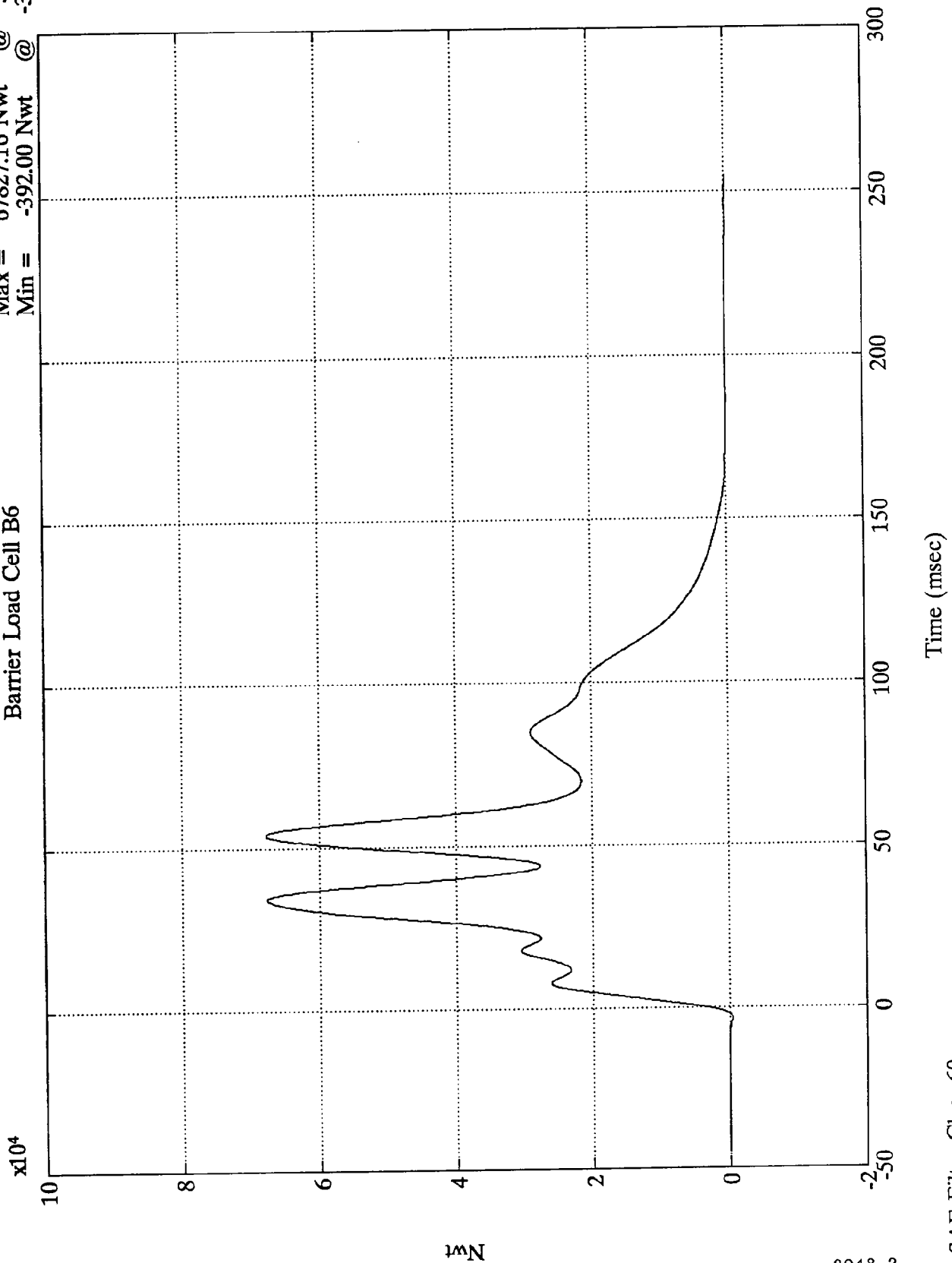
SAE Filter Class 60



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell B6

Max = 67827.16 Nwt @ 54.00 msec  
Min = -392.00 Nwt @ -3.48 msec



10N  
B-43

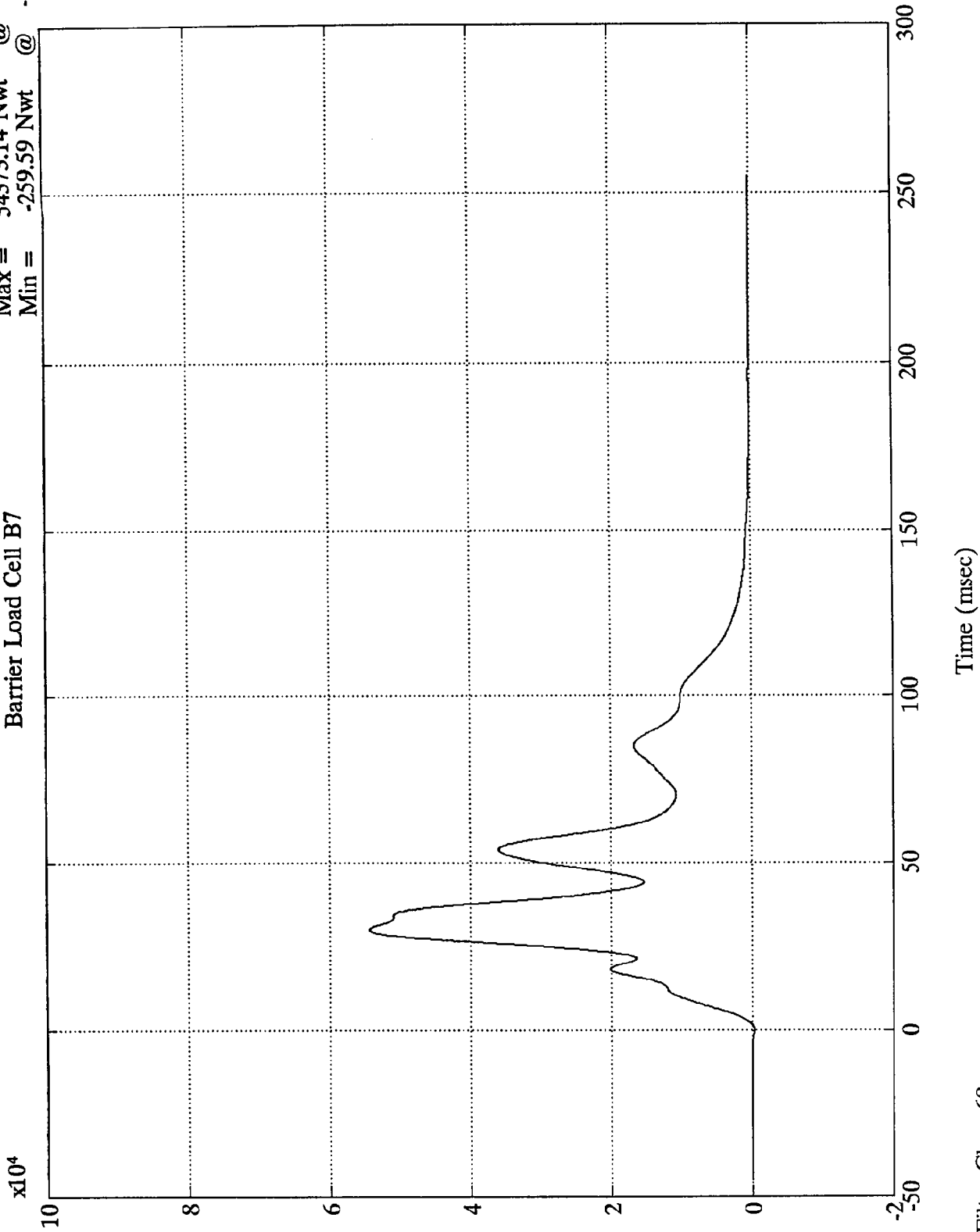
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell B7

Max = 54373.14 Nwt @ 29.88 msec  
Min = -259.59 Nwt @ -0.12 msec

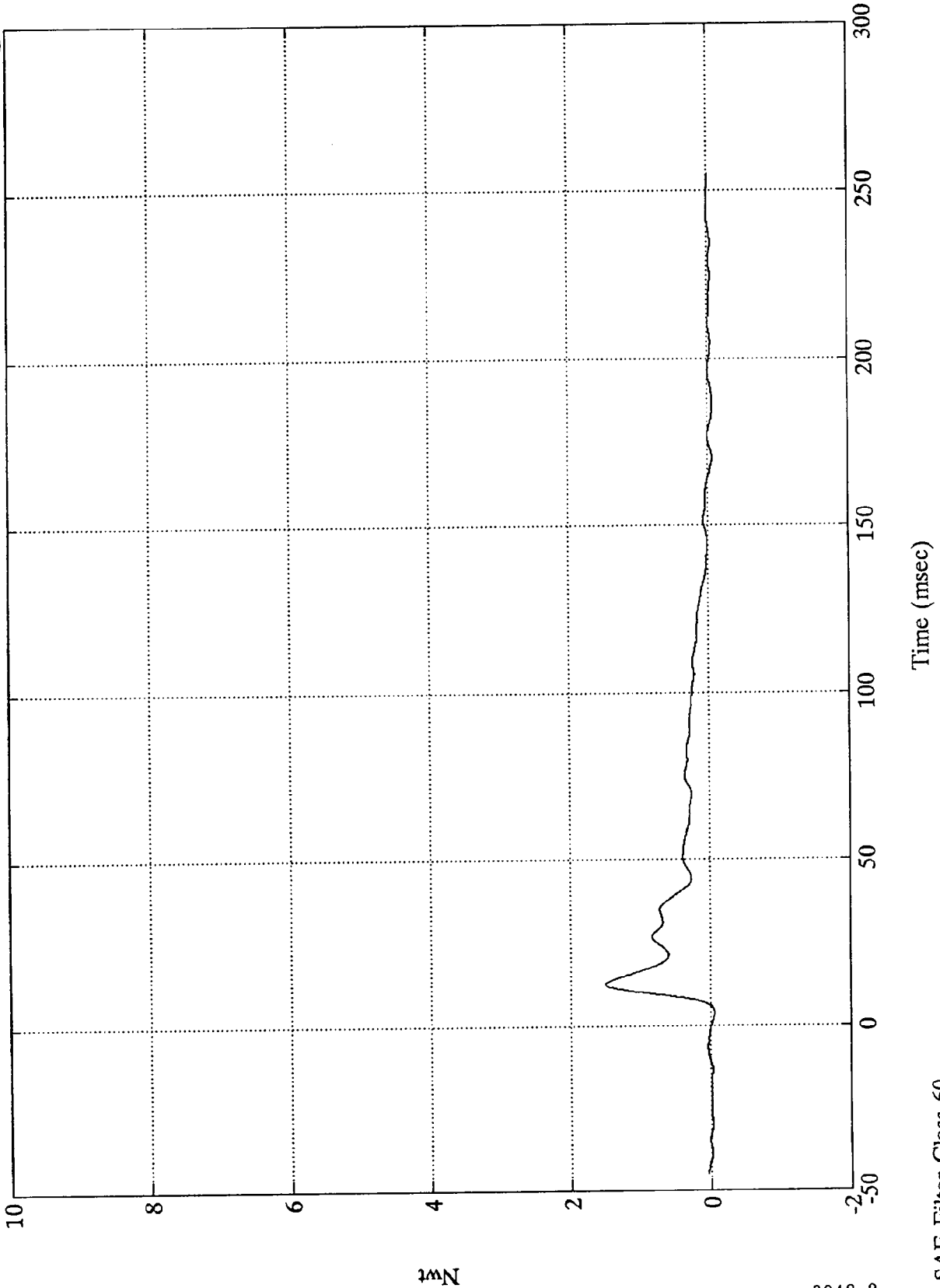


NCAP TEST #4 - 1993 PONTIAC GRAND AM

Max = 15074.78 Nwt @ 12.47 msec  
Min = -698.15 Nwt @ 186.36 msec

Barrier Load Cell B8

$\times 10^4$



Nwt  
B-45

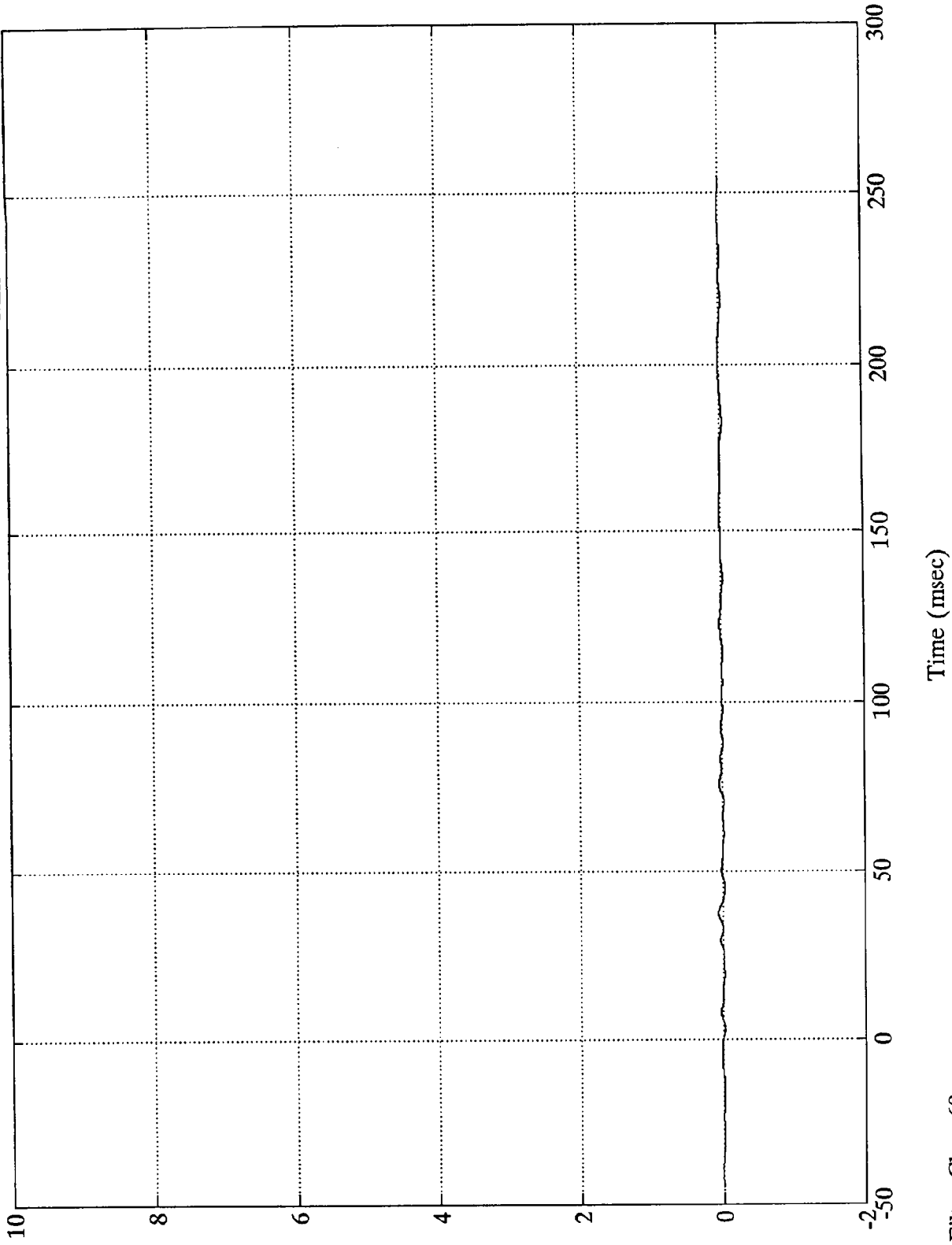
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell B9

Max = 661.26 Nwt @ 37.31 msec  
Min = -345.34 Nwt @ 183.00 msec



1Nwt  
B-46

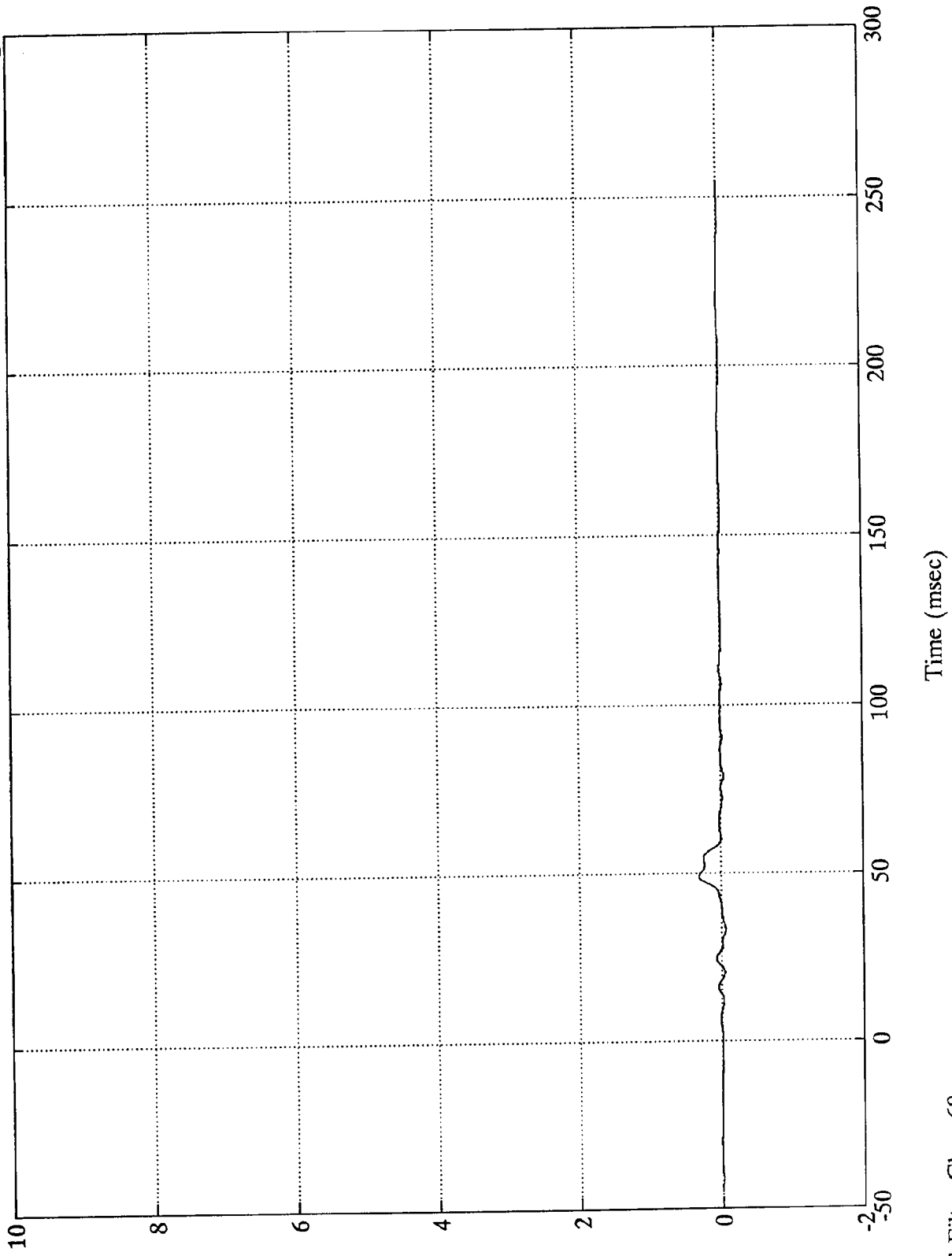
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell C1

Max = 3093.04 Nwt @ 49.07 msec  
Min = -631.62 Nwt @ 33.00 msec



1MN  
B-47

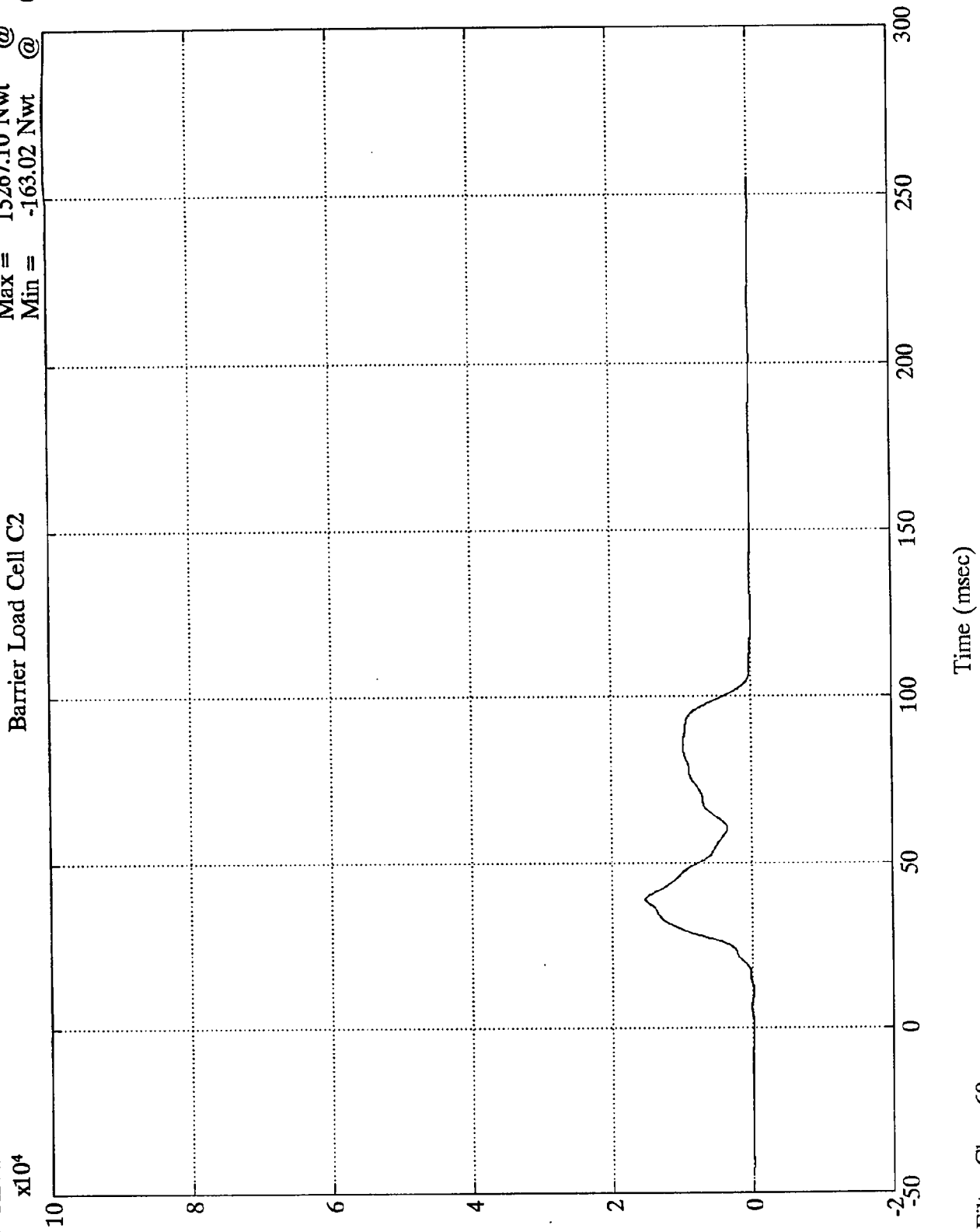
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell C2

Max = 15267.10 Nwt @ 39.23 msec  
Min = -163.02 Nwt @ 0.83 msec



1MN  
B-48

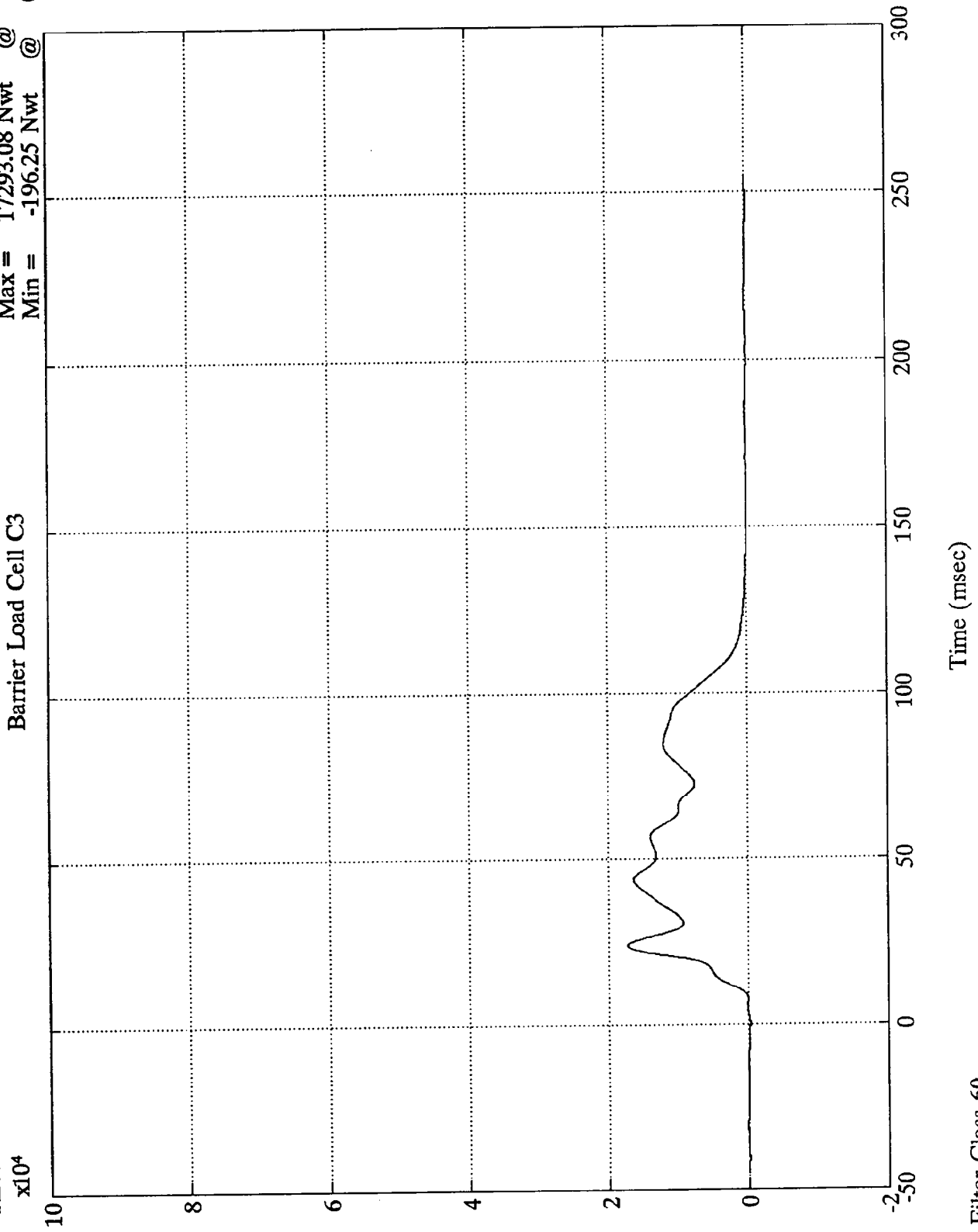
8048-2

SAE Filter Class 60

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

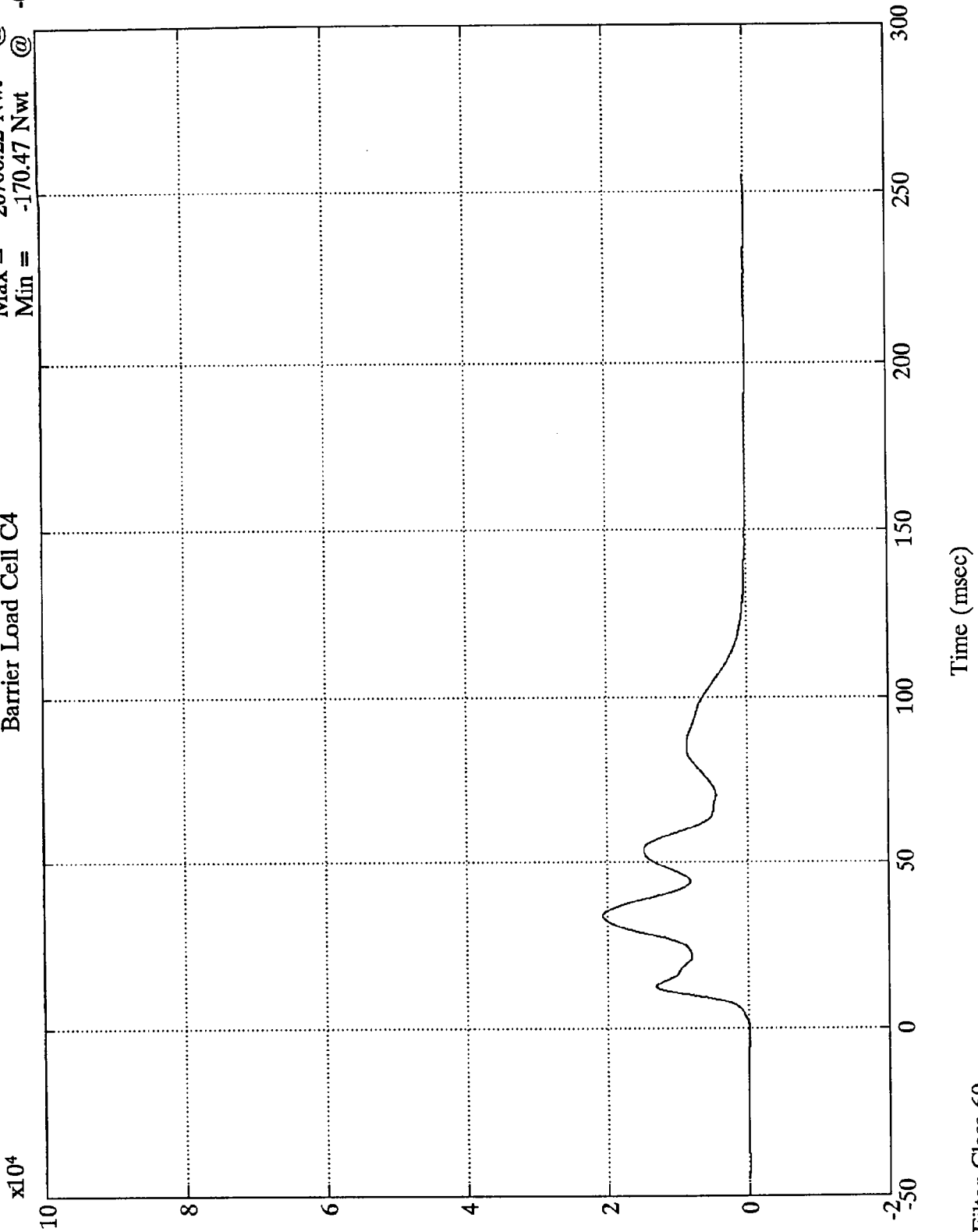
Barrier Load Cell C3  
Max = 17293.08 Nwt @ 24.11 msec  
Min = -196.25 Nwt @ 0.11 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell C4

Max = 20700.22 Nwt @ 33.72 msec  
Min = -170.47 Nwt @ -0.60 msec



1Nwt  
B-50

8048-2

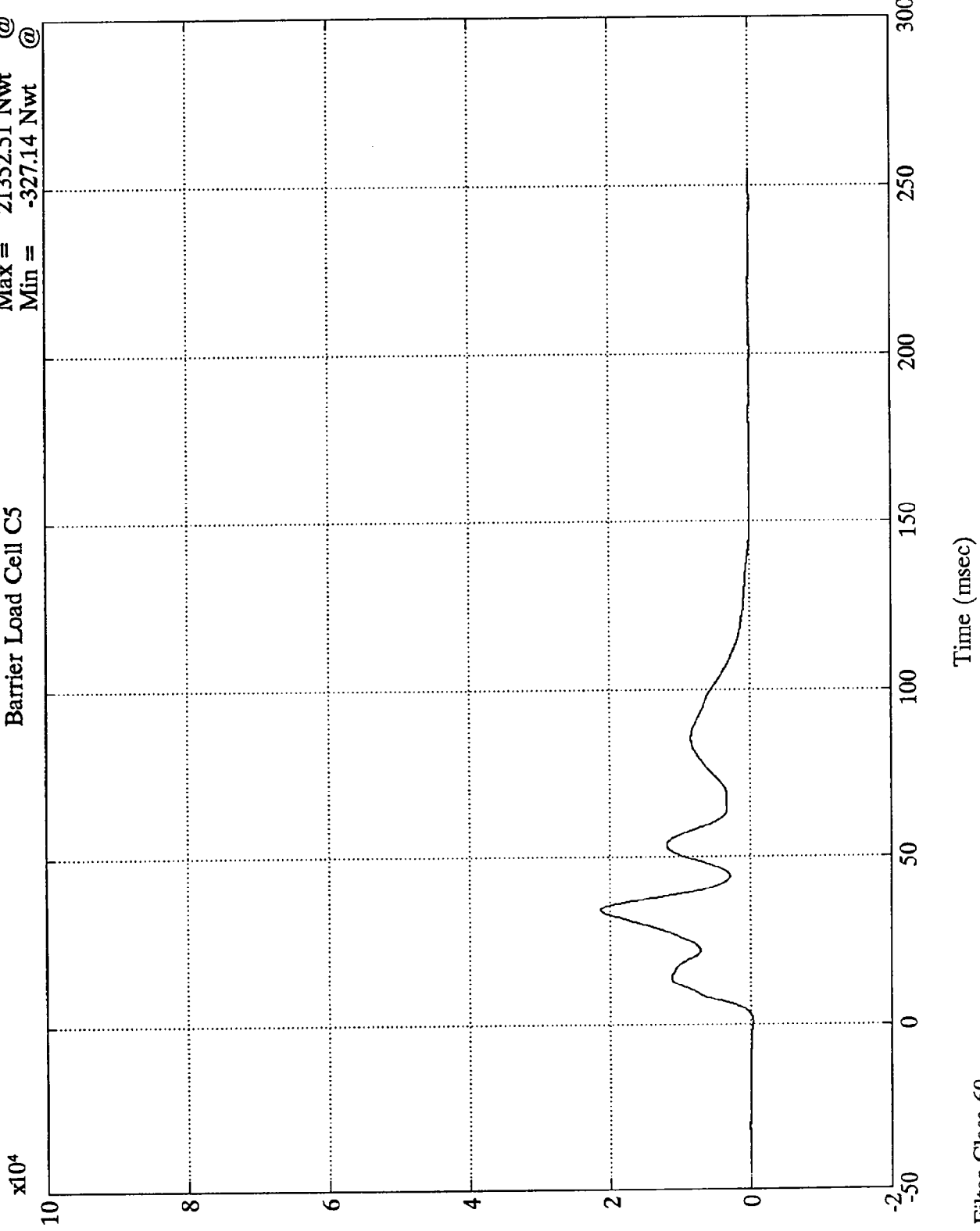
SAE Filter Class 60

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Max = 21352.51 Nwt @ 34.07 msec  
Min = -327.14 Nwt @ 0.71 msec

Barrier Load Cell C5



B-51

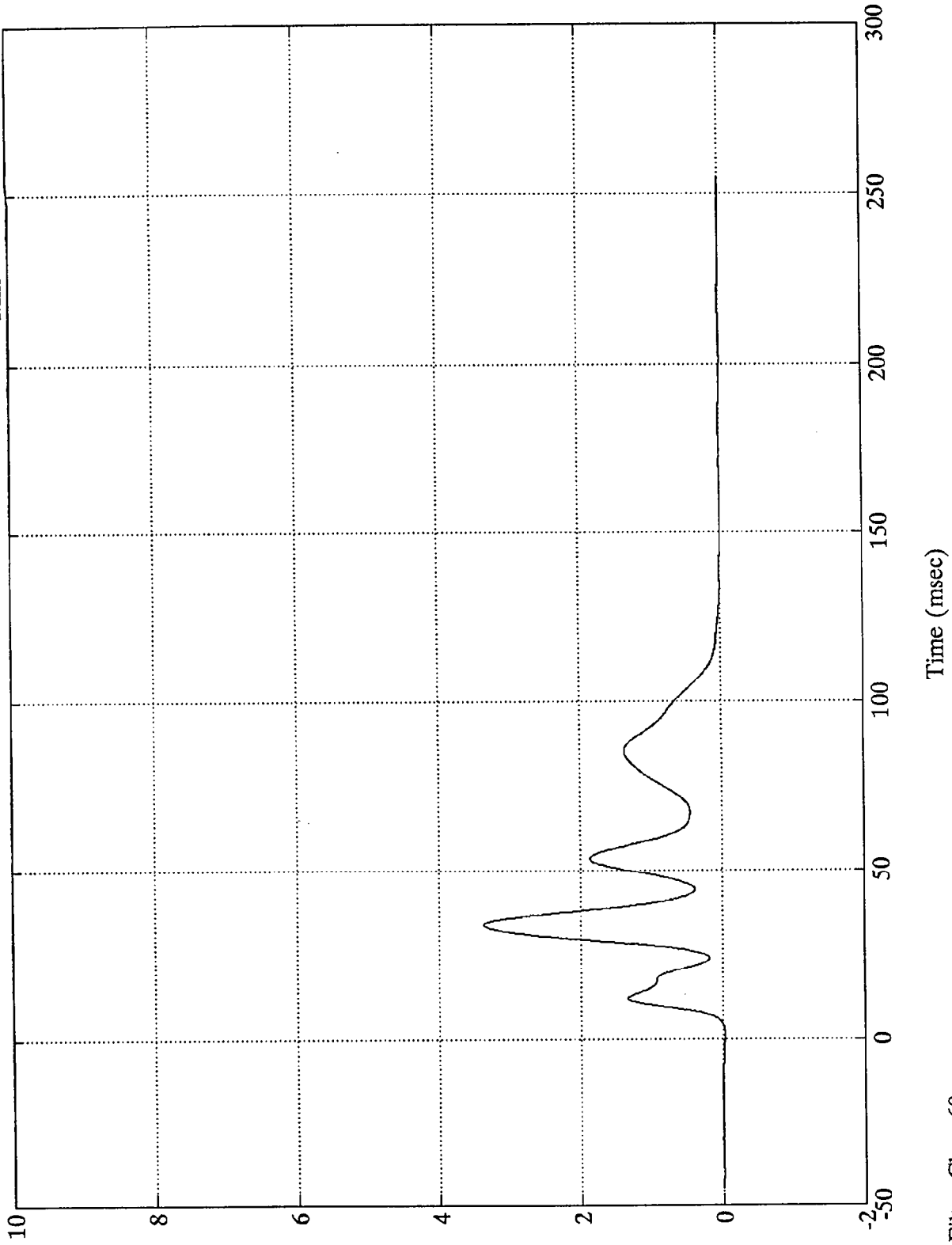
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell C6

Max = 33715.83 Nwt @ 33.95 msec  
Min = -255.65 Nwt @ 0.95 msec



1MN  
B-52

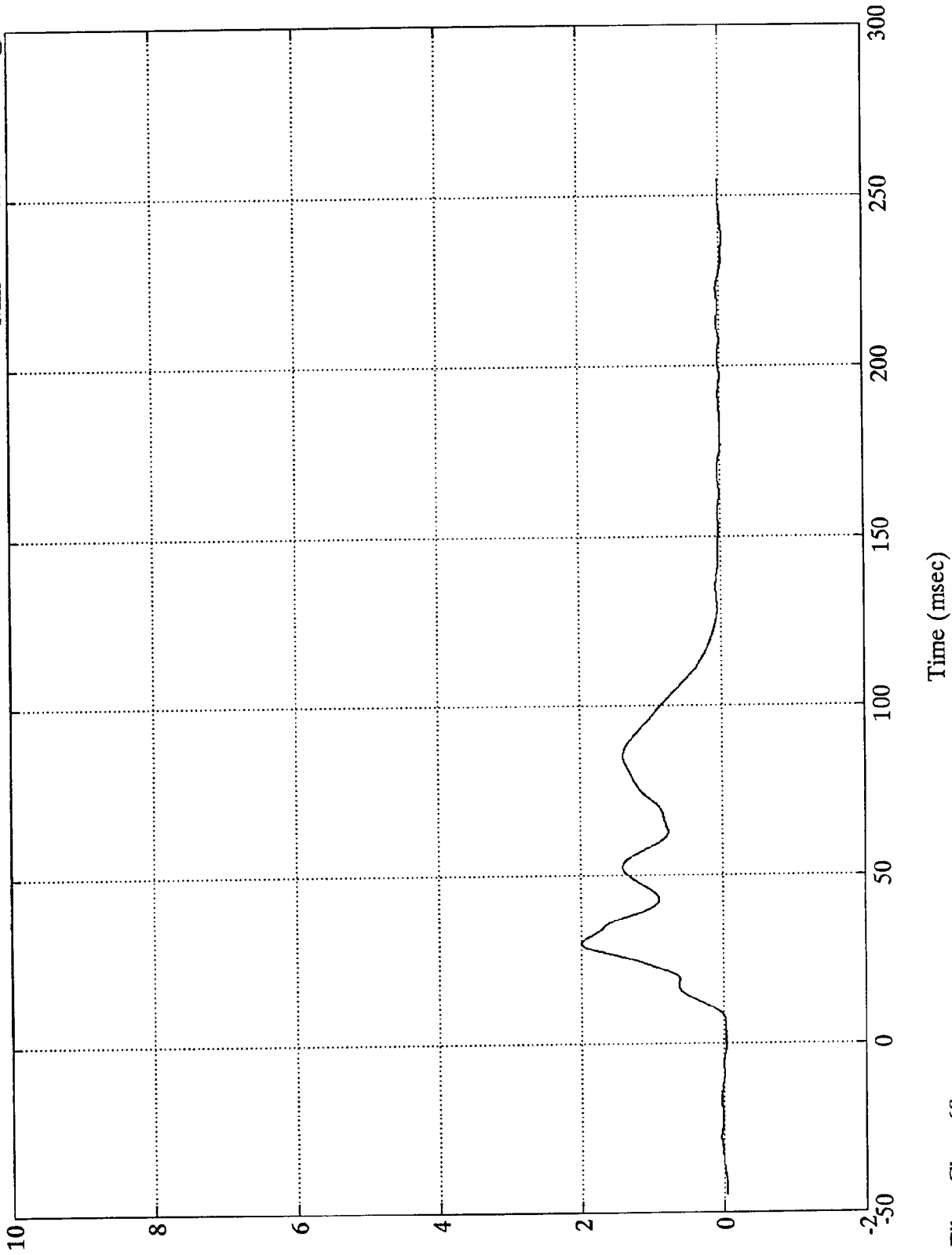
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell C7

Max = 19957.30 Nwt @ 29.76 msec  
Min = -439.12 Nwt @ 0.35 msec



11N  
B-53

8048-2

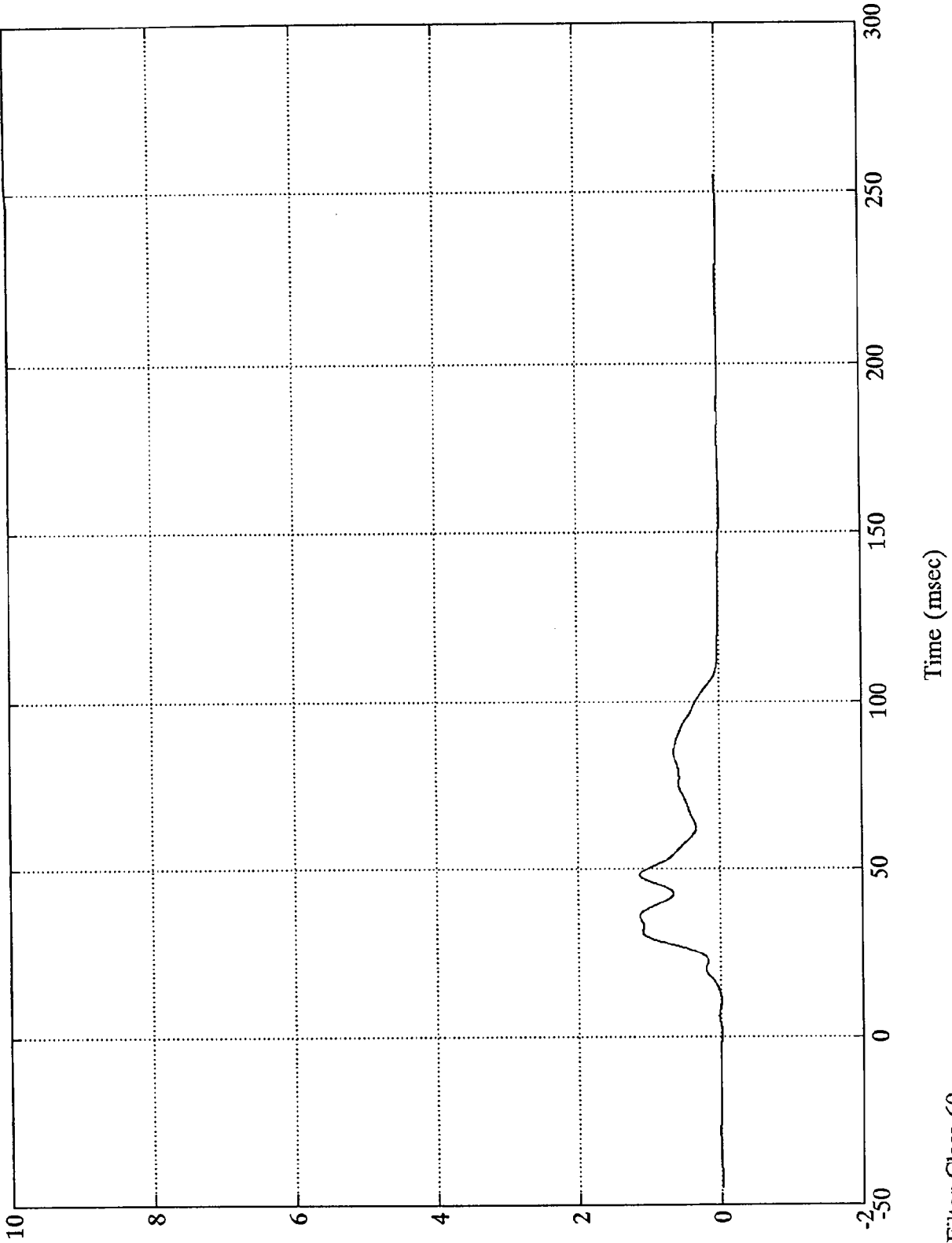
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

$\times 10^4$

Barrier Load Cell C8

Max = 11366.86 Nwt @ 48.11 msec  
Min = -157.02 Nwt @ 1.31 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell C9

Max = 603.71 Nwt @ 38.52 msec  
Min = -566.33 Nwt @ 33.72 msec

x10<sup>4</sup>



1Nwt  
B-55

8048-2

Time (msec)

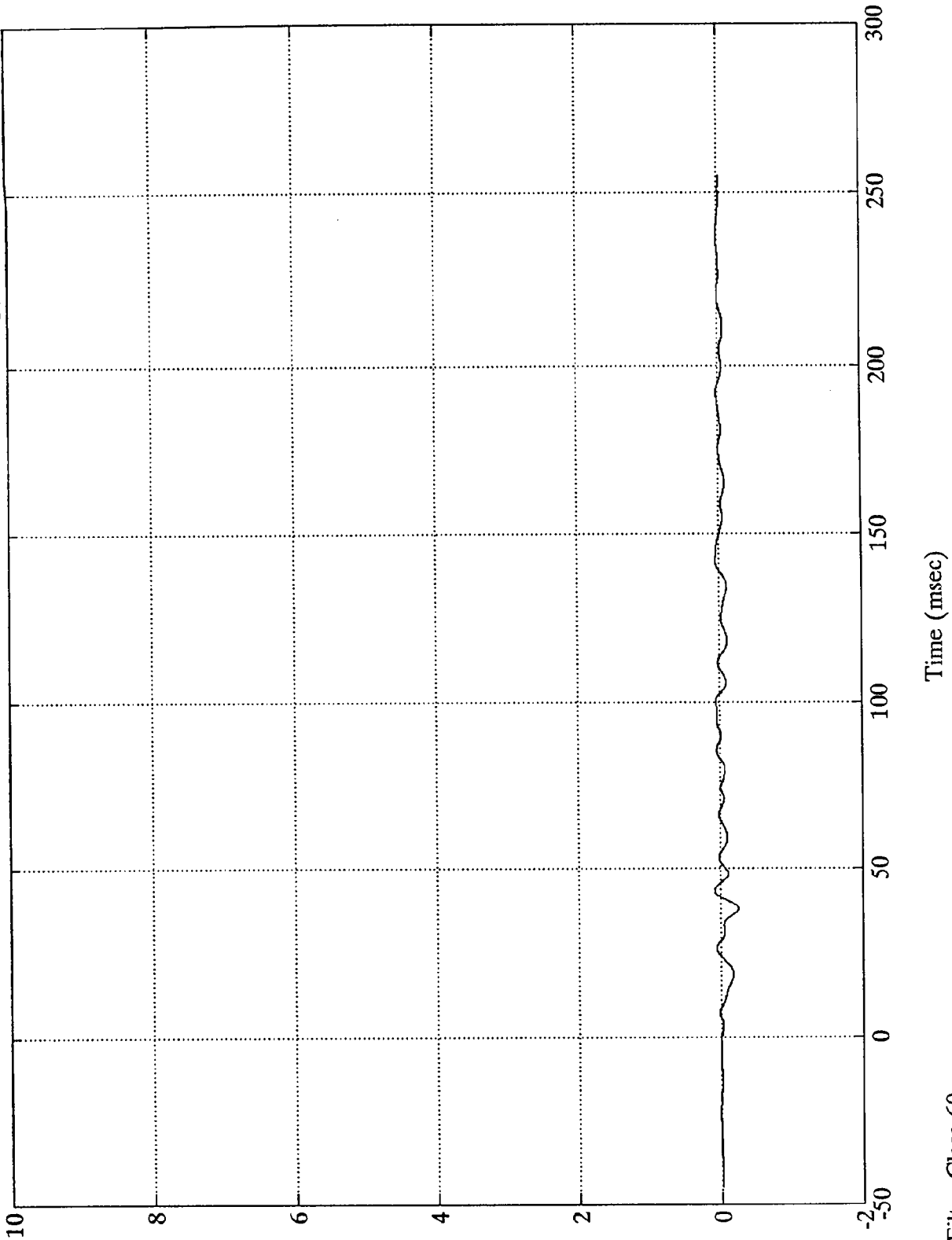
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell D1

Max = 865.18 Nwt @ 43.08 msec  
Min = -2496.19 Nwt @ 37.79 msec

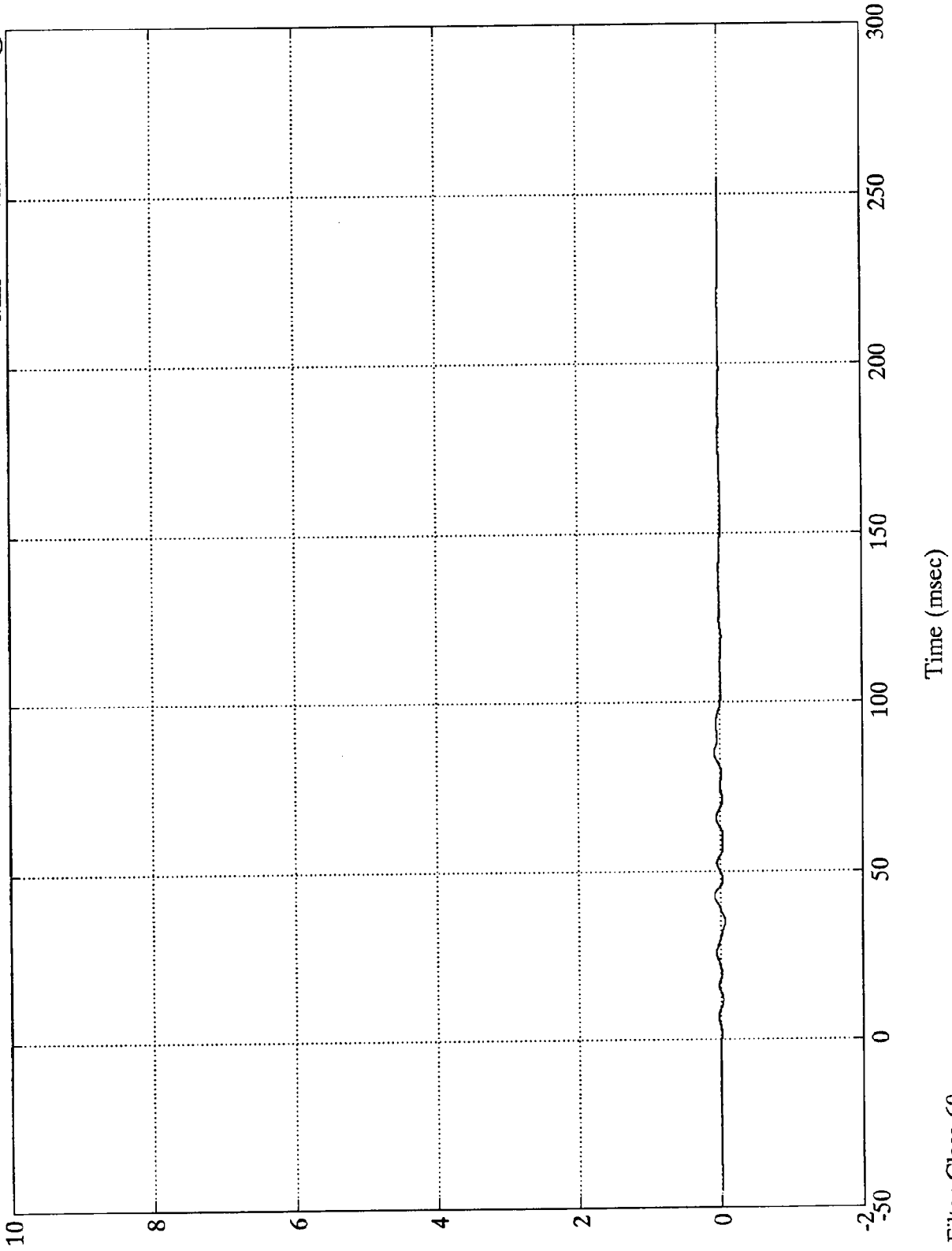
x10<sup>4</sup>



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell D2

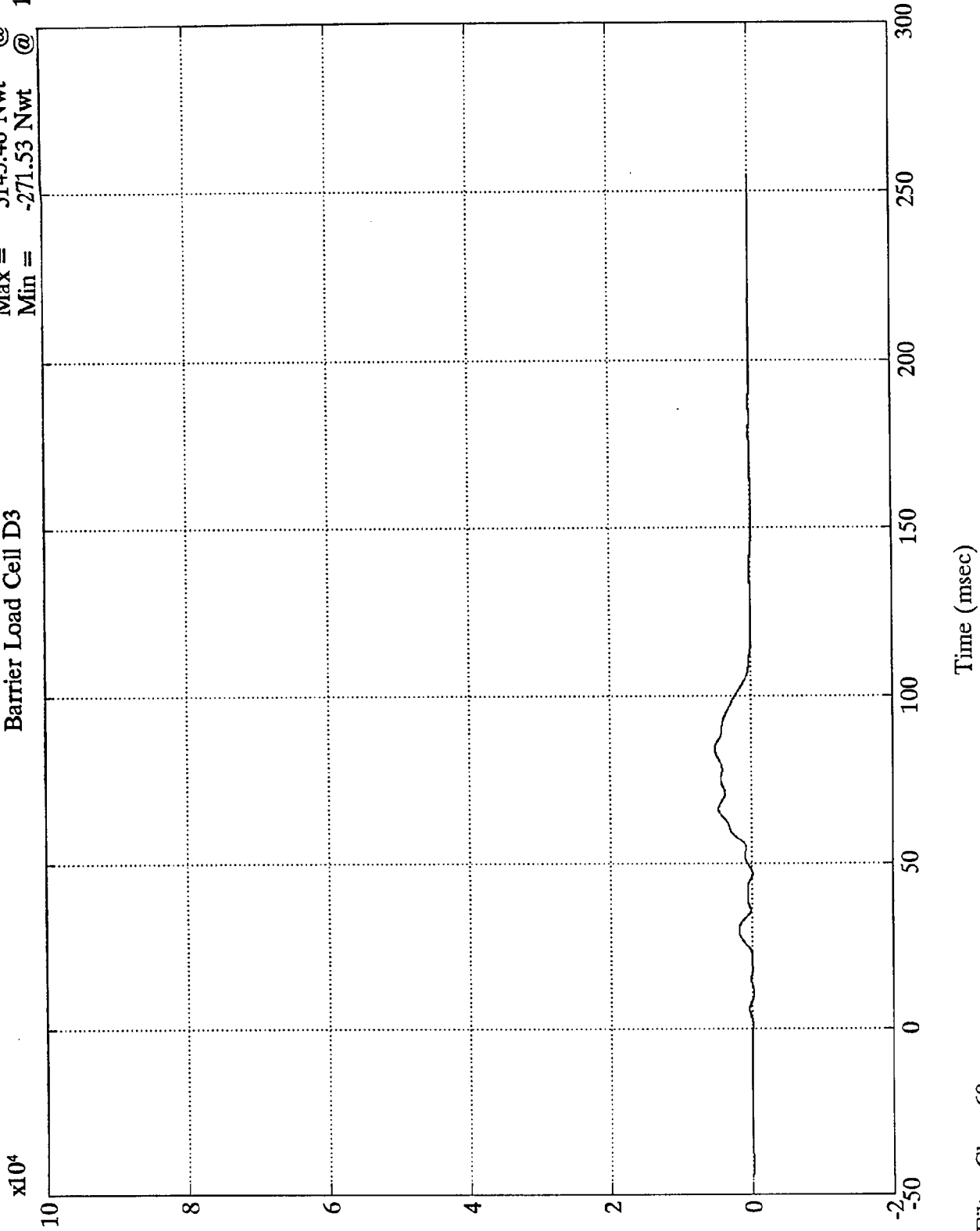
Max = 861.54 Nwt @ 42.60 msec  
Min = -719.65 Nwt @ 34.91 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell D3

Max = 5145.46 Nwt @ 84.24 msec  
Min = -271.53 Nwt @ 10.67 msec



11N  
B-58

8048-2

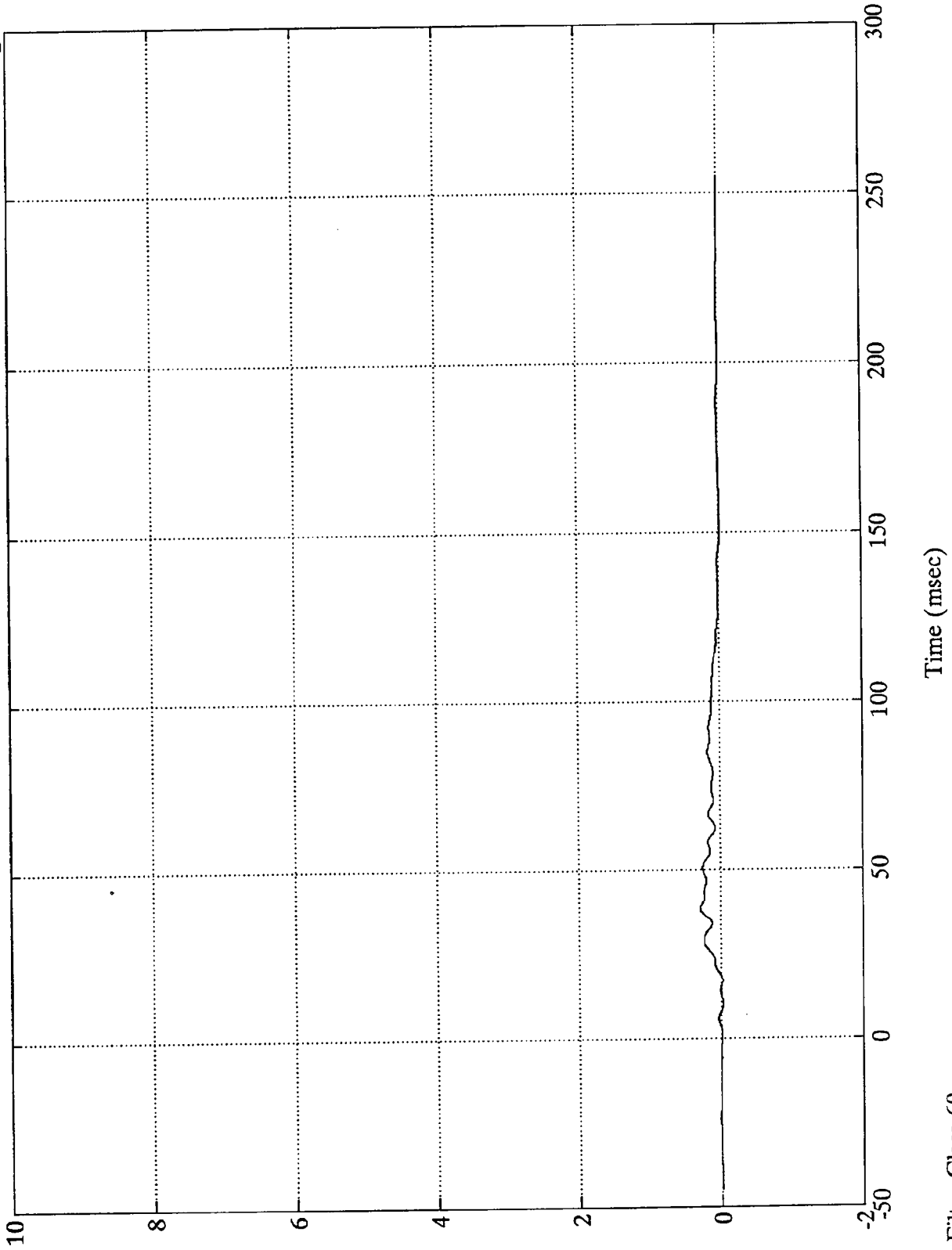
SAE Filter Class 60



NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell D4

Max = 2895.38 Nwt @ 38.40 msec  
Min = -283.59 Nwt @ 10.55 msec



11N  
B-59

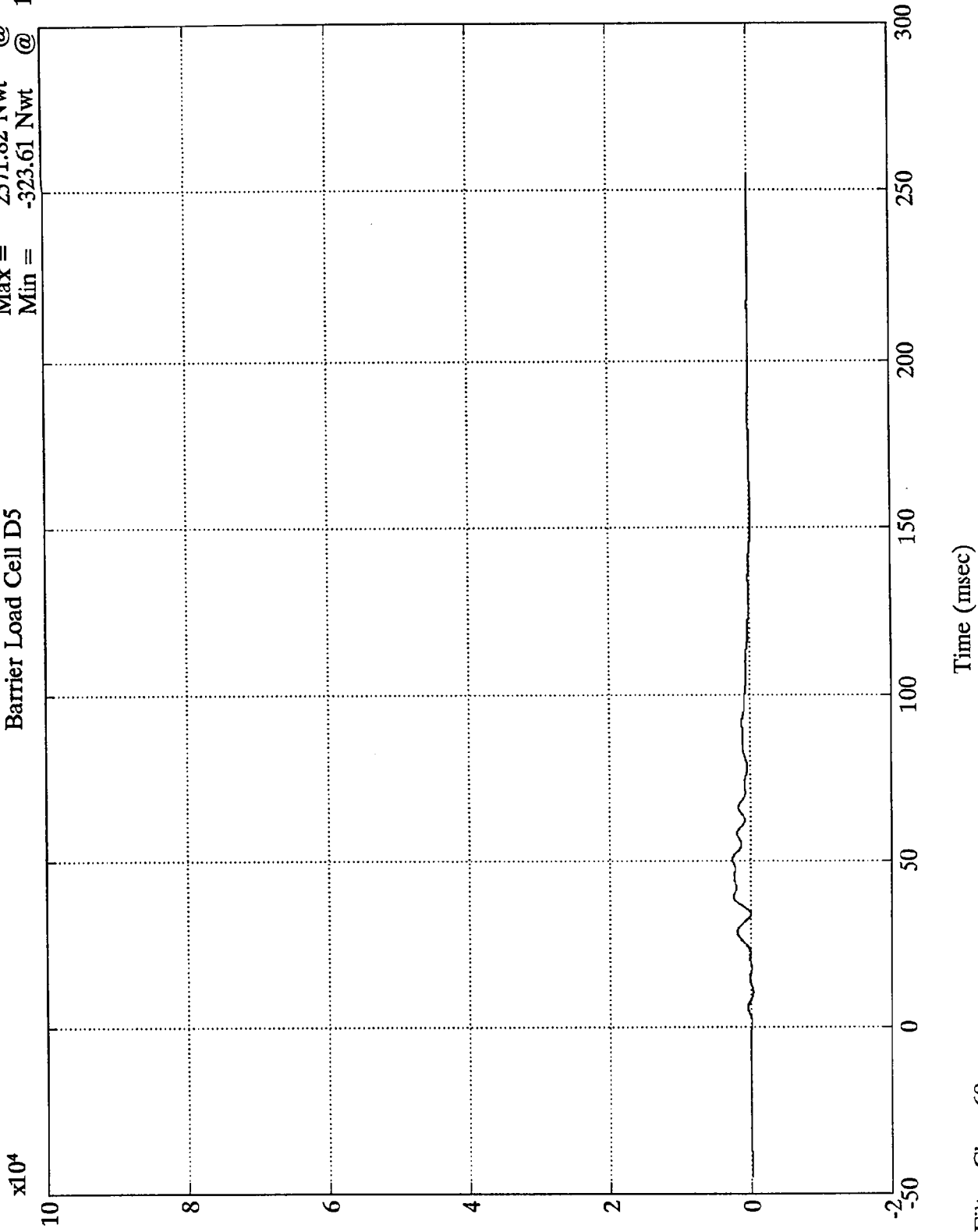
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell D5

Max = 2571.82 Nwt @ 50.40 msec  
Min = -323.61 Nwt @ 10.31 msec



10N  
B-60

8048-2

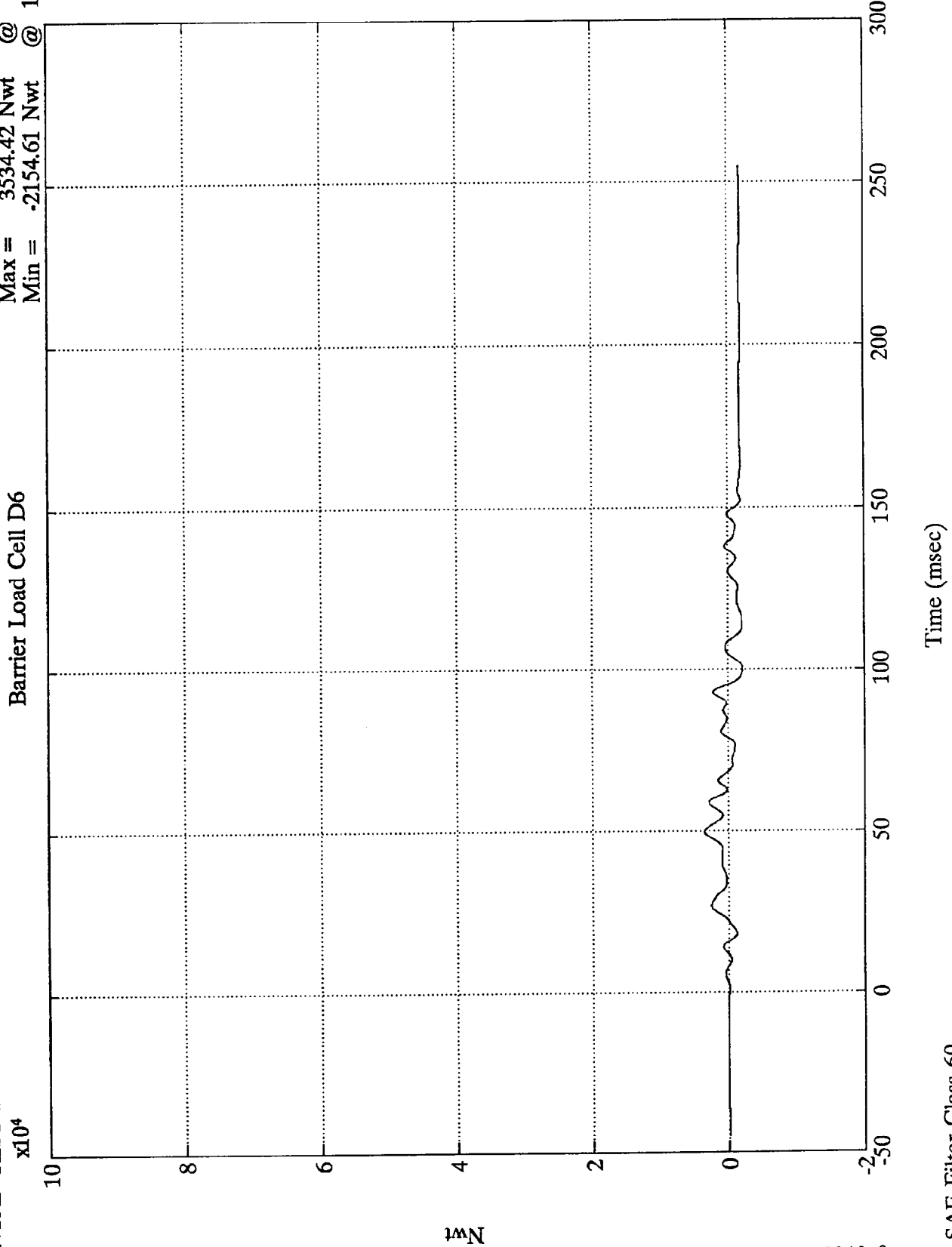
SAE Filter Class 60

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell D6

Max = 3534.42 Nwt @ 49.68 msec  
Min = -2154.61 Nwt @ 100.08 msec



B-61

8048-2

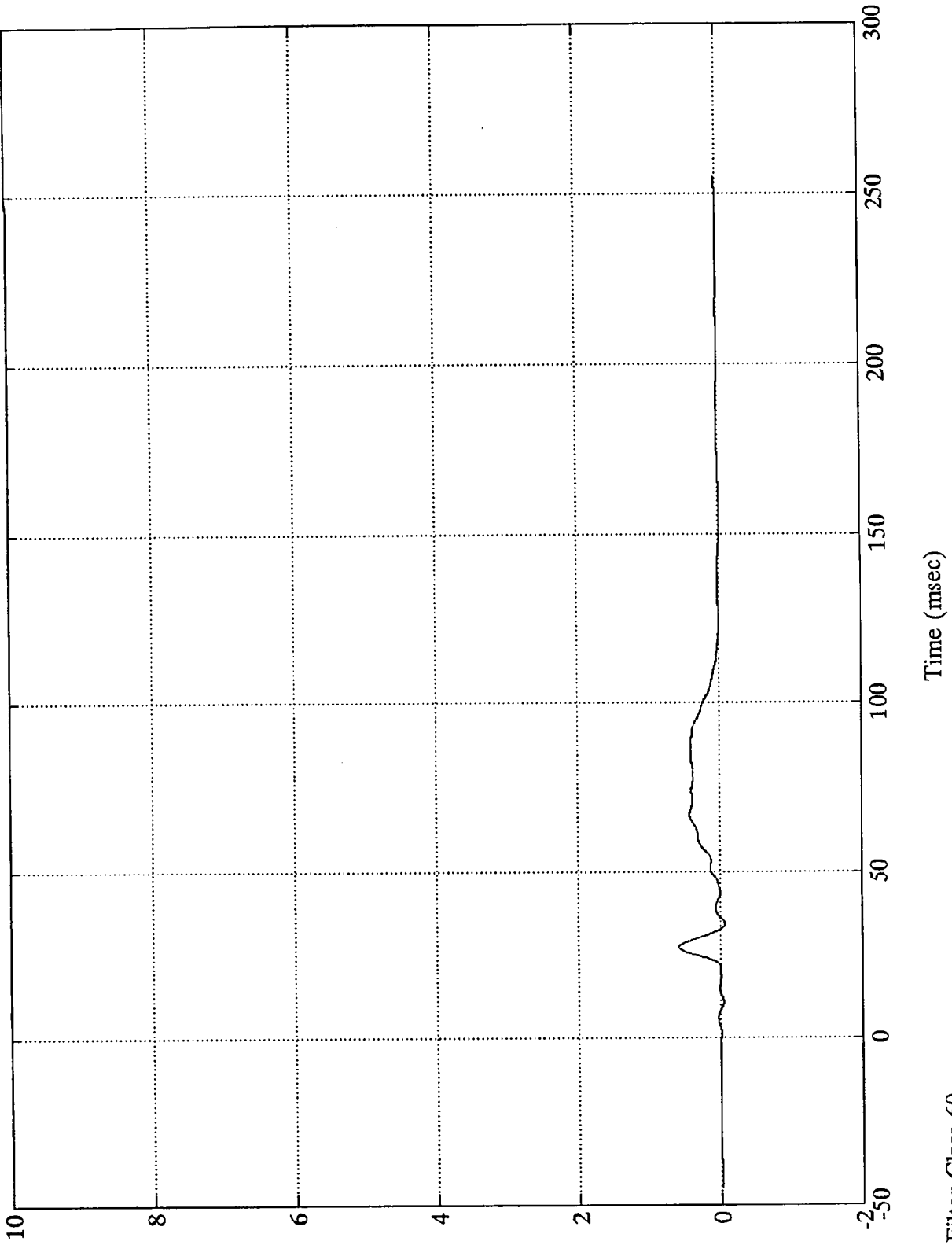
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

x10<sup>4</sup>

Barrier Load Cell D7

Max = 5889.54 Nwt @ 27.23 msec  
Min = -608.15 Nwt @ 34.20 msec



10N  
B-62

8048-2

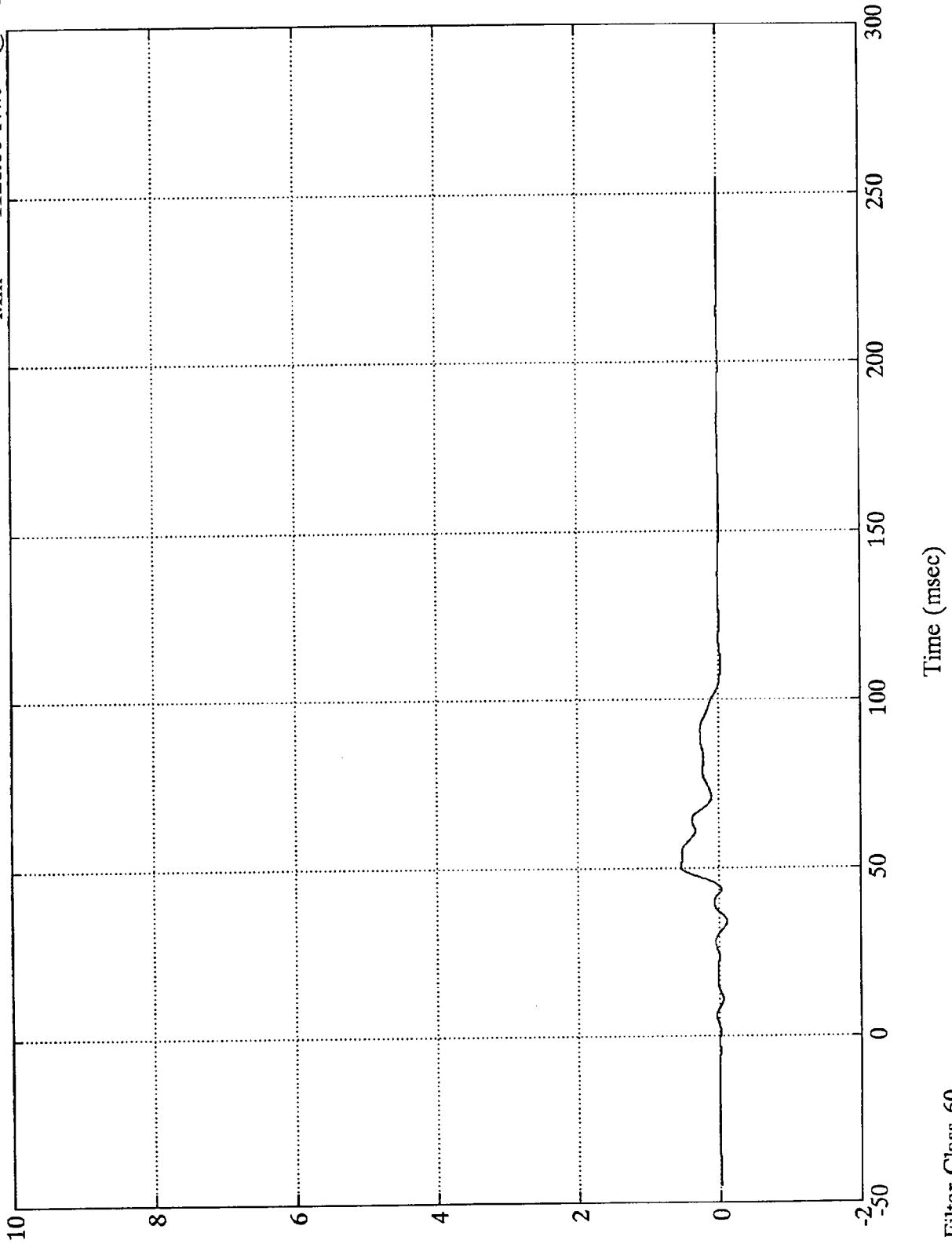
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Barrier Load Cell D8

Max = 5448.20 Nwt @ 50.52 msec  
Min = -1120.00 Nwt @ 34.07 msec

x10<sup>4</sup>



1MN  
B-63

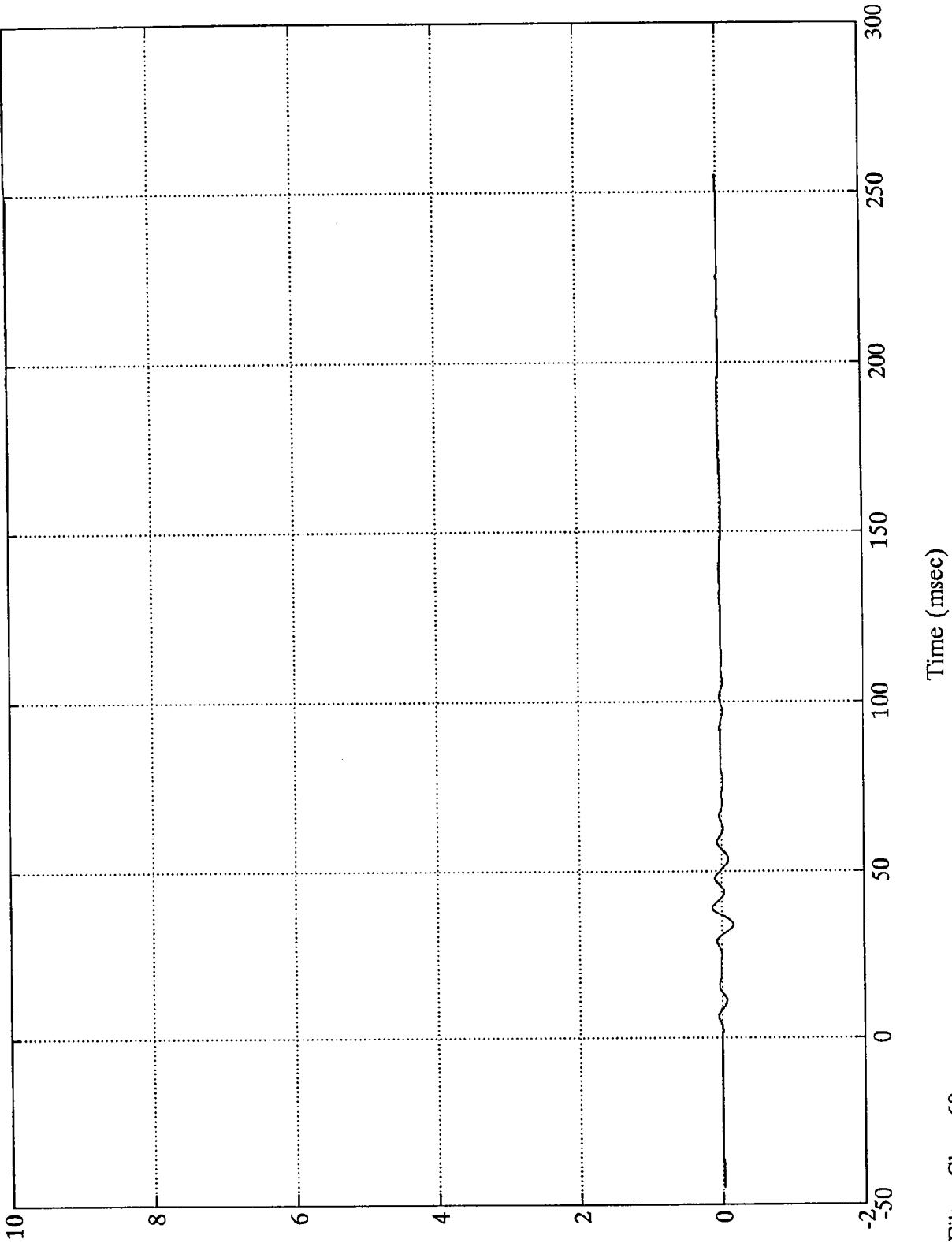
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>4</sup>

Barrier Load Cell D9

Max = 1347.96 Nwt @ 38.88 msec  
Min = -1562.35 Nwt @ 33.95 msec



1MN  
B-64

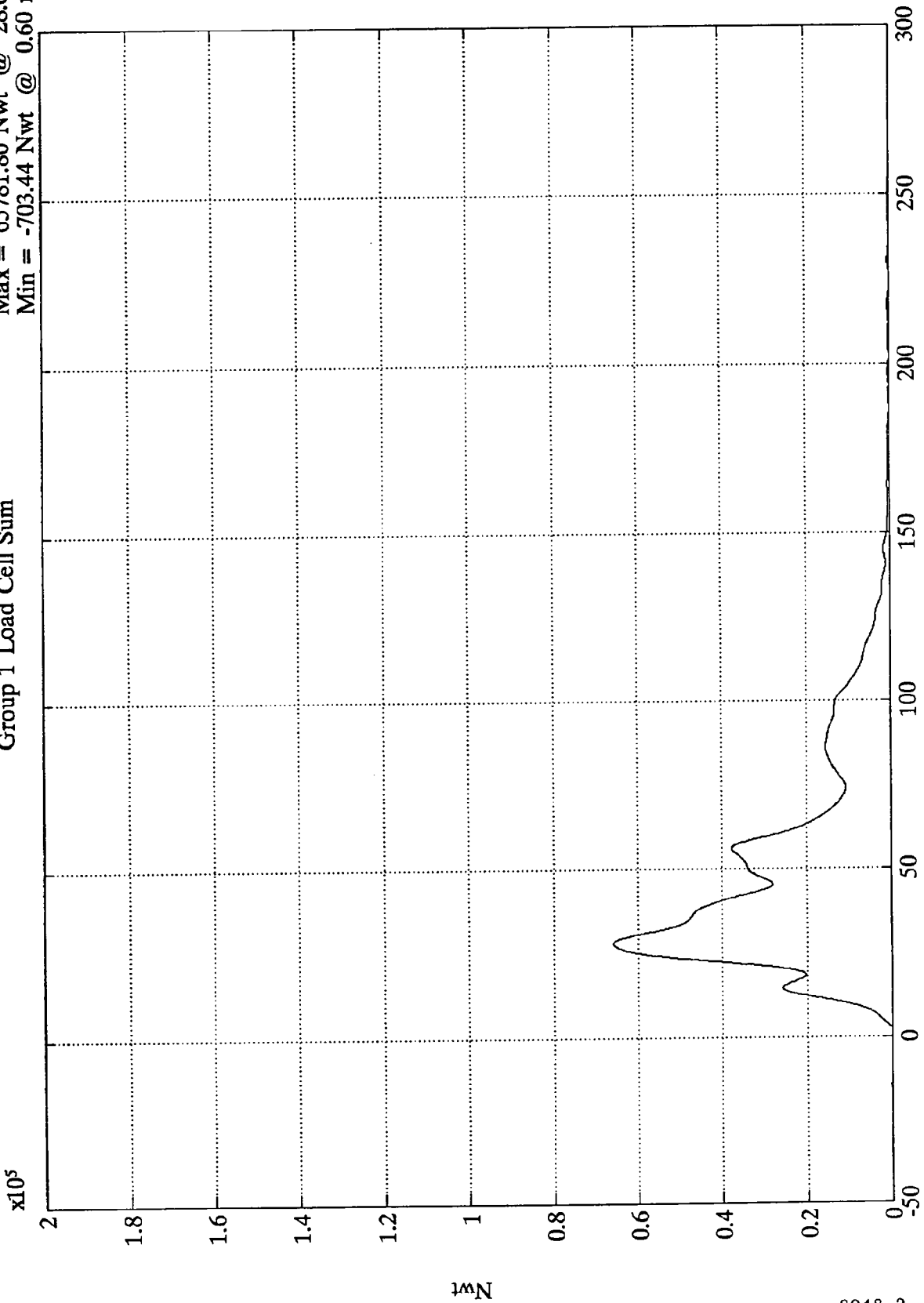
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Group 1 Load Cell Sum

Max = 65781.80 Nwt @ 28.08 msec  
Min = -703.44 Nwt @ 0.60 msec



Time (msec)

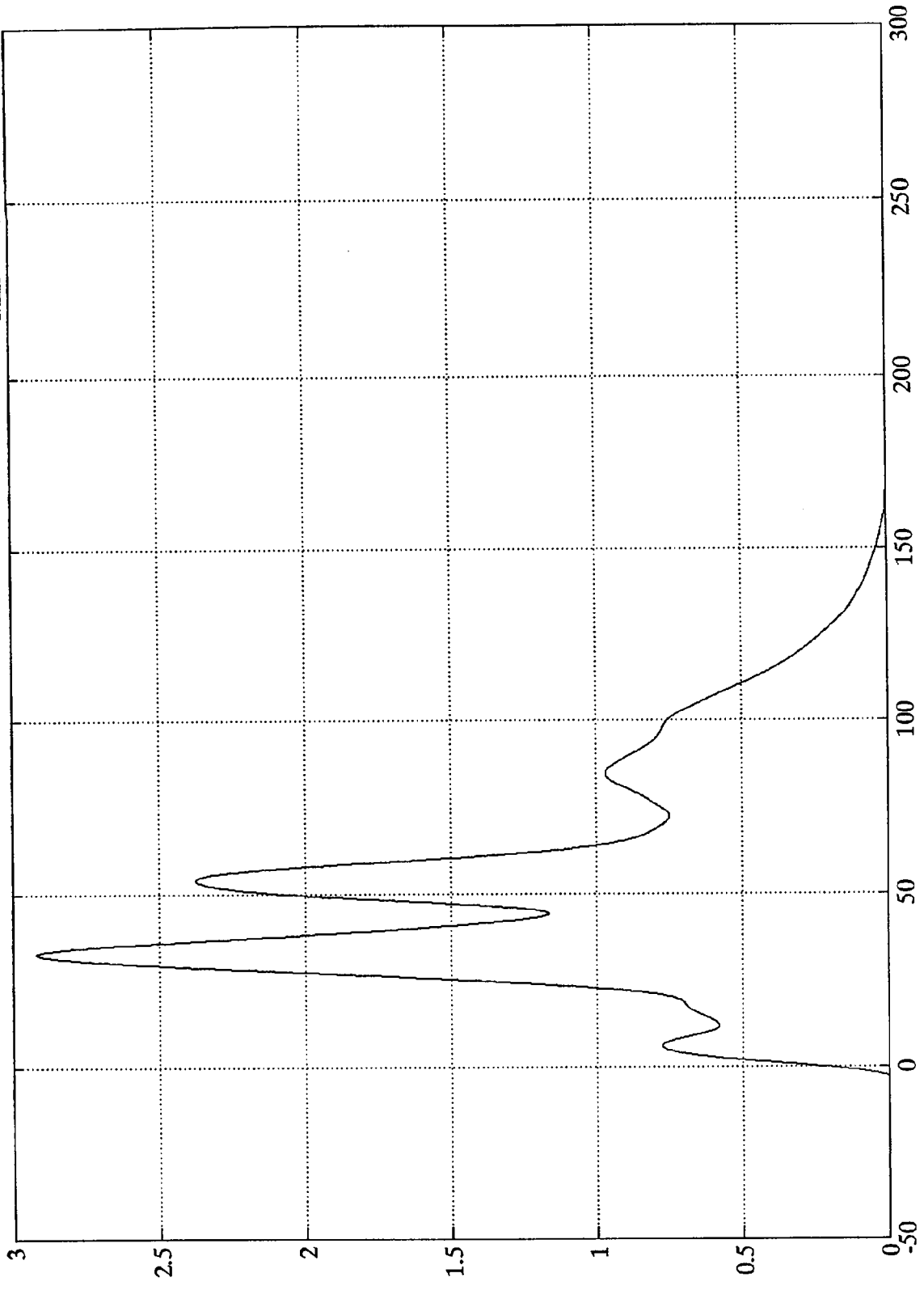
Load Cells (A1,A2,A3,B1,B2,B3)

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>5</sup>

Group 2 Load Cell Sum

Max = 291934.00 Nwt @ 32.76 msec  
Min = -1778.60 Nwt @ -4.44 msec



Load Cells (A4,A5,A6,B4,B5,B6)

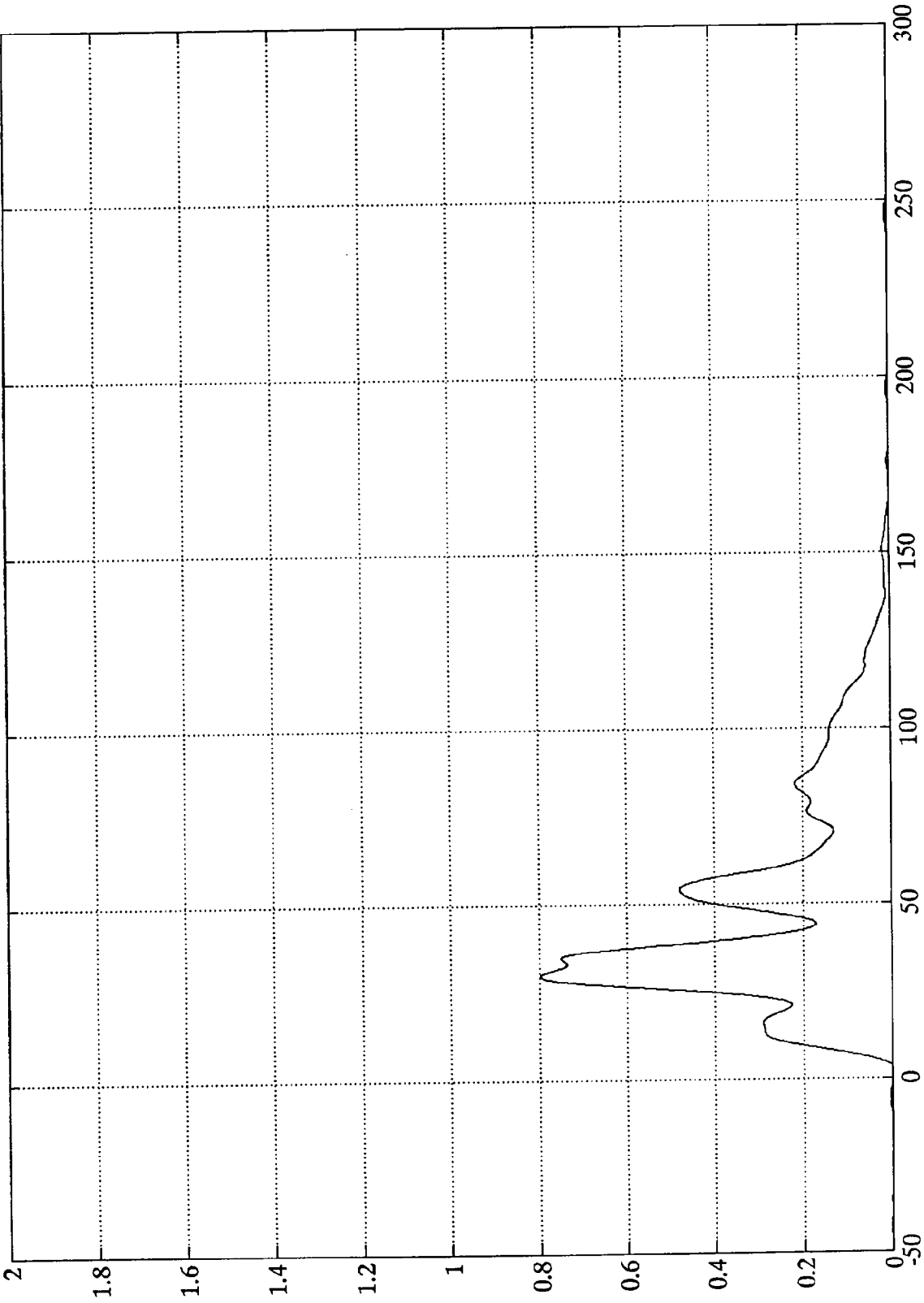
Time (msec)

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>5</sup>

Group 3 Load Cell Sum

Max = 79733.80 Nwt @ 29.76 msec  
Min = -1415.40 Nwt @ 1.56 msec



Time (msec)

Load Cells (A7,A8,A9,B7,B8,B9)

10N  
B-67

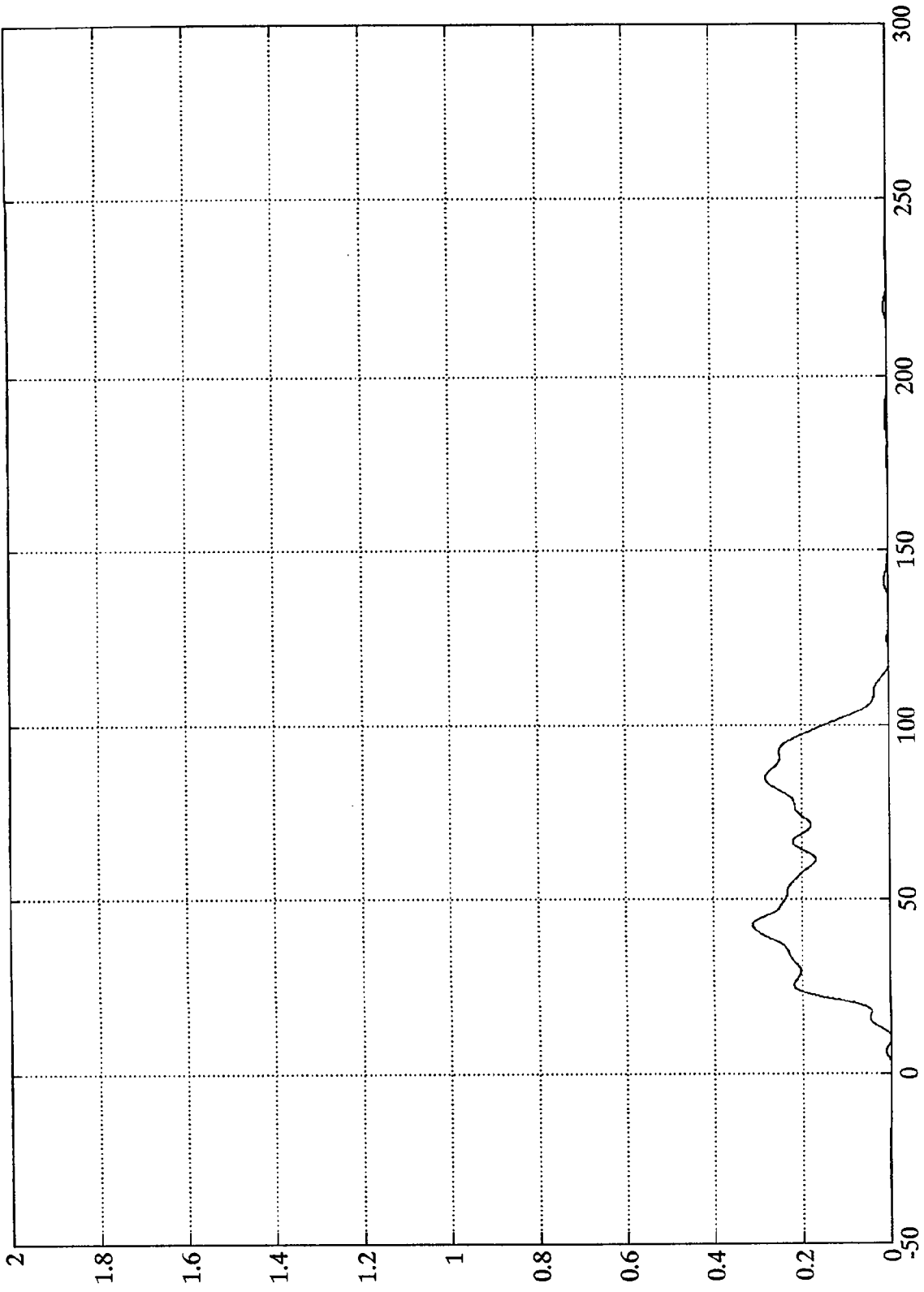
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Group 4 Load Cell Sum

Max = 31219.10 Nwt @ 42.48 msec  
Min = -967.55 Nwt @ 163.80 msec



Load Cells (C1,C2,C3,D1,D2,D3)

Time (msec)

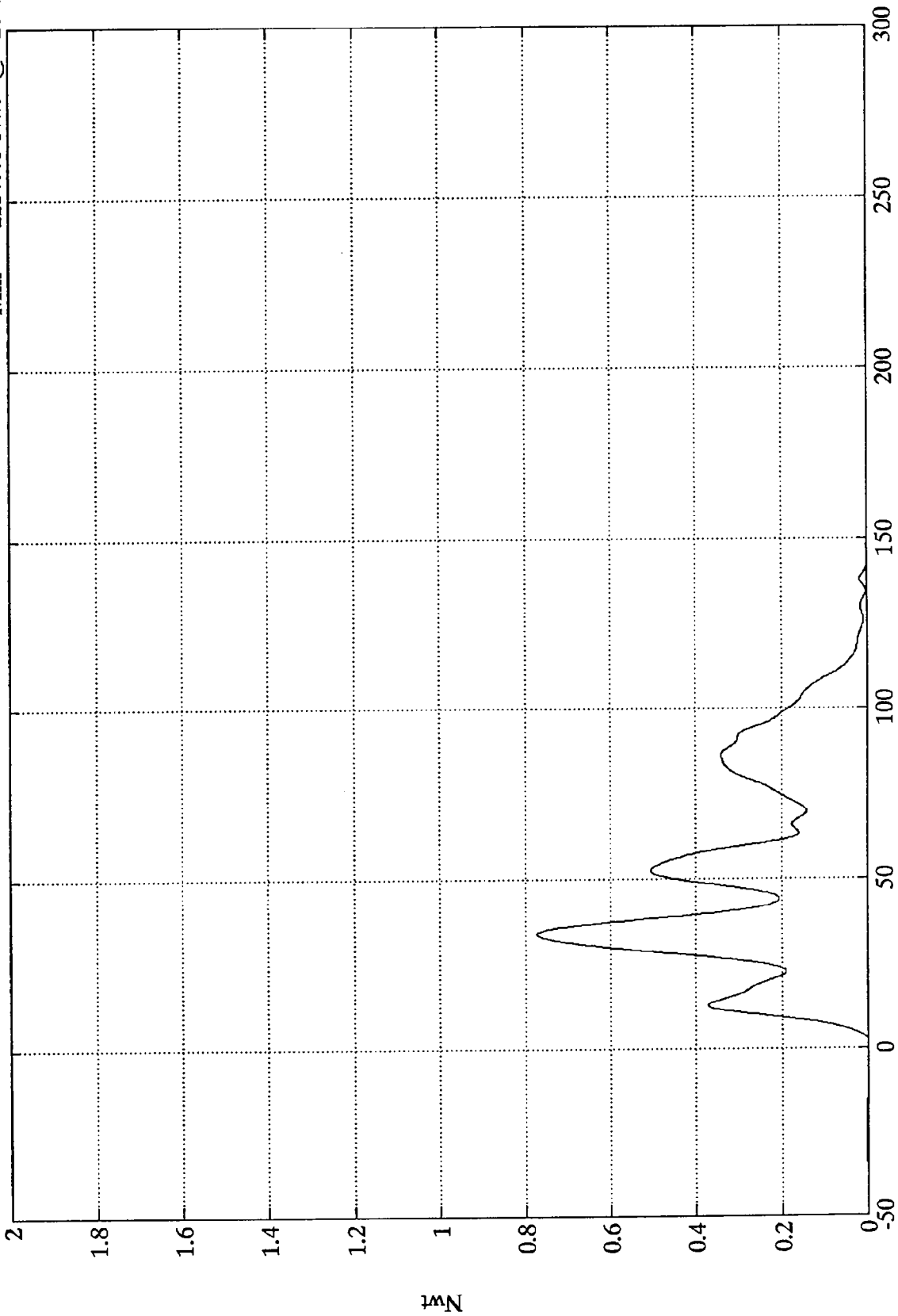
SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Group 5 Load Cell Sum

Max = 77263.40 Nwt @ 33.96 msec  
Min = -2157.40 Nwt @ 200.64 msec

$\times 10^5$



Nwt  
B-69

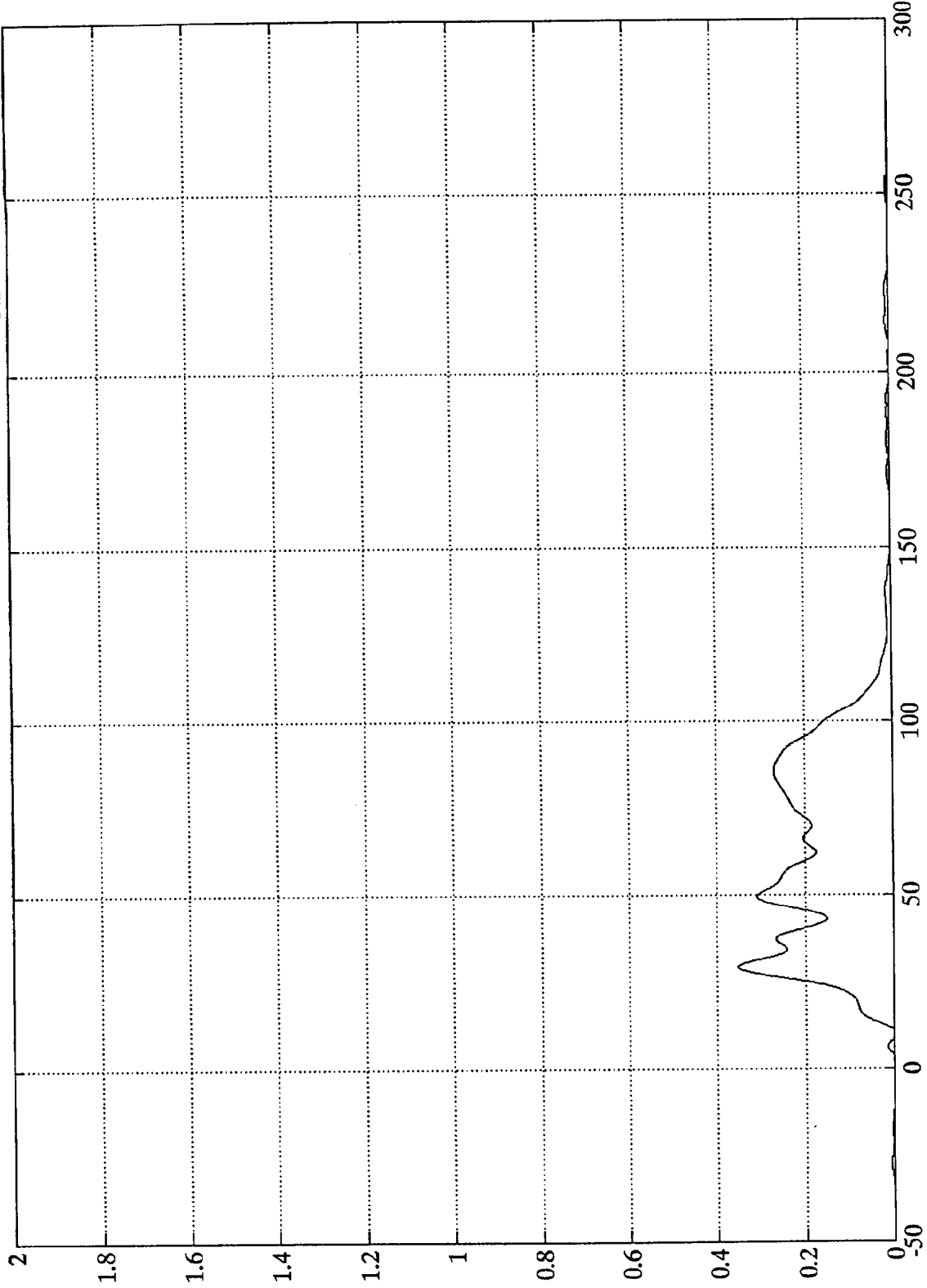
8048-2

SAE Filter Class 60  
Time (msec)  
Load Cells (C4,C5,C6,D4,D5,D6)

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>5</sup>

Group 6 Load Cell Sum

Max = 35348.80 Nwt @ 29.16 msec  
Min = -1084.93 Nwt @ -42.60 msec



1000  
B-70

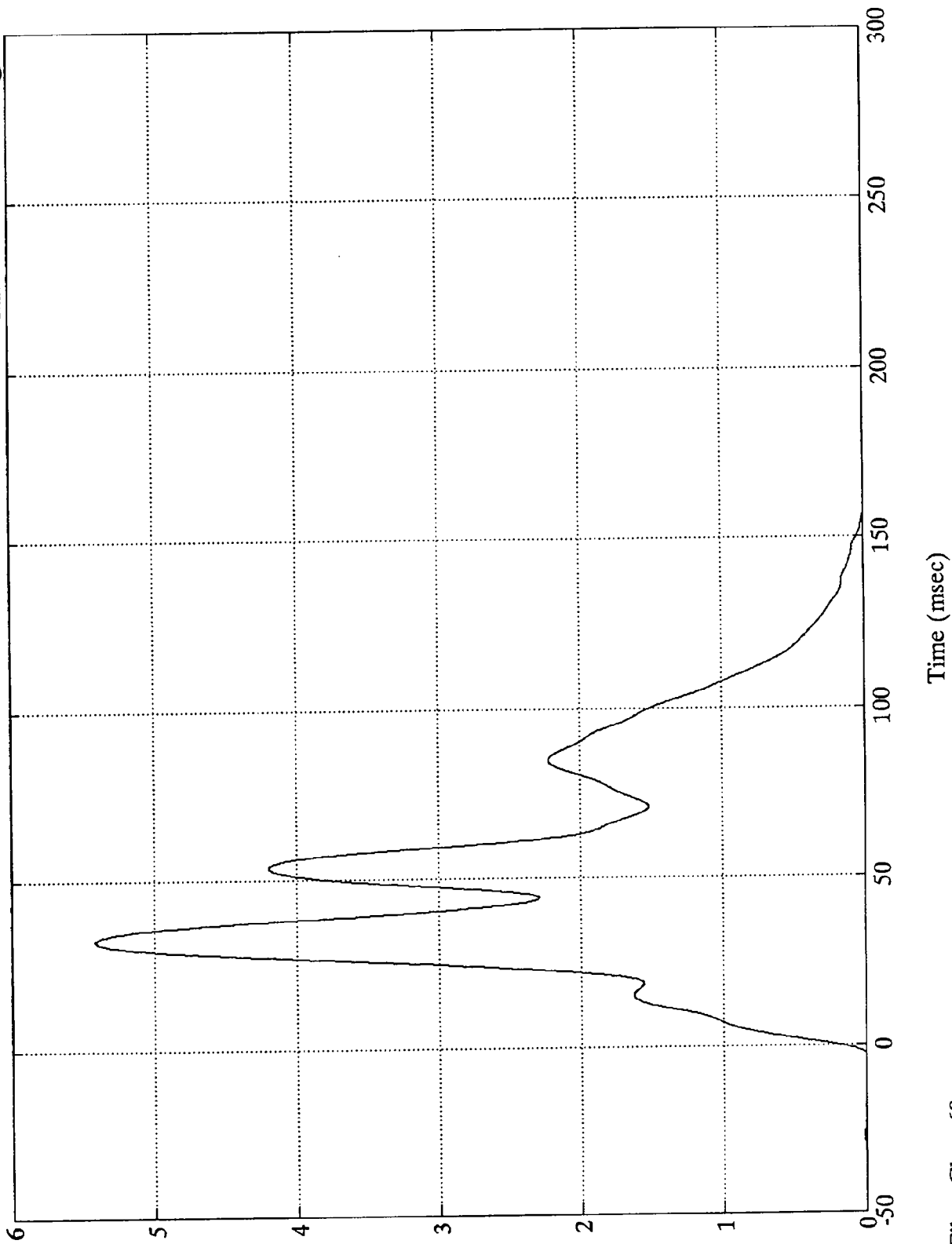
8048-2

SAE Filter Class 60  
Load Cells (C7,C8,C9,D7,D8,D9)

NCAP TEST #4 - 1993 PONTIAC GRAND AM  
x10<sup>5</sup>

Max = 541476.00 Nwt @ 32.28 msec  
Min = -3261.44 Nwt @ 201.72 msec

Total Load Cell Sum



Nwt  
B-71

8048-2

SAE Filter Class 60

TEST NO. MP0100

DUMMY DATA

CLASS	FILTER CHANNEL
Head Accelerations	1000
Chest Accelerations	180
Chest Displacements	60
Femur Forces	600
Belt Loads	60
Belt Displacements	180
Neck Forces	1000
Neck Moments	600

FACILITY: TRACK  
 RUN #: 1222  
 SERIES #: 4

TEST DATE: 13 Oct 1992  
 TEST TIME: 14:14:23  
 BOARD: a

TITLE: NCAP TEST #4 - 1993 PONTIAC GRAND AM

CHANNEL NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM		MINIMUM	
			AMP	msec	AMP	msec
1	Pos. 1 Head X	Gs	23.0	220.2	-207.7	78.4
2	Pos. 1 Head Y	Gs	10.5	79.7	-31.4	74.3
3	Pos. 1 Head Z	Gs	66.2	74.0	-2.1	28.7
4	Pos. 1 Left Femur	Nwt	109.6	162.8	-4198.7	89.5
5	Pos. 1 Chest X	Gs	8.4	198.4	-57.7	80.9
6	Pos. 1 Chest Y	Gs	9.9	78.7	-6.0	70.0
7	Pos. 1 Chest Z	Gs	14.4	74.6	-4.5	96.7
8	Pos. 1 Right Femur	Nwt	540.1	92.9	-4687.6	52.9
9	Pos. 2 Head X	Gs	18.7	202.6	-126.0	97.2
10	Pos. 2 Head Y	Gs	11.7	91.9	-7.1	96.5
11	Pos. 2 Head Z	Gs	54.5	89.4	-1.0	31.1
12	Pos. 2 Left Femur	Nwt	558.9	55.0	-3312.7	66.4
13	Pos. 2 Chest X	Gs	50.1	82.0	-6.1	232.9
14	Pos. 2 Chest Y	Gs	6.7	89.2	-5.1	109.6
15	Pos. 2 Chest Z	Gs	9.9	97.2	-19.1	72.6
16	Pos. 2 Right Femur	Nwt	495.4	55.2	-3698.1	66.4
17	Pos. 1 Head Resultant	Gs	207.8	78.4	.1	7.9
18	Pos. 1 Chest Resultant	Gs	59.3	74.9	.0	-20.9
19	Pos. 2 Head Resultant	Gs	126.4	97.2	.0	-18.6
20	Pos. 2 Chest Resultant	Gs	50.5	82.0	.1	-18.7

36 ms Fixed Duration HIC SUMMARY: Pos. 1 Head Resultant

hic: 1459.33  
 t1 = 73.560 msec  
 t2 = 81.120 msec  
 Average G's Over Hic Duration = 130.09

36 ms Fixed Duration HIC SUMMARY: Pos. 2 Head Resultant

hic: 1093.20  
 t1 = 73.440 msec  
 t2 = 104.400 msec  
 Average G's Over Hic Duration = 65.94

CLIP SUMMARY: Pos. 1 Chest Resultant

Peak Resultant (3 ms CLIPPED DURATION) = 50.902 G's  
 Tstart = 79.2000 ms  
 Tend = 82.3200 ms  
 CSI = 486.594

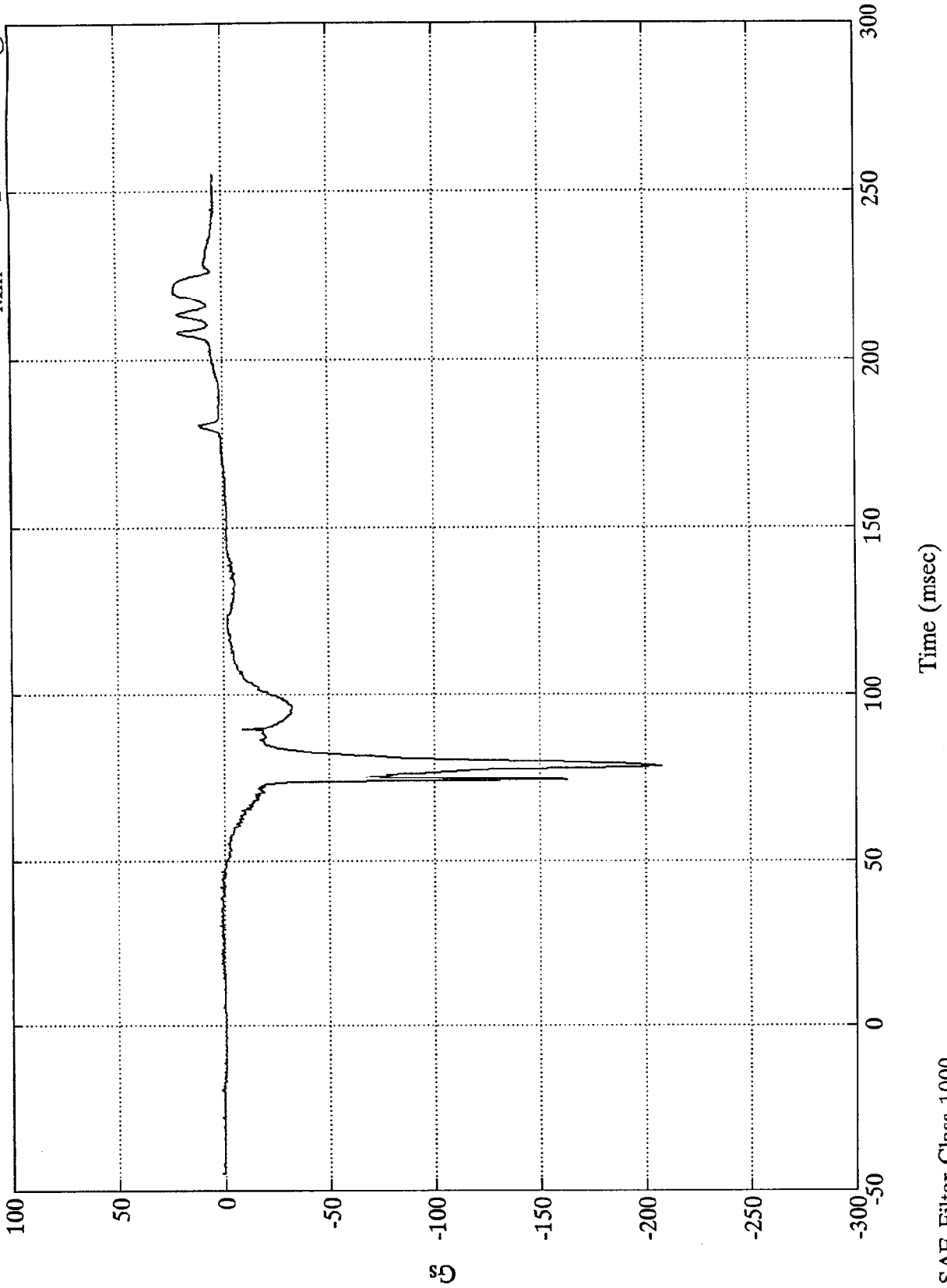
CLIP SUMMARY: Pos. 2 Chest Resultant

Peak Resultant (3 ms CLIPPED DURATION) = 49.749 G's  
 Tstart = 79.6800 ms  
 Tend = 82.8000 ms  
 CSI = 455.847

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Head X

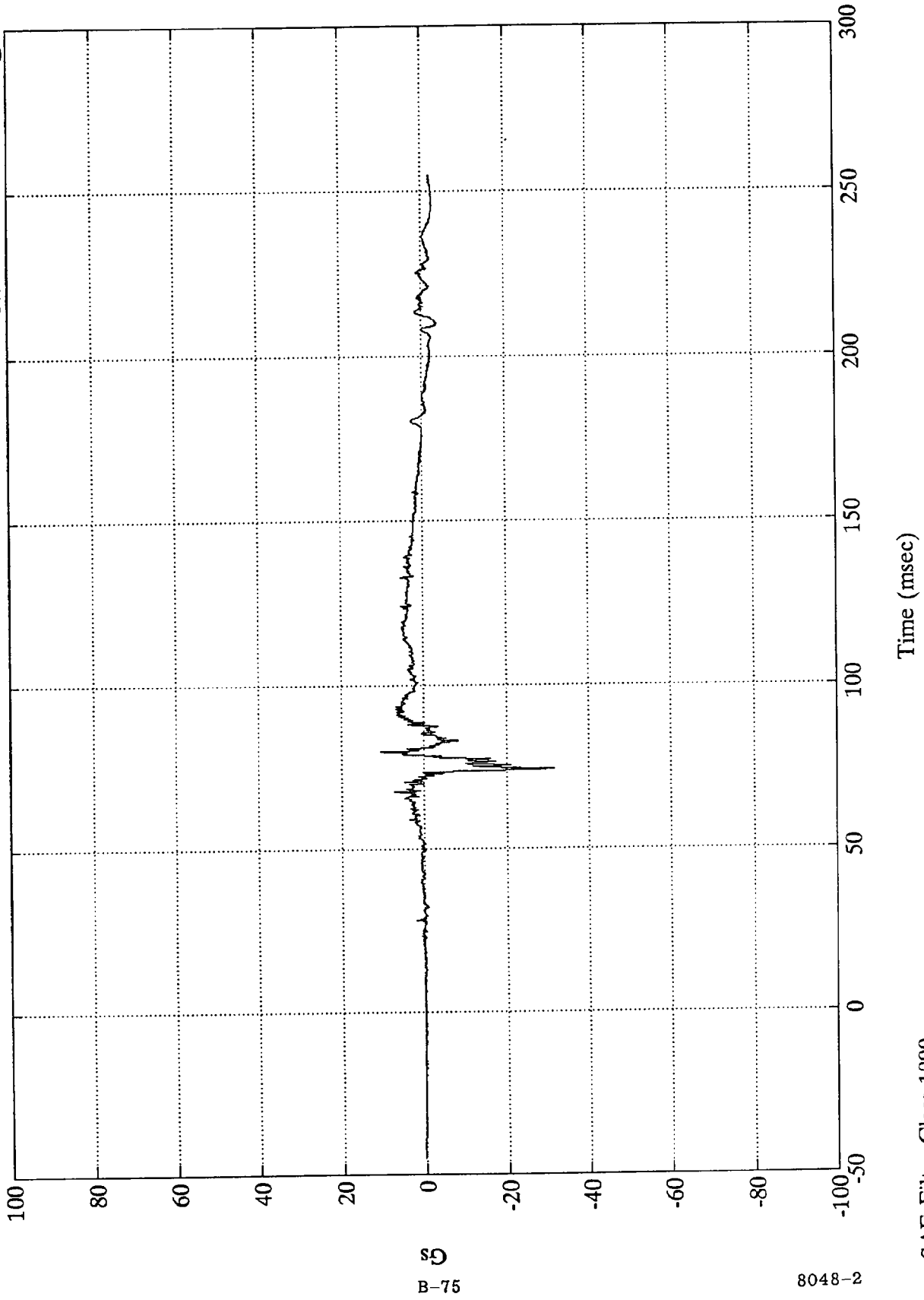
Max = 22.95 Gs @ 220.19 msec  
Min = -207.71 Gs @ 78.36 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Head Y

Max = 10.52 Gs @ 79.68 msec  
Min = -31.41 Gs @ 74.27 msec



8D  
B-75

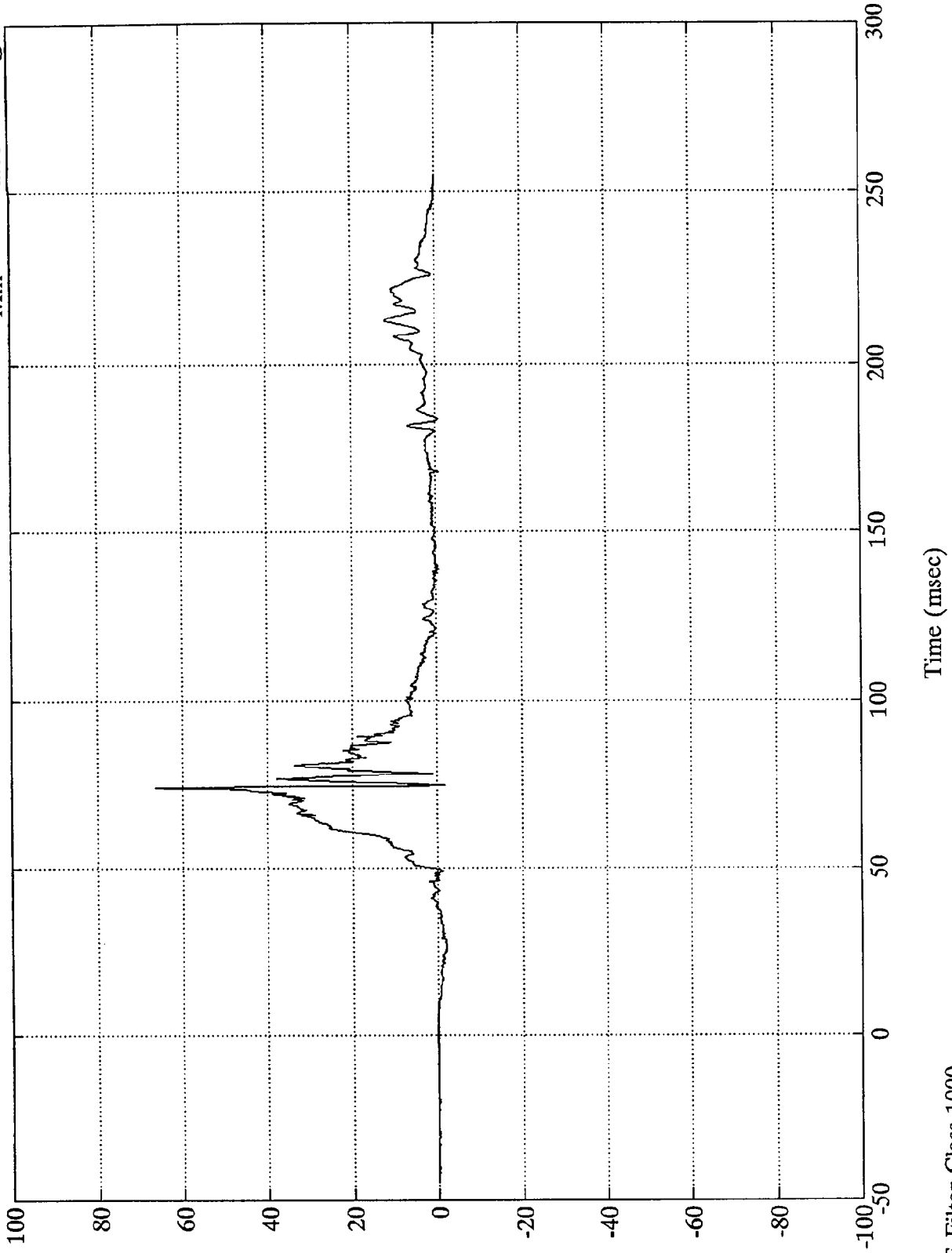
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Head Z

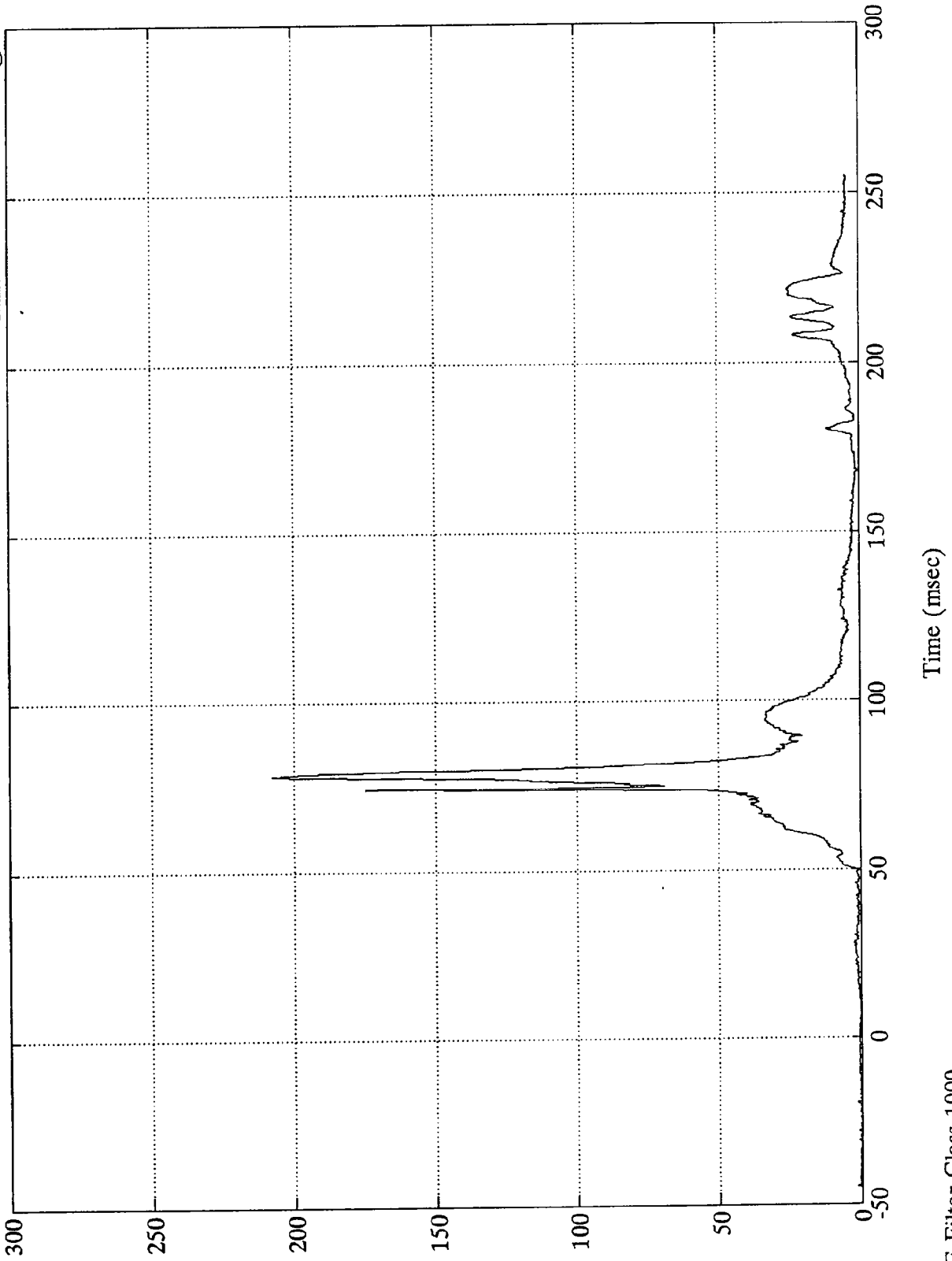
Max = 66.16 Gs @ 74.04 msec  
Min = -2.08 Gs @ 28.68 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Head Resultant

Max = 207.75 Gs @ 78.36 msec  
Min = .05 Gs @ 7.91 msec



80  
B-77

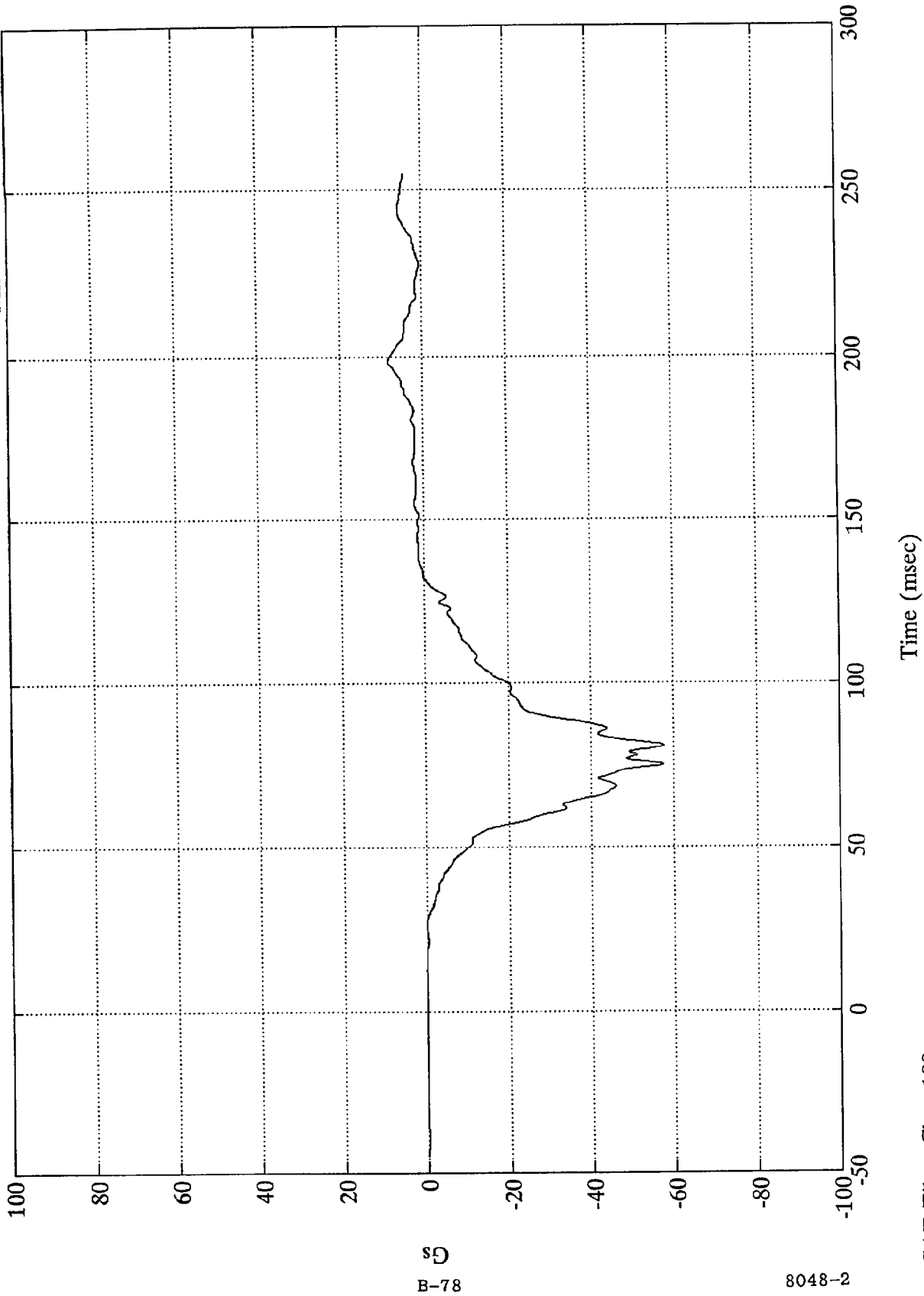
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Chest X

Max = 8.36 Gs @ 198.36 msec  
Min = -57.67 Gs @ 80.88 msec



SD  
B-78

8048-2

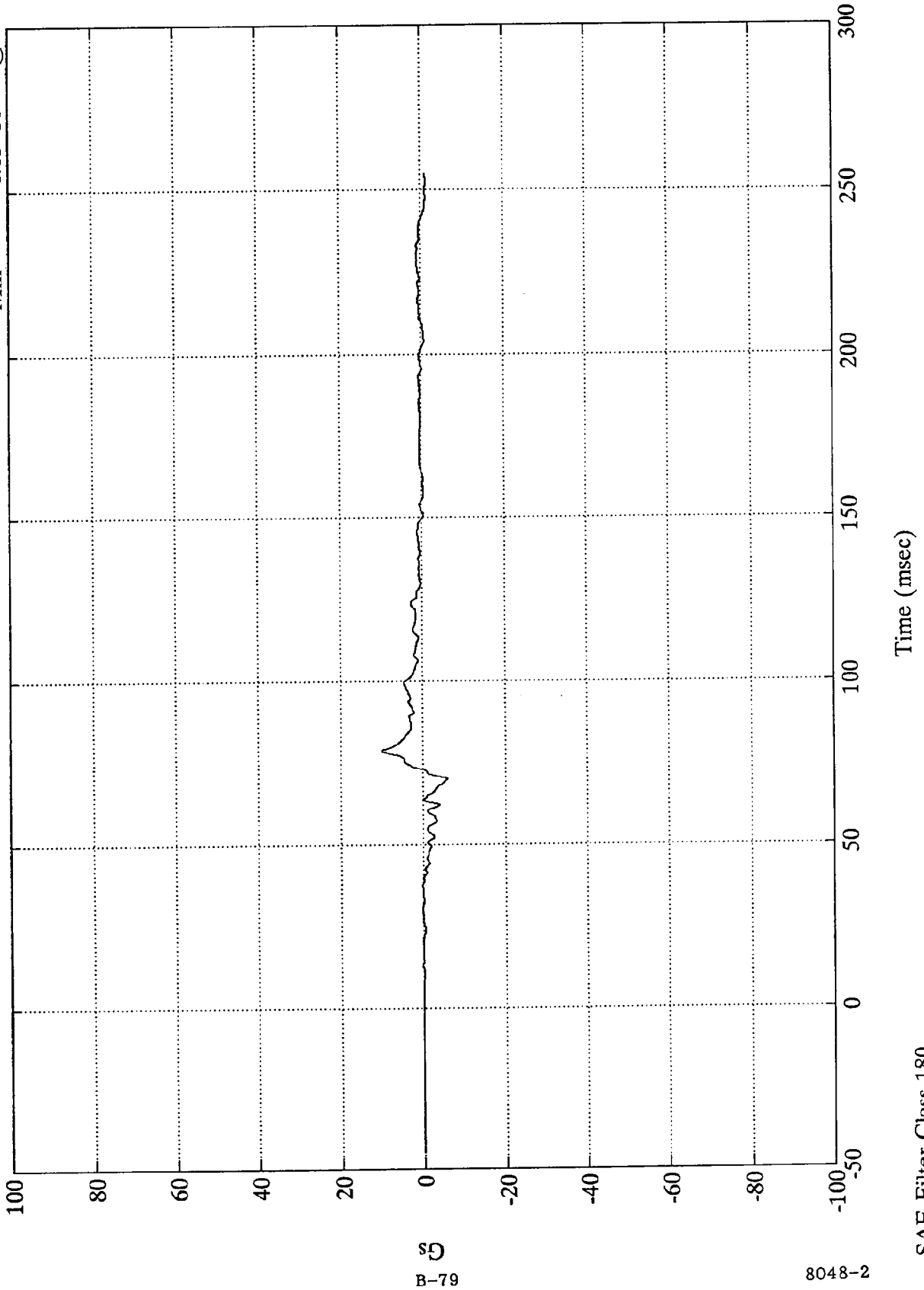
SAE Filter Class 180



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Chest Y

Max = 9.91 Gs @ 78.72 msec  
Min = -6.03 Gs @ 69.95 msec



8D  
B-79

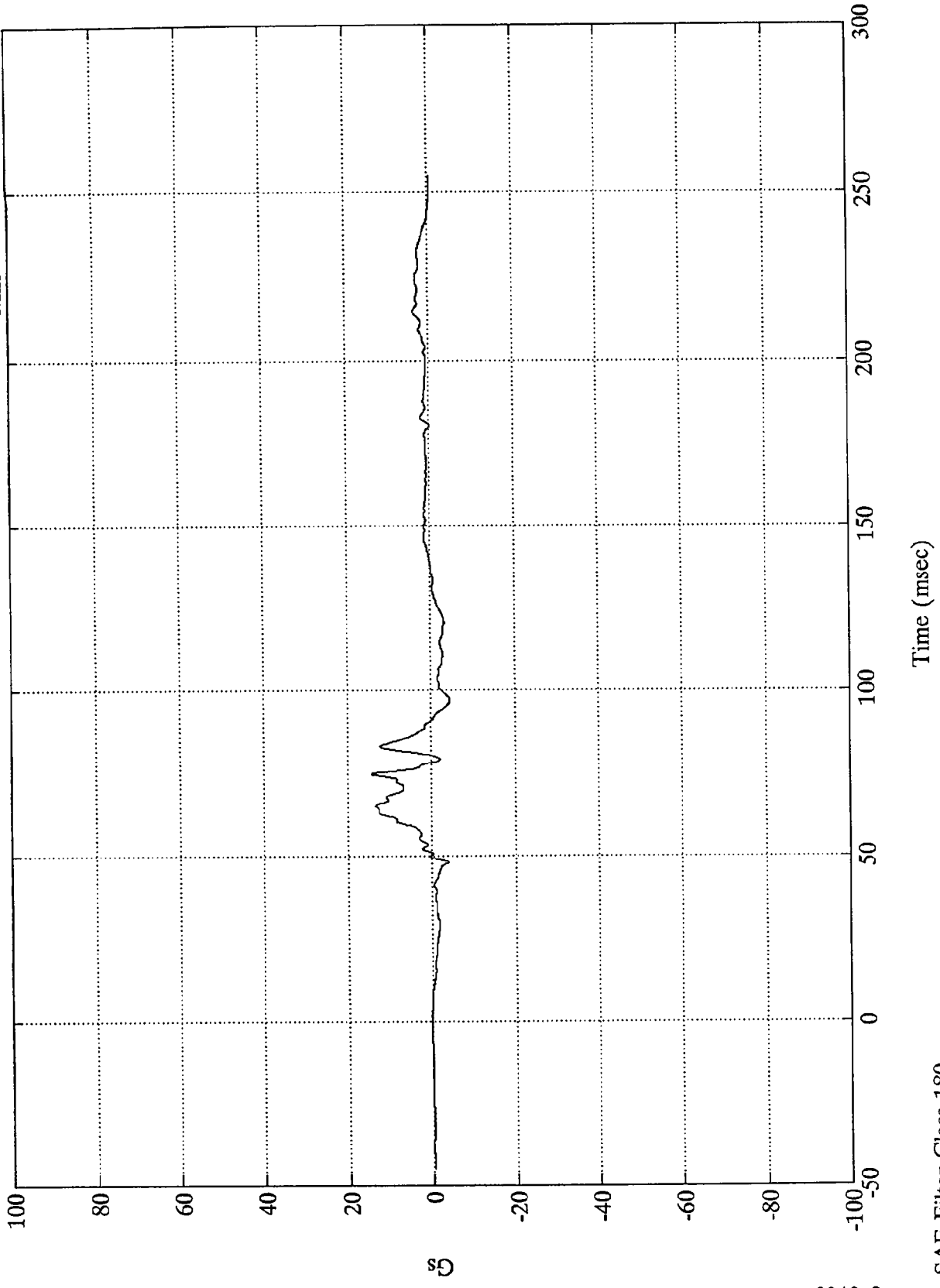
8048-2

SAE Filter Class 180

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Chest Z

Max = 14.37 Gs @ 74.63 msec  
Min = -4.53 Gs @ 96.72 msec



B-80

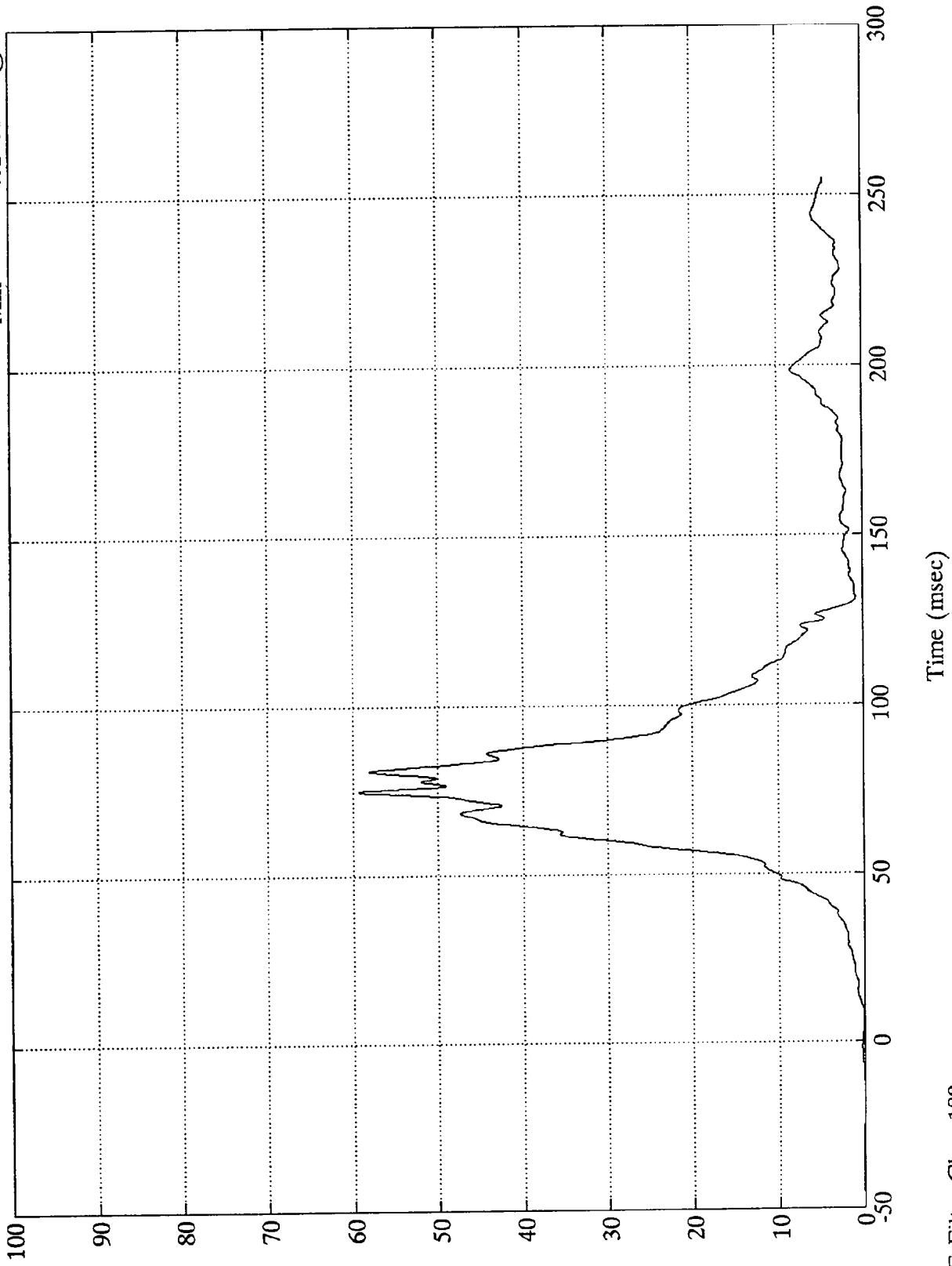
8048-2

SAE Filter Class 180

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Chest Resultant

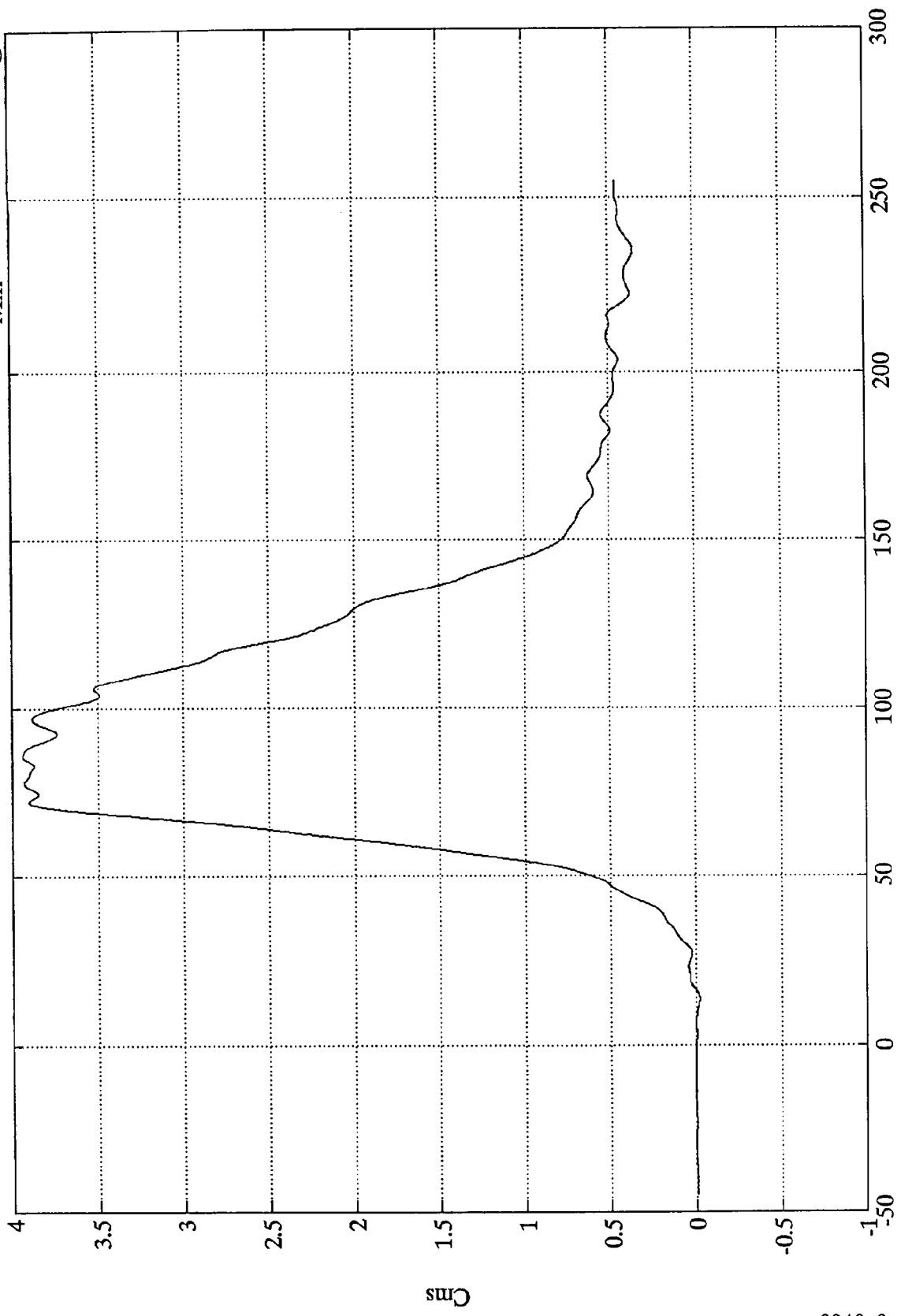
Max = 59.25 Gs @ 74.88 msec  
Min = .01 Gs @ -20.88 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Chest Disp.

Max = 3.94 Cms @ 85.91 msec  
Min = -0.02 Cms @ 13.31 msec



Cms  
B-82

Time (msec)

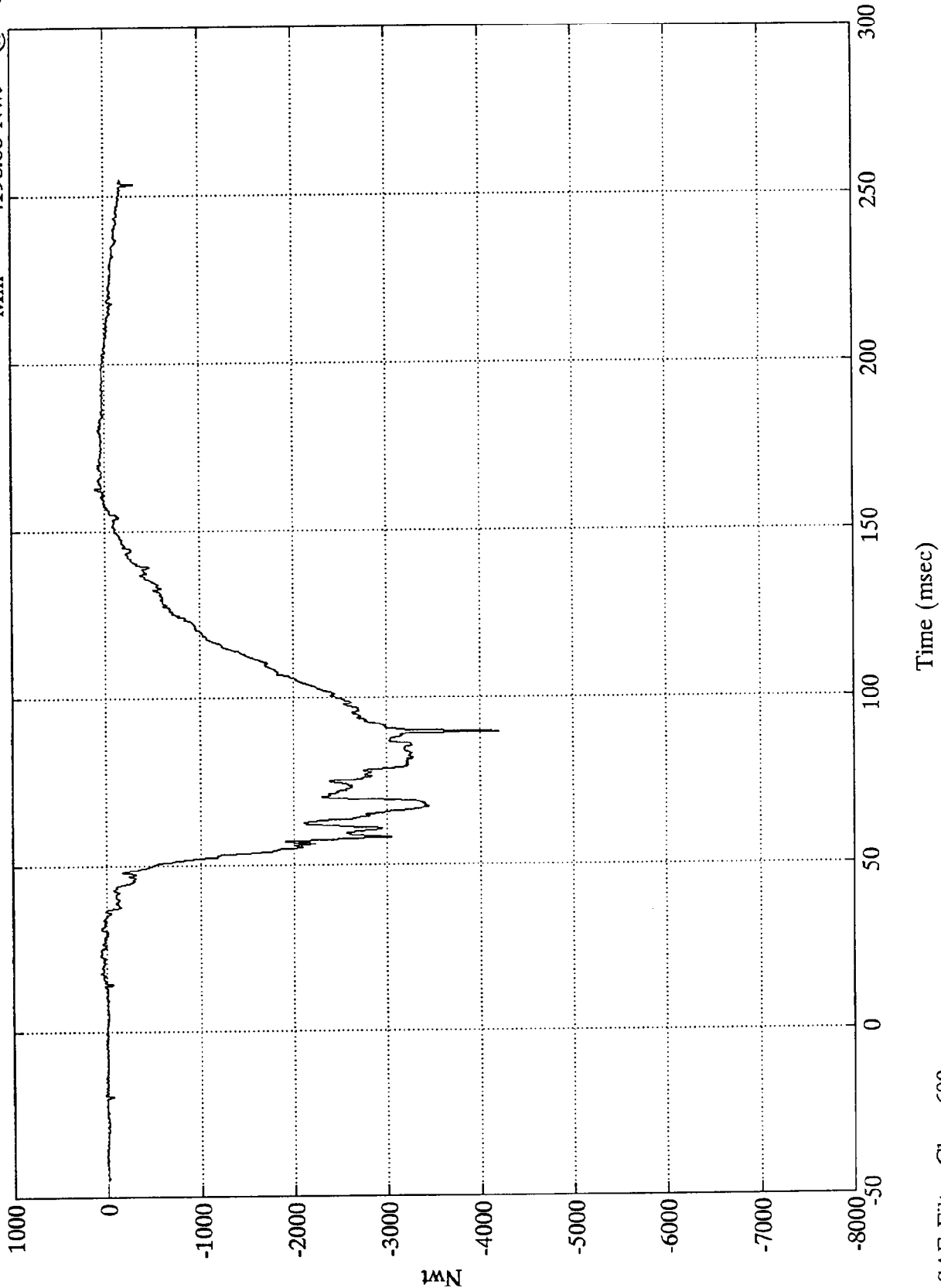
SAE Filter Class 60

8048-2

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Left Femur

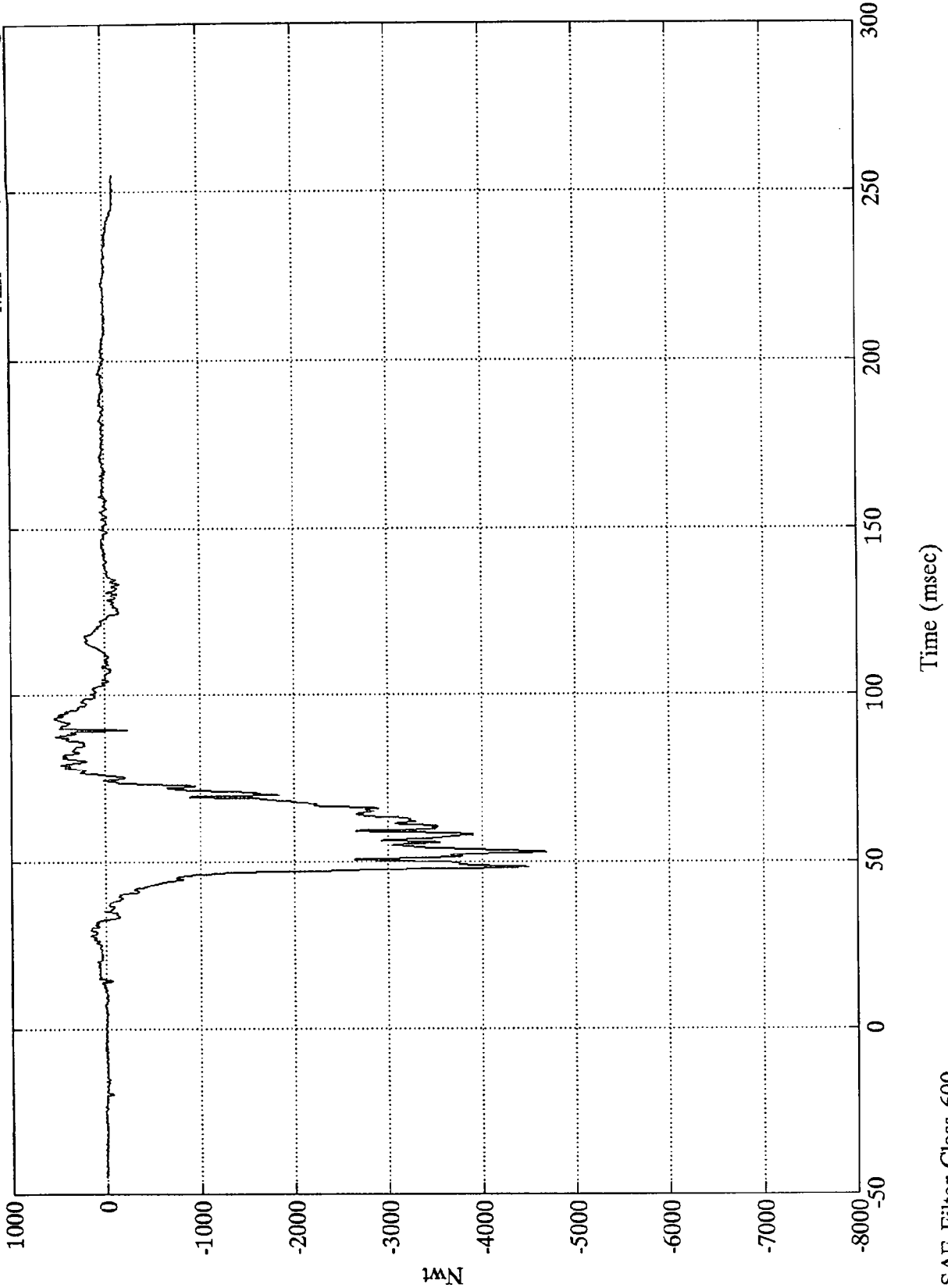
Max = 109.64 Nwt @ 162.84 msec  
Min = -4198.68 Nwt @ 89.51 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Right Femur

Max = 540.10 Nwt @ 92.88 msec  
Min = -4687.57 Nwt @ 52.92 msec



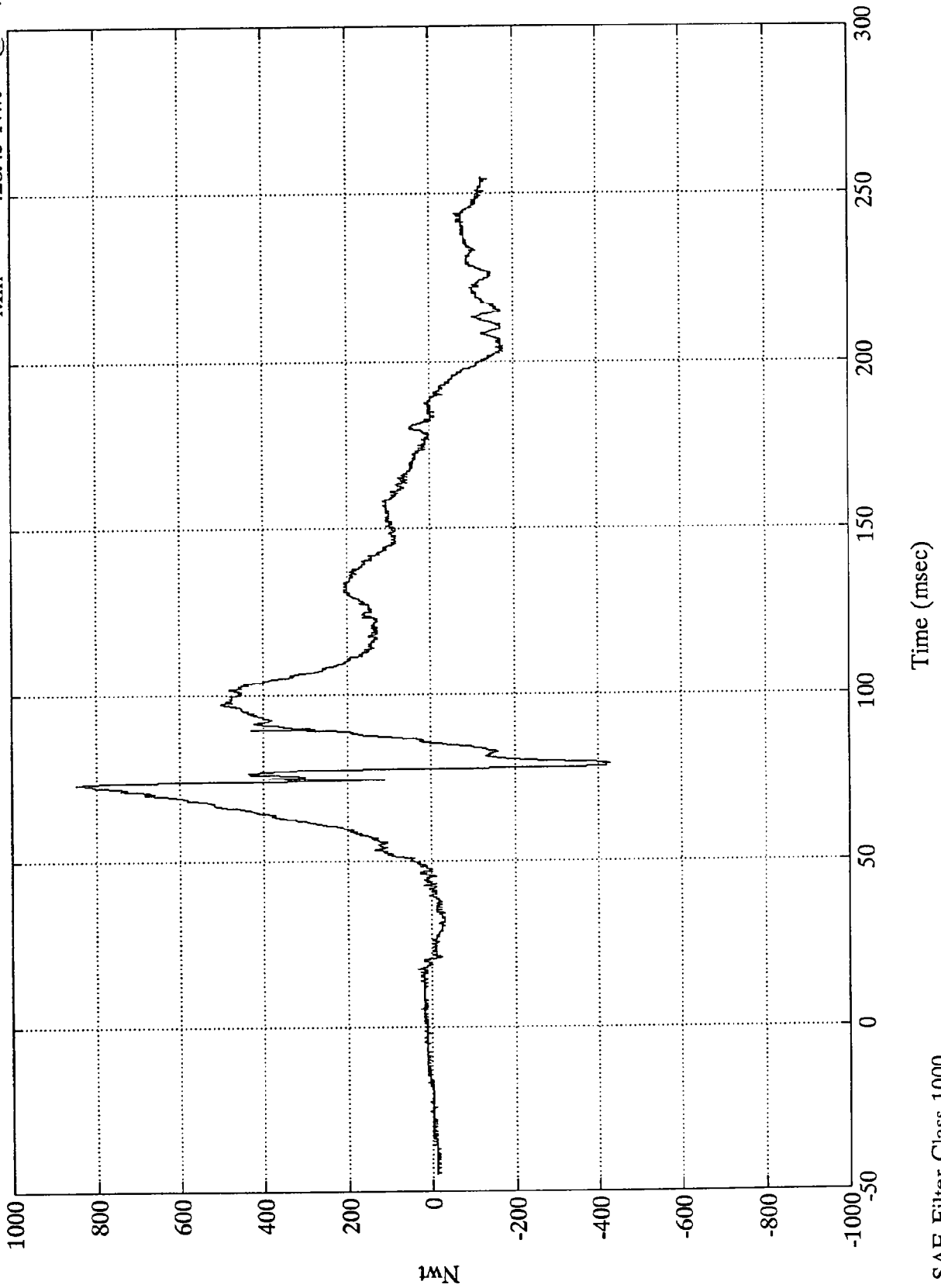
1MN  
B-84

8048-2

SAE Filter Class 600

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Upper Neck Fx  
Max = 848.80 Nwt @ 72.96 msec  
Min = -428.45 Nwt @ 79.31 msec



1mN  
B-85

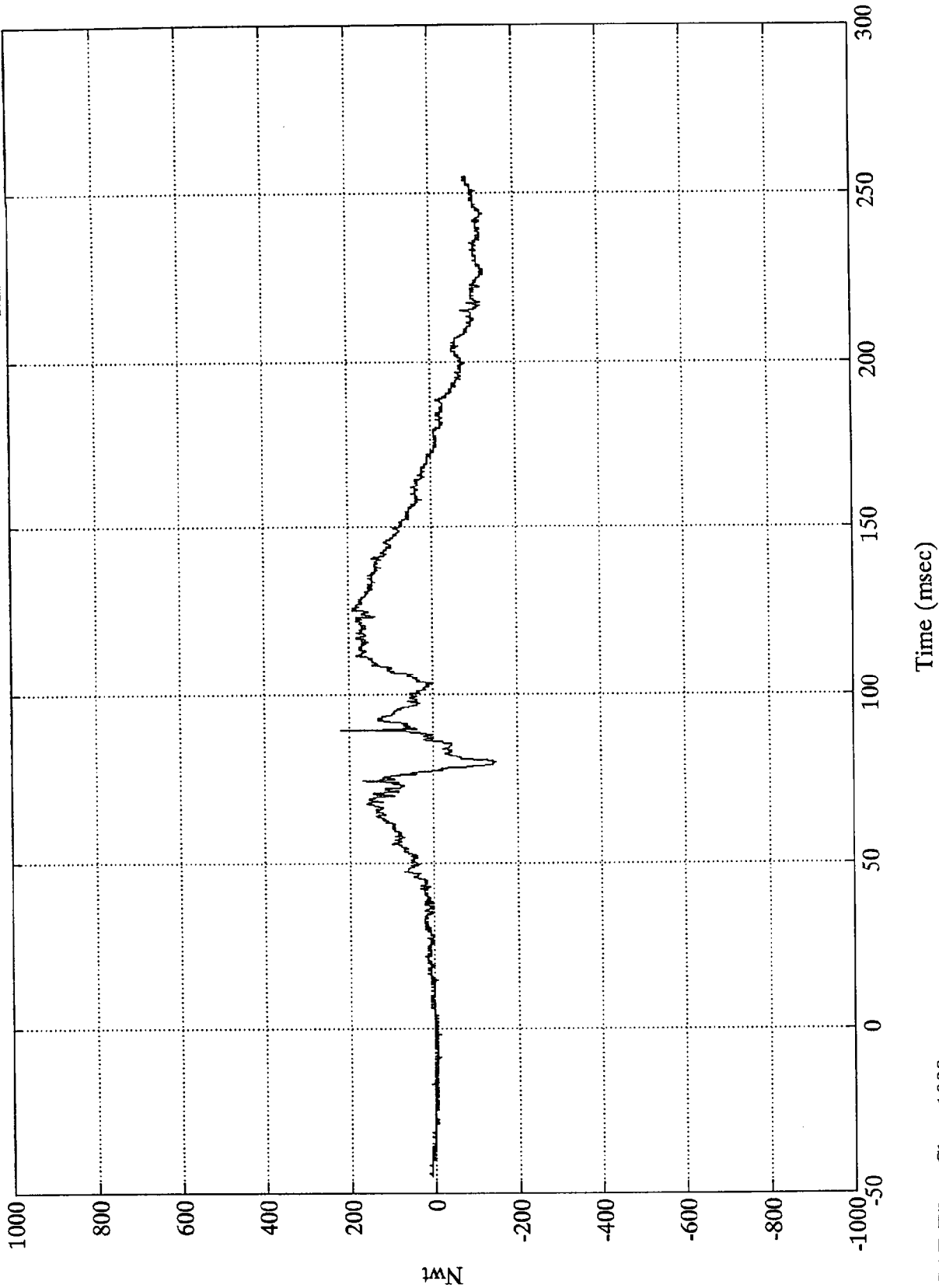
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Upper Neck Fy

Max = 219.87 Nwt @ 89.40 msec  
Min = -150.06 Nwt @ 80.04 msec



B-86

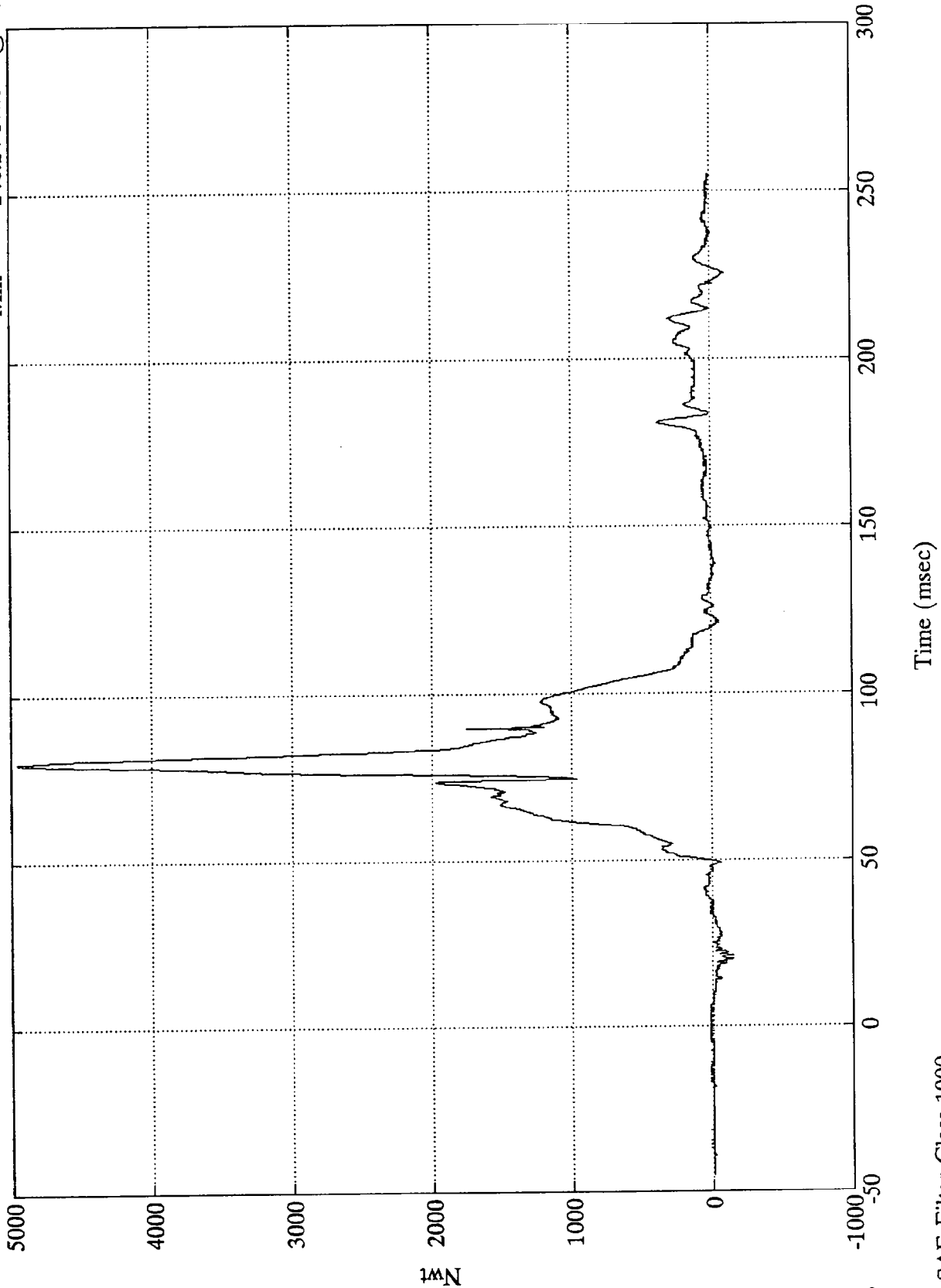
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Upper Neck Fz

Max = 4956.11 Nwt @ 79.68 msec  
Min = -146.14 Nwt @ 21.35 msec



1MN  
B-87

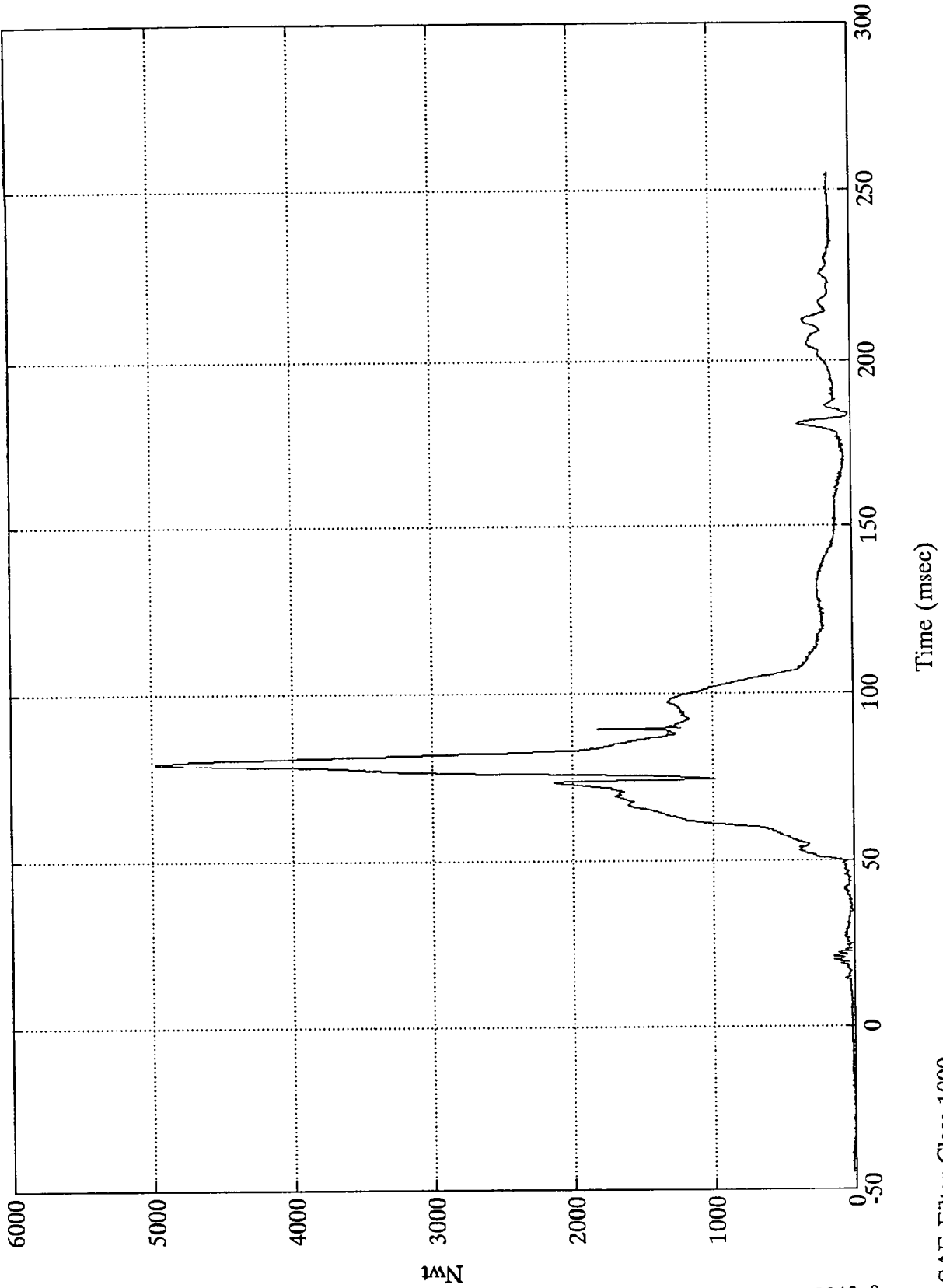
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Neck Force Res.

Max = 4974.23 Nwt @ 79.56 msec  
Min = 3.89 Nwt @ -16.68 msec



B-88

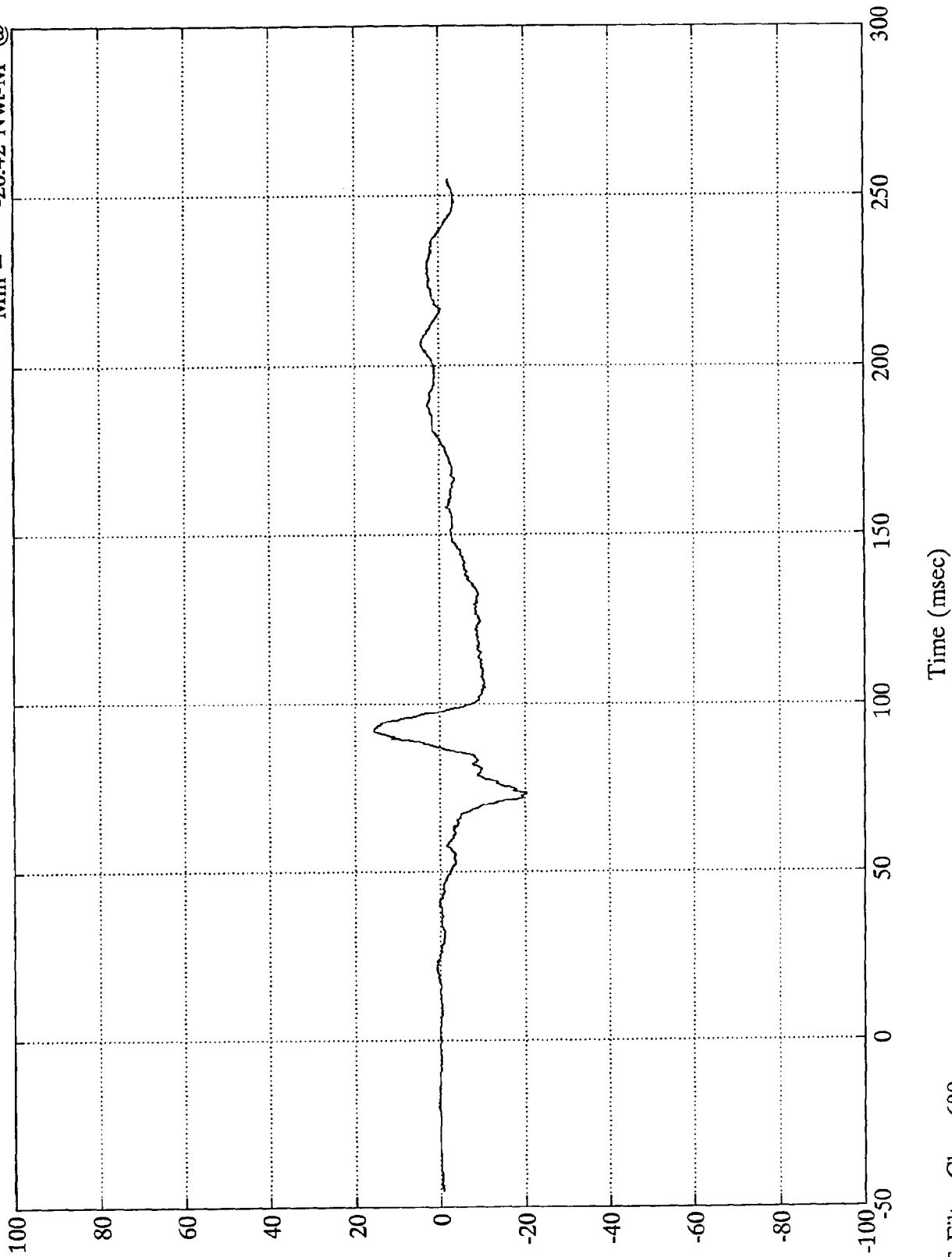
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Upper Neck Mx

Max = 15.68 Nwt-M @ 91.68 msec  
Min = -20.42 Nwt-M @ 73.31 msec



B-89  
Nwt-M

8048-2

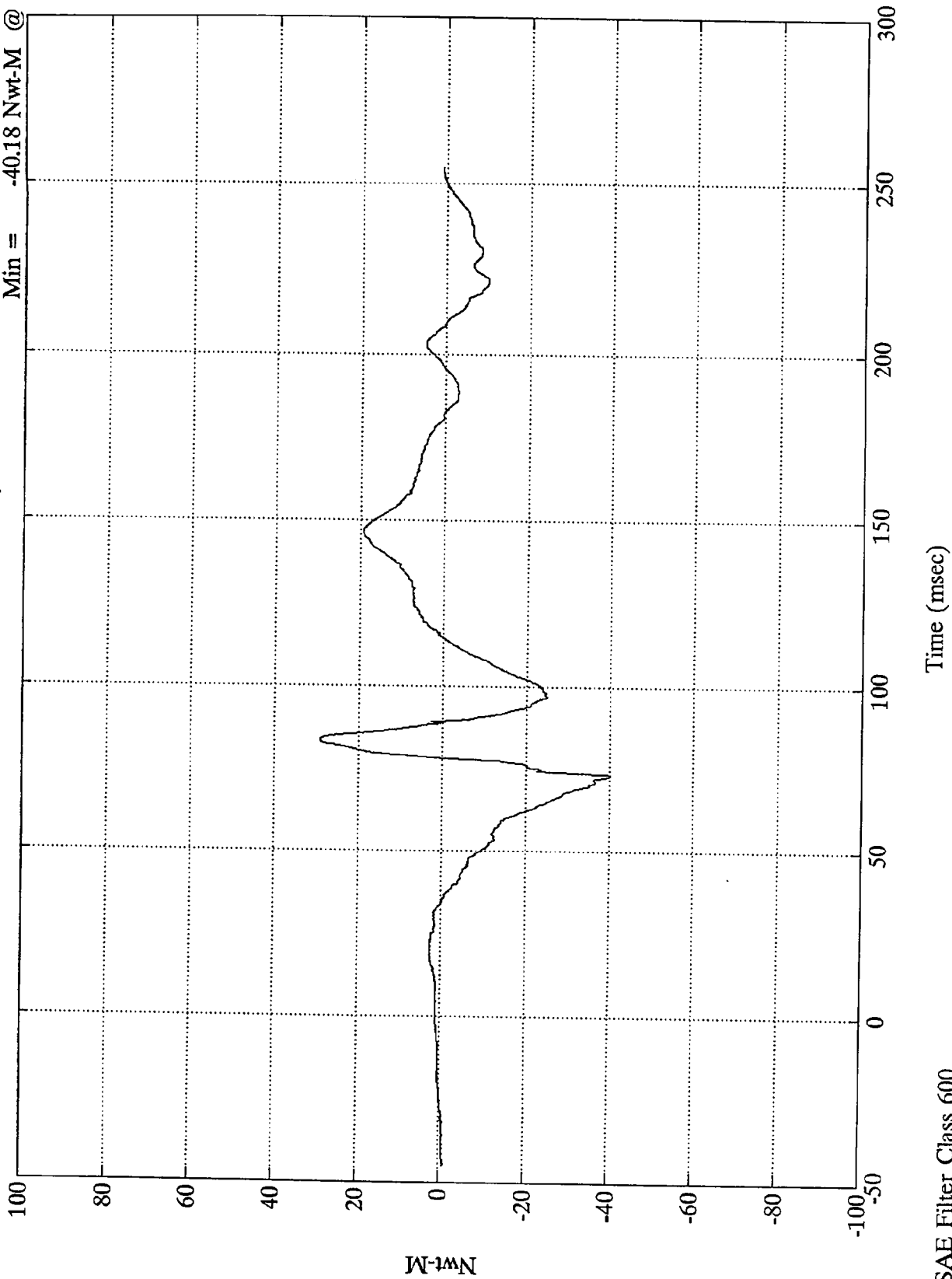
SAE Filter Class 600

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Upper Neck My

Max = 29.11 Nwt-M @ 83.76 msec  
Min = -40.18 Nwt-M @ 73.08 msec



B-90  
Nwt-M

8048-2

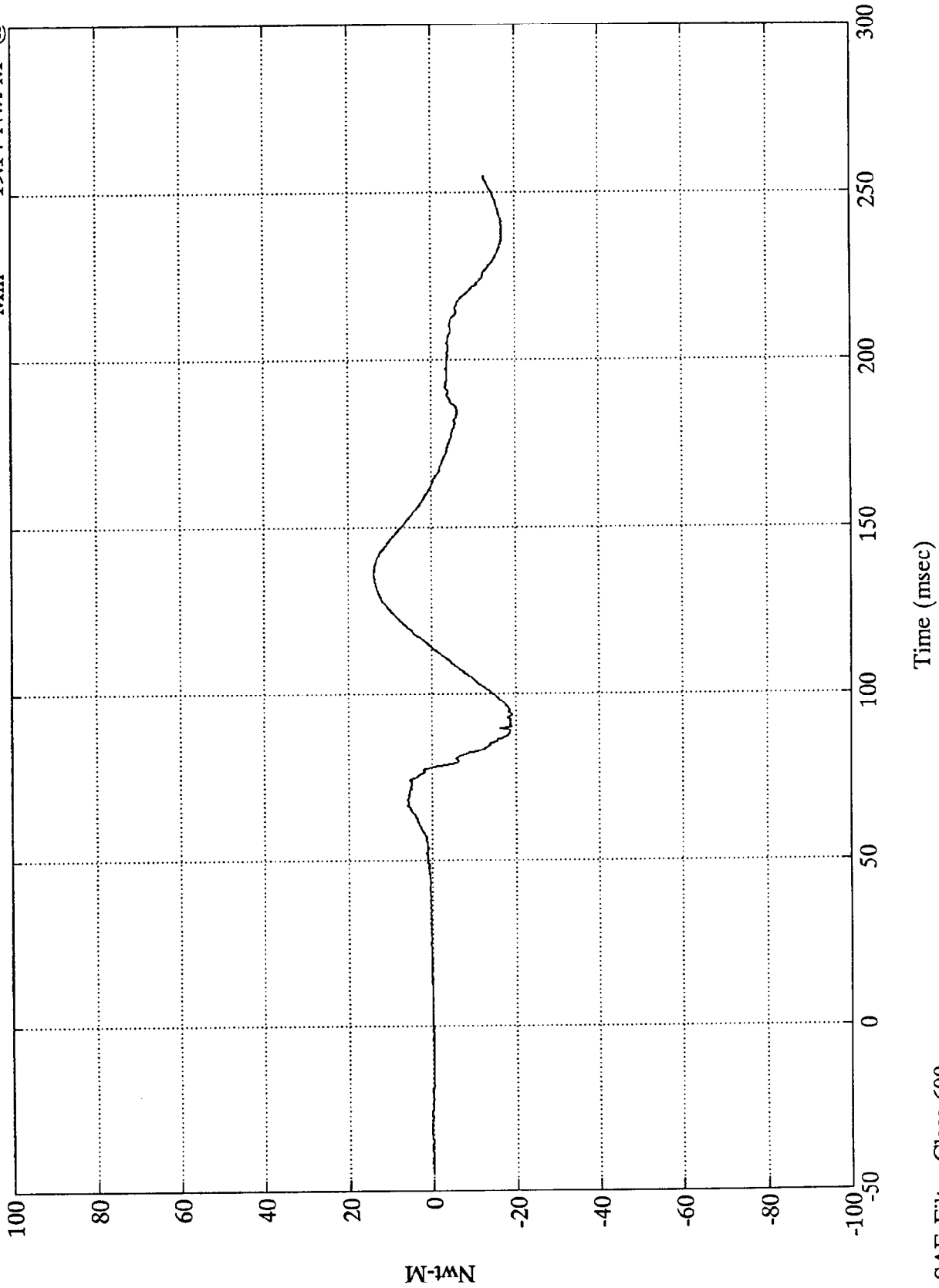
SAE Filter Class 600

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Upper Neck Mz

Max = 13.98 Nwt-M @ 136.20 msec  
Min = -19.14 Nwt-M @ 93.48 msec



B-91  
16-91

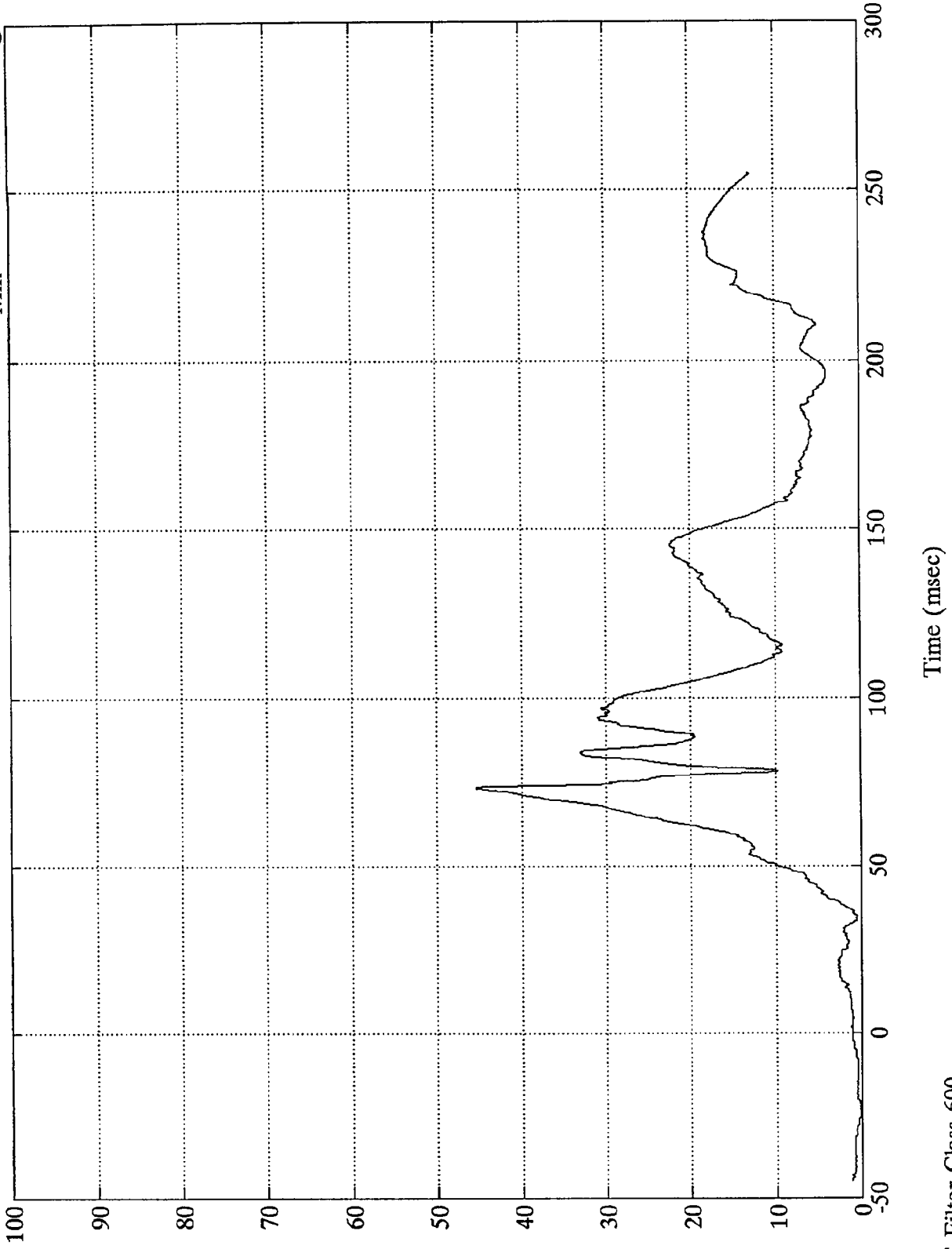
8048-2

SAE Filter Class 600

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Neck Moment Res.

Max = 45.29 Nwt-M @ 73.20 msec  
Min = .13 Nwt-M @ -23.04 msec



Nwt-M

B-92

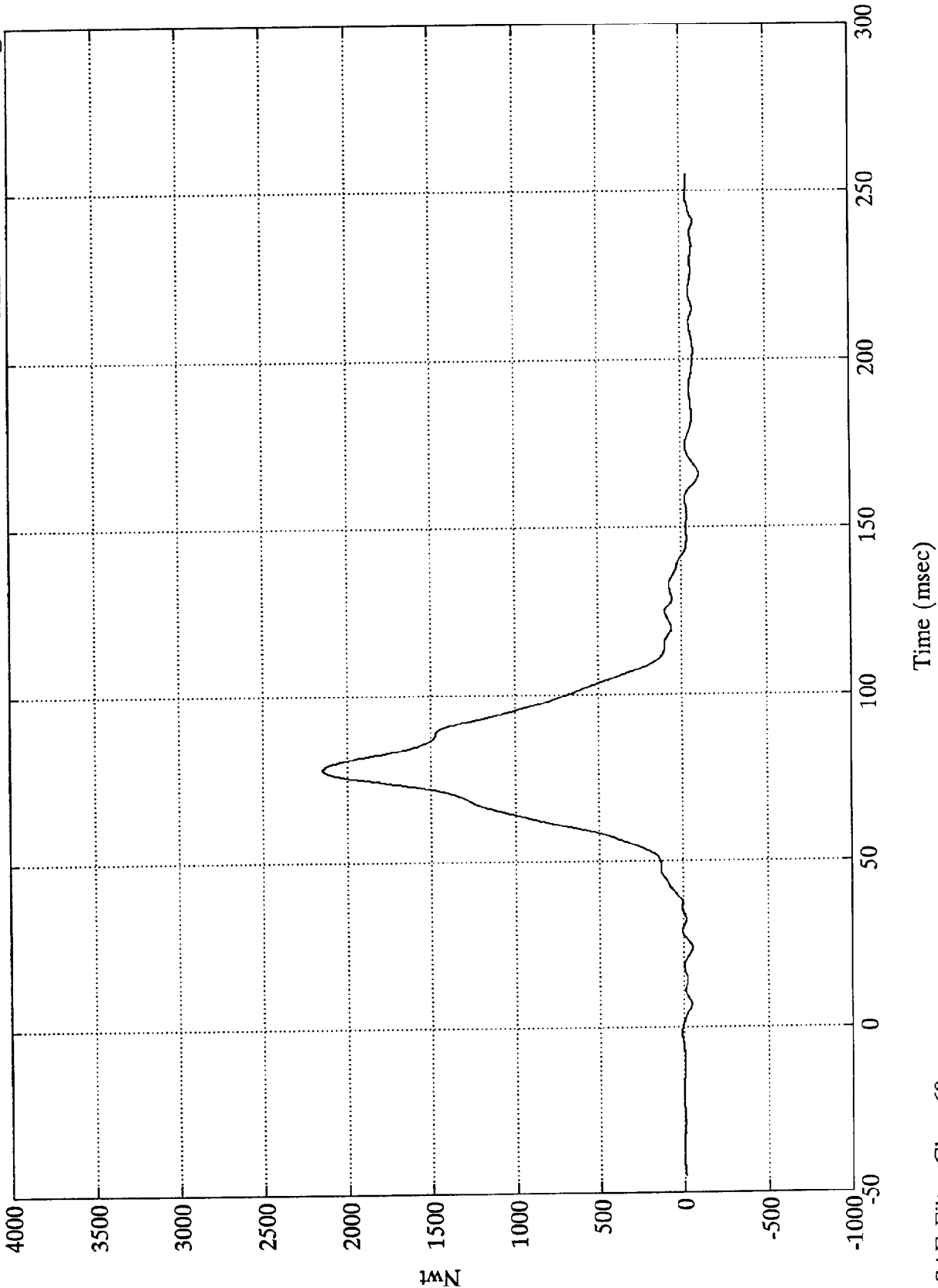
8048-2

SAE Filter Class 600

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Left Belt Load

Max = 2146.69 Nwt @ 77.88 msec  
Min = -104.22 Nwt @ 165.83 msec



B-93

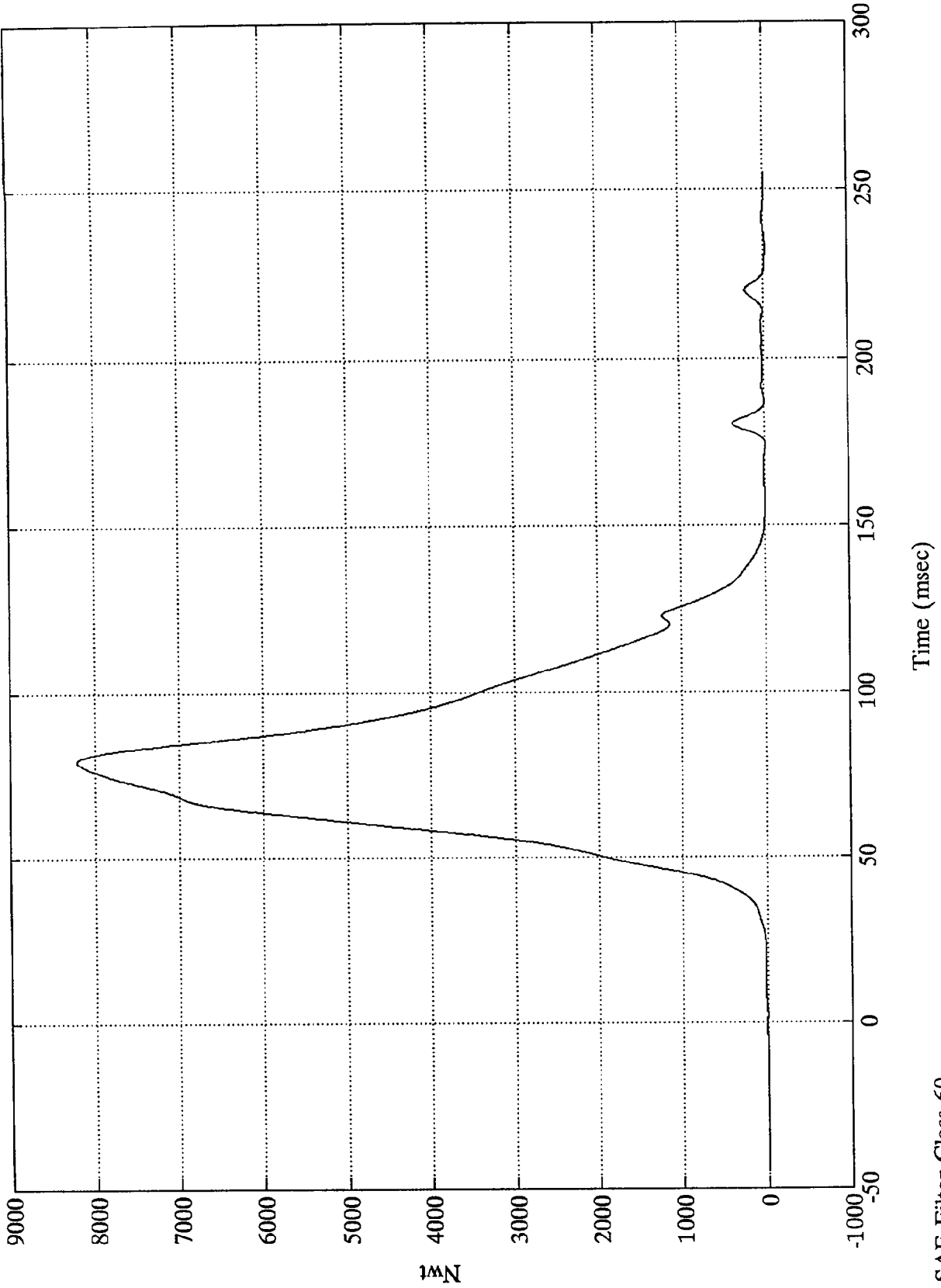
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Torso Belt Load

Max = 8209.00 Nwt @ 79.44 msec  
Min = -27.39 Nwt @ 232.44 msec



1MN  
B-94

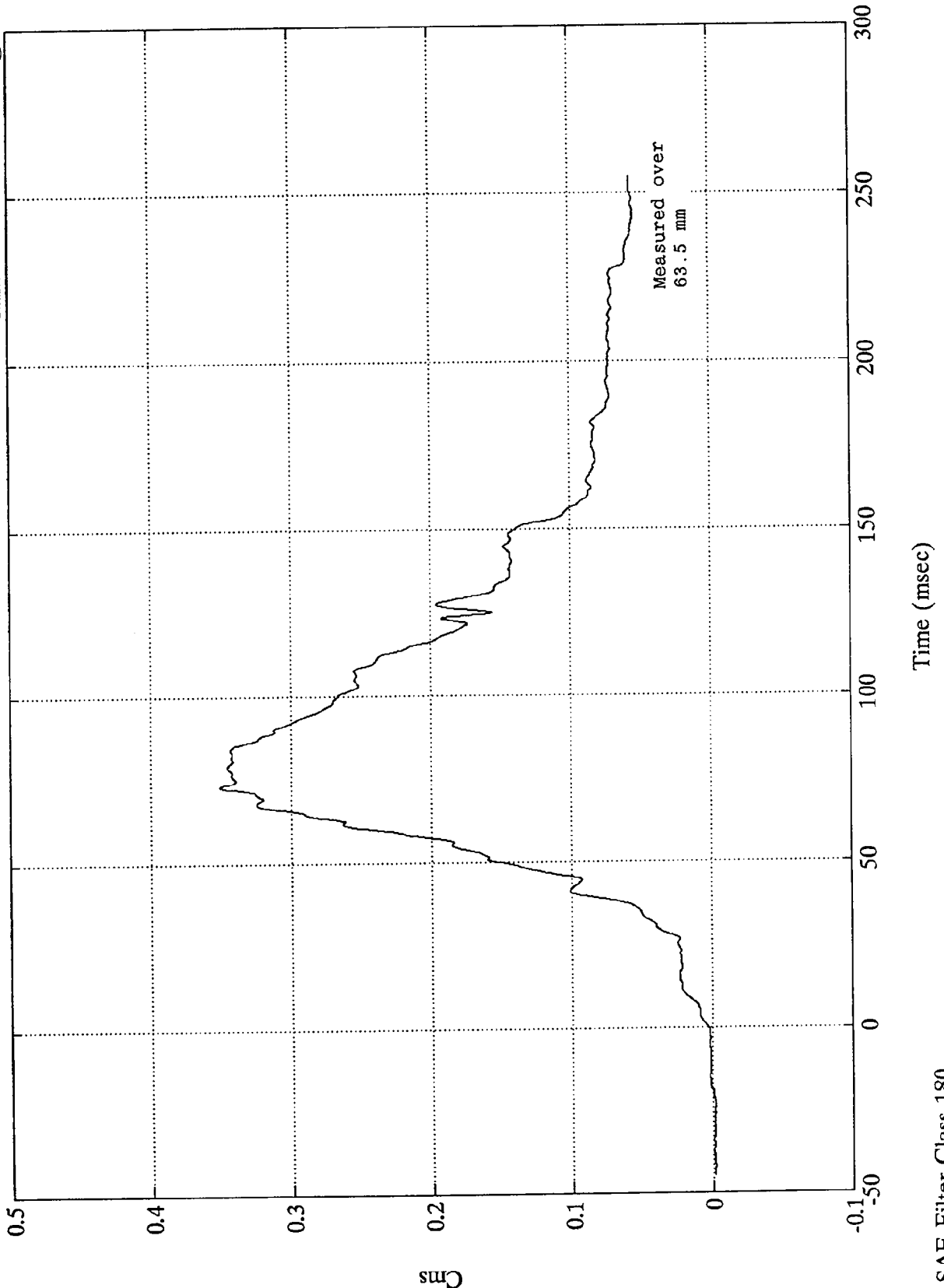
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 1 Belt Elongation

Max = .35 Cms @ 72.83 msec  
Min = -.00 Cms @ -23.88 msec



B-95  
Cms

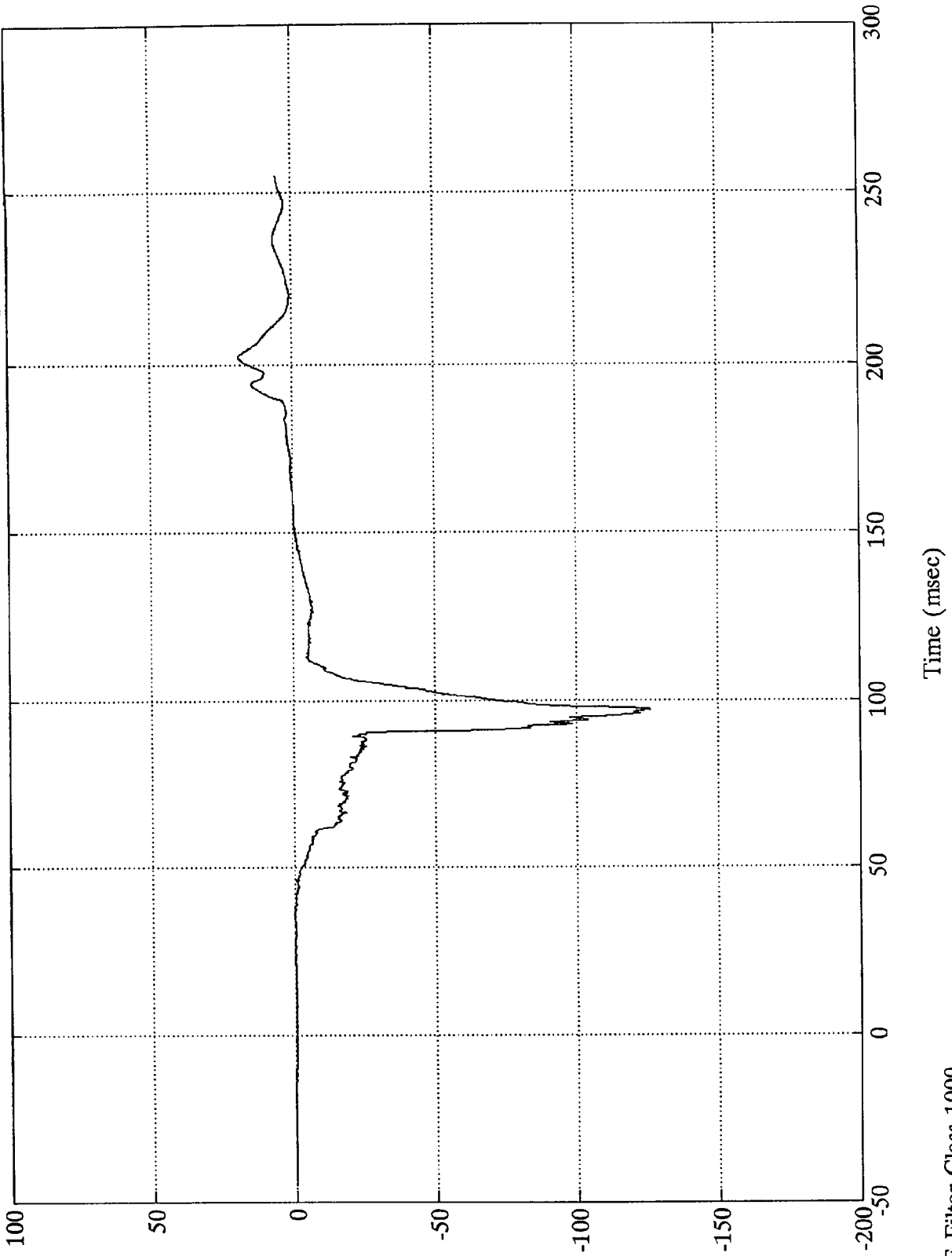
8048-2

SAE Filter Class 180

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Head X

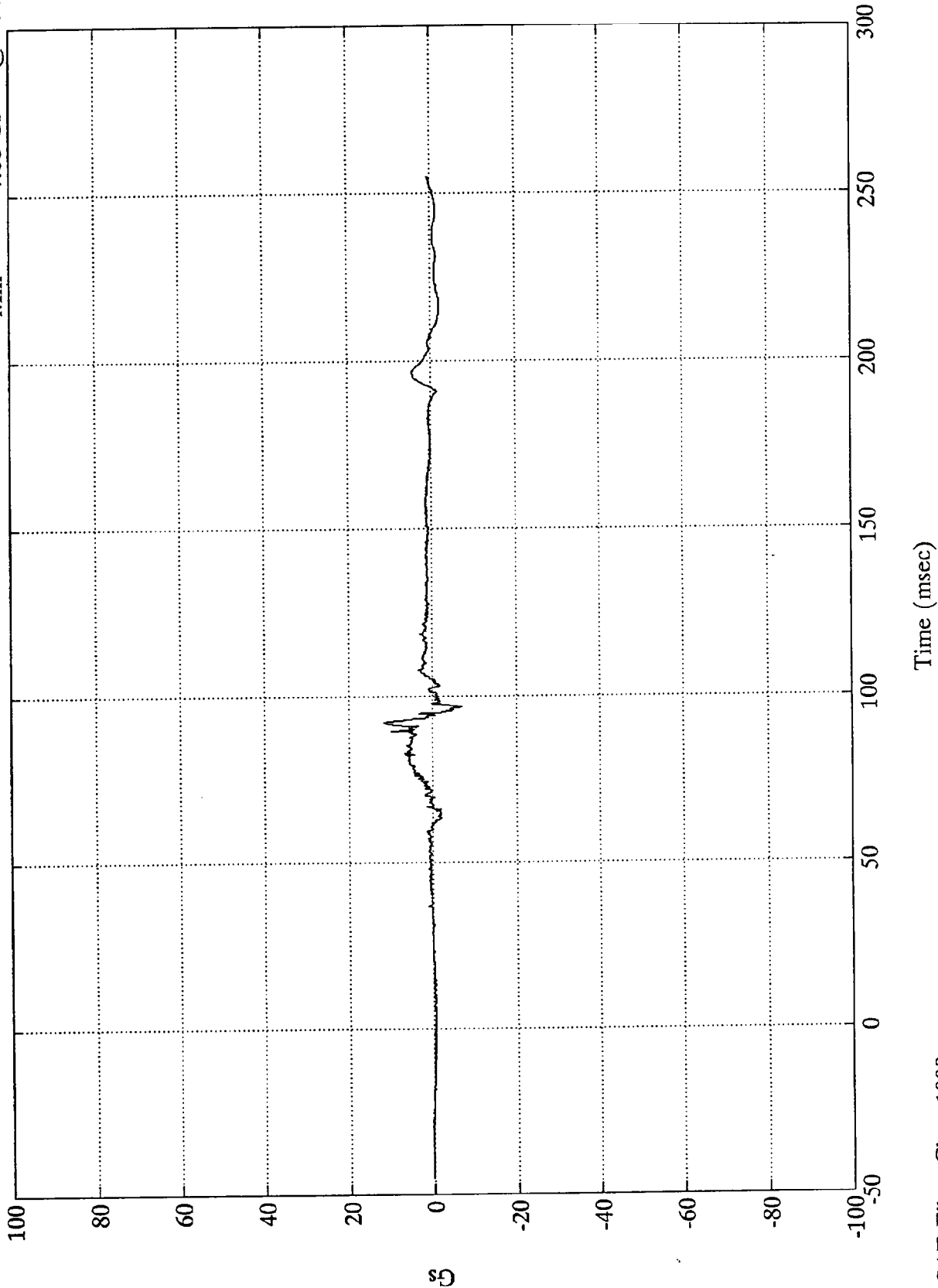
Max = 18.71 Gs @ 202.56 msec  
Min = -126.01 Gs @ 97.19 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Head Y

Max = 11.72 Gs @ 91.92 msec  
Min = -7.08 Gs @ 96.48 msec



B-97

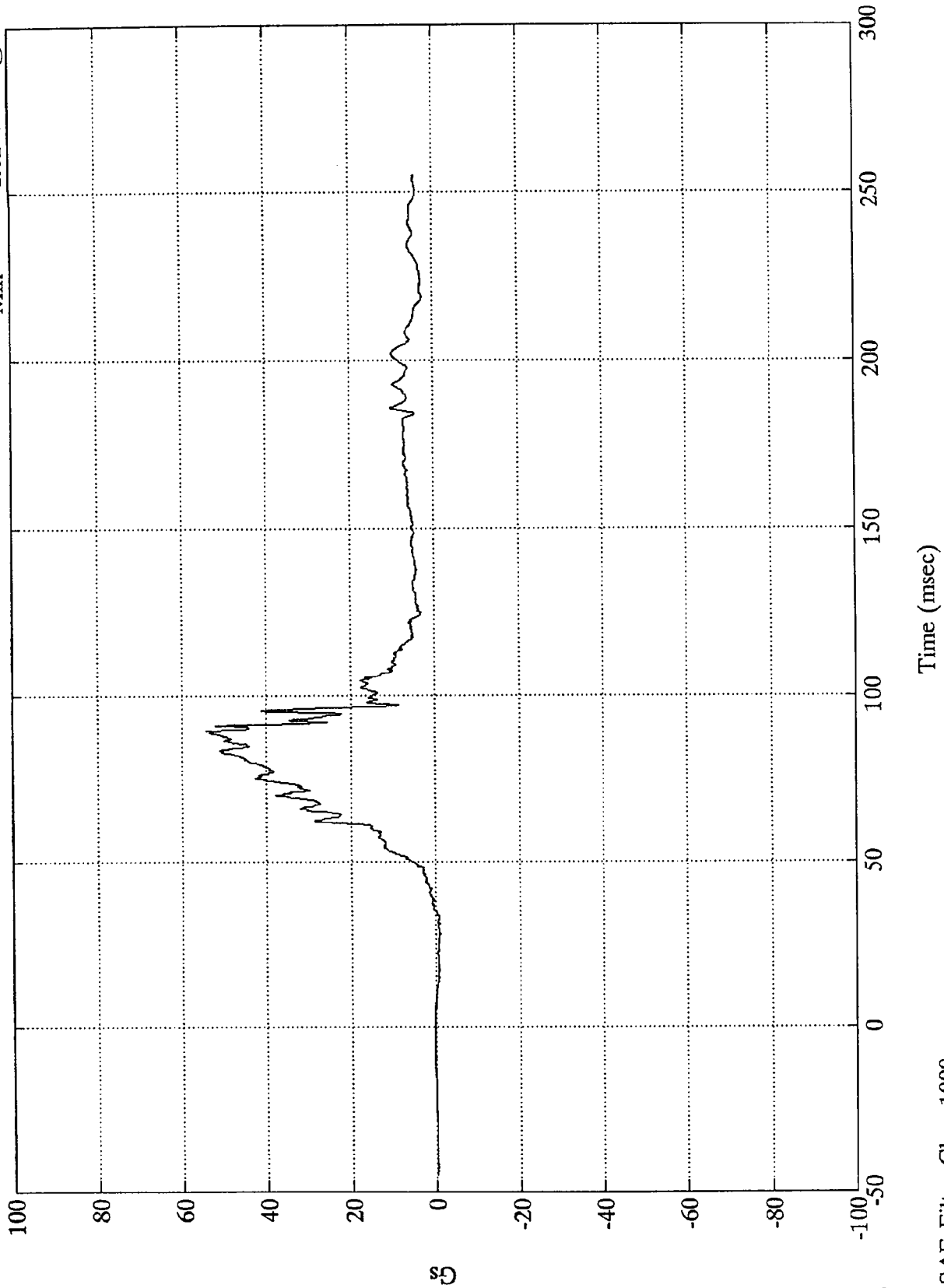
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Head Z

Max = 54.45 Gs @ 89.40 msec  
Min = -1.02 Gs @ 31.07 msec



B-98

8048-2

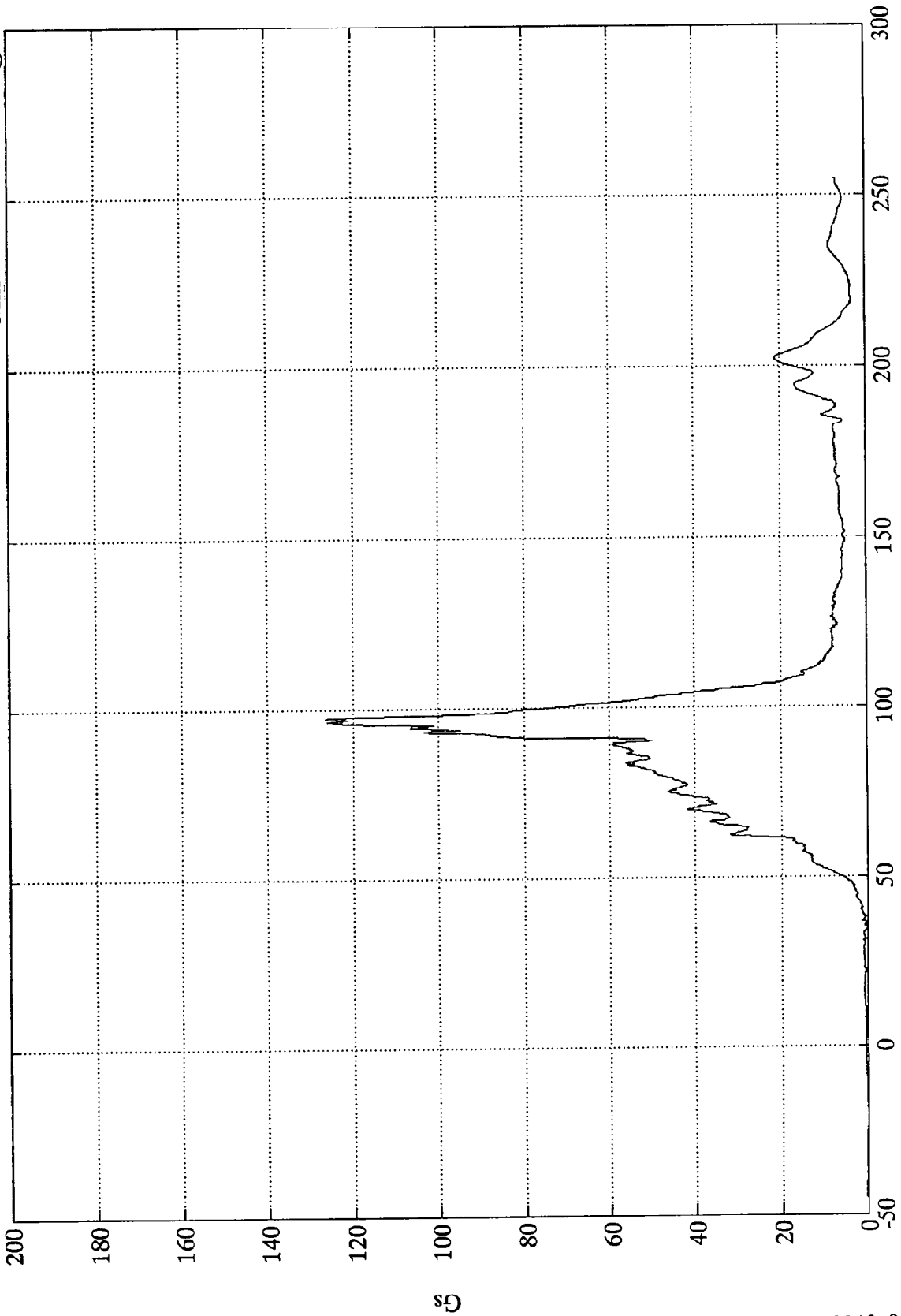
SAE Filter Class 1000

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Head Resultant

Max = 126.42 Gs @ 97.19 msec  
Min = .05 Gs @ -18.60 msec



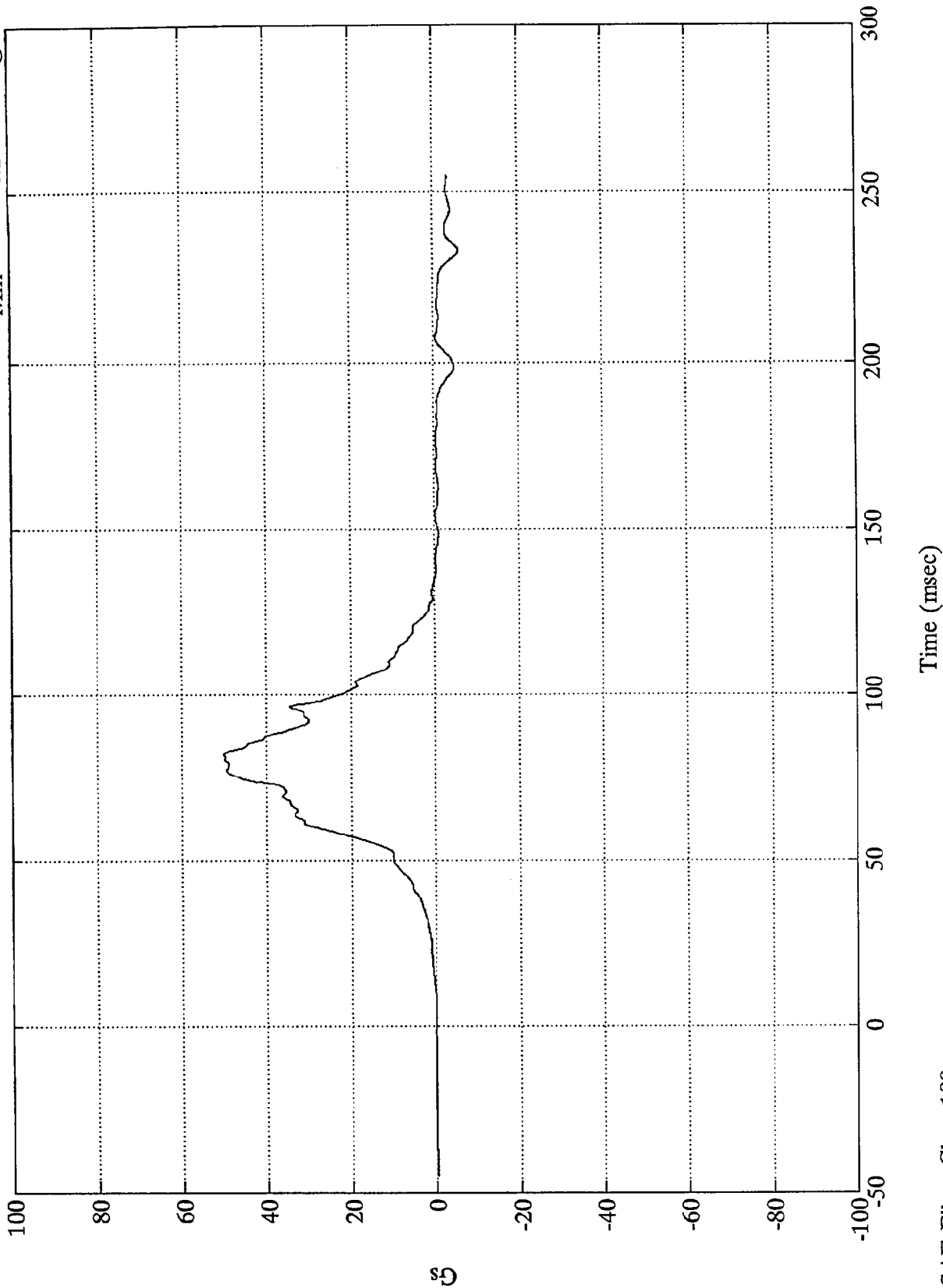
Time (msec)

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Chest X

Max = 50.11 Gs @ 81.95 msec  
Min = -6.12 Gs @ 232.92 msec



B-100

8048-2

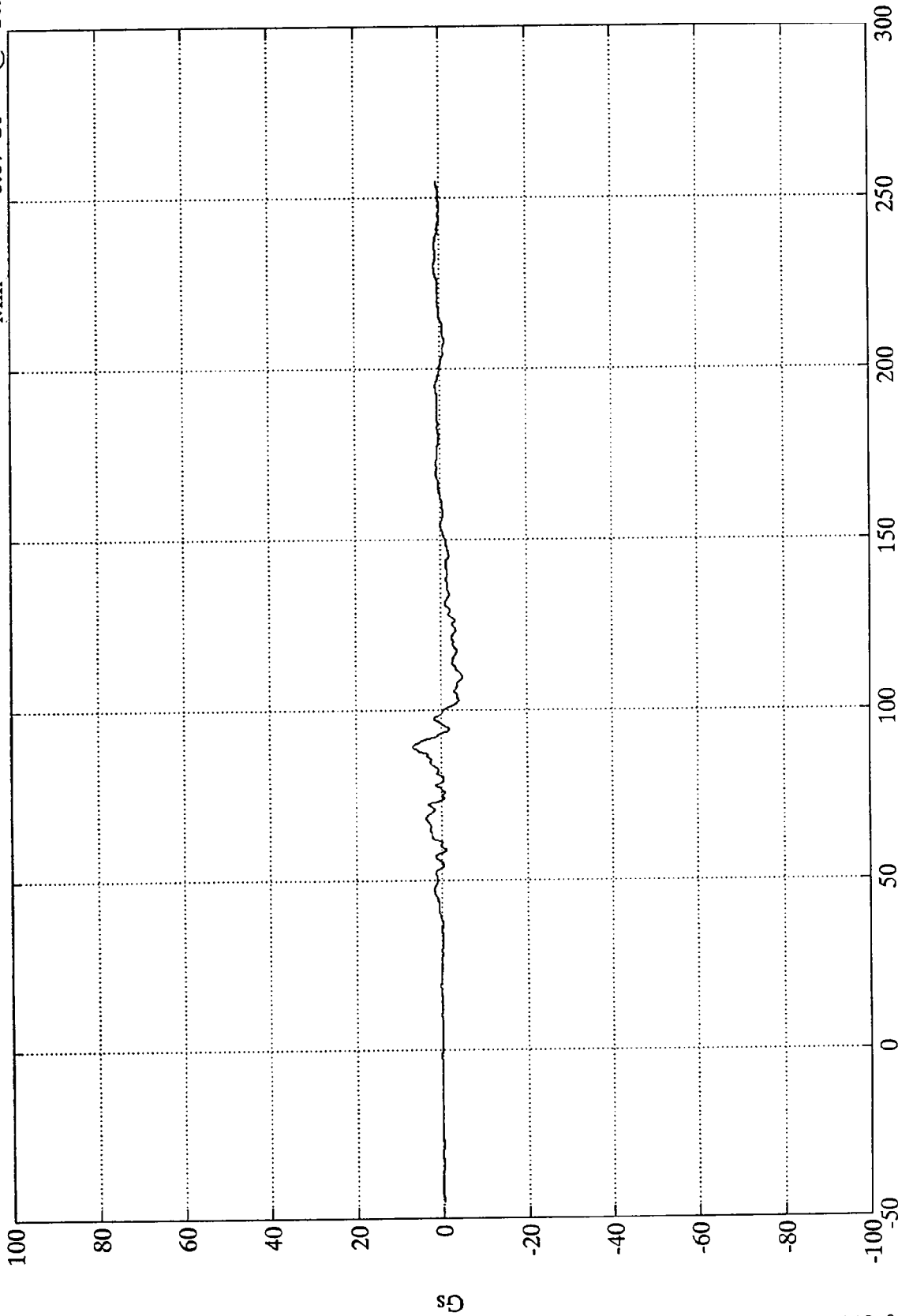
SAE Filter Class 180



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Chest Y

Max = 6.68 Gs @ 89.16 msec  
Min = -5.07 Gs @ 109.56 msec



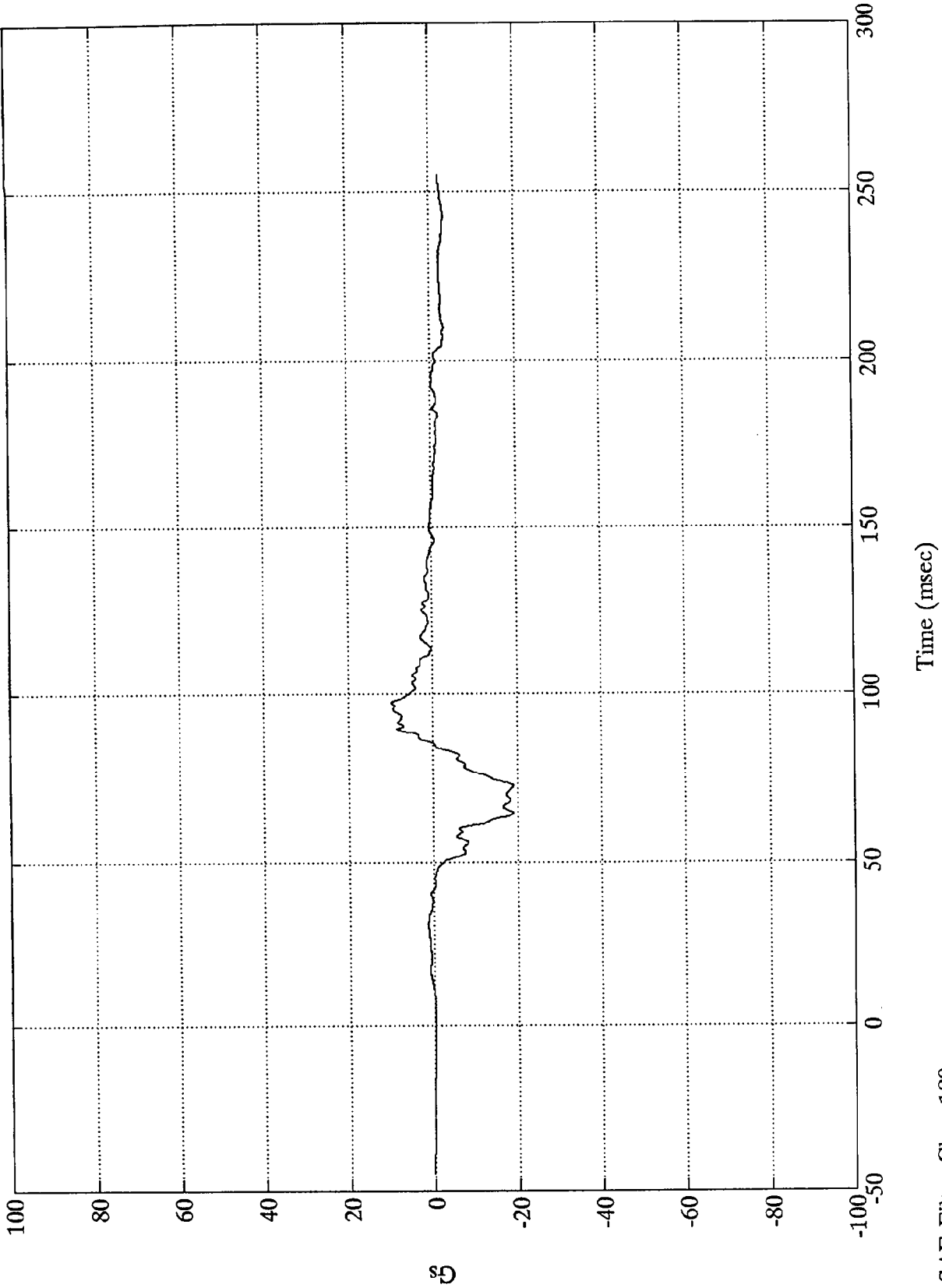
Time (msec)

SAE Filter Class 180

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Chest Z

Max = 9.92 Gs @ 97.19 msec  
Min = -19.12 Gs @ 72.59 msec



B-102

8048-2

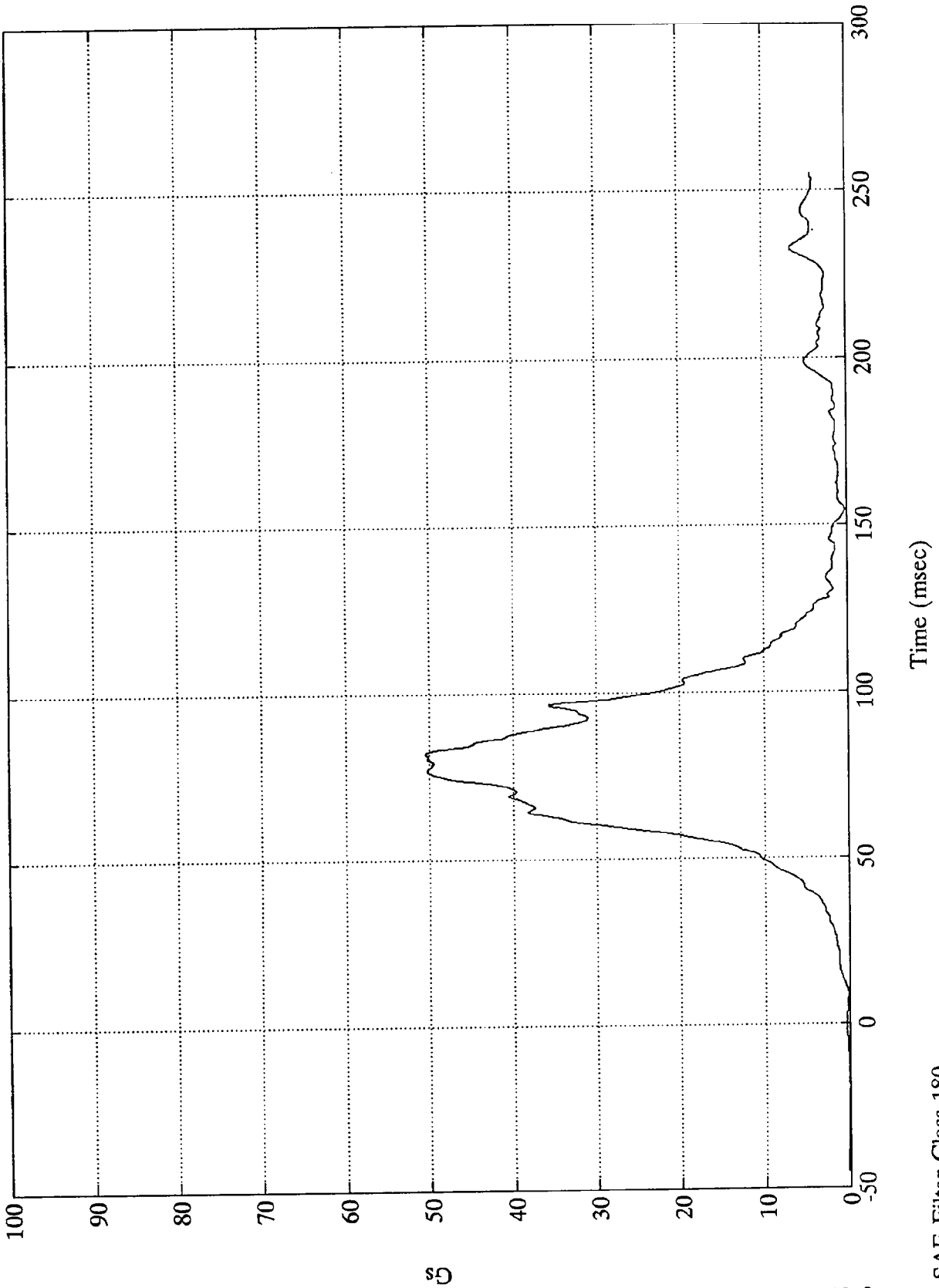
SAE Filter Class 180

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Chest Resultant

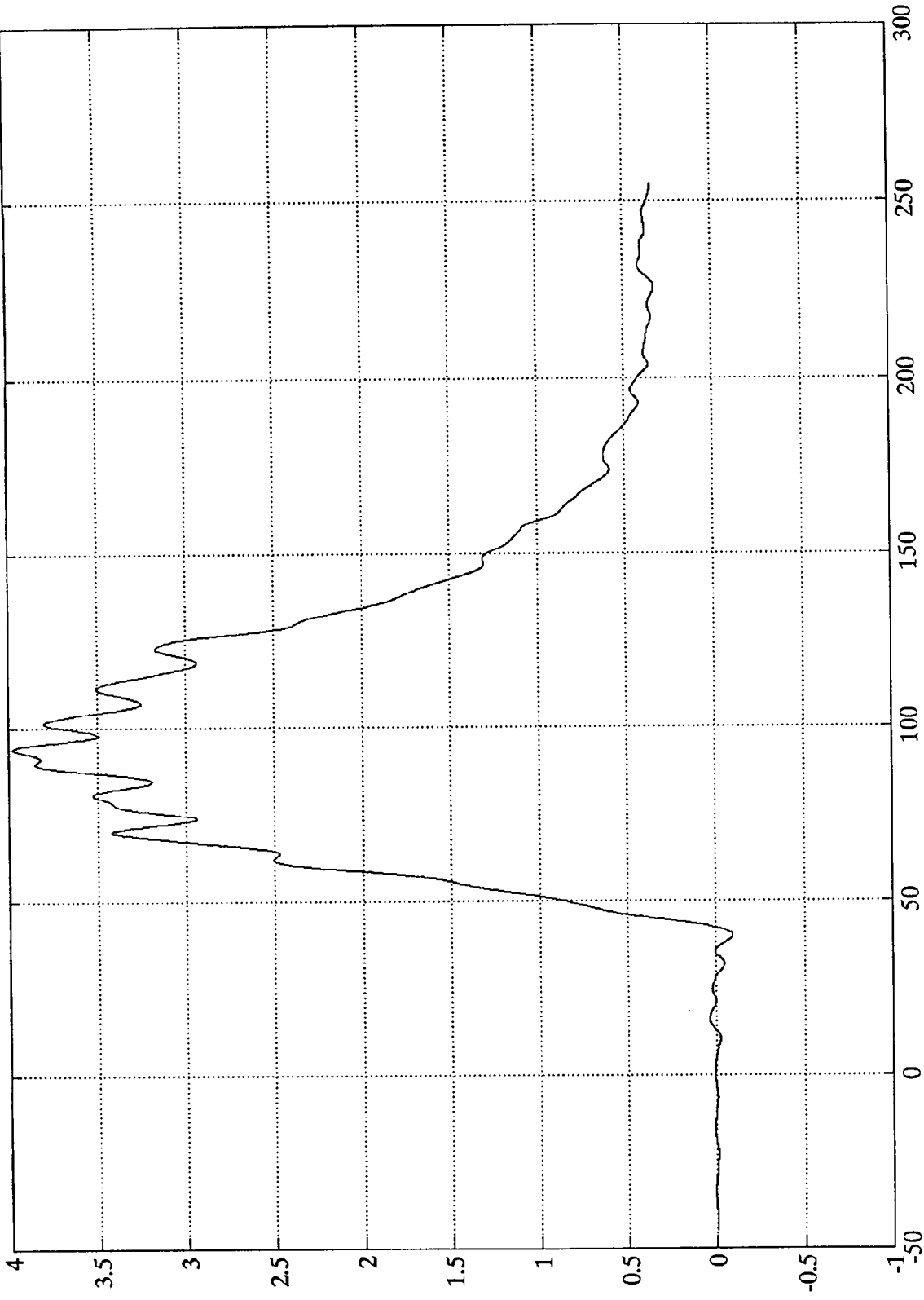
Max = 50.49 Gs @ 81.95 msec  
Min = .05 Gs @ -18.72 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Max = 3.98 Cms @ 93.84 msec  
Min = -1.10 Cms @ 39.84 msec

Pos. 2 Chest Disp.



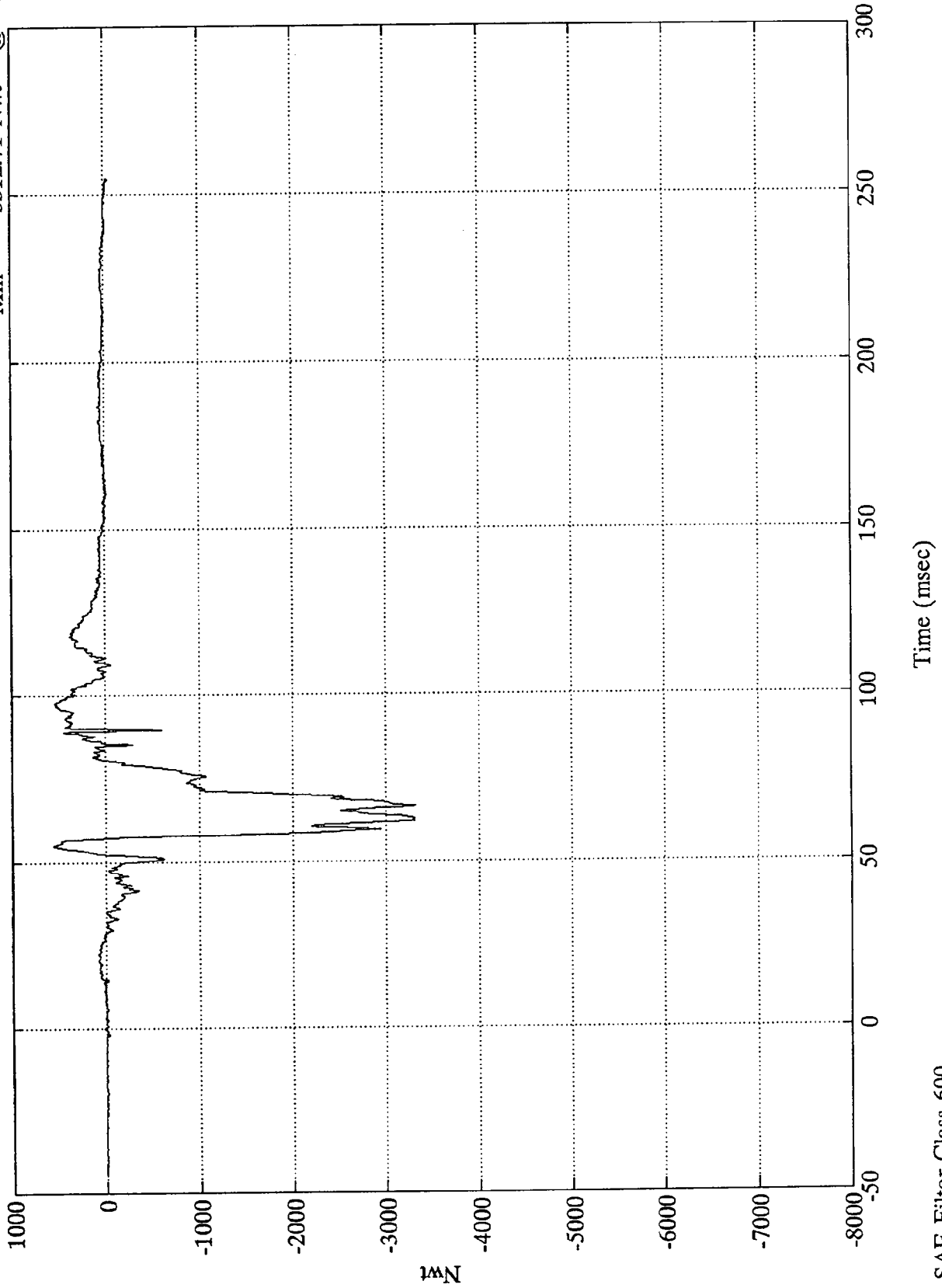
Time (msec)

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Left Femur

Max = 558.91 Nwt @ 54.96 msec  
Min = -3312.71 Nwt @ 66.36 msec



1000 Nwt  
B-105

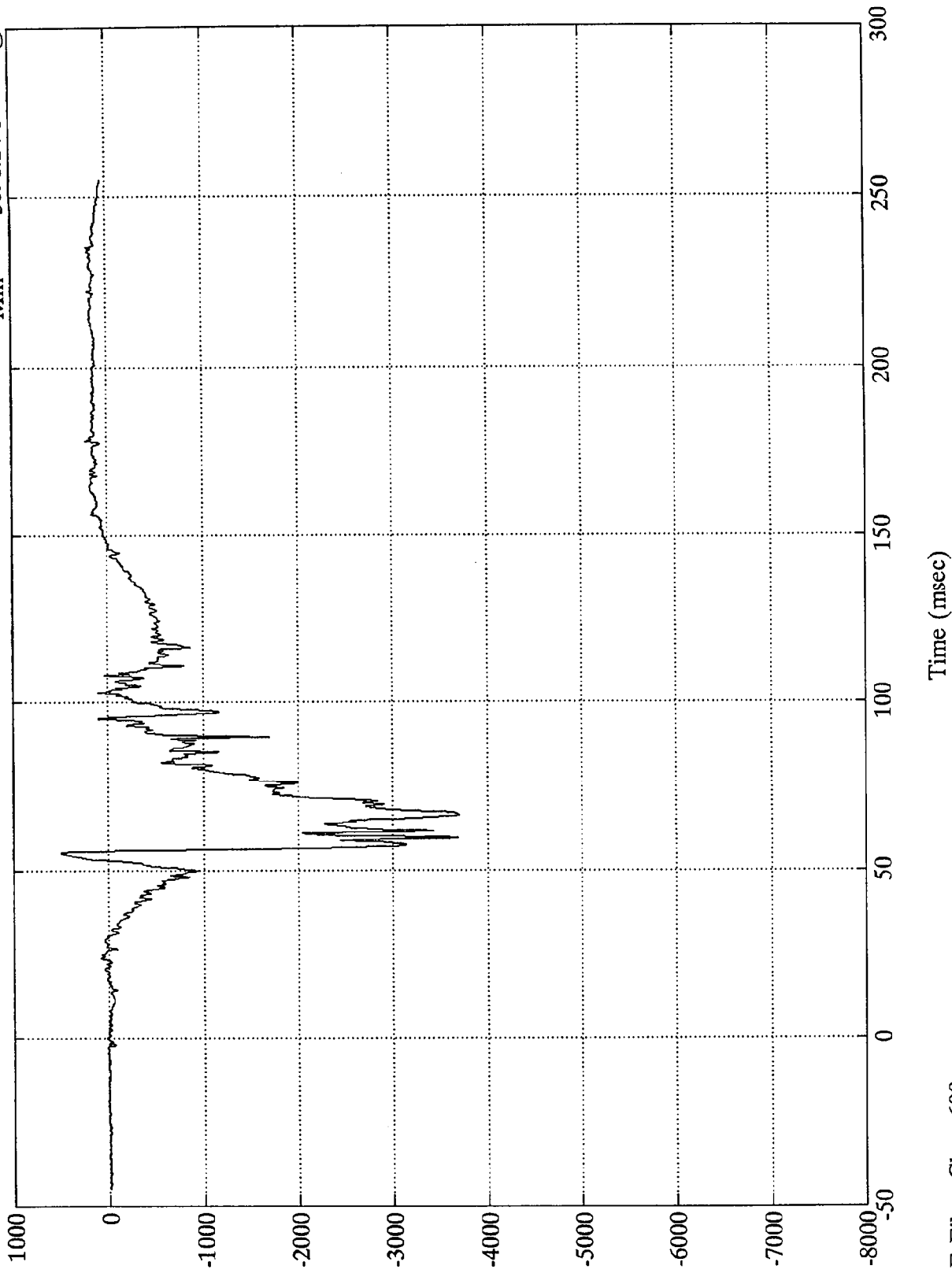
8048-2

SAE Filter Class 600

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Right Femur

Max = 495.41 Nwt @ 55.20 msec  
Min = -3698.14 Nwt @ 66.36 msec



1mN  
B-106

8048-2

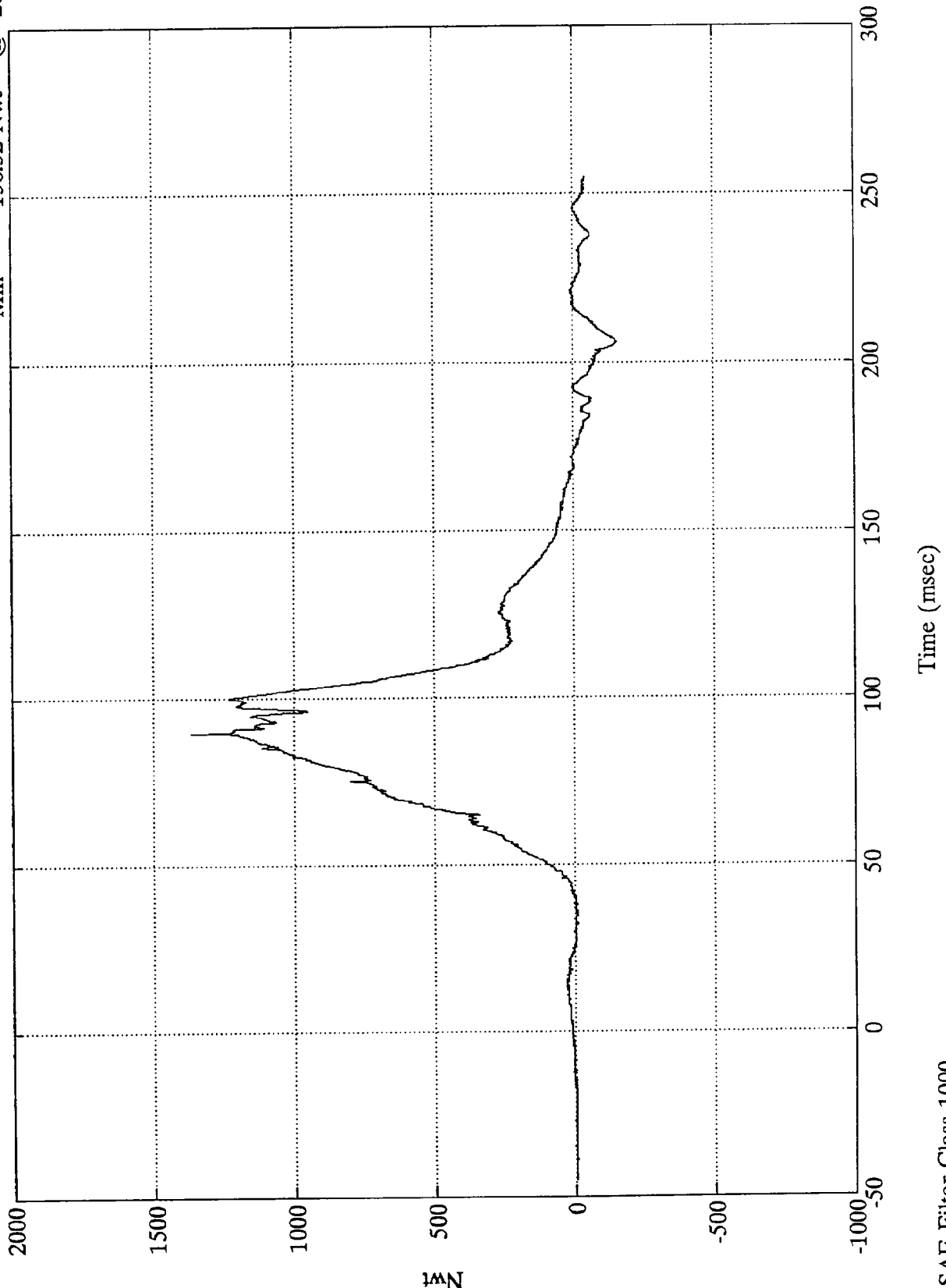
SAE Filter Class 600

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Upper Neck Fx

Max = 1365.45 Nwt @ 89.40 msec  
Min = -156.52 Nwt @ 205.80 msec



1000 Nwt  
B-107

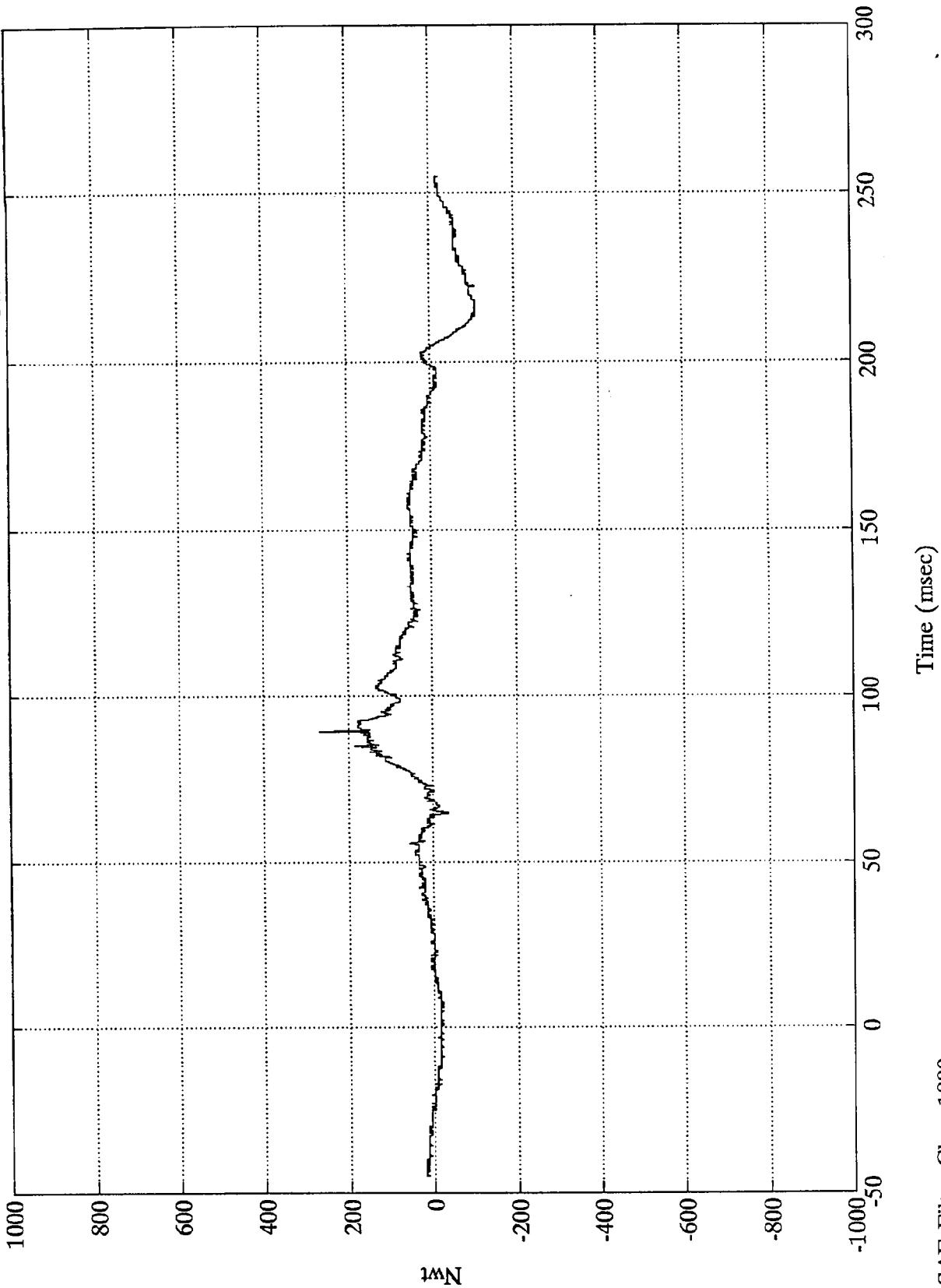
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Upper Neck Fy

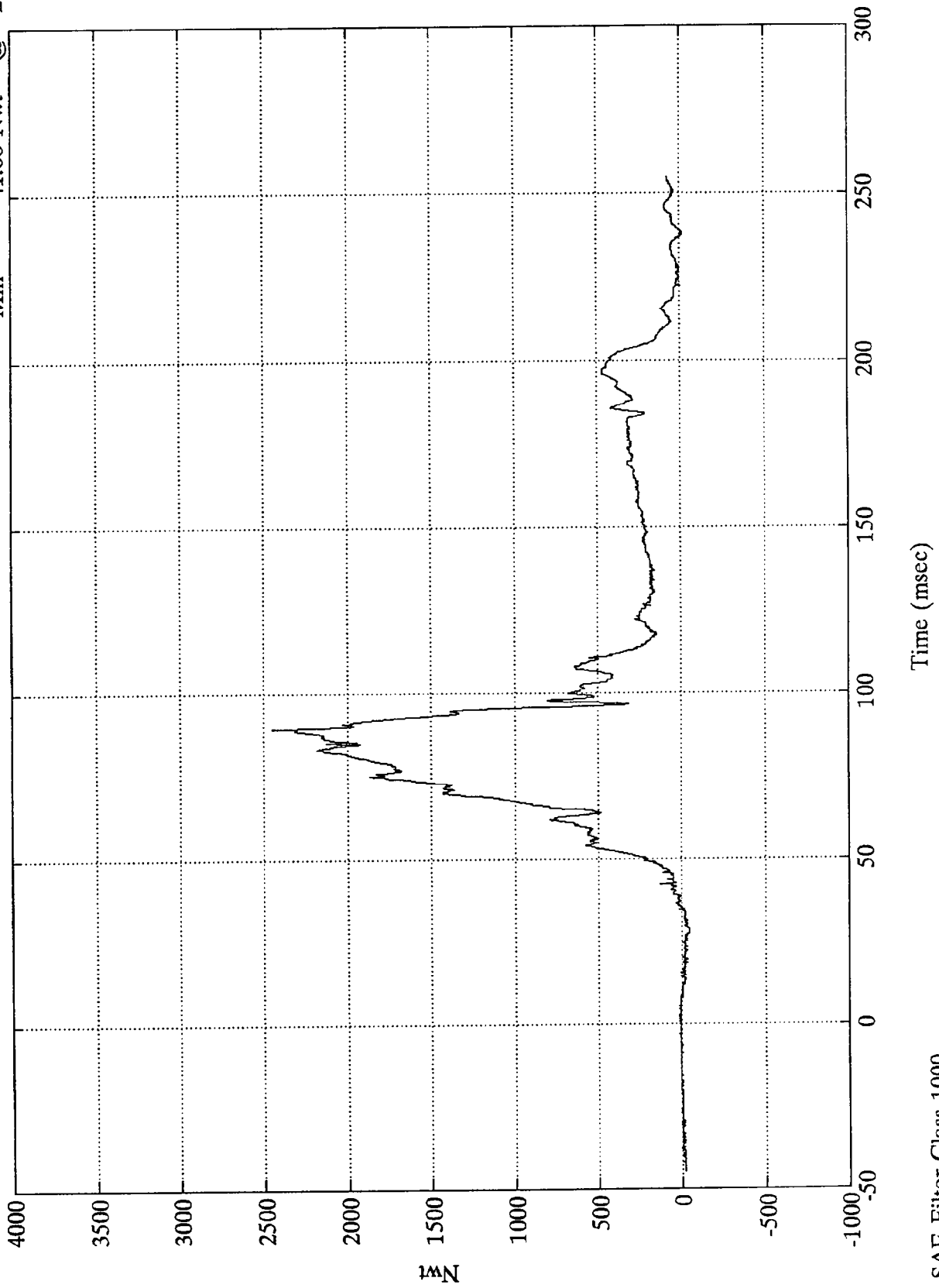
Max = 269.43 Nwt @ 89.40 msec  
Min = -107.68 Nwt @ 222.48 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Upper Neck Fz

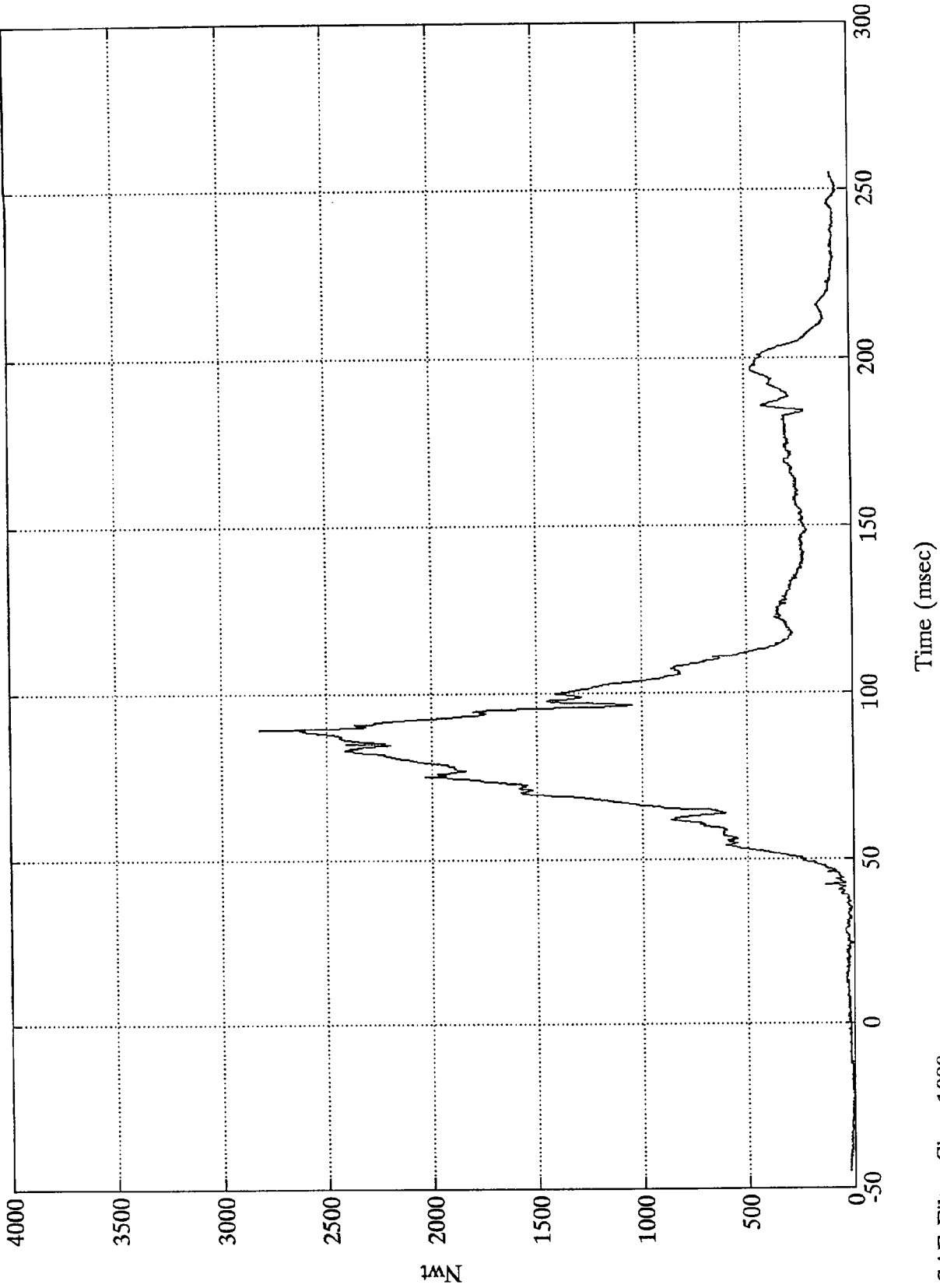
Max = 2450.76 Nwt @ 89.40 msec  
Min = -41.00 Nwt @ 28.92 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Neck Force Res.

Max = 2818.38 Nwt @ 89.40 msec  
Min = 4.17 Nwt @ -19.20 msec



1kN  
B-110

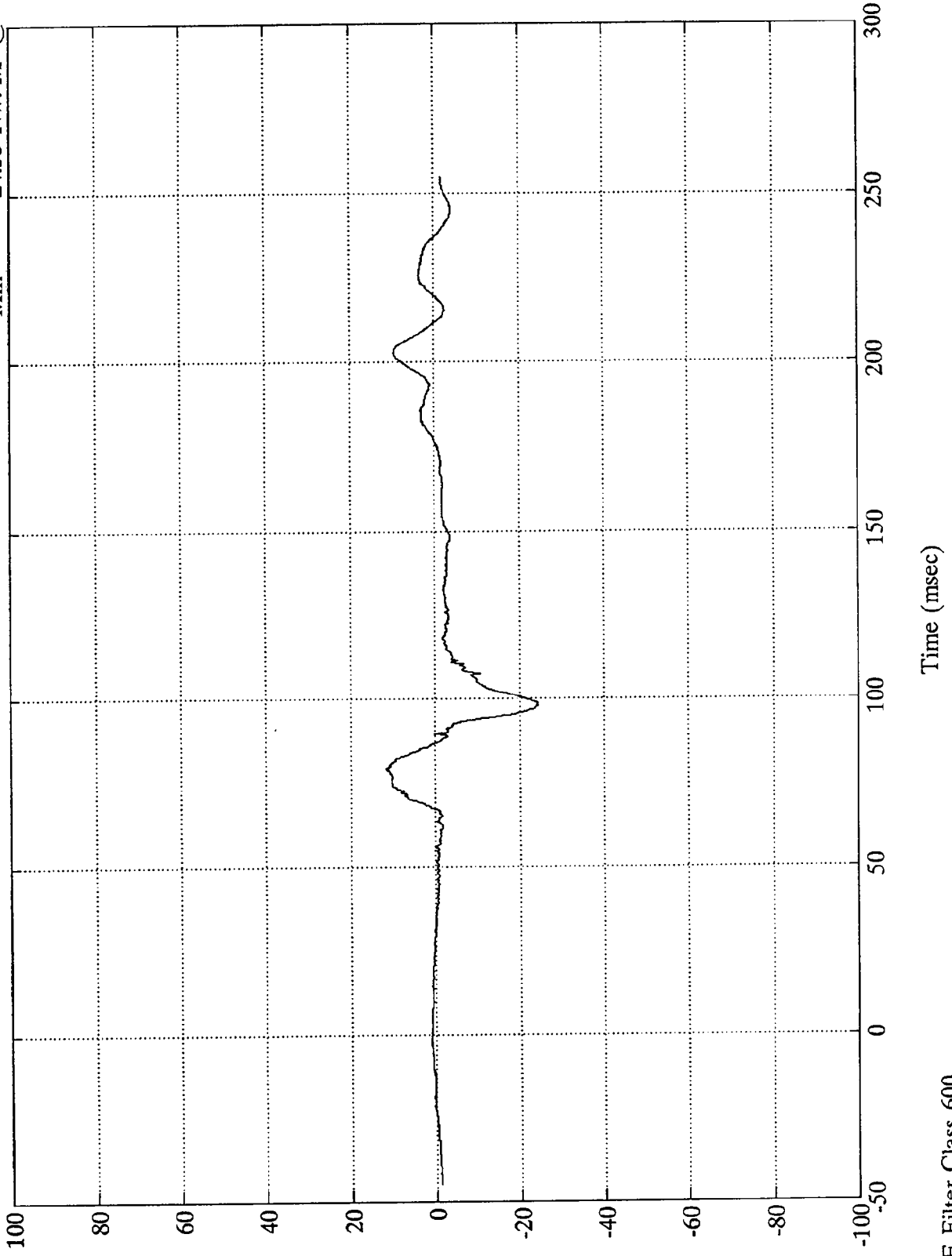
8048-2

SAE Filter Class 1000

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Upper Neck Mx

Max = 11.56 Nwt-M @ 79.08 msec  
Min = -24.33 Nwt-M @ 97.80 msec



Nwt-M

B-111

8048-2

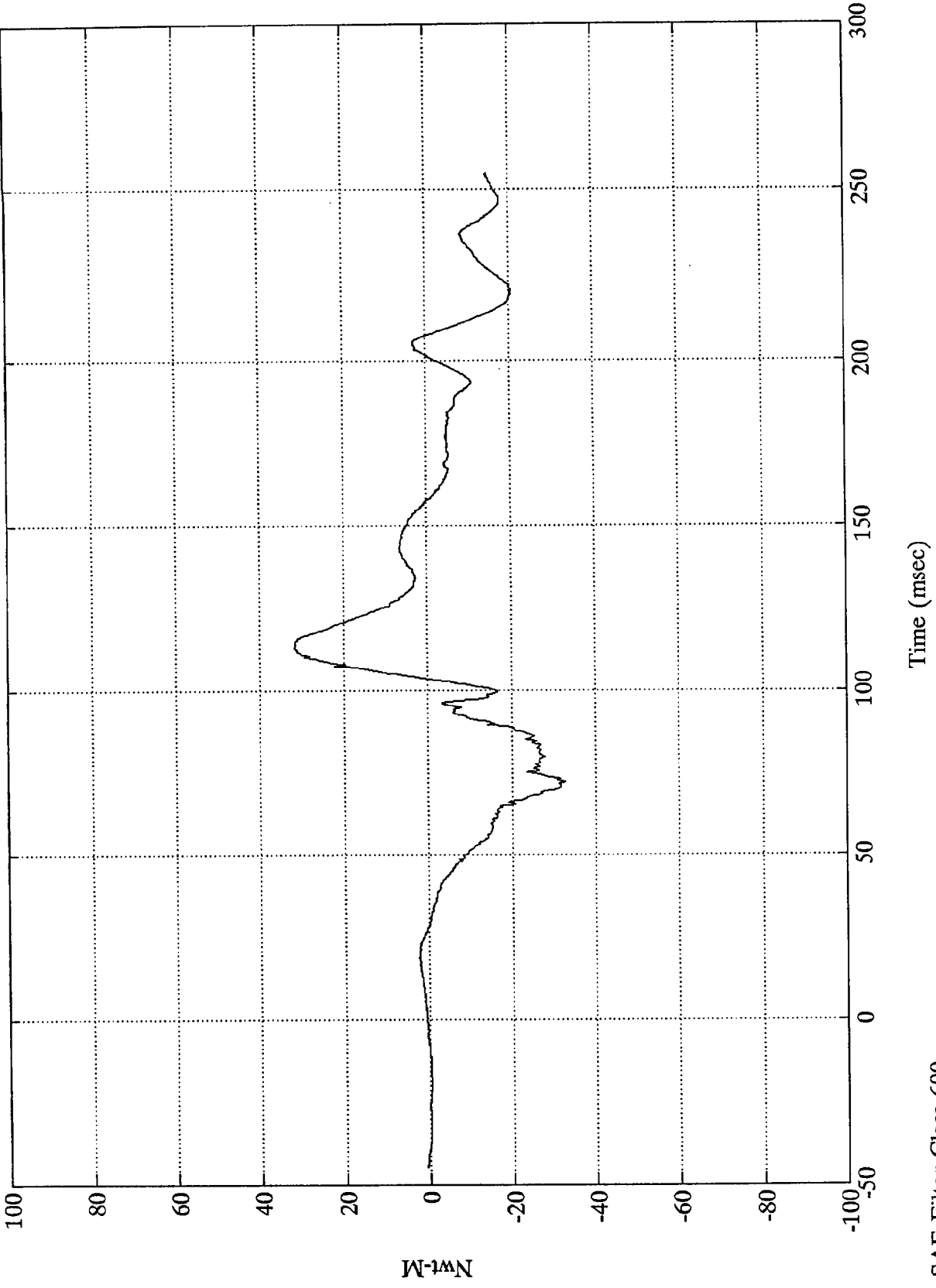
SAE Filter Class 600

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Upper Neck My

Max = 31.89 Nwt-M @ 113.04 msec  
Min = -32.78 Nwt-M @ 72.12 msec



Nwt-M  
B-112

8048-2

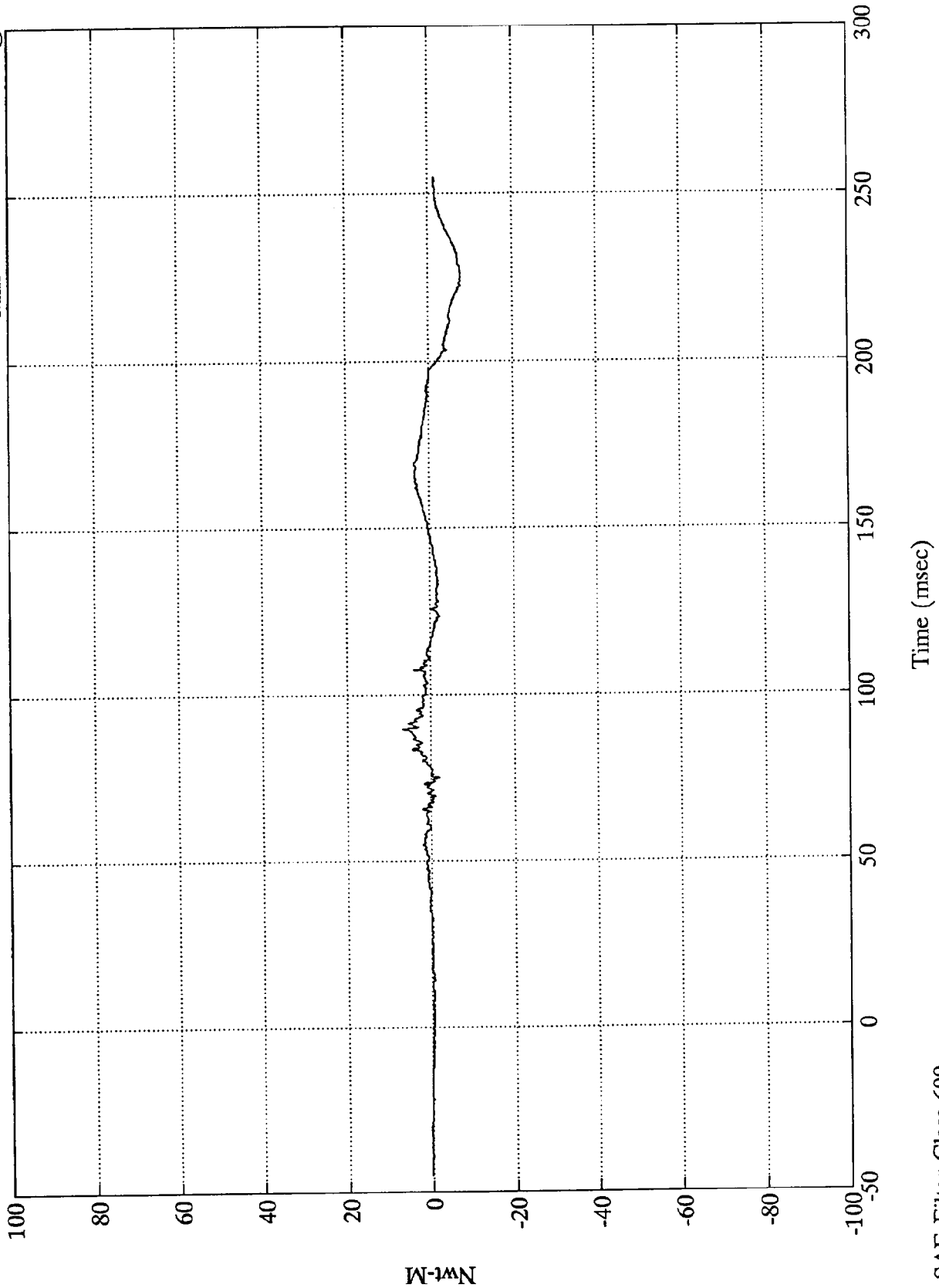
SAE Filter Class 600

Time (msec)

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Upper Neck Mz

Max = 6.75 Nwt-M @ 89.40 msec  
Min = -7.79 Nwt-M @ 225.96 msec



Nwt-M

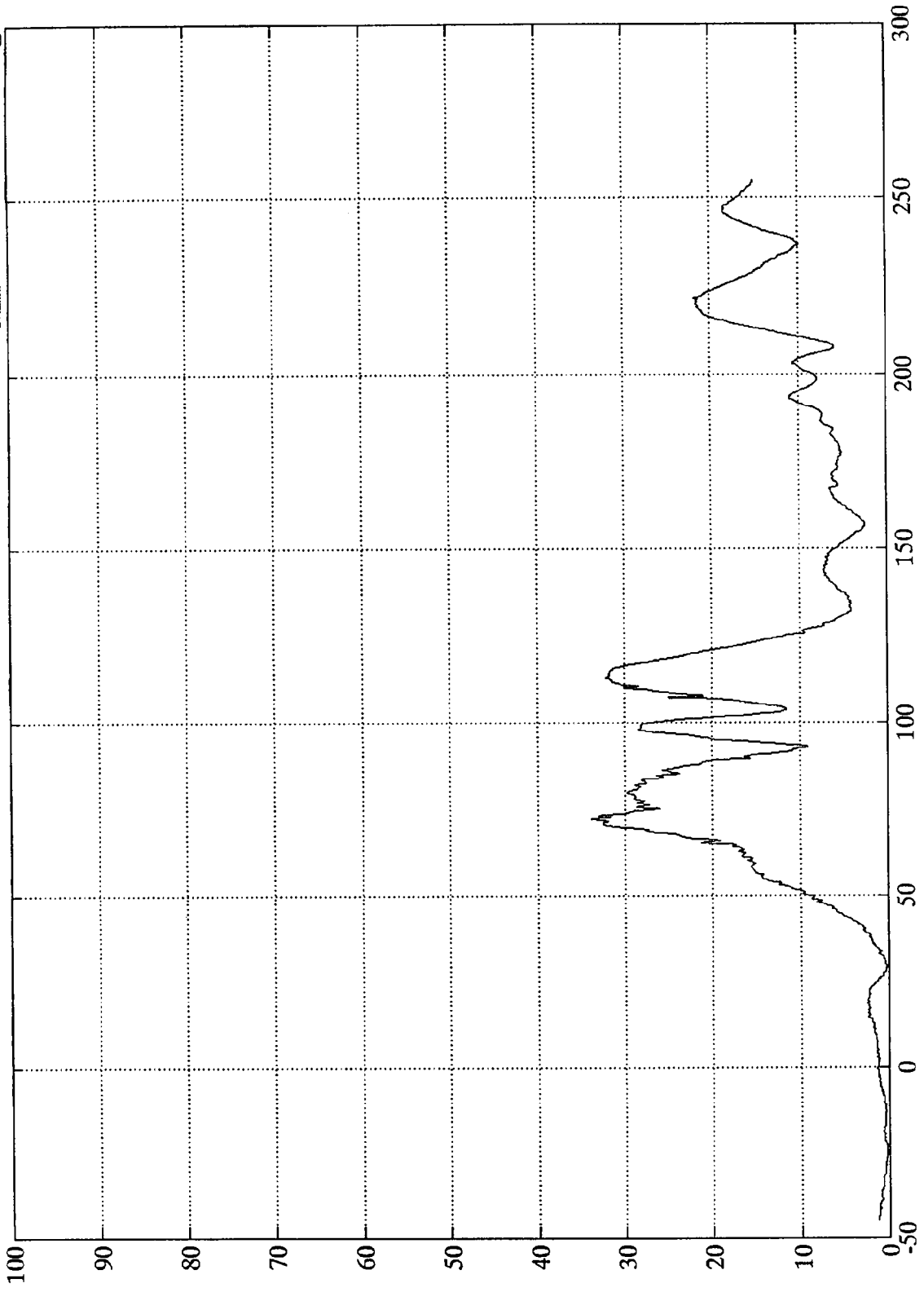
Time (msec)

SAE Filter Class 600

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Neck Moment Res.

Max = 33.85 Nwt-M @ 72.12 msec  
Min = .13 Nwt-M @ -25.44 msec



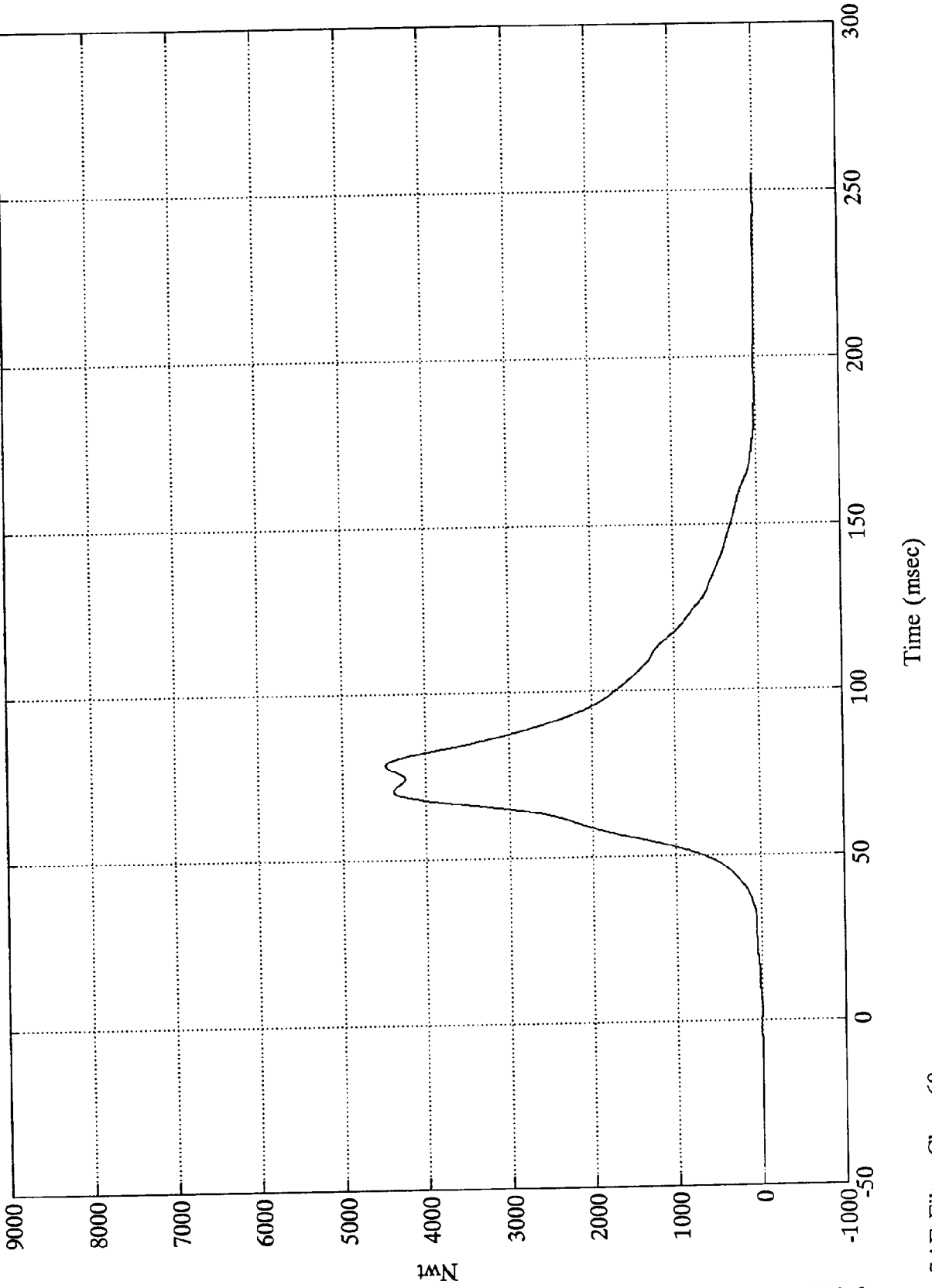
Time (msec)

SAE Filter Class 600

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Right Belt Load

Max = 4479.24 Nwt @ 78.48 msec  
Min = -5.75 Nwt @ -44.88 msec



1kN  
B-115

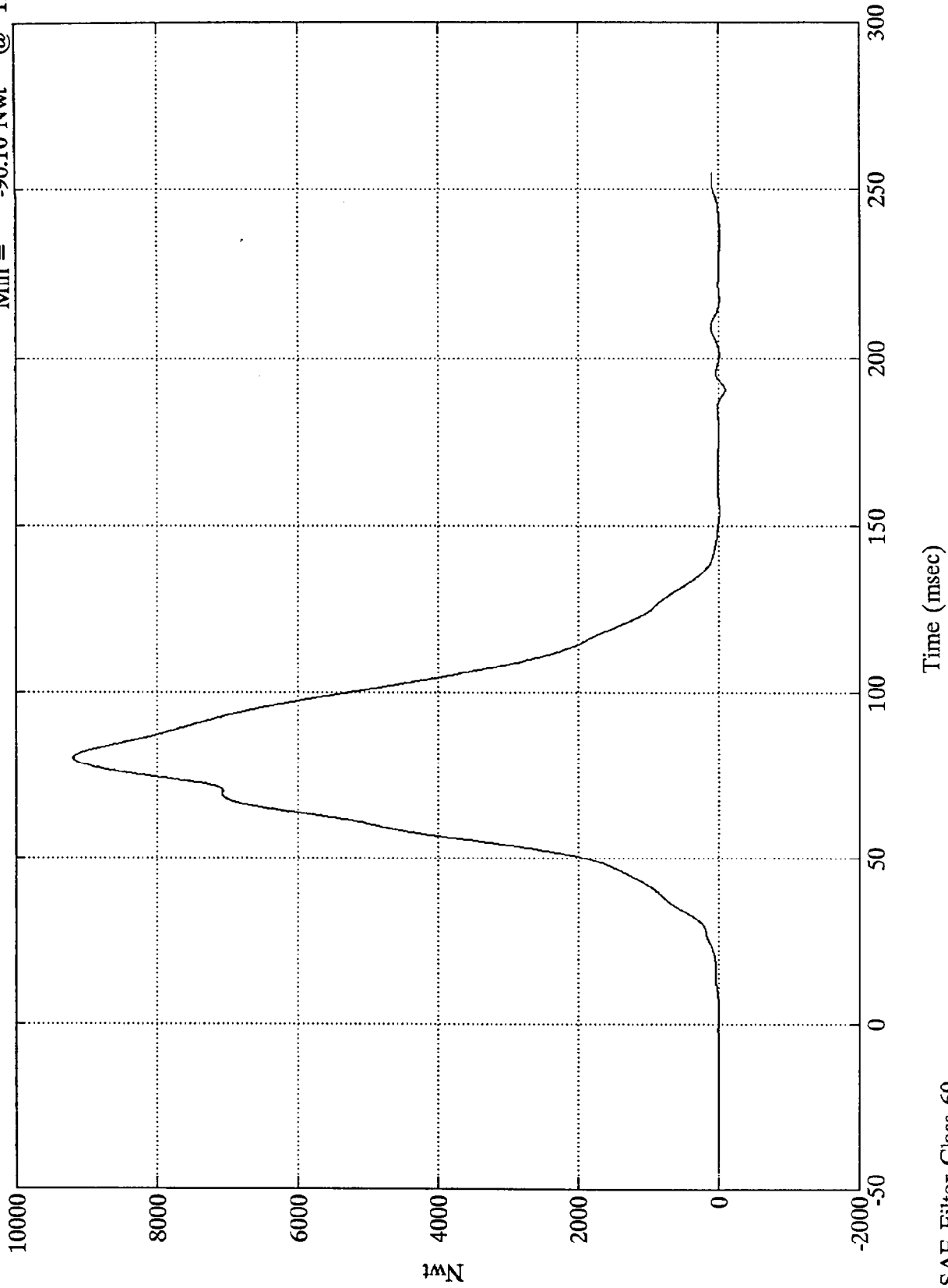
8048-2

SAE Filter Class 60

NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Torso Belt Load

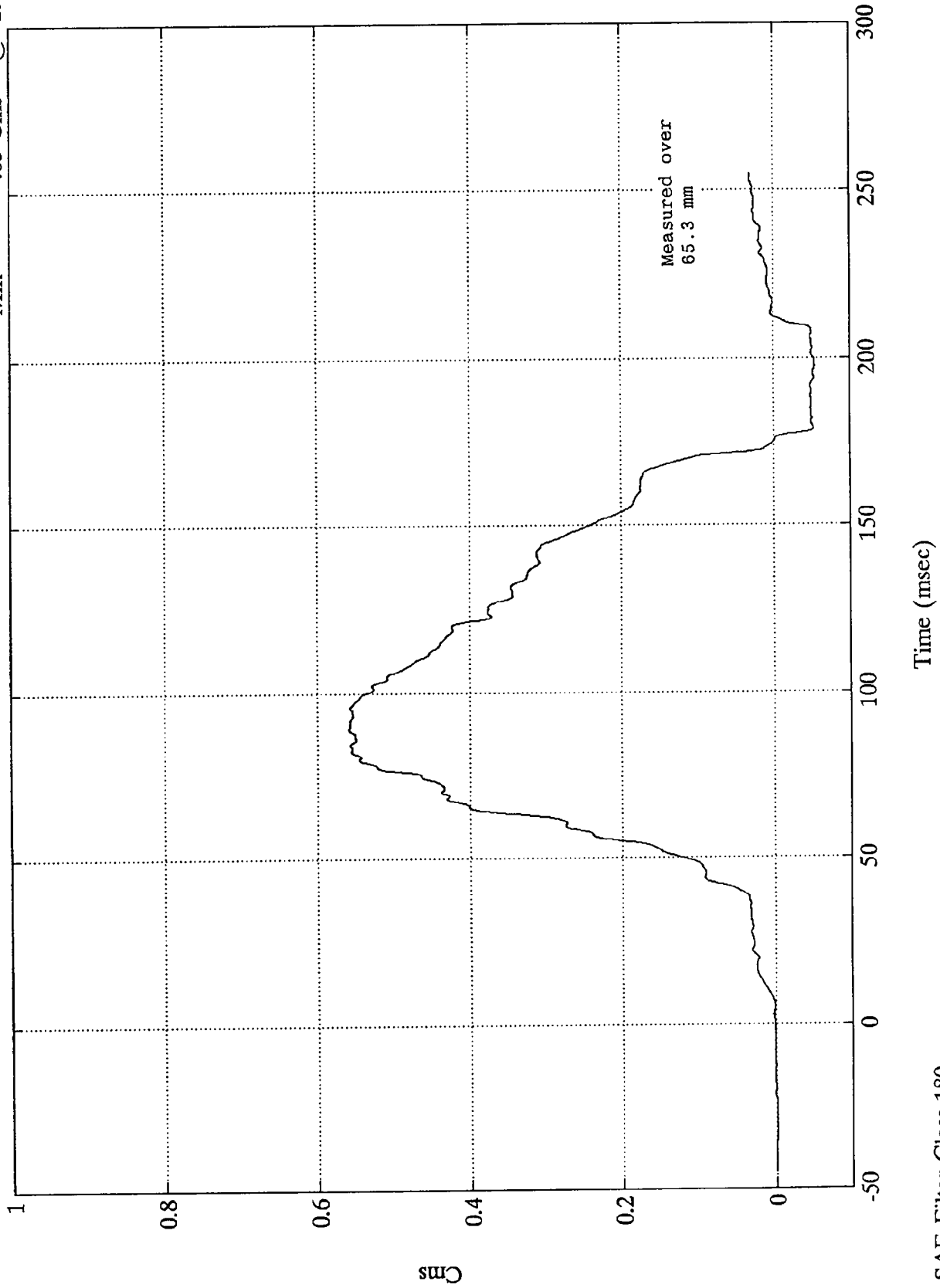
Max = 9190.74 Nwt @ 80.40 msec  
Min = -90.10 Nwt @ 190.44 msec



NCAP TEST #4 - 1993 PONTIAC GRAND AM

Pos. 2 Belt Elongation

Max = .56 Cms @ 88.92 msec  
Min = -.05 Cms @ 197.40 msec



Cms

Time (msec)



Appendix C

PART 572E DUMMY CONFIGURATION  
AND PERFORMANCE VERIFICATION DATA SHEETS

Appendix C contains the results from certification tests performed on the 50th percentile male anthropomorphic test devices utilized for this crash test. The results indicate that the dummies meet all of the performance requirements of the six standard tests as specified in 49 CFR Part 572, Federal Register, Volume 42, No. 25, dated February 7, 1977.

The tests were conducted at the Dummy Certification Test Facility of Calspan Corporation, Advanced Technology Center. A summary of the test results, and Part 572 specifications are included in this Appendix.

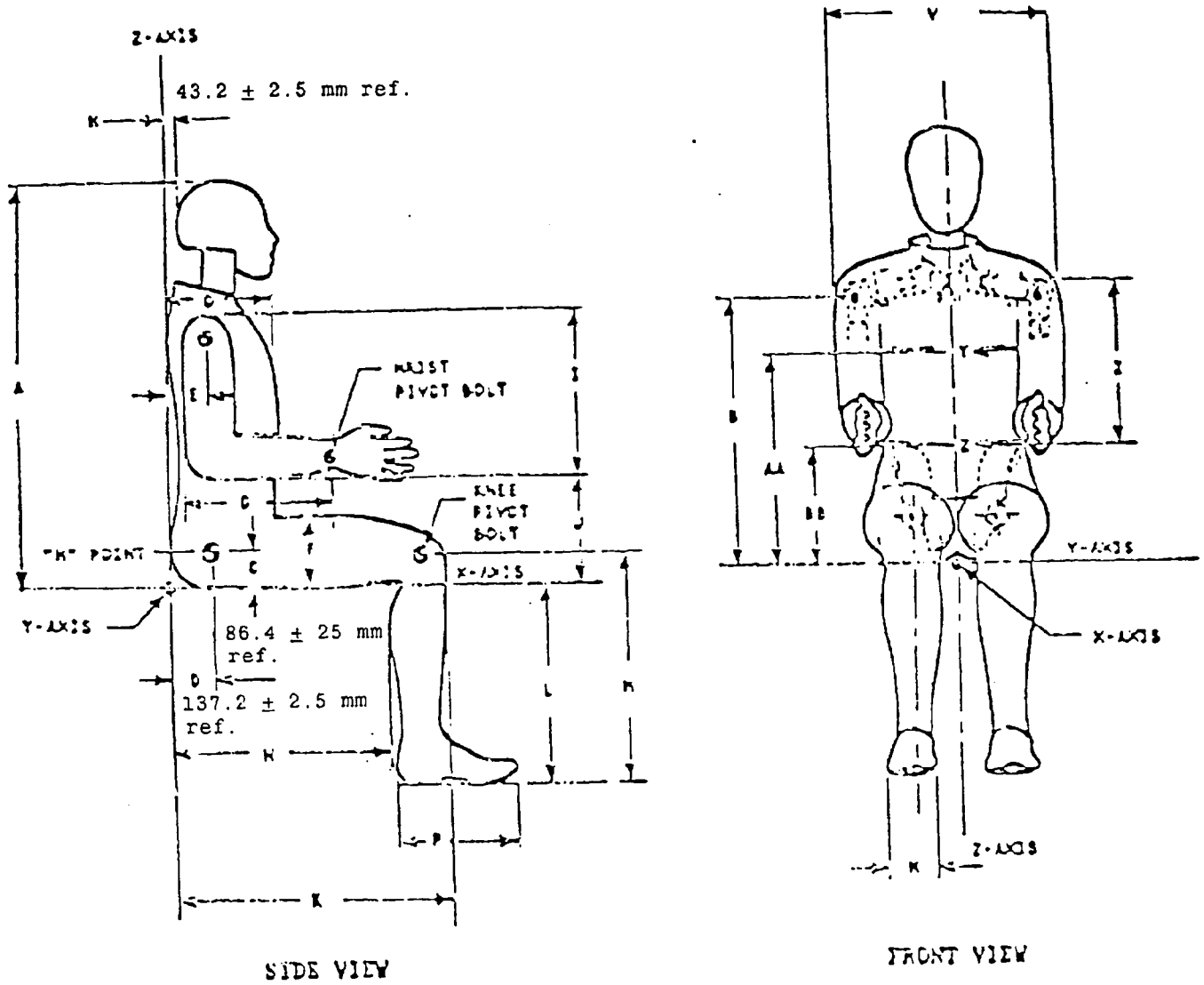
Dummy serial numbers and certification dates are:

<u>Serial No.</u>	<u>Completion Date</u>
45	8-20-92
150	8-20-92

#### Electronic Test Equipment

The complement of signal conditioning, recording and display equipment, in conjunction with dummy certification testing, can be found in New Car Assessment and Standards Indicant Testing Final Report No. 6525-V-1.

Figure 7  
DUMMY CONFIGURATION DIMENSIONS



Note: Figure is referenced to the erect seated position. The curved lumbar does not allow the Hybrid III to be positioned in a perfect erect attitude.

HYBRID III EXTERNAL DIMENSIONS

S/N 45 HUMANOID

DUMMY SERIAL NO. 45		DATE: 8-21-92
TEMPERATURE		20.6 DEG. C
RELATIVE HUMIDITY		45 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)	429-434 mm	432 mm
LOCATION FOR WAIST CIRCUMFERENCE (BB)	226-231 mm	229 mm
CHEST CIRCUMFERENCE (Y)	970-1001 mm	1001 mm
WAIST CIRCUMFERENCE (Z)	815-866 mm	866 mm
CHEST DEPTH (O)	213-229 mm	213 mm
H-POINT HEIGHT (C)	84-89 mm	89 mm
H-POINT FROM SEAT BACK (D)	135-140 mm	137 mm
SKULL CAP TO BACKLINE (H)	41-46 mm	43 mm
TOTAL SITTING HEIGHT (A)	879-889 mm	879 mm
THIGH CLEARANCE (F)	140-155 mm	147 mm
BUTTOCK KNEE LENGTH (K)	580-605 mm	601 mm
BUTTOCK POPLITAL LENGTH (N)	452-477 mm	475 mm
POPLITEAL LENGTH (L)	430-455 mm	447 mm
KNEE PIVOT HEIGHT (M)	485-501 mm	488 mm
FOOT LENGTH (P)	252-267 mm	259 mm
FOOT BREADTH (W)	91-107 mm	102 mm
SHOULDER PIVOT FROM BACKLINE (E)	84-94 mm	94 mm
SHOULDER BREADTH (V)	422-437 mm	427 mm
SHOULDER PIVOT HEIGHT (B)	505-521 mm	510 mm
ELBOW REST HEIGHT (J)	190-211 mm	196 mm
SHOULDER-ELBOW LENGTH (I)	330-345 mm	338 mm
BACK OF ELBOW TO WRIST PIVOT (G)	290-305 mm	292 mm

DUMMY MEETS SPECIFICATIONS

TECHNICIAN: IVAN MINKEWICZ

CALSPAN CORPORATION  
 TRANSPORTATION RESEARCH DEPARTMENT  
NECK FLEXION TEST

HYBRID III

DATE : 8-19-92

AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 45 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5-22.2 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY		10% - 70%	44 %
IMPACT VELOCITY		24.8 - 25.7 KPH	24.8 KPH
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G'S	23.33 G'S
	20 MS	17.60 - 22.60 G'S	21.57 G'S
	30 MS	12.50 - 18.50 G'S	16.75 G'S
MAX PENDULUM G'S ABOVE 30 MS		29 G'S MAX	16.75 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		34 - 42 MS	40.63 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	74.06 DEG.
	TIME	57 - 64 MS	60.75 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	88 - 108 N-M	99.2 N-M
	TIME	47 - 58 MS	54.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	122.13 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	103.25 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
 TRANSPORTATION RESEARCH DEPARTMENT  
NECK EXTENSION TEST  
 HYBRID III

DATE : 8-19-92

AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 45 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5 - 22.2 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY		10% - 70%	43 %
IMPACT VELOCITY		21.4 - 22.3 KPH	21.9 KPH
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G'S	18.48 G'S
	20 MS	14.00 - 19.00 G'S	18.20 G'S
	30 MS	11.00 - 16.00 G'S	15.96 G'S
MAX PENDULUM G'S ABOVE 30 MS		22 G'S MAX	15.96 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		38 - 46 MS	41.25 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	94.69 DEG.
	TIME	72 - 82 MS	74.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-80.0/-52.9 N-M	-76.3 N-M
	TIME	65 - 79 MS	70.00 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	153.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	130.50 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT  
THORAX IMPACT TEST  
HYBRID III

DATE : 8-20-92

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN 45

H.S. THORAX

CAL

TEST PARAMETER	HIGH SPEED TEST	TEST RESULTS
	SPECIFICATION	
TEMPERATURE	20.5 - 22.2 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY	10% - 70%	45 %
PENDULUM VELOCITY	23.7 - 24.6 KPH	23.7 KPH
MAXIMUM DEFLECTION	64 - 73 mm	64.7 mm
MAXIMUM RESISTIVE FORCE	4804 - 5538 NEWTONS	5515 NEWTONS
INTERNAL HYSTERESIS	69% - 85%	71.6 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT

KNEE IMPACT TEST

HYBRID III

DATE : 7-31-92

KNEE: LEFT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 45 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY	10% - 70%	46 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.7 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	4813 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT

KNEE IMPACT TEST

HYBRID III

DATE : 7-31-92

KNEE: RIGHT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 45 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	20.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	46 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.7 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	4942 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT

HEAD DROP TEST  
HYBRID III

DATE : 8-5-92

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 45 HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21 DEG. C
RELATIVE HUMIDITY	10% - 70%	45 %
PEAK RESULTANT ACCELERATION	225 - 275 G'S	247.5 G'S
PEAK LATERAL ACCELERATION	15 G'S MAX	5.1 G'S
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

HYBRID III EXTERNAL DIMENSIONS

S/N 150 HUMANOID

DUMMY SERIAL NO. 150

DATE: 8-21-92

TEMPERATURE		20.5 DEG. C
RELATIVE HUMIDITY		45 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)	429-434 mm	432 mm
LOCATION FOR WAIST CIRCUMFERENCE (BB)	226-231 mm	229 mm
CHEST CIRCUMFERENCE (Y)	970-1001 mm	998 mm
WAIST CIRCUMFERENCE (Z)	815-866 mm	864 mm
CHEST DEPTH (O)	213-229 mm	213 mm
H-POINT HEIGHT (C)	84-89 mm	89 mm
H-POINT FROM SEAT BACK (D)	135-140 mm	137 mm
SKULL CAP TO BACKLINE (H)	41-46 mm	43 mm
TOTAL SITTING HEIGHT (A)	879-889 mm	881 mm
THIGH CLEARANCE (F)	140-155 mm	142 mm
BUTTOCK KNEE LENGTH (K)	580-605 mm	592 mm
BUTTOCK POPLITAL LENGTH (N)	452-477 mm	470 mm
POPLITEAL LENGTH (L)	430-455 mm	452 mm
KNEE PIVOT HEIGHT (M)	485-501 mm	500 mm
FOOT LENGTH (P)	252-267 mm	259 mm
FOOT BREADTH (W)	91-107 mm	96 mm
SHOULDER PIVOT FROM BACKLINE (E)	84-94 mm	94 mm
SHOULDER BREADTH (V)	422-437 mm	429 mm
SHOULDER PIVOT HEIGHT (B)	505-521 mm	513 mm
ELBOW REST HEIGHT (J)	190-211 mm	208 mm
SHOULDER-ELBOW LENGTH (I)	330-345 mm	338 mm
BACK OF ELBOW TO WRIST PIVOT (G)	290-305 mm	292 mm

DUMMY MEETS SPECIFICATIONS

TECHNICIAN: IVAN MINKEWICZ

CALSPAN CORPORATION  
 TRANSPORTATION RESEARCH DEPARTMENT

NECK FLEXION TEST

HYBRID III

DATE : 8-19-92

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN:150 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5-22.2 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY		10% - 70%	43 %
IMPACT VELOCITY		24.8 - 25.7 KPH	25.0 KPH
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G'S	23.67 G'S
	20 MS	17.60 - 22.60 G'S	21.74 G'S
	30 MS	12.50 - 18.50 G'S	17.62 G'S
MAX PENDULUM G'S ABOVE 30 MS		29 G'S MAX	17.62 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		34 - 42 MS	39.13 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	74.77 DEG.
	TIME	57 - 64 MS	59.5 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	88 - 108 N-M	107.2 N-M
	TIME	47 - 58 MS	53.88 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	117.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	98.13 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
 TRANSPORTATION RESEARCH DEPARTMENT  
NECK EXTENSION TEST  
 HYBRID III

DATE : 8-19-92

AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN:150 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5 - 22.2 DEG. C	21 DEG. C
RELATIVE HUMIDITY		10% - 70%	43 %
IMPACT VELOCITY		21.4 - 22.3 KPH	21.9 KPH
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G'S	18.47 G'S
	20 MS	14.00 - 19.00 G'S	18.46 G'S
	30 MS	11.00 - 16.00 G'S	16.0 G'S
MAX PENDULUM G'S ABOVE 30 MS		22 G'S MAX	16.0 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		38 - 46 MS	39.5 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	94.99 DEG.
	TIME	72 - 82 MS	72.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-80.0/-52.9 N-M	-79.4 N-M
	TIME	65 - 79 MS	68.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	149.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	128.63 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT  
THORAX IMPACT TEST  
HYBRID III

DATE : 8-20-92

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN 150 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	TEST RESULTS
	SPECIFICATION	
TEMPERATURE	20.5 - 22.2 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY	10% - 70%	43 %
PENDULUM VELOCITY	23.7 - 24.6 KPH	23.7 KPH
MAXIMUM DEFLECTION	64 - 73 mm	65.0 mm
MAXIMUM RESISTIVE FORCE	4804 - 5538 NEWTONS	5471 NEWTONS
INTERNAL HYSTERESIS	69% - 85%	74.4 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT

KNEE IMPACT TEST

HYBRID III

DATE : 7-31-92

KNEE: LEFT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 150 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY	10% - 70%	48 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.7 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	4991 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT

KNEE IMPACT TEST  
HYBRID III

DATE : 7-31-92

KNEE: RIGHT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 150 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY	10% - 70%	48 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.7 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	5235 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION  
TRANSPORTATION RESEARCH DEPARTMENT

HEAD DROP TEST

HYBRID III

DATE : 8-7-92

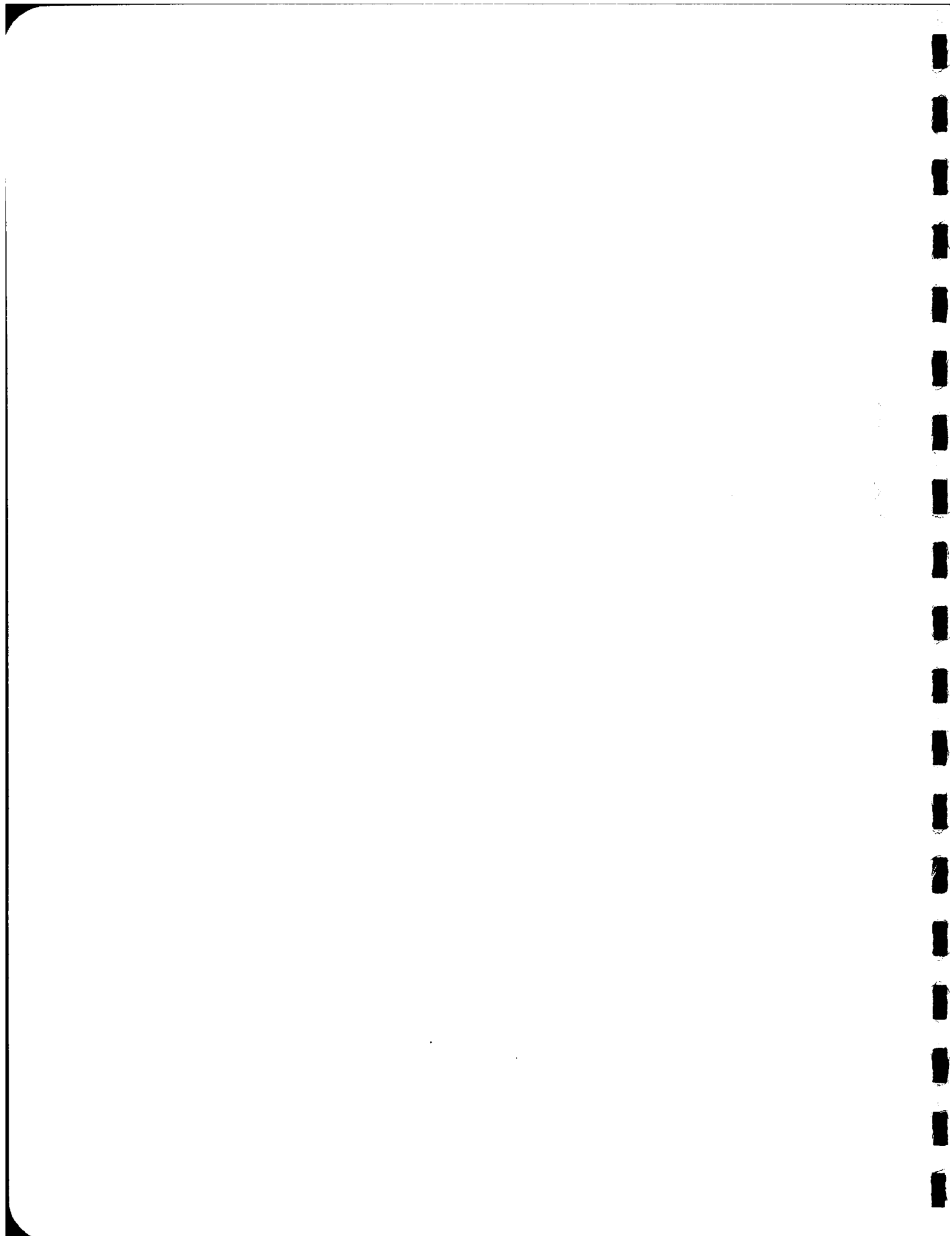
CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 150 HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY	10% - 70%	45 %
PEAK RESULTANT ACCELERATION	225 - 275 G'S	261.2 G'S
PEAK LATERAL ACCELERATION	15 G'S MAX	1.5 G'S
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ



Appendix D

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENT CALIBRATION FOR DRIVER DUMMY  
(6 Month Calibration Minimum)

DRIVER DUMMY S/N 45	Serial #	Manufacturer	Calibration		
			Last	Next	
Head	X	A12C	ENDEVCO	9/92	3/93
	Y	A60C	ENDEVCO	9/92	3/93
	Z	A84G	ENDEVCO	9/92	3/93
Chest	X	EM94	ENDEVCO	9/92	3/93
	Y	A83G	ENDEVCO	9/92	3/93
	Z	A30G	ENDEVCO	9/92	3/93
Right Femur Load Cell	952	GSE	5/92	11/92	
Left Femur Load Cell	951	GSE	5/92	11/92	
Neck Load Cell	X	269	DENTON	8/91	2/92
	Y	269	DENTON	8/91	2/92
	Z	269	DENTON	8/91	2/92
Neck Moment	X	269	DENTON	8/91	2/92
	Y	269	DENTON	8/91	2/92
	Z	269	DENTON	8/91	2/92
Chest Deflection Gauge Hybrid III Use Only	45	HUMANOID	7/92	1/93	
Lap Belt Load Cells	123	LEBOW	5/92	11/92	
Shoulder Belt Load Cells	127	LEBOW	5/92	11/92	
Belt Stretch Transducer	E1	CALSPAN	8/92	2/93	

INSTRUMENT CALIBRATION FOR PASSENGER DUMMY  
(6 Month Calibration Minimum)

PASSENGER DUMMY S/N150	Serial #	Manufacturer	Calibration		
			Last	Next	
Head	X	A39J	ENDEVCO	9/92	3/93
	Y	A33F	ENDEVCO	9/92	3/93
	Z	A27F	ENDEVCO	9/92	3/93
Chest	X	A28F	ENDEVCO	8/92	2/93
	Y	EP58	ENDEVCO	7/92	1/93
	Z	A08A	ENDEVCO	7/92	1/93
Right Femur Load Cell	955	GSE	5/92	11/92	
Left Femur Load Cell	954	GSE	5/92	11/92	
Neck Load Cell	X	76	DENTON	7/91	1/92
	Y	76	DENTON	7/91	1/92
	Z	76	DENTON	7/91	1/92
Neck Moment	X	76	DENTON	7/91	1/92
	Y	76	DENTON	7/91	1/92
	Z	76	DENTON	7/91	1/92
Chest Deflection Gauge Hybrid III Use Only	150	HUMANOID	7/91	1/92	
Lap Belt Load Cells	133	LEBOW	5/92	11/92	
Shoulder Belt Load Cells	135	LEBOW	5/92	11/92	
Belt Stretch Transducer	E2	CALSPAN	8/92	2/93	

INSTRUMENT CALIBRATION FOR VEHICLE ACCELEROMETERS  
(6 Month Calibration Minimum)

	Serial #	Manufacturer	Calibration	
			Last	Next
Left Seat Rear Crossmember	A178	CEC	4/92	10/92
Right Rear Seat Crossmember	A142	CEC	7/92	1/93
Top of Engine	A83	CEC	7/92	1/93
Bottom of Engine	A69	CEC	6/92	12/92
Left Disc Brake Caliper	A152	CEC	4/92	10/92
Right Disc Brake Caliper	A70	CEC	8/92	2/93
Instrument Panel	A182	CEC	4/92	10/92
Left Rear Crossmember	A155	CEC	6/92	12/92
Right Rear Crossmember	A175	CEC	4/92	10/92

Appendix E

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

## Seats & Safety Belts



X1123



X1142

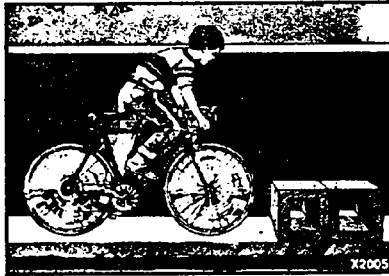
### ■ *Safety Belts— They're For Everyone (Cont.)*

This figure lights up when you turn the key to **Run** or **Start**. When your safety belt isn't buckled, you'll hear a chime, too. It's the reminder to buckle up. In many states and Canadian provinces, the law says to wear safety belts. Here's why: **They work.**

You never know if you'll be in a crash. If you do have a crash, you don't know if it will be a bad one.

A few crashes are very mild. In them, you won't get hurt even if you're not buckled up. And some crashes can be so serious, like being hit by a train, that even buckled up a person wouldn't survive. But most crashes are in between. In many of them, people who buckle up can survive and sometimes walk away. Without belts they could be badly hurt or killed.

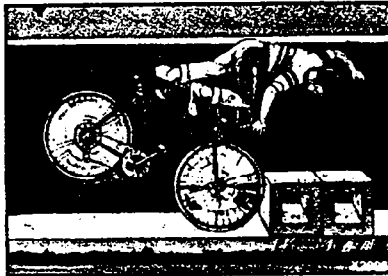
After 25 years of safety belts in vehicles, the facts are clear. In most crashes buckling up does matter . . . a lot!



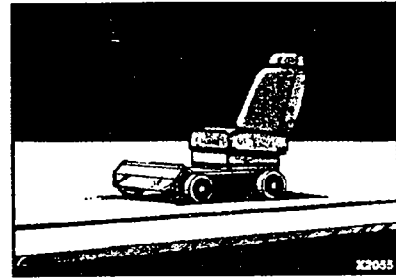
### **Why Safety Belts Work**

When you ride in or on anything, you go as fast as it goes.

1. For example, if the bike is going 10 mph (16 km/h), so is the child.

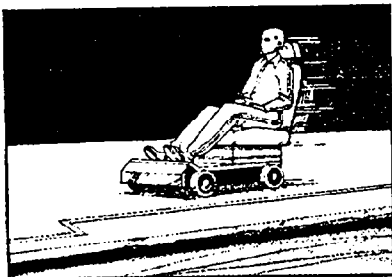


2. When the bike hits the block, it stops. But the child keeps going!

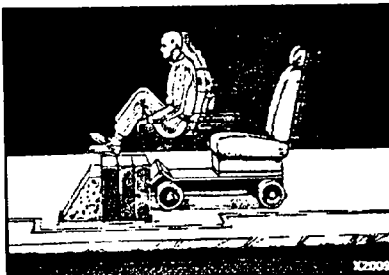


3. Take the simplest "car." Suppose it's just a seat on wheels.

## Seats & Safety Belts



*Why Safety Belts Work (CONT.)*  
4. Put someone on it.



5. Get it up to speed. Then stop the "car." The rider doesn't stop.



6. The person keeps going until stopped by something. In a real vehicle, it could be the windshield...



7. or the instrument panel...



8. or the safety belts!

With safety belts, you slow down as the vehicle does. You get more time to stop. You stop over more distance, and your strongest bones take the forces. That's why safety belts make such good sense.

***Here Are Questions Many People Ask About Safety Belts—and the Answers***

**Q:** Won't I be trapped in the vehicle after an accident if I'm wearing a safety belt?

**A:** You could be—whether you're wearing a safety belt or not. But you can easily unbuckle a safety belt, even if you're upside down. And your chance of being conscious during and after an accident, so you can unbuckle and get out, is much greater if you are belted.

**Q:** Why don't they just put in air bags so people won't have to wear safety belts?

**A:** "Air bags," or Supplemental Inflatable Restraint systems, are in some vehicles today and will be in more of them in the future. But they are supplemental systems only—so they work with safety belts, not instead of them. Every "air bag" system ever offered for sale has required the use of safety belts. Even if you're in a vehicle that has "air bags," you still have to buckle up to get the most protection. That's true not only in frontal collisions, but especially in side and other collisions.

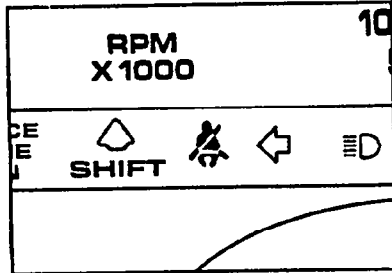
**Q:** If I'm a good driver, and I never drive far from home, why should I wear safety belts?

**A:** You may be an excellent driver, but if you're in an accident—even one that isn't your fault—you and your passengers can be hurt. Being a good driver doesn't protect you from things beyond your control, such as bad drivers.

Most accidents occur within 25 miles (40 km) of home. And the greatest number of serious injuries and deaths occur at speeds of less than 40 mph (65 km/h).

Safety belts are for everyone.

## Seats & Safety Belts



### Safety Belt Reminder Light

When the key is turned to Run or Start, a light will come on for about eight seconds to remind people to fasten their safety belts. Unless the driver's safety belt is buckled, a chime will also sound.

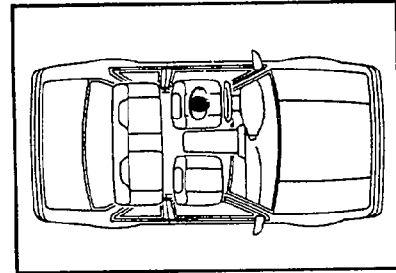
### ■ How to Wear Safety Belts Properly—Adults

This section is only for people of adult size.

#### CAUTION

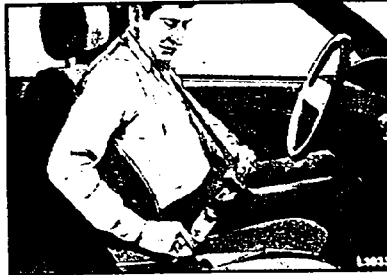
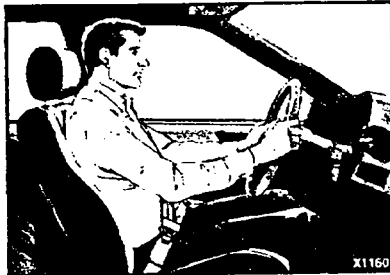
⚠ There are special things to know about safety belts and children. And there are different rules for babies and smaller children. If a child will be riding in your Chevrolet, see the *Index* under *Children and Safety Belts*. Follow those rules for everyone's protection.

First, you'll want to know which restraint systems your vehicle has. We'll start with the driver position.



### Driver Position

This section describes the driver's restraint system.



### **Lap-Shoulder Belt**

The driver has a lap-shoulder belt. Here's how to wear it properly.

1. Close and lock the door.
2. Adjust the seat so you can sit up straight. To see how, see the *Index* under *Seat Controls*.

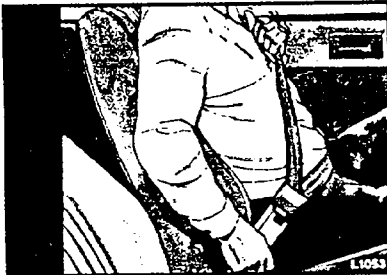
3. Pick up the latch plate and pull the belt across you. Don't let it get twisted.
4. Push the latch plate into the buckle until it clicks.

If the belt stops before it reaches the buckle, tilt the latch plate and keep pulling until you can buckle the belt.

If the belt isn't long enough, see the *Index* under *Safety Belt Extender*.

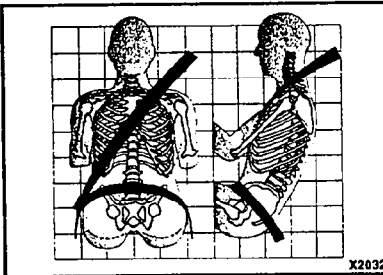
Make sure the release button on the buckle faces upward or outward so you would be able to unbuckle it quickly if you ever had to.

## Seats & Safety Belts



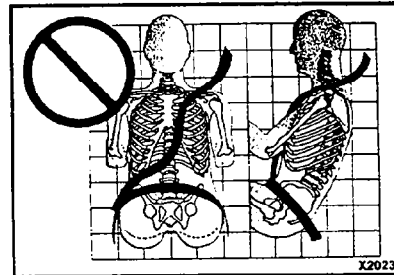
### Lap-Shoulder Belt (CONT.)

5. To make the lap part tight, pull down on the buckle end of the belt as you pull up on the shoulder belt.



The lap part of the belt should be low and snug below the hips, just touching the thighs. In a crash, this applies force to the strong pelvic bones. And you'd be less likely to slide under the lap belt. If you slid under it, the belt would apply force at your abdomen. This could cause serious or even fatal injuries. The shoulder belt should go over the shoulder and across the chest. These parts of the body are best able to take belt restraining forces.


The safety belt locks if there's a sudden stop or a crash.

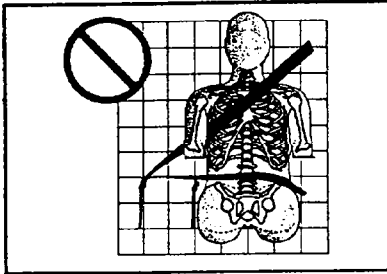


### Q: What's wrong with this?

- A: The shoulder belt is too loose. It won't give nearly as much protection this way.

### CAUTION

 You can be seriously hurt if your shoulder belt is too loose. In a crash you would move forward too much, which could increase injury. The shoulder belt should fit against your body.

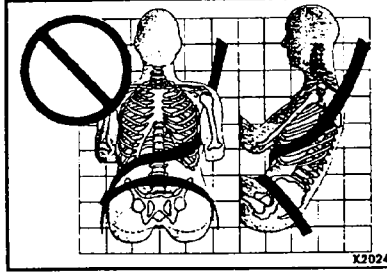


**Q:** What's wrong with this?

**A:** The belt is buckled in the wrong place.

**CAUTION**

⚠ You can be seriously injured if your belt is buckled in the wrong place like this. In a crash the belt would go up over your abdomen. The belt forces would be there, not at the pelvic bones. This could cause serious internal injuries. Always buckle your belt into the buckle nearest you.

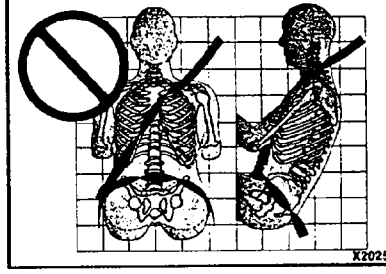


**Q:** What's wrong with this?

**A:** The shoulder belt is worn under the arm. It should be worn over the shoulder at all times.

**CAUTION**

⚠ You can be seriously injured if you wear the shoulder belt under your arm. In a crash, your body would move too far forward, which would increase the chance of head and neck injury. Also, the belt would apply too much force to the ribs, which aren't as strong as shoulder bones. You could also severely injure internal organs like your liver or spleen.



**Q:** What's wrong with this?

**A:** The belt is twisted across the body.

**CAUTION**

⚠ You can be seriously injured by a twisted belt. In a crash, you wouldn't have the full width of the belt to take impact forces. If a belt is twisted, make it straight so it can work properly, or ask your dealer to fix it.

## Seats & Safety Belts



### *Lap-Shoulder Belt (CONT.)*

To unlatch the belt, just push the button on the buckle. The belt should go back out of the way.


Before you close the door, be sure the belt is out of the way. If you slam the door on it, you can damage both the belt and your vehicle.

### ■ *Supplemental Inflatable Restraint System*

This section explains the driver's "air bag," or Supplemental Inflatable Restraint (SIR) system.

Here's the Most Important Thing to Know:

### **CAUTION**

 If you are ever in a crash and you're not wearing a safety belt, your injuries may be much worse. You can hit things inside the vehicle or be ejected from it. You can be seriously injured or killed. In the same crash, you might not be if you're buckled up. That's true even when you have the SIR system. And, a driver whose body is against or very close to the steering wheel when the "air bag" inflates can be injured. For protection in frontal and all other collisions, everyone in the vehicle, including children, should be properly restrained.