

REPORT NUMBER: CAL-91-N08

**NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST**

**ISUZU MOTORS LIMITED
1991 ISUZU RODEO
4-DOOR MPV**

NHTSA NUMBER: MM5701

CALSPAN TEST NUMBER: 7893-4

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

March 14, 1991



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 Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-90-D-02121. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

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:
[Signature]
Manager, New Car Assessment Program (NCAP)

Date of Report Acceptance

Har San Chan
Contracting Officer's Tech. Rep. (COTR)

JUN 24 1991

Date of Report Acceptance

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. CAL-91-N08		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 1991 Isuzu Rodeo 4-Door MPV				5. Report Date March 14, 1991	
				6. Performing Organization Code CAL	
7. Author(s) Vincent M. Paolini, Author Michael J. Kilgallon, Project Engineer Walter E. Levan, Program Manager				8. Performing Organization Report No. 7893-4	
9. Performing Organization Name and Address Calspan Advanced Technology Center P.O. Box 400 Buffalo, New York 14225				10. Work Unit No. J61-080-1047	
				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 March-April	
				14. Sponsoring Agency Code DOT/NHTSA/RM/OMI	
15. Supplementary Notes					
16. Abstract A frontal load cell barrier test of a 1991 Isuzu Rodeo 4-Door MPV was performed at Calspan Advanced Technology Center crash test facility in Buffalo, New York on March 14, 1991. The impact speed was 35.1 mph and the ambient temperature at the barrier face was 40°F. The maximum post-test vehicle crush was 16.3 inches. The test vehicle was equipped with a 3-point continuous loop belt system as each of the front seating positions. With regard to FMVSS 208 "Occupant Crash Protection," injury criteria, both the driver and passenger appear to exceed the maximum chest resultant acceleration. The driver dummy also appears to exceed the maximum head injury criteria.					
17. Key Words 35 mph 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	

Form DOT F1700.7 (8-69)

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 572-E 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	Part 572 Dummy In-Vehicle Position	3-4
2	Occupant Clearance Dimensions	3-5
3	Seat Belt Positioning Data	3-6
4	Driver Dummy to Steering Column/Wheel Dimensions	3-8
5	Camera Positions for Frontal Impacts	3-9
6	Vehicle Target Locations	3-11
7	Load Cell Locations on Fixed Barrier	3-12
8	Vehicle Accelerometer Locations	3-13
9	Test Vehicle Measurements	3-14
10	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	Seat Belt Performance Assessment Test Data	3-7
5	High Speed Camera Locations	3-10
6	Vehicle Measurements	3-15

Section 1

PURPOSE AND TEST PROCEDURE

This 35 mph frontal barrier impact test is part of the Composite FY 90 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 30 mph requirements.

The 35 mph 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 MM5701

A load cell barrier consisting of 36 load cells was impacted by a 1991 Isuzu Rodeo 4-Door MPV at a velocity of 35.1 mph. The test was performed at the Calspan Corporation Advanced Technology center on March 14, 1991. 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 15 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572-E, 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 on one previous test (MM0301). Injury criteria values were not exceeded in that test. Certification details, along with instrumentation calibration data, can be found in Appendices C and D.

The 83 channels of data were recorded on six 14-channel FM tape recorders. Appendix B contains the vehicle, load cell barrier and dummy response data traces. Load cells B3, B6 and C5 did not return to zero load after the impact. These load cells are located where the vehicle's frame impacted the barrier. It is assumed that these load cells were deformed by the vehicle's frame since a multi-purpose vehicle is inherently a stiff framed vehicle. Vehicle accelerometers #5 and #6 did not record accurately. These accelerometers experienced a cut wire during the impact. Velocity and displacement integrations are not available for these channels.

The driver's head struck the steering wheel rim and hub; the HIC was 1254.0. The maximum chest deceleration over 3 milliseconds was 68.9 g's and femur loads were 568.1 and 469.3 pounds.

The right front passenger's HIC was 884.3 and maximum chest deceleration over 3 milliseconds was 70.5 g's. Femur loads were 334.3 and 420.4 pounds.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1991 Isuzu Rodeo MPV 4-DoorNHTSA No.: MM5701 VIN.: 4S2CG58E4M4300150Body Color: Silver Date Of Manufacture: May 1990Engine: 4 Cylinders; - C.I.D.; - Liters; - CCX Gas; - Diesel; - TurbochargedX Longitudinal; X TransverseTransmission: 5 Speed; X Manual; - Automatic; - OverdriveFinal Drive: - Front Wheel; X Rear Wheel; - Four WheelDate Received: 1-29 Odometer Reading: 143 miles- A/C; X P/S; X P/B; - P/wdo.; - Tilt Wheel- P/seats; - Cruise ControlType of Occupant Restraint: 3-point continuous restraint system.DATA RECORDED FROM VEHICLE'S TIRE PLACARD:Tire Pressure (at capacity): Front 35 psi, Rear 35 psiRecommended Tire Size: P225/75R15Recommended Cold Tire Pressure: Front 29 psi, Rear 29 psiTires on Vehicle: P225/75R15; Manufacturer: Dunlop SP QualifierNumber of Occupants: 3 Front; 3 Rear; - 3rd Seat; 6 TOTALType of Front Seats: - Bucket; X Bench; - Split BenchType of Front Seat Back: X Fixed - Adj. With - Lever - Rot. Knob

Rated Cargo and Luggage

Weight (RCLW) = 300 lbs.GVWR 4800 lbs. GAWR: Front 2200 lbs. Rear 2700 lbs.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

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

Right Front = 770 lbs. Right Rear = 900 lbs.
 Left Front = 910 lbs. Left Rear = 870 lbs.
 TOTAL FRONT WEIGHT = 1680 lbs. (48.7 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 1770 lbs. (51.3 % of Total Vehicle Weight)
 TOTAL DELIVERY WEIGHT = 3450 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (3450 lbs.)
 DSC = Designated Seating Capacity (6)
 RCLW = 300 lbs.
 Target Test Weight = UDW + RCLW + (2 dummies x 167 lbs./dummy)
 Target Test Weight = 4084 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 296 POUNDS CARGO:

Right Front = 900 lbs. Right Rear = 1160 lbs.
 Left Front = 970 lbs. Left Rear = 1050 lbs.
 TOTAL FRONT WEIGHT = 1870 lbs. (45.8 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 2210 lbs. (54.2 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 4080 lbs.
 Weight of ballast secured in vehicle trunk area = 50 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude: RF 32.8 LF 32.9 RR 34.1 LR 34.3
 Test Attitude: RF 32.5 LF 33.0 RR 33.1 LR 33.7
 Wheel Base: 108.8 in.; C.G. = 58.9 in. rearward of front wheel C/L
 Remarks: 19.7 gallons 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 Angle: 0°
 Date of Test: 3-14-91 Time of Test: 12:25
 Ambient Temperature: 40 °F at impact area
 Temperature in Occupant Compartment: 72 °F
 Windshield Molding Temperature: 72 °F
 Required Impact Velocity Range: 34.5 to 35.5 mph
 Impact Velocity: primary = 35.1 mph, secondary = 35.1 mph
 Distance From Front Bumper to Barrier Face When
 Entering Speed Trap: 52 inches
 Exiting Speed Trap: 12 inches

VEHICLE REBOUND AND CRUSH (inches):

Vehicle Length: Pre-test = R 173.5 C_L 175.7 L 173.6
 Post-test = R 157.5 C_L 159.4 L 156.6
 Crush = R 16.0 C_L 16.3 L 17.0

Distance from front of test vehicle to point of impact:

R 12.2 C_L 11.9 L 13.5

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Upper Rim & Hub</u>	<u>"B" Pillar on Rebound</u>
Chest	<u>Hub & Rim</u>	<u>No Contact</u>
Abdomen	<u>No Contact</u>	<u>No Contact</u>
Left Knee	<u>Dash Panel</u>	<u>Glove Compartment Door</u>
Right Knee	<u>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>Tools Required</u>	<u>Tools Required</u>	<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>	<u>-</u>	<u>-</u>
Seat Shift (in.)	<u>None</u>	<u>None</u>	<u>-</u>	<u>-</u>

Glazing Damage

Backlight/Windshield The windshield sustained stress fractures but
remained intact.

Other Notable Impact Effects: -

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 Positioning Data
4. Seat Belt Performance Assessment Data
5. Driver Dummy to Steering Column Dimensions
6. Camera Locations
7. Vehicle Target Locations

II. OVR DATA

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

Table 2
DUMMY INJURY CRITERIA VALUES

NHTSA No.: MM5701 Vehicle: 1991 Isuzu Rodeo 4-Door MPV

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-152.0	30.5	56.2	154.7
Position #2 - Passenger	-58.8	9.1	62.9	67.6

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-73.0	8.4	21.6	68.9
Position #2 - Passenger	-60.3	18.9	44.4	70.5

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

	MAXIMUM FORCE - FEMUR LOAD (lbs.)	
	LEFT FEMUR	RIGHT FEMUR
Position #1 - Driver	568.1	469.3
Position #2 - Passenger	334.3	420.4

	MAXIMUM FORCE - SEAT BELT LOADS (lbs.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	2269.5	-	3011.8
Position #2 - Passenger	2257.2	2781.3	-

	HEAD INJURY CRITERIA (HIC)			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
Position #1 - Driver	1254.0	.05124	.07512	77.3
Position #2 - Passenger	884.3	.05676	.09264	57.1

HIC is as defined in FMVSS 208. The maximum time interval from t₁ to t₂ is 36 milliseconds.

Table 3
HYBRID III NECK AND CHEST DATA SHEET

Vehicle Year/Make/Model/Body Style: 1991 Isuzu Rodeo 4-Door MPV

Vehicle NHTSA No.: MM5701 Test Date: March 14, 1991

MAXIMUM VALUES	DRIVER DUMMY ID # <u>45</u>	PASSENGER DUMMY ID # <u>150</u>
Neck Load X	553.7	572.8
Neck Load Y	-289.8	-149.4
Neck Load Z	3456.4	1063.8
Neck Moment X	-491.1	616.2
Neck Moment Y	847.0	1360.8
Neck Moment Z	568.0	-889.3
Chest Deflection X (in.)	1.6	1.6
Time of Max. Occurance	54.6 msec	63.0 msec

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

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION

Test No.: MM5701 Vehicle: 1991 Isuzu Rodeo 4-Door MPV

SEAT TYPE:

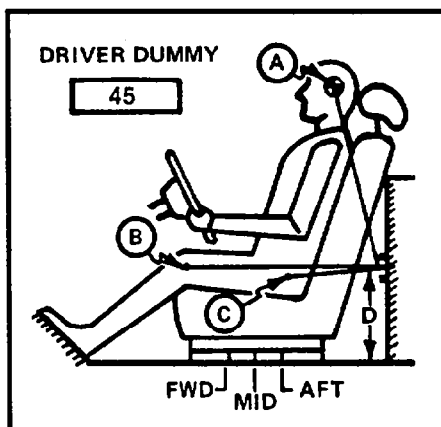
X Bench
- Bucket
- Split Bench

ADJUSTER TYPE:

X Manual
- Power

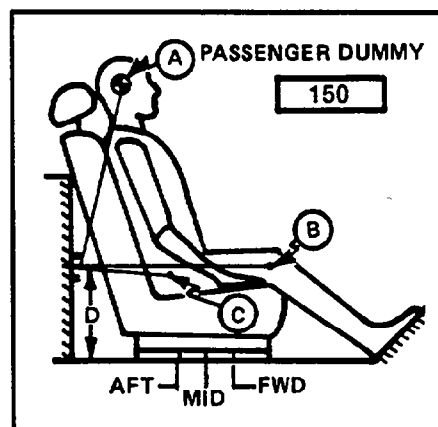
SEAT BACK TYPE:

X Fixed
- Adjustable Reclining



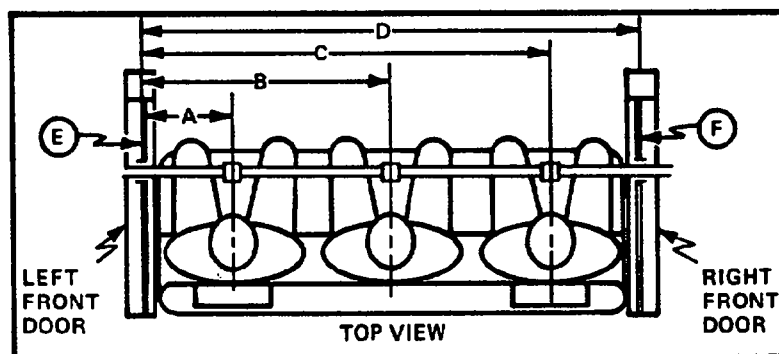
MEASUREMENT LOCATION

- A - Head Target
- B - Knee Joint
- C - Approximate 'H' Point
- D - Sill to Reference Point



A = 23.8 in. 20 Degrees
 B = 27.8 in. 90 Degrees
 C = 11.8 in. 108 Degrees
 D = 14.5 in.

A = 23.8 in. 20 Degrees
 B = 27.6 in. 90 Degrees
 C = 12.2 in. 105 Degrees
 D = 14.5 in.



S/N 45

DUMMY ID

150

A = Left Door to Driver Centerline 12.7 in.
 B = Left Door to Center Passenger Centerline - in.
 C = Left Door to Right Passenger Centerline 41.8 in.
 D = Left Door to Right Door 54.7 in.
 E, F = Window Glass Height (Right and Left Must Be Equal) 11.0 in.

Figure 2
OCCUPANT CLEARANCE DIMENSIONS

	DRIVER	PASSENGER
HH	14.6	14.8
HW	21.7	21.3
CD	20.2	20.5
CS	12.8	-
KDL	3.8	4.1
KDR	4.9	4.2
SA	Fixed	Fixed
TA	21°	21°
HSW	17.1	-

HH = Head to Windshield Header

HW = Head to Windshield

HSW = Head to Steering Wheel

CD = Chest to Dash

CS = Chest to Steering Wheel

KD(L/R) = Knee to Dash (Left/Right)

SA = Seat Back Angle

TA = Torso Angle

HA = Head Target to "A" Pillar

HR = Head to Side Roof

HS = Head to Side Window

AD = Arm to Door

HD = Hip to Door

KK = Knee to Knee

AA = Ankle to Ankle

	DRIVER	PASSENGER
HR	7.9	7.9
HS	9.7	9.8
AD	4.1	4.1
HD	6.1	5.8
KK	9.0	6.5
HA	20.8	20.9
AA	10.4	6.5

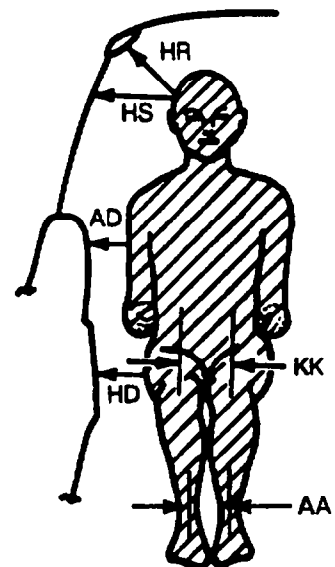
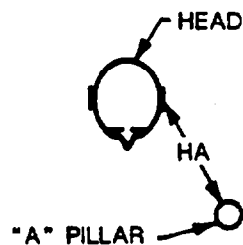
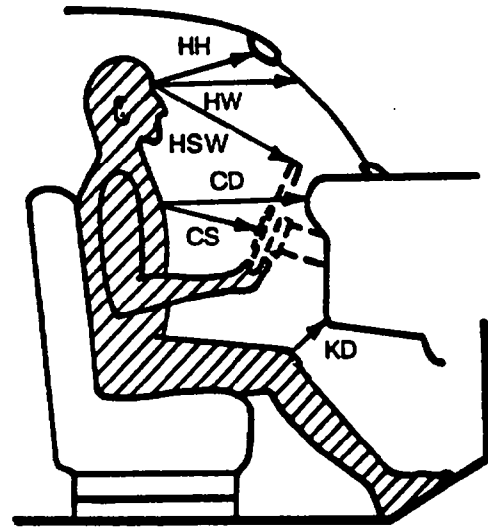
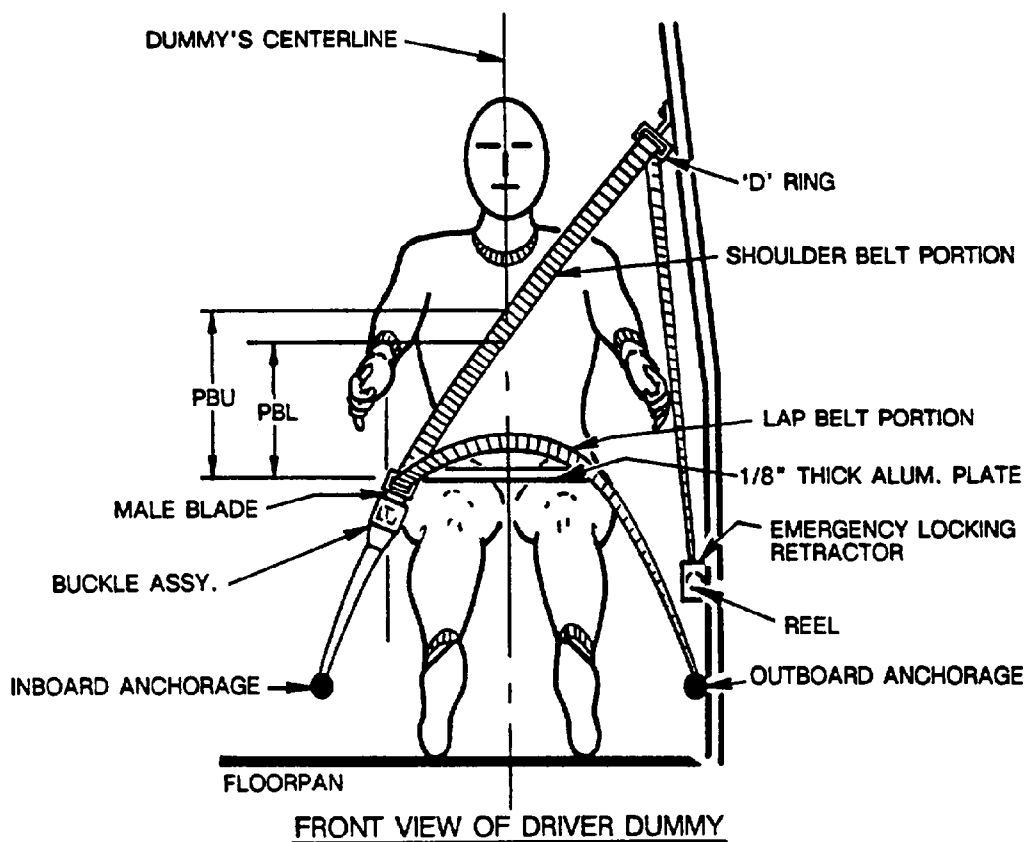


Figure 3
SEAT BELT POSITIONING DATA



	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
<u>PBU</u> -- Top surface of alum. plate to upper edge	12.5	12.5
<u>PBL</u> -- Top surface of alum. plate to belt lower edge	9.5	9.5
<u>LAP BELT TENSION</u>	2.0 lbs.	2.0 lbs.
<u>SHOULDER BELT TENSION</u>	-	-

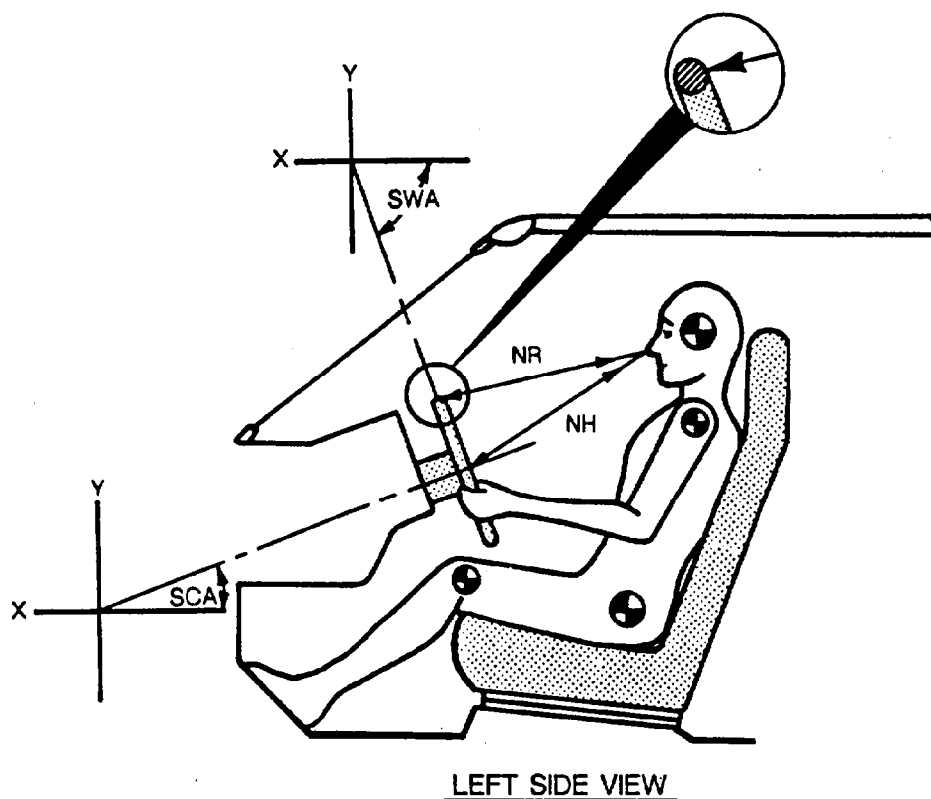
Table 4

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

<u>BELT LENGTH DATA:</u>	<u>Driver</u>	<u>Passenger</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>83.5"</u>	<u>83.5"</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>34.5"</u>	<u>34.5"</u>
Lap belt length as measured on Part 572 Dummy.	<u>34.5"</u>	<u>34.5"</u>
<u>SHOULDER BELT SPOOL-OFF DATA:</u>		
As determined by film analysis.	<u>4.5"</u>	<u>4.0"</u>
As determined mechanically.	<u>4.2"</u>	<u>4.5"</u>
As determined electronically.	<u>6.0"</u>	<u>2.8"</u>
<u>BELT STRETCH DATA:</u>		
Measured electronically between shoulder belt load cell and the "D" ring.	<u>3.2 in/ft</u>	<u>1.1 in/ft</u>
Measured mechanically	<u>0.0 in/ft</u>	<u>0.0 in/ft</u>

Figure 4

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



		MEASUREMENTS	
<u>NR</u>	-- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim	15.6	Inches
<u>NH</u>	-- Distance from tip of dummy's nose to center of steering column hub	16.1	Inches
<u>SCA</u>	-- Angle of steering column relative to the horizontal X axis	24.0	Degrees
<u>SWA</u>	-- Angle of steering wheel relative to the horizontal X axis	-66.0	Degrees

Figure 5
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

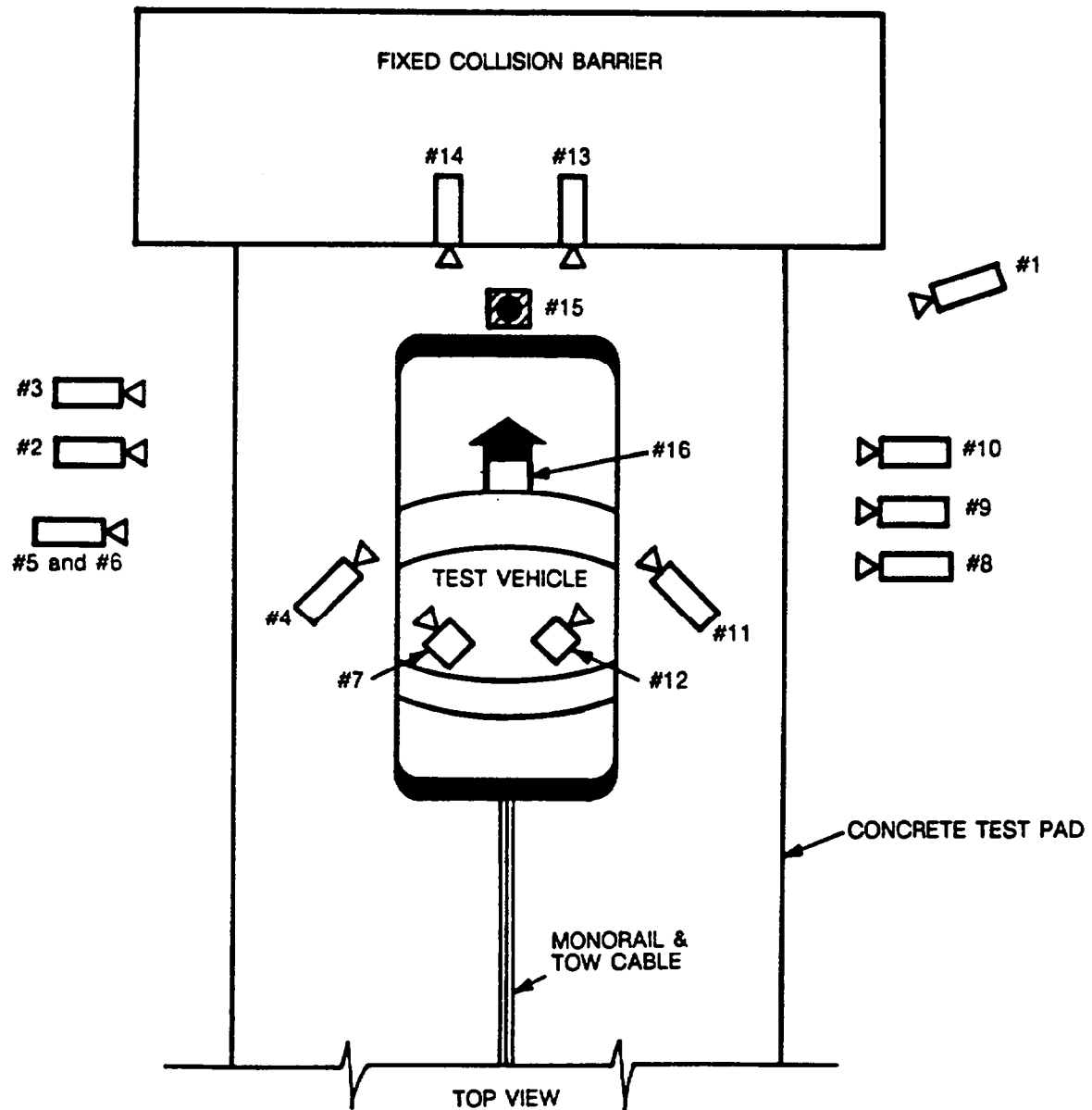


Table 5

HIGH-SPEED CAMERA LOCATIONS

CAMERA NO.	VIEW	CAMERA POSITIONS (in)*			ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Camera	-	-	-	-	-	-	24
2	Overall Left Side	216	55	41	-6	199	13	550
3	Left Side View	297	45	41	-2	280	25	N.T.
4	Driver and Interior View	98	92	68	-13	81	13	660
5	Steering Column (Bottom)	276	79	47	-1	259	25	550
6	Steering Column (Top)	276	79	71	-8	259	25	605
7	Left Belt	-	-	-	-	-	8	540
8	Overall Right Side	217	63	41	-2	200	13	740
9	Right Side View	274	48	41	-1	257	25	620
10	Right Passenger View	281	66	54	-2	264	35	480
11	Passenger and Interior View	100	95	68	-16	83	25	540
12	Right Belt	-	-	-	-	-	8	440
13	Passenger Front View	24	-5	72	-39	-	13	540
14	Driver Front View	24	-5	72	-35	-	13	535
15	Windshield View	0	0	125	-45	-	13	555
16	Pit View of Engine	0	32	-120	90	-	13	870

*X = film plane to monorail centerline

Y = film plane to impact location

Z = film plane to ground

** = referenced to horizontal plane

The image contains three technical drawings of a vehicle, likely a station wagon, for a crash test setup. The drawings include dimensions in inches.

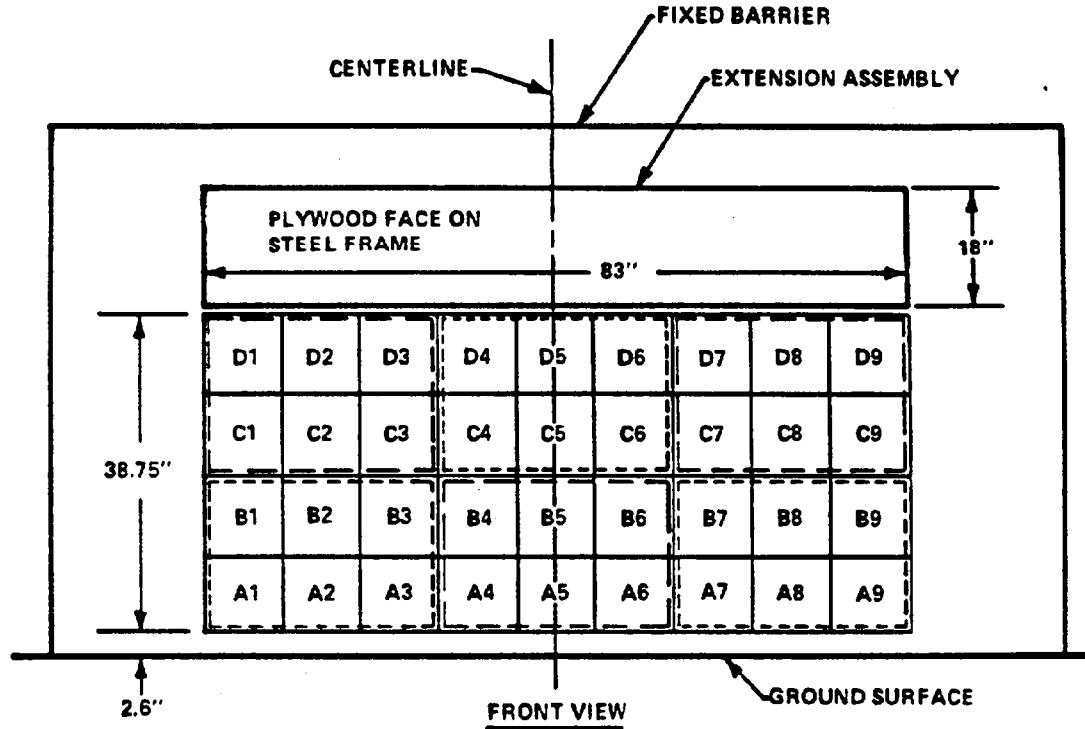
- Top View:** Shows the vehicle from above. Dimensions include a width of 77.5 inches, a distance of 44.0 inches from the front to the centerline (C/L), and a distance of 20.0 inches from the C/L to the rear. The distance from the front to the rear wheel center is 60.3 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches.
- Side View:** Shows the vehicle from the side. Dimensions include a height of 22.4 inches from the ground to the top of the vehicle, a height of 14.3 inches from the ground to the centerline (C/L), and a height of 22.4 inches from the C/L to the top of the vehicle. The distance from the front wheel center to the rear wheel center is 40.7 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches.
- Front View:** Shows the vehicle from the front. Dimensions include a width of 77.5 inches, a distance of 44.0 inches from the front to the centerline (C/L), and a distance of 20.0 inches from the C/L to the rear. The distance from the front to the rear wheel center is 60.3 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches. The distance from the front wheel center to the rear wheel center is 40.7 inches.

7893-4

Figure 7

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

TOP VIEW

The diagram shows a rectangular plate with the following dimensions and features:

- Overall width: 162.8
- Overall height: 106.4
- Left side features:
 - A vertical line at 30.5 from the left edge.
 - A vertical line at 28.0 from the left edge.
 - A vertical line at 24.3 from the left edge.
 - A vertical line at 58.6 from the left edge.
- Right side features:
 - A vertical line at 106.4 from the left edge.
- Internal features:
 - Four rounded rectangular shapes, each labeled with a vertical line and the number 1.
 - Two vertical lines, each labeled with the number 2.
 - Two vertical lines, each labeled with the number 3.
 - Two vertical lines, each labeled with the number 4.
 - Two vertical lines, each labeled with the number 5.
 - Two vertical lines, each labeled with the number 6.
 - Two vertical lines, each labeled with the number 7.
 - Two vertical lines, each labeled with the number 8.
 - Two vertical lines, each labeled with the number 9.
- Coordinate system:
 - Origin at the top-left corner.
 - X-axis pointing right.
 - Y-axis pointing down.
 - Z-axis pointing out of the page.

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

****Note:** Due to location the top engine accelerometer was removed prior to test.

Figure 9
TEST VEHICLE MEASUREMENTS

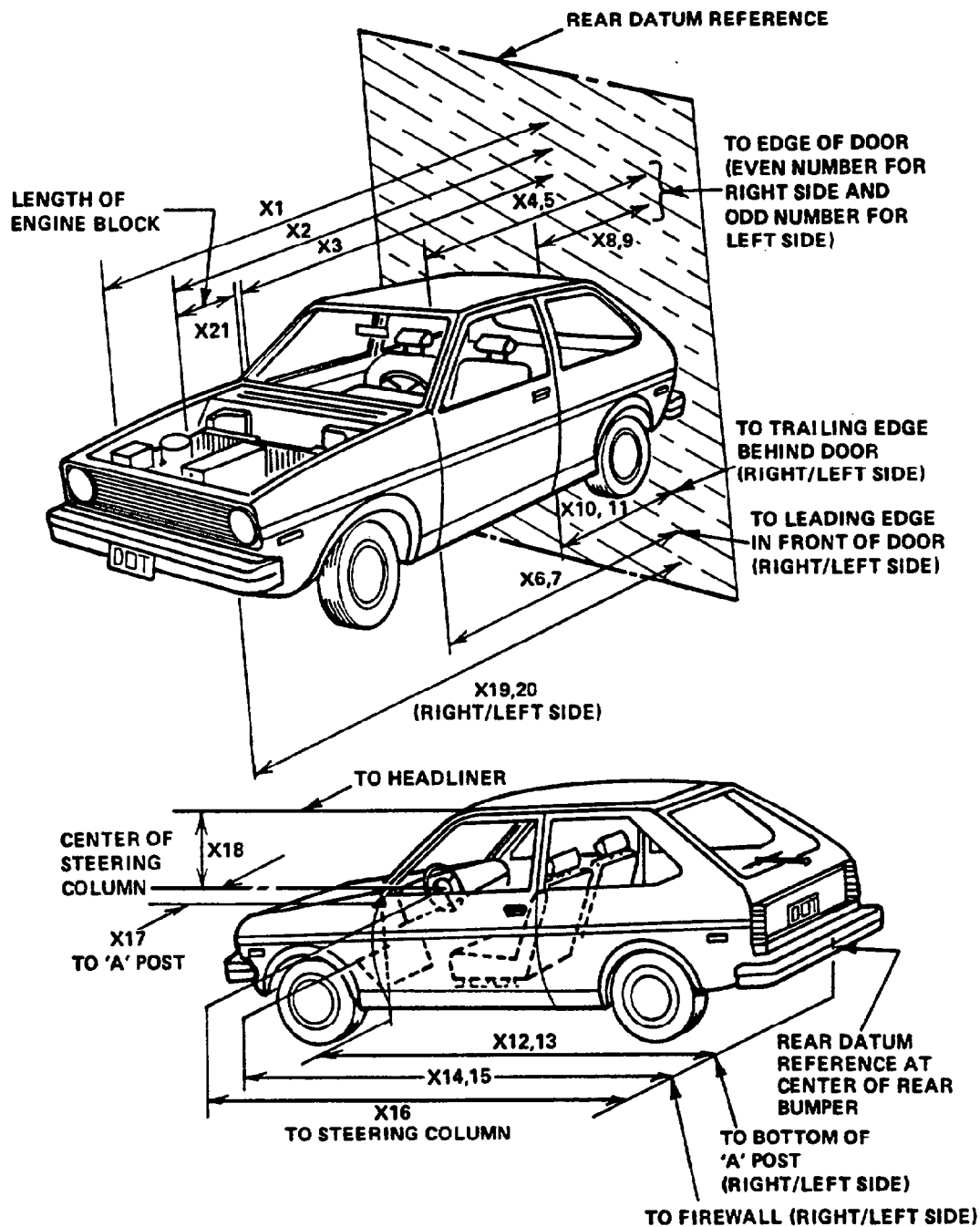


Table 6

VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	175.7	159.4	16.3
X2	Rear Surface of Vehicle to Front of Engine	156.1	148.9	7.2
X3	Rear Surface of Vehicle to Firewall	135.7	134.6	1.1
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	127.1	127.0	0.1
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	127.3	127.2	0.1
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	126.5	125.2	1.3
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	126.6	125.3	1.3
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	82.1	81.8	0.3
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	82.4	82.5	-0.1
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	81.6	80.3	1.3
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	81.9	80.9	1.0
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	126.3	124.6	1.7
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	126.6	124.9	1.7
X14	Rear Surface of Vehicle to Firewall, Right Side	136.5	134.2	2.3
X15	Rear Surface of Vehicle to Firewall, Left Side	136.2	135.2	1.0
X16	Rear Surface of Vehicle to Steering Column	108.9	108.3	0.6
X17	Center of Steering Column to "A" Post	14.5	15.1	-0.6
X18	Center of Steering Column to Headliner	17.3	17.4	-0.1
X19	Rear Surface of Vehicle to Right Side of Front Bumper	173.5	157.5	16.0
X20	Rear Surface of Vehicle to Left Side of Front Bumper	173.6	156.6	17.0
X21	Length of Engine Block	19.0	19.0	0.0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	117.3	116.3	1.0
CD	Rear Surface of Vehicle to Center of Dash Panel	117.4	115.7	1.7
LD	Rear Surface of Vehicle to Left Side of Dash Panel	117.5	117.0	0.5

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	POST-TEST ENGINE COMPARTMENT VIEW	A-17
A-16	FUEL CAP VIEW	A-18
A-17	PRE-TEST FRONT UNDERBODY VIEW	A-19
A-18	POST-TEST FRONT UNDERBODY VIEW	A-20
A-19	PRE-TEST FRONT SIDE UNDERBODY VIEW	A-21
A-20	POST-TEST FRONT SIDE UNDERBODY VIEW	A-22
A-21	PRE-TEST REAR UNDERBODY VIEW	A-23
A-22	POST-TEST REAR UNDERBODY VIEW	A-24
A-23	PRE-TEST DRIVER POSITION VIEW	A-25
A-24	POST-TEST DRIVER POSITION VIEW	A-26
A-25	PRE-TEST PASSENGER POSITION VIEW	A-27
A-26	POST-TEST PASSENGER POSITION VIEW	A-28
A-27	PRE-TEST DRIVER AND INTERIOR VIEW	A-29
A-28	POST-TEST DRIVER AND INTERIOR VIEW	A-30
A-29	PRE-TEST PASSENGER AND INTERIOR VIEW	A-31
A-30	POST-TEST PASSENGER AND INTERIOR VIEW	A-32
A-31	IMPACT VIEW	A-33

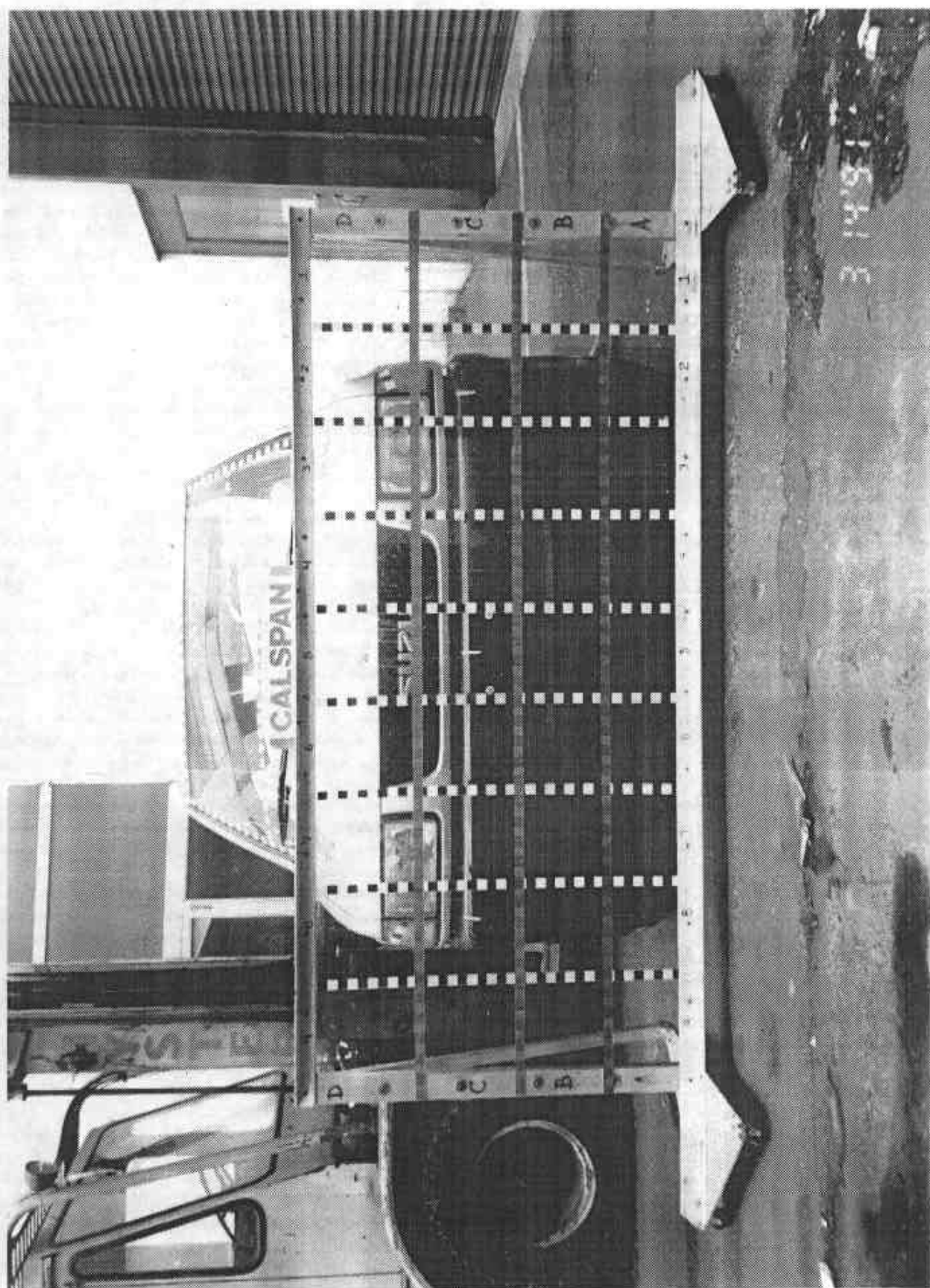


Figure A-1 LOAD CELL LOCATIONS



Figure A-2 PRE-TEST FRONT VIEW

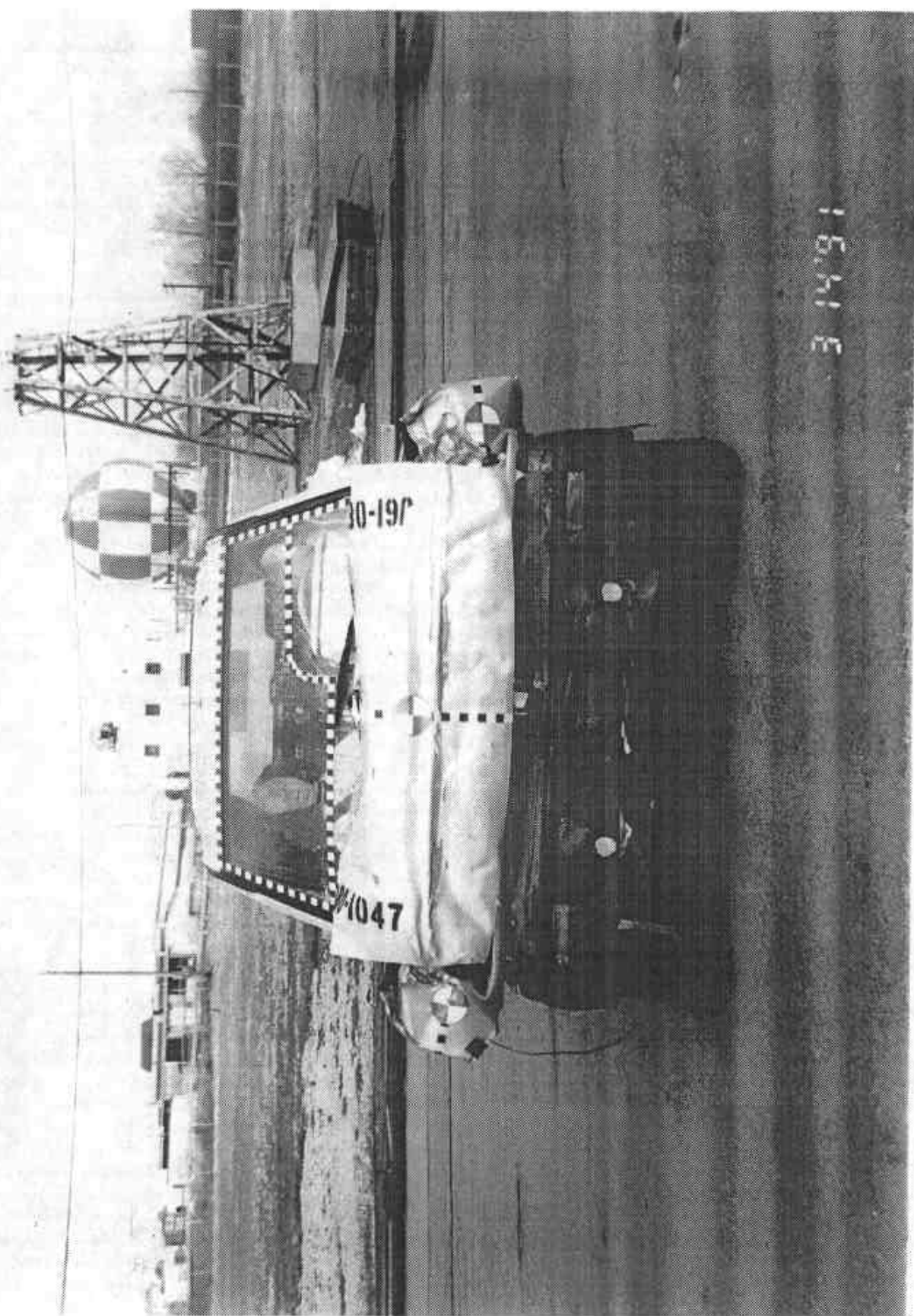
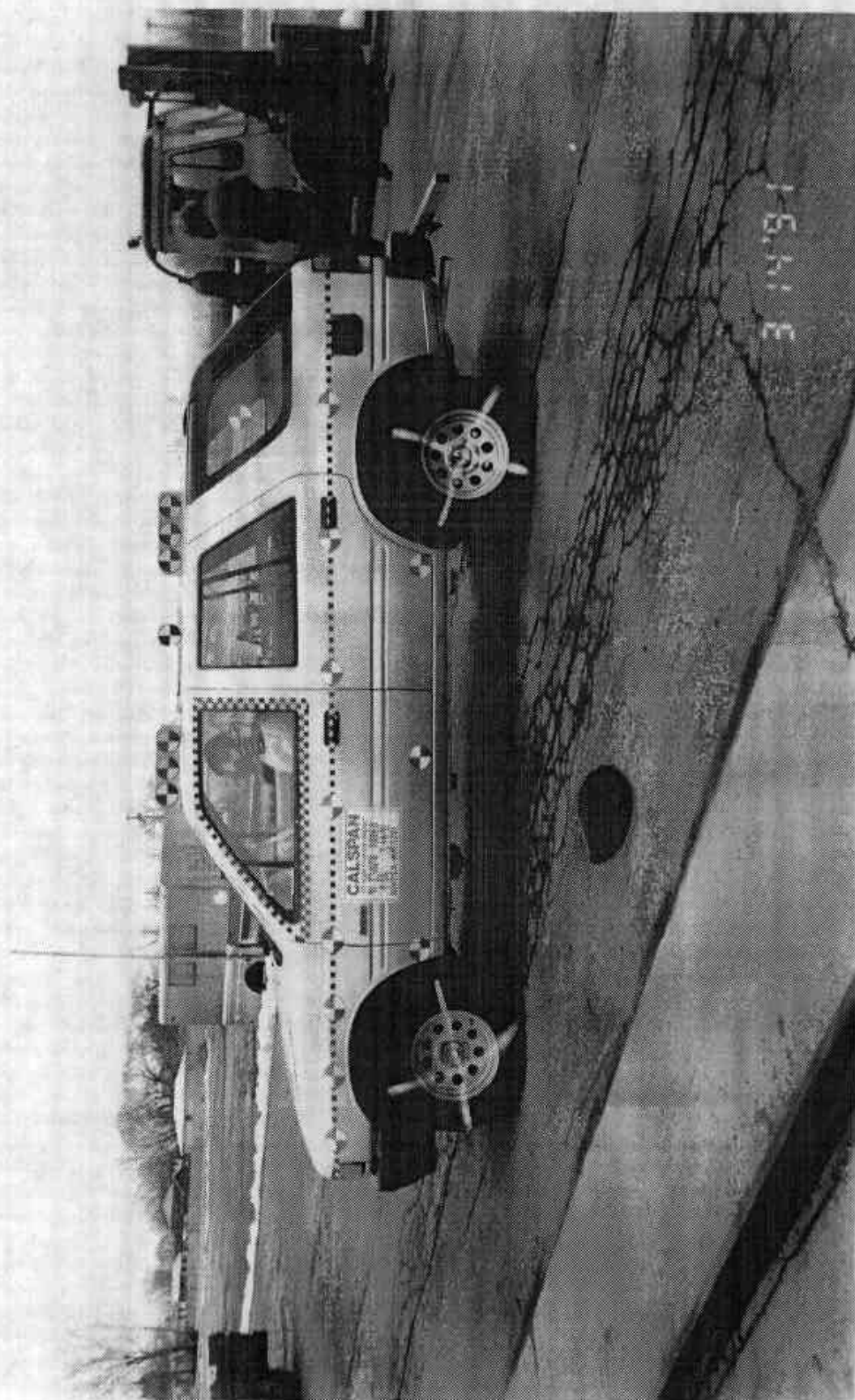


Figure A-3 POST TEST FRONT VIEW

A-5

7893-4

3 1491



A-6

7893-4

FIGURE A-4 PRE-TEST LEFT SIDE VIEW

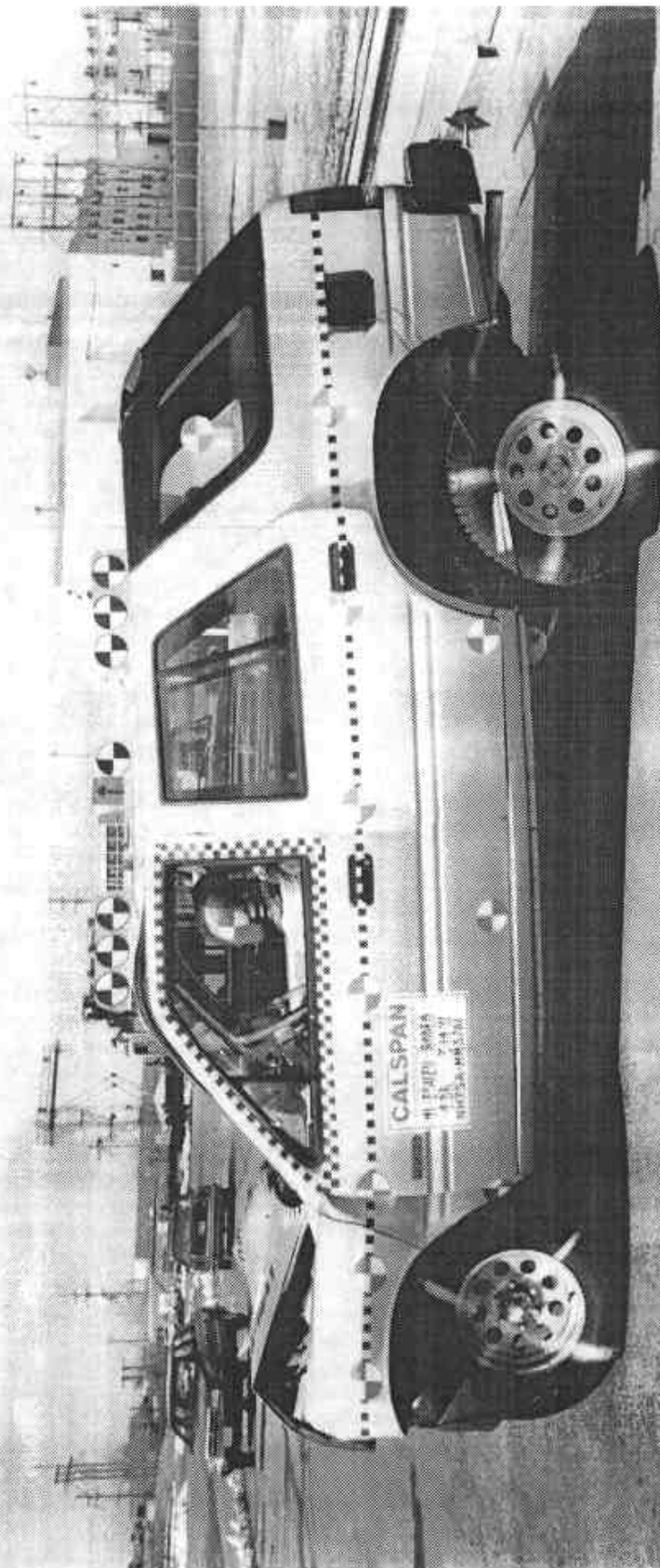


Figure A-5 POST TEST LEFT SIDE VIEW



1641 E
31491

Figure A-6 PRE-TEST RIGHT SIDE VIEW

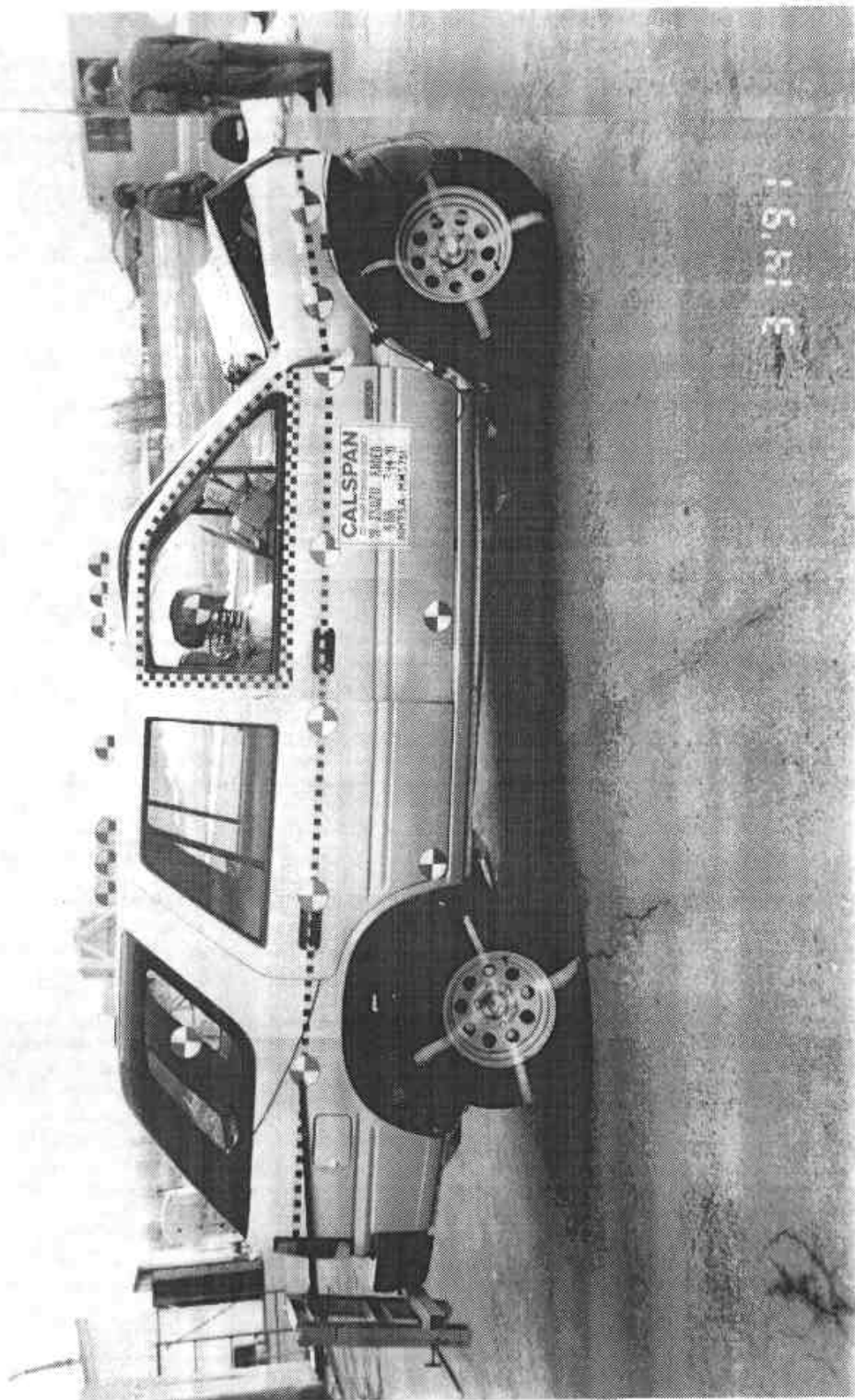


FIGURE A-7 POST-TEST RIGHT SIDE VIEW



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

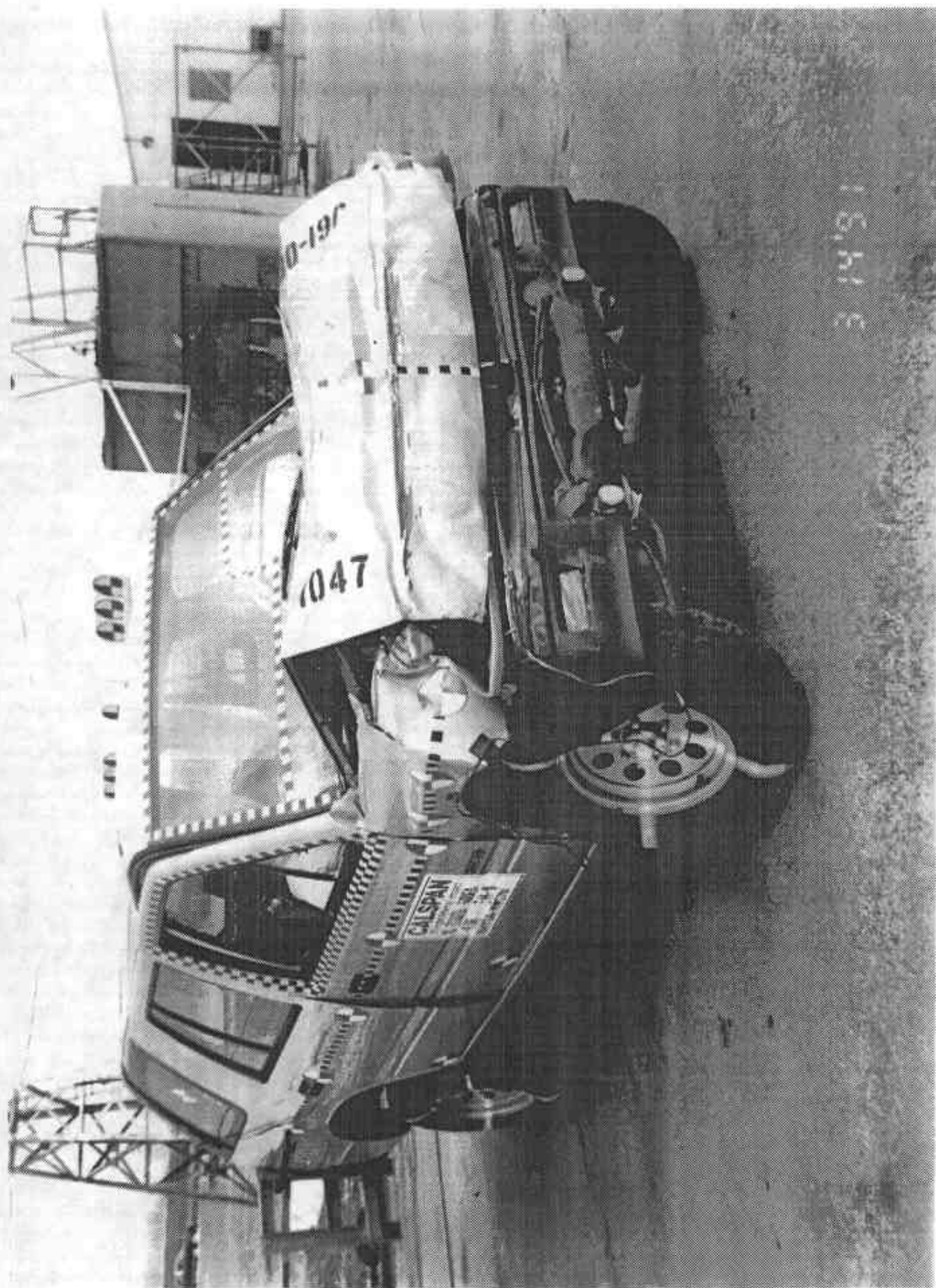


Figure A-9 POST-TEST RIGHT FRONT THREE-QUARTER VIEW



3 14'31

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



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

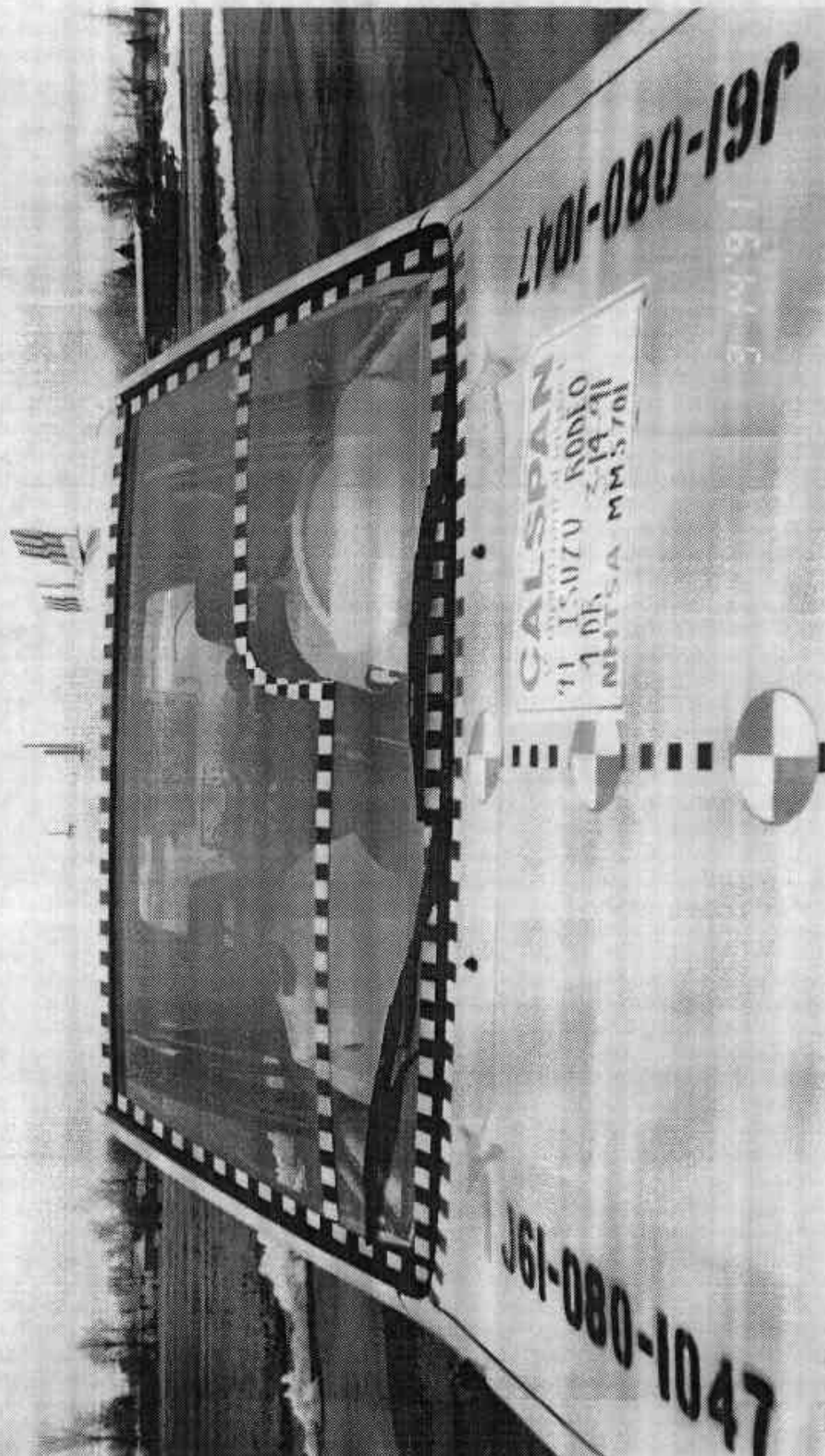


Figure A-12 PRE-TEST WINDSHIELD VIEW

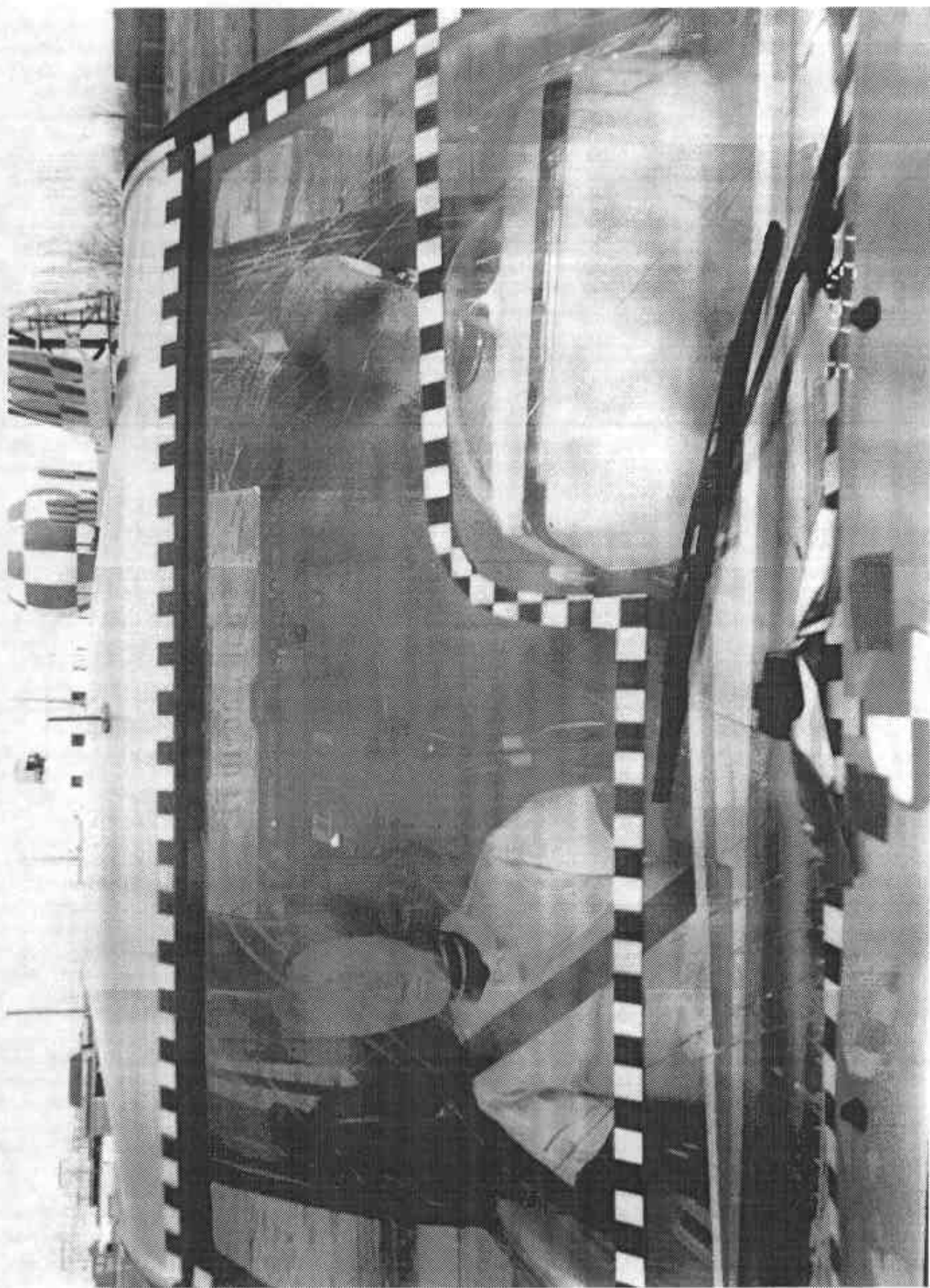


Figure A-13 POST-TEST WINDSHIELD VIEW

A-15

7893-4

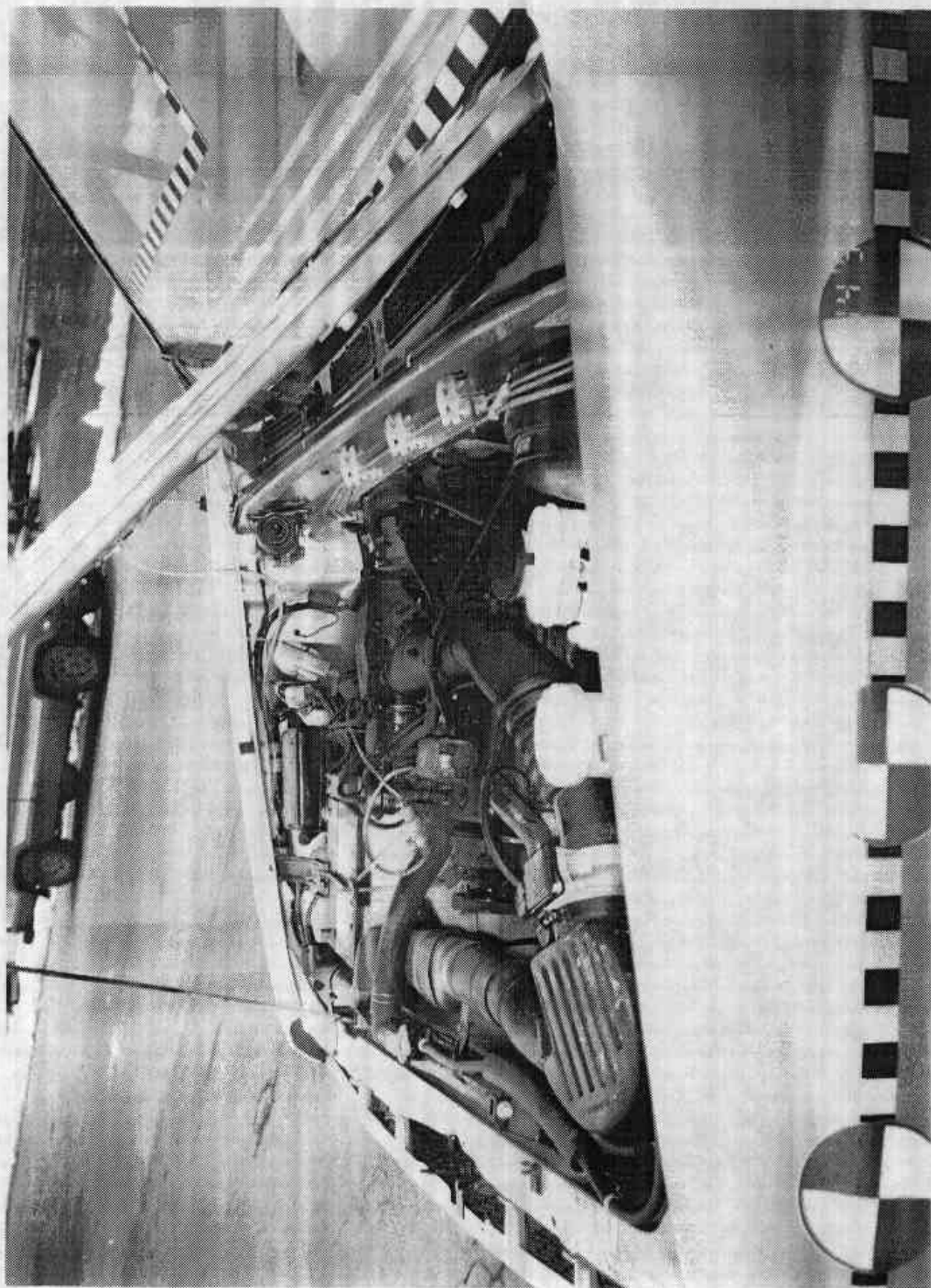


FIGURE A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-10

7893-4

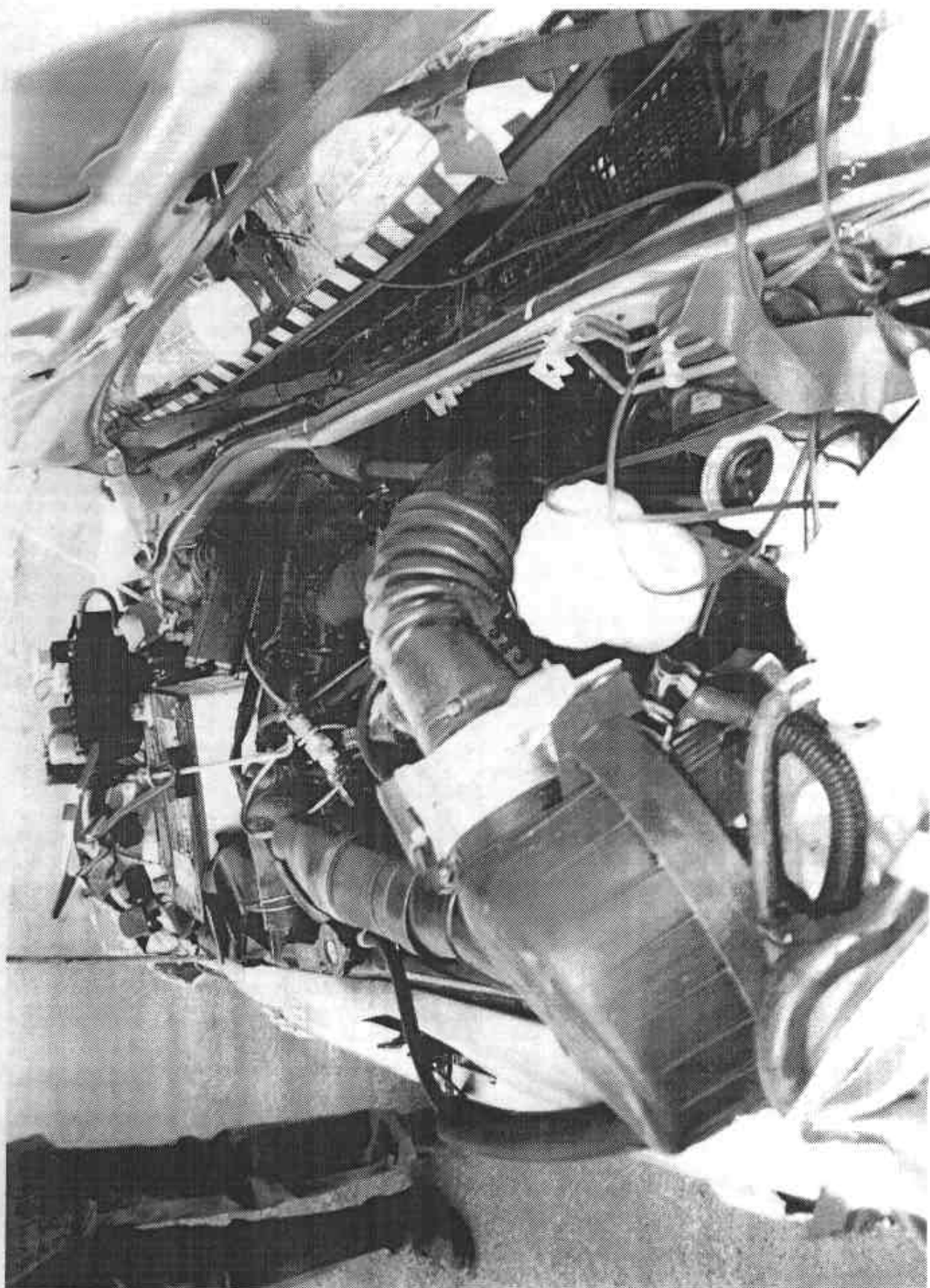


Figure A-16 POST-TEST ENGINE COMPARTMENT VIEW

A-17

7893-4

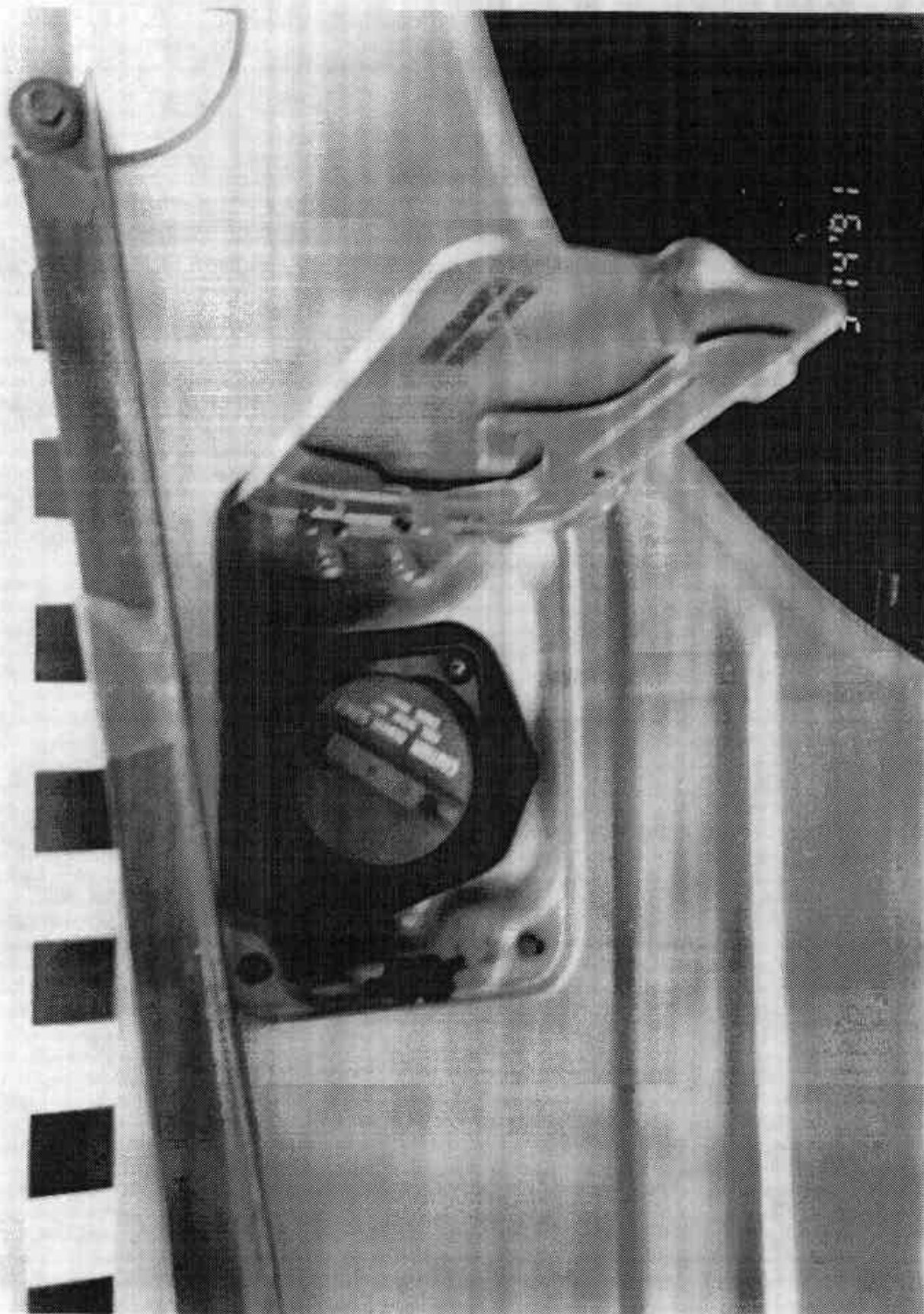


FIGURE A-16 FUEL CAP VIEW

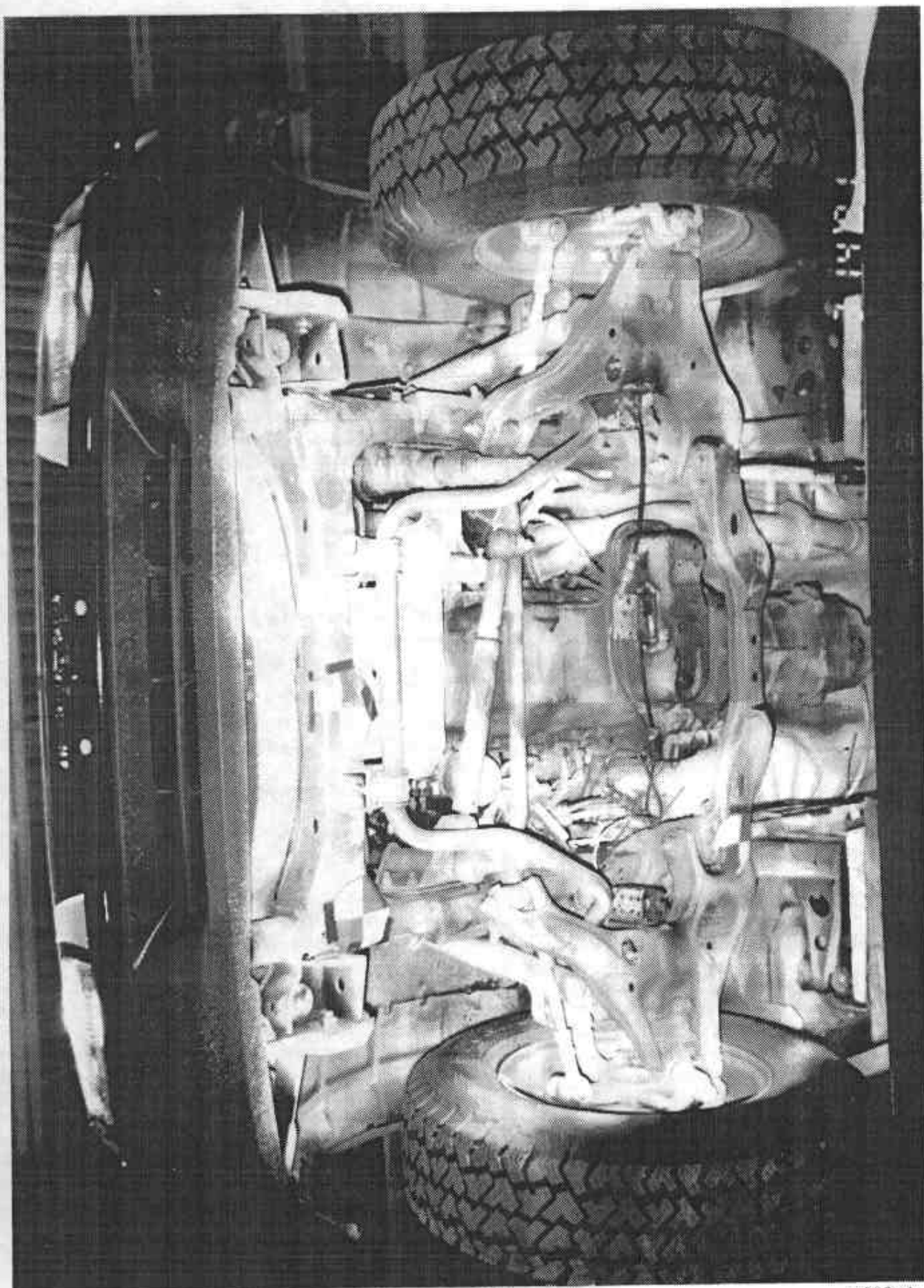


Figure A-17 PRE-TEST FRONT UNDERBODY VIEW

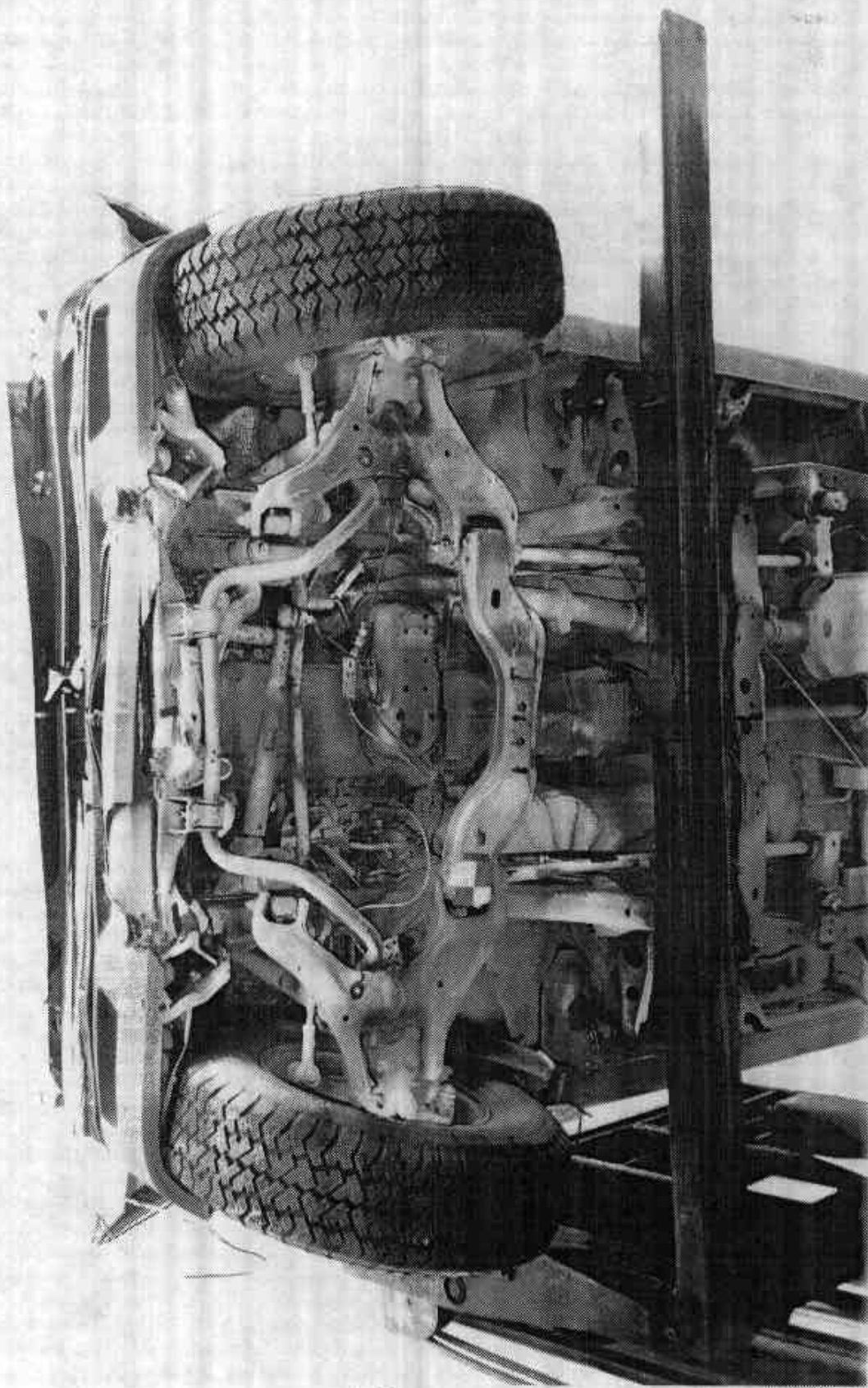
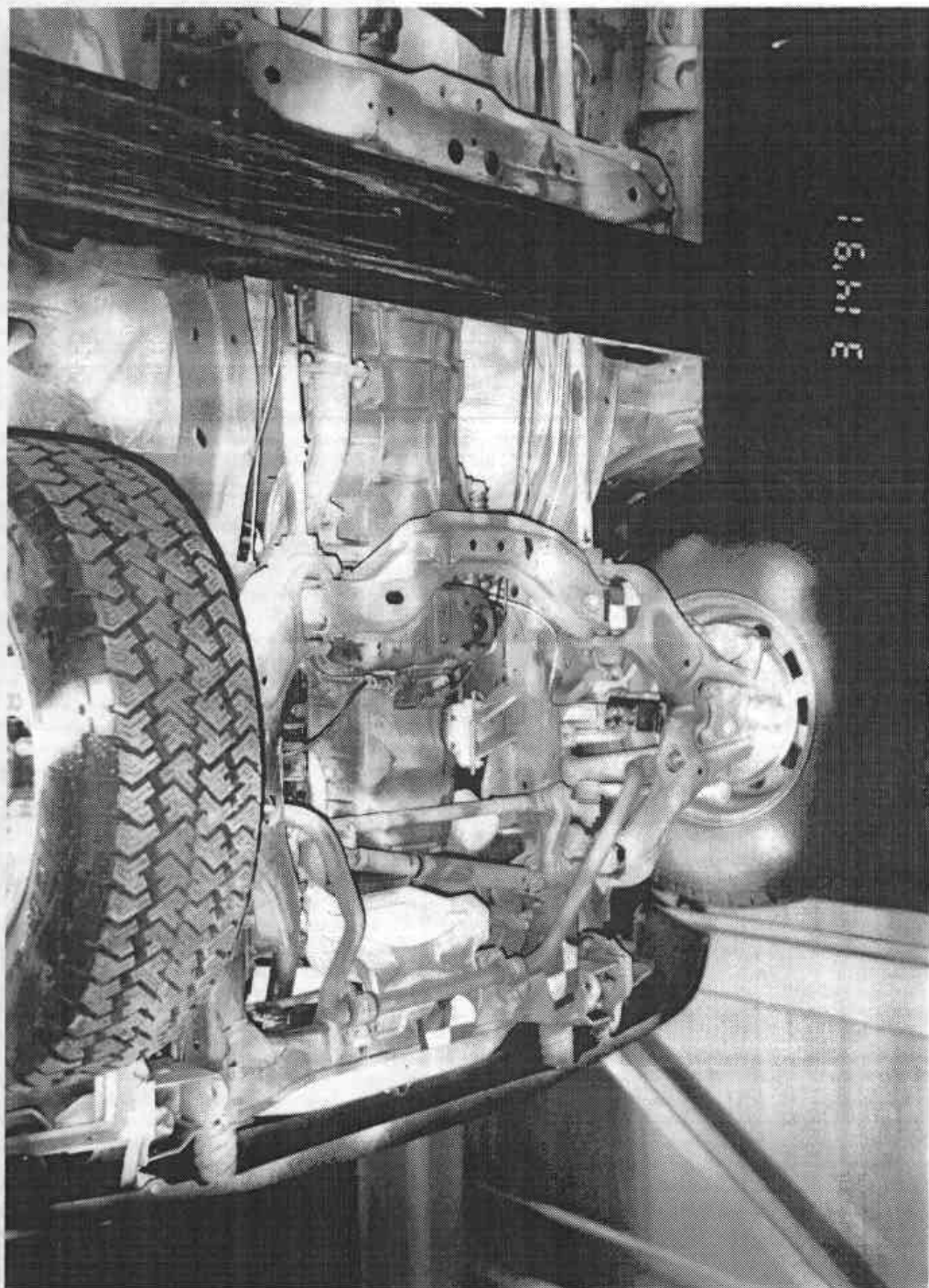


Figure A-18 POST-TEST FRONT UNDERBODY VIEW

A-20

7893-4



3 14'9 1

Figure A-19 PRE-TEST FRONT SIDE UNDERBODY VIEW

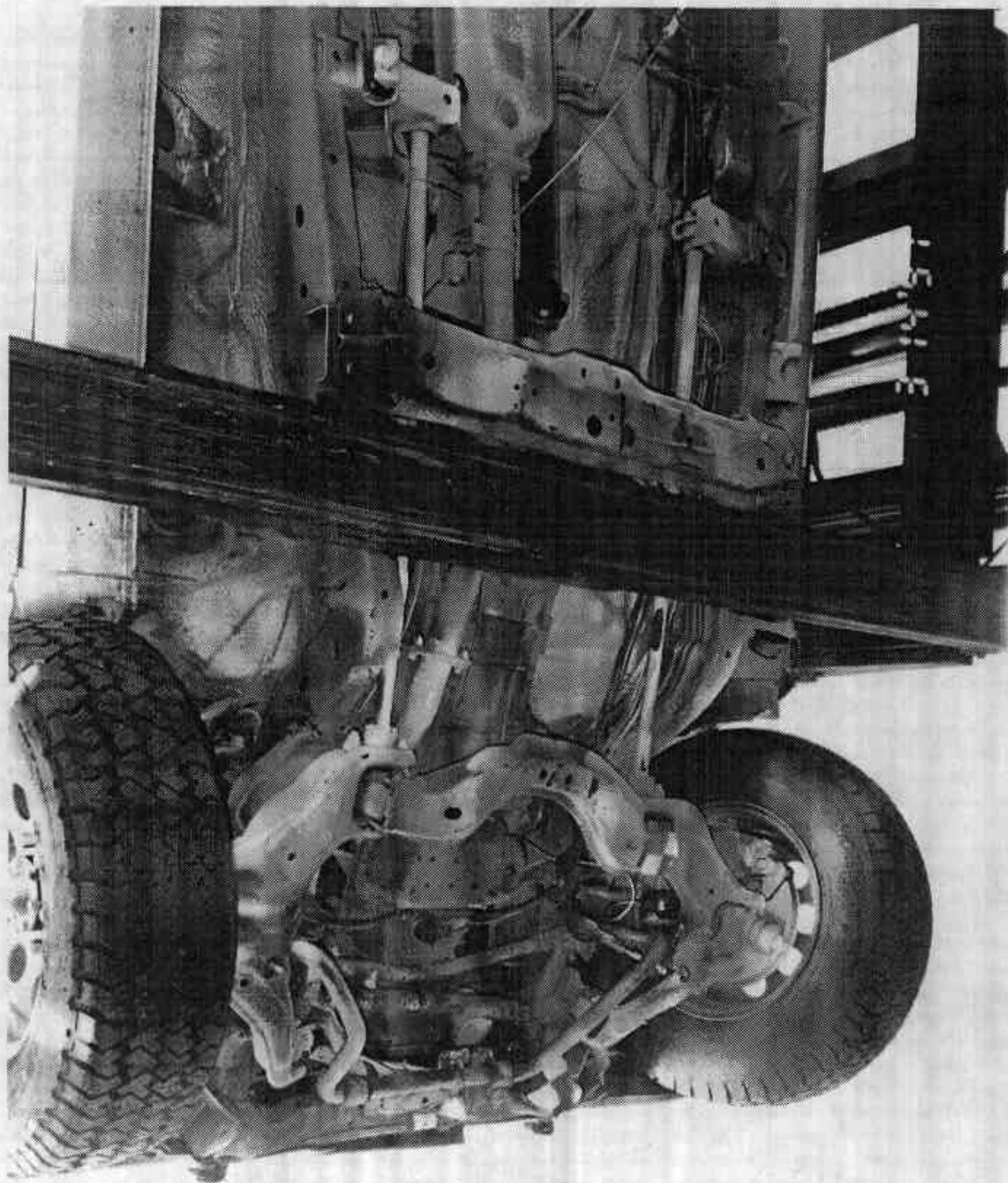


Figure A-20 POST-TEST FRONT SIDE UNDERBODY VIEW

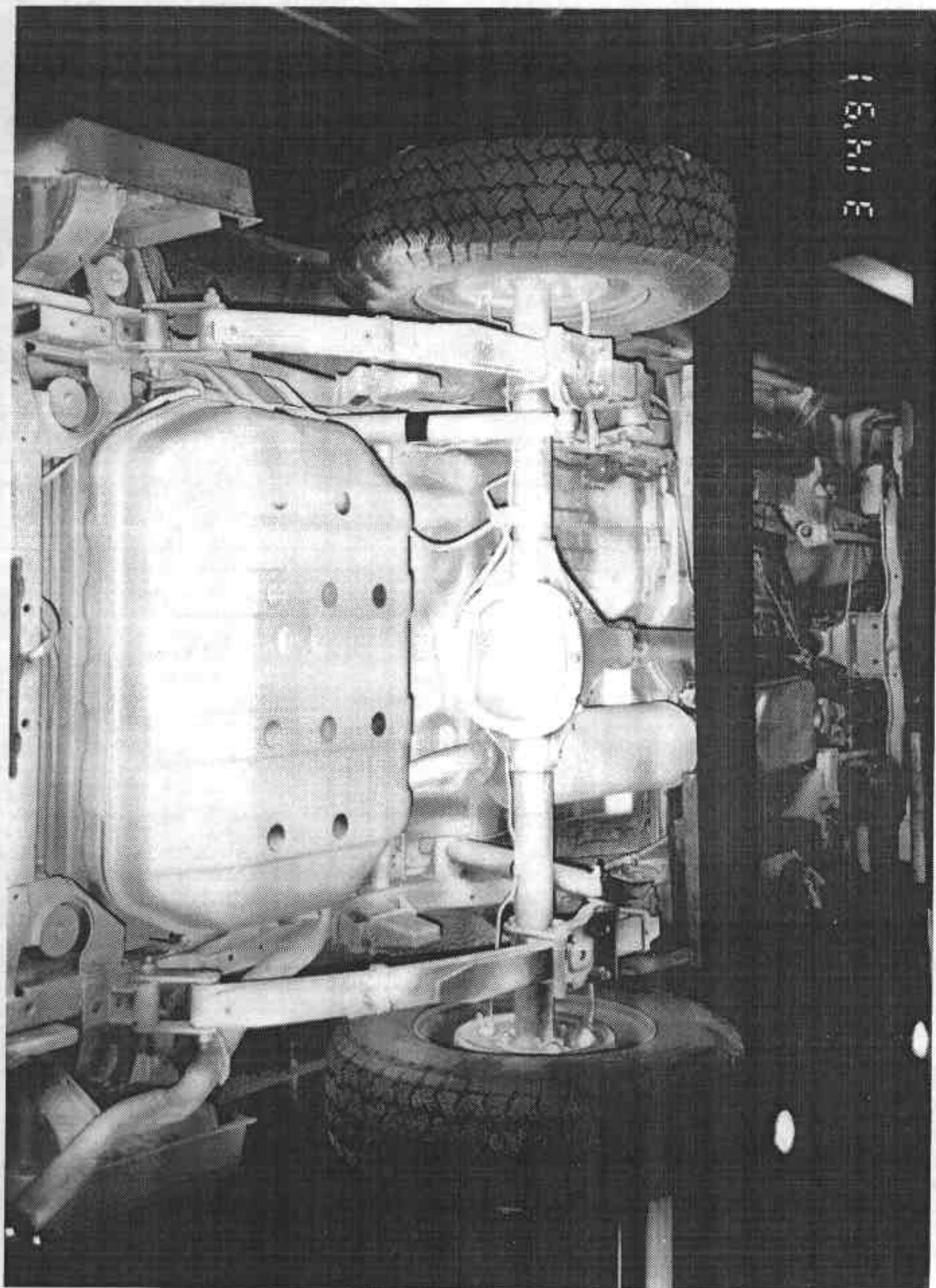


Figure A-21 PRE-TEST REAR UNDERBODY VIEW

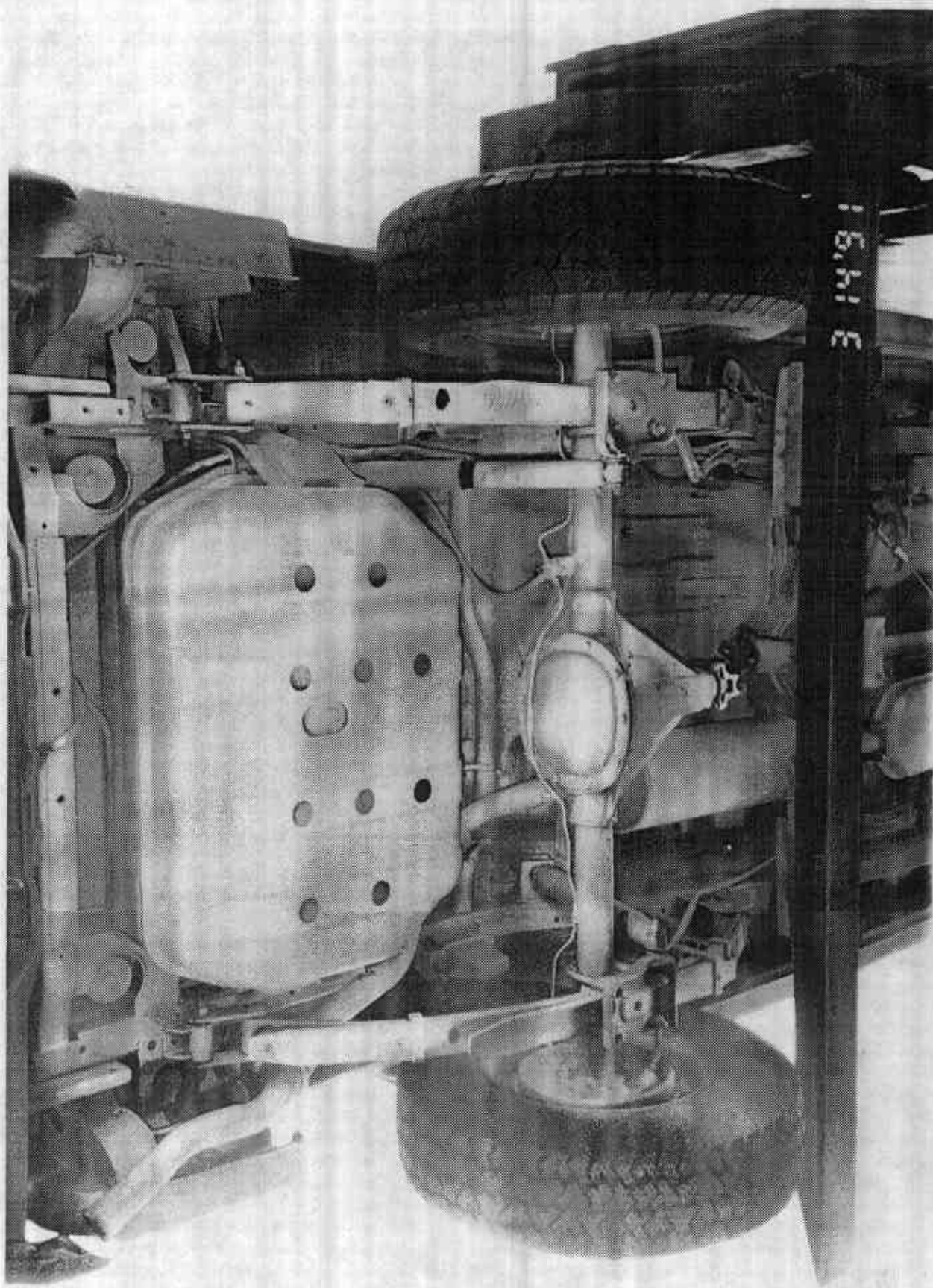


FIGURE A-22 POST-TEST REAR UNDERBODY VIEW

A-24

7893-4



Figure A-23 PRE-TEST DRIVER POSITION VIEW



Figure A-24 POST-TEST DRIVER POSITION VIEW



Figure A-25 PRE-TEST PASSENGER POSITION VIEW

A-27

7893-4



Figure A-26 POST-TEST PASSENGER POSITION VIEW

A-28

7893-4



FIGURE A-27 PRE-TEST DRIVER AND INTERIOR VIEW

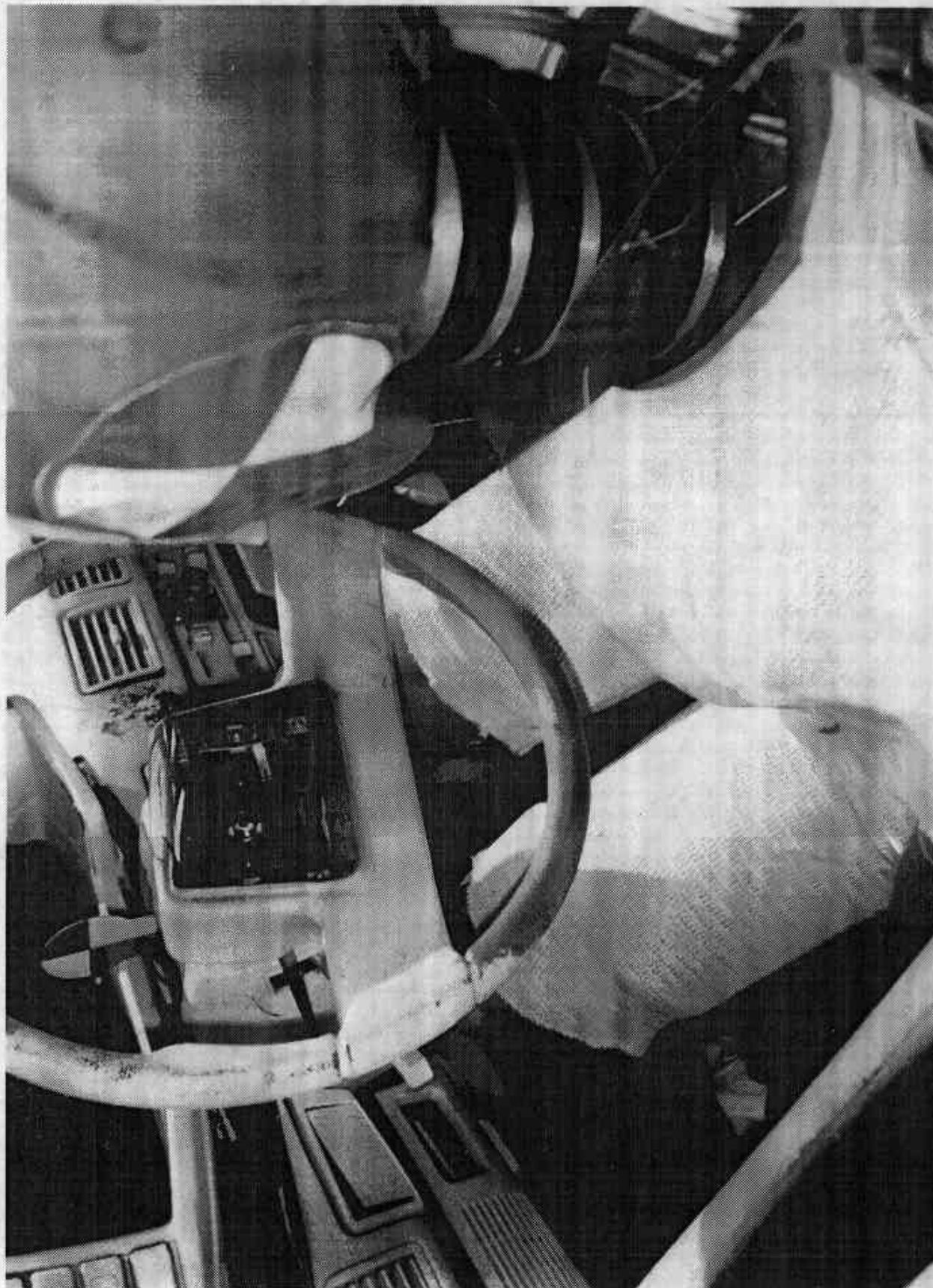


Figure A-28 POST-TEST DRIVER AND INTERIOR VIEW

A-30

7803-4



Figure A-29 PRE-TEST PASSENGER AND INTERIOR VIEW



Figure A-30 POST-TEST PASSENGER AND INTERIOR VIEW

A-32

7893-4

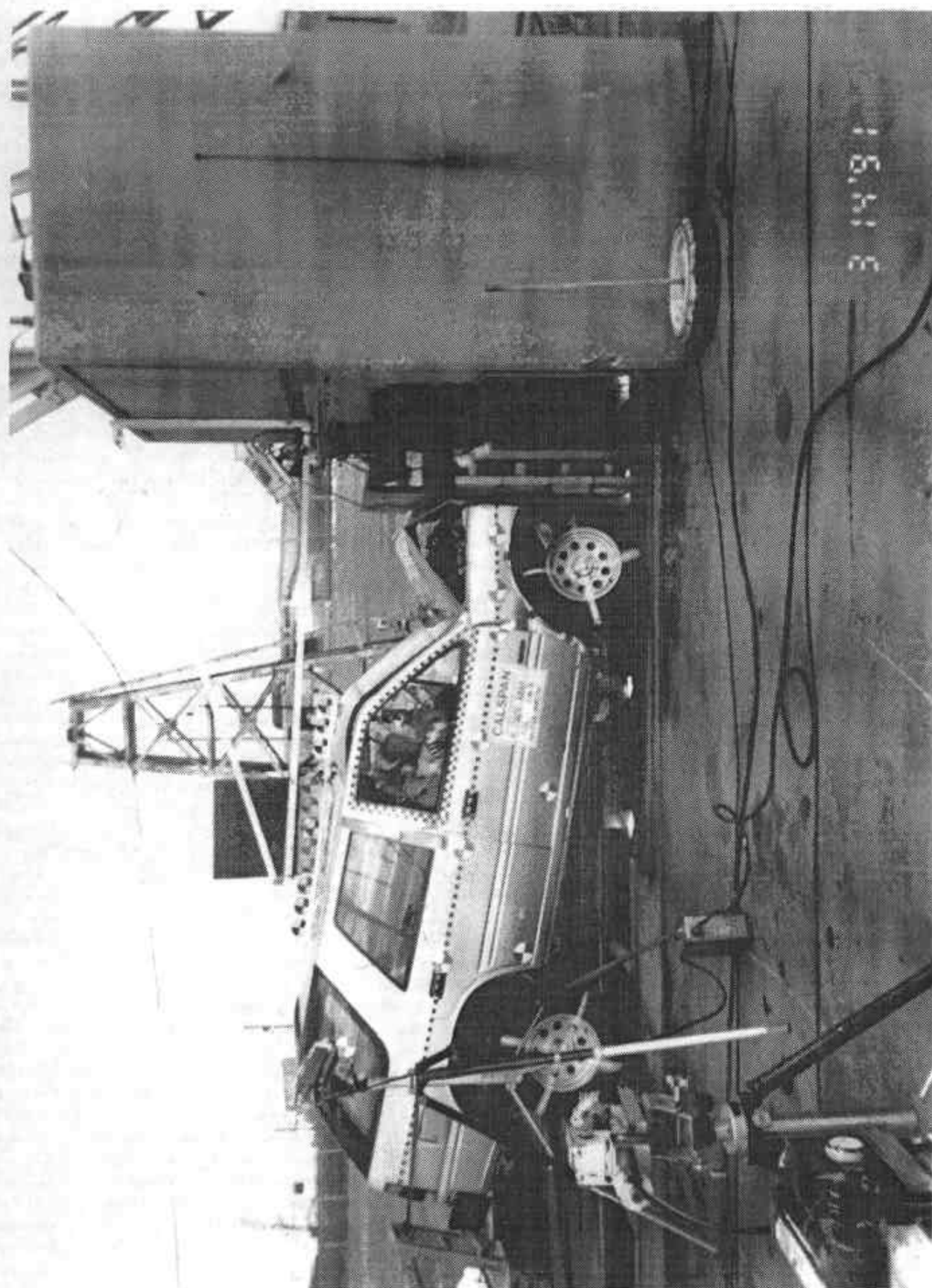


Figure A-31 IMPACT VIEW

A-33

7893-4

Appendix B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

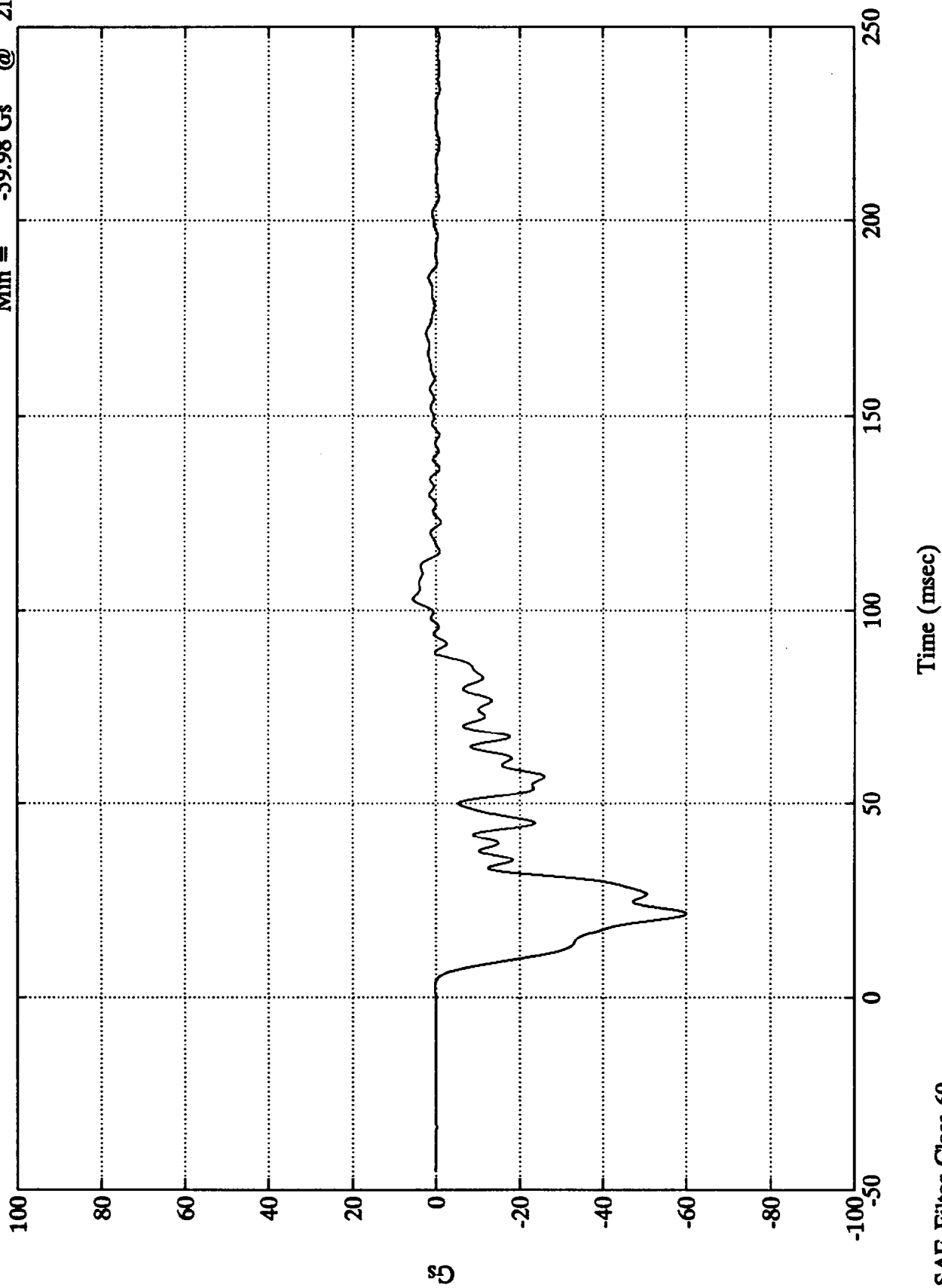
TEST NO. MM5701

VEHICLE DATA

FILTER CHANNEL CLASS

60

Acc. #1(x) Max = 5.55 Gs @ 103.08 msec
Min = -59.98 Gs @ 21.71 msec

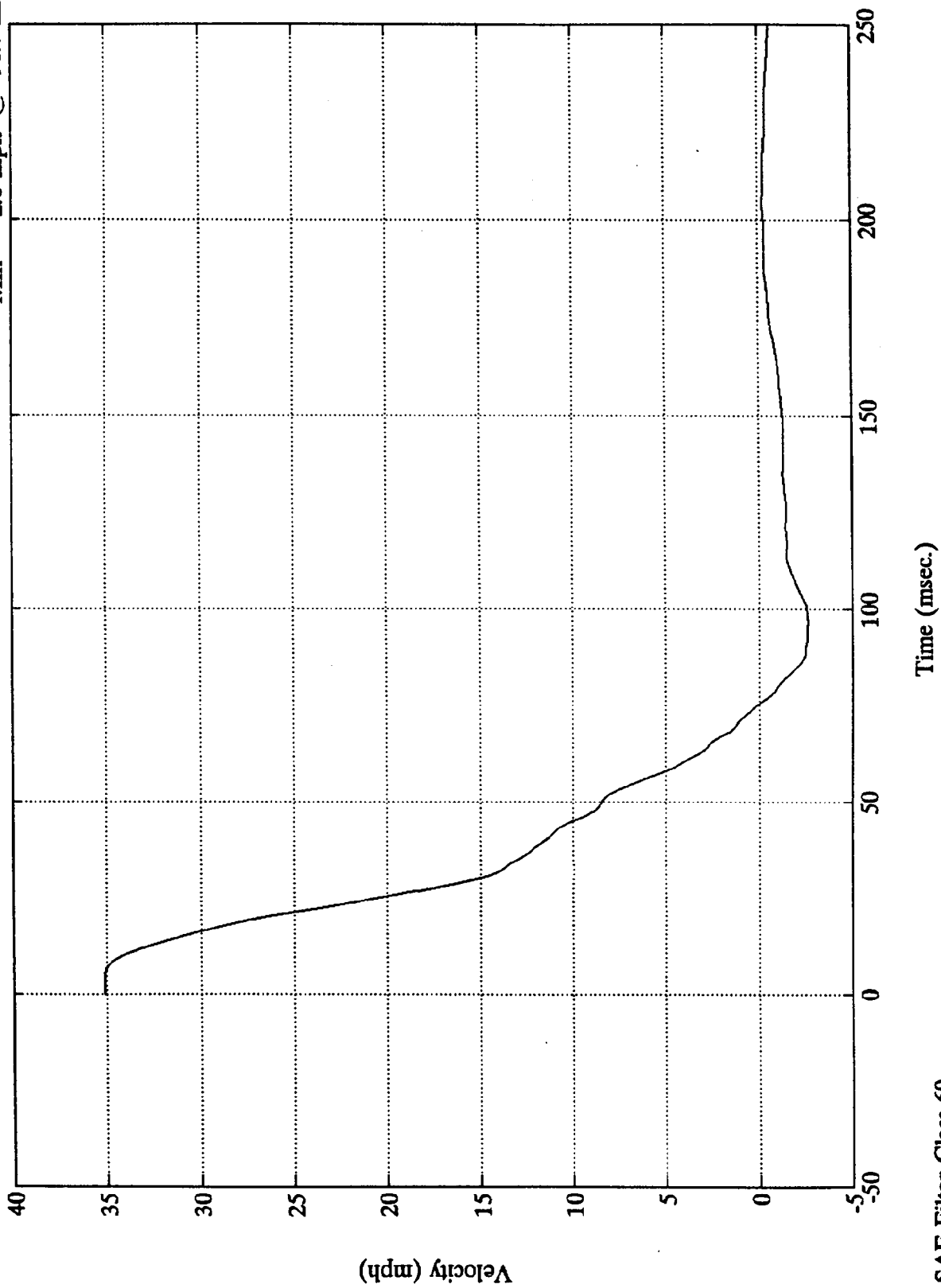


SAE Filter Class 60

Max = 35.1 mph @ 5.0 msec
Min = -2.6 mph @ 96.7 msec

Acc. #1(x)

Test 1047

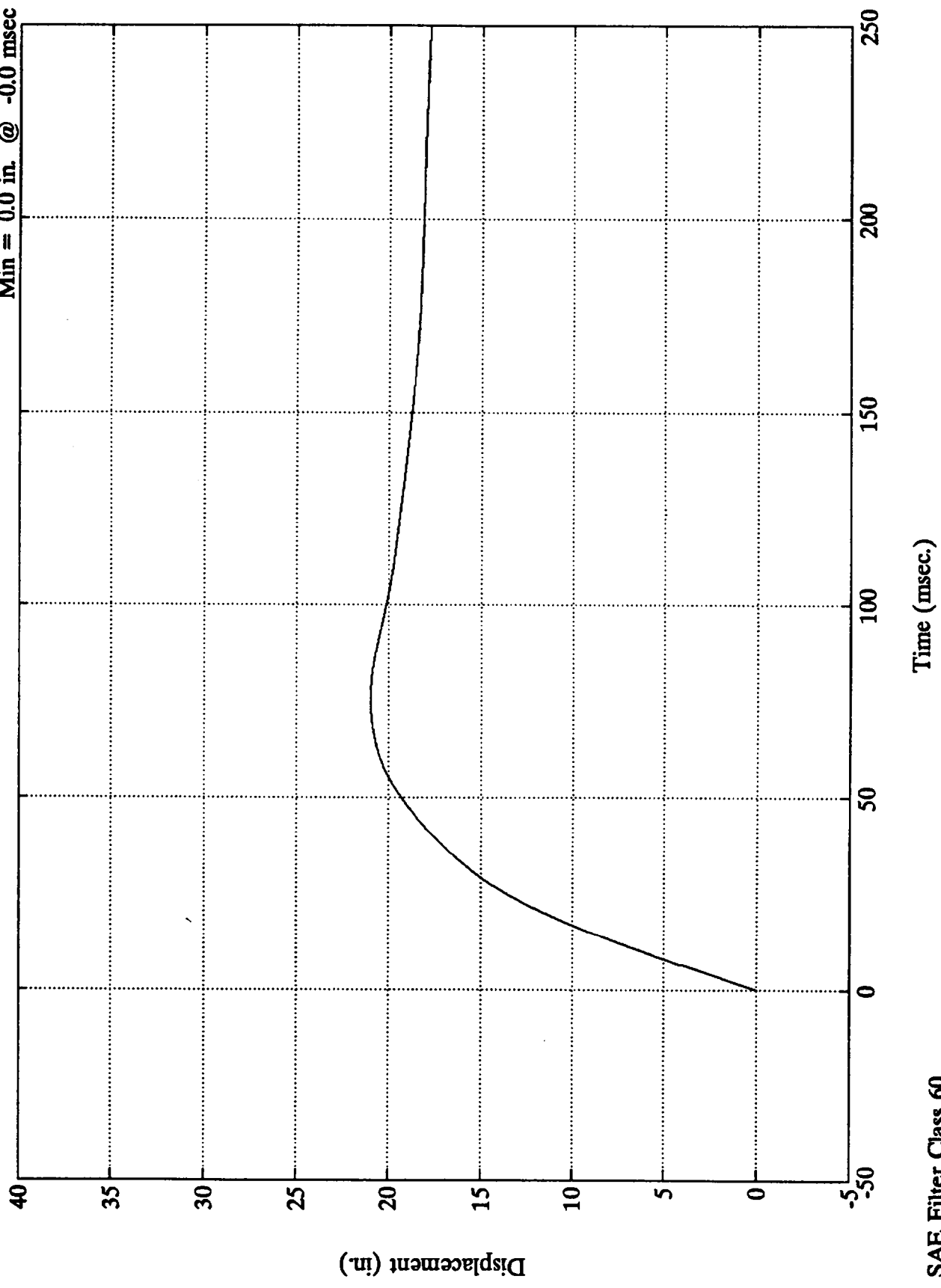


SAE Filter Class 60

Test 1047

Acc. #1(x)

Max = 21.0 in. @ 77.3 msec
Min = 0.0 in. @ -0.0 msec



B-5

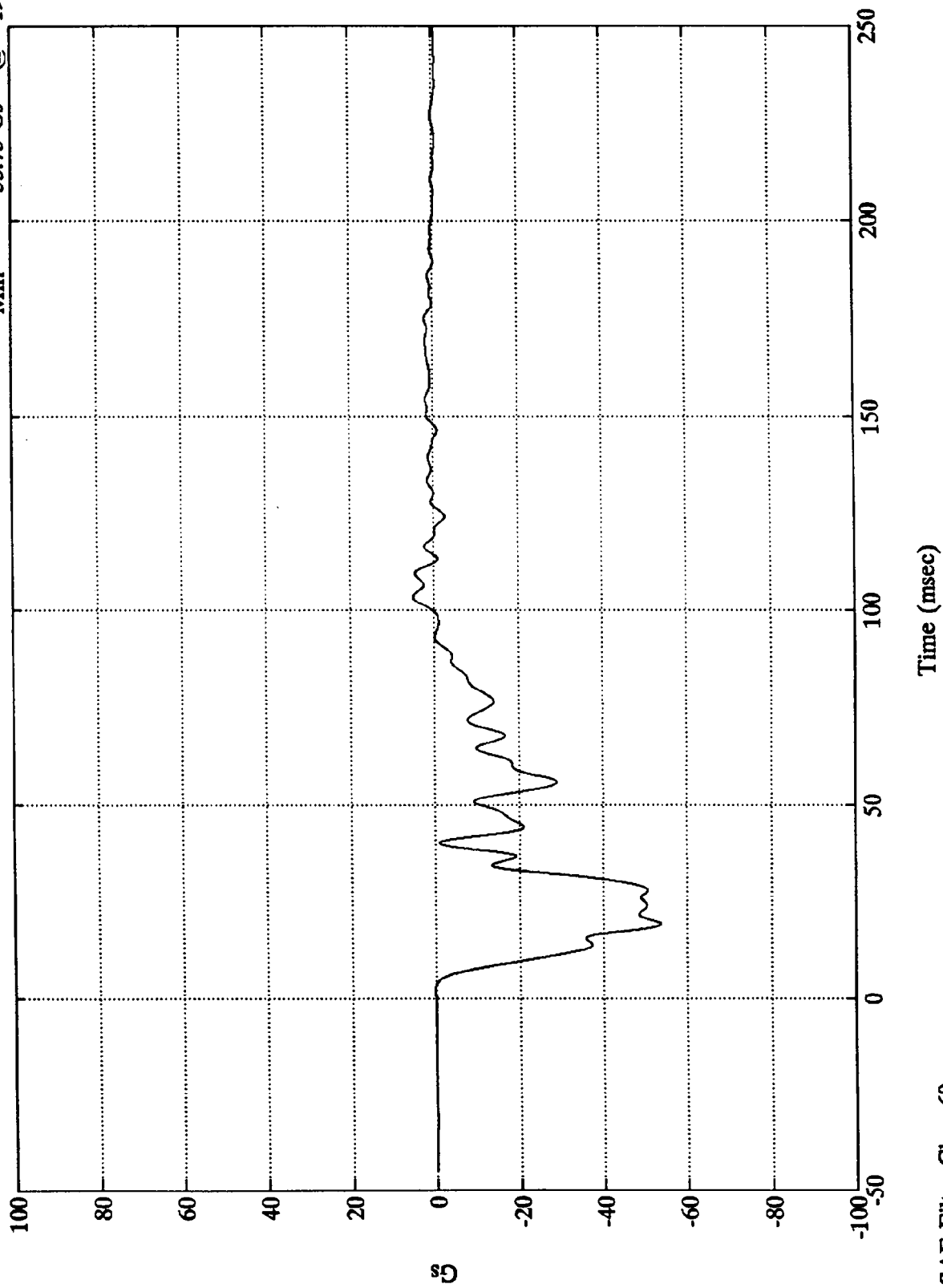
7893-4

SAE Filter Class 60

Test 1047

Acc. #2(x)

Max = 5.01 Gs @ 103.44 msec
Min = -53.73 Gs @ 19.19 msec



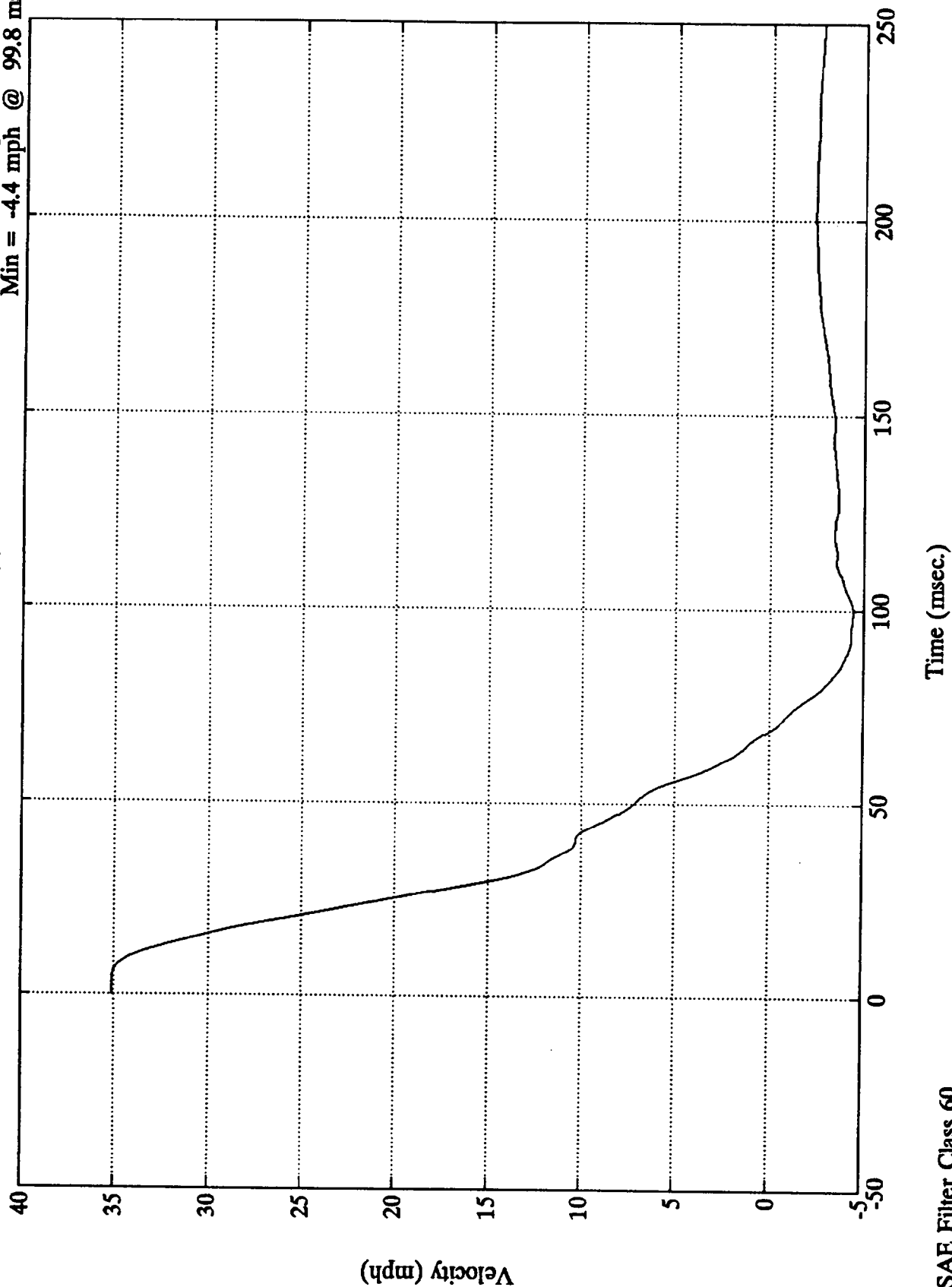
B-6

7893-4 SAE Filter Class 60

Test 1047

Acc. #2(x)

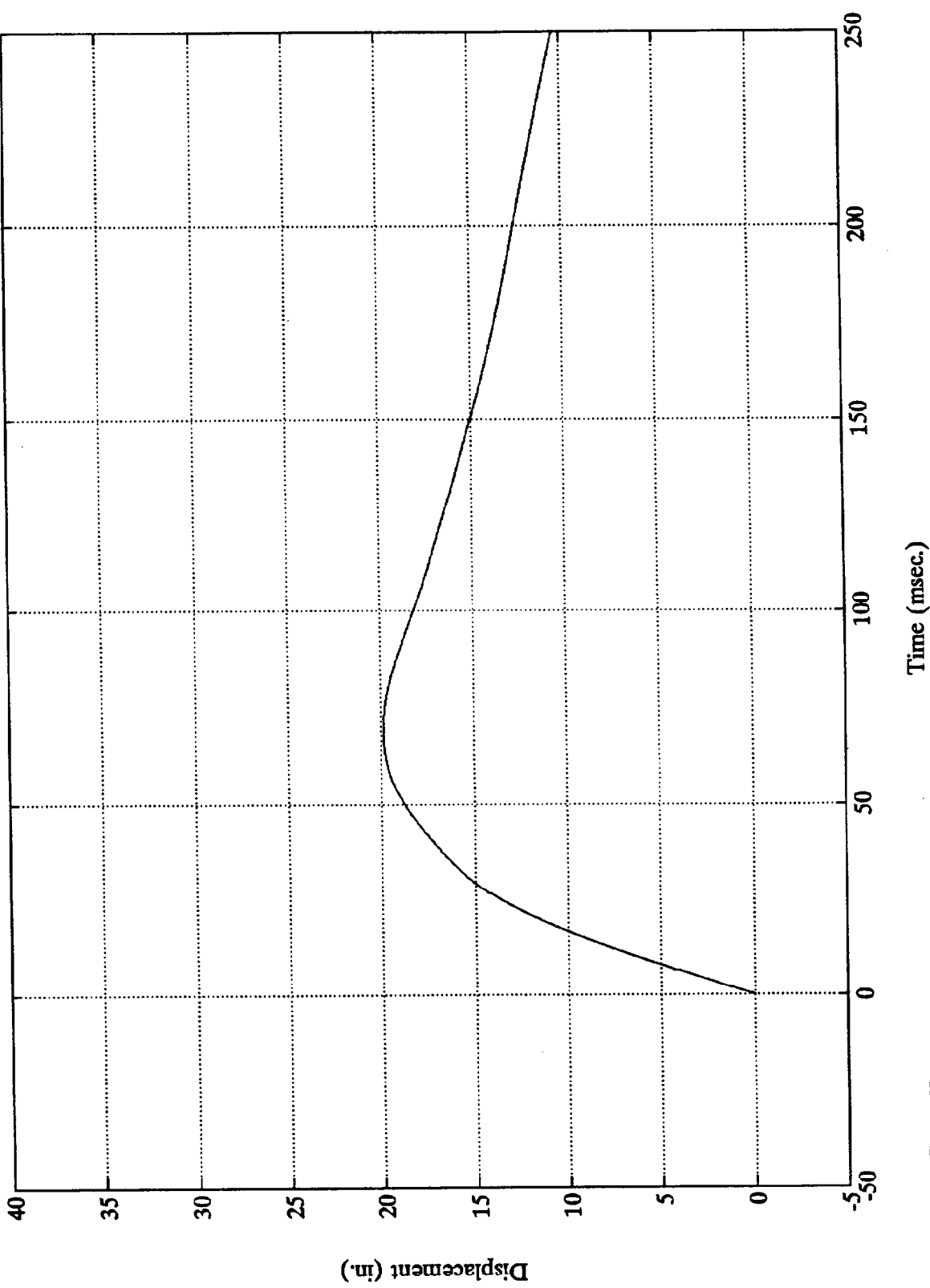
Max = 35.1 mph @ 4.3 msec
Min = -4.4 mph @ 99.8 msec



Max = 19.9 in. @ 69.8 msec
Min = 0.0 in. @ -0.0 msec

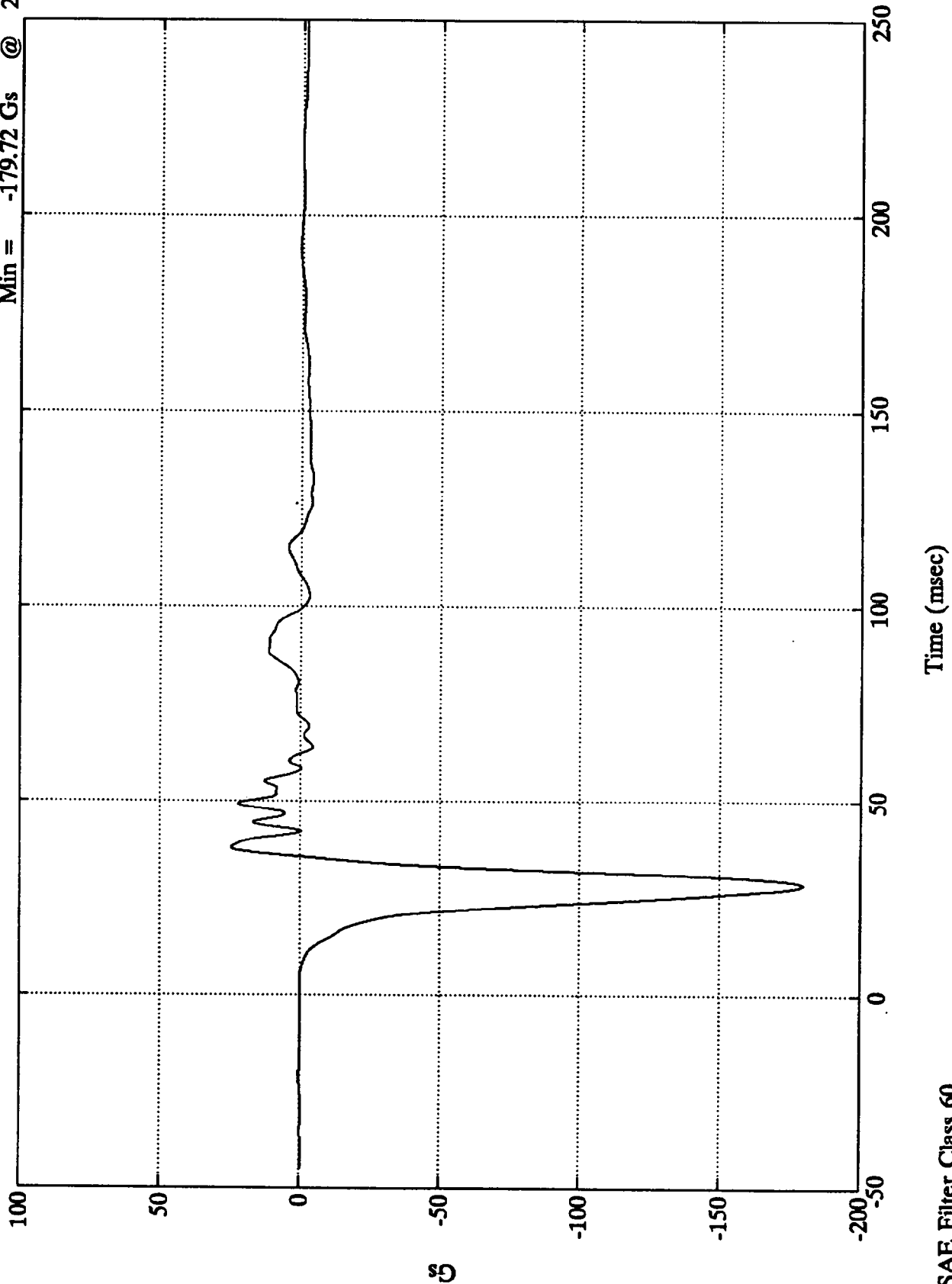
Acc. #2(x)

Test 1047



SAE Filter Class 60

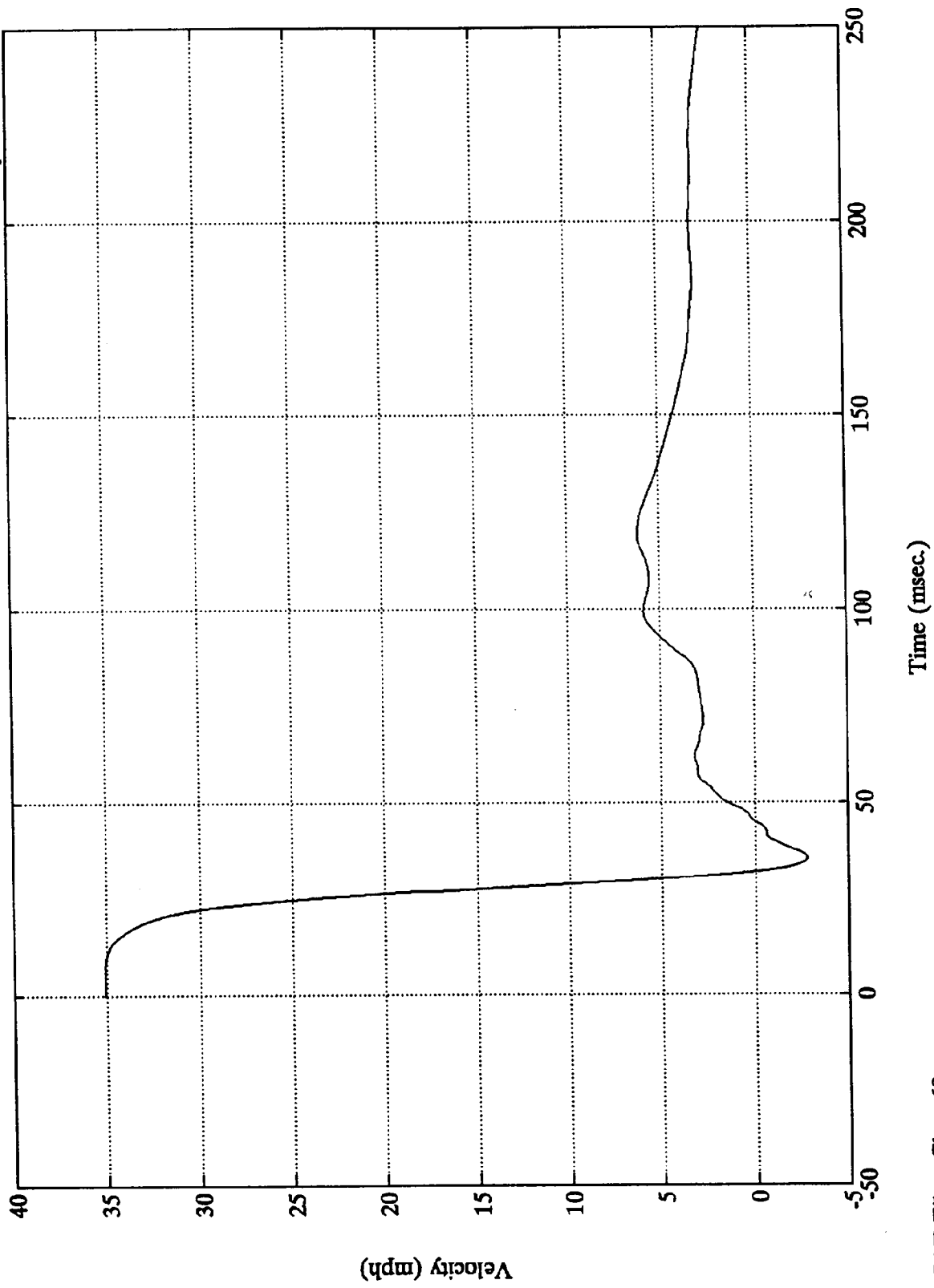
Acc. #3(x) Max = 24.50 Gs @ 37.92 msec
Min = -179.72 Gs @ 28.55 msec



Test 1047

Max = 35.1 mph @ 6.2 msec
Min = -2.8 mph @ 35.8 msec

Acc. #3(x)



B-10

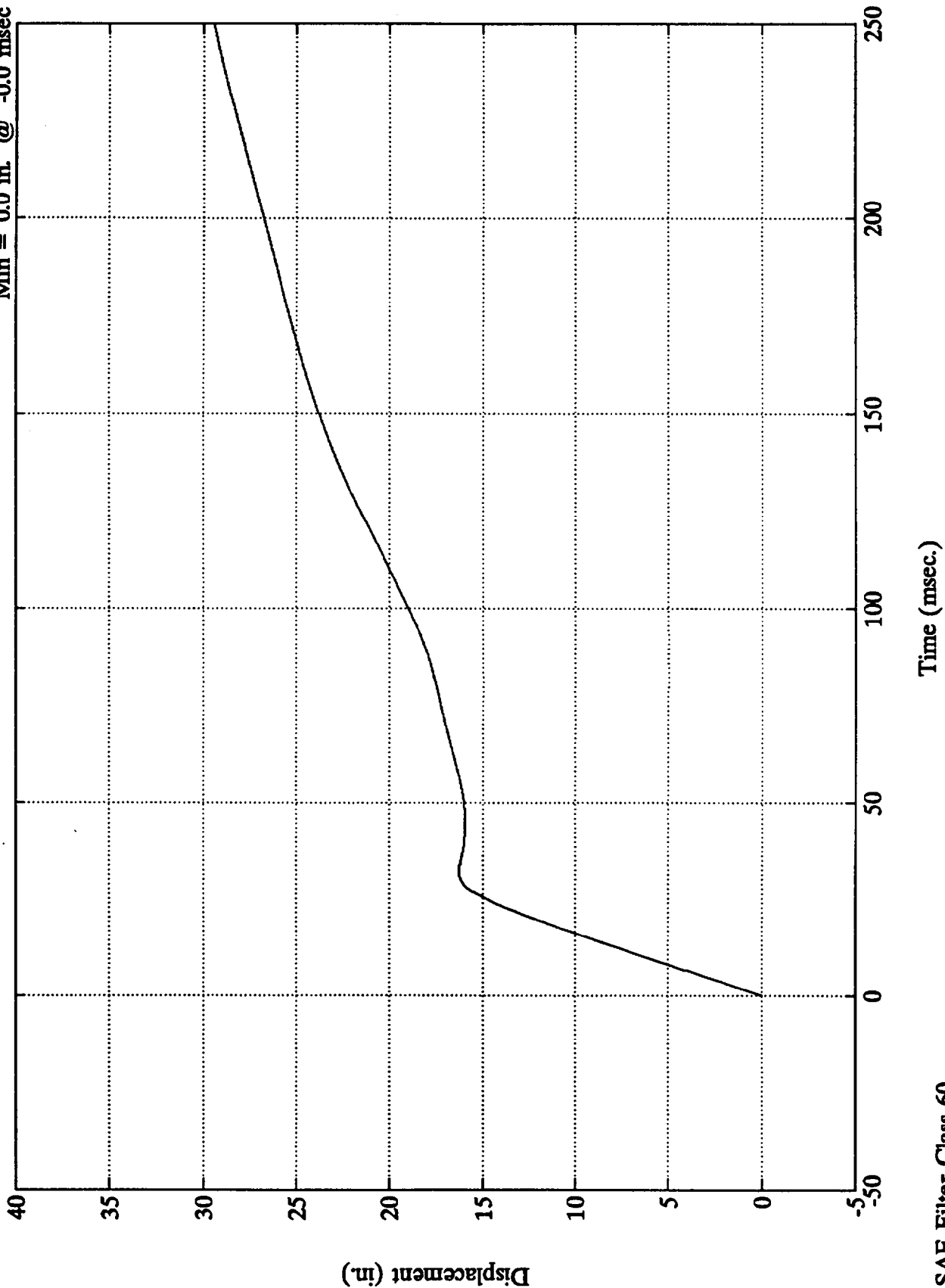
7893-4

SAE Filter Class 60

Test 1047

Acc. #3(x)

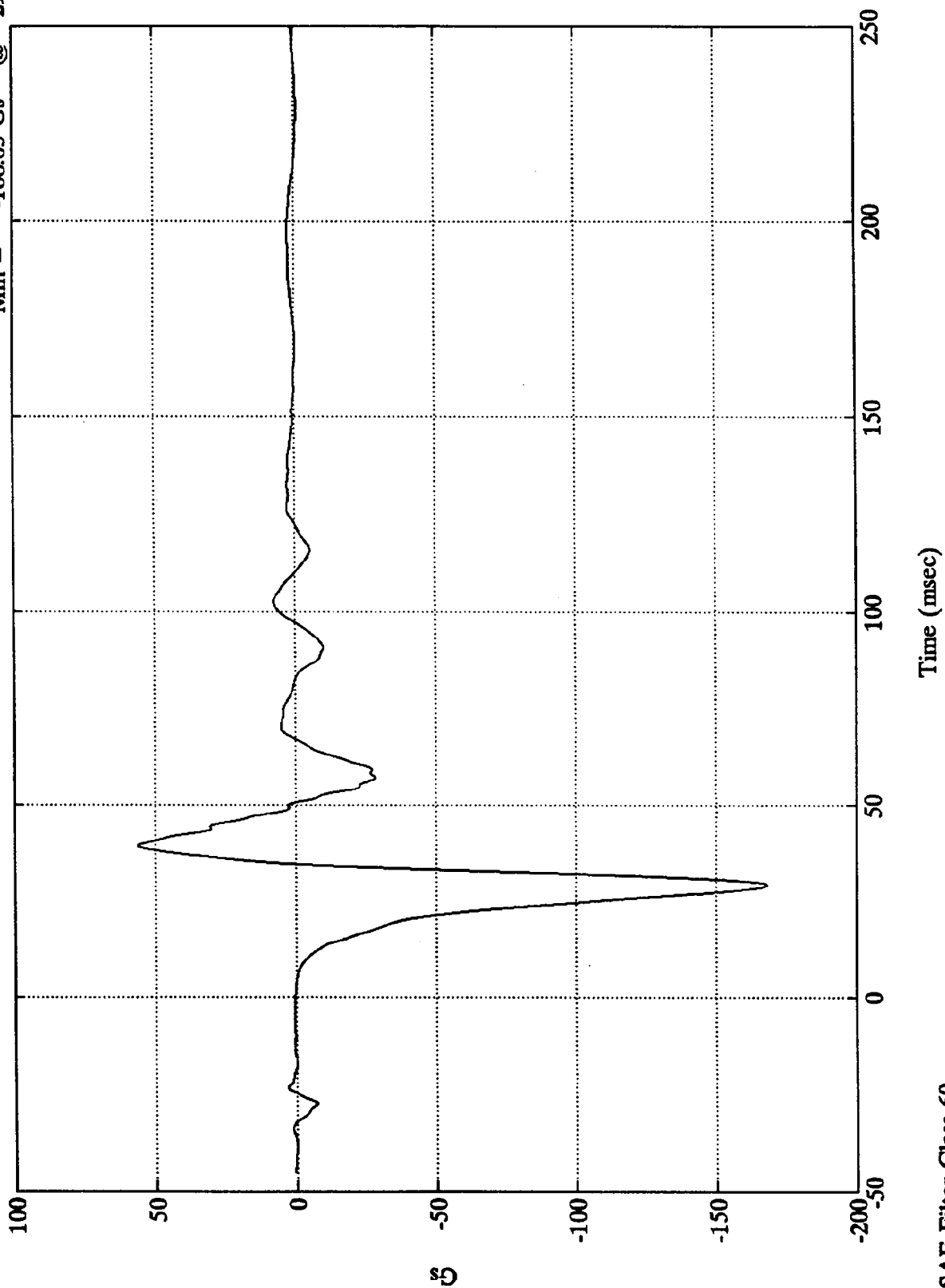
Max = 29.6 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



Test 1047

Acc. #4(x)

Max = 56.19 Gs @ 39.71 msec
Min = -168.03 Gs @ 29.39 msec



B-12

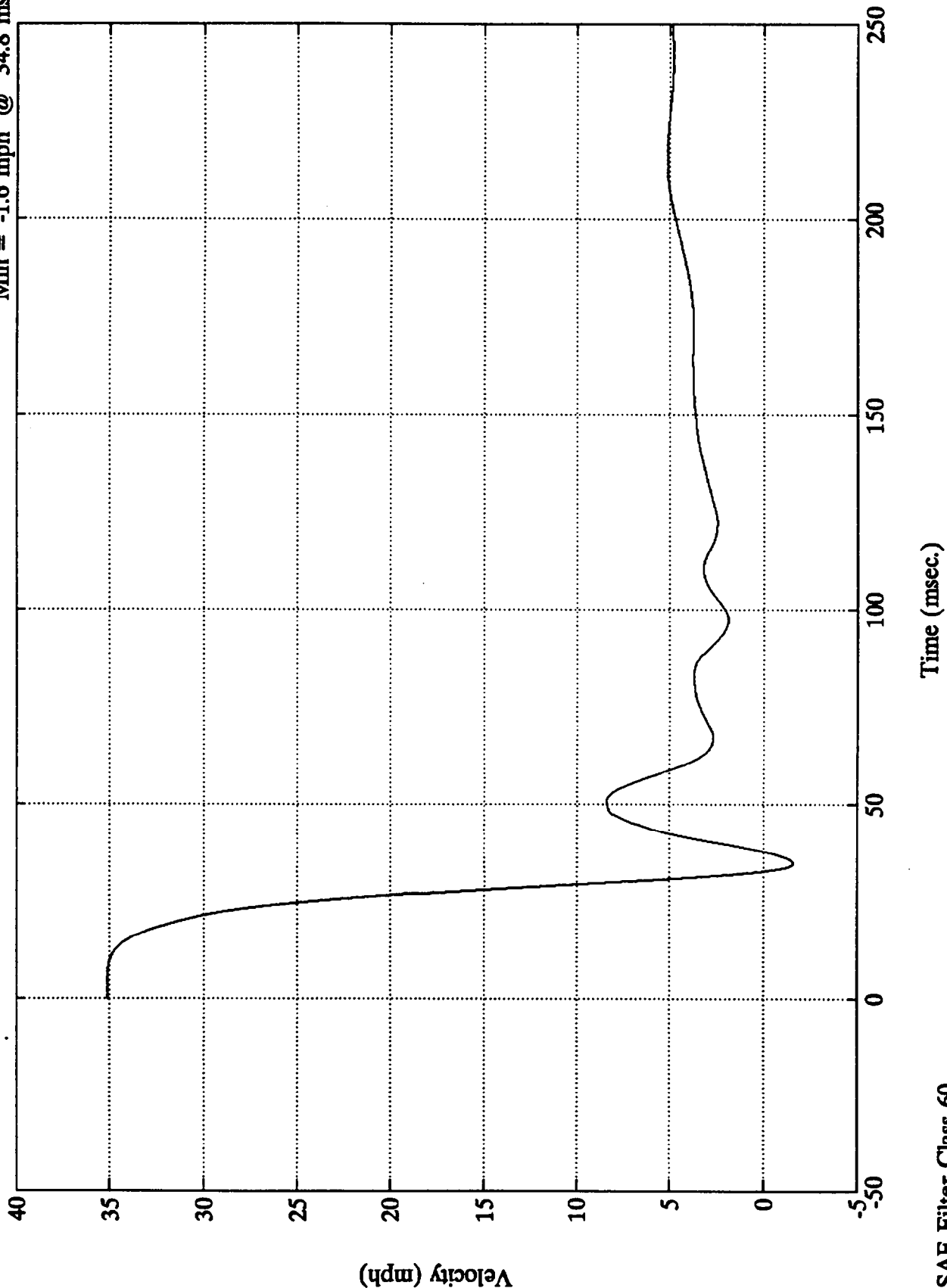
7893-4

SAE Filter Class 60

Test 1047

Acc. #4(x)

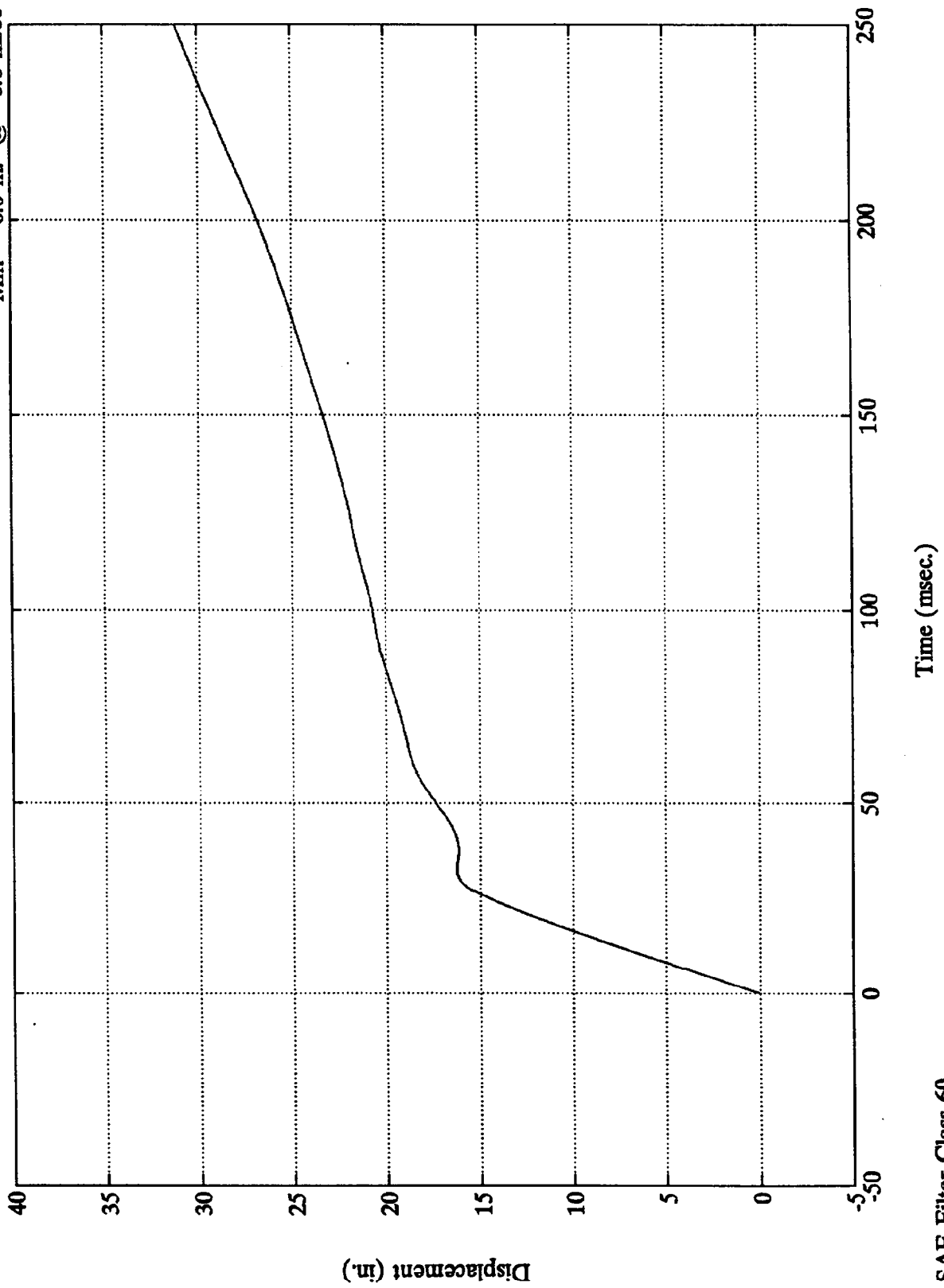
Max = 35.1 mph @ 5.5 msec
Min = -1.6 mph @ 34.8 msec



Max = 31.6 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec

Acc. #4(x)

Test 1047



B-14

7893-4
SAE Filter Class 60

Acc. #5(x)

Max =

30.04 Gs

@

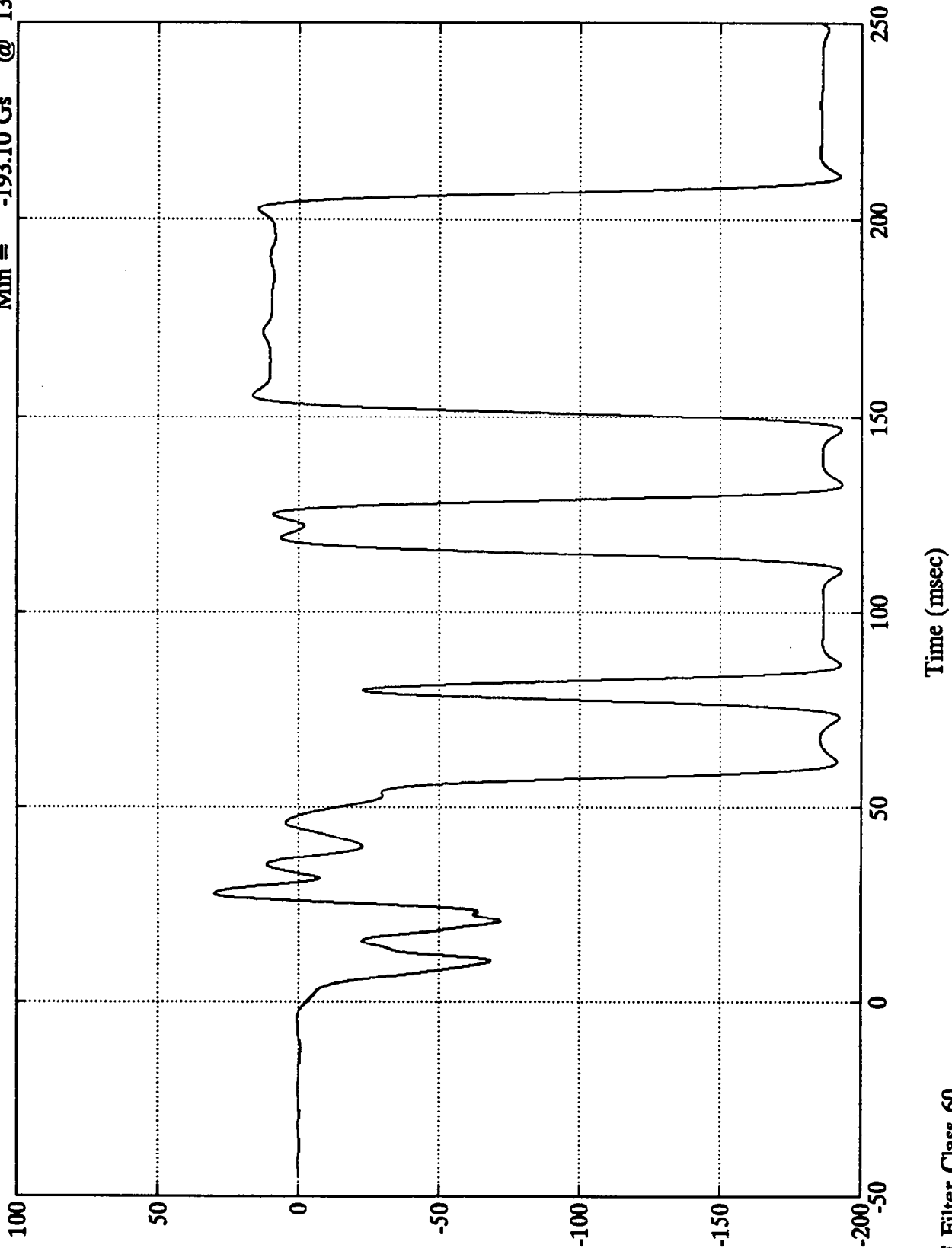
28.20 msec

Min =

-193.10 Gs

@

132.84 msec



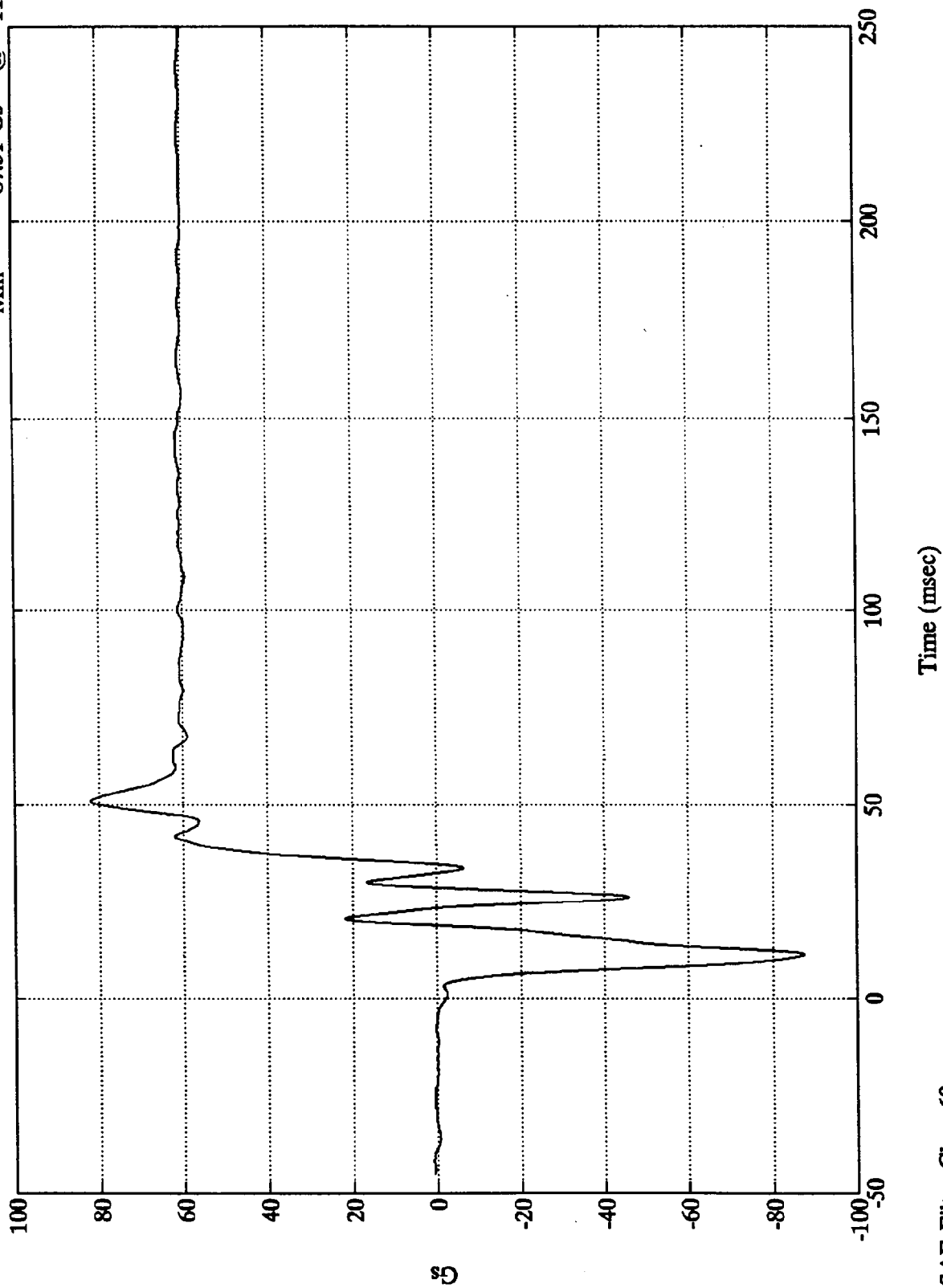
B-15

SAE Filter Class 60

Test 1047

Max = 81.84 Gs @ 51.12 msec
Min = -87.51 Gs @ 11.27 msec

Acc. #6(x)



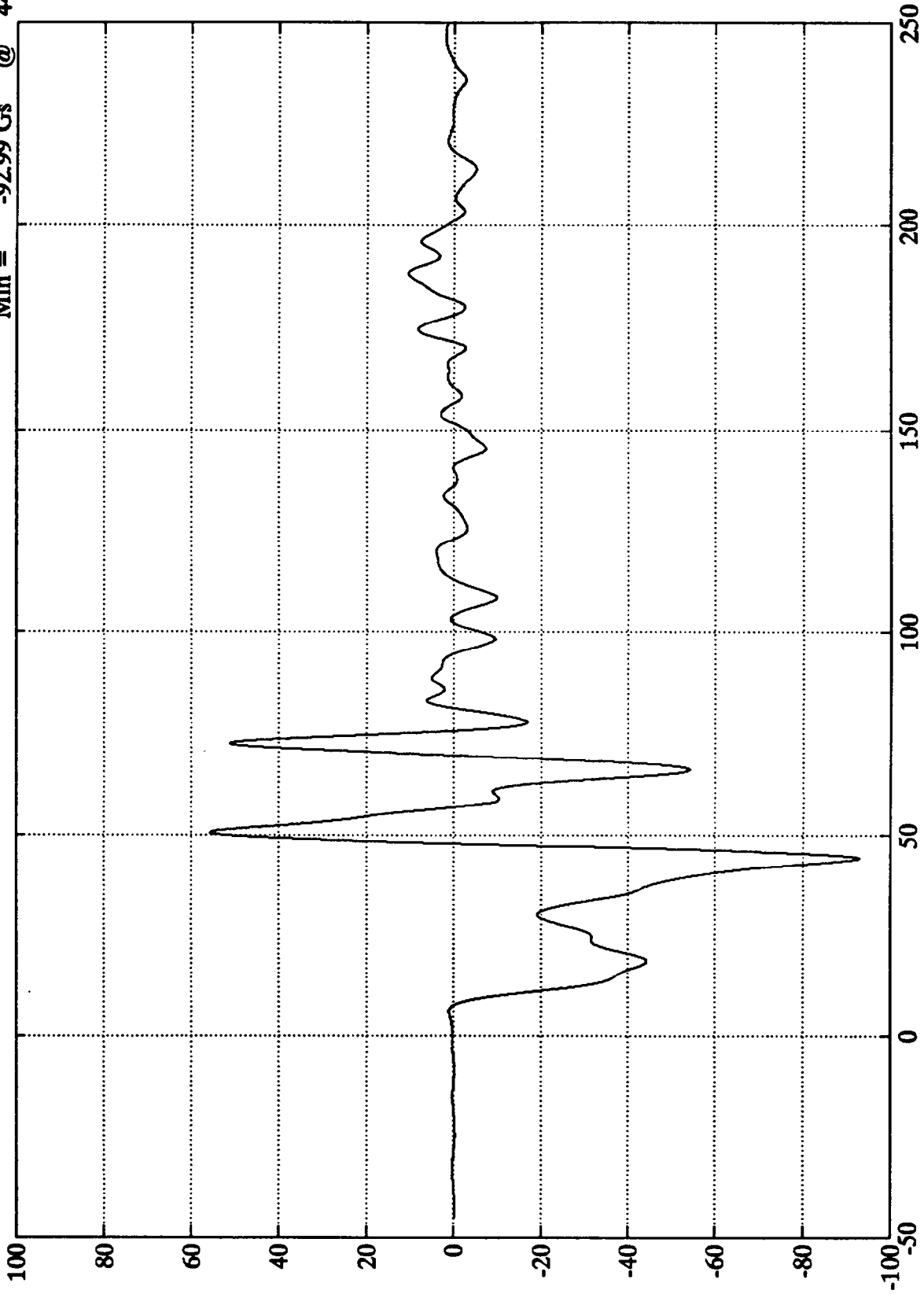
B-16

7893-4 SAE Filter Class 60

Test 1047

Acc. #7(x)

Max = 55.79 Gs @ 50.76 msec
Min = -92.99 Gs @ 44.39 msec



B-17

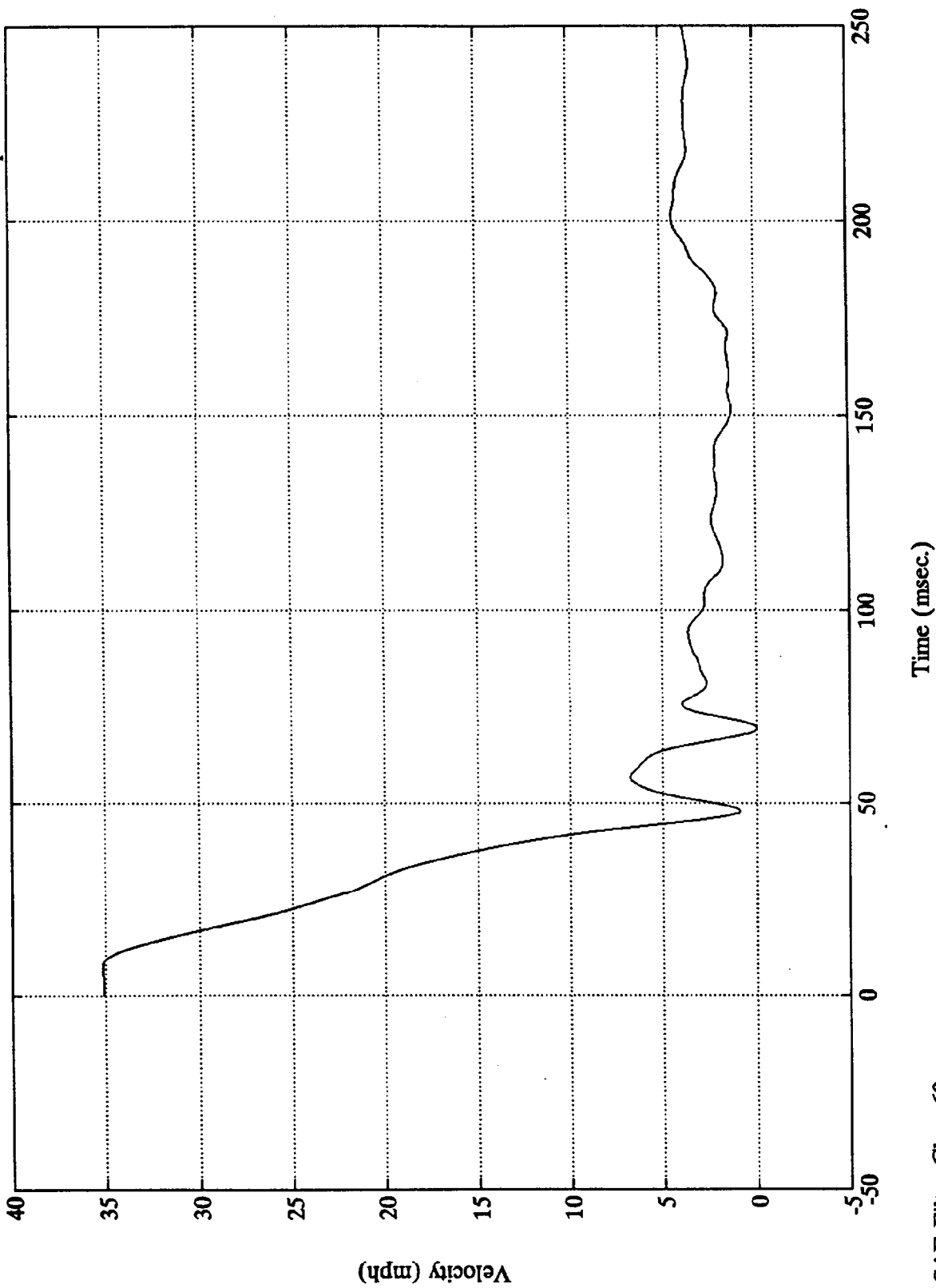
Time (msec)

SAE Filter Class 60

7893-4

Test 1047
Max = 35.2 mph @ 7.4 msec
Min = -0.0 mph @ 69.6 msec

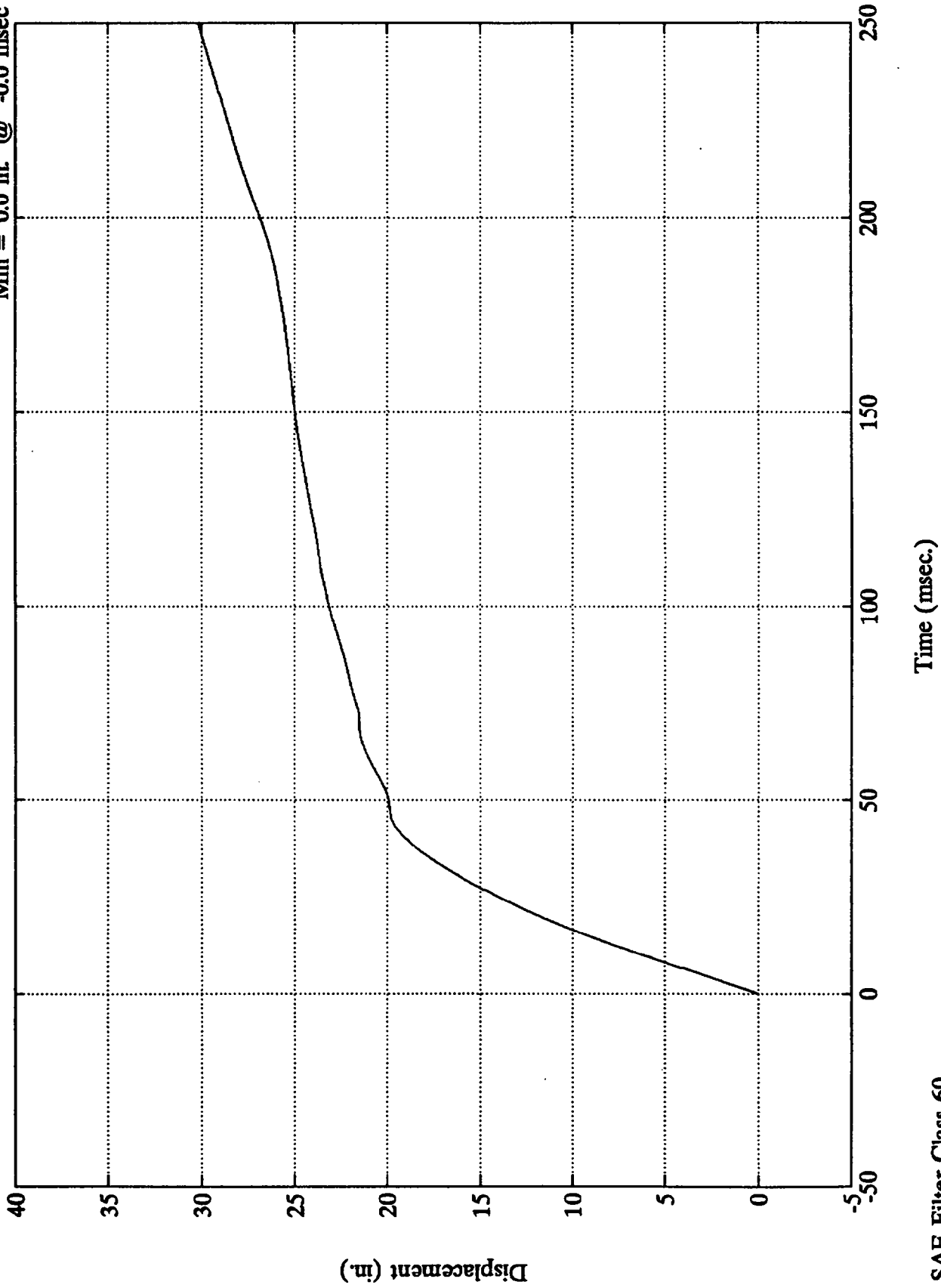
Acc. #7(x)



Test 1047

Acc. #7(x)

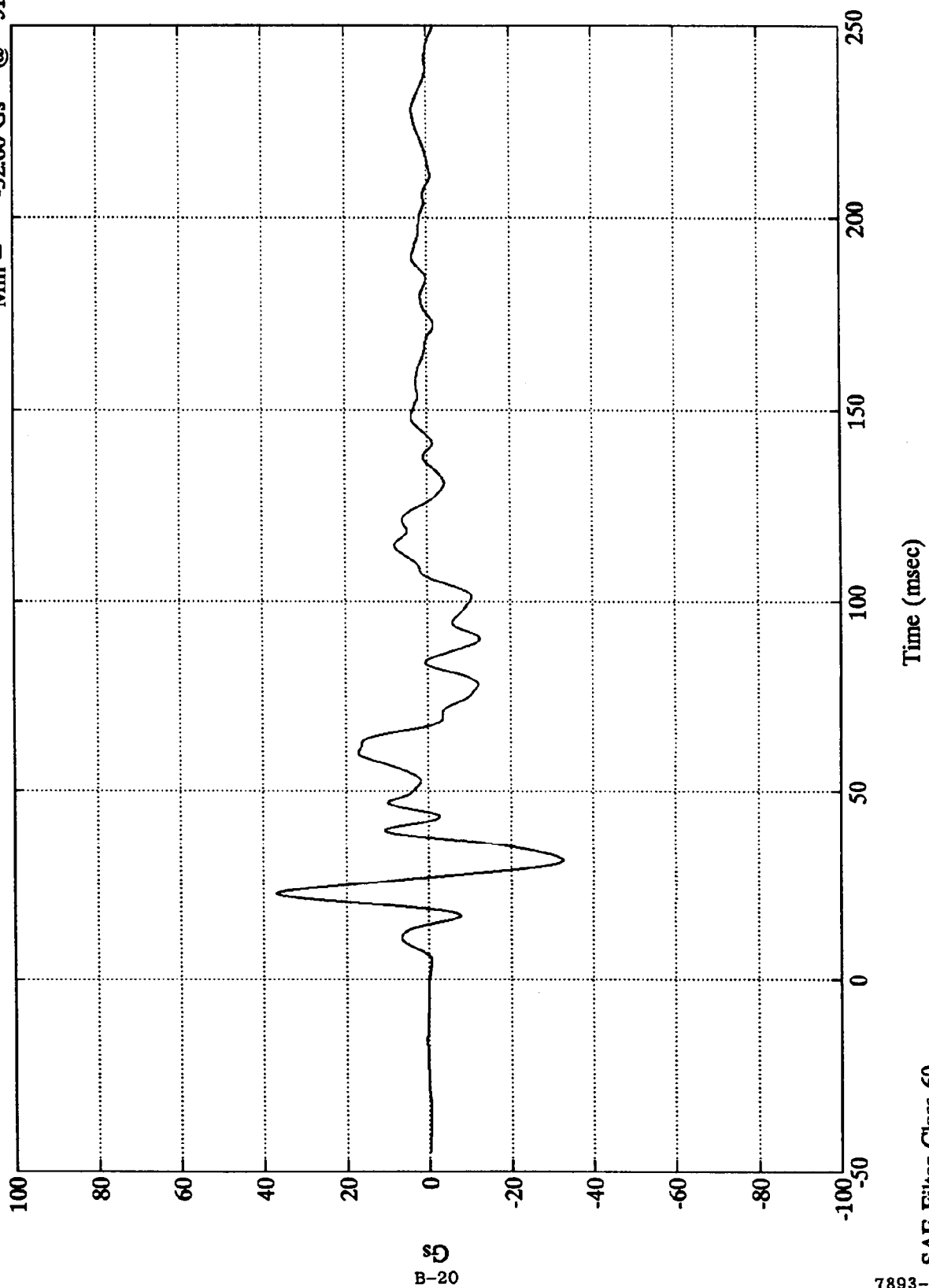
Max = 30.5 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



Test 1047

Acc. #8(z)

Max = 36.84 Gs @ 22.80 msec
Min = -32.66 Gs @ 31.92 msec



B-20

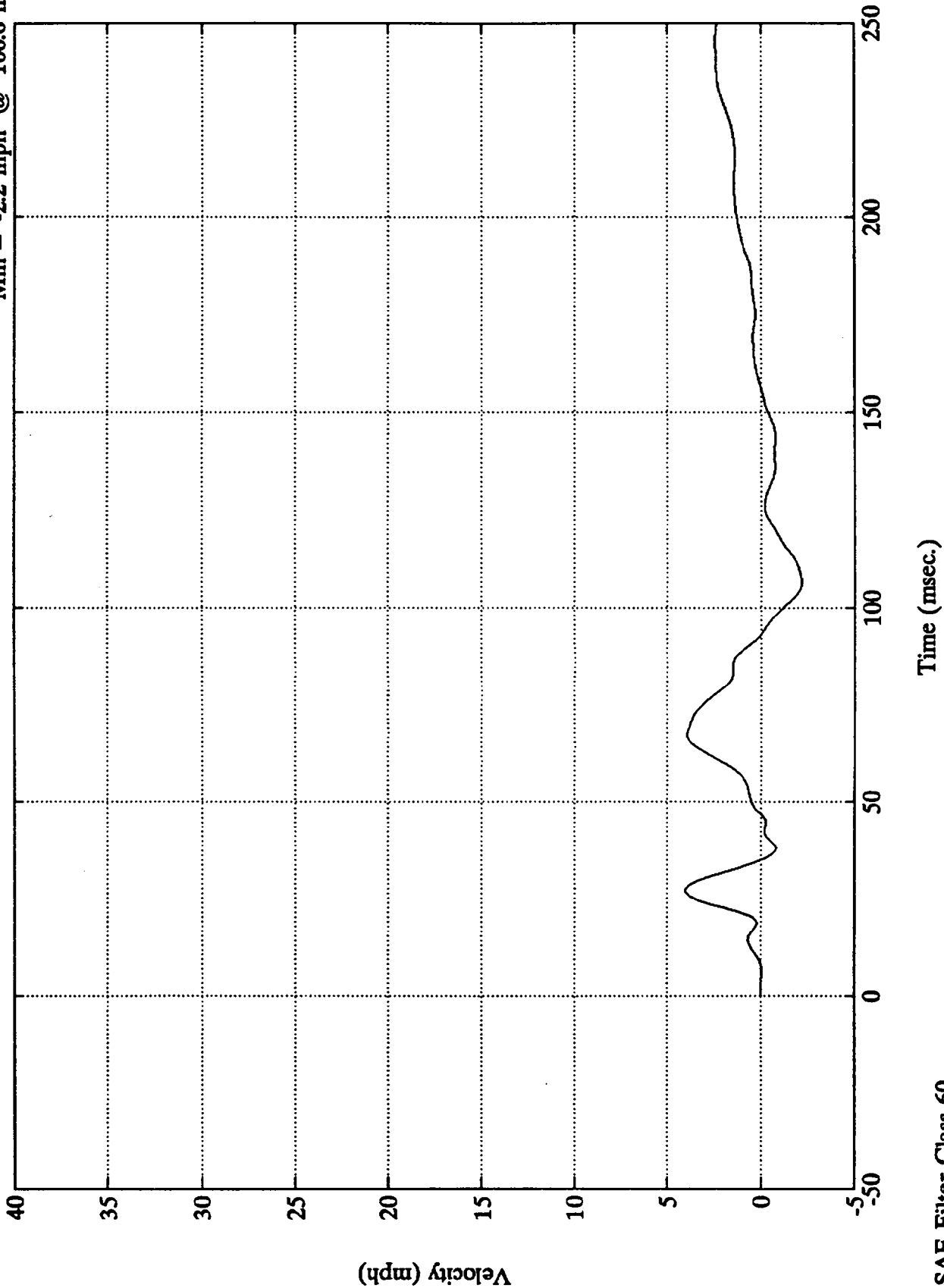
7893-4

SAE Filter Class 60

Test 1047

Acc. #8(z)

Max = 4.1 mph @ 27.4 msec
Min = -2.2 mph @ 106.6 msec



B-21

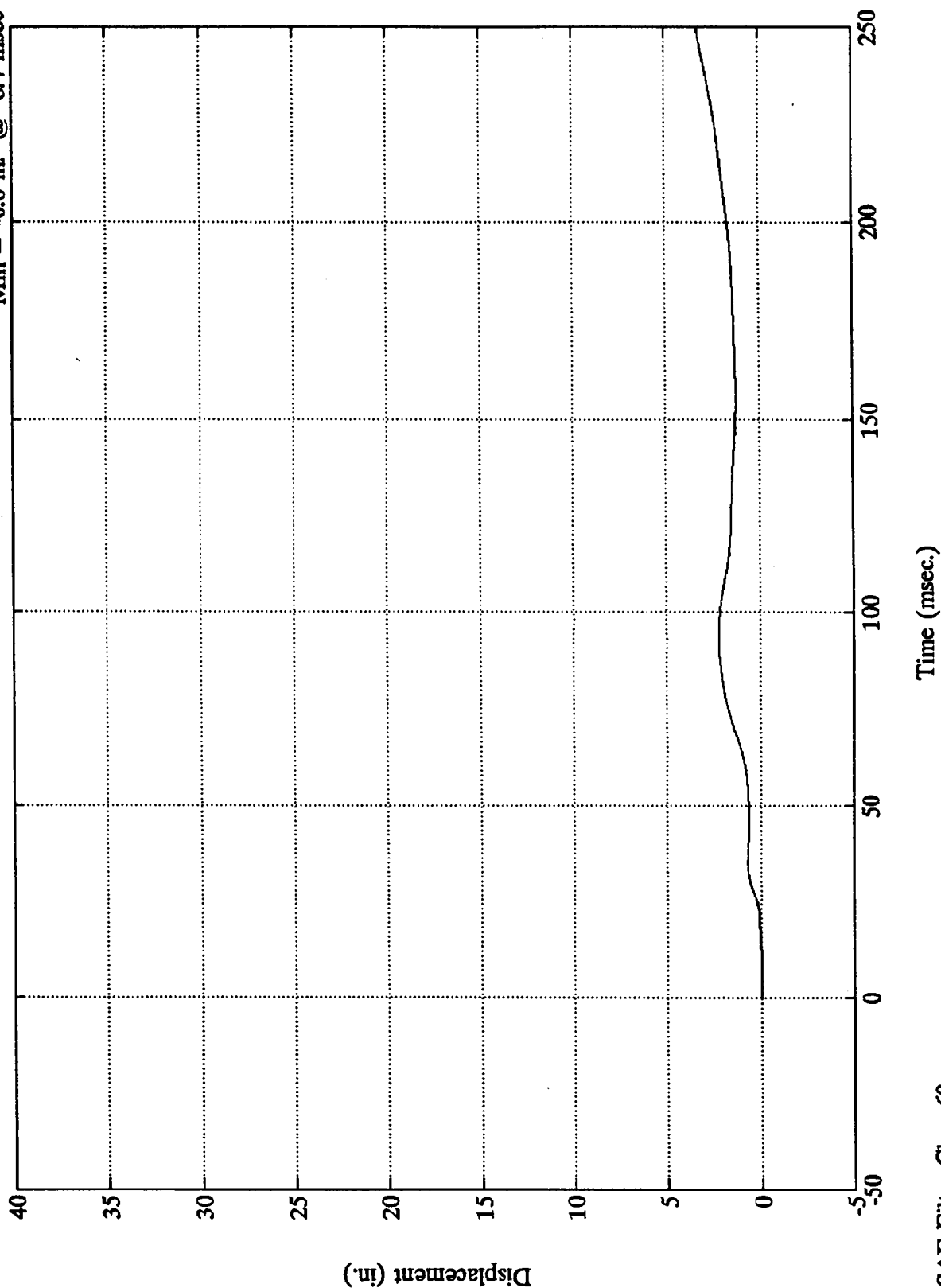
7893-4

SAE Filter Class 60

Max = 3.5 in. @ 254.9 msec
Min = -0.0 in. @ 8.4 msec

Acc. #8(z)

Test 1047

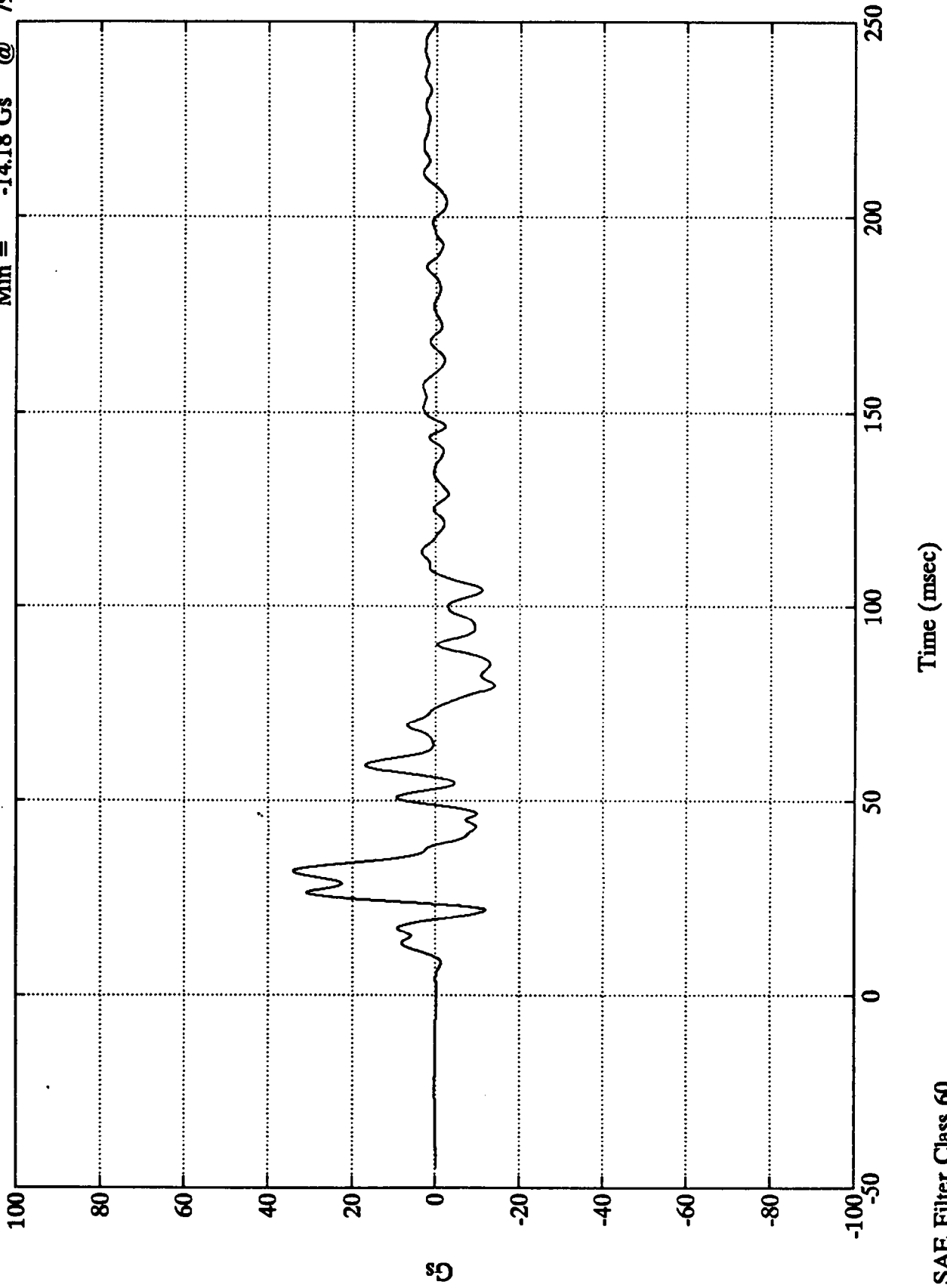


B-22

7893-4

SAE Filter Class 60

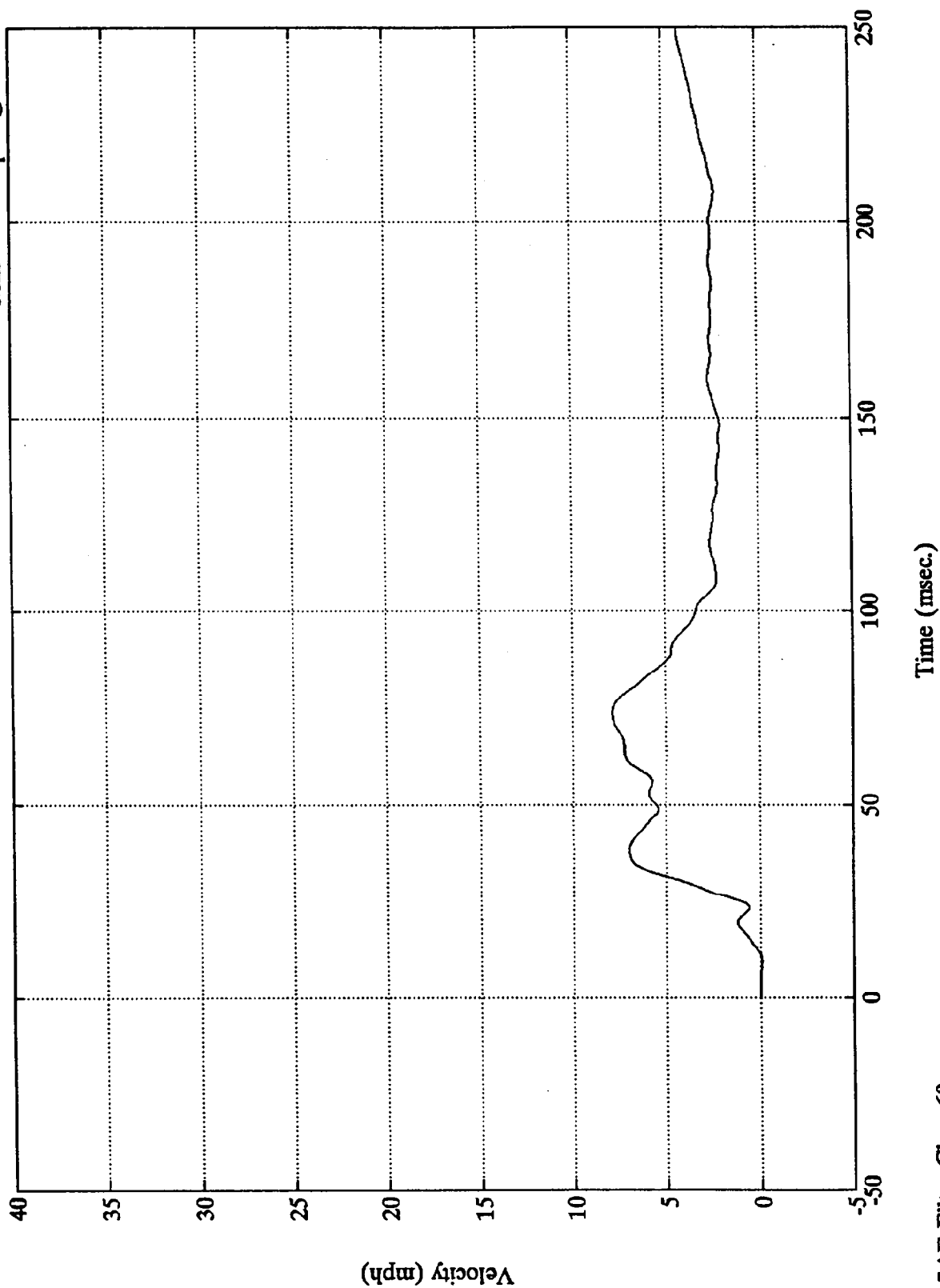
Acc. #9(z) Max = 34.13 Gs @ 31.67 msec
Min = -14.18 Gs @ 79.68 msec



Max = 7.9 mph @ 74.4 msec
Min = -0.1 mph @ 9.8 msec

Acc. #9(z)

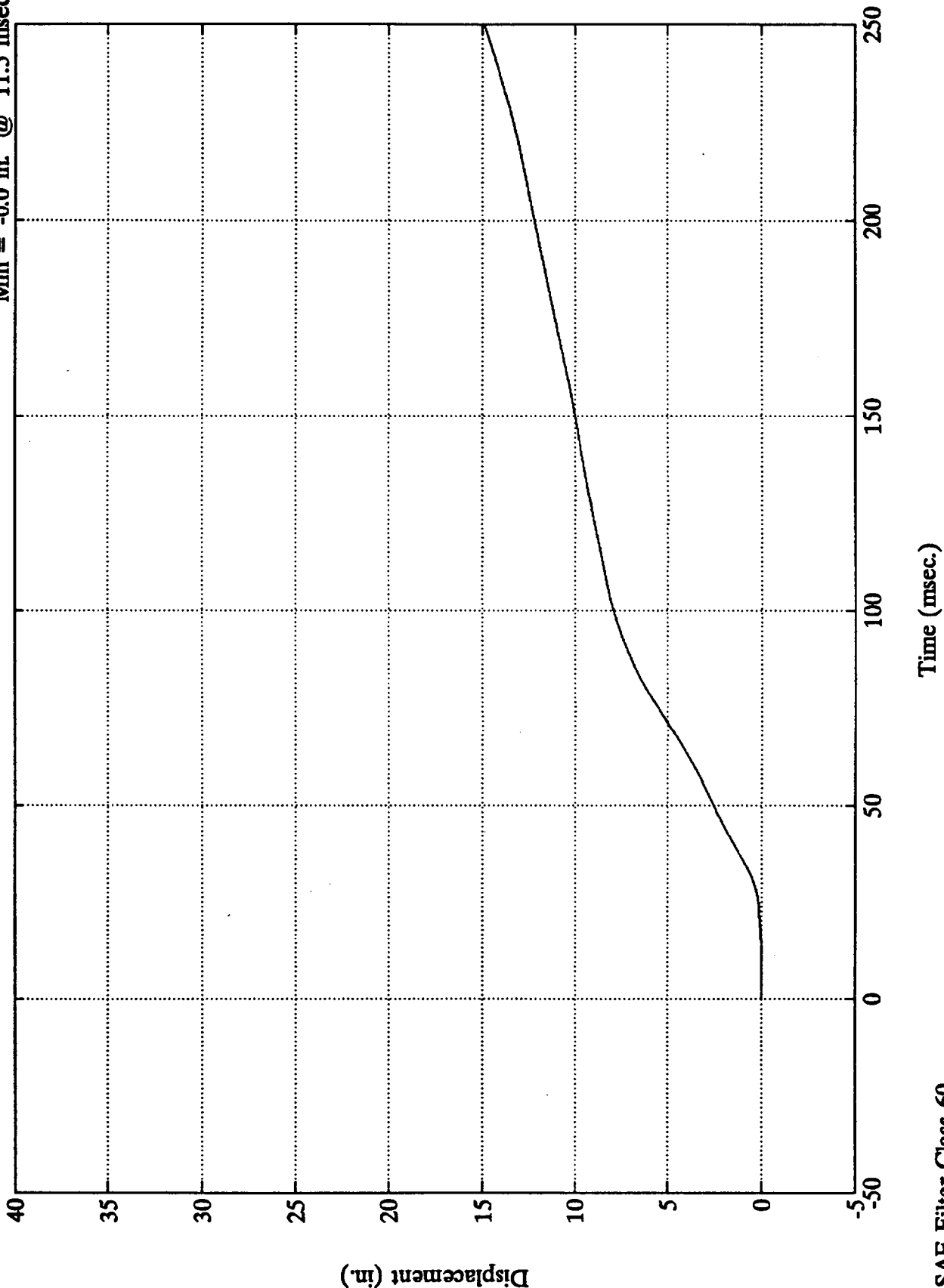
Test 1047



Test 1047

Acc. #9(z)

Max = 15.3 in. @ 254.9 msec
Min = -0.0 in. @ 11.5 msec



TEST NO. MM5701

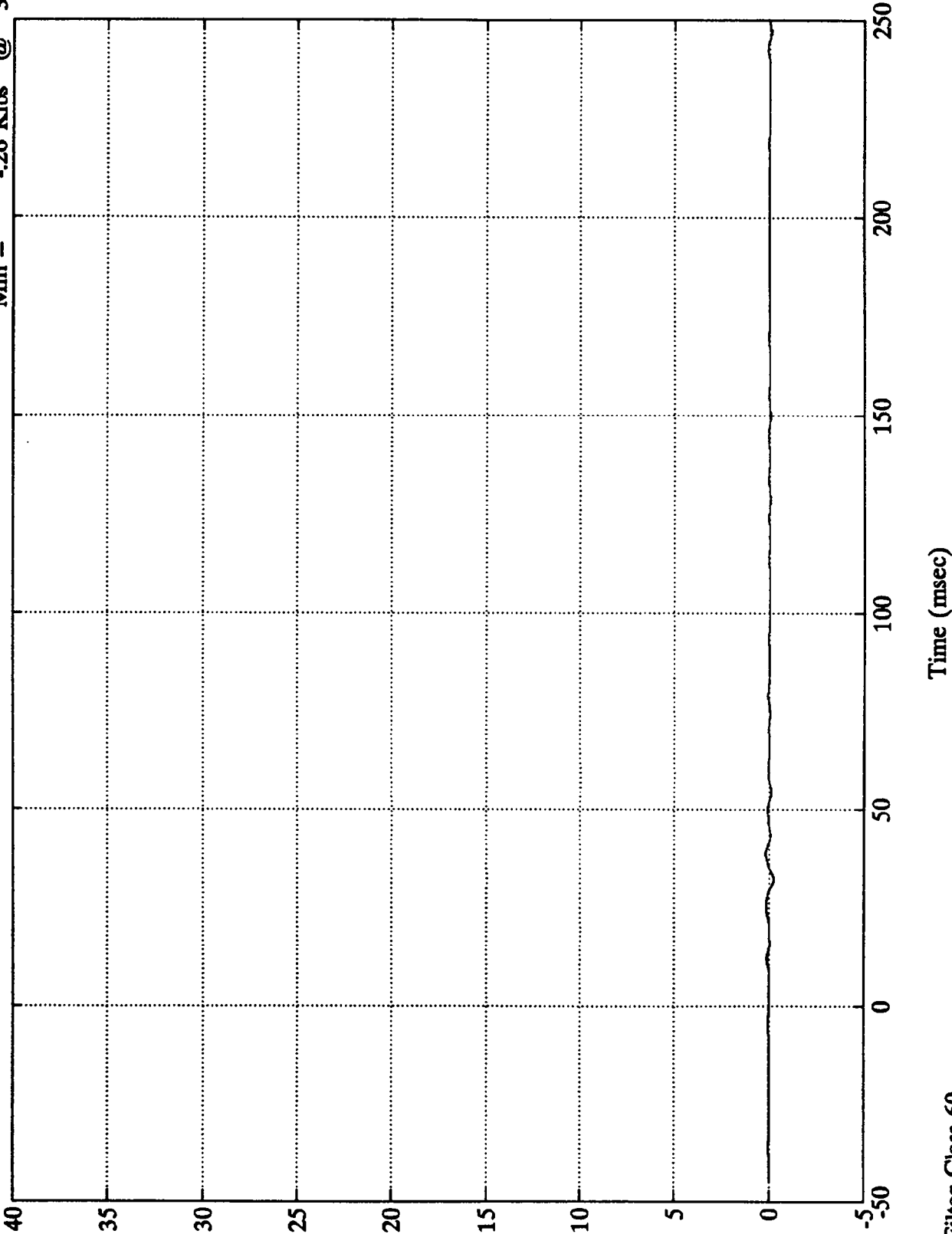
LOAD CELL BARRIER DATA

FILTER CHANNEL CLASS

60

Barrier Load Cell A1

Max = .18 Klbs @ 38.88 msec
Min = -.26 Klbs @ 32.28 msec

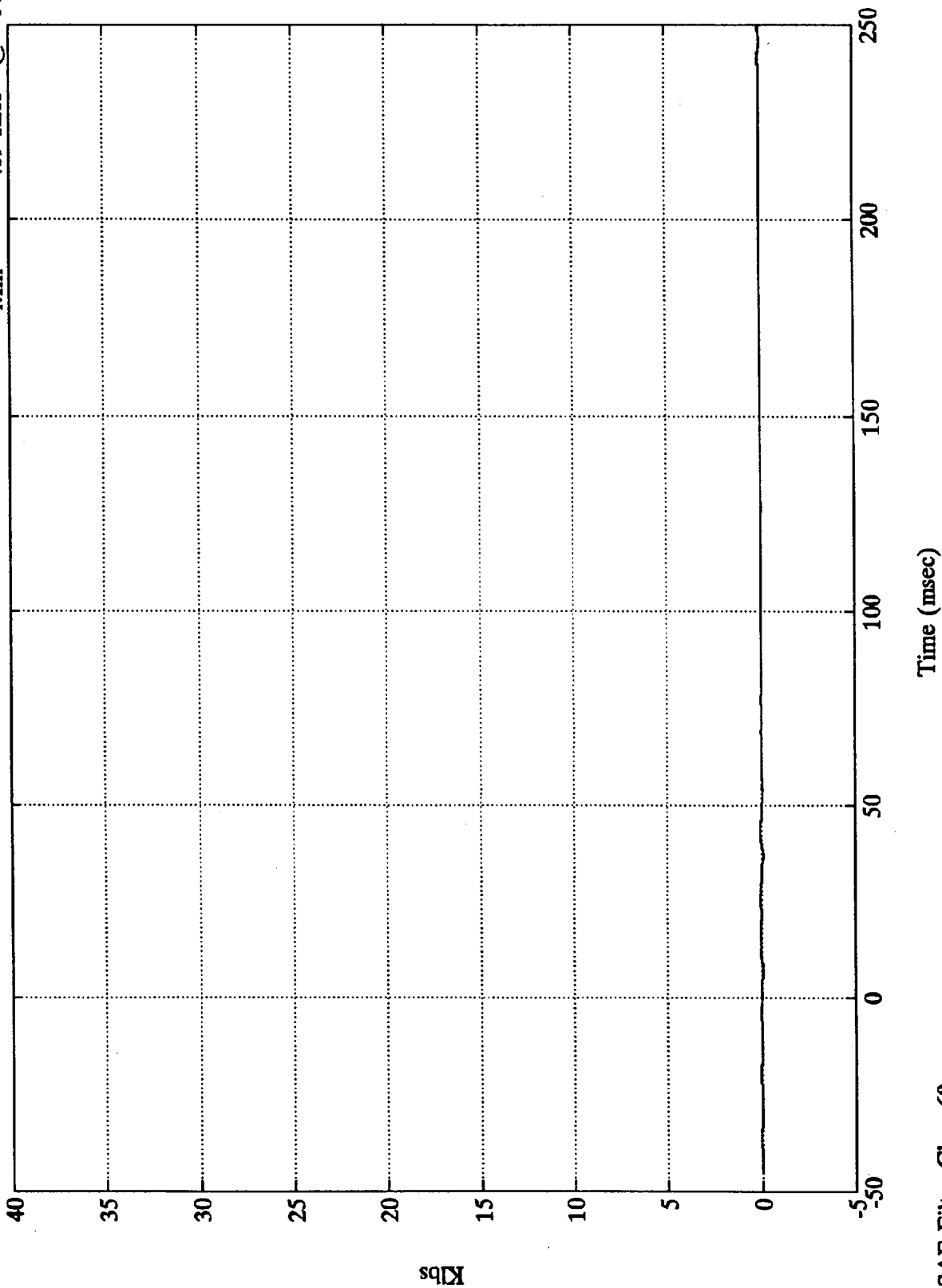


SAE Filter Class 60

Test 1047

Barrier Load Cell A2

Max = .10 Klbs @ 25.07 msec
Min = -.09 Klbs @ 36.84 msec



B-28

SAE Filter Class 60

7893-4

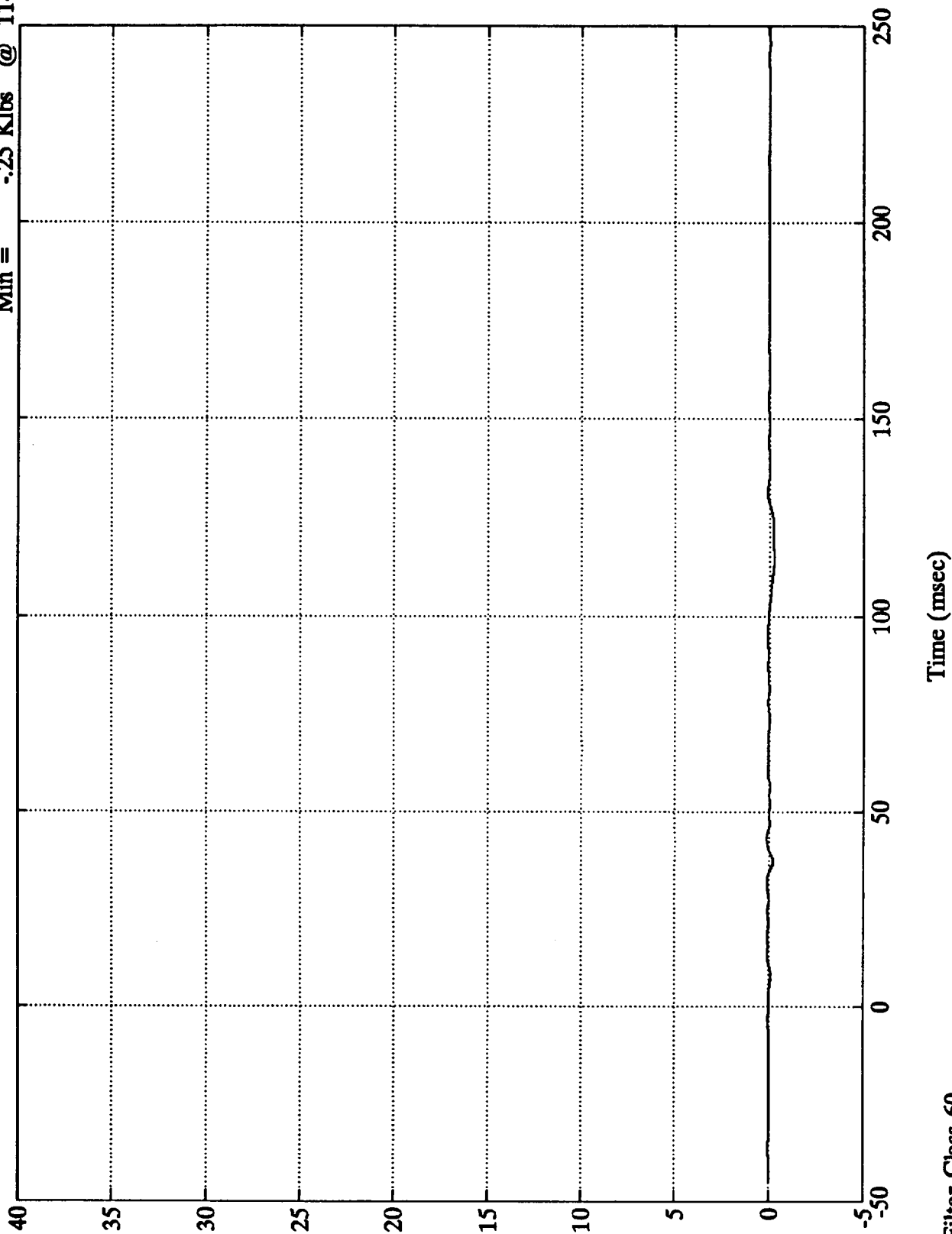
Test 1047

B-29

7893-4 SAE Filter Class 60

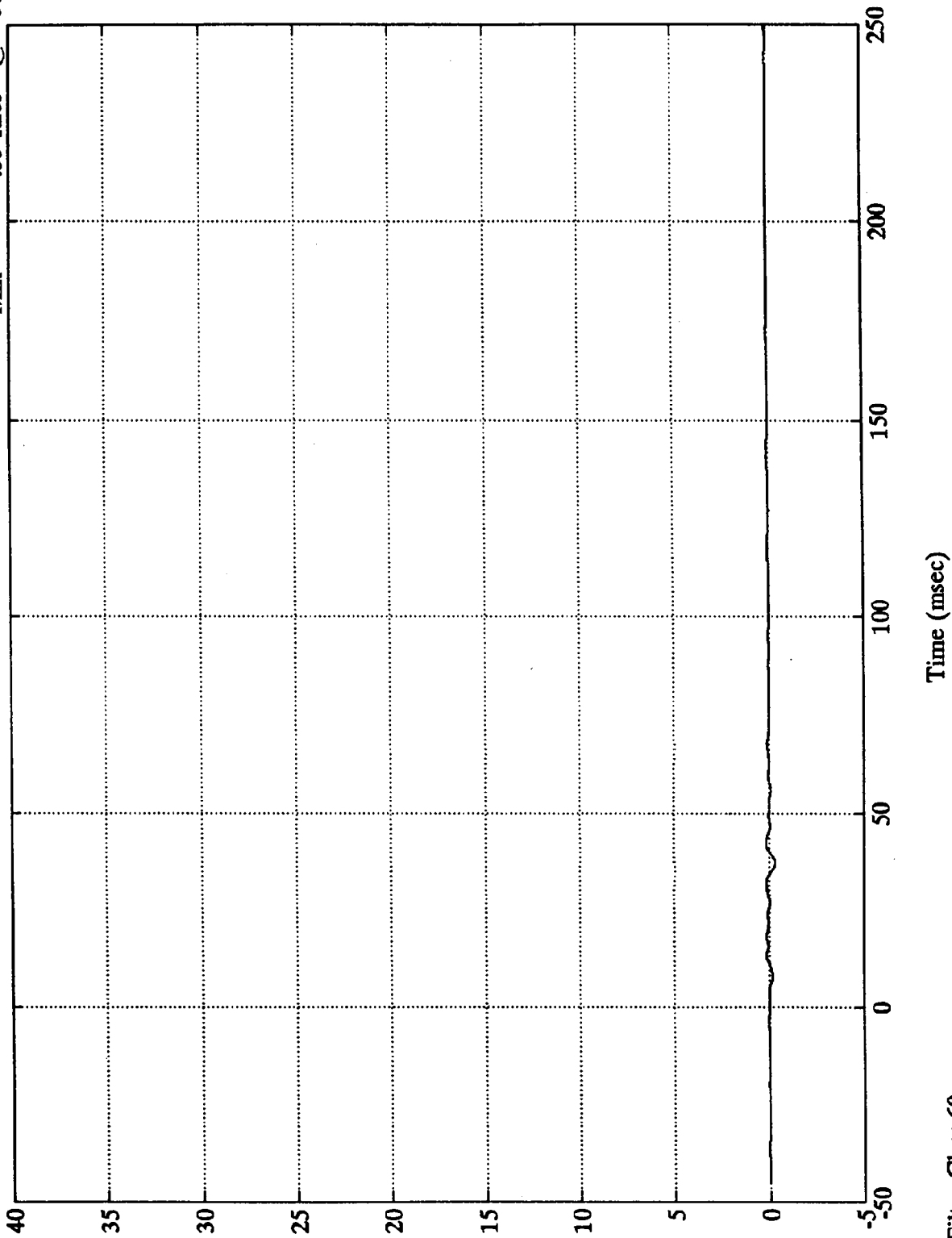
Barrier Load Cell A3

Max = .13 Klbs @ 43.31 msec
Min = -.25 Klbs @ 114.72 msec



Test 1047

Barrier Load Cell A4
Max = .15 Klbs @ 42.36 msec
Min = -.33 Klbs @ 37.20 msec



B-30
Klbs

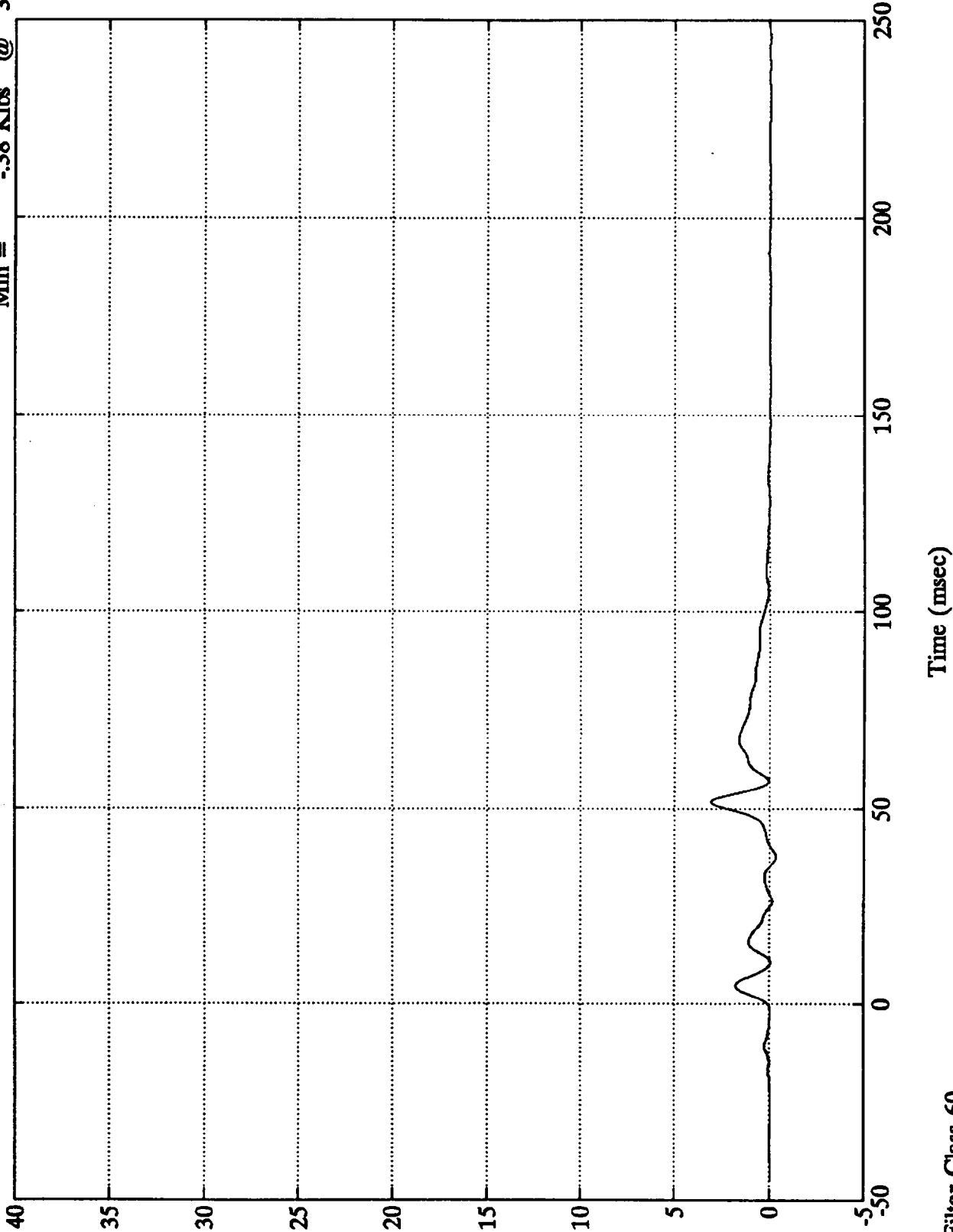
7893-4
SAE Filter Class 60

Barrier Load Cell A5

Max =
Min =

3.07 Klbs @
-38 Klbs @

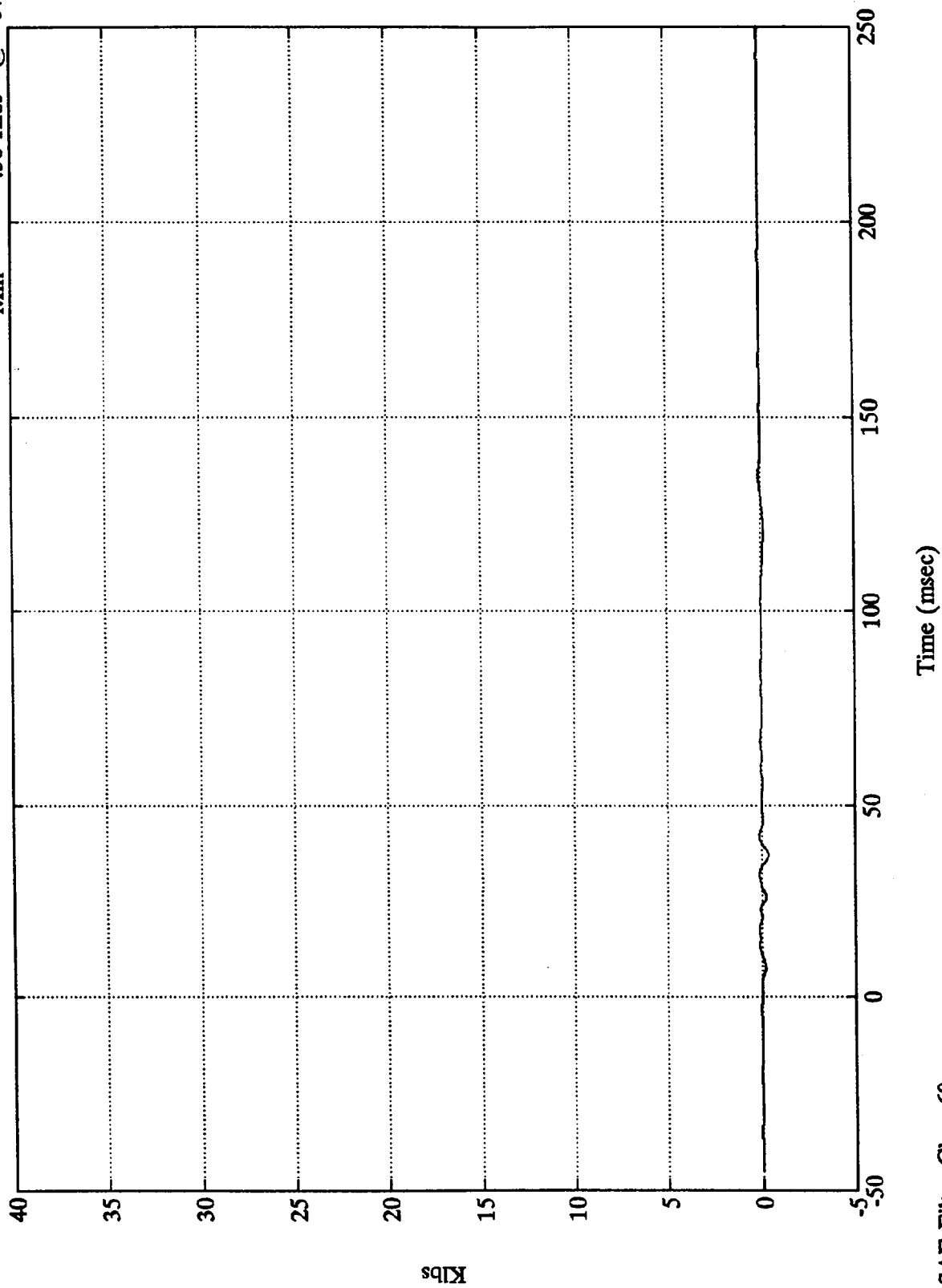
51.72 msec
37.56 msec



B-31
Klbs

Test 1047

Barrier Load Cell A6
Max = .14 Klbs @ 42.24 msec
Min = -.36 Klbs @ 37.31 msec



B-32
Klbs

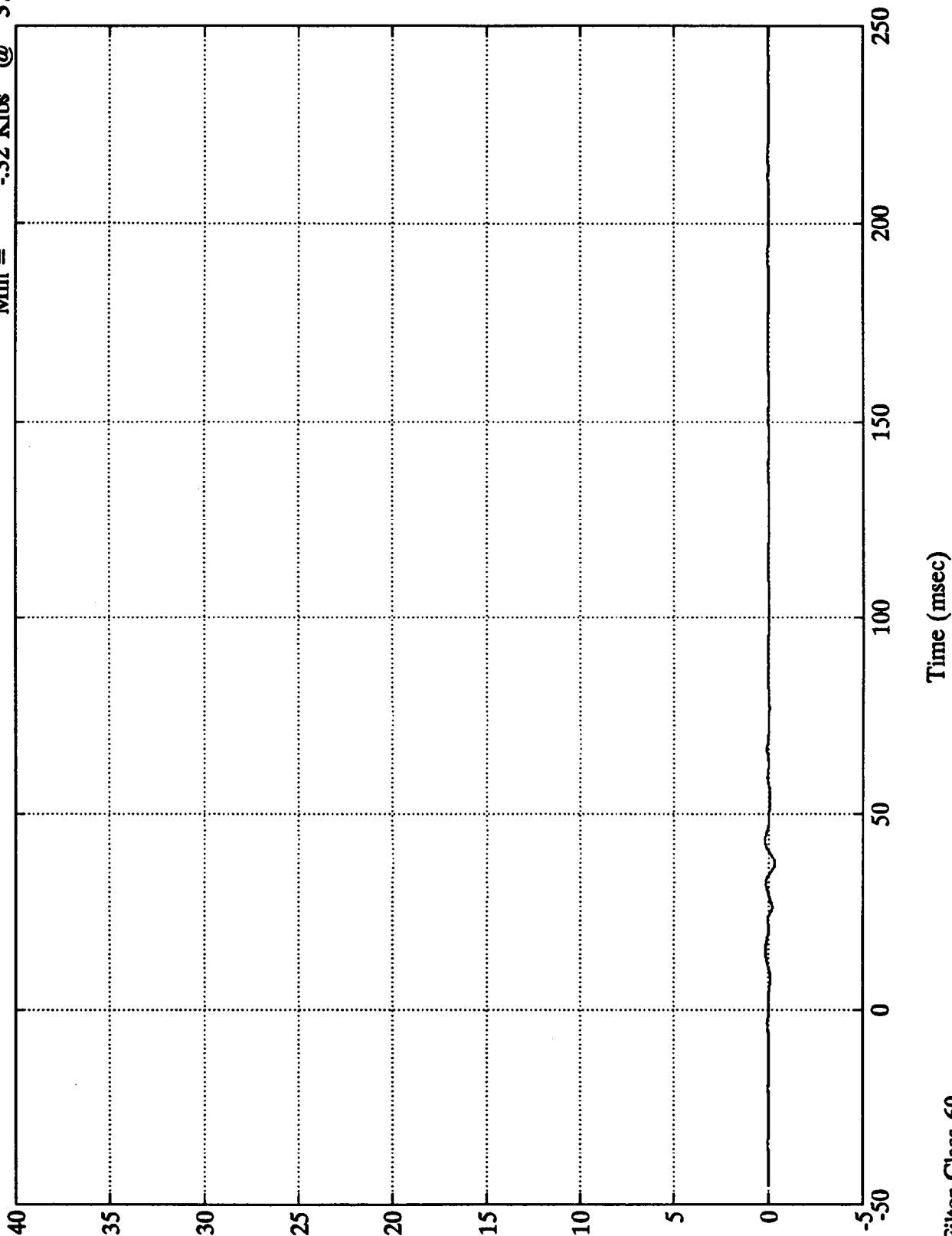
7893-4 SAE Filter Class 60

Test 1047

B-33
Klbs

Barrier Load Cell A7

Max = .18 Klbs @ 43.08 msec
Min = -.32 Klbs @ 37.31 msec



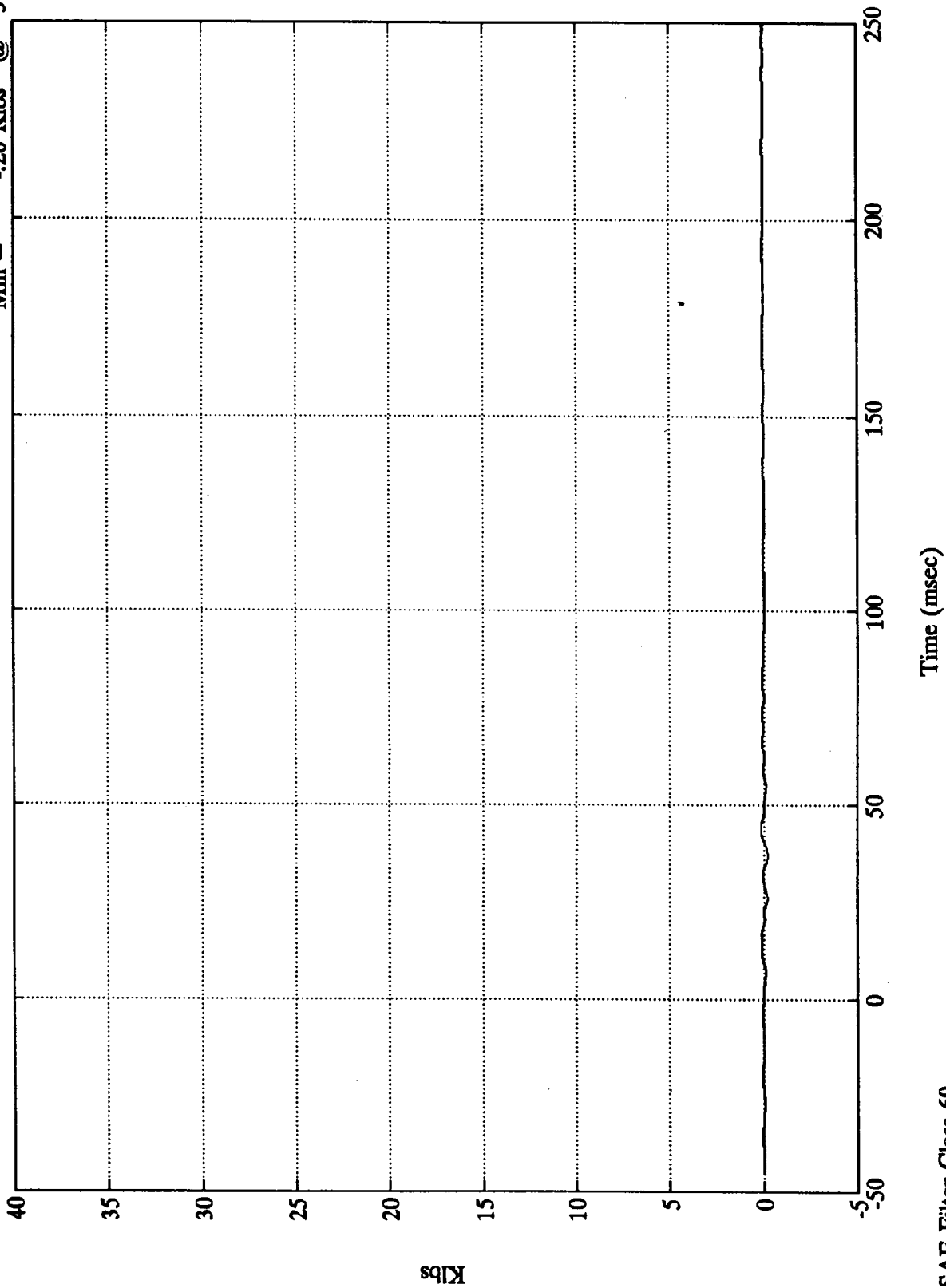
SAE Filter Class 60

7893-4

Test 1047

Max = .15 Klbs @ 44.15 msec
Min = -.20 Klbs @ 37.20 msec

Barrier Load Cell A8



B-34

7893-4
SAE Filter Class 60

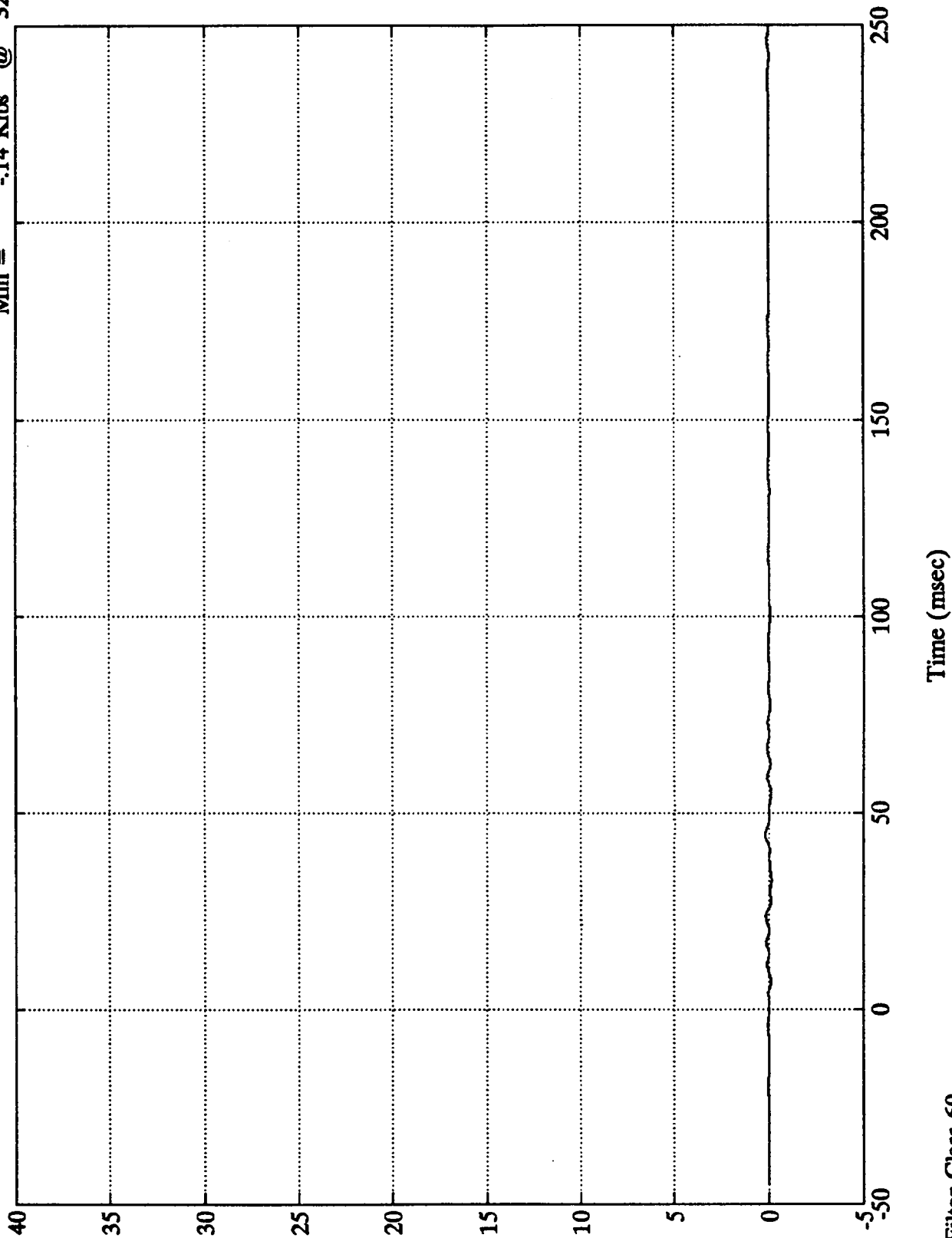
Test 1047

Klbs
B-35

7893-4

Barrier Load Cell A9

Max = .19 Klbs @ 44.27 msec
Min = -.14 Klbs @ 32.76 msec

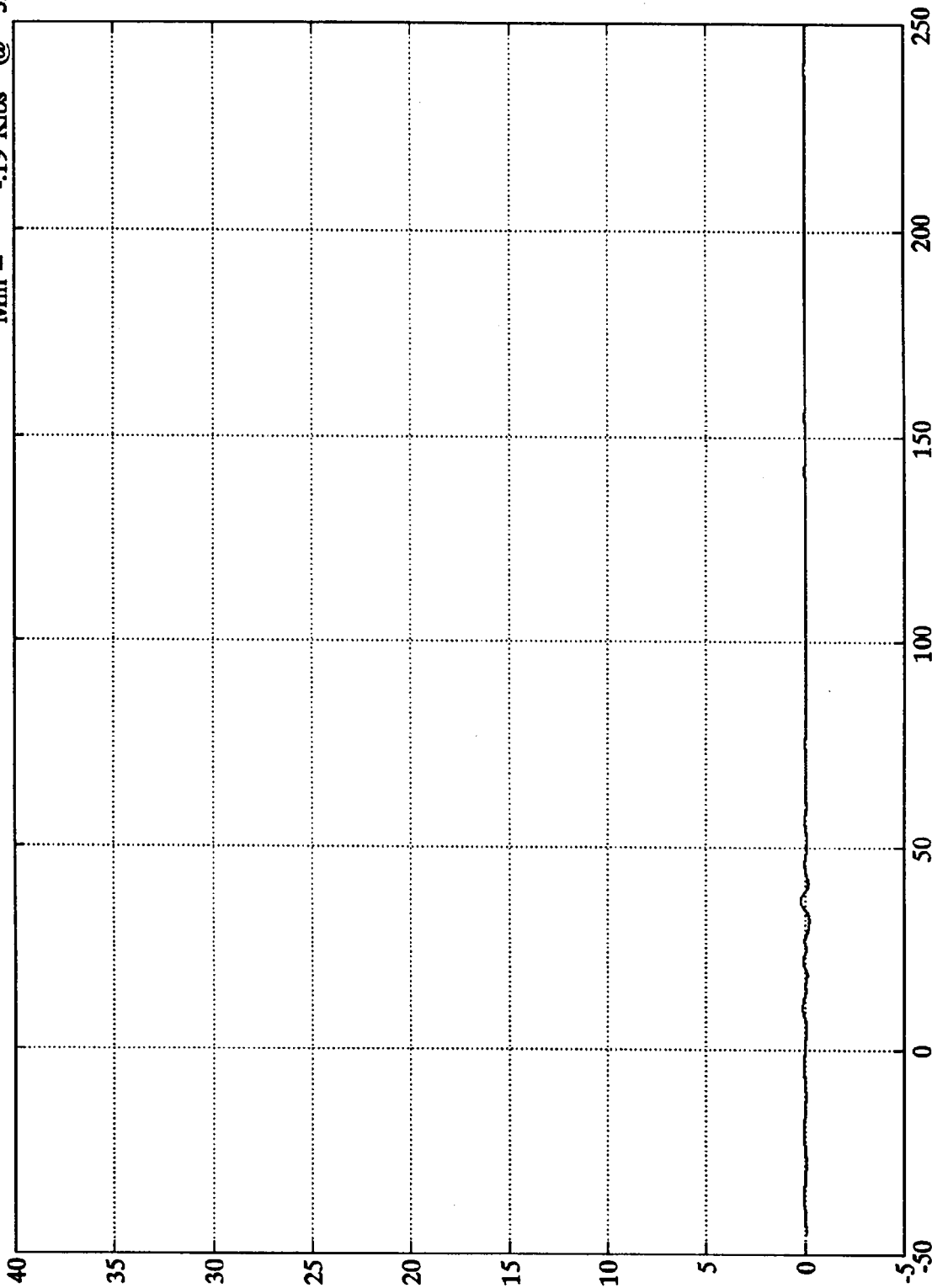


SAE Filter Class 60

Test 1047

Barrier Load Cell B1

Max = .25 Klbs @ 37.44 msec
Min = -.19 Klbs @ 32.52 msec



B-36
Klbs

Time (msec)

SAE Filter Class 60

7893-4

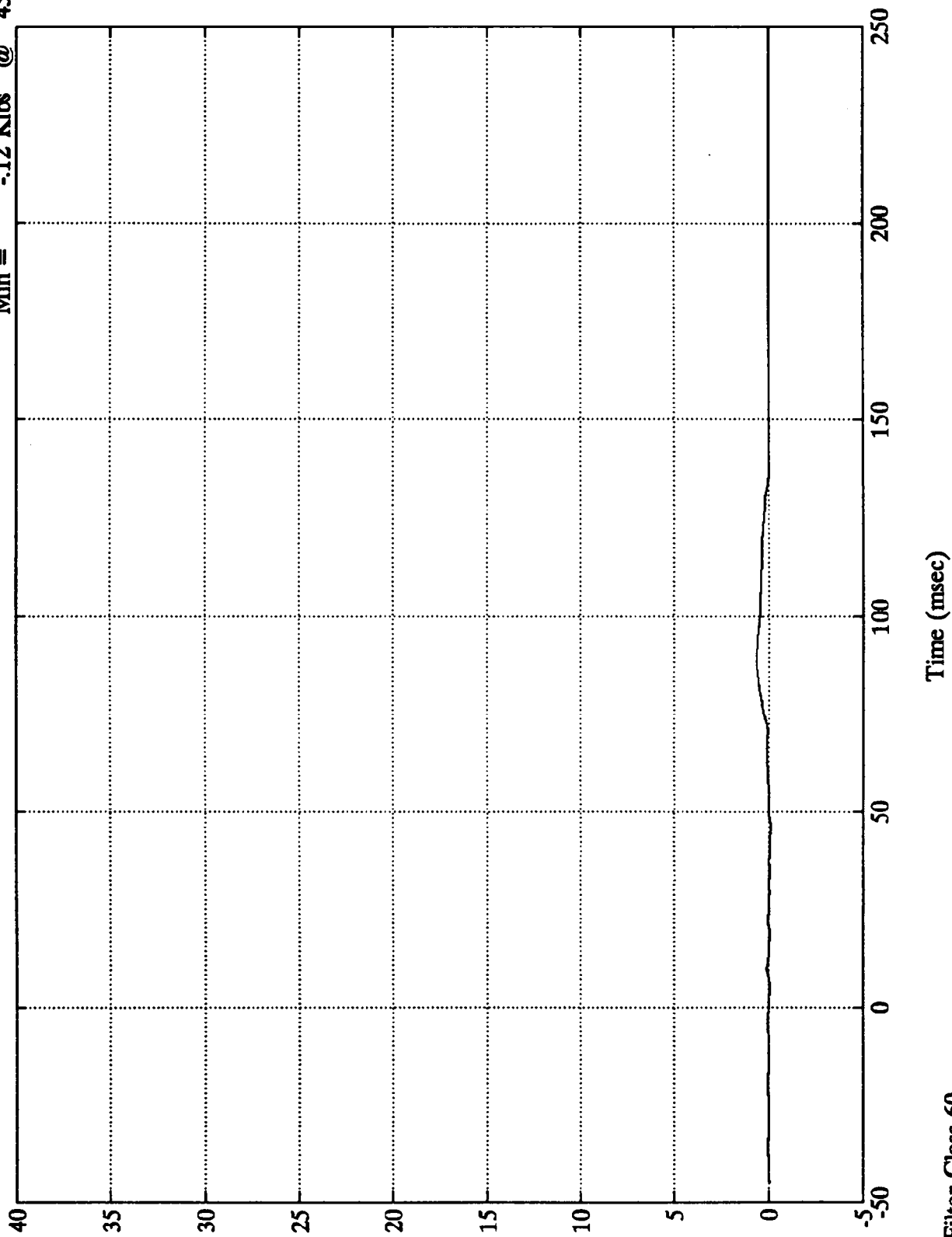
Test 1047

Klbs
B-37

7893-4 SAE Filter Class 60

Barrier Load Cell B2

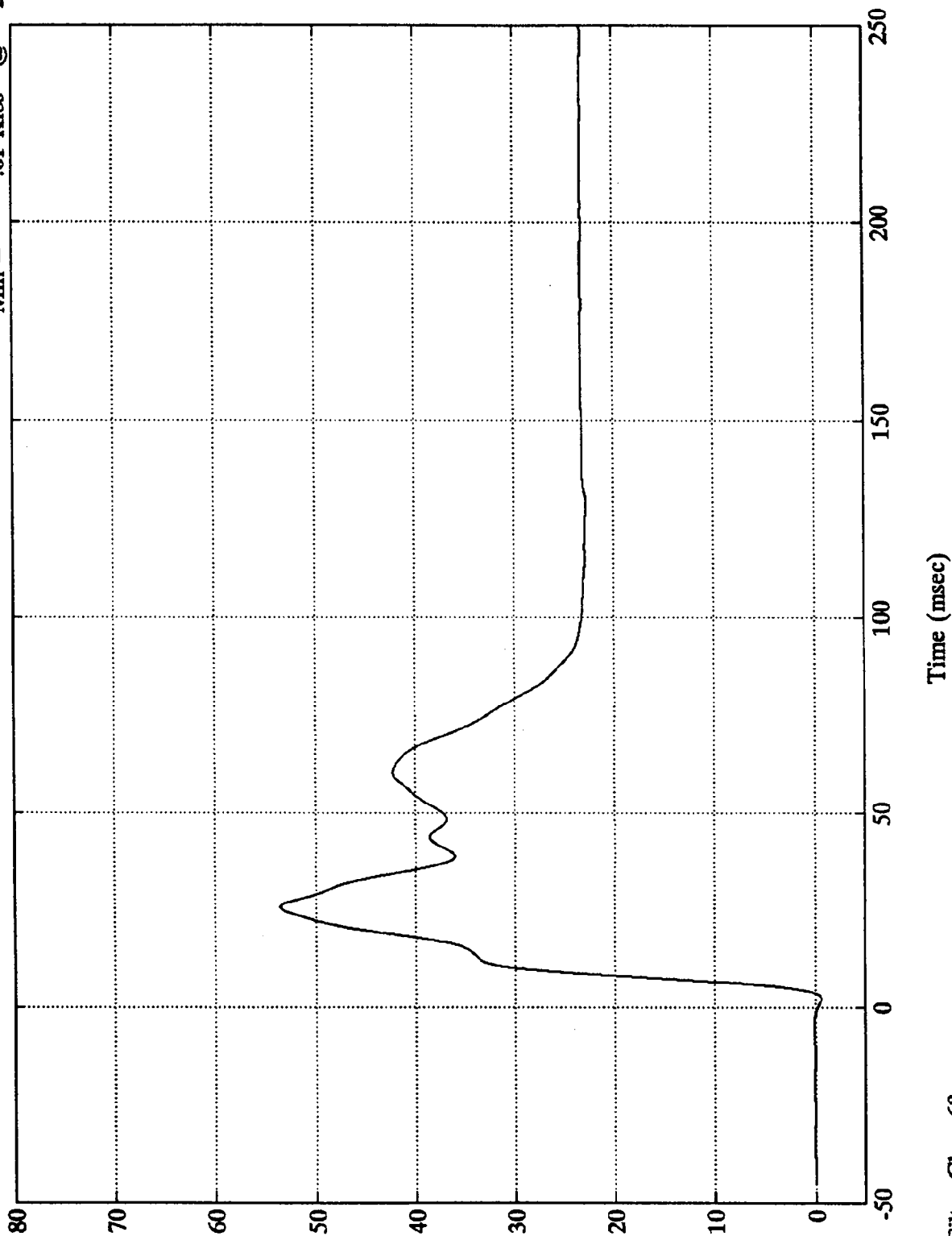
Max = .63 Klbs @ 88.31 msec
Min = -.12 Klbs @ 45.48 msec



Test 1047

Barrier Load Cell B3

Max = 53.54 Klbs @ 25.55 msec
Min = -.61 Klbs @ 2.39 msec



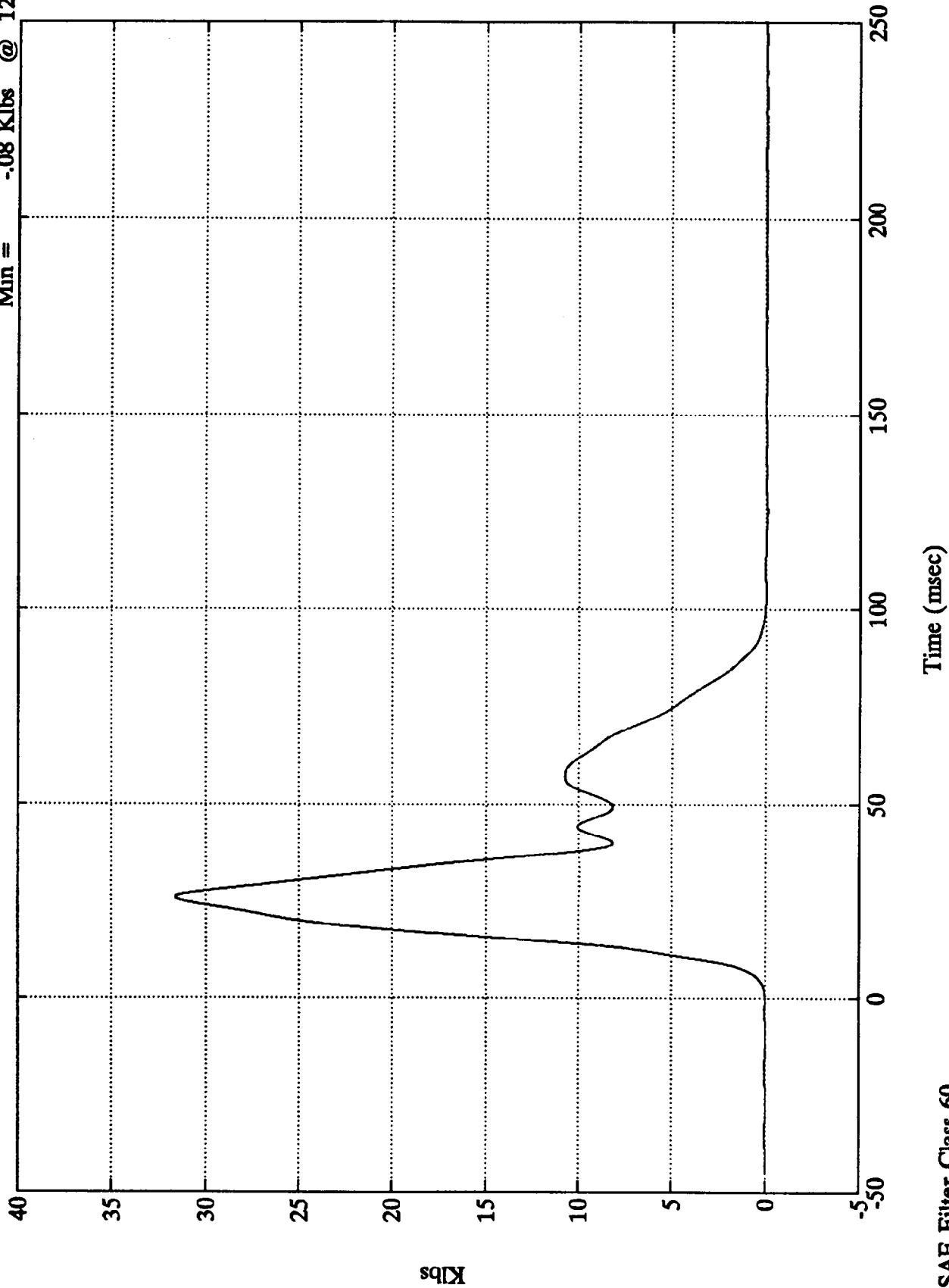
B-38
Klbs

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell B4

Max = 31.62 Klbs @ 26.03 msec
Min = -.08 Klbs @ 125.52 msec



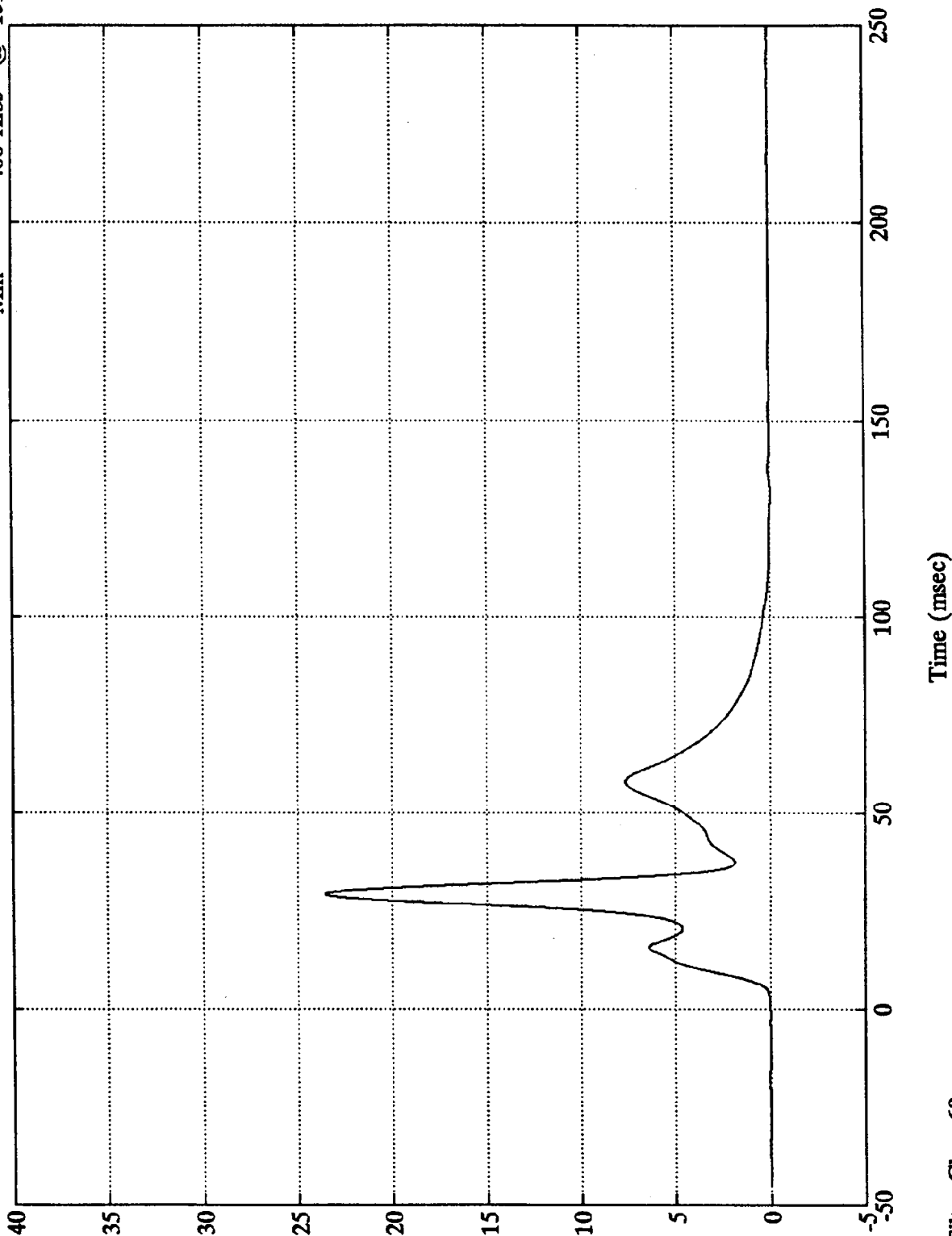
B-39
Klbs

7893-4
SAE Filter Class 60

Test 1047

Barrier Load Cell B5

Max = 23.56 Klbs @ 29.51 msec
Min = -.06 Klbs @ 131.40 msec



B-40
Klbs

7893-4 SAE Filter Class 60

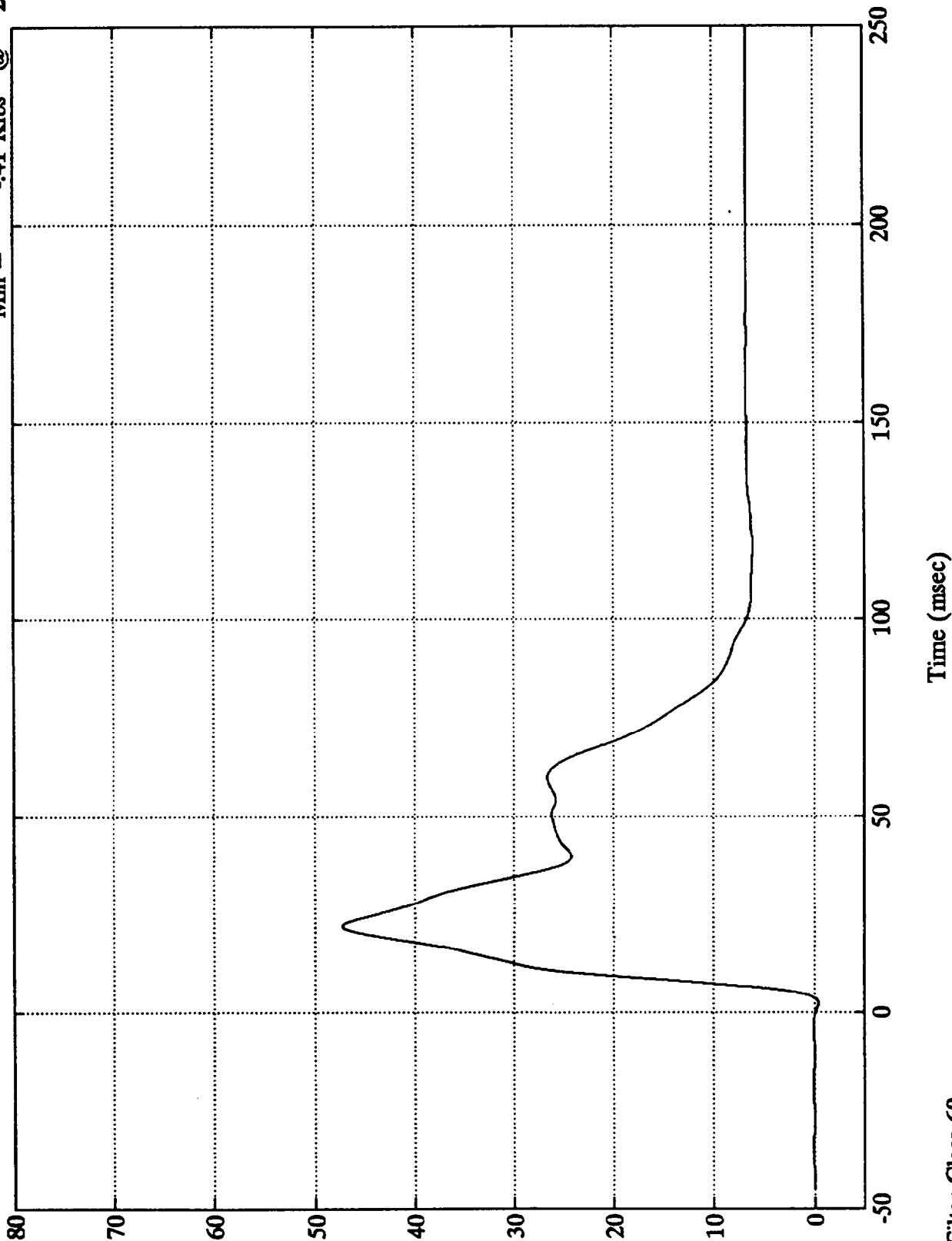
Test 1047

Klbs
B-41

7893-4

Barrier Load Cell B6

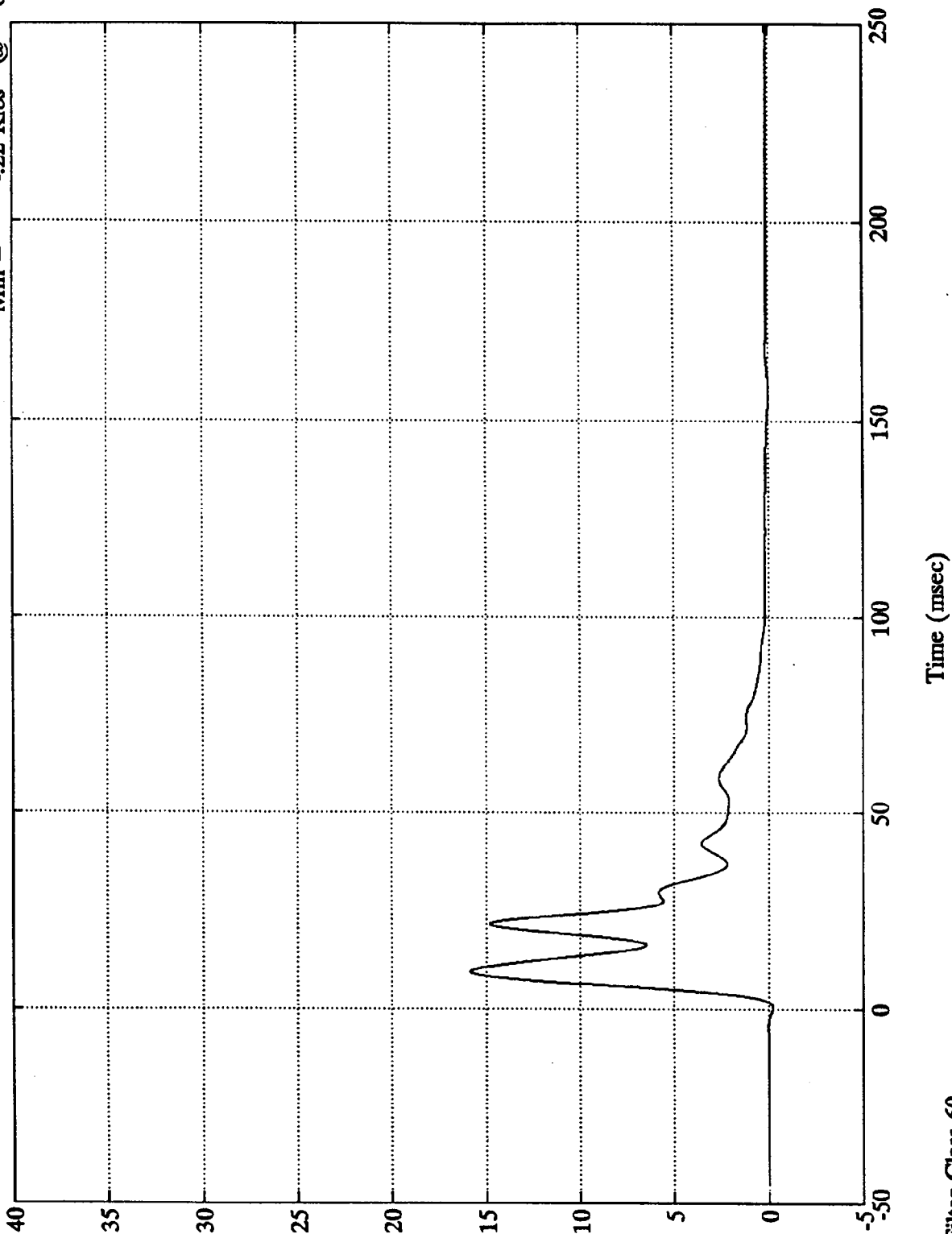
Max = 47.24 Klbs @ 21.95 msec
Min = -41 Klbs @ 2.27 msec



SAE Filter Class 60

Test 1047

Barrier Load Cell B7
Max = 15.85 Klbs @ 9.71 msec
Min = -2.22 Klbs @ 0.59 msec



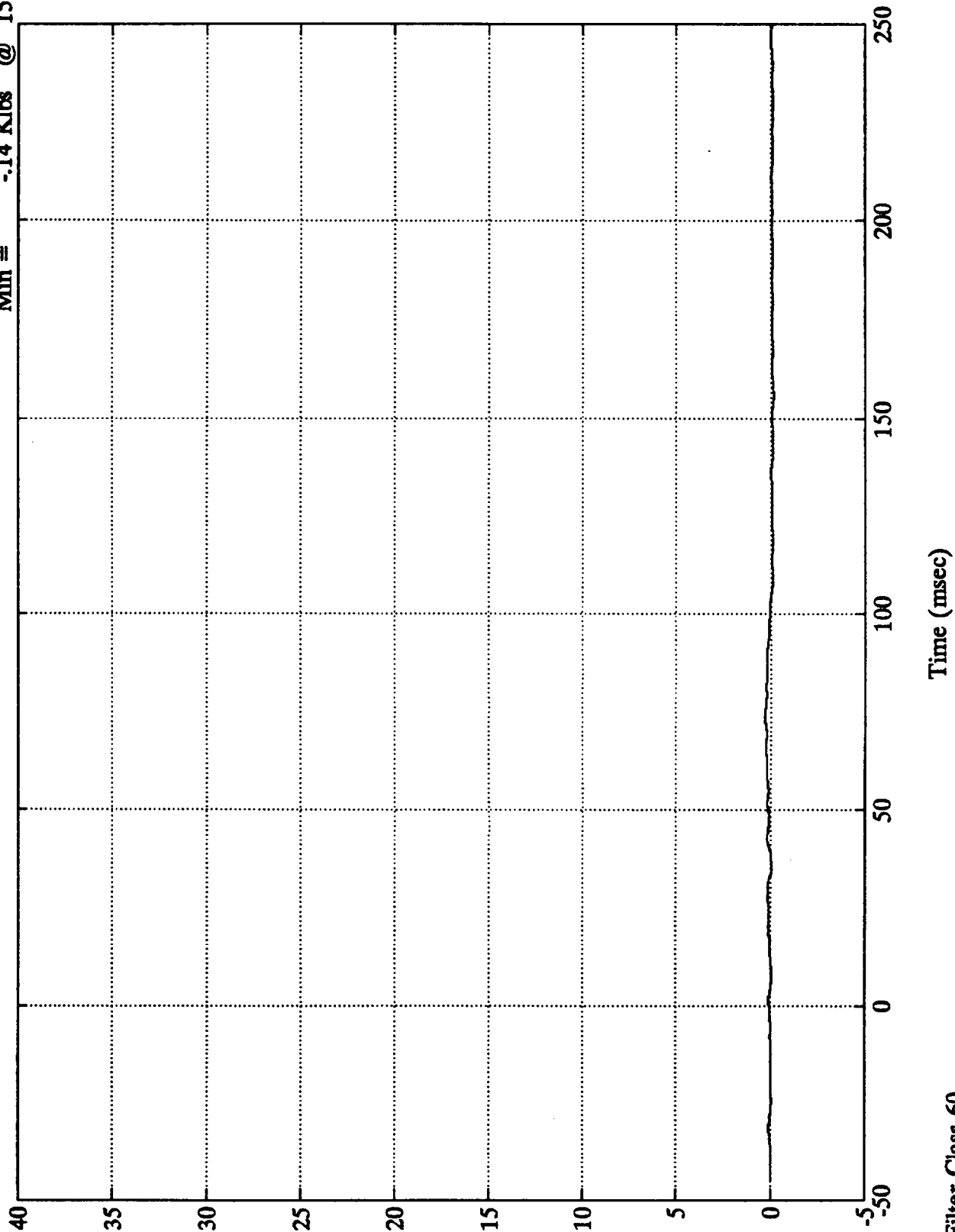
B-42

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell B8

Max = .28 Klbs @ 74.04 msec
Min = -.14 Klbs @ 155.52 msec

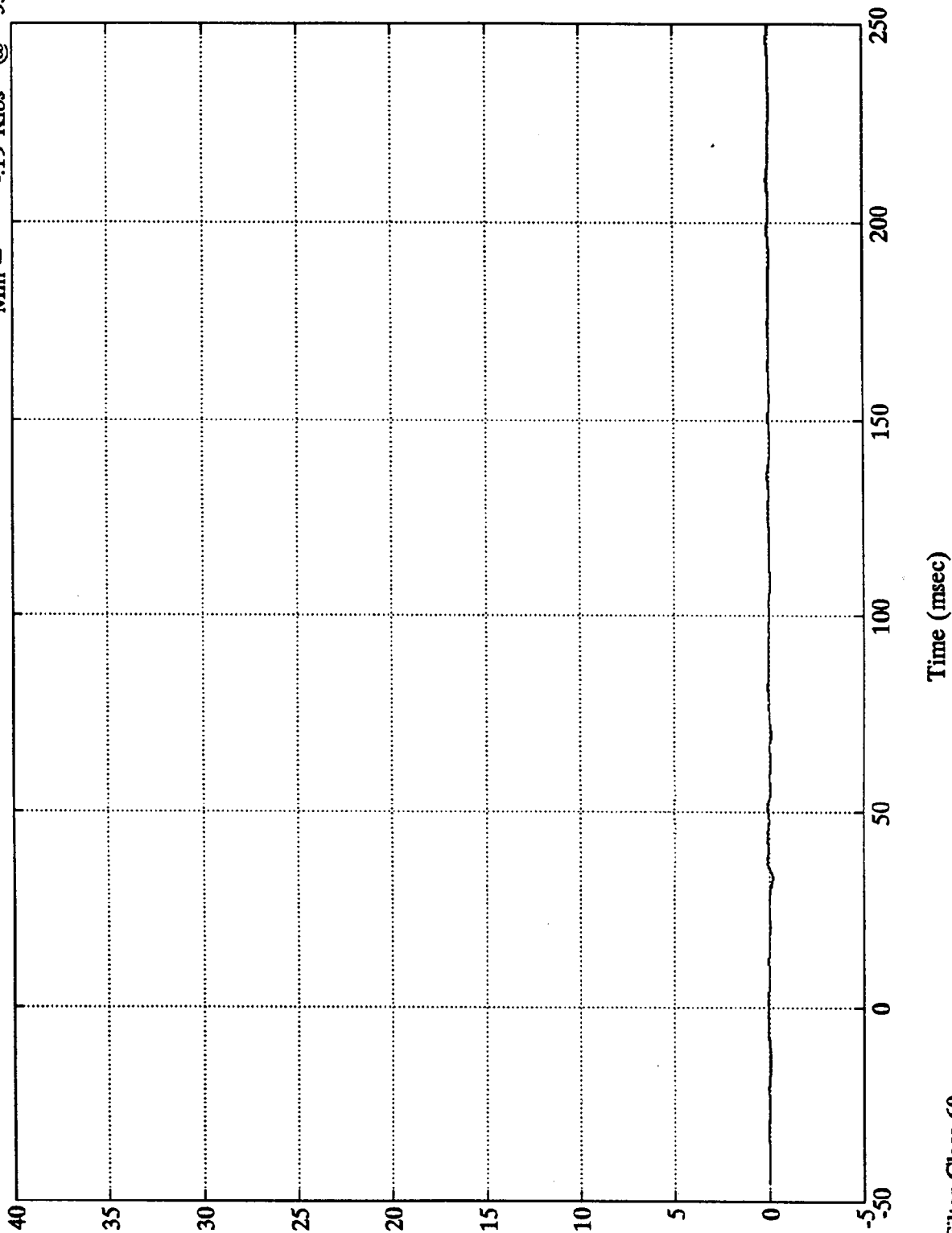


B-43
Klbs

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell B9
Max = .10 Klbs @ 37.68 msec
Min = -.19 Klbs @ 33.36 msec



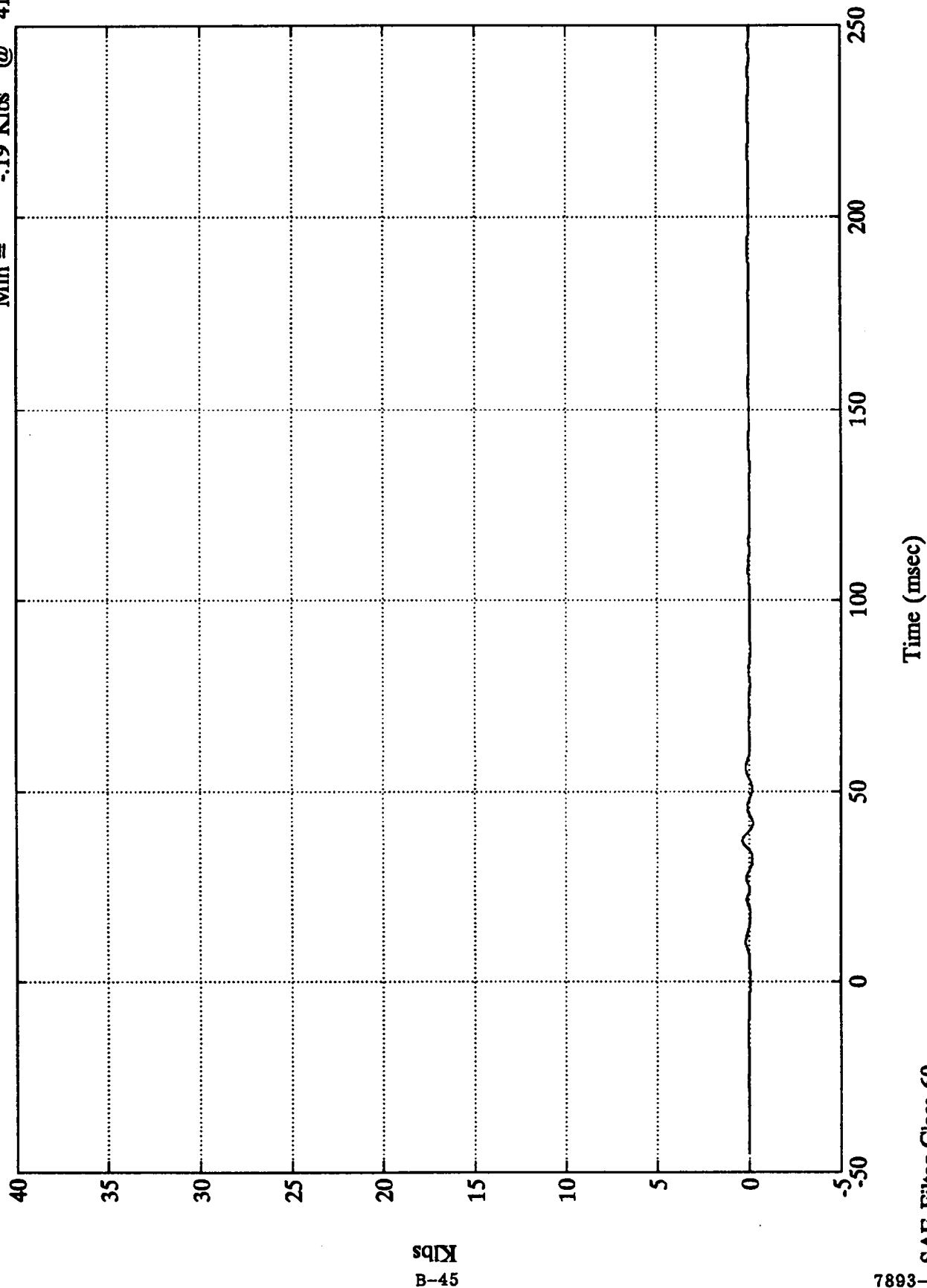
B-44
Klbs

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell C1

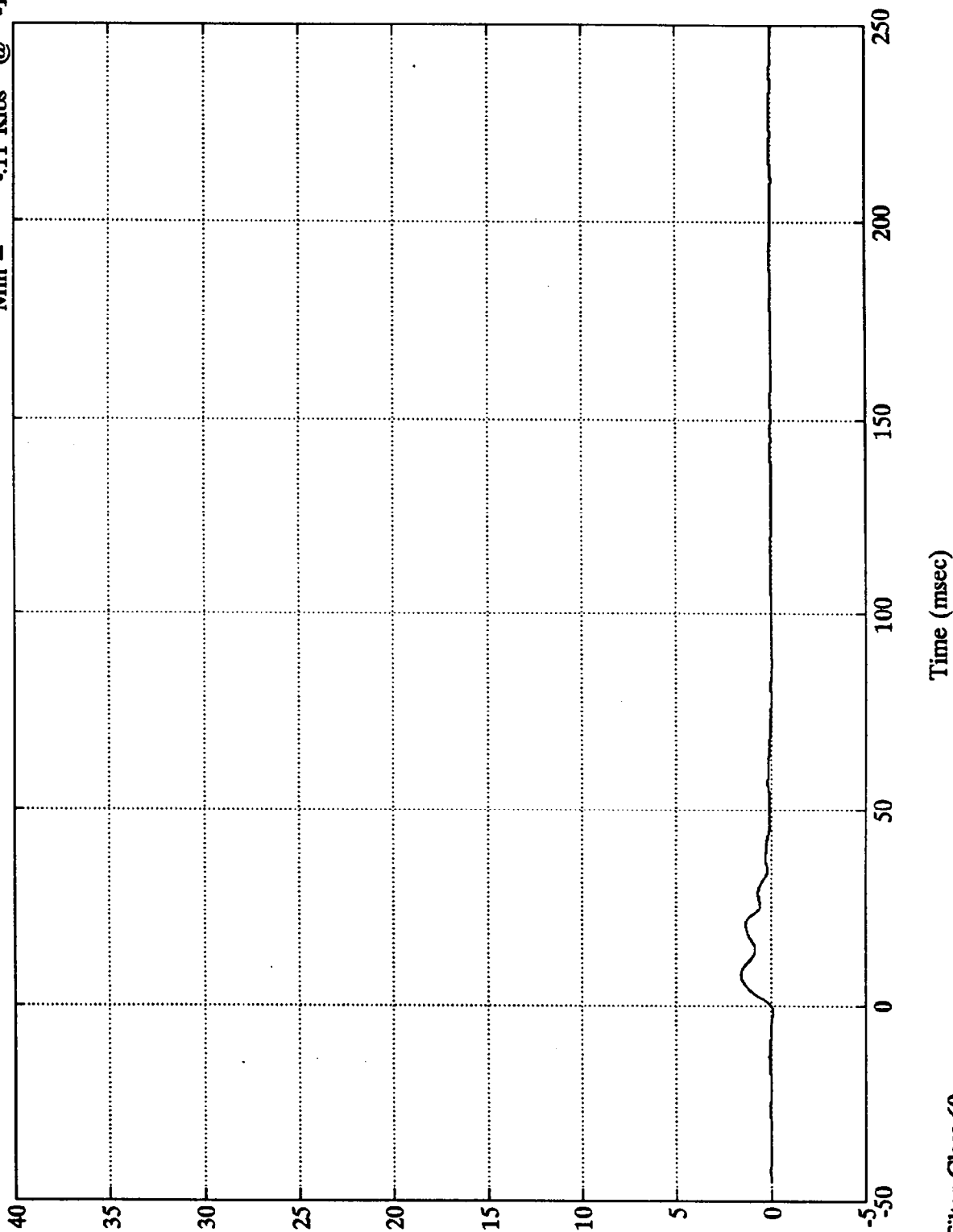
Max = .37 Klbs @ 37.08 msec
Min = -.19 Klbs @ 41.76 msec



Test 1047

Barrier Load Cell C2

Max = 1.57 Klbs @ 7.79 msec
Min = -1.11 Klbs @ -1.56 msec

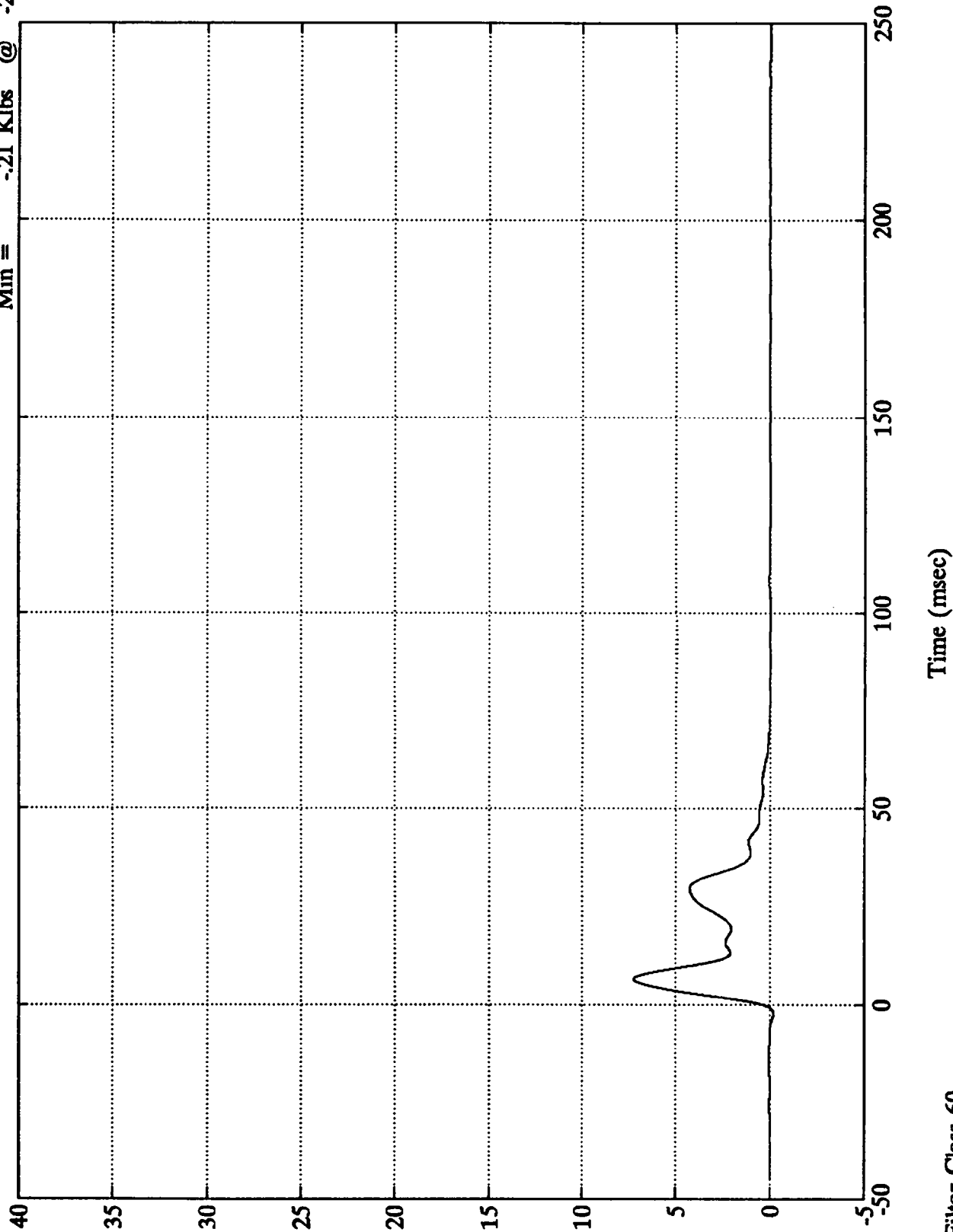


B-46

7893-4 SAE Filter Class 60

Barrier Load Cell C3

Max = 7.26 Klbs @ 6.71 msec
Min = -21 Klbs @ -2.16 msec

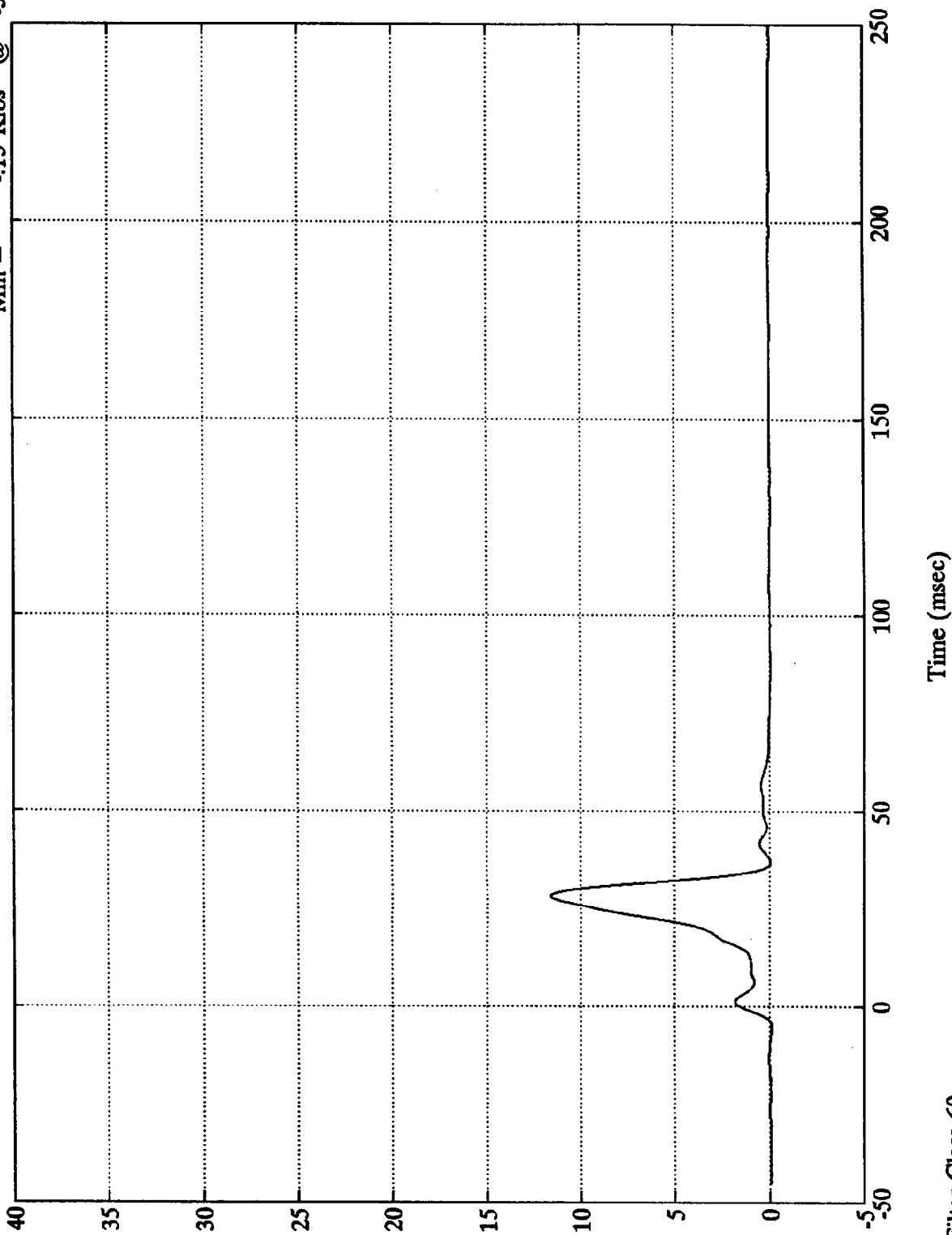


B-47

Test 1047

Barrier Load Cell C4

Max = 11.58 Klbs @ 28.68 msec
Min = -13 Klbs @ -5.28 msec



B-48

7893-4

SAE Filter Class 60

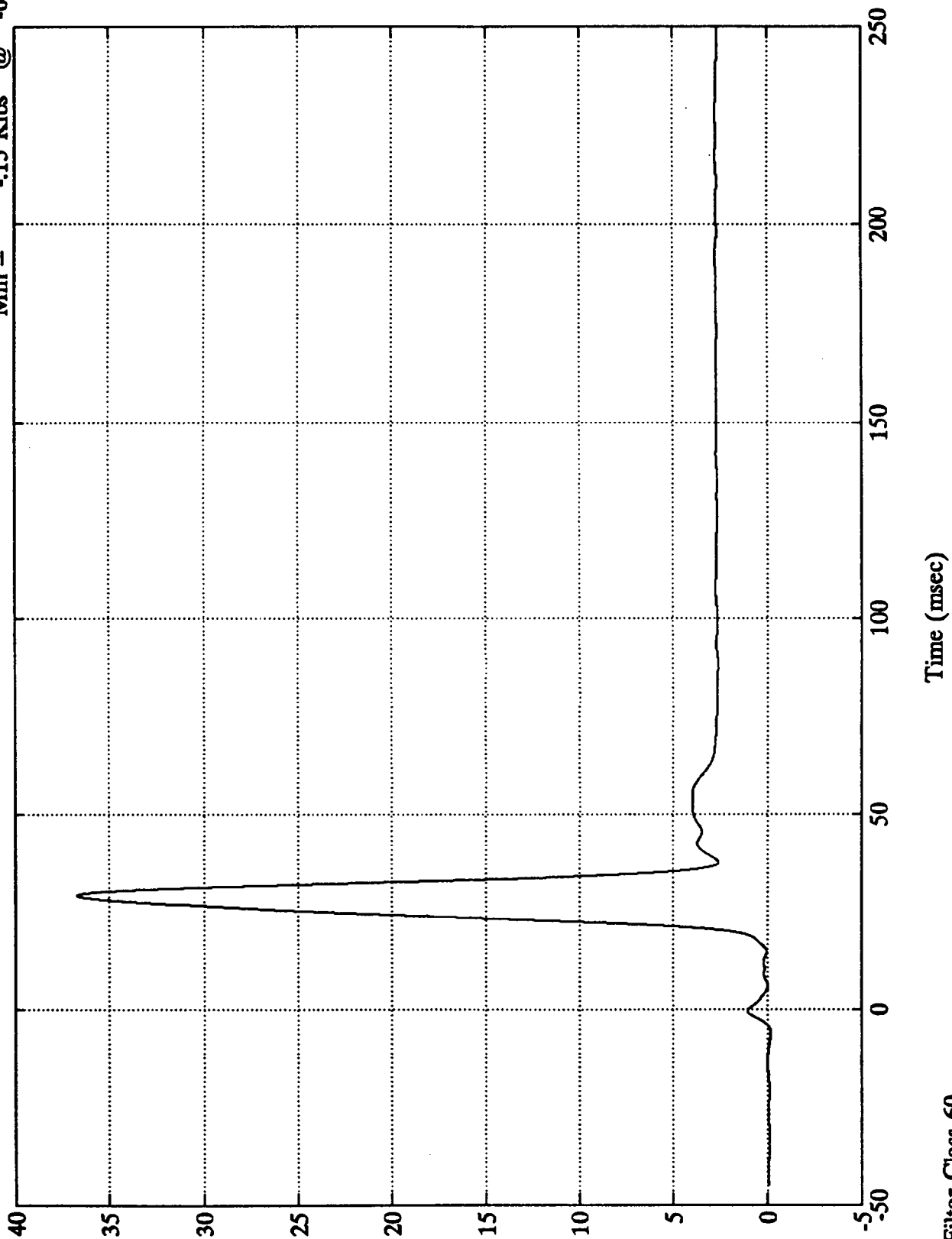
Test 1047

Klbs
B-49

7893-4

Barrier Load Cell C5

Max = 36.73 Klbs @ 29.39 msec
Min = -15 Klbs @ -6.12 msec

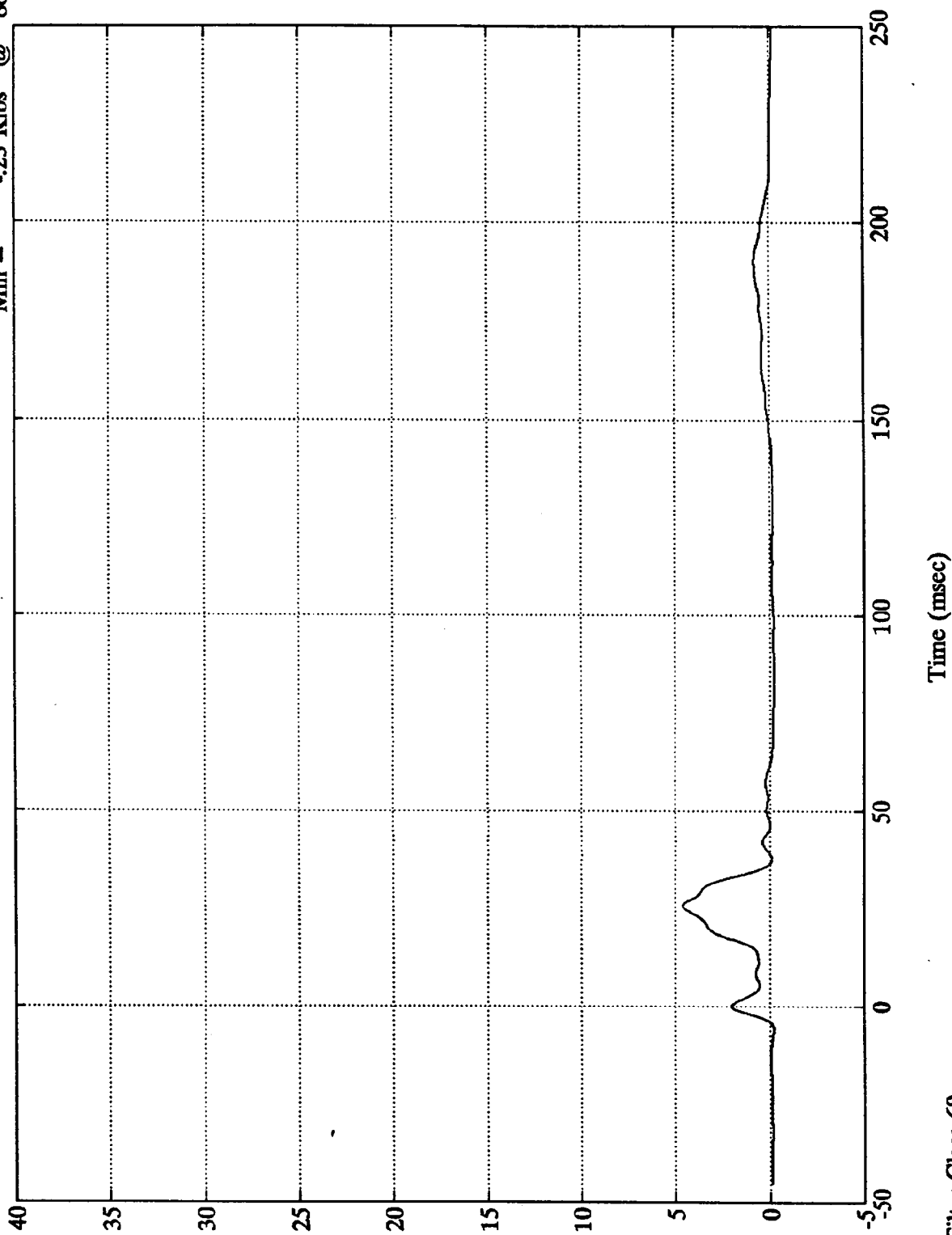


SAE Filter Class 60

Test 1047

Barrier Load Cell C6

Max = 4.62 Klbs @ 25.55 msec
Min = -.23 Klbs @ 88.08 msec



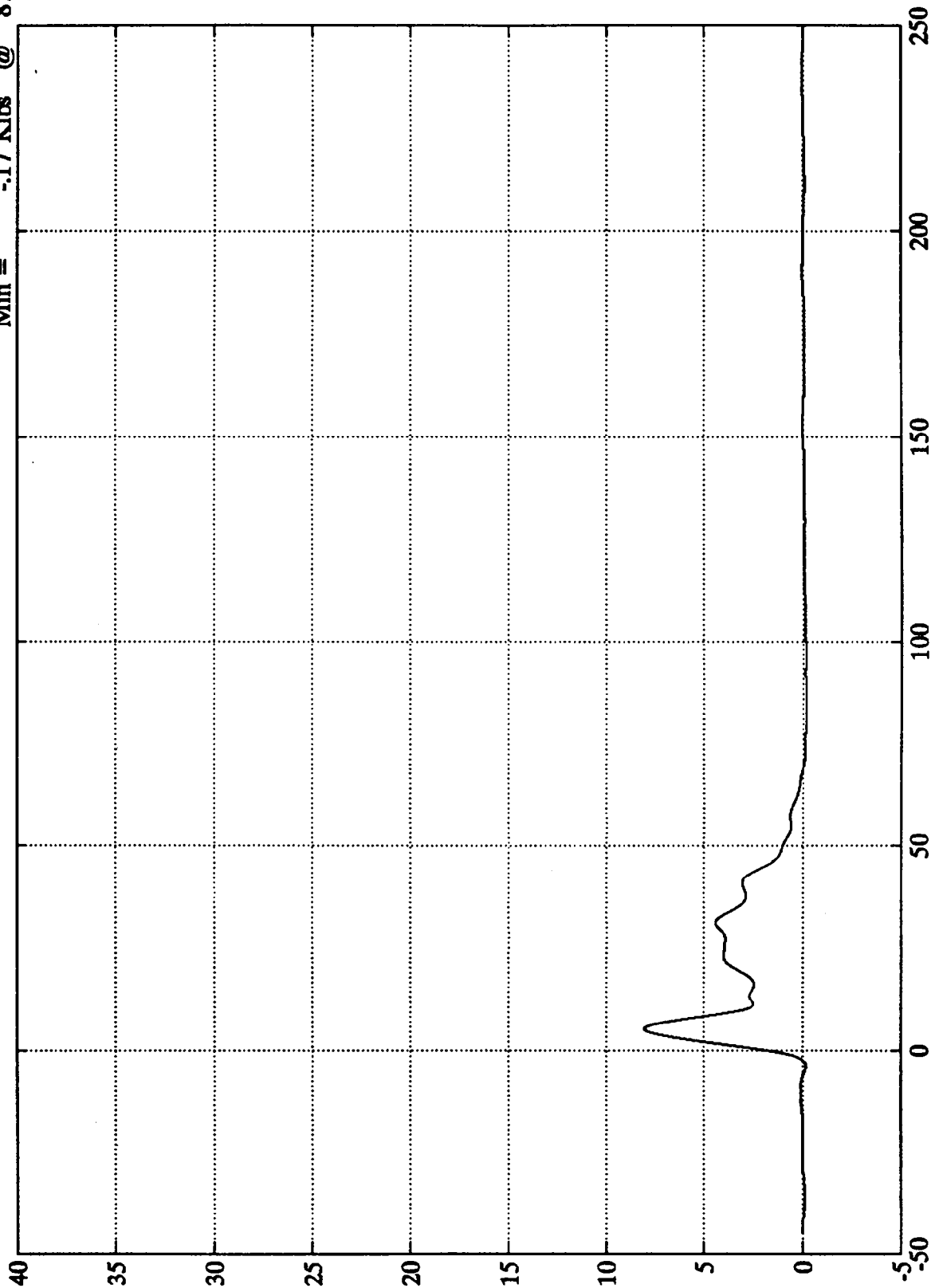
Klbs
B-50

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell C7

Max = 8.03 Klbs @ 5.27 msec
Min = -1.17 Klbs @ 87.24 msec



Time (msec)

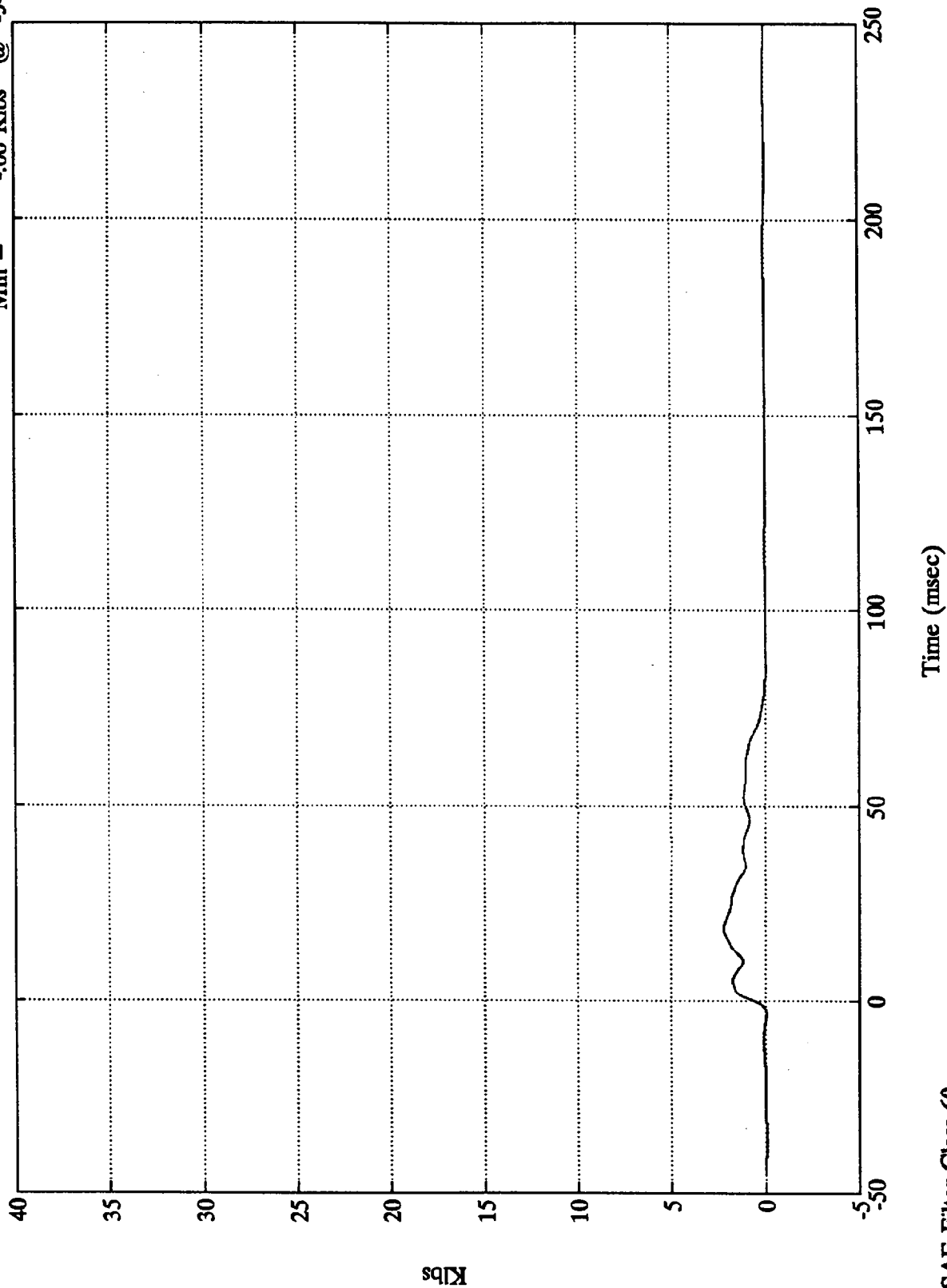
B-51
Klbs

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell C8

Max = 2.21 Klbs @ 18.36 msec
Min = -.06 Klbs @ -34.80 msec



B-52

7893-4 SAE Filter Class 60

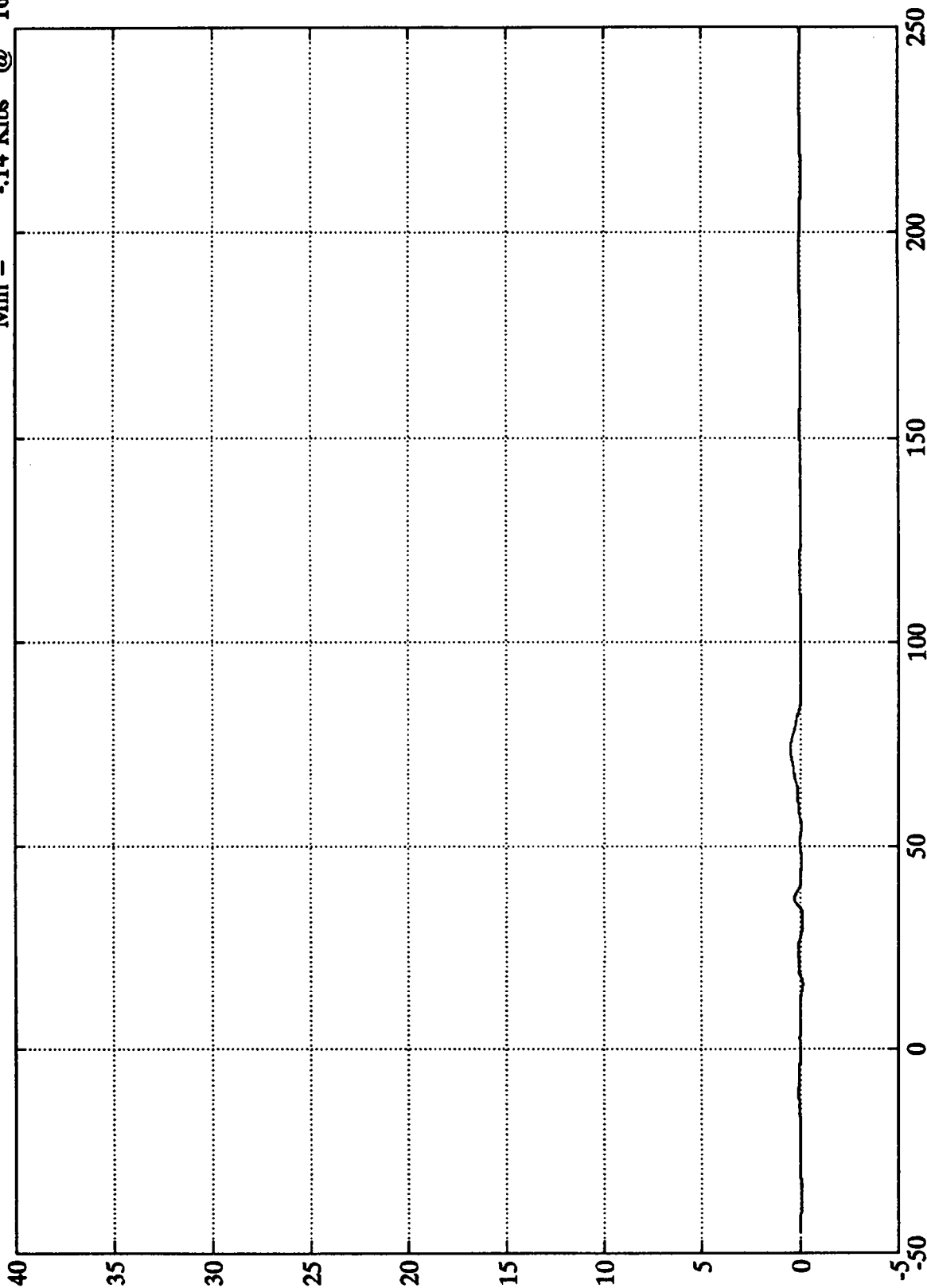
Test 1047

Klbs
B-53

7893-4

Barrier Load Cell C9

Max = .48 Klbs @ 74.04 msec
Min = -.14 Klbs @ 16.07 msec

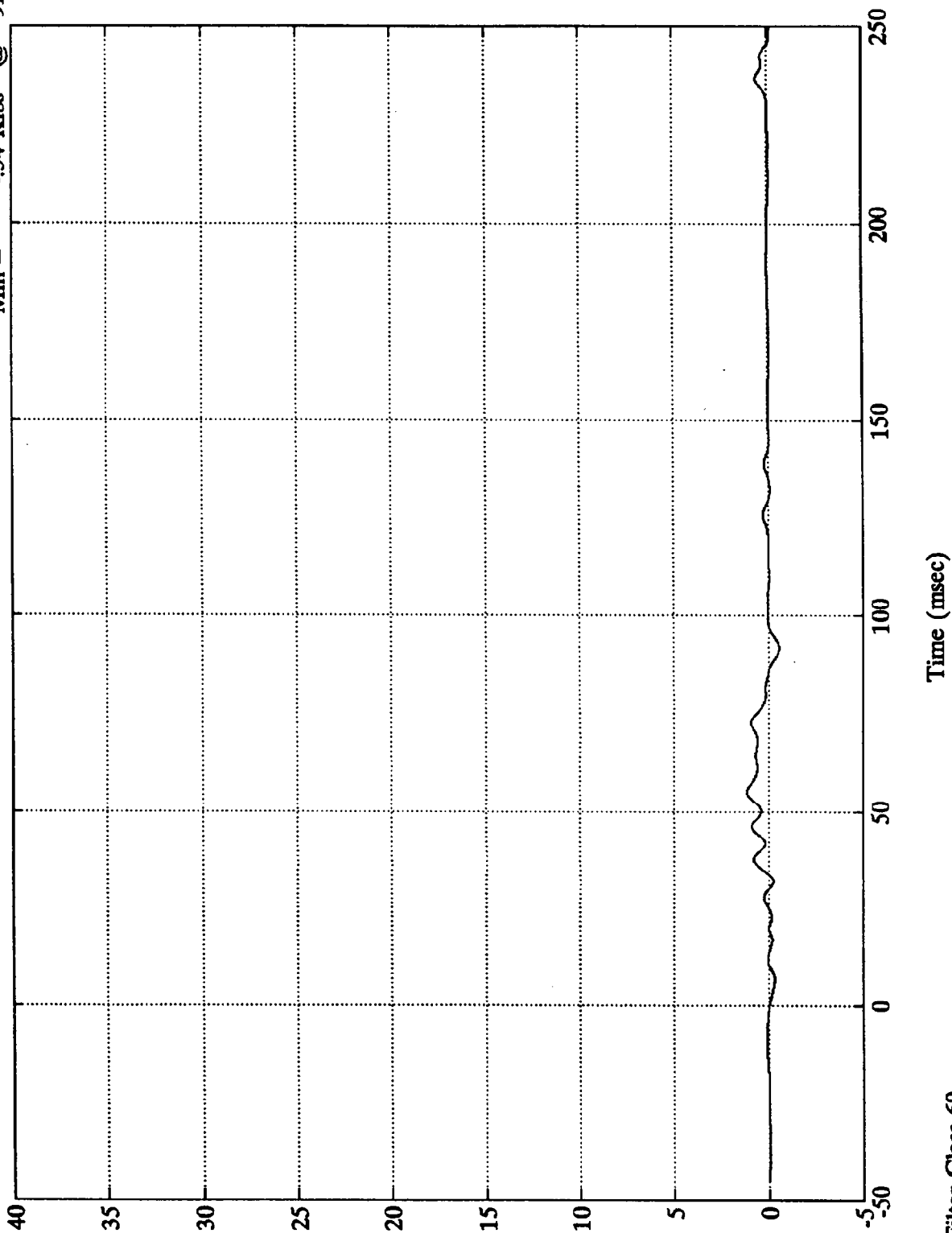


Time (msec)

SAE Filter Class 60

Test 1047

Barrier Load Cell D1
Max = 1.15 Klbs @ 55.20 msec
Min = -.54 Klbs @ 91.92 msec



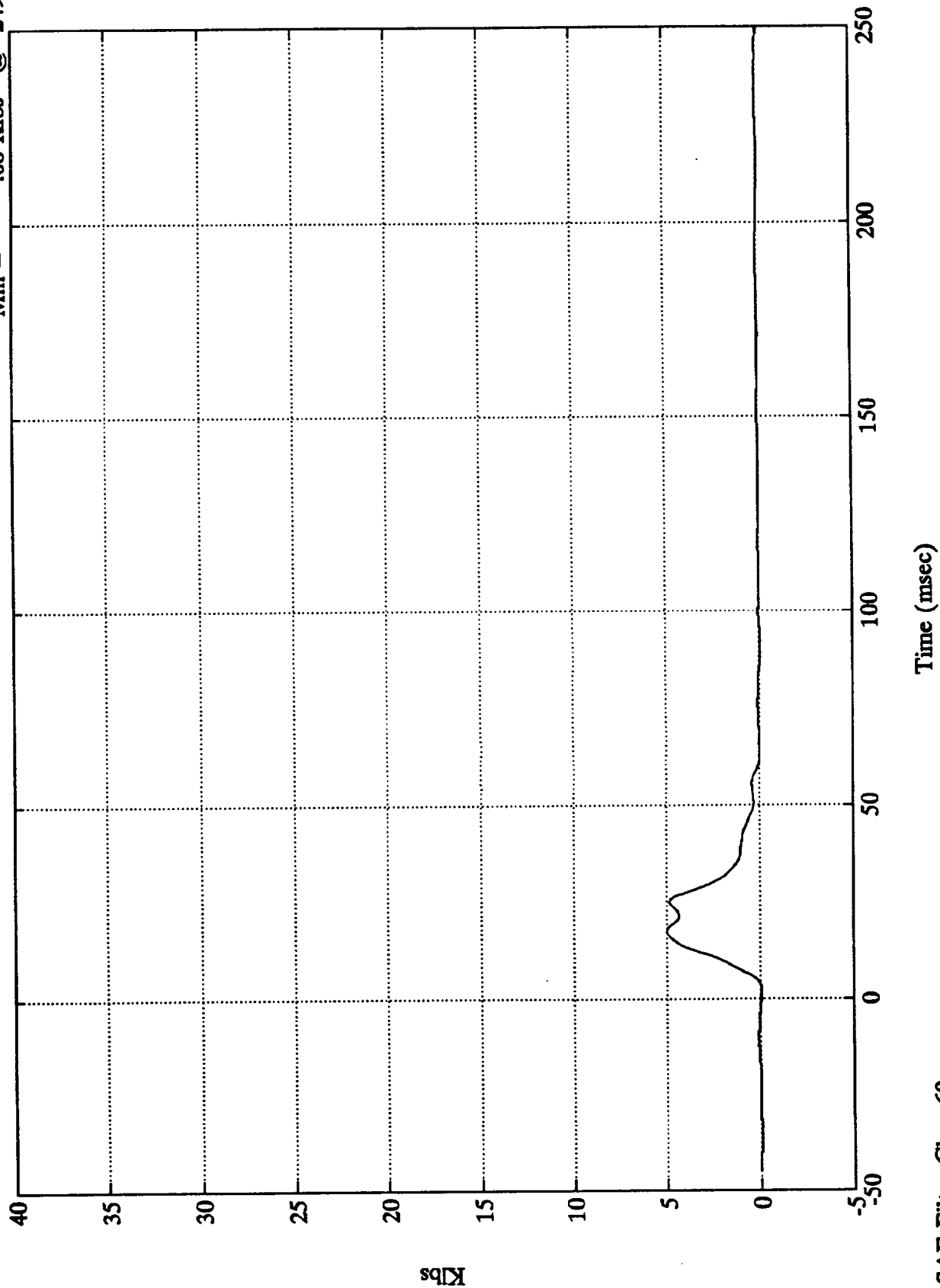
B-54

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell D2

Max = 5.04 Klbs @ 17.39 msec
Min = -.08 Klbs @ 249.48 msec



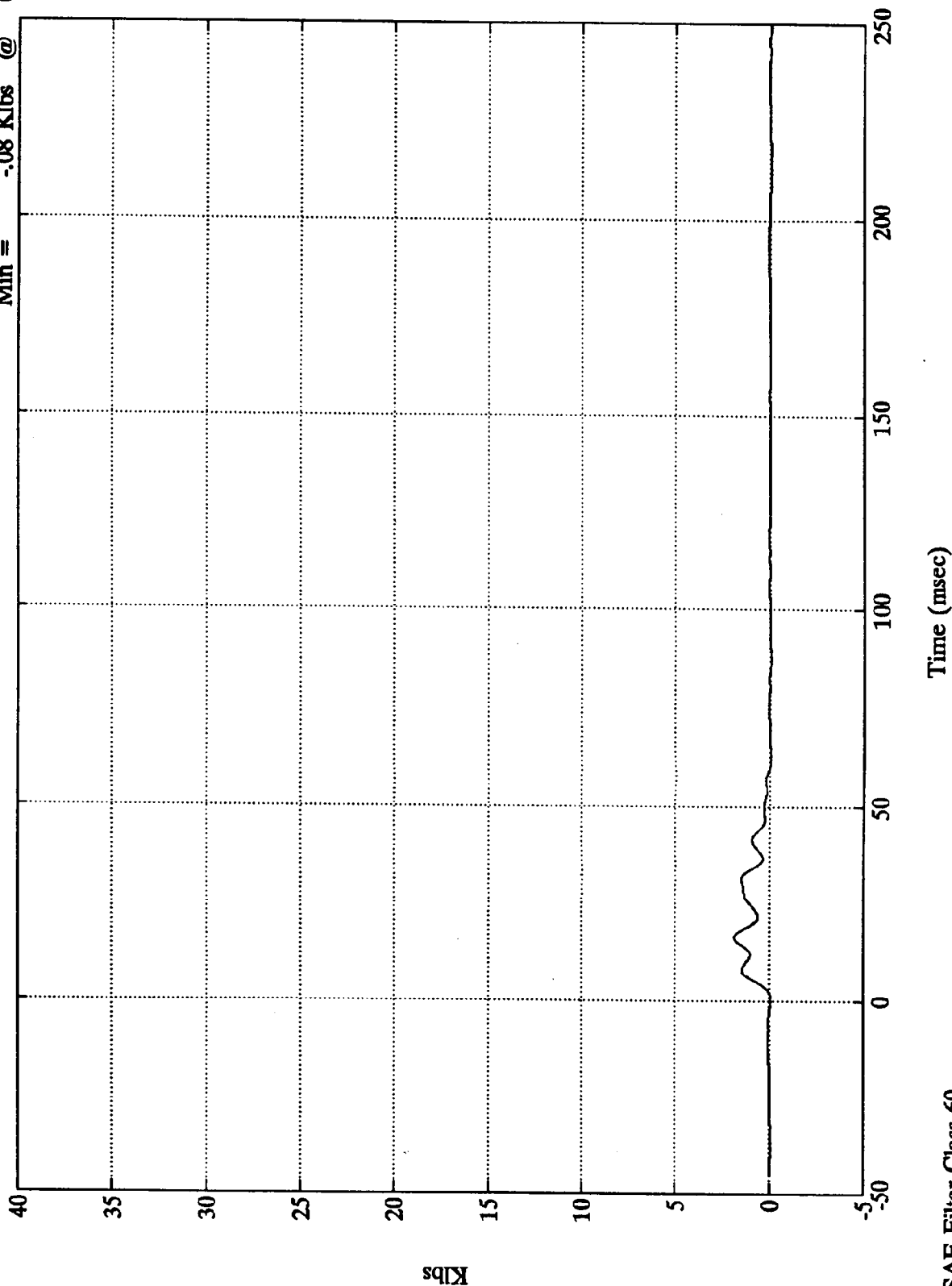
Klbs
B-55

7893-4
SAE Filter Class 60

Test 1047

Barrier Load Cell D3

Max = 1.87 Klbs @ 16.31 msec
Min = -0.08 Klbs @ 0.35 msec



Klbs

B-56

7893-4

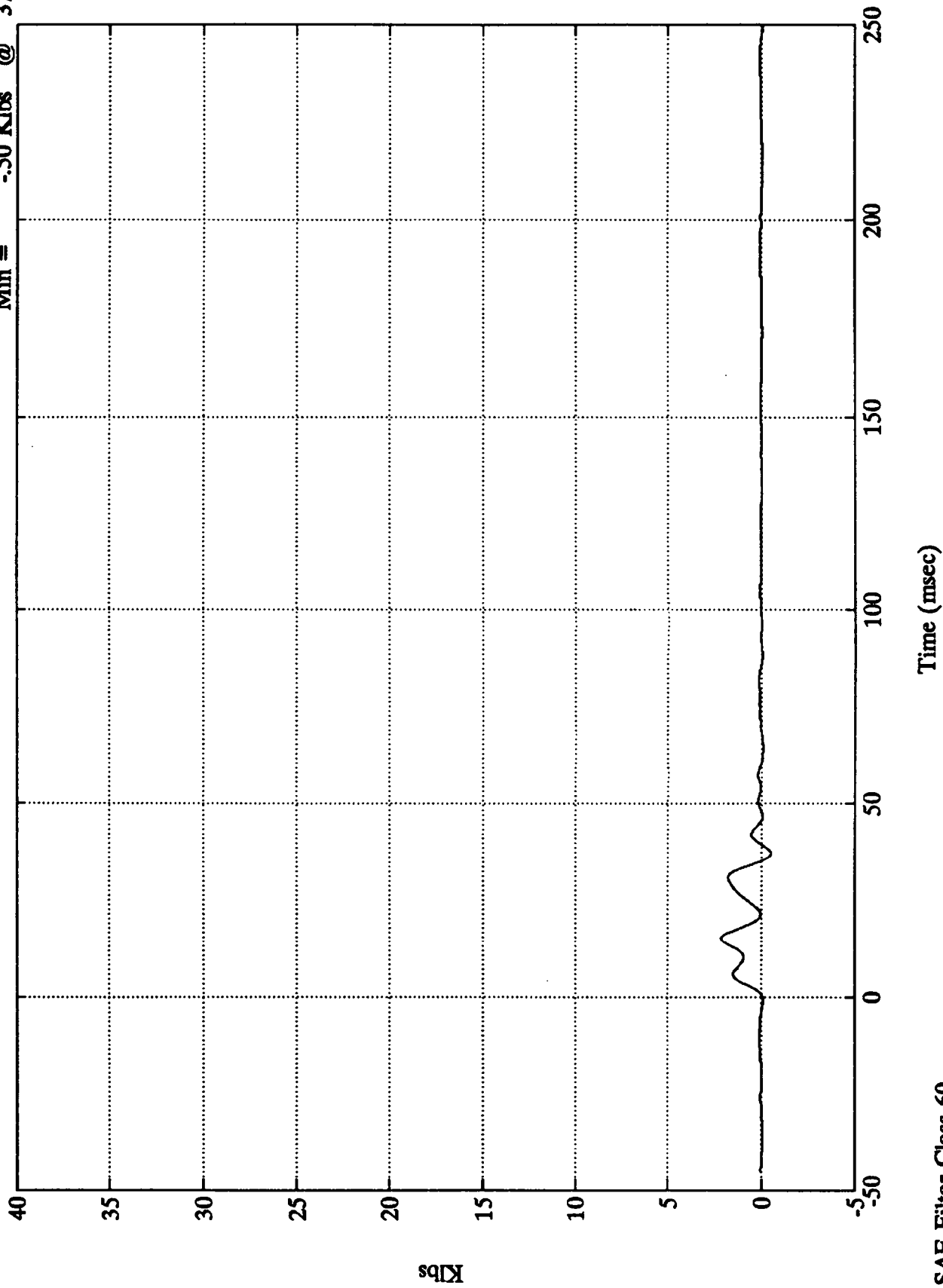
SAE Filter Class 60

Time (msec)

Test 1047

Barrier Load Cell D4

Max = 2.16 Klbs @ 15.23 msec
Min = -.50 Klbs @ 37.20 msec



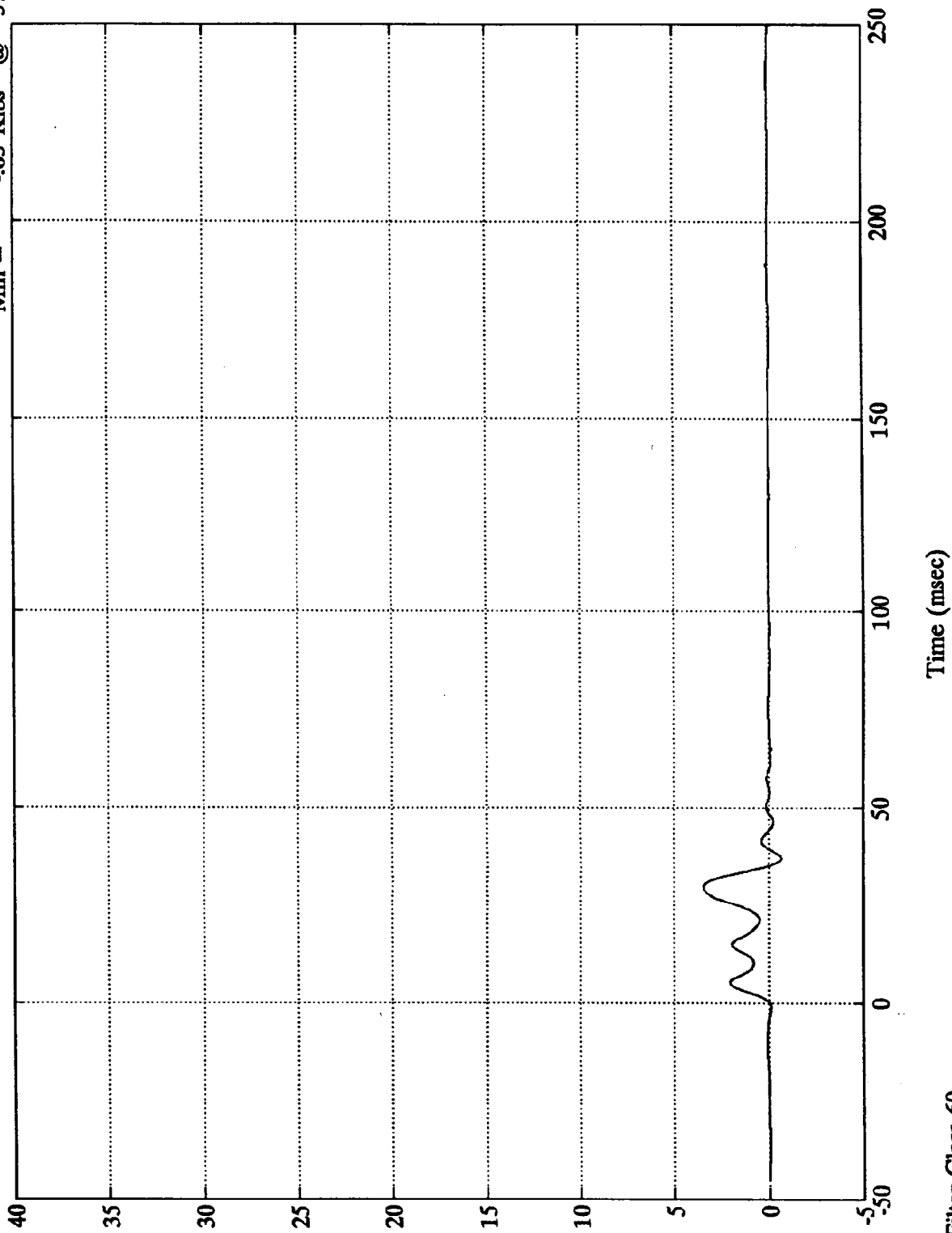
B-57

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell D5

Max = 3.48 Klbs @ 30.00 msec
Min = -.65 Klbs @ 37.31 msec



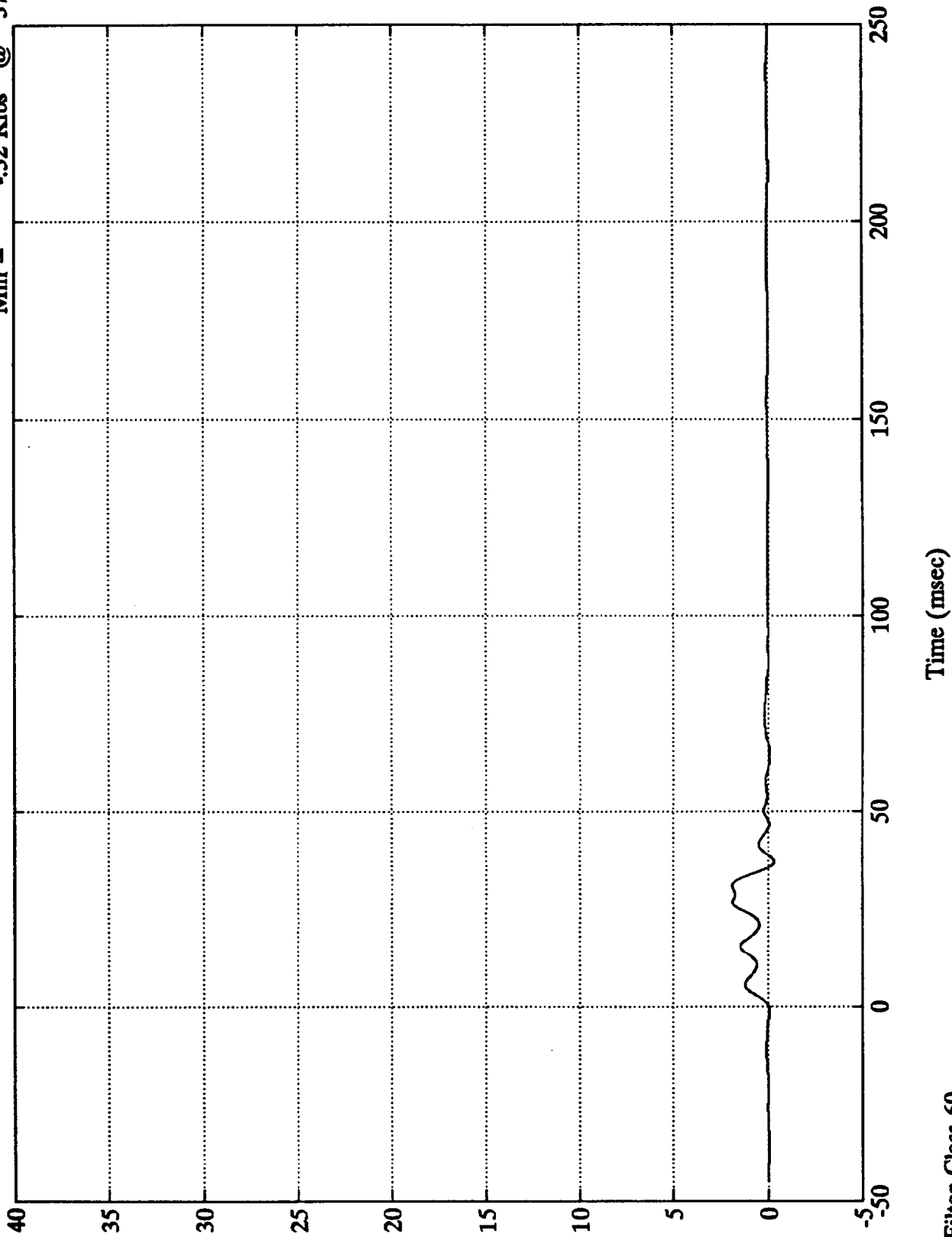
B-58

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell D6

Max = 1.89 Klbs @ 30.95 msec
Min = -.32 Klbs @ 37.20 msec



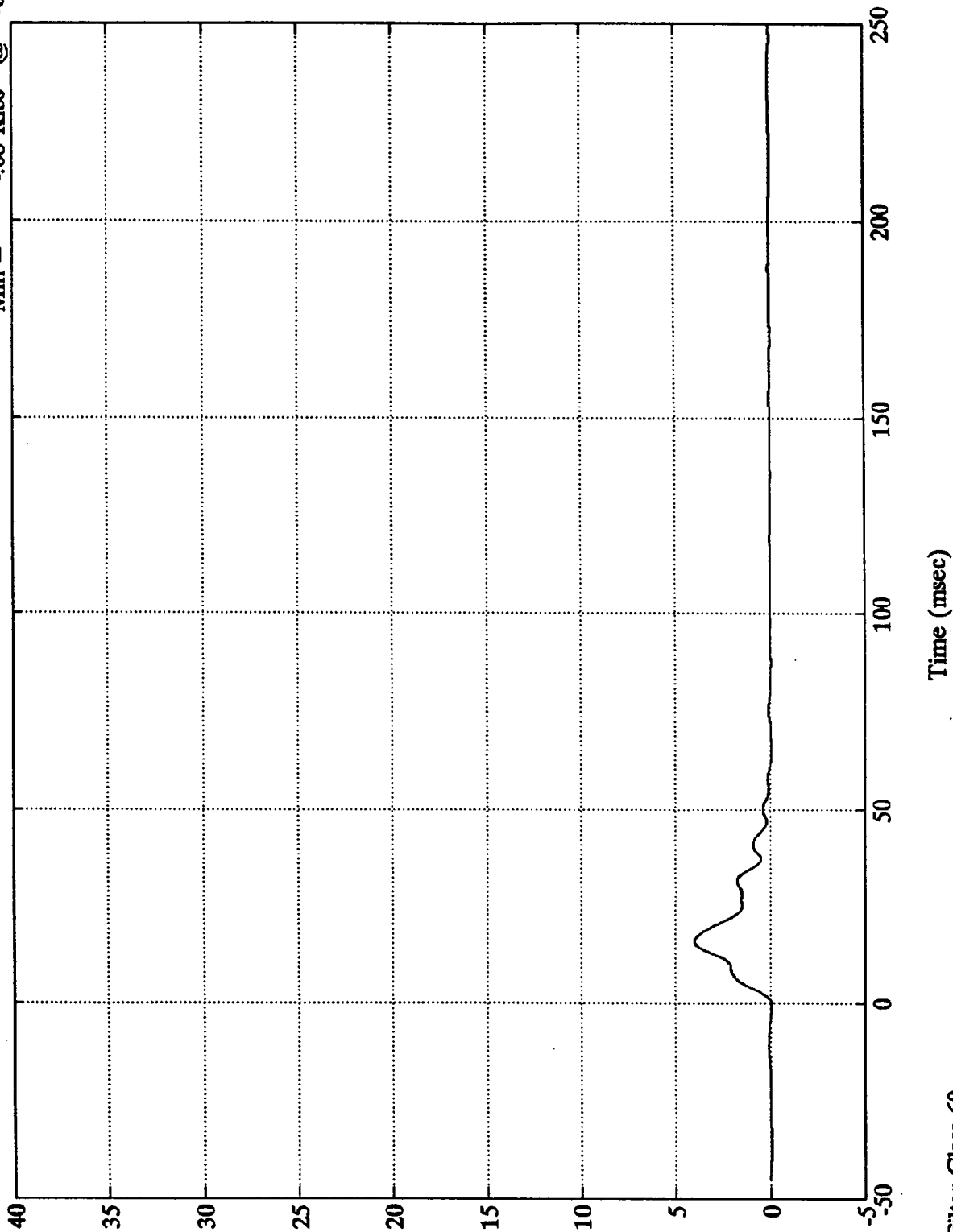
B-59

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell D7

Max = 4.01 Klbs @ 16.07 msec
Min = -.08 Klbs @ -0.72 msec



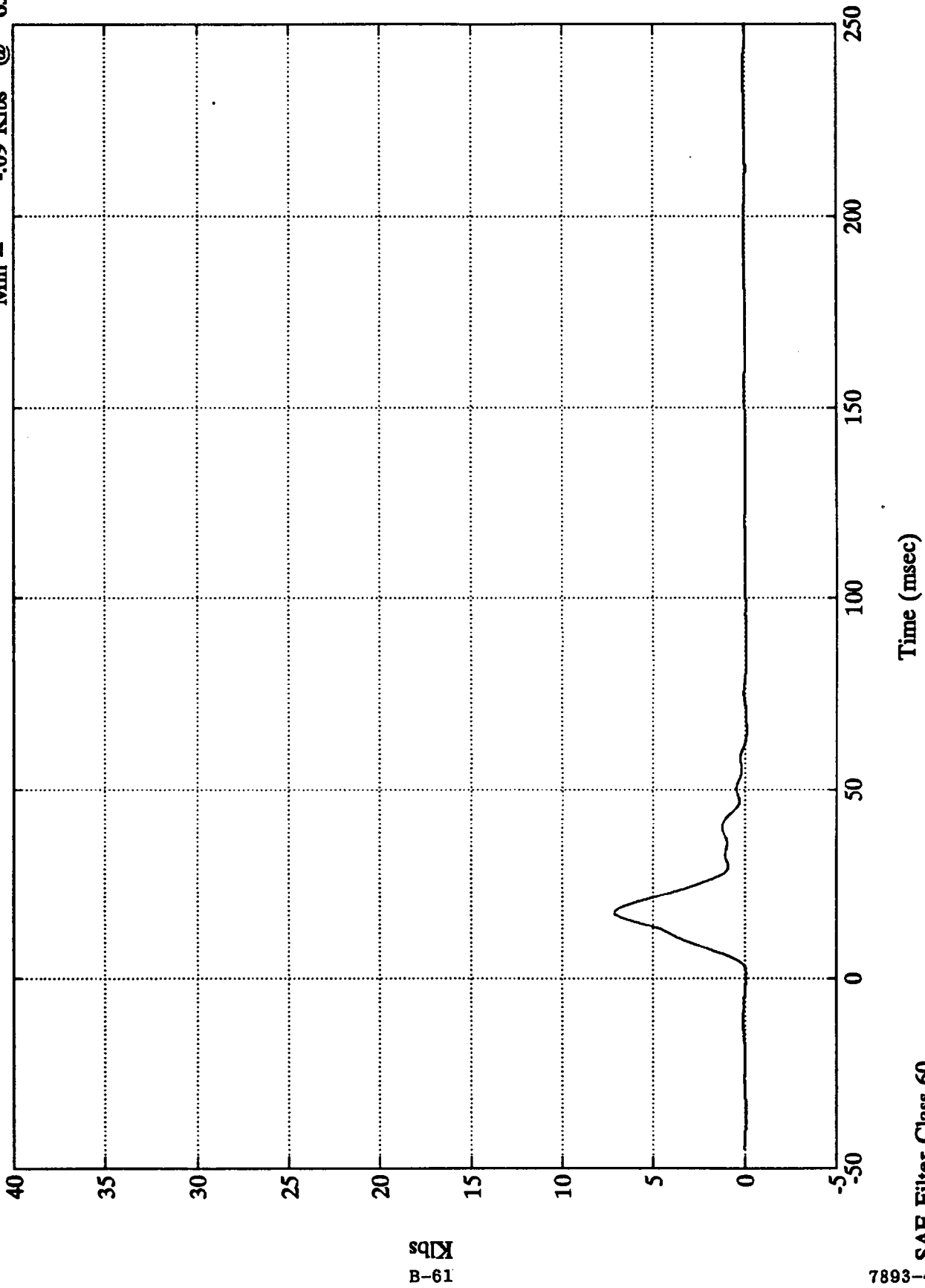
B-60
Klbs

7893-4 SAE Filter Class 60

Test 1047

Barrier Load Cell D8

Max = 7.14 Klbs @ 17.51 msec
Min = -.09 Klbs @ 65.15 msec



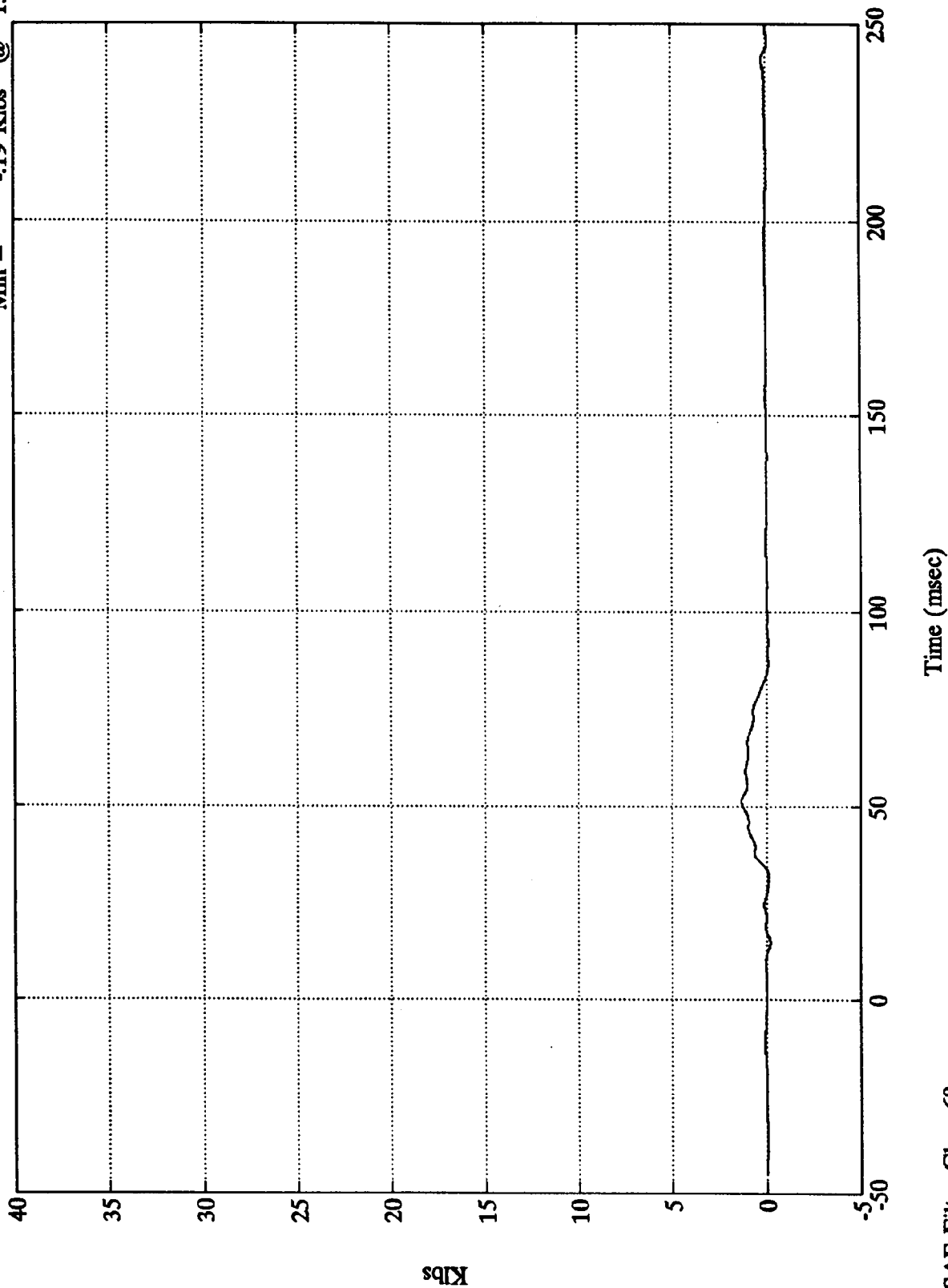
B-61
Klbs

7893-4
SAE Filter Class 60

Test 1047

Barrier Load Cell D9

Max = 1.33 Klbs @ 51.47 msec
Min = -.19 Klbs @ 15.00 msec



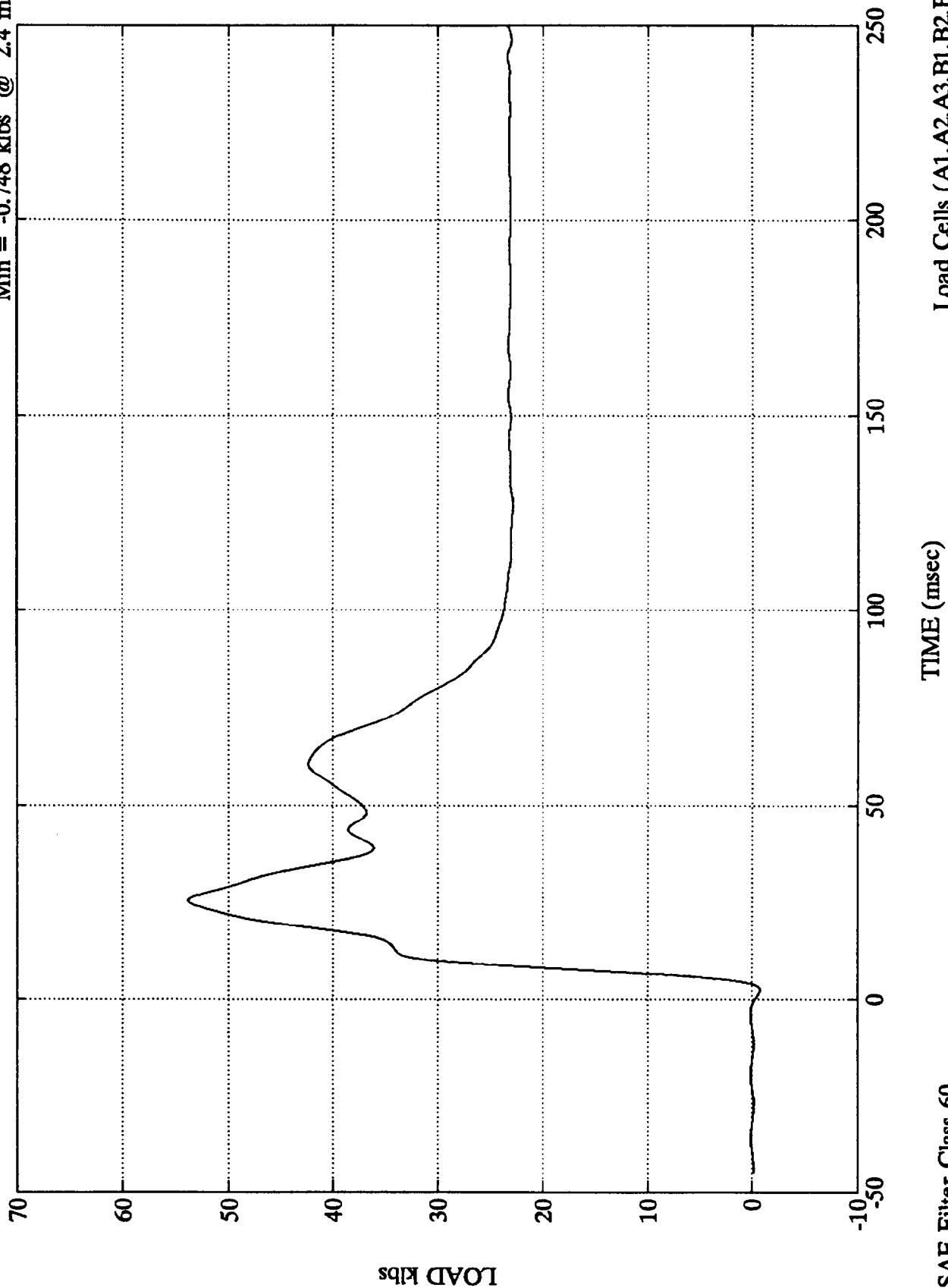
B-62

7893-4 SAE Filter Class 60

Test 1047

Group 1 Load Cell Sum

Max = 53.780 klbs @ 25.6 msec
Min = -0.748 klbs @ 2.4 msec



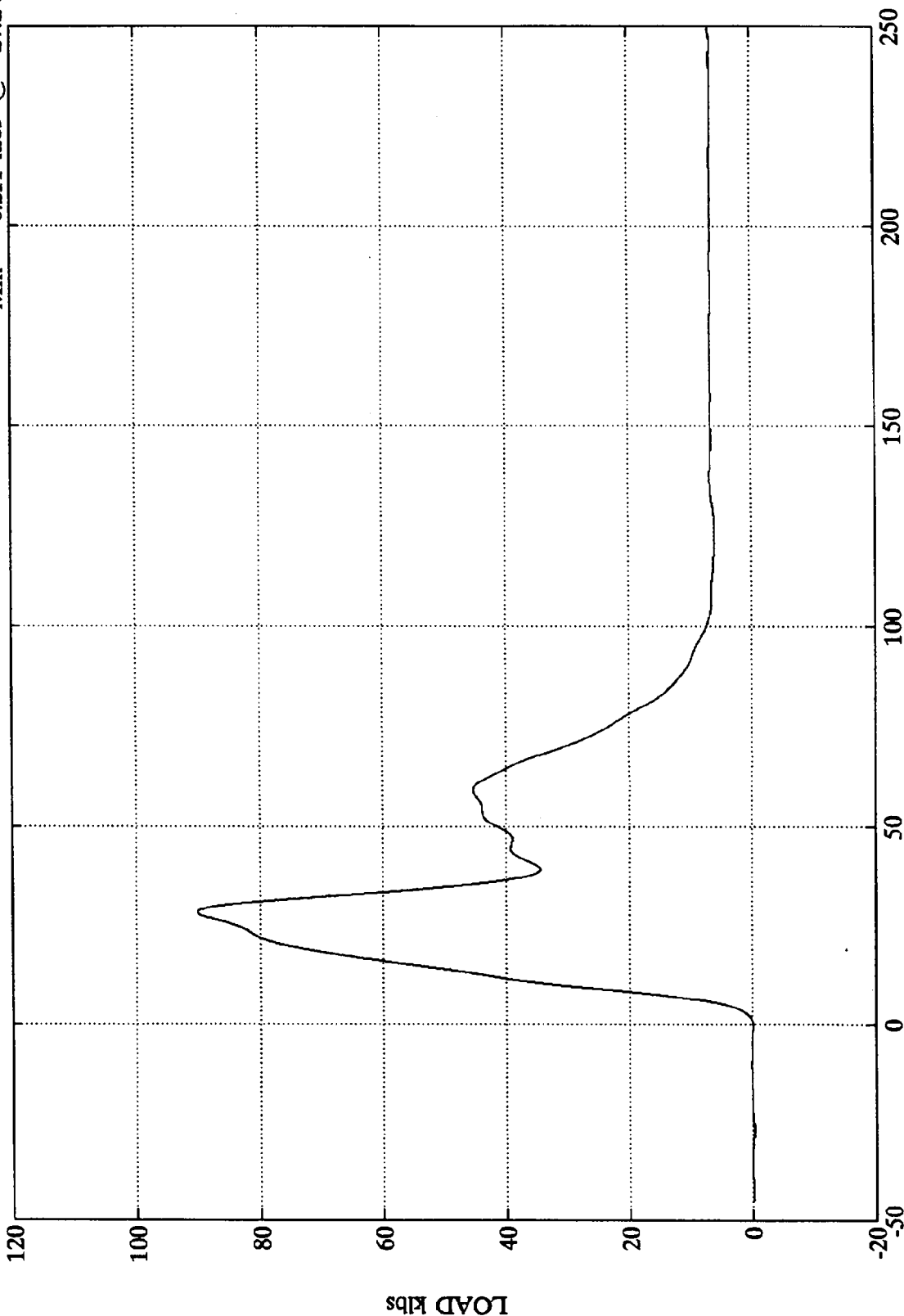
SAE Filter Class 60

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

Test 1047

Group 2 Load Cell Sum

Max = 90.131 klbs @ 28.4 msec
Min = -0.211 klbs @ -27.2 msec



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

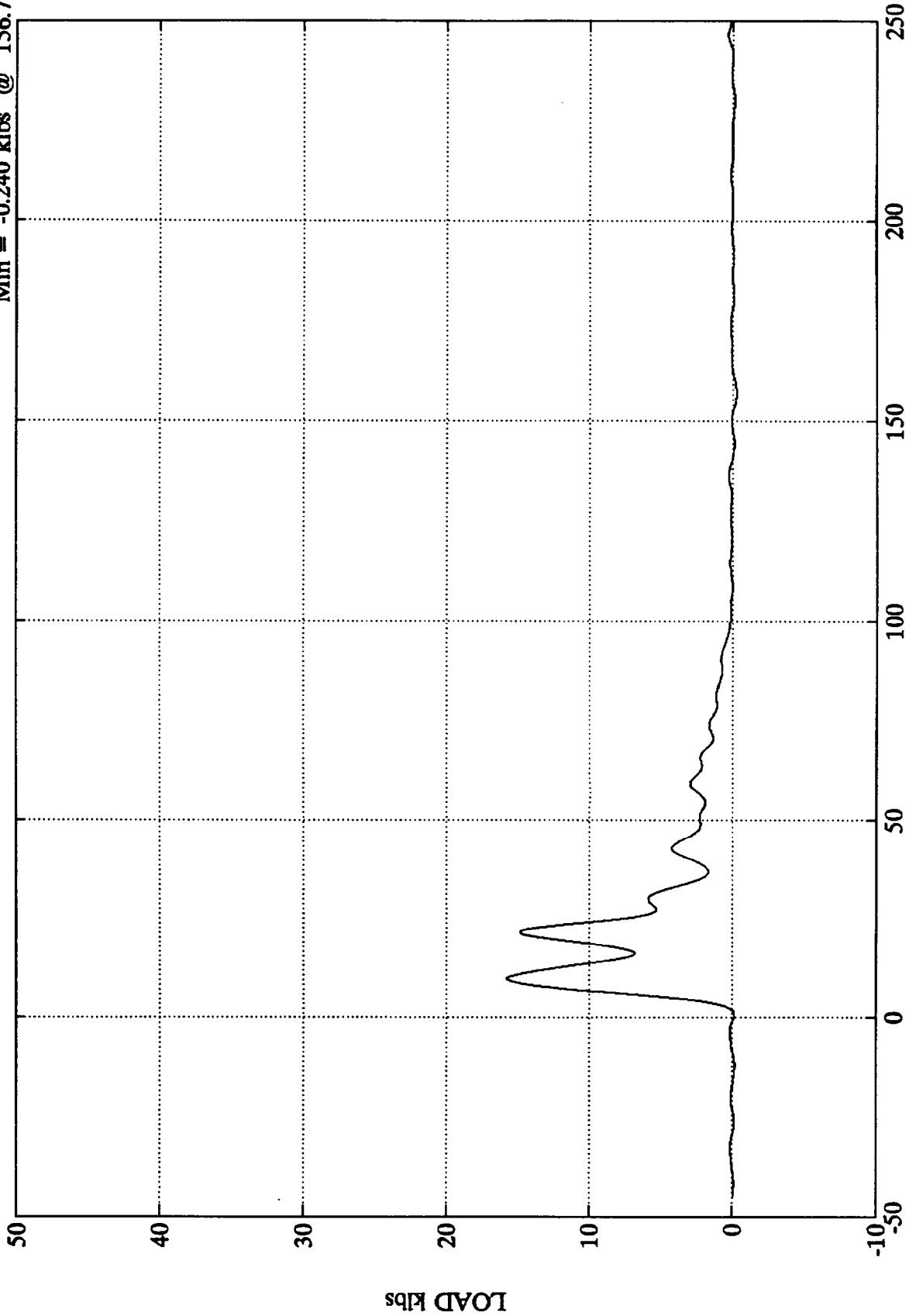
TIME (msec)

SAE Filter Class 60

Test 1047

Group 3 Load Cell Sum

Max = 15.763 klbs @ 9.8 msec
Min = -0.240 klbs @ 156.7 msec



TIME (msec)

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

SAE Filter Class 60

LOAD klbs

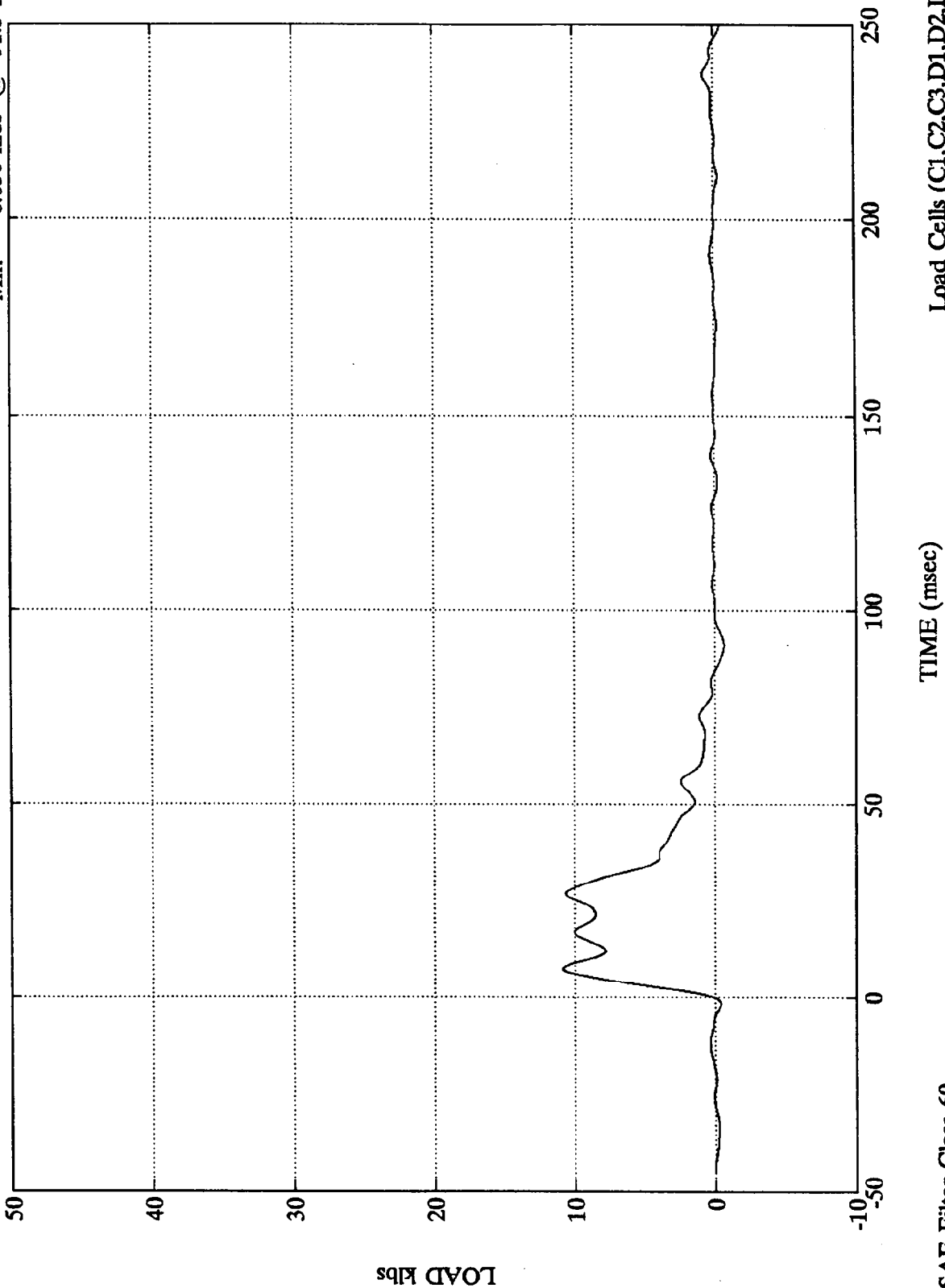
B-65

7893-4

Test 1047

Group 4 Load Cell Sum

Max = 10.855 klbs @ 7.6 msec
Min = -0.636 klbs @ 91.3 msec



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

TIME (msec)

SAE Filter Class 60

LOAD klbs

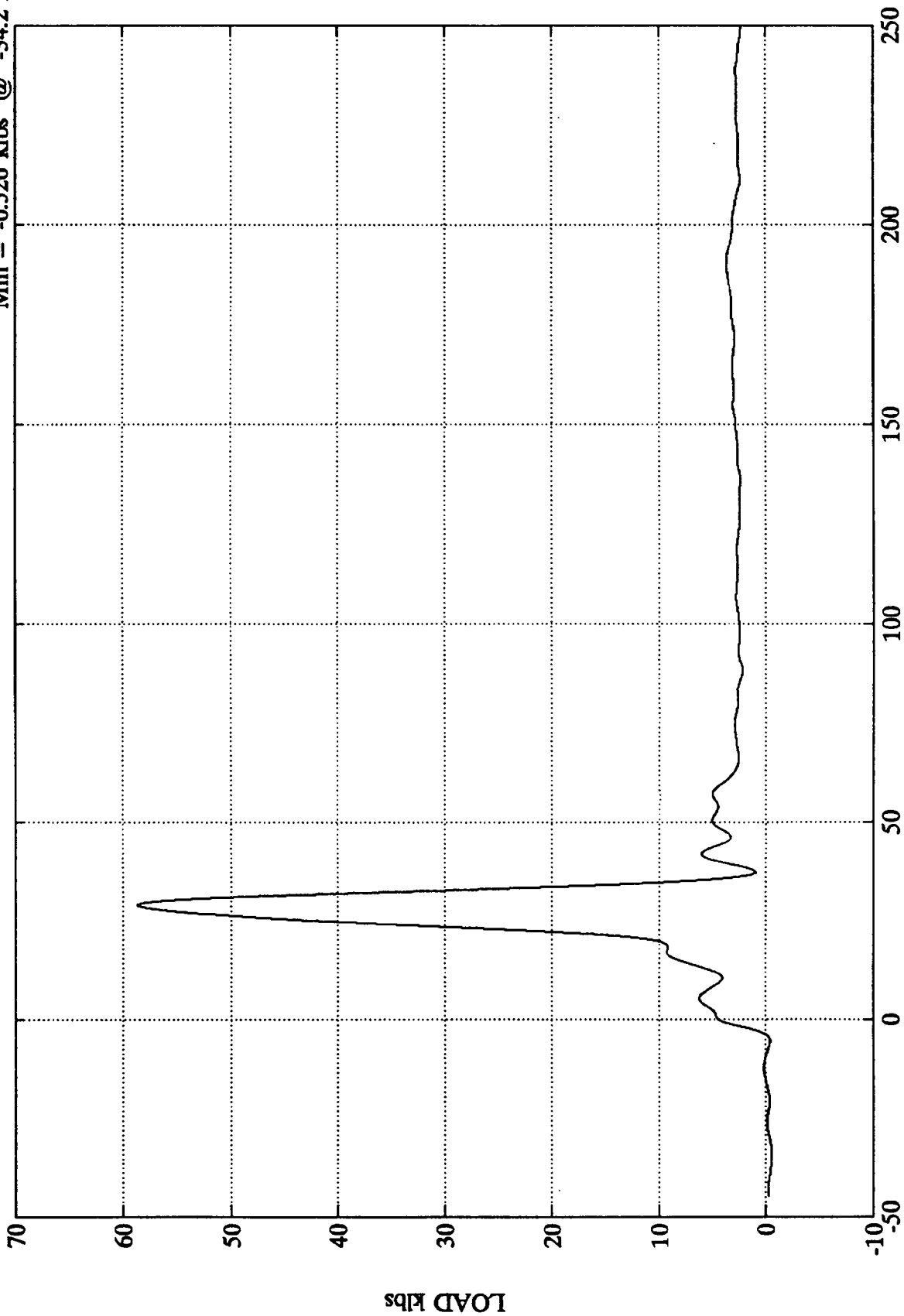
B-66

7893-4

Test 1047

Group 5 Load Cell Sum

Max = 58.653 klbs @ 29.3 msec
Min = -0.526 klbs @ -34.2 msec



TIME (msec)

Load Cells (C4,C5,C6,D4,D5,D6)

SAE Filter Class 60

LOAD klbs

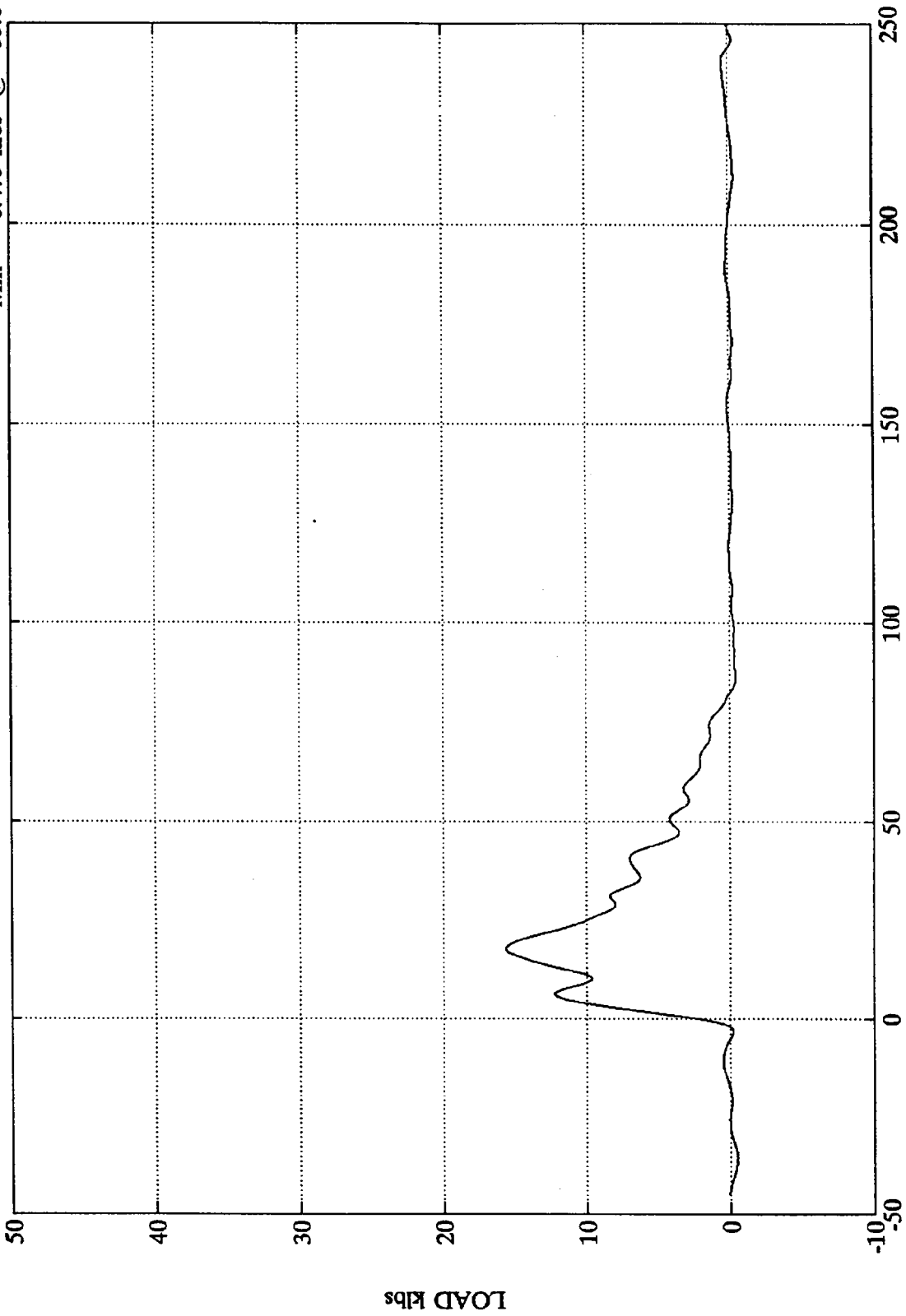
B-67

7893-4

Test 1047

Group 6 Load Cell Sum

Max = 15.640 klbs @ 17.9 msec
Min = -0.473 klbs @ -35.6 msec



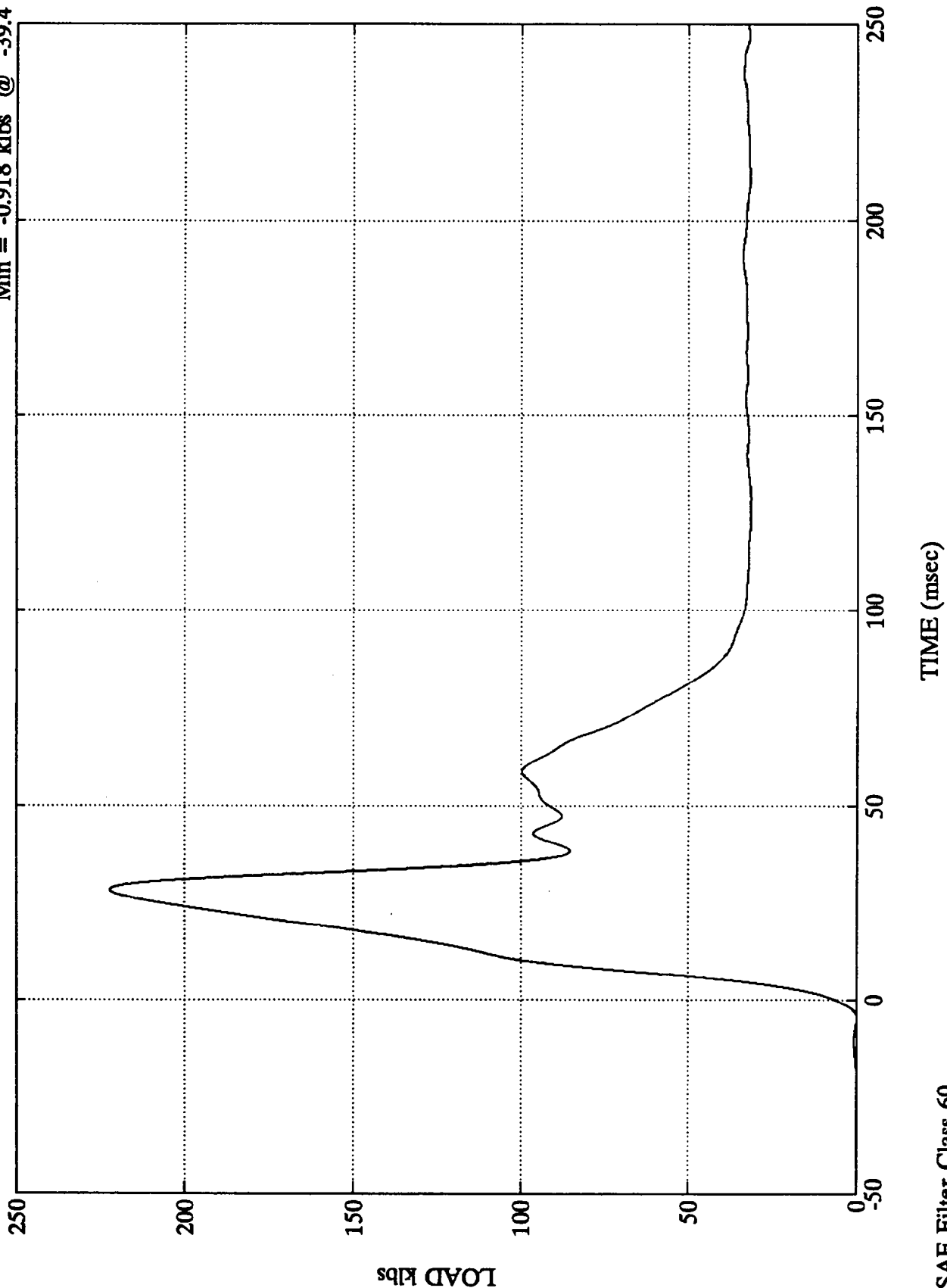
SAE Filter Class 60

Load Cells (C7,C8,C9,D7,D8,D9)

Test 1047

TOTAL LOAD CELL SUM

Max = 222.162 klbs @ 28.6 msec
Min = -0.918 klbs @ -39.4 msec



B-69

7893-4

SAE Filter Class 60

TEST NO. MM5701

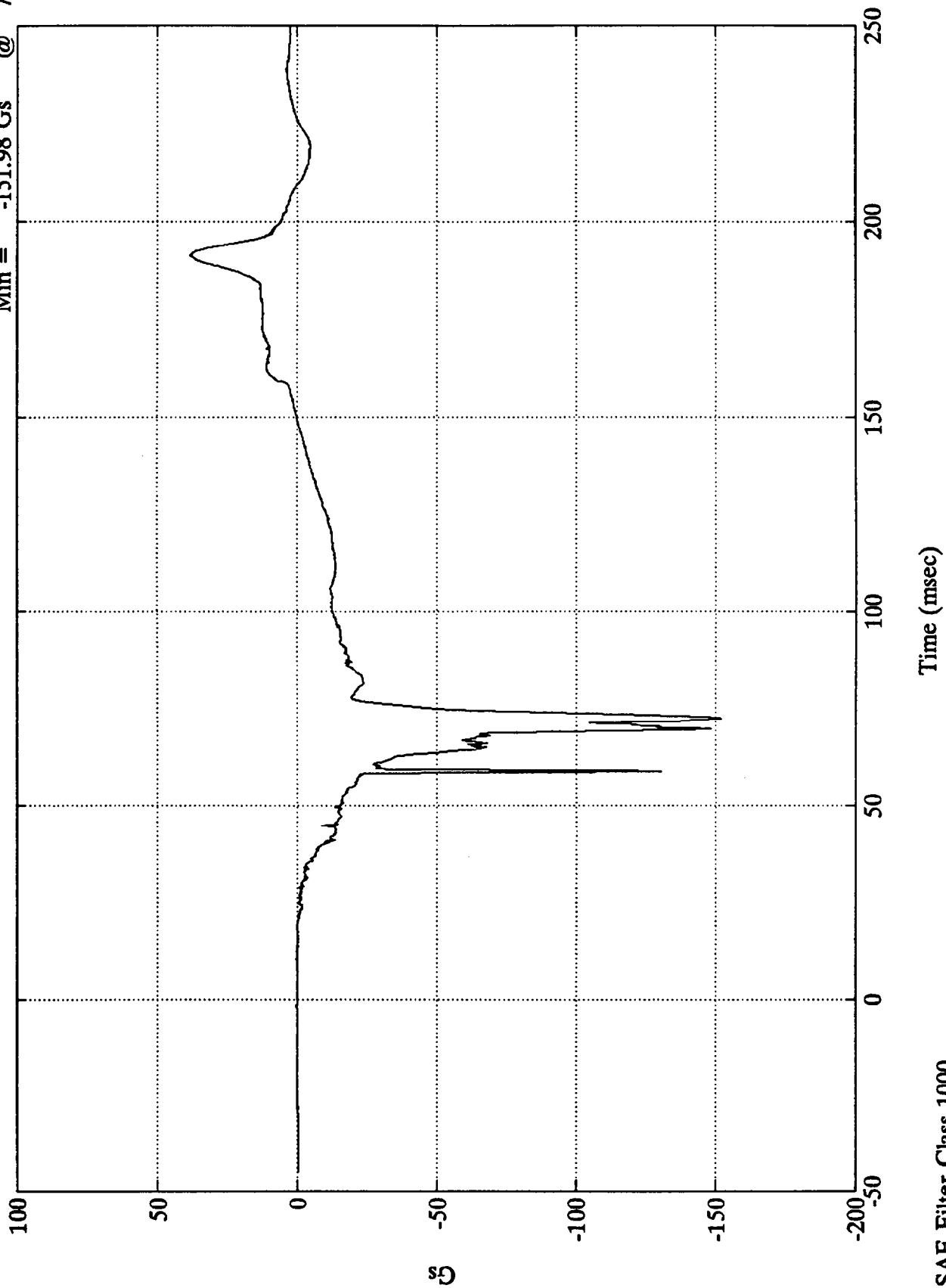
DUMMY DATA

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

Test 1047

Pos. 1 Head X

Max = 38.17 Gs @ 191.40 msec
Min = -151.98 Gs @ 72.24 msec

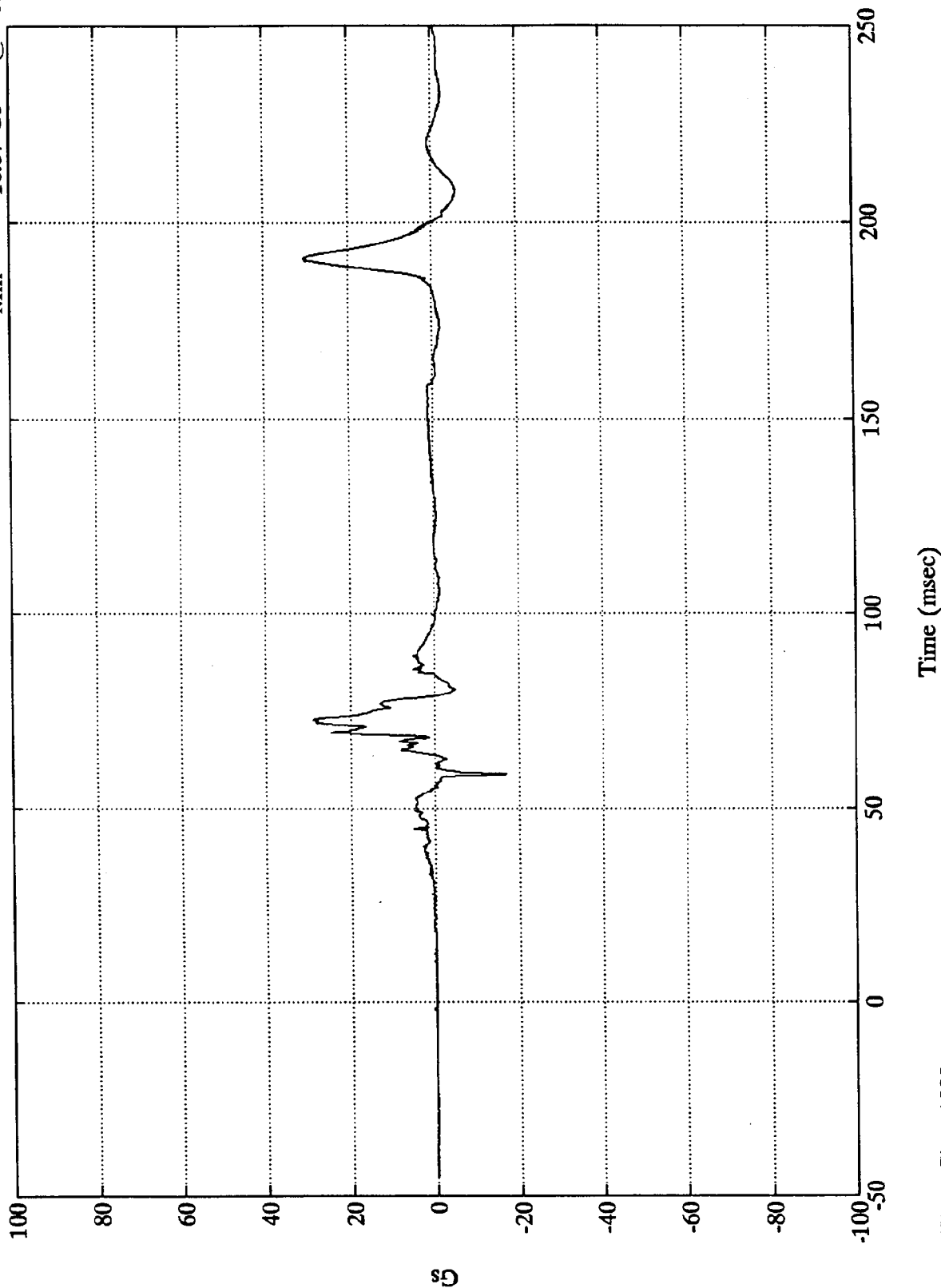


B-71

7893-4 SAE Filter Class 1000

Test 1047

Pos. 1 Head Y
Max = 30.46 Gs @ 190.80 msec
Min = -16.87 Gs @ 59.04 msec



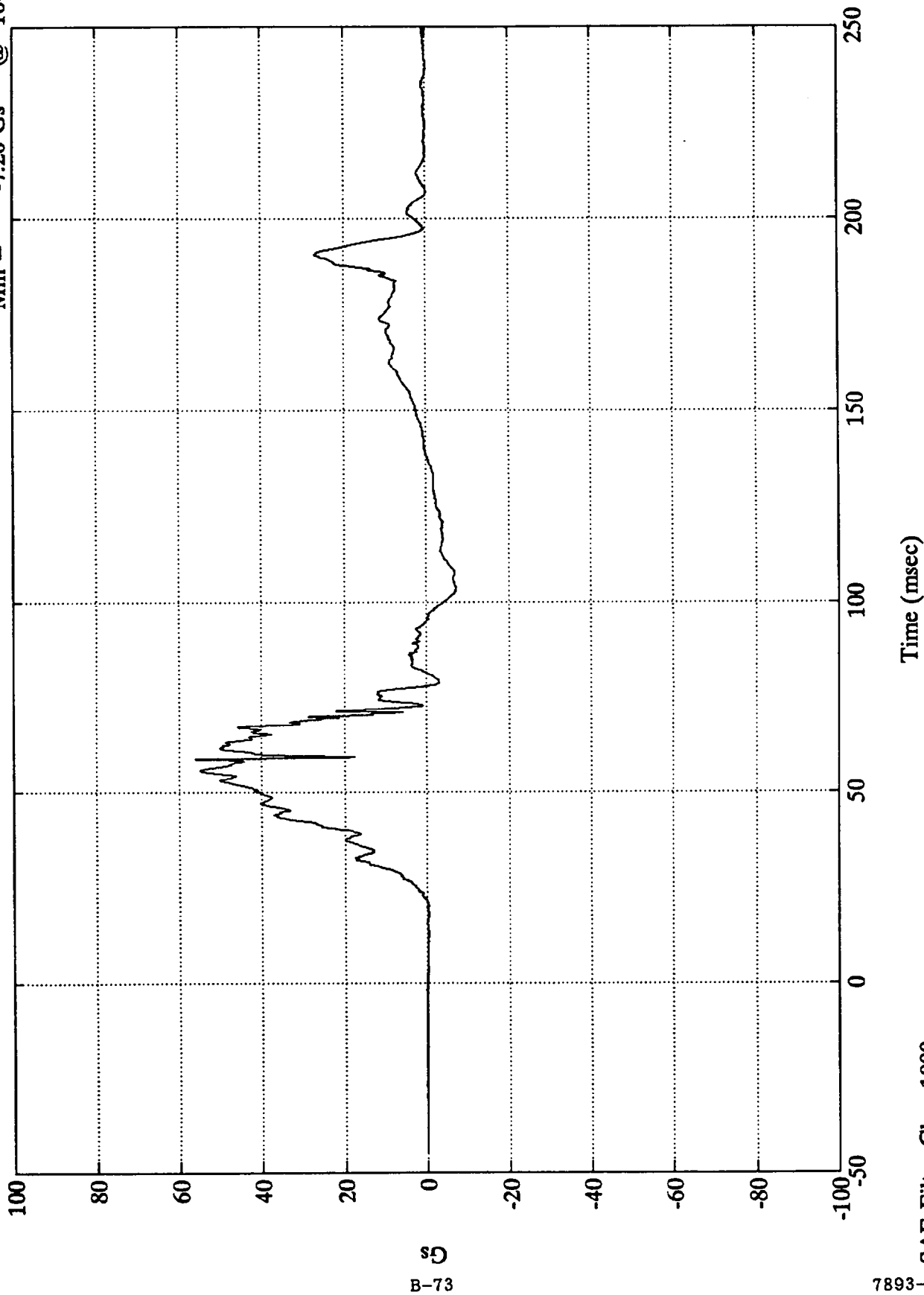
B-72

7893-4
SAE Filter Class 1000

Test 1047

Pos. 1 Head Z

Max = 56.19 Gs @ 58.79 msec
Min = -7.26 Gs @ 104.04 msec



B-73

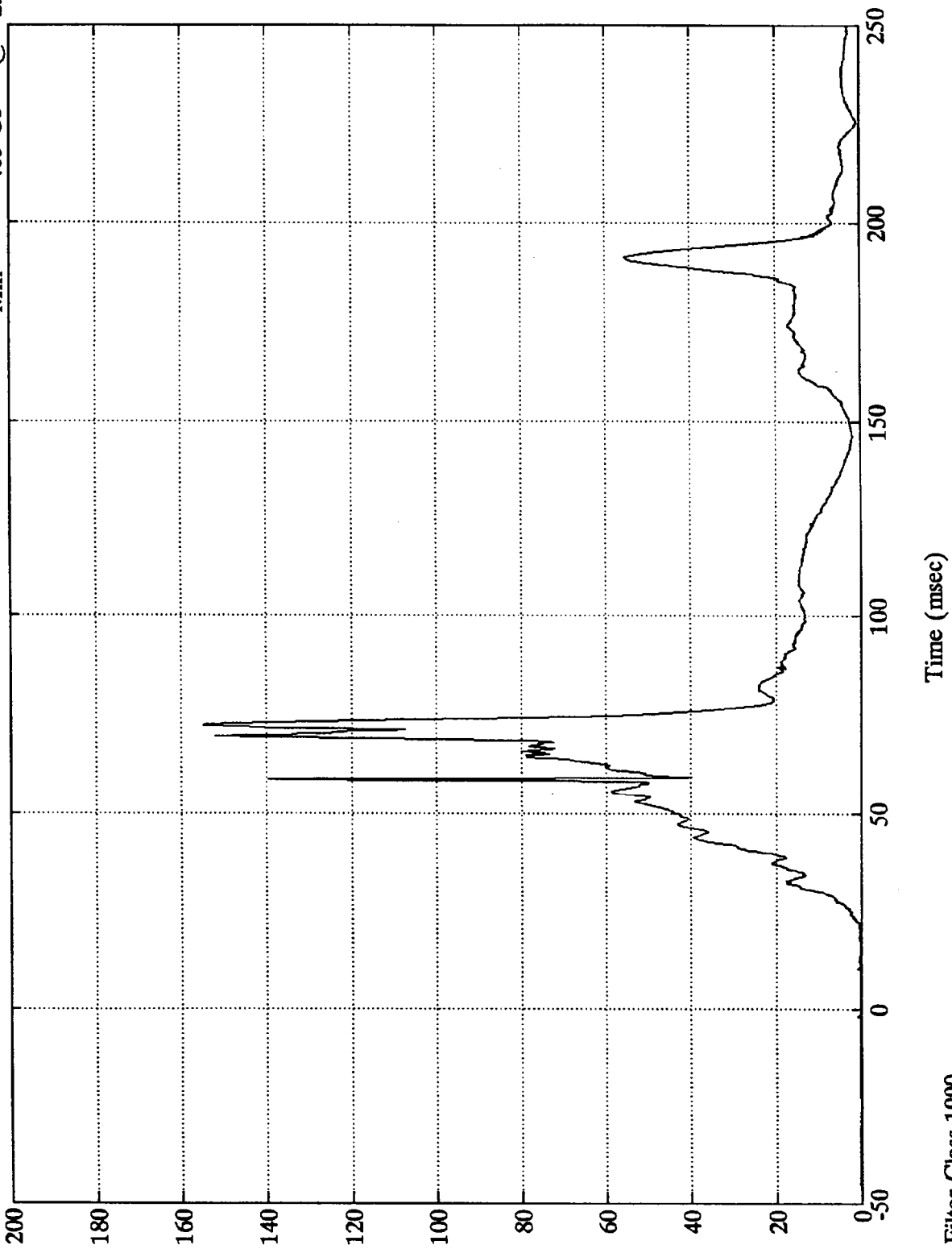
7893-4

SAE Filter Class 1000

Test 1047

Pos. 1 Head Resultant

Max = 154.74 Gs @ 72.24 msec
Min = .05 Gs @ -22.32 msec

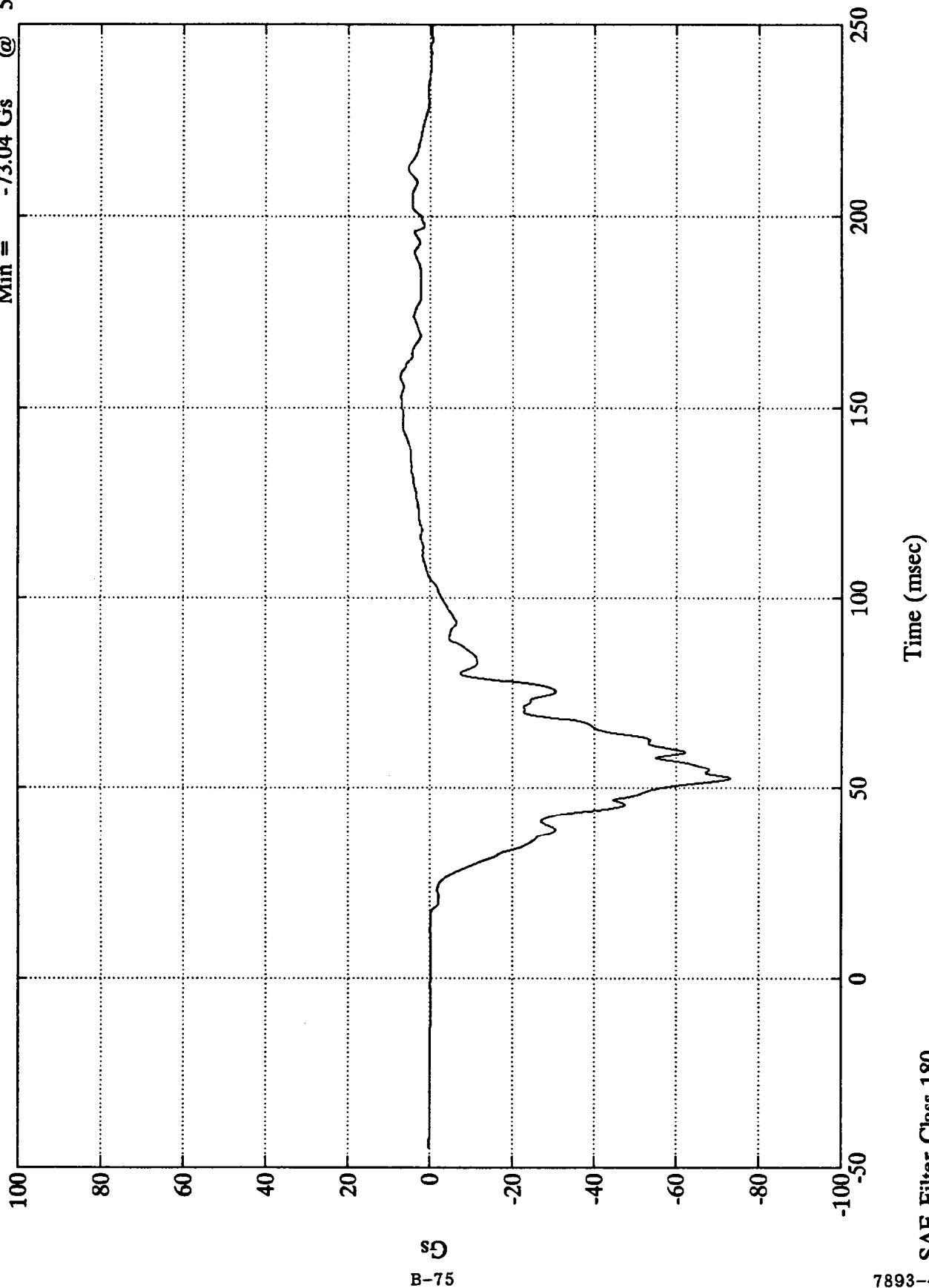


B-74

7893-4 SAE Filter Class 1000

Pos. 1 Chest X

Max = 7.34 Gs @ 157.91 msec
Min = -73.04 Gs @ 52.56 msec

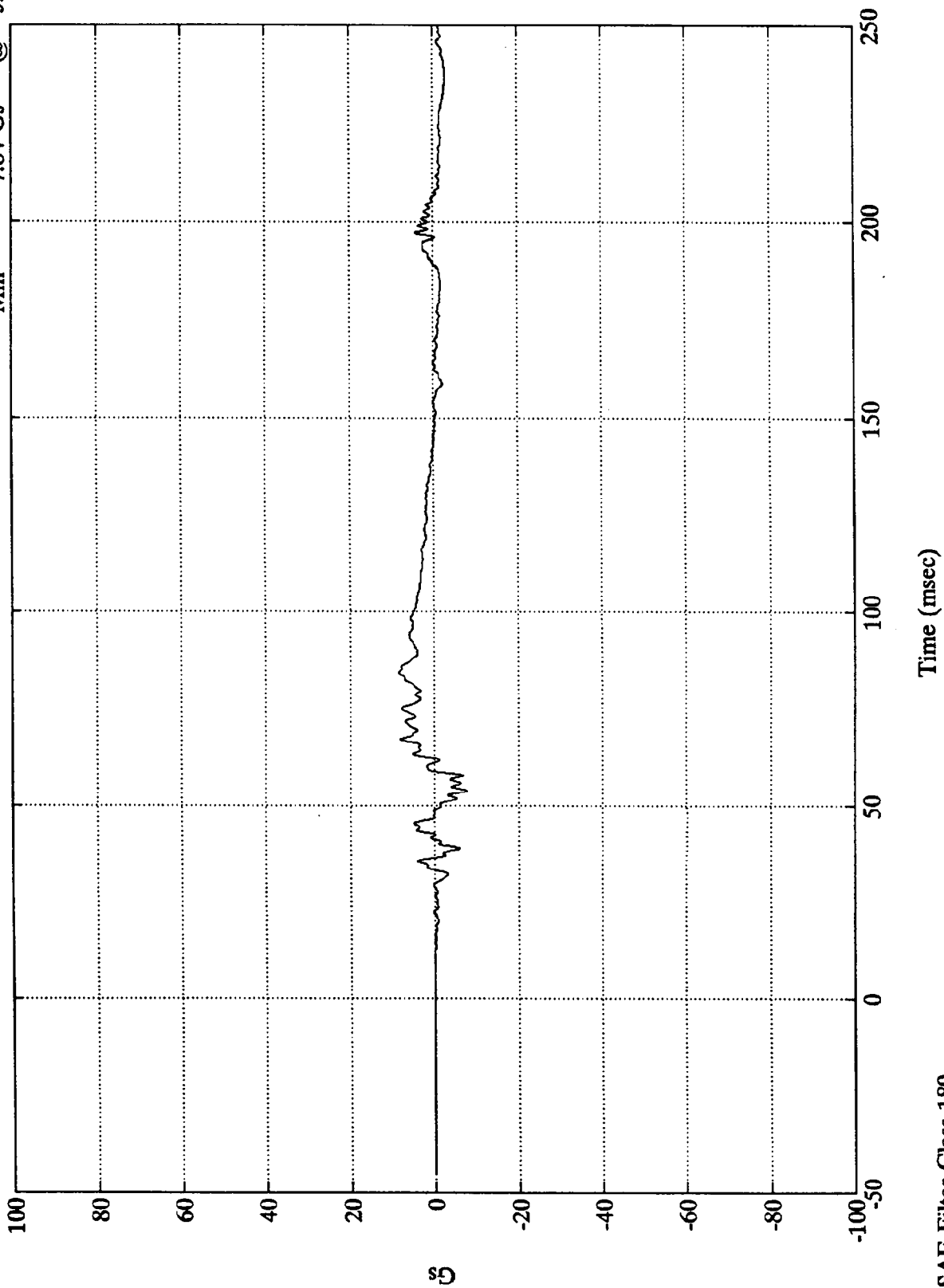


B-75

Test 1047

Pos. 1 Chest Y

Max = 8.42 Gs @ 84.24 msec
Min = -7.84 Gs @ 53.88 msec

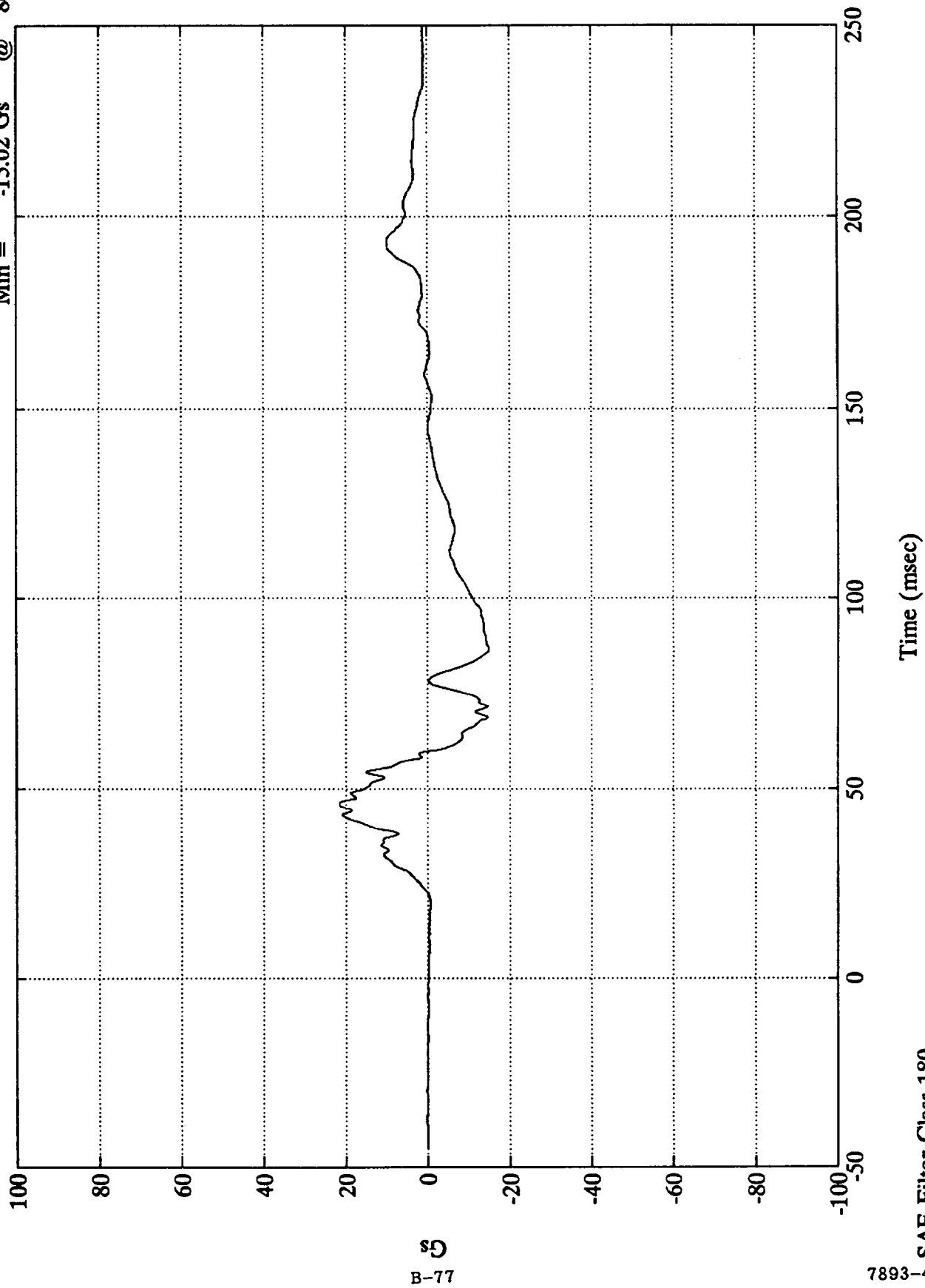


B-76

7893-4
SAE Filter Class 180

Pos. 1 Chest Z

Max = 21.59 Gs @ 45.96 msec
Min = -15.02 Gs @ 86.28 msec



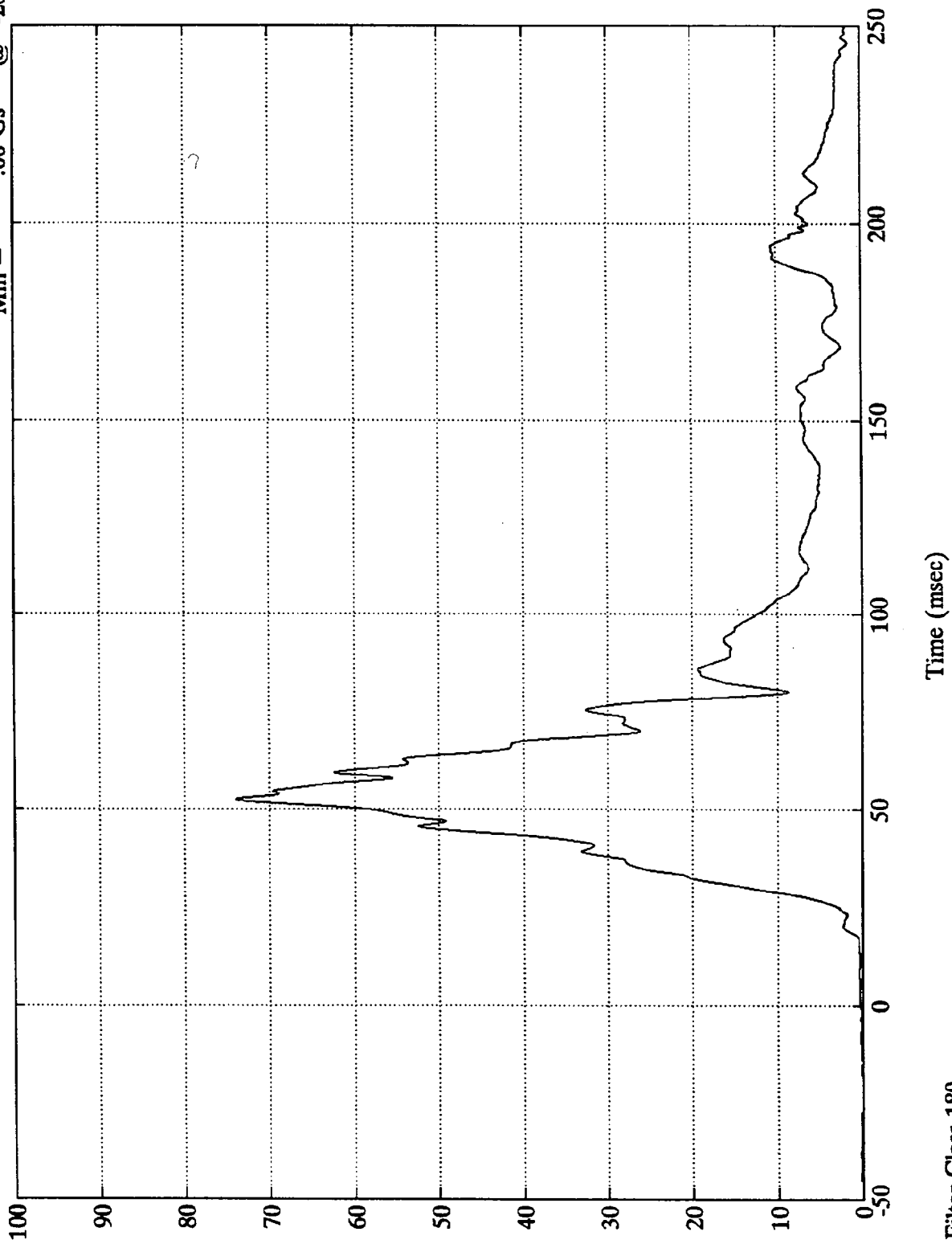
B-77

7893-4

SAE Filter Class 180

Test 1047

Pos. 1 Chest Resultant
Max = 73.99 Gs @ 52.56 msec
Min = .00 Gs @ -20.64 msec



B-78

7893-4 SAE Filter Class 180

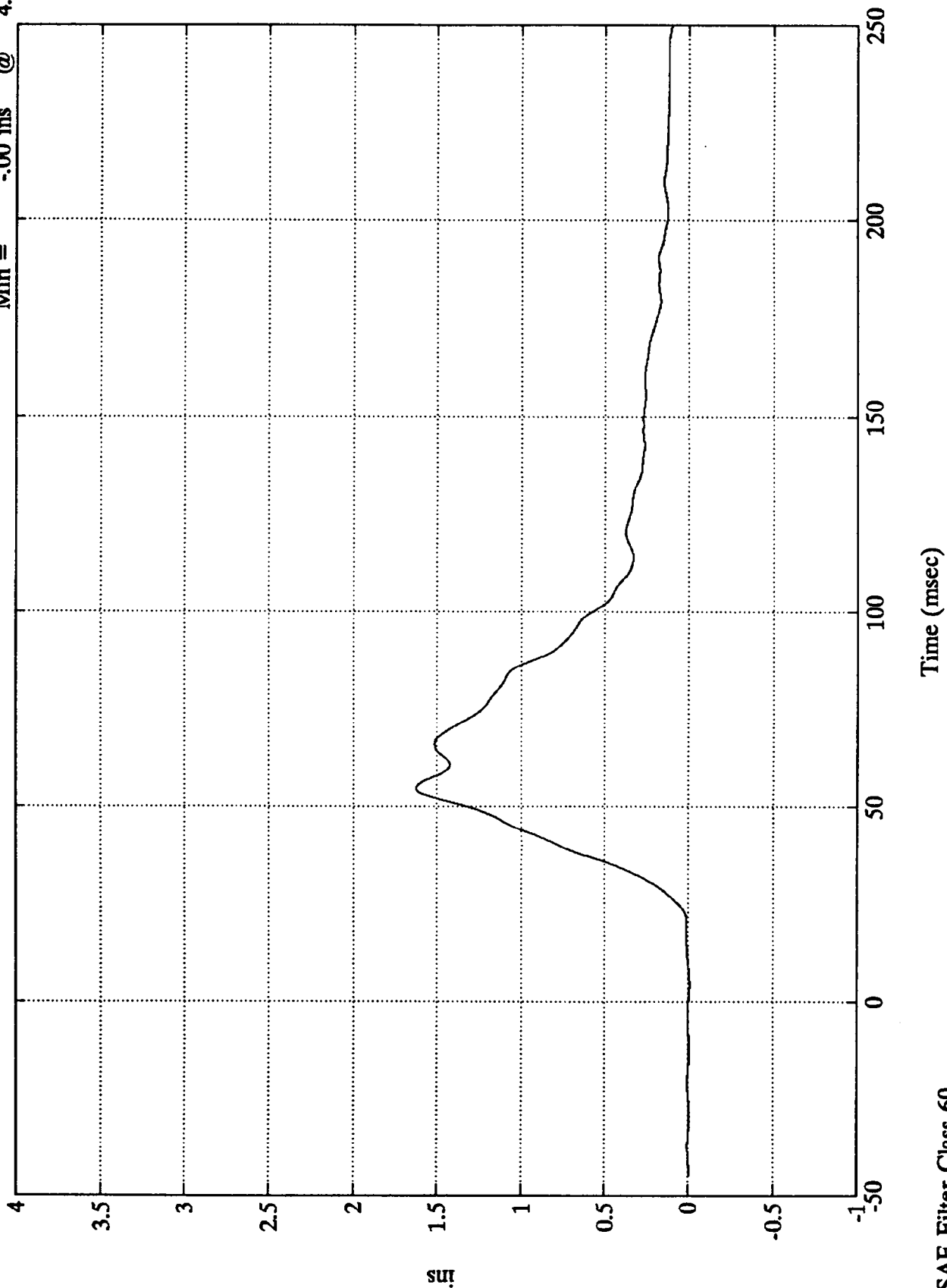
Test 1047

B-79

7893-4

Pos. 1 Chest Disp.

Max = 1.62 ins @ 54.59 msec
Min = -.00 ins @ 4.19 msec

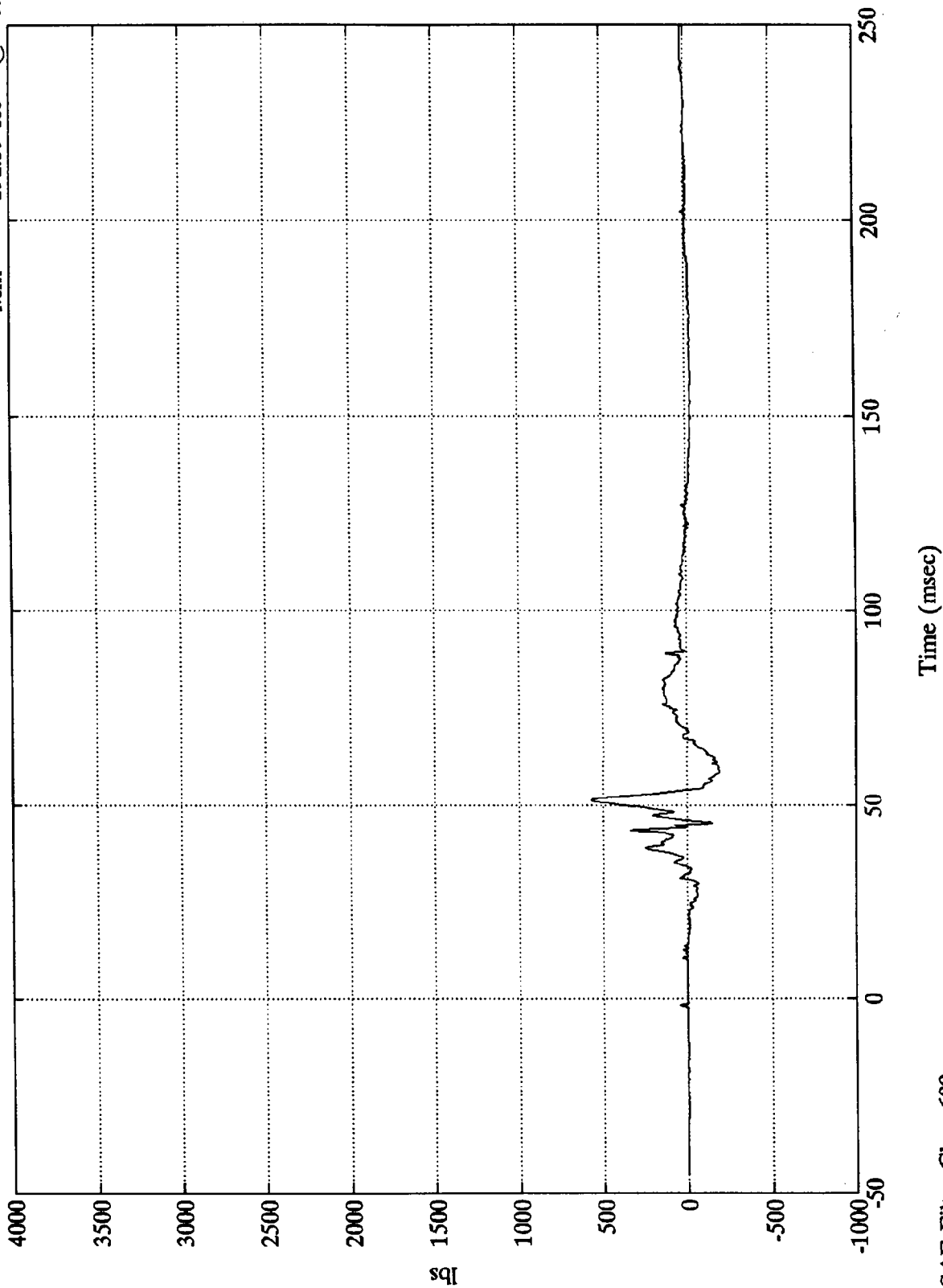


SAE Filter Class 60

Test 1047

Pos. 1 Left Femur

Max = 568.06 lbs @ 51.47 msec
Min = -192.39 lbs @ 59.04 msec



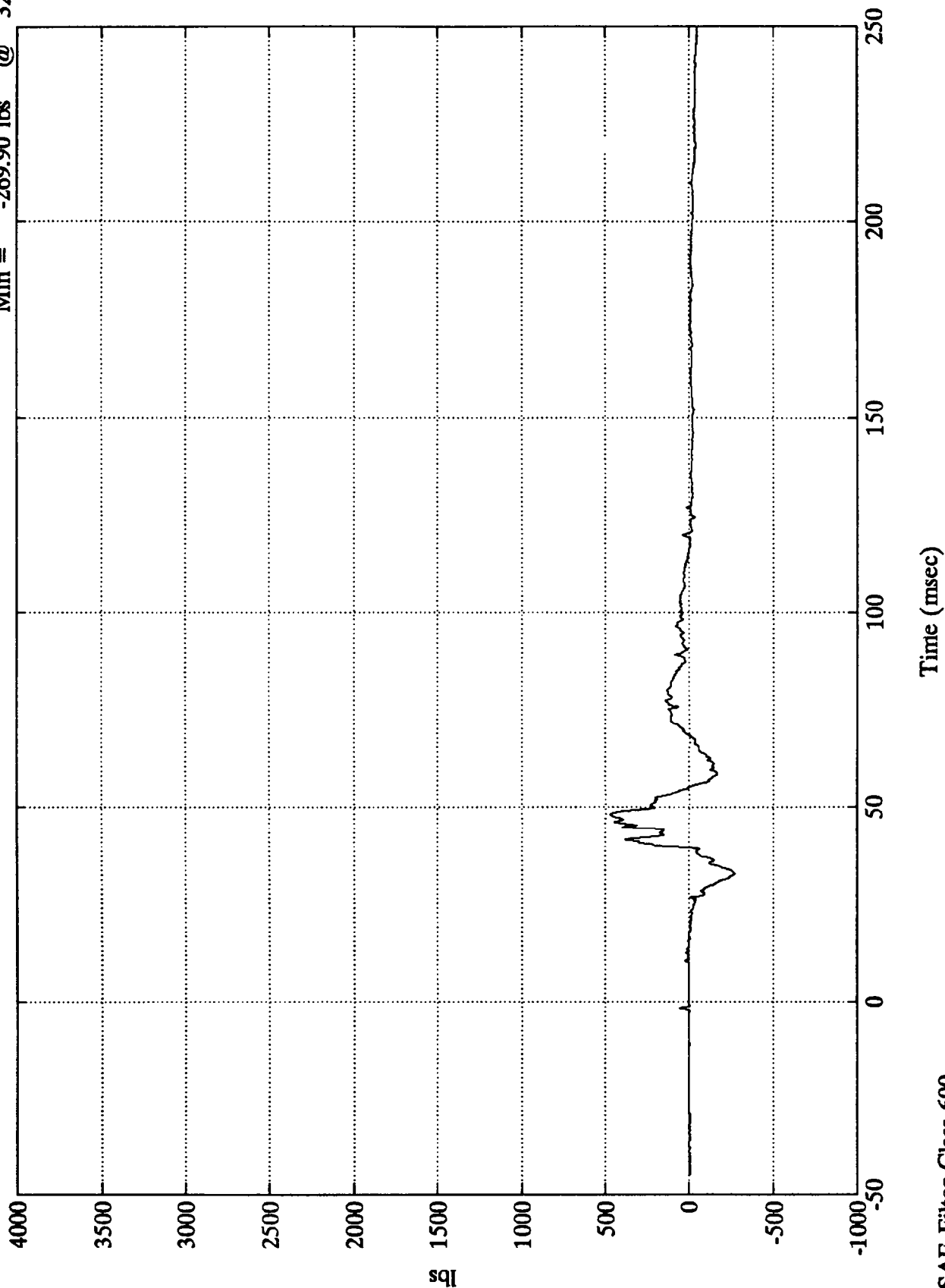
B-80

7893-4
SAE Filter Class 600

Test 1047

Pos. 1 Right Femur

Max = 469.30 lbs @ 48.24 msec
Min = -269.90 lbs @ 32.88 msec



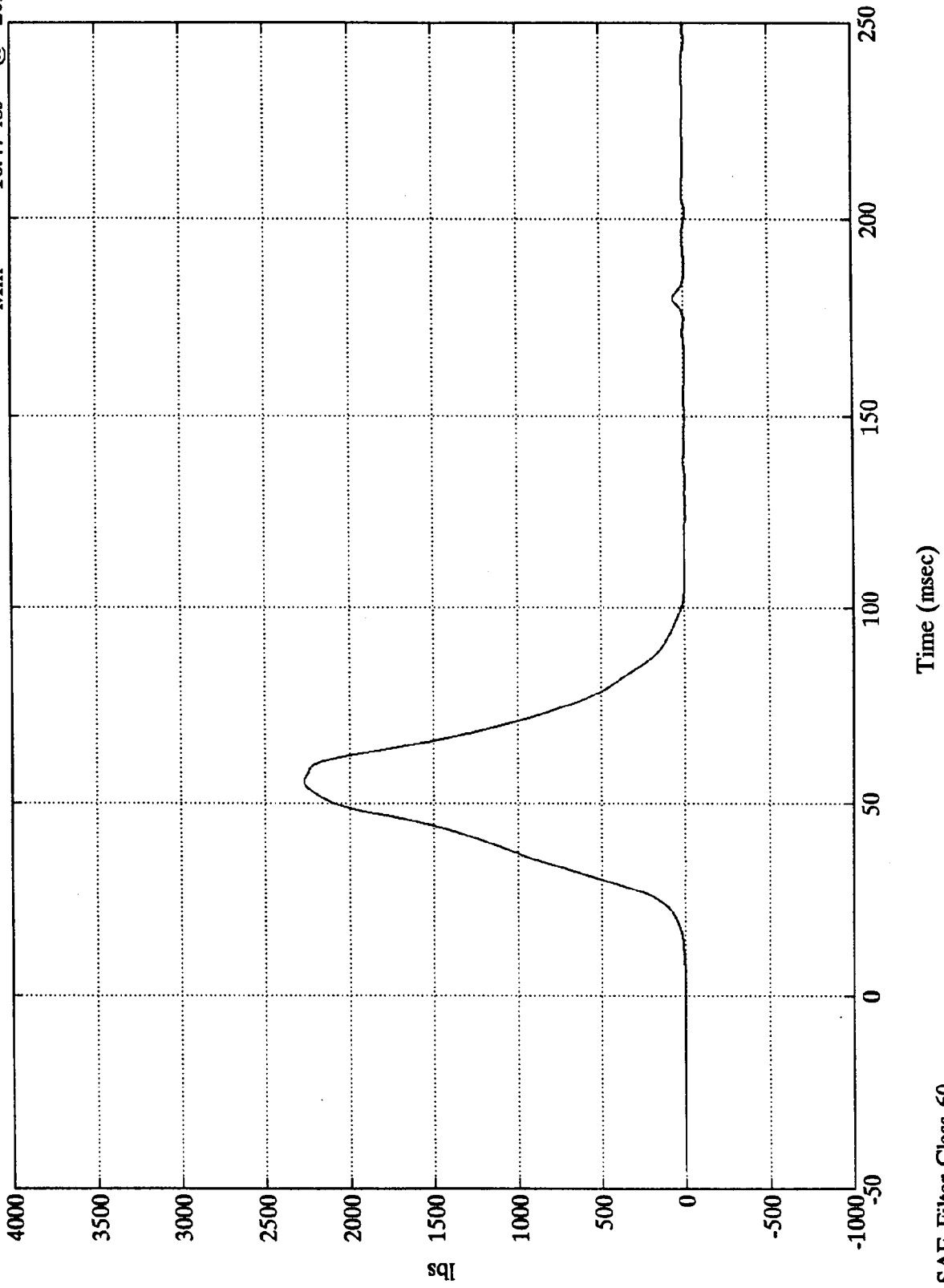
B-81

7893-4 SAE Filter Class 600

Test 1047

Pos. 1 Torso Belt Load

Max = 2269.54 lbs @ 55.80 msec
Min = -10.47 lbs @ 201.47 msec

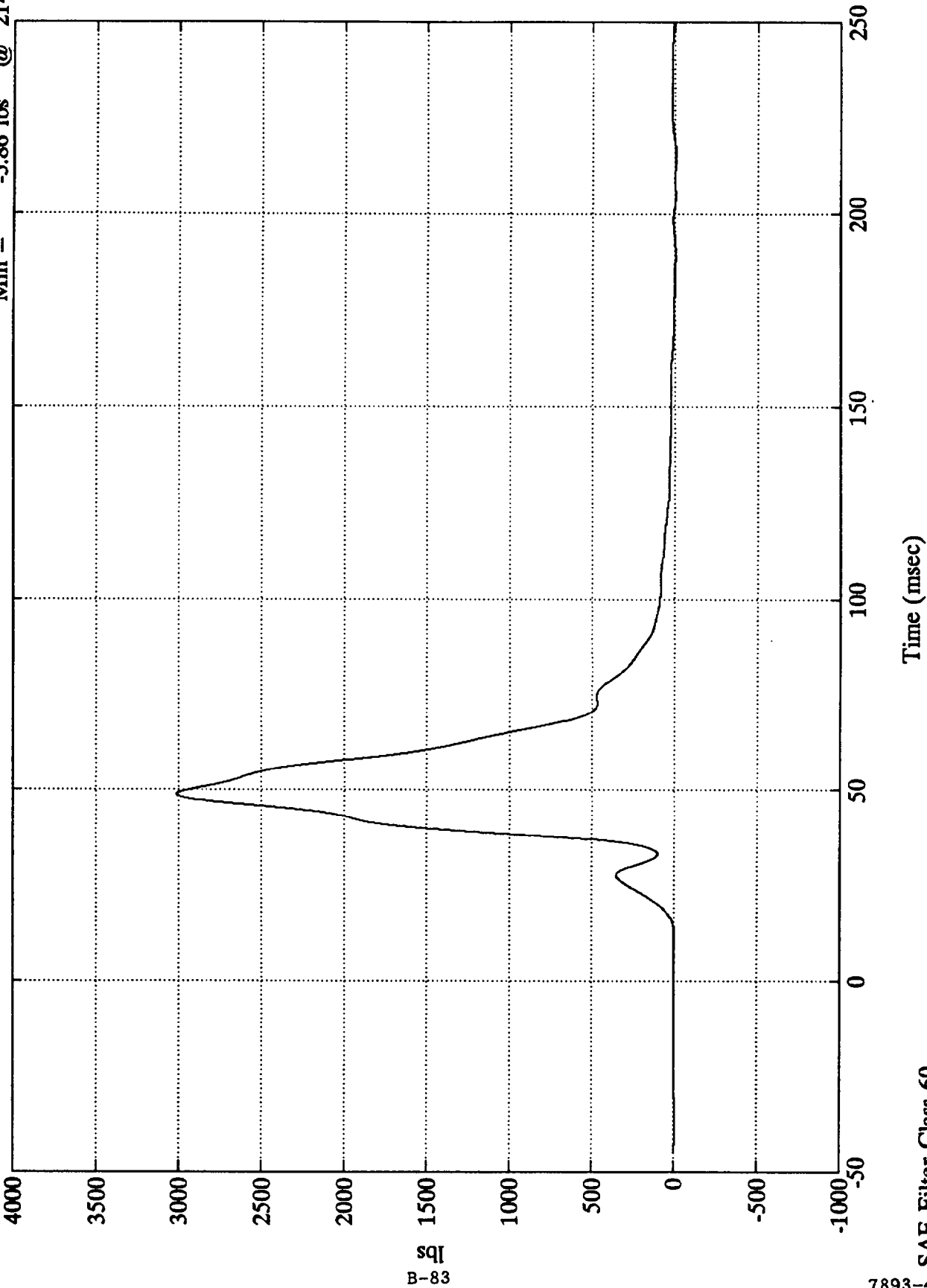


B-82

7893 4
SAE Filter Class 60

Pos. 1 Left Belt Load

Max = 3011.77 lbs @ 48.84 msec
Min = -5.86 lbs @ 214.80 msec

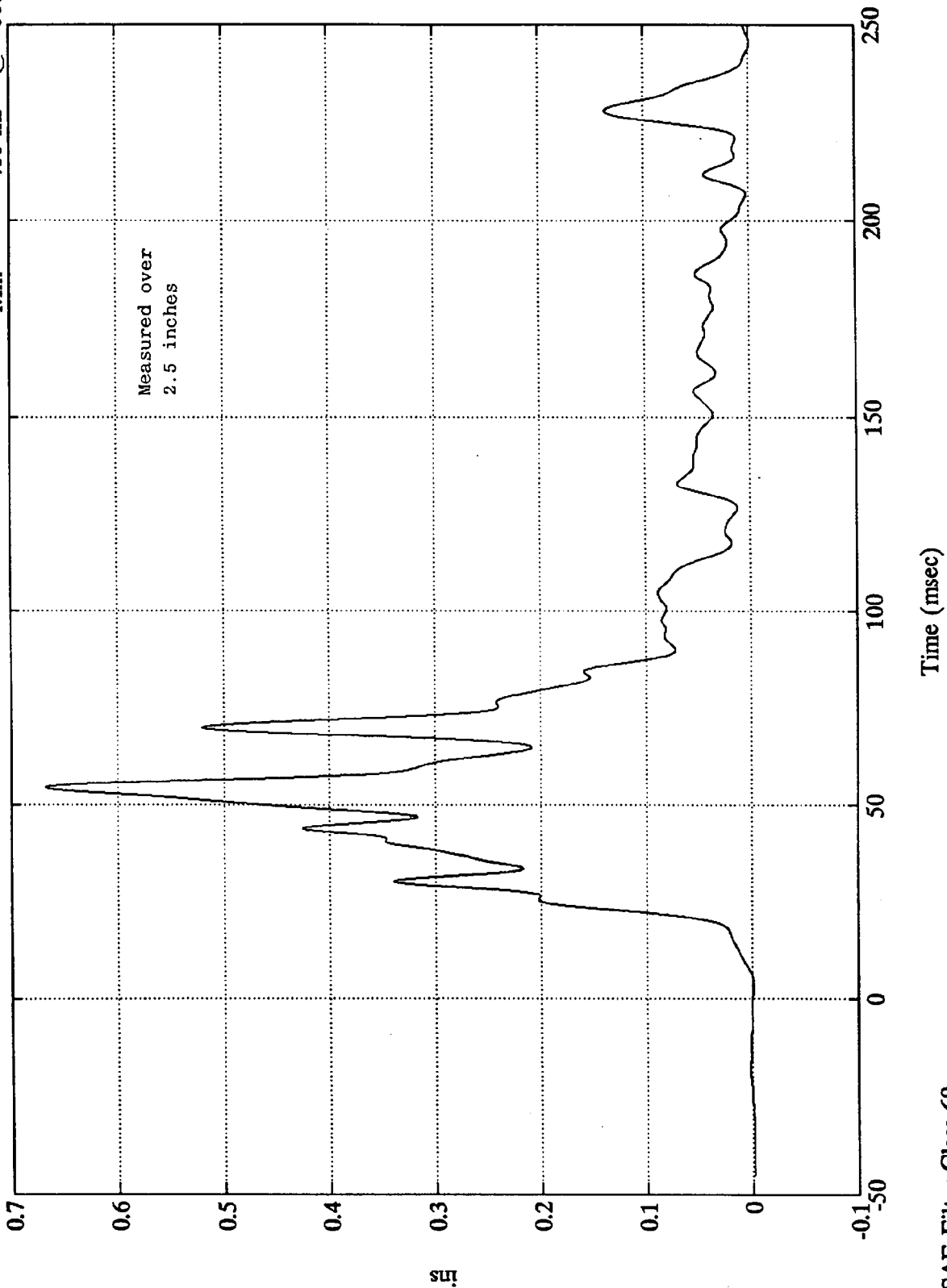


B-83

Test 1047

Pos. 1 Belt Elongation

Max = .66 ins @ 54.47 msec
Min = -.00 ins @ -33.84 msec

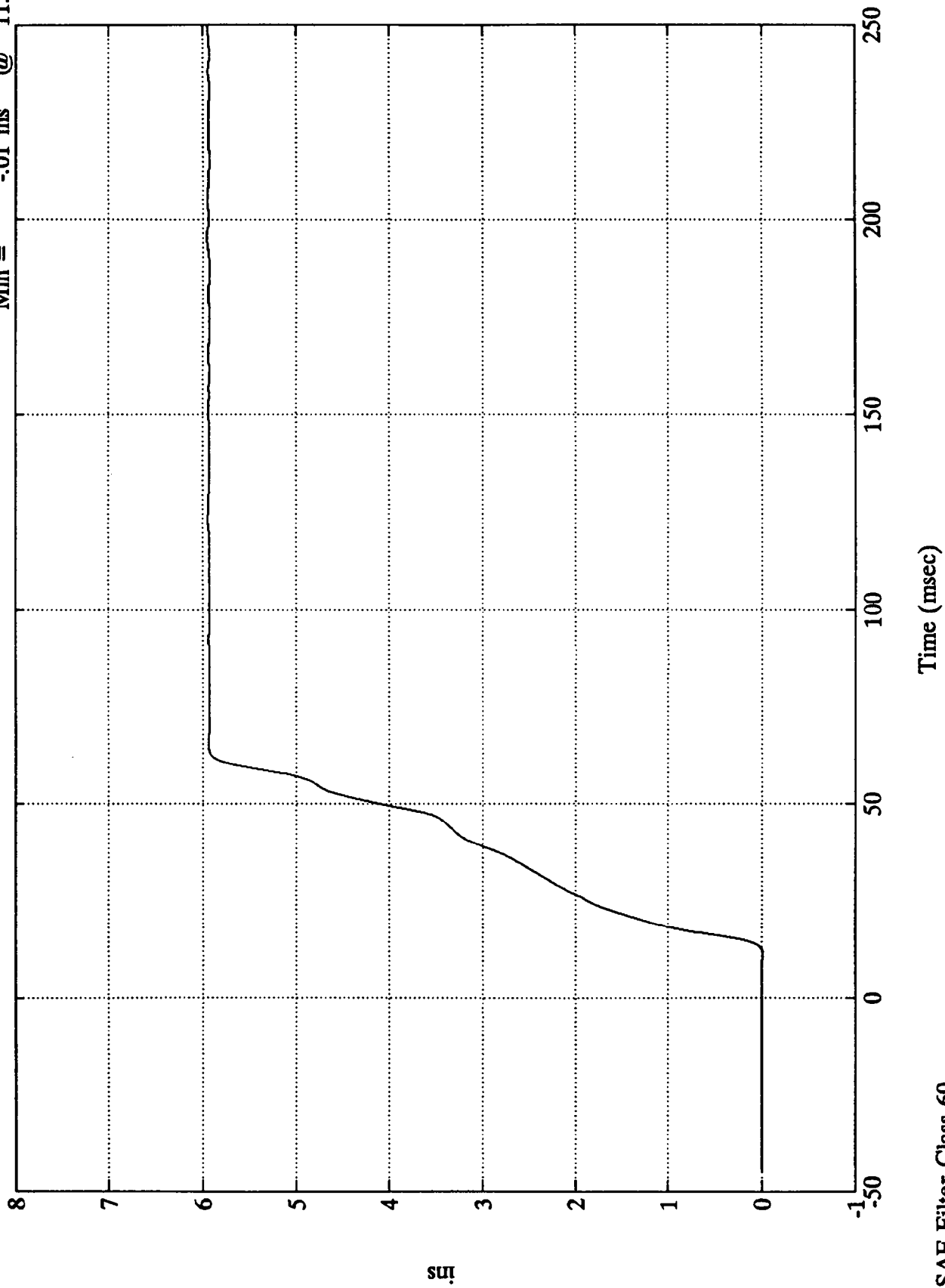


B-84

7893-1 SAE Filter Class 60

Test 1047

Pos. 1 Belt Spool Out Max = 5.95 ins @ 195.72 msec
Min = -0.01 ins @ 11.39 msec



ins
B-85

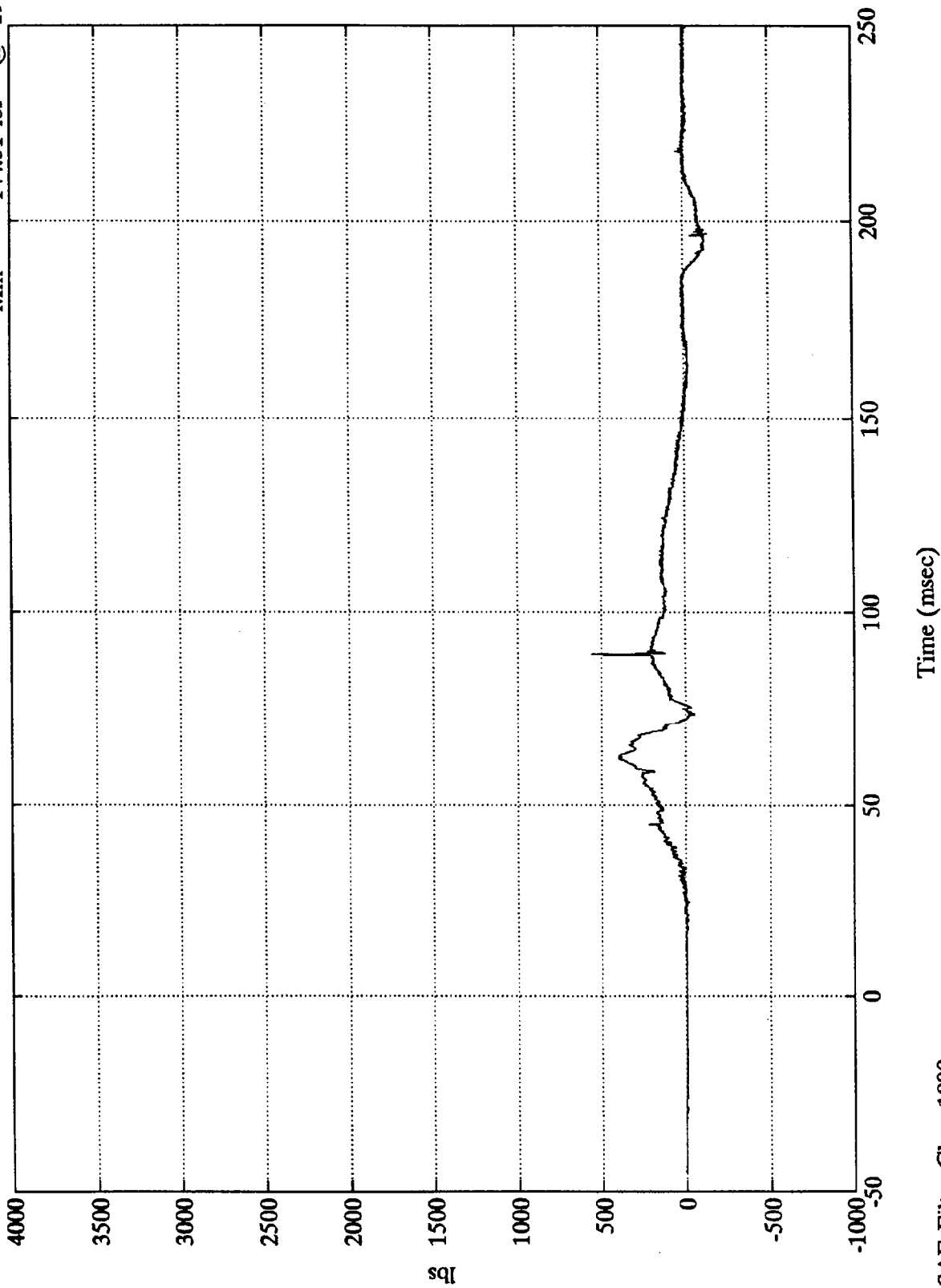
7893-4

SAE Filter Class 60

Test 1047

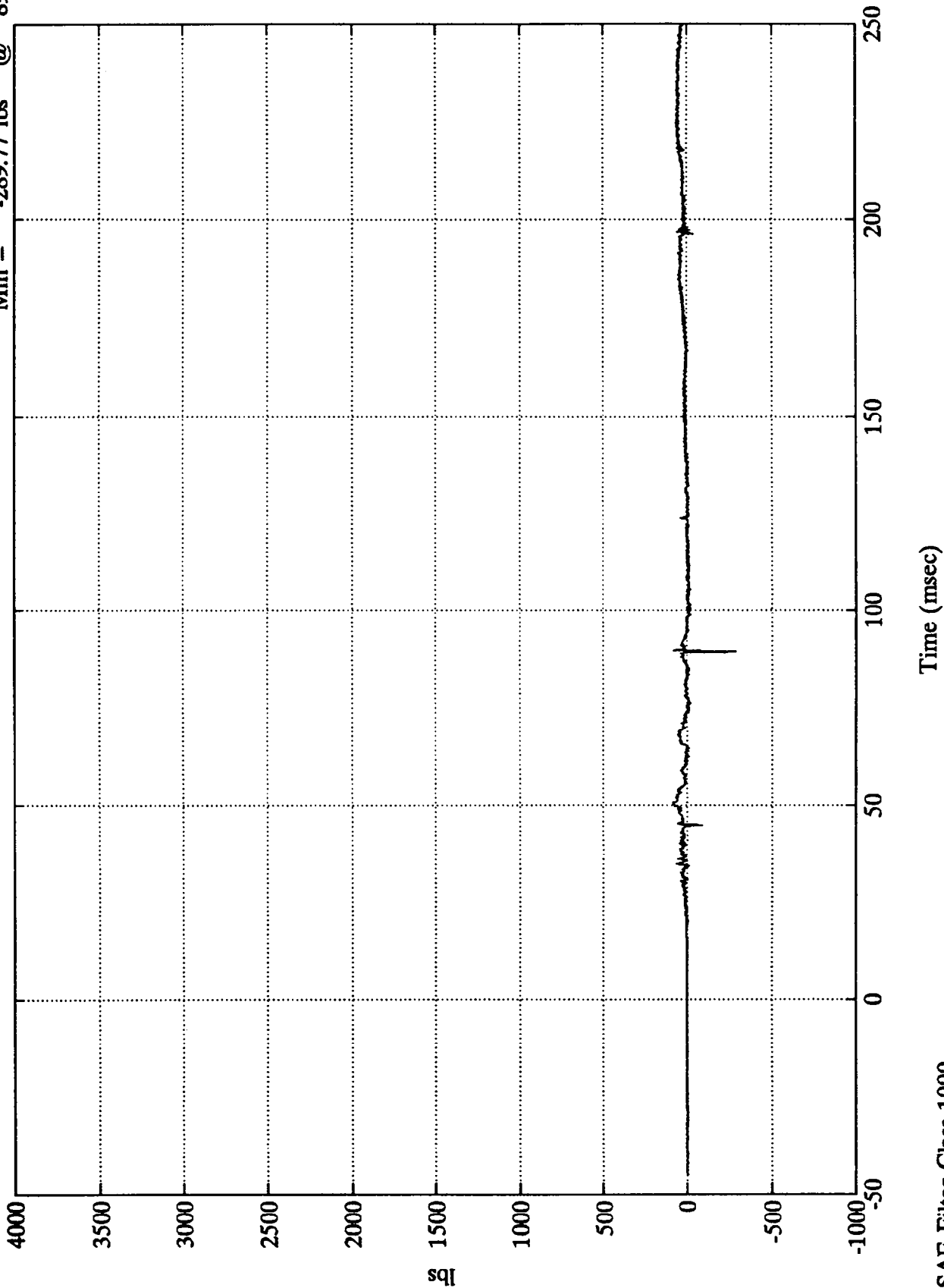
Pos. 1 Upper Neck Fx

Max = 553.70 lbs @ 89.40 msec
Min = -144.51 lbs @ 196.68 msec



Pos. 1 Upper Neck Fy

Max = 88.37 lbs @ 50.76 msec
Min = -289.77 lbs @ 89.40 msec

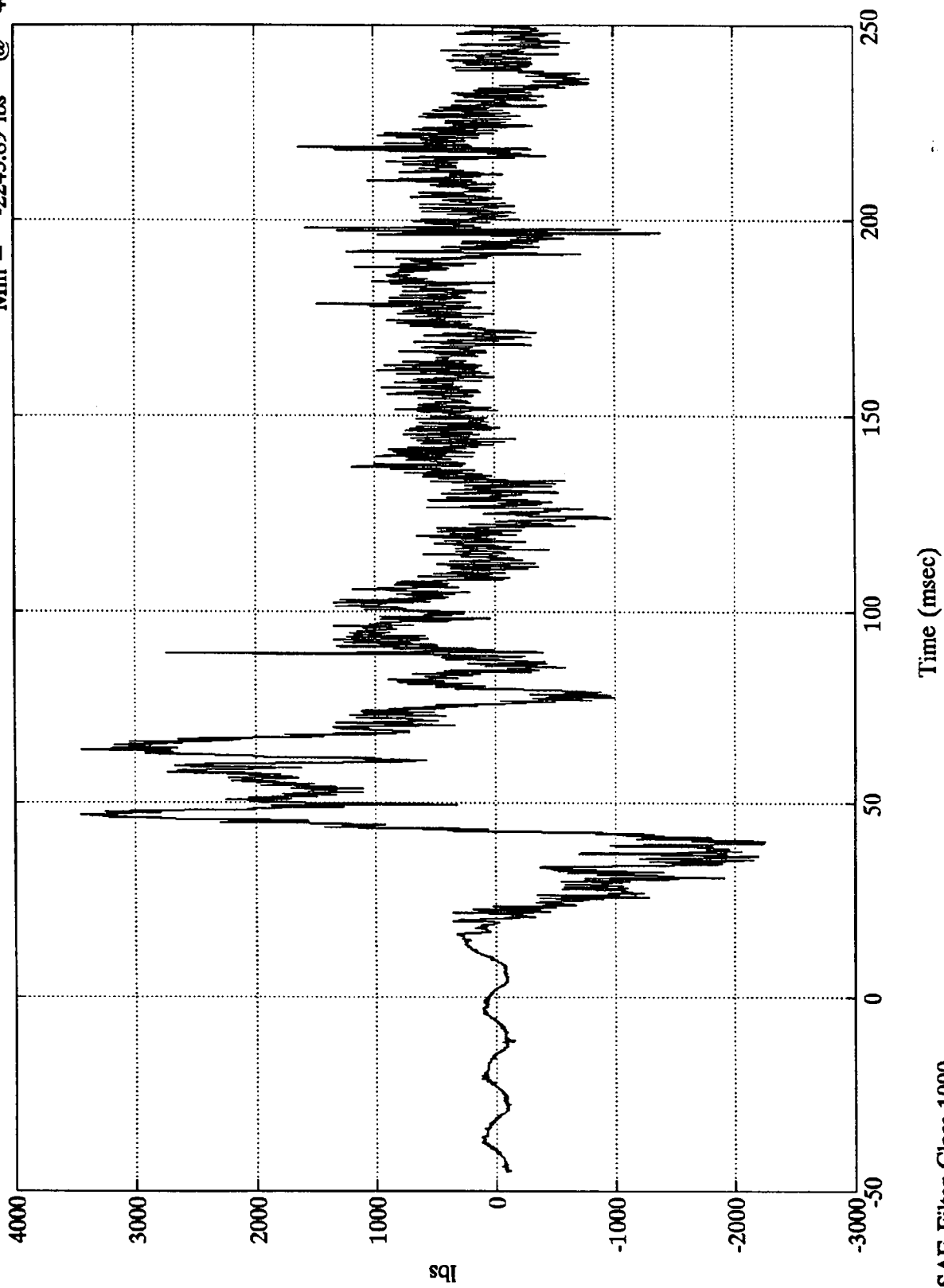


SAE Filter Class 1000

Test 1047

Pos. 1 Upper Neck Fz

Max = 3456.38 lbs @ 46.92 msec
Min = -2245.89 lbs @ 40.31 msec



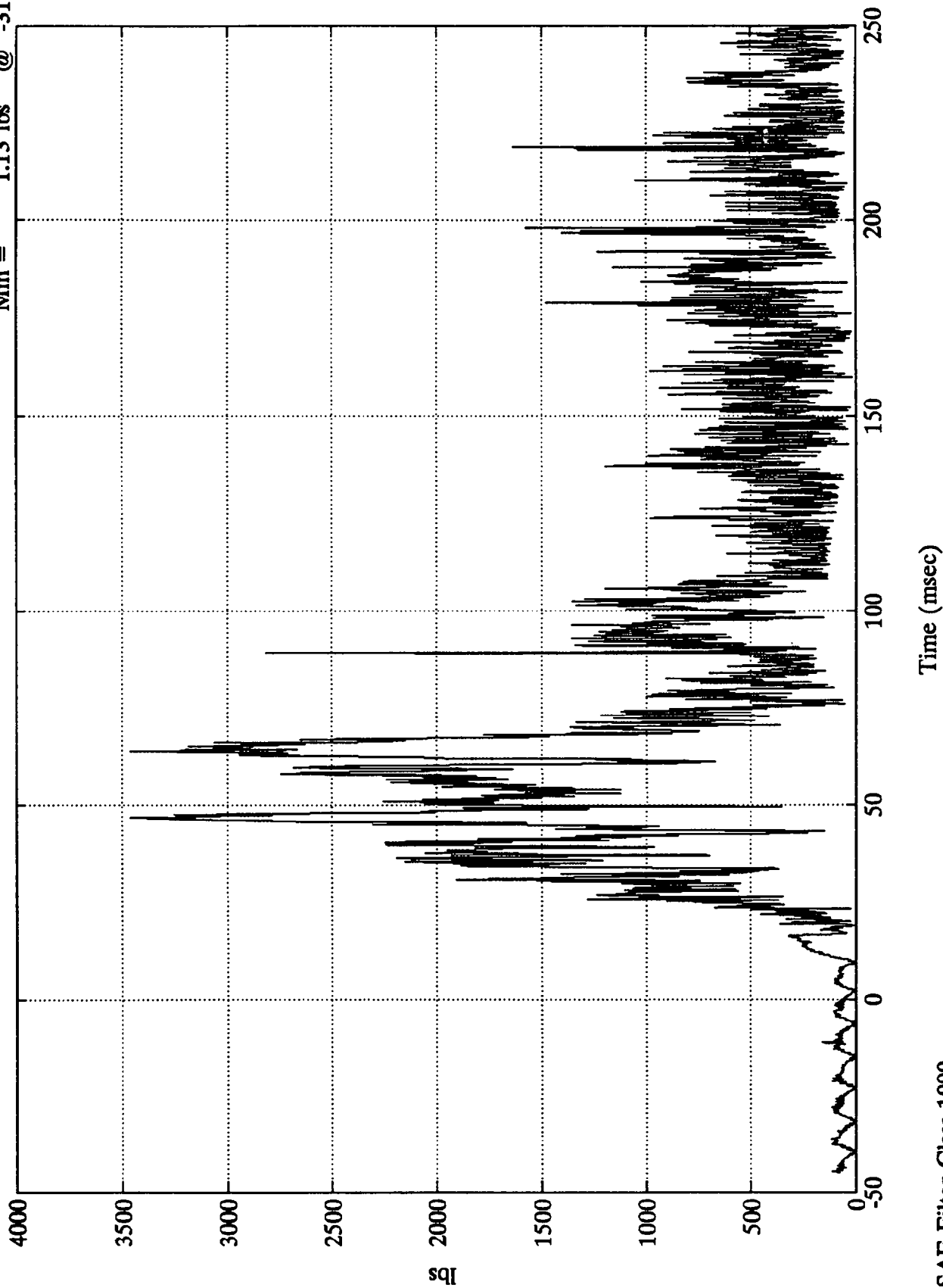
B-88

7893-4 SAE Filter Class 1000

Test 1047

Pos. 1 Neck Force Res.

Max = 3459.98 lbs @ 46.92 msec
Min = 1.13 lbs @ -31.68 msec



B-89

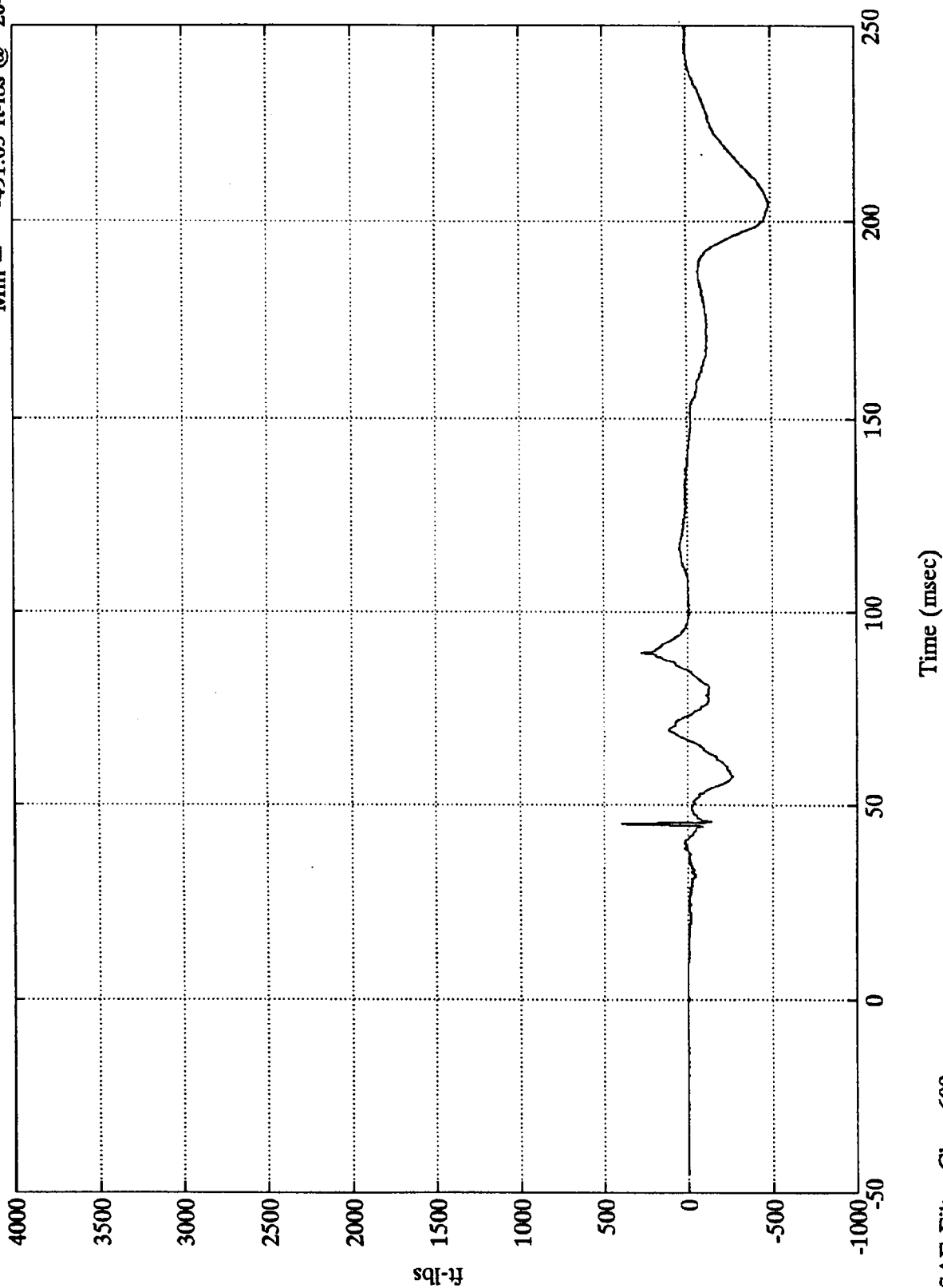
7893-4

SAE Filter Class 1000

Test 1047

Pos. 1 Upper Neck Mx

Max = 394.69 ft-lbs @ 45.12 msec
Min = -491.05 ft-lbs @ 204.84 msec



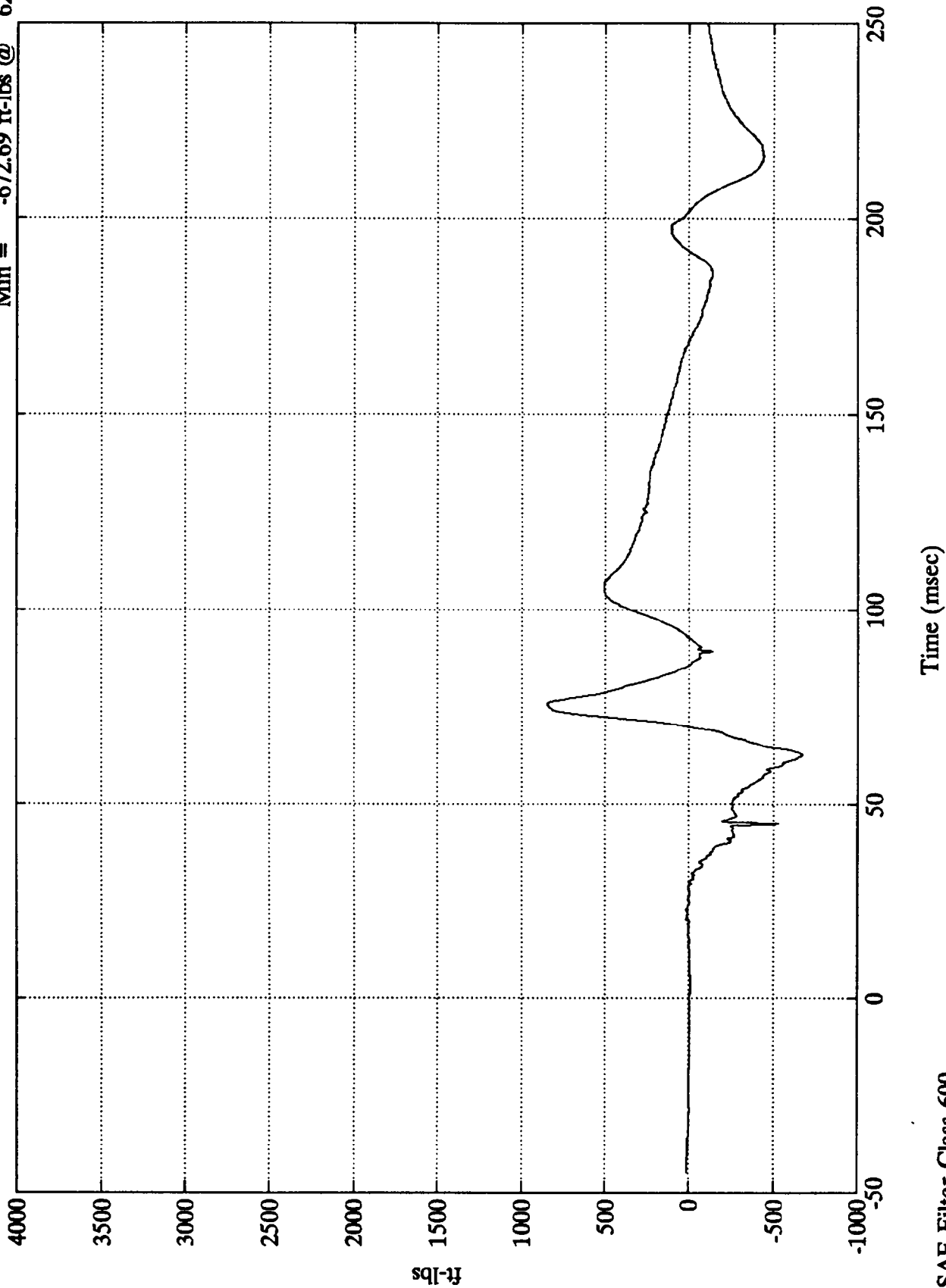
B-90

7893-4
SAE Filter Class 600

Test 1047

Pos. 1 Upper Neck My

Max = 847.00 ft-lbs @ 75.84 msec
Min = -672.69 ft-lbs @ 62.64 msec



B-91

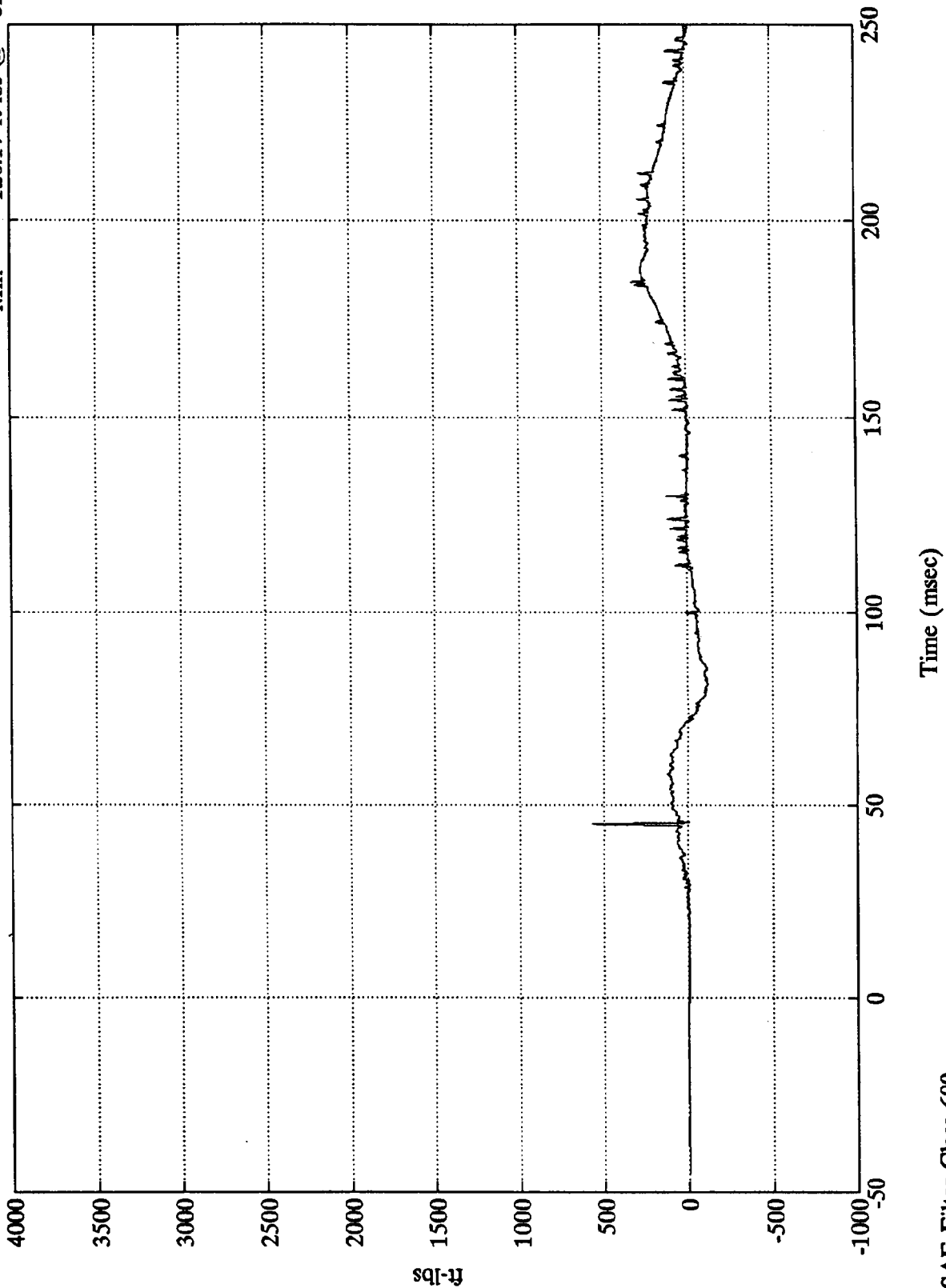
7893-4

SAE Filter Class 600

Test 1047

Pos. 1 Upper Neck Mz

Max = 568.18 ft-lbs @ 45.12 msec
Min = -120.17 ft-lbs @ 81.60 msec

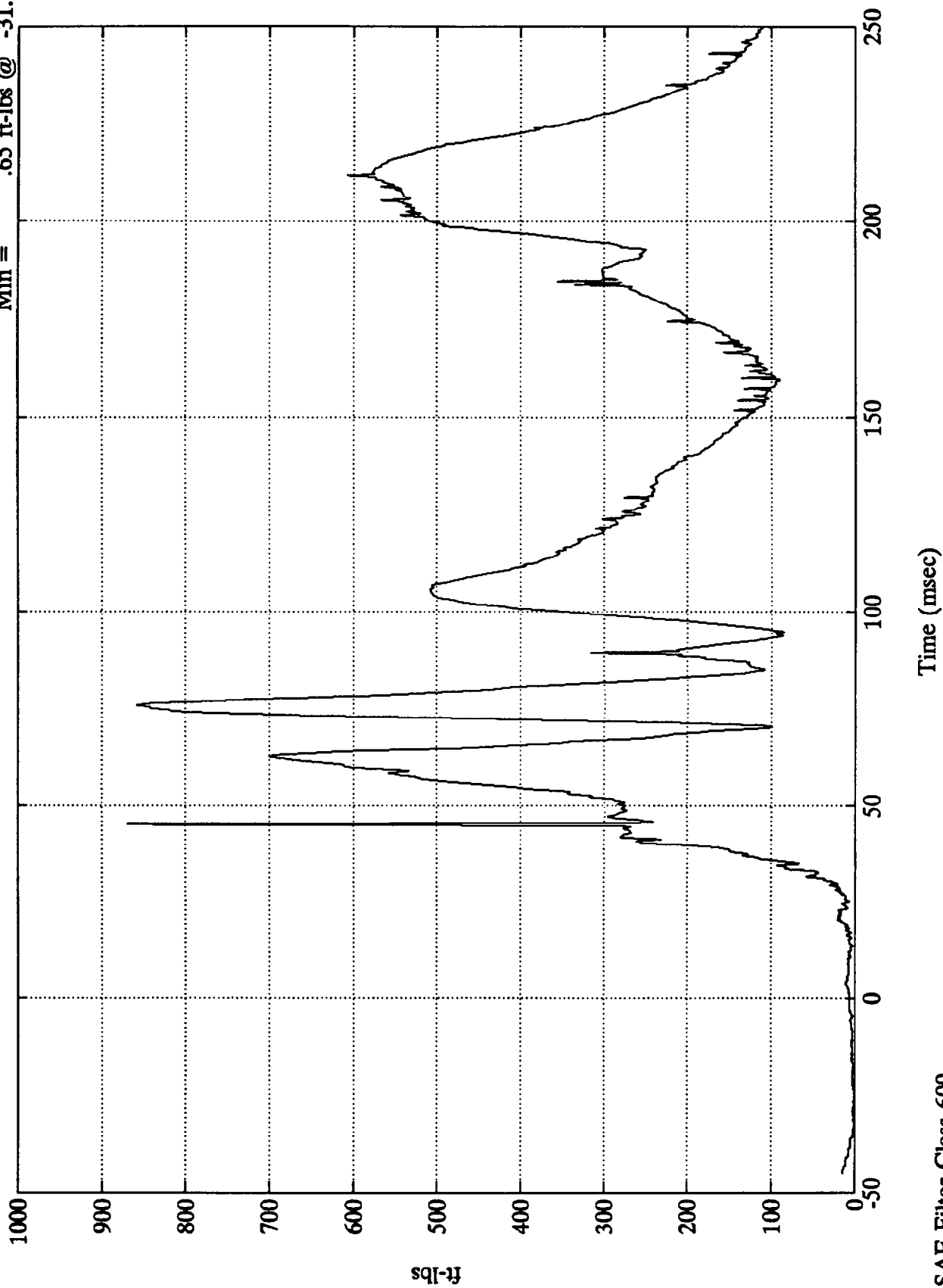


B-92

7893-4
SAE Filter Class 600

Pos. 1 Neck Moment Res.

Max = 869.61 ft-lbs @ 45.12 msec
Min = .65 ft-lbs @ -31.56 msec

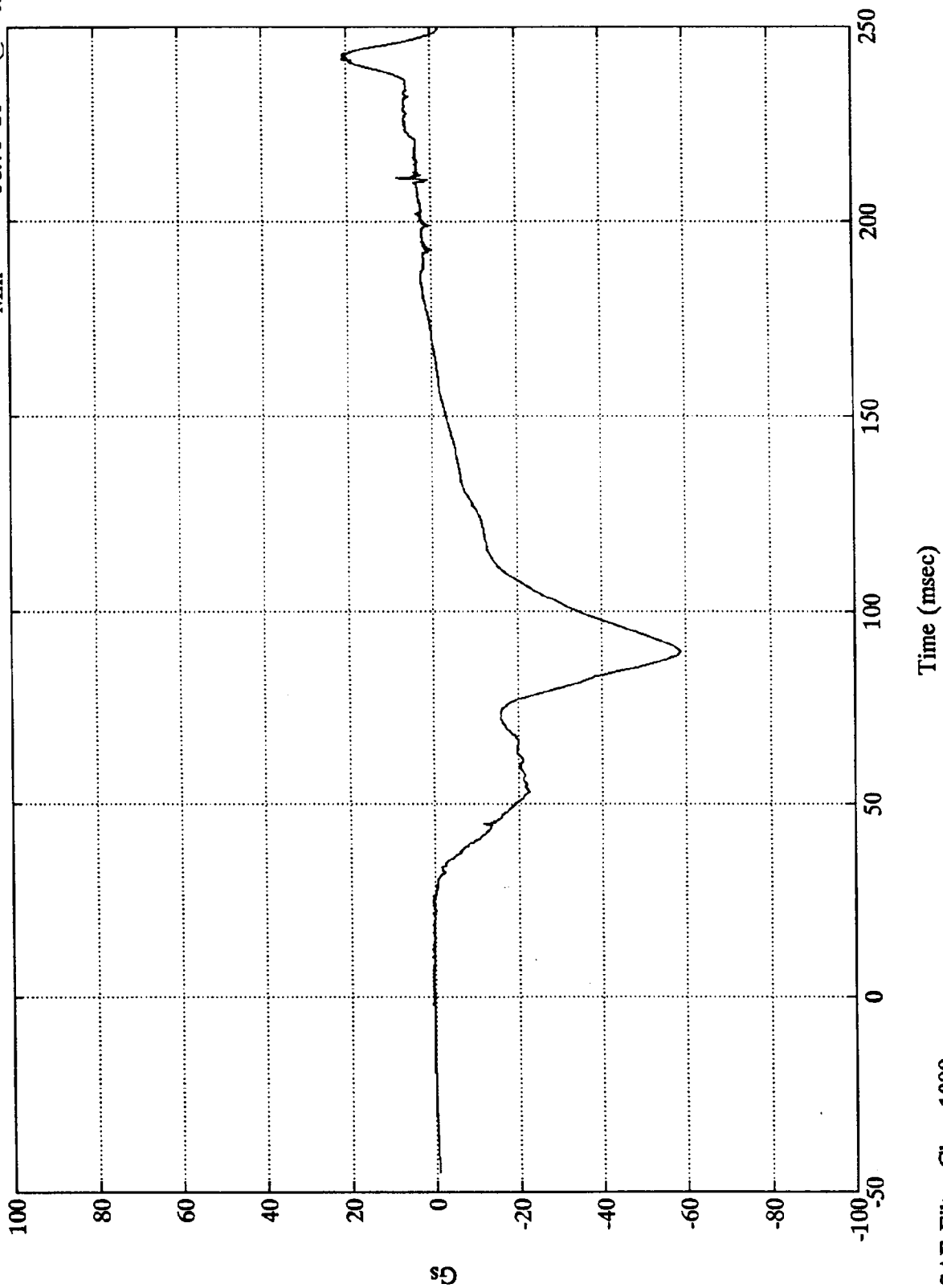


B-93

Test 1047

Pos. 2 Head X

Max = 21.04 Gs @ 241.32 msec
Min = -58.76 Gs @ 89.76 msec



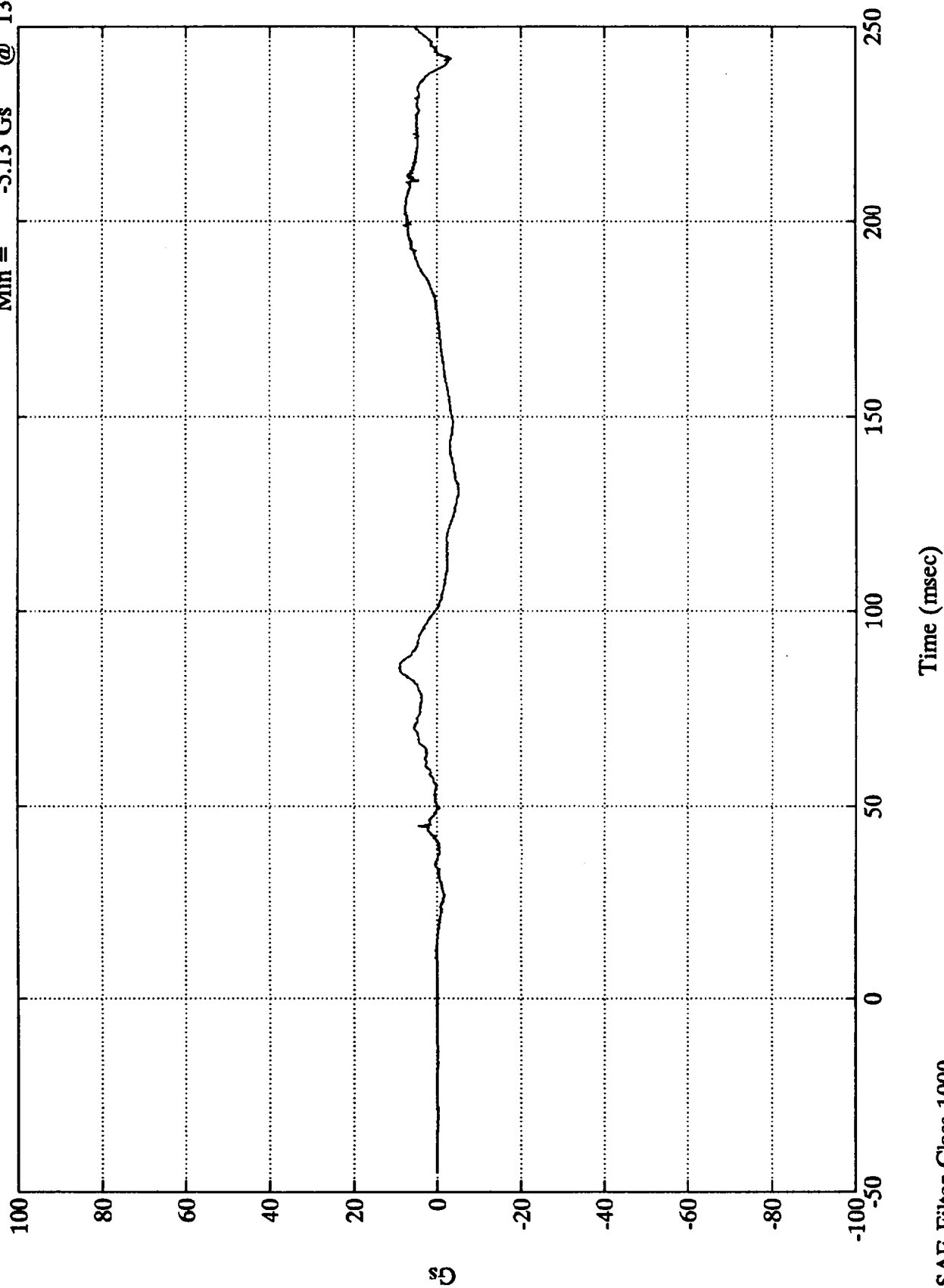
B-94

7893-4 SAE Filter Class 1000

Test 1047

Pos. 2 Head Y

Max = 9.09 Gs @ 85.56 msec
Min = -5.13 Gs @ 130.56 msec



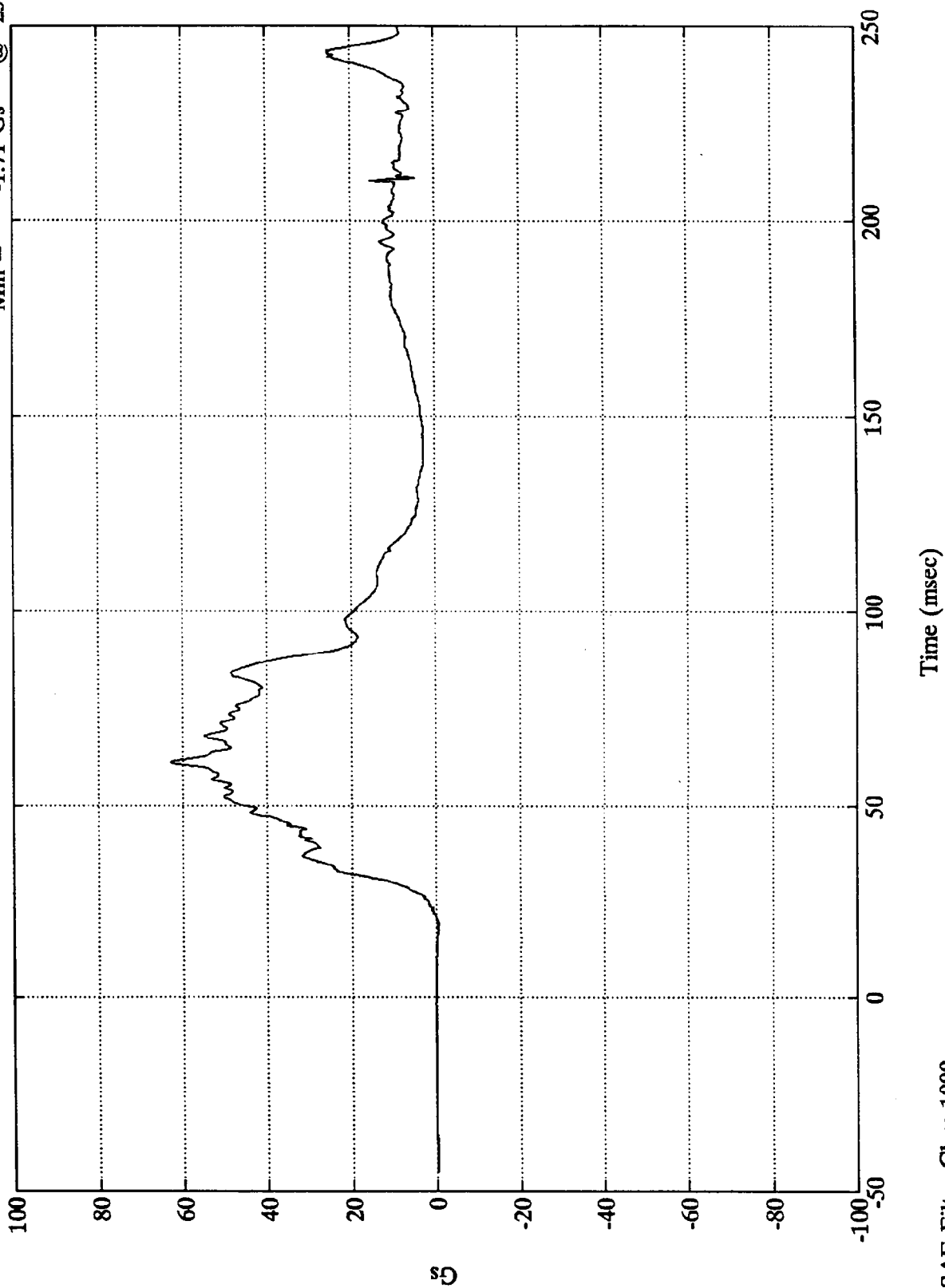
B-95

SAE Filter Class 1000

7893-4

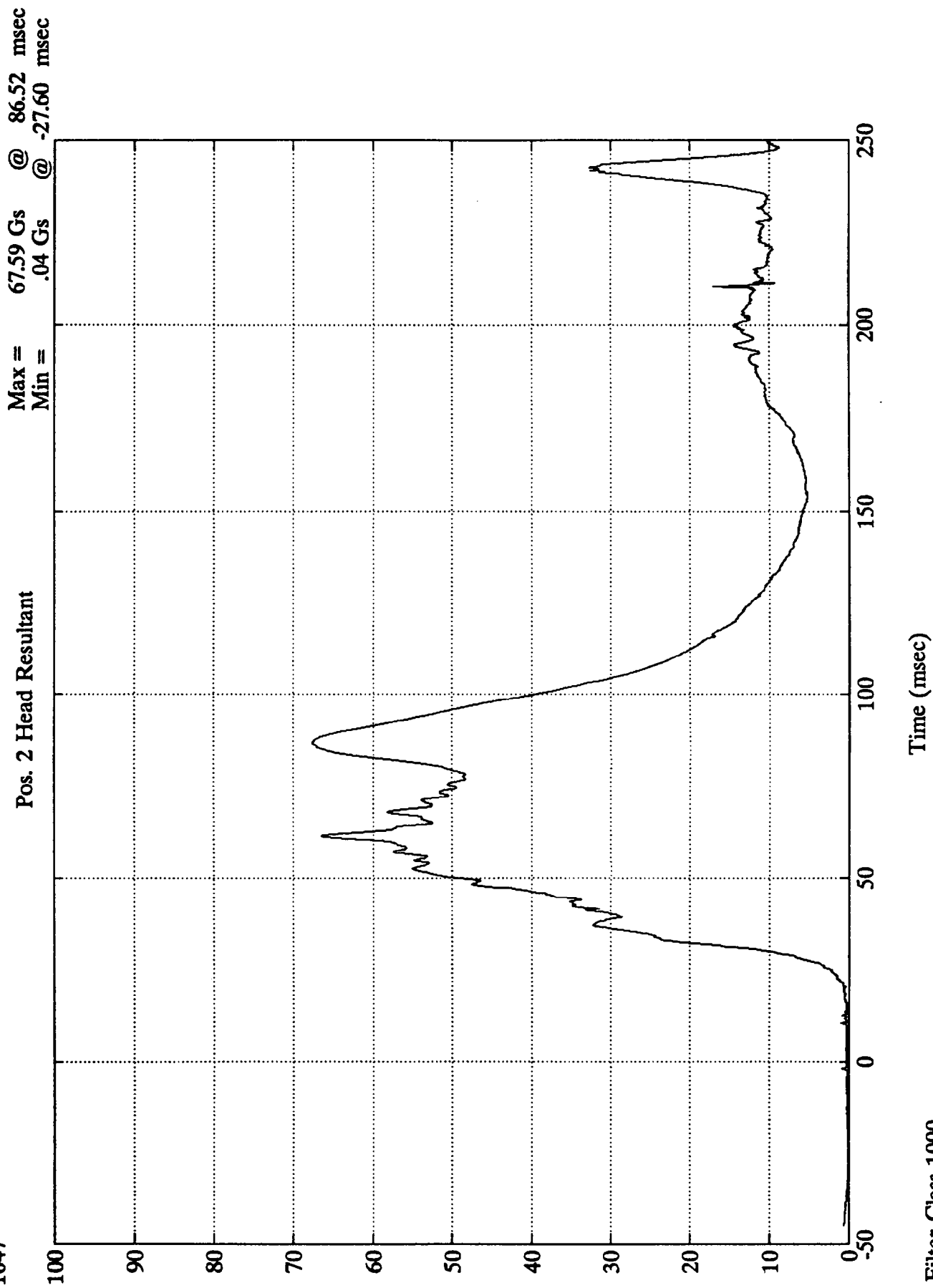
Test 1047

Pos. 2 Head Z
Max = 62.94 Gs @ 61.56 msec
Min = -1.71 Gs @ 254.88 msec



B-96

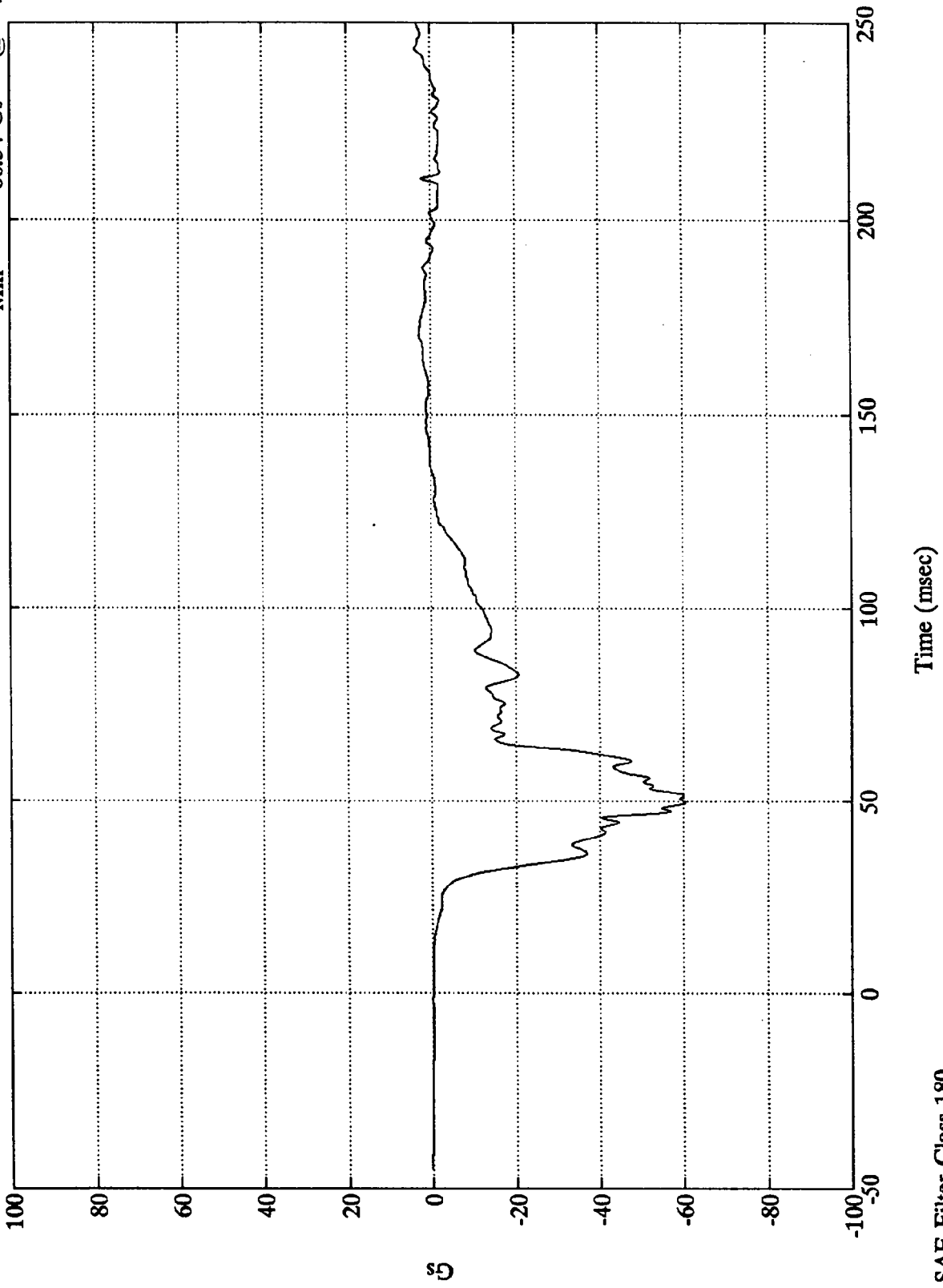
7893-4 SAE Filter Class 1000



Test 1047

Pos. 2 Chest X

Max = 3.55 Gs @ 243.36 msec
Min = -60.34 Gs @ 49.79 msec

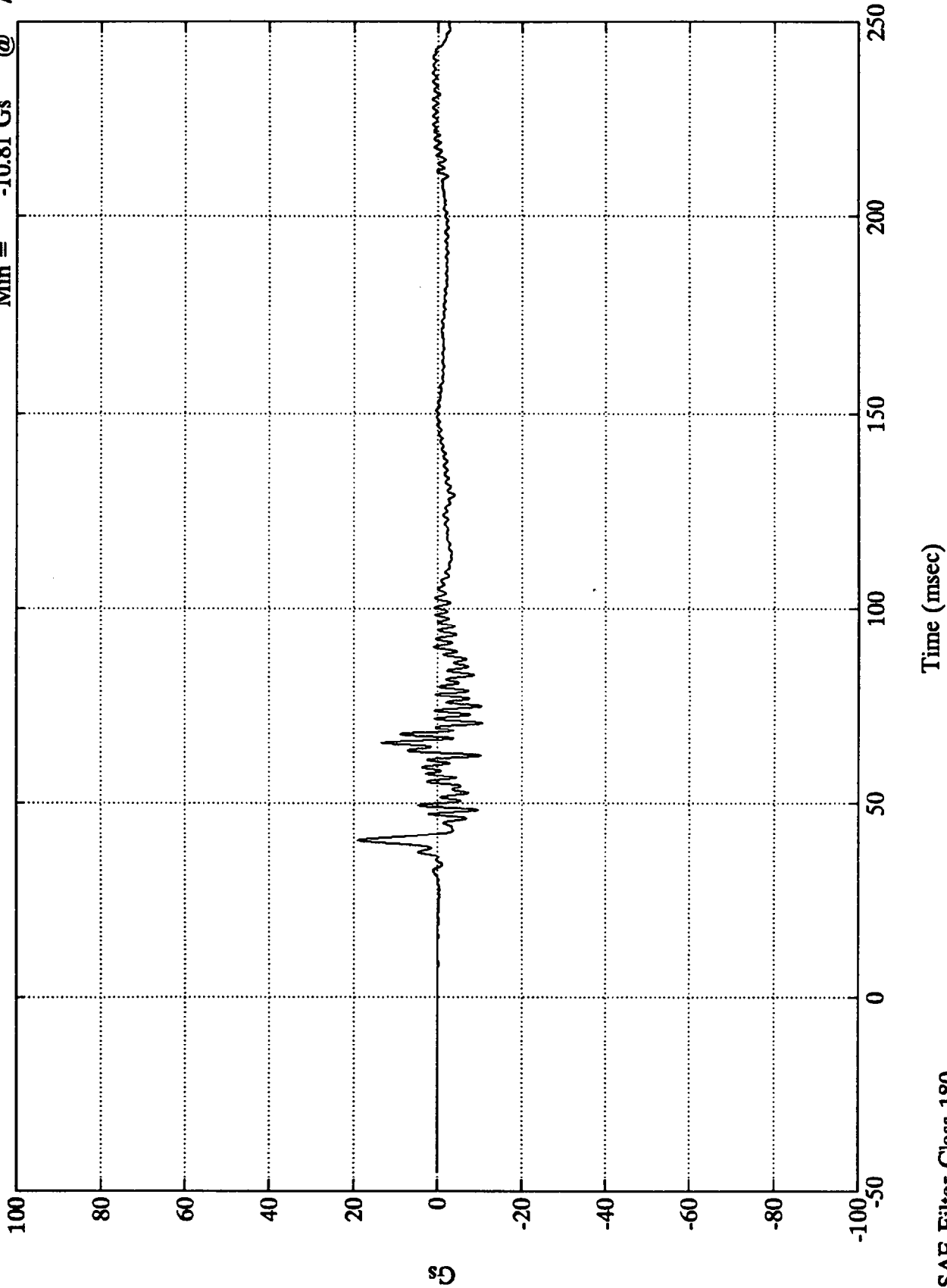


B-98

7893-4 SAE Filter Class 180

Pos. 2 Chest Y

Max = 18.93 Gs @ 40.44 msec
Min = -10.81 Gs @ 70.55 msec



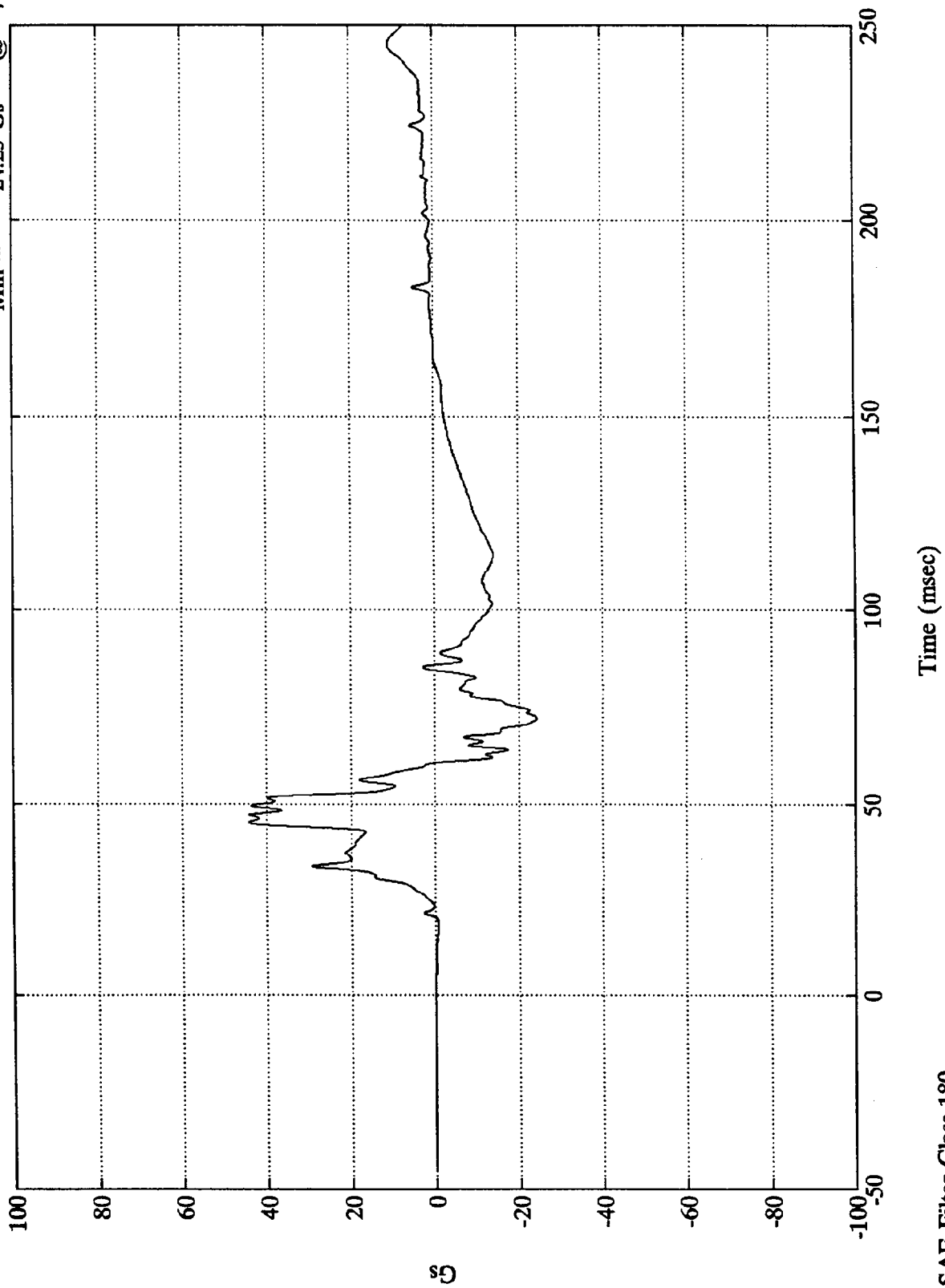
B-99

SAE Filter Class 180

Test 1047

Pos. 2 Chest Z

Max = 44.38 Gs @ 47.27 msec
Min = -24.25 Gs @ 72.24 msec



B-100

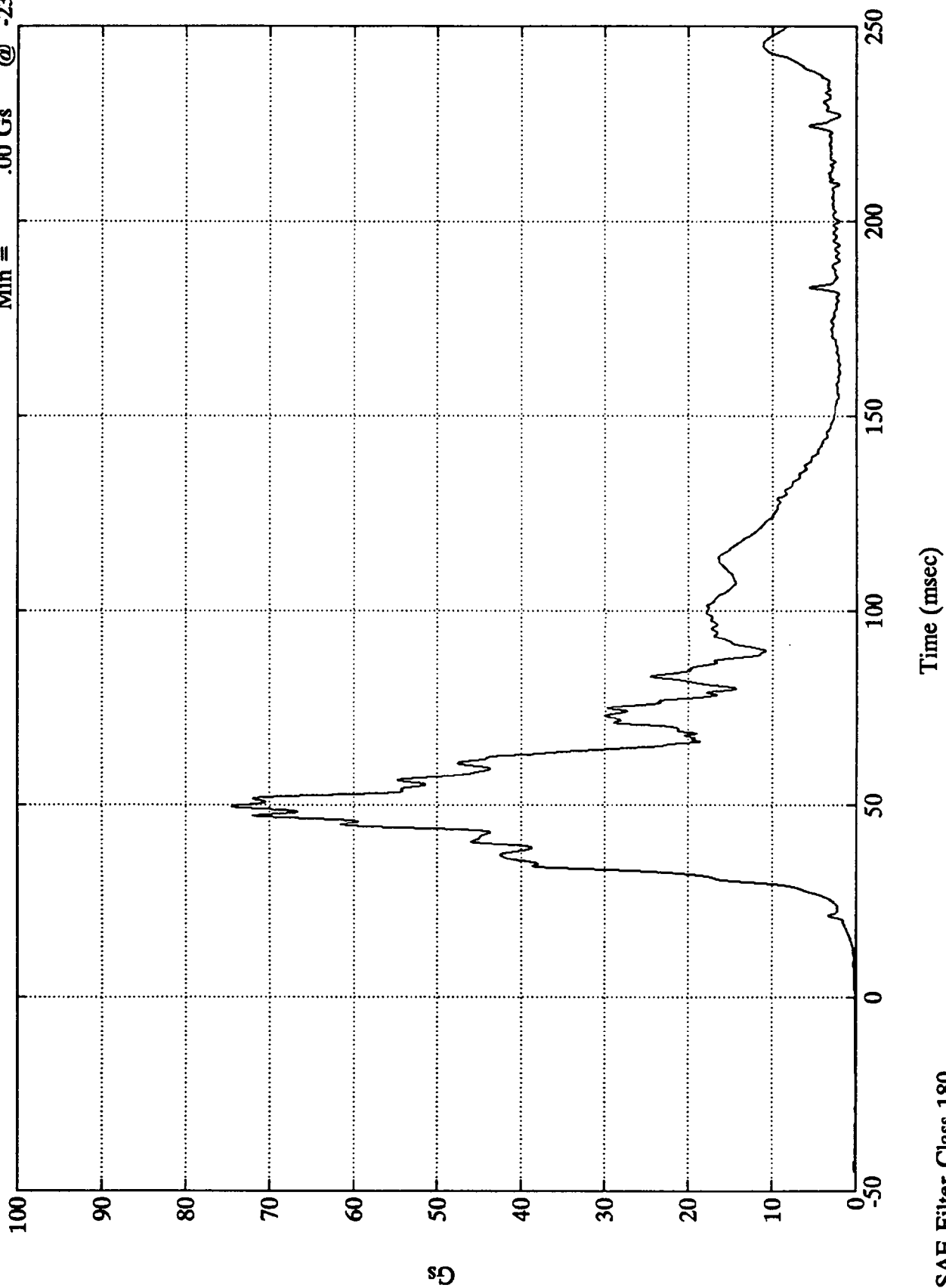
7893-4

SAE Filter Class 180

Test 1047

Pos. 2 Chest Resultant

Max = 74.53 Gs @ 49.68 msec
Min = .00 Gs @ -23.88 msec



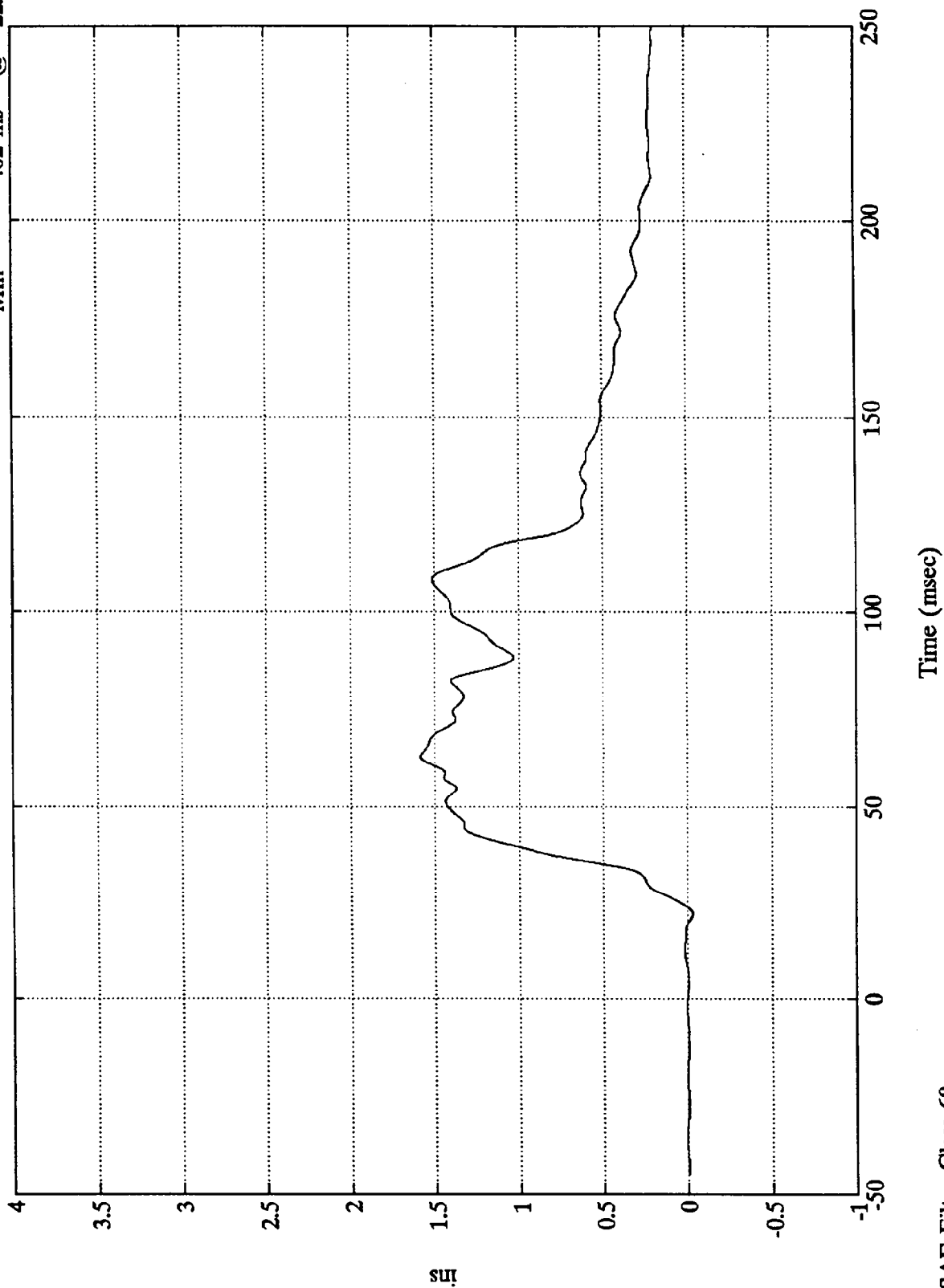
B-101

7893-4 SAE Filter Class 180

Test 1047

Pos. 2 Chest Disp.

Max = 1.58 ins @ 63.00 msec
Min = -0.02 ins @ 22.07 msec



B-102

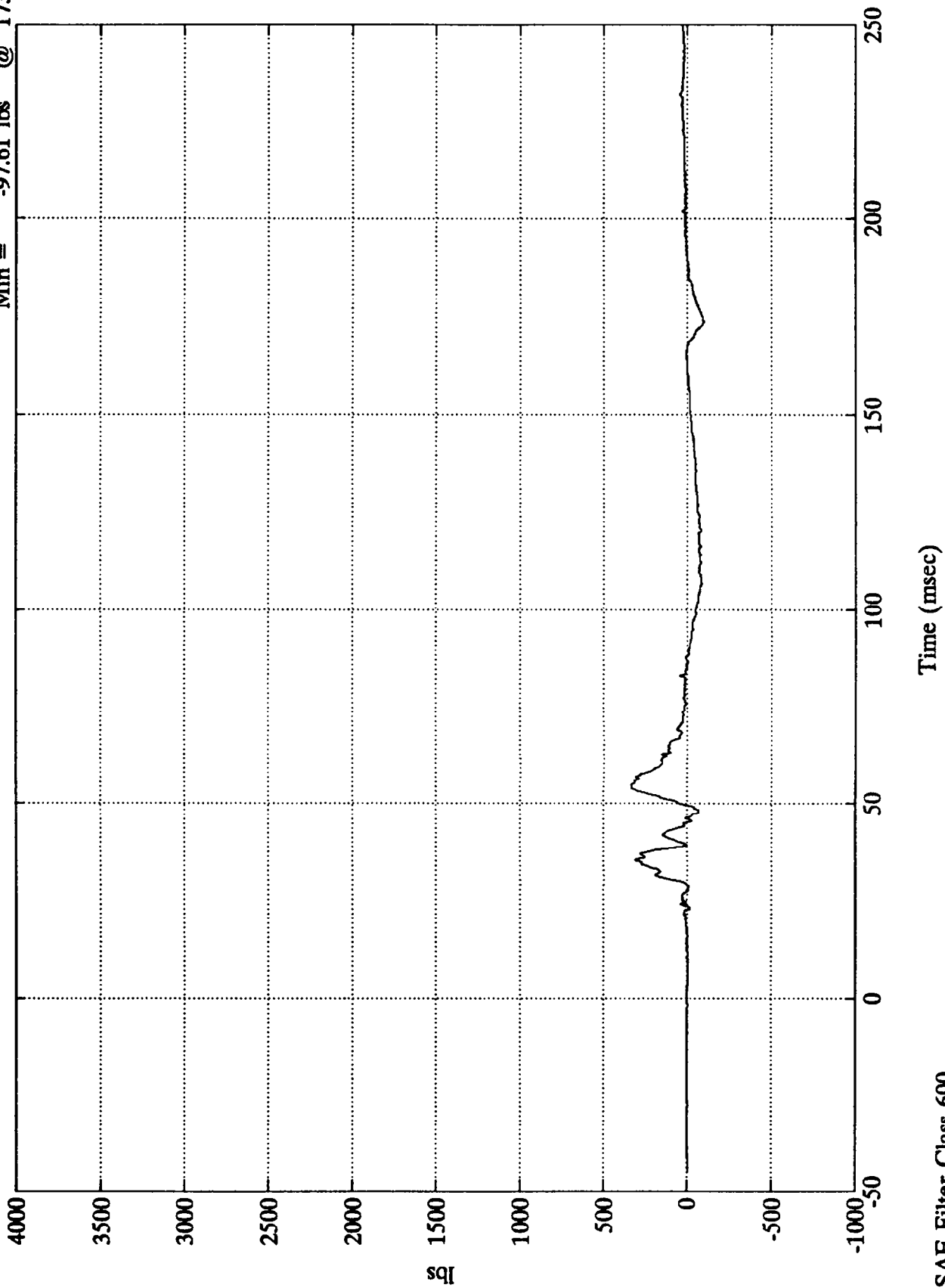
7893-4

SAE Filter Class 60

Test 1047

Pos. 2 Left Femur

Max = 334.34 lbs @ 54.11 msec
Min = -97.61 lbs @ 173.63 msec



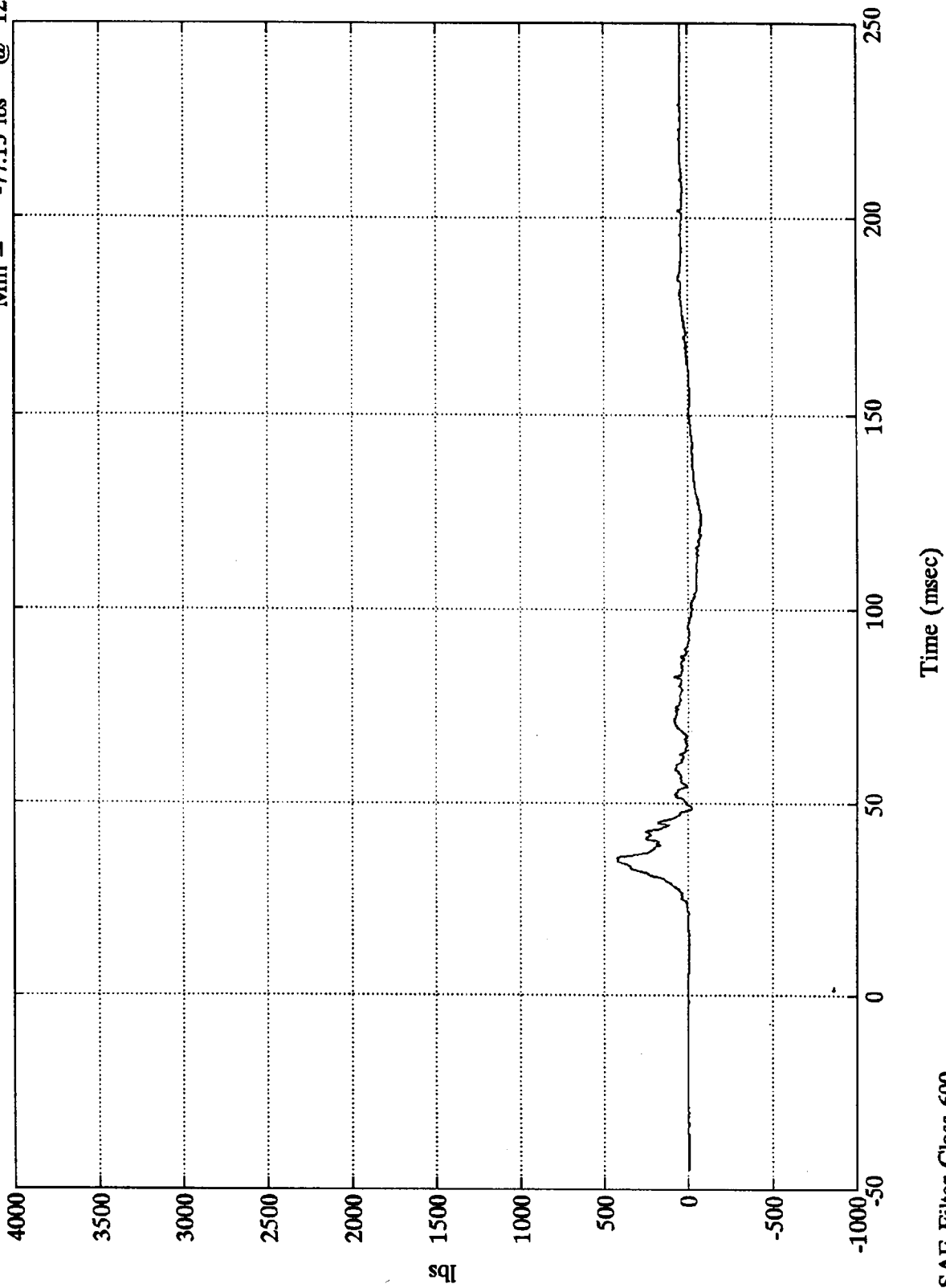
B-103

7893-4 SAE Filter Class 600

Test 1047

Pos. 2 Right Femur

Max = 420.43 lbs @ 35.76 msec
Min = -77.13 lbs @ 123.84 msec



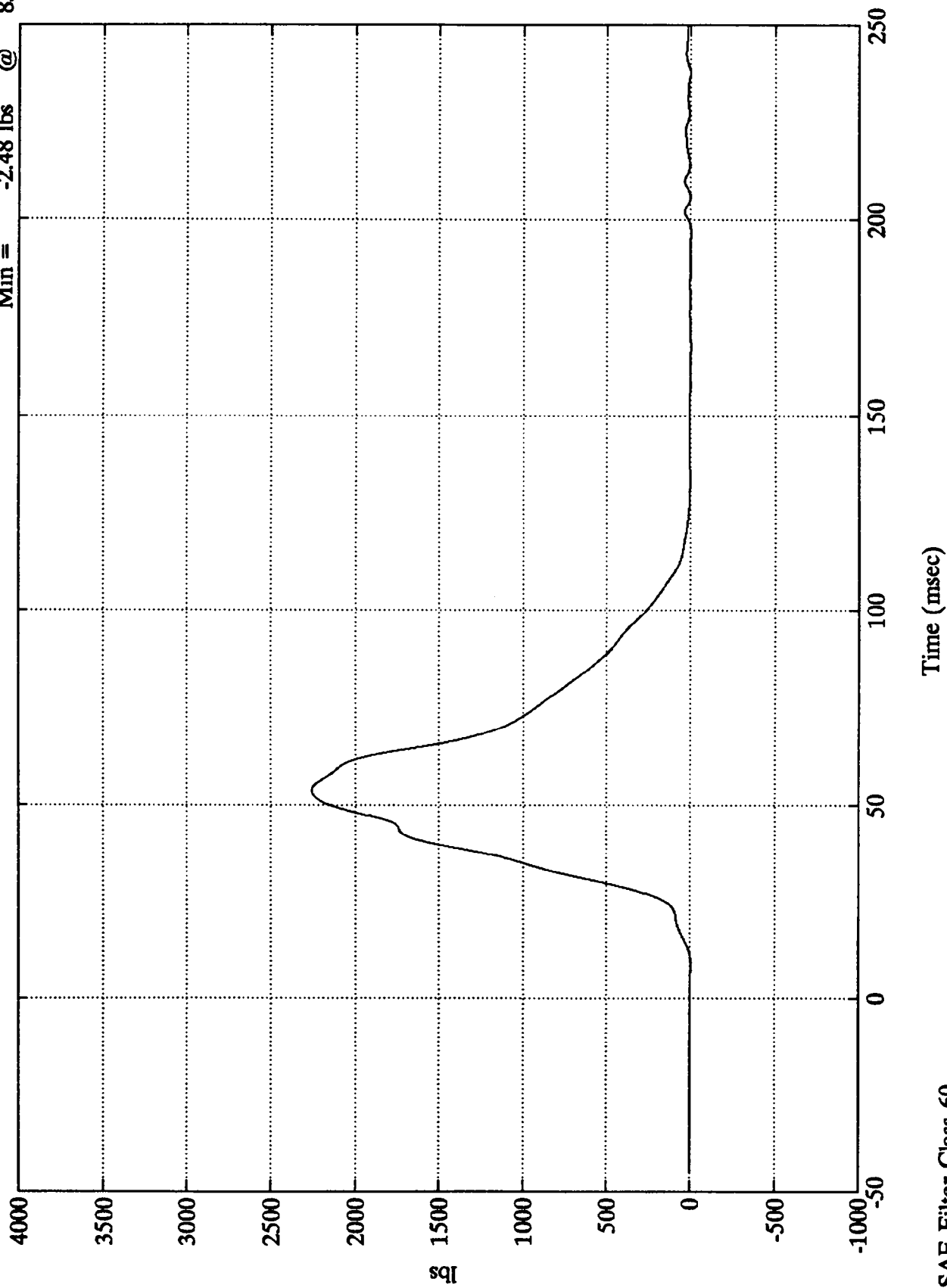
B-104

7893-4
SAE Filter Class 600

Test 1047

Pos. 2 Torso Belt Load

Max = 2257.23 lbs @ 53.88 msec
Min = -2.48 lbs @ 8.87 msec



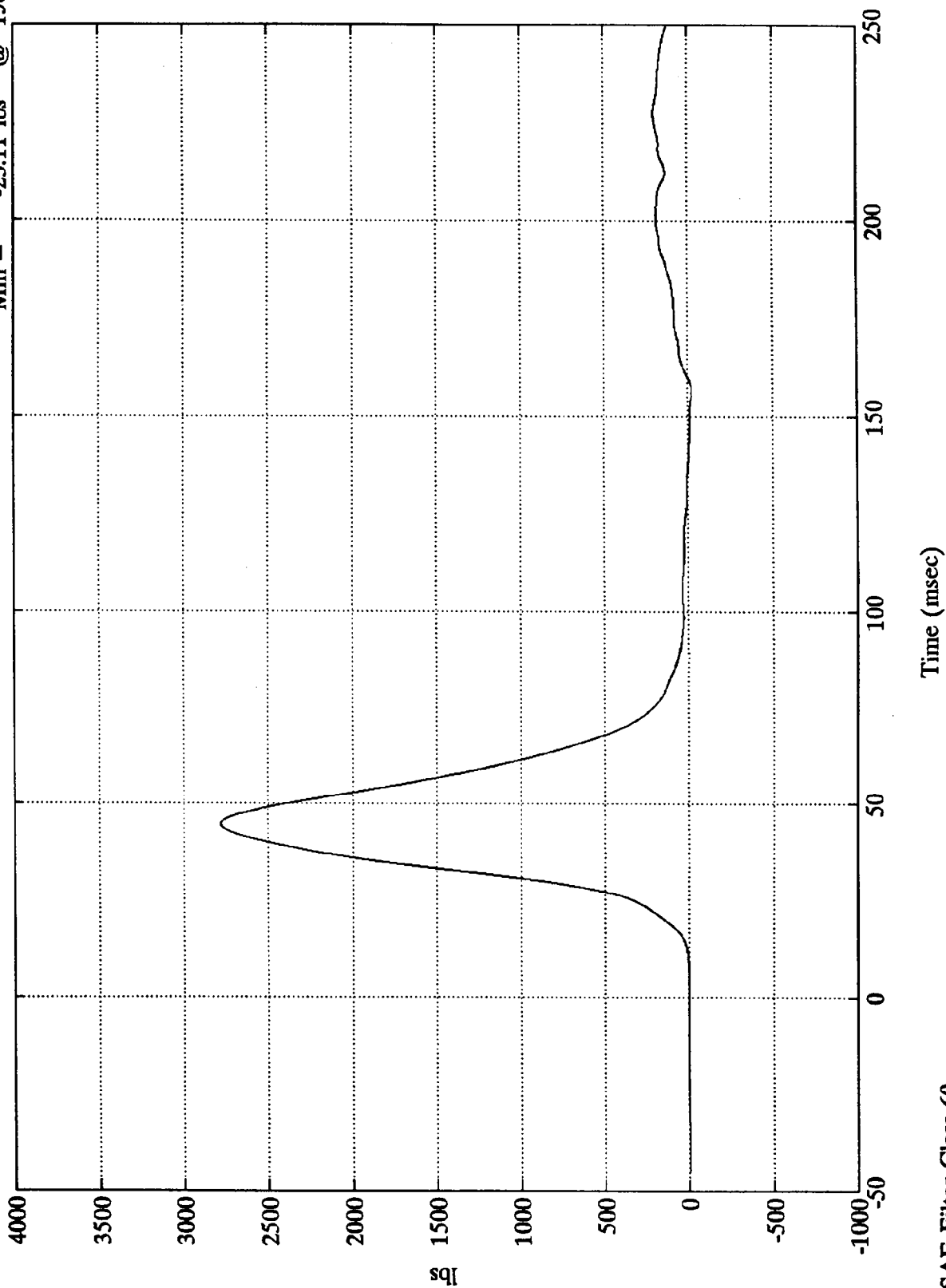
B-105

SAE Filter Class 60
7893-4

Test 1047

Pos. 2 Right Belt Load

Max = 2781.28 lbs @ 44.63 msec
Min = -23.11 lbs @ 156.60 msec

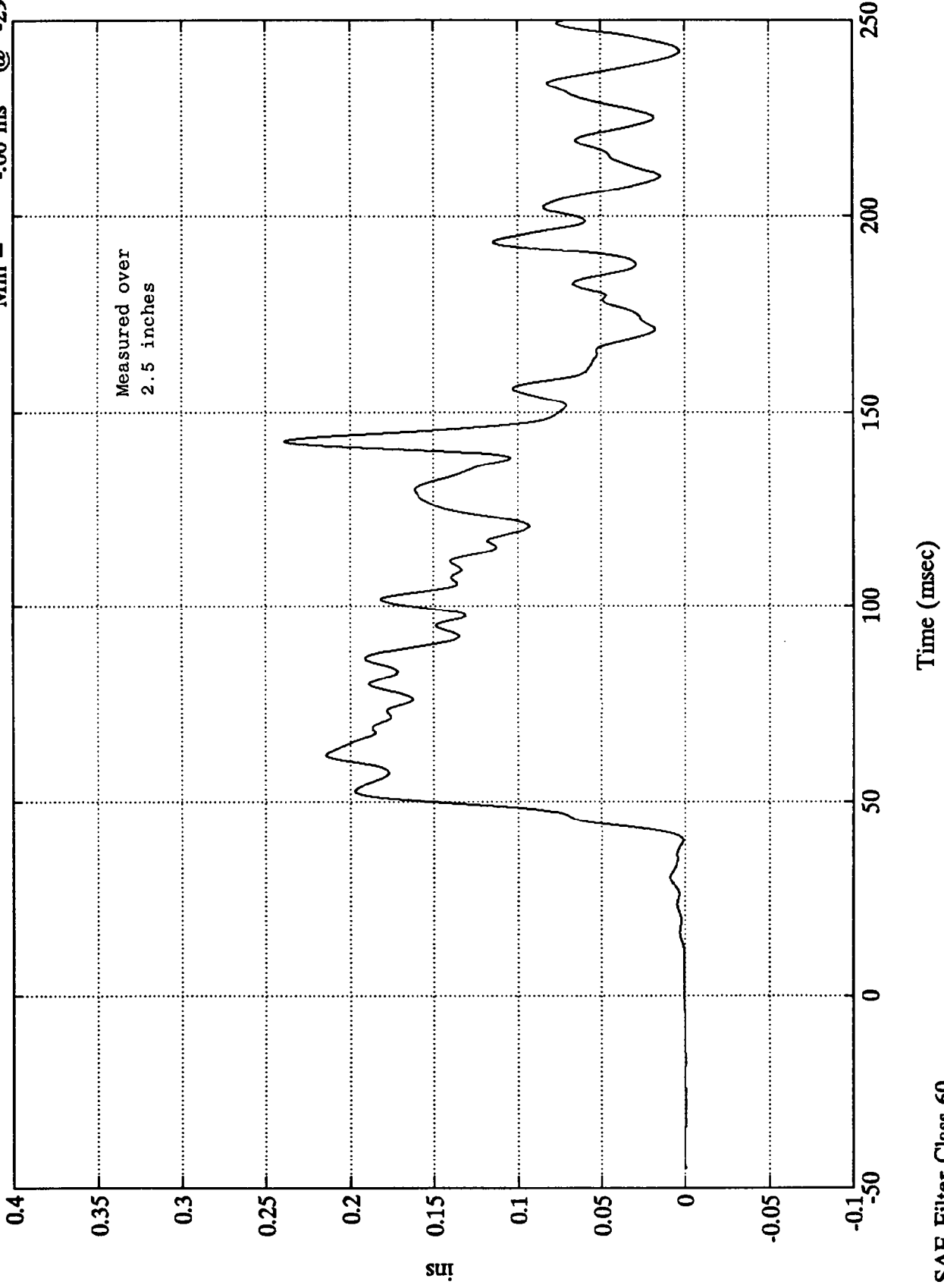


B-106

7893-4 SAE Filter Class 60

Pos. 2 Belt Elongation

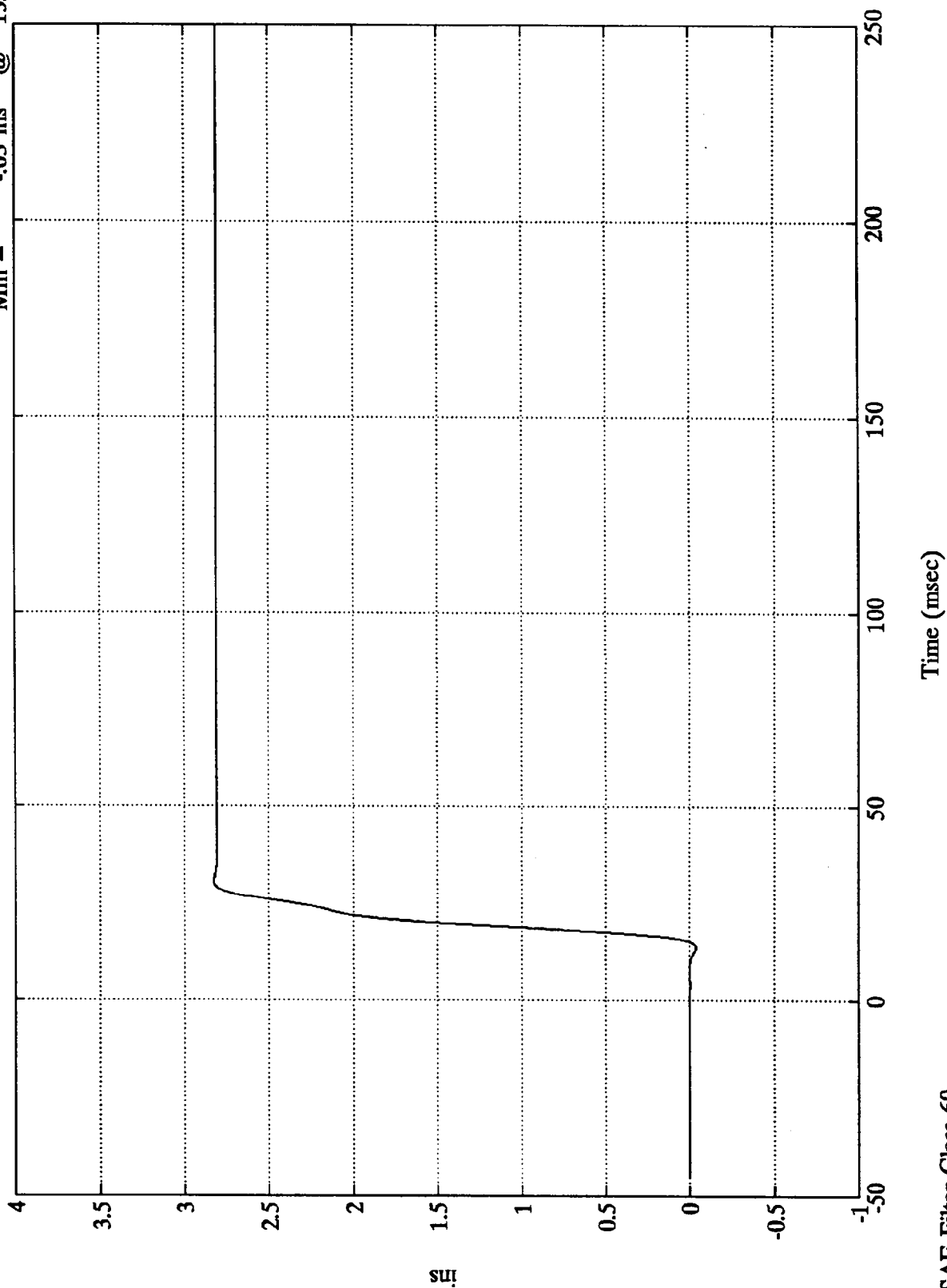
Max = .23 ins @ 142.55 msec
 Min = -.00 ins @ -29.16 msec



Test 1047

Pos. 2 Belt Spool Out

Max = 2.82 ins @ 30.84 msec
Min = -.03 ins @ 13.91 msec



B-108

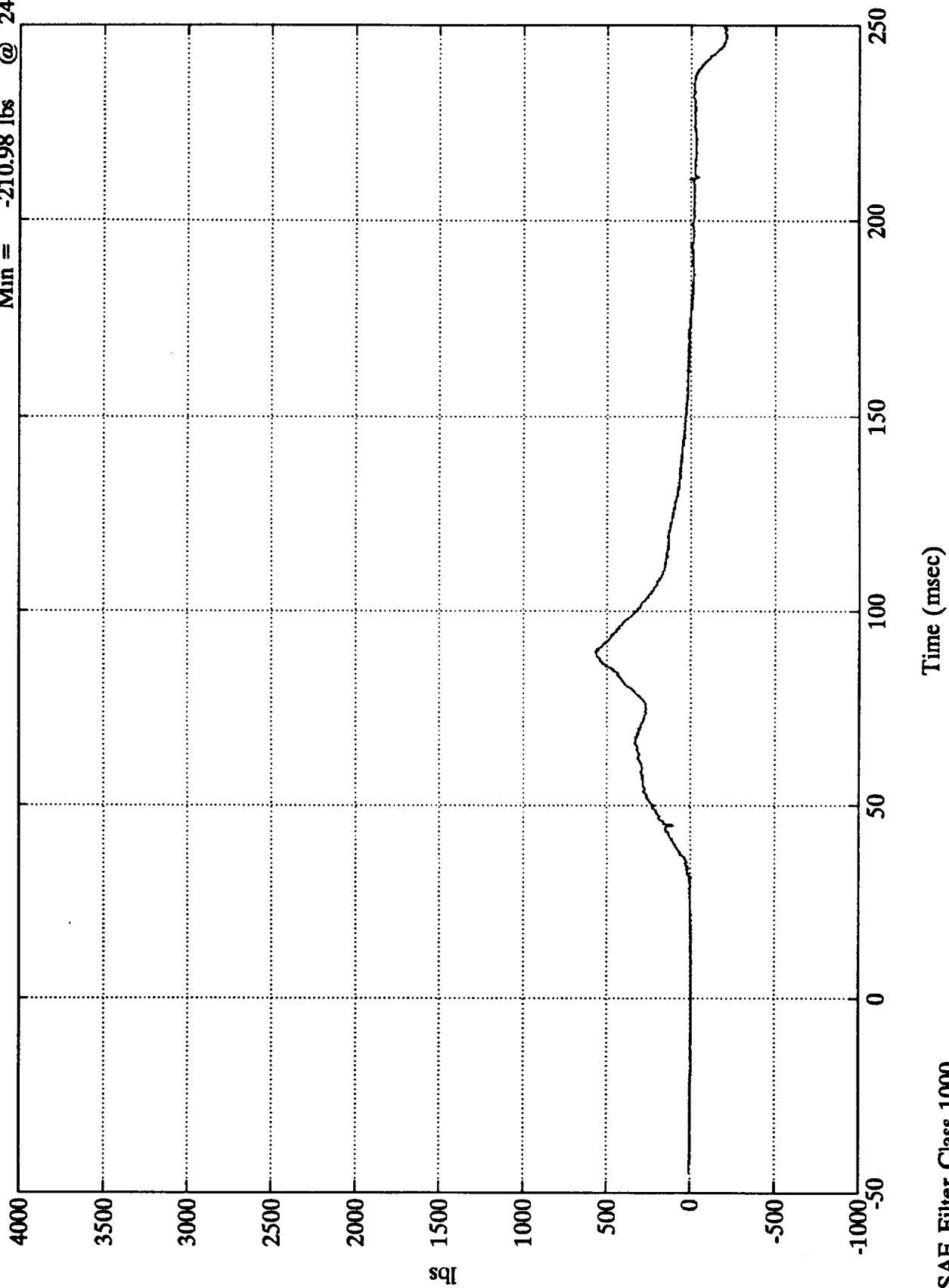
7893-4

SAE Filter Class 60

Test 1047

Pos. 2 Upper Neck Fx

Max = 572.76 lbs @ 89.40 msec
Min = -210.98 lbs @ 248.88 msec



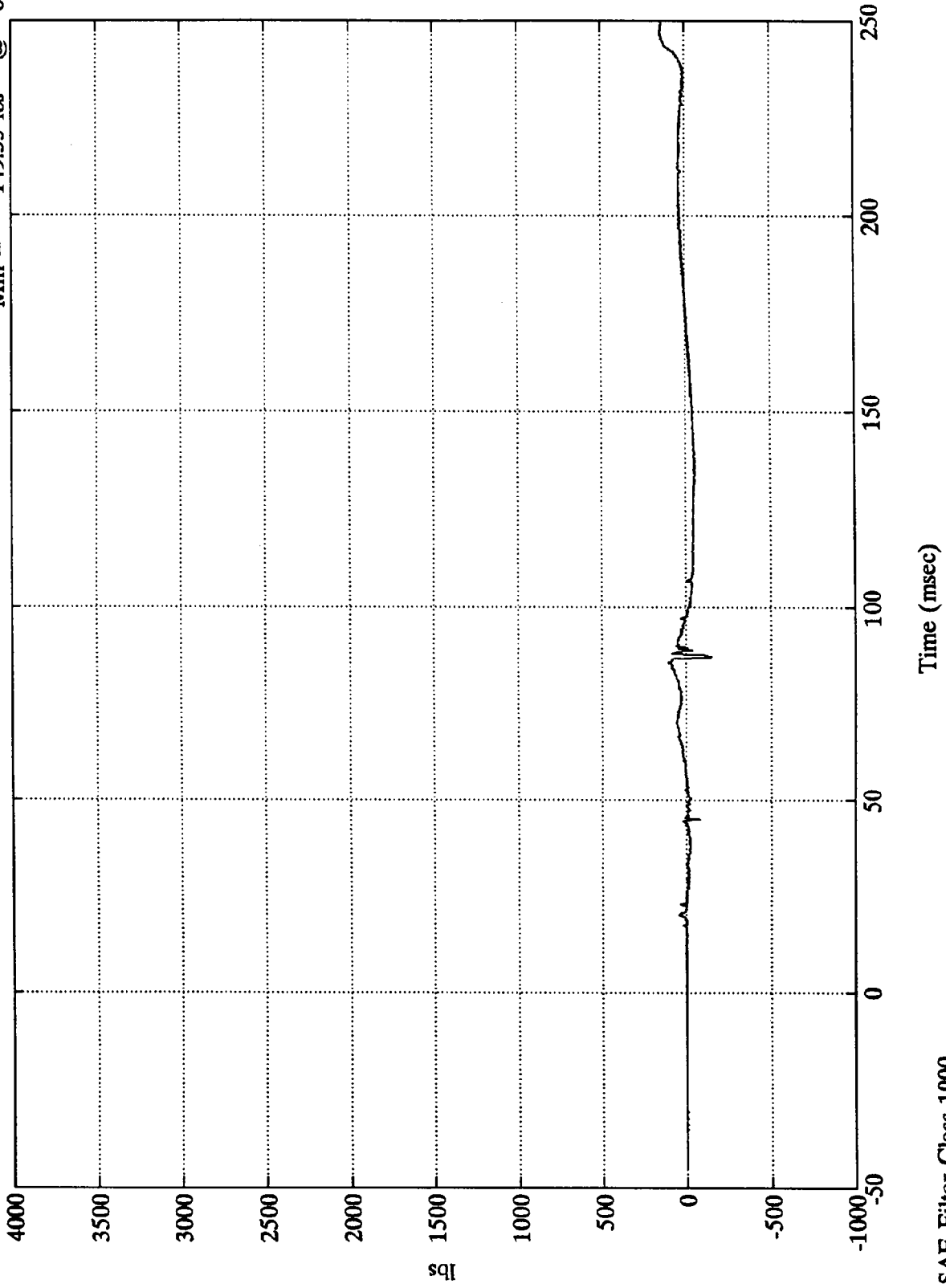
B-109

7893-4 SAE Filter Class 1000

Test 1047

Pos. 2 Upper Neck Fy

Max = 144.60 lbs @ 247.56 msec
Min = -149.35 lbs @ 87.59 msec



B-110

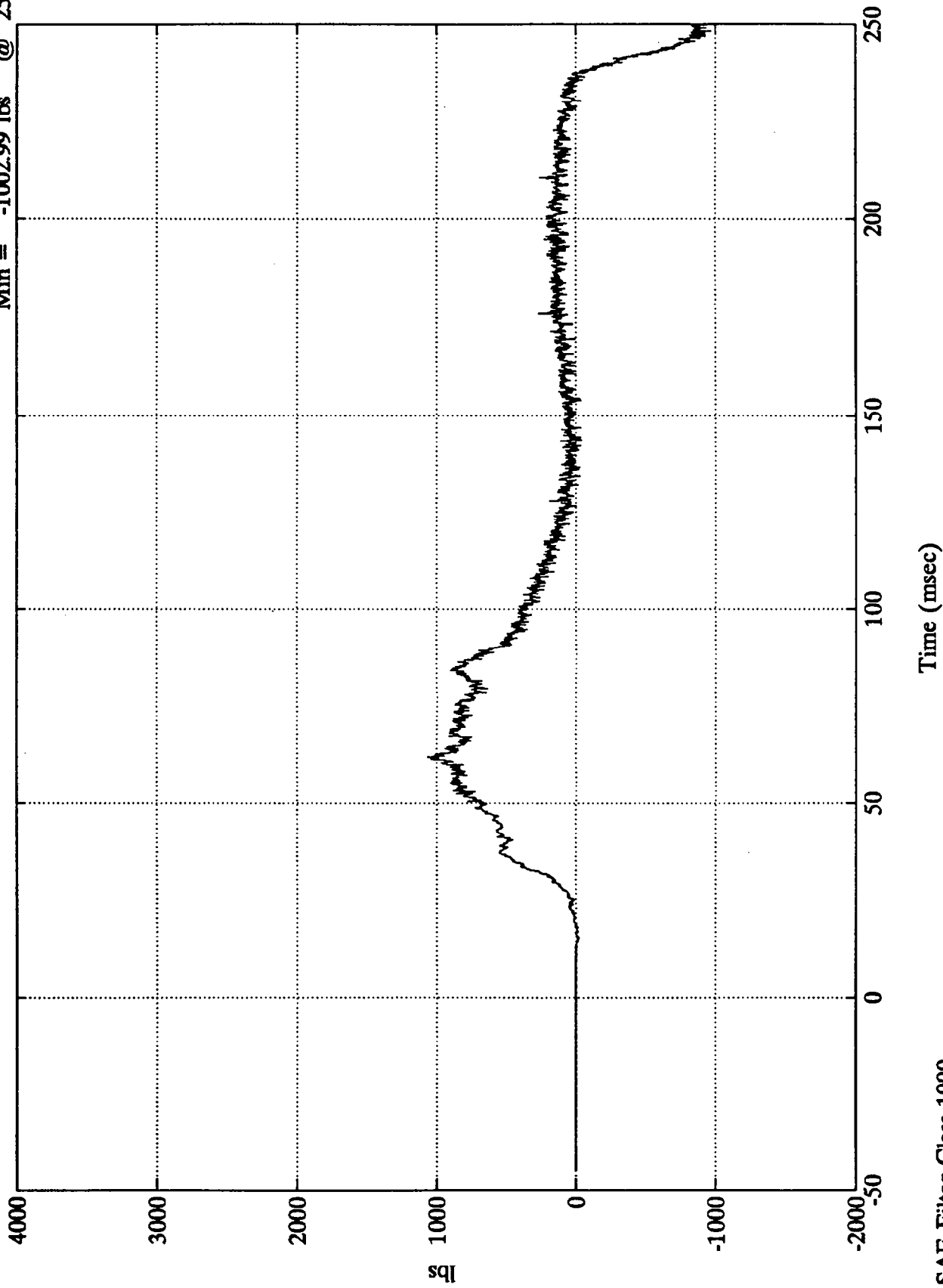
7893-4
SAE Filter Class 1000

Test 1047

Pos. 2 Upper Neck Fz

Max = 1063.77 lbs
Min = -1002.99 lbs

@ 62.04 msec
@ 250.08 msec



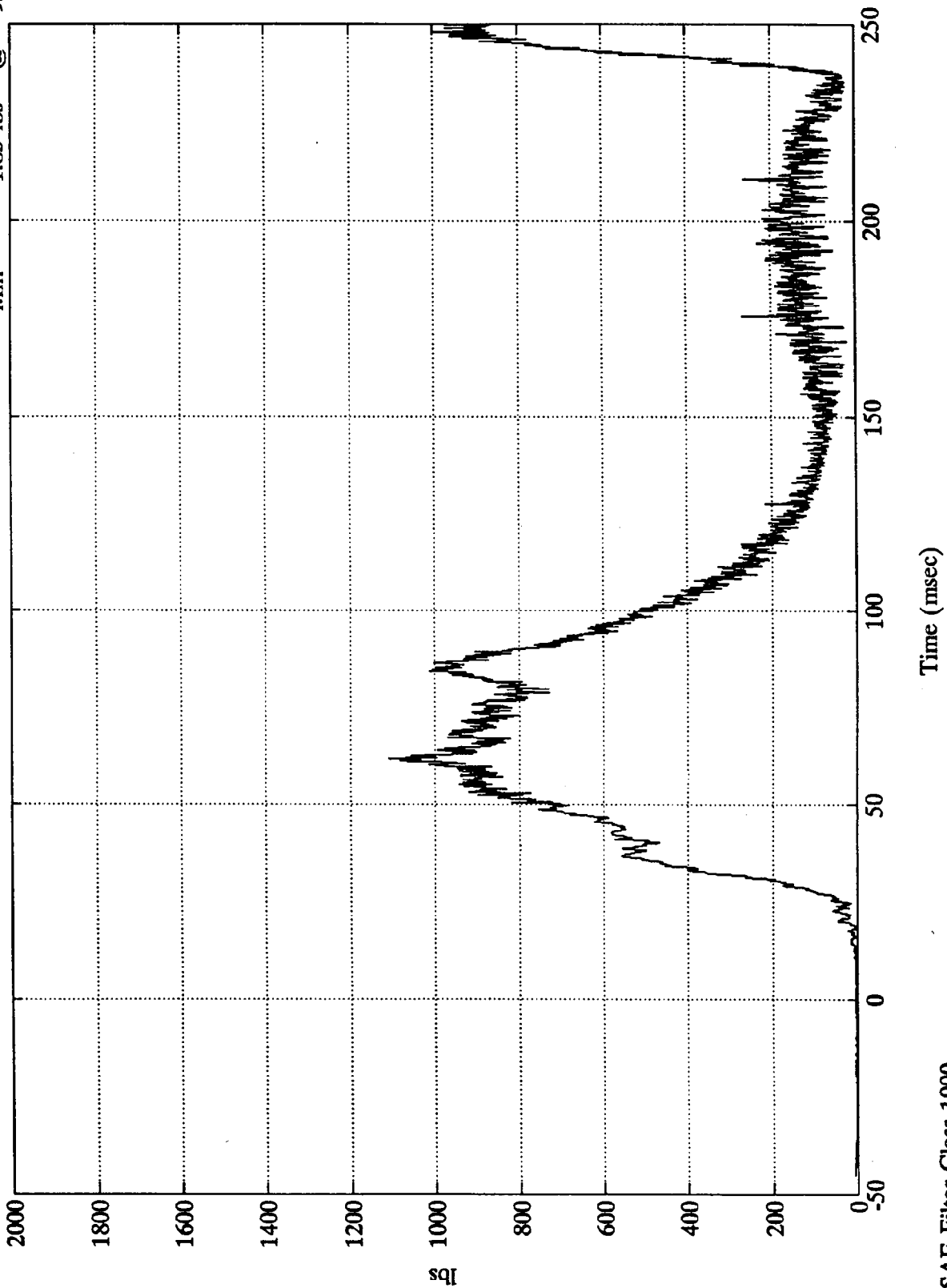
B-111

7893-4 SAE Filter Class 1000

Test 1047

Pos. 2 Neck Force Res.

Max = 1109.65 lbs @ 62.04 msec
Min = 1.83 lbs @ -9.12 msec



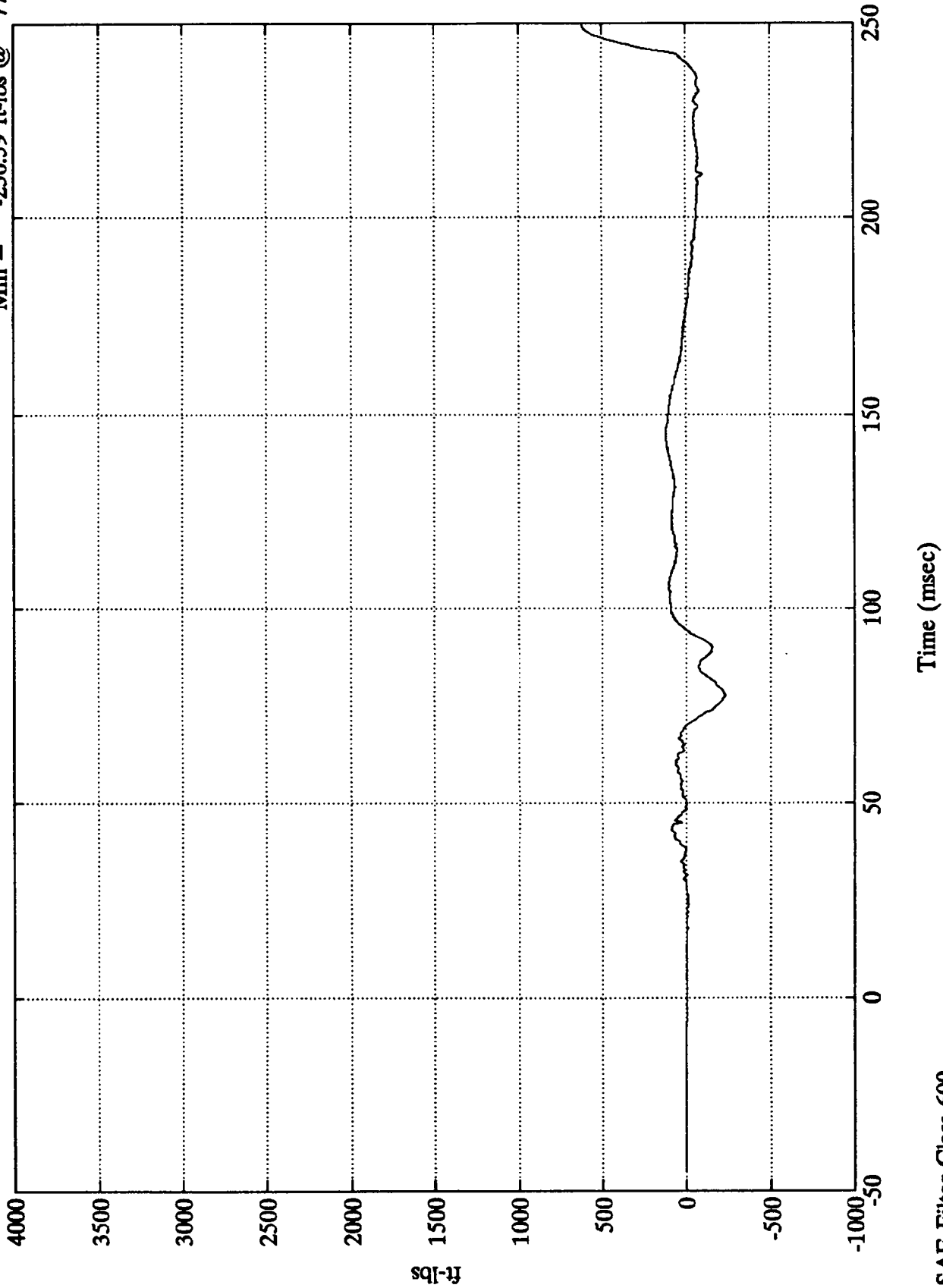
B-112

7893-4 SAE Filter Class 1000

Test 1047

Pos. 2 Upper Neck Mx

Max = 616.23 ft-lbs @ 249.60 msec
Min = -230.59 ft-lbs @ 77.76 msec



B-113

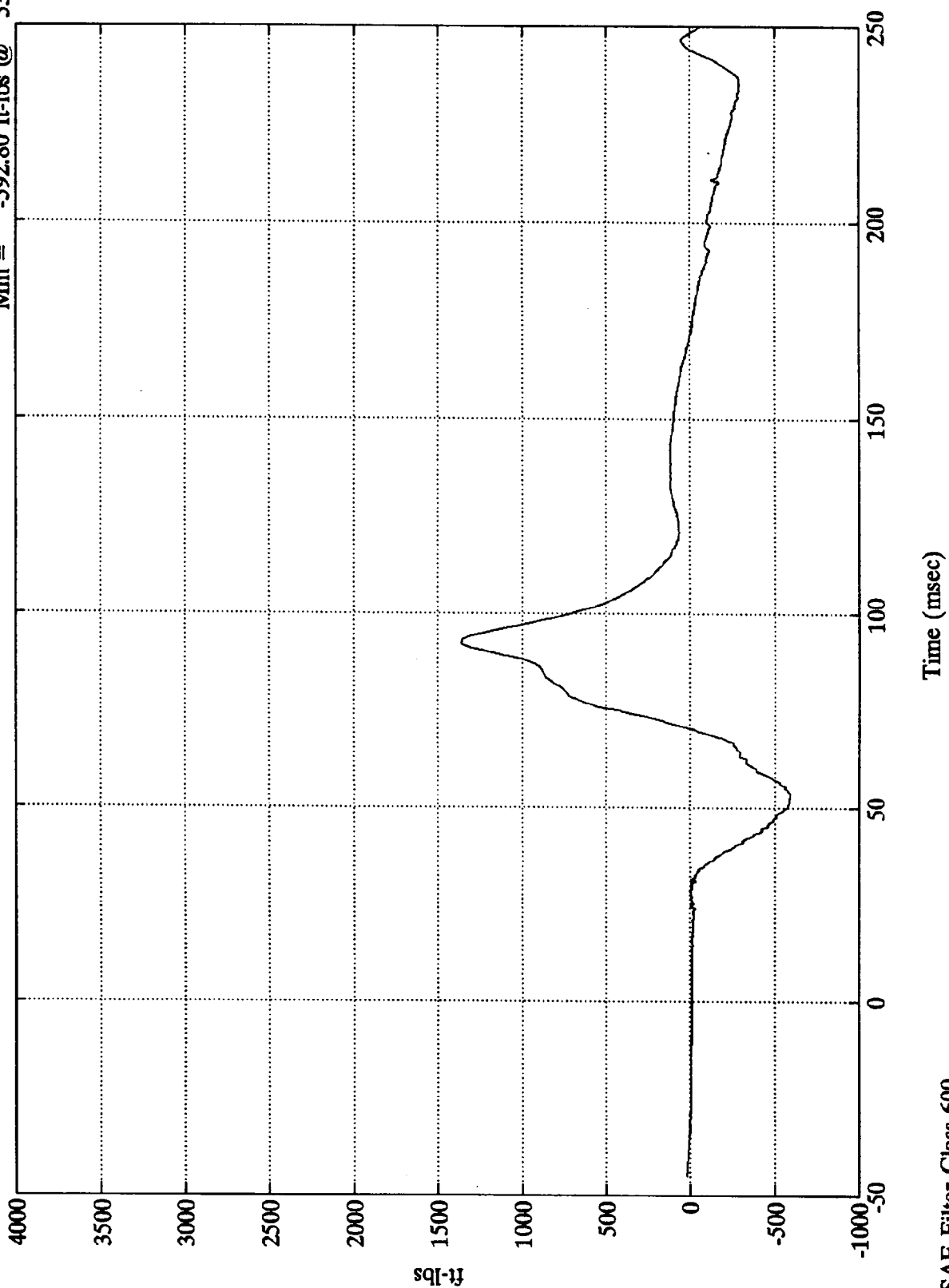
7893-4

SAE Filter Class 600

Test 1047

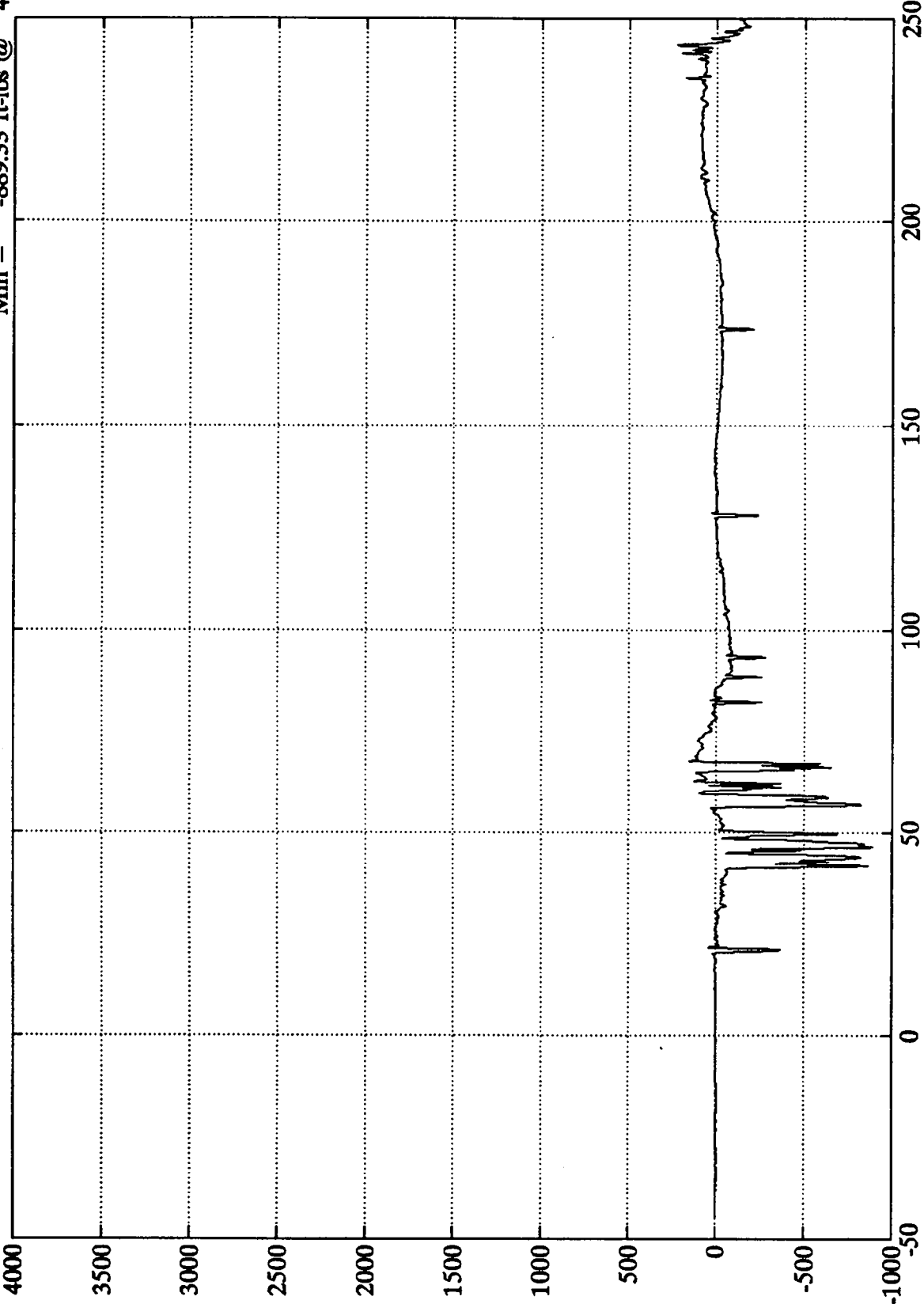
Pos. 2 Upper Neck My

Max = 1360.81 ft-lbs @ 92.27 msec
Min = -592.80 ft-lbs @ 53.04 msec



Pos. 2 Upper Neck Mz

Max = 226.83 ft-lbs @ 243.36 msec
Min = -889.33 ft-lbs @ 46.56 msec

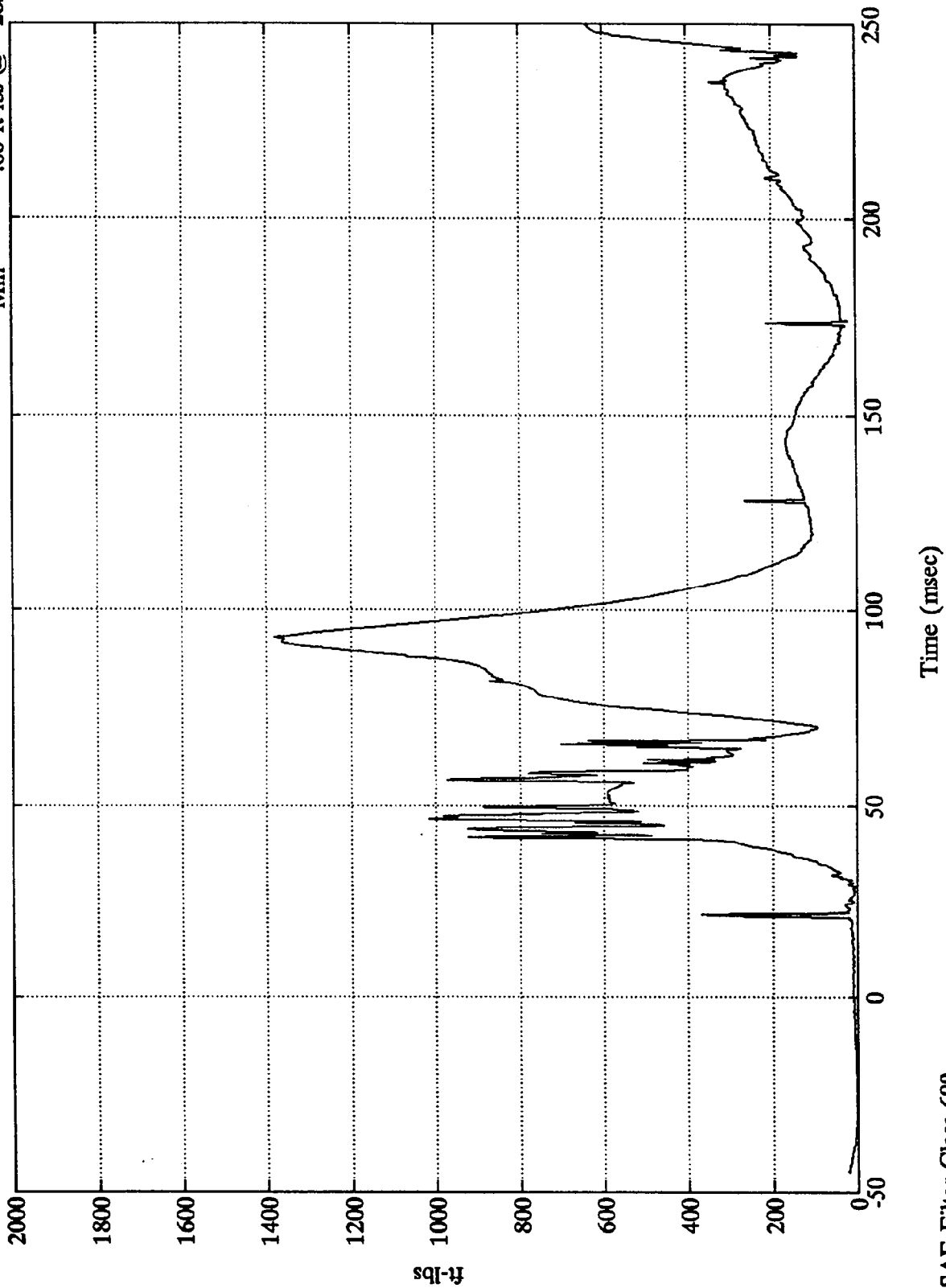


Time (msec)

Test 1047

Pos. 2 Neck Moment Res.

Max = 1382.52 ft-lbs @ 93.36 msec
Min = .66 ft-lbs @ -28.92 msec



B-116

7893-4

SAE Filter Class 600

Appendix C

PART 572-E 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	12-18-90
150	12-21-90

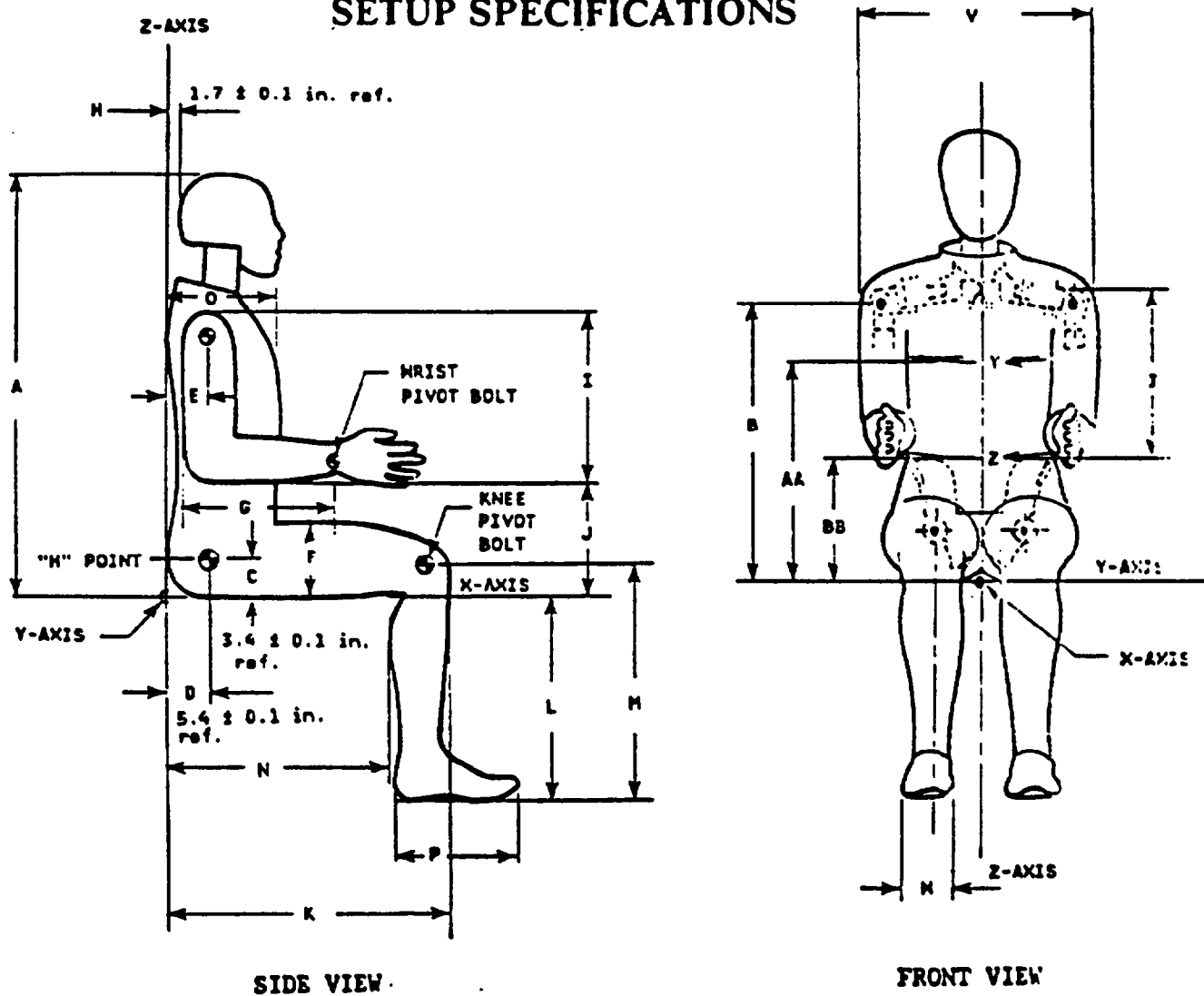
Electronic Test Equipment

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 10

DUMMY CONFIGURATION DIMENSIONS

EXTERNAL DIMENSIONS
SETUP SPECIFICATIONS



NOTE: FIGURE IS REFERENCED TO
THE ERECT SEATED POSITION.
THE CURVED LUMBAR DOES NOT ALLOW
THE BYBRID III TO BE POSITIONED
IN A PERFECT ERECT ATTITUDE.

**HYBRID III EXTERNAL DIMENSIONS
S/N 45 HUMANOID**

DUMMY SERIAL NO. 45

DATE: 12-9-90

TEMPERATURE		70 DEG. F
RELATIVE HUMIDITY		50 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)	16.9-17.1 IN	17.1 IN
LOCATION FOR WAIST CIRCUMFERENCE (BB)	8.9-9.1 IN	9.0 IN
CHEST CIRCUMFERENCE (Y)	38.2-39.4 IN	38.8 IN
WAIST CIRCUMFERENCE (Z)	32.1-34.1 IN	33.3 IN
CHEST DEPTH (O)	8.4-9.0 IN	8.7 IN
H-POINT HEIGHT (C)	3.3-3.5 IN	3.4 IN
H-POINT FROM SEAT BACK (D)	5.3-5.5 IN	5.4 IN
SKULL CAP TO BACKLINE (H)	1.6-1.8 IN	1.6 IN
TOTAL SITTING HEIGHT (A)	34.6-35.0 IN	34.8 IN
THIGH CLEARANCE (F)	5.5-6.1 IN	5.7 IN
BUTTOCK KNEE LENGTH (K)	22.8-23.8 IN	23.4 IN
BUTTOCK POPLITAL LENGTH (N)	17.8-18.8 IN	17.9 IN
POPLITEAL LENGTH (L)	16.9-17.9 IN	17.4 IN
KNEE PIVOT HEIGHT (M)	19.1-19.7 IN	19.3 IN
FOOT LENGTH (P)	9.9-10.5 IN	10.2 IN
FOOT BREADTH (W)	3.6-4.2 IN	4.1 IN
SHOULDER PIVOT FROM BACKLINE (E)	3.3-3.7 IN	3.6 IN
SHOULDER BREADTH (V)	16.6-17.2 IN	16.9 IN
SHOULDER PIVOT HEIGHT (B)	19.9-20.5 IN	20.0 IN
ELBOW REST HEIGHT (J)	7.5-8.3 IN	7.9 IN
SHOULDER-ELBOW LENGTH (I)	13.0-13.6 IN	13.3 IN
BACK OF ELBOW TO WRIST PIVOT (G)	11.4-12.0 IN	11.9 IN

DUMMY MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKIEWICZ

CALSPAN CORPOPATION
TRANSPORTATION RESEARCH DEPARTMENT
HEAD DROP TEST
HYBRID III

DATE : 12-10-90

CALSPAN SEQUENTIAL NUMBER 2

HY3 SN 45

HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	32 %
PEAK RESULTANT ACCELERATION	225 - 275 G	250.3 G
PEAK LATERAL ACCELERATION	15 G MAX	5.2 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN ____IVAN MINKEWICZ____

CAI-SPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 12-11-90

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 2

HY3 SN 45 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY		10% - 70%	26 %
IMPACT VELOCITY		22.6 - 23.4 FPS	22.7 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.46 G
	20 MS	17.60 - 22.60 G	20.84 G
	30 MS	12.50 - 18.50 G	16.76 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	16.76 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	42.0 MS
D PLANE	MAX	64 - 78 DEG.	76.98 DEG.
ROTATION	TIME	57 - 64 MS	60.38 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT.-LBS.	79.44 FT.-LBS.
	TIME	47 - 58 MS	56.13 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	118 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	100 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 12-11-90

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 2

HY3 SN 45 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY		10% - 70%	26 %
IMPACT VELOCITY		19.50 - 20.30 FPS	20.0 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	17.49 G
	20 MS	14.00 - 19.00 G	17.73 G
	30 MS	11.00 - 16.00 G	15.57 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	15.57 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	44.88 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	98.74 DEG.
	TIME	72 - 82 MS	75.25 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-59.0/-39.0 FT.-LBS.	-58.41 FT.-LBS.
	TIME	65 - 79 MS	71.13 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	151.5 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	132.88 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 12-18-90

CALSPAN SEQUENTIAL NUMBER 2

HY3 SN 45

H.S. THORAX

CAL

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY	10% - 70%	42 %
PENDULUM VELOCITY	21.6 - 22.4 FT/SEC	21.6 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 INCHES	2.53 INCHES
MAXIMUM RESISTIVE FORCE	1080 - 1245 POUNDS	1235 POUNDS
INTERNAL HYSTERESIS	69% - 85%	70.3 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 12-17-90

KNEE : LEFT

CALSPAN SEQUENTIAL NUMBER 2

HY3 SN 45 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	32 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.0 FT/SEC
PEAK KNEE IMPACT FORCE	996 - 1566 LBS.	1072 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN ____ IVAN MINKEWICZ ____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 12-17-90

KNEE : RIGHT

CALSPAN SEQUENTIAL NUMBER 2

HY3 SN 45 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	32 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.0 FT/SEC
PEAK KNEE IMPACT FORCE	996 - 1566 LBS.	1090 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____IVAN MINKEWICZ_____

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 45

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	CS75	10-90	4-91
HY LATERAL--	ENDEVCO	CY89	9-90	3-91
HZ VERTICAL--	ENDEVCO	CE76	10-90	4-91
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A147	10-90	4-91
CY LATERAL--	ENDEVCO	CJ54	10-90	4-91
CZ VERTICAL--	CEC	A148	10-90	4-91
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	311	9-90	3-91
RIGHT SIDE	GSE	312	9-90	3-91
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	11-90	5-91
2. TEST PROBE ACCELEROMETER--	CEC	A161	11-90	5-91
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS- DUCER INC	20051	1-91	7-91
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	1-91	7-91
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	1-91	7-91

**HYBRID III EXTERNAL DIMENSIONS
S/N 150 HUMANOID**

DUMMY SERIAL NO. 150

DATE: 12-9-90

TEMPERATURE		70 DEG. F
RELATIVE HUMIDITY		50 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)	16.9-17.1 IN	17.0 IN
LOCATION FOR WAIST CIRCUMFERENCE (BB)	8.9-9.1 IN	9.0 IN
CHEST CIRCUMFERENCE (Y)	38.2-39.4 IN	38.9 IN
WAIST CIRCUMFERENCE (Z)	32.1-34.1 IN	33.1 IN
CHEST DEPTH (O)	8.4-9.0 IN	8.7 IN
H-POINT HEIGHT (C)	3.3-3.5 IN	3.4 IN
H-POINT FROM SEAT BACK (D)	5.3-5.5 IN	5.5 IN
SKULL CAP TO BACKLINE (H)	1.6-1.8 IN	1.6 IN
TOTAL SITTING HEIGHT (A)	34.6-35.0 IN	34.7 IN
THIGH CLEARANCE (F)	5.5-6.1 IN	5.9 IN
BUTTOCK KNEE LENGTH (K)	22.8-23.8 IN	23.1 IN
BUTTOCK POPLITAL LENGTH (N)	17.8-18.8 IN	18.2 IN
POPLITEAL LENGTH (L)	16.9-17.9 IN	17.5 IN
KNEE PIVOT HEIGHT (M)	19.1-19.7 IN	19.4 IN
FOOT LENGTH (P)	9.9-10.5 IN	10.1 IN
FOOT BREADTH (W)	3.6-4.2 IN	4.1 IN
SHOULDER PIVOT FROM BACKLINE (E)	3.3-3.7 IN	3.5 IN
SHOULDER BREADTH (V)	16.6-17.2 IN	16.7 IN
SHOULDER PIVOT HEIGHT (B)	19.9-20.5 IN	20.1 IN
ELBOW REST HEIGHT (J)	7.5-8.3 IN	8.2 IN
SHOULDER-ELBOW LENGTH (I)	13.0-13.6 IN	13.4 IN
BACK OF ELBOW TO WRIST PIVOT (G)	11.4-12.0 IN	11.8 IN

DUMMY MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKIEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
HEAD DROP TEST
HYBRID III

DATE : 12-10-90

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 150 HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	32 %
PEAK RESULTANT ACCELERATION	225 - 275 G	243.8 G
PEAK LATERAL ACCELERATION	15 G MAX	9.7 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 12-12-90

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 150 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY		10% - 70%	29 %
IMPACT VELOCITY		22.6 - 23.4 FPS	23.0 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.06 G
	20 MS	17.60 - 22.60 G	22.5 G
	30 MS	12.50 - 18.50 G	18.27 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	18.27 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	40 MS
D PLANE	MAX	64 - 78 DEG.	73.27 DEG.
ROTATION	TIME	57 - 64 MS	58.38 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT.-LBS.	71.45 FT.-LBS.
	TIME	47 - 58 MS	52.38 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	118.5 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	100.0 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 12-12-90

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 150 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY		10% - 70%	29 %
IMPACT VELOCITY		19.50 - 20.30 FPS	20.1 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	17.62 G
	20 MS	14.00 - 19.00 G	18.12 G
	30 MS	11.00 - 16.00 G	15.34 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	15.34 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	43.38 MS
D PLANE	MAX	81 - 106 DEG.	94.5 DEG.
ROTATION	TIME	72 - 82 MS	74.25 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-59.0/-39.0 FT.-LBS.	-52.84 FT.-LBS.
	TIME	65 - 79 MS	69.38 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	152.0 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	127.5 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 12-21-90

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 150 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	36 %
PENDULUM VELOCITY	21.6 - 22.4 FT/SEC	21.6 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 INCHES	2.52 INCHES
MAXIMUM RESISTIVE FORCE	1080 - 1245 POUNDS	1237 POUNDS
INTERNAL HYSTERESIS	69% - 85%	74.9 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 12-17-90

KNEE : LEFT

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 150 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	31 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.0 FT/SEC
PEAK KNEE IMPACT FORCE	996 - 1566 LBS.	1104 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____IVAN MINKEWICZ_____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 12-17-90

KNEE : RIGHT

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 150 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	31 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.0 FT/SEC
PEAK KNEE IMPACT FORCE	996 - 1566 LBS.	1112 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____ IVAN MINKEWICZ _____

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 150

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	ER72	10-90	4-91
HY LATERAL--	ENDEVCO	GD54	10-90	4-91
HZ VERTICAL--	ENDEVCO	CK11	10-90	4-91
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A145	10-90	4-91
CY LATERAL--	ENDEVCO	FL04	10-90	4-91
CZ VERTICAL--	CEC	A149	10-90	4-91
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	548	9-90	3-91
RIGHT SIDE	GSE	549	9-90	3-91
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	11-90	5-91
2. TEST PROBE ACCELEROMETER--	CEC	A161	11-90	5-91
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS- DUCER INC	20051	1-91	7-91
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	1-91	7-91
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	1-91	7-91



Appendix D

DUMMY, VEHICLE AND LABORATORY INSTRUMENT CALIBRATION

INSTRUMENT CALIBRATION FOR DRIVER DUMMY
(6 Month Calibration Minimum)

DRIVER DUMMY	Serial #	Manufacturer	Calibration	
			Last	Next
Head X Y Z	CS75	ENDEVCO	10-90	4-91
	CY89	ENDEVCO	9-90	3-91
	CE76	ENDEVCO	10-90	4-91
Chest X Y Z	AL47	CEC	10-90	4-91
	CJ54	ENDEVCO	10-90	4-91
	AL48	CEC	10-90	4-91
Right Femur Load Cell	312	GSE	9-90	3-91
Left Femur Load Cell	311	GSE	9-90	3-91
Neck Load Cell X Y Z	269	DENTON	10-90	4-91
	269	DENTON	10-90	4-91
	269	DENTON	10-90	4-91
Neck Moment X Y Z	269	DENTON	10-90	4-91
	269	DENTON	10-90	4-91
	269	DENTON	10-90	4-91
Chest Deflection Gauge Hybrid III Use Only	84892-15	HUMANOID	10-90	4-91
Lap Belt Load Cells	123	LEBOW	9-90	3-91
Shoulder Belt Load Cells	127	LEBOW	9-90	3-91
Spool-Out Potentiometer	52	SERVONIC INST.	10-90	4-91
Belt Stretch Transducer	E1	CALSPAN	10-90	4-91

INSTRUMENT CALIBRATION FOR PASSENGER DUMMY
(6 Month Calibration Minimum)

PASSENGER DUMMY	Serial #	Manufacturer	Calibration	
			Last	Next
Head X Y Z	ER72	ENDEVCO	10-90	4-91
	GD54	ENDEVCO	10-90	4-91
	CK11	ENDEVCO	10-90	4-91
Chest X Y Z	A145	CEC	10-90	4-91
	FL04	ENDEVCO	10-90	4-91
	A149	CEC	10-90	4-91
Right Femur Load Cell	549	GSE	9-90	3-91
Left Femur Load Cell	548	GSE	9-90	3-91
Neck Load Cell X Y Z	076	DENTON	10-90	4-91
	076	DENTON	10-90	4-91
	076	DENTON	10-90	4-91
Neck Moment X Y Z	076	DENTON	10-90	4-91
	076	DENTON	10-90	4-91
	076	DENTON	10-90	4-91
Chest Deflection Gauge Hybrid III Use Only	150	HUMANOID	10-90	4-91
Lap Belt Load Cells	133	LEBOW	9-90	3-91
Shoulder Belt Load Cells	135	LEBOW	9-90	3-91
Spool-Out Potentiometer	42	SERVONIC INST.	10-90	4-91
Belt Stretch Transducer	E3	CALSPAN	10-90	4-91

INSTRUMENT CALIBRATION FOR VEHICLE ACCELEROMETERS
(6 Month Calibration Minimum)

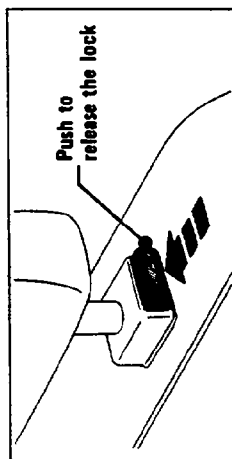
	Serial #	Manufacturer	Calibration	
			Last	Next
Left Seat Rear Crossmember	A29	CEC	1-91	7-91
Right Rear Seat Crossmember	A156	CEC	9-90	3-91
Top of Engine	A157	CEC	9-90	3-91
Bottom of Engine	A144	CEC	10-90	4-91
Left Disc Brake Caliper	A180	CEC	12-90	6-91
Right Disc Brake Caliper	A68	CEC	10-90	4-91
Instrument Panel	A179	CEC	12-90	6-91
Center Rear Crossmember Z	A70	CEC	1-91	7-91
Vehicle Rear Z	A146	CEC	1-91	7-91

INSTRUMENT CALIBRATION FOR LABORATORY INSTRUMENTS
(6 Month Calibration Minimum)

	Serial #	Manufacturer	Calibration	
			Last	Next
Neck Bending Pendulum Accel.	A160	CEC	11-90	5-91
Neck Bending Rotary Potentiometer	None	BOURNS	8-90	2-91
Femur Probe Accelerometer	A161	CEC	11-90	5-91
Chest/Thorax Probe Accel.	A161	CEC	11-90	5-91
Lumbar Flexion Force Gauge	20051	TRANSDUCER INC.	8-90	2-91

Appendix E

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

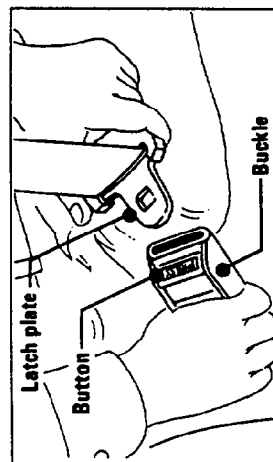


Push the lock knob to unlock the head restraint. Move the restraint up or down as required.

WARNING

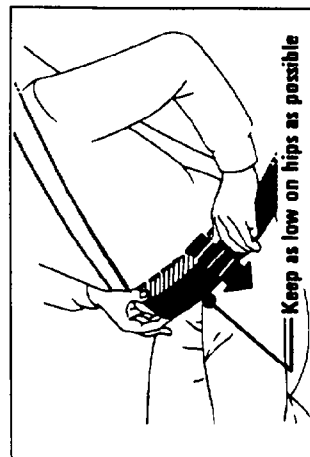
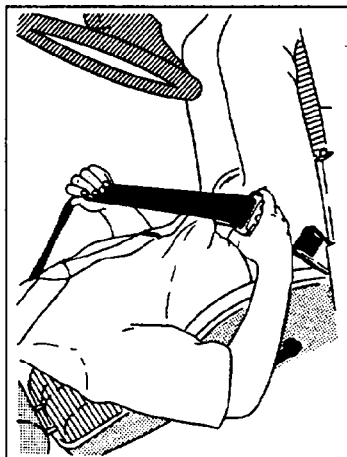
- Do not attempt to adjust the driver's head restraint while the vehicle is in motion.
- Do not operate the vehicle with the head restraint removed.
- When the rear seats are folded in the down position, the head restraints should always be properly secured between the seat back and seat cushion to prevent them from becoming a hazard in the event of a sudden stop or an accident.
- To lessen the risk of neck injuries, the head restraints should always be locked in the appropriate position when the seat is occupied.

FRONT SEAT LAP/SHOULDER BELT



To lessen the chance of injury and/or the severity of injury in accidents or sudden stops, driver and passengers should be properly restrained at all times, using the seat belts provided. (See the following pages for the use of restraints by children and pregnant women.)

- Adjust the front seat as needed and sit up straight and well back in the seat.
- Take hold of the seat belt latch plate and pull the lap/shoulder belt webbing across the body. At the same time, slide the latch plate along the belt until it reaches the buckle. Push the latch plate into the buckle until it clicks.



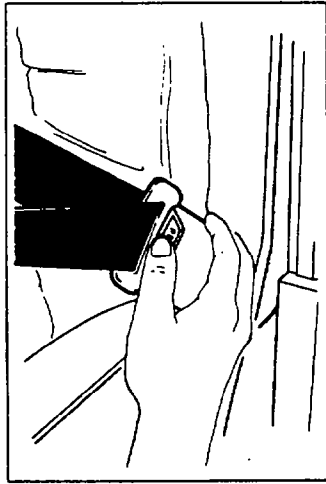
- Position the "lap" portion of the belt across the lap as **LOW ON THE HIPS** as possible. Then, adjust to a **SNUG FIT** by holding the "shoulder" portion of the front seat belt and pulling it **UPWARD** through the latch plate until the lap portion is snug

across the lap. This reduces the risk of sliding under the belt during an accident.

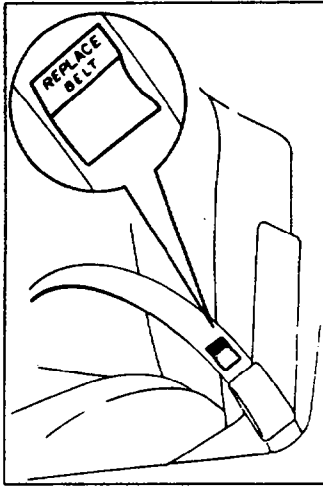
WARNING

- A snug fit with the lap belt positioned low on the hips is necessary to lessen the chance of injury and/or the degree of injury in an accident. This spreads the force of the lap belt over the hip bone instead of across the abdomen.
- Never use the same seat belt for more than one person at a time. A seat belt worn by more than one person will not provide adequate protection in the event of a collision.
- Never wear twisted seat belts.
- Be very careful not to damage seat belts or seat belt buckles by pinching them in the seat or the door.
- Too much slack could increase the possibility of injury because the belt would not be able to properly restrain you in an accident. DO NOT wear shoulder belt under the arm or out of position. Such use could increase the chance of injury and/or the degree of injury in an accident.

- NOTE**
- The retractor will lock the belt only during a sudden stop or on impact.
 - At other times you can move around freely.

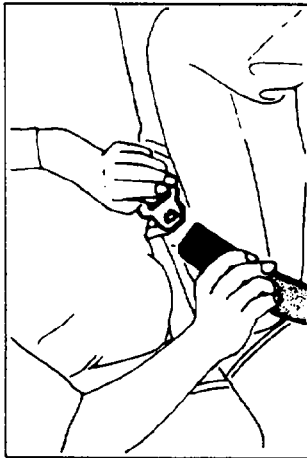


To unfasten the belts, push in the button at the top of the buckle. When no longer in use, seat belts can be stowed by letting them rewind into their retractors.



- Replace the seat belt if the warning label under the sleeve can be seen. The warning label "REPLACE BELT" will appear if the belt receives a severe impact or other force.

■ CENTER SEAT LAP BELTS (Bench seat only)



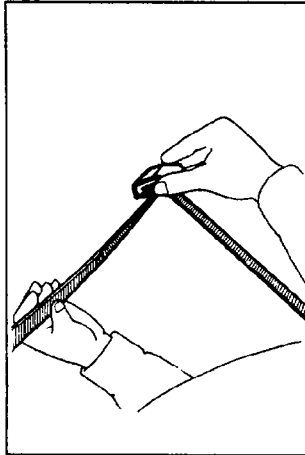
- The center seat is provided with two sets of lap belts.
- The lap belts are equipped with an individual retractor which is designed to take up extra webbing automatically.
- To use the center seat belts, hold the latch plate and pull out the webbing until it reaches the buckle. Push the latch plate into the buckle until it clicks.
- After fastening, check that the belt is **SNUG** by pulling the belt firmly across the lap toward the lap belt retractor. This will allow the retractor to take up slack.
- To unfasten the belts, push in the button at the top of the buckle.

WARNING

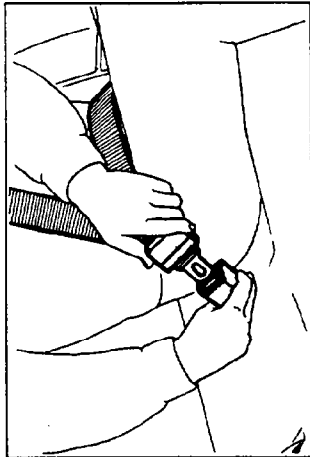
- *Position the lap belt as low as possible on your hips (not on your waist) then adjust it to a snug fit. Failure to do so could increase the chance of injury due to sliding under the lap belt during an accident.*

■ REAR SEAT LAP-SHOULDER BELT

1. Sit up straight and well back in the seat.
2. Take hold of the latch plate at an angle to the webbing and slide it toward the front of vehicle.



Then pull it slowly across your lap and push the latch plate into the buckle until it clicks.



3. Position the "lap" portion of the belt across the lap as **LOW ON THE HIPS** as possible. Then, adjust to **SNUG FIT** by holding the "shoulder" portion of the rear seat belt and pulling it **UPWARD** through the latch plate until the "lap" portion is snug across the lap. This reduces the risk of sliding under the belt during an accident.
4. To unfasten the belt, push in the button on the buckle. The belt should retract when the buckle is unlatched, but you should hold the latch plate as it does so, to keep it from hitting people or nearby objects.

SEAT BELT INSPECTION

- Occasionally check that the belts, buckles, latch plates, retractors, reminder systems, guide loops, keepers, and anchors work properly. Also check for damage that could keep the restraint system from doing its job.
- Keep sharp edges and damaging objects away from the belts and other parts of the restraint system.
- Replace belts if cut, weakened, or frayed. Also, have belts replaced if they have been worn in a collision.
- If there is any doubt have all related parts including belts replaced.
- Keep belts clean and dry.
- Clean only with mild soap and lukewarm water.
- Do not bleach or dye belts since this may badly weaken them.

CHILD RESTRAINT

Children in vehicles should be restrained to help lessen the chance and/or severity of injury in accidents or sudden stops. Never let a child of any age stand or kneel on any seat. Use of infant or child restraint systems which conform to federal motor vehicle safety standards and which are installed ac-

cording to their instructions is the surest way of minimizing the risk of injury to young passengers. Older children should be placed on a seat and restrained with the seat belts provided with your vehicle. Both lap and shoulder belts should be used. The use of infant or child restraint systems may be required by the laws of your state. You should check with the appropriate state authorities to ensure that you are in compliance with these laws.

WARNING

- *For effective protection in automobile accidents and sudden stops, children should not be transported unrestrained. The preferred restraint for small children is a child restraint system. If this is not available, children should be placed in the rear seat (if so equipped) and restrained with the lap belt if they are old enough to sit alone.*
- *Holding a child in your arms is dangerous. In an accident, a child held in a person's arms can be struck or crushed by any unrestrained occupant. An unrestrained child can also be injured by striking the interior, or by being ejected from the vehicle during a sudden maneuver or impact.*
- *All child restraint systems are designed to be secured in vehicle seats by lap belts or the*

lap belt portion of a lap-shoulder belt. Children could be endangered in a crash if the child restraint is not properly secured in your vehicle.

- *According to Federal accident statistics, children are safer when properly restrained in rear seating positions (if so equipped) than in the front seating positions.*
- *Children should not ride in the cargo area.*

RESTRAINT OF PREGNANT WOMEN

It is recommended that pregnant women use seat belts. Check with your doctor for specific recommendations. The lap belt should be snug and positioned as low as possible around the hips. Do not position the lap belt around the waist. This can be very dangerous in the event of an accident or sudden stop.