

REPORT NUMBER: CAL-91-N12

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

**GENERAL MOTORS CORPORATION
1991 GEO STORM
2-DOOR HATCHBACK**

NHTSA NUMBER: MM0107

CALSPAN TEST NUMBER: 7893-8

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

April 10, 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

Harlan S. Chan
Contracting Officer's Tech. Rep. (COTR)

JUN 24 1991

Date of Report Acceptance

1. Report No. CAL-91-N12		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 Geo Storm 2-Door Hatchback				5. Report Date April 10, 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. 7893-8	
9. Performing Organization Name and Address Calspan Advanced Technology Center P.O. Box 400 Buffalo, New York 14225				10. Work Unit No. J61-12-1055	
				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 April-May	
				14. Sponsoring Agency Code DOT/NHTSA/RM/OMI	
15. Supplementary Notes					
16. Abstract A frontal load cell barrier test of a 1991 Geo Storm 2-Door Hatchback was performed at Calspan Advanced Technology Center crash test facility in Buffalo, New York on April 10, 1991. The impact speed was 35.0 mph and the ambient temperature at the barrier face at the time of impact was 40°F. The maximum post-test vehicle crush was 23.7 inches. The test vehicle was equipped with a 3-point continuous loop restraint system at each of the front outboard seating positions. The test vehicle was also equipped with a driver side airbag as a supplemental restraint device. With regard to FMVSS 208 "Occupant Crash Protection," injury criteria, both the driver and passenger dummies appear to comply with the maximum head, chest and femur requirements.					
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	

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 MM0107

A load cell barrier consisting of 36 load cells was impacted by a 1991 Geo Storm 2-Door Hatchback at a velocity of 35.0 mph. The test was performed at the Calspan Corporation Advanced Technology center on April 10, 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) was used in two previous tests (MM0105 and MM0302). Injury criteria values were not exceeded in those tests. The right-front passenger ATD (Serial No. 150) was calibrated previous to this 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. Position 1 - Upper Neck FZ and Position 2 - Chest Displacement did not record accurately.

The driver's head struck the airbag; the HIC was 416.7. The maximum chest deceleration over 3 milliseconds was 47.4 g's and femur loads were 393.7 and 507.9 pounds.

The right front passenger's HIC was 981.2 and maximum chest deceleration over 3 milliseconds was 45.3 g's. Femur loads were 478.0 and 555.2 pounds.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1991 Geo Storm 2-Door HatchbackNHTSA No.: MM0107 VIN.: J81RF2365M7517644Body Color: Red Date Of Manufacture: August 1990Engine: 4 Cylinders; - C.I.D.; 1.6 Liters; - CCX Gas; - Diesel; - Turbocharged- Longitudinal; X TransverseTransmission: 5 Speed; X Manual; - Automatic; - OverdriveFinal Drive: X Front Wheel; - Rear Wheel; - Four WheelDate Received: 3-8-91 Odometer Reading: 104 miles- A/C; X P/S; X P/B; - P/wdo.; - Tilt Wheel- P/seats; - Cruise ControlType of Occupant Restraint: 3-point continuous belt system with driver
side airbag.DATA RECORDED FROM VEHICLE'S TIRE PLACARD:Tire Pressure (at capacity): Front 30 psi, Rear 30 psiRecommended Tire Size: P185/60R14 82HRecommended Cold Tire Pressure: Front 30 psi, Rear 30 psiTires on Vehicle: P185/60R14 RE92 ; Manufacturer: BridgestoneNumber of Occupants: 2 Front; 2 Rear; - 3rd Seat; 4 TOTALType of Front Seats: X Bucket; - Bench; - Split BenchType of Front Seat Back: - Fixed X Adj. With X Lever - Rot. KnobVehicle Capacity Weight (VCW) = 665 lbs. (A)No. of Occupants x 150 lbs. = 600 lbs. (B)

Rated Cargo and Luggage

Weight (RCLW) A-B = 65 lbs.GVWR 3131 lbs. GAWR: Front 1804 lbs. Rear 1376 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 = 720 lbs. Right Rear = 390 lbs.
 Left Front = 710 lbs. Left Rear = 430 lbs.
 TOTAL FRONT WEIGHT = 1430 lbs. (64 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 820 lbs. (36 % of Total Vehicle Weight)
 TOTAL DELIVERY WEIGHT = 2250 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (2250 lbs.)
 VCW = Vehicle Capacity Weight (665 lbs.)
 DSC = Designated Seating Capacity (4)
 RCLW = VCW - 150 (DSC) = 65 lbs.
 Target Test Weight = UDW + RCLW + (2 dummies x 167 lbs./dummy)
 Target Test Weight = 2649 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 56 POUNDS CARGO:

Right Front = 770 lbs. Right Rear = 550 lbs.
 Left Front = 780 lbs. Left Rear = 540 lbs.
 TOTAL FRONT WEIGHT = 1550 lbs. (59 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 1090 lbs. (41 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 2640 lbs.
 Weight of ballast secured in vehicle trunk area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude: RF 25.6 LF 25.5 RR 25.0 LR 24.6
 Test Attitude: RF 25.6 LF 25.5 RR 23.7 LR 23.7
 Wheel Base: 96.7 in.; C.G. = 39.9 in. rearward of front wheel C/L.

Remarks: The fuel tank contained 11.5 gallons of stoddard solution.
 Hatchback and exhaust system from catalytic converter downward
 were removed from vehicle to obtain test weight.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Angle: 0°
 Date of Test: April 10, 1991 Time of Test: 12:55
 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 = 35.0 mph, secondary = 35.0 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 157.2 C_L 162.7 L 157.5
 Post-test = R 139.1 C_L 139.0 L 141.5
 Crush = R 18.1 C_L 23.7 L 16.0

Distance from front of test vehicle to point of impact:

R 14.6 C_L 14.8 L 14.5

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Air Bag</u>	<u>No Contact</u>
Chest	<u>Air Bag</u>	<u>No Contact</u>
Abdomen	<u>No Contact</u>	<u>No Contact</u>
Left Knee	<u>Dash Panel</u>	<u>Dash Panel</u>
Right Knee	<u>Dash Panel</u>	<u>Dash Panel</u>

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

	<u>Front</u>	
	<u>Left</u>	<u>Right</u>
Door Opening	<u>operable</u>	<u>operable</u>

	<u>Front</u>	
<u>Seat Movement</u>	<u>Left</u>	<u>Right</u>
Seat Back Failure	<u>None</u>	<u>None</u>
Seat Shift (in.)	<u>None</u>	<u>None</u>

	<u>Glazing Damage</u>
Backlight/Windshield	<u>The windshield sustained stress fractures but remained intact.</u>

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.: MM0107 Vehicle: 1991 Geo Storm 2-Door Hatchback

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	50.7	-6.3	39.4	63.4
Position #2 - Passenger	-55.5	-8.0	60.3	68.9

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-49.2	5.8	-12.9	47.4
Position #2 - Passenger	-46.5	35.7	-12.8	45.3

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	393.7	507.9
Position #2 - Passenger	478.0	555.2

	MAXIMUM FORCE - SEAT BELT LOADS (lbs.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	1147.4	-	1408.5
Position #2 - Passenger	2145.4	1294.4	-

	HEAD INJURY CRITERIA (HIC)			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
Position #1 - Driver	416.7	.04500	.08088	42.3
Position #2 - Passenger	981.2	.06900	.10488	59.5

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 Geo Storm 2-Door Hatchback

Vehicle NHTSA No.: MM0107 Test Date: April 10, 1991

MAXIMUM VALUES	DRIVER DUMMY ID # <u>45</u>	PASSENGER DUMMY ID # <u>150</u>
Neck Load X	210.3 lbs.	491.2 lbs.
Neck Load Y	61.1 lbs.	66.7 lbs.
Neck Load Z	N/A	1033.9 lbs.
Neck Moment X	123.8 ft/lbs	232.9 ft/lbs
Neck Moment Y	739.7 ft/lbs	989.4 ft/lbs
Neck Moment Z	110.3 ft/lbs	174.4 ft/lbs
Chest Deflection X (in.)	1.4 in.	N/A
Time of Max. Occurance	73.8 msec	N/A

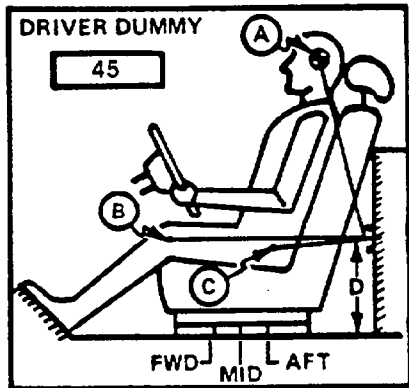
NOTE: All values listed must be occurring during primary impact event.

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION

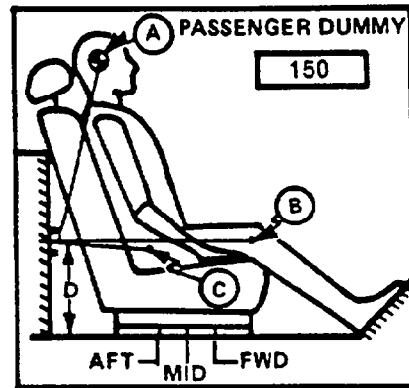
Test No.: MM0107 Vehicle: 1991 Geo Storm 2-Door Hatchback

<u>SEAT TYPE:</u>	<u>ADJUSTER TYPE:</u>	<u>SEAT BACK TYPE:</u>
<u> </u> Bench	<u> X </u> Manual	<u> </u> Fixed
<u> X </u> Bucket	<u> </u> Power	<u> X </u> Adjustable Reclining
<u> </u> Split Bench		

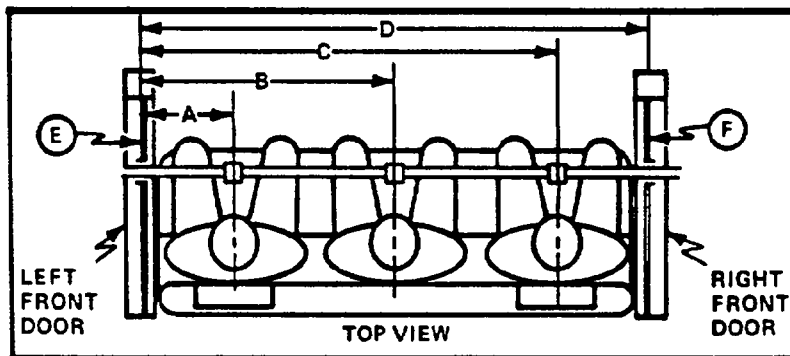


MEASUREMENT
LOCATION

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



A = <u>24.2</u> in.	<u>40</u> Degrees	A = <u>23.8</u> in.	<u>40</u> Degrees
B = <u>33.6</u> in.	<u>95</u> Degrees	B = <u>34.2</u> in.	<u>95</u> Degrees
C = <u>19.5</u> in.	<u>114</u> Degrees	C = <u>19.8</u> in.	<u>112</u> Degrees
D = <u>13.2</u> in.		D = <u>13.2</u> in.	



S/N 45

DUMMY ID

S/N 150

A = Left Door to Driver Centerline	<u>11.8</u> in.
B = Left Door to Center Passenger Centerline	<u> </u> in.
C = Left Door to Right Passenger Centerline	<u>39.1</u> in.
D = Left Door to Right Door	<u>51.4</u> in.
E,F = Window Glass Height (Right and Left Must Be Equal)	<u>10.0</u> in.

Figure 2

OCCUPANT CLEARANCE DIMENSIONS

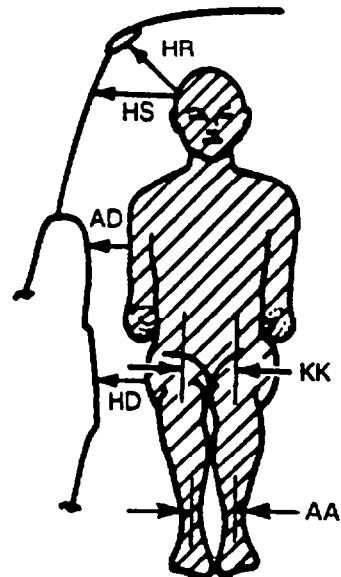
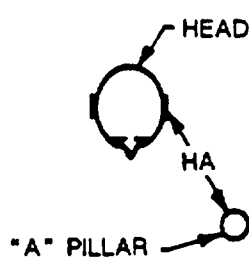
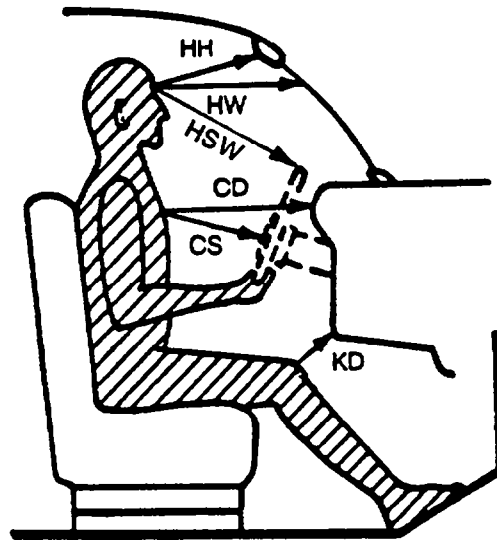
	DRIVER	PASSENGER
HH	13.6	13.8
HW	23.1	22.9
CD	20.1	21.1
CS	11.3	—
KDL	5.6	6.4
KDR	5.9	6.4
SA	See Note	See Note
TA	16°	17°
HSW	14.3	—

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

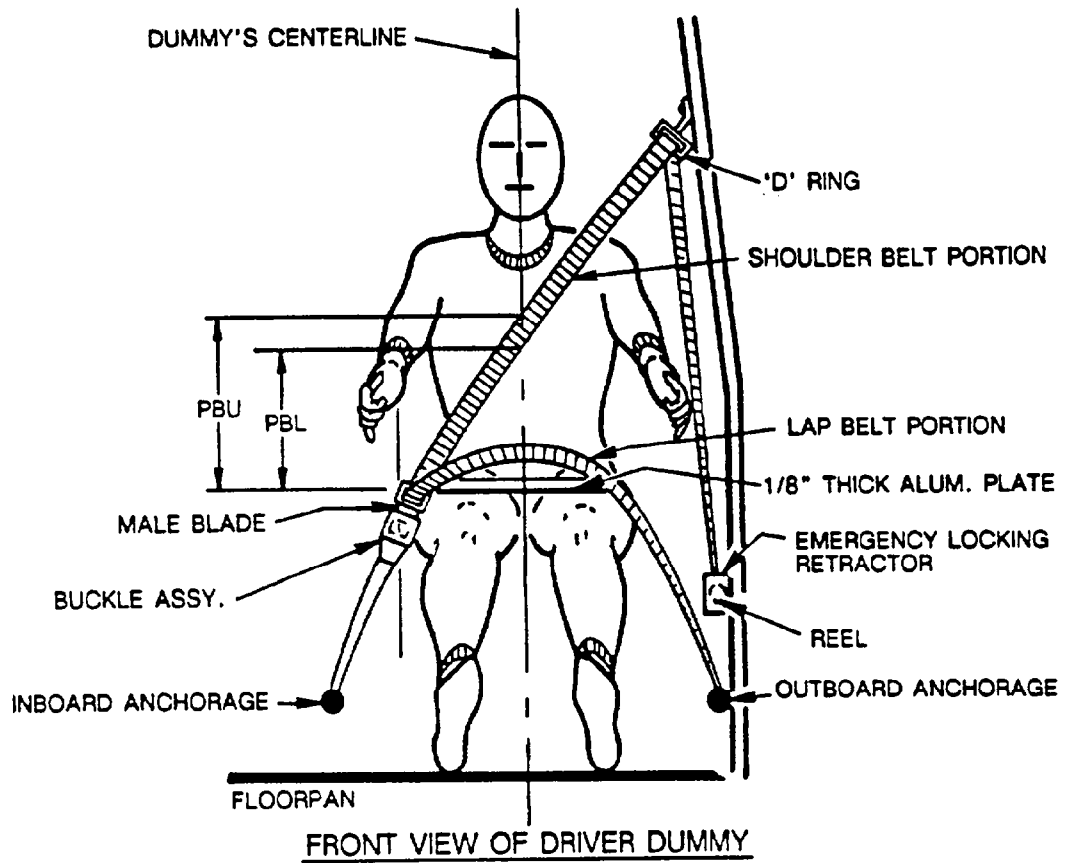
HA = Head Target to "A" Pillar
 HR = Head to Side Roof
 HS = Head to Side Window
 AD = Arm to Door
 HD = Hip to Door
 KK = Knee to Knee
 AA = Ankle to Ankle

	DRIVER	PASSENGER
HR	5.2	5.6
HS	8.8	9.2
AD	4.4	5.0
HD	5.1	4.8
KK	9.7	8.7
HA	17.2	17.2
AA	13.1	8.0



Note: Seat was positioned according to manufacturer's specifications

Figure 3
SEAT BELT POSITIONING DATA



	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
<u>PBU</u> -- Top surface of alum. plate to upper edge	13.0	12.6
<u>PBL</u> -- Top surface of alum. plate to belt lower edge	9.7	9.5
<u>LAP BELT TENSION</u>	2.0 lbs.	2.0 lbs.
<u>SHOULDER BELT TENSION</u>	-	-

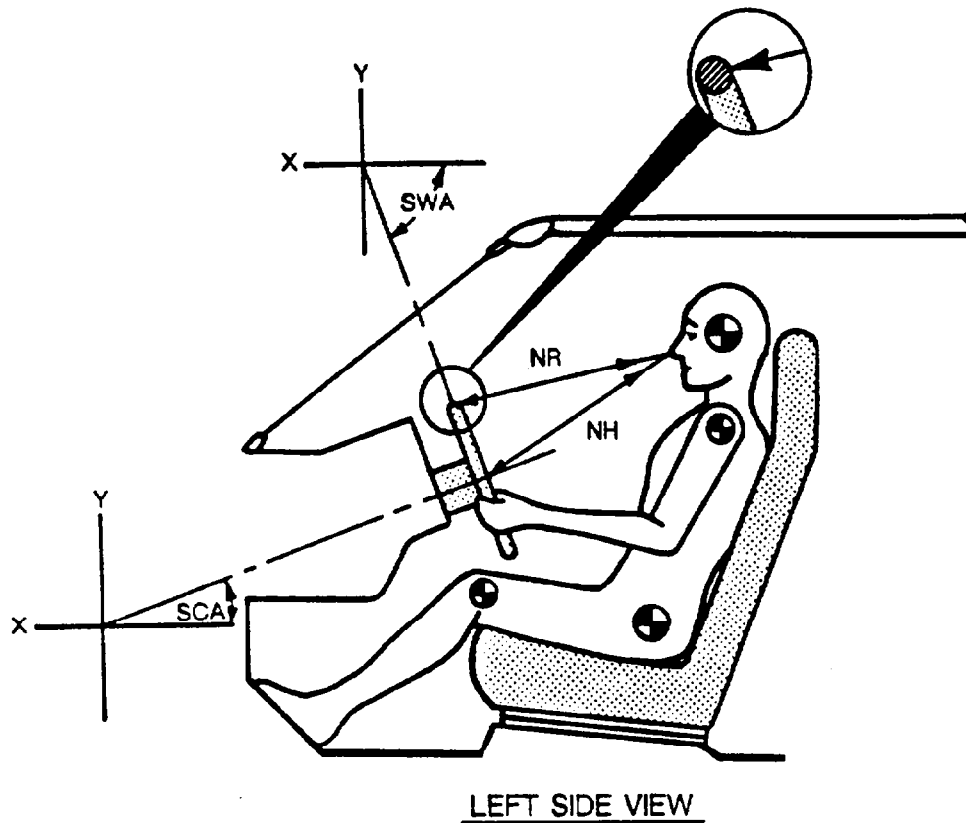
Table 4

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

<u>BELT LENGTH DATA:</u>	<u>Driver</u>	<u>Passenger</u>
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems.	<u>78.0</u>	<u>77.0</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>36.0</u>	<u>36.0</u>
Lap belt length as measured on Part 572 Dummy.	<u>30.0</u>	<u>29.0</u>
<u>LAP BELT SPOOL-OFF DATA:</u>		
As determined by film analysis.	<u>3.0"</u>	<u>2.5"</u>
As determined mechanically.	<u>2.2"</u>	<u>2.3"</u>
As determined electronically.	<u>2.4"</u>	<u>2.1"</u>
<u>BELT STRETCH DATA:</u>		
Measured electronically between shoulder belt load cell and the "D" ring.	<u>1.3</u> in/ft	<u>1.3</u> in/ft
Measured mechanically	<u>0.0</u> in/ft	<u>0.2</u> in/ft

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	14.2	Inches
<u>NH</u>	-- Distance from tip of dummy's nose to center of steering column hub	14.7	Inches
<u>SCA</u>	-- Angle of steering column relative to the horizontal X axis	20.0	Degrees
<u>SWA</u>	-- Angle of steering wheel relative to the horizontal X axis	-70.0	Degrees

Figure 5
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

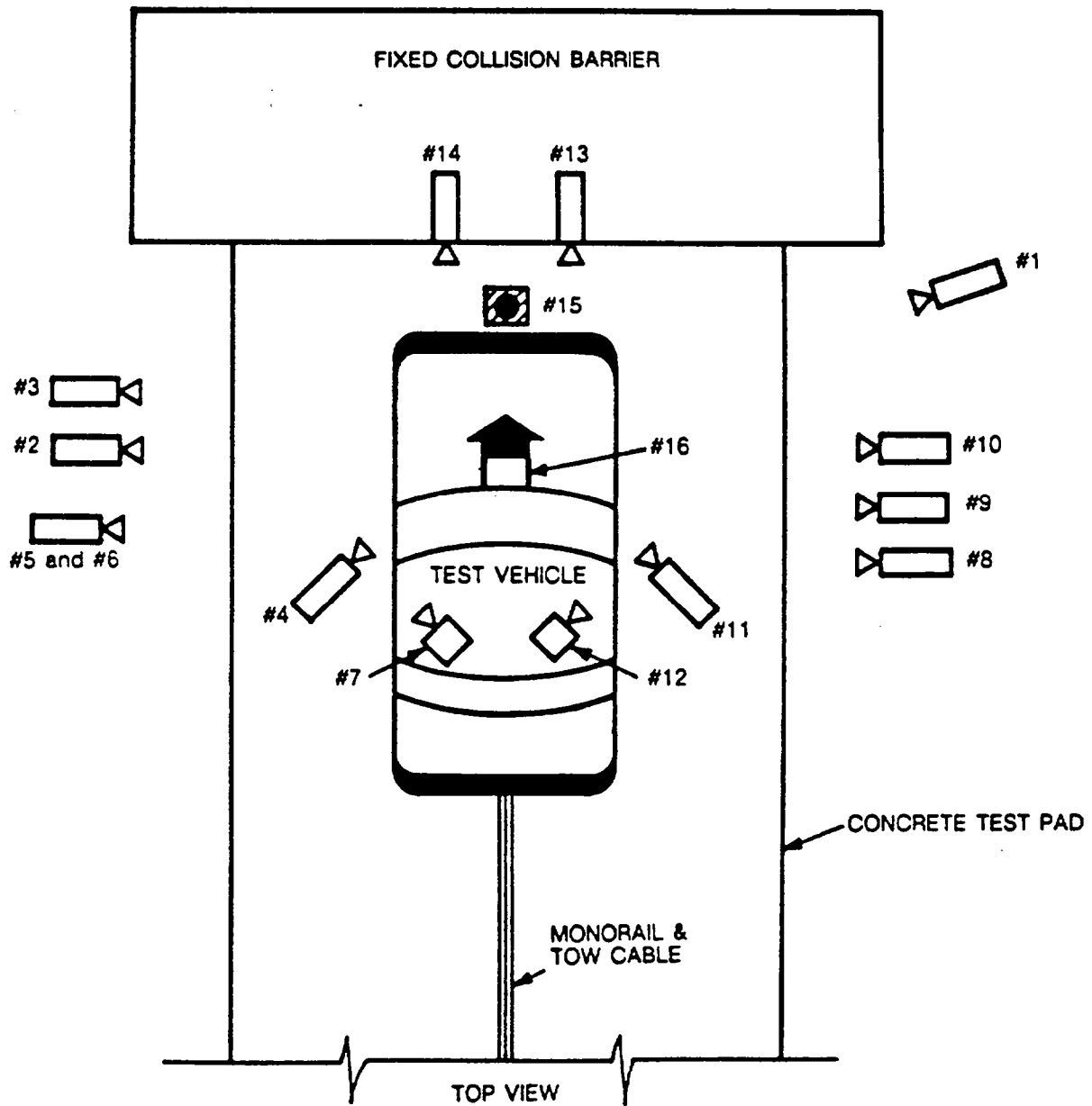


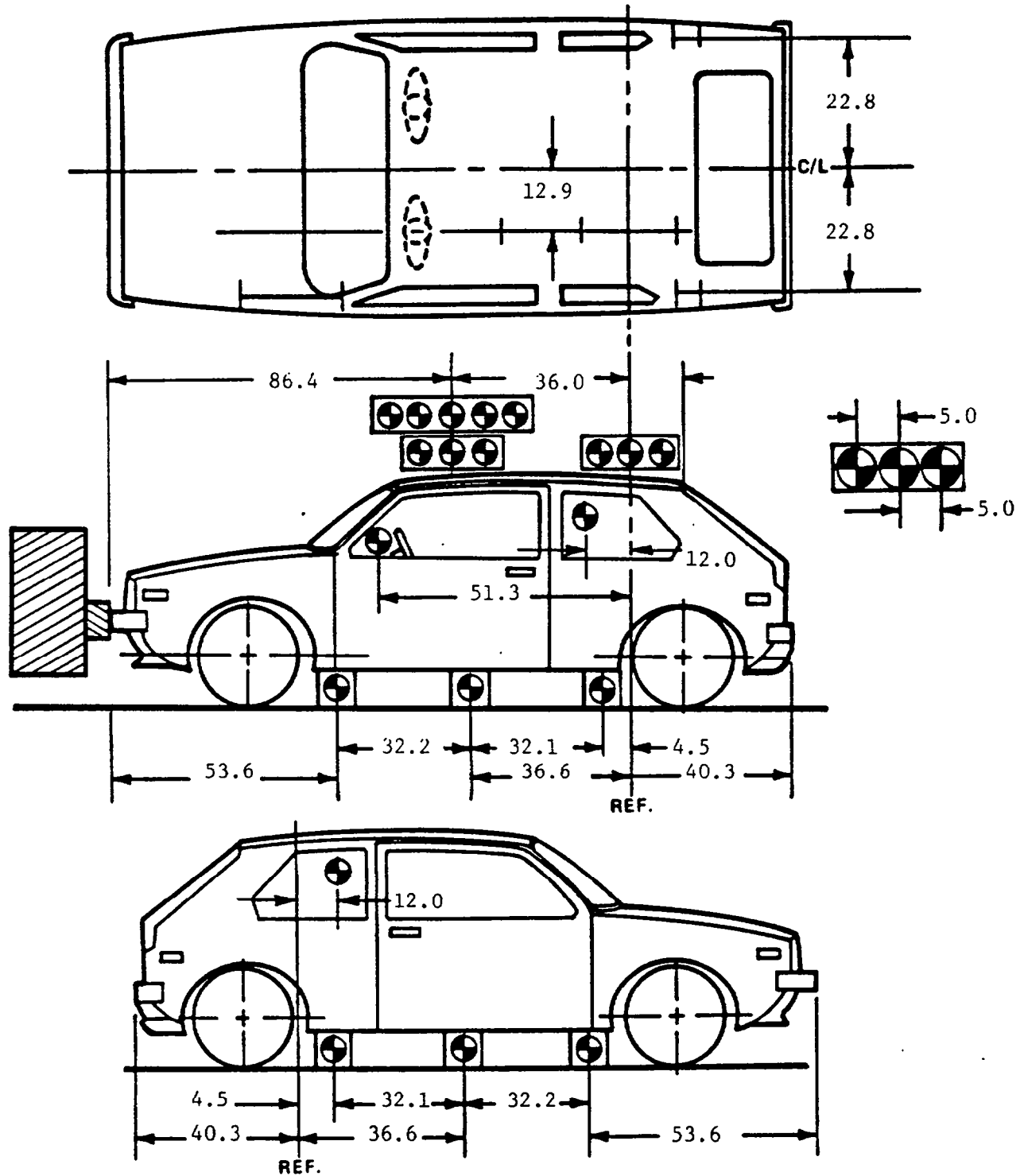
Table 5

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	204	52	41	-6	187	13	550
3	Left Side View	296	27	41	-4	279	25	570
4	Driver and Interior View	99	103	67	-20	82	13	660
5	Steering Column (Bottom)	264	70	46	-5	247	25	560
6	Steering Column (Top)	264	70	70	-10	247	25	560
7	Left Belt	-	-	-	-	-	8	530
8	Overall Right Side	218	67	42	-4	201	13	570
9	Right Side View	286	52	41	-1	269	25	600
10	Right Passenger View	276	69	55	-4	259	35	490
11	Passenger and Interior View	98	101	66	-23	81	25	530
12	Right Belt	-	-	-	-	-	8	460
13	Passenger Front View	24	-5	72	-41	-	13	540
14	Driver Front View	24	-5	72	-41	-	13	540
15	Windshield View	0	0	125	-45	-	13	550
16	Pit View of Engine	0	32	-120	90	-	13	710

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

Figure 6
VEHICLE TARGET LOCATIONS

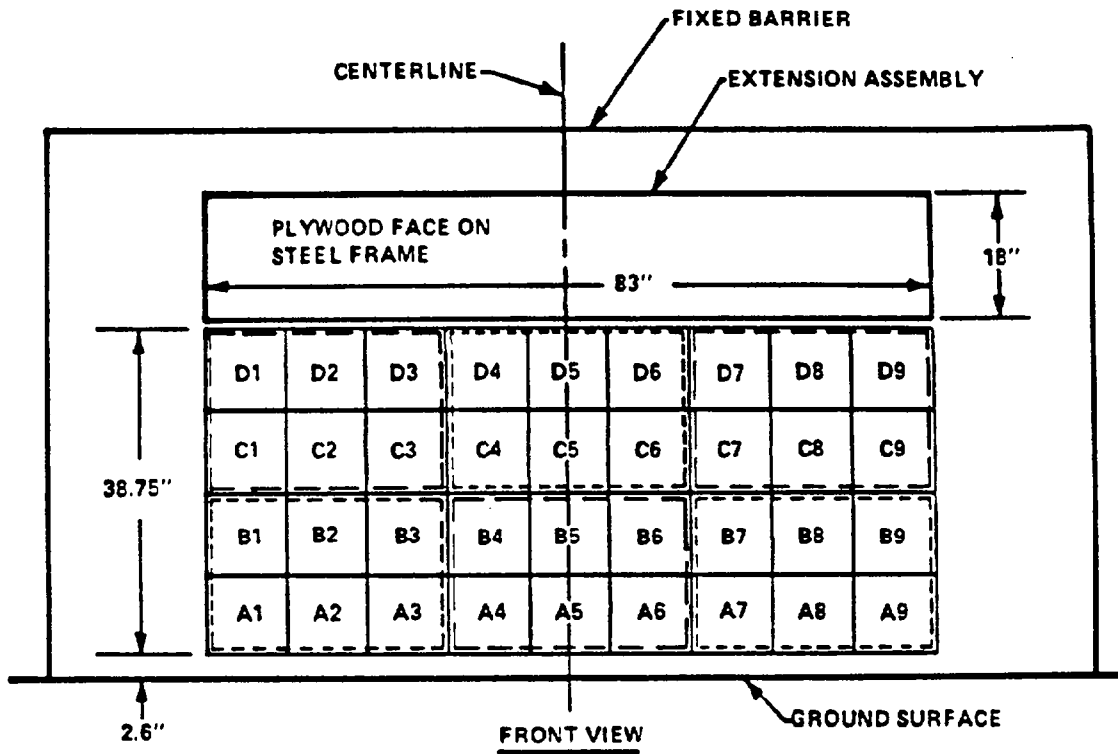


(DIMENSIONS IN INCHES)

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

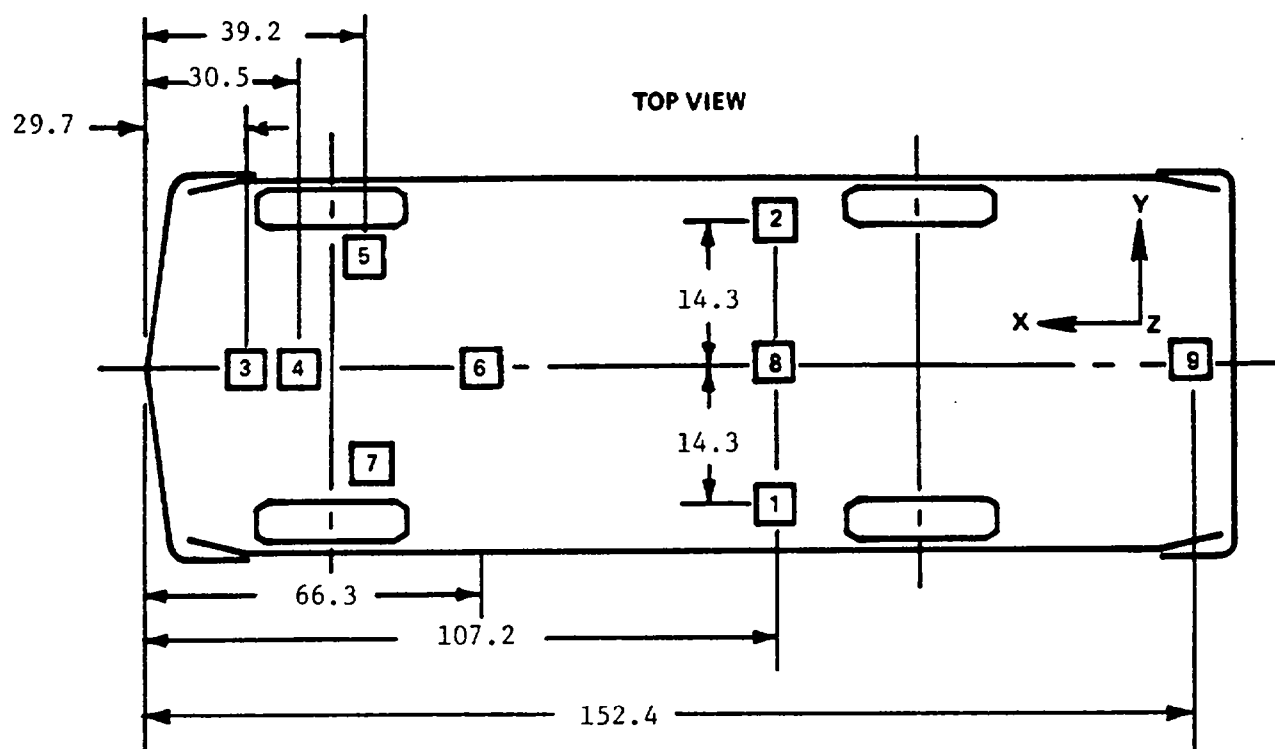
Group 4	Group 5	Group 6
C1 thru D3	C4 thru D6	C7 thru D9
Group 1	Group 2	Group 3
A1 thru B3	A4 thru B6	A7 thru B9

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)

Figure 8

VEHICLE ACCELEROMETER LOCATIONS



(All Measurements in Inches)

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 Disc Brake Caliper	X		
7	Instrument Panel	X		
8	Center Rear Seat Crossmember			X
9	Rear Trunk Centerline			X

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

Figure 9
TEST VEHICLE MEASUREMENTS

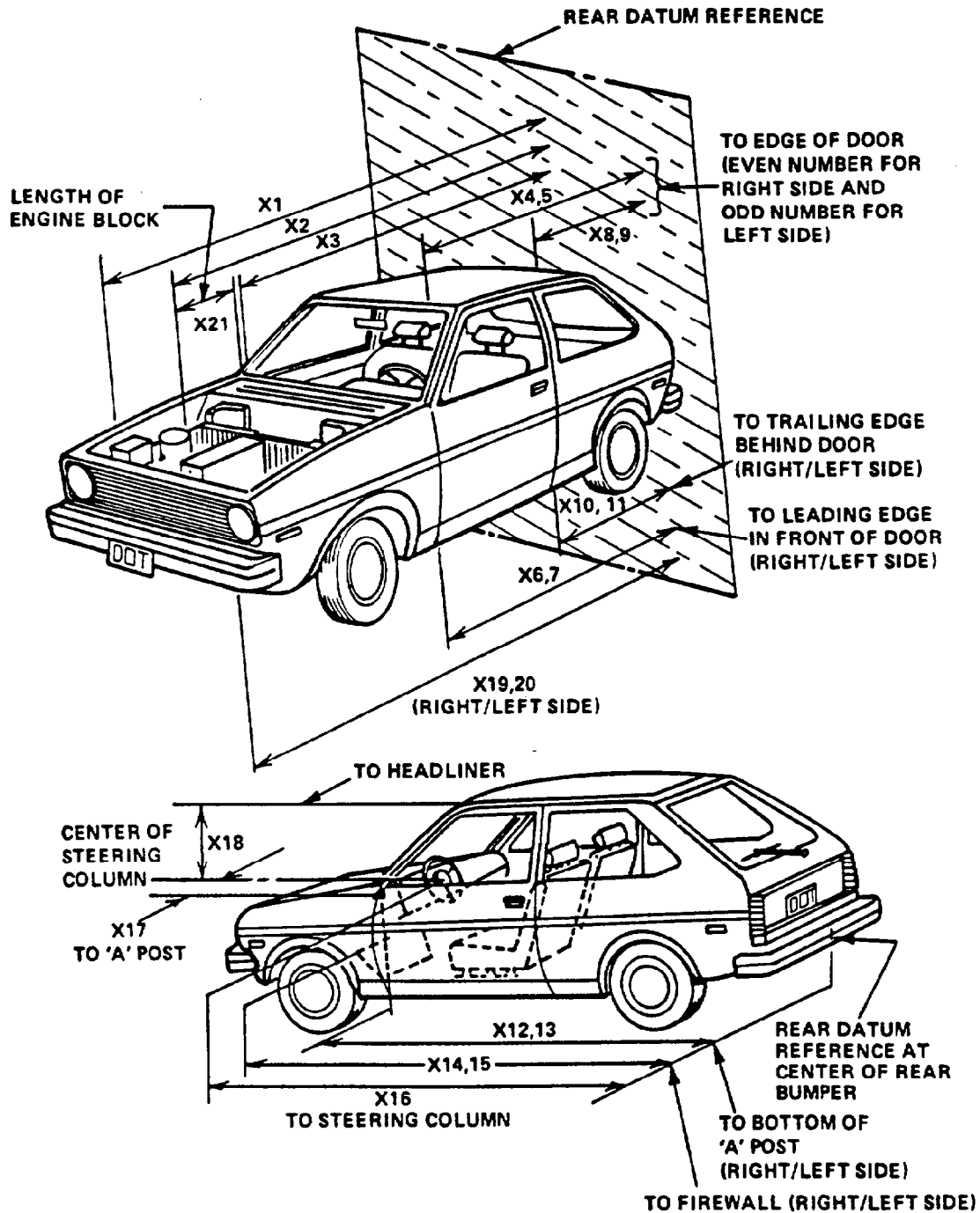


Table 5
VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	162.7	139.0	23.7
X2	Rear Surface of Vehicle to Front of Engine	137.5	128.5	9.0
X3	Rear Surface of Vehicle to Firewall	121.0	114.6	6.4
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	104.4	103.5	0.9
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	104.6	104.5	0.1
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	107.0	105.8	1.2
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	107.1	106.8	0.3
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	54.5	53.4	1.1
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	54.8	54.0	0.8
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	58.1	57.2	0.9
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	58.6	58.1	0.5
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	107.1	105.5	1.6
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	107.4	106.9	0.5
X14	Rear Surface of Vehicle to Firewall, Right Side	119.2	116.5	2.7
X15	Rear Surface of Vehicle to Firewall, Left Side	119.1	115.0	4.1
X16	Rear Surface of Vehicle to Steering Column	87.4	87.0	0.4
X17	Center of Steering Column to "A" Post	17.5	18.3	-0.8
X18	Center of Steering Column to Headliner	16.0	14.8	1.2
X19	Rear Surface of Vehicle to Right Side of Front Bumper	157.2	139.1	18.1
X20	Rear Surface of Vehicle to Left Side of Front Bumper	157.5	141.5	16.0
X21	Length of Engine Block	13.6	13.6	0.0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	97.9	96.5	1.4
CD	Rear Surface of Vehicle to Center of Dash Panel	97.8	96.6	1.2
LD	Rear Surface of Vehicle to Left Side of Dash Panel	97.3	97.0	0.3

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	PRE-TEST DRIVER HEAD LOCATION	A-32
A-31	PRE-TEST PASSENGER HEAD LOCATION	A-33
A-32	IMPACT VIEW	A-34

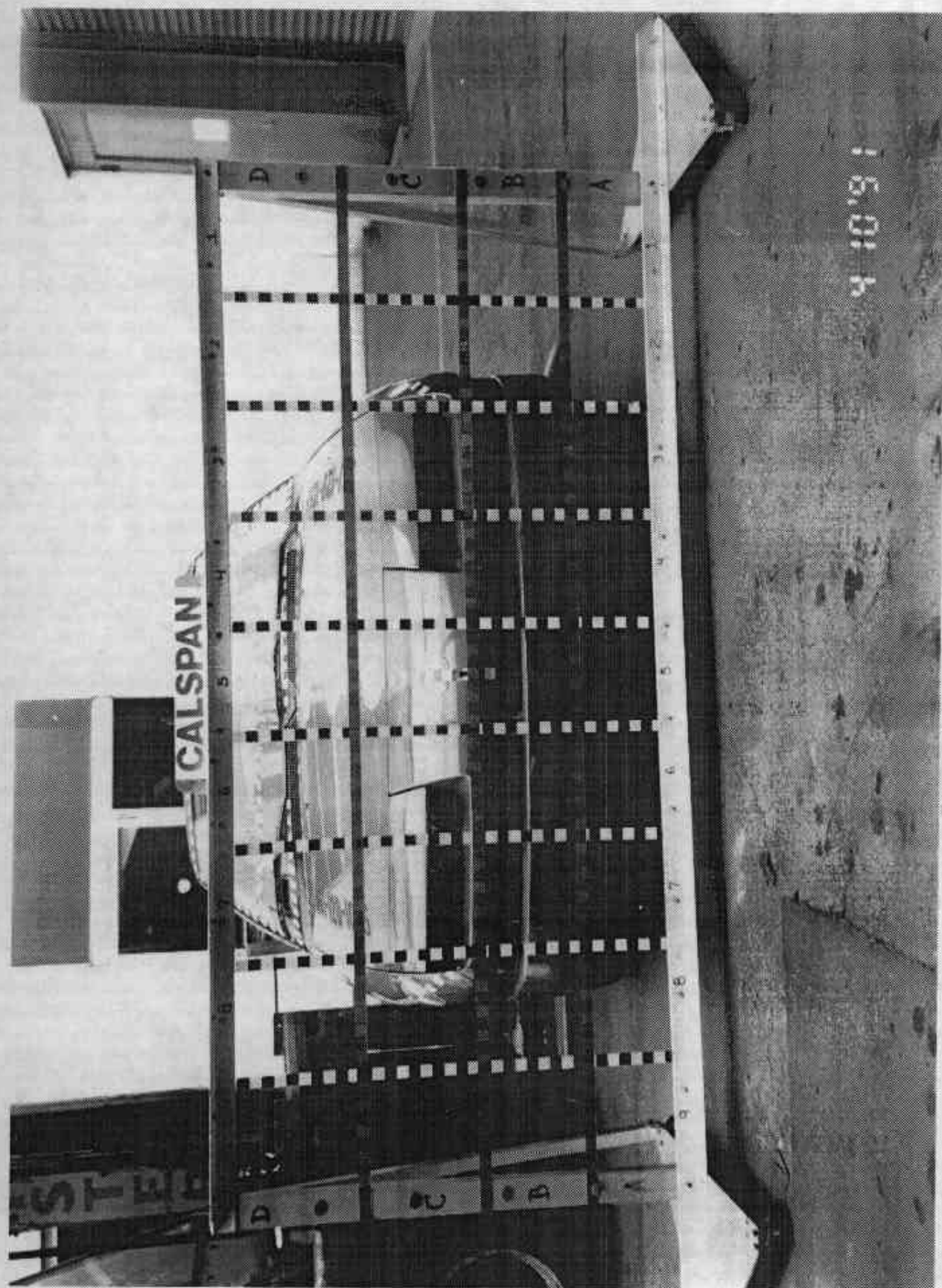


Figure A-1 LOAD CELL LOCATIONS



FIGURE A-2 PRE-TEST FRONT VIEW

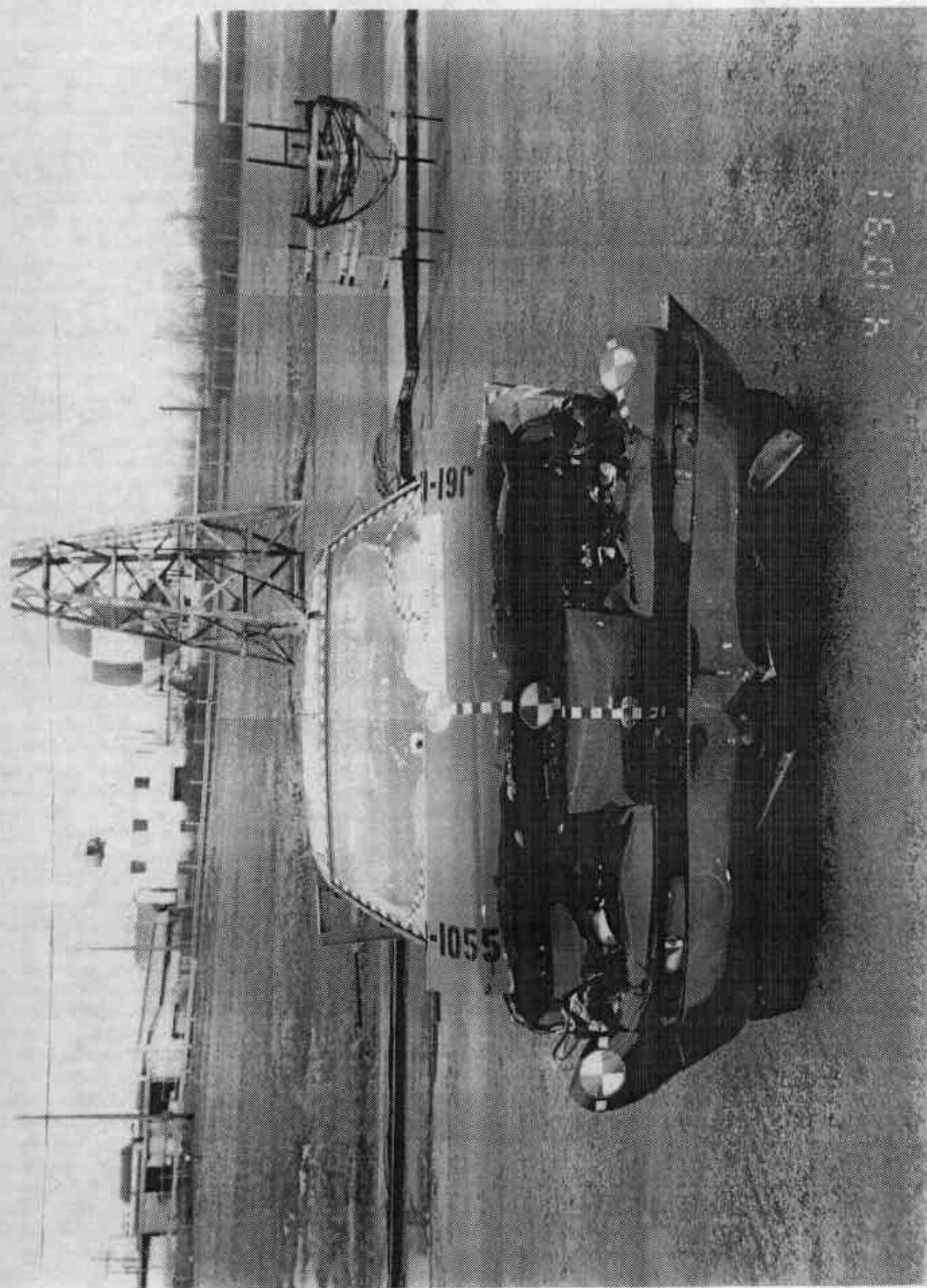


Figure A-3. POST TEST FRONT VIEW

A-5

7893-8

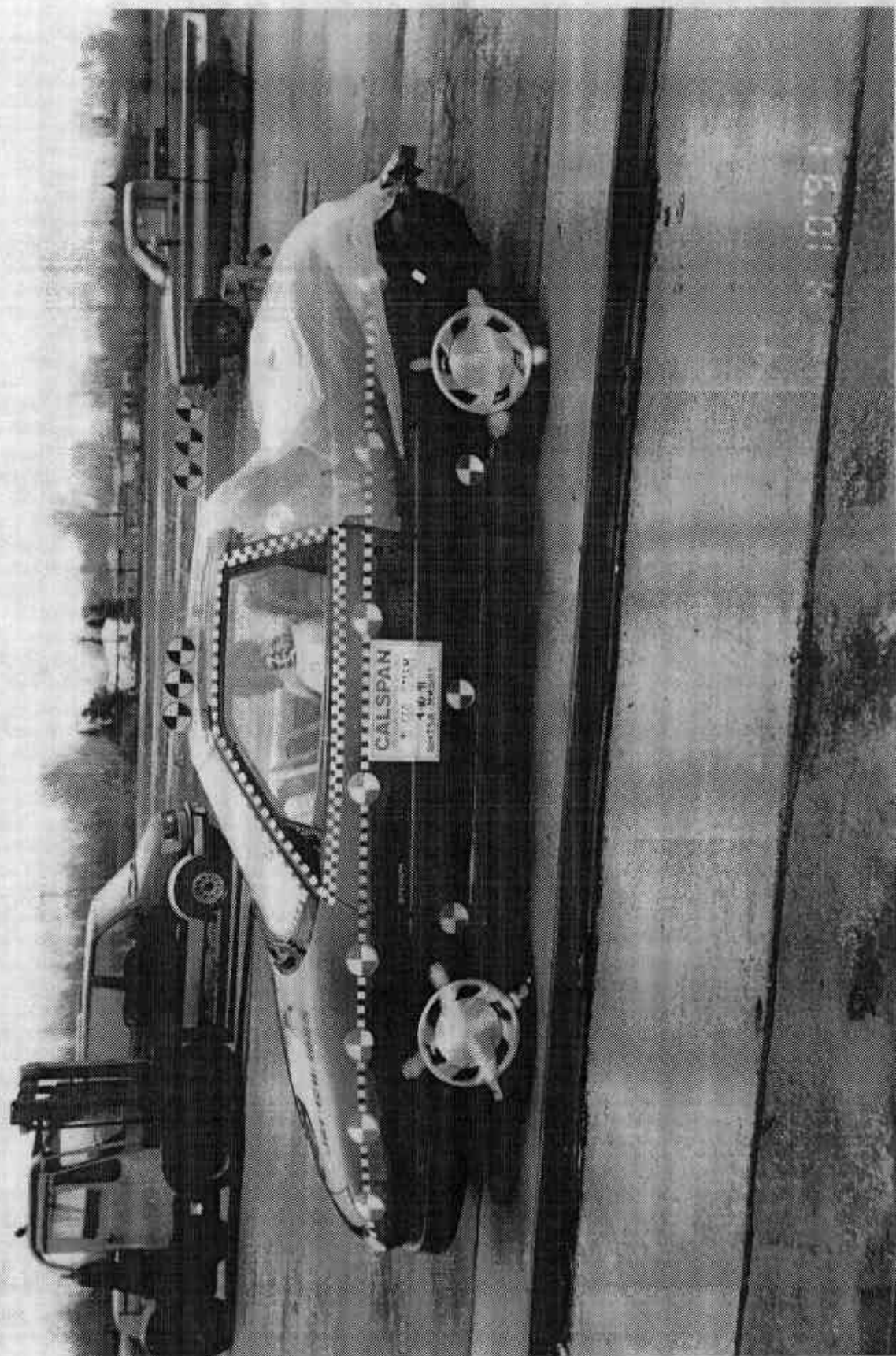


FIGURE A-4 PRE-TEST LEFT SIDE VIEW

A-6

7893-8

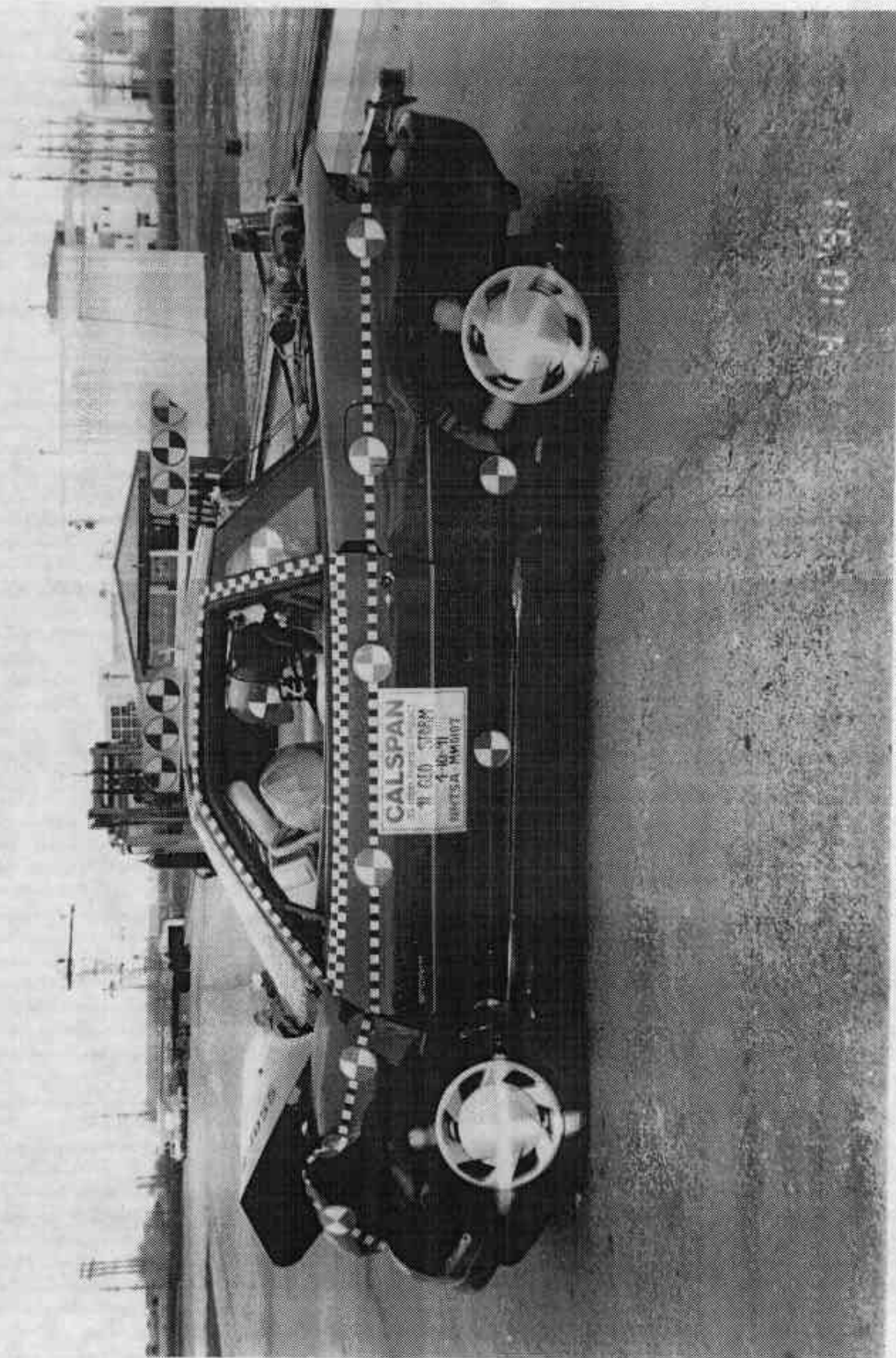


Figure A-3 POST TEST LEFT SIDE VIEW

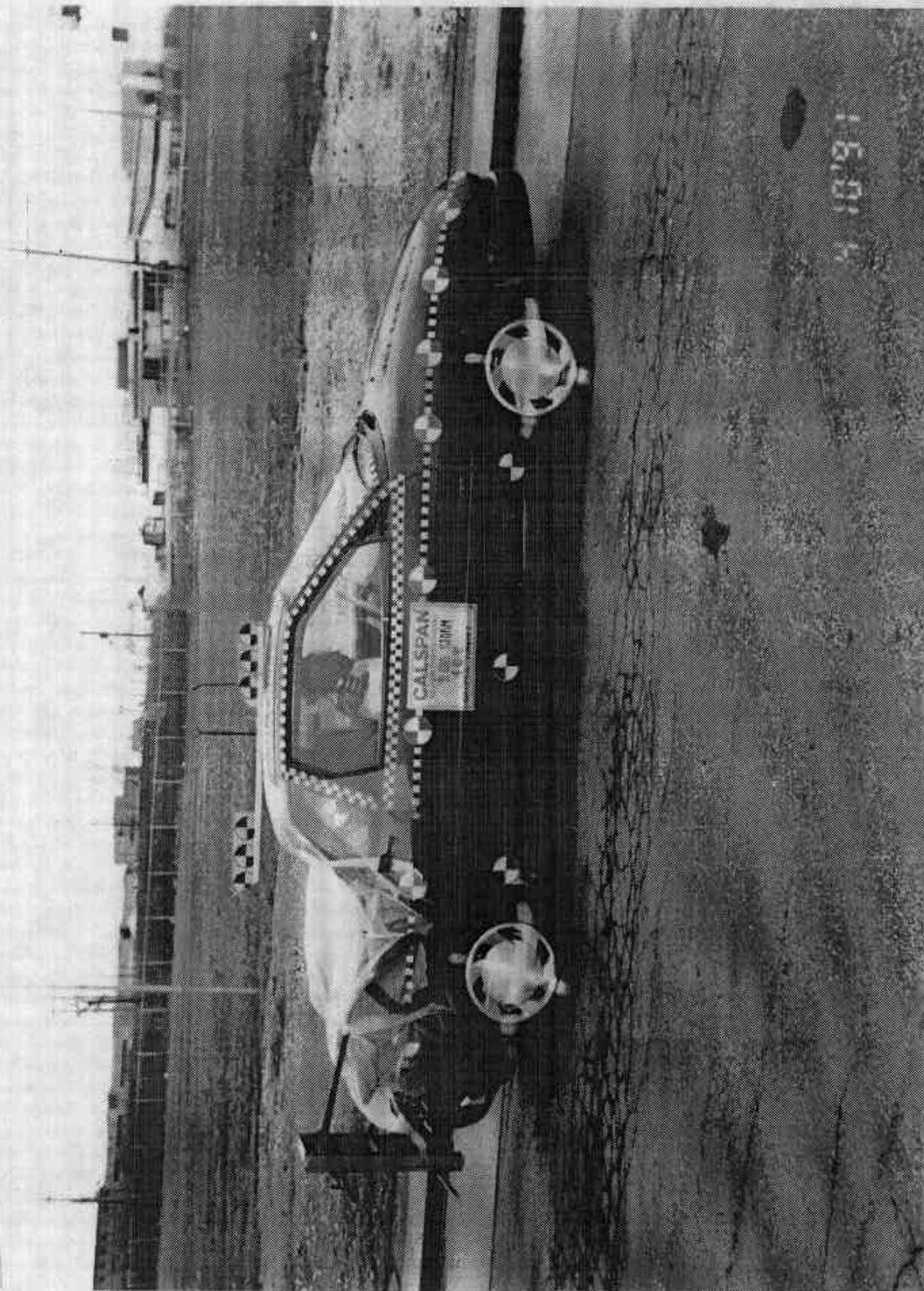


FIGURE A-6 PRE-TEST RIGHT SIDE VIEW

A-8

7893-8

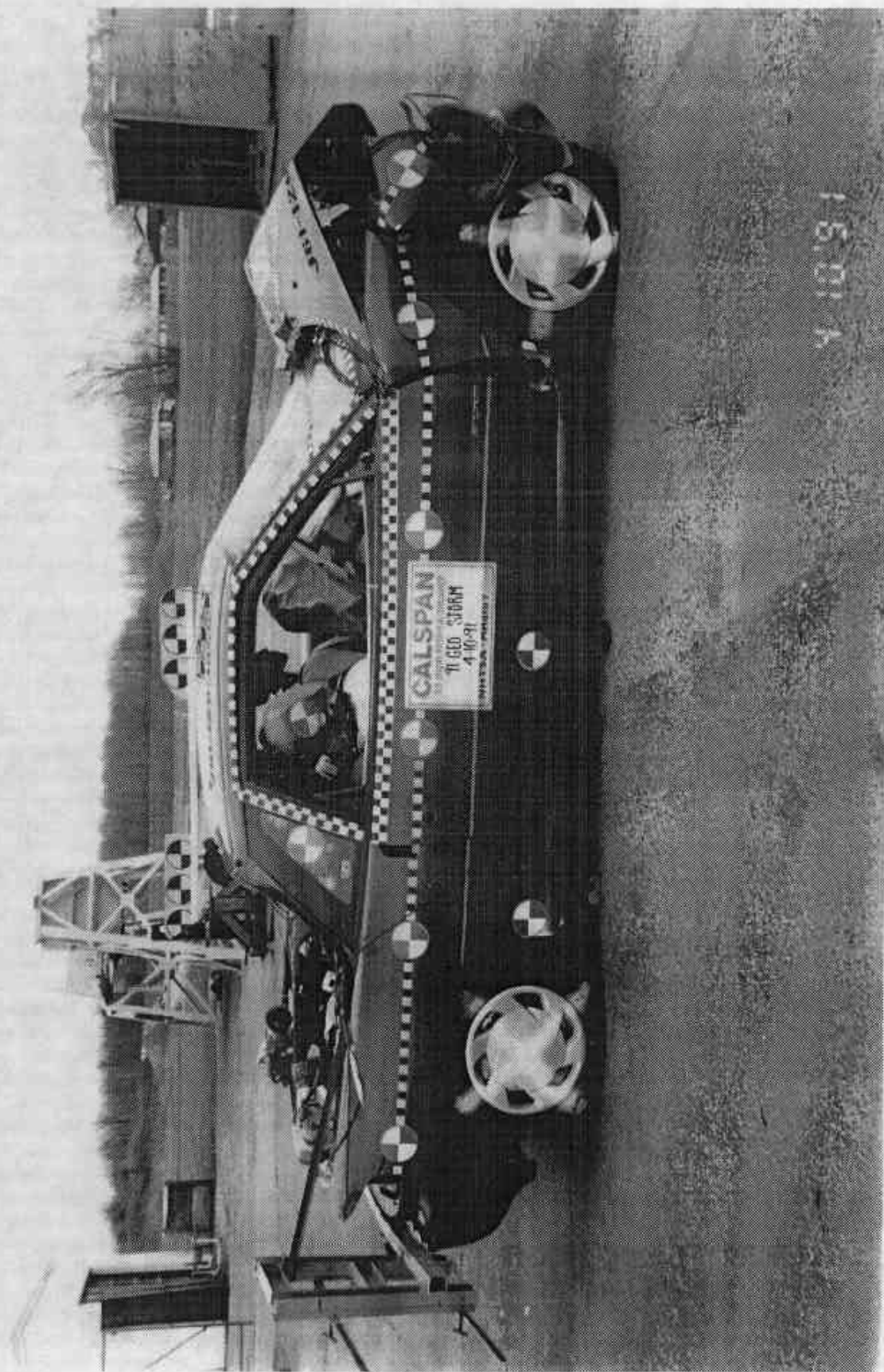


Figure A-7 POST-TEST RIGHT SIDE VIEW



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

A-10

7893-8

4 10 81

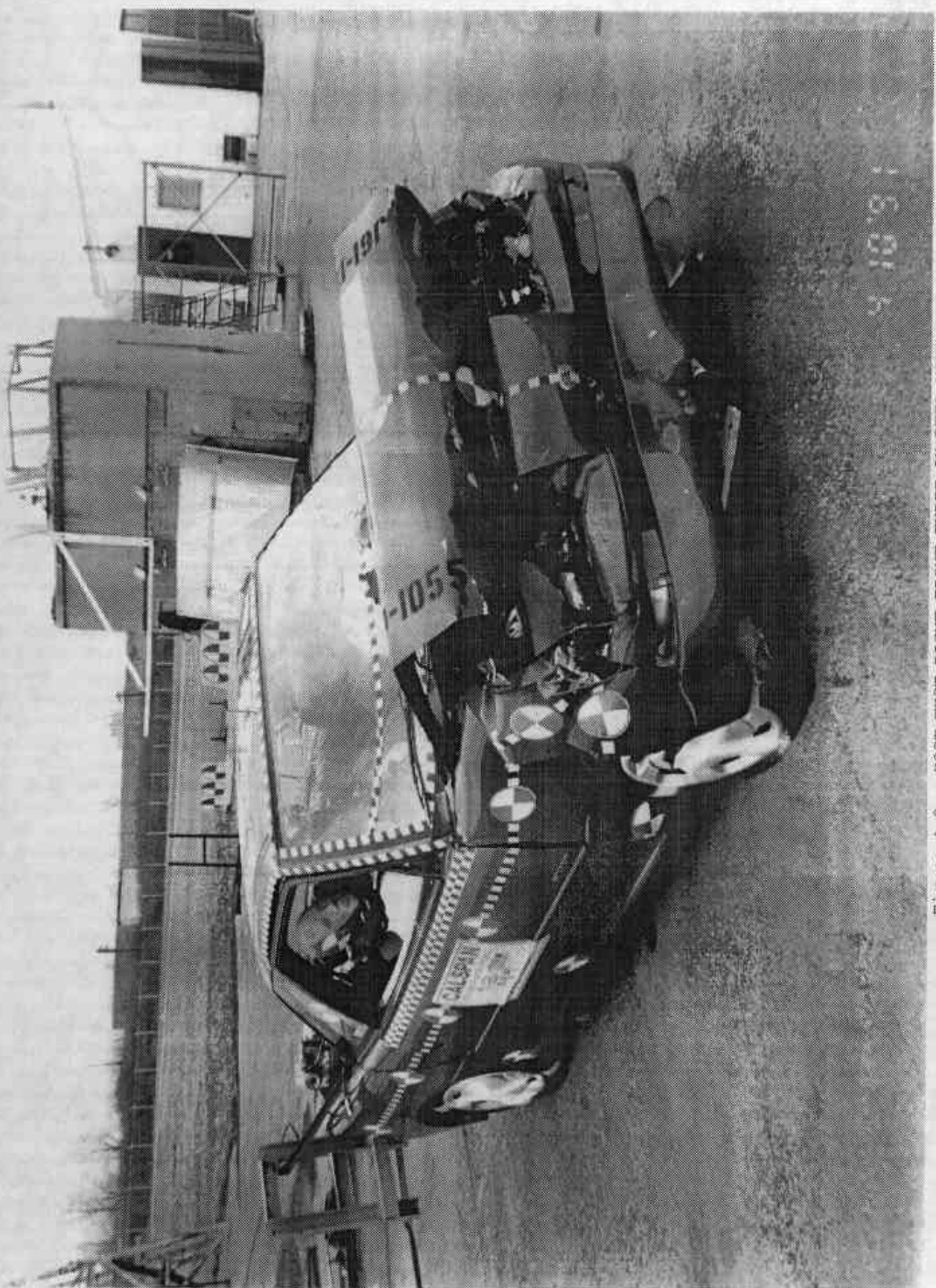


Figure A-9 POST-TEST RIGHT FRONT THREE-QUARTER VIEW

A-11

7893-8

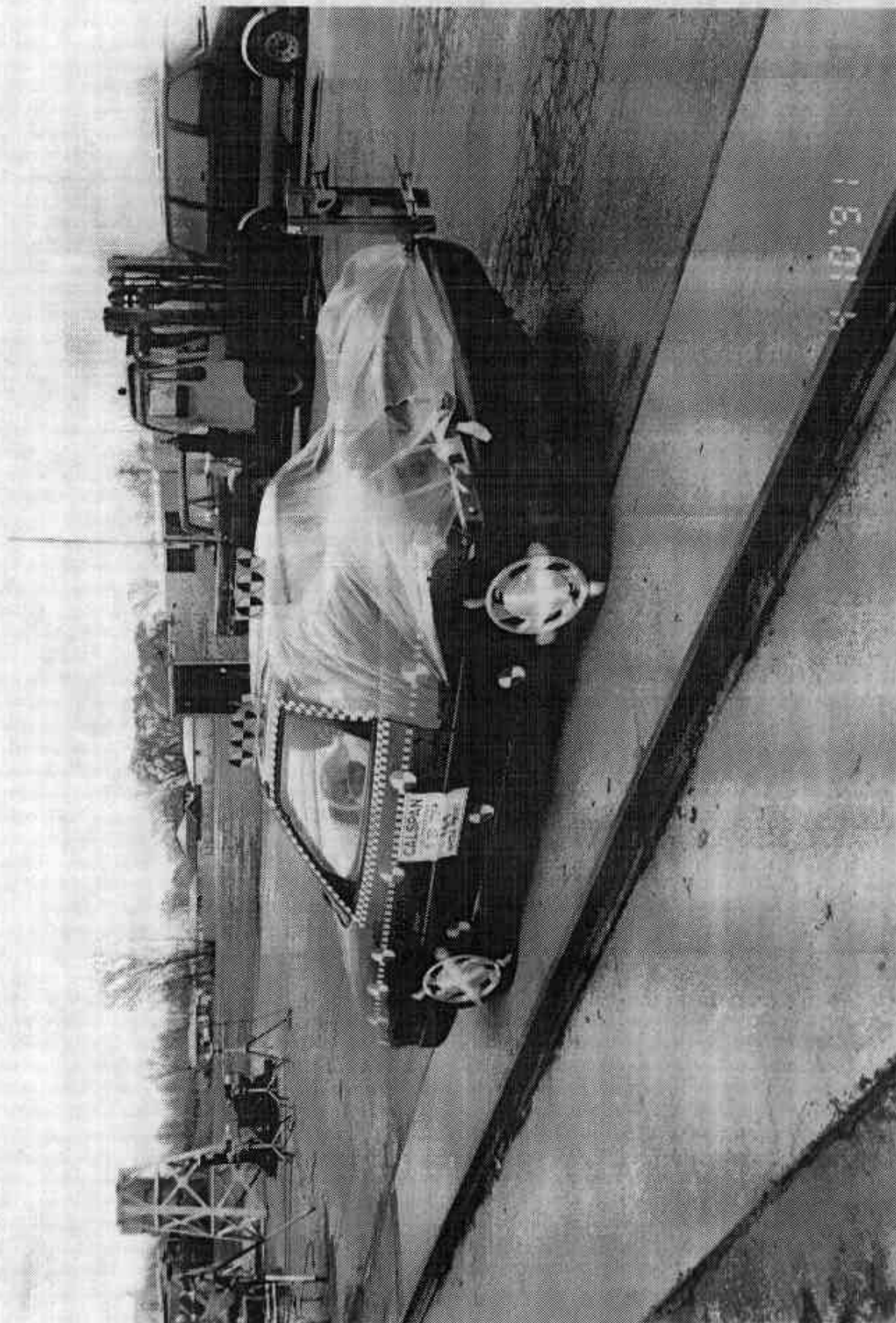


FIGURE A-10 PRE-TEST LEFT REAR THREE-QUARTER VIEW

A-12

7893-8



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

A-13

7893-8

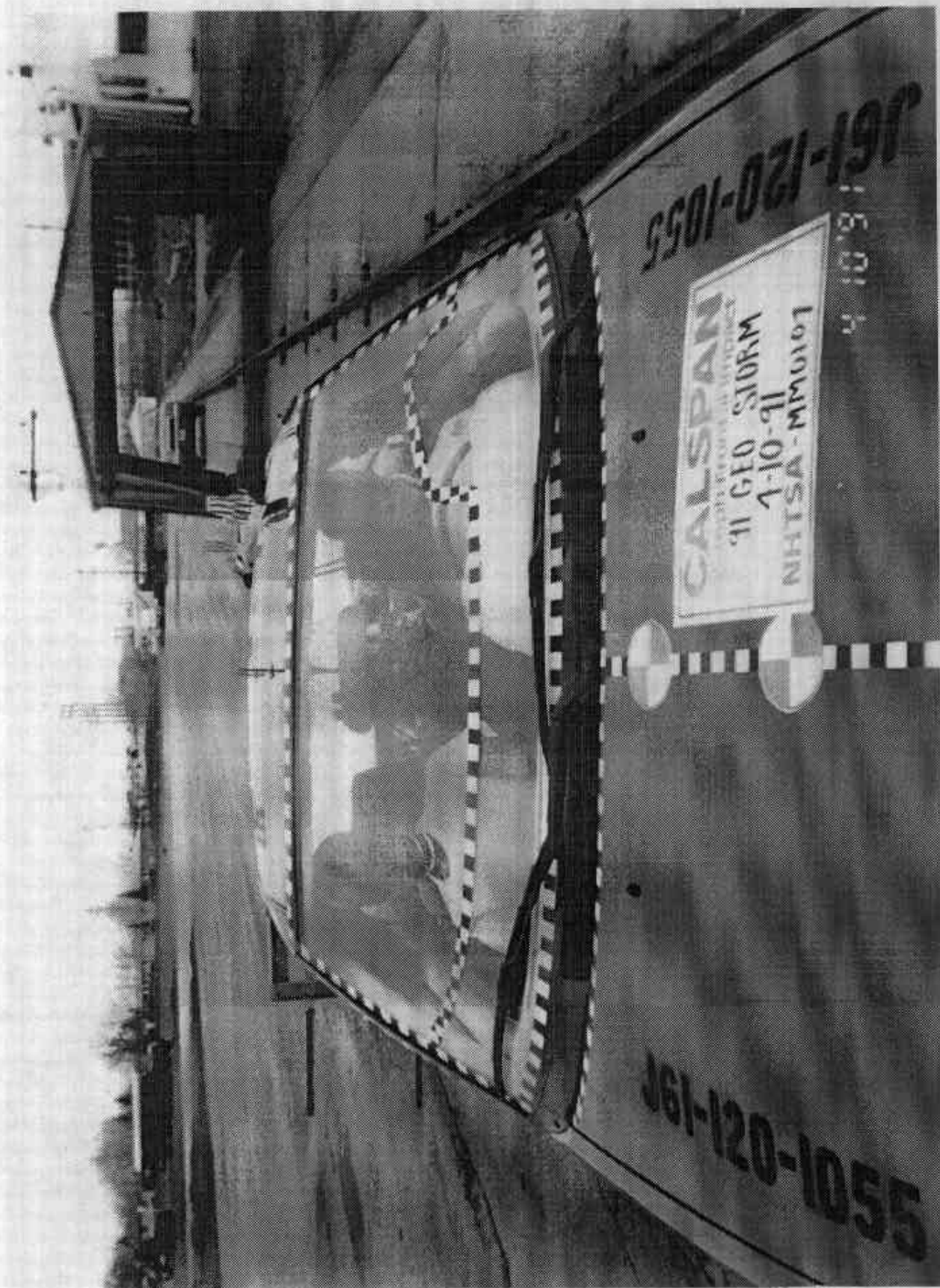


Figure A-12 PRE-TEST WINDSHIELD VIEW



Figure A-13 POST-TEST WINDSHIELD VIEW

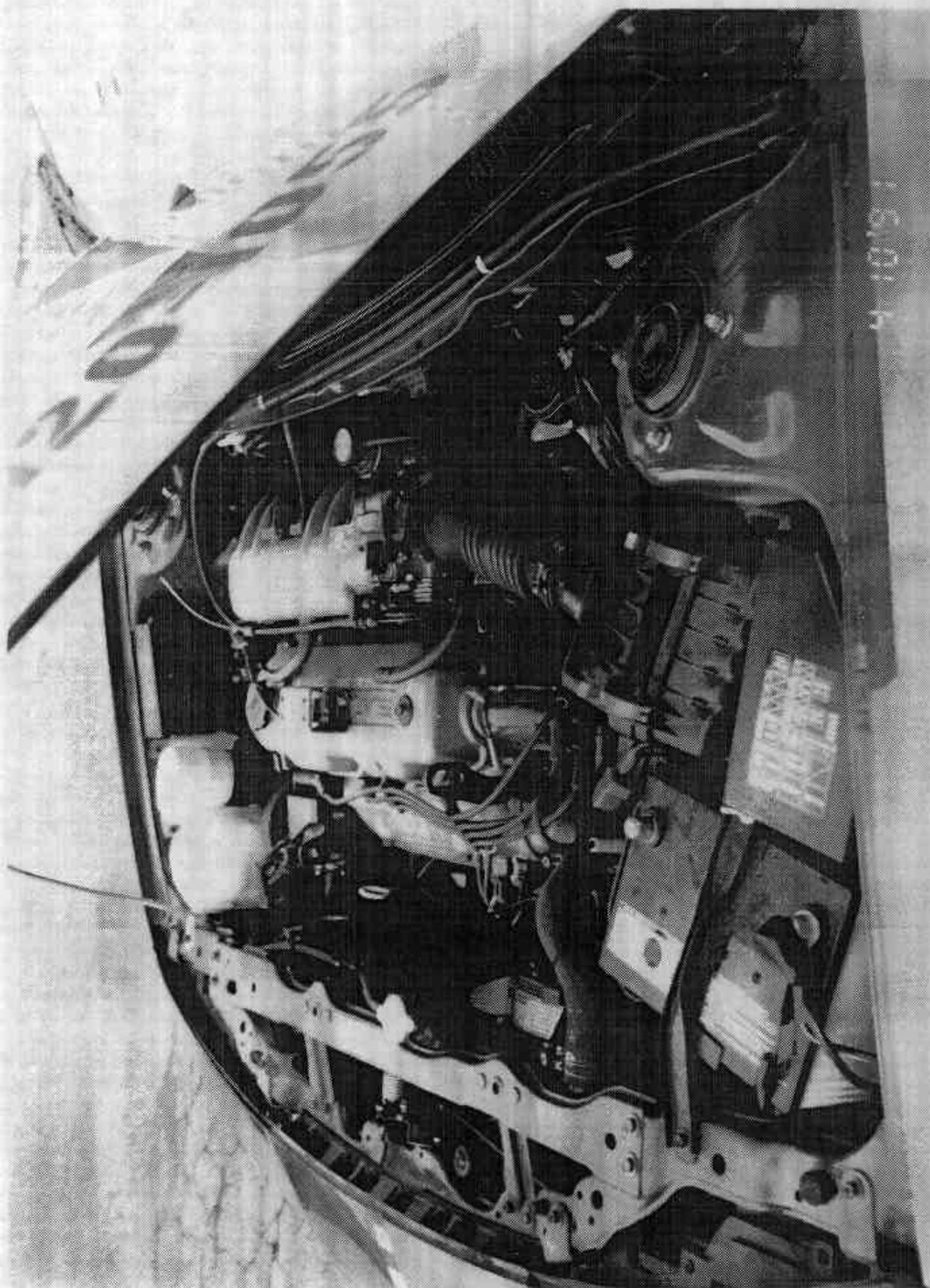


FIGURE A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-16

7893-8

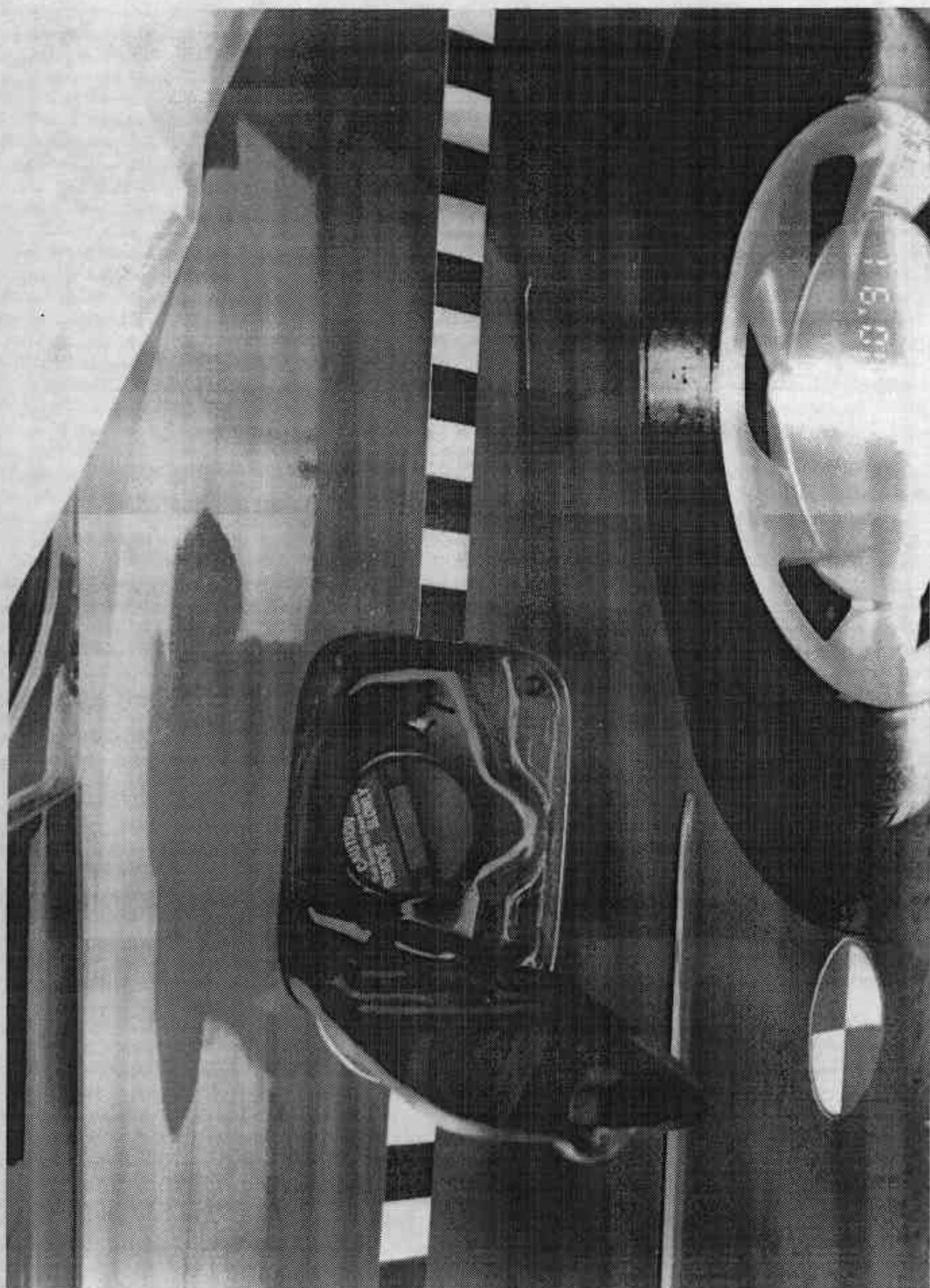


Figure A-15 FUEL CAP VIEW

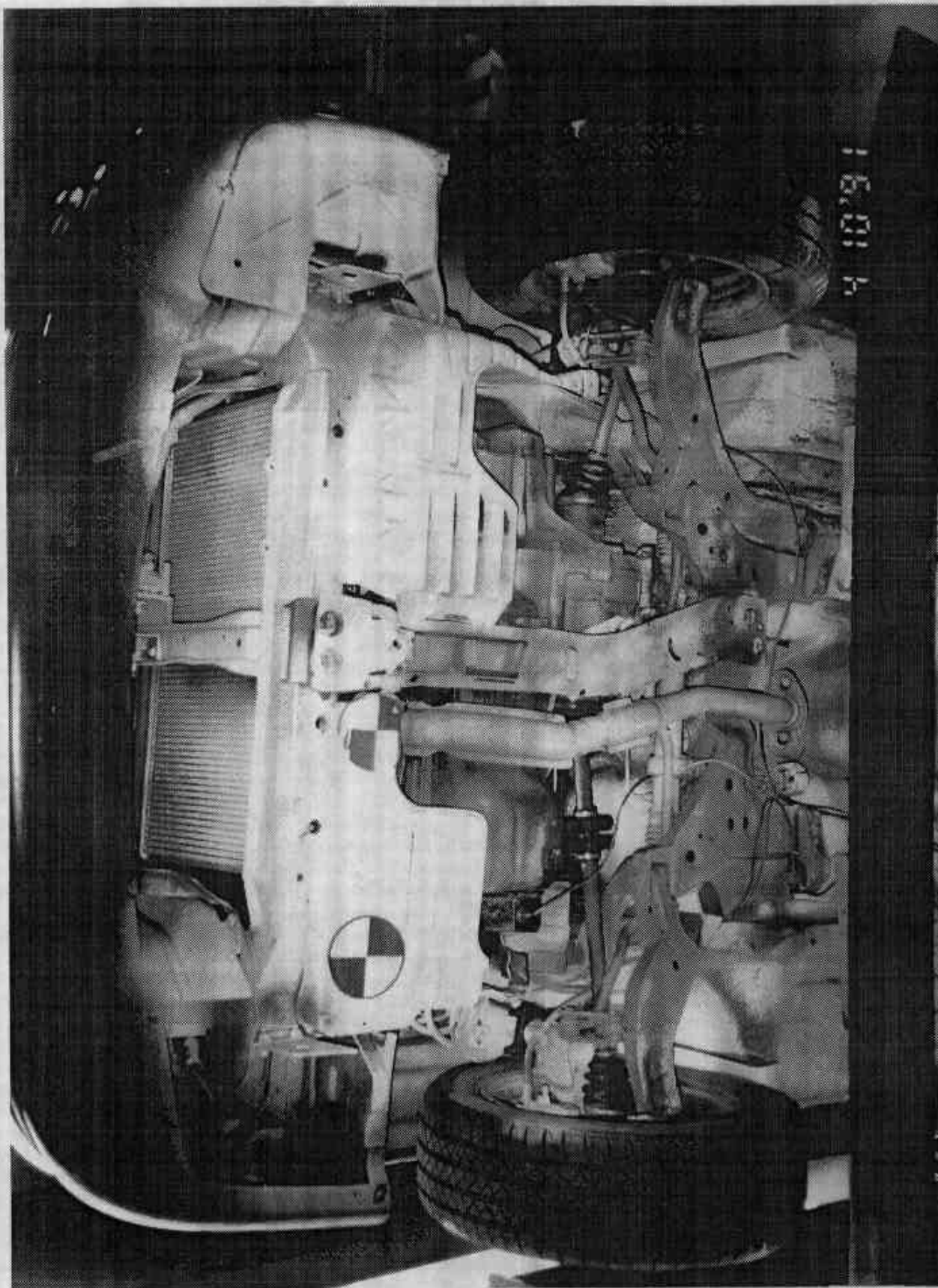


FIGURE A-18 PRE-TEST FRONT UNDERBODY VIEW

A-18

7893-8

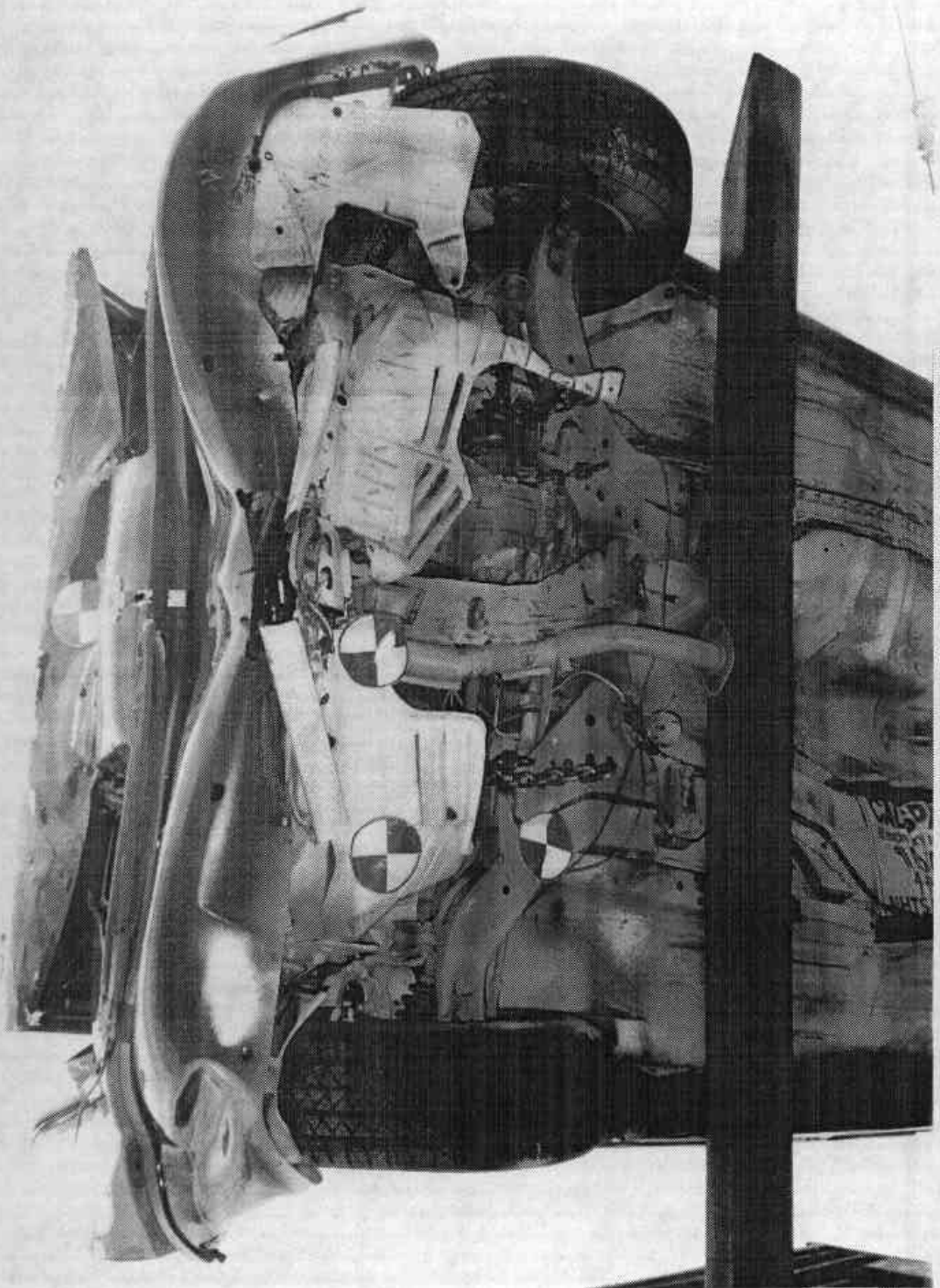


Figure A-17 POST-TEST FRONT UNDERBODY VIEW

A-19

7893-8

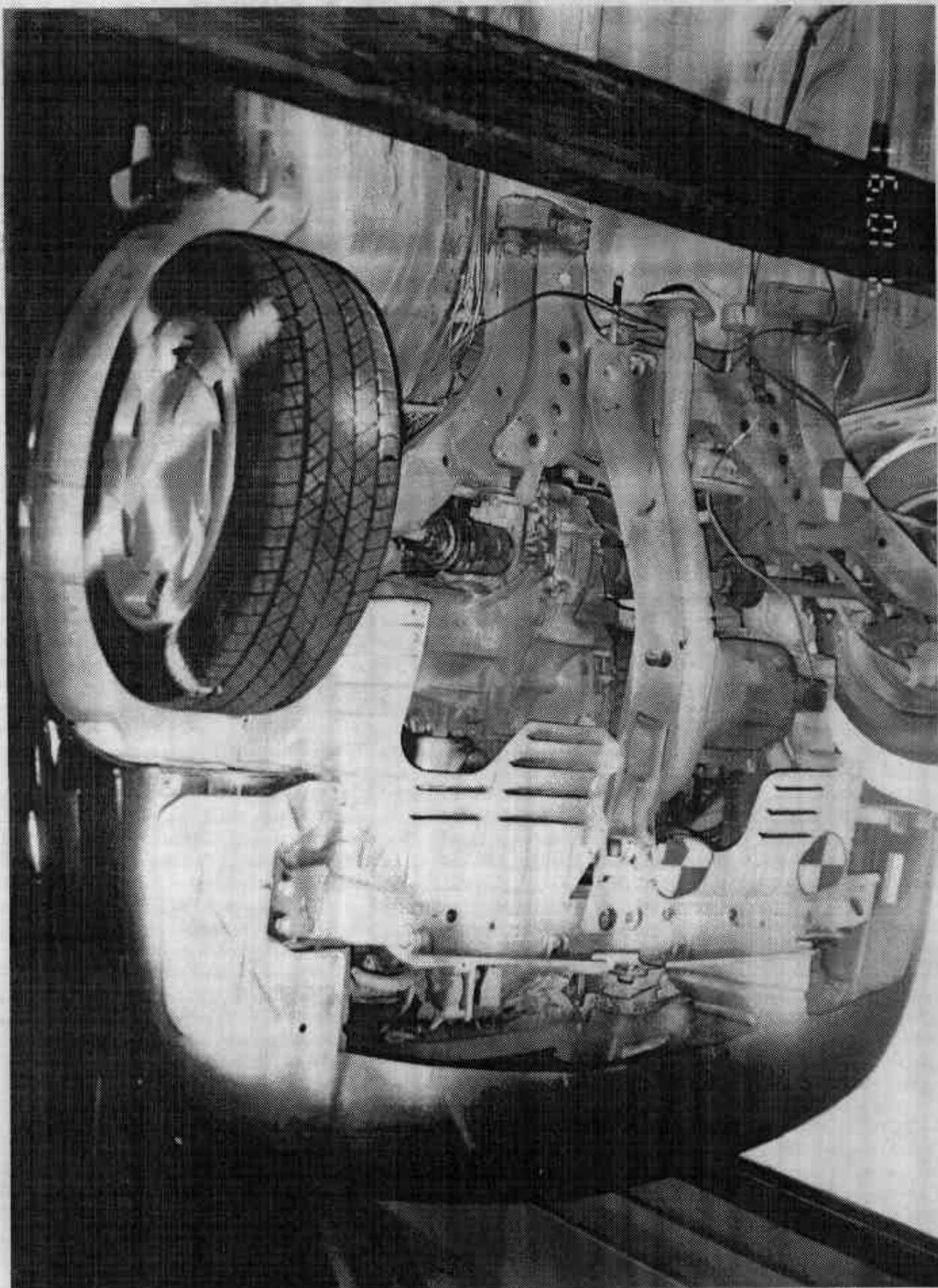


Figure A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW

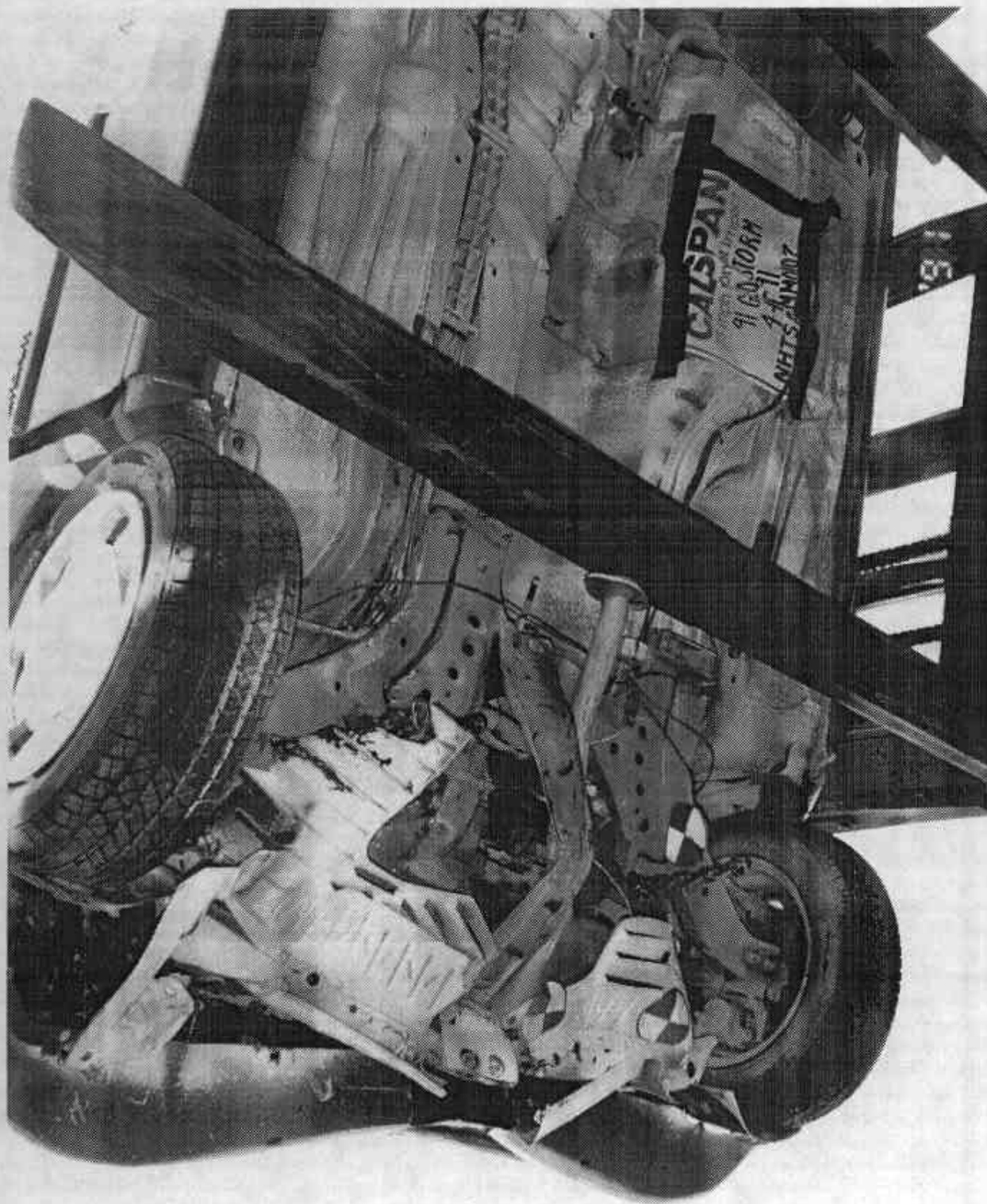


Figure A-19 POST-TEST FRONT SIDE UNDERBODY VIEW

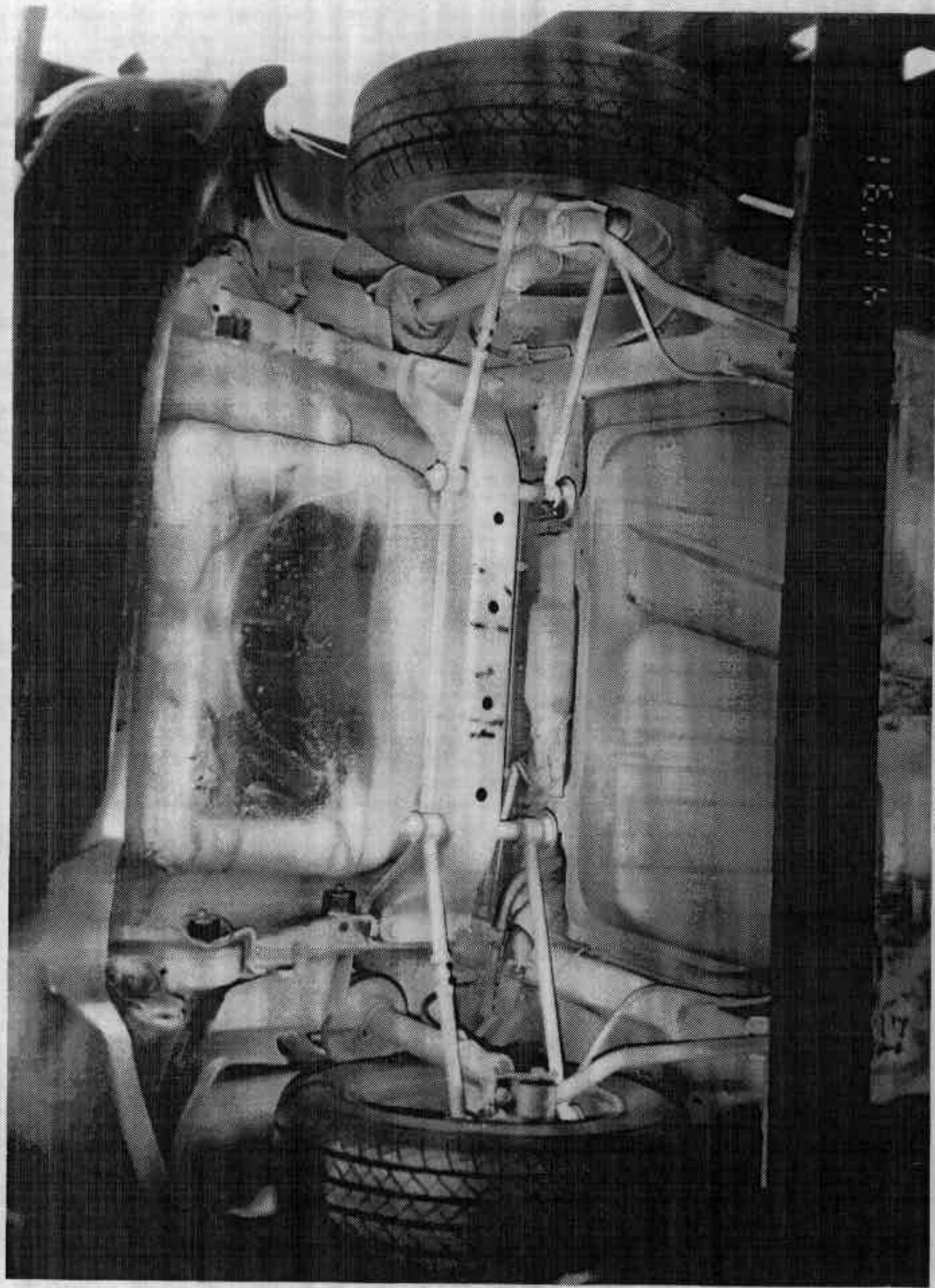


FIGURE A-20 PRE-TEST REAR UNDERBODY VIEW

A-22

7893-8

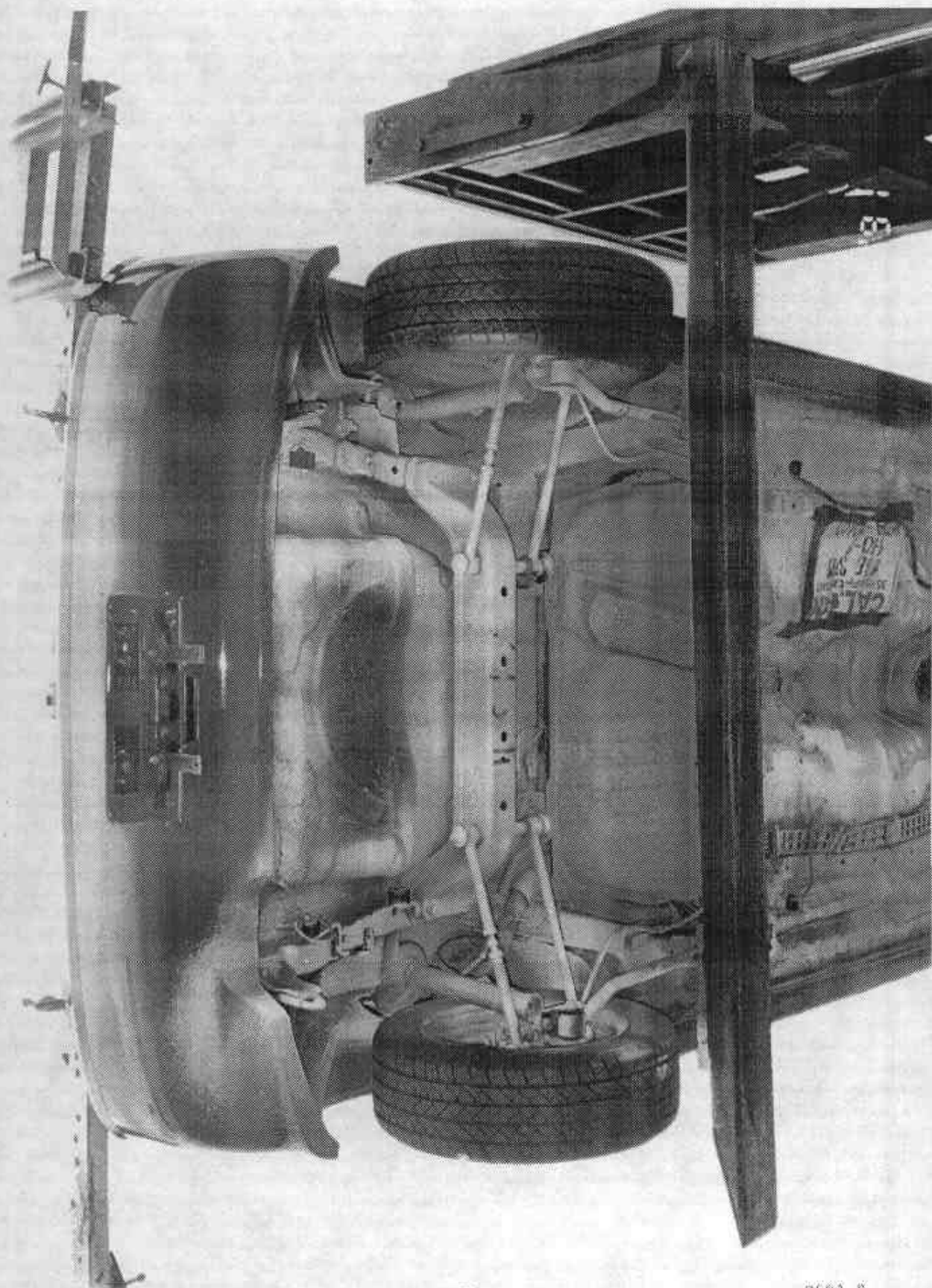


Figure A-21 POST-TEST REAR UNDERBODY VIEW

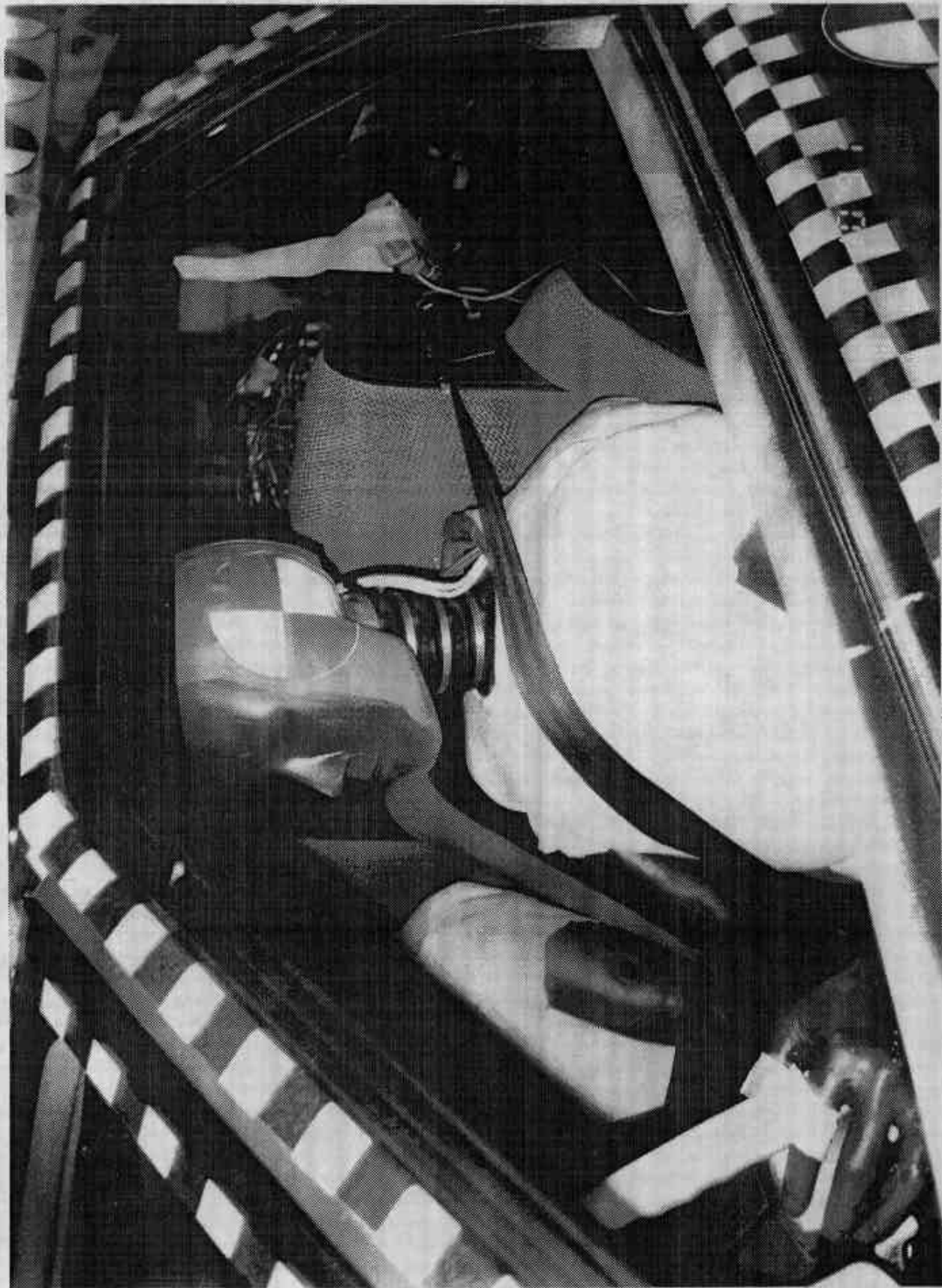


Figure A-21 PRE-TEST DRIVER POSITION VIEW

A-24

7893-8



Figure A-23 POST-TEST DRIVER POSITION VIEW

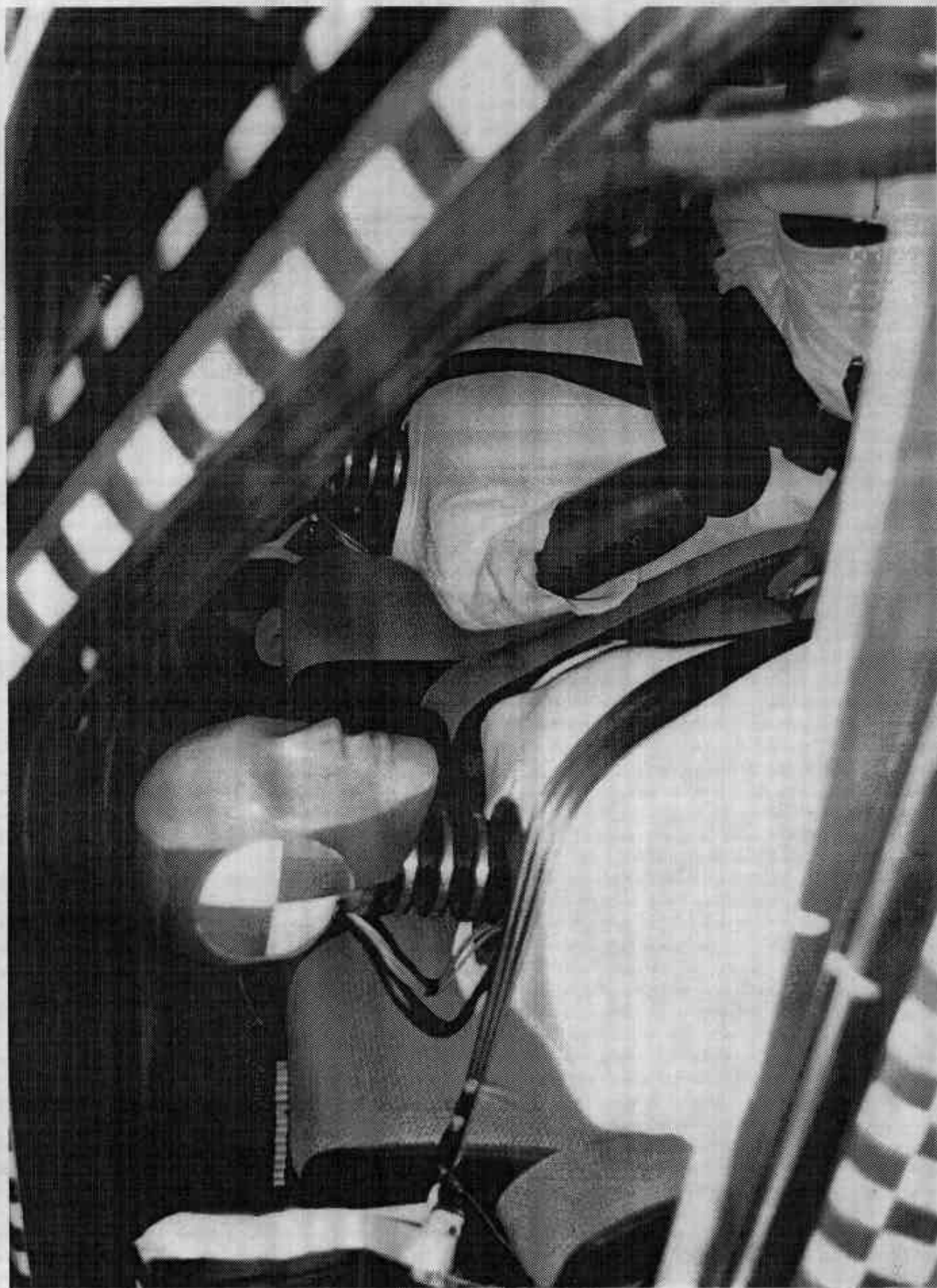


FIGURE A-24 PRE-TEST PASSENGER POSITION VIEW

A-26

7893-8



Figure A-25 POST-TEST PASSENGER POSITION VIEW

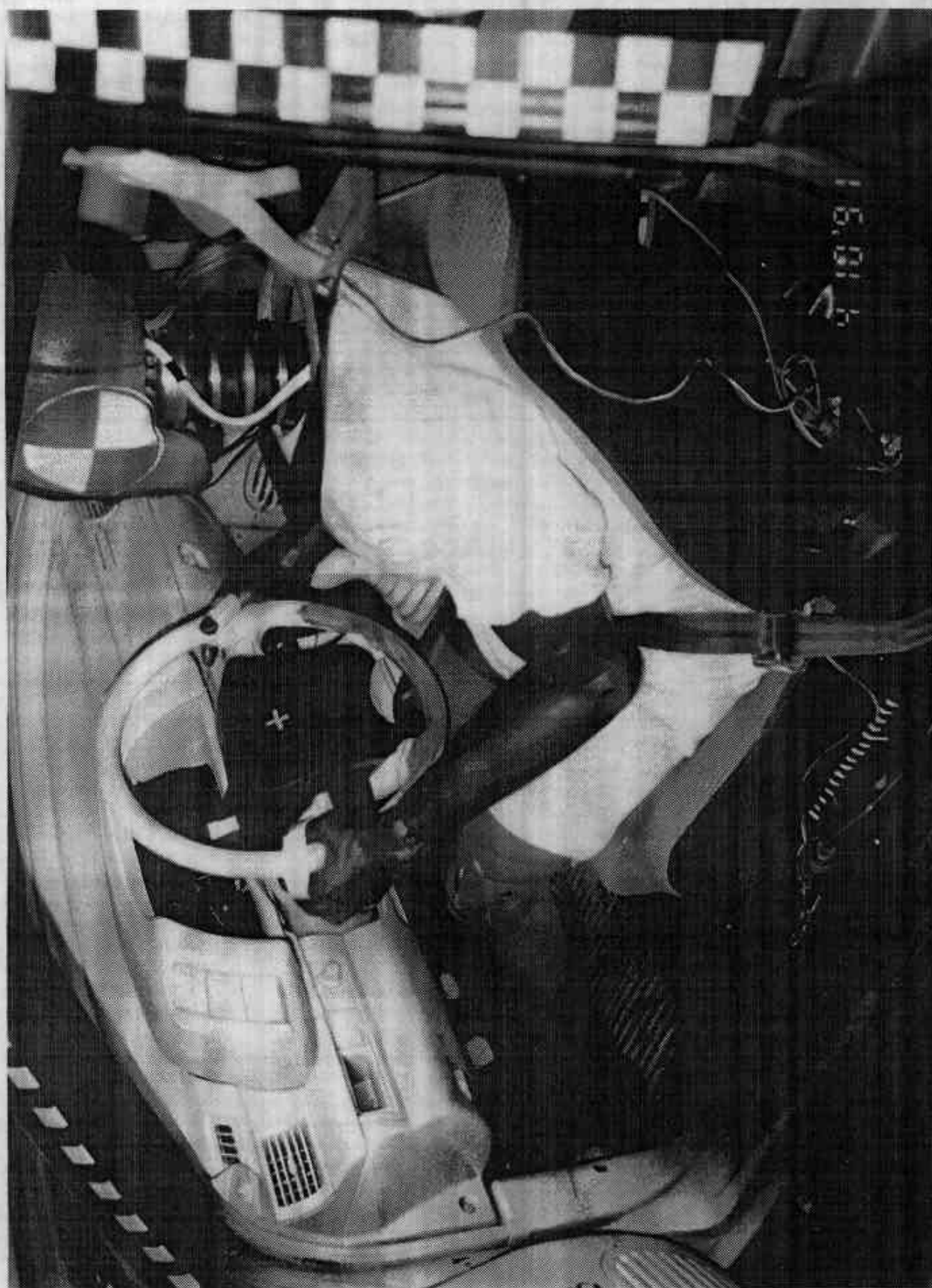


Figure A-26 PRE-TEST DRIVER AND INTERIOR VIEW

A-28

7893-8



Figure A-27 POST-TEST DRIVER AND INTERIOR VIEW

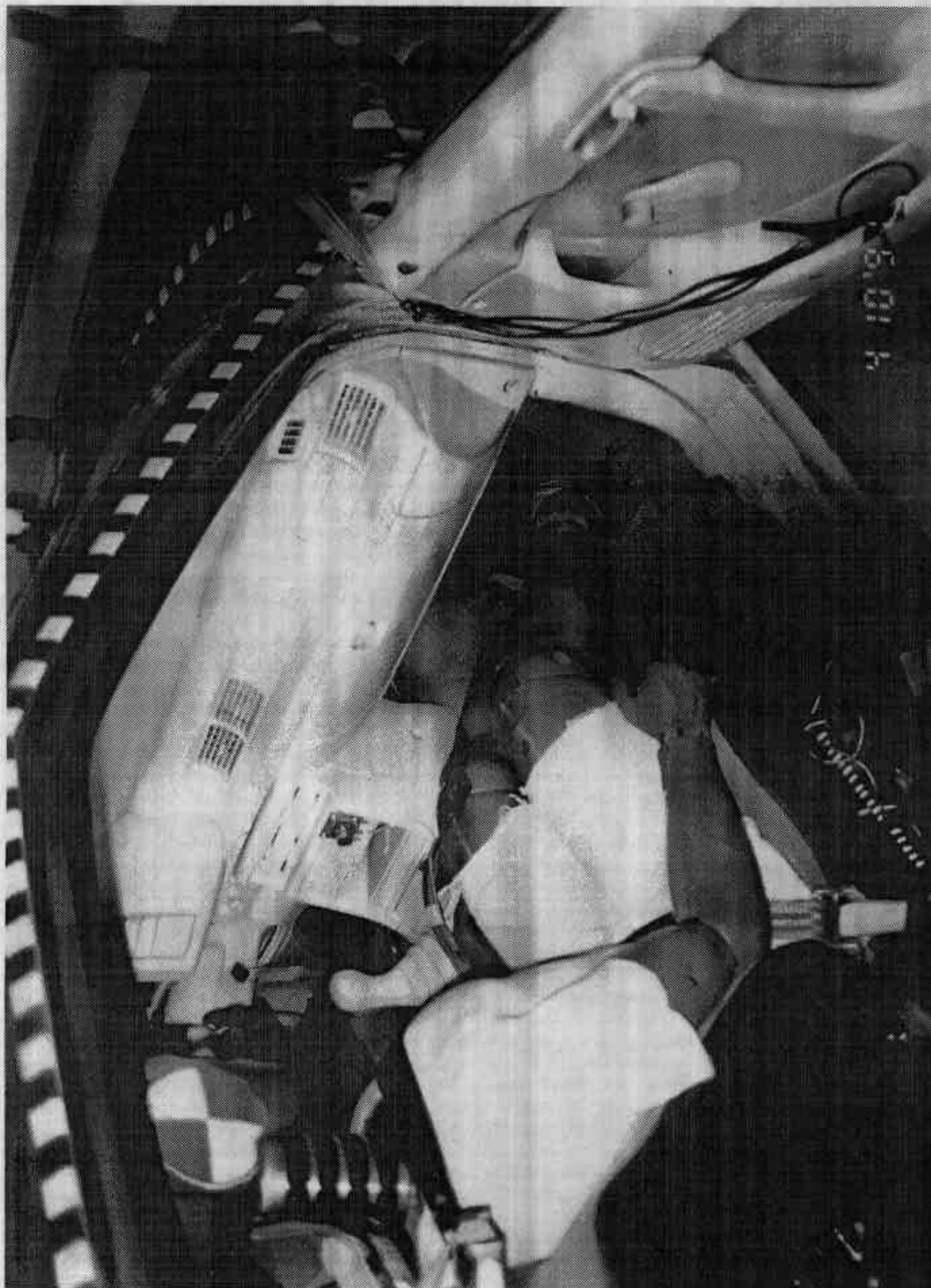


FIGURE A-28 PRE-TEST PASSENGER AND INTERIOR VIEW

A-30

7893-8

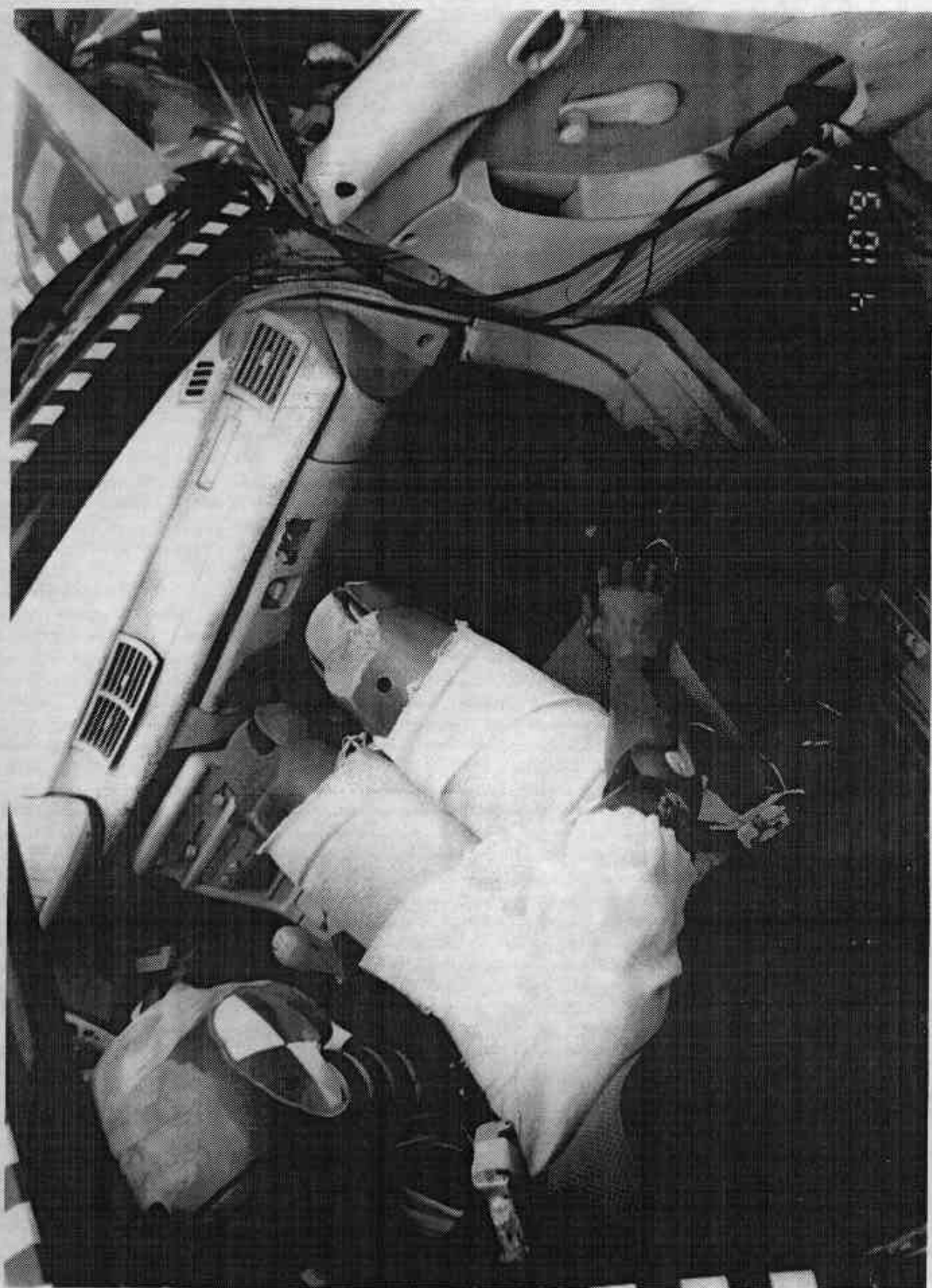


Figure A-29 POST-TEST PASSENGER AND INTERIOR VIEW

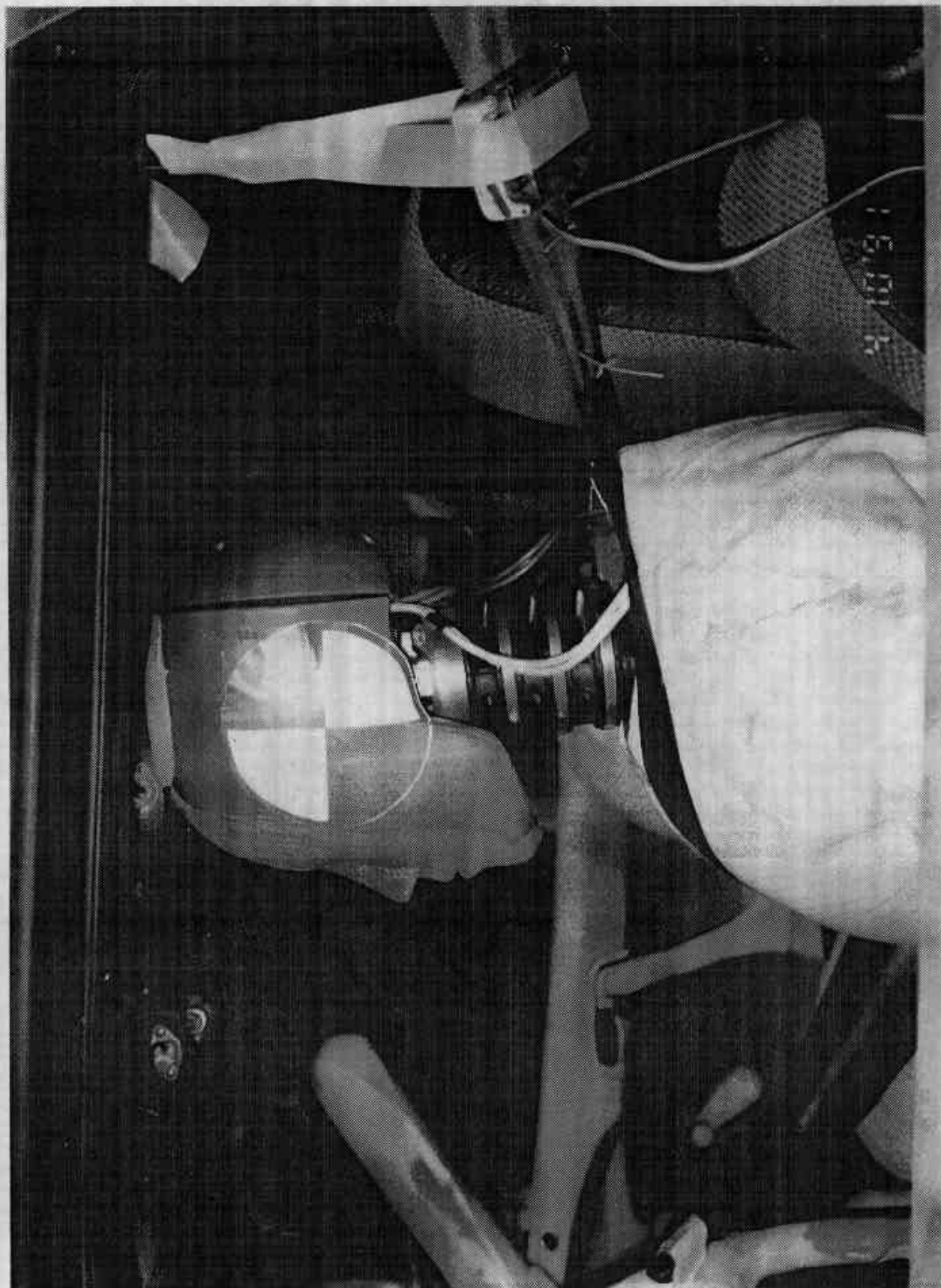


FIGURE A-30. PRE-TEST DRIVER HEAD LOCATION

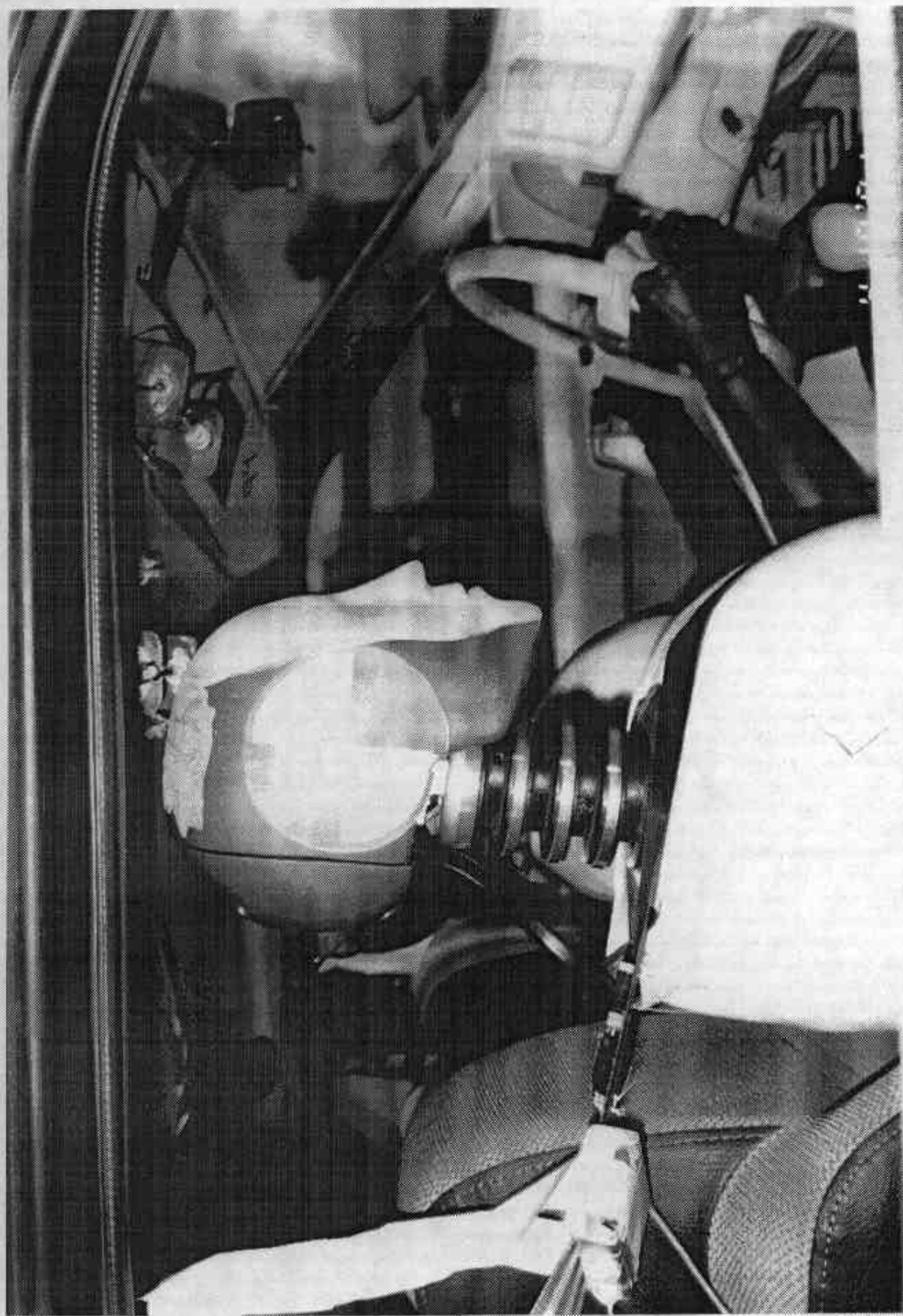
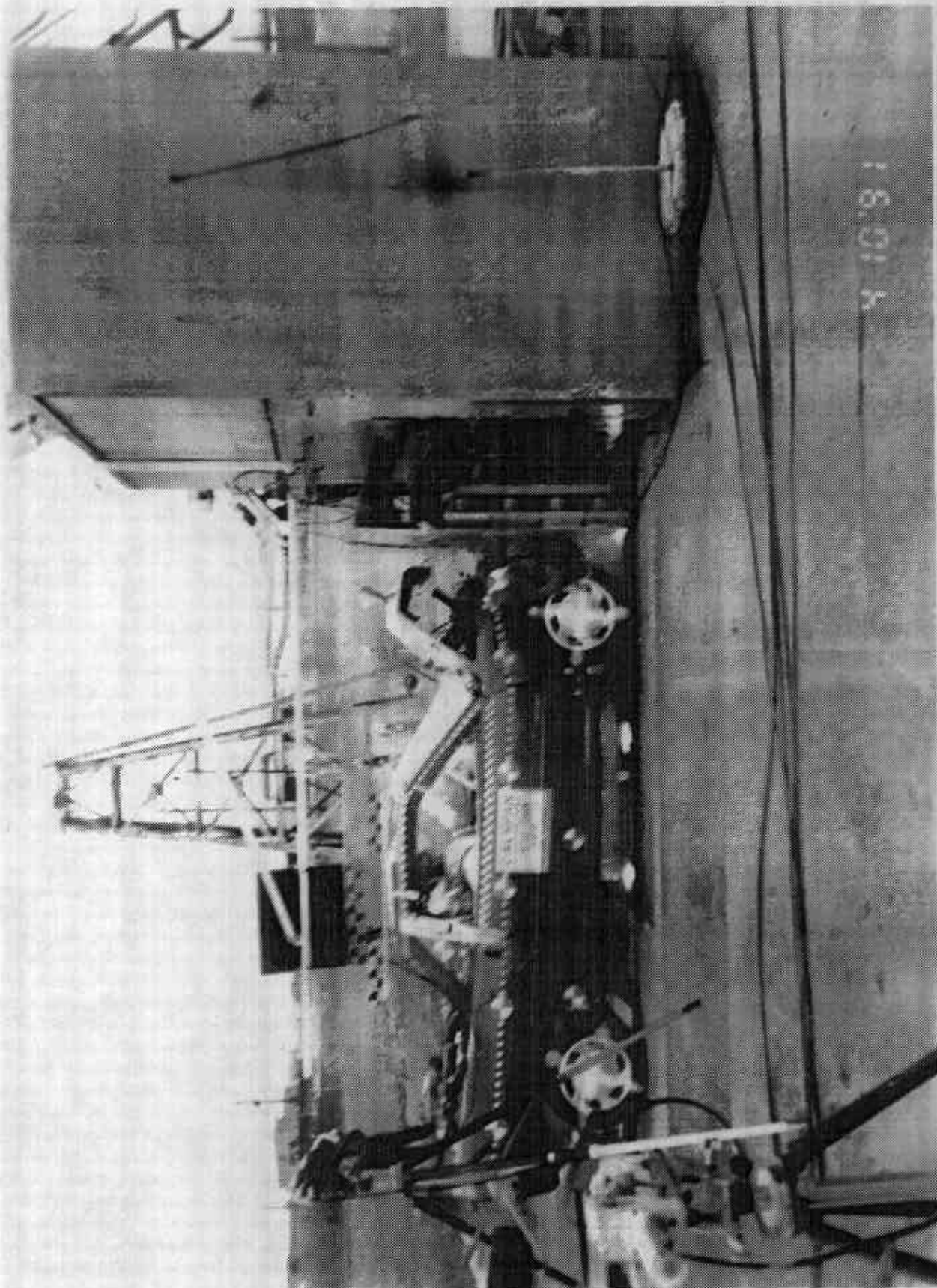


Figure A-31 PRE-TEST PASSENGER HEAD LOCATION

A-33

7893-8



A-34

7893-8

Figure A-32 IMPACT VIEW

4 10' 9"

Appendix B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

TEST NO. MM0107

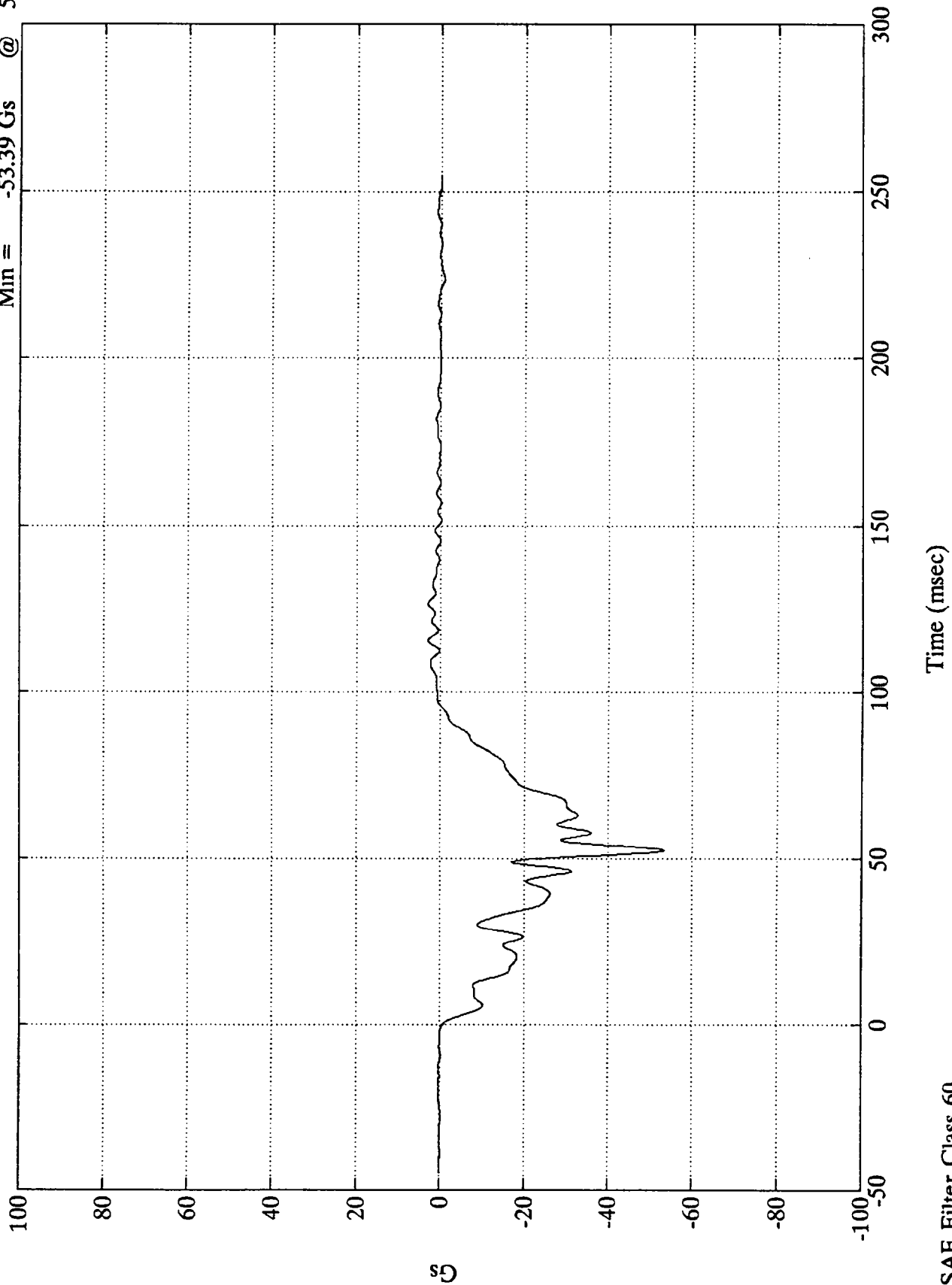
VEHICLE DATA

FILTER CHANNEL CLASS

60

NCAP TEST #12 1991 GEO STORM

Acc. #1(x) Max = 2.94 Gs @ 115.32 msec
 Min = -53.39 Gs @ 52.56 msec



B-3

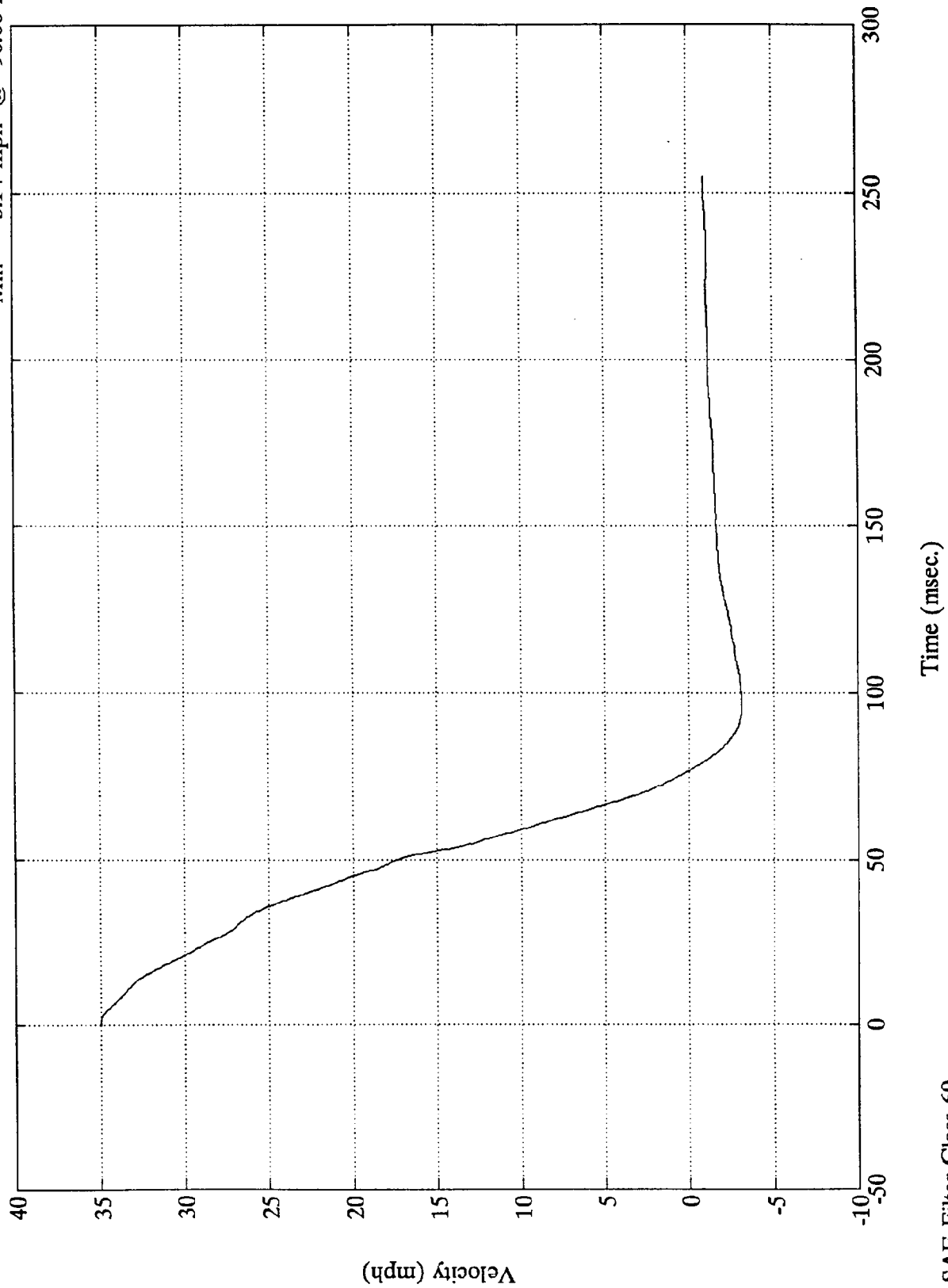
7893-8

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Max = 35.00 mph @ 0.24 msec
Min = -3.14 mph @ 96.00 msec

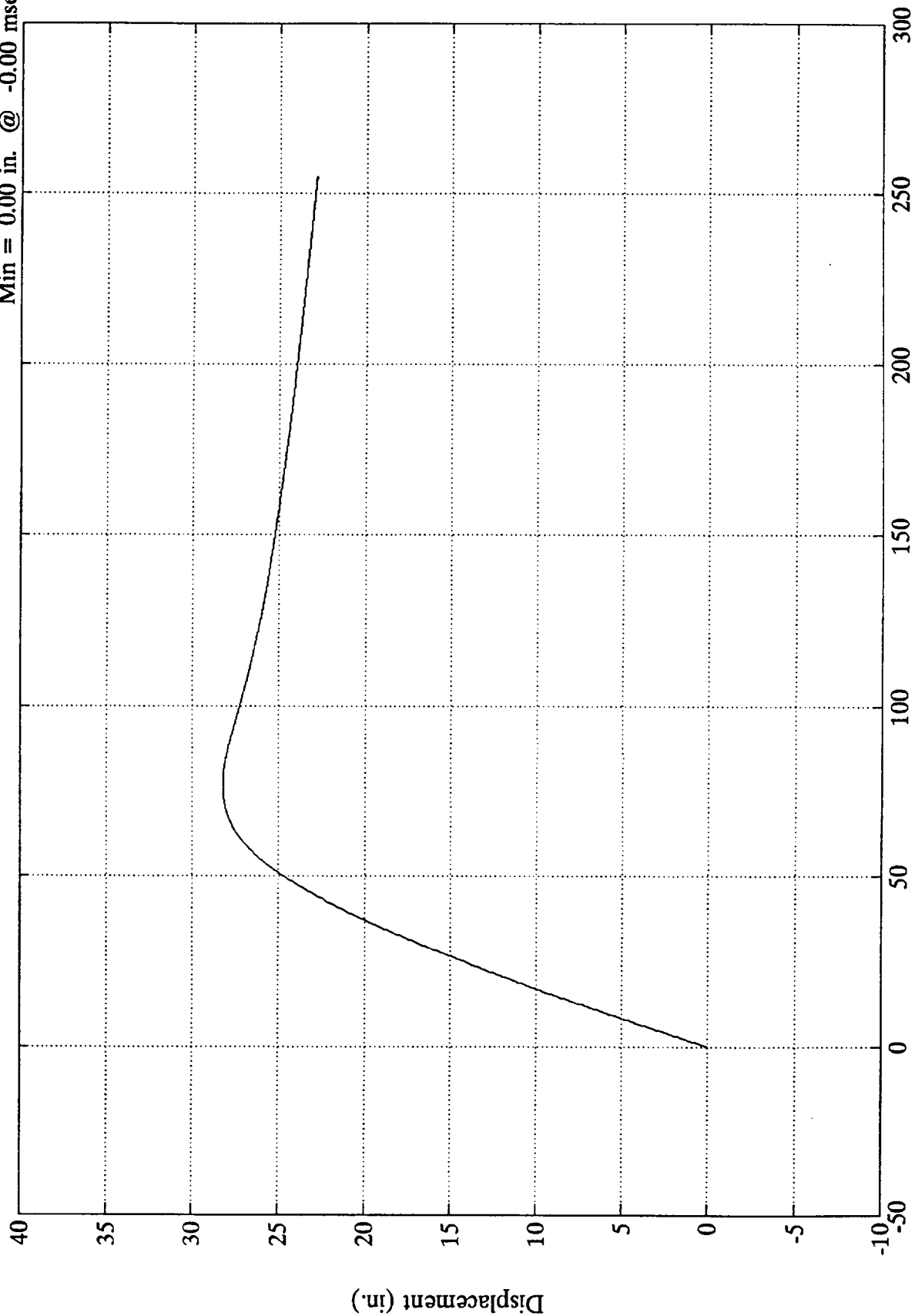
Acc. #1(x)



NCAP TEST #12 GEO STORM

Max = 28.23 in. @ 78.24 msec
Min = 0.00 in. @ -0.00 msec

Acc. #1(x)



B-5

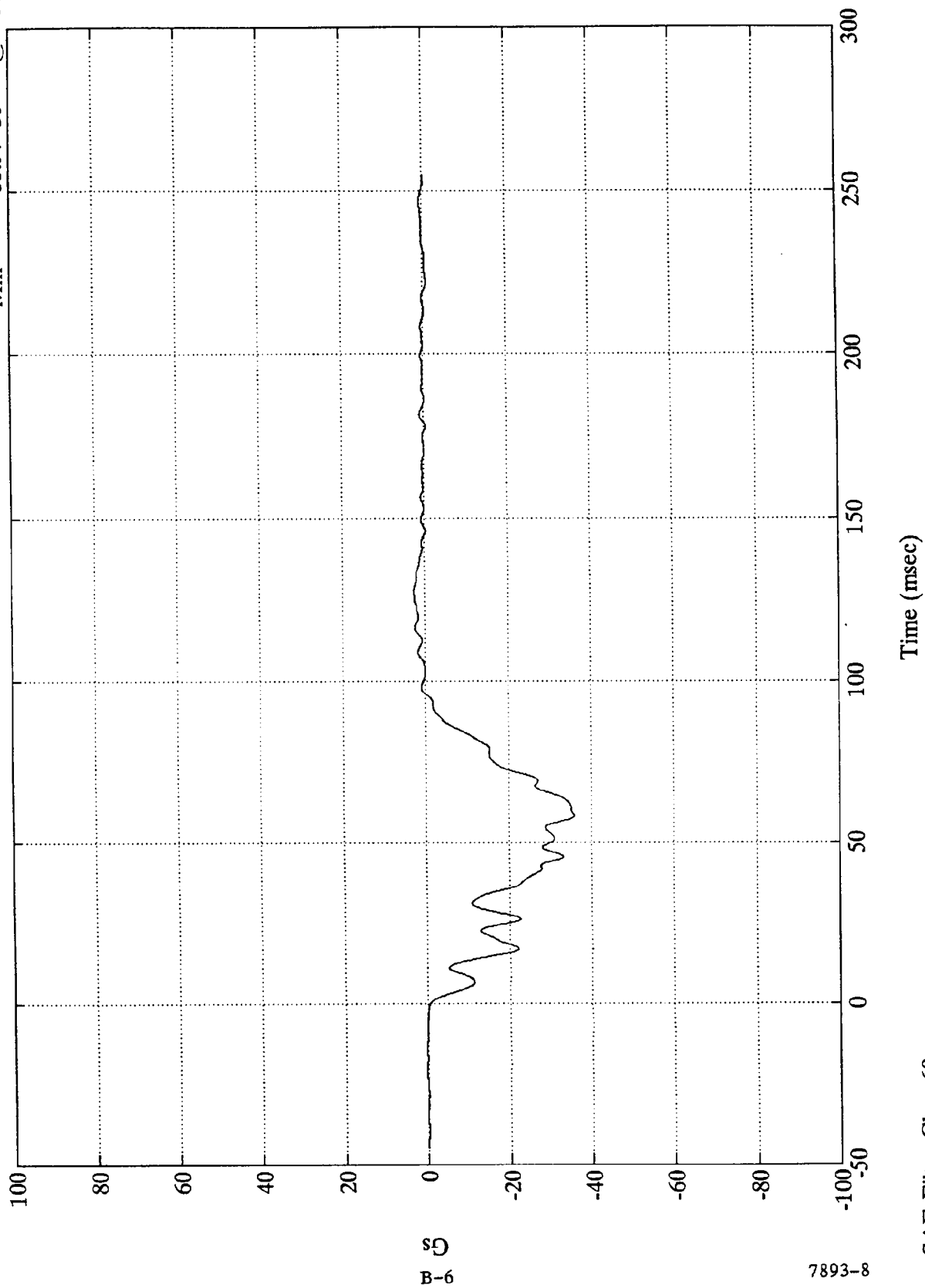
7893-8

Time (msec.)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Acc. #2(x) Max = 2.63 Gs @ 127.44 msec
Min = -35.97 Gs @ 58.43 msec

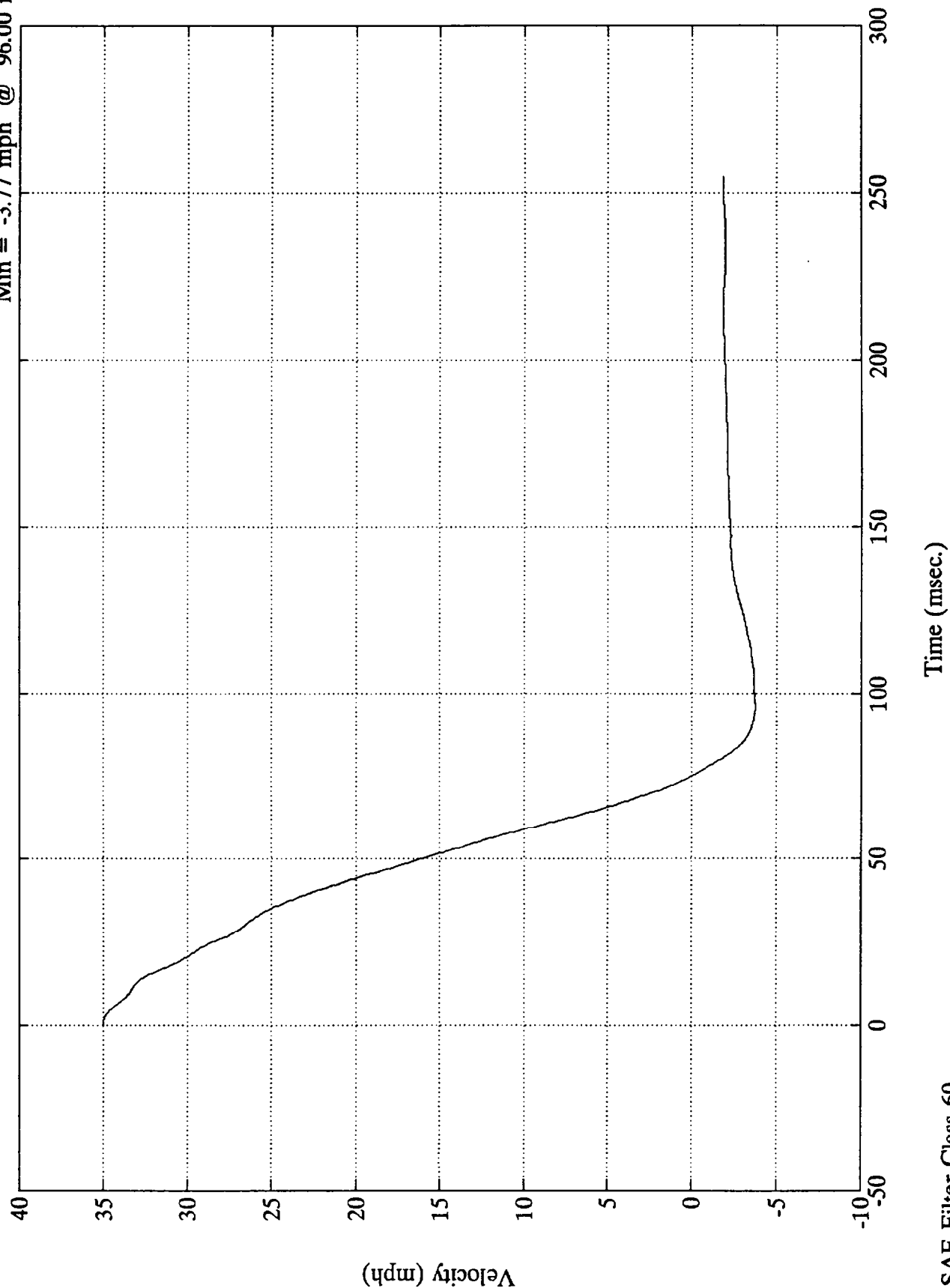


SAE Filter Class 60

NCAP TEST #12 GEO STORM

Max = 35.00 mph @ 0.24 msec
Min = -3.77 mph @ 96.00 msec

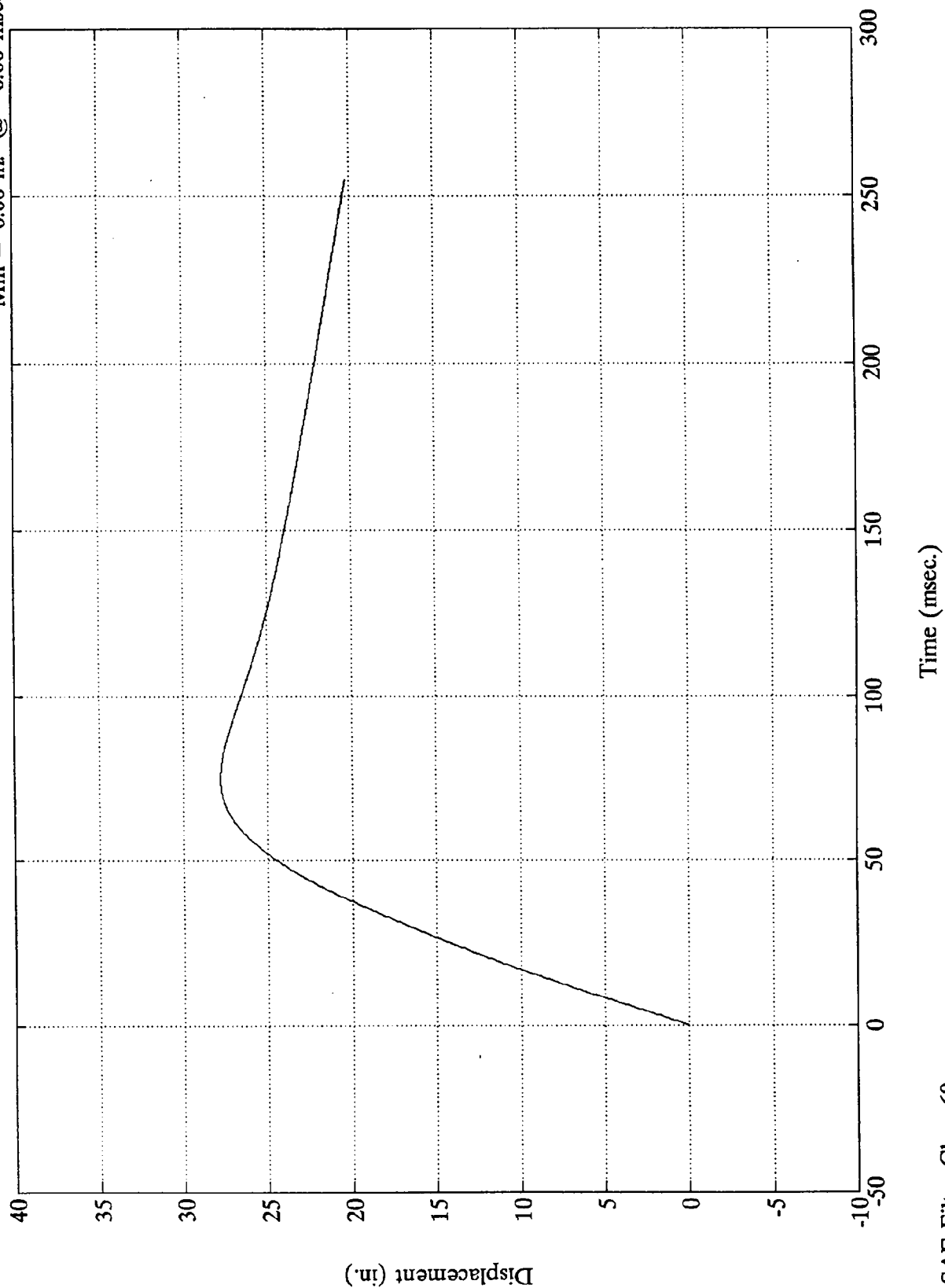
Acc. #2(x)



NCAP TEST #12 GEO STORM

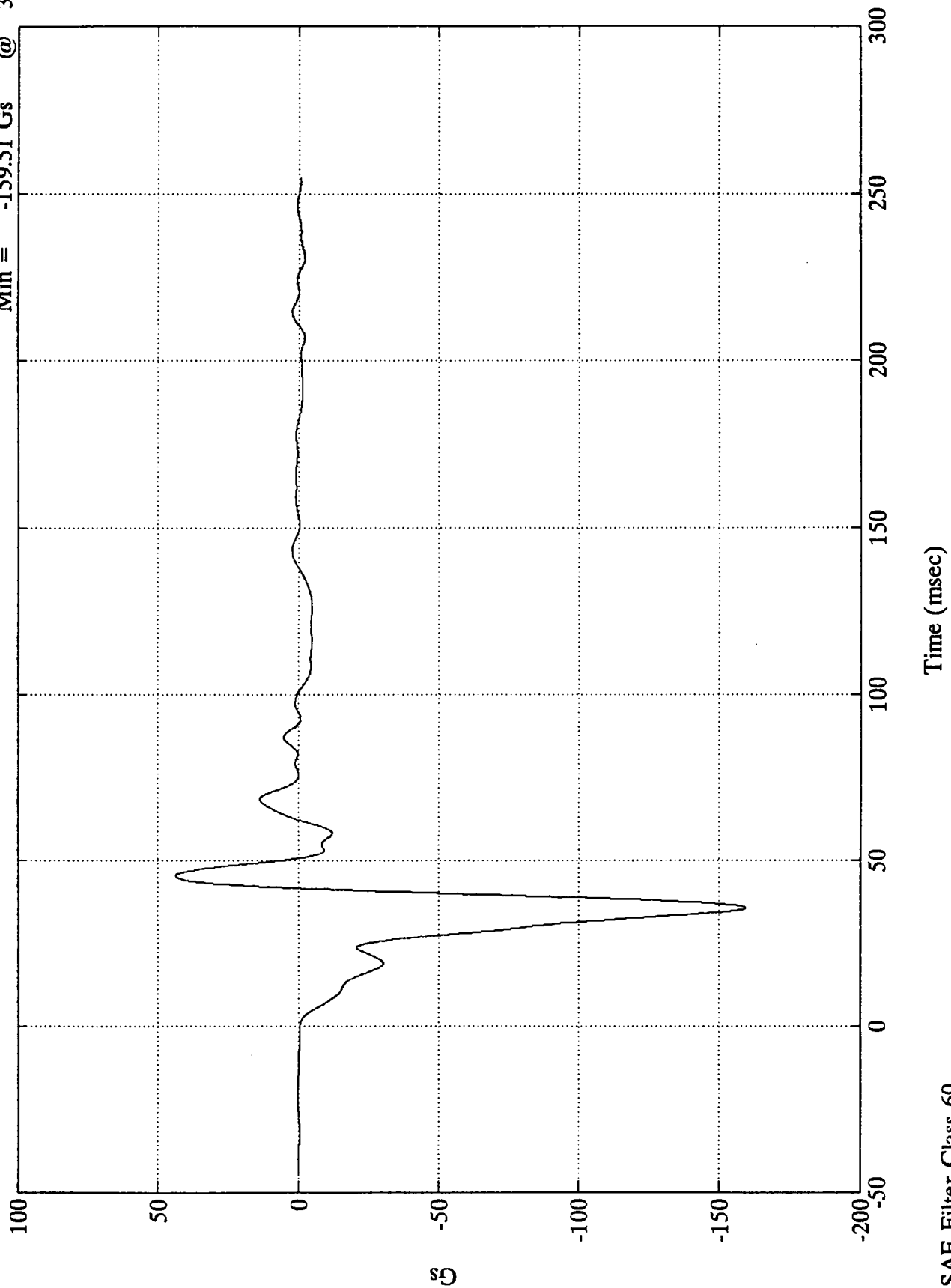
Acc. #2(x)

Max = 27.80 in. @ 75.84 msec
Min = 0.00 in. @ -0.00 msec



NCAP TEST #12 1991 GEO STORM

Acc. #3(x) Max = 43.76 Gs @ 45.48 msec
Min = -159.51 Gs @ 35.88 msec



SD
B-9

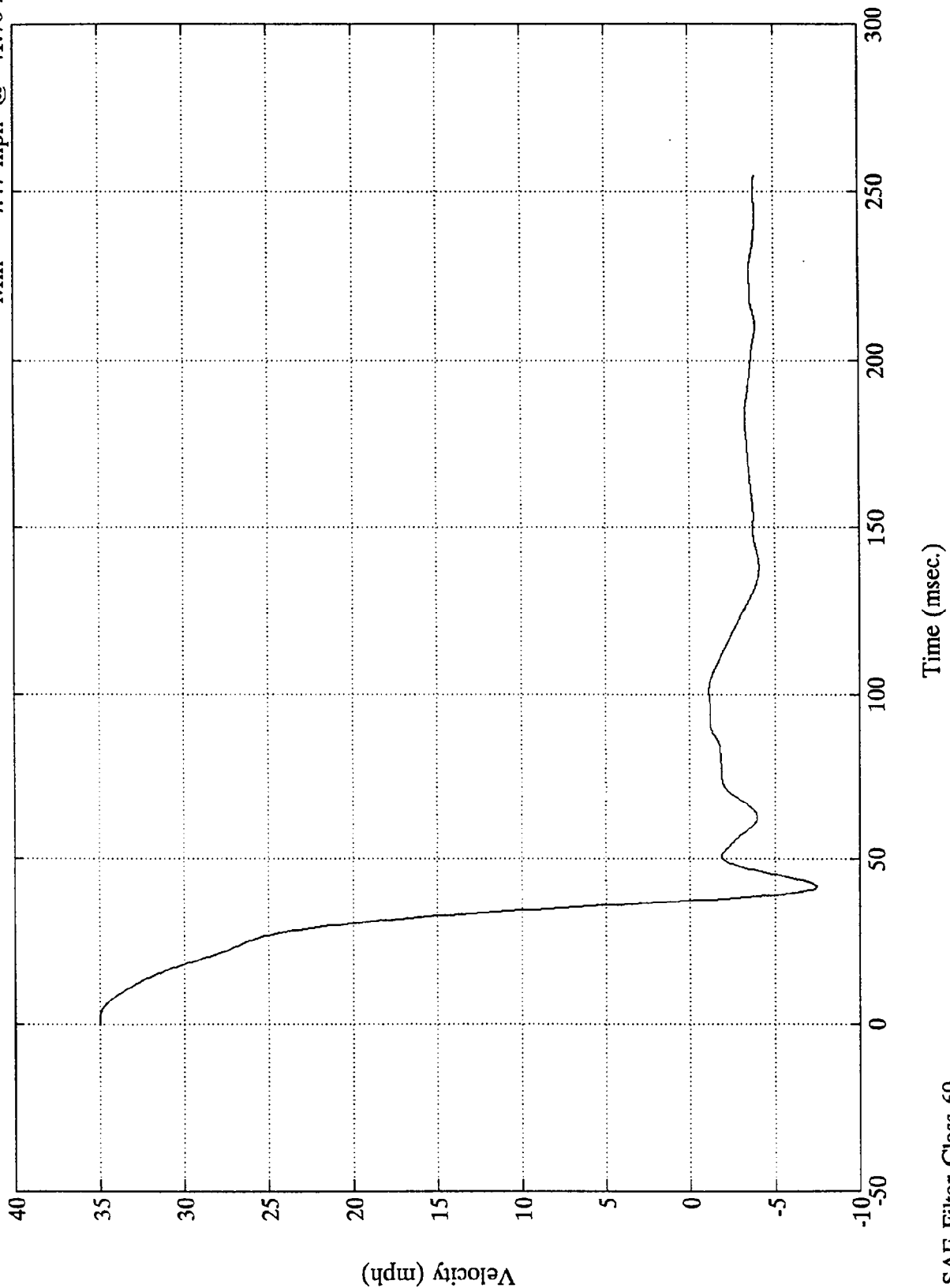
7893-8

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Acc. #3(x)

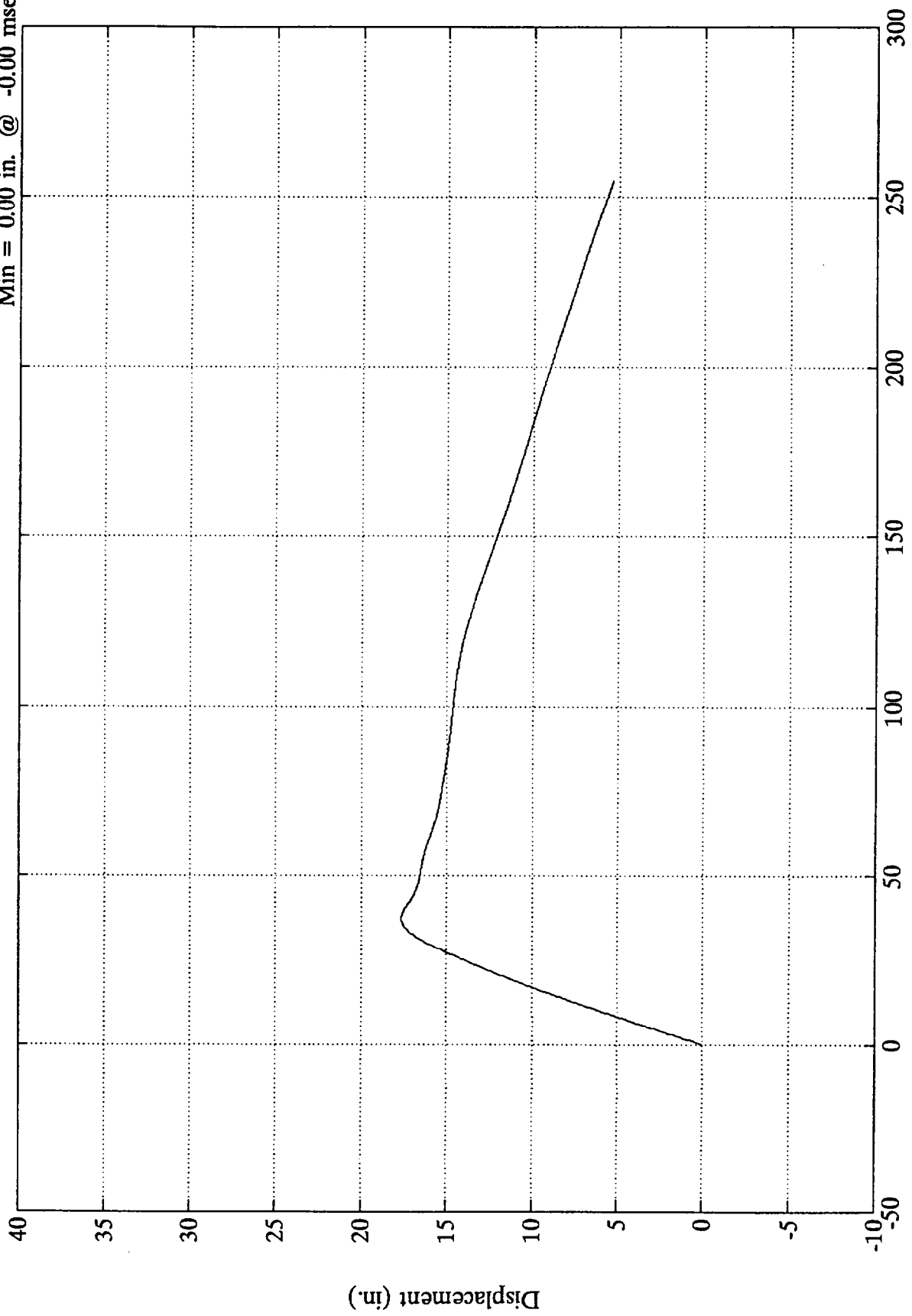
Max = 35.00 mph @ 0.48 msec
Min = -7.47 mph @ 41.76 msec



NCAP TEST #12 GEO STORM

Max = 17.62 in. @ 37.68 msec
Min = 0.00 in. @ -0.00 msec

Acc. #3(x)



SAE Filter Class 60

Time (msec.)

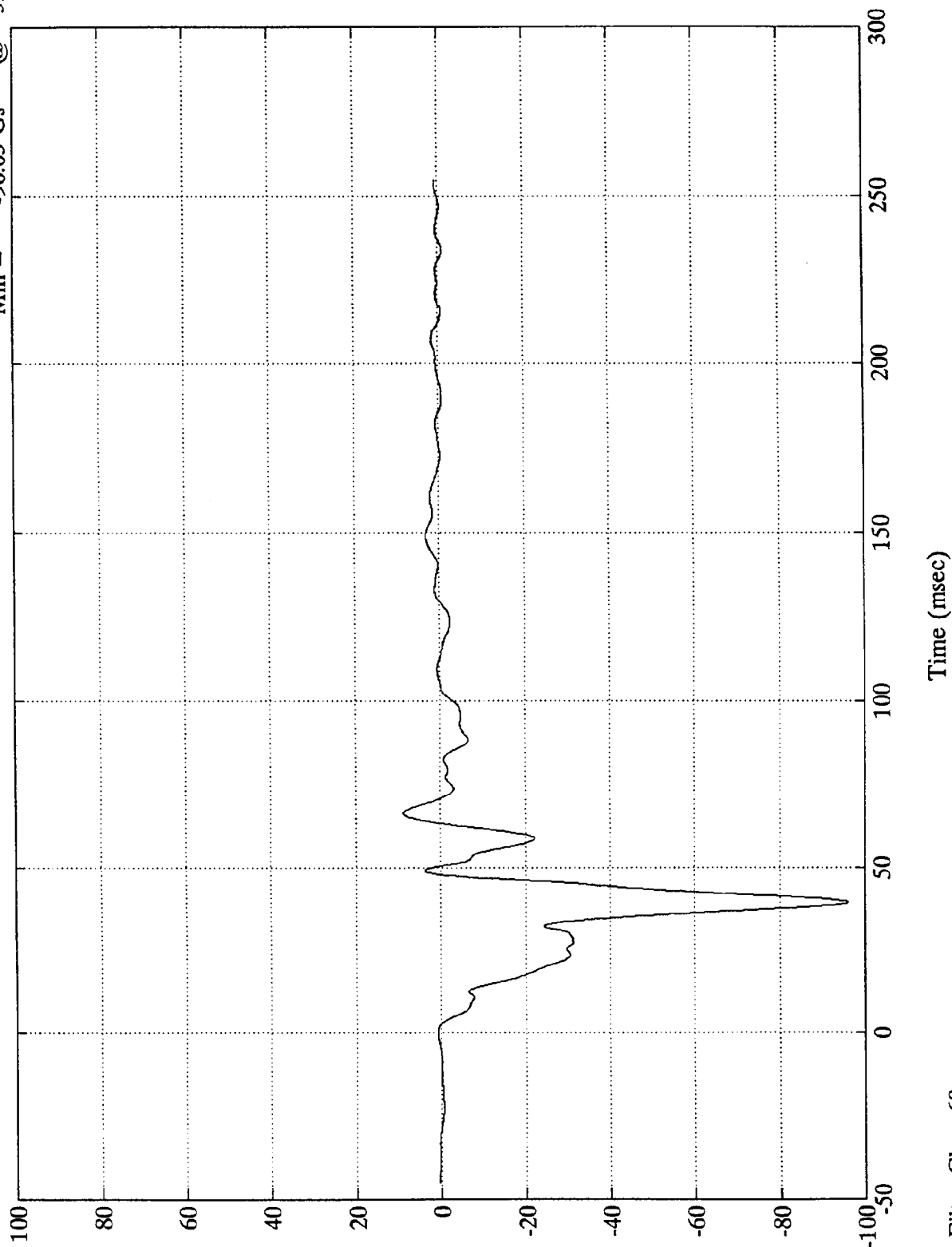
11-B
Displacement (in.)

7893-8

NCAP TEST #12 1991 GEO STORM

Max = 8.72 Gs @ 66.36 msec
 Min = -96.03 Gs @ 39.36 msec

Acc. #4(x)



B-12

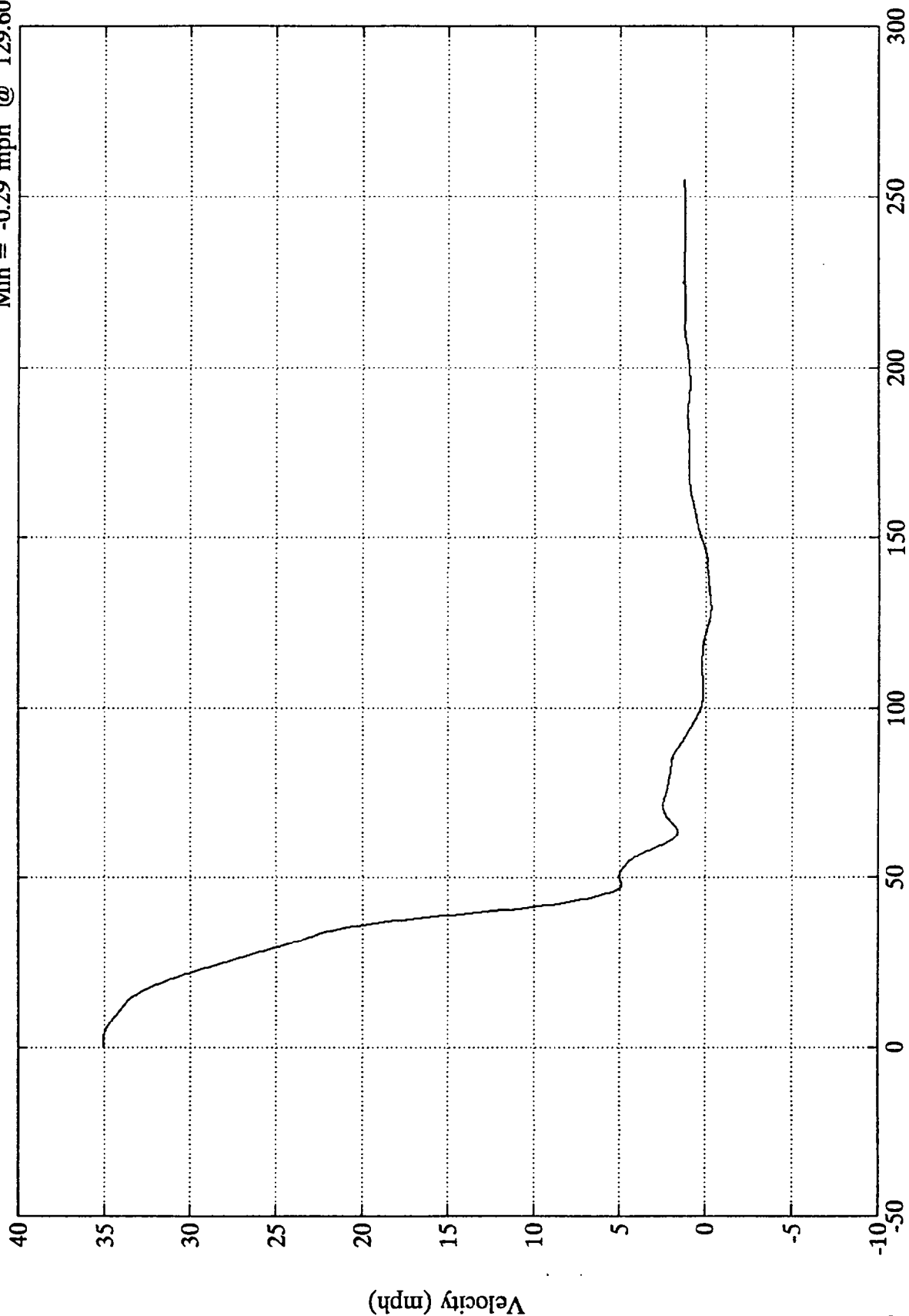
7893-8

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Max = 35.03 mph @ 2.88 msec
Min = -0.29 mph @ 129.60 msec

Acc. #4(x)



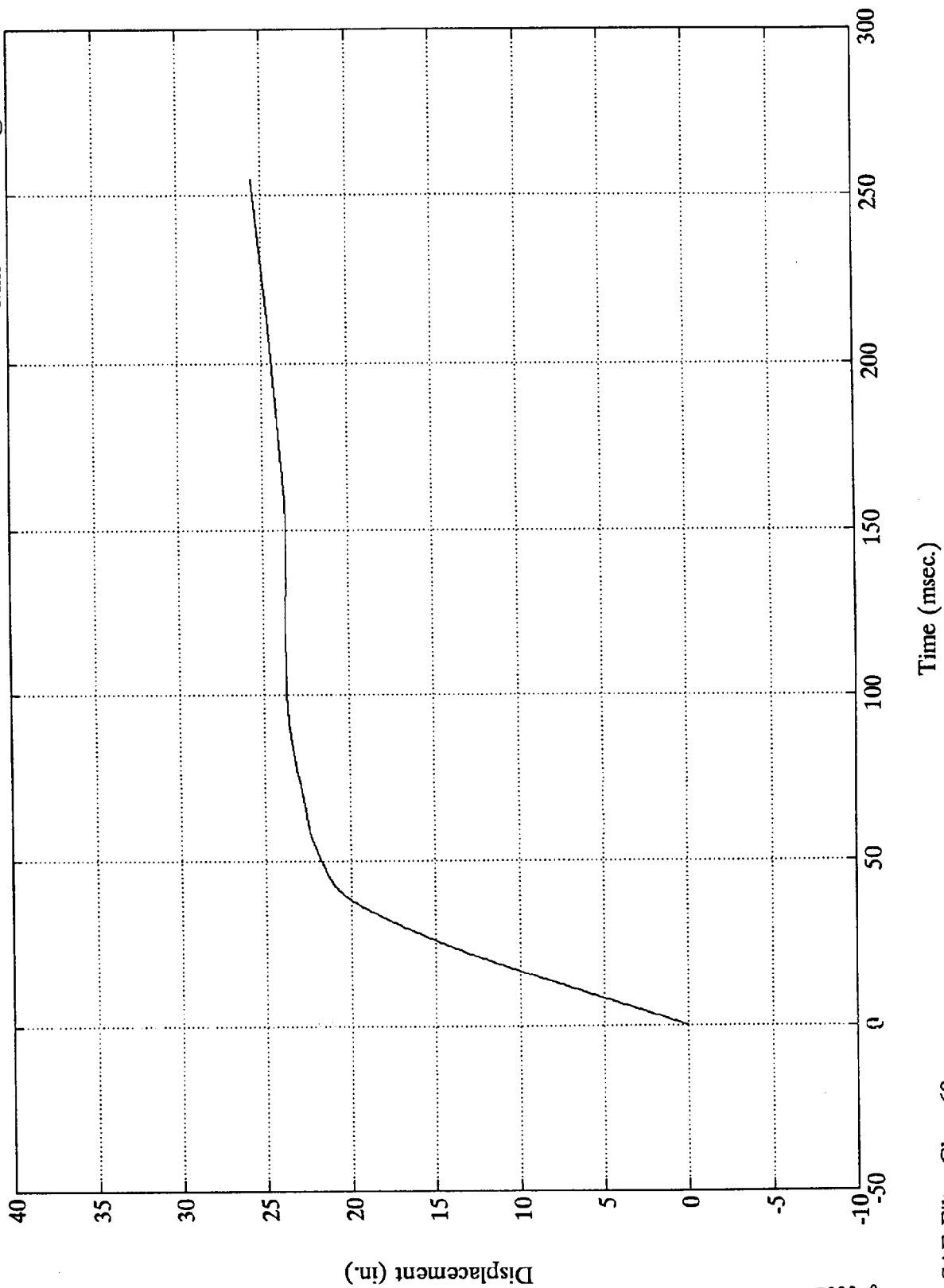
Time (msec.)

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Acc. #4(x)

Max = 25.58 in. @ 254.88 msec
Min = 0.00 in. @ -0.00 msec



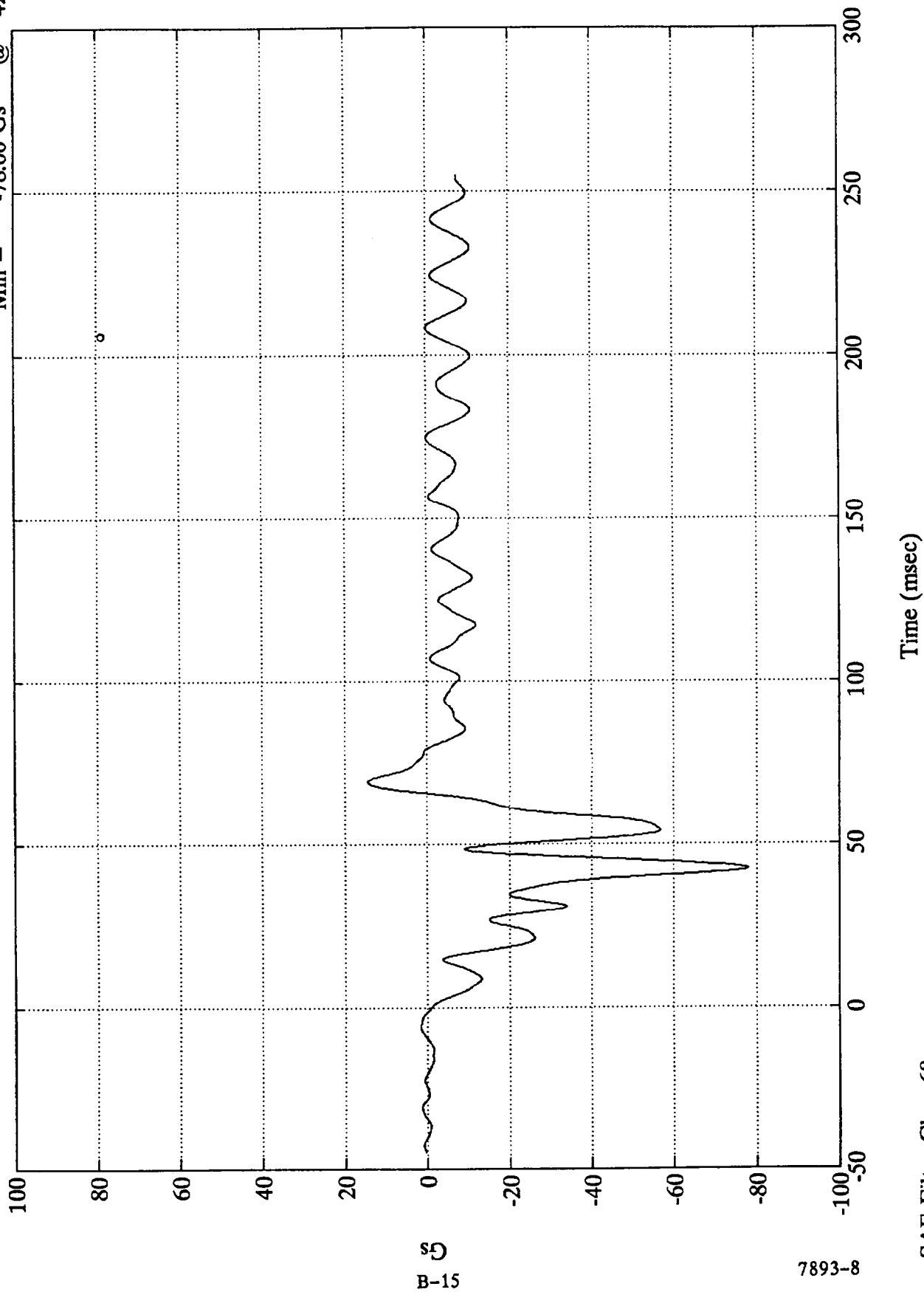
B-14

7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Acc. #5(x) Max = 14.39 Gs @ 69.24 msec
Min = -78.00 Gs @ 42.60 msec



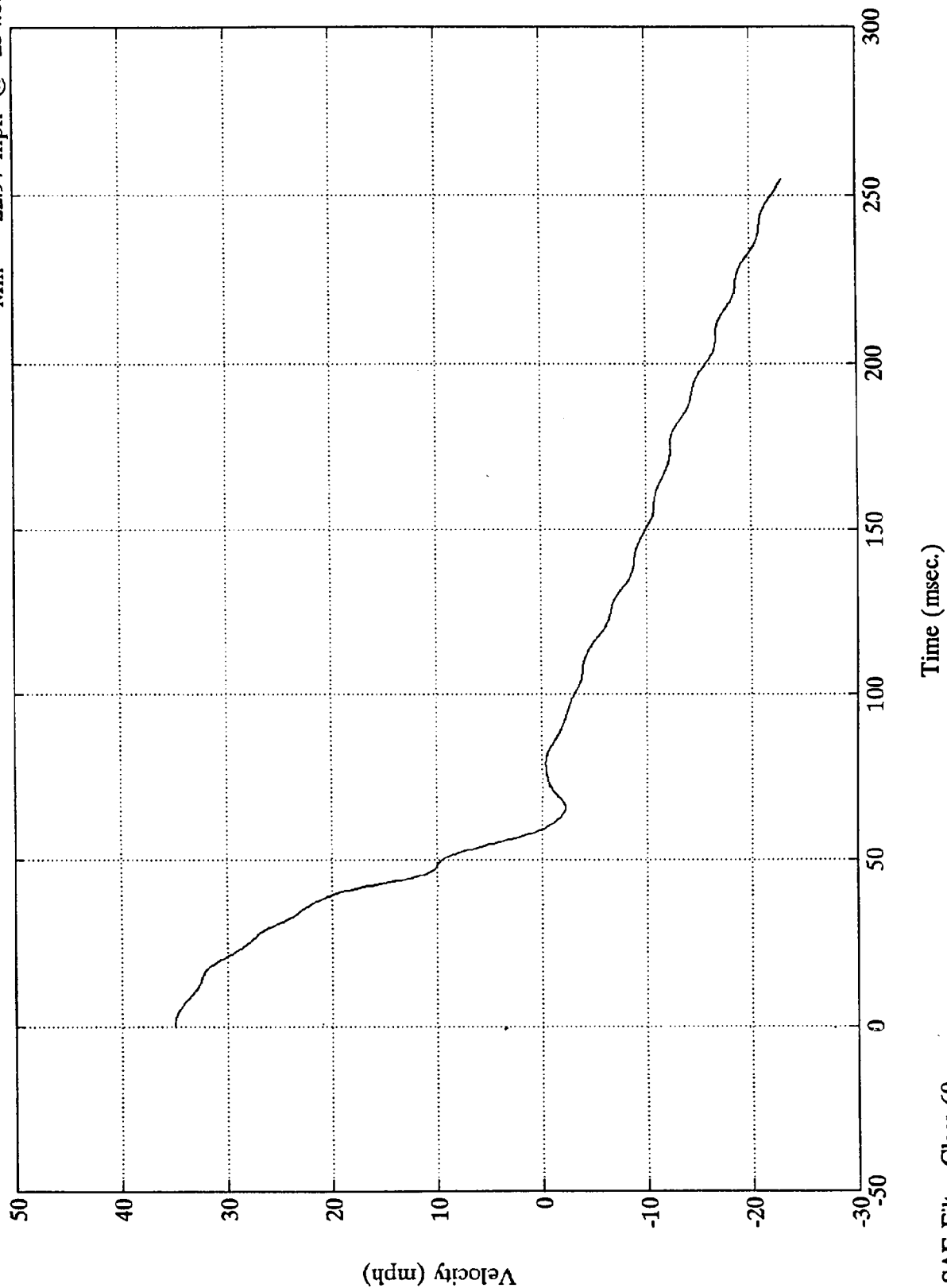
7893-8
B-15

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Max = 35.00 mph @ -0.00 msec
Min = -22.97 mph @ 254.88 msec

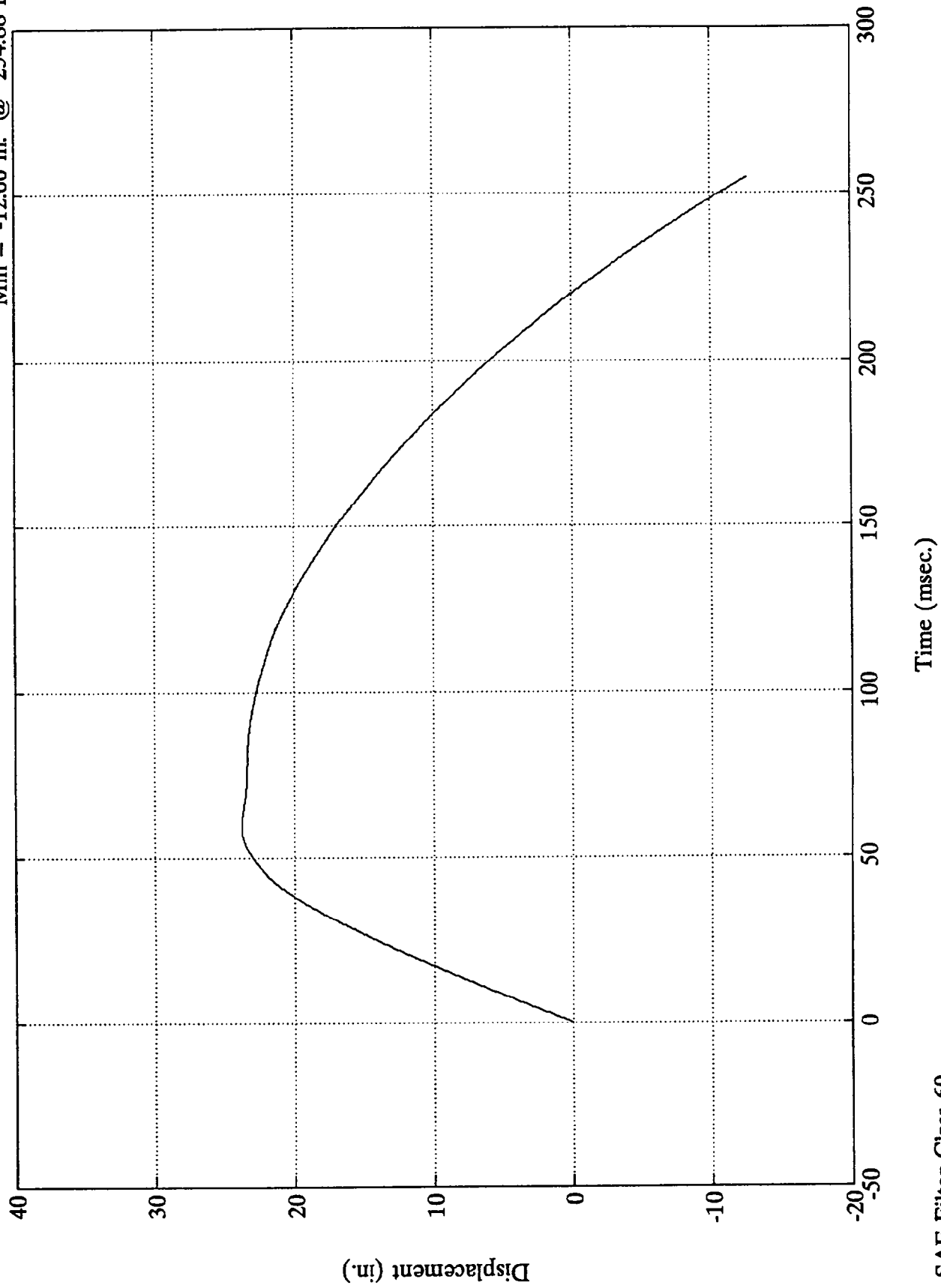
Acc. #5(x)



NCAP TEST #12 GEO STORM

Max = 23.79 in. @ 60.24 msec
Min = -12.60 in. @ 254.88 msec

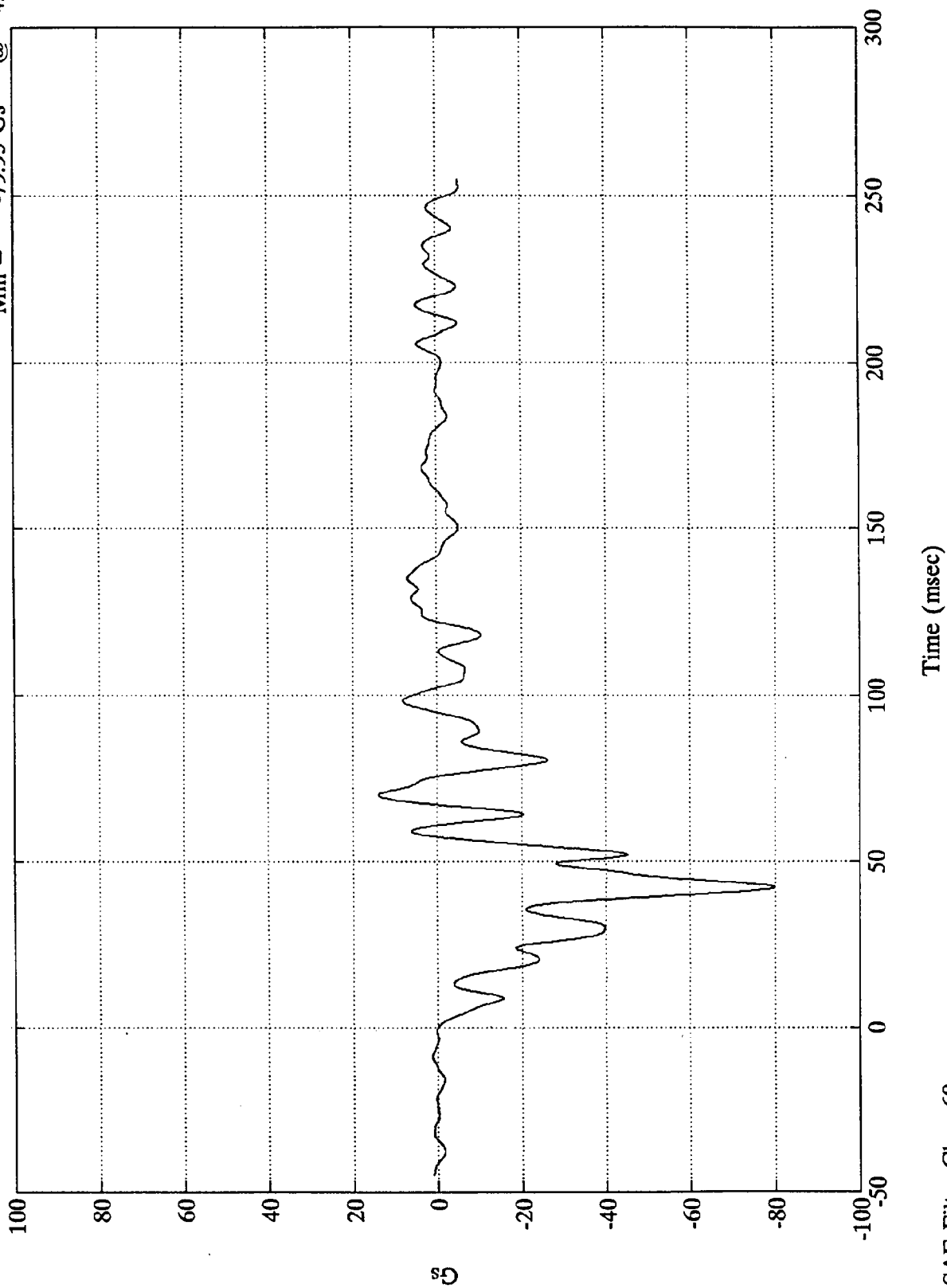
Acc. #5(x)



NCAP TEST #12 1991 GEO STORM

Max = 13.98 Gs @ 69.83 msec
 Min = -79.95 Gs @ 42.11 msec

Acc. #6(x)



B-18

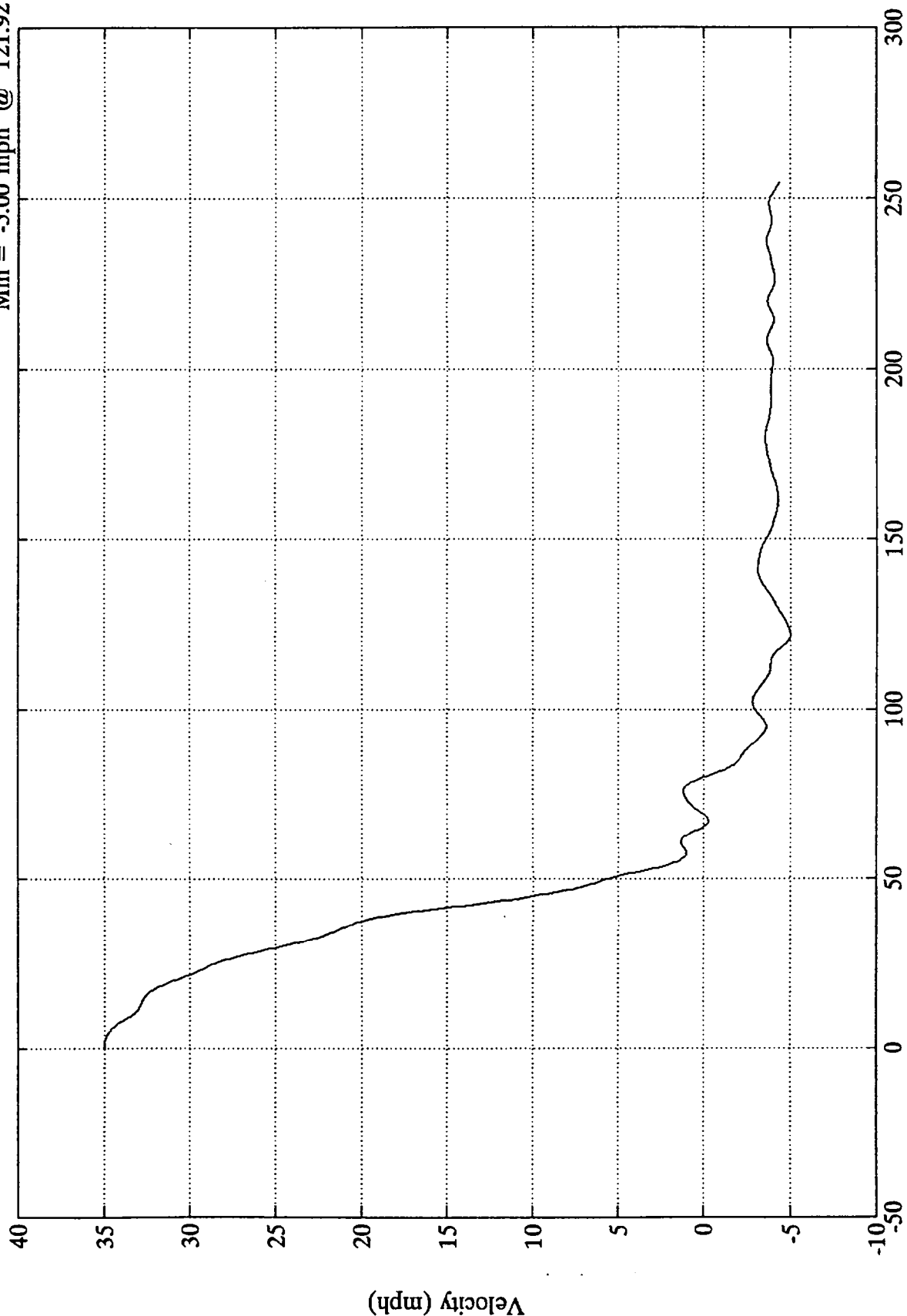
7893-8

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Max = 35.00 mph @ 0.72 msec
Min = -5.00 mph @ 121.92 msec

Acc. #6(x)



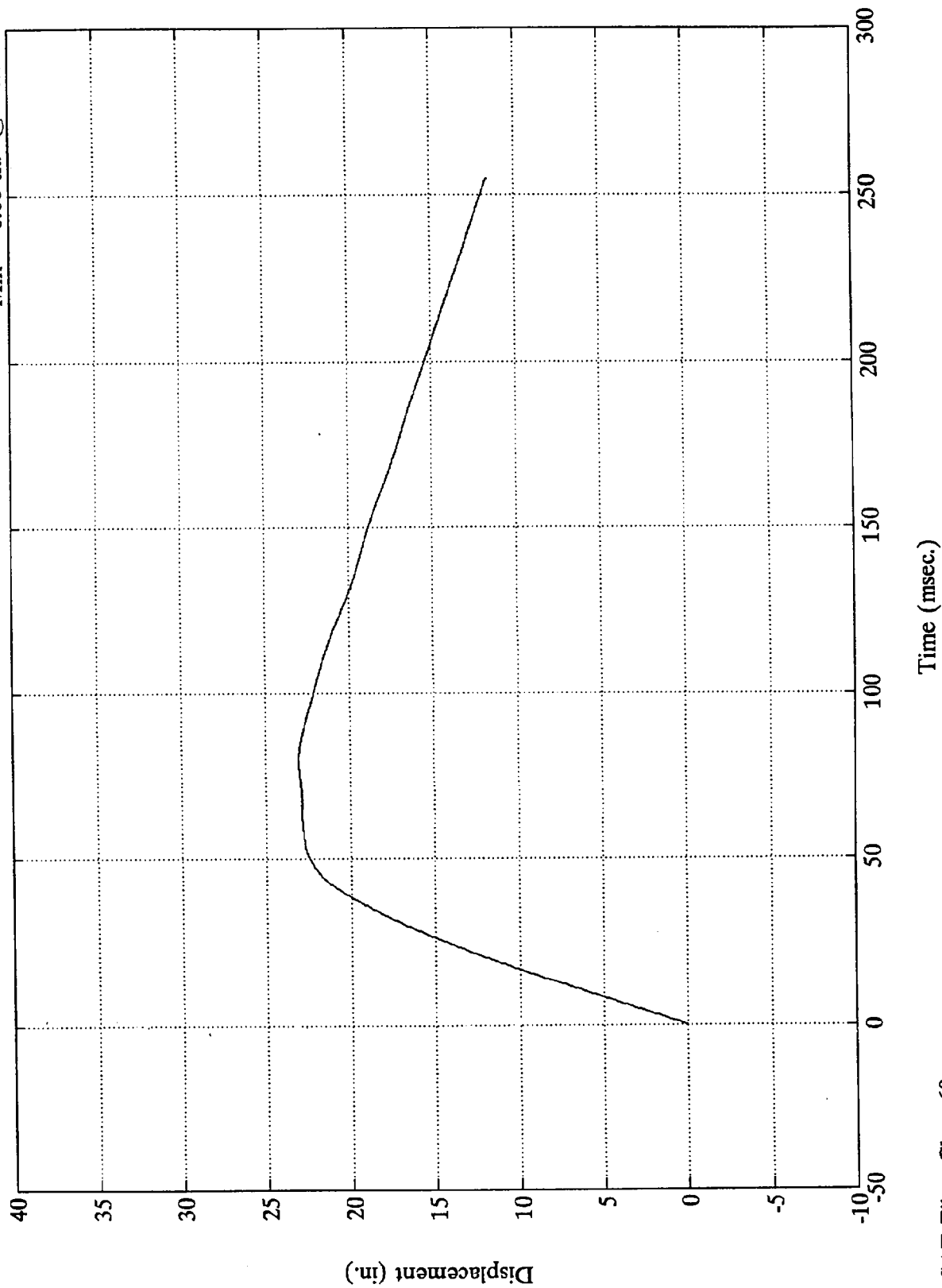
Time (msec.)

SAE Filter Class 60

NCAP TEST #12 GEO STORM

Max = 23.06 in. @ 80.64 msec
Min = 0.00 in. @ -0.00 msec

Acc. #6(x)



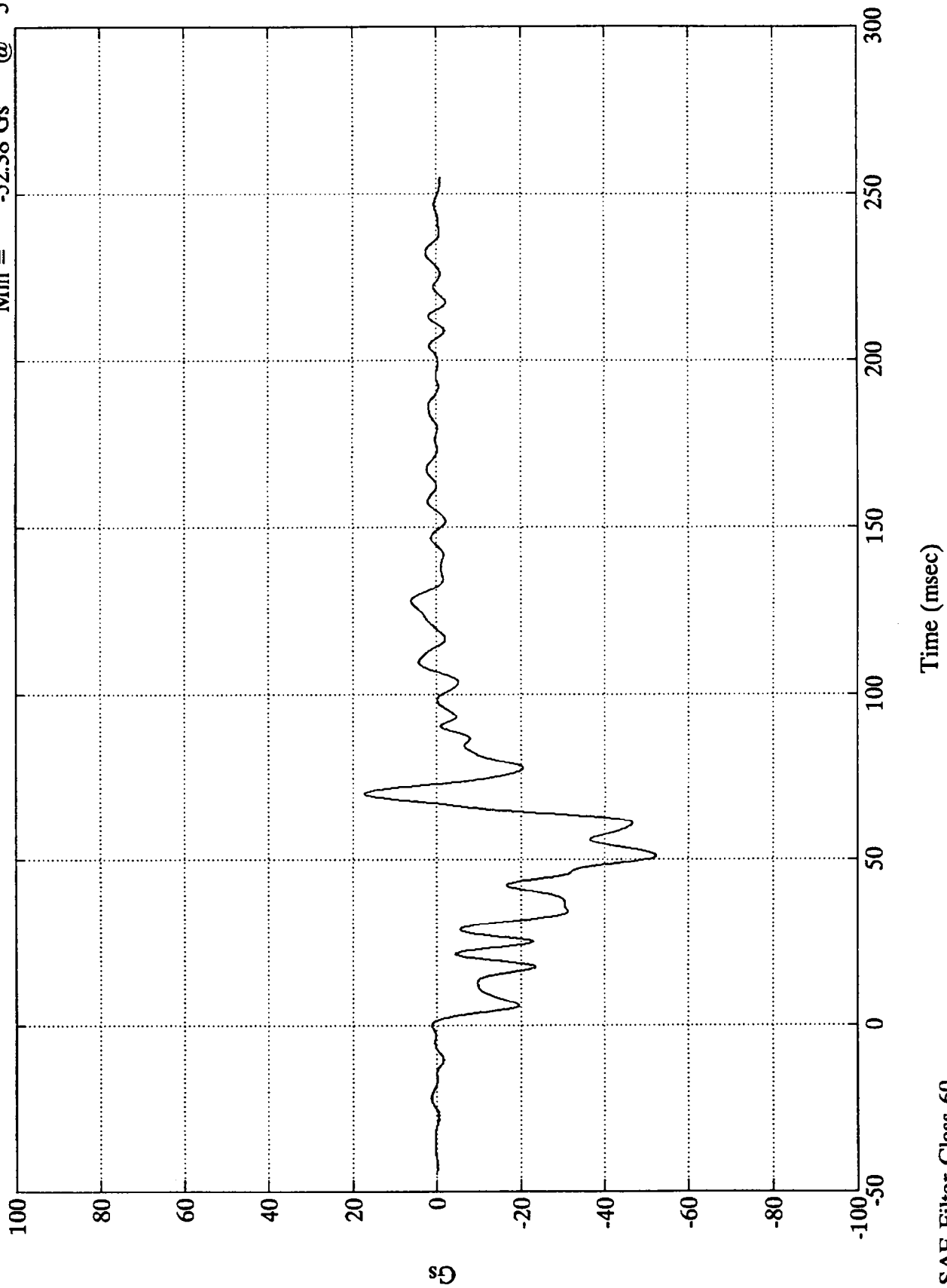
B-20

7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Acc. #7(x) Max = 17.24 Gs @ 70.20 msec
Min = -52.38 Gs @ 51.12 msec



SAE Filter Class 60

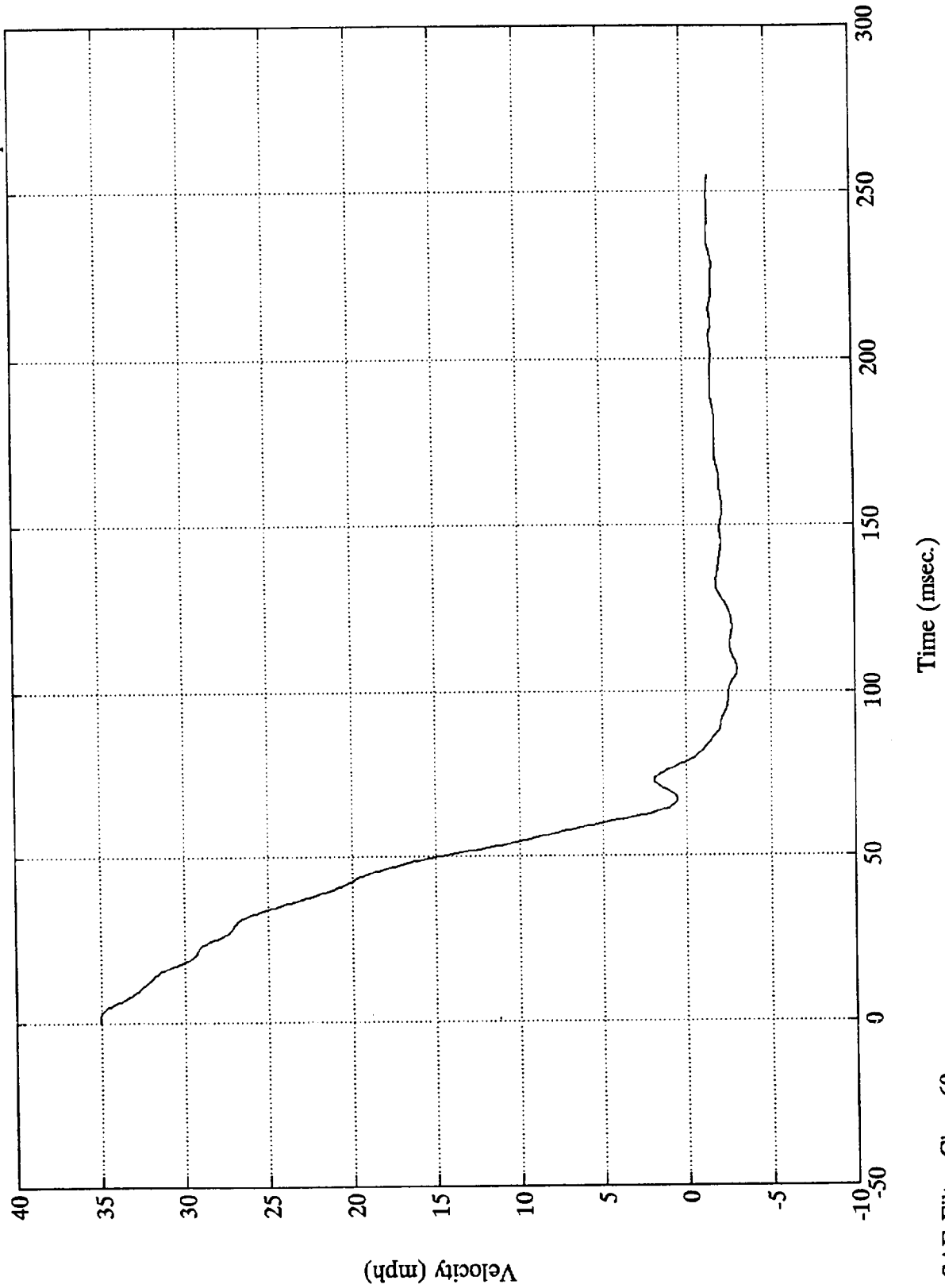
B-21

7893-8

NCAP TEST #12 GEO STORM

Max = 35.03 mph @ 1.44 msec
Min = -3.04 mph @ 106.80 msec

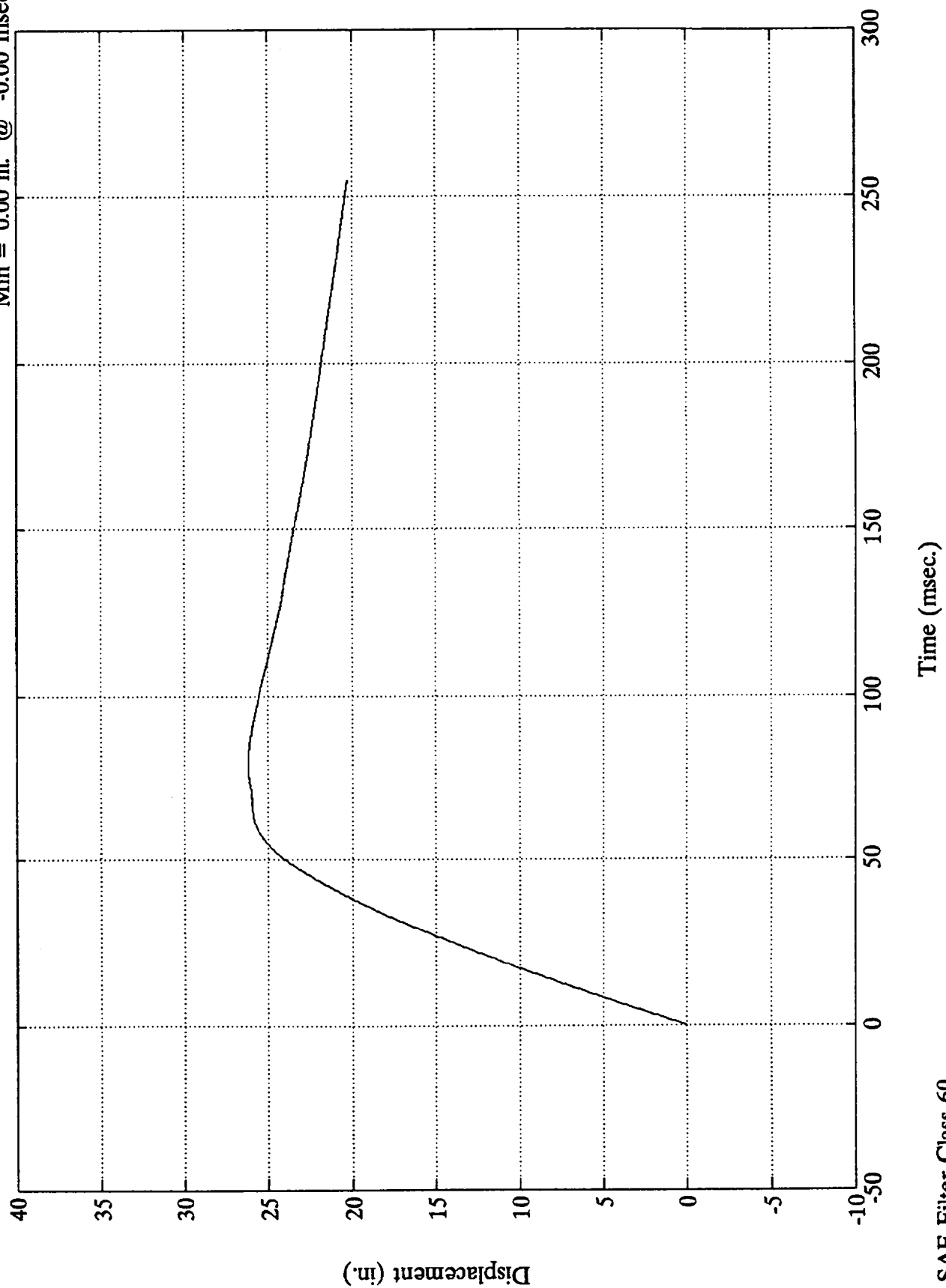
Acc. #7(x)



SAE Filter Class 60

NCAP TEST #12 GEO STORM

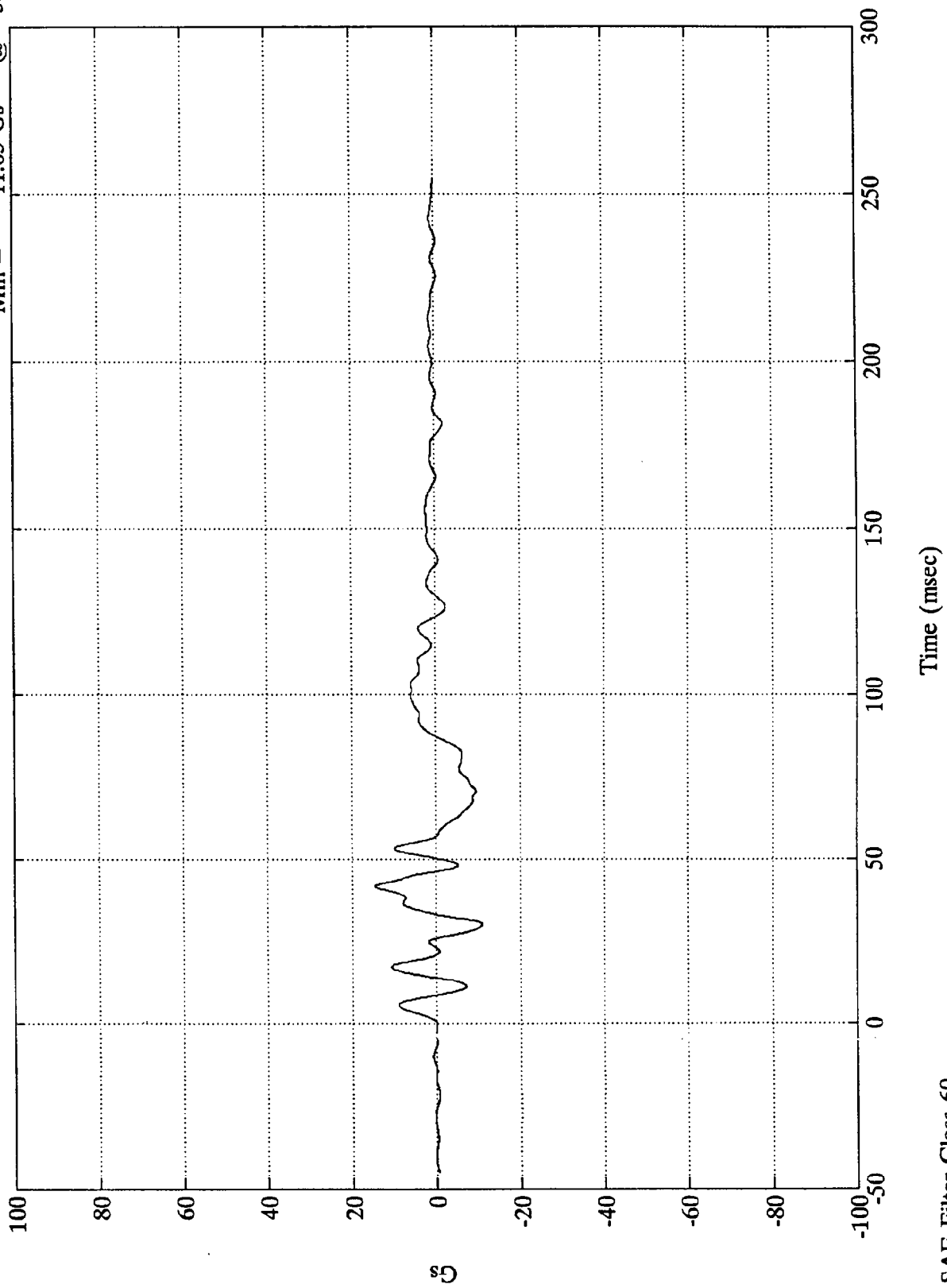
Acc. #7(x)
Max = 26.22 in. @ 80.16 msec
Min = 0.00 in. @ -0.00 msec



NCAP TEST #12 1991 GEO STORM

Max = 14.67 Gs @ 41.63 msec
 Min = -11.03 Gs @ 30.12 msec

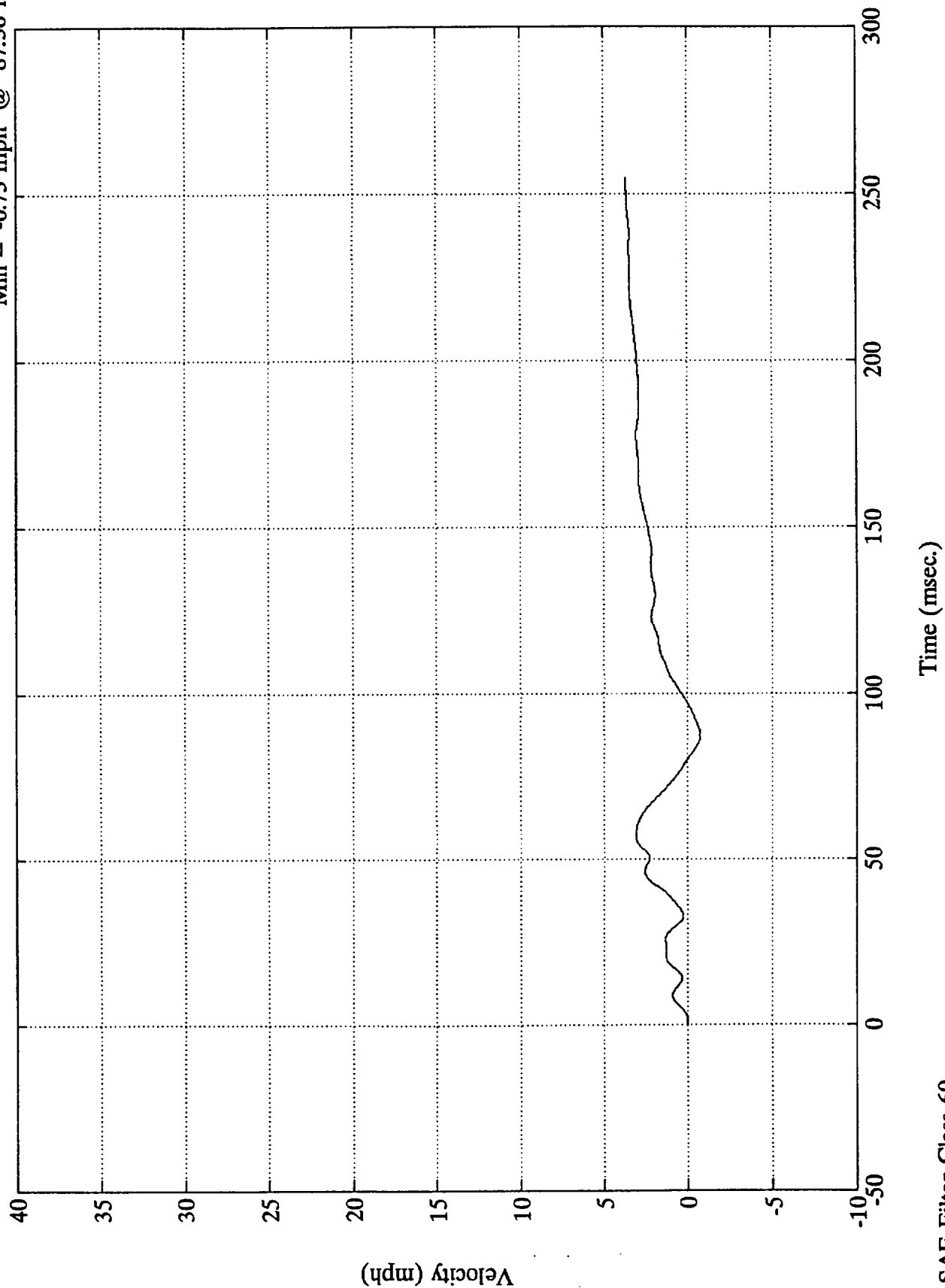
Acc. #8(z)



NCAP TEST #12 GEO STORM

Max = 3.64 mph @ 254.88 msec
Min = -0.73 mph @ 87.36 msec

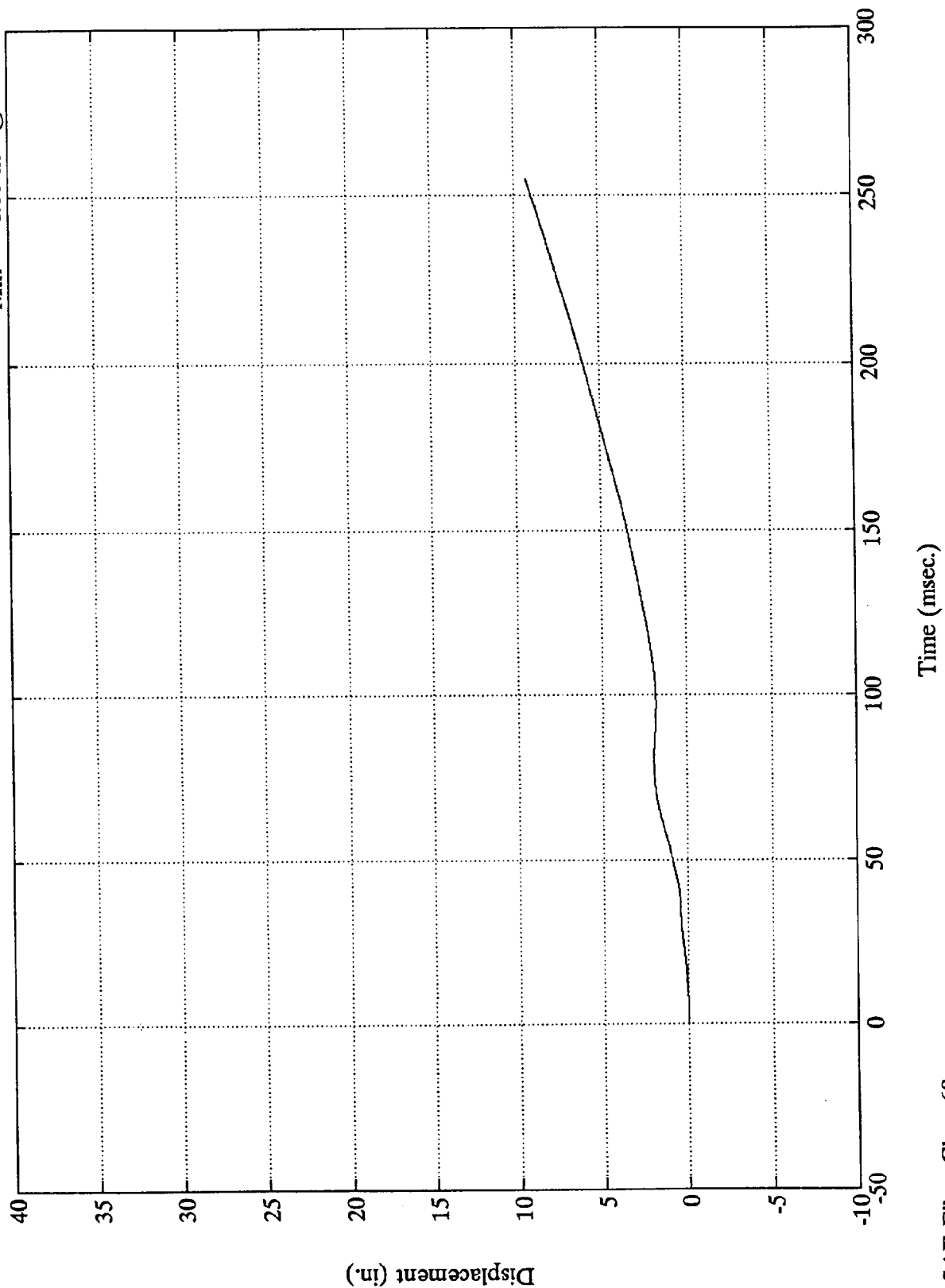
Acc. #8(z)



NCAP TEST #12 GEO STORM

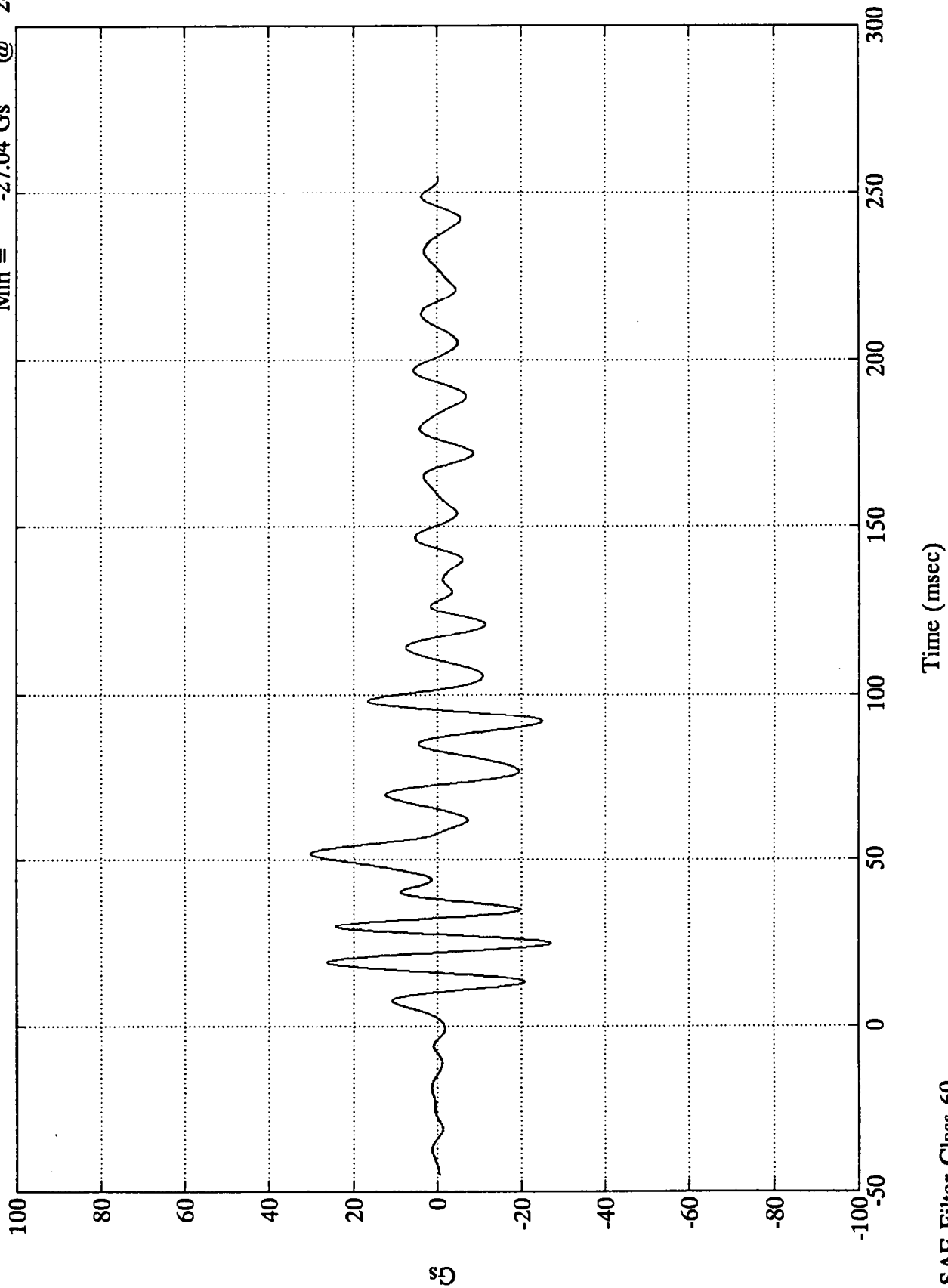
Max = 9.26 in. @ 254.88 msec
Min = -0.00 in. @ 0.24 msec

Acc. #8(z)



NCAP TEST #12 1991 GEO STORM

Acc. #9(z) Max = 30.19 Gs @ 51.84 msec
Min = -27.04 Gs @ 24.71 msec



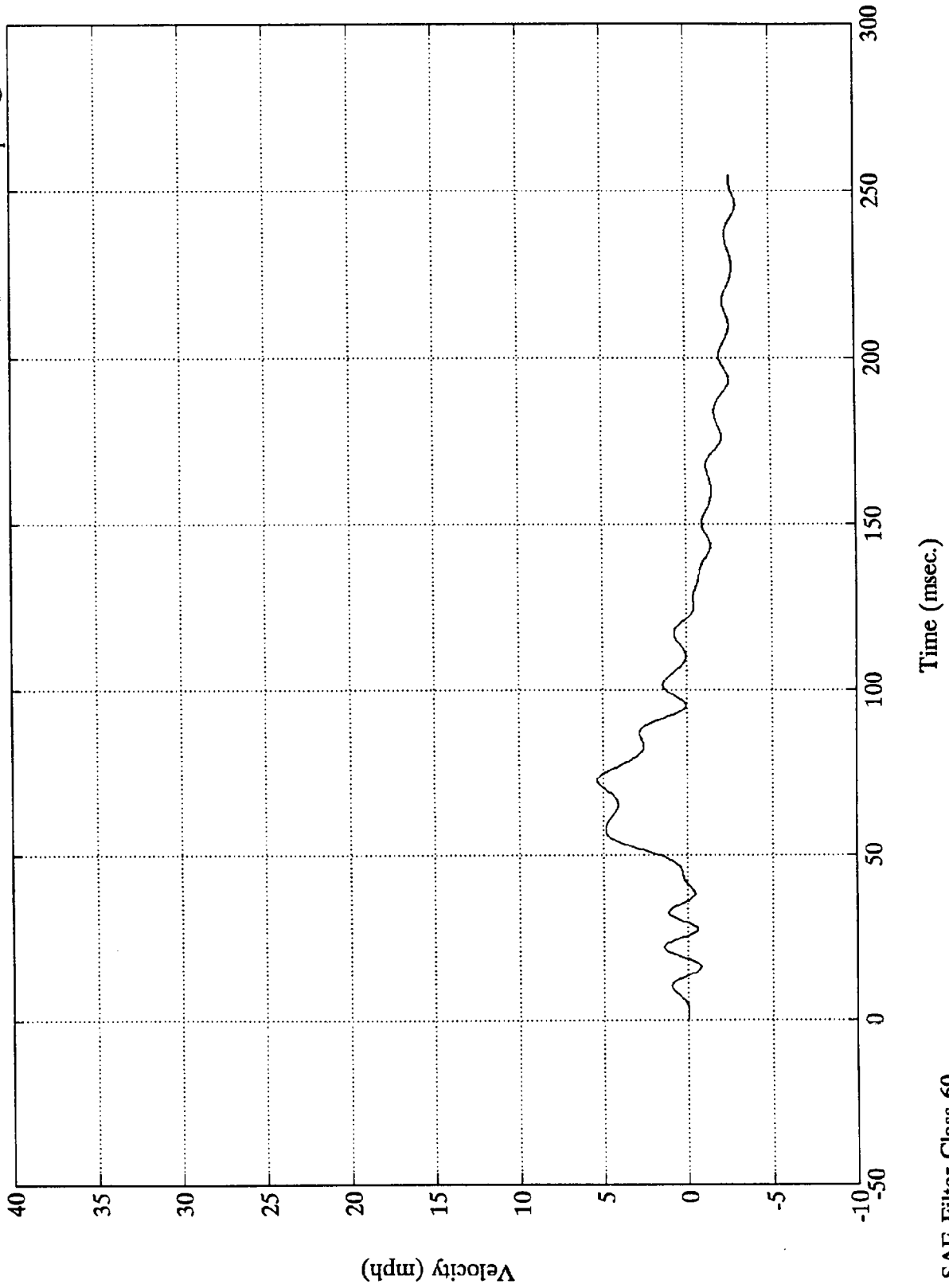
50
B-27

7893-8

SAE Filter Class 60

NCAP TEST #12 GEO STORM

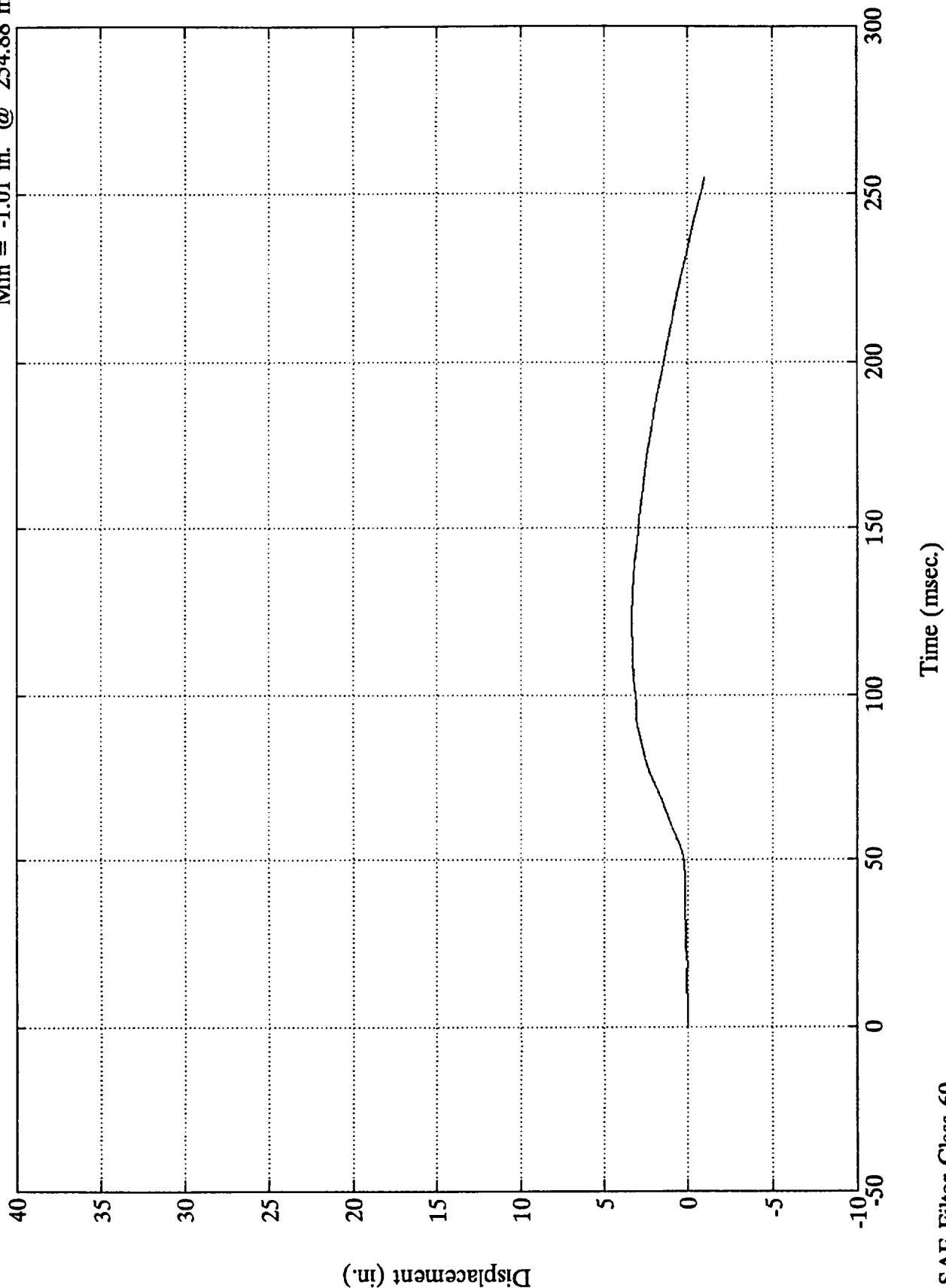
Acc. #9(z)
Max = 5.34 mph @ 72.72 msec
Min = -3.04 mph @ 245.76 msec



NCAP TEST #12 GEO STORM

Acc. #9(z)

Max = 3.38 in. @ 121.68 msec
Min = -1.01 in. @ 254.88 msec



B-29

7893-8

SAE Filter Class 60

TEST NO. MM0107

LOAD CELL BARRIER DATA

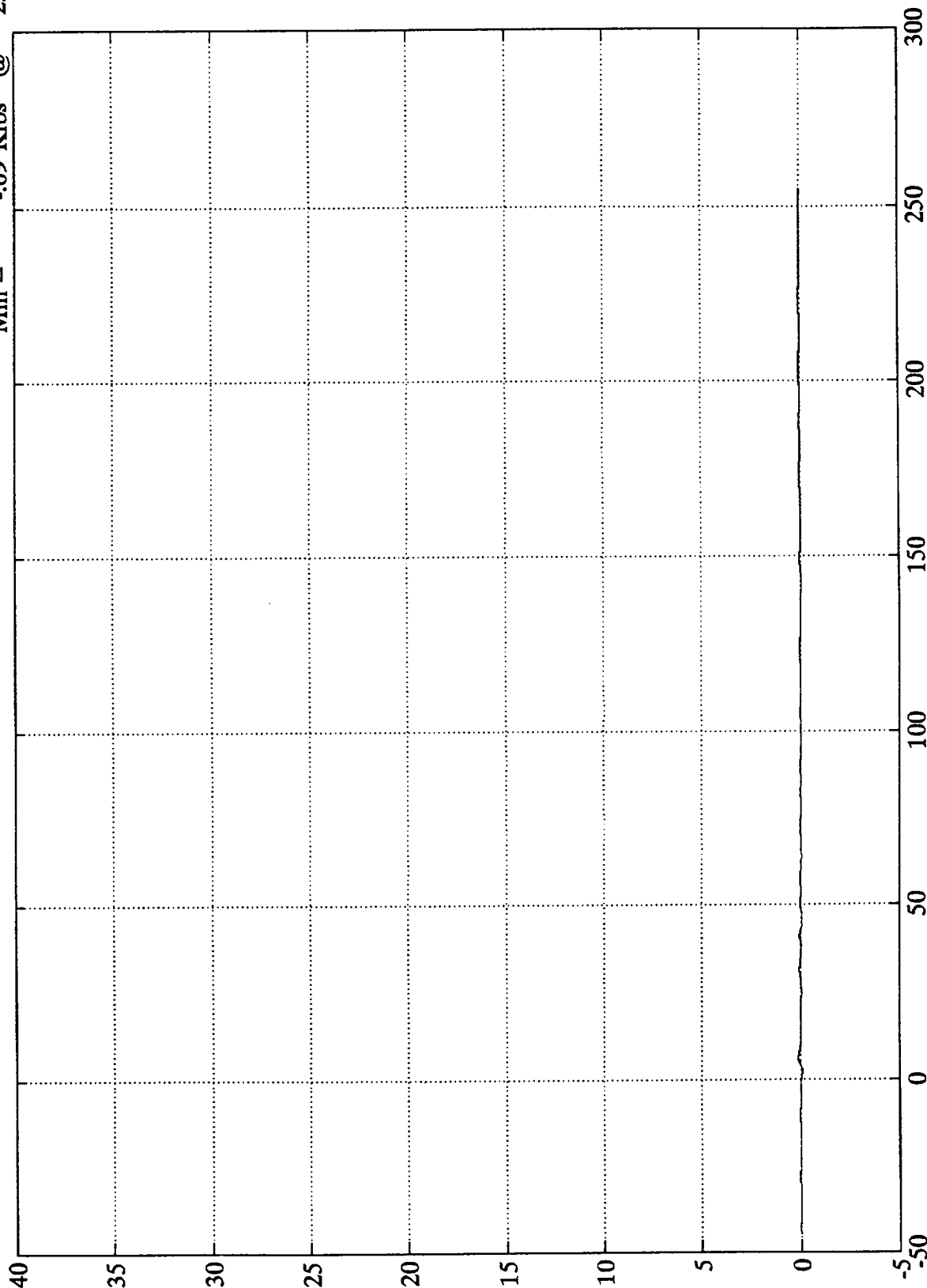
FILTER CHANNEL CLASS

60

NCAP TEST #12 1991 GEO STORM

Max = .12 Klbs @ 5.87 msec
 Min = -.09 Klbs @ 2.15 msec

Barrier Load Cell A1



Time (msec)

SAE Filter Class 60

Klbs

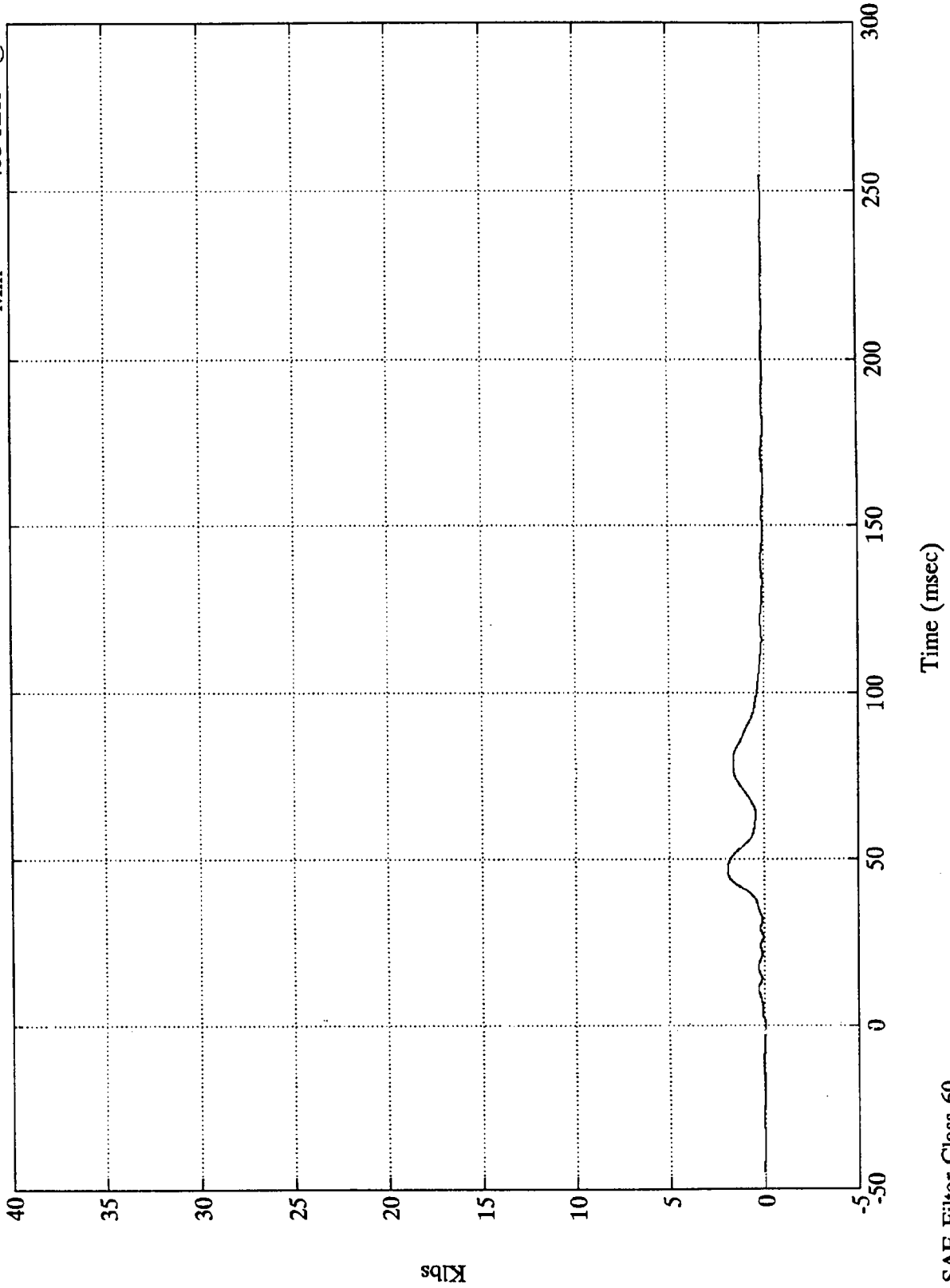
B-31

7893-8

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell A2

Max = 1.90 Klbs @ 46.44 msec
Min = -0.08 Klbs @ -0.12 msec



Klbs
B-32

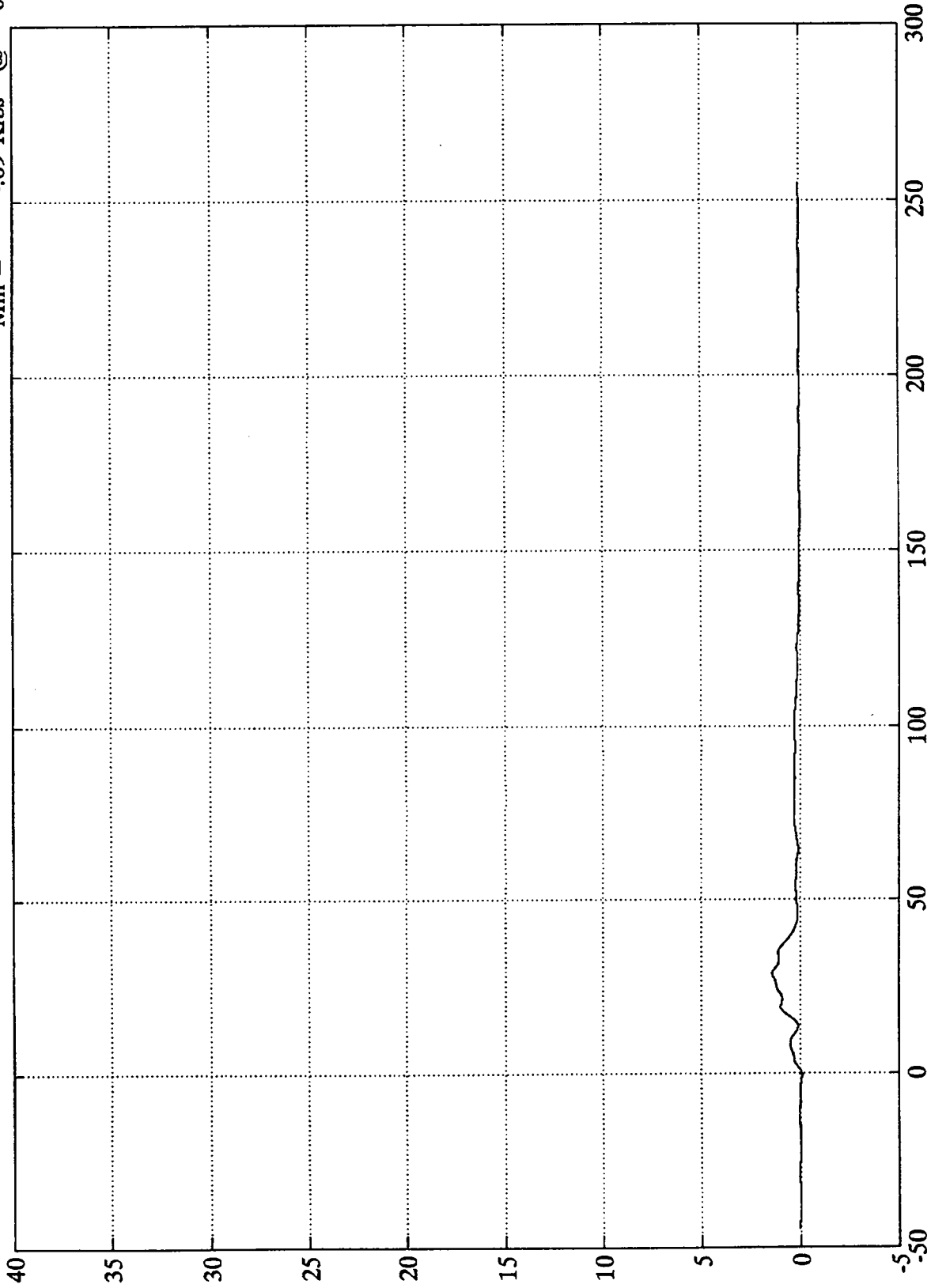
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 1.42 Klbs @ 28.55 msec
Min = -.09 Klbs @ -0.72 msec

Barrier Load Cell A3



B-33
Klbs

7893-8

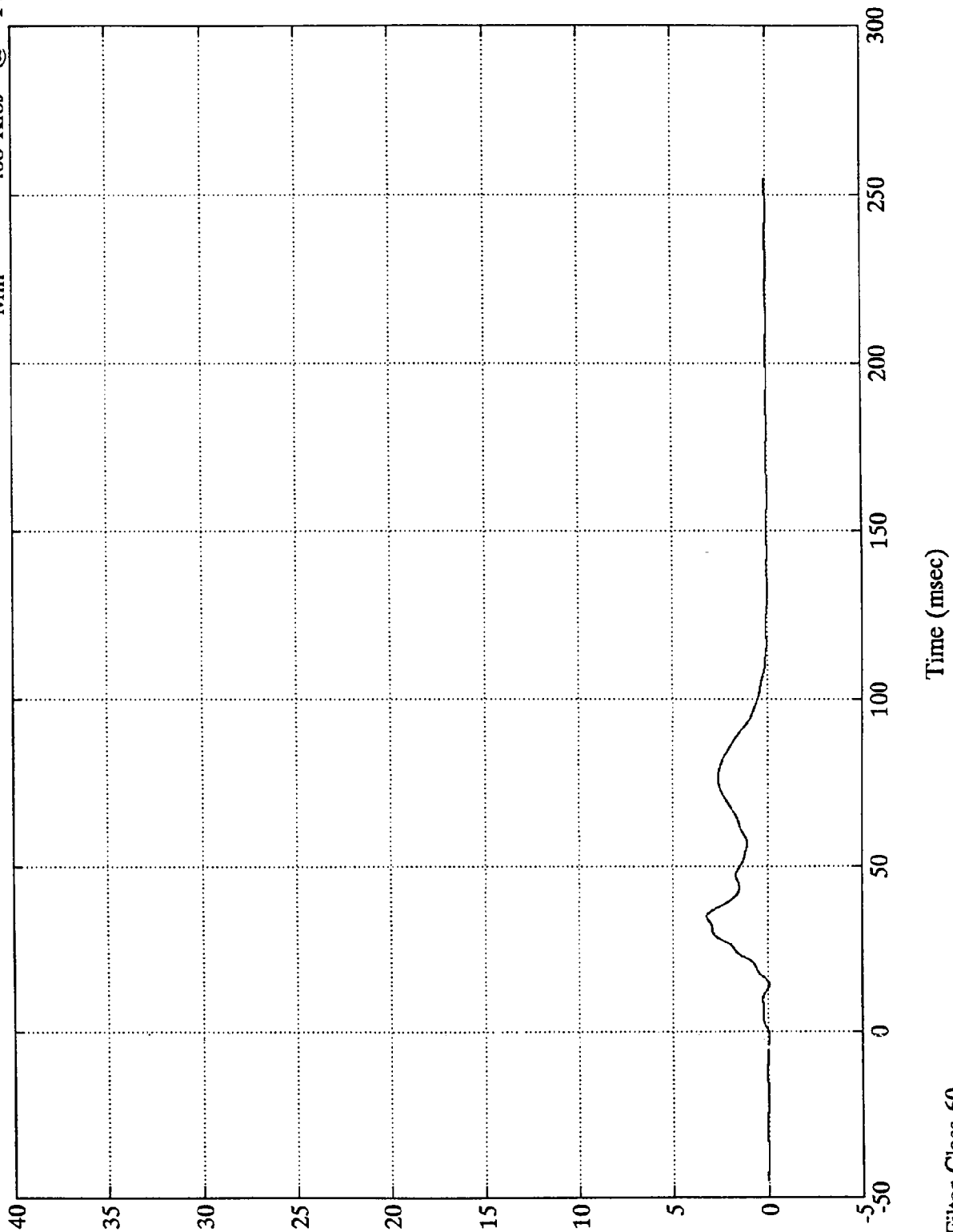
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell A4

Max = 3.24 Klbs @ 34.79 msec
Min = -.08 Klbs @ 14.03 msec



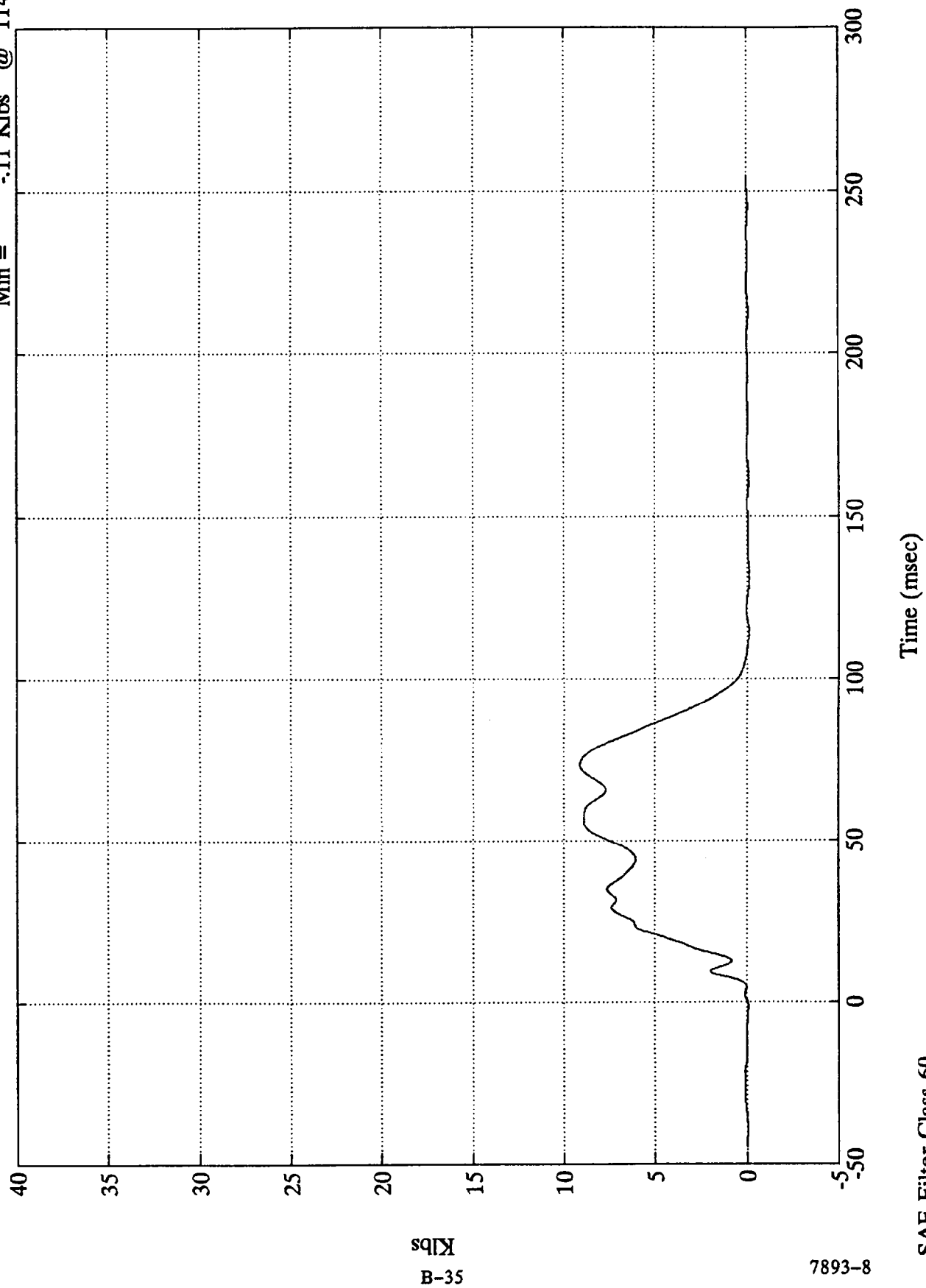
B-34

7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

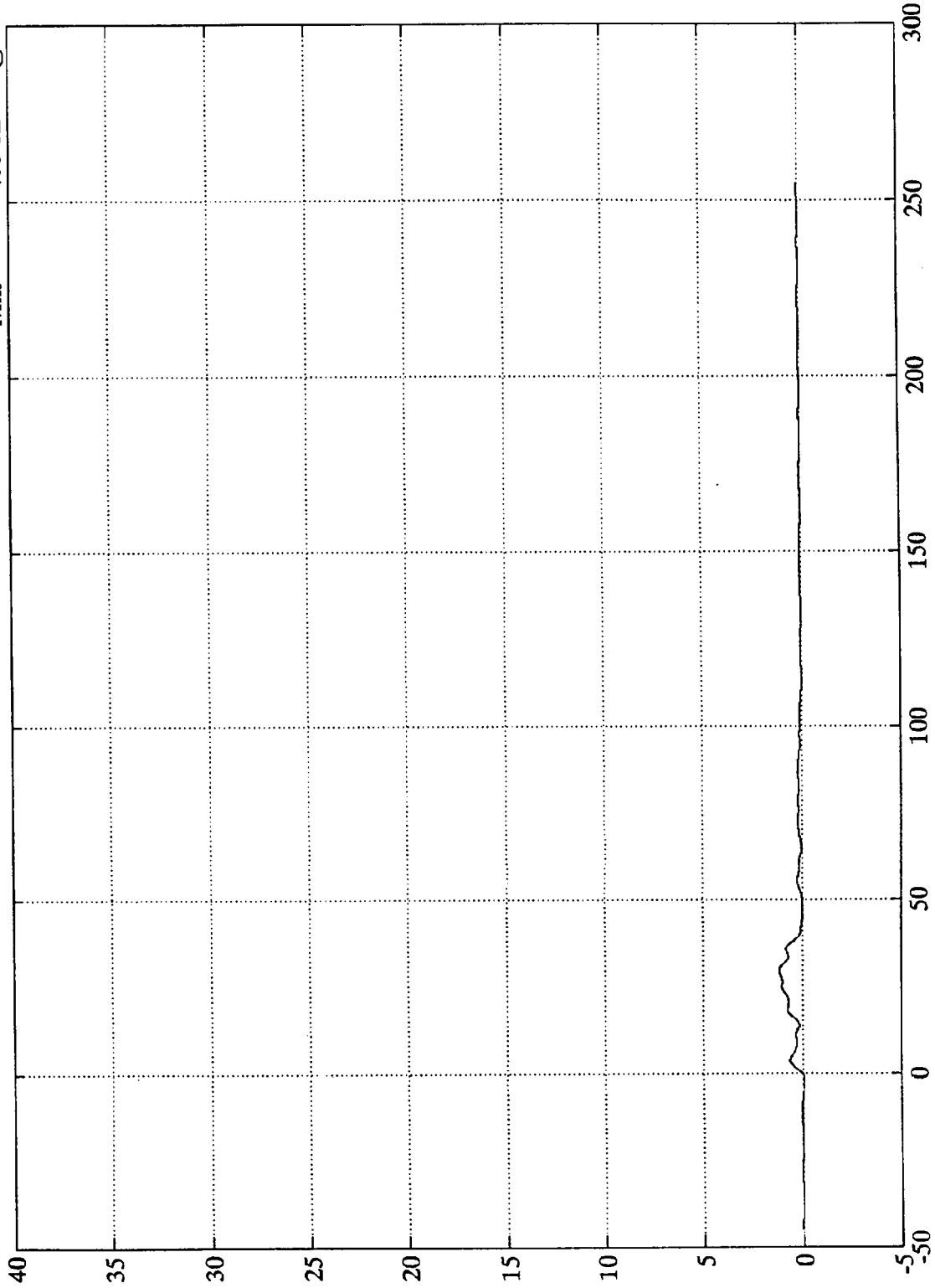
Barrier Load Cell A5
Max = 9.13 Klbs @ 73.68 msec
Min = -1.11 Klbs @ 114.36 msec



NCAP TEST #12 1991 GEO STORM

Barrier Load Cell A6

Max = 1.16 Klbs @ 29.27 msec
Min = -.08 Klbs @ -1.80 msec



B-36

7893-8

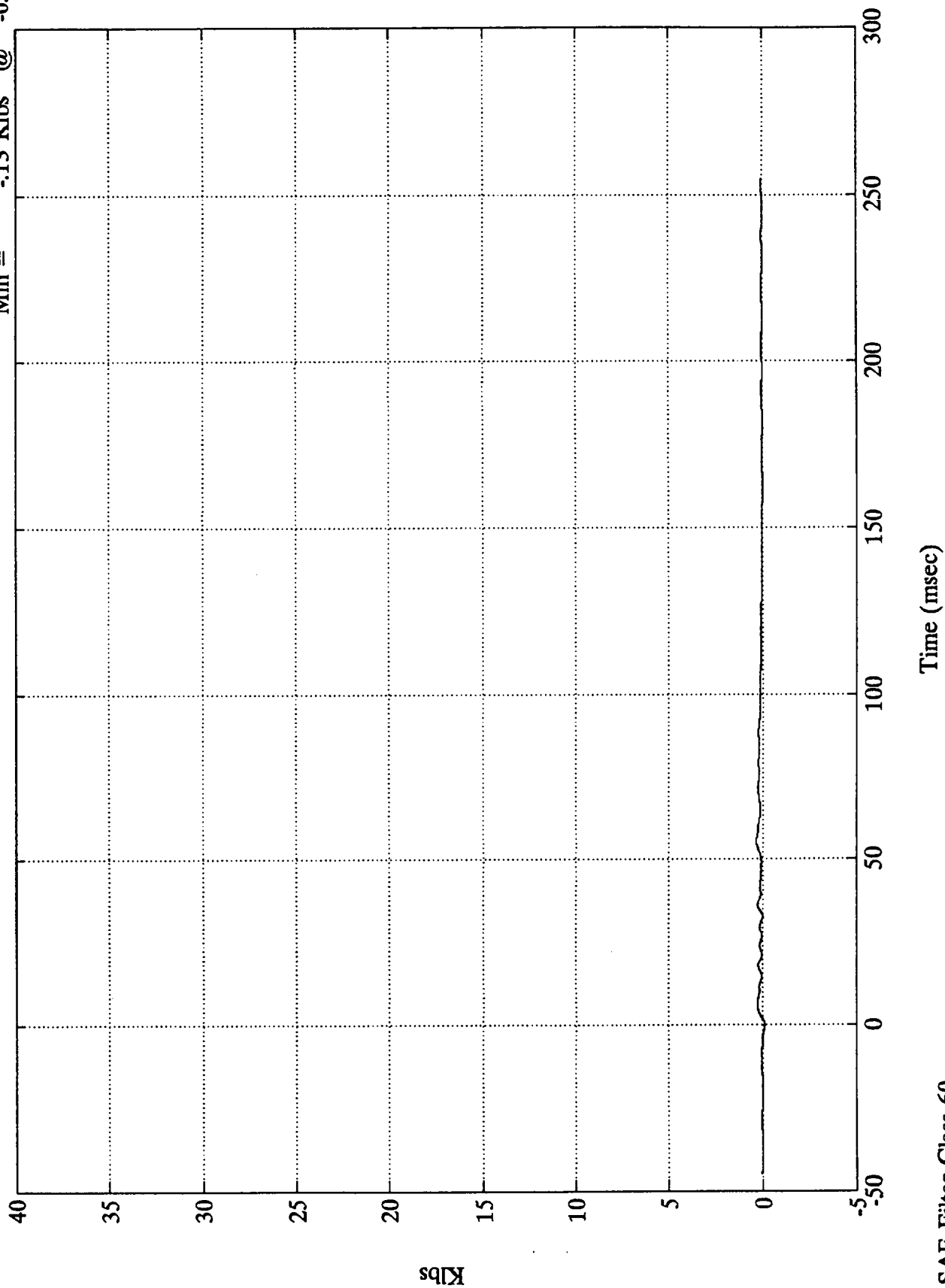
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = .34 Klbs @ 55.32 msec
Min = -.13 Klbs @ -0.24 msec

Barrier Load Cell A7



Klbs

B-37

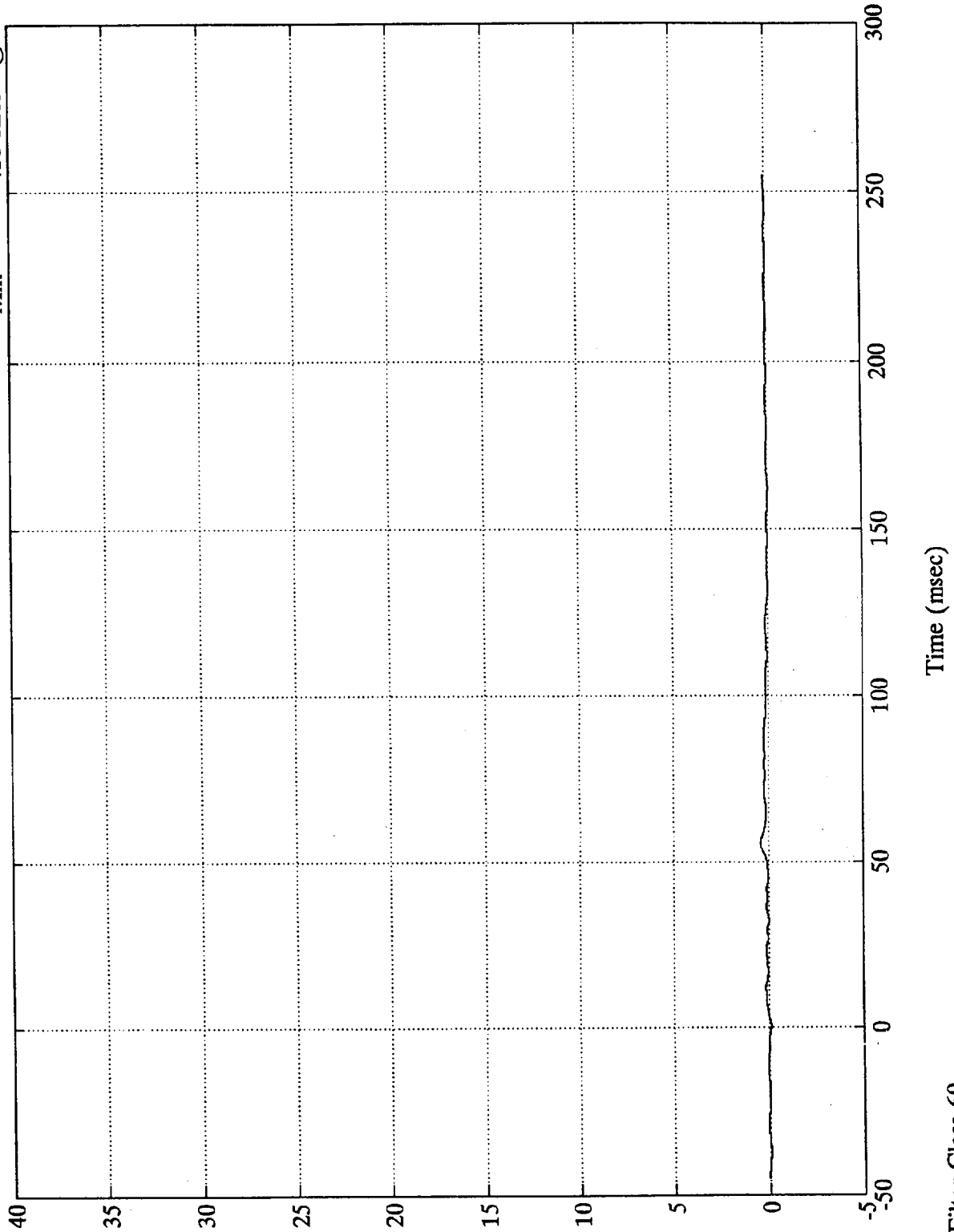
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = .41 Klbs @ 55.68 msec
Min = -.10 Klbs @ 0.35 msec

Barrier Load Cell A8



Klbs
B-38

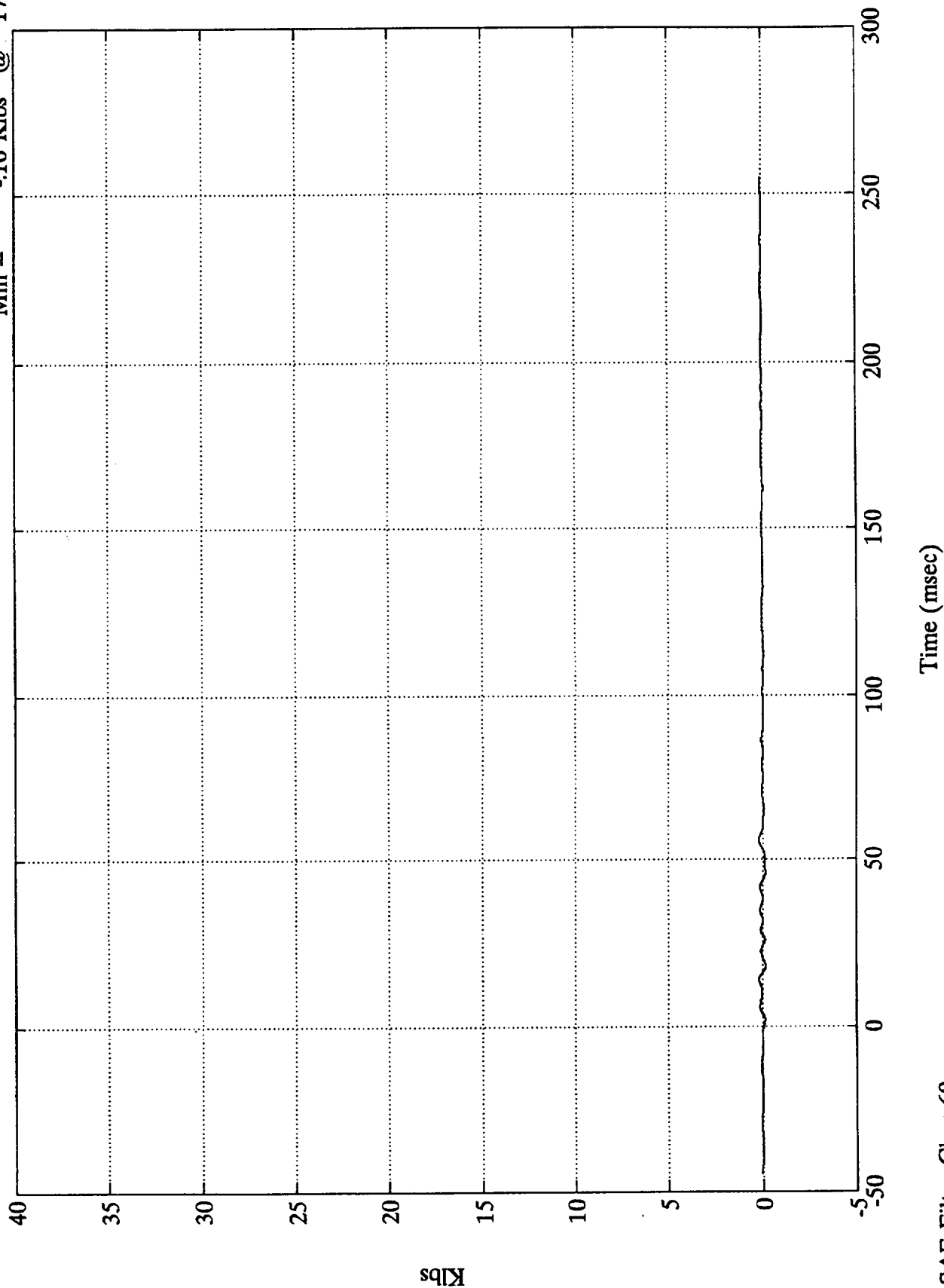
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell A9

Max =	.19 Klbs	@	55.92 msec
Min =	-.16 Klbs	@	17.63 msec



B-39

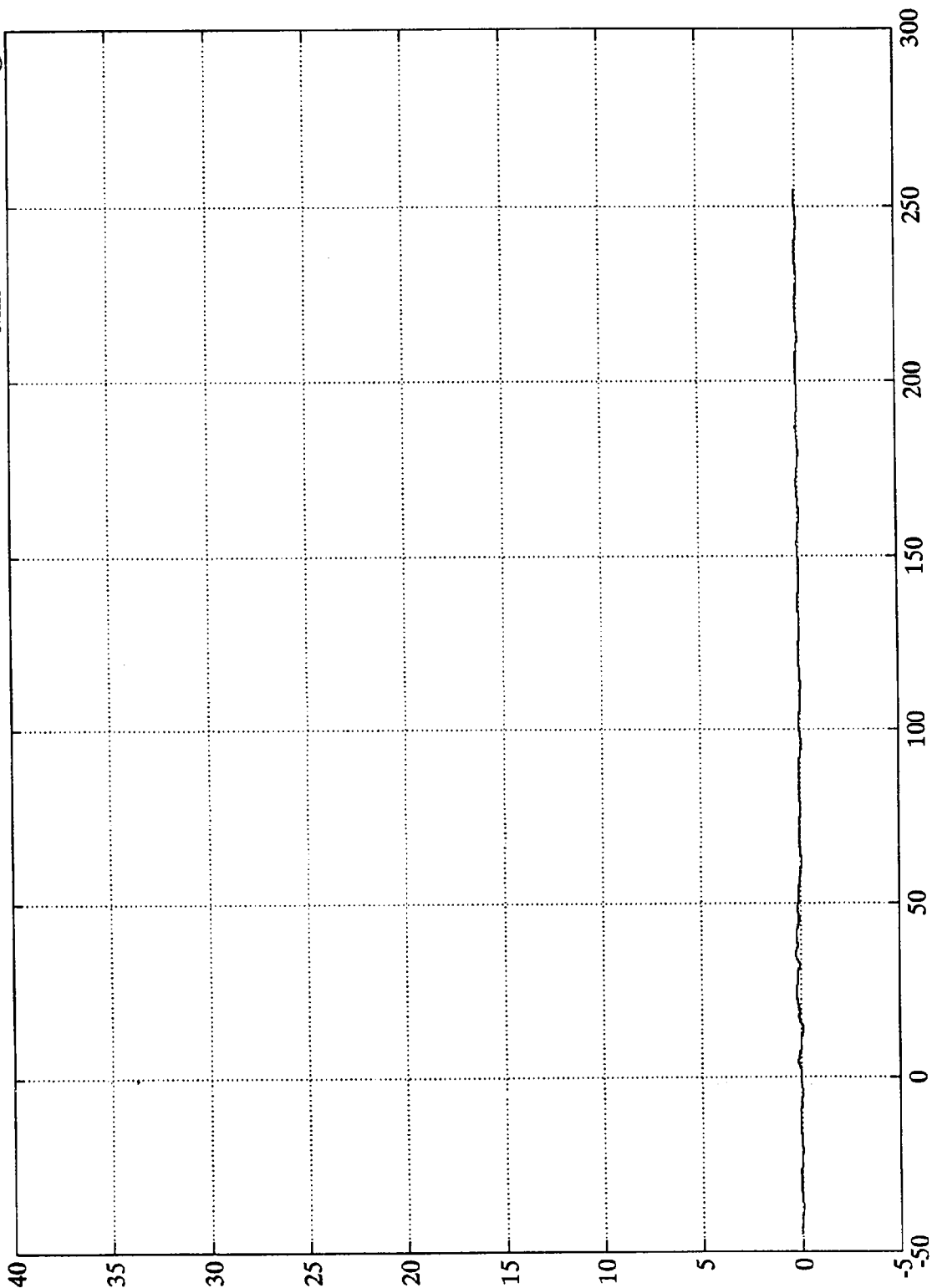
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B1

Max = .25 Klbs @ 35.15 msec
Min = -.13 Klbs @ 13.43 msec



B-40
Klbs

Time (msec)

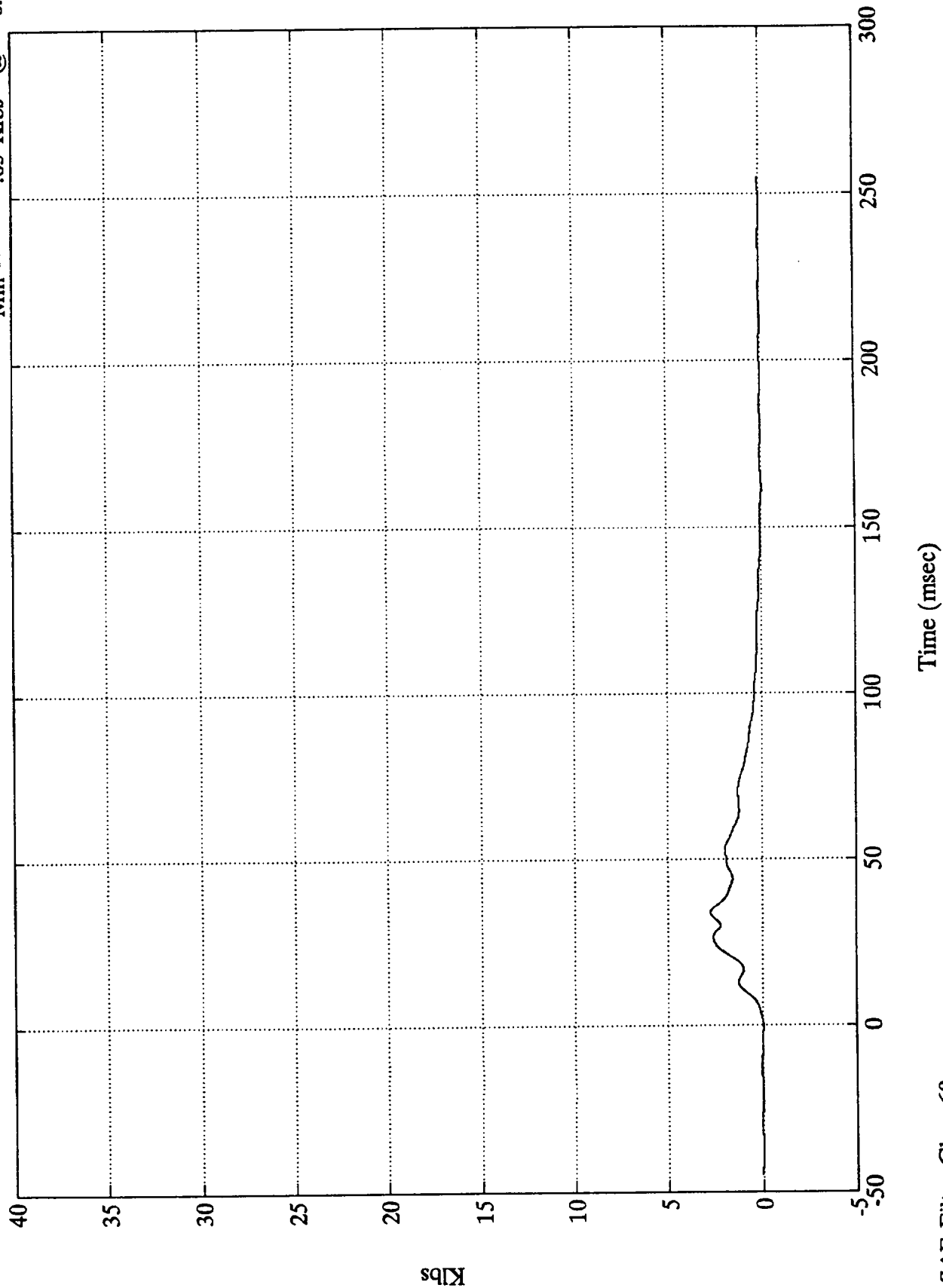
SAE Filter Class 60

7893-8

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B2

Max =	2.73 Klbs	@	34.07 msec
Min =	-0.05 Klbs	@	-0.48 msec



14-B
B-41

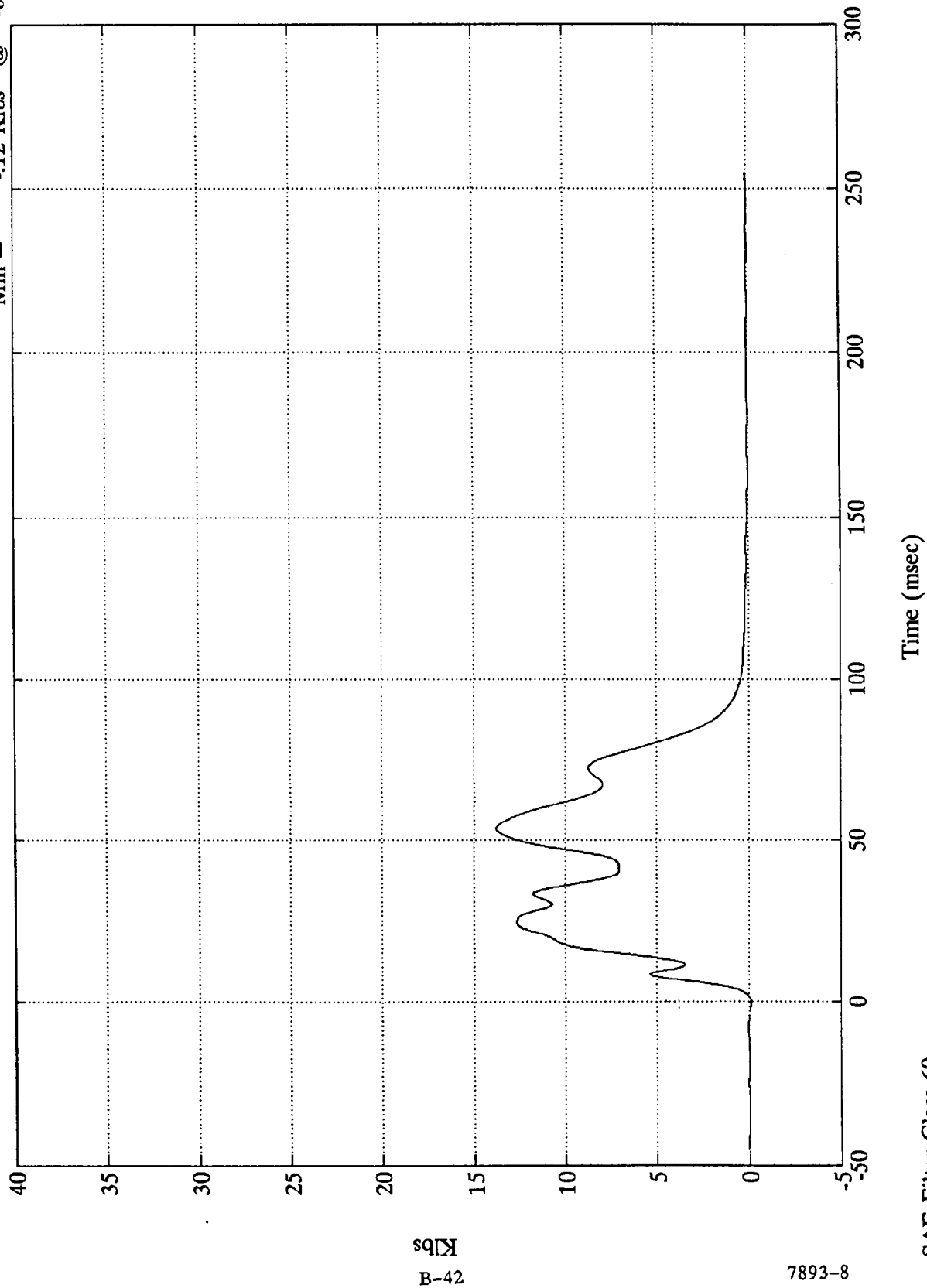
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B3

Max = 13.76 Klbs @ 53.63 msec
Min = -12 Klbs @ -0.36 msec



B-42

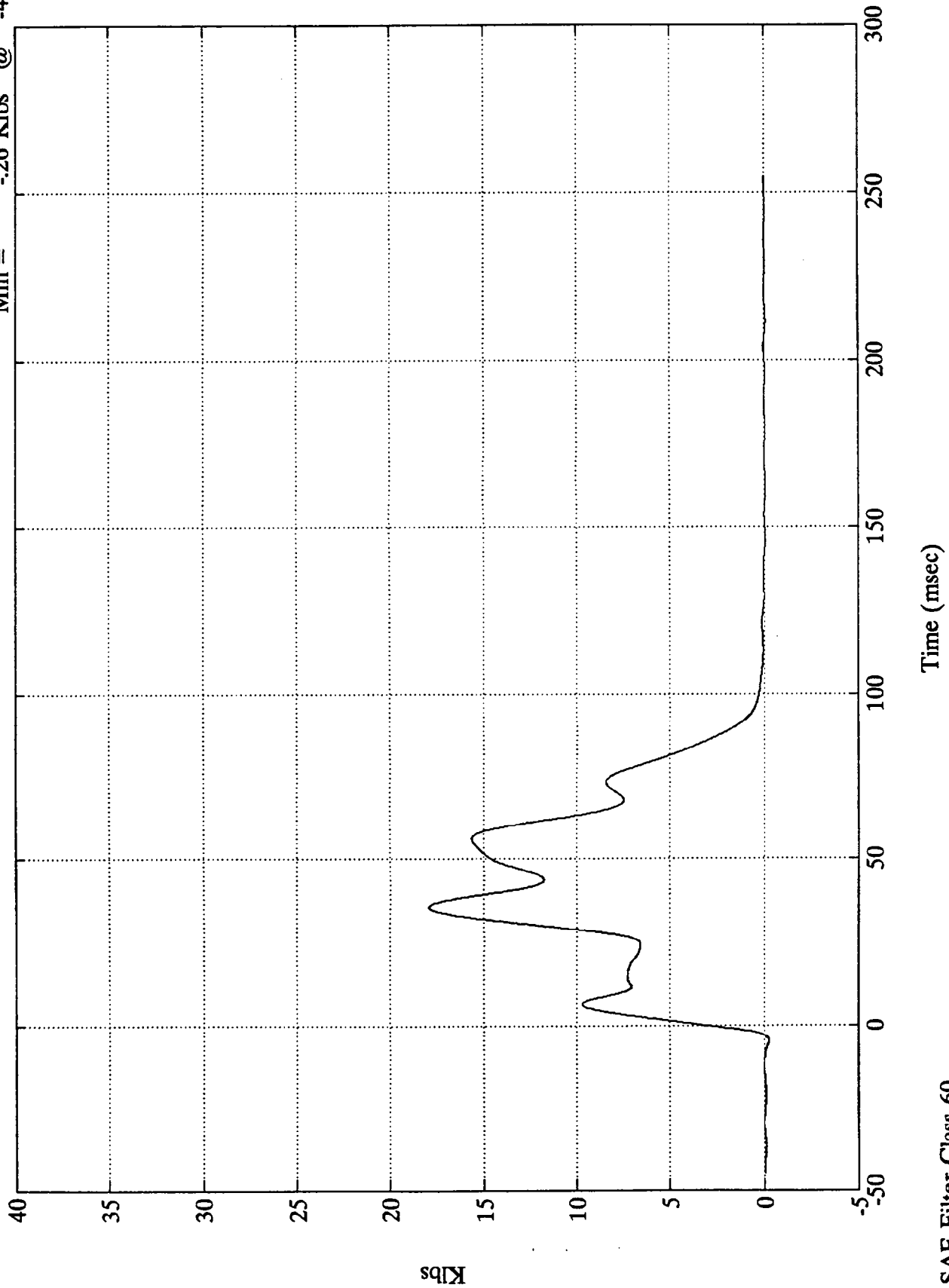
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B4

Max =	17.94 Klbs	@	35.39 msec
Min =	-2.6 Klbs	@	-4.80 msec



B-43

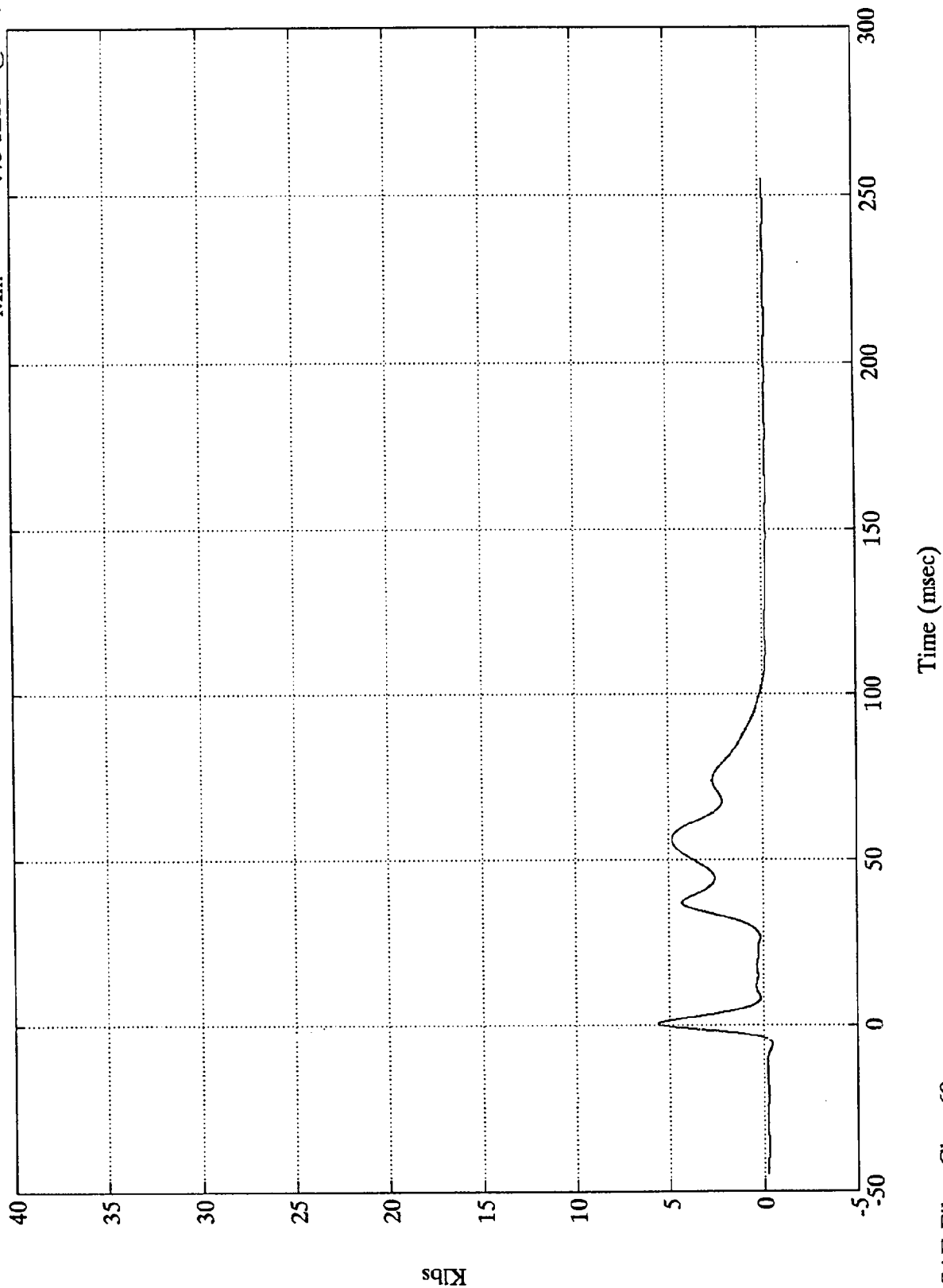
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 5.61 Klbs @ 0.23 msec
Min = -48 Klbs @ -5.76 msec

Barrier Load Cell B5



B-44

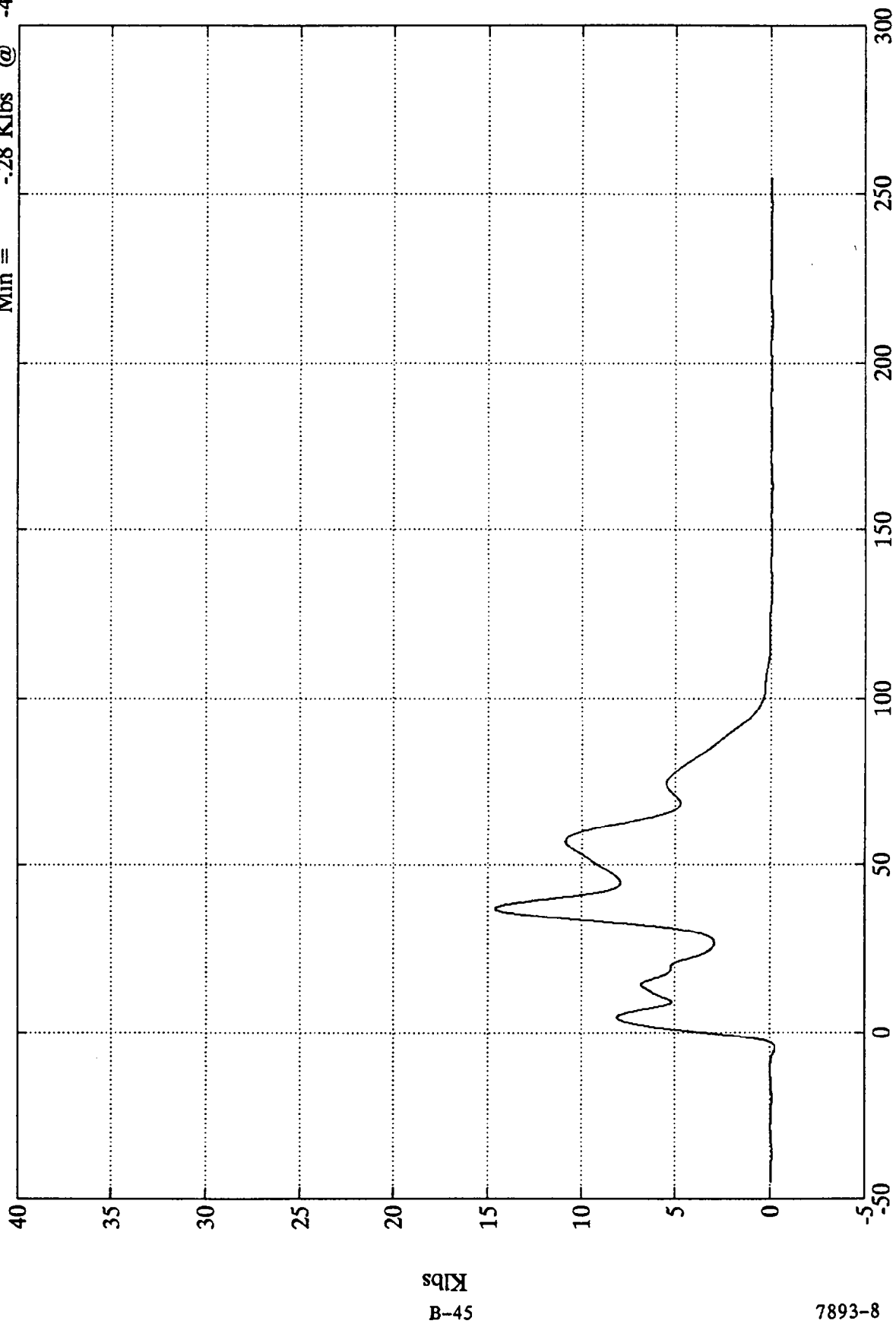
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B6

Max = 14.60 Klbs @ 37.20 msec
Min = -2.8 Klbs @ -4.68 msec



Time (msec)

SAE Filter Class 60

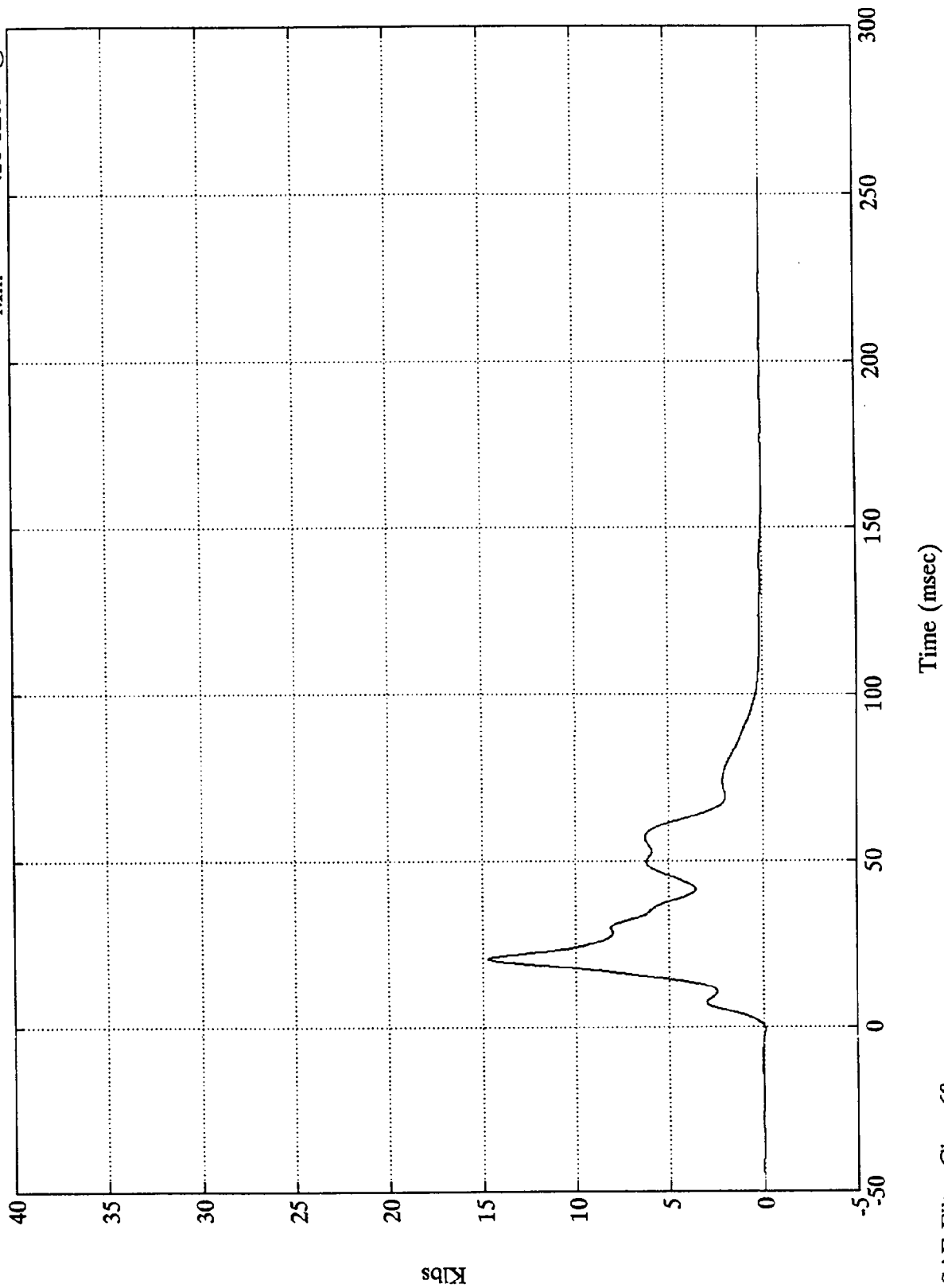
Klbs
B-45

7893-8

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B7

Max = 14.72 Klbs @ 20.52 msec
Min = -1.10 Klbs @ -0.84 msec



Klbs
B-46

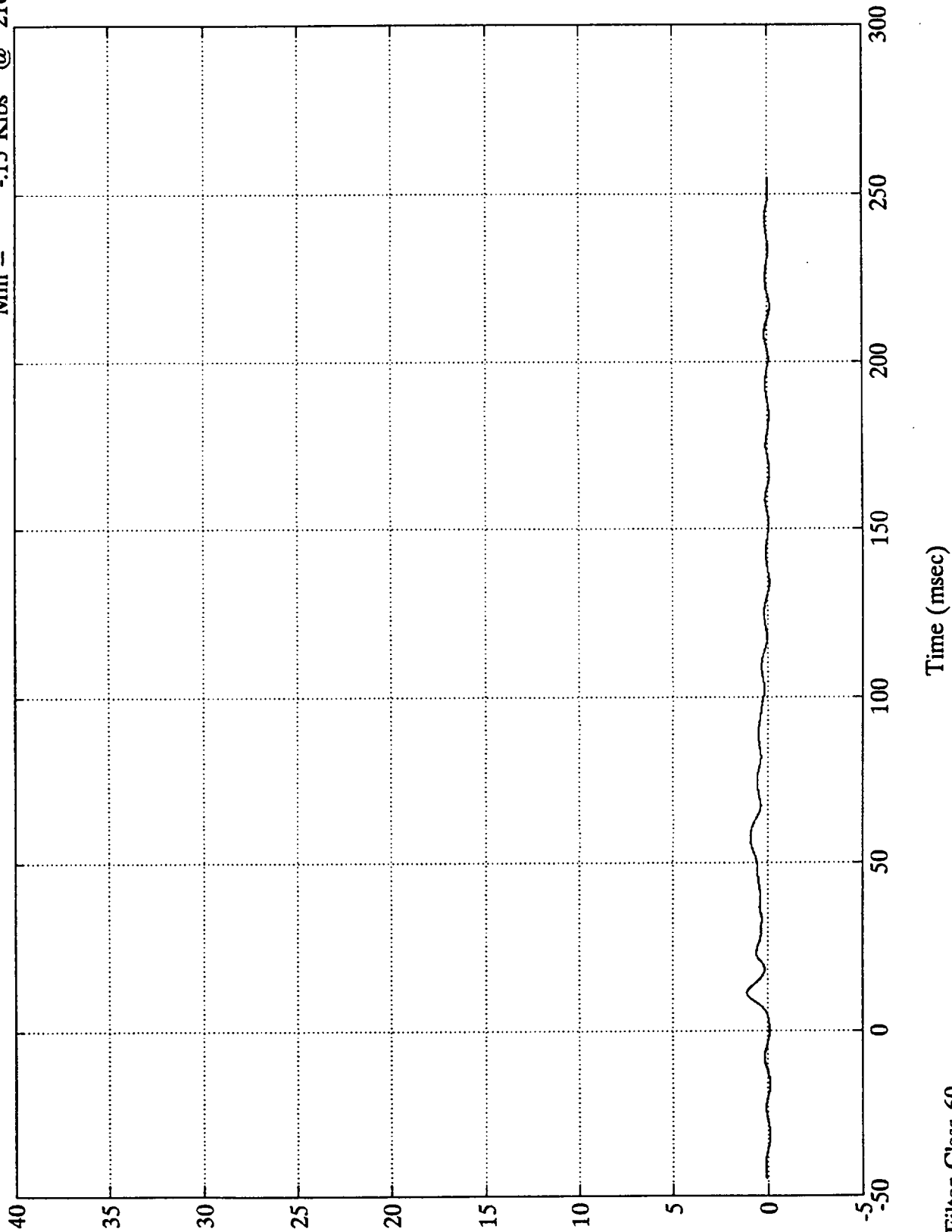
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B8

Max =	1.08 Klbs	@	11.15	msec
Min =	-1.15 Klbs	@	216.36	msec



Klbs

B-47

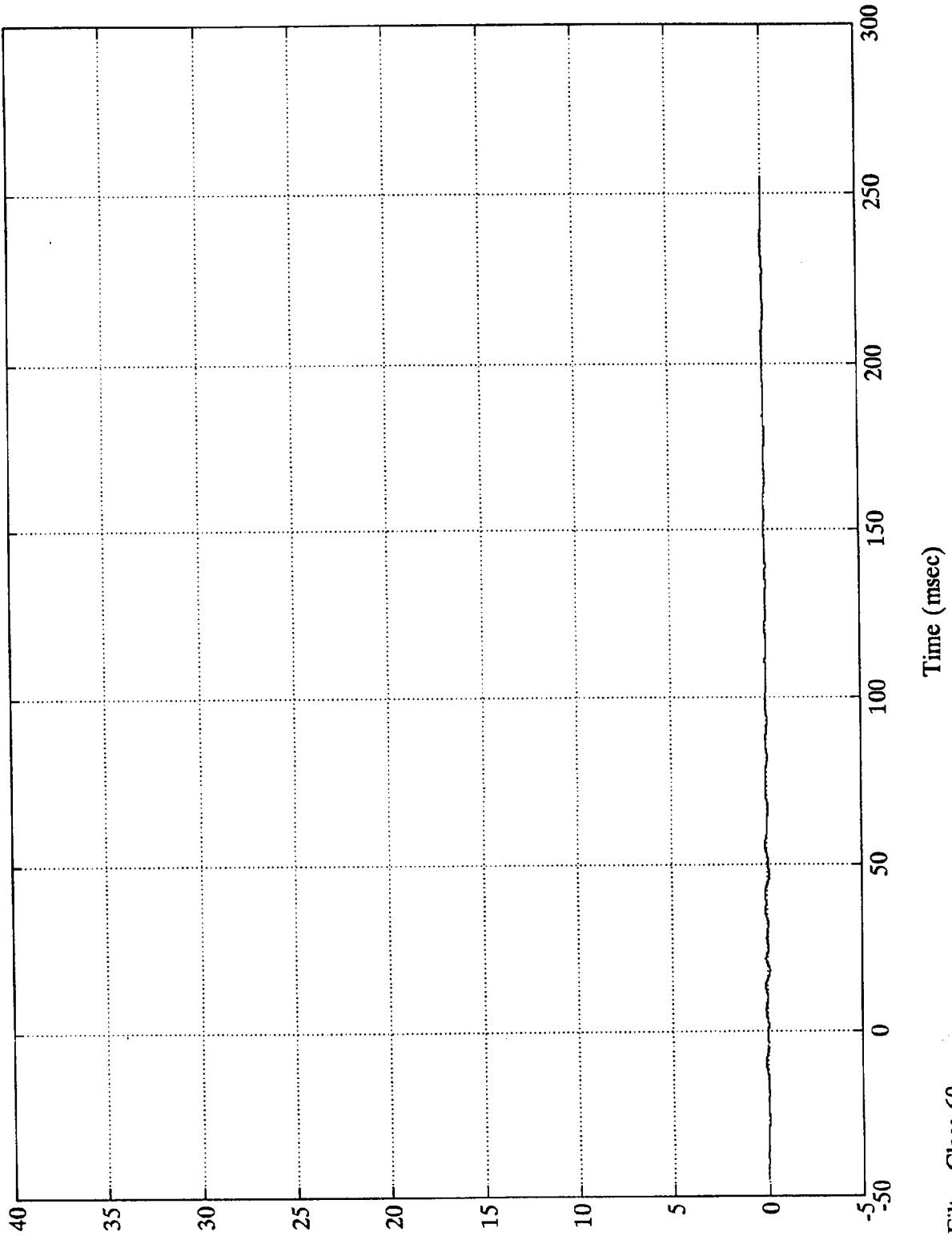
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell B9

Max = .10 Klbs @ 35.88 msec
Min = -.13 Klbs @ 18.12 msec



B-48
Klbs

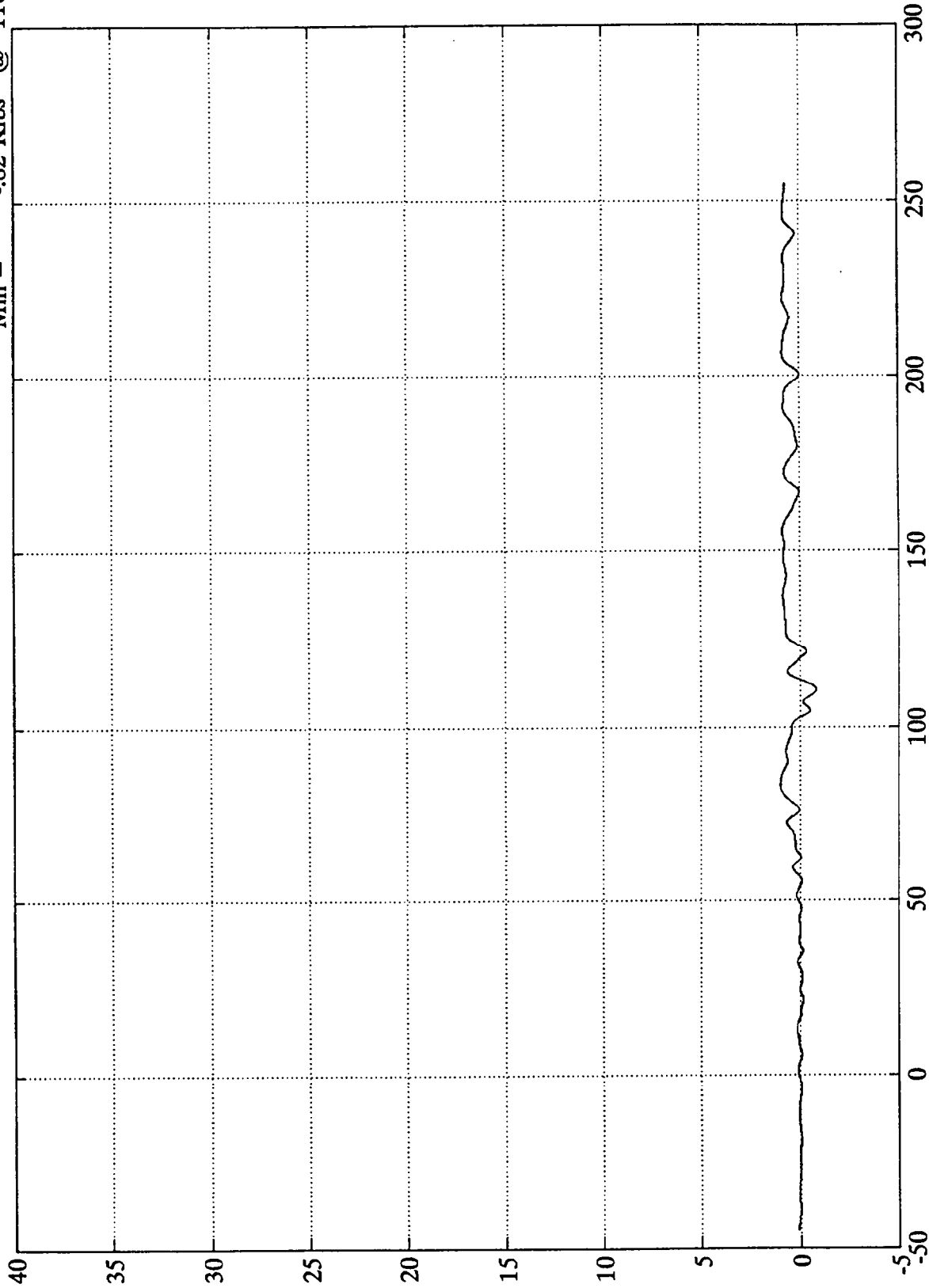
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 1.02 Klbs @ 83.28 msec
Min = -.82 Klbs @ 110.52 msec

Barrier Load Cell C1



B-49
Klbs

Time (msec)

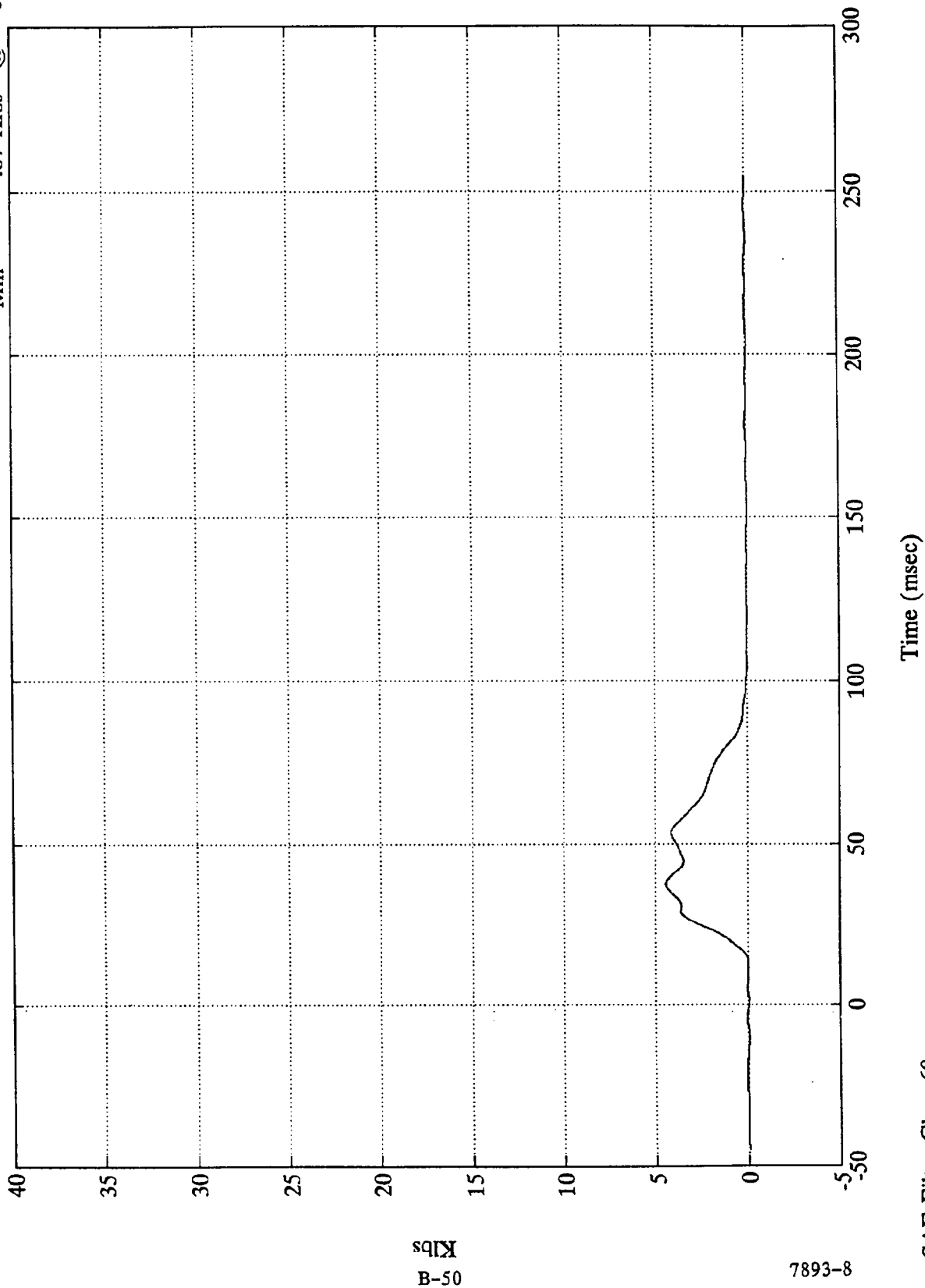
SAE Filter Class 60

7893-8

NCAP TEST #12 1991 GEO STORM

Max = 4.44 Klbs @ 37.44 msec
Min = -.07 Klbs @ 0.59 msec

Barrier Load Cell C2



B-50

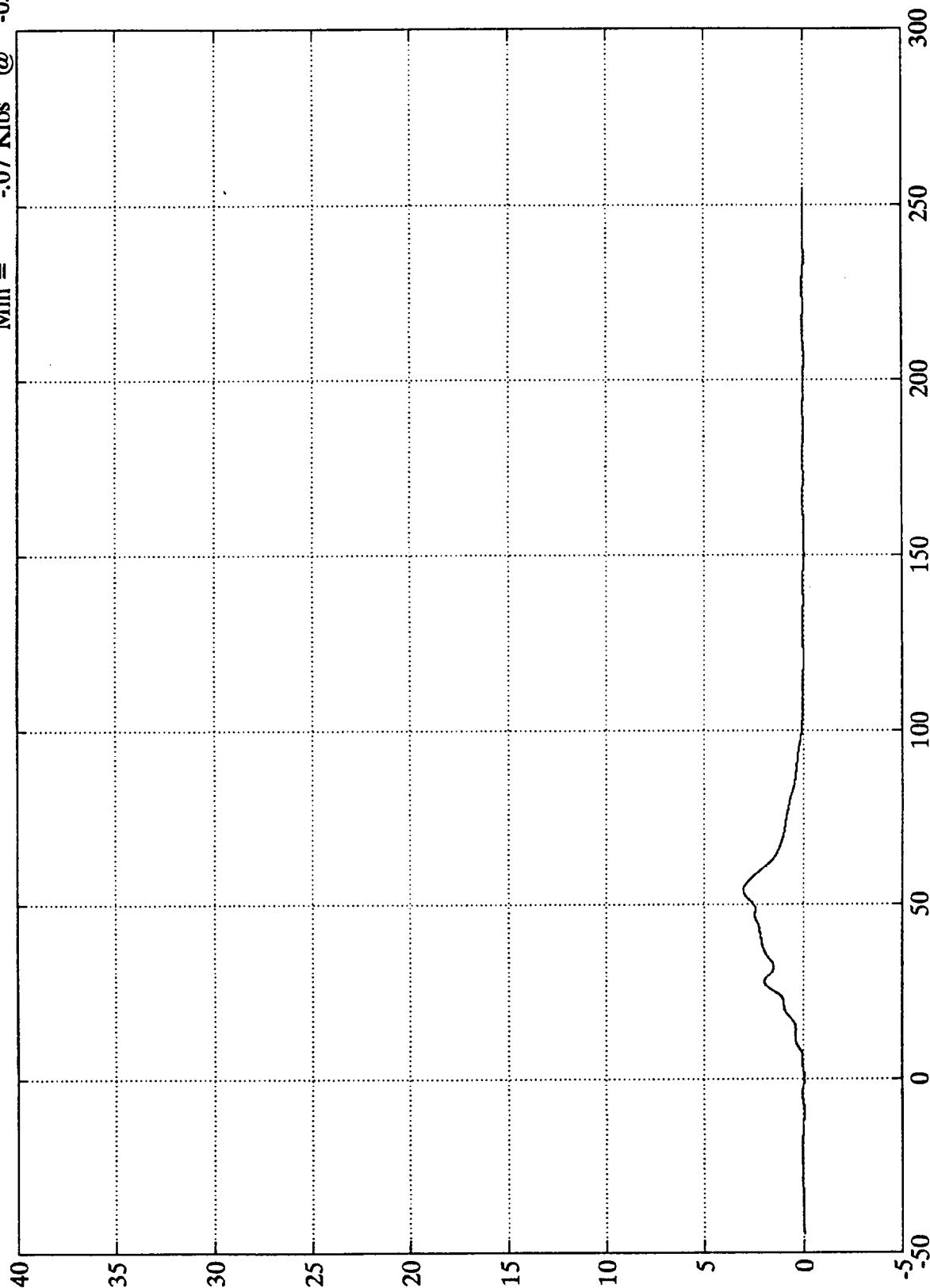
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 3.02 Klbs @ 54.11 msec
Min = -.07 Klbs @ -0.00 msec

Barrier Load Cell C3



B-51

7893-8

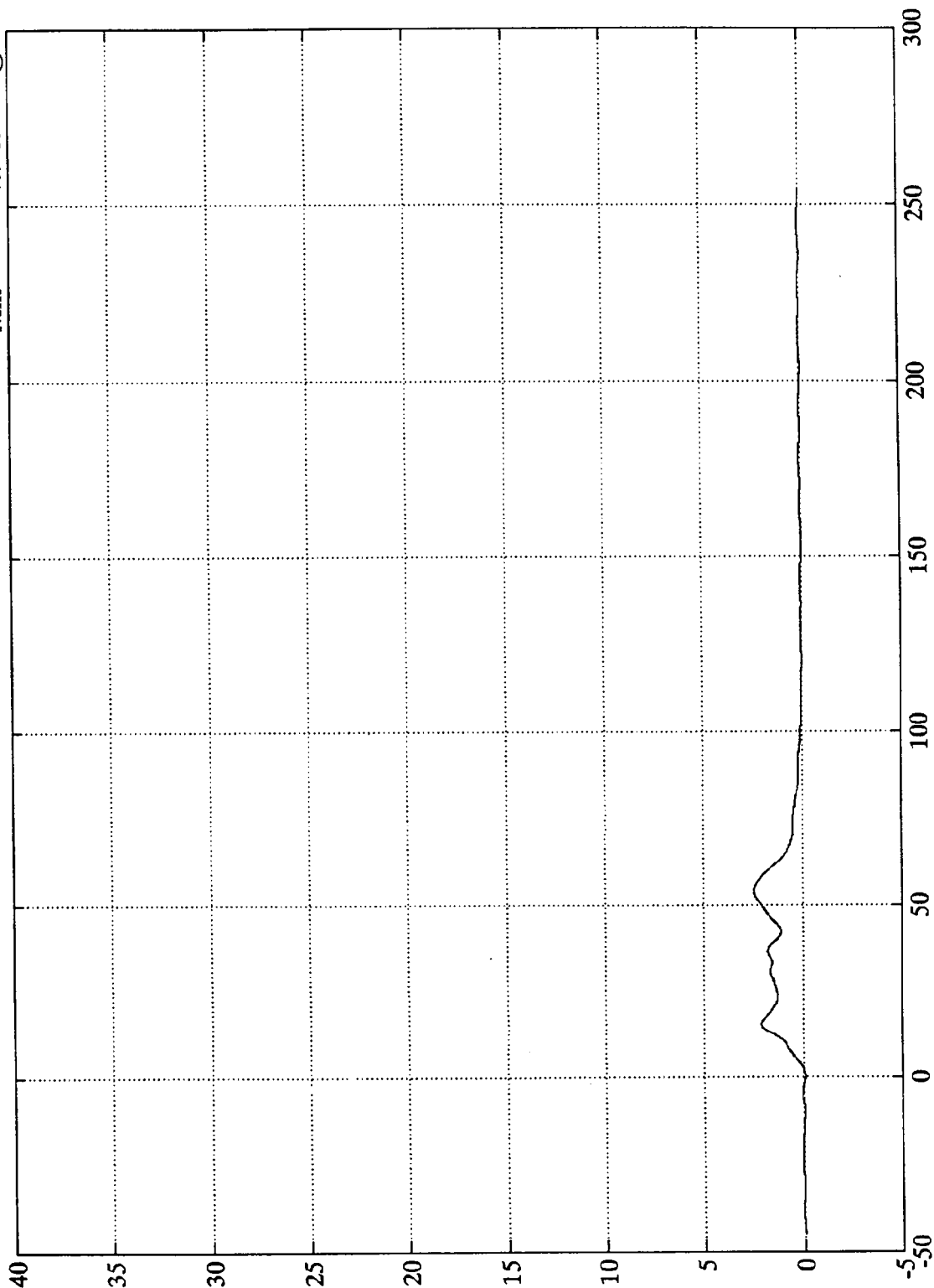
SAE Filter Class 60

Time (msec)

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell C4

Max = 2.45 Klbs @ 53.88 msec
Min = -.09 Klbs @ -0.12 msec



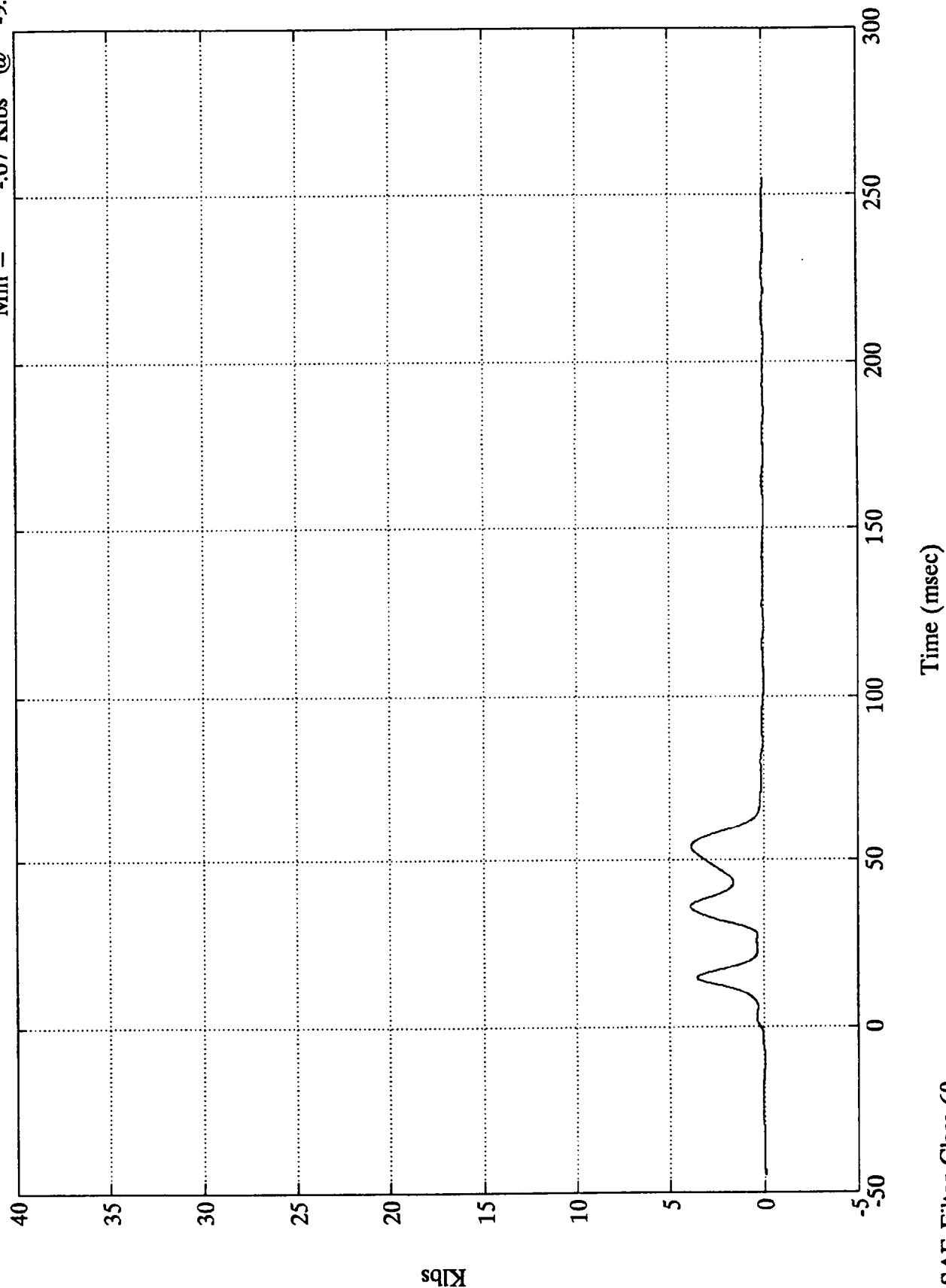
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 3.91 Klbs @ 36.12 msec
Min = -.07 Klbs @ -9.72 msec

Barrier Load Cell C5



B-53
Klbs

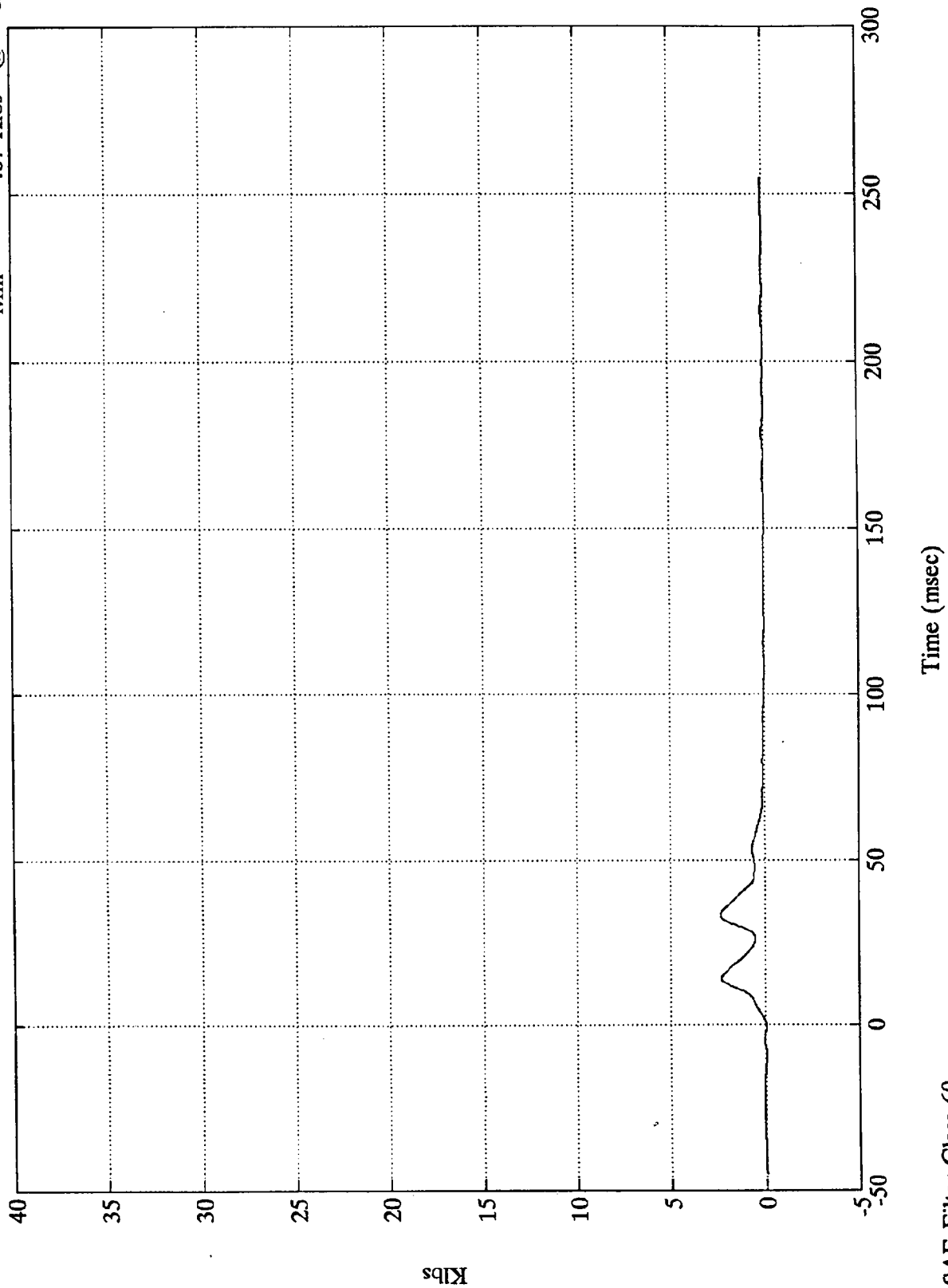
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell C6

Max = 2.36 Klbs @ 33.24 msec
Min = -0.07 Klbs @ -0.48 msec



B-54
Klbs

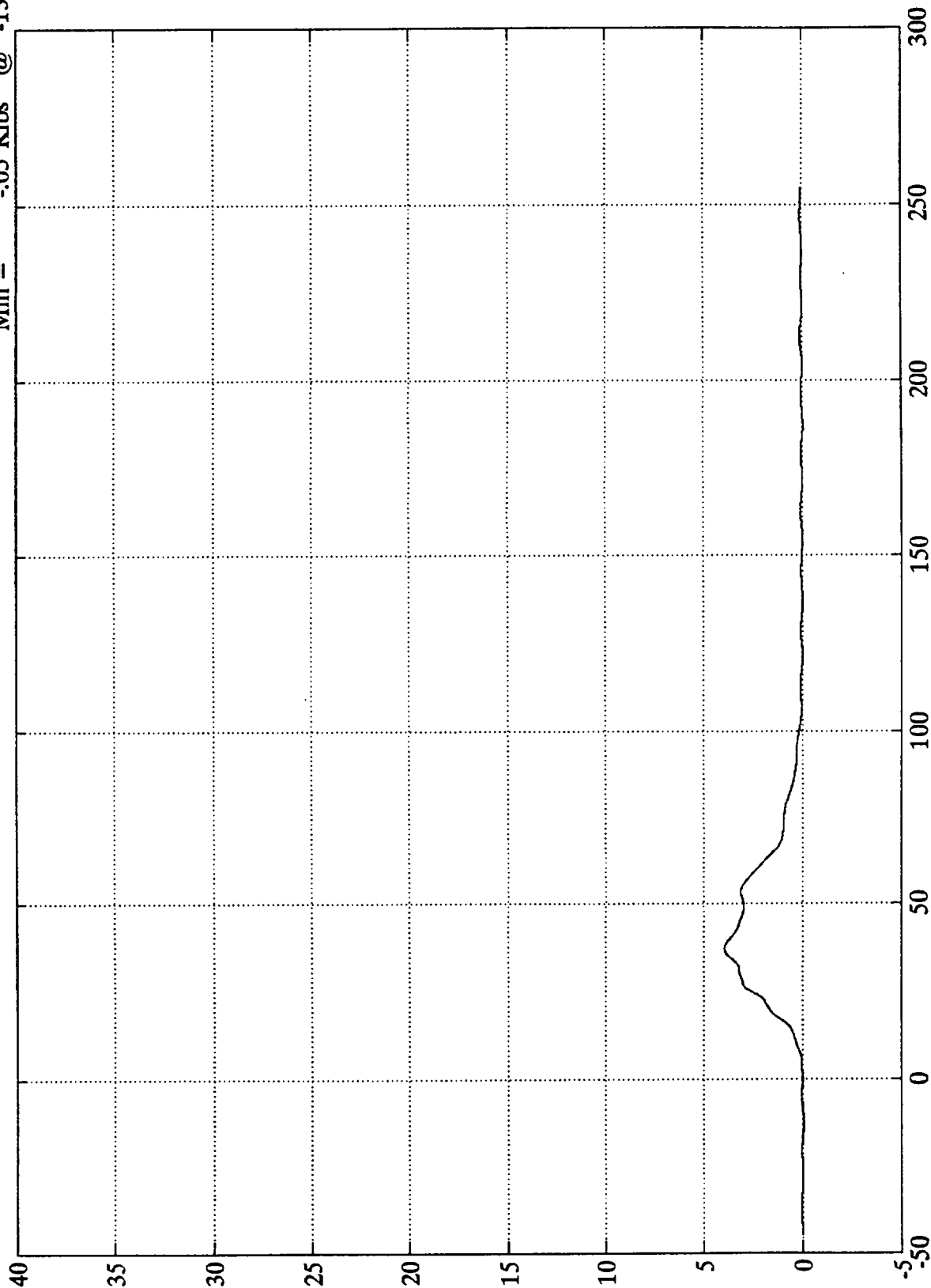
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 3.98 Klbs @ 37.31 msec
Min = -.05 Klbs @ -13.08 msec

Barrier Load Cell C7



Time (msec)

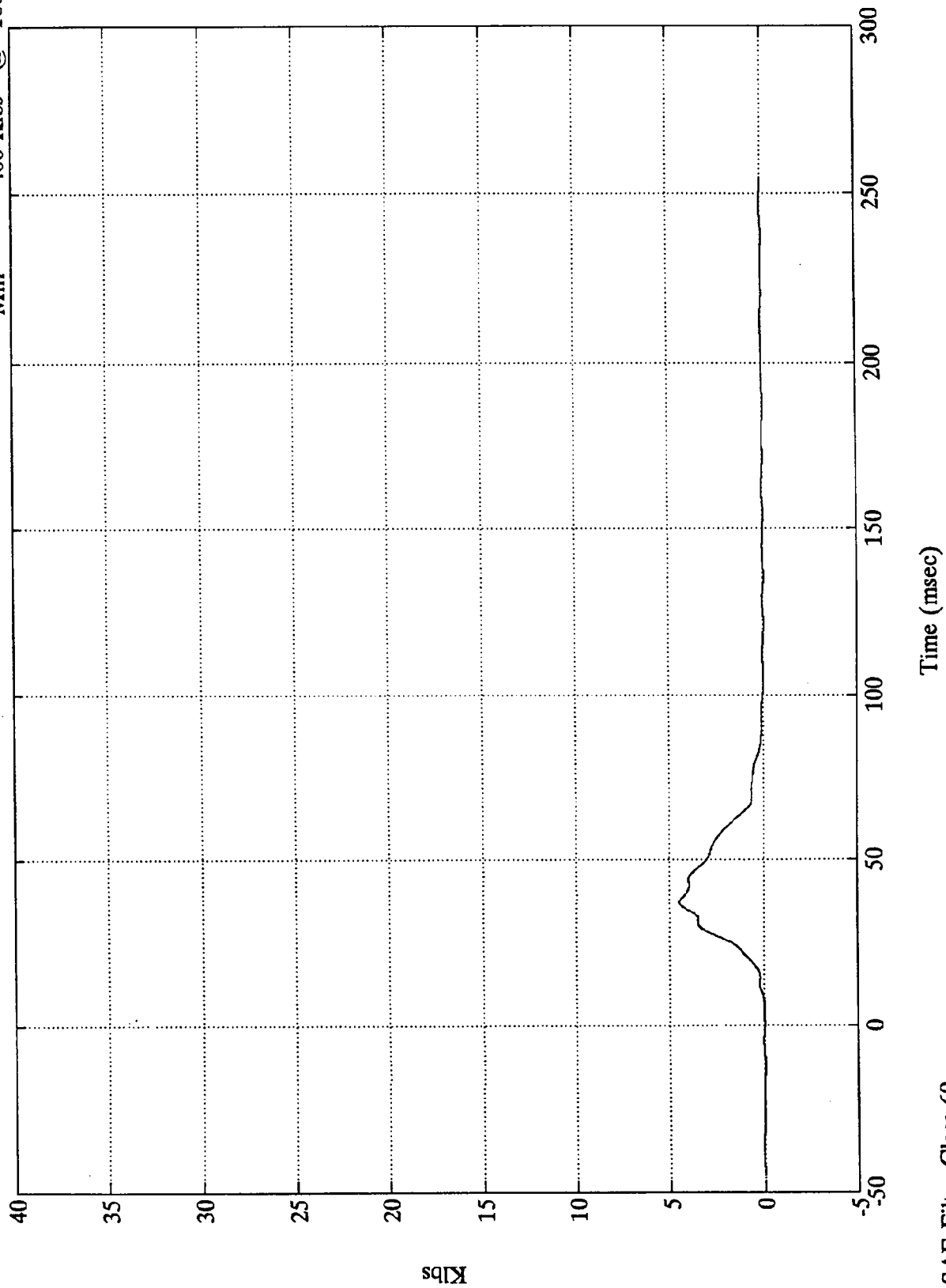
SAE Filter Class 60

B-55
Klbs

7893-8

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell C8
Max = 4.51 Klbs @ 36.84 msec
Min = -0.06 Klbs @ 186.24 msec



B-56
Klbs

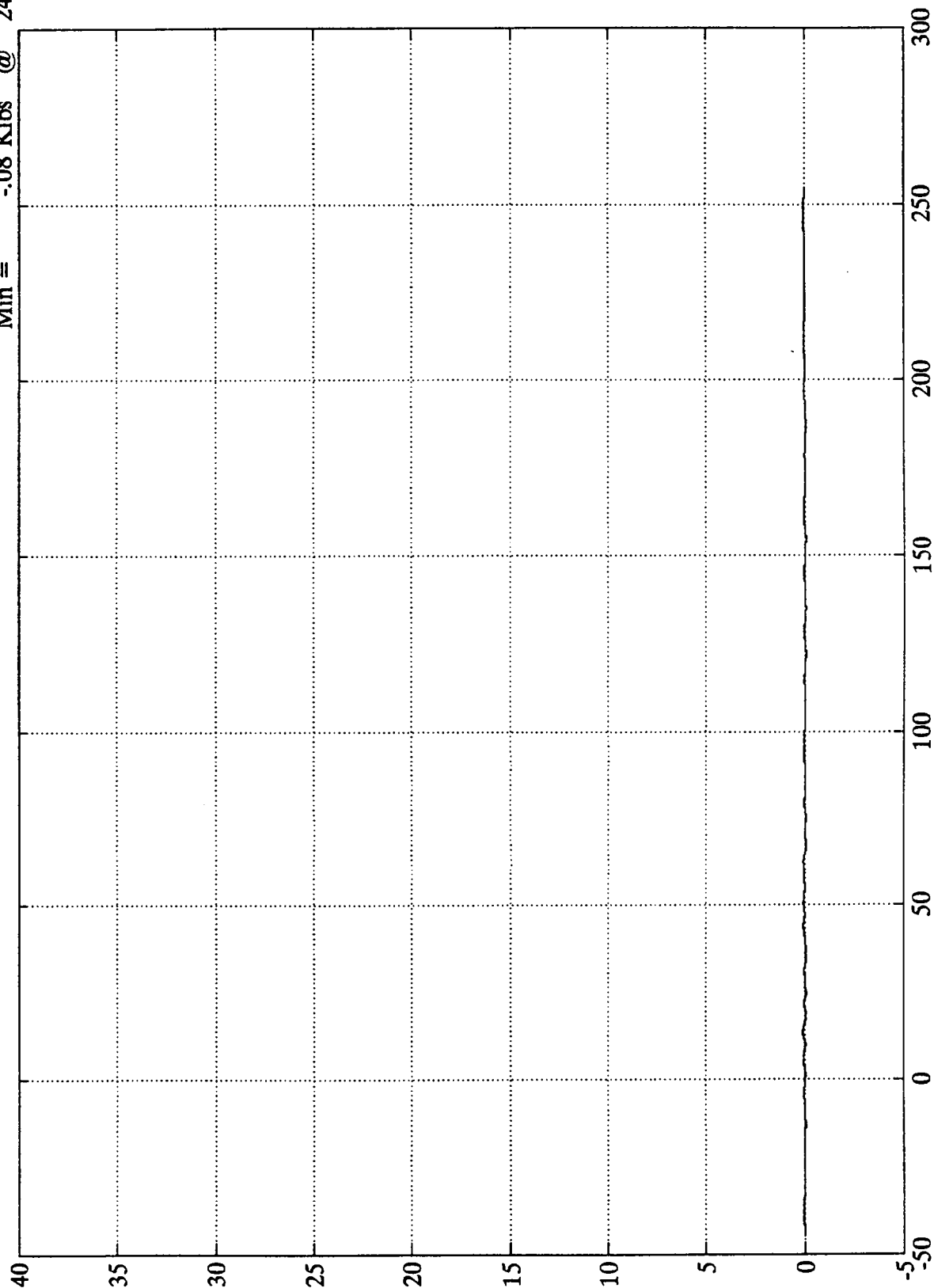
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = .07 Klbs @ 13.07 msec
Min = -.08 Klbs @ 24.59 msec

Barrier Load Cell C9



B-57
Klbs

Time (msec)

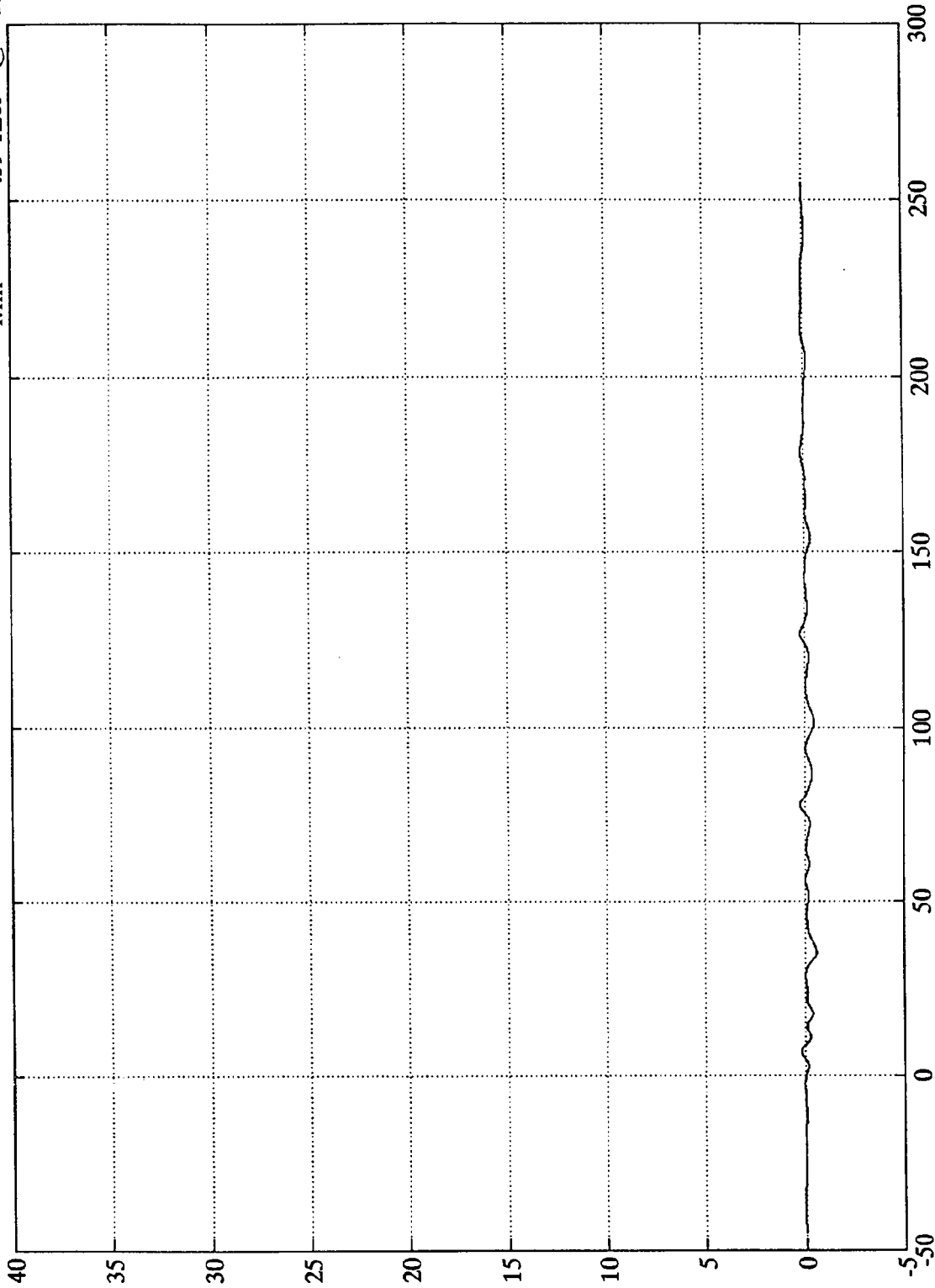
SAE Filter Class 60

7893-8

NCAP TEST #12 1991 GEO STORM

Max = .26 Klbs @ 78.00 msec
Min = -.59 Klbs @ 35.15 msec

Barrier Load Cell D1



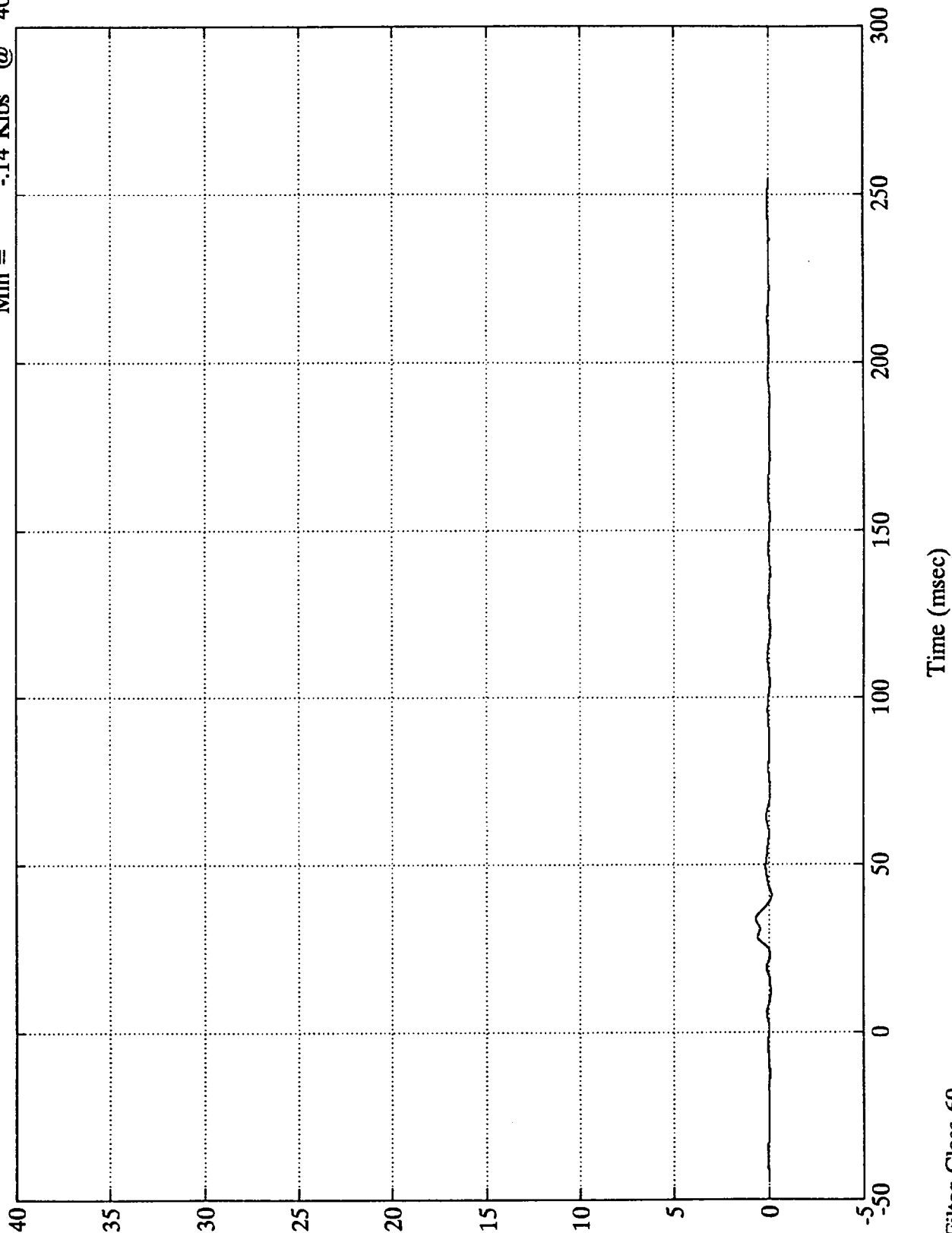
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = .69 Klbs @ 33.95 msec
Min = -.14 Klbs @ 40.92 msec

Barrier Load Cell D2



B-59
Klbs

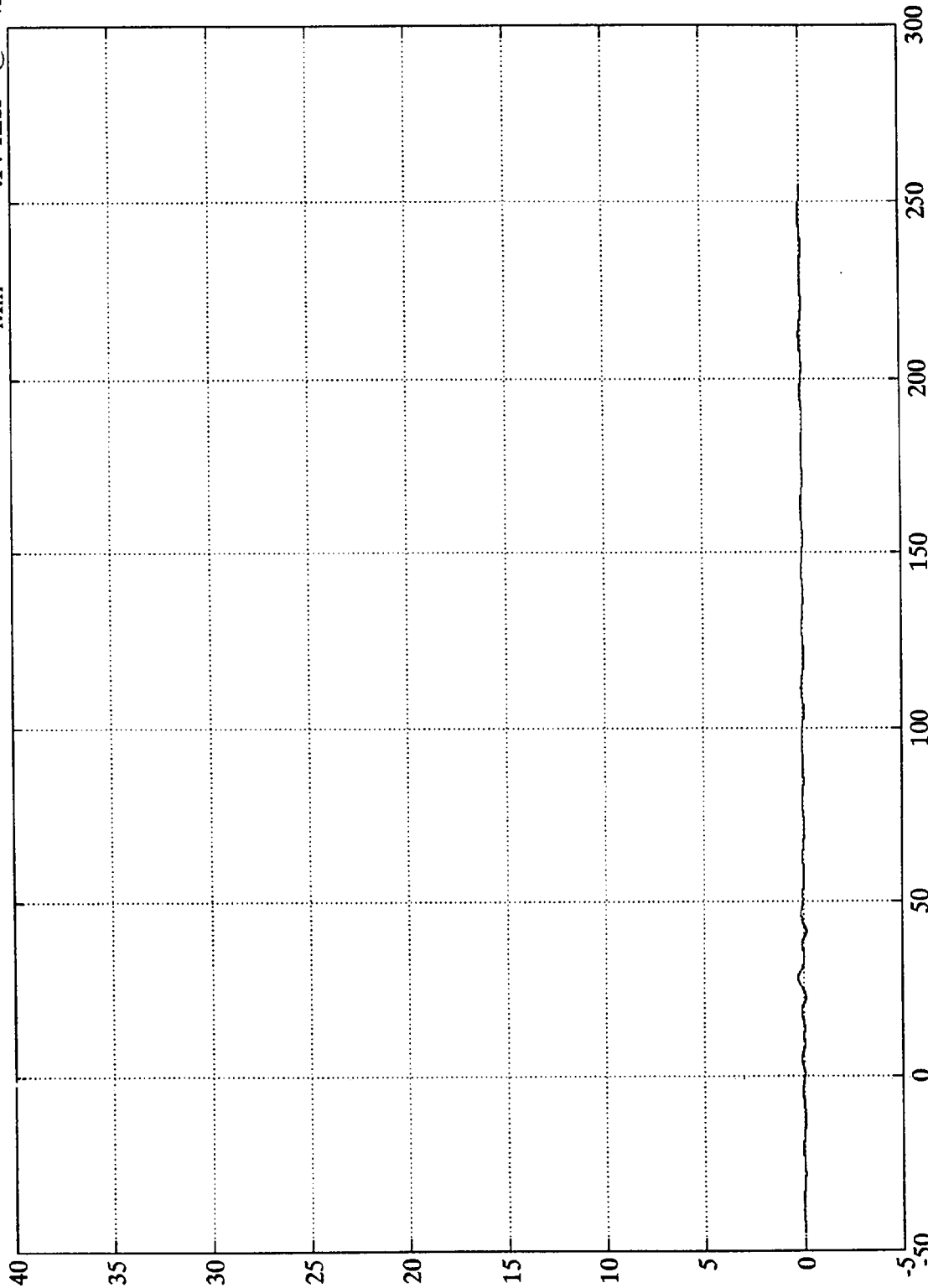
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = .30 Klbs @ 27.84 msec
Min = -.14 Klbs @ 41.28 msec

Barrier Load Cell D3



Time (msec)

SAE Filter Class 60

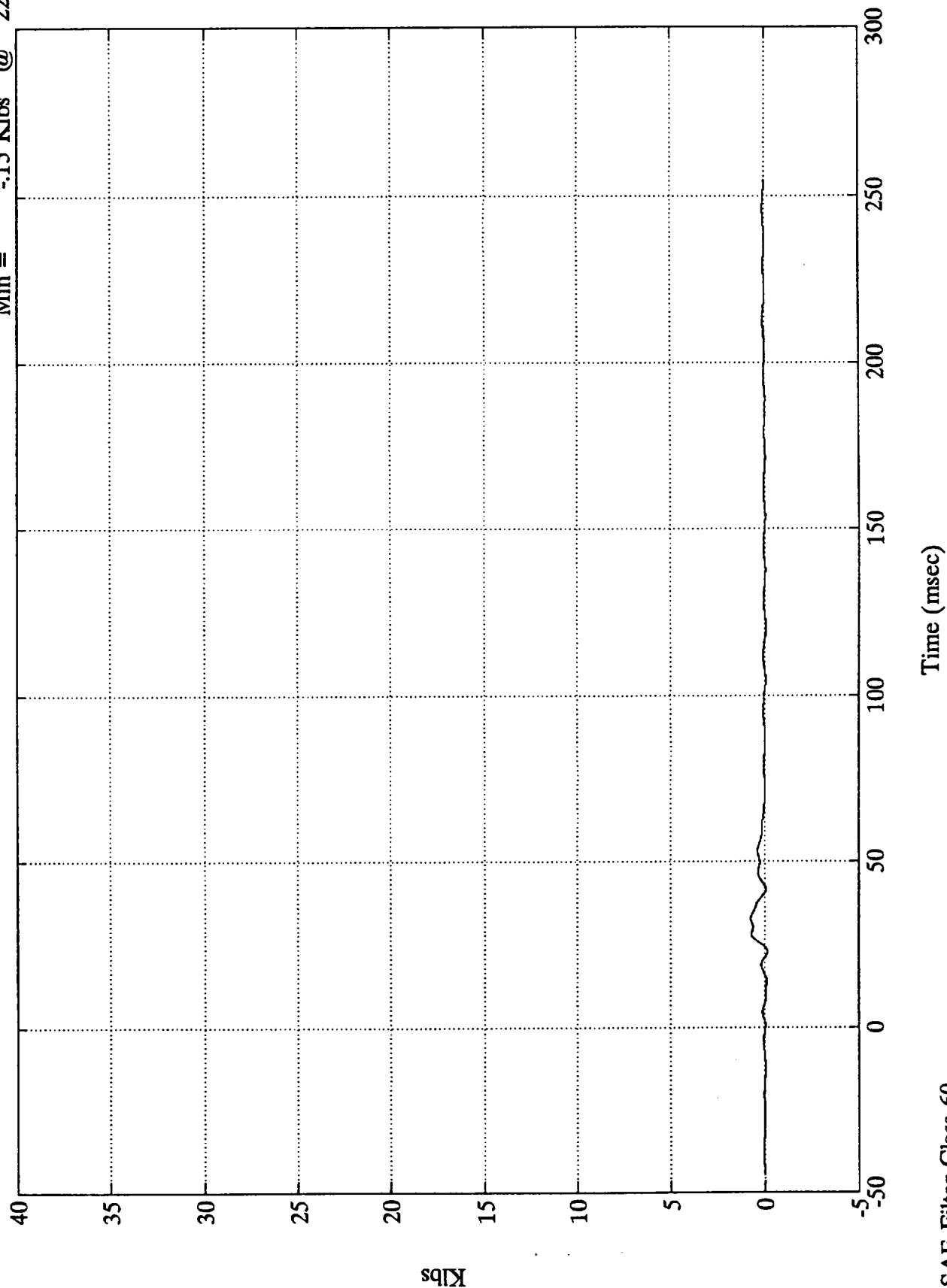
B-60
Klbs

7893-8

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell D4

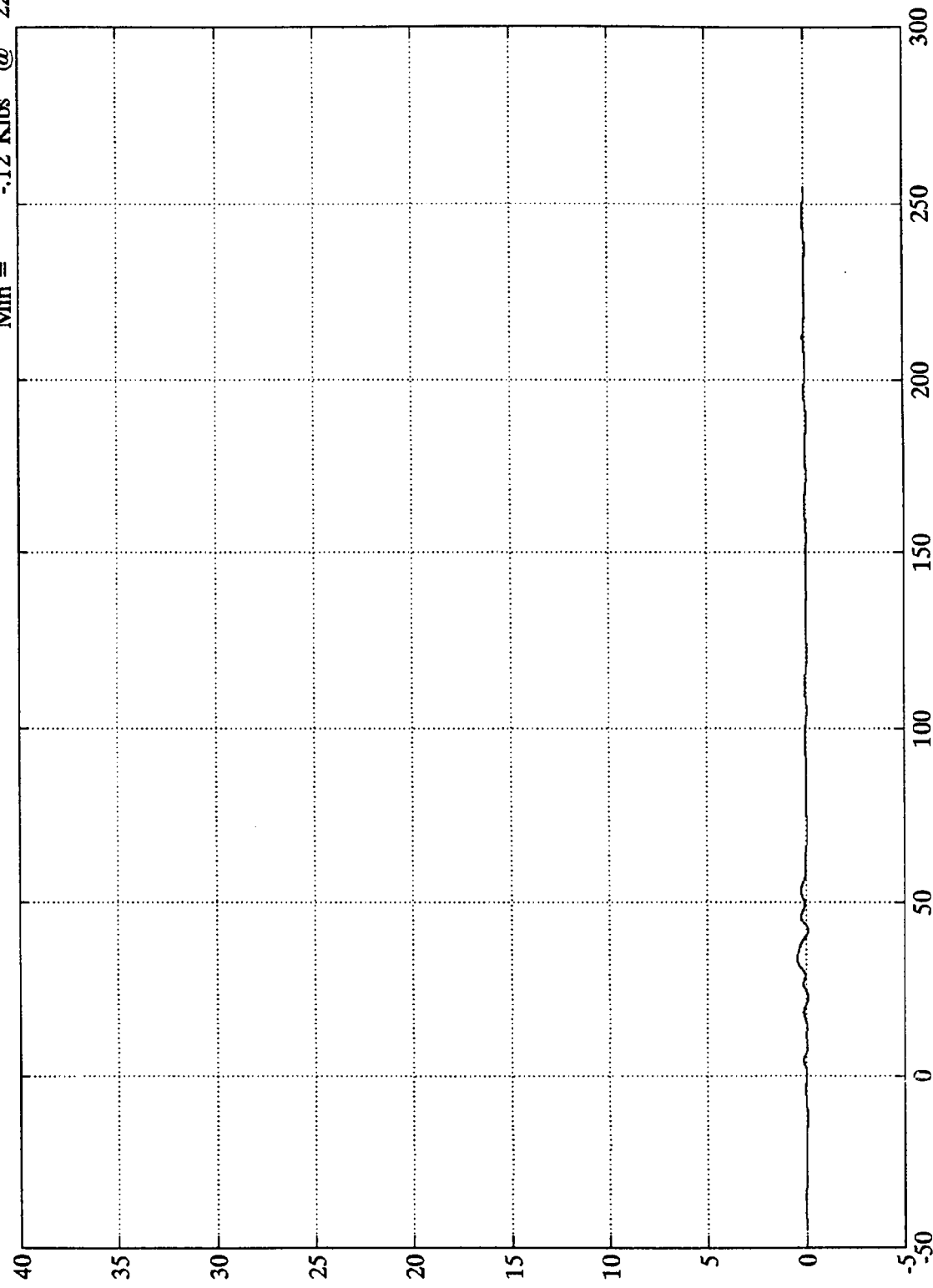
Max =	.73 Klbs	@	33.00 msec
Min =	-.15 Klbs	@	22.68 msec



NCAP TEST #12 1991 GEO STORM

Max = .45 Klbs @ 33.84 msec
Min = -.12 Klbs @ 22.80 msec

Barrier Load Cell D5



B-62

7893-8

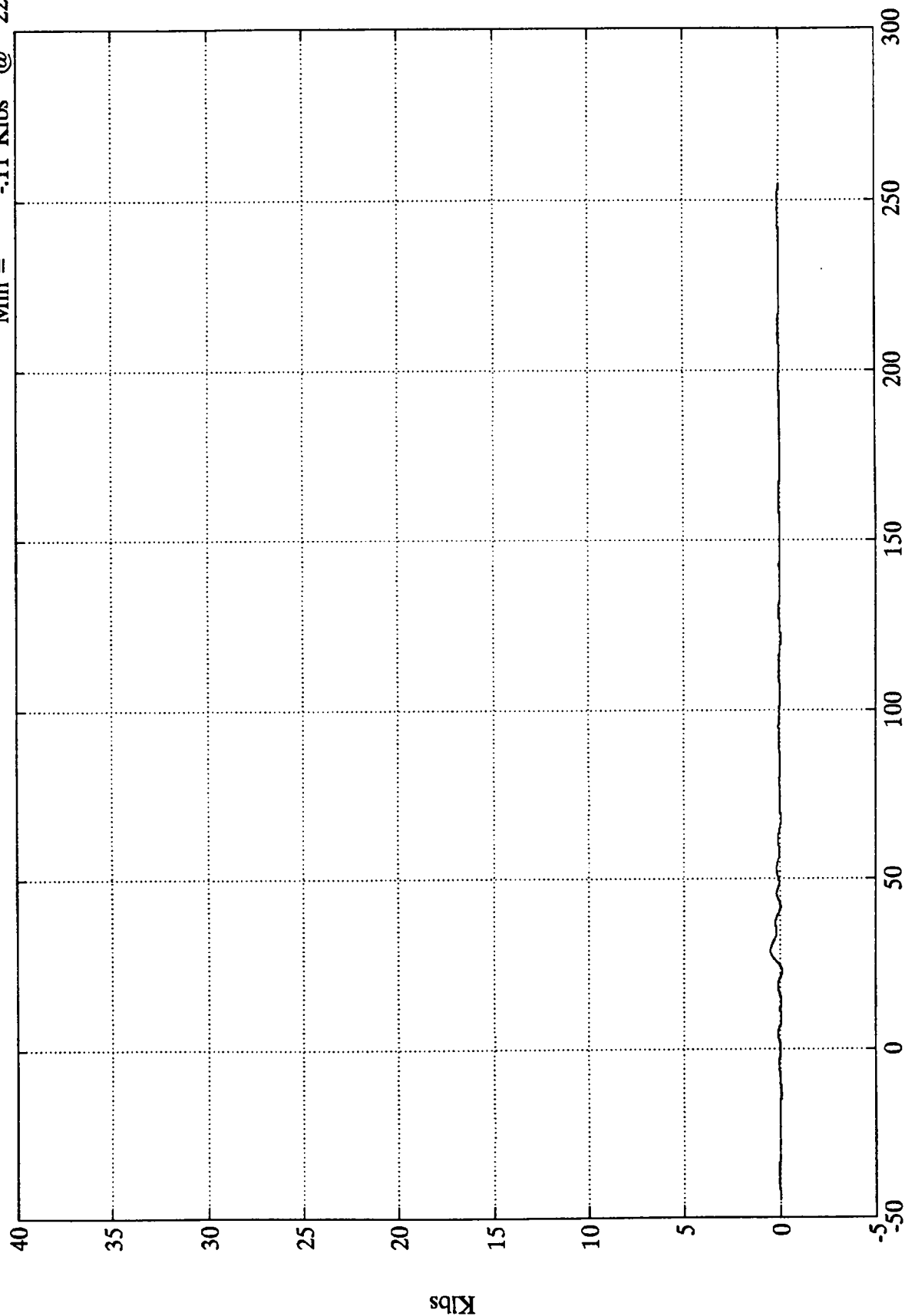
SAE Filter Class 60

Time (msec)

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell D6

Max =	.48 Klbs	@	29.03 msec
Min =	-.11 Klbs	@	22.92 msec



B-63

7893-8

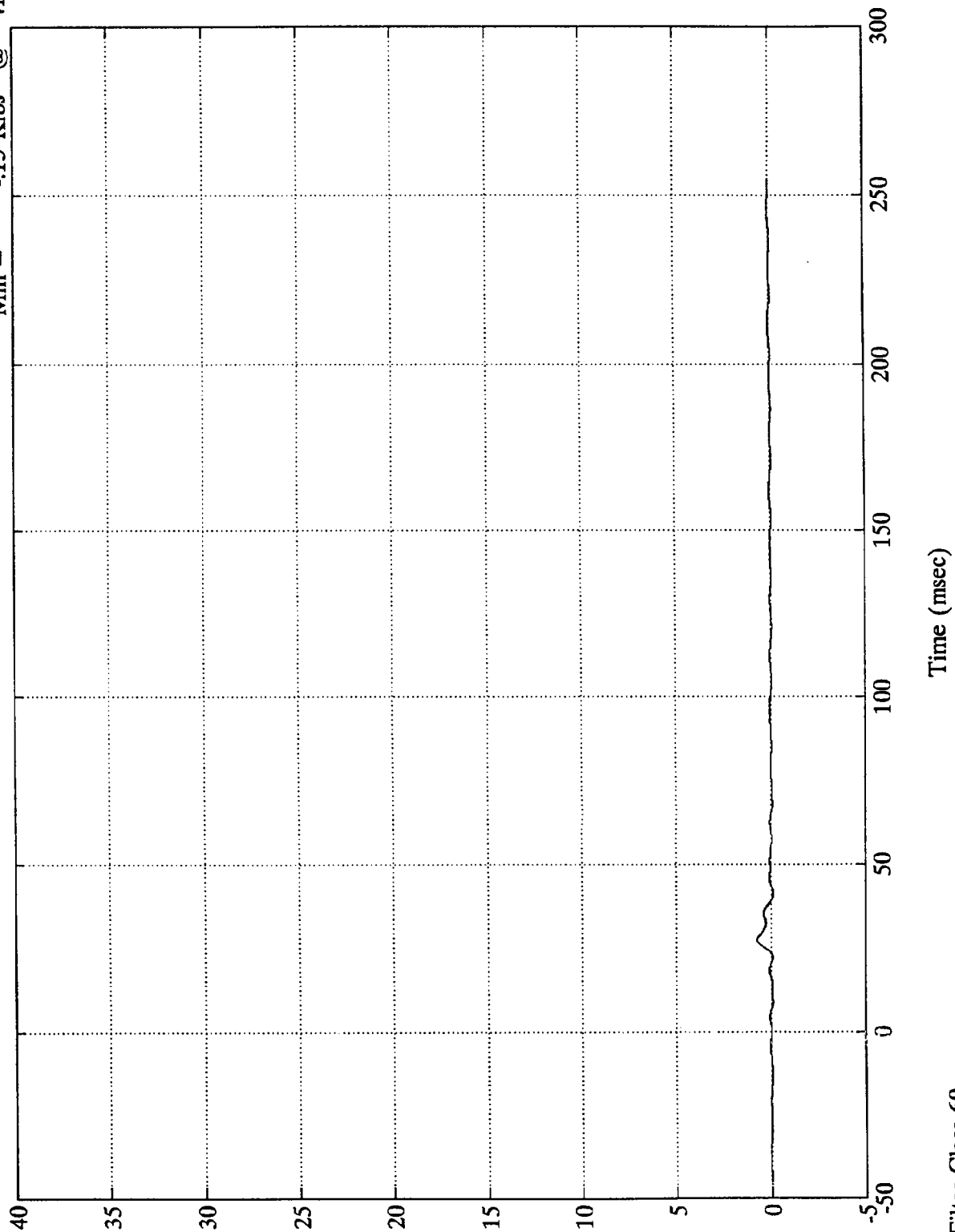
SAE Filter Class 60

Time (msec)

NCAP TEST #12 1991 GEO STORM

Max = .74 Klbs @ 27.23 msec
Min = -.13 Klbs @ 41.28 msec

Barrier Load Cell D7



B-64
sqib

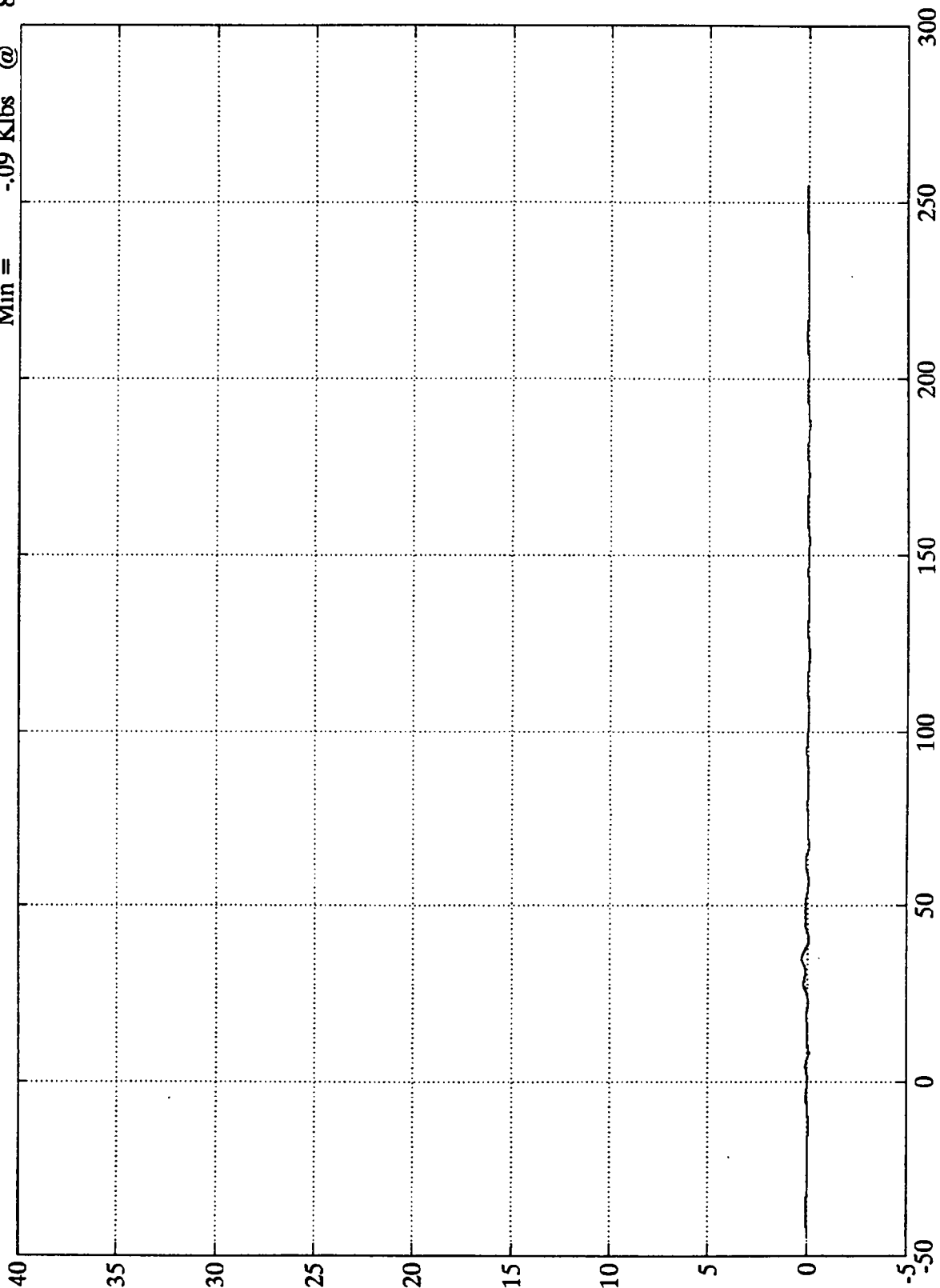
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = .27 Klbs @ 35.15 msec
Min = -.09 Klbs @ 8.27 msec

Barrier Load Cell D8



Time (msec)

SAE Filter Class 60

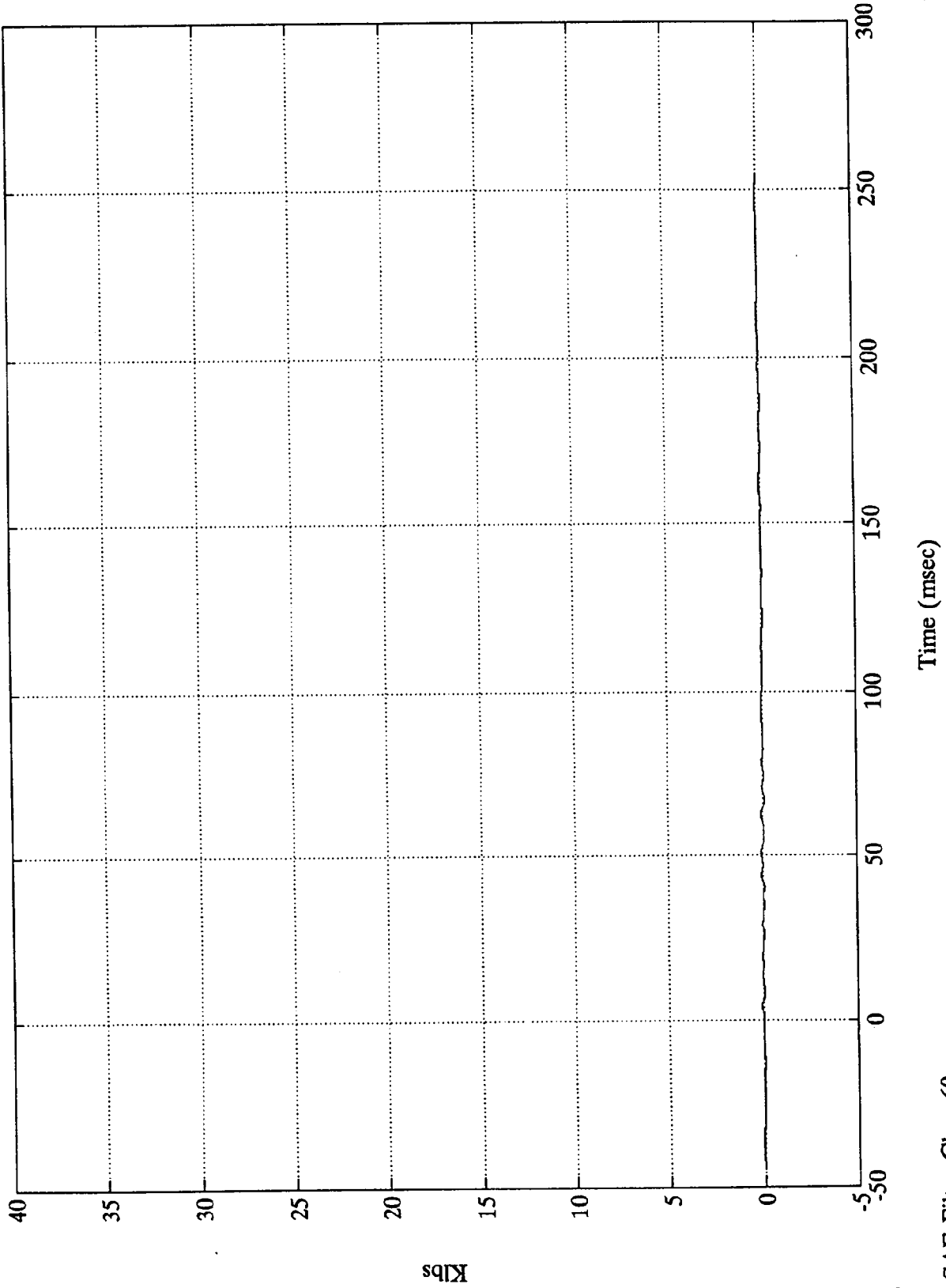
B-65

7893-8

NCAP TEST #12 1991 GEO STORM

Barrier Load Cell D9

Max = .10 Klbs @ 62.64 msec
Min = -.12 Klbs @ 67.32 msec



B-66

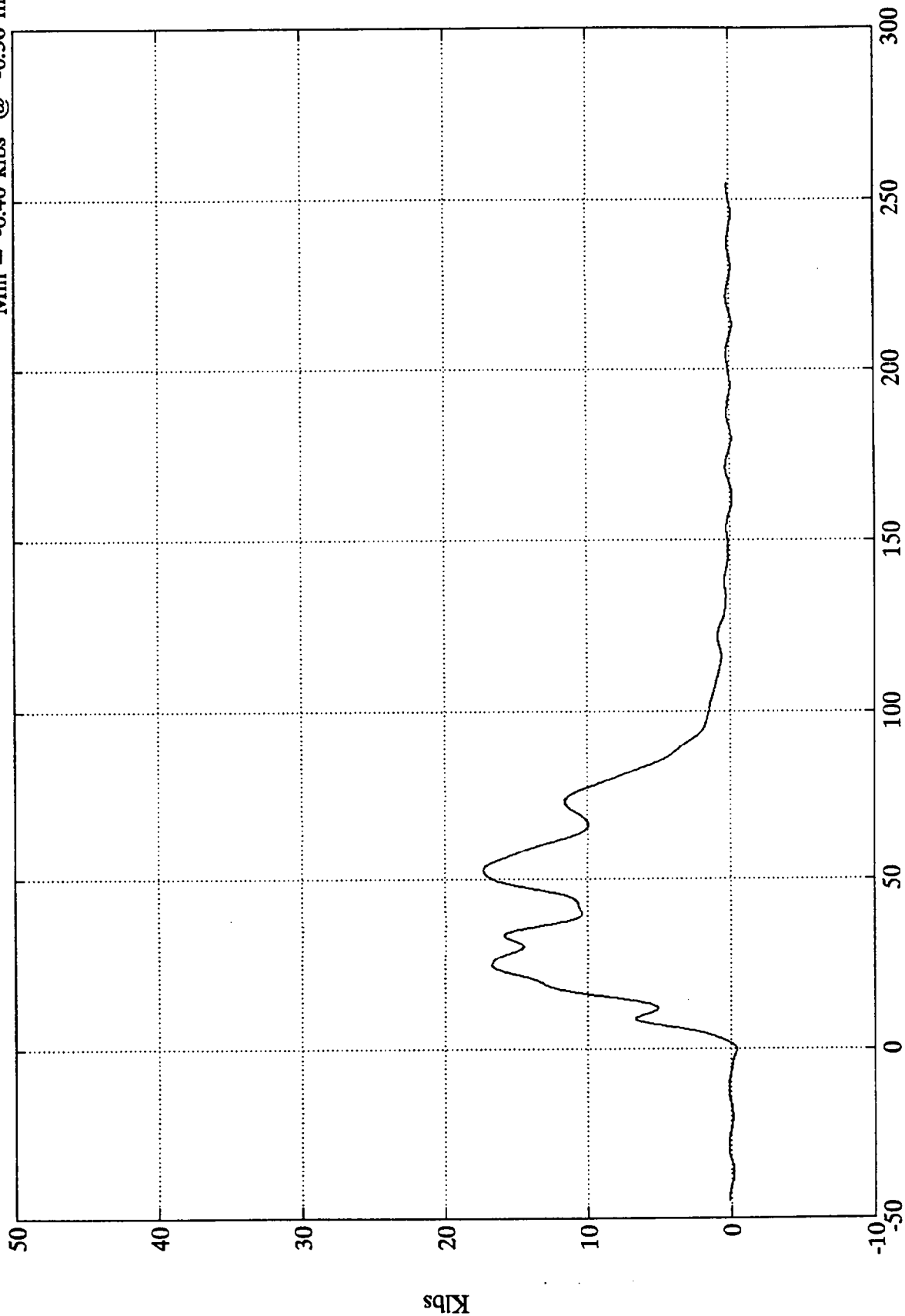
7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 17.32 klbs @ 52.80 msec
Min = -0.40 klbs @ -0.36 msec

Group 1 Load Cell Sum



Time (msec)

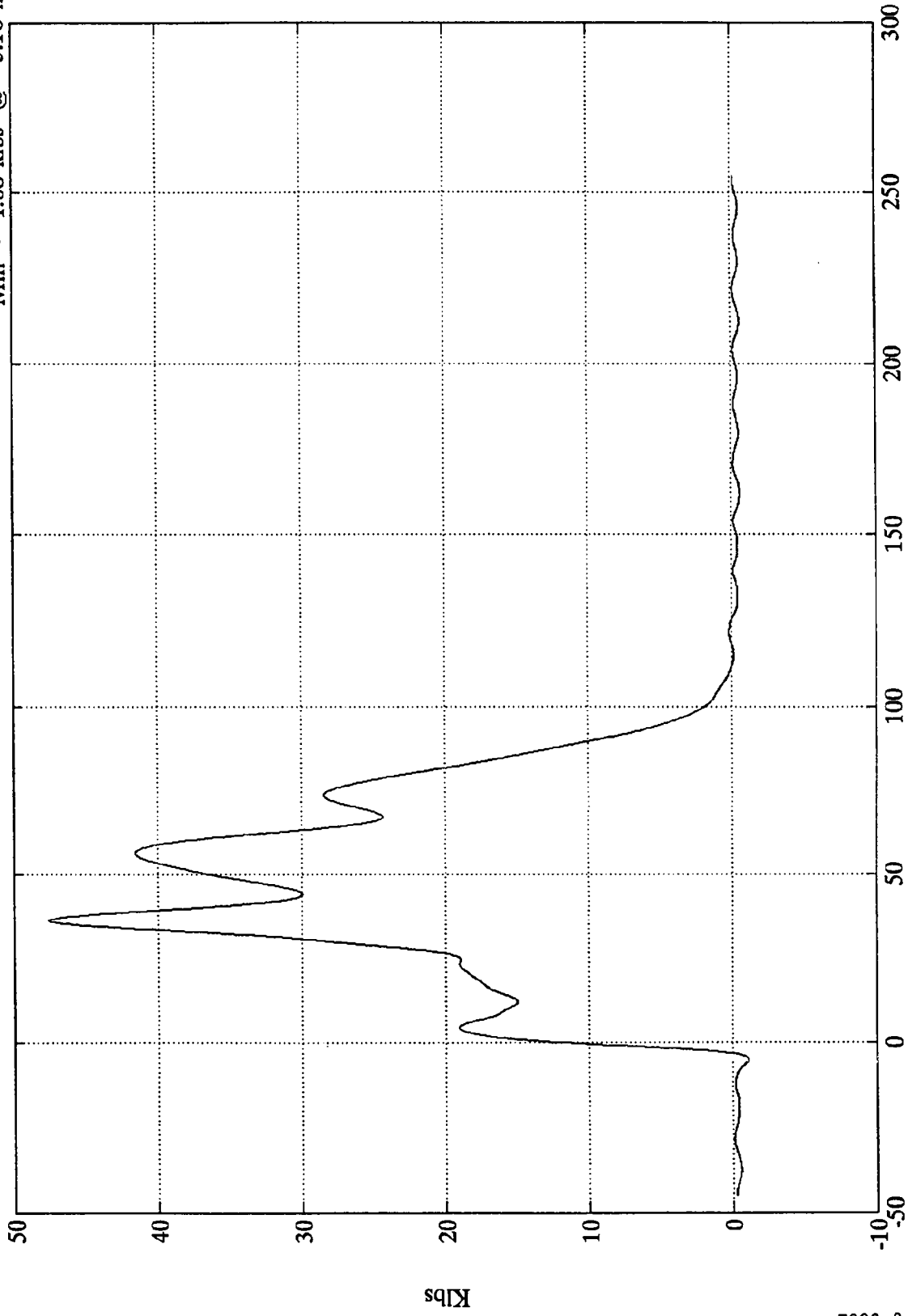
Load Cells (A1,A2,A3,B1,B2,B3)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Group 2 Load Cell Sum

Max = 47.56 klbs @ 36.24 msec
Min = -1.08 klbs @ -5.16 msec



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

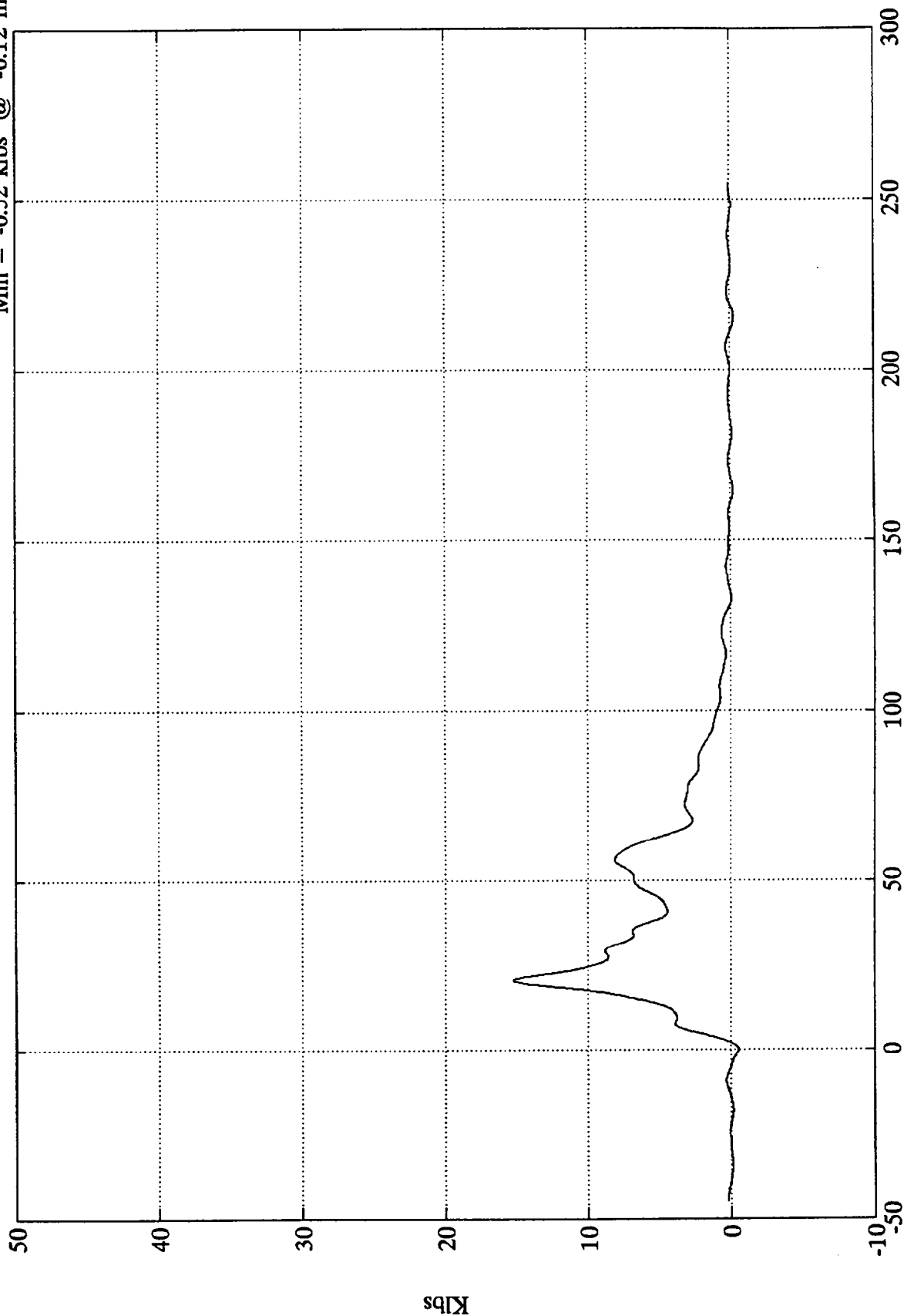
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 15.25 klbs @ 20.64 msec
Min = -0.52 klbs @ -0.12 msec

Group 3 Load Cell Sum



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

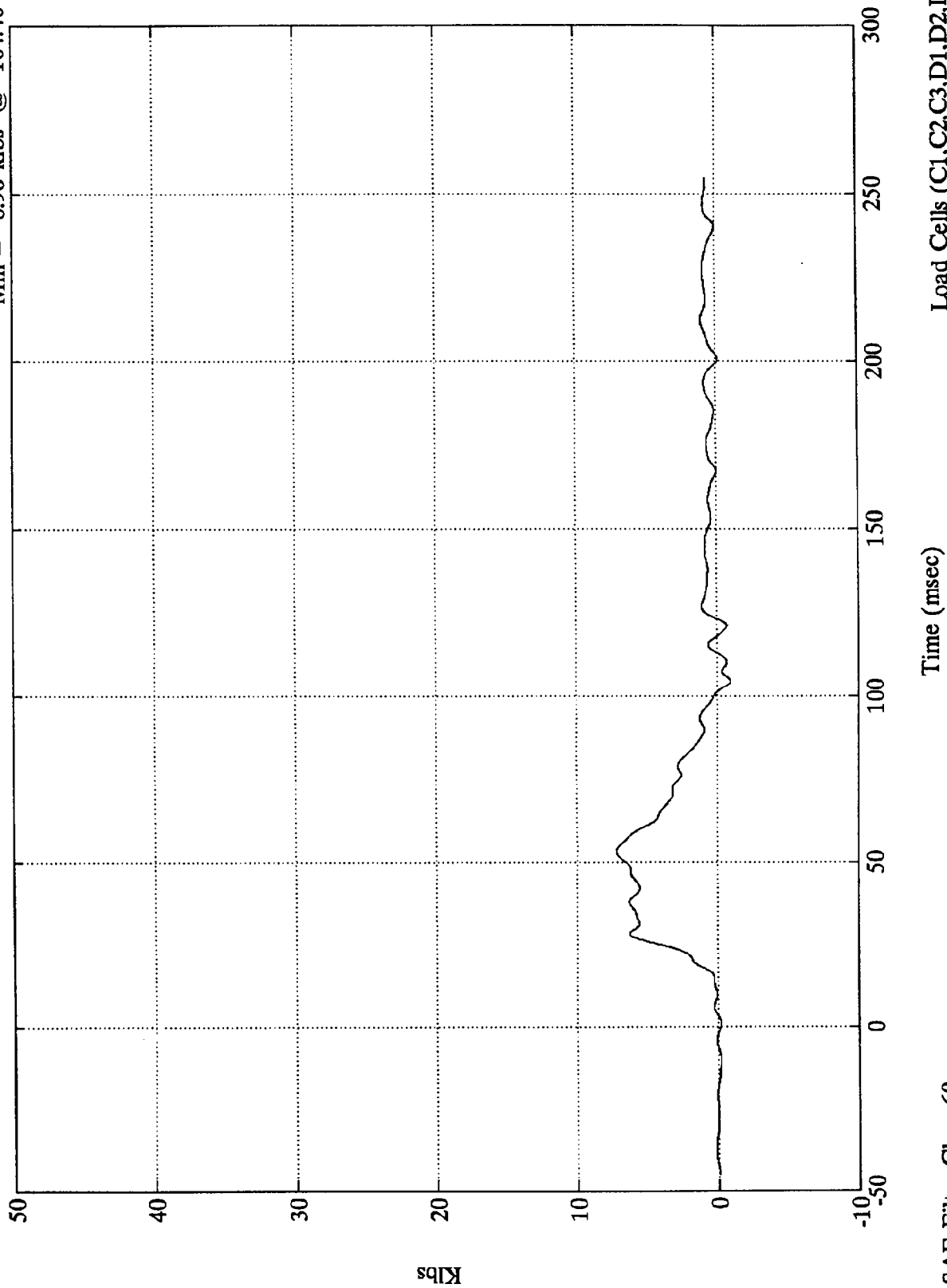
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Group 4 Load Cell Sum

Max = 7.18 klbs @ 53.28 msec
Min = -0.96 klbs @ 104.40 msec



SAE Filter Class 60

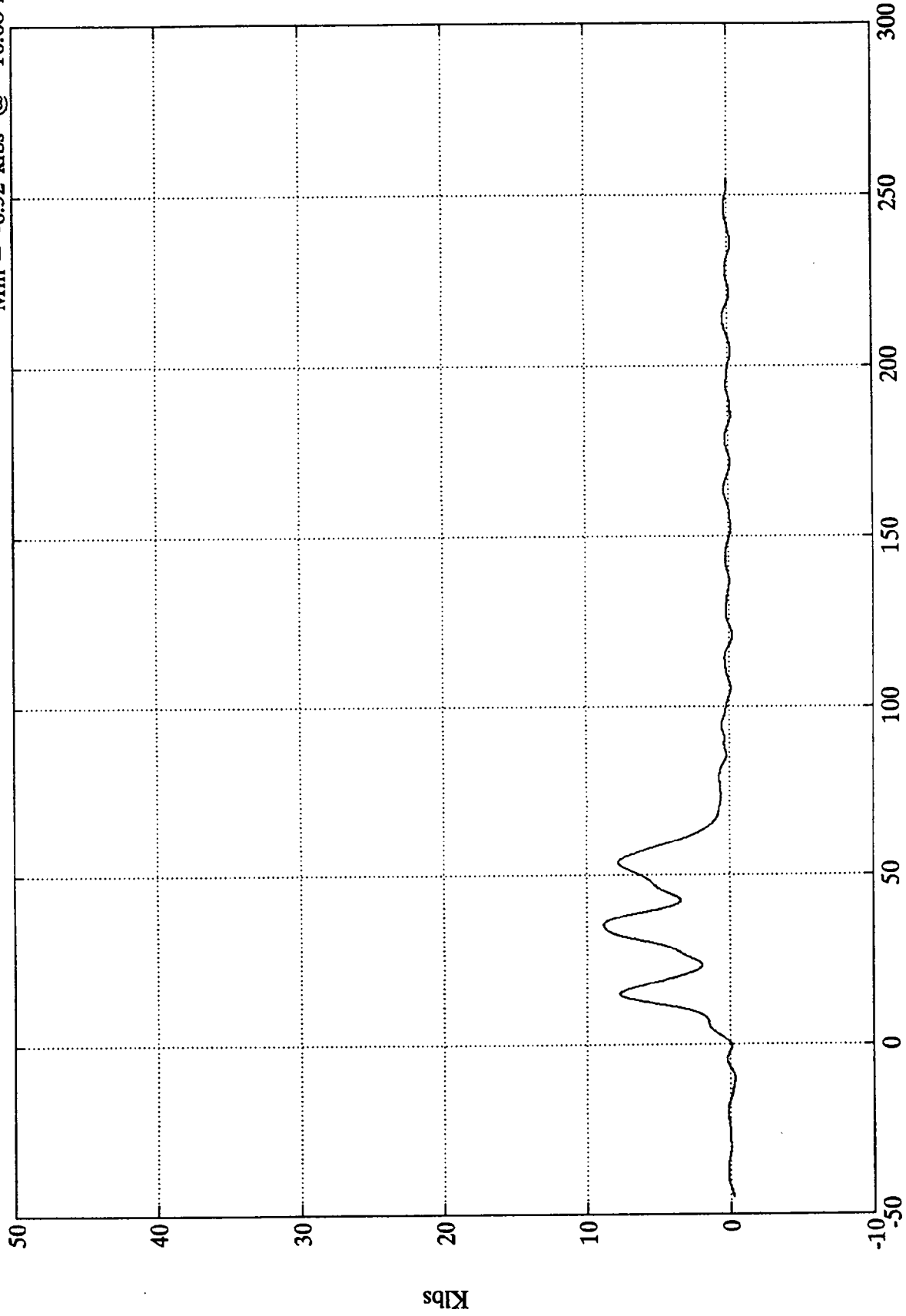
Time (msec)

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

NCAP TEST #12 1991 GEO STORM

Max = 8.84 klbs @ 35.40 msec
Min = -0.32 klbs @ -10.08 msec

Group 5 Load Cell Sum



Time (msec)

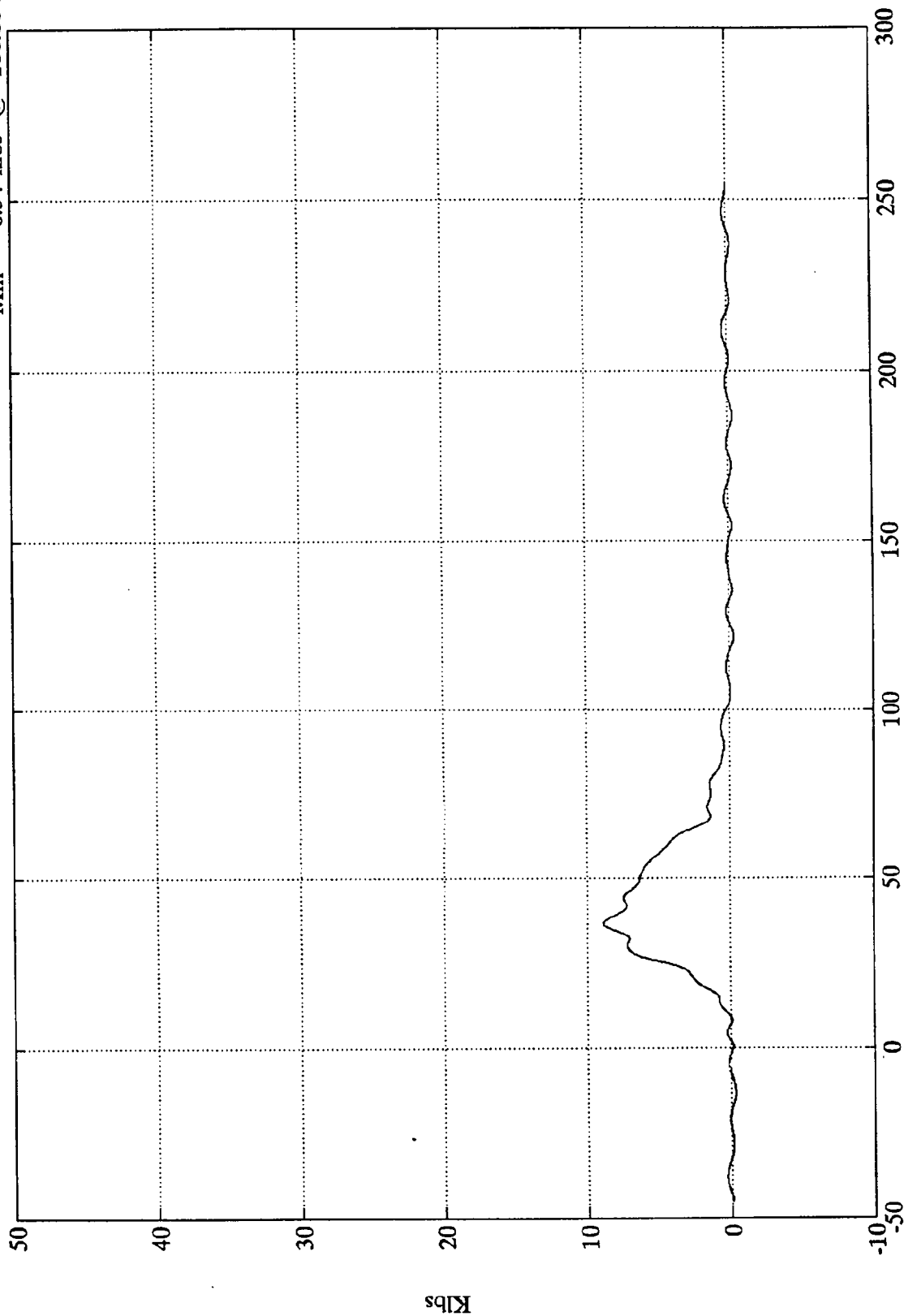
Load Cells (C4,C5,C6,D4,D5,D6)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Group 6 Load Cell Sum

Max = 8.90 klbs @ 36.60 msec
Min = -0.34 klbs @ 186.60 msec



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

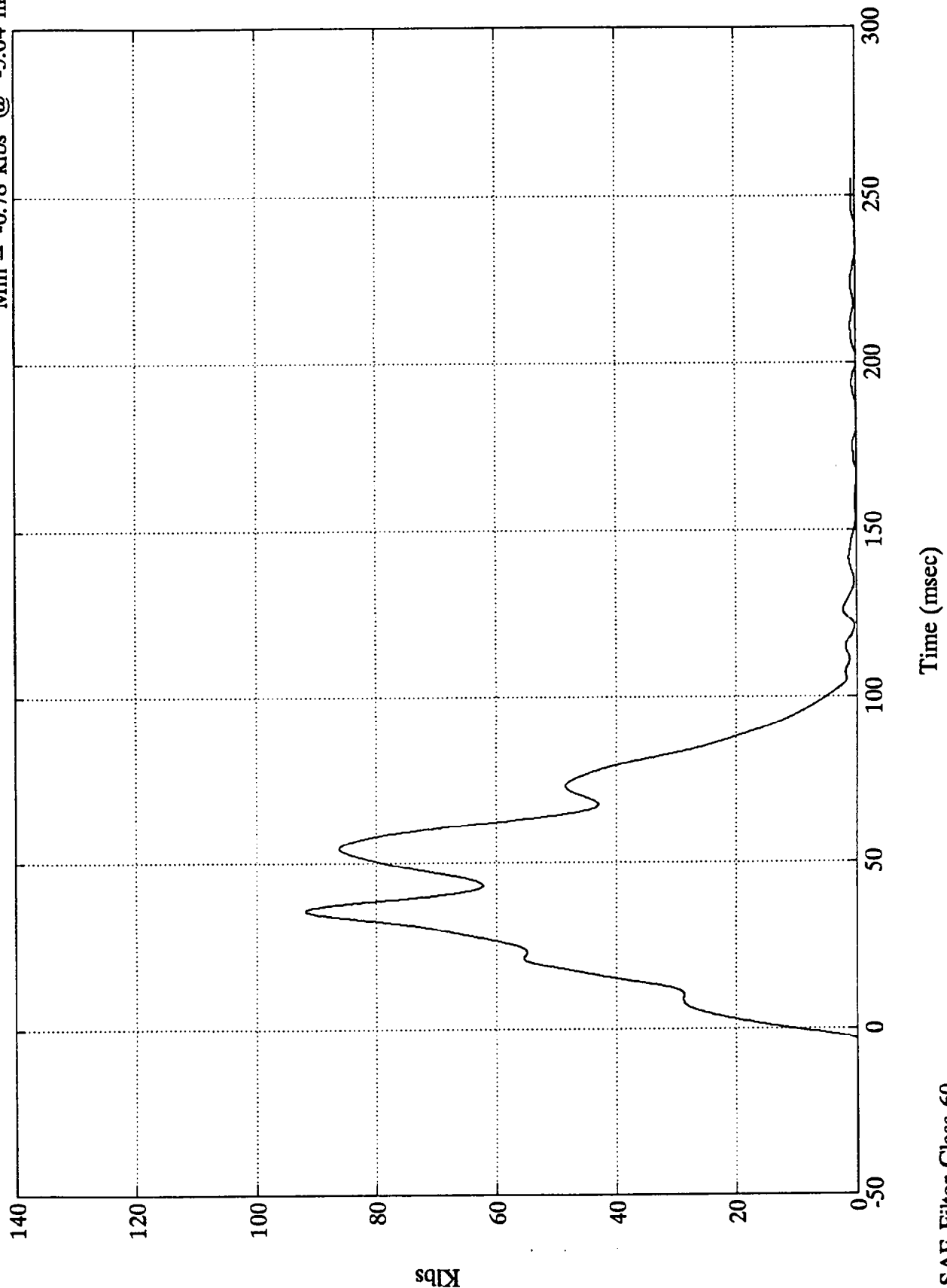
Time (msec)

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Max = 91.85 klbs @ 35.76 msec
Min = -0.78 klbs @ -5.04 msec

Total Load Cell Sum



Klbs

B-73

7893-8

SAE Filter Class 60

TEST NO. MM0107

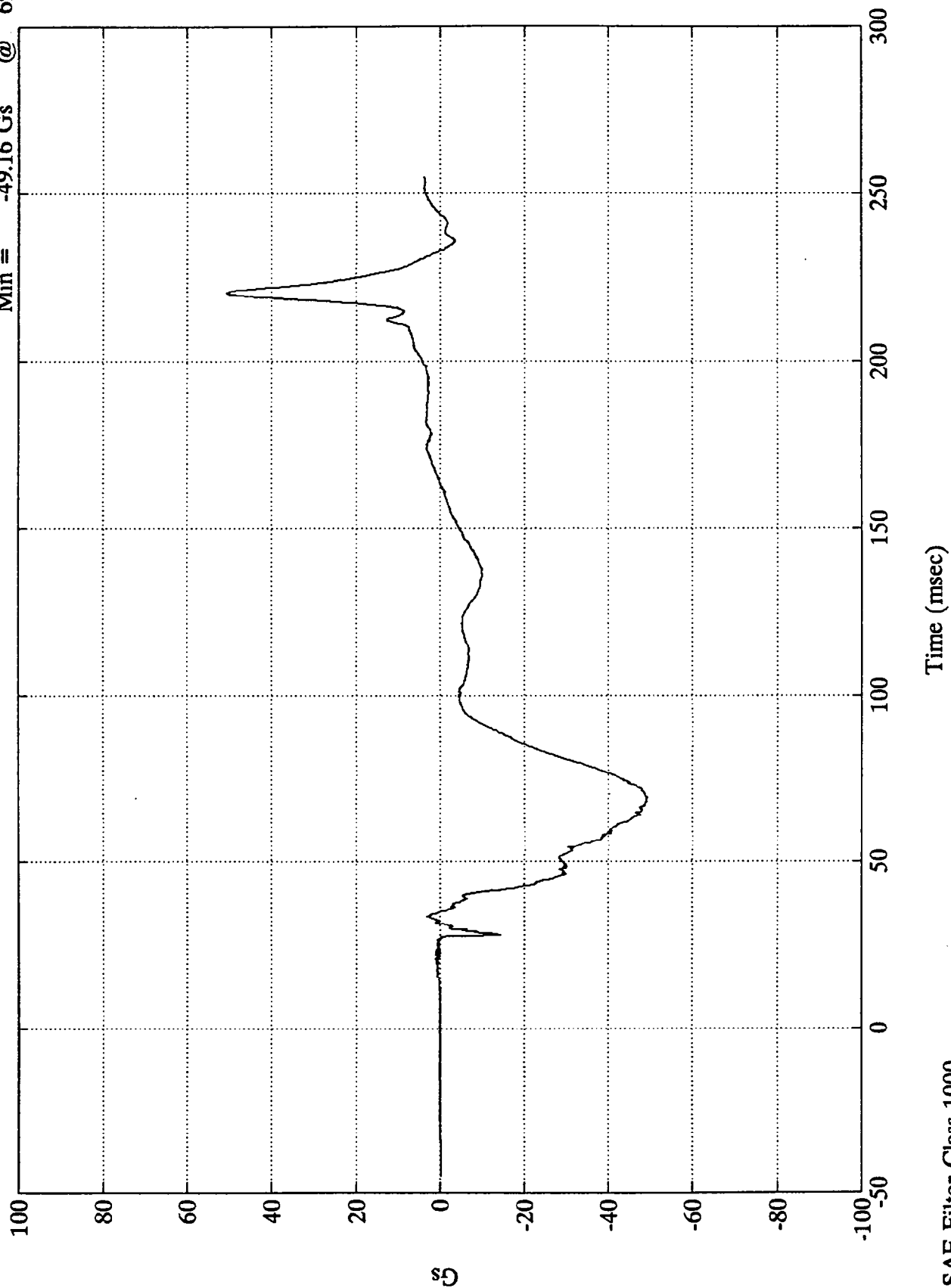
DUMMY DATA

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

NCAP TEST #12 1991 GEO STORM

Max = 50.73 Gs @ 220.32 msec
Min = -49.16 Gs @ 69.48 msec

Pos. 1 Head X



Gs
B-75

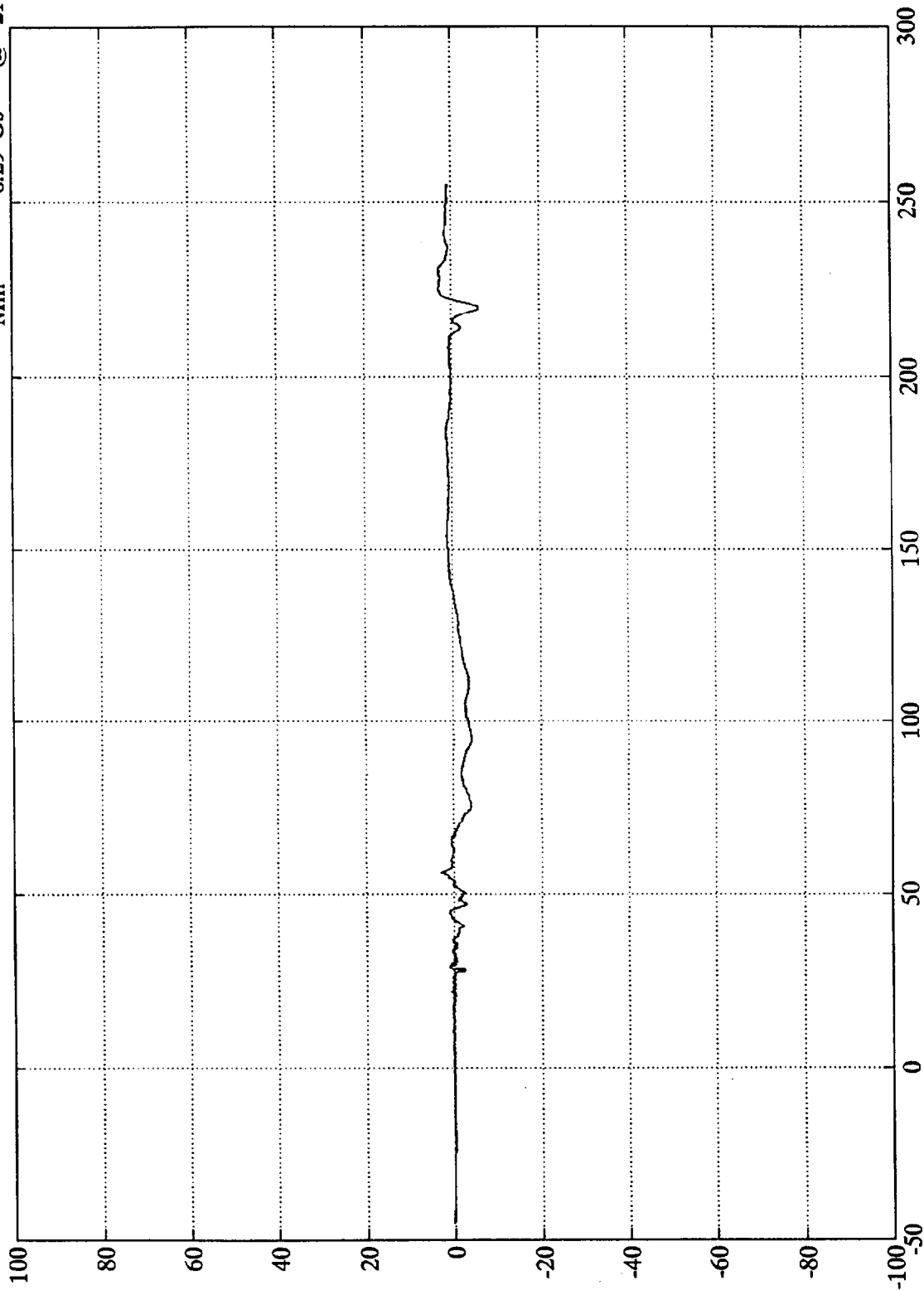
7893-8

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Max = 2.97 Gs @ 230.76 msec
Min = -6.29 Gs @ 219.84 msec

Pos. 1 Head Y



Time (msec)

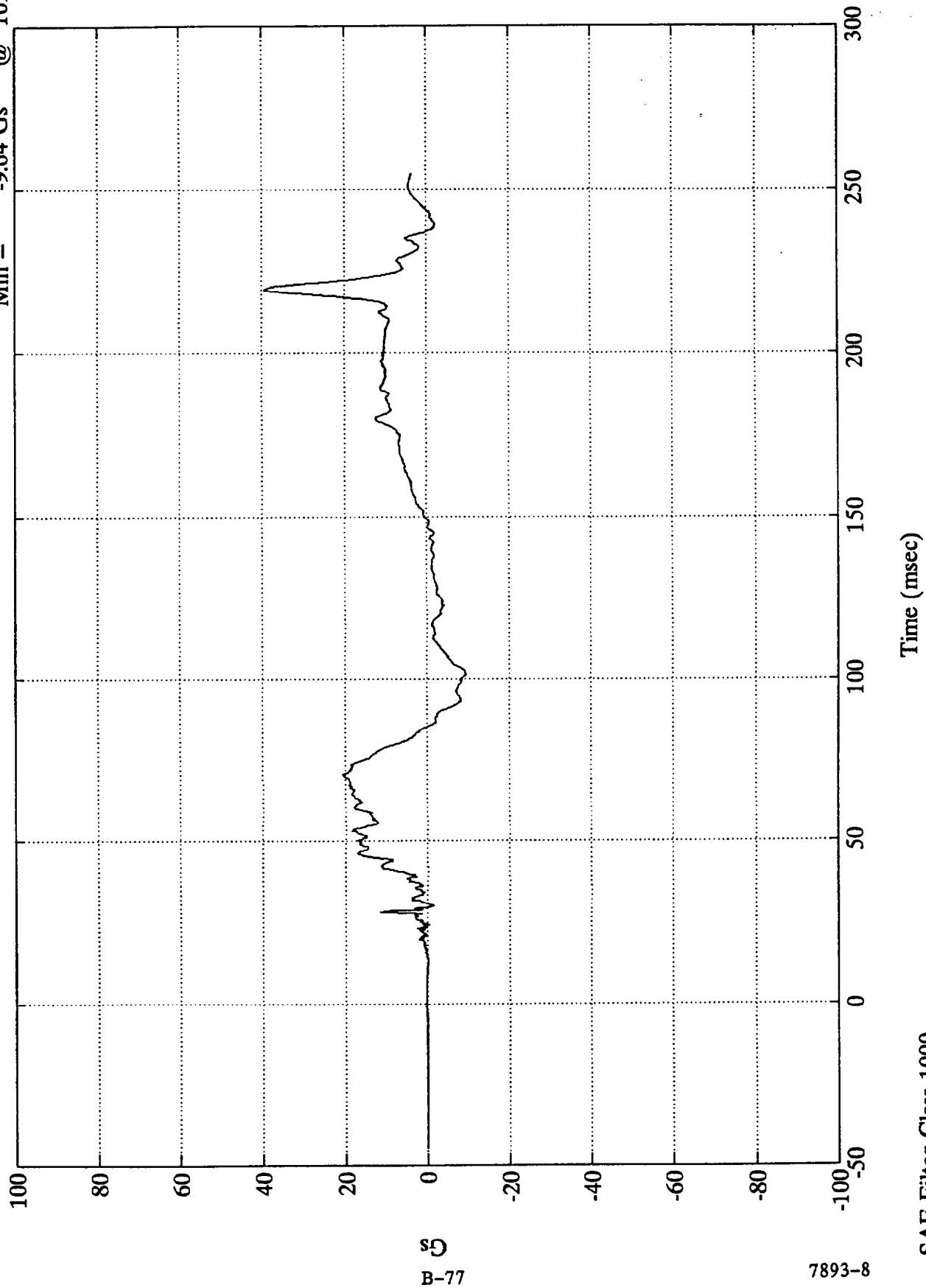
SAE Filter Class 1000

B-76

7893-8

NCAP TEST #12 1991 GEO STORM

Pos. 1 Head Z
Max = 39.37 Gs @ 219.24 msec
Min = -9.64 Gs @ 101.52 msec

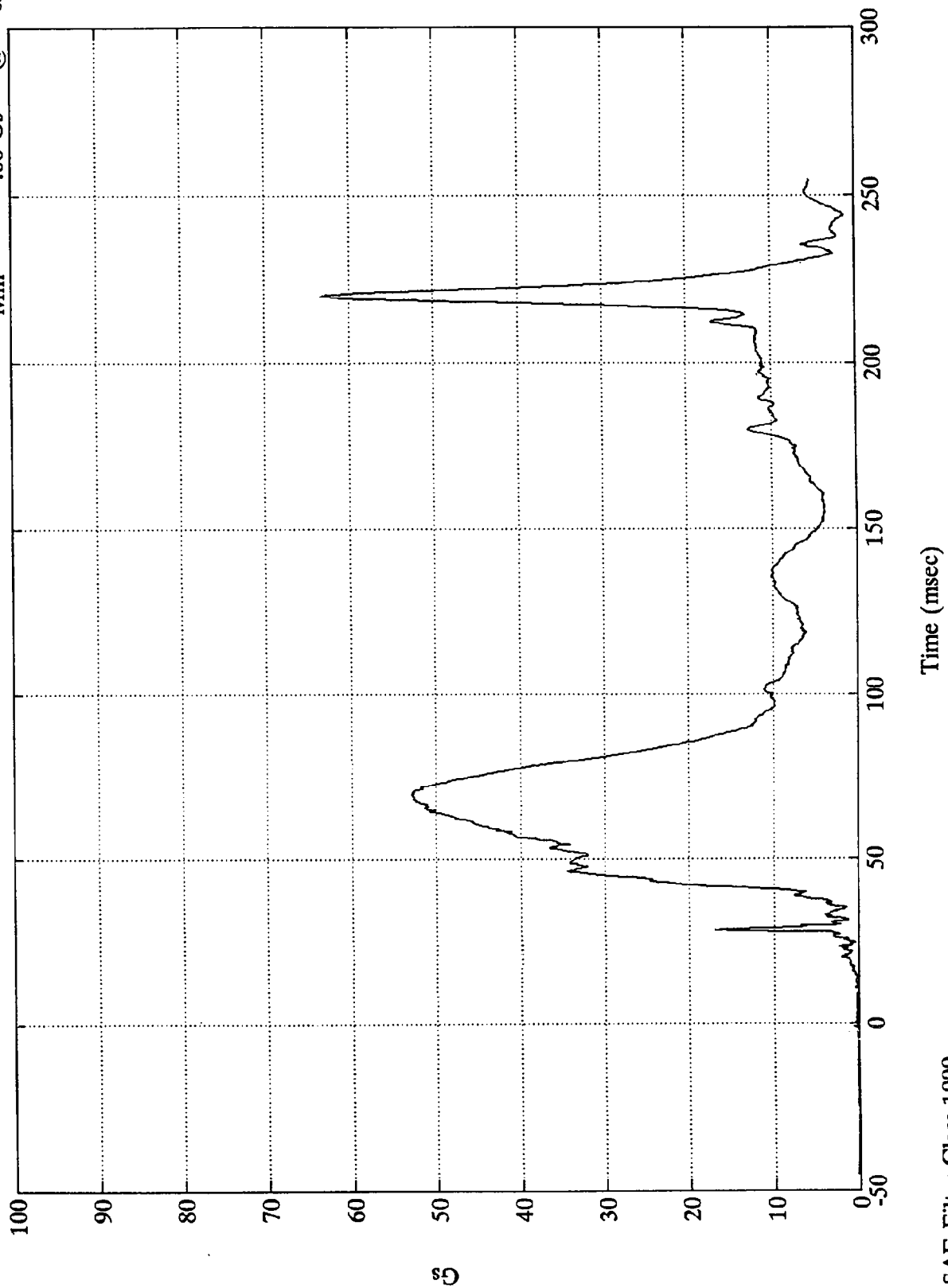


B-77

7893-8

NCAP TEST #12 1991 GEO STORM

Pos. 1 Head Resultant
Max = 63.35 Gs @ 219.72 msec
Min = .06 Gs @ -6.36 msec



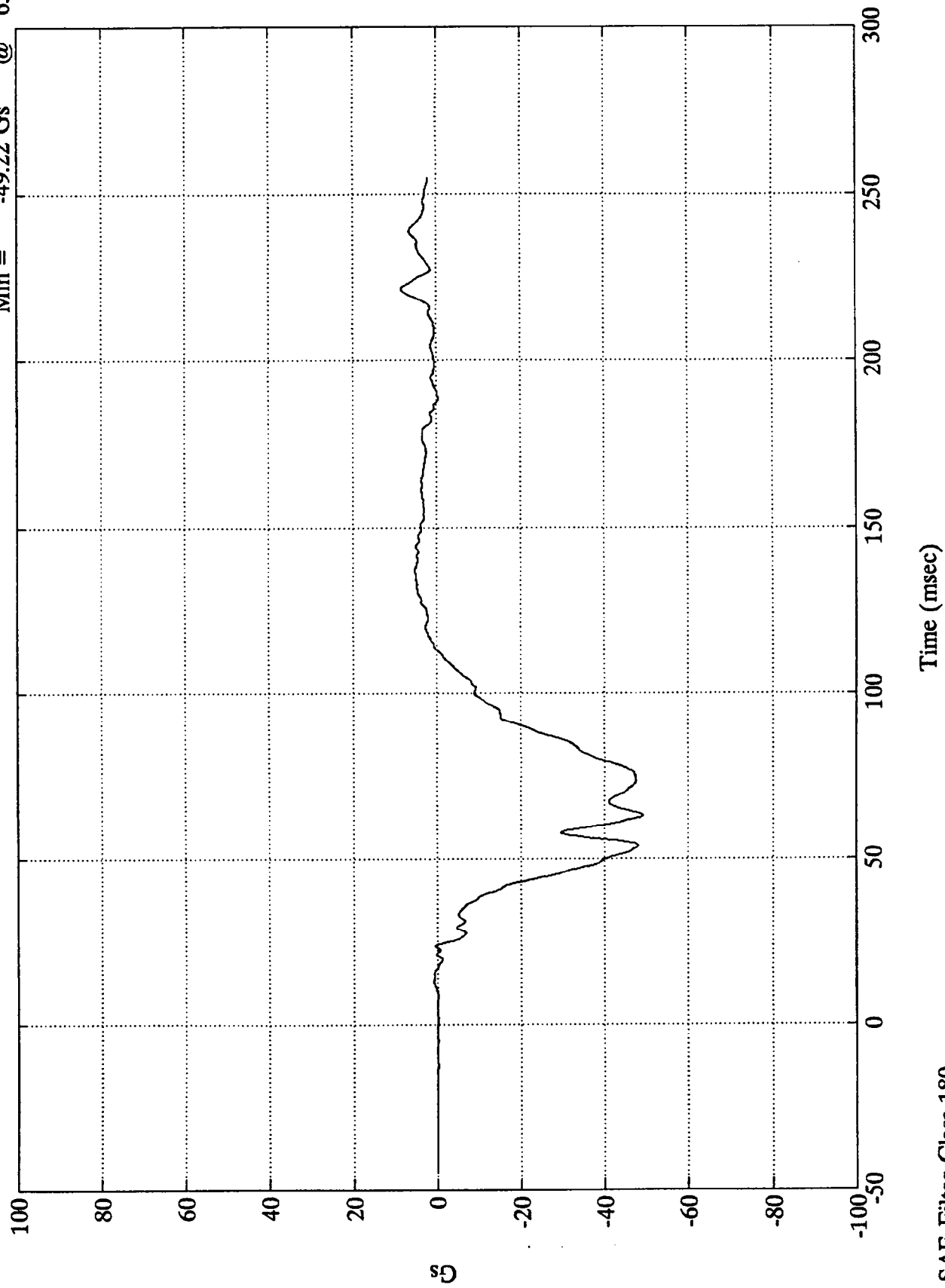
B-78

7893-8

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Pos. 1 Chest X
Max = 8.38 Gs @ 221.28 msec
Min = -49.22 Gs @ 63.11 msec



B-79

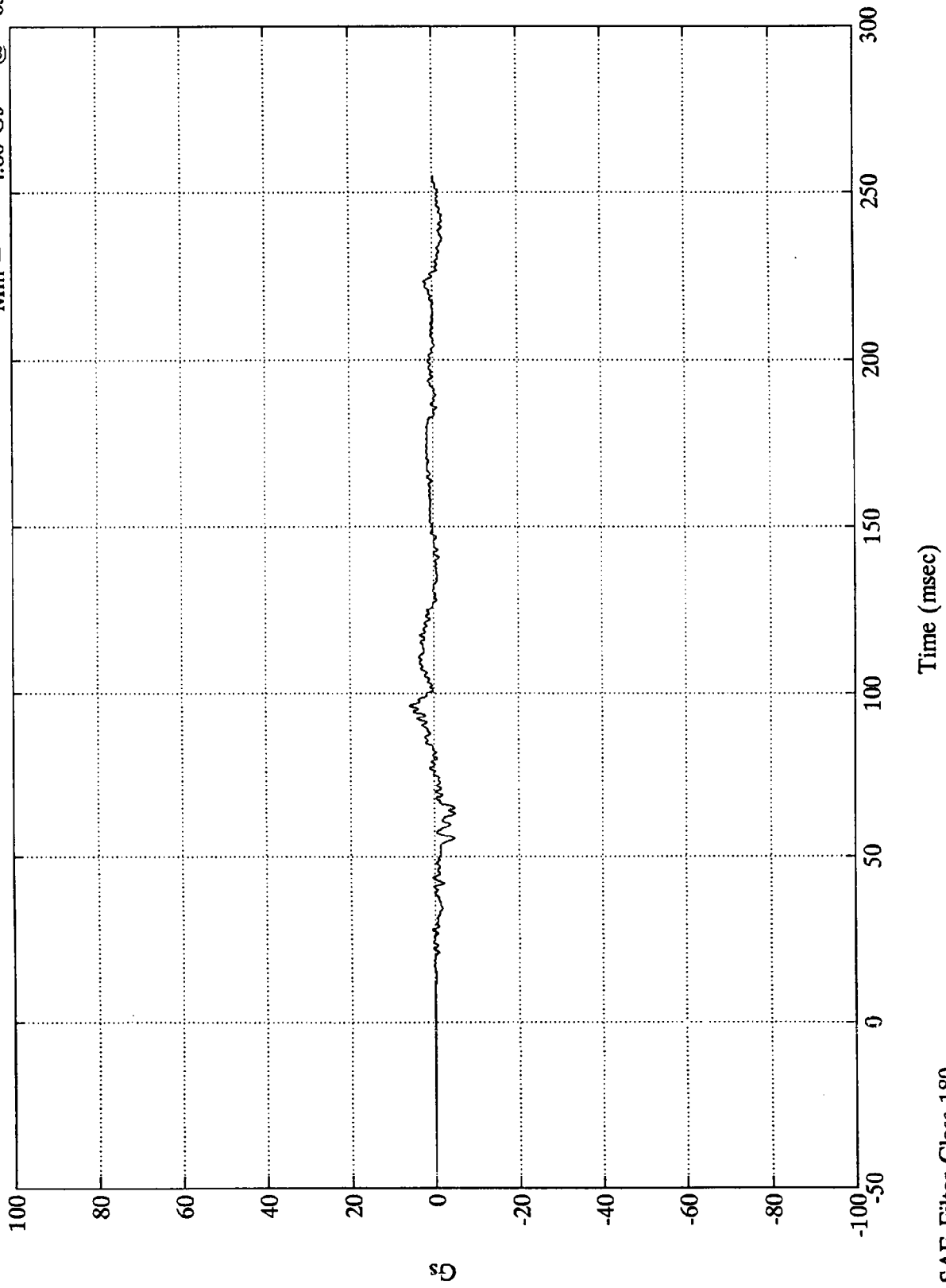
7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Max = 5.78 Gs @ 96.23 msec
Min = -4.80 Gs @ 63.11 msec

Pos. 1 Chest Y



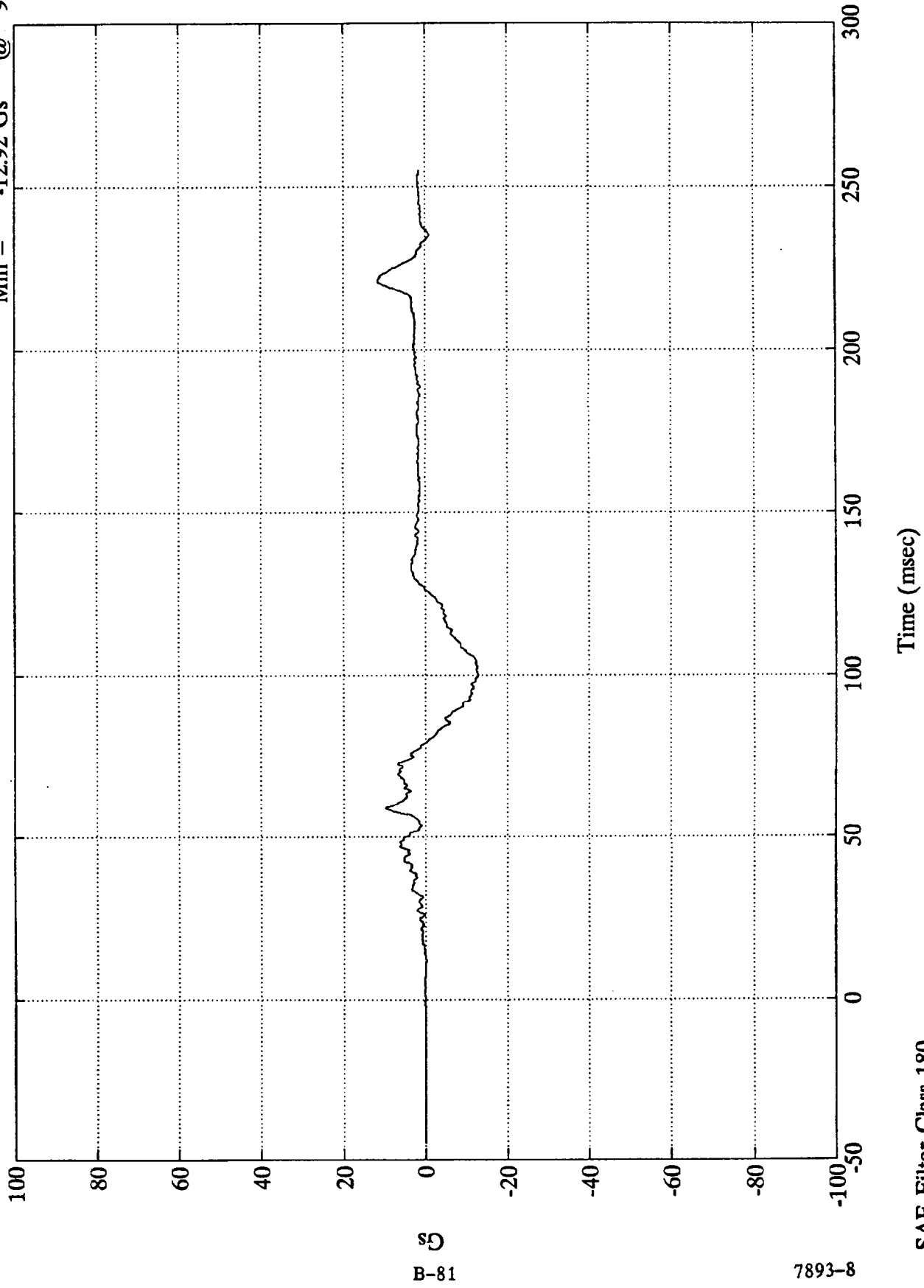
B-80

7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Pos. 1 Chest Z
Max = 11.48 Gs @ 221.04 msec
Min = -12.92 Gs @ 99.84 msec



B-81

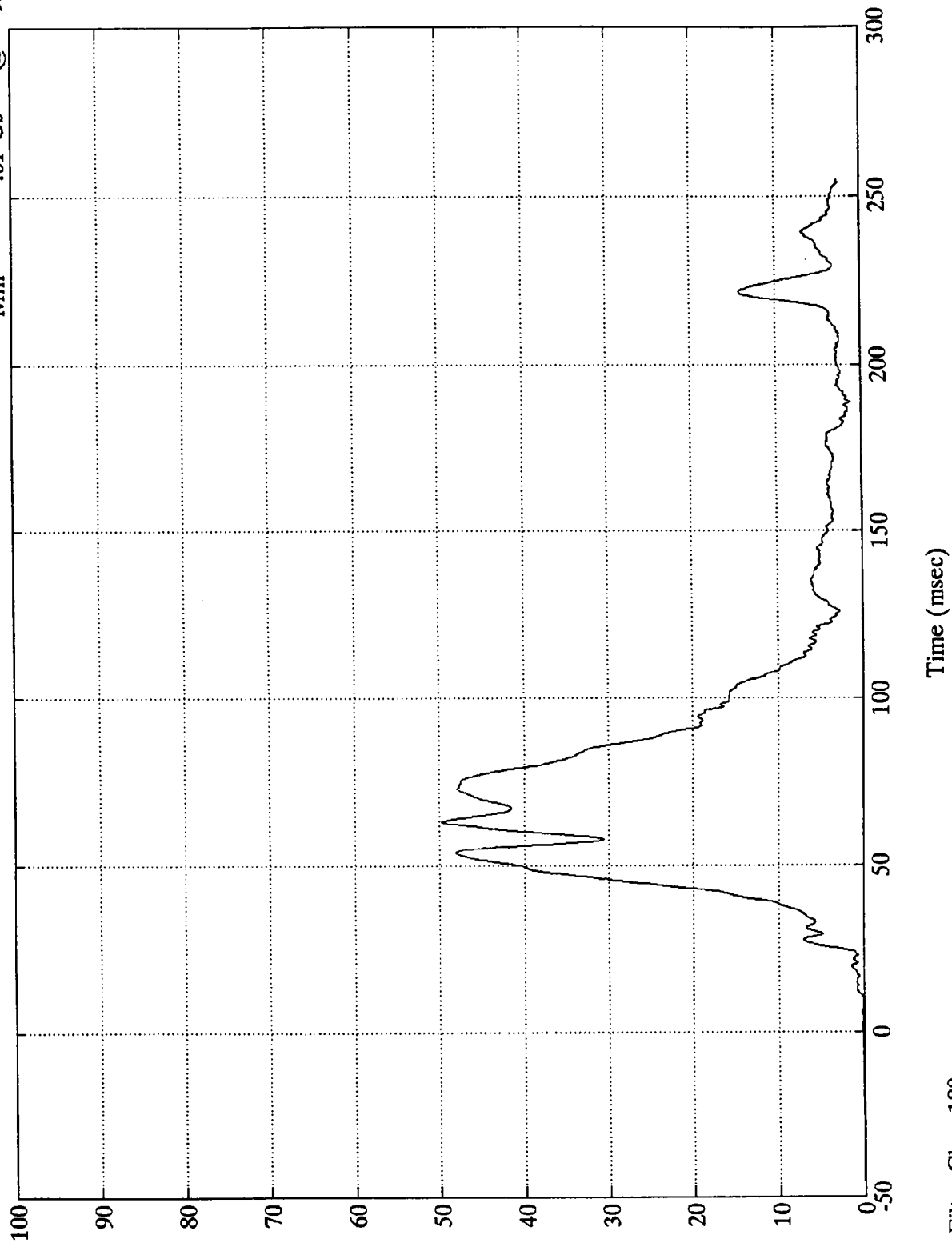
7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Max = 49.67 Gs @ 63.11 msec
 Min = .01 Gs @ 9.59 msec

Pos. 1 Chest Resultant



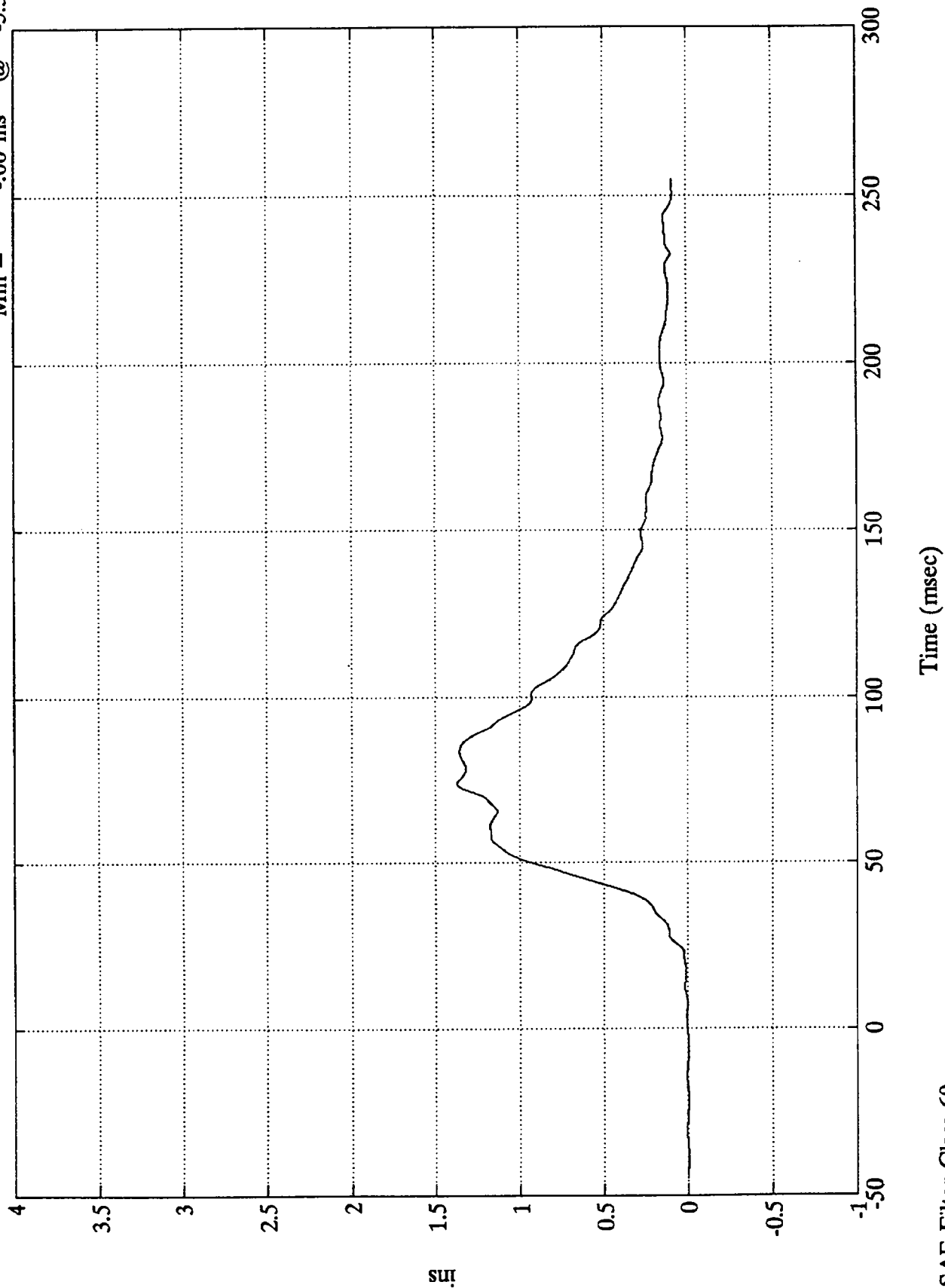
B-82

7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Pos. 1 Chest Disp. Max = 1.37 ins @ 73.80 msec
Min = -.00 ins @ -5.52 msec



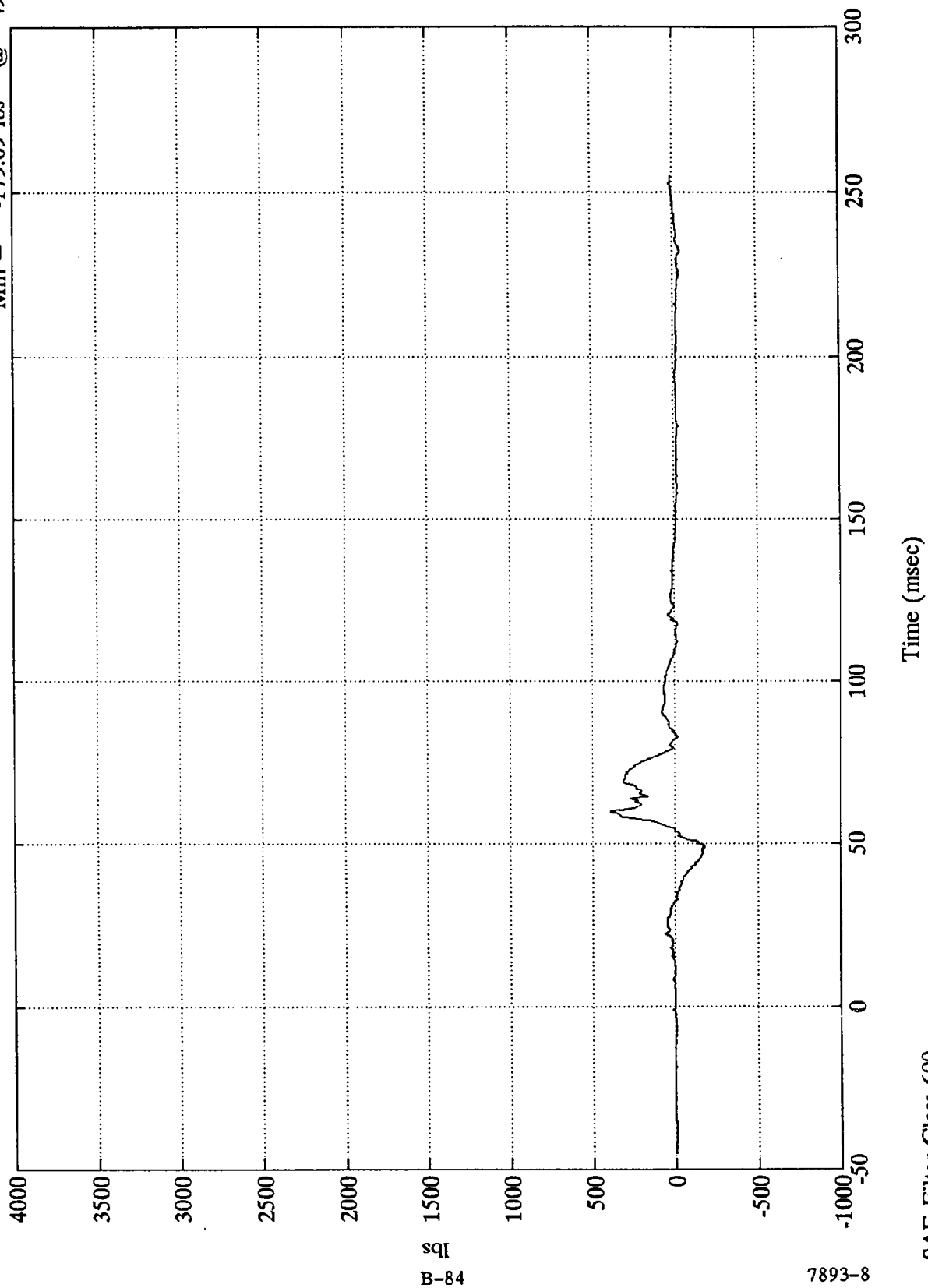
ins
B-83

7893-8

SAE Filter Class 60

NCAP TEST #12 1991 GEO STORM

Pos. 1 Left Femur
Max = 393.66 lbs @ 59.76 msec
Min = -179.09 lbs @ 49.55 msec



B-84

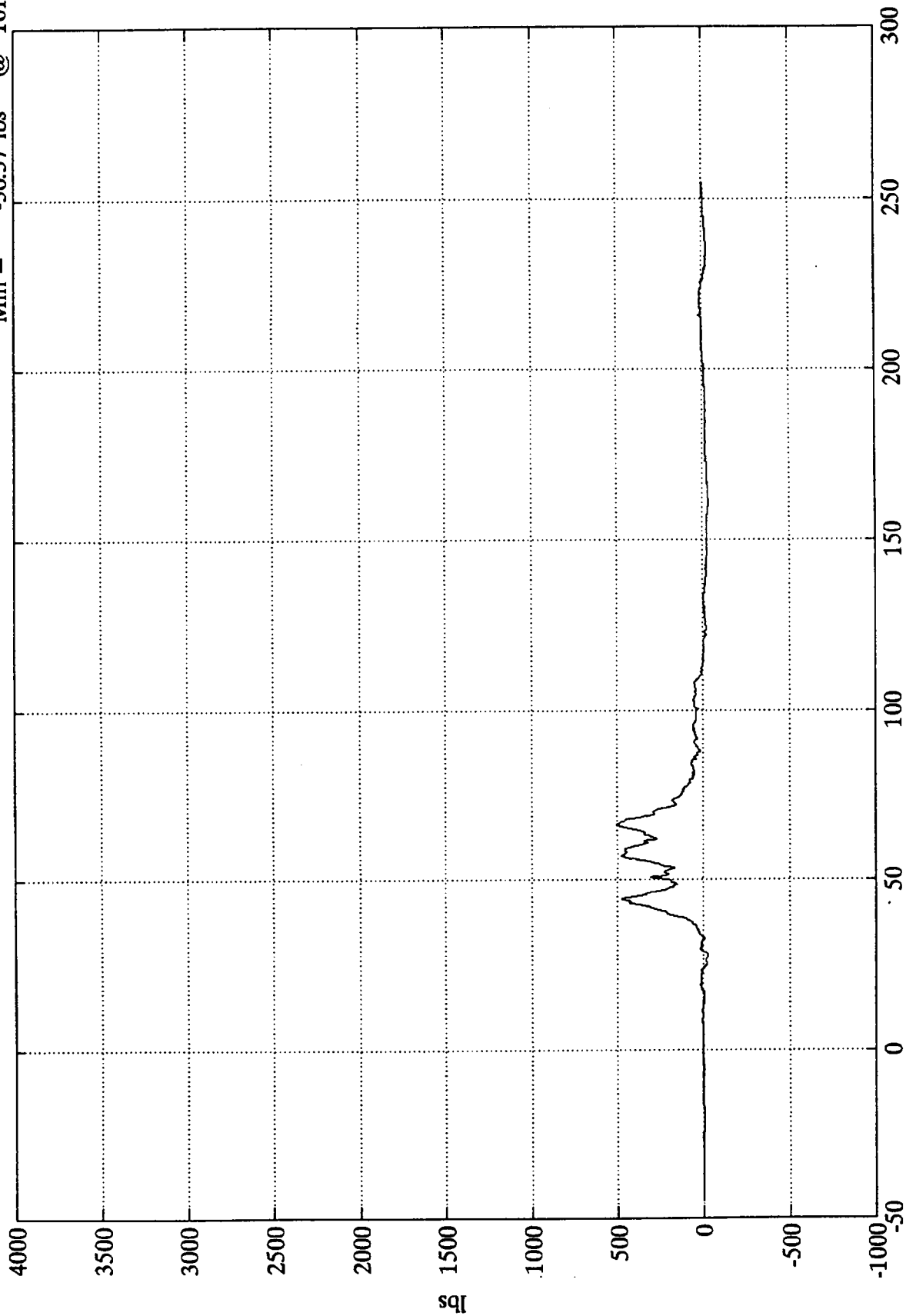
7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 1 Right Femur

Max = 507.88 lbs @ 66.48 msec
Min = -36.37 lbs @ 161.27 msec



B-85

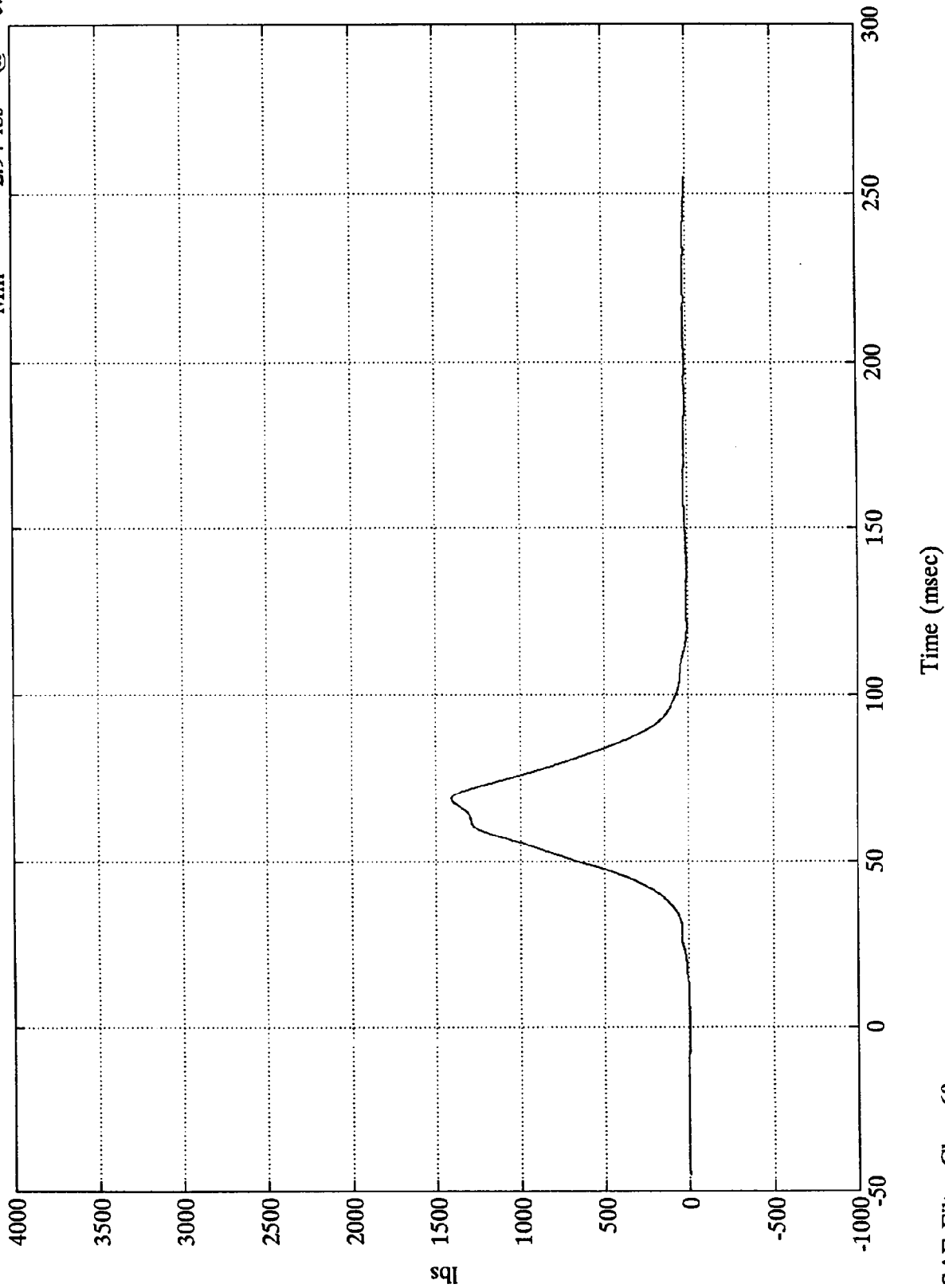
7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 1 Left Belt Load

Max = 1408.53 lbs @ 68.87 msec
Min = -2.94 lbs @ 3.23 msec



sqI
B-86

7893-8

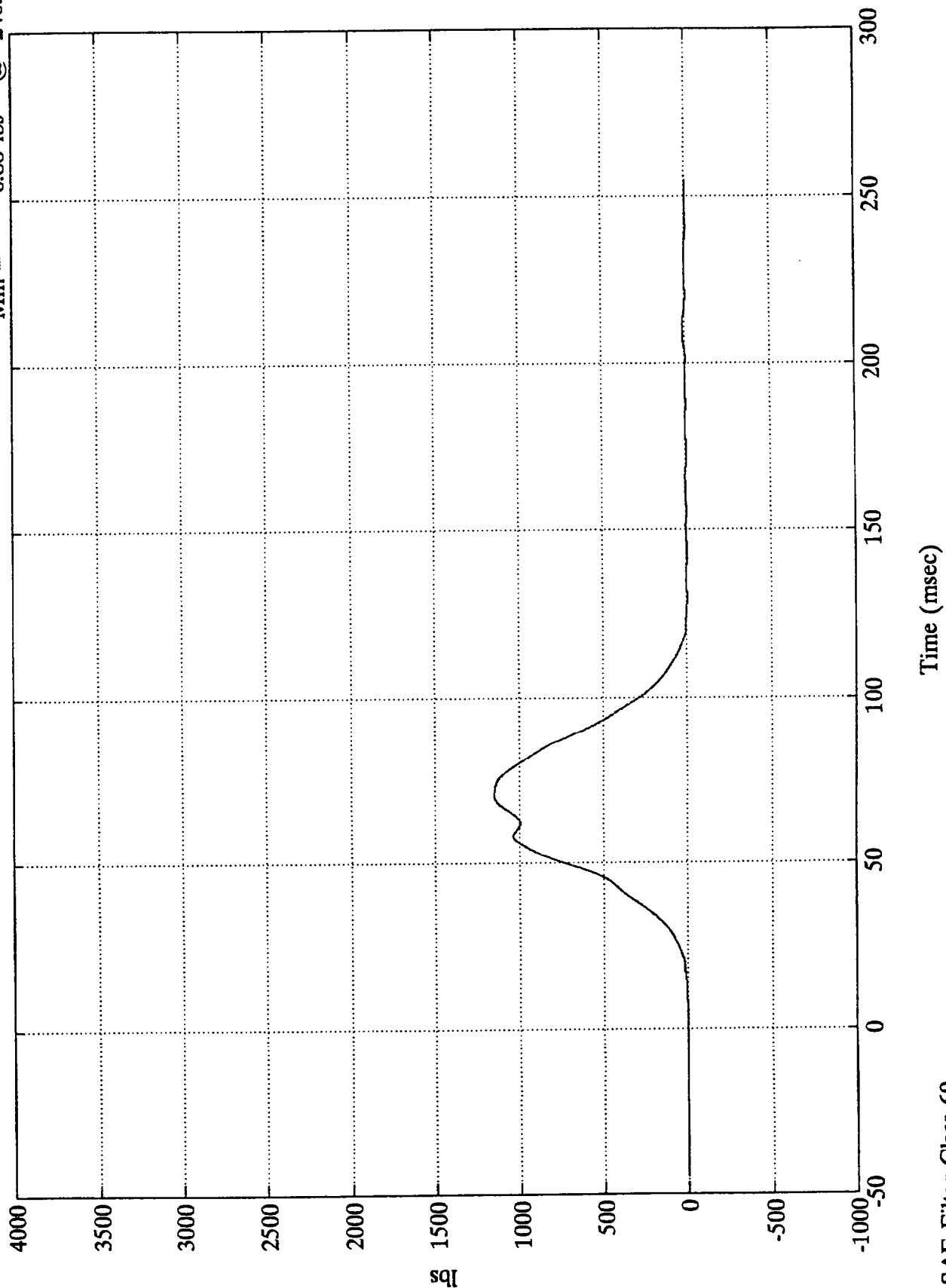
SAE Filter Class 60

Time (msec)

NCAP TEST #12 1991 GEO STORM

Pos. 1 Torso Belt Load

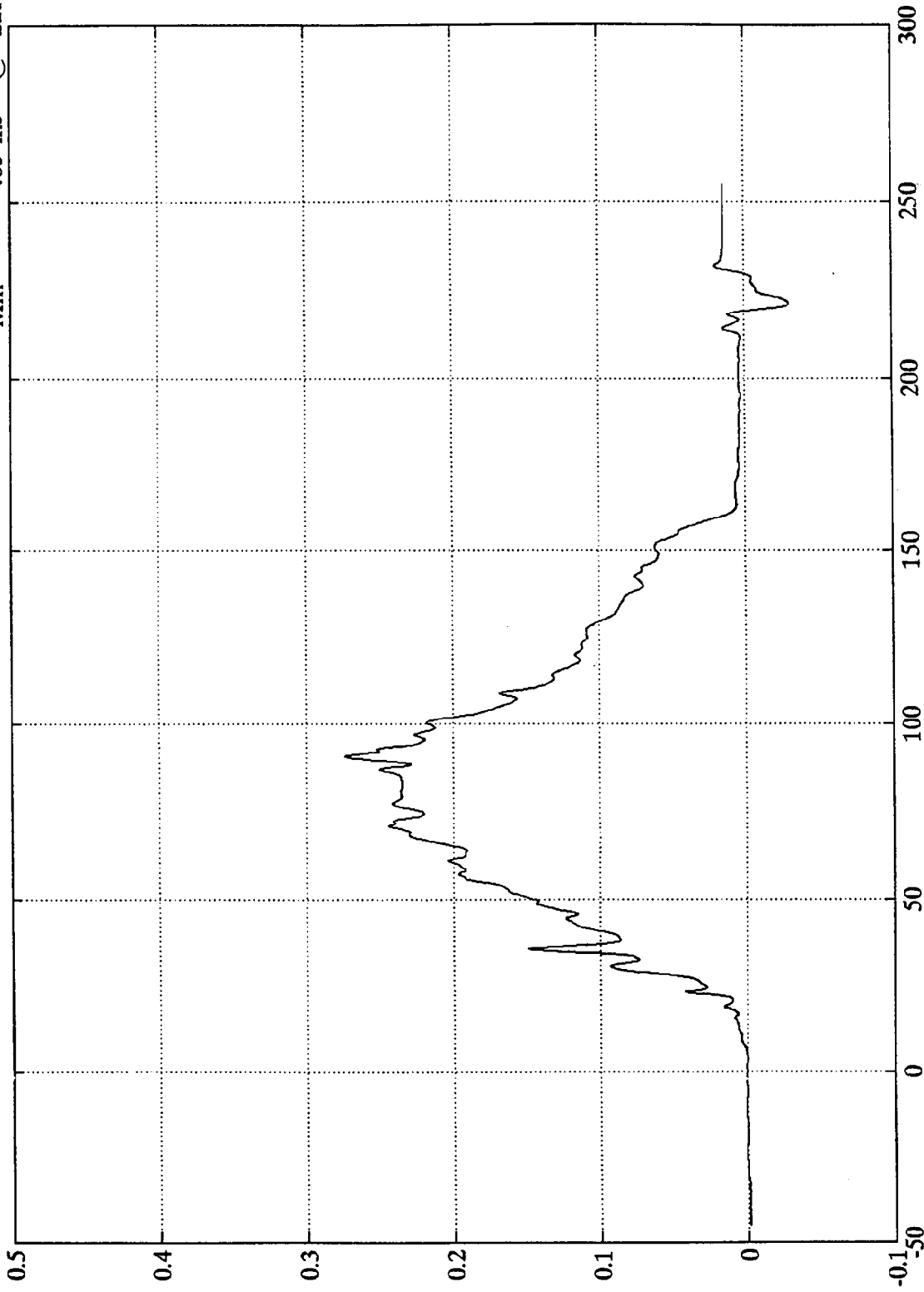
Max = 1147.44 lbs @ 70.44 msec
Min = -6.88 lbs @ 240.60 msec



NCAP TEST #12 1991 GEO STORM

Pos. 1 Belt Elongation

Max =	.27 ins	@	90.59 msec
Min =	-.03 ins	@	221.16 msec

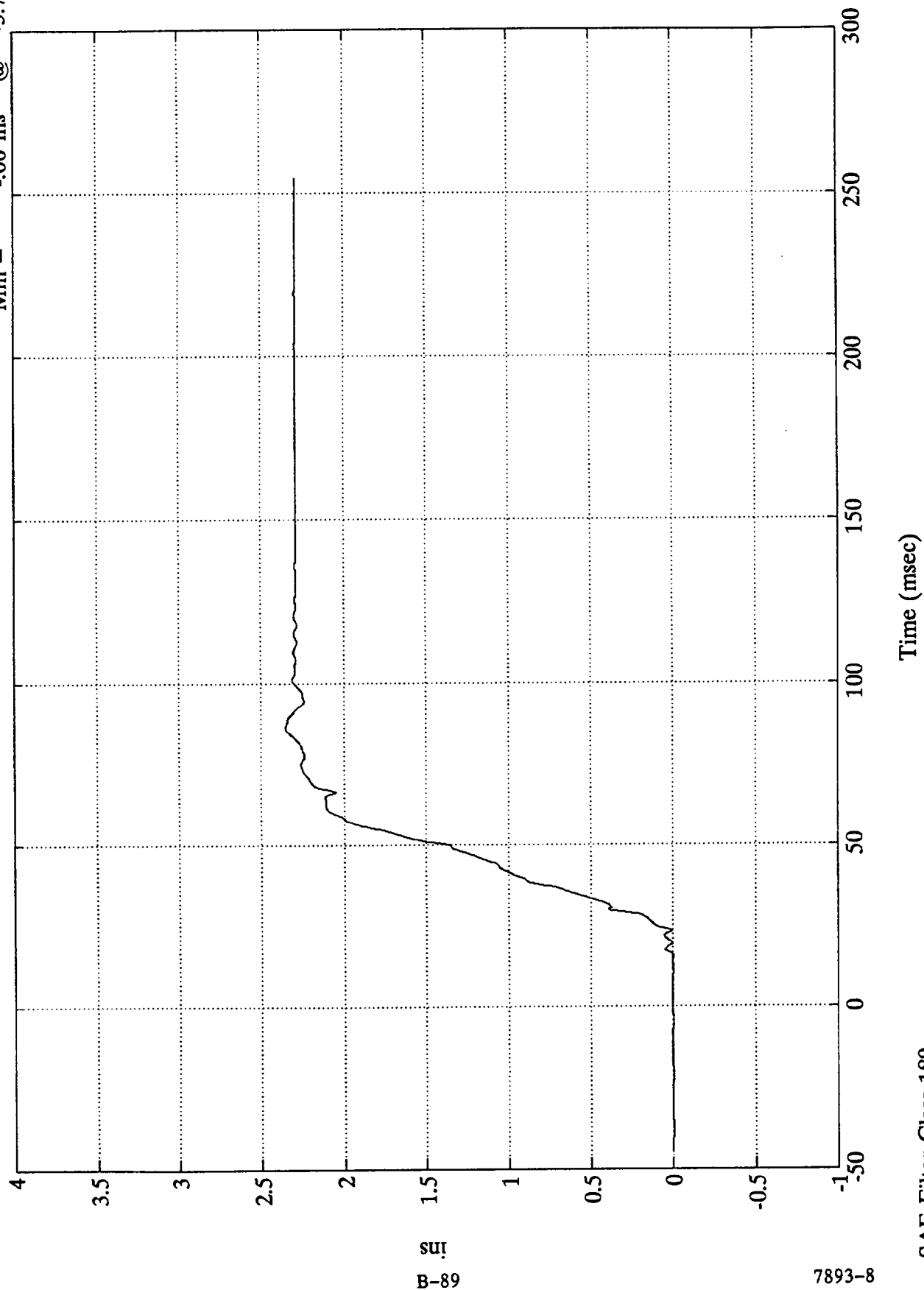


Measured over 2.5 inches

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Pos. 1 Belt Spool Out
Max = 2.35 ins @ 85.91 msec
Min = -.00 ins @ -5.76 msec



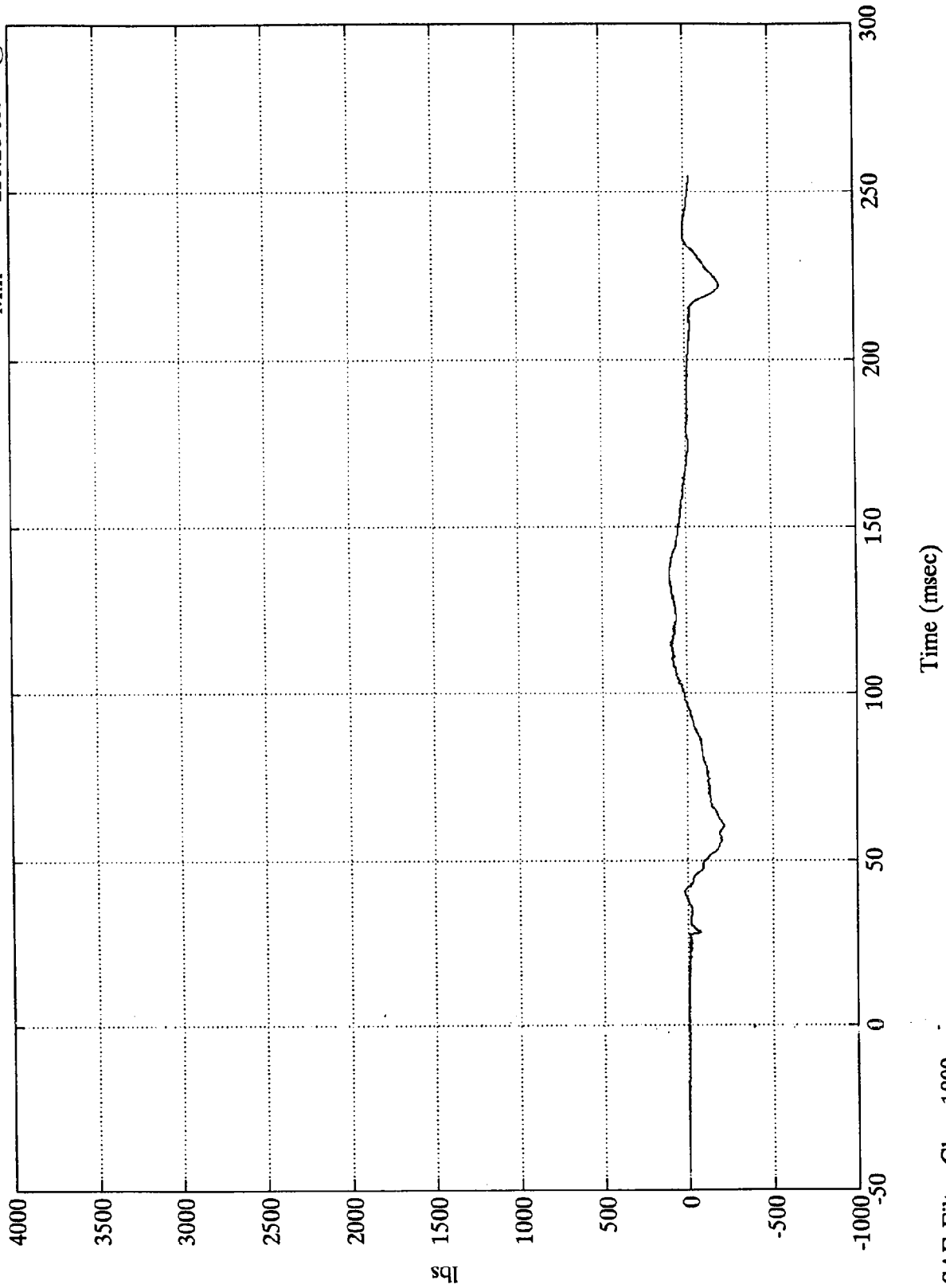
ins
B-89

7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Pos. 1 Upper Neck Fx Max = 104.33 lbs @ 136.44 msec
Min = -210.28 lbs @ 60.84 msec



sq
B-90

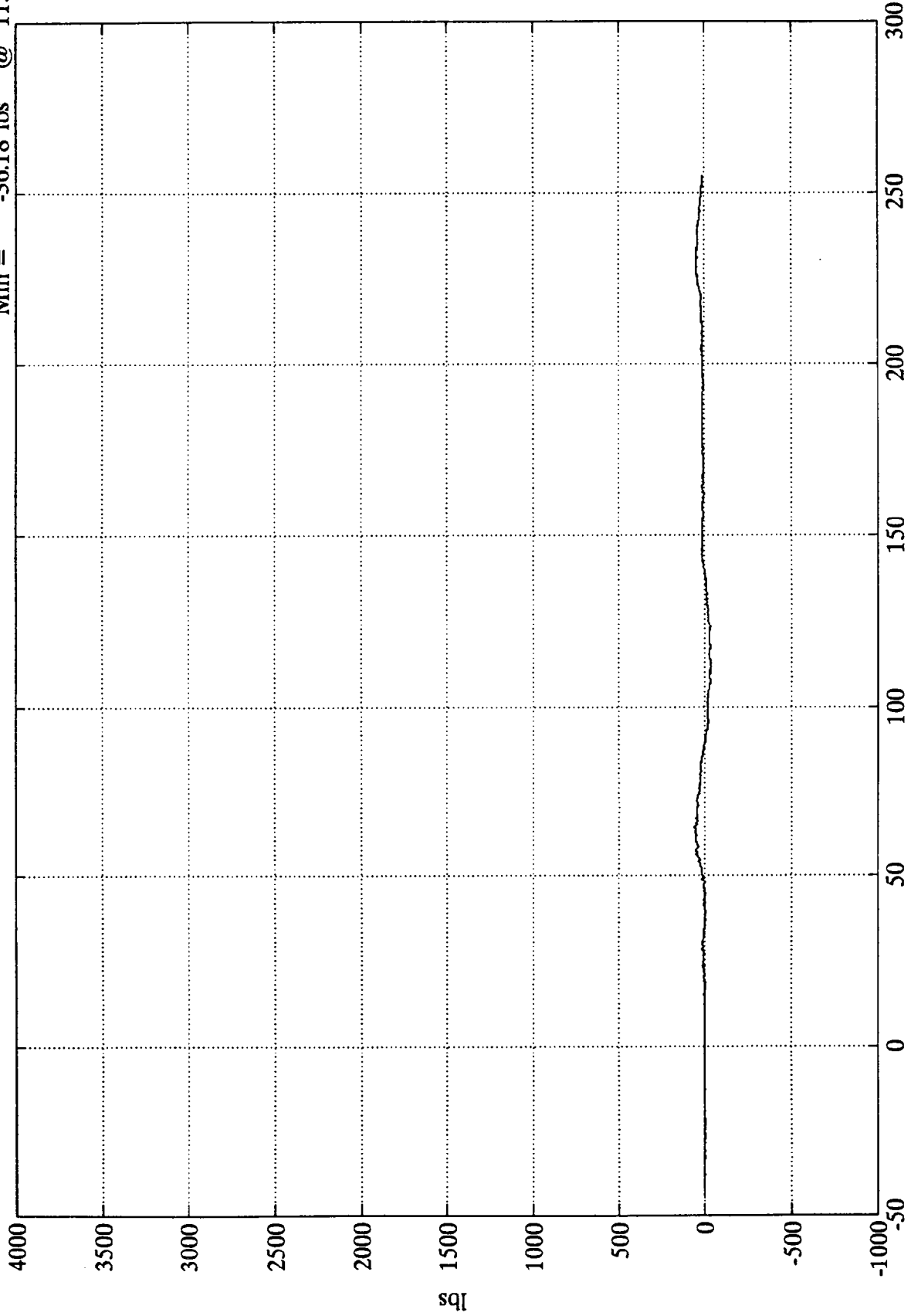
7893-8

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Pos. 1 Upper Neck Fy

Max = 61.08 lbs @ 64.56 msec
Min = -36.18 lbs @ 113.40 msec



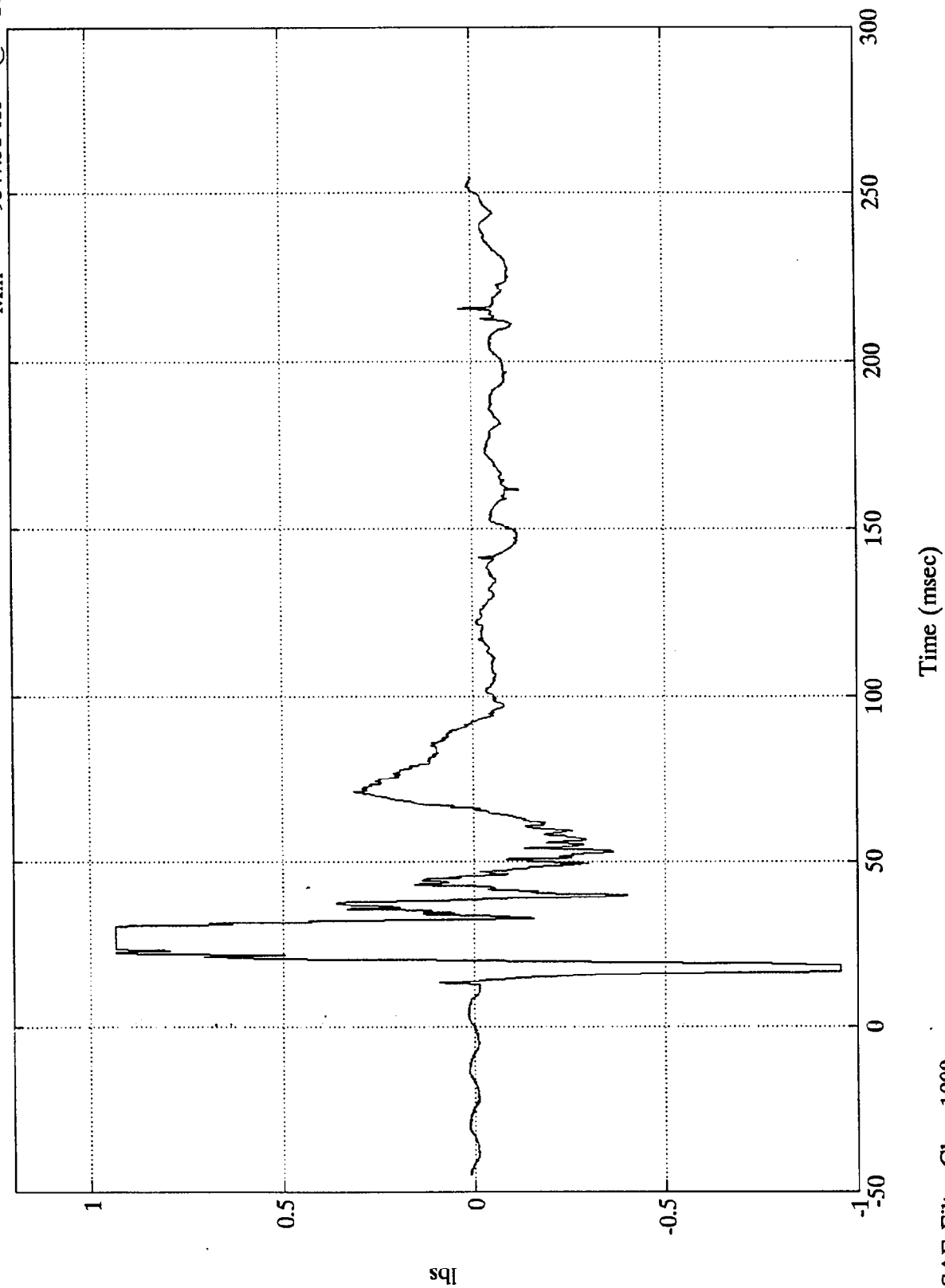
Time (msec)

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM
x10⁴

Pos. 1 Upper Neck Fz

Max = 9335.05 lbs @ 30.23 msec
Min = -9547.58 lbs @ 18.60 msec



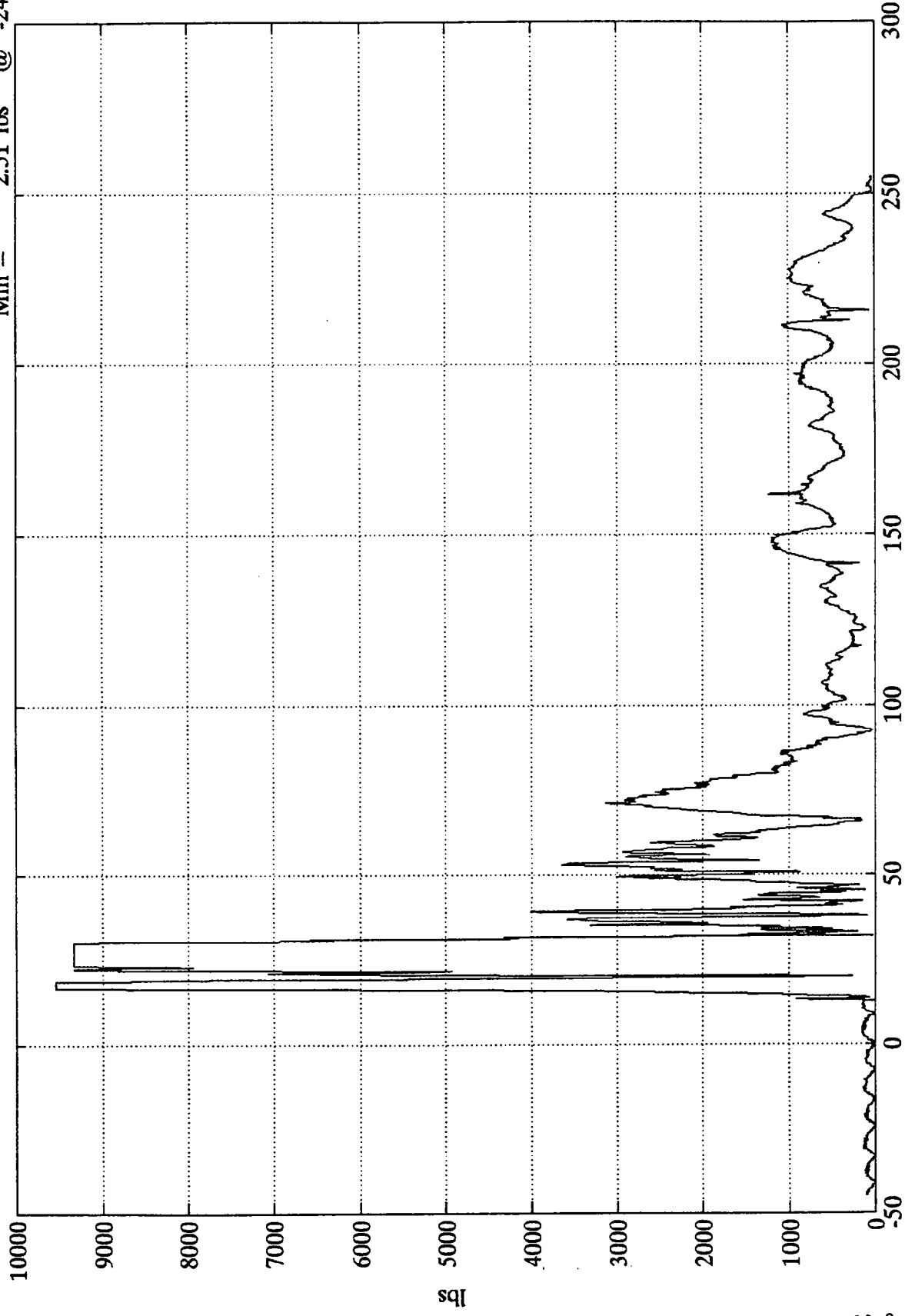
sqi
B-92

7893-8

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Pos. 1 Neck Force Res.
Max = 9547.59 lbs @ 16.92 msec
Min = 2.51 lbs @ -24.48 msec



sqI
B-93

Time (msec)

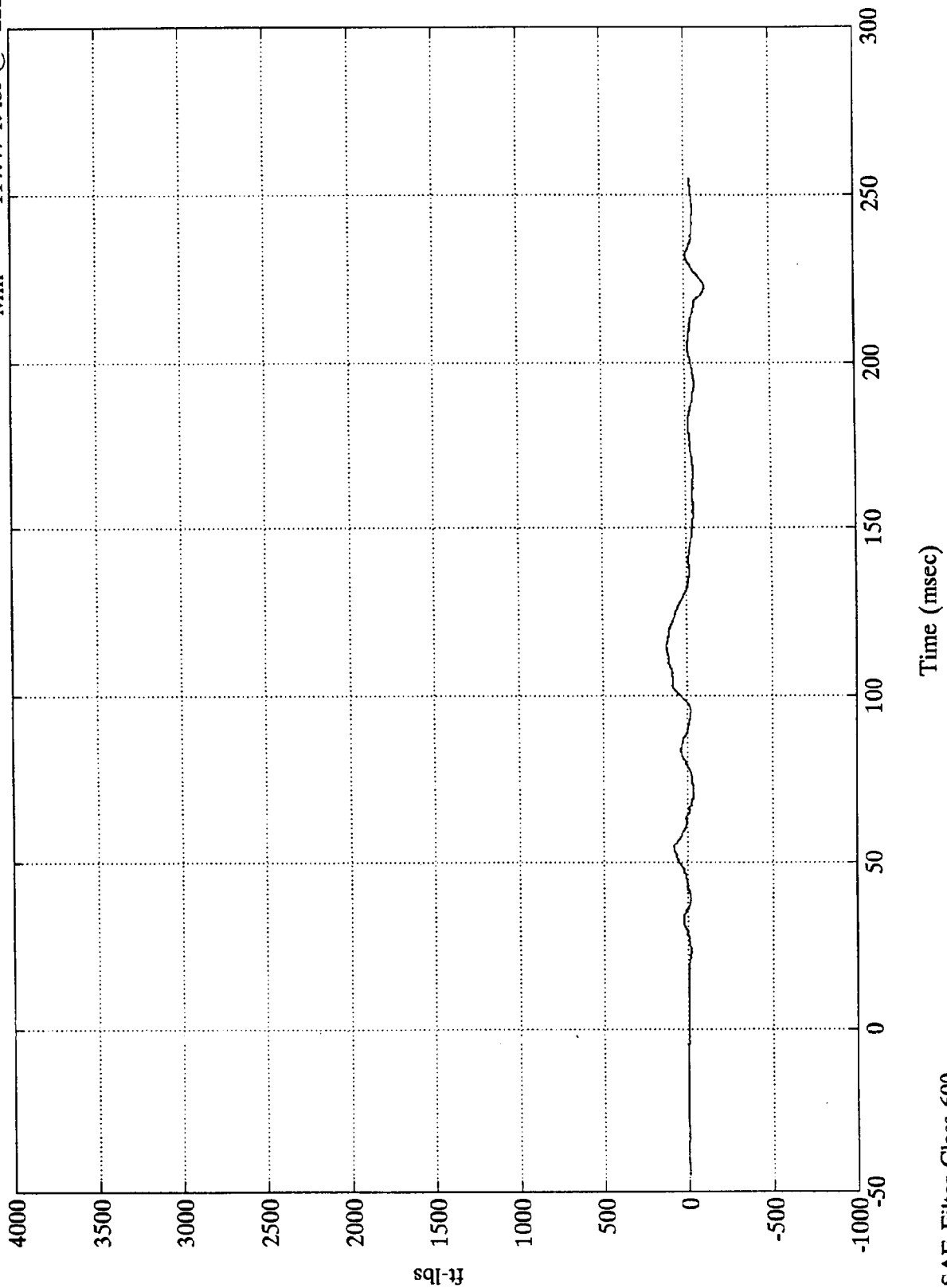
SAE Filter Class 1000

7893-8

NCAP TEST #12 1991 GEO STORM

Pos. 1 Upper Neck Mx

Max = 123.85 ft-lbs @ 115.08 msec
Min = -117.47 ft-lbs @ 222.48 msec



B-94

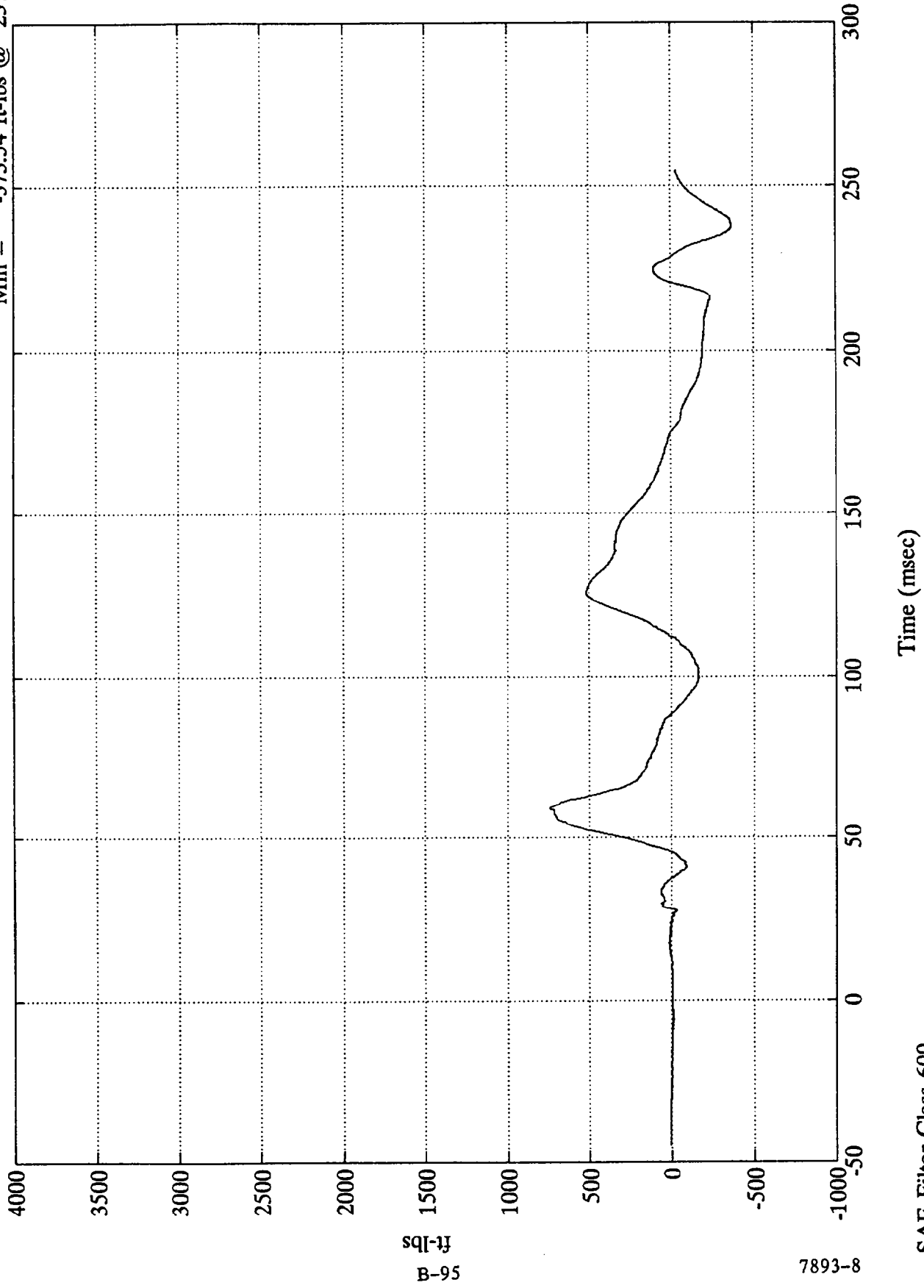
7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 1 Upper Neck My

Max = 739.74 ft-lbs @ 59.15 msec
Min = -373.54 ft-lbs @ 237.48 msec



sqi-1j
B-95

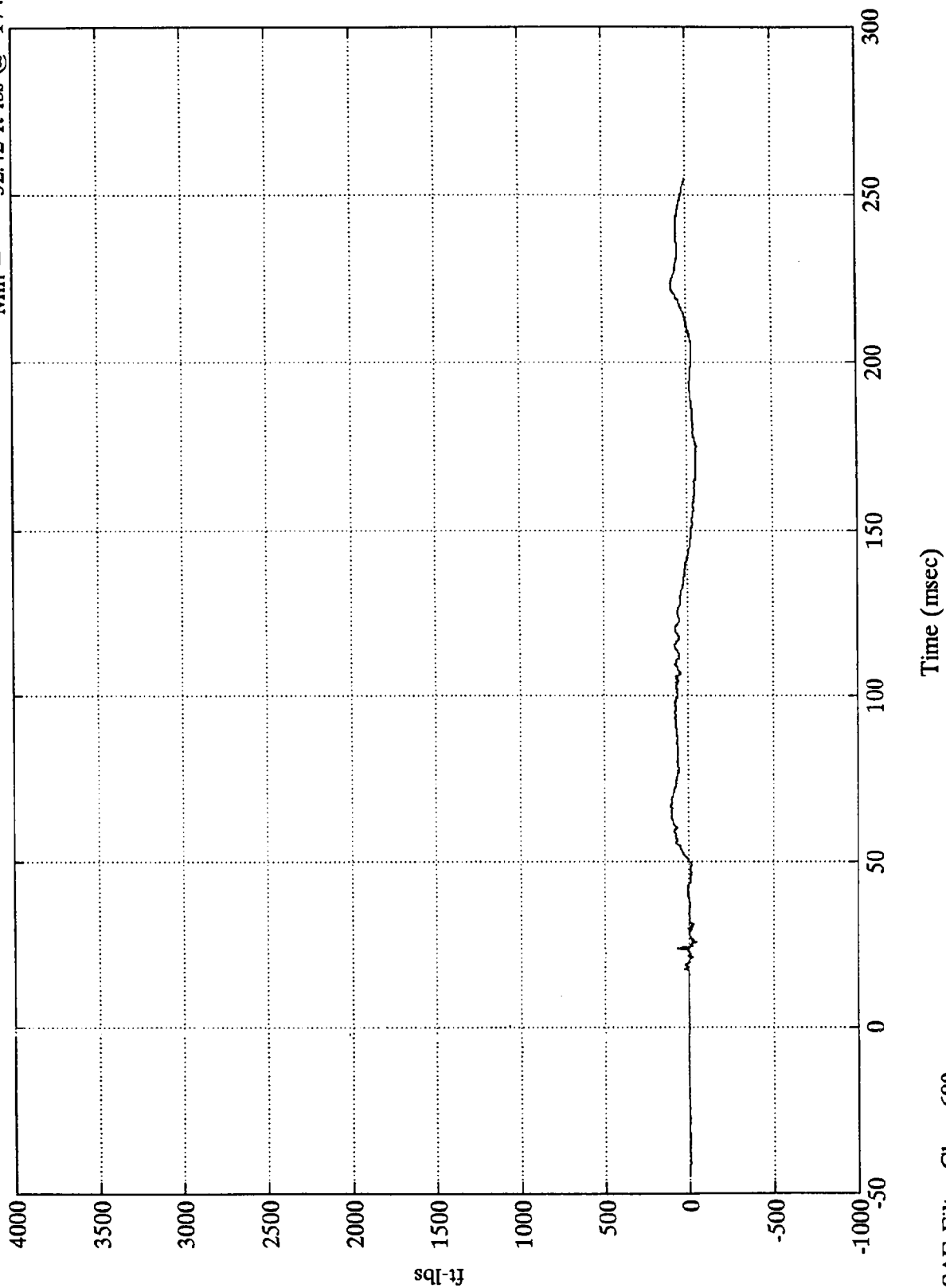
7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 1 Upper Neck Mz

Max = 110.30 ft-lbs @ 66.48 msec
Min = -52.42 ft-lbs @ 174.96 msec



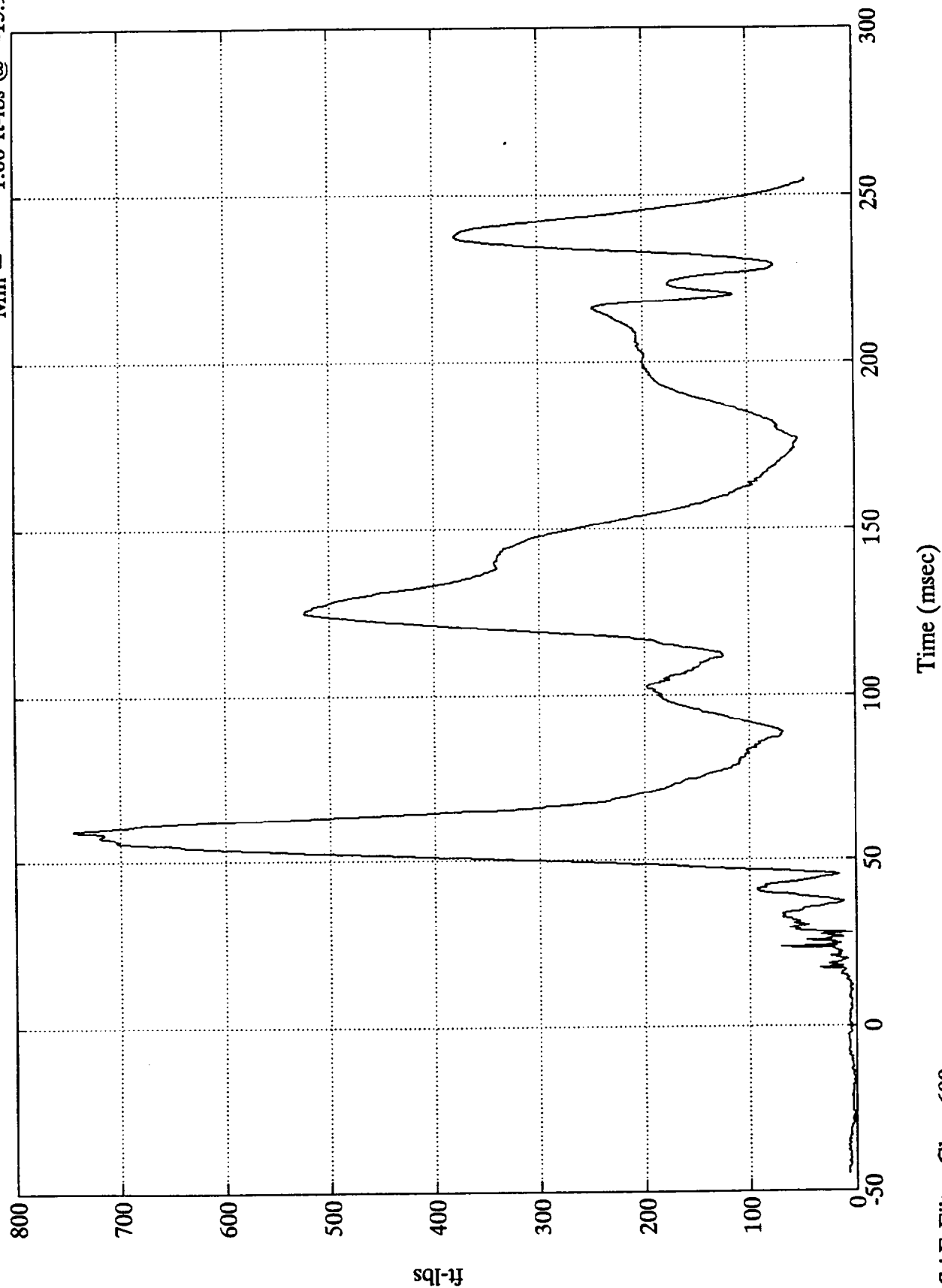
B-96

7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 1 Neck Moment Res.
Max = 745.07 ft-lbs @ 59.15 msec
Min = 1.00 ft-lbs @ -15.96 msec



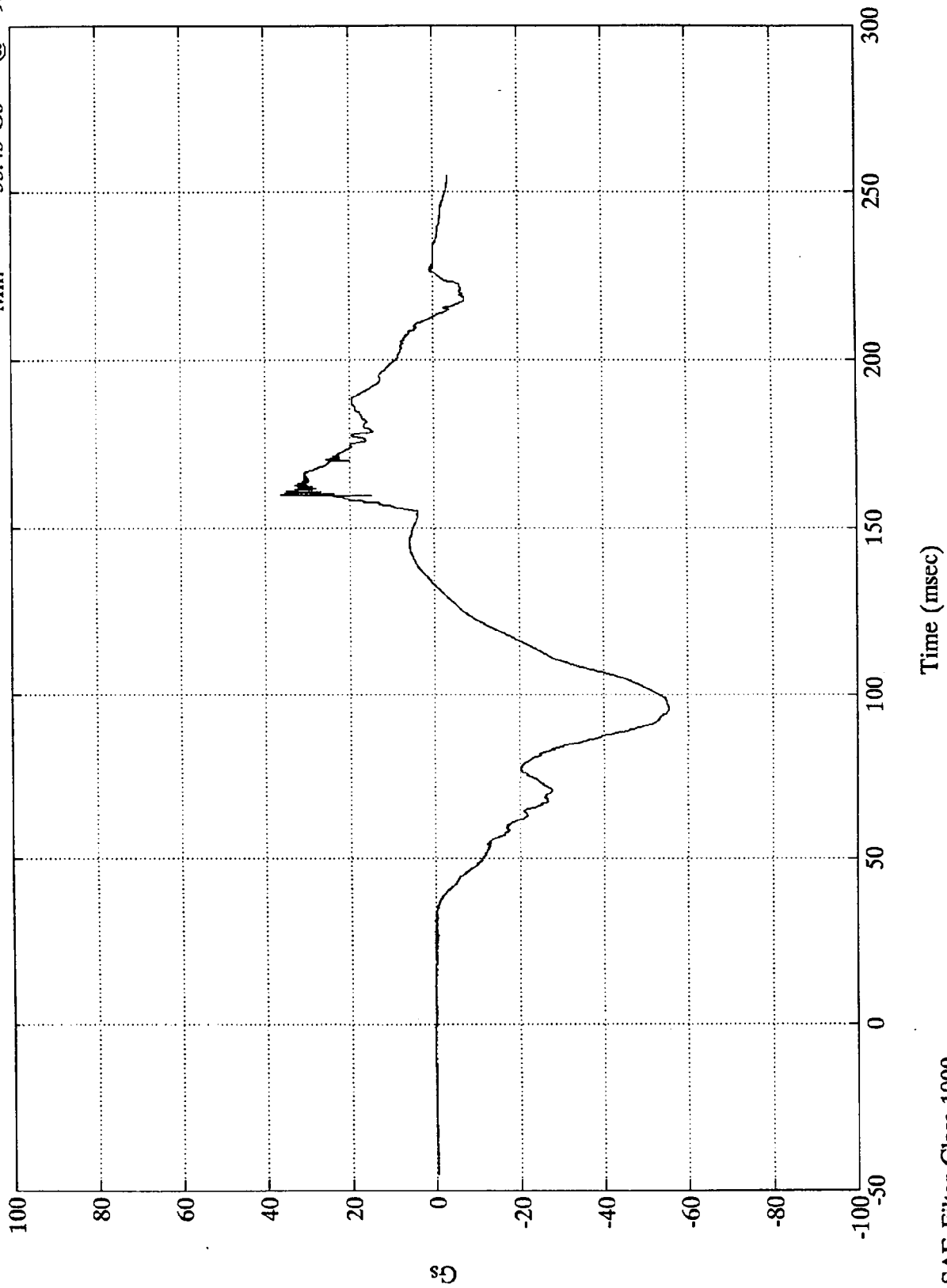
sqi-1j
B-97

7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

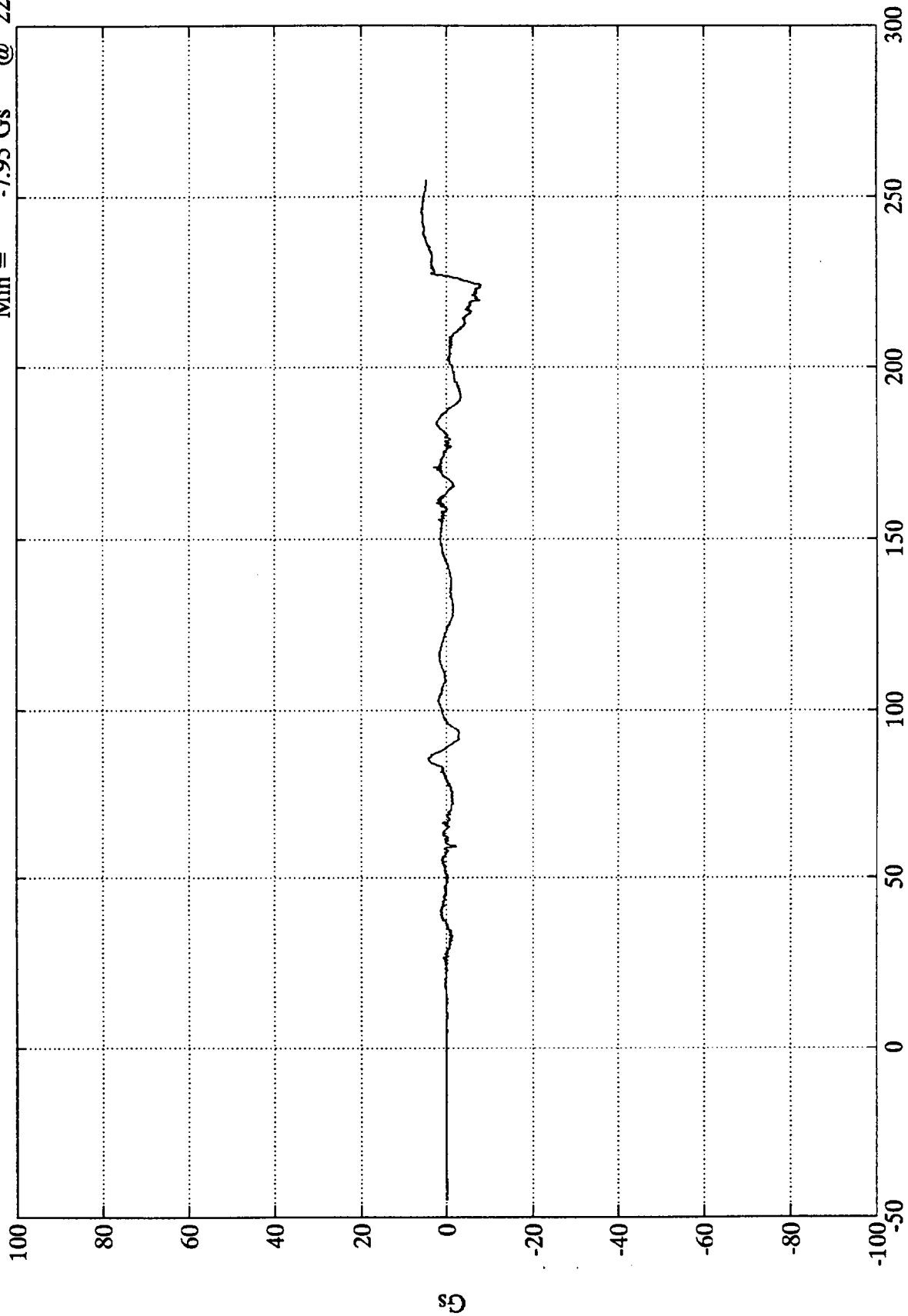
Pos. 2 Head X
Max = 36.22 Gs @ 160.19 msec
Min = -55.45 Gs @ 95.40 msec



NCAP TEST #12 1991 GEO STORM

Max = 5.83 Gs @ 246.36 msec
Min = -7.95 Gs @ 223.91 msec

Pos. 2 Head Y



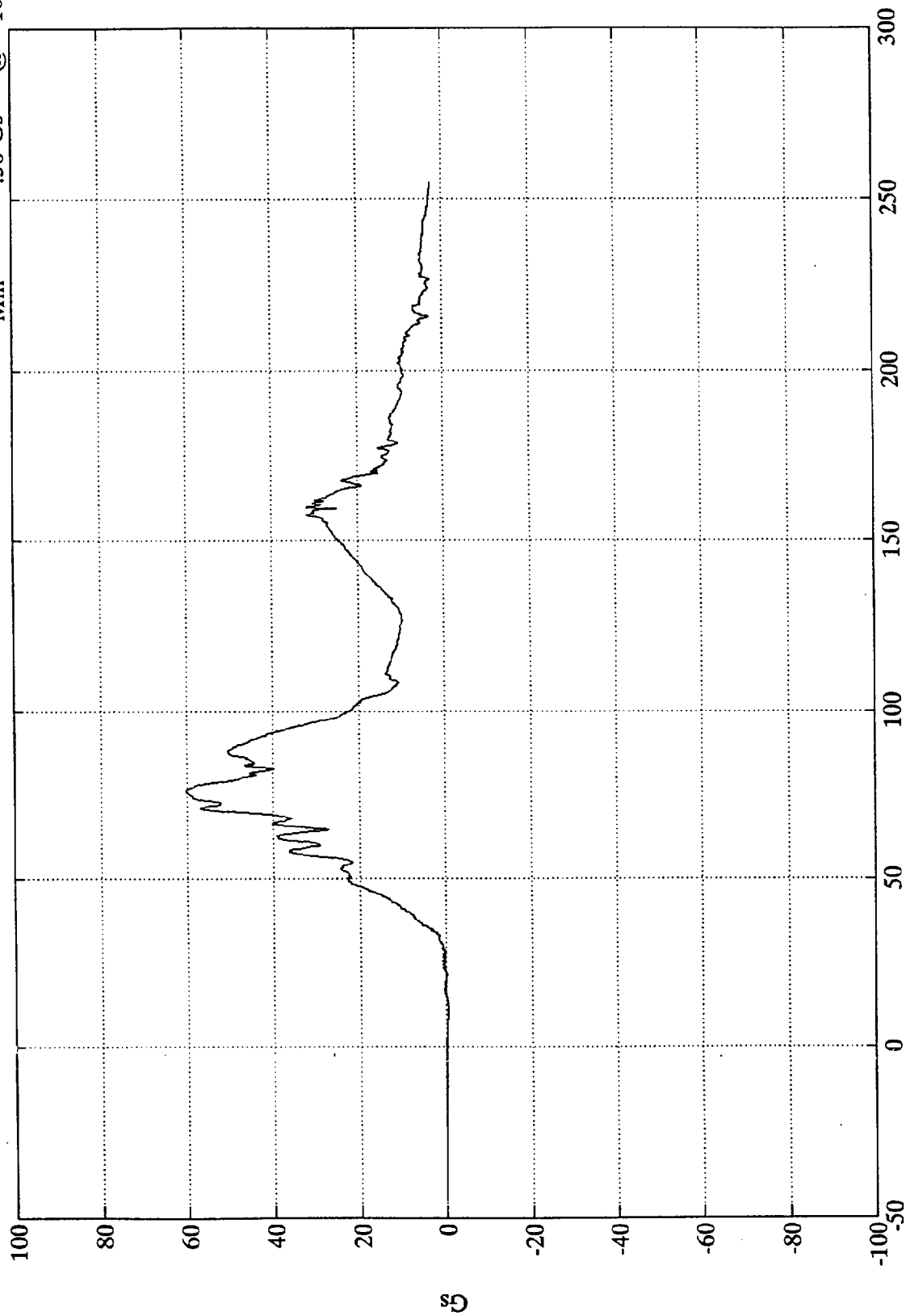
Time (msec)

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Max = 60.31 Gs @ 76.44 msec
Min = -.50 Gs @ 10.19 msec

Pos. 2 Head Z

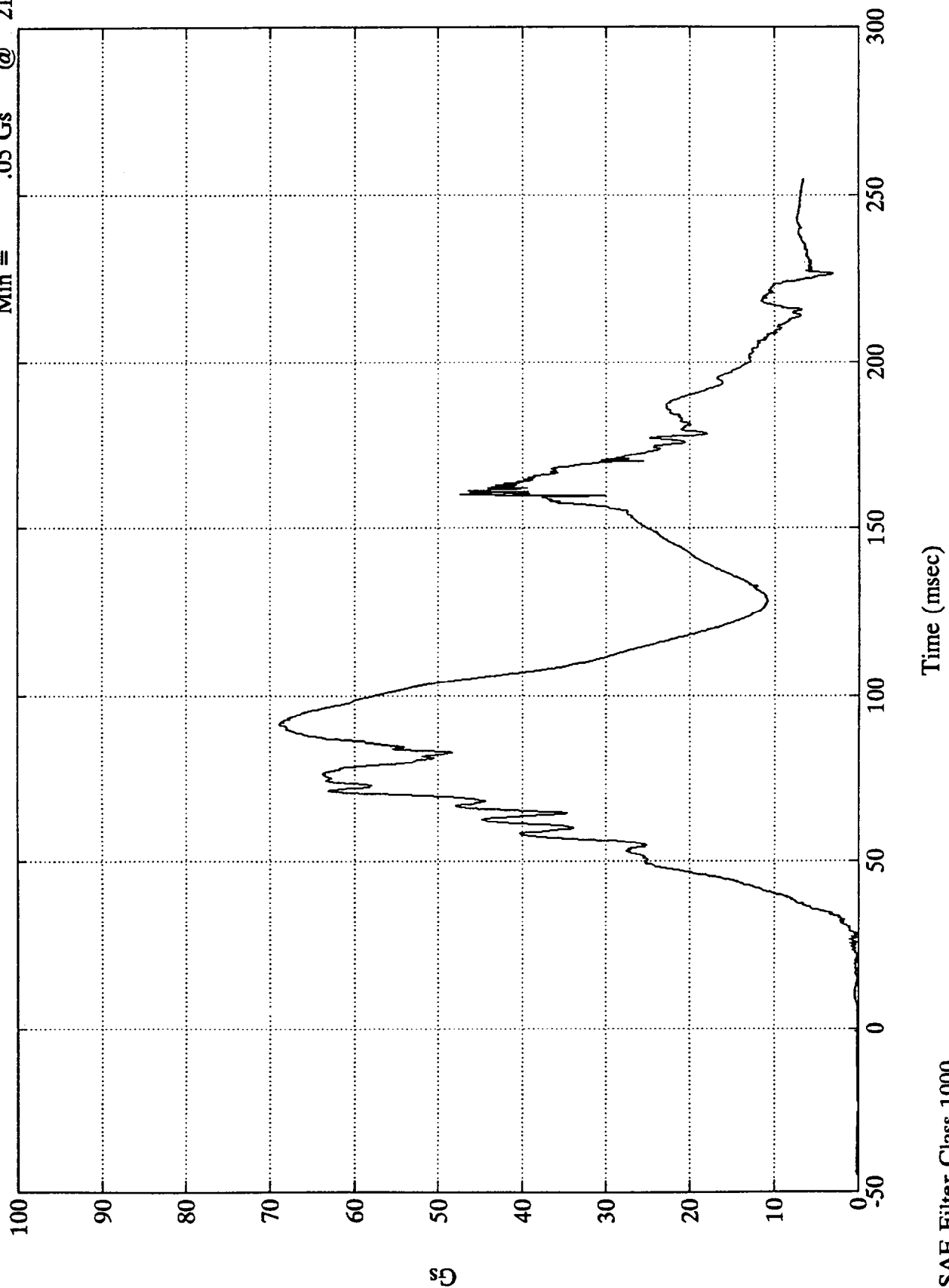


Time (msec)

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Pos. 2 Head Resultant
Max = 68.93 Gs @ 91.44 msec
Min = .05 Gs @ 21.71 msec



B-101

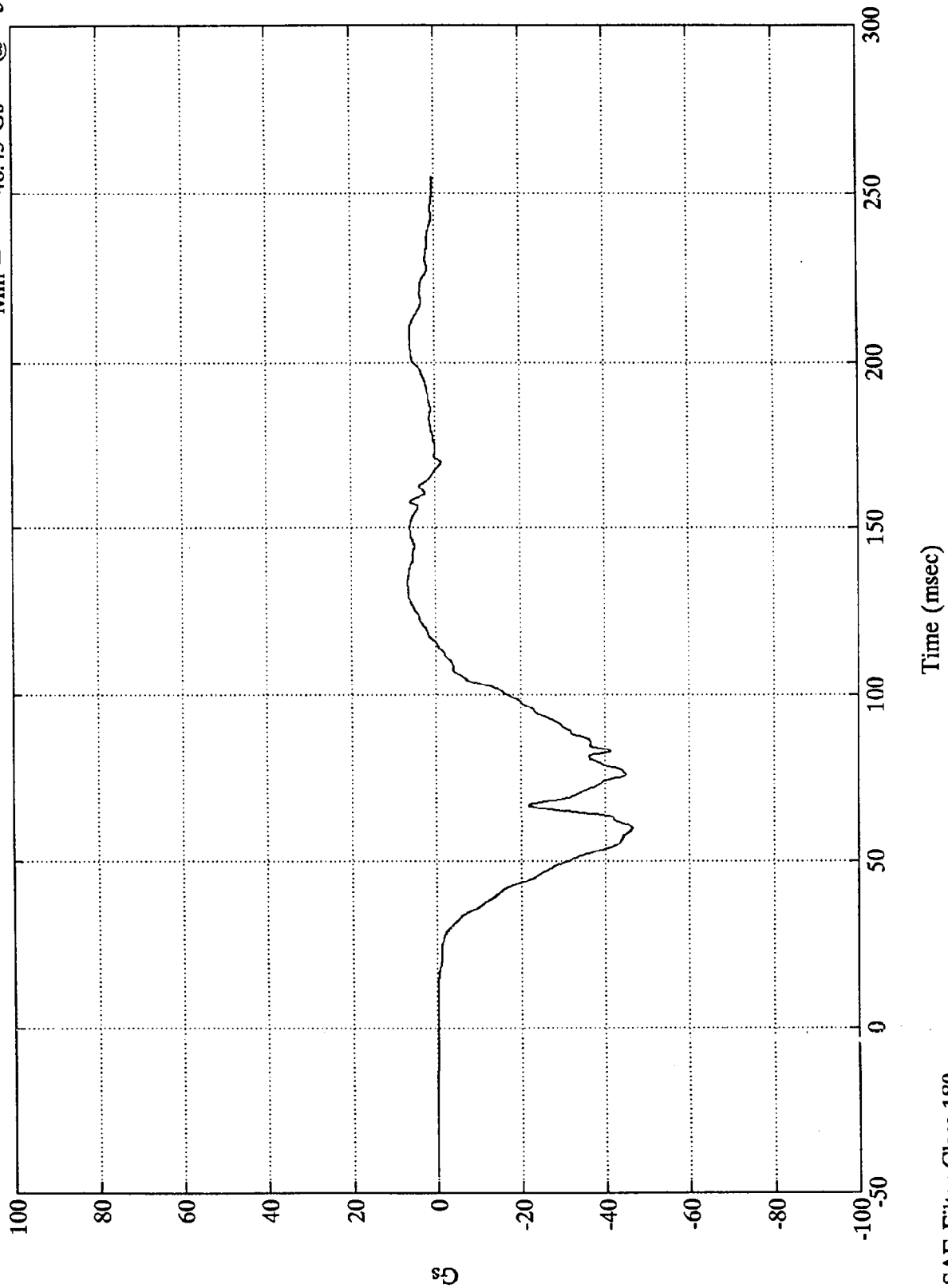
7893-8

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Max = 6.70 Gs @ 133.55 msec
 Min = -46.45 Gs @ 59.88 msec

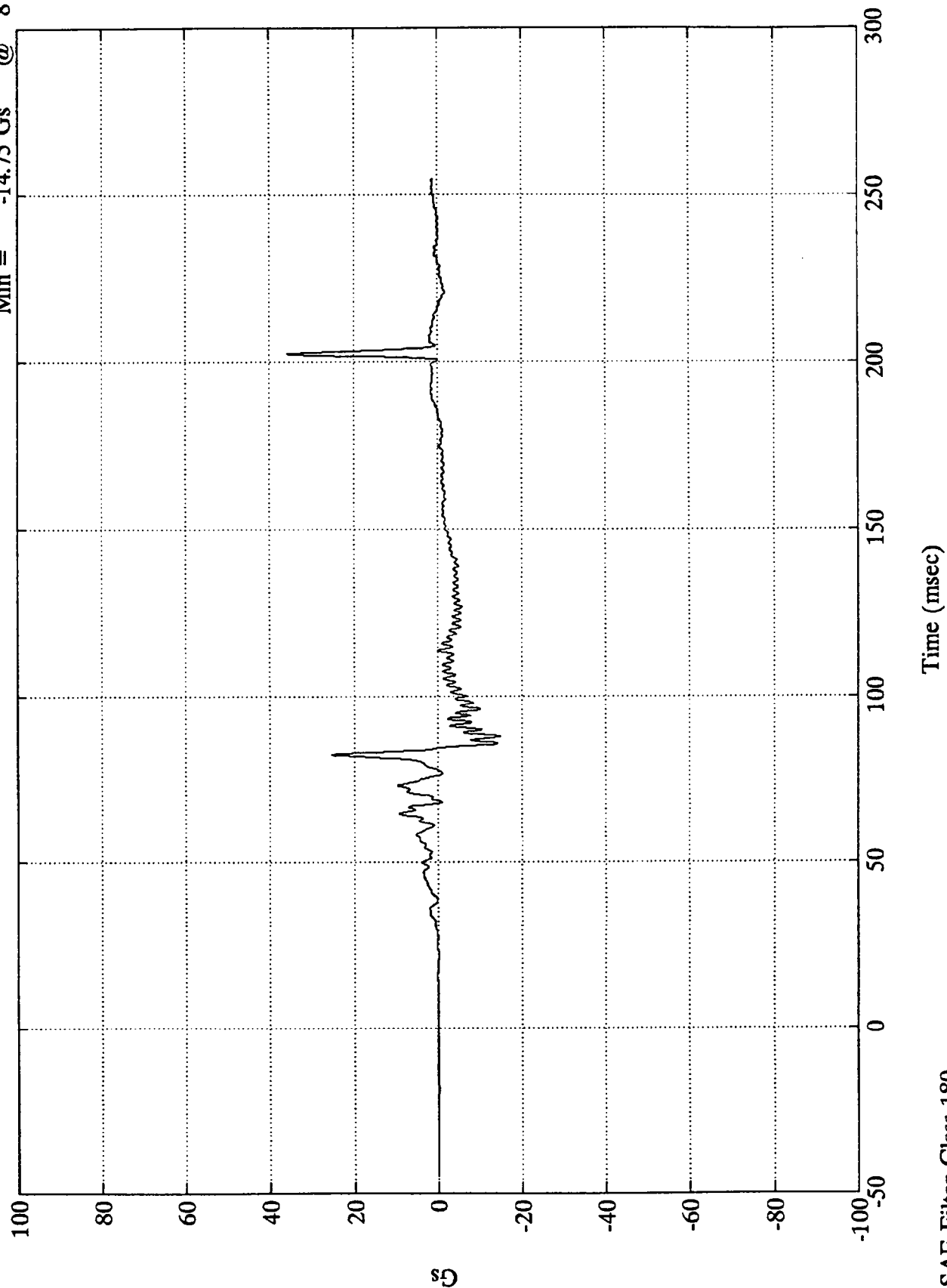
Pos. 2 Chest X



NCAP TEST #12 1991 GEO STORM

Max = 35.73 Gs @ 202.32 msec
 Min = -14.75 Gs @ 87.83 msec

Pos. 2 Chest Y



Gs
 B-103

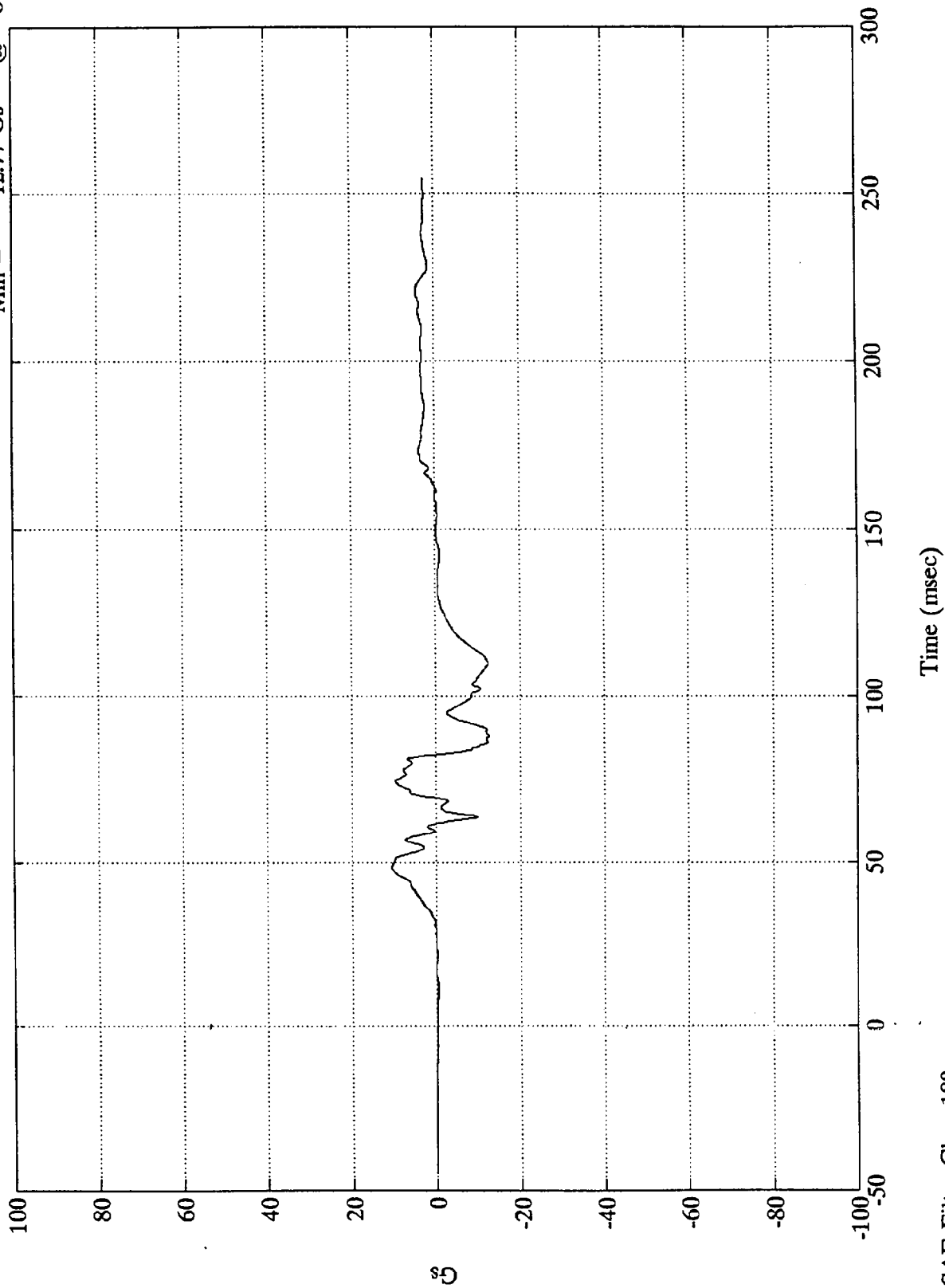
7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Max = 10.61 Gs @ 48.59 msec
 Min = -12.77 Gs @ 87.96 msec

Pos. 2 Chest Z



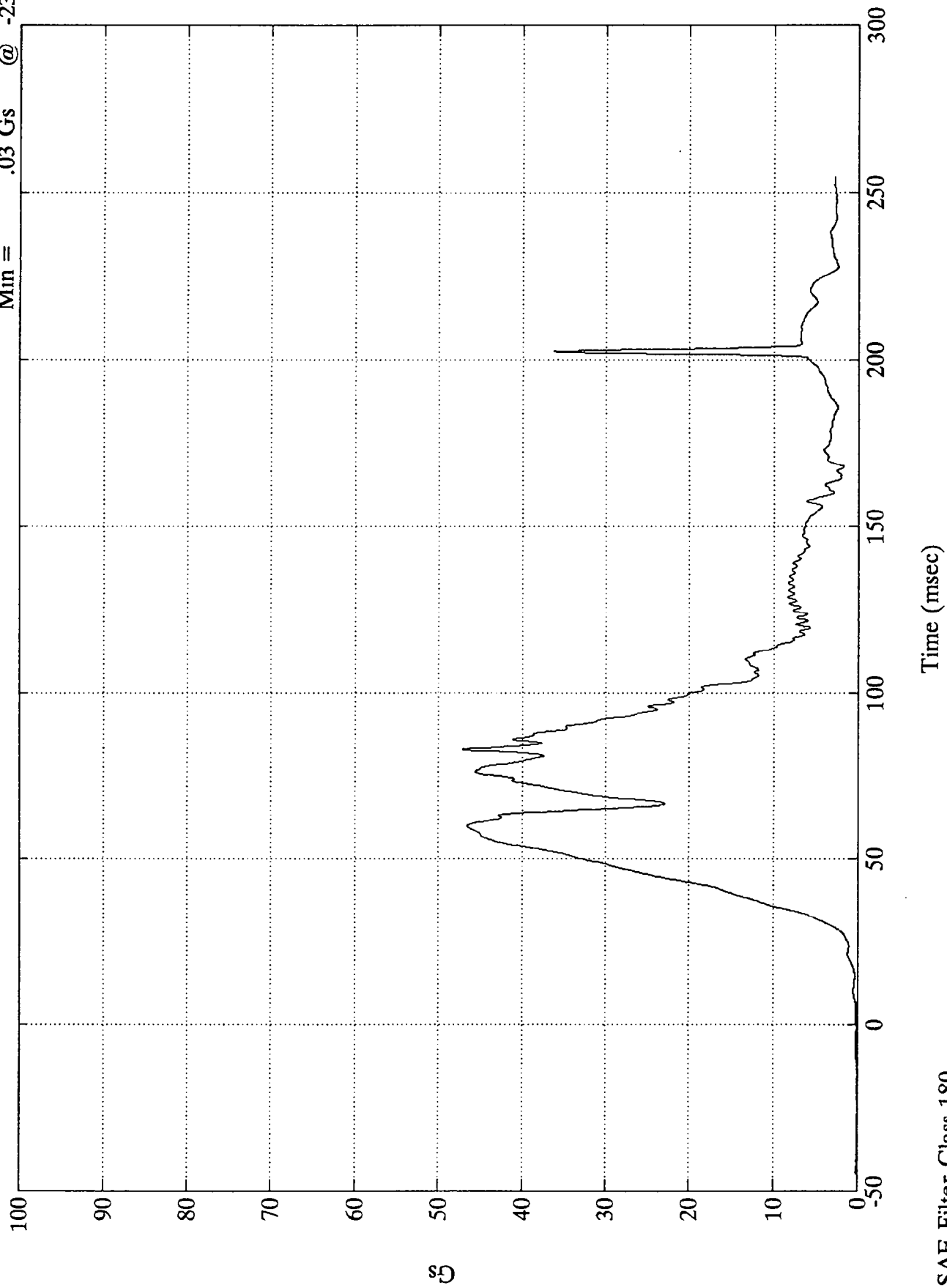
B-104

7893-8

SAE Filter Class 180

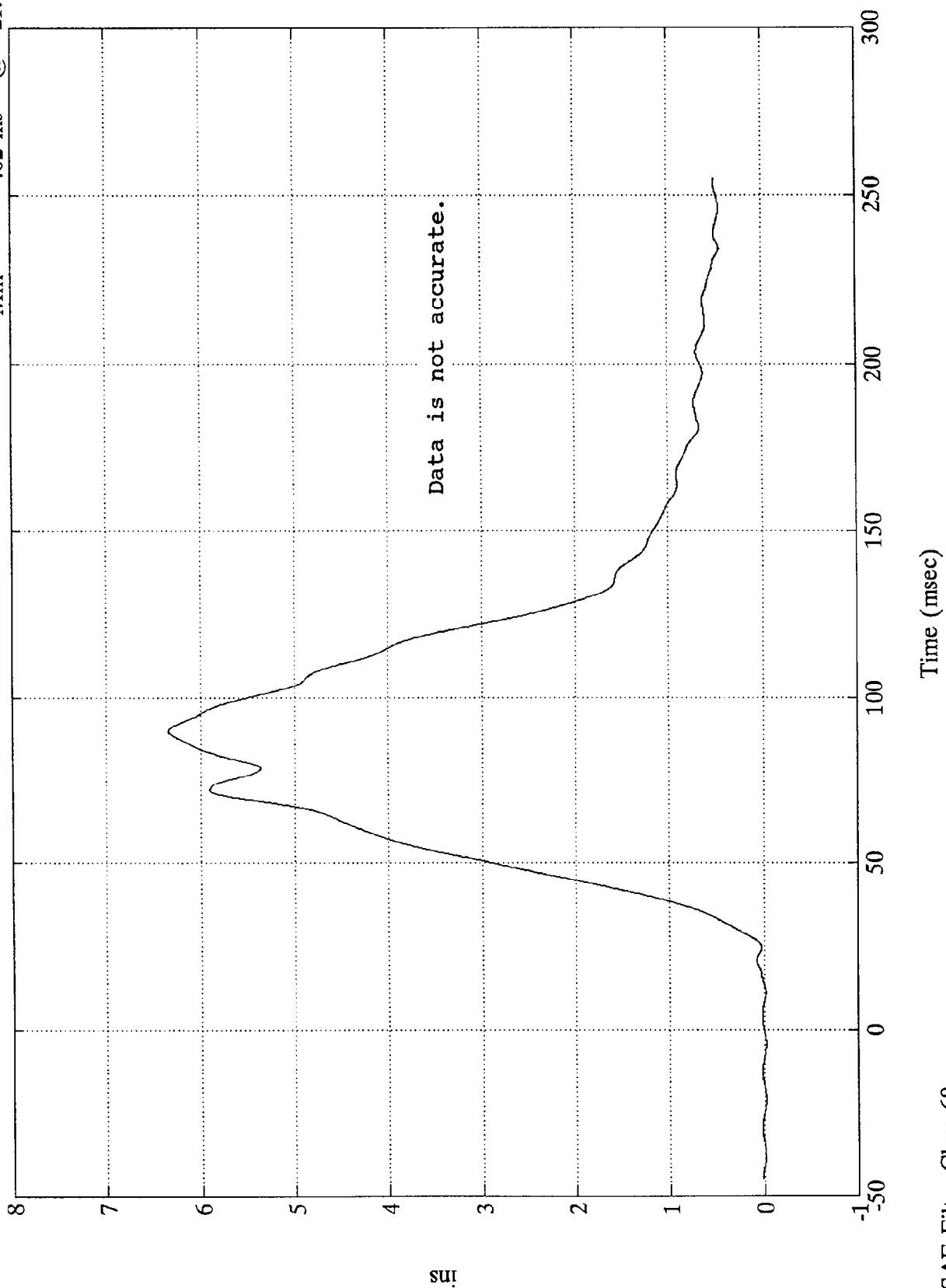
NCAP TEST #12 1991 GEO STORM

Pos. 2 Chest Resultant
Max = 47.11 Gs @ 82.68 ms
Min = .03 Gs @ -23.52 ms



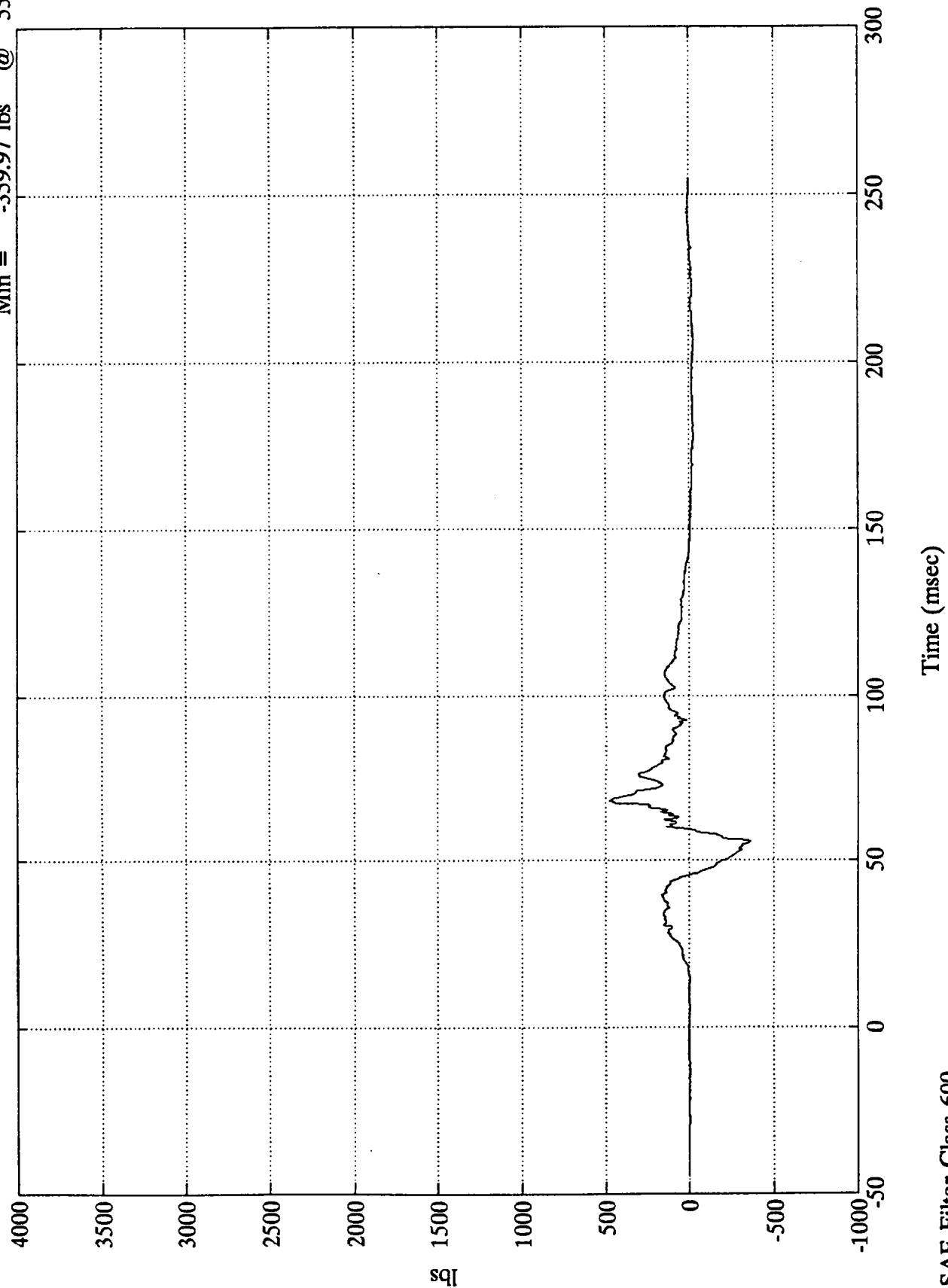
NCAP TEST #12 1991 GEO STORM

Pos. 2 Chest Disp. Max = 6.34 ins @ 90.00 msec
Min = -.02 ins @ -21.12 msec



NCAP TEST #12 1991 GEO STORM

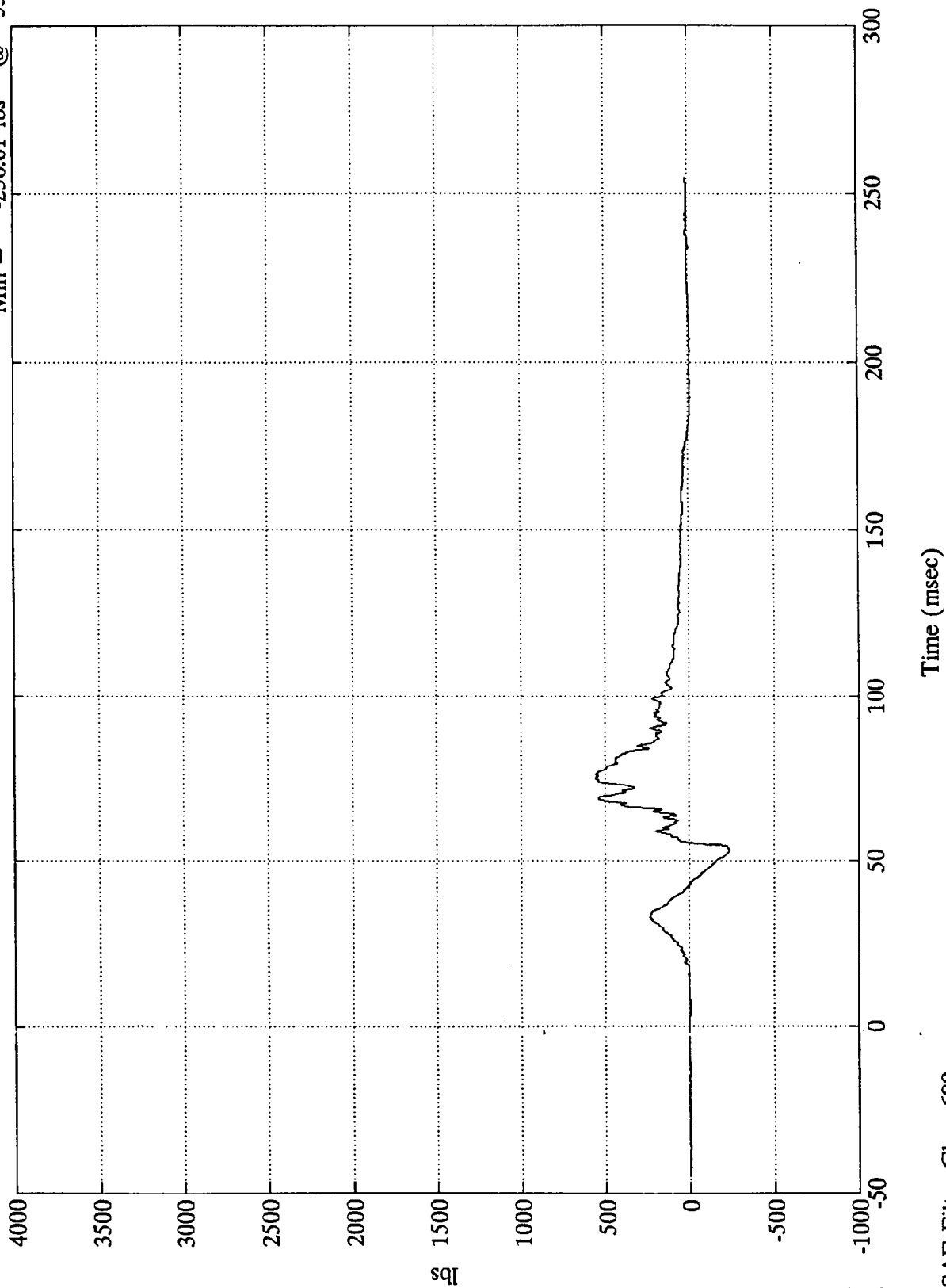
Pos. 2 Left Femur
Max = 477.97 lbs @ 68.16 msec
Min = -359.97 lbs @ 55.68 msec



NCAP TEST #12 1991 GEO STORM

Pos. 2 Right Femur

Max = 555.16 lbs @ 74.76 msec
Min = -236.01 lbs @ 53.27 msec



B-108

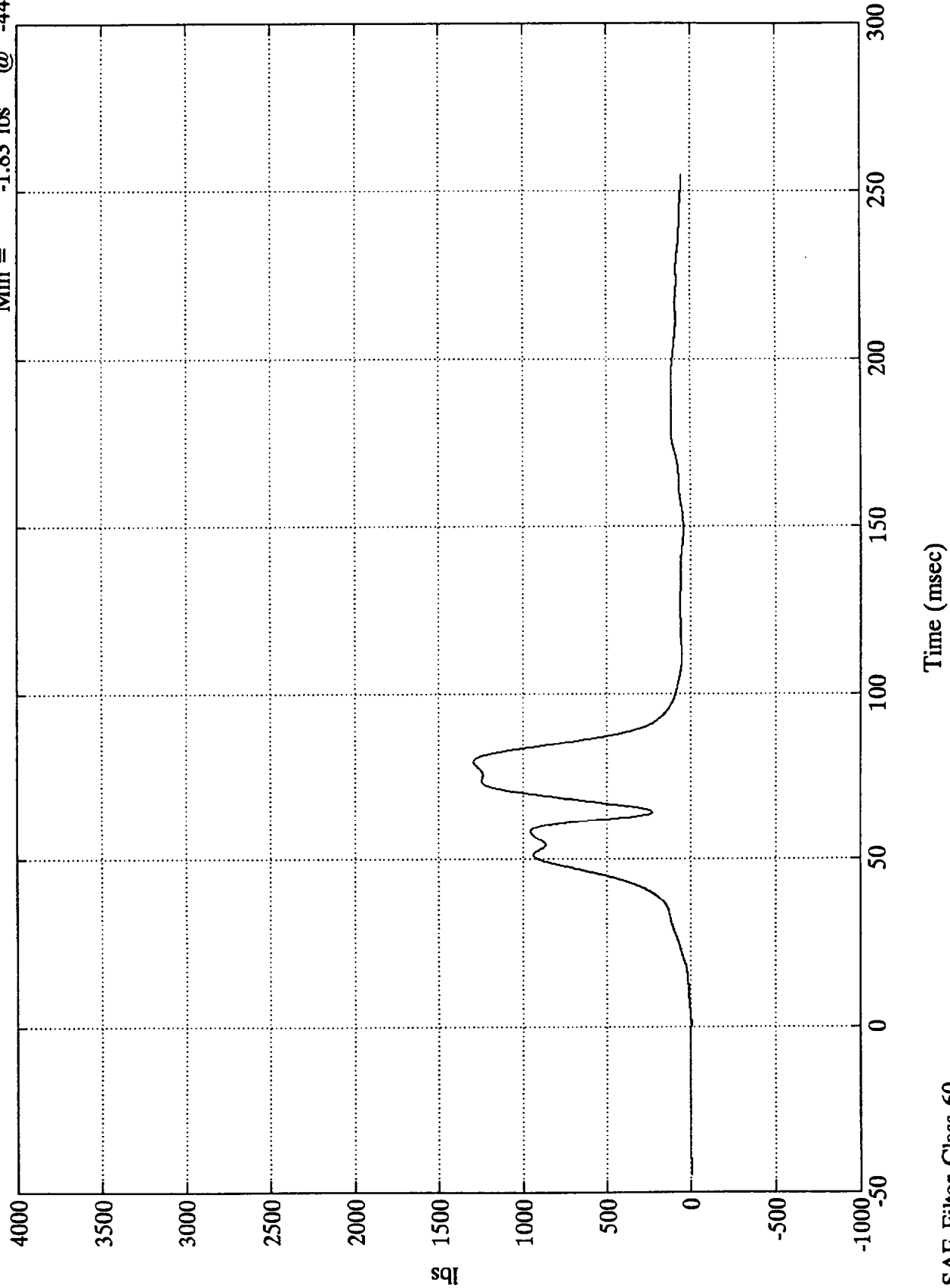
7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 2 Right Belt Load

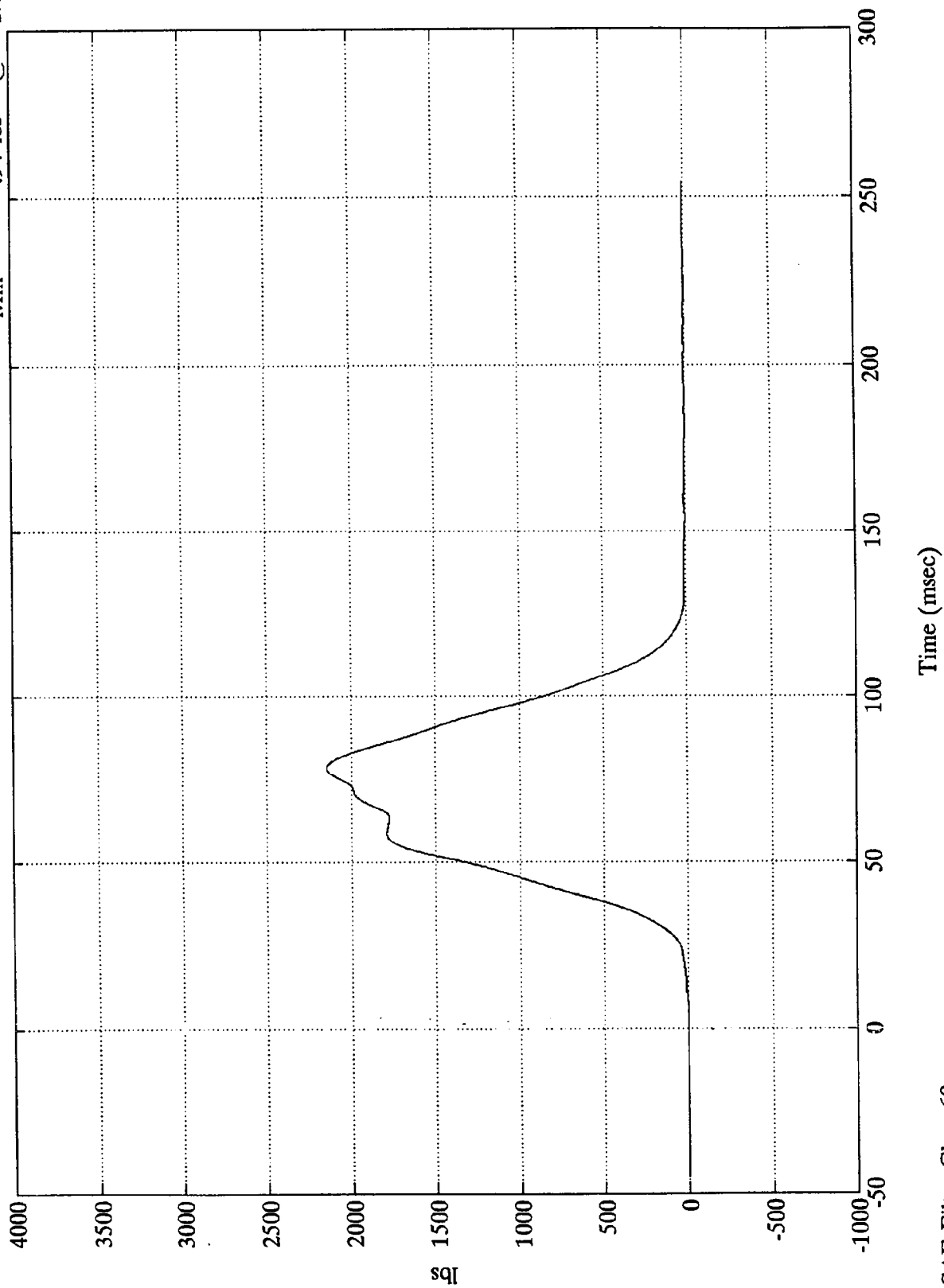
Max = 1294.35 lbs @ 79.44 msec
Min = -1.83 lbs @ -44.88 msec



NCAP TEST #12 1991 GEO STORM

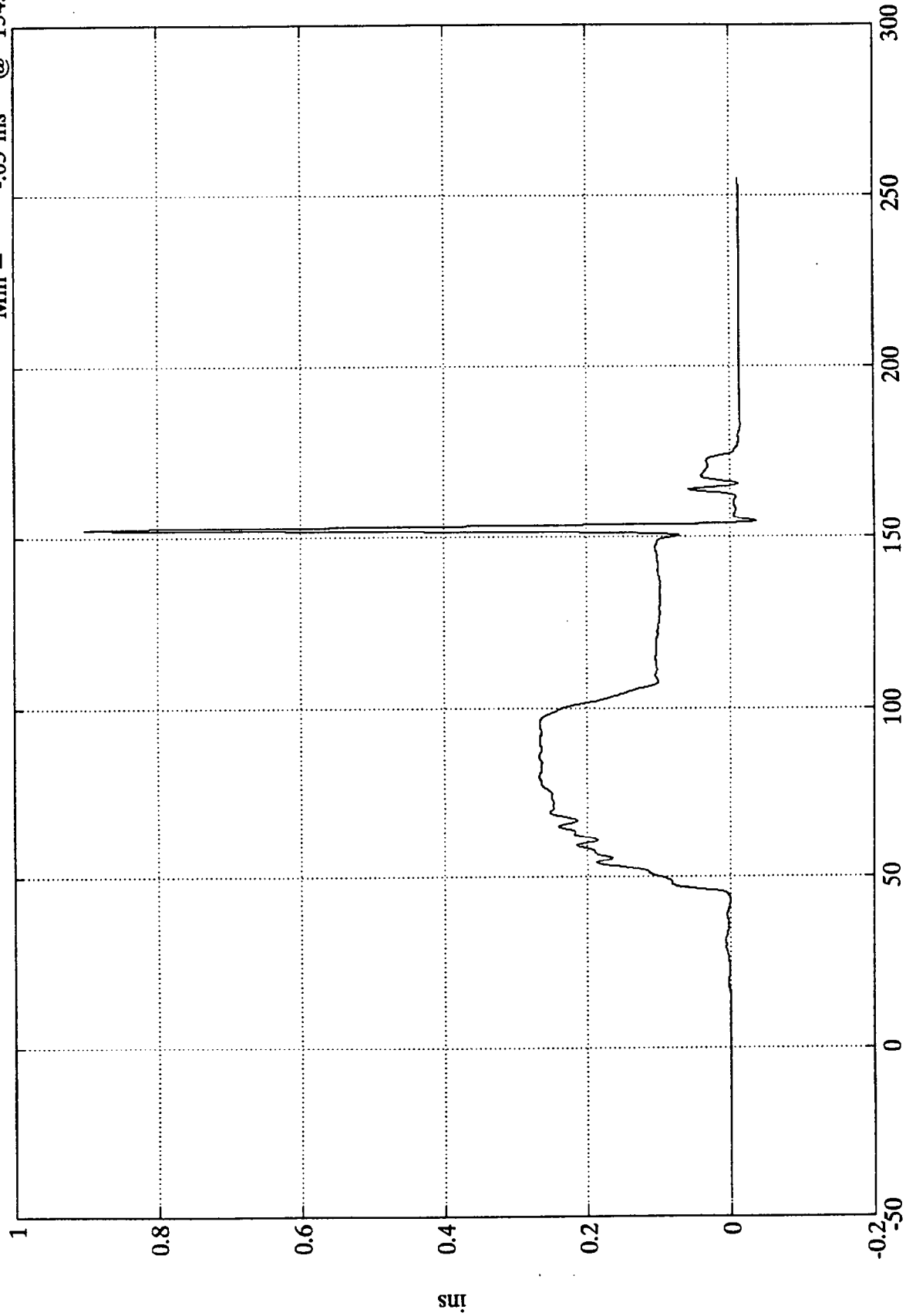
Pos. 2 Torso Belt Load

Max = 2145.44 lbs @ 78.48 msec
Min = -.94 lbs @ 1.67 msec



NCAP TEST #12 1991 GEO STORM

Pos. 2 Belt Elongation
Max = .90 ins @ 152.40 msec
Min = -.03 ins @ 154.55 msec



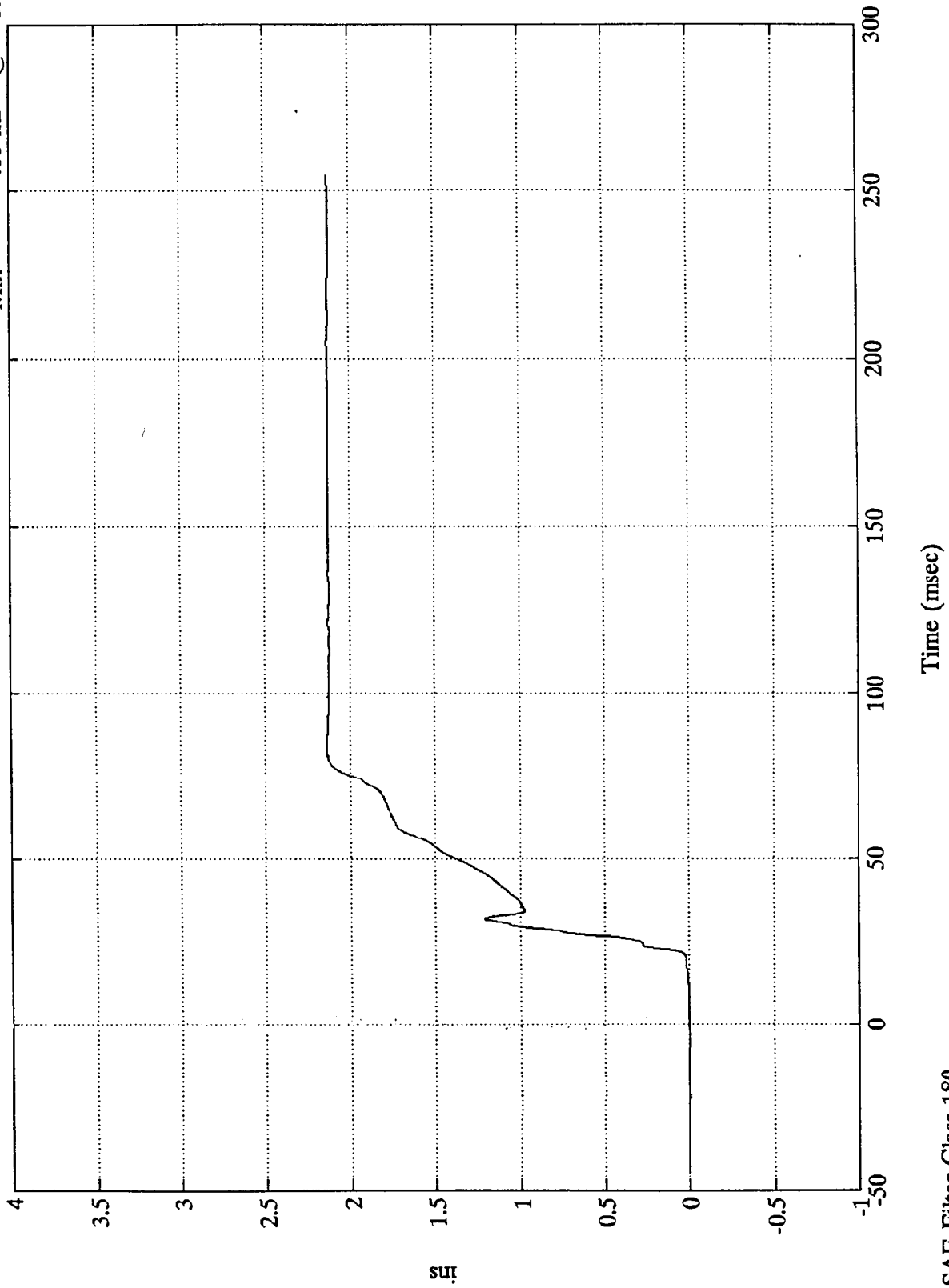
Measured over 2.5 inches

Time (msec)

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Pos. 2 Belt Spool Out
Max = 2.13 ins @ 83.40 msec
Min = -.00 ins @ -3.36 msec



ins
B-112

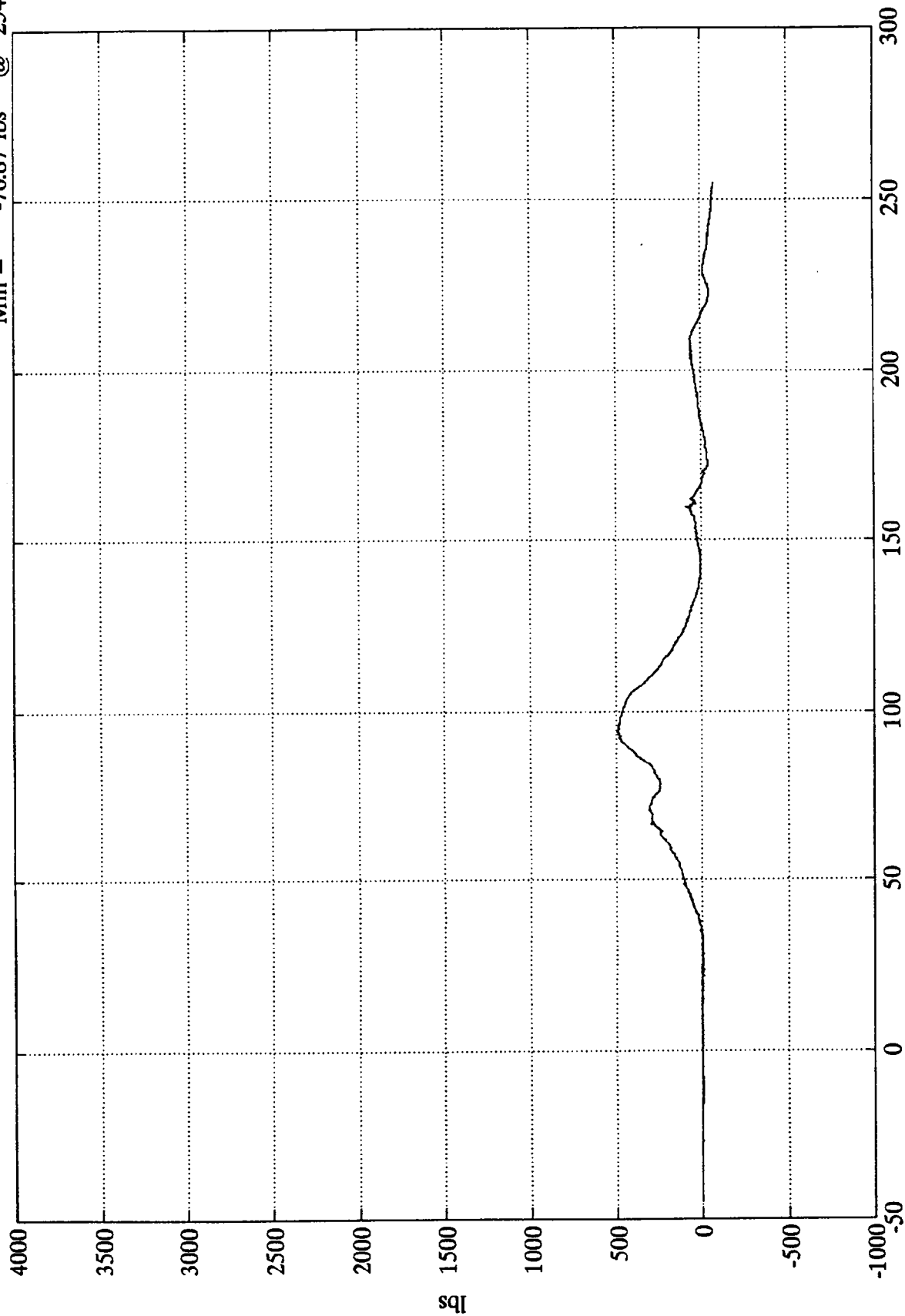
7893-8

SAE Filter Class 180

NCAP TEST #12 1991 GEO STORM

Pos. 2 Upper Neck Fx

Max = 491.18 lbs @ 94.08 msec
Min = -76.87 lbs @ 254.88 msec



B-113

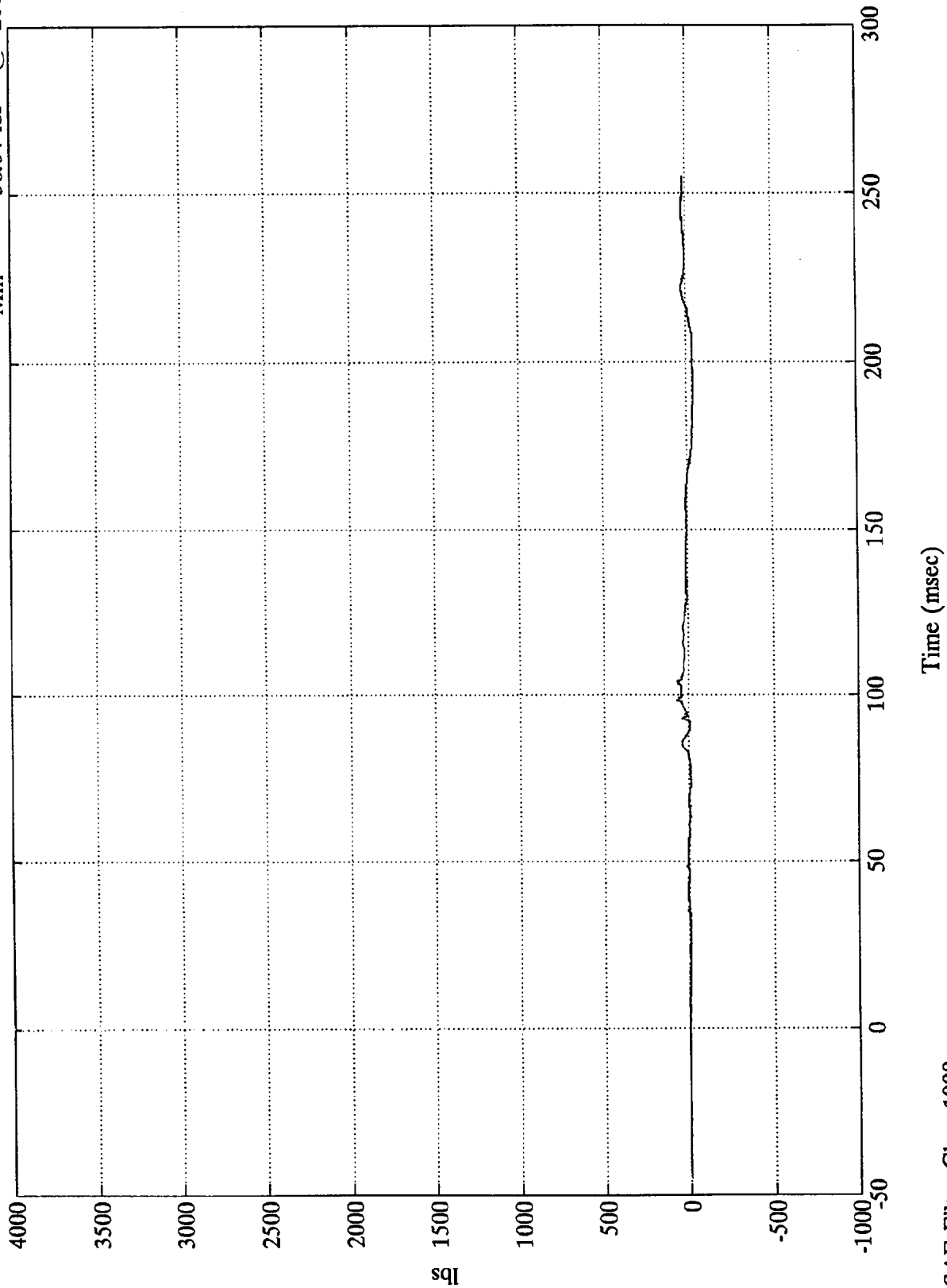
7893-8

Time (msec)

SAE Filter Class 1000

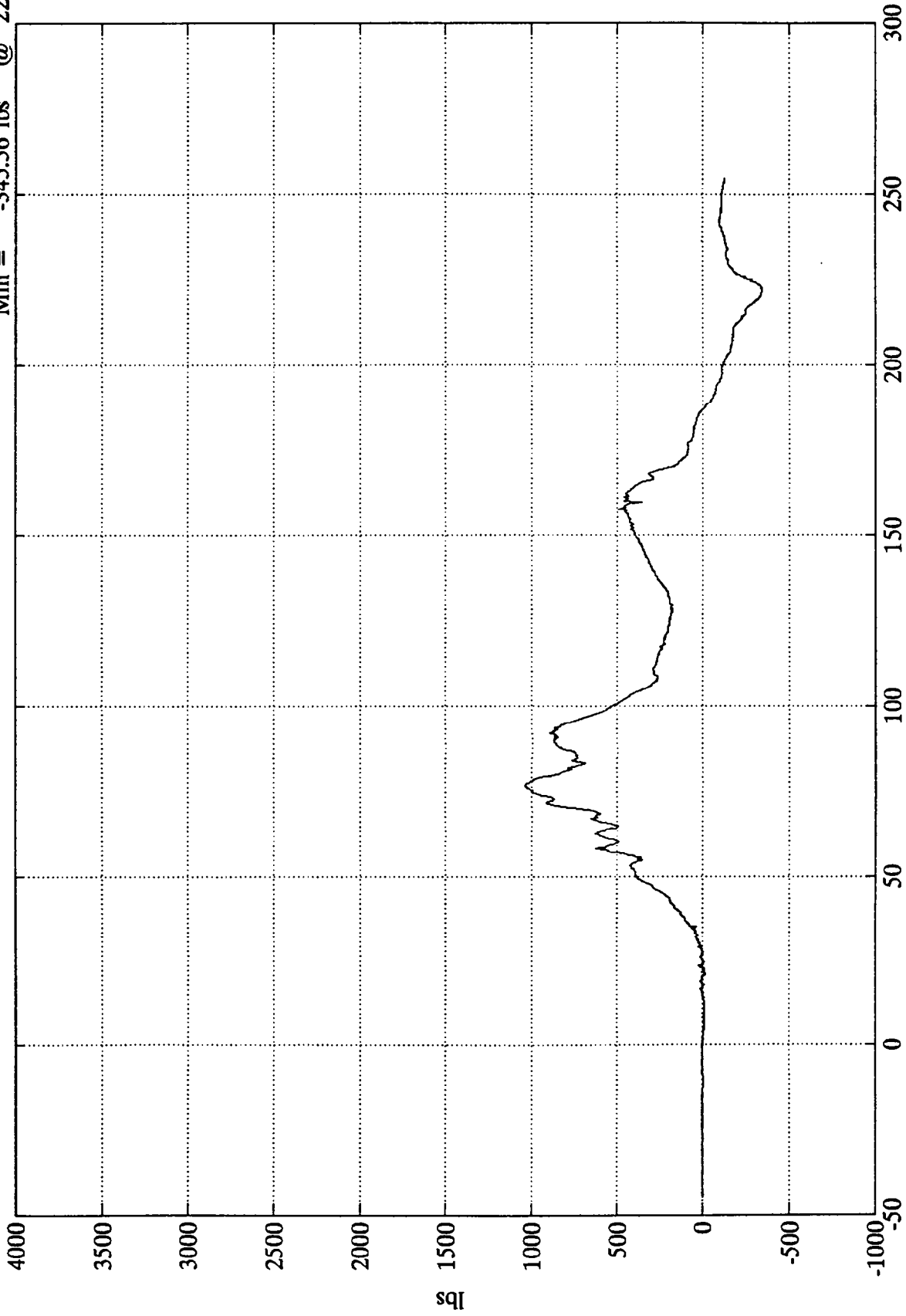
NCAP TEST #12 1991 GEO STORM

Pos. 2 Upper Neck Fy Max = 66.66 lbs @ 103.92 msec
Min = -36.04 lbs @ 200.52 msec



NCAP TEST #12 1991 GEO STORM

Pos. 2 Upper Neck Fz
Max = 1033.87 lbs @ 76.80 msec
Min = -345.56 lbs @ 222.48 msec



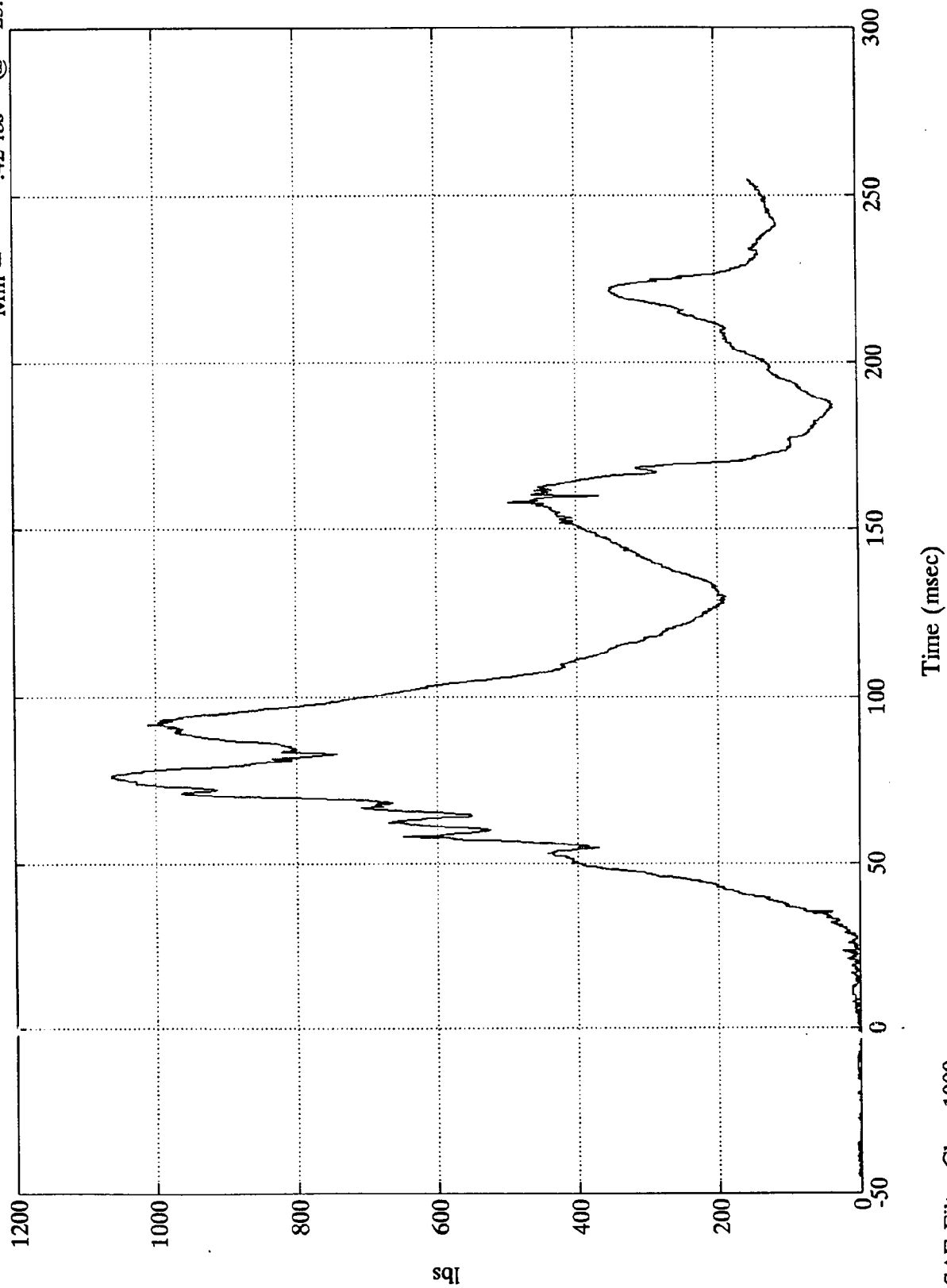
Time (msec)

SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Pos. 2 Neck Force Res.

Max = 1063.29 lbs @ 76.68 msec
Min = .42 lbs @ 23.87 msec

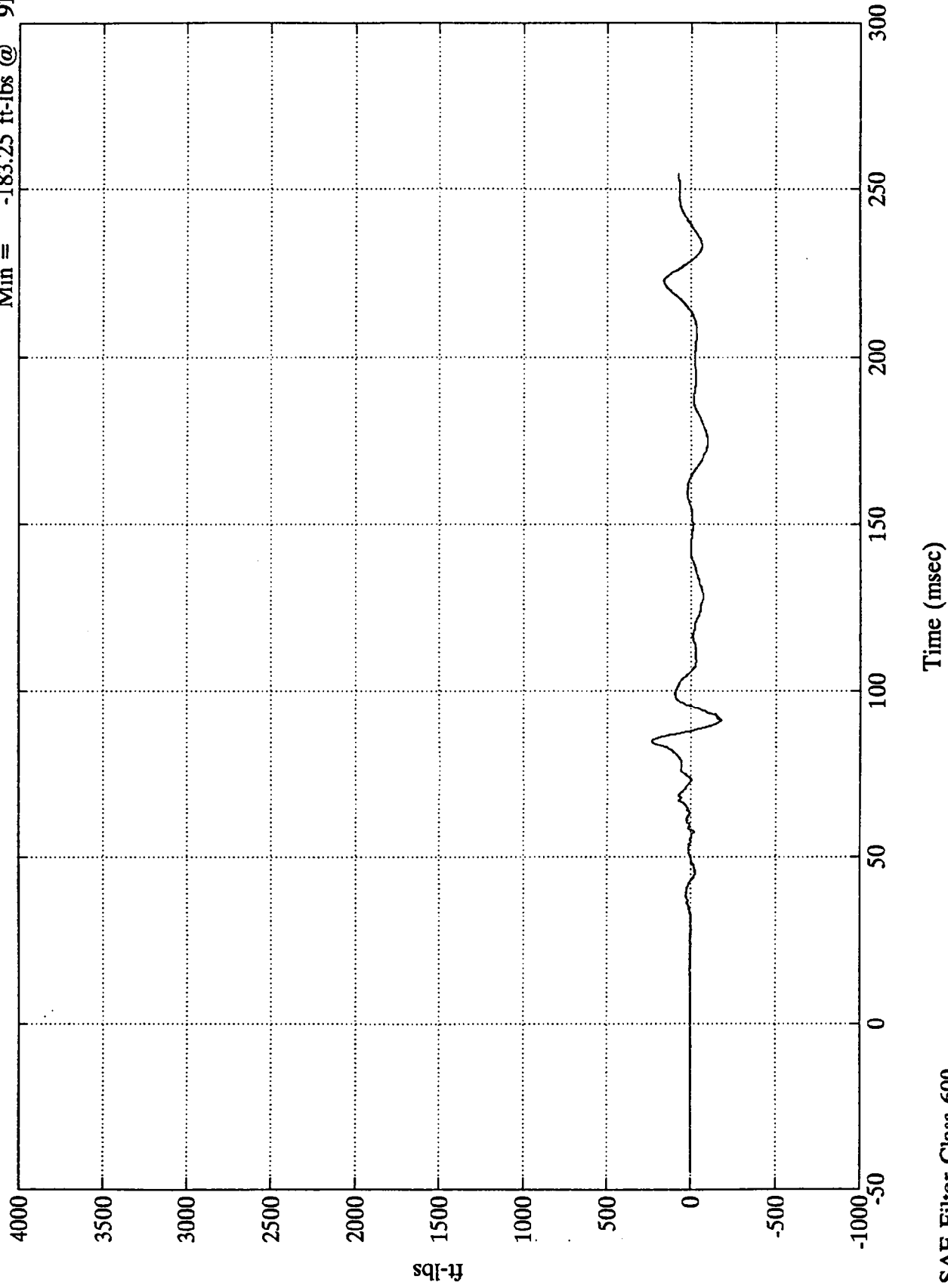


SAE Filter Class 1000

NCAP TEST #12 1991 GEO STORM

Pos. 2 Upper Neck Mx

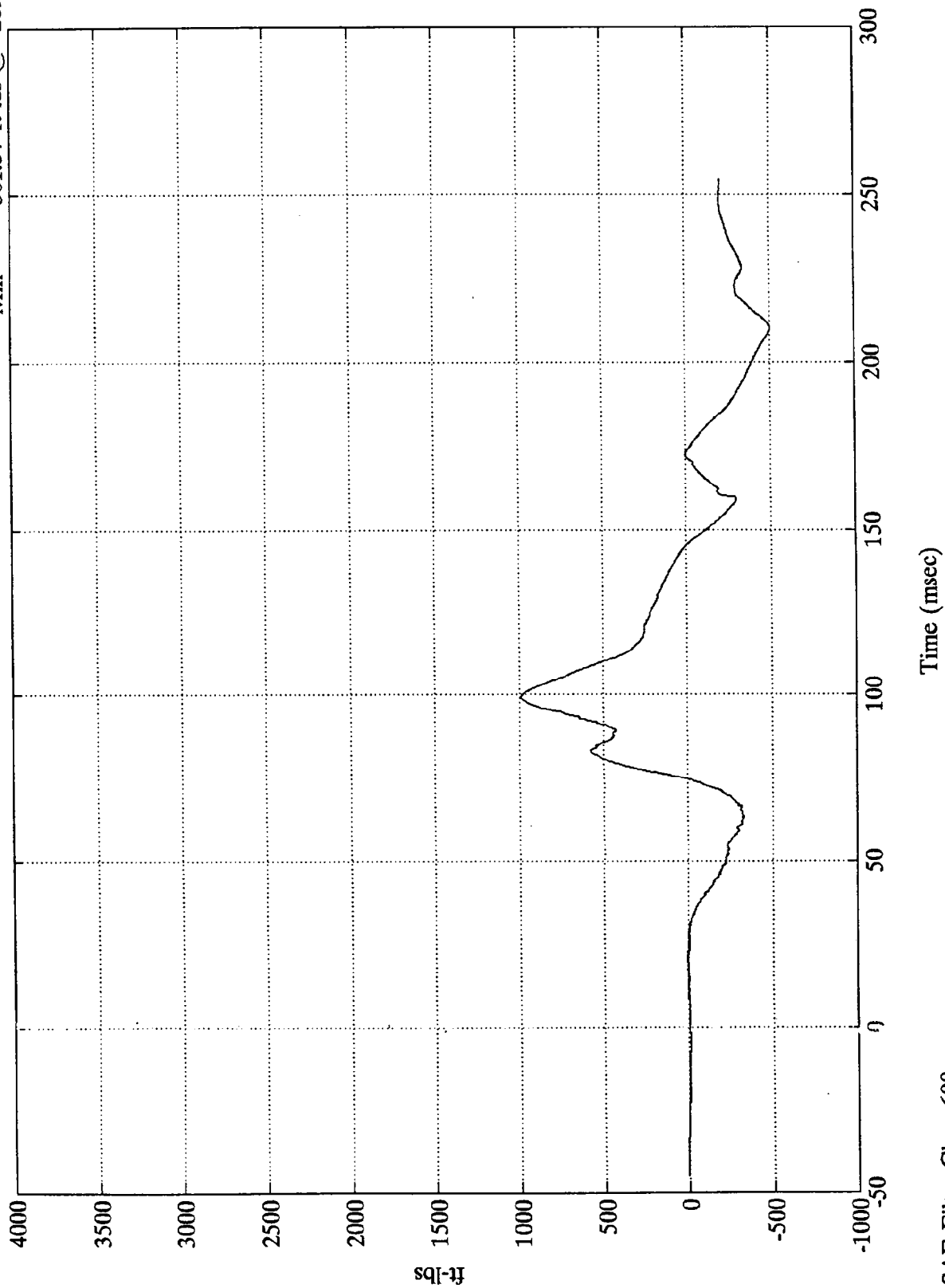
Max = 232.90 ft-lbs @ 84.83 msec
Min = -183.25 ft-lbs @ 91.08 msec



NCAP TEST #12 1991 GEO STORM

Pos. 2 Upper Neck My

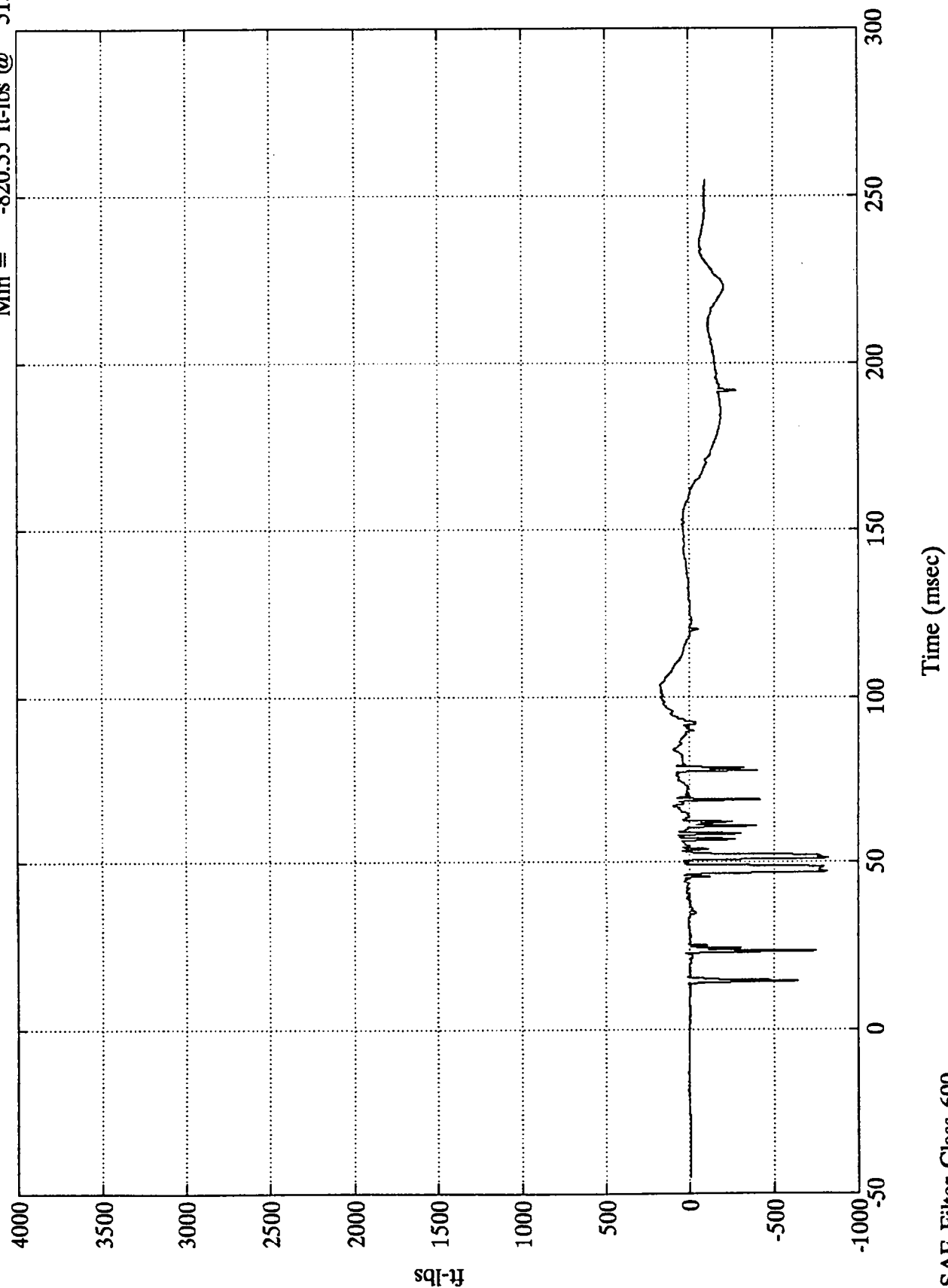
Max = 989.41 ft-lbs @ 98.87 msec
Min = -501.57 ft-lbs @ 209.88 msec



NCAP TEST #12 1991 GEO STORM

Pos. 2 Upper Neck Mz

Max = 174.40 ft-lbs @ 103.44 msec
Min = -820.55 ft-lbs @ 51.12 msec



B-119

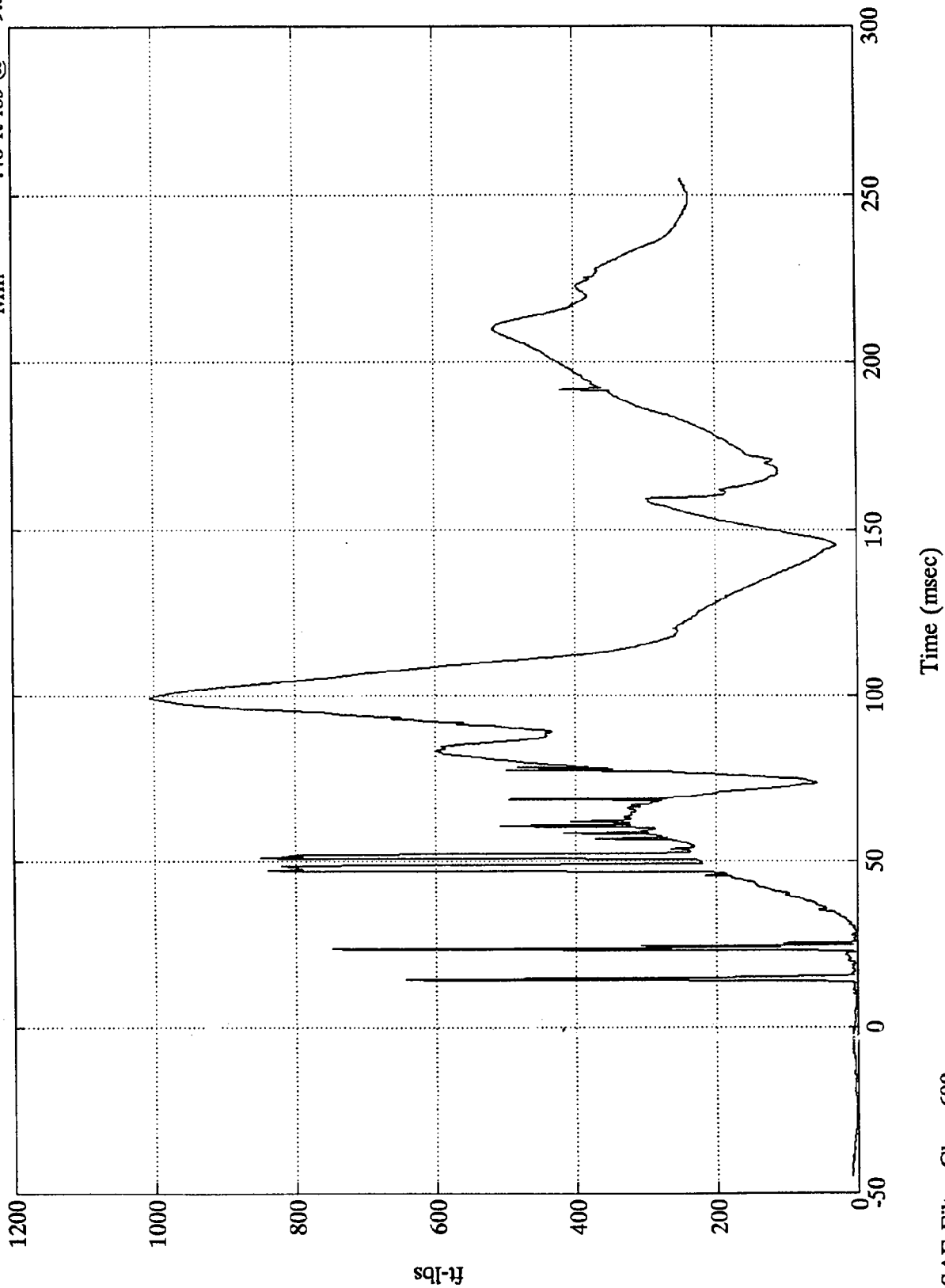
7893-8

SAE Filter Class 600

NCAP TEST #12 1991 GEO STORM

Pos. 2 Neck Moment Res.

Max = 1006.68 ft-lbs @ 98.87 msec
Min = .46 ft-lbs @ 9.35 msec



ft-lbs
B-120

7893-8

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	3-20-91
150	3-25-91

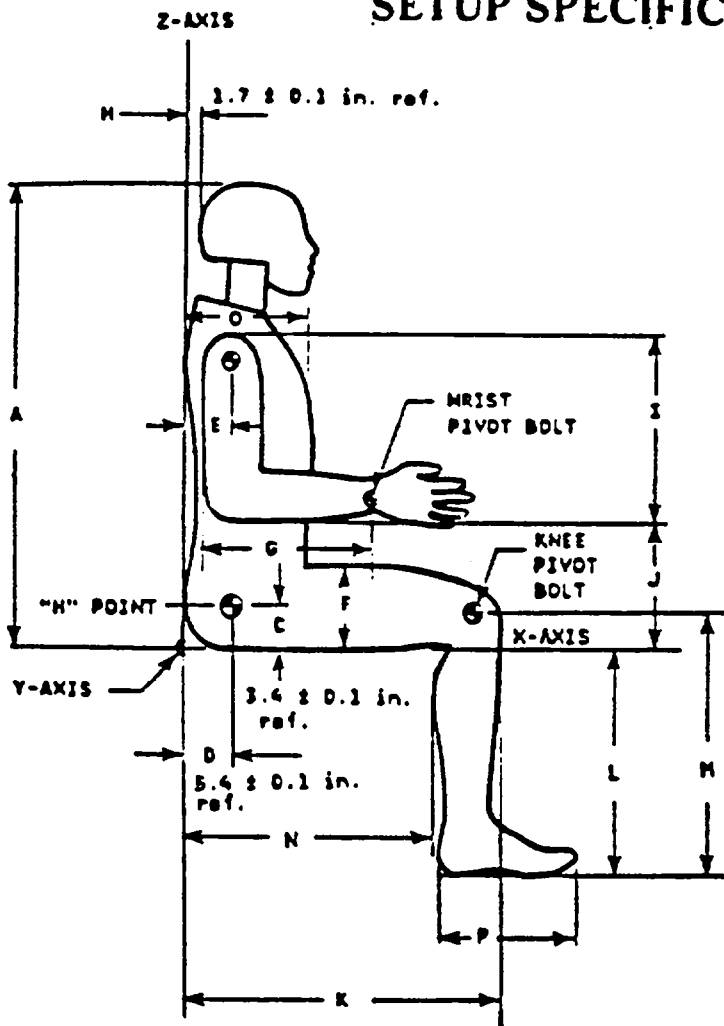
Electronic Test Equipment

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

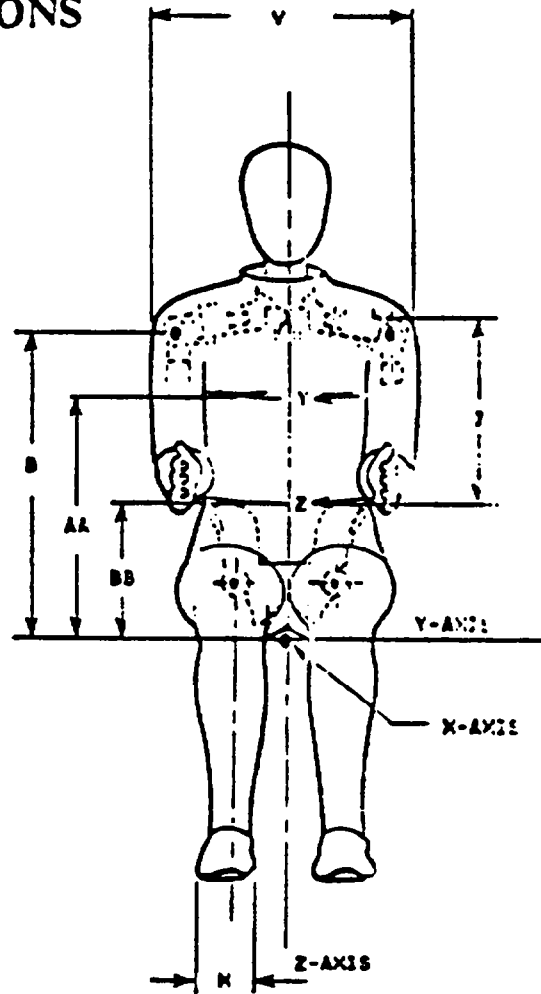
Figure 10

DUMMY CONFIGURATION DIMENSIONS

EXTERNAL DIMENSIONS
SETUP SPECIFICATIONS



SIDE VIEW



FRONT VIEW

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

HYBRID III EXTERNAL DIMENSIONS
S/N 45 HUMANOID

DUMMY SERIAL NO. 45

DATE: 3-18-91

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 CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 3-18-91

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 45 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY		10% - 70%	35 %
IMPACT VELOCITY		19.50 - 20.30 FPS	19.6 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	17.48 G
	20 MS	14.00 - 19.00 G	16.98 G
	30 MS	11.00 - 16.00 G	15.67 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	15.67 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	45.88 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	97.7 DEG.
	TIME	72 - 82 MS	77.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-59.0/-39.0 FT.-LBS.	-57.91 FT.-LBS.
	TIME	65 - 79 MS	73.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	154.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	136.63 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 3-18-91

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 45 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY		10% - 70%	35 %
IMPACT VELOCITY		22.6 - 23.4 FPS	22.7 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.34 G
	20 MS	17.60 - 22.60 G	21.16 G
	30 MS	12.50 - 18.50 G	17.49 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	17.49 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	41.13 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	77.41 DEG.
	TIME	57 - 64 MS	60.50 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT.-LBS.	79.72 FT.-LBS.
	TIME	47 - 58 MS	55.88 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	118.0 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	103.63 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 3-19-91

CALSPAN SEQUENTIAL NUMBER 3 HY3 SN 45 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	TEST RESULTS
	SPECIFICATION	
TEMPERATURE	69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY	10% - 70%	33 %
PENDULUM VELOCITY	21.6 - 22.4 FT/SEC	21.6 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 INCHES	2.69 INCHES
MAXIMUM RESISTIVE FORCE	1080 - 1245 POUNDS	1238 POUNDS
INTERNAL HYSTERESIS	69% - 85%	71.5 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 3-20-91

KNEE : LEFT

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 45

KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	33 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.0 FT/SEC
PEAK KNEE IMPACT FORCE	996 - 1566 LBS.	1061 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____IVAN MINKEWICZ_____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 3-20-91

KNEE : RIGHT

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 45 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	33 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	7.0 FT/SEC
PEAK KNEE IMPACT FORCE	996 - 1566 LBS.	1075 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____IVAN MINKEWICZ_____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
HEAD DROP TEST
HYBRID III

DATE : 3-18-91

CALSPAN SEQUENTIAL NUMBER 3

HY3 SN 45

HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	34 %
PEAK RESULTANT ACCELERATION	225 - 275 G	257 G
PEAK LATERAL ACCELERATION	15 G MAX	5.4 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

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	4-91	10-91
RIGHT SIDE	GSE	312	4-91	10-91
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: 3-18-91

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	38.8 IN
WAIST CIRCUMFERENCE (Z)	32.1-34.1 IN	32.7 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	1.7 IN
TOTAL SITTING HEIGHT (A)	34.6-35.0 IN	34.9 IN
THIGH CLEARANCE (F)	5.5-6.1 IN	5.8 IN
BUTTOCK KNEE LENGTH (K)	22.8-23.8 IN	23.4 IN
BUTTOCK POPLITAL LENGTH (N)	17.8-18.8 IN	18.4 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	4.0 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	20.3 IN
ELBOW REST HEIGHT (J)	7.5-8.3 IN	8.0 IN
SHOULDER-ELBOW LENGTH (I)	13.0-13.6 IN	13.6 IN
BACK OF ELBOW TO WRIST PIVOT (G)	11.4-12.0 IN	11.9 IN

DUMMY MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 3-20-91

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 4

HY3 SN 150 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY		10% - 70%	32 %
IMPACT VELOCITY		19.50 - 20.30 FPS	19.9 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	18.61 G
	20 MS	14.00 - 19.00 G	17.63 G
	30 MS	11.00 - 16.00 G	14.41 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	14.41 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	43.25 MS
D PLANE	MAX	81 - 106 DEG.	94.06 DEG.
ROTATION	TIME	72 - 82 MS	73.5 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-59.0/-39.0 FT.-LBS.	-50.0 FT.-LBS.
	TIME	65 - 79 MS	67.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	151.63 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	126.88 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 3-20-91

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 4

HY3 SN 150 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70 DEG. F
RELATIVE HUMIDITY		10% - 70%	32 %
IMPACT VELOCITY		22.6 - 23.4 FPS	22.9 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.46 G
	20 MS	17.60 - 22.60 G	22.3 G
	30 MS	12.50 - 18.50 G	18.41 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	18.41 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	40.0 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	76.52 DEG.
	TIME	57 - 64 MS	59.38 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT.-LBS.	72.24 FT.-LBS.
	TIME	47 - 58 MS	53.38 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	119 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	99.25 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 3-25-91

CALSPAN SEQUENTIAL NUMBER 4

HY3 SN 150 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	TEST RESULTS
	SPECIFICATION	
TEMPERATURE	69 - 72 DEG. F	70 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	2.51 INCHES
MAXIMUM RESISTIVE FORCE	1080 - 1245 POUNDS	1243 POUNDS
INTERNAL HYSTERESIS	69% - 85%	70.6 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN ____IVAN MINKEWICZ____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 3-20-91

KNEE : LEFT

CALSPAN SEQUENTIAL NUMBER 4

HY3 SN 150 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	70 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.	1068 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____IVAN MINKEWICZ_____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 3-20-91

KNEE : RIGHT

CALSPAN SEQUENTIAL NUMBER 4

HY3 SN 150 KNEE 11LB. CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	70 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.	1095 LBS.
PROBE WEIGHT	11 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN _____IVAN MINKEWICZ_____

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
HEAD DROP TEST
HYBRID III

DATE : 3-18-91

CALSPAN SEQUENTIAL NUMBER 4

HY3 SN 150 HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	68 - 78 DEG. F	69 DEG. F
RELATIVE HUMIDITY	10% - 70%	34 %
PEAK RESULTANT ACCELERATION	225 - 275 G	274.4 G
PEAK LATERAL ACCELERATION	15 G MAX	12.1 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

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	4-91	10-91
HY LATERAL--	ENDEVCO	GD54	4-91	10-91
HZ VERTICAL--	ENDEVCO	CK11	4-91	10-91
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A145	4-91	10-91
CY LATERAL--	ENDEVCO	FL04	4-91	10-91
CZ VERTICAL--	CEC	A149	4-91	10-91
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	548	4-91	10-91
RIGHT SIDE	GSE	549	4-91	10-91
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	3-91	9-91
	CE76	ENDEVCO	10-90	4-91
Chest X Y Z	A147	CEC	10-90	4-91
	CJ54	ENDEVCO	10-90	4-91
	A148	CEC	10-90	4-91
Right Femur Load Cell	312	GSE	3-91	9-91
Left Femur Load Cell	311	GSE	3-91	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	3-91	9-91
Shoulder Belt Load Cells	127	LEBOW	3-91	9-91
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
	FLO4	ENDEVCO	10-90	4-91
	A149	CEC	10-90	4-91
Right Femur Load Cell	549	GSE	3-91	9-91
Left Femur Load Cell	548	GSE	3-91	9-91
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	3-91	9-91
Shoulder Belt Load Cells	135	LEBOW	3-91	9-91
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	A70	CEC	10-90	4-91
Right Rear Seat Crossmember	A177	CEC	12-90	6-91
Top of Engine	A83	CEC	3-91	9-91
Bottom of Engine	A154	CEC	1-91	7-91
Left Disc Brake Caliper	A157	CEC	3-91	9-91
Right Disc Brake Caliper	A29	CEC	1-91	7-91
Instrument Panel	A179	CEC	12-90	6-91
Center Rear Crossmember Z	A156	CEC	3-91	9-91
Vehicle Rear Z	A155	CEC	3-91	9-91

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	1-91	7-91
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.	1-91	7-91

Appendix E

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

Seats & Safety Belts

■ *Safety Belts: They're For Everyone*

This part of the manual tells you how to use safety belts properly. It also tells you some things you should not do with safety belts. And it explains the Supplemental Inflatable Restraint (SIR).

CAUTION

⚠ If you are in a crash and you're not wearing a safety belt, your injuries can 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 are buckled up.



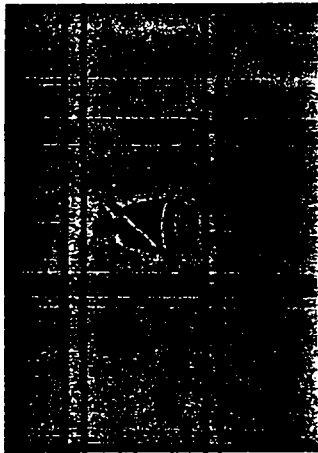
This figure lights up when you turn the key to **ON** or **START** when your safety belt isn't buckled, and you'll hear a buzzer, too. It's the reminder to buckle up. In many states and Canadian provinces, the law says to wear safety belts. Here's why: **They work.**



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.

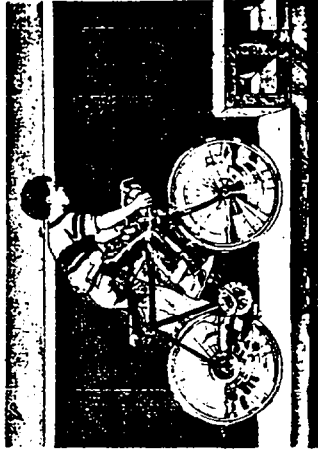
A few crashes are very mild. In them, you won't get hurt even if you're not buckled up. And some crashes can be so serious, like being hit by a train, that even buckled up a person wouldn't survive. But most crashes are in between. In many of them, people who buckle up can survive and sometimes walk 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!



Safety Belt Reminder Light

When the key is turned to **ON** 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 buzzer will also sound.

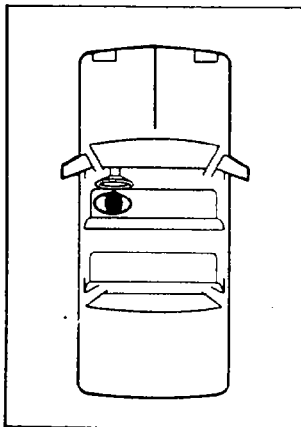


Why Safety Belts Work

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

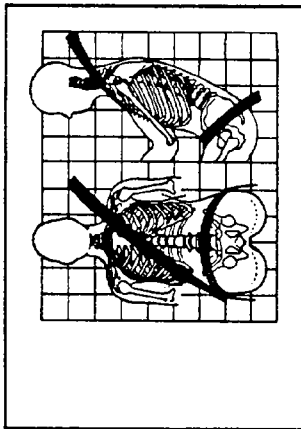
For example, if the bike is going 10 mph (16 km/h), so is the child.

Seats & Safety Belts



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 (to see how, see the Index under "Seats") so you can sit up straight.
3. Pick up the latch plate and pull the belt across you. Don't let it get twisted.

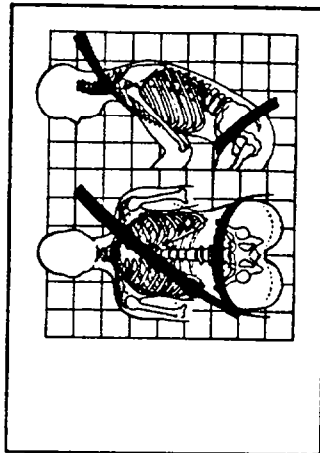


- 4. Push the latch plate into the buckle until it clicks. If the belt stops before it reaches the buckle, tilt the latch plate and keep pulling until you can buckle the belt.**

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.



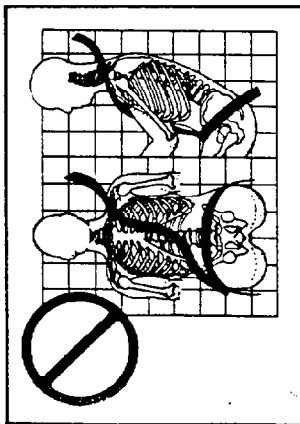
- 5. Pull up on the shoulder belt to tighten the lap belt.**
If the belt isn't long enough, see "Safety Belt Extender" at the end of this section.



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 only if there's a sudden stop or crash, or if you pull the belt very quickly out of the retractor.

Seats & Safety Belts

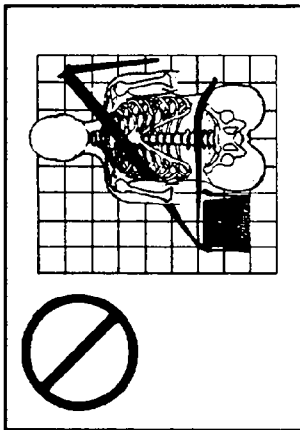


Q: What's wrong with this?

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.

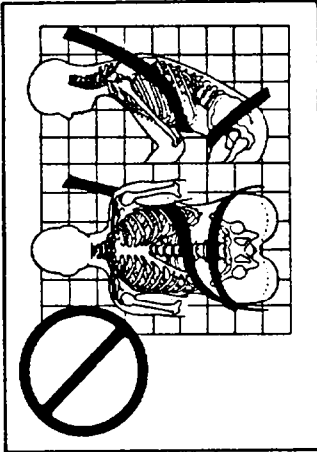
CAUTION

 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.



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.



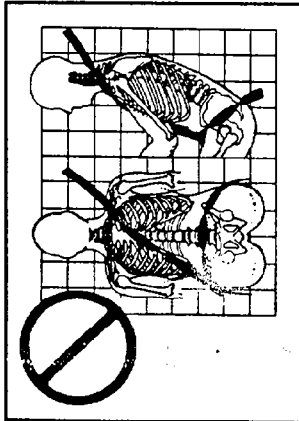
Q: What's wrong with this?

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.

Seats & Safety Belts

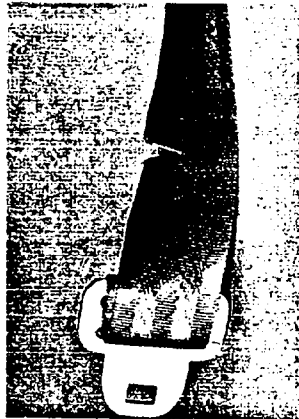


Q: What's wrong with this?

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.



Q: What's wrong with this?

A: The belt is torn.

CAUTION

 Torn or frayed belts may not protect you in a crash. They can rip apart under impact forces. If a belt is torn or frayed, get a new one right away.

Supplemental Inflatable Restraint (SIR)

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. For protection in frontal and all other collisions, everyone in the vehicle should be properly restrained.

Supplemental Inflatable Restraint Light

There is an inflatable restraint light on the instrument panel. The system checks itself and the light tells you if there is a problem.

You will see this light flash for a few seconds when you turn your ignition to ON or START. Then the light should go out, which means the system is ready.

CAUTION

⚠ Have your vehicle serviced right away if the inflatable restraint light doesn't come on, or stays on, or comes on when you are driving. If you don't, your inflatable restraint system may not work properly.

Seats & Safety Belts

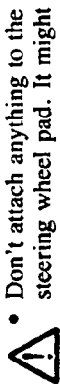


How the SIR Works

The "air bag" part of the SIR is in the middle of the steering wheel.

The SIR is for crashes where the front area of your vehicle hits something. If the collision is hard enough, the bag inflates in a fraction of a second. It helps restrain the driver, and then it quickly deflates. Some grey "smoke" is normal when this happens. The SIR can give extra protection for the driver's upper body.

CAUTION



- Don't attach anything to the steering wheel pad. It might injure the driver if the SIR inflates.

- The SIR is designed to inflate only once. After it inflates, if you don't get a new system, the SIR won't be there to help protect you in another crash. A new system will include an inflator module, crash sensors, and possibly other parts, such as a new steering wheel and steering column.

- Let only qualified technicians work on your SIR. Improper service can mean that your SIR won't work properly. See your dealer for service.

Servicing Your Geo with the SIR System

Please tell or remind anyone who works on your Geo that it has the SIR. There are parts of the SIR system in several places around your vehicle. You don't want the system to inflate while someone is doing other work on your car. The SIR system doesn't need regular maintenance. Your Geo dealer and the 1991 Storm Service Manual are good sources of advice about the SIR system, including repair or disposal.

CAUTION

 You can be injured if you are close to an "air bag" when it inflates. During improper service the "air bag" can inflate for up to 10 minutes even if the ignition key is turned off and the battery is disconnected.

When electrical work is done under the hood or inside the car, the ignition should be in **LOCK** if possible.

Avoid yellow tape around wires, or orange connectors. They are probably part of the SIR system.

But if the ignition has to be on for electrical work, or if the steering

column is to be disassembled, the SIR system should be disconnected. To do this:

- Remove the SIR fuse (see the Index under "Fuses").
- Disconnect the orange connector at the base of the steering column.

When the work is done, if the SIR system was disconnected, be sure to reattach everything and replace the fuse before turning the ignition on. When you turn the ignition key on, be sure you see the inflatable restraint light on the instrument panel. If you don't see this light go on and then off as usual, have your SIR repaired.



Safety Belt Use During Pregnancy

Safety belts work for everyone, including pregnant women. Like all occupants, they are more likely to be seriously injured if they don't wear safety belts. A pregnant woman should wear a lap-shoulder belt if at all possible. The lap portion should be worn as low as possible throughout the pregnancy.

The best way to protect the fetus is to protect the mother. When a safety belt is worn properly, it's more likely that the fetus won't be hurt in a crash. For pregnant women, as for anyone, the key to making safety belts effective is wearing them properly.