

REPORT NUMBER: CAL-91-N06

NEW CAR ASSESSMENT PROGRAM (NCAP)
FRONTAL BARRIER IMPACT TEST

TOYOTA MOTOR CORPORATION
1991 TOYOTA COROLLA
4-DOOR SEDAN

NHTSA NUMBER: MM5101

CALSPAN TEST NUMBER: 7893-2

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

February 19, 1991



FINAL REPORT

PREPARED FOR:

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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:

HT B. Ford
Manager, New Car Assessment Program (NCAP)

AUG 01 1991

Date of Report Acceptance

Han Sun Chan
Contracting Officer's Tech. Rep. (COTR)

AUG 01 1991

Date of Report Acceptance

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16. Abstract A frontal load cell barrier test of a 1991 Toyota Corolla 4-Door Sedan was performed at Calspan Advanced Technology Center crash test facility in Buffalo, New York on February 19, 1991. The impact speed was 35.0 mph and the ambient temperature at the barrier face at the time of impact was 51°F. The maximum post-test vehicle crush was 21.1 inches. The test vehicle was equipped with an automatic torso belt and manual lap belt at each of the front seating positions. With regard to FMVSS 208 "Occupant Crash Protection," injury criteria, the driver dummy appeared to exceed the maximum head injury criteria.					
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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 B 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	3-3
2	Occupant Clearance Dimensions	3-4
3	Seat Belt Positioning Data	3-5
4	Driver Dummy to Steering Column/Wheel Dimensions	3-7
5	Camera Positions for Frontal Impacts	3-8
6	Vehicle Target Locations	3-10
7	Load Cell Locations on Fixed Barrier	3-11
8	Vehicle Accelerometer Locations	3-12
9	Test Vehicle Measurements	3-13

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	Seat Belt Performance Assessment Test Data	3-6
4	High Speed Camera Locations	3-9
5	Vehicle Measurements	3-14

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 MM5101

A load cell barrier consisting of 36 load cells was impacted by a 1991 Toyota Corolla 4-Door Sedan at a velocity of 35.0 mph. The test was performed at the Calspan Corporation Advanced Technology center on February 19, 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 B, 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. 320) and the right-front passenger ATD (Serial No. 749) were used in a previous test (MM5300). The Injury Criteria Values were not exceeded during that test. Certification details, along with instrumentation calibration data, can be found in Appendices C and D.

The 67 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. Three accelerometers did not record accurately: Accelerometer #1(x), located on the left rear seat crossmember; Accelerometer #3(x), located on the top of engine block; Accelerometer #4(x), located on the bottom of engine block. the velocity and displacement integrations are not available for these channels. Data for barrier load cell D9 did not record accurately. Data for this channel was not used in the calculation of the load cell sum. Position #2 chest Z data is unavailable after 9.0 msec; the sensor may have sustained a cut wire.

The driver's HIC was 1238.0 The maximum chest deceleration over 3 milliseconds was 54.0 g's and femur loads were 1375.3 and 917.2 pounds.

The right front passenger's HIC was 612.8. The maximum chest deceleration over 3 milliseconds was not calculated due to the chest z data. Femur loads were 1341.5 pounds and 1469.0 pounds.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1991 Toyota Corolla 4-Door SedanNHTSA No.: MM5101 VIN.: 1NXAE94A4MZ164780Body Color: White Date Of Manufacture: August 1990Engine: 4 Cylinders; - C.I.D.; 1.6 Liters; - CCX Gas; - Diesel; - TurbochargedX Longitudinal; - TransverseTransmission: - Speed; - Manual; X Automatic; - OverdriveFinal Drive: X Front Wheel; - Rear Wheel; - Four WheelDate Received: 1-25-91 Odometer Reading: 49.6 milesX A/C; X P/S; X P/B; - P/wdo.; - Tilt Wheel- P/seats; - Cruise ControlType of Occupant Restraint: Automatic torso belt and manual lap belt.DATA RECORDED FROM VEHICLE'S TIRE PLACARD:Tire Pressure (at capacity): Front 28 psi, Rear 28 psiRecommended Tire Size: P175/70R13Recommended Cold Tire Pressure: Front 28 psi, Rear 28 psiTires on Vehicle: P175/70R13; Manufacturer: Goodyear InvictaNumber of Occupants: 2 Front; 3 Rear; - 3rd Seat; 5 TOTALType of Front Seats: X Bucket; - Bench; - Split BenchType of Front Seat Back: - Fixed X Adj. With X Lever - Rot. KnobVehicle Capacity Weight (VCW) = 850 lbs. (A)No. of Occupants x 150 lbs. = 750 lbs. (B)

Rated Cargo and Luggage

Weight (RCLW) A-B = 100 lbs.GVWR 3415 lbs. GAWR: Front 1770 lbs. Rear 1690 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 = 450 lbs.
 Left Front = 765 lbs. Left Rear = 470 lbs.
 TOTAL FRONT WEIGHT = 1485 lbs. (62.0 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 920 lbs. (38.0 % of Total Vehicle Weight)
 TOTAL DELIVERY WEIGHT = 2405 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight (2405 lbs.)
 VCW = Vehicle Capacity Weight (850 lbs.)
 DSC = Designated Seating Capacity (5)
 RCLW = VCW - 150 (DSC) = 100 lbs.
 Target Test Weight = UDW + RCLW + (2 dummies x 164 lbs./dummy)
 Target Test Weight = 2839 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 97 POUNDS CARGO:

Right Front = 810 lbs. Right Rear = 600 lbs.
 Left Front = 810 lbs. Left Rear = 610 lbs.
 TOTAL FRONT WEIGHT = 1620 lbs. (57.0 % of Total Vehicle Weight)
 TOTAL REAR WEIGHT = 1210 lbs. (43.0 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 2830 lbs.
 Weight of ballast secured in vehicle trunk area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

Delivered Attitude: RF 25.3 LF 25.3 RR 24.7 LR 24.5
 Test Attitude: RF 24.7 LF 25.0 RR 23.2 LR 23.2
 Wheel Base: 96.7 in.; C.G. = 41.4 in. rearward of front wheel C/L
 Remarks: 12.0 gallons of stoddard solution was placed in the fuel tank.

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: Frontal Barrier Impact Angle: 0°
 Date of Test: 2-19-91 Time of Test: 12:45
 Ambient Temperature: 51 °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 165.9 C 170.3 L 166.6
 Post-test = R 147.1 C 149.2 L 148.5
 Crush = R 18.8 C 21.1 L 18.1

Distance from front of test vehicle to point of impact:

R 20.7 C 19.7 L 21.1

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Upper Steering Wheel Rim and Steering Hub</u>	<u>Top of Head Grazed Sun Visor</u>
Chest	<u>No Contact</u>	<u>No Contact</u>
Abdomen	<u>Lower Steering Wheel Rim</u>	<u>No Contact</u>
Left Knee	<u>Dash Panel</u>	<u>Glove Box Door</u>
Right Knee	<u>Dash Panel</u>	<u>Glove Box Door</u>

Table 1

GENERAL TEST AND VEHICLE PARAMETER DATA (cont'd)

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
	<u>Operable</u>	<u>Operable</u>	<u>Operable</u>	<u>Operable</u>
Door Opening				

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
	<u>Seat Movement</u>			
Seat Back Failure	<u>None</u>	<u>None</u>	<u>-</u>	<u>-</u>
Seat Shift (in.)	<u>0.0</u>	<u>0.0</u>	<u>-</u>	<u>-</u>

Glazing Damage

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

Other Notable Impact Effects: None

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.: MM5101 Vehicle: 1991 Toyota Corolla 4-Door Sedan

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-125.2	-19.2	130.7	180.1
Position #2 - Passenger	-16.8	16.2	60.1	60.9

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-53.4	-9.5	10.5	54.0
Position #2 - Passenger	-49.6	-26.4	*	*

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	1375.3	917.2
Position #2 - Passenger	1341.5	1469.0

	MAXIMUM FORCE - SEAT BELT LOADS (lbs.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	2474.5	-	302.2
Position #2 - Passenger	2825.0	701.2	-

	HEAD INJURY CRITERIA (HIC)			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
Position #1 - Driver	1238.0	.06312	.09840	65.8
Position #2 - Passenger	612.8	.05628	.09216	49.3

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

*Chest Z acceleration data unavailable after 9.0 msec.

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION

Test No.: MM5101 Vehicle: 1991 Toyota Corolla 4-Door Sedan

SEAT TYPE:

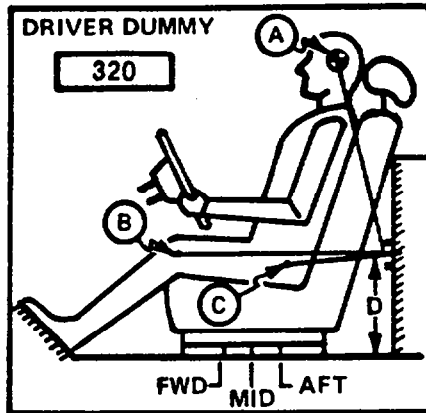
- Bench
X Bucket
- Split Bench

ADJUSTER TYPE:

X Manual
- Power

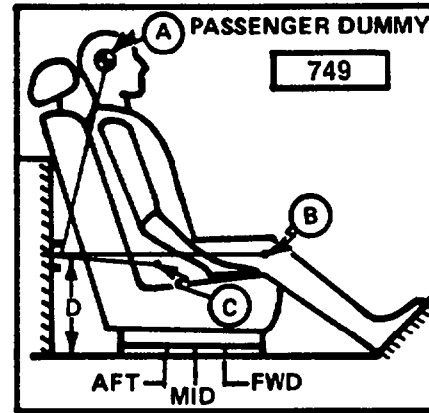
BUCKET SEAT BACK TYPE:

- Fixed
X Adjustable Reclining



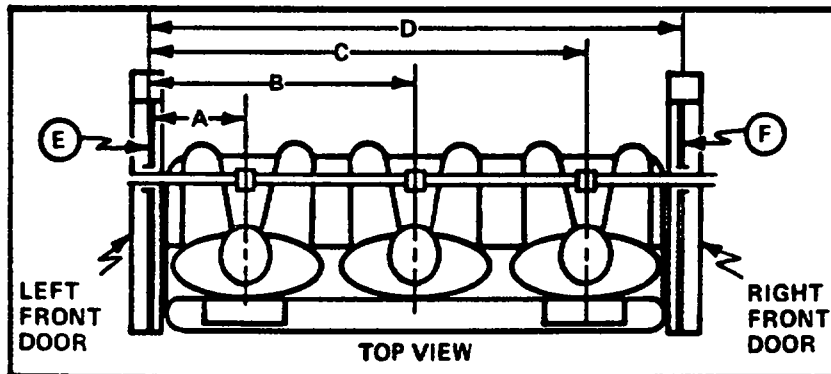
MEASUREMENT LOCATION

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



A = 21.3 in. 5 Degrees
 B = 21.6 in. 99 Degrees
 C = 9.0 in. 130 Degrees
 D = 14.0 in.

A = 21.2 in. 4 Degrees
 B = 21.1 in. 100 Degrees
 C = 8.7 in. 130 Degrees
 D = 14.0 in.



S/N 320

DUMMY ID

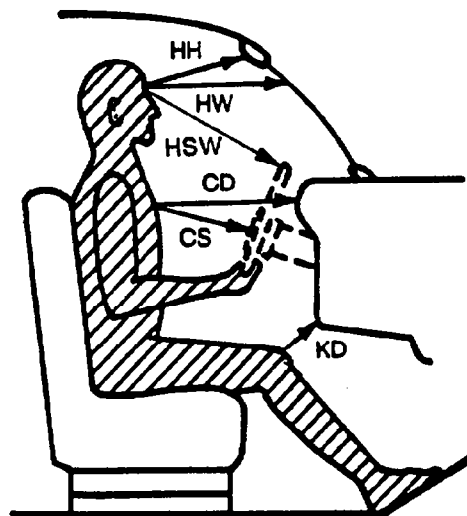
749

A = Left Door to Driver Centerline 11.4 in.
 B = Left Door to Center Passenger Centerline - in.
 C = Left Door to Right Passenger Centerline 37.7 in.
 D = Left Door to Right Door 48.9 in.
 E,F = Window Glass Height (Right and Left Must Be Equal) 11.5 in.

Figure 2

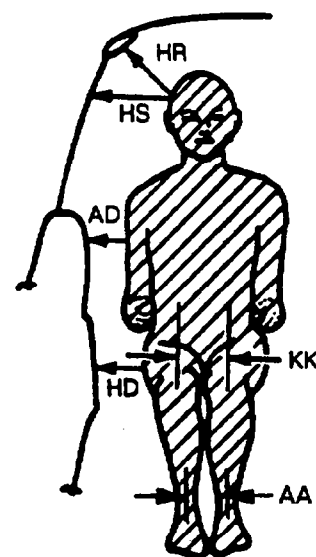
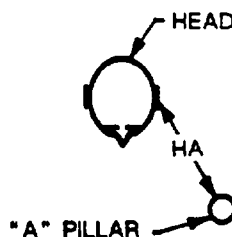
OCCUPANT CLEARANCE DIMENSIONS

	DRIVER	PASSENGER
HH	12.2	11.9
HW	17.8	17.3
CD	20.3	22.2
CS	14.1	-
KDL	5.5	5.3
KDR	4.1	5.5
SA	See Note	See Note
TA	24°	24°
HSW	20.0	-



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

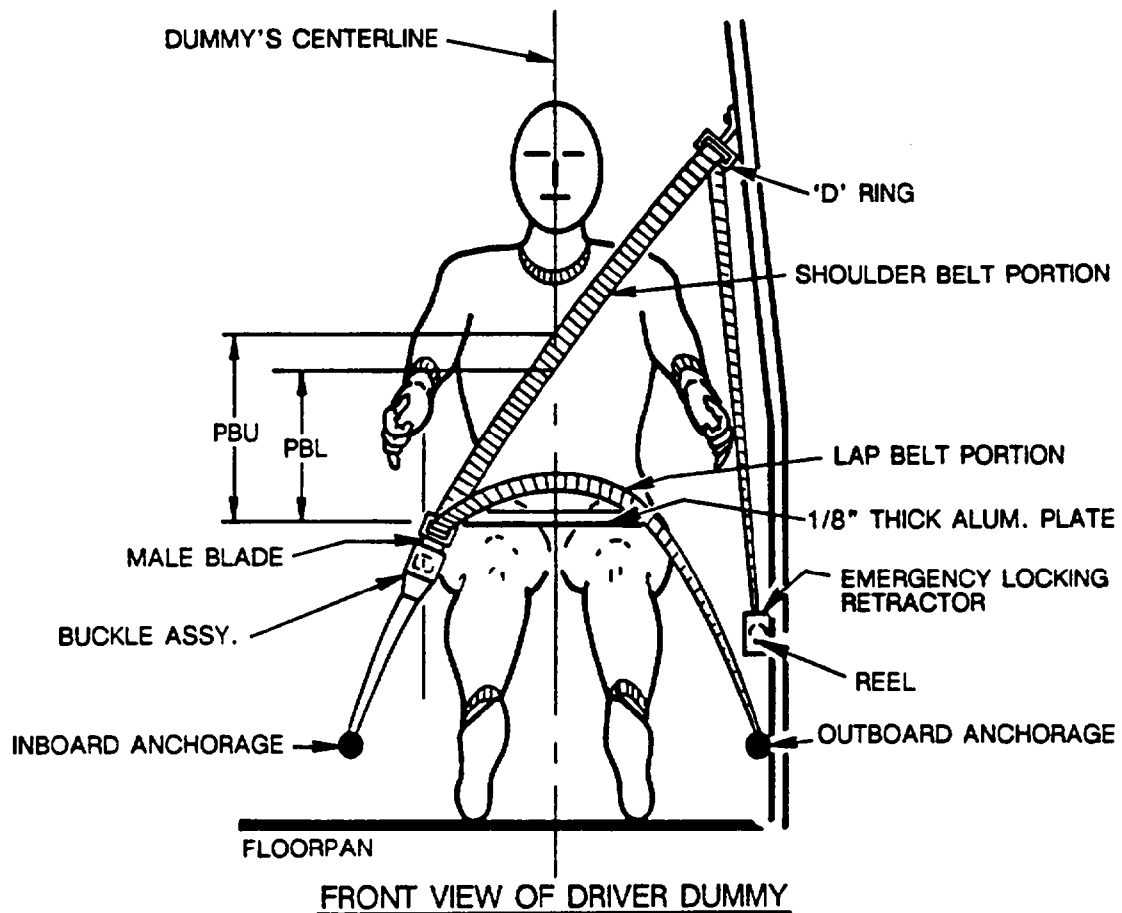
HA = Head Target to "A" Pillar
 HR = Head to Side Roof
 HS = Head to Side Window
 AD = Arm to Door
 HD = Hip to Door
 KK = Knee to Knee
 AA = Ankle to Ankle



	DRIVER	PASSENGER
HR	5.5	5.5
HS	8.2	8.2
AD	4.0	4.1
HD	6.7	7.1
KK	9.0	7.9
HA	17.6	17.5
AA	11.0	8.1

Note: Seat back was positioned as recommended by manufacturer.

Figure 3
SEAT BELT POSITIONING DATA



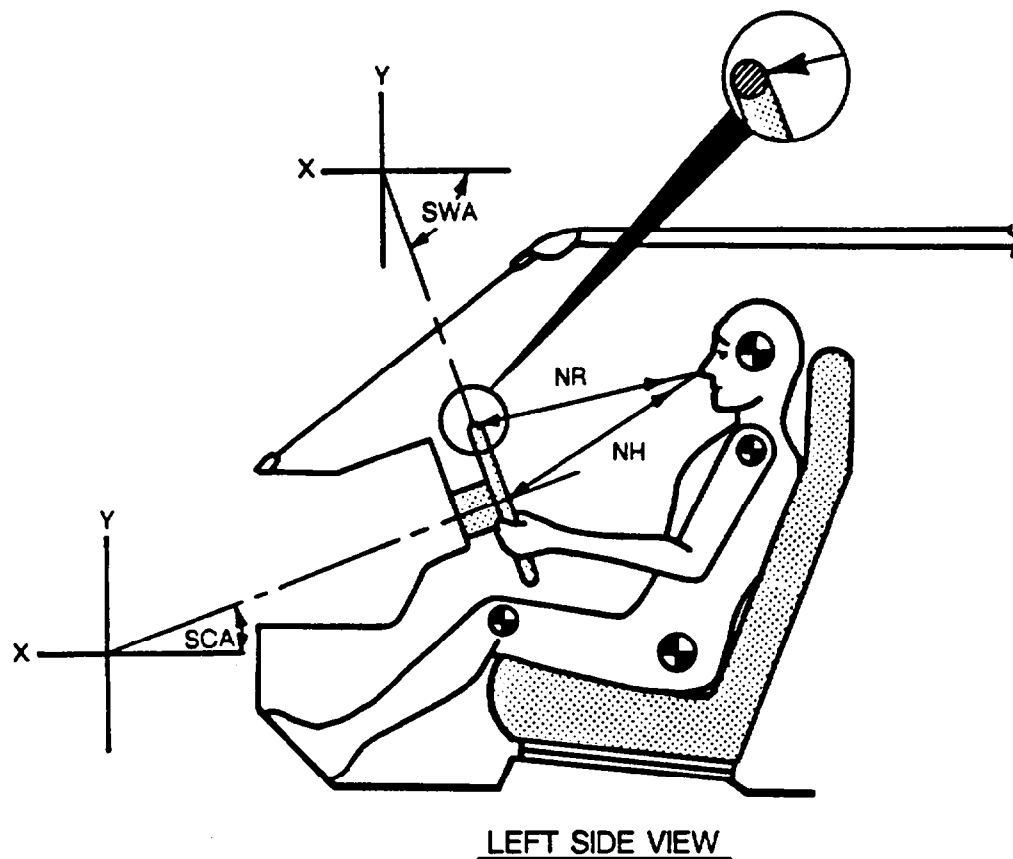
	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
<u>PBU</u> -- Top surface of alum. plate to upper edge	13.1	13.2
<u>PBL</u> -- Top surface of alum. plate to belt lower edge	10.0	10.0
<u>LAP BELT TENSION</u>	-	-
<u>SHOULDER BELT TENSION</u>	-	-

Table 3
SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

<u>BELT LENGTH DATA:</u>	<u>Driver</u>	<u>Passenger</u>
Shoulder belt length as measured on Part 572 Dummy.	<u>35.5"</u>	<u>35.5"</u>
Lap belt length as measured on Part 572 Dummy.	<u>33.0"</u>	<u>33.0"</u>
<u>BELT STRETCH DATA:</u>		
Measured mechanically	<u>2.1 in/ft</u>	<u>1.3 in/ft</u>

Figure 4

DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



		MEASUREMENTS	
<u>NR</u>	-- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim	18.1	Inches
<u>NH</u>	-- Distance from tip of dummy's nose to center of steering column hub	18.5	Inches
<u>SCA</u>	-- Angle of steering column relative to the horizontal X axis	26.0	Degrees
<u>SWA</u>	-- Angle of steering wheel relative to the horizontal X axis	-64.0	Degrees

Figure 5
CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 4

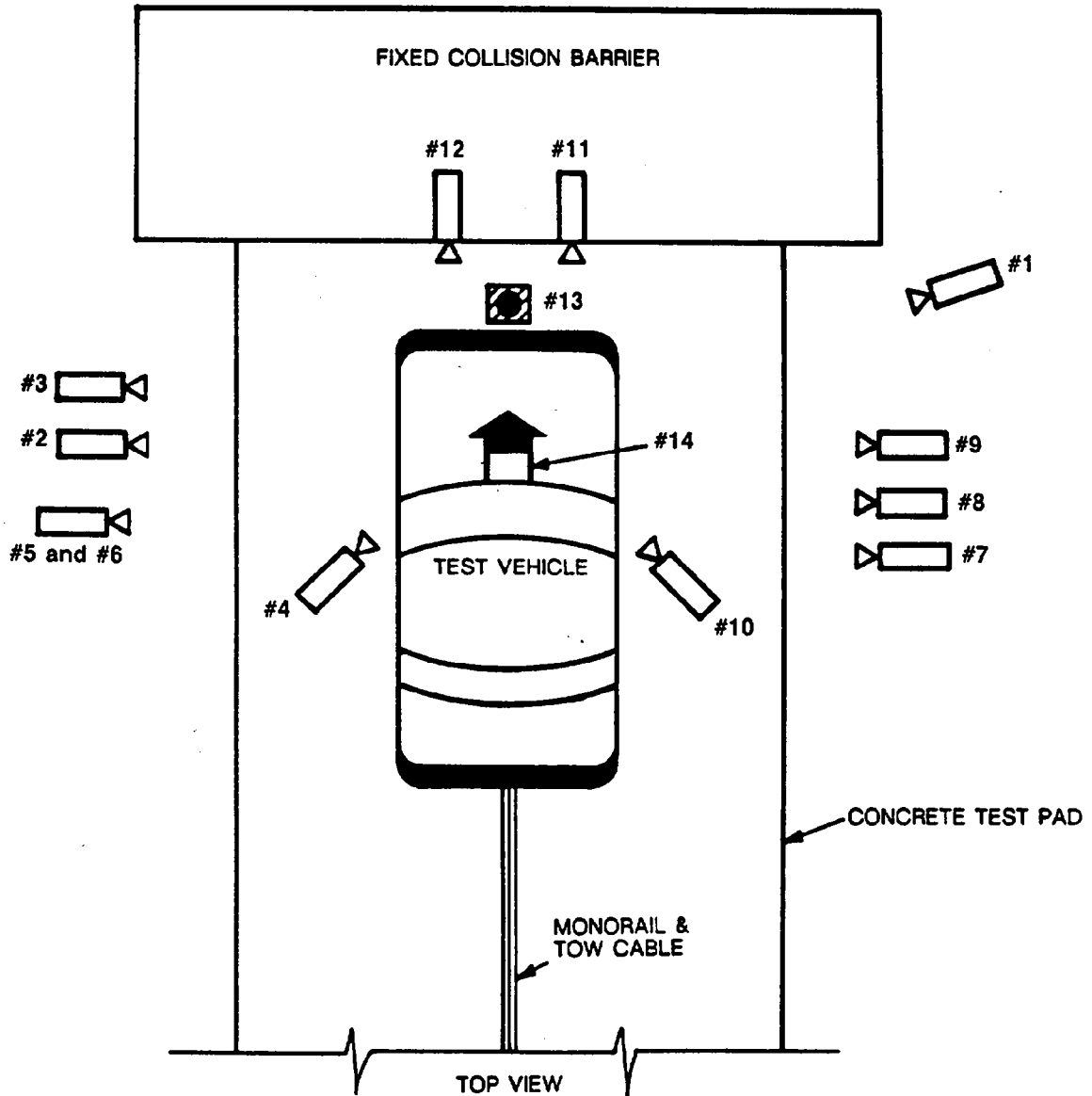


Table 4

HIGH-SPEED CAMERA LOCATIONS

Test No. MM5101 Vehicle: 1991 Toyota Corolla 4-Door Sedan

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	214	52	41	-7	198.1	13	550
3	Left Side View	283	28	41	-4	267.1	25	525
4	Driver and Interior View	97	94	68	-20	81.1	13	650
5	Steering Column (Bottom)	258	66	46	-5	242.1	25	550
6	Steering Column (Top)	258	66	70	-10	242.1	25	450
7	Overall Right Side	215	53	42	-3	199.1	13	800
8	Right Side View	283	31	41	-2	267.1	25	690
9	Right Passenger View	276	53	54	-5	260.1	35	630
10	Passenger and Interior View	101	95	66	-20	85.1	25	540
11	Passenger Front View	24	-5	72	-40	-	13	530
12	Driver Front View	24	-5	72	-40	-	13	540
13	Windshield View	0	0	125	-45	-	13	575
14	Pit View of Engine	0	34	-120	90	-	13	N/A

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

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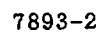
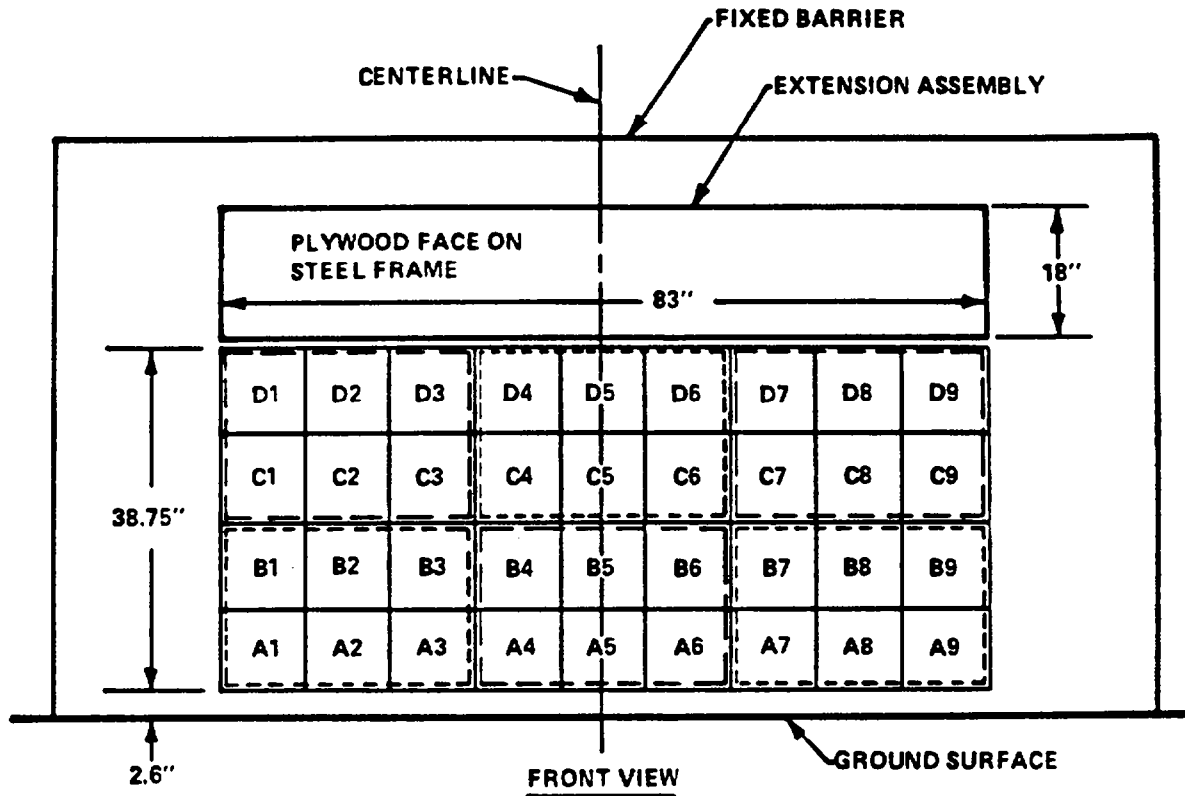


Figure 7

LOAD CELL LOCATIONS ON FIXED BARRIER

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



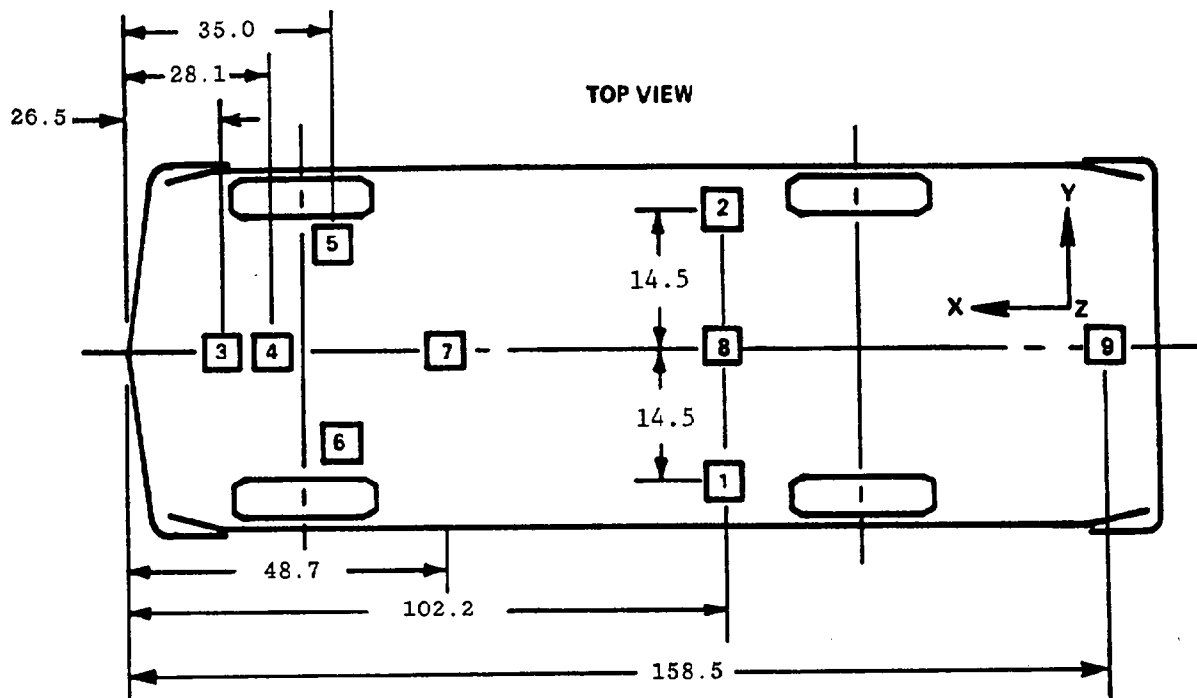
6 GROUPS OF 6 LOAD CELLS EACH

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 Disk 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.

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

Figure 9
TEST VEHICLE MEASUREMENTS

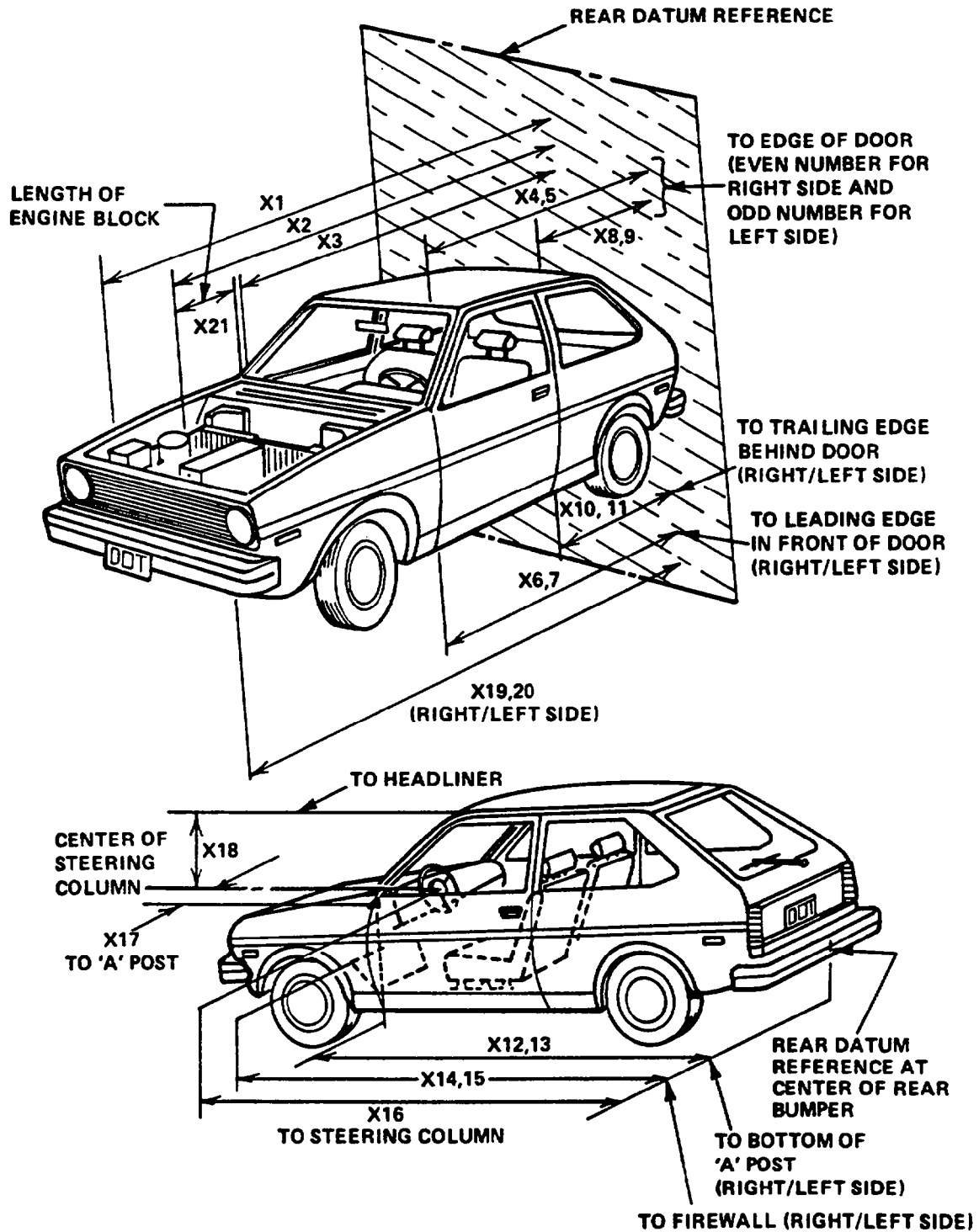


Table 5
VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	170.3	149.2	21.1
X2	Rear Surface of Vehicle to Front of Engine	147.9	136.6	11.3
X3	Rear Surface of Vehicle to Firewall	127.2	119.5	7.7
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	115.9	115.5	0.4
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	116.0	116.0	0.0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	115.0	115.2	-0.2
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	115.1	114.9	0.2
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	76.6	77.0	-0.4
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	77.0	76.6	0.4
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	76.9	77.0	-0.1
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	76.9	76.8	0.1
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	114.8	115.2	-0.4
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	115.3	114.8	0.5
X14	Rear Surface of Vehicle to Firewall, Right Side	125.6	120.7	4.9
X15	Rear Surface of Vehicle to Firewall, Left Side	125.5	122.7	2.8
X16	Rear Surface of Vehicle to Steering Column	100.0	100.0	0.0
X17	Center of Steering Column to "A" Post	15.4	15.4	0.0
X18	Center of Steering Column to Headliner	17.2	17.3	-0.1
X19	Rear Surface of Vehicle to Right Side of Front Bumper	165.9	147.1	18.8
X20	Rear Surface of Vehicle to Left Side of Front Bumper	166.6	148.5	18.1
X21	Length of Engine Block	15.0	15.0	0.0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	108.4	108.9	-0.5
CD	Rear Surface of Vehicle to Center of Dash Panel	107.4	106.9	0.5
LD	Rear Surface of Vehicle to Left Side of Dash Panel	108.3	108.4	-0.1

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 (Not Available)	A-19
A-18	PRE-TEST FRONT SIDE UNDERBODY VIEW	A-20
A-19	POST-TEST FRONT SIDE UNDERBODY VIEW	A-21
A-20	PRE-TEST REAR UNDERBODY VIEW	A-22
A-21	POST-TEST REAR UNDERBODY VIEW	A-23
A-22	PRE-TEST DRIVER POSITION VIEW	A-24
A-23	POST-TEST DRIVER POSITION VIEW	A-25
A-24	PRE-TEST PASSENGER POSITION VIEW	A-26
A-25	POST-TEST PASSENGER POSITION VIEW	A-27
A-26	PRE-TEST DRIVER AND INTERIOR VIEW	A-28
A-27	POST-TEST DRIVER AND INTERIOR VIEW	A-29
A-28	PRE-TEST PASSENGER AND INTERIOR VIEW	A-30
A-29	POST-TEST PASSENGER AND INTERIOR VIEW	A-31
A-30	IMPACT VIEW	A-34

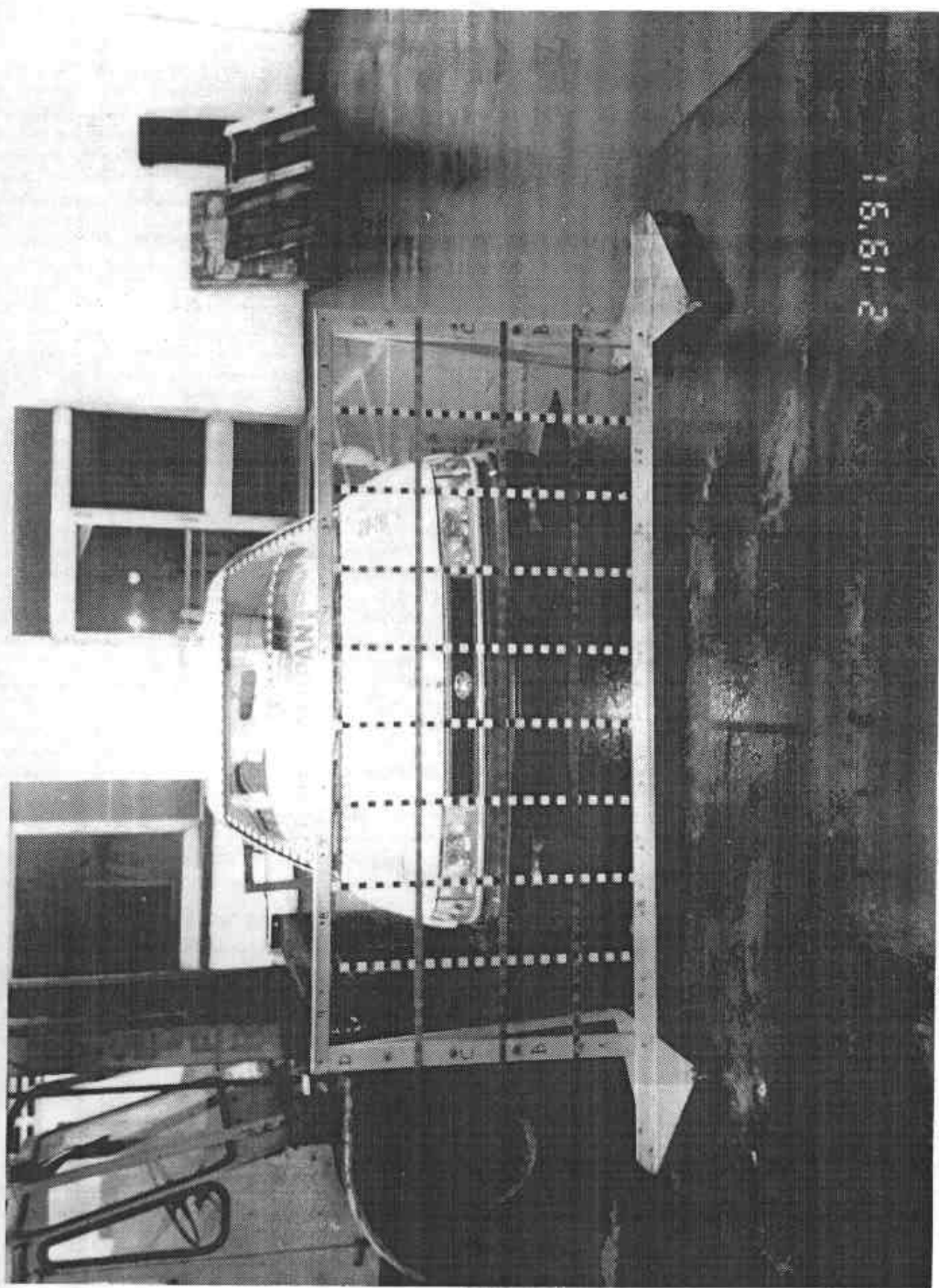


Figure A-1 LOAD CELL LOCATIONS

16,612

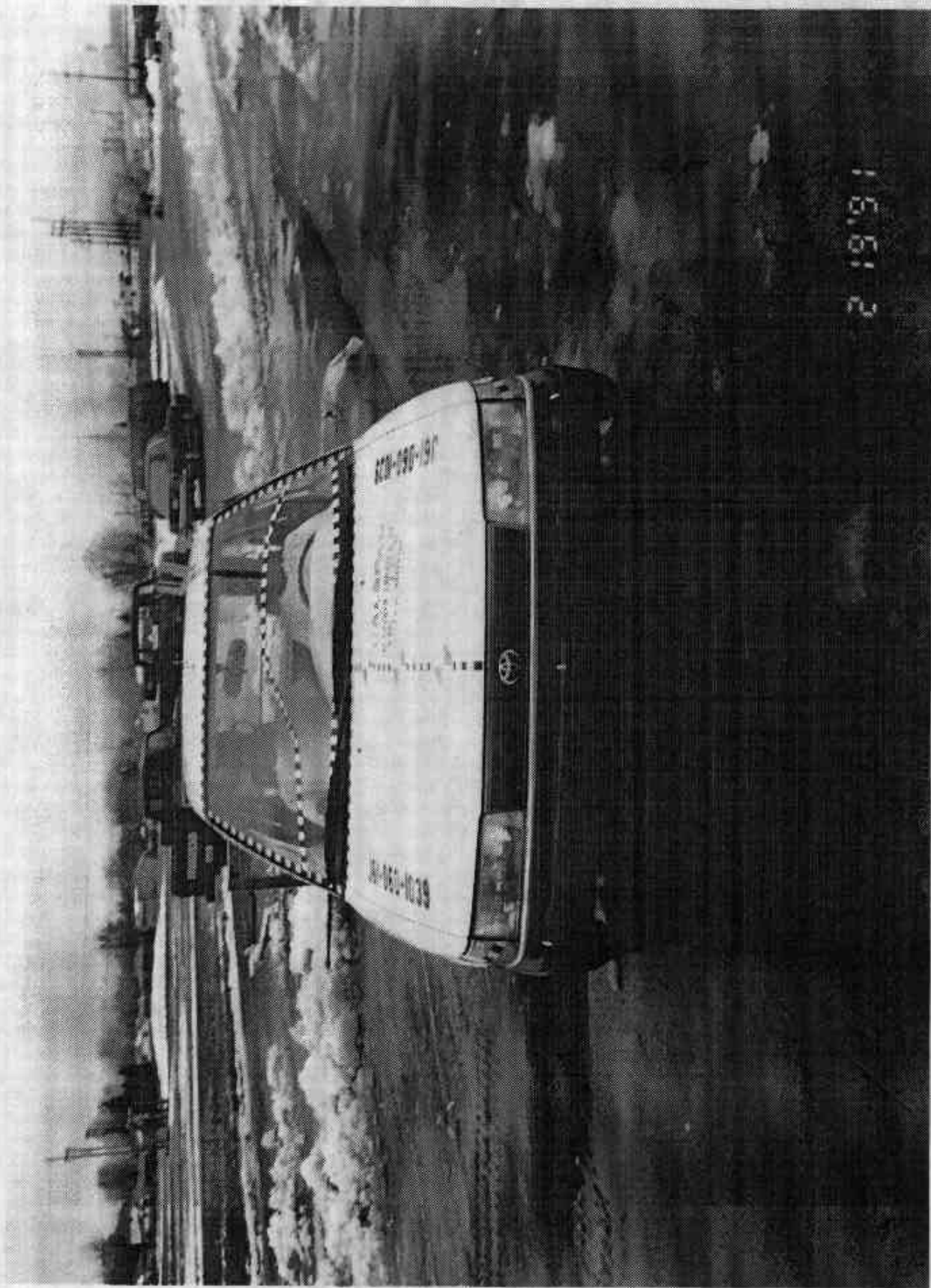


Figure A-2 PRE-TEST FRONT VIEW



Figure A-3 POST TEST FRONT VIEW



Figure A-4 PRE-TEST LEFT SIDE VIEW

A-6

7893-2



Figure A-5 POST TEST LEFT SIDE VIEW

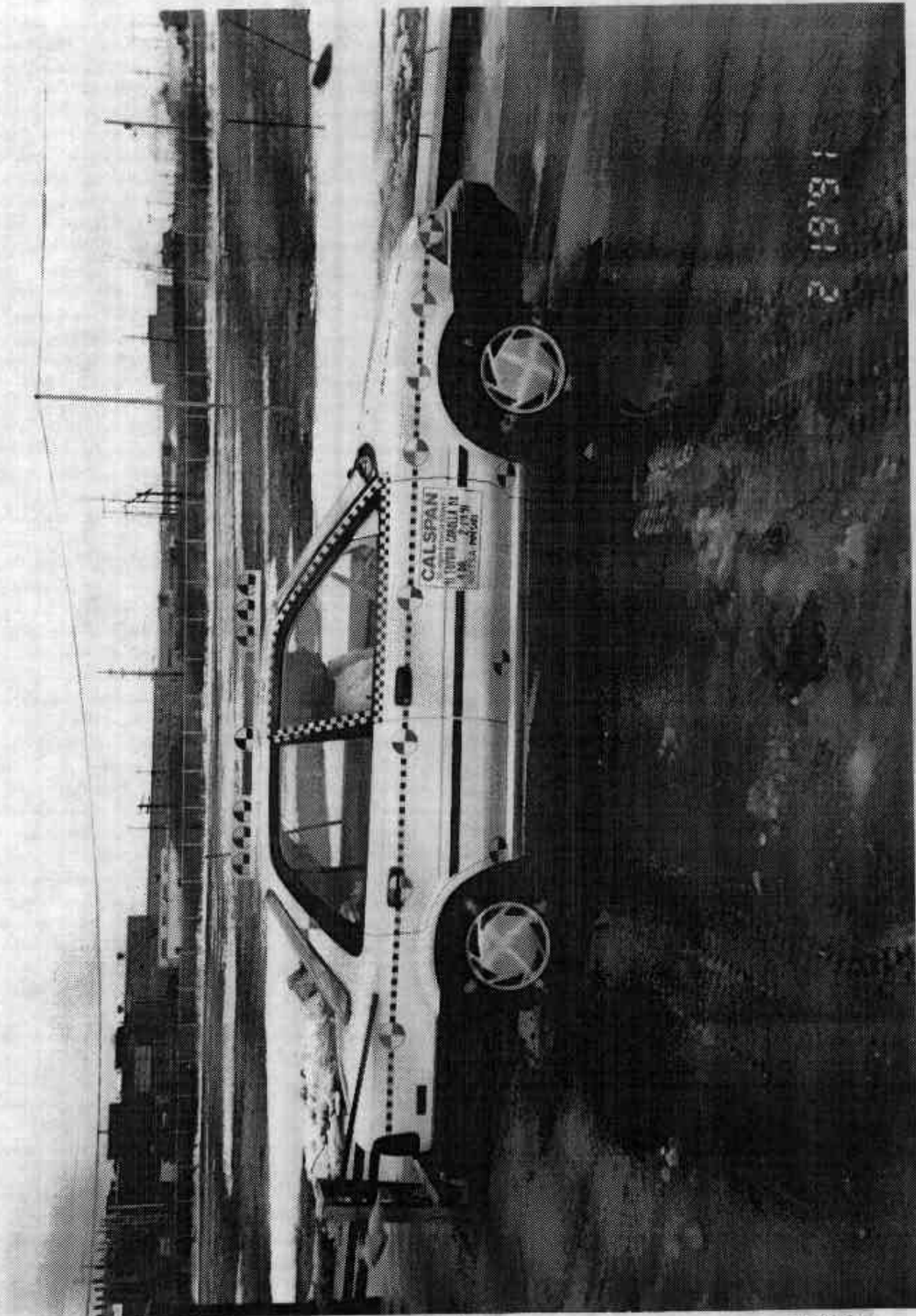


Figure A-8 PRE-TEST RIGHT SIDE VIEW



Figure A-7 POST-TEST RIGHT SIDE VIEW

A-9

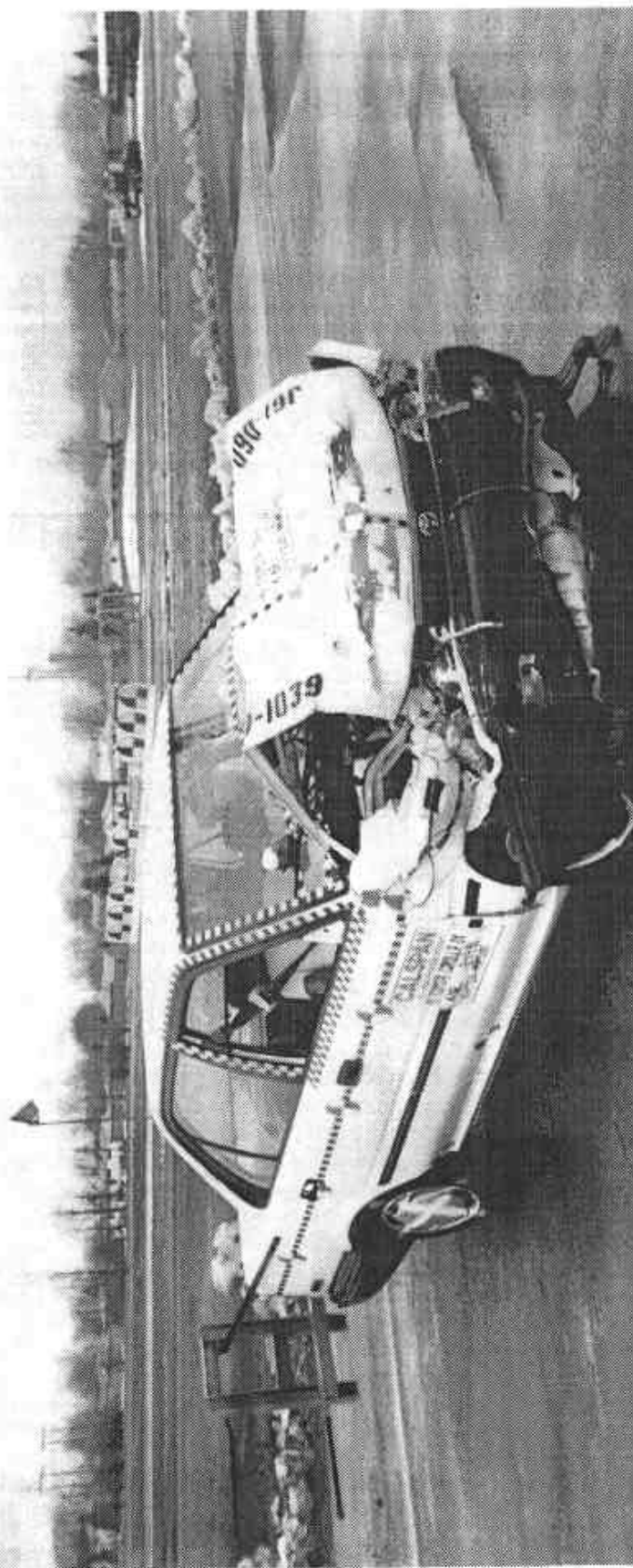
7893-2

16.61 2 19.91



2 19 91

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



2 19'91

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

A-11

7893-2



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

2 19'9"

A-12

7893-2



2 19'91

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

A-13

7893-2

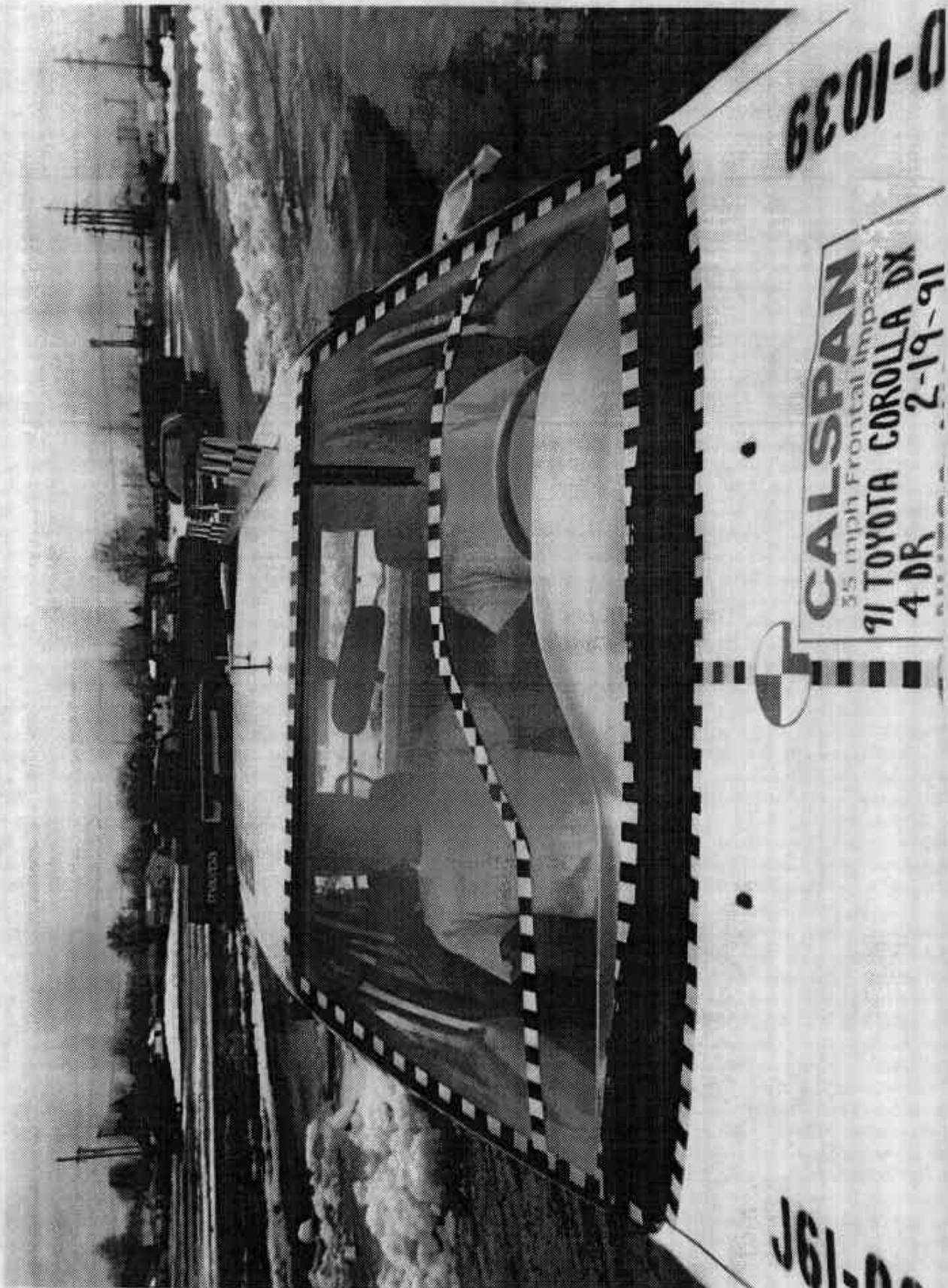


FIGURE A-12 PRE-TEST WINDSHIELD VIEW

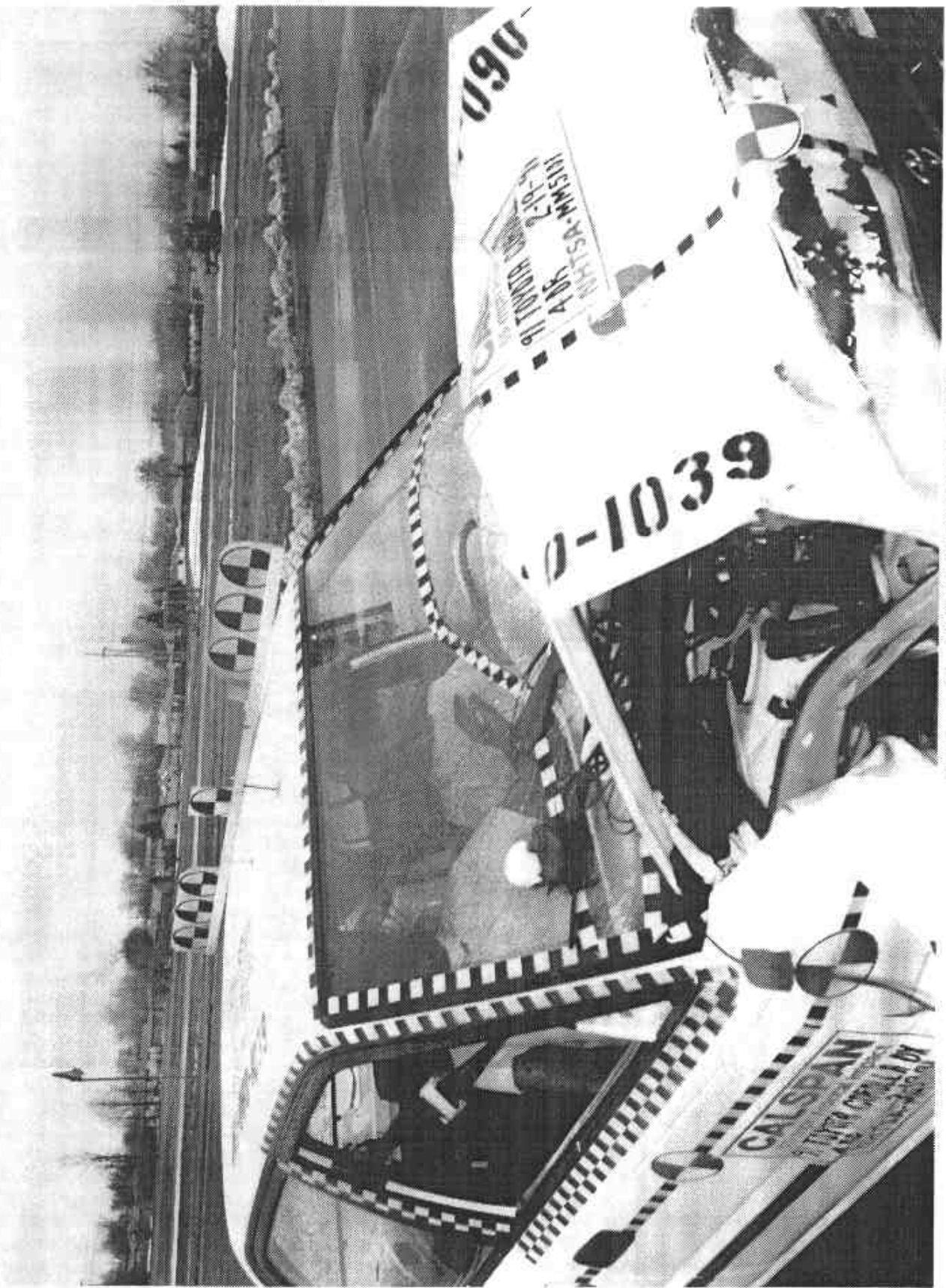


Figure A-13 POST-TEST WINDSHIELD VIEW

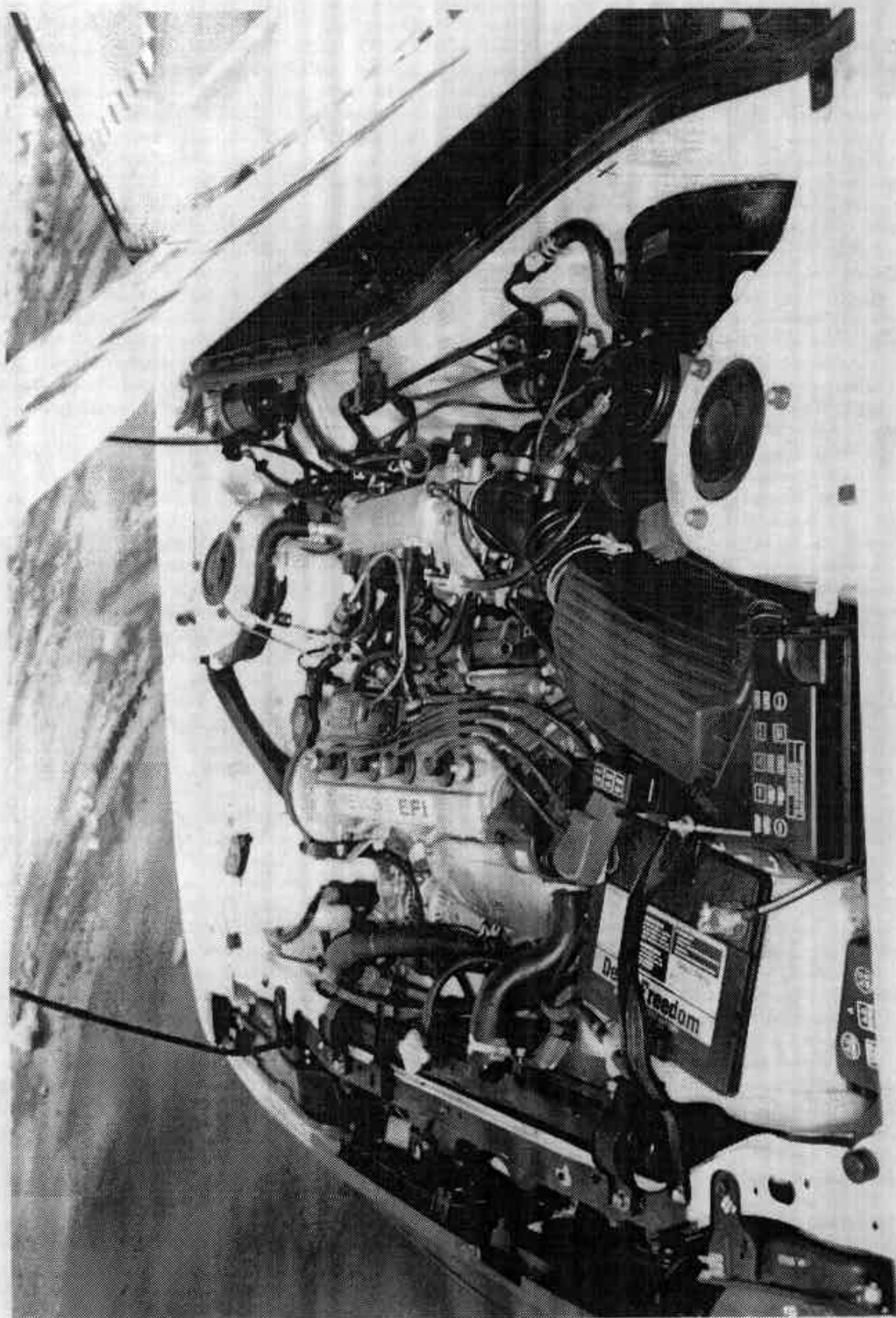


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-16

7893-2

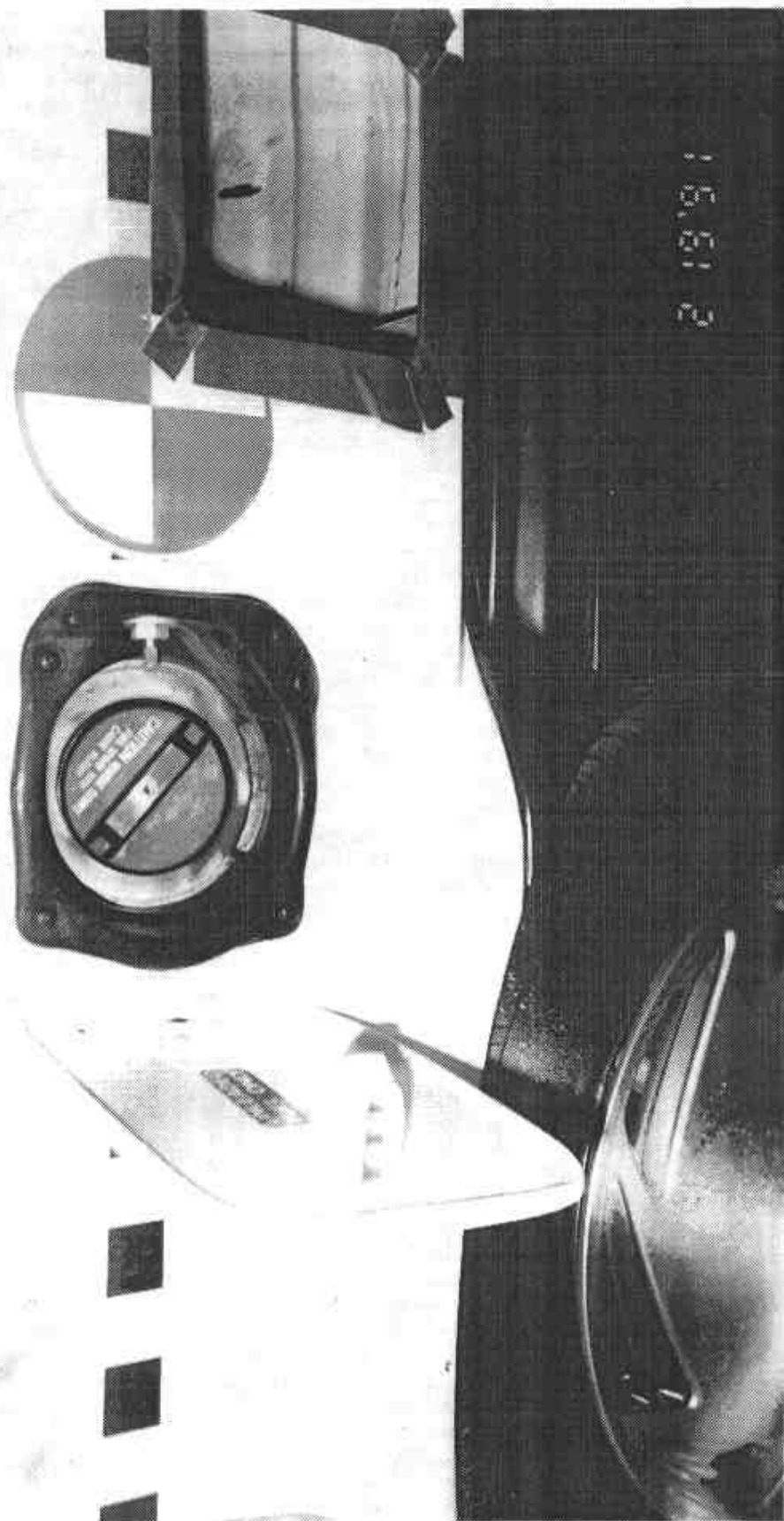


FIGURE A-15 FUEL CAP VIEW

A-17

7893 2

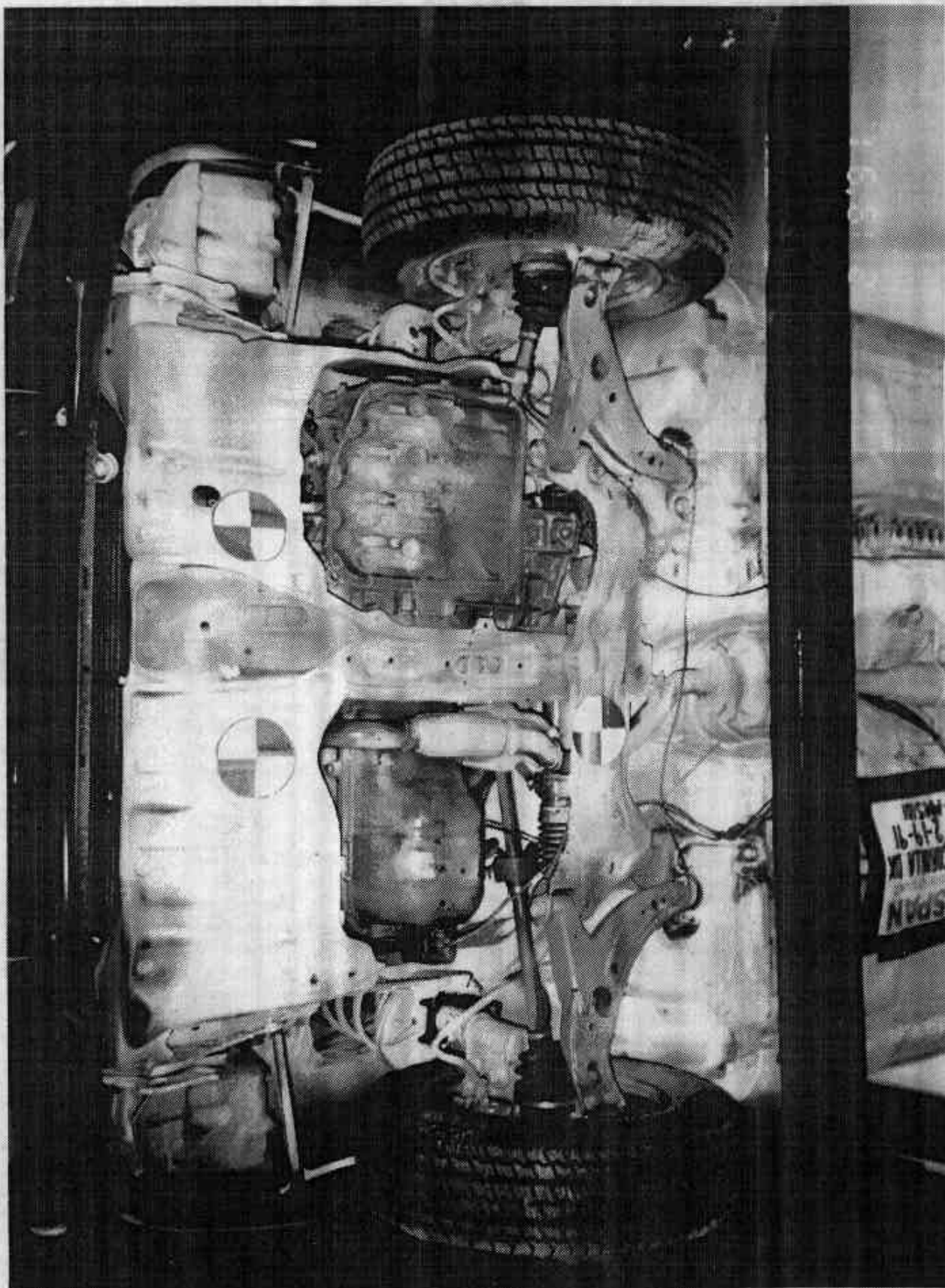


Figure A-16 PRE-TEST FRONT UNDERBODY VIEW

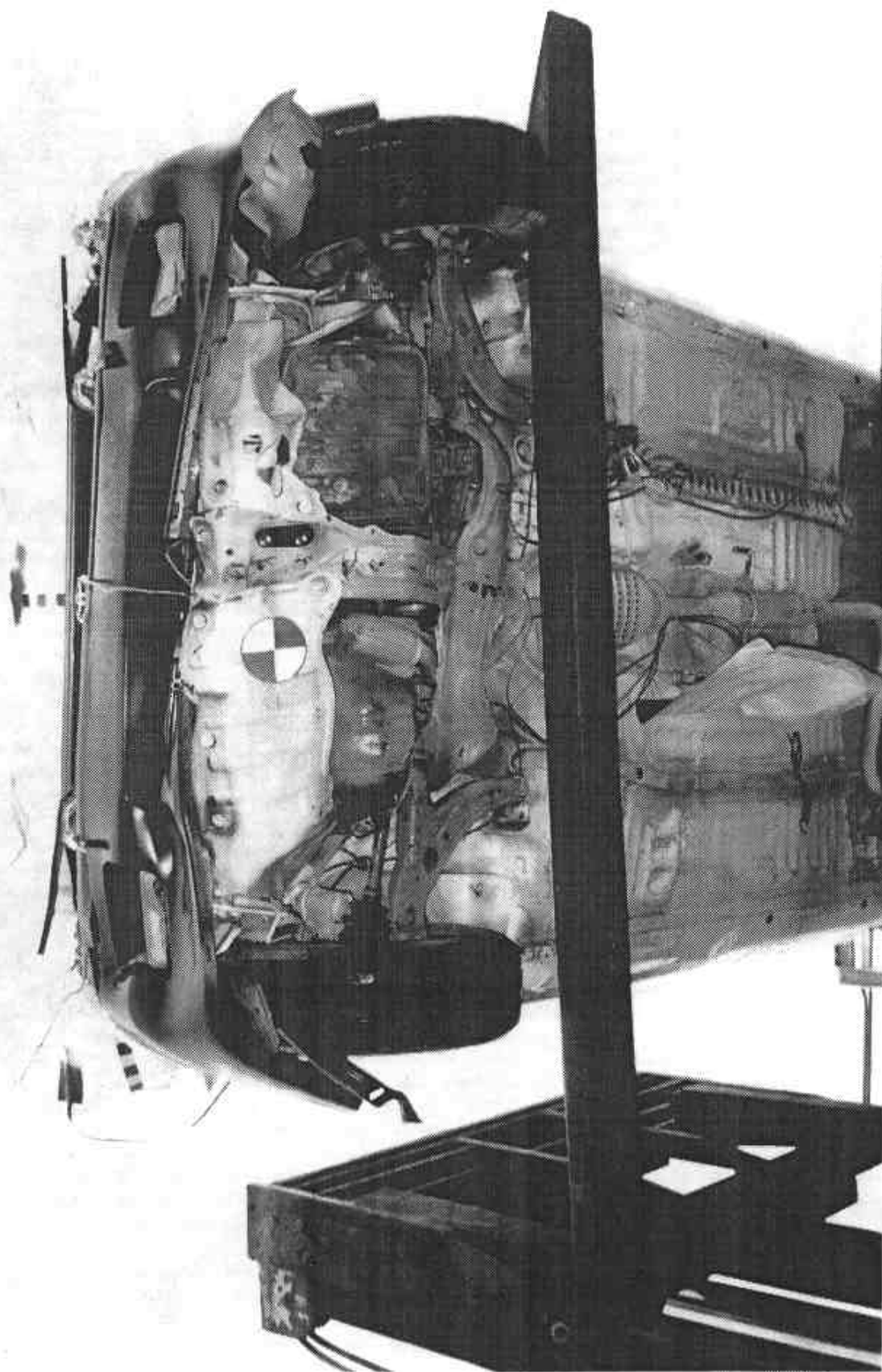


Figure A-17 POST-TEST FRONT UNDERBODY VIEW

A-19

7893-2

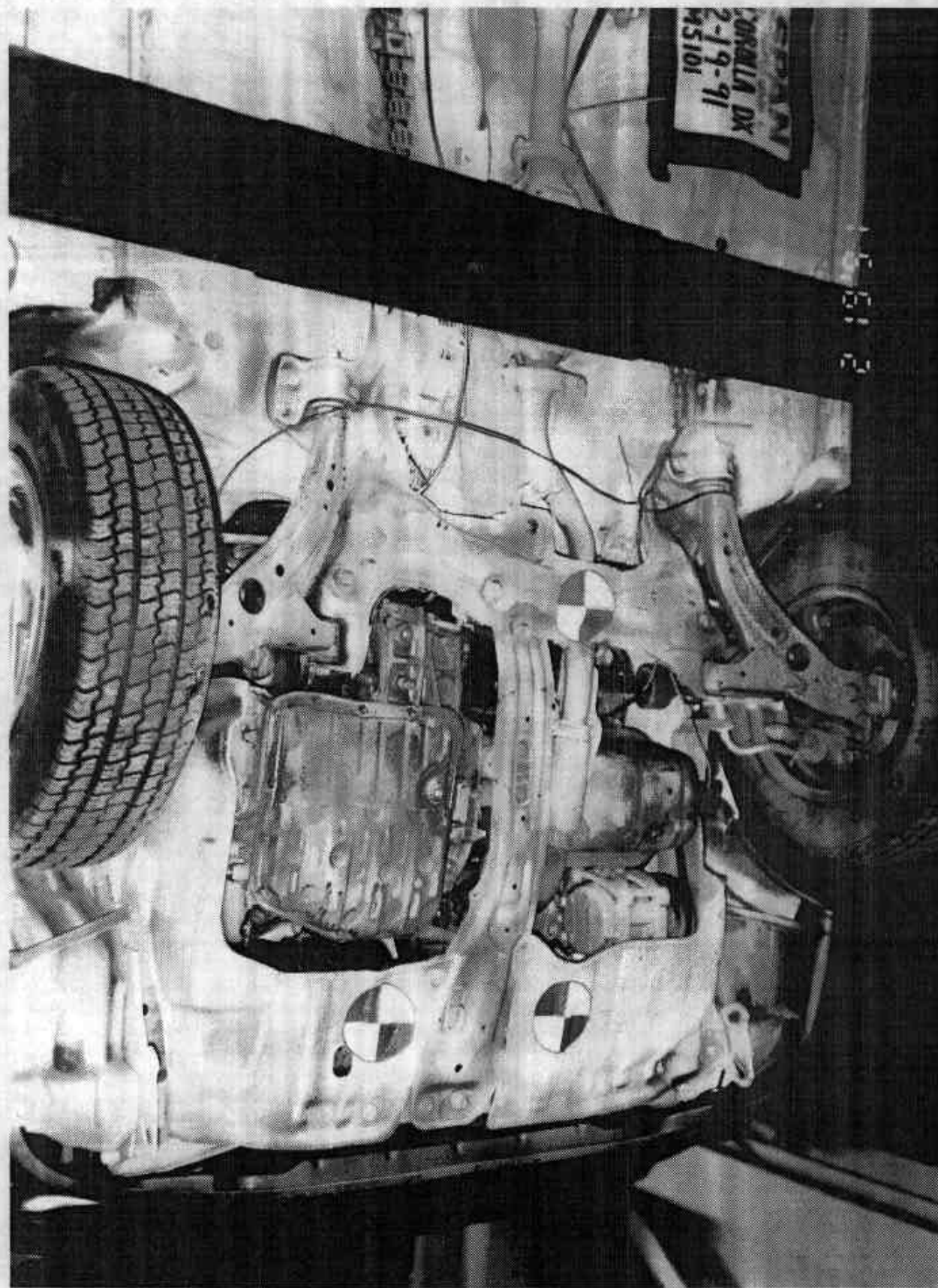


FIGURE A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW

A-20

7893-2

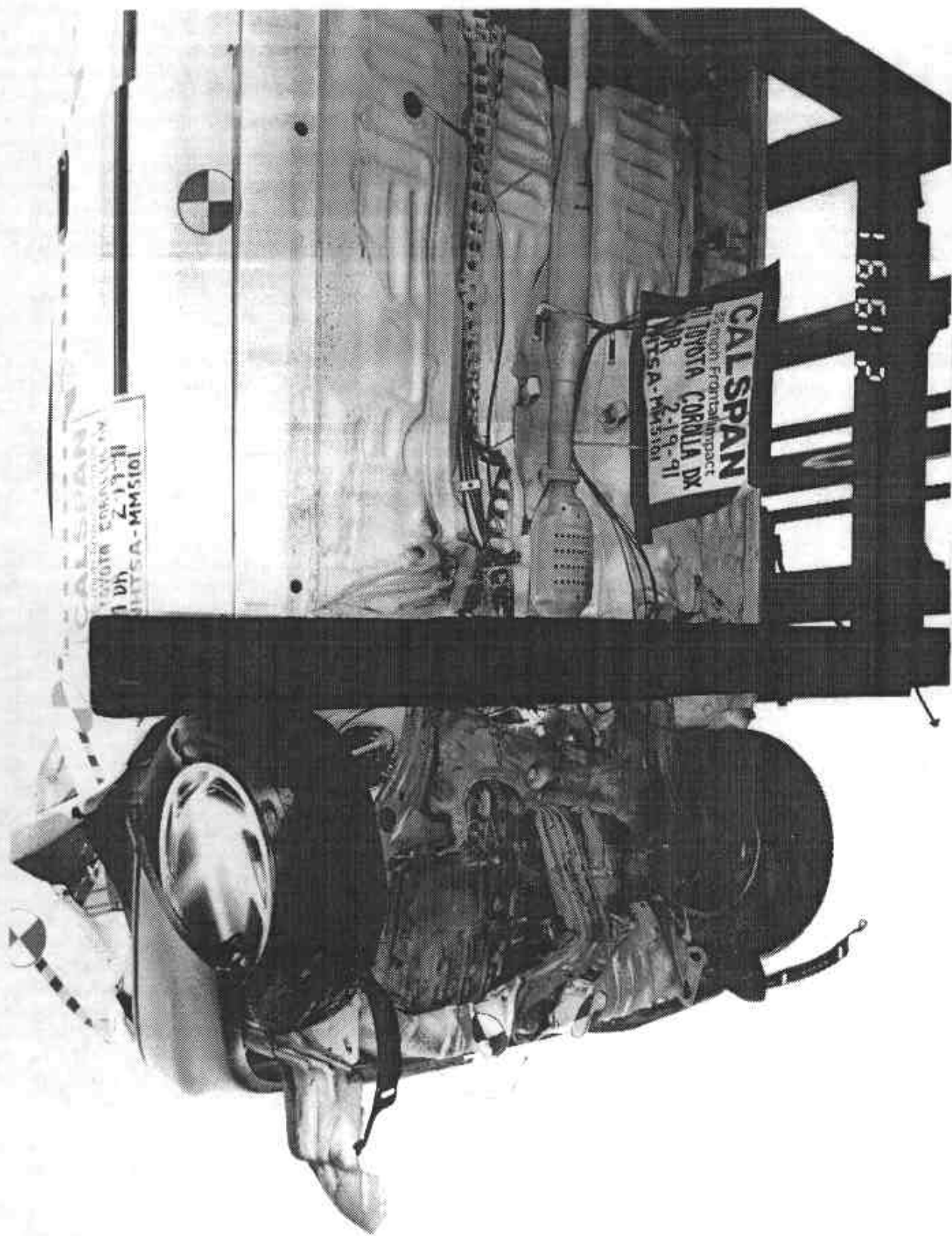


FIGURE A-19 POST-TEST FRONT SIDE UNDERBODY VIEW

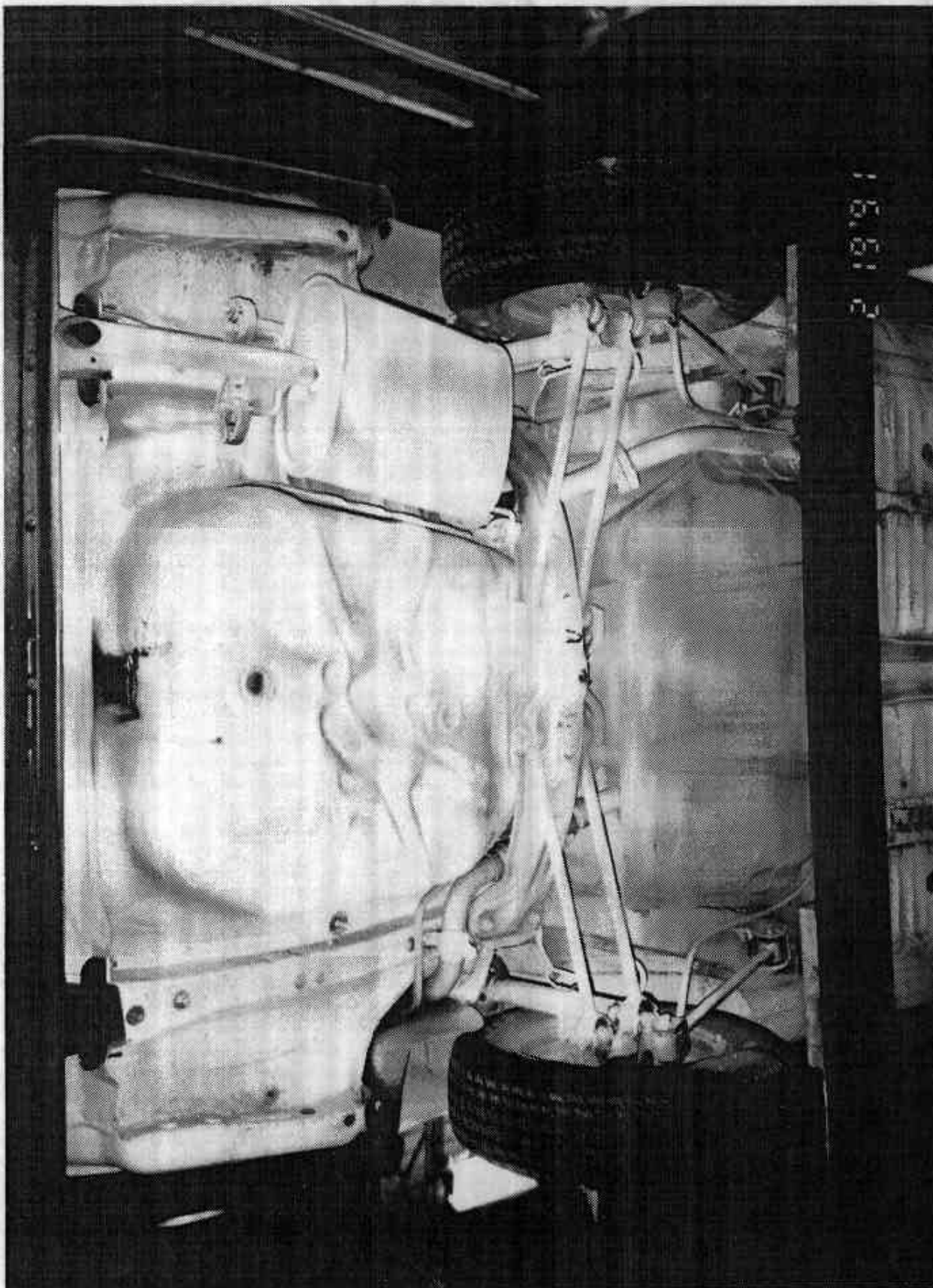


Figure A-20. PRE-TEST REAR UNDERBODY VIEW

A-22

7893-2

15.01

Figure A-21 POST-TEST REAR UNDERBODY VIEW
(NOT AVAILABLE)



FIGURE A-22 PRE-TEST DRIVER POSITION VIEW

A-24

7893-2



Figure A-23 POST-TEST DRIVER POSITION VIEW

A-25

7893 2

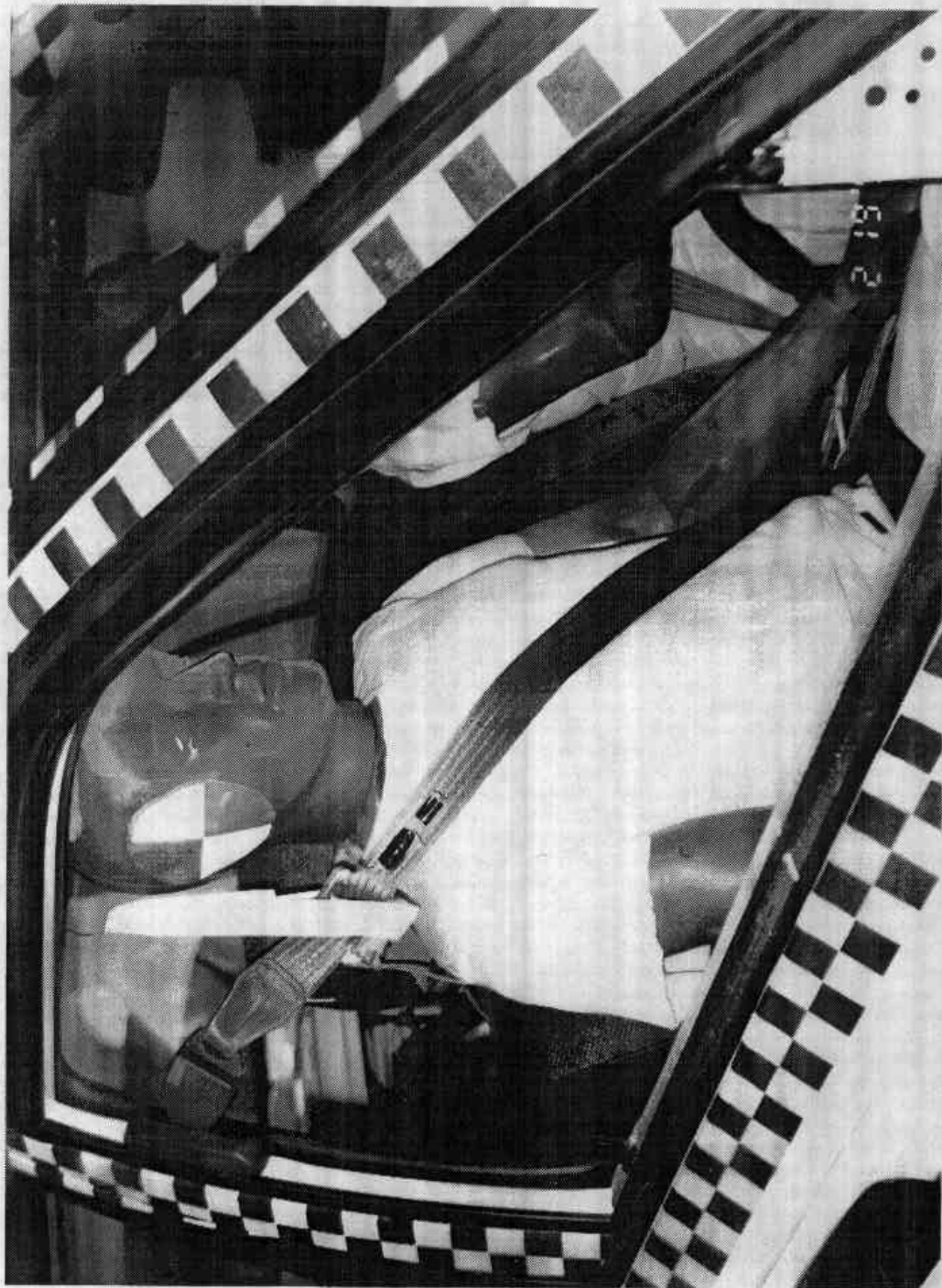


FIGURE A-24 PRE-TEST PASSENGER POSITION VIEW

A-26

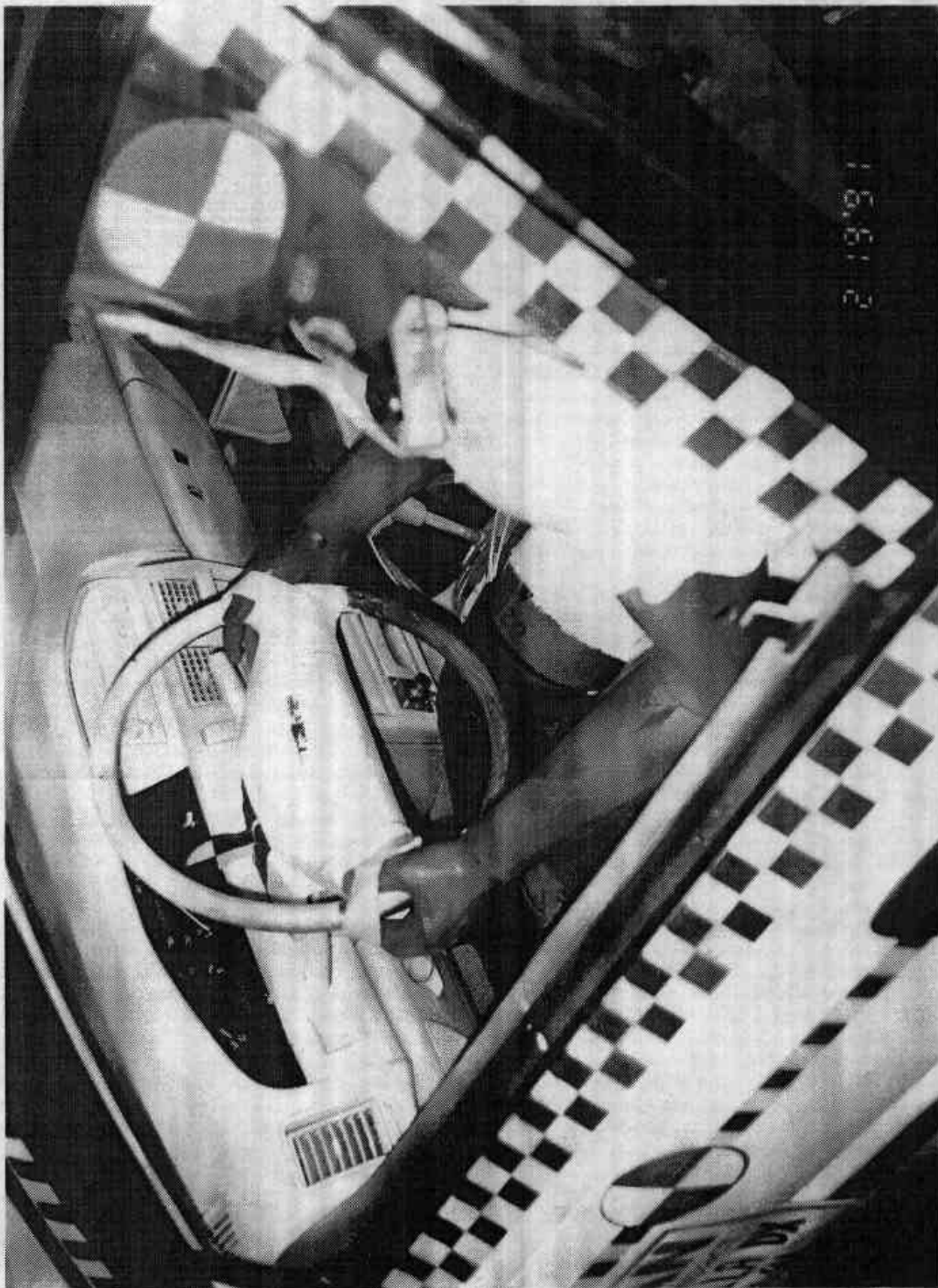
7893-2



Figure A-25 POST-TEST PASSENGER POSITION VIEW

A-27

7893-2



16.619
2 19.91

FIGURE A-28 PRE-TEST DRIVER AND INTERIOR VIEW

A-28

7893-2

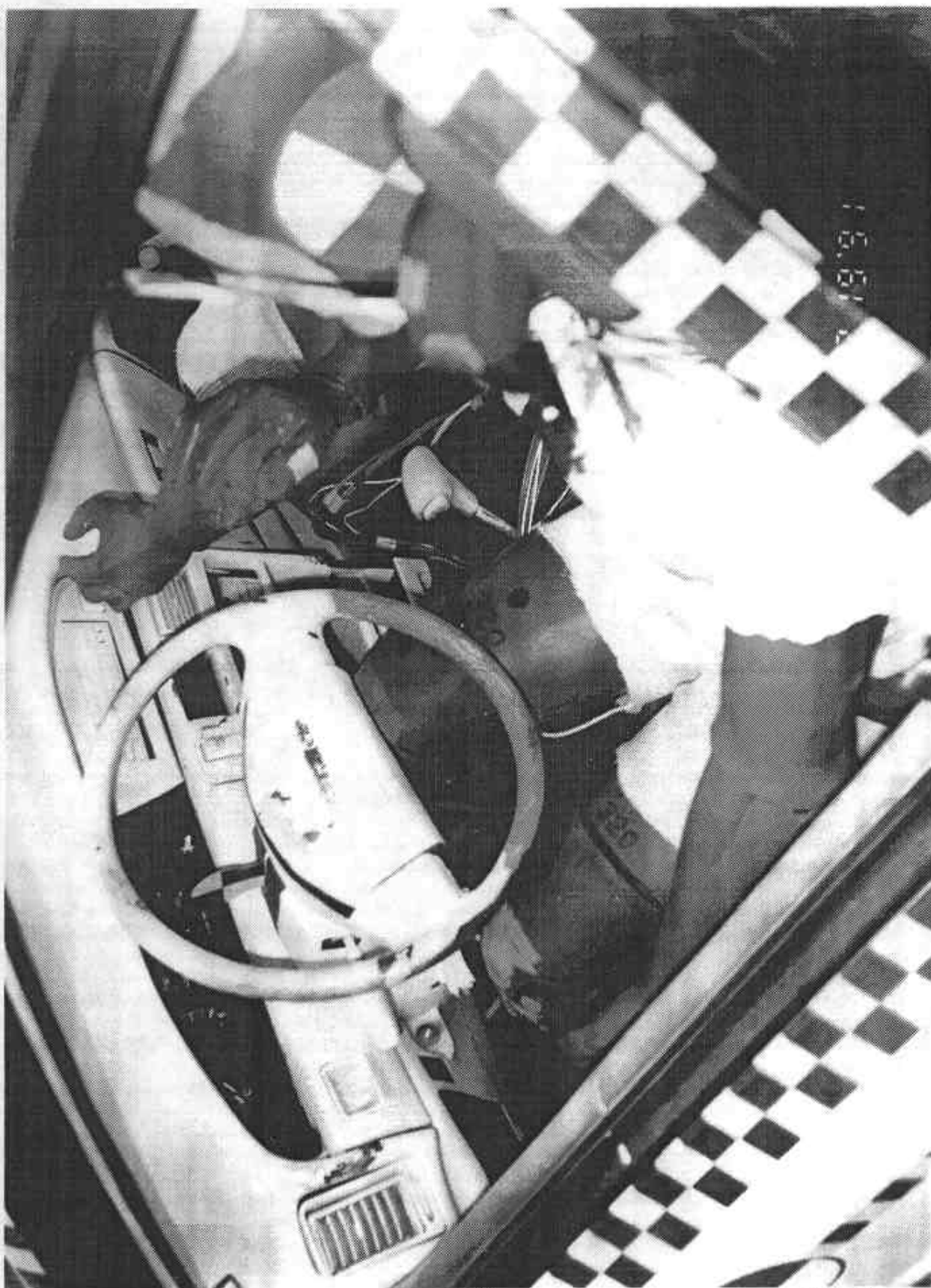


Figure A-27 POST-TEST DRIVER AND INTERIOR VIEW

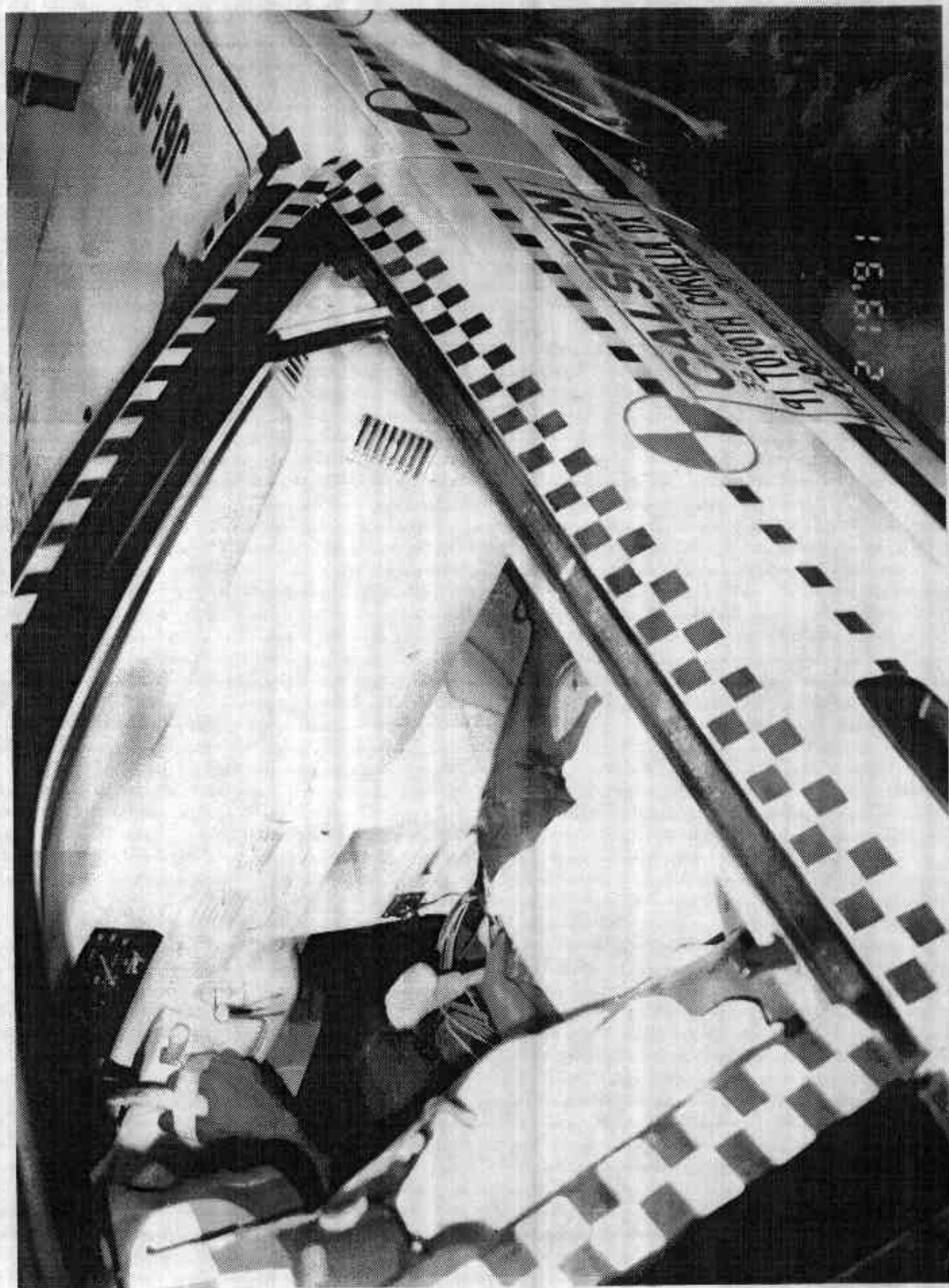


FIGURE A-28 PRE-TEST PASSENGER AND INTERIOR VIEW

A-30

7893-2

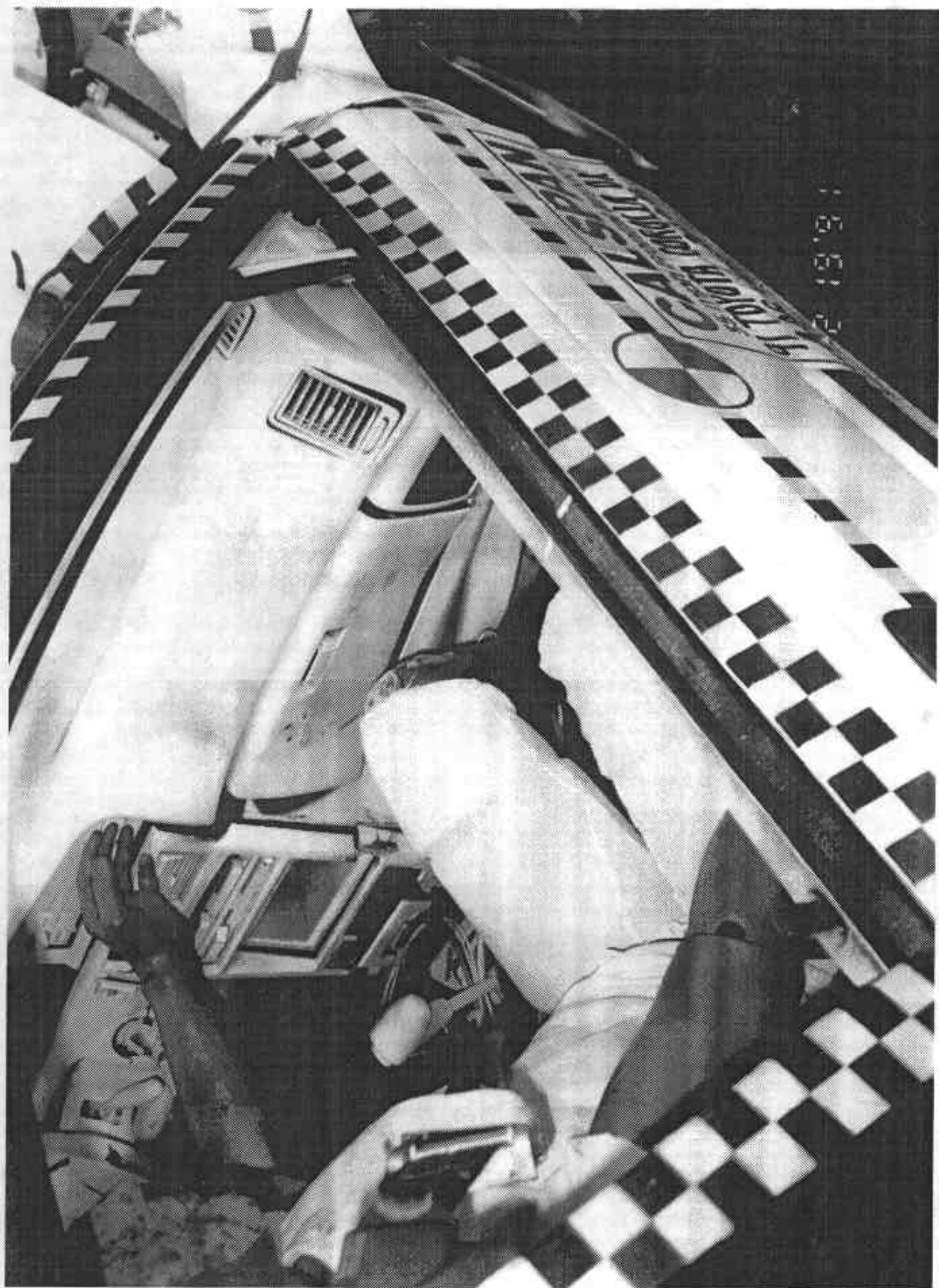


Figure A-29 POST-TEST PASSENGER AND INTERIOR VIEW

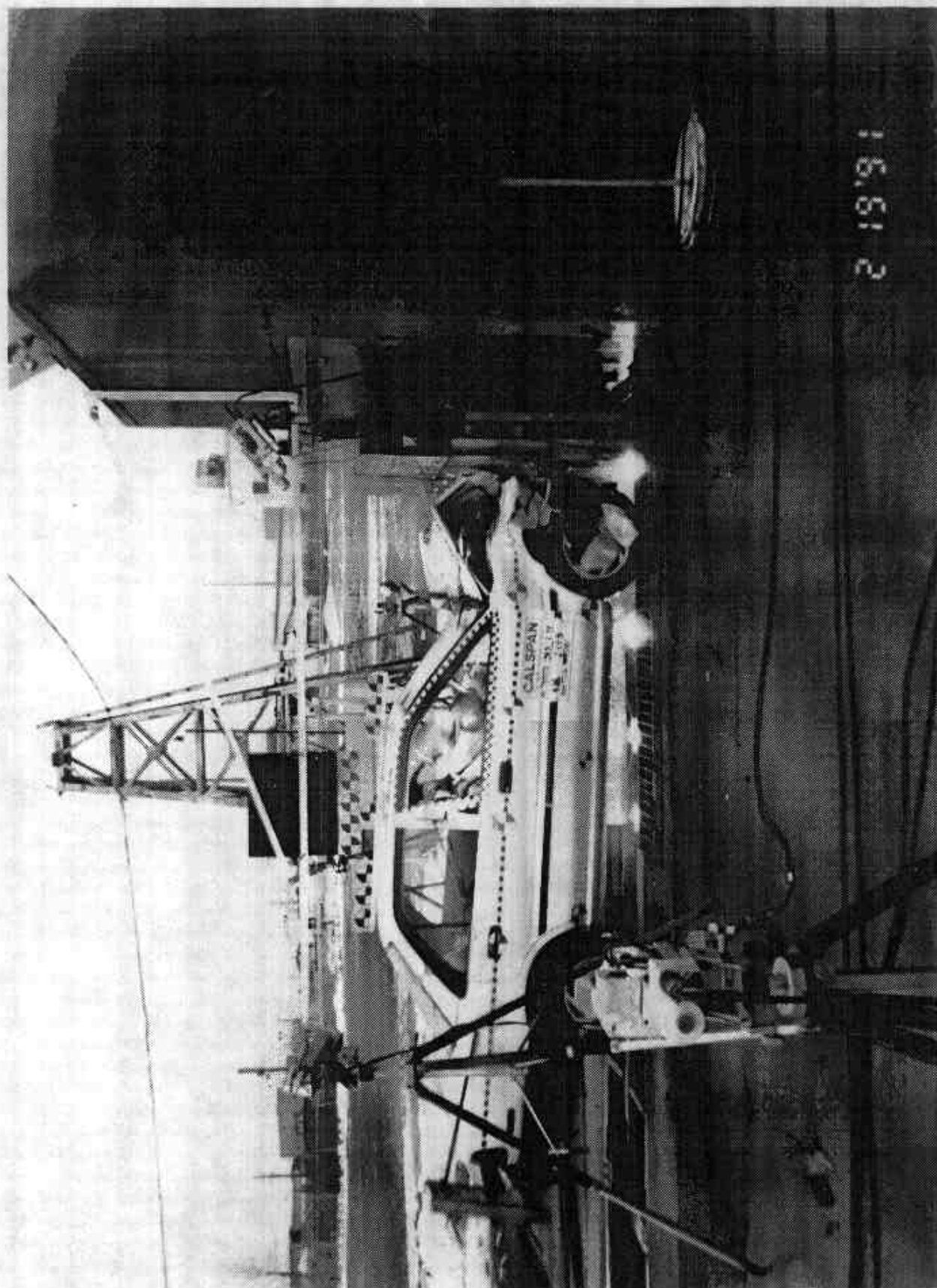


Figure A-30 IMPACT VIEW

A-32

7893-2

Appendix B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

TEST NO. MM5101

VEHICLE DATA

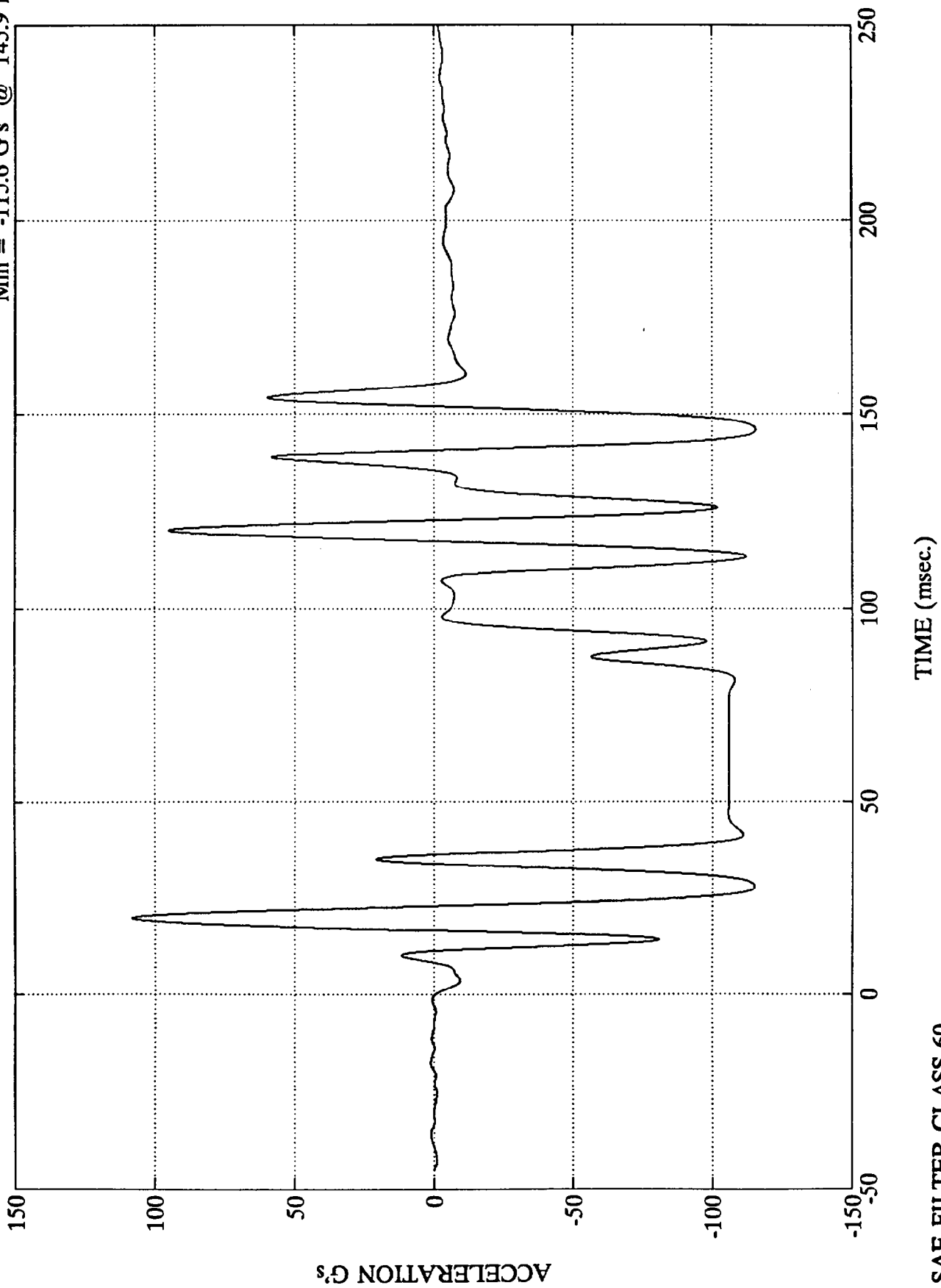
FILTER CHANNEL CLASS

60

Test 1039

ACCELEROMETER #1(X)

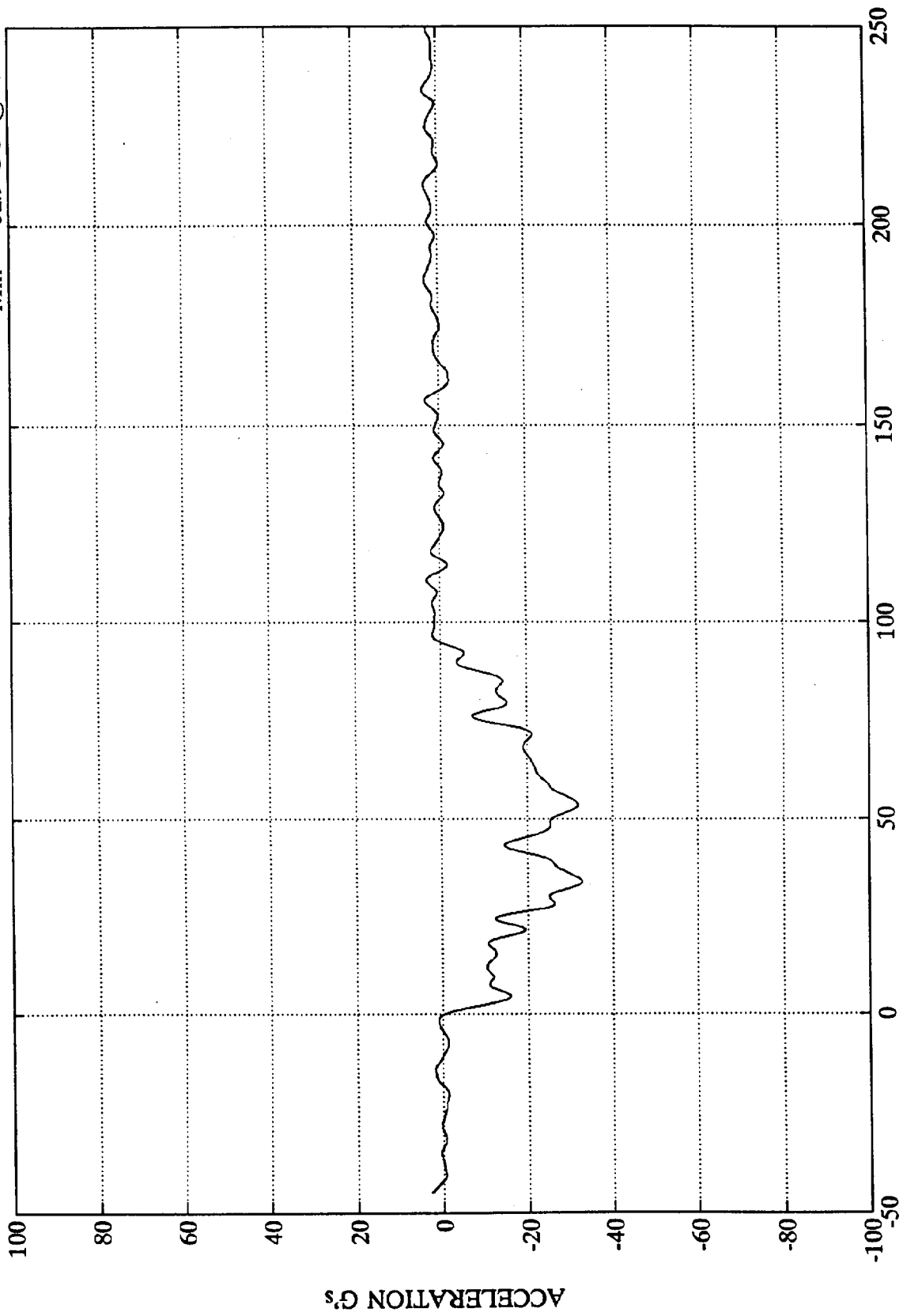
Max = 108.0 G's @ 19.9 msec
Min = -115.6 G's @ 145.9 msec



Test 1039

ACCELEROMETER #2(X)

Max = 3.4 G's @ 234.2 msec
Min = -32.9 G's @ 34.0 msec

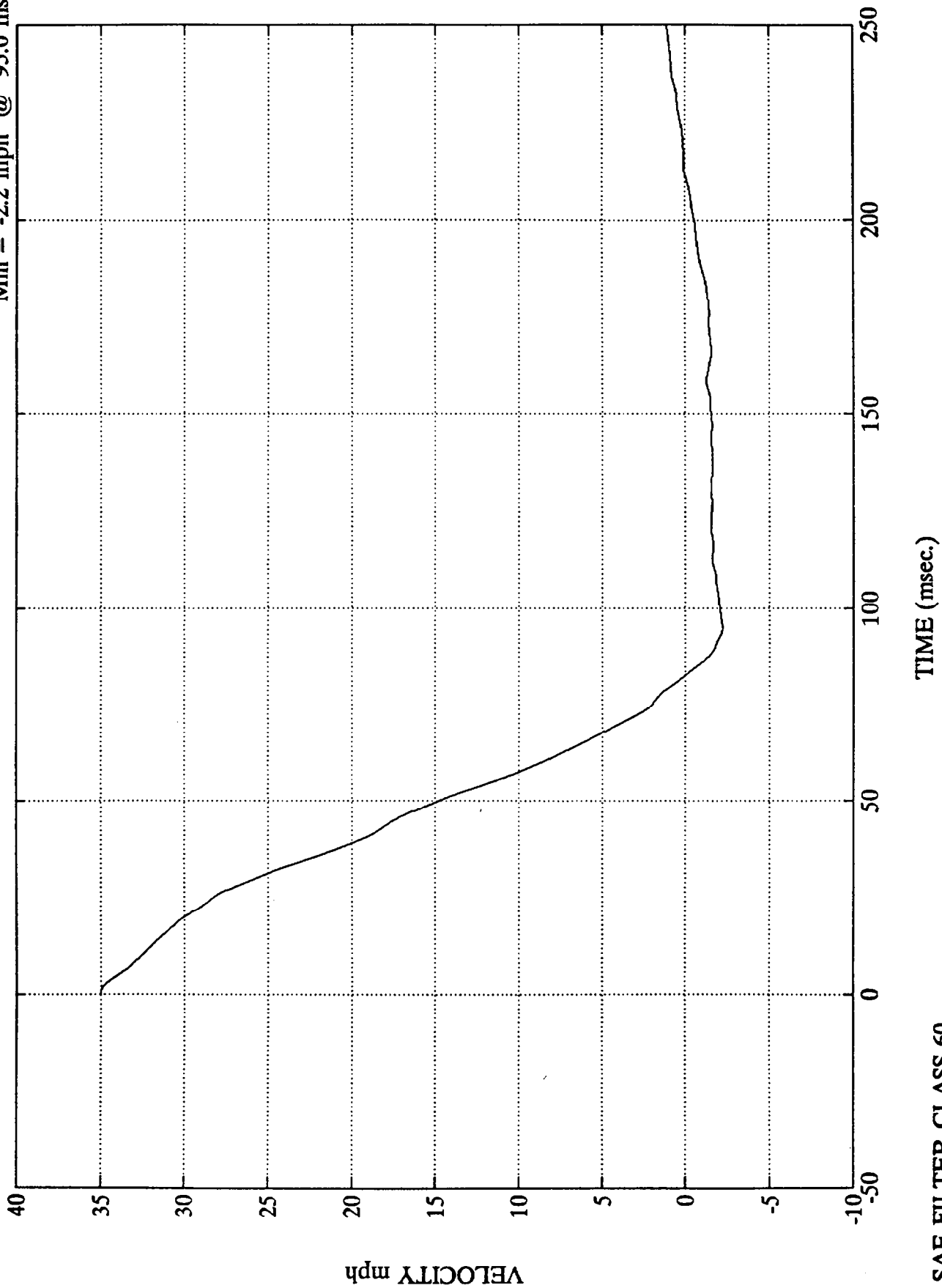


TIME (msec.)

SAE FILTER CLASS 60

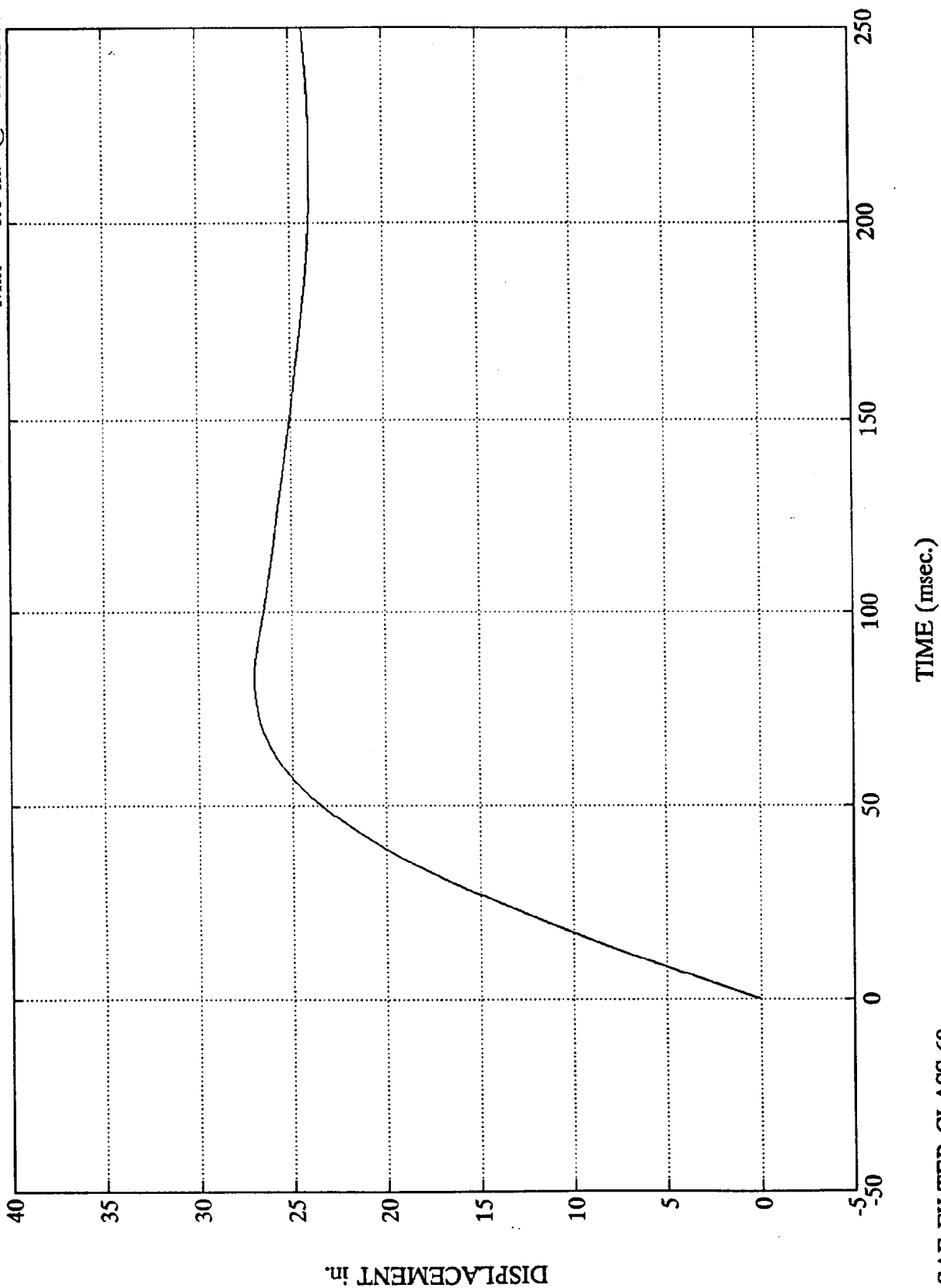
Test 1039
Max = 35.0 mph @ -0.0 msec
Min = -2.2 mph @ 95.0 msec

ACCELEROMETER #2(X)



SAE FILTER CLASS 60

Test 1039
ACCELEROMETER #2(X)
Max = 27.0 in. @ 84.0 msec
Min = 0.0 in. @ -0.0 msec

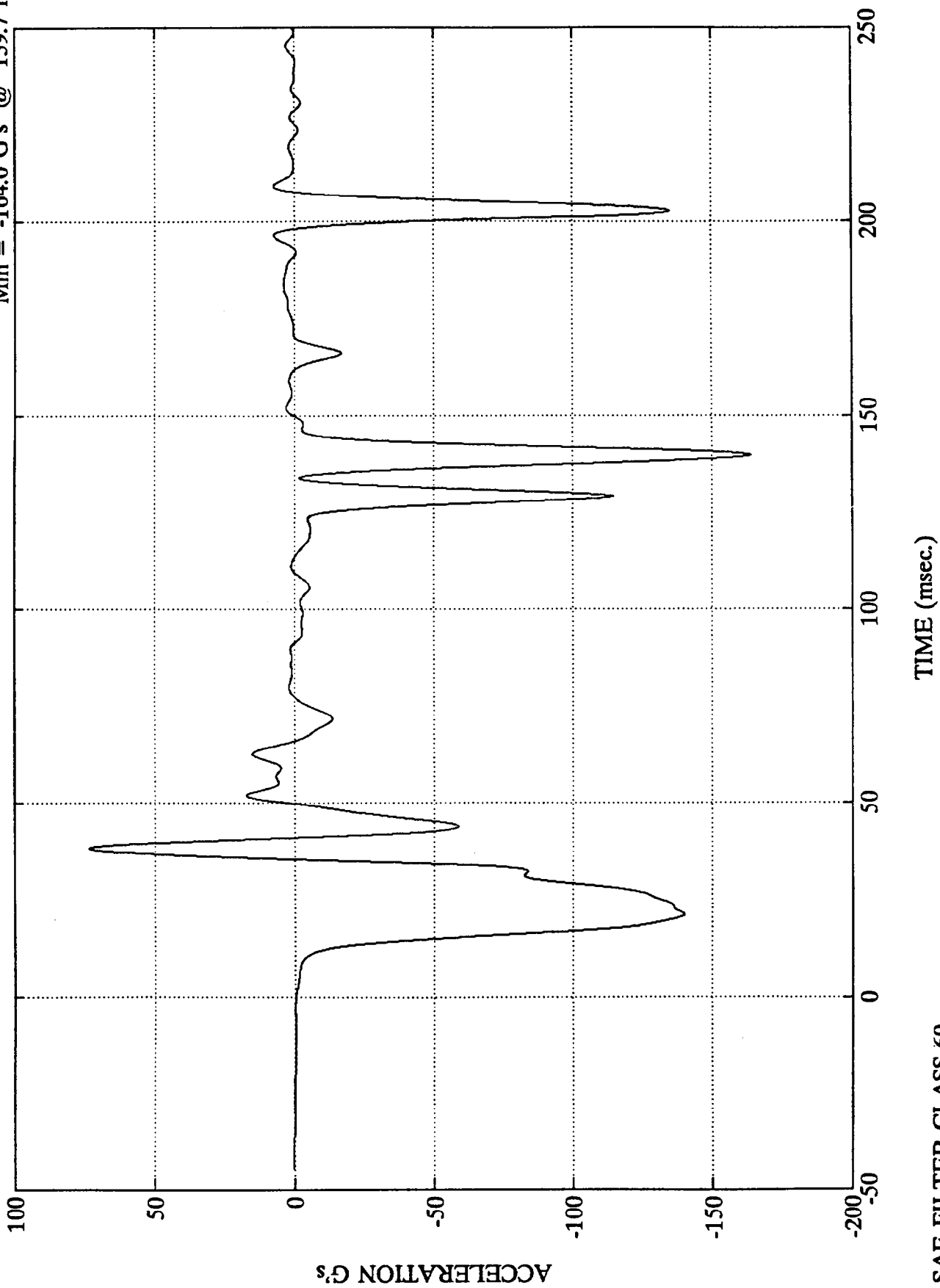


SAE FILTER CLASS 60

Test 1039

ACCELEROMETER #3(X)

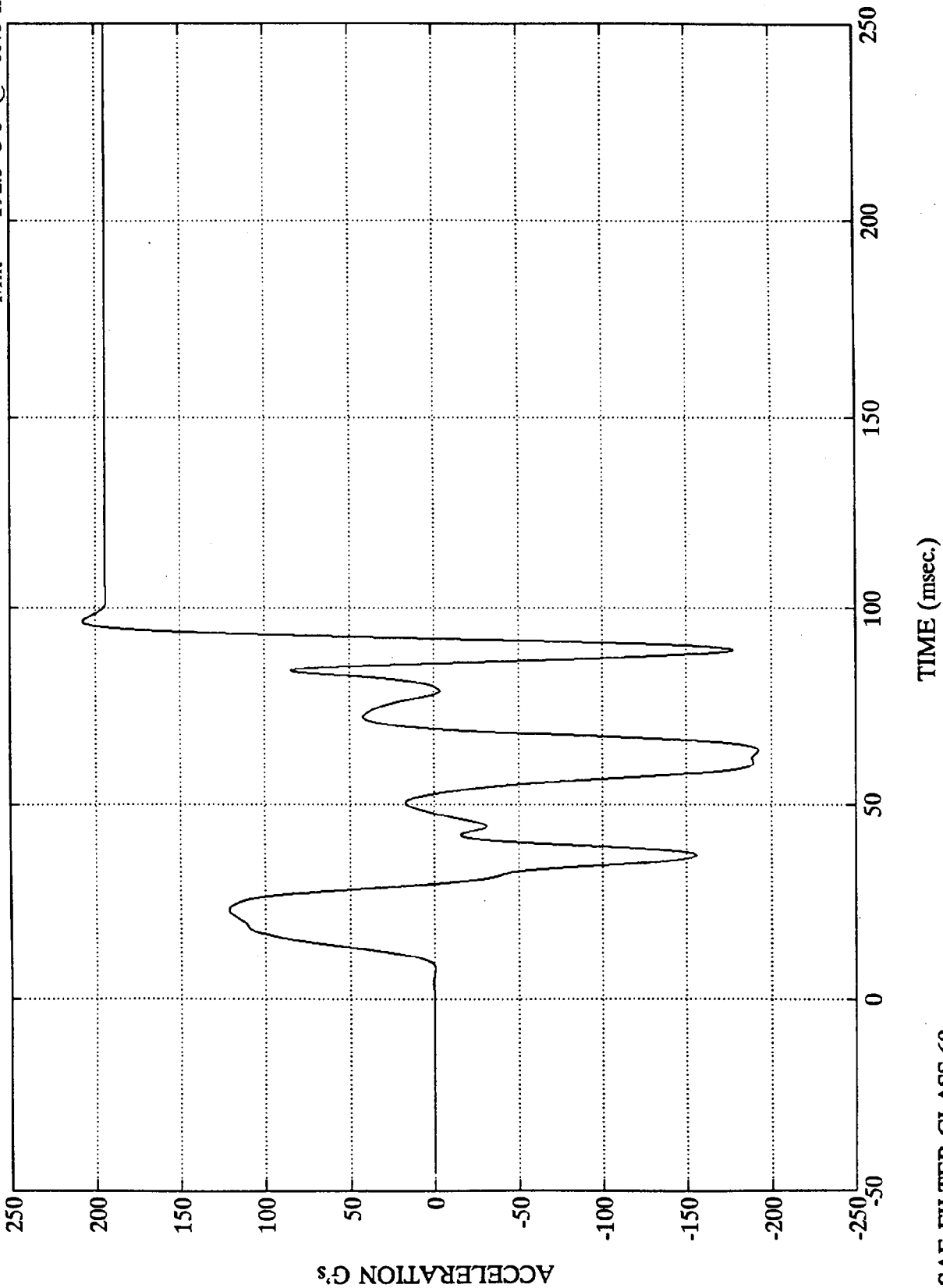
Max = 73.5 G's @ 38.3 msec
Min = -164.0 G's @ 139.7 msec



SAE FILTER CLASS 60

Test 1039
Max = 207.0 G's @ 96.6 msec
Min = -192.5 G's @ 63.8 msec

ACCELEROMETER #4(X)



Test 1039
Max = 112.8 G's @ 35.2 msec
Min = -104.0 G's @ 28.9 msec

ACCELEROMETER #5(X)

150

100

50

0

ACCELERATION G's

-50

-100

-150

250

200

150

100

50

0

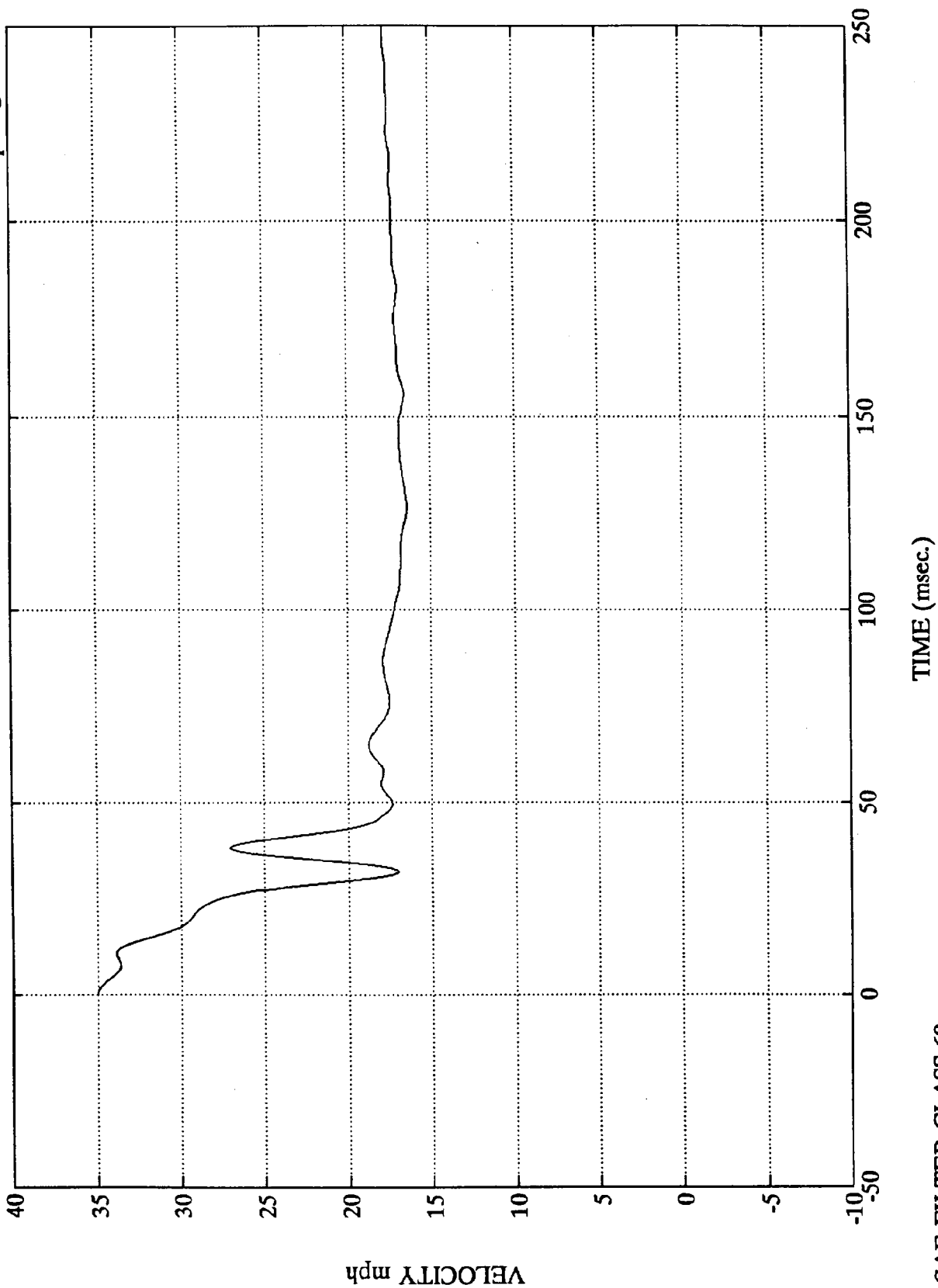
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

ACCELEROMETER #5(X)

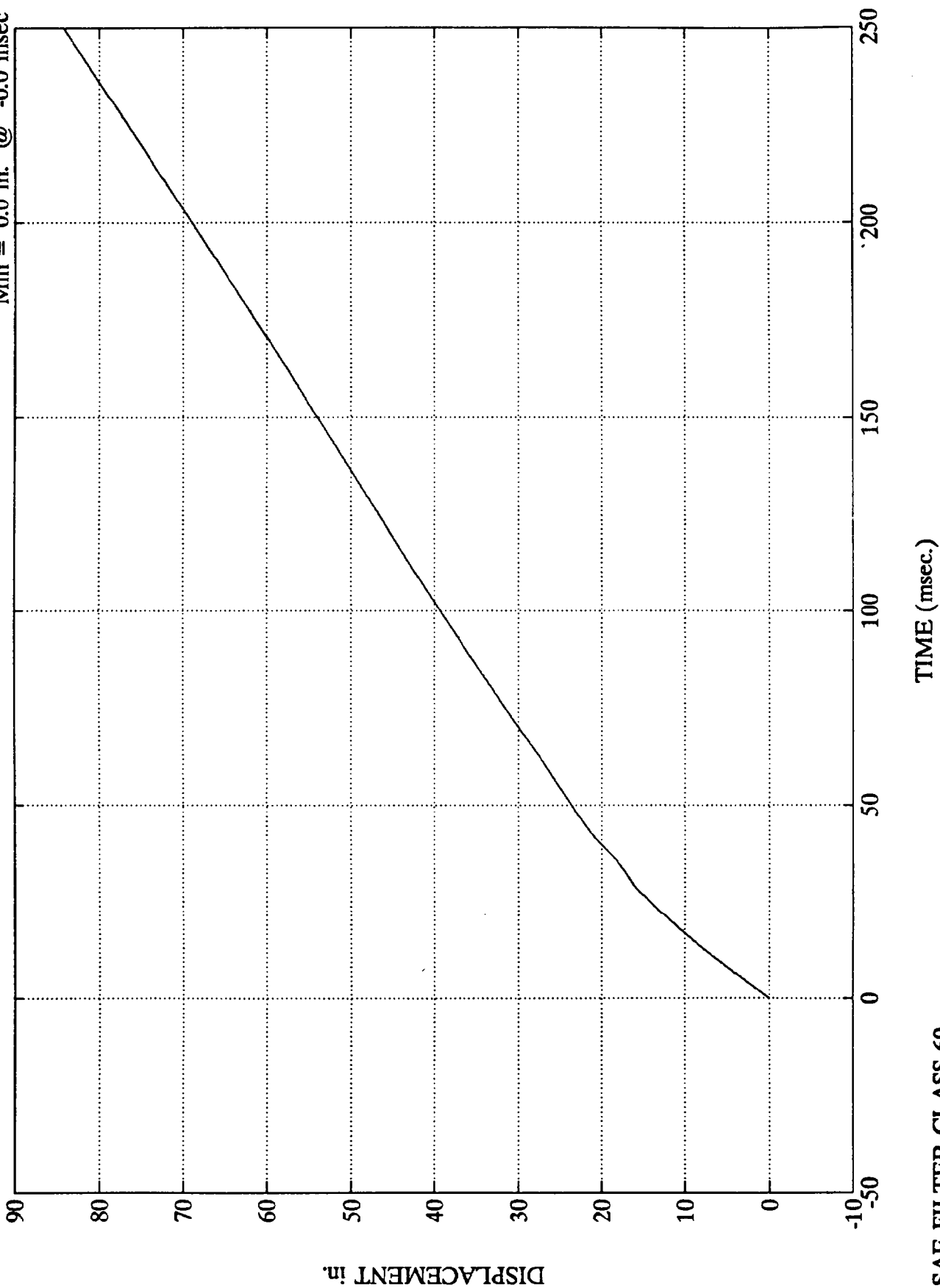
Max = 35.0 mph @ -0.0 msec
Min = 16.4 mph @ 126.7 msec



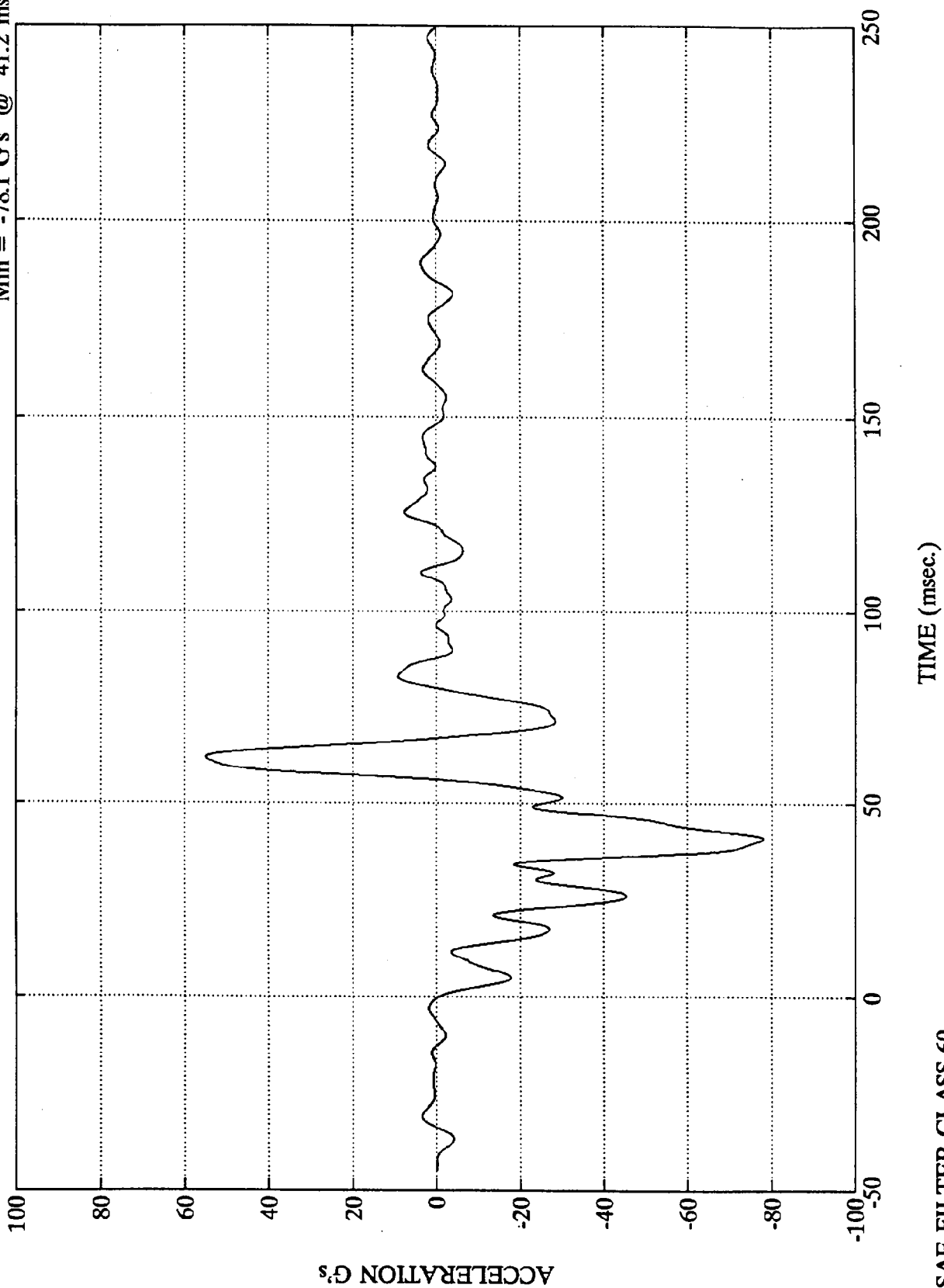
Test 1039
ACCELEROMETER #5(X)
Max = 85.8 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec

DISPLACEMENT in.

SAE FILTER CLASS 60



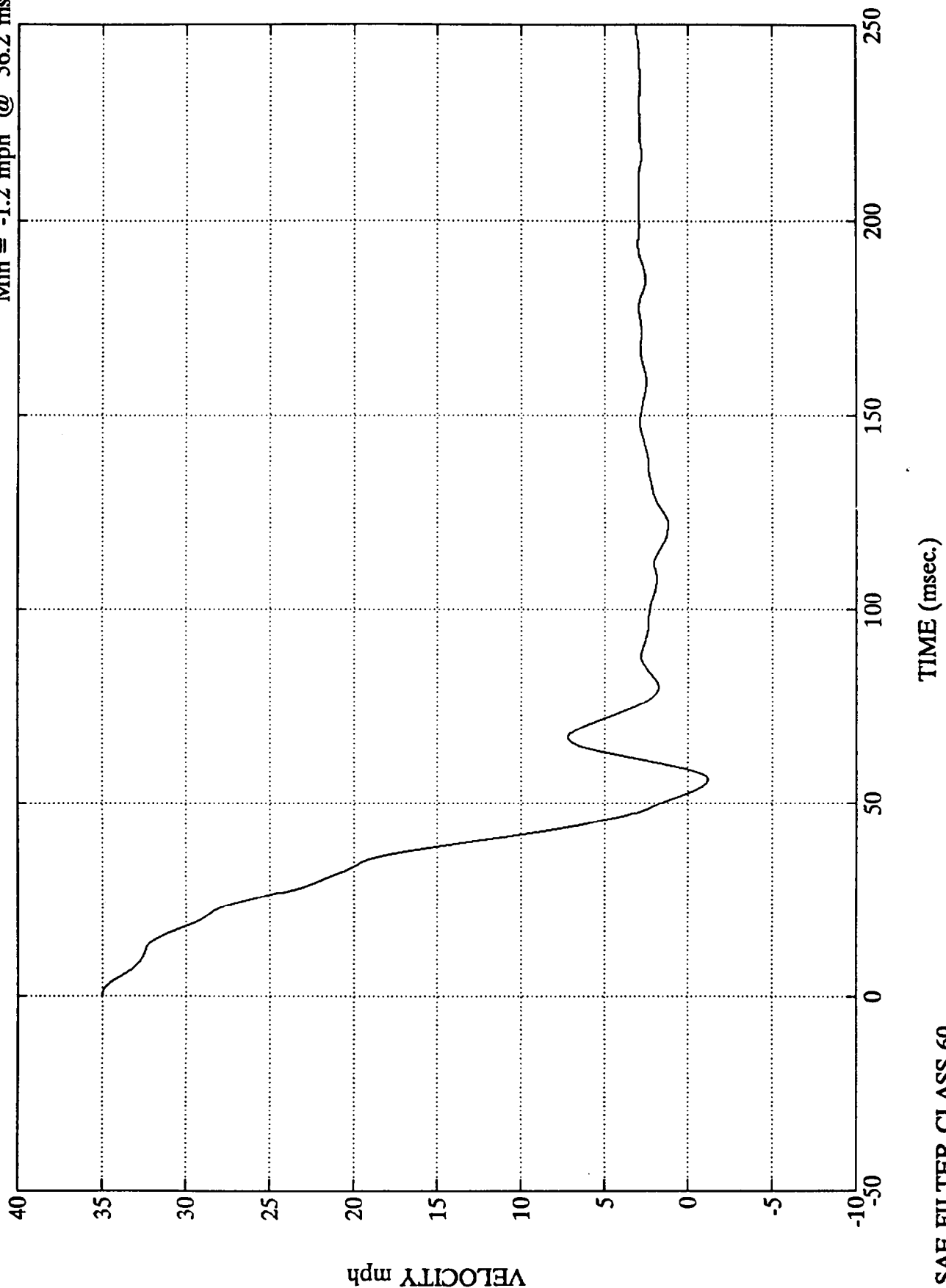
Test 1039
ACCELEROMETER #6(X)
Max = 55.0 G's @ 61.9 msec
Min = -78.1 G's @ 41.2 msec



SAE FILTER CLASS 60

Test 1039
Max = 35.0 mph @ -0.0 msec
Min = -1.2 mph @ 56.2 msec

ACCELEROMETER #6(X)

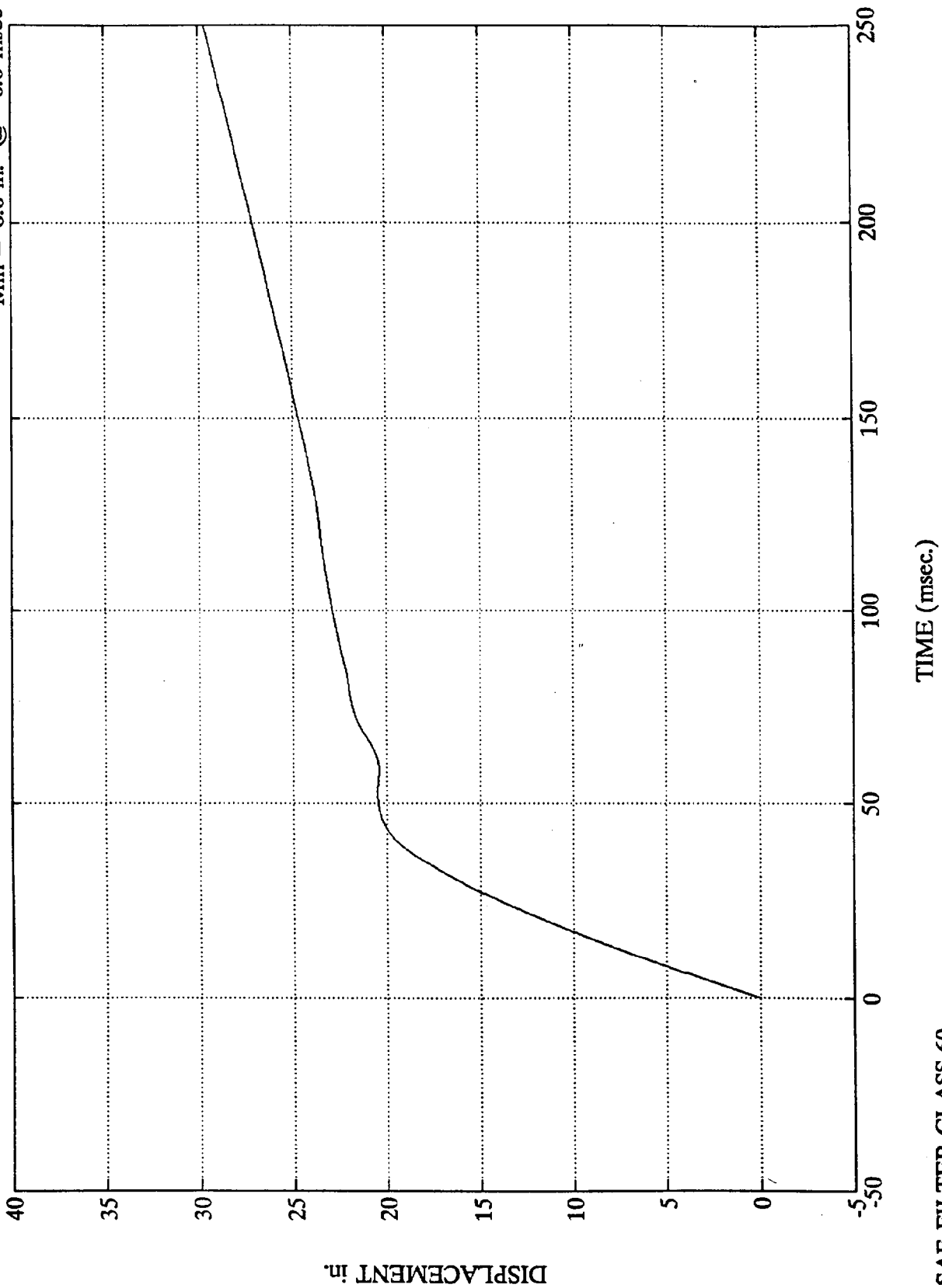


SAE FILTER CLASS 60

Test 1039

ACCELEROMETER #6(X)

Max = 29.9 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec

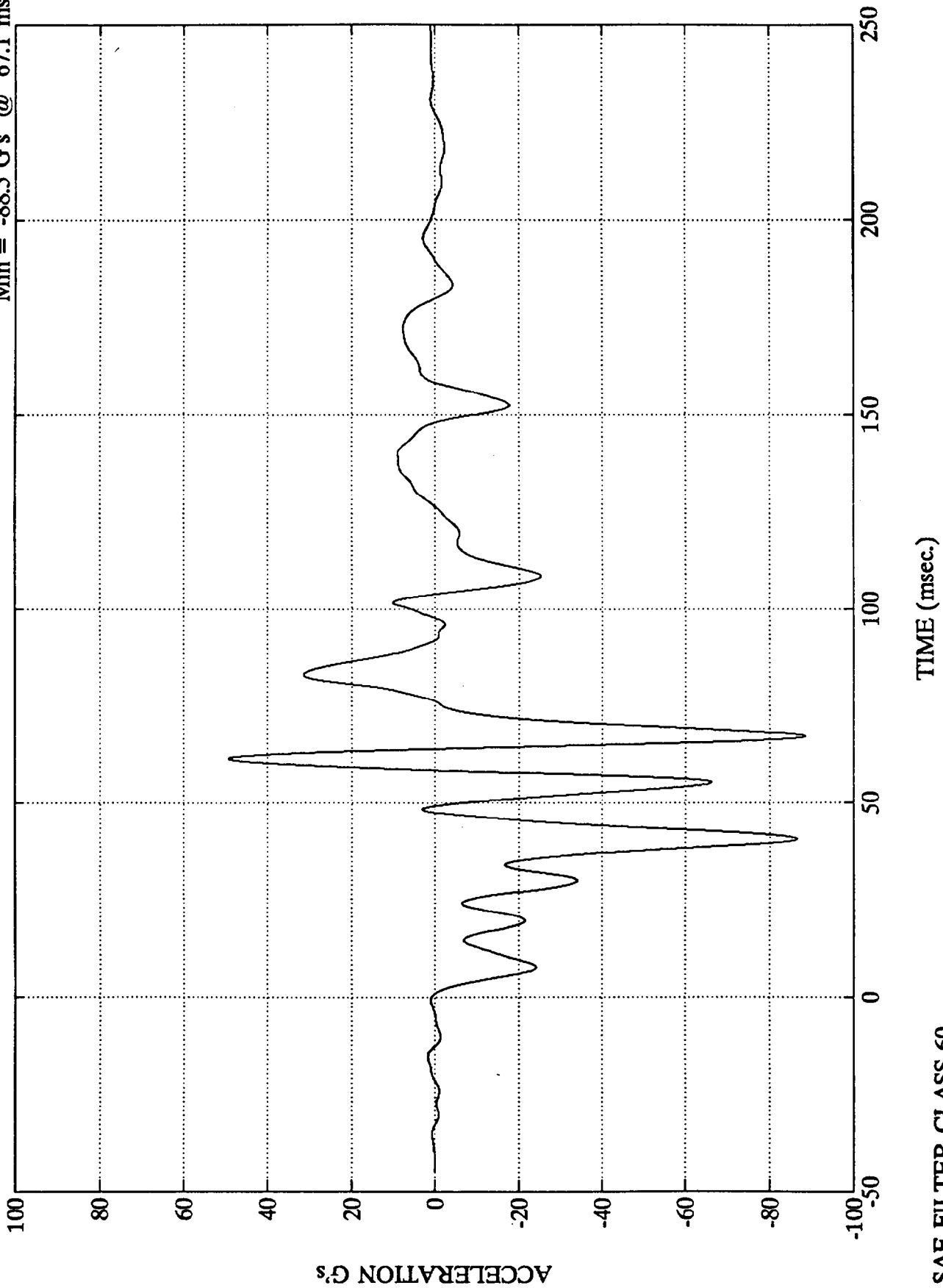


SAE FILTER CLASS 60

Test 1039

ACCELEROMETER #7(X)

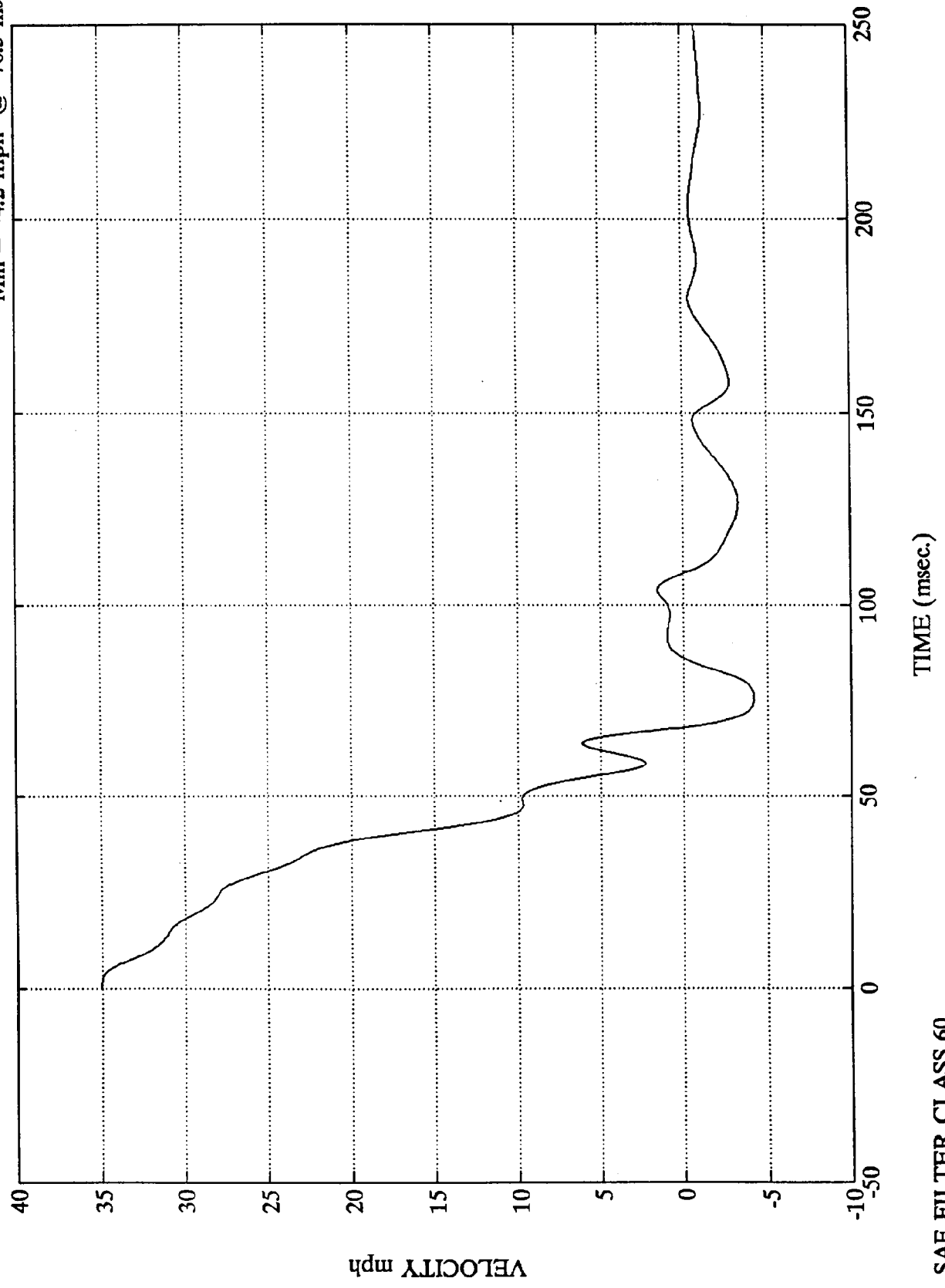
Max = 49.3 G's @ 61.4 msec
Min = -88.5 G's @ 67.1 msec



SAE FILTER CLASS 60

Test 1039
Max = 35.0 mph @ 1.0 msec
Min = -4.2 mph @ 76.3 msec

ACCELEROMETER #7(X)

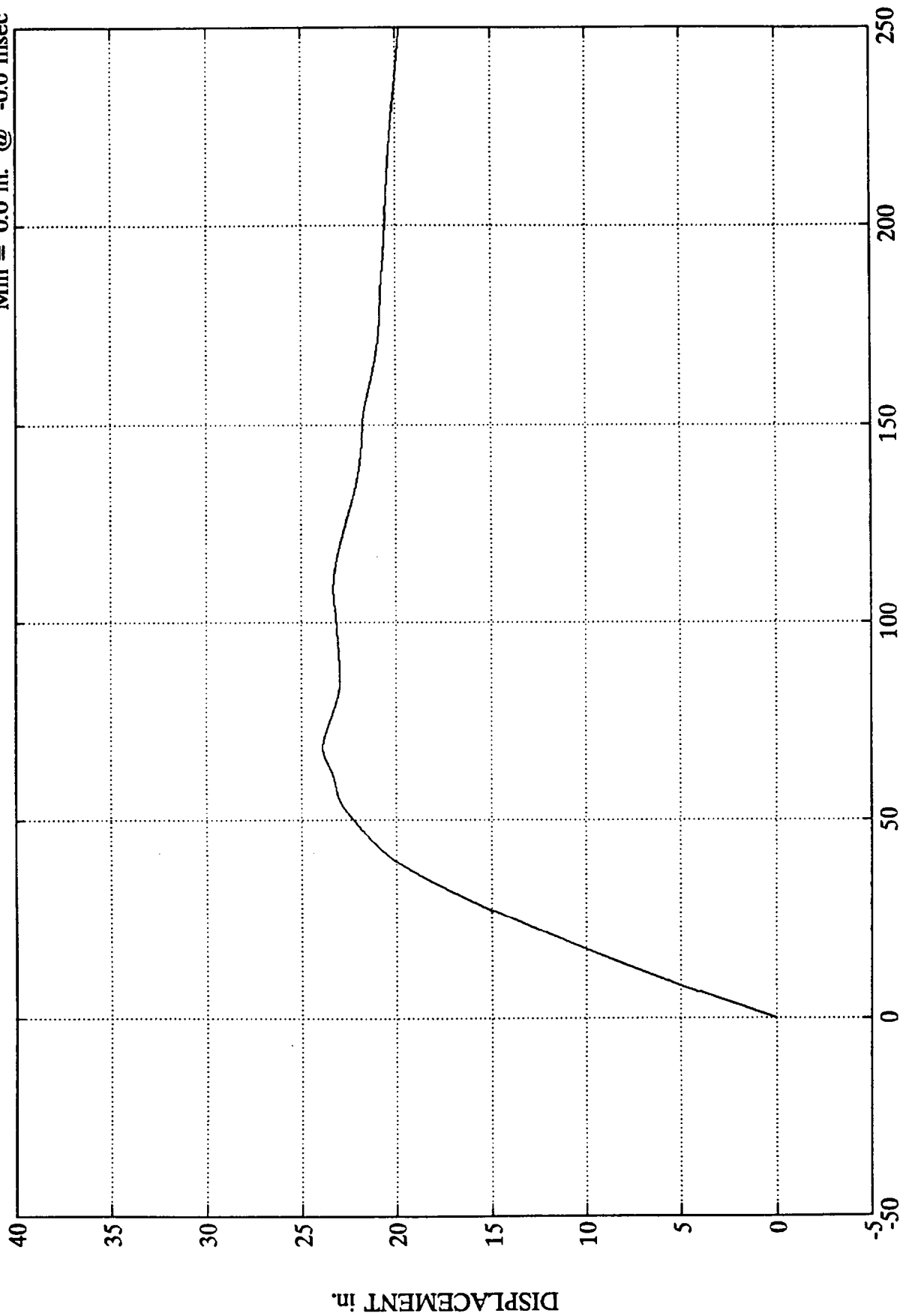


SAE FILTER CLASS 60

Test 1039

ACCELEROMETER #7(X)

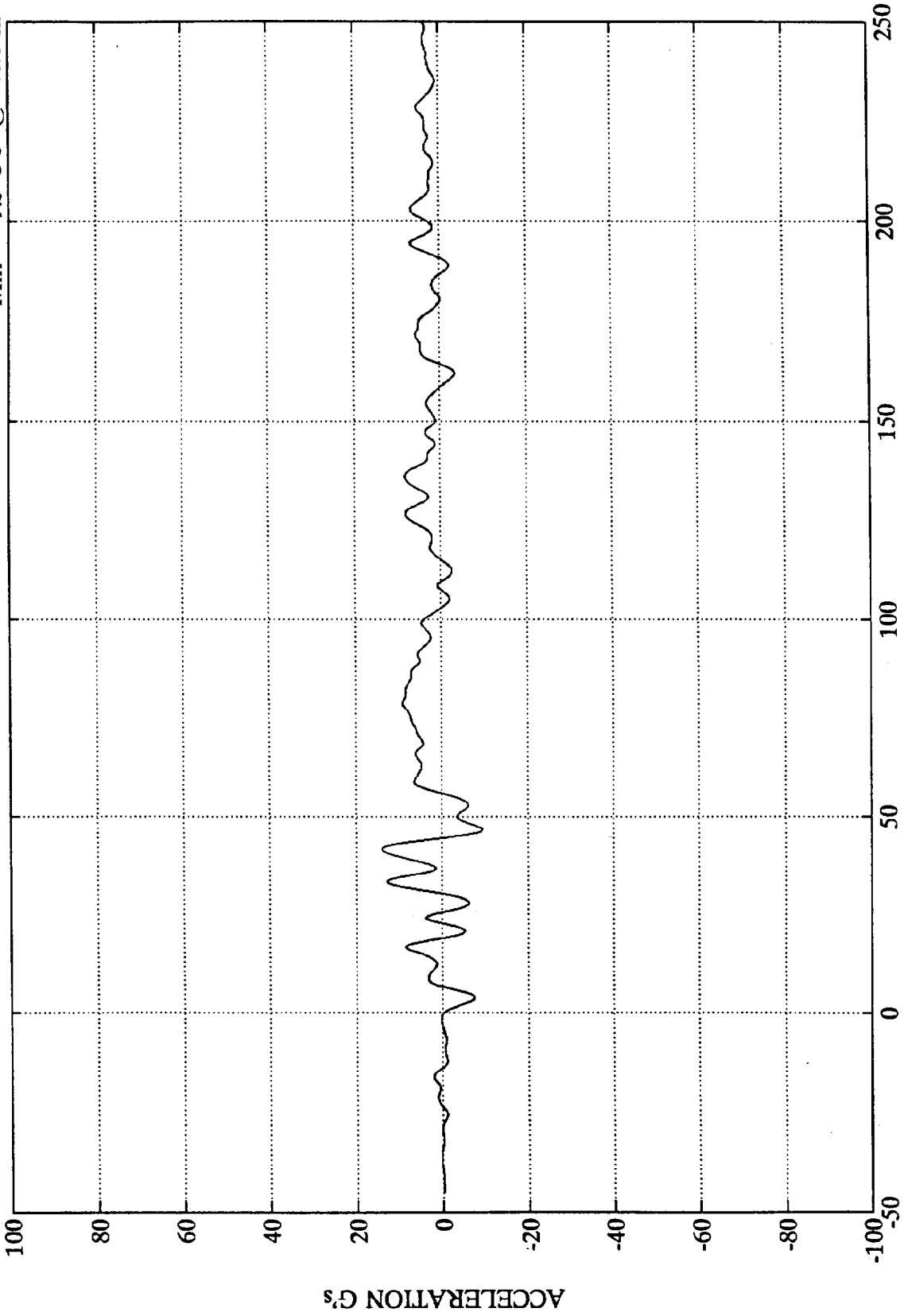
Max = 23.9 in. @ 68.9 msec
Min = 0.0 in. @ -0.0 msec



TIME (msec.)

SAE FILTER CLASS 60

Test 1039
ACCELEROMETER #8(Z)
Max = 14.0 G's @ 41.9 msec
Min = -9.5 G's @ 46.8 msec

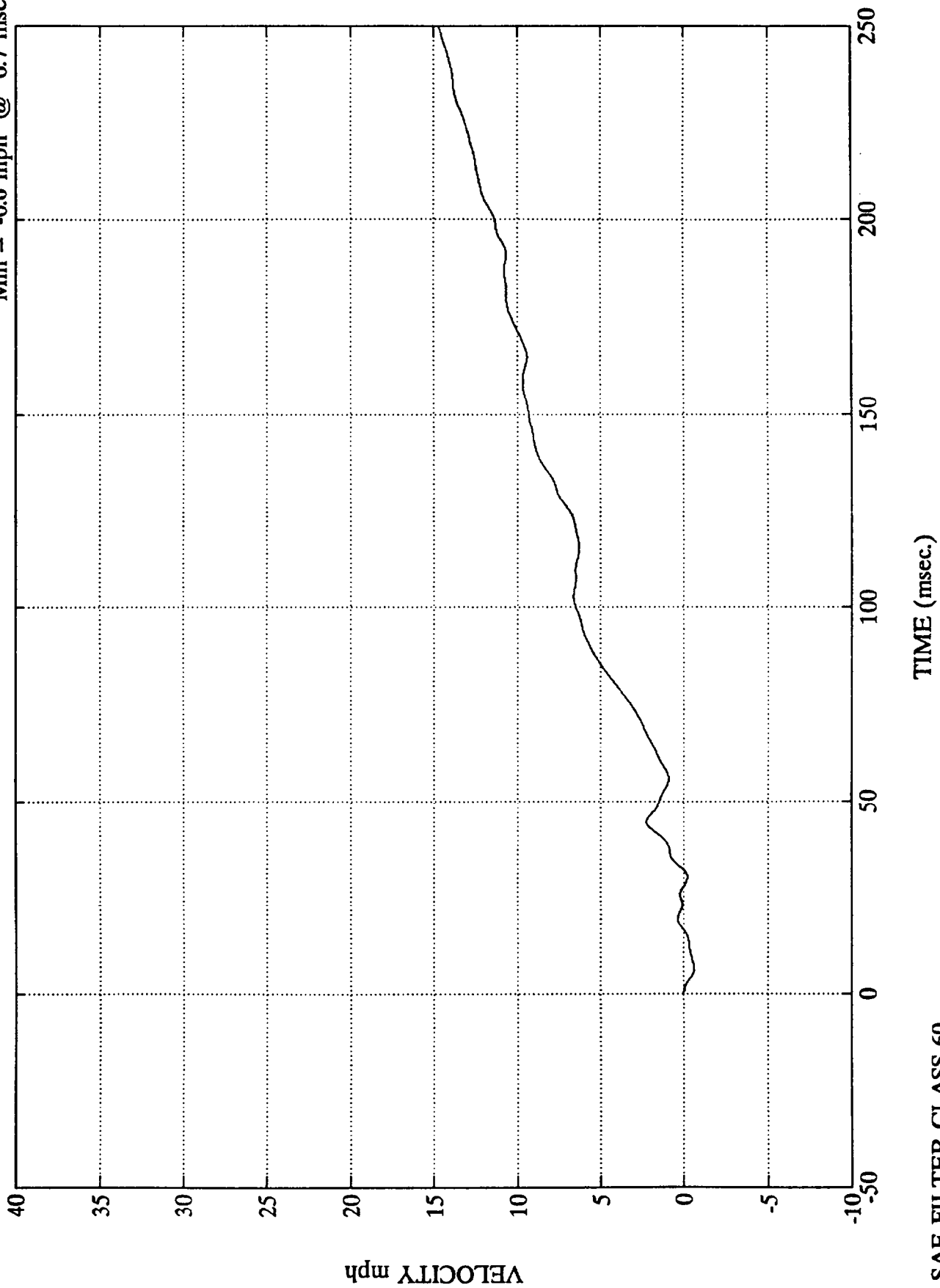


TIME (msec.)

SAE FILTER CLASS 60

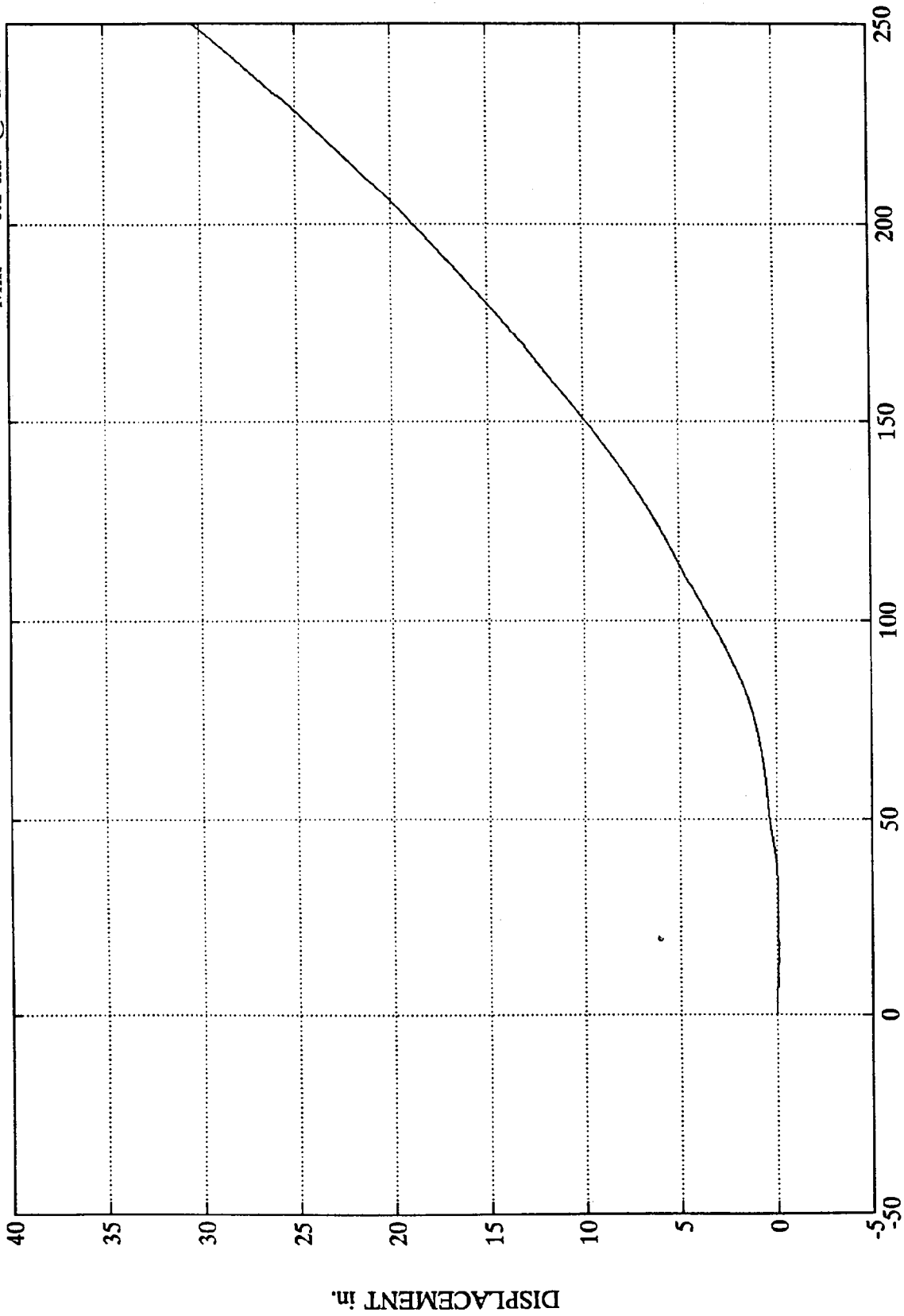
Test 1039
Max = 15.2 mph @ 254.9 msec
Min = -0.6 mph @ 6.7 msec

ACCELEROMETER #8(Z)



SAE FILTER CLASS 60

Test 1039
ACCELEROMETER #8(Z)
Max = 31.7 in. @ 254.9 msec
Min = -0.1 in. @ 16.6 msec

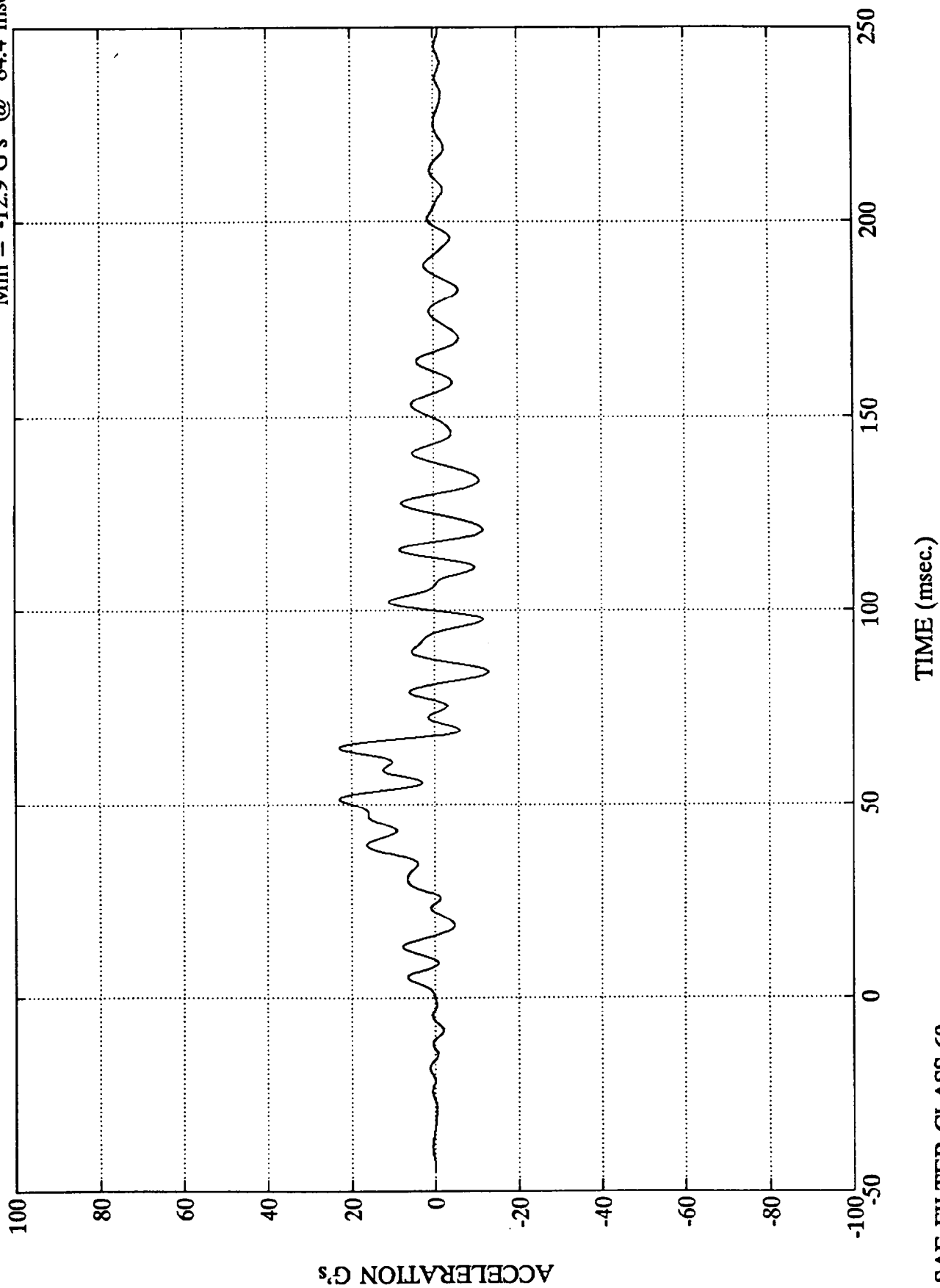


TIME (msec.)

SAE FILTER CLASS 60

Test 1039
Max = 22.9 G's @ 64.7 msec
Min = -12.9 G's @ 84.4 msec

ACCELEROMETER #9(Z)

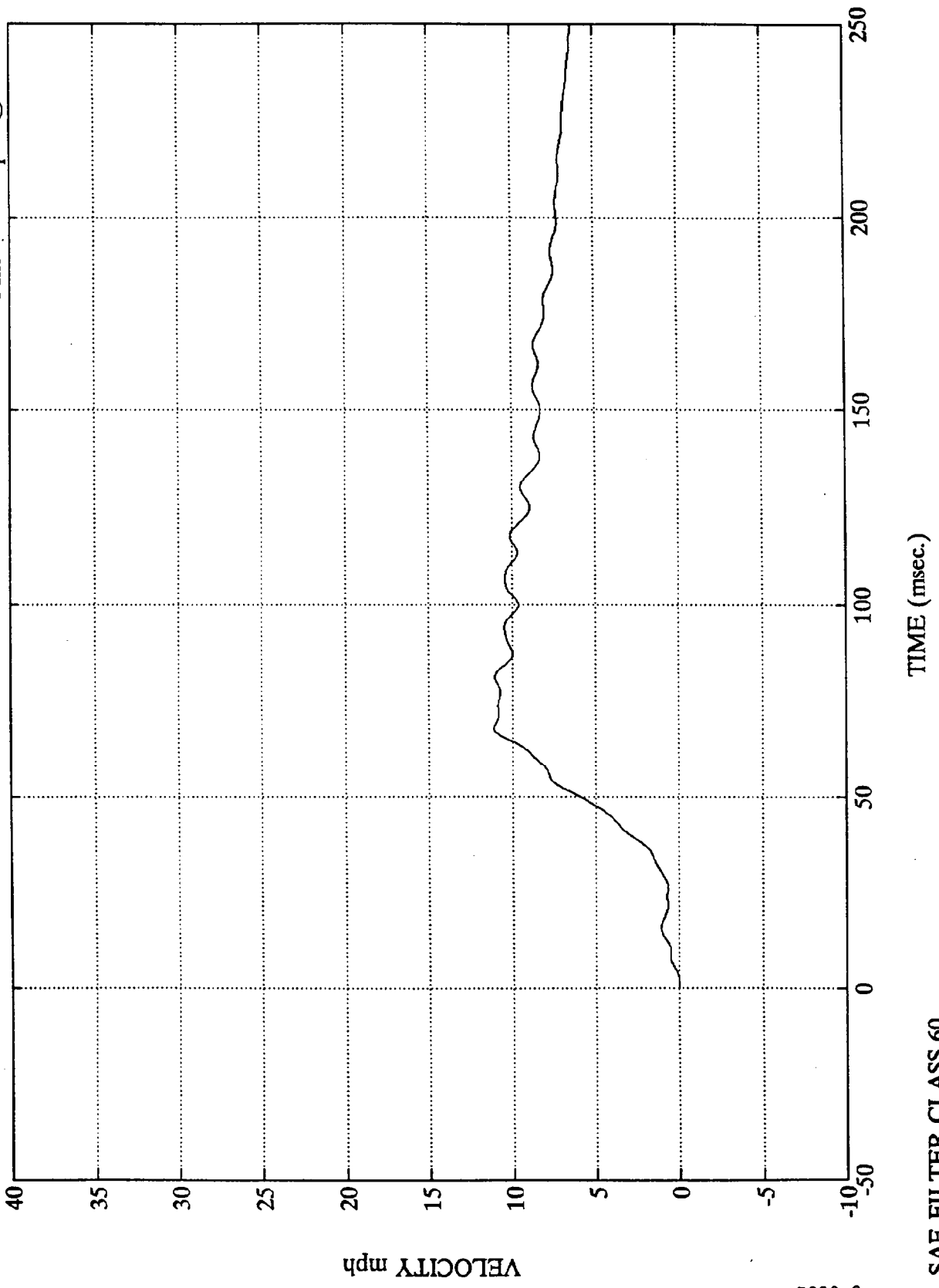


SAE FILTER CLASS 60

Test 1039
ACCELEROMETER #9(Z)
Max = 11.1 mph @ 68.2 msec
Min = 0.0 mph @ -0.0 msec

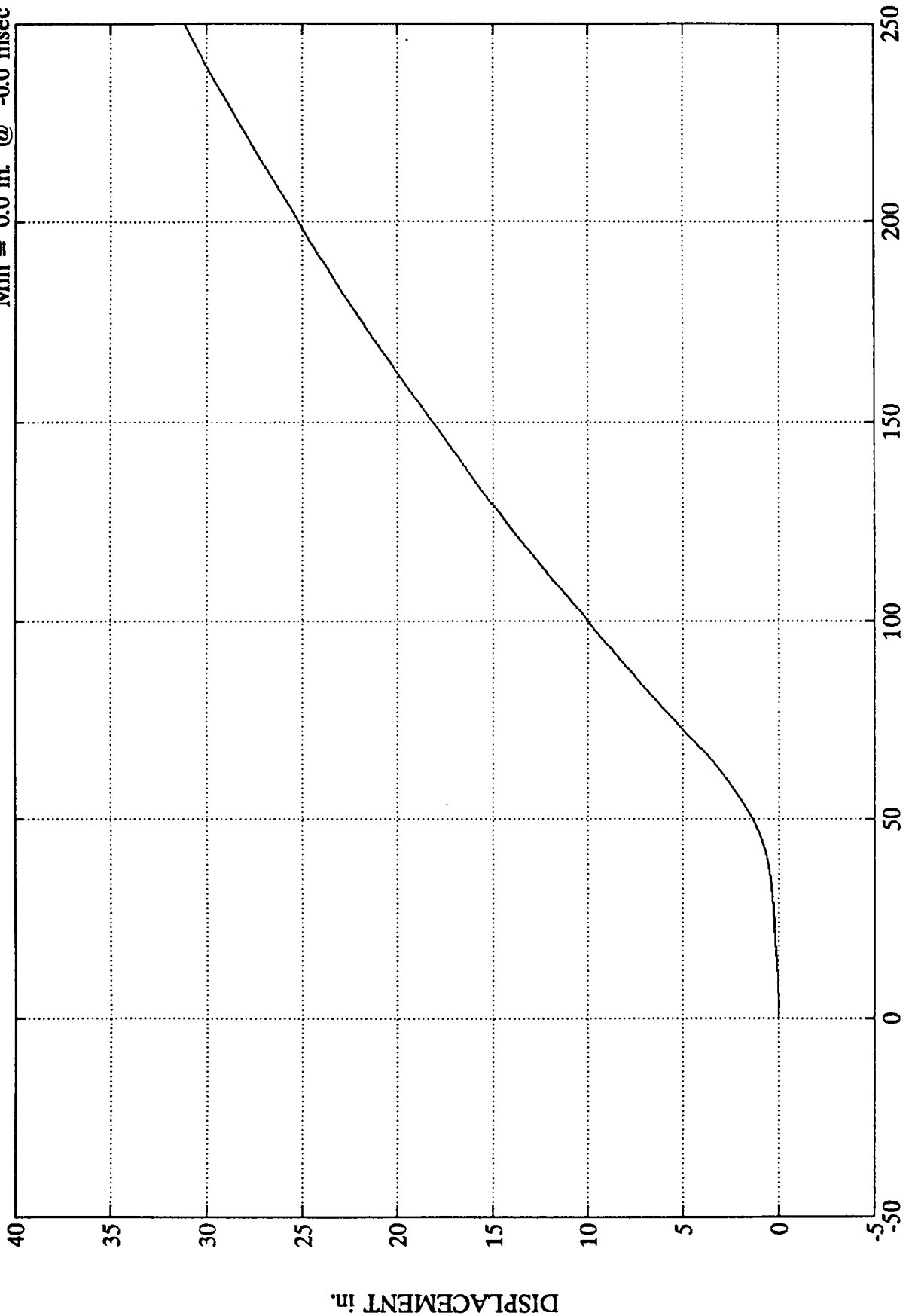
SAE FILTER CLASS 60

7893-2



Test 1039
Max = 31.8 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec

ACCELEROMETER #9(Z)



TIME (msec.)

SAE FILTER CLASS 60

TEST NO. MM5101

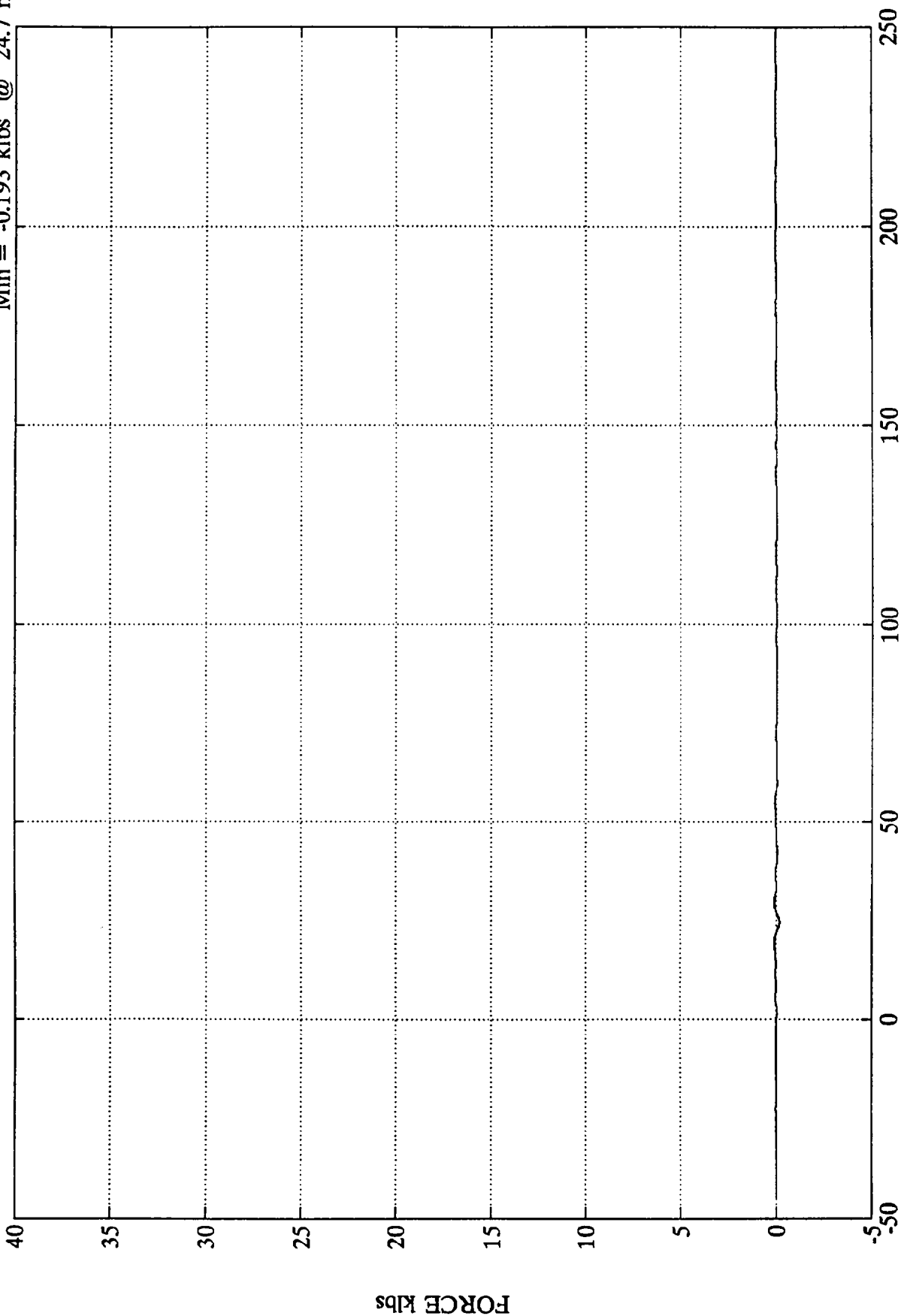
LOAD CELL BARRIER DATA

FILTER CHANNEL CLASS

60

Test 1039
Max = 0.114 klbs @ 19.6 msec
Min = -0.193 klbs @ 24.7 msec

BARRIER LOAD CELL A1

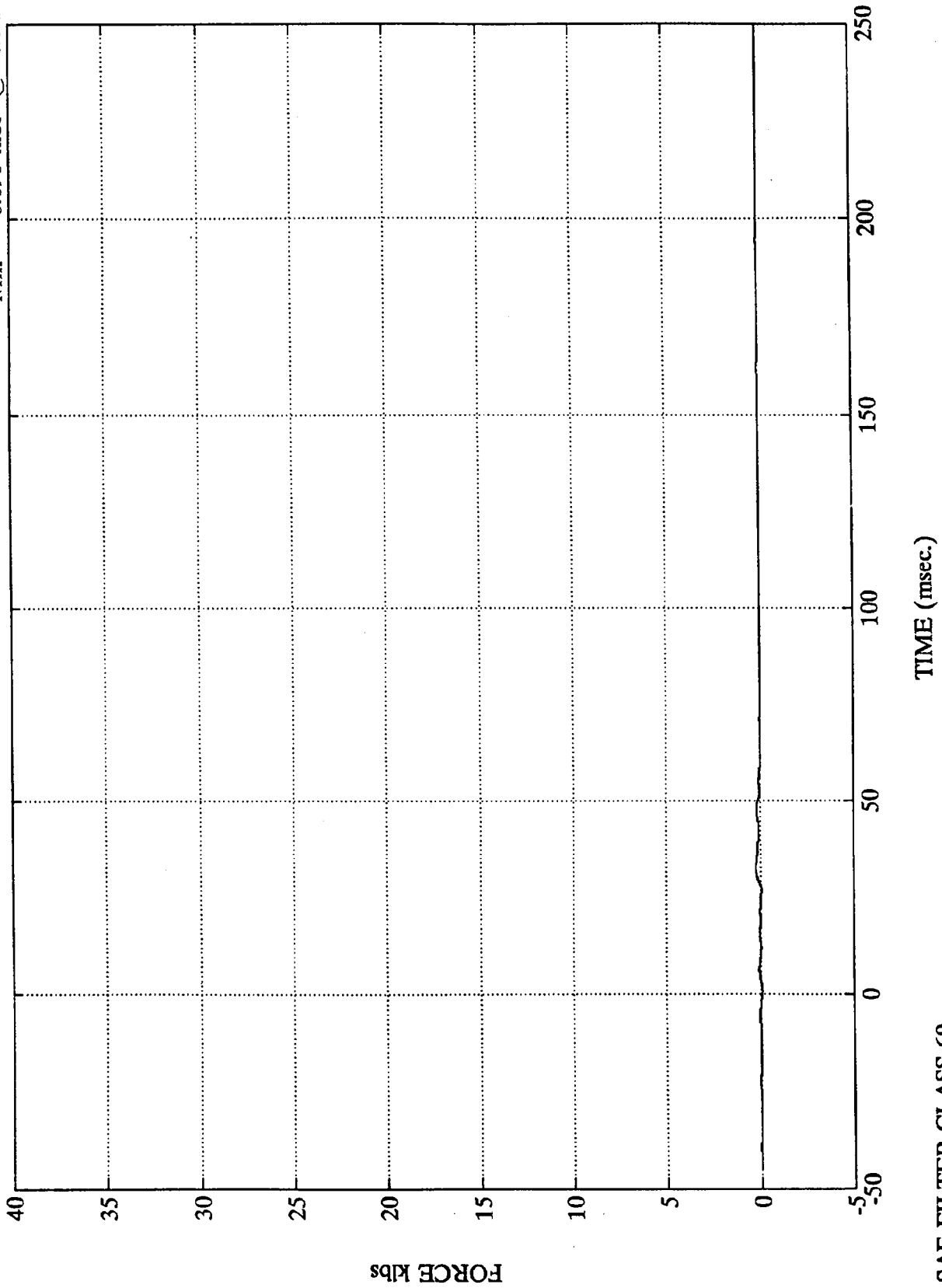


TIME (msec.)

SAE FILTER CLASS 60

Test 1039

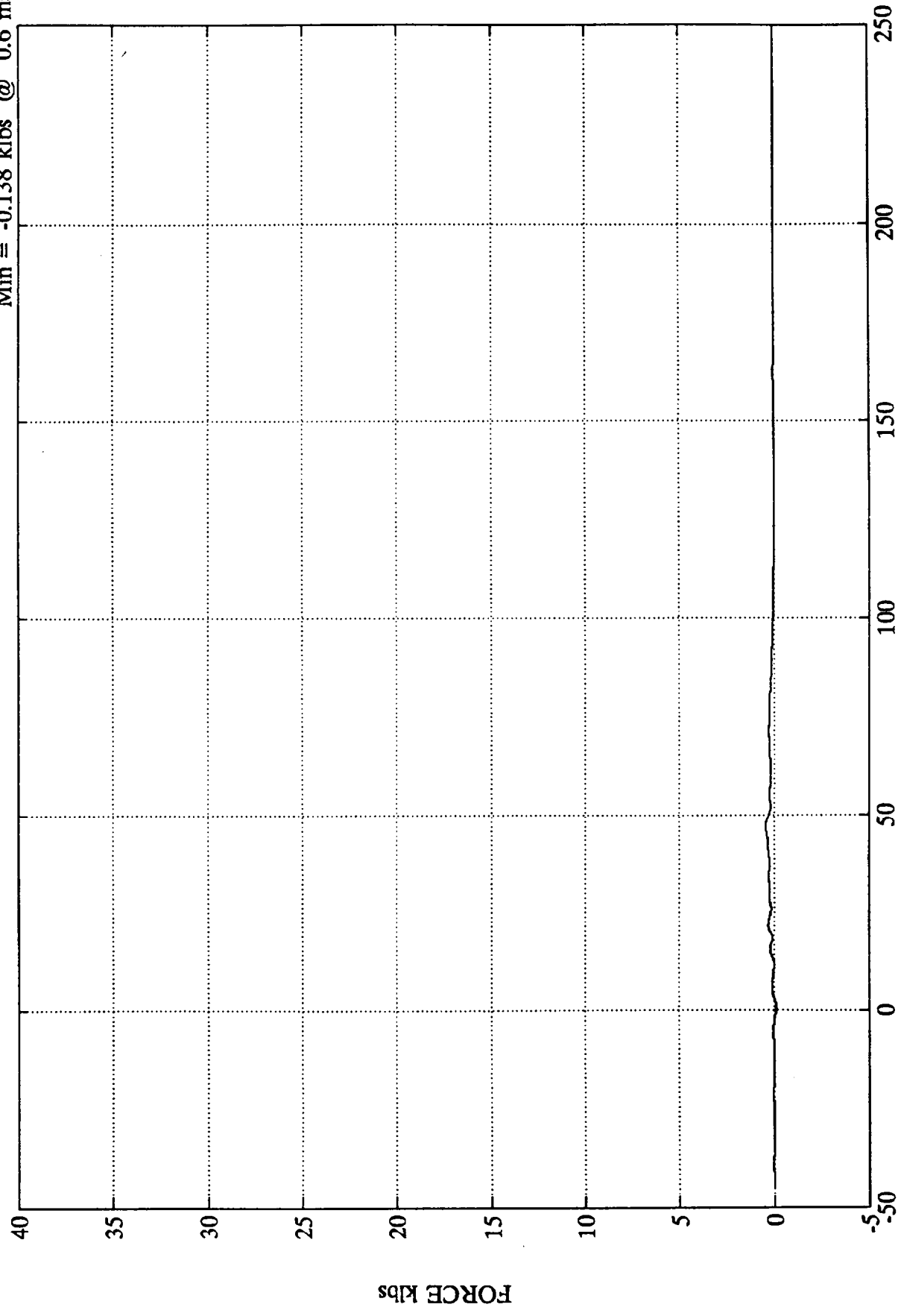
Test 1039
BARRIER LOAD CELL A2
Max = 0.232 klbs @ 31.9 msec
Min = -0.090 klbs @ 0.8 msec



SAE FILTER CLASS 60

Test 1039
Max = 0.453 klbs @ 47.3 msec
Min = -0.138 klbs @ 0.6 msec

BARRIER LOAD CELL A3



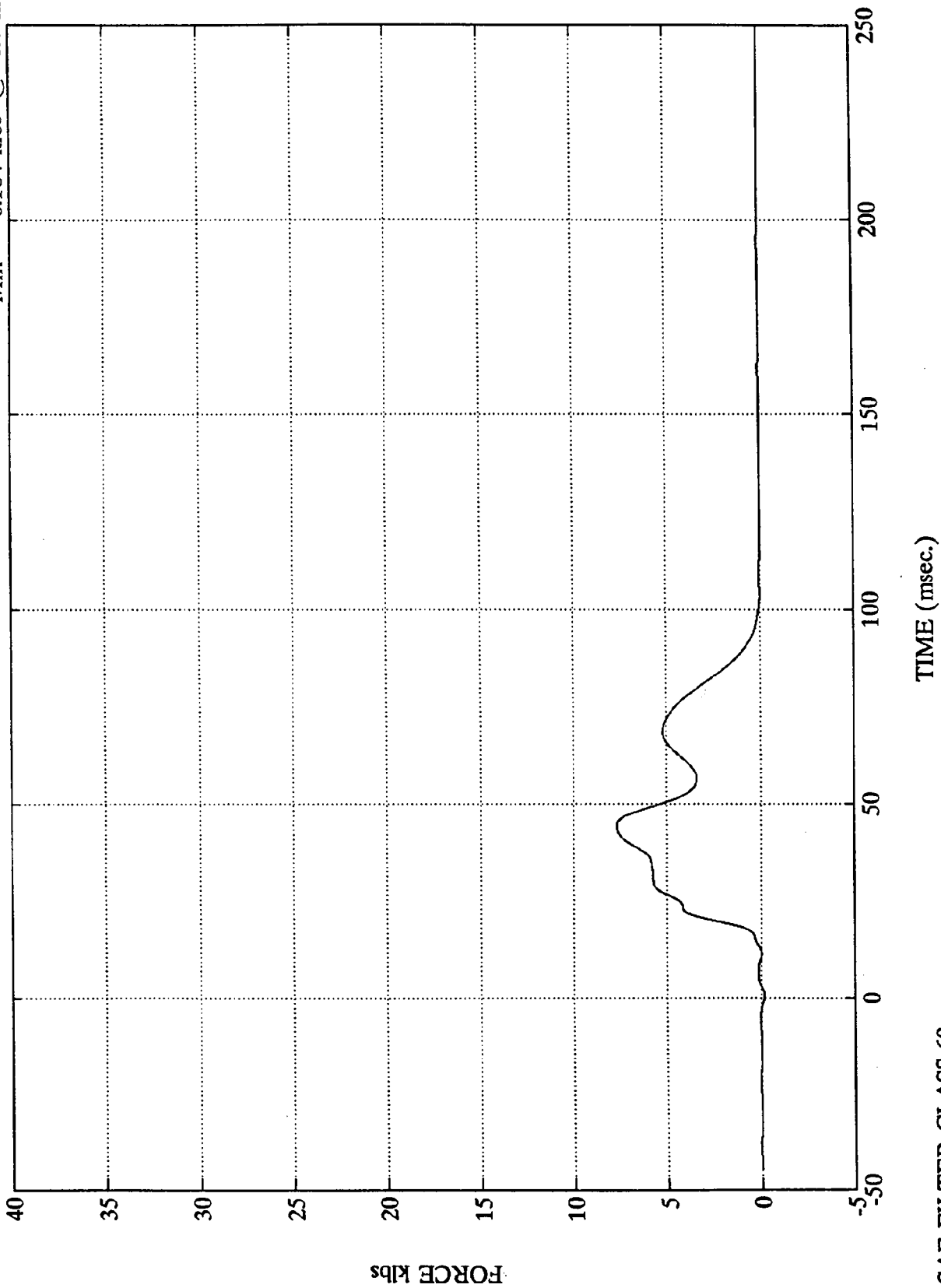
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL A4

Max = 7.711 klbs @ 44.4 msec
Min = -0.184 klbs @ 0.7 msec



FORCE klbs

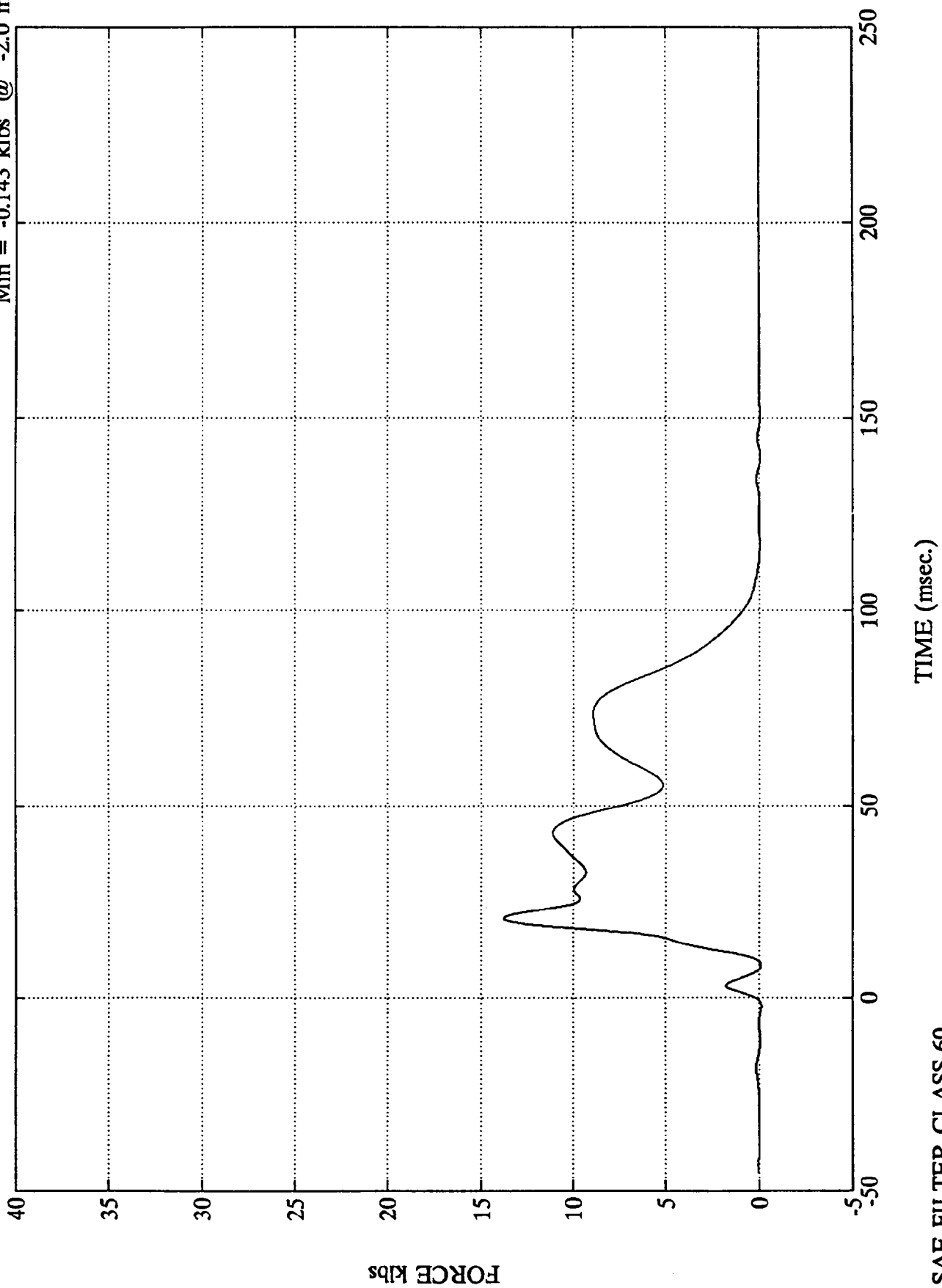
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL A5

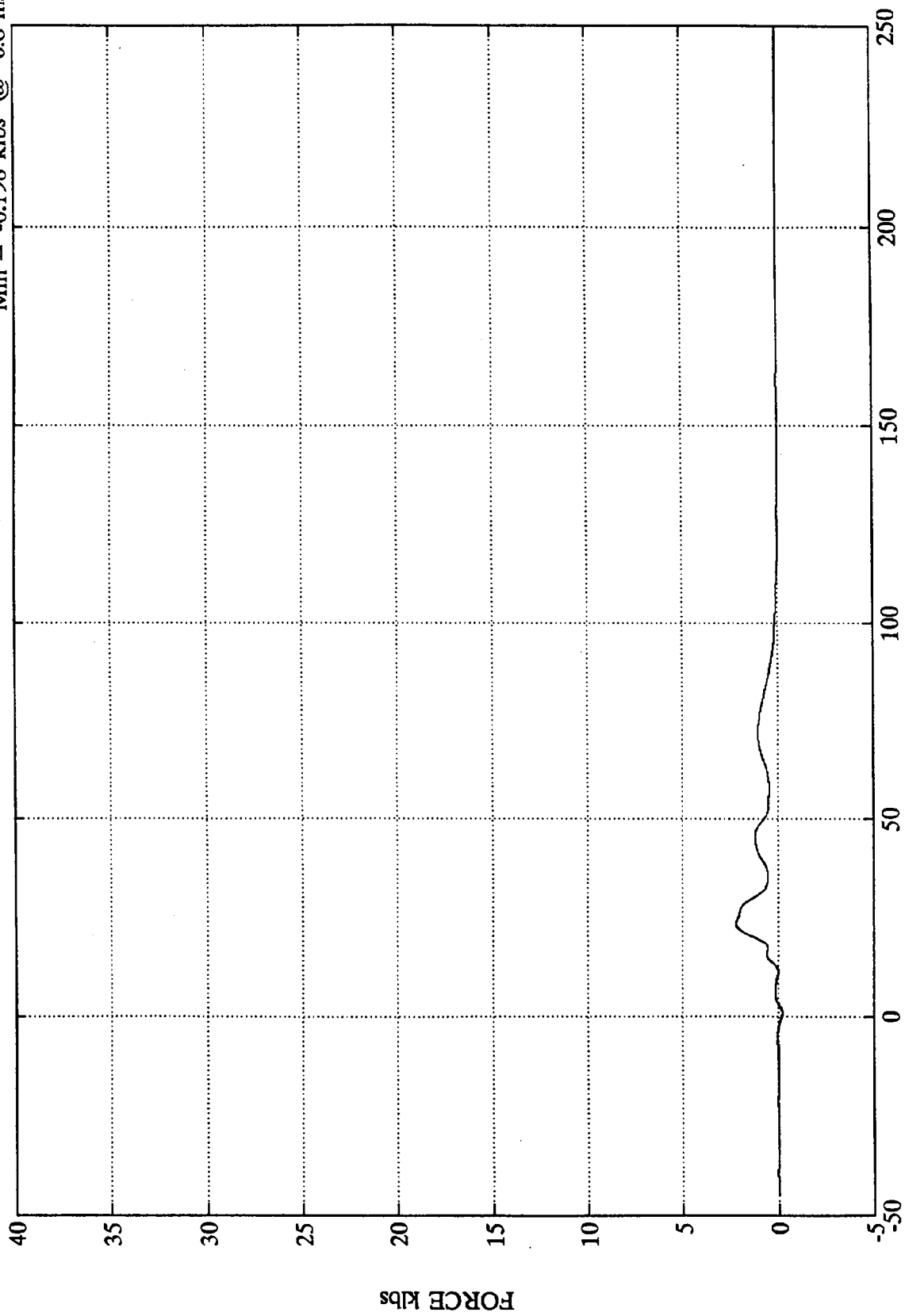
Max = 13.757 klbs @ 20.5 msec
Min = -0.143 klbs @ -2.0 msec



Test 1039

BARRIER LOAD CELL A6

Max = 2.215 klbs @ 23.5 msec
Min = -0.198 klbs @ 0.8 msec



FORCE klbs

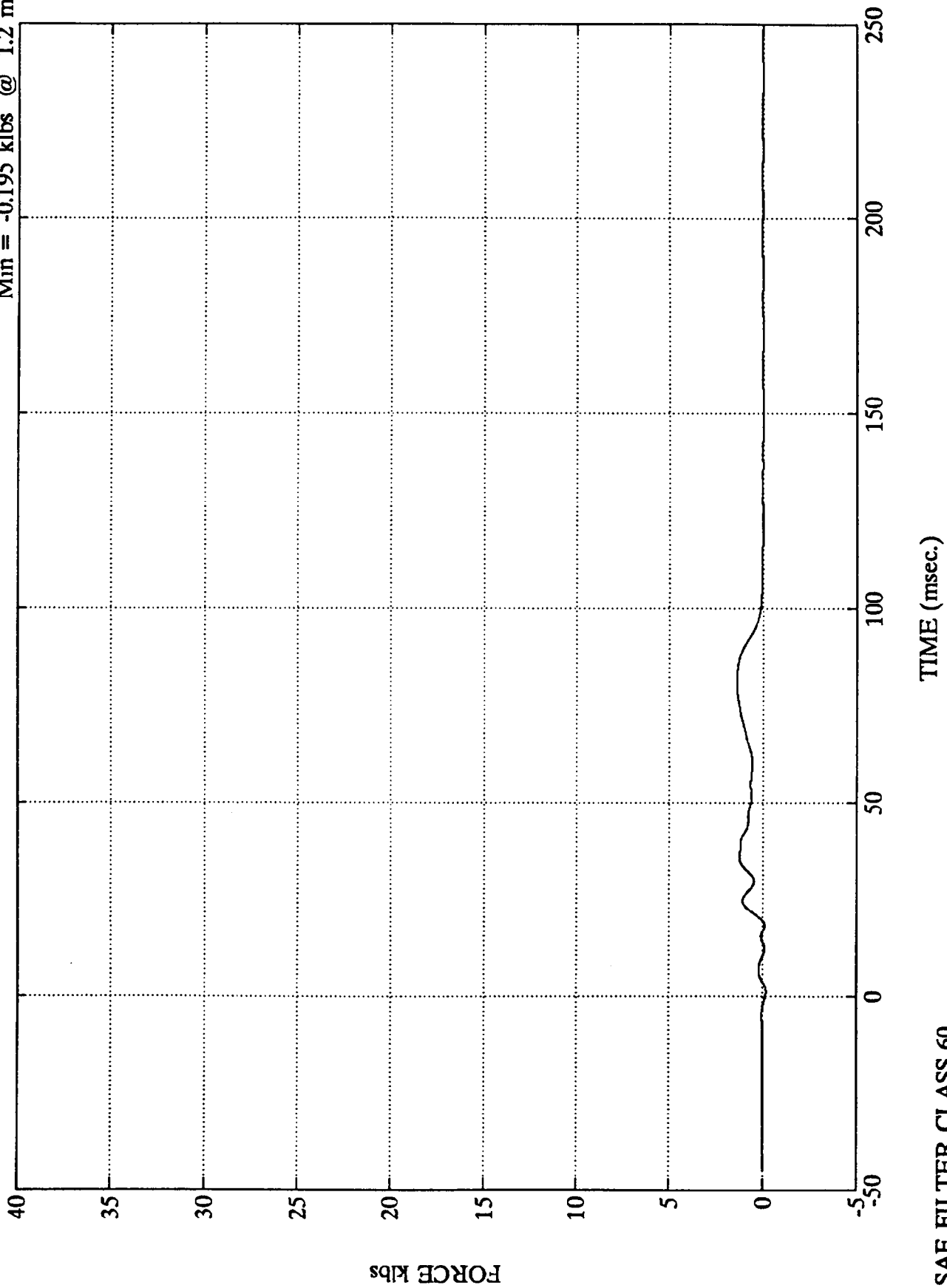
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL A7

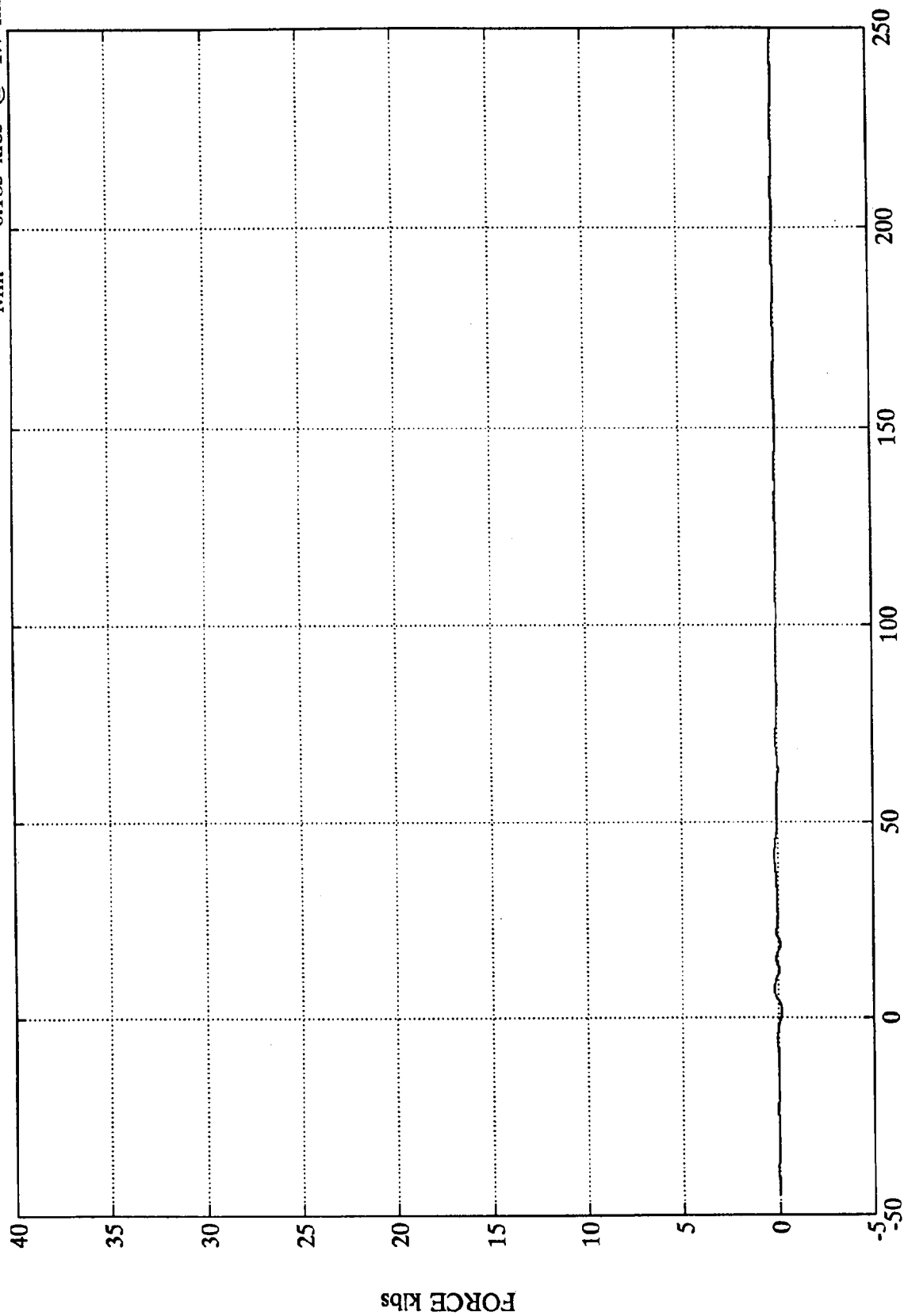
Max = 1.397 klbs @ 82.2 msec
Min = -0.195 klbs @ 1.2 msec



Test 1039

BARRIER LOAD CELL A8

Max = 0.199 klbs @ 6.8 msec
Min = -0.185 klbs @ 1.7 msec



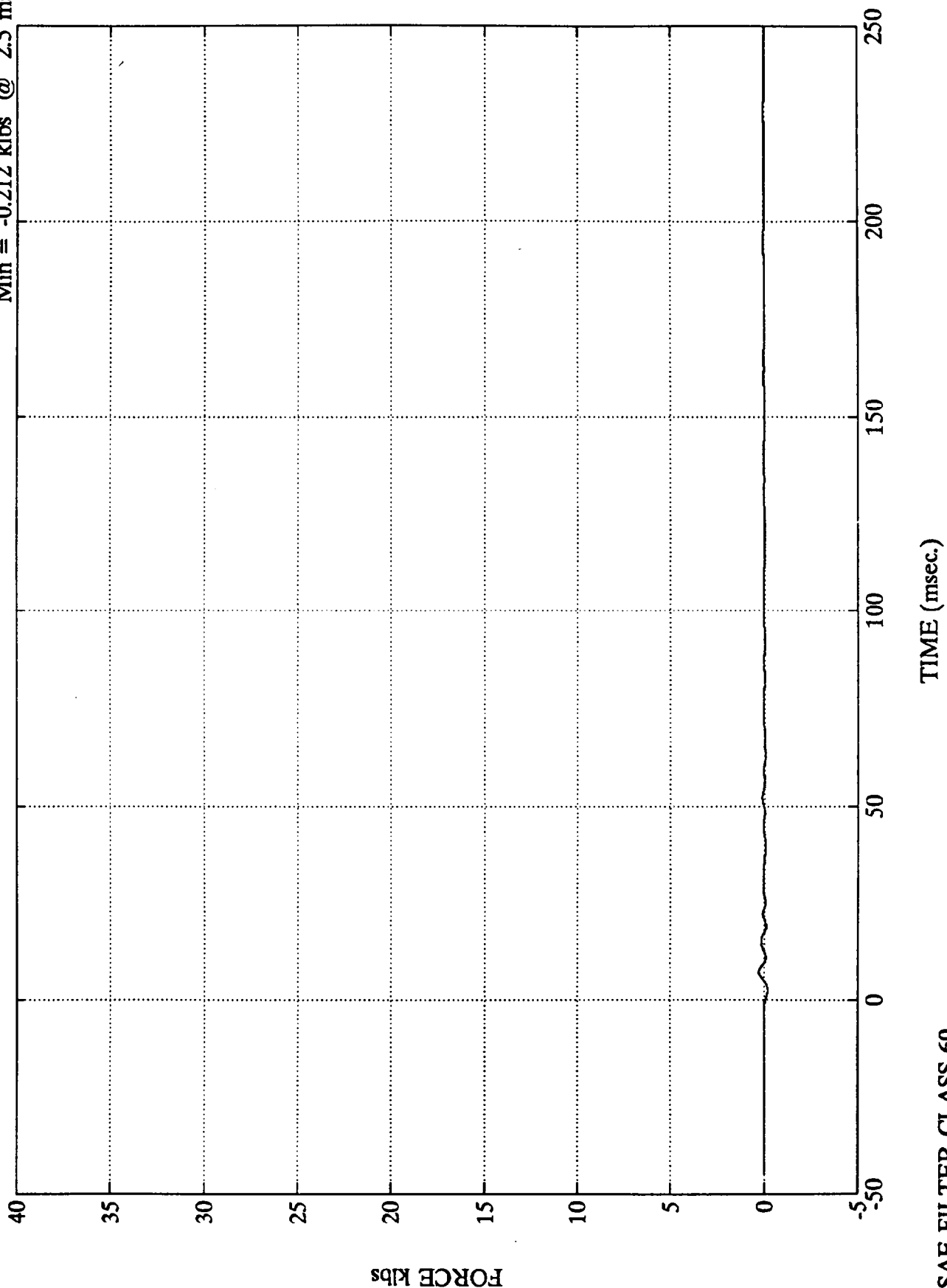
TIME (msec.)

SAE FILTER CLASS 60

FORCE klbs

Test 1039
Max = 0.271 klbs @ 7.2 msec
Min = -0.212 klbs @ 2.5 msec

BARRIER LOAD CELL A9

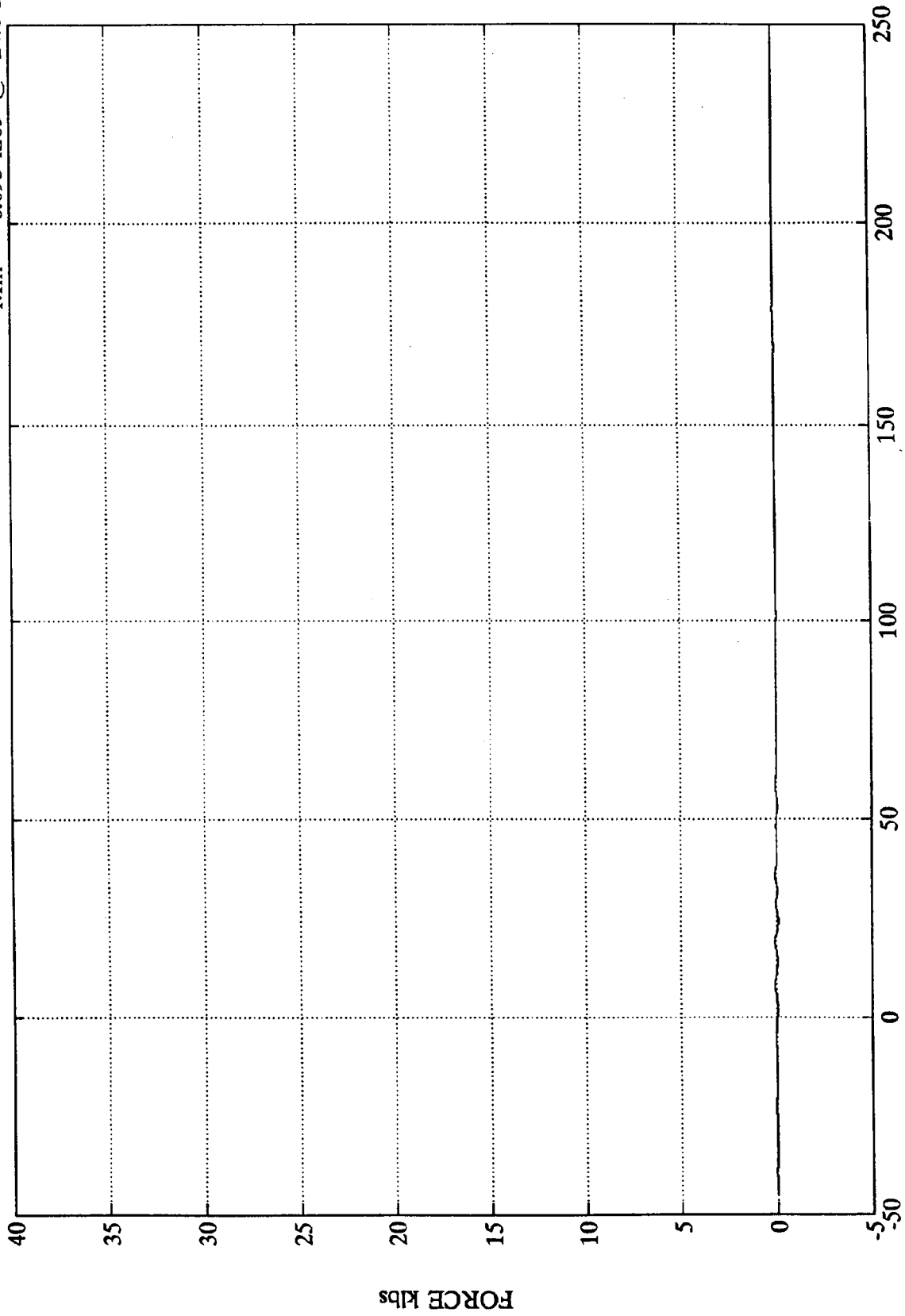


SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL B1

Max = 0.112 klbs @ 19.0 msec
Min = -0.093 klbs @ 24.0 msec



B-34

7893-2

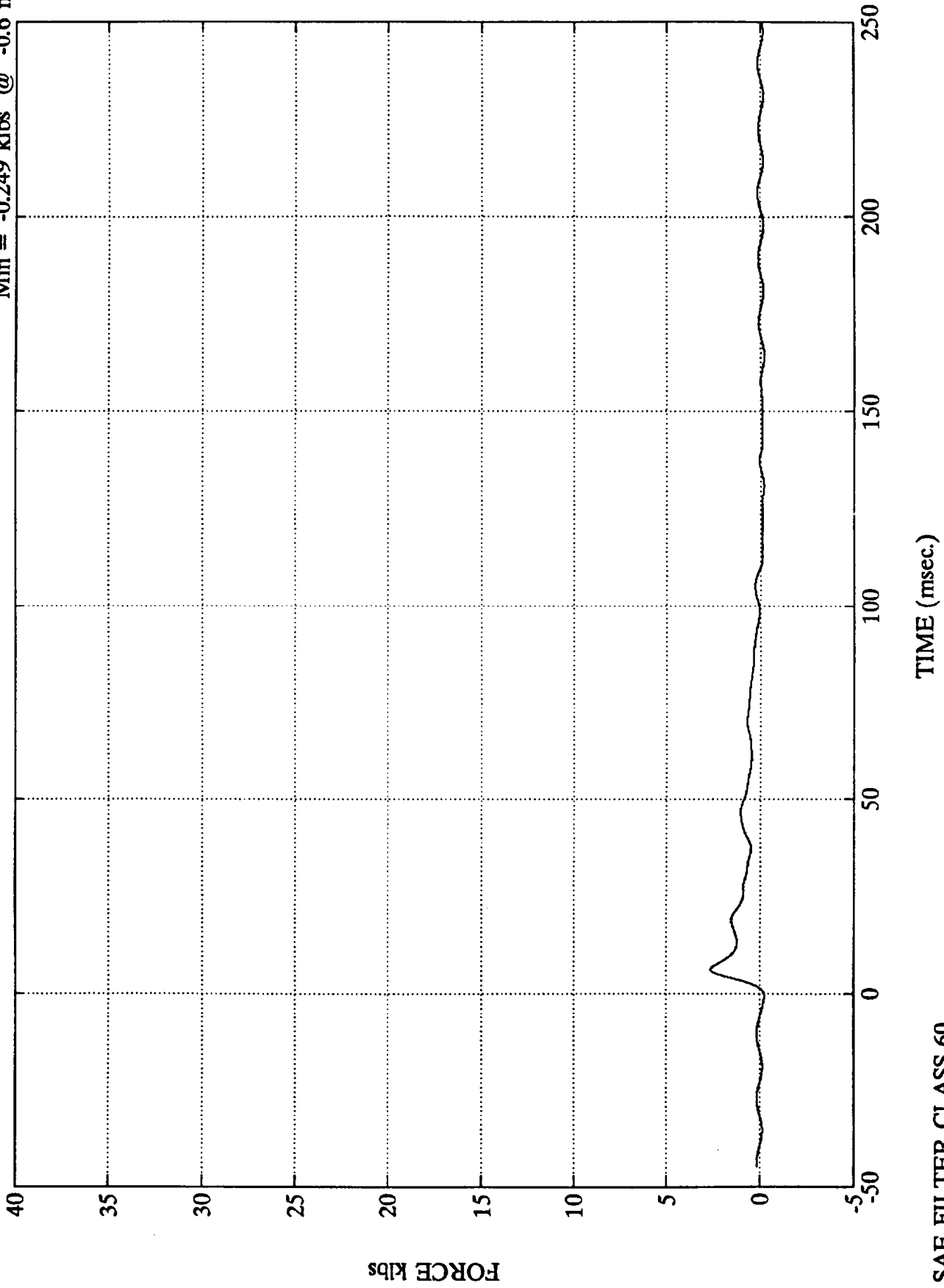
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL B2

Max = 2.647 klbs @ 6.1 msec
Min = -0.249 klbs @ -0.6 msec



B-35

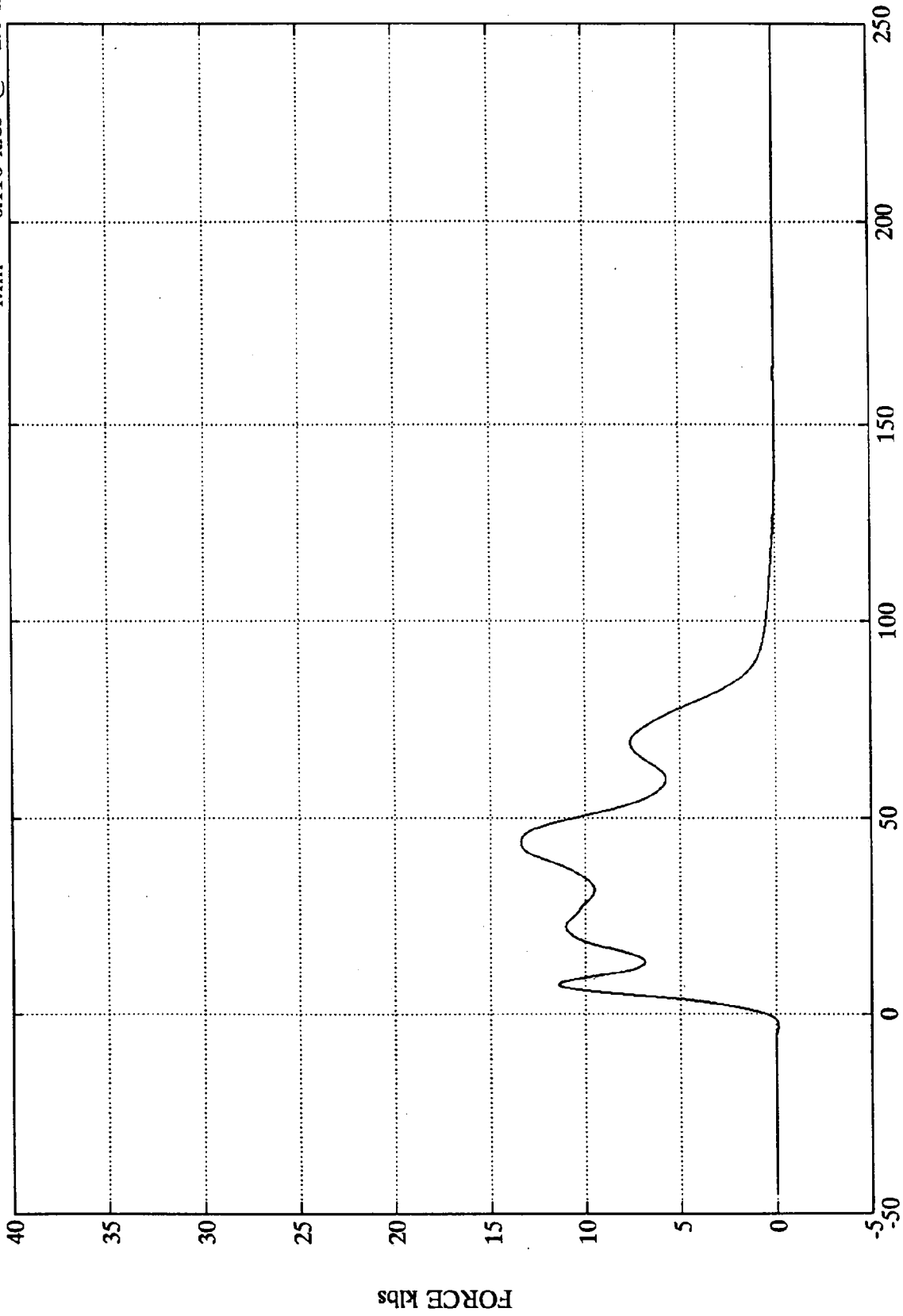
7893-2

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL B3

Max = 13.403 klbs @ 43.8 msec
Min = -0.116 klbs @ -2.6 msec



B-36

7893-2

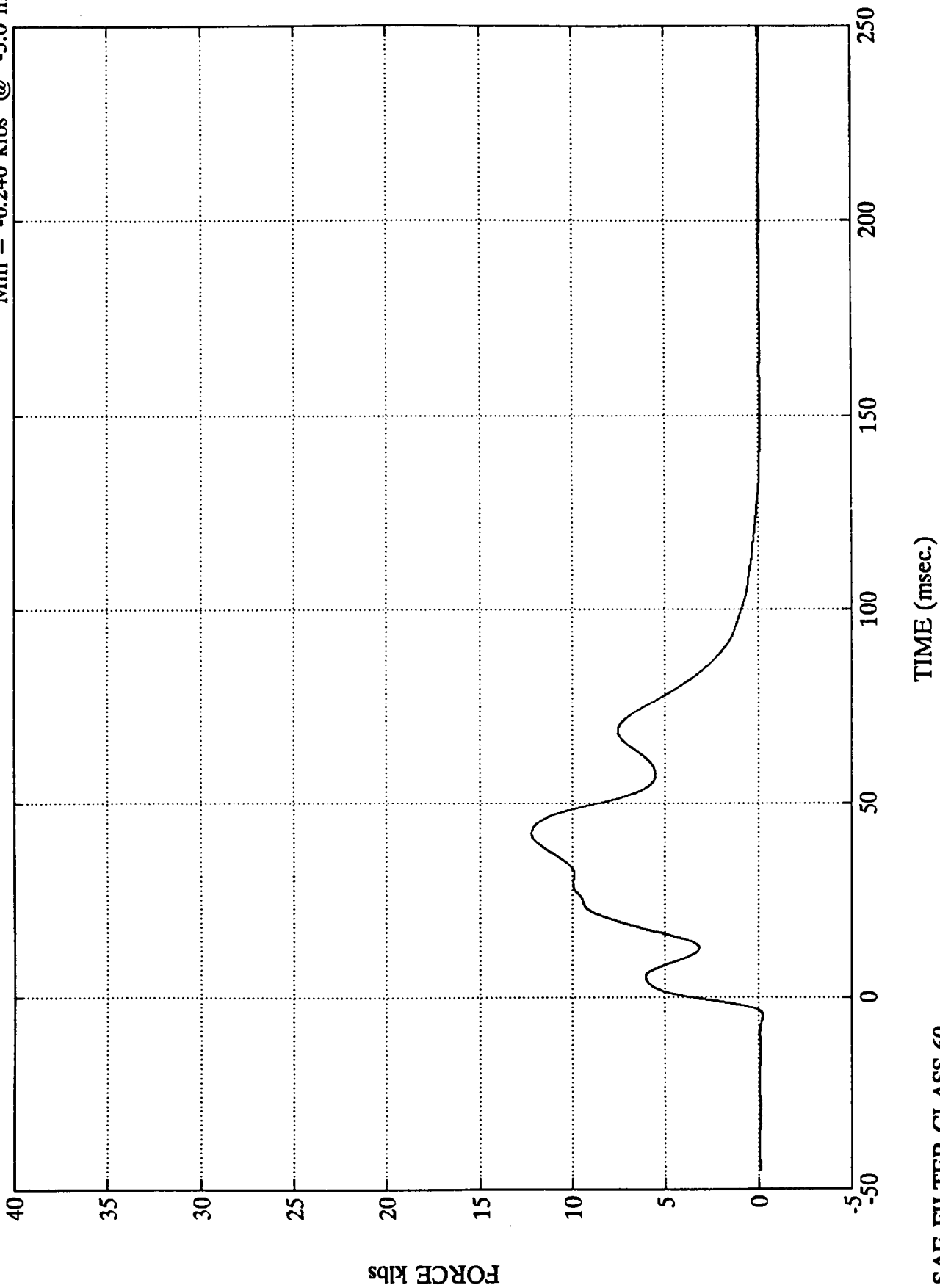
TIME (msec.)

SAE FILTER CLASS 60

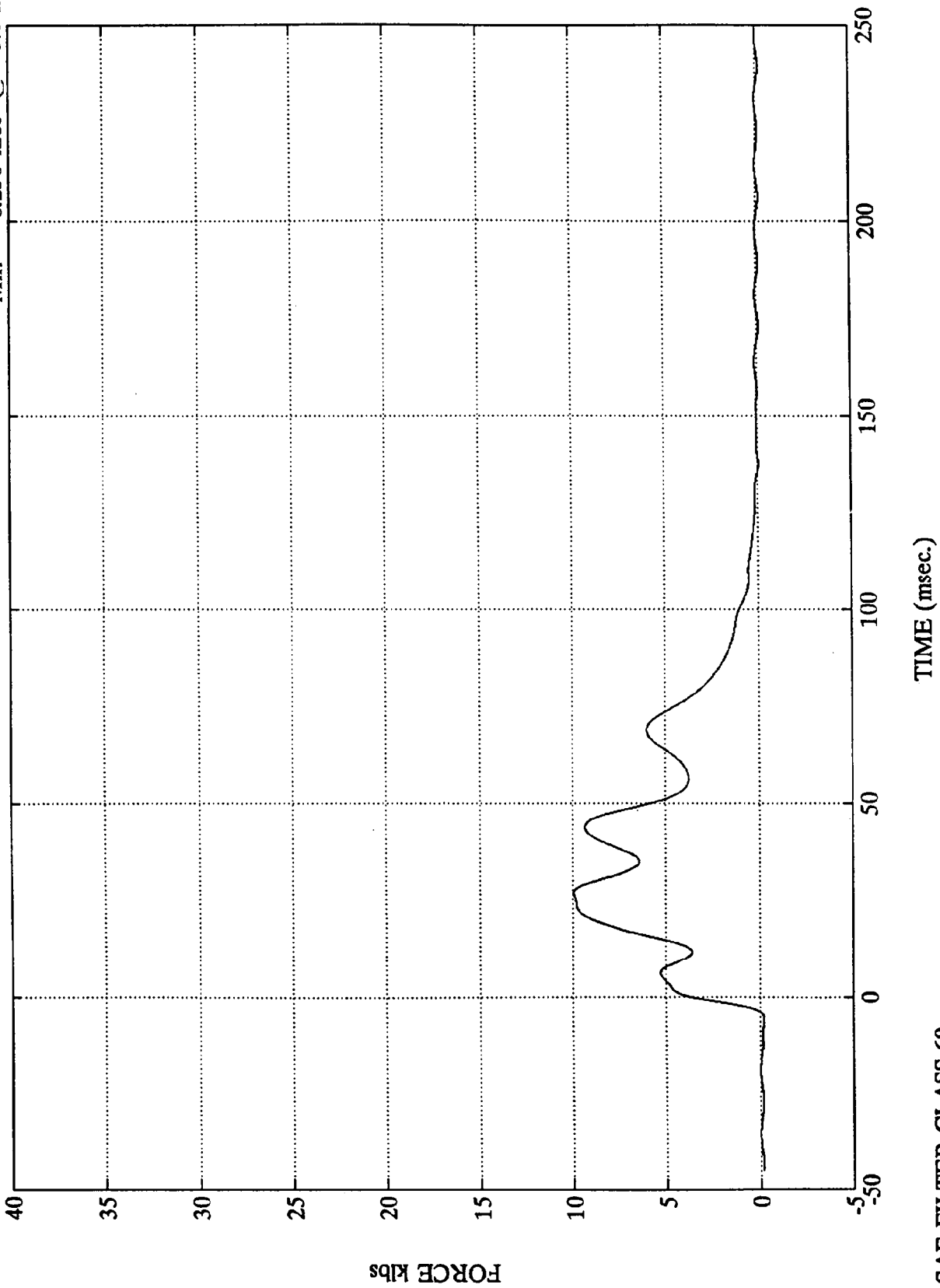
Test 1039

BARRIER LOAD CELL B4

Max = 12.201 klbs @ 42.1 msec
Min = -0.240 klbs @ -5.0 msec



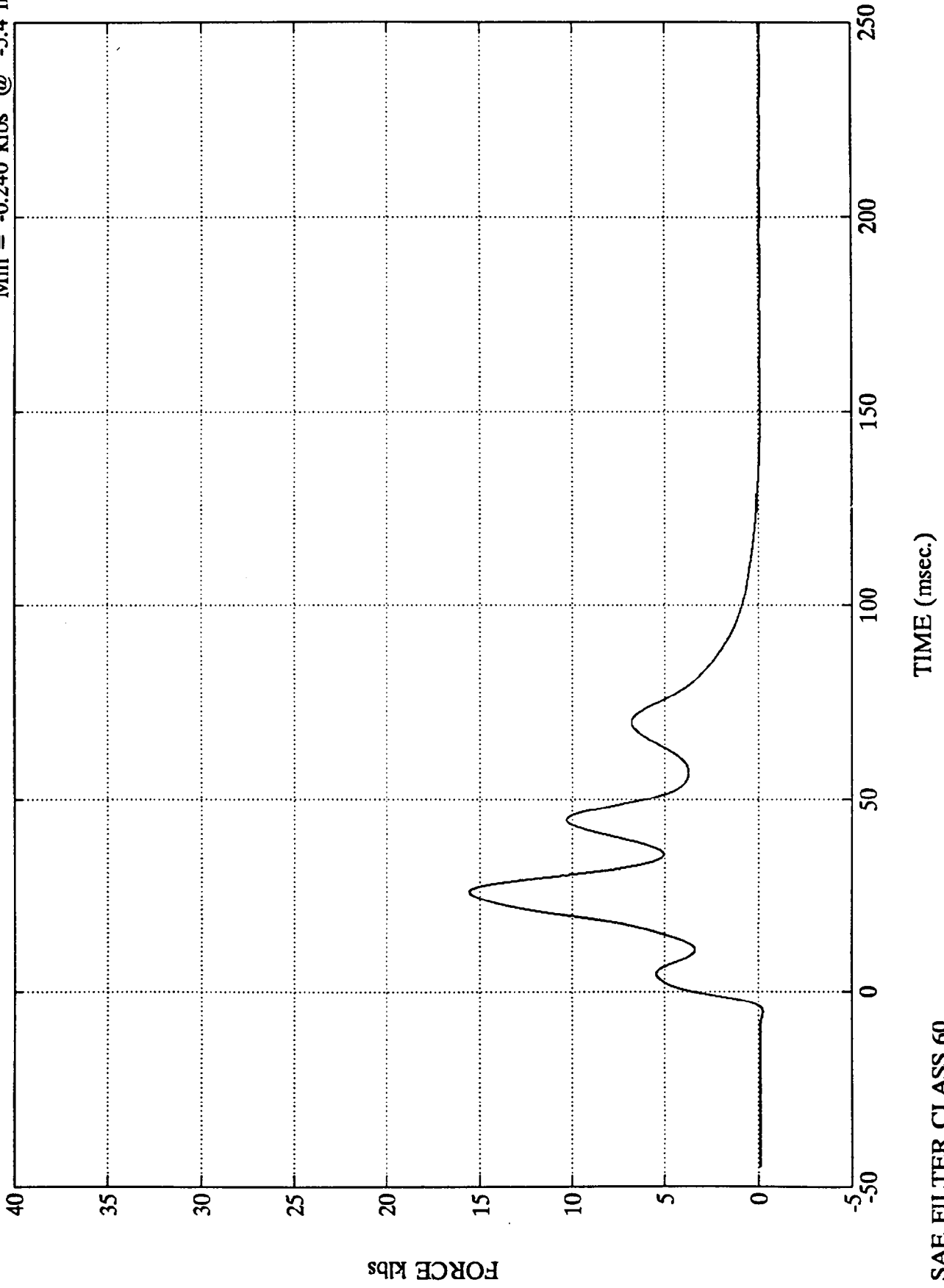
Test 1039
BARRIER LOAD CELL B5
Max = 9.968 klbs @ 27.0 msec
Min = -0.236 klbs @ -5.6 msec



Test 1039

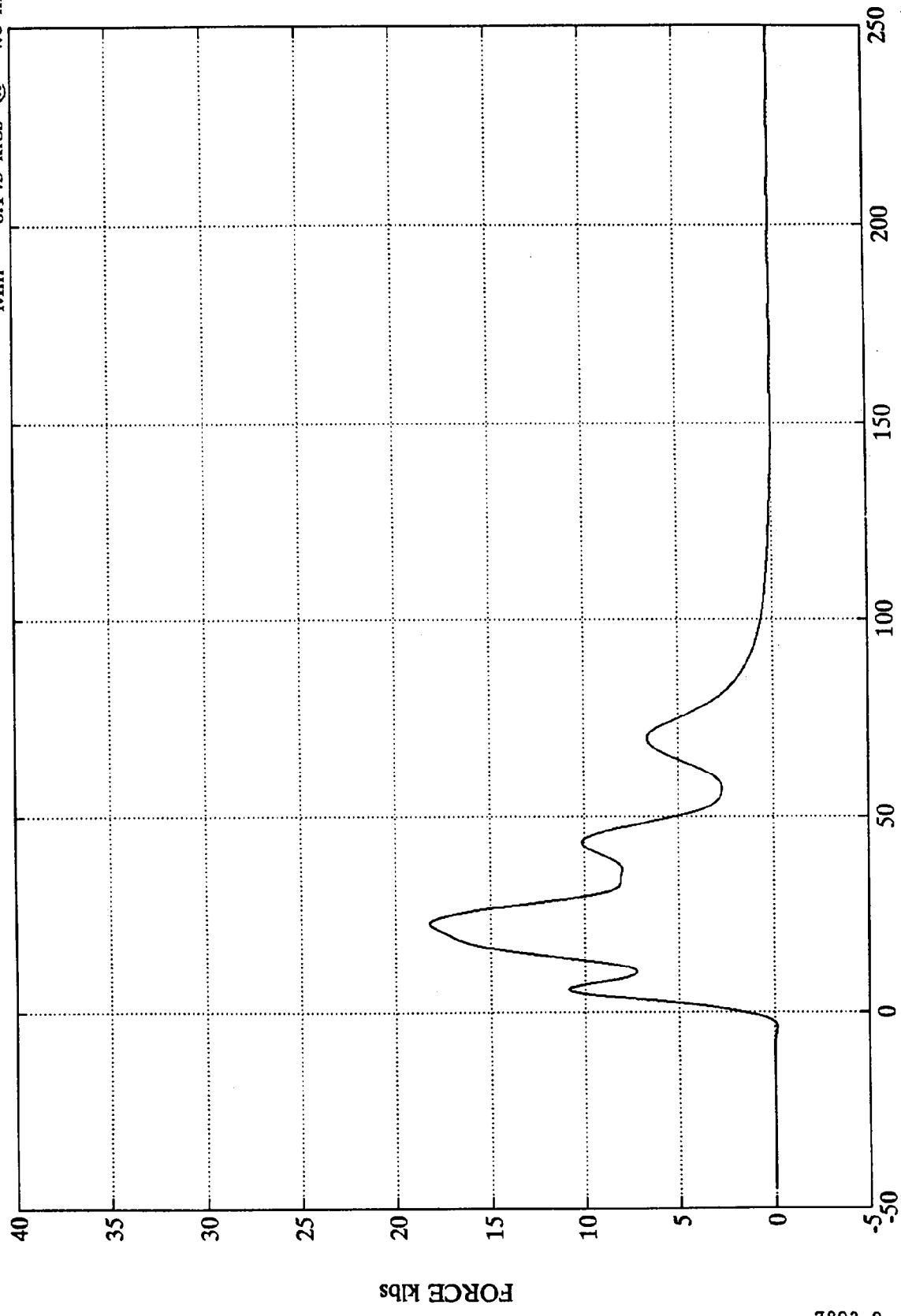
BARRIER LOAD CELL B6

Max = 15.558 klbs @ 26.4 msec
Min = -0.240 klbs @ -5.4 msec



Test 1039
Max = 18.226 klbs @ 22.9 msec
Min = -0.143 klbs @ -4.0 msec

BARRIER LOAD CELL B7



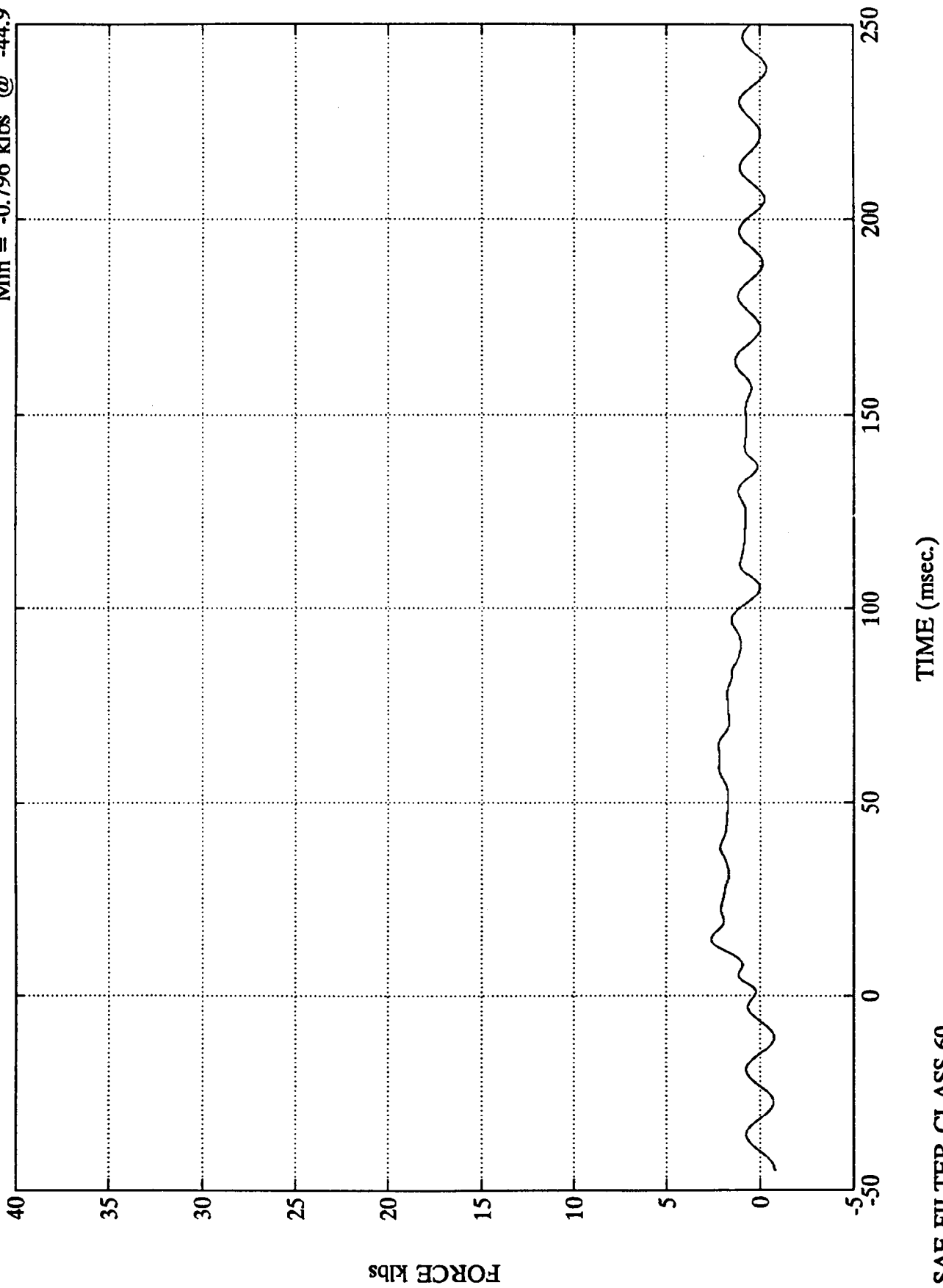
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL B8

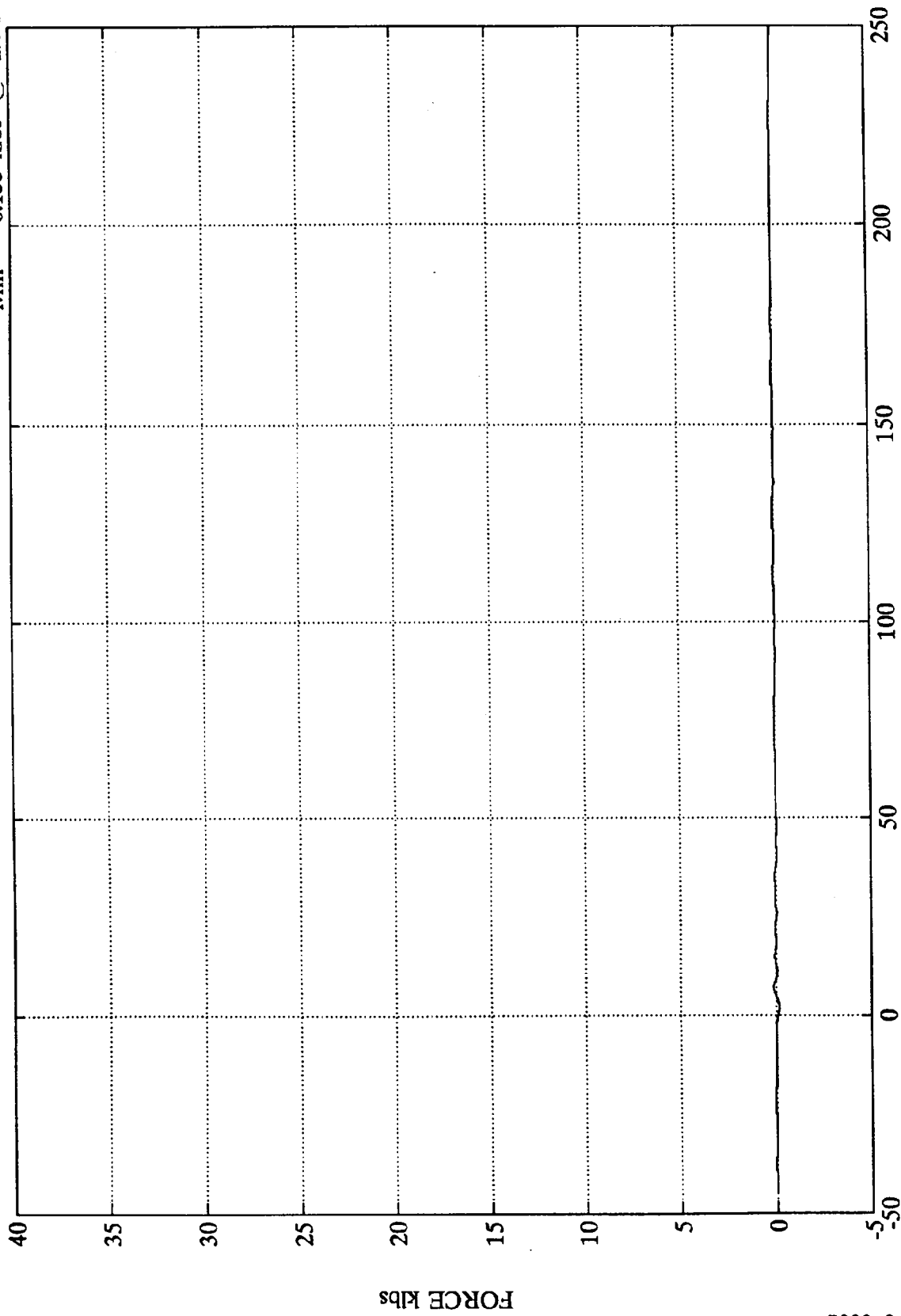
Max = 2.609 klbs @ 14.5 msec
Min = -0.796 klbs @ -44.9 msec



Test 1039

BARRIER LOAD CELL B9

Max = 0.137 klbs @ 7.0 msec
Min = -0.153 klbs @ 2.0 msec



TIME (msec.)

SAE FILTER CLASS 60

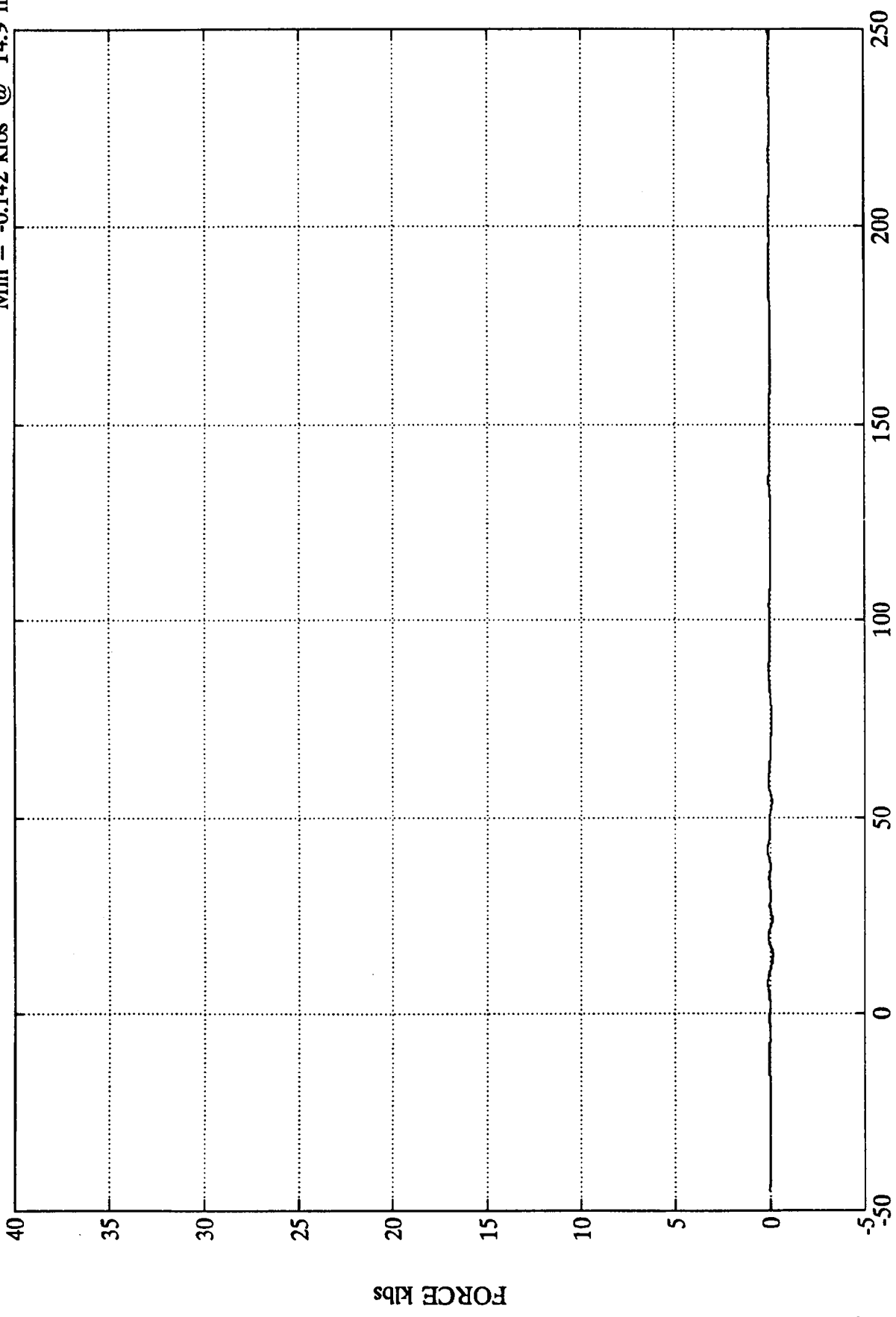
FORCE klbs

B-42

7893-2

Test 1039
Max = 0.151 klbs @ 41.8 msec
Min = -0.142 klbs @ 14.9 msec

BARRIER LOAD CELL C1



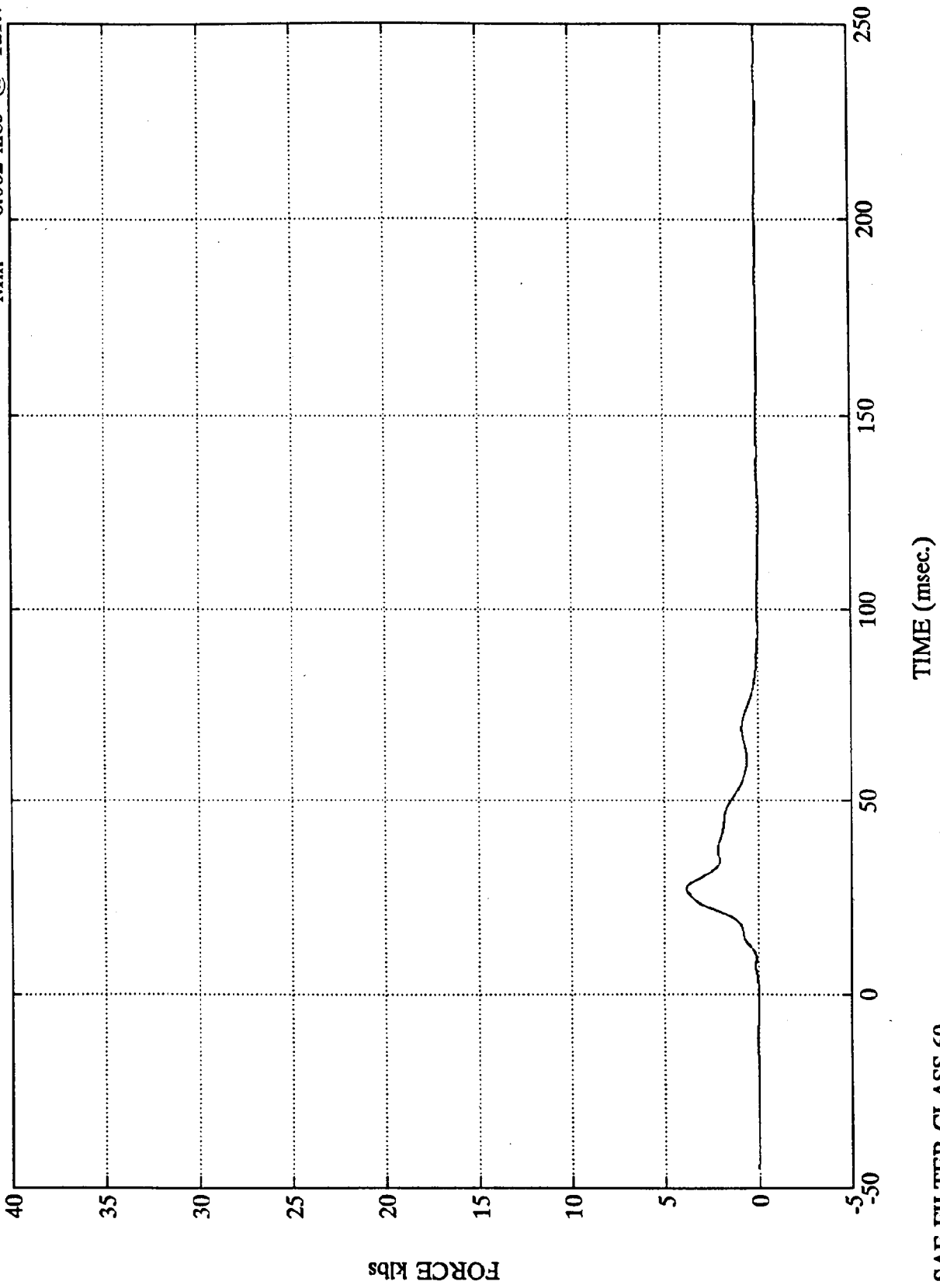
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL C2

Max = 3.847 klbs @ 27.1 msec
Min = -0.062 klbs @ 121.7 msec



FORCE klbs

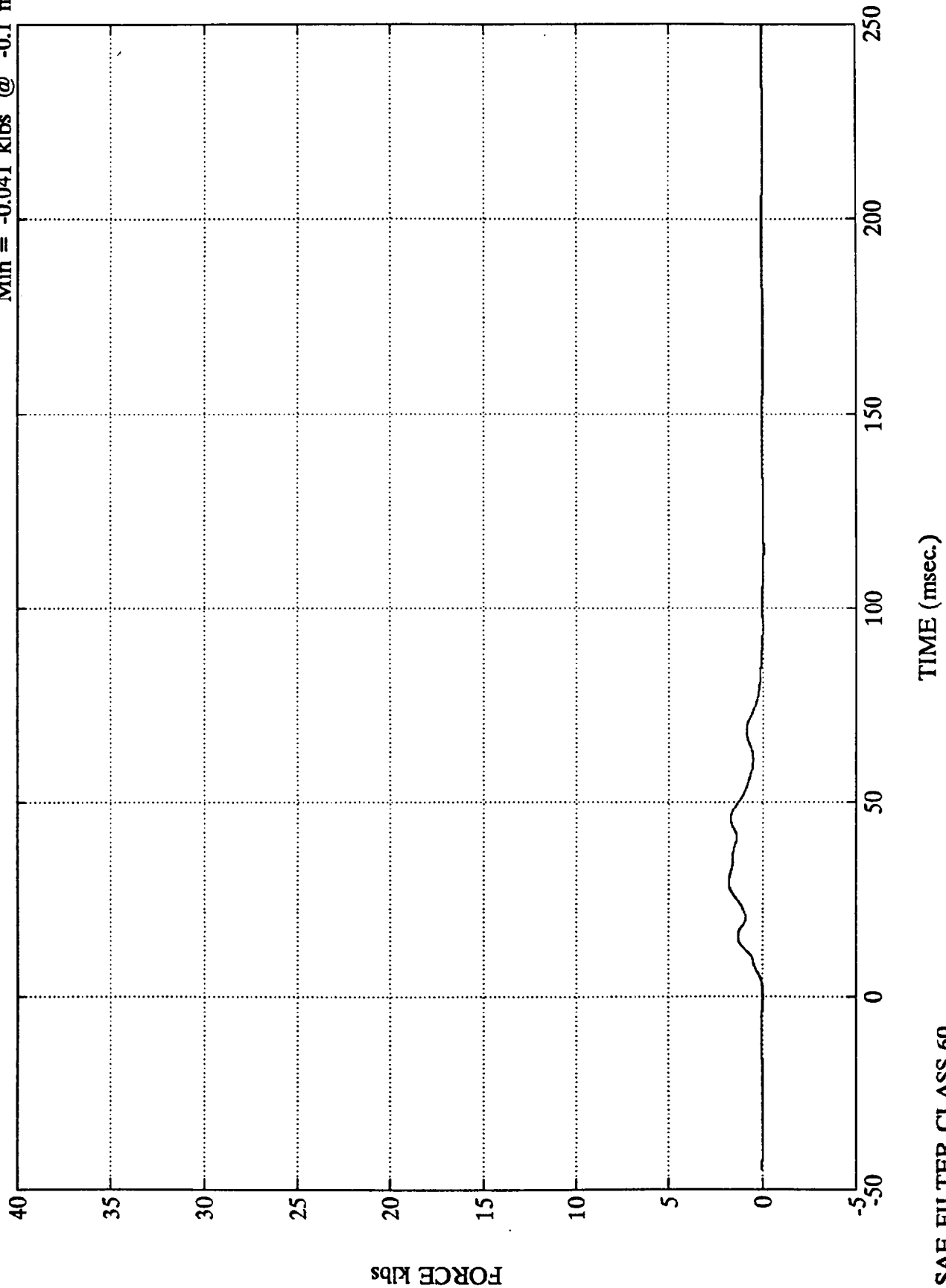
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL C3

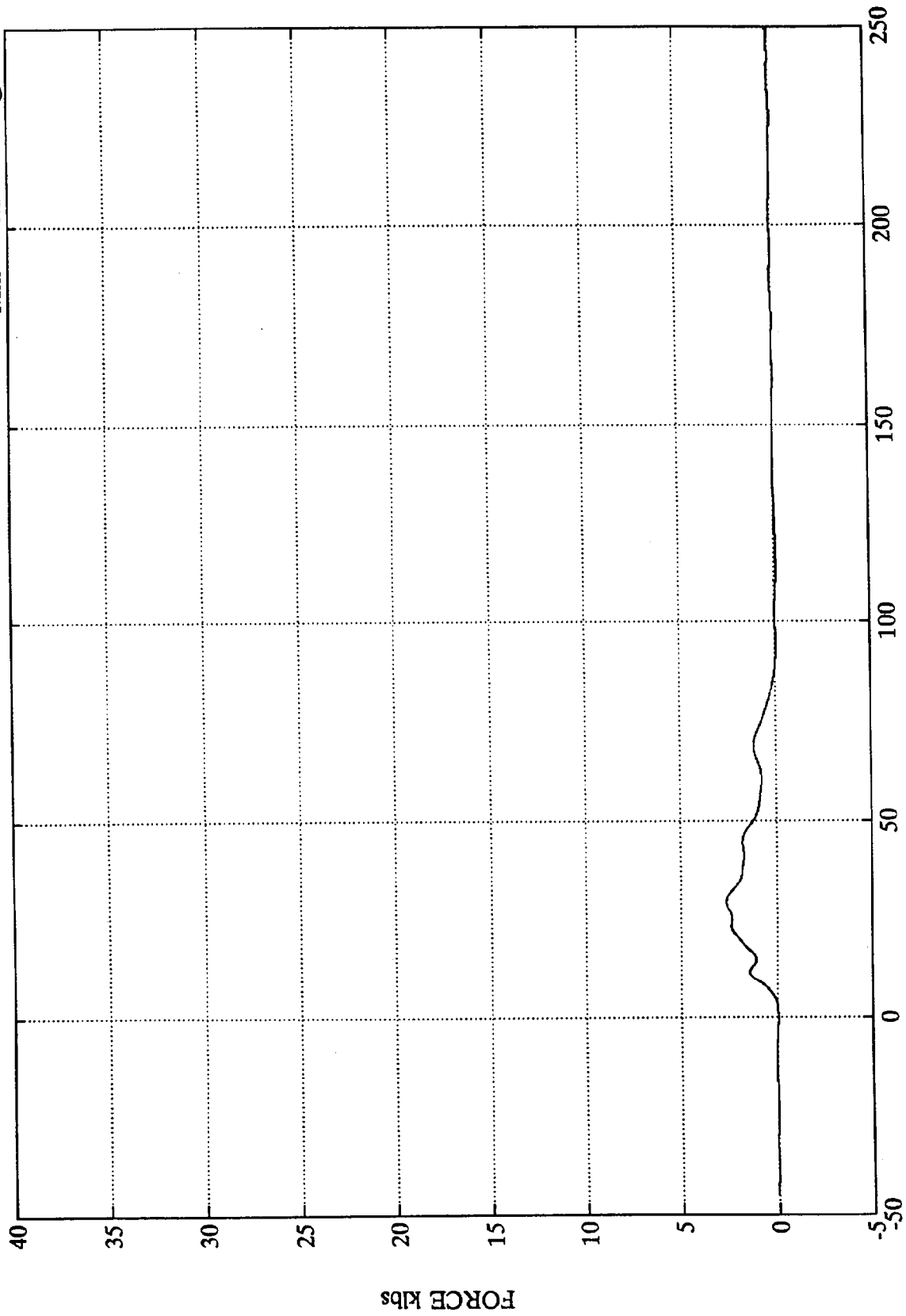
Max = 1.802 klbs @ 29.4 msec
Min = -0.041 klbs @ -0.1 msec



Test 1039

Max = 2.643 klbs @ 29.4 msec
Min = -0.105 klbs @ 120.2 msec

BARRIER LOAD CELL C4



TIME (msec.)

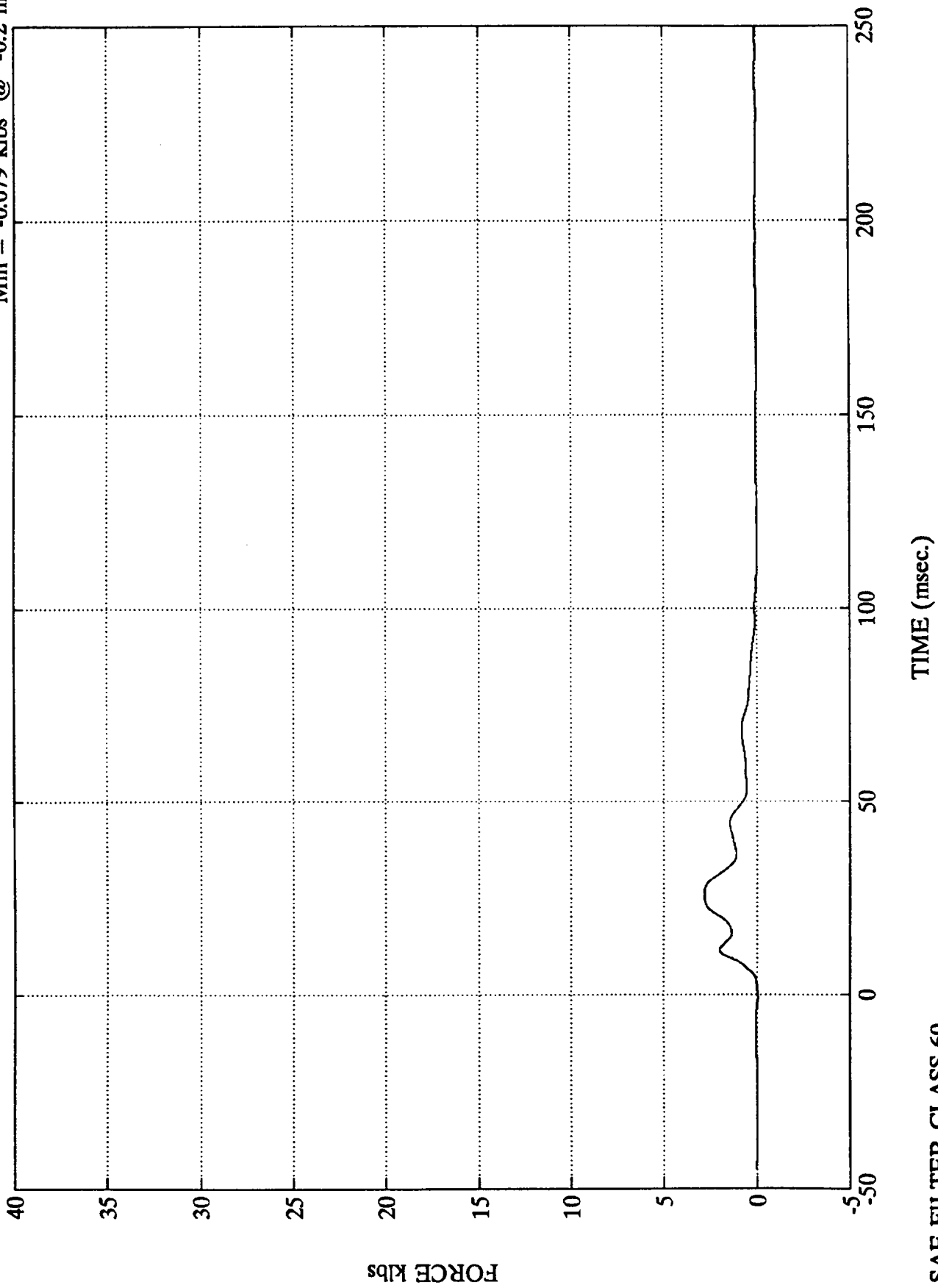
SAE FILTER CLASS 60

FORCE klbs

Test 1039

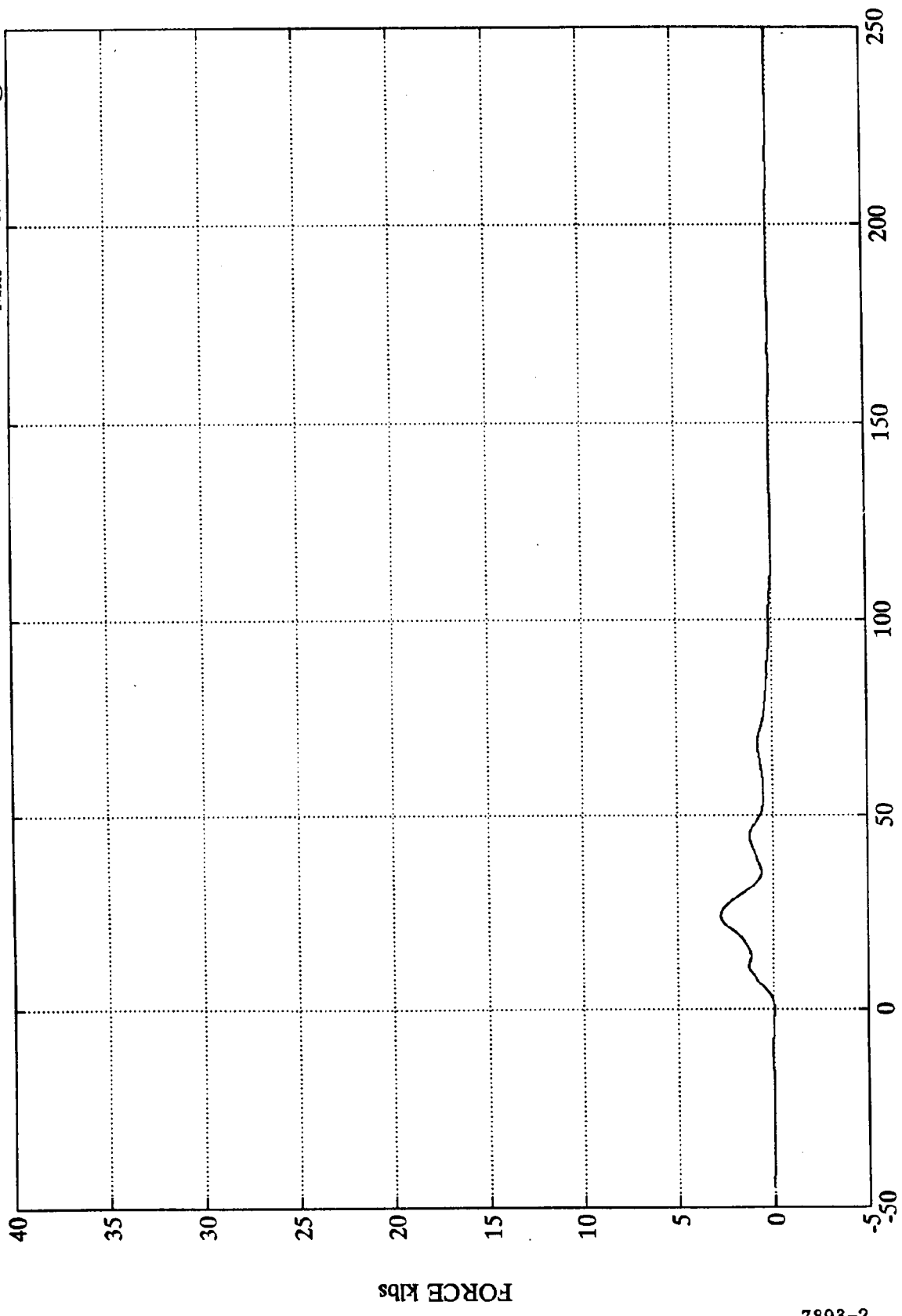
BARRIER LOAD CELL C5

Max = 2.806 klbs @ 26.6 msec
Min = -0.079 klbs @ -0.2 msec



Test 1039
Max = 2.740 klbs @ 24.2 msec
Min = -0.061 klbs @ -0.4 msec

BARRIER LOAD CELL C6



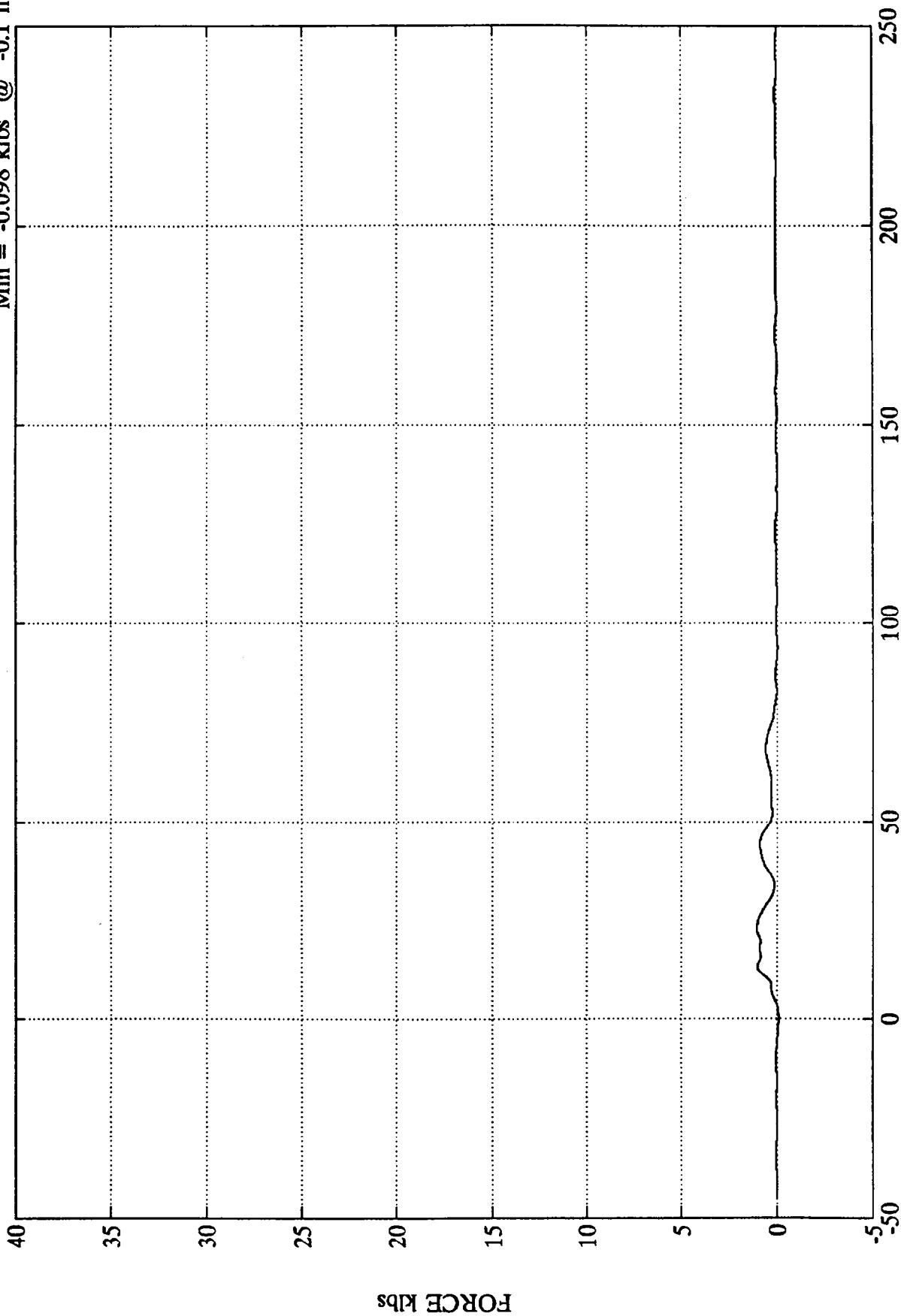
TIME (msec.)

SAE FILTER CLASS 60

FORCE klbs

Test 1039
Max = 1.053 klbs @ 22.9 msec
Min = -0.098 klbs @ -0.1 msec

BARRIER LOAD CELL C7



TIME (msec.)

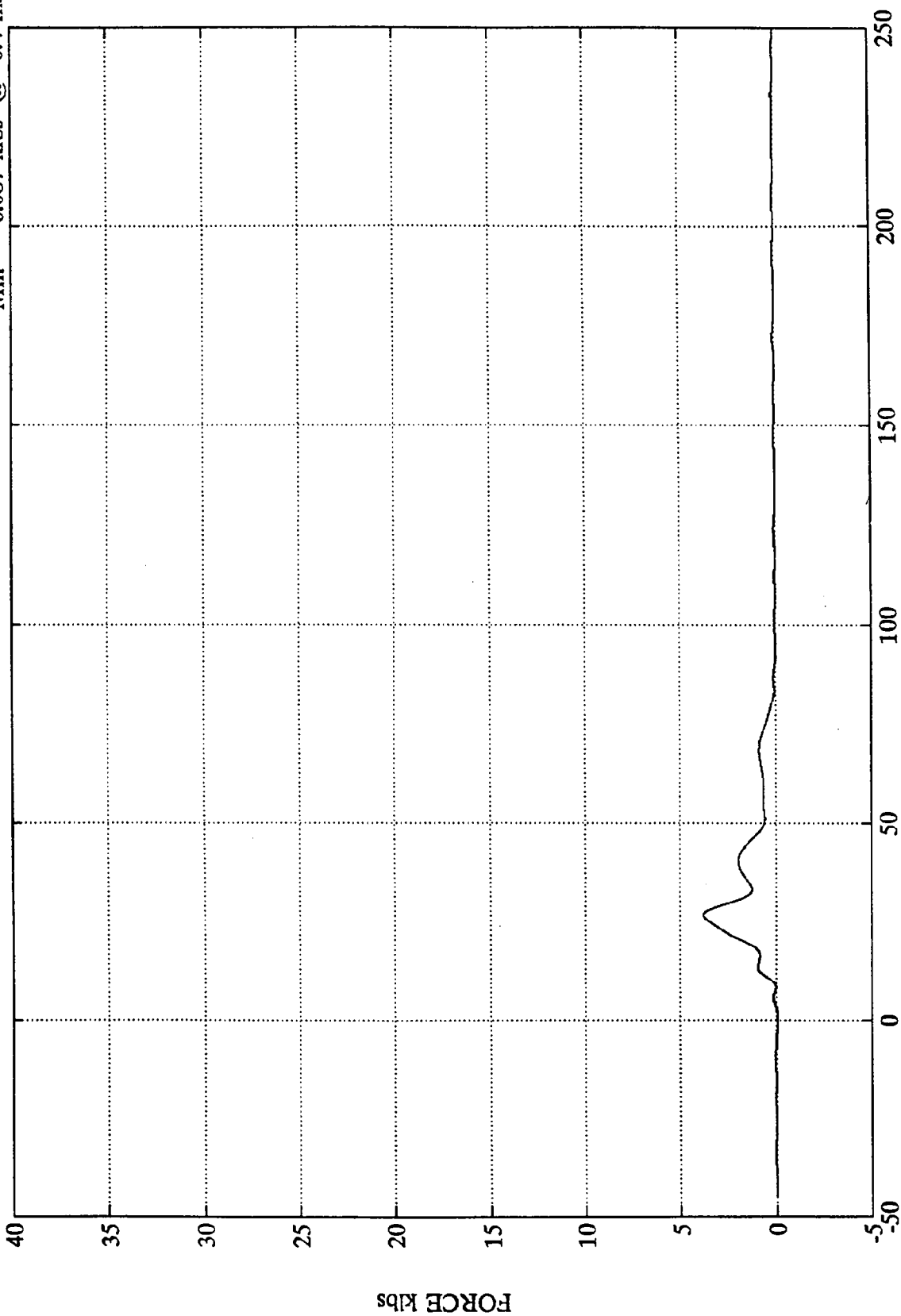
SAE FILTER CLASS 60

Test 1039

FORCE klbs

Test 1039
Max = 3.809 klbs @ 26.6 msec
Min = -0.087 klbs @ 0.4 msec

BARRIER LOAD CELL C8



TIME (msec.)

SAE FILTER CLASS 60

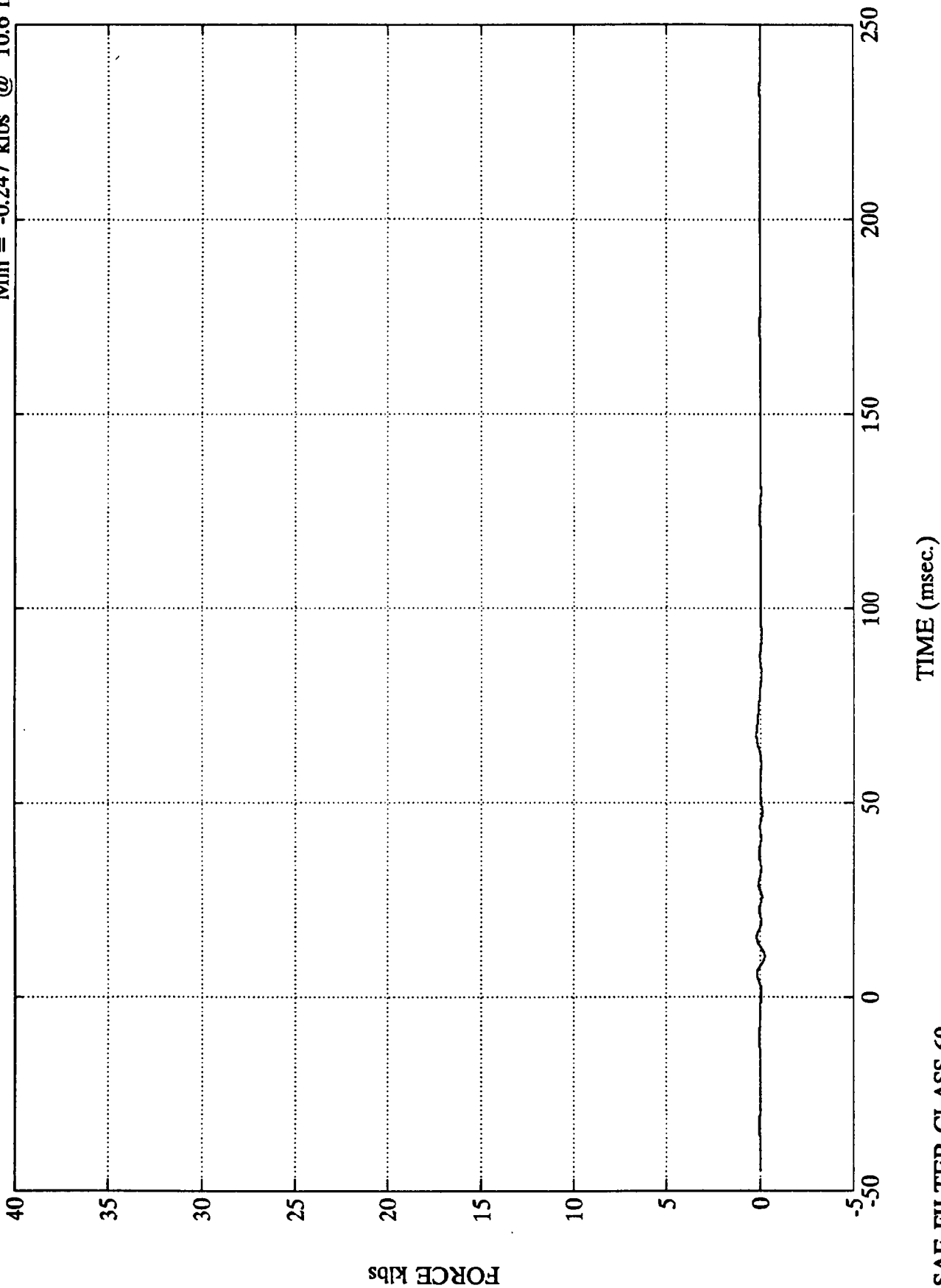
B-50
FORCE klbs

7893-2

Test 1039

BARRIER LOAD CELL C9

Max = 0.220 klbs @ 67.4 msec
Min = -0.247 klbs @ 10.6 msec



FORCE klbs

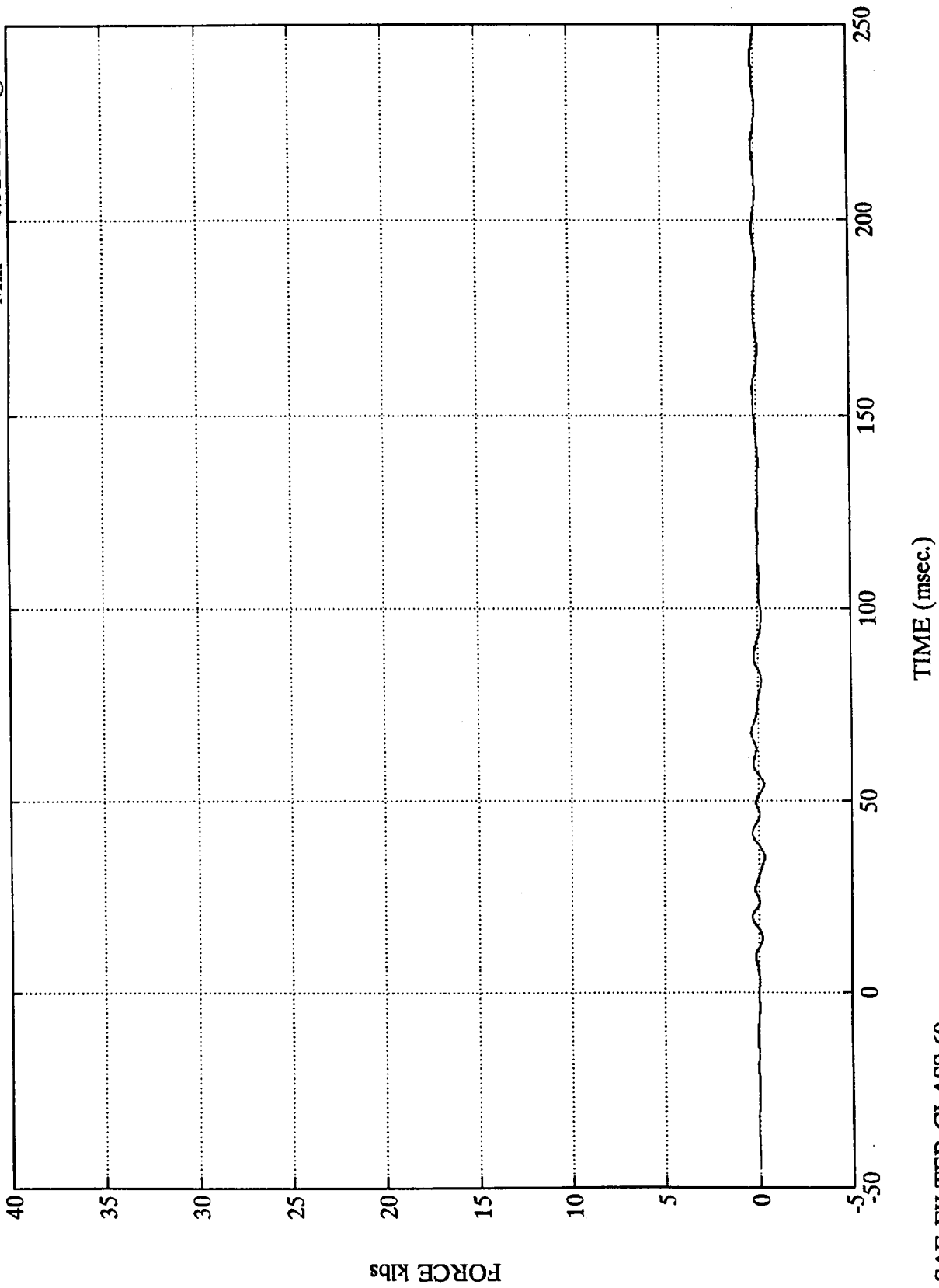
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL D1

Max = 0.371 klbs @ 67.9 msec
Min = -0.313 klbs @ 35.5 msec



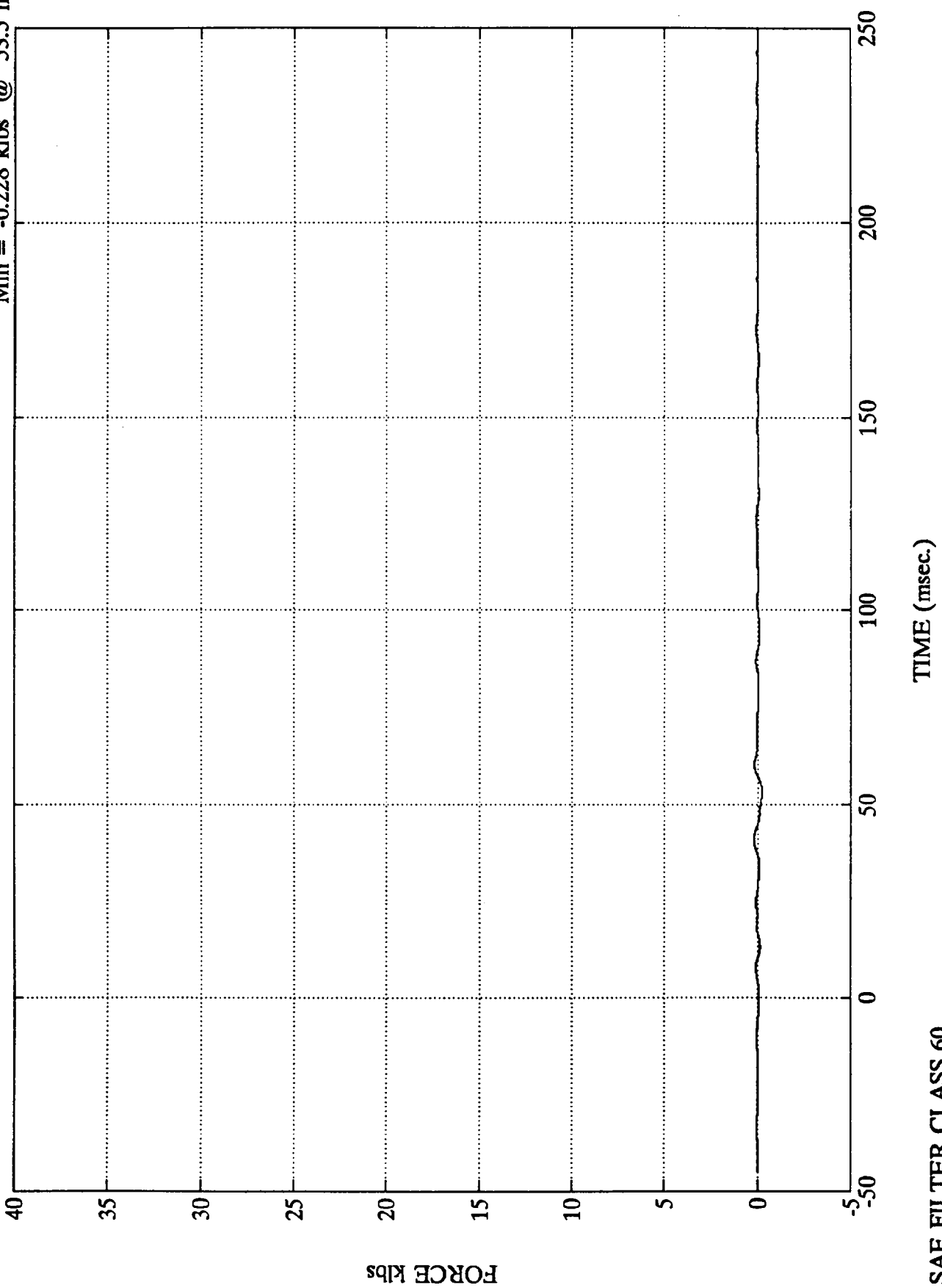
SAE FILTER CLASS 60

FORCE klbs

TIME (msec.)

Test 1039
Max = 0.193 klbs @ 40.9 msec
Min = -0.228 klbs @ 53.5 msec

BARRIER LOAD CELL D2



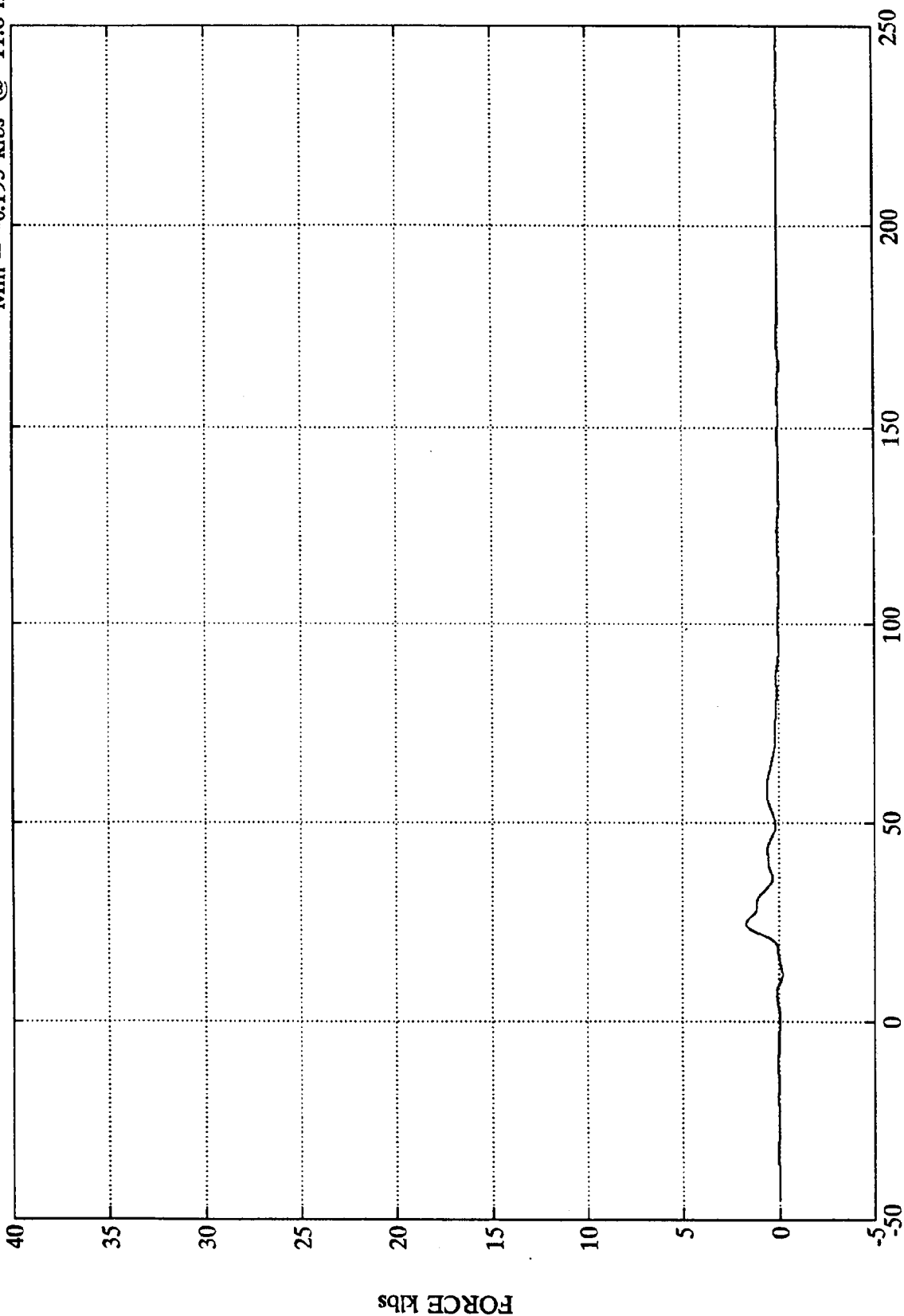
Test 1039

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL D3

Max = 1.700 klbs @ 24.5 msec
Min = -0.195 klbs @ 11.8 msec

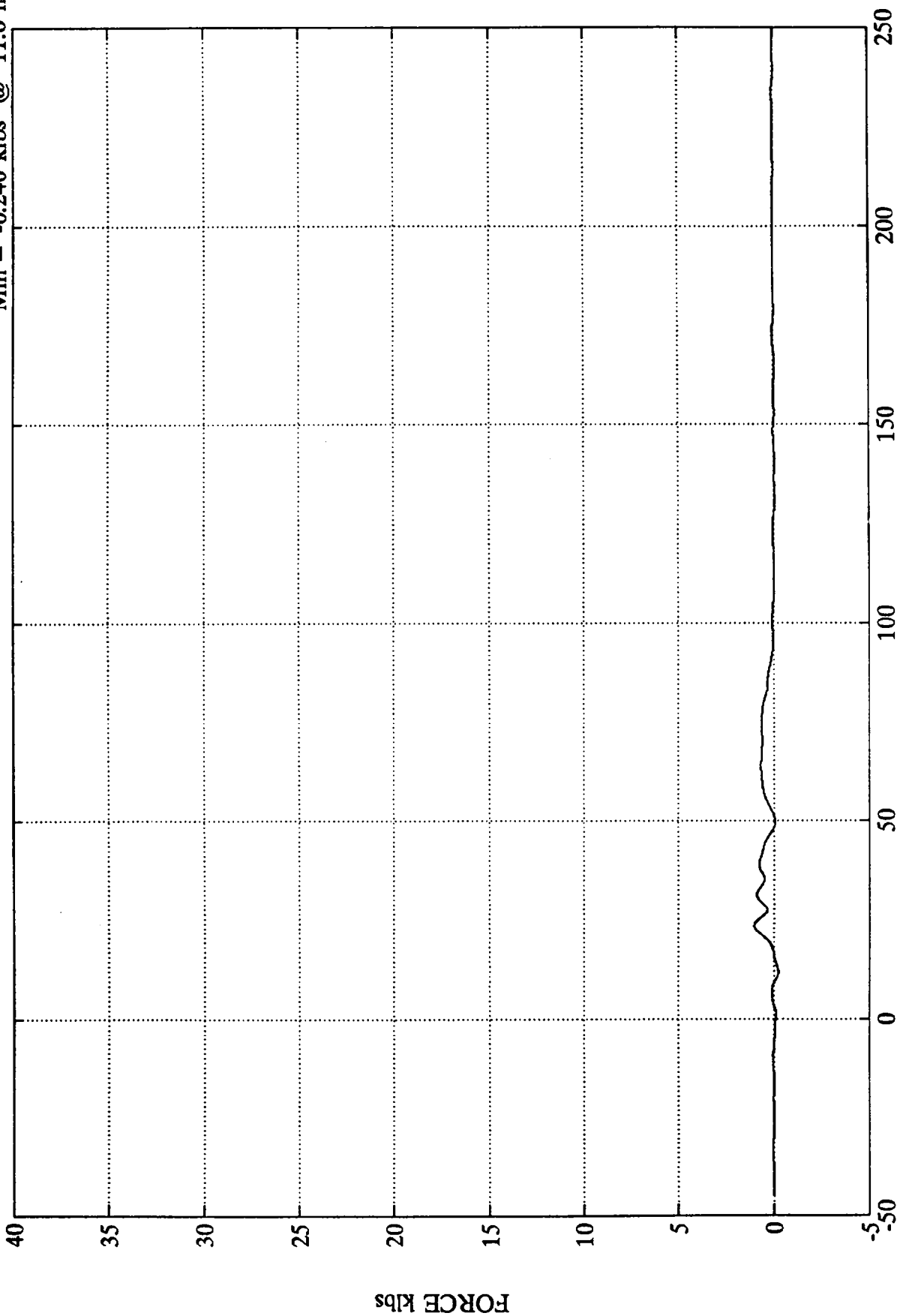


TIME (msec.)

SAE FILTER CLASS 60

Test 1039
Max = 1.026 klbs @ 23.5 msec
Min = -0.240 klbs @ 11.6 msec

BARRIER LOAD CELL D4



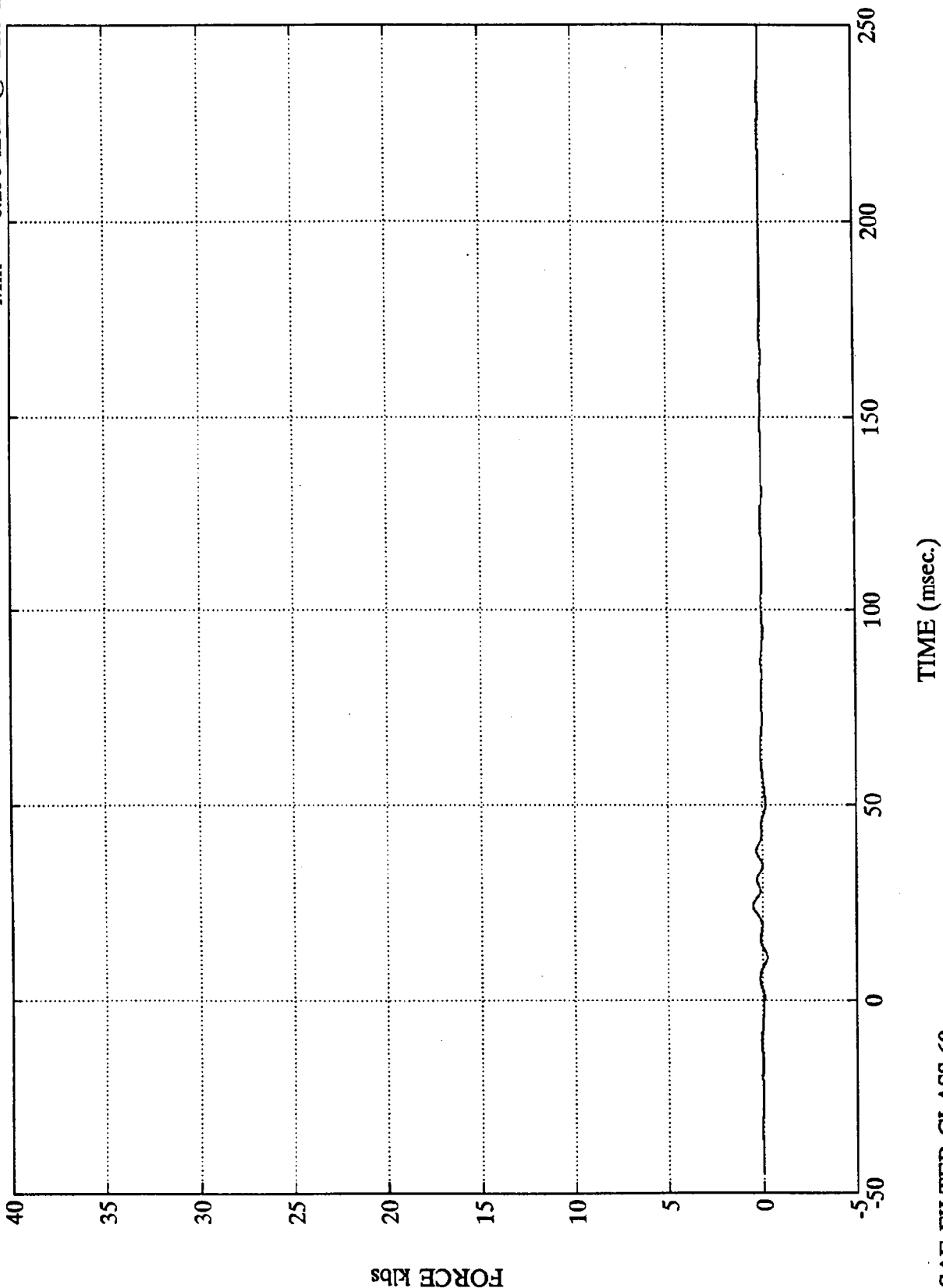
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL D5

Max = 0.499 klbs @ 24.4 msec
Min = -0.250 klbs @ 11.3 msec

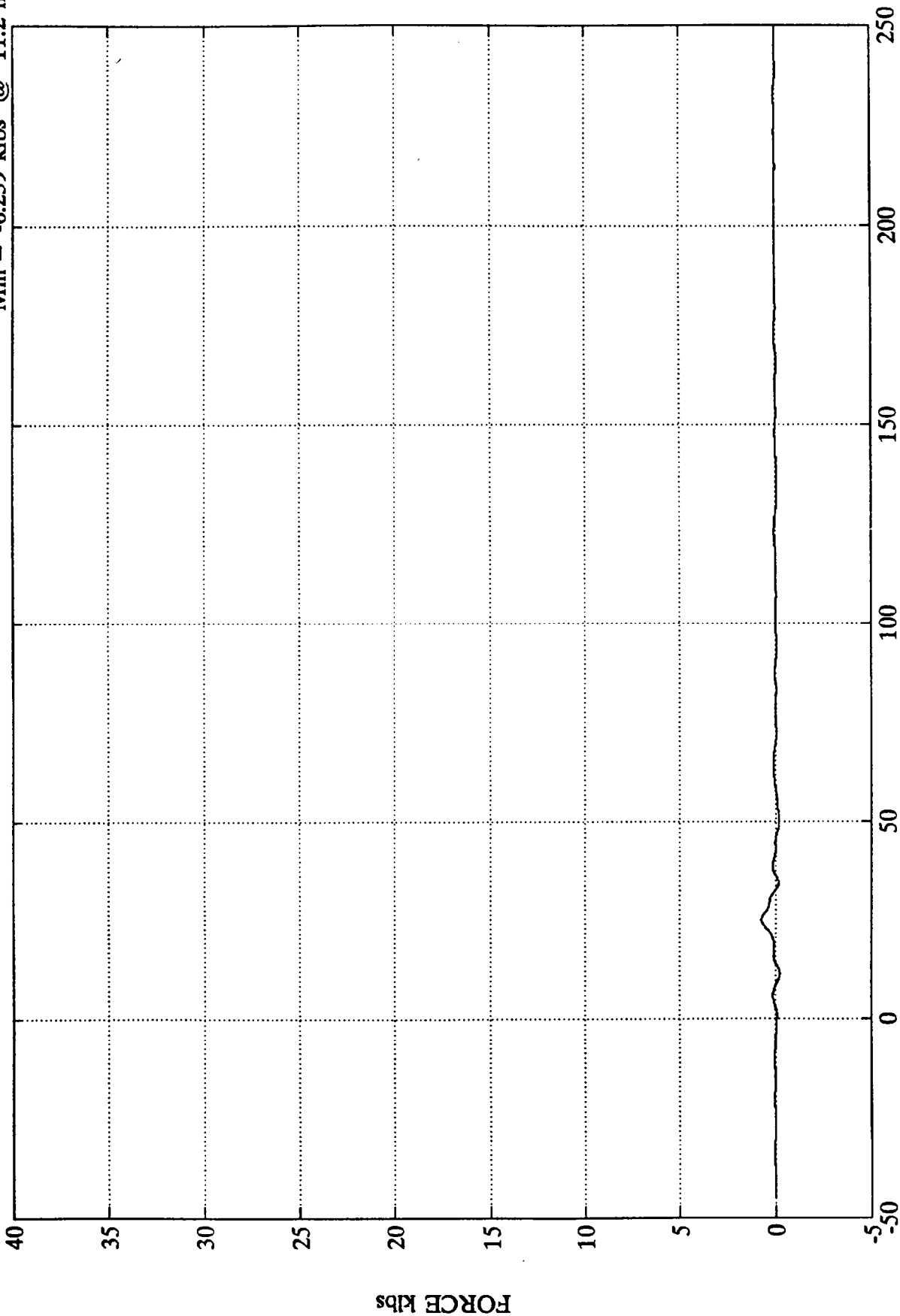


SAE FILTER CLASS 60

Test 1039
Max = 0.727 klbs @ 25.1 msec
Min = -0.239 klbs @ 11.2 msec

BARRIER LOAD CELL D6

Test 1039



TIME (msec.)

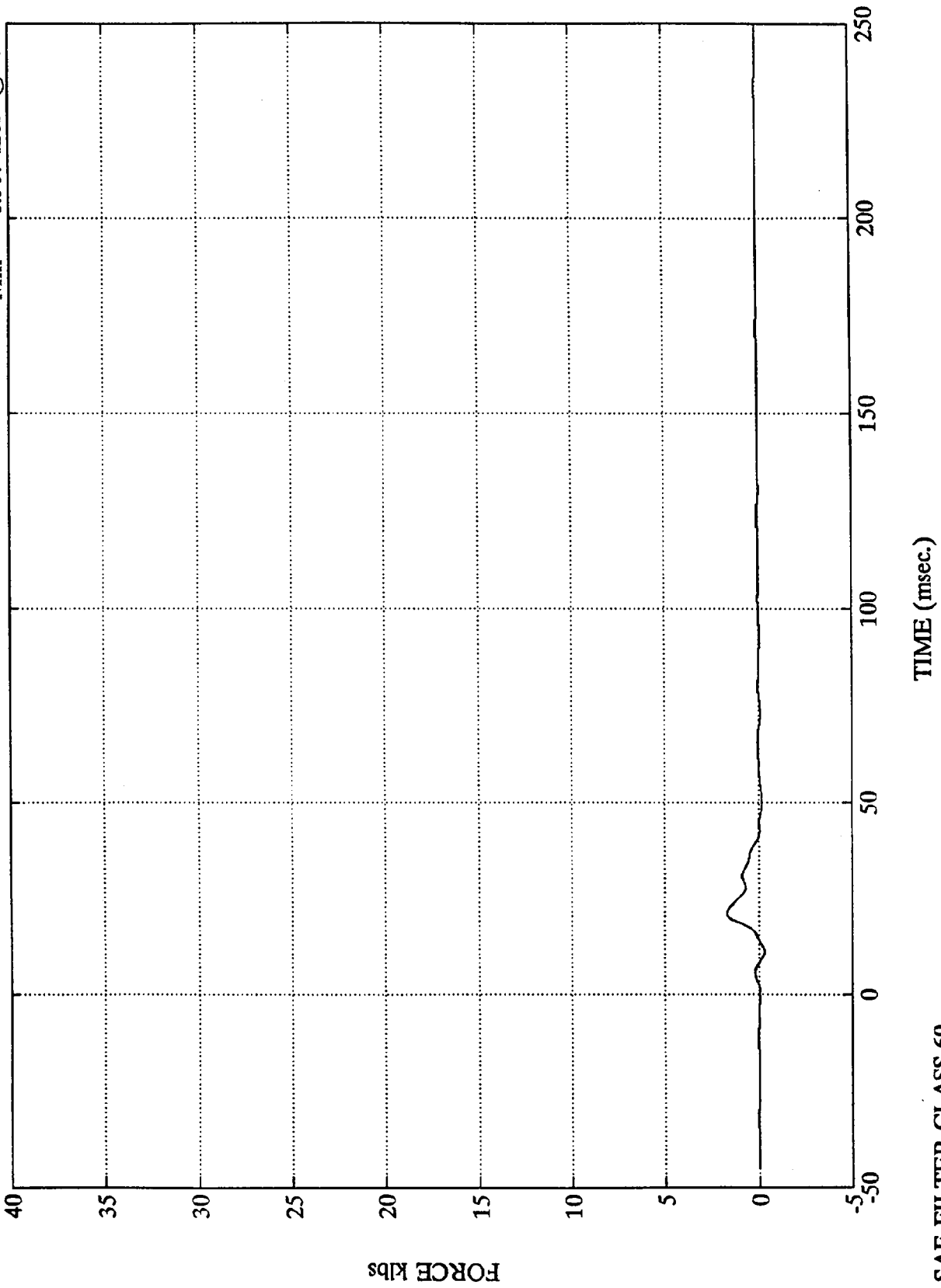
SAE FILTER CLASS 60

FORCE klbs

Test 1039

BARRIER LOAD CELL D7

Max = 1.709 klbs @ 21.1 msec
Min = -0.307 klbs @ 11.3 msec



FORCE klbs

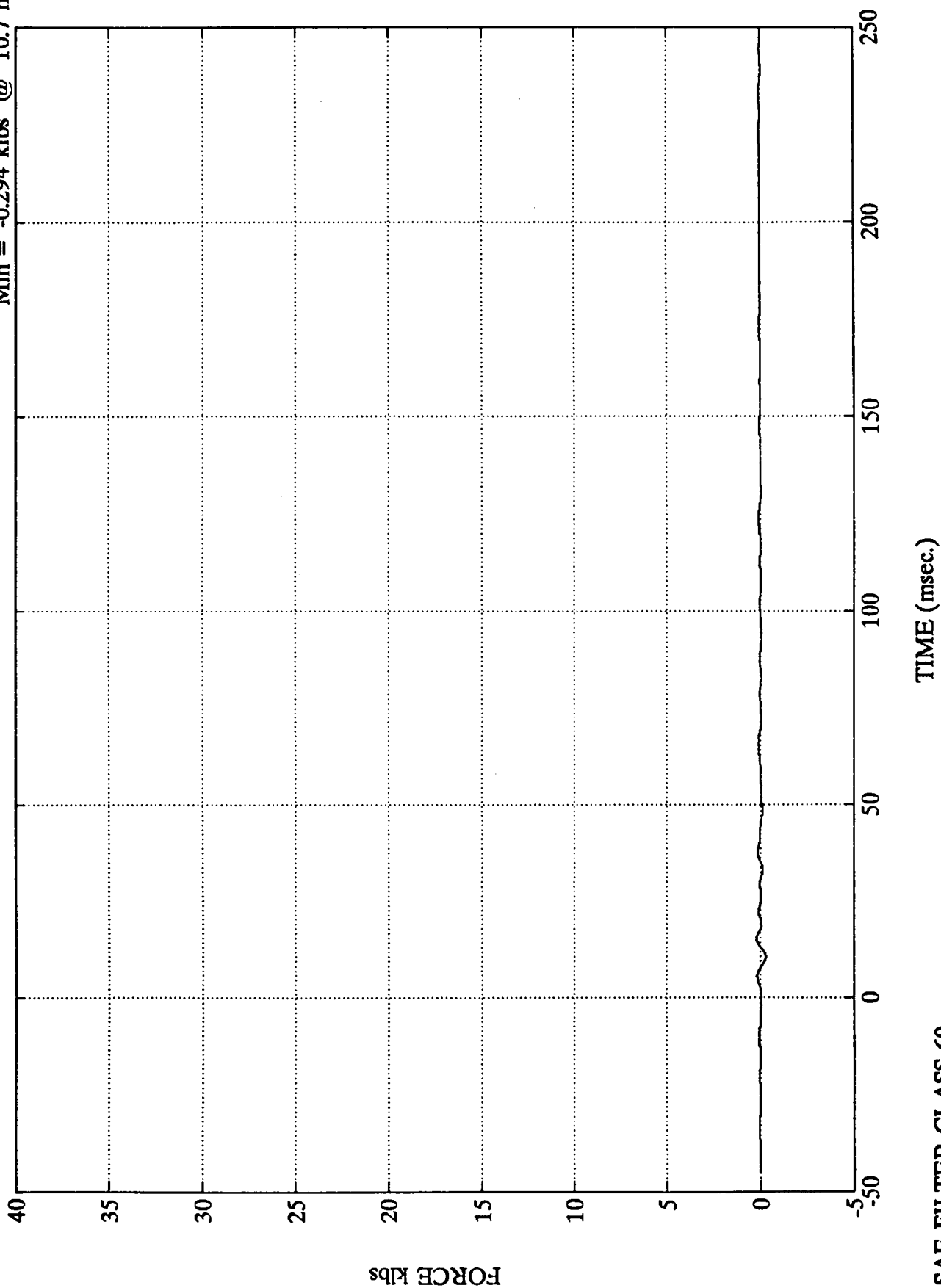
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

BARRIER LOAD CELL D8

Max = 0.197 klbs @ 15.4 msec
Min = -0.294 klbs @ 10.7 msec

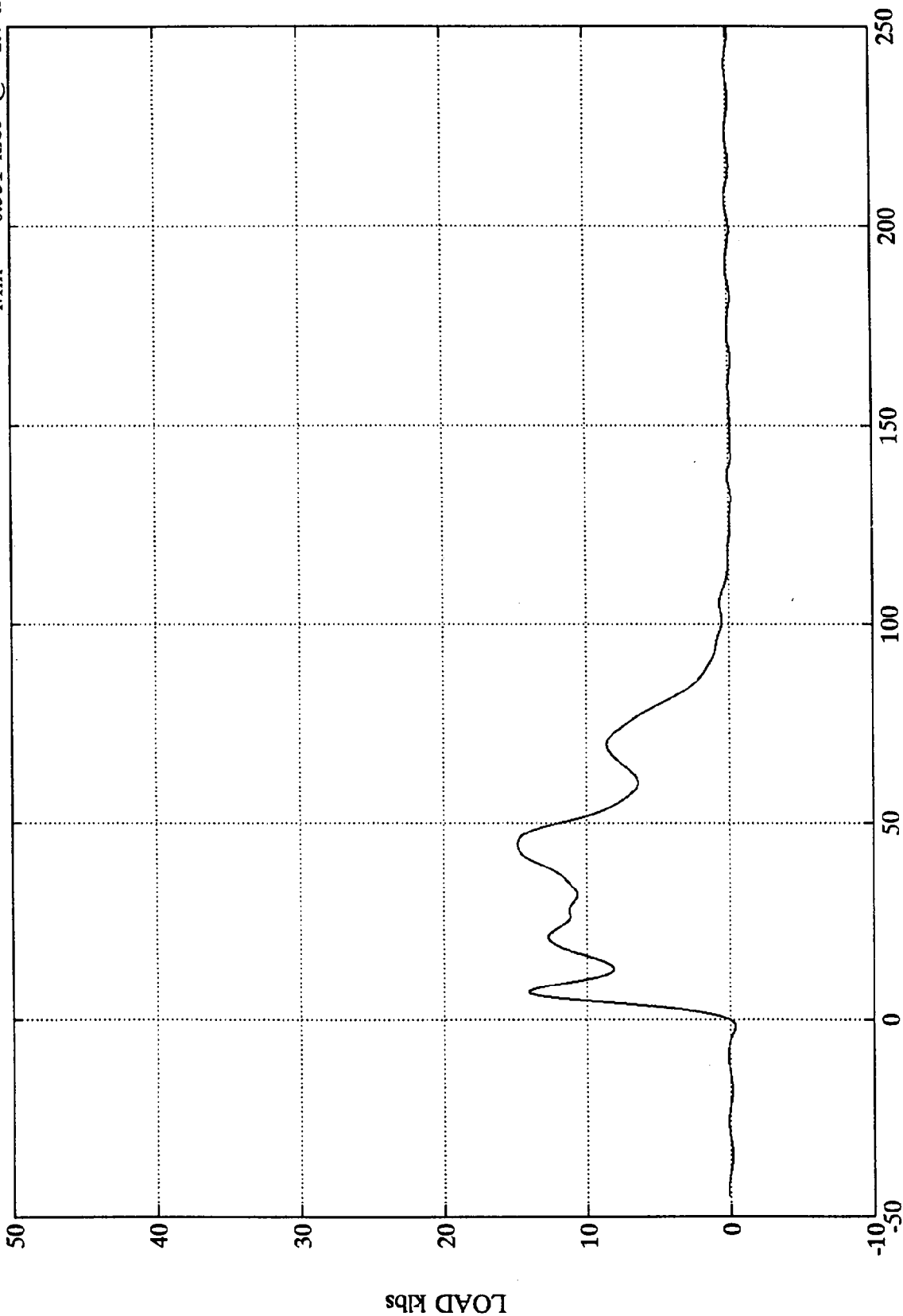


SAE FILTER CLASS 60

Test 1039

GROUP 1 LOAD CELL SUM

Max = 14.823 klbs @ 44.8 msec
Min = -0.351 klbs @ -1.7 msec

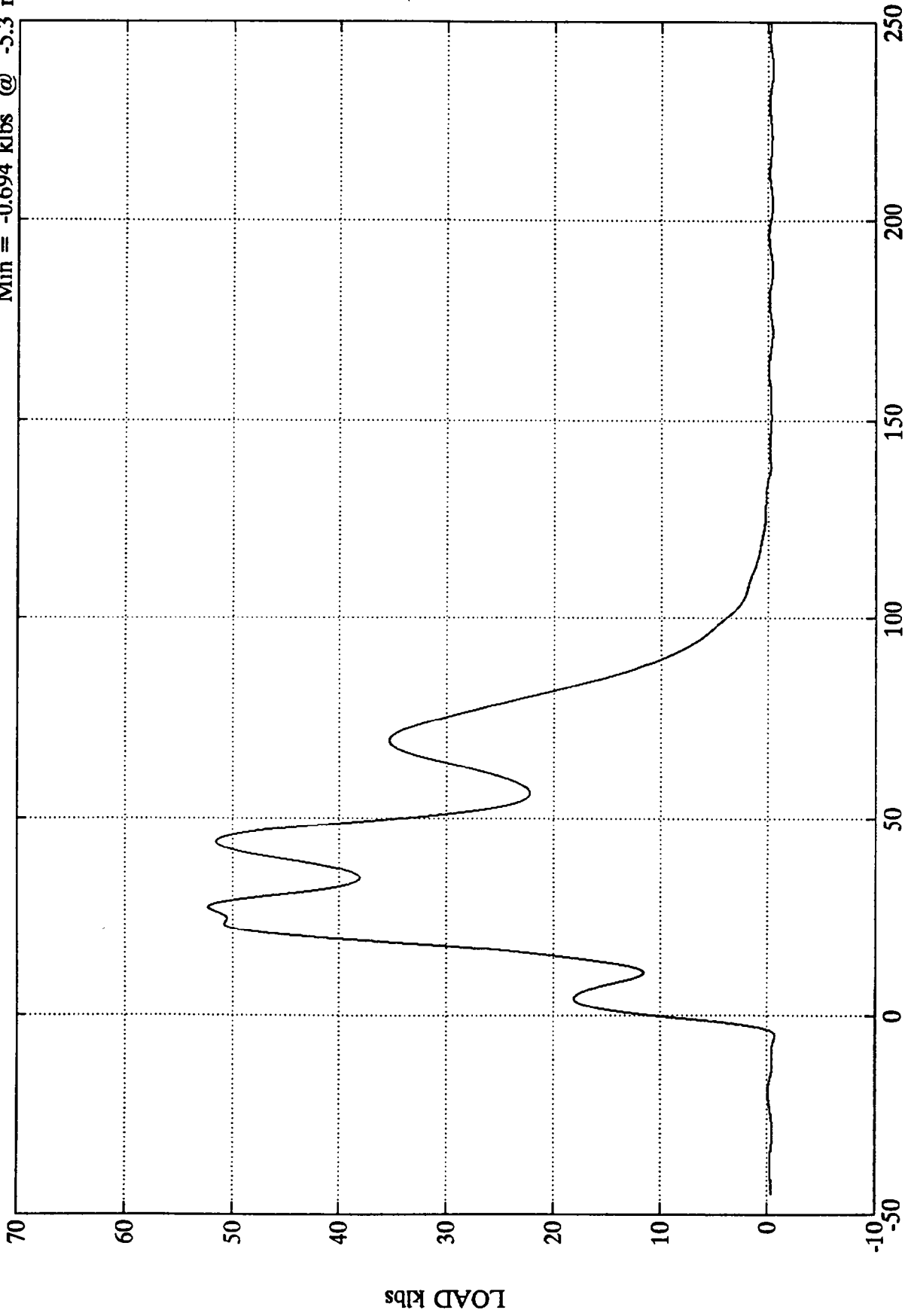


SAE Filter Class 60

Test 1039

GROUP 2 LOAD CELL SUM

Max = 52.256 klbs @ 27.4 msec
Min = -0.694 klbs @ -5.3 msec



TIME (msec)

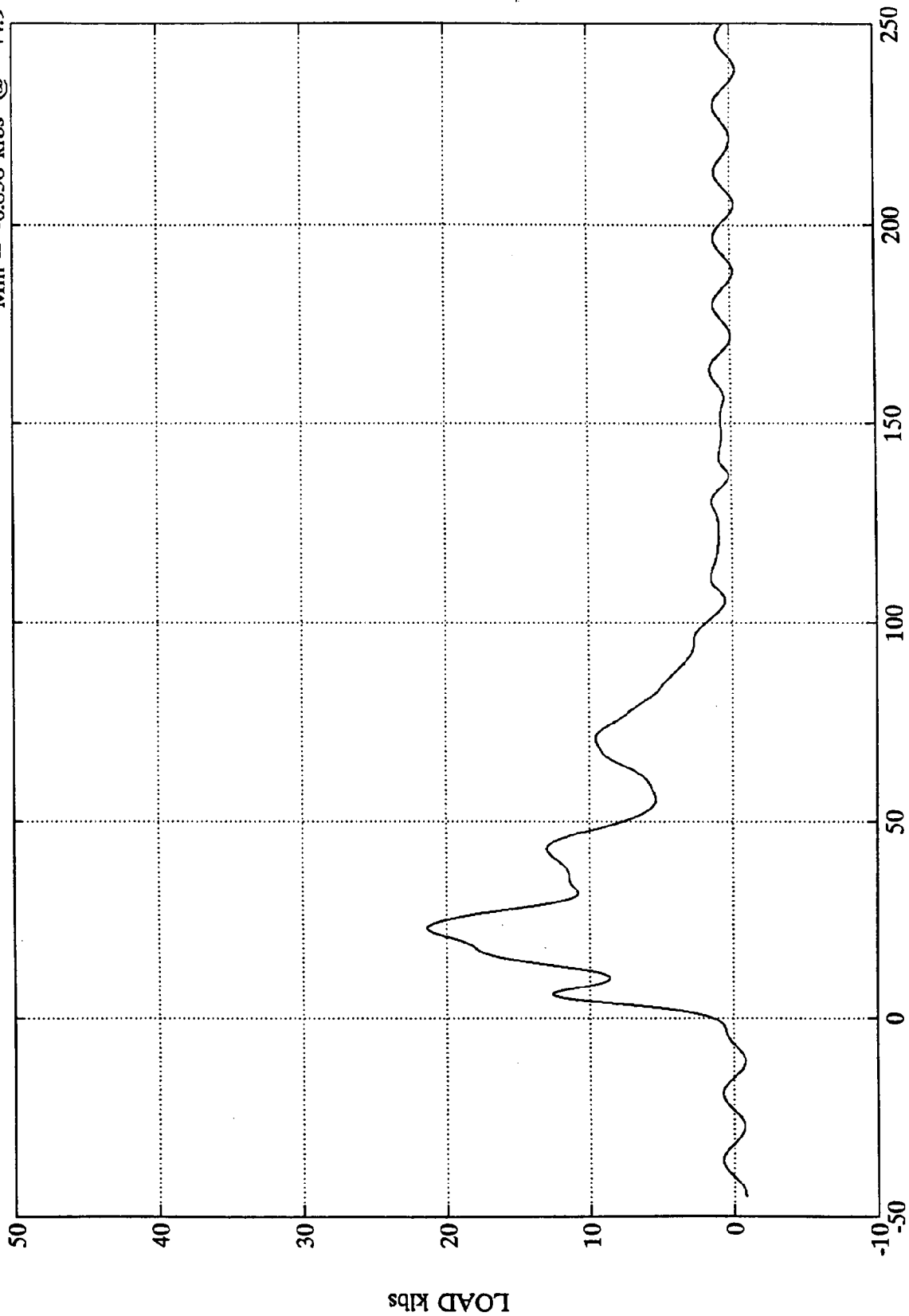
SAE Filter Class 60

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

Test 1039

GROUP 3 LOAD CELL SUM

Max = 21.351 klbs @ 23.0 msec
Min = -0.838 klbs @ -44.9 msec



TIME (msec)

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

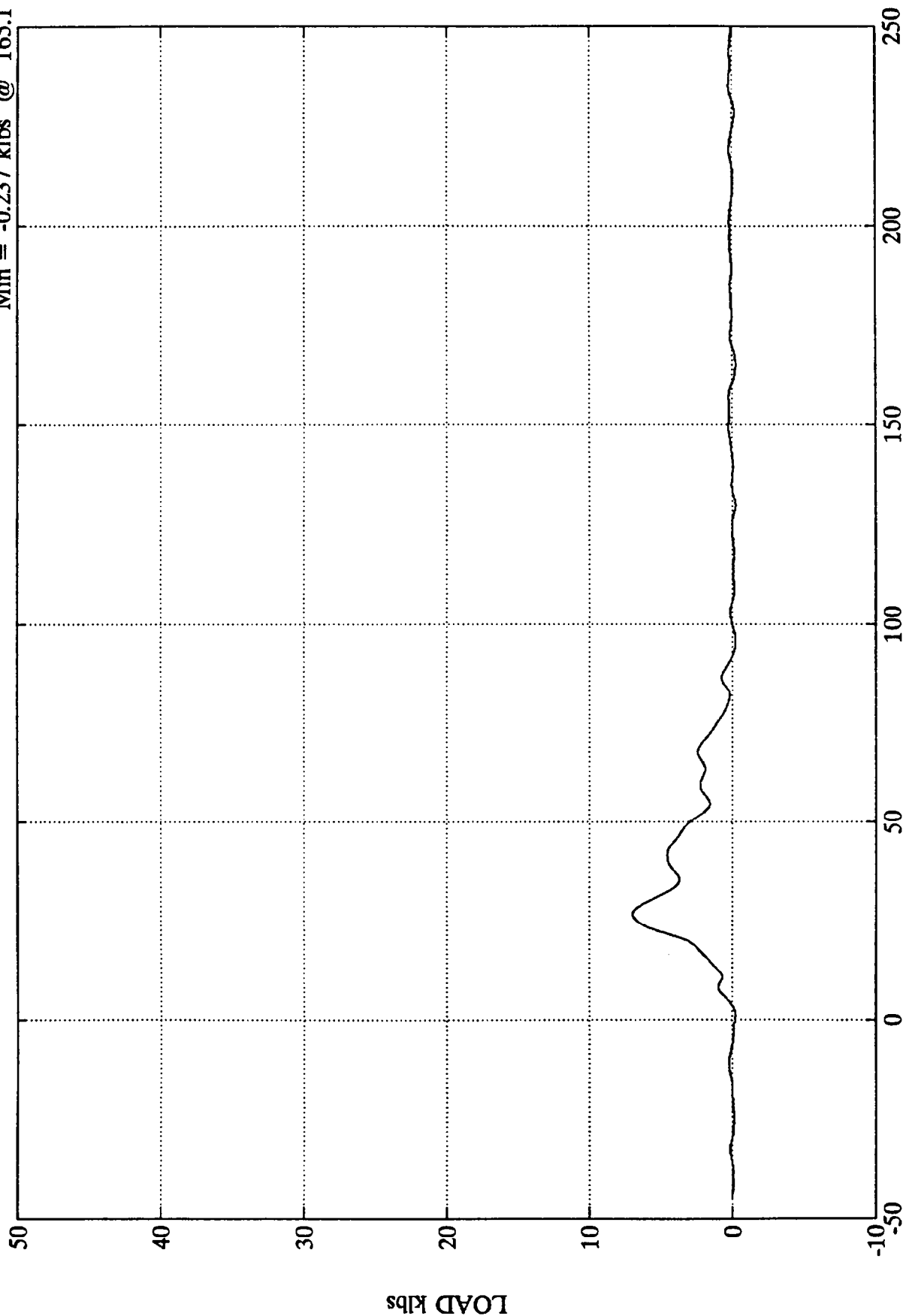
SAE Filter Class 60

LOAD klbs

Test 1039

GROUP 4 LOAD CELL SUM

Max = 6.990 klbs @ 27.0 msec
Min = -0.237 klbs @ 165.1 msec



TIME (msec)

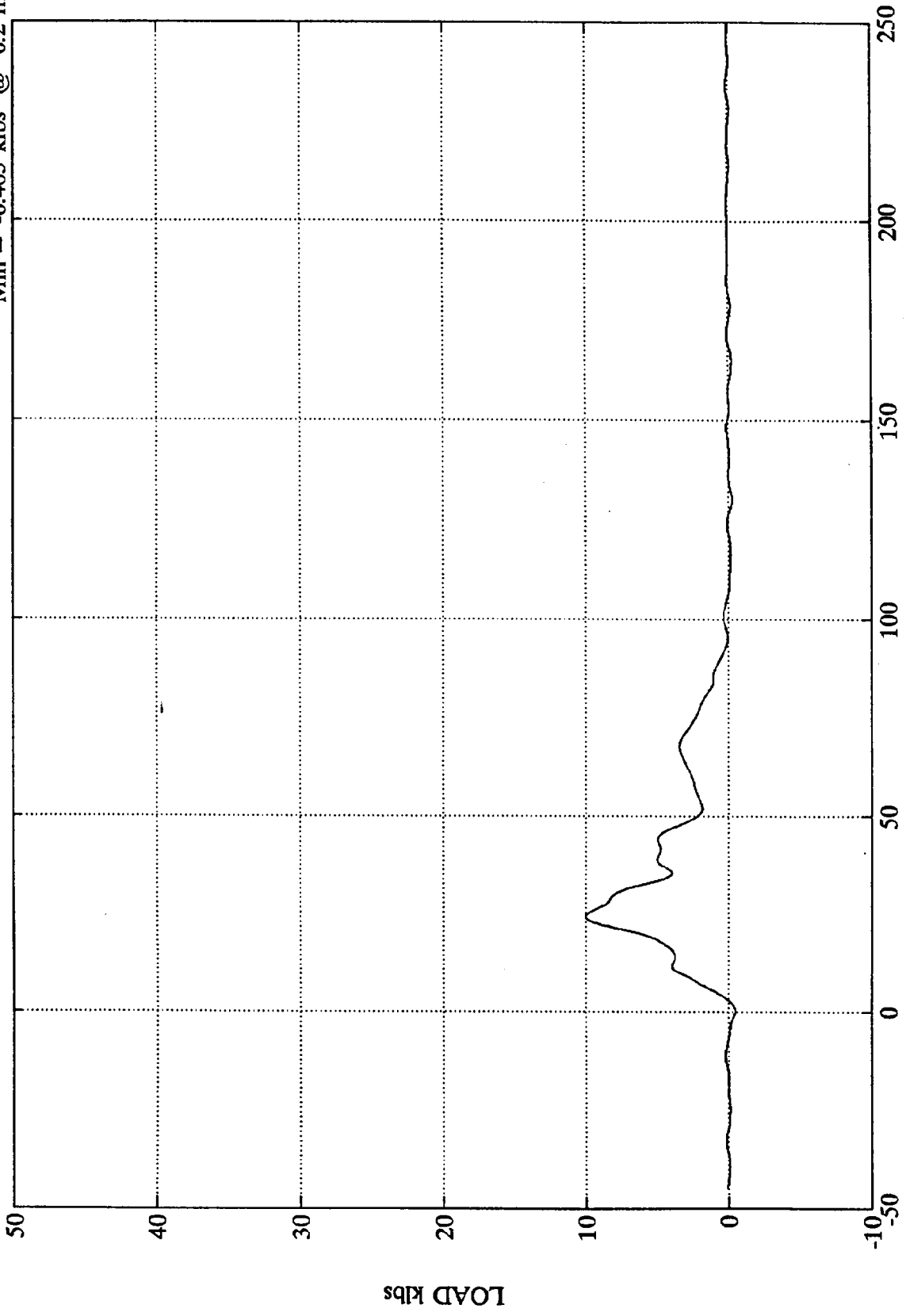
Load Cells (C1,C2,C3,D1,D2,D3)

SAE Filter Class 60

Test 1039

GROUP 5 LOAD CELL SUM

Max = 10.041 klbs @ 24.2 msec
Min = -0.465 klbs @ 0.2 msec



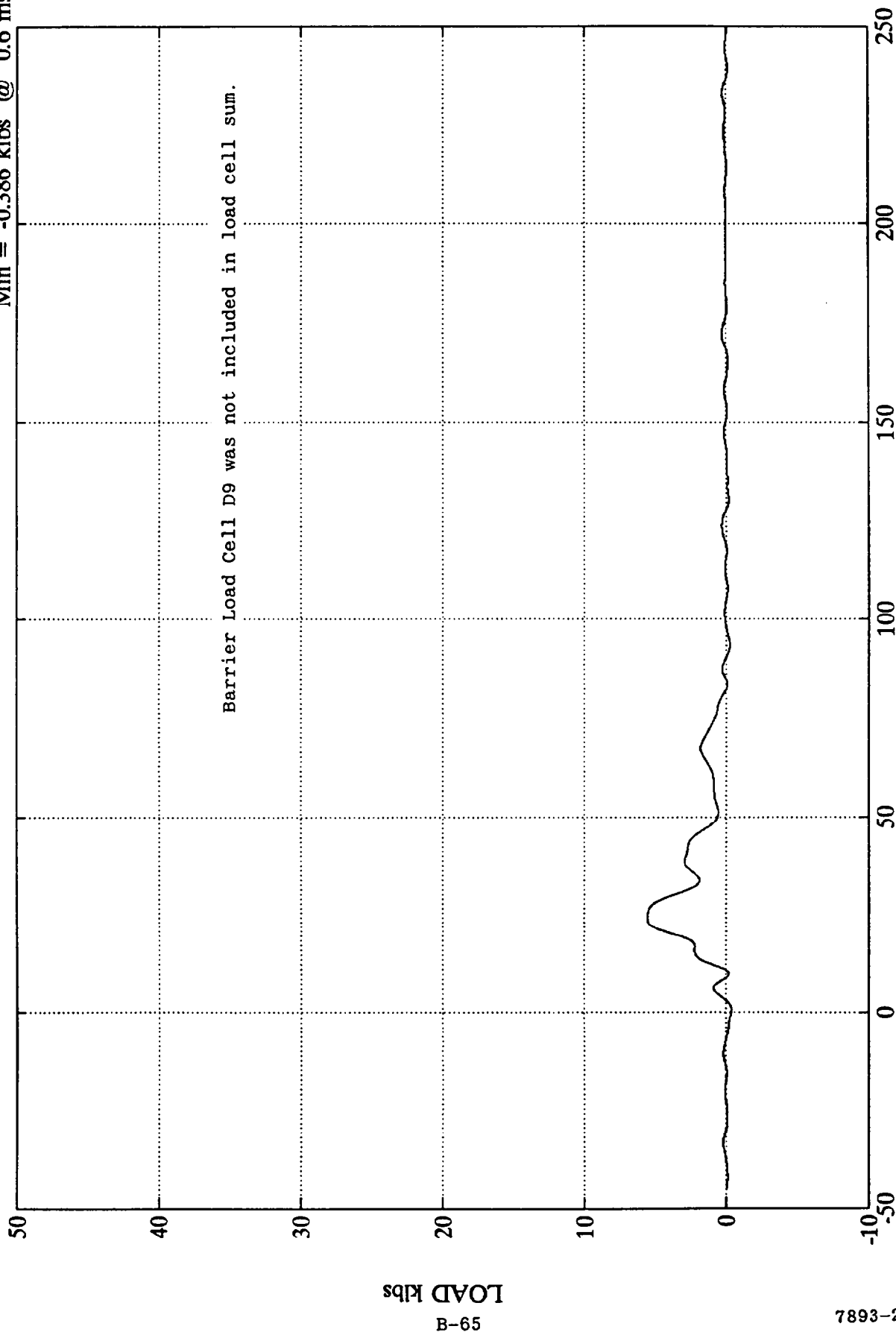
SAE Filter Class 60

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

Test 1039

GROUP 6 LOAD CELL SUM

Max = 5.512 klbs @ 23.9 msec
Min = -0.386 klbs @ 0.6 msec



TIME (msec)

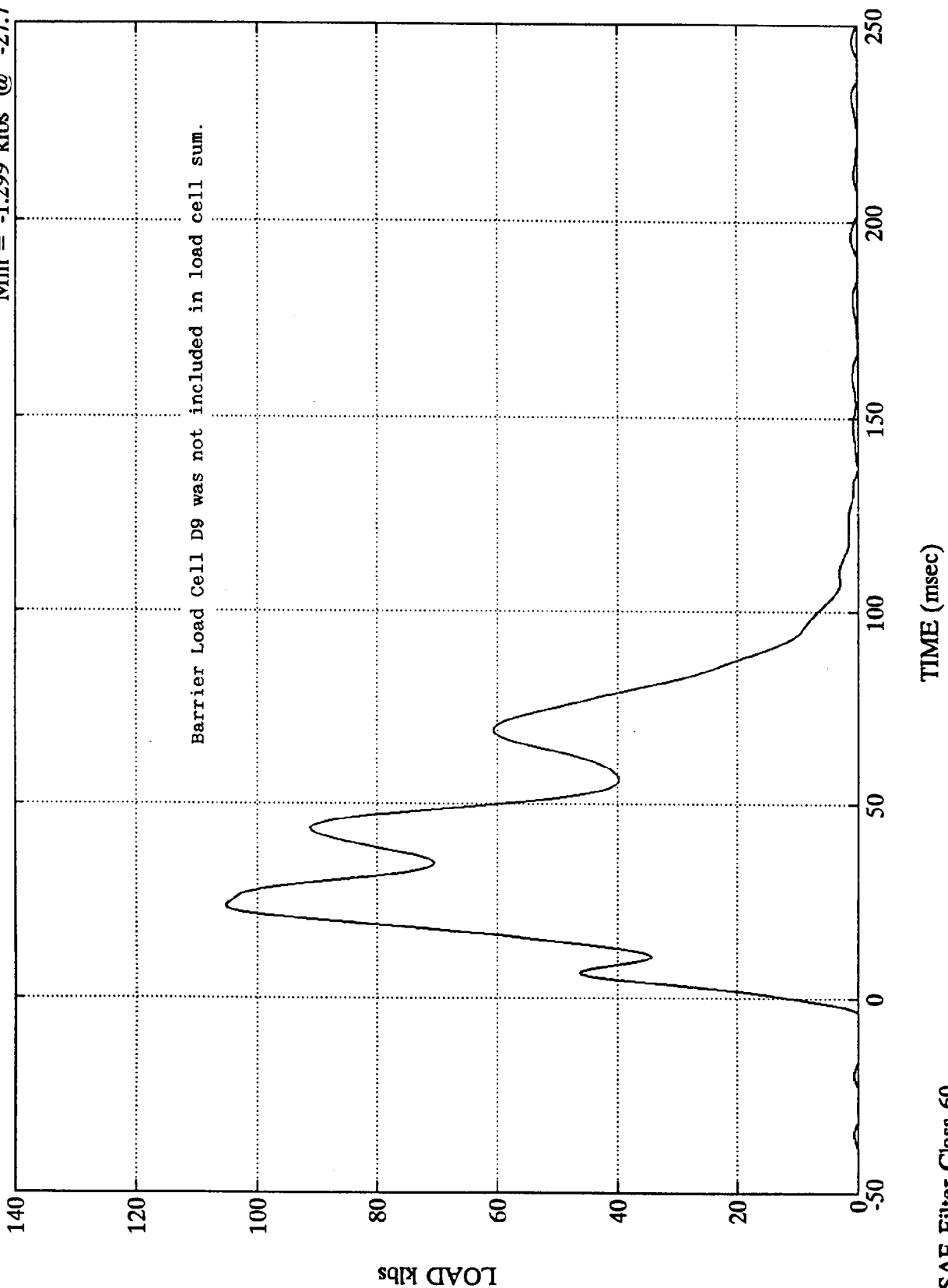
Load Cells (C7,C8,C9,D7,D8,D9)

SAE Filter Class 60

Test 1039

TOTAL LOAD CELL SUM

Max = 105.088 klbs @ 23.5 msec
Min = -1.299 klbs @ -27.7 msec



B-66

7893-2

SAE Filter Class 60

TEST NO. MM5101

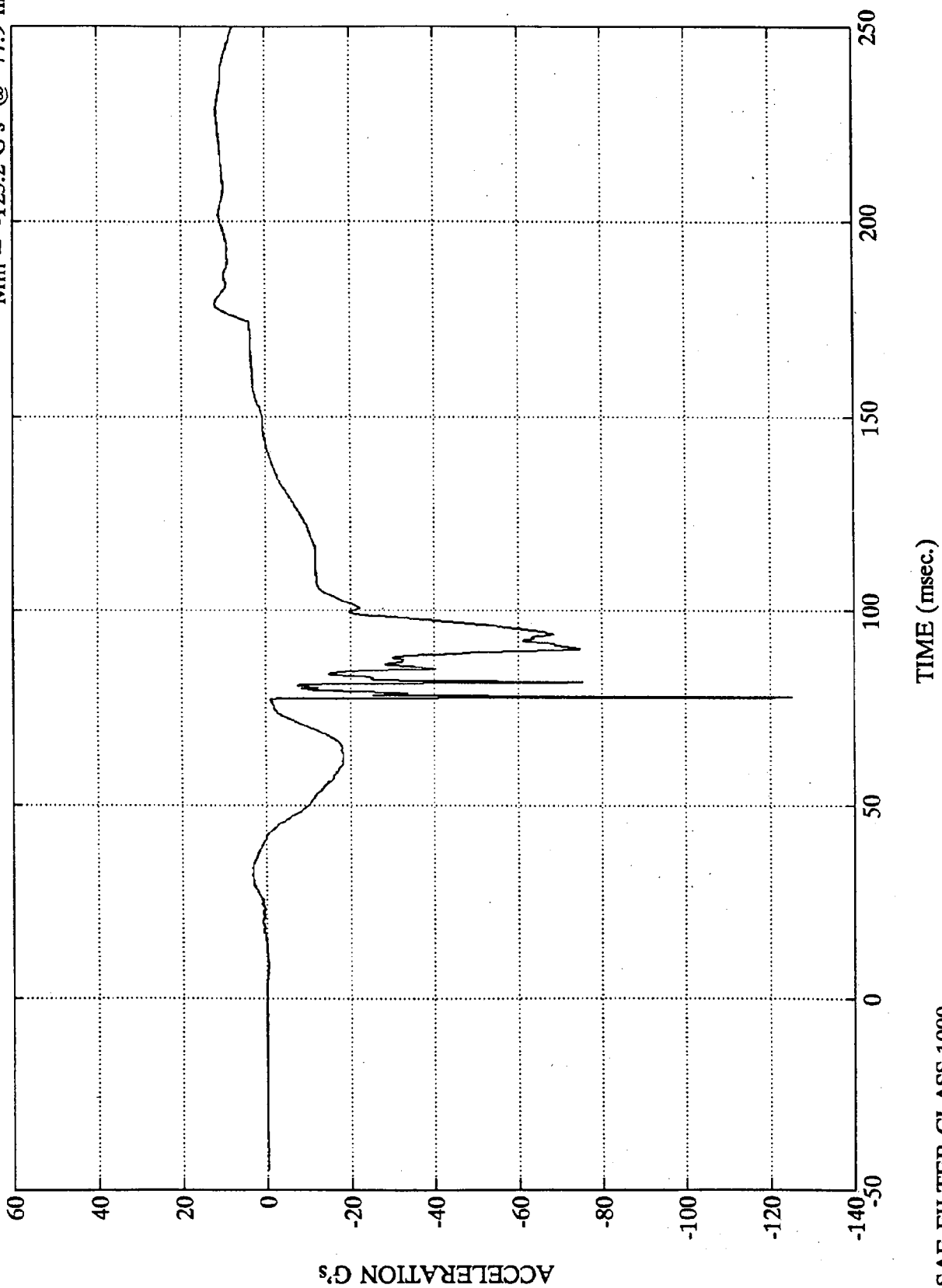
DUMMY DATA

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

Test 1039

POS #1 HEAD X

Max = 12.1 G's @ 179.3 msec
Min = -125.2 G's @ 77.9 msec

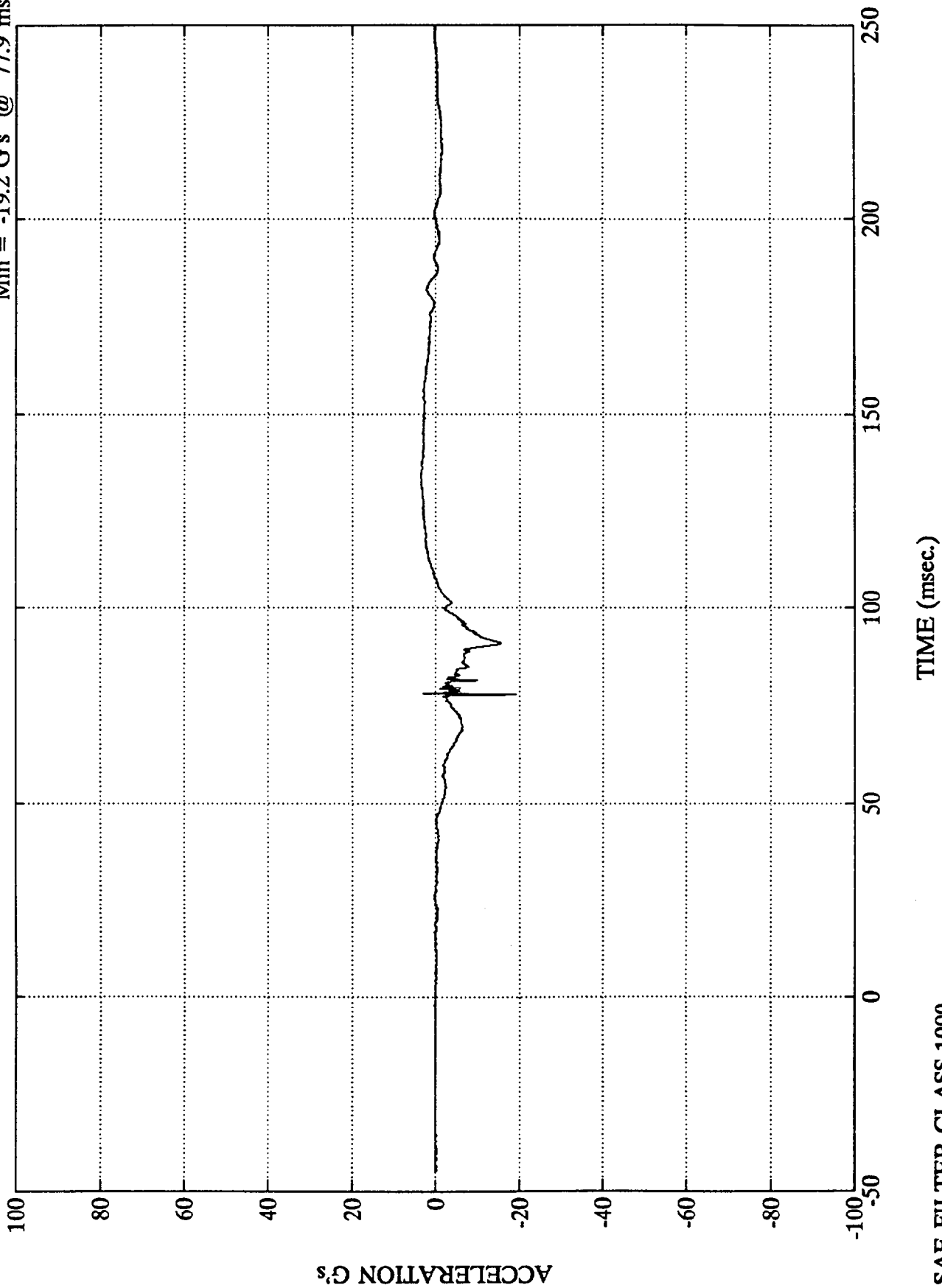


SAE FILTER CLASS 1000

Test 1039
Max = 3.6 G's @ 134.8 msec
Min = -19.2 G's @ 77.9 msec

POS #1 HEAD Y

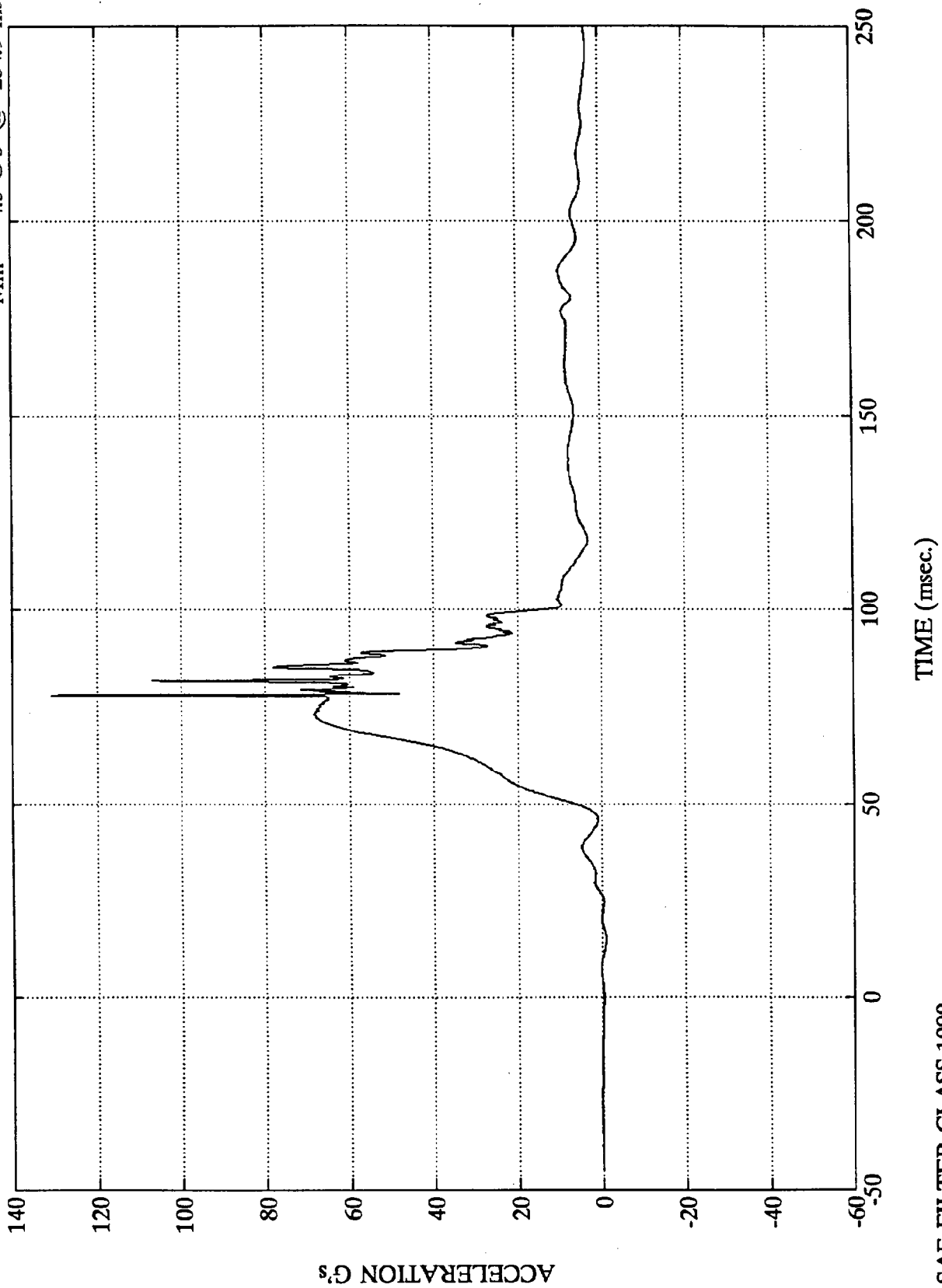
SAE FILTER CLASS 1000



Test 1039

POS #1 HEAD Z

Max = 130.7 G's @ 77.8 msec
Min = -4.5 G's @ 254.9 msec

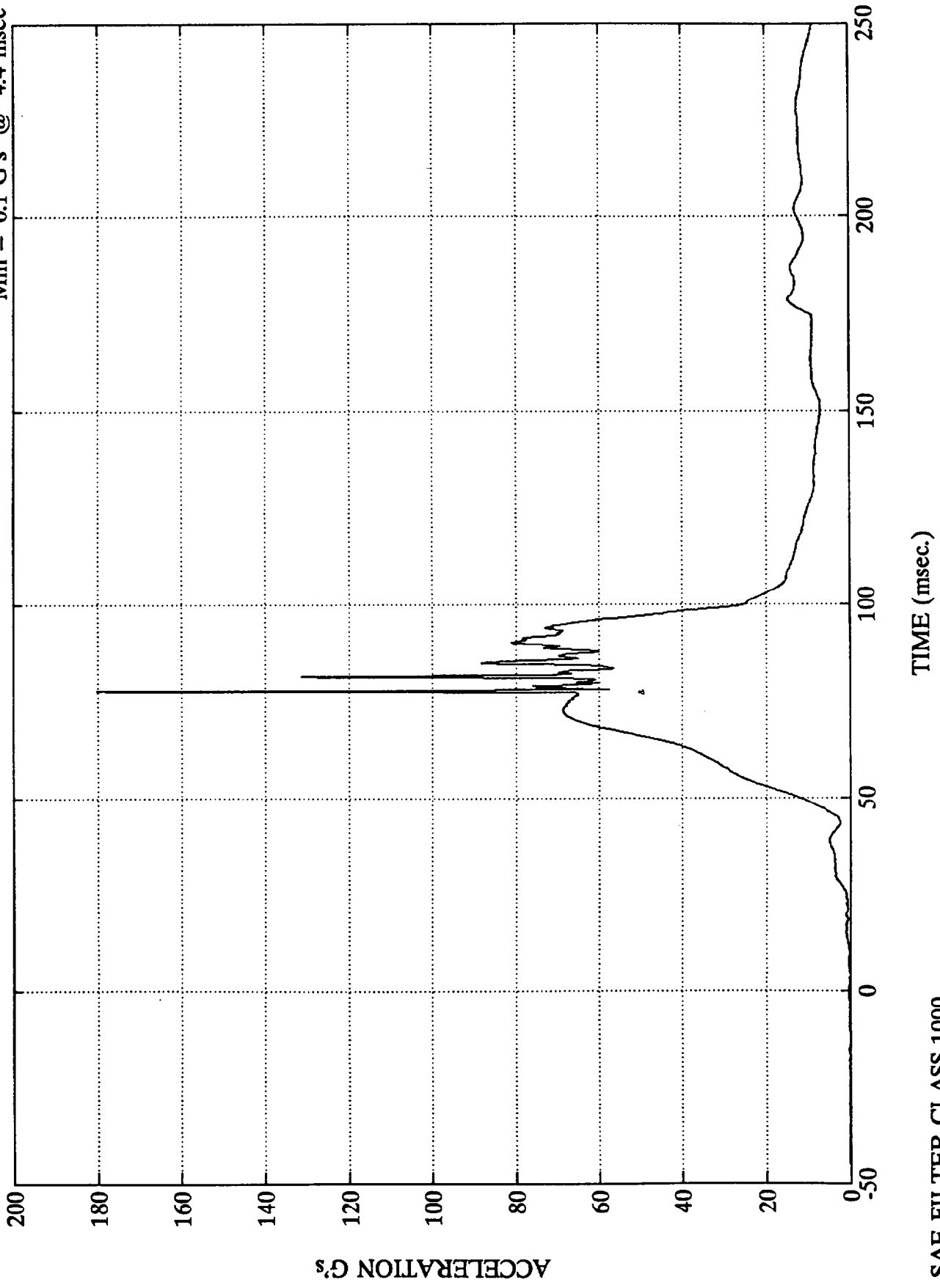


SAE FILTER CLASS 1000

Test 1039
Max = 180.1 G's @ 77.9 msec
Min = 0.1 G's @ 4.4 msec

POS #1 HEAD RESULTANT

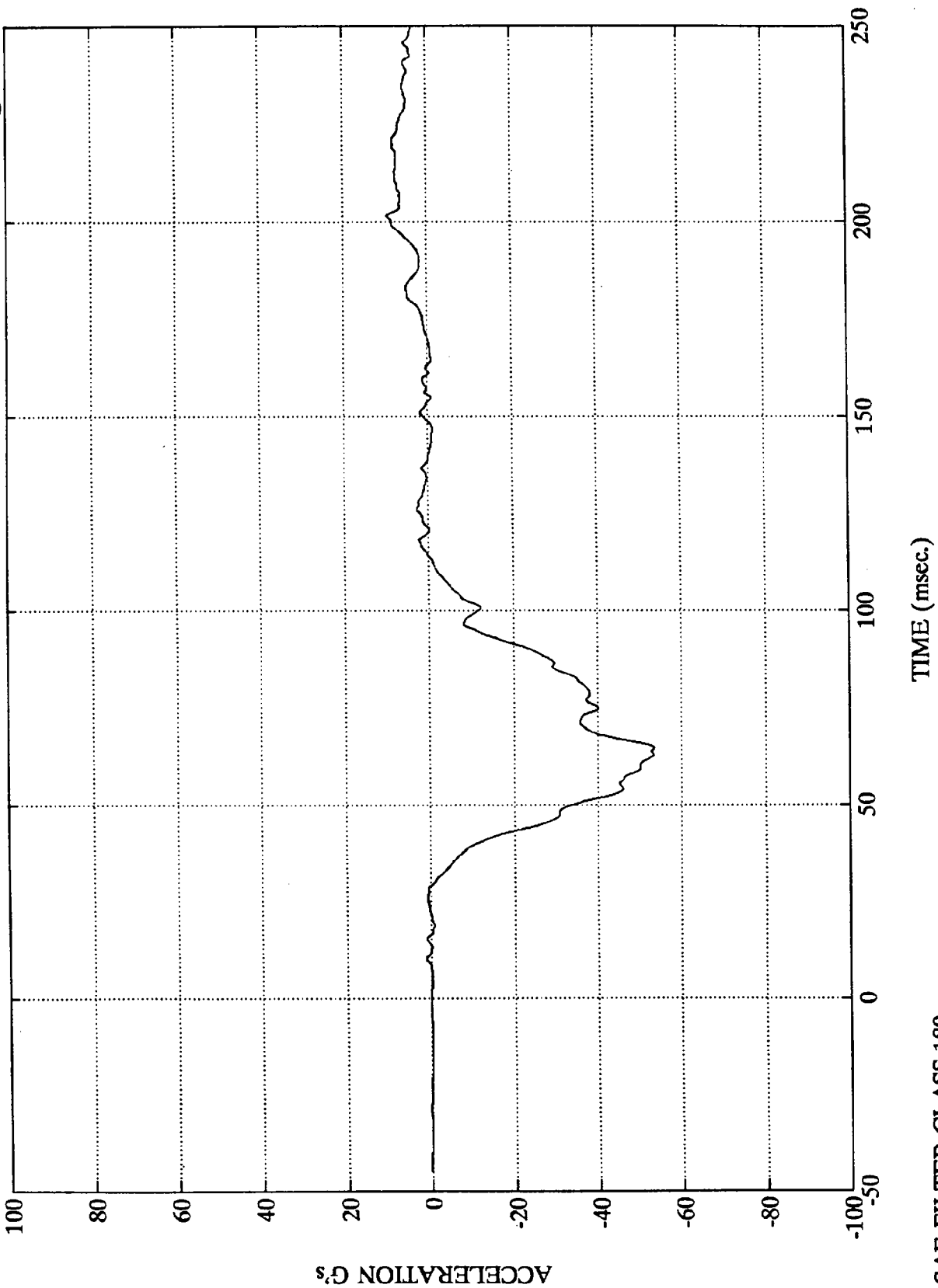
7893-2



Test 1039

POS #1 CHEST X

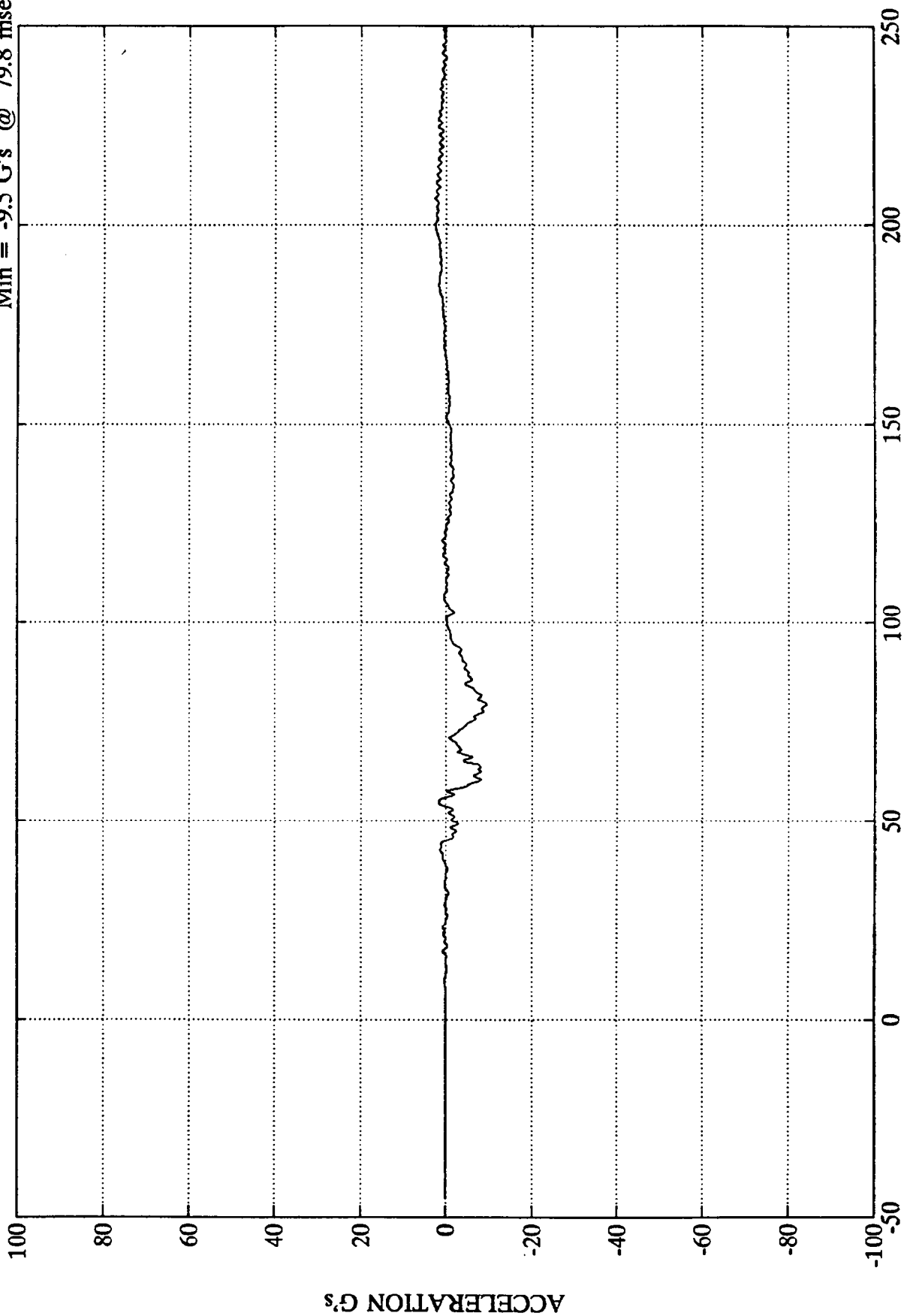
Max = 9.3 G's @ 201.4 msec
Min = -53.4 G's @ 64.7 msec



SAE FILTER CLASS 180

Test 1039
Max = 2.6 G's @ 206.4 msec
Min = -9.5 G's @ 79.8 msec

POS #1 CHEST Y



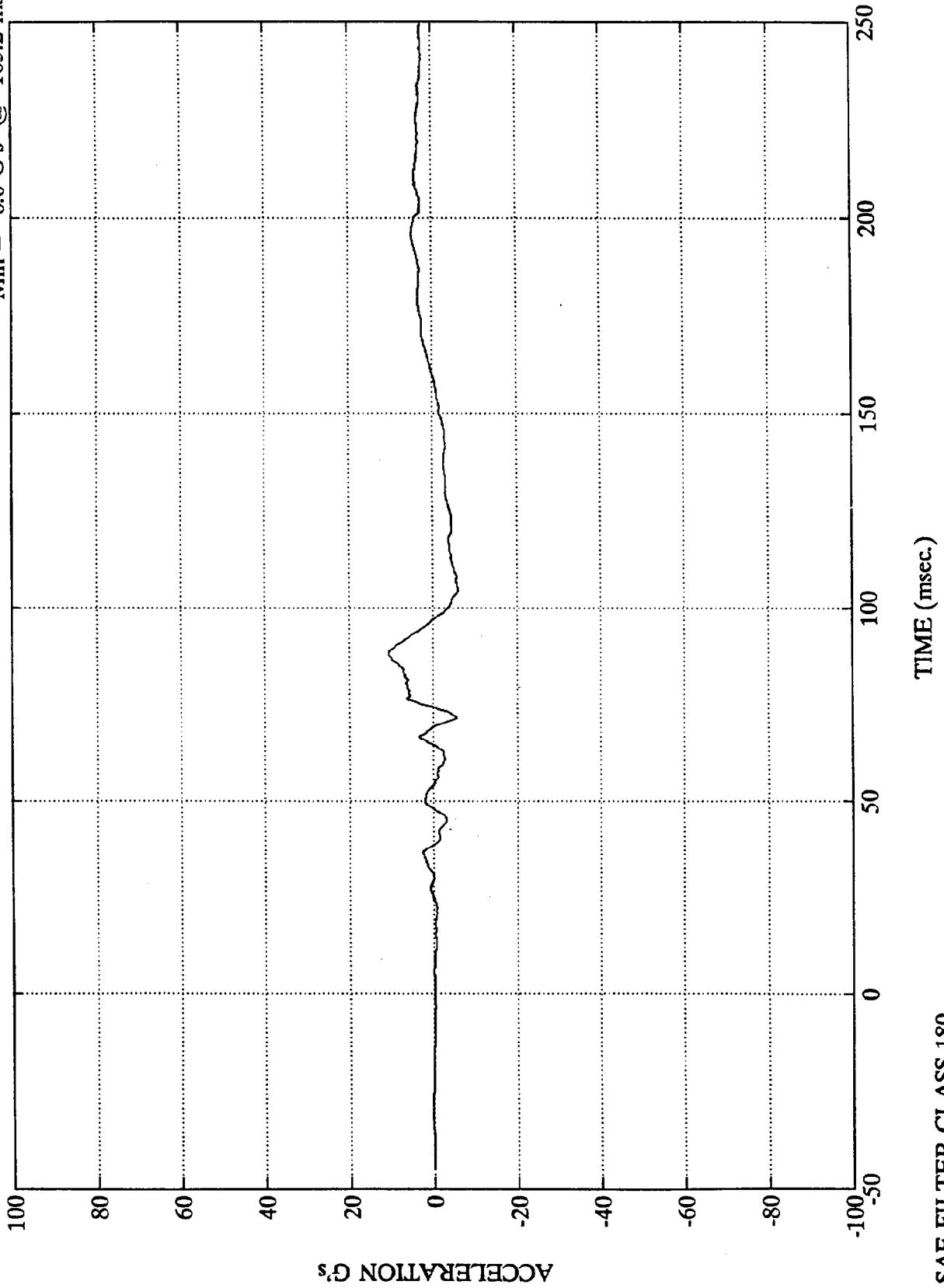
TIME (msec.)

SAE FILTER CLASS 180

Test 1039

Max = 10.5 G's @ 87.8 msec
Min = -6.0 G's @ 105.2 msec

POS #1 CHEST Z

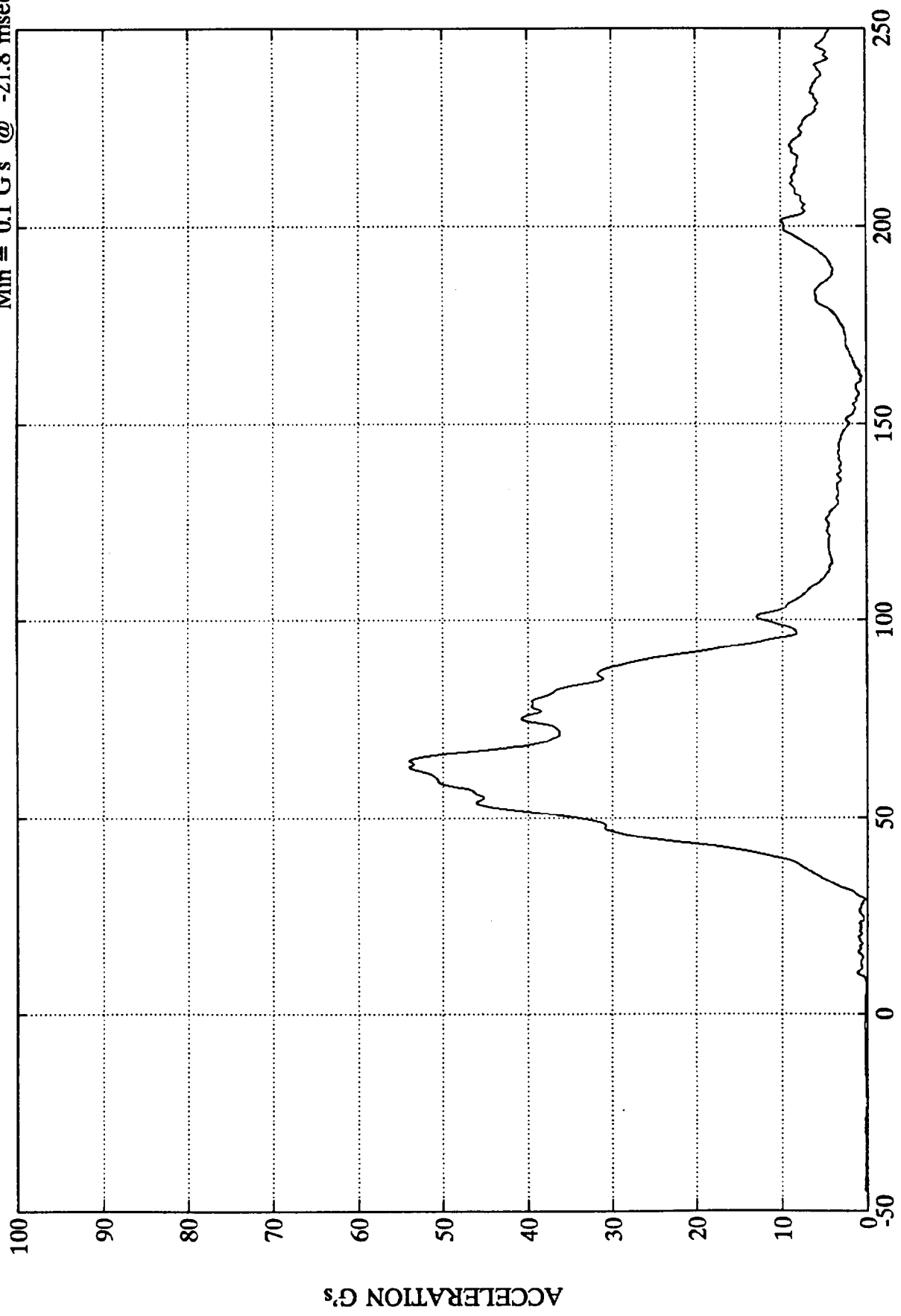


SAE FILTER CLASS 180

Test 1039
Max = 54.0 G's @ 62.9 msec
Min = 0.1 G's @ -21.8 msec

POS #1 CHEST RESULTANT

7893-2



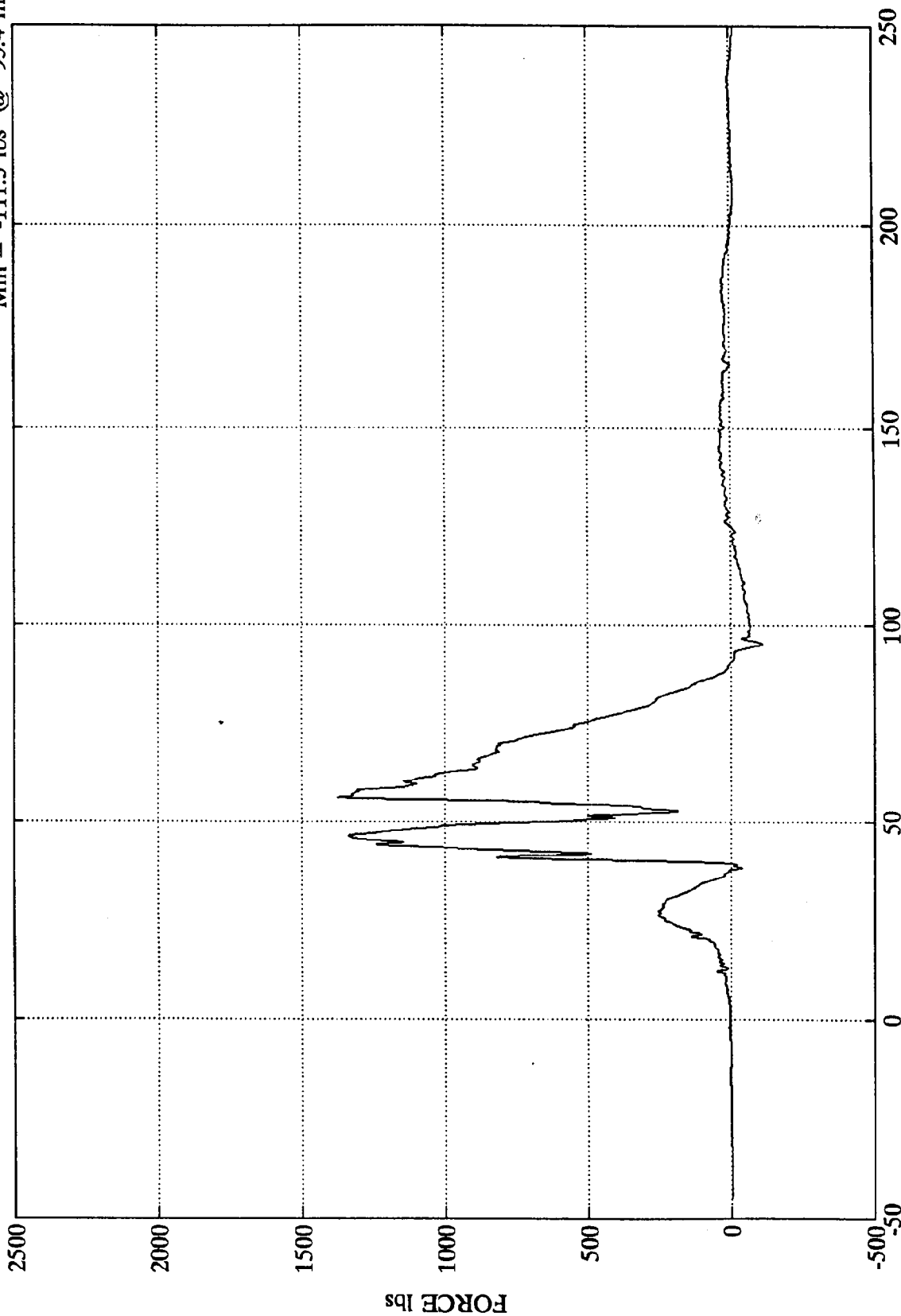
TIME (msec.)

SAE FILTER CLASS 180

Test 1039

POS #1 LEFT FEMUR

Max = 1375.3 lbs @ 56.2 msec
Min = -111.5 lbs @ 95.4 msec

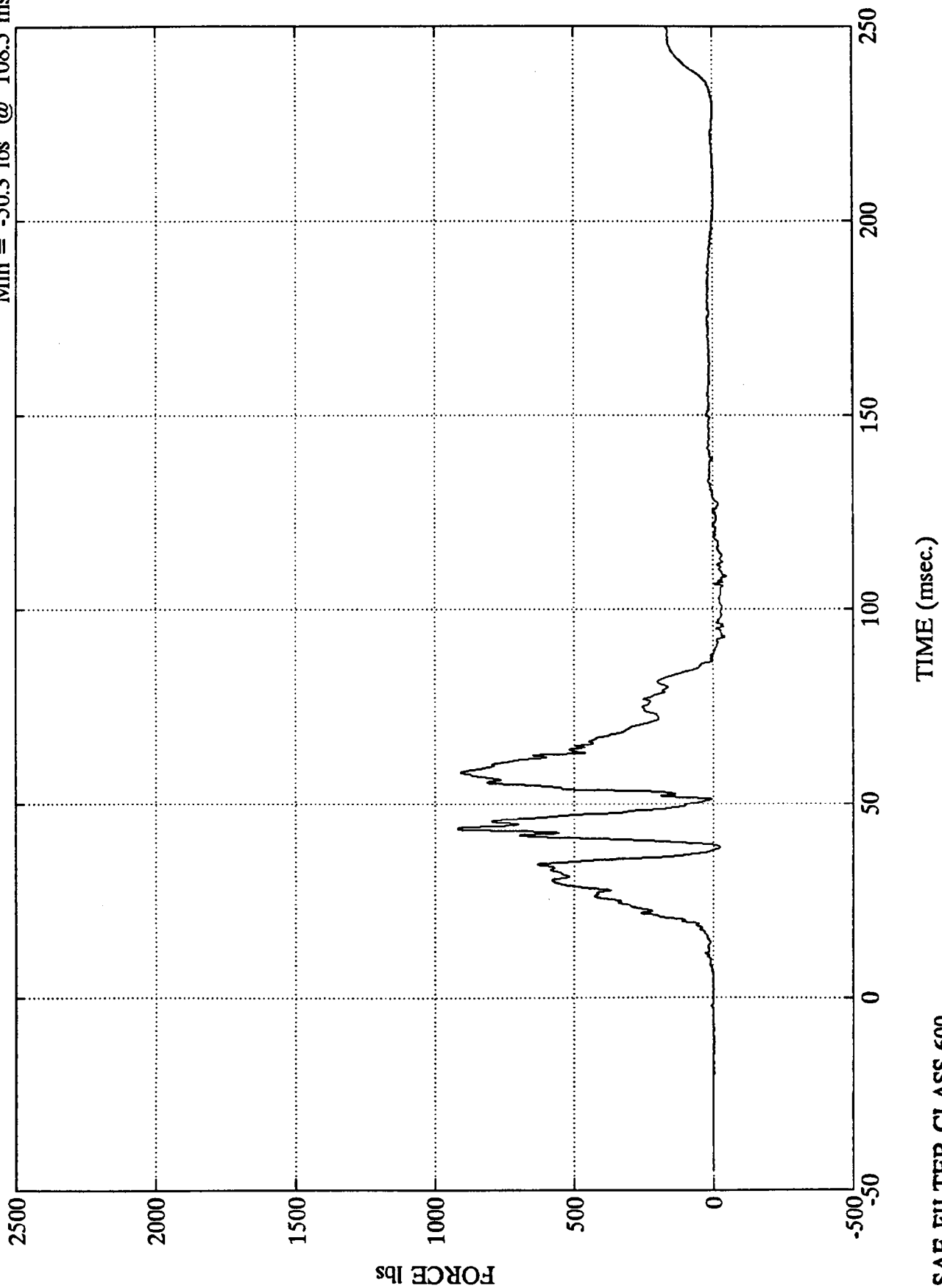


TIME (msec.)

SAE FILTER CLASS 600

Test 1039
Max = 917.2 lbs @ 43.3 msec
Min = -50.3 lbs @ 108.5 msec

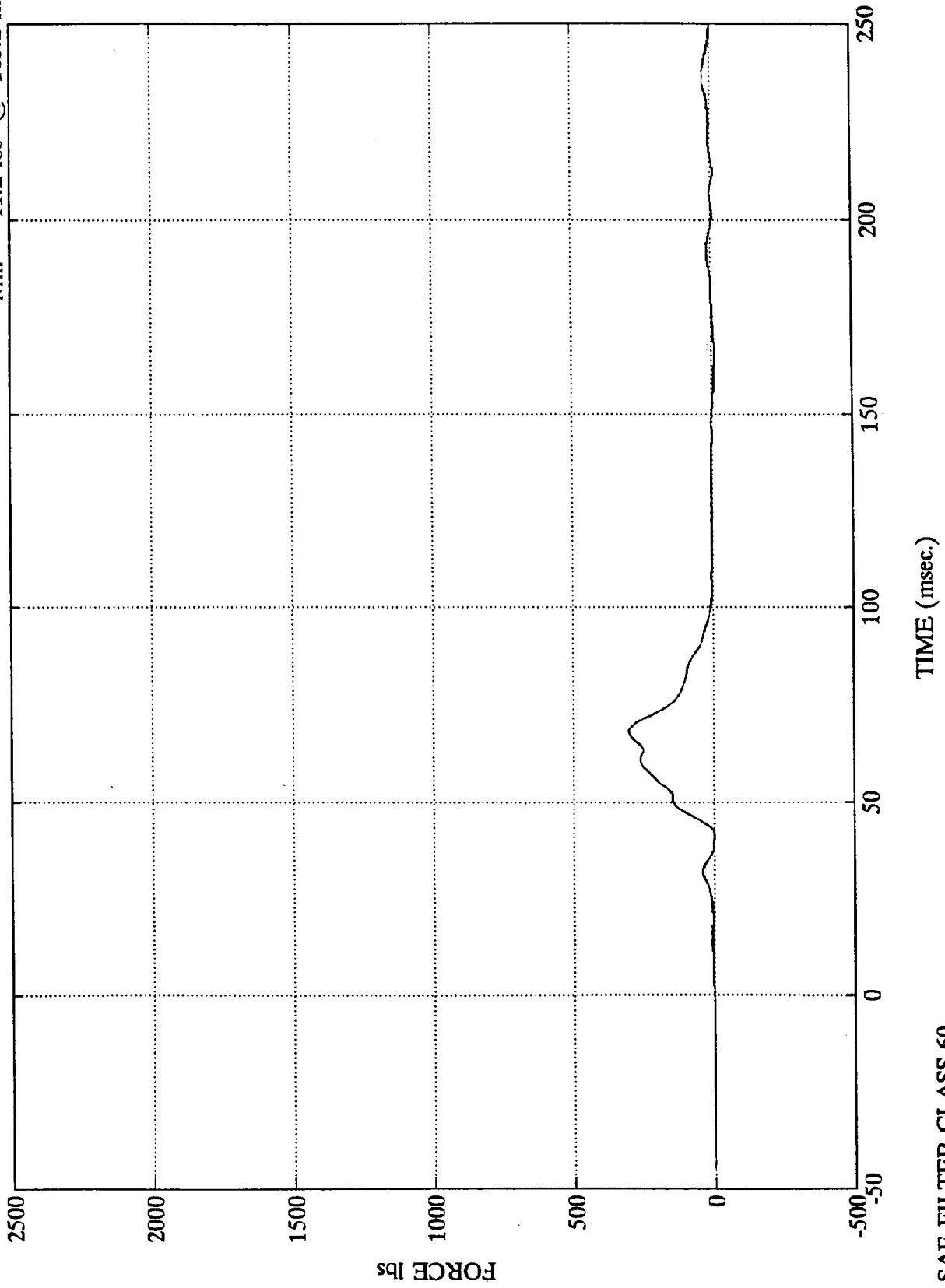
POS #1 RIGHT FEMUR



Test 1039

Max = 302.2 lbs @ 68.3 msec
Min = -11.2 lbs @ 165.2 msec

POS #1 LAP BELT

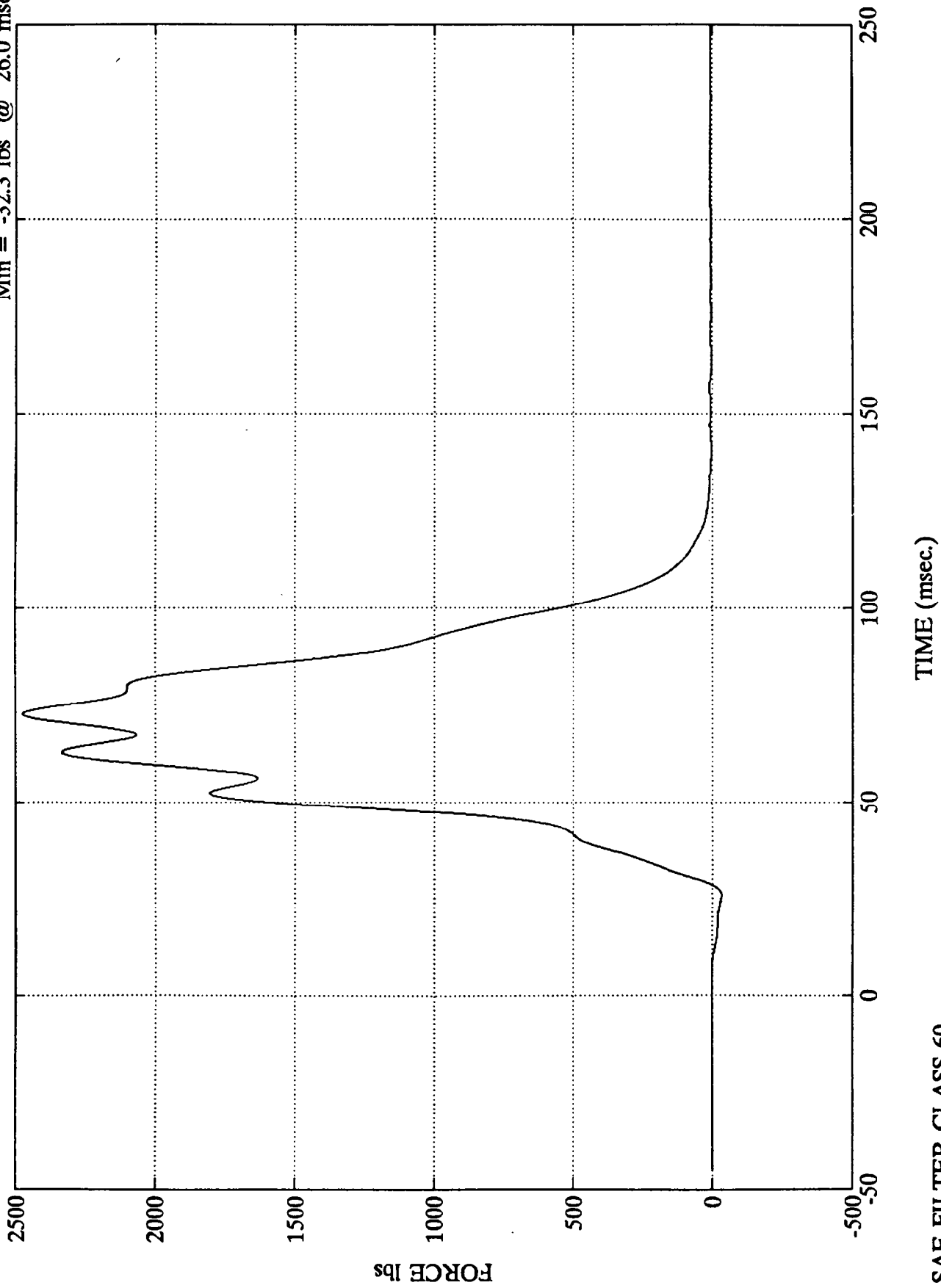


SAE FILTER CLASS 60

Test 1039

POS #1 TORSO BELT

Max = 2474.5 lbs @ 72.7 msec
Min = -32.3 lbs @ 26.0 msec



FORCE lbs

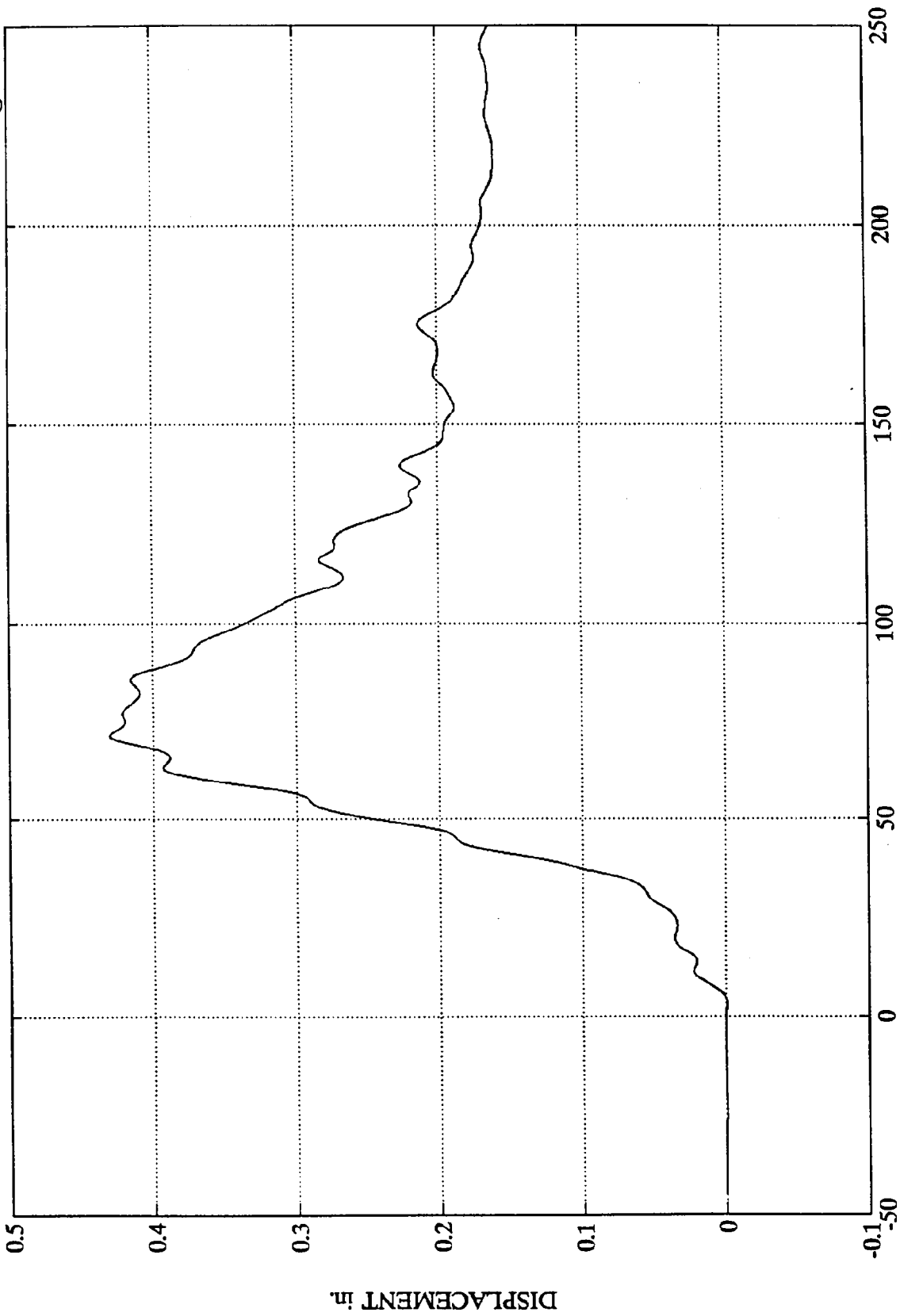
TIME (msec.)

SAE FILTER CLASS 60

Test 1039

POS #1 BELT ELONGATION

Max = 0.430 in. @ 71.5 msec
Min = -0.000 in. @ 3.4 msec



TIME (msec.)

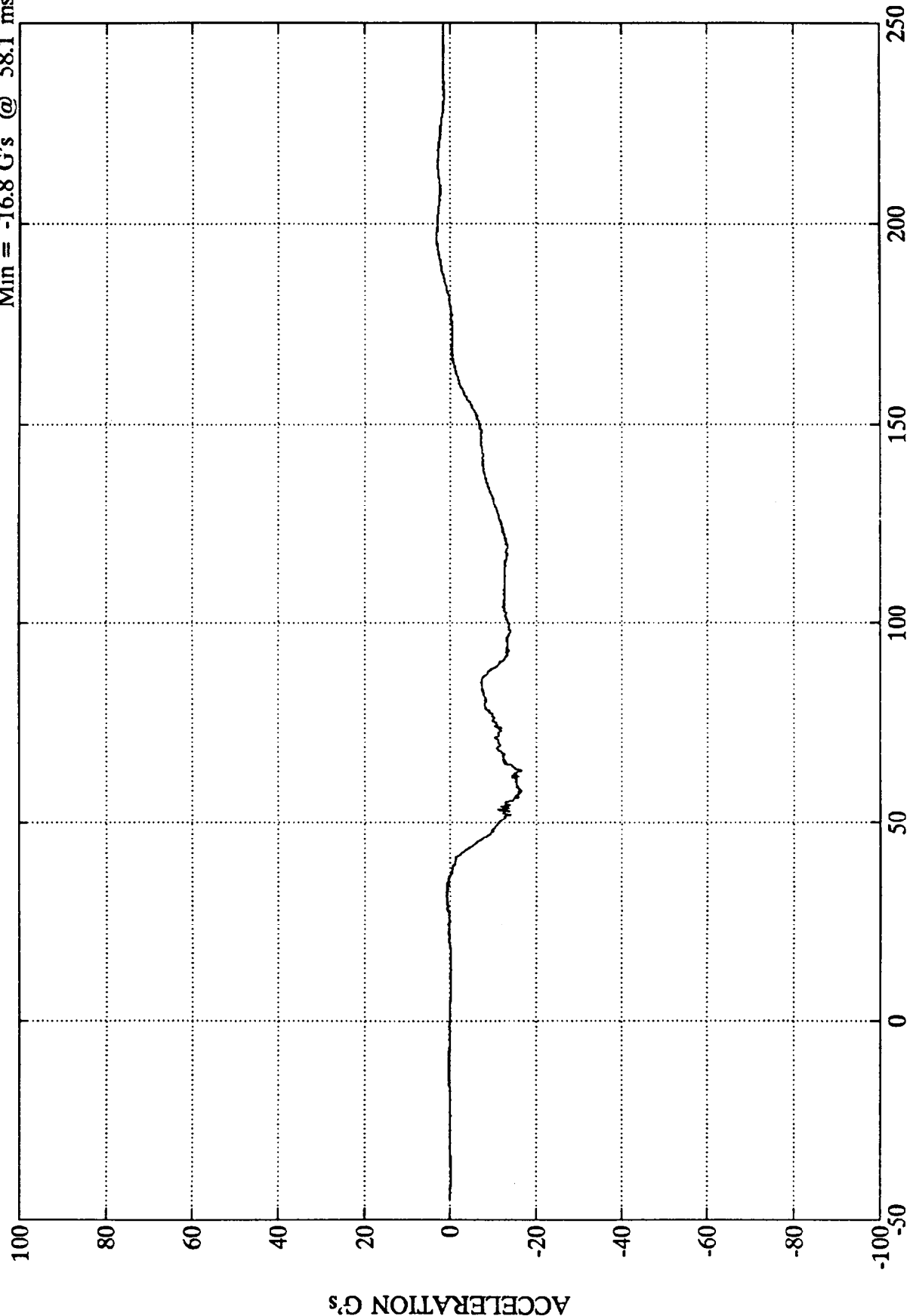
Measured over 2.5 inches

SAE FILTER CLASS 60

Test 1039
Max = 3.2 G's @ 197.2 msec
Min = -16.8 G's @ 58.1 msec

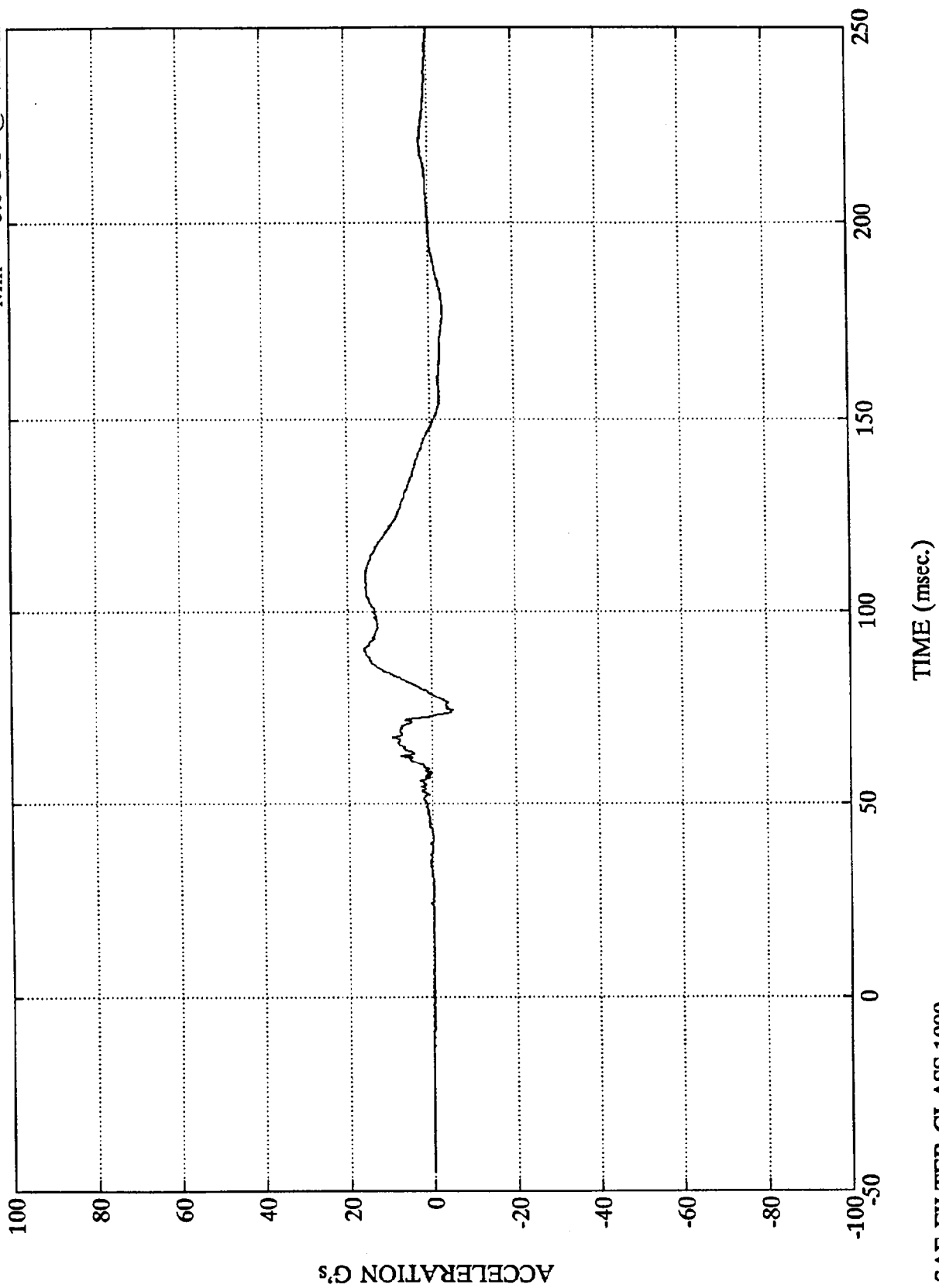
POS #2 HEAD X

SAE FILTER CLASS 1000



TIME (msec.)

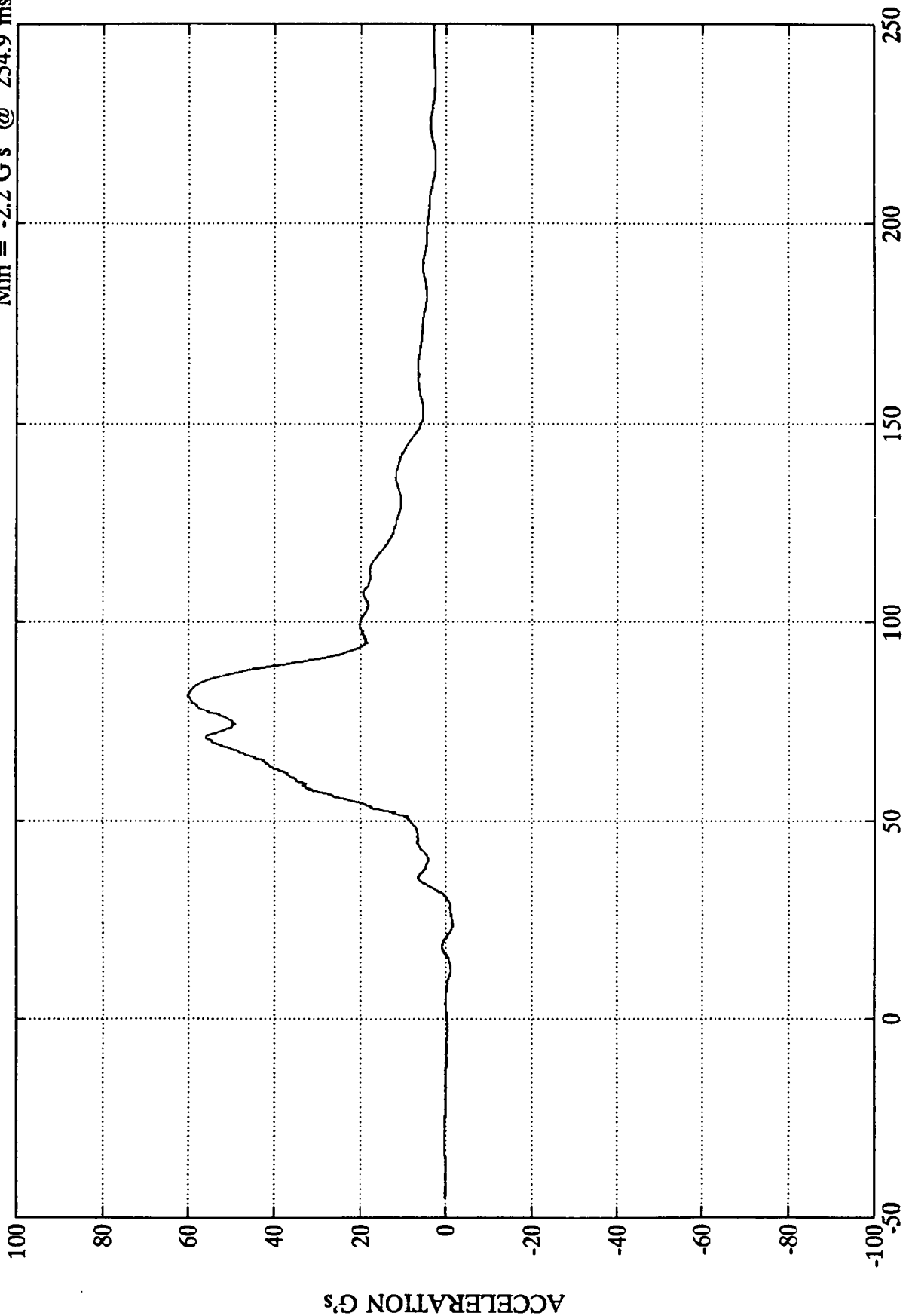
Test 1039
POS #2 HEAD Y
Max = 16.2 G's @ 90.4 msec
Min = -5.0 G's @ 74.3 msec



SAE FILTER CLASS 1000

Test 1039
Max = 60.1 G's @ 81.8 msec
Min = -2.2 G's @ 254.9 msec

POS #2 HEAD Z



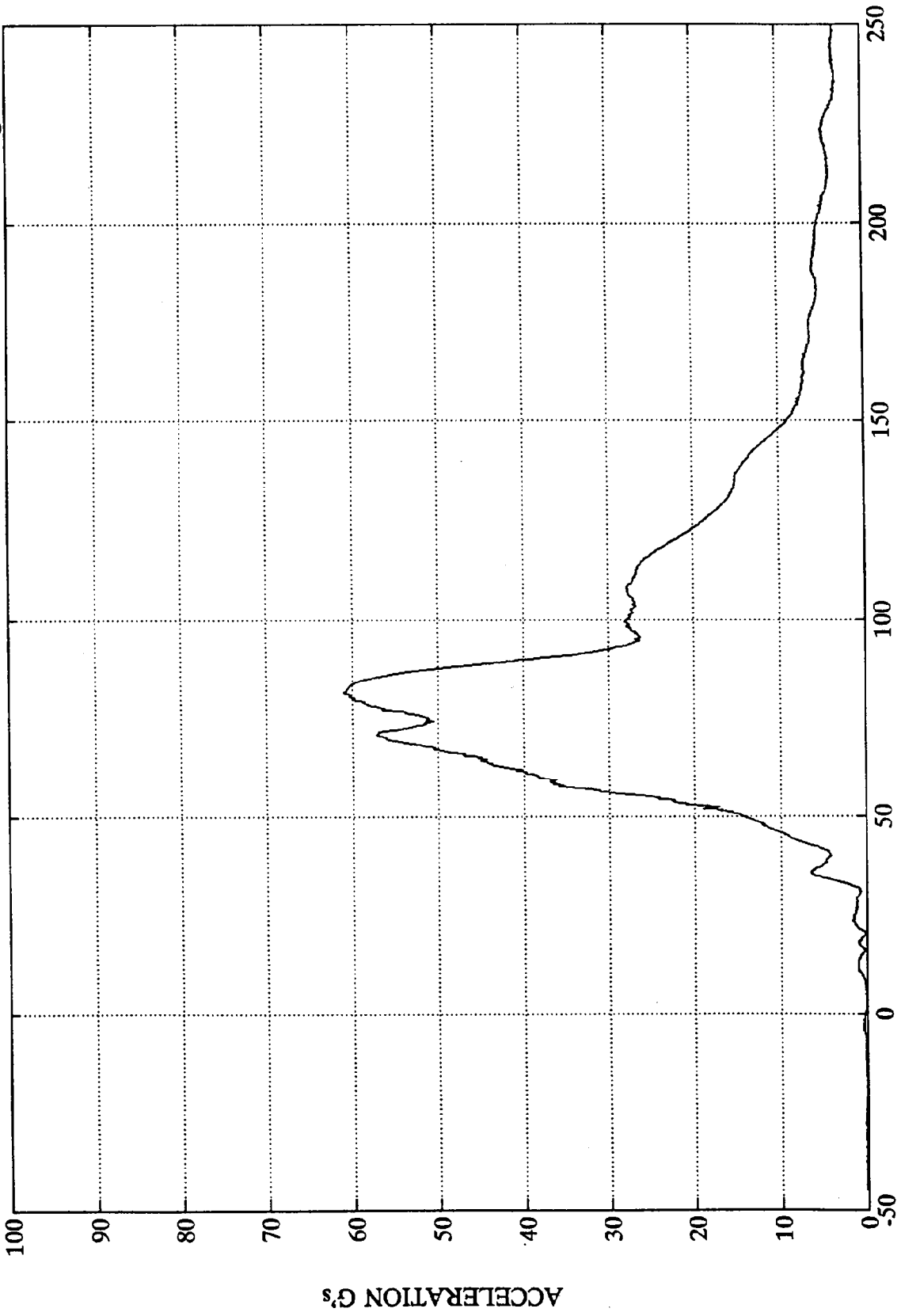
TIME (msec.)

SAE FILTER CLASS 1000

Test 1039

Max = 60.9 G's @ 81.7 msec
Min = 0.1 G's @ 2.9 msec

POS #2 HEAD RESULTANT

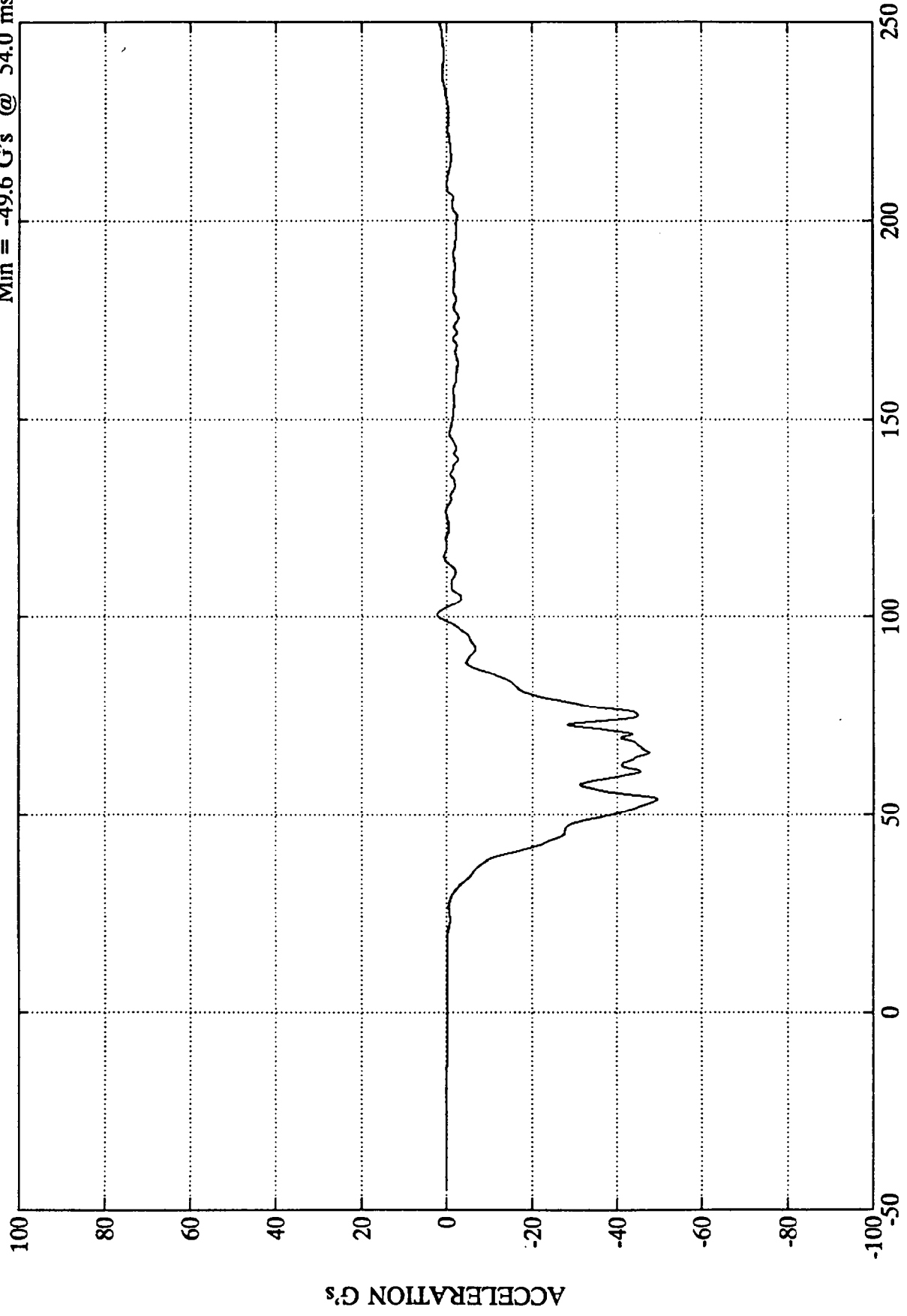


TIME (msec.)

SAE FILTER CLASS 1000

Test 1039
Max = 2.2 G's @ 100.6 msec
Min = -49.6 G's @ 54.0 msec

POS #2 CHEST X



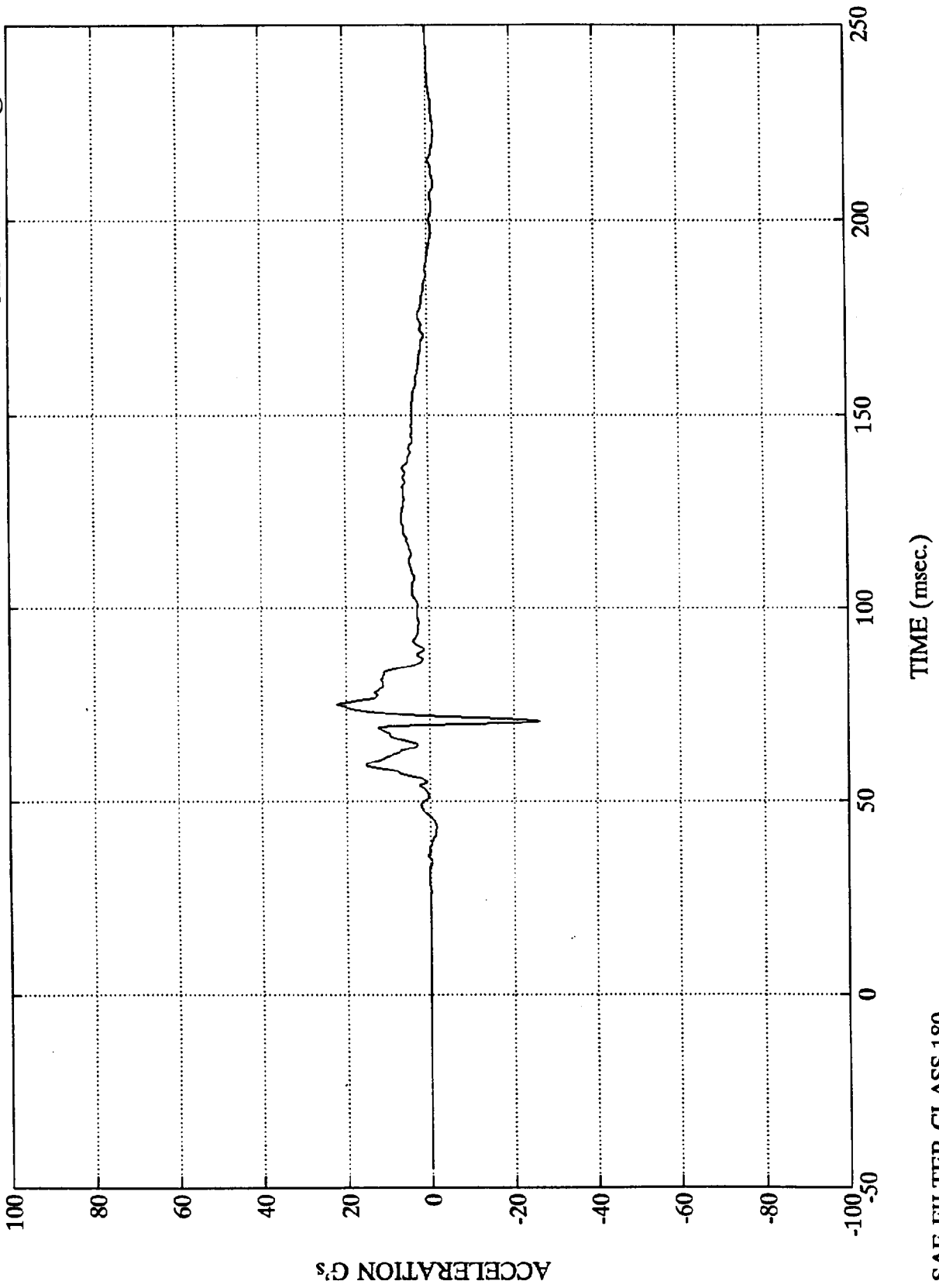
TIME (msec.)

SAE FILTER CLASS 180

Test 1039

POS #2 CHEST Y

Max = 22.1 G's @ 75.2 msec
Min = -26.4 G's @ 70.9 msec

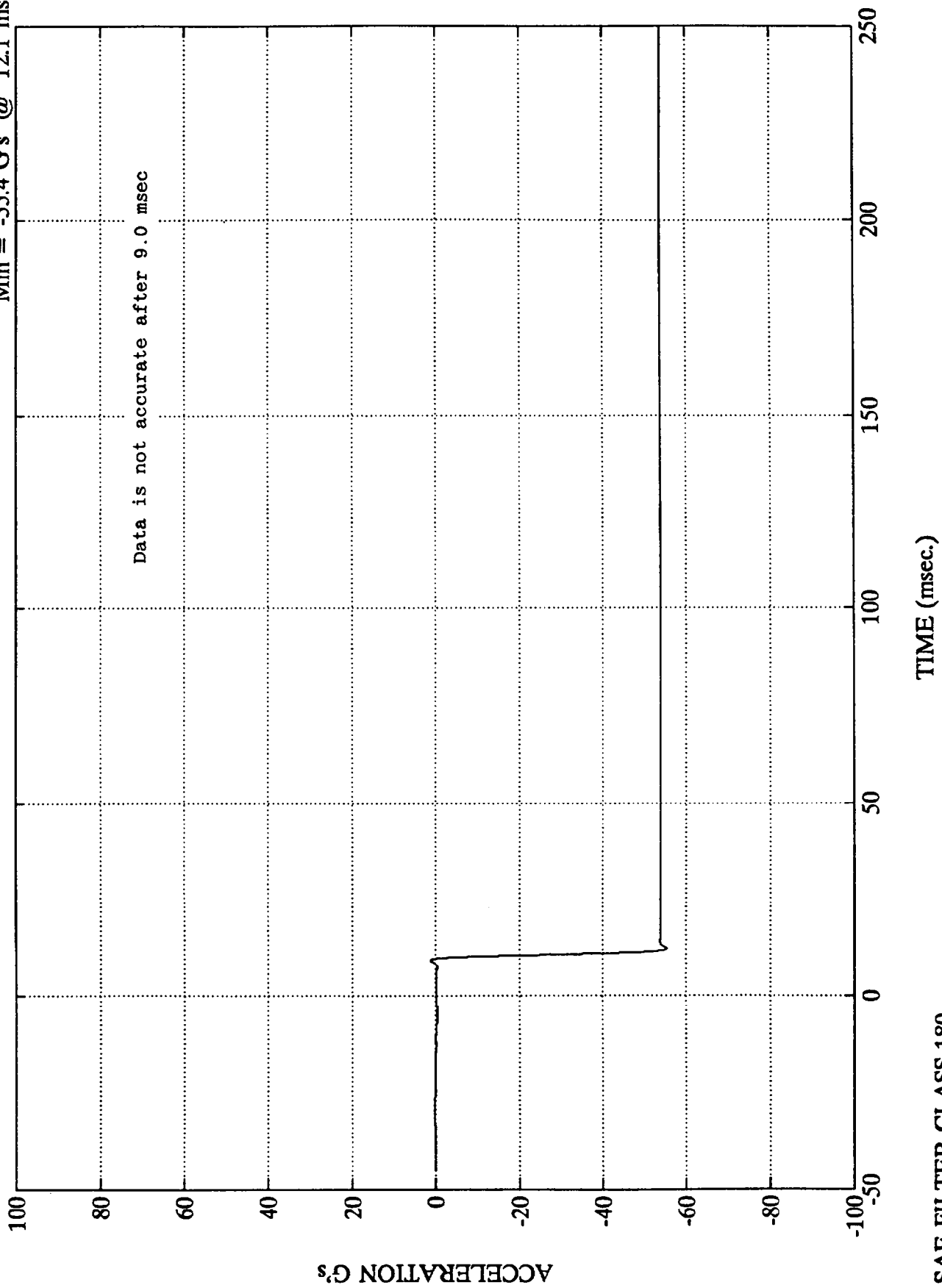


SAE FILTER CLASS 180

Test 1039

POS #2 CHEST Z

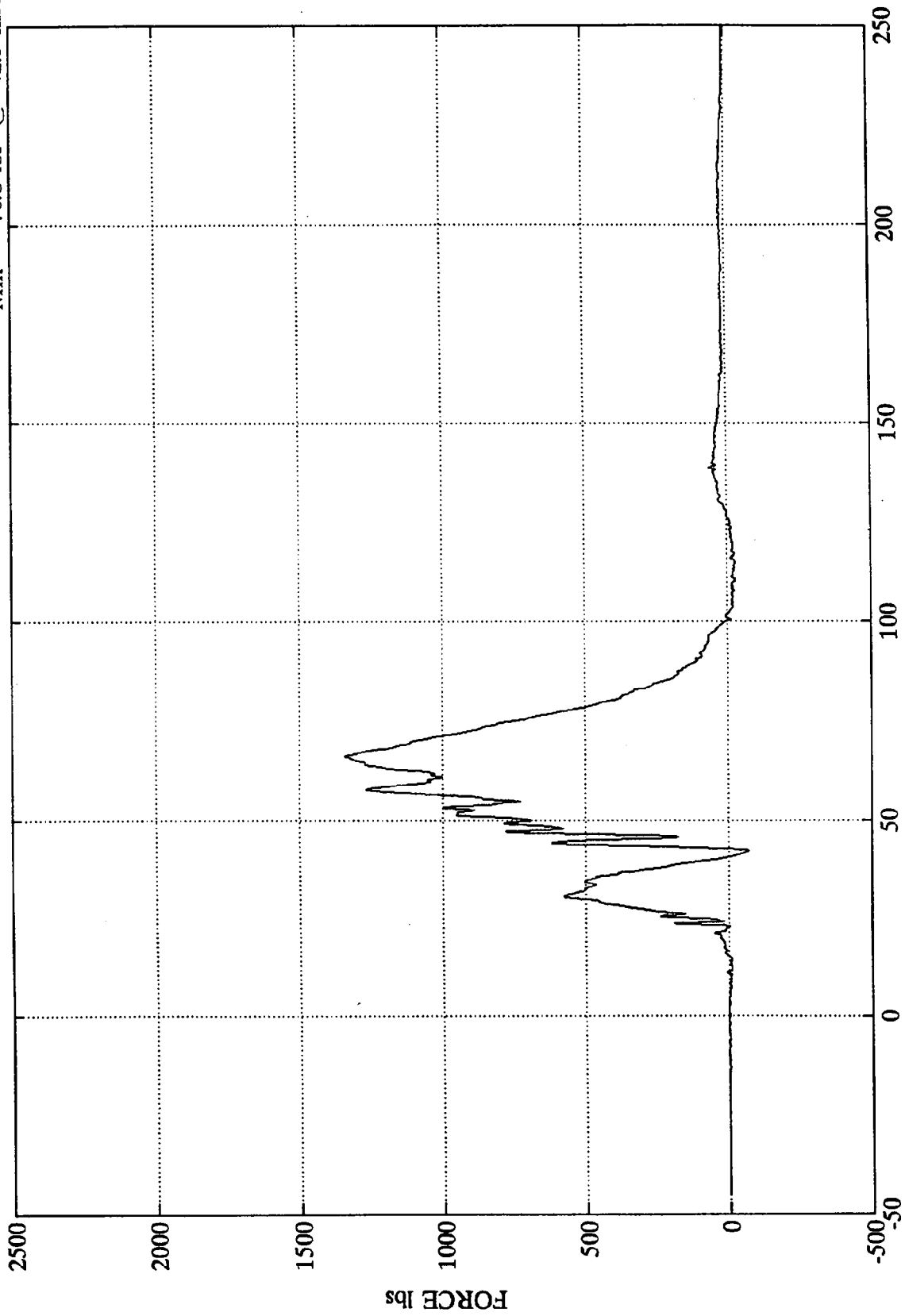
Max = 1.3 G's @ 9.2 msec
Min = -55.4 G's @ 12.1 msec



Max = 1341.5 lbs @ 66.2 msec
Min = -70.8 lbs @ 42.5 msec

POS #2 LEFT FEMUR

Test 1039

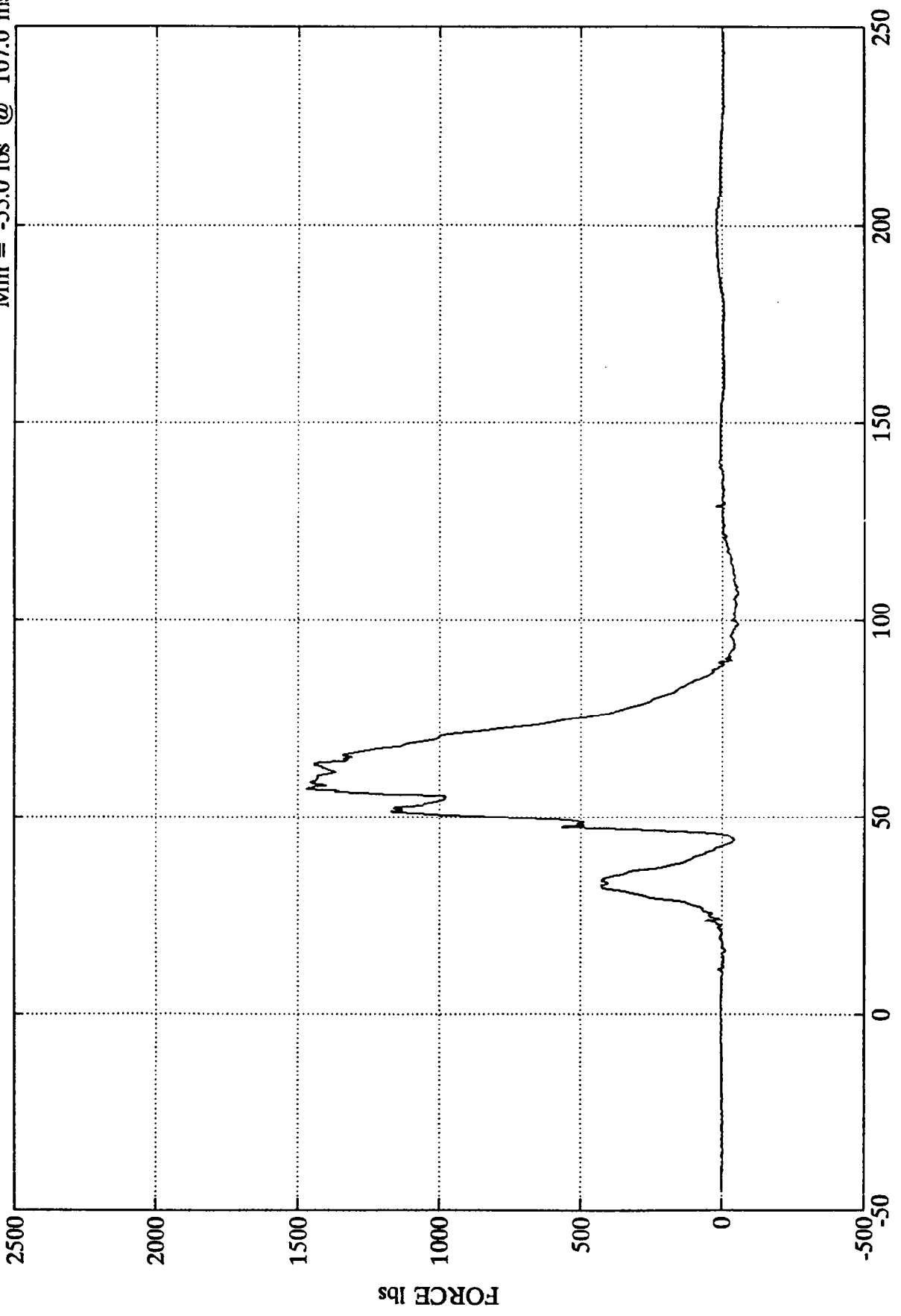


TIME (msec.)

SAE FILTER CLASS 600

Test 1039
Max = 1469.0 lbs @ 57.1 msec
Min = -55.0 lbs @ 107.0 msec

POS #2 RIGHT FEMUR



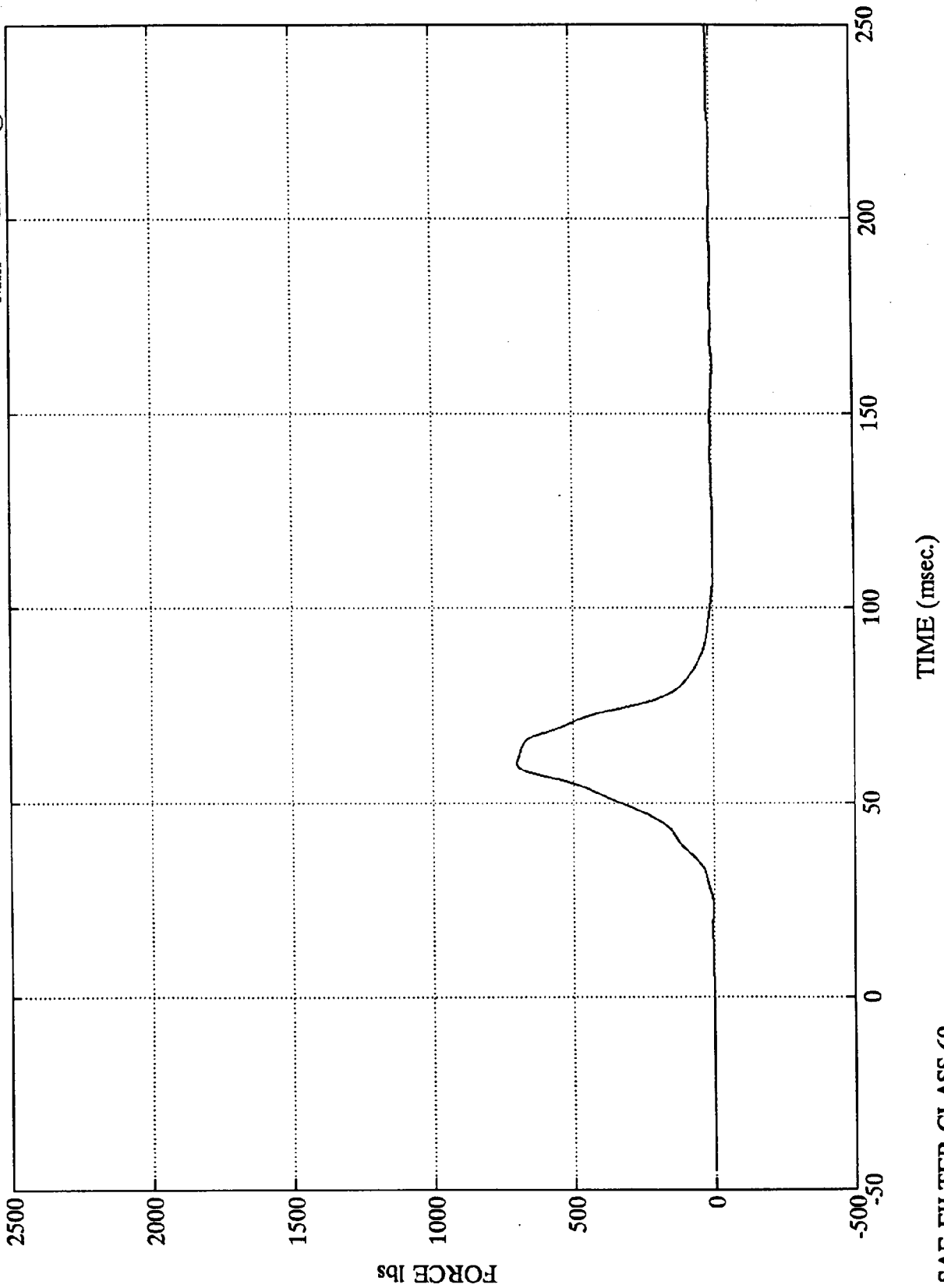
TIME (msec.)

SAE FILTER CLASS 600

Test 1039

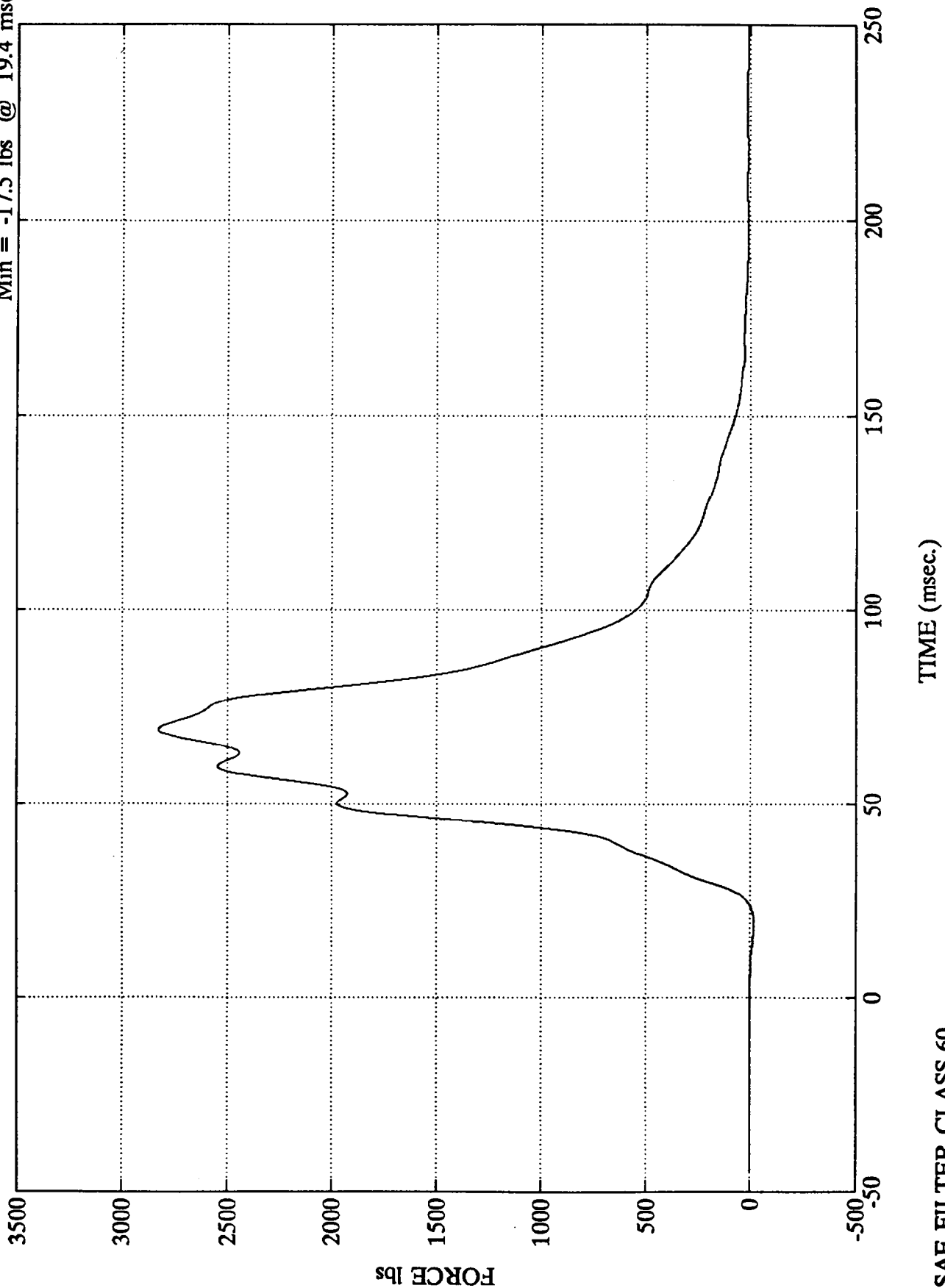
Max = 701.2 lbs @ 60.4 msec
Min = -2.0 lbs @ 162.8 msec

POS #2 LAP BELT



Test 1039
Max = 2825.0 lbs @ 69.0 msec
Min = -17.5 lbs @ 19.4 msec

POS #2 TORSO BELT

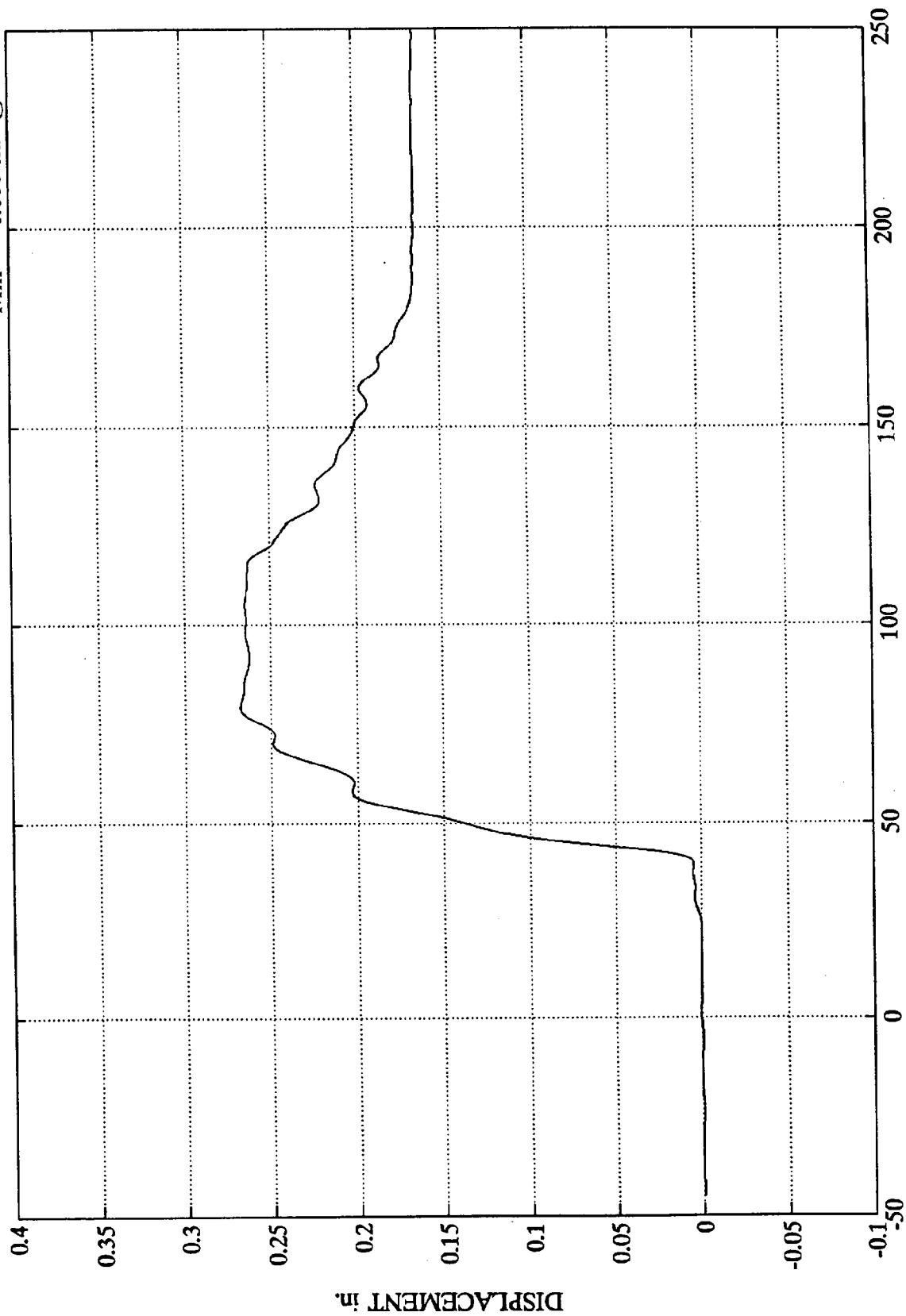


SAE FILTER CLASS 60

Test 1039

Max = 0.268 in. @ 79.2 msec
Min = -0.000 in. @ -43.6 msec

POS #2 BELT ELONGATION



TIME (msec.)

Measured over 2.5 inches

SAE FILTER CLASS 60

Appendix C

PART 572 B 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.

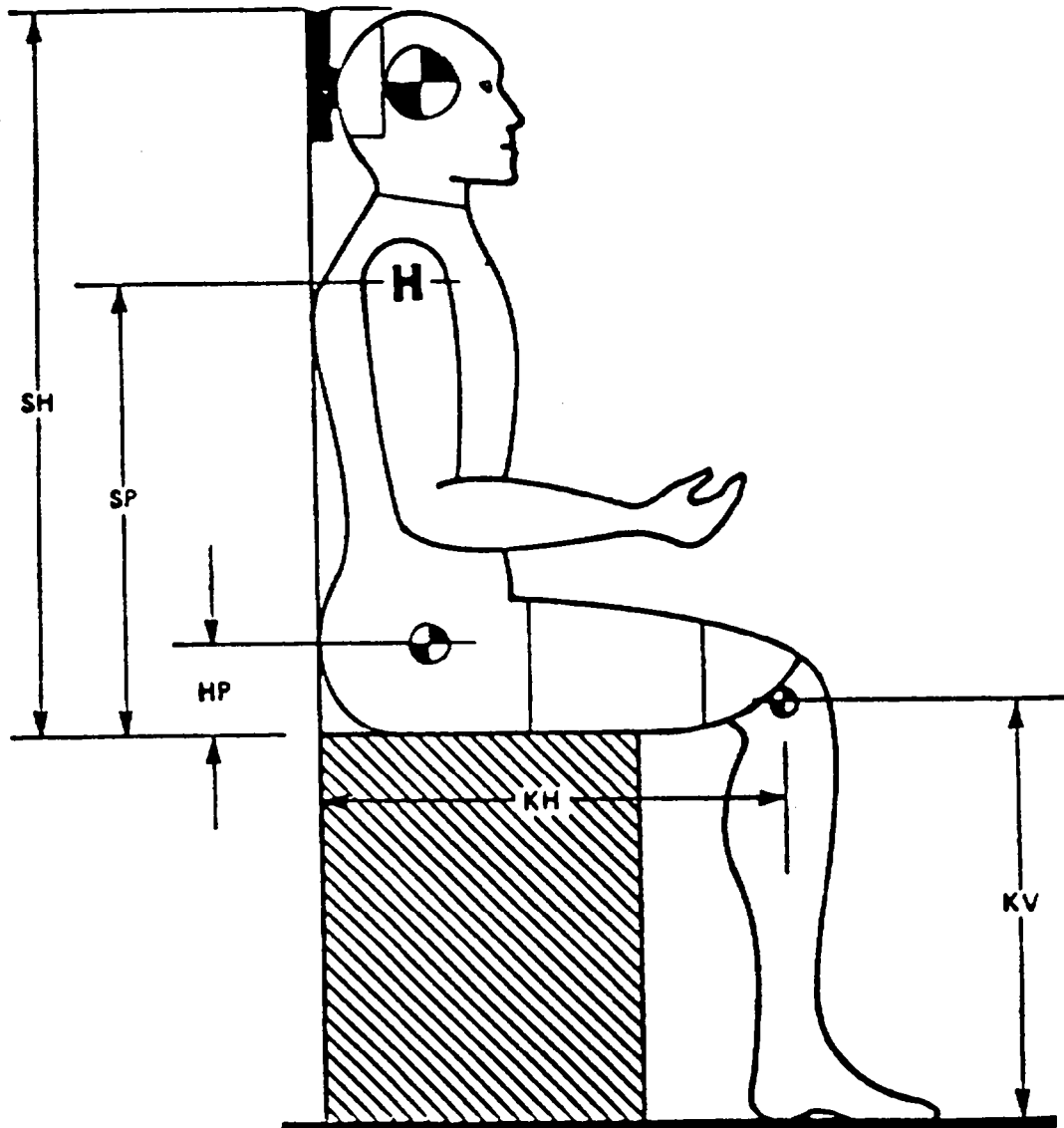
Dummy serial numbers and certification dates are:

<u>Serial No.</u>	<u>Completion Date</u>
320	9-25-90
749	9-25-90

Electronic Test Equipment

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

Figure 10
DUMMY CONFIGURATION DIMENSIONS



PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NUMBER.: 320

I. CONFIGURATION VERIFICATION DATA

	P. 572 SPECIFICATION	PRE-TEST if required	POST-TEST if required
DATE OF CONFIGURATION VERIFICATION	XXXXXXXXXXXXXX	09-25-90	
VERIFICATION NUMBER FOR DUMMY (*)	XXXXXXXXXXXXXX	1	
SH - Seated Height	35.6 to 35.8"	35.7 "	"
SP - Shoulder Pivot Height	21.8 to 22.4"	22.0 "	"
HP - Hip Pivot Height	3.9" ref.	3.9 "	"
KH - Knee Pivot from Back Line	20.1 to 20.7"	20.4 "	"
KV - Knee Pivot from floor	19.3 to 19.9"	19.6 "	"
SW - Shoulder Width	17.8 to 18.4"	18.1 "	"
HW - Hip Width	14.0 to 15.4"	14.8 "	"

II. PERFORMANCE VERIFICATION DATA:

		PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION		9-25-90	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY (*)		1	
VERIFICATION LAB TEMPERATURE (66 to 78 deg.)		69-71 deg	deg
VERIFICATION LAB HUMIDITY (10 TO 70 %)		44-51 %	%
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST			
a. peak resultant accel.	210 to 260 G's	253.8 G's	G's
b. peak lateral accel.	<= 10 G's	6.7 G's	G's
c. Time above 100 G's	0.9 to 1.5 ms.	1.25 ms	ms

* Sequential number beginning with "1" at the start of each fiscal years' crash test program.

TECHNICIAN'S NAME: IVAN MINKEWICZ

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 320

TEST PARAMETER		SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
2. NECK BENDING TEST				
a. Pendulum Speed		21.5 to 25.5 fps.	22.7 fps	
b. Pend. Avg. Decel. over t3 to t2		20 to 24 G's	23.8 G's	
c. Peak Resultant Head Acceleration		26 G's max.	25.93 G's	
d. Pendulum Decel. (t2-t1)		<= 3 ms.	2.6 ms	
e. Pendulum Decel. (t3-t2)		25 to 30 ms.	27.28 ms	
f. Pendulum Decel. (t4-t3)		<= 10 ms.	4.46 ms	
g. Max. Head Rotation		63 to 73 deg.	70.48 deg	
h. Chordal Displacement				
HEAD ROTATION ANGLE				
0 deg.	Time	-2 to 2 ms.	0.0 ms	
	Displ.	-.5 to .5"	0.0 "	
30 deg.	Time	25.6 to 34.4 ms.	28.03 ms	
	Displ.	2.1 to 3.1"	2.69 "	
60 deg.	Time	40.3 to 51.7 ms.	41.29 "	
	Displ.	4.3 to 5.3"	4.39 "	
Maximum	Time	53.2 to 66.8 ms.	56.42 ms	
	Displ.	5.0 to 6.0"	5.12 "	
60 deg.	Time	67.0 to 83.0 ms.	71.55 ms	
	Displ.	4.3 to 5.3"	4.48 "	
30 deg.	Time	85.4 to 104.6 ms.	89.04 ms	
	Displ.	2.1 to 3.1"	2.26 "	
0 deg.	Time	101.0 - 123.0 ms.	103.55 ms	
	Displ.	-.5 to 0.5"	0.0 "	

TECHNICIANS NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 320

TEST PARAMETER	SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
3. ABDOMINAL COMPRESSION			
TEST: (preload = 50 lbs.)			
a. Force @ 0.5"	23 to 36 lbs.	26.5 lbs	
b. Force @ 0.75"	36 to 50 lbs.	41 lbs	
c. Force @ 1.0"	50 to 63 lbs.	55.5 lbs	
d. Force @ 1.3"	73 to 88 lbs.	82 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20 deg.	22 to 34 lbs.	28.5 lbs	
b. Force @ 30 deg.	34 to 46 lbs.	41 lbs	
c. Force @ 40 deg.	46 to 58 lbs.	54 lbs	
d. Return Angle	12 deg. maximum	7.5 deg	
5. CHEST IMPACT TESTS:			
A. High Speed			
(1) Probe Speed	21.78-22.22 fps.	21.8 fps	
(2) Peak Deflection	1.7" maximum	1.54 "	
(3) Peak Resistive Force	2250 lbs maximum	2075 lbs	
(4) Internal Hysteresis	50 to 70%	57.6 %	
B. Low Speed			
(1) Probe Speed	13.86-14.14 fps.	13.9 fps	
(2) Peak Deflection	1.1" maximum	.96 "	
(3) Peak Resistive Force	1450 lbs maximum	1243 lbs	
(4) Internal Hysteresis	50 to 70%	50.7 %	

TECHNICIAN'S NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 320

		PRE-TEST (if required)	POST-TEST (if required)
TEST PARAMETER	SPECIFICATION		
6. KNEE IMPACT TEST			
A. Left Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	1998 lbs	
(3) Time above 1000 lbs.	1.7 ms. minimum	1.875 ms	
B. Right Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	2360 lbs	
(3) Time Above 1000 lbs.	1.7 ms. minimum	1.75 ms	

REMARKS:

TECHNICIAN'S NAME: IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 320

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	CP30	9-90	3-91
HY LATERAL--	ENDEVCO	CX05	9-90	3-91
HZ VERTICAL--	ENDEVCO	DB47	9-90	3-91
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A74	9-90	3-91
CY LATERAL--	ENDEVCO	FH01	9-90	3-91
CZ VERTICAL--	CEC	A128	9-90	3-91
3. FEMUR LOAD CELLS				
RIGHT SIDE	GSE	951	9-90	3-91
LEFT SIDE	GSE	952	9-90	3-91
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	11-90	5-91
2. TEST PROBE ACCELEROMETER--	CEC	A161	11-90	5-91
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS- DUCER INC	20051	8-90	2-91
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	8-90	2-91
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	8-90	2-91

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA

NHTSA DUMMY I.D. NUMBER.: 749

I. CONFIGURATION VERIFICATION DATA

	P. 572 SPECIFICATION	PRE-TEST if required	POST-TEST if required
DATE OF CONFIGURATION VERIFICATION	XXXXXXXXXXXXXX	9-25-90	
VERIFICATION NUMBER FOR DUMMY (*)	XXXXXXXXXXXXXX	1	
SH - Seated Height	35.6 to 35.8"	35.6 "	"
SP - Shoulder Pivot Height	21.8 to 22.4"	22.0 "	"
HP - Hip Pivot Height	3.9" ref.	3.9 "	"
KH - Knee Pivot from Back Line	20.1 to 20.7"	20.5 "	"
KV - Knee Pivot from floor	19.3 to 19.9"	19.5 "	"
SW - Shoulder Width	17.8 to 18.4"	18.1 "	"
HW - Hip Width	14.0 to 15.4"	14.7 "	"

II. PERFORMANCE VERIFICATION DATA:

		PRE-TEST (if required)	POST-TEST (if required)
DATE OF PERFORMANCE VERIFICATION		9-25-90	
SEQUENTIAL VERIFICATION NUMBER FOR DUMMY (*)		1	
VERIFICATION LAB TEMPERATURE (66 to 78 deg.)		69-70 deg	deg
VERIFICATION LAB HUMIDITY (10 TO 70 %)		45-50 %	%
TEST PARAMETER	SPECIFICATION		
1. HEAD DROP TEST			
a. peak resultant accel.	210 to 260 G's	233.9 G's	G's
b. peak lateral accel.	<= 10 G's	5.4 G's	G's
c. Time above 100 G's	0.9 to 1.5 ms.	1.25 ms	ms

* Sequential number beginning with "1" at the start of each fiscal years' crash test program.

TECHNICIAN'S NAME: IVAN MINKEWICZ

PART 572 DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA...continued

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 749

TEST PARAMETER		SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
2. NECK BENDING TEST				
a. Pendulum Speed		21.5 to 25.5 fps.	22.8 fps	
b. Pend. Avg. Decel. over t3 to t2		20 to 24 G's	23.5 G's	
c. Peak Resultant Head Acceleration		26 G's max.	25.32 G's	
d. Pendulum Decel. (t2-t1)		<= 3 ms.	2.48 ms	
e. Pendulum Decel. (t3-t2)		25 to 30 ms.	27.78 ms	
f. Pendulum Decel. (t4-t3)		<= 10 ms.	4.59 ms	
g. Max. Head Rotation		63 to 73 deg.	72.65 deg	
h. Chordal Displacement				
HEAD ROTATION ANGLE				
0 deg.	Time	-2 to 2 ms.	0.0 ms	
	Displ.	-.5 to .5"	0.0 "	
30 deg.	Time	25.6 to 34.4 ms.	29.27 "	
	Displ.	2.1 to 3.1"	3.01 "	
60 deg.	Time	40.3 to 51.7 ms.	43.65 ms	
	Displ.	4.3 to 5.3"	4.69 "	
Maximum	Time	53.2 to 66.8 ms.	56.42 ms	
	Displ.	5.0 to 6.0"	5.15 "	
60 deg.	Time	67.0 to 83.0 ms.	72.79 ms	
	Displ.	4.3 to 5.3"	4.62 "	
30 deg.	Time	85.4 to 104.6 ms.	90.28 ms	
	Displ.	2.1 to 3.1"	2.19 "	
0 deg.	Time	101.0 - 123.0 ms.	106.03 ms	
	Displ.	-.5 to 0.5"	0.0 "	

TECHNICIANS NAME: IVAN MINKIEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 749

TEST PARAMETER	SPECIFICATION	PRE-TEST (if required)	POST-TEST (if required)
3. ABDOMINAL COMPRESSION			
TEST: (preload = 50 lbs.)			
a. Force @ 0.5"	23 to 36 lbs.	27.5 lbs	
b. Force @ 0.75"	36 to 50 lbs.	42 lbs	
c. Force @ 1.0"	50 to 63 lbs.	57.5 lbs	
d. Force @ 1.3"	73 to 88 lbs.	81 lbs	
4. LUMBAR FLEXION TEST:			
a. Force @ 20 deg.	22 to 34 lbs.	30 lbs	
b. Force @ 30 deg.	34 to 46 lbs.	43 lbs	
c. Force @ 40 deg.	46 to 58 lbs.	55.5 lbs	
d. Return Angle	12 deg. maximum	9 deg	
5. CHEST IMPACT TESTS:			
A. High Speed			
(1) Probe Speed	21.78-22.22 fps.	21.8 fps	
(2) Peak Deflection	1.7" maximum	1.61 "	
(3) Peak Resistive Force	2250 lbs maximum	2075 lbs	
(4) Internal Hysteresis	50 to 70%	64.1 %	
B. Low Speed			
(1) Probe Speed	13.86-14.14 fps.	13.9 fps	
(2) Peak Deflection	1.1" maximum	.98 "	
(3) Peak Resistive Force	1450 lbs maximum	1293 lbs	
(4) Internal Hysteresis	50 to 70%	57 %	

TECHNICIAN'S NAME: IVAN MINKEWICZ

DUMMY CONFIGURATION AND PERFORMANCE VERIFICATION DATA (continued)

II. PERFORMANCE VERIFICATION DATA (continued)

NHTSA DUMMY I.D. NUMBER: 749

NHTSA DUMMY I.D. NUMBER: 749		PRE-TEST (if required)	POST-TEST (if required)
TEST PARAMETER	SPECIFICATION		
6. KNEE IMPACT TEST			
A. Left Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	1926 lbs	
(3) Time above 1000 lbs.	1.7 ms. minimum	1.75 ms	
B. Right Knee			
(1) Probe Speed	6.76 to 7.04 fps	7.0 fps	
(2) Maximum Force	1850 to 2500 lbs	2242 lbs	
(3) Time Above 1000 lbs.	1.7 ms. minimum	1.75 ms	

REMARKS:

TECHNICIAN'S NAME: IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY ID NUMBER 749

DUMMY INSTRUMENT--	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER--				
HX LONGITUDINAL--	ENDEVCO	FY05	9-90	3-91
HY LATERAL--	ENDEVCO	GD98	9-90	3-91
HZ VERTICAL--	ENDEVCO	CD75	9-90	3-91
2. CHEST ACCELEROMETER--				
CX LONGITUDINAL--	CEC	A73	9-90	3-91
CY LATERAL--	ENDEVCO	CE06	9-90	3-91
CZ VERTICAL--	CEC	A44	9-90	3-91
3. FEMUR LOAD CELLS				
RIGHT SIDE	GSE	954	9-90	3-91
LEFT SIDE	GSE	955	9-90	3-91
CALIBRATION LABORATORY INSTRUMENTS--				
1. PENDULUM ACC.--	CEC	A160	11-90	5-91
2. TEST PROBE ACCELEROMETER--	CEC	A161	11-90	5-91
3. LUMBAR FLEXION TEST PUSH FORCE GAUGE--	TRANS- DUCER INC	20051	8-90	2-91
4. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	BLH	72952	8-90	2-91
5. ABDOMINAL COMPRESS. TEST FORCE GAUGE--	CIC	567-11	8-90	2-91

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	CP30	ENDEVCO	9-90	3-91
	CX05	ENDEVCO	9-90	3-91
	DB47	ENDEVCO	9-90	3-91
Chest X Y Z	A74	CEC	9-90	3-91
	FH01	ENDEVCO	9-90	3-91
	A128	CEC	9-90	3-91
Right Femur Load Cell	952	GSE	9-90	3-91
Left Femur Load Cell	951	GSE	9-90	3-91
Neck Load Cell X Y Z				
Neck Moment X Y Z				
Chest Deflection Gauge Hybrid III Use Only				
Lap Belt Load Cells	123	LEBOW	9-90	3-91
Shoulder Belt Load Cells	127	LEBOW	9-90	3-91
Spool-Out Potentiometer	-	-	-	-
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	FY05	ENDEVCO	9-90	3-91
Y	GD98	ENDEVCO	9-90	3-91
Z	CD75	ENDEVCO	9-90	3-91
Chest X	A73	CEC	9-90	3-91
Y	CE06	ENDEVCO	9-90	3-91
Z	A44	CEC	9-90	3-91
Right Femur Load Cell	955	GSE	9-90	3-91
Left Femur Load Cell	954	GSE	9-90	3-91
Neck Load Cell X				
Y				
Z				
Neck Moment X				
Y				
Z				
Chest Deflection Gauge Hybrid III Use Only				
Lap Belt Load Cells	133	LEBOW	9-90	3-91
Shoulder Belt Load Cells	135	LEBOW	9-90	3-91
Spool-Out Potentiometer	-	-	-	-
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	A181	CEC	12-90	6-91
Right Rear Seat Crossmember	A156	CEC	9-90	3-91
Top of Engine	A115	CEC	9-90	3-91
Bottom of Engine	A154	CEC	2-91	8-91
Left Disc Brake Caliper	A180	CEC	12-90	6-91
Right Disc Brake Caliper	A131	CEC	9-90	3-91
Instrument Panel	A179	CEC	12-90	6-91
Center Rear Crossmember Z	A70	CEC	12-90	6-91
Vehicle Rear Z	A157	CEC	9-90	3-91

INSTRUMENT CALIBRATION FOR LABORATORY INSTRUMENTS
(6 Month Calibration Minimum)

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

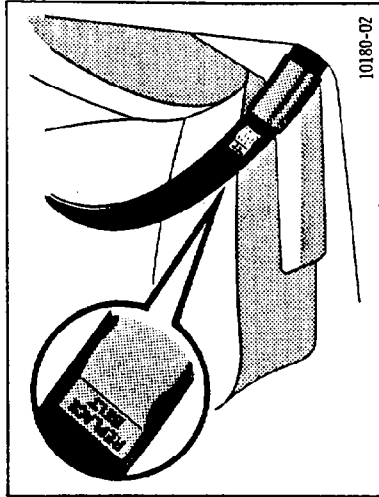
Appendix E

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

CAUTION: Persons should ride in their seats properly wearing their seat belts whenever the vehicle is moving. Otherwise, they are much more likely to suffer serious bodily injury in the event of sudden braking or a collision. When using the seat belts, observe the following:

- Use the belt for only one person at a time. Do not use a single belt for two or more people—even children.
- After inserting the tab, make sure that the connection is secure and the belt is not twisted.
- Avoid reclining the seatbacks too much. The seat belts provide maximum protection when the seatbacks are in the upright position. (See the seat adjustment instructions.)
- Be careful not to damage the belt webbing or hardware, and take care that they do not get caught or pinched in the seat or doors.

- Inspect the belt system periodically. Check for cuts, frays, and loose parts. Damaged parts should be replaced. Do not disassemble or modify the system.
- Keep the belts clean and dry. If they need cleaning, use a mild soap solution or lukewarm water. Never use bleach, dye, or abrasive cleaners—they may severely weaken the belts.
- Replace the belt assembly if it has been used in a severe impact. The entire assembly should be replaced even if damage is not obvious.



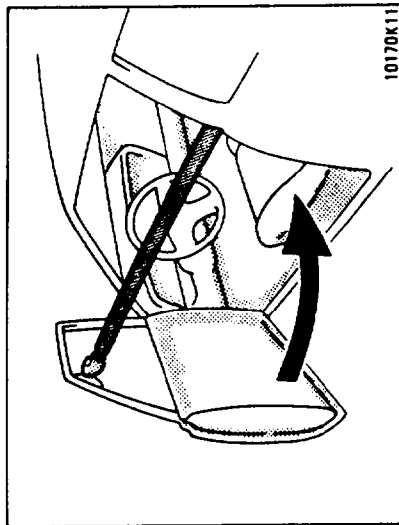
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- Canada only—Replace the front seat belt if the warning label under the sleeve can be seen. The warning label, "REPLACE BELT", will appear if the belt receives a severe impact or other force.

—Front seat belts (U.S.A.)

Your front seat belt consists of an Automatic Shoulder Belt and a Manual Lap Belt.

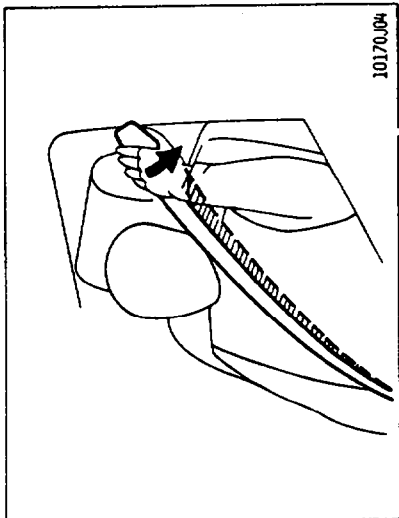
CAUTION: Be sure to fasten the Manual Lap Belt as well as the Automatic Shoulder Belt. Failure to wear the Manual Lap Belt could increase the chance of injury during an accident.



10170K11

To fasten your shoulder belt, enter the vehicle and close the door.

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



10170J04

Adjust the seat so that the front passenger's shoe soles may touch the toeboard and sit up straight and well back in the seat.

For those who find the belt irritating across the neck, the belt position may be lowered by pulling down the belt anchor until it clicks.

CAUTION:

- Always be sure that the belt is positioned well across the shoulder. Failure to do so could reduce the amount of protection in an accident and increase the chance of injury.
- For your safety, do not place the shoulder belt under your arm.



Automatic locking retractor type --

When extending the lap belt, it will automatically lock in the position where the pulling motion stops. Once the lap belt locks, it cannot be extended further unless it is first fully retracted and then pulled out again.

The lap belt length automatically adjusts to your size.

You will hear a click when the tab locks into the buckle.

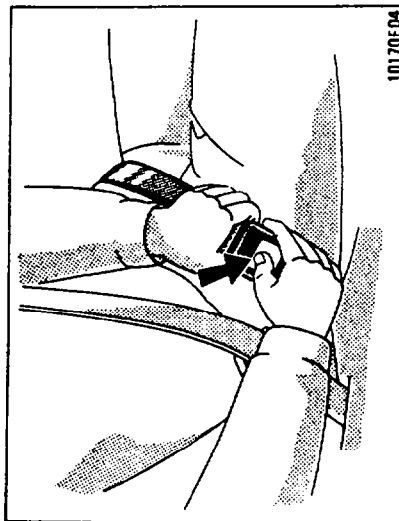
The retractor will lock the belt during a sudden stop or on impact. At other times you can move around freely.



Adjust the position of the lap belt.

CAUTION: High-positioned lap belts could increase the chance of injury due to sliding under the lap belt during an accident.

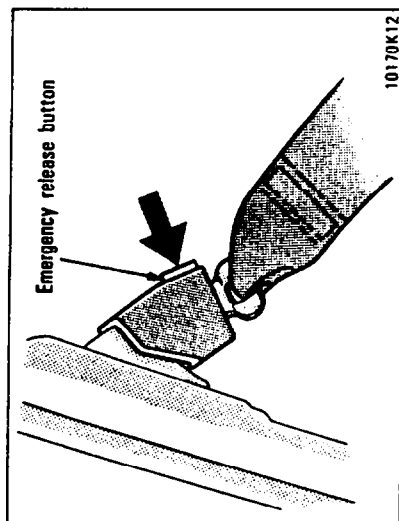
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10170ED4

To release the lap belt, press the buckle-release button and allow the belt to retract.

If the belt does not smoothly retract, pull it out and check for kinks or twists. Then make sure that it remains untwisted as it retracts.



10170K12

EMERGENCY ESCAPE

To release the shoulder belt locking mechanism for emergency escape, push the emergency release button.

Use this feature only when the shoulder belt keeps you from leaving the vehicle in an accident.

However, on a steep slope the shoulder belt retractor locks and the door cannot be opened. To be able to get out of the vehicle, release the shoulder belt by using the emergency release button.

CAUTION: Do not push the emergency release button except for an emergency, or you will not obtain needed shoulder belt restraint.

Do not push the emergency release button except for an emergency, or you will not obtain needed shoulder belt restraint.