

CALSPAN REPORT NUMBER: 7883-4

VEHICLE-TO-VEHICLE FRONTAL 60% OVERLAP
35 MPH IMPACT OF A
1991 SUBARU JUSTY 2-DOOR HATCHBACK AND
1991 FORD CROWN VICTORIA LTD 4-DOOR SEDAN

CALSPAN TEST NUMBER: Y42-4-1041

February 22, 1991

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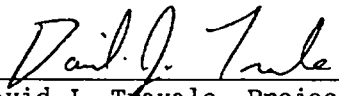
FINAL REPORT

PREPARED FOR:

U. S. Department of Transportation
Research and Special Programs Administration
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Cambridge, MA 02142

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16. Abstract A vehicle-to-vehicle frontal 35 mph test of a 60% overlapped 1991 Subaru Justy 2-door Hatchback into a 47% overlapped 1991 Ford Crown Victoria 4-door Sedan was performed at the Calspan Corporation Advanced Technology Center Crash test facility in Buffalo, New York on February 22, 1991. Actual impact speed was 36.0 mph for each vehicle and the ambient temperature was 38°F. Vehicle number one, a 1991 Subaru Justy 2-door Hatchback, contained one Hybrid III dummy in the driver seating position. The dummy was restrained using the Vehicle's 3-point seat belt restraint system. The driver's HIC was 716 and 3 millisecond clipped chest g's were 61.6. The left femur load was 3111 lbs. and the right femur load was 1774 lbs. Vehicle number two, a 1991 Ford Crown Victoria LTD 4-door Sedan, contained one Hybrid III dummy in the driver's seating position. The dummy was restrained using the vehicle's 3-point continuous belt restraint system. The driver's HIC was 432 and 3 millisecond clipped chest g's were 31.9. The maximum femur loads were 947 and 673 lbs. on the left and right femur, respectively.					
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Section 1

PURPOSE AND TEST PROCEDURE

This 35 mph offset frontal vehicle-to-vehicle impact test is part of the Crashworthiness Testing and Analysis Program sponsored by the Research and Special Programs Administration under Contract No. DTRS57-87-C-00047. The purpose of this Technical Task Directive (TTD) is to obtain responses from vehicles and restrained Hybrid III dummies during car-to-car overlapped frontal crashes.

This test was performed using a 1991 Subaru Justy and a 1991 Ford Crown Victoria. The vehicles were each traveling at 36.0 mph and the 1991 Subaru Justy was positioned at a 60% offset relative to the 1991 Ford Crown Victoria. The offset was arranged such that 60% of the Subaru Justy's maximum width was engaged by the Ford Crown Victoria at time of impact. Primary frontal contact was on the driver side of each vehicle.

Vehicle number one, a 1991 Subaru Justy, contained one Hybrid III dummy in the driver seating position. The dummy was restrained using the vehicle's automatic 3-point seat belt restraint system.

Vehicle number two, a 1991 Ford Crown Victoria, contained one Hybrid III dummy in the driver seating position. The dummy was restrained using the vehicle's manual 3-point seat belt restraint system. The airbag automatic restraint system was not used for this test.

Section 2

SUMMARY OF TEST

A 1991 Subaru Justy 2-door Hatchback and a 1991 Ford Crown Victoria 4-door Sedan were impacted into each other with each vehicle traveling 36.0 mph. The 1991 Subaru Justy was offset such that 60% of the maximum vehicle width was engaged with the 1991 Ford Crown Victoria. Figure 1 of this report contains a sketch of the test layout. The test was performed at the Calspan Corporation Advanced Technology Center on February 22, 1991. Pre- and post-test photographs of both vehicles and dummies can be found in Appendix A of this report.

The vehicle-to-vehicle test was documented by one real-time camera and 15 high-speed cameras. Film analysis indicated the vehicles struck 0.5 inches from the target point in such a way as to create slightly more overlap. Camera locations and other pertinent camera information can be found in Table 8 and Figure 12 of this report.

Vehicle 1 (1991 Subaru Justy) contained one Hybrid III 50th percentile male anthropomorphic test device (ATD) in the driver seat position. Vehicle 2 (1991 Ford Crown Victoria) contained one Hybrid III 50th percentile male ATD in the driver seating position. The ATDs were restrained using the vehicle's restraint system after being placed in the vehicle following the dummy placement instructions specified in the Laboratory Indicant Test Procedure. The Vehicle 2 airbag restraint system was not used for this test.

Both ATDs were instrumented with head and chest triaxial accelerometers, chest potentiometer, left/right femur load cells, neck transducers, and upper and lower tibia transducers.

The 77 channels of data were recorded on seven 14-channel FM tape recorders. Appendix B contains the vehicle and dummy response data traces.

The driver's head in Vehicle 1 had a HIC value of 716. The maximum chest deceleration over 3 milliseconds was 61.6 g's. The femur loads were 3111 lbs. on the left and 1774 lbs. on the right. The Vehicle 1 torso belt load was 1660 lbs.

The driver's head in Vehicle 2 had a HIC value of 432. The maximum chest deceleration over 3 milliseconds was 31.9 g's. The left femur load was 947 lbs. and 673 lbs. on the right femur load. The Vehicle 2 torso belt load was 978 lbs.

TEST ANOMALIES

Vehicle 1, Rear seat centerline Z accelerometer data is questionable.

Vehicle 1, Engine bottom X accelerometer data is questionable after approximately 150 msec.

Vehicle 1, Front crossmember Z accelerometer data is questionable.

Vehicle 1, Brake Pedal Z accelerometer data is questionable.

Vehicle 1, position 1 upper neck force Z data is questionable.

Vehicle 1, position 1 upper neck moment Y data is questionable.

Vehicle 2, position 1 left upper tibia moment X transducer did not record correctly.

Section 3
VEHICLE AND OCCUPANT INFORMATION

Figure 1
VEHICLE-TO-VEHICLE OVERLAP LAYOUT

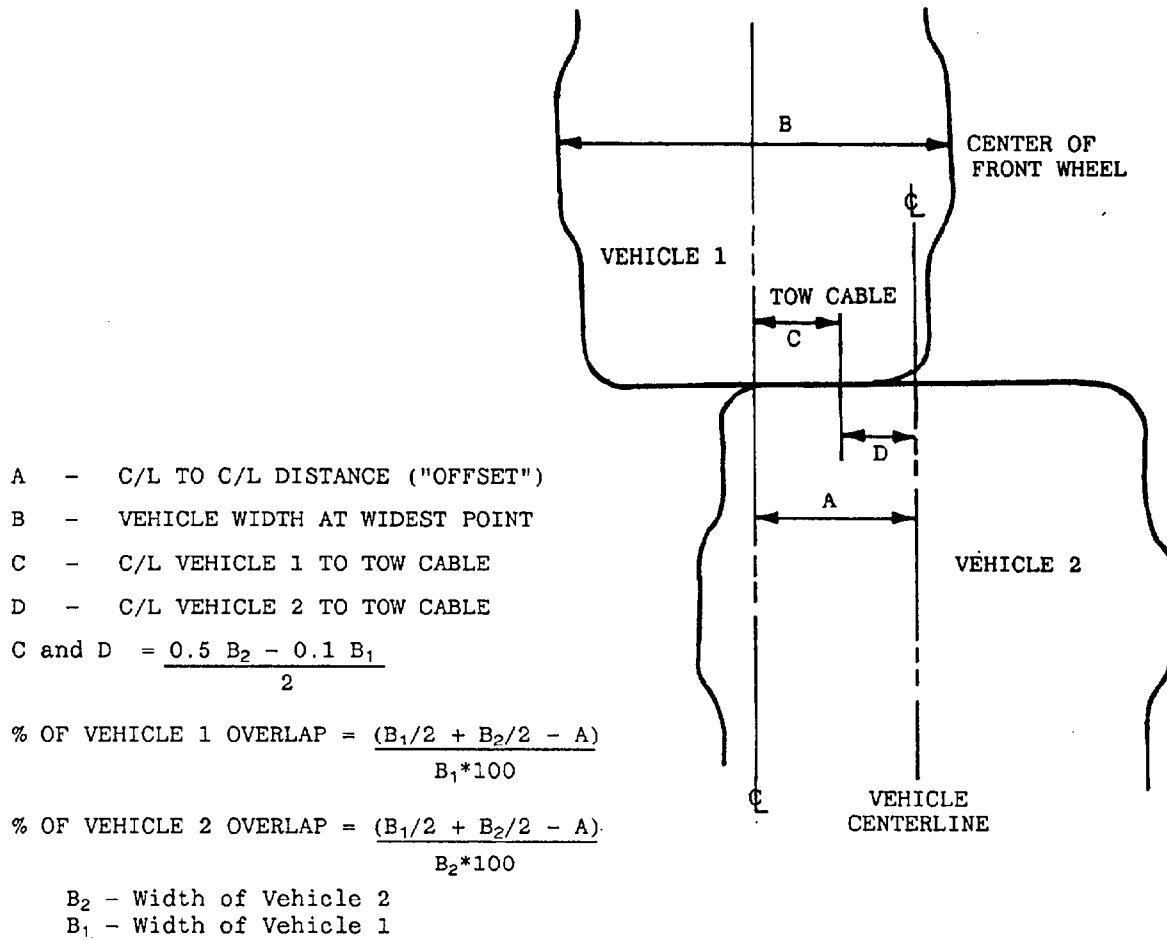


Table 1
VEHICLE-TO-VEHICLE OVERLAP MEASUREMENTS (in.)

Measurement Code	Vehicle 1	Vehicle 2
A	-	32.7
B	60.4	77.5
C	16.36	-
D	-	16.36
% Vehicle Overlap	60.0%	46.8%

VEHICLE ONE DATA

Table 2

GENERAL TEST AND VEHICLE 1 PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1991 Subaru Justy 2-Door Hatchback

Test Test No.: Y42-4-1041 VIN.: JF1KA7223MB700141

Body Color: White Date of Manufacture: 07/90

Engine: 3 Cylinders; - C.I.D.; 1.2 Liters; - CC
X Gas; - Diesel; - Turbocharged
- Longitudinal; X Transverse

Transmission: 5 Speed; X Manual; - Automatic; - Overdrive

Final Drive: X Front Wheel; - Rear Wheel; - Four Wheel
- A/C; X P/S; X P/B; - P/wdo;
- Tilt Wheel - P/seats; - Cruise Control

Type of Occupant Restraint: Passive 3-Point Belt Restraint System

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 28 psi, Rear 28 psi

Recommended Tire Size: 145SR12

Recommended Cold Tire Pressure: Front 28 psi, Rear 28 psi

Tires on Vehicle: 145SR12; Manufacturer: Bridgestone

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

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

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

Vehicle Capacity Weight (VCW) = 850 lbs. (A)

No. of Occupants x 150 lbs. = 750 lbs. (B)

Rated Cargo and Luggage
Weight (RCLW) A-B = 100 lbs.

GVWR 2650 lbs. GAWR: Front 1445 lbs. Rear 1280 lbs.

Table 2

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

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

Right Front = 580 lbs. Right Rear = 380 lbs.
 Left Front = 580 lbs. Left Rear = 370 lbs.
 TOTAL FRONT WEIGHT = 1160 lbs. (60.7 % of Total Vehicle Weight)
 TOTAL FRONT WEIGHT = 750 lbs. (39.3 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 1910 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMY:

Right Front = 620 lbs. Right Rear = 440 lbs.
 Left Front = 620 lbs. Left Rear = 520 lbs.
 TOTAL FRONT WEIGHT = 1240 lbs. (53.7 % of Total Vehicle Weight)
 TOTAL FRONT WEIGHT = 960 lbs. (46.3 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 2200 lbs.
 Weight of Ballast Secured in Vehicle Trunk Area = 0 lbs.

VEHICLE ATTITUDE (all dimensions in inches):

AS DELIVERED: RF 24.8 ; LF 24.8 ; RR 24.3 ; LR 24
 AS TESTED: RF 24.2 ; LF 24.1 ; RR 23.1 ; LR 22.6
 Vehicle's Wheel Base = 90.2 in.
 Location of Vehicle's C.G. = 37.5 inches from front wheel center.

Table 2

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

POST-IMPACT DATA:

Type of Test: VTV Frontal Impact Angle: 0 °
 Date of Test: February 22, 1991 Time of Test: 12:22
 Ambient Temperature: 38 °F at impact area
 Temperature in Occupant Compartment: 70 °F
 Windshield Molding Temperature: 69 °F
 Required Impact Velocity Range: 34.5 to 36.5 mph
 Impact Velocity: primary = 36.0 mph, secondary = - mph
 Distance From Front Bumper to Impact Point When
 Entering Speed Trap: 52 inches
 Exiting Speed Trap: 12 inches

VISIBLE DUMMY CONTACT POINTS:

Driver

Head Upper Steering rim & hub
 Chest Lower Steering rim
 Abdomen No contact
 Left Knee Dash panel
 Right Knee Dash panel

Table 2

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

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Door Opening	Closed, <u>Non-operable</u>	Closed <u>Operable</u>	<u>-</u>	<u>-</u>
<u>Seat Movement</u>	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Seat Back Failure	<u>N/M</u>	<u>-</u>	<u>-</u>	<u>-</u>
Seat Shift (in.)	<u>N/M</u>	<u>-</u>	<u>-</u>	<u>-</u>

Table 3
VEHICLE 1 DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G")							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DUMMY (1)	-50	81	51	97	-49	31	32	61.6
DUMMY (2)								
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE FEMUR LOAD (LBS.)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	1774	3111
DUMMY (2)		
DUMMY (3)		
DUMMY (4)		

	MAXIMUM FORCE SEAT BELT LOADS (LBS.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
DUMMY (1)	1660	N/M	N/M
DUMMY (2)			
DUMMY (3)			
DUMMY (4)			

	HEAD INJURY CRITERIA (HIC)			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
DUMMY (1)	716	0.071040	0.106920	52.47
DUMMY (2)				
DUMMY (3)				
DUMMY (4)				

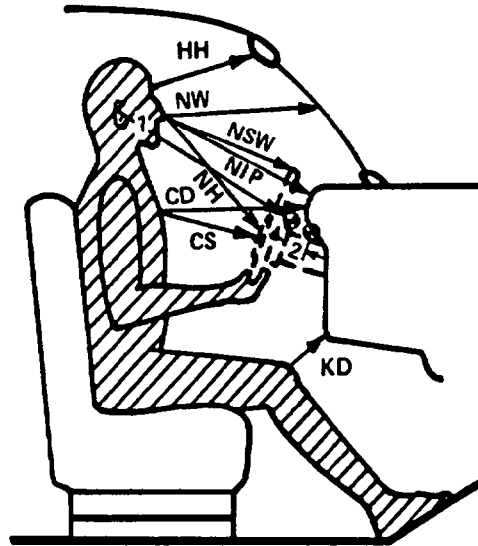
*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

Figure 2

VEHICLE 1 OCCUPANT CLEARANCE DIMENSIONS

	DRIVER
HH	14.8
NW	19.2
NSW	16.5
NIP	21.3
NH	16.3
CD	20.6
CS	12.7
KDL	6.6
KDR	4.1
1	26.3
2	2.0
SA	24.0
TA	23.0
ULA	106.0
LLA	225.0

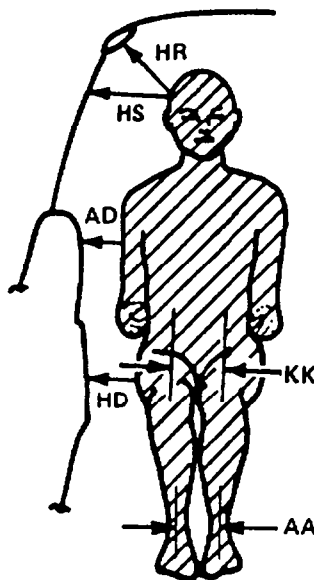


H-Point from target position
 Vertical - 0.0"
 Horizontal - 0.0"

HH = Head to Windshield Header
 NW = Nose to Windshield
 NSW = Nose to Steering Wheel
 NIP = Nose to Instrument Panel
 NH = Nose to Steering Wheel Hub
 CD = Chest to Dash
 CS = Chest to Steering Wheel Hub
 KDL = Knee to Dash Left
 KDR = Knee to Dash Right
 1 = Head Target to Steering Column Target
 2 = Distance between Steering Column Targets

Angles taken relative to vertical

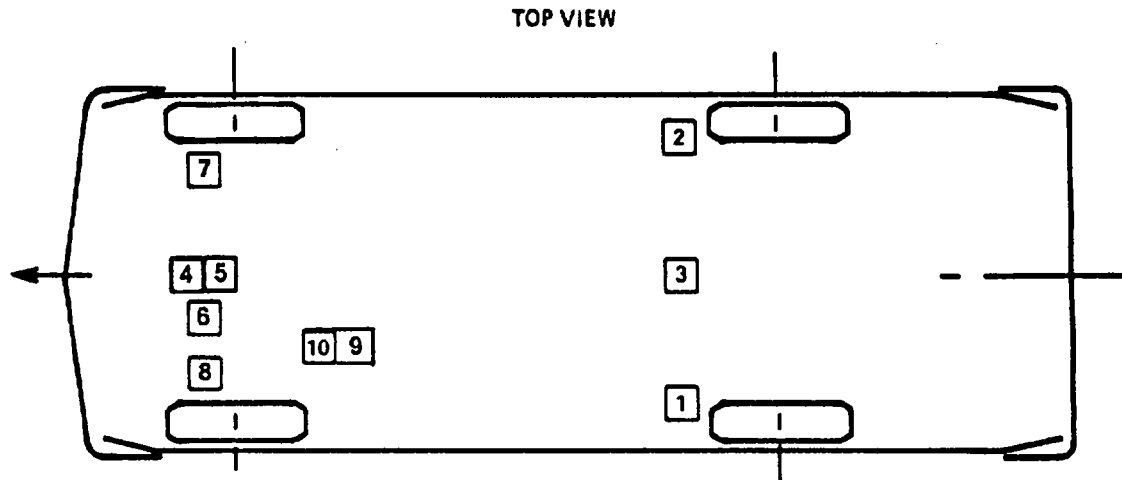
SA = Seat Back Angle
 TA = Torso Angle
 ULA = Upper Leg Angle
 LLA = Lower Leg Angle



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
 DT = Dummy Temperature °F

	DRIVER
HR	6.6
HS	8.2
AD	3.2
HD	5.2
KK	9.8
AA	11.2
DT	70°

Figure 3
SUMMARY OF VEHICLE 1 ACCELEROMETER DATA



Vehicle: 1991 Subaru Justy 2-Door Hatchback

Lot No.	Description	Axis	Maximum Value (g's)*	
			"-"	"+"
1	Rear seat crossmember left side	x	-32	3
2	Rear seat crossmember right side	x	-26	2
3	Rear seat crossmember centerline	x	-28	3
3	Rear seat crossmember centerline, Y	y	-3	12
3	Rear seat crossmember centerline, Z	z	**	**
4	Top of engine block	x	-160	103
4	Top of engine block	z	-69	105
5	Bottom of engine block	x	-60	31
6	Front suspension crossmember	x	-55	51
6	Front suspension crossmember	z	-33	22
7	Right front brake caliper	x	-67	3
8	Left front brake caliper	x	-170	52
9	Brake pedal	x	-199	55
9	Brake pedal	z	-63	63
10	Toe Pan	x	-62	17

* Values filtered using SAE class 60 filter.

**Value questionable.

Figure 4

VEHICLE 1 PRE- AND POST-TEST POSITION OF TEST VEHICLE

ACCELEROMETER MOUNTING LOCATIONS

Test Description: 35 mph Offset Frontal Vehicle-to-Vehicle Impact

Test Vehicle: 1991 Subaru Justy 2-Door Hatchback

Reference Plane: Vehicle plane at rear bumper

Accelerometer Description	LONGITUDINAL LOCATION		
	Pre-Test	Post-Test	Change
Rear seat crossmember left side	54.3	52.2	2.1
Rear seat crossmember right side	54.3	54.1	0.2
Rear seat crossmember centerline, primary	49.8	48.7	1.1
Top of engine block	115.8	107.8	8.0
Bottom of engine block	120.1	119.2	0.9
Front suspension crossmember	110.1	108.2	1.9
Right front brake caliper	114.1	114.6	-0.5
Left front brake caliper	114.2	107.6	6.6
Toe Pan	106.8	92.5	14.3
Brake Pedal	103.8	N/M	-

Figure 5
 VEHICLE 1 TARGET LOCATIONS
 (all dimensions in inches)

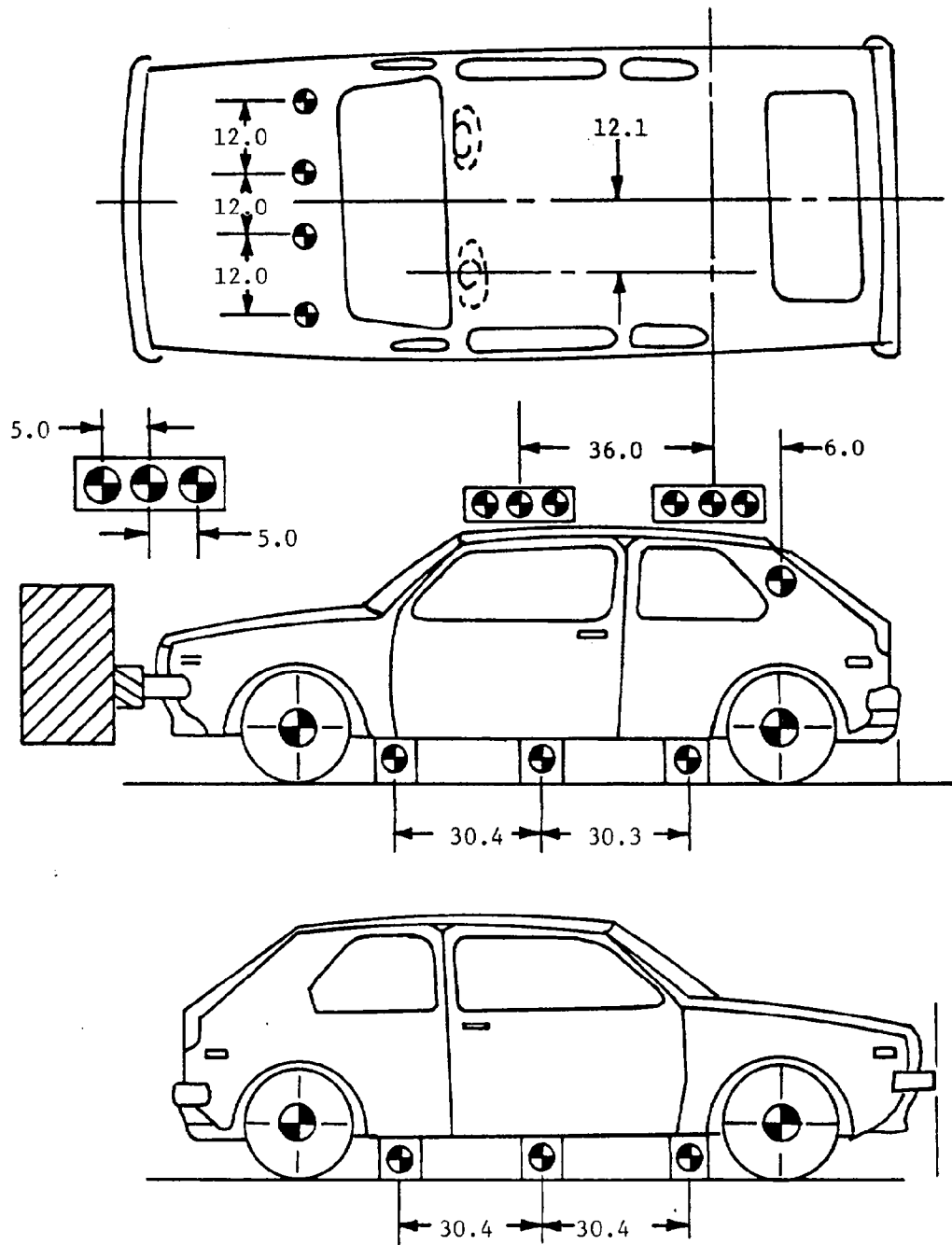


Figure 6

VEHICLE 1 MEASUREMENT POINTS

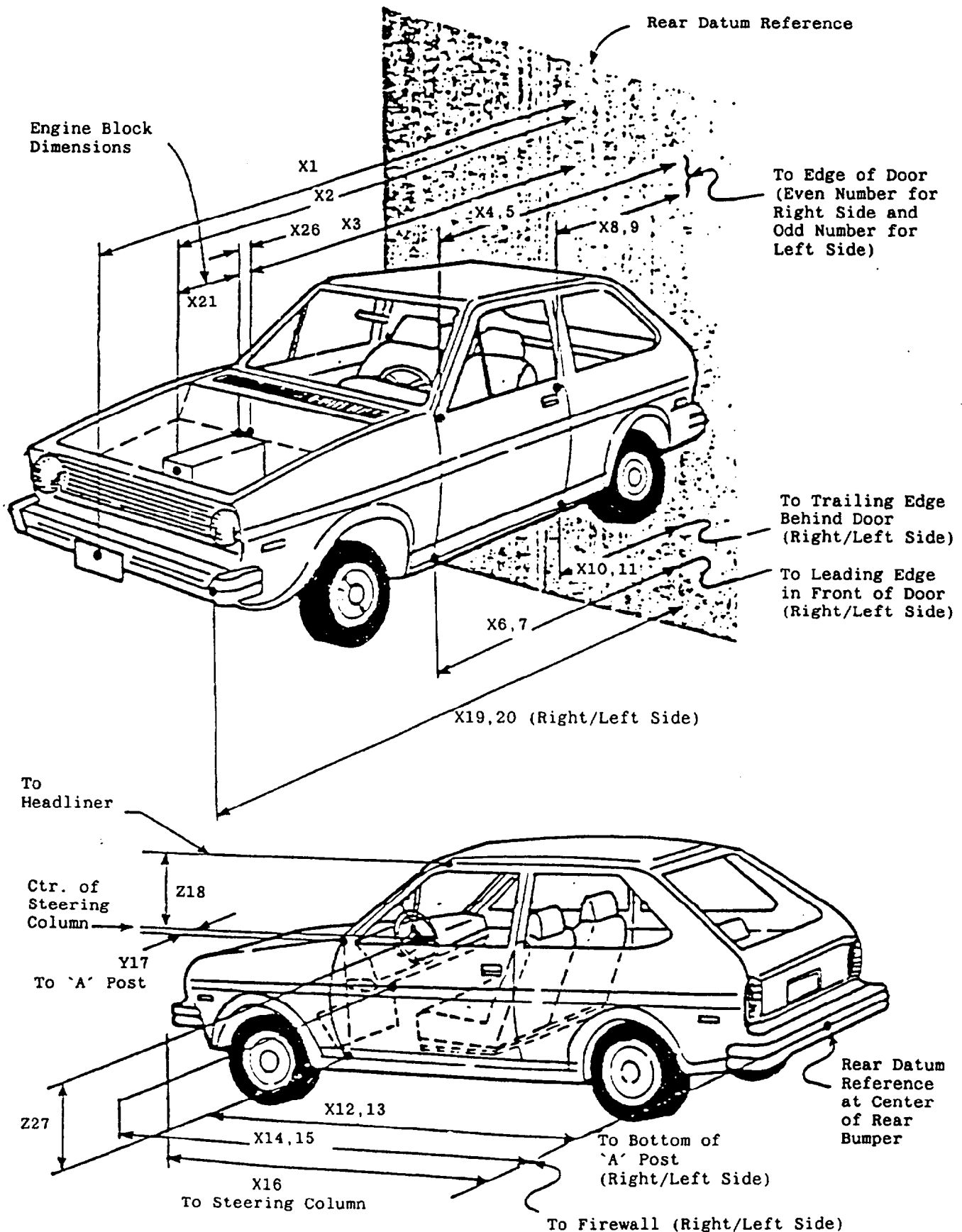


Figure 6
VEHICLE 1 MEASUREMENT POINTS (continued)

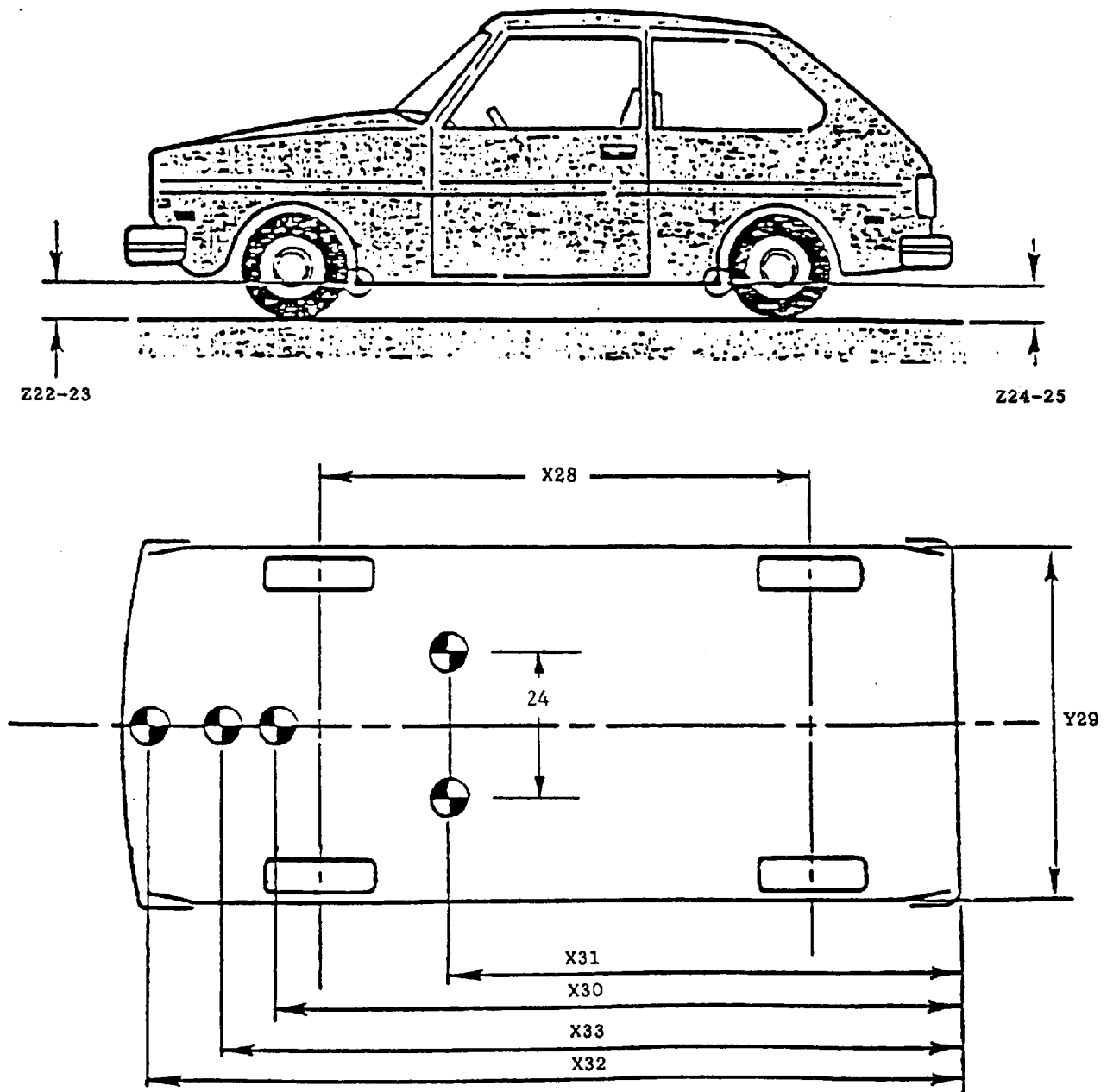


Table 4
VEHICLE 1 MEASUREMENTS

No.	TYPE OF MEASUREMENT	All Dimensions in Inches	
		Pre-Test	Post-Test
X1	Total Length of Vehicle at Centerline	145.6	119.8
X2	Rear Surface of Vehicle to Front of Engine	126.5	111.5
X3	Rear Surface of Vehicle to Firewall	106.8	94.0
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	99.0	99.3
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	98.8	92.0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	98.7	97.9
X7	Rear Surface of vehicle to Lower Leading Edge of Left Door	98.5	95.2
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	54.5	55.0
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	54.4	46.5
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	54.8	53.9
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	54.3	51.8
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	98.5	97.6
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	98.2	96.5
X14	Rear Surface of Vehicle to Firewall - Right Side	107.1	104.2
X15	Rear Surface of Vehicle to Firewall - Left Side	106.3	95.5
X16	Rear Surface of Vehicle to Steering Wheel Center	82.5	75.2
Y17	Steering Column to "A" Post	15.5	14.5

Table 4

VEHICLE 1 MEASUREMENTS (continued)

No.	TYPE OF MEASUREMENT	All Dimensions in Inches	
		Pre-Test	Post-Test
Z18	Rear of Windshield Header to Steering Wheel Column	15.8	16.6
X19	Rear Surface of Vehicle to Right Side of Front Bumper	142.8	140.8
X20	Rear Surface of Vehicle to Left Side of Front Bumper	142.5	108.3
X21	Width of Engine Block	9.0	9.0
Z22	Right Front Sill to Ground Plane	10.2	5.6
Z23	Left Front Sill to Ground Plane	10.0	4.1
Z24	Right Rear Sill to Ground Plane	10.6	9.8
Z25	Left Rear Sill to Ground Plane	10.5	8.4
X26	Firewall to Engine or Transaxle	12.0	0.0
Z27	Vertical Dim. from Door Sill to Centerline of Steering Column	21.1	26.8
X28	Wheelbase of Vehicle	89.7	93.7
Y29	Width of Vehicle at Maximum Width Point	59.2	59.5
X30	Rear Surface of Vehicle to Engine Target	121.2	112.7
X31	Rear Surface of Vehicle to Compartment Target	98.6	98.4
X32	Rear Surface of Vehicle to Bumper Target	141.4	118.2
X33	Rear Surface of Vehicle to Frame Crossmember	107.7	106.5
	Rear Surface of Vehicle to Instrument Panel Targets	Left 92.4 Right 92.5	Left 86.0 Right 82.3

VEHICLE TWO DATA

Table 5

GENERAL TEST AND VEHICLE 2 PARAMETER DATA

Vehicle Year/Make/Model/Body Style: 1991 Ford Crown Victoria LTD 4-Door SedanTest Test No.: Y42-4-1041 VIN.: 2FACP73F6MX138575Body Color: Brown Date of Manufacture: 7/90Engine: 8 Cylinders; - C.I.D.; 5.0 Liters; - CCX Gas; - Diesel; - TurbochargedX Longitudinal; - TransverseTransmission: - Speed; - Manual; X Automatic; X OverdriveFinal Drive: - Front Wheel; X Rear Wheel; - Four WheelX A/C; X P/S; X P/B; X P/wdo;X Tilt Wheel - P/seats; - Cruise ControlType of Occupant Restraint: 3-Point Continuous Belt*DATA RECORDED FROM VEHICLE'S TIRE PLACARD:Tire Pressure (at capacity): Front 31 psi, Rear 31 psiRecommended Tire Size: P215/70R15Recommended Cold Tire Pressure: Front 31 psi, Rear 35 psiTires on Vehicle: P215/70R15; Manufacturer: MichelinNumber of Occupants: 3 Front; 3 Rear; - 3rd Seat; 6 TOTALType of Front Seats: X Bucket; - Bench; - Split BenchType of Front Seat Back: - Fixed; X Adj. With X Lever - Rot. KnobVehicle Capacity Weight (VCW) = 1100 lbs. (A)No. of Occupants x 150 lbs. = 900 lbs. (B)

Rated Cargo and Luggage

Weight (RCLW) A-B = 200 lbs.GVWR 5302 lbs. GAWR: Front 2680 lbs. Rear 2672 lbs.

* Driver air bag was not set for test.

Table 5

GENERAL TEST AND VEHICLE 2 PARAMETER DATA (cont'd)

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

Right Front = 1100 lbs. Right Rear = 840 lbs.
 Left Front = 1100 lbs. Left Rear = 840 lbs.
 TOTAL FRONT WEIGHT = 2200 lbs. (56.7 % of Total Vehicle Weight)
 TOTAL FRONT WEIGHT = 1680 lbs. (43.3 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 3880 lbs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMY:

Right Front = 1030 lbs. Right Rear = 850 lbs.
 Left Front = 1170 lbs. Left Rear = 920 lbs.
 TOTAL FRONT WEIGHT = 2200 lbs. (55.4 % of Total Vehicle Weight)
 TOTAL FRONT WEIGHT = 1770 lbs. (44.6 % of Total Vehicle Weight)
 TOTAL TEST WEIGHT = 3970 lbs.
 Weight of Ballast Secured in Vehicle Trunk Area = - lbs.

TEST VEHICLE ATTITUDE (all dimensions in inches):

AS DELIVERED: RF 28.7 ; LF 28.8 ; RR 28.3 ; LR 28.4
 AS TESTED: RF 29.1 ; LF 28.7 ; RR 28.2 ; LR 27.2
 Vehicle's Wheel Base = 114.2 in.
 Location of Vehicle's C.G. = 50.9 inches from front wheel center.

Table 5

GENERAL TEST AND VEHICLE 2 PARAMETER DATA (cont'd)

POST-IMPACT DATA:

Type of Test: VTV Frontal Impact Angle: 0 °
 Date of Test: February 22, 1991 Time of Test: 12:22
 Ambient Temperature: 38 °F at impact area
 Temperature in Occupant Compartment: 69 °F
 Windshield Molding Temperature: 70 °F
 Required Impact Velocity Range: 34.5 to 36.5 mph
 Impact Velocity: primary = 36.0 mph, secondary = - mph
 Distance From Front Bumper to Barrier Face When
 Entering Speed Trap: 52 inches
 Exiting Speed Trap: 12 inches

VISIBLE DUMMY CONTACT POINTS:

Driver

Head Upper steering wheel rim
 Chest No contact
 Abdomen Lower steering wheel rim
 Left Knee Dash panel
 Right Knee Dash panel

Table 5

GENERAL TEST AND VEHICLE 2 PARAMETER DATA (cont'd)

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Door Opening	<u>Operable</u>	<u>Operable</u>	<u>Operable</u>	<u>Operable</u>
<u>Seat Movement</u>	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Seat Back Failure	<u>None</u>	<u>-</u>	<u>-</u>	<u>-</u>
Seat Shift (in.)	<u>1 notch forward</u>	<u>-</u>	<u>-</u>	<u>-</u>

Table 6
VEHICLE 2 DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G")							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DUMMY (1)	-73	-14	37	80	-32	8	13	31.9
DUMMY (2)								
DUMMY (3)								
DUMMY (4)								

	MAXIMUM FORCE FEMUR LOAD (LBS.)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	673	947
DUMMY (2)		
DUMMY (3)		
DUMMY (4)		

	MAXIMUM FORCE SEAT BELT LOADS (LBS.)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
DUMMY (1)	972	N/M	N/M
DUMMY (2)			
DUMMY (3)			
DUMMY (4)			

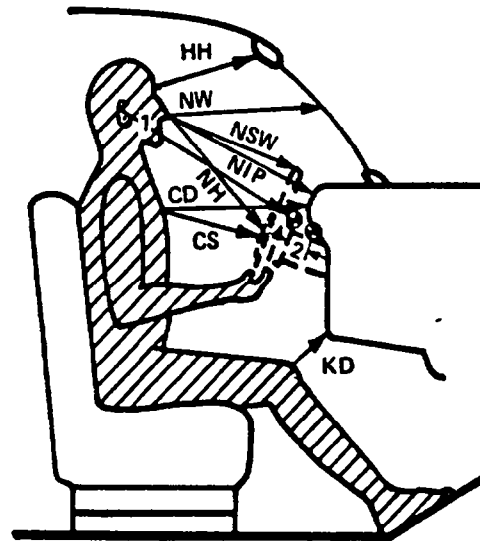
	HEAD INJURY CRITERIA (HIC)			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
DUMMY (1)	432	0.092400	0.128400	42.83
DUMMY (2)				
DUMMY (3)				
DUMMY (4)				

*Defined as exceeding 0.003 sec. duration
**As defined in FMVSS No. 208

Figure 7

VEHICLE 2 OCCUPANT CLEARANCE DIMENSIONS

	DRIVER
HH	14.0
NW	21.7
NSW	15.3
NIP	23.0
NH	16.3
CD	21.0
CS	10.8
KDL	3.3
KDR	3.2
1	26.7
2	2.0
SA	See Note
TA	25°
ULA	74°
LLA	130°



H point from target:

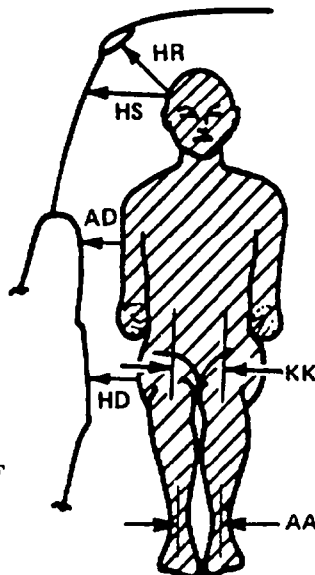
Horizontal - 0.2" rearward target
Vertical - 0.2" below target

HH = Head to Windshield Header
NW = Nose to Windshield
NSW = Nose to Steering Wheel
NIP = Nose to Instrument Panel
NH = Nose to Steering Wheel Hub
CD = Chest to Dash
CS = Chest to Steering Wheel Hub
KDL = Knee to Dash Left
KDR = Knee to Dash Right
1 = Head Target to Steering Column Target
2 = Distance between Steering Column Targets

Angles taken relative to vertical

SA = Seat Back Angle
TA = Torso Angle
ULA = Upper Leg Angle
LLA = Lower Leg Angle

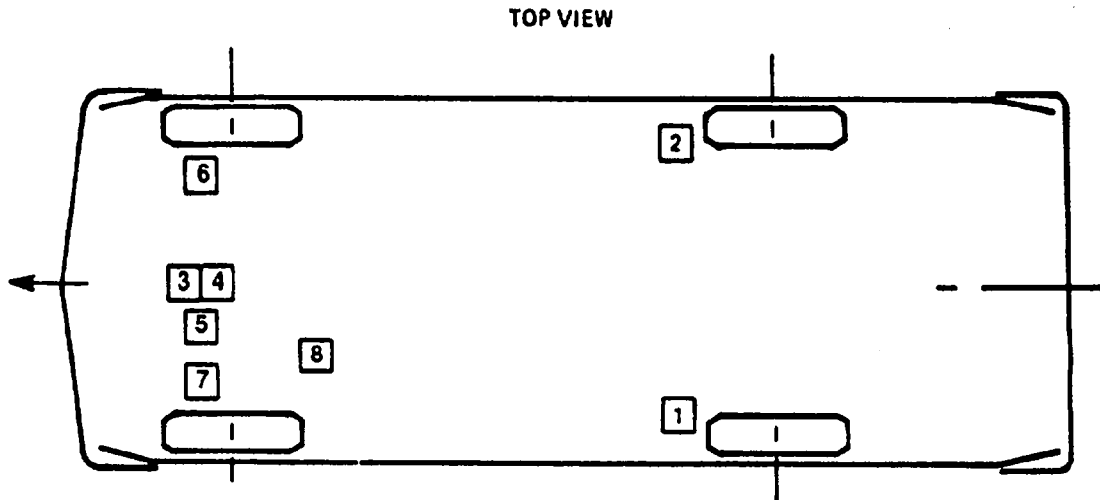
HR = Head to Side Roof
HS = Head to Side Window
AD = Arm to Door
HD = Hip to Door
KK = Knee to Knee
AA = Ankle to Ankle
DT = Dummy Temperature °F



	DRIVER
HR	5.9
HS	9.2
AD	5.5
HD	7.6
KK	9.3
AA	10.9
DT	70°F

Note: As per manufacturer

Figure 8
SUMMARY OF VEHICLE 2 ACCELEROMETER DATA



Vehicle: 1991 Ford Crown Victoria LTD 4-Door Sedan

Lot No.	Description	Axis	Maximum Value (g's)*	
			"-"	"+"
1	Rear seat crossmember left side	x	-41	22
2	Rear seat crossmember right side	x	-20	1
3	Top of engine block	x	-21	4
3	Top of engine block	z	- 5	7
4	Bottom of engine block	x	-20	0
5	Front suspension crossmember	x	-36	32
5	Front suspension crossmember	z	-21	12
6	Right front brake caliper	x	-36	9
7	Left front brake caliper	x	-49	45
8	Toe Pan	x	-48	25

*Values filtered using SAE class 60 filter.

Figure 9

VEHICLE 2 PRE- AND POST-TEST POSITION OF TEST VEHICLE
ACCELEROMETER MOUNTING LOCATIONS

Test Description: 35 mph Offset Frontal Vehicle-to-Vehicle Impact

Test Vehicle: 1991 Ford Crown Victoria LTD 4-Door Sedan

Reference Plane: Vehicle plane at rear bumper

Accelerometer Description	LONGITUDINAL LOCATION		
	Pre-Test	Post-Test	Change
Rear seat crossmember left side	88.5	88.4	0.1
Rear seat crossmember right side	88.5	88.3	0.2
Top of engine block	169.4	167.4	2.0
Bottom of engine block	175.1	174.1	1.0
Front suspension crossmember	167.2	162.7	4.5
Right front brake caliper	162.1	167.7	-5.6
Left front brake caliper	162.1	157.2	4.9
Toe Pan	147.3	139.7	7.6

Figure 10
 VEHICLE 2 TARGET LOCATIONS
 (all dimensions in inches)

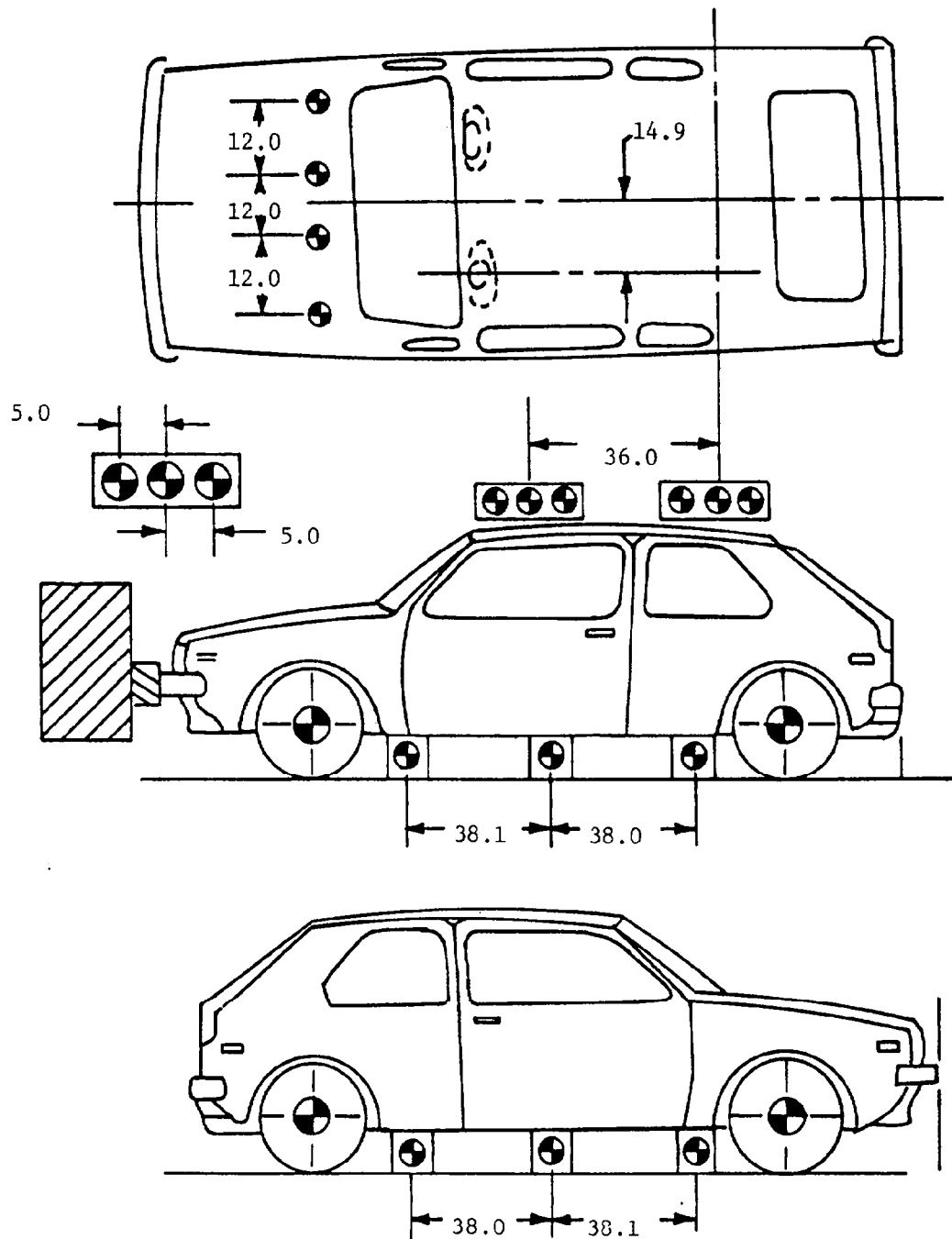


Figure 11

VEHICLE 2 MEASUREMENT POINTS

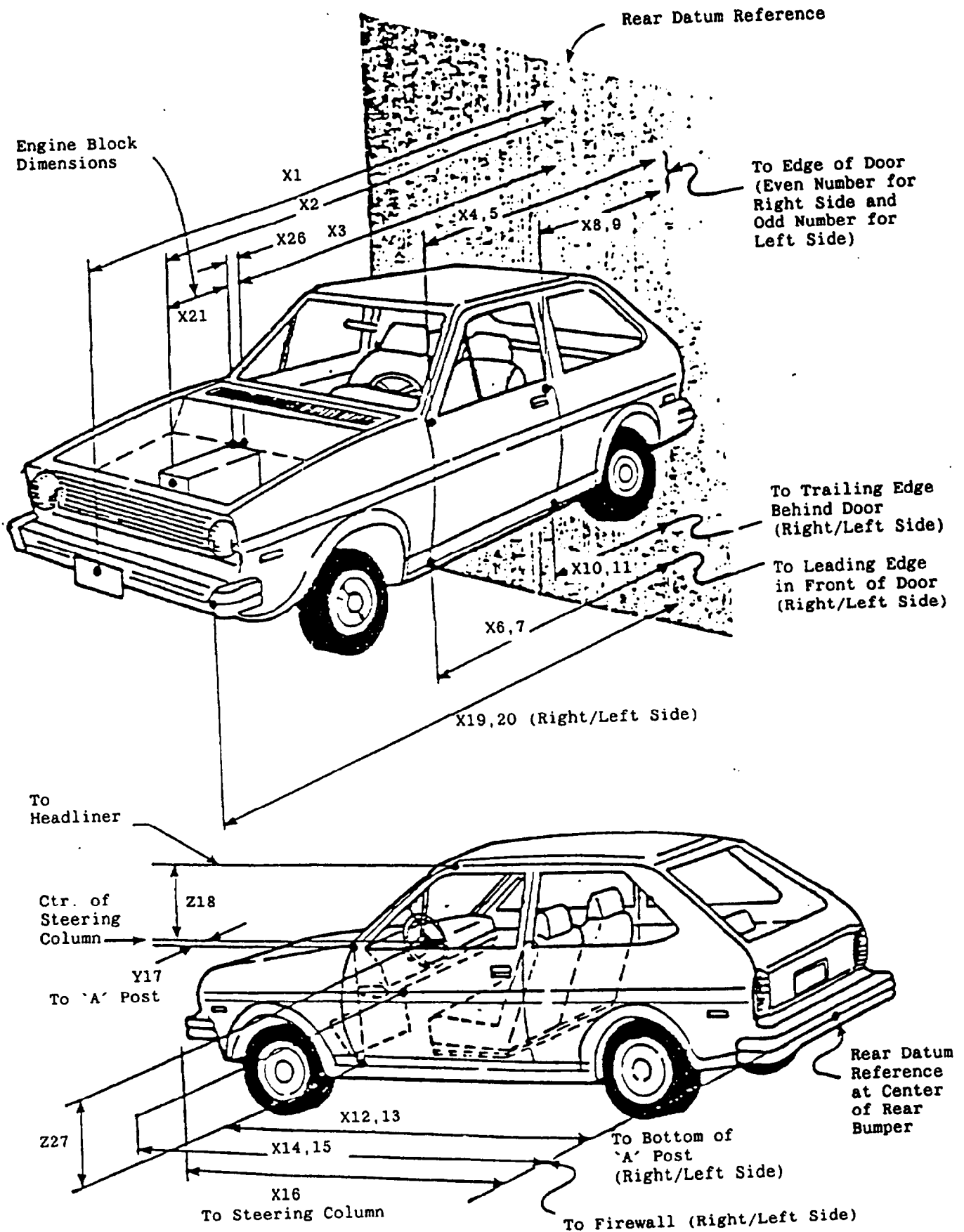


Figure 11
VEHICLE 2 MEASUREMENT POINTS (continued)

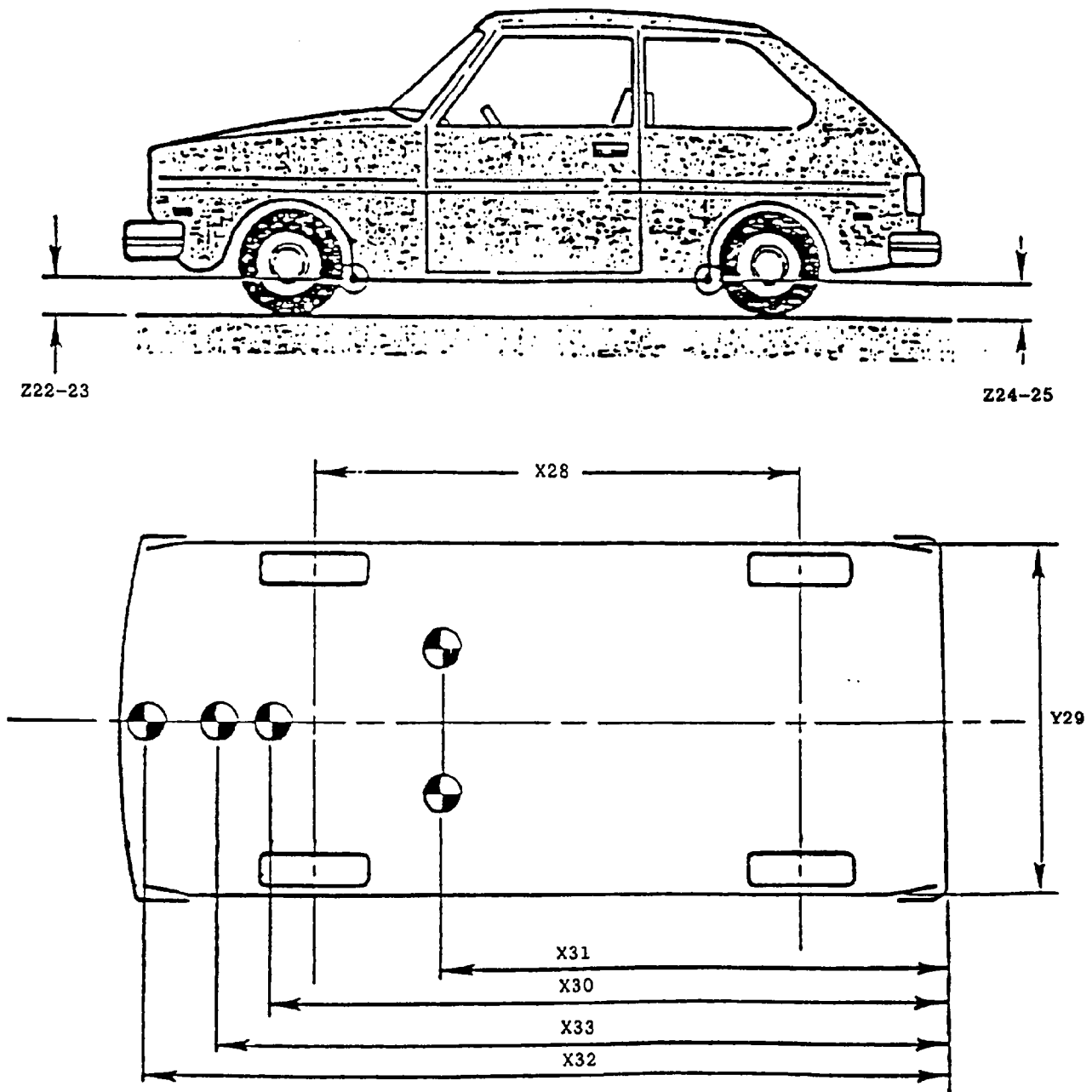


Table 7

VEHICLE 2 MEASUREMENTS

No.	TYPE OF MEASUREMENT	All Dimensions in Inches	
		Pre-Test	Post-Test
X1	Total Length of Vehicle at Centerline	211.0	193.8
X2	Rear Surface of Vehicle to Front of Engine	181.3	178.5
X3	Rear Surface of Vehicle to Firewall	152.7	152.3
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	139.9	139.9
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	139.8	140.0
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	139.8	139.3
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	139.3	139.0
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	99.4	99.4
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	99.3	99.2
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	98.0	97.5
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	97.7	97.3
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	146.5	146.1
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	146.2	144.5
X14	Rear Surface of Vehicle to Firewall - Right Side	150.6	150.8
X15	Rear Surface of Vehicle to Firewall - Left Side	150.6	151.8
X16	Rear Surface of Vehicle to Steering Wheel Center	122.4	121.3
Y17	Steering Column to "A" Post	17.0	16.3

Table 7

VEHICLE 2 MEASUREMENTS (continued)

No.	TYPE OF MEASUREMENT	All Dimensions in Inches	
		Pre-Test	Post-Test
Z18	Rear of Windshield Header to Steering Wheel Center	16.4	18.6
X19	Rear Surface of Vehicle to Right Side of Front Bumper	205.6	208.6
X20	Rear Surface of Vehicle to Left Side of Front Bumper	205.7	180.2
X21	Width of Engine Block	24.0	24.0
Z22	Right Front Sill to Ground Plane	12.2	12.4
Z23	Left Front Sill to Ground Plane	10.8	2.0
Z24	Right Rear Sill to Ground Plane	11.6	14.8
Z25	Left Rear Sill to Ground Plane	11.3	5.3
X26	Firewall to Engine or Transaxle	6.0	4.5
Z27	Vertical Dim. from Door Sill to Centerline of Steering Column	24.0	26.7
X28	Wheelbase of Vehicle	114.1	116.8
Y29	Width of Vehicle at Maximum Width Point	77.2	77.2
X30	Rear Surface of Vehicle to Engine Target	175.1	174.2
X31	Rear Surface of Vehicle to Compartment Target	139.5	Left 137.7 Right 139.2
X32	Rear Surface of Vehicle to Bumper Target	205.2	178.2
X33	Rear Surface of Vehicle to Frame Crossmember	185.3	174.2
	Rear Surface of Vehicle to Instrument Panel Target	Left 131.4 Right 131.4	Left 131.2 Right 131.2

Figure 12

CAMERA POSITIONS FOR VTV OFFSET FRONTAL IMPACT

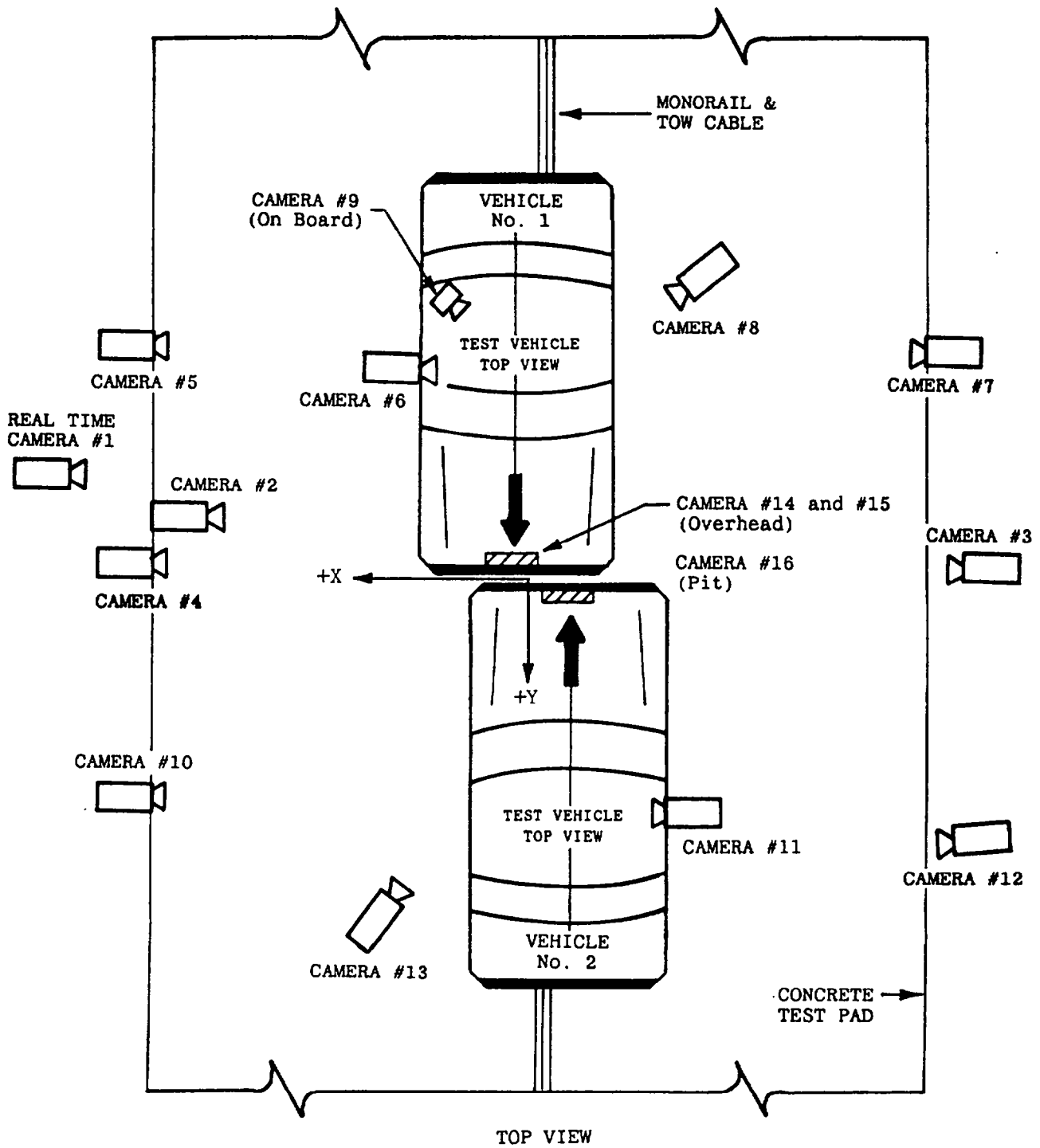


Table 8

HIGH-SPEED CAMERA LOCATIONS

CAMERA NO.	VIEW	CAMERA POSITIONS (in)*			ANGLE** (deg)	LENS (mm)	SPEED (fps)
		X	Y	Z			
1	Real-Time Camera	-	-	-	-	-	24
2	Overall View	373	-8	70	-9	13	550
3	Impact Point Right Side View	-275	-10	40.5	-1	25	535
4	Impact Point Left Side View	285	0	40.5	-2	25	did not operate
5	Vehicle 1 Overall View	-382	-36	39.5	-3	35	505
6	Vehicle 1 Onboard Driver View	-	-	-	-	8	560
7	Vehicle 1 Right Side View	463	-70	53.5	-4	25	655
8	Vehicle 1 Driver and Steering Column View	-76	-93	67	-20	13	655
9	Vehicle 1 Onboard Seat Belt View	-	-	-	-	8	930
10	Vehicle 2 Overall View	501	35	41	0	35	530
11	Vehicle 2 Onboard Passenger View	-	-	-	-	8	820
12	Vehicle 2 Passenger Side View	-426	62	41	-2	25	550
13	Vehicle 2 Passenger and Interior View	96	113	70.5	-18	13	620
14	Overhead View	0.0	0.0	376	-90	13	540
15	Overhead Closeup	0.0	0.0	376	-90	25	575
16	Underbody View	0.0	0.0	-80	90	13	840

*X = film plane to monorail centerline

Y = film plane to impact location

Z = film plane to ground

** = referenced to horizontal plane

Appendix A

PHOTOGRAPHS

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OVERALL TEST SETUP

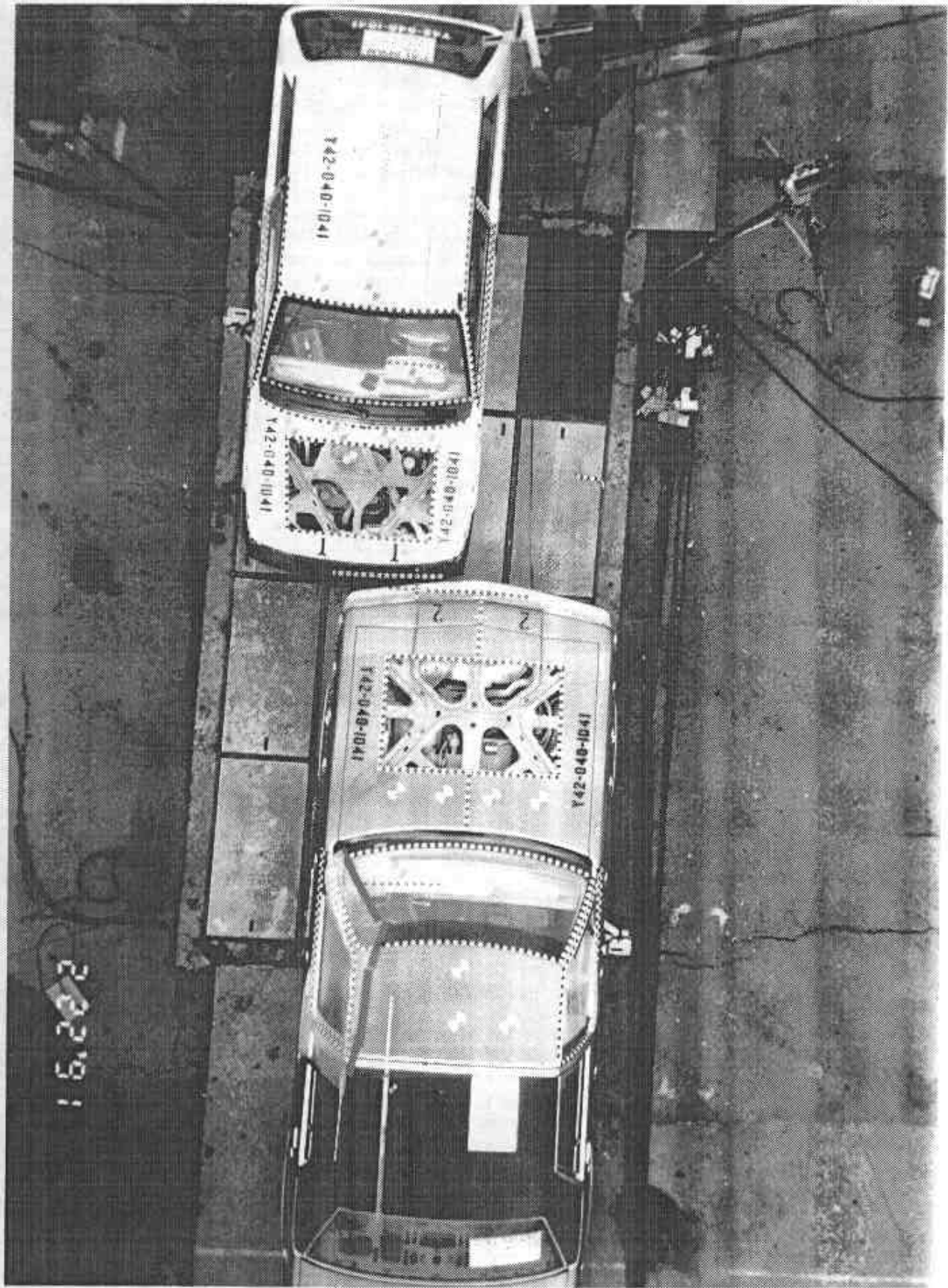


FIGURE A-1 PRE-TEST OVERHEAD VIEW

162291

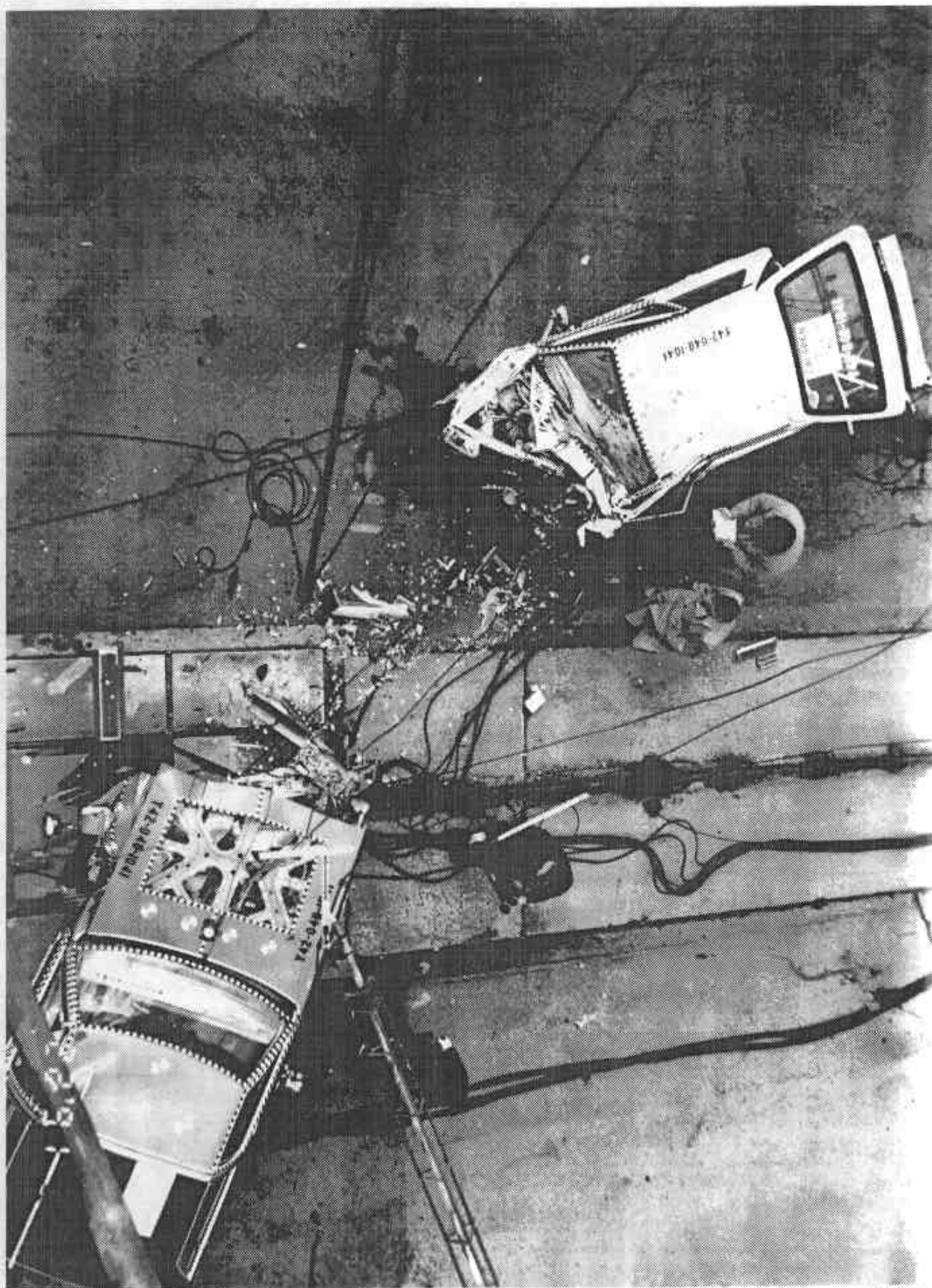


Figure A-2 POST-TEST OVERHEAD VIEW

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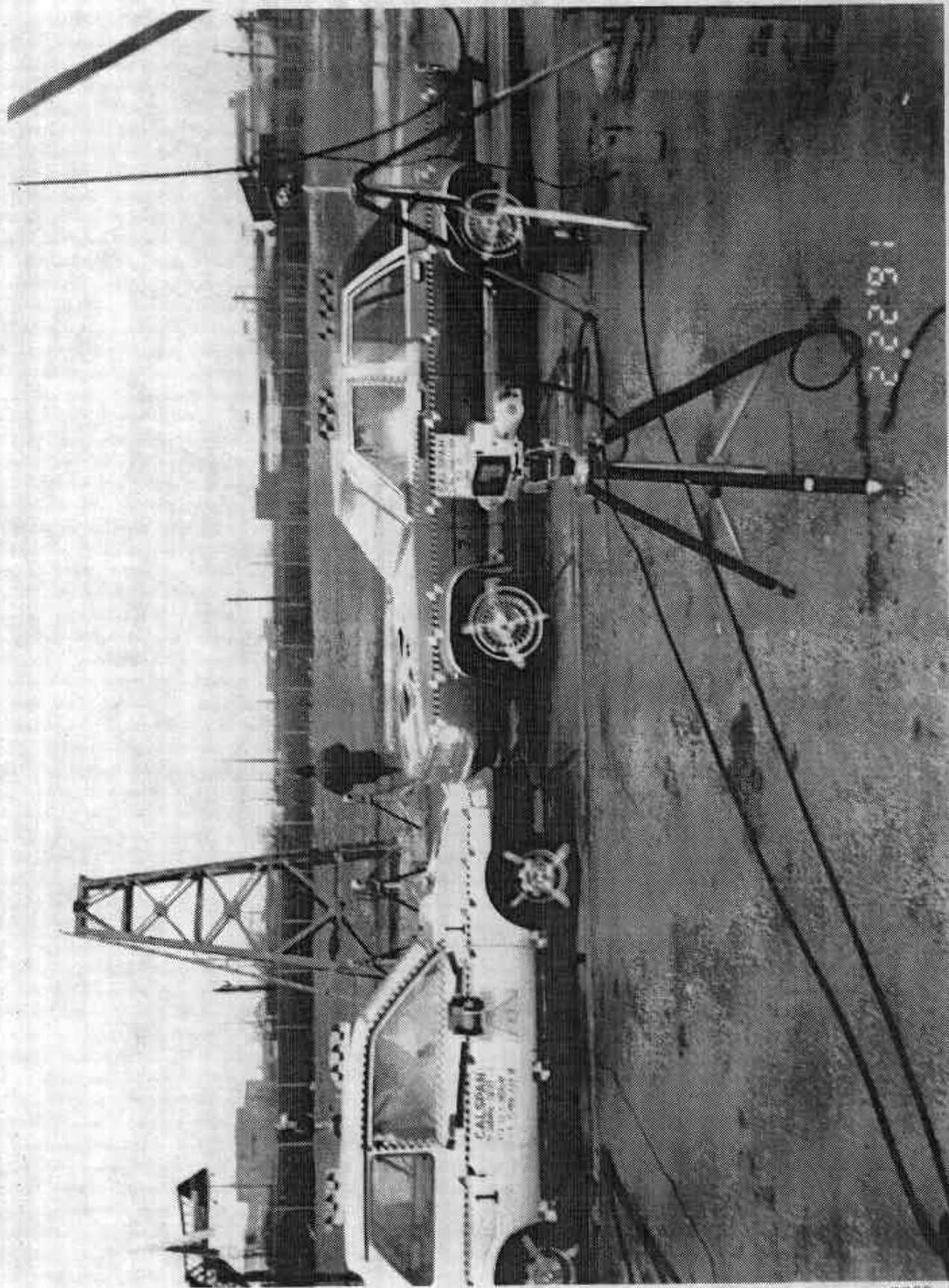
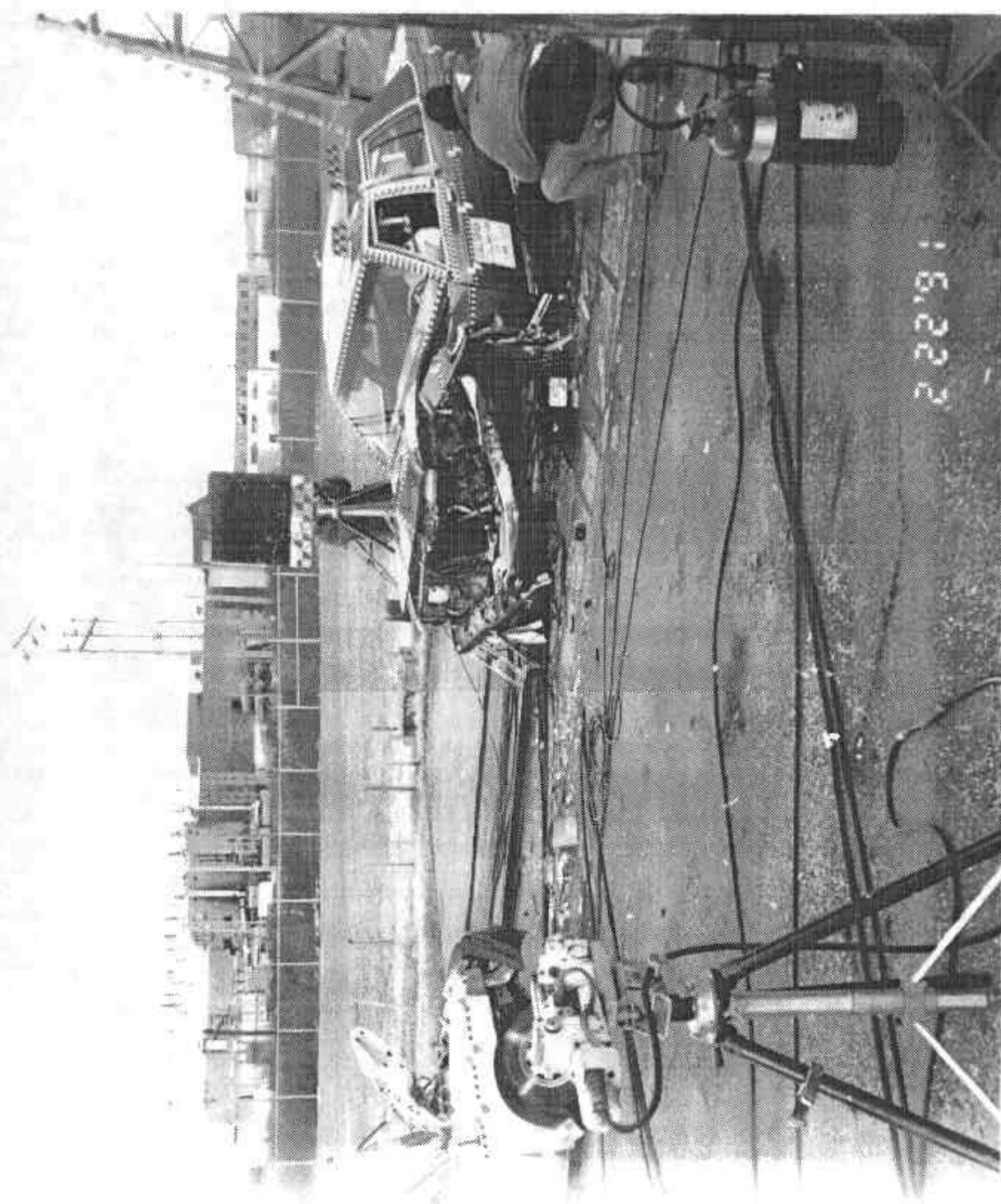


Figure A-3 PRE-TEST OVERALL SIDE VIEW

A-5

7883-4

1622'91



15.223

Figure A-4 POST-TEST OVERALL SIDE VIEW

IMPACT PHOTO
(Photograph is not available)

VEHICLE 1 PHOTOGRAPHS

1991 SUBARU JUSTY 2-DOOR HATCHBACK



FIGURE A-6 VEHICLE 1 PRE-TEST FRONT VIEW

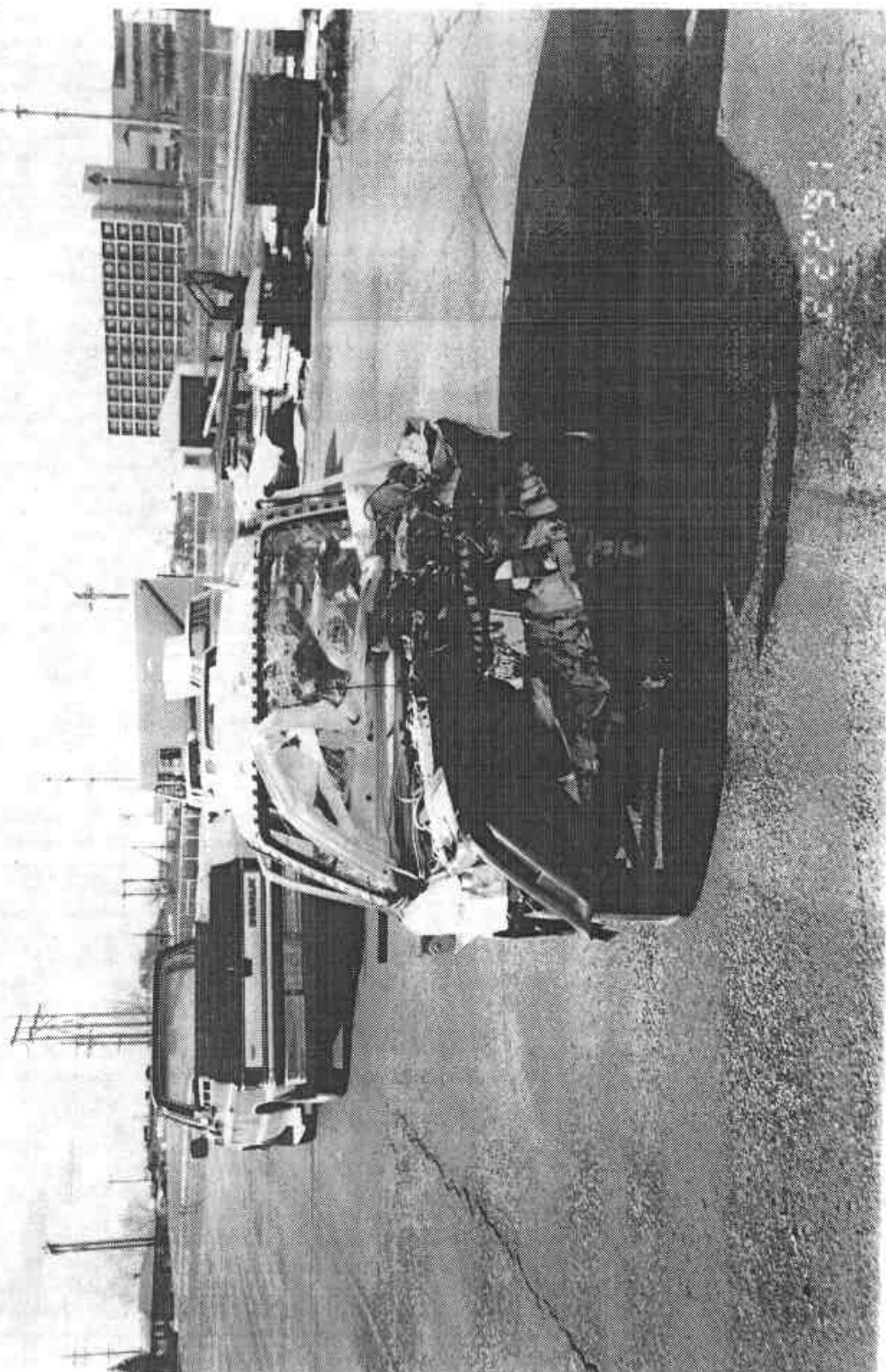
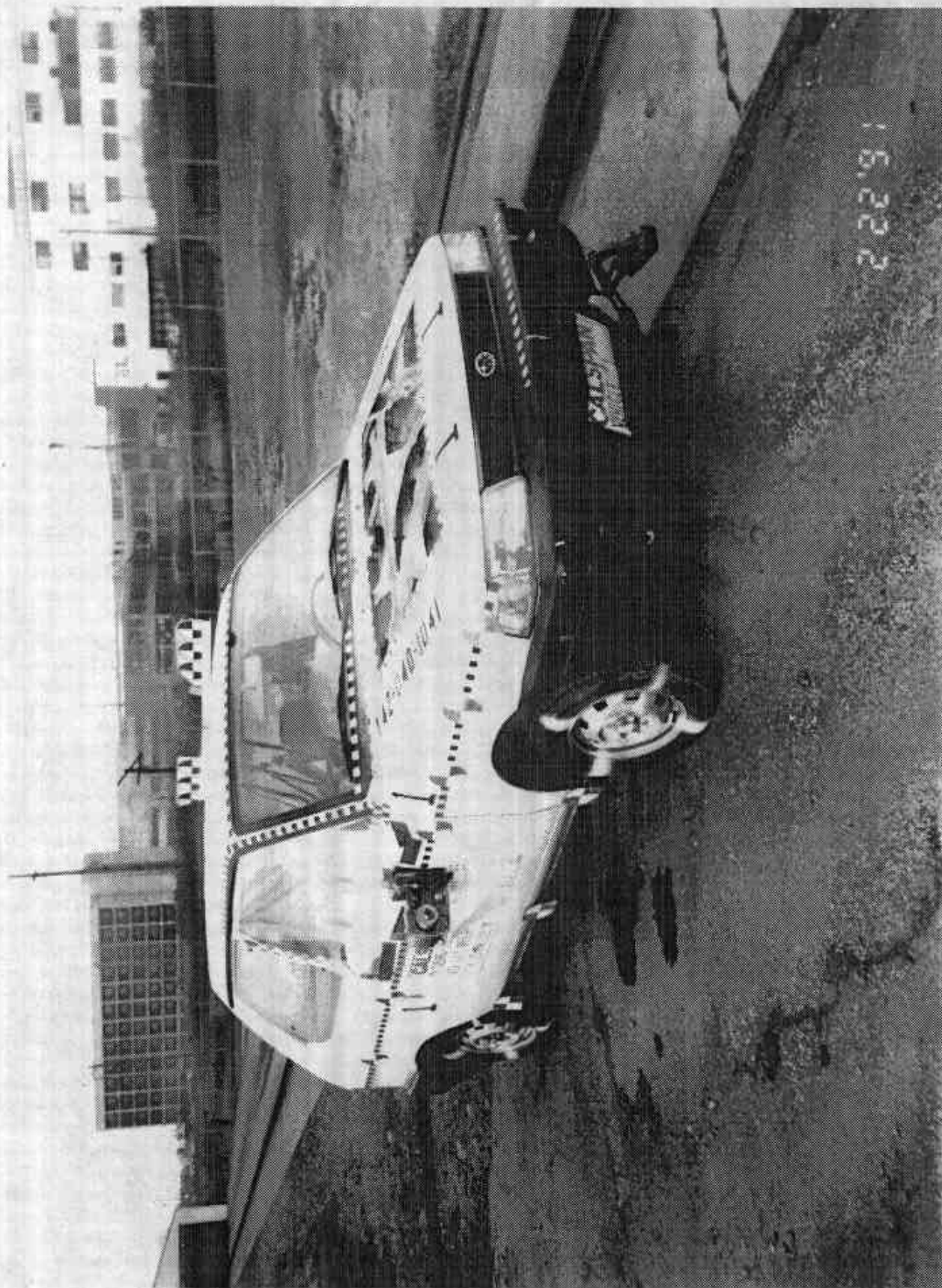


Figure A-7 VEHICLE 1 POST-TEST FRONT VIEW

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FIGURE A-8 VEHICLE 1 PRE-TEST FRONT RIGHT THREE-QUARTER VIEW

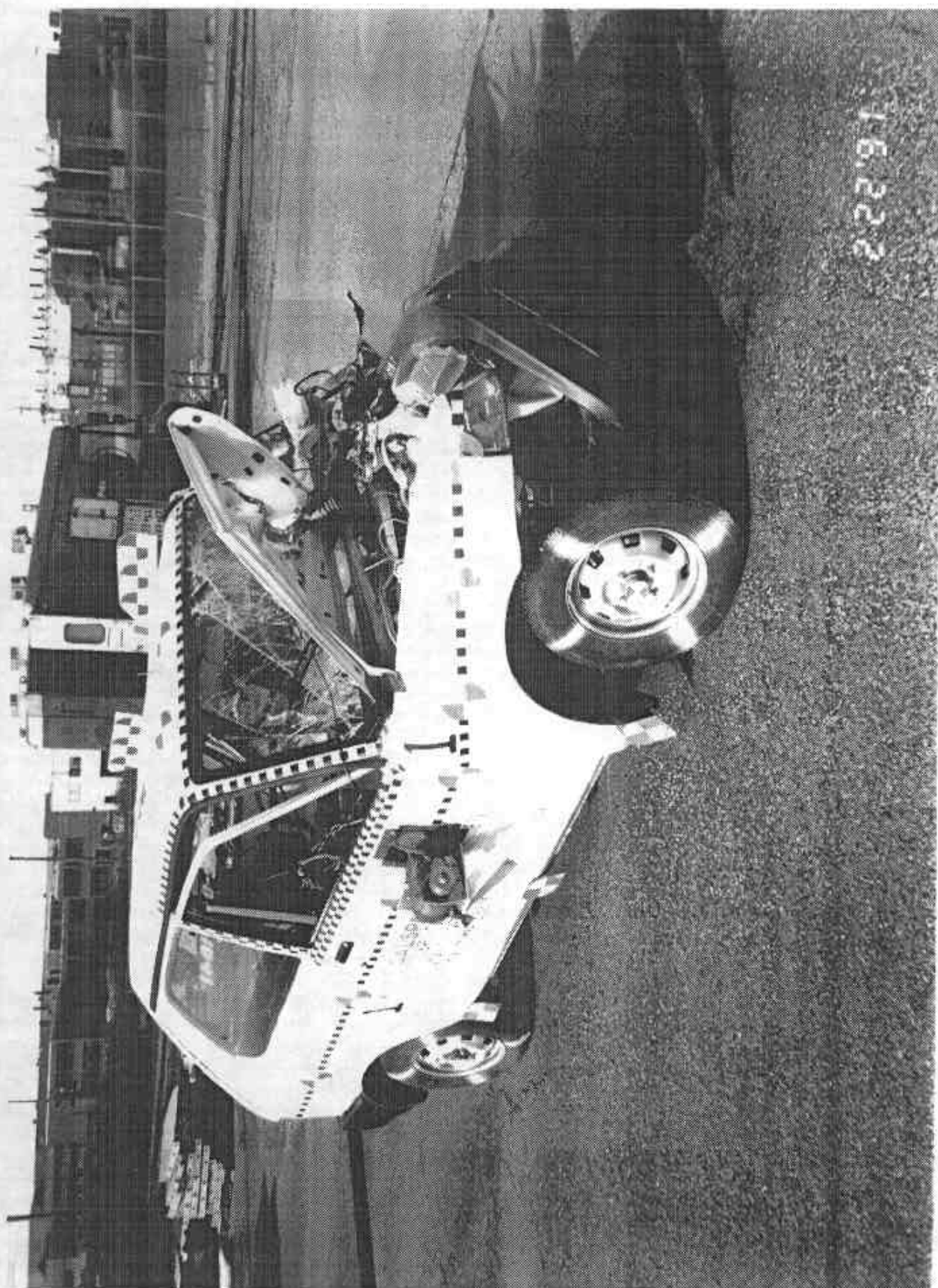
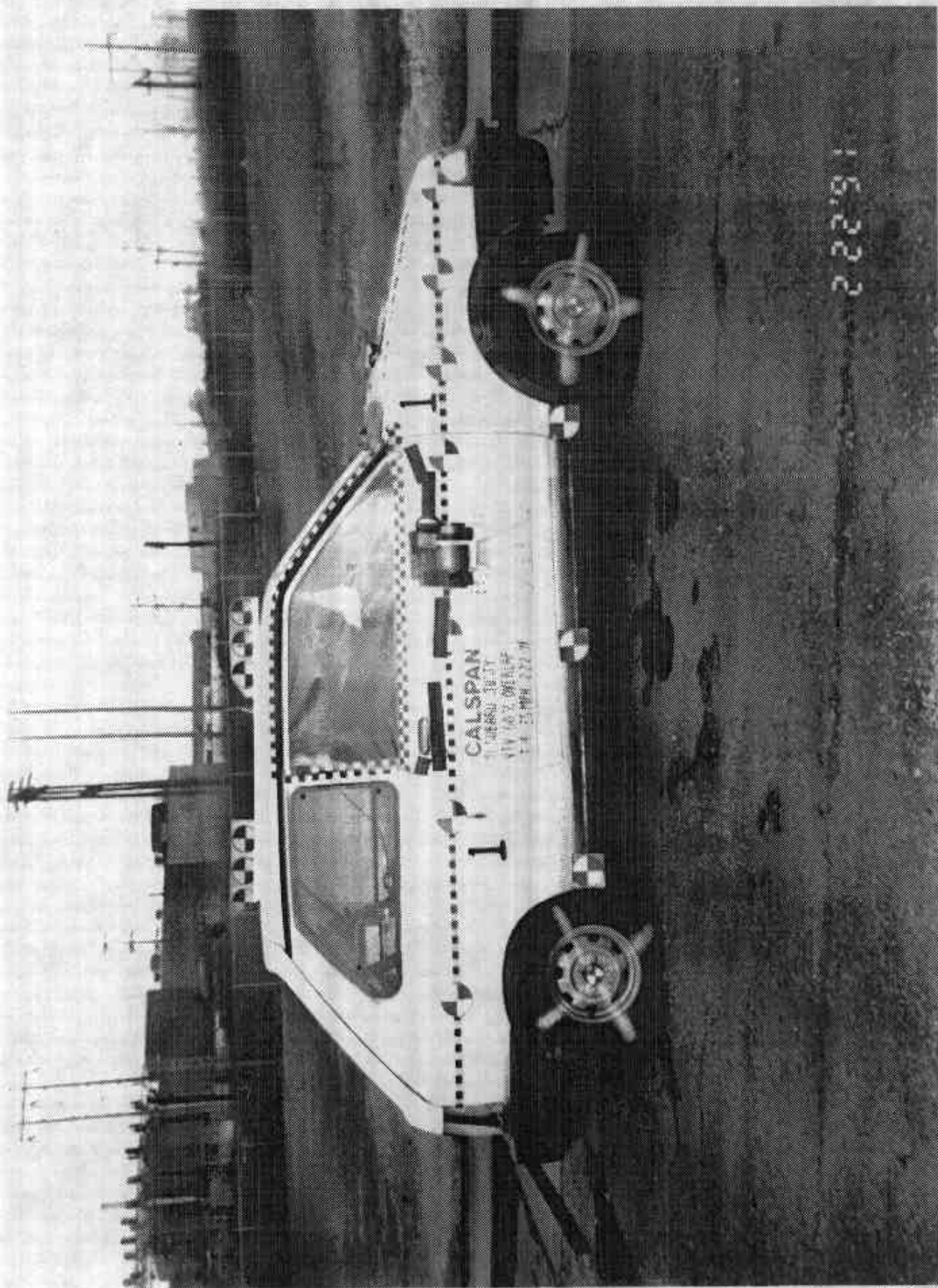


Figure A-9 VEHICLE 1 POST-TEST FRONT RIGHT THREE QUARTER VIEW

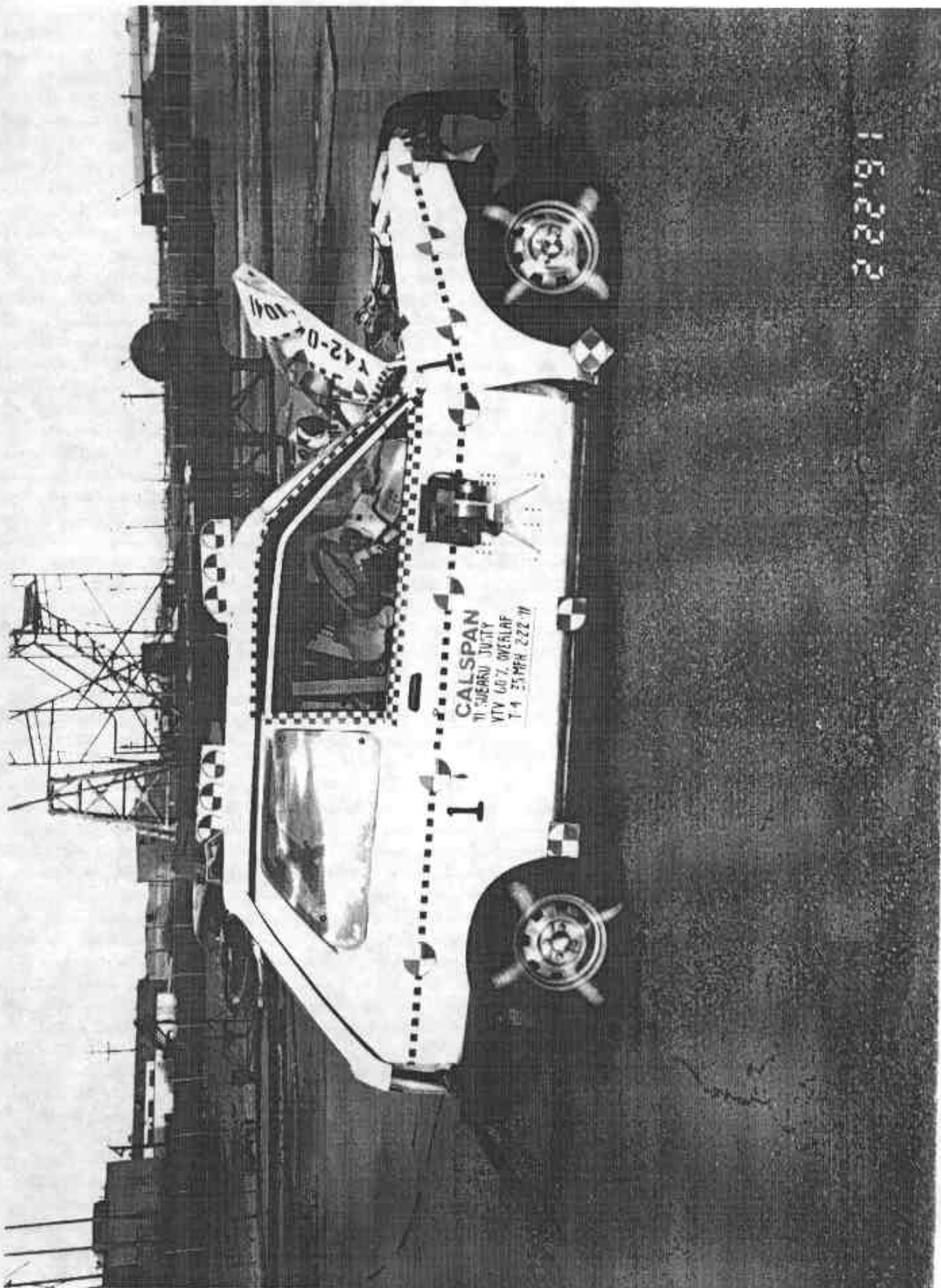
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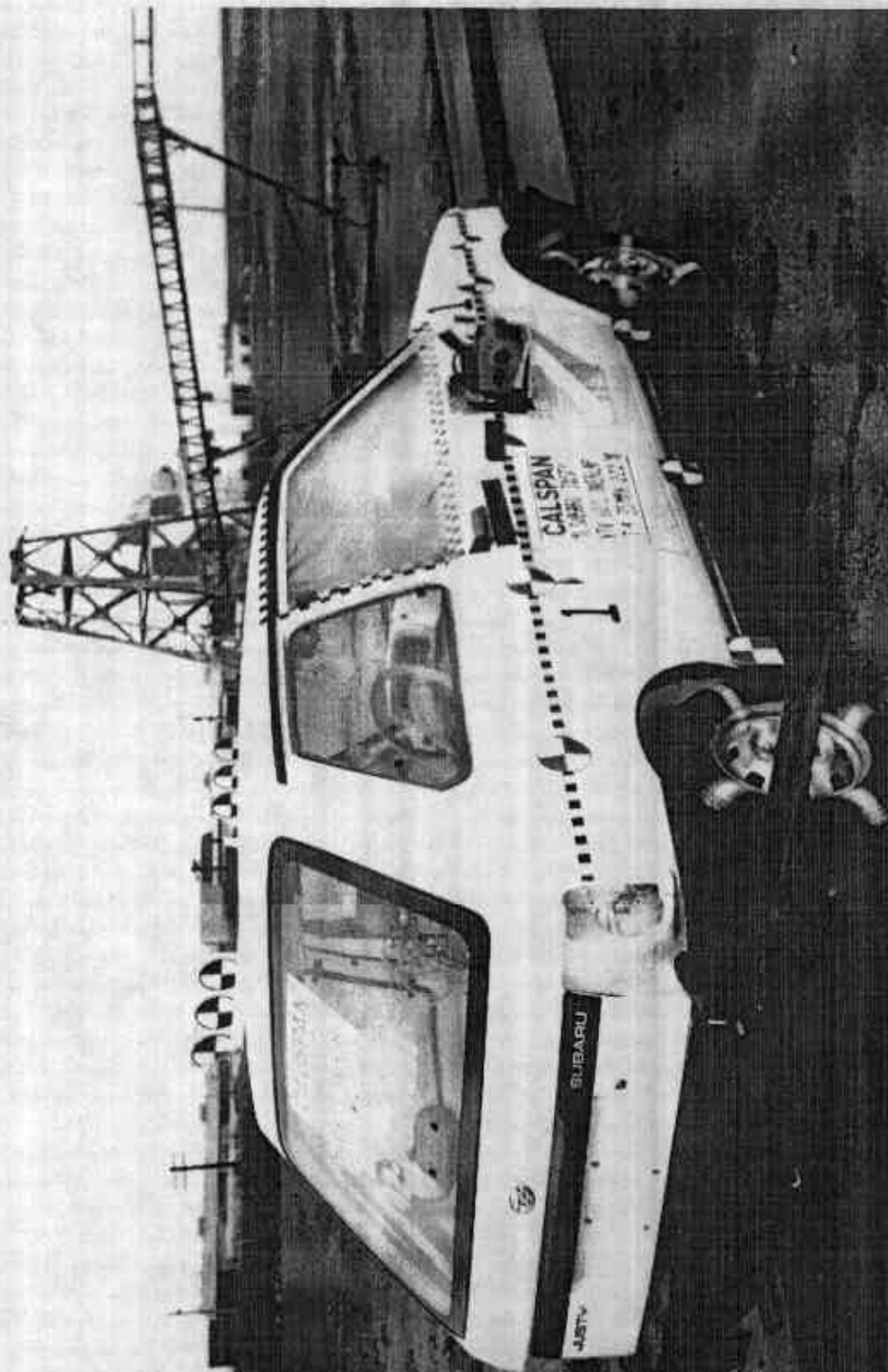
162291

FIGURE A-10 VEHICLE 1 PRE-TEST RIGHT SIDE VIEW



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Figure A-11 VEHICLE 1 POST-TEST RIGHT SIDE VIEW

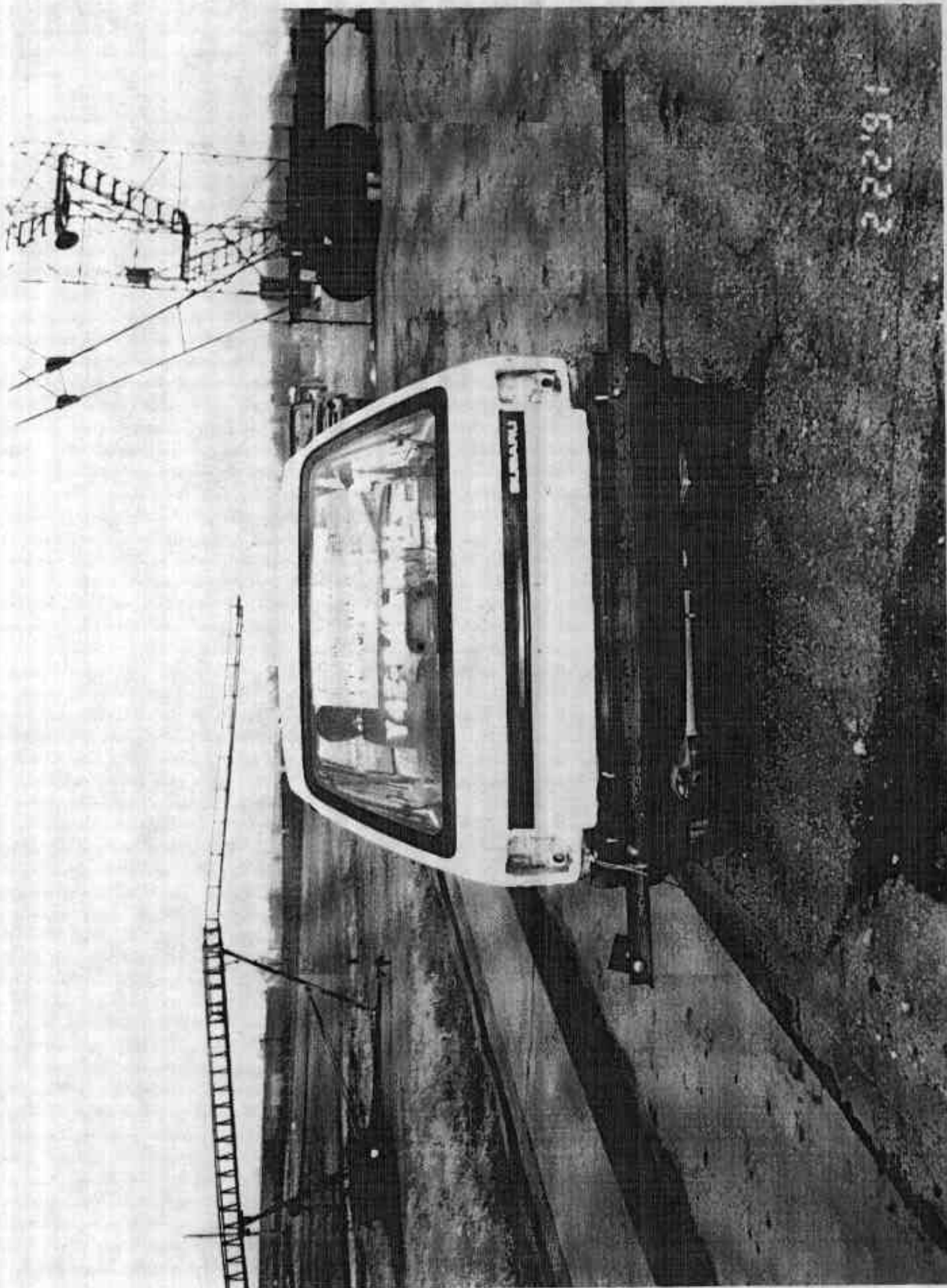


16223

Figure A-12 VEHICLE 1 PRE-TEST REAR RIGHT THREE QUARTER VIEW



Figure A-13 VEHICLE 1 POST-TEST REAR RIGHT THREE QUARTER VIEW



152291

FIGURE A-14 VEHICLE 1 PRE-TEST REAR VIEW

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Figure A-15 VEHICLE 1 POST-TEST REAR VIEW



FIGURE A-10 VEHICLE, 1 PRE-TEST REAR LEFT THREE QUARTER VIEW

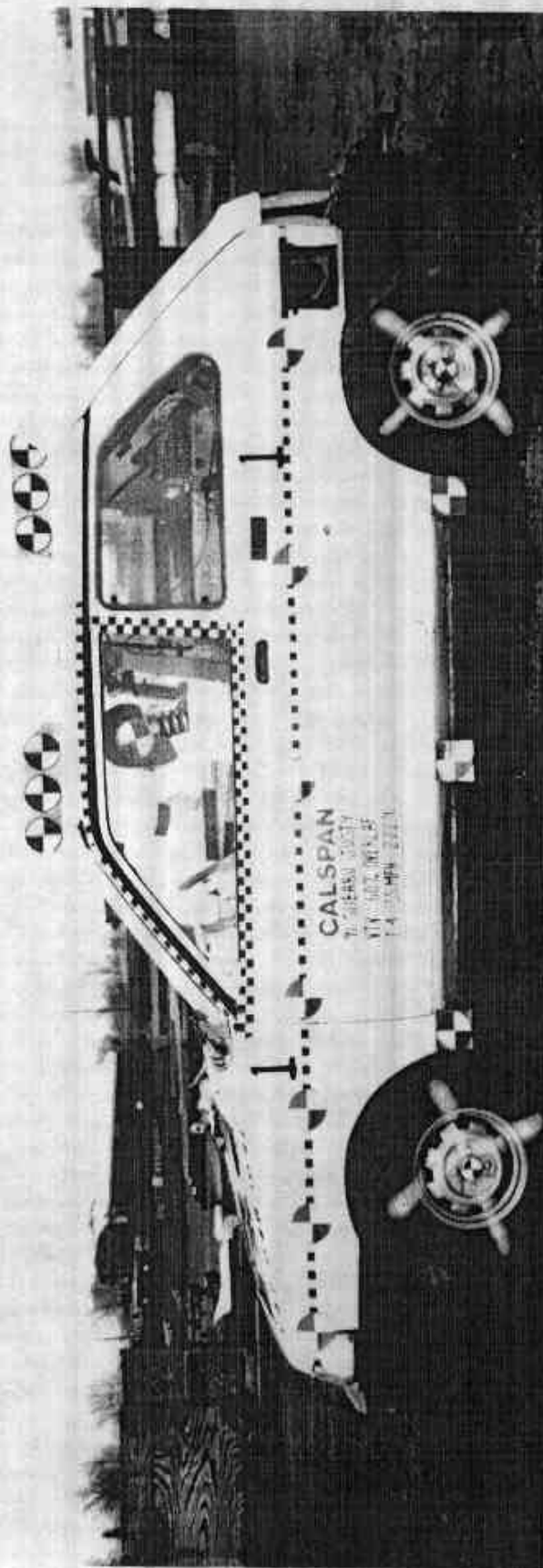
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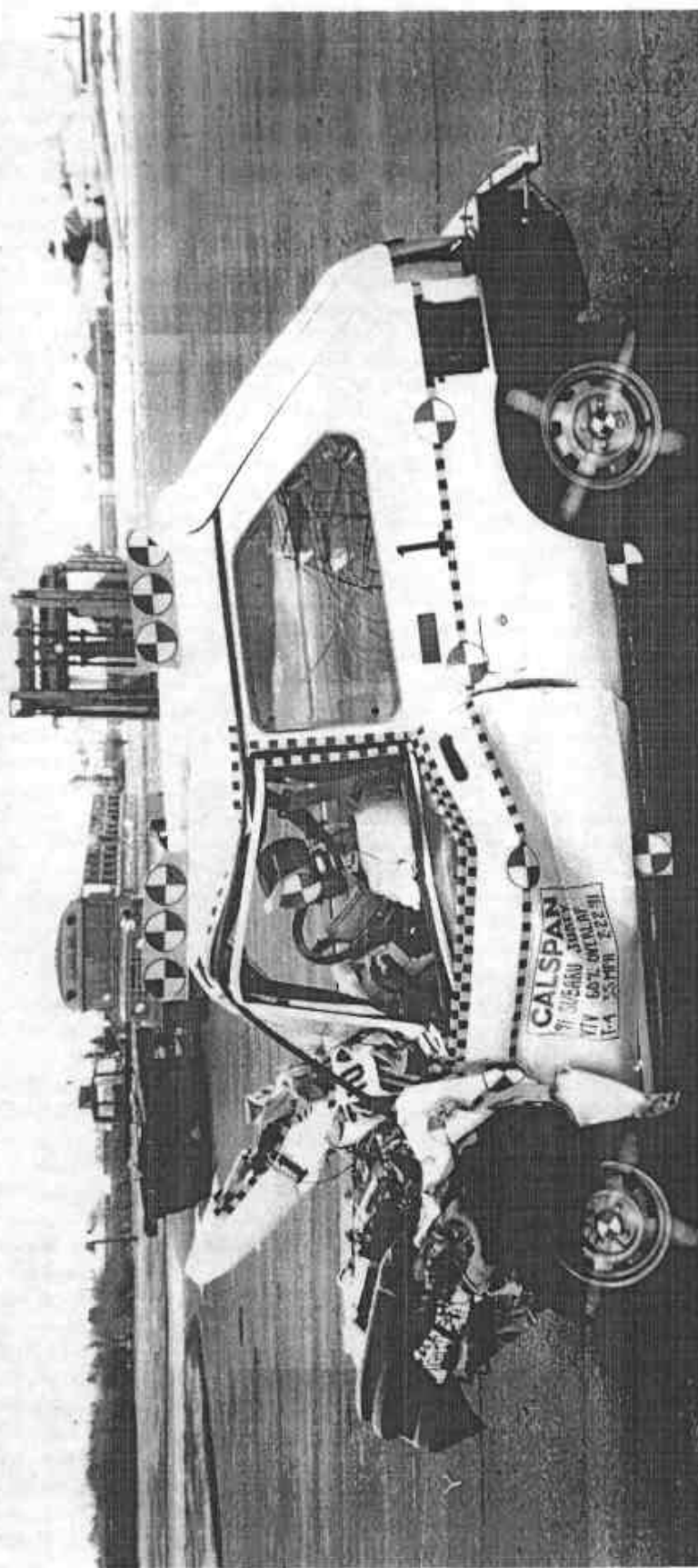
15.222

Figure A-17 VEHICLE 1 POST-TEST REAR LEFT THREE QUARTER VIEW



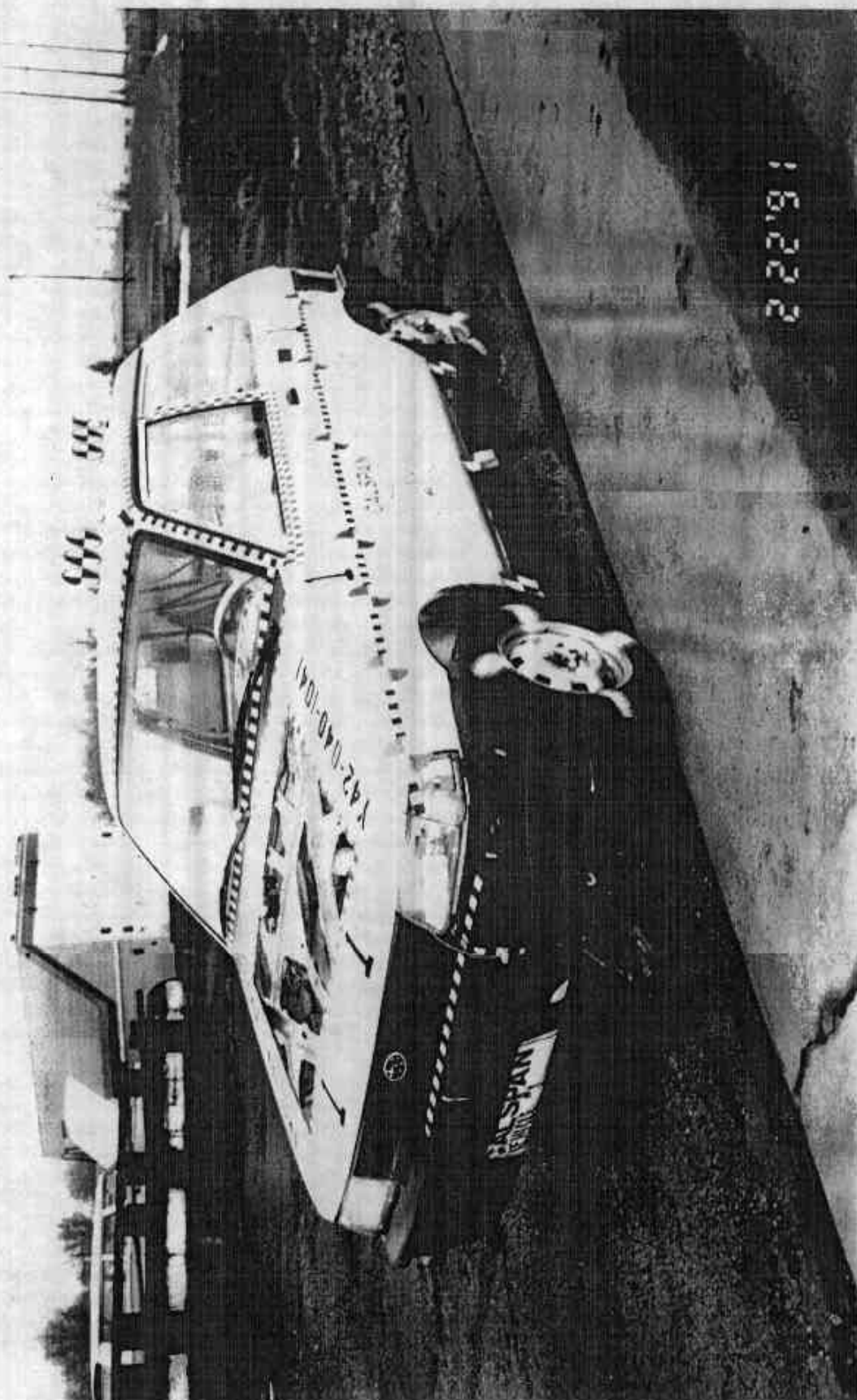
15.222

Figure A-18 VEHICLE 1 PRE-TEST LEFT SIDE VIEW



162291

Figure A-19 VEHICLE 1 POST-TEST LEFT SIDE VIEW



222'9"

Figure A-20 Vehicle 1 Pre-Test Front Left Three Quarter View

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7883 4



FIGURE A-21 VEHICLE 1 POST-TEST FRONT LEFT THREE QUARTER VIEW

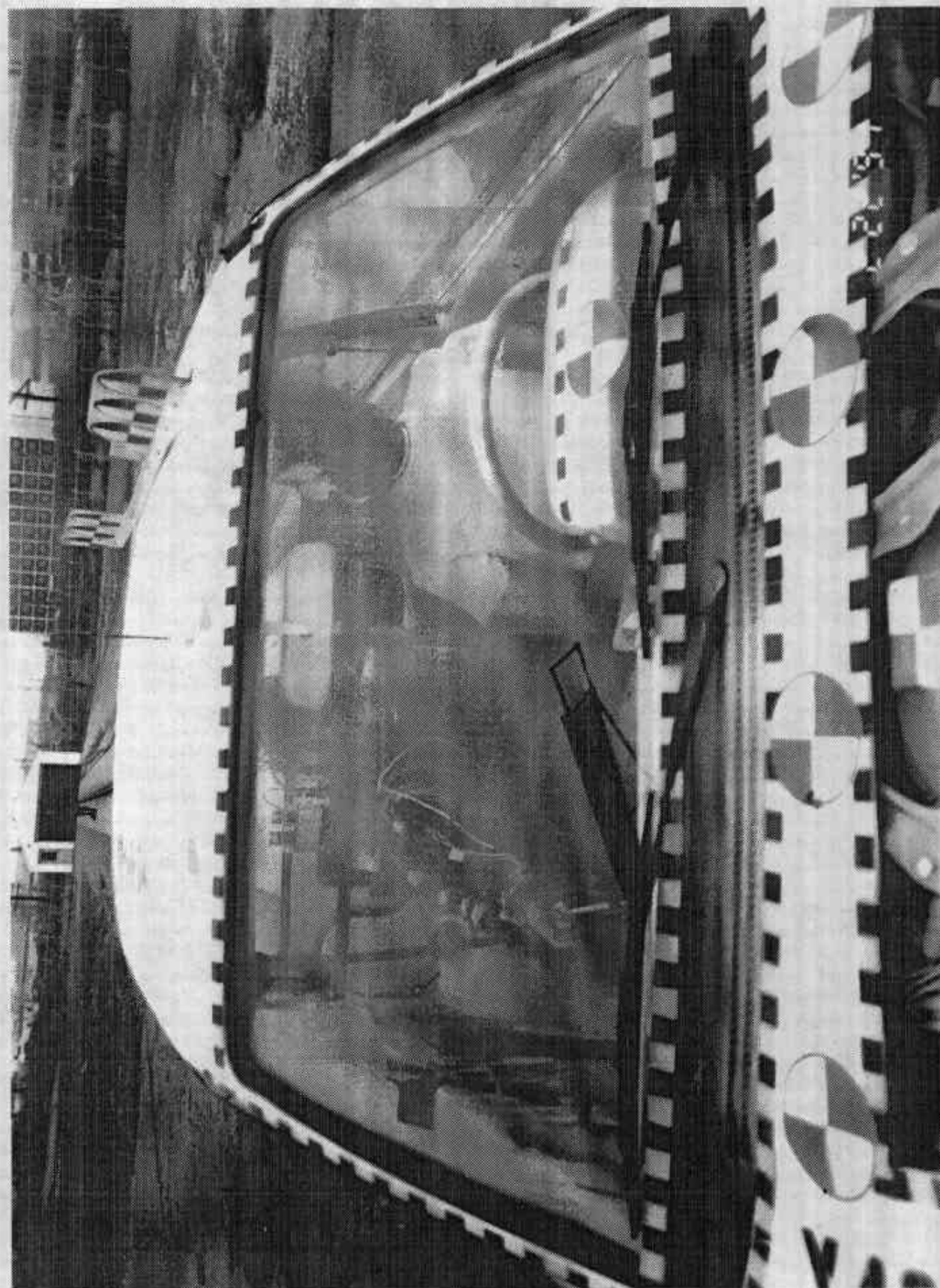


Figure A-22 VEHICLE 1 PRE-TEST WINDSHIELD VIEW



FIGURE A-23. VEHICLE 1. POST-TEST WINDSHIELD VIEW

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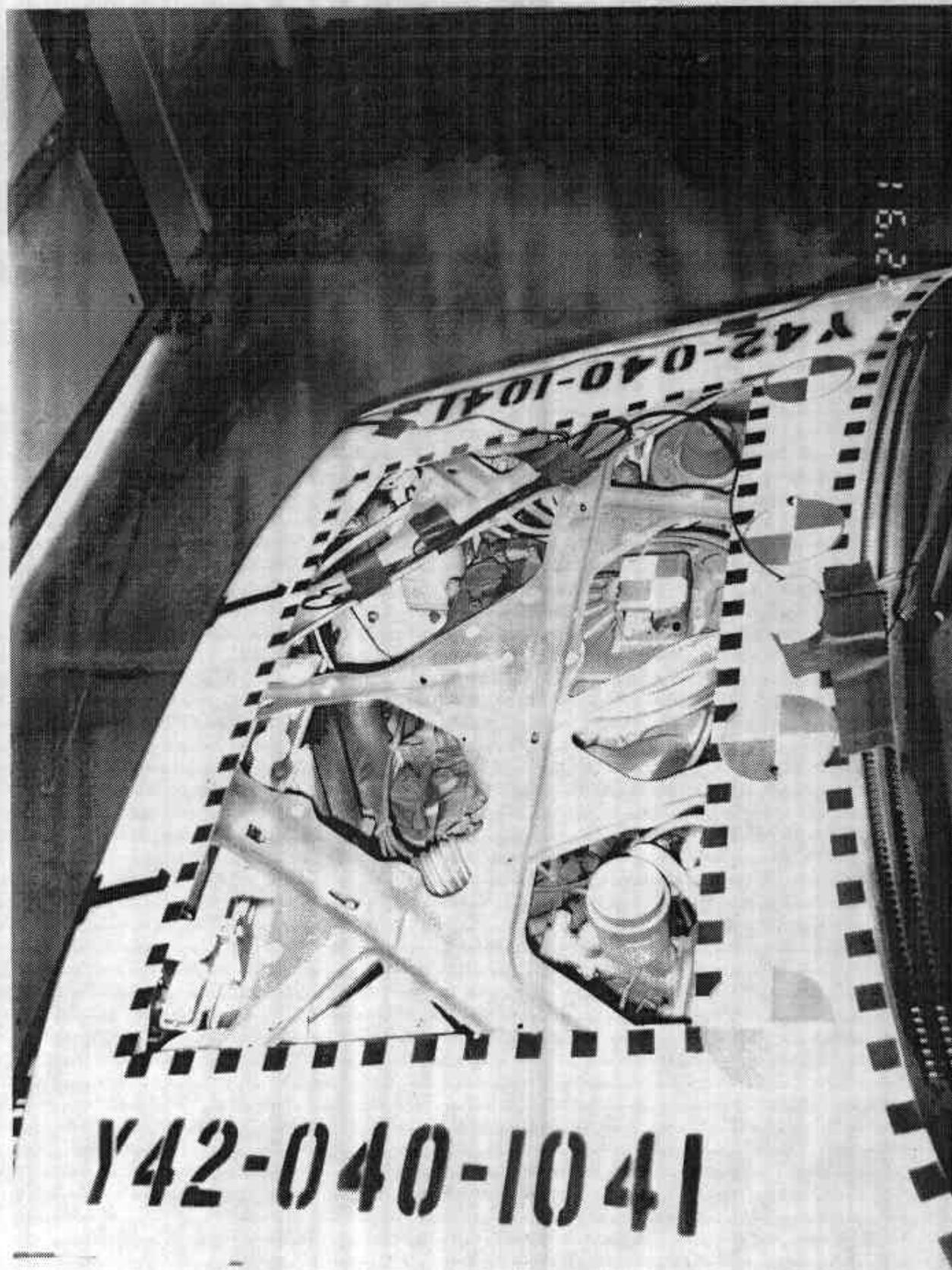


FIGURE A-24 VEHICLE 1 PRE-TEST OVERHEAD ENGINE COMPARTMENT VIEW

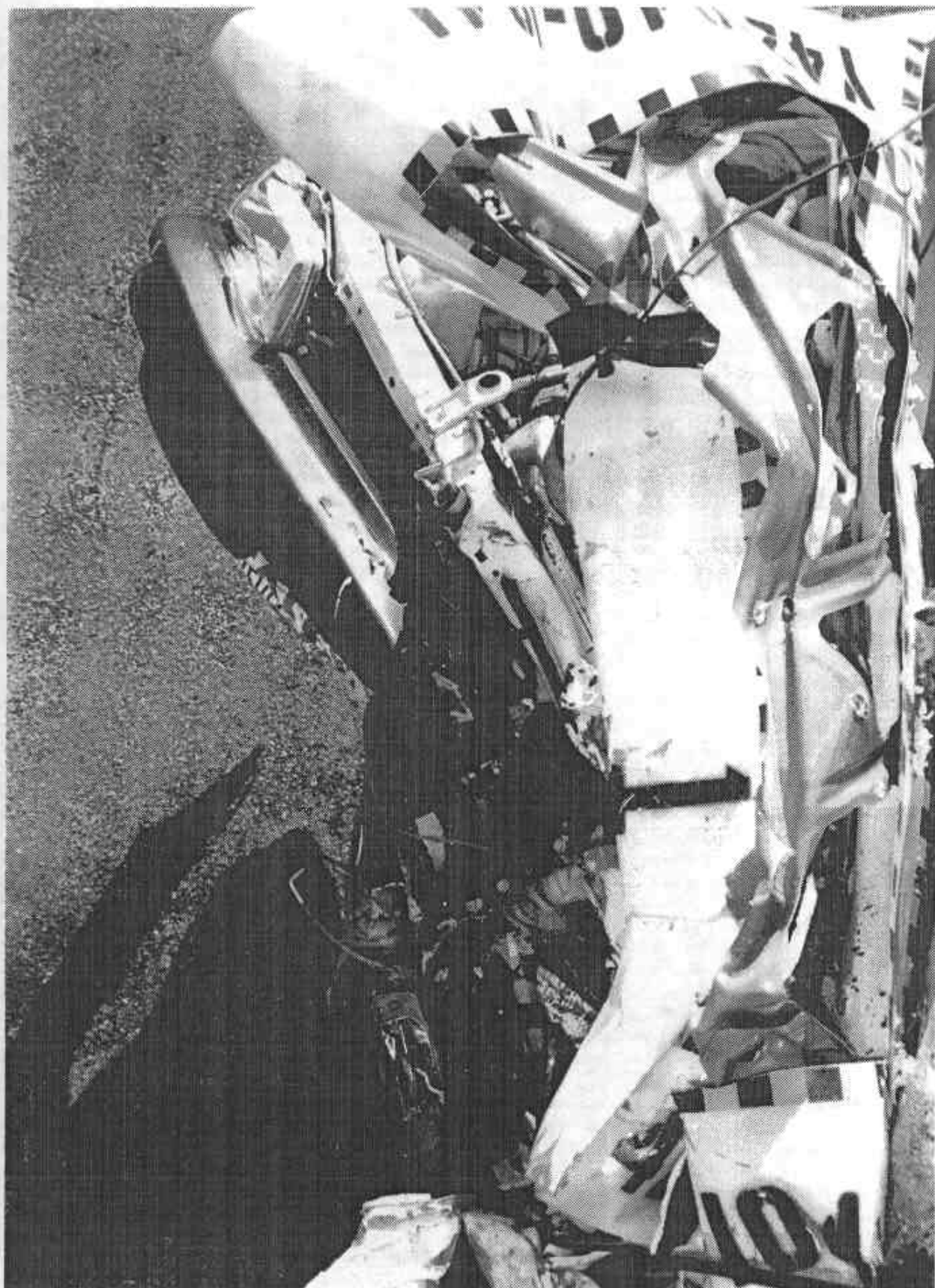


Figure A-25 VEHICLE 1 POST-TEST OVERHEAD ENGINE COMPARTMENT VIEW

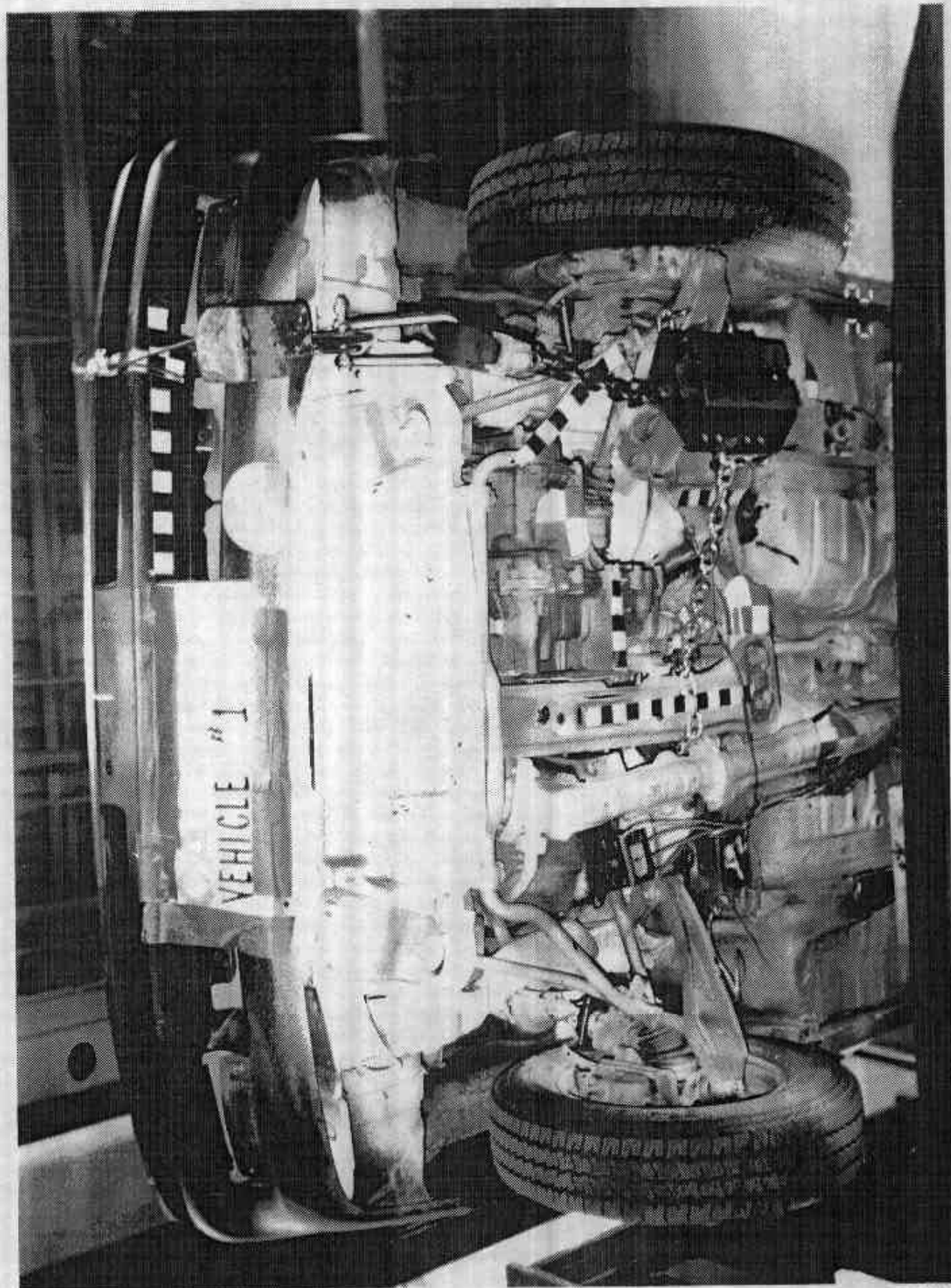


Figure A-26 VEHICLE 1 PRE-TEST UNDERBODY FRONT VIEW

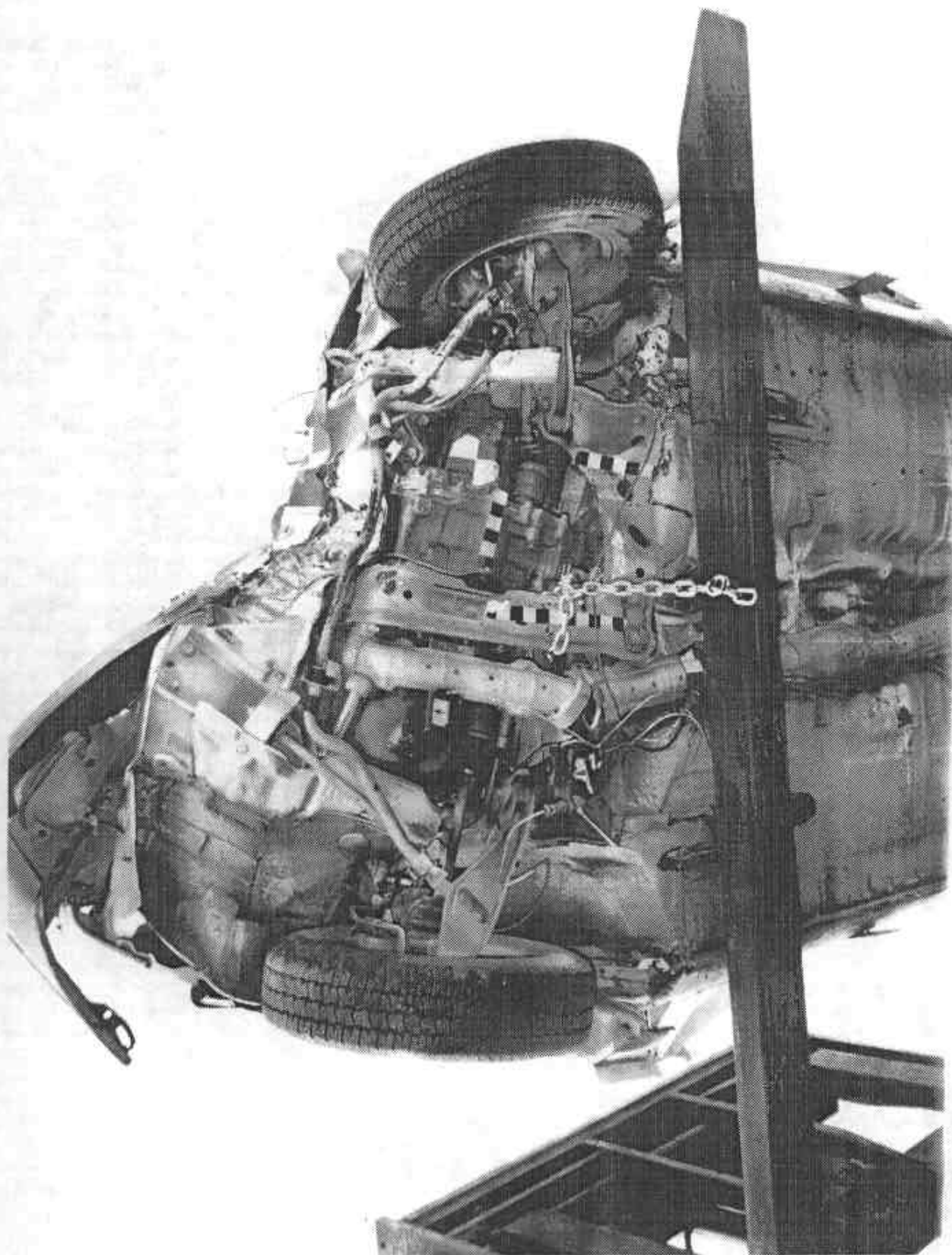


Figure A-27 VEHICLE 1 POST-TEST UNDERBODY FRONT VIEW

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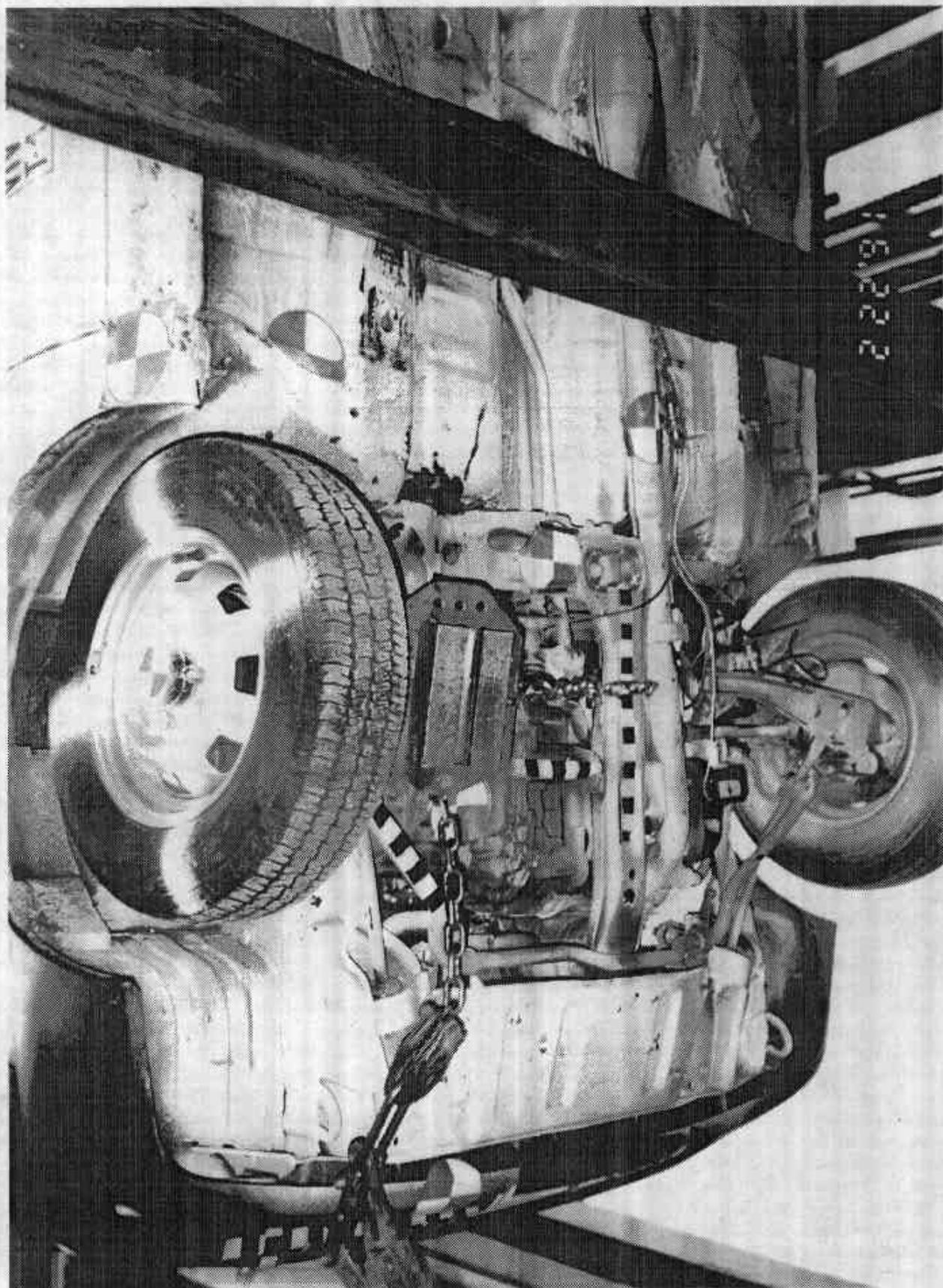


FIGURE A-28 VEHICLE 1 PRE-TEST UNDERBODY FRONT SIDE VIEW

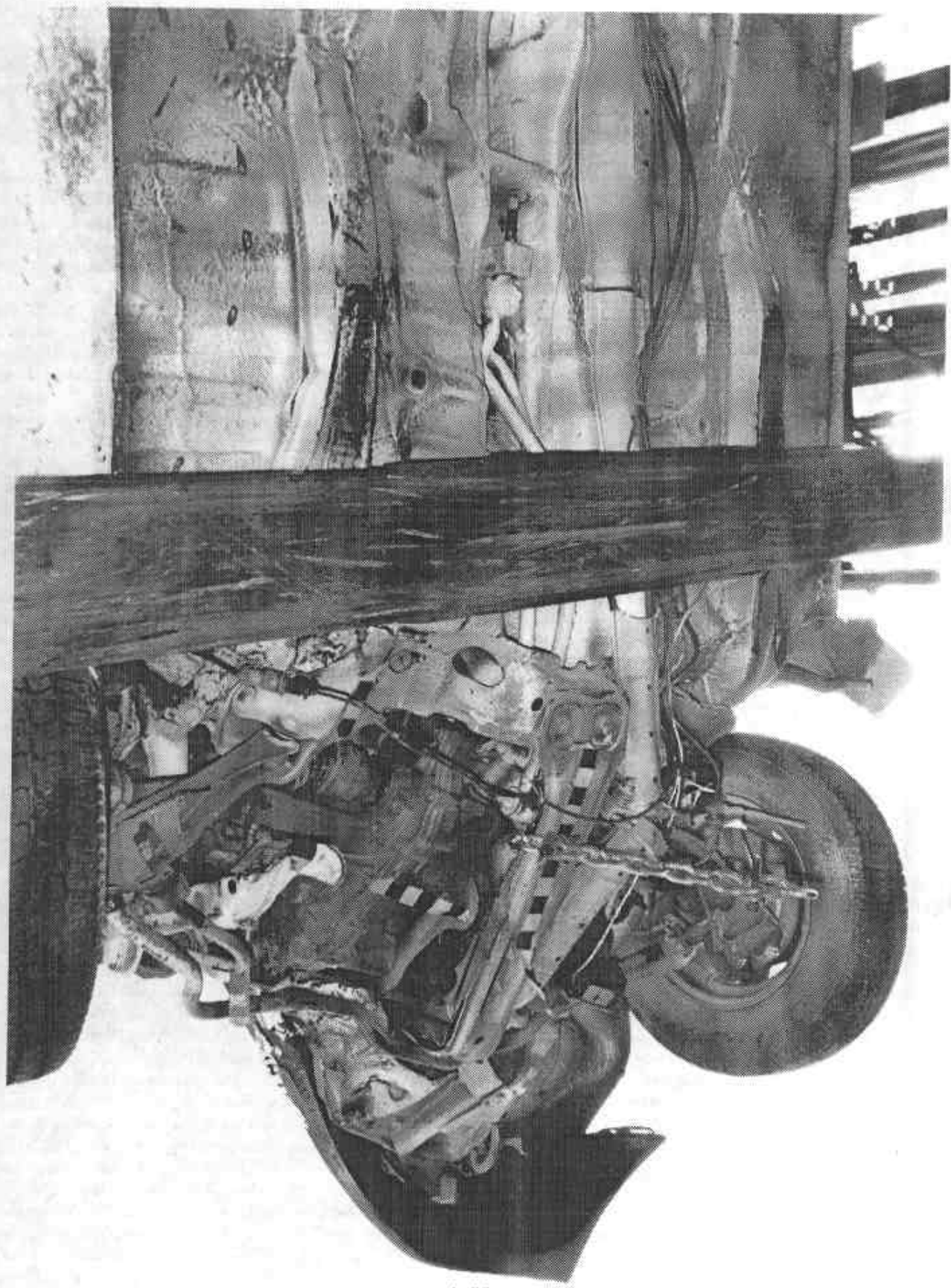


Figure A-29 VEHICLE 1 POST-TEST UNDERBODY FRONT SIDE VIEW

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7883-4

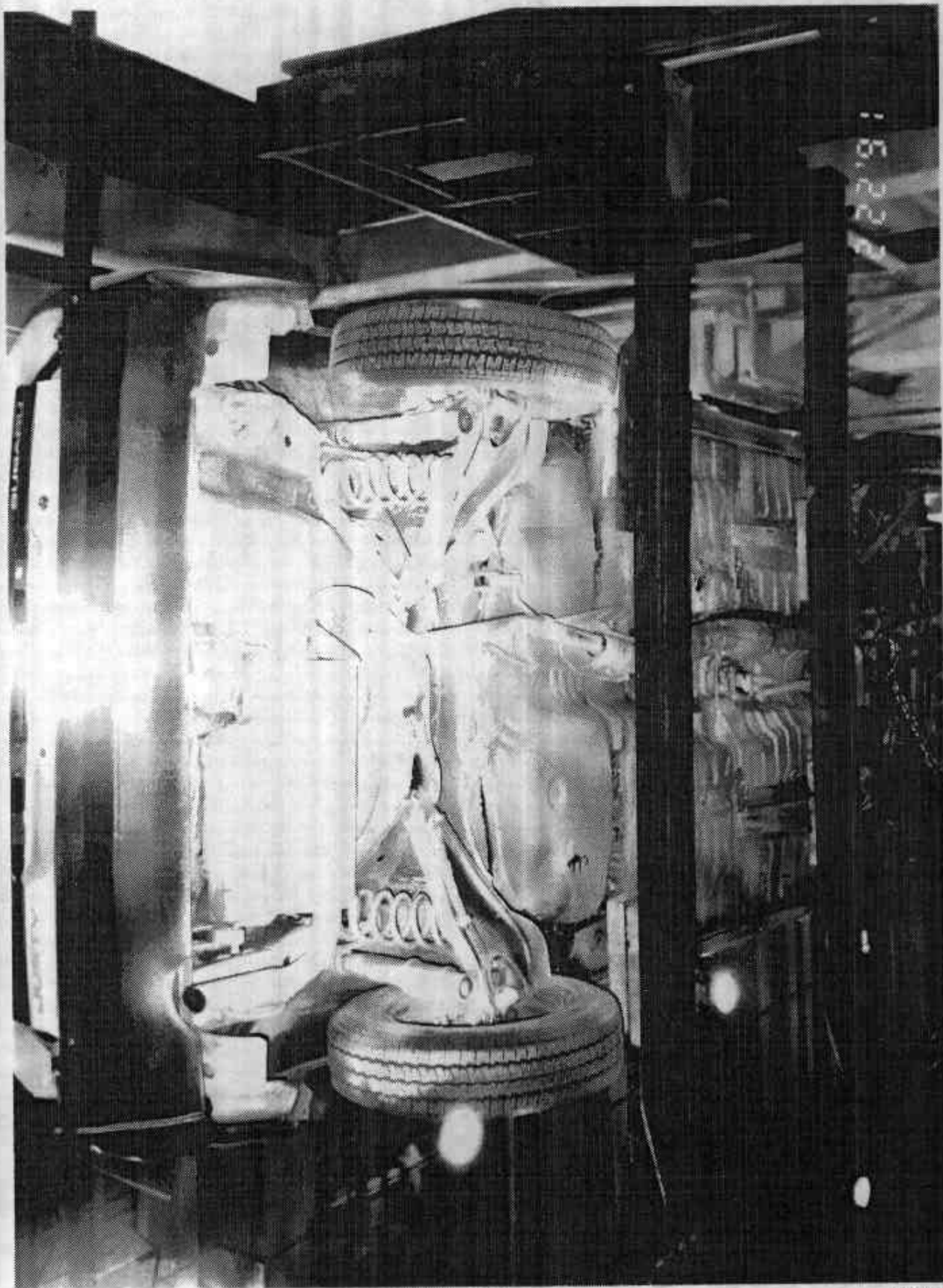


Figure A-30 VEHICLE 1 PRE-TEST UNDERBODY REAR VIEW

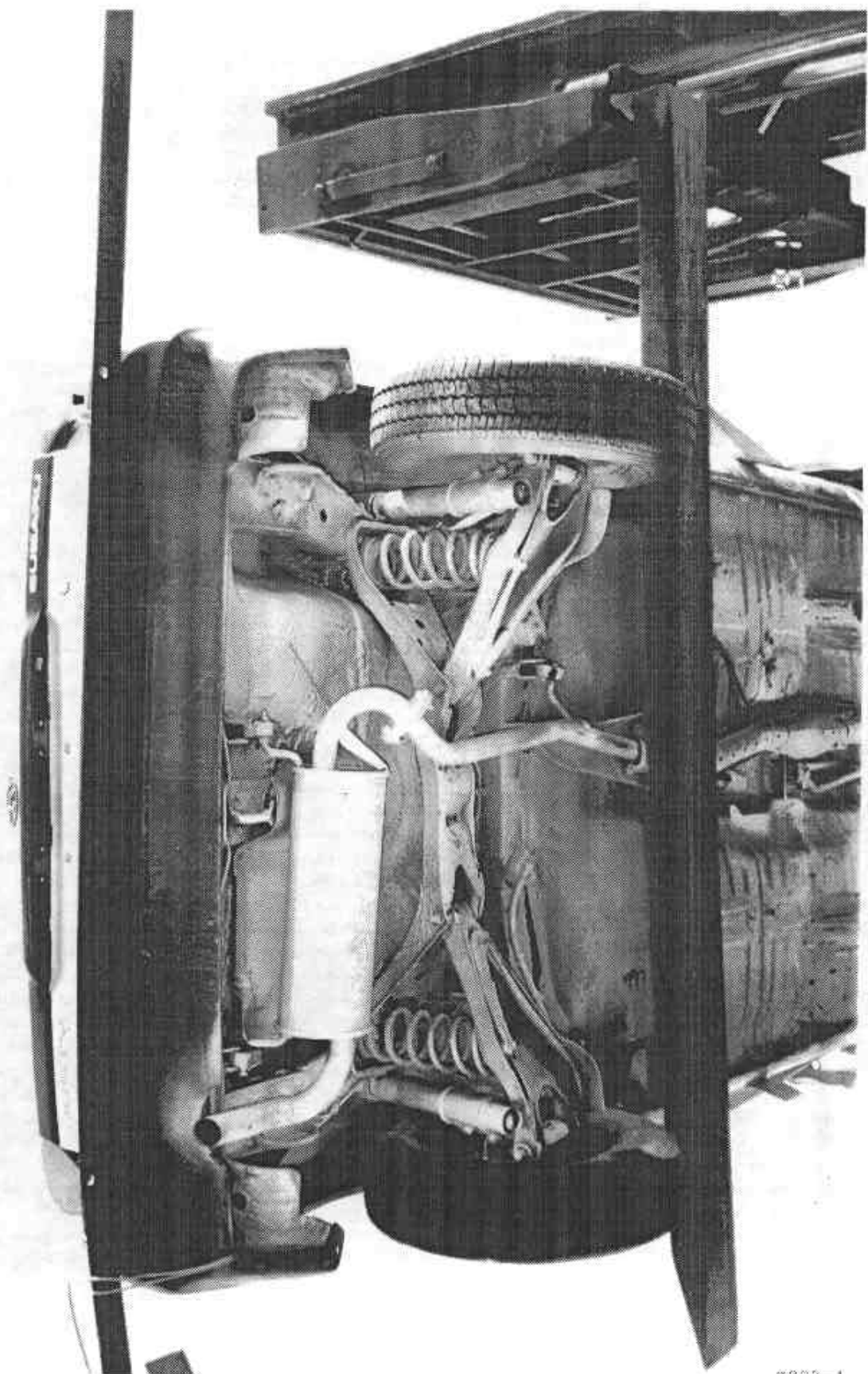
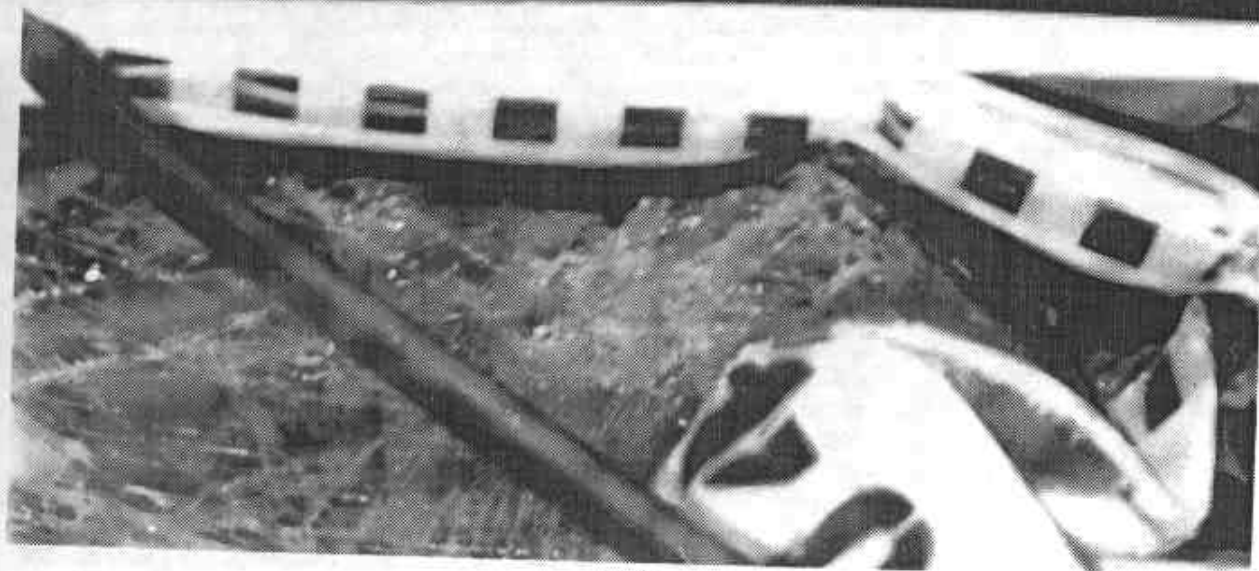


Figure A-31 VEHICLE 1 POST-TEST UNDERBODY REAR VIEW

VEHICLE 1 PRE-TEST DRIVER POSITION VIEW

(Photograph is not available)



A-36

7883-1

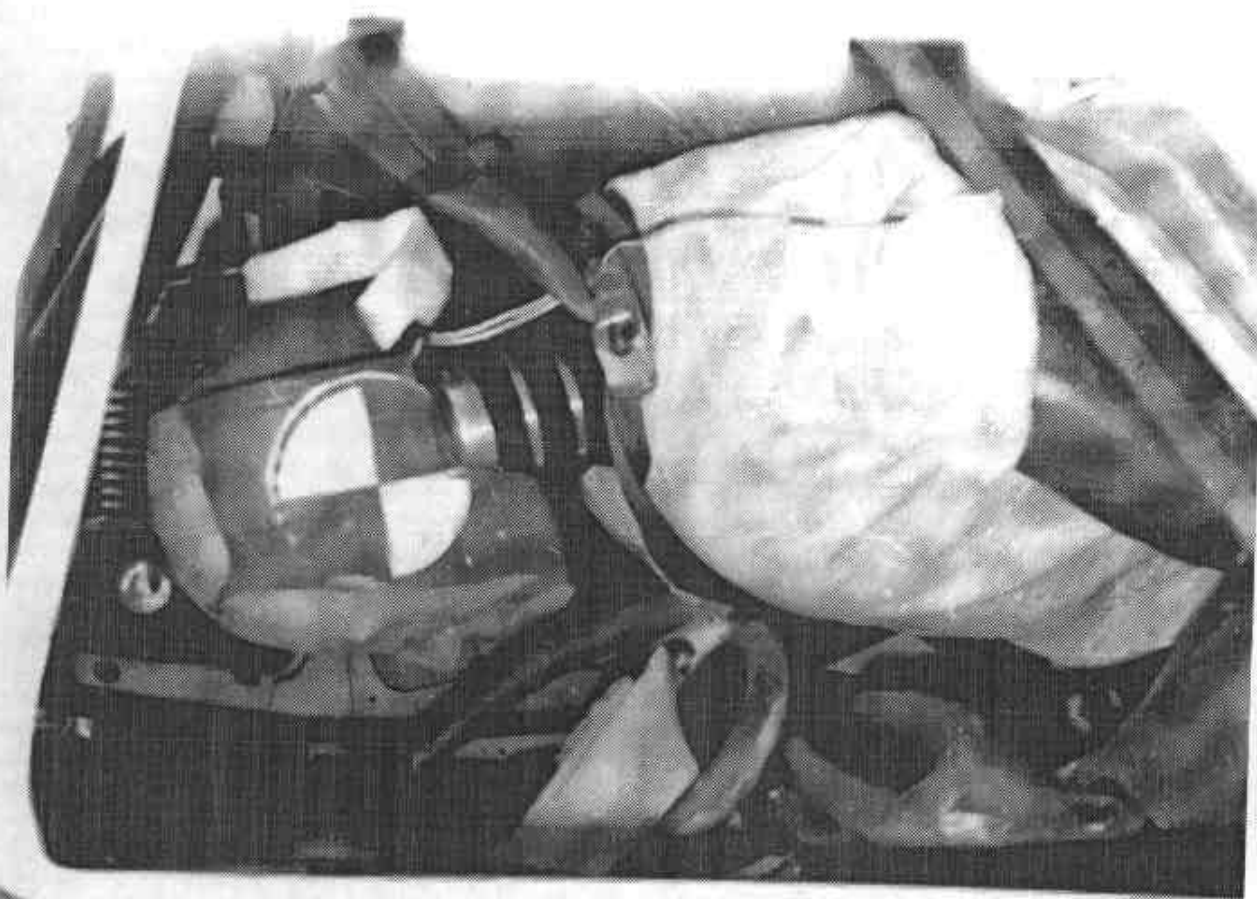


Figure A-33 VEHICLE 1 POST-TEST DRIVER POSITION VIEW

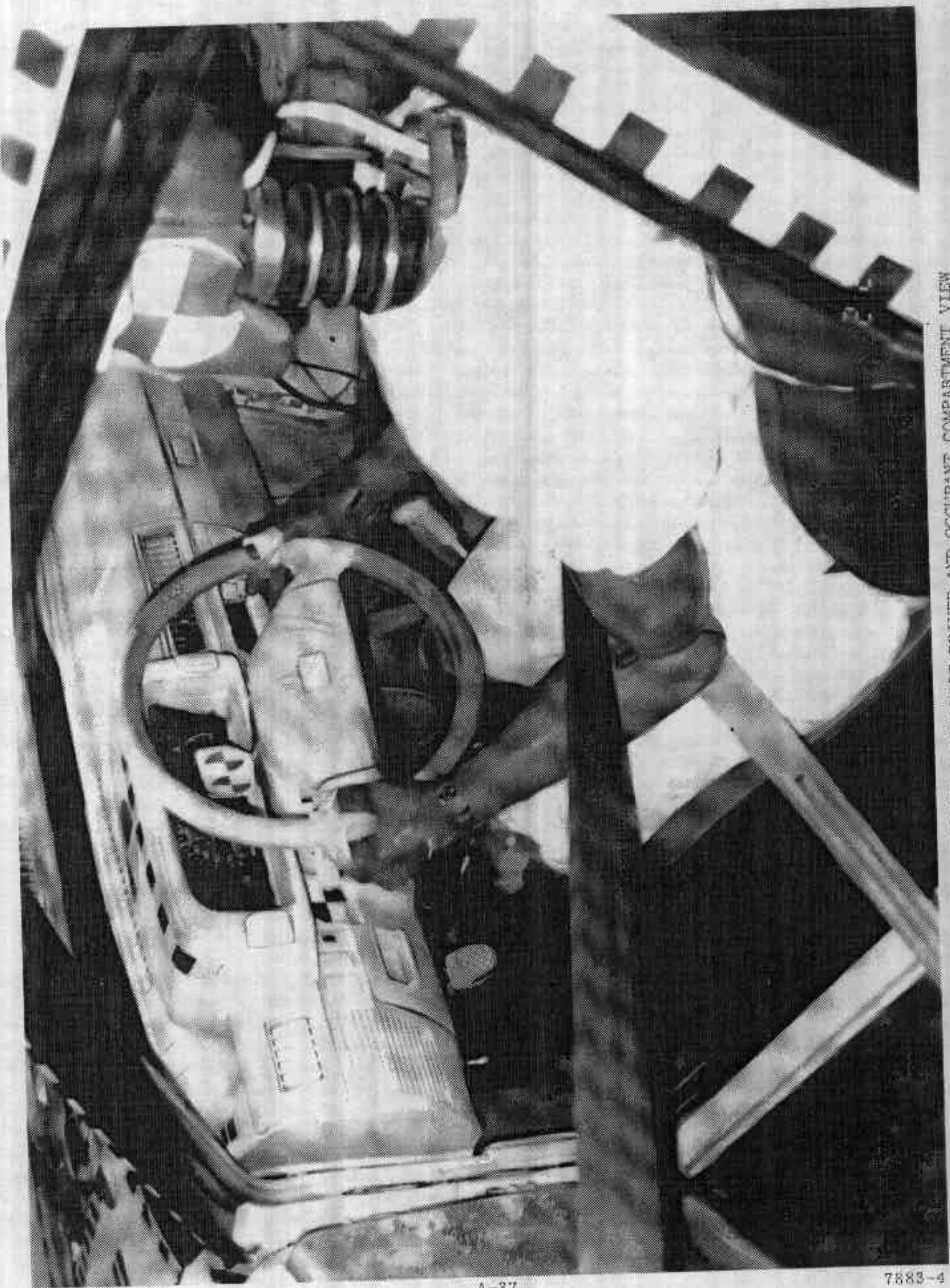


FIGURE A-34 VEHICLE 1 PRE-TEST DRIVER AND OCCUPANT COMPARTMENT VIEW

A-37

7883-4

VEHICLE 1 POST-TEST DRIVER AND OCCUPANT COMPARTMENT VIEW
(Photograph is not available)

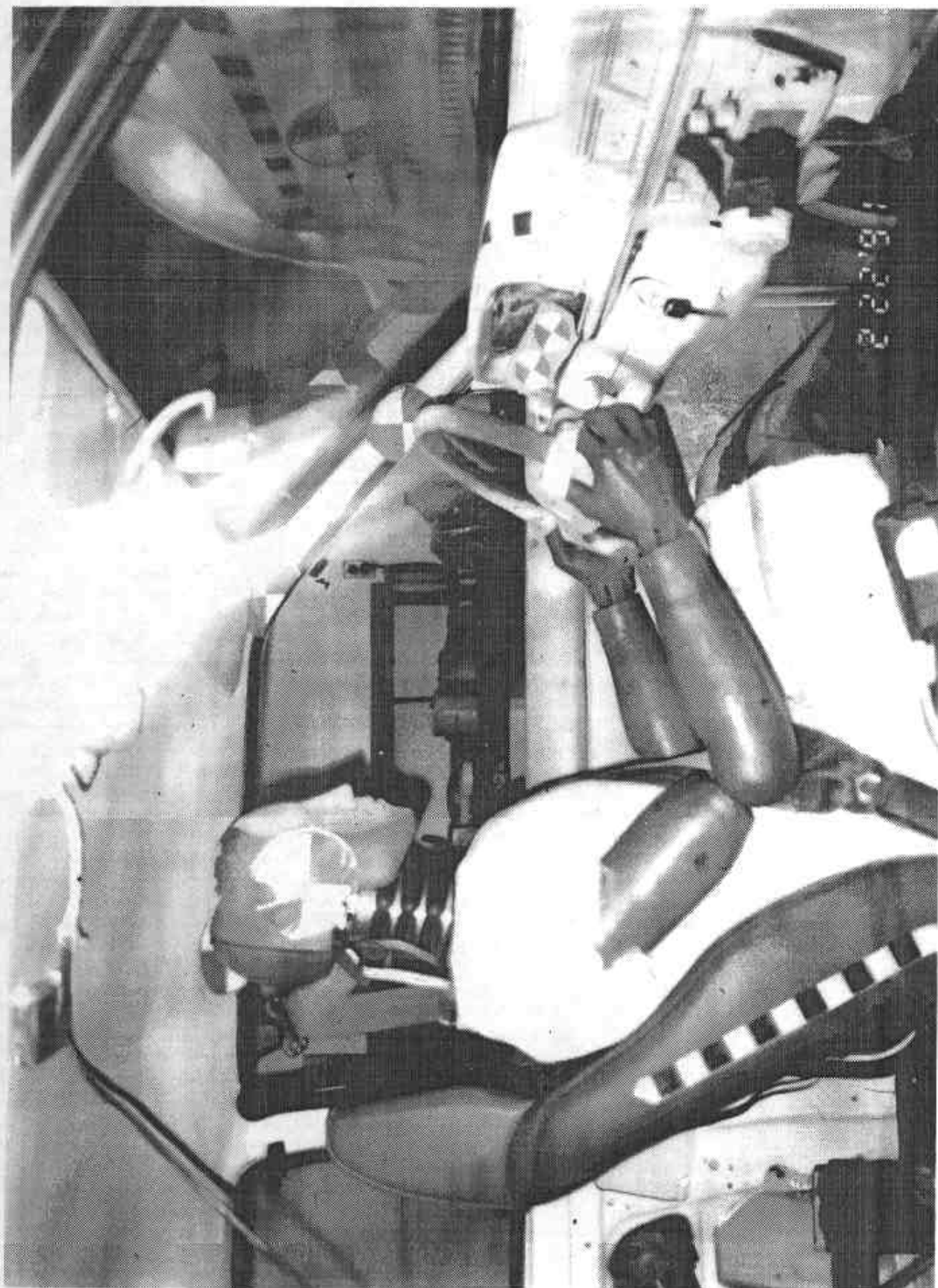


Figure A-36 VEHICLE 1 PRE-TEST DRIVER AND OCCUPANT COMPARTMENT
RIGHT SIDE VIEW

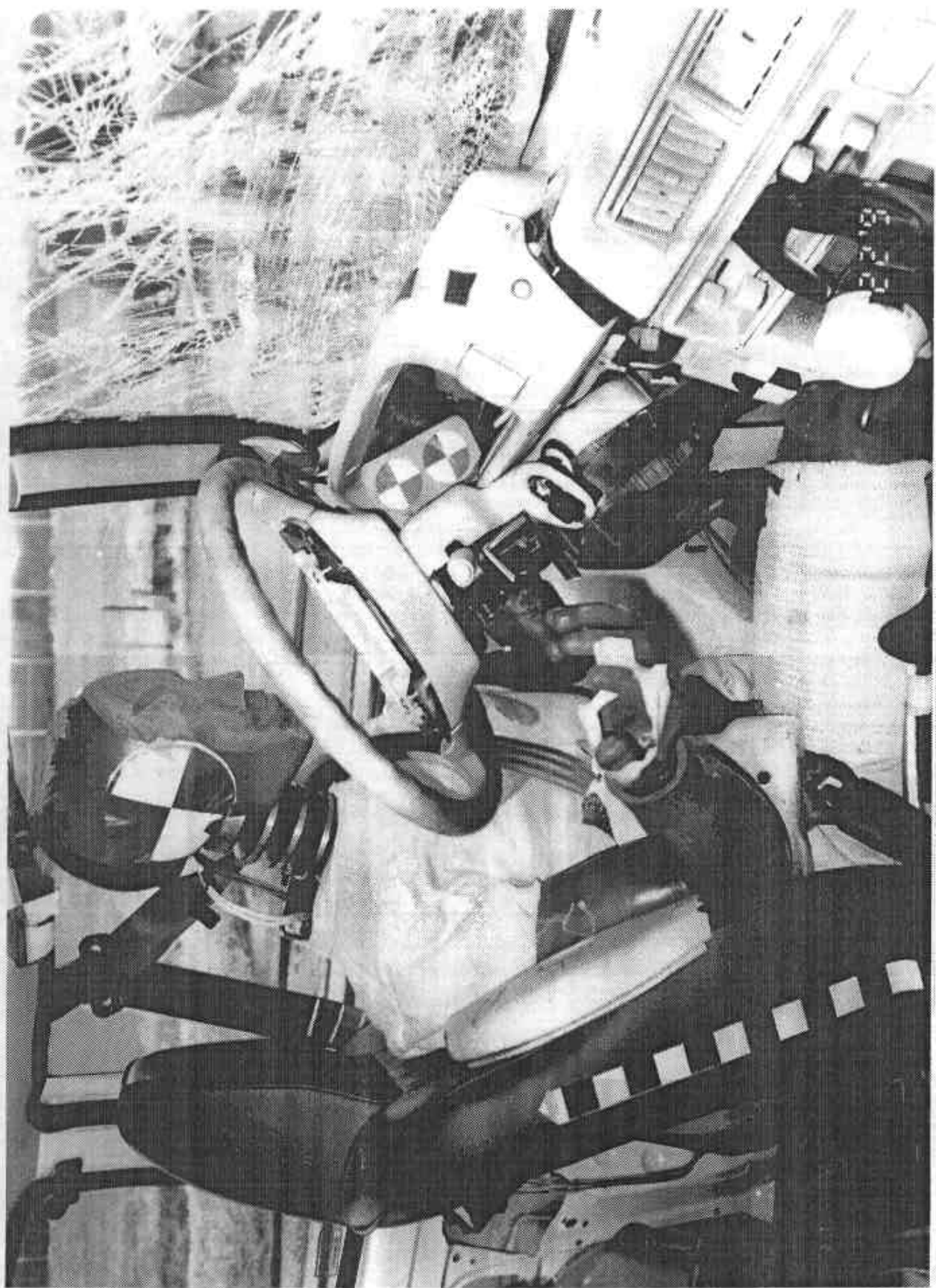


Figure A-37 VEHICLE 1 POST-TEST DRIVER AND OCCUPANT COMPARTMENT
RIGHT SIDE VIEW

VEHICLE 2 PHOTOGRAPHS

1991 FORD CROWN VICTORIA LTD 4-DOOR SEDAN



15,222

FIGURE A-28 VEHICLE 2 PRE-TEST FRONT VIEW

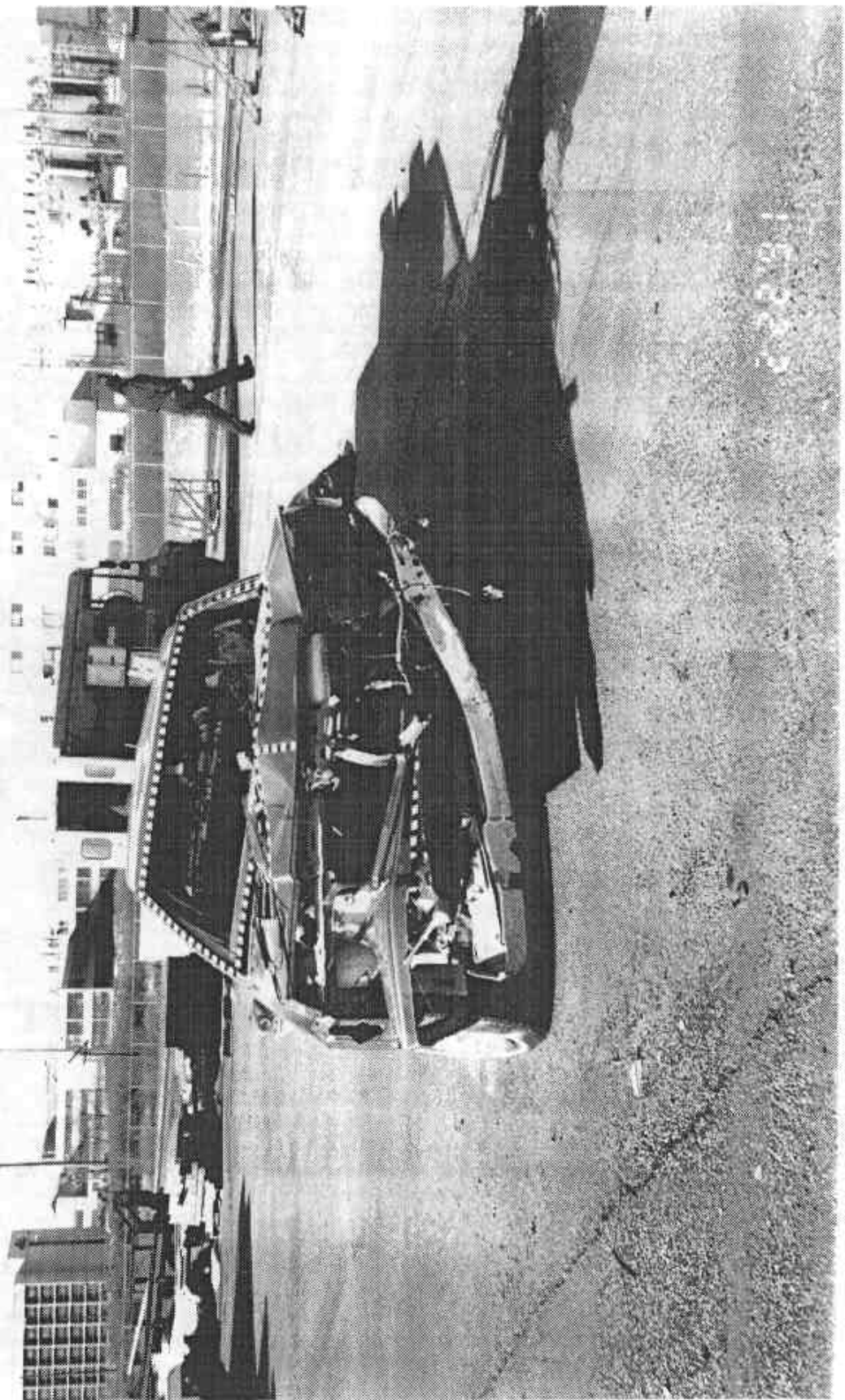


FIGURE A-39 VEHICLE 2 POST-TEST FRONT VIEW

A-43

7883-4



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FIGURE A-40 VEHICLE 2 PRE-TEST FRONT NIGHT THREE QUARTER VIEW

A-44

7883-4

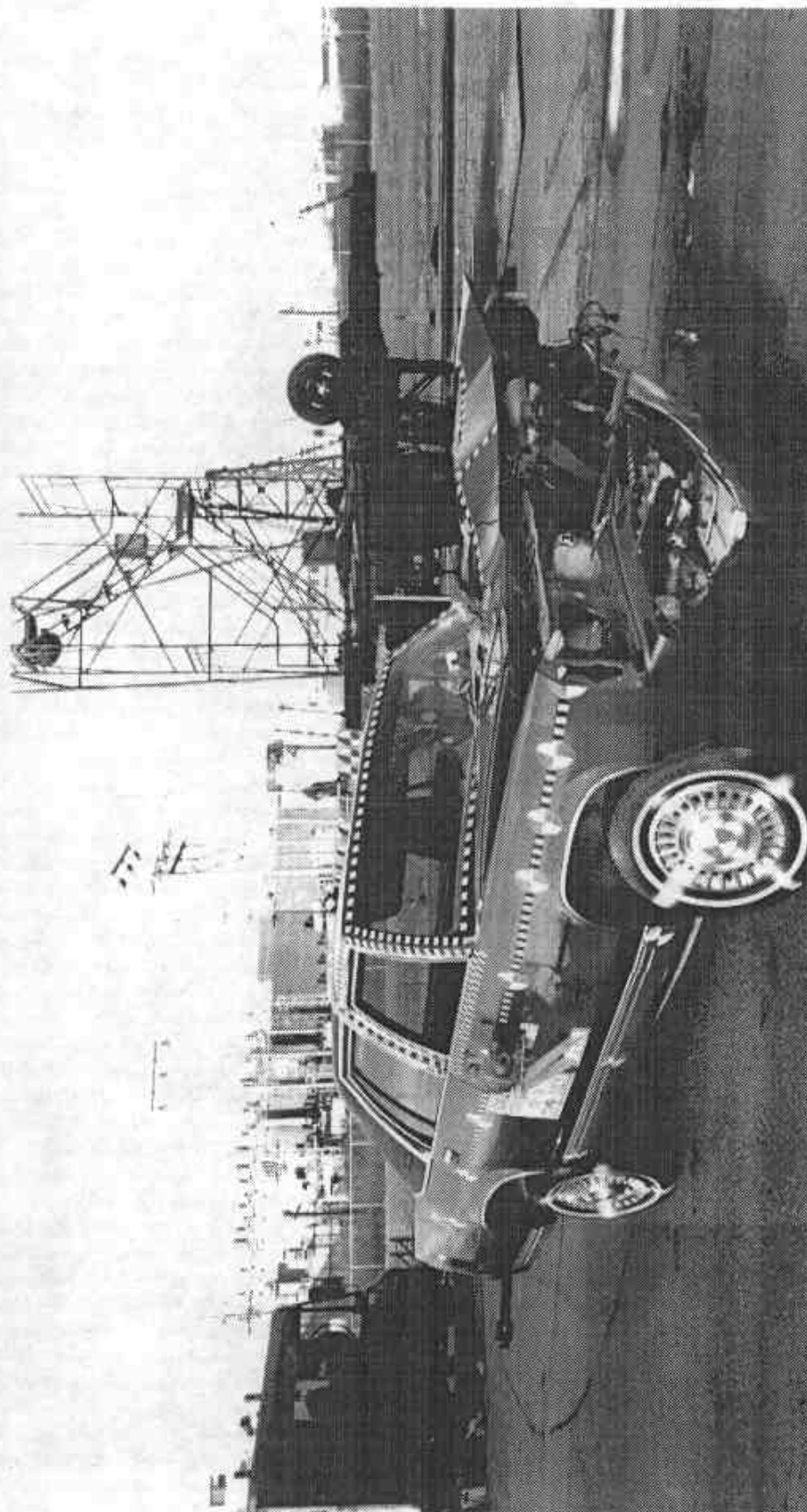


Figure A-41 VEHICLE 2 POST-TEST FRONT RIGHT THREE QUARTER VIEW

A-45

7883-4

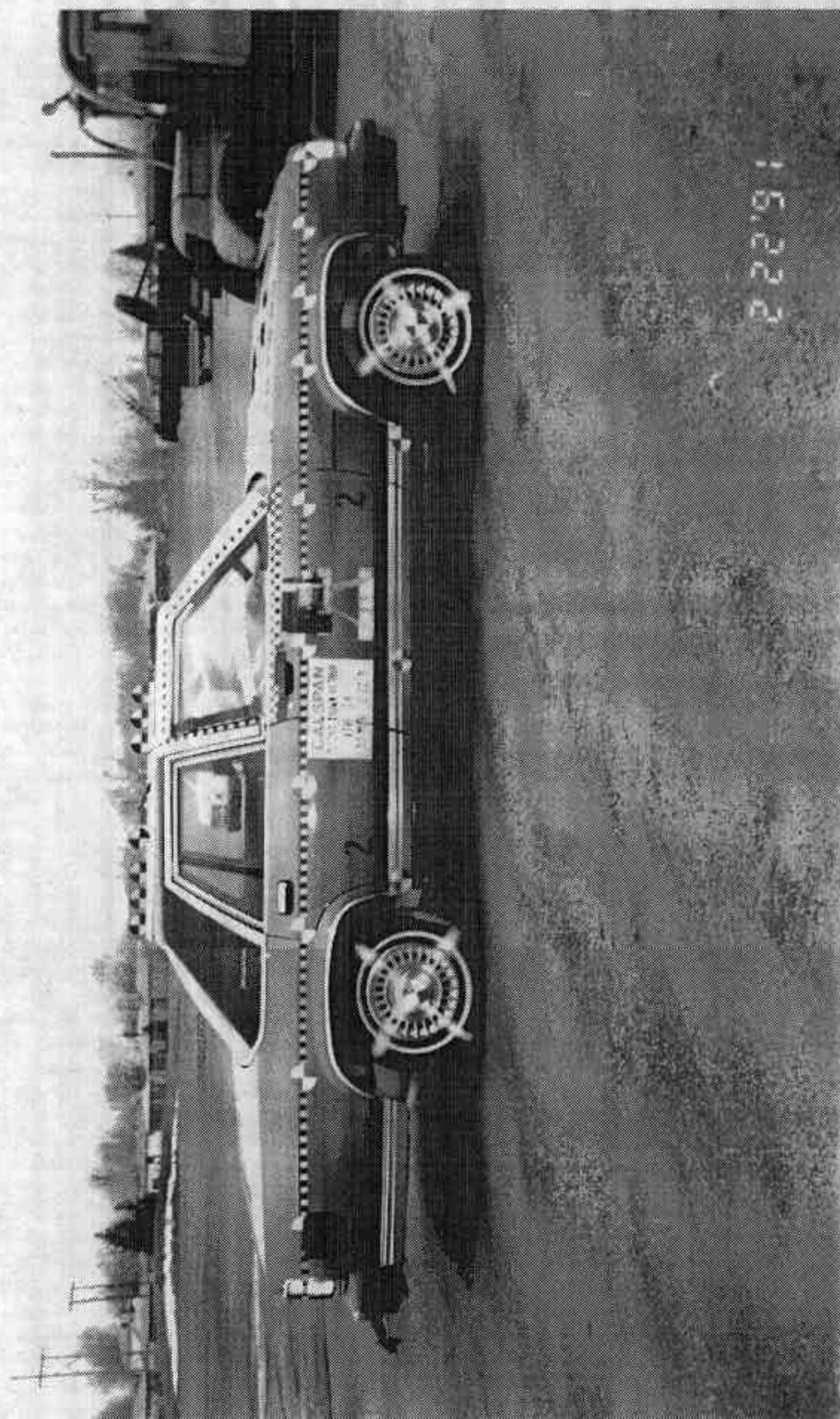
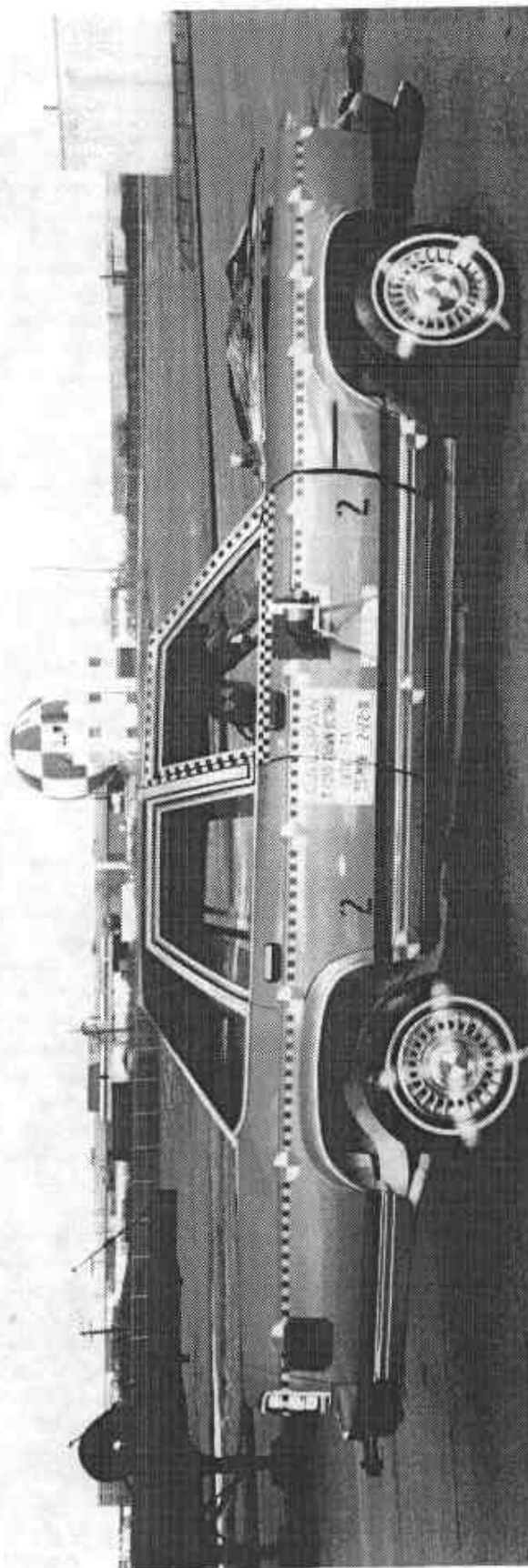


Figure A-42 VEHICLE 2 PRE-TEST RIGHT SIDE VIEW

A-46

7883-4



2.22.91

Figure A-43 VEHICLE 2 POST-TEST RIGHT SIDE VIEW



Figure A-44 VEHICLE 2 PRE-TEST REAR RIGHT THREE QUARTER VIEW

A-48

7883-4



Figure A-45 VEHICLE 2 POST-TEST REAR RIGHT THREE QUARTER VIEW

A-49

7883-4



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Figure A-68 VEHICLE 2 PRE-TEST REAR VIEW

A-50

7883-4



Figure A-47 VEHICLE 2 POST-TEST REAR VIEW



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FIGURE A-48 VEHICLE 2 PRE-TEST REAR LEFT THREE QUARTER VIEW

A-52

7883-4

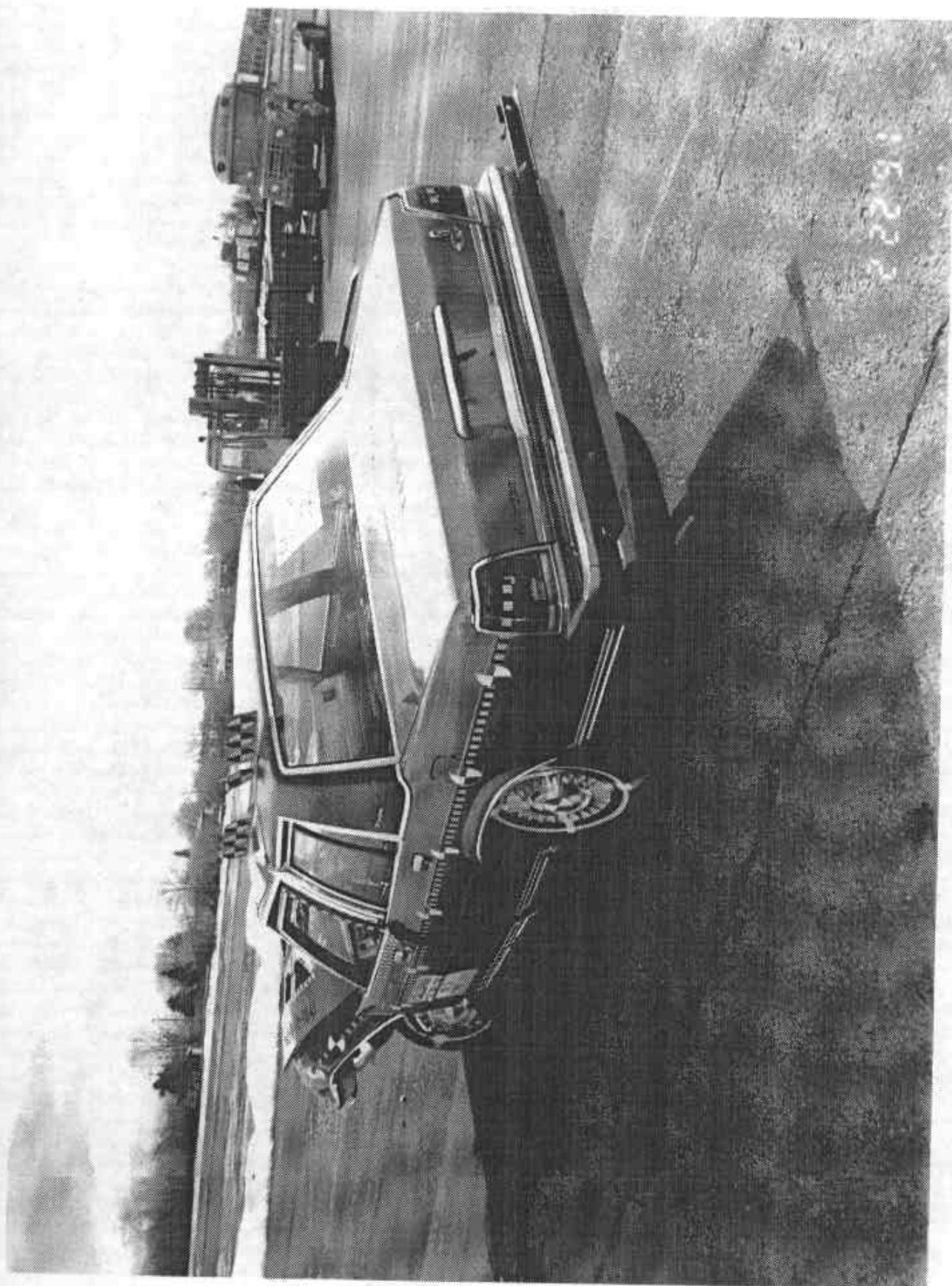


FIGURE A-49 VEHICLE 2 POST-TEST REAR LEFT THREE QUARTER VIEW

A-53

7883-4

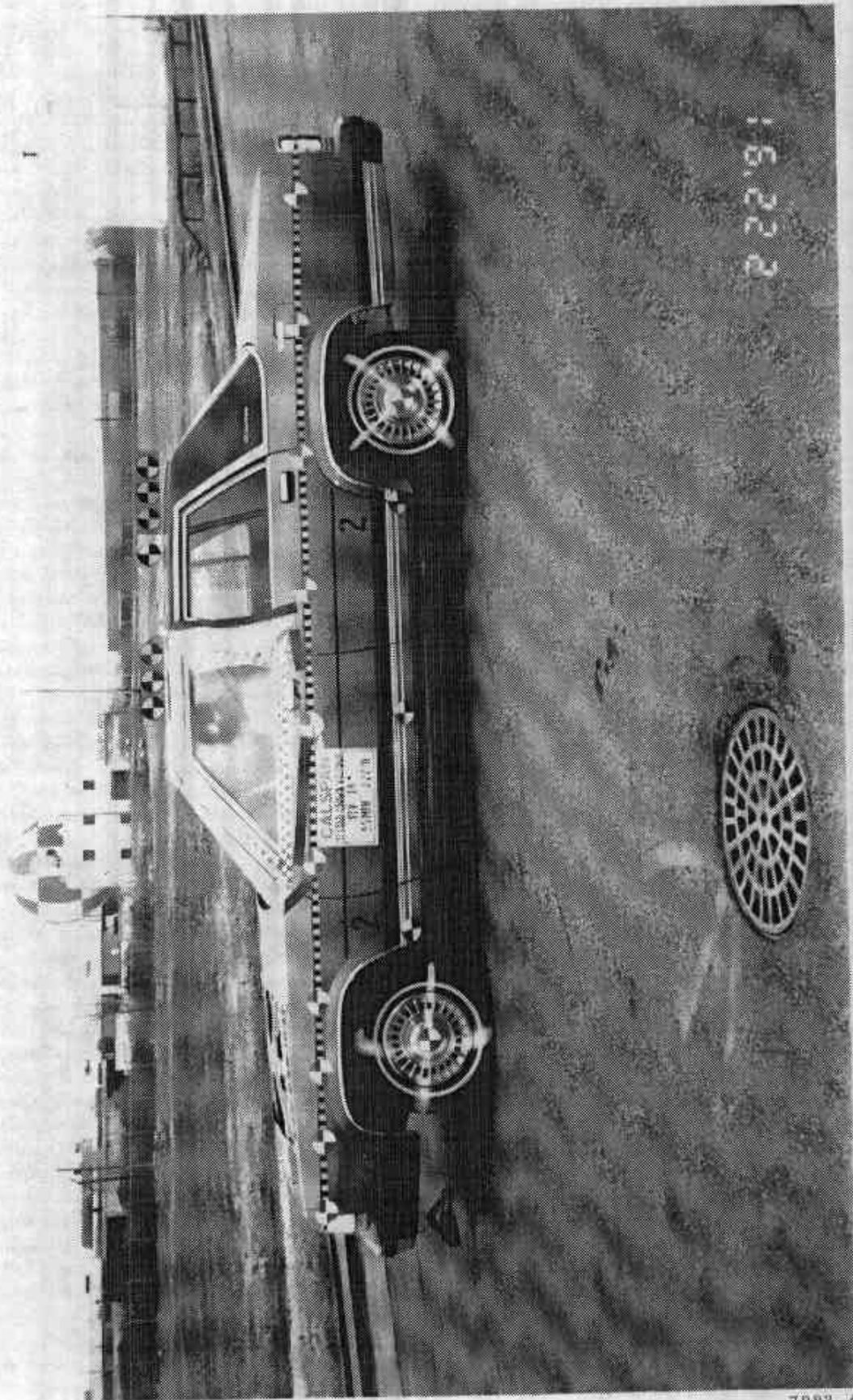


Figure A-50 VEHICLE 2 PRE-TEST LEFT SIDE VIEW

A-54

7883-4

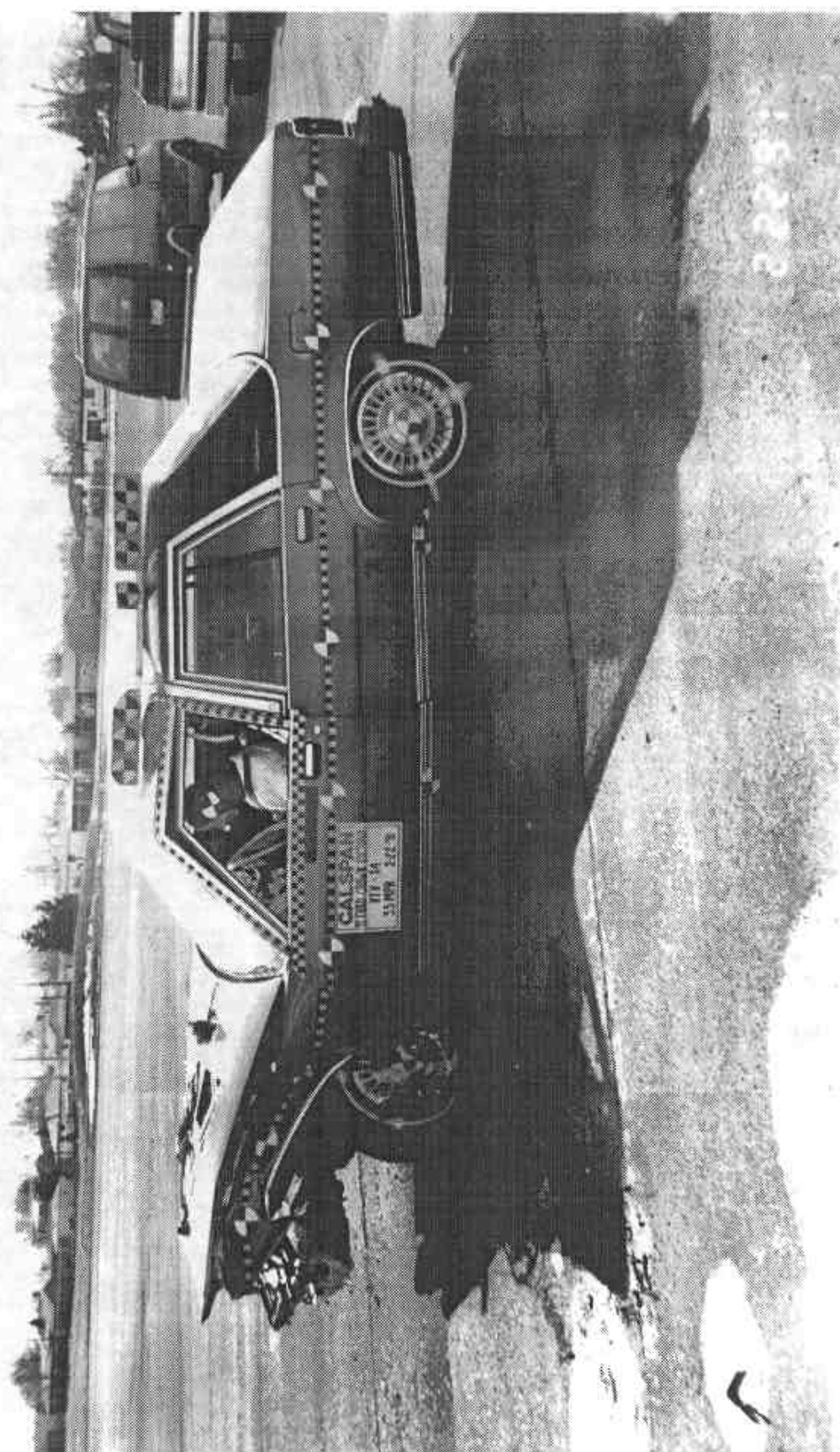


Figure A-51 VEHICLE 2 POST-TEST LEFT SIDE VIEW

A-55

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Figure A-52 VEHICLE 2 PRE-TEST FRONT LEFT THREE QUARTER VIEW

A-56

7883-4

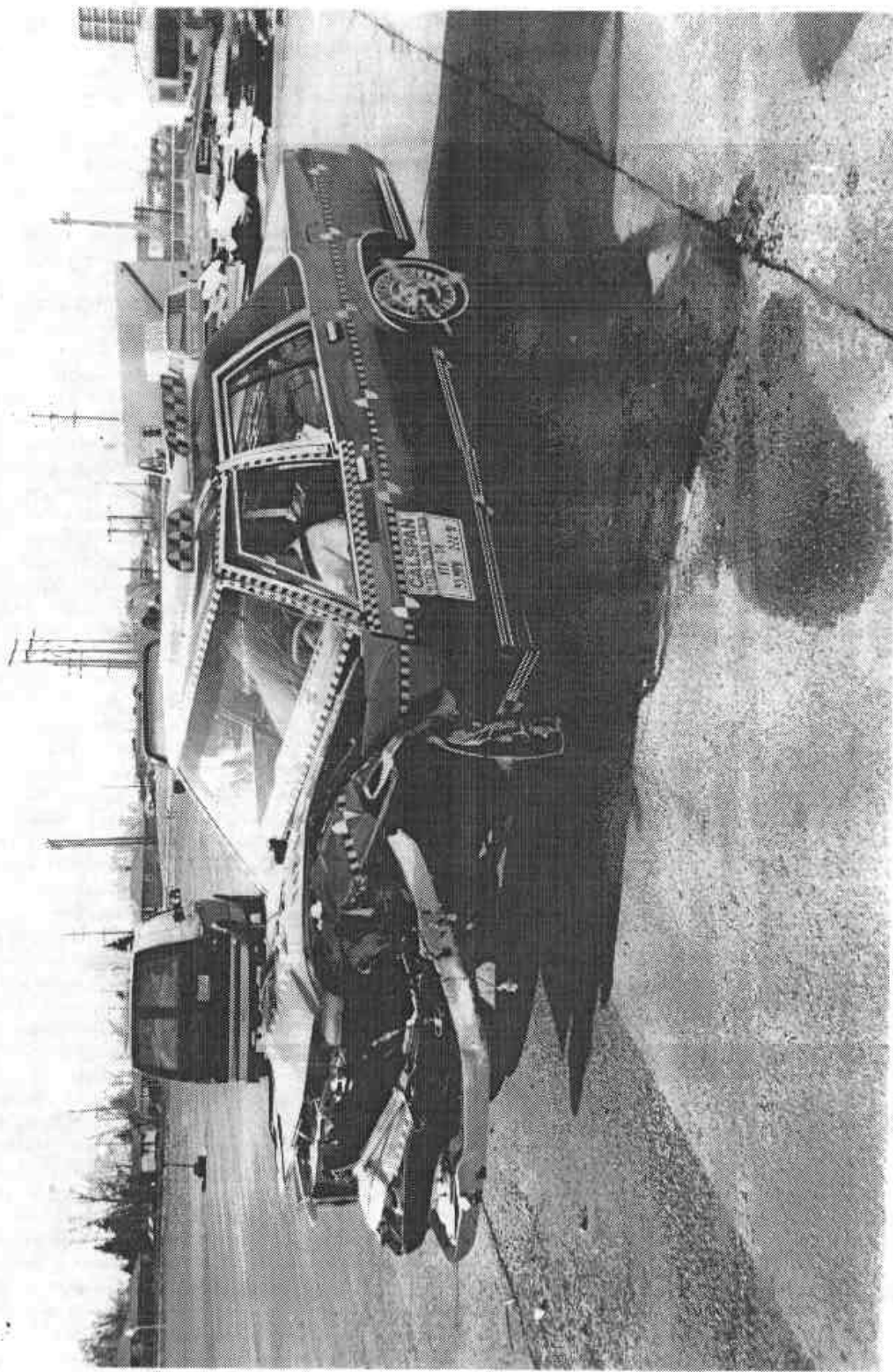


Figure A-53 VEHICLE 2 POST-TEST FRONT LEFT THREE QUARTER VIEW

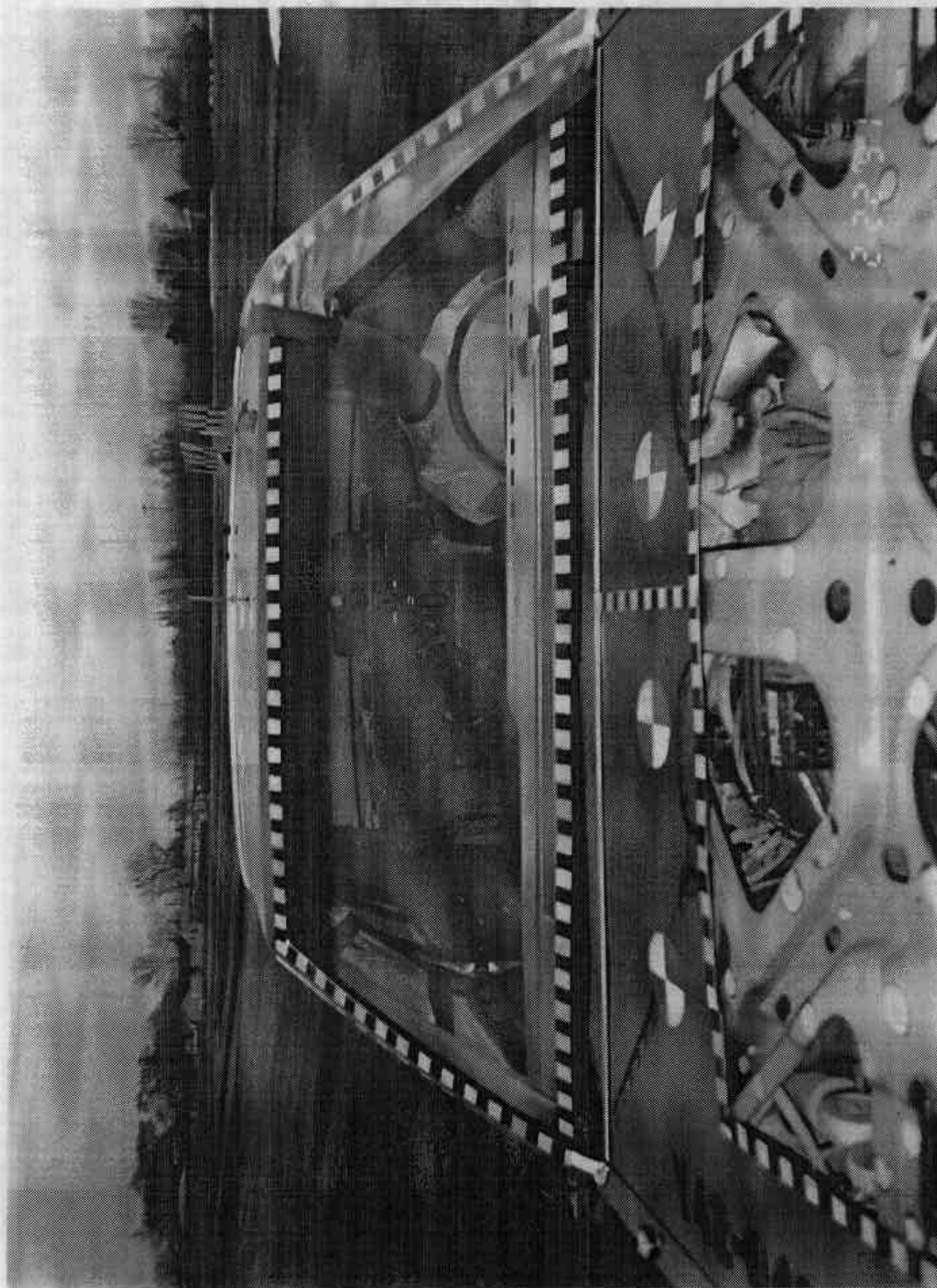


Figure A-54 VEHICLE 2 PRE-TEST WINDSHIELD VIEW

A-58

7883-4

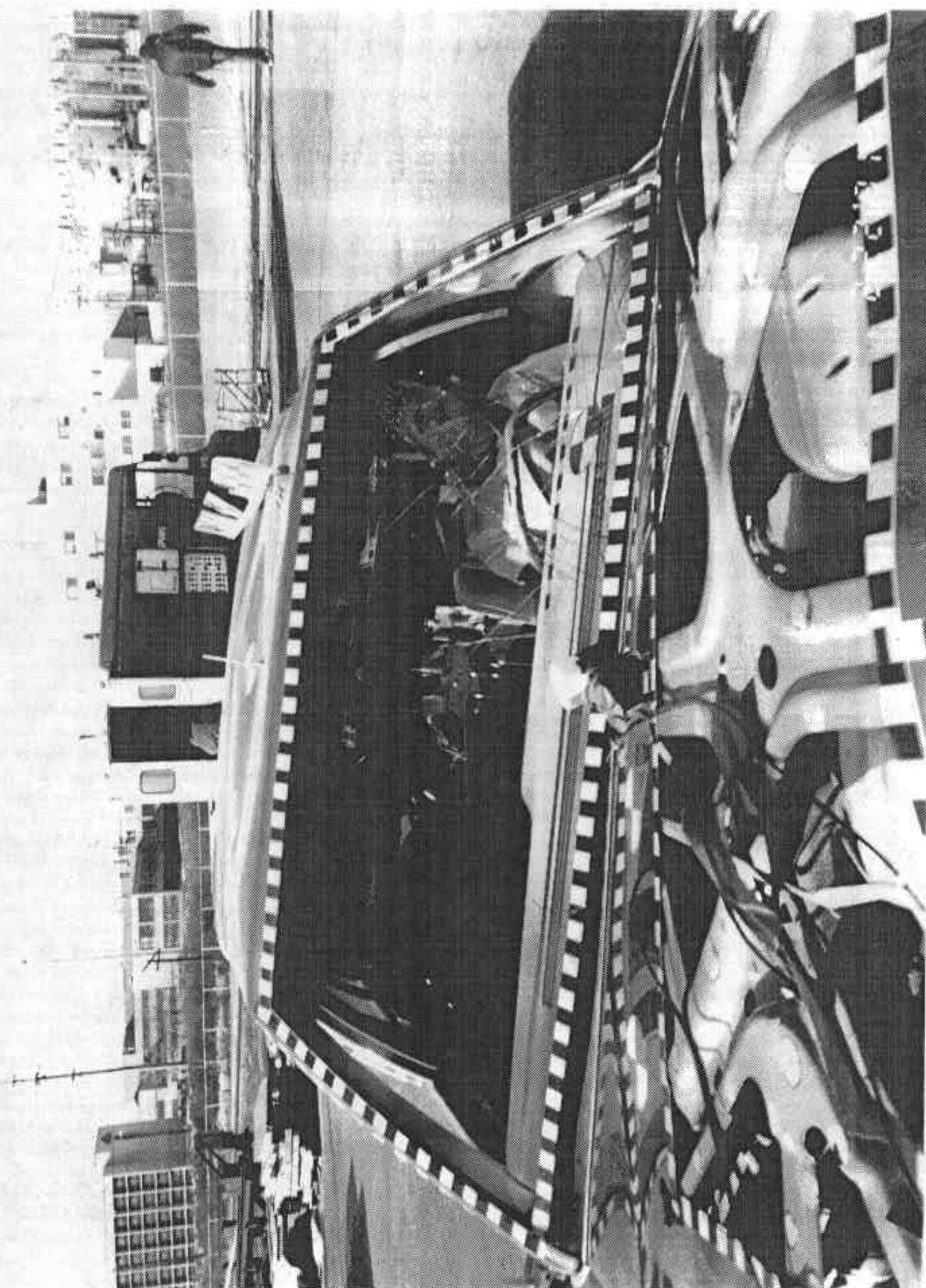


Figure A-55 VEHICLE 2 POST-TEST WINDSHIELD VIEW

A-59

7883-4

VEHICLE 2 PRE-TEST OVERHEAD ENGINE COMPARTMENT VIEW
(Photograph is not available)

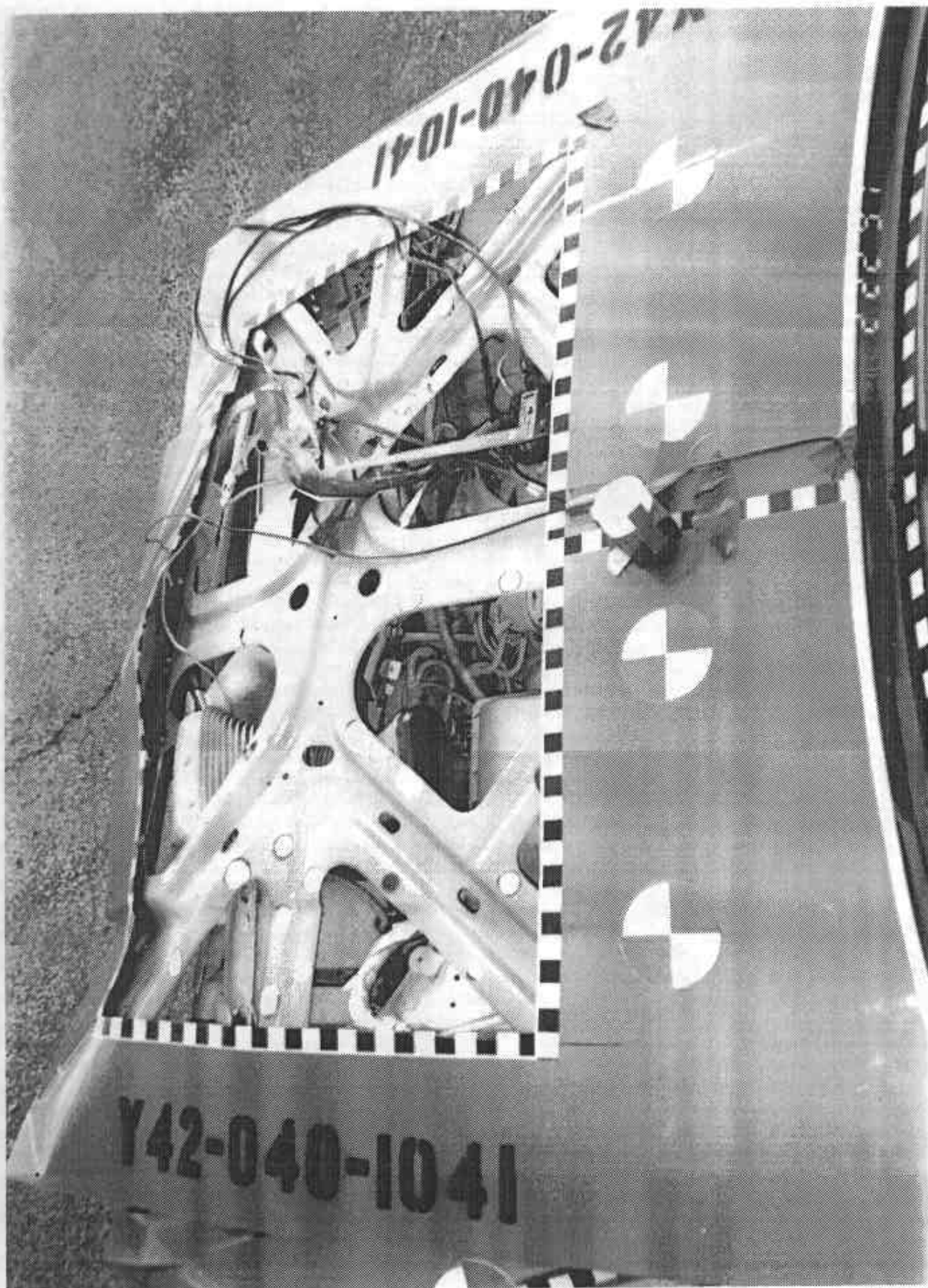


Figure A-57 VEHICLE 2 POST-TEST OVERHEAD ENGINE COMPARTMENT VIEW

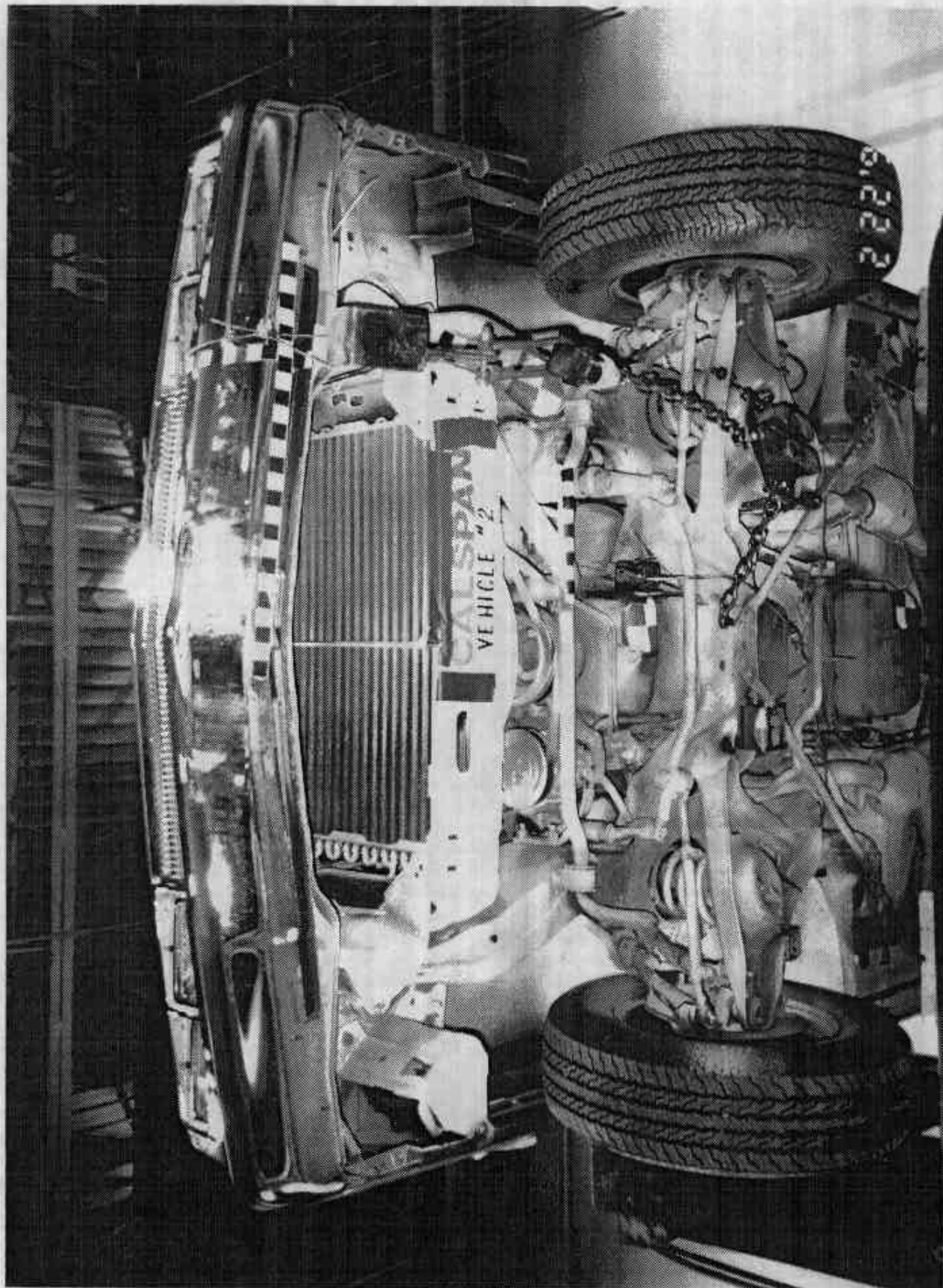


Figure A-58 VEHICLE 2 PRE-TEST UNDERBODY FRONT VIEW

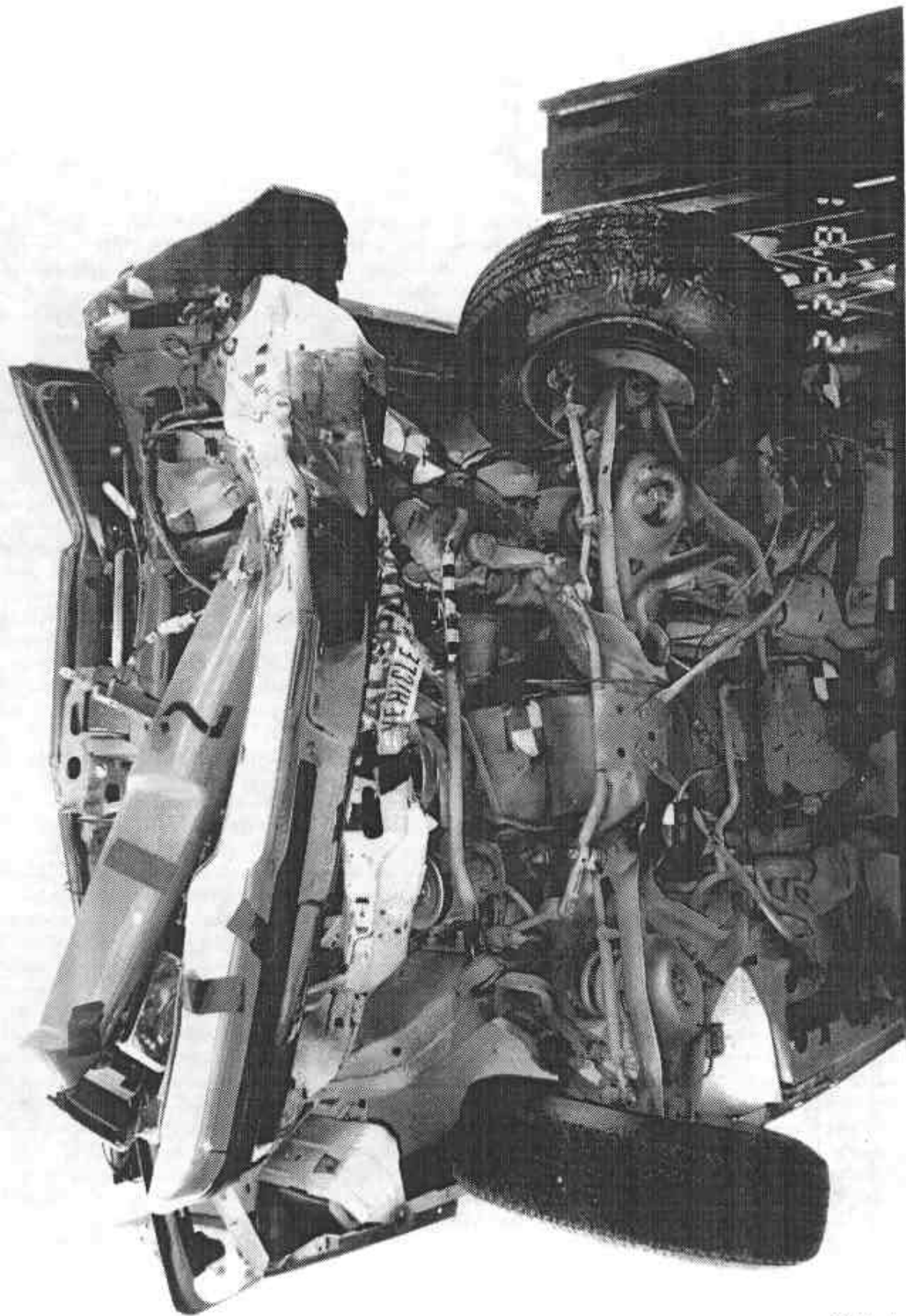


FIGURE A-59 VEHICLE 2 POST-TEST UNDERBODY FRONT VIEW

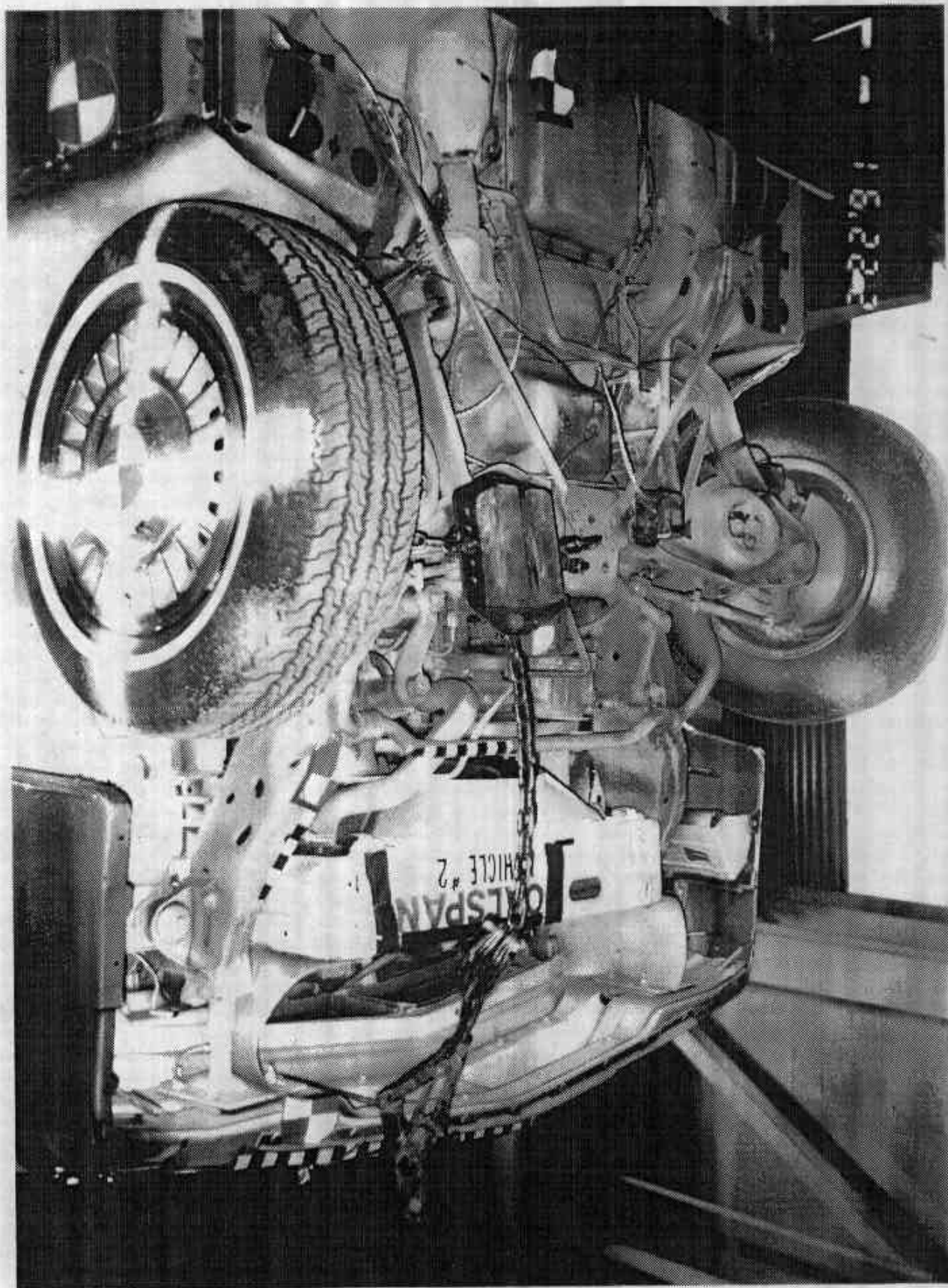


FIGURE A-60 VEHICLE 2 PRE-TEST UNDERBODY FRONT SIDE VIEW

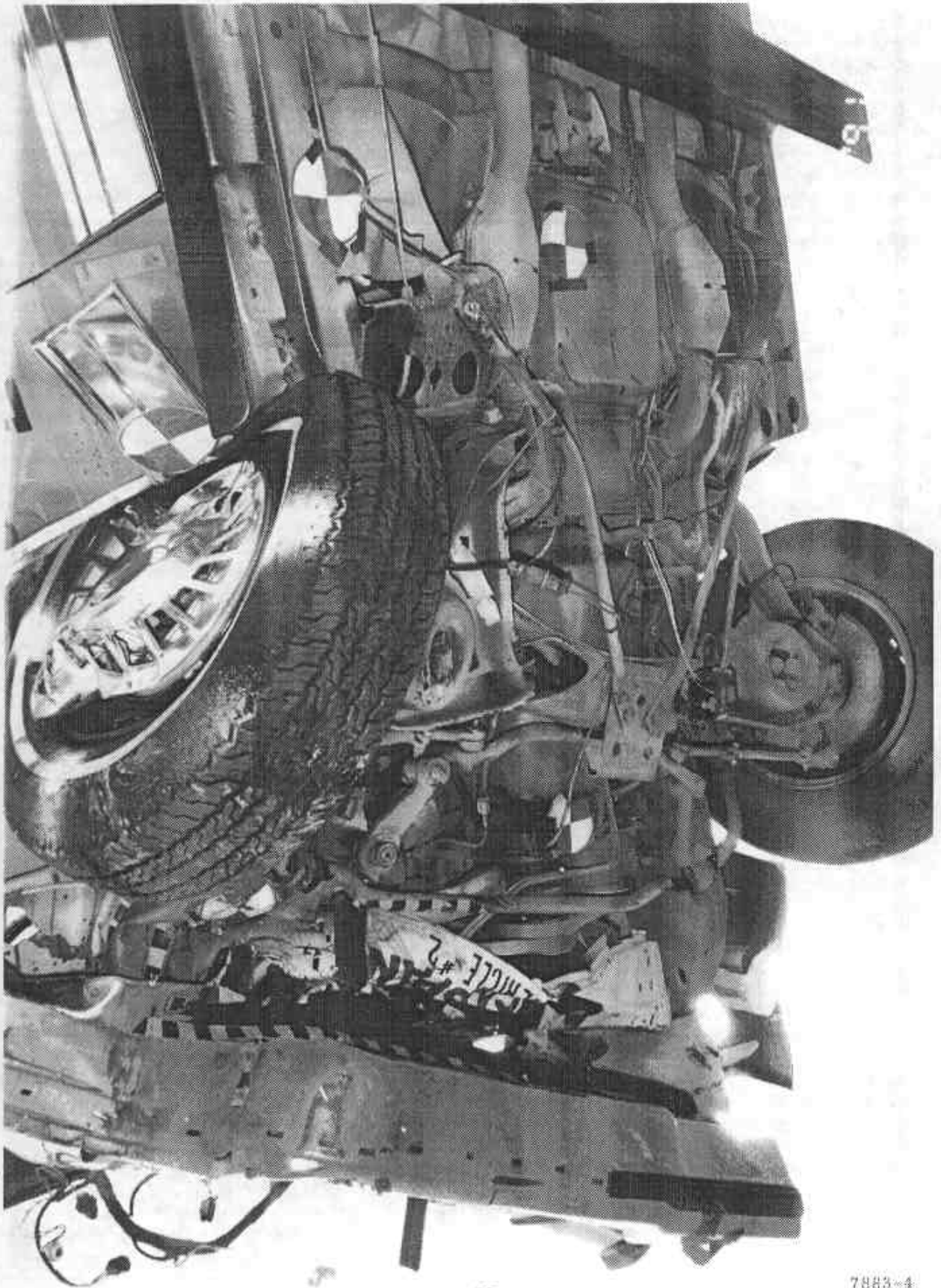


Figure A-61. VEHICLE 2 POST-TEST UNDERBODY FRONT SIDE VIEW

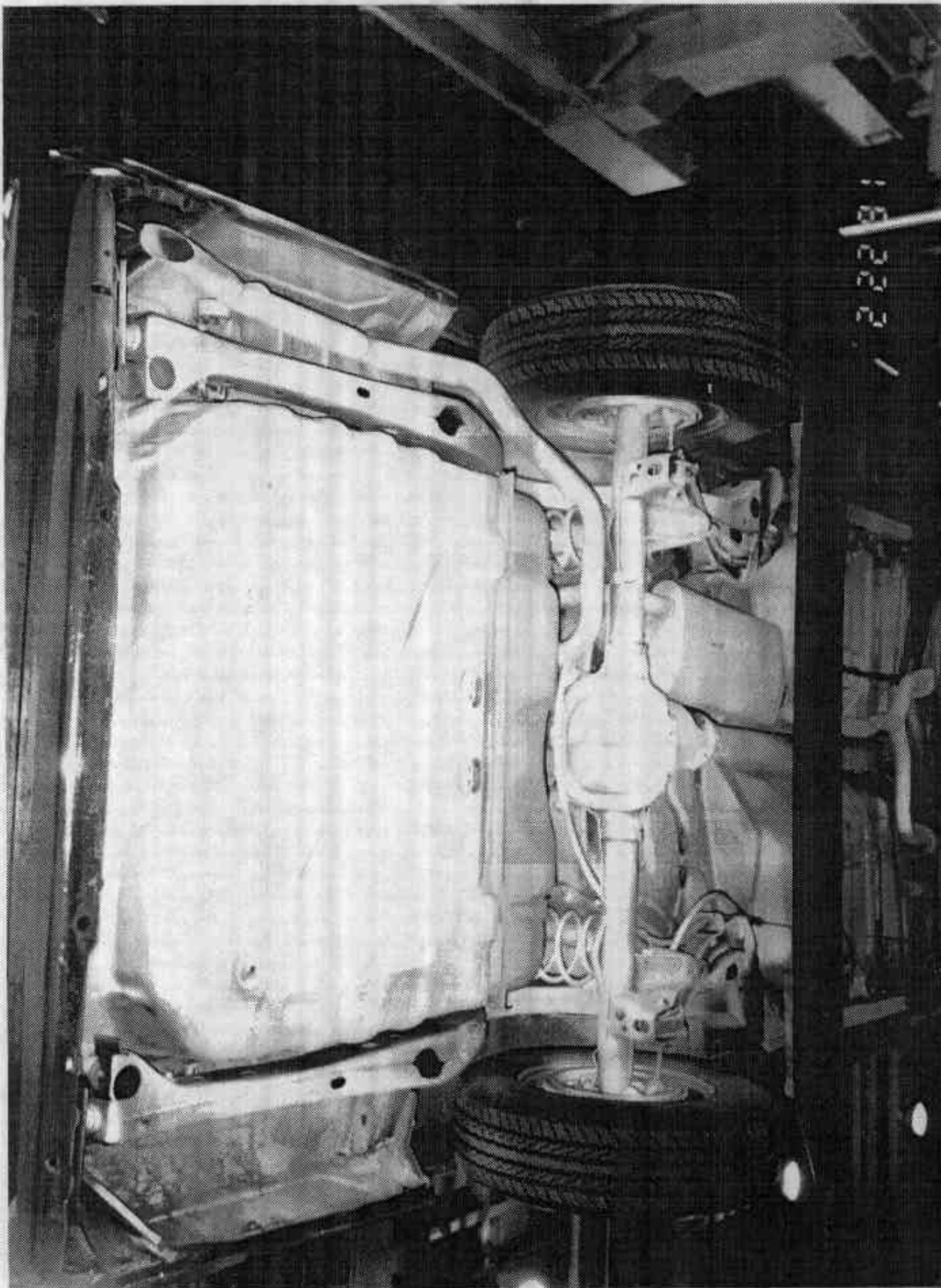


Figure A-62 VEHICLE 2 PRE-TEST UNDERBODY REAR VIEW

A-66

7883-4

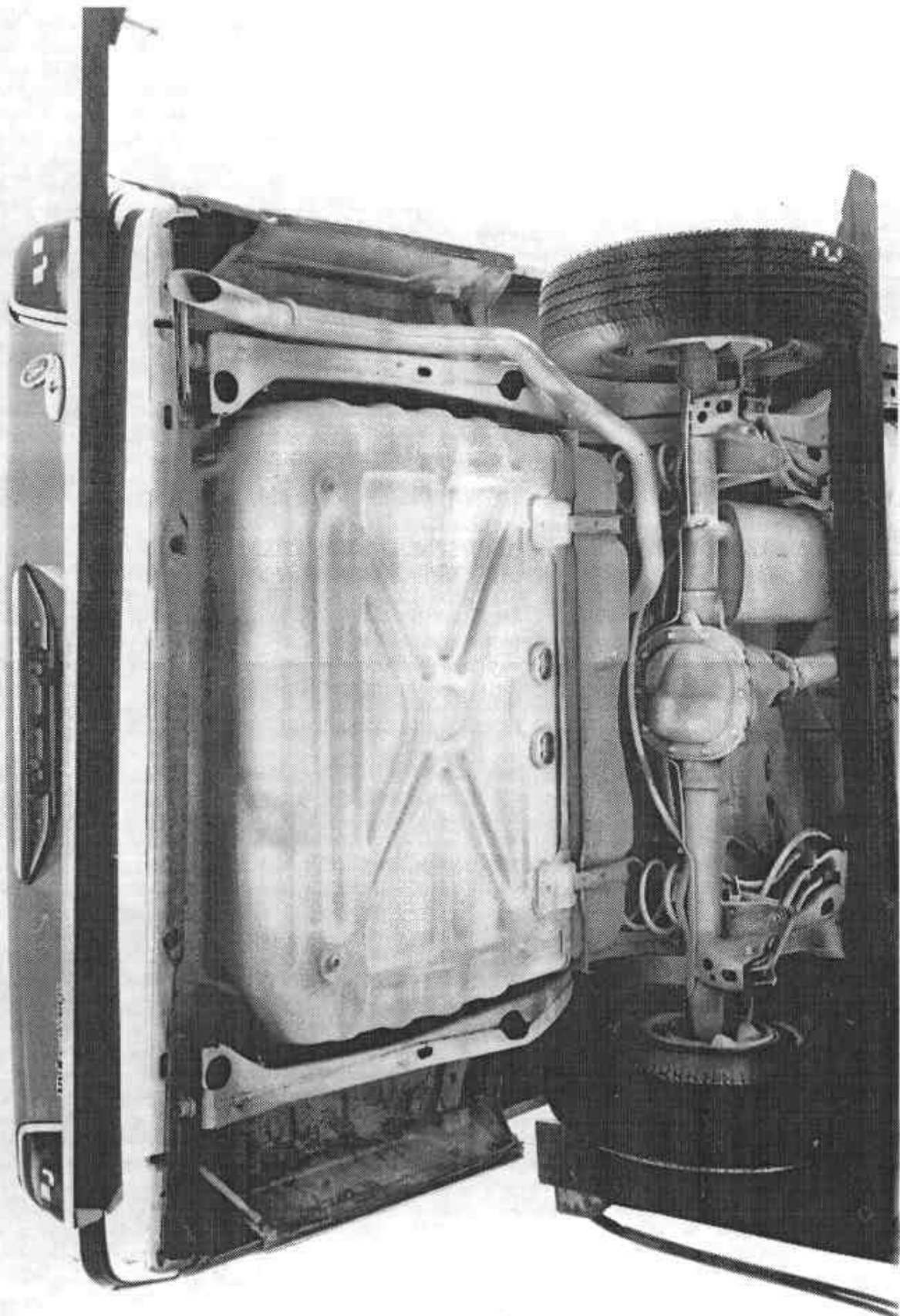


FIGURE A-63 VEHICLE 2 POST-TEST UNDERBODY REAR VIEW

A-67

7883-4

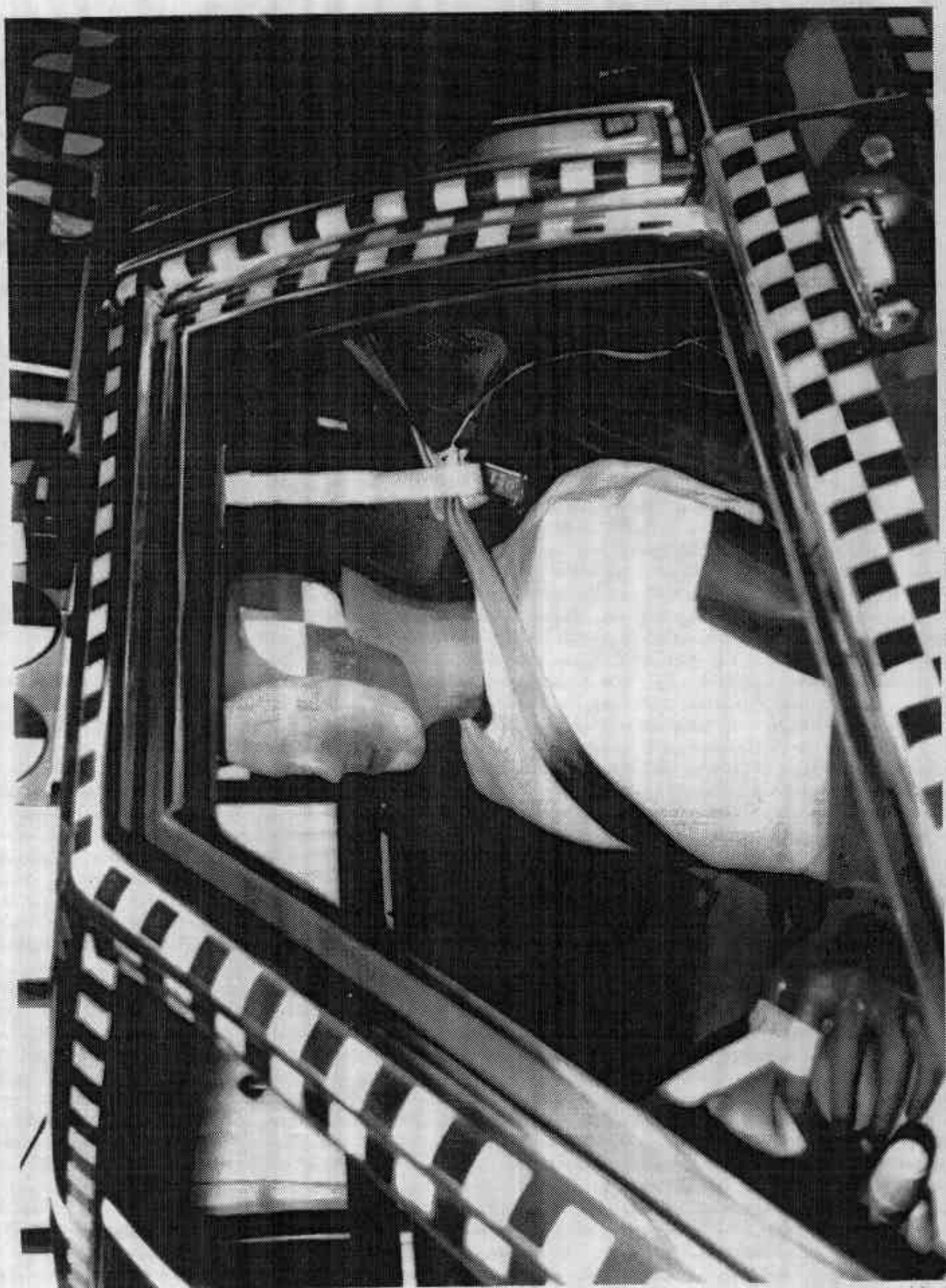


FIGURE A-64 VEHICLE 2 PRE-TEST DRIVER POSITION VIEW

A-68

7883-4



Figure A-65 VEHICLE 2 POST-TEST DRIVER POSITION VIEW

A-69

7883-4

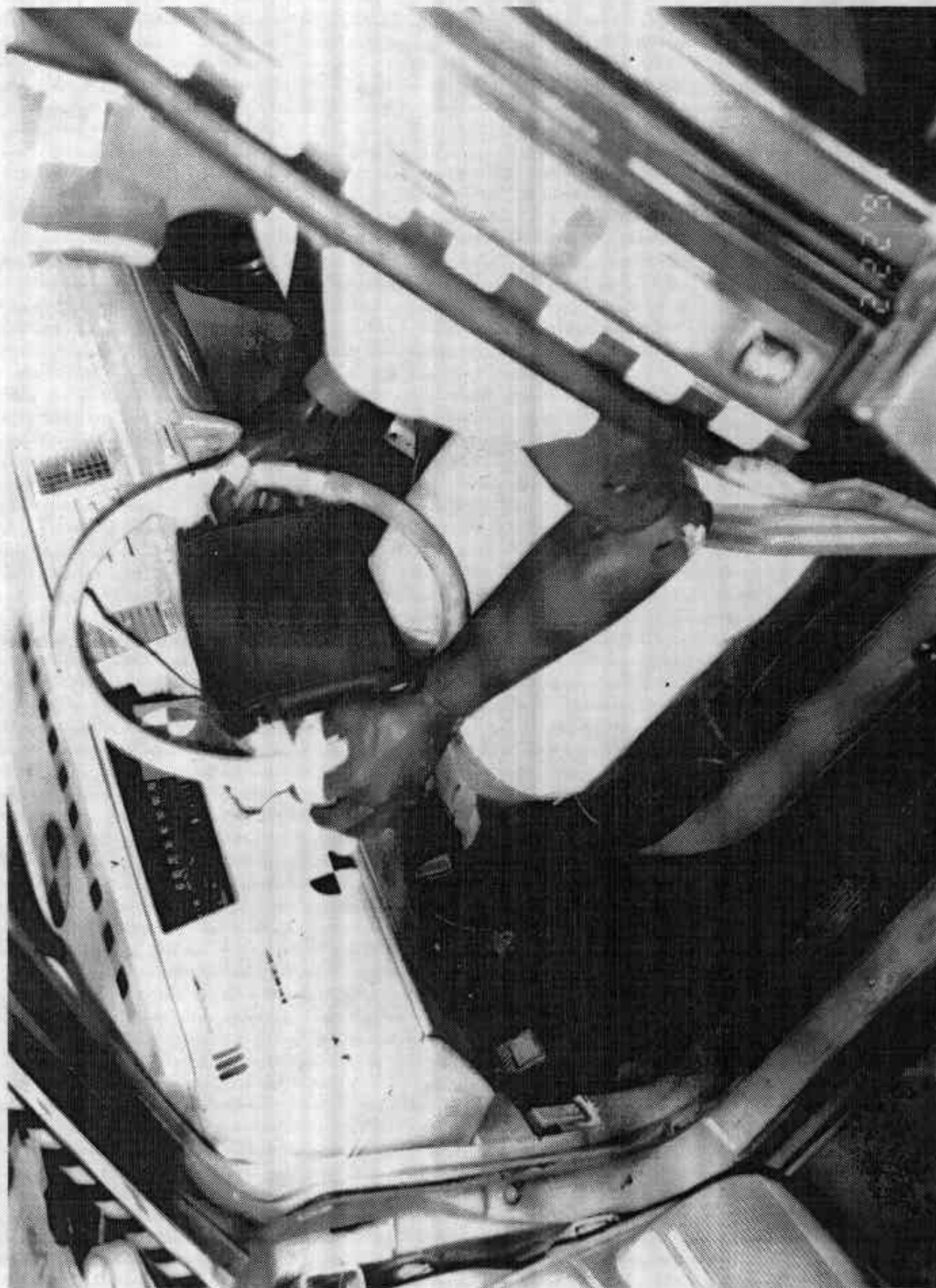


Figure A-00 VEHICLE 2 PRE-TEST DRIVER AND OCCUPANT COMPARTMENT VIEW

A-70

7883-4



Figure A-67 VEHICLE 2 POST-TEST DRIVER AND OCCUPANT COMPARTMENT VIEW

A-71

7883-4

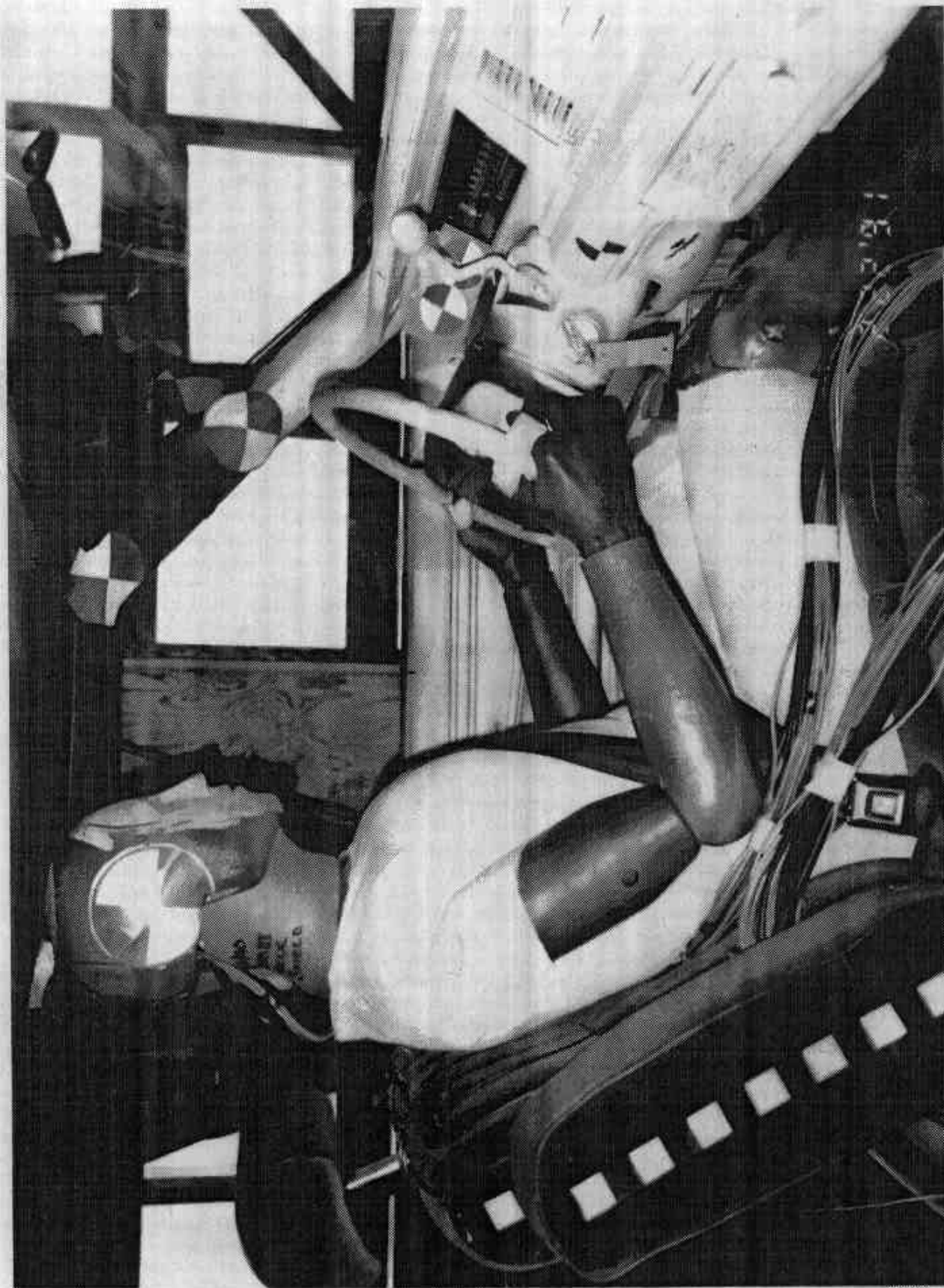


Figure A-68 VEHICLE 2 PRE-TEST DRIVER AND OCCUPANT COMPARTMENT
LEFT SIDE VIEW

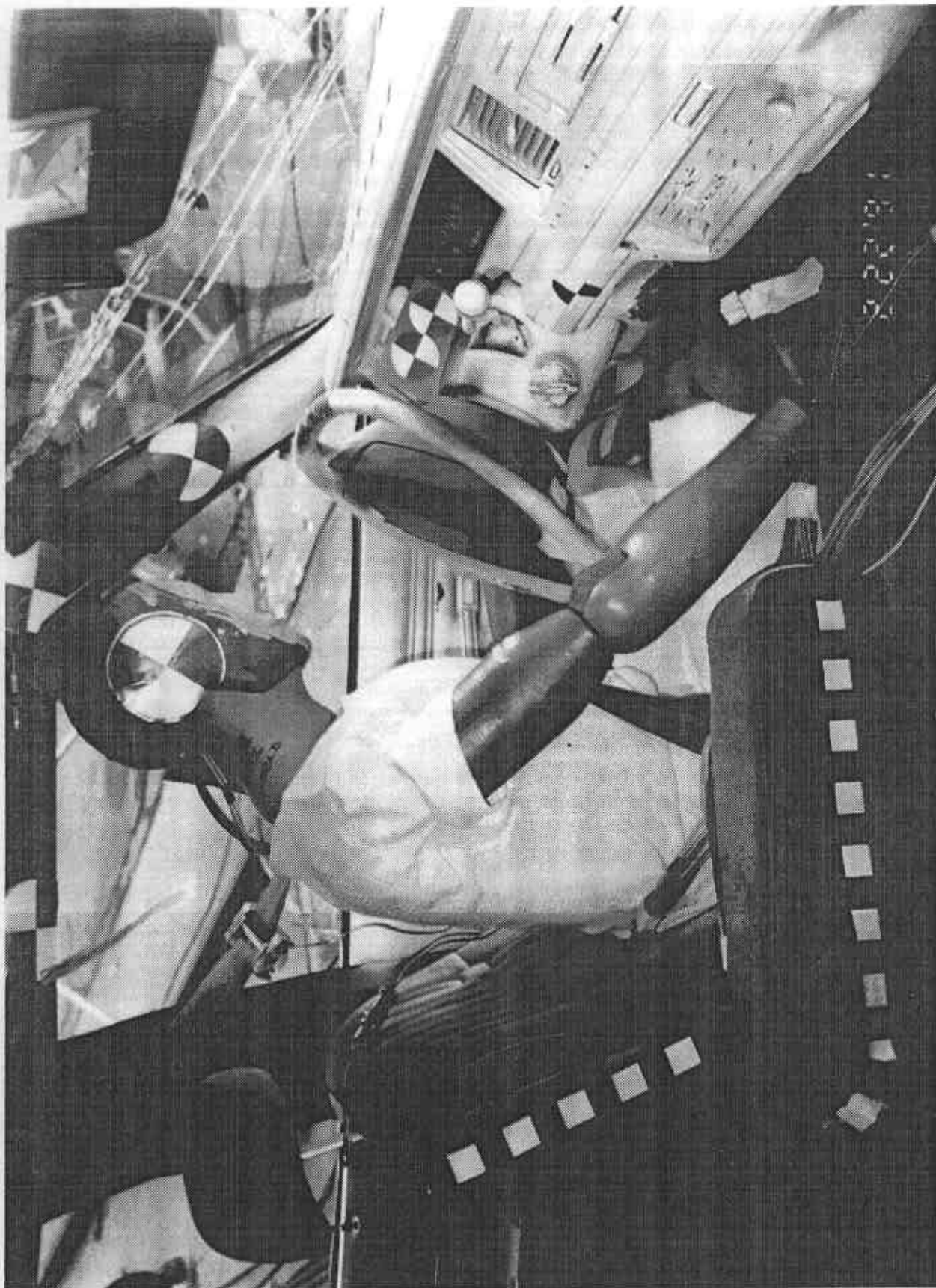


Figure A-69 VEHICLE 2 POST-TEST DRIVER AND OCCUPANT COMPARTMENT
LEFT SIDE VIEW

Appendix B

VEHICLE AND DUMMY RESPONSE DATA

Key: V1 - Vehicle 1
V2 - Vehicle 2

VEHICLE ONE DATA

1991 SUBARU JUSTY 2-DOOR HATCHBACK

TEST NO. Y42-4-1041

VEHICLE DATA

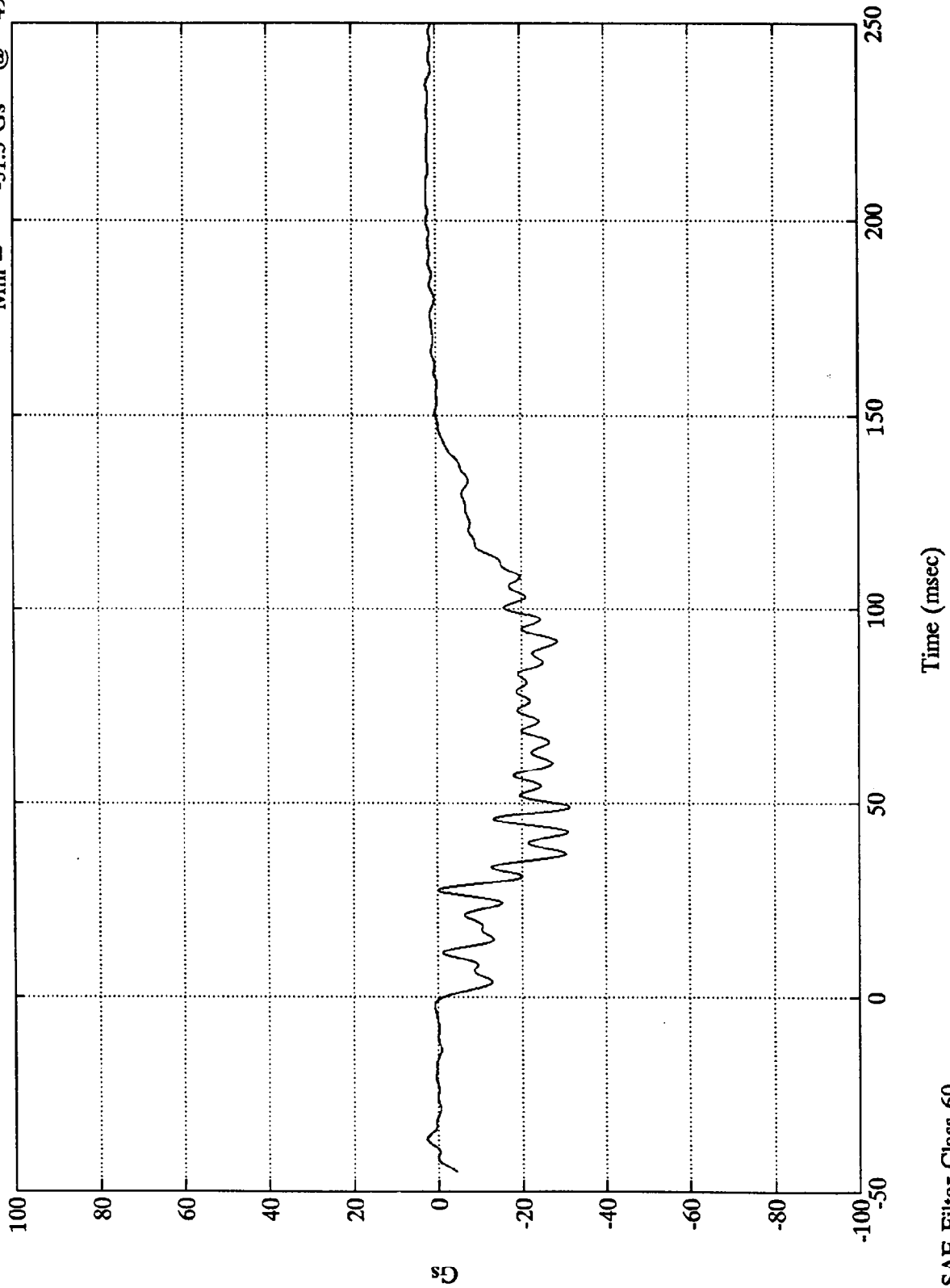
FILTER CHANNEL CLASS

60

V-to-V Test #4

Veh. 1 L R Seat (X)

Max = 2.6 Gs @ -36.36 msec
Min = -31.5 Gs @ 49.07 msec

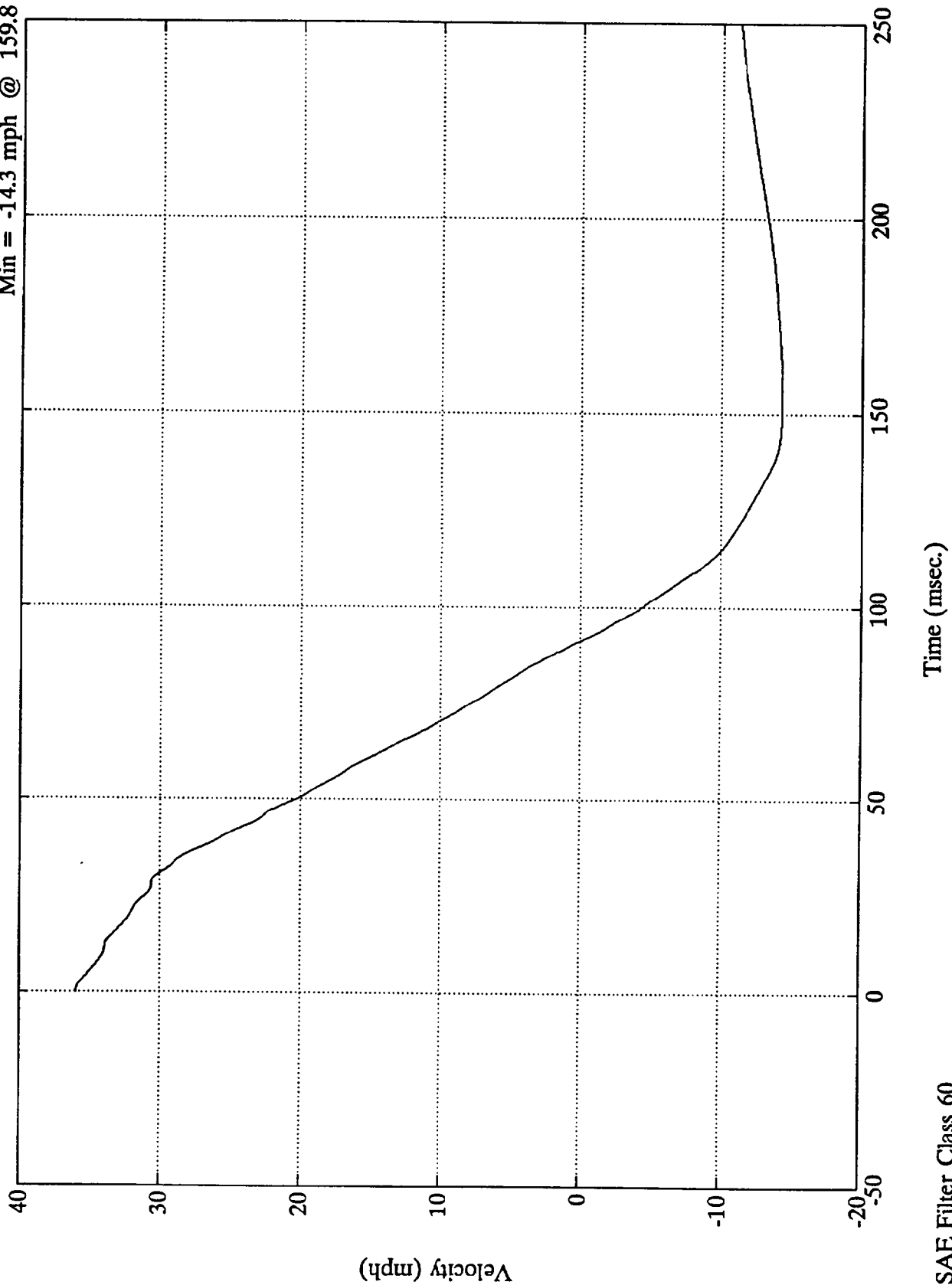


B-4

7883-4

SAE Filter Class 60

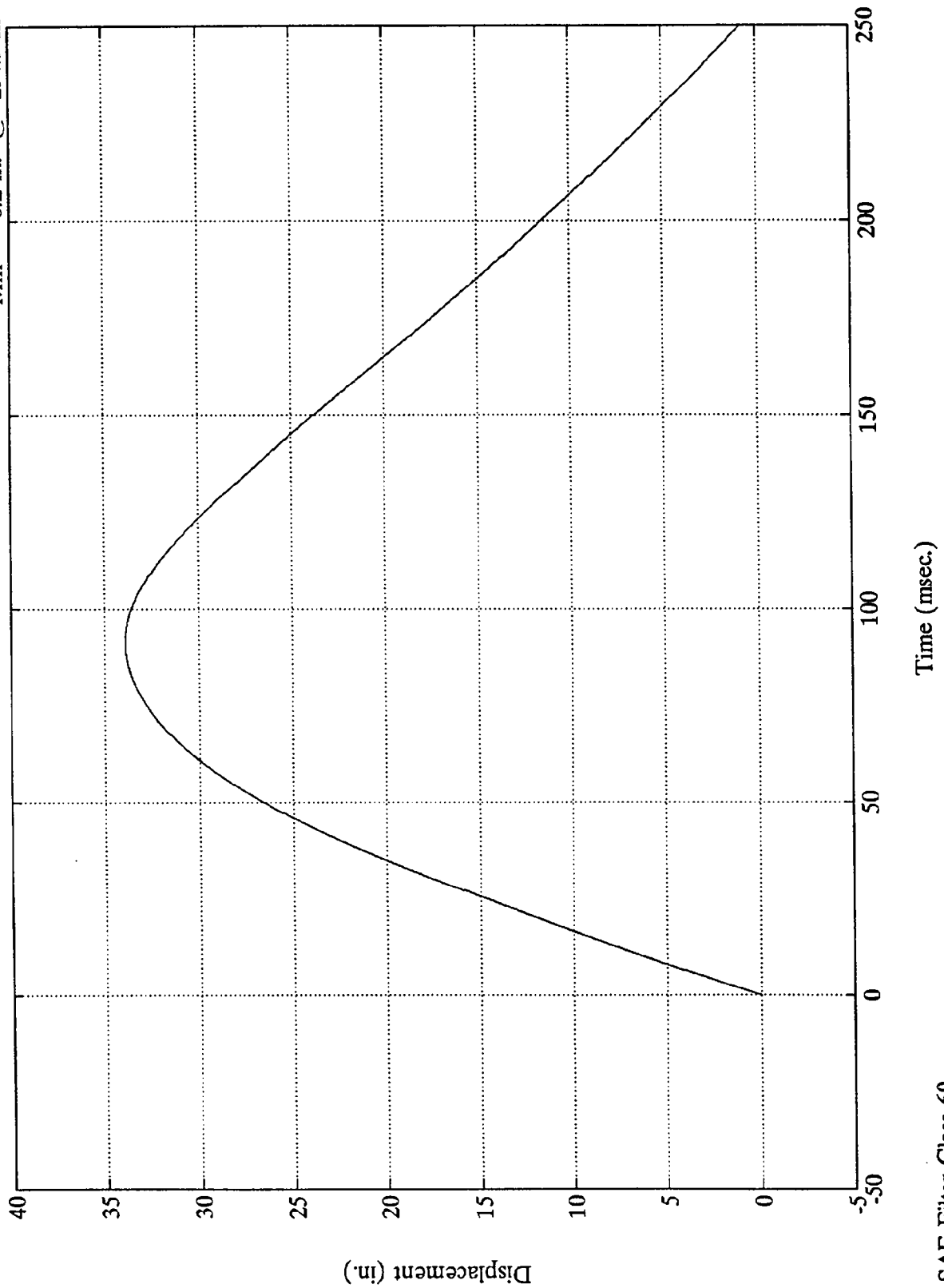
Veh. 1 L R Seat (X)
Max = 36.0 mph @ -0.0 msec
Min = -14.3 mph @ 159.8 msec



V-to-V Test #4

Veh. 1 L R Seat (X)

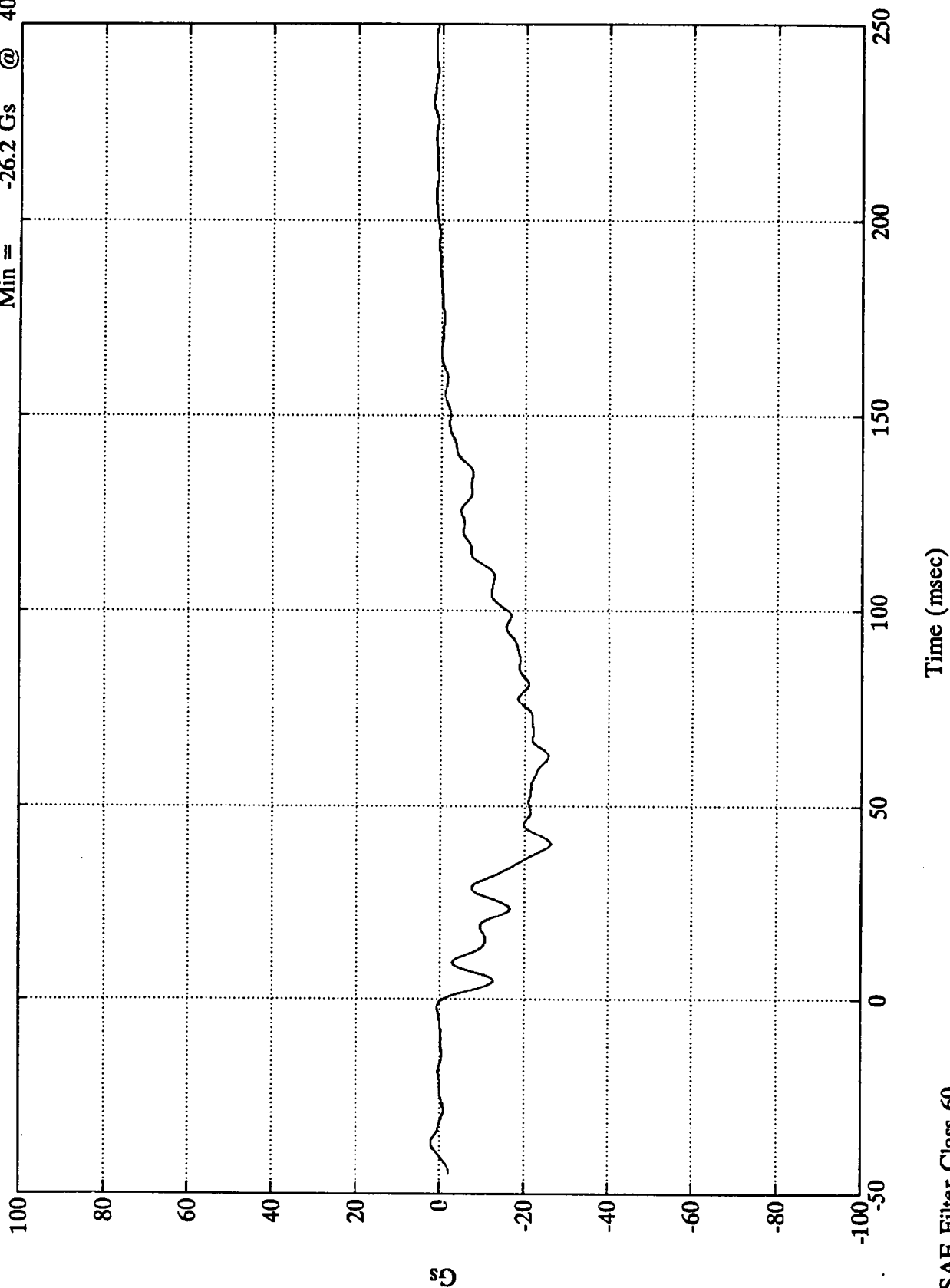
Max = 33.9 in. @ 92.2 msec
Min = -0.2 in. @ 254.9 msec



V-to-V Test #4

Veh. 1 R R Seat (X)

Max = 2.1 Gs @ -37.08 msec
Min = -26.2 Gs @ 40.31 msec



Gs

B-7

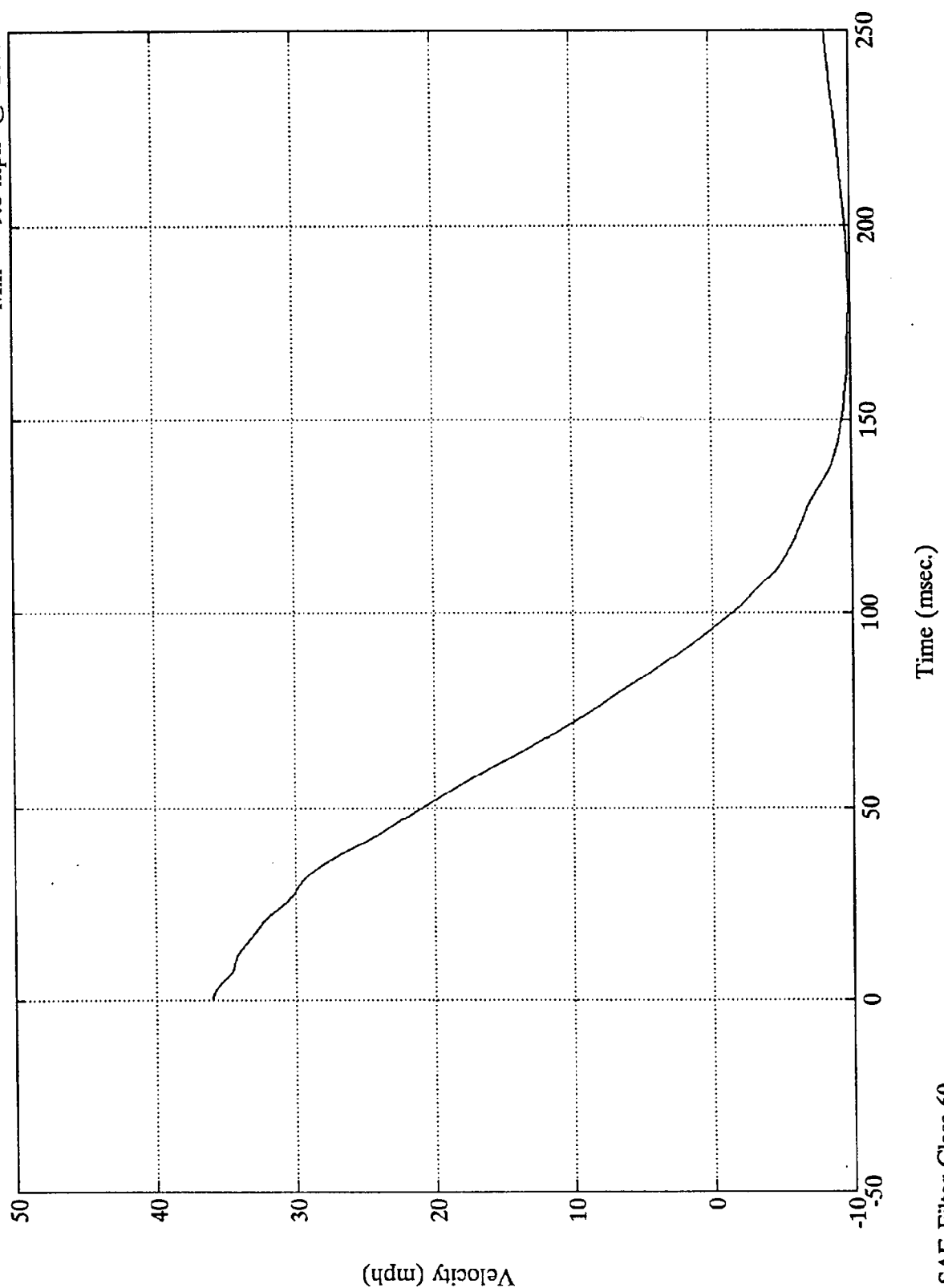
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 R R Seat (X)

Max = 36.0 mph @ -0.0 msec
Min = -9.8 mph @ 183.4 msec

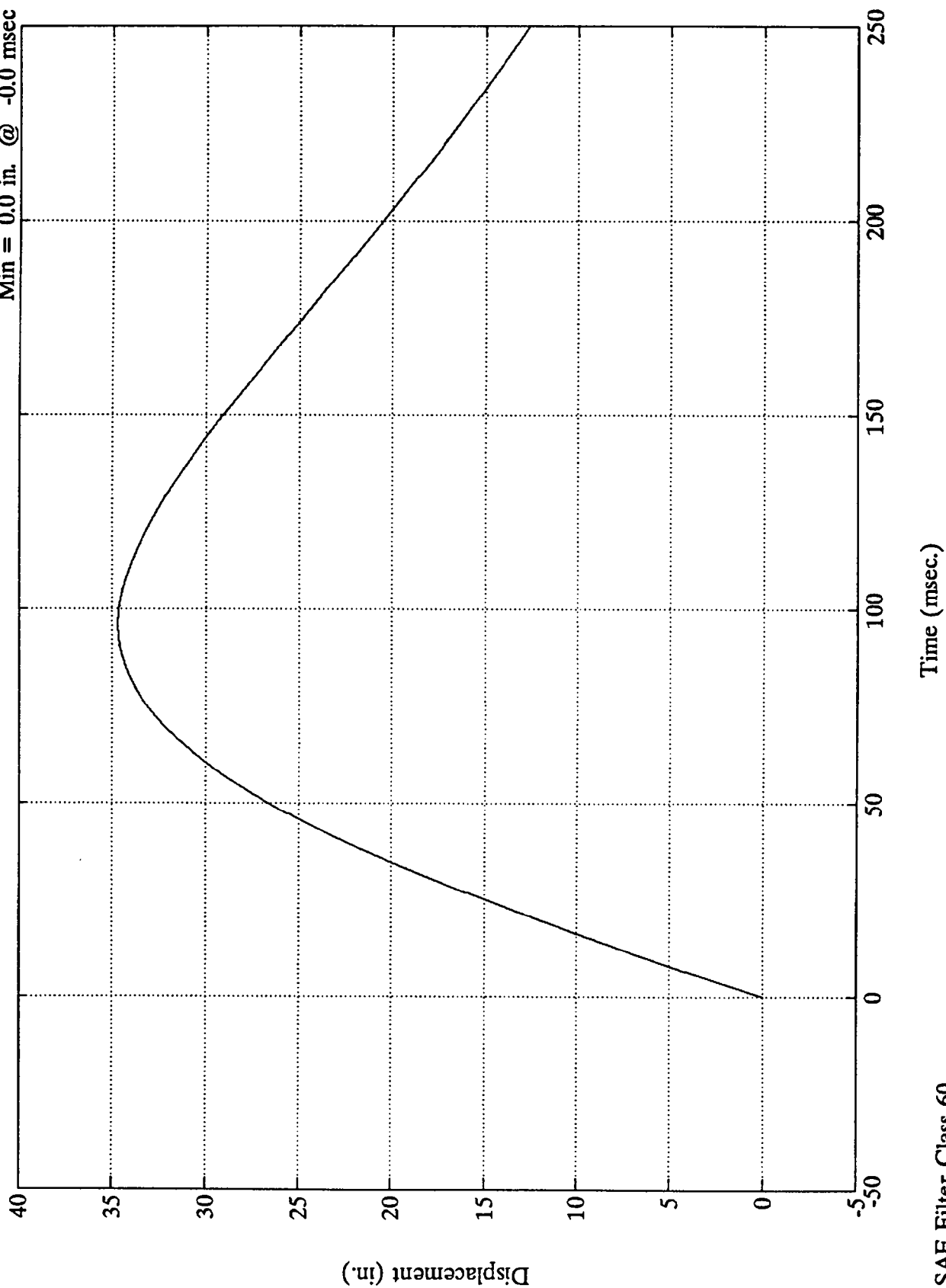


SAE Filter Class 60

V-to-V Test #4

Veh. 1 R R Seat (X)

Max = 34.7 in. @ 97.7 msec
Min = 0.0 in. @ -0.0 msec



B-9

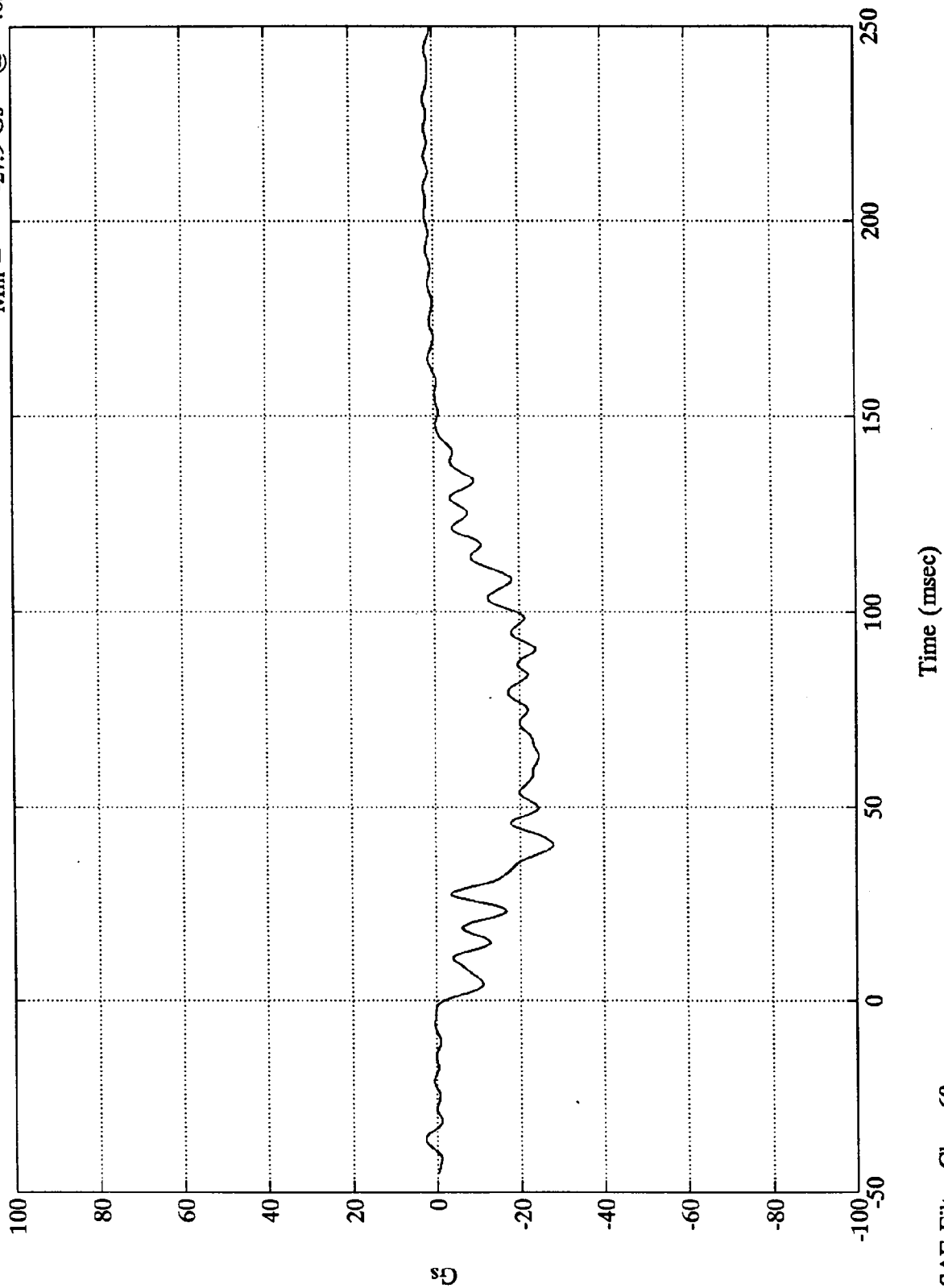
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 C/L Seat (X)

Max = 2.8 Gs @ -36.24 msec
Min = -27.9 Gs @ 40.44 msec



B-10

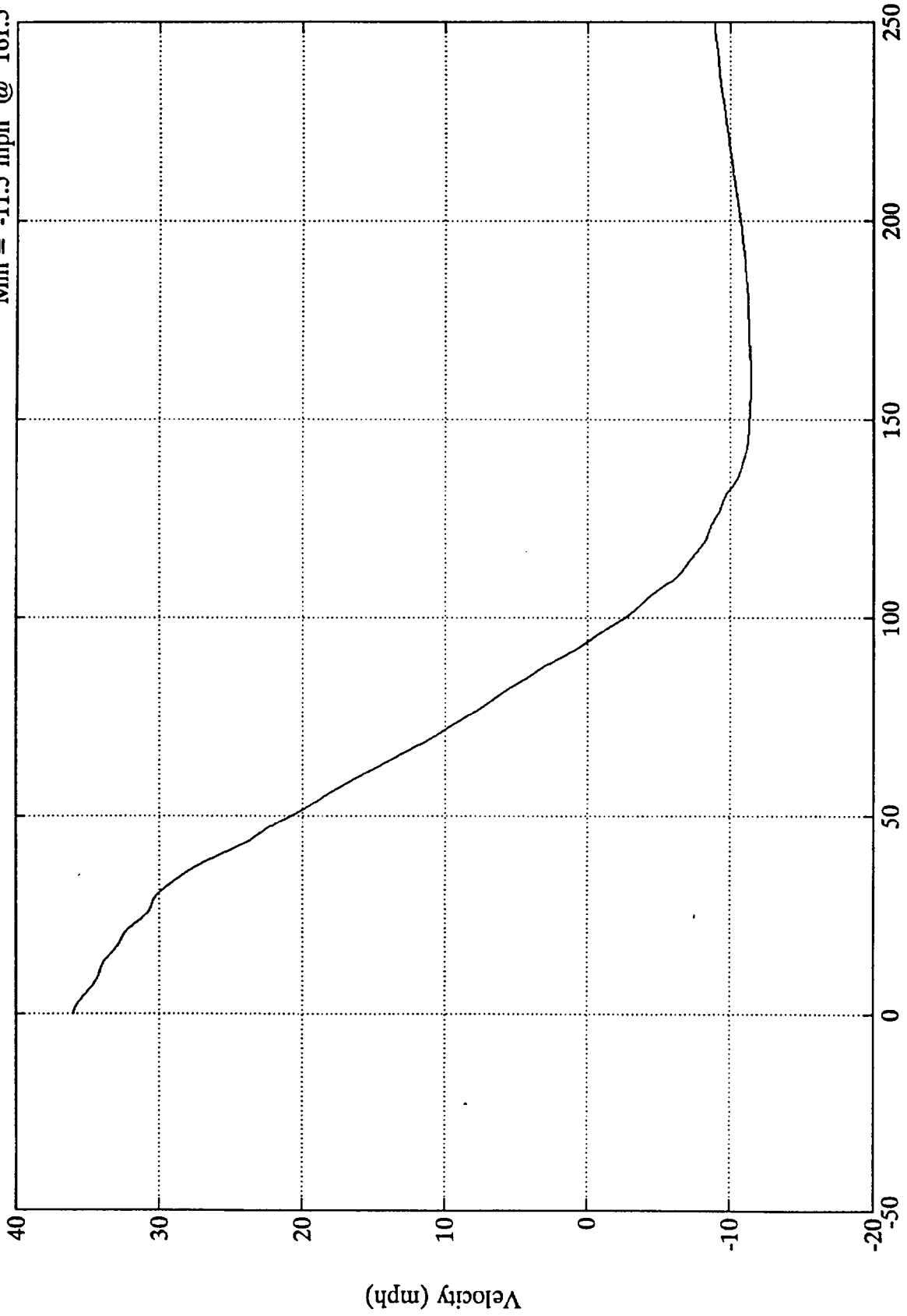
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 C/L Seat (X)

Max = 36.0 mph @ -0.0 msec
Min = -11.5 mph @ 161.5 msec



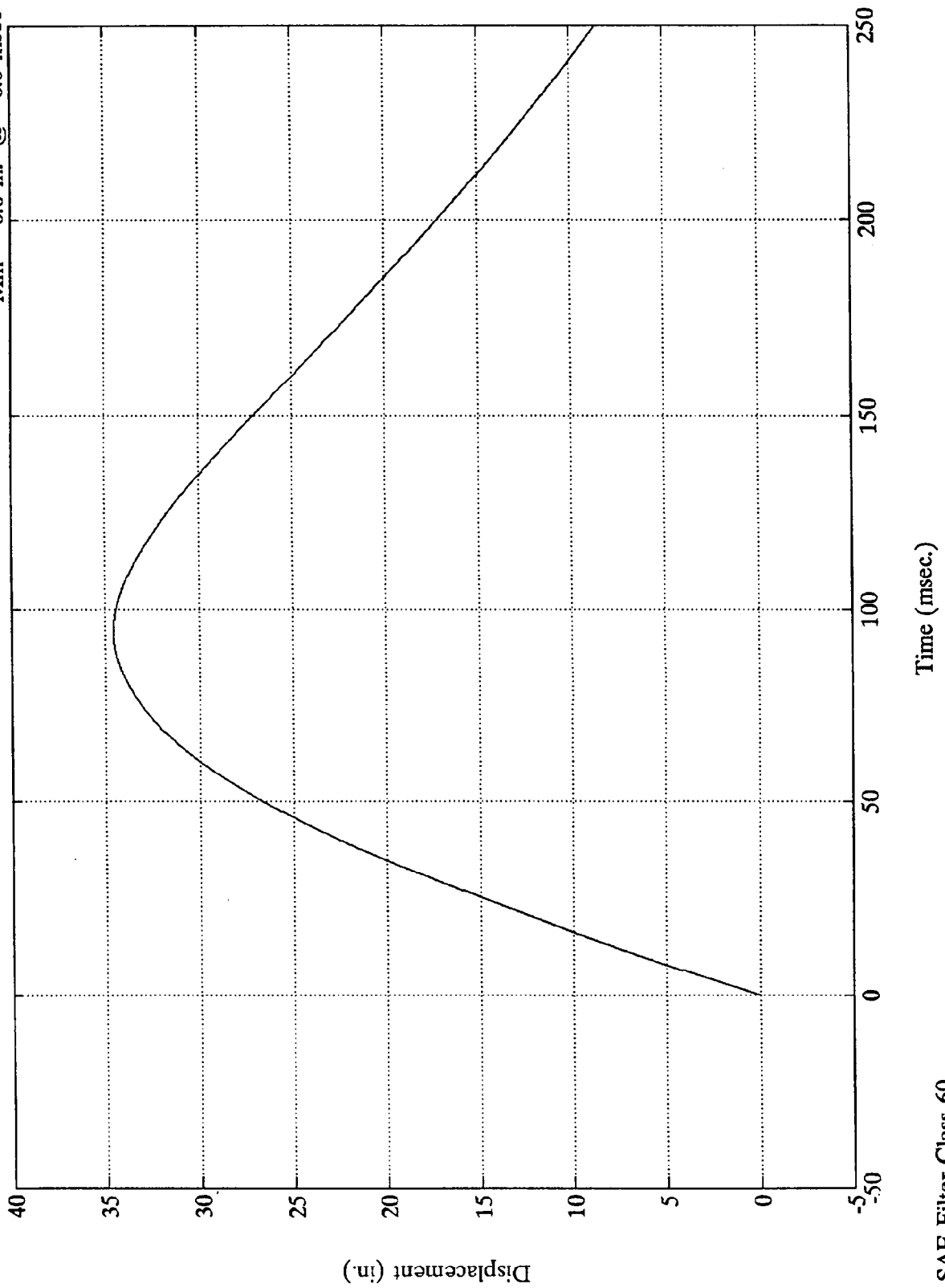
Time (msec.)

SAE Filter Class 60

V-to-V Test #4

Veh. 1 C/L Seat (X)

Max = 34.6 in. @ 95.5 msec
Min = 0.0 in. @ -0.0 msec



21-B

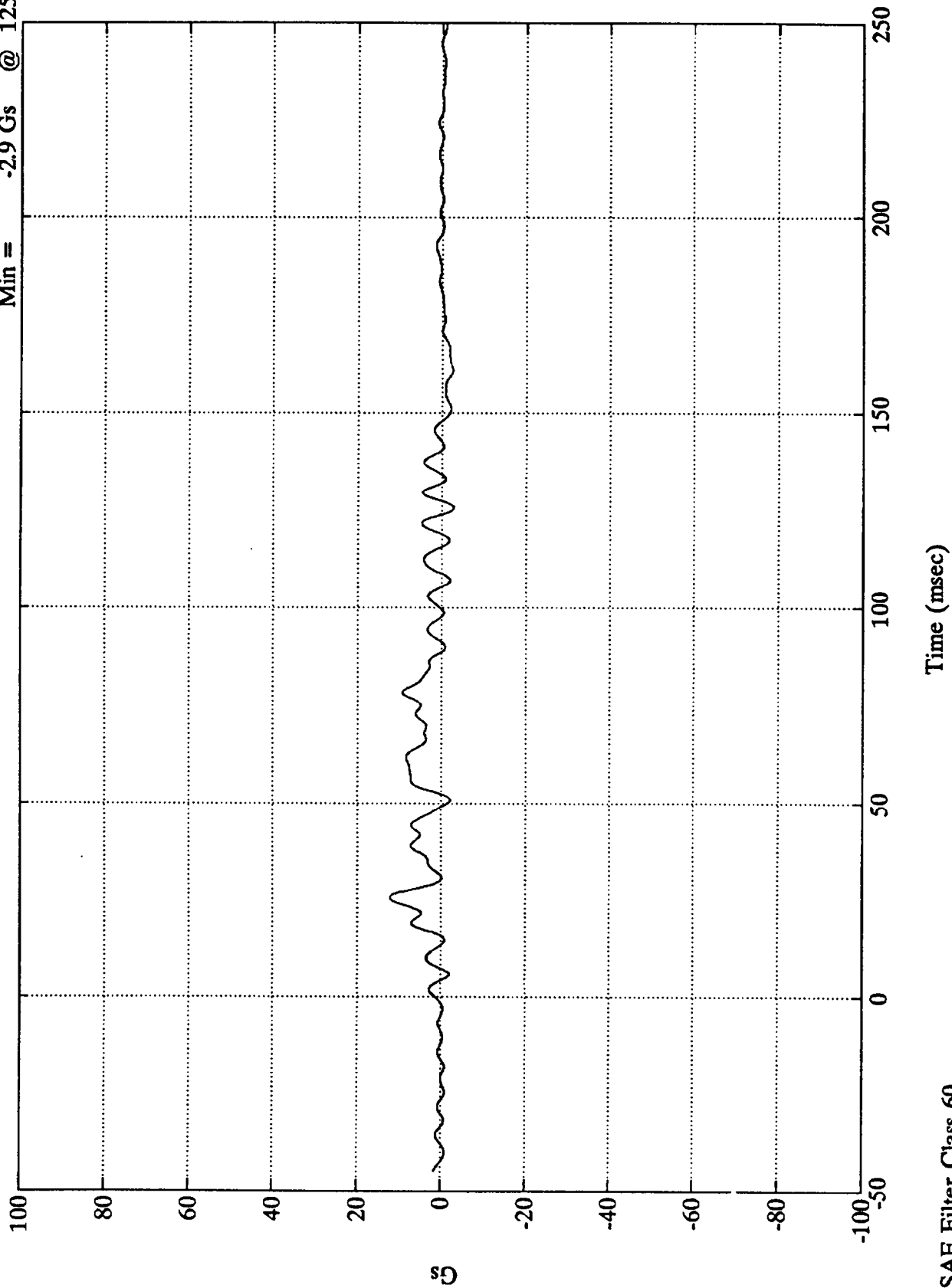
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 C/L Seat (Y)

Max = 12.2 Gs @ 25.44 msec
Min = -2.9 Gs @ 125.64 msec



B-13

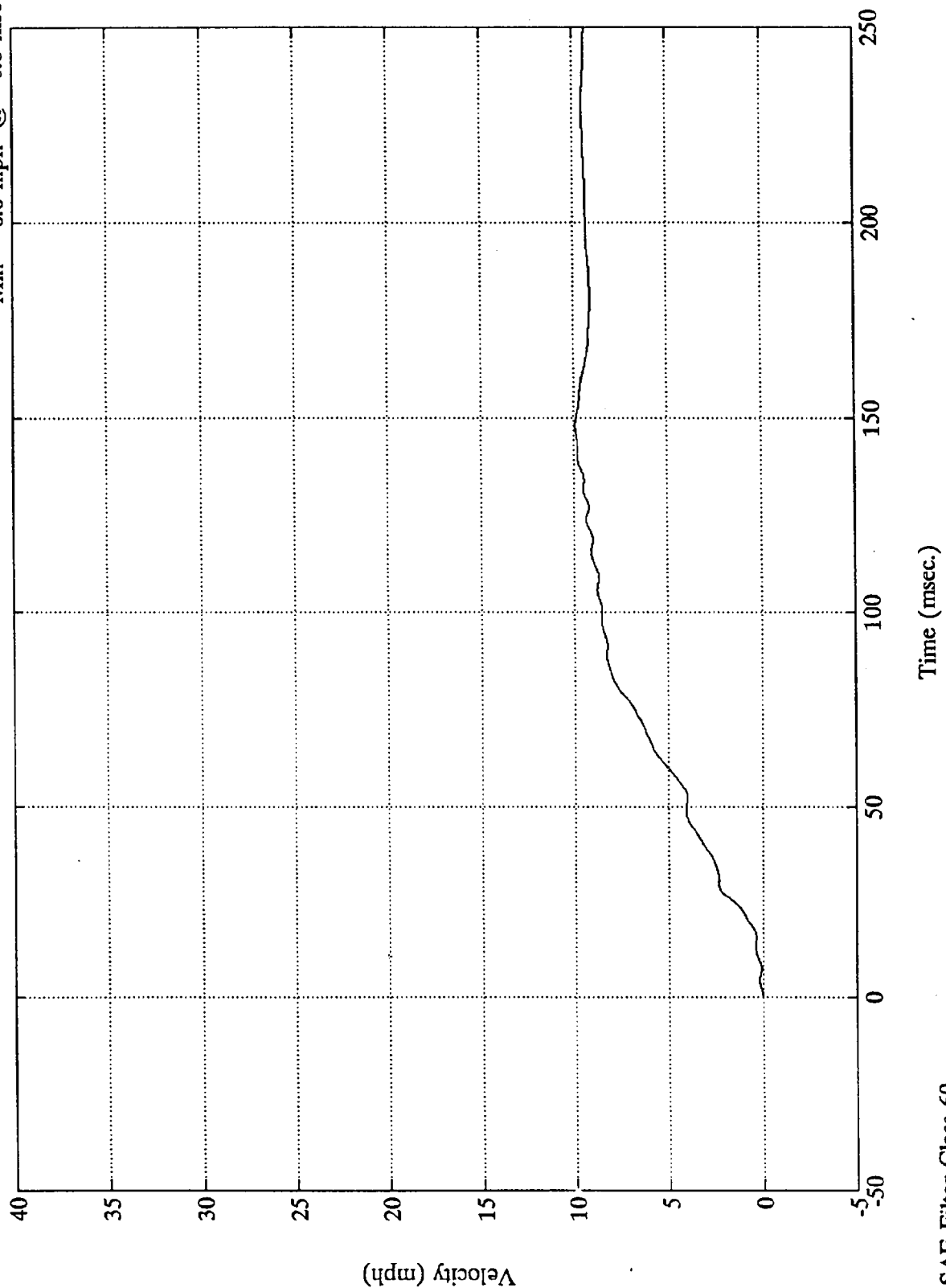
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 C/L Seat (Y)

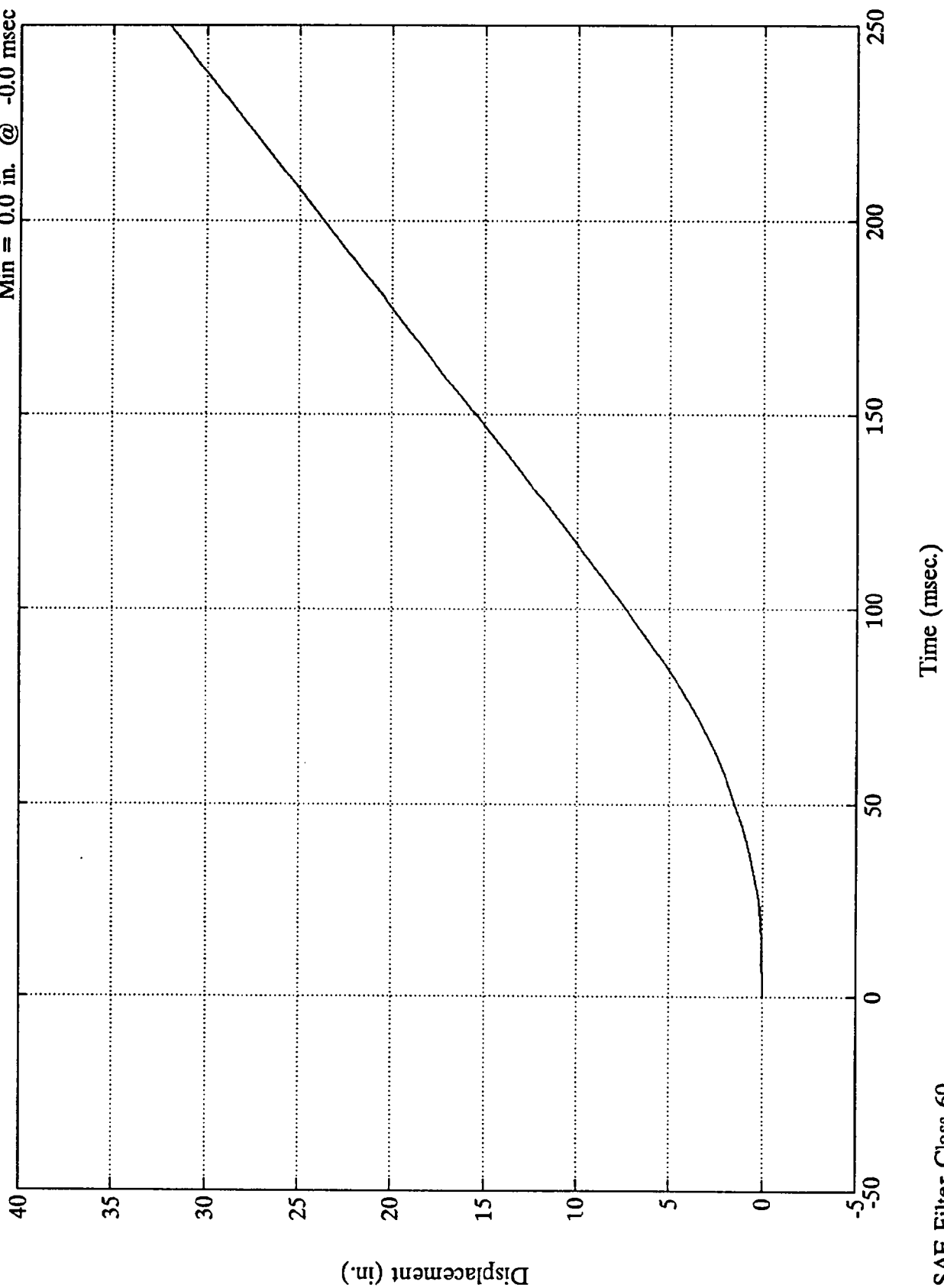
Max = 9.9 mph @ 148.3 msec
Min = 0.0 mph @ -0.0 msec



V-to-V Test #4

Veh. 1 C/L Seat (Y)

Max = 32.8 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



B-15

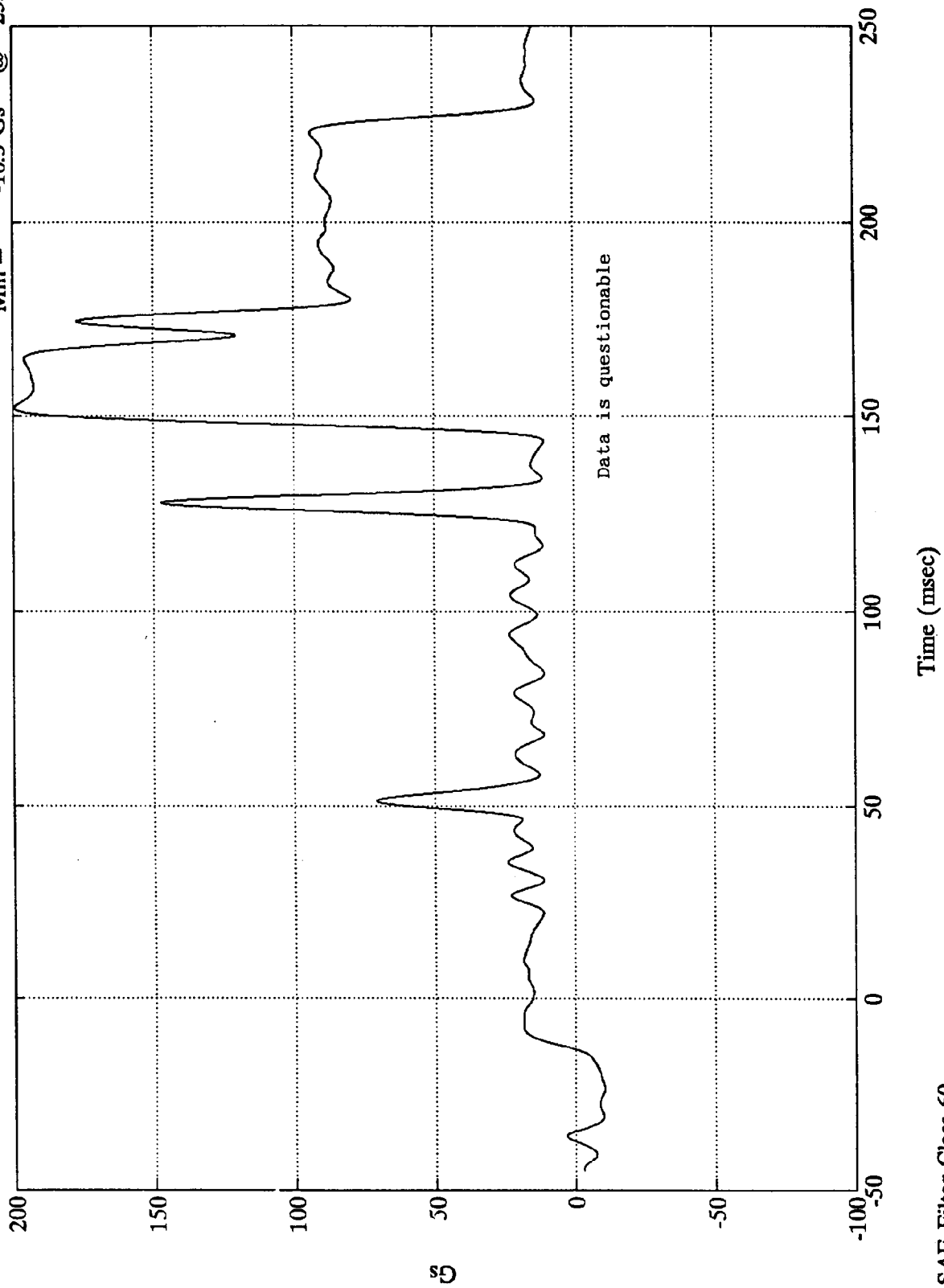
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 C/L Seat (Z)

Max = 199.5 Gs @ 151.91 msec
Min = -10.3 Gs @ -23.40 msec



B-16

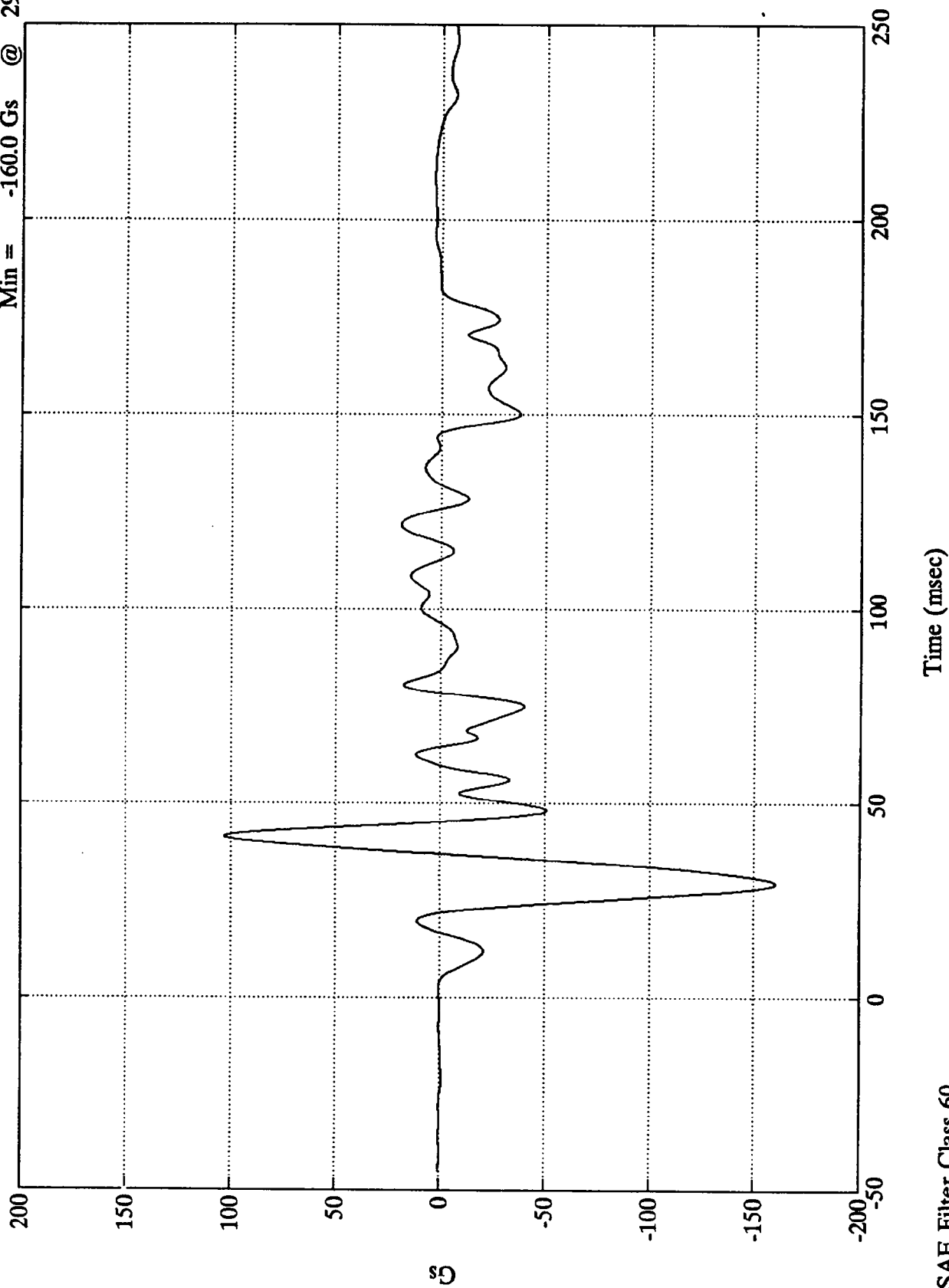
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 Engine Top (X)

Max = 103.0 Gs @ 41.40 msec
Min = -160.0 Gs @ 29.39 msec



B-17

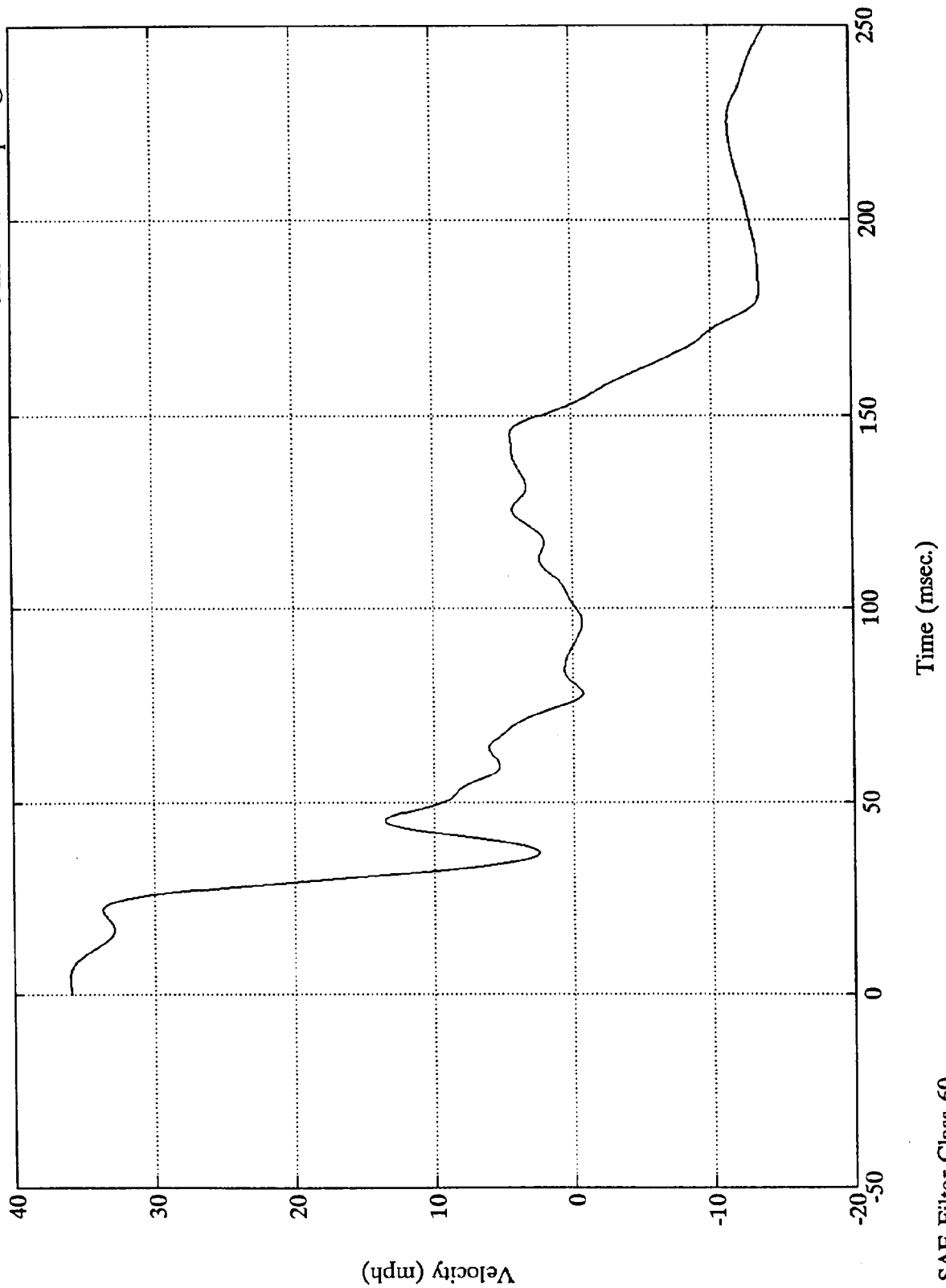
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 Engine Top (X)

Max = 36.0 mph @ 4.6 msec
Min = -14.7 mph @ 254.9 msec

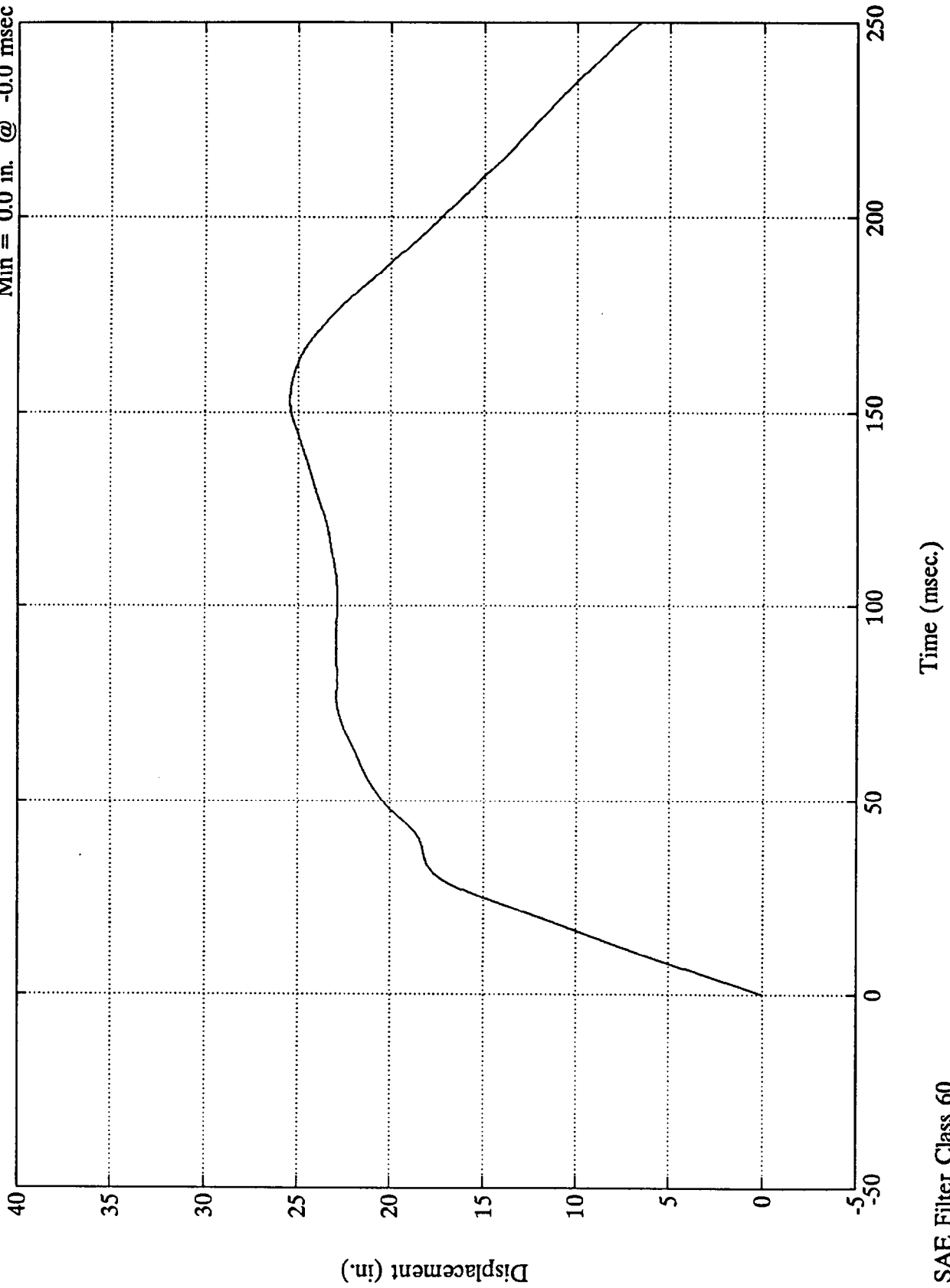


B-18

7883-4

SAE Filter Class 60

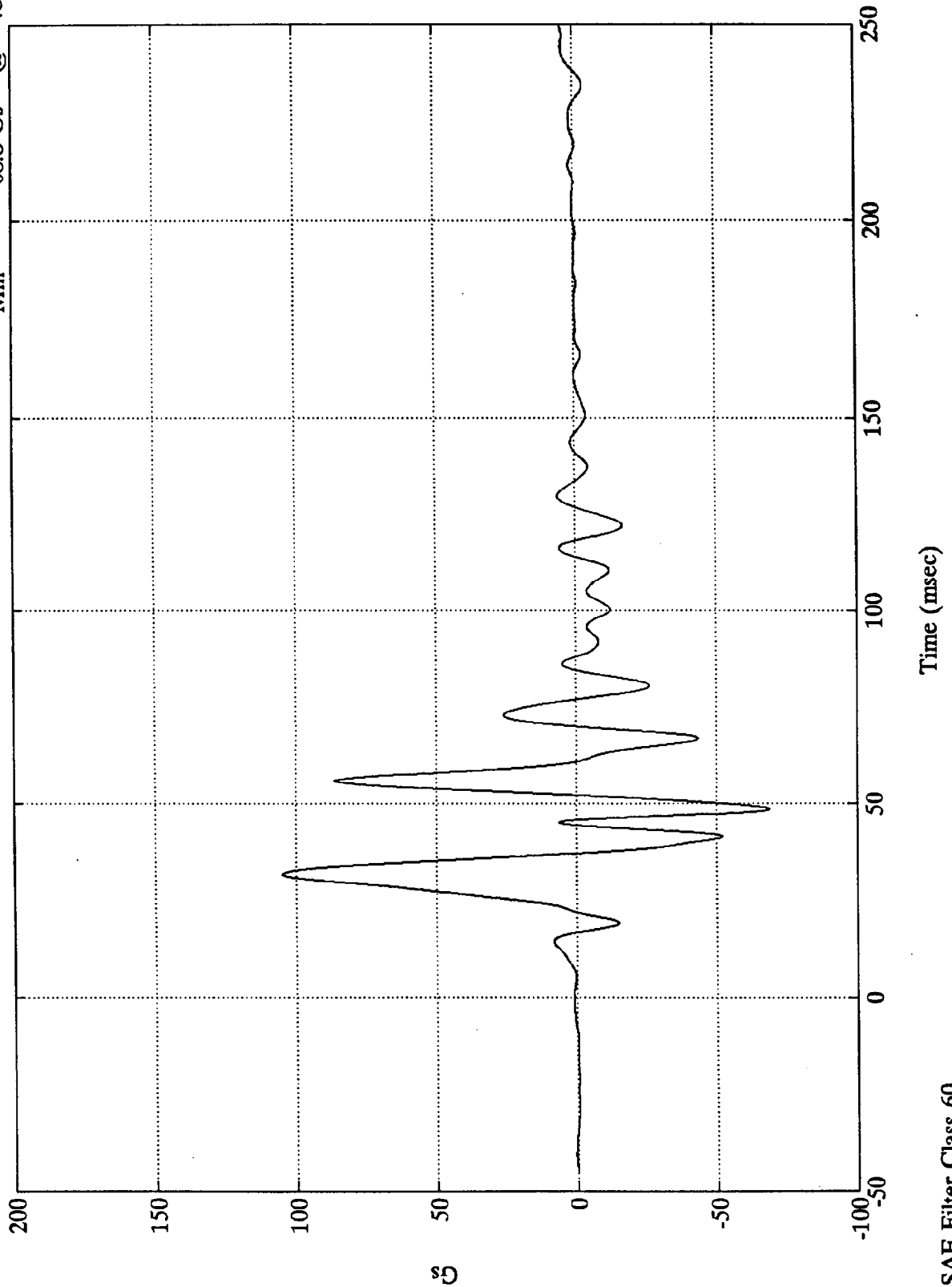
Veh. 1 Engine Top (X)
Max = 25.5 in. @ 153.6 msec
Min = 0.0 in. @ -0.0 msec



V-to-V Test #4

Veh. 1 Engine Top (Z)

Max = 105.1 Gs @ 31.79 msec
Min = -68.8 Gs @ 48.72 msec



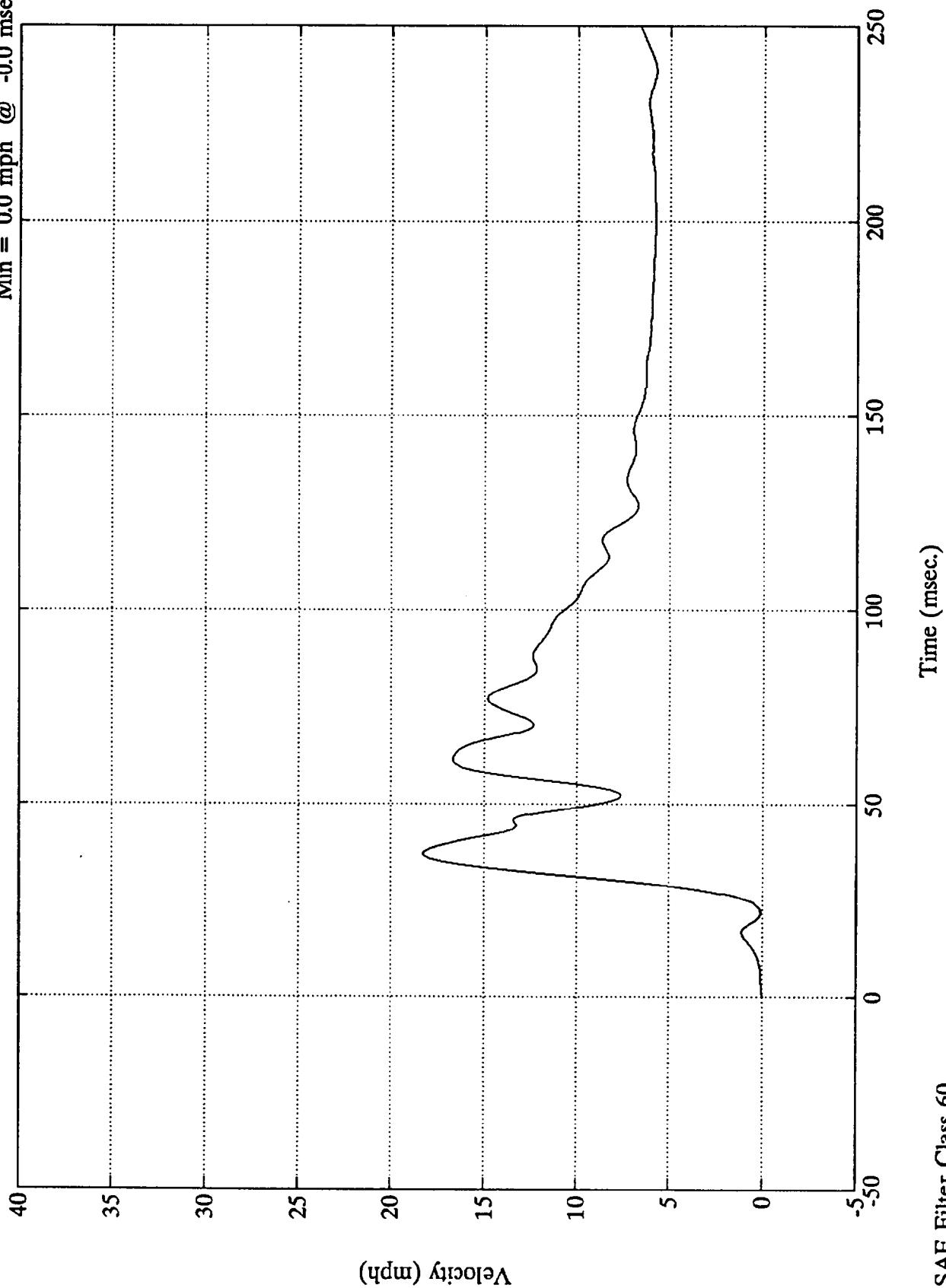
5

B-20

7883-4

SAE Filter Class 60

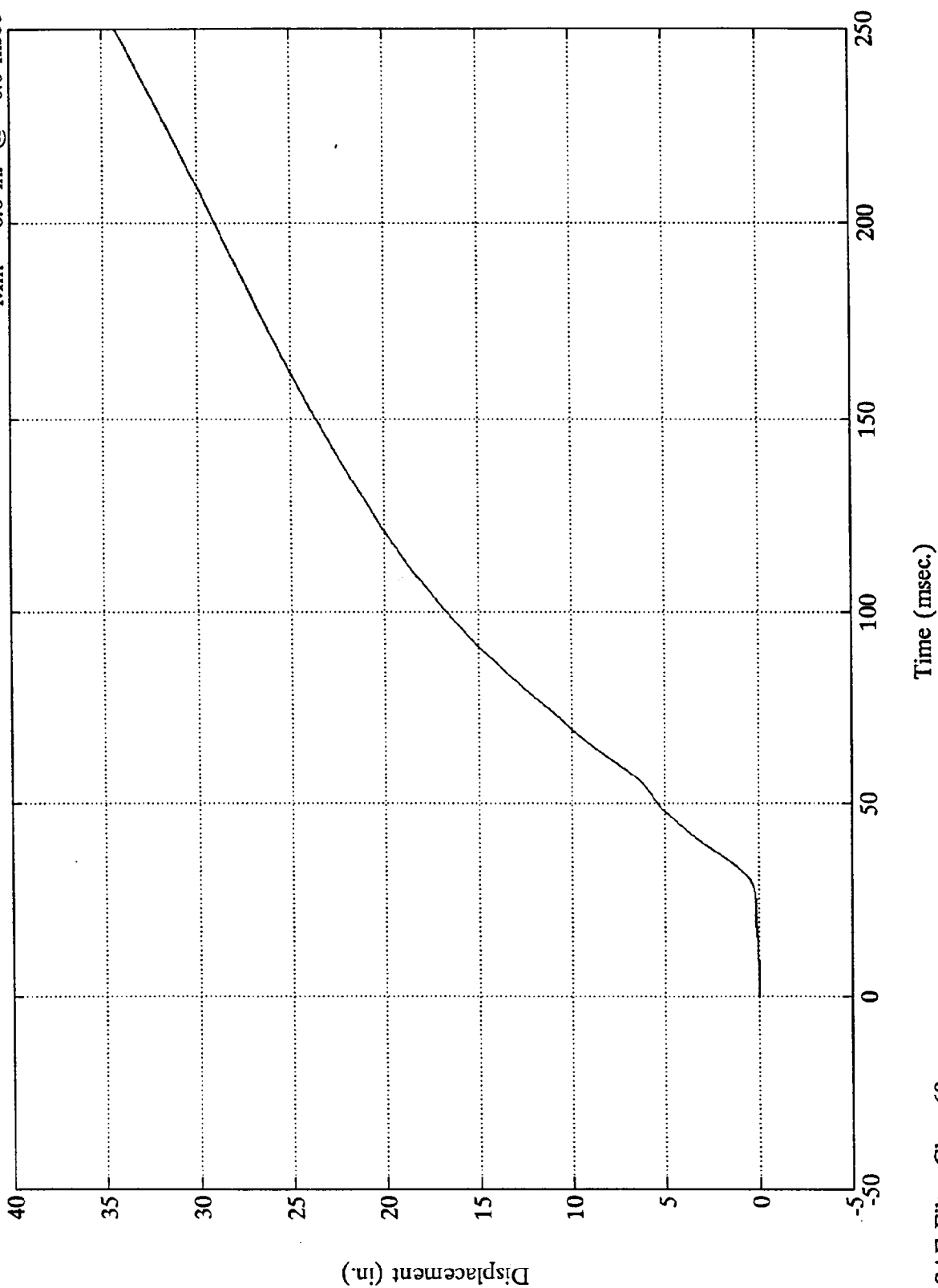
Veh. 1 Engine Top (Z)
Max = 18.3 mph @ 37.2 msec
Min = 0.0 mph @ -0.0 msec



V-to-V Test #4

Veh. 1 Engine Top (Z)

Max = 34.9 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



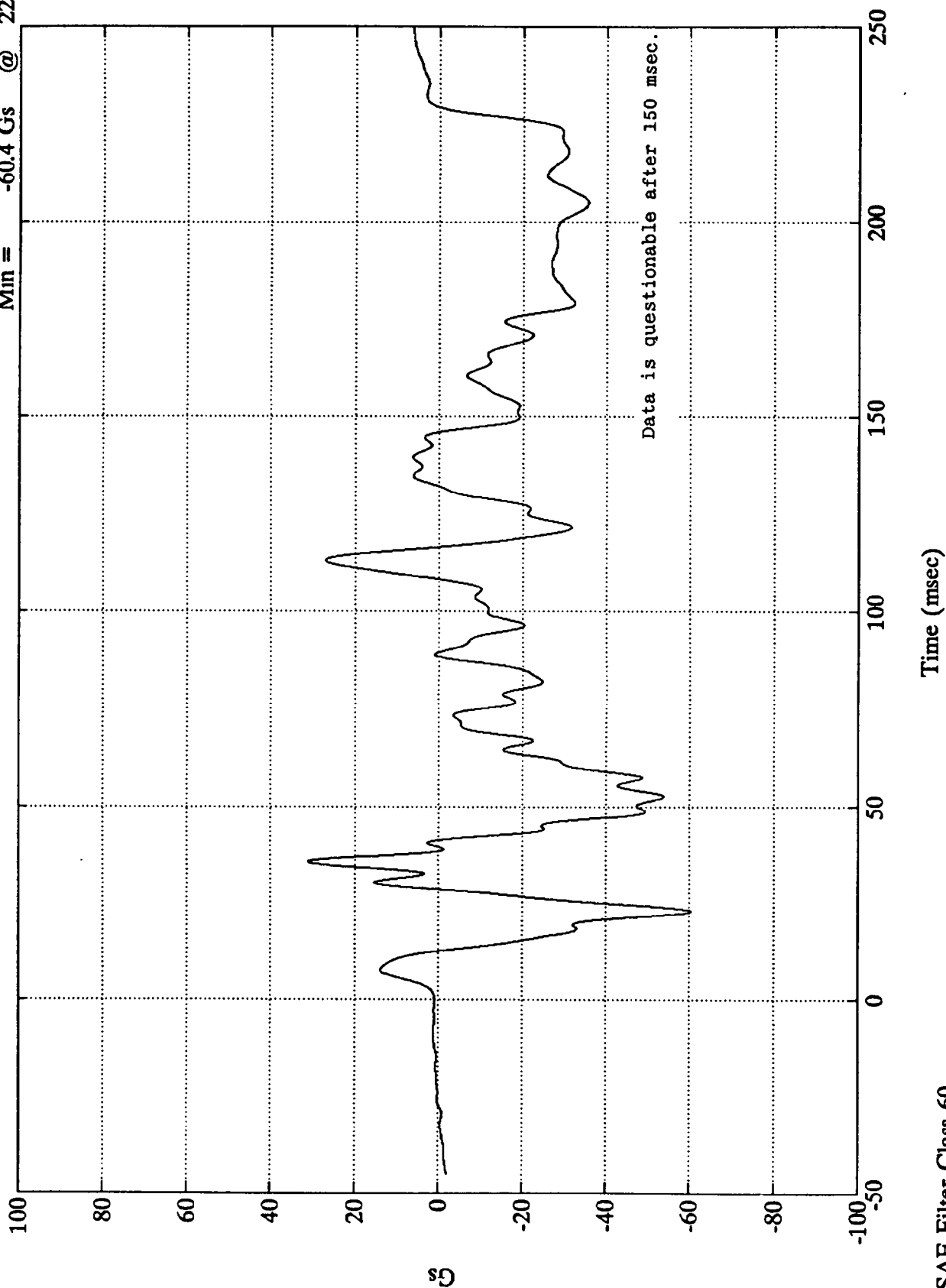
B-22

7883-4

SAE Filter Class 60

Veh. 1 Engine Bottom (X)

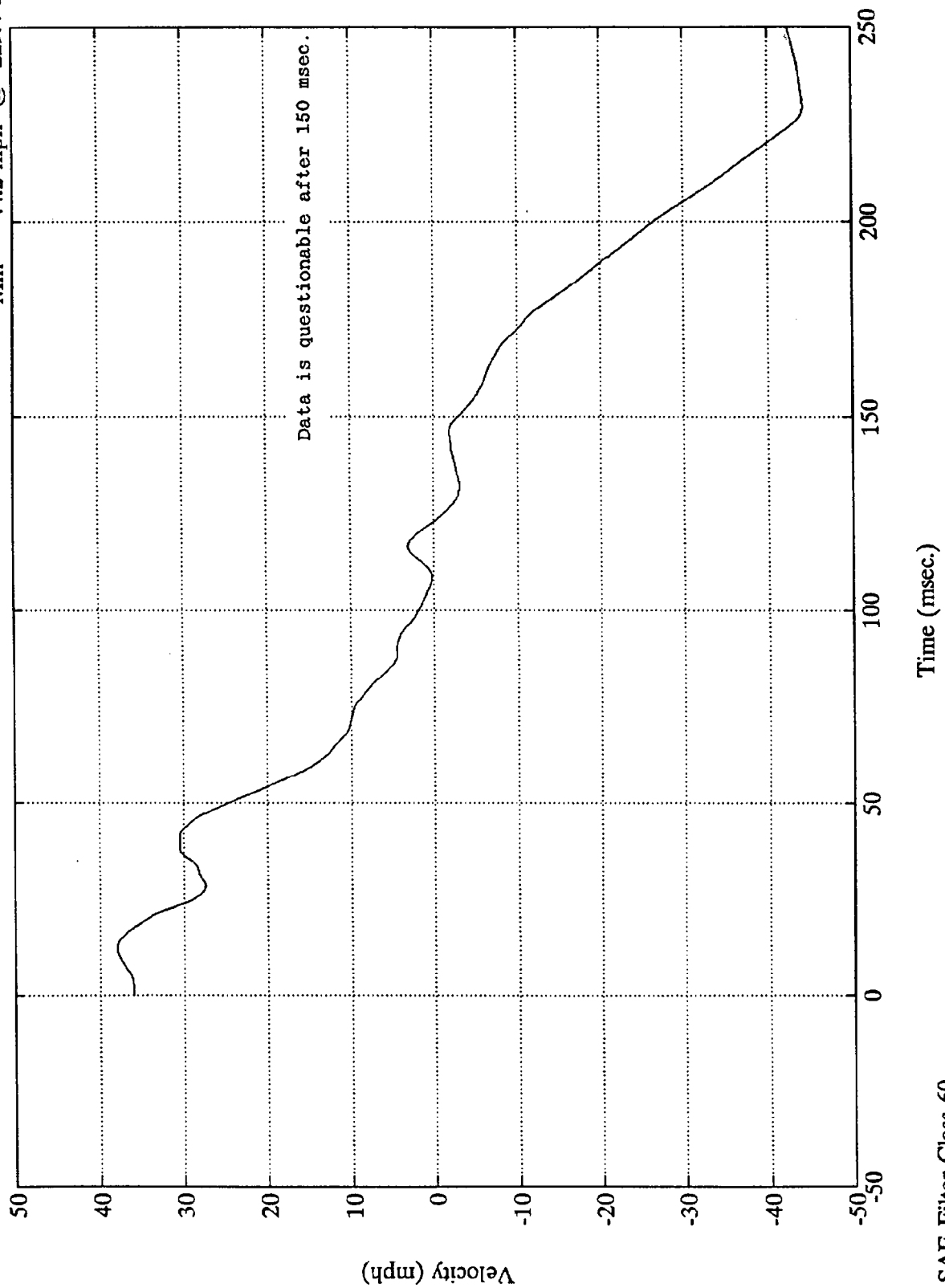
Max = 31.2 Gs @ 35.76 msec
 Min = -60.4 Gs @ 22.92 msec



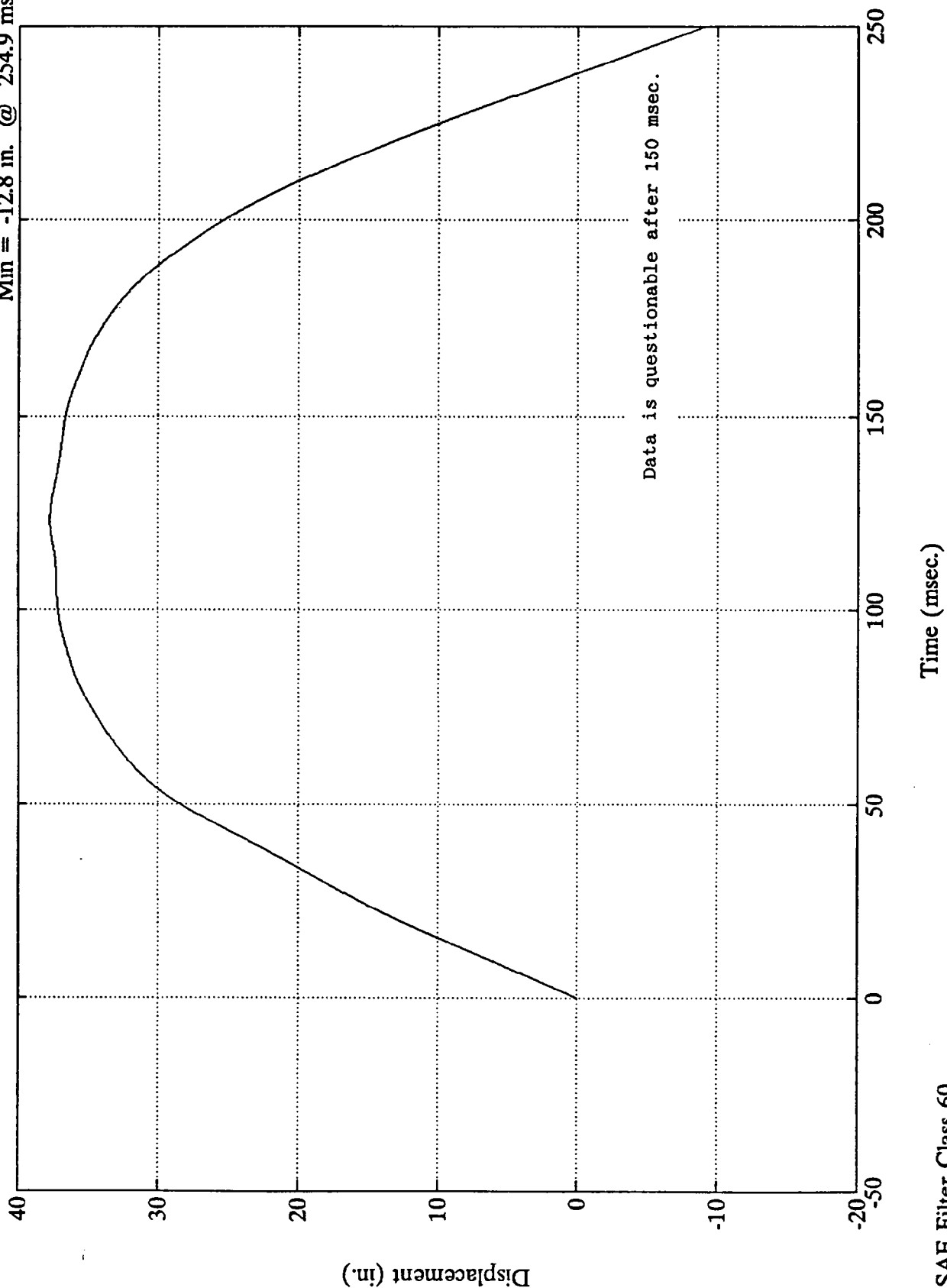
V-to-V Test #4

Veh. 1 Engine Bottom (X)

Max = 38.0 mph @ 12.7 msec
Min = -44.2 mph @ 229.4 msec

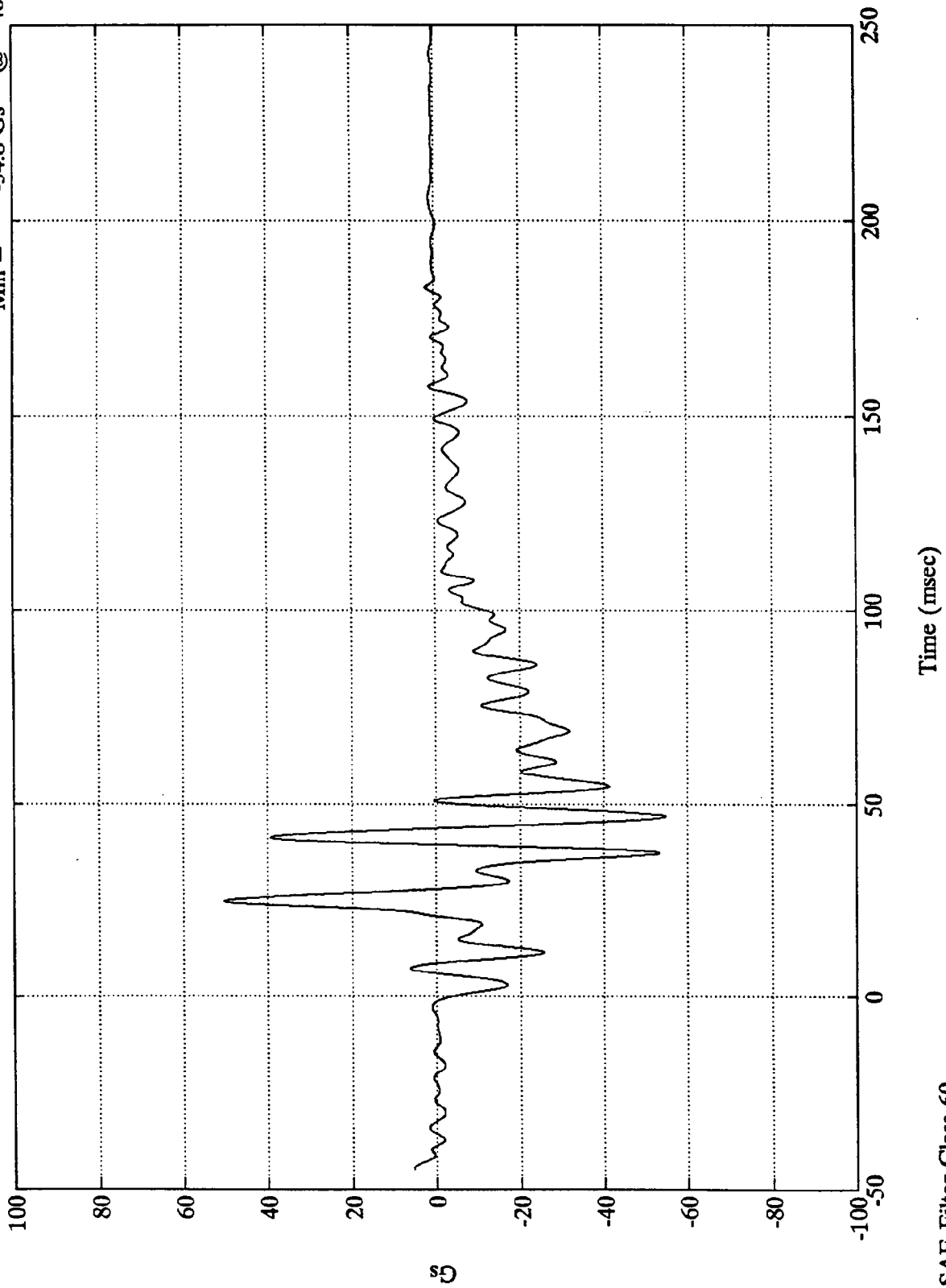


Veh. 1 Engine Bottom (X)
 Max = 37.7 in. @ 123.8 msec
 Min = -12.8 in. @ 254.9 msec



V-to-V Test #4

Veh. 1 Front X Mem. (X) Max = 50.4 Gs @ 24.59 msec
Min = -54.8 Gs @ 46.92 msec



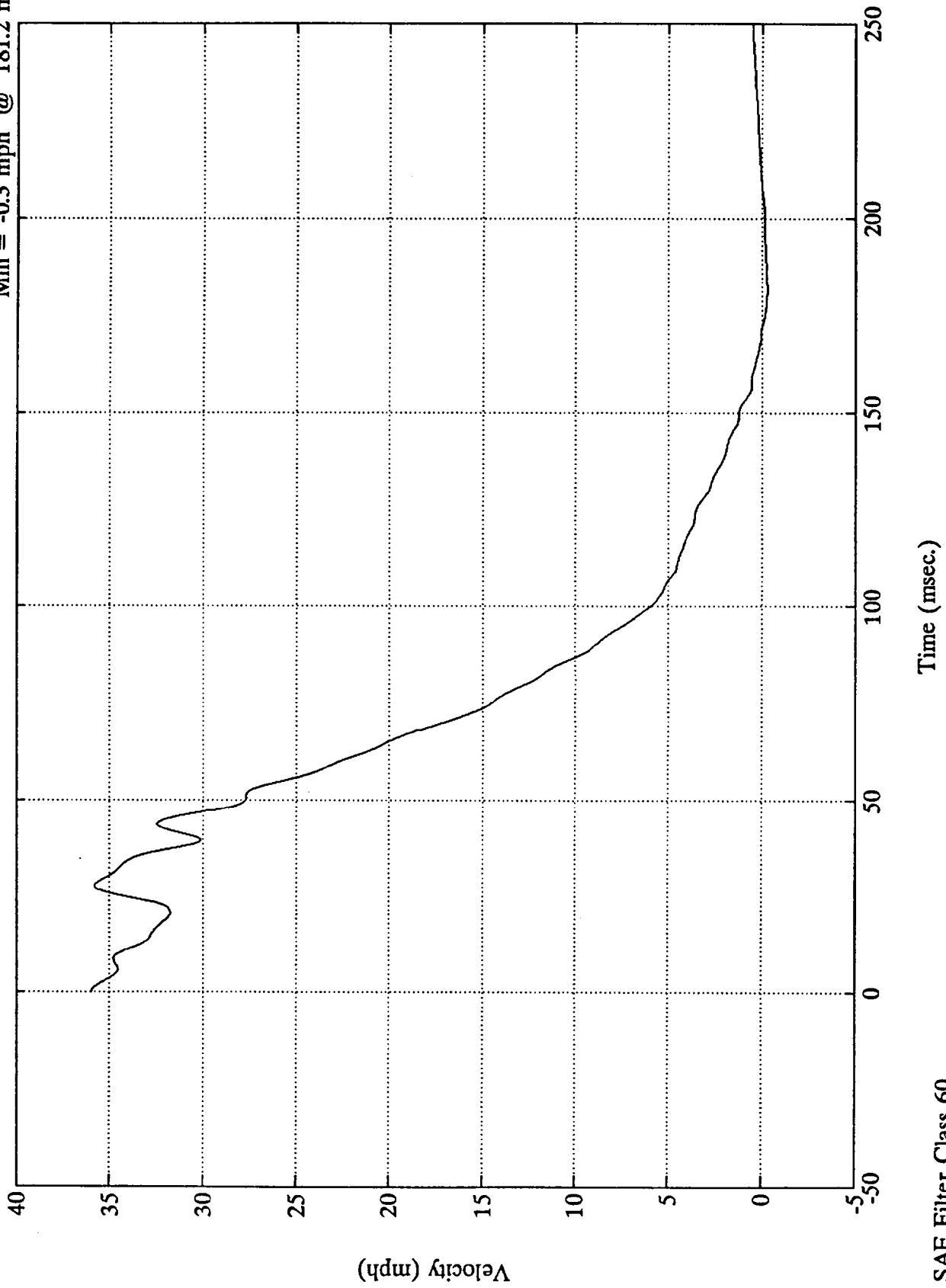
B-26

7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 Front X Mem. (X)
Max = 36.0 mph @ -0.0 msec
Min = -0.3 mph @ 181.2 msec



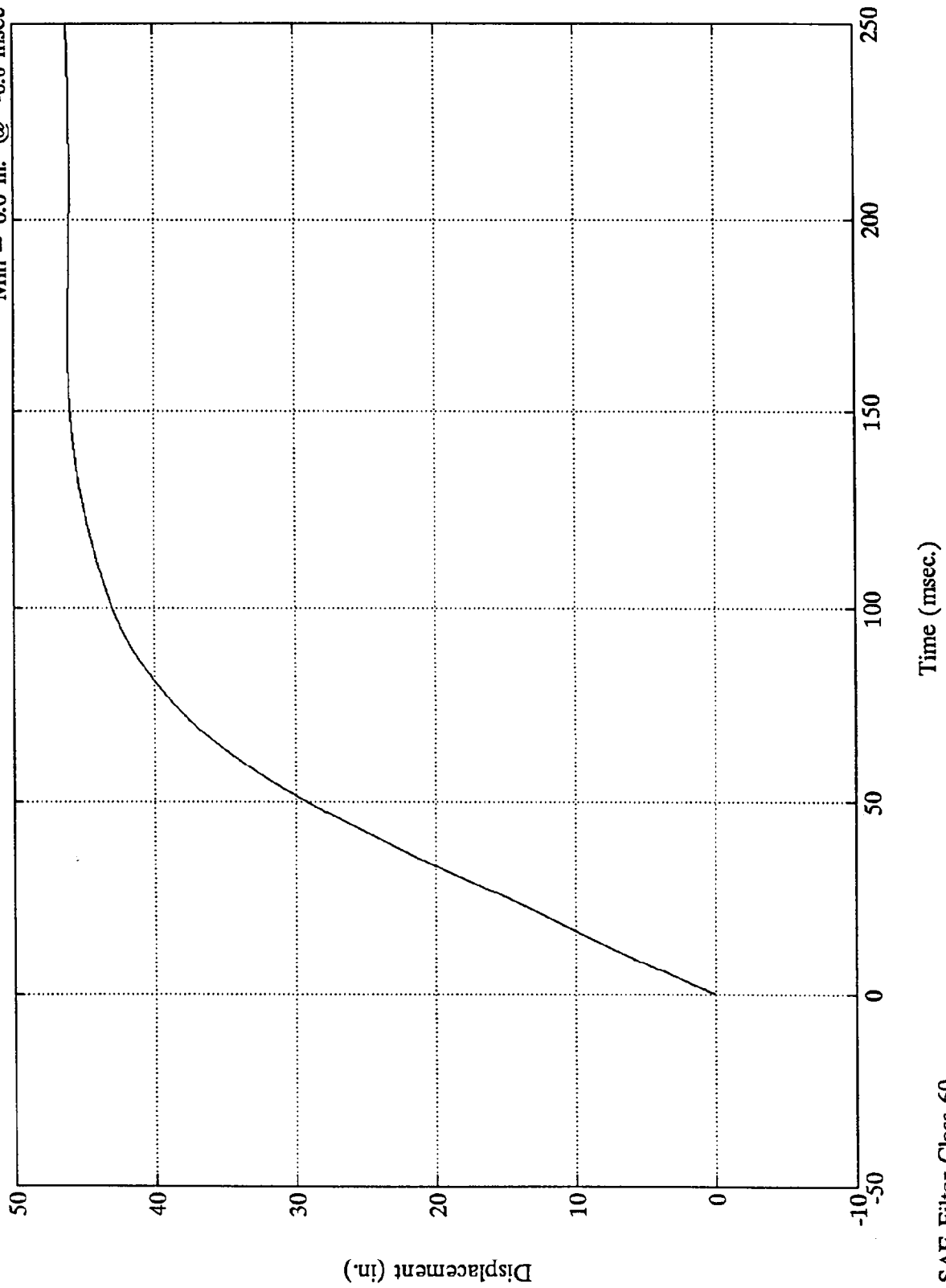
B-27

7883-4

SAE Filter Class 60

V-to-V Test #4

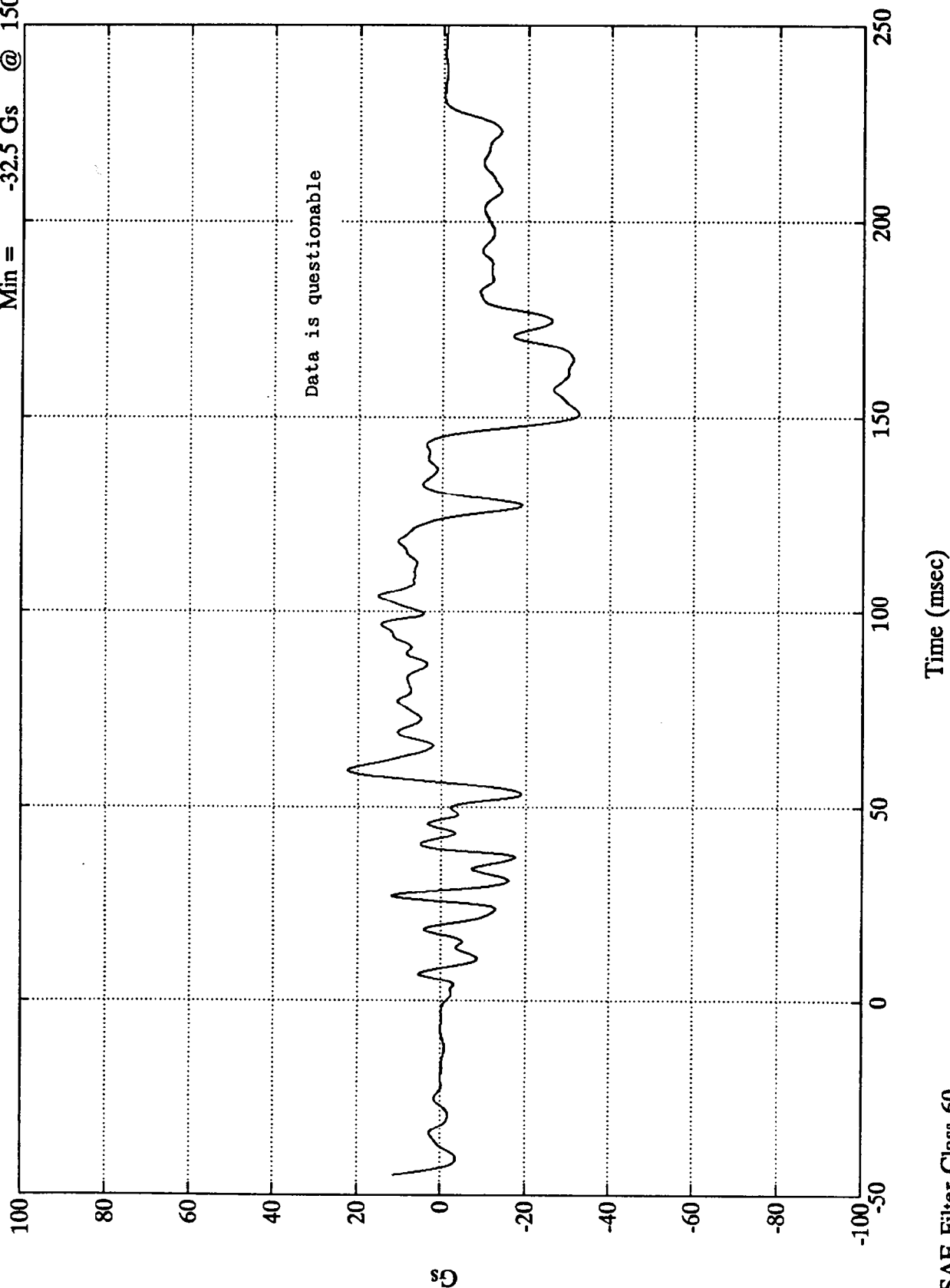
Veh. 1 Front X Mem. (X)
Max = 46.2 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



V-to-V Test #4

Veh. 1 Front X Mem. (Z)

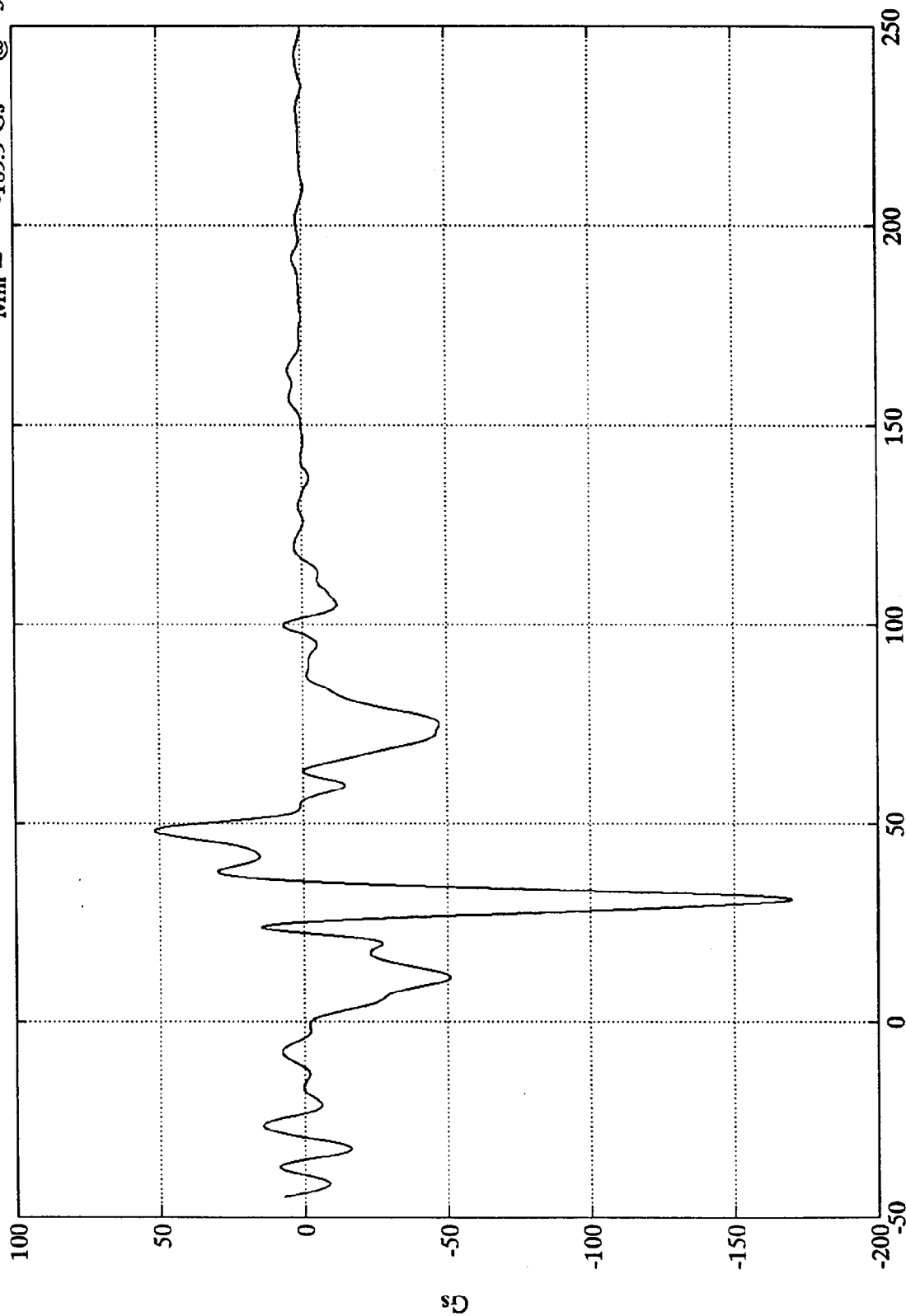
Max = 22.3 Gs @ 59.40 msec
Min = -32.5 Gs @ 150.83 msec



V-to-V Test #4

Veh. 1 Left Caliper (X)

Max = 51.8 Gs @ 48.11 msec
Min = -169.9 Gs @ 30.95 msec



Time (msec)

SAE Filter Class 60

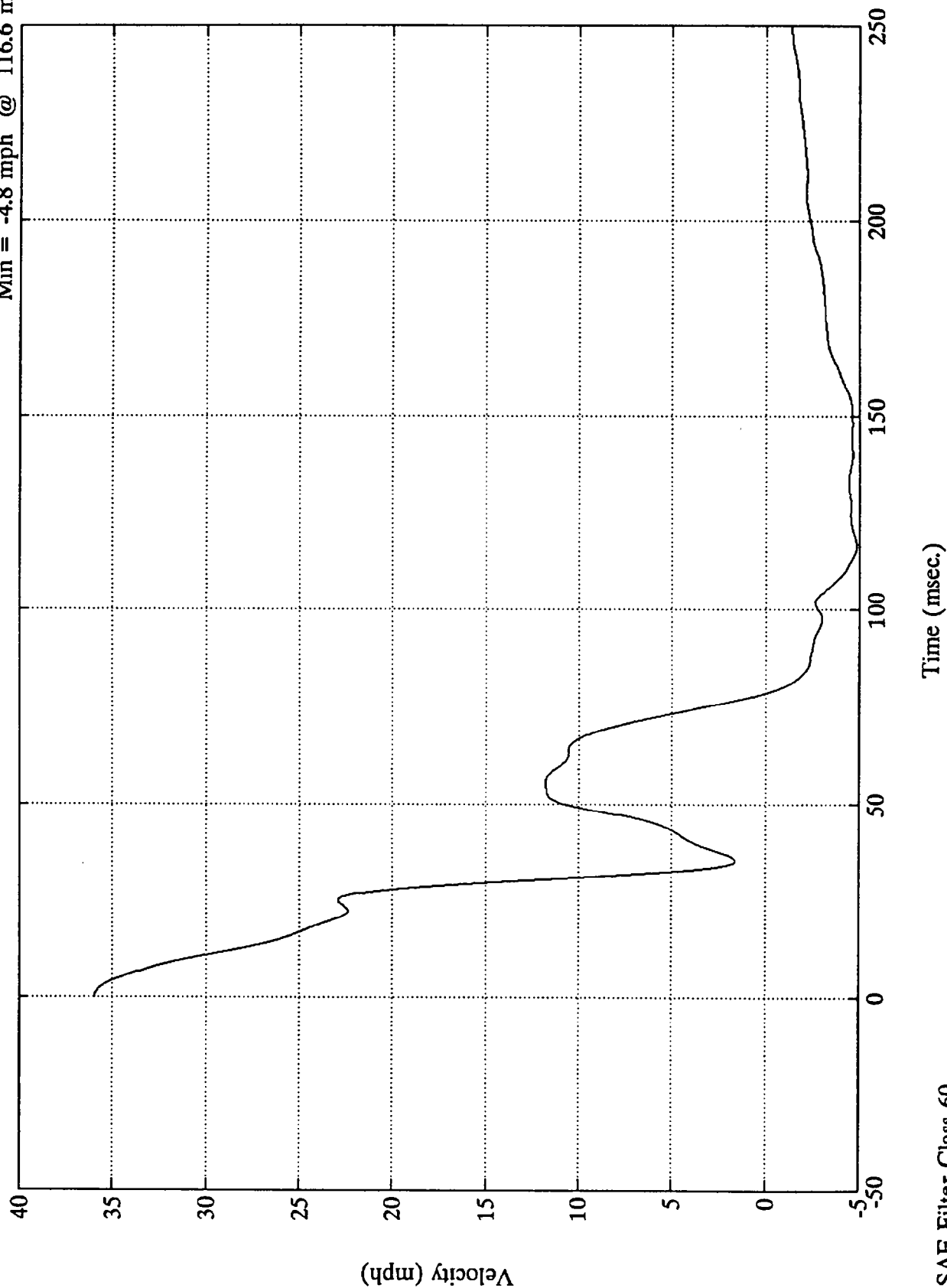
Gs

B-30

7883-4

Veh. 1 Left Caliper (X)

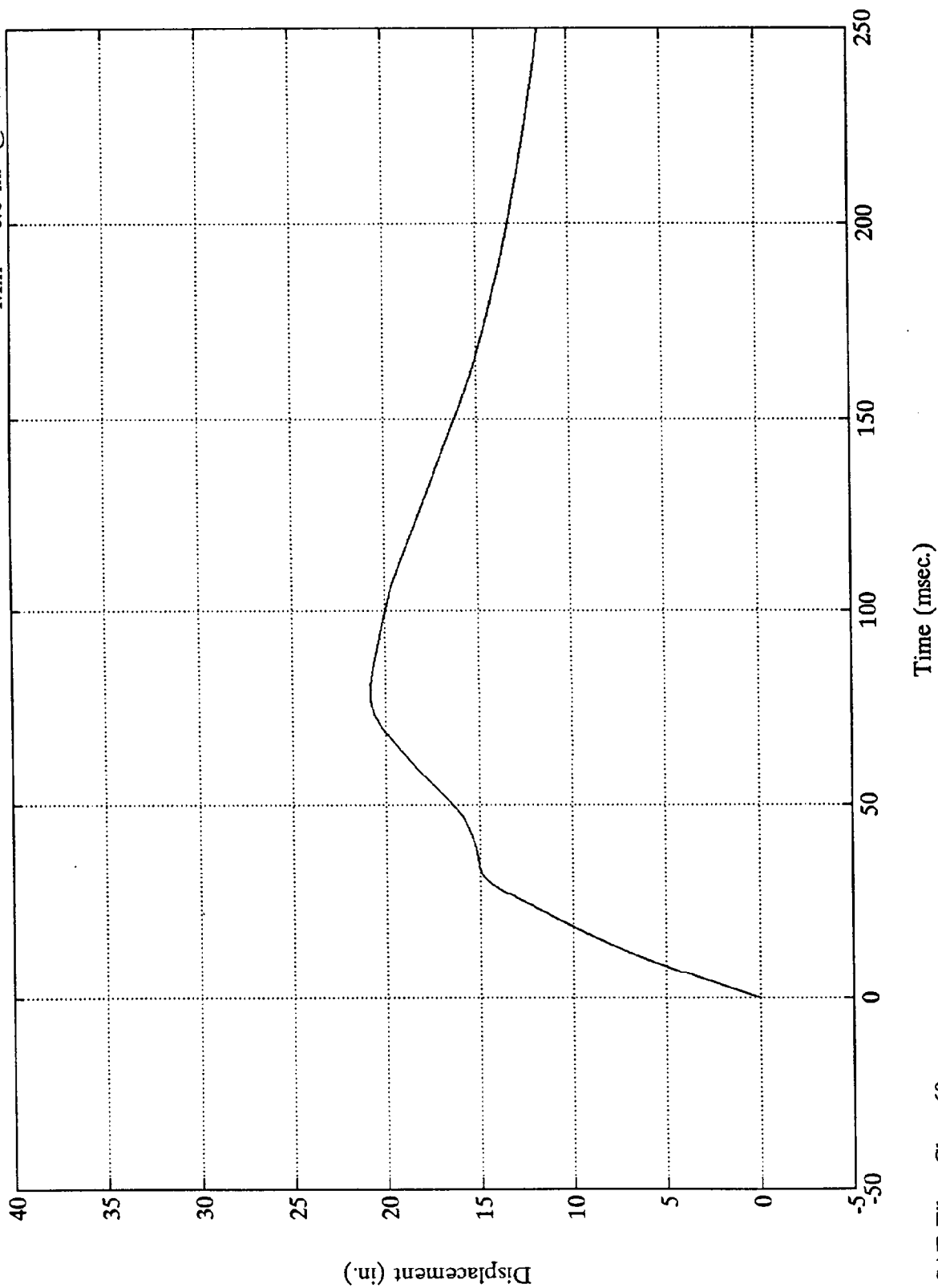
Max = 36.0 mph @ -0.0 msec
Min = -4.8 mph @ 116.6 msec



V-to-V Test #4

Veh. 1 Left Caliper (X)

Max = 20.9 in. @ 79.2 msec
Min = 0.0 in. @ -0.0 msec



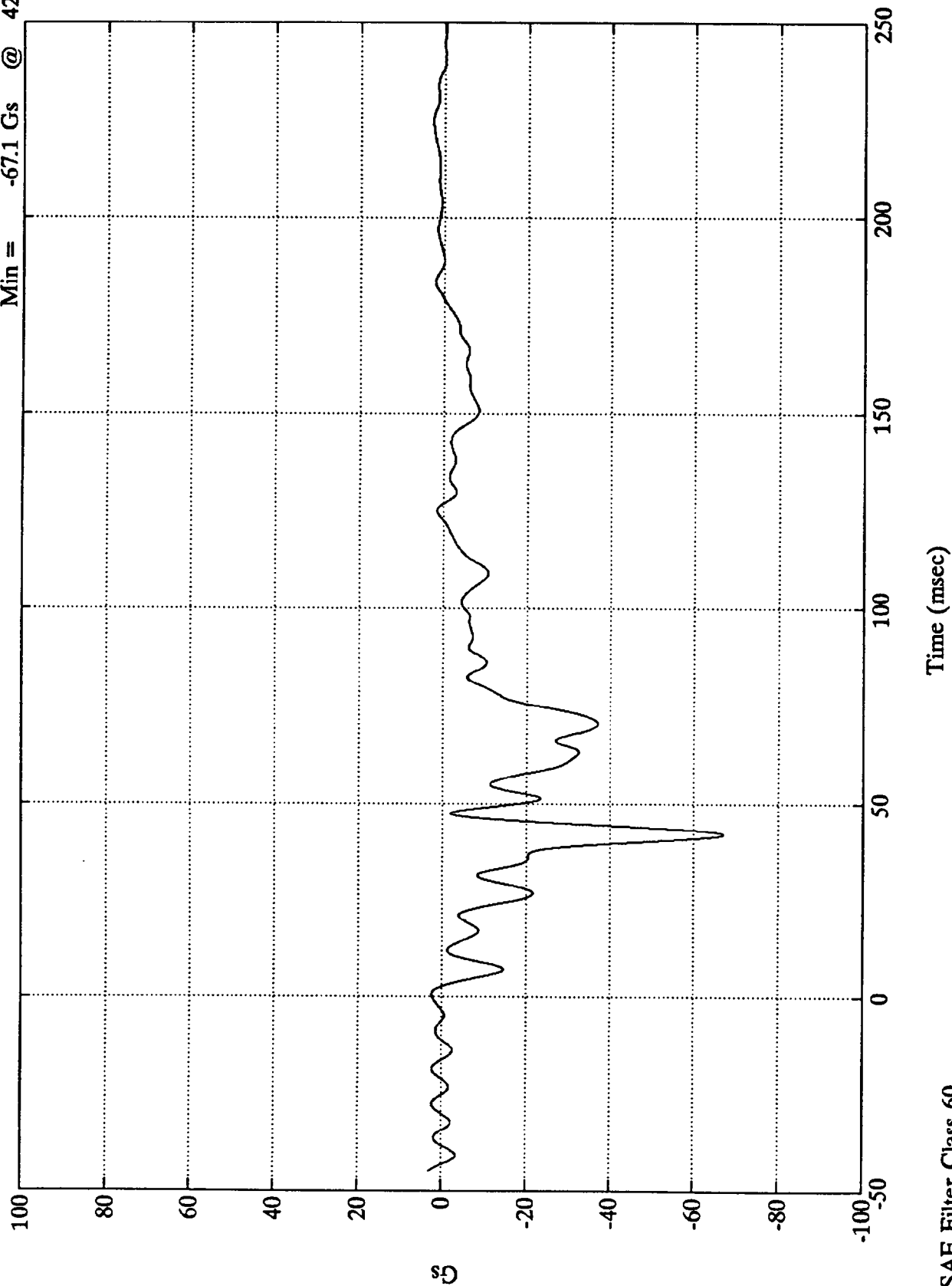
B-32

7883-4

SAE Filter Class 60

Veh. 1 Right Caliper (X)

Max = 2.8 Gs @ -44.88 msec
 Min = -67.1 Gs @ 42.11 msec



50

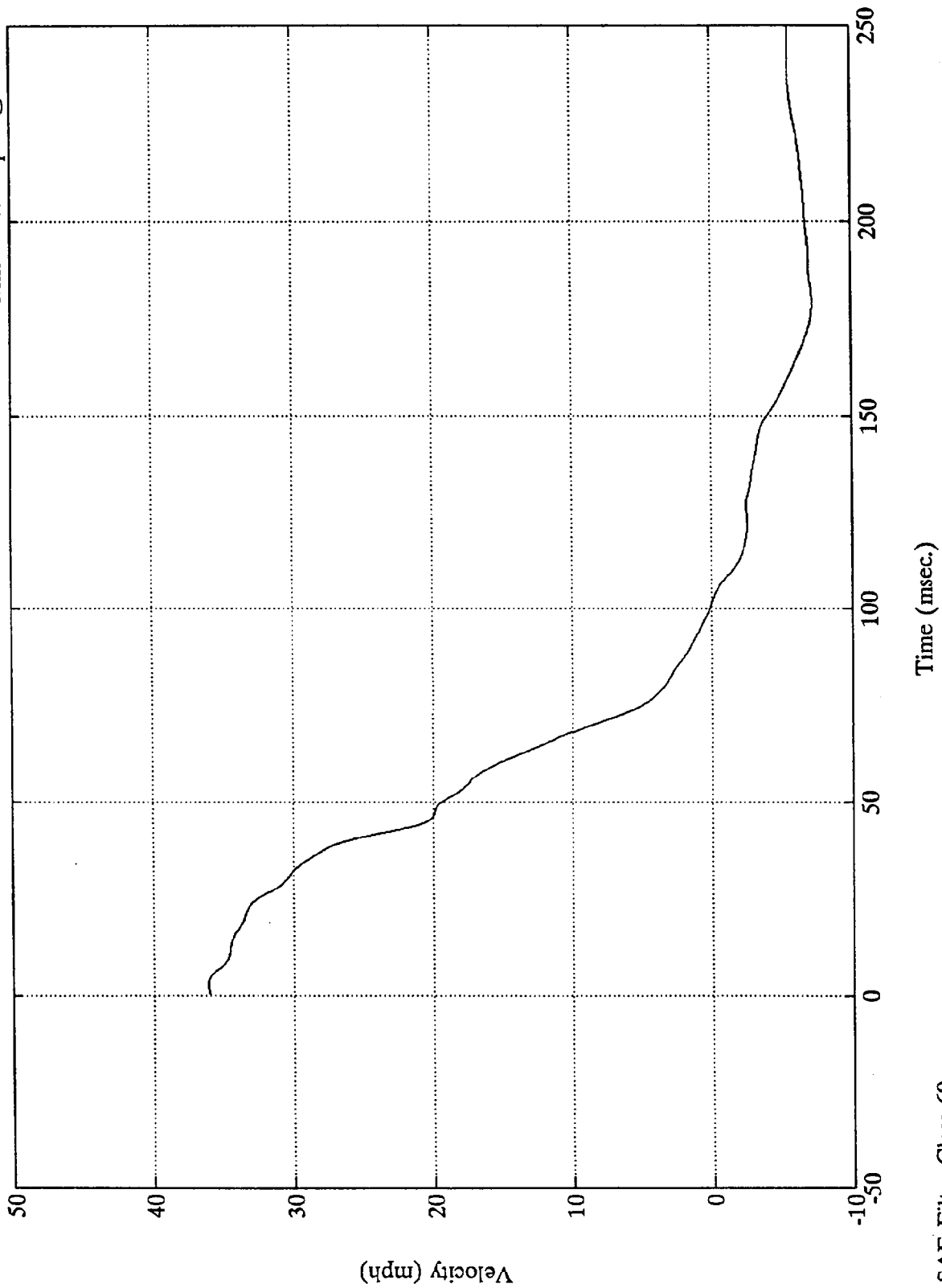
B-33

7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 1 Right Caliper (X)
Max = 36.1 mph @ 3.1 msec
Min = -7.2 mph @ 179.3 msec

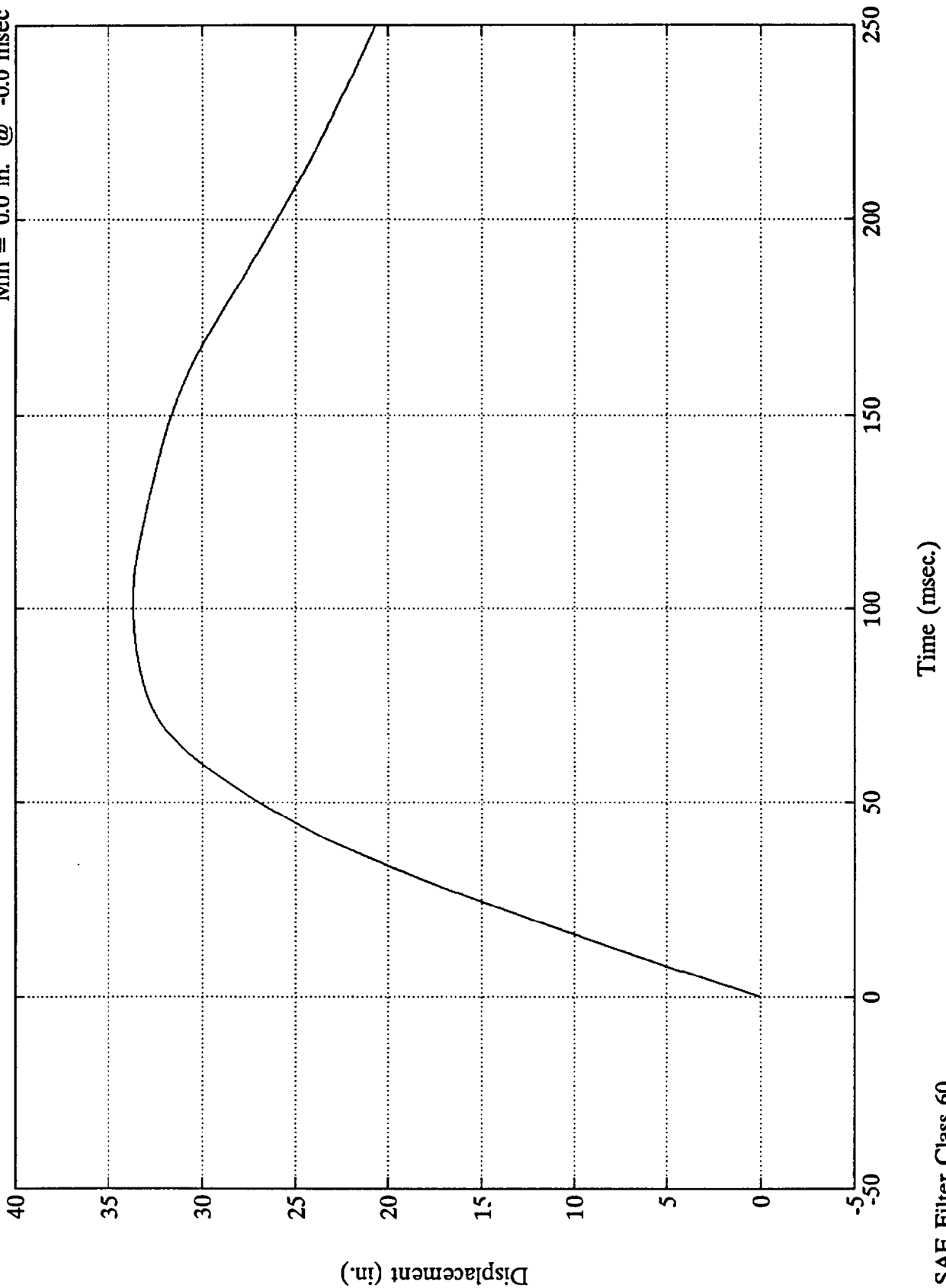


B-34

7883-4

SAE Filter Class 60

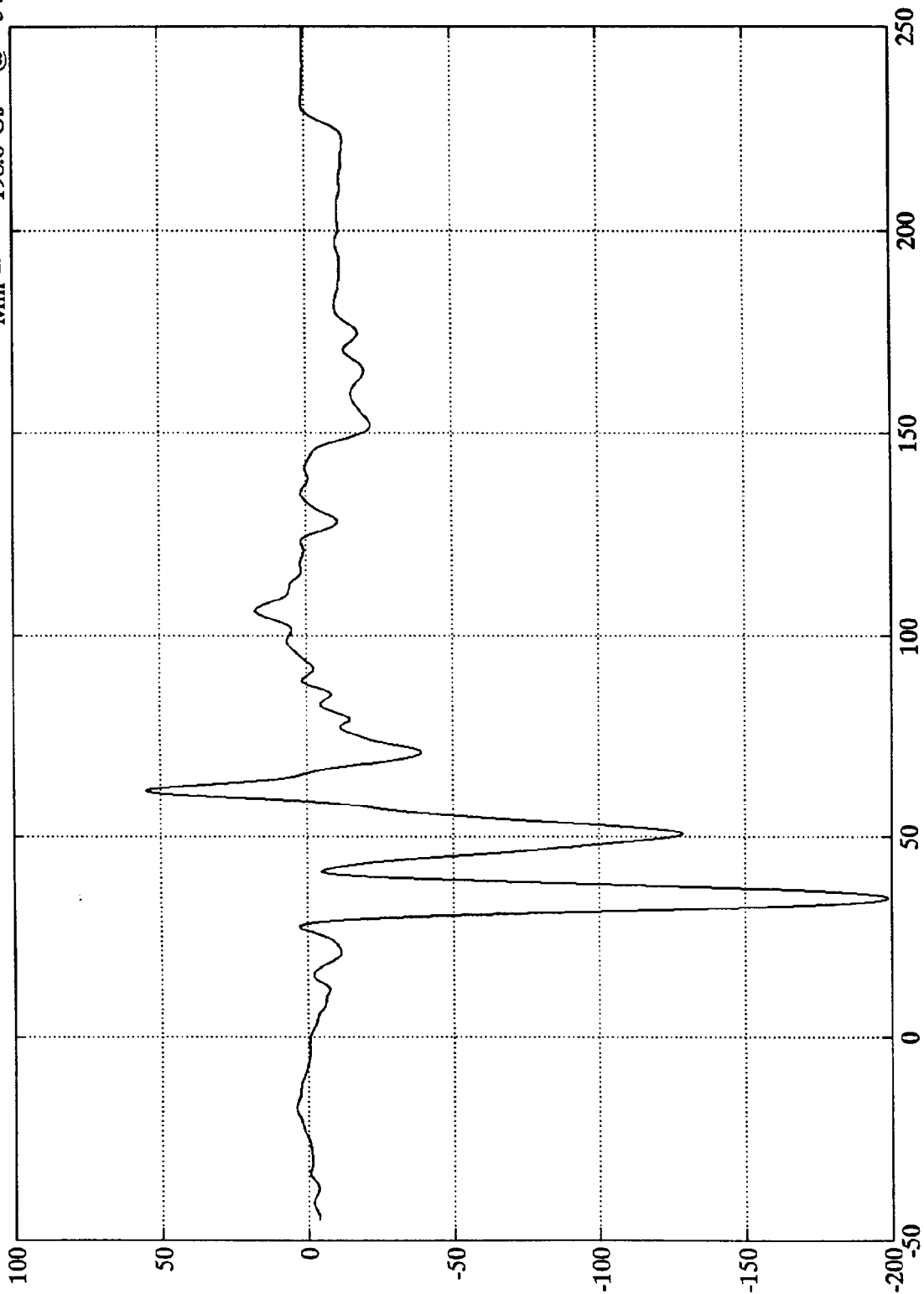
Veh. 1 Right Caliper (X)
Max = 33.7 in. @ 104.4 msec
Min = 0.0 in. @ -0.0 msec



V-to-V Test #4

Veh. 1 Brake Pedal (X)

Max = 54.9 Gs @ 61.56 msec
Min = -198.6 Gs @ 34.91 msec



Time (msec)

SAE Filter Class 60

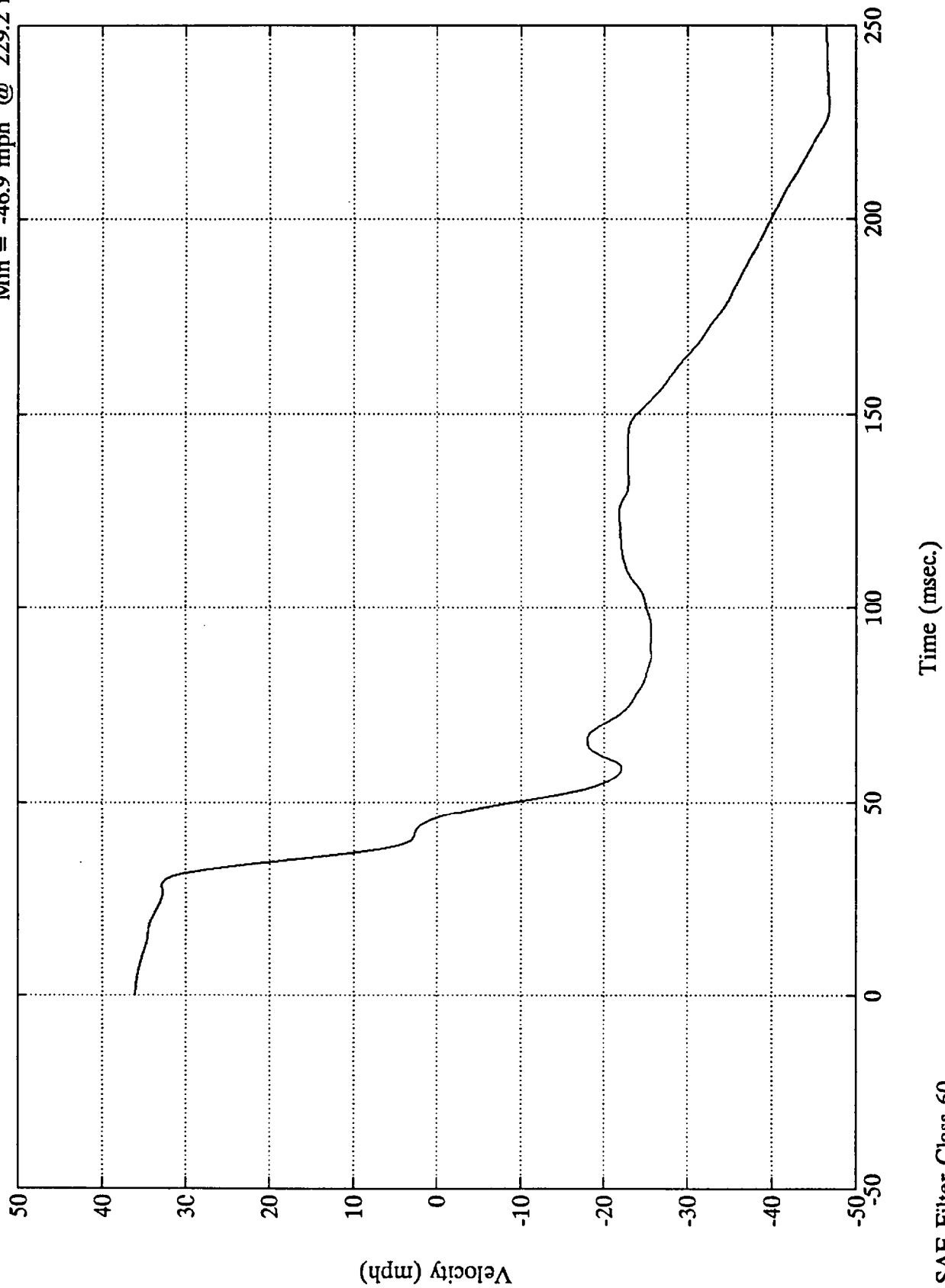
50

B-36

7883-4

Veh. 1 Brake Pedal (X)

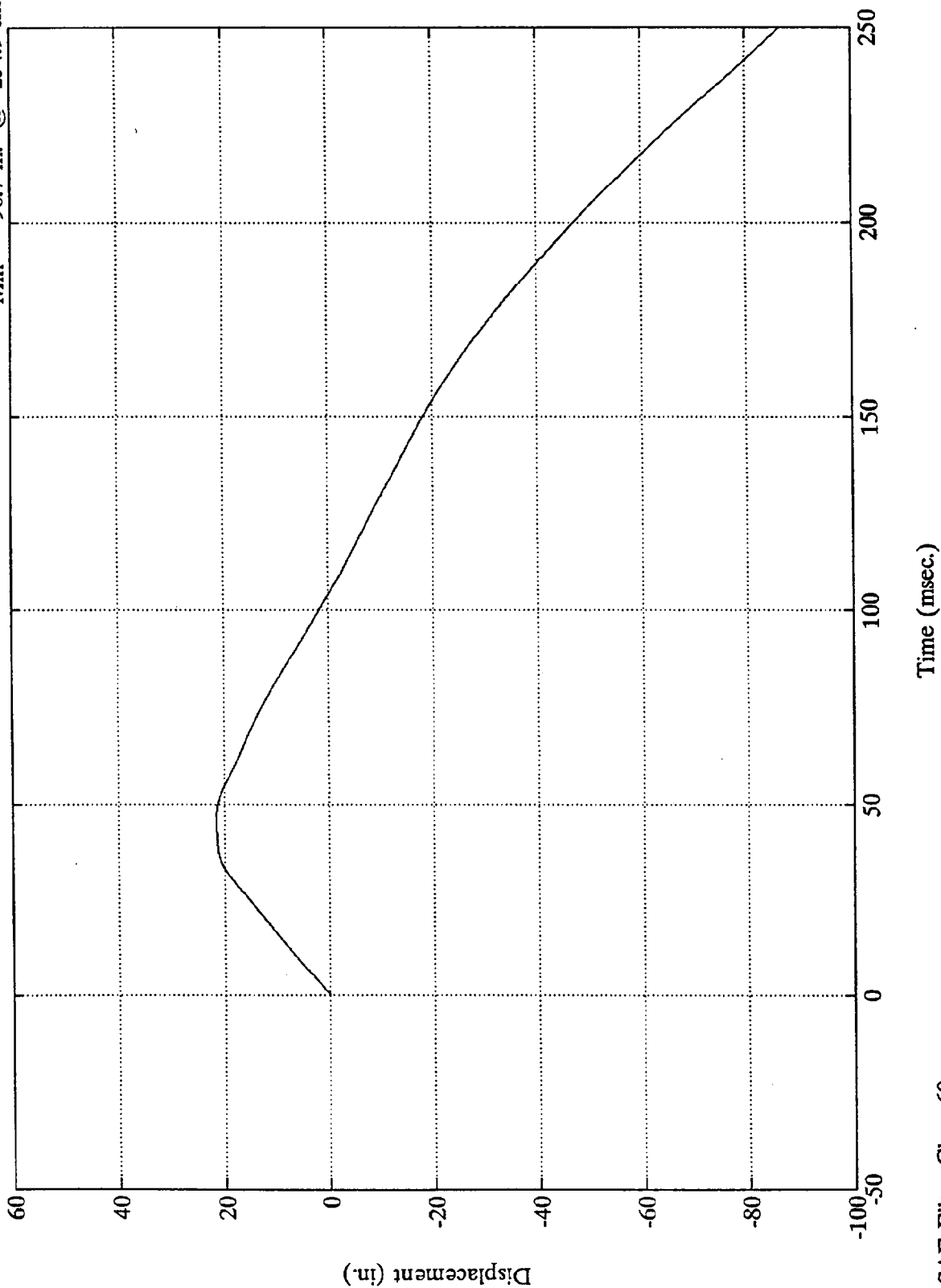
Max = 36.0 mph @ 0.2 msec
Min = -46.9 mph @ 229.2 msec



V-to-V Test #4

Veh. 1 Brake Pedal (X)

Max = 21.5 in. @ 46.8 msec
Min = -90.7 in. @ 254.9 msec



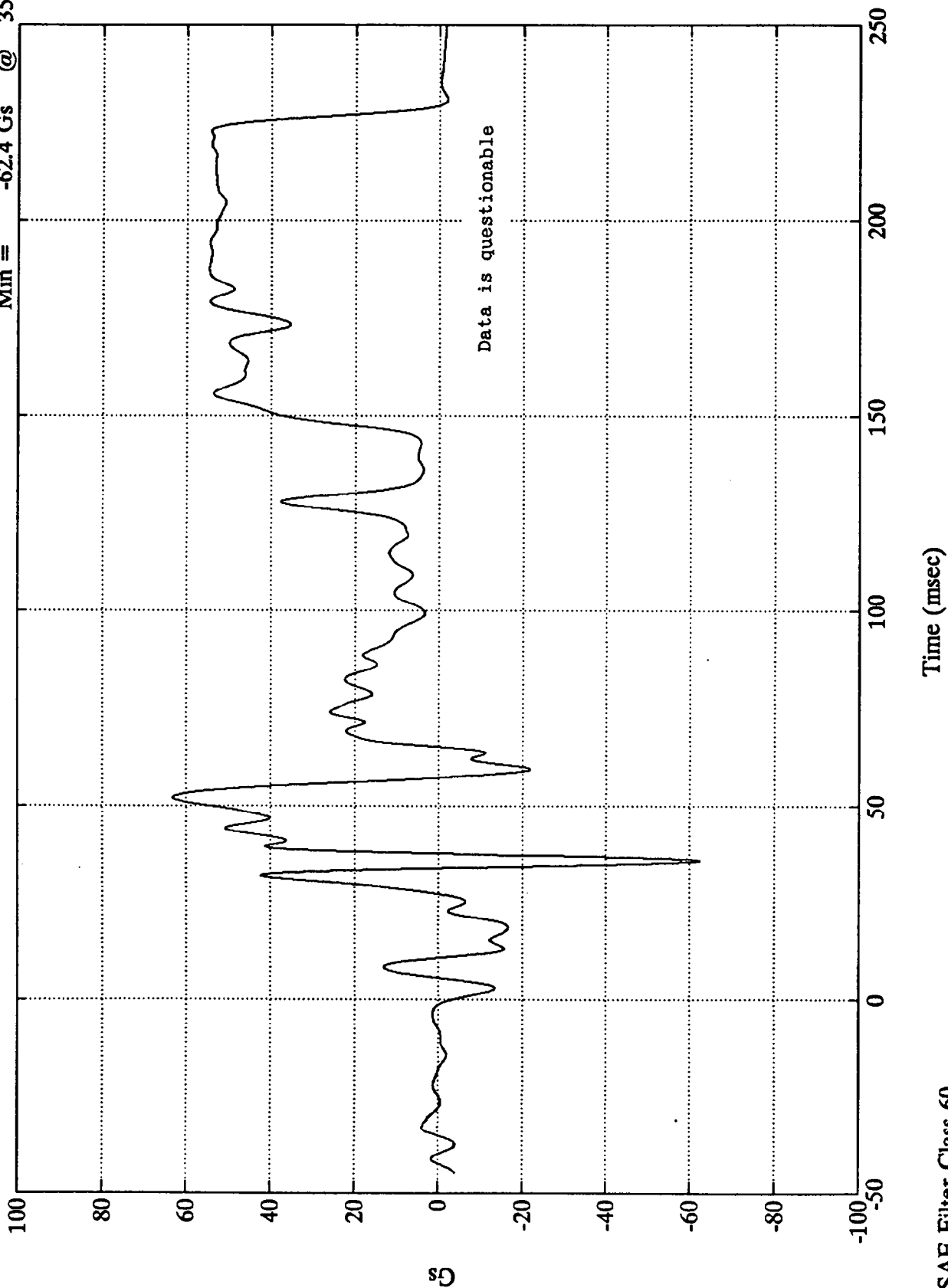
B-38

7883-4

SAE Filter Class 60

Veh. 1 Brake Pedal (Z)

Max = 63.0 Gs @ 52.08 msec
 Min = -62.4 Gs @ 35.76 msec

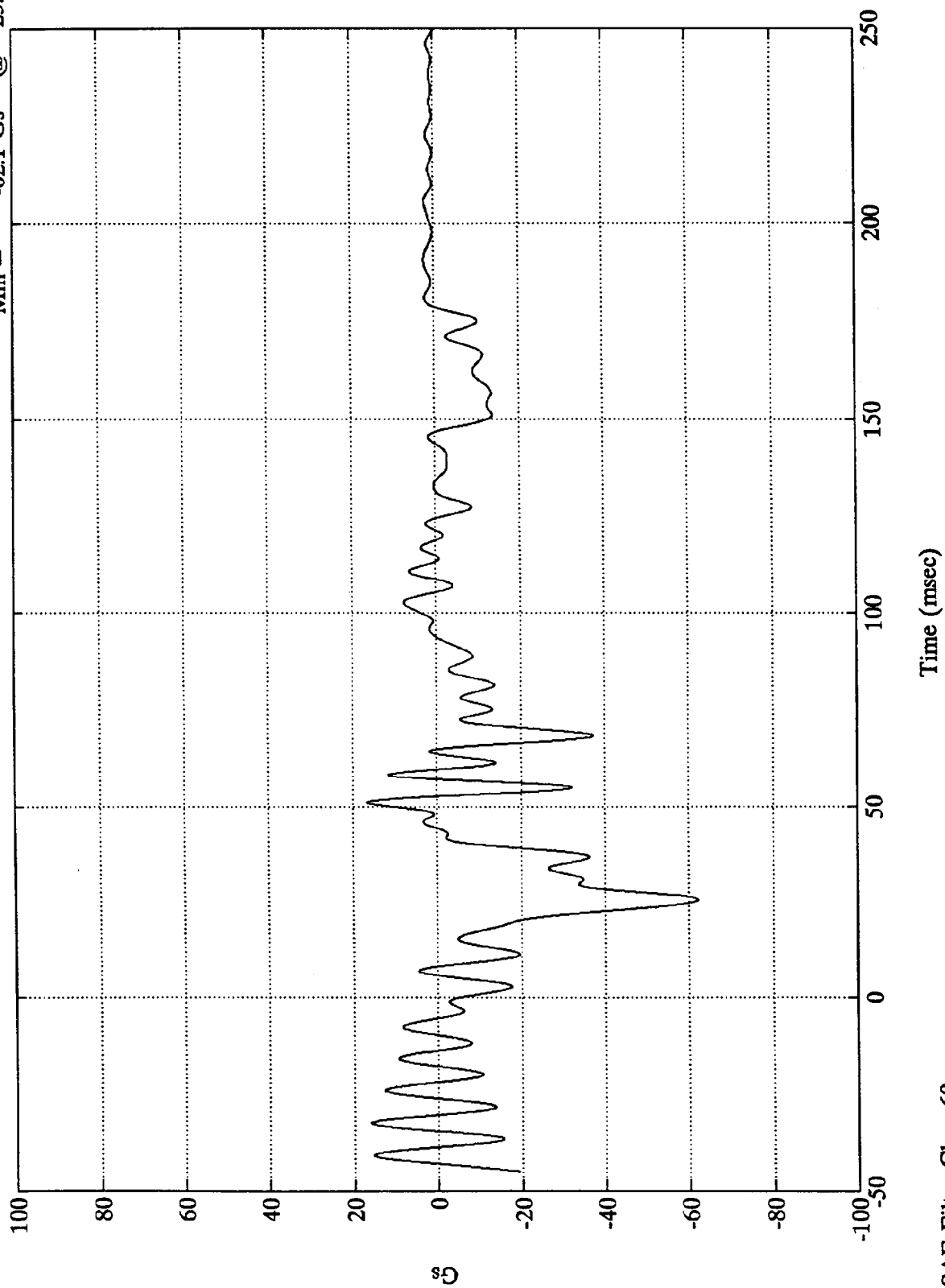


Gs

V-to-V Test #4

Veh. 1 Toe Pan (X)

Max = 16.7 Gs @ 51.24 msec
Min = -62.1 Gs @ 25.68 msec



Gs

Time (msec)

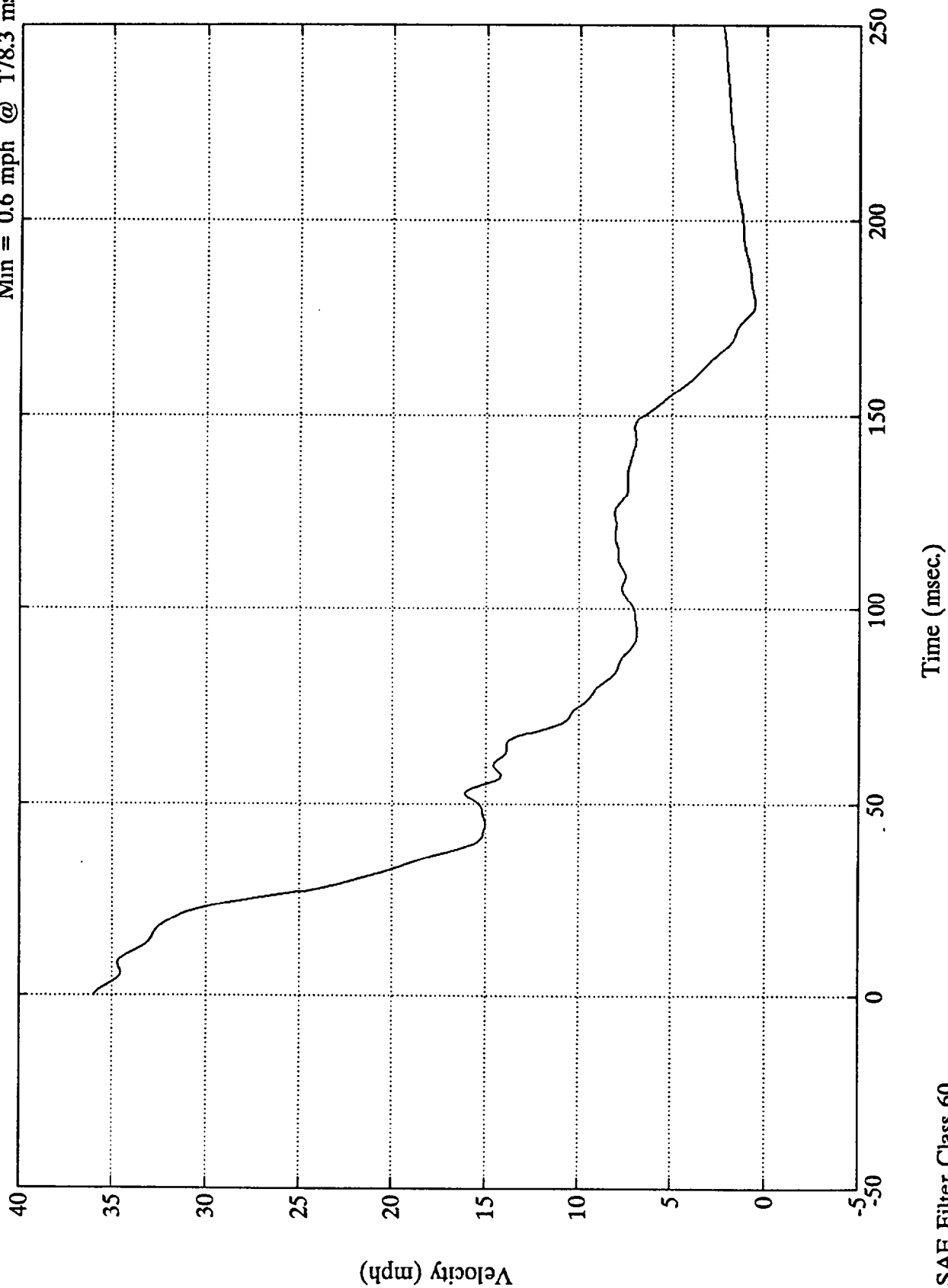
SAE Filter Class 60

B-40

7883-4

V-to-V Test #4

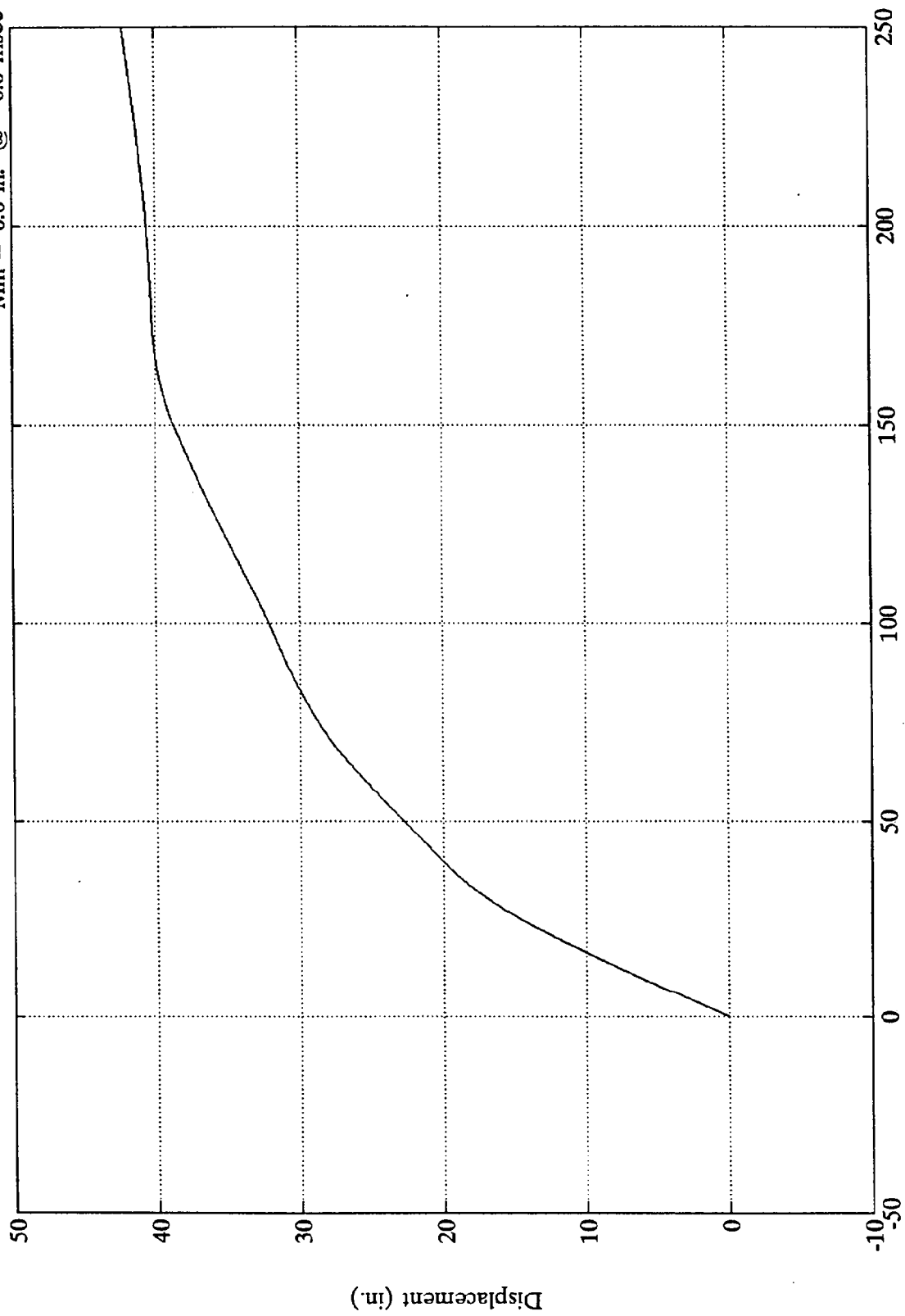
Veh. 1 Toe Pan (X)
Max = 36.0 mph @ -0.0 msec
Min = 0.6 mph @ 178.3 msec



V-to-V Test #4

Veh. 1 Toe Pan (X)

Max = 42.4 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



Time (msec.)

SAE Filter Class 60

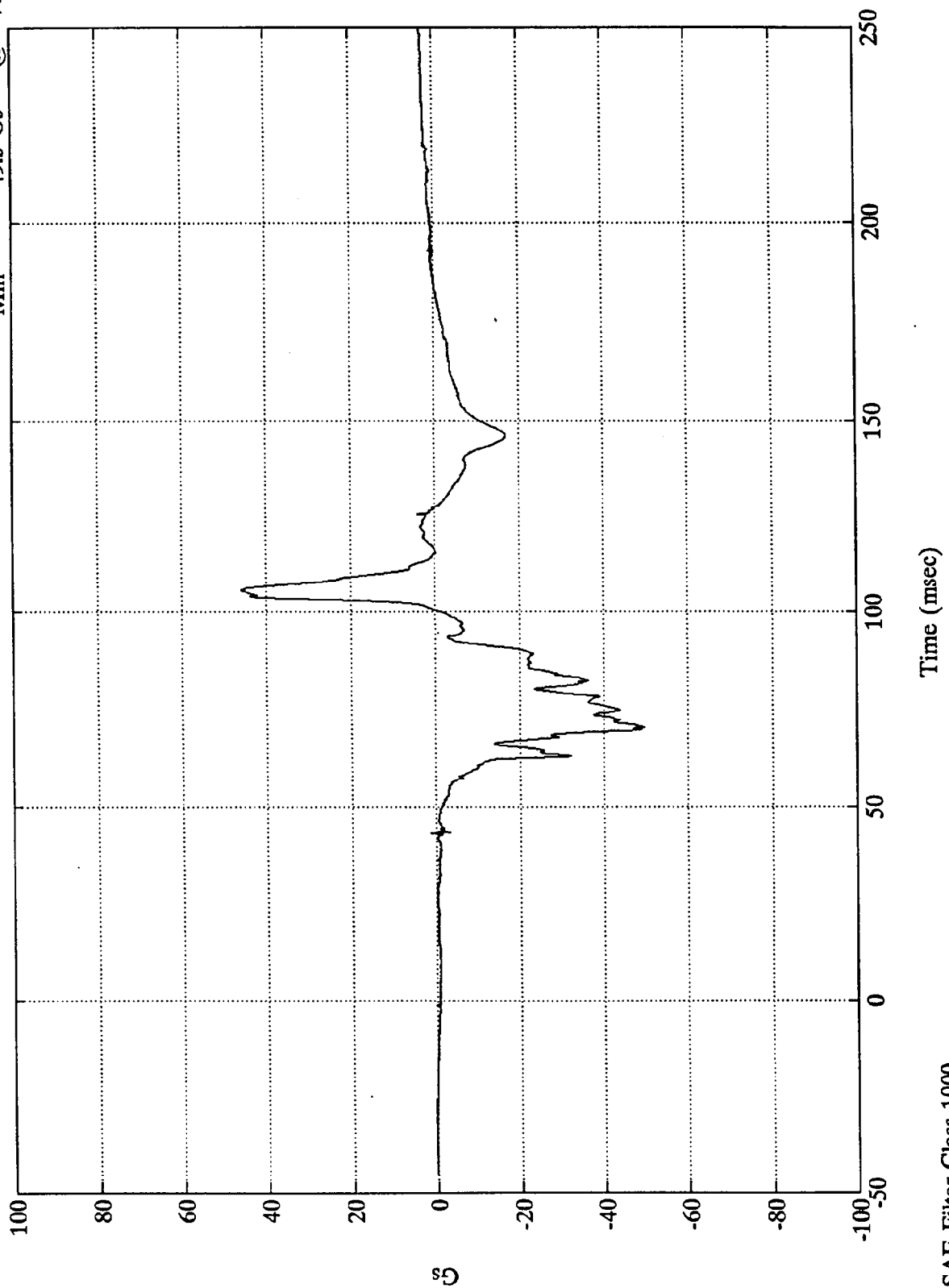
TEST NO. Y42-4-1041
DUMMY DATA

CLASS	FILTER CHANNEL
Head Accelerations	1000
Chest Accelerations	180
Femur Forces	600
Torso Belt	60
Chest Displacement	180
Neck Forces	1000
Neck Moments	600
Tibia Forces, Moments	600

V-to-V Test #4

Veh. 1 Head X

Max = 45.8 Gs @ 105.84 msec
Min = -49.5 Gs @ 70.79 msec



gs

Time (msec)

SAE Filter Class 1000

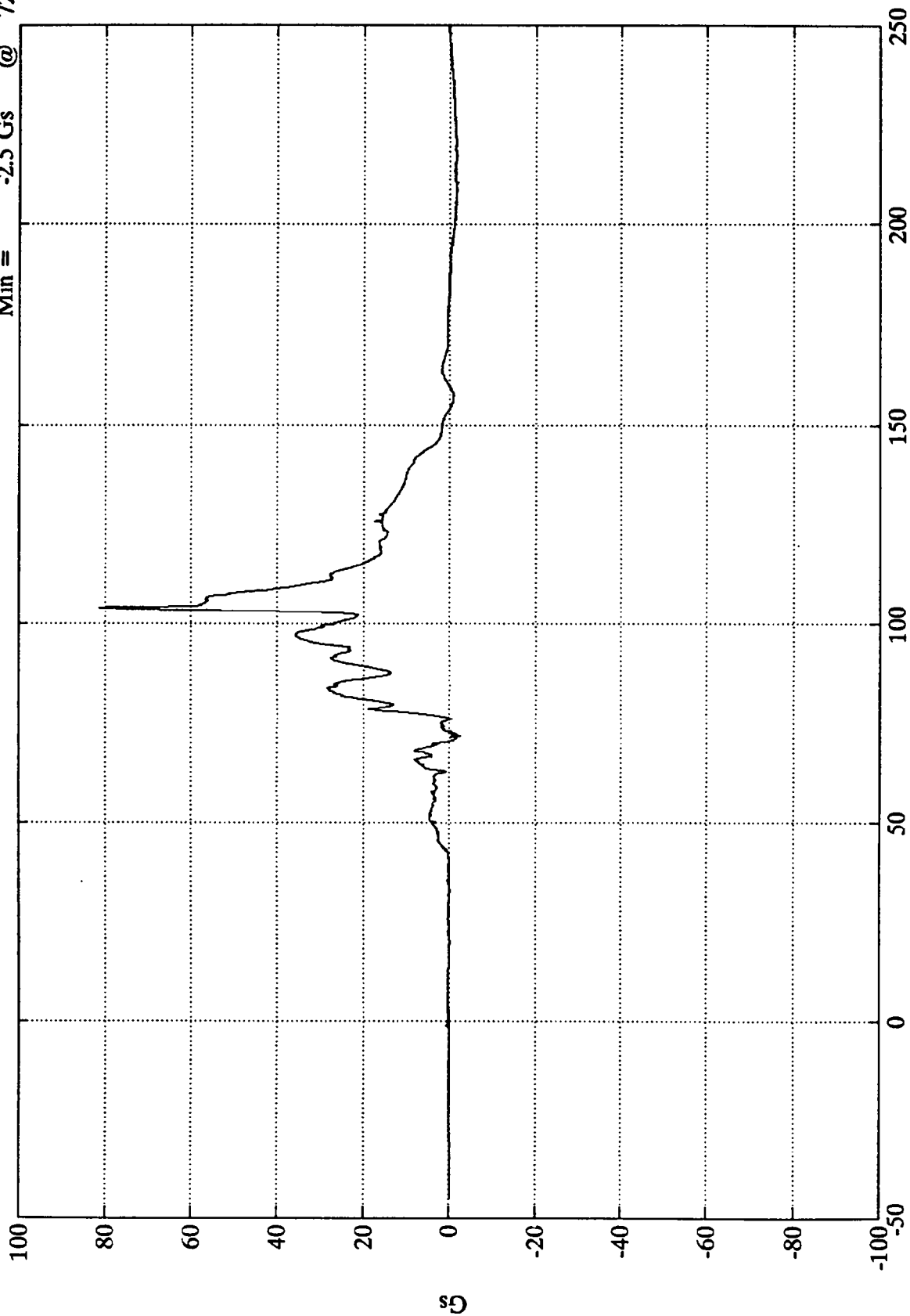
B-44

7883-4

V-to-V Test #4

Veh. 1 Head Y

Max = 81.2 Gs @ 104.04 msec
Min = -2.5 Gs @ 72.00 msec



Time (msec)

SAE Filter Class 1000

Gs

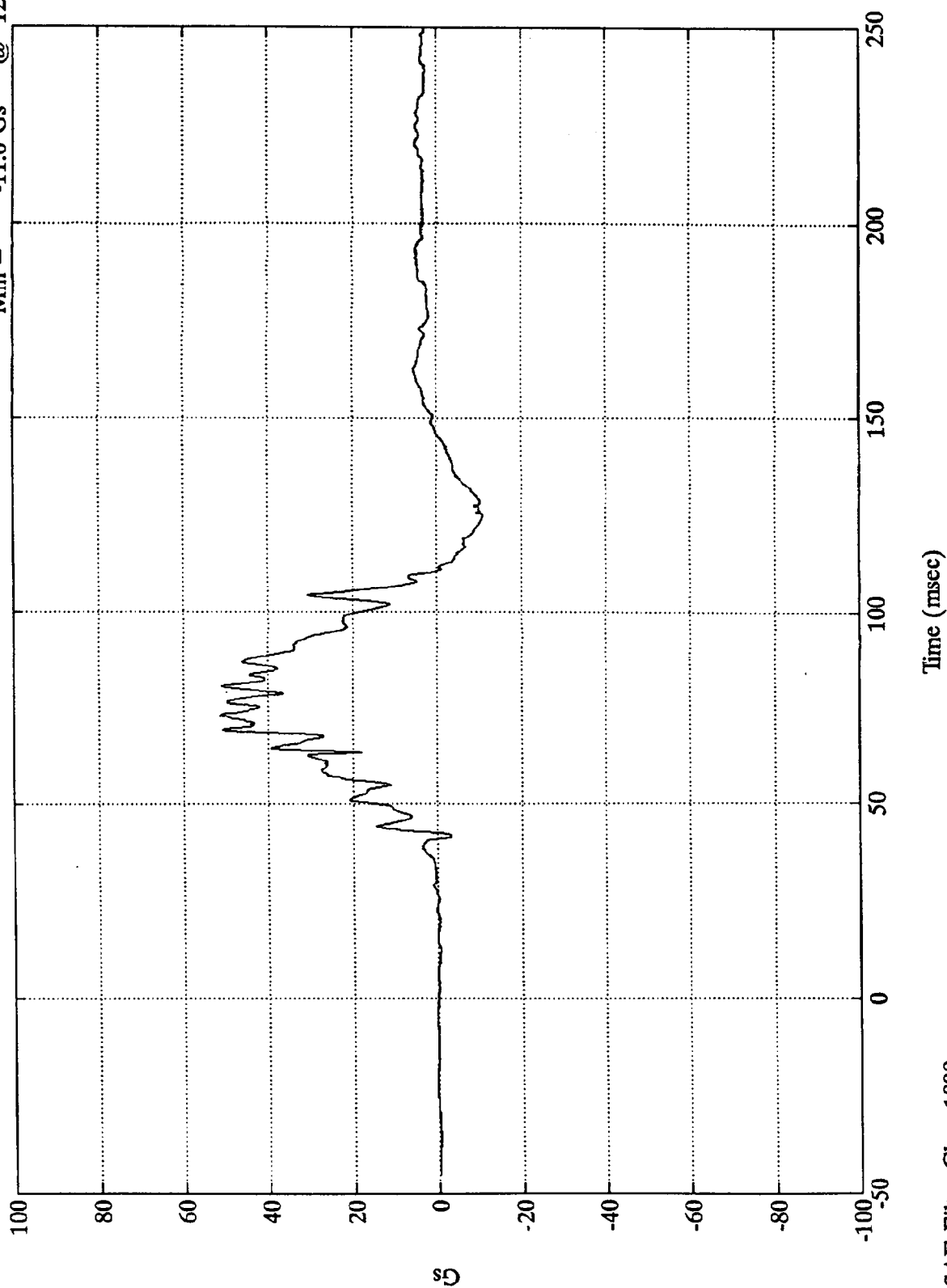
B-45

7883-4

V-to-V Test #4

Max = 51.4 Gs @ 72.72 msec
Min = -11.0 Gs @ 124.68 msec

Veh. 1 Head Z



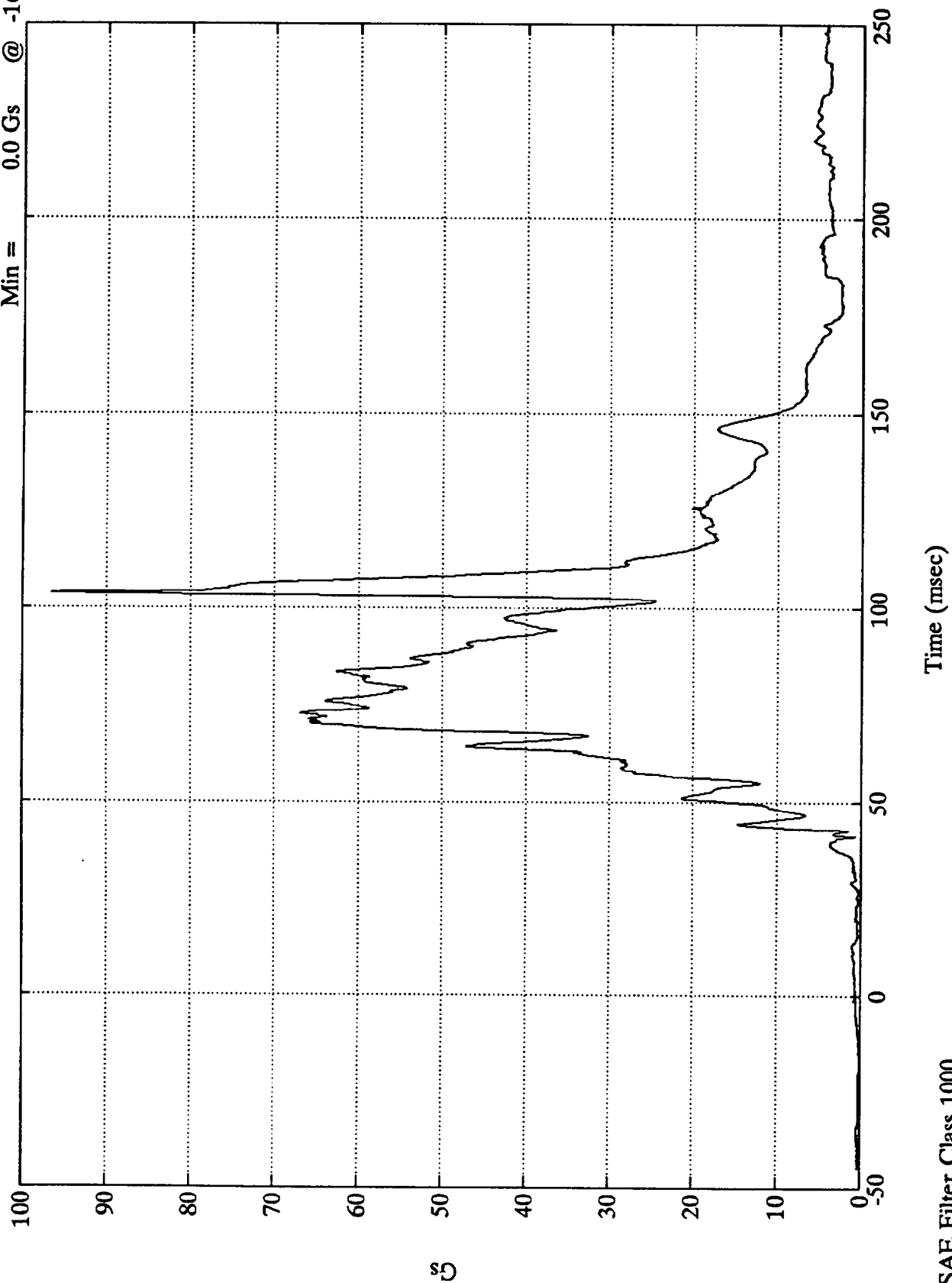
B-46

7883-4

SAE Filter Class 1000

V-to-V Test #4

Veh. 1 Head Resultant
Max = 96.5 Gs @ 104.04 msec
Min = 0.0 Gs @ -16.08 msec



Gs

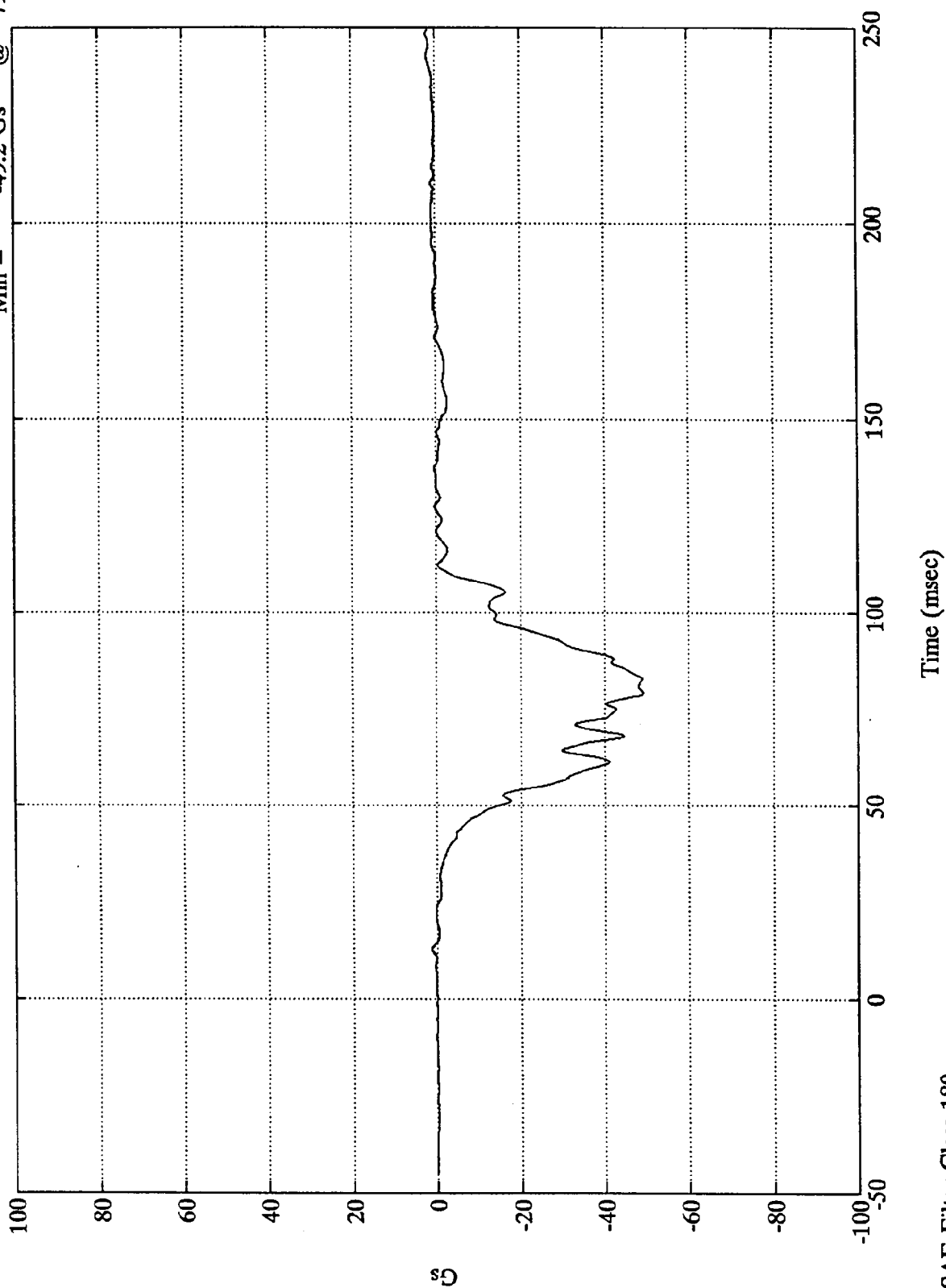
B-47

7883-4

SAE Filter Class 1000

V-to-V Test #4

Veh. 1 Chest X
Max = 2.2 Gs @ 248.27 msec
Min = -49.2 Gs @ 79.19 msec



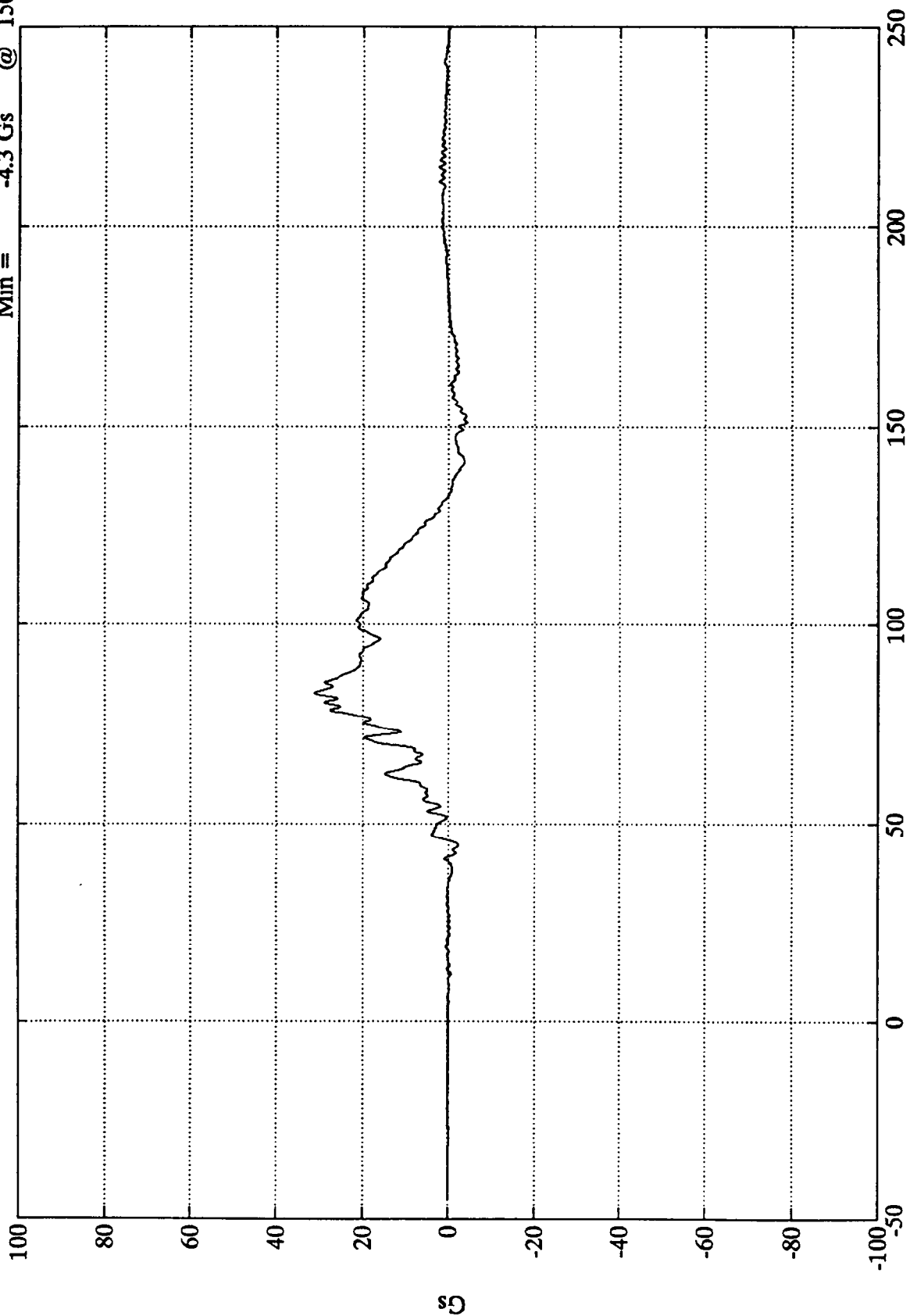
Gs

Time (msec)

SAE Filter Class 180

V-to-V Test #4

Veh. 1 Chest Y
Max = 31.3 Gs @ 82.91 msec
Min = -4.3 Gs @ 150.95 msec



Time (msec)

SAE Filter Class 180

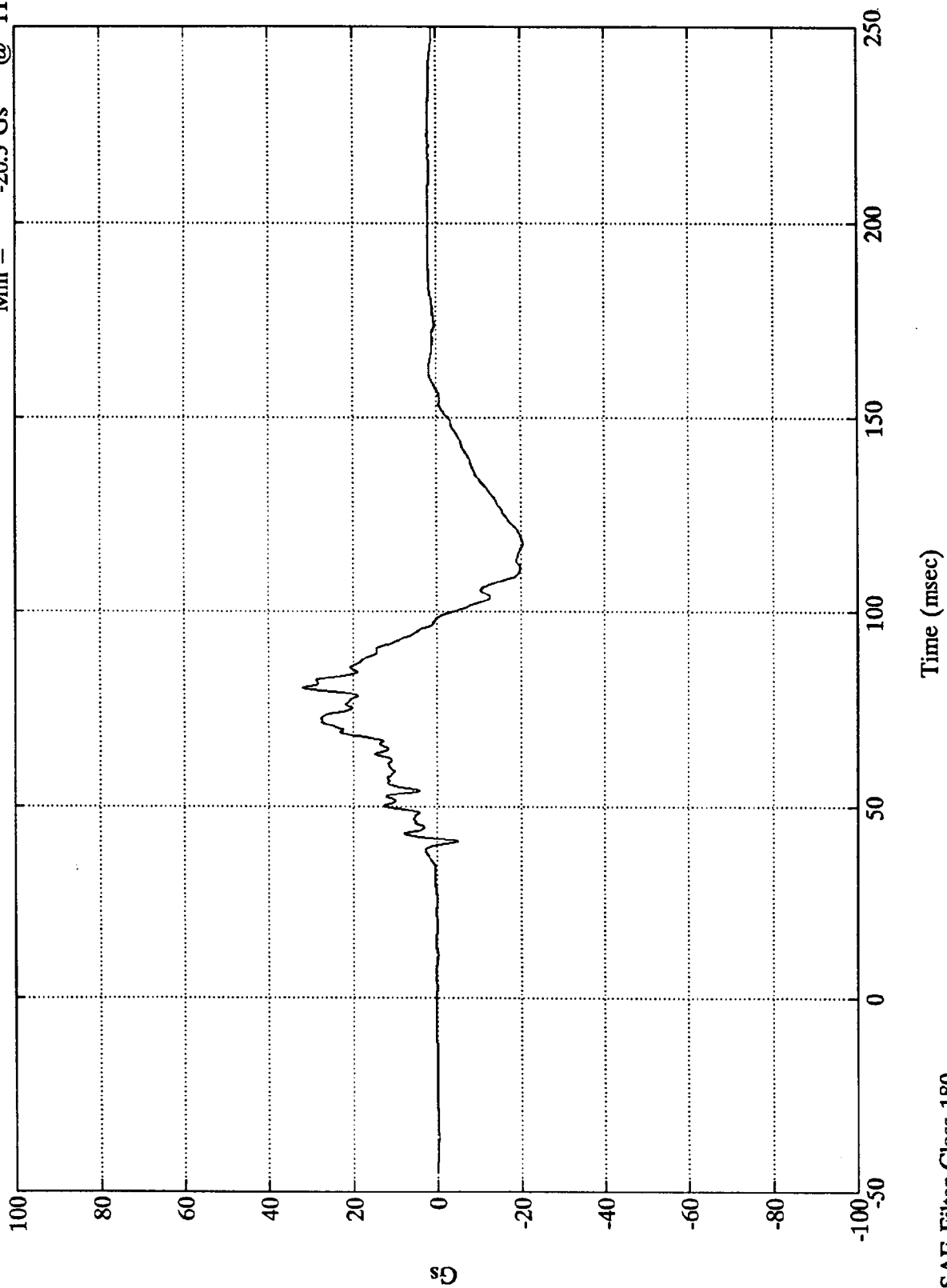
50

B-49

7883-4

V-to-V Test #4

Veh. 1 Chest Z
Max = 31.9 Gs @ 80.52 msec
Min = -20.5 Gs @ 117.96 msec



sg

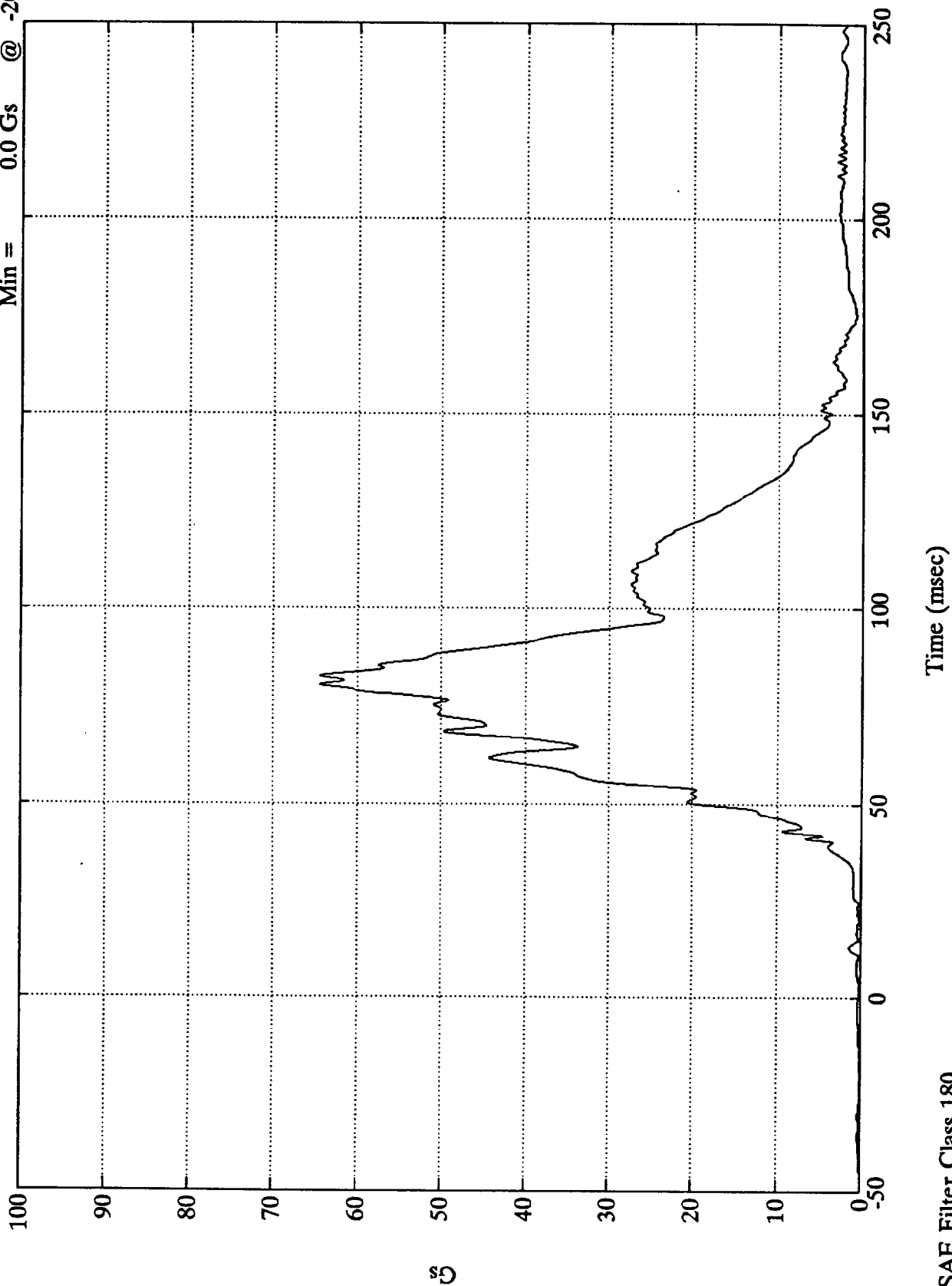
B-50

7883-4

SAE Filter Class 180

V-to-V Test #4

Veh. 1 Chest Resultant
Max = 64.4 Gs @ 80.52 msec
Min = 0.0 Gs @ -20.40 msec



50

B-51

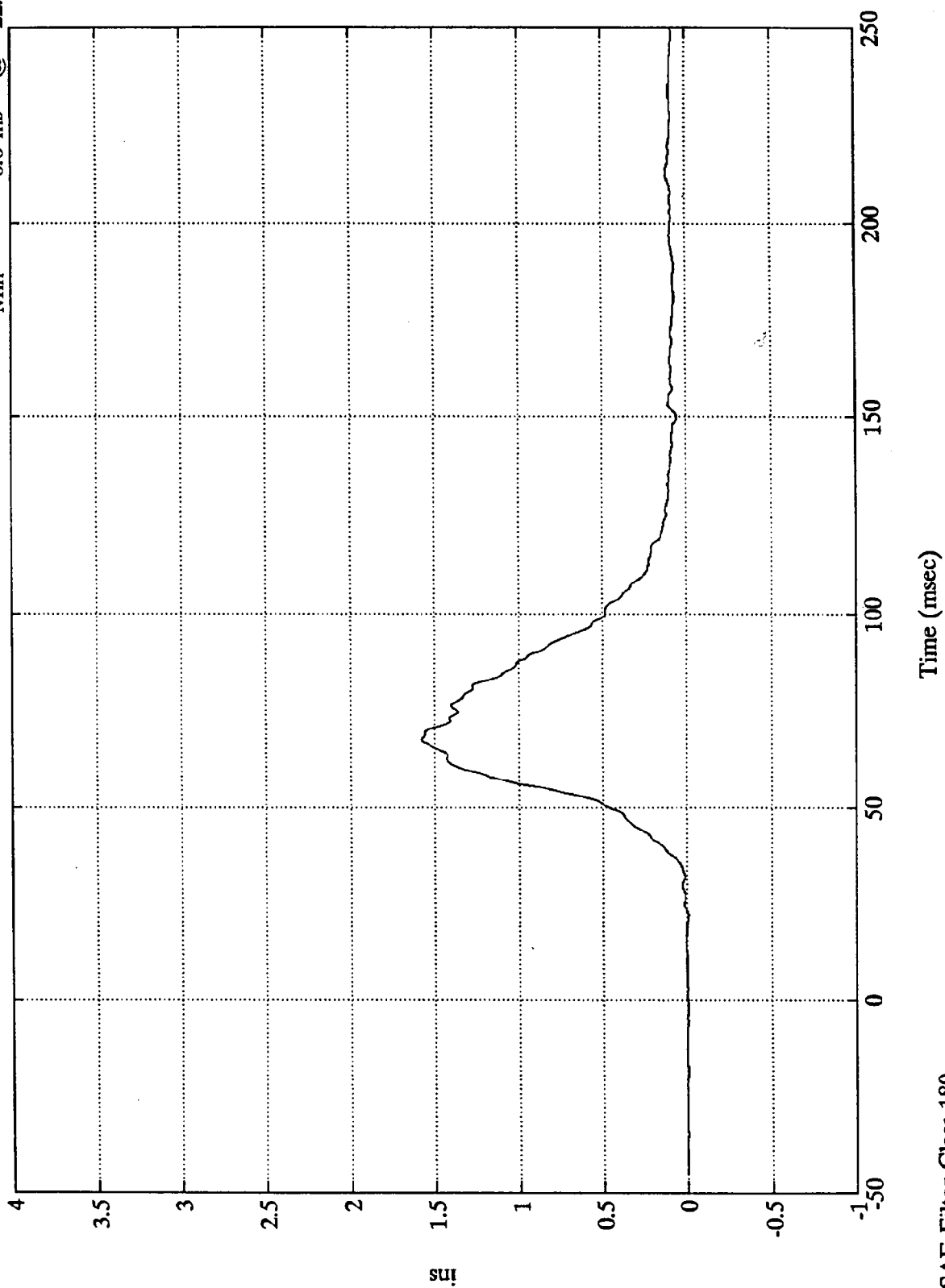
7883-4

SAE Filter Class 180

V-to-V Test #4

Veh. 1 Chest Displacement

Max = 1.5 ins @ 67.44 msec
Min = -0.0 ins @ 22.31 msec



in.

B-52

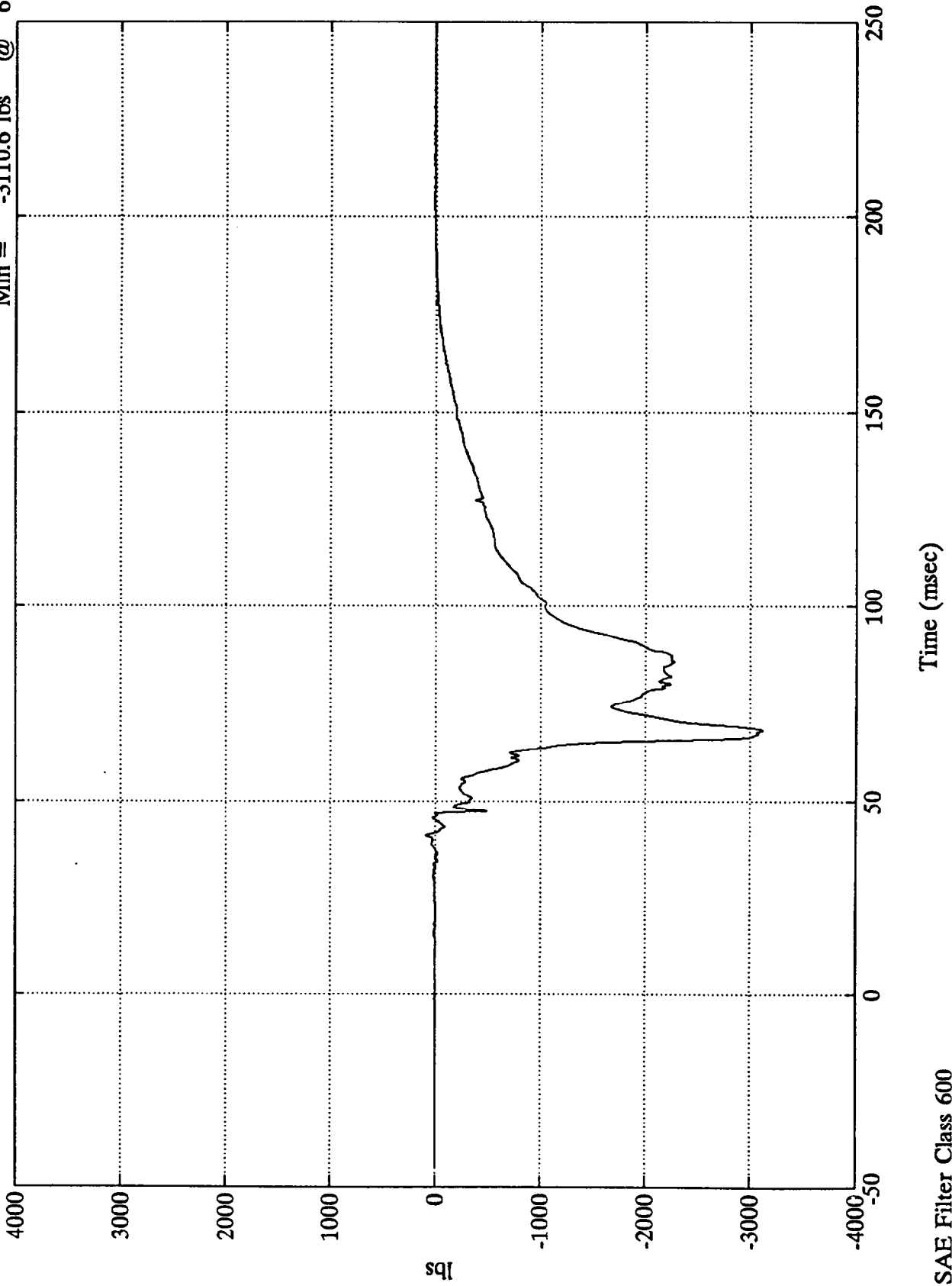
7883-4

SAE Filter Class 180

V-to-V Test #4

Veh. 1 Left Femur

Max = 88.4 lbs @ 41.04 msec
Min = -3110.6 lbs @ 68.16 msec



sq[

B-53

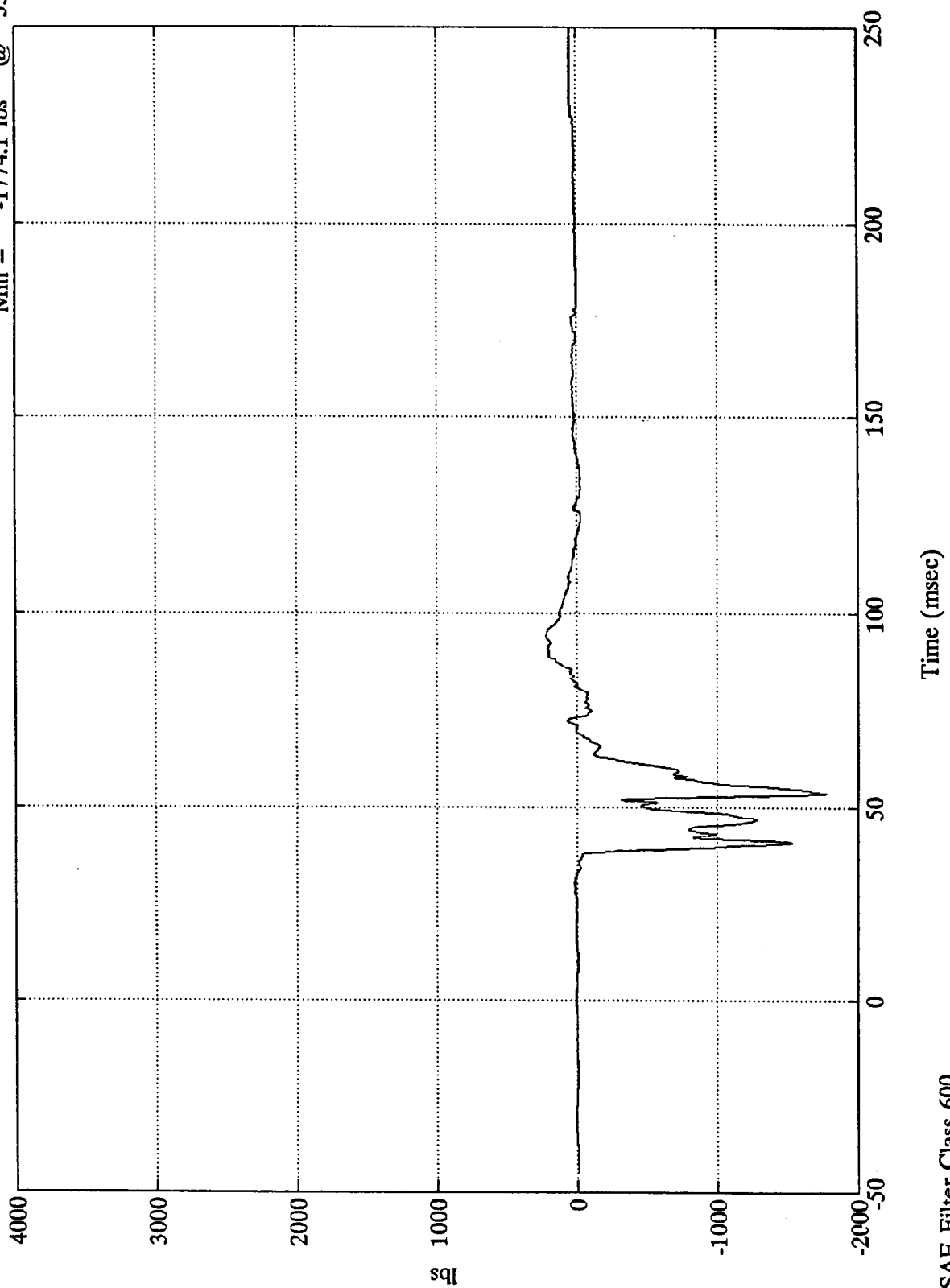
7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 1 Right Femur

Max = 219.9 lbs @ 94.08 msec
Min = -1774.1 lbs @ 53.63 msec



lbs

Time (msec)

SAE Filter Class 600

V-to-V Test #4

Veh. 1 Torso Belt L.C.

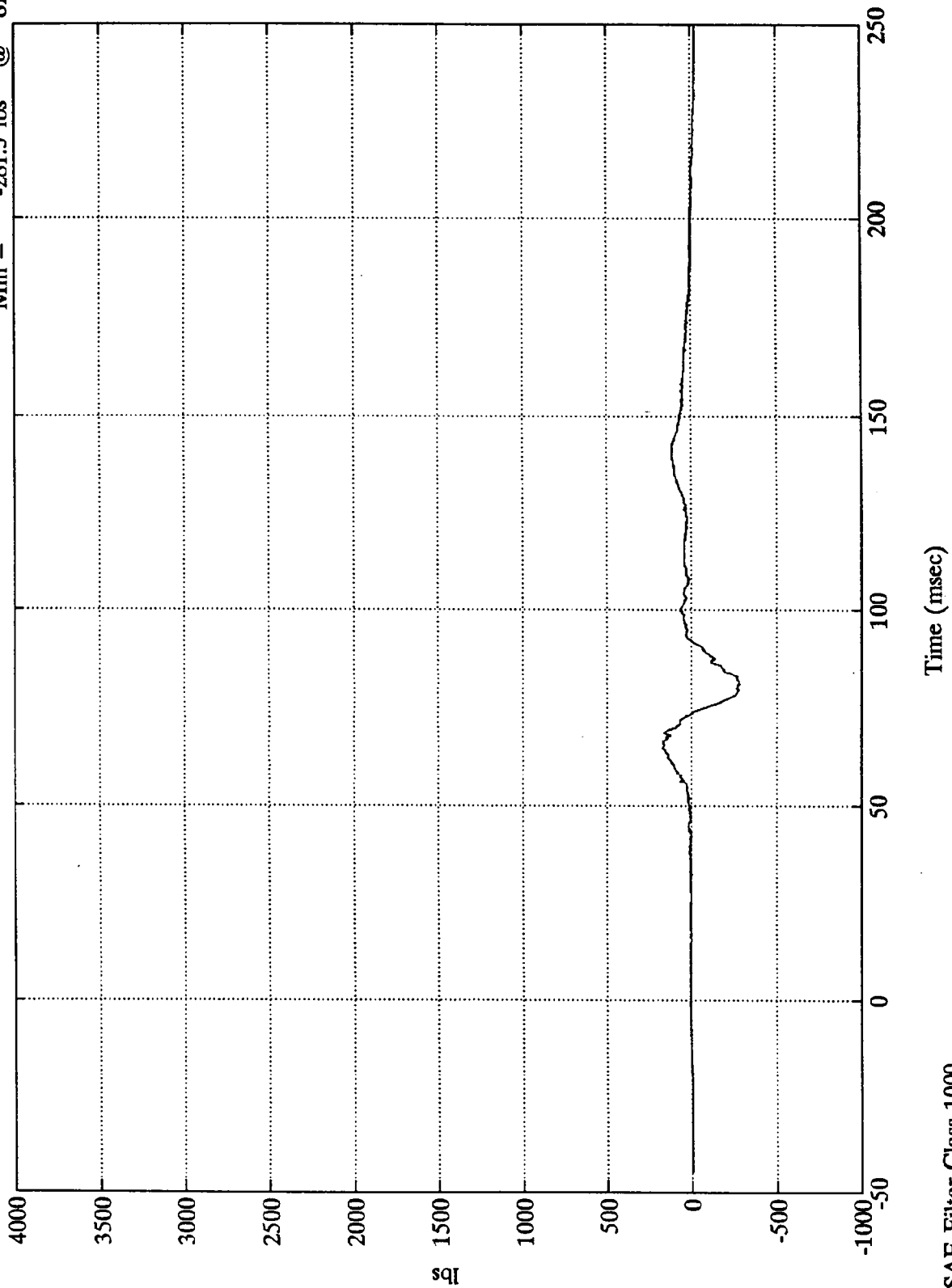
Max = 1659.4 lbs @ 70.91 msec
Min = -6.6 lbs @ 22.19 msec



V-to-V Test #4

Veh. 1 Upper Neck Fx

Max = 170.4 lbs @ 66.60 msec
Min = -281.5 lbs @ 81.12 msec



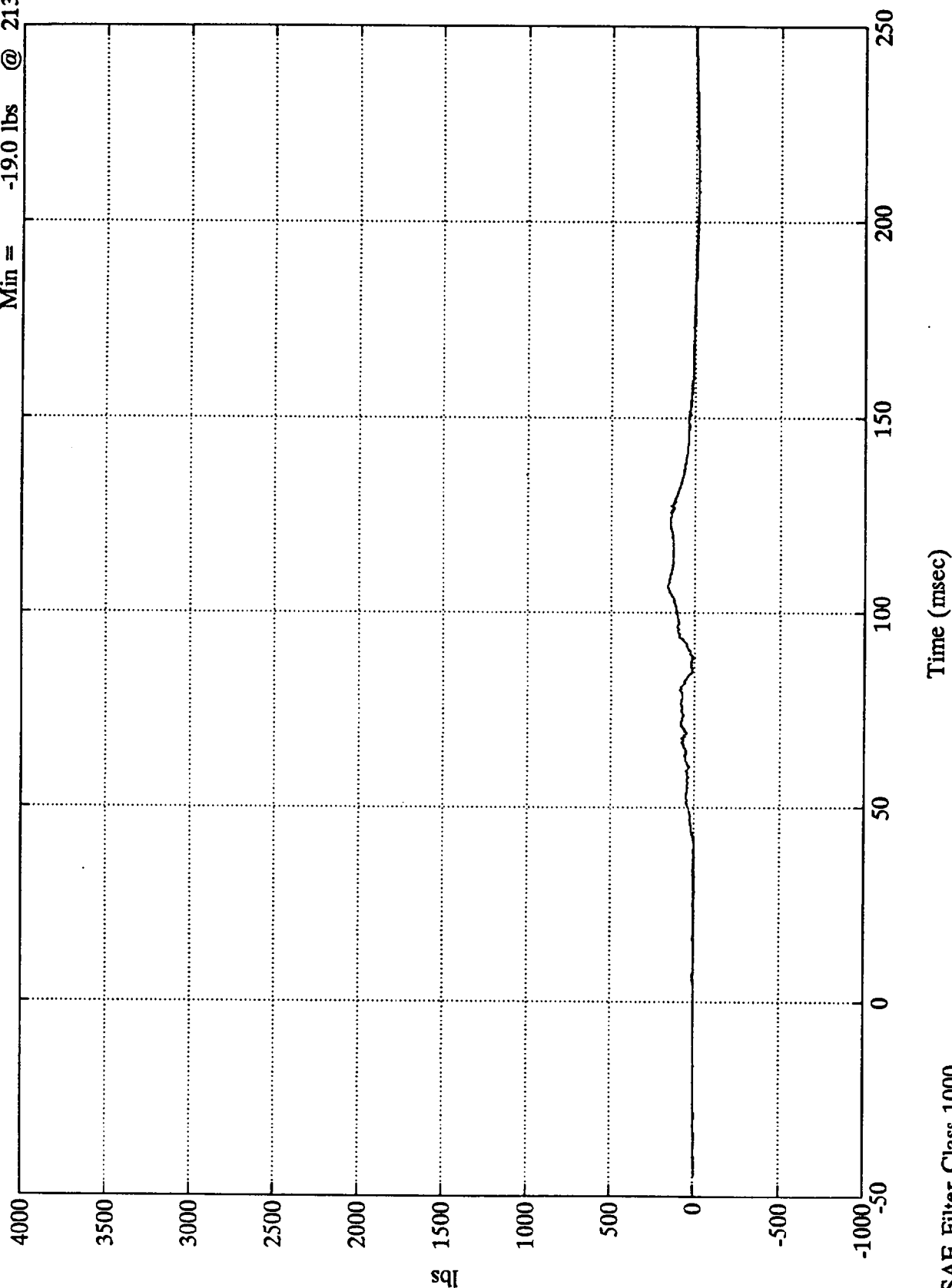
sqi

SAE Filter Class 1000

V-to-V Test #4

Veh. 1 Upper Neck Fy

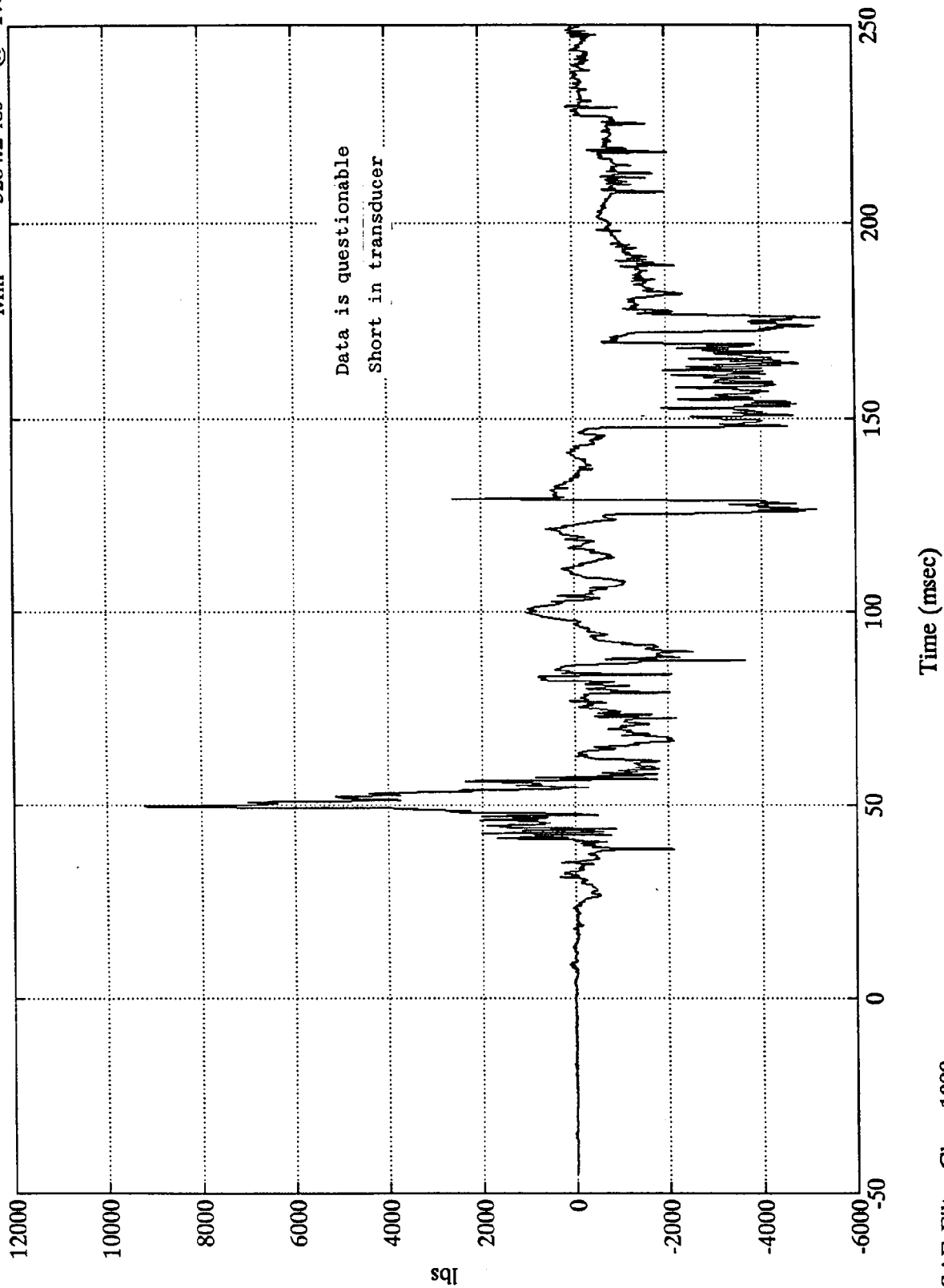
Max = 163.9 lbs @ 107.16 msec
Min = -19.0 lbs @ 213.12 msec



V-to-V Test #4

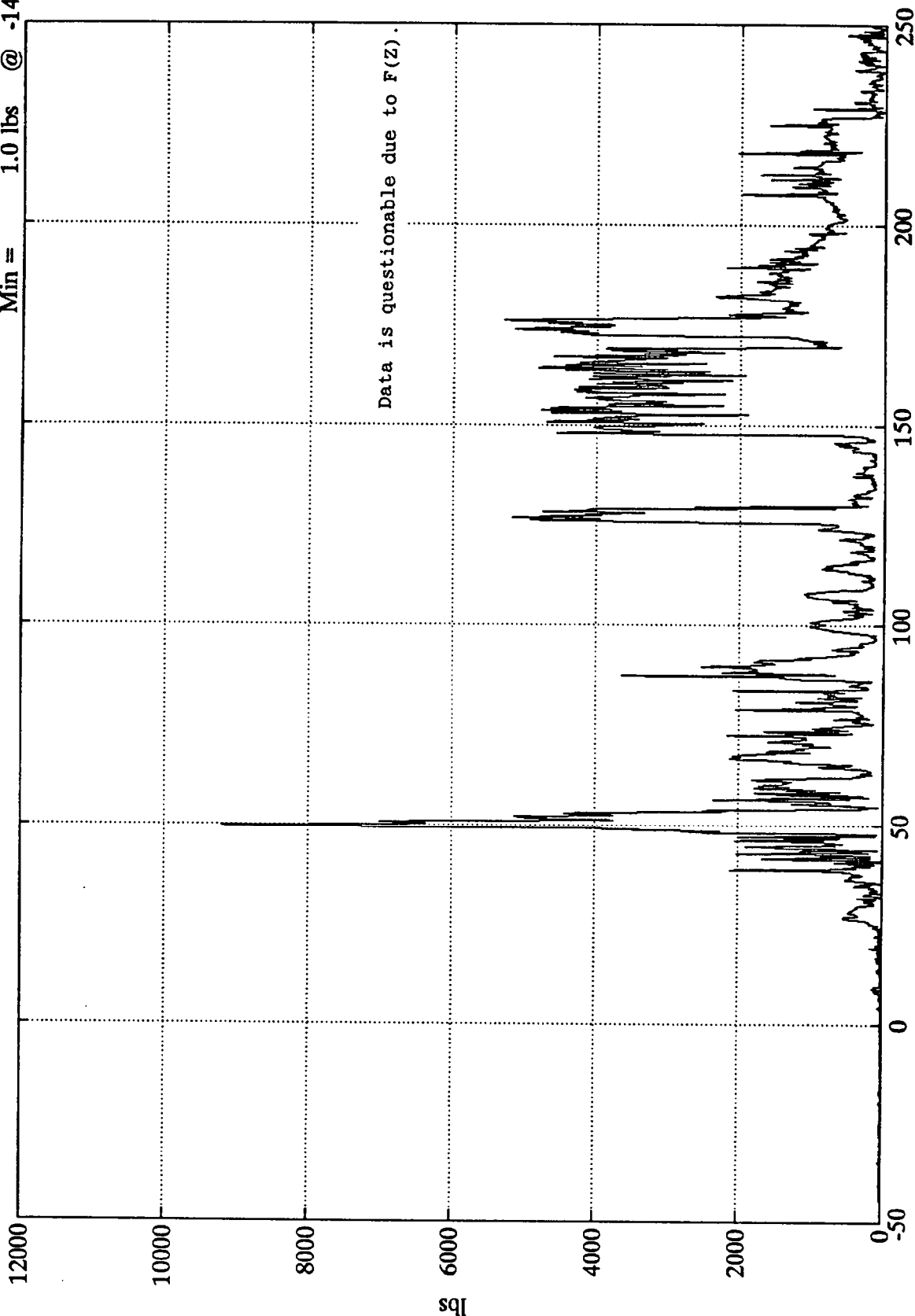
Veh. 1 Upper Neck Fz

Max = 9214.1 lbs @ 49.79 msec
Min = -5284.2 lbs @ 175.80 msec



V-to-V Test #4

Veh. 1 Neck Force Res. Max = 9214.1 lbs @ 49.79 msec
Min = 1.0 lbs @ -14.28 msec



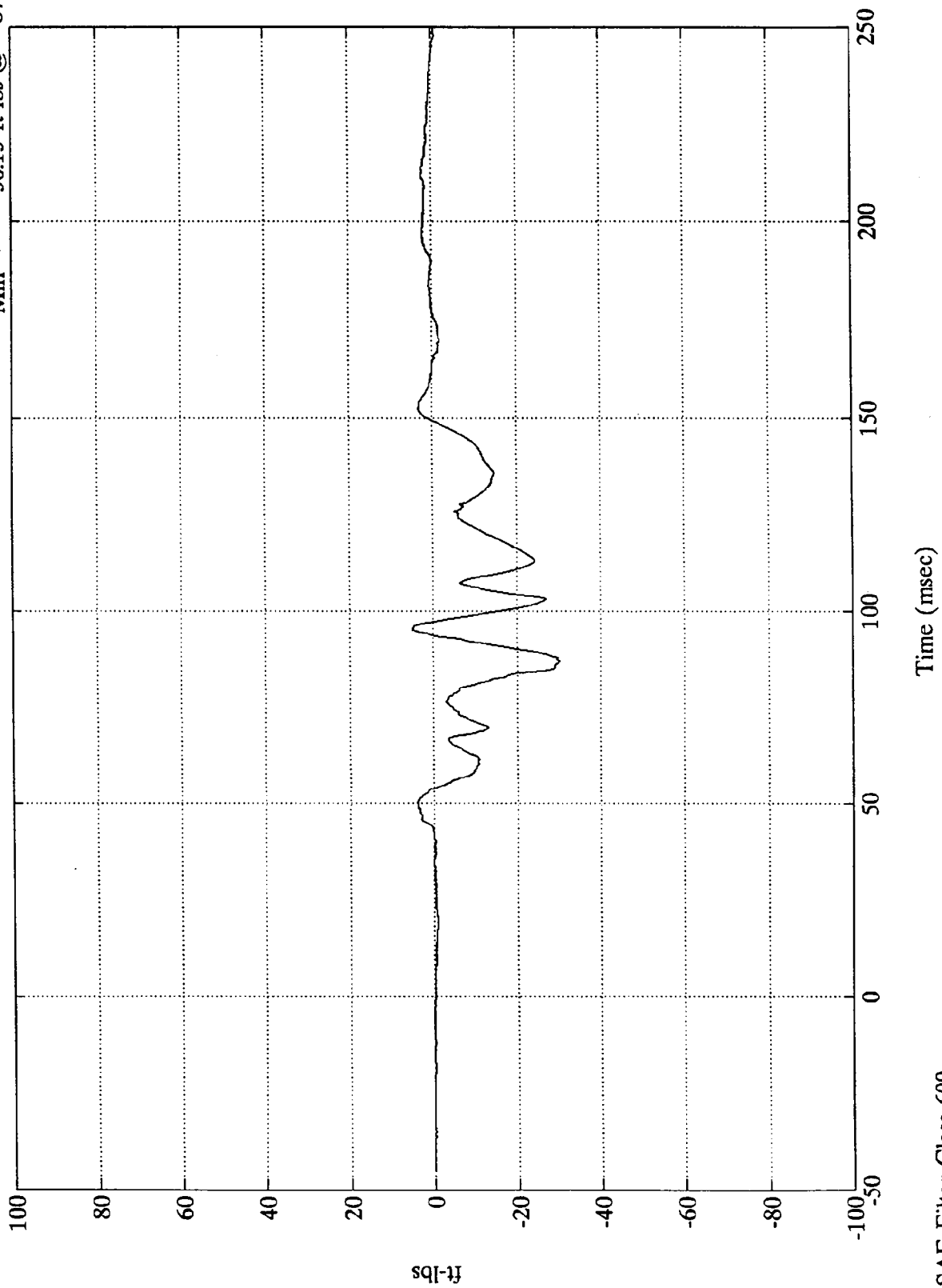
Time (msec)

SAE Filter Class 1000

V-to-V Test #4

Veh. 1 Upper Neck Mx

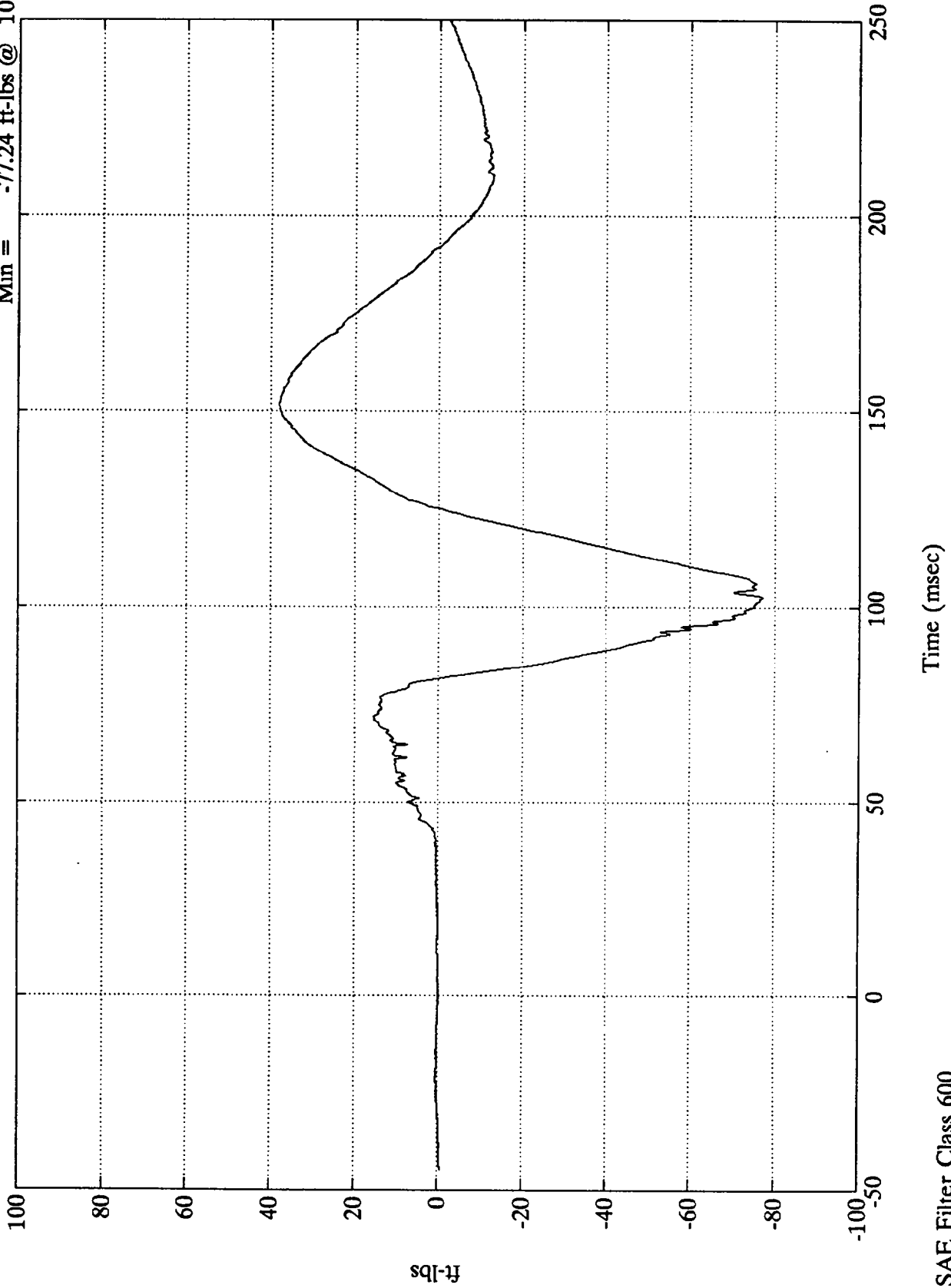
Max = 4.98 ft-lbs @ 95.52 msec
Min = -30.15 ft-lbs @ 87.24 msec



B-60

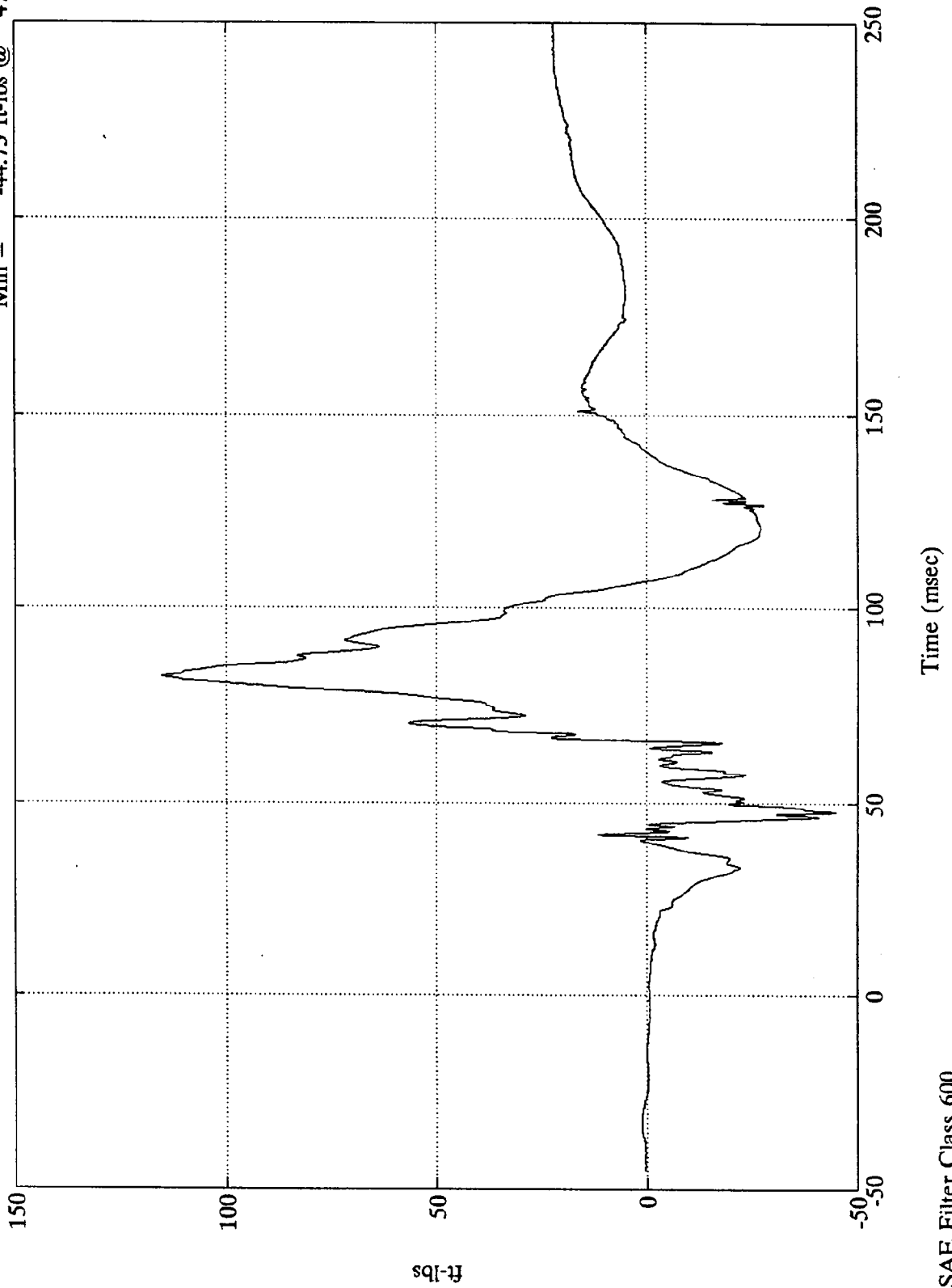
7883-4

SAE Filter Class 600



V-to-V Test #4

Veh. 1 Lt U Tibia Mx
Max = 115.32 ft-lbs @ 82.44 msec
Min = -44.73 ft-lbs @ 47.88 msec



sq[-1]

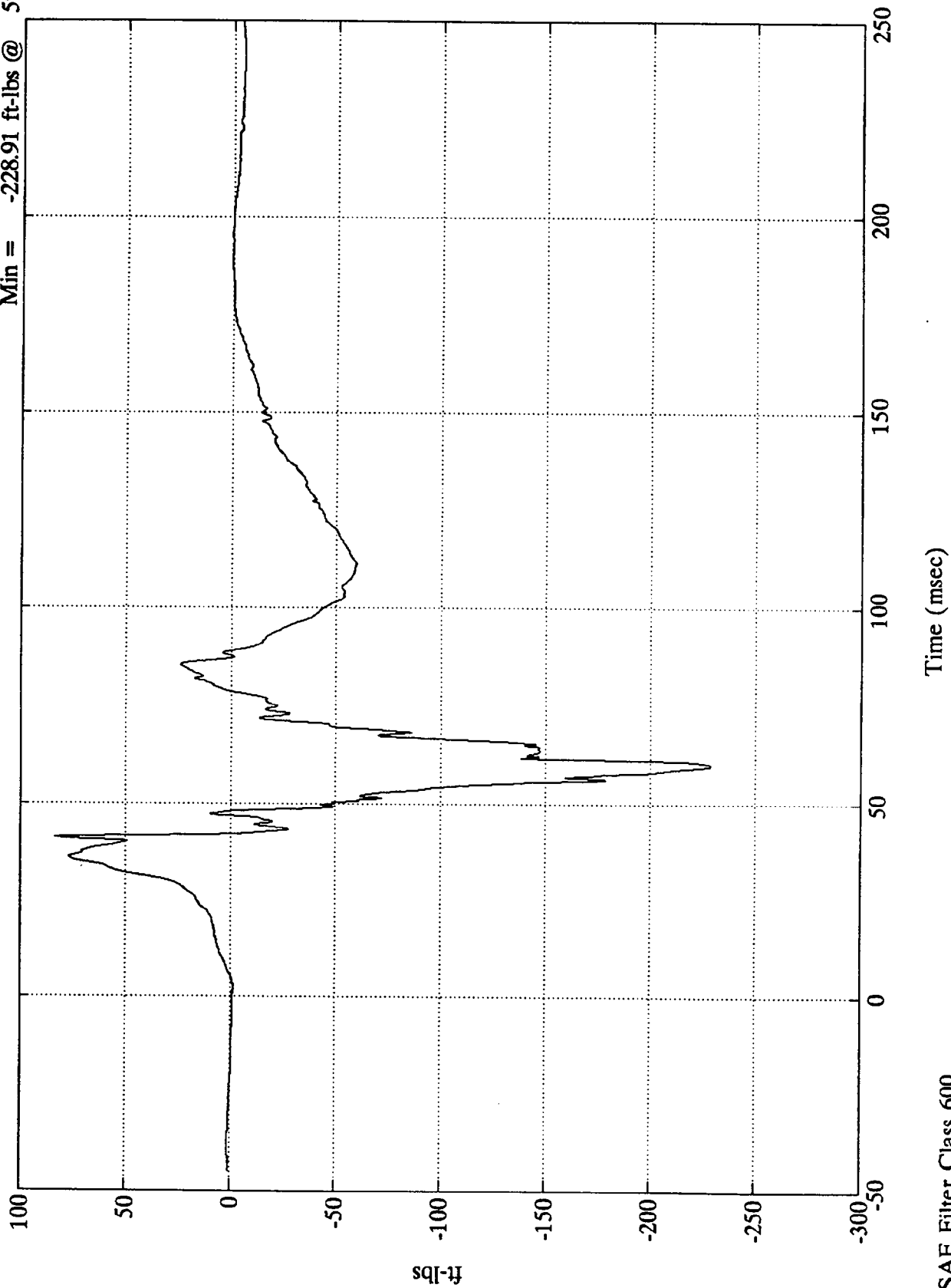
B-62

7883-4

SAE Filter Class 600

Veh. 1 Lt U Tibia My

Max = 83.45 ft-lbs @ 41.15 msec
Min = -228.91 ft-lbs @ 59.88 msec

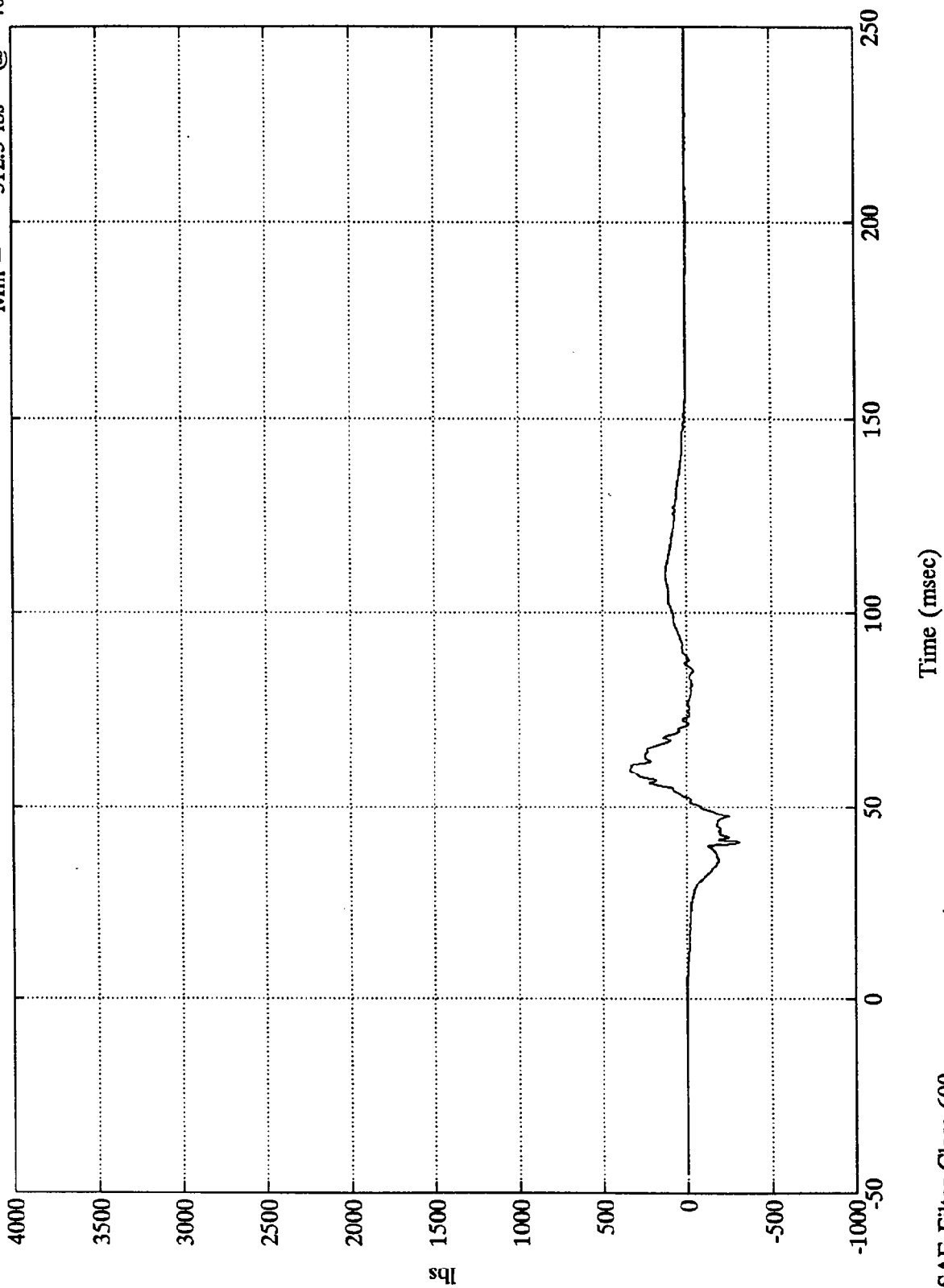


SAE Filter Class 600

V-to-V Test #4

Veh. 1 Lt L Tibia Fy

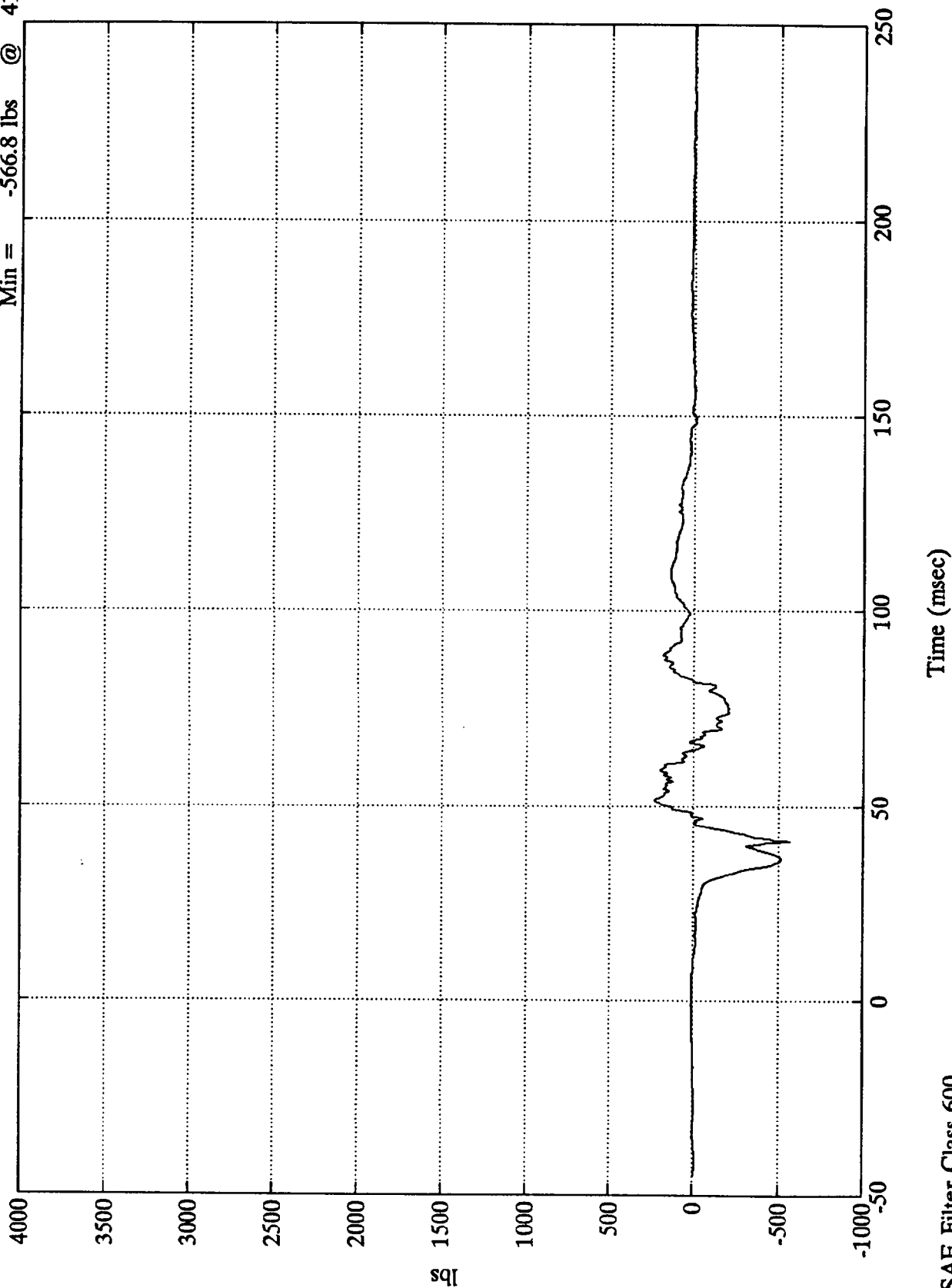
Max = 339.9 lbs @ 59.88 msec
Min = -312.3 lbs @ 40.80 msec



V-to-V Test #4

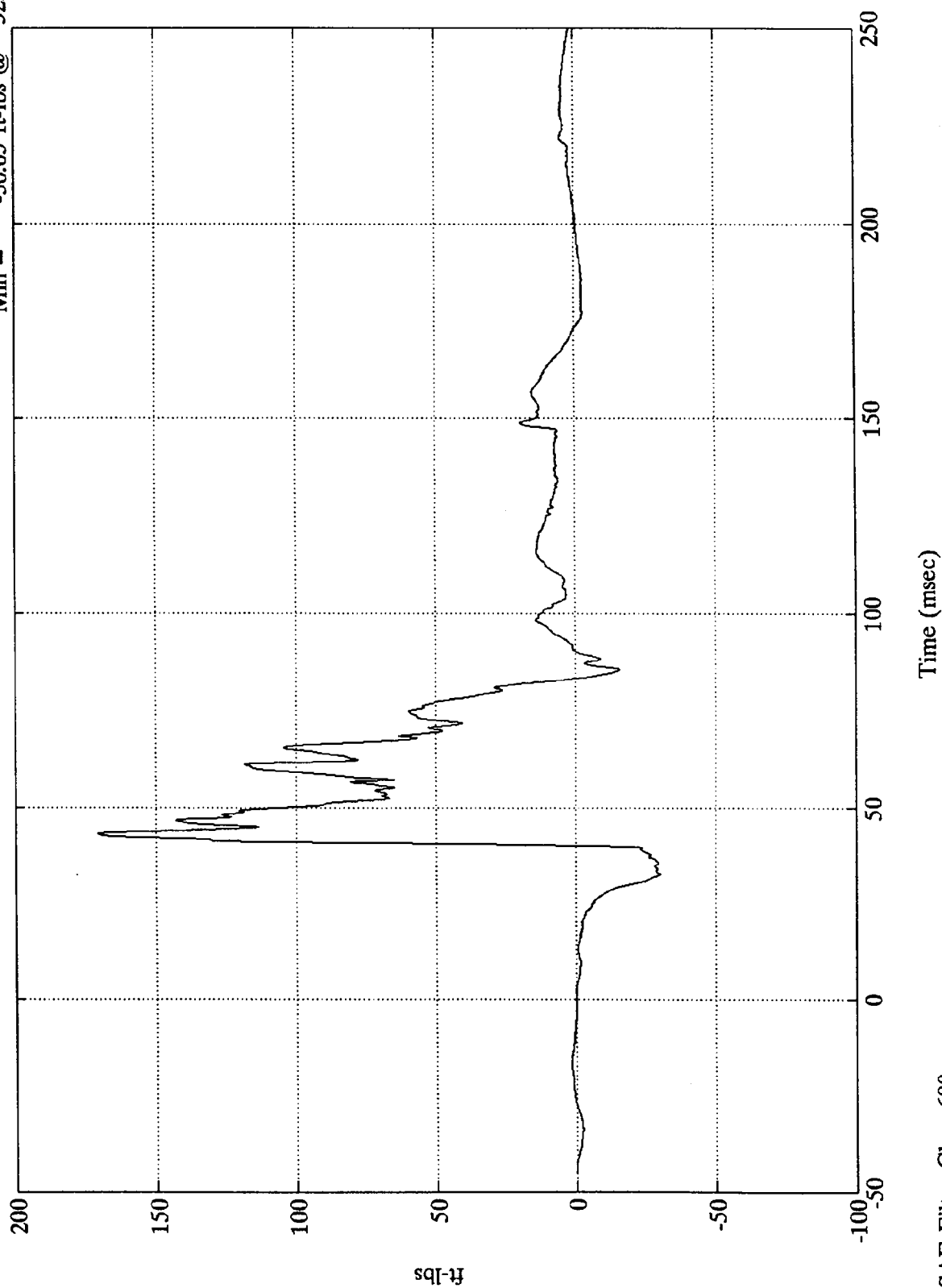
Veh. 1 Lt L Tibia Fz

Max = 233.5 lbs @ 51.84 msec
Min = -566.8 lbs @ 41.15 msec



V-to-V Test #4

Veh. 1 Lt L Tibia Mx
Max = 170.82 ft-lbs @ 43.43 msec
Min = -30.05 ft-lbs @ 32.88 msec



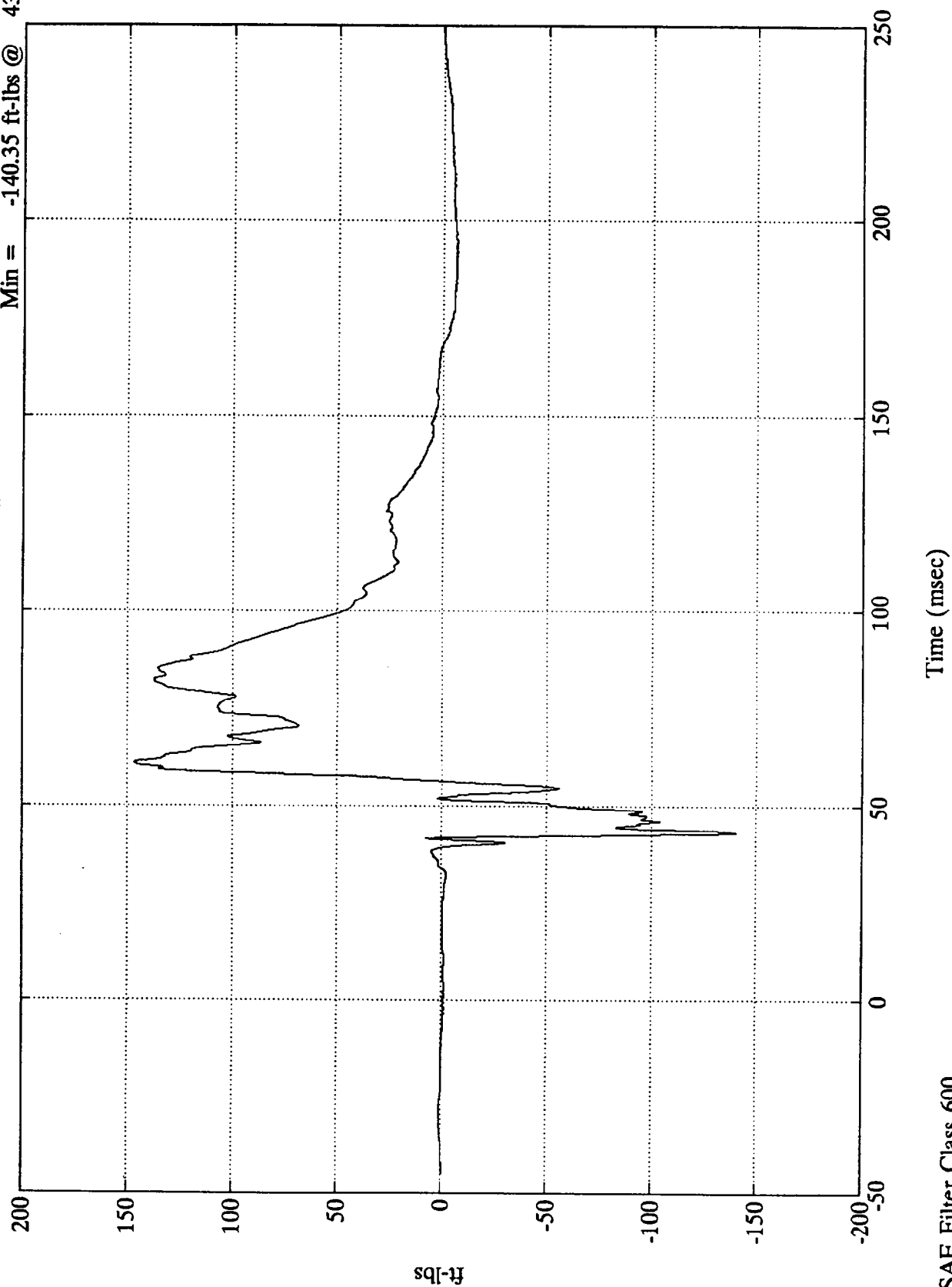
B-66

7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 1 Rt U Tibia Mx
Max = 146.27 ft-lbs @ 61.08 msec
Min = -140.35 ft-lbs @ 43.08 msec



B-67

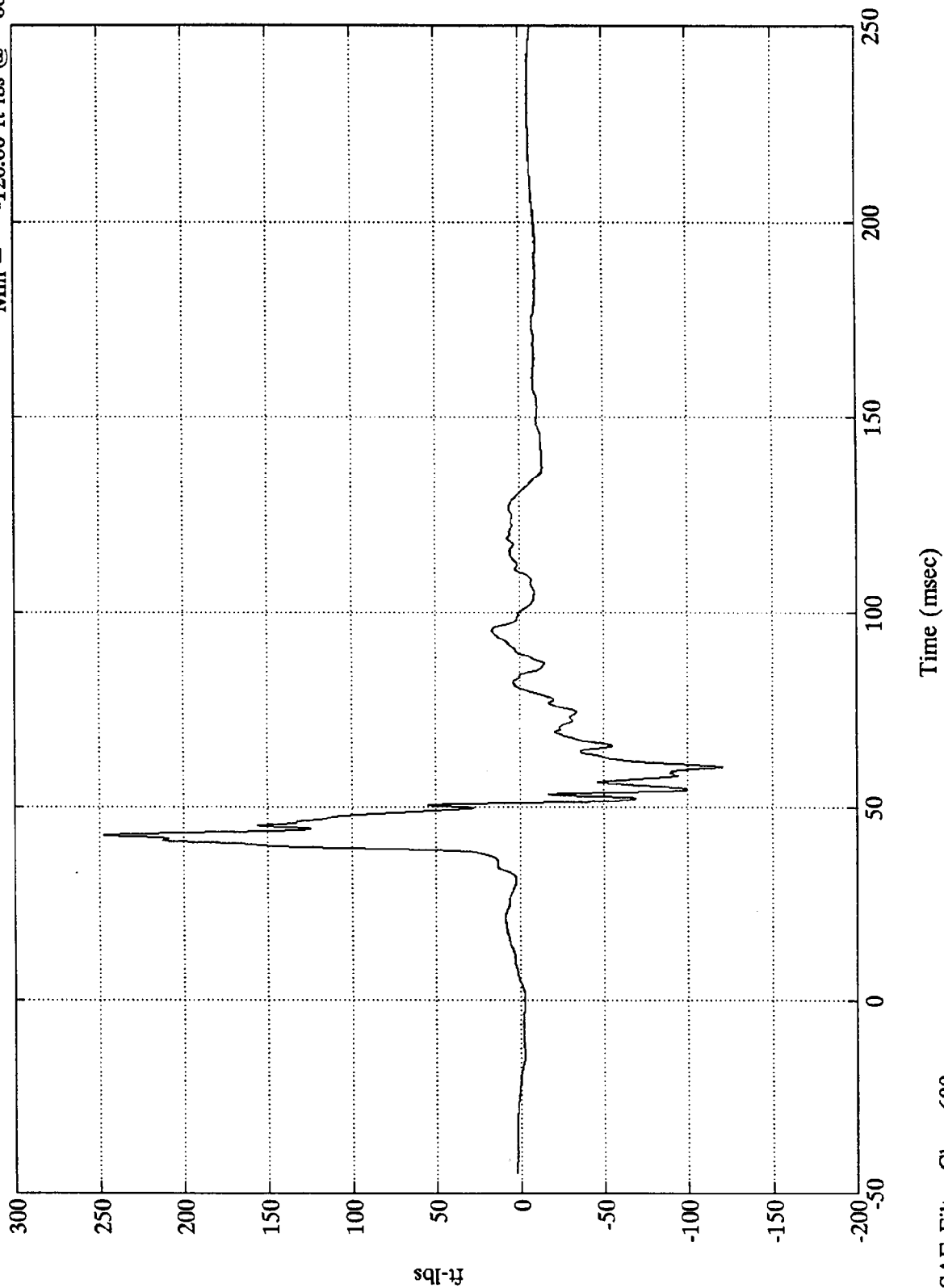
7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 1 Rt U Tibia My

Max = 247.05 ft-lbs @ 42.84 msec
Min = -120.60 ft-lbs @ 60.36 msec



B-68

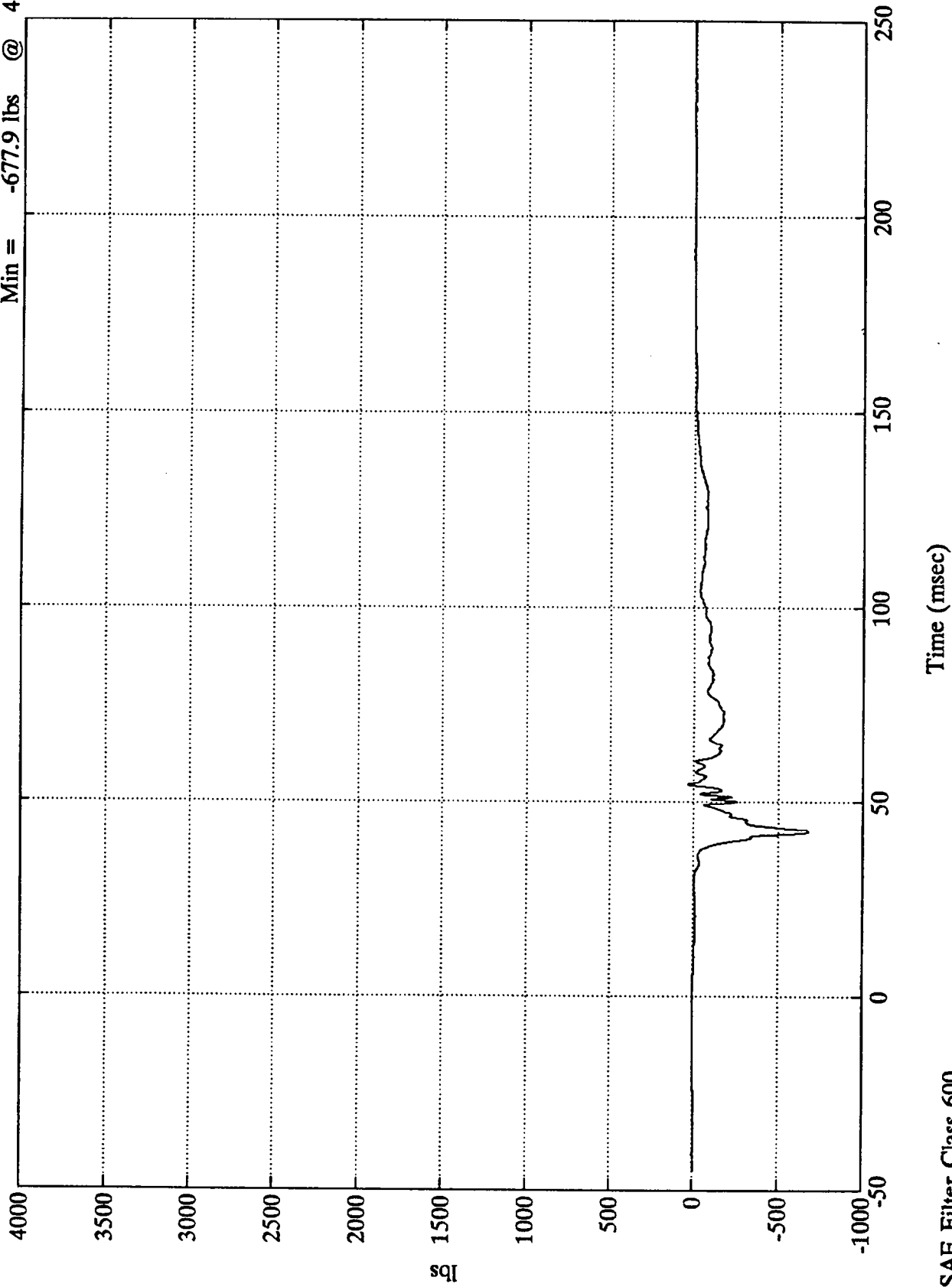
7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 1 Rt L Tibia Fy

Max = 36.3 lbs @ 54.47 msec
Min = -677.9 lbs @ 42.36 msec



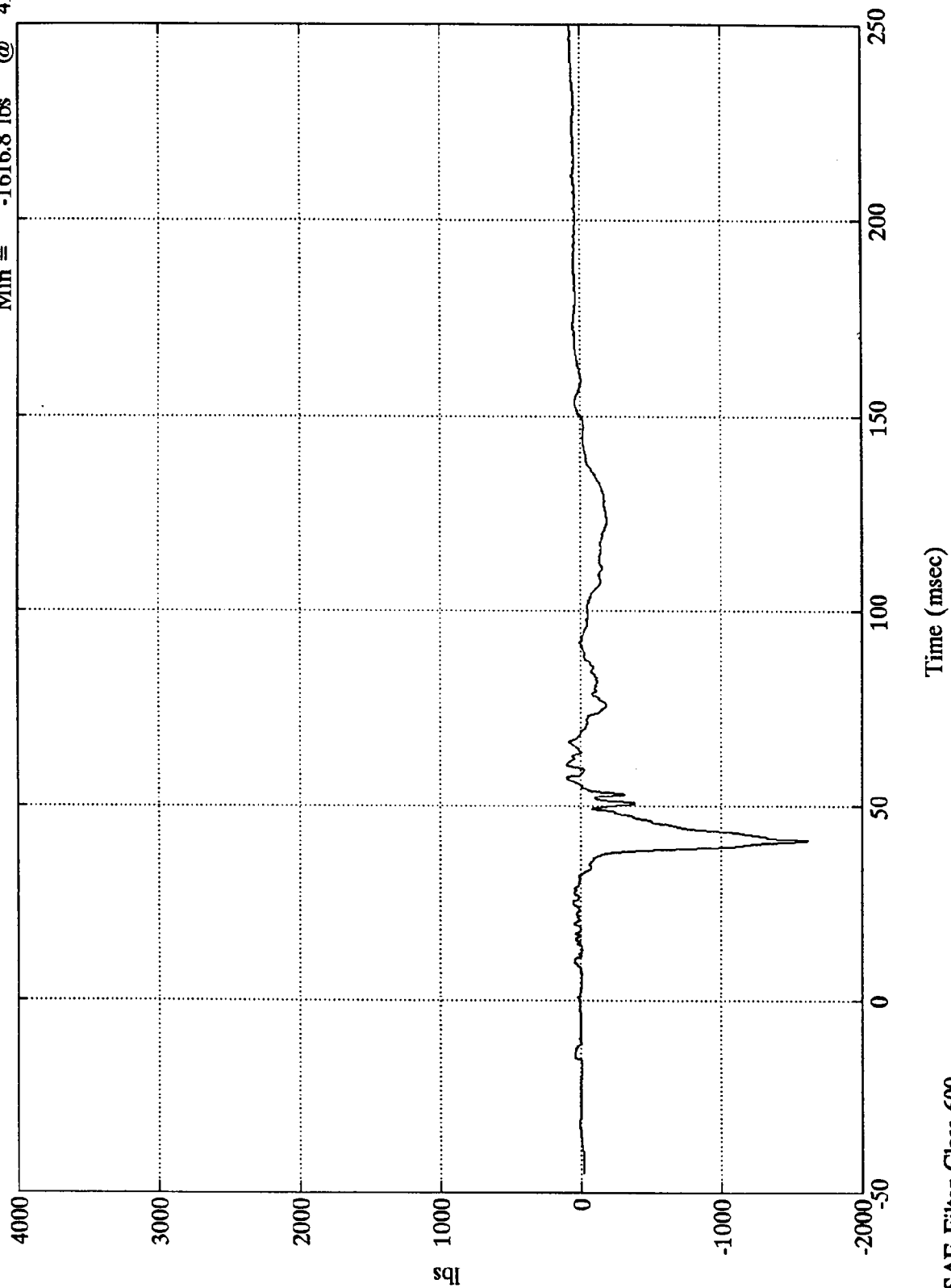
B-69

7883-4

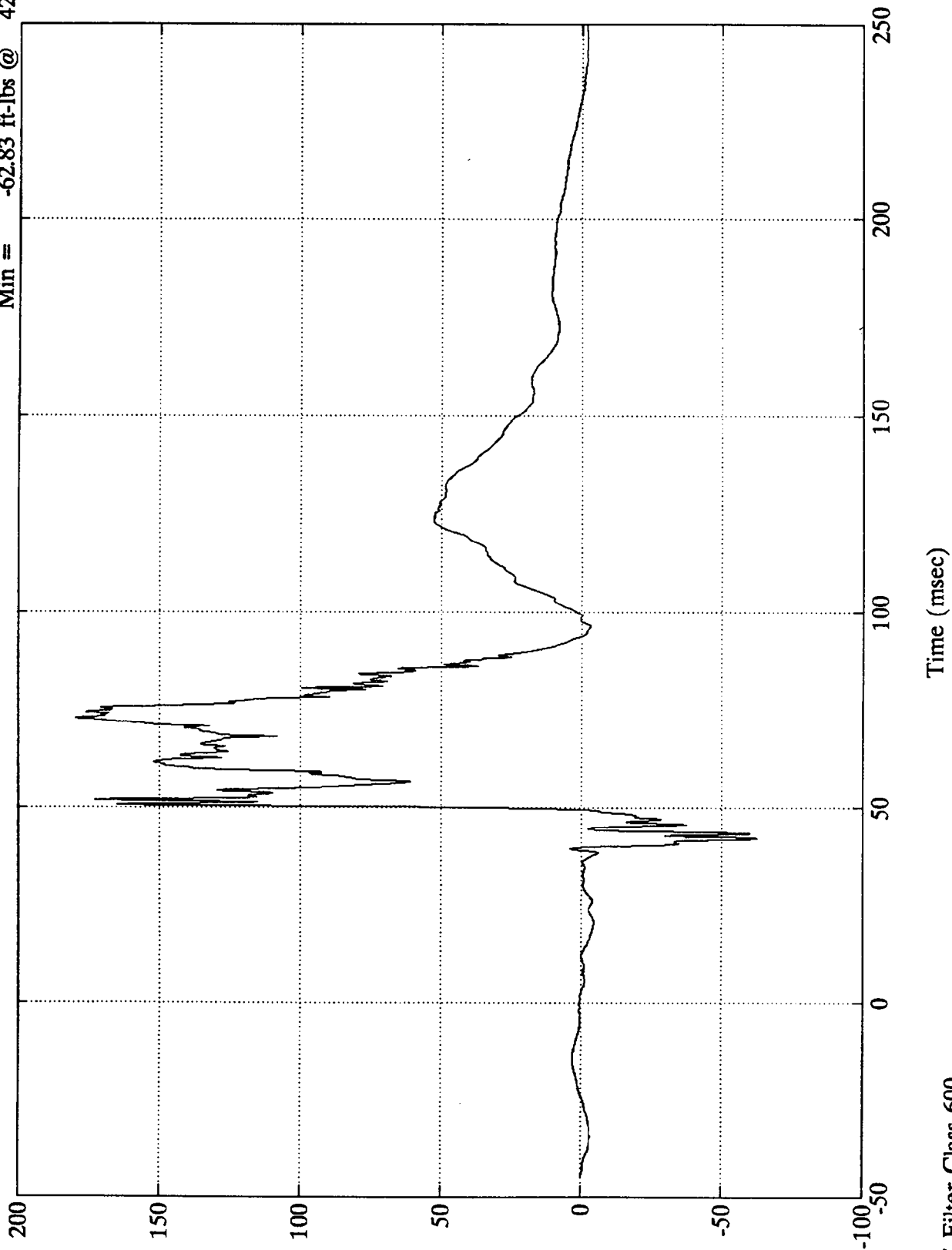
SAE Filter Class 600

V-to-V Test #4

Veh. 1 Rt L Tibia Fz
Max = 100.1 lbs @ 60.72 msec
Min = -1616.8 lbs @ 41.28 msec



SAE Filter Class 600



sq[-ij
B-71

7883-4

SAE Filter Class 600

VEHICLE TWO DATA

1991 FORD CROWN VICTORIA LTD 4-DOOR SEDAN

TEST NO. Y42-4-1041

VEHICLE DATA

FILTER CHANNEL CLASS

60

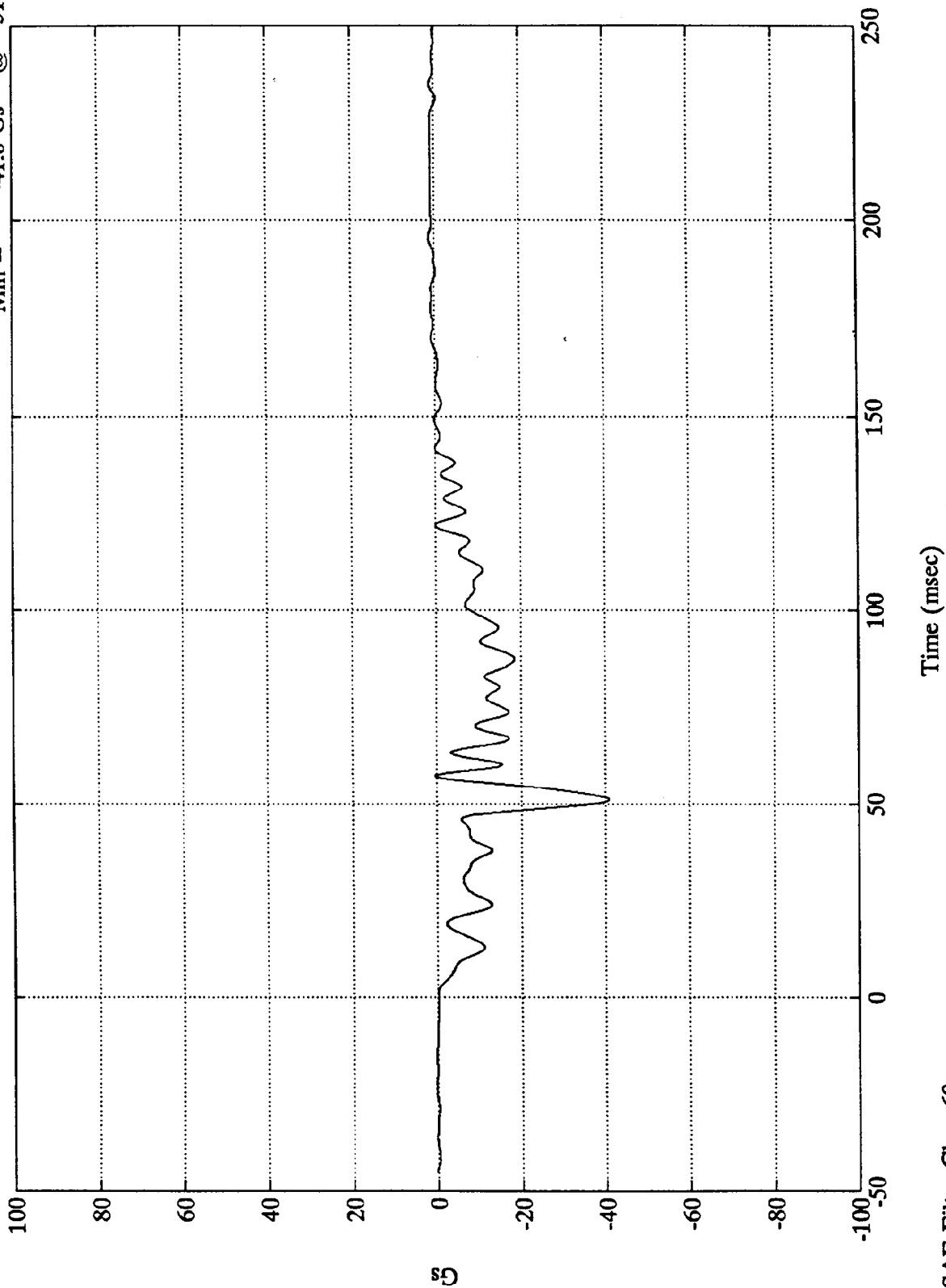
B-73

7883-4

V-to-V Test #4

Veh. 2 L R Seat (X)

Max = 1.4 Gs @ 195.48 msec
Min = -41.0 Gs @ 51.24 msec



Gs

B-74

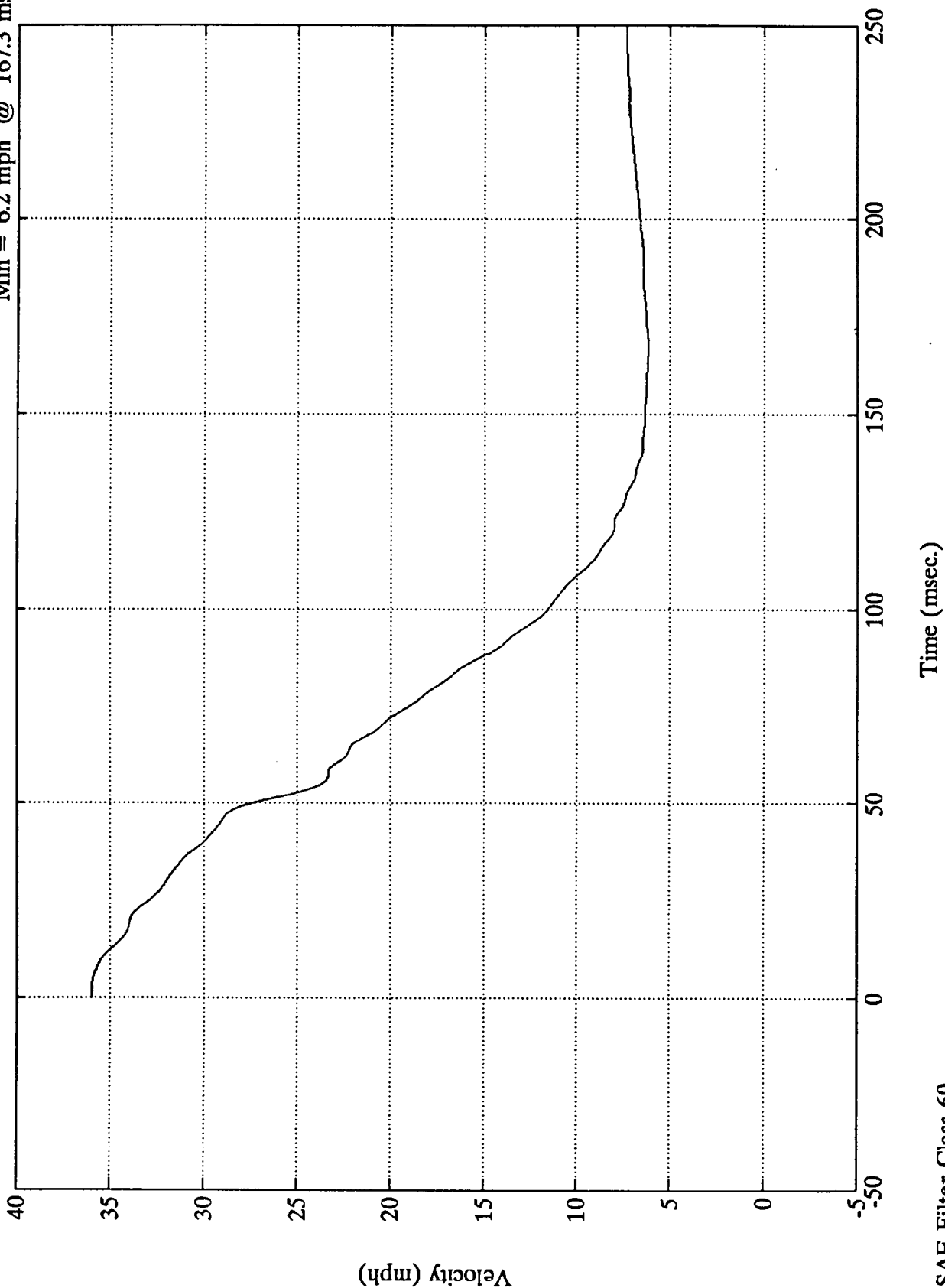
SAE Filter Class 60

7883-4

V-to-V Test #4

Veh. 2 L R Seat (X)

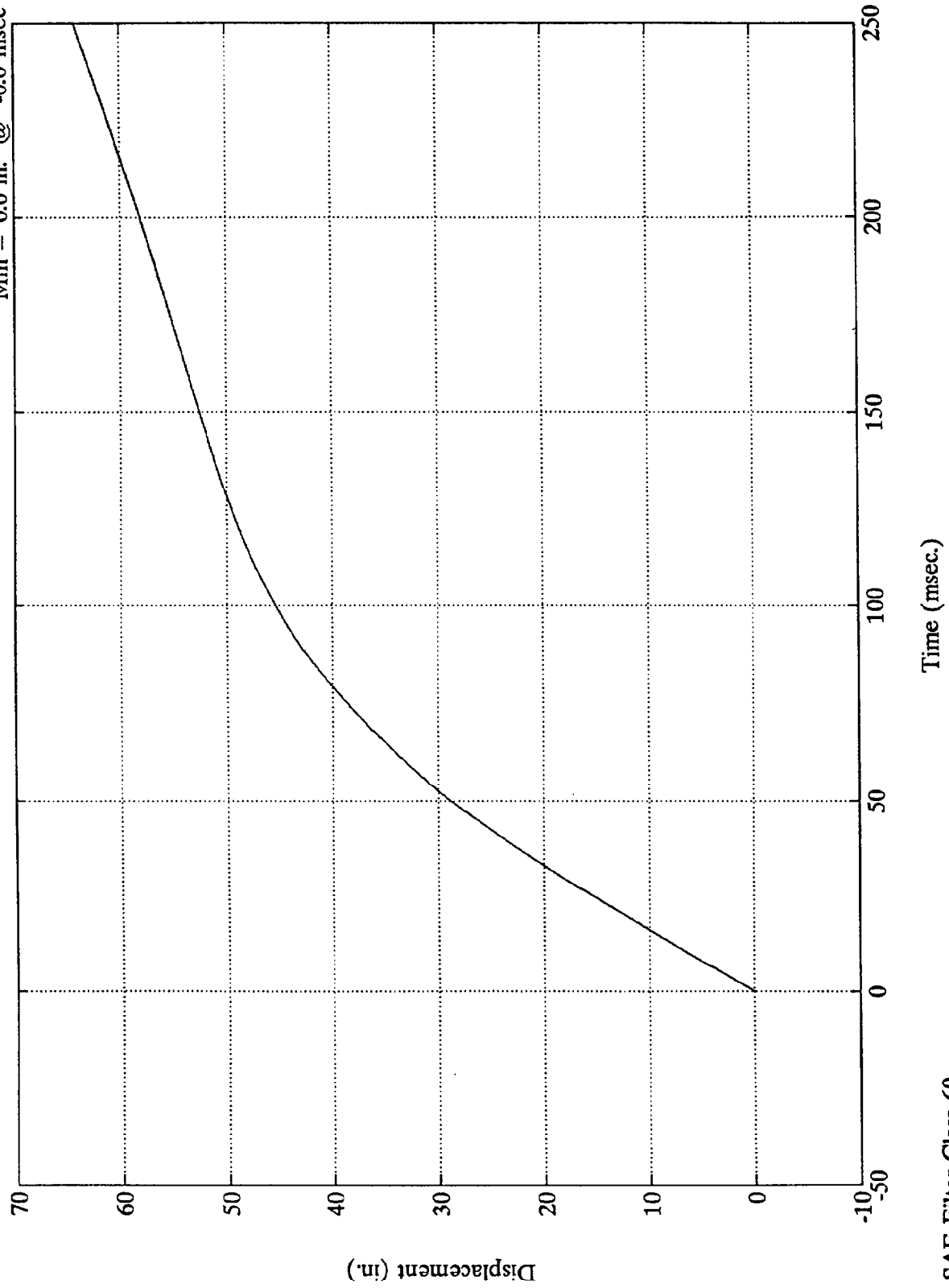
Max = 36.0 mph @ 1.2 msec
Min = 6.2 mph @ 167.3 msec



Max = 65.0 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec

Veh. 2 L R Seat (X)

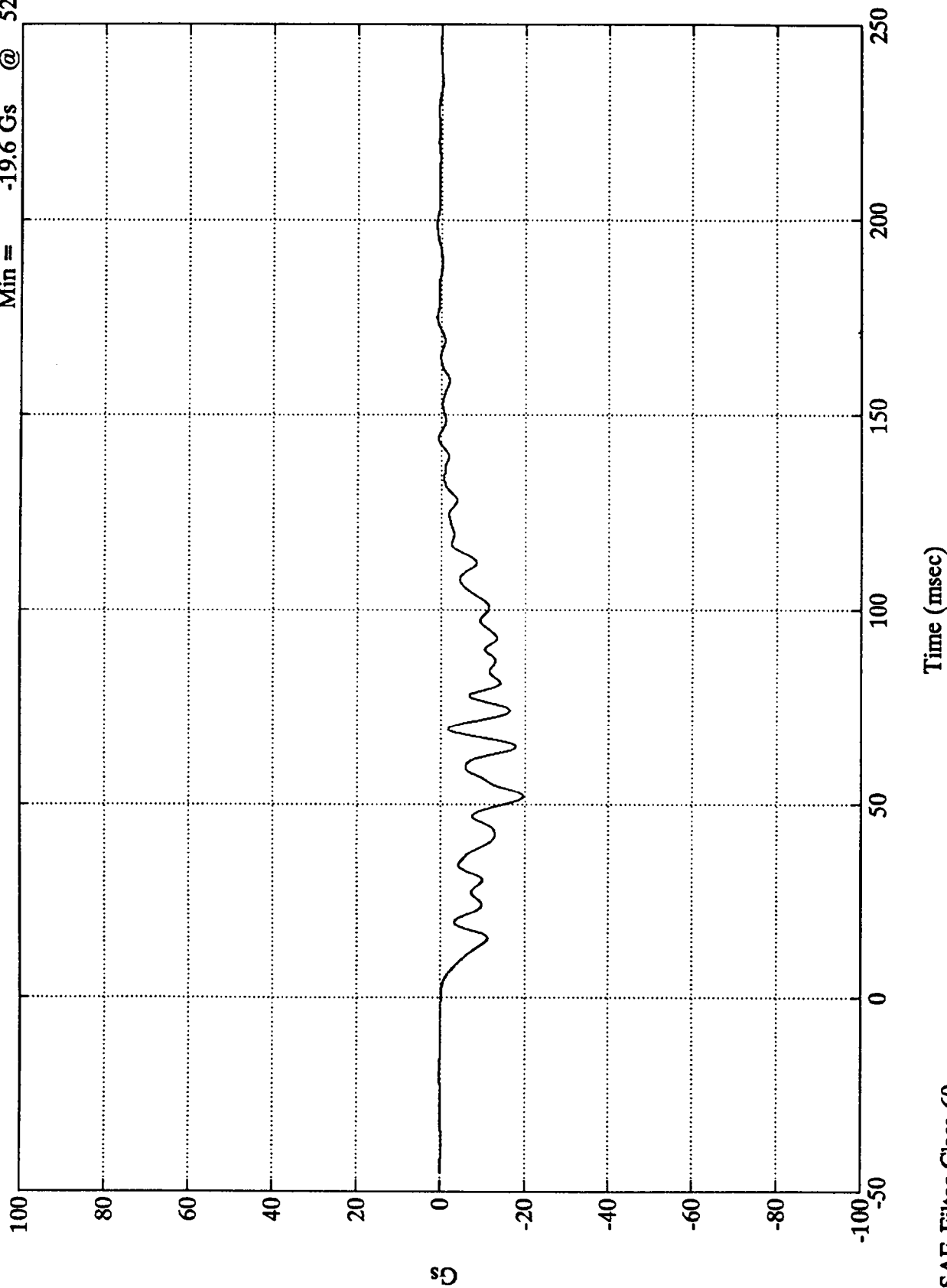
V-to-V Test #4



SAE Filter Class 60

Veh. 2 R R Seat (X)

Max = 1.0 Gs @ 198.84 msec
Min = -19.6 Gs @ 52.08 msec



Gs

B-77

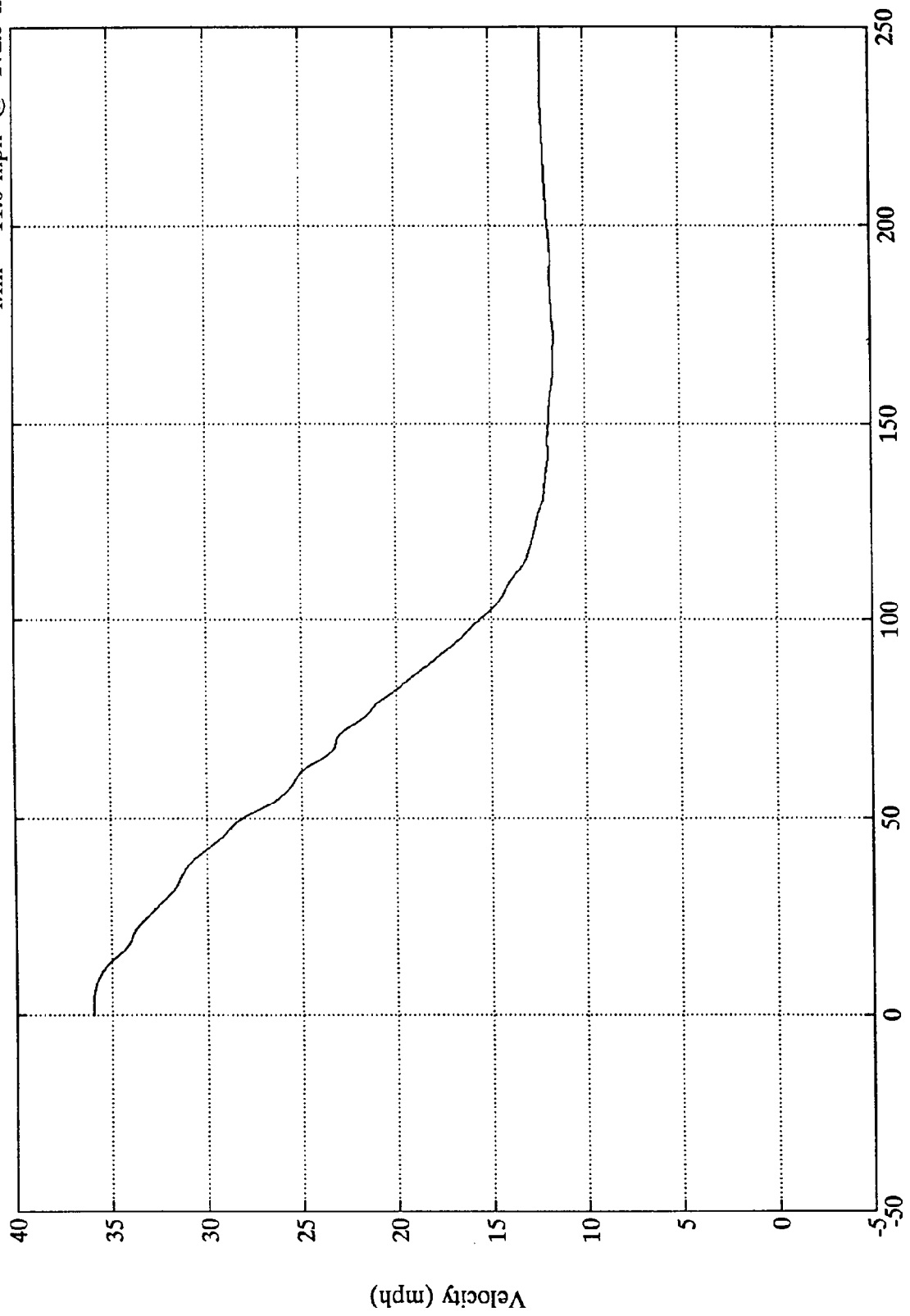
7883-4

SAE Filter Class 60

Max = 36.0 mph @ 1.2 msec
Min = 11.6 mph @ 172.3 msec

Veh. 2 R R Seat (X)

V-to-V Test #4



Time (msec.)

SAE Filter Class 60

Velocity (mph)

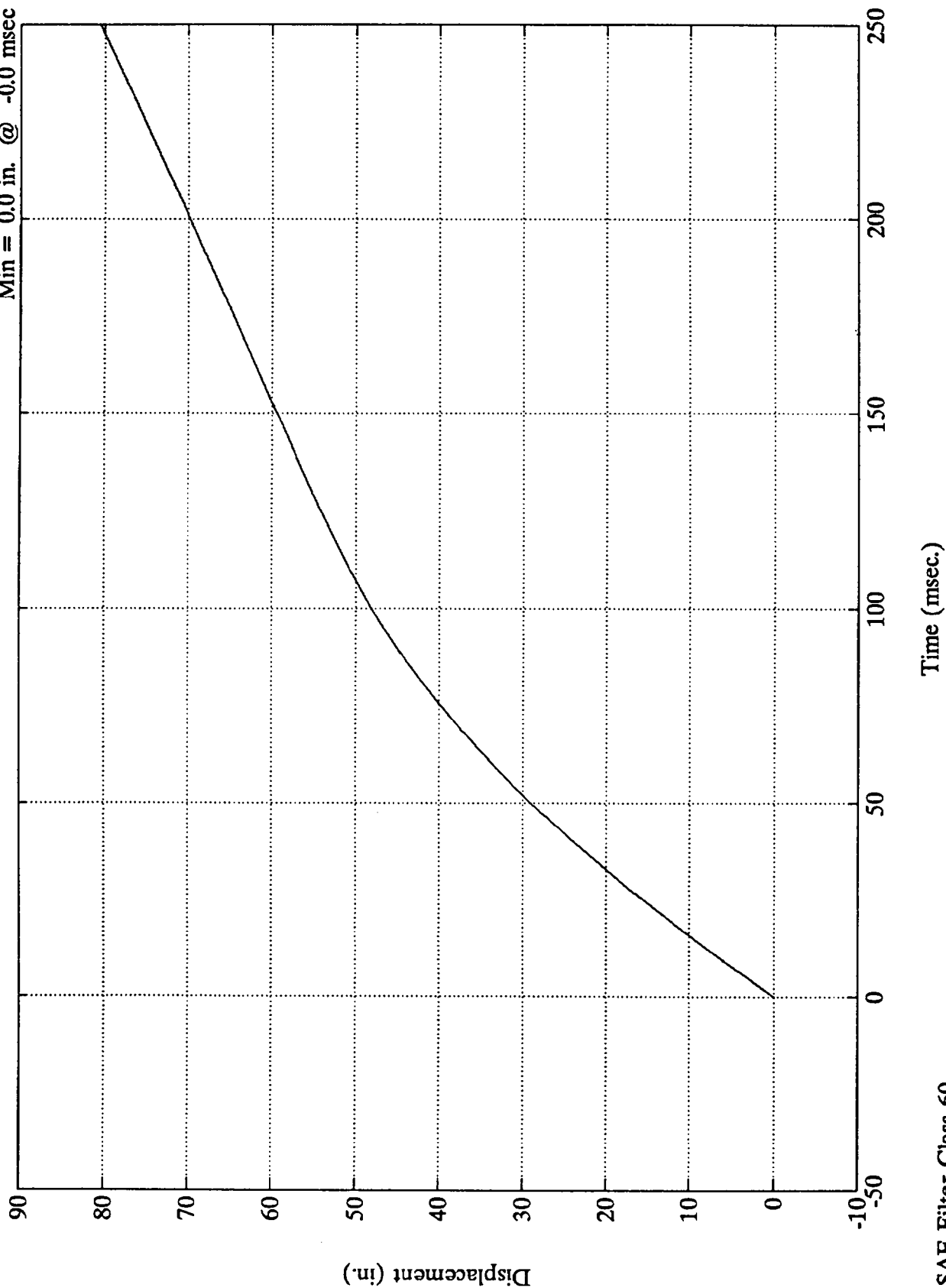
B-78

7883-4

V-to-V Test #4

Veh. 2 R R Seat (X)

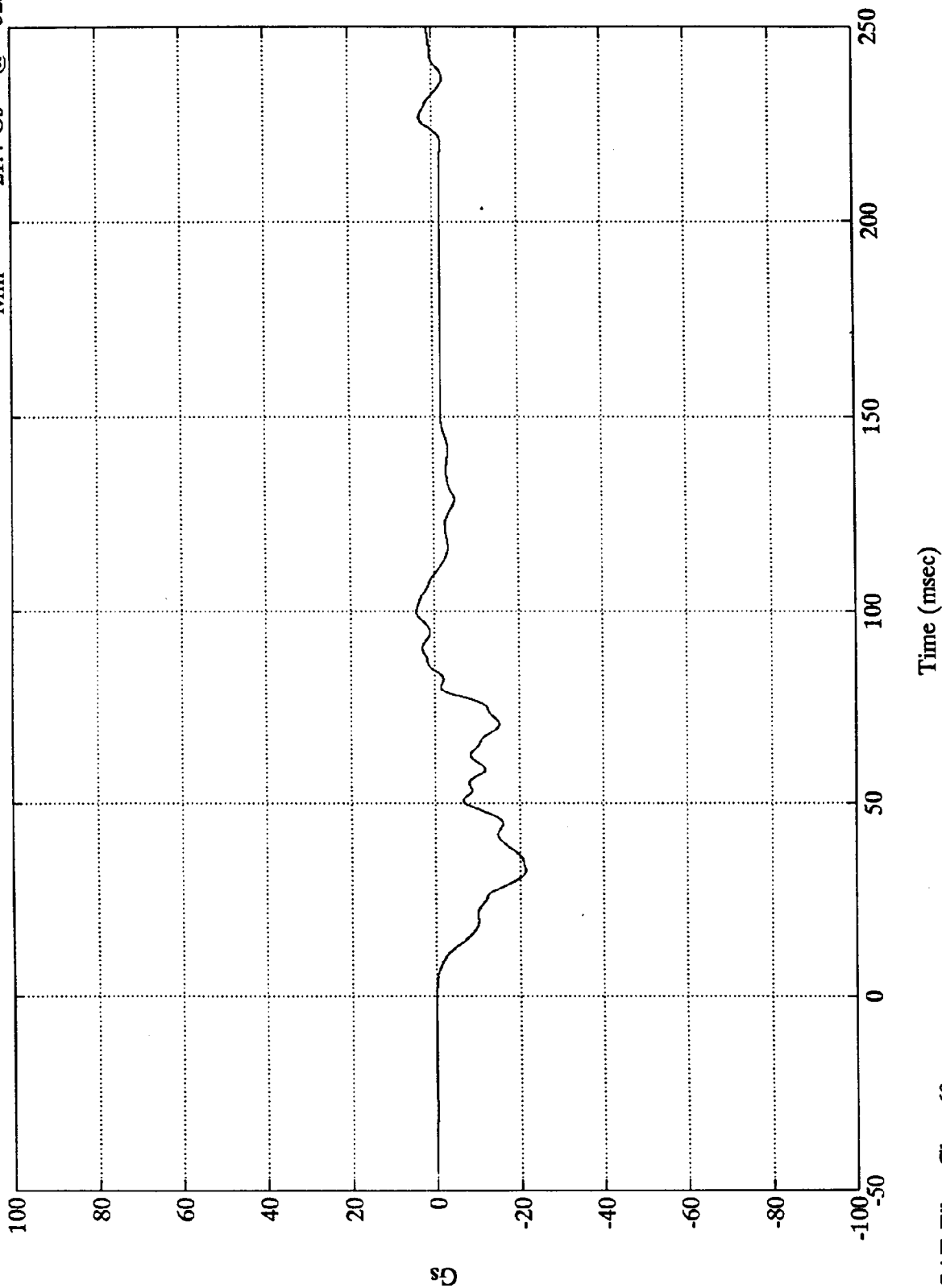
Max = 81.6 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



V-to-V Test #4

Veh. 2 Engine Top (X)

Max = 4.2 Gs @ 99.95 msec
Min = -21.4 Gs @ 32.76 msec



B-80

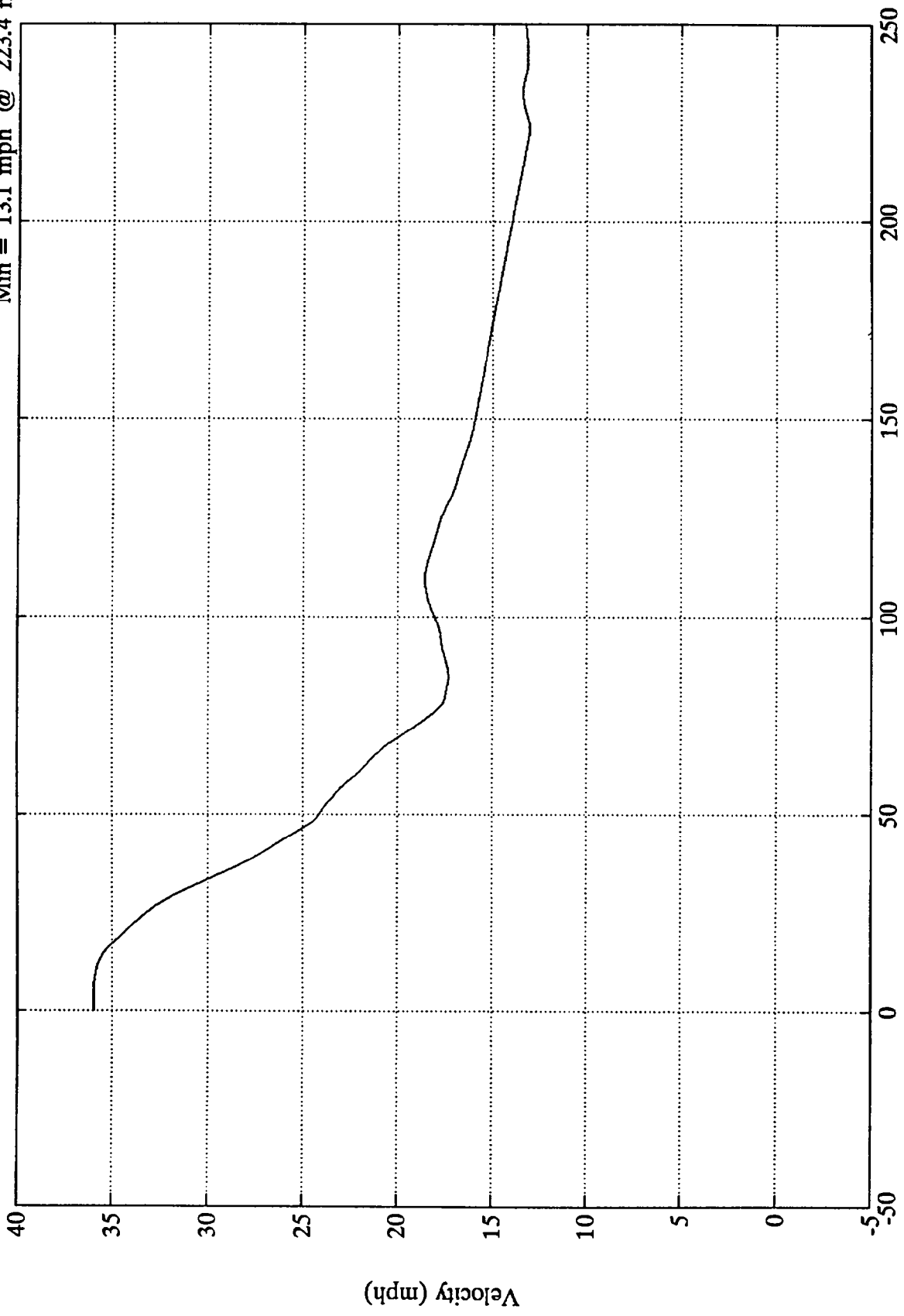
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 2 Engine Top (X)

Max = 36.0 mph @ 3.4 msec
Min = 13.1 mph @ 223.4 msec



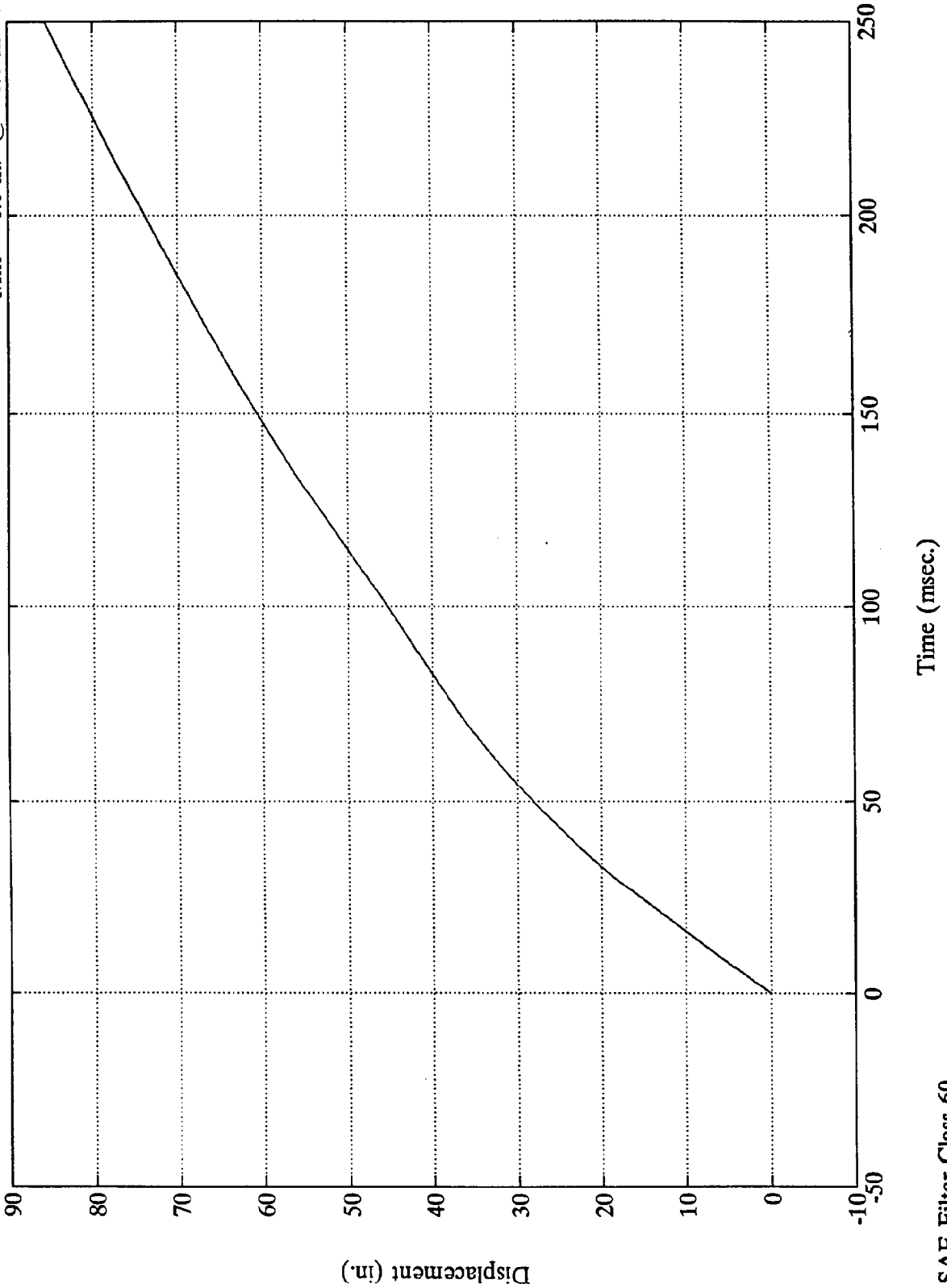
Time (msec.)

SAE Filter Class 60

V-to-V Test #4

Veh. 2 Engine Top (X)

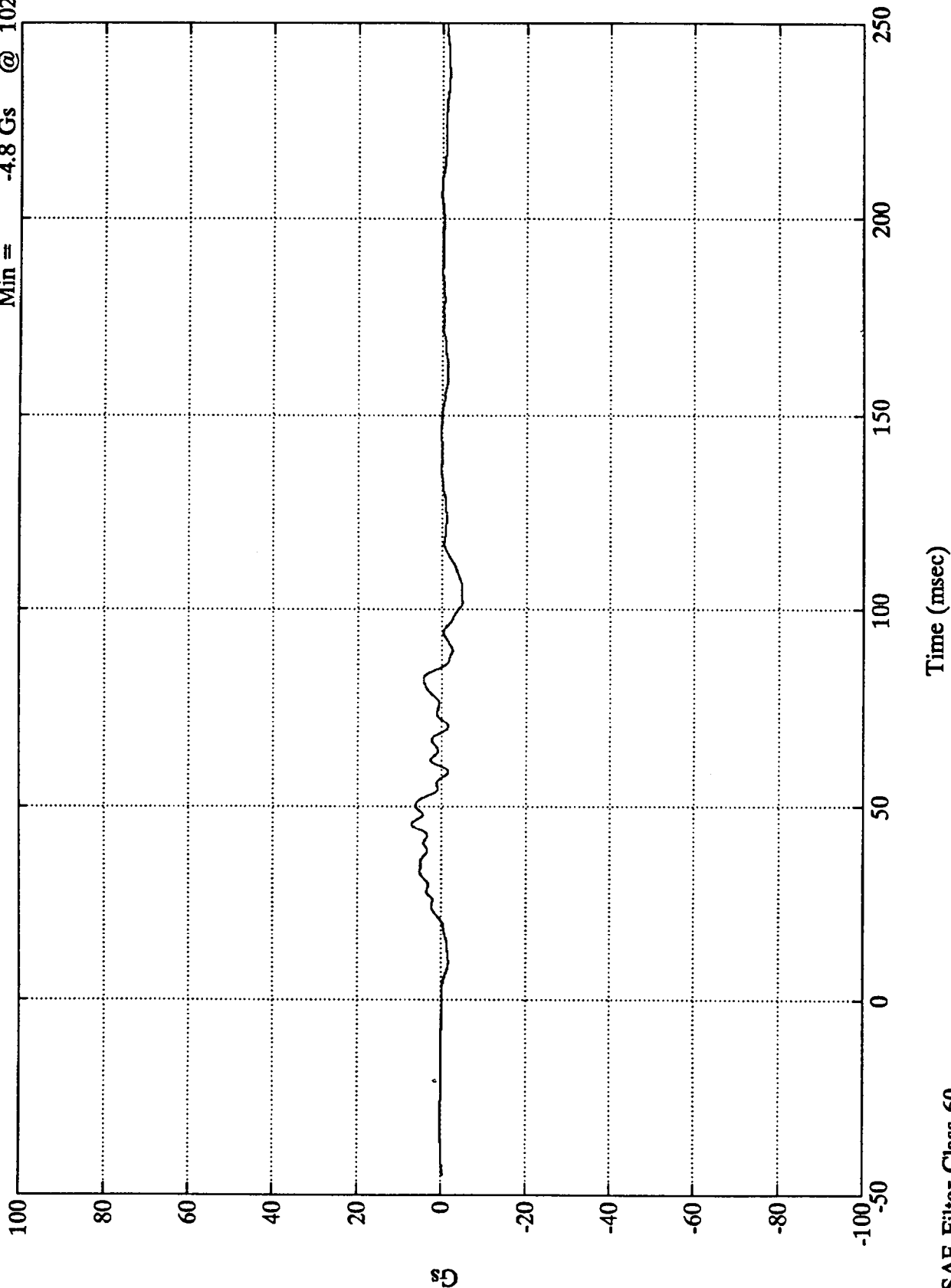
Max = 86.7 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



SAE Filter Class 60

Veh. 2 Engine Top (Z)

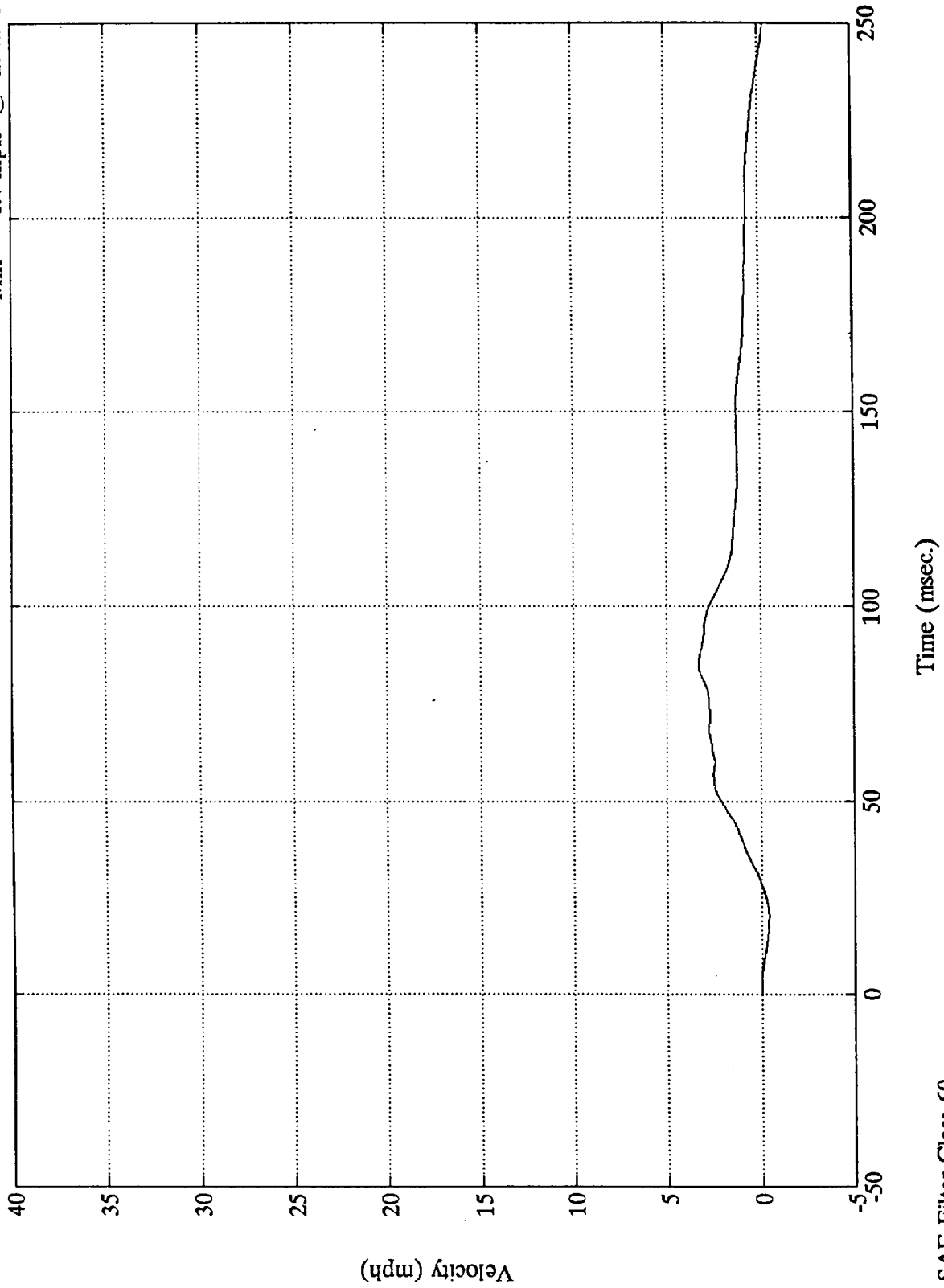
Max =	7.0 Gs	@	45.48 msec
Min =	-4.8 Gs	@	102.00 msec

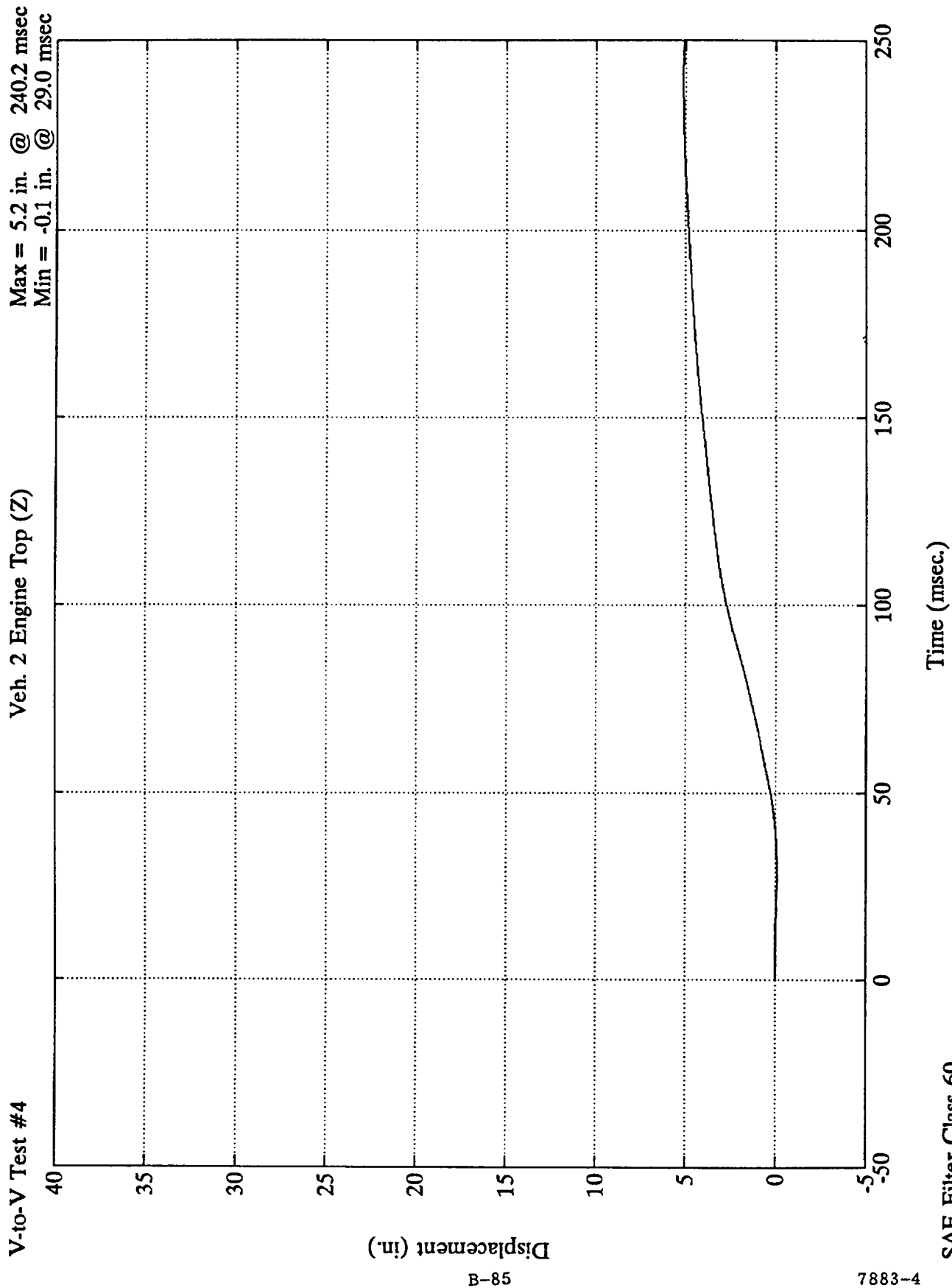


V-to-V Test #4

Veh. 2 Engine Top (Z)

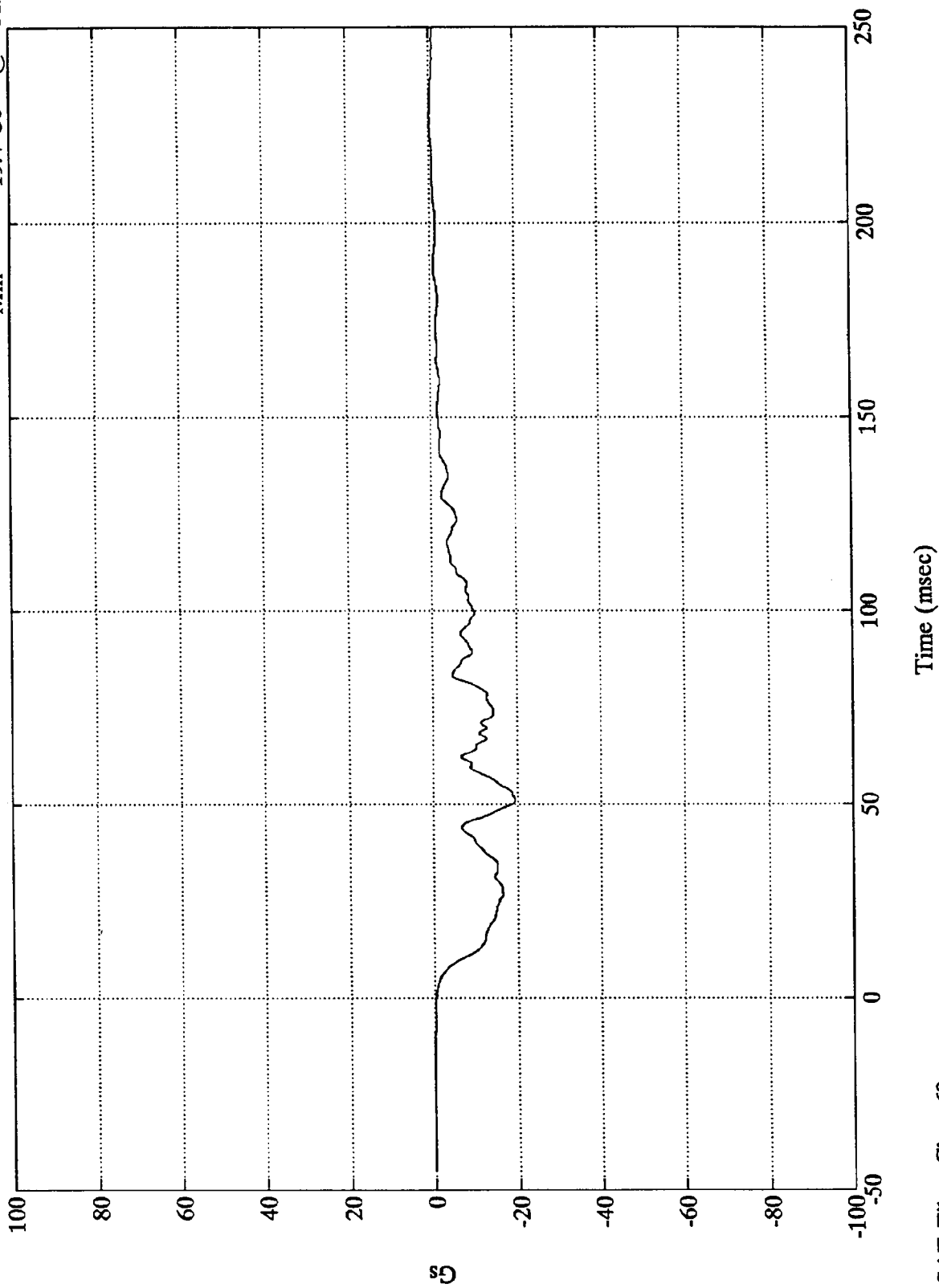
Max = 3.3 mph @ 85.4 msec
Min = -0.4 mph @ 254.9 msec





V-to-V Test #4

Veh. 2 Engine Bottom (X) Max = 0.1 Gs @ -30.48 msec
Min = -19.4 Gs @ 51.12 msec



gs

B-86

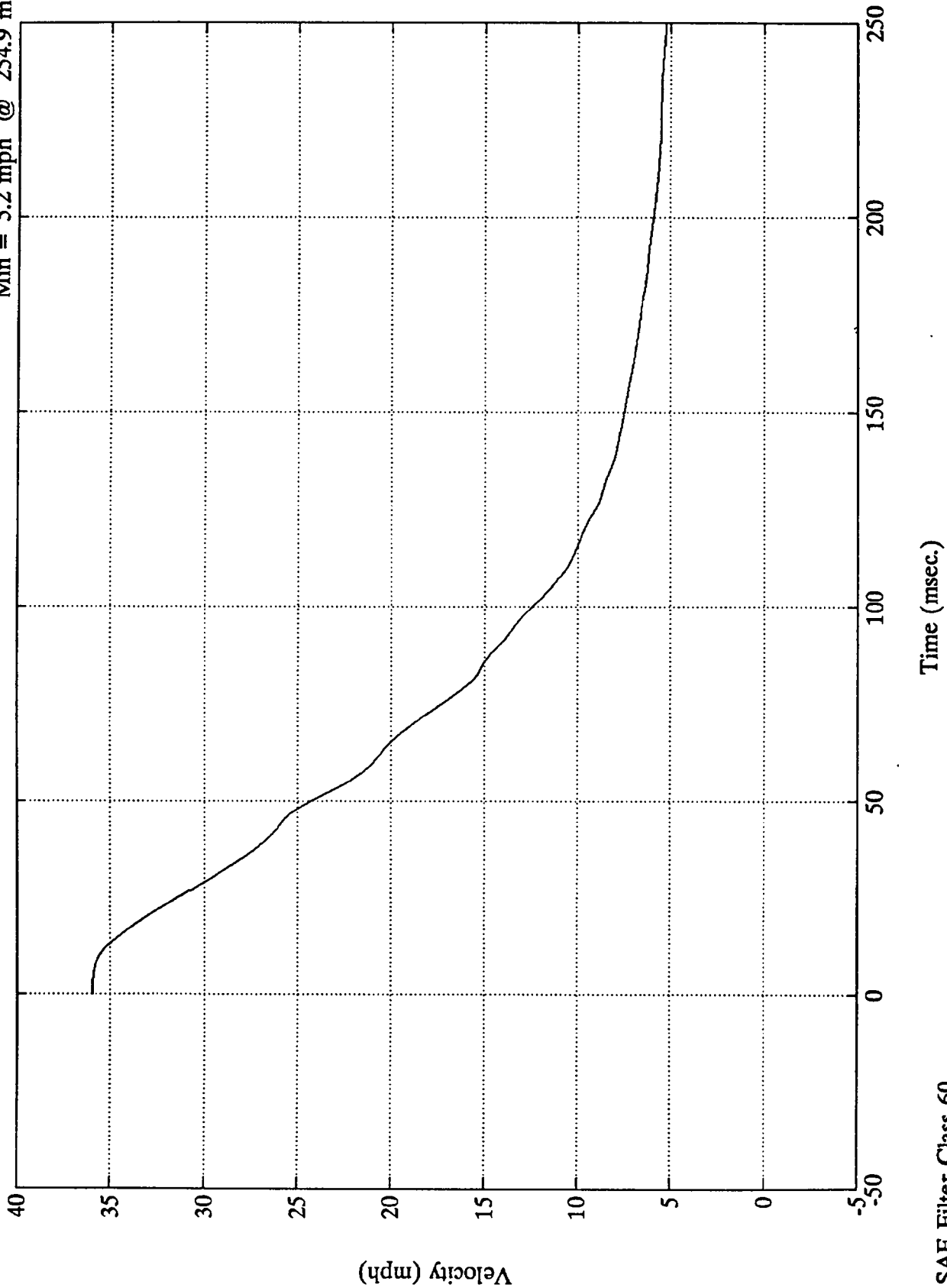
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 2 Engine Bottom (X)

Max = 36.0 mph @ 0.5 msec
Min = 5.2 mph @ 254.9 msec

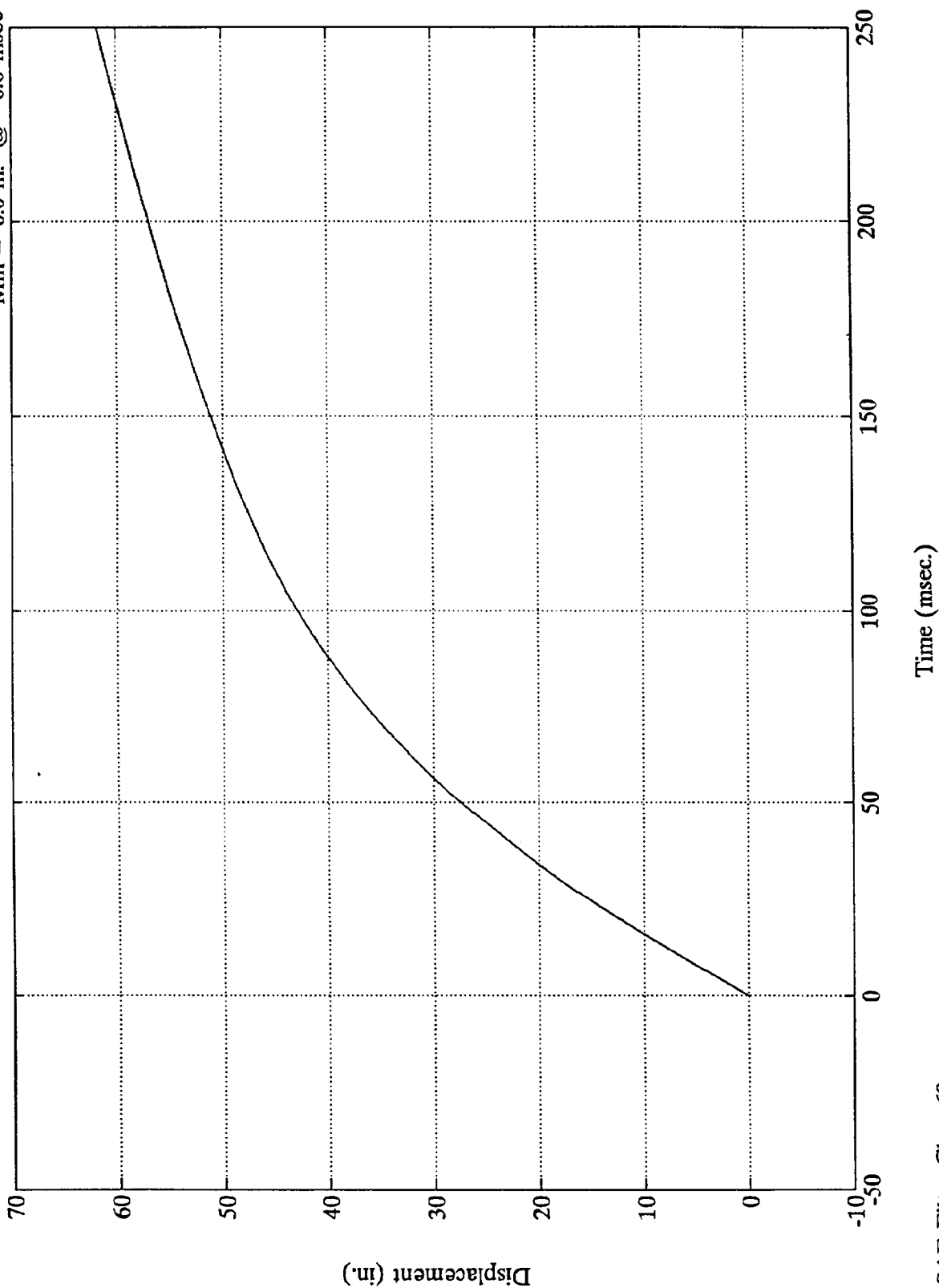


SAE Filter Class 60

V-to-V Test #4

Veh. 2 Engine Bottom (X)

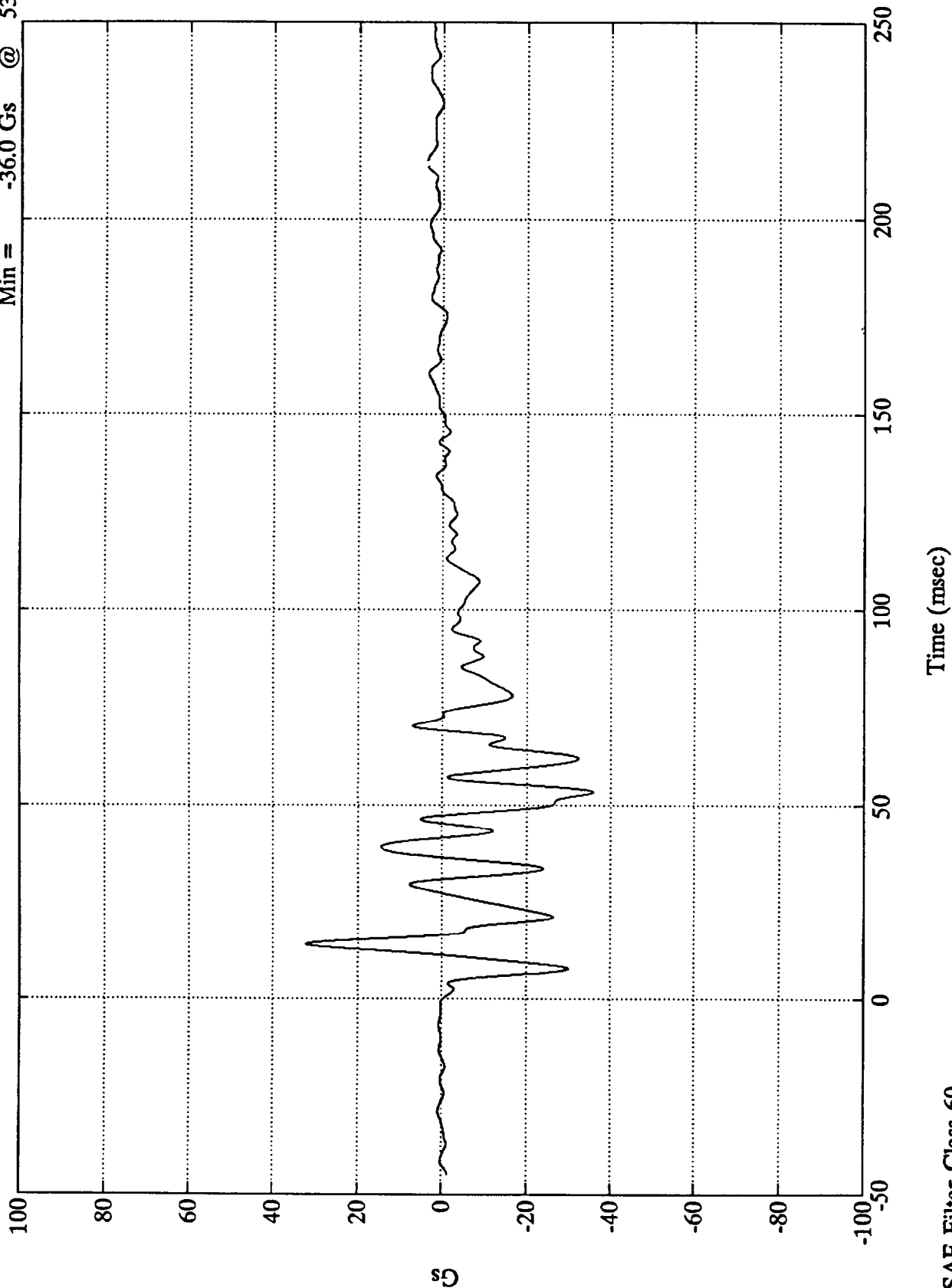
Max = 62.3 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



SAE Filter Class 60

Veh. 2 Front X Mem. (X)

Max = 32.1 Gs @ 14.03 msec
Min = -36.0 Gs @ 53.27 msec



Gs

B-89

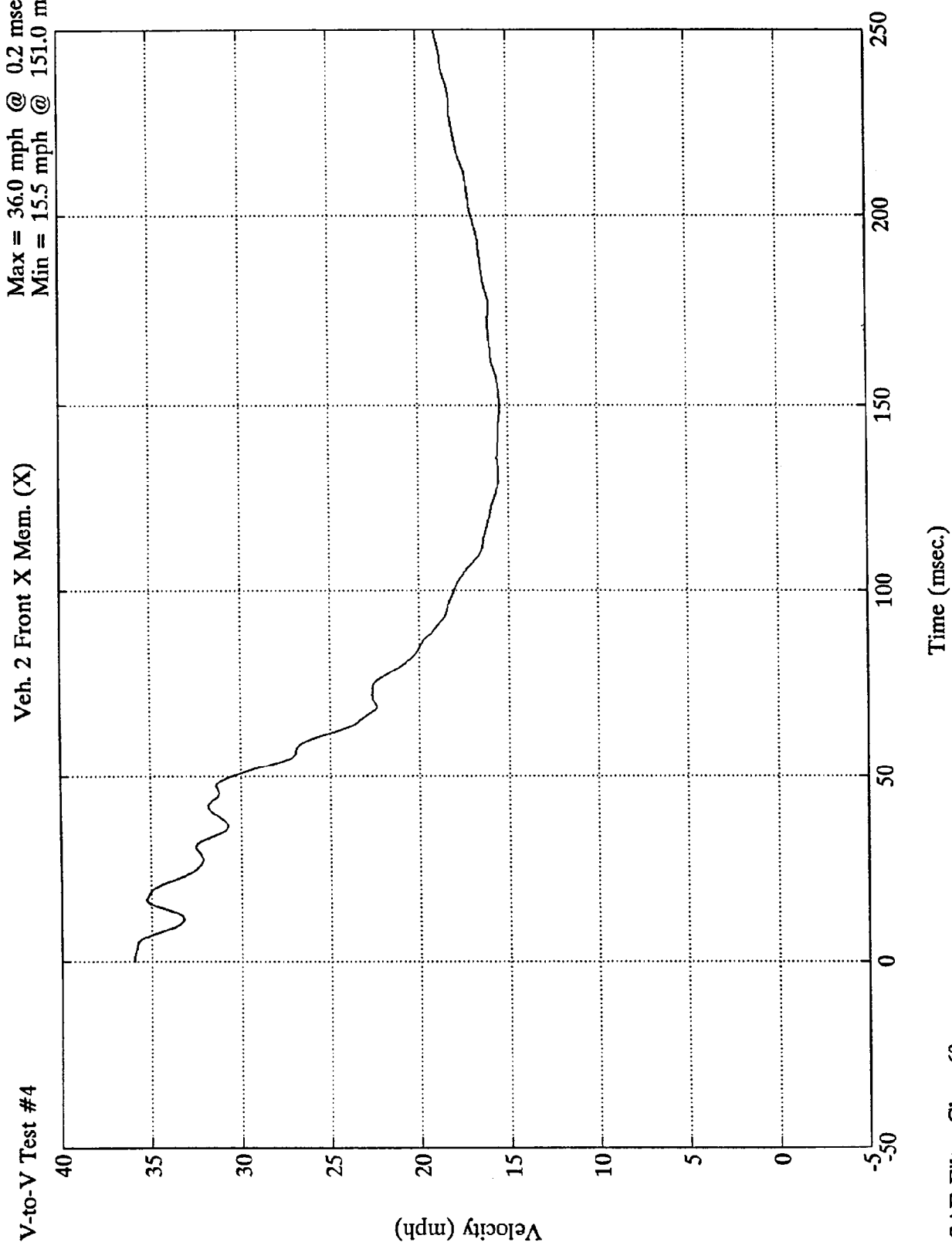
7883-4

SAE Filter Class 60

V-to-V Test #4

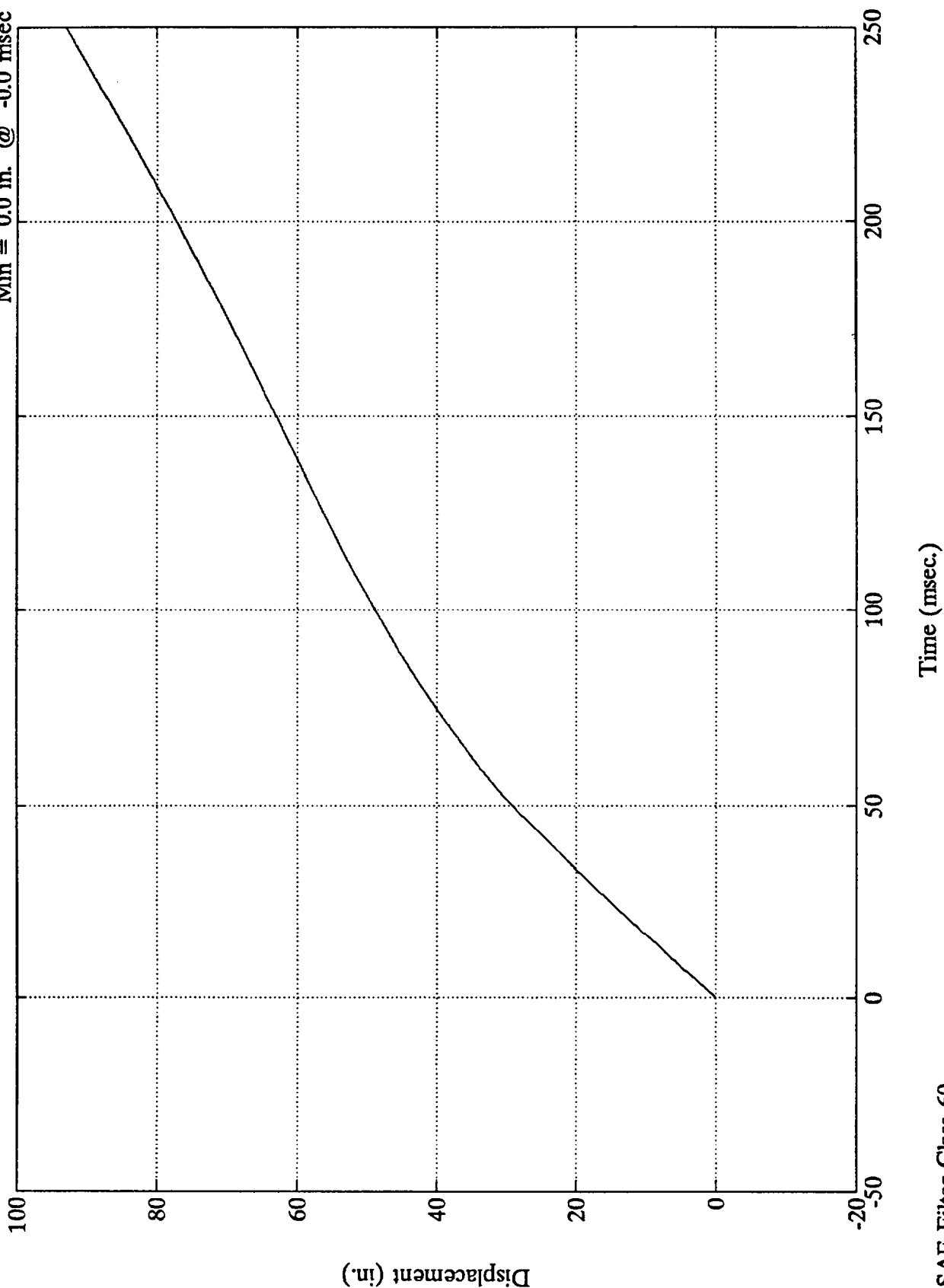
Veh. 2 Front X Mem. (X)

Max = 36.0 mph @ 0.2 msec
Min = 15.5 mph @ 151.0 msec



SAE Filter Class 60

Max = 94.8 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



SAE Filter Class 60

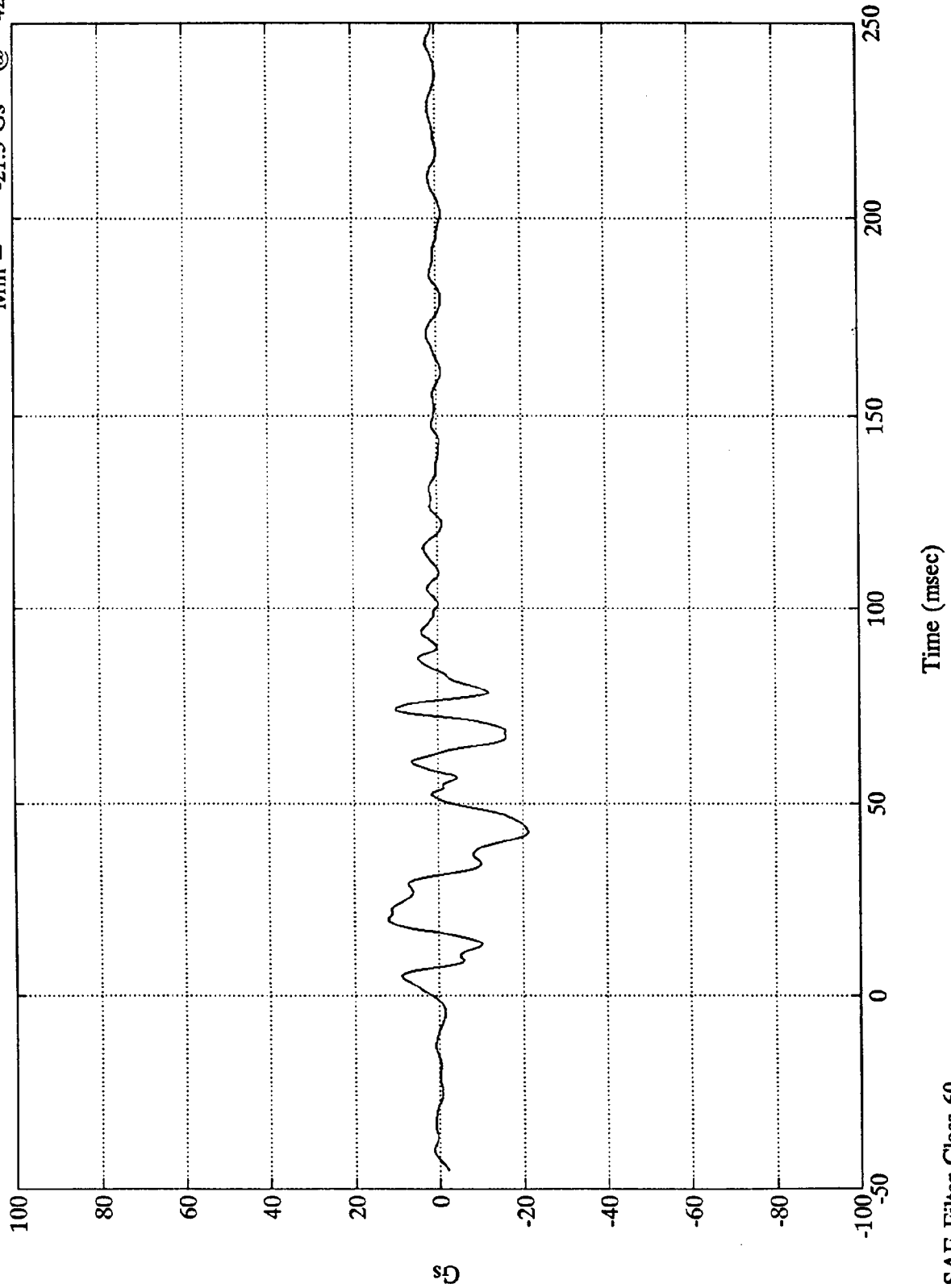
7883-4

B-91

V-to-V Test #4

Veh. 2 Front X Mem. (Z)

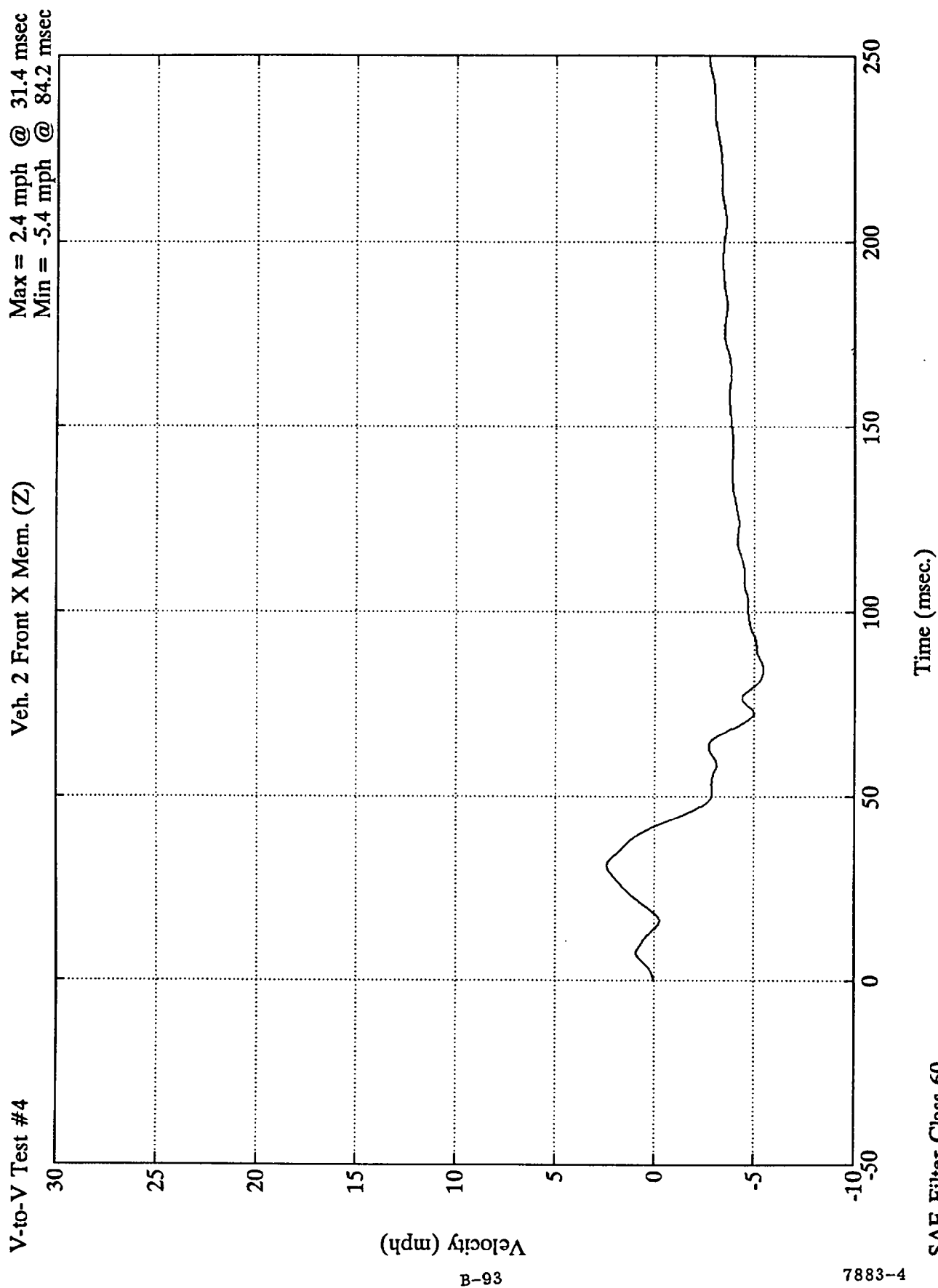
Max = 12.0 Gs @ 19.67 msec
Min = -21.3 Gs @ 42.72 msec



B-92

7883-4

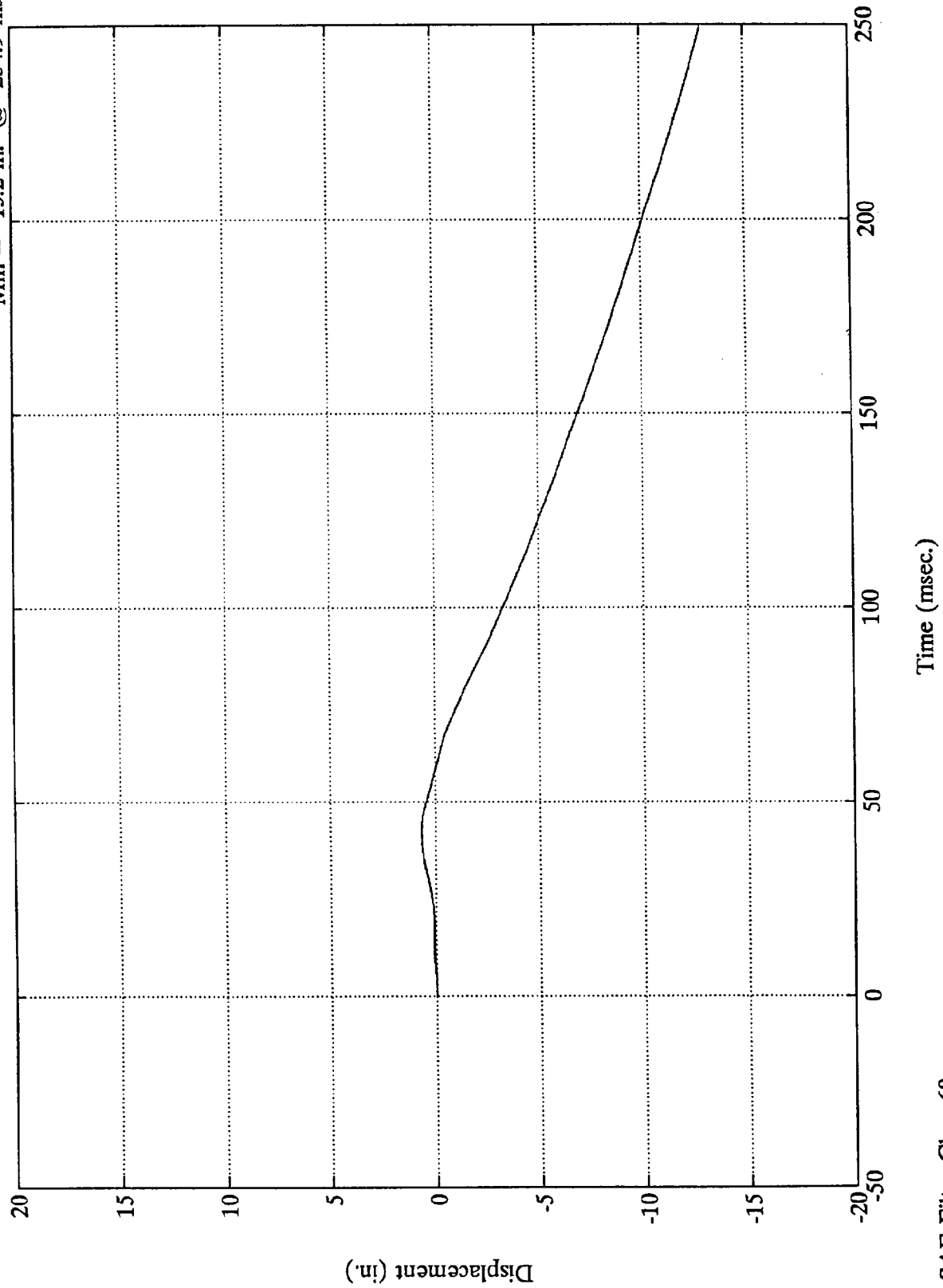
SAE Filter Class 60



V-to-V Test #4

Veh. 2 Front X Mem. (Z)

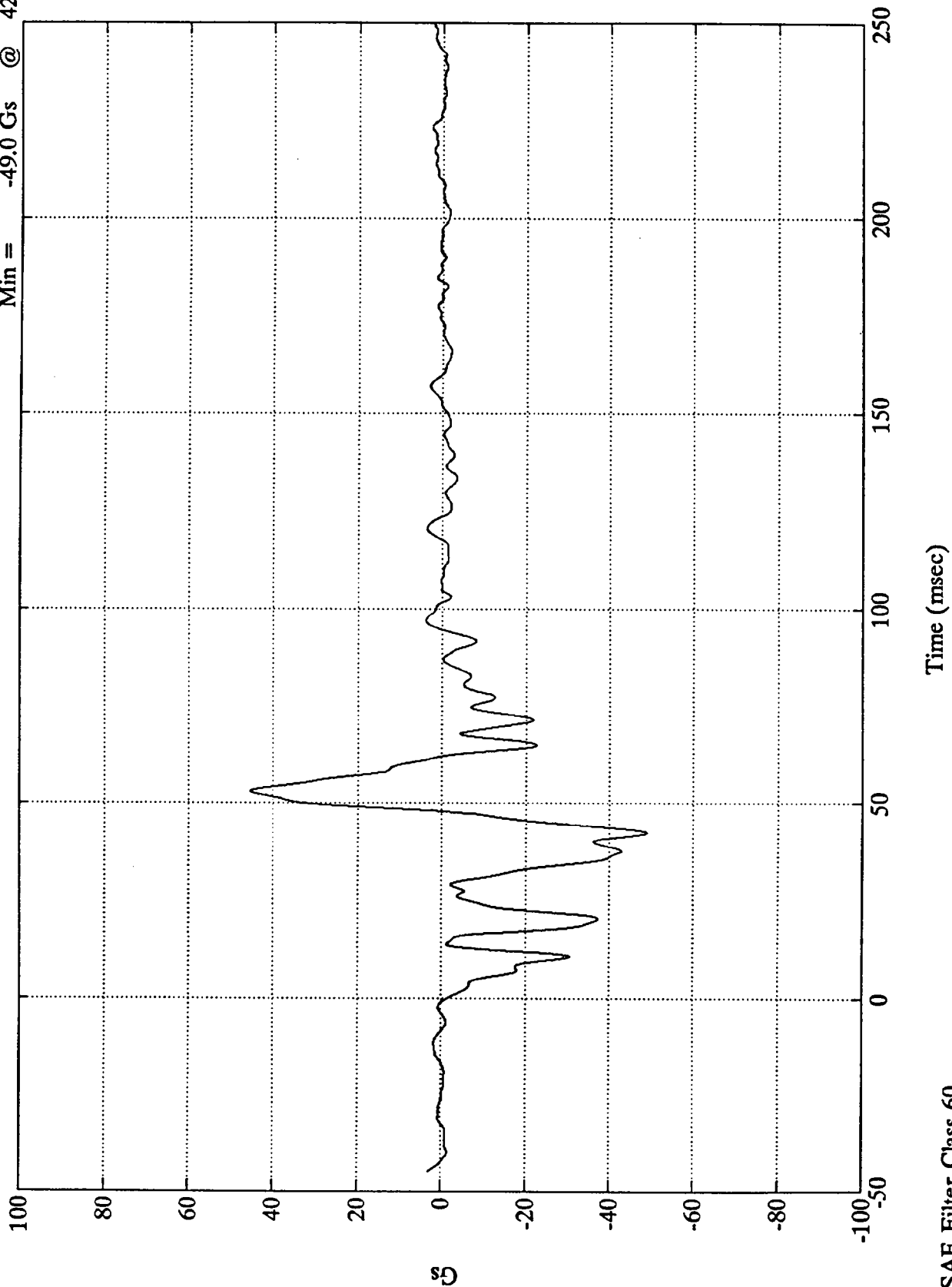
Max = 0.7 in. @ 42.0 msec
Min = -13.2 in. @ 254.9 msec



SAE Filter Class 60

Veh. 2 Left Caliper (X)

Max = 45.4 Gs @ 53.04 msec
Min = -49.0 Gs @ 42.47 msec



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B-95

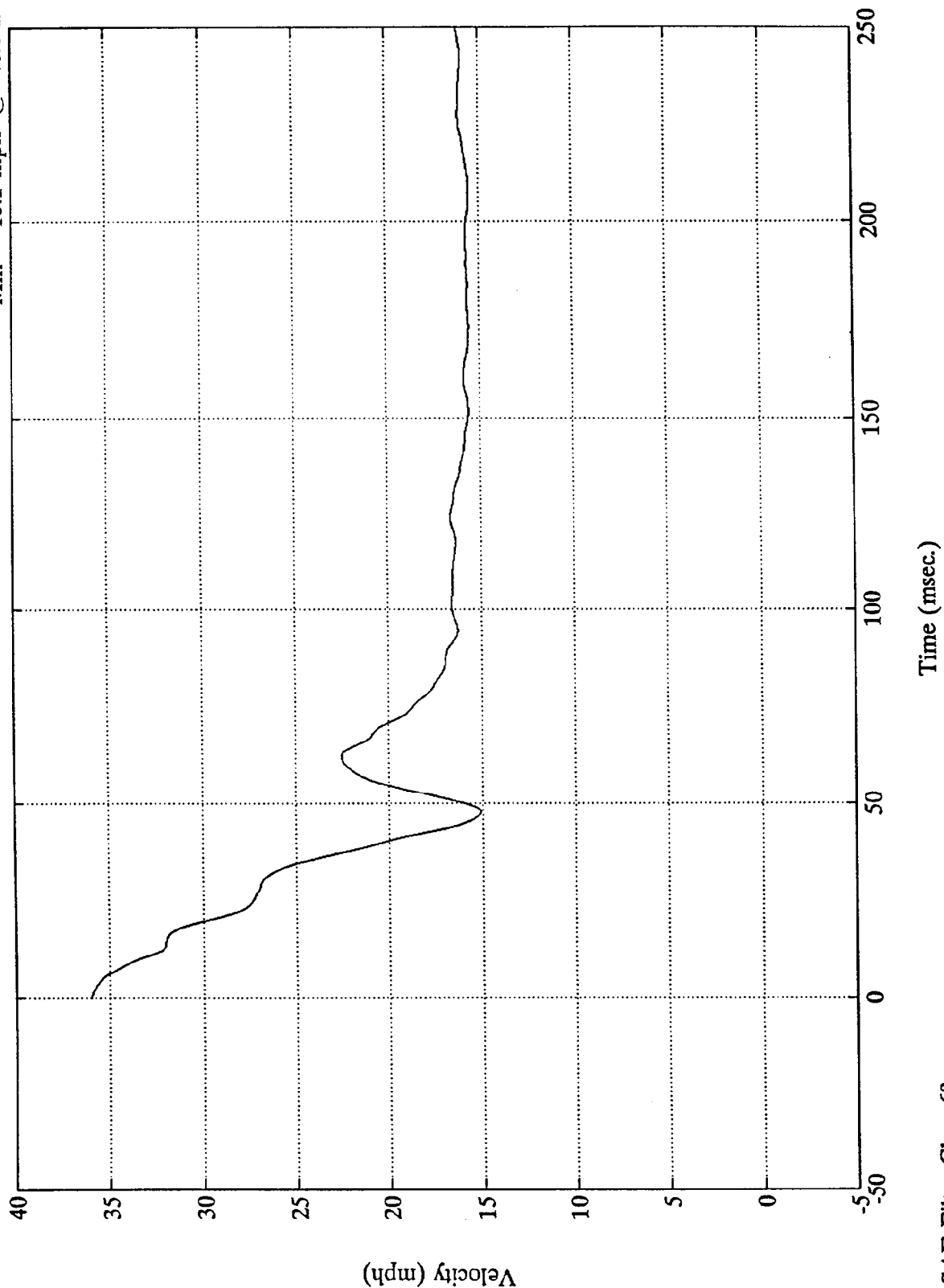
7883-4

SAE Filter Class 60

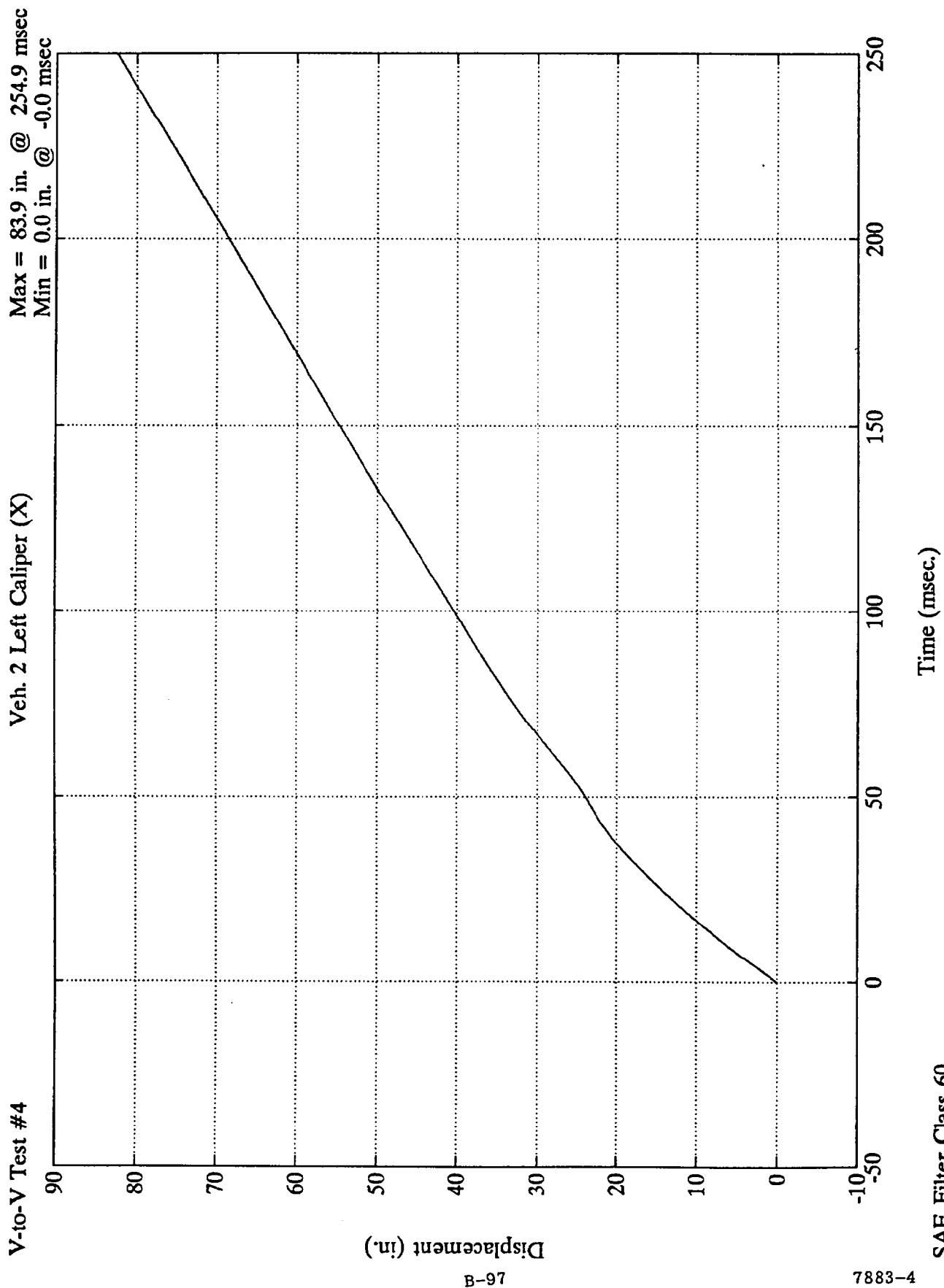
Max = 36.0 mph @ -0.0 msec
Min = 15.1 mph @ 48.0 msec

Veh. 2 Left Caliper (X)

V-to-V Test #4



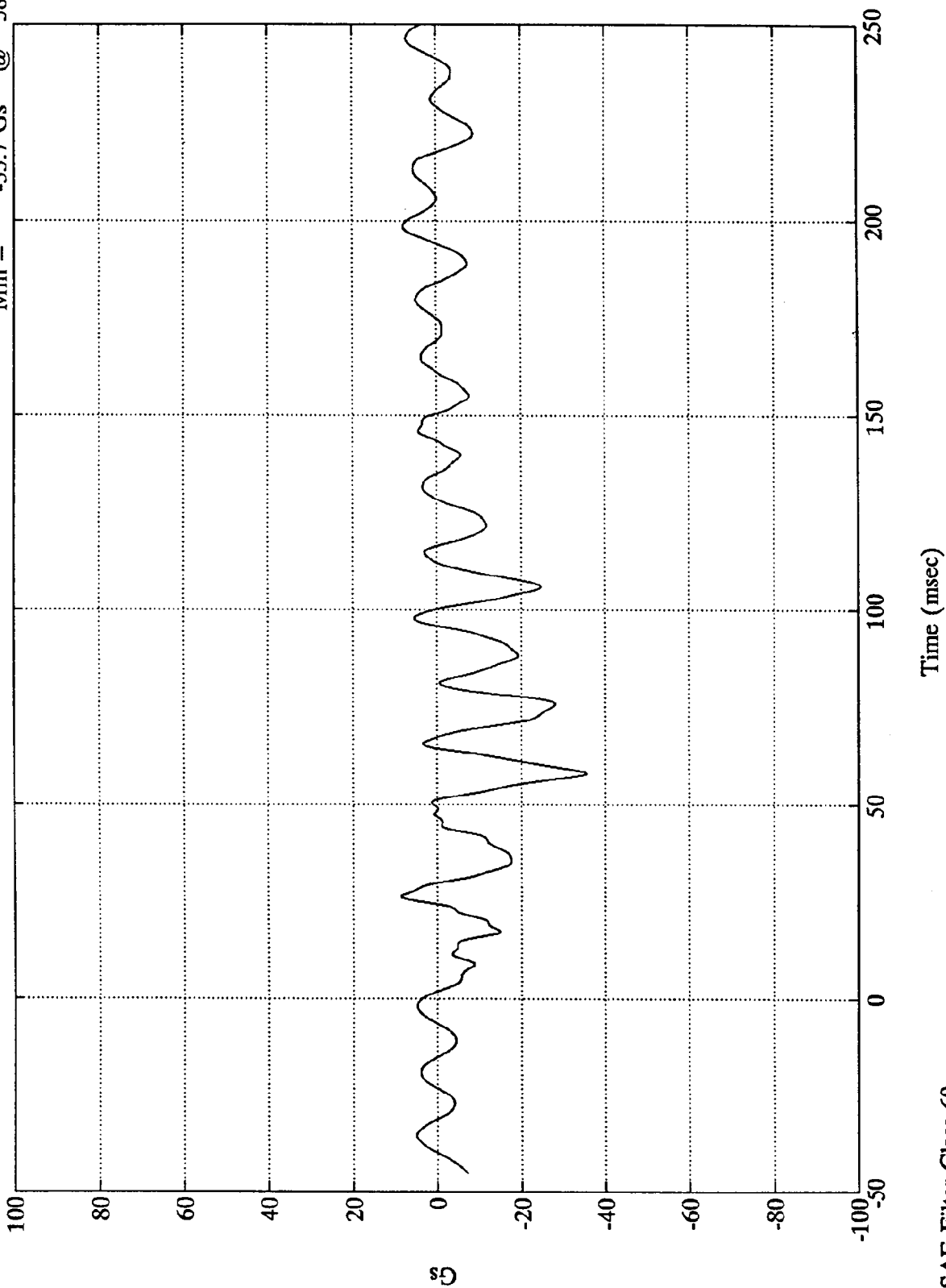
SAE Filter Class 60



V-to-V Test #4

Veh. 2 Right Caliper (X)

Max = 8.5 Gs @ 26.39 msec
Min = -35.7 Gs @ 58.08 msec



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B-98

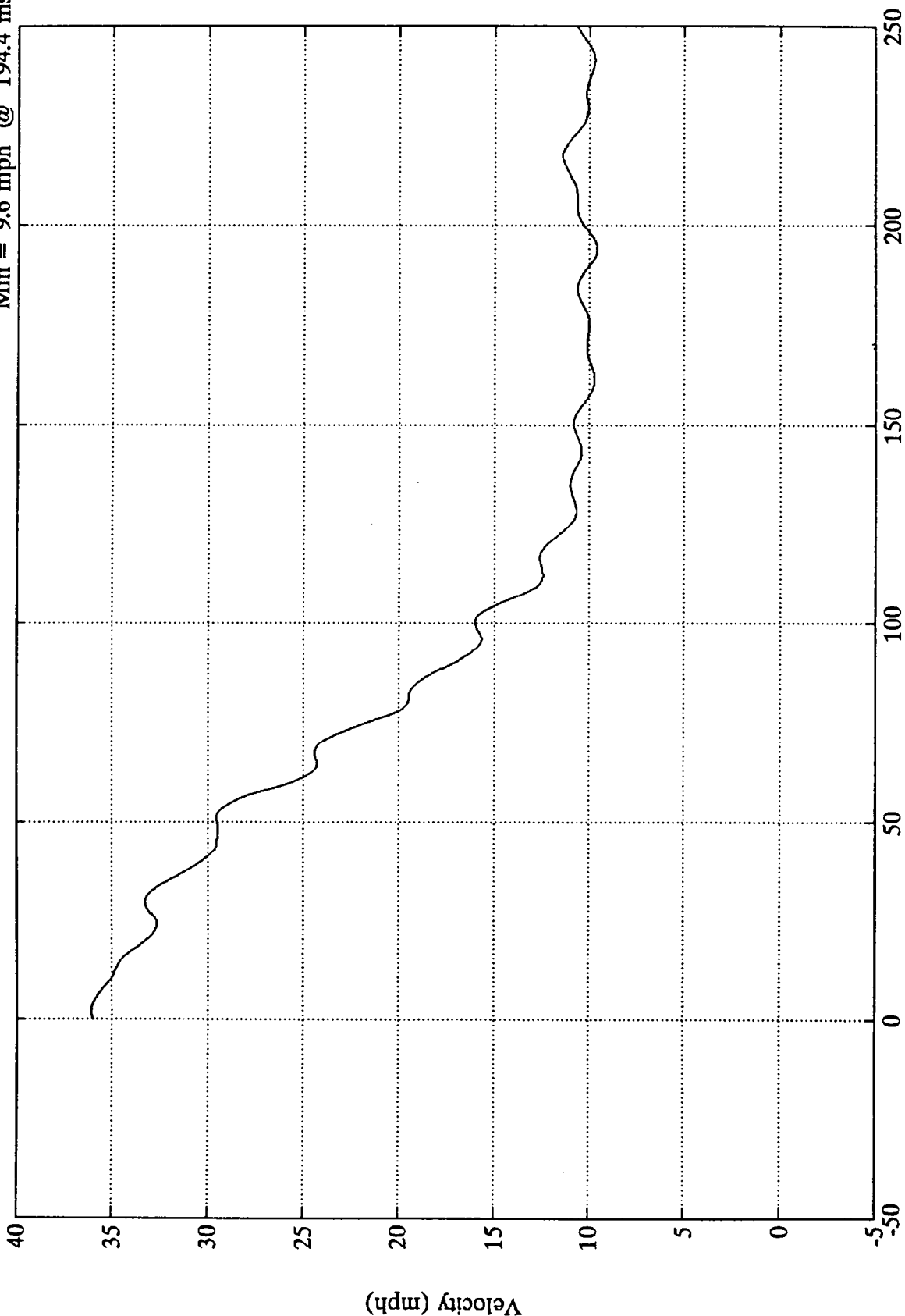
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 2 Right Caliper (X)

Max = 36.1 mph @ 2.2 msec
Min = 9.6 mph @ 194.4 msec



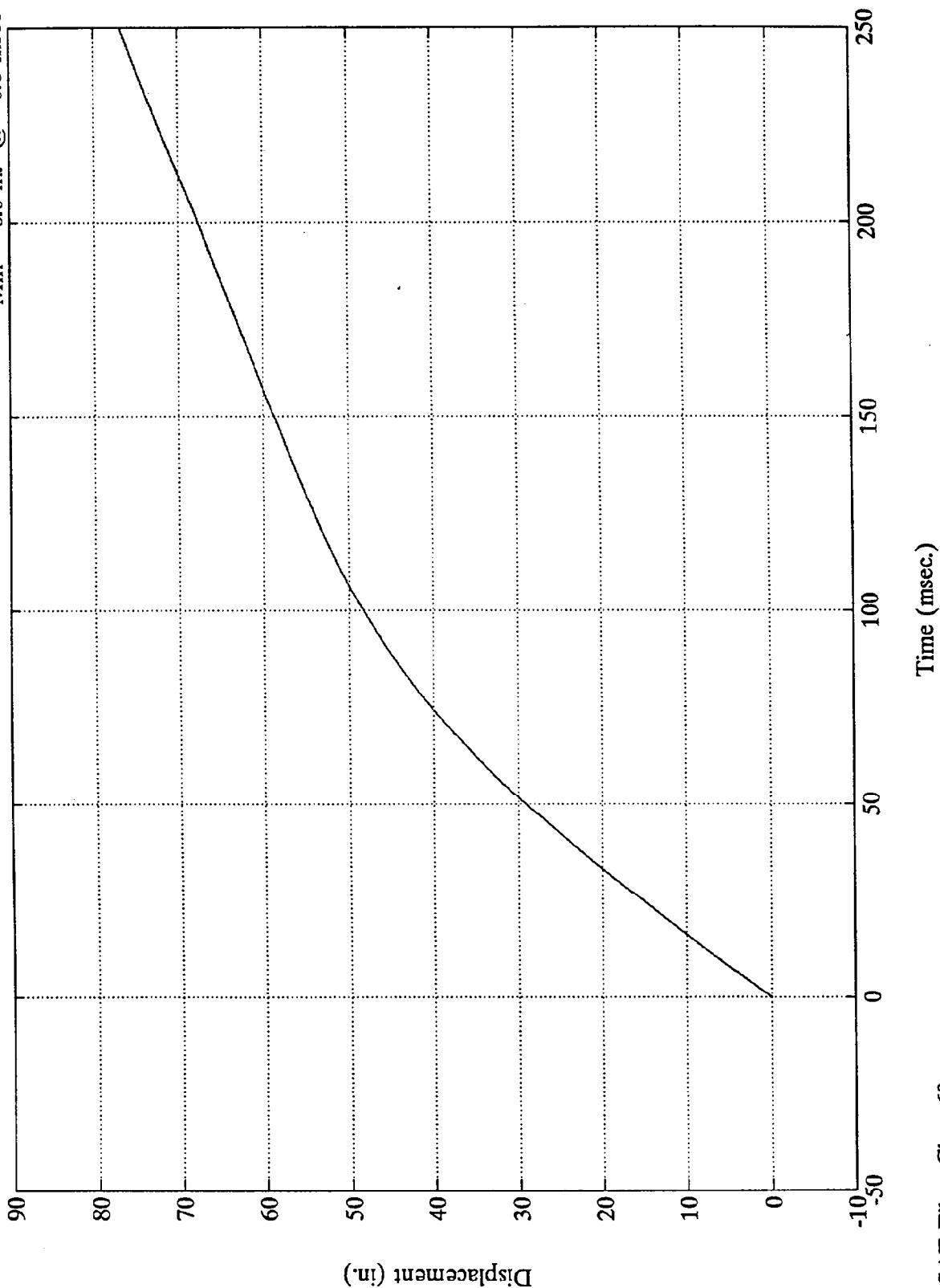
Time (msec.)

SAE Filter Class 60

Max = 77.8 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec

Veh. 2 Right Caliper (X)

V-to-V Test #4



B-100

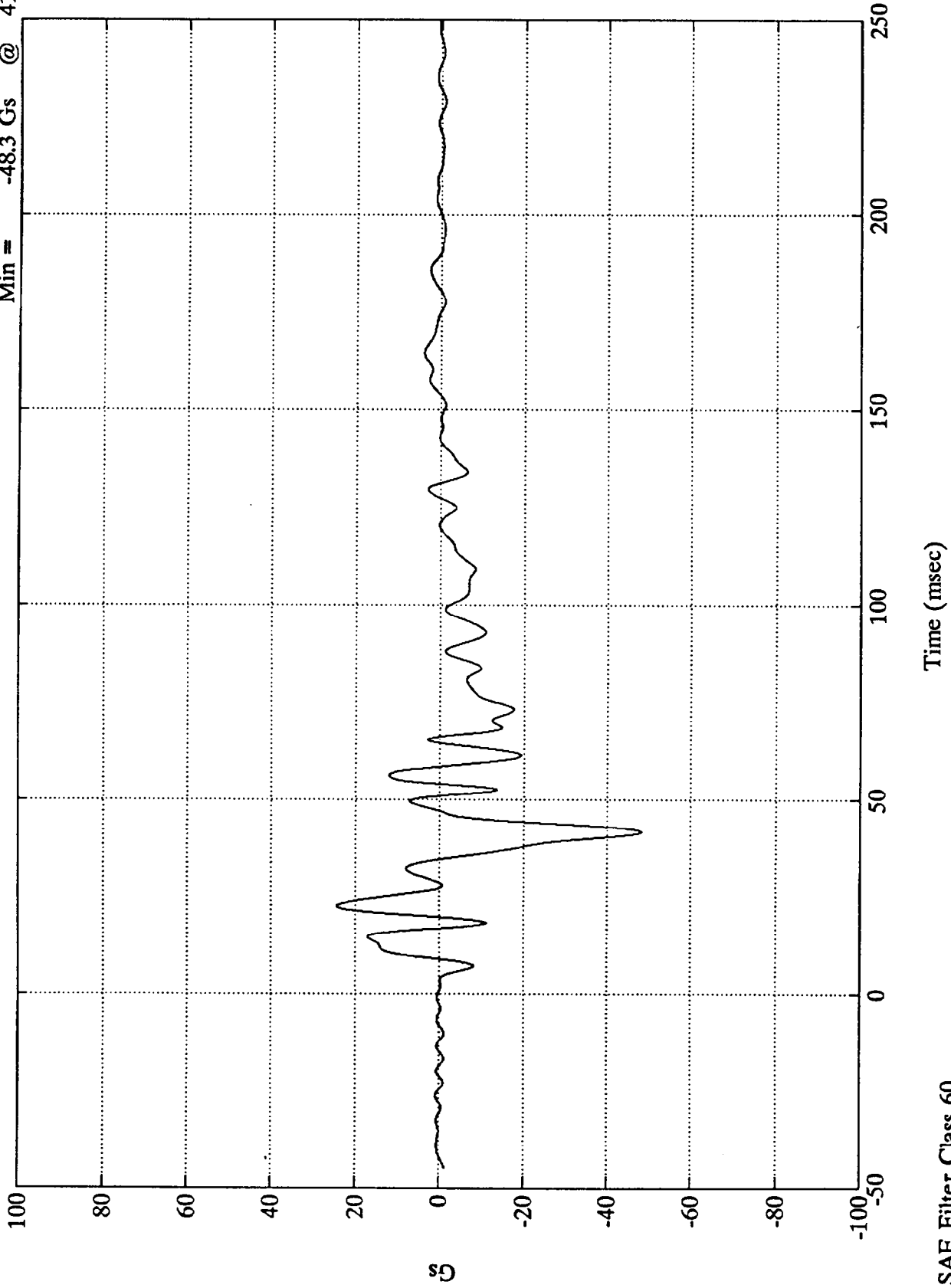
7883-4

SAE Filter Class 60

V-to-V Test #4

Veh. 2 Toe Pan (X)

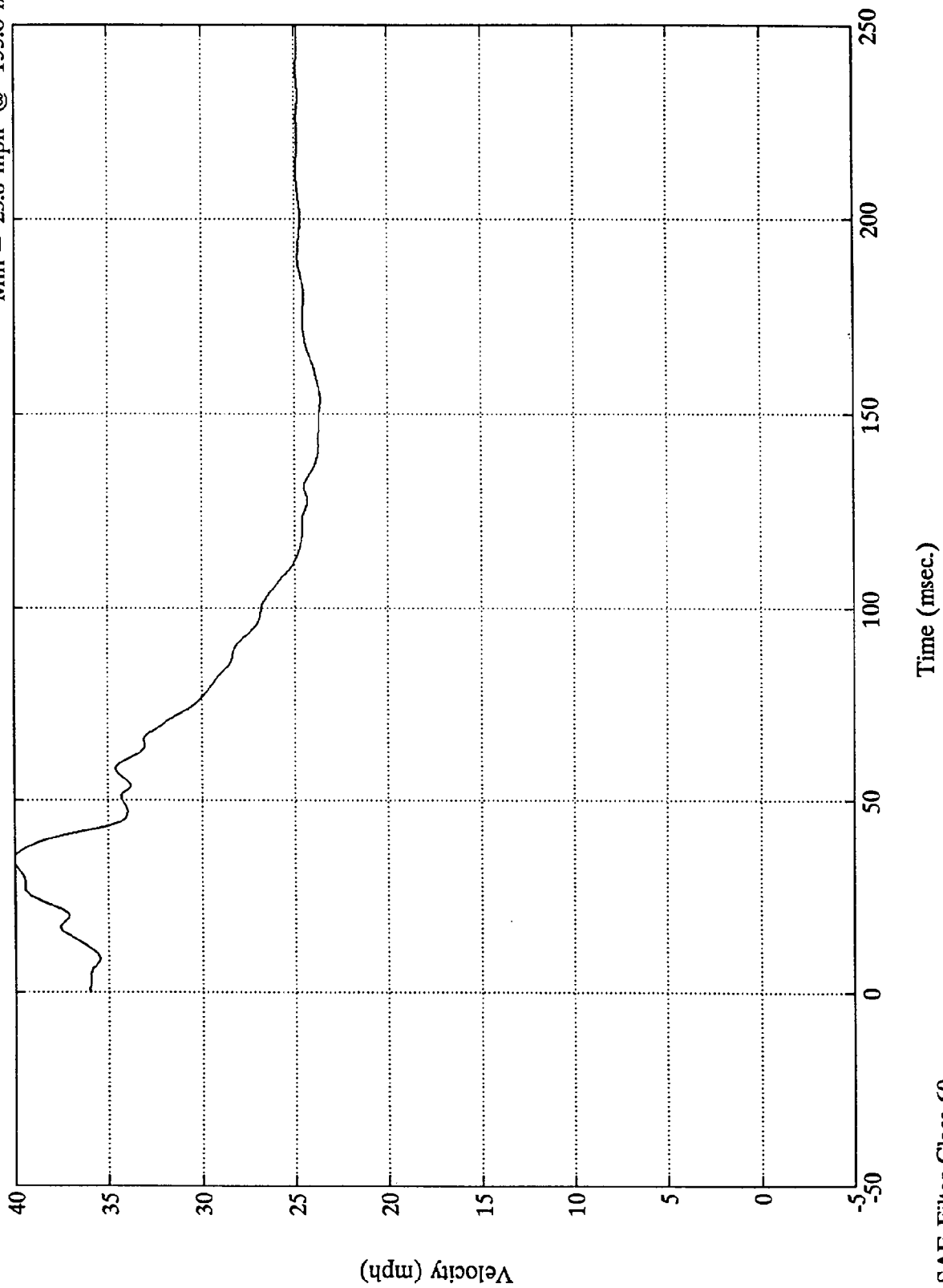
Max = 24.4 Gs @ 22.56 msec
Min = -48.3 Gs @ 41.88 msec



Max = 40.1 mph @ 34.8 msec
Min = 23.6 mph @ 153.8 msec

Veh. 2 Toe Pan (X)

V-to-V Test #4

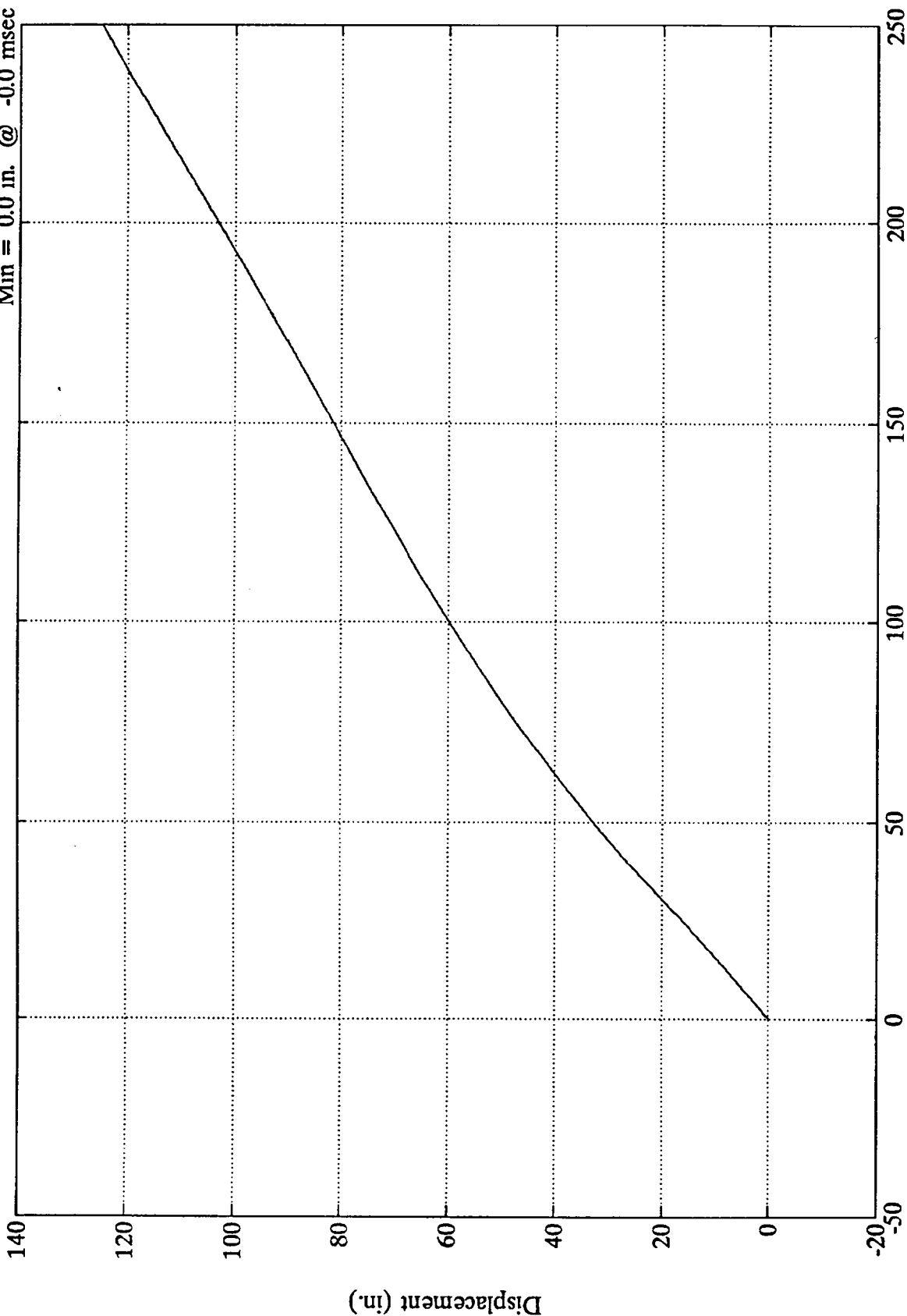


SAE Filter Class 60

V-to-V Test #4

Veh. 2 Toe Pan (X)

Max = 127.0 in. @ 254.9 msec
Min = 0.0 in. @ -0.0 msec



Time (msec.)

SAE Filter Class 60

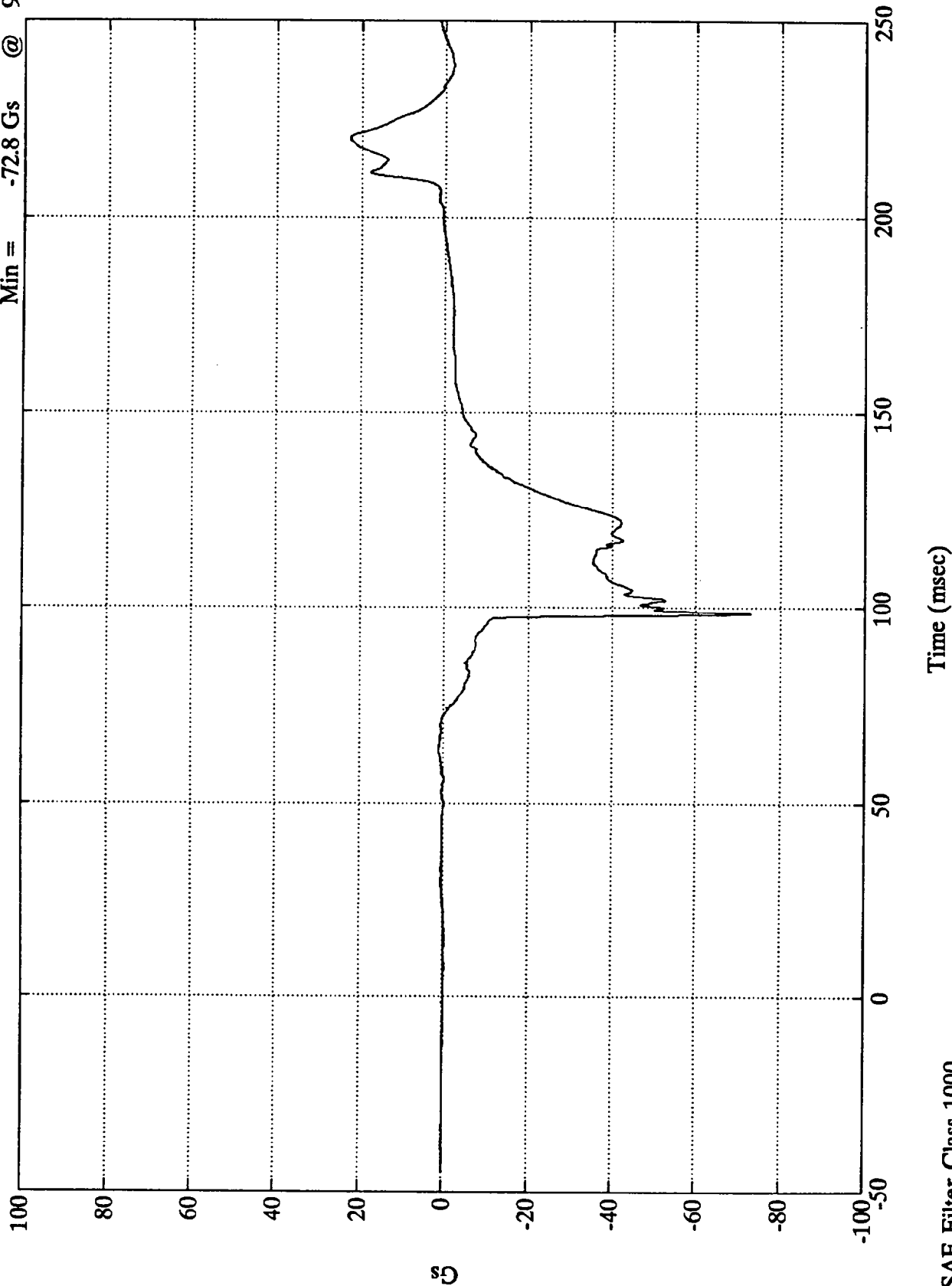
TEST NO. Y42-4-1041

DUMMY DATA

CLASS	FILTER CHANNEL
Head Accelerations	1000
Chest Accelerations	180
Femur Forces	600
Torso Belt	60
Chest Displacement	180
Neck Forces	1000
Neck Moments	600
Tibia Forces, Moments	600

V-to-V Test #4

Veh. 2 Head X
Max = 22.6 Gs @ 220.55 msec
Min = -72.8 Gs @ 98.40 msec



B-105

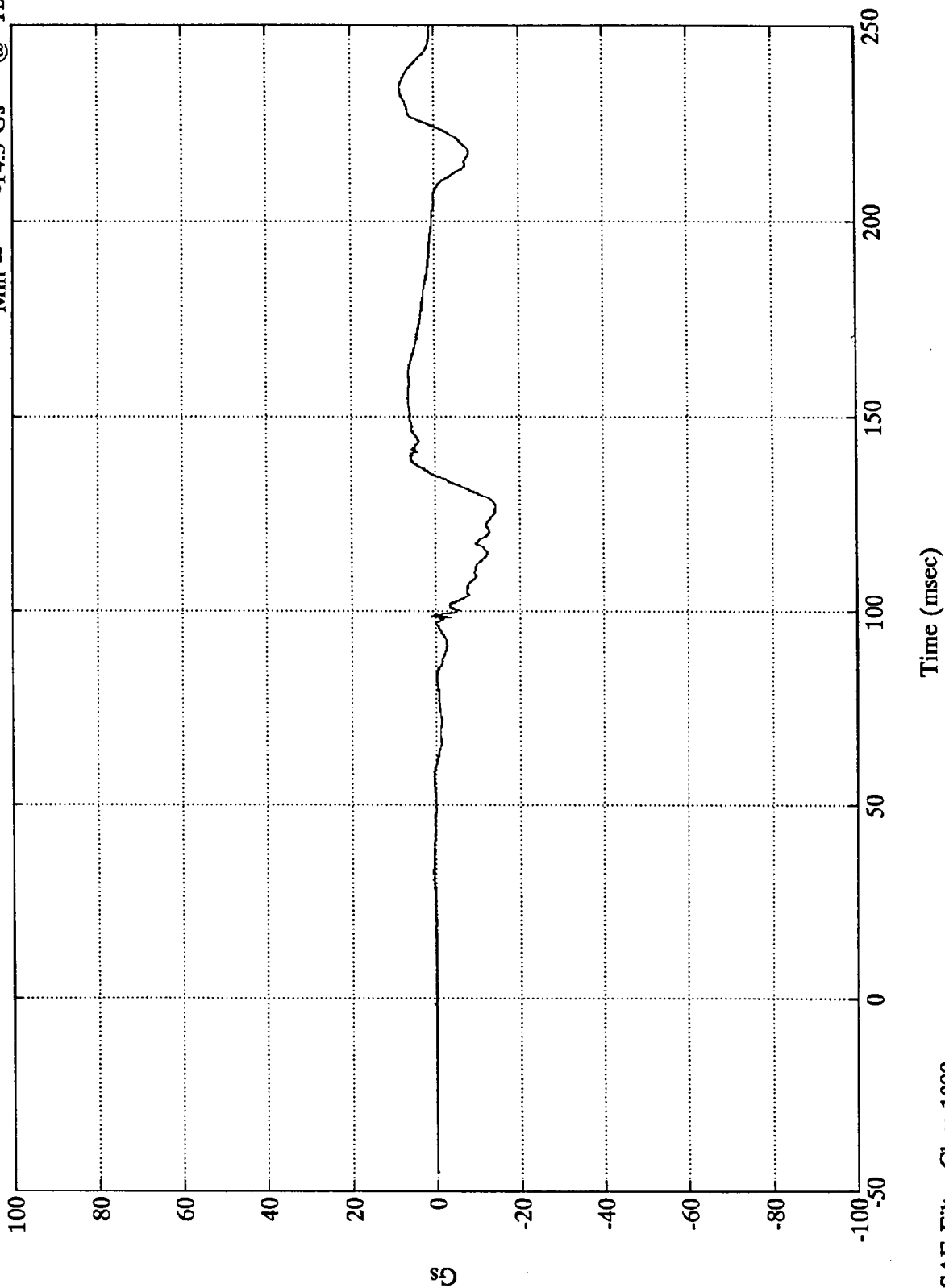
7883-4

SAE Filter Class 1000

V-to-V Test #4

Veh. 2 Head Y

Max = 8.2 Gs @ 234.24 msec
Min = -14.3 Gs @ 126.71 msec



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B-106

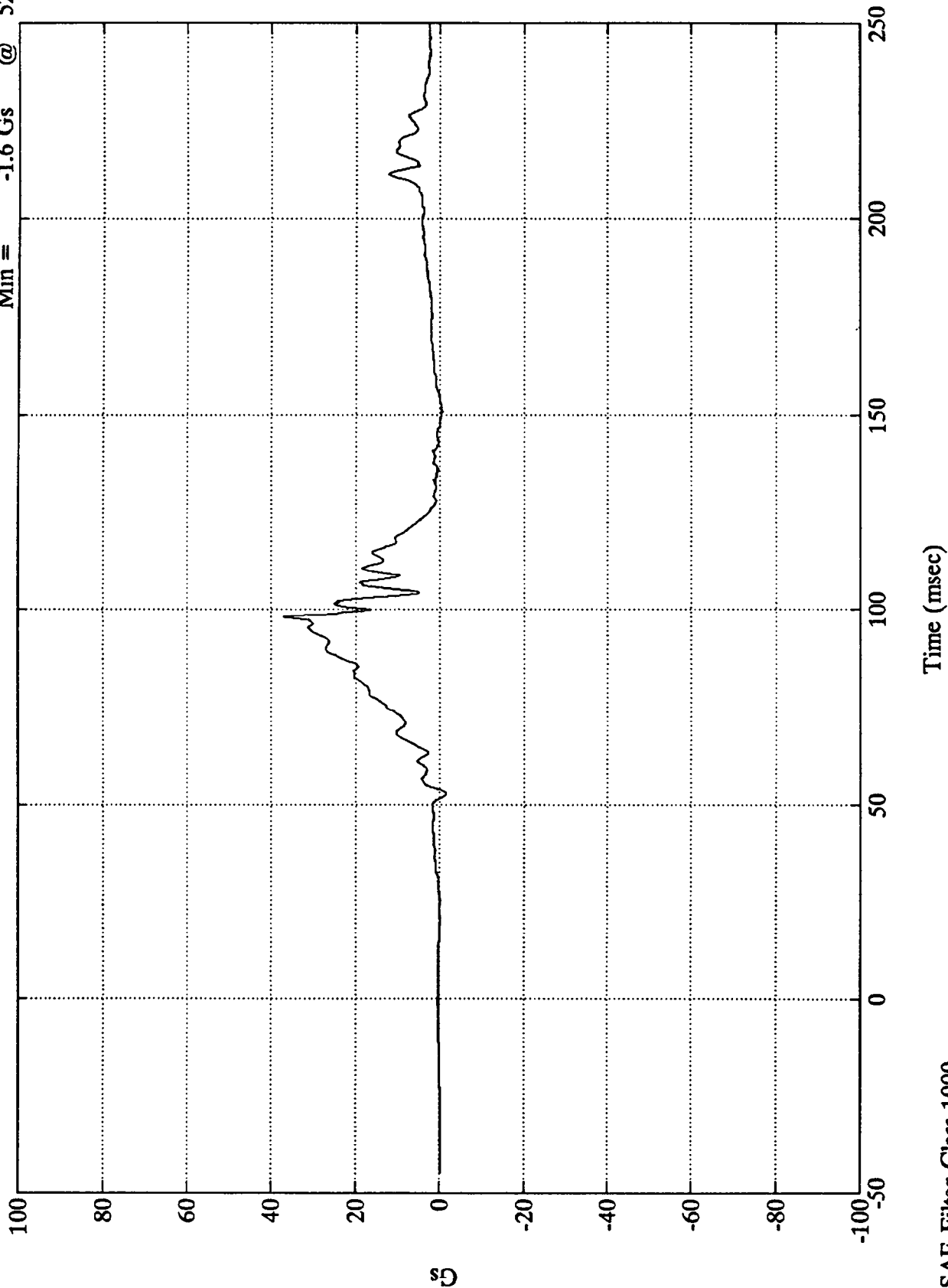
7883-4

SAE Filter Class 1000

V-to-V Test #4

Veh. 2 Head Z

Max =	37.2 Gs	@	98.04 msec
Min =	-1.6 Gs	@	52.92 msec



Gs

B-107

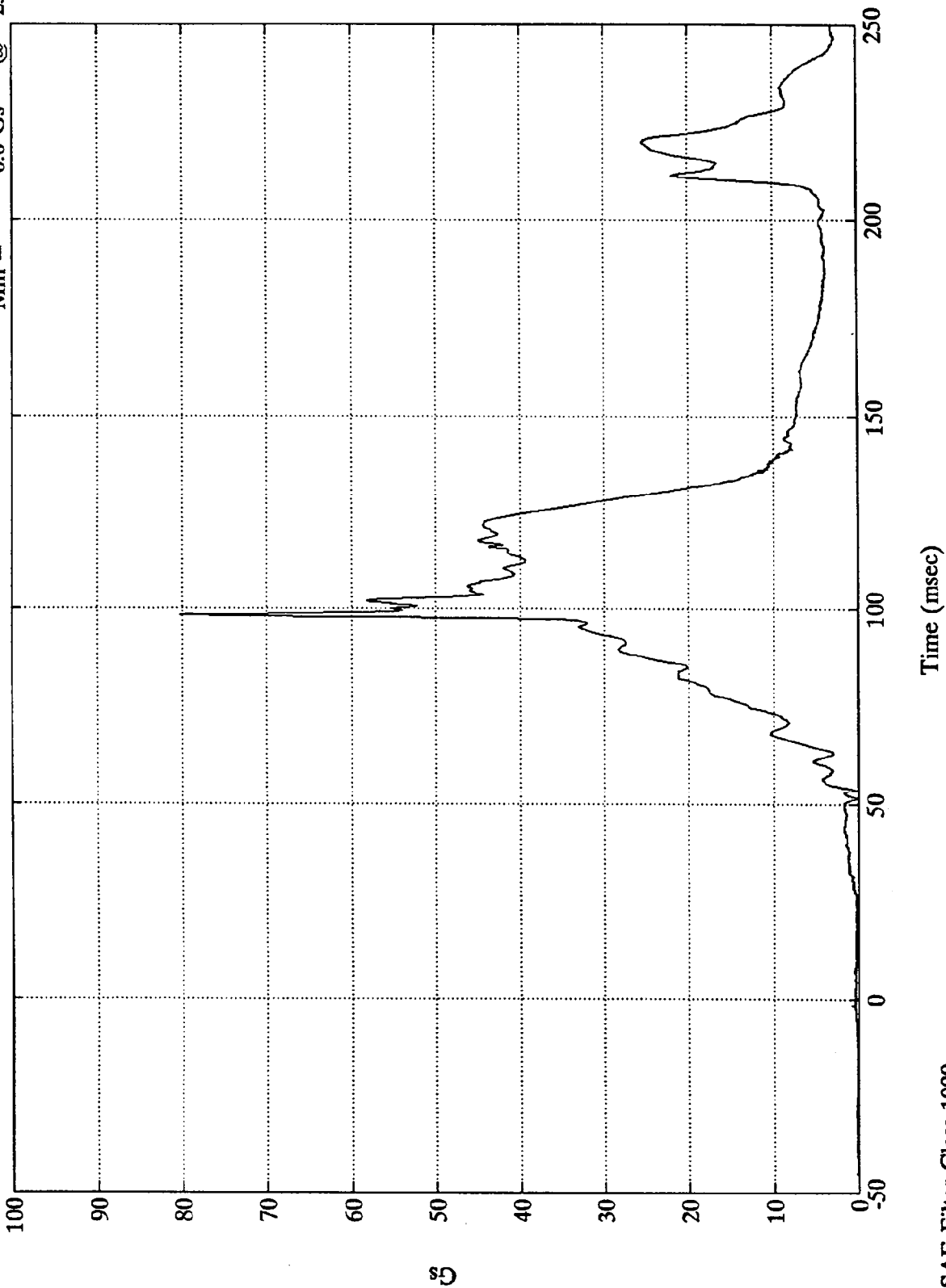
7883-4

SAE Filter Class 1000

V-to-V Test #4

Veh. 2 Head Resultant

Max = 80.1 Gs @ 98.40 msec
Min = 0.0 Gs @ -23.28 msec

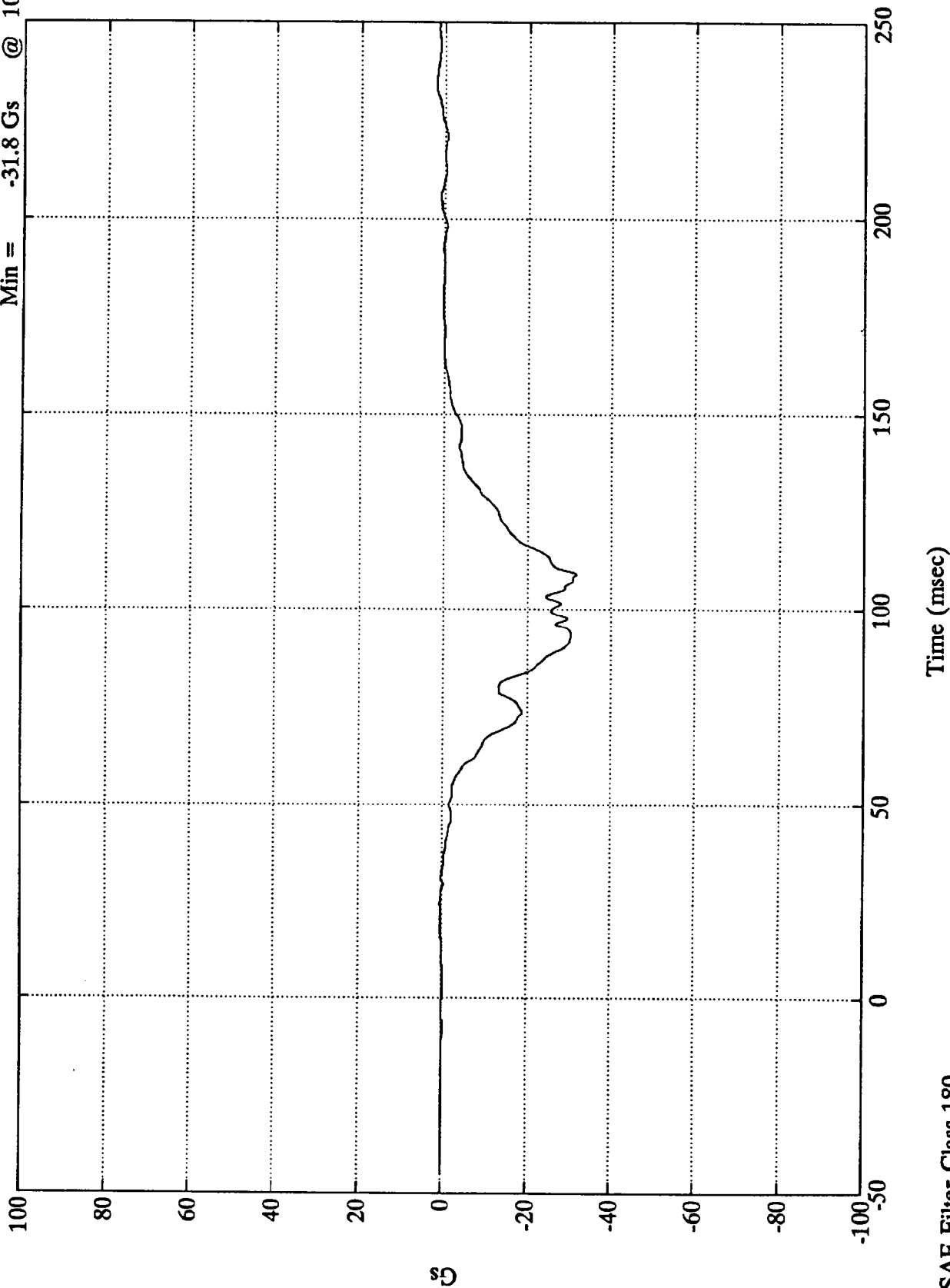


Gs

Time (msec)

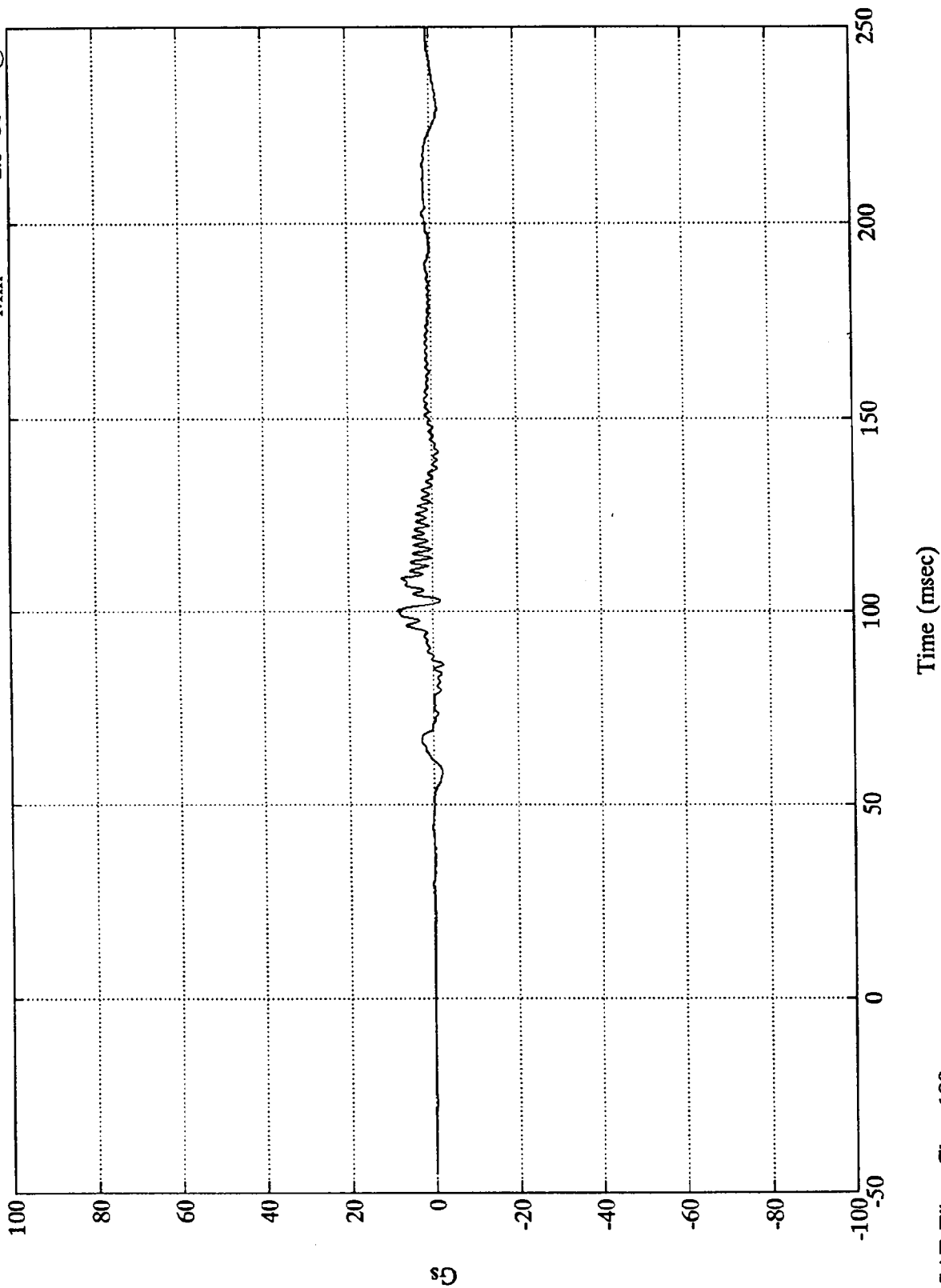
SAE Filter Class 1000

Veh. 2 Chest X
Max = 2.1 Gs @ 234.12 msec
Min = -31.8 Gs @ 109.08 msec



V-to-V Test #4

Veh. 2 Chest Y
Max = 8.2 Gs @ 100.32 msec
Min = -2.5 Gs @ 86.40 msec



B-110

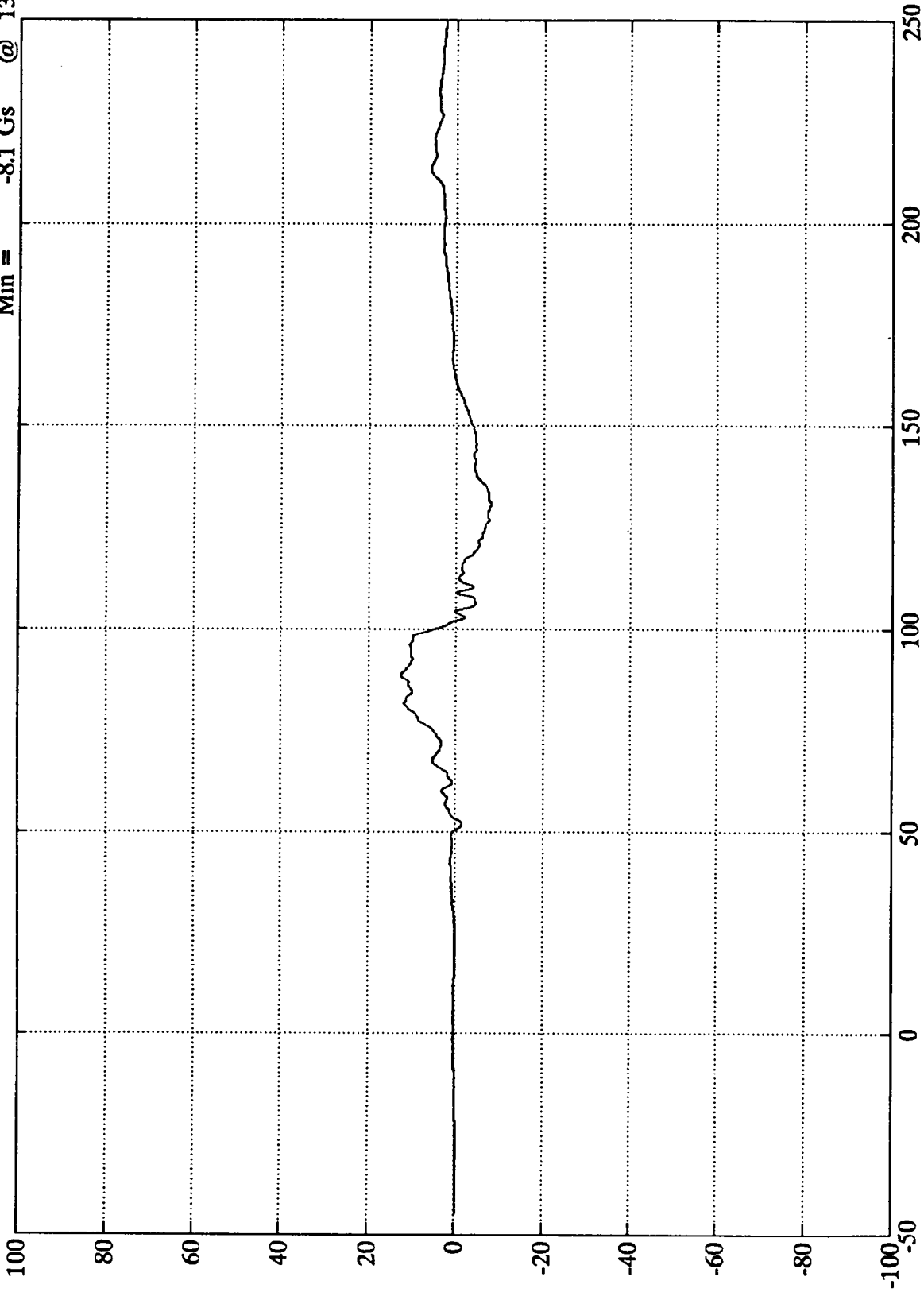
7883-4

SAE Filter Class 180

V-to-V Test #4

Veh. 2 Chest Z

Max =	12.5 Gs	@	88.55 msec
Min =	-8.1 Gs	@	131.04 msec



Time (msec)

SAE Filter Class 180

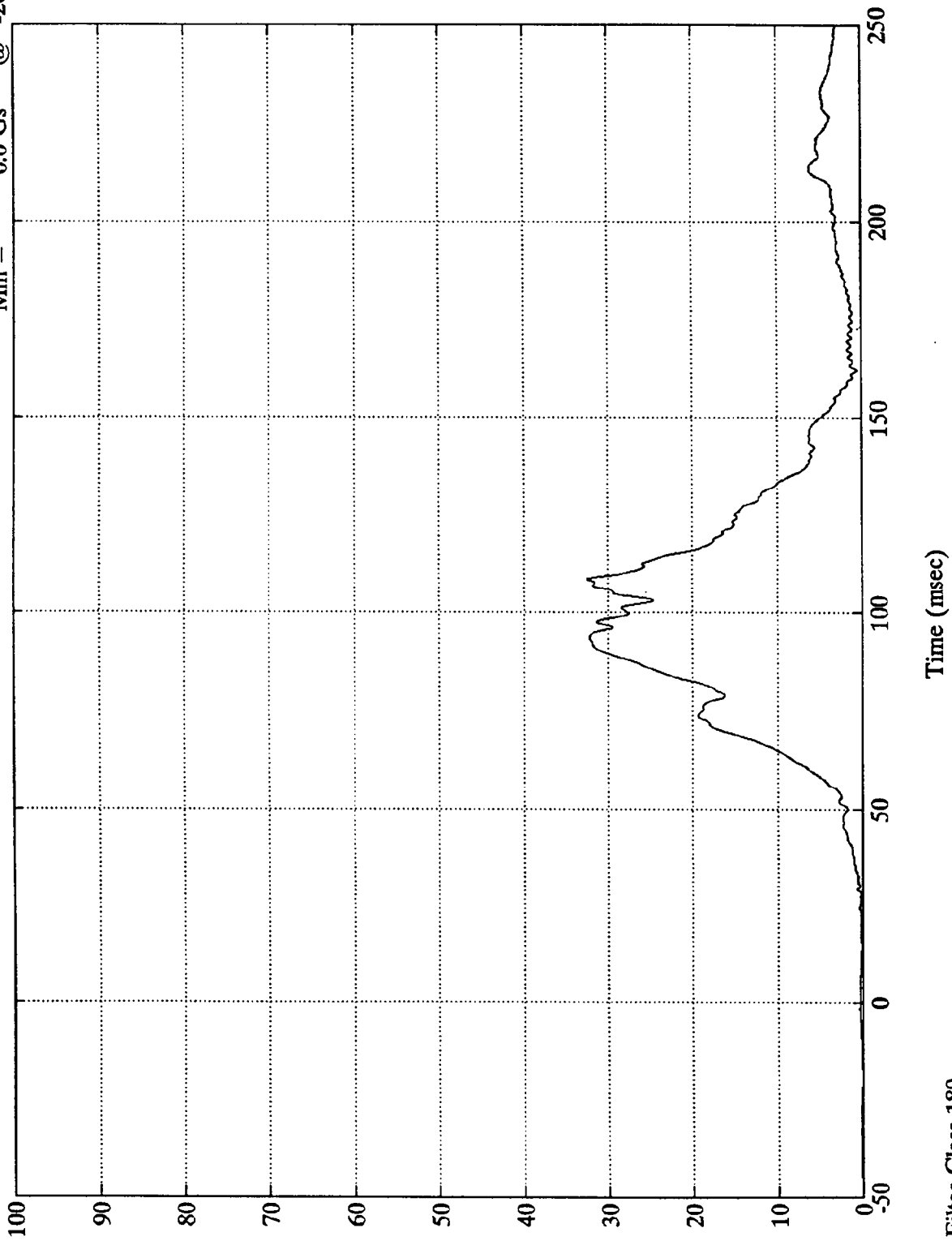
Gs

B-111

7883-4

V-to-V Test #4

Veh. 2 Chest Resultant
Max = 32.4 Gs @ 108.84 msec
Min = 0.0 Gs @ -20.16 msec



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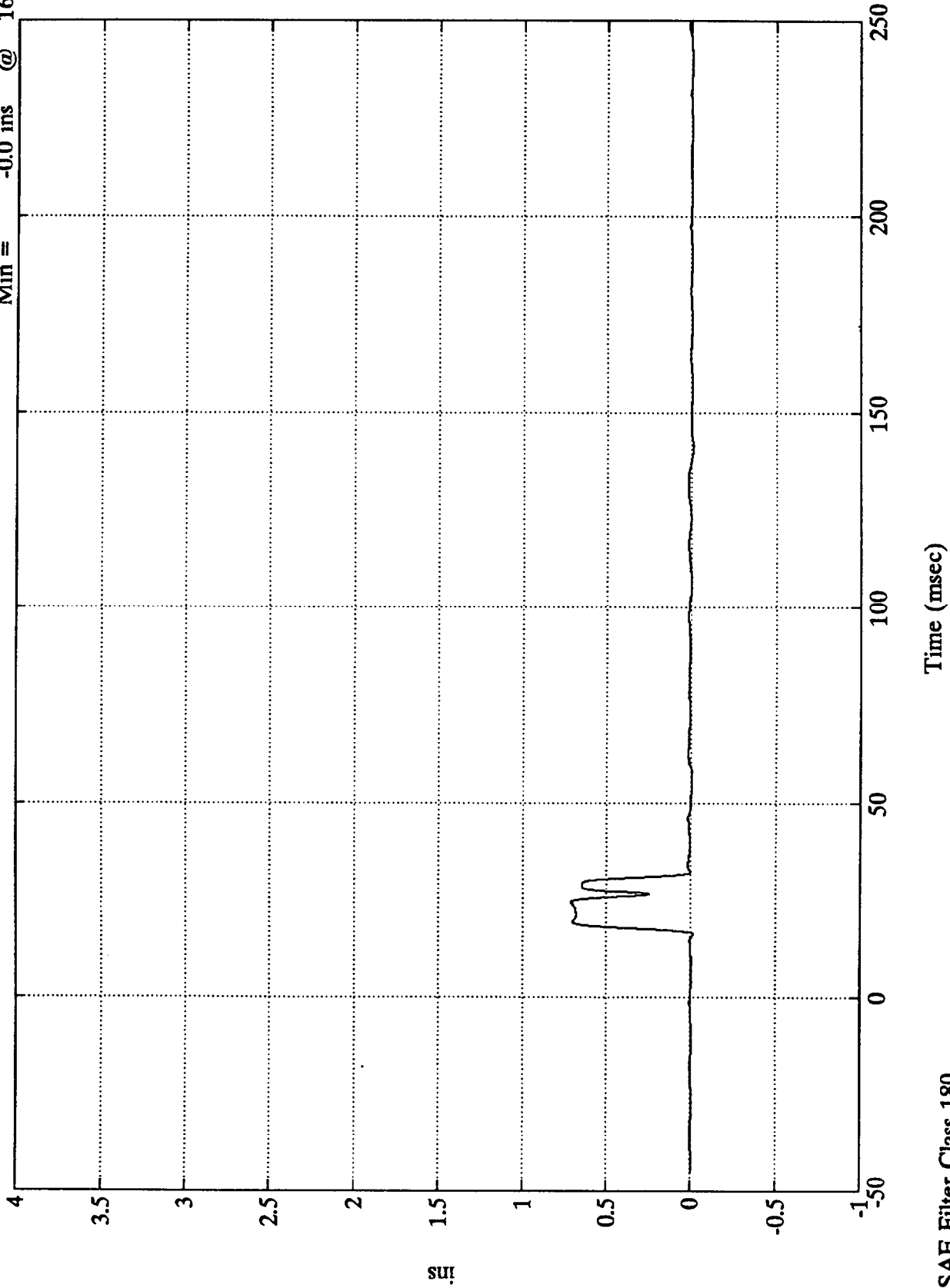
B-112

7883-4

SAE Filter Class 180

Veh. 2 Chest Displacement

Max = 0.7 ins @ 24.23 msec
Min = -0.0 ins @ 16.31 msec



su

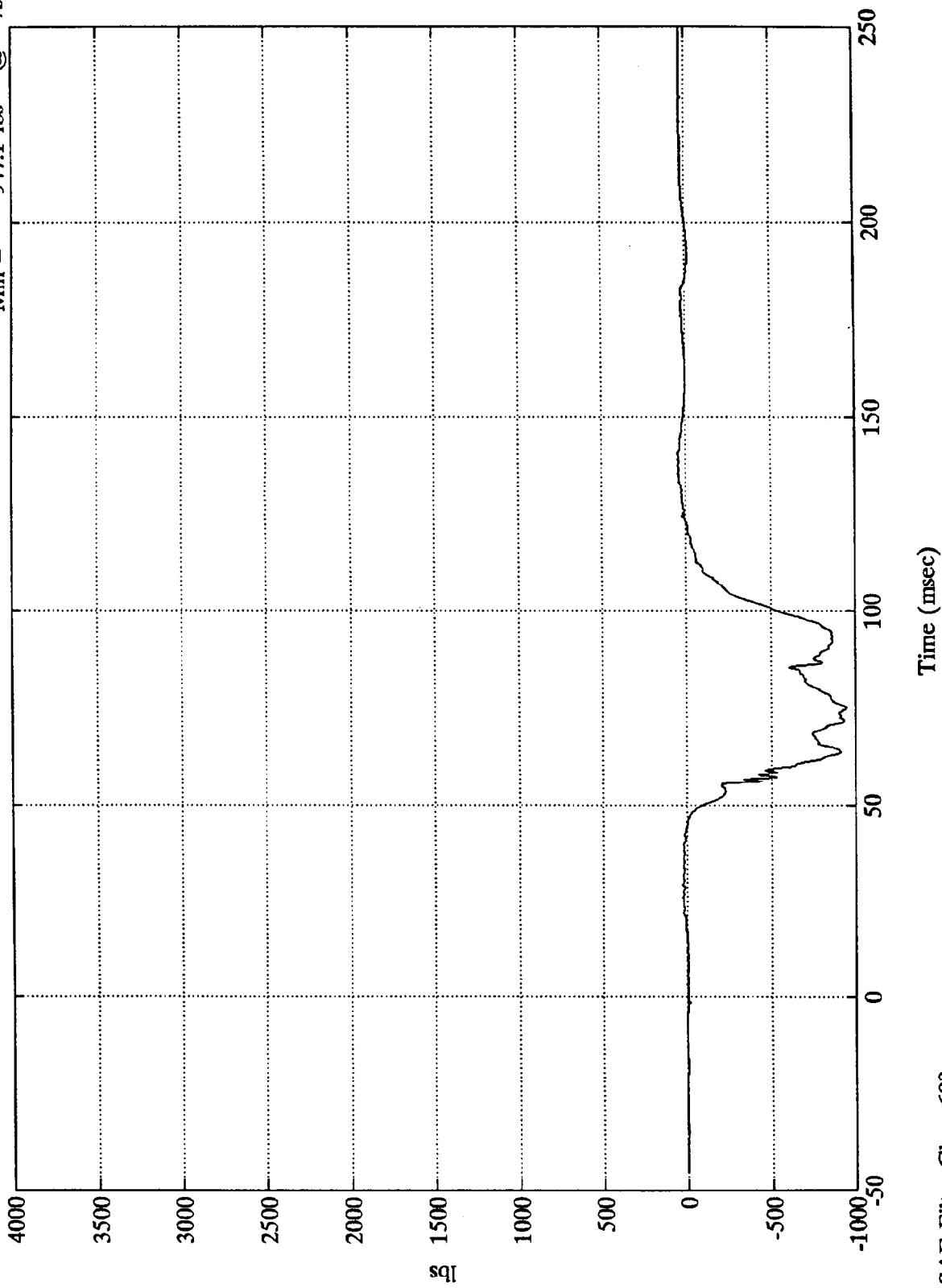
B-113

7883-4

SAE Filter Class 180

V-to-V Test #4

Veh. 2 Left Femur
Max = 47.5 lbs @ 140.76 msec
Min = -947.1 lbs @ 75.00 msec



sqi

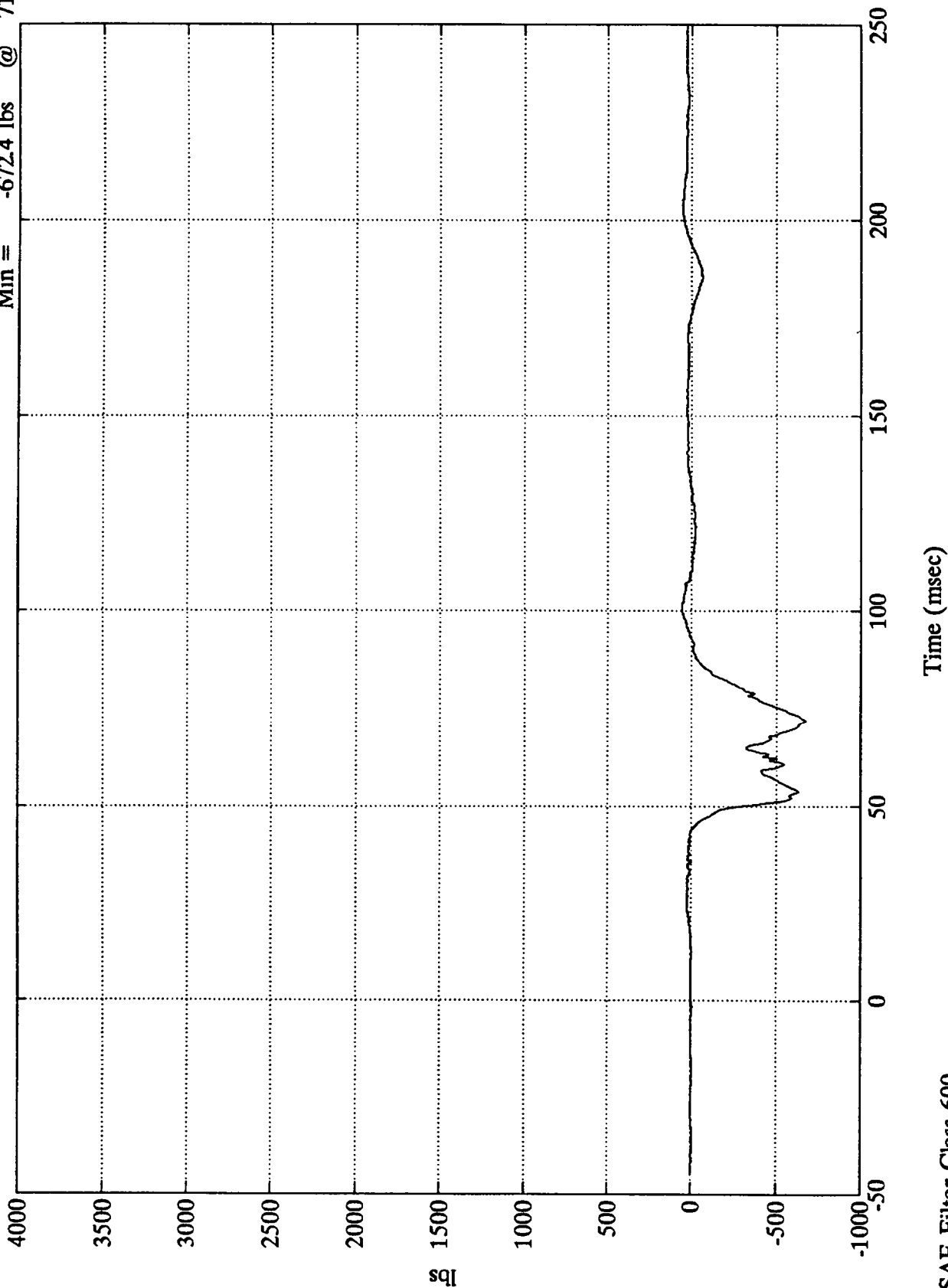
B-114

7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 2 Right Femur
Max = 59.2 lbs @ 100.44 msec
Min = -672.4 lbs @ 71.87 msec



sqi

B-115

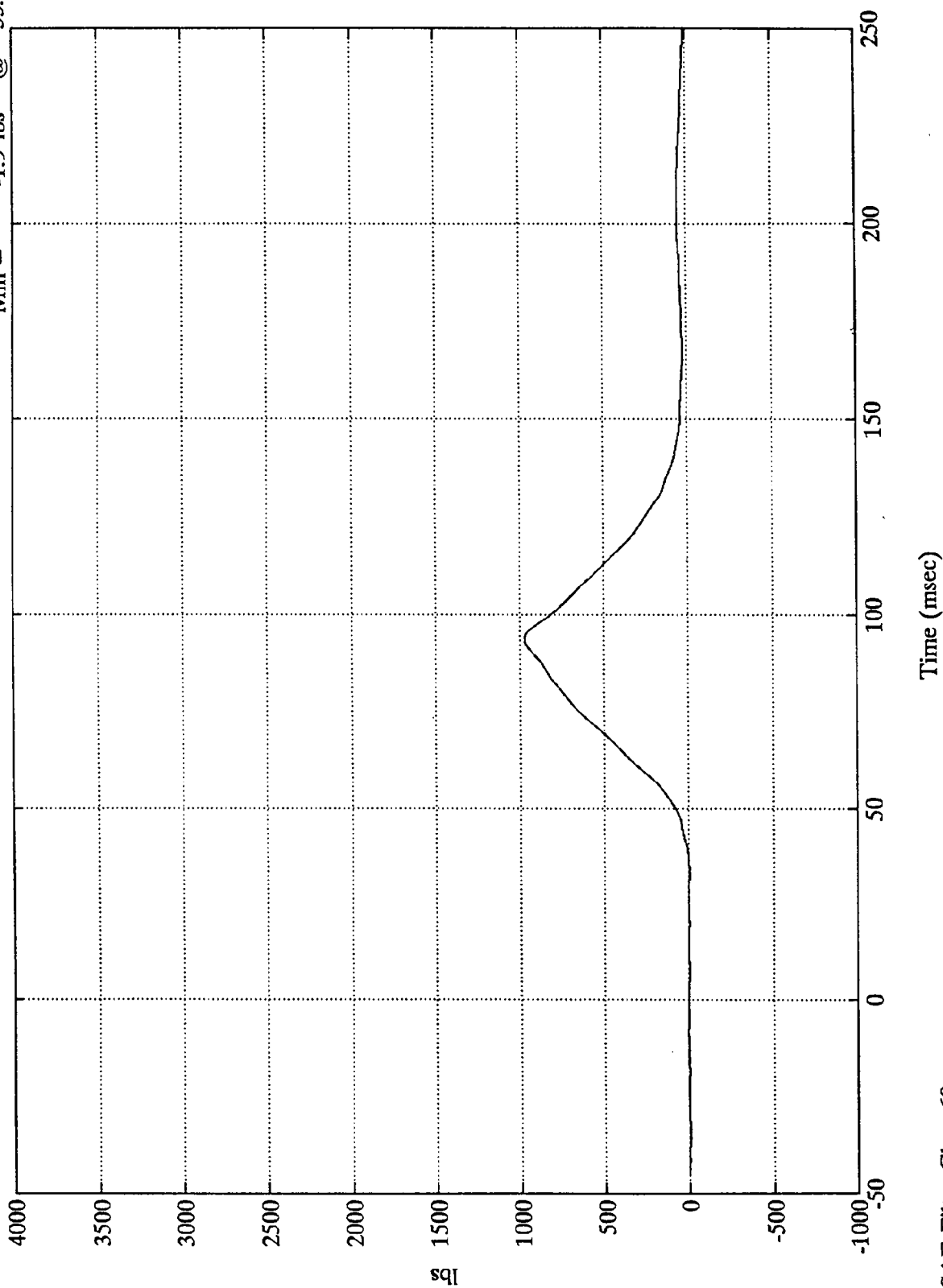
7883-4

SAE Filter Class 600

V-to-V Test #4

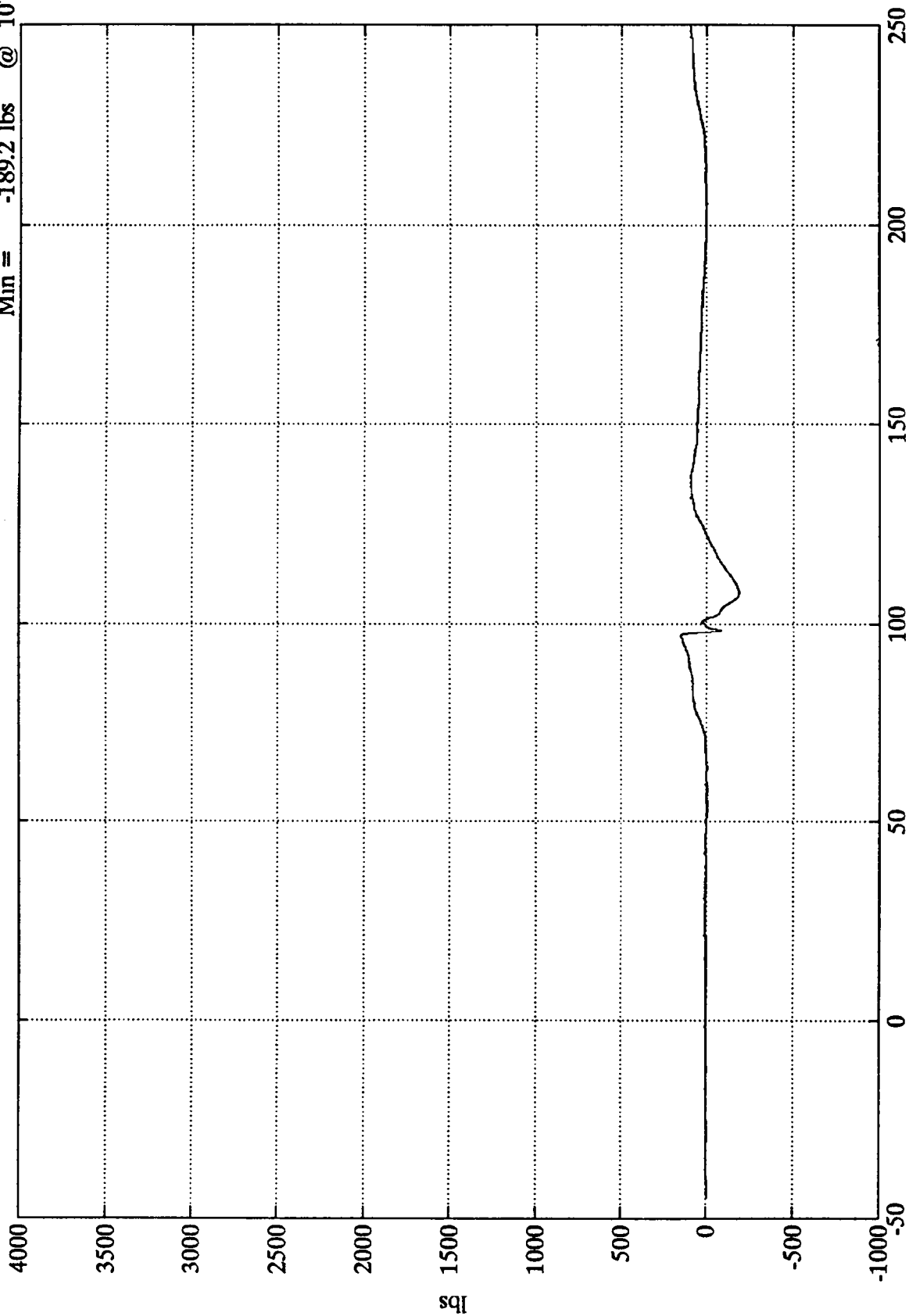
Veh. 2 Torso Belt L.C.

Max = 971.8 lbs @ 93.60 msec
Min = -1.9 lbs @ 33.47 msec



Veh. 2 Upper Neck Fx

Max = 154.2 lbs @ 97.08 msec
Min = -189.2 lbs @ 107.88 msec



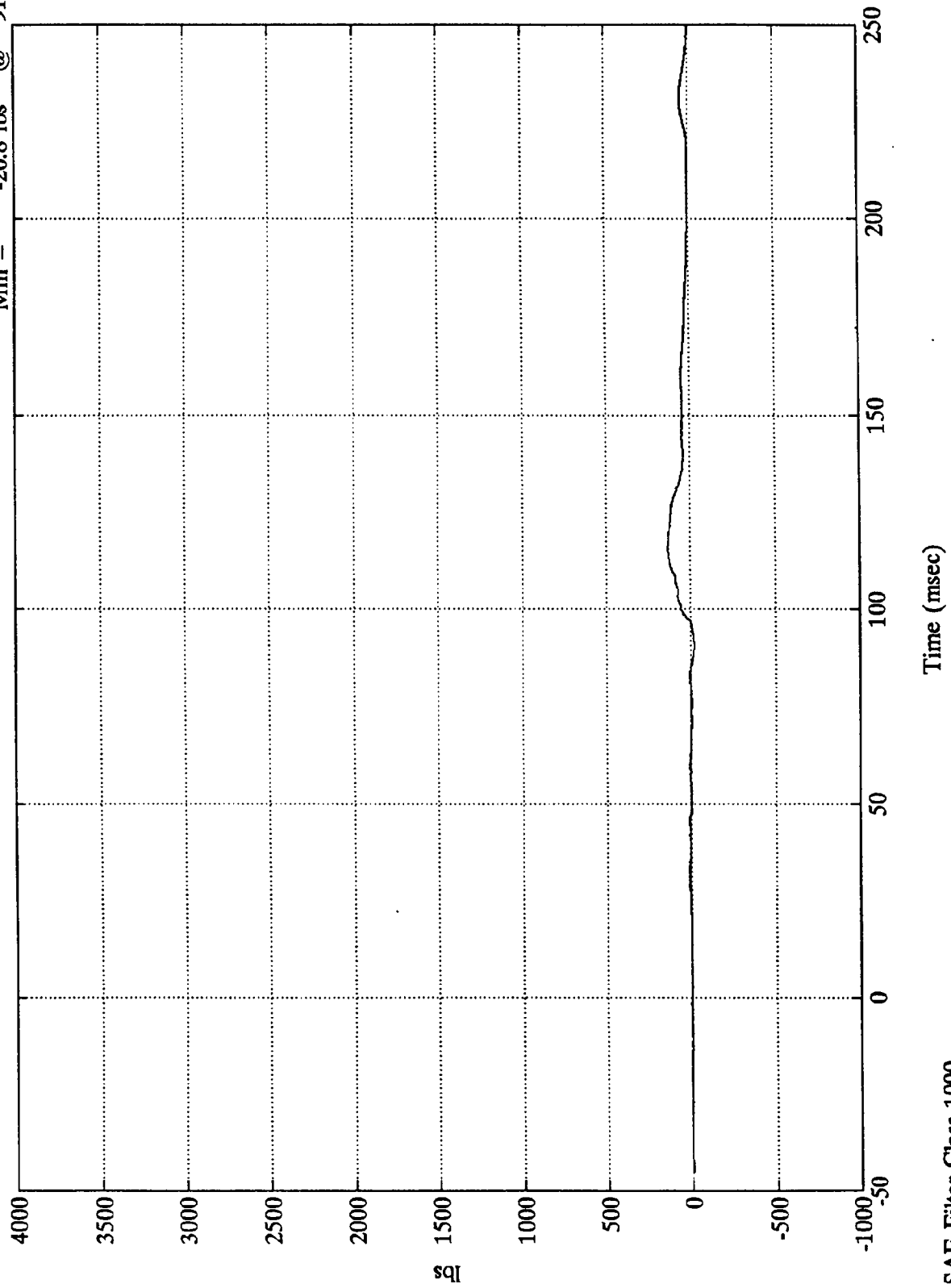
Time (msec)

SAE Filter Class 1000

V-to-V Test #4

Veh. 2 Upper Neck Fy

Max = 134.5 lbs @ 116.40 msec
Min = -20.8 lbs @ 91.31 msec



B-118

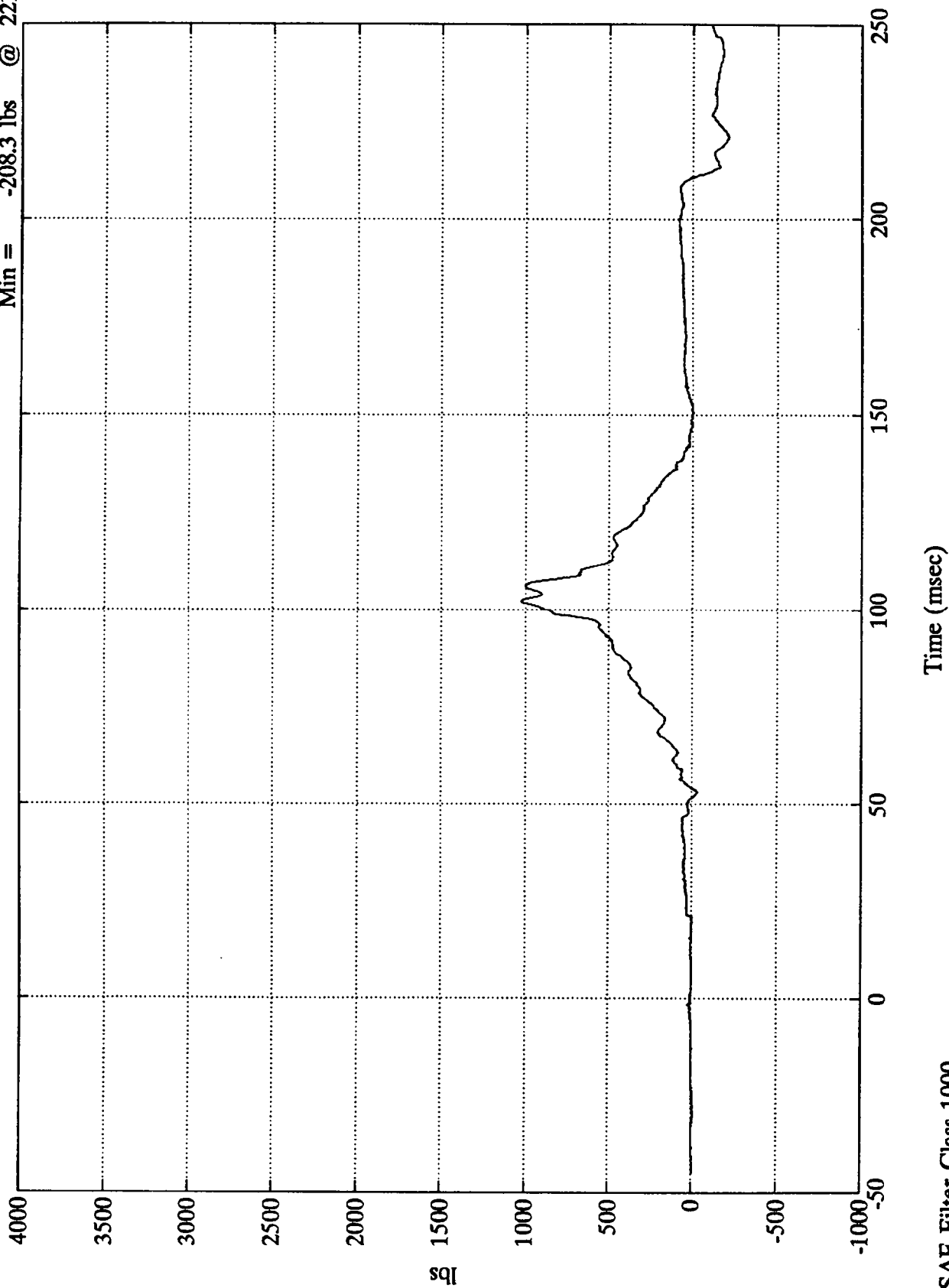
7883-4

SAE Filter Class 1000

V-to-V Test #4

Veh. 2 Upper Neck Fz

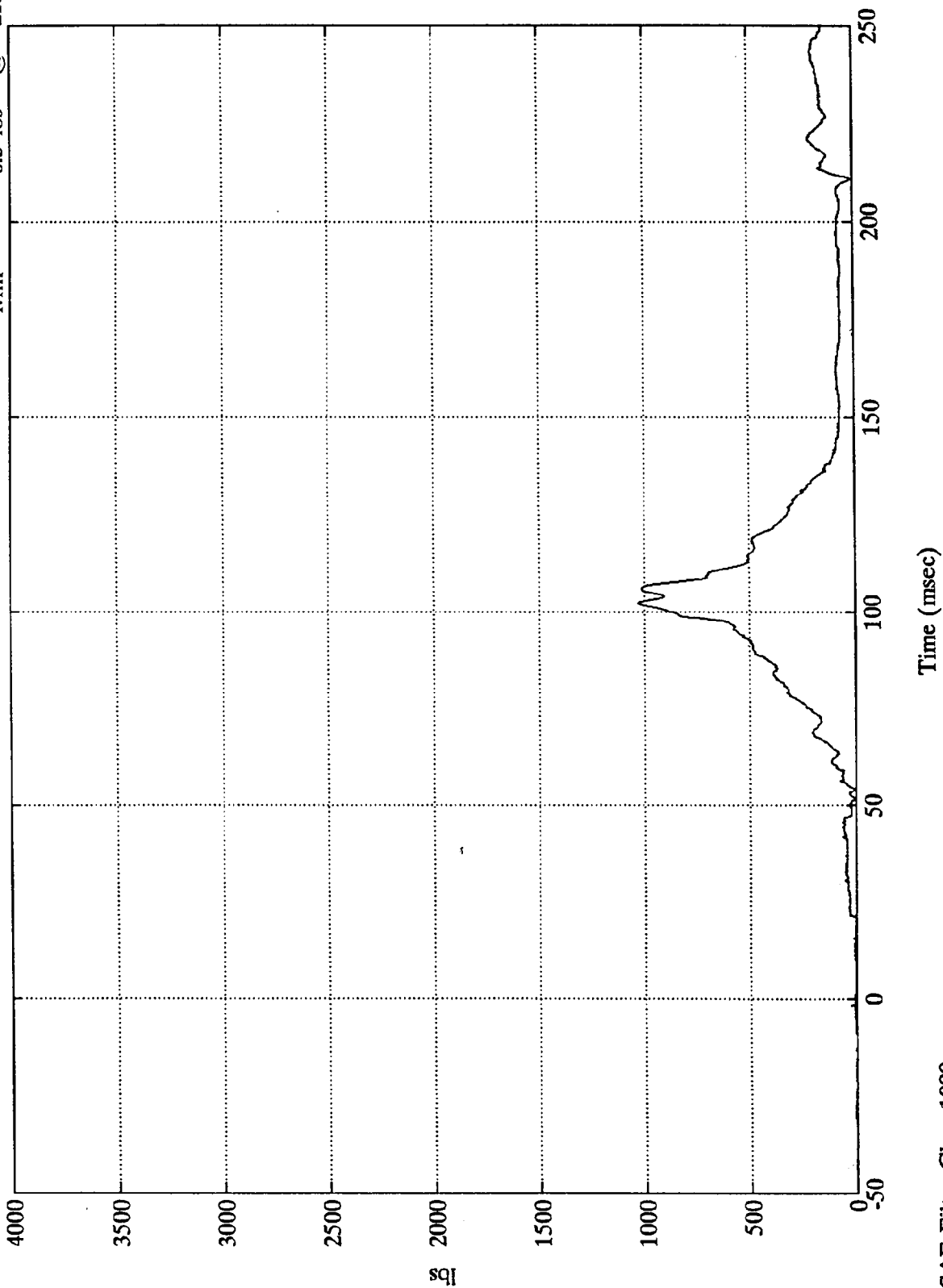
Max = 1024.4 lbs @ 102.36 msec
Min = -208.3 lbs @ 221.28 msec



V-to-V Test #4

Veh. 2 Neck Force Res.

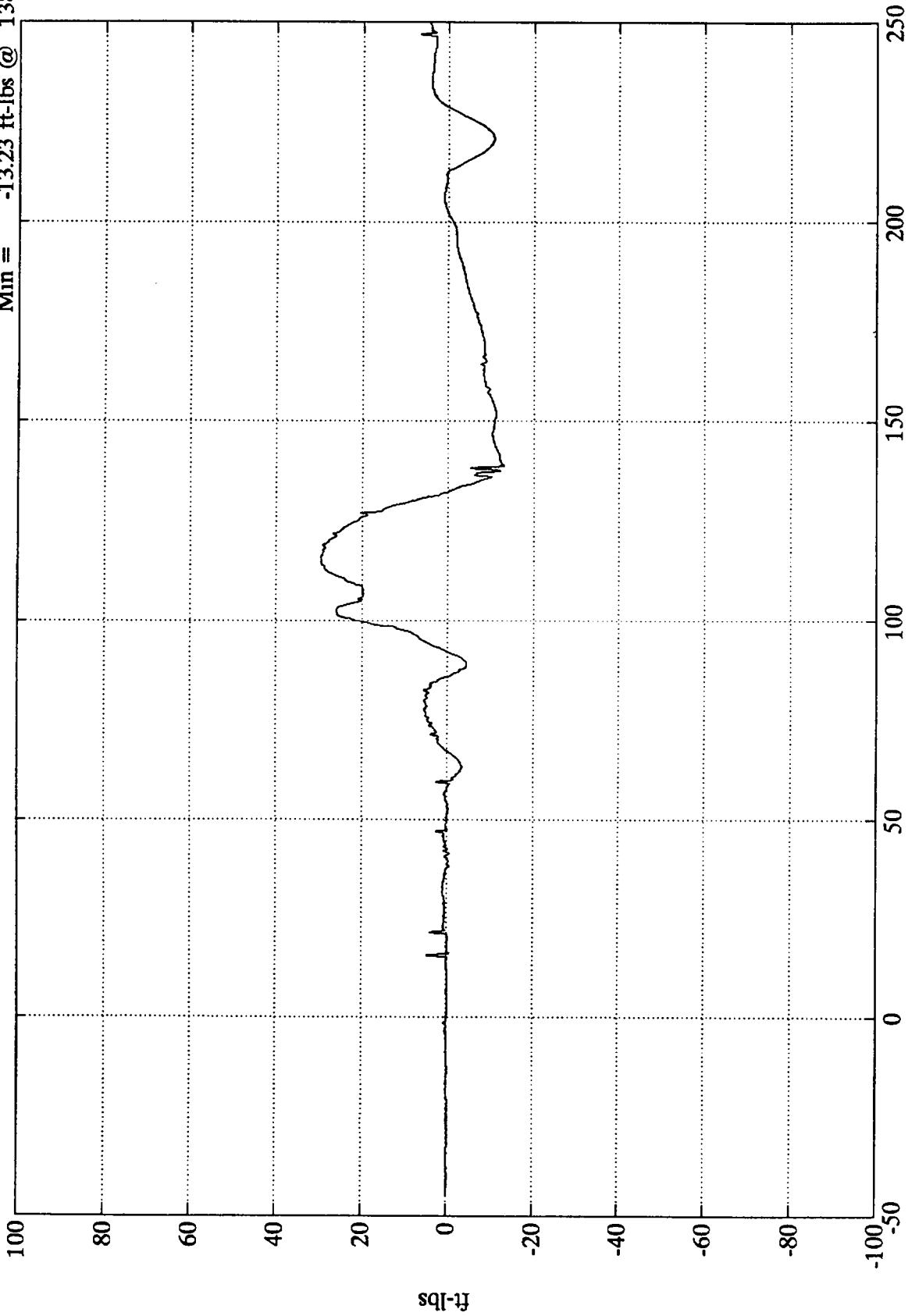
Max = 1028.5 lbs @ 102.36 msec
Min = 0.5 lbs @ 21.23 msec



B-120

7883-4

SAE Filter Class 1000



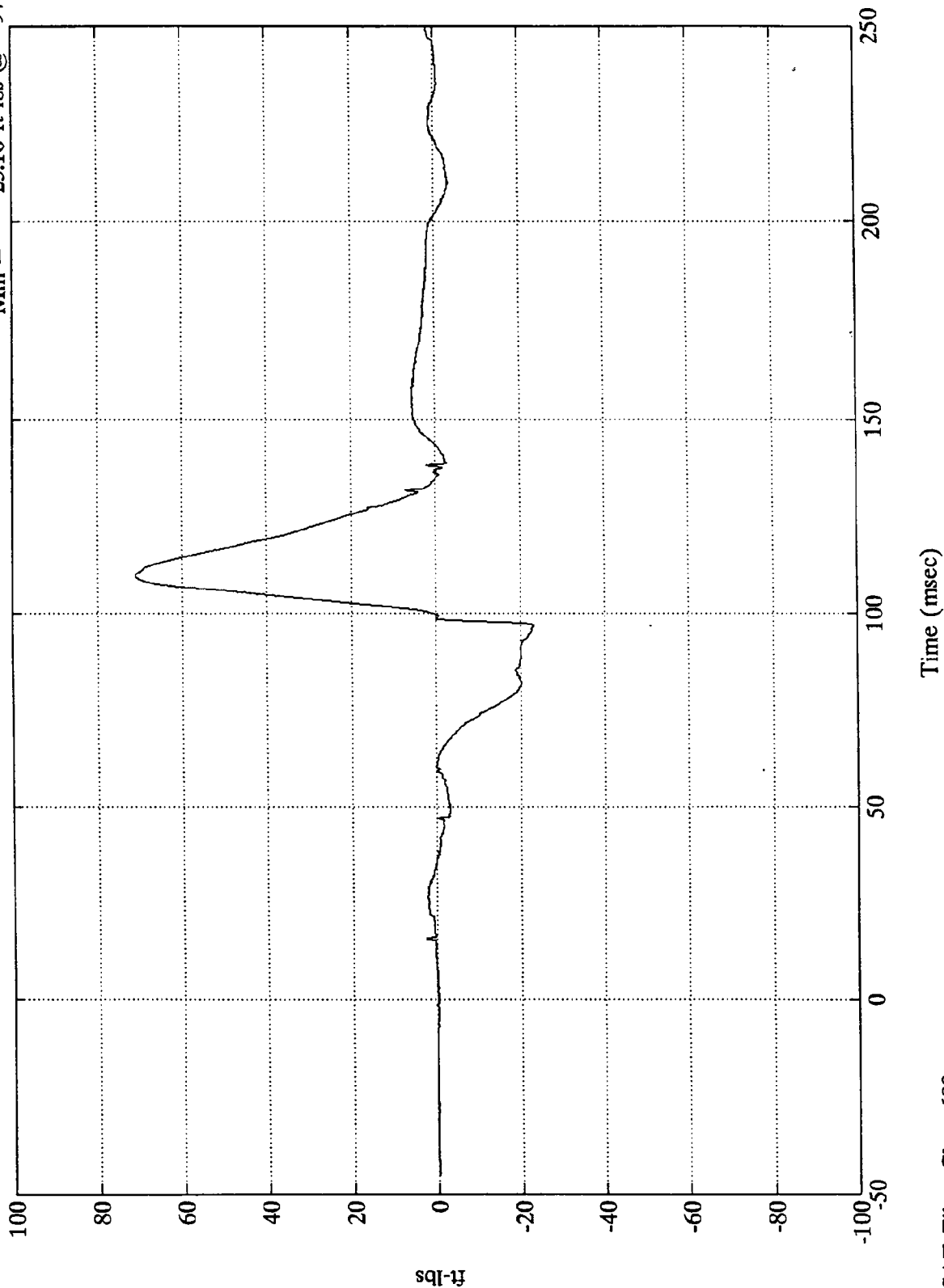
Time (msec)

SAE Filter Class 600

V-to-V Test #4

Veh. 2 Upper Neck My

Max = 71.04 ft-lbs @ 109.92 msec
Min = -23.16 ft-lbs @ 97.08 msec

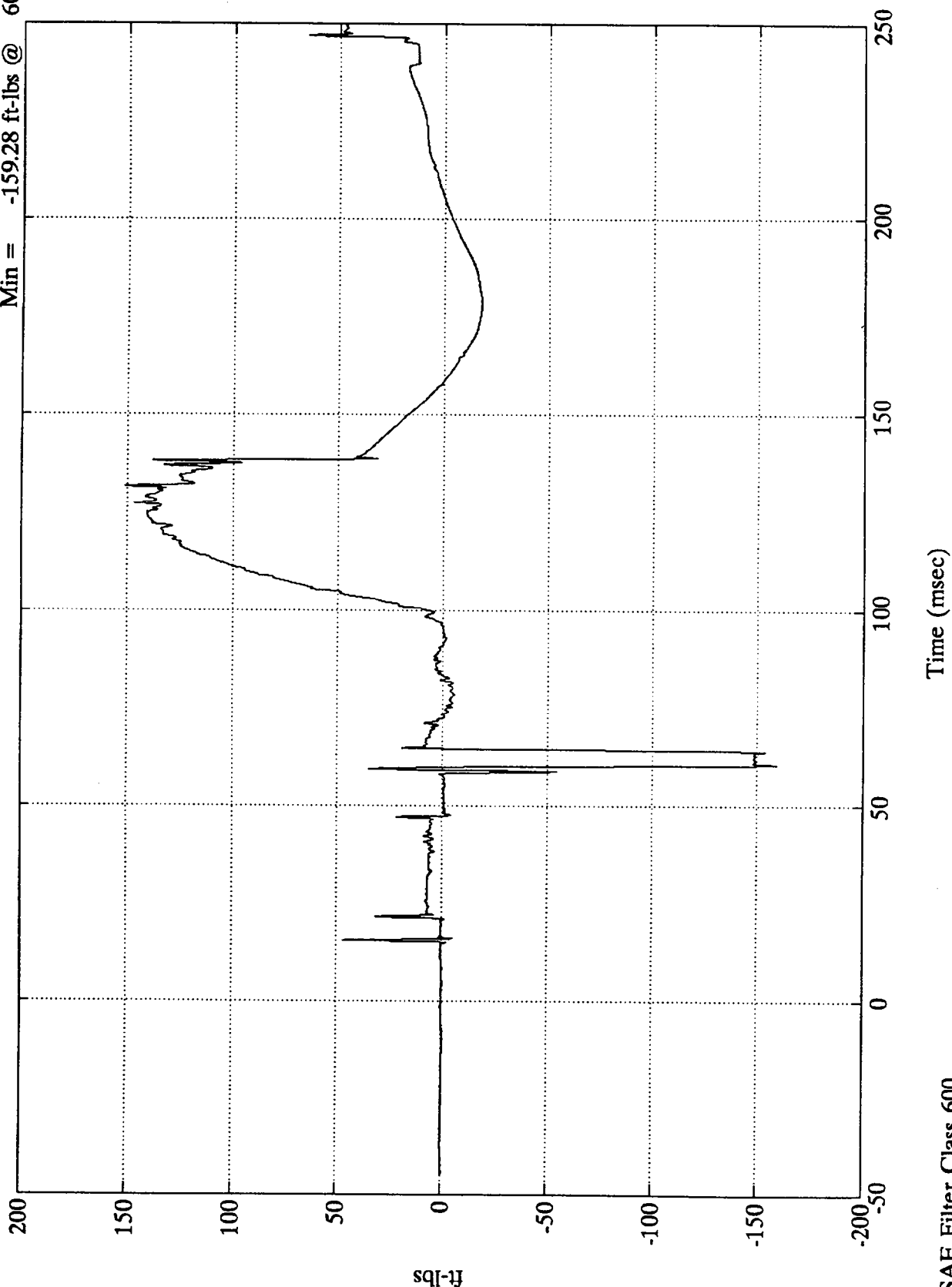


B-122

7883-4

SAE Filter Class 600

Veh. 2 Upper Neck Mz
 Max = 150.72 ft-lbs @ 131.63 msec
 Min = -159.28 ft-lbs @ 60.60 msec



sq[-1]
 B-123

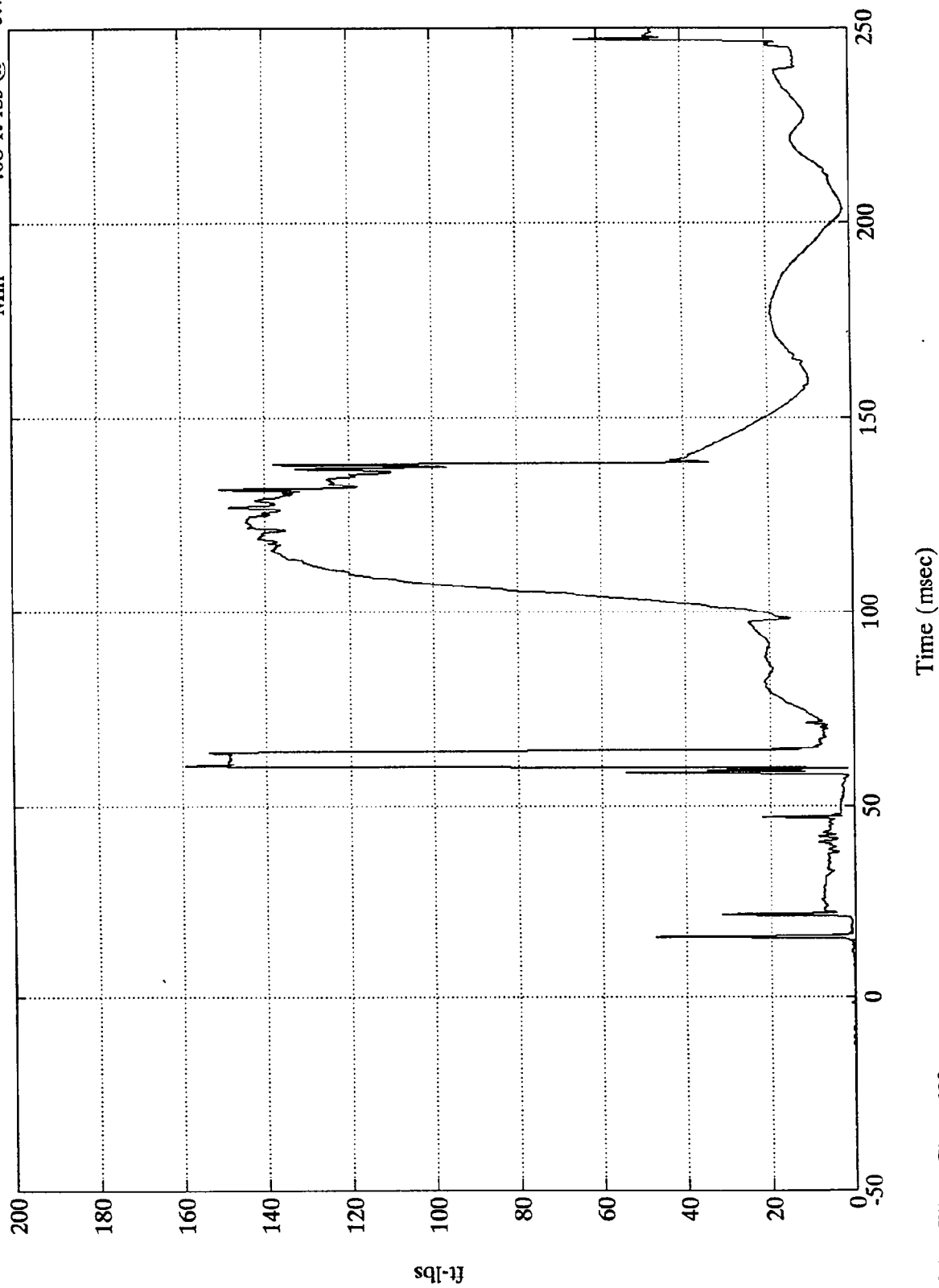
7883-4

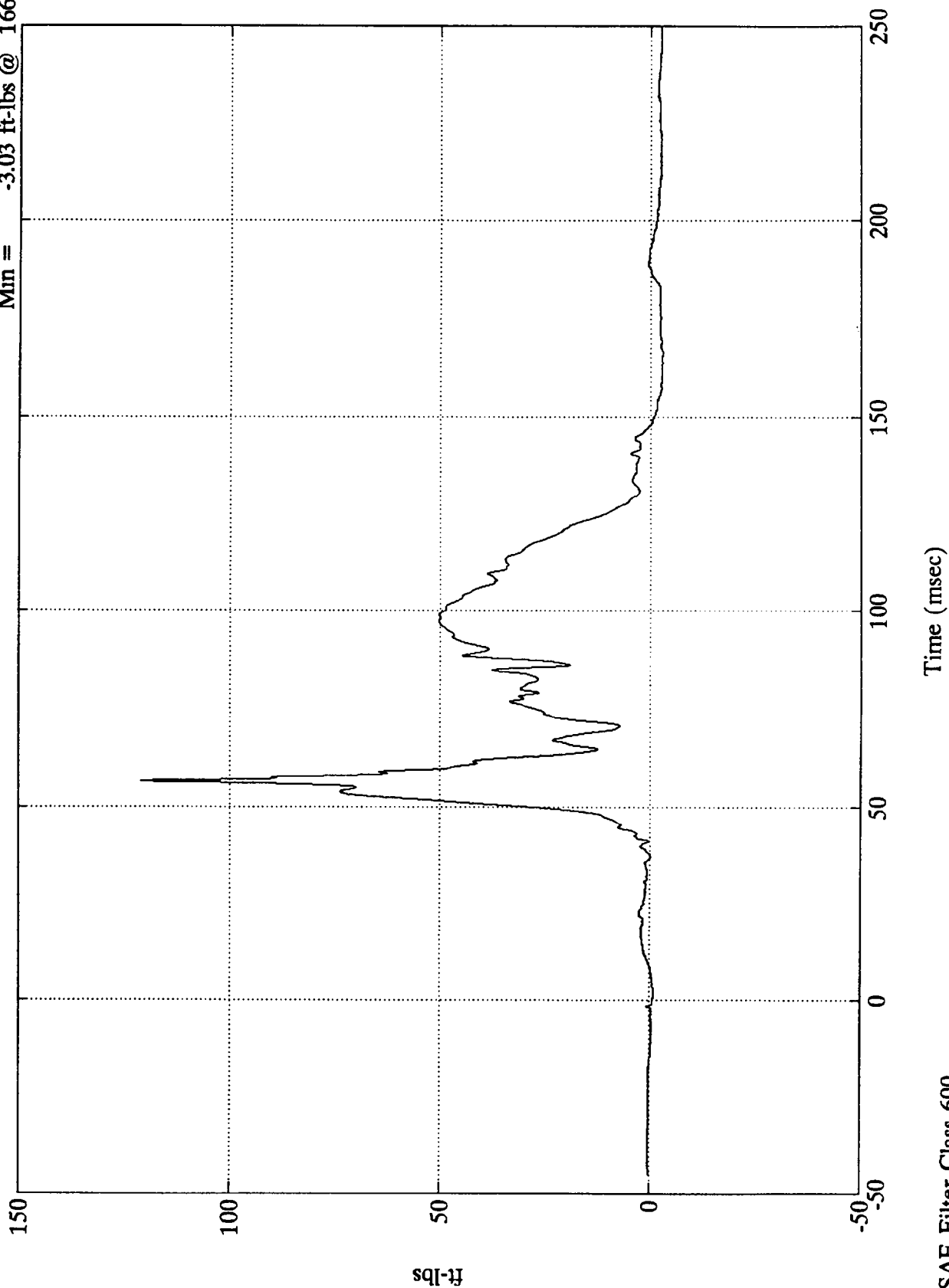
SAE Filter Class 600

V-to-V Test #4

Veh. 2 Neck Moment Res.

Max = 159.29 ft-lbs @ 60.60 msec
Min = .08 ft-lbs @ -5.76 msec

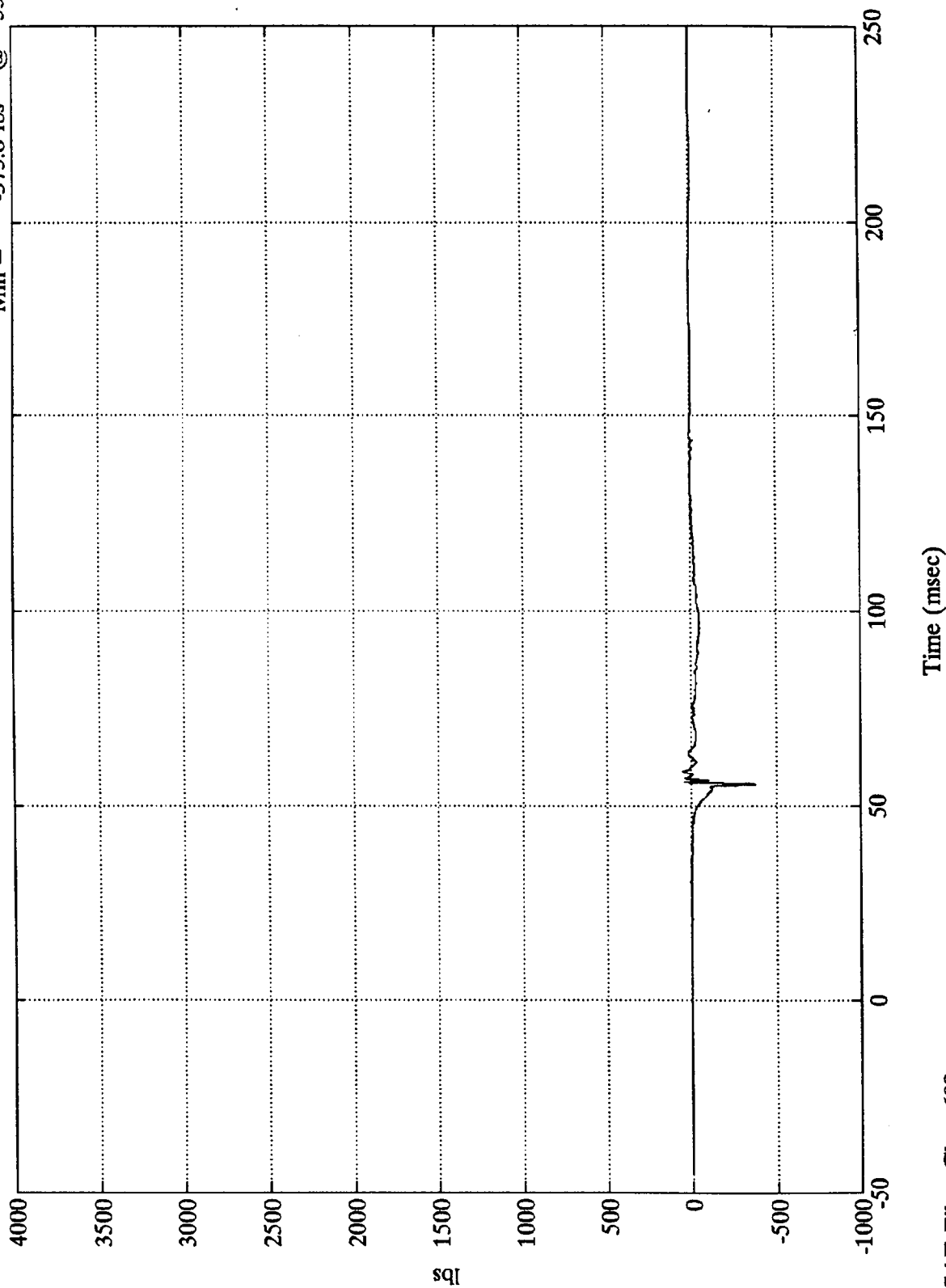




V-to-V Test #4

Veh. 2 Lt L Tibia Fy

Max = 52.3 lbs @ 59.04 msec
Min = -375.8 lbs @ 55.68 msec

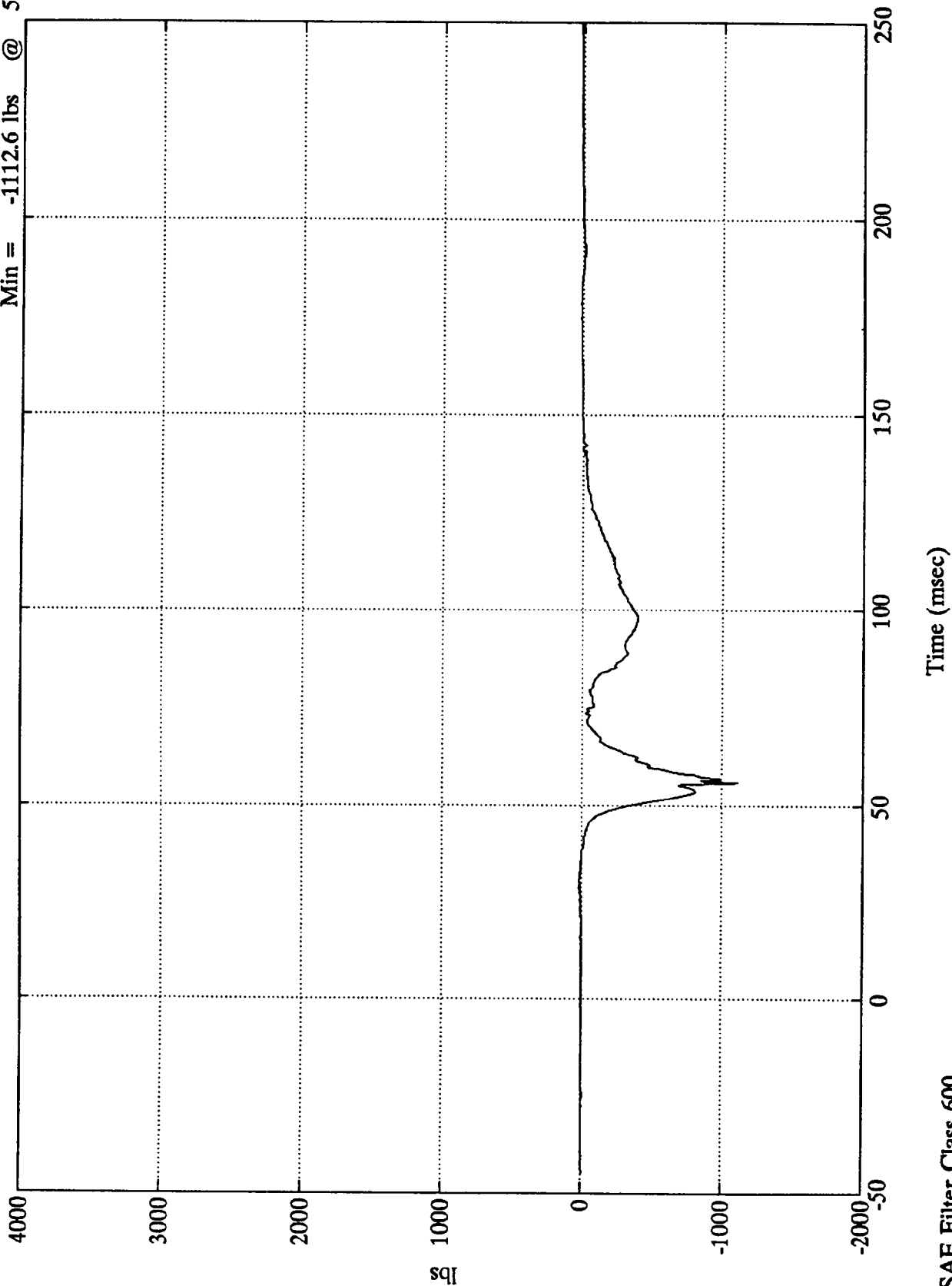


B-126

7883-4

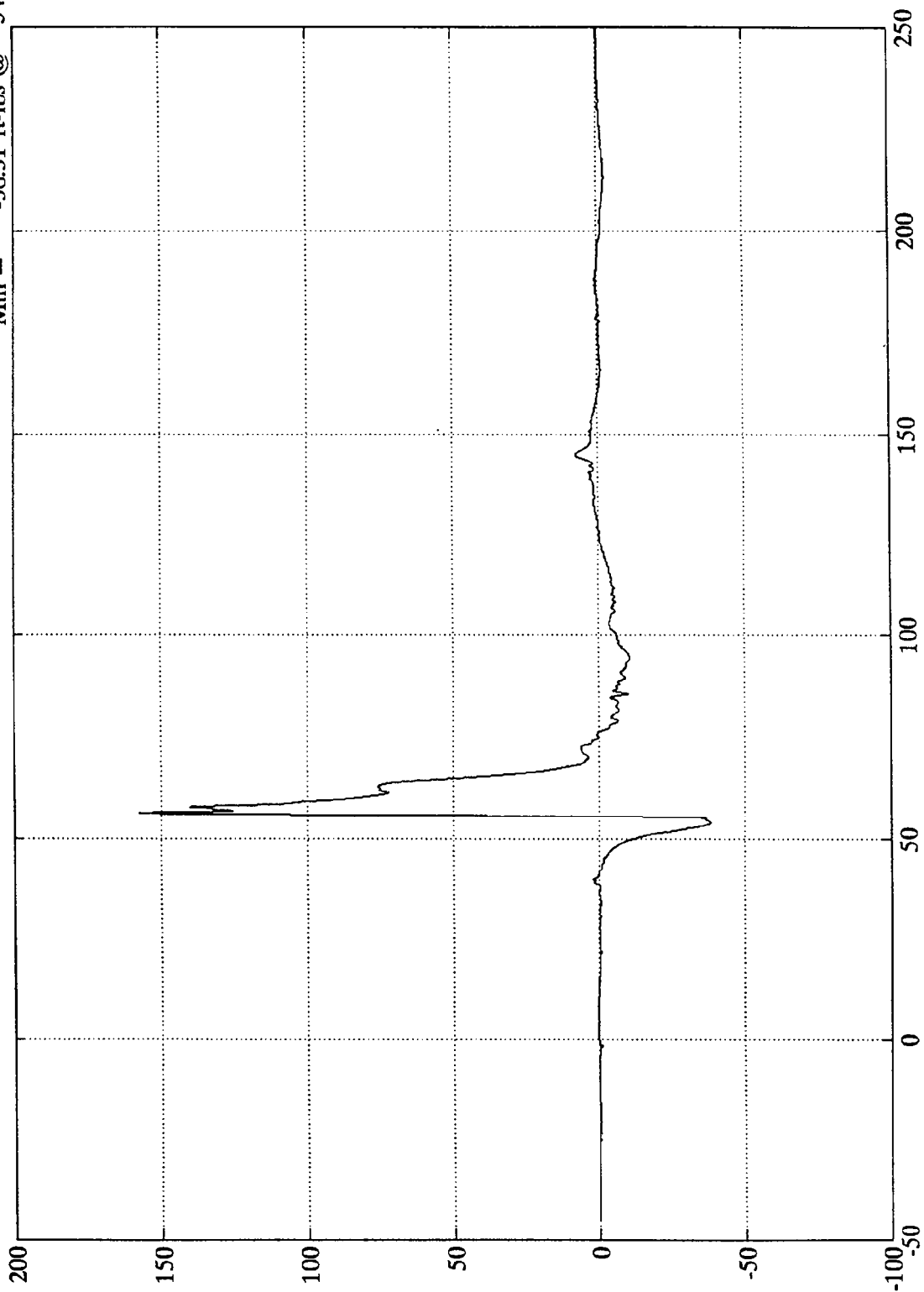
SAE Filter Class 600

Veh. 2 Lt L Tibia Fz
Max = 23.7 lbs @ 30.84 msec
Min = -1112.6 lbs @ 55.80 msec



V-to-V Test #4

Veh. 2 Lt L Tibia Mx
Max = 157.29 ft-lbs @ 56.40 msec
Min = -38.31 ft-lbs @ 54.00 msec



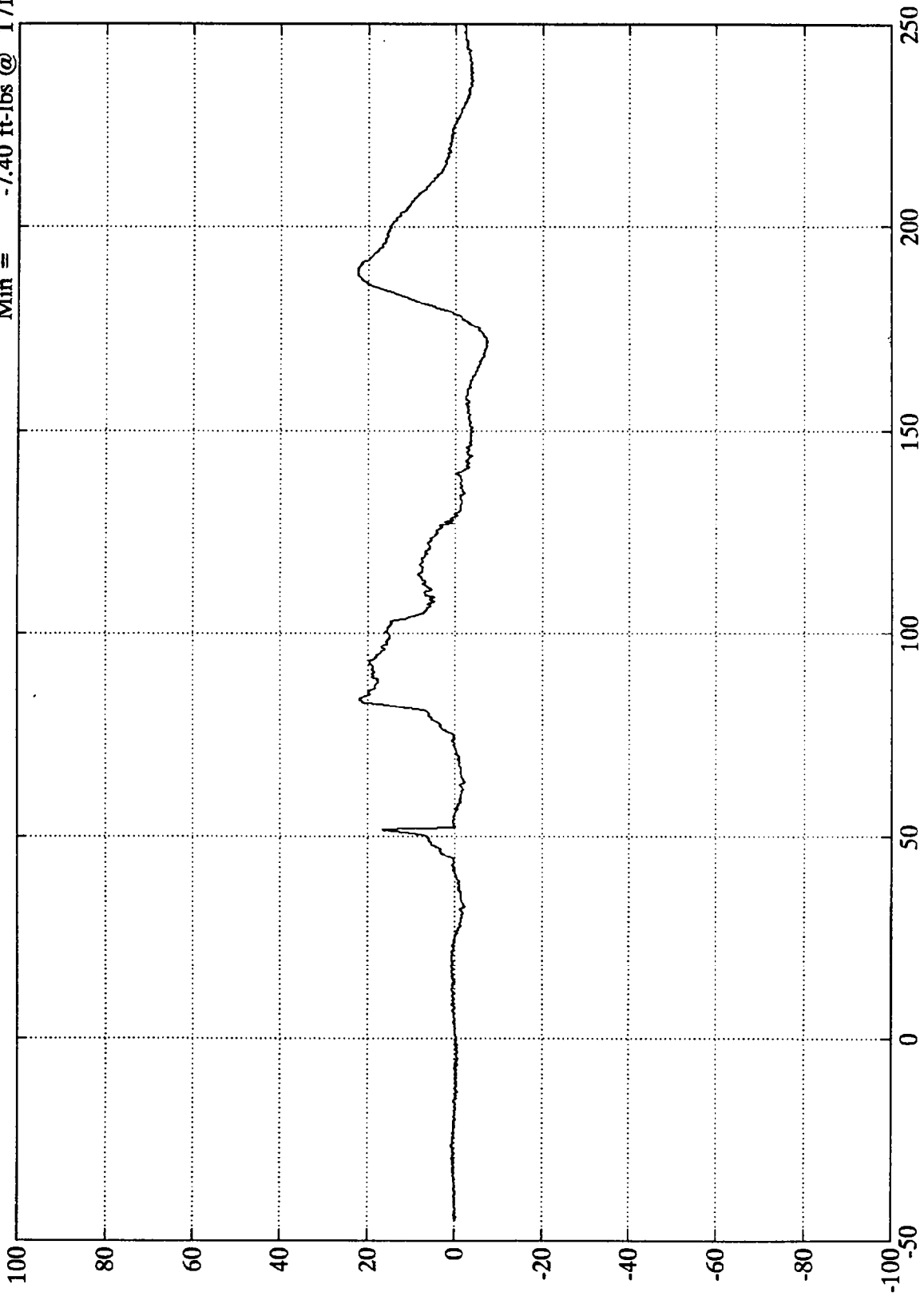
B-128

7883-4

SAE Filter Class 600

Time (msec)

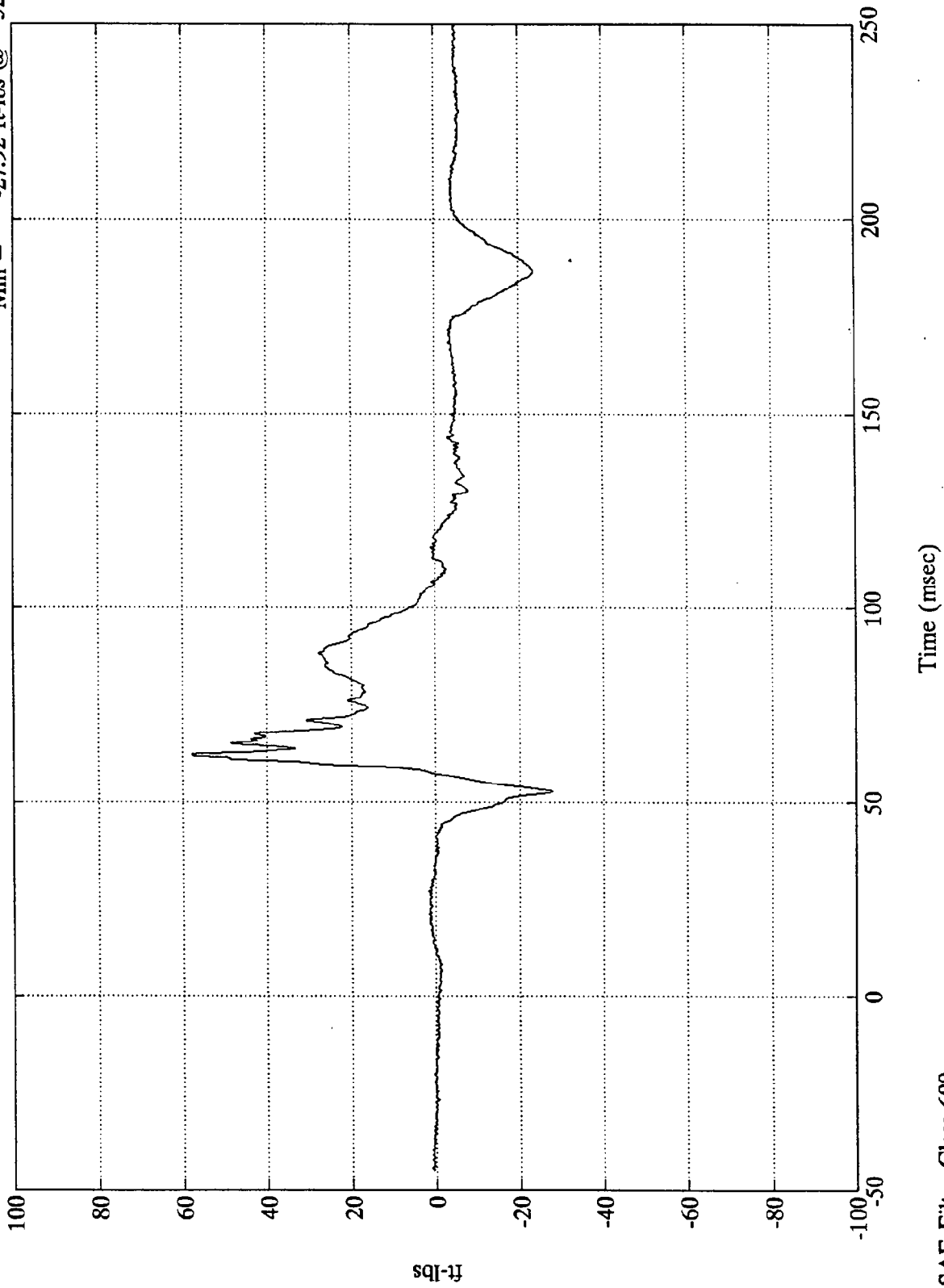
Veh. 2 Rt U Tibia Mx
Max = 22.50 ft-lbs @ 188.63 msec
Min = -7.40 ft-lbs @ 171.60 msec



V-to-V Test #4

Veh. 2 Rt U Tibia My

Max = 57.85 ft-lbs @ 62.15 msec
Min = -27.92 ft-lbs @ 52.92 msec



B-130

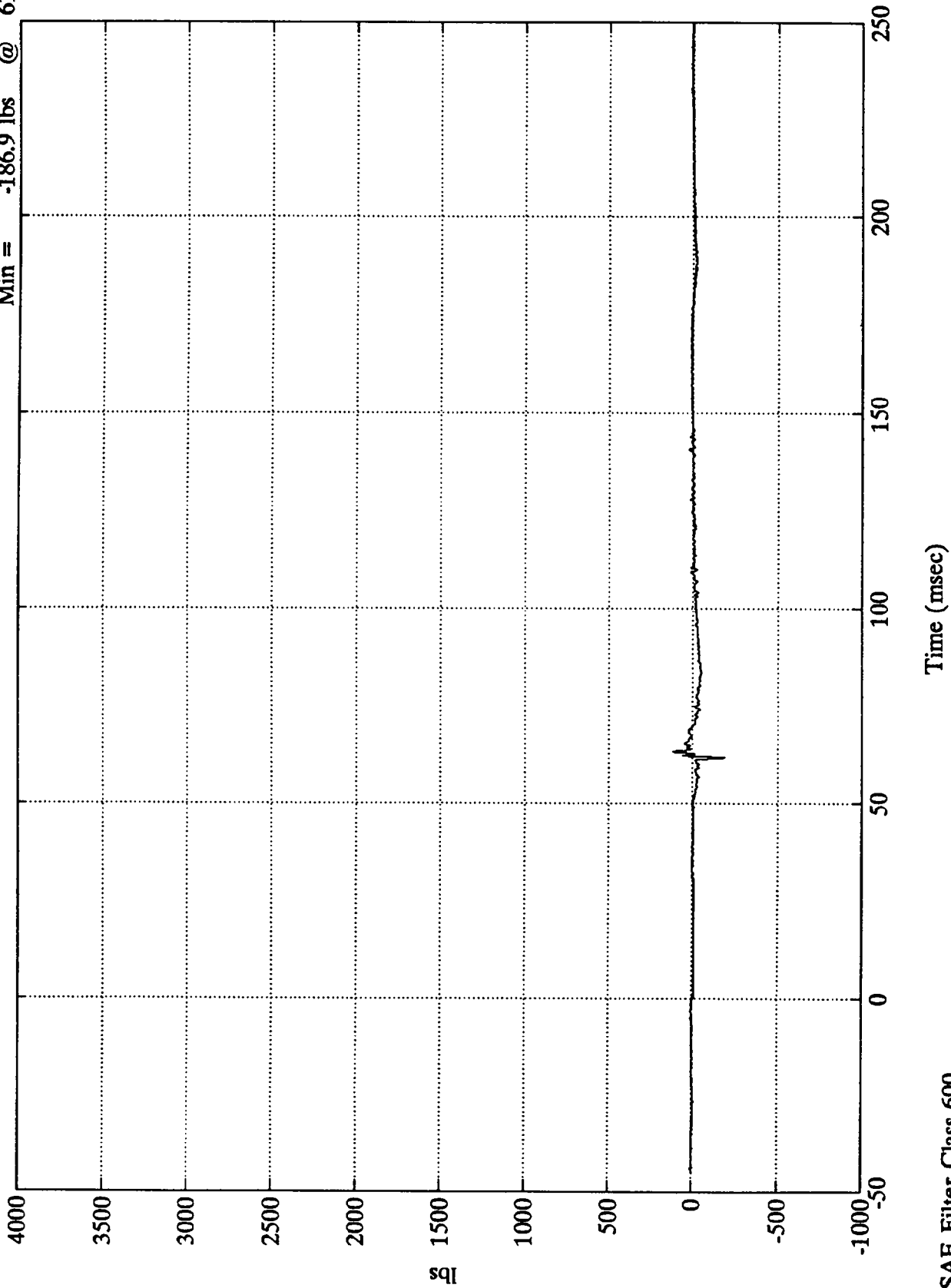
7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 2 Rt L Tibia Fy

Max = 121.4 lbs @ 63.35 msec
Min = -186.9 lbs @ 61.92 msec



lbs

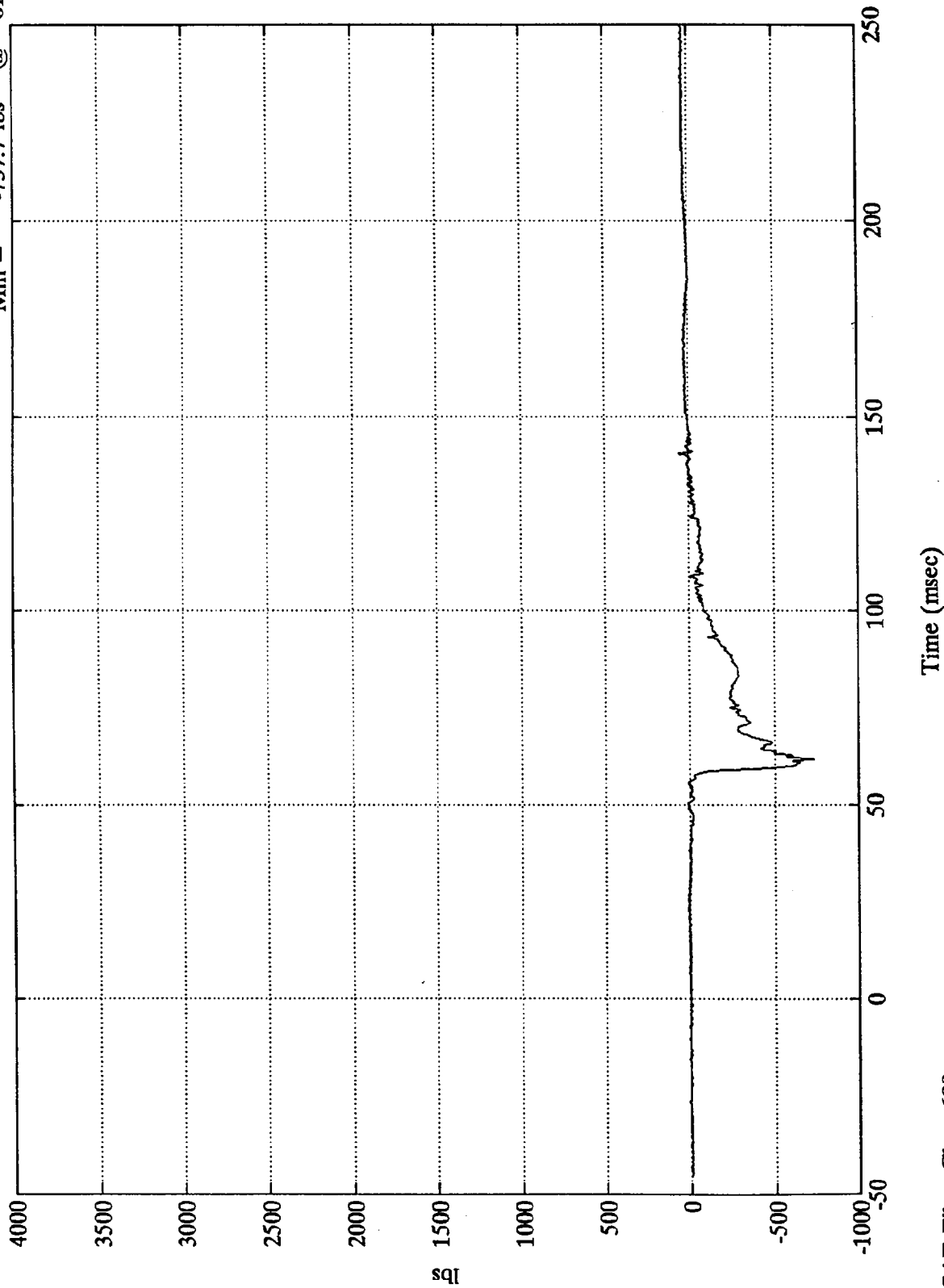
B-131

7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 2 Rt L Tibia Fz
Max = 58.4 lbs @ 140.63 msec
Min = -737.7 lbs @ 61.79 msec



sqi

B-132

7883-4

SAE Filter Class 600

V-to-V Test #4

Veh. 2 Rt L Tibia Mx
Max = 133.42 ft-lbs @ 63.35 msec
Min = -8.85 ft-lbs @ 90.59 msec

