

REPORT NUMBER: CAL-94-N03

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

**GENERAL MOTORS CORPORATION
1993 CHEVROLET ASTRO VAN
8-PASSENGER VAN**

NHTSA NUMBER: MP0107

CALSPAN TEST NUMBER: 8120-3

AUGUST 31, 1993

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FINAL REPORT

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16. <i>Abstract</i> A frontal load cell barrier test of a 1993 Chevrolet Astro Van was performed at the Calspan Advanced Technology Center Crash Test Facility in Buffalo, New York on August 31, 1993. The impact velocity was 56.2 kph and the temperature at the barrier face as 30°C. The maximum post-test vehicle crush was 567 mm. The test vehicle was equipped with a 3-point continuous belt system at each of the outboard seating positions. The vehicle was also equipped with a supplemental driver side airbag. With regard to FMVSS 208 "Occupant Crash Protection," injury criteria, both the driver and passenger exceeded the maximum Chest Resultant criteria also the passenger exceeded the maximum Head Injury Criteria.			
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Section 1

PURPOSE AND TEST PROCEDURE

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

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

Section 2

SUMMARY OF TEST MP0107

A load cell barrier consisting of 36 load cells was impacted by a 1993 Chevrolet Astro Van at a velocity of 56.2 kph. The test was performed at the Calspan Corporation Advanced Technology Center on August 31, 1993. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by 1 real-time camera and 16 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

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

Both ATDs were fully instrumented with head and chest triaxial accelerometers and right/left femur load cells. Seat belt load cells were also on the driver's and passenger's lap and shoulder belts to measure dummy torso and pelvic section loading. The driver ATD (Serial No. 150) and the right-front passenger ATD (Serial No. 245) were used in two previous tests (MR0300 and MP0106). Injury criteria were not exceeded in either test MR0300 or test MP0106. Certification details, along with instrumentation calibration data, are found in Appendix C.

The 83 channels of data were recorded on a P.C. based data acquisition system. Appendix B contains the vehicle, load cell barrier and dummy response data traces. The following data channels did not record accurately:

- Position #1 - Upper Neck Fy
- Position #1 - Upper Neck Fz
- Position #2 - Upper Neck Fy
- Position #2 - Upper Neck Fz
- Vehicle Accelerometer #5

The driver's head struck the airbag; the HIC was 831.6. The maximum chest deceleration over 3 milliseconds was 62.3 g's and maximum chest deflection was 48.2 mm. Femur loads were 6060.8 newtons on the left femur and 4671.1 newtons on the right femur.

The right front passenger's HIC was 1511.7. Maximum chest deceleration over 3 milliseconds was 60.4 g's and maximum chest deflection was 39.4 mm. Femur loads were 4453.4 newtons on the left and 1825.1 newtons on the right.

Table 1

GENERAL TEST AND VEHICLE DATA

Vehicle Year/Make/Model/Body Style: 1993 Chevrolet Astro Van

NHTSA Test No.: MP0107 VIN.: 1GNDM15Z4PB193584

Body Color: Blue Date of Manufacture: 4-93

Date Received: 7-13-93

Odometer Reading: 618 km

Engine: 6 Cylinders; --- C.I.D.; 4.3 Liters; --- CC
X Gas; --- Diesel; --- Turbocharged
X Longitudinal; --- Transverse

Transmission: 4 Speed; --- Manual; X Automatic; --- Overdrive

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

Accessories: X A/C; X P/S; X P/B; --- P/wdo
X Tilt Wheel; --- P/seats; X Cruise Control --- Other

Type of Occupant Restraint: 3-point restraint system with a driver side airbag

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 240 kPa, Rear 240 kPa

Recommended Tire Size: P205/75R15

Recommended Cold Tire Pressure: Front 240 kPa, Rear 240 kPa

Tires on Vehicle: P205/75R15M&S Manufacturer: Uniroyal

Number of Occupants: 2 Front; 3 Rear; 3 3rd Seat; 8 TOTAL

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

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

Rated Cargo and Luggage Weight (RCLW) A-B = 136 kgs.

GVWR 2586 kgs. GAWR: Front 1270 kgs. Rear 1315 kgs.

Table 1

GENERAL TEST AND VEHICLE DATA (cont'd)WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with maximum fluids) = UDW:

Right Front =	<u>526</u>	kgs.	Right Rear =	<u>408</u>	kgs.
Left Front =	<u>517</u>	kgs.	Left Rear =	<u>399</u>	kgs.
TOTAL FRONT WEIGHT =	<u>1043</u>	kgs.	(	<u>56</u>	% of Total Vehicle Weight)
TOTAL REAR WEIGHT =	<u>807</u>	kgs.	(	<u>44</u>	% of Total Vehicle Weight)
TOTAL DELIVERED WEIGHT =	<u>1850</u>	kgs.			

CALCULATION FOR TARGET TEST WEIGHT:

UDW = Unloaded Delivered Weight 1850 kgs.

RCLW = 136 kgs.

Target Test Weight = UDW + RCLW + (2 dummies x 76 kgs./ dummy)

Target Test Weight = 2138 kgs.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 130 KGS CARGO:

Right Front =	<u>581</u>	kgs.	Right Rear =	<u>485</u>	kgs.
Left Front =	<u>581</u>	kgs.	Left Rear =	<u>485</u>	kgs.
TOTAL FRONT WEIGHT =	<u>1162</u>	kgs.	(	<u>55</u>	% of Total Vehicle Weight)
TOTAL REAR WEIGHT =	<u>970</u>	kgs.	(	<u>45</u>	% of Total Vehicle Weight)
TOTAL TEST WEIGHT =	<u>2132</u>	kgs.			
Weight of ballast secured in vehicle trunk area =	<u>68</u>	kgs.			

VEHICLE ATTITUDE (all dimensions in mm):

Delivered Attitude:	RF	<u>758</u>	LF	<u>760</u>	RR	<u>785</u>	LR	<u>791</u>
Test Attitude:	RF	<u>744</u>	LF	<u>746</u>	RR	<u>762</u>	LR	<u>775</u>
Wheel Base:	<u>2820</u>	mm.;	C.G. =	<u>1269</u>	mm. rearward of front wheel C/L			
Remarks:	<u>95 liters of stoddard solution was placed in the fuel tank.</u>							

Table 1

GENERAL TEST AND VEHICLE DATA (cont'd)POST -IMPACT DATA:

Type of Test:	<u>Frontal Barrier</u>	Impact Angle:	<u>0°</u>
Date of Test:	<u>August 31, 1993</u>	Time of Test:	<u>12:25</u>
Ambient Temperature:	<u>30</u>	° C at impact area	
Temperature in Occupant Compartment:	<u>21</u>	° C	
Windshield Molding Temperature:	<u>21</u>	° C	
Required Impact Velocity Range:	<u>55.5</u>	to	<u>57.1</u> kph
Impact Velocity: primary =	<u>56.2</u> kph,	secondary =	<u>56.0</u> kph
Distance From Front Bumper to Barrier Face When			
Entering Speed Trap:	<u>1321</u>	mm	
Exiting Speed Trap:	<u>305</u>	mm	

VEHICLE REBOUND AND CRUSH (mm):

Vehicle Length:	Pre-test = R	<u>4430</u>	C _L	<u>4535</u>	L	<u>4420</u>
	Post-test = R	<u>3982</u>	C _L	<u>3968</u>	L	<u>3926</u>
	Crush = R	<u>448</u>	C _L	<u>567</u>	L	<u>494</u>

Distance from front of test vehicle to point of impact:

R	<u>361</u>	C _L	<u>401</u>	L	<u>451</u>
---	------------	----------------	------------	---	------------

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	<u>Airbag</u>	<u>Upper dashpanel, head contacted right knee</u>
Chest	<u>Airbag</u>	<u>No contact</u>
Abdomen	<u>No contact</u>	<u>No contact</u>
Left Knee	<u>Lower dashpanel</u>	<u>Lower dashpanel</u>
Right Knee	<u>Lower dashpanel</u>	<u>Lower dashpanel</u>

Table 1

GENERAL TEST AND VEHICLE DATA (cont'd)

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Door Opening	Yes with use of tools	Yes with use of tools	Yes	Yes
	<u>Front</u>		<u>Rear</u>	
<u>Seat Movement</u>	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Seat Back Failure	None	None	----	----
Seat Shift (mm.)	0.0	40.0 mm	----	----
		forward		

Glazing Damage

Backlight/Windshield:	The windshield sustained stress fractures but remained intact.
Other Notable Impact Effects:	None

Table 2

DUMMY INJURY CRITERIA VALUESNHTSA No.: MP0107 Vehicle: 1993 Chevrolet Astro Van

	MAXIMUM HEAD ACCELERATION (g's)			
	X	Y	Z	R
Position #1 - Driver	-90.4	-19.2	-31.3	91.9
Position #2 - Passenger	142.7	-32.7	76.6	148.7

	MAXIMUM CHEST ACCELERATION (g's)			
	X	Y	Z	R*
Position #1 - Driver	-67.0	-13.3	16.7	62.3
Position #2 - Passenger	-59.7	12.5	23.0	60.4

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

	MAXIMUM FORCE - FEMUR LOAD (nwt)	
	LEFT FEMUR	RIGHT FEMUR
Position #1 - Driver	6060.8	4671.1
Position #2 - Passenger	4453.4	1825.1

	MAXIMUM FORCE - SEAT BELT LOADS (nwt)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
Position #1 - Driver	8764.8	-	5169.7
Position #2 - Passenger	10433.6	10563.7	-

	HEAD INJURY CRITERIA (HIC)			
	HIC**	t ₁ (mSec)	t ₂ (mSec)	Average Acceleration t ₁ to t ₂
Position #1 - Driver	831.6	50.88	84.72	57.04
Position #2 - Passenger	1511.7	68.52	104.40	70.77

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

Table 3

HYBRID III NECK AND CHEST DATA SHEETVehicle Year/Make/Model/Body Style: 1993 Chevrolet Astro VanVehicle NHTSA No.: MP0107Test Date: August 31, 1993

MAXIMUM VALUES	DRIVER DUMMY ID # : 150	PASSENGER DUMMY ID # : 245
Neck Load X (nwt)	1241.3	1625.0
Neck Load Y (nwt)	N/A	N/A
Neck Load Z (nwt)	N/A	3152.0
Neck Moment X (nwt-m)	-39.6	-17.8
Neck Moment Y (nwt-m)	83.6	88.4
Neck Moment Z (nwt-m)	18.9	-52.6
Chest Deflection X (mm.)	48.2	39.4
Time of Max. Occurrence (msec)	86.0	86.0

Note: All values listed occur during the primary impact event.

Figure 1

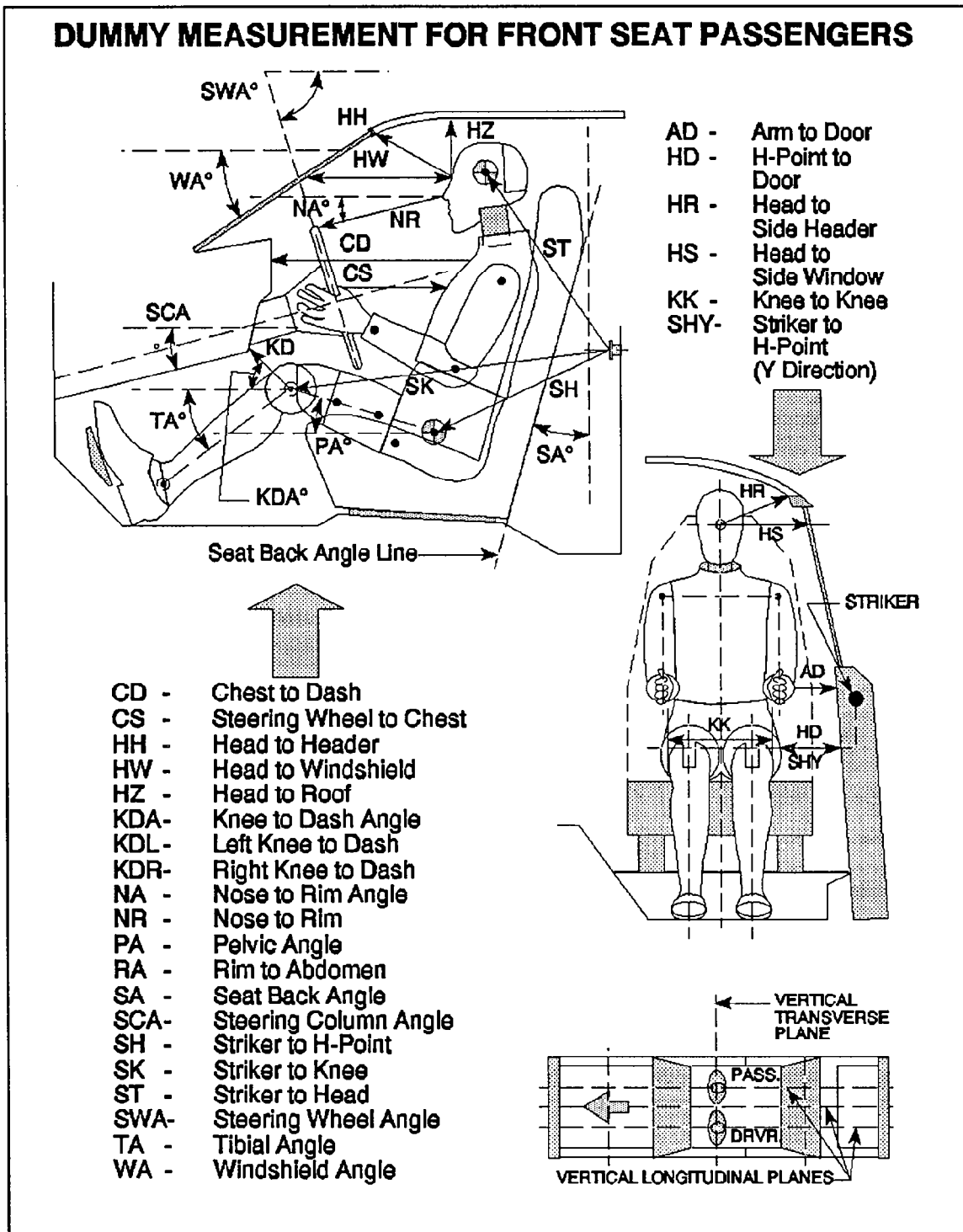
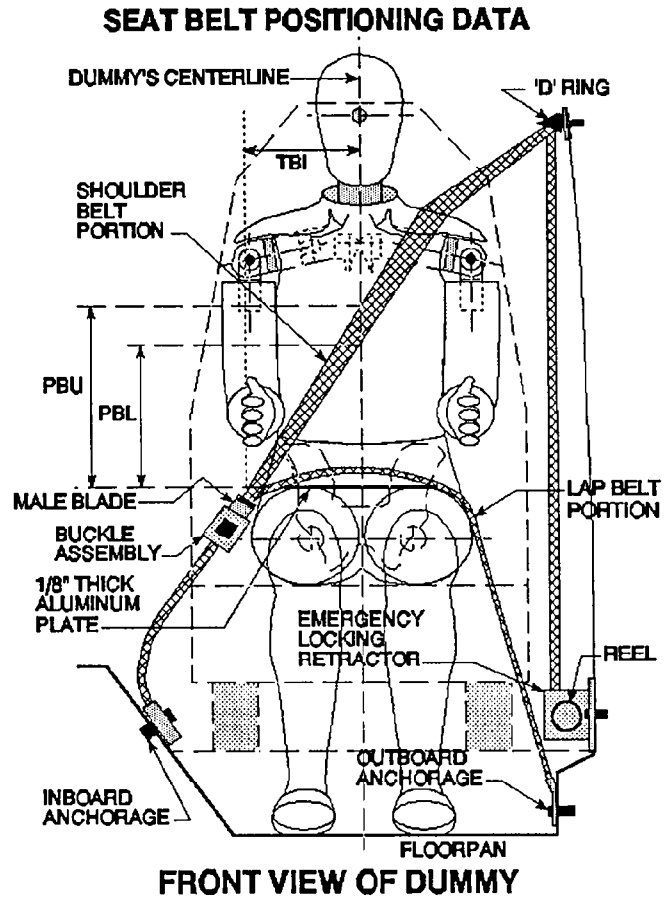


Table 4
FRONT SEAT OCCUPANT MEASUREMENTS

	DRIVER (Serial # 150)			PASS. (Serial # 245)		
WA°	42°			42°		
SWA°	66°			N/A		
SCA°	24°			N/A		
SA°	See Note			See Note		
HZ	210 mm			235 mm		
HH	470 mm			489 mm		
HW	605 mm			625 mm		
HR	221 mm			240 mm		
NR	388 mm	Angle	17°	N/A		
CD	560 mm			53		
CS	288 mm			N/A		
RA	167 mm			N/A		
KDL	200 mm	Angle (KDA)	20°	204 mm		
KDR	204 mm			180 mm	Angle (KDA)	35°
PA°	N/A			25°		
TA°	17°			25°		
KK	310 mm			289 mm		
ST	605 mm	Angle	19°	587 mm	Angle	18°
SK	686 mm	Angle	93°	655 mm	Angle	86°
SH	295 mm	Angle	113°	295 mm	Angle	111°
SHY	230 mm			238 mm		
HS	355 mm			352 mm		
HD	150 mm			153 mm		
AD	130 mm			126 mm		

Figure 2

SEAT BELT POSITIONING DATA



	DRIVER DUMMY (mm)	PASSENGER DUMMY (mm)
PBU -- Top surface of alum. plate to upper edge	295	315
PBL-- Top surface of alum. plate to belt lower edge	225	230
<u>LAP BELT TENSION</u>	----	----
<u>SHOULDER BELT TENSION</u>	2 lbs.	2 lbs.

Table 5

SEAT BELT PERFORMANCE ASSESSMENT TEST DATA

<u>BELT LENGTH DATA:</u>	<u>Driver</u>	<u>Passenger</u>
Belt length from trim panel exit to bolt hole anchor point for continuous webbing systems.	2560 mm	2490 mm
Shoulder belt length as measured on Part 572 Dummy.	920 mm	900 mm
Lap belt length as measured on Part 572 Dummy.	900 mm	900 mm
<u>SHOULDER BELT SPOOL-OFF DATA:</u>		
As determined by film analysis.	49 mm	N/A
As determined mechanically.	65 mm	90 mm
As determined electronically.	81 mm	49 mm
<u>BELT STRETCH DATA:</u>		
Measured electronically between shoulder belt load cell and the "D" ring.	92 mm/M	43 mm/M
Measured mechanically.	100 mm/M	100 mm/M

Figure 3

CAMERA POSITIONS FOR FRONTAL IMPACTS

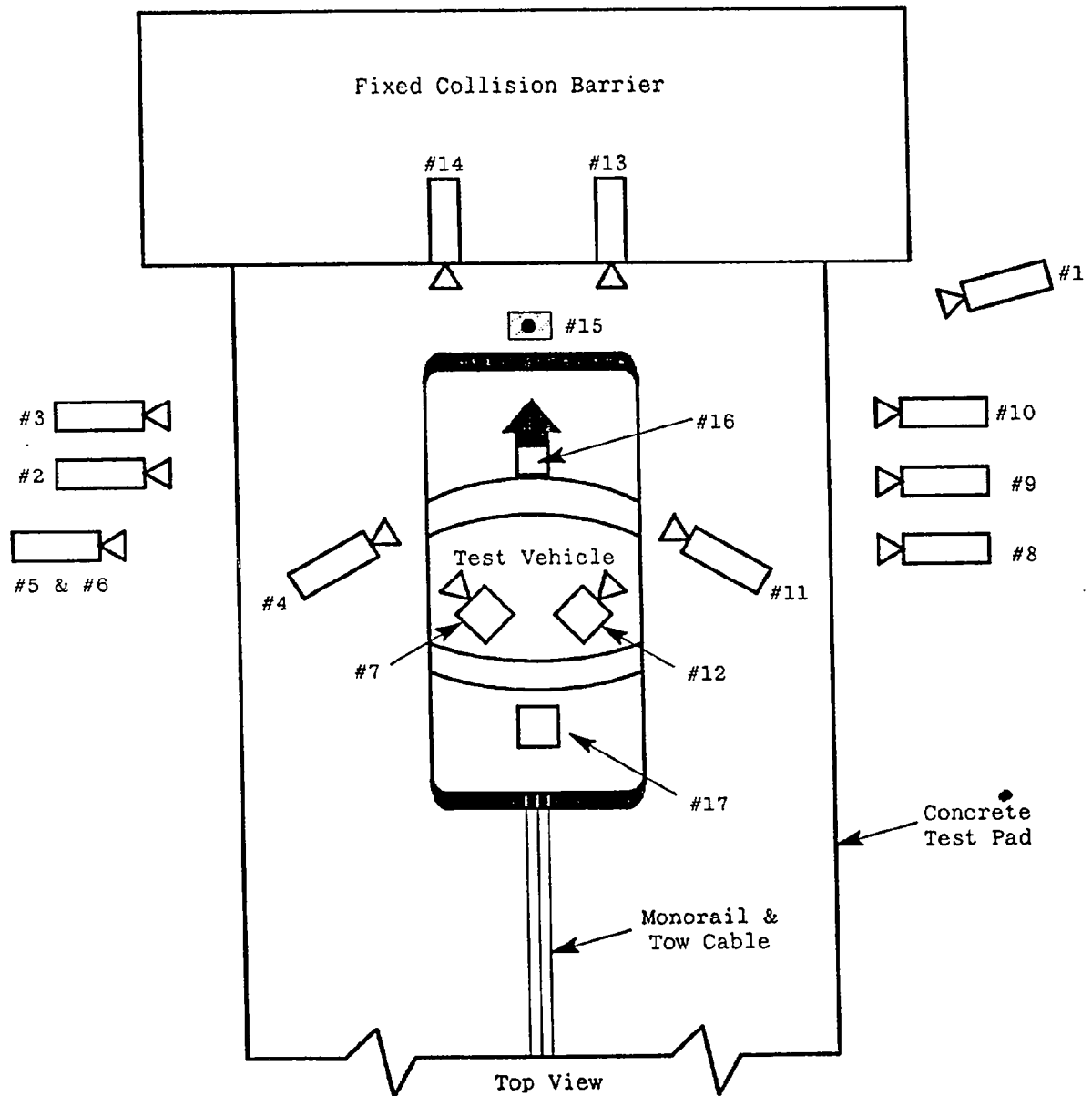


Table 6
HIGH-SPEED CAMERA LOCATIONS

Test No. MP0107		Vehicle: 1993 Chevrolet Astro Van						
CAMERA NO.	VIEW	CAMERA POSITIONS (MM.)*			ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Camera	----	----	----	----	----	----	24
2	Overall Left Side	6096	1549	1067	-1°	2259	13	1020
3	Left Side View	8001	991	1092	-1°	7434	25	1010
4	Driver and Interior View	2769	2235	1905	-15°	2202	13	N.T.
5	Steering Column (Bottom)	7315	1930	1194	-3°	6748	25	920
6	Steering Column (Top)	7315	1930	1803	-8°	6748	25	980
7	Left Belt	----	----	----	----	----	8	N.T.
8	Overall Right Side	6223	1854	1067	-1°	5656	13	500
9	Right Side View	7747	1422	1041	-1°	7180	25	540
10	Right Passenger View	7823	1778	1473	-2°	7256	35	1010
11	Passenger and Interior View	2642	2159	1803	-10°	2075	13	980
12	Right Belt	----	----	----	----	----	8	N.T.
13	Passenger Front View	559	127	1778	-35°	----	13	990
14	Driver Front View	559	127	1778	-35°	----	13	1010
15	Windshield View	0	0	3048	-45°	----	13	1080
16	Pit View of Engine	0	505	-3048	90°	----	13	720
17	Pit View of Fuel Tank	0	3432	-3048	90°	----	13	710

*X = film plane to monorail centerline ** = referenced to horizontal plane

Y = film plane to impact location

N.T. indicates No Timing

Z = film plane to ground

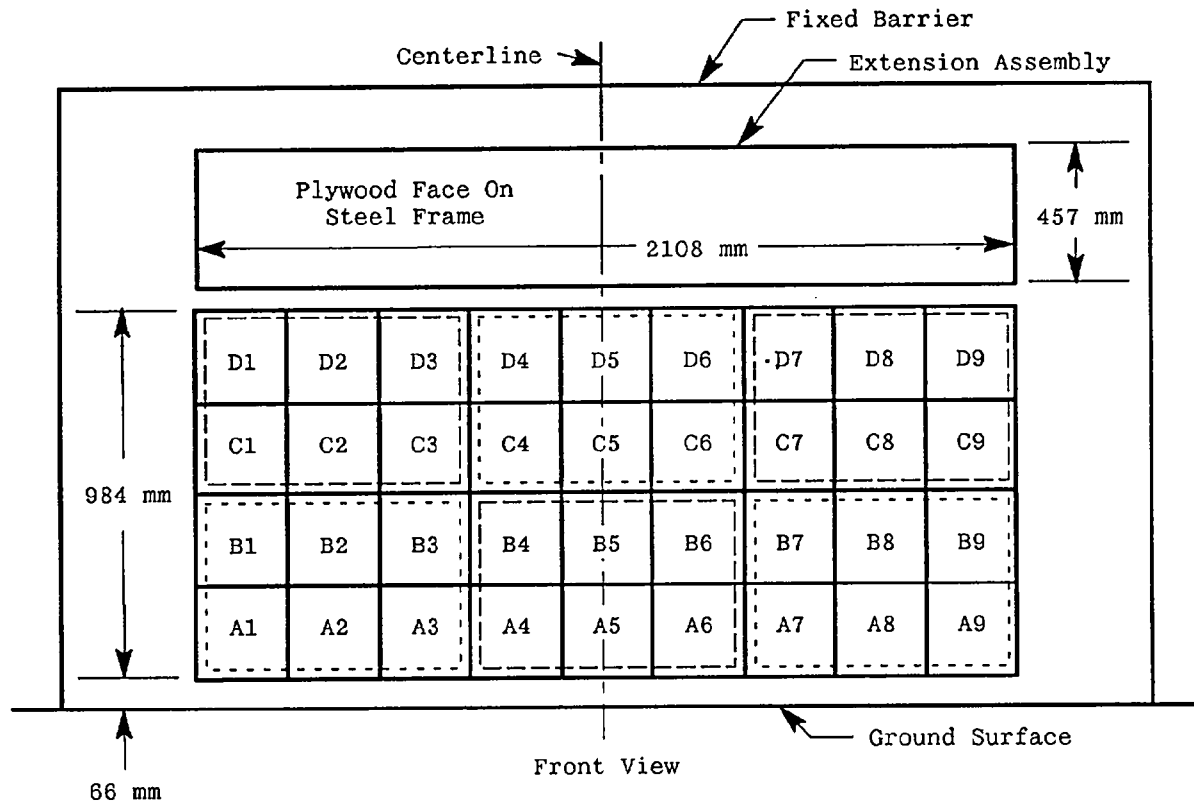
1. The first step in the process of creating a new product is to identify a market need. This involves conducting market research to understand what consumers want and what problems they are facing. Once a need is identified, the next step is to develop a concept that addresses this need. This is often done through brainstorming sessions with a team of designers and engineers. The concept is then refined through prototyping and testing. Once a viable concept is developed, the next step is to create a business plan that outlines the costs, revenue, and potential risks of the new product. This plan is then used to secure funding from investors or lenders. Finally, the product is manufactured and distributed to the market. Throughout this process, it is important to maintain open communication with customers and stakeholders to ensure that the product meets their needs and expectations.



Figure 5

LOAD CELL LOCATIONS ON FIXED BARRIER

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



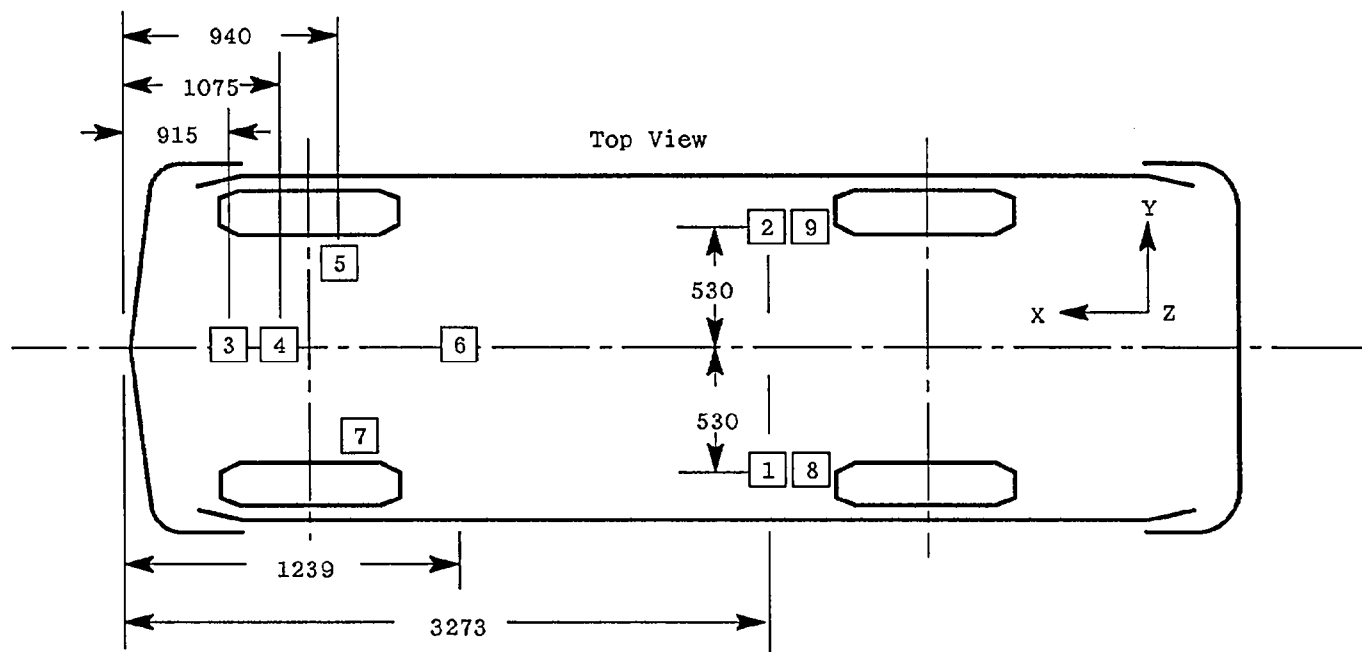
6 GROUPS OF 6 LOAD CELLS EACH

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

The following data is presented in Appendix B:

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

Figure 6

VEHICLE ACCELEROMETER LOCATIONS

All dimensions are in millimeters

All dimensions are in millimeters

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

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

Figure 7

TEST VEHICLE MEASUREMENTS

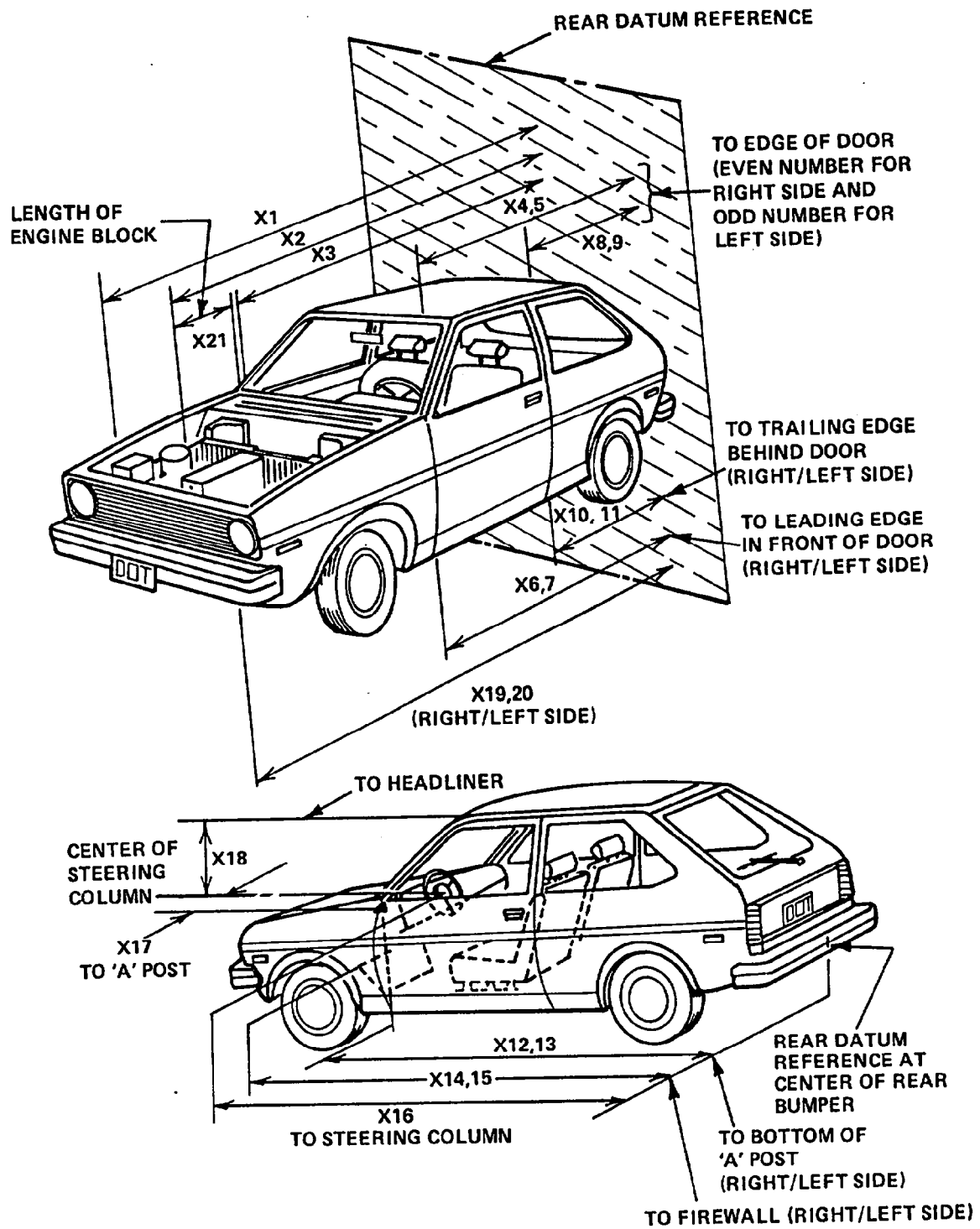


Table 7

VEHICLE MEASUREMENTS

No.		All Dimensions in mm		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	4535	3968	567
X2	Rear Surface of Vehicle to Front of Engine	3910	N/A	N/A
X3	Rear Surface of Vehicle to Firewall	N/A	N/A	N/A
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	3400	3362	38
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	3395	3364	31
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	3245	3228	17
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	3231	3200	31
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	2410	2381	29
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	2403	2370	33
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	2408	2384	21
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	2393	2361	32
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	3232	3211	21
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	3233	3210	23
X14	Rear Surface of Vehicle to Firewall, Right Side	3770	3660	110
X15	Rear Surface of Vehicle to Firewall, Left Side	3780	3610	170
X16	Rear Surface of Vehicle to Steering Column	3000	2991	9
X17	Center of Steering Column to "A" Post	380	350	30
X18	Center of Steering Column to Headliner	480	360	120
X19	Rear Surface of Vehicle to Right Side of Front Bumper	4430	3982	448
X20	Rear Surface of Vehicle to Left Side of Front Bumper	4420	3926	494
X21	Length of Engine Block	900	900	0
RD	Rear Surface of Vehicle to Right Side of Dash Panel	3265	3210	55
CD	Rear Surface of Vehicle to Center of Dash Panel	3265	3225	40
LD	Rear Surface of Vehicle to Left Side of Dash Panel	3240	3189	51

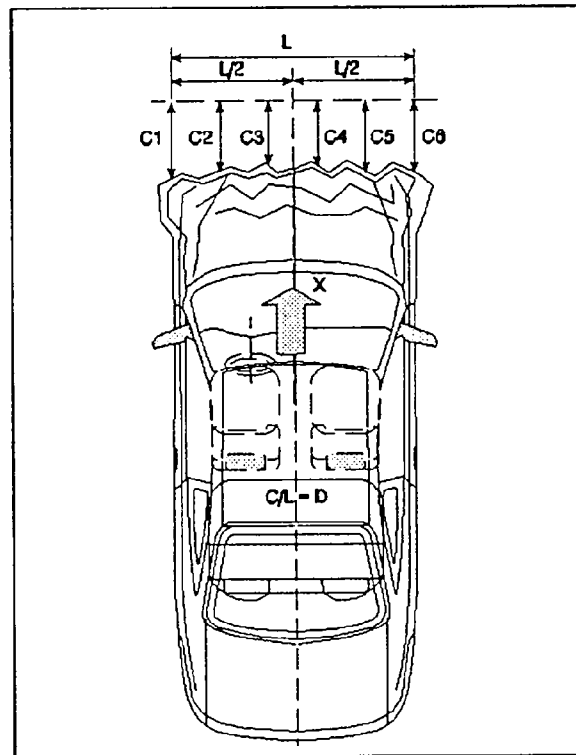
Table 8

ACCIDENT INVESTIGATION DIVISION DATA
FOR 56.3 KPH FRONTAL BARRIER IMPACT

Vehicle Make/Model/Body Style: 1993 Chevrolet Astro Van
 Vehicle NHTSA No.: MP0107 VIN: IGNDM15Z4PB193584
 Model Year: 1993 Build Date: 4-93 Test Date: 8-31-93
 Vehicle Size Category: Truck Test Weight: 2132 Kgs
 Vehicle Wheelbase: 2820 mm; Front Overhang: 1239 mm; Overall Width: 1968 mm
 Collision Deformation Classification (CDC) Code: 12FDEW3

Crush Depth Dimensions;

C1 = 495 mm
 C2 = 530 mm
 C3 = 555 mm
 C4 = 555 mm
 C5 = 454 mm
 C6 = 448 mm



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

Length of Damaged Region: L = 1968 mm

Section 4

SUMMARY OF RESULTS OF FMVSS 212, 219 (Partial) AND 301

"Windshield Mounting" FMVSS No. 212 Data

"Windshield Zone Intrusion" FMVSS No. 219 Data

"Fuel System Integrity" FMVSS No. 301

Figure 8

FMVSS NO. 212 - "WINDSHIELD MOUNTING" DATA

DETAILS OF WINDSHIELD MOUNTING SUCH AS RETENTION METHOD, TRIM TYPE, ETC.:

Windshield is bonded in place and covered with 20 mm. molding.

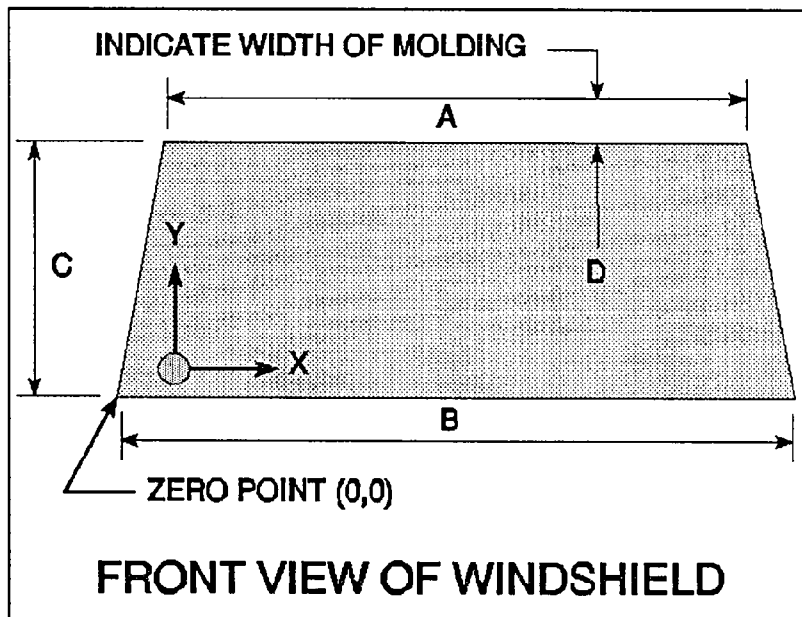
FMVSS 212 REQUIREMENTS:

The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of the windshield for vehicles equipped with automatic restraint systems for front occupants,

FMVSS 212 TEST DATA

	WINDSHIELD PERIPHERY		
	PRE-TEST (mm)	POST-TEST(mm)	% OF RETENTION
RIGHT SIDE	2280	2280	100
LEFT SIDE	2280	2280	100
TOTAL	4560	4560	100

AREA OF RETENTION FAILURE:



DIMENSIONS	
A	1470
B	1750
C	670
D	20

FAILURE DETAILS: NONE

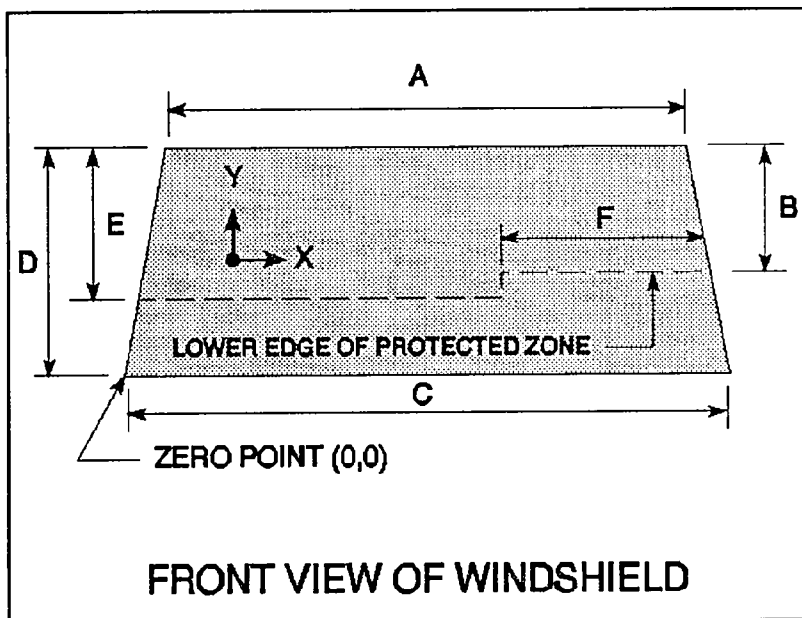
Figure 9

FMVSS NO. 219 (PARTIAL) - "WINDSHIELD ZONE INTRUSION" DATA

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5" diameter rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. The locus of points is drawn on the inner surface of the windshield contacted by the sphere across the width of the instrument panel. From the outermost contactable points extend the locus line horizontally to the edges of the windshield, then draw a line on the inner surface of the windshield below and 1/2" distant from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection of this line onto the outer surface of the windshield.

FMVSS 219 TEST DATA: (Dimensions in mm)



DIMENSIONS	
A	1470
B	268
C	1750
D	670
E	370
F	638

DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4": NONE

(Show location of penetration on the above sketch)

COORDINATES		
	X	Y
1.		
2.		
3.		
4.		

Table 9

FMVSS NO. 301-75 "FUEL SYSTEM INTEGRITY" POST IMPACT TEST DATATEST VEHICLE NHTSA NO.: MP0107TEST DATE: 8-31-93Vehicle Make/Model: 1993 Chevrolet Astro Van

The test vehicle was filled from 92% to 94% of the manufacture's "usable" capacity. The electric fuel pump was operating if it will operate without engine operation. Two Part 572 anthropomorphic test devices were located at each of the front designated seating positions.

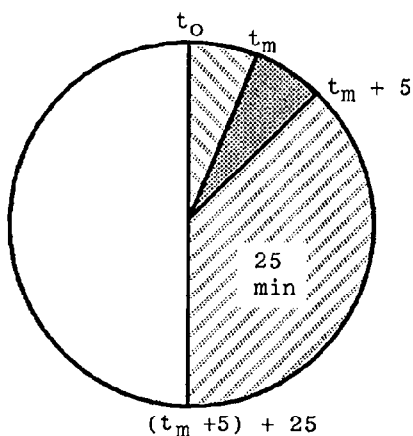
=====

TEST VEHICLE IMPACT TYPE: X Frontal (35 mph)

 ---- Oblique (30 mph) with deg. barrier face first contacting
(driver/passenger) side

 ---- Rear Moving Barrier (30 mph)

 ---- Lateral Moving Barrier (20 mph)

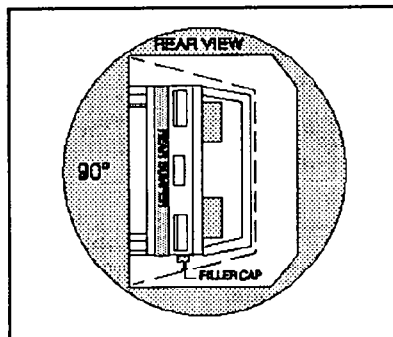
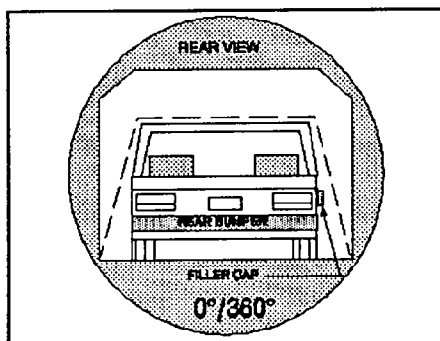
FUEL SPILLAGE MEASUREMENT:

1. From impact until vehicle motion ceases
2. For 5 minute period after vehicle motion ceases
3. For next 25 minutes

ACTUAL	MAX ALLOWED
0	1 oz.
0	5 oz.
0	1 oz./min.

SOLVENT SPILLAGE DETAILS: None

Table 10

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET**TEST PHASE:**Vehicle NHTSA ID No.
MP0107**I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:**Rollover Fixture 90 deg. Rotation Time
(Spec. Range = 1 to 3 minutes)

2	minutes	50	seconds
---	---------	----	---------

FMVSS 301 Position Hold Time +

5	minutes	00	seconds
---	---------	----	---------

TOTAL

7	minutes	50	seconds
---	---------	----	---------

Next whole minute interval

8	minutes	00	seconds
---	---------	----	---------

II. FMVSS 301 REQUIREMENTS:**(1) Time Period**

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.
-------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

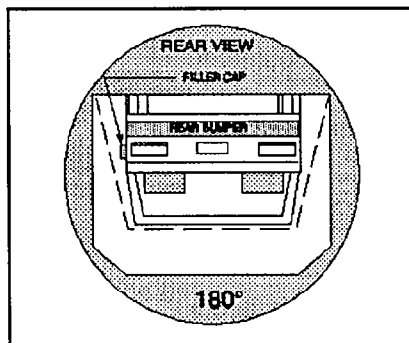
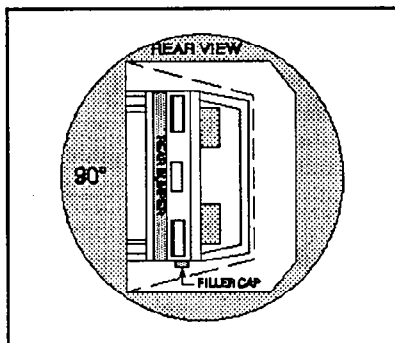
III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0
---	---	---	---

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S): None

Table 10

FMVSS NO. 301 STATIC ROLLOVER DATA SHEETTEST PHASE:Vehicle NHTSA ID No.
MP0107I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:Rollover Fixture 90 deg. Rotation Time
(Spec. Range = 1 to 3 minutes)2 minutes 50 seconds

FMVSS 301 Position Hold Time +

5 minutes 00 seconds**TOTAL**7 minutes 50 seconds

Next whole minute interval

8 minutes 00 secondsII. REQUIREMENTS:FMVSS 301(1) Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.
-------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

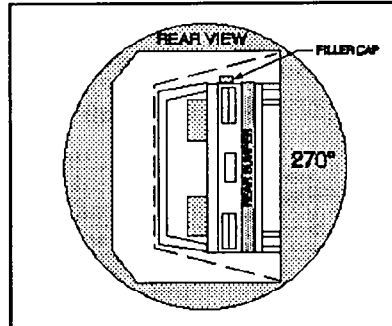
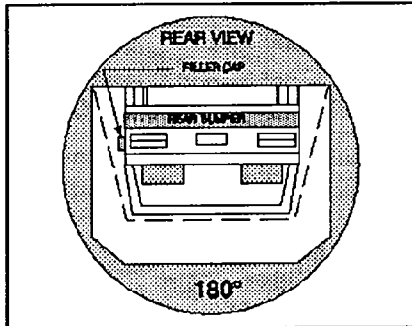
III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0
---	---	---	---

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S): None

Table 10

FMVSS NO. 301 STATIC ROLLOVER DATA SHEETTEST PHASE:Vehicle NHTSA ID No.
MP0107I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90 deg. Rotation Time
(Spec. Range = 1 to 3 minutes)

2	minutes	45	seconds
---	---------	----	---------

FMVSS 301 Position Hold Time +

5	minutes	00	seconds
---	---------	----	---------

TOTAL

7	minutes	45	seconds
---	---------	----	---------

Next whole minute interval

8	minutes	00	seconds
---	---------	----	---------

II. FMVSS 301 REQUIREMENTS:(1) Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.
-------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

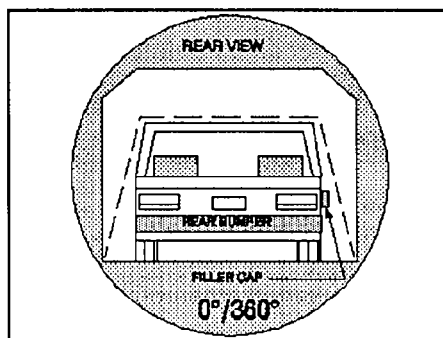
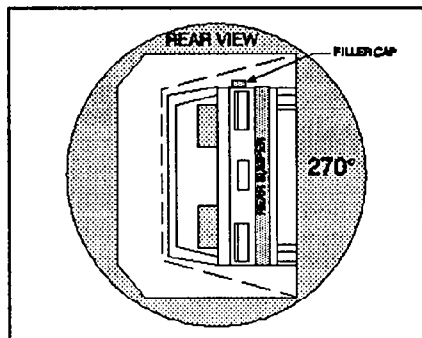
III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0
---	---	---	---

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S): None

Table 10

FMVSS NO. 301 STATIC ROLLOVER DATA SHEETTEST PHASE:Vehicle NHTSA ID No.
MP0107I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90 deg. Rotation Time
(Spec. Range = 1 to 3 minutes)

2	minutes	50	seconds
---	---------	----	---------

FMVSS 301 Position Hold Time +

5	minutes	00	seconds
---	---------	----	---------

TOTAL

7	minutes	50	seconds
---	---------	----	---------

Next whole minute interval

8	minutes	00	seconds
---	---------	----	---------

II. FMVSS 301 REQUIREMENTS:(1) Time Period

First 5 min. from onset of rotation	6th min.	7th min.	8th min. if reqd.
-------------------------------------	----------	----------	-------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0
---	---	---	---

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S): None

Appendix A
PHOTOGRAPHS

PHOTOGRAPHS

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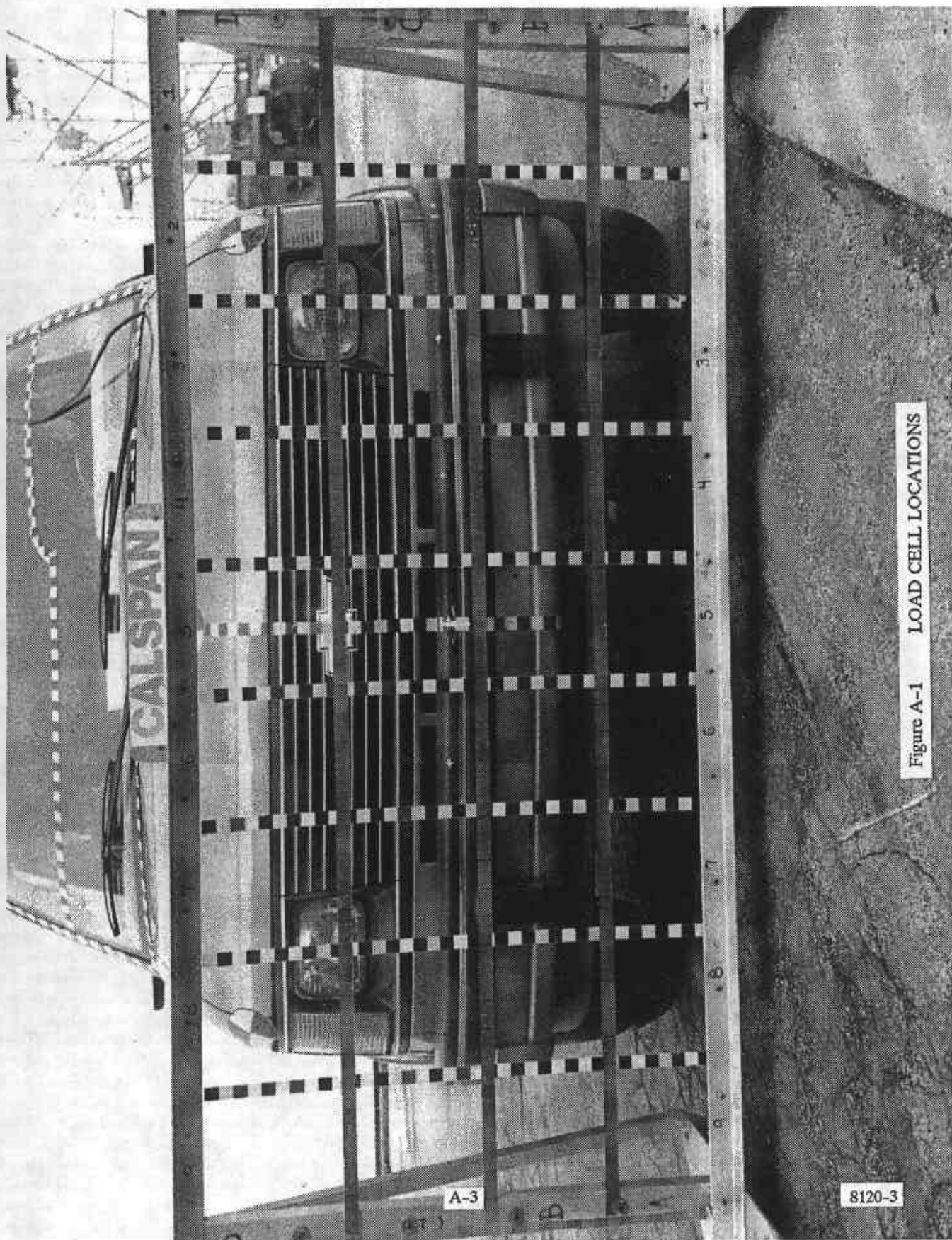


Figure A-1 LOAD CELL LOCATIONS



Figure A-2 PRE-TEST FRONT VIEW

A-4

8120-3

Figure A-3 POST TEST FRONT VIEW



A-5

8120-3



Figure A-4 PRE-TEST LEFT SIDE VIEW

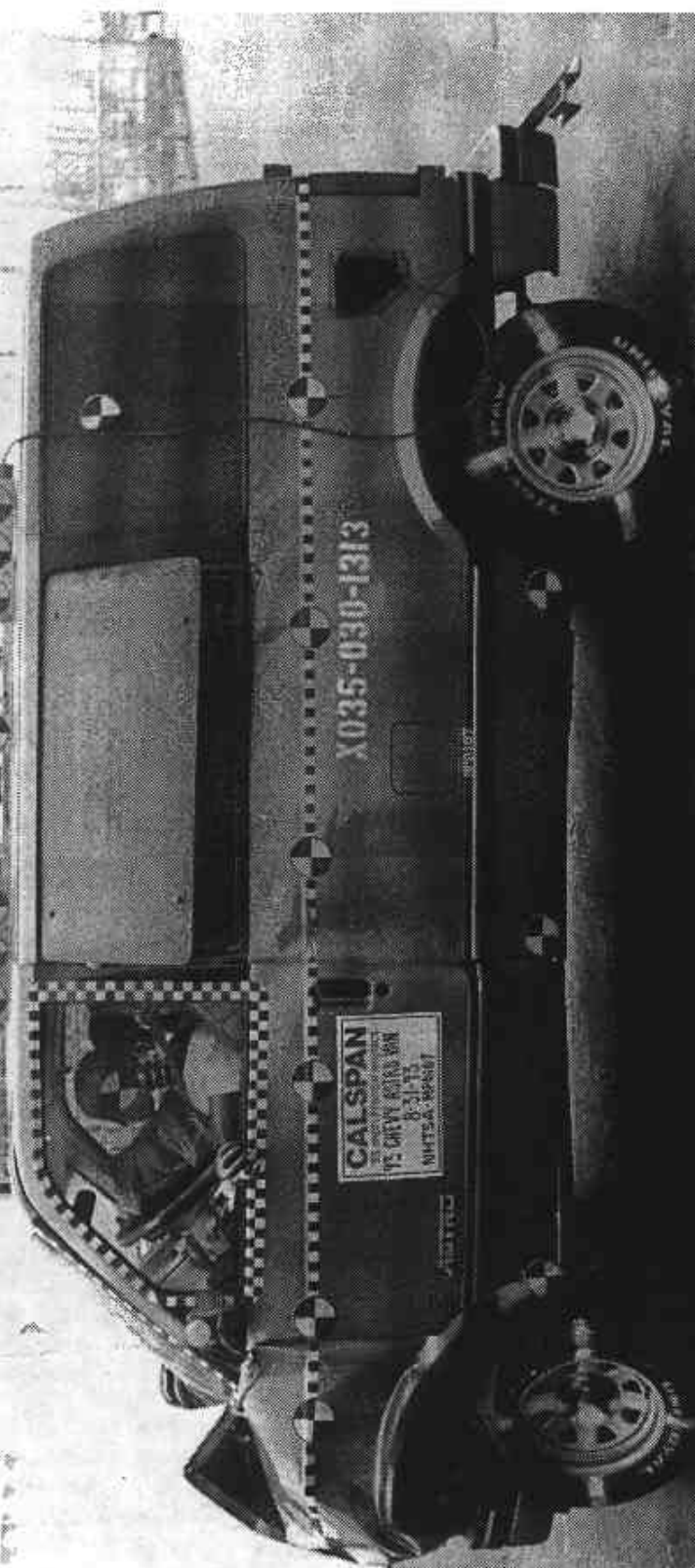
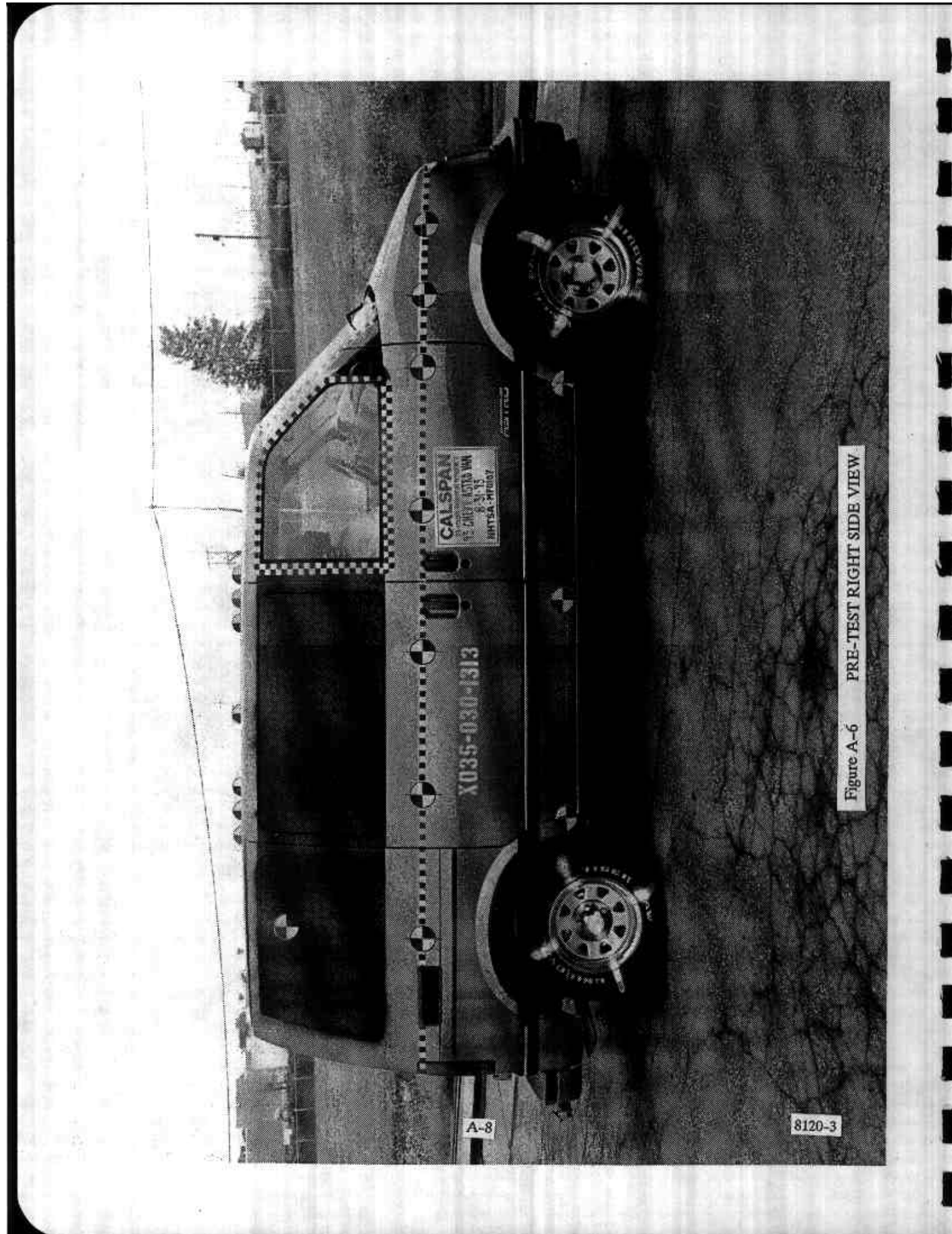


Figure A-5 POST TEST LEFT SIDE VIEW



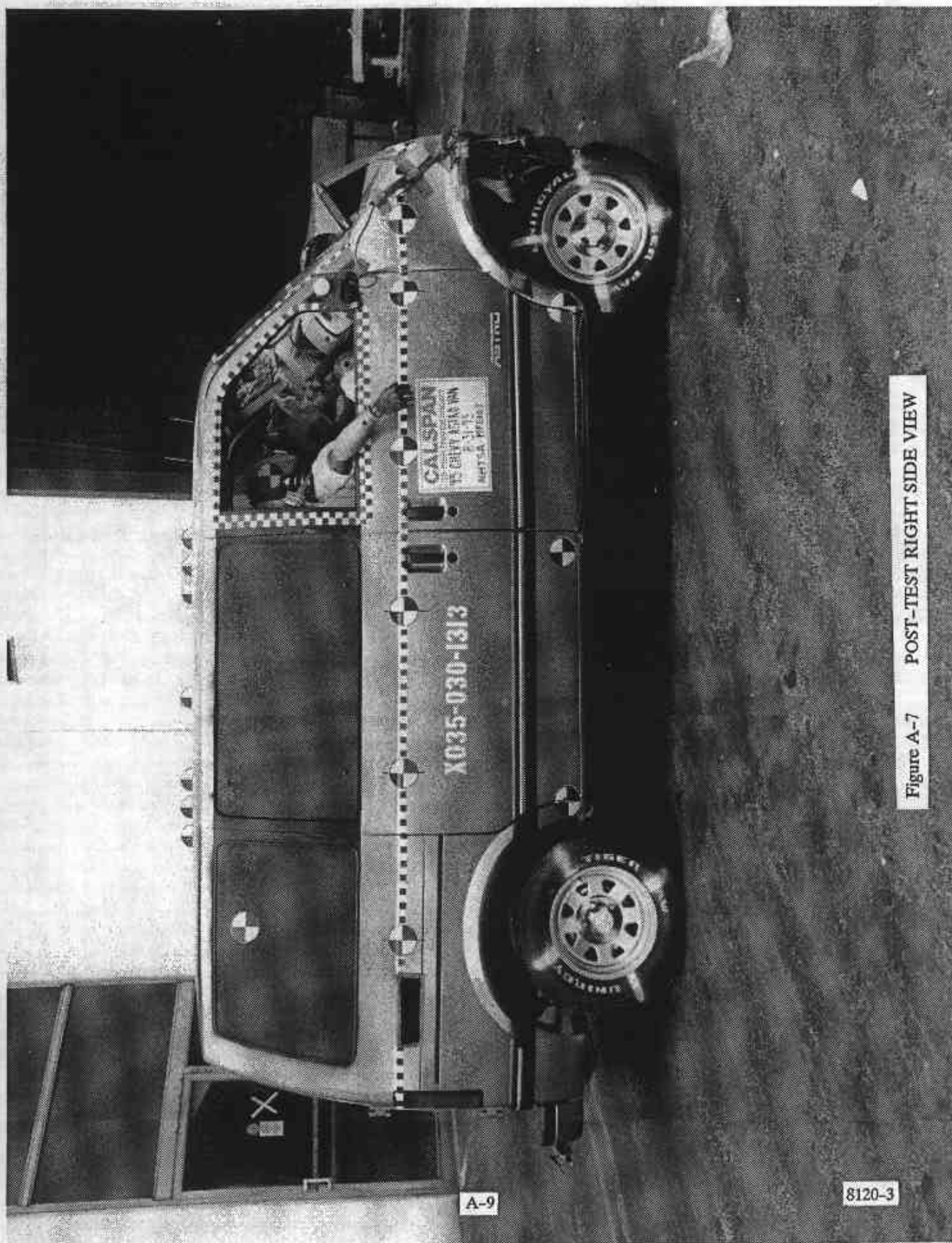


Figure A-7 POST-TEST RIGHT SIDE VIEW

A-9

8120-3

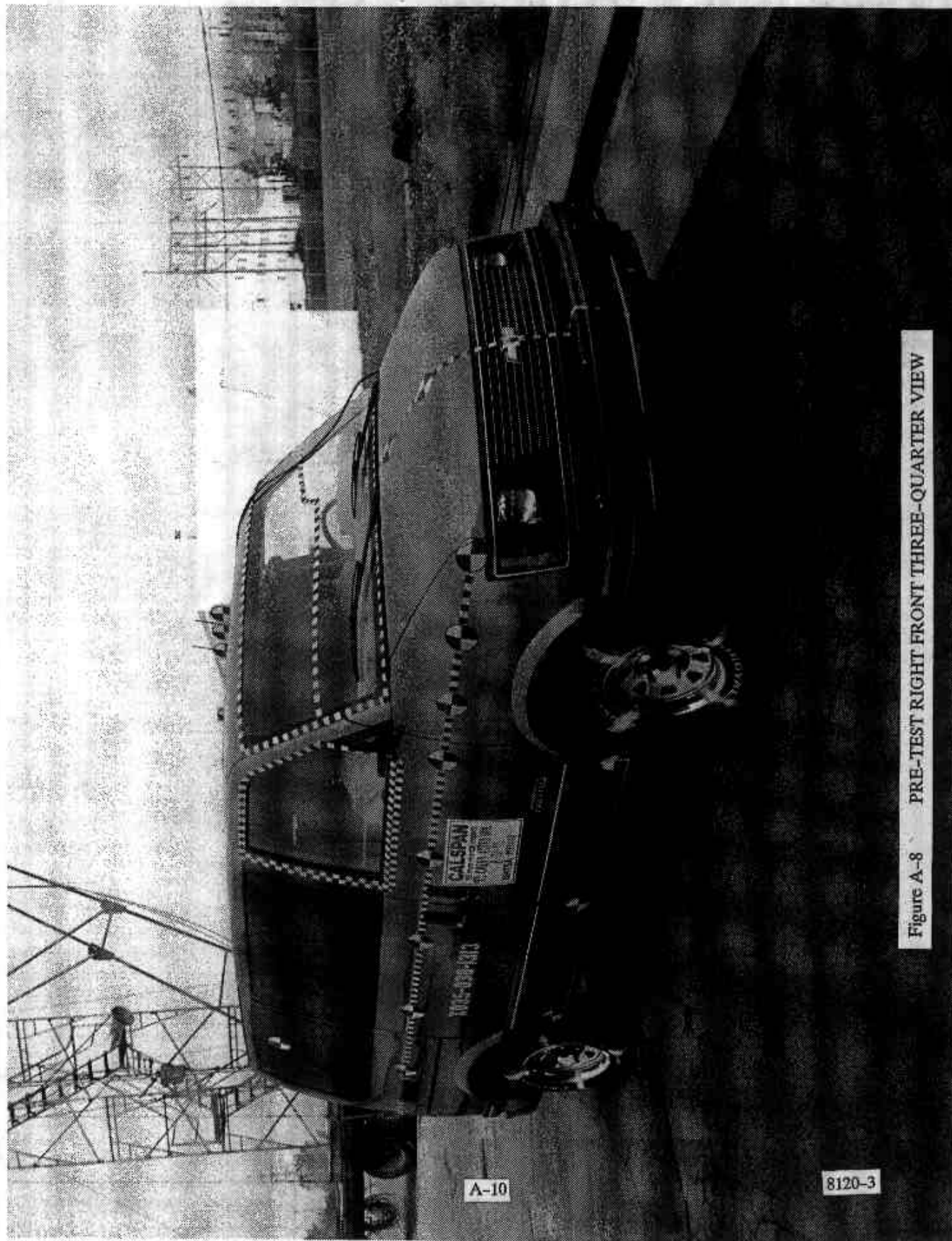


Figure A-8 PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

A-10

8120-3

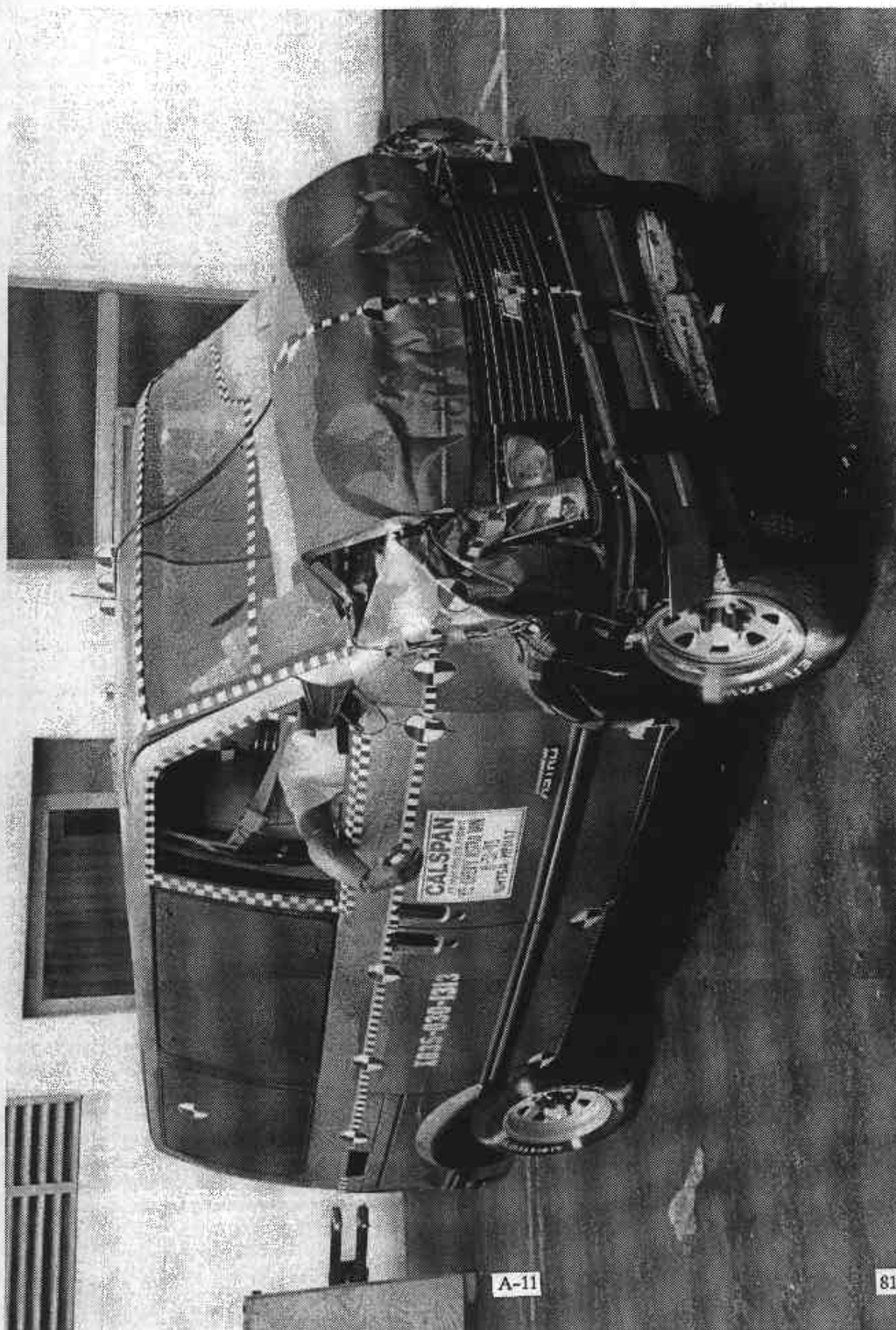


Figure A-9 POST-TEST RIGHT FRONT THREE-QUARTER VIEW

A-11

8120-3



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



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

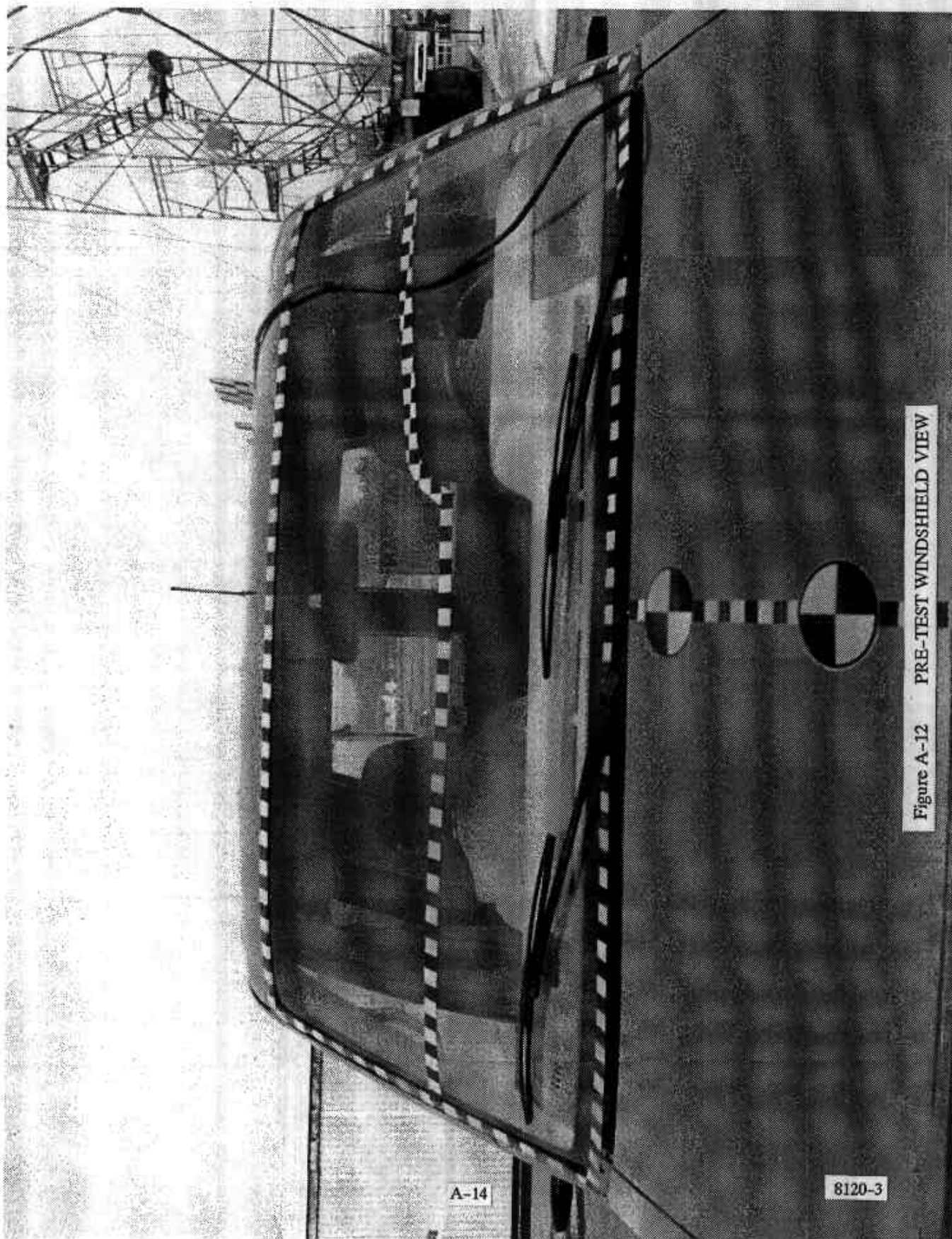


Figure A-12 PRE-TEST WINDSHIELD VIEW

A-14

8120-3

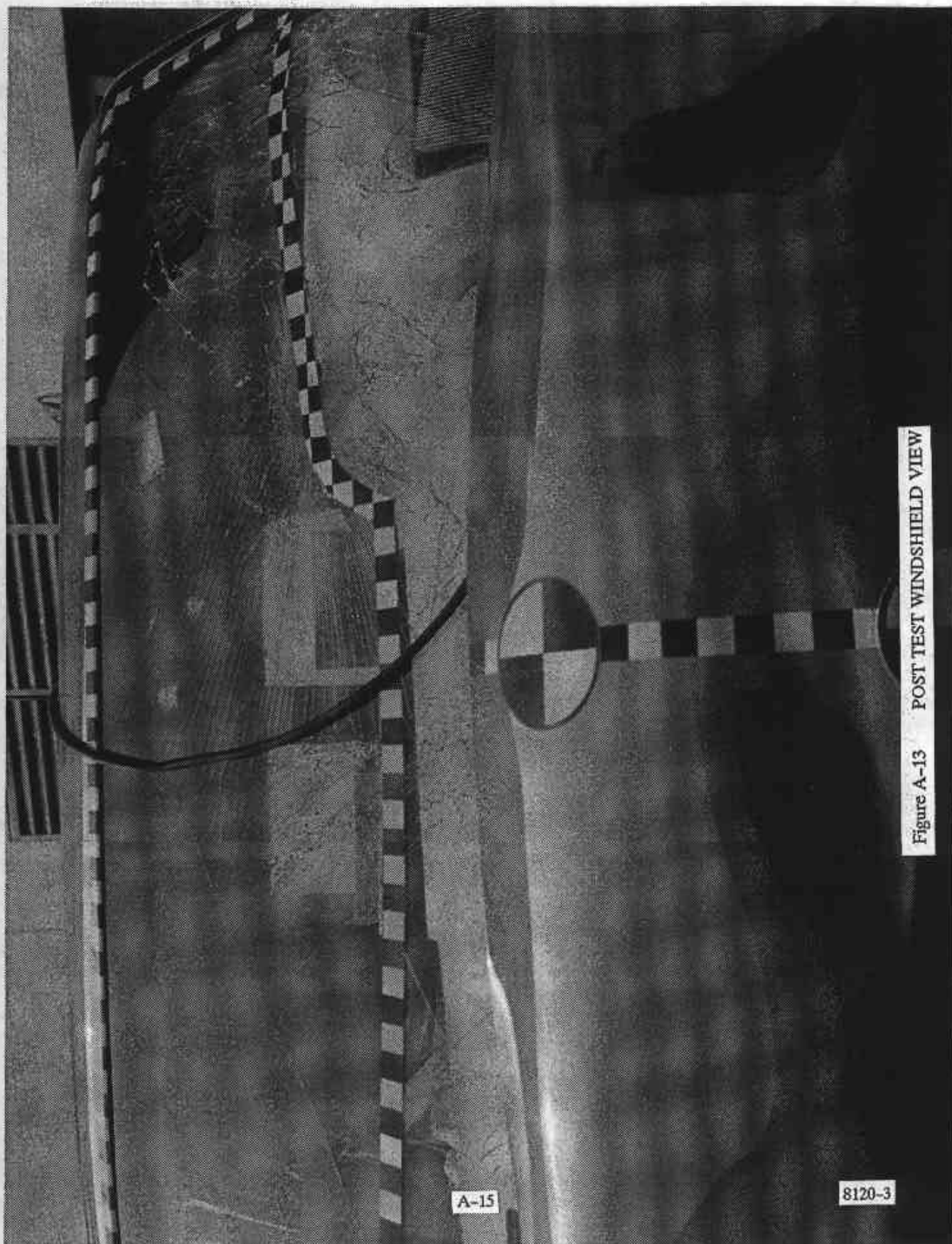


Figure A-13 POST TEST WINDSHIELD VIEW

A-15

8120-3

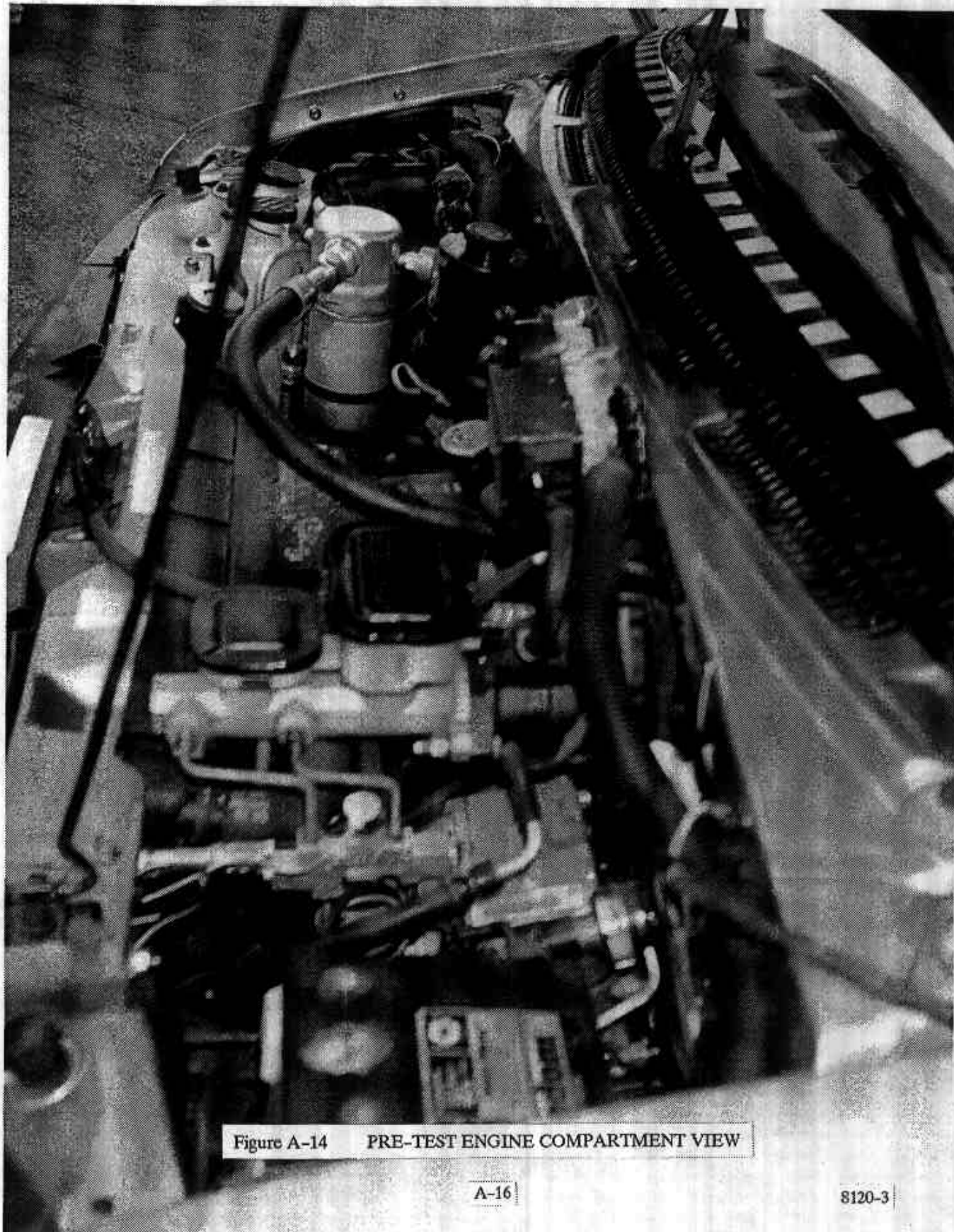


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

A-16

8120-3

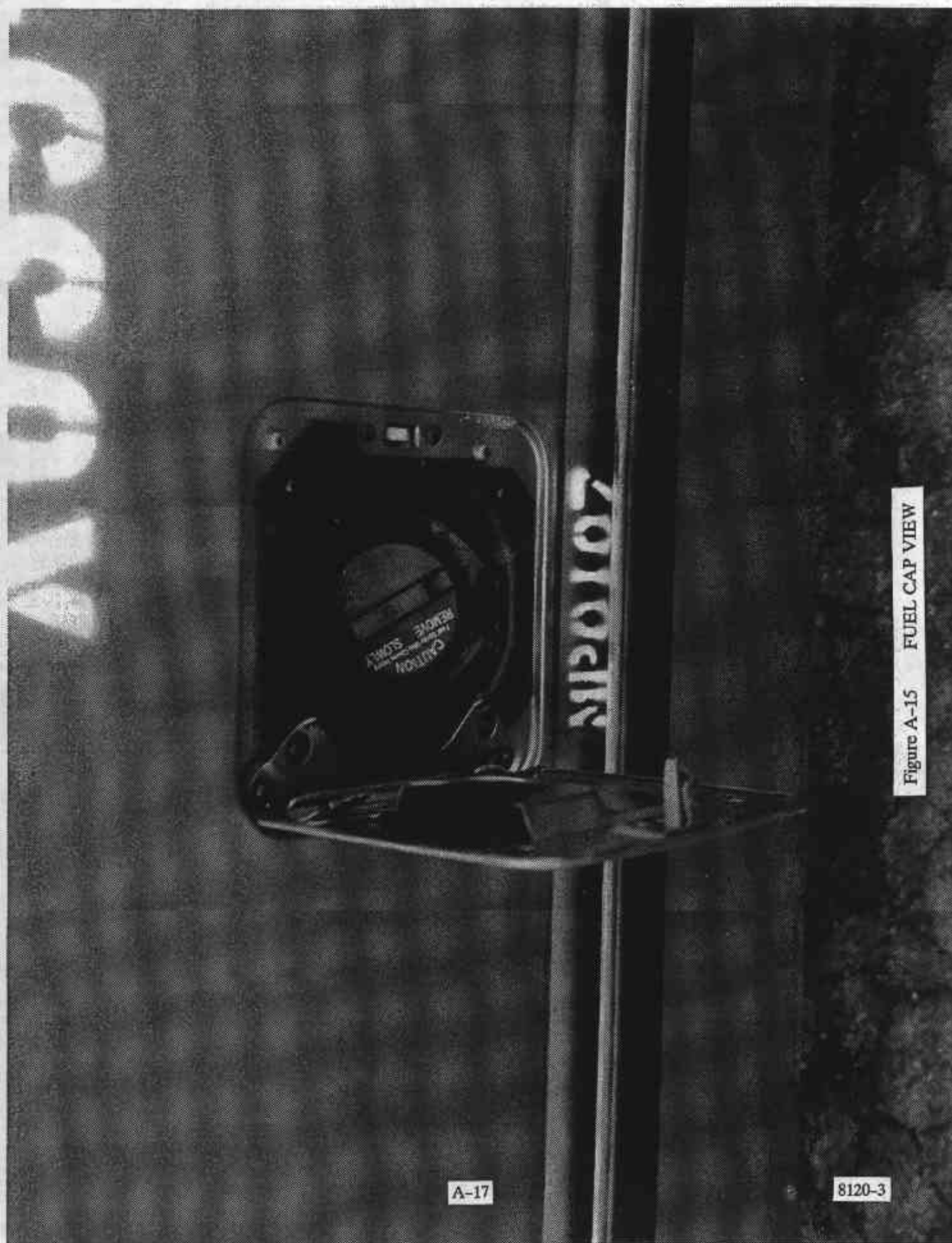


Figure A-15 FUEL CAP VIEW

A-17

8120-3



Figure A-16 PRE-TEST FRONT UNDERBODY VIEW

A-18

8120-3

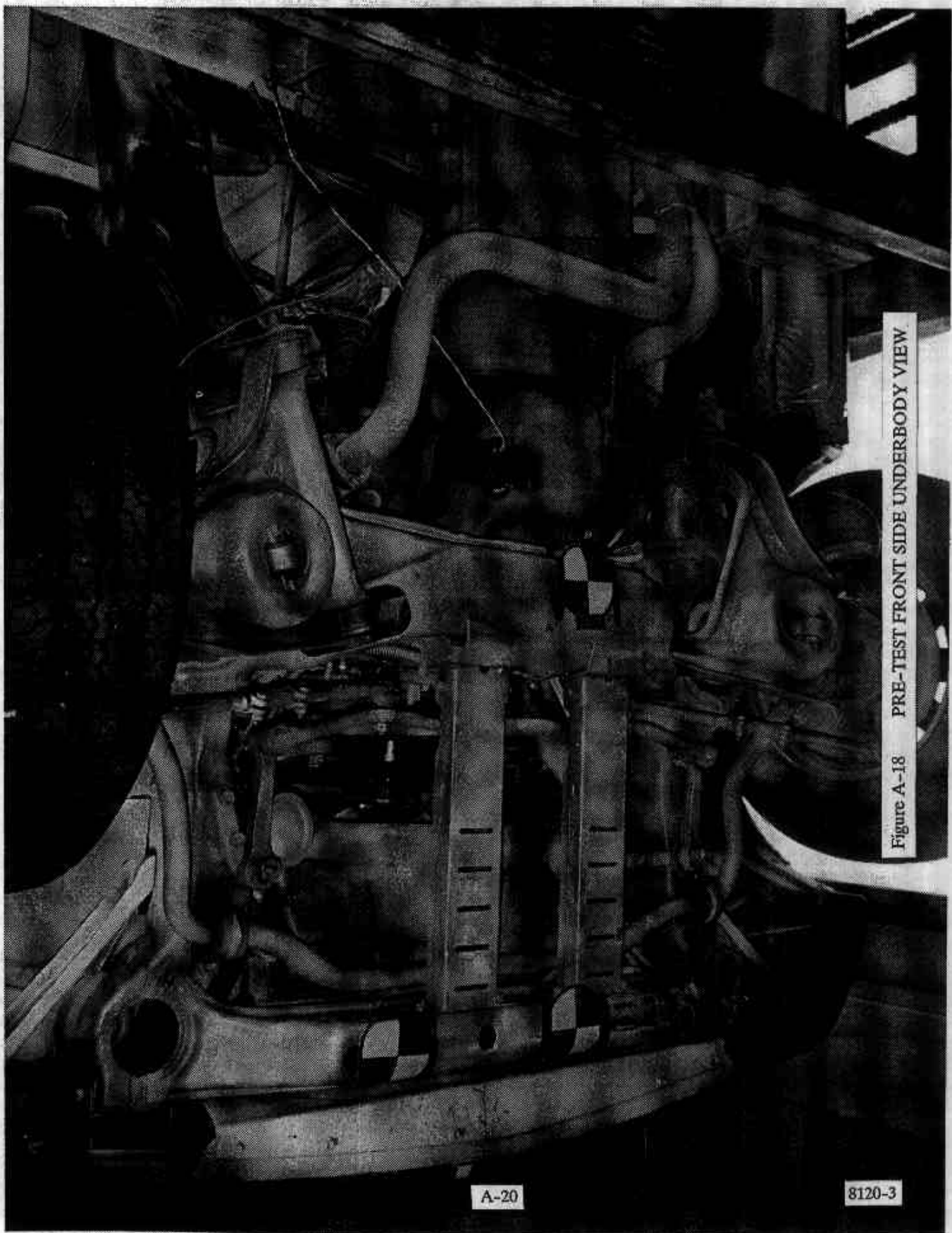
Figure A-17 POST TEST FRONT UNDERBODY VIEW

A-19

8120-3



Figure A-18 PRE-TEST FRONT SIDE UNDERBODY VIEW



A-20

8120-3

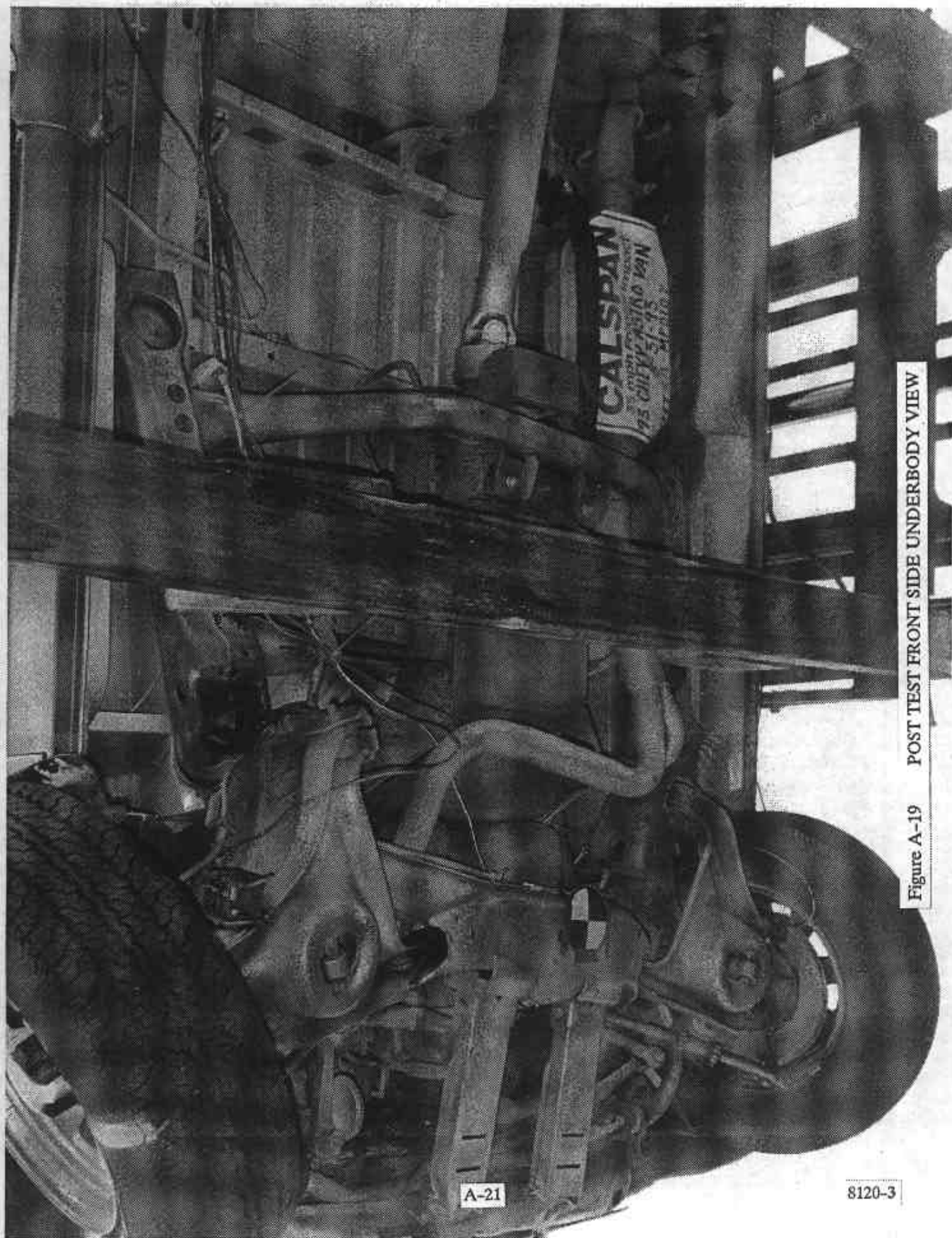


Figure A-19 POST TEST FRONT SIDE UNDERBODY VIEW

A-21

8120-3



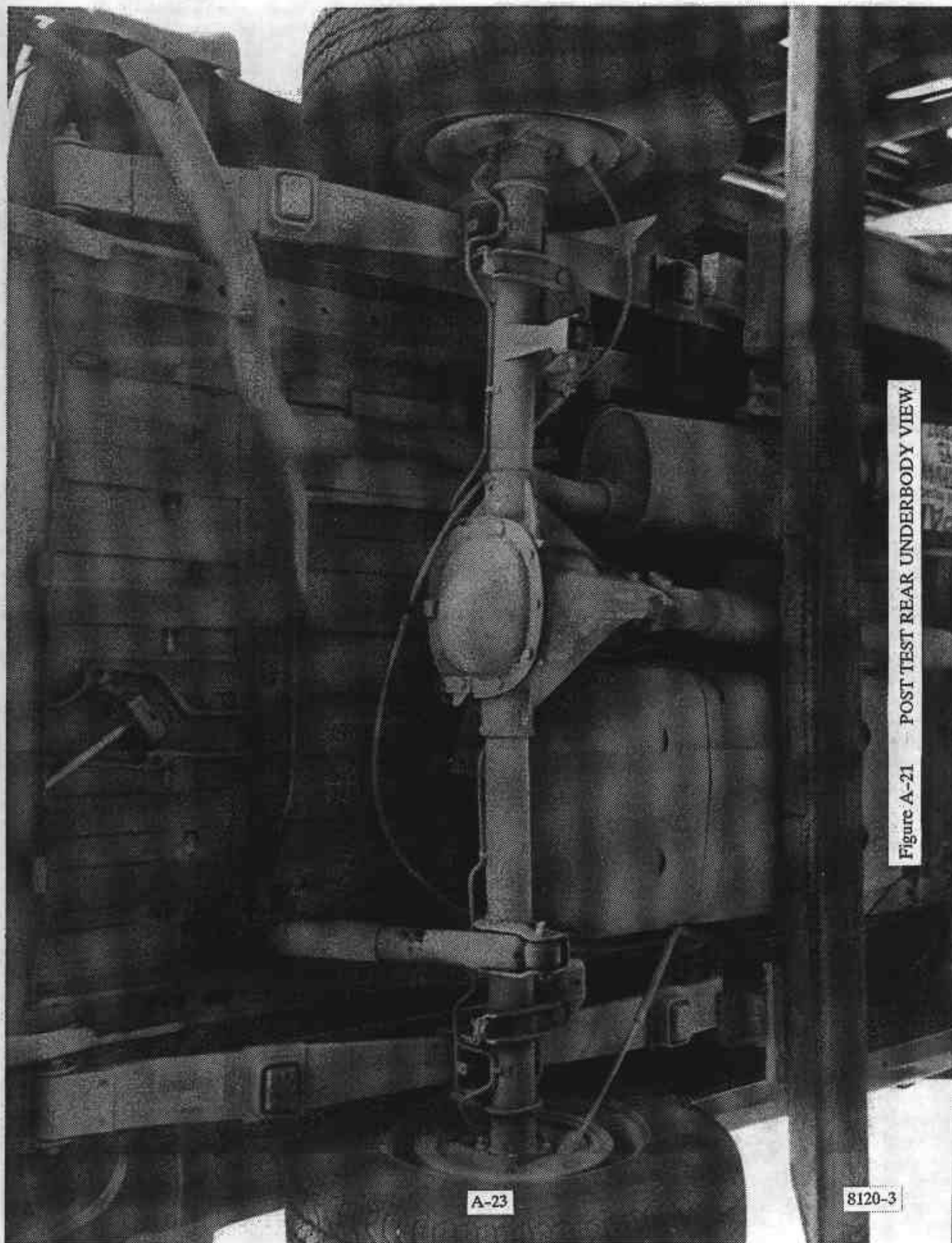
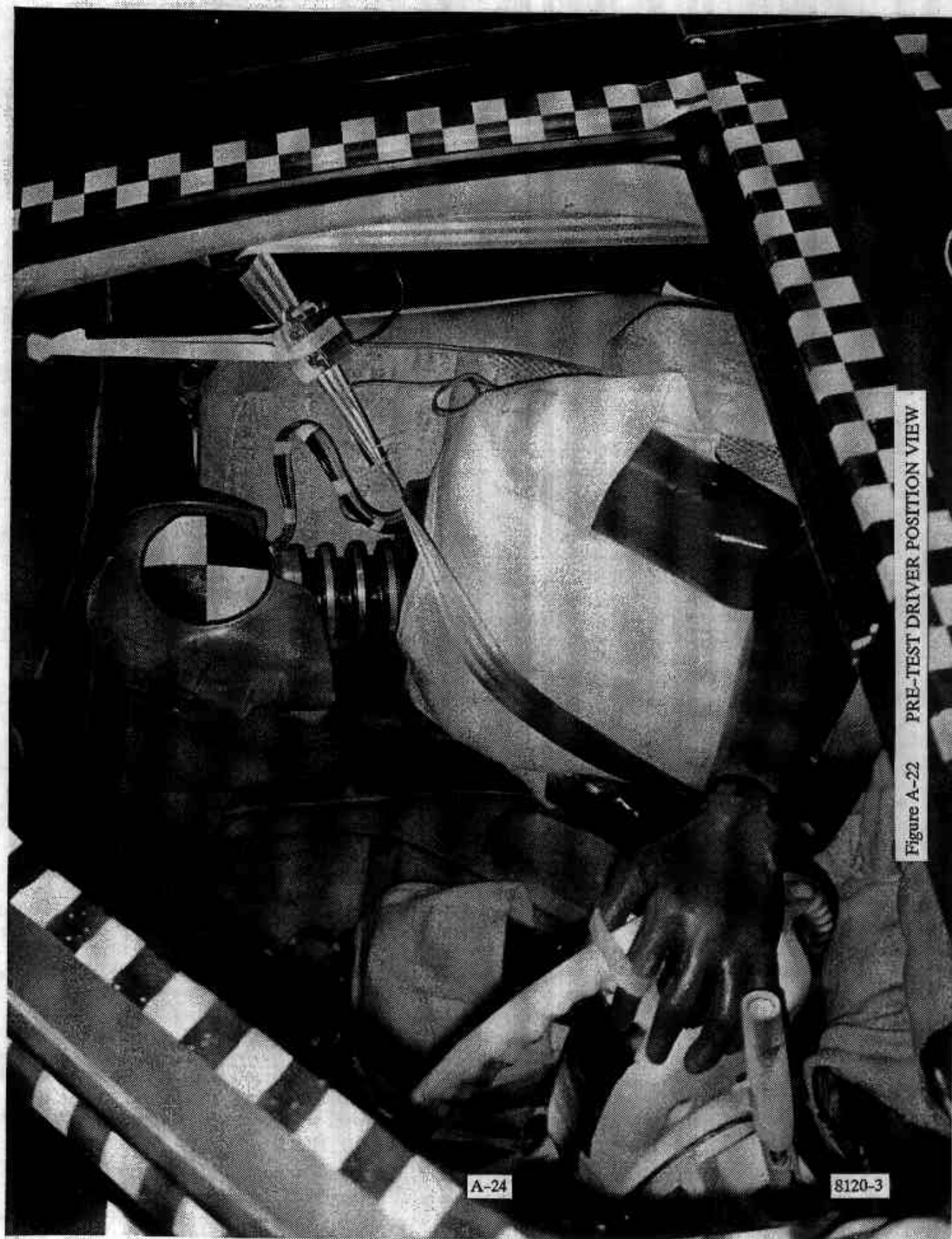


Figure A-21 POST TEST REAR UNDERBODY VIEW

A-23

8120-3

Figure A-22 PRE-TEST DRIVER POSITION VIEW



A-24

8120-3



Figure A-23 POST TEST DRIVER POSITION VIEW

A-25

8120-3

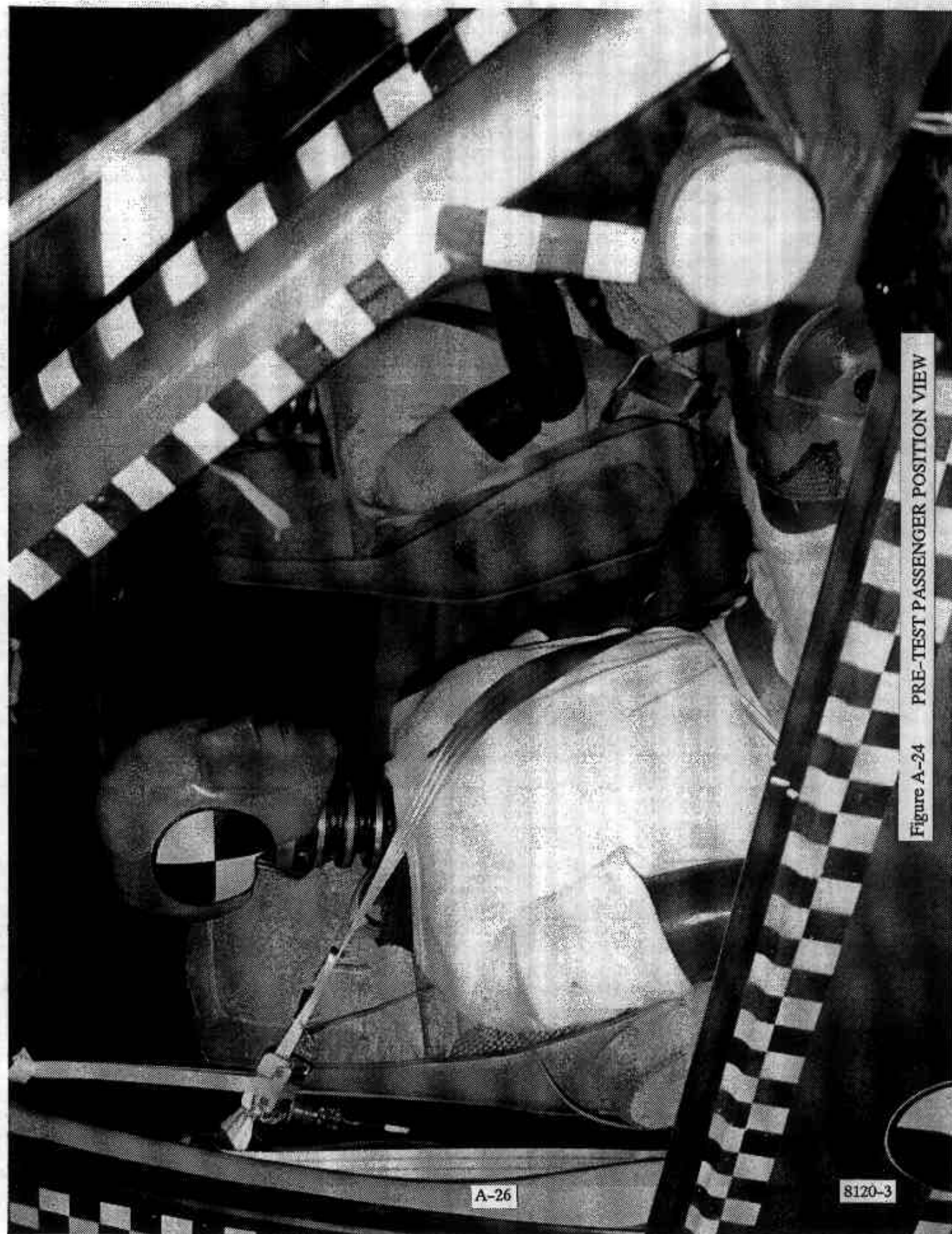


Figure A-24 PRE-TEST PASSENGER POSITION VIEW

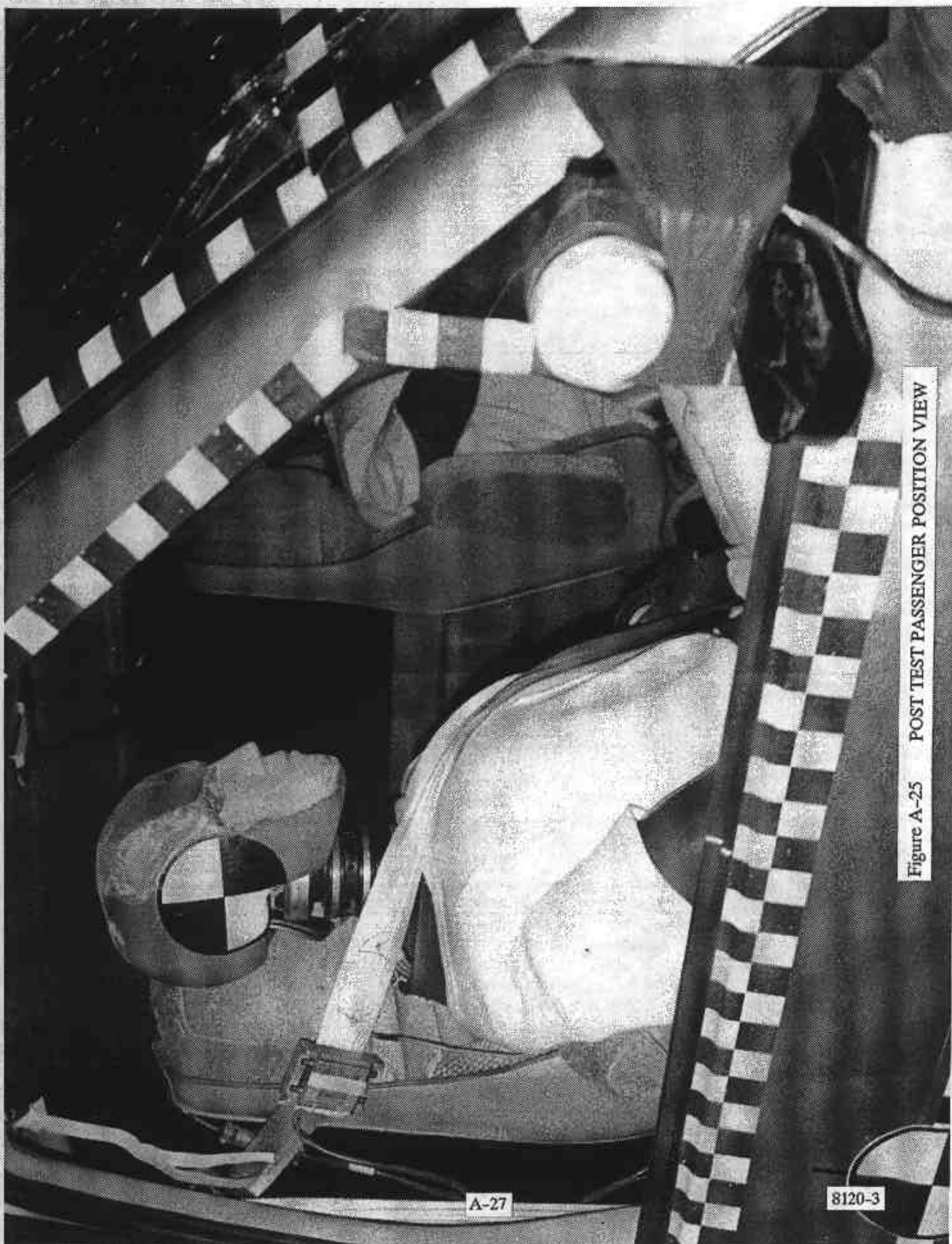


Figure A-25 POST TEST PASSENGER POSITION VIEW

A-27

8120-3



Figure A-26 PRE-TEST DRIVER AND INTERIOR VIEW

A-28

8120-3



Figure A-27 POST TEST DRIVER AND INTERIOR VIEW

A-29

8120-3



Figure A-28 PRE-TEST PASSENGER AND INTERIOR VIEW

A-30

8120-3



Figure A-29 POST TEST PASSENGER AND INTERIOR VIEW

A-31

8120-3

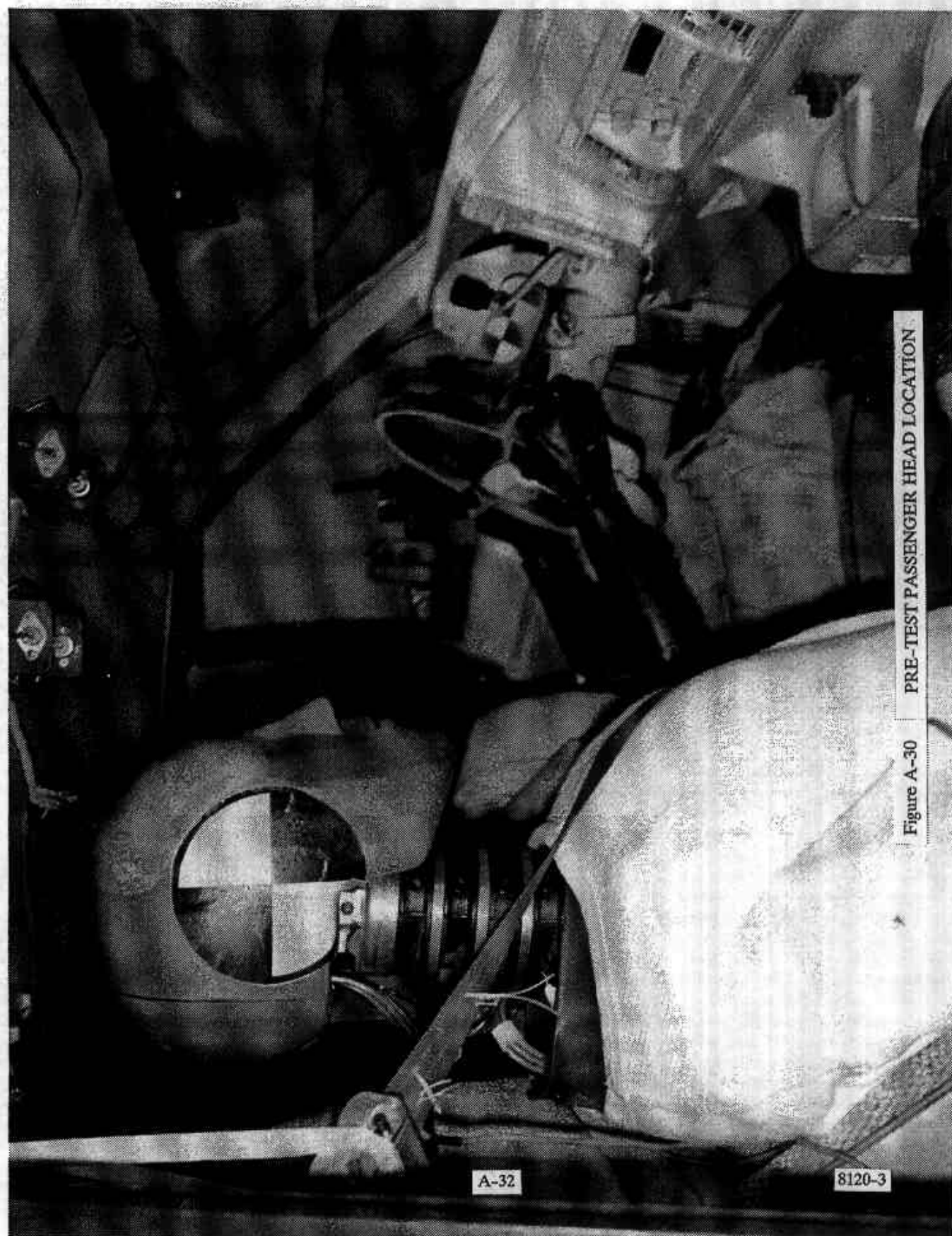


Figure A-30 PRE-TEST PASSENGER HEAD LOCATION

A-32

8120-3

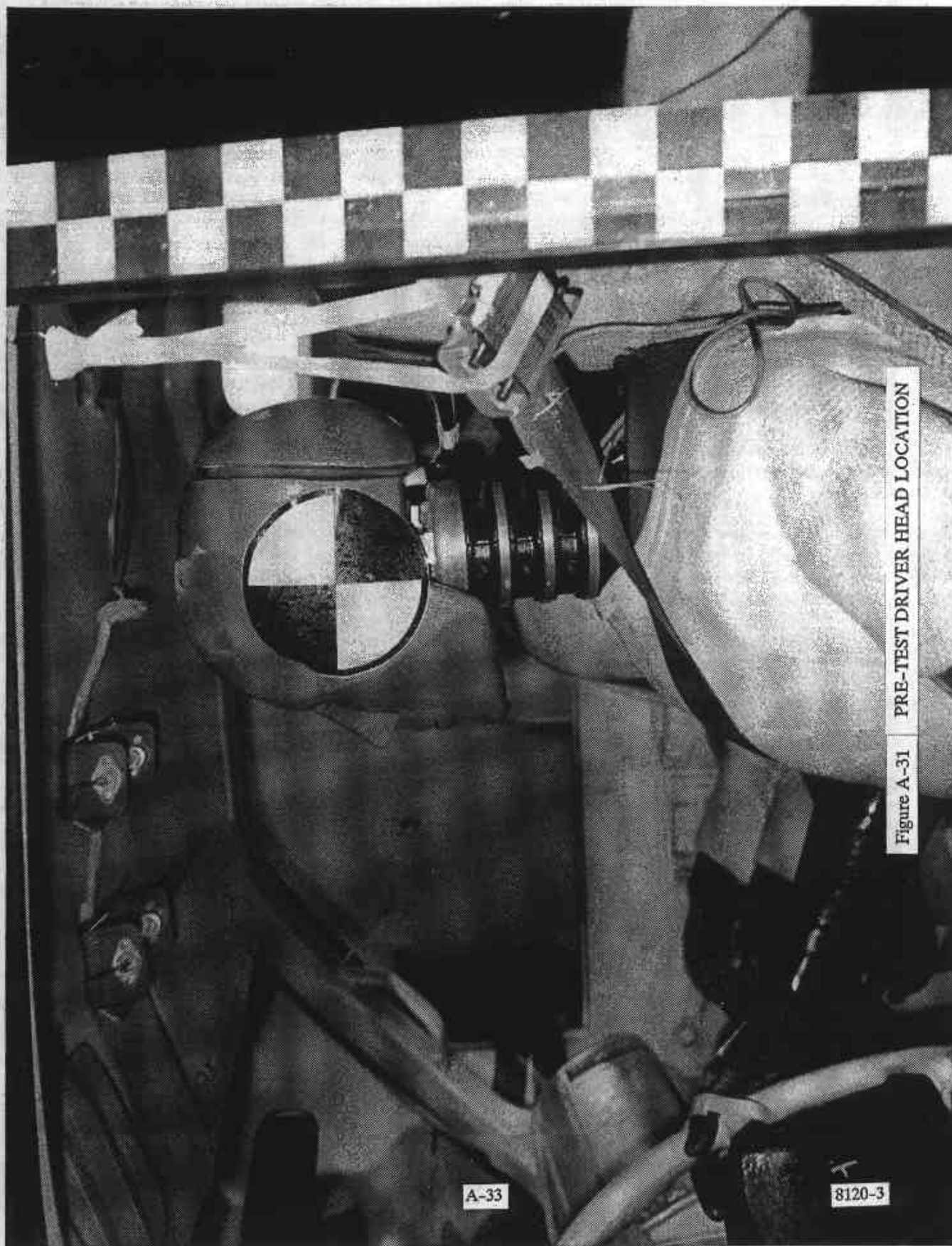


Figure A-31 PRE-TEST DRIVER HEAD LOCATION

A-33

8120-3

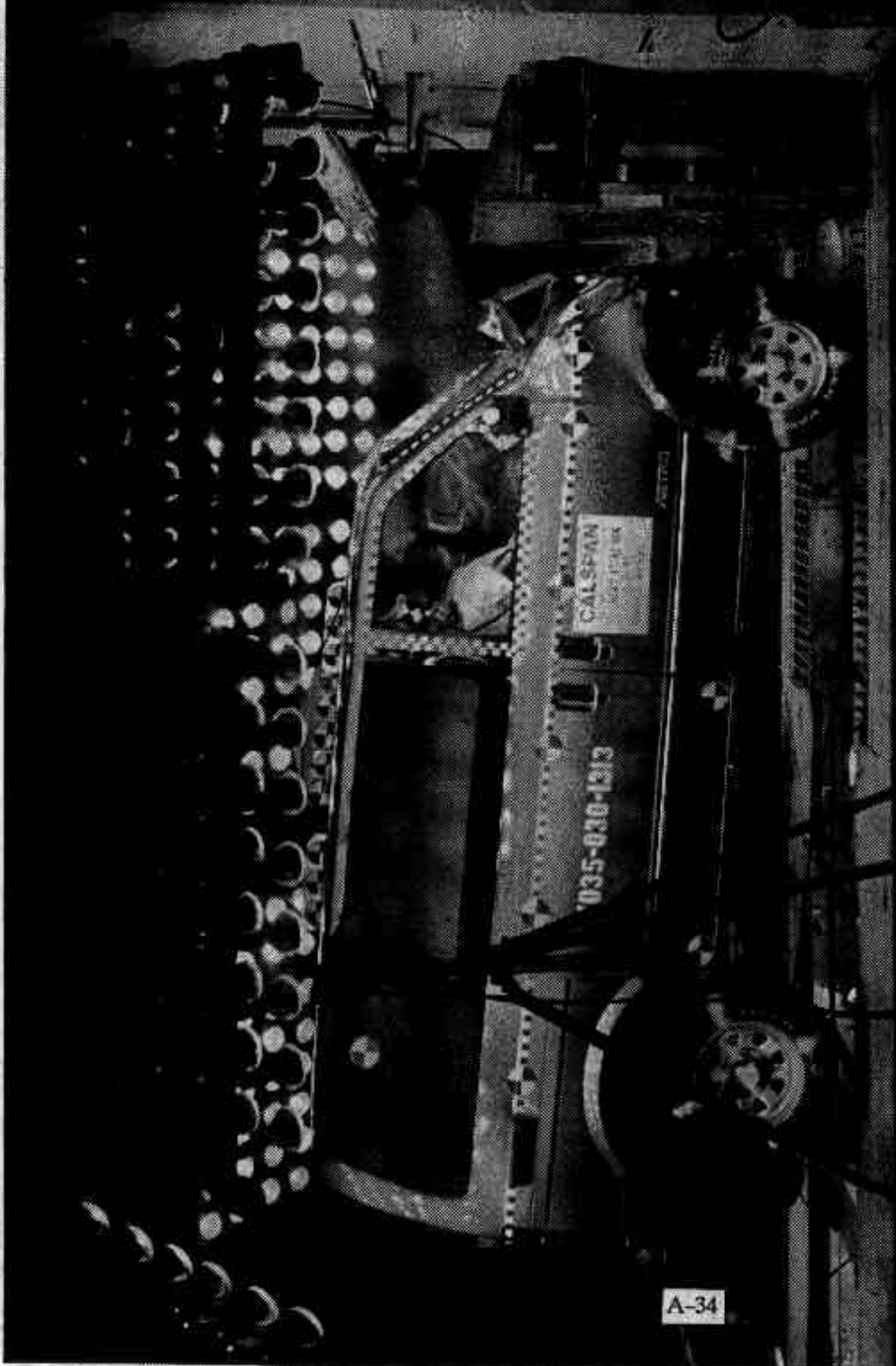


Figure A-32 IMPACT VIEW

8120-3

Appendix B

VEHICLE, LOAD CELL BARRIER AND DUMMY RESPONSE DATA

TEST NO. MP0107

VEHICLE DATA

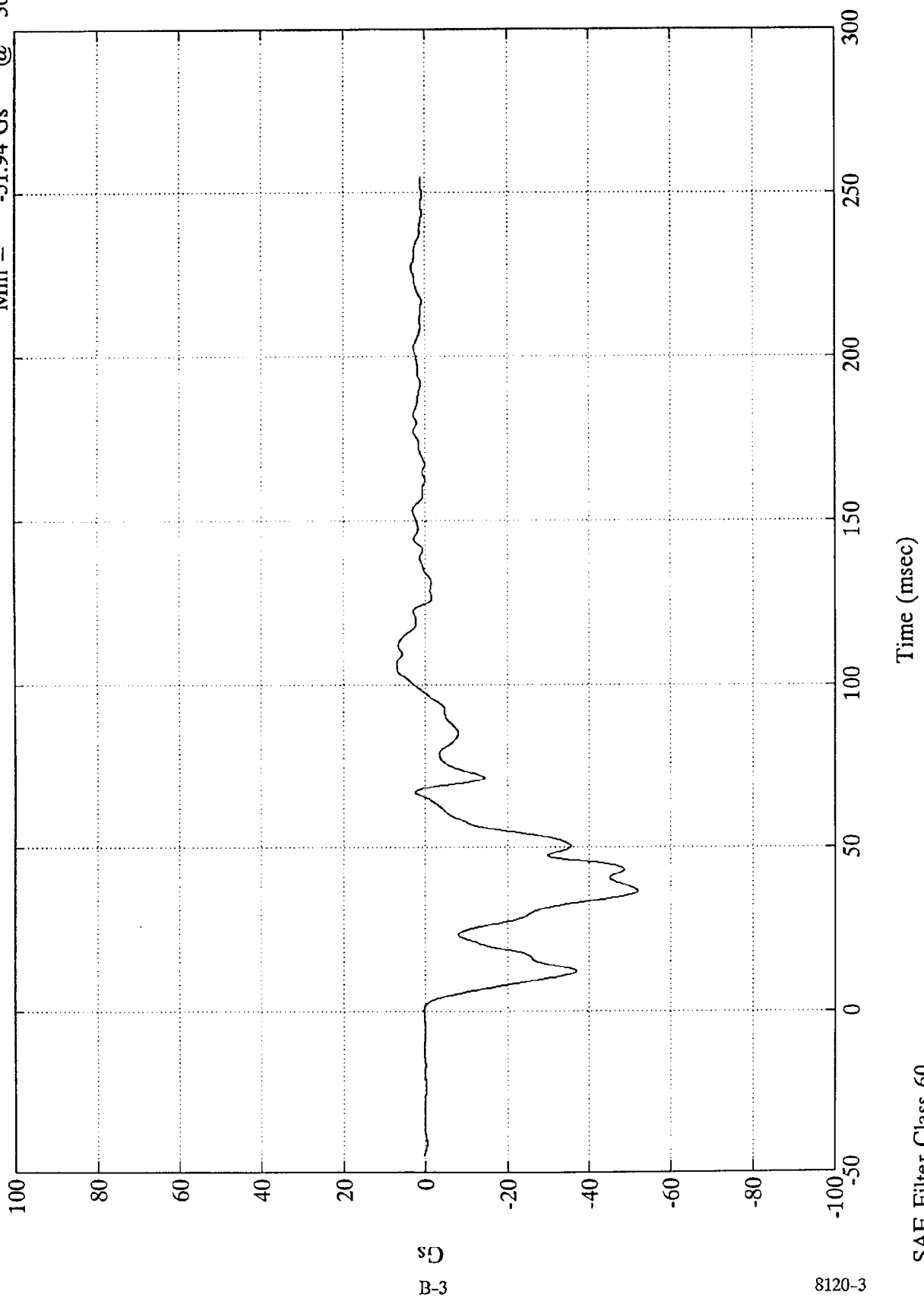
FILTER CHANNEL CLASS

60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #1(x)

Max = 7.03 Gs @ 106.44 msec
Min = -51.94 Gs @ 36.36 msec

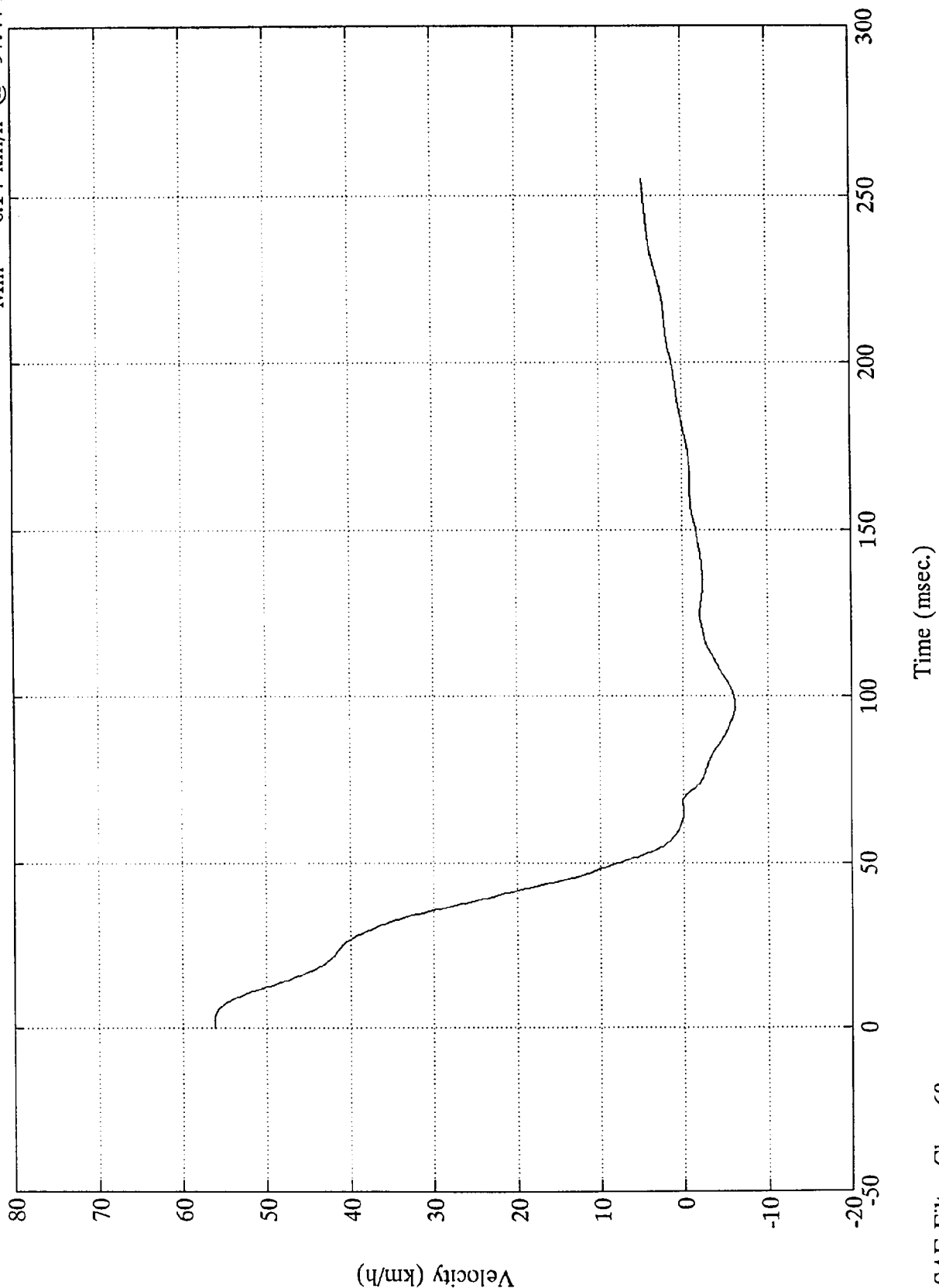


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #1(x)

Max = 56.18 km/h @ 2.40 msec
Min = -6.14 km/h @ 97.44 msec

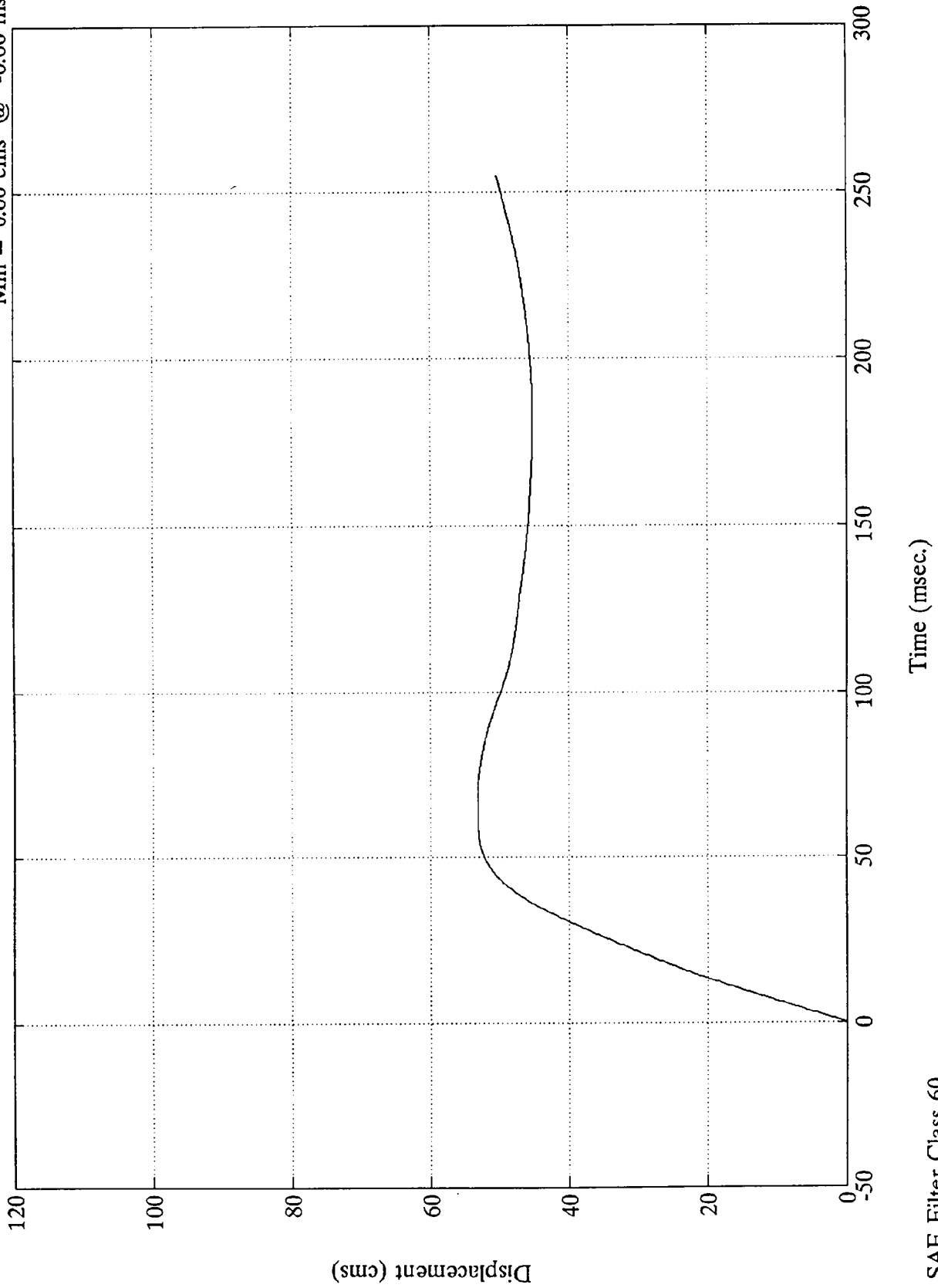


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #1(x)

Max = 53.19 cms @ 70.80 msec
Min = 0.00 cms @ -0.00 msec

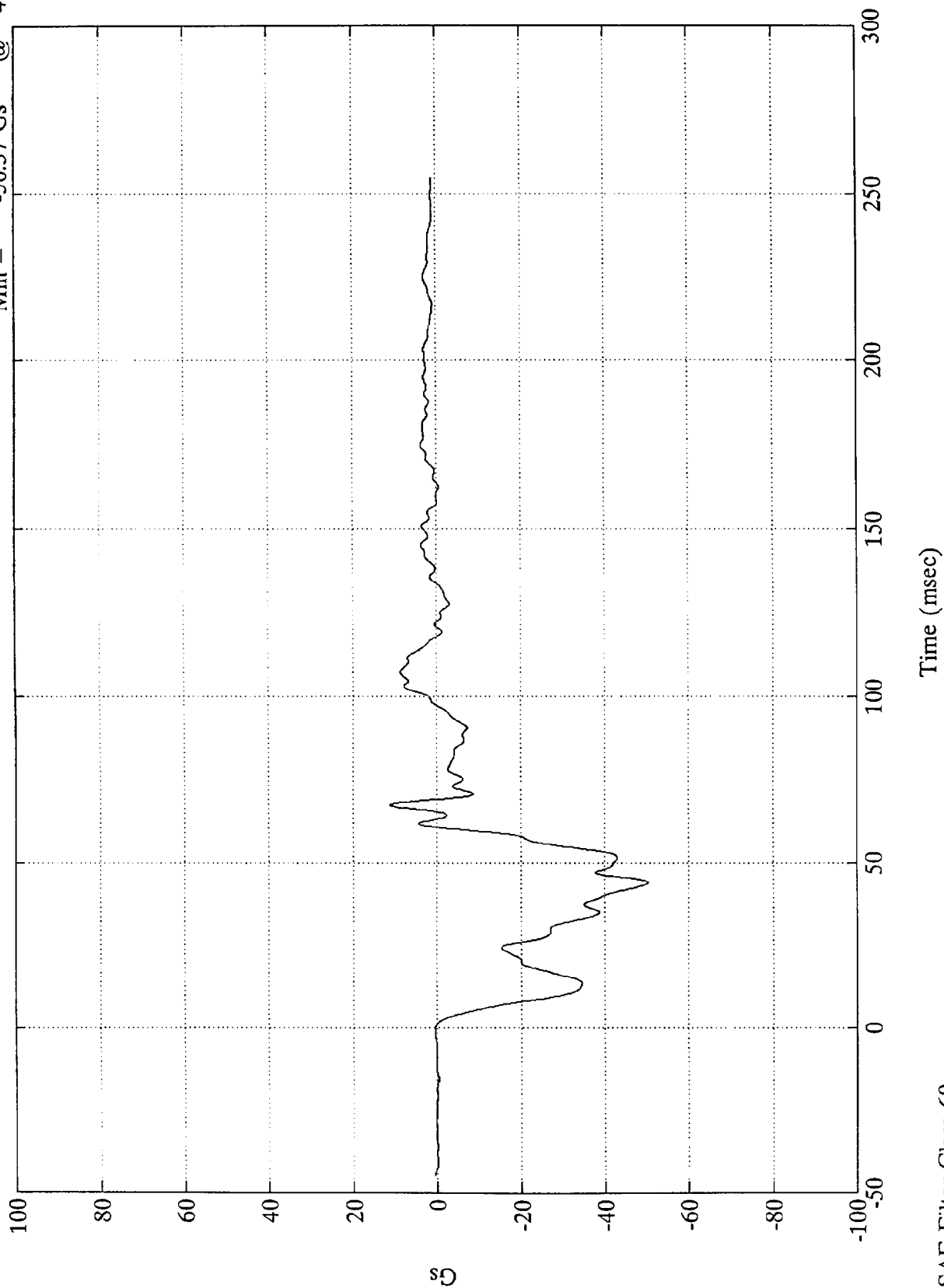


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #2(x)

Max = 11.31 Gs @ 67.32 msec
Min = -50.37 Gs @ 43.91 msec

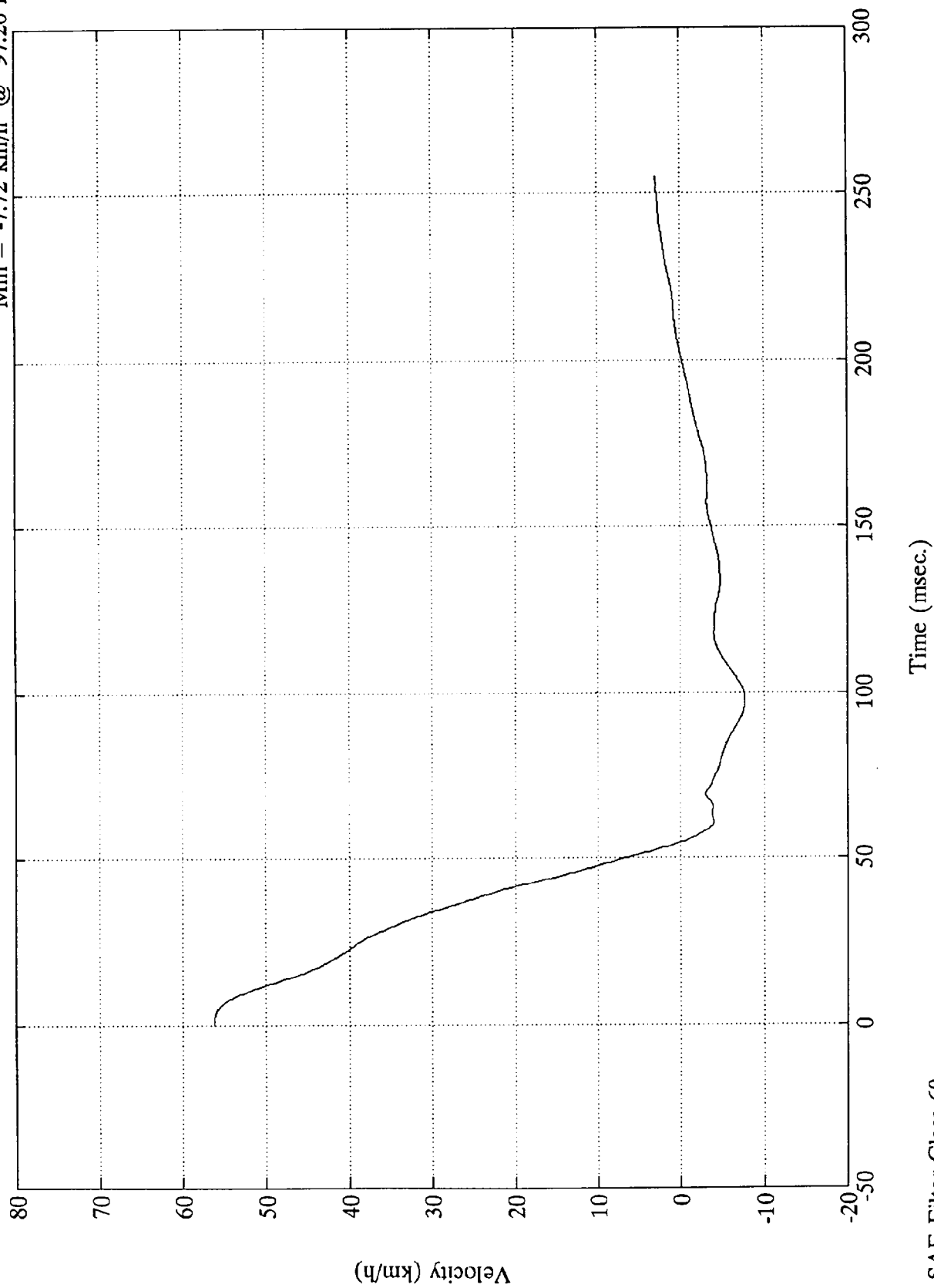


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #2(x)

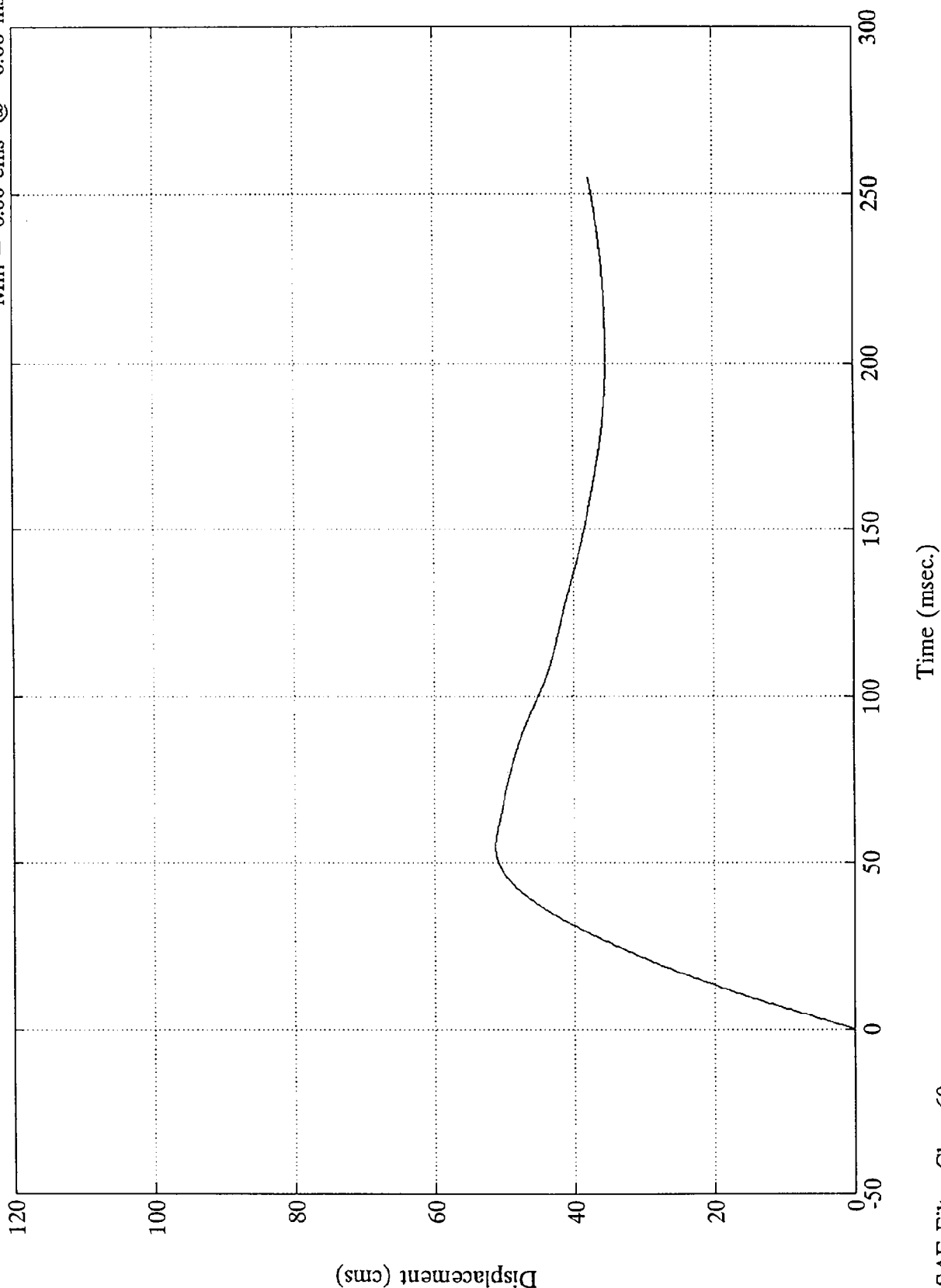
Max = 56.17 km/h @ 1.68 msec
Min = -7.72 km/h @ 97.20 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #2(x)

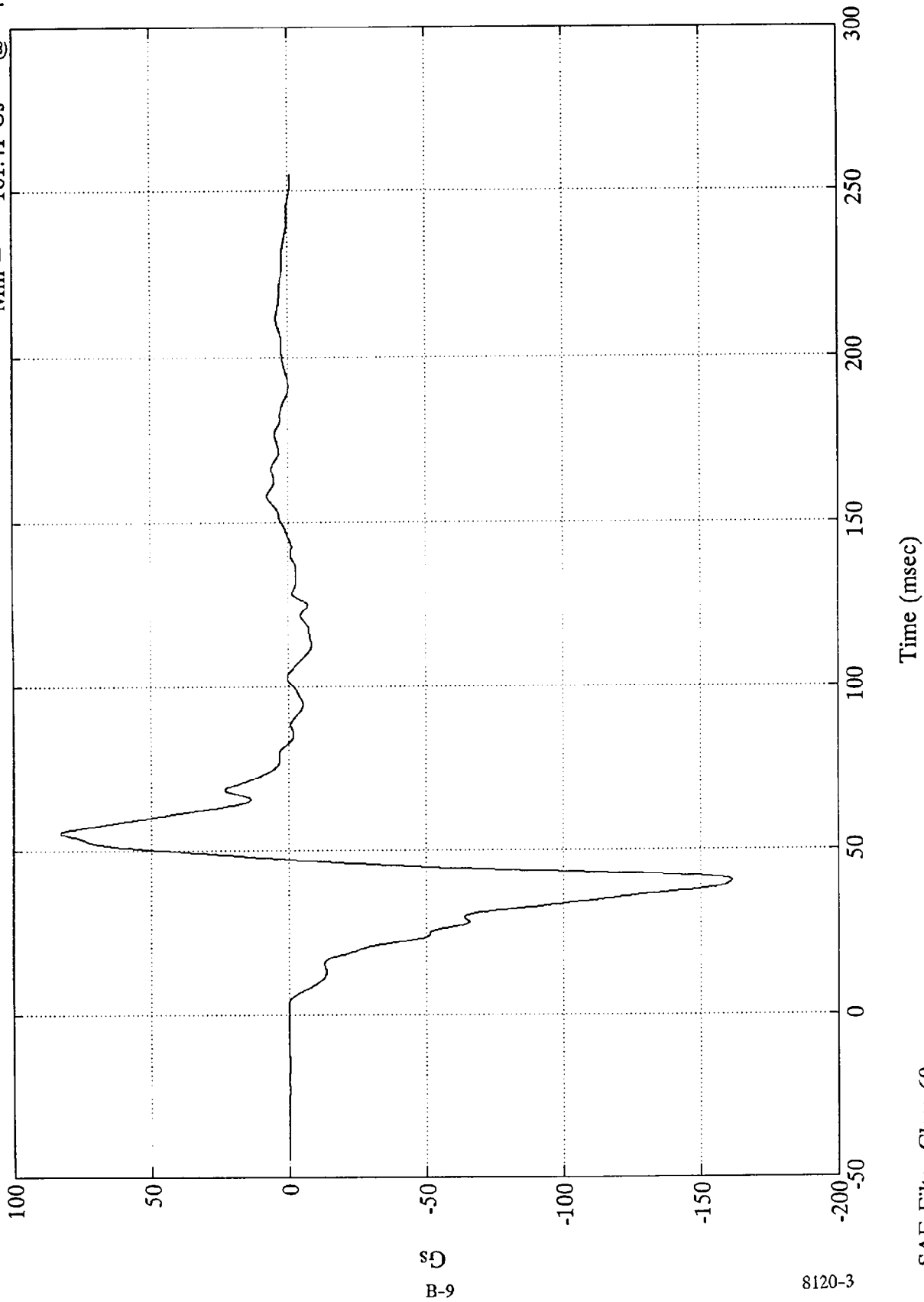
Max = 51.26 cms @ 54.96 msec
Min = 0.00 cms @ -0.00 msec



SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #3(x) Max = 83.08 Gs @ 55.32 msec
Min = -161.41 Gs @ 40.56 msec

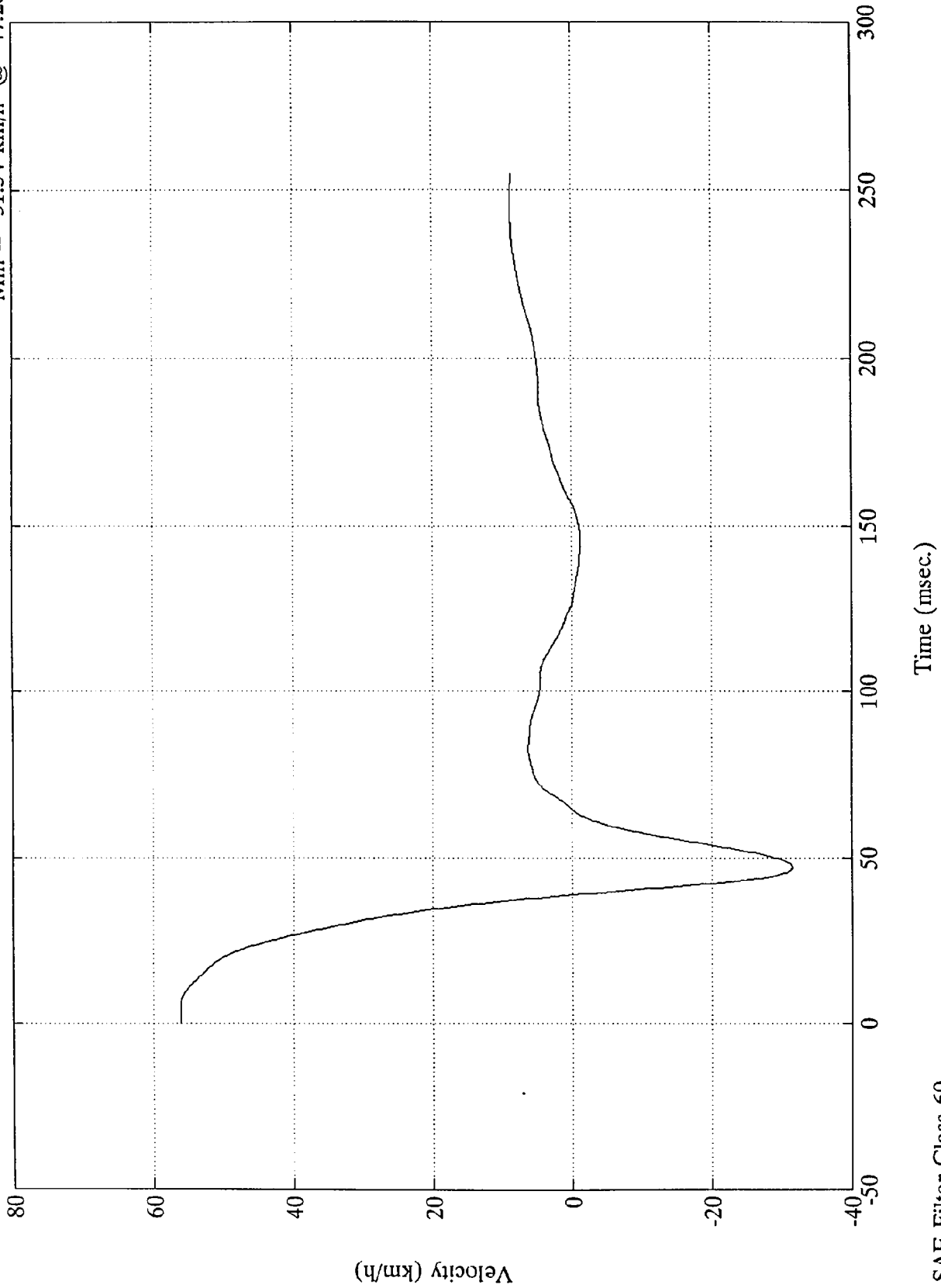


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #3(x)

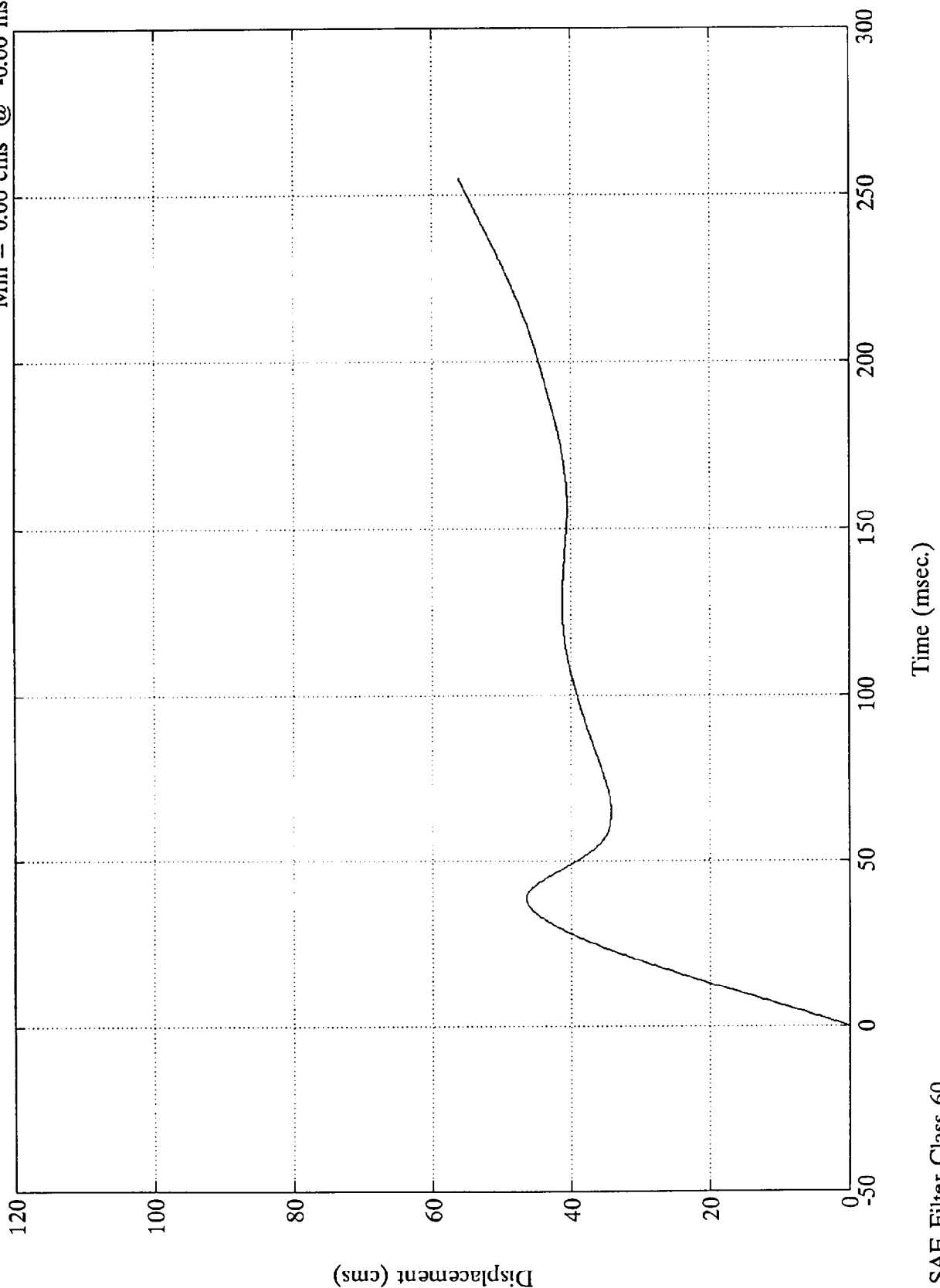
Max = 56.17 km/h @ 4.32 msec
Min = -31.54 km/h @ 47.28 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

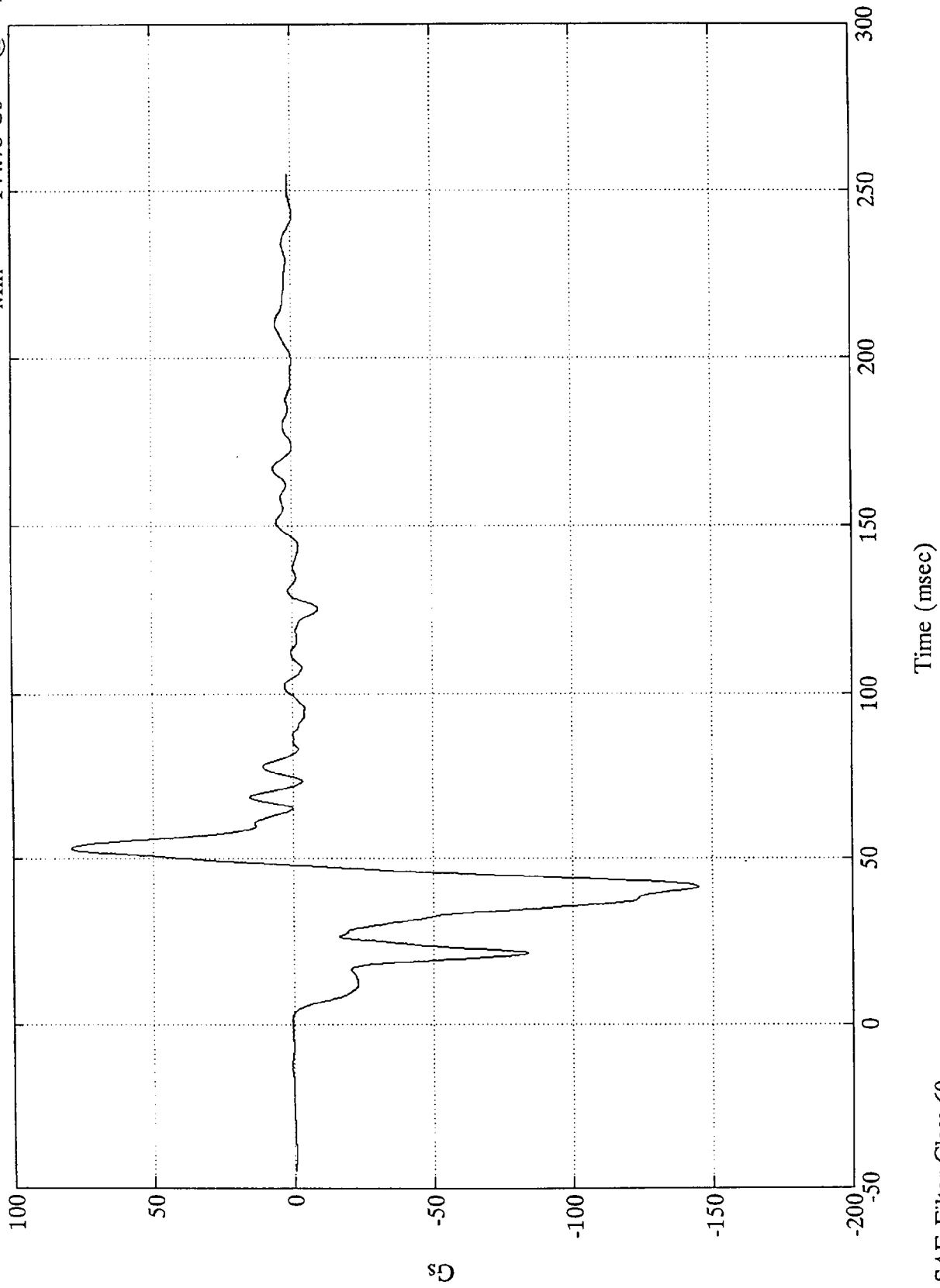
Acc. #3(x)

Max = 56.16 cms @ 254.88 msec
Min = 0.00 cms @ -0.00 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #4(x) Max = 79.27 Gs @ 53.15 msec
 Min = -144.78 Gs @ 41.04 msec

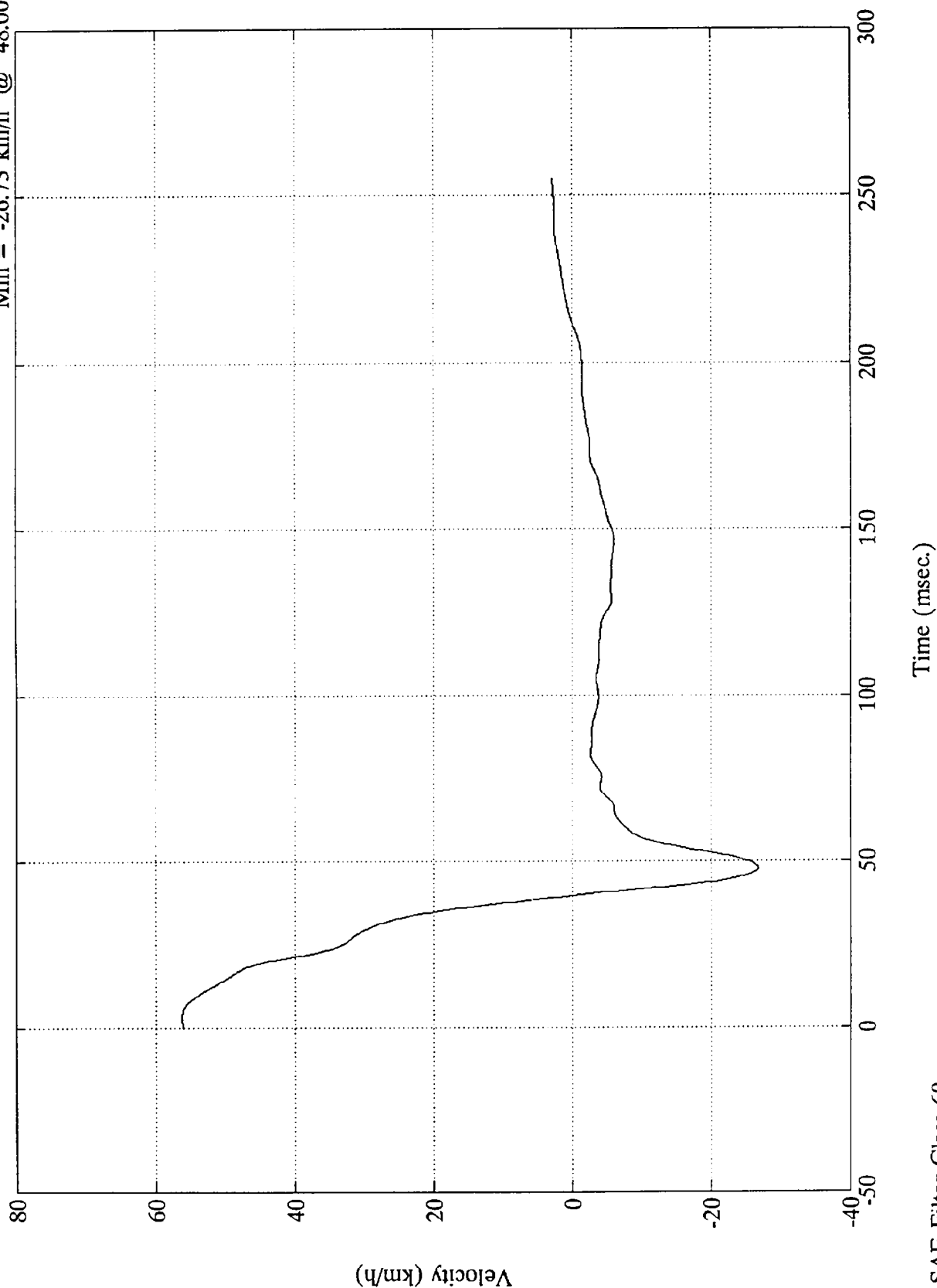


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #4(x)

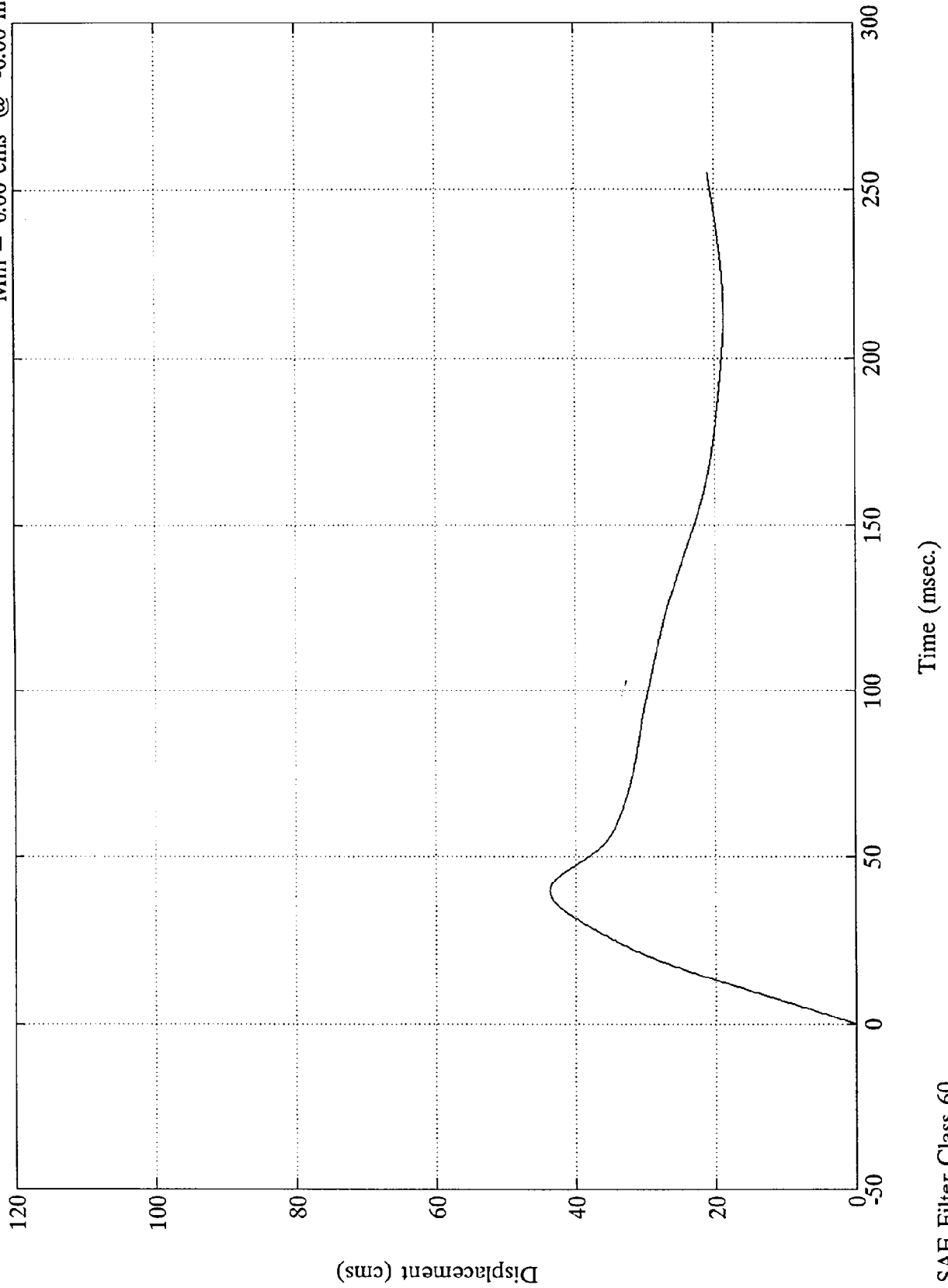
Max = 56.21 km/h @ 3.84 msec
Min = -26.73 km/h @ 48.00 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #4(x)

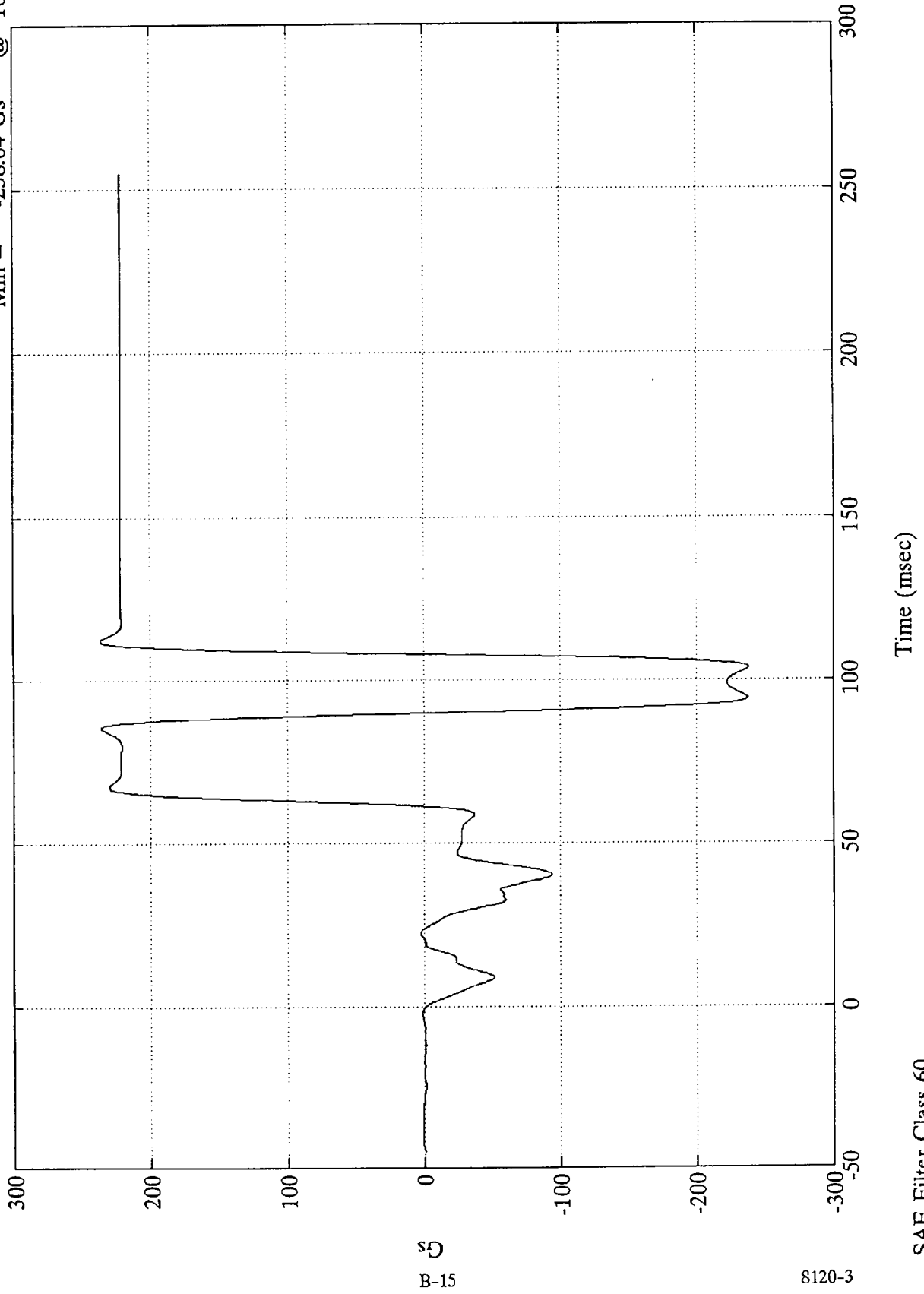
Max = 43.71 cms @ 39.60 msec
Min = 0.00 cms @ -0.00 msec



SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #5(x) Max = 236.59 Gs @ 112.08 msec
Min = -238.04 Gs @ 103.55 msec



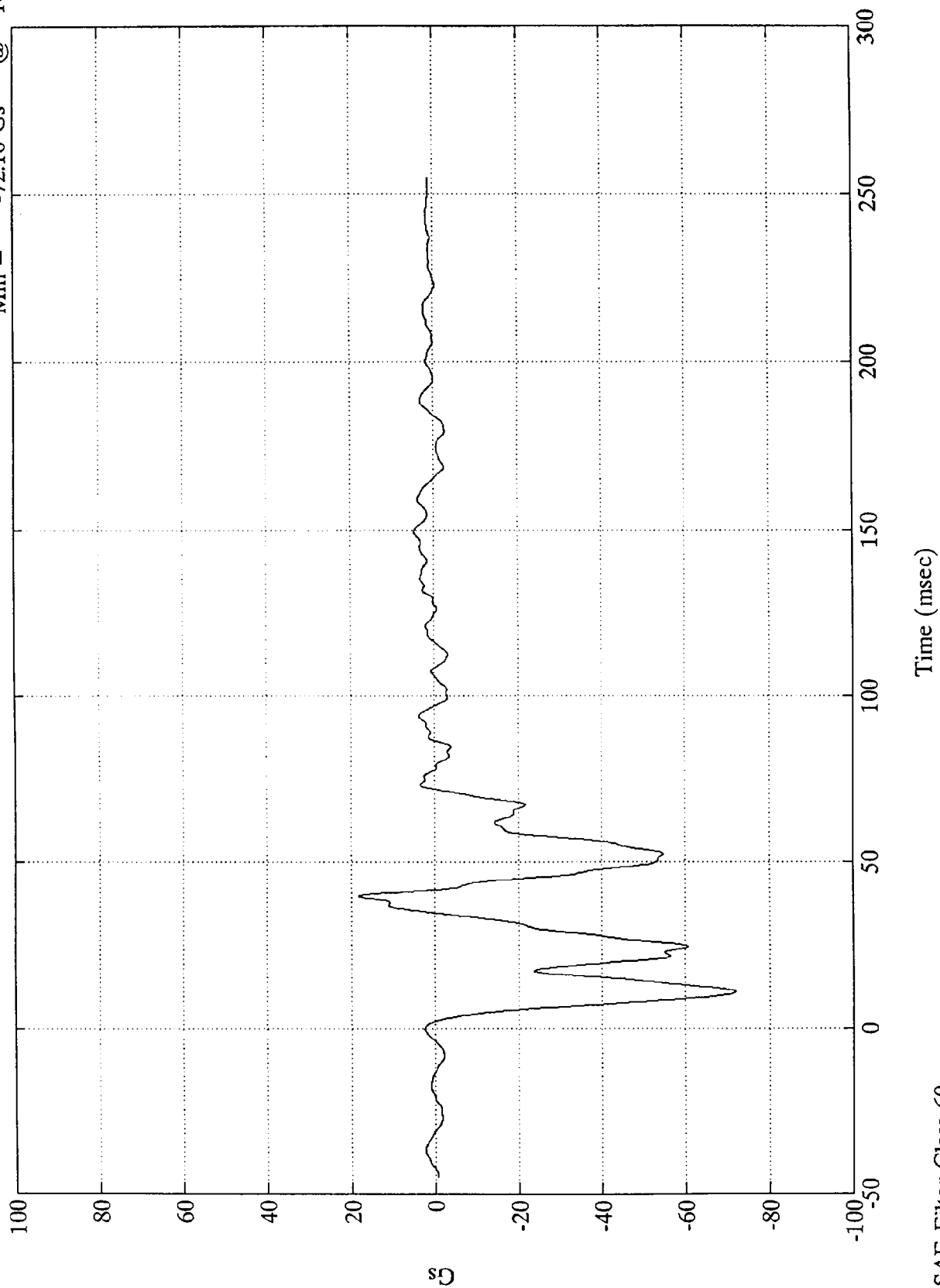
SAE Filter Class 60

8120-3

B-15

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #6(x)
Max = 18.16 Gs @ 39.71 msec
Min = -72.10 Gs @ 10.91 msec



B-16

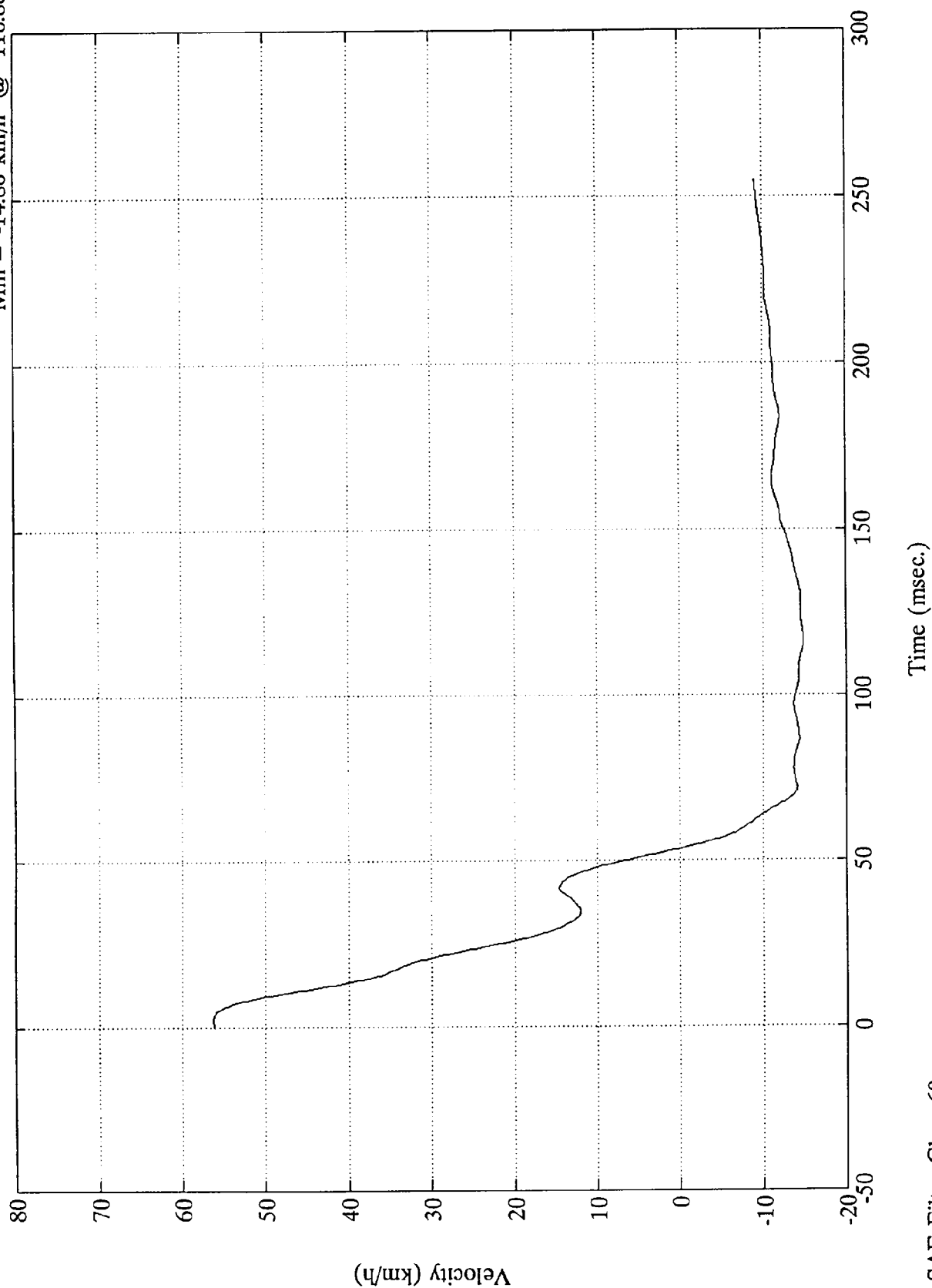
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #6(x)

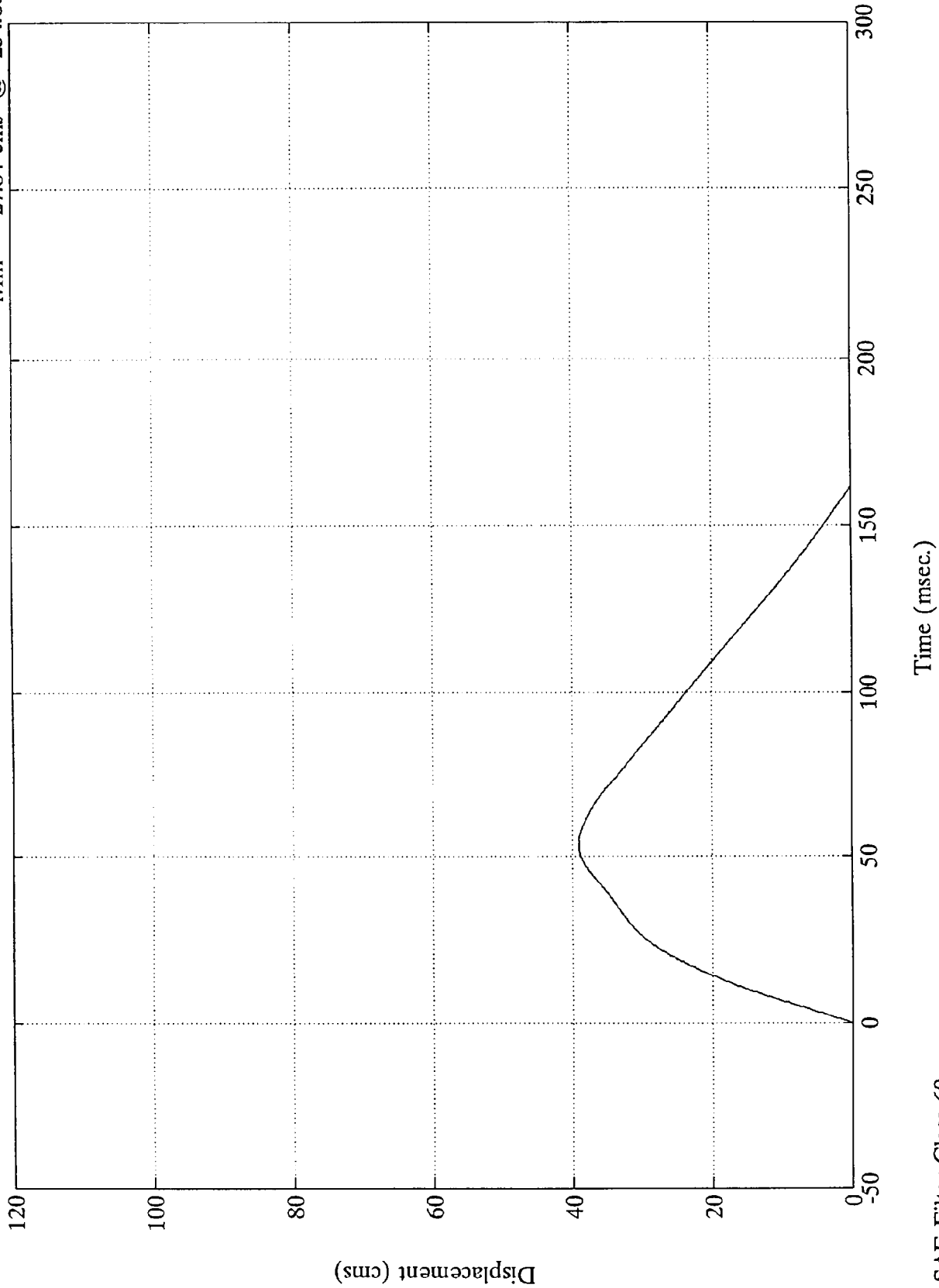
Max = 56.28 km/h @ 2.16 msec
Min = -14.86 km/h @ 116.88 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #6(x)

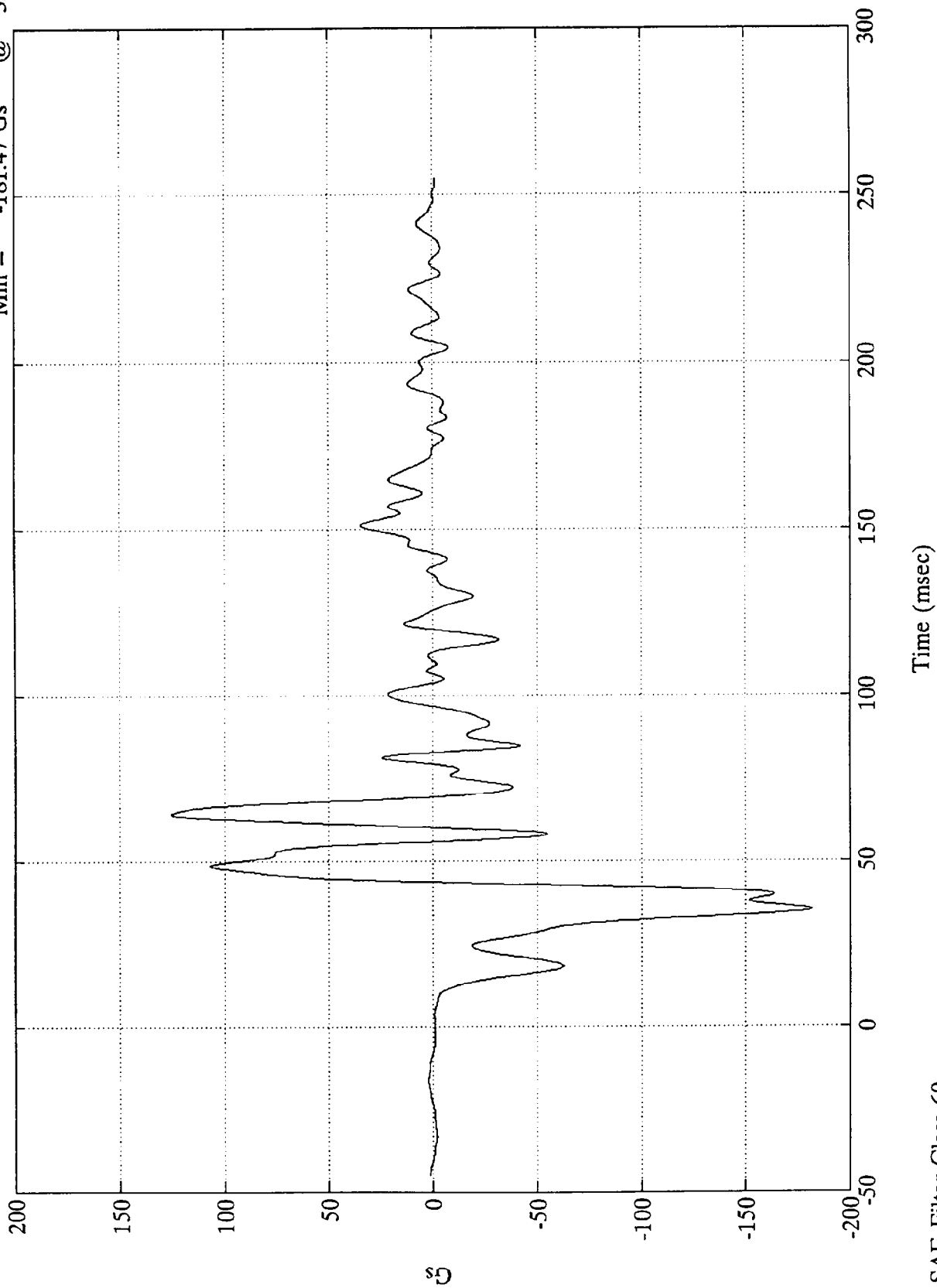
Max = 39.14 cms @ 54.24 msec
Min = -27.84 cms @ 254.88 msec



SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #7(x) Max = 125.25 Gs @ 63.95 msec
 Min = -181.47 Gs @ 35.15 msec



B-19

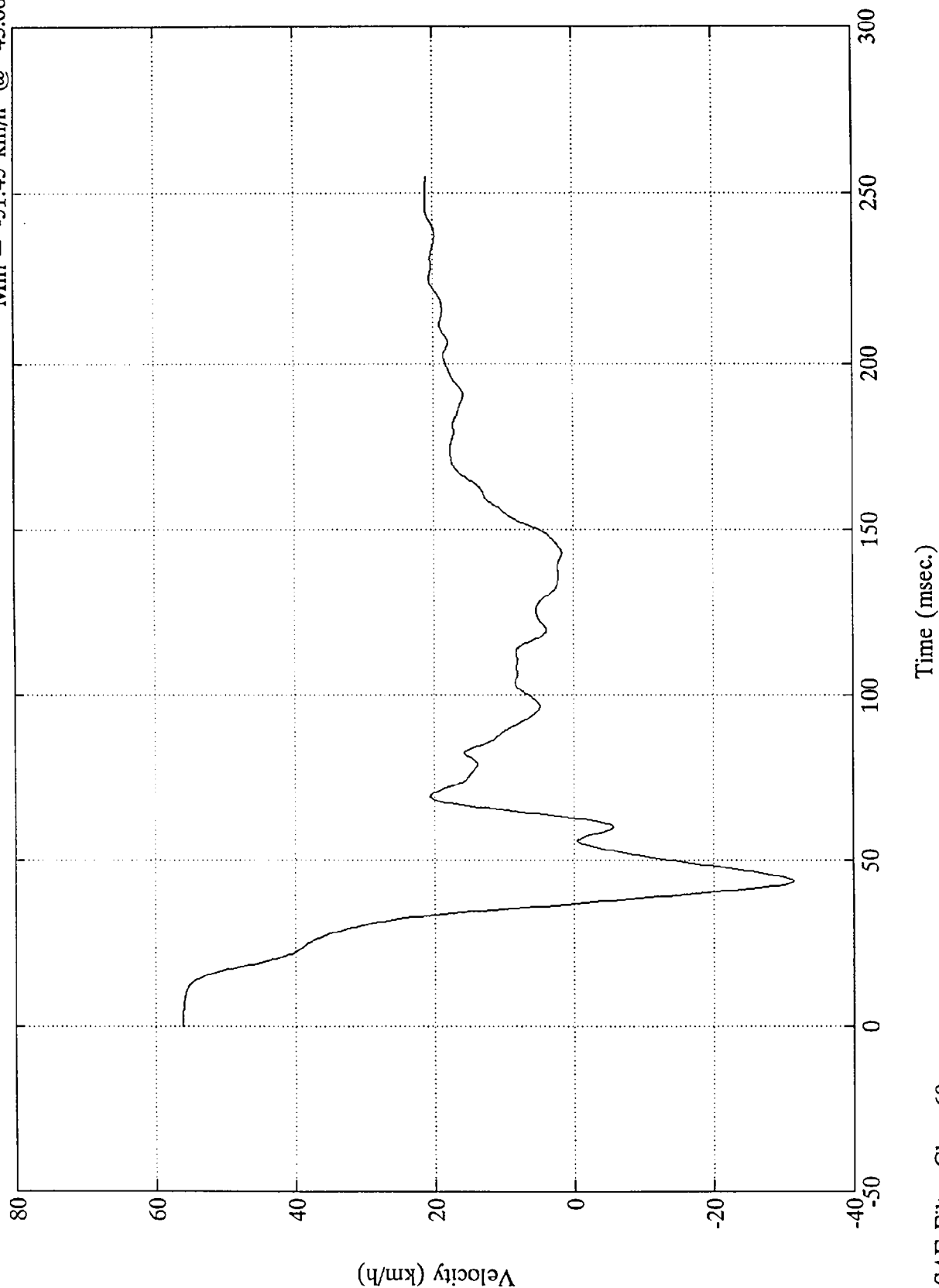
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #7(x)

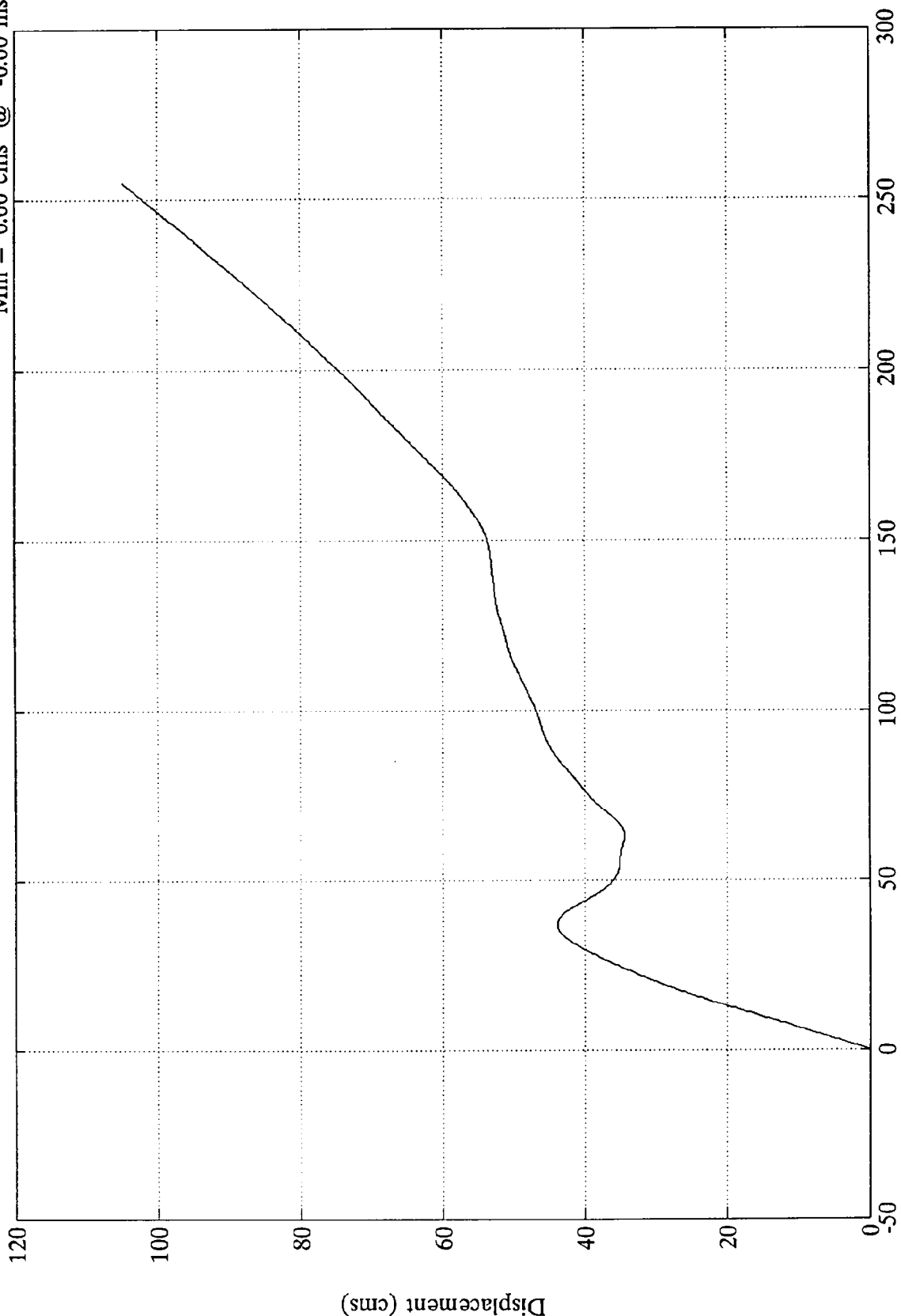
Max = 56.17 km/h @ -0.00 msec
Min = -31.45 km/h @ 43.68 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #7(x)

Max = 104.83 cms @ 254.88 msec
Min = 0.00 cms @ -0.00 msec



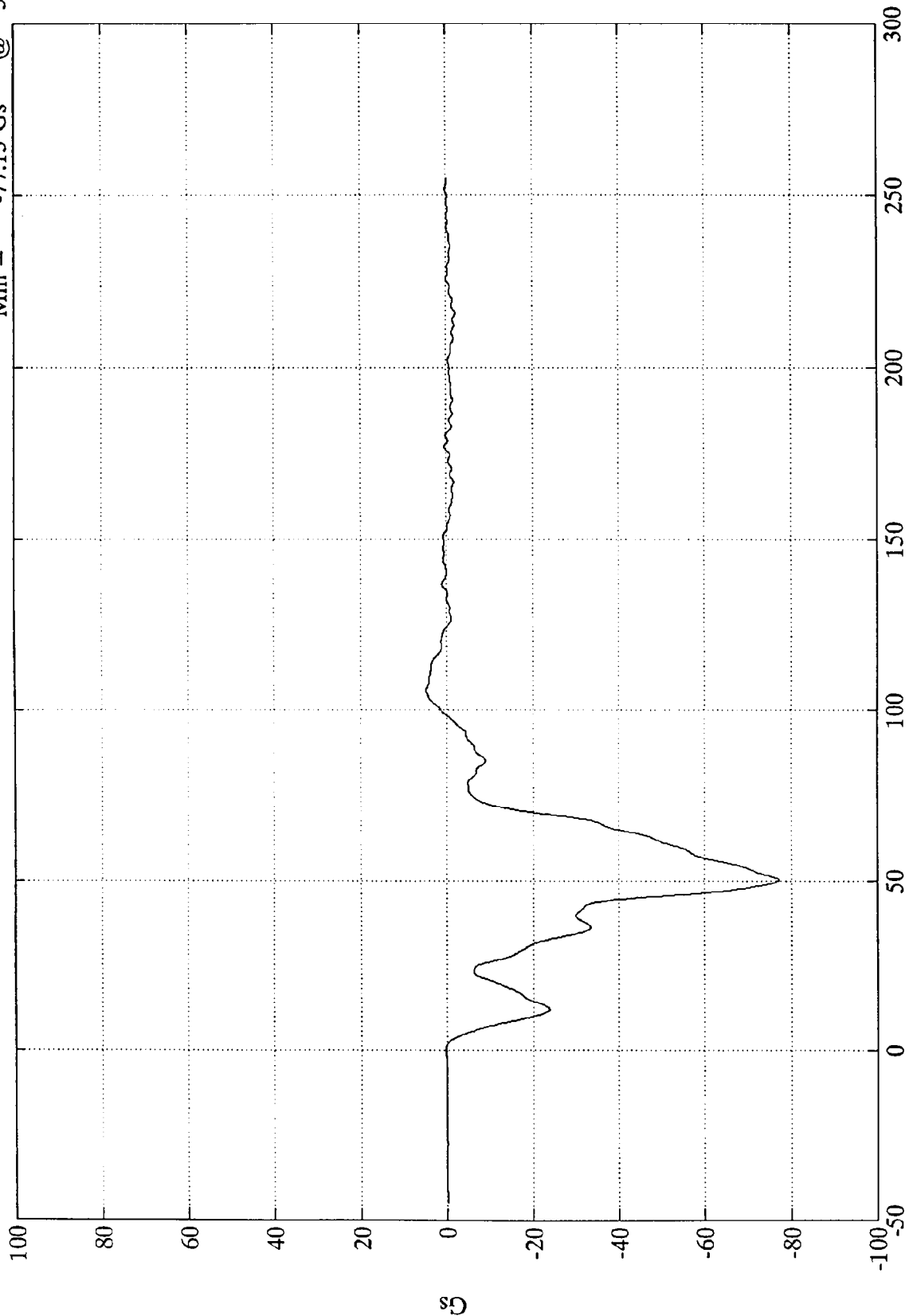
Time (msec.)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #8(x)

Max = 4.71 Gs @ 105.84 msec
Min = -77.13 Gs @ 50.28 msec



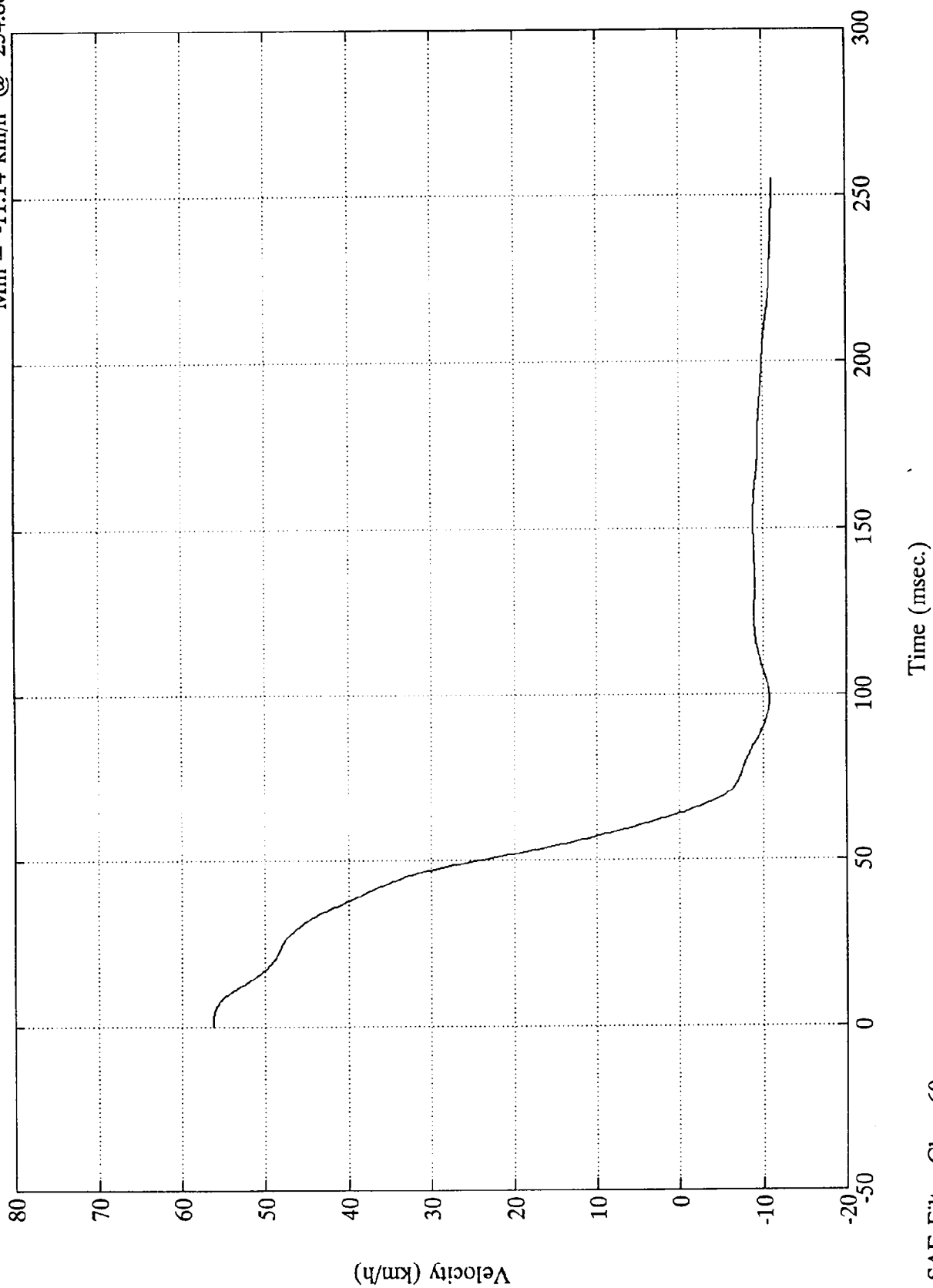
Time (msec)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #8(x)

Max = 56.17 km/h @ 2.40 msec
Min = -11.14 km/h @ 254.88 msec

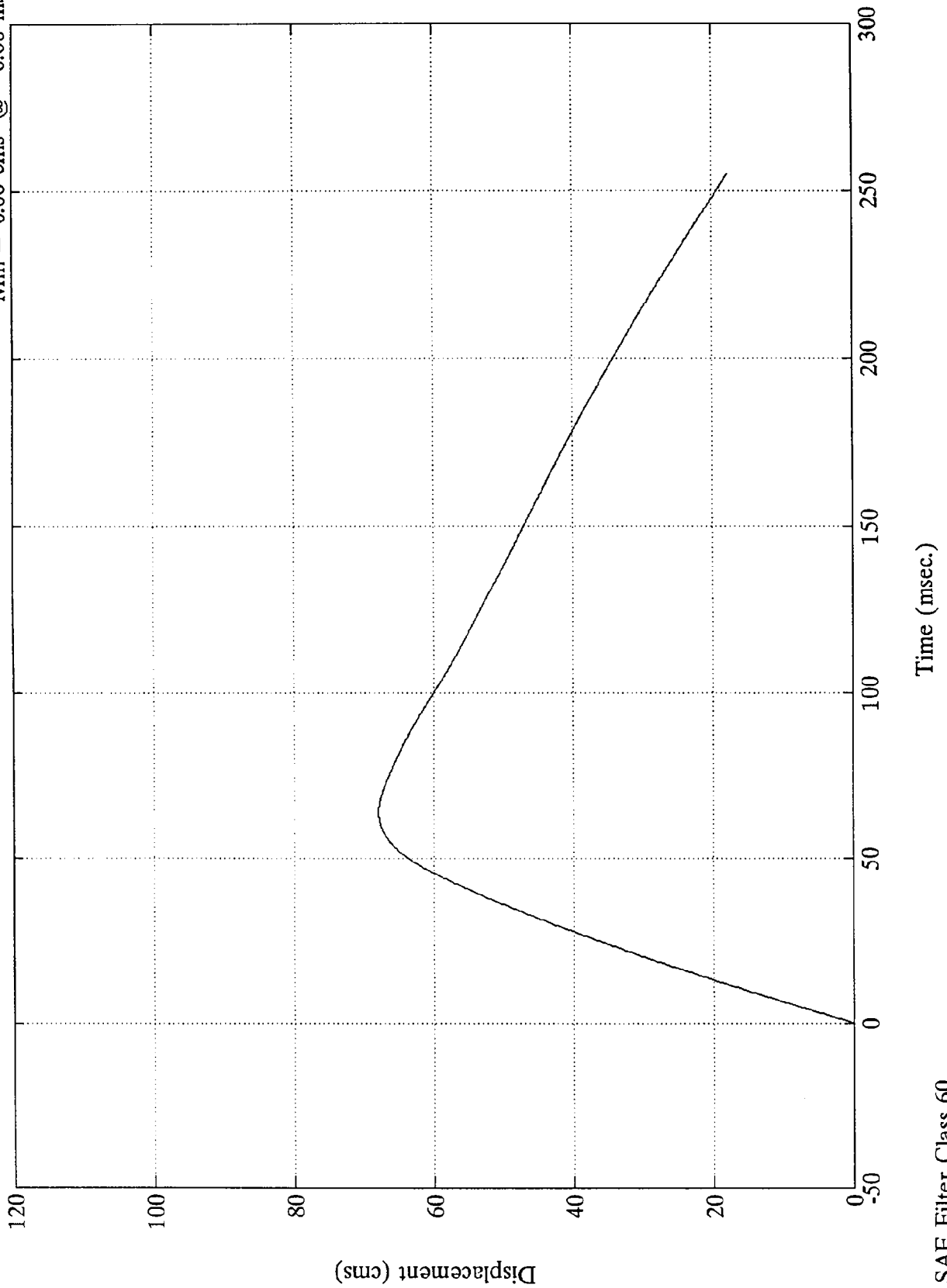


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #8(x)

Max = 67.92 cms @ 64.80 msec
Min = 0.00 cms @ -0.00 msec

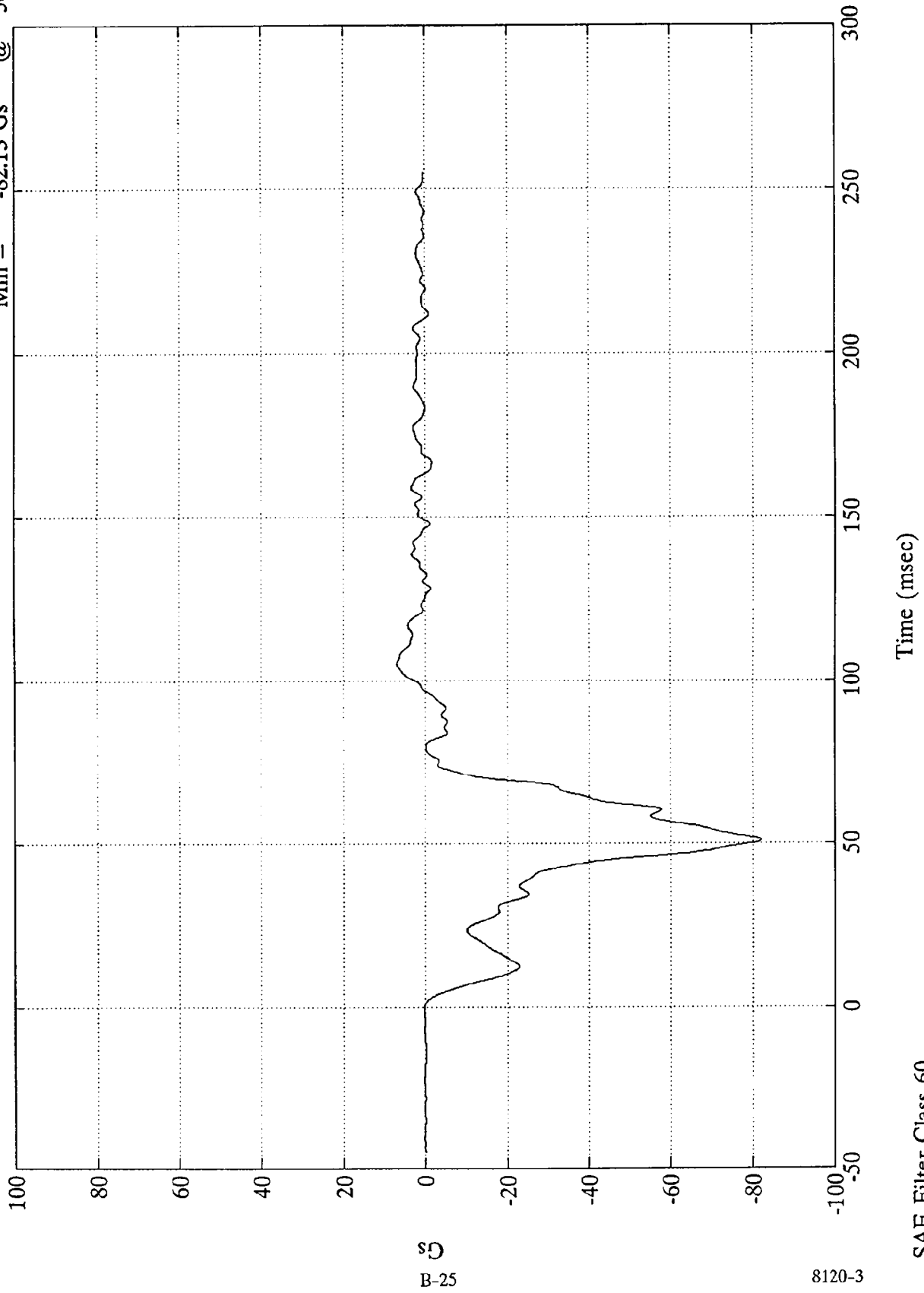


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #9(x)

Max = 6.94 Gs @ 105.24 msec
Min = -82.13 Gs @ 50.88 msec



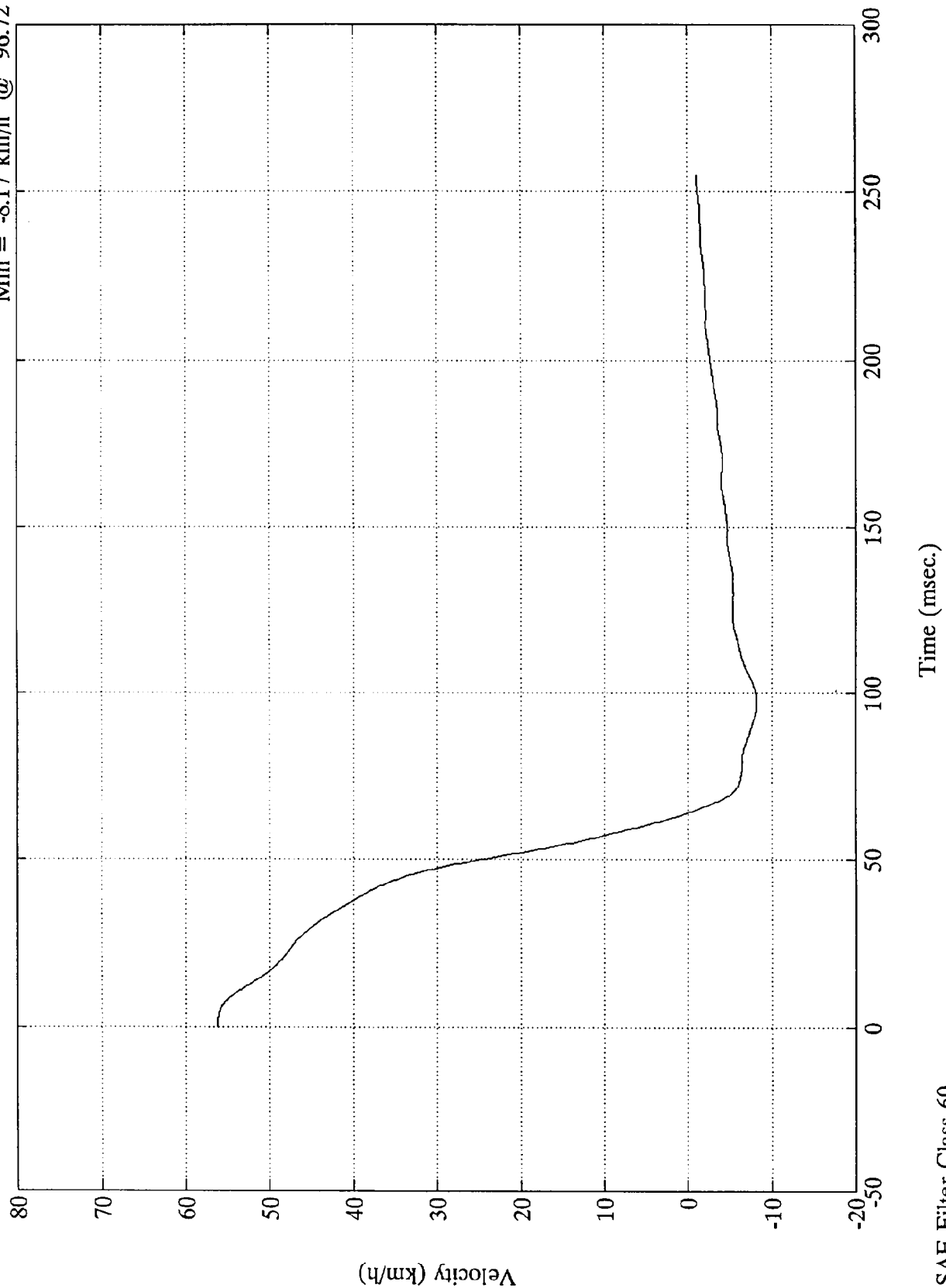
8120-3
B-25

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #9(x)

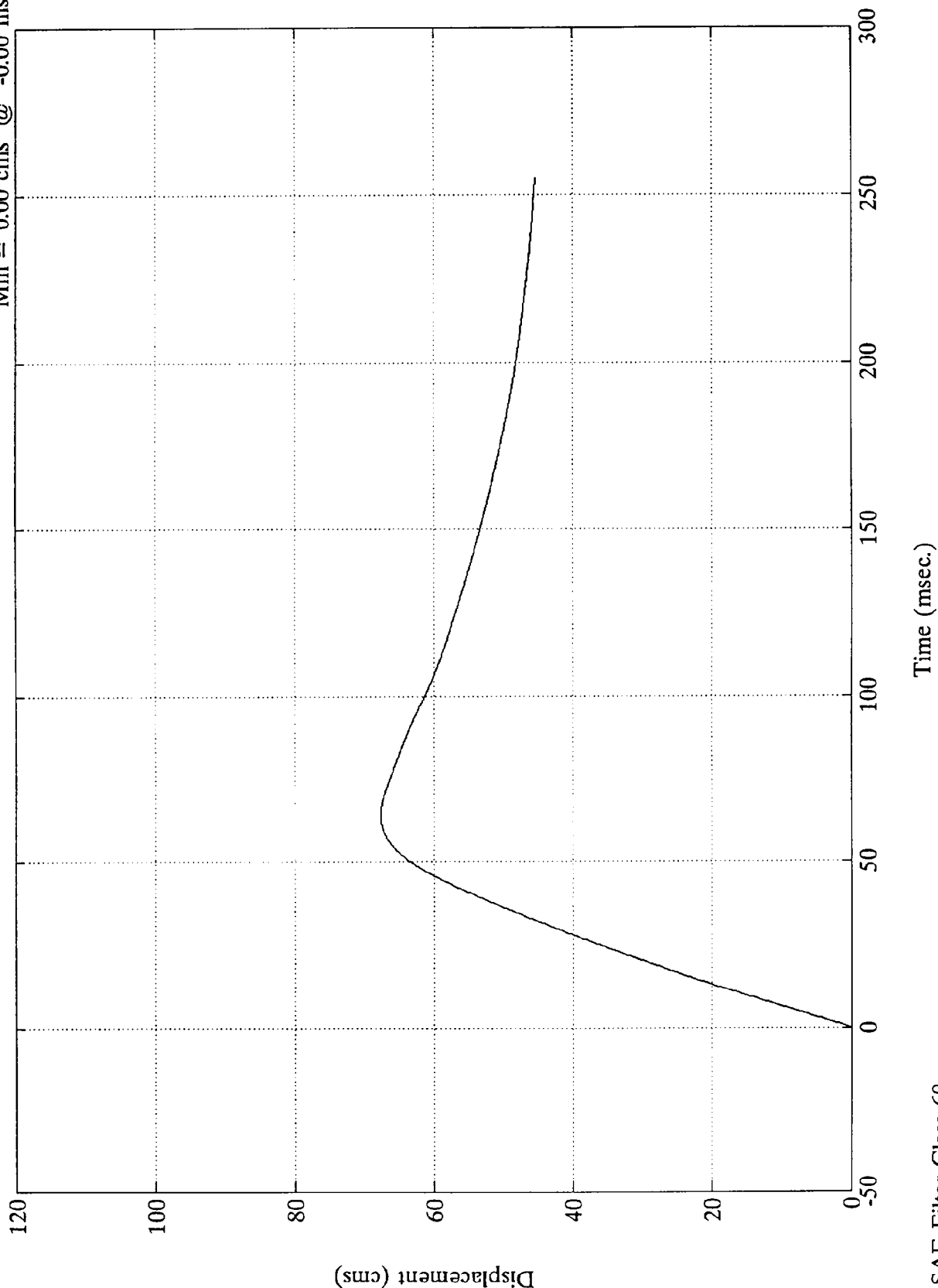
Max = 56.17 km/h @ 1.68 msec
Min = -8.17 km/h @ 96.72 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Acc. #9(x)

Max = 67.72 cms @ 64.56 msec
Min = 0.00 cms @ -0.00 msec



TEST NO. MP0107

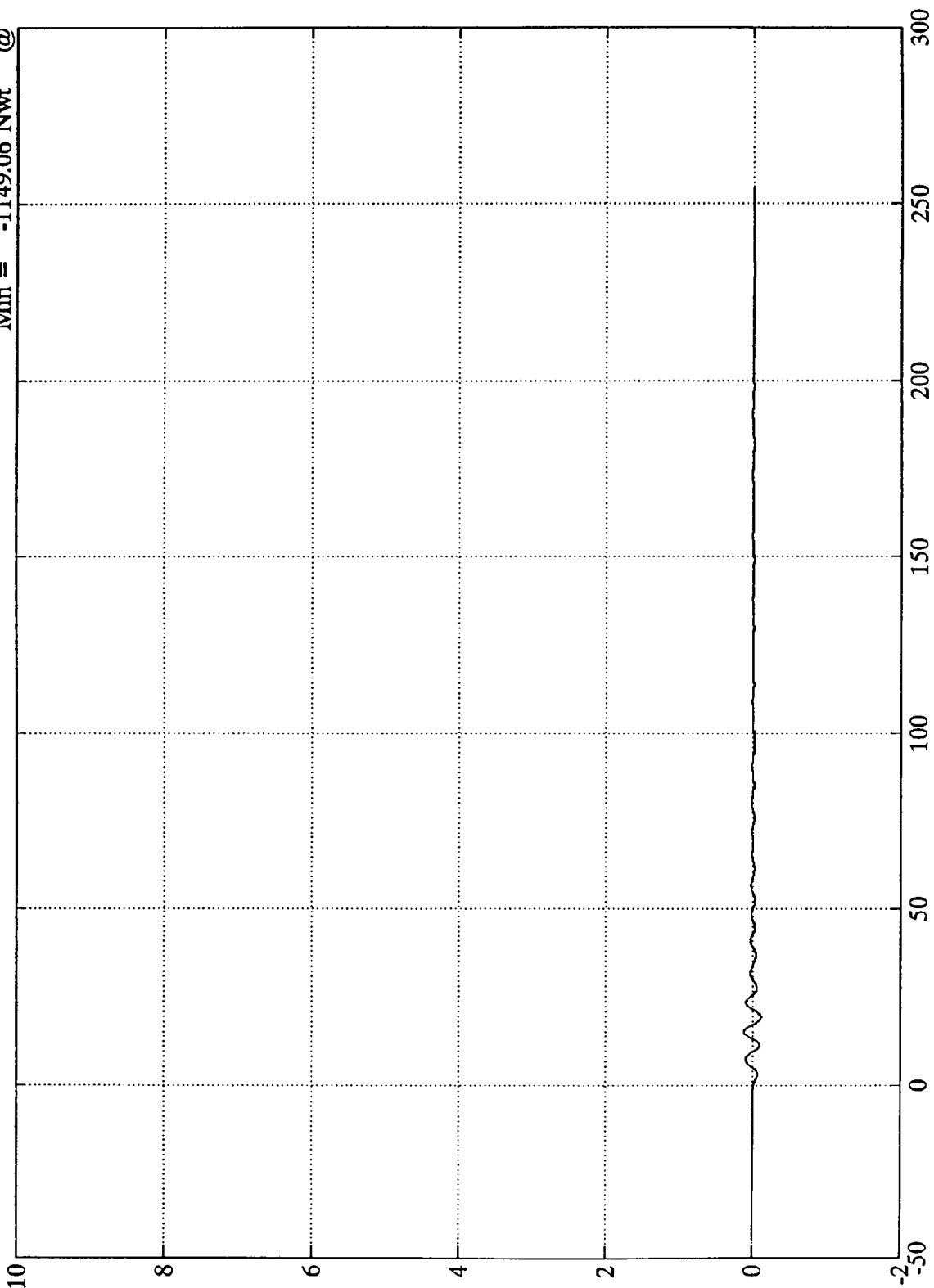
LOAD CELL BARRIER DATA

FILTER CHANNEL CLASS

60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A1
 Max = 1245.28 Nwt @ 15.00 msec
 Min = -1149.06 Nwt @ 19.31 msec



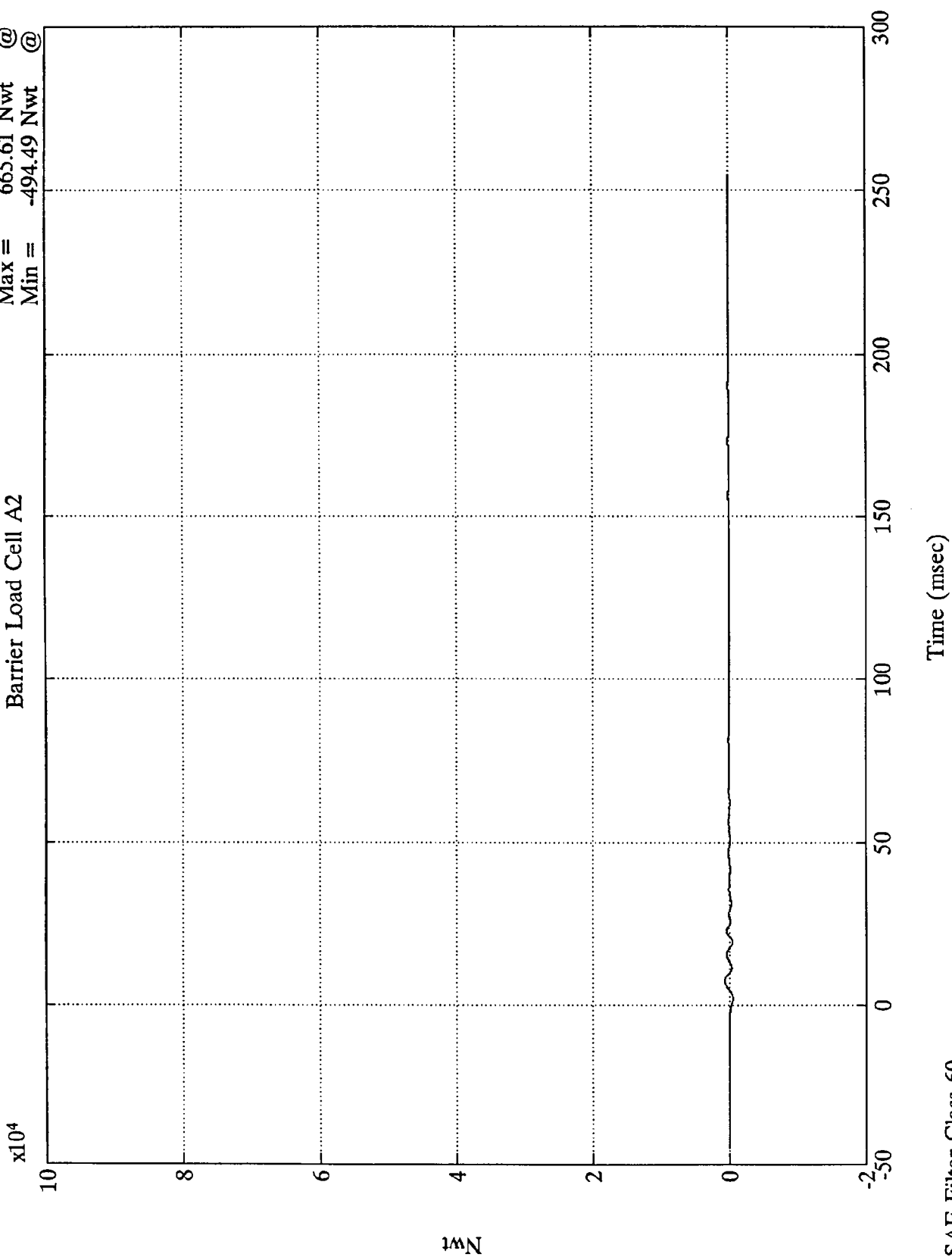
Time (msec)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A2

Max = 665.61 Nwt @ 7.31 msec
 Min = -494.49 Nwt @ 2.03 msec



11N
B-30

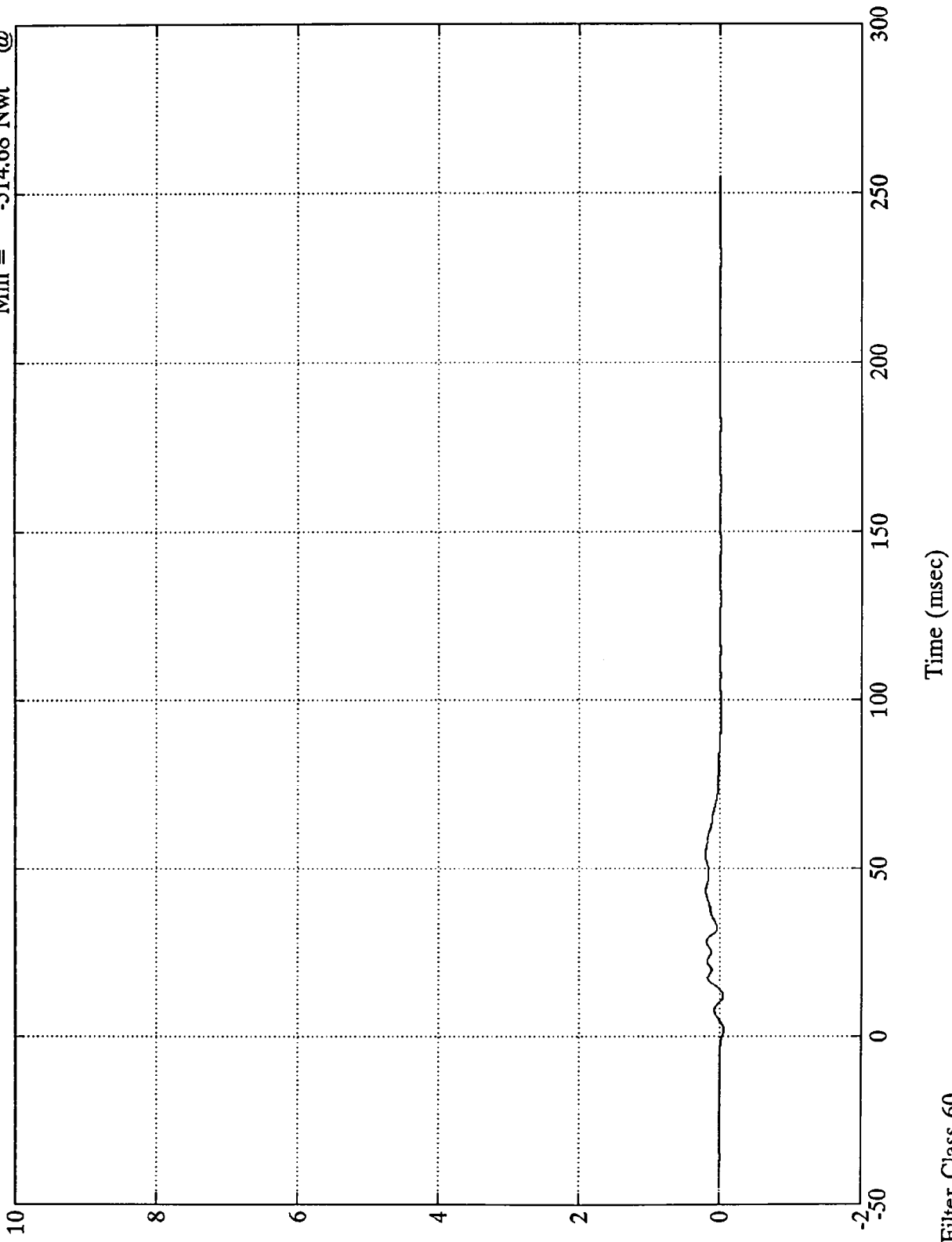
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A3

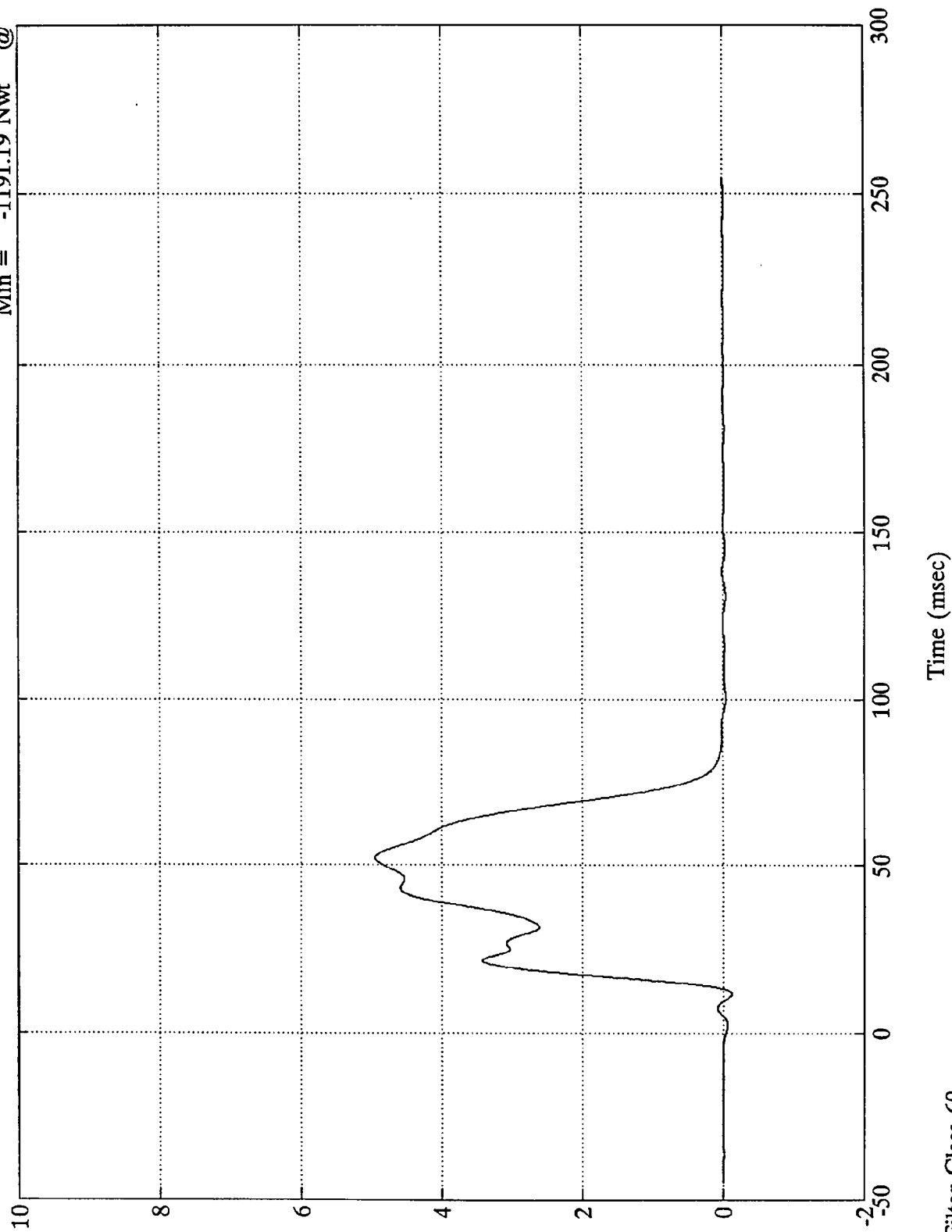
Max = 2080.34 Nwt @ 54.00 msec
Min = -514.68 Nwt @ 1.91 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A4

Max = 49522.11 Nwt @ 52.20 msec
Min = -1191.19 Nwt @ 11.63 msec



10N
B-32

8120-3

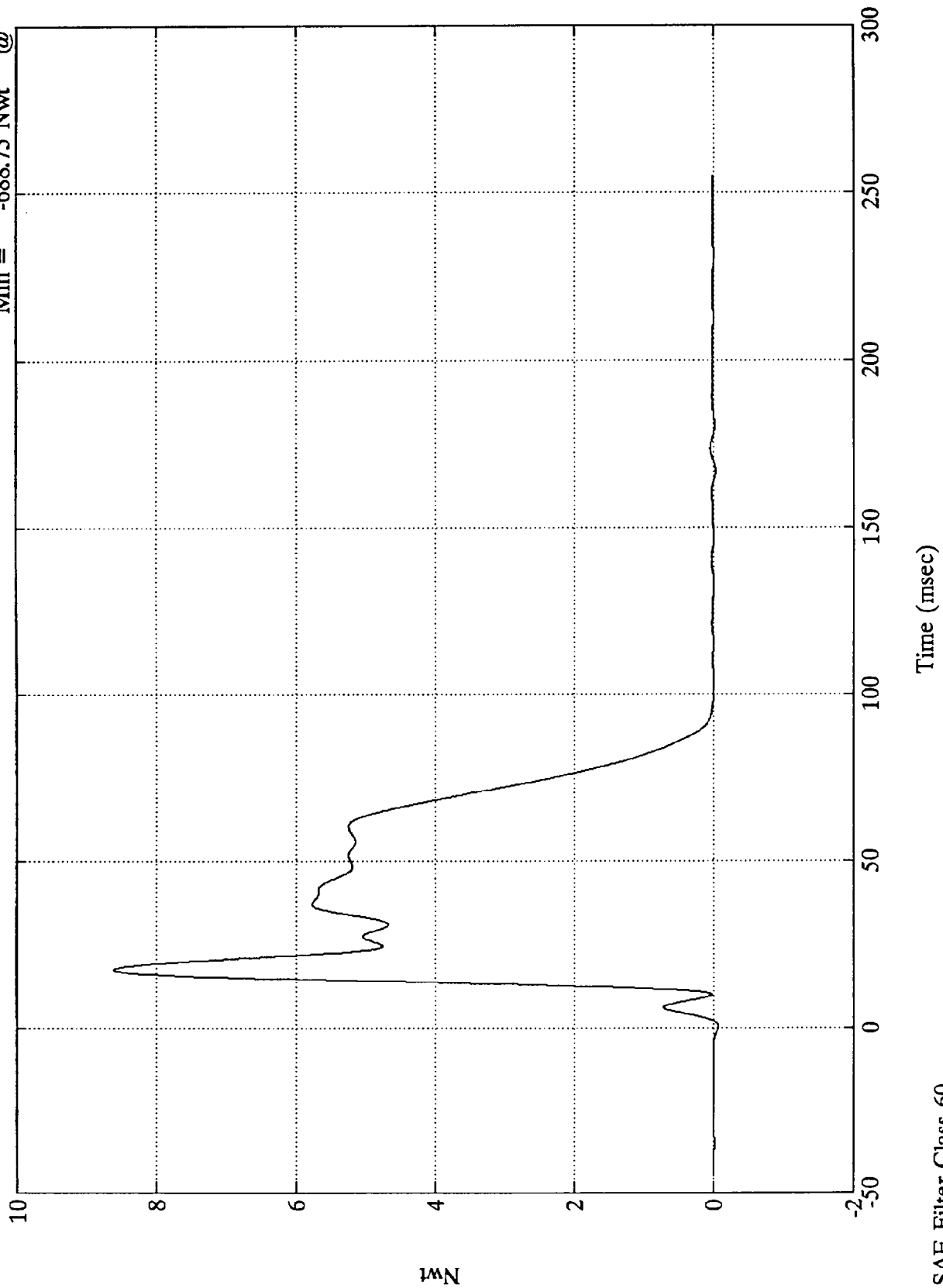
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A5

Max = 86081.15 Nwt @ 17.63 msec
Min = -688.75 Nwt @ 0.35 msec

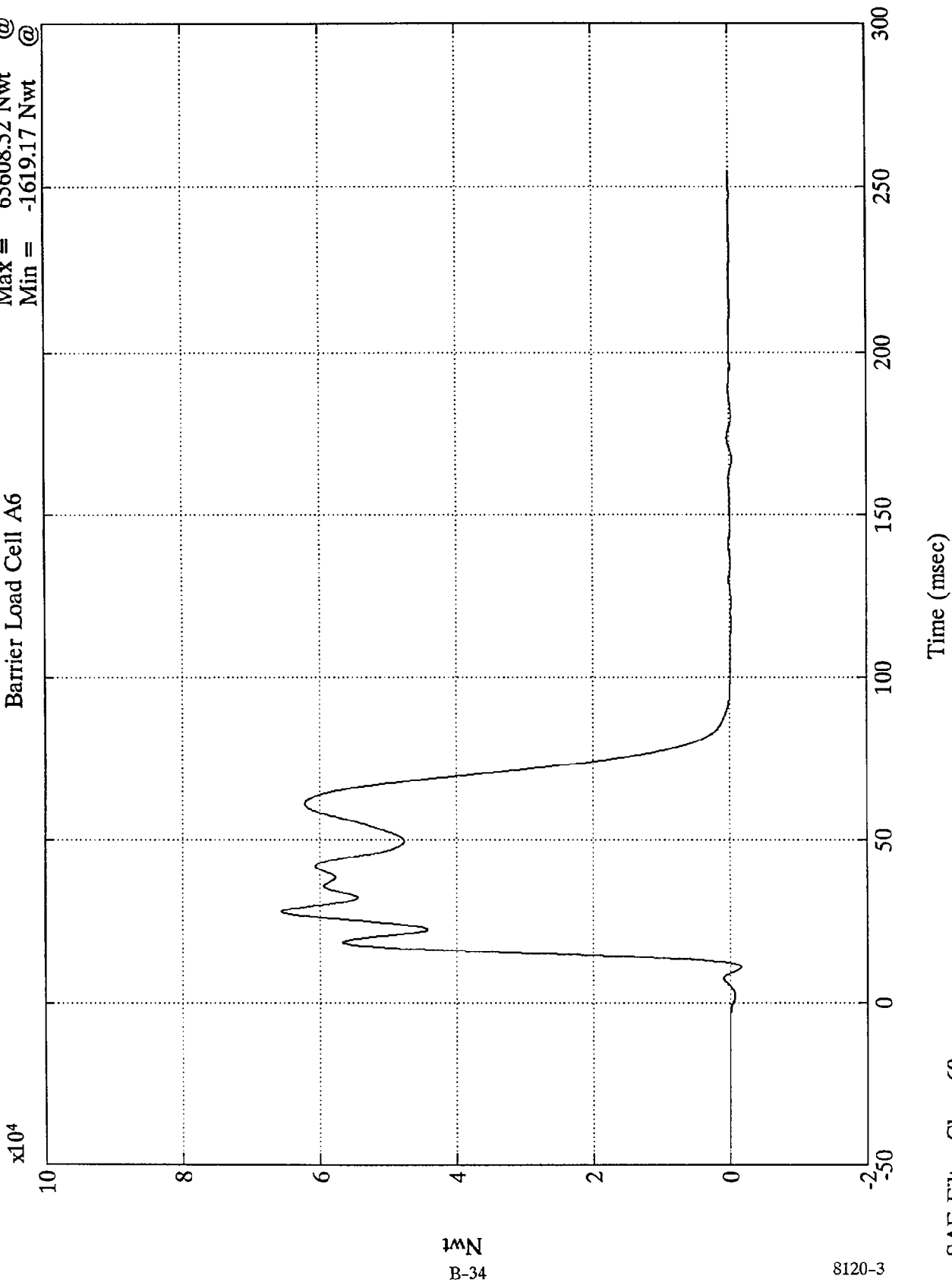
$\times 10^4$



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A6

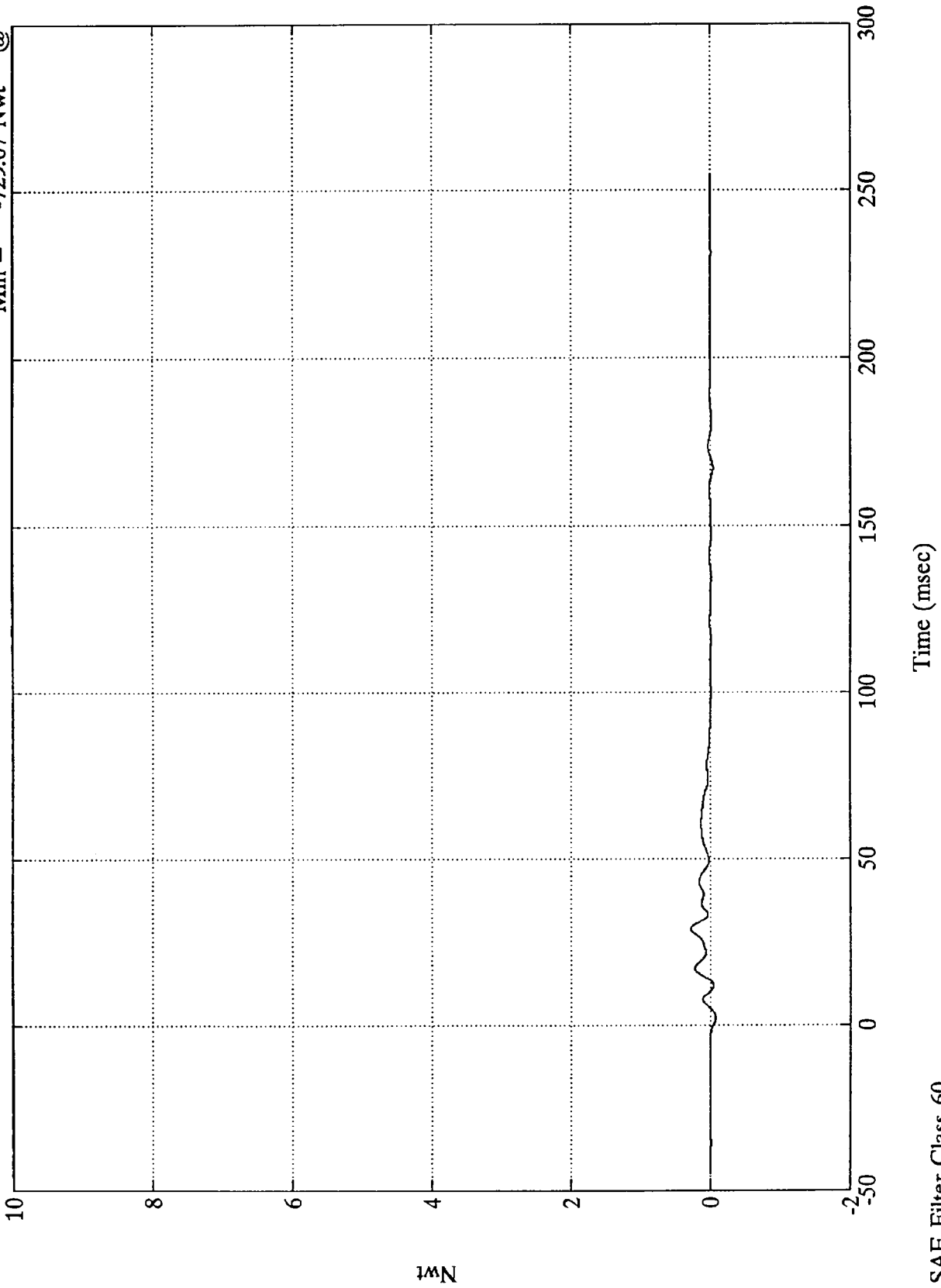
Max = 65608.52 Nwt @ 27.72 msec
 Min = -1619.17 Nwt @ 10.79 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

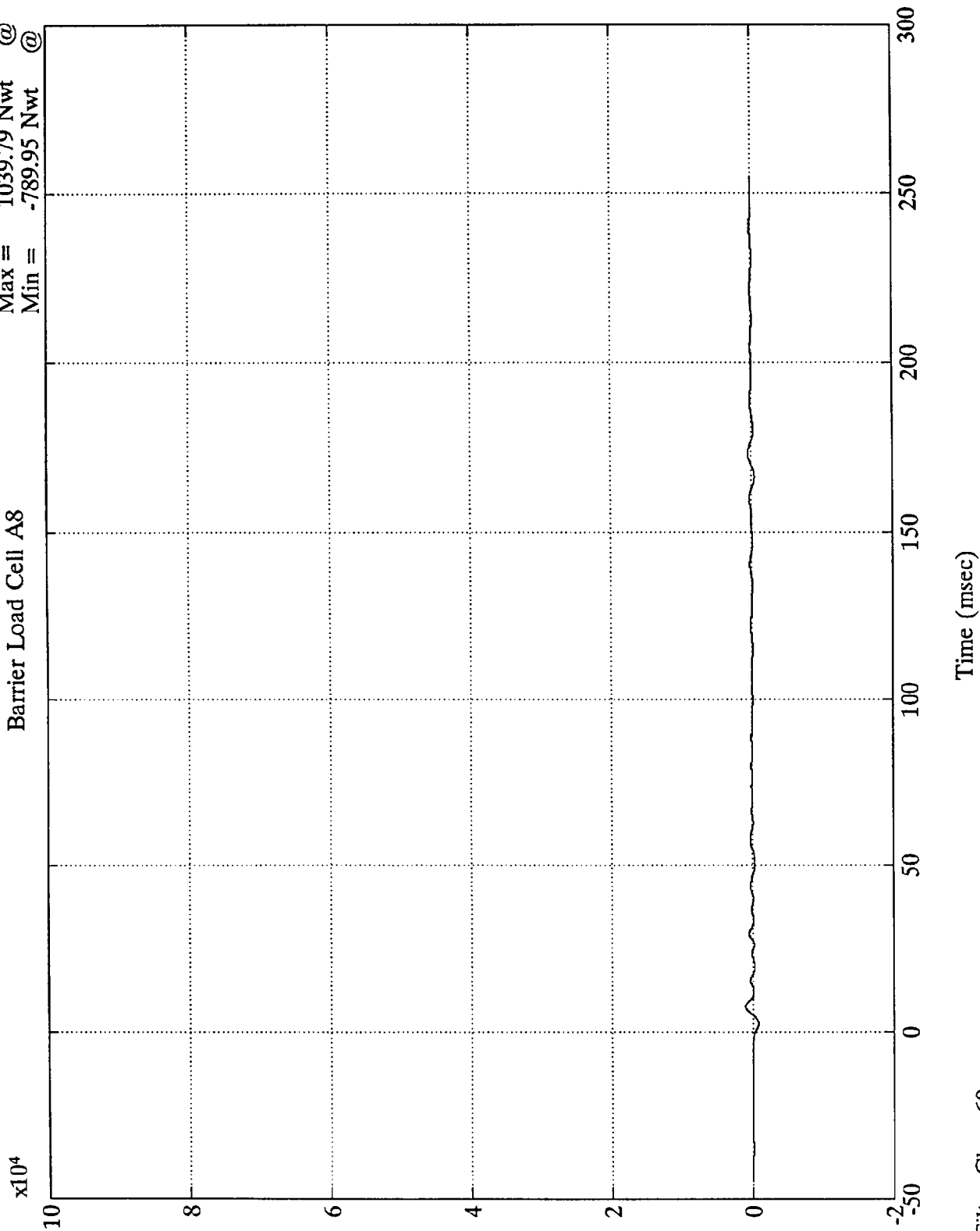
Barrier Load Cell A7

Max = 2848.46 Nwt @ 28.68 msec
Min = -729.07 Nwt @ 2.03 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

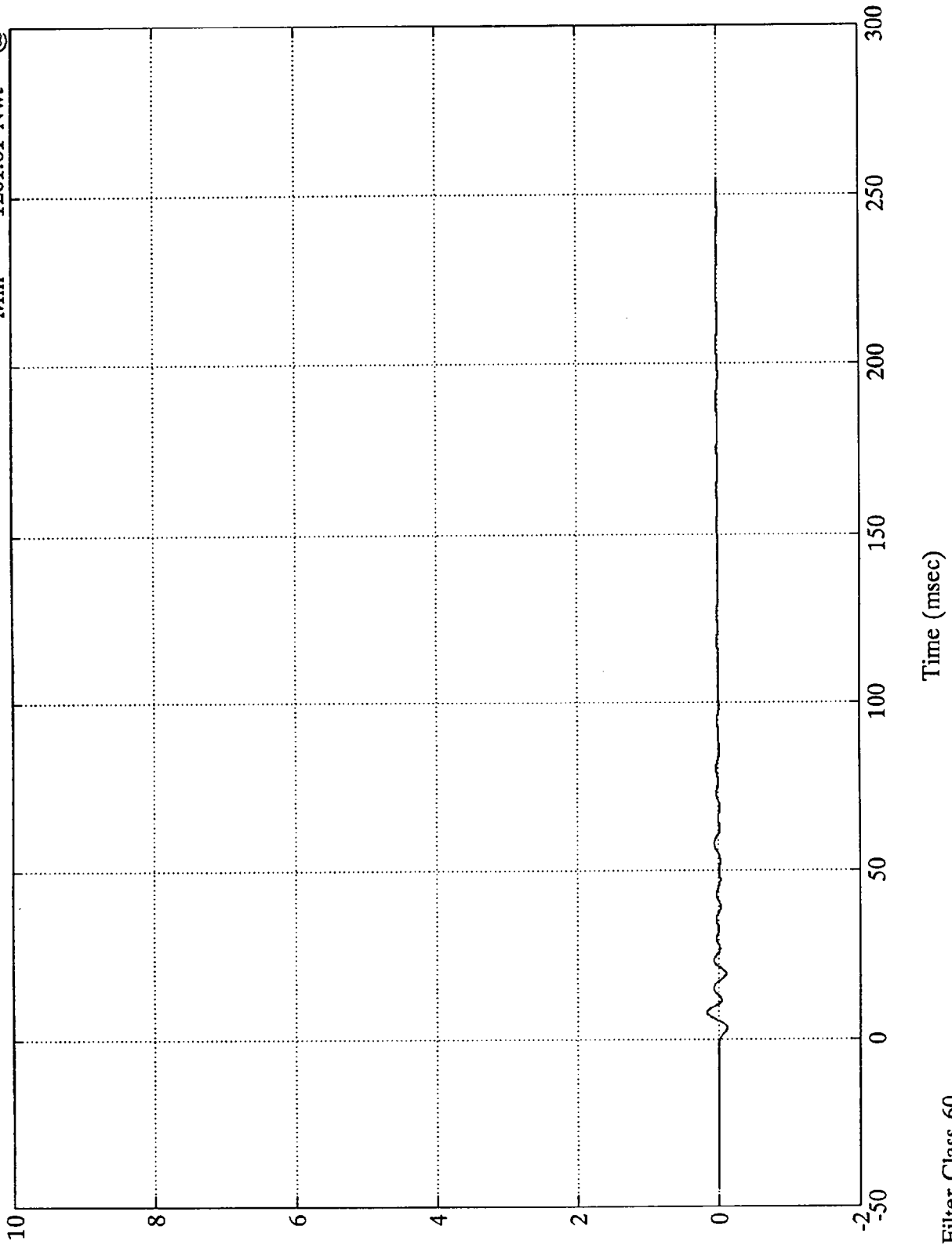
Barrier Load Cell A8
 Max = 1039.79 Nwt @ 7.43 msec
 Min = -789.95 Nwt @ 2.51 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell A9

Max = 1631.43 Nwt @ 7.67 msec
Min = -1201.01 Nwt @ 3.23 msec

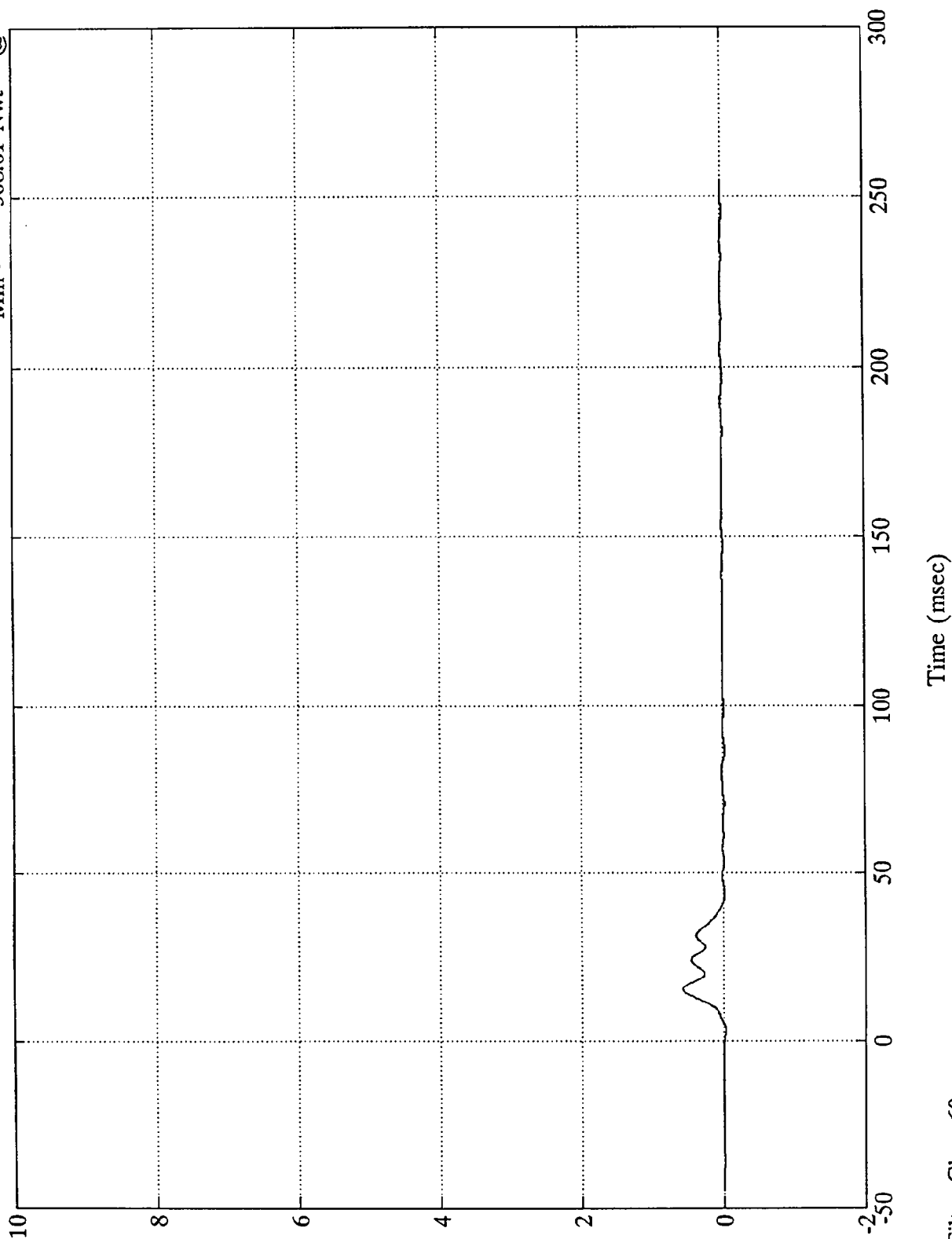


NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B1

$\times 10^4$

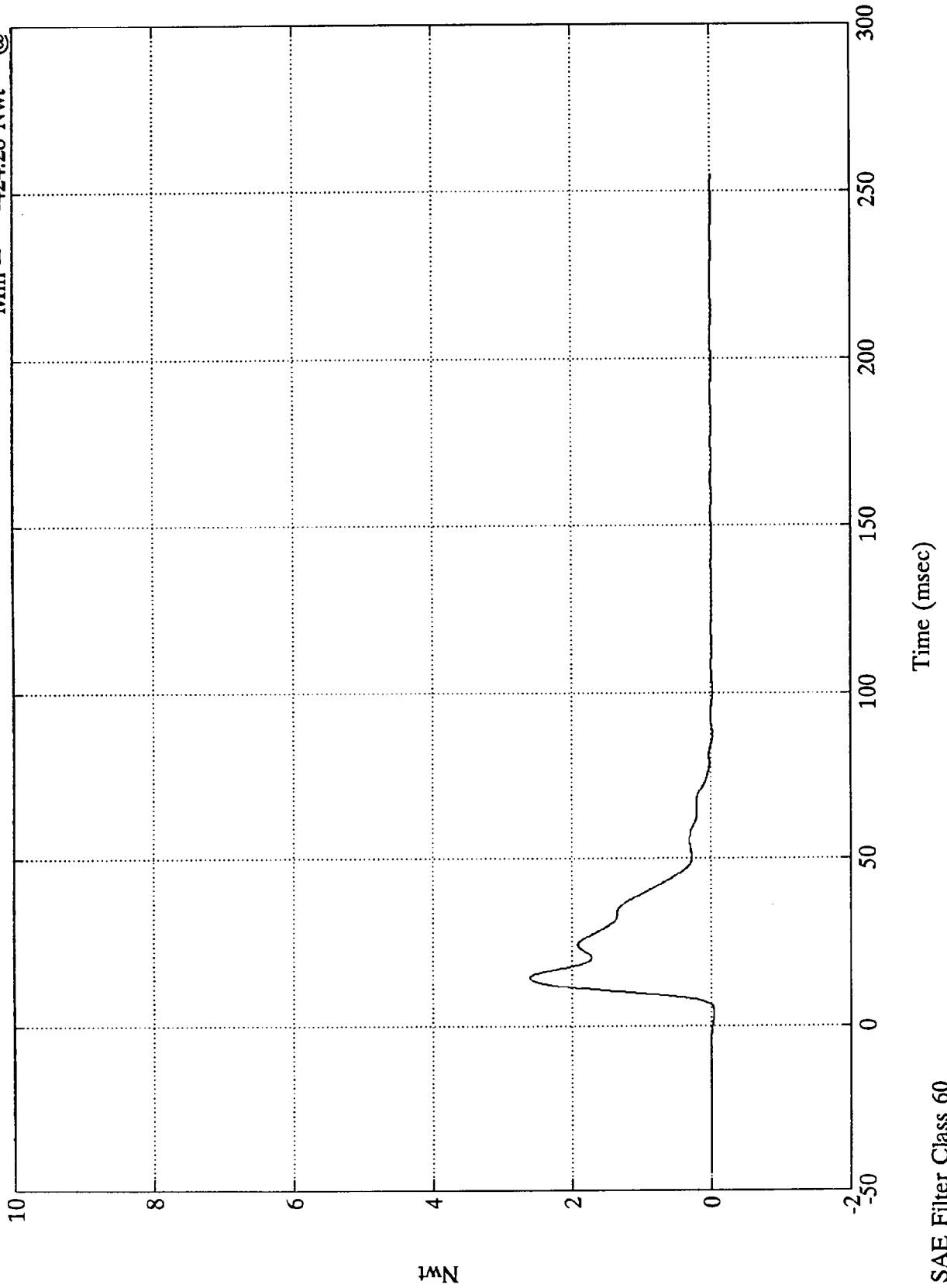
Max = 5779.48 Nwt @ 15.23 msec
Min = -308.01 Nwt @ 2.87 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B2

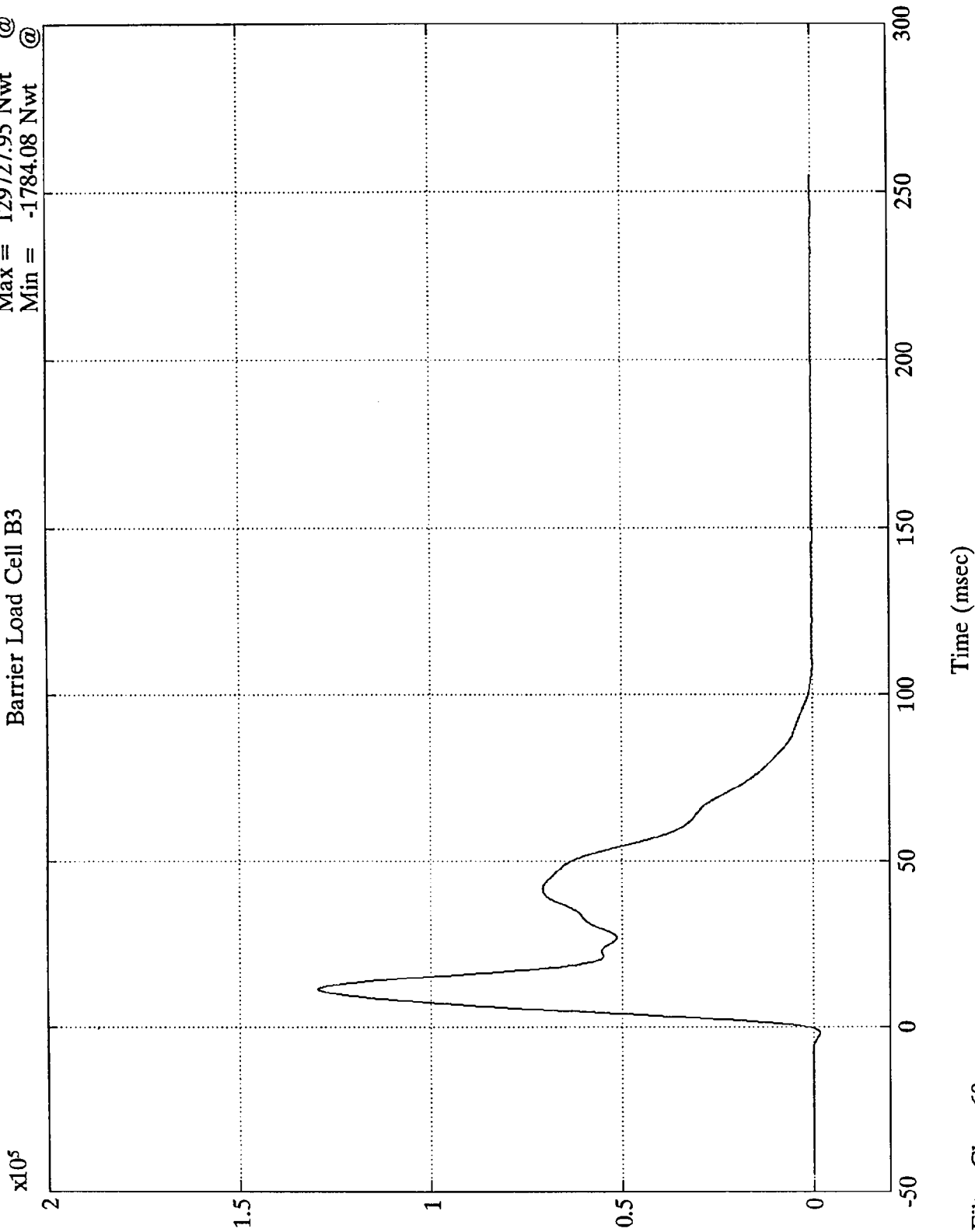
Max = 26106.30 Nwt @ 14.27 msec
Min = -424.28 Nwt @ 4.31 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B3

Max = 129727.95 Nwt @ 11.27 msec
Min = -1784.08 Nwt @ -1.92 msec



1Nwt
B-40

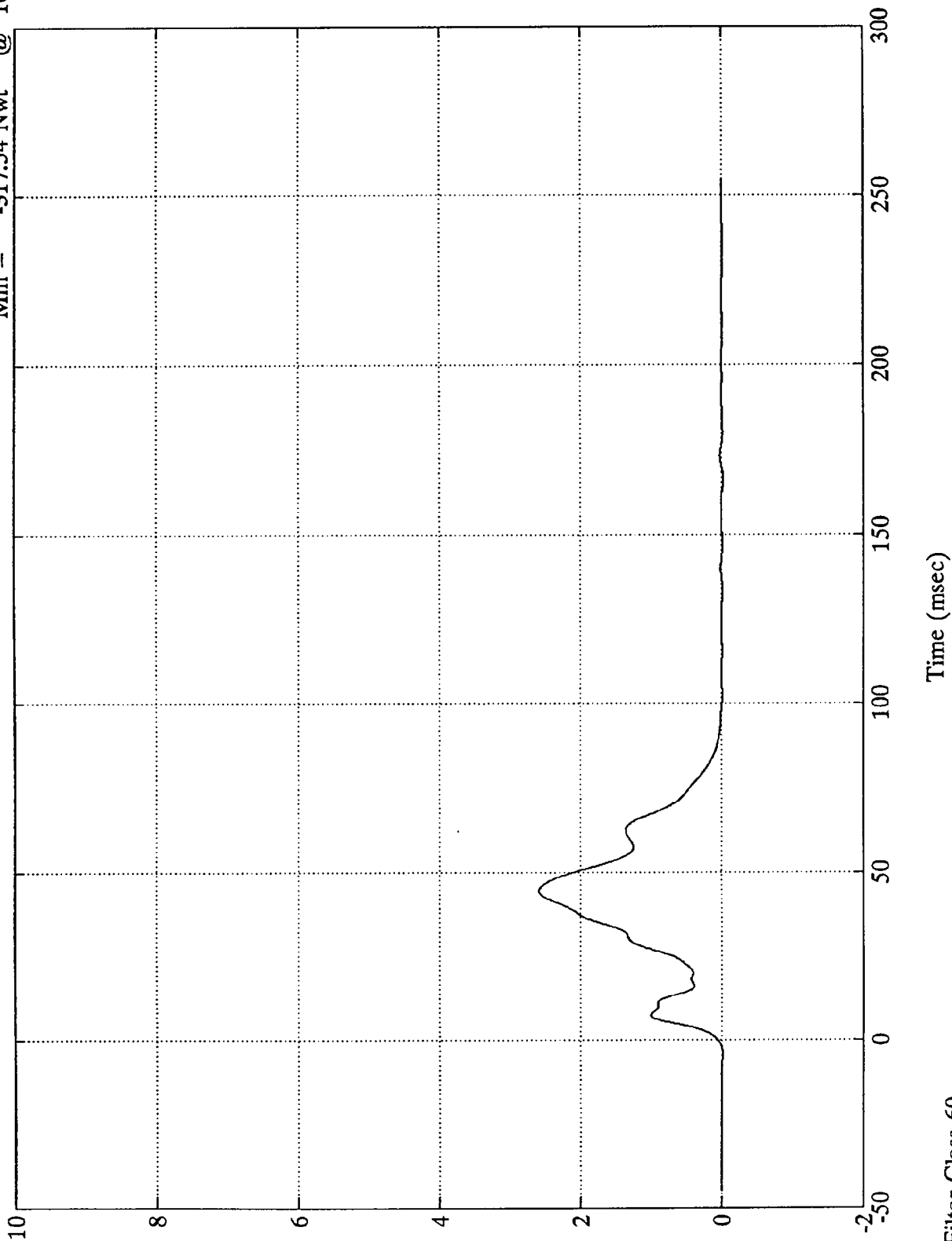
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B4

Max = 25885.77 Nwt @ 44.63 msec
Min = -317.54 Nwt @ 166.32 msec



11N
B-41

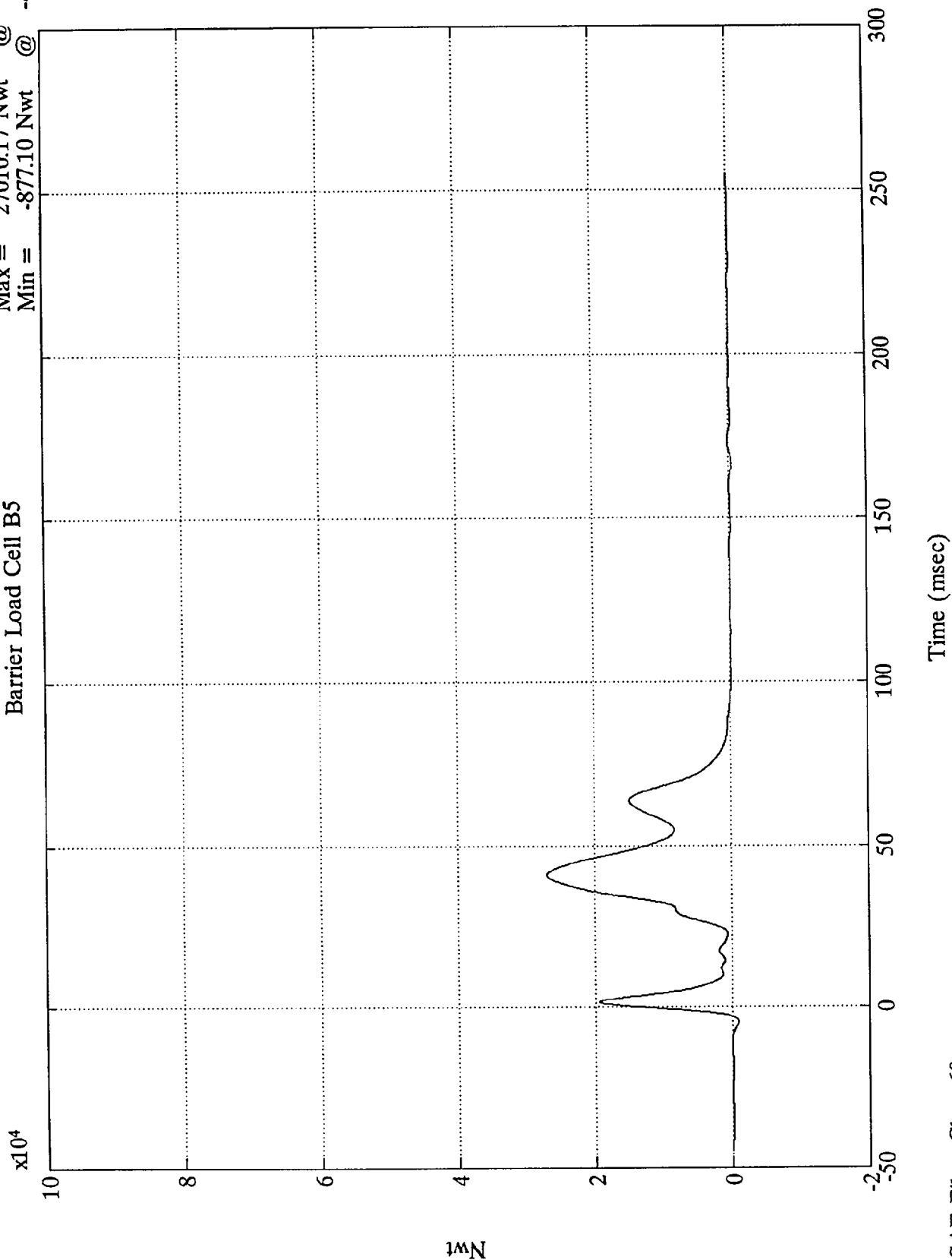
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B5

Max = 27010.17 Nwt @ 41.04 msec
Min = -877.10 Nwt @ -4.68 msec

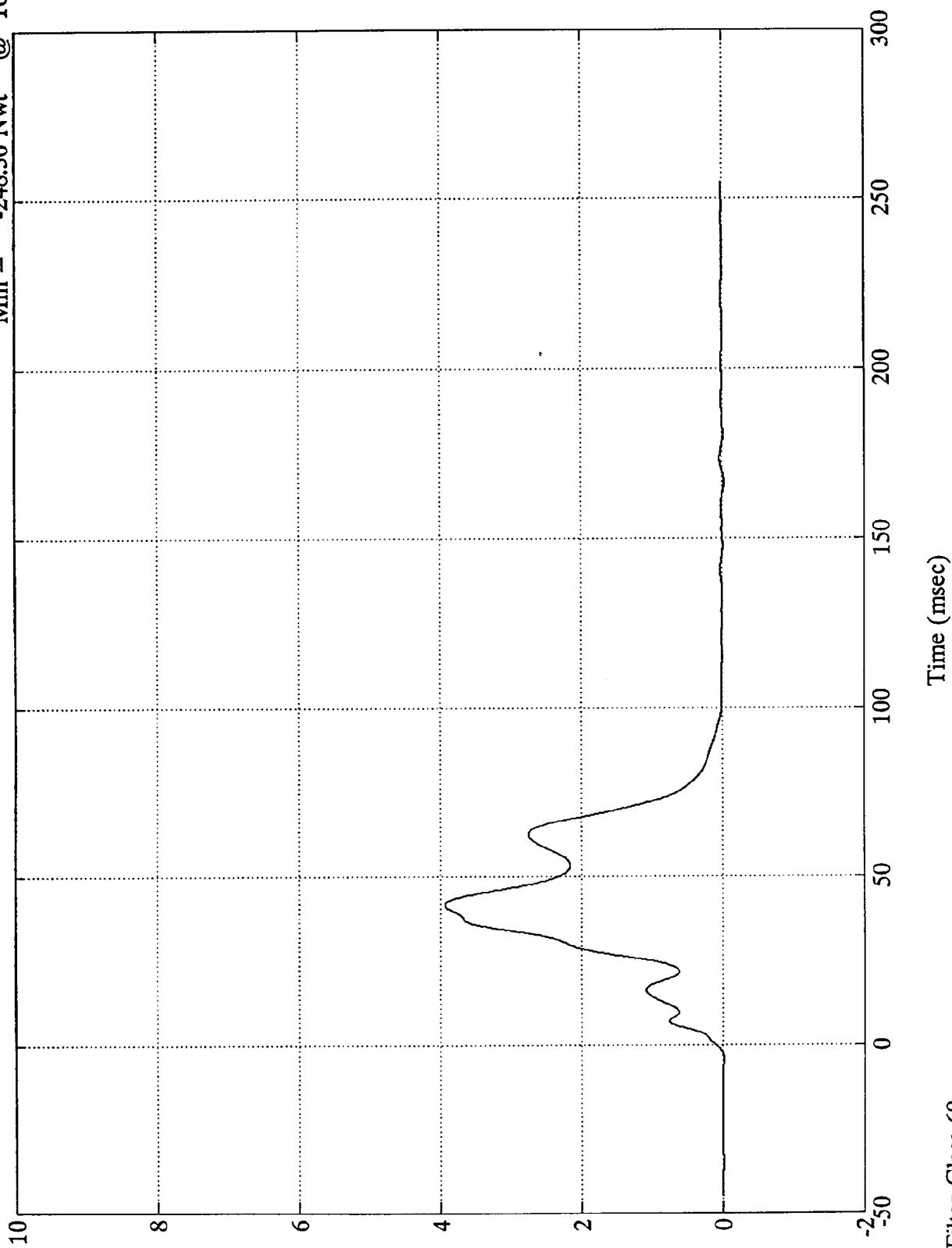


NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Max = 39412.14 Nwt @ 41.76 msec
 Min = -248.36 Nwt @ 166.44 msec

Barrier Load Cell B6

x10⁴

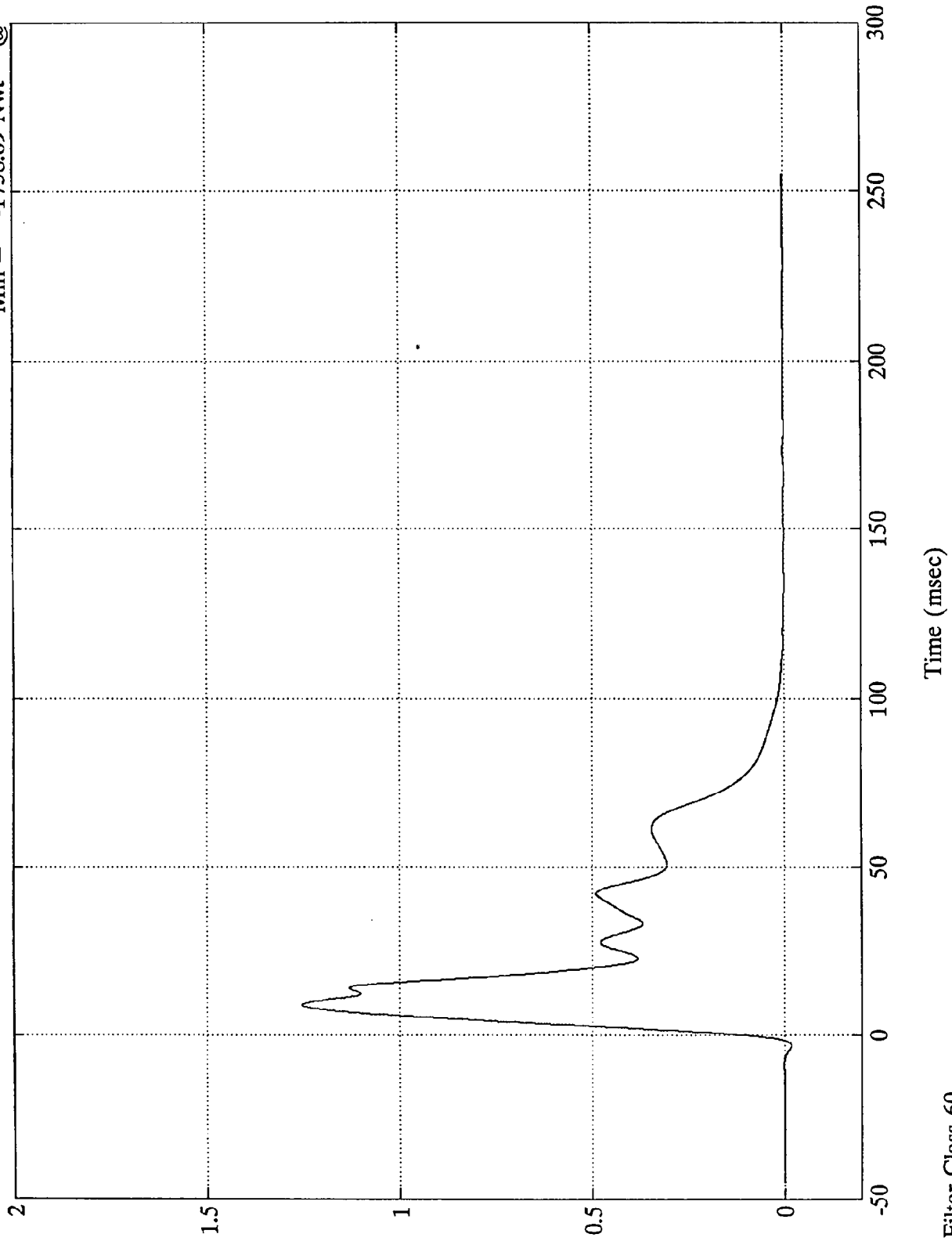


NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B7

Max = 125449.00 Nwt @ 8.87 msec
 Min = -1758.69 Nwt @ -3.24 msec

x10⁵



B-44

8120-3

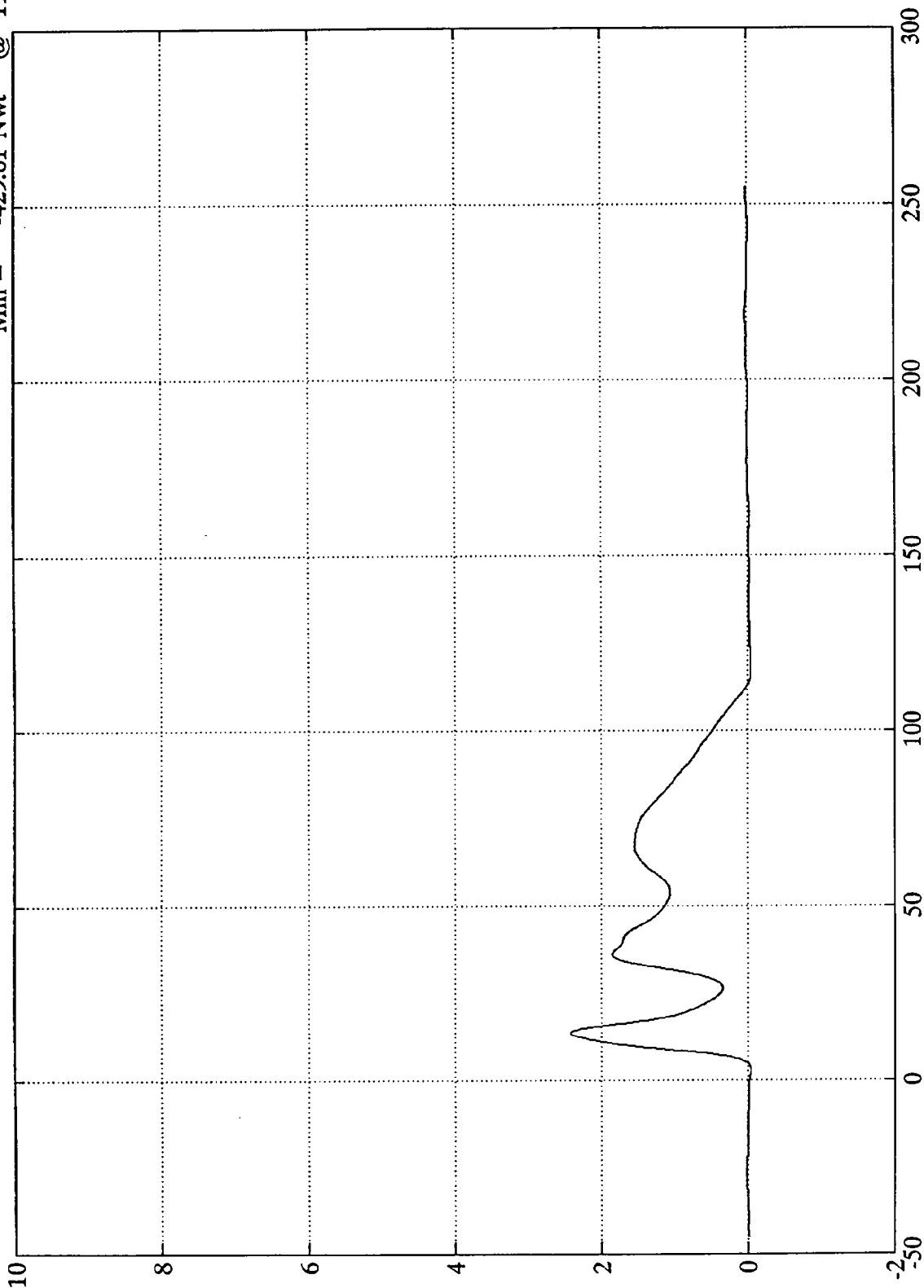
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B8

Max = 24226.76 Nwt @ 13.55 msec
Min = -429.61 Nwt @ 117.00 msec

x10⁴



Time (msec)

11N
B-45

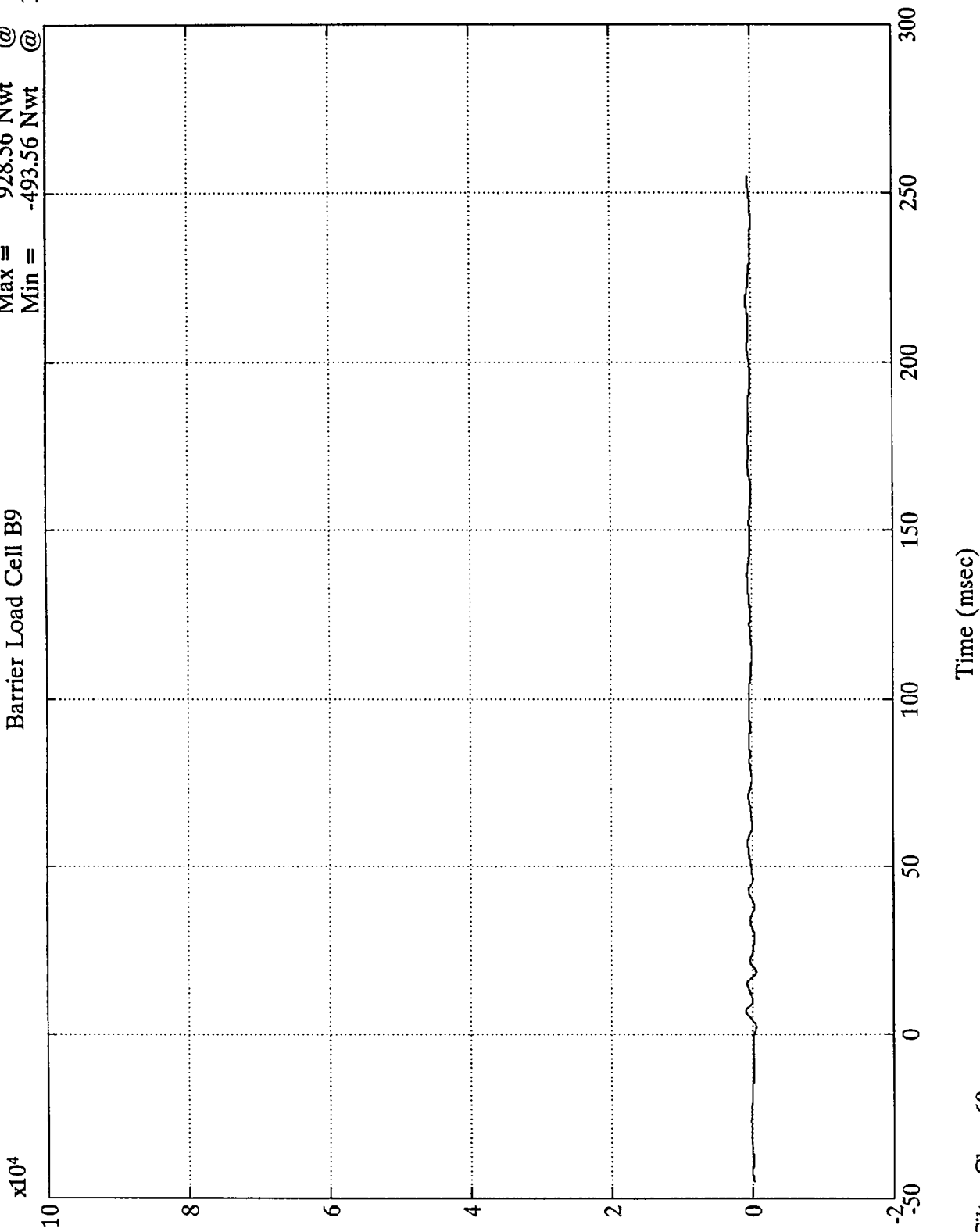
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell B9

Max = 928.56 Nwt @ 6.95 msec
Min = -493.56 Nwt @ 18.84 msec



1Nwt
B-46

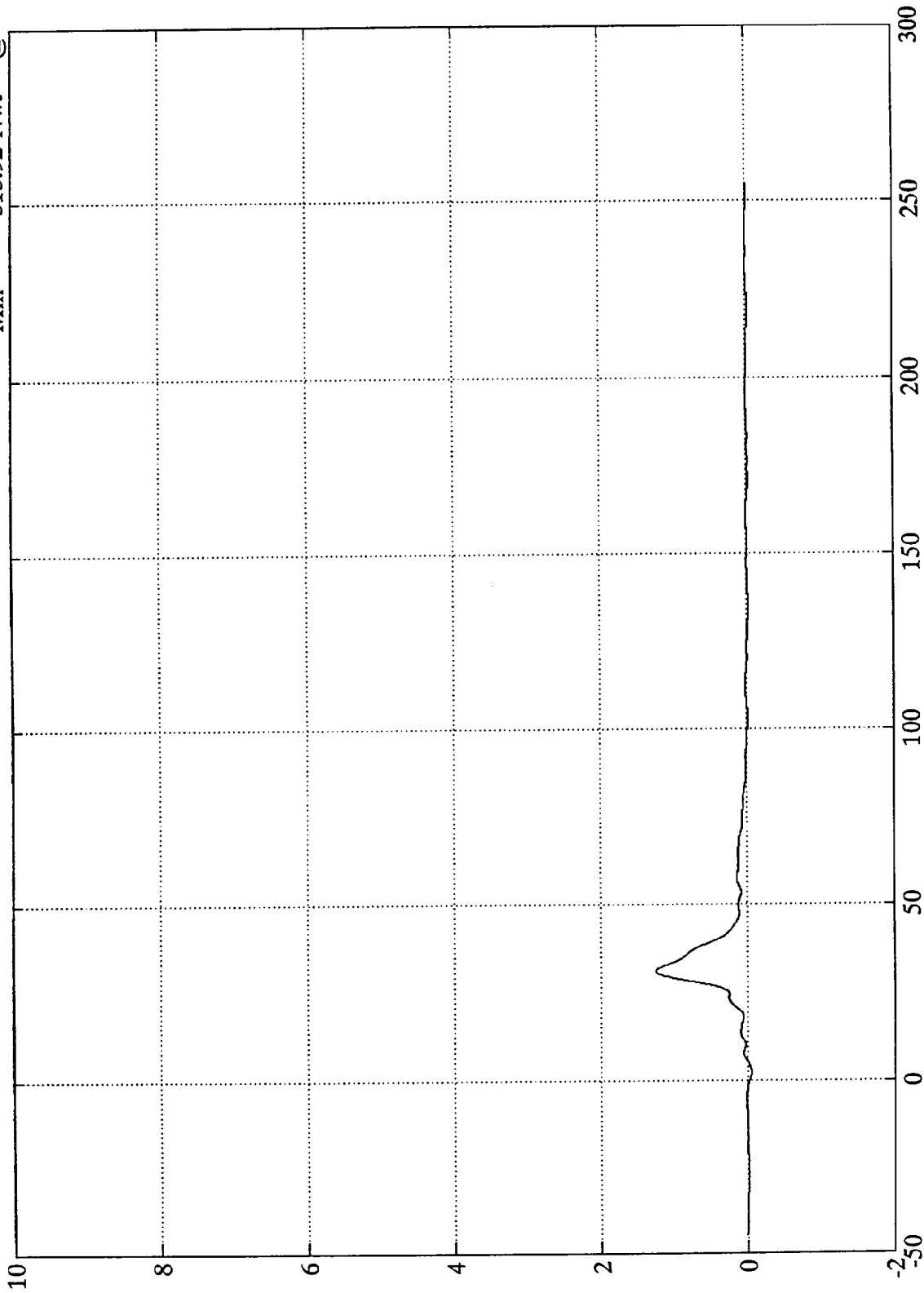
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C1

Max = 12503.77 Nwt @ 31.07 msec
Min = -513.92 Nwt @ 2.27 msec



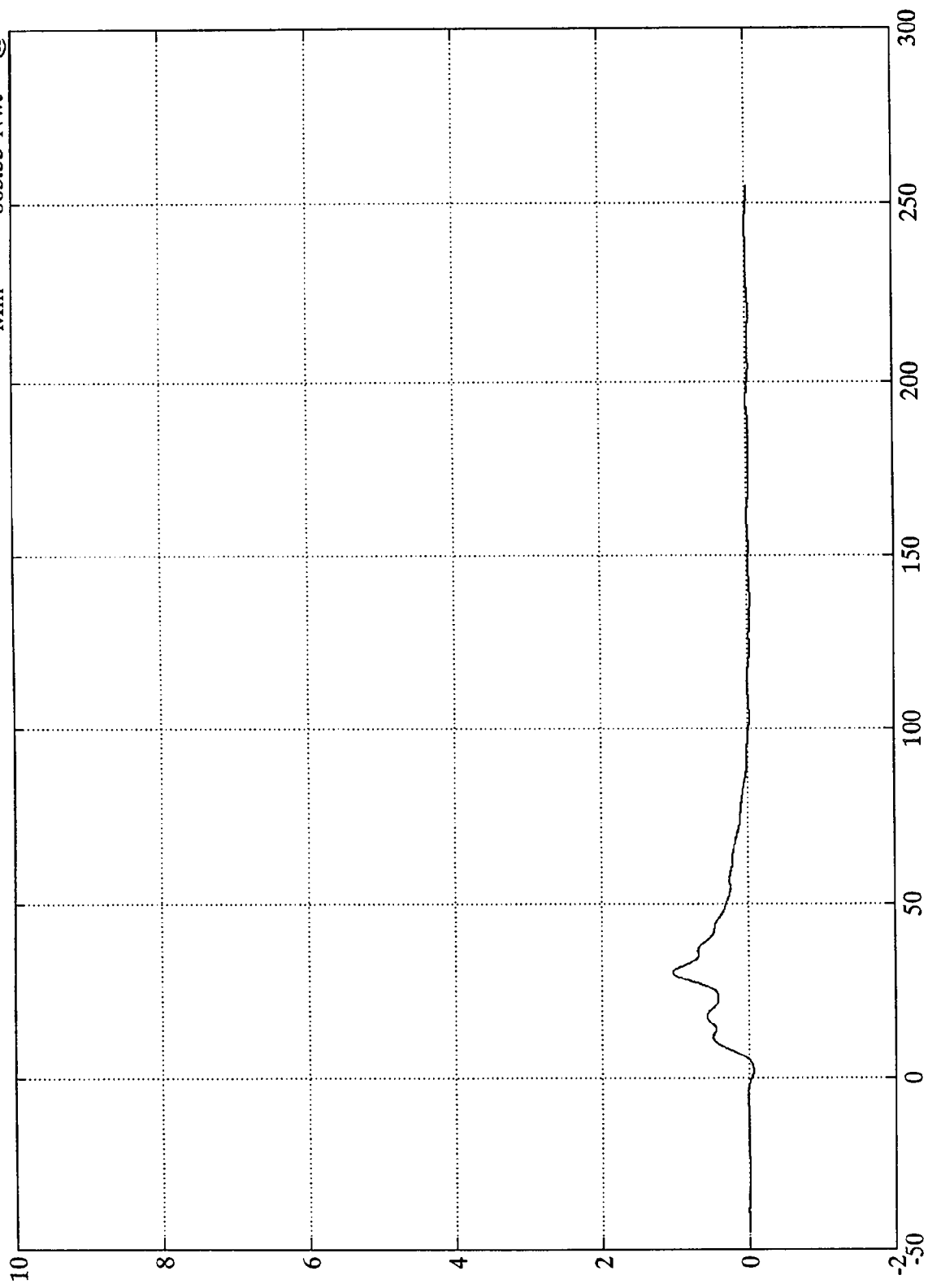
Time (msec)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C2

$\times 10^4$



Time (msec)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C3

Max = 9090.37 Nwt @ 12.59 msec
 Min = -481.39 Nwt @ 1.43 msec



11N
 B-49

8120-3

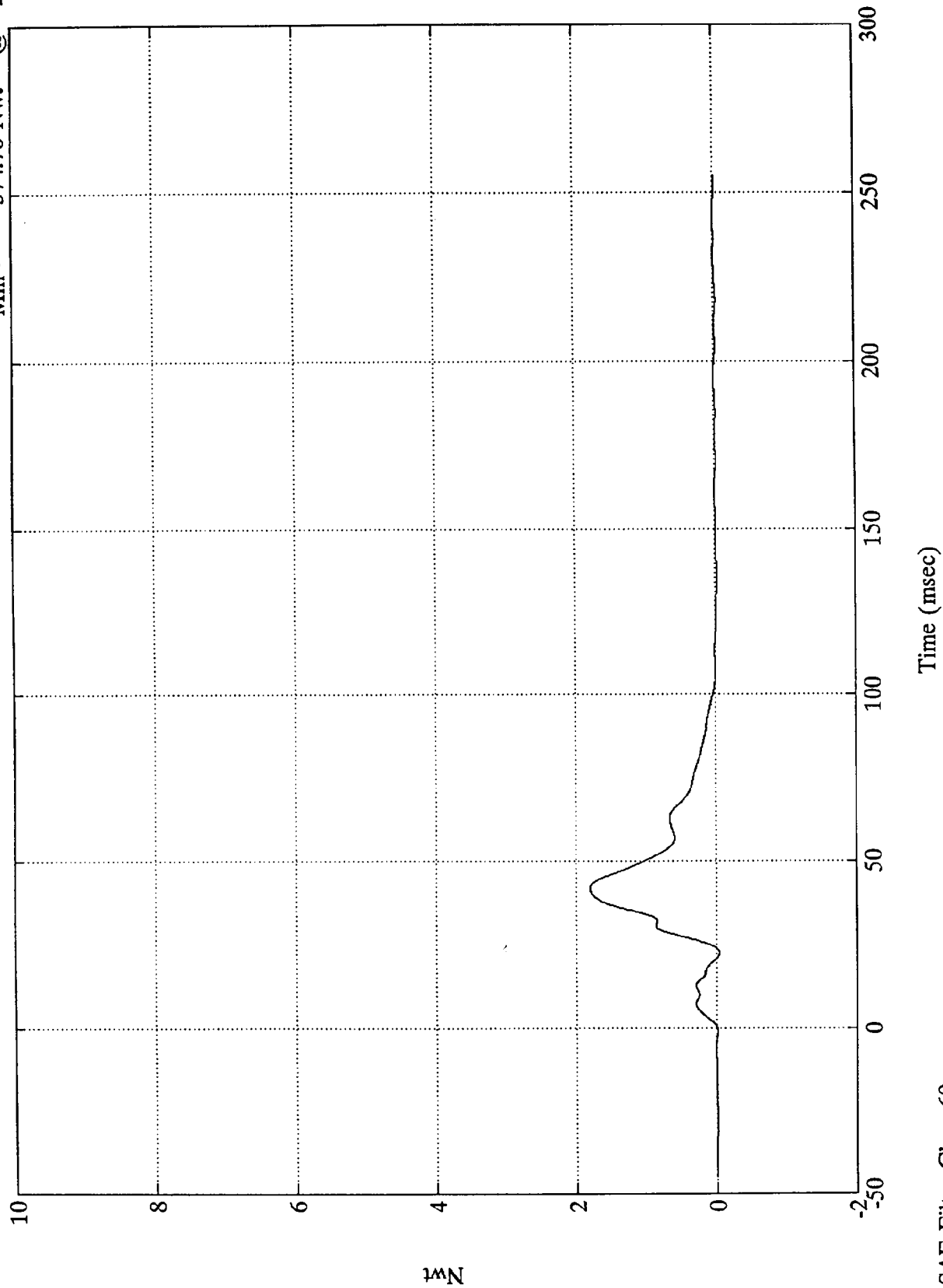
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C4

Max = 18037.91 Nwt @ 41.63 msec
Min = -374.76 Nwt @ 22.56 msec

$\times 10^4$

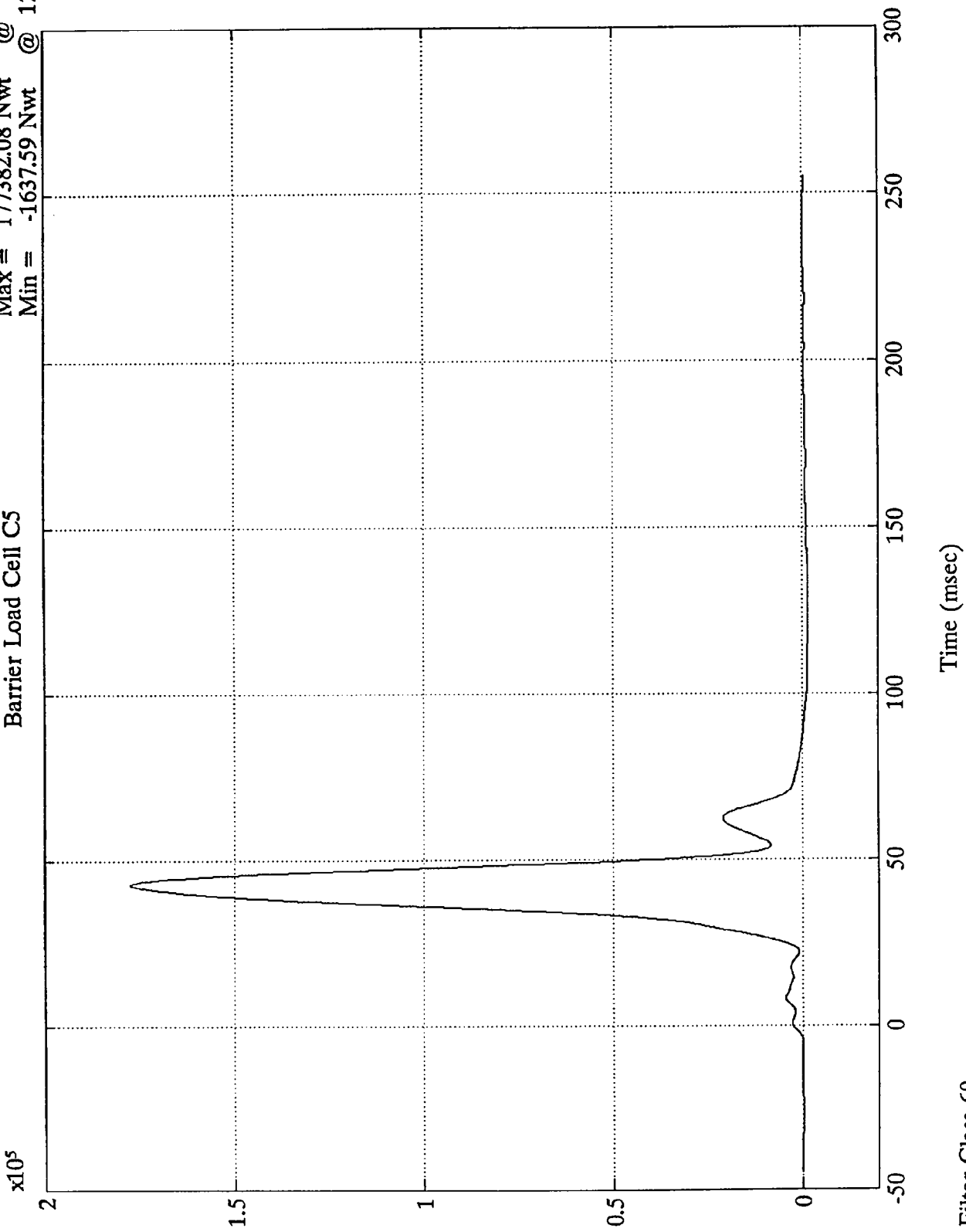


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C5

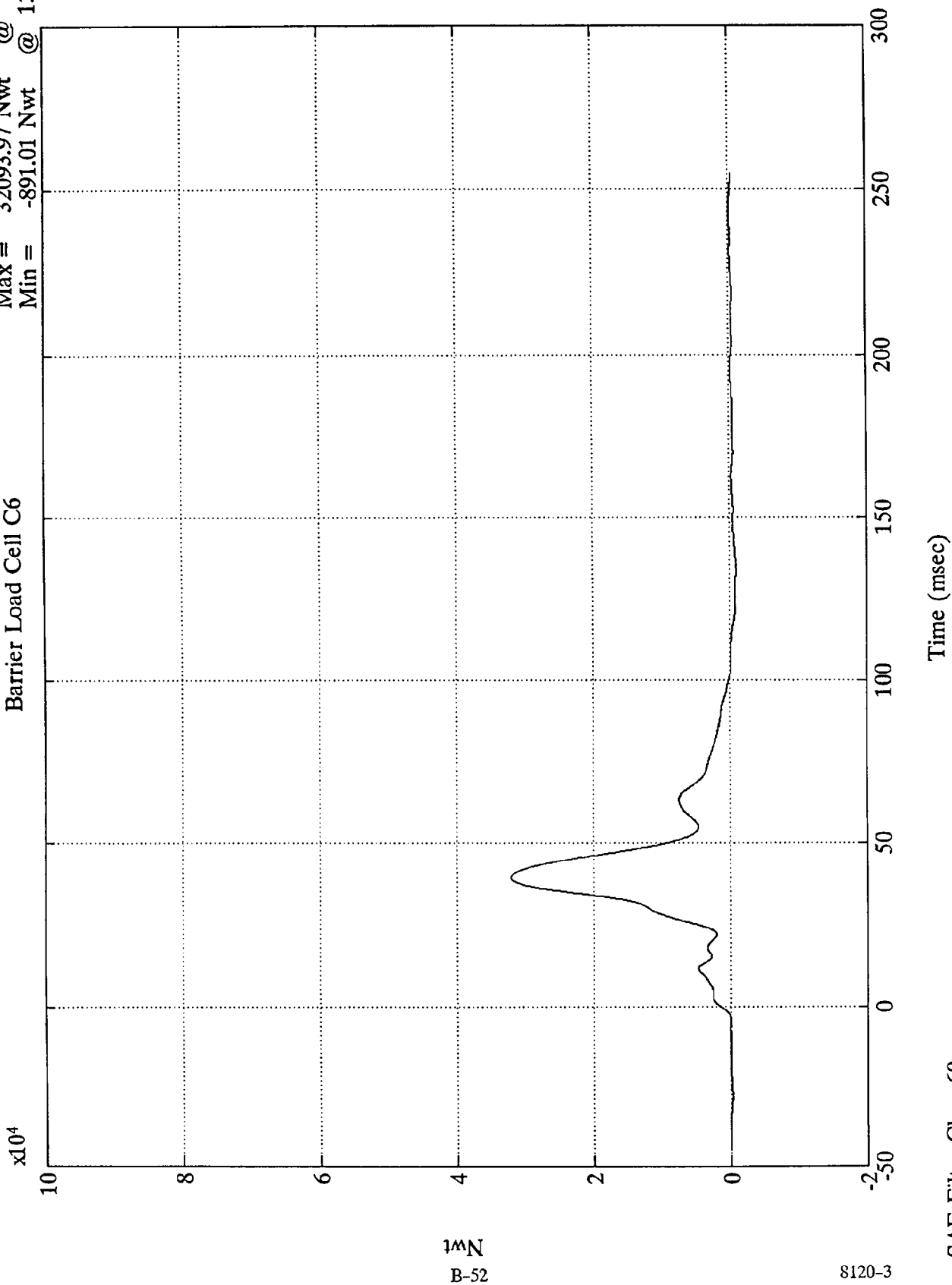
Max = 177382.08 Nwt @ 42.60 msec
Min = -1637.59 Nwt @ 121.20 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C6

Max = 32093.97 Nwt @ 39.23 msec
Min = -891.01 Nwt @ 134.76 msec



10N
B-52

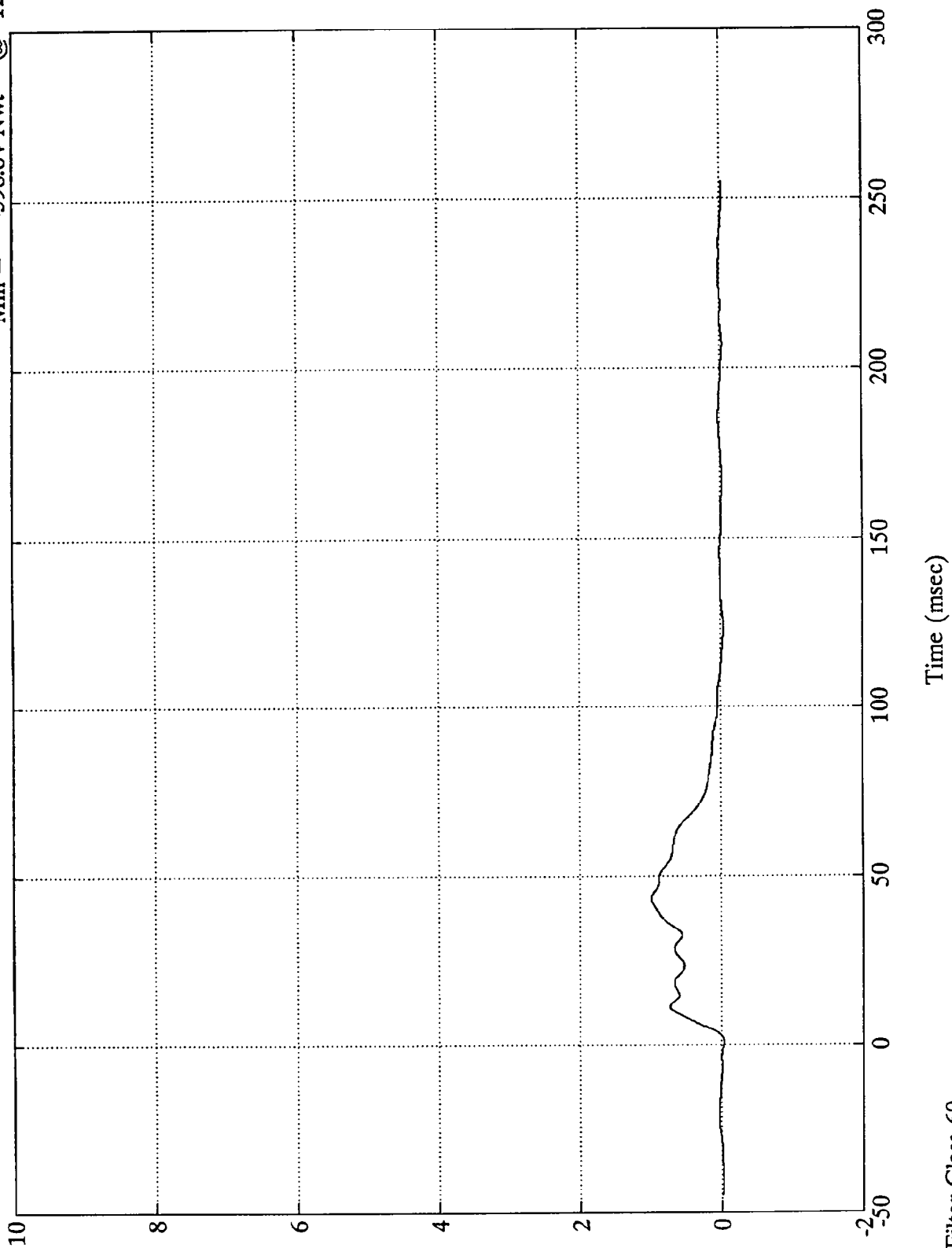
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

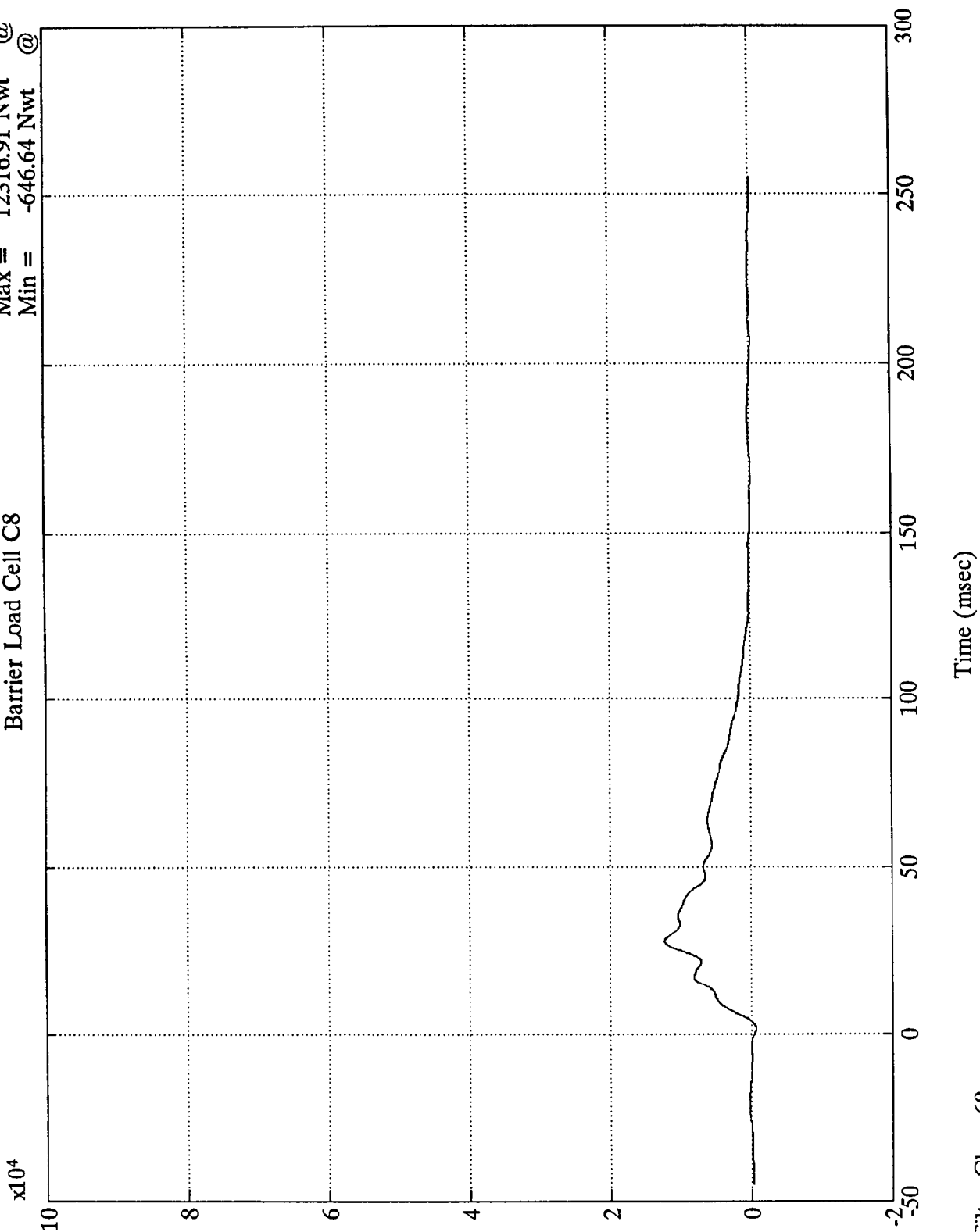
Barrier Load Cell C7

Max = 9851.65 Nwt @ 43.31 msec
 Min = -398.84 Nwt @ 123.84 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C8
Max = 12316.91 Nwt @ 27.84 msec
Min = -646.64 Nwt @ 1.43 msec



1Nwt
B-54

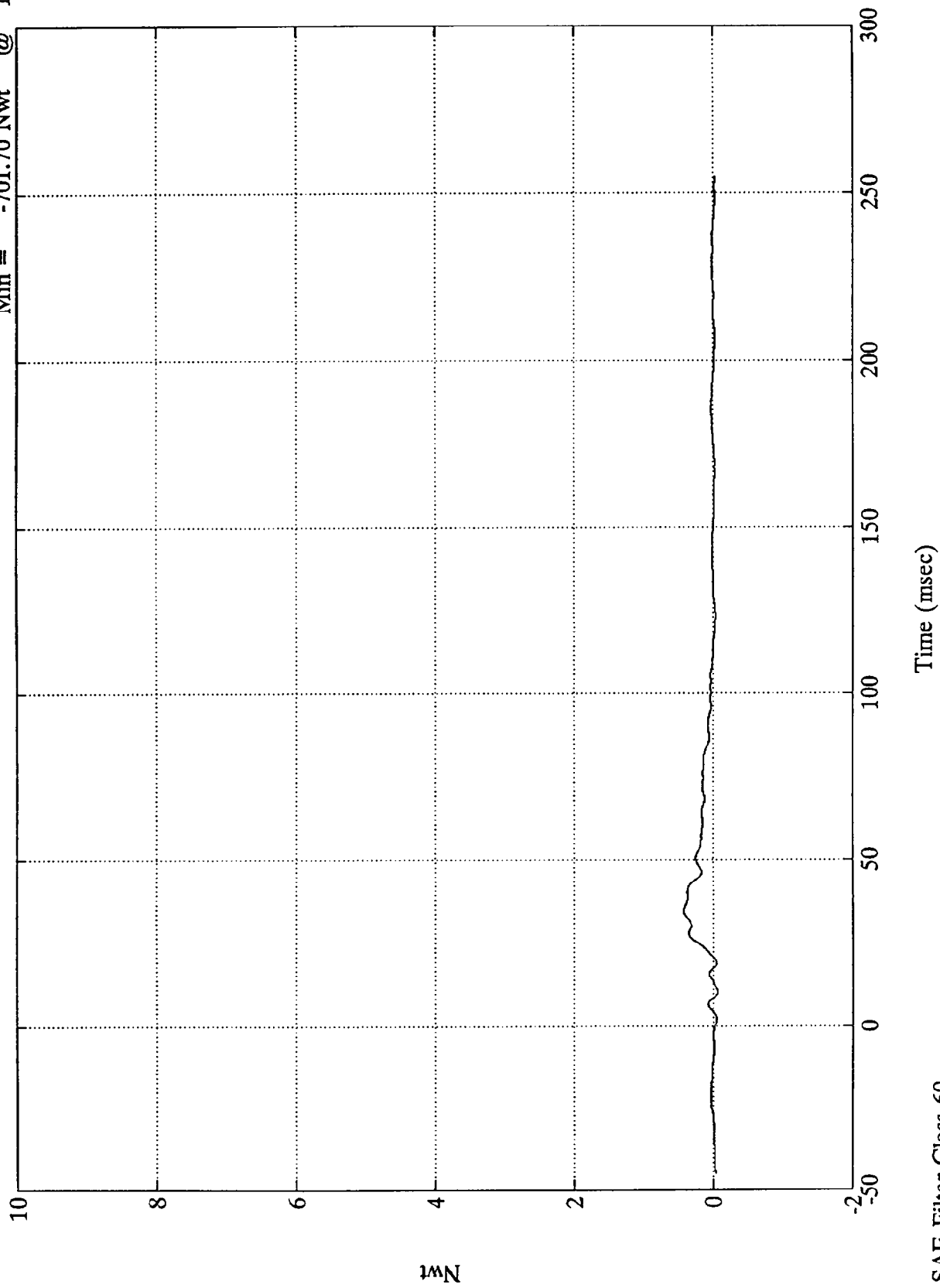
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell C9

Max = 4198.30 Nwt @ 34.55 msec
Min = -701.70 Nwt @ 10.07 msec



1wN
B-55

8120-3

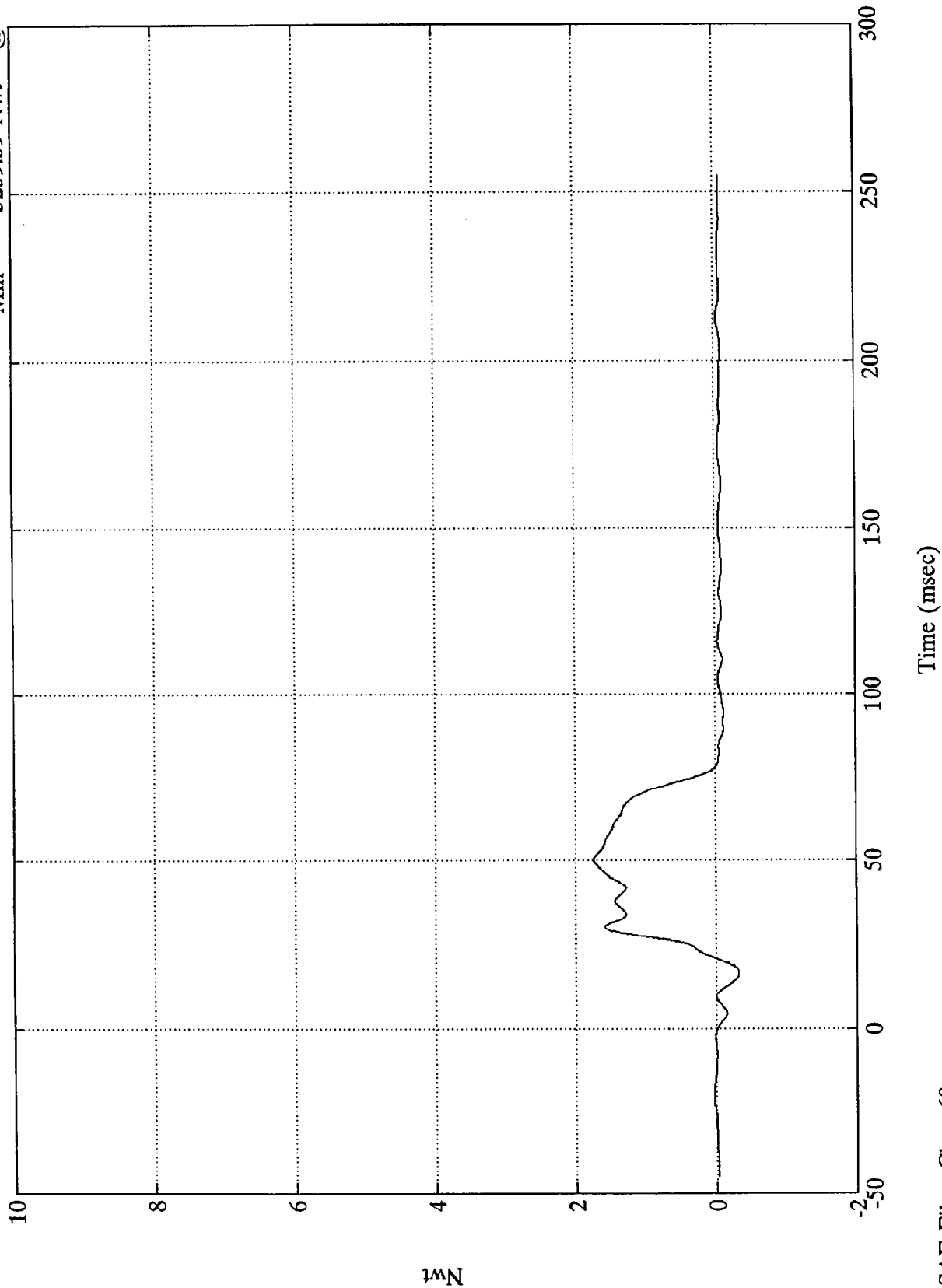
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D1

Max = 17410.90 Nwt @ 50.16 msec
Min = -3259.39 Nwt @ 16.43 msec

$\times 10^4$

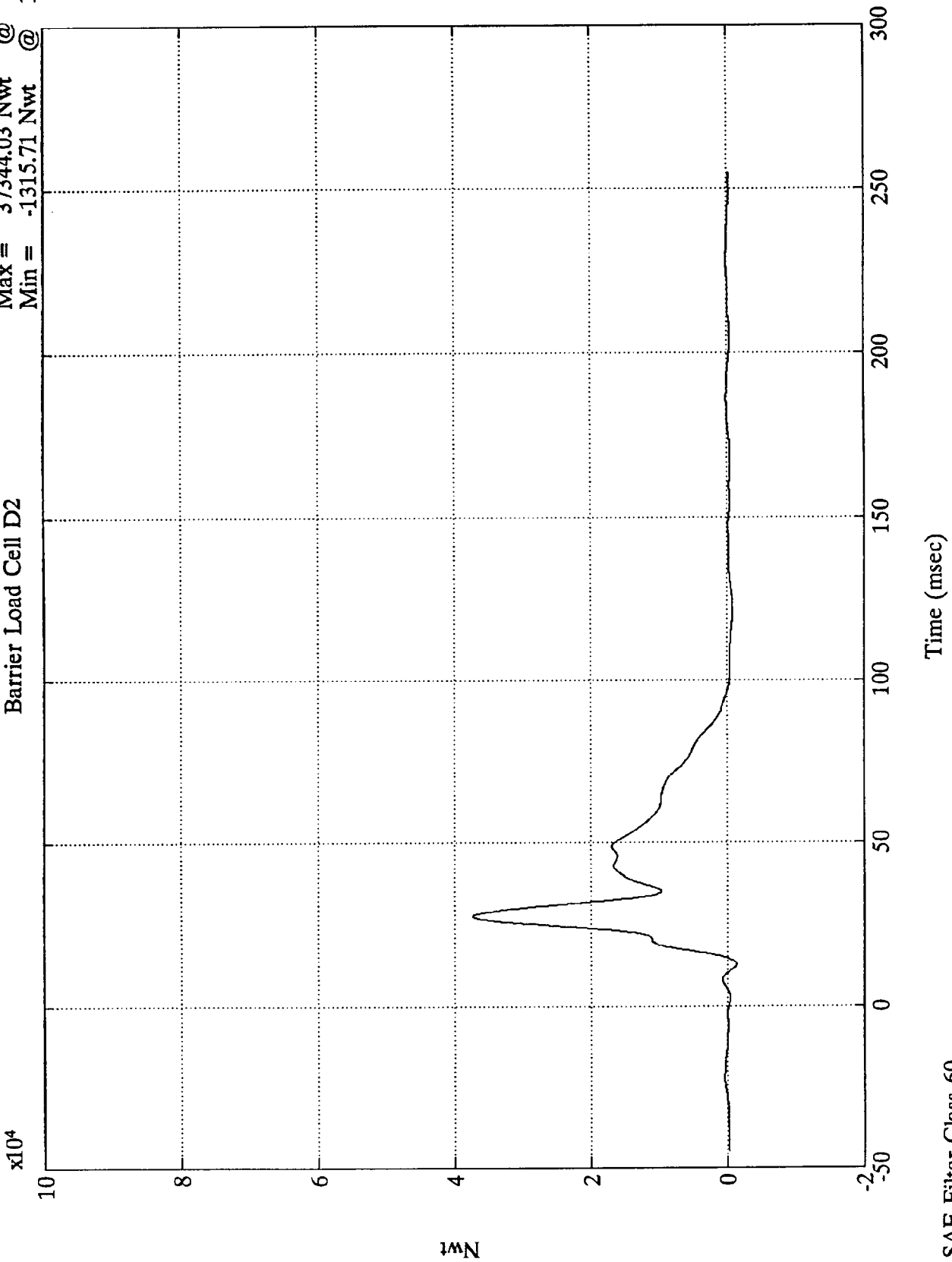


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D2

Max = 37344.03 Nwt @ 27.48 msec
Min = -1315.71 Nwt @ 12.59 msec



B-57

8120-3

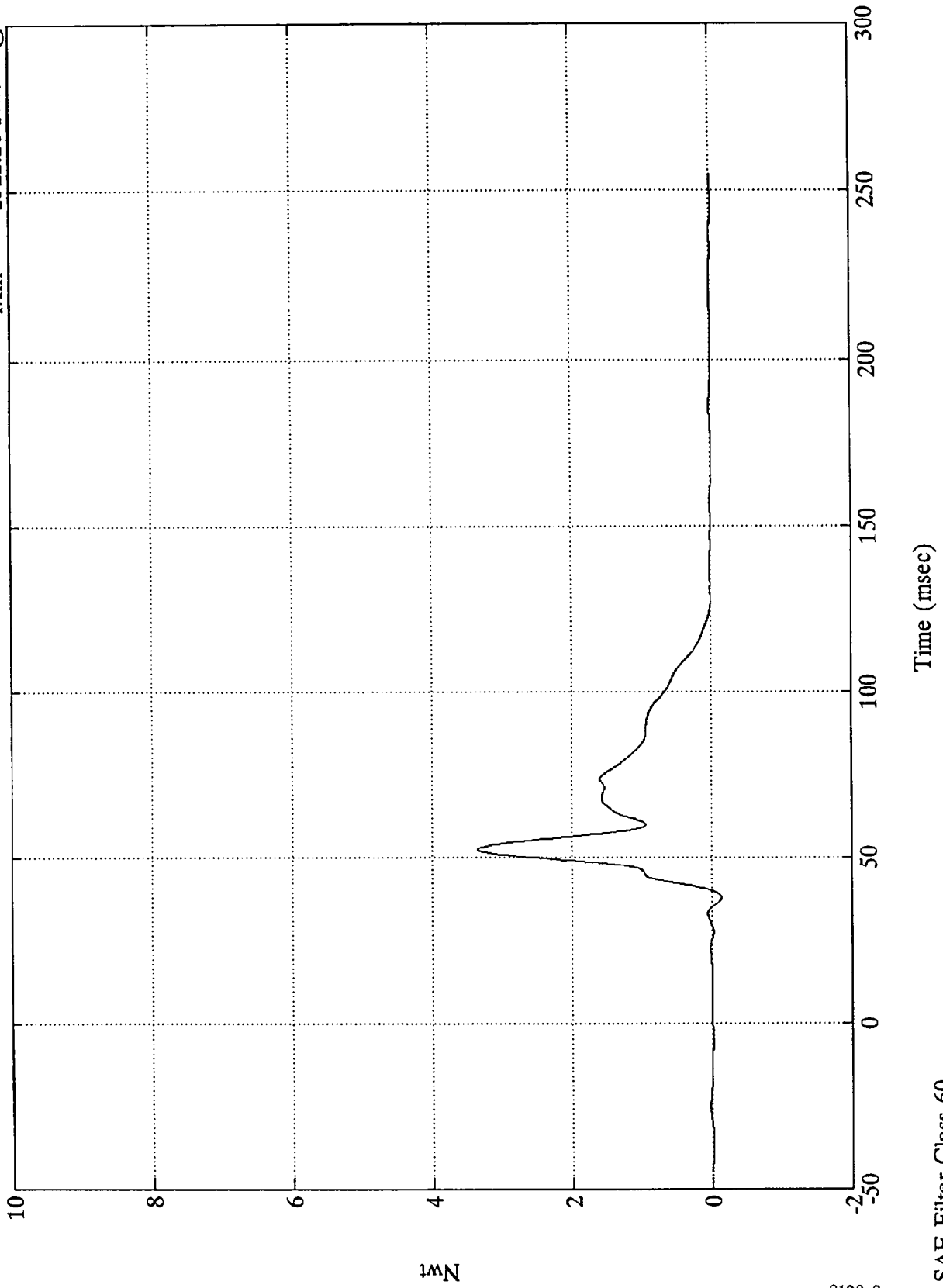
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D3

Max = 33569.51 Nwt @ 52.56 msec
Min = -1321.16 Nwt @ 37.68 msec

$\times 10^4$



1Nwt
B-58

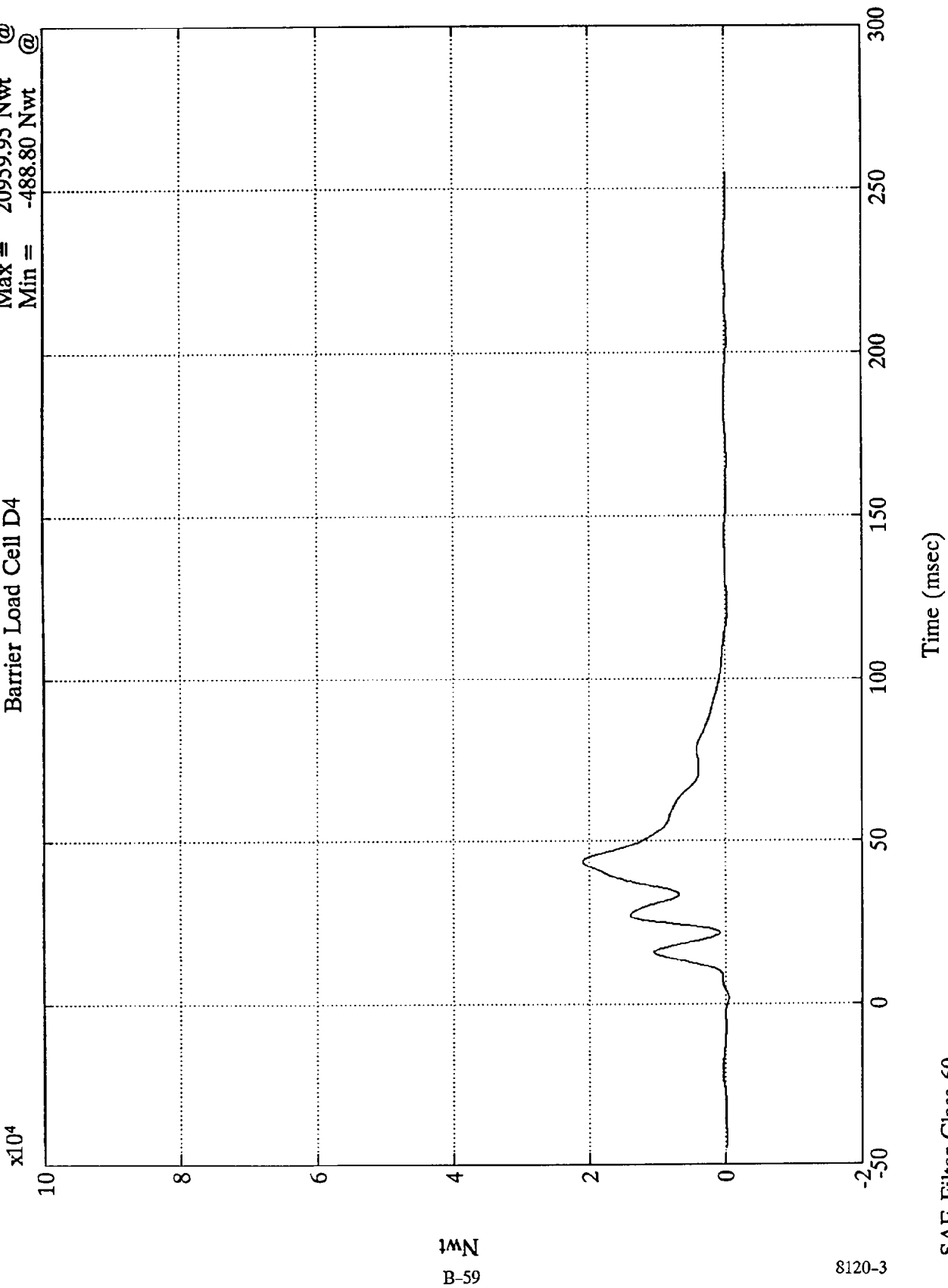
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D4

Max = 20959.95 Nwt @ 43.68 msec
Min = -488.80 Nwt @ 1.67 msec



11N
B-59

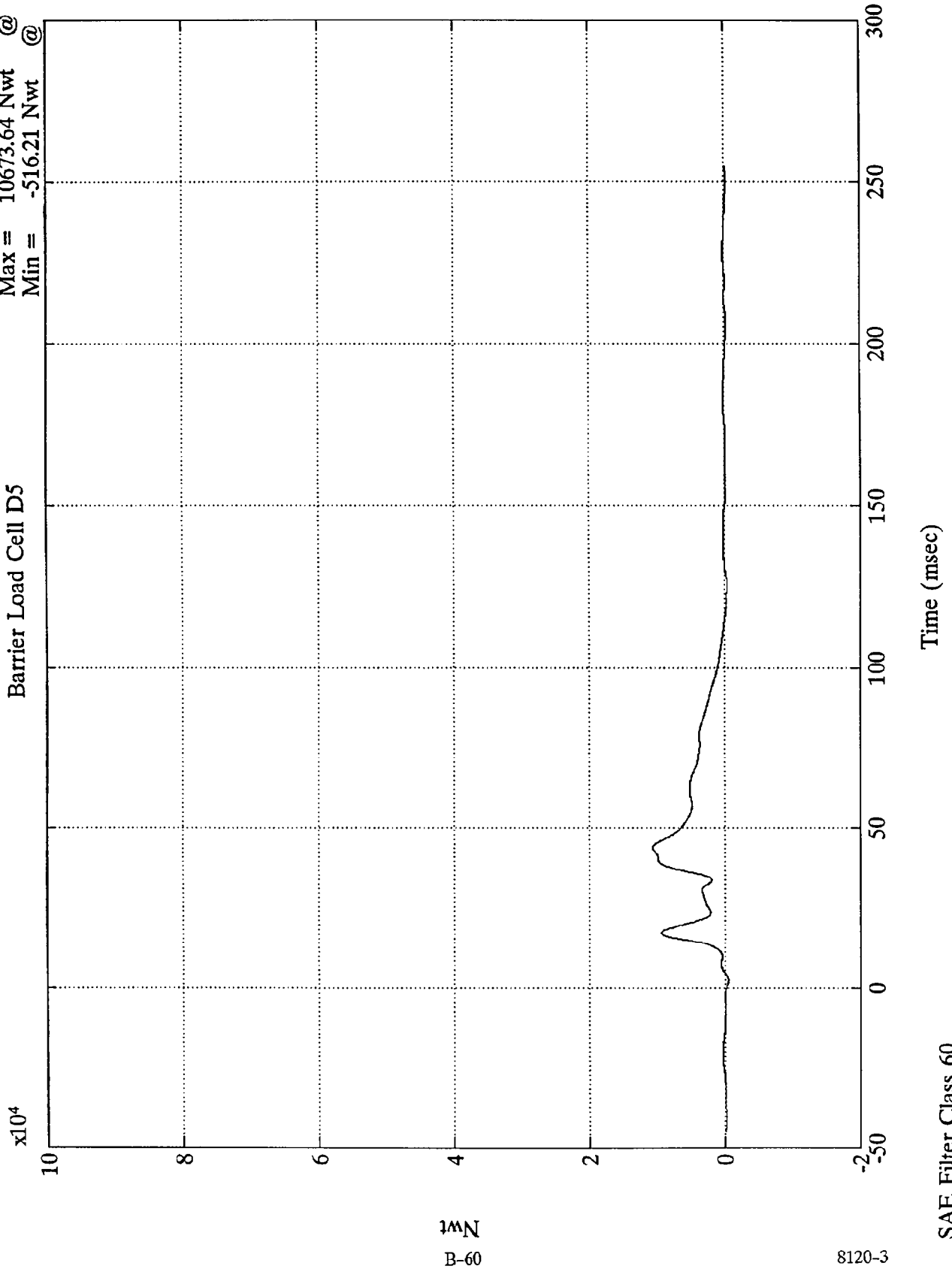
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D5

Max = 10673.64 Nwt @ 43.79 msec
Min = -516.21 Nwt @ 2.15 msec



1wN
B-60

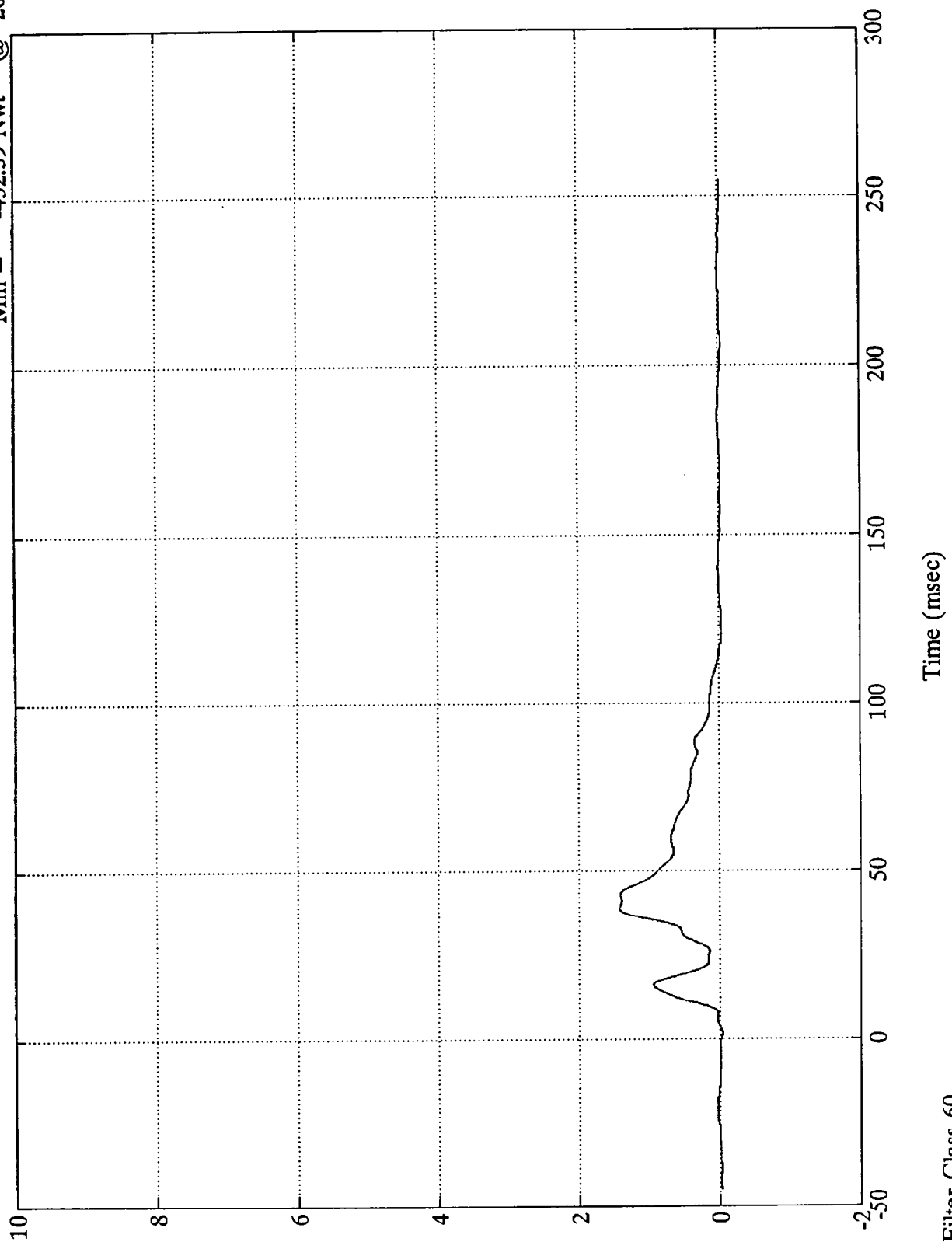
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D6

Max = 14210.41 Nwt @ 38.75 msec
Min = -432.39 Nwt @ 206.88 msec



Nwt
B-61

8120-3

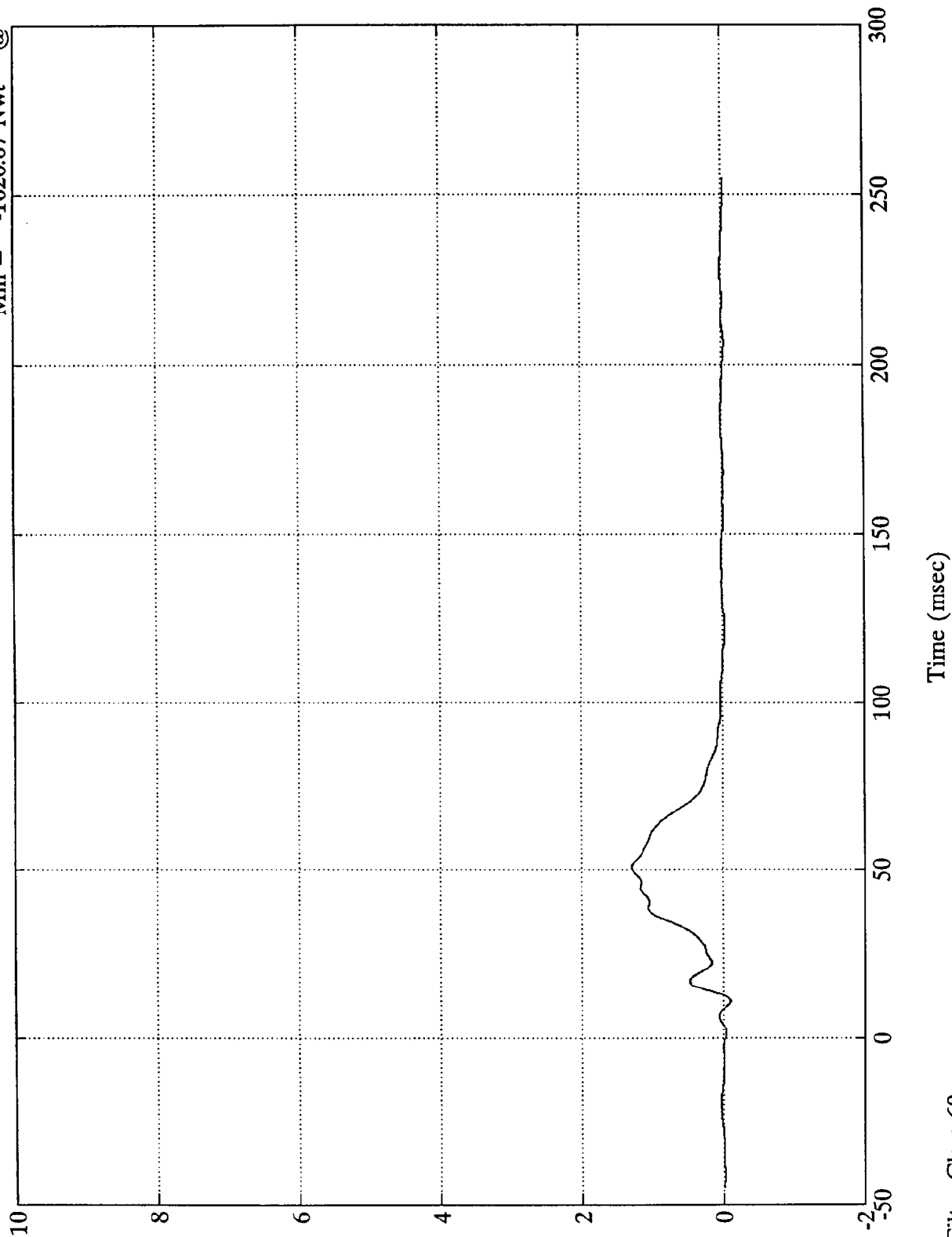
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D7

Max = 12914.72 Nwt @ 50.64 msec
Min = -1020.67 Nwt @ 10.91 msec

$\times 10^4$



1Nwt
B-62

8120-3

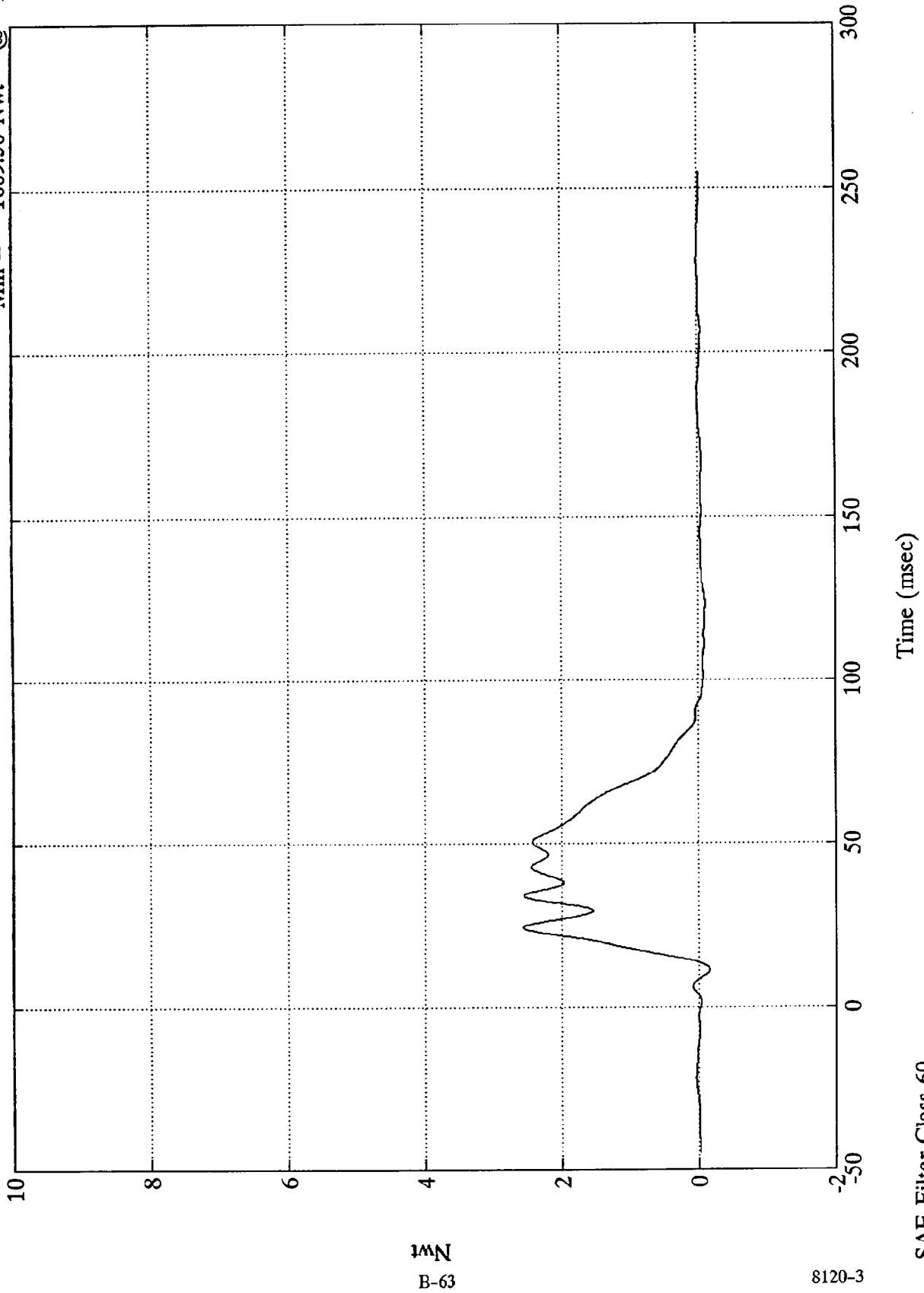
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D8

Max = 25647.69 Nwt @ 24.35 msec
Min = -1609.50 Nwt @ 11.15 msec

$\times 10^4$



B-63

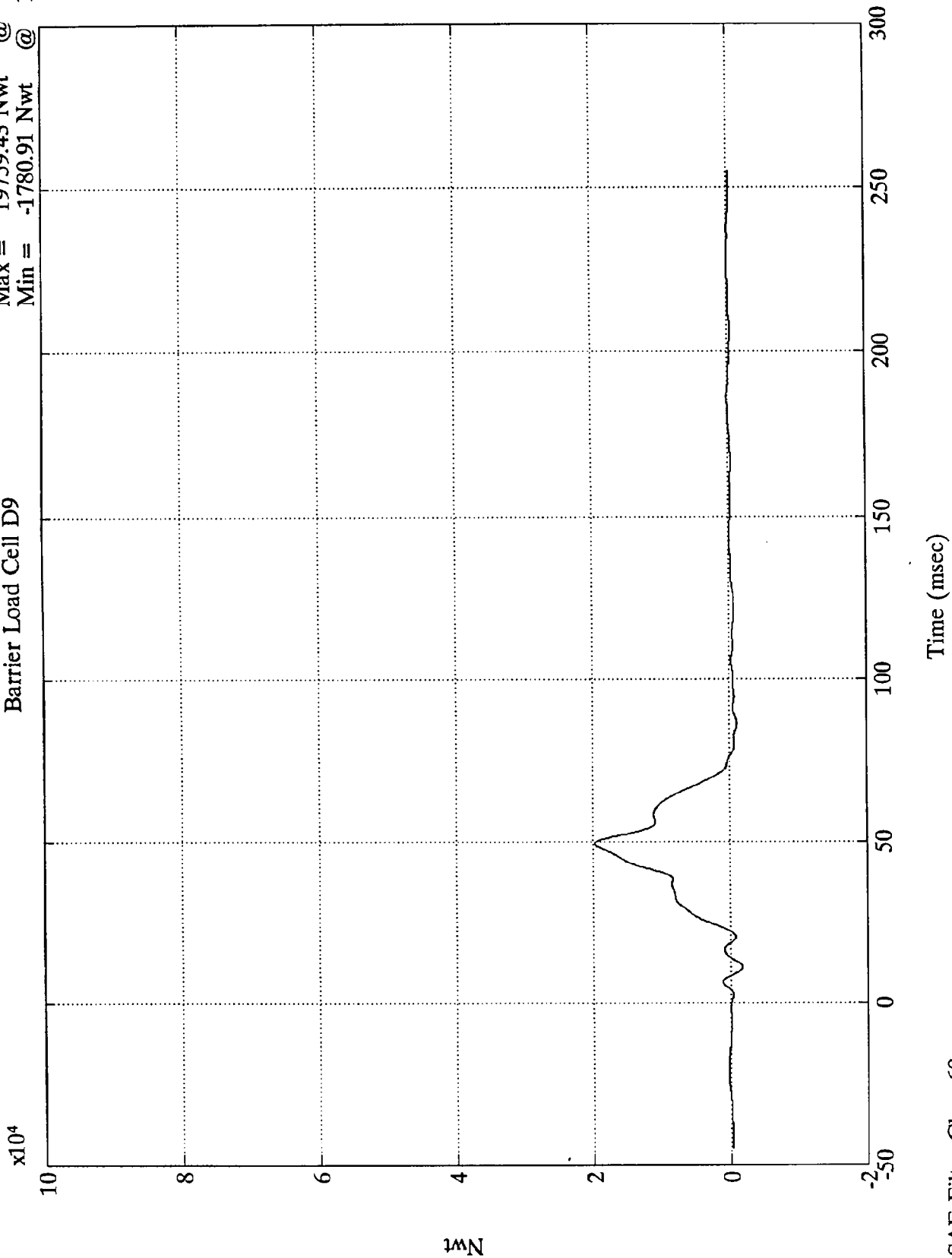
8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Barrier Load Cell D9

Max = 19759.43 Nwt @ 49.55 msec
Min = -1780.91 Nwt @ 10.91 msec

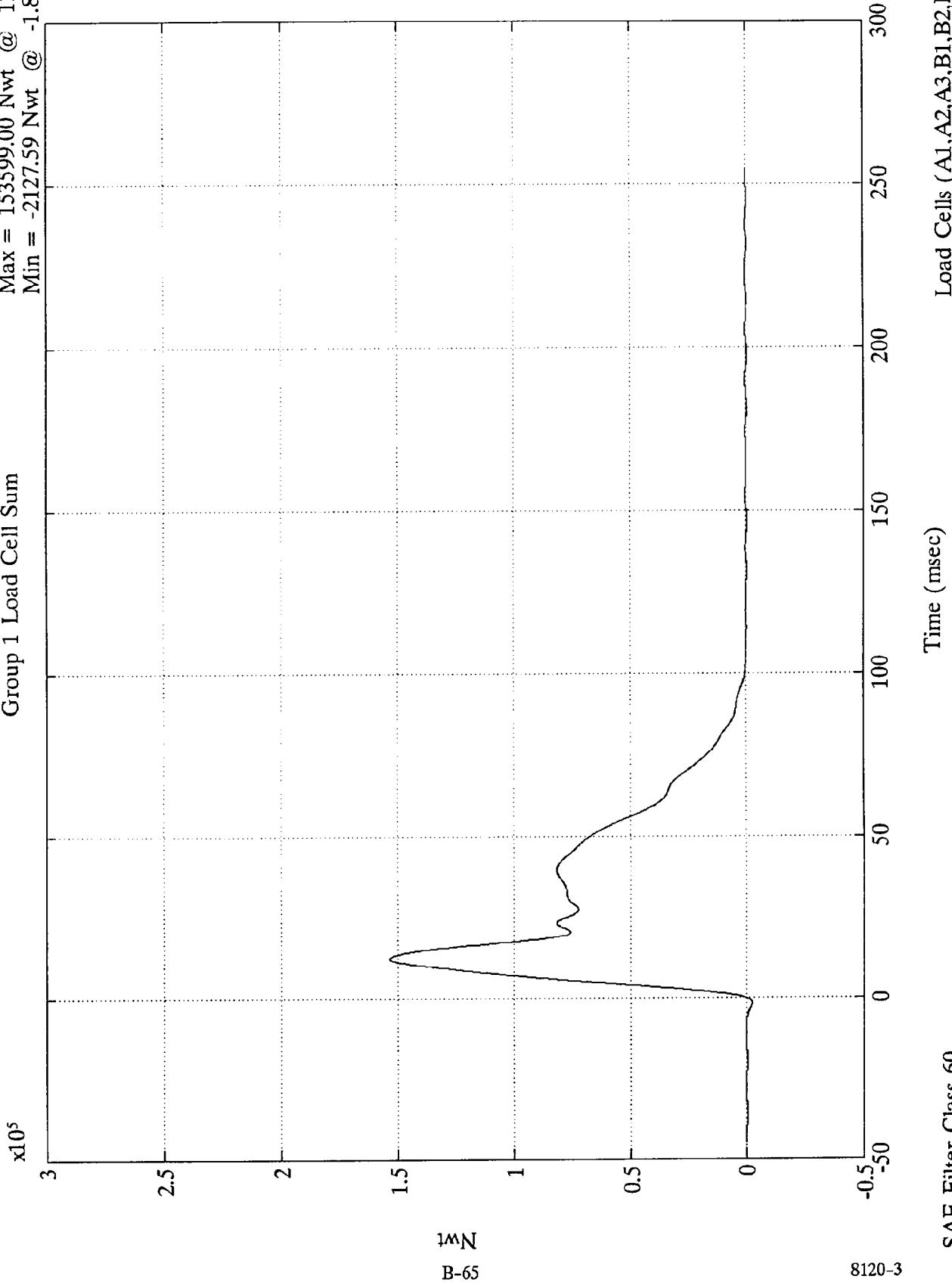


SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Group 1 Load Cell Sum

Max = 153599.00 Nwt @ 12.24 msec
Min = -2127.59 Nwt @ -1.80 msec



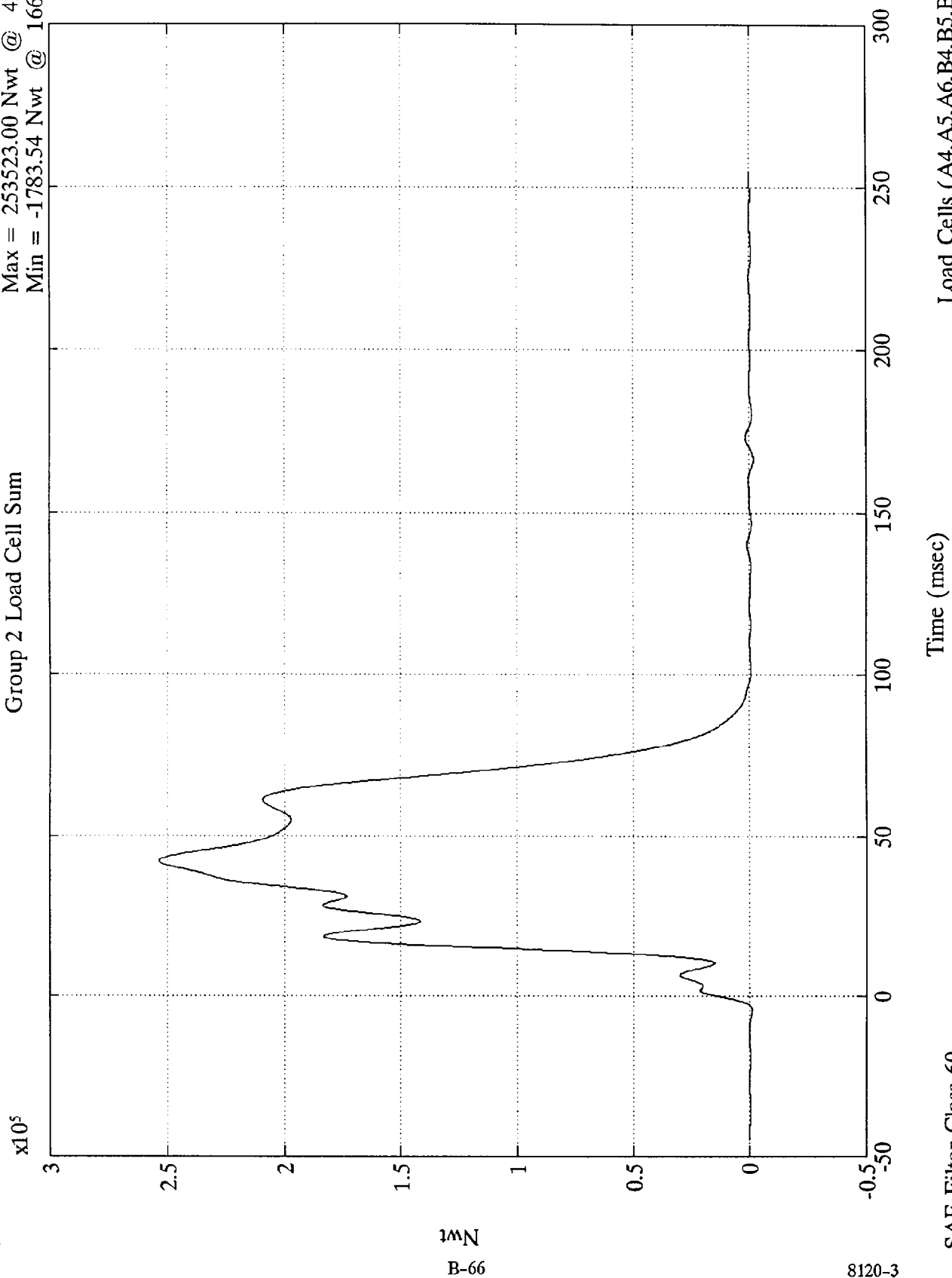
Load Cells (A1,A2,A3,B1,B2,B3)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Group 2 Load Cell Sum

Max = 253523.00 Nwt @ 42.12 msec
Min = -1783.54 Nwt @ 166.56 msec



SAE Filter Class 60

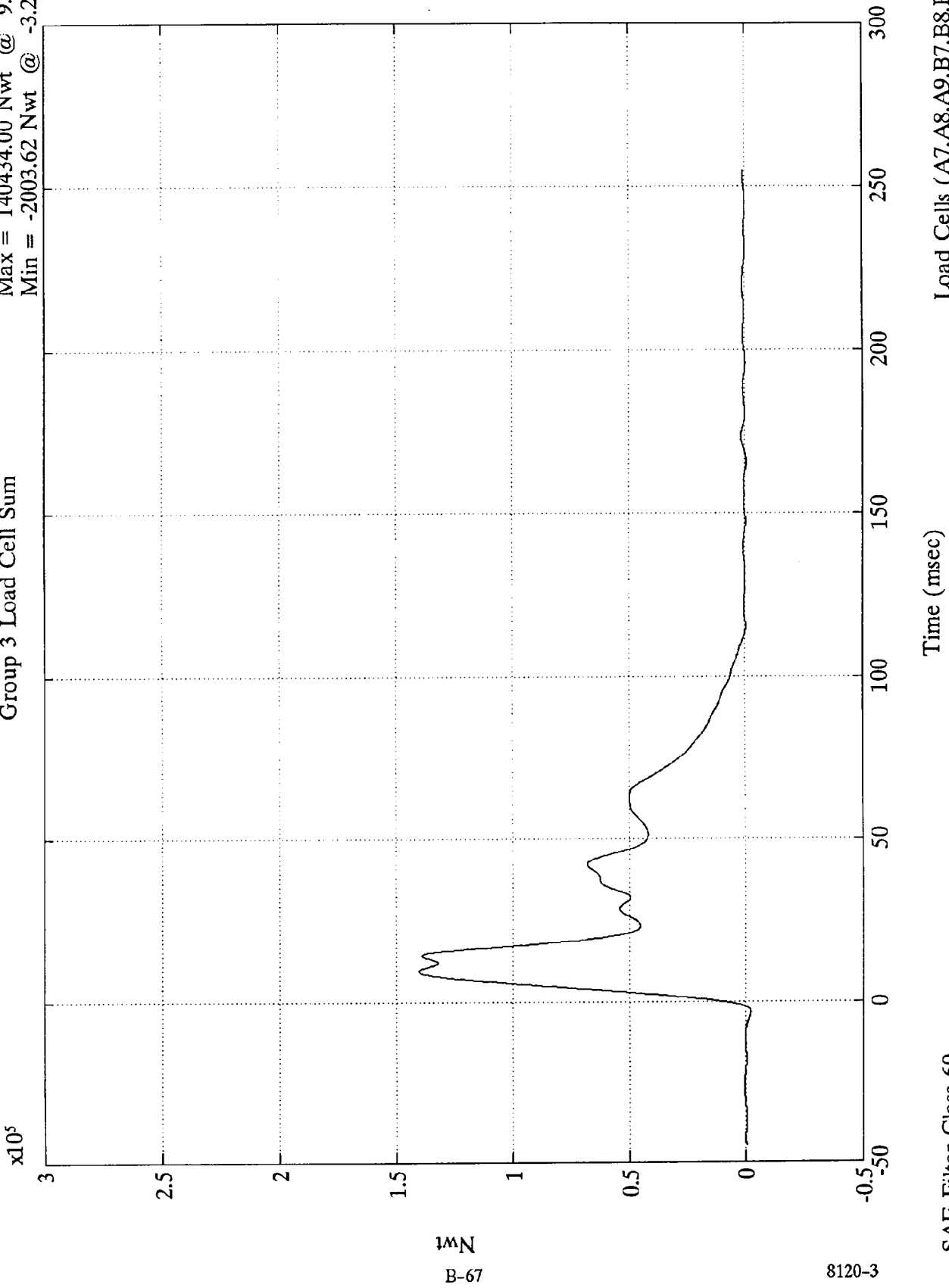
Nwt
B-66

8120-3

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Group 3 Load Cell Sum

Max = 140434.00 Nwt @ 9.36 msec
Min = -2003.62 Nwt @ -3.24 msec



SAE Filter Class 60

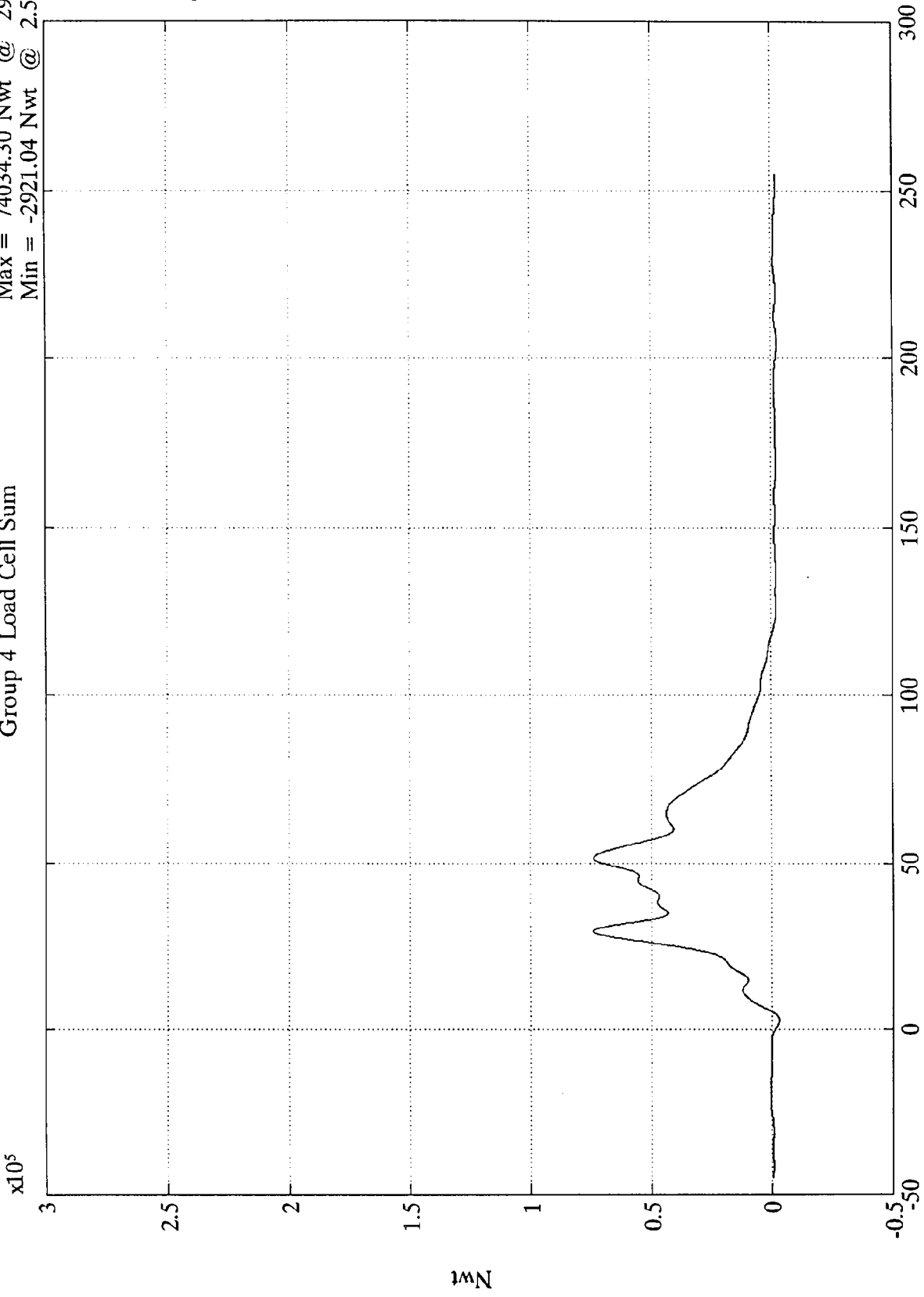
Time (msec)

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

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Group 4 Load Cell Sum

Max = 74034.30 Nwt @ 29.40 msec
Min = -2921.04 Nwt @ 2.52 msec



Time (msec)

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

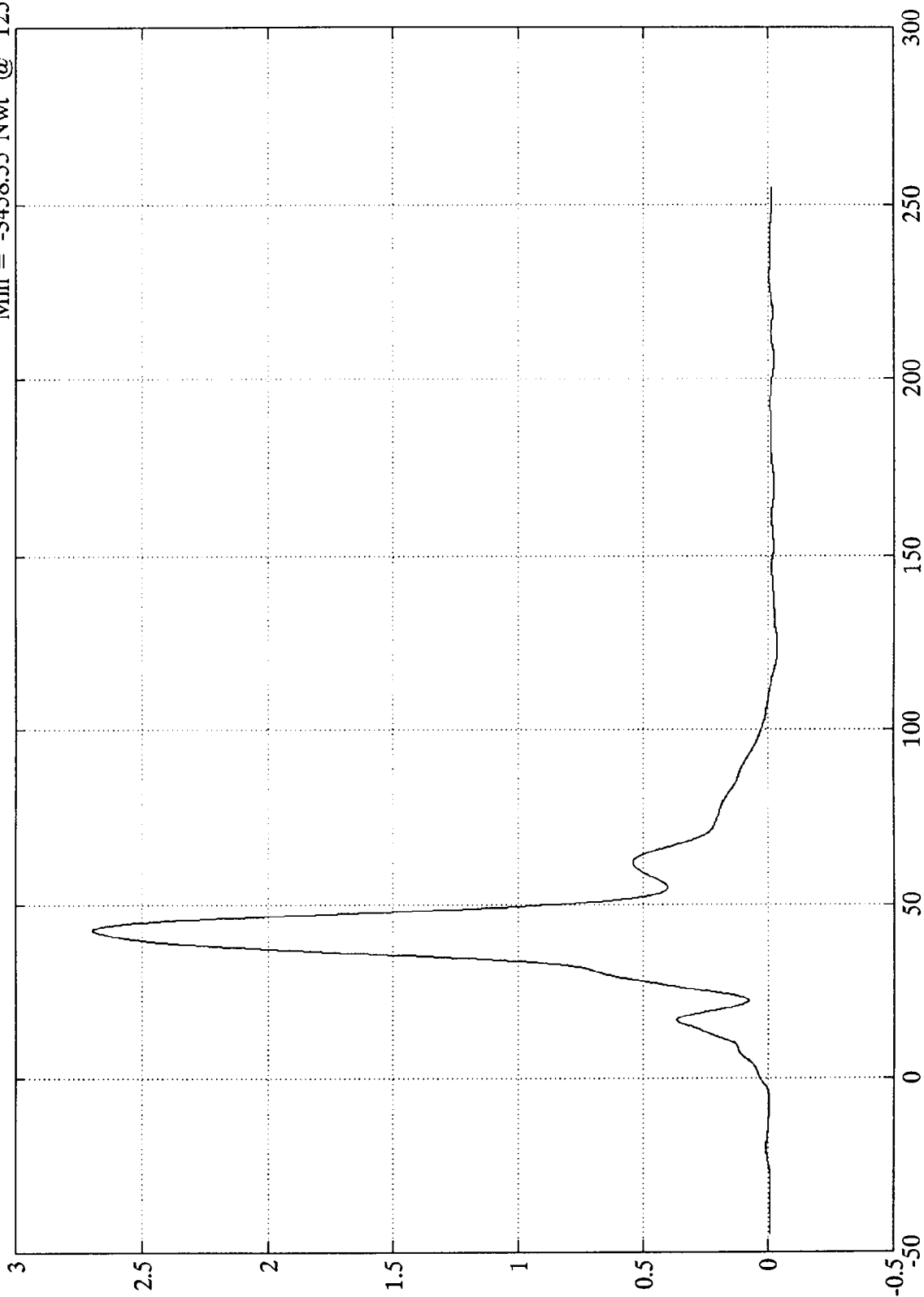
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Group 5 Load Cell Sum

Max = 269326.00 Nwt @ 42.60 msec
Min = -3458.55 Nwt @ 125.16 msec

$\times 10^5$



Time (msec)

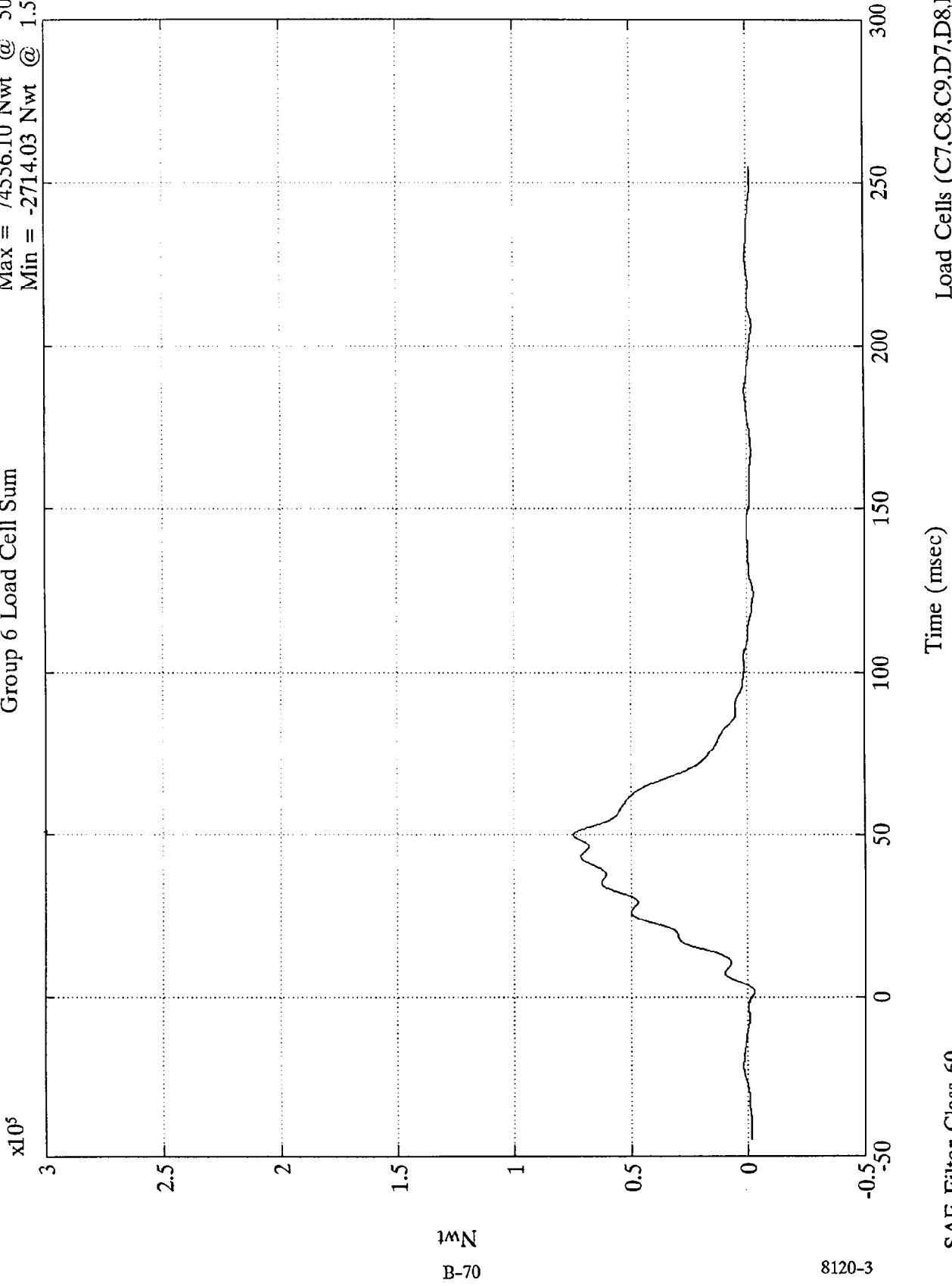
Load Cells (C4,C5,C6,D4,D5,D6)

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Group 6 Load Cell Sum

Max = 74556.10 Nwt @ 50.04 msec
Min = -2714.03 Nwt @ 1.56 msec



SAE Filter Class 60

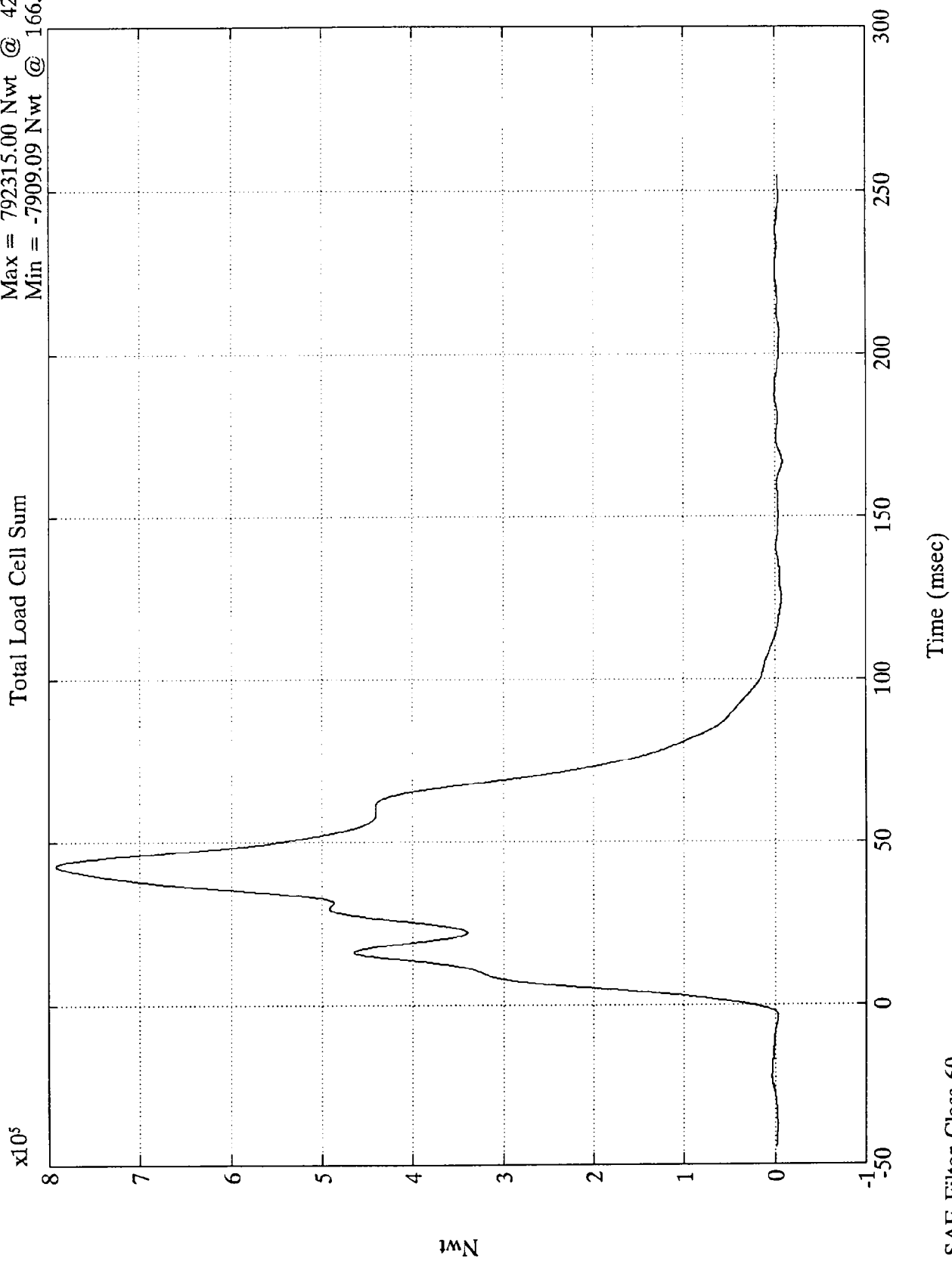
Time (msec)

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

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Total Load Cell Sum

Max = 792315.00 Nwt @ 42.48 msec
Min = -7909.09 Nwt @ 166.80 msec



Nwt
B-71

8120-3

SAE Filter Class 60

TEST NO. MP0107

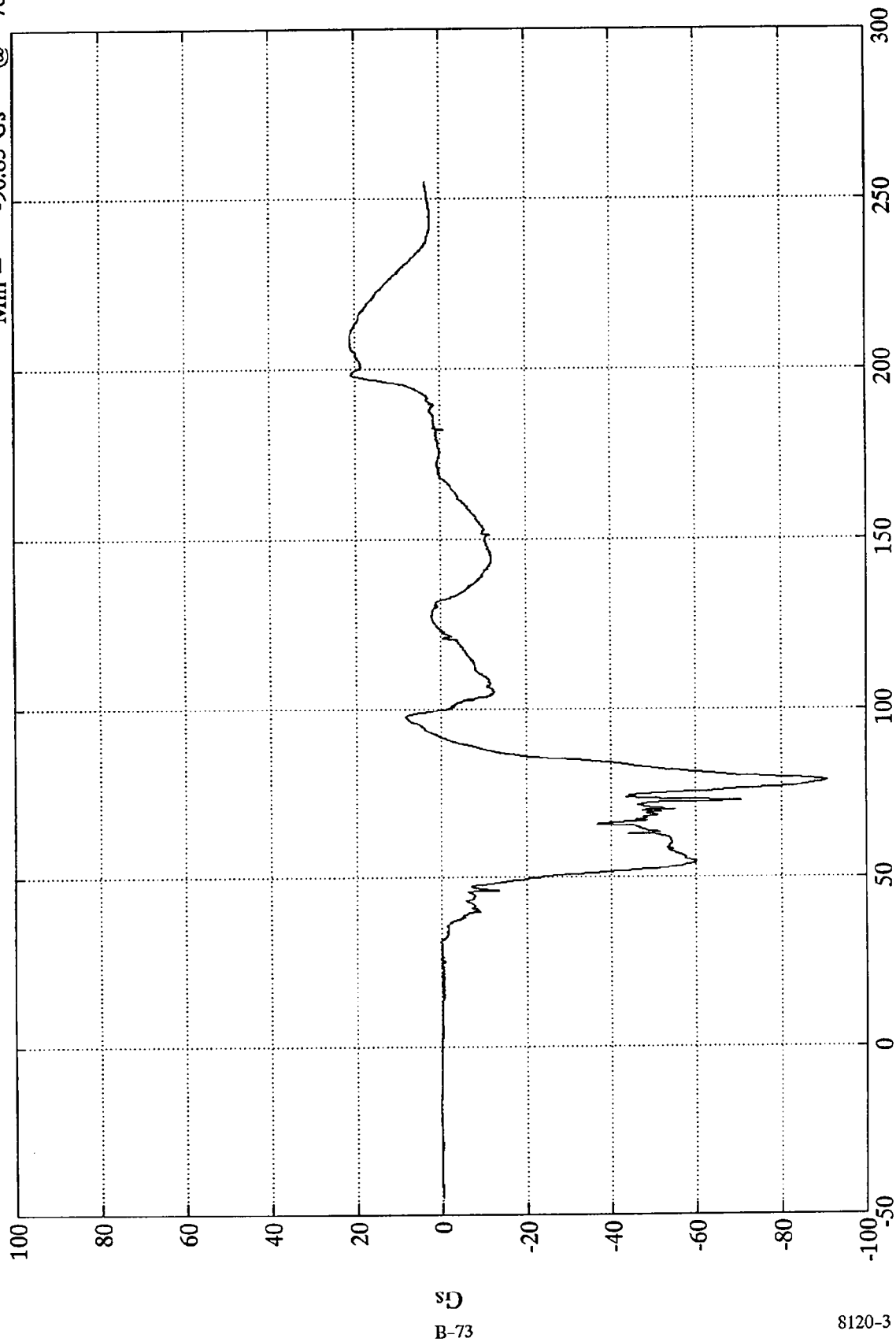
DUMMY DATA

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

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Head X

Max = 21.14 Gs @ 209.40 msec
Min = -90.83 Gs @ 78.36 msec



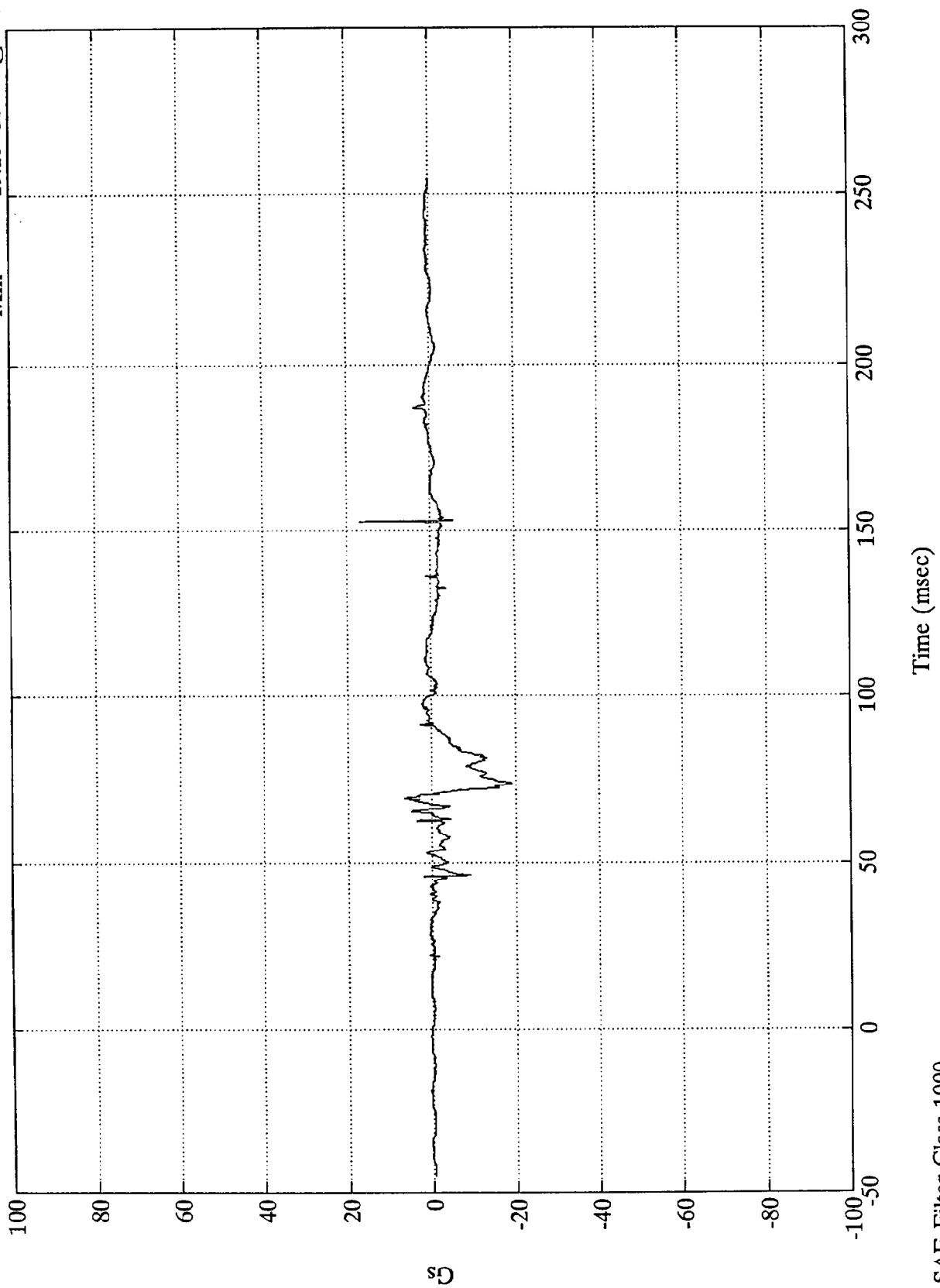
Time (msec)

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Head Y

Max = 16.82 Gs @ 152.63 msec
Min = -19.15 Gs @ 73.92 msec

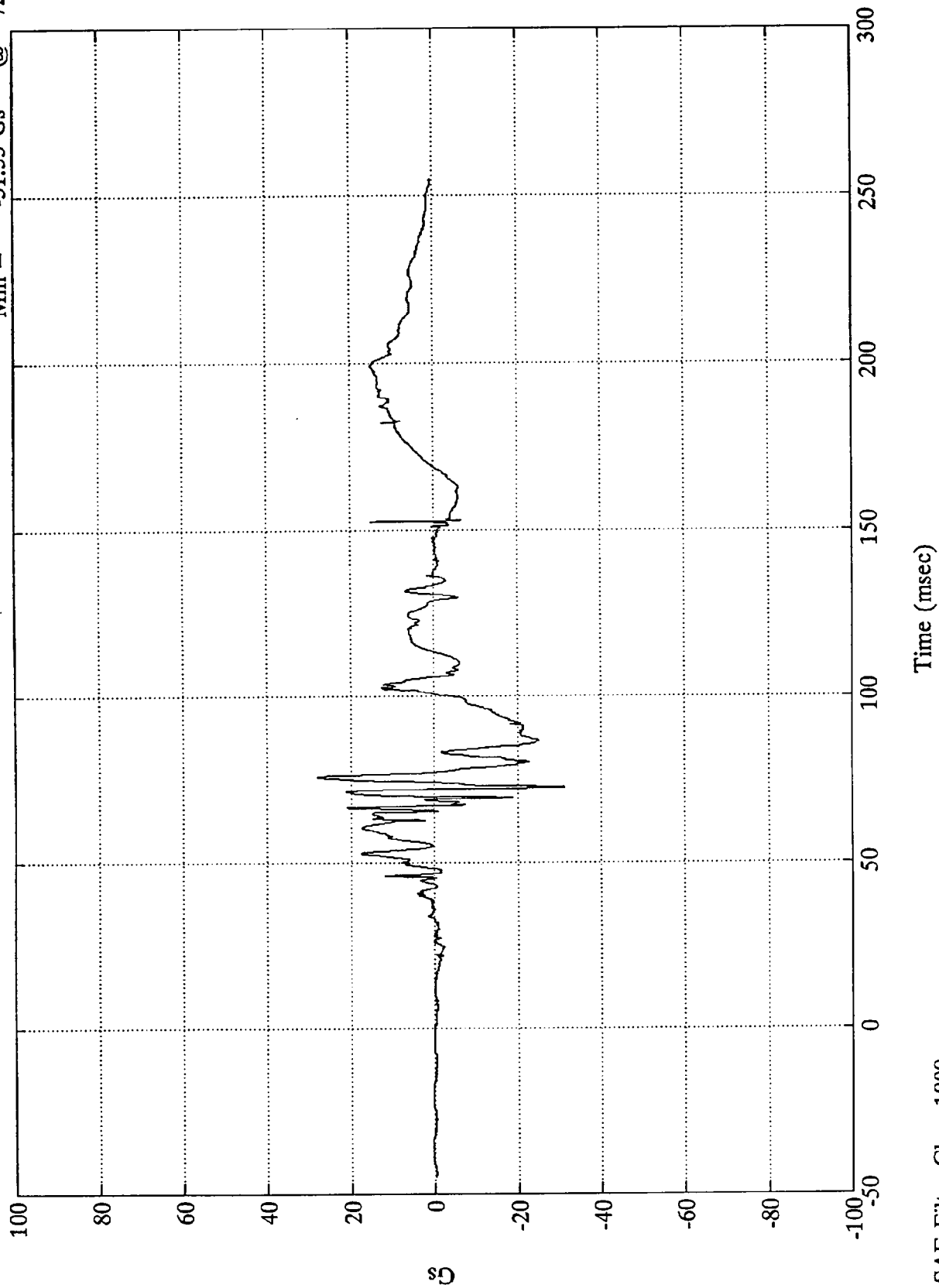


SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Head Z

Max = 27.89 Gs @ 75.72 msec
Min = -31.33 Gs @ 72.48 msec



B-75

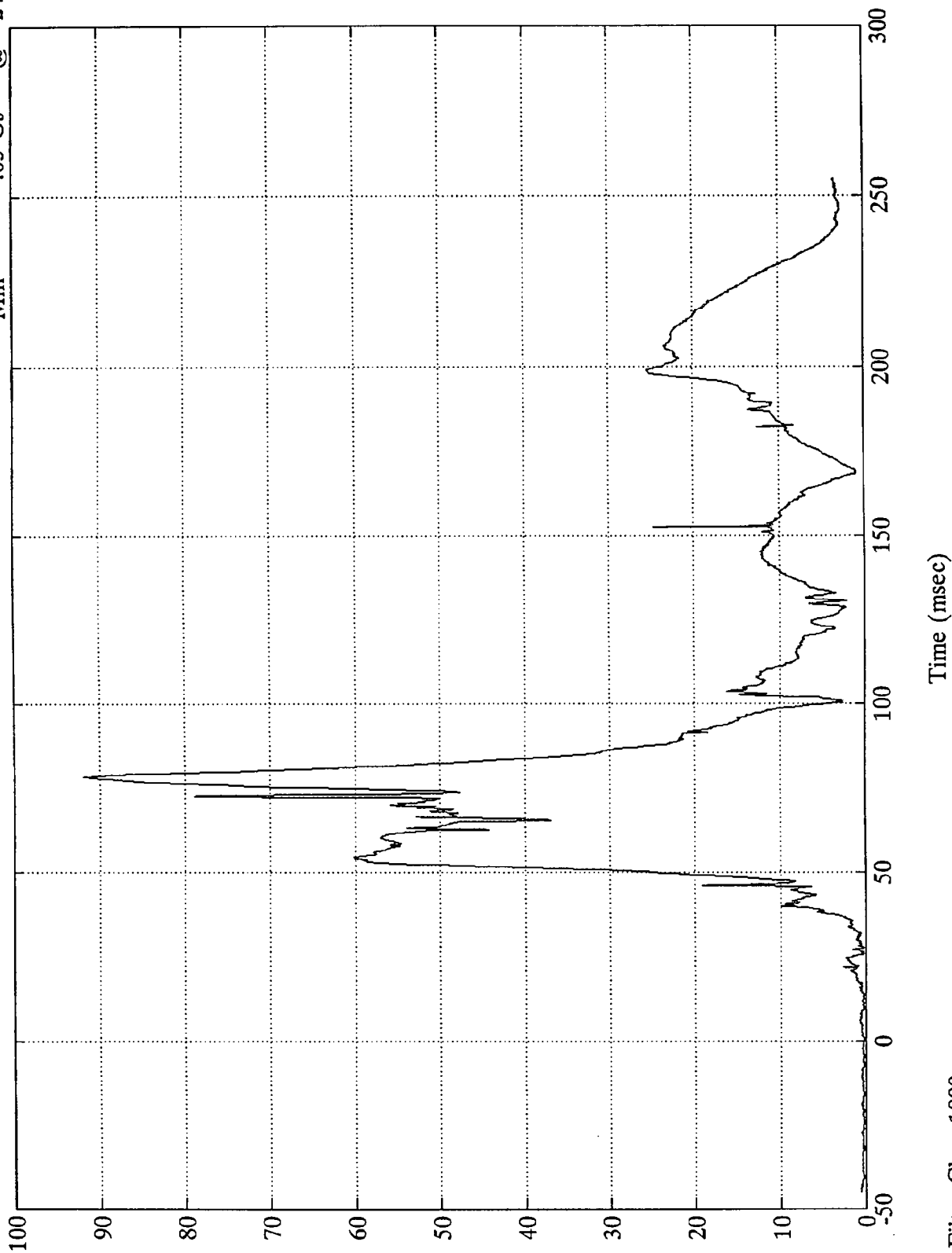
8120-3

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Head Resultant

Max = 91.86 Gs @ 78.36 msec
 Min = .05 Gs @ -24.24 msec



B-76

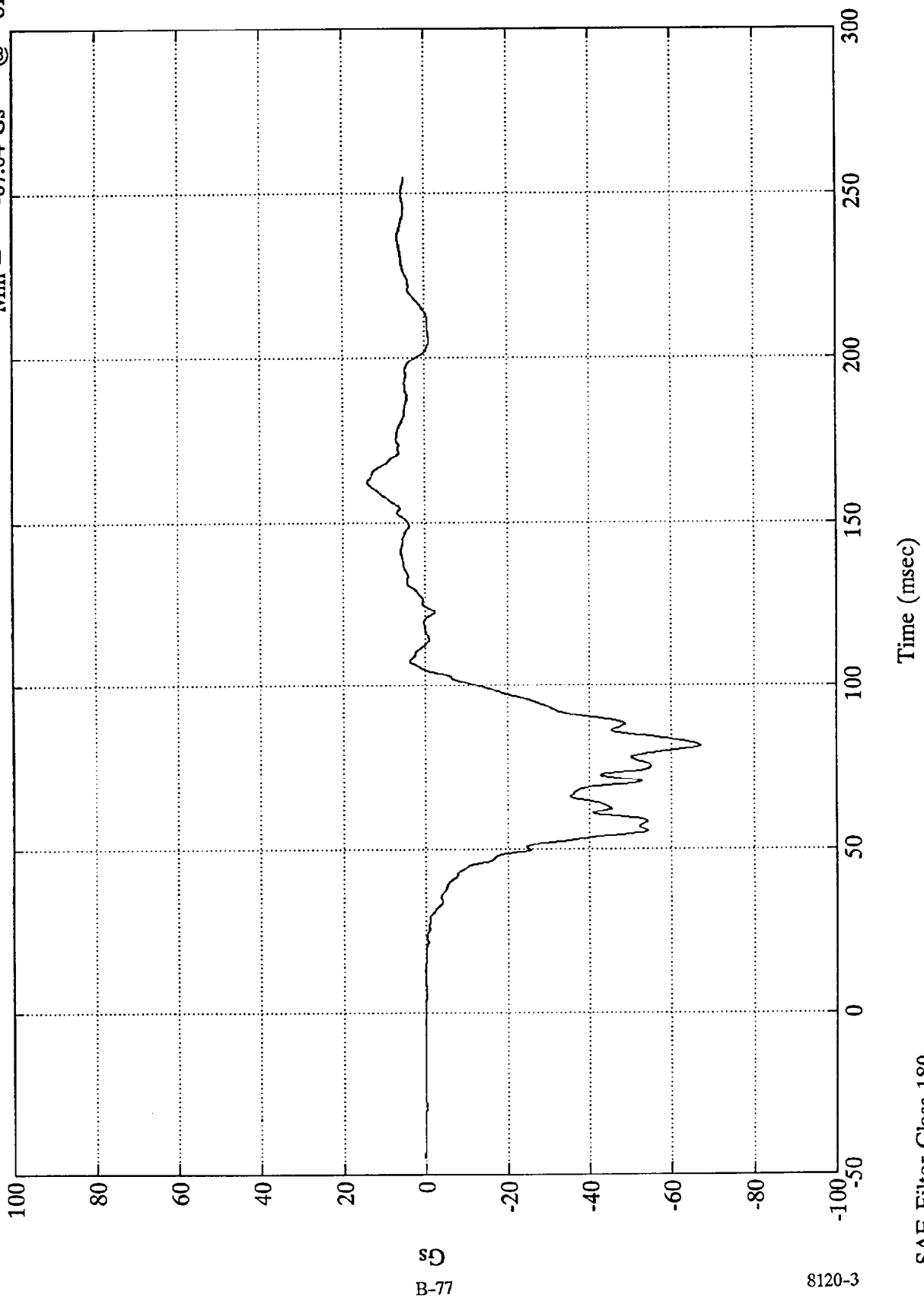
8120-3

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Chest X

Max = 13.98 Gs @ 162.36 msec
Min = -67.04 Gs @ 81.48 msec



B-77

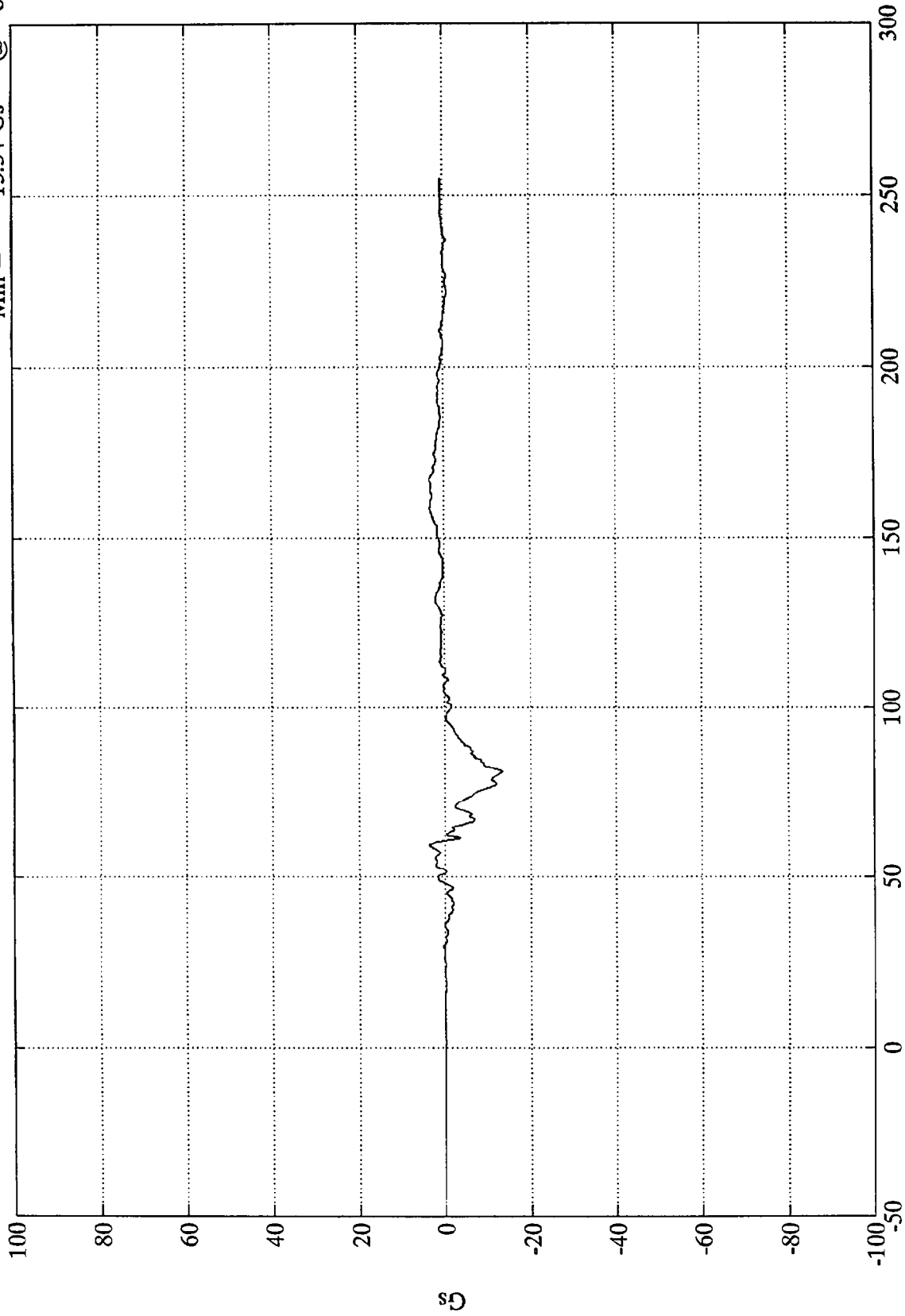
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Max = 3.59 Gs @ 59.15 msec
Min = -13.34 Gs @ 81.00 msec

Pos. 1 Chest Y



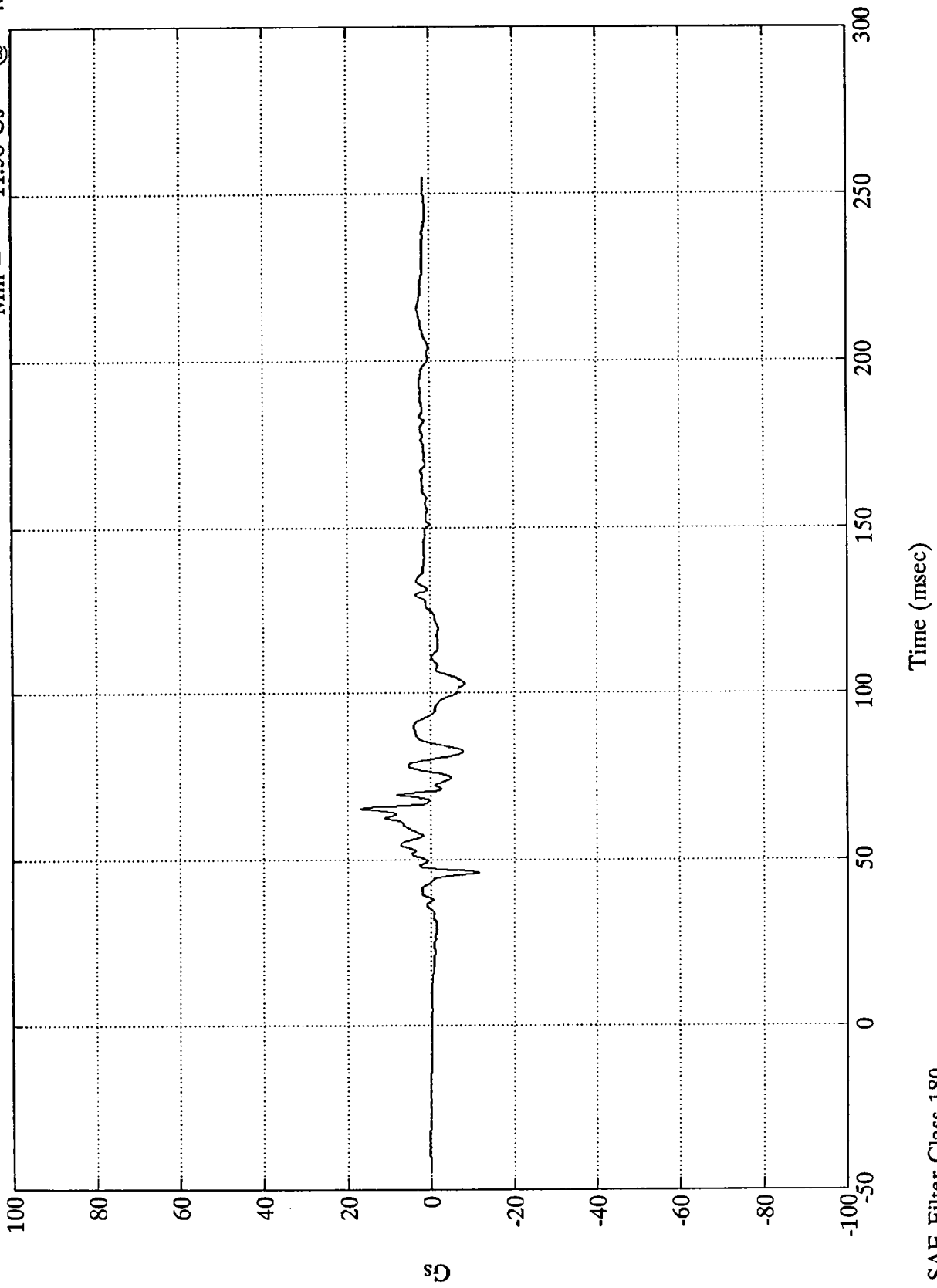
Time (msec)

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Chest Z

Max = 16.75 Gs @ 65.27 msec
Min = -11.58 Gs @ 46.20 msec



B-79

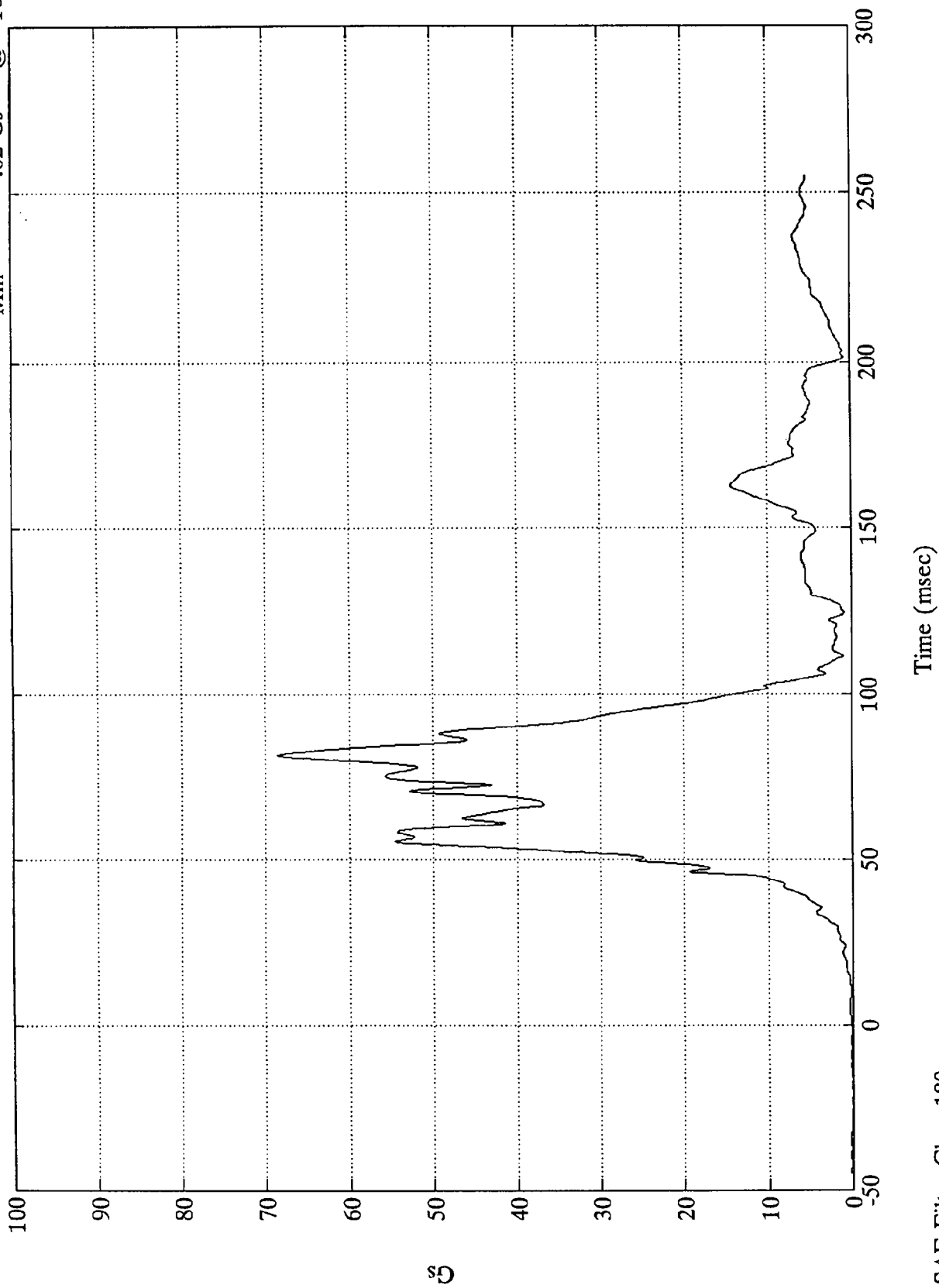
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Chest Resultant

Max = 68.56 Gs @ 81.48 msec
Min = .02 Gs @ -16.32 msec



B-80

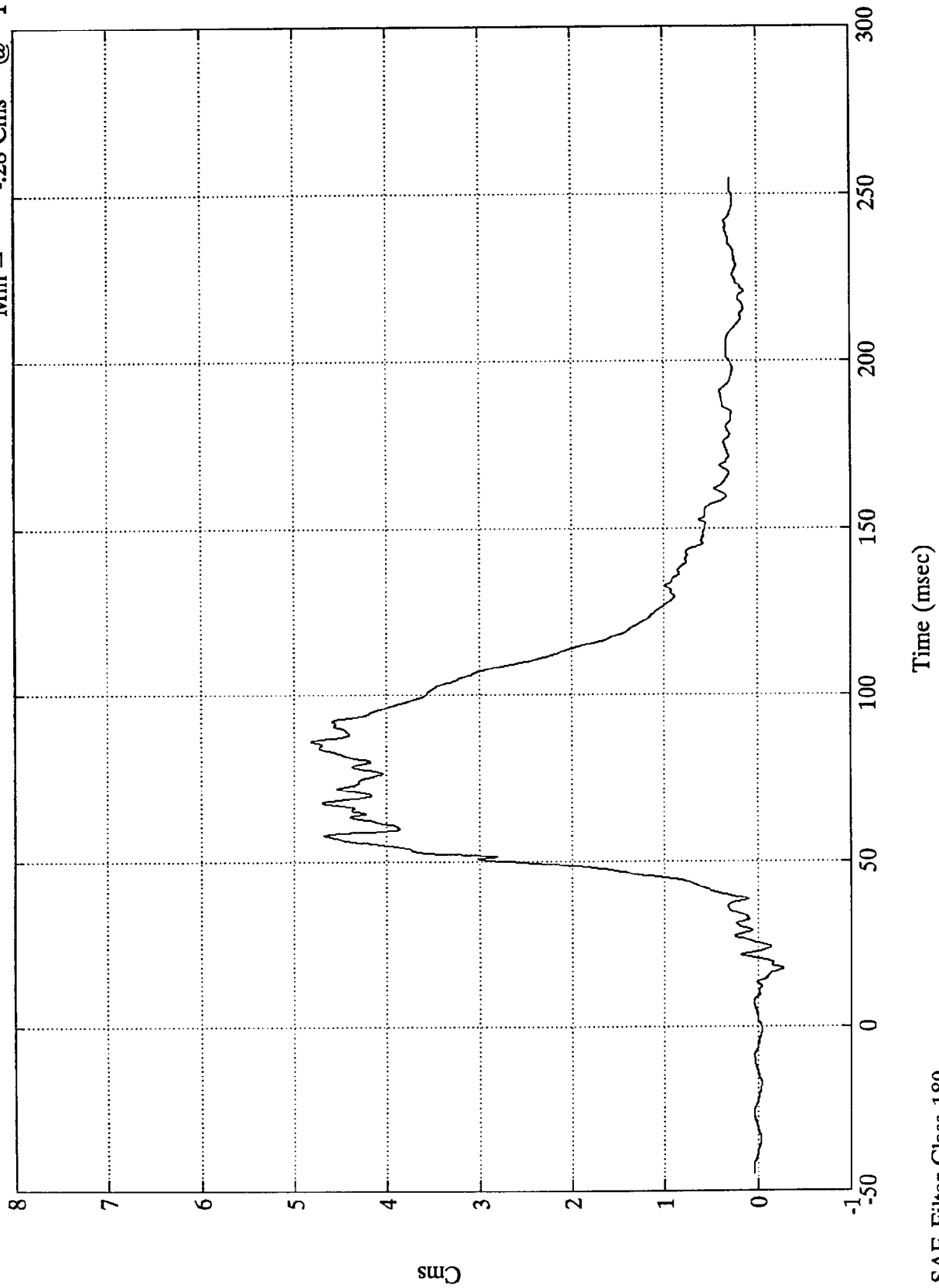
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Chest Disp.

Max = 4.82 Cms @ 86.04 msec
Min = -.28 Cms @ 17.39 msec



18-B
Cms

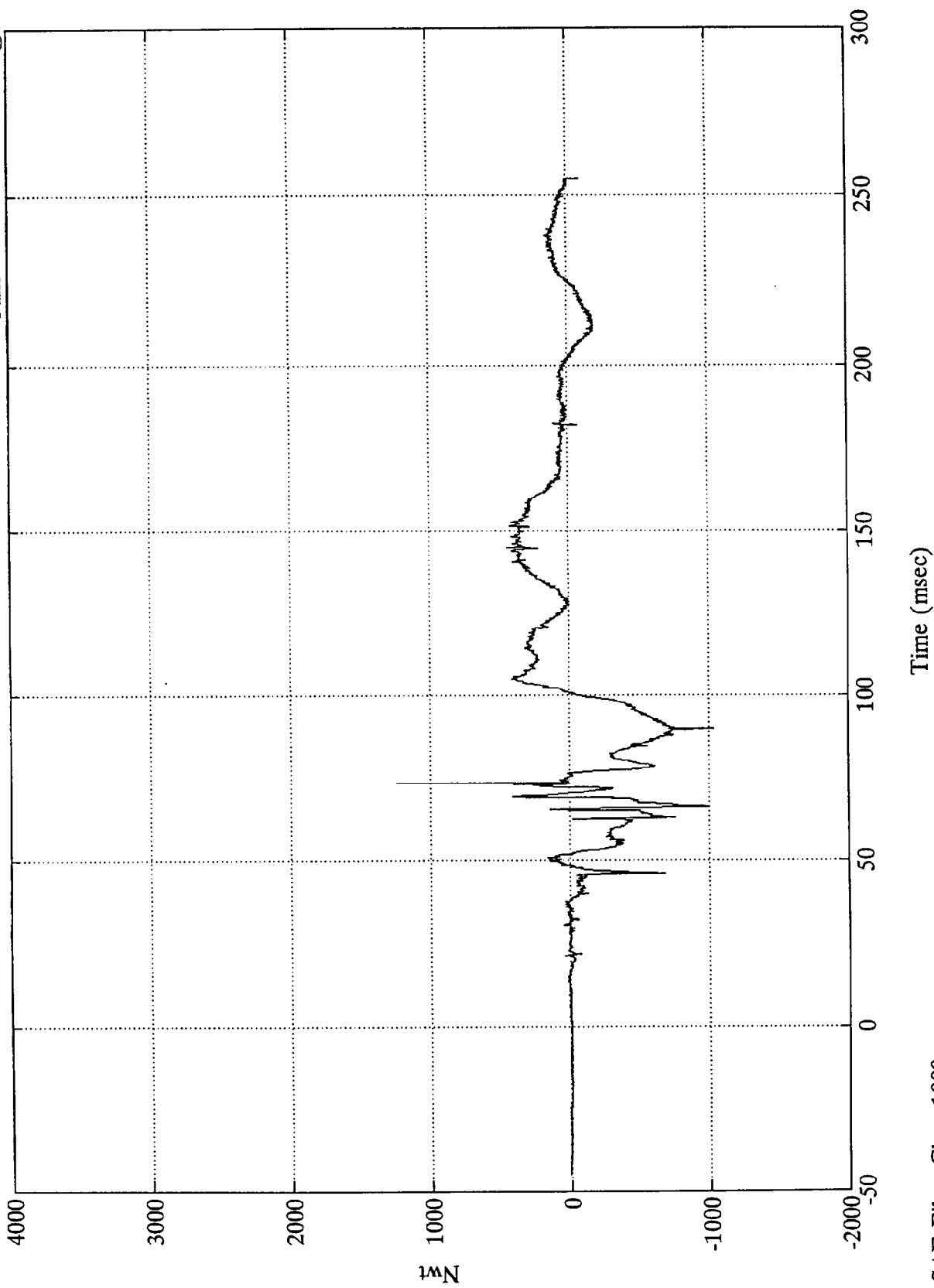
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Upper Neck Fx

Max = 1241.30 Nwt @ 73.55 msec
Min = -1033.46 Nwt @ 89.63 msec

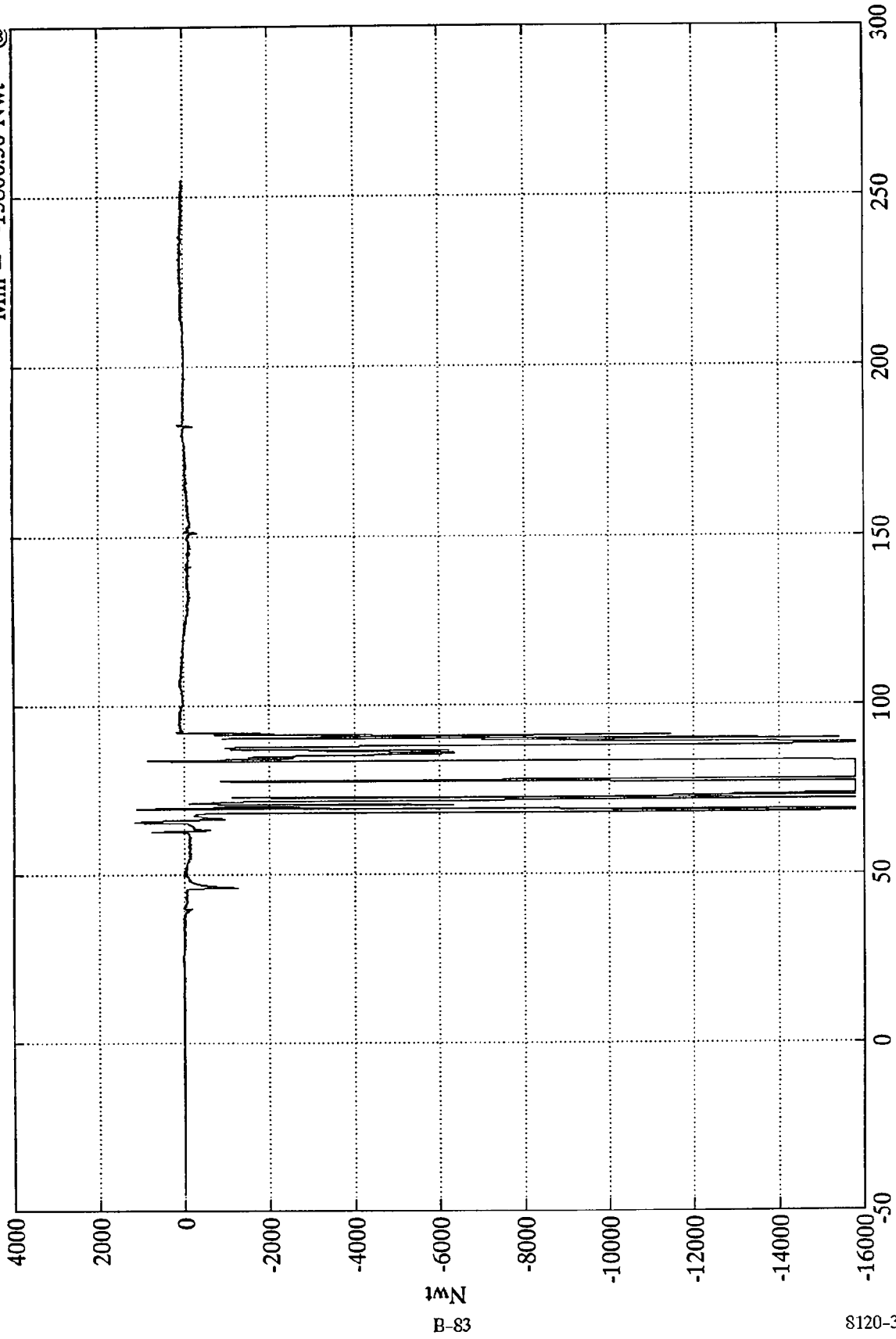


SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Upper Neck Fy

Max = 1165.78 Nwt @ 65.27 msec
Min = -15800.30 Nwt @ 88.68 msec



DATA IS NOT ACCURATE

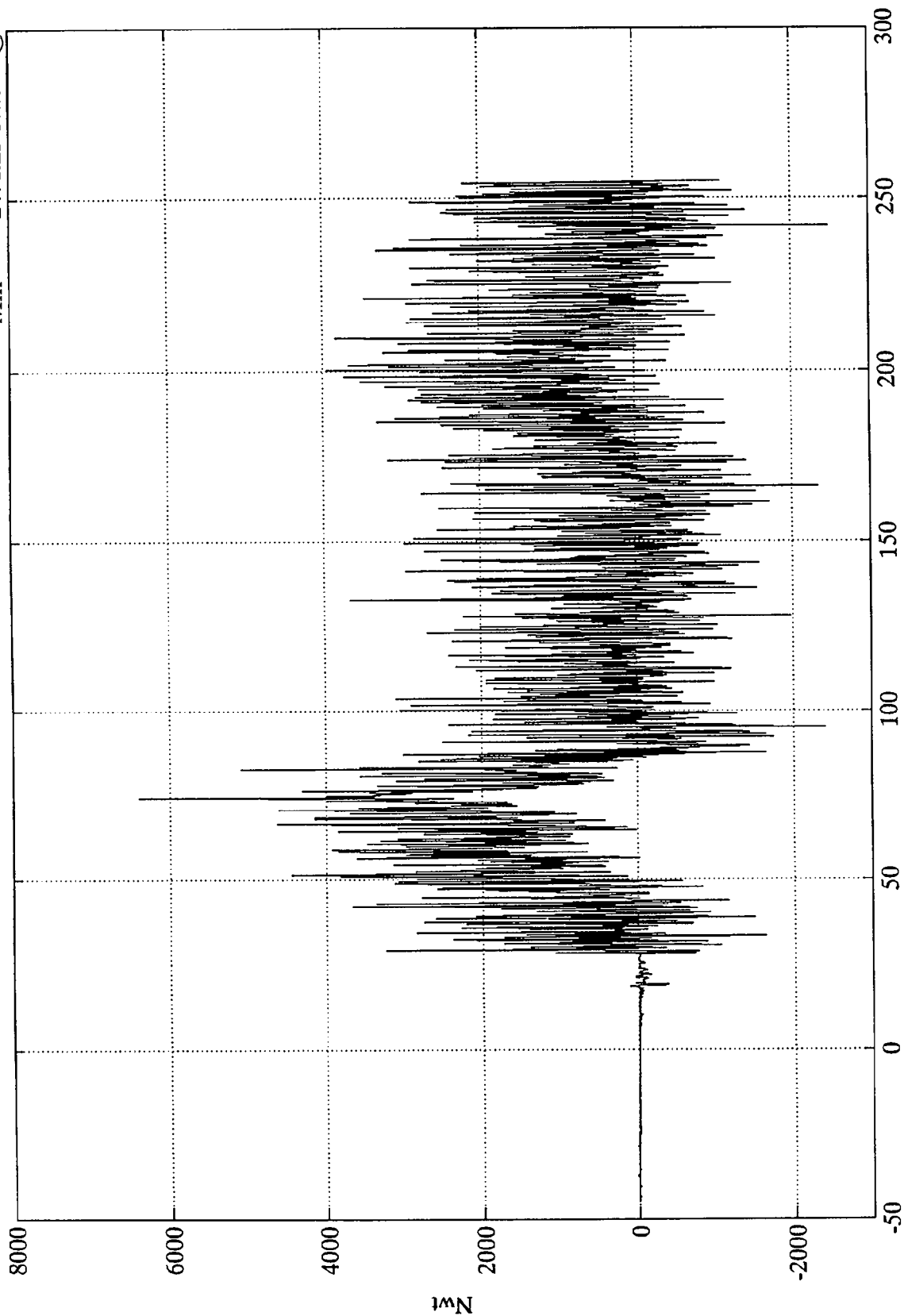
Time (msec)

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Upper Neck Fz

Max = 6391.83 Nwt @ 74.27 msec
Min = -2476.25 Nwt @ 241.92 msec



Time (msec)

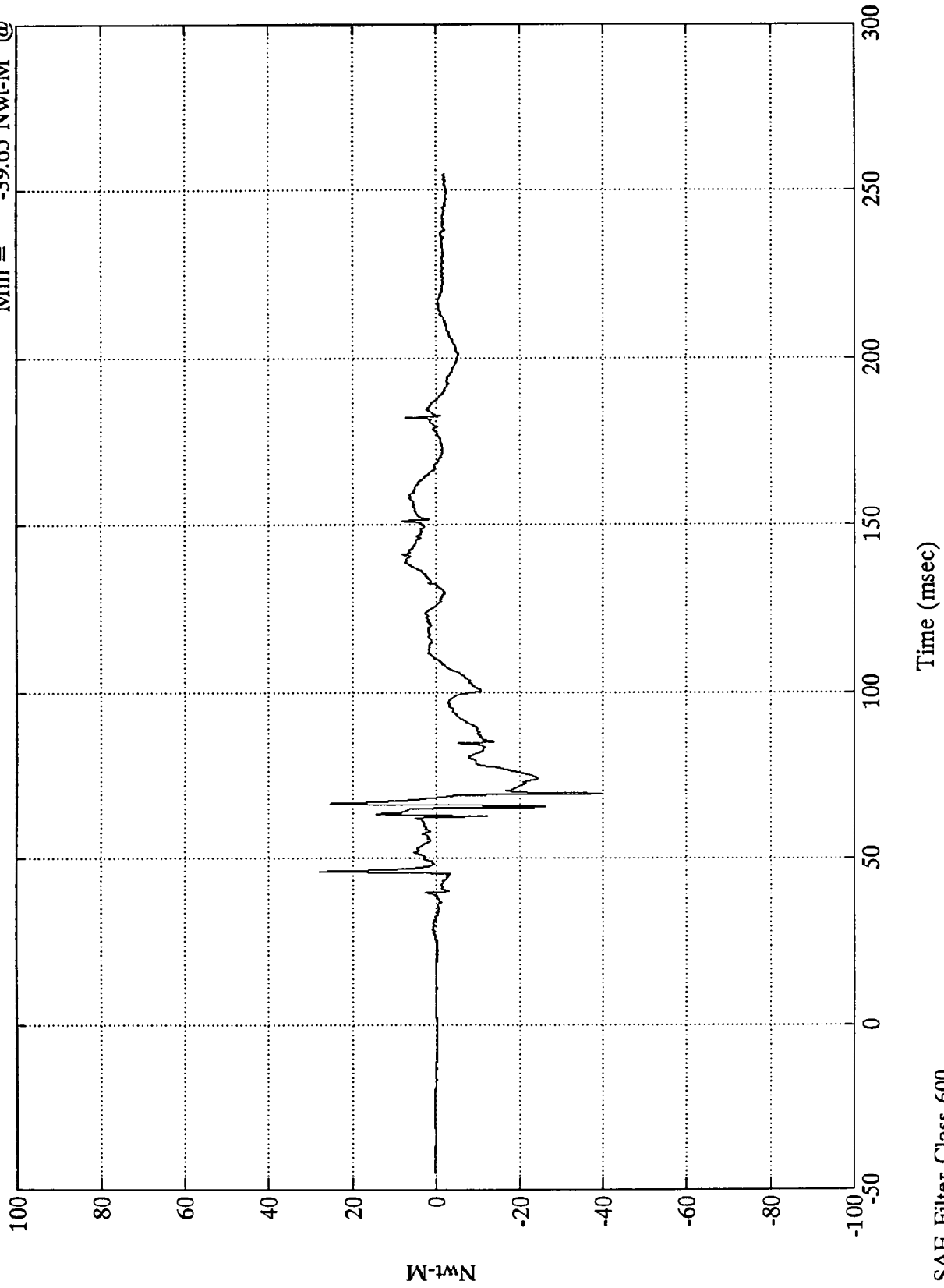
SAE Filter Class 1000

DATA IS NOT ACCURATE

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Upper Neck Mx

Max = 28.01 Nwt-M @ 46.20 msec
Min = -39.65 Nwt-M @ 69.24 msec



B-85

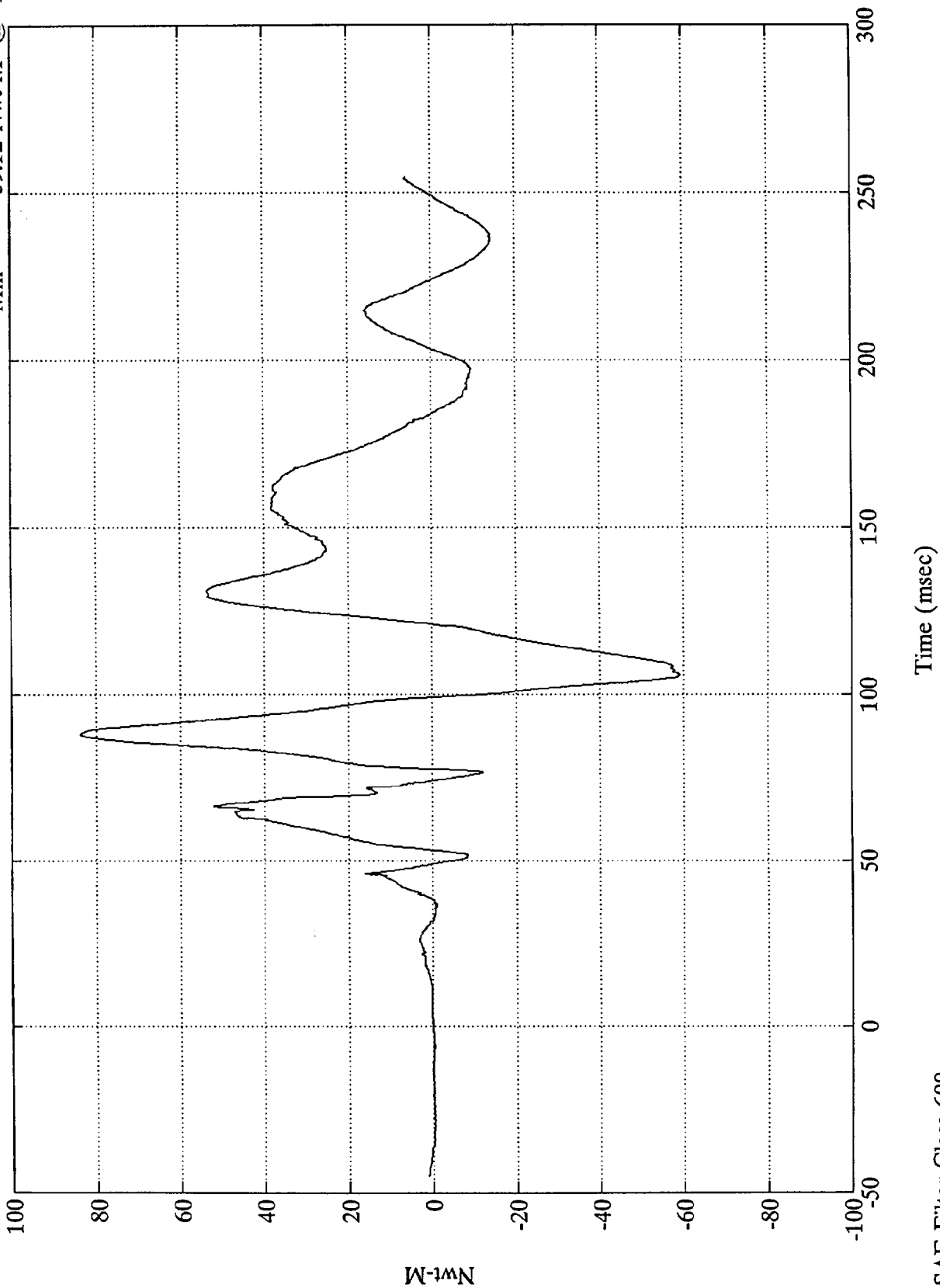
8120-3

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Upper Neck My

Max = 83.63 Nwt-M @ 87.83 msec
Min = -59.12 Nwt-M @ 106.08 msec



B-86
Nwt-M

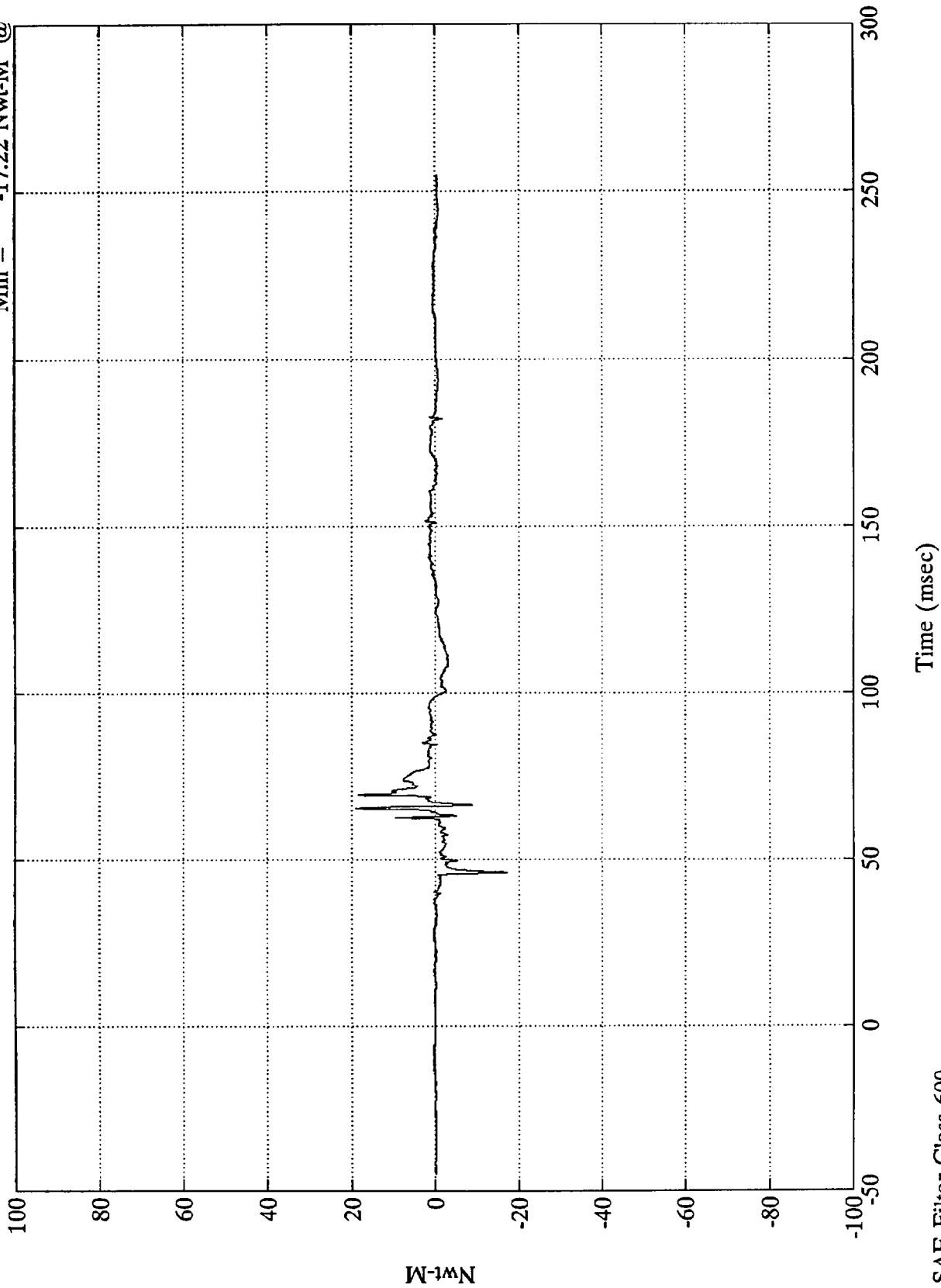
8120-3

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Upper Neck Mz

Max = 18.94 Nwt-M @ 65.40 msec
Min = -17.22 Nwt-M @ 46.20 msec



B-87
Nwt-M

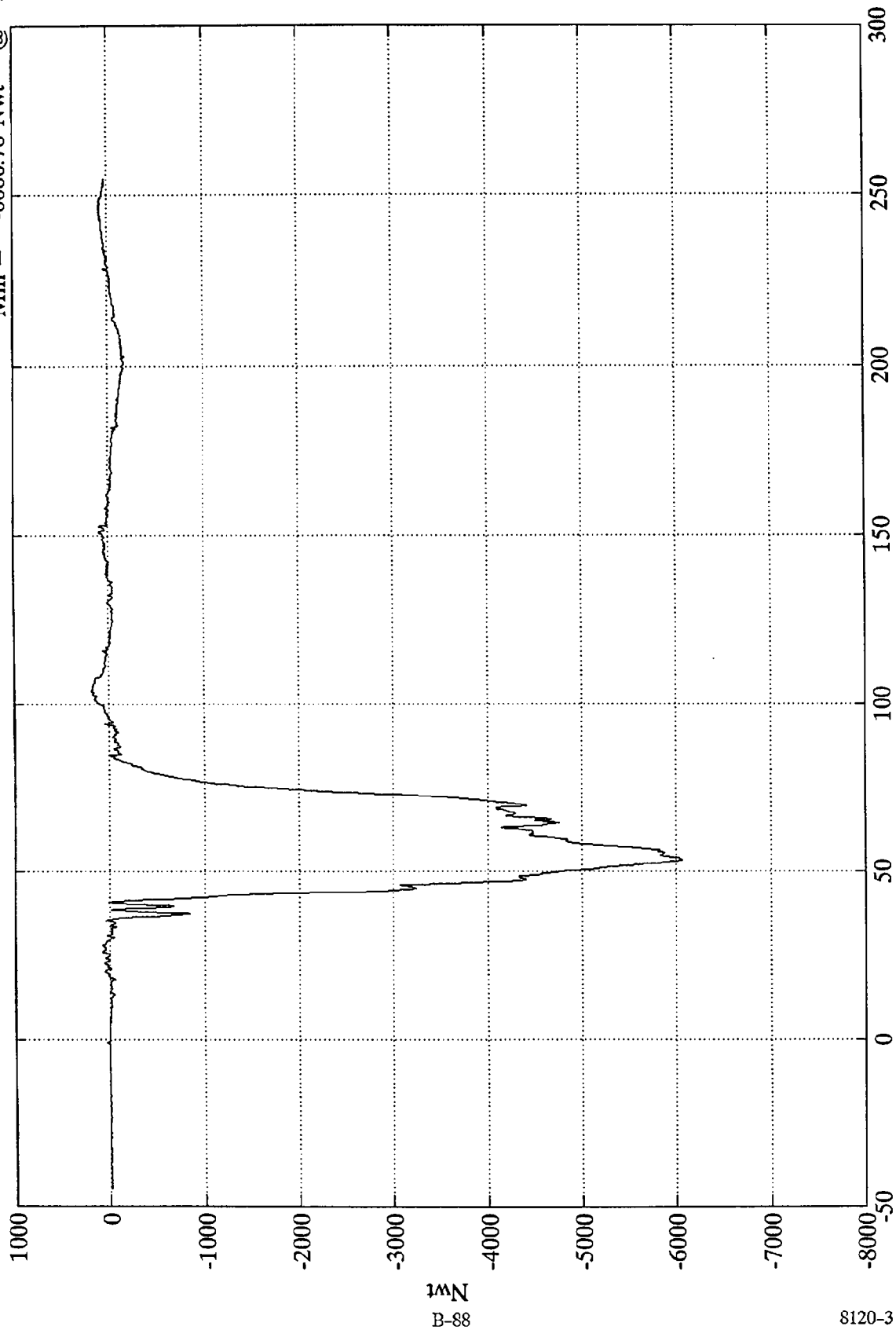
8120-3

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Left Femur

Max = 187.03 Nwt @ 103.92 msec
Min = -6060.76 Nwt @ 53.27 msec



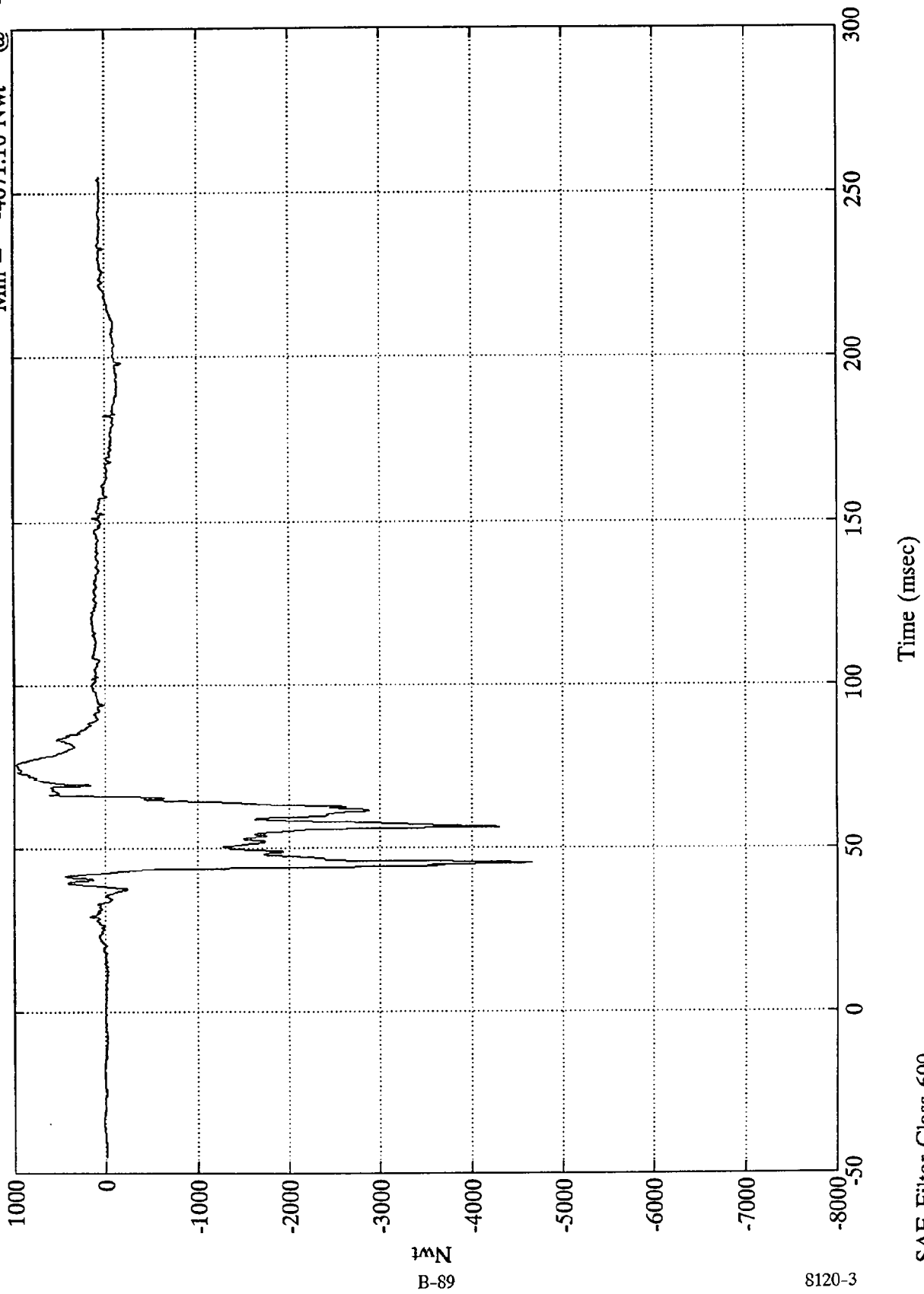
Time (msec)

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Right Femur

Max = 979.85 Nwt @ 75.84 msec
Min = -4671.10 Nwt @ 45.36 msec



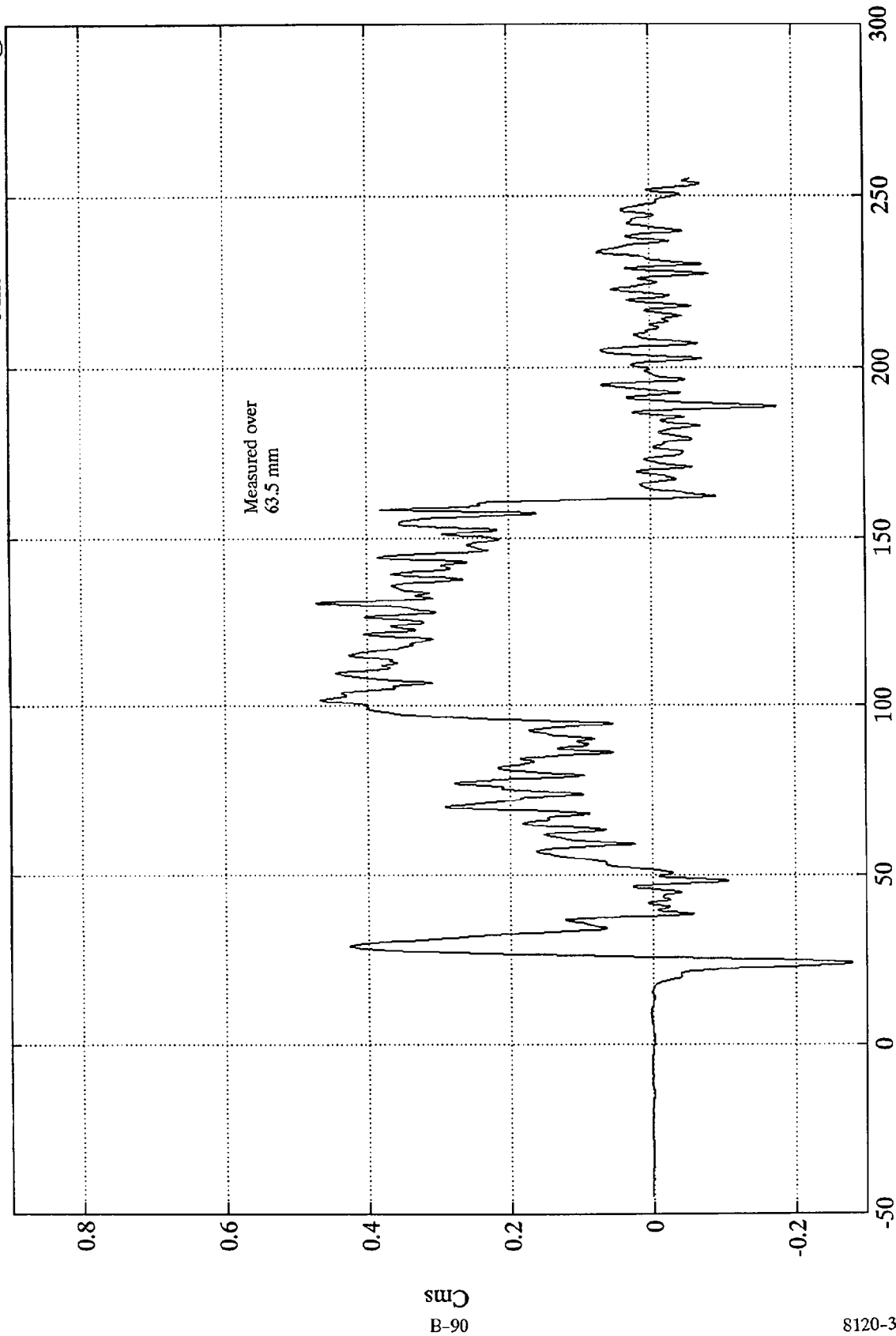
B-89

8120-3

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Belt Elongation

Max = .47 Cms @ 131.04 msec
Min = -.28 Cms @ 23.87 msec

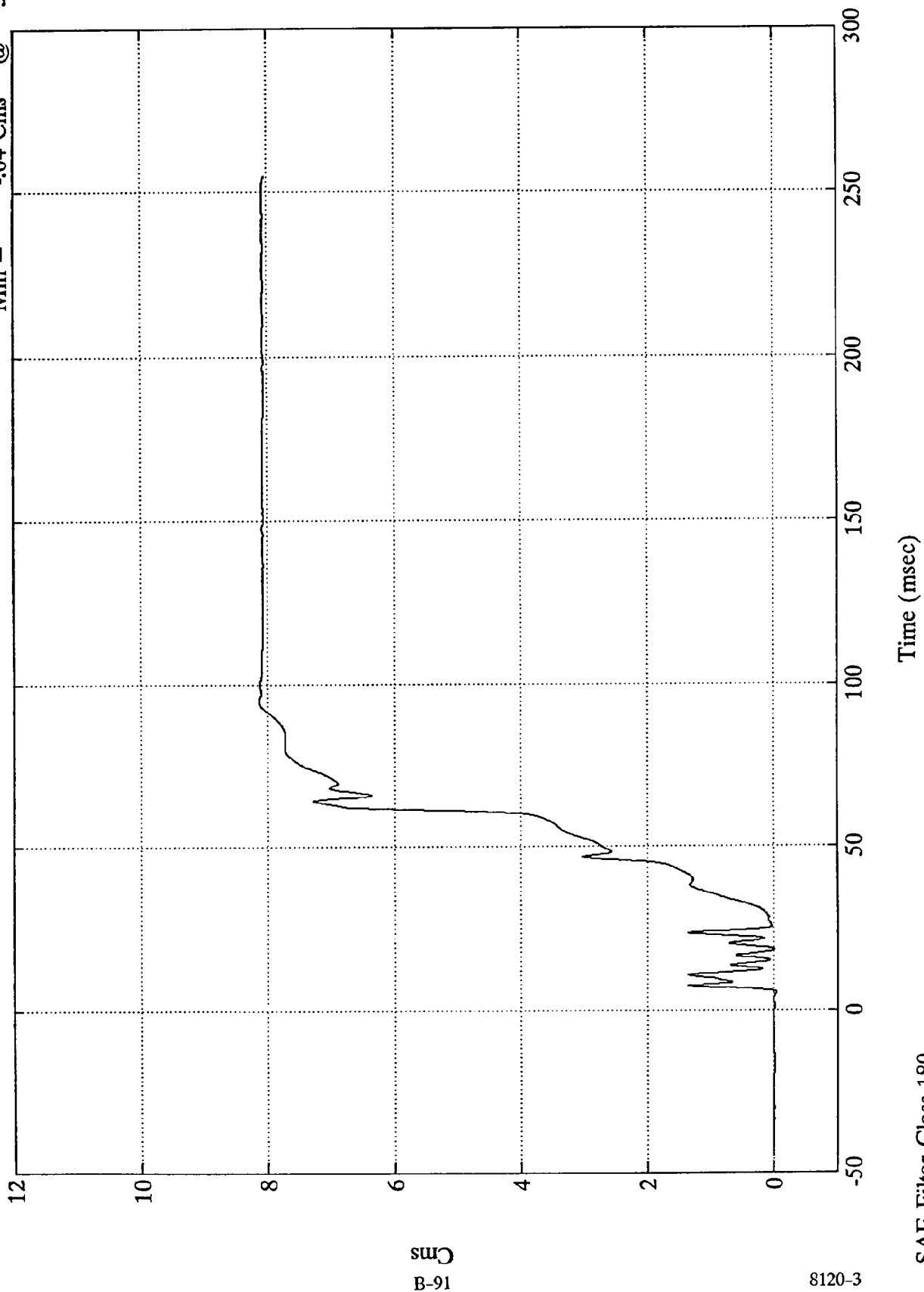


Time (msec)

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN
Pos. 1 Belt Spool Out

Max = 8.14 Cms @ 94.68 msec
Min = -0.04 Cms @ 5.39 msec



SAE Filter Class 180

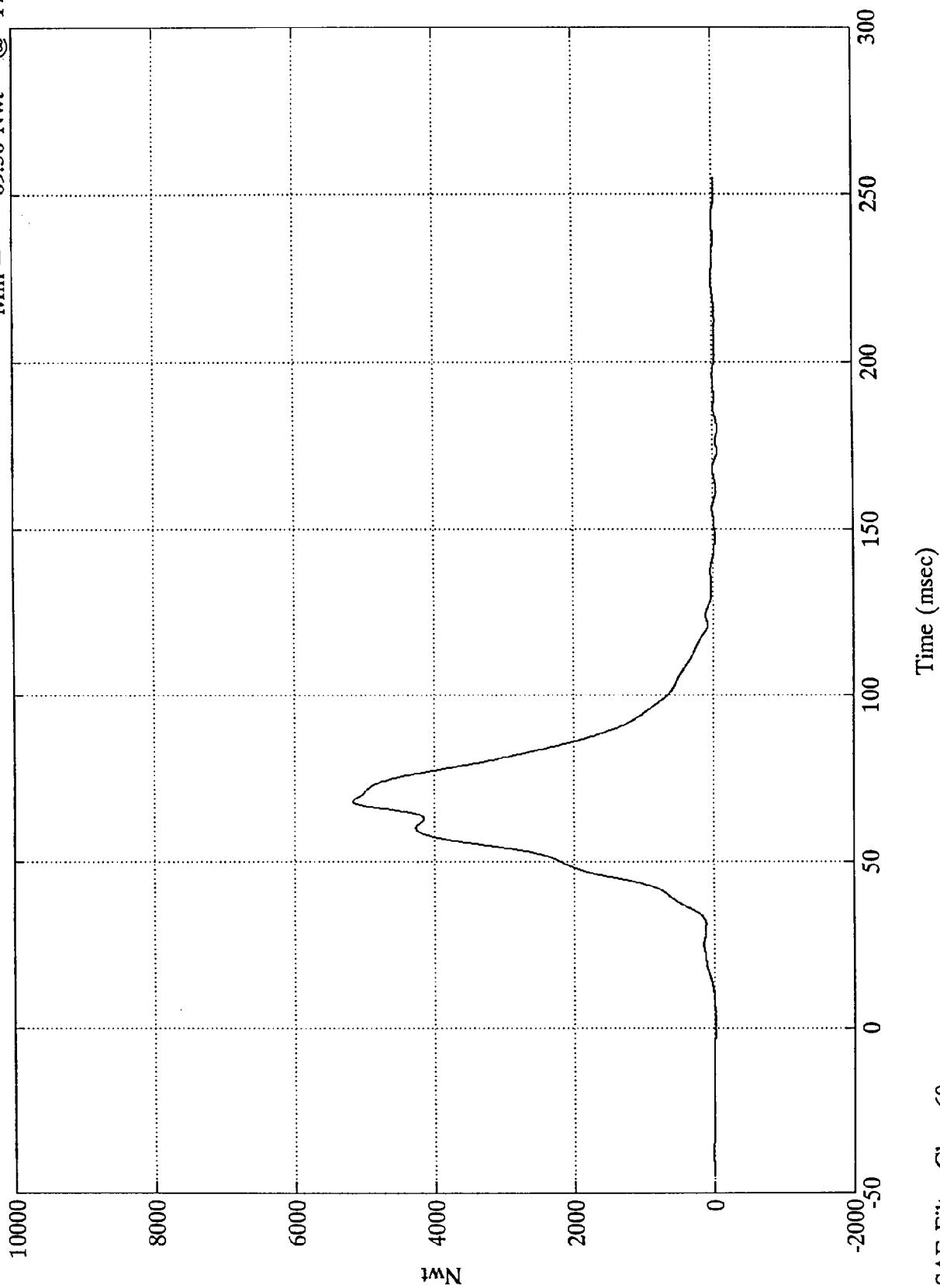
8120-3

16-B
Cms

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Left Belt Load

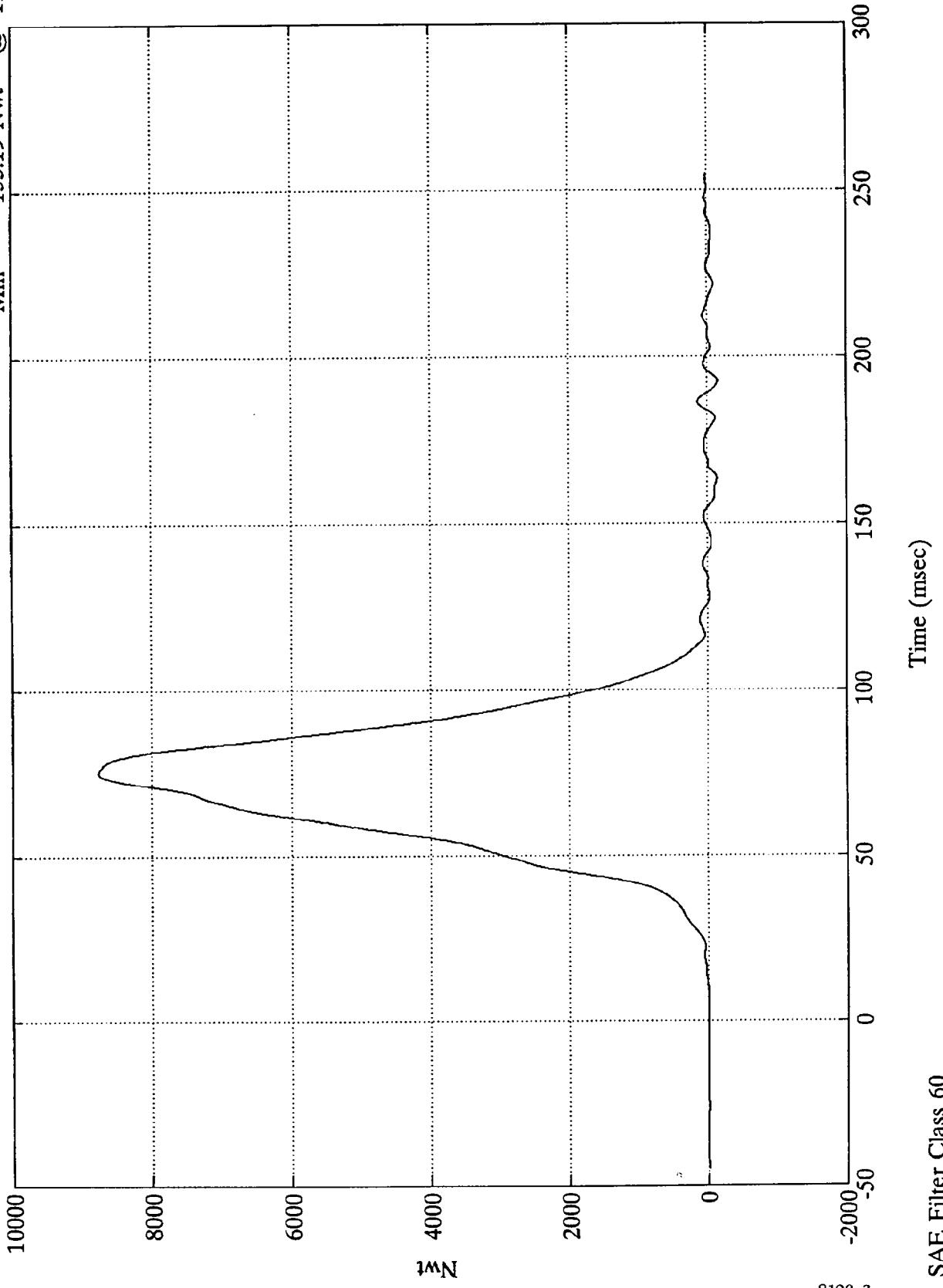
Max = 5169.66 Nwt @ 68.04 msec
Min = -69.30 Nwt @ 173.27 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 1 Torso Belt Load

Max = 8764.77 Nwt @ 75.12 msec
Min = -153.19 Nwt @ 192.72 msec



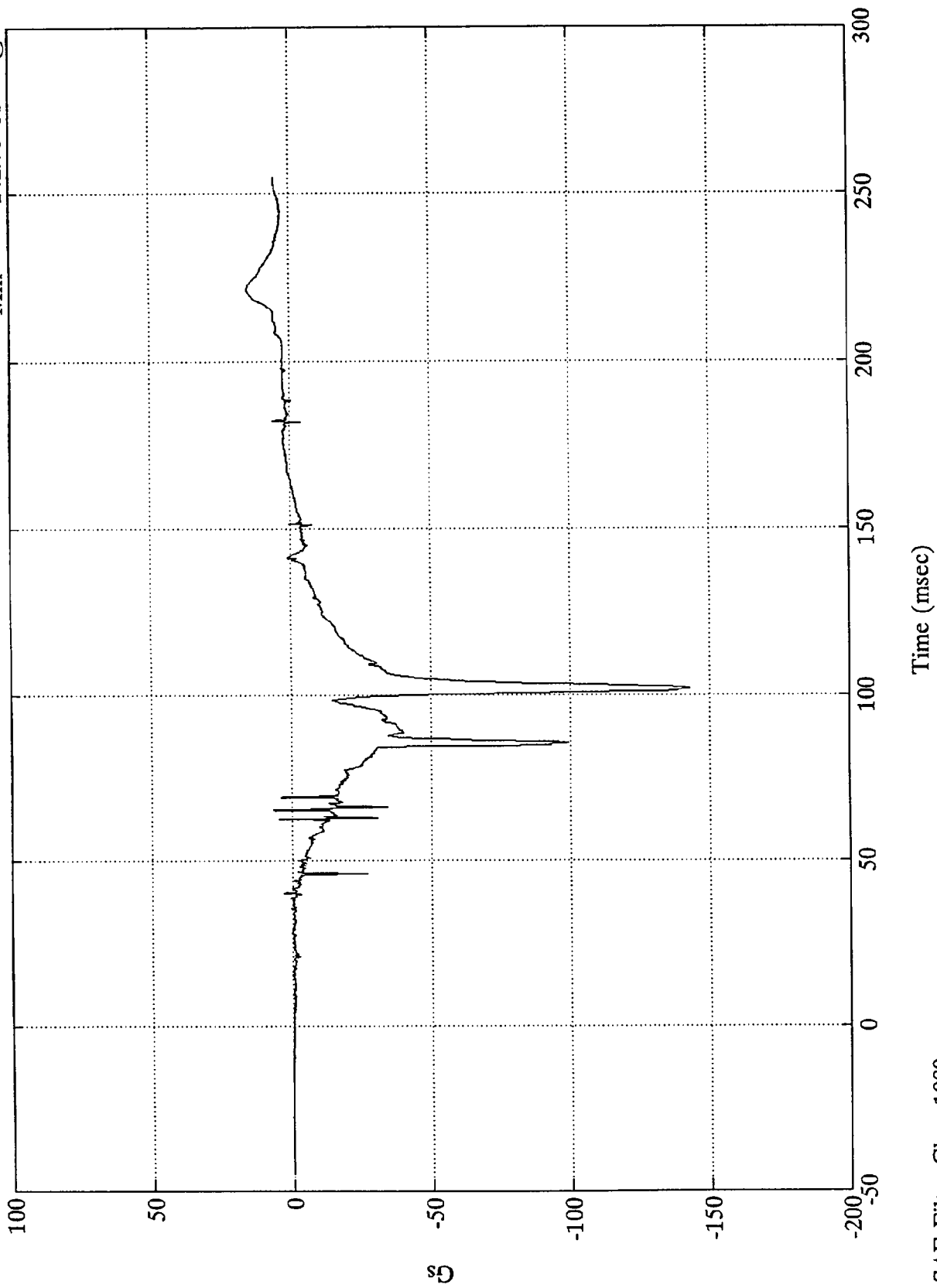
B-93

8120-3

SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

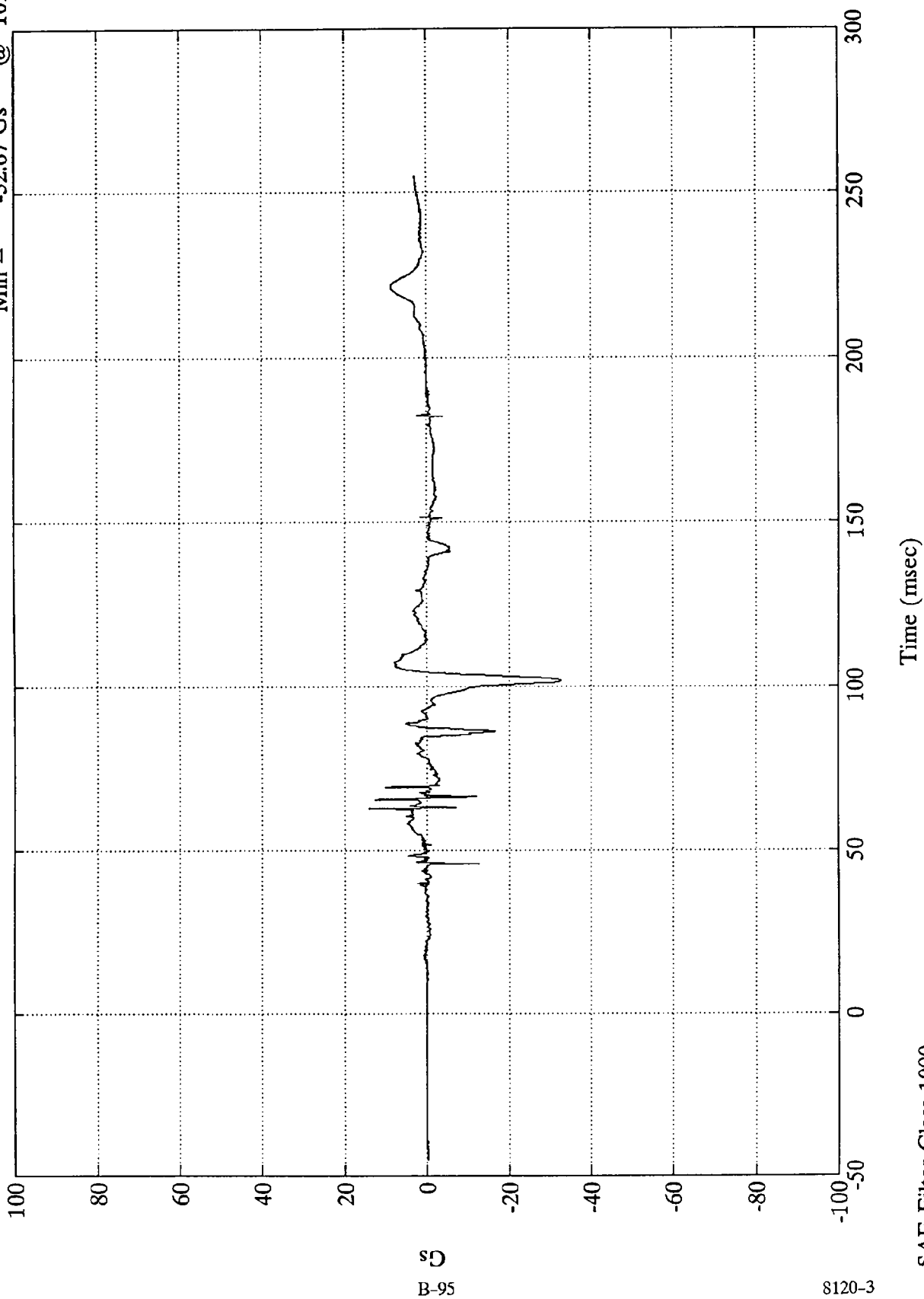
Pos. 2 Head X
Max = 15.18 Gs @ 221.88 msec
Min = -142.70 Gs @ 102.12 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Head Y

Max = 14.02 Gs @ 62.51 msec
Min = -32.67 Gs @ 101.76 msec



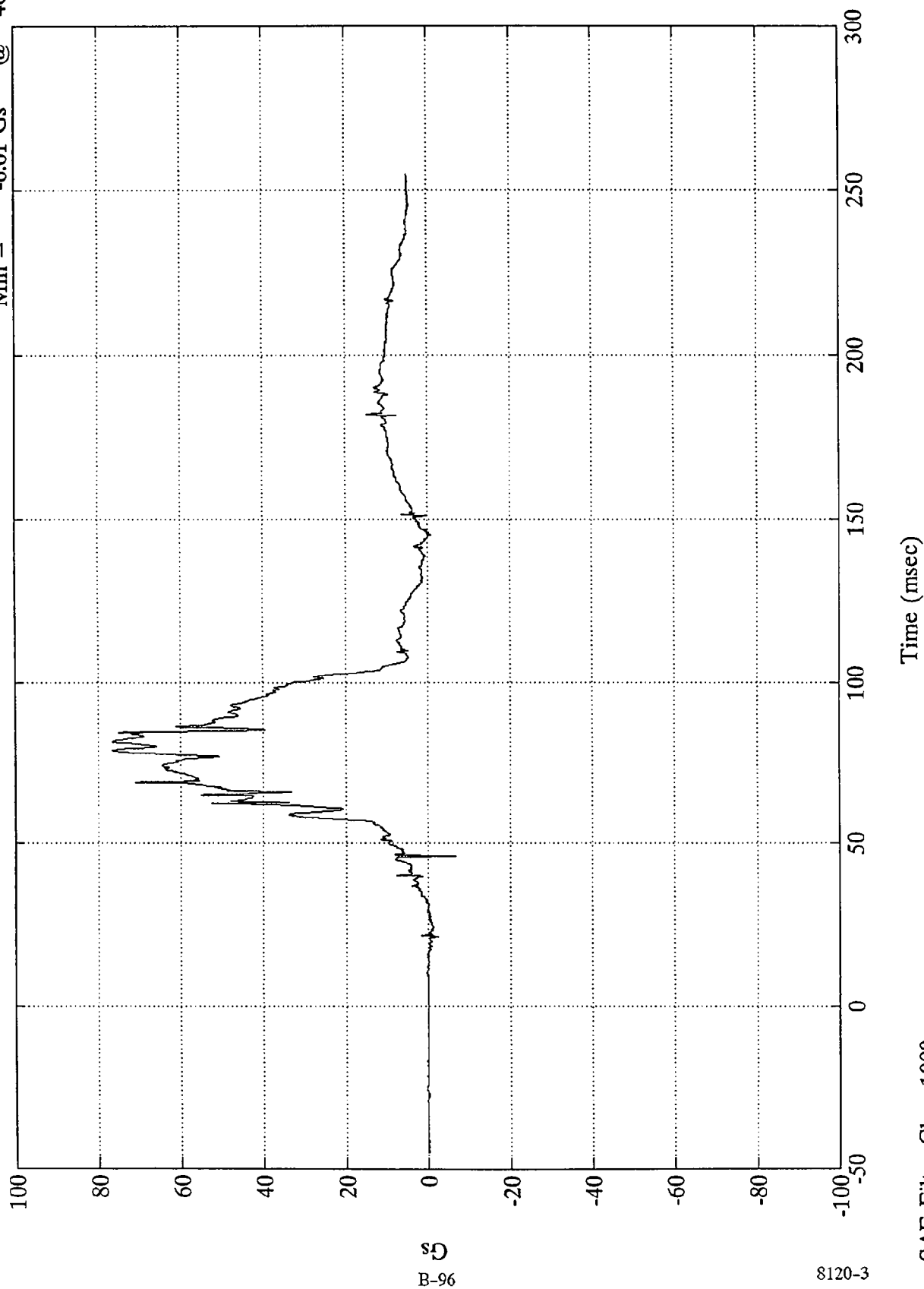
B-95

8120-3

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Head Z
Max = 76.65 Gs @ 79.08 msec
Min = -6.61 Gs @ 46.08 msec



B-96

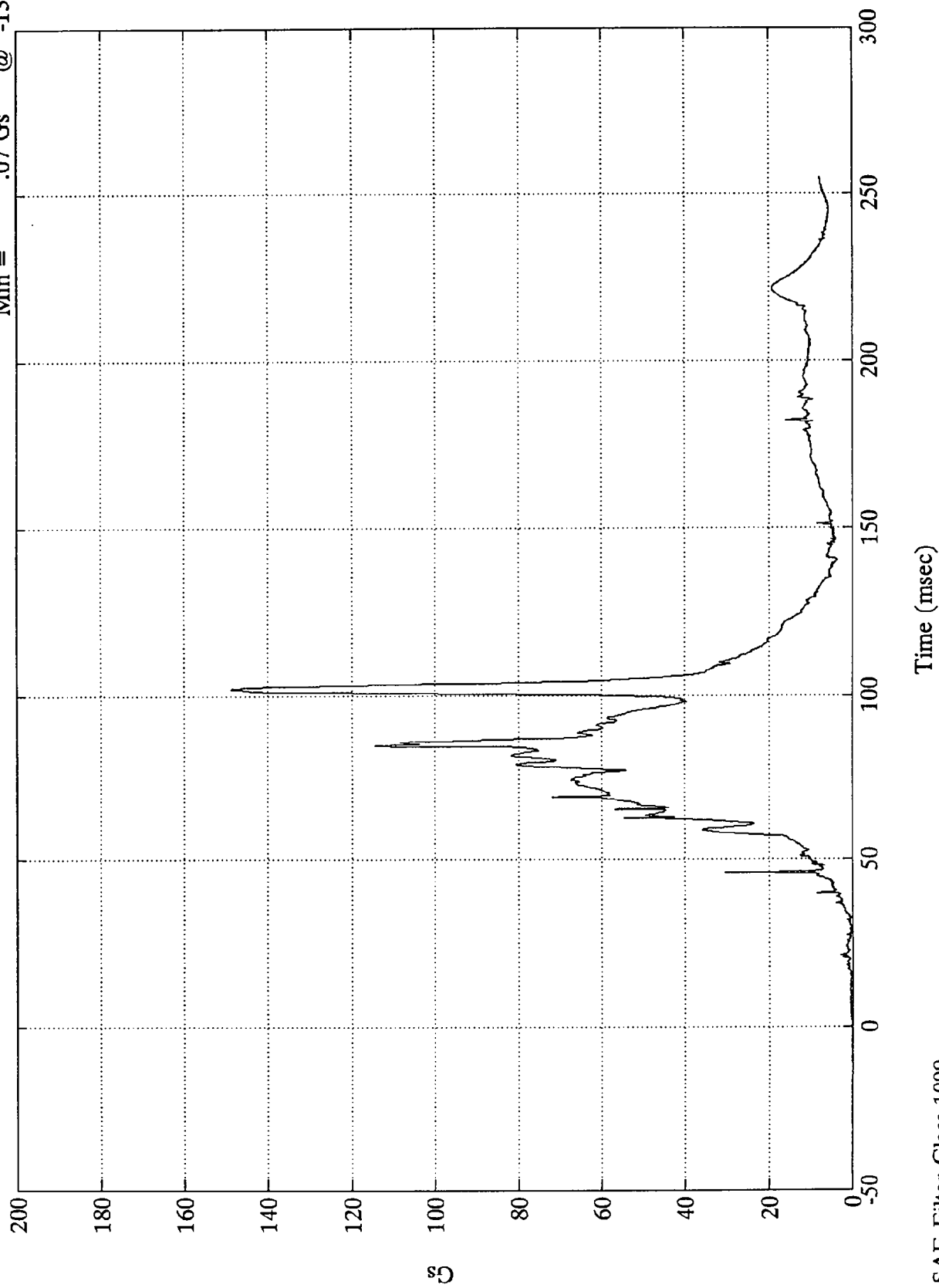
8120-3

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Head Resultant

Max = 148.70 Gs @ 102.00 msec
Min = .07 Gs @ -13.08 msec



B-97

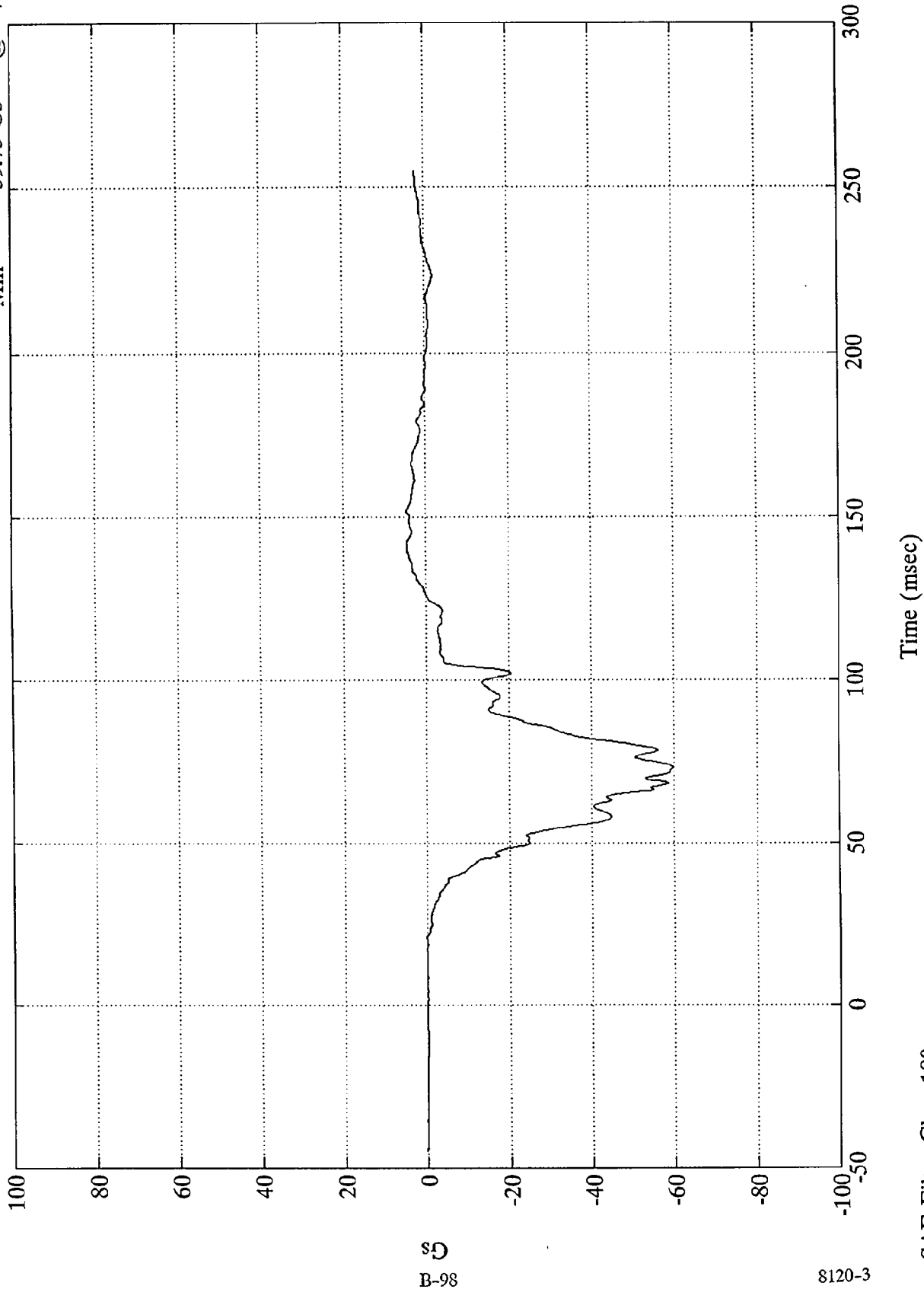
8120-3

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Max = 4.78 Gs @ 151.68 msec
Min = -59.73 Gs @ 73.31 msec

Pos. 2 Chest X



B-98

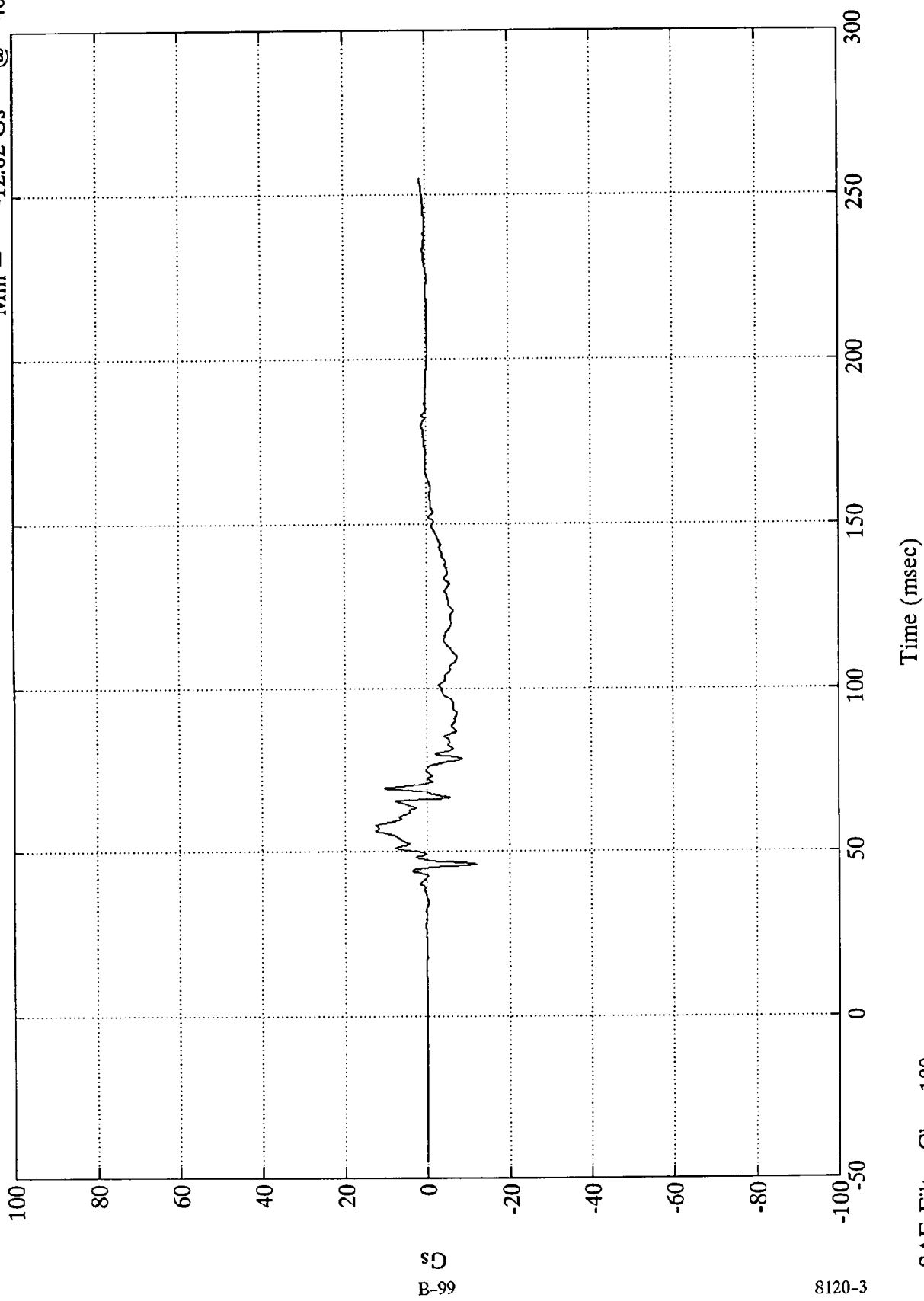
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Chest Y

Max = 12.53 Gs @ 57.84 msec
Min = -12.02 Gs @ 46.20 msec



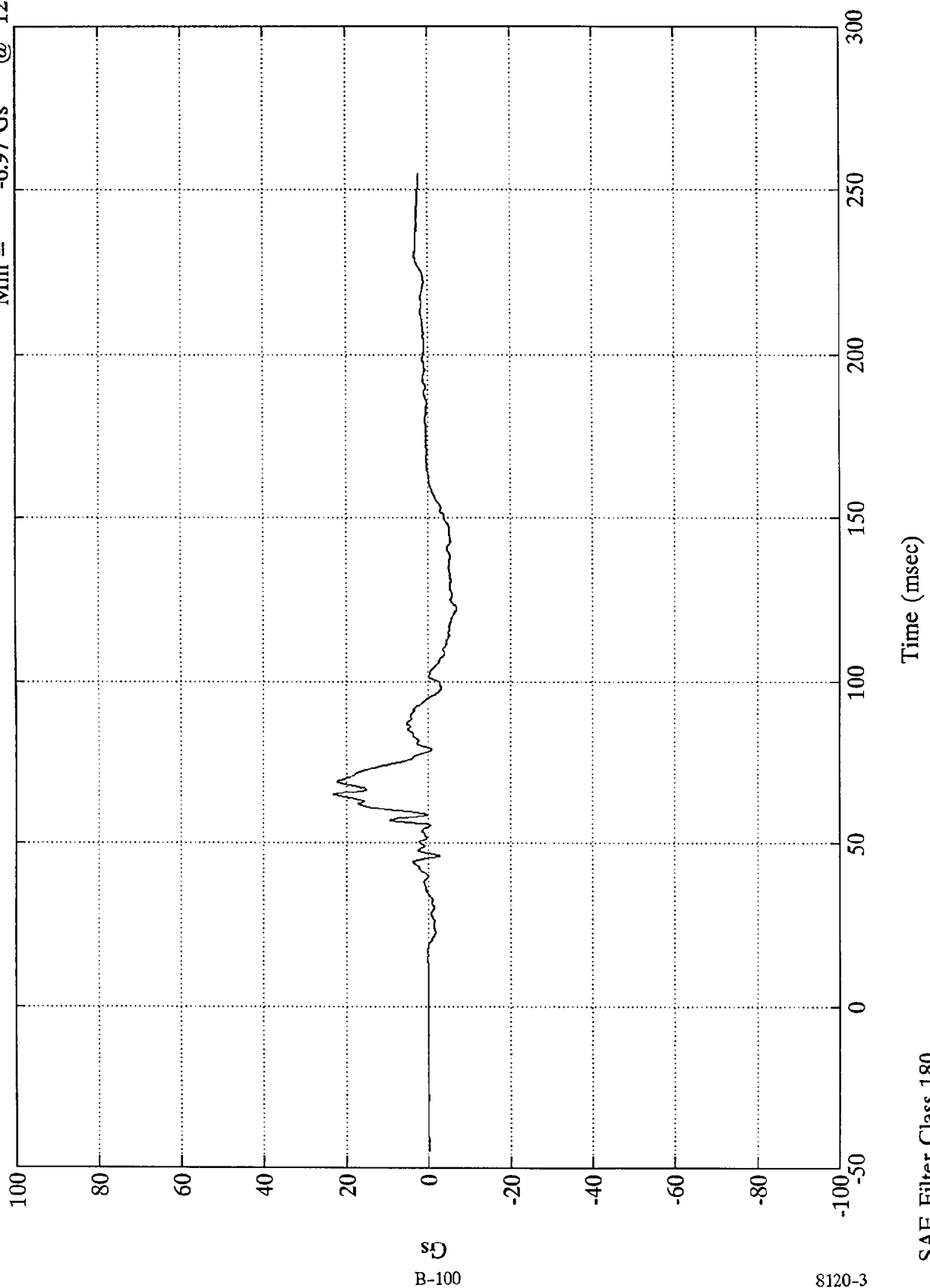
B-99

8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Chest Z
Max = 23.03 Gs @ 65.15 msec
Min = -6.97 Gs @ 122.16 msec



B-100

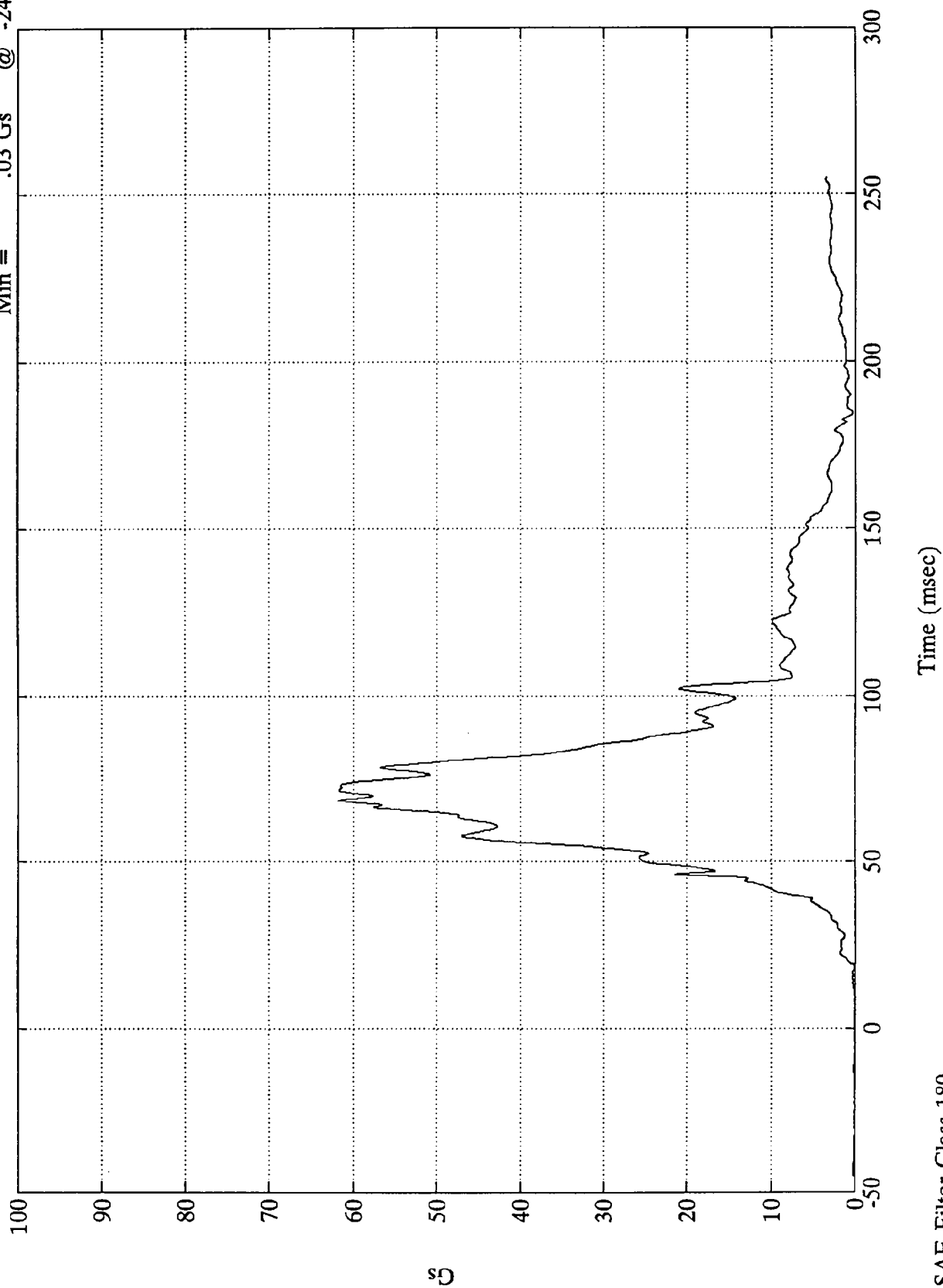
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Chest Resultant

Max = 61.78 Gs @ 68.40 msec
Min = .03 Gs @ -24.24 msec



B-101

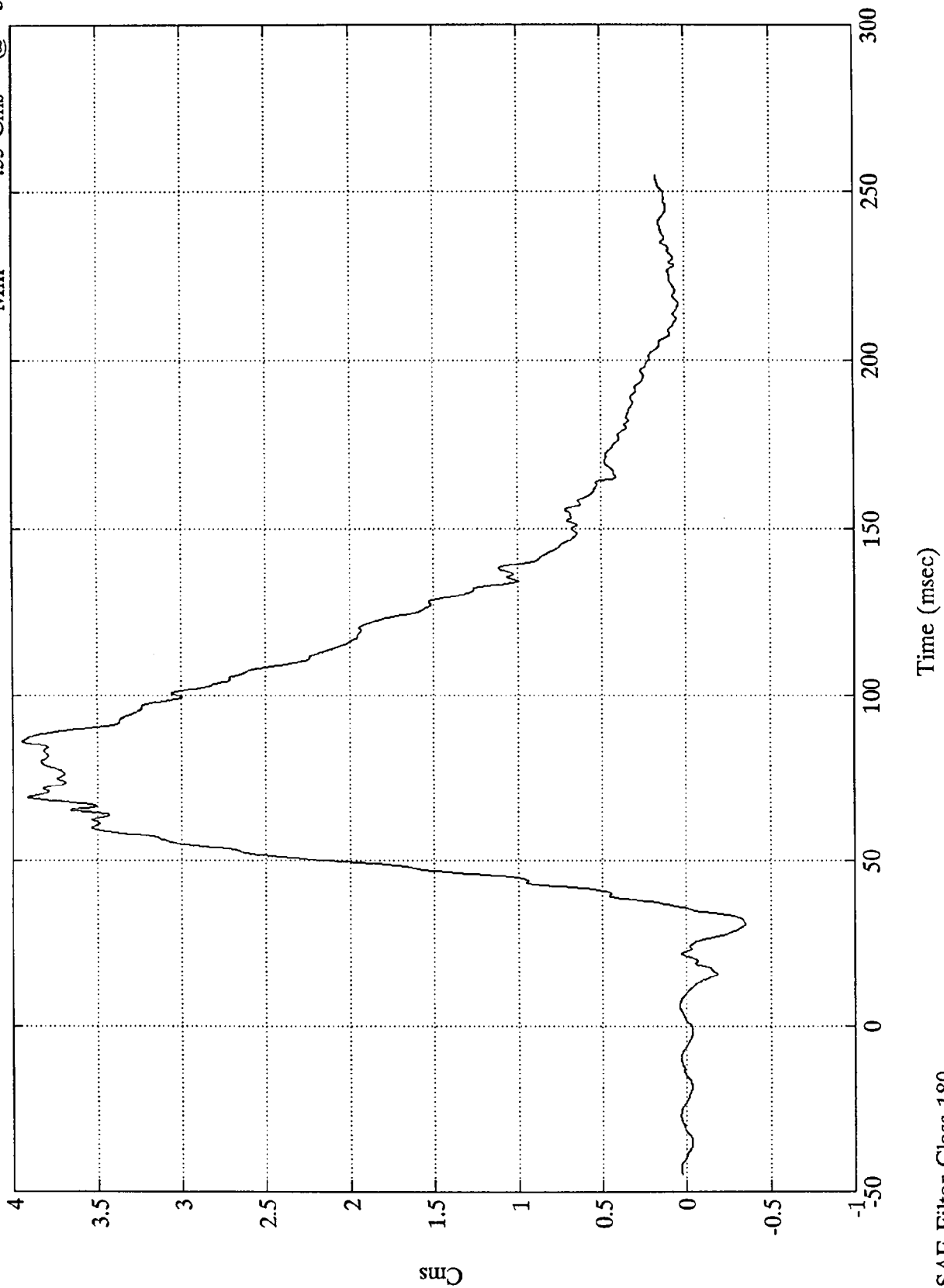
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Chest Disp.

Max = 3.94 Cms @ 86.16 msec
Min = -.35 Cms @ 30.71 msec



B-102

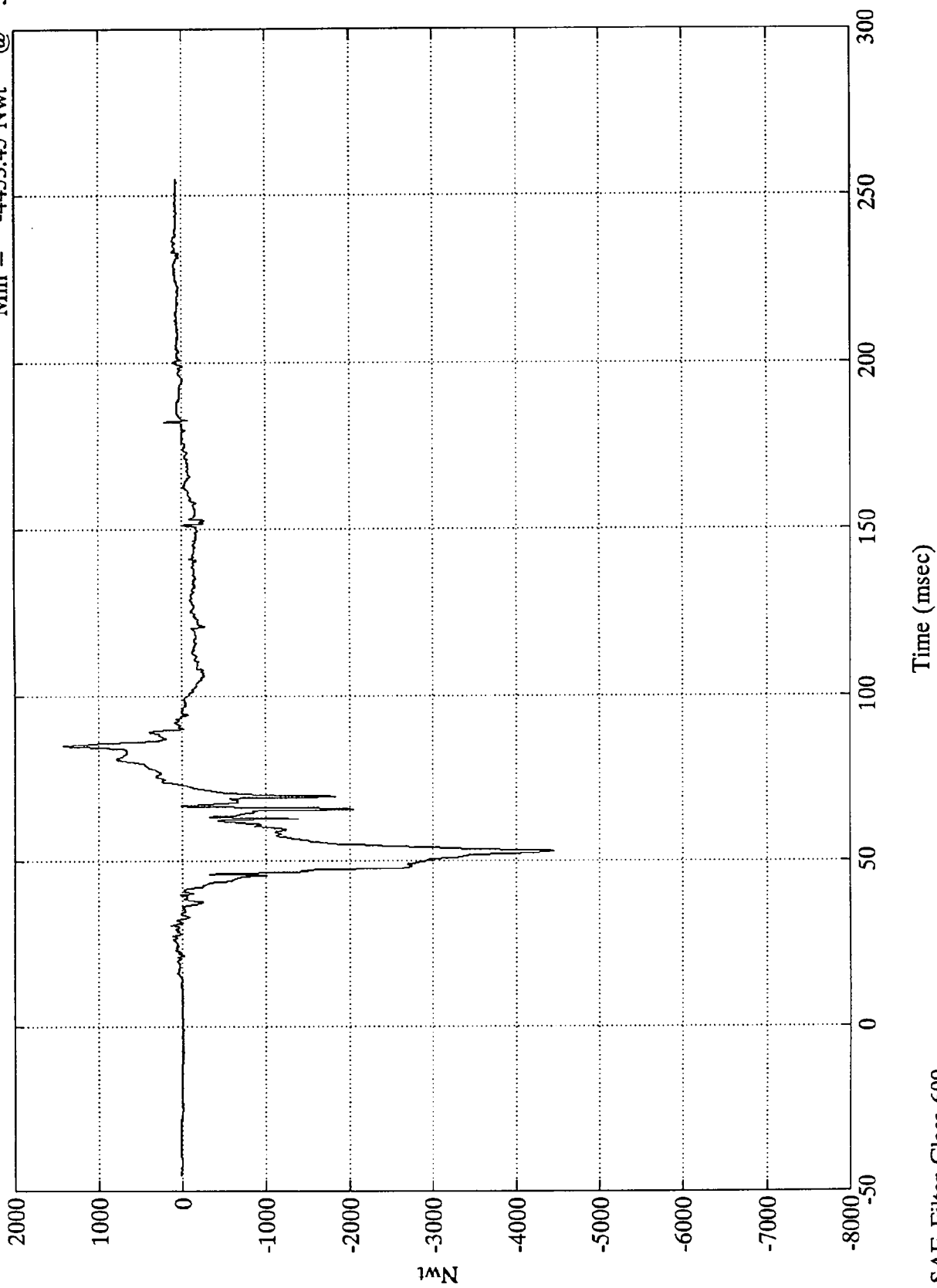
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Left Femur

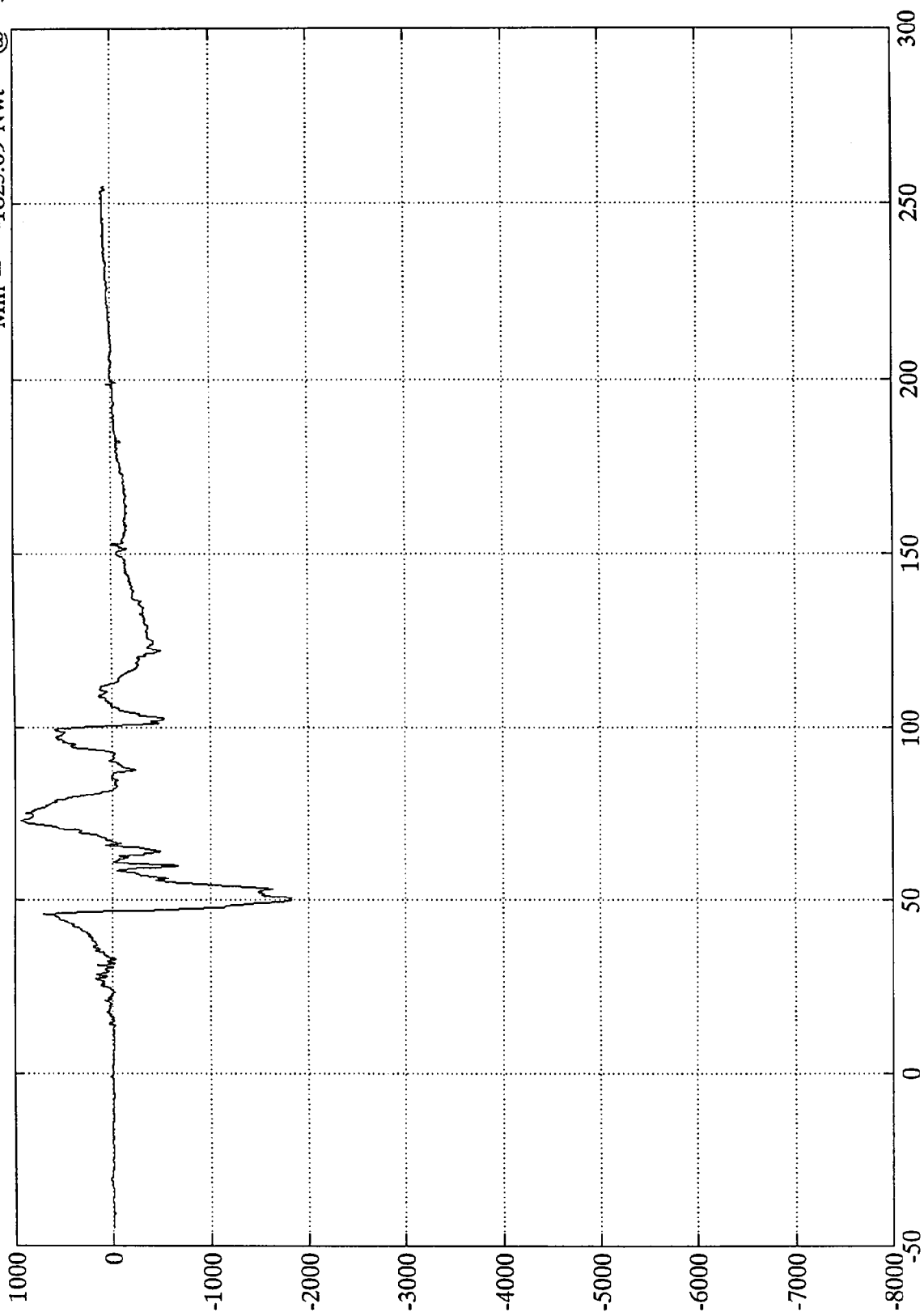
Max = 1419.12 Nwt @ 84.59 msec
Min = -4453.45 Nwt @ 52.92 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Right Femur

Max = 941.38 Nwt @ 73.08 msec
Min = -1825.09 Nwt @ 50.52 msec



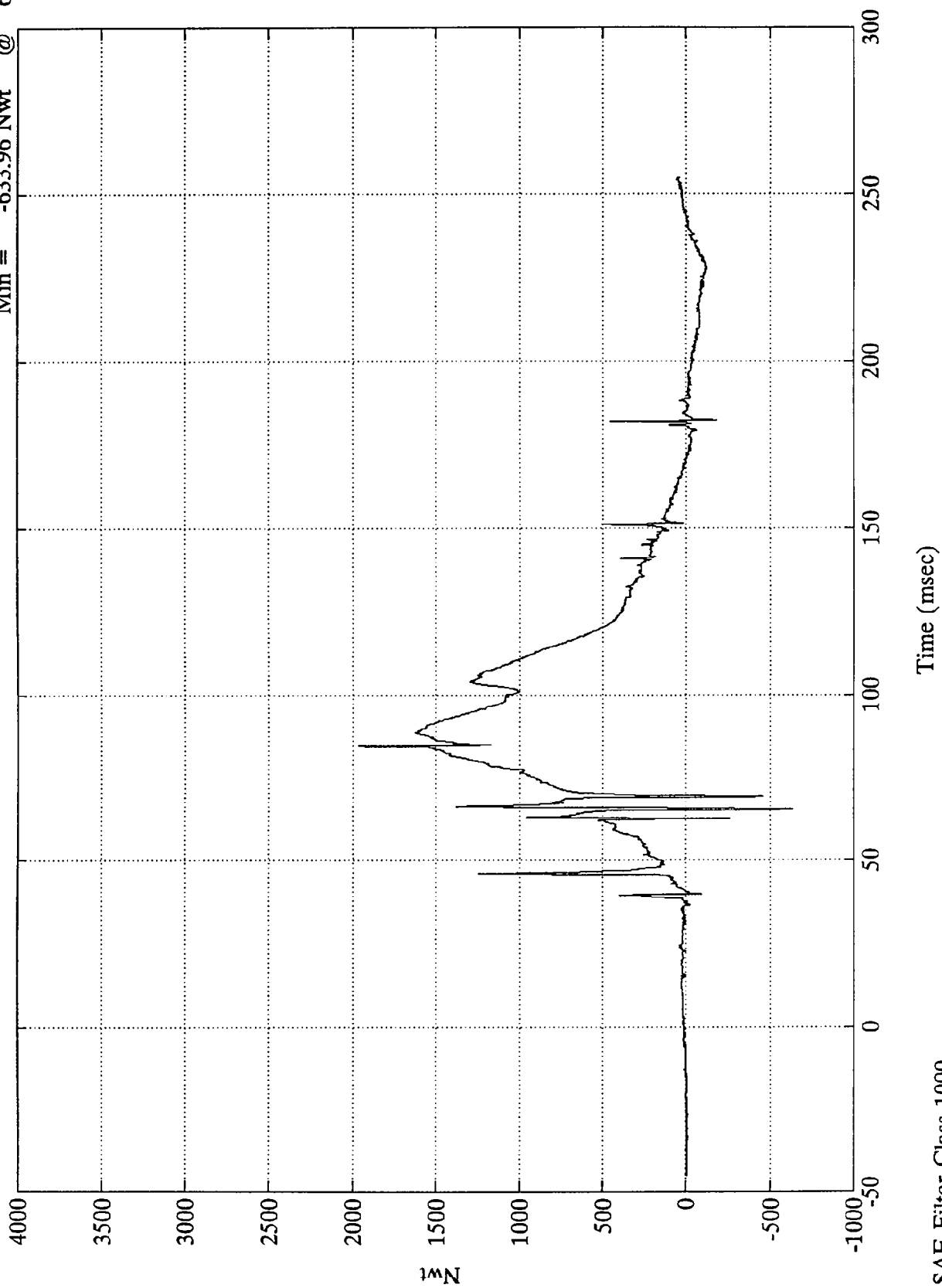
Time (msec)

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Upper Neck Fx

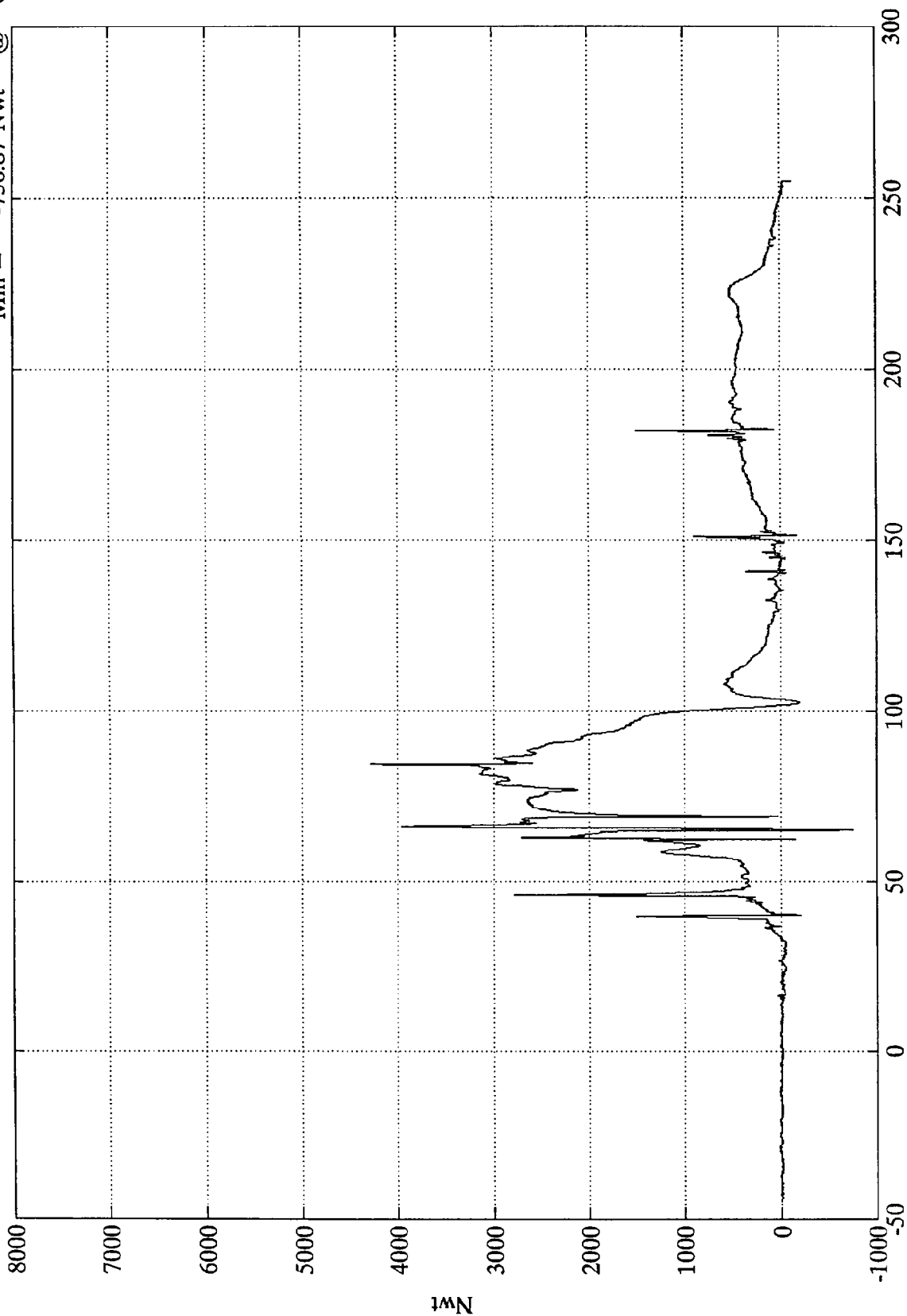
Max = 1965.62 Nwt @ 84.48 msec
Min = -633.96 Nwt @ 65.27 msec



NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Upper Neck Fz

Max = 4282.69 Nwt @ 84.48 msec
Min = -756.87 Nwt @ 65.27 msec



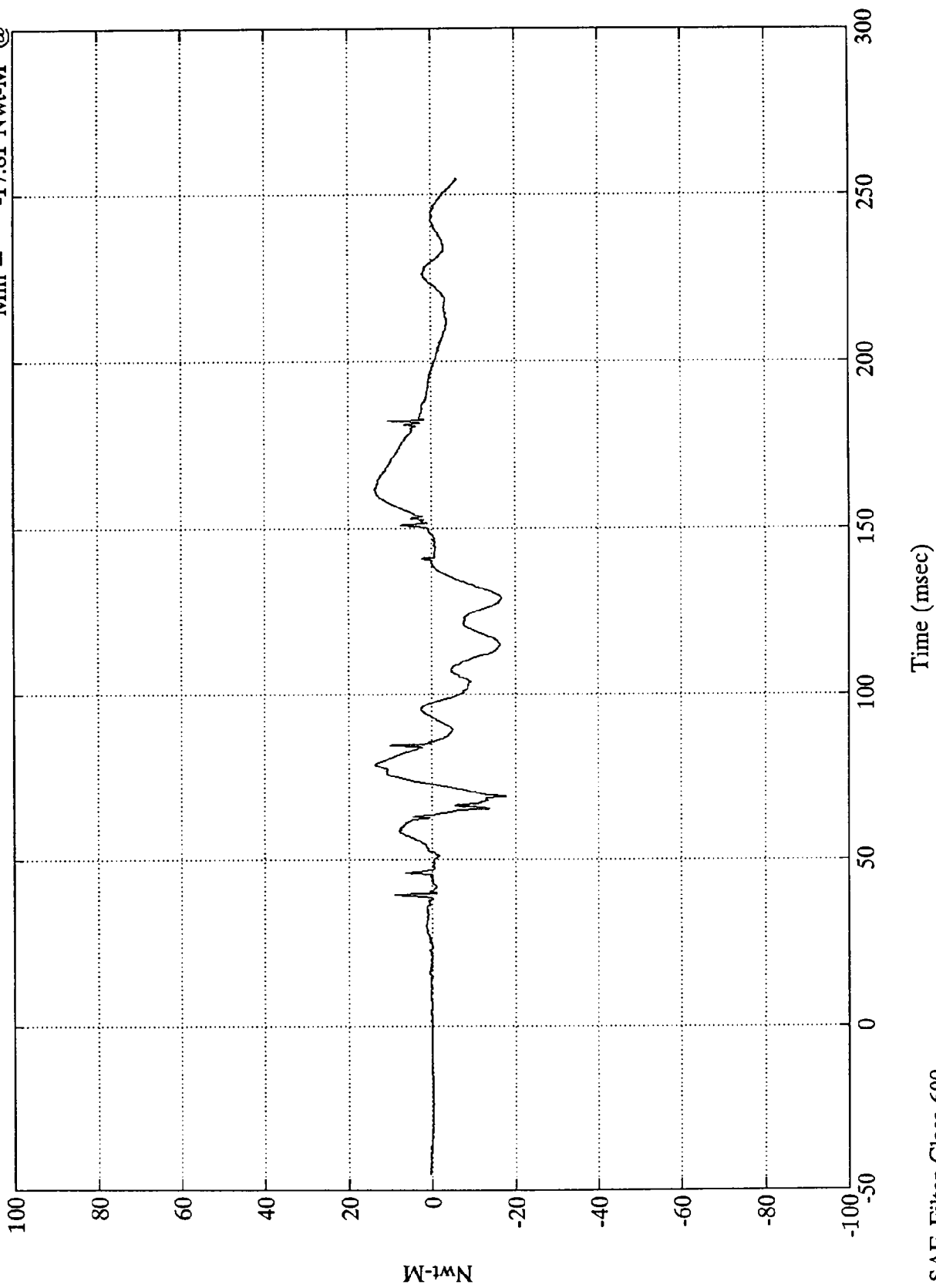
DATA IS NOT ACCURATE

SAE Filter Class 1000

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Upper Neck Mx

Max = 13.58 Nwt-M @ 78.60 msec
 Min = -17.81 Nwt-M @ 69.12 msec



B-107

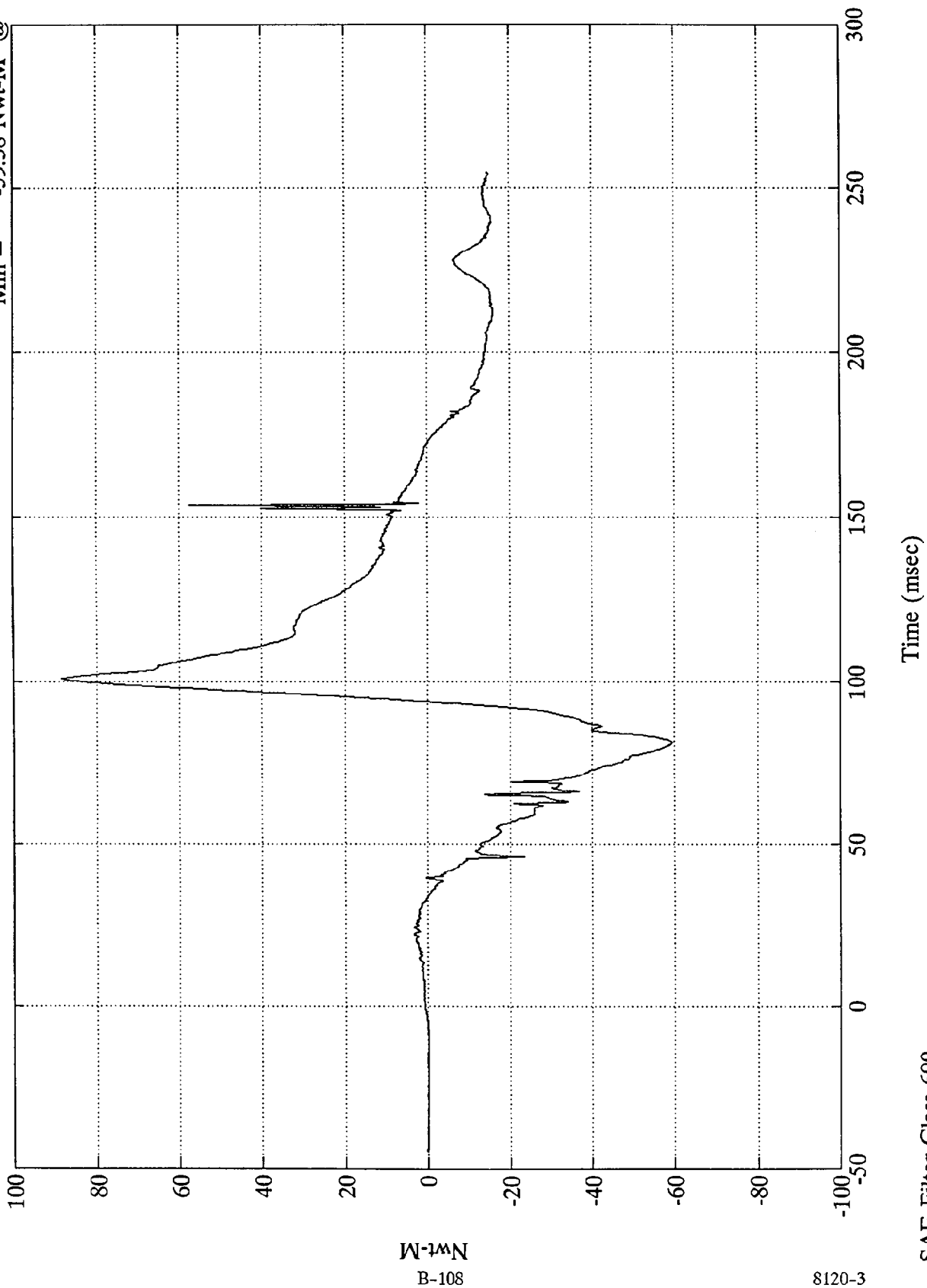
8120-3

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Upper Neck My

Max = 88.37 Nwt-M @ 100.80 msec
Min = -59.38 Nwt-M @ 81.36 msec



B-108
Nwt-M

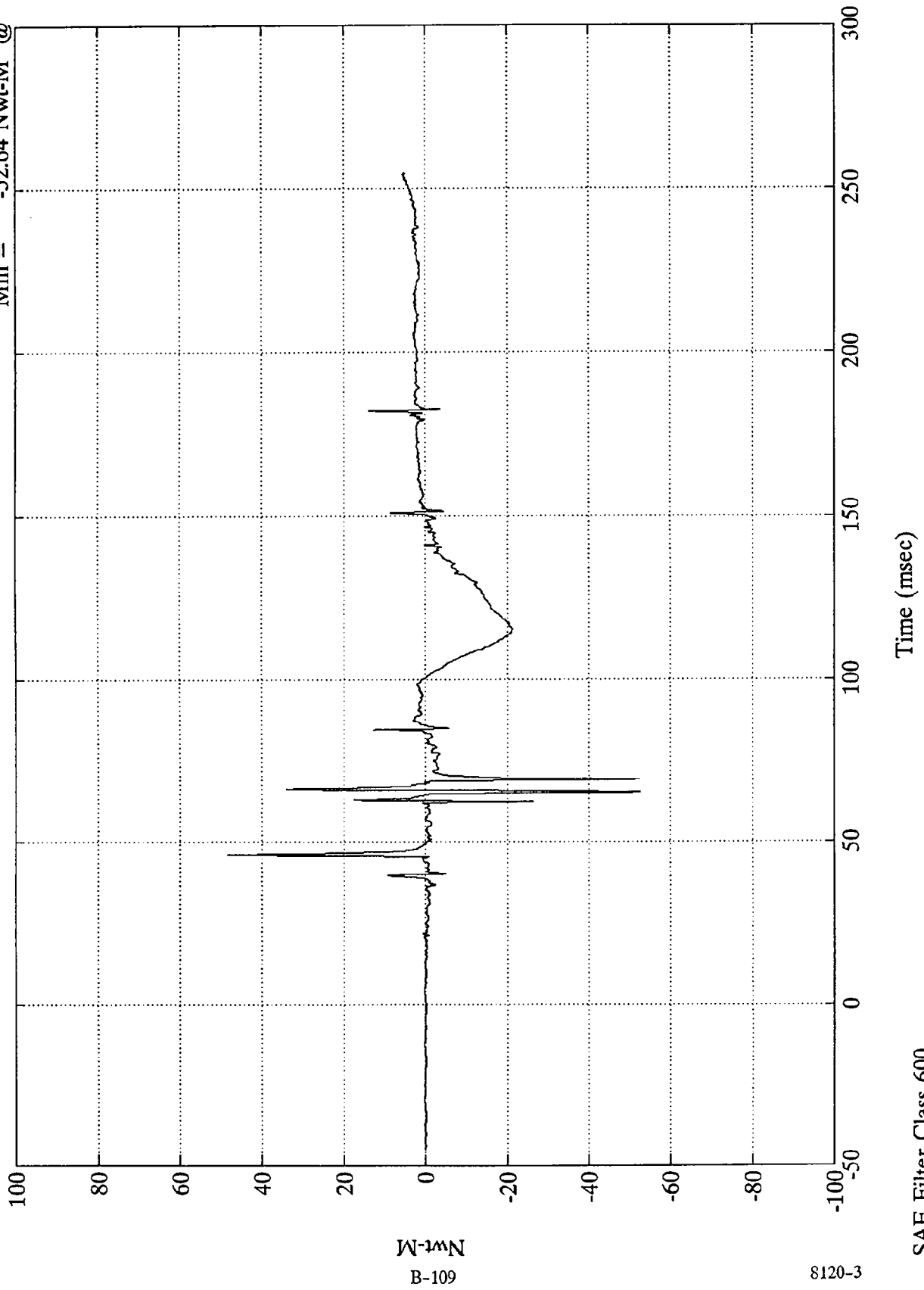
8120-3

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Upper Neck Mz

Max = 48.30 Nwt-M @ 46.08 msec
Min = -52.64 Nwt-M @ 65.27 msec



B-109

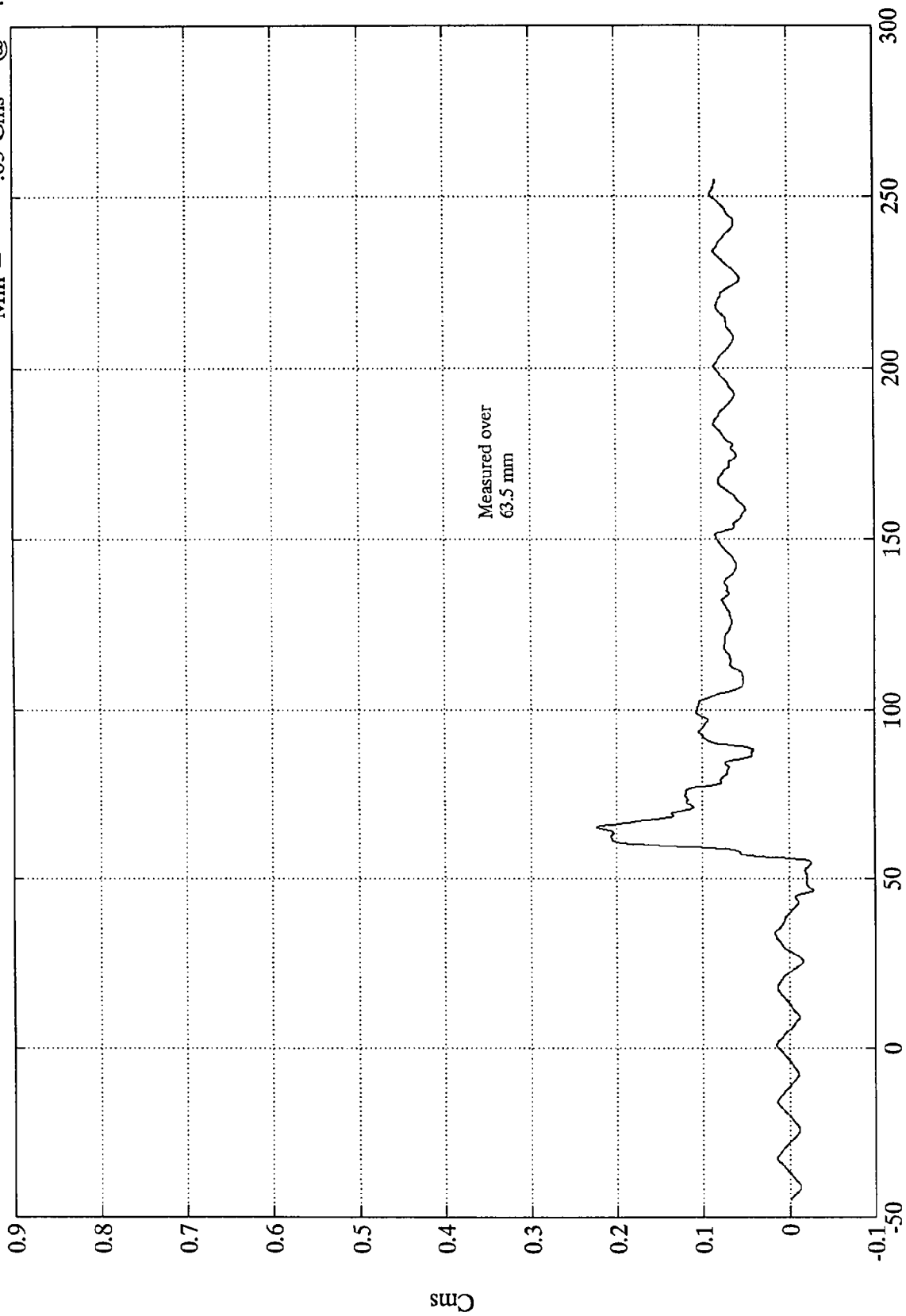
8120-3

SAE Filter Class 600

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Belt Elongation

Max = .22 Cms @ 65.15 msec
Min = -.03 Cms @ 46.44 msec

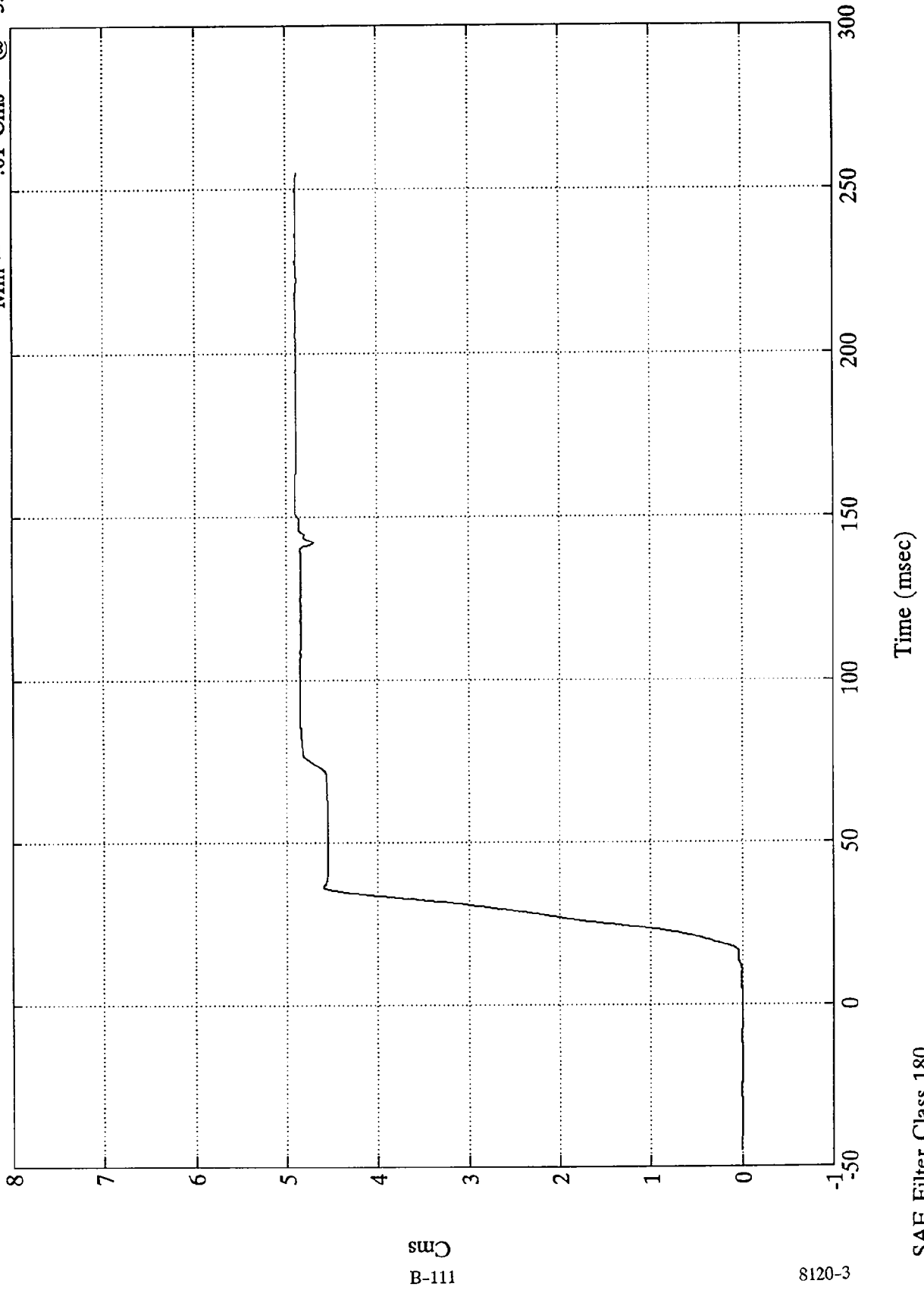


Time (msec)

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN
Pos. 2 Belt Spool Out

Max = 4.90 Cms @ 152.52 msec
Min = -.01 Cms @ -33.72 msec



B-111
Cms

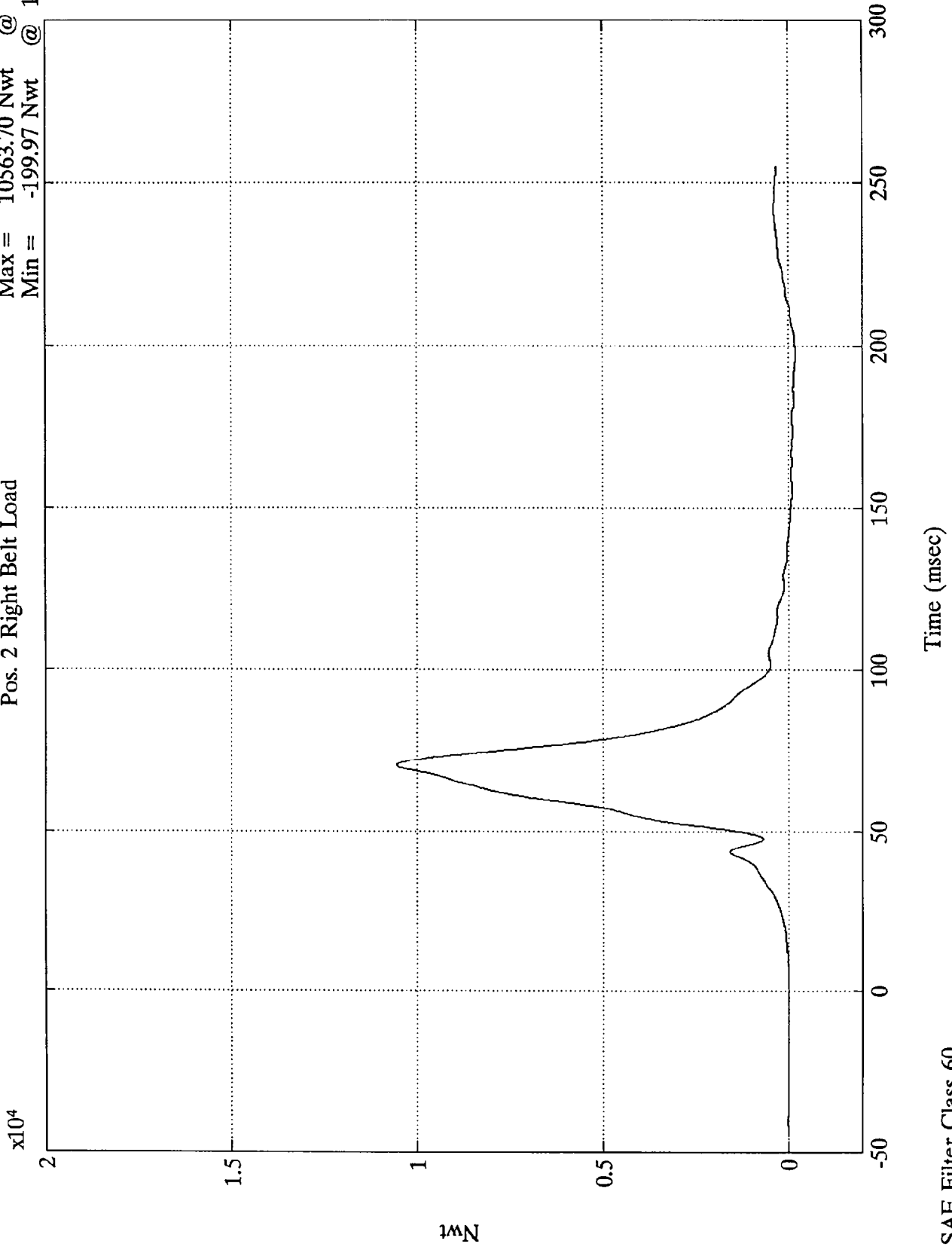
8120-3

SAE Filter Class 180

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Pos. 2 Right Belt Load

Max = 10563.70 Nwt @ 70.31 msec
 Min = -199.97 Nwt @ 197.04 msec



B-112

8120-3

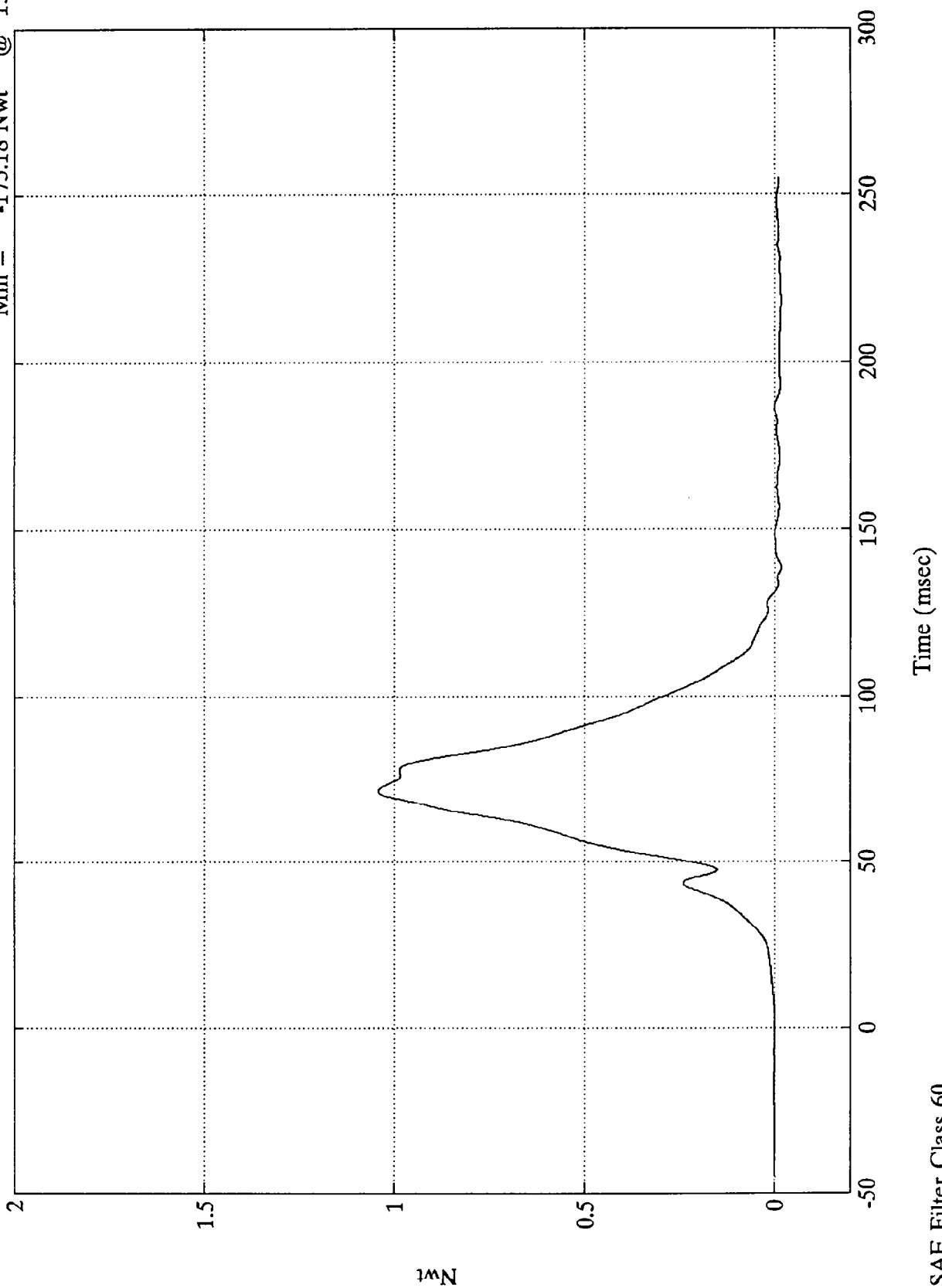
SAE Filter Class 60

NCAP TEST #3 - 1993 CHEVROLET ASTRO VAN

Max = 10433.58 Nwt @ 71.40 msec
Min = -175.18 Nwt @ 138.60 msec

Pos. 2 Torso Belt Load

$\times 10^4$



1wN
B-113

8120-3

SAE Filter Class 60

Appendix C

PART 572B/E DUMMY CONFIGURATION
AND PERFORMANCE VERIFICATION DATA SHEETS

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

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

Dummy serial numbers and certification dates are:

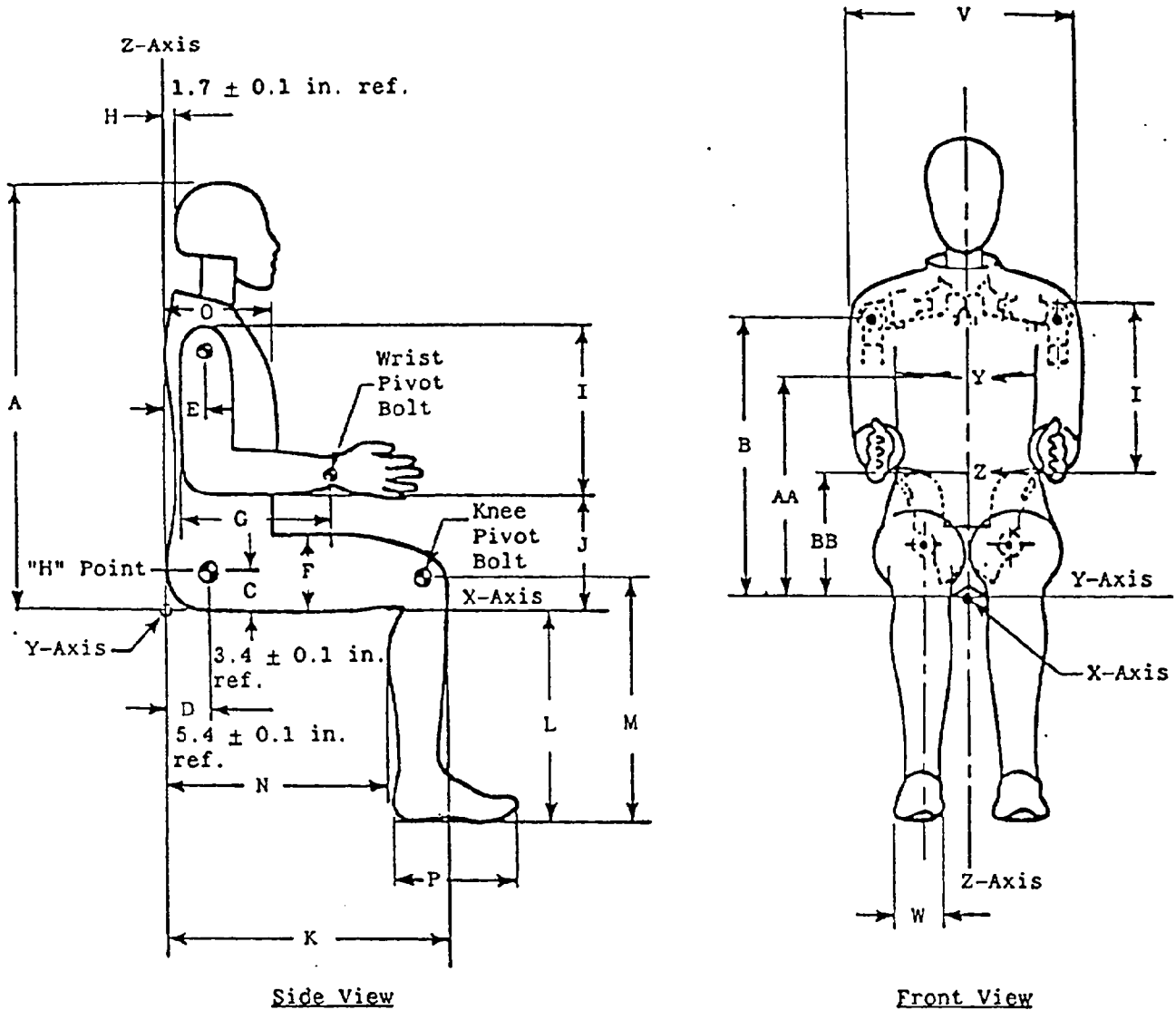
<u>Serial No.</u>	<u>Completion Date</u>
150	7-30-93
245	5-05-93

Electronic Test Equipment

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

Figure 7

DUMMY CONFIGURATION DIMENSIONS



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

HYBRID III EXTERNAL DIMENSIONS

S/N 150 HUMANOID

DUMMY SERIAL NO. 150

DATE: 7/30/93

TEMPERATURE		20.5 DEG. C
RELATIVE HUMIDITY		26 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)	429-434 mm	431 mm
LOCATION FOR WAIST CIRCUMFERENCE (BB)	226-231 mm	228 mm
CHEST CIRCUMFERENCE (Y)	970-1001 mm	998 mm
WAIST CIRCUMFERENCE (Z)	815-866 mm	863 mm
CHEST DEPTH (O)	213-229 mm	213 mm
H-POINT HEIGHT (C)	84-89 mm	88 mm
H-POINT FROM SEAT BACK (D)	135-140 mm	137 mm
SKULL CAP TO BACKLINE (H)	41-46 mm	43 mm
TOTAL SITTING HEIGHT (A)	879-889 mm	881 mm
THIGH CLEARANCE (F)	140-155 mm	142 mm
BUTTOCK KNEE LENGTH (K)	580-605 mm	591 mm
BUTTOCK POPLITAL LENGTH (N)	452-477 mm	470 mm
POPLITEAL LENGTH (L)	430-455 mm	452 mm
KNEE PIVOT HEIGHT (M)	485-501 mm	500 mm
FOOT LENGTH (P)	252-267 mm	259 mm
FOOT BREADTH (W)	91-107 mm	96 mm
SHOULDER PIVOT FROM BACKLINE (E)	84-94 mm	94 mm
SHOULDER BREADTH (V)	422-437 mm	429 mm
SHOULDER PIVOT HEIGHT (B)	505-521 mm	513 mm
ELBOW REST HEIGHT (J)	190-211 mm	208 mm
SHOULDER-ELBOW LENGTH (I)	330-345 mm	337 mm
BACK OF ELBOW TO WRIST PIVOT (G)	290-305 mm	292 mm

DUMMY MEETS SPECIFICATIONS

TECHNICIAN: IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
HEAD DROP TEST
HYBRID III

DATE : 7/27/93

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 150 HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	51 %
PEAK RESULTANT ACCELERATION	225 - 275 G'S	242.2 G'S
PEAK LATERAL ACCELERATION	15 G'S MAX	11.8 G'S
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST
HYBRID III

DATE : 7/28/93

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN:150 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5-22.2 DEG. C	21.1 DEG. C
RELATIVE HUMIDITY		10% - 70%	53 %
IMPACT VELOCITY		24.8 - 25.7 KPH	24.9 KPH
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G'S	25.89 G'S
	20 MS	17.60 - 22.60 G'S	21.36 G'S
	30 MS	12.50 - 18.50 G'S	17.36 G'S
MAX PENDULUM G'S ABOVE 30 MS		29 G'S MAX	17.36 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		34 - 42 MS	39.38 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	70.76 DEG.
	TIME	57 - 64 MS	59.13 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	88 - 108 N-M	100.6 N-M
	TIME	47 - 58 MS	52.88 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	113.25 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	99 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 7/28/93

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN:150 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5 - 22.2 DEG. C	20.5 DEG. C
RELATIVE HUMIDITY		10% - 70%	53 %
IMPACT VELOCITY		21.4 - 22.3 KPH	21.94 KPH
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G'S	17.43 G'S
	20 MS	14.00 - 19.00 G'S	17.19 G'S
	30 MS	11.00 - 16.00 G'S	14.09 G'S
MAX PENDULUM G'S ABOVE 30 MS		22 G'S MAX	17.29 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		38 - 46 MS	45.25 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	87 DEG.
	TIME	72 - 82 MS	74.5 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-80.0/-52.9 N-M	-77.87 N-M
	TIME	65 - 79 MS	69.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	153.13 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	128.38 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 7/28/93

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN 150 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	TEST RESULTS
	SPECIFICATION	
TEMPERATURE	20.5 - 22.2 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	52 %
PENDULUM VELOCITY	23.7 - 24.6 KPH	23.7 KPH
MAXIMUM DEFLECTION	64 - 73 mm	68.3 mm
MAXIMUM RESISTIVE FORCE	4804 - 5538 NEWTONS	5488 NEWTONS
INTERNAL HYSTERESIS	69% - 85%	71.1 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 7/29/93

KNEE: LEFT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 150 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	49 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.68 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	5048 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 7/29/93

KNEE: RIGHT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 150 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	49 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.68 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	4746 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY I.D. NUMBER: 150

A. DUMMY INSTRUMENTS

1. HEAD ACCELEROMETER

HX LONGITUDINAL

HY LATERAL

HZ VERTICAL

2. CHEST ACCELEROMETER

CX LONGITUDINAL

CY LATERAL

CZ VERTICAL

3. FEMUR LOAD CELLS

LEFT SIDE

RIGHT SIDE

MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
ENDEVCO	ADMB8	3/93	9/93
ENDEVCO	ADL44	3/93	9/93
ENDEVCO	AC2J3	3/93	9/93
ENDEVCO	ADMB6	3/93	9/93
ENDEVCO	AC209	3/93	9/93
ENDEVCO	ADL98	3/93	9/93
GSE	951	5/93	11/93
GSE	952	5/93	11/93

B. CALIBRATION LABORATORY
INSTRUMENTS

1. PENDULUM ACC.

2. TEST PROBE
ACCELEROMETER

MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
CEC	A160	6/93	12/93
CEC	A161	6/93	12/93

HYBRID III EXTERNAL DIMENSIONS

S/N 245 HUMANOID

DUMMY SERIAL NO. 245

DATE: 5/5/93

TEMPERATURE		21.6 DEG. C
RELATIVE HUMIDITY		35 %
LOCATION FOR CHEST CIRCUMFERENCE (AA)	429-434 mm	431 mm
LOCATION FOR WAIST CIRCUMFERENCE (BB)	226-231 mm	228 mm
CHEST CIRCUMFERENCE (Y)	970-1001 mm	998 mm
WAIST CIRCUMFERENCE (Z)	815-866 mm	863 mm
CHEST DEPTH (O)	213-229 mm	213 mm
H-POINT HEIGHT (C)	84-89 mm	89 mm
H-POINT FROM SEAT BACK (D)	135-140 mm	137 mm
SKULL CAP TO BACKLINE (H)	41-46 mm	43 mm
TOTAL SITTING HEIGHT (A)	879-889 mm	889 mm
THIGH CLEARANCE (F)	140-155 mm	152 mm
BUTTOCK KNEE LENGTH (K)	580-605 mm	596 mm
BUTTOCK POPLITAL LENGTH (N)	452-477 mm	464 mm
POPLITEAL LENGTH (L)	430-455 mm	447 mm
KNEE PIVOT HEIGHT (M)	485-501 mm	487 mm
FOOT LENGTH (P)	252-267 mm	256 mm
FOOT BREADTH (W)	91-107 mm	96 mm
SHOULDER PIVOT FROM BACKLINE (E)	84-94 mm	89 mm
SHOULDER BREADTH (V)	422-437 mm	426 mm
SHOULDER PIVOT HEIGHT (B)	505-521 mm	518 mm
ELBOW REST HEIGHT (J)	190-211 mm	205 mm
SHOULDER-ELBOW LENGTH (I)	330-345 mm	335 mm
BACK OF ELBOW TO WRIST PIVOT (G)	290-305 mm	294 mm

DUMMY MEETS SPECIFICATIONS

TECHNICIAN: IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
HEAD DROP TEST
HYBRID III

DATE : 4/18/93

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 245 HEAD DROP CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21.1 DEG. C
RELATIVE HUMIDITY	10% - 70%	41 %
PEAK RESULTANT ACCELERATION	225 - 275 G'S	235.4 G'S
PEAK LATERAL ACCELERATION	15 G'S MAX	4.2 G'S
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK FLEXION TEST

HYBRID III

DATE : 5/5/93

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN:245 CAL NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5-22.2 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY		10% - 70%	43 %
IMPACT VELOCITY		24.8 - 25.7 KPH	25 KPH
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G'S	24.36 G'S
	20 MS	17.60 - 22.60 G'S	20.66 G'S
	30 MS	12.50 - 18.50 G'S	17.21 G'S
MAX PENDULUM G'S ABOVE 30 MS		29 G'S MAX	17.21 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		34 - 42 MS	40.75 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	71.15 DEG.
	TIME	57 - 64 MS	57.13 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	88 - 108 N-M	96 N-M
	TIME	47 - 58 MS	53.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	113.88 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	99 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
NECK EXTENSION TEST
HYBRID III

DATE : 5/5/93

6 AXIS NECK TRANSDUCER

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN:245 CAL NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.5 - 22.2 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY		10% - 70%	43 %
IMPACT VELOCITY		21.4 - 22.3 KPH	22.16 KPH
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G'S	17.41 G'S
	20 MS	14.00 - 19.00 G'S	17.05 G'S
	30 MS	11.00 - 16.00 G'S	14.36 G'S
MAX PENDULUM G'S ABOVE 30 MS		22 G'S MAX	17.27 G'S
DECELERATION -TIME CURVE DECAY TIME TO 5 G'S		38 - 46 MS	44.88 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	99.41 DEG.
	TIME	72 - 82 MS	74 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	-80.0/-52.9 N-M	-77.6 N-M
	TIME	65 - 79 MS	69.25 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	150.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	125.13 MS

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
THORAX IMPACT TEST
HYBRID III

DATE : 4/30/93

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN 245 H.S. THORAX CAL

TEST PARAMETER	HIGH SPEED TEST	TEST RESULTS
	SPECIFICATION	
TEMPERATURE	20.5 - 22.2 DEG. C	21.1 DEG. C
RELATIVE HUMIDITY	10% - 70%	39 %
PENDULUM VELOCITY	23.7 - 24.6 KPH	23.7 KPH
MAXIMUM DEFLECTION	64 - 73 mm	64 mm
MAXIMUM RESISTIVE FORCE	4804 - 5538 NEWTONS	5444 NEWTONS
INTERNAL HYSTERESIS	69% - 85%	70.7 %

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 5/4/93

KNEE: LEFT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 245 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	40 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.68 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	5004 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

CALSPAN CORPORATION
TRANSPORTATION RESEARCH DEPARTMENT
KNEE IMPACT TEST
HYBRID III

DATE : 5/4/93

KNEE: RIGHT

CALSPAN SEQUENTIAL NUMBER 1

HY3 SN: 245 KNEE 4.9 KGS CAL

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	20 - 25 DEG. C	21.6 DEG. C
RELATIVE HUMIDITY	10% - 70%	40 %
PROBE VELOCITY	7.5 - 7.7 KPH	7.68 KPH
PEAK KNEE IMPACT FORCE	4430 - 6965 N	5084 N
PROBE WEIGHT	4.9 KGS	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN IVAN MINKEWICZ

INSTRUMENT CALIBRATION INFORMATION

NHTSA DUMMY I.D. NUMBER: 245

A. DUMMY INSTRUMENTS

	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. HEAD ACCELEROMETER				
HX LONGITUDINAL	ENDEVCO	A39J	3/93	9/93
HY LATERAL	ENDEVCO	A33F	3/93	9/93
HZ VERTICAL	ENDEVCO	A27F	3/93	9/93
2. CHEST ACCELEROMETER				
CX LONGITUDINAL	ENDEVCO	A12C	3/93	9/93
CY LATERAL	ENDEVCO	A60C	3/93	9/93
CZ VERTICAL	ENDEVCO	A84G	3/93	9/93
3. FEMUR LOAD CELLS				
LEFT SIDE	GSE	954	5/93	11/93
RIGHT SIDE	GSE	955	5/93	11/93

B. CALIBRATION LABORATORY
INSTRUMENTS

	MFG	SERIAL NUMBER	DATE LAST CALIBRATED	DATE OF NEXT CALIBRATION
1. PENDULUM ACC.	CEC	A160	6/93	12/93
2. TEST PROBE ACCELEROMETER	CEC	A161	6/93	12/93

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	ADMB8	ENDEVCO	3-93	9-93
Y	ADL44	ENDEVCO	3-93	9-93
Z	AC2J3	ENDEVCO	3-93	9-93
Chest				
X	ADMB6	ENDEVCO	3-93	9-93
Y	AC209	ENDEVCO	3-93	9-93
Z	ADL98	ENDEVCO	3-93	9-93
Right Femur Load Cell	952	GSE	5-93	11-93
Left Femur Load Cell	951	GSE	5-93	11-93
Neck Load Cell				
X	269	DENTON	11-92	5-93
Y	296	DENTON	11-92	5-93
Z	269	DENTON	11-92	5-93
Neck Moment				
X	269	DENTON	11-92	5-93
Y	269	DENTON	11-92	5-93
Z	269	DENTON	11-92	5-93
Chest Deflection Gauge				
Hybrid III Use Only	150	HUMANOID	8-93	2-94
Lap Belt Load Cells	706	LEBOW	5-93	11-93
Shoulder Belt Load Cells	707	LEBOW	5-93	11-93
Spool-Out Potentiometer	42	SERVONIC INST.	5-93	11-93
Belt Stretch Transducer	E1	CALSPAN	8-93	2-94

INSTRUMENT CALIBRATION FOR PASSENGER DUMMY

(6 Month Calibration Minimum)

PASSENGER DUMMY	Serial #	Manufacturer	Calibration	
			Last	Next
Head				
X	A39J	ENDEVCO	3-93	9-93
Y	A33F	ENDEVCO	3-93	9-93
Z	A27F	ENDEVCO	3-93	9-93
Chest				
X	A12C	ENDEVCO	3-93	9-93
Y	A60C	ENDEVCO	3-93	9-93
Z	A84G	ENDEVCO	3-93	9-93
Right Femur Load Cell	955	GSE	5-93	11-93
Left Femur Load Cell	954	GSE	5-93	11-93
Neck Load Cell				
X	076	DENTON	11-92	5-93
Y	076	DENTON	11-92	5-93
Z	076	DENTON	11-92	5-93
Neck Moment				
X	076	DENTON	11-92	5-93
Y	076	DENTON	11-92	5-93
Z	076	DENTON	11-92	5-93
Chest Deflection Gauge				
Hybrid III Use Only	245	HUMANOID	8-93	2-94
Lap Belt Load Cells	710	LEBOW	5-93	11-93
Shoulder Belt Load Cells	711	LEBOW	5-93	11-93
Spool-Out Potentiometer	52	SERVONIC INST.	5-93	11-93
Belt Stretch Transducer	E2	CALSPAN	8-93	2-94

INSTRUMENT CALIBRATION FOR VEHICLE ACCELEROMETERS

(6 Month Calibration Minimum)

	Serial #	Manufacturer	Calibration	
			Last	Next
Left Seat Rear Crossmember	A89	CEC	5-93	11-93
Right Rear Seat Crossmember	A157	CEC	5-93	11-93
Top of Engine	A164	CEC	5-93	11-93
Bottom of Engine	A149	CEC	5-93	11-93
Left Disc Brake Caliper	A183	CEC	5-93	11-93
Right Disc Brake Caliper	A152	CEC	5-93	11-93
Instrument Panel	A182	CEC	5-93	11-93
Center Rear Crossmember	A185	CEC	5-93	11-93
Vehicle Rear Z	A178	CEC	5-93	11-93

Appendix E

VEHICLE OWNER'S MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

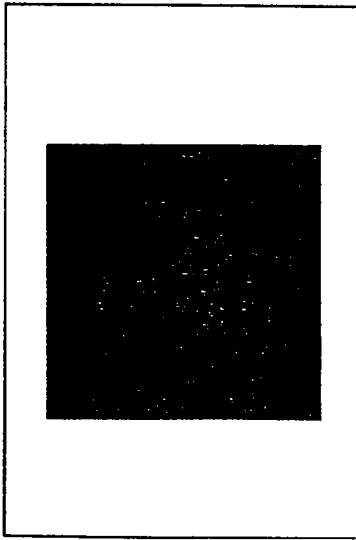
Seats and Safety Belts

Safety Belts: They're For Everyone

This part of the manual tells you how to use safety belts properly. It also tells you some things you should not do with safety belts.

CAUTION

⚠ Don't let anyone ride where they can't wear a safety belt properly. If you are in a crash and you're not wearing a safety belt, your injuries can be much worse. You can hit things inside the vehicle or be ejected from it. You can be seriously injured or killed. In the same crash, you might not be if you are buckled up. Always fasten your safety belt, and check that your passengers' belts are fastened properly too.



AM110001

This figure lights up when you turn the key to **RUN** or **START** when your safety belt isn't buckled, and you'll hear a chime too.

It's the reminder to buckle up. In many states and Canadian provinces, the law says to wear safety belts. Here's why: **They work.**

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

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

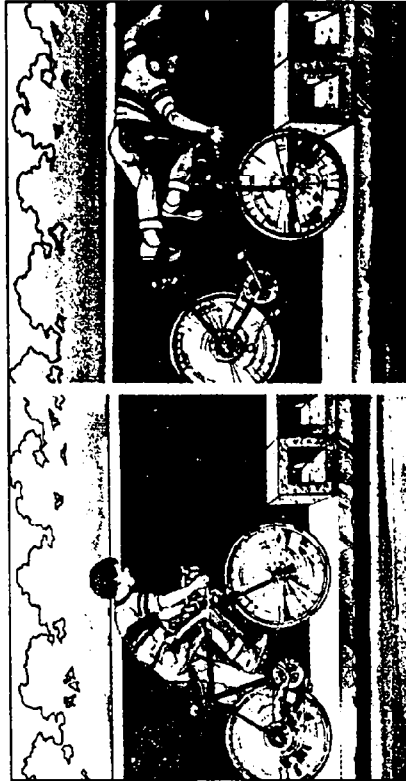
1-12

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



AM110014

Why Safety Belts Work



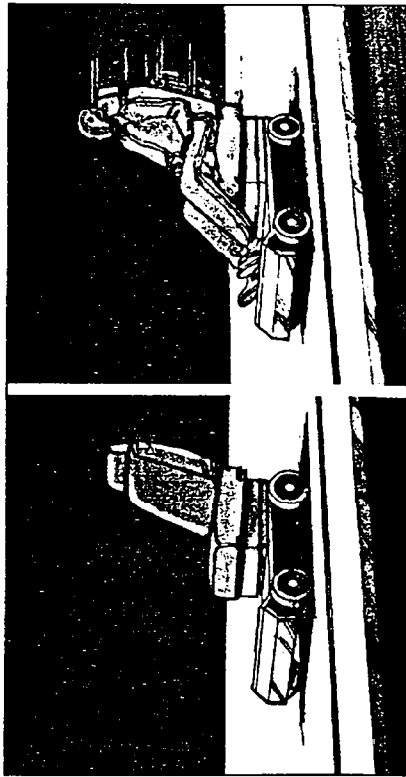
AM115001

AM115002

When you ride in or on anything, you go as fast as it goes. For example, if the bike is going 10 mph (16 km/h), so is the child. When the bike hits the block, it stops. But the child keeps going!

1-13

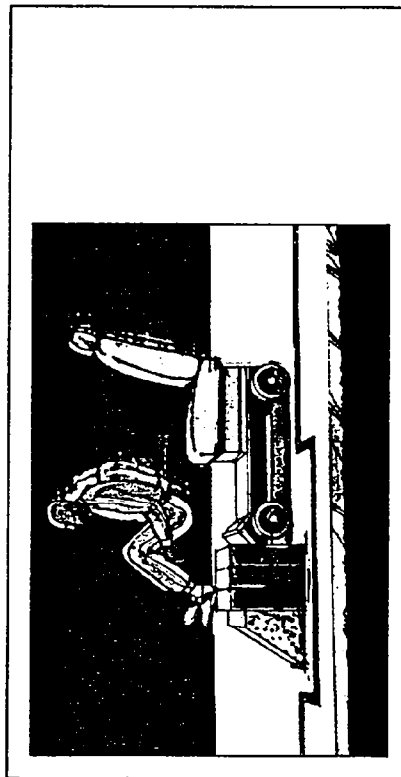
Seats and Safety Belts



AM115003

AM115004

Take the simplest "vehicle." Suppose it's just a seat on wheels. Put someone on it.



AM115005

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

1-14



AM115006

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



AM115007

or the instrument panel . . .

1-15

Seats and Safety Belts



AM115008

or the safety belts!

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

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

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

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

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

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

1-16

8120-3

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

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

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

Safety belts are for everyone.

Safety Belt Reminder Light



K3264

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

1-17

E-4

Seats and Safety Belts

How To Wear Safety Belts Properly

Adults

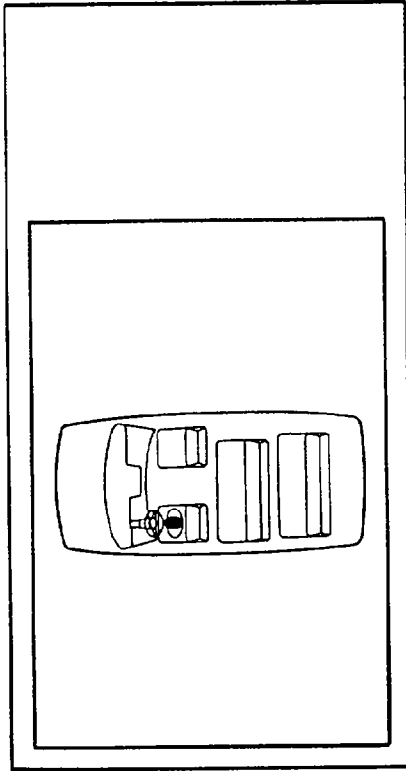
This section is only for people of adult size.

CAUTION

 There are special things to know about safety belts and children. And there are different rules for babies and smaller children. If a child will be riding in your vehicle, see the part after this one, called "Children." Follow those rules for everyone's protection.

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

Driver Position



This part describes the driver's restraint system.

Lap-Shoulder Belt



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

1. Close and lock the door.
2. Adjust the seat (to see how, see "Seats" in the Index) so you can sit up straight.



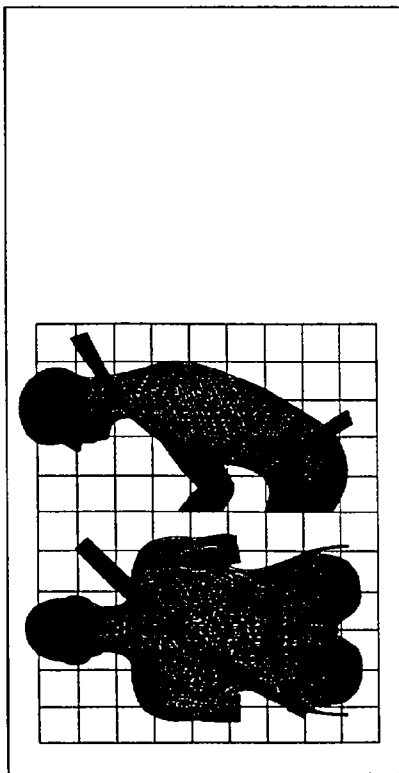
3. Pick up the latch plate and pull the belt across you. Don't let it get twisted.
4. Push the latch plate into the buckle until it clicks. If the belt isn't long enough, see "Safety Belt Extender" at the end of this section.
Make sure the release button on the buckle faces upward or outward so you would be able to unbuckle it quickly if you ever had to.

Seats and Safety Belts



AM120167

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



AM120007

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

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

1-20

Shoulder Belt Height Adjuster

You can move the shoulder belt adjuster to the height that is right for you.



AM120160

AM120161

To move it down, push in the adjuster at the arrows and pull down on the adjuster. After you move the adjuster to where you want it, try to move it up and down to make sure it is locked into place.

You can move the adjuster up from a lower position just by pushing up on it.



AM120162

Adjust the height so that the shoulder portion of the belt is centered on your shoulder. The belt should be away from your face and neck but not falling off your shoulder.

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