

V2825

REPORT NUMBER: 301-CAL-98-01

**SAFETY COMPLIANCE TESTING FOR FMVSS 301
FUEL SYSTEM INTEGRITY**

SUZUKI
1998 SUZUKI ESTEEM
2-DOOR SEDAN

NHTSA NUMBER: CW0504

CALSPAN TEST NUMBER: 8412-1

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



February 26, 1998

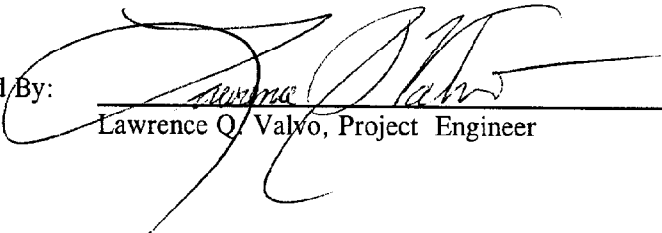
FINAL REPORT

PREPARED FOR:

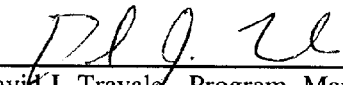
U. S. Department of Transportation
National Highway Traffic Safety Administration
ENFORCEMENT
Office of Vehicle Safety Compliance
400 Seventh Street, S. W.
Room No. 6115 (NEF-30)
Washington, DC 20590

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings and conclusions expressed in this publication are those of the author(s) and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is only because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Prepared By:


Lawrence Q. Valvo, Project Engineer

Approved By:


David J. Travale, Program Manager
Transportation Sciences Center

Approval Date:

March 10, 1998

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By:



Acceptance Date:

4/7/98

RECEIVED
FBI: 46
00-468-100-00

TECHNICAL REPORT STANDARD TITLE PAGE

1. Report No. 301-CAL-98-01	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle Final Report of FMVSS301 Compliance Testing of a 1998 Suzuki Esteem 2-Door Sedan NHTSA No. CW0504		5. Report Date February 26, 1998	
		6. Performing Organization Code CAL	
7. Author(s) Lawrence Q. Valvo, Project Engineer David J. Travale, Program Manager		8. Performing Organization Report No. 8412-1	
9. Performing Organization Name and Address Calspan Corporation P.O. Box 400 Buffalo, New York 14225		10. Work Unit No.	
		11. Contract or Grant No. DTNH22-95-D-11000	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance (NEF-30) 400 Seventh St , S.W., Rm. 6115, Washington, D.C. 20590		13. Type of Report and Period Covered Final Test Report February - March 1998	
		14. Sponsoring Agency Code NEF-30	
15. Supplementary Notes			
16. Abstract Compliance tests were conducted on the subject 1998 Suzuki Esteem 2-Door Sedan in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-301-01 for the determination of FMVSS 301 compliance. Test failures identified were as follows: The test vehicle appeared to comply with all requirements of FMVSS 301 "Fuel System Integrity."			
17. Key Words Compliance Testing Safety Engineering FMVSS 301		18. Distribution Statement Copies of this report are available from: NHTSA Technical Reference Division Room 5108 (NAD-52), 400 Seventh , S.W., Washington, D.C. 20590 Telephone No. (202) 366-4946	
19. Security Classif. (of this report) UNCLASSIFIED	20. Security Classif. (of this page) UNCLASSIFIED	21. No. of Pages 86	22. Price

TABLE OF CONTENTS

<u>Section</u>	<u>Page No.</u>
1 PURPOSE OF COMPLIANCE TEST	1-1
2 SUMMARY OF COMPLIANCE TEST RESULTS	2-1
3 COMPLIANCE TEST DATA	3-1
APPENDIX A PHOTOGRAPHS	A-1
APPENDIX B VEHICLE AND DUMMY RESPONSE DATA (REAR IMPACT ONLY)	B-1

LIST OF FIGURES

<u>Figure No.</u>		<u>Page No.</u>
1	PART 572 DUMMY IN-VEHICLE POSITION	3-2
2	CAMERA POSITION FOR REAR IMPACT	3-9

LIST OF TABLES

<u>Table No.</u>		<u>Page No.</u>
1	CRASH TEST SUMMARY	2-2
2	GENERAL TEST AND VEHICLE PARAMETER DATA	2-3
3	MOVING BARRIER PARAMETER DATA	2-6
4	POST-IMPACT DATA	2-7
5	FRONT SEAT OCCUPANT MEASUREMENTS	3-3
6	FMVSS NO. 301 - "FUEL SYSTEM INTEGRITY" POST-IMPACT TEST DATA	3-4
7	FMVSS NO. 301 - STATIC ROLLOVER DATA SHEET	3-5
8	HIGH-SPEED CAMERA LOCATIONS	3-10

Section 1

PURPOSE OF COMPLIANCE TEST

This 30 mph rear moving barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 301 Compliance Test Program conducted for the National Highway Traffic Safety Administration (NHTSA) by Calspan Corporation under Contract No. DTNH22-95-D-11000. The purpose of this test was to determine if the subject vehicle, a 1998 Suzuki Esteem 2-Door Sedan, meets the performance requirements of FMVSS No. 301, "Fuel System Integrity." This compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-301-01, dated March 28, 1994.

Section 2

COMPLIANCE TEST RESULTS SUMMARY

A 2671 pound 1998 Suzuki Esteem 2-Door Sedan was impacted from the rear by a 3961 pound moving barrier at a velocity of 29.9 mph. The test was performed by the Calspan Corporation on February 26, 1998.

One instrumented Part 572 E and non-instrumented Part 572 B, 50th percentile male Anthropomorphic Test Device (ATD) were placed in the driver and right-front passenger seating positions respectively. Additional ballast (10 pounds) was secured in the vehicle cargo area.

Average longitudinal crush was 14.3 inches. Pre- and post-test photographs of the vehicle can be found in appendix A.

The gallon fuel tank was filled to 92.5 percent capacity with orange Stoddard fluid prior to the impact. After the impact, there was no fluid leakage for the first 30 minutes nor during any phase of the rollover test. The vehicle appeared to comply with all the requirements of FMVSS No. 301 "Fuel System Integrity." Section 3 presents the results of these tests.

The crash event was recorded by one real-time and eight high-speed cameras. Camera locations and other pertinent camera information are found on pages 3-9 and 3-10 of this report.

The Upper Seatback X accelerometer data is not accurate after 75 milliseconds. Therefore the derived data channels, Seatback Angular Acceleration, Velocity, and Position, are not accurate after this point.

Table 1

CRASH TEST SUMMARY

Vehicle NHTSA No.: CW0504 Test Mode: 30 mph Rear Barrier
 Test Date: February 26, 1998 Time: 16:07 Temperature : 71 °F
 Vehicle Make/Model/Body Style: 1998 Suzuki Esteem 2-Door Sedan
 Vehicle Test Weight: 2671 lbs Impact Velocity: 29.9 mph
 Static Crush: Left Side = 14.2 inches
 Right Side = 13.3 inches
 Centerline = 15.5 inches
 Average Crush: 14.3 inches

TYPE OF FRONT OCCUPANT RESTRAINT SYSTEM INSTALLED IN TEST VEHICLE:

Driver's DSP: Airbag / 3-Point Active Seat Belt
 Right Passenger's DSP: Airbag / 3-Point Active Seat belt

VISIBLE DUMMY CONTACT POINTS:

Driver: Back and top of head to left rear seat backrest

 Passenger: Back and top of head to left rear seat backrest

DOOR OPENING DATA:

Closed / Operable - Left Front
Closed / Operable - Right Front

Stoddard Solvent Spillage from Vehicle's Fuel System: None

Remarks: The driver and passenger seat backrests reclined approximately 30 degrees to their full rearward position. The seat backrest recline mechanism remained operable following the impact.

Table 2

GENERAL TEST AND VEHICLE PARAMETER DATATEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1998 Suzuki Esteem 2-Door Sedan

NHTSA No.: CW0504 ; VIN: JS2GB31S5W5140766 ; Color: Silver

Engine Data: 4 cylinders; - CID; 1.6 Liters; - cc

Placement: - Longitudinal or In-Line; X Transverse or Lateral

Transmission Data: 4 speeds; - Manual; X Automatic; X Overdrive

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

Major Options: X A/C; X Pwr.Strg.; X Pwr. Brakes

- Pwr. Windows; - Pwr. Door Locks; - Tilt Wheel

Date Received: 01/13/98 ; Odometer Reading 188 miles

Selling Dealer: Ourisman Dodge & Suzuki

& Address: 5900 Richmond Hwy., Alexandria VA 22303-1805

DATA FROM TIRE VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Suzuki

Date of Manufacture: 06/97

GVWR: 3219 lbs.; GAWR: 1687 lbs. FRONT; 1565 lbs. REAR

DATA FROM TIRE PLACARD:

Location of Placard on Vehicle: Left lower B-pillar

Tire Pressure with Maximum Capacity Vehicle Load: 35 psi FRONT 35 psi REAR

Recommended Tire Size: P175/70R13 or P185/60R14

* Recommended Cold Tire Pressure: 30 psi FRONT; 30 psi REAR

Size of Tires on Test Vehicle: P175/70R13

Type of Spare Tire: T115/70D14

Vehicle Capacity Data:

Type of Front Seats:	<u>-</u> Bench;	<u>X</u> Bucket;	<u>-</u> Split Bench
Number of Occupants:	<u>2</u> Front;	<u>3</u> Rear;	<u>5</u> Total
Vehicle Capacity Weight (VCW) =	<u>870</u>	lbs.	
No. of Occupants x 150 lbs. =	<u>750</u>	lbs.	
Rated Cargo/Luggage Weight (RCLW) =	<u>120</u>	lbs.	

*Tire pressure used for test

Table 2

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

Right Front	=	<u>685</u>	lbs.	Right Rear	=	<u>421</u>	lbs.
Left Front	=	<u>697</u>	lbs.	Left Rear	=	<u>437</u>	lbs.
TOTAL FRONT	=	<u>1,382</u>	lbs.	TOTAL REAR	=	<u>858</u>	lbs.
TOTAL DELIVERED WEIGHT = <u>2,240</u> lbs.							
% of Total Front of Vehicle Weight = <u>61.7</u> %				% of Total Rear Weight = <u>38.3</u> %			

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight	=	<u>2,240</u>	lbs.
Rated Cargo/Luggage Weight (RCLW)	=	<u>120</u>	lbs.
Weight of 2 p.572 Dummies, 167 & 164 lbs	=	<u>331</u>	lbs.
TARGET TEST WEIGHT	=	<u>2,691</u>	lbs.

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 100 POUNDS OF CARGO WEIGHT:

Right Front	=	<u>813</u>	lbs.	Right Rear	=	<u>495</u>	lbs.
Left Front	=	<u>841</u>	lbs.	Left Rear	=	<u>522</u>	lbs.
TOTAL FRONT	=	<u>1,654</u>	lbs.	TOTAL REAR	=	<u>1,017</u>	lbs.
TOTAL TEST WEIGHT = <u>2,671</u> lbs.							
% of Total Front Weight = <u>61.9</u> %				% of Total Rear Weight = <u>38.1</u> %			

* Weight of Ballast Secured in Vehicle Trunk Area = 10 lbs.

Type of Ballast: Iron plate

Method of Securing Ballast: Rear seatbelt assembly

Vehicle Components Removed for Weight Reduction: None

VEHICLE ATTITUDE (all dimension in inches):

AS DELIVERED:	RF	<u>26.4</u>	LF	<u>25.9</u>	RR	<u>25.8</u>	LR	<u>25.3</u>
---------------	----	-------------	----	-------------	----	-------------	----	-------------

AS TESTED:	RF	<u>25.6</u>	LF	<u>25.0</u>	RR	<u>24.7</u>	LR	<u>24.2</u>
------------	----	-------------	----	-------------	----	-------------	----	-------------

Vehicle's Wheel Base: 97.6 in.

Location of Vehicle's C.G.: 37.2 inches rearward of front wheel center.

FUEL SYSTEM DATA:

Fuel System Capacity From Owner's Manual = 13.5 gallons

Usable Capacity Figure Furnished by COTR = 13.47 gallons

Test Volume Range (91 to 94% of Usable Capacity) = 12.3 to 12.7 gallons

ACTUAL TEST VOLUME = 12.5 gallons (with entire fuel system filled)

* Ballast weight includes the RCLW, the weight of drained vehicle fluids and the weight of any removed vehicle components less the weight of onboard instrumentation, cameras, and hardware.

Table 2

GENERAL TEST AND VEHICLE PARAMETER DATA (cont.)FUEL SYSTEM DATA (continued):

Test Fluid Type:	Stoddard Solution
Test Fluid Specific Gravity:	0.764
Test Fluid Kinematic Viscosity:	0.96 centistokes
Test Fluid Color:	Orange ("red" is preferred)
Type of Vehicle Fuel Pump:	Electric
Electric Fuel Pump Operation with Ignition Switch ON and Engine OFF - Fuel pump operated.	
Details of Fuel System:	Filler - Left side aft of rear axle; Tank - Forward of rear axle;
Fuel lines - Vehicle underbody inboard of the left frame rail	

Table 3

MOVING BARRIER PARAMETER DATA

WEIGHT OF MOVING BARRIER:

Right Front	=	<u>1113</u>	lbs.	Right Rear	=	<u>868</u>	lbs.
Left Front	=	<u>1102</u>	lbs.	Left Rear	=	<u>878</u>	lbs.
TOTAL FRONT	=	<u>2,215</u>	lbs.	TOTAL REAR	=	<u>1,746</u>	lbs.
TOTAL BARRIER WEIGHT	=	<u>3,961</u>	lbs.				

MOVING BARRIER DIMENSIONS:

Barrier Face Height:	<u>60.0</u>	in.
Barrier Face Width:	<u>78.0</u>	in.
Barrier Face		
Ground Clearance:	<u>5.0</u>	in.
Tread Width:	<u>59.5</u>	in.
Wheel Base:	<u>120.0</u>	in.
Location of C.G.:	X: <u>52.9</u> inches rearward of front wheel center.	
	Y: <u>0.0</u> inches from longitudinal-vertical plane of symmetry.	
	Z: <u>16.3</u> inches above ground.	

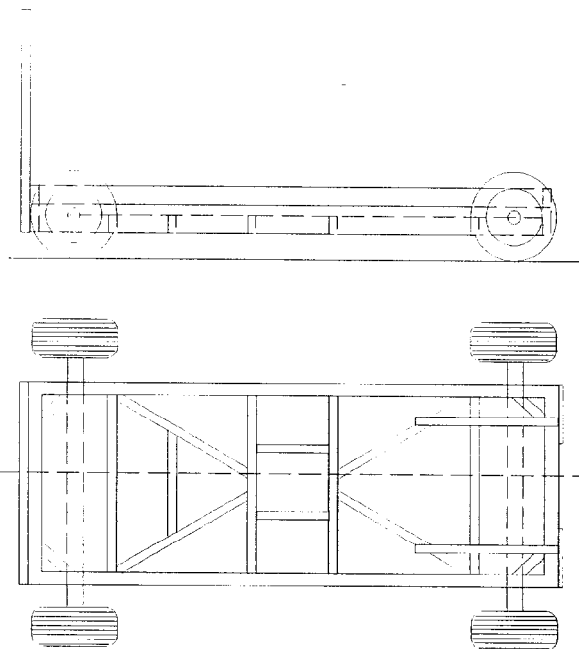


Table 4

POST IMPACT DATA

TYPE OF TEST:

Type of Test: Rear Barrier Impact Angle: 0°
 Test Date: February 26, 1998 Time: 16:07 Temperature: 71 °F
 Vehicle NHTSA No.: CW0504
 Required Impact Velocity Range: 28.9 to 29.9 mph

BARRIER IMPACT VELOCITY: (Speed traps within 5 feet of impact plane.)

Trap No. 1 = 29.9 mph; Trap No. 2 = 29.9 mph
 Average Impact Speed = 29.9 mph

VEHICLE STATIC CRUSH: (For frontal and rear impacts only.)

Vehicle Length:

Pre-Test Right = 161.8; C/L = 164.8; Left = 161.7
 Post-Test Right = 148.5; C/L = 149.3; Left = 147.5
 Crush Right = 13.3; C/L = 15.5; Left = 14.2
 AVERAGE = 14.3 inches

Section 3

COMPLIANCE TEST DATA

Figure 1

PART 572 DUMMY IN-VEHICLE POSITION
(FOR REAR IMPACTS ONLY)

DUMMY MEASUREMENT FOR FRONT SEAT PASSENGERS

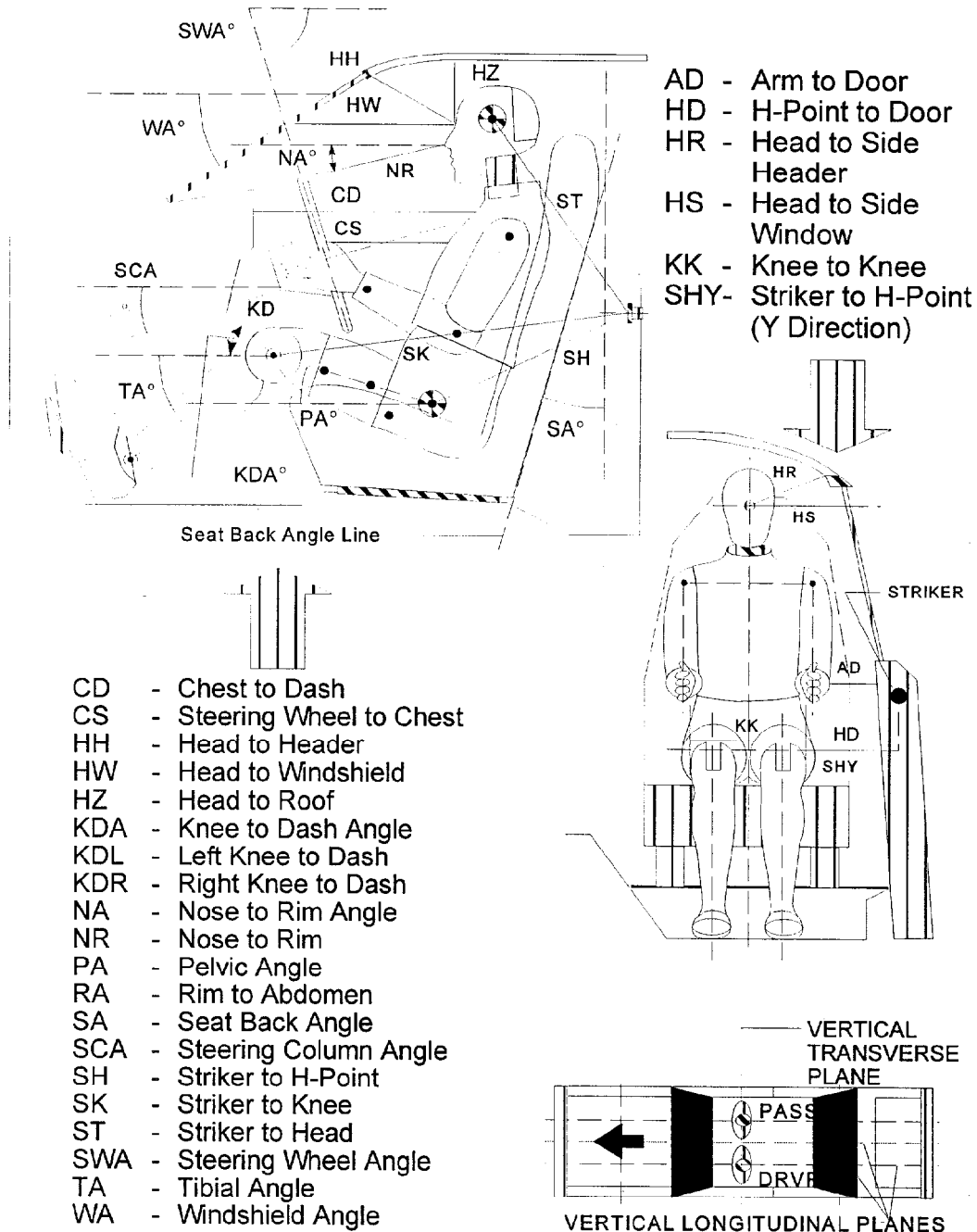


Table 5

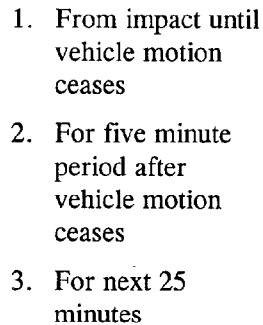
FRONT SEAT OCCUPANT MEASUREMENTS
(FOR REAR IMPACT ONLY)

	DRIVER (Serial #152)		
WA°	30 deg.		
SWA°	66 deg.		
SCA°	24 deg.		
SA°	24 deg.		
HZ	7.2		
HH	12.1		
HW	19.5		
HR	8.4		
NR	14.6	Angle	14.0 deg.
CD	20.6		
CS	10.9		
RA	7.4		
KDL	6.2	Angle (KDA)	37 deg.
KDR	6.2		
PA°	24 deg.		
TA°	36 deg.		
KK	11.1		
ST	20.1	Angle	11 deg.
SK	22.9	Angle	99 deg.
SH	9.1	Angle	130 deg.
SHY	9.4		
HS	12.4		
HD	5.6		
AD	3.9		

FMVSS NO. 301

Vehicle Mfgr./Make/Model: 1998 Suzuki Esteem 2-Door Sedan

FUEL SPILLAGE MEASUREMENT:



SOLVENT SPILLAGE DETAILS:

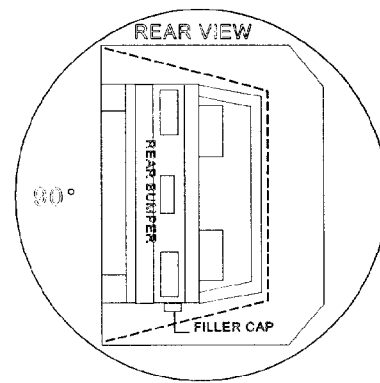
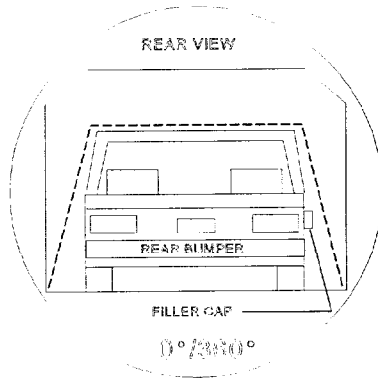
8412-1

Table 7

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE :
0-90 Deg.

Vehicle NHTSA ID No. :
CW0504

I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 minutes)	<u>1</u> minutes <u>17</u> seconds
FMVSS 301 Position Hold Time +	<u>5</u> minutes <u>00</u> seconds
TOTAL	<u>6</u> minutes <u>17</u> seconds
Next whole minute interval	<u>7</u> minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 minutes 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 ounces	0 ounces	0 ounces	N/A
----------	----------	----------	-----

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

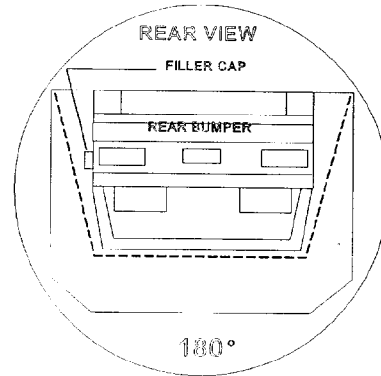
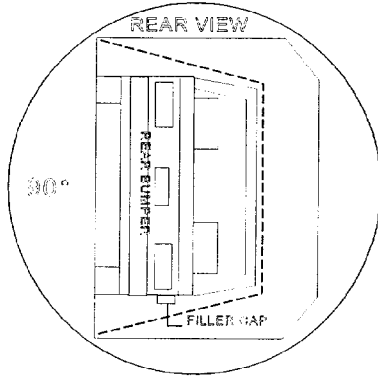
IV. SOLVENT SPILLAGE LOCATION(S):

None

Table 7
FMVSS NO. 301 STATIC ROLLOVER DATA SHEET (cont.)

TEST PHASE :
90-180 Deg.

Vehicle NHTSA ID No. :
CW0504



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 minutes)	<u>1</u> minutes <u>6</u> seconds
FMVSS 301 Position Hold Time +	<u>5</u> minutes <u>00</u> seconds
TOTAL	<u>6</u> minutes <u>6</u> seconds
Next whole minute interval	<u>7</u> minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 minutes 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 ounces	0 ounces	0 ounces	N/A
----------	----------	----------	-----

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

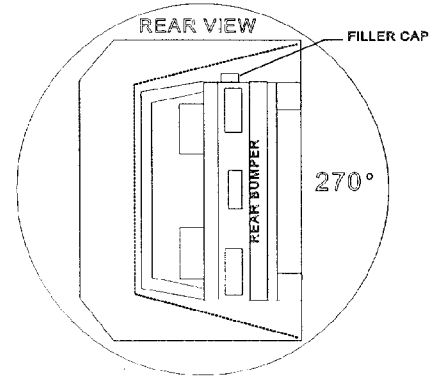
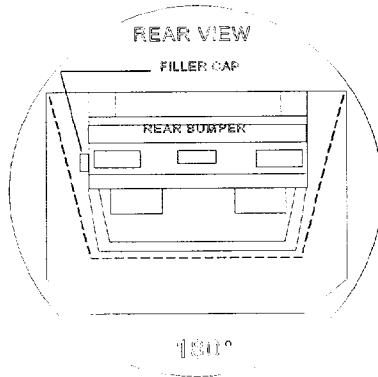
IV. SOLVENT SPILLAGE LOCATION(S):

None

Table 7
FMVSS NO. 301 STATIC ROLLOVER DATA SHEET (cont.)

TEST PHASE :
180-270 Deg.

Vehicle NHTSA ID No. :
CW0504



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 1 minutes 2 seconds
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 5 minutes 00 seconds

TOTAL 6 minutes 2 seconds

Next whole minute interval 7 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 minutes 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 ounces	0 ounces	0 ounces	N/A
----------	----------	----------	-----

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

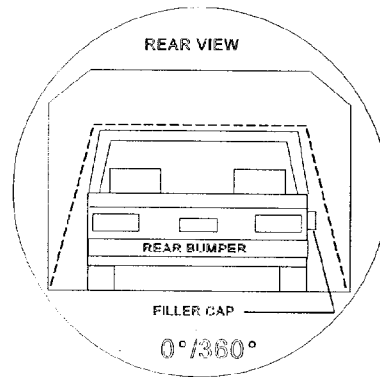
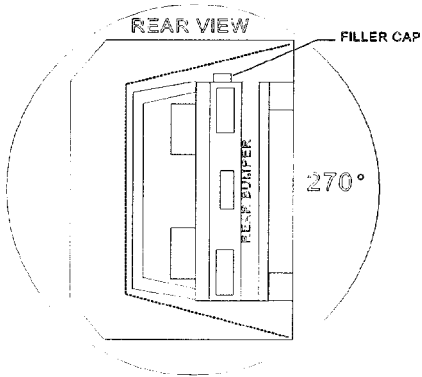
IV. SOLVENT SPILLAGE LOCATION(S):

None

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET (cont.)

TEST PHASE :
270-360 Deg.

Vehicle NHTSA ID No. :
CW0504



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time (Spec. Range = 1 to 3 minutes) 1 minutes 11 seconds

FMVSS 301 Position Hold Time + 5 minutes 00 seconds

TOTAL 6 minutes 11 seconds

Next whole minute interval

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 minutes 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 ounces	0 ounces	0 ounces	N/A
----------	----------	----------	-----

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

IV. SOLVENT SPILLAGE LOCATION(S):

None

Figure 2

CAMERA POSITIONS FOR REAR IMPACTS

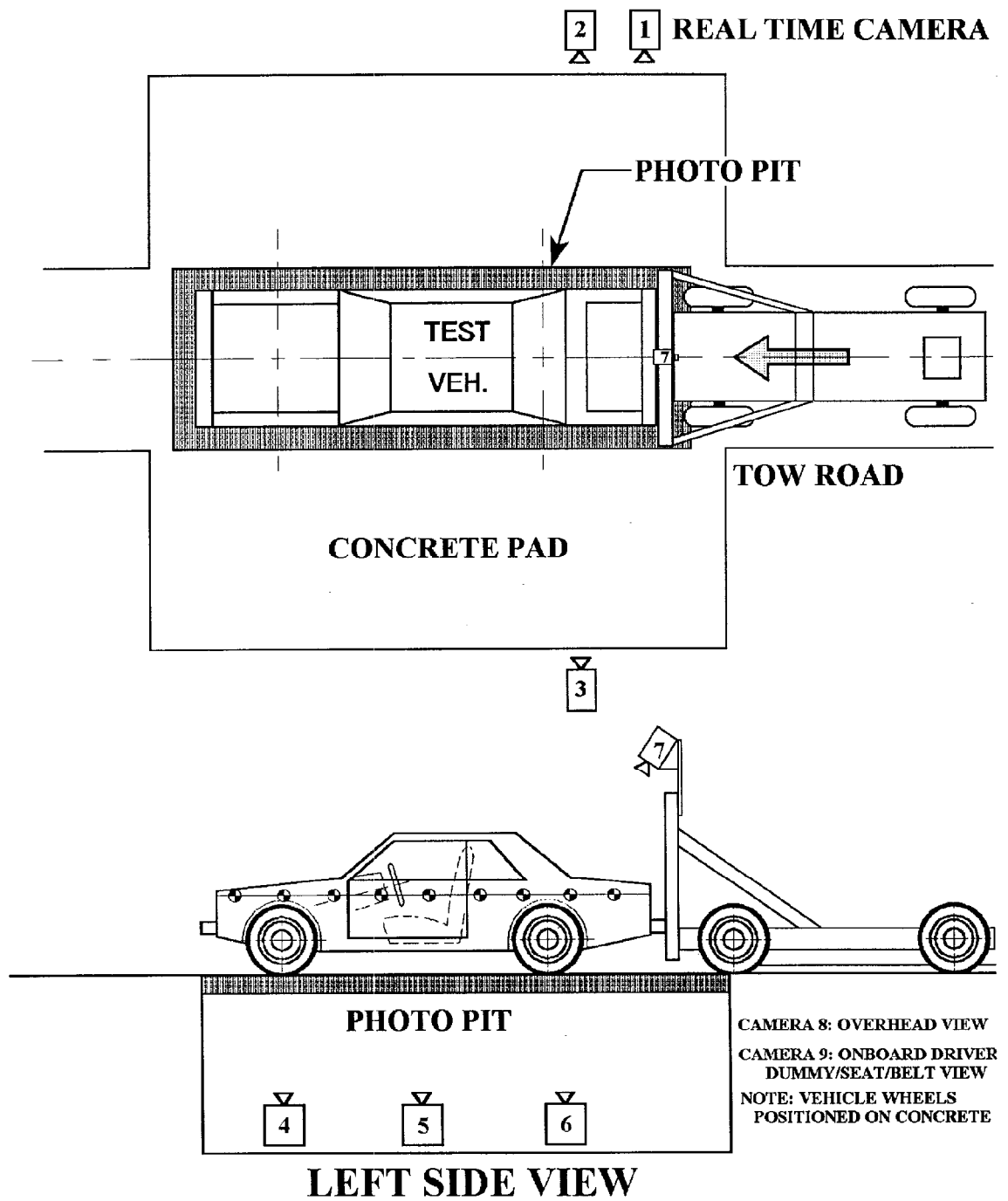


Table 8

HIGH-SPEED CAMERA LOCATIONSNHTSA No. : CW0504 Vehicle : 1998 Suzuki Esteem 2-Door Sedan

CAMERA NO.	VIEW	CAMERA POSITIONS (inches)*			ANGLE** (degrees)	LENS (mm)	SPEED (fps)
		X	Y	Z			
1	Real-Time Camera	-	-	-	-	-	24
2	Right Side View	-442	-26	43	-2	25	1040
3	Left Side View	469	64	44	1	25	760
4	Vehicle Front Underbody View	0	126	-77	90	13	620
5	Vehicle Mid-Section Underbody View	0	62	-77	90	13	780
6	Vehicle Rear Underbody View	0	23	-77	90	13	625
7	Moving Barrier View	0	0	99	-78	7.5	N.T.
8	Overhead Overall View	-20	0	386	-90	25	1000
9	Onboard Driver Dummy/Seat/Belt View	-	-	-	-	12.5	850

* X = film plant to monorail centerline (+ to left of rail)

Y = film plane to impact location (+ ahead of impact location)

Z = film plane to ground (+ above ground)

** = referenced to horizontal plane

N.T. indicates No Timing

LIST OF PHOTOGRAPHS

<u>Figure</u>	<u>Photograph Title</u>	<u>Page No.</u>
A-1	PRE-TEST FRONT VIEW	A-3
A-2	POST-TEST FRONT VIEW	A-4
A-3	PRE-TEST LEFT SIDE VIEW	A-5
A-4	POST-TEST LEFT SIDE VIEW	A-6
A-5	PRE-TEST RIGHT SIDE VIEW	A-7
A-6	POST-TEST RIGHT SIDE VIEW	A-8
A-7	PRE-TEST REAR VIEW	A-9
A-8	POST-TEST REAR VIEW	A-10
A-9	PRE-TEST LEFT FRONT THREE-QUARTER VIEW	A-11
A-10	POST-TEST LEFT FRONT THREE-QUARTER VIEW	A-12
A-11	PRE-TEST RIGHT REAR THREE-QUARTER VIEW	A-13
A-12	POST-TEST RIGHT REAR THREE-QUARTER VIEW	A-14
A-13	PRE-TEST FRONT UNDERBODY VIEW	A-15
A-14	POST-TEST FRONT UNDERBODY VIEW	A-16
A-15	PRE-TEST REAR UNDERBODY VIEW	A-17
A-16	POST-TEST REAR UNDERBODY VIEW	A-18
A-17	CERTIFICATION PLACARD	A-19
A-18	TIRE PLACARD	A-20
A-19	ROLLOVER 90°	A-21
A-20	ROLLOVER 180°	A-22
A-21	ROLLOVER 270°	A-23
A-22	ROLLOVER 360°	A-24



Figure A-1 PRE-TEST FRONT VIEW

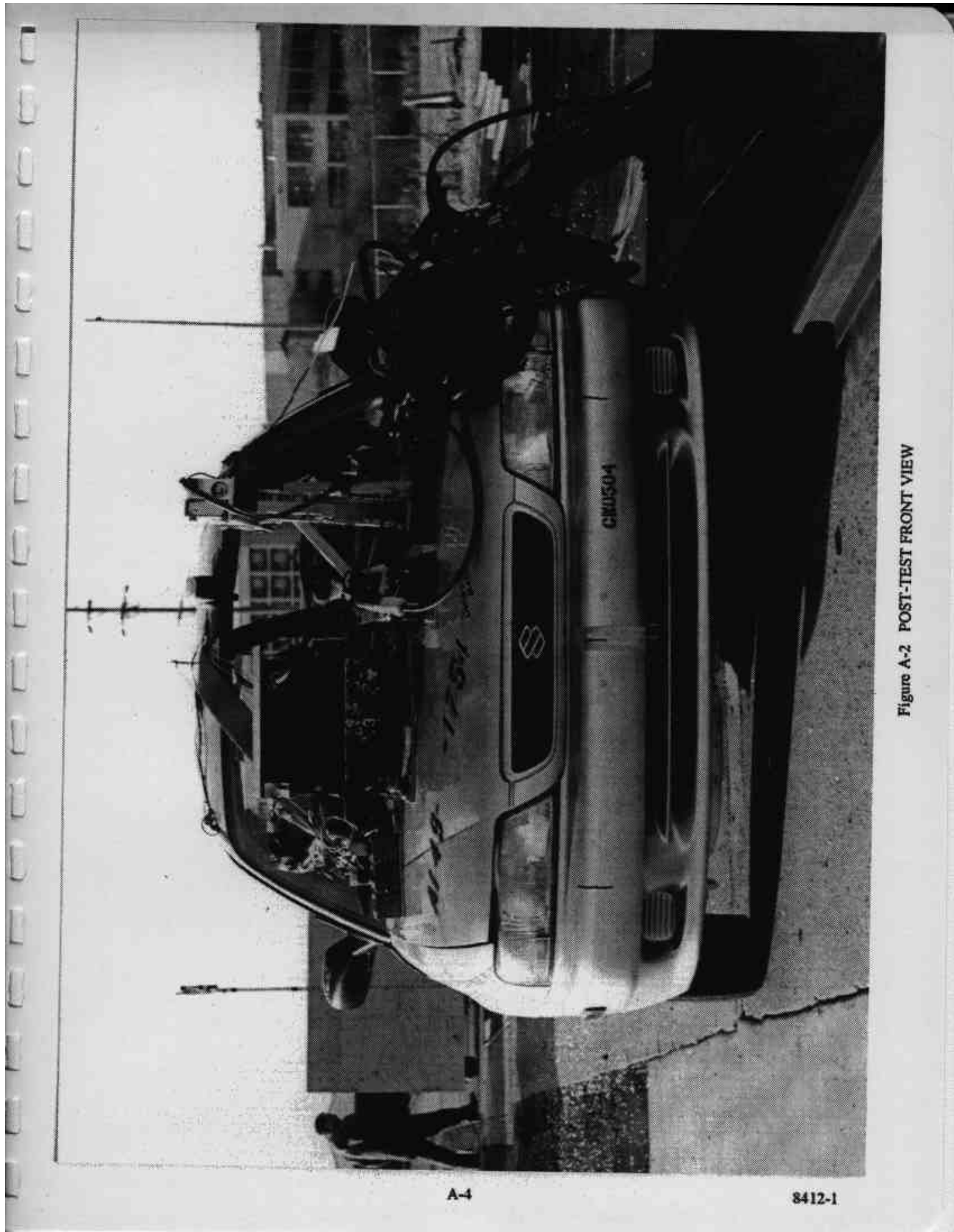


Figure A-2 POST-TEST FRONT VIEW

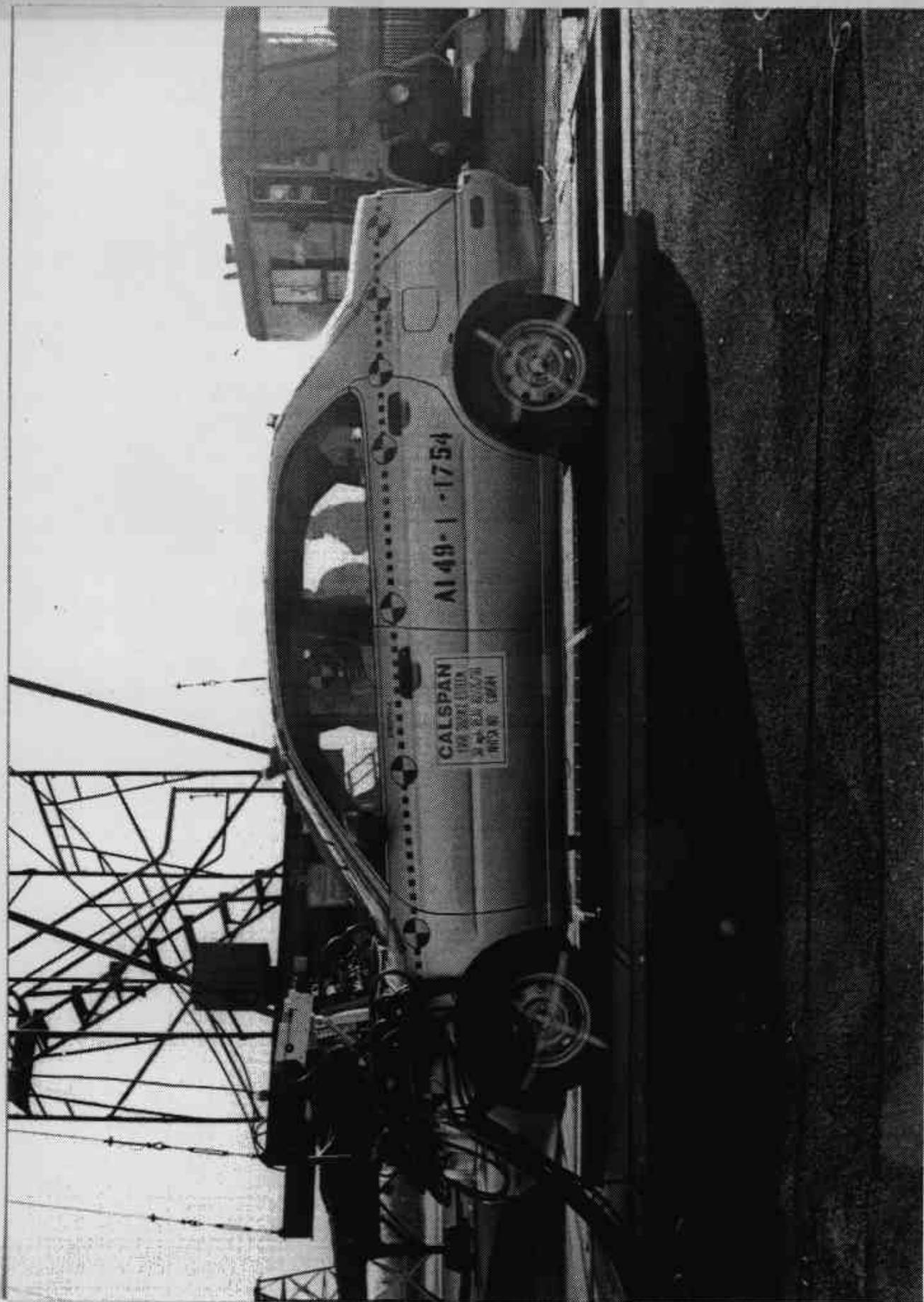


Figure A-3 PRE-TEST LEFT SIDE VIEW



Figure A-4 POST-TEST LEFT SIDE VIEW



Figure A-5 PRE-TEST RIGHT SIDE VIEW

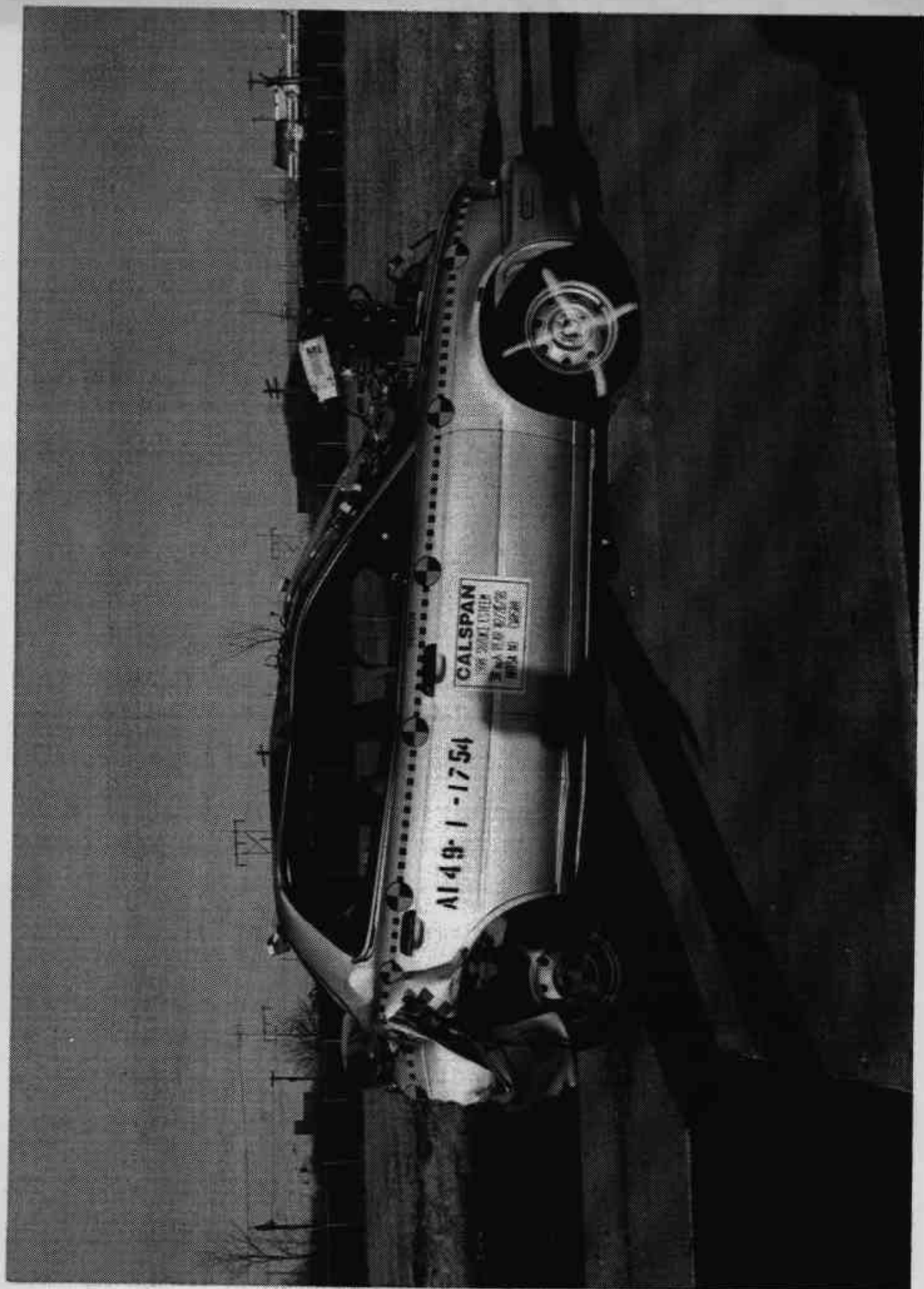


Figure A-6 POST-TEST RIGHT SIDE VIEW



Figure A-7 PRE-TEST REAR VIEW

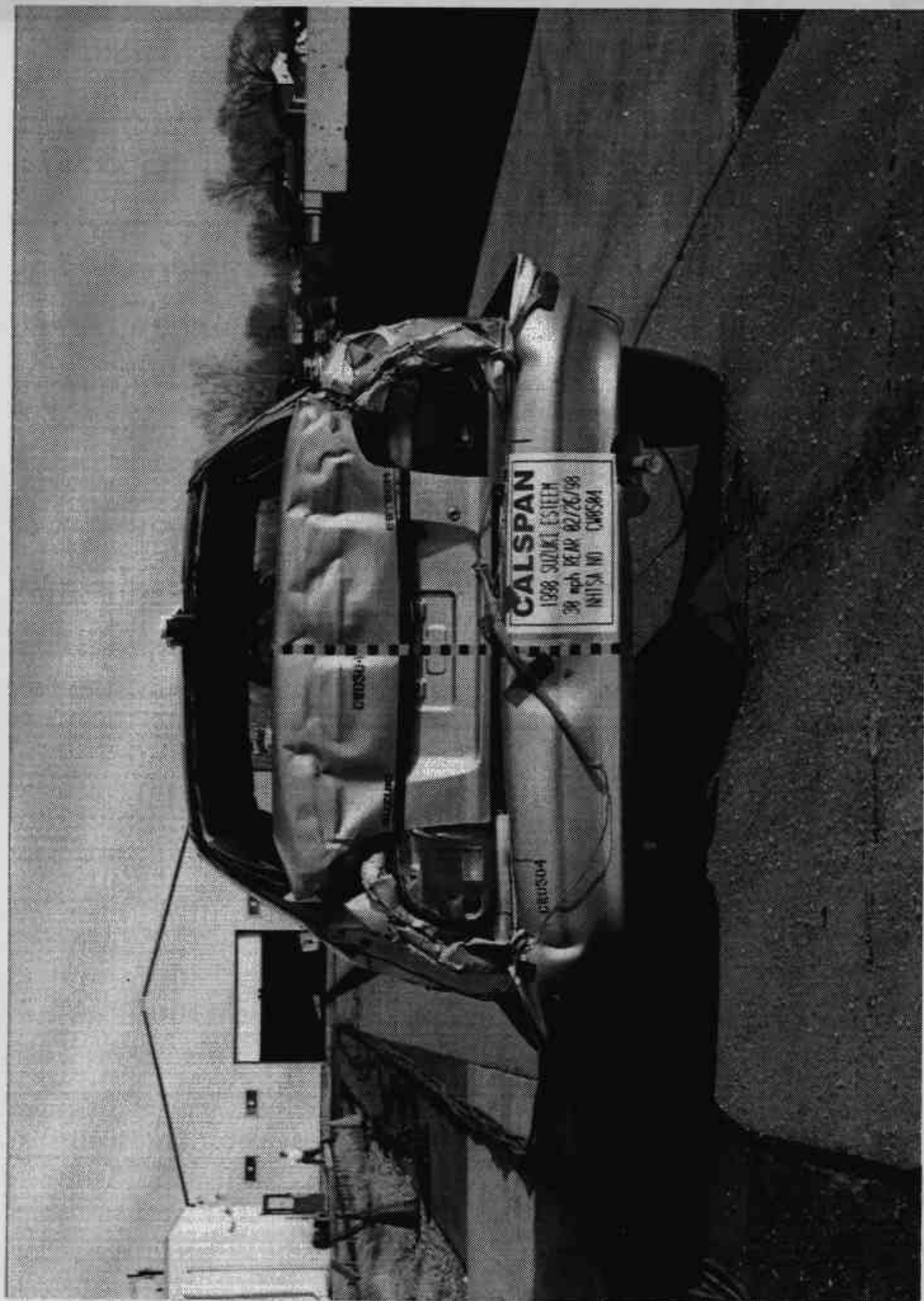


Figure A-8 POST-TEST REAR VIEW



Figure A-9 PRE-TEST LEFT FRONT THREE-QUARTER VIEW

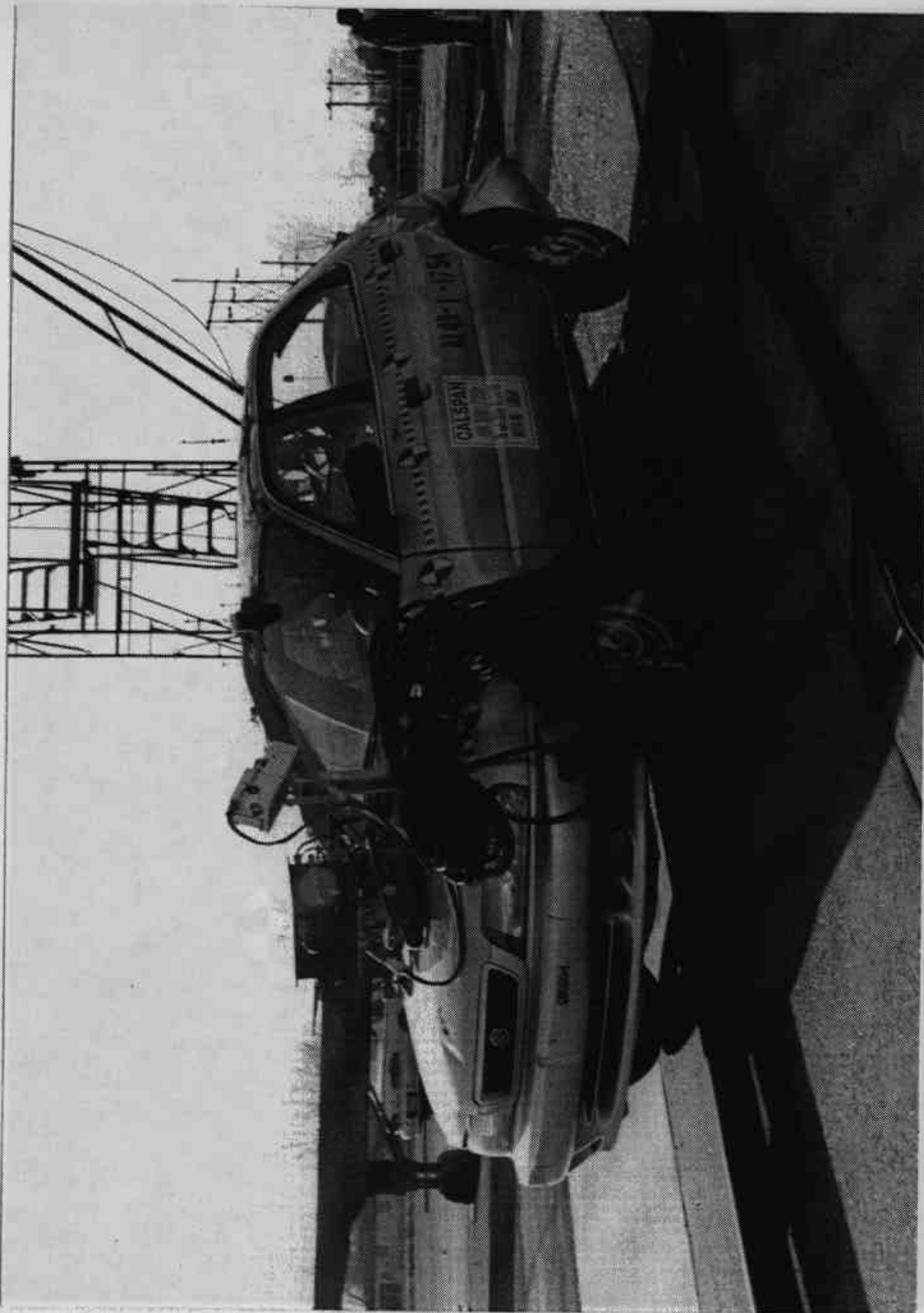


Figure A-10 POST-TEST LEFT FRONT THREE-QUARTER VIEW

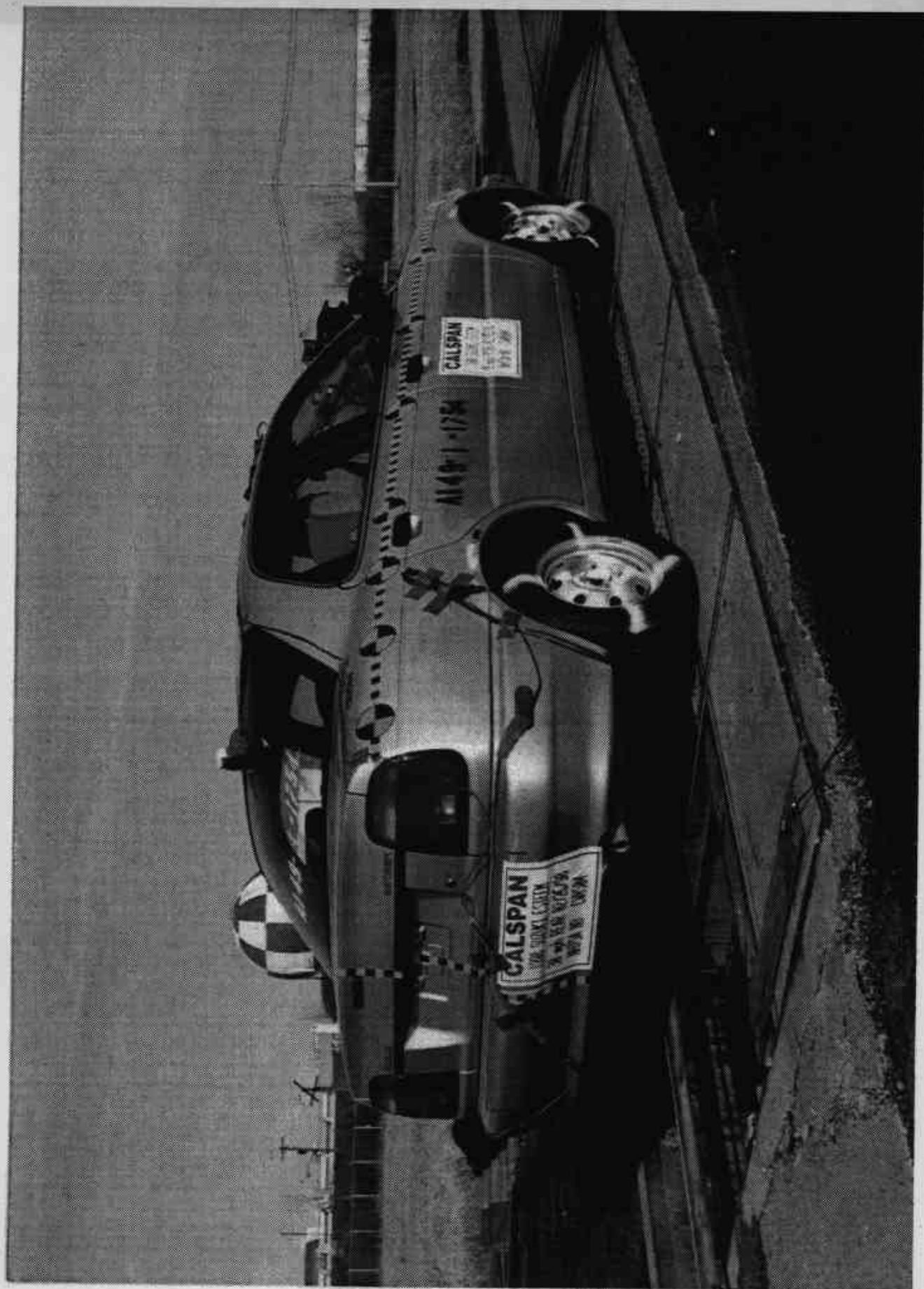


Figure A-11 PRE-TEST RIGHT REAR THREE-QUARTER VIEW

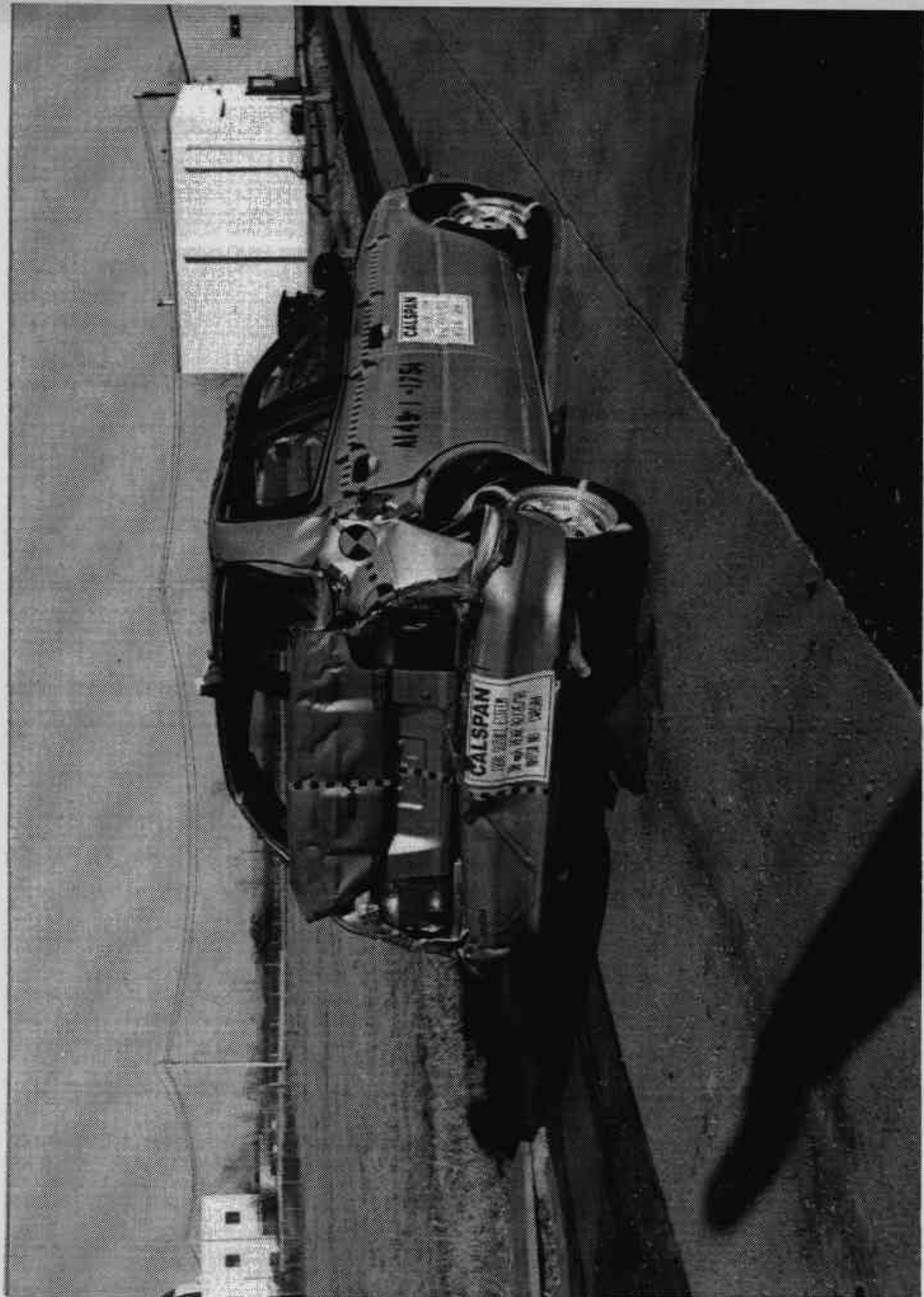
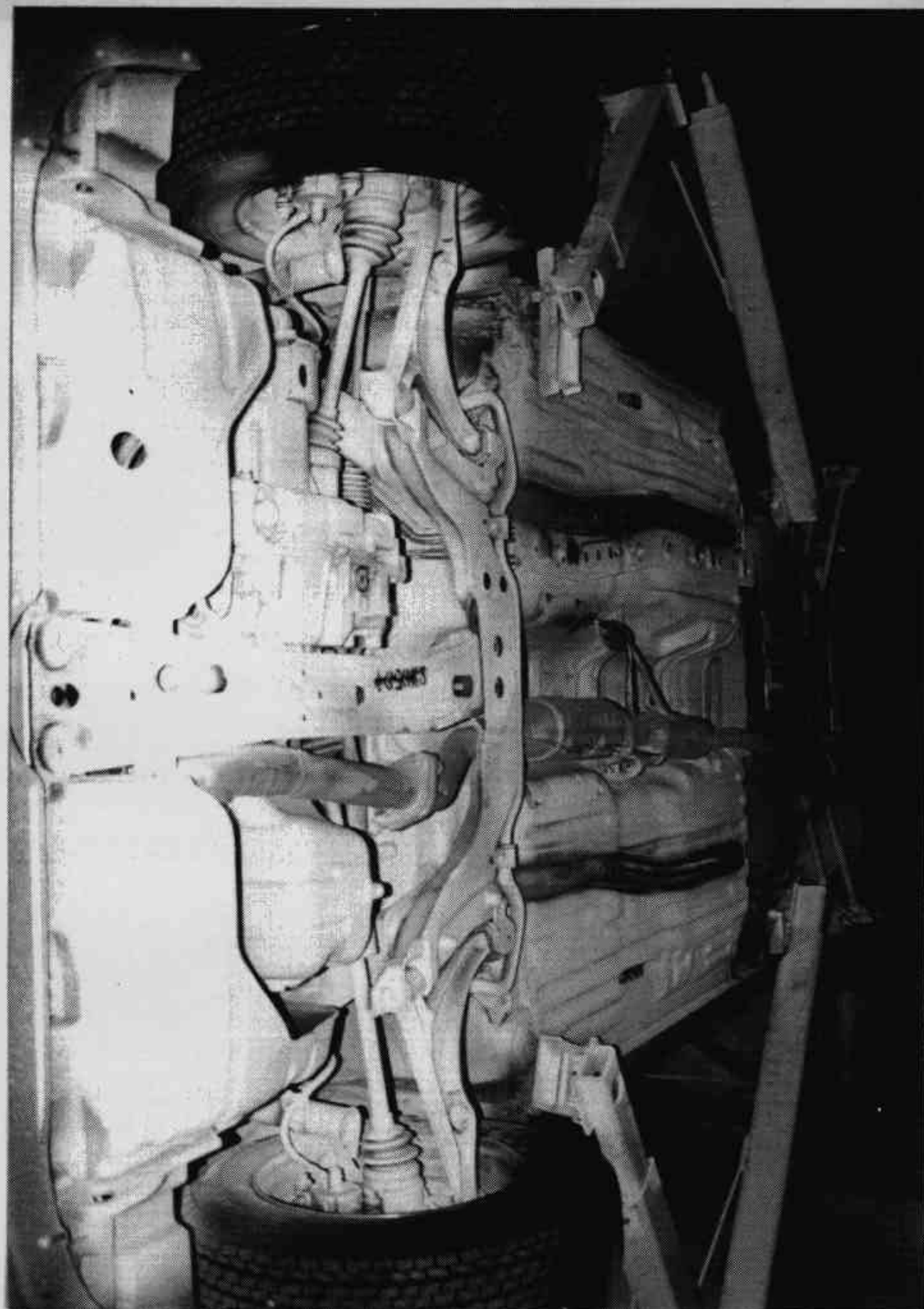


Figure A-12 POST-TEST RIGHT REAR THREE-QUARTER VIEW

Figure A-13 PRE-TEST FRONT UNDERBODY VIEW



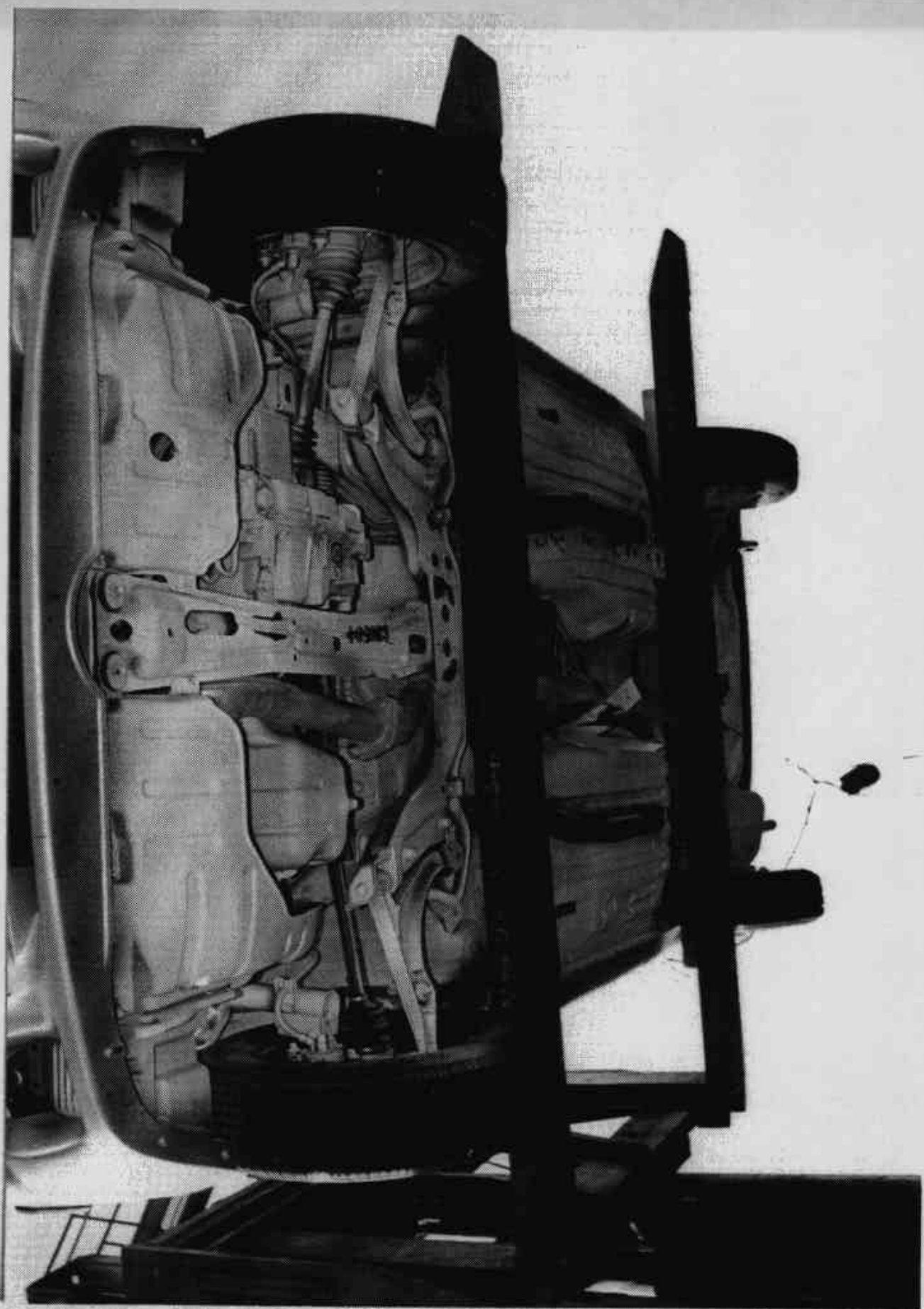


Figure A-14 POST-TEST FRONT UNDERBODY VIEW

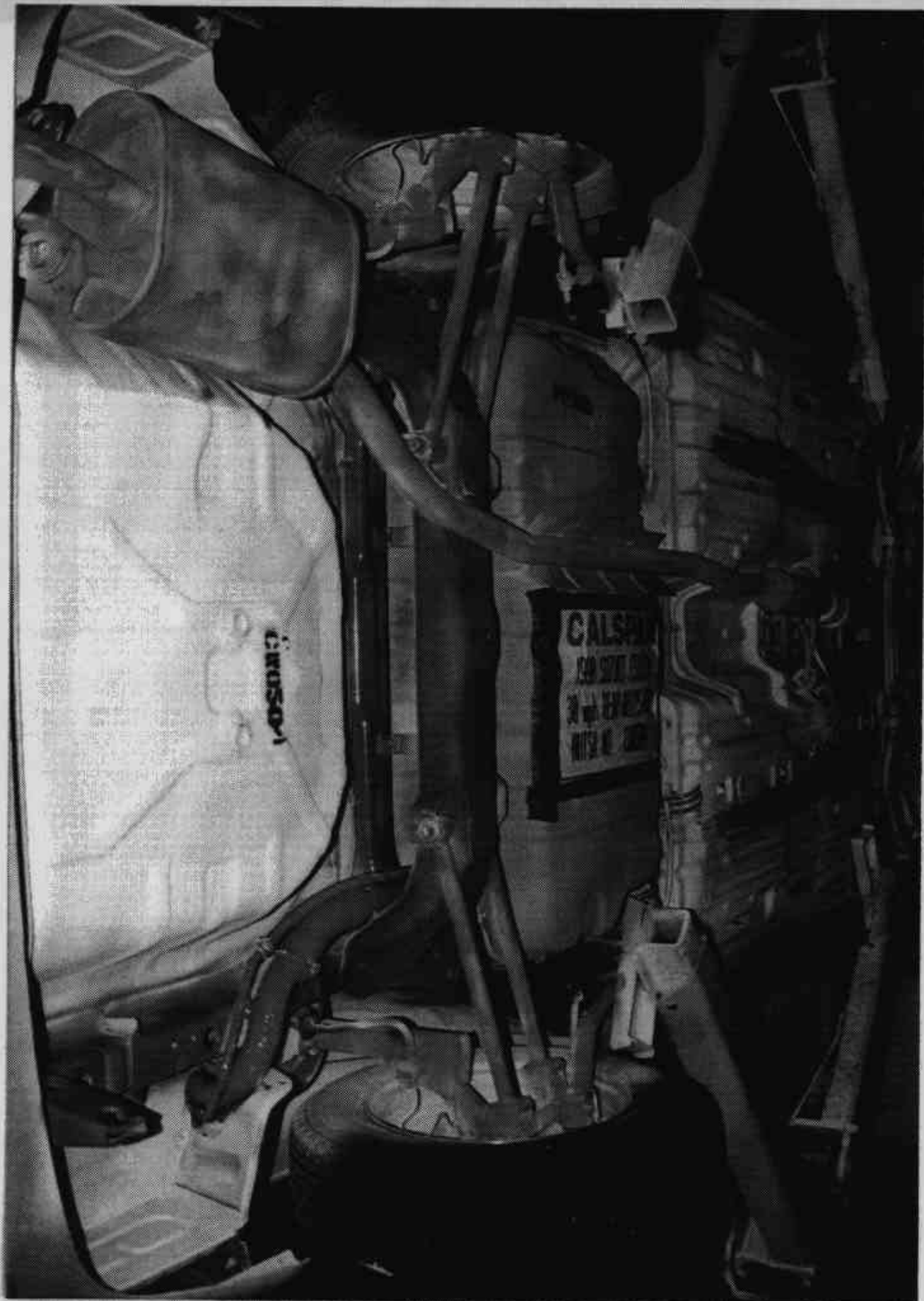


Figure A-15 PRE-TEST REAR UNDERBODY VIEW

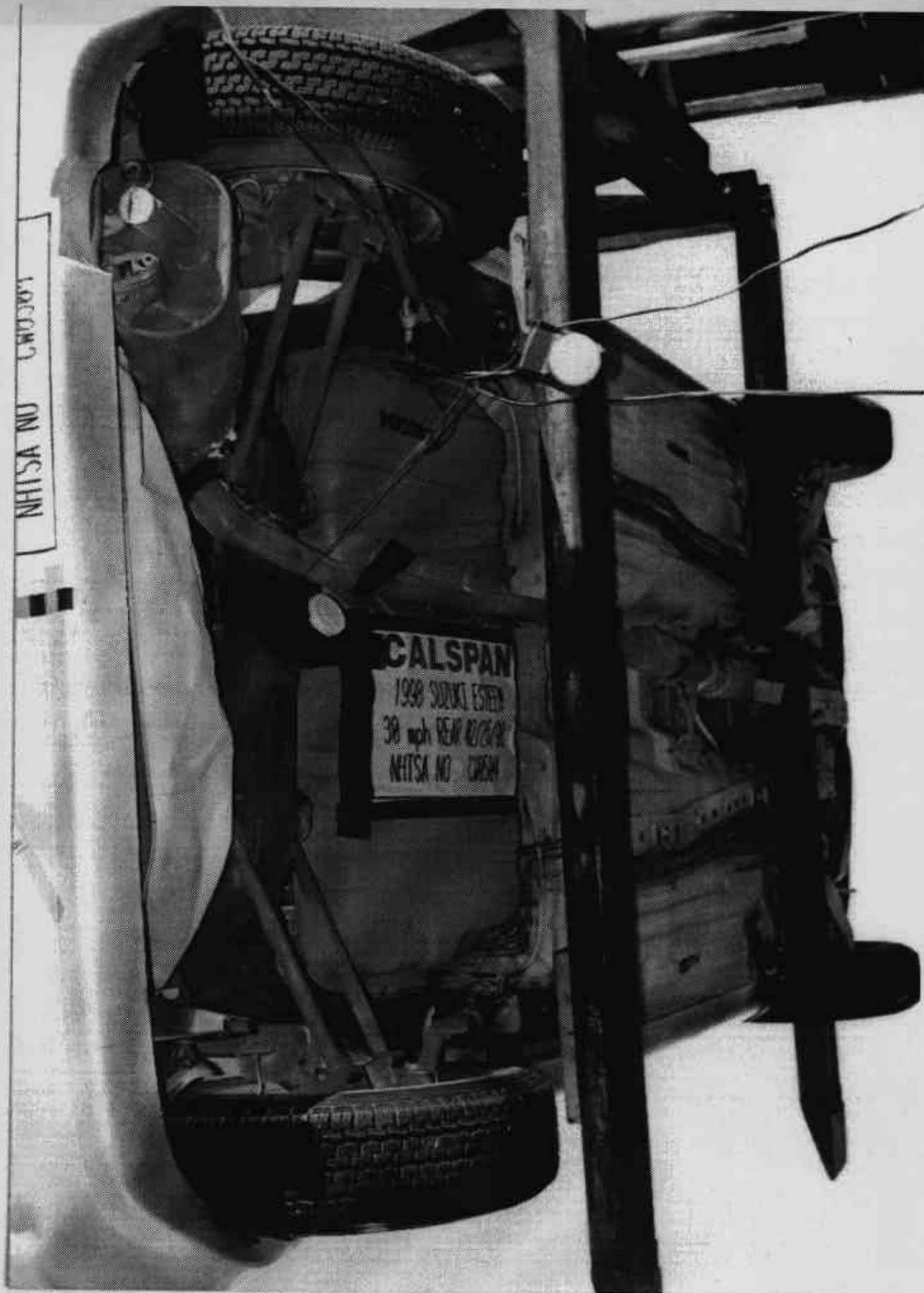


Figure A-16 POST-TEST REAR UNDERBODY VIEW



Figure A-17 CERTIFICATION PLACARD

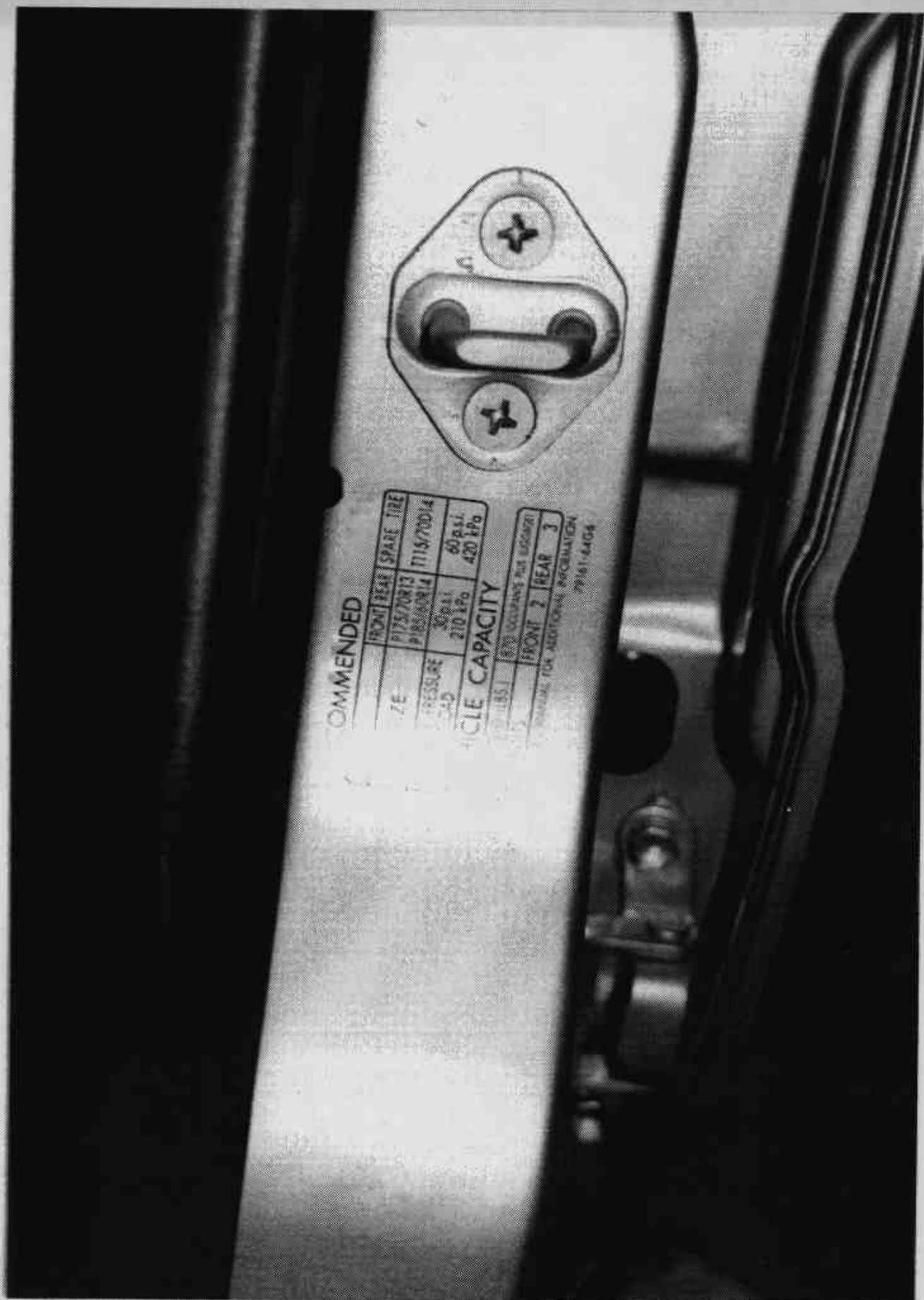


Figure A-18 TIRE PLACARD

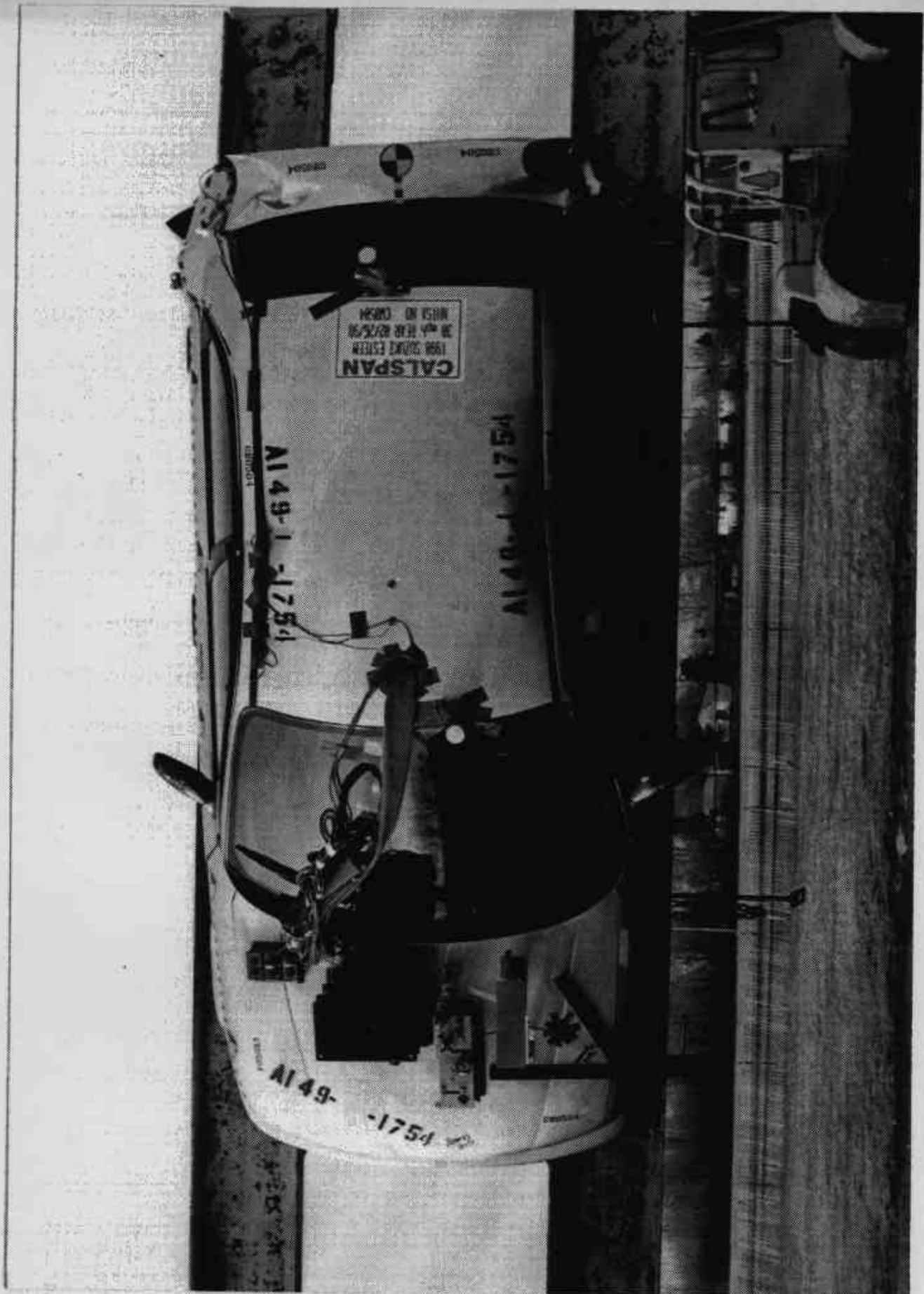


Figure A-19 ROLLOVER 90°

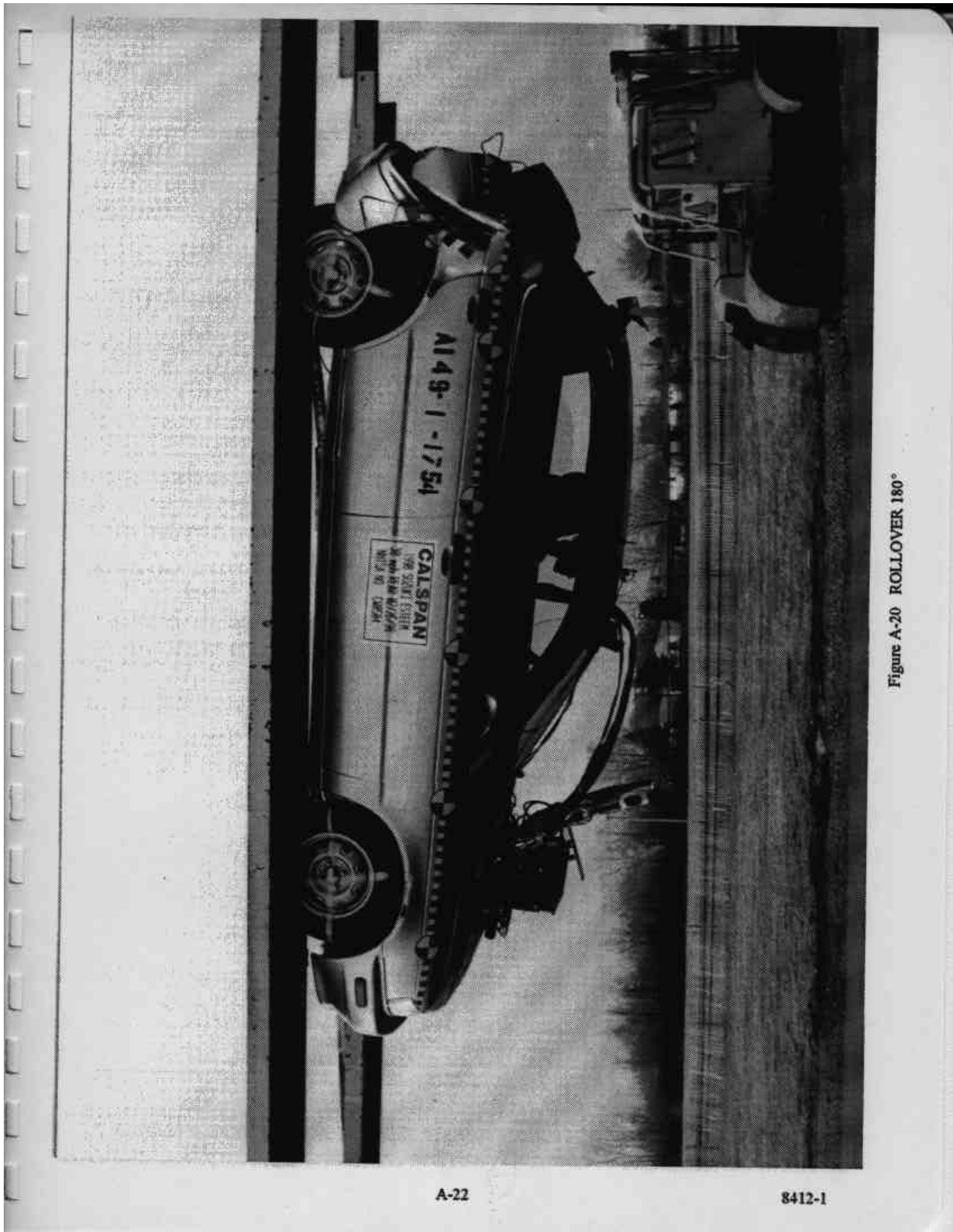


Figure A-20 ROLLOVER 180°

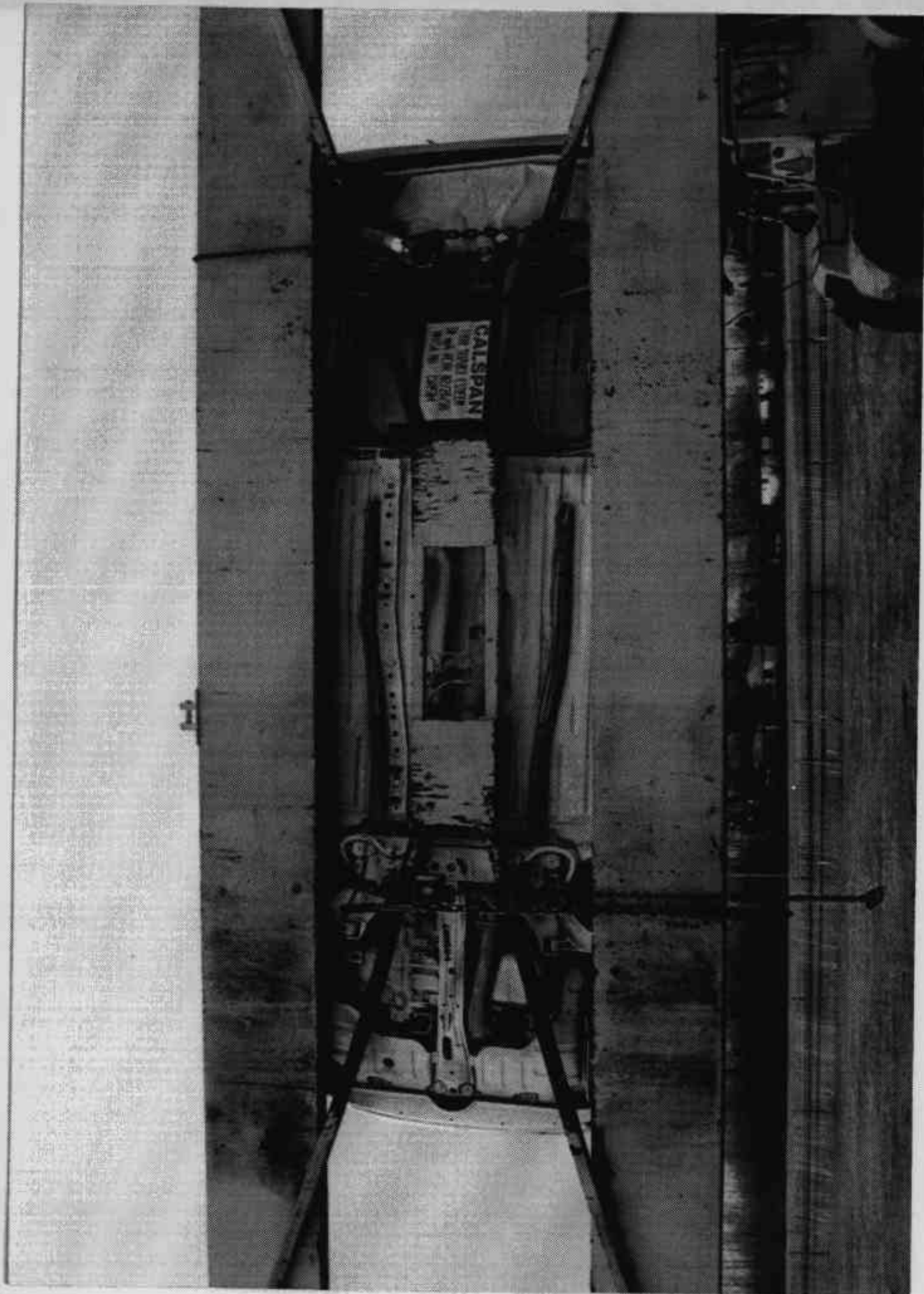


Figure A-21 ROLLOVER 270°



Figure A-22 ROLLOVER 360°

Appendix B

VEHICLE AND DUMMY RESPONSE DATA

(REAR IMPACT ONLY)

FACILITY: track TEST DATE: 26 Feb 1998
 RUN #: 1754 TEST TIME: 16:06:42
 SERIES #: 1 BOARD: a

TITLE: 301 Rear 30 MPH-1998 Suzuki Esteem

CHANNEL NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM		MINIMUM		FILTER CLASS
			AMP	msec	AMP	msec	
1	Pos. 1 Head X	Gs	61.5	145.4	-4.5	163.2	1000.0
2	Pos. 1 Head Y	Gs	3.1	264.6	-2.4	148.2	1000.0
3	Pos. 1 Head Z	Gs	35.0	140.2	-1.1	265.0	1000.0
4	Pos. 1 Chest Disp	ins	.0	168.8	.0	75.4	60.0
5	Pos. 1 Chest X	Gs	11.7	71.5	-.7	353.8	180.0
6	Pos. 1 Chest Y	Gs	2.0	89.9	-3.1	59.7	180.0
7	Pos. 1 Chest Z	Gs	9.1	148.2	-2.2	264.7	180.0
8	Pos. 1 Lap Belt Load	lbs	232.9	148.6	-4.7	24.3	60.0
9	Pos. 1 Pelvic X	Gs	19.3	60.9	-2.8	101.7	1000.0
10	Pos. 1 Pelvic Y	Gs	6.9	81.9	-2.9	56.0	1000.0
11	Pos. 1 Pelvic Z	Gs	8.9	146.4	-2.8	89.8	1000.0
12	Pos. 1 Belt Spoolout	ins	.0	-38.6	-1.9	68.7	60.0
13	Pos. 1 Upper Neck Fx	lbs	97.8	148.1	-56.0	161.4	1000.0
14	Pos. 1 Upper Neck Fy	lbs	17.9	74.5	-24.6	264.7	1000.0
15	Pos. 1 Upper Neck Fz	lbs	263.7	134.8	-266.9	152.3	1000.0
16	Left Rear Xmember X	Gs	25.4	5.9	-2.0	154.3	60.0
17	Pos. 1 Head Resultant	Gs	67.8	144.9	.0	8.3	1000.0
18	Pos. 1 Chest Resultant	Gs	12.6	71.4	.0	-9.2	180.0
19	Pos. 1 Pelvic Res.	Gs	20.1	60.9	.1	5.7	1000.0
20	Pos. 1 Upper Neck F(Res)	lbs	275.7	151.4	.5	8.8	1000.0

V2 36 ms Fixed Duration HIC SUMMARY: Pos. 1 Head Resultant

hic: 358.65
 t1 = 133.700 msec
 t2 = 153.900 msec
 Average G's Over Hic Duration = 50.09

CLIP V2.1 SUMMARY: Pos. 1 Chest Resultant

Peak Resultant (3 ms CLIPPED DURATION) = 11.526 G's
 Tstart = 69.4373 ms
 Tend = 72.4373 ms
 CSI = 26.042

FACILITY: track TEST DATE: 26 Feb 1998
 RUN #: 1754 TEST TIME: 16:06:42
 SERIES #: 1 BOARD: b

TITLE: 301 Rear 30 MPH-1998 Suzuki Esteem

CHANNEL NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM		MINIMUM		FILTER CLASS
			AMP	msec	AMP	msec	
1	Pos. 1 Upper Neck Mx	Ft-Lbs	5.2	78.5	-5.6	146.3	600.0
2	Pos. 1 Upper Neck My	Ft-Lbs	19.4	148.1	-39.8	162.5	600.0
3	Pos. 1 Upper Neck Mz	Ft-Lbs	4.3	75.5	-4.1	102.0	600.0
4	Right Rear Xmember X	Gs	27.1	7.0	-2.9	173.1	60.0
5	Upper Seatback X	Gs	113.5	76.0	-41.4	71.2	60.0
6	Lower Seatback X	Gs	28.3	9.5	-16.3	118.2	60.0
17	Pos. 1 Neck Moment Res.	Ft-Lbs	39.9	162.5	.0	-17.8	600.0

TEST NO. CW0504

VEHICLE

SAE FILTER CHANNEL CLASS

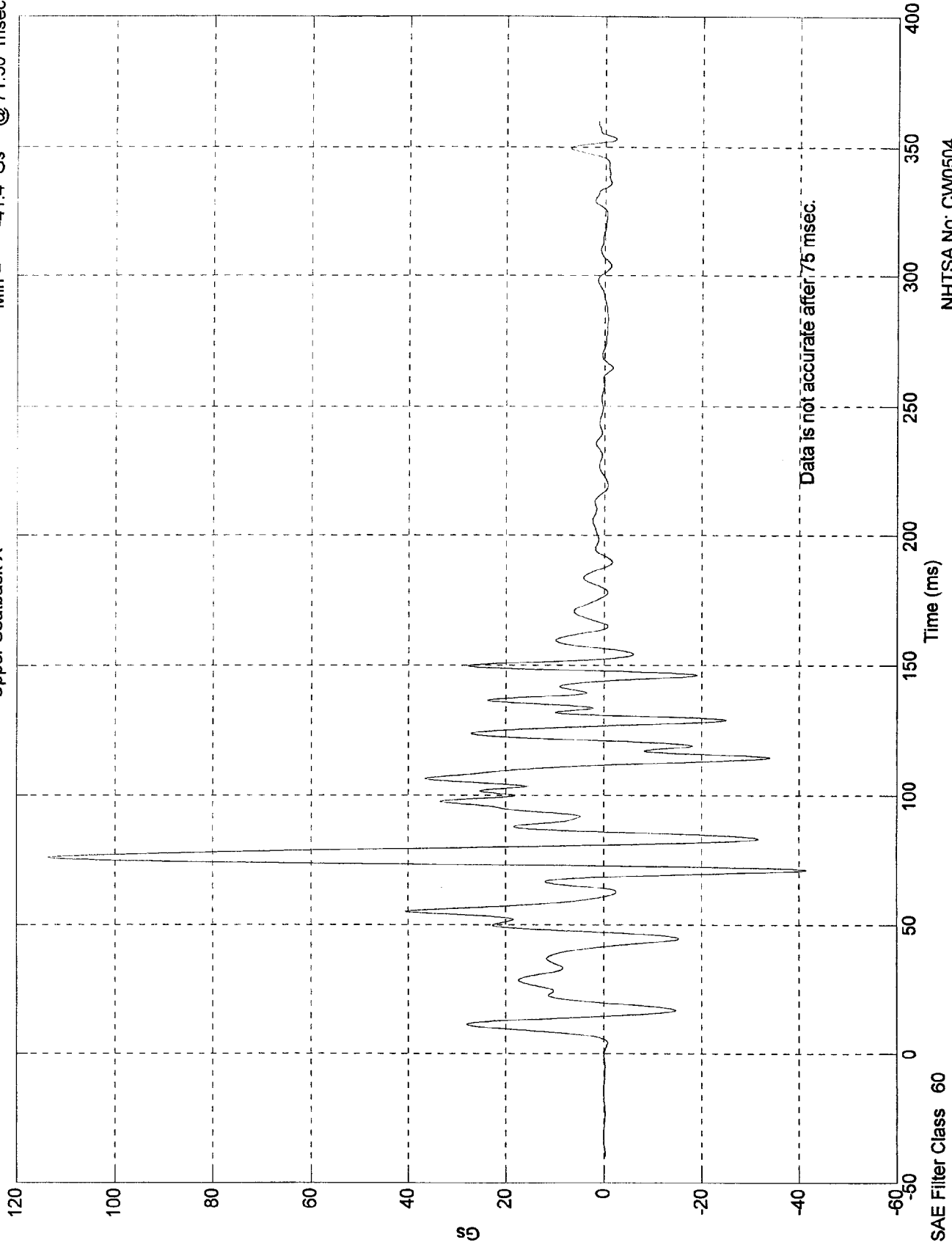
60

Note: Angular seatback position is measured in degrees of rotation from the initial (design) position.

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 114 Gs @ 76.10 msec
Min = -41.4 Gs @ 71.30 msec

Upper Seatback X

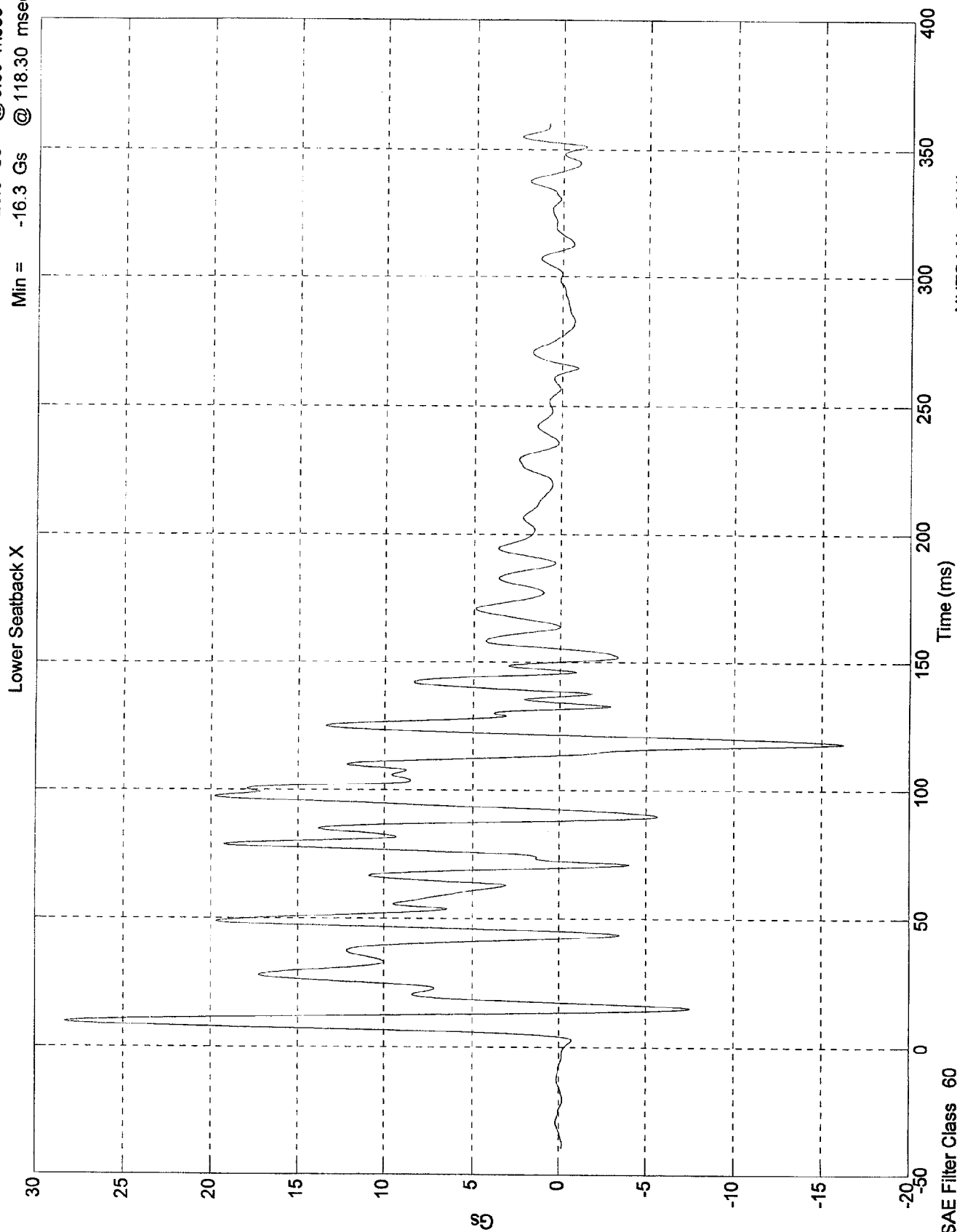


NHTSA No: CW0504
Date: 26 Feb 1998

SAE Filter Class 60

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 28.3 Gs @ 9.60 msec
Min = -16.3 Gs @ 118.30 msec

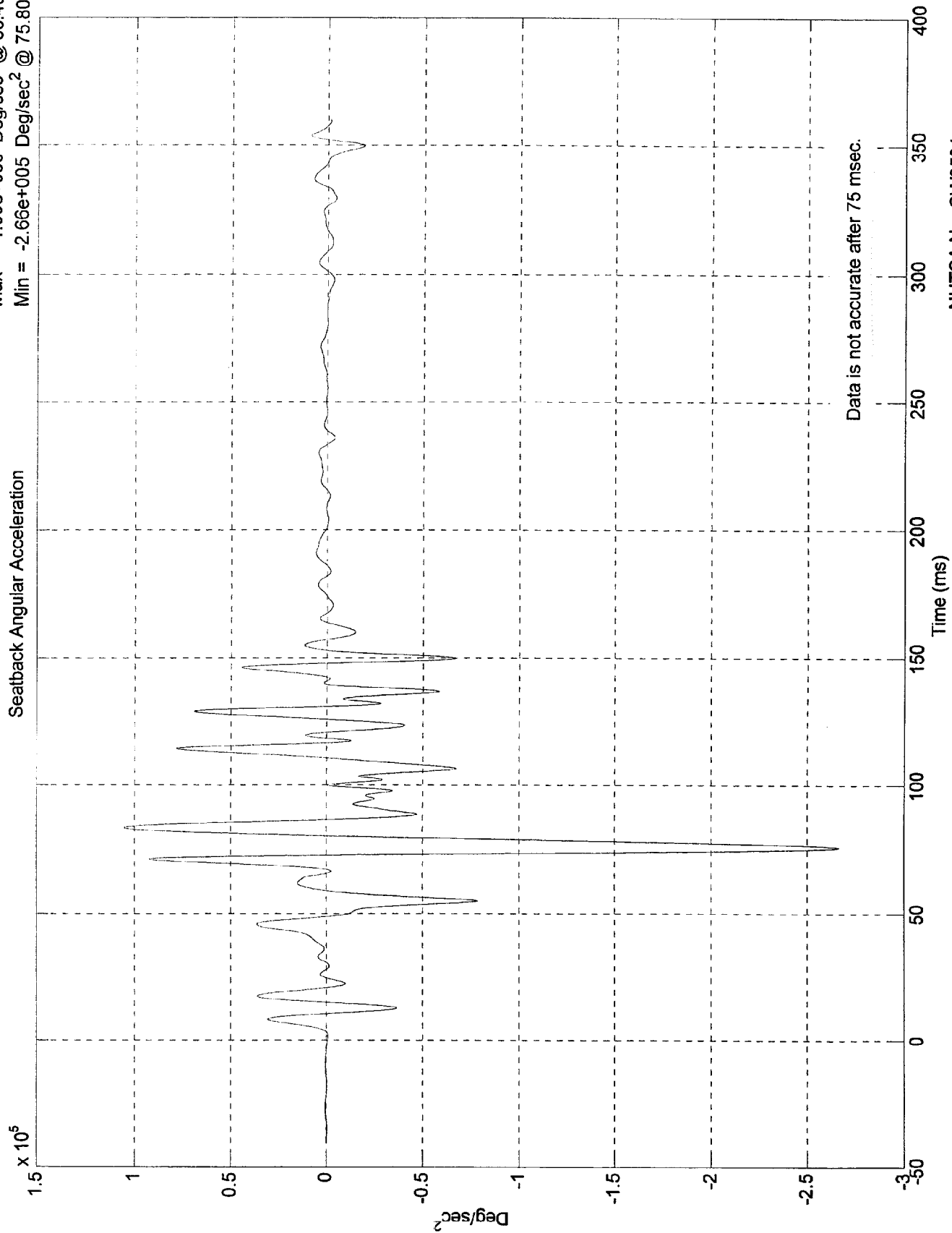


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = $1.05\text{e}+005$ Deg/sec² @ 83.40 msec
Min = $-2.66\text{e}+005$ Deg/sec² @ 75.80 msec

Seatback Angular Acceleration

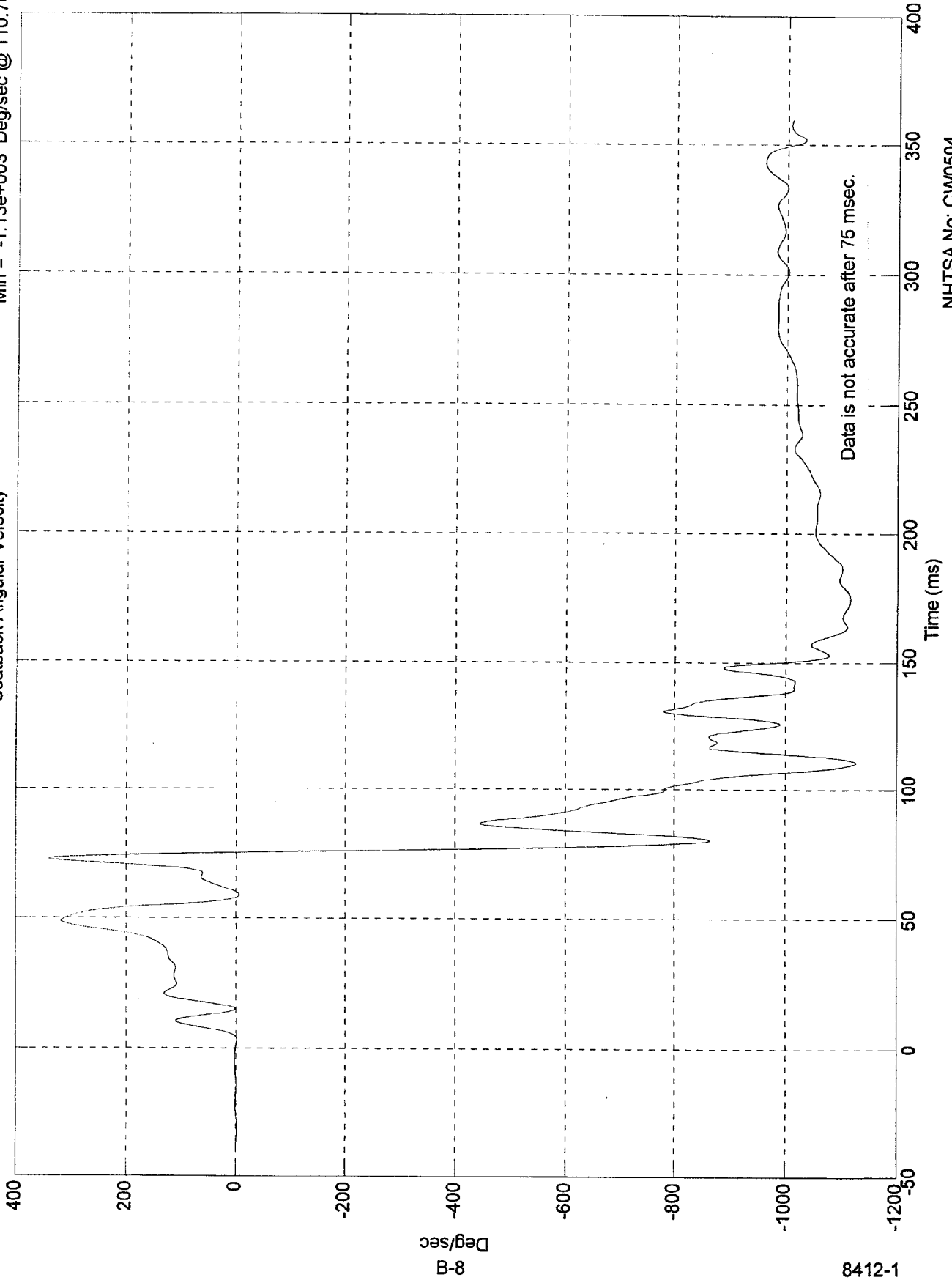


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

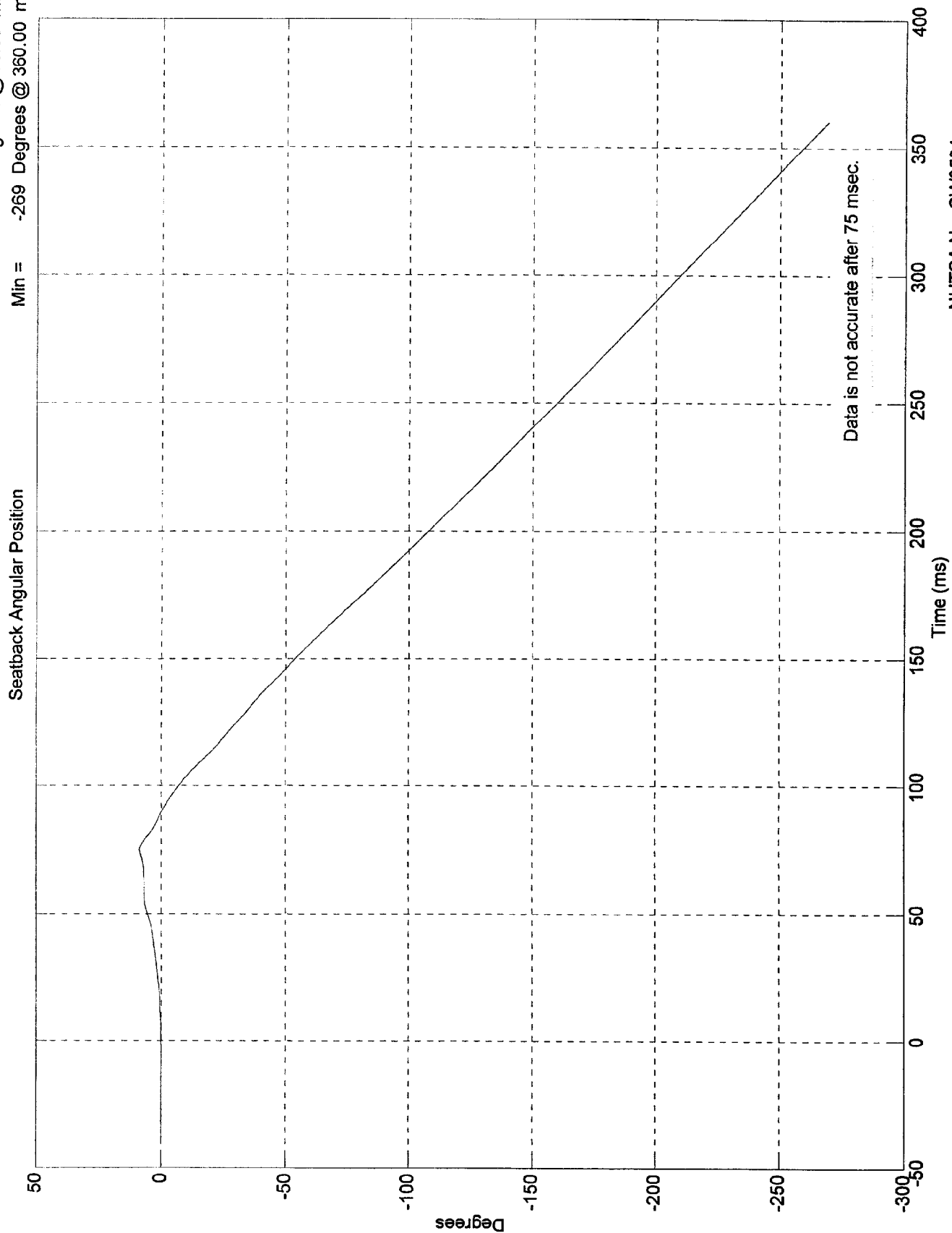
Max = 340 Deg/sec @ 72.70 msec
Min = -1.13e+003 Deg/sec @ 110.70 msec

Seatback Angular Velocity



NHTSA No: CW0504
Date: 26 Feb 1998

Max = 8.62 Degrees @ 75.00 msec
 Min = -269 Degrees @ 360.00 msec

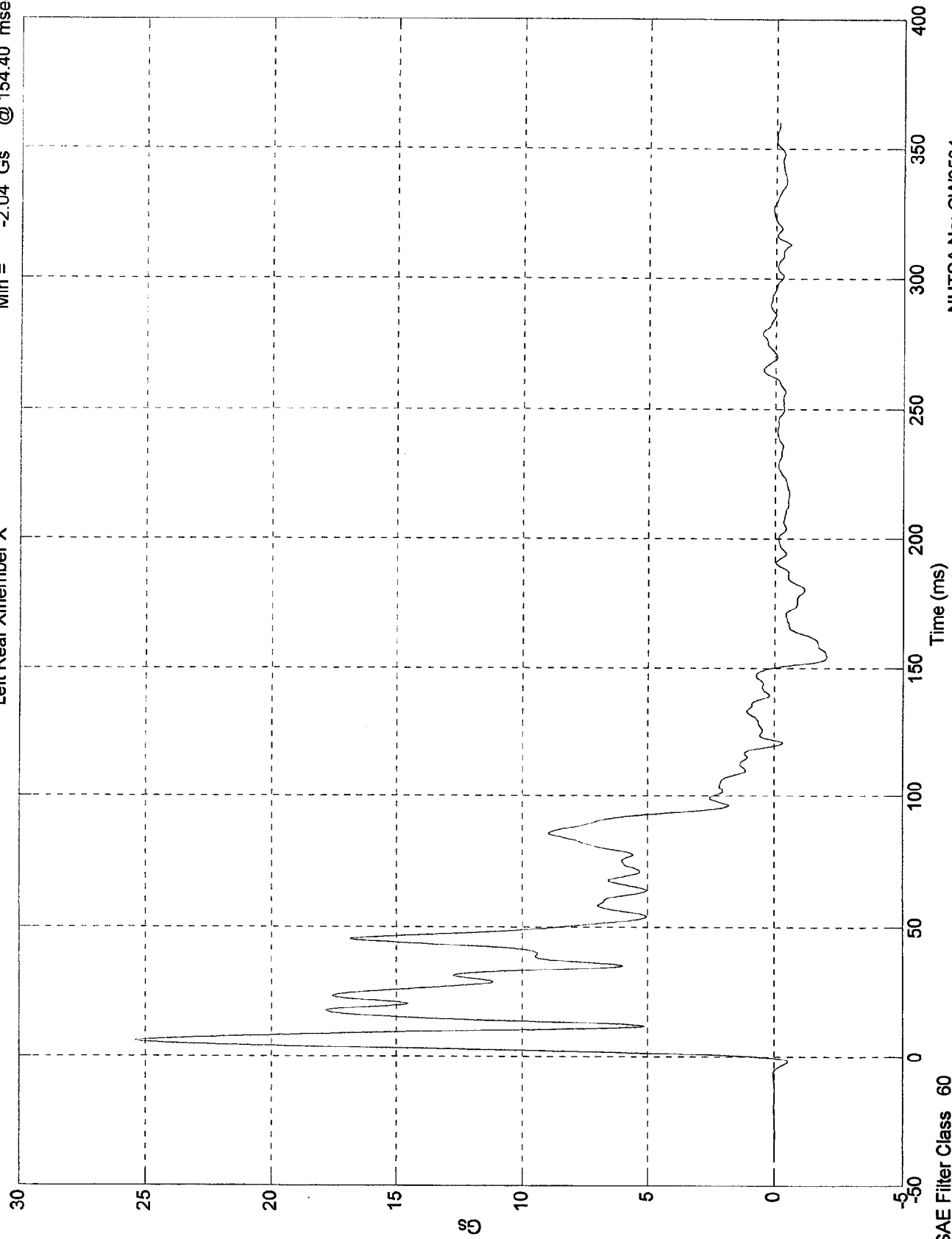


NHTSA No: CW0504
 Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 25.4 Gs @ 6.00 msec
Min = -2.04 Gs @ 154.40 msec

Left Rear Xmember X

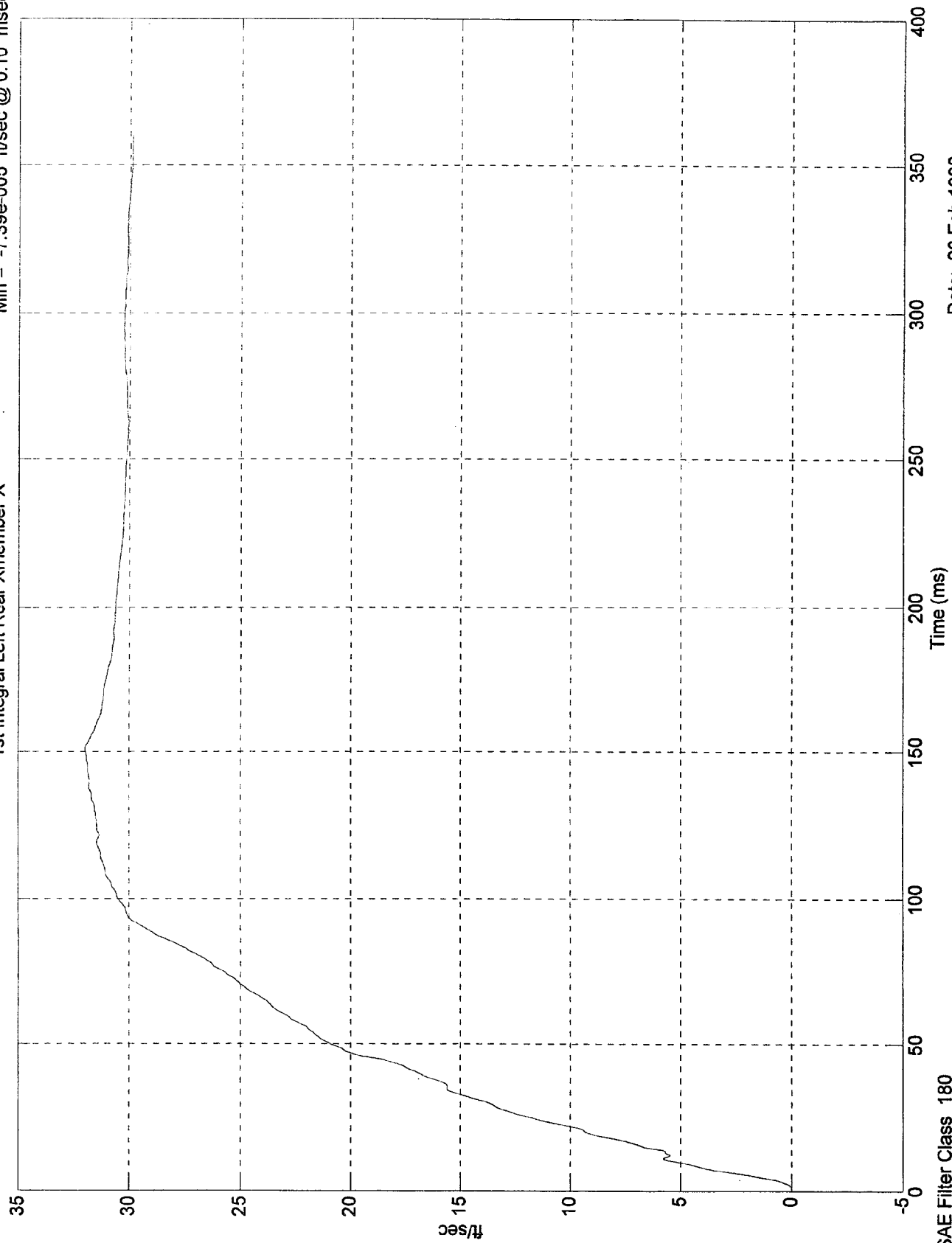


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 32 ft/sec @ 151.00 msec
Min = -7.39e-005 ft/sec @ 0.10 msec

1st Integral Left Rear Xmember X



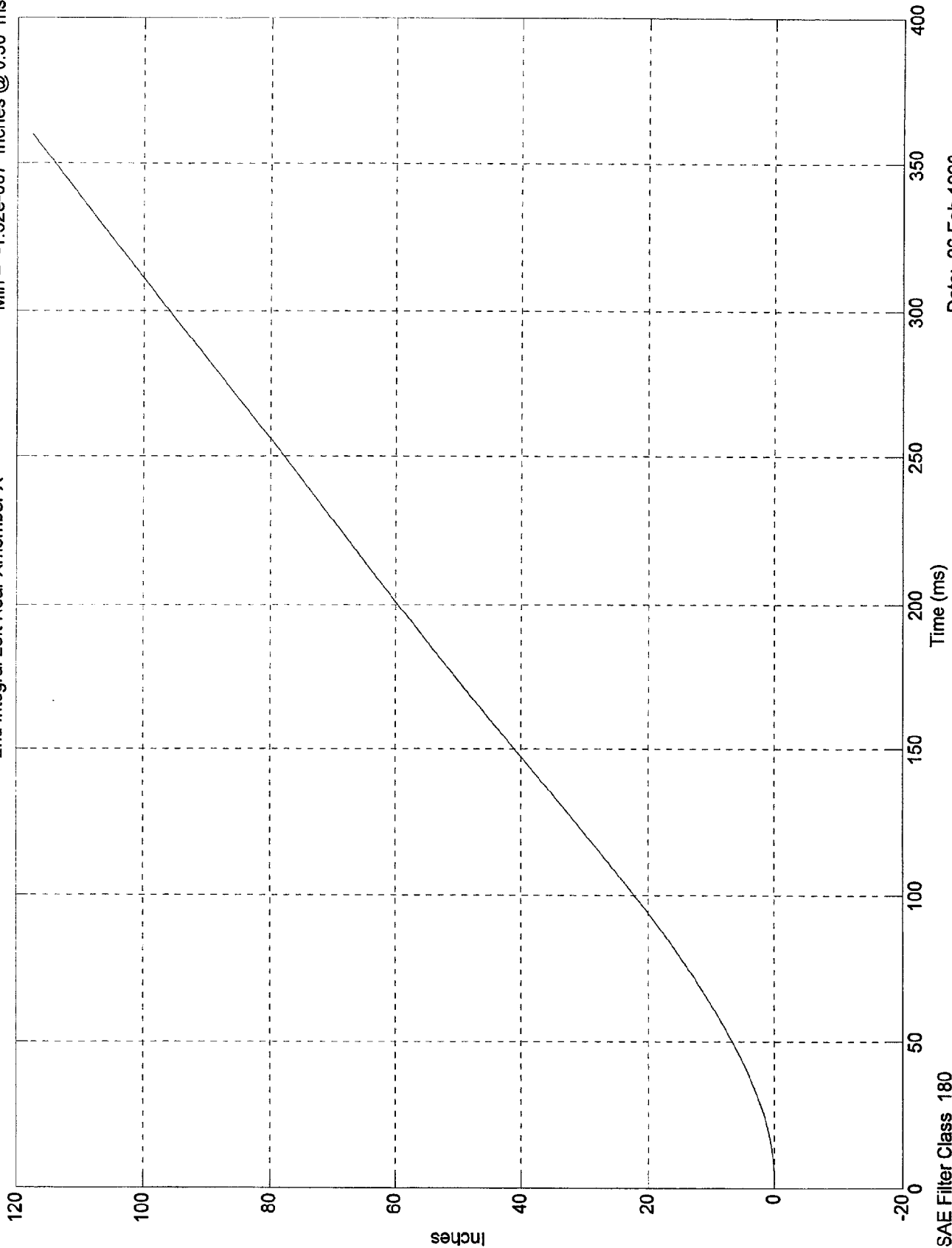
SAE Filter Class 180

Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 118 Inches @ 360.00 msec
Min = -1.32e-007 Inches @ 0.30 msec

2nd Integral Left Rear Xmember X



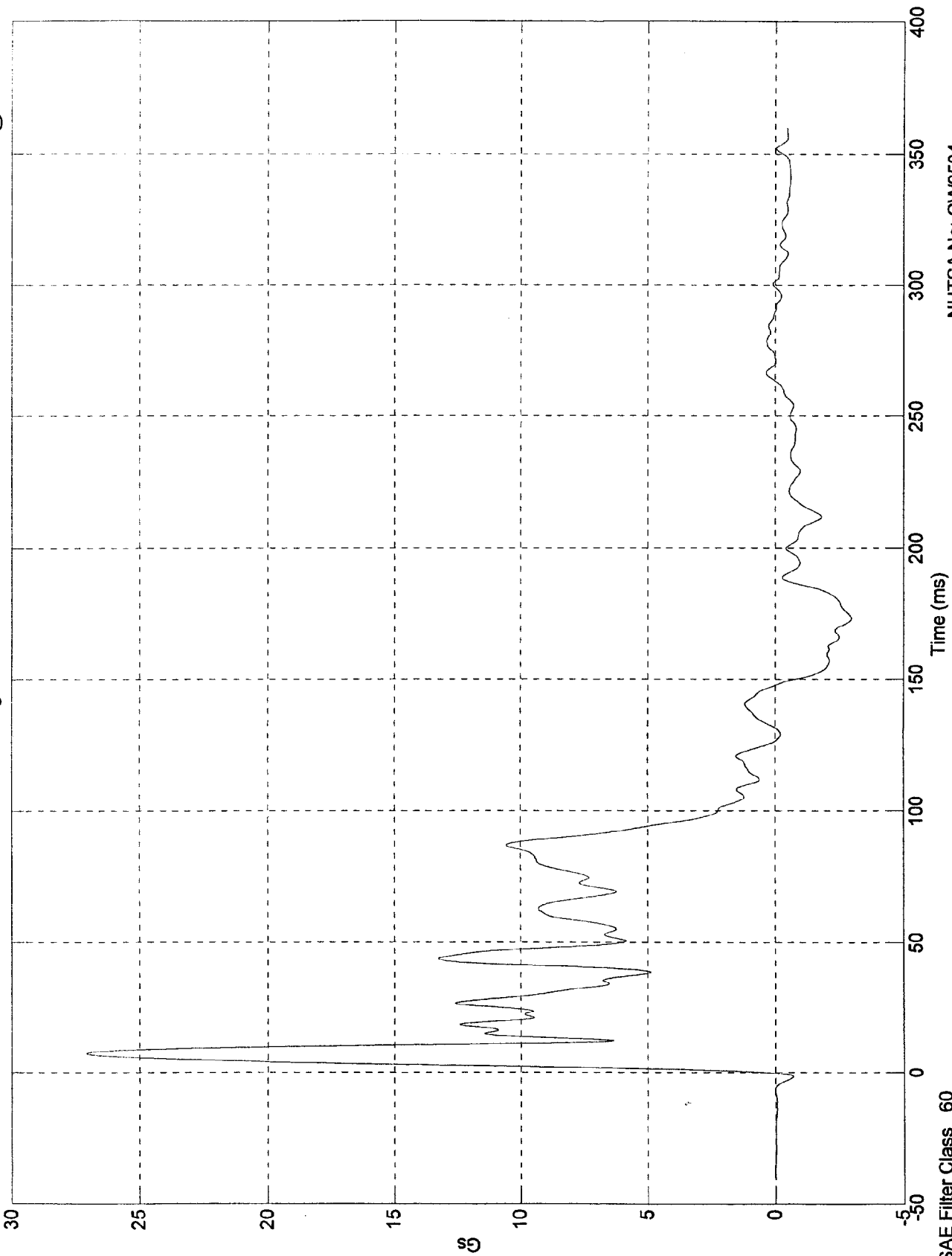
Date: 26 Feb 1998

SAE Filter Class 180

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 27.1 Gs @ 7.10 msec
Min = -2.95 Gs @ 173.20 msec

Right Rear Xmember X



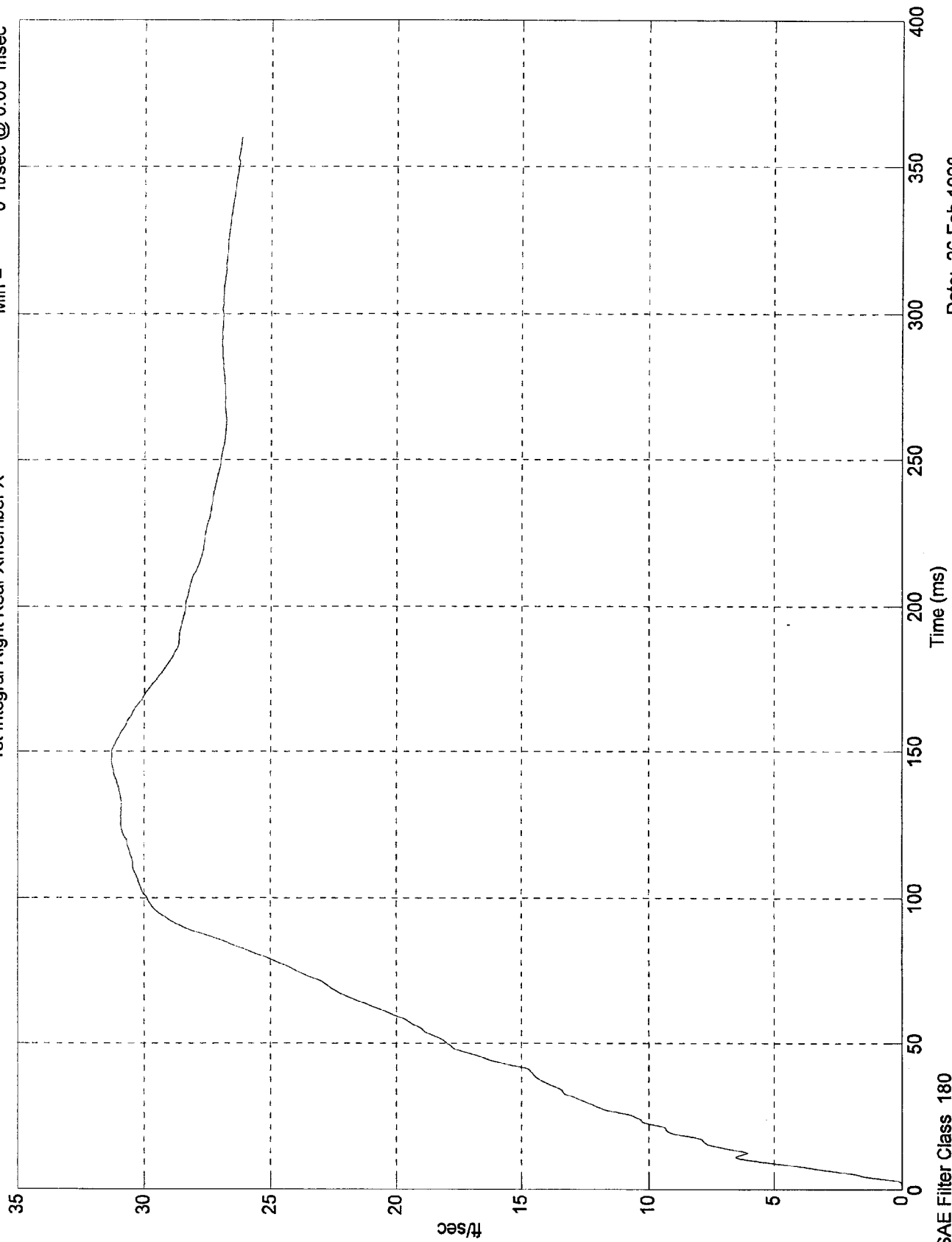
NHTSA No: CW0504
Date: 26 Feb 1998

SAE Filter Class 60

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 31.3 ft/sec @ 146.80 msec
Min = 0 ft/sec @ 0.00 msec

1st Integral Right Rear Xmember X



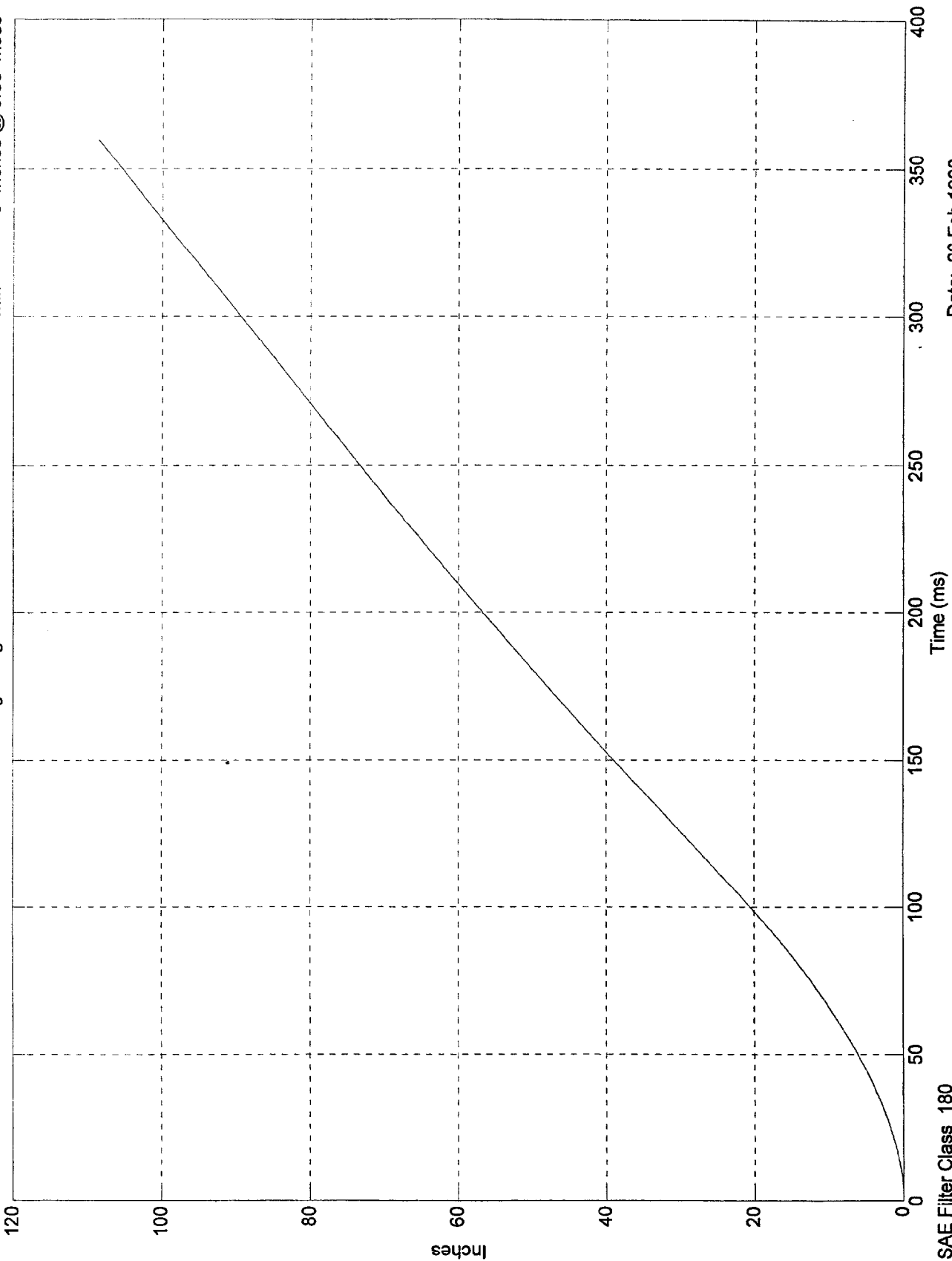
SAE Filter Class 180

Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 109 Inches @ 360.00 msec
Min = 0 Inches @ 0.00 msec

2nd Integral Right Rear Xmember X



SAE Filter Class 180

Date: 26 Feb 1998

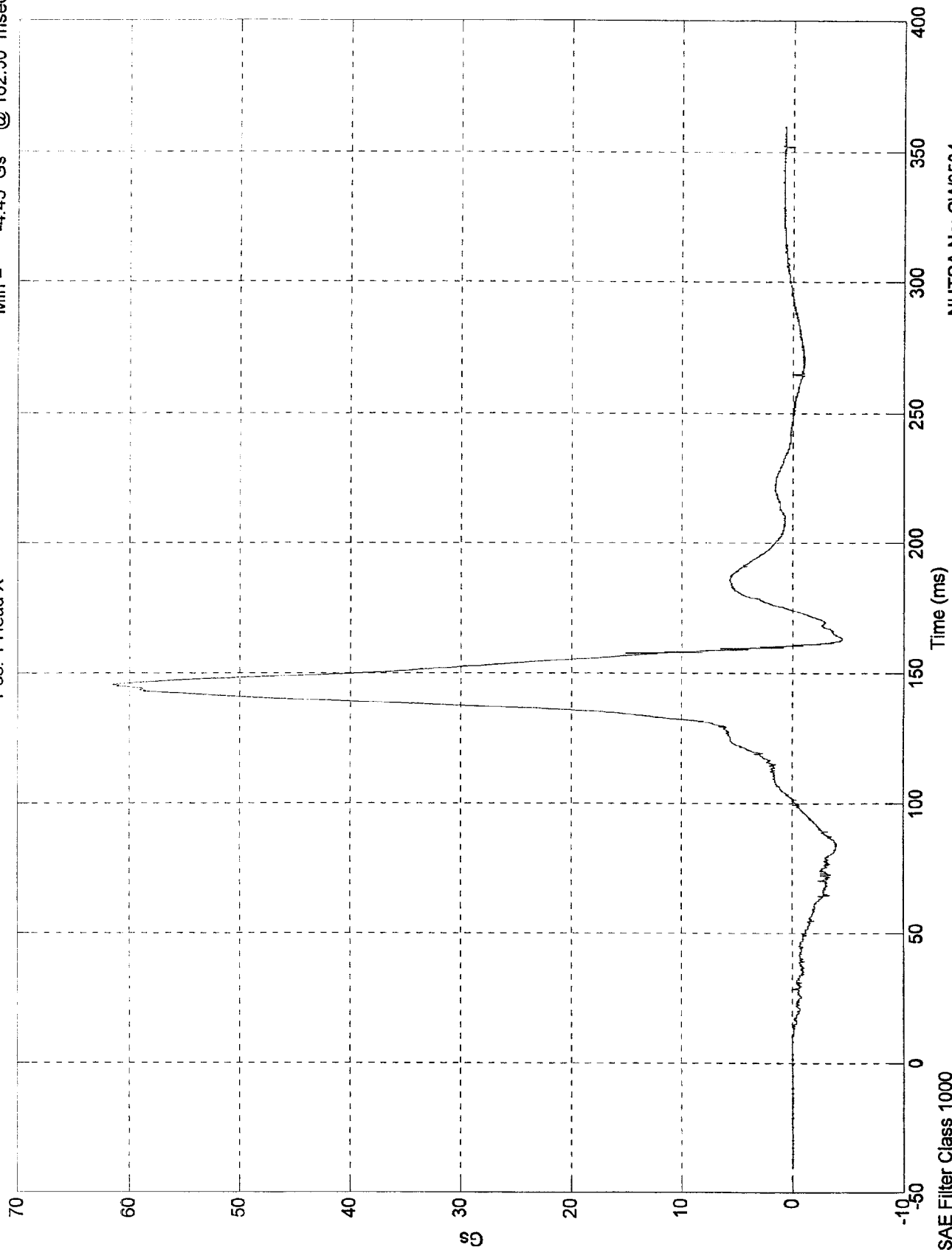
TEST NO. CW0504

DRIVER DUMMY (Pos. 1)	SAE FILTER CHANNEL CLASS
Head Accelerations	1000
Chest Accelerations	180
Pelvic Accelerations	1000
Upper Neck Forces	1000
Upper Neck Moments	600
Belt Forces	60
Belt Spoolout	60

301 Rear 30 MPH-1998 Suzuki Esteem

Pos. 1 Head X

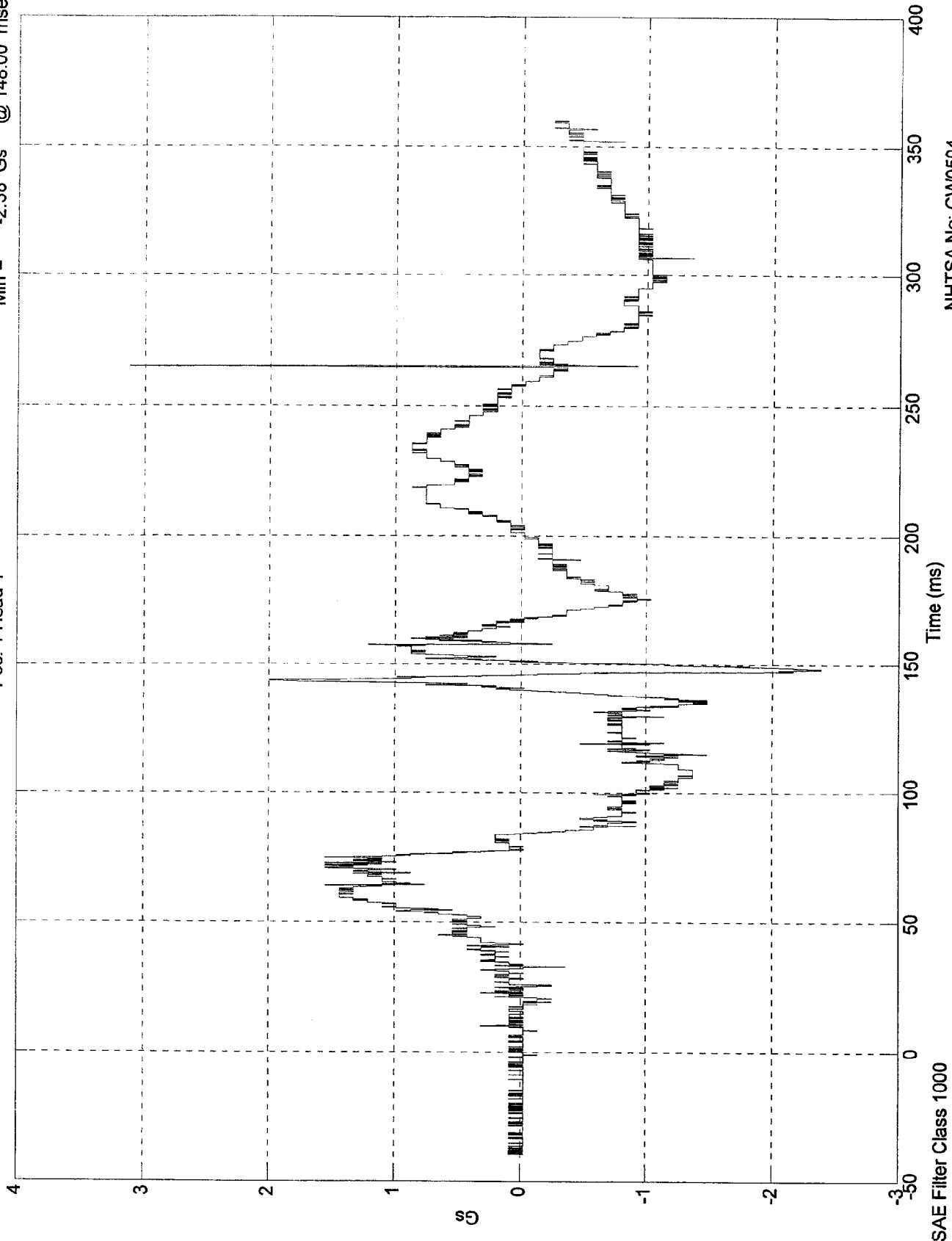
Max = 61.5 Gs @ 145.50 msec
Min = -4.45 Gs @ 162.50 msec



NHTSA No: CW0504
Date: 26 Feb 1998

Max = 3.12 Gs @ 264.70 msec
 Min = -2.38 Gs @ 148.00 msec

Pos. 1 Head Y

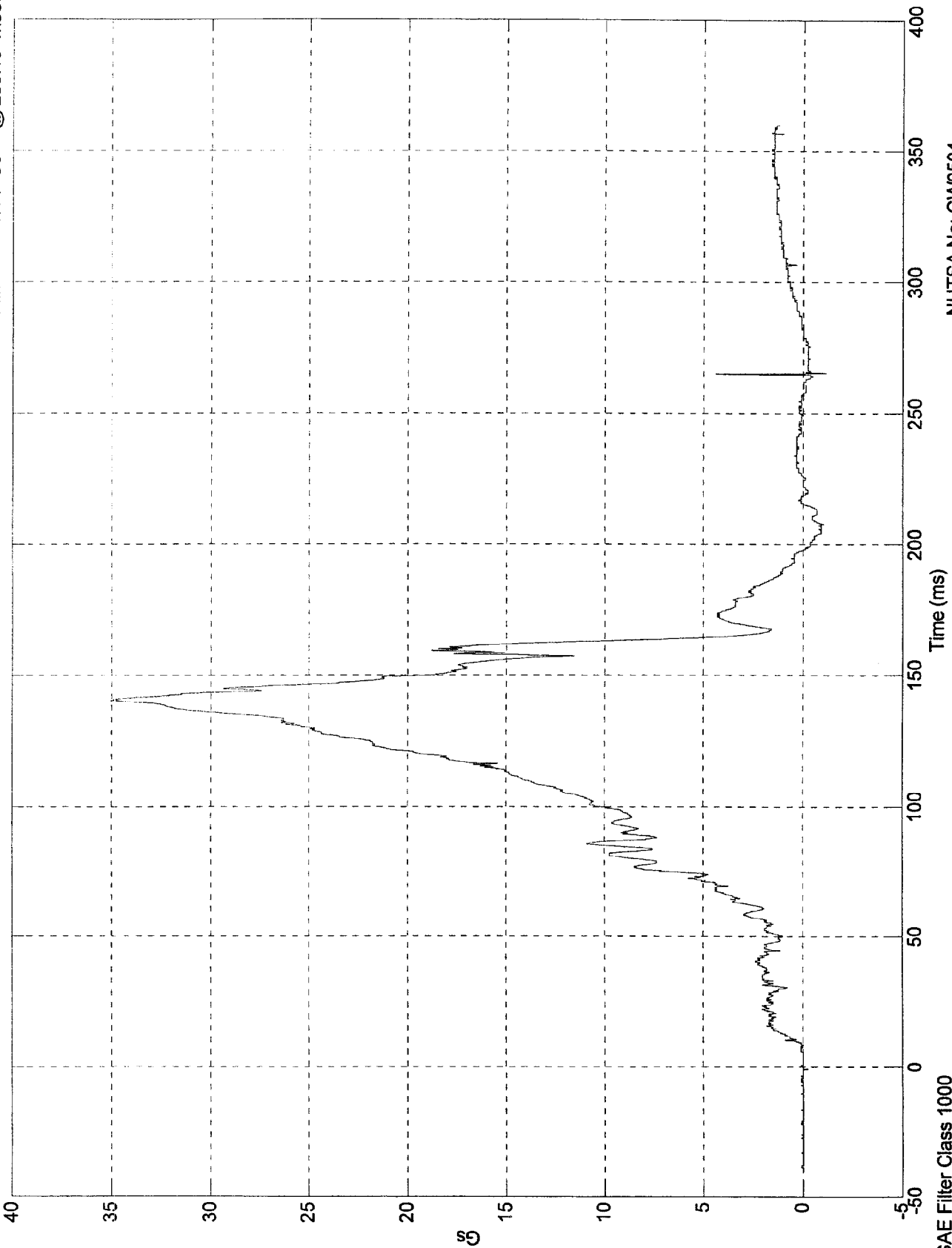


NHTSA No: CW0504
 Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Pos. 1 Head Z

Max = 35 Gs @ 140.30 msec
Min = -1.14 Gs @ 265.10 msec



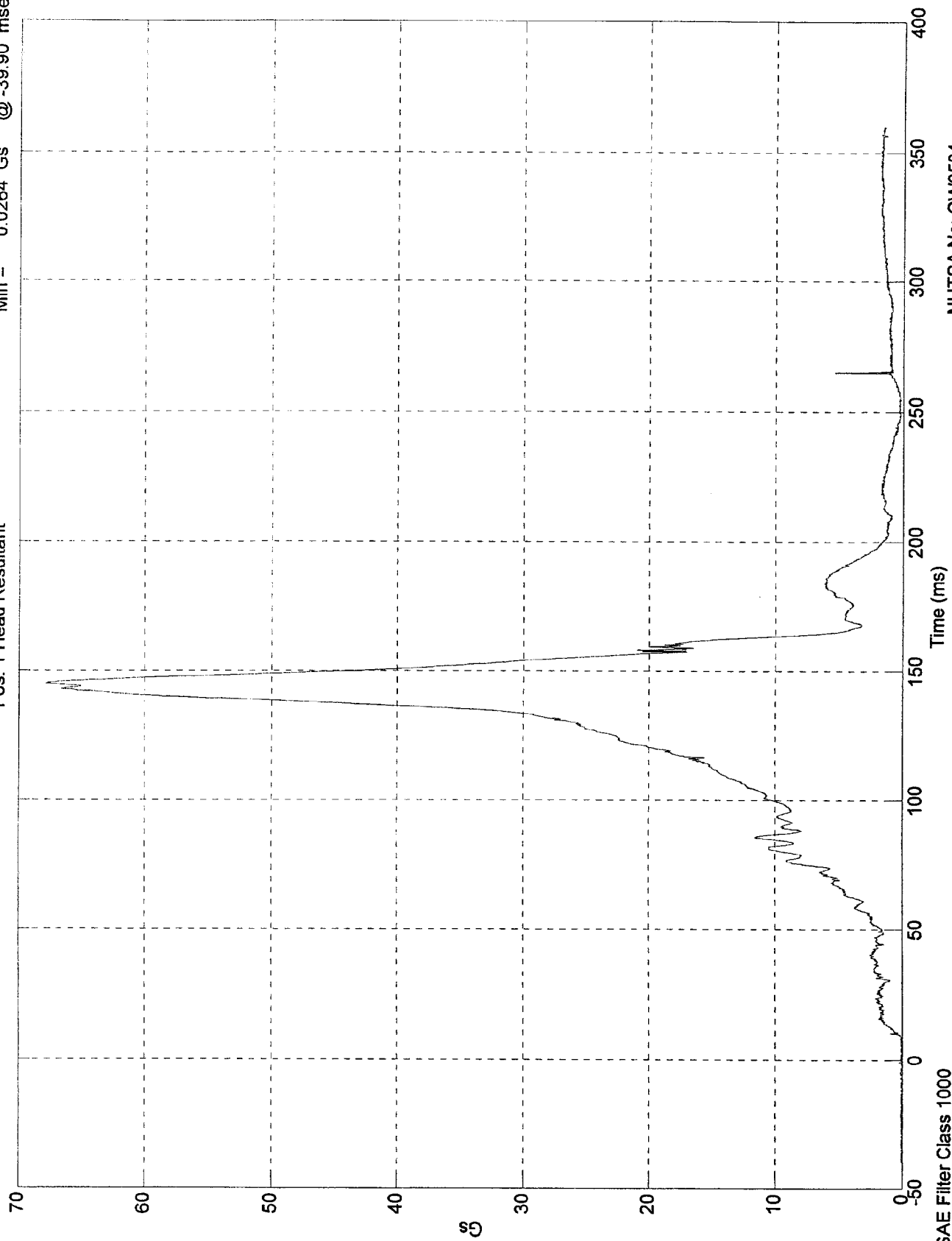
SAE Filter Class 1000

NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 67.8 Gs @ 145.00 msec
Min = 0.0264 Gs @ -39.90 msec

Pos. 1 Head Resultant

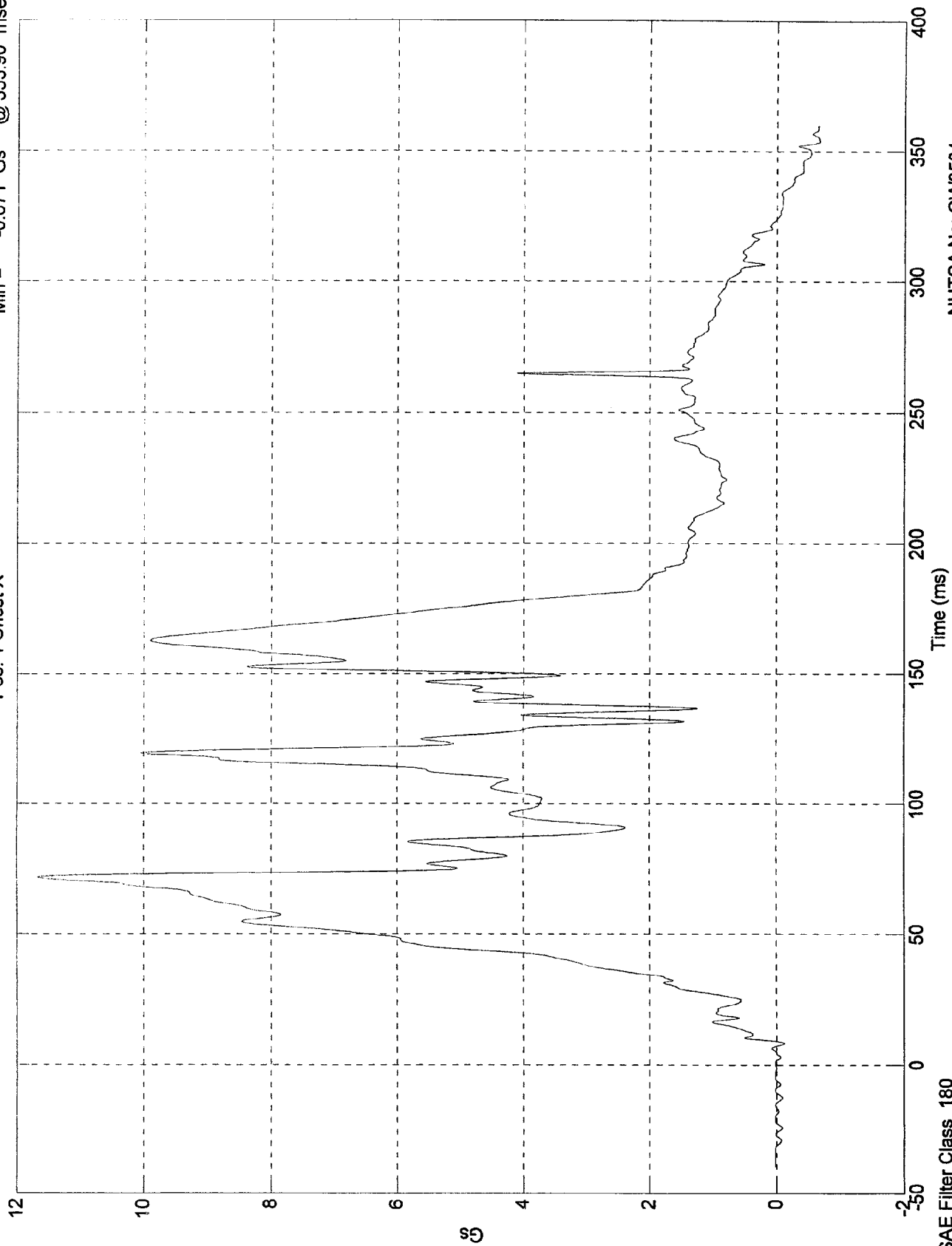


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Pos. 1 Chest X

Max = 11.7 Gs @ 71.50 msec
Min = -0.671 Gs @ 353.90 msec



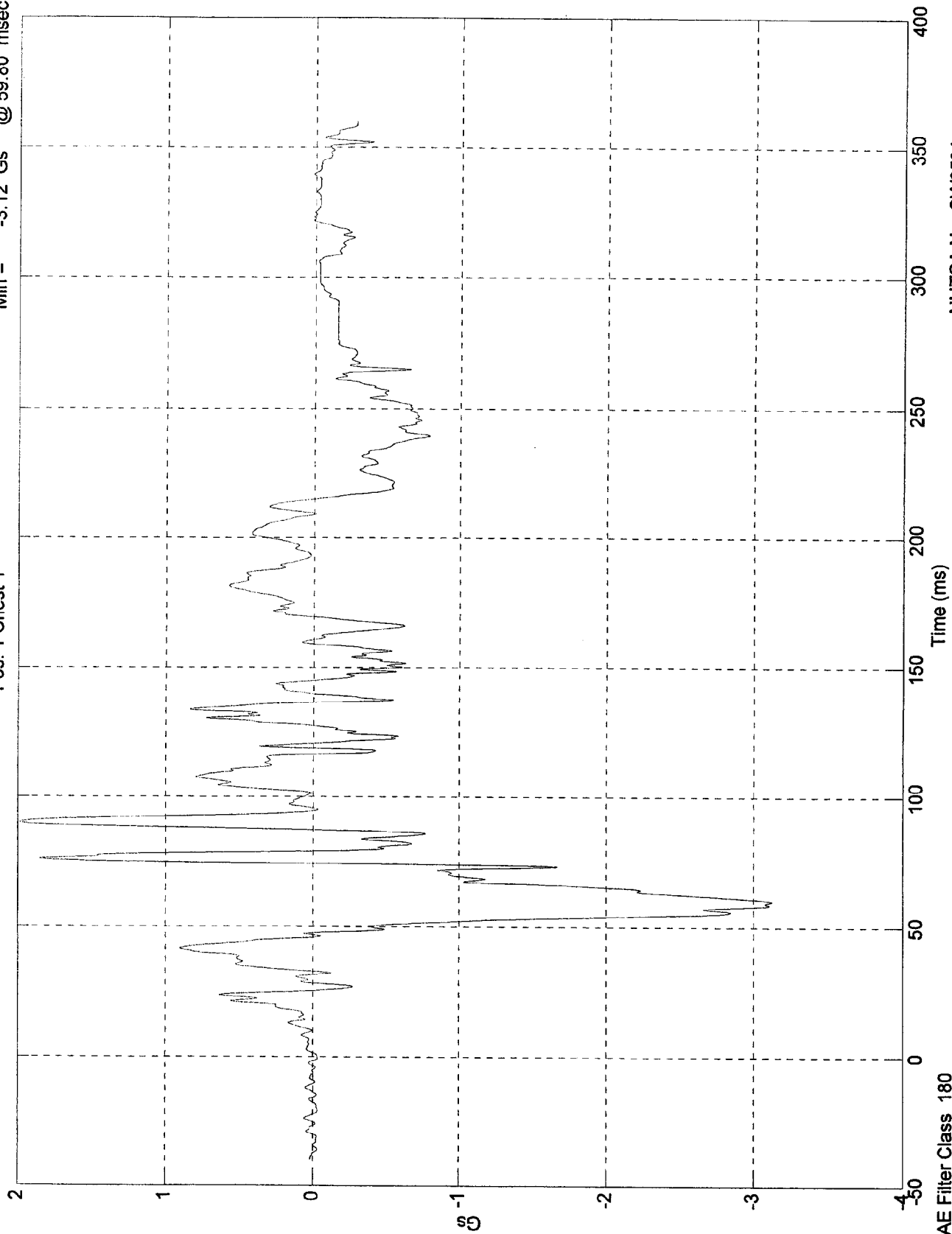
SAE Filter Class 180

NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 1.99 Gs @ 90.00 msec
Min = -3.12 Gs @ 59.80 msec

Pos. 1 Chest Y



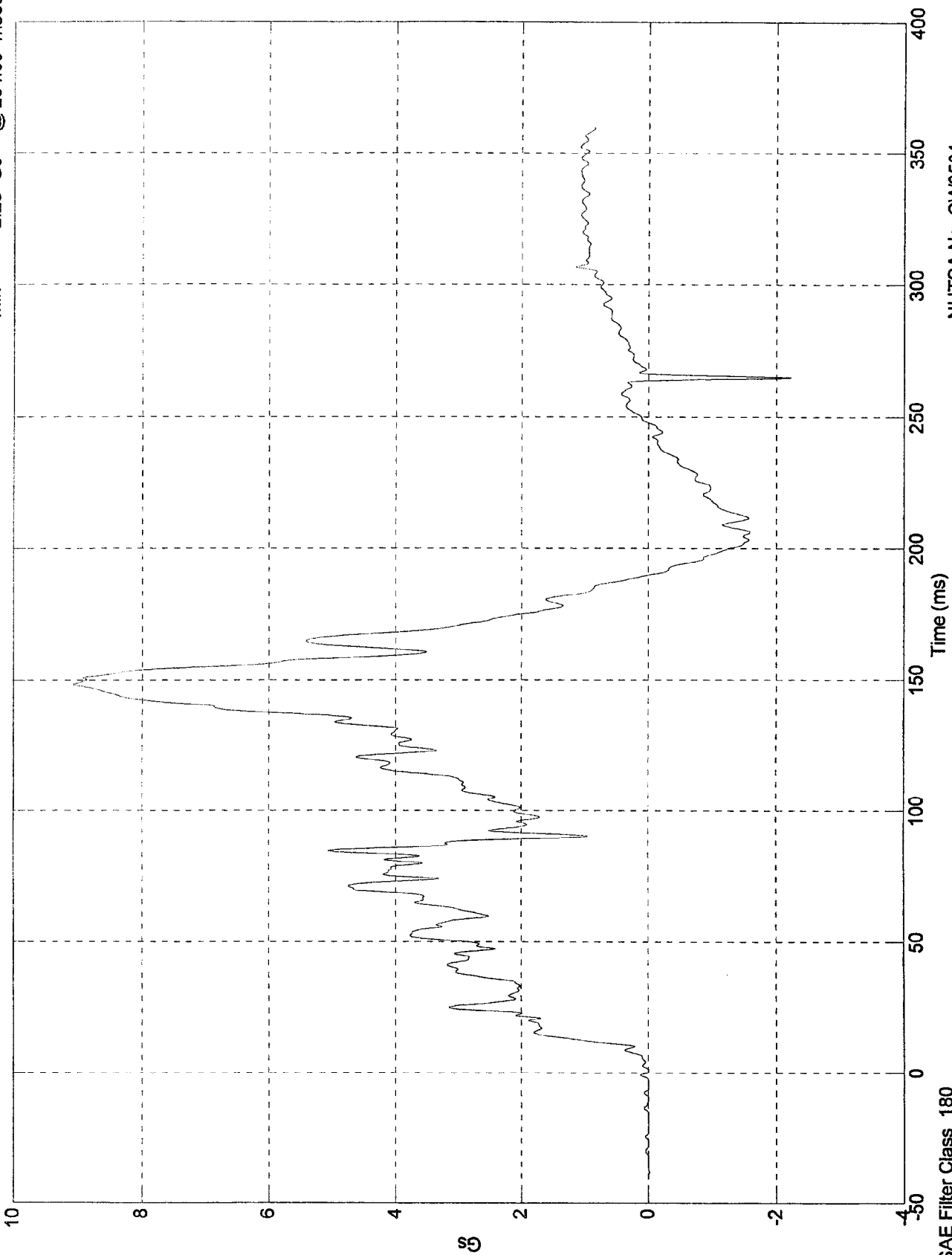
SAE Filter Class 180

NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Pos. 1 Chest Z

Max = 9.07 Gs @ 148.30 msec
Min = -2.23 Gs @ 264.80 msec

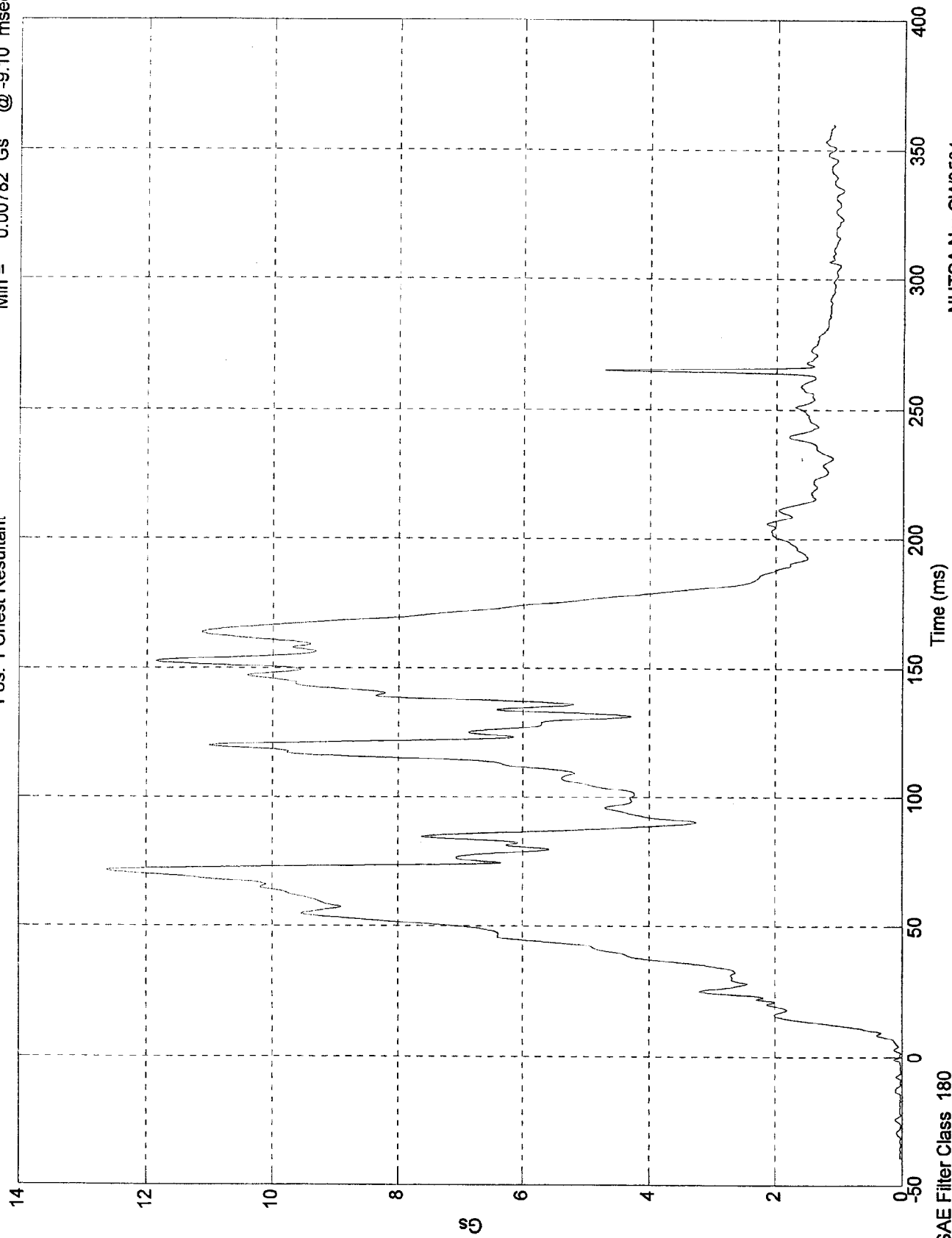


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 12.6 Gs @ 71.50 msec
Min = 0.00782 Gs @ -9.10 msec

Pos. 1 Chest Resultant



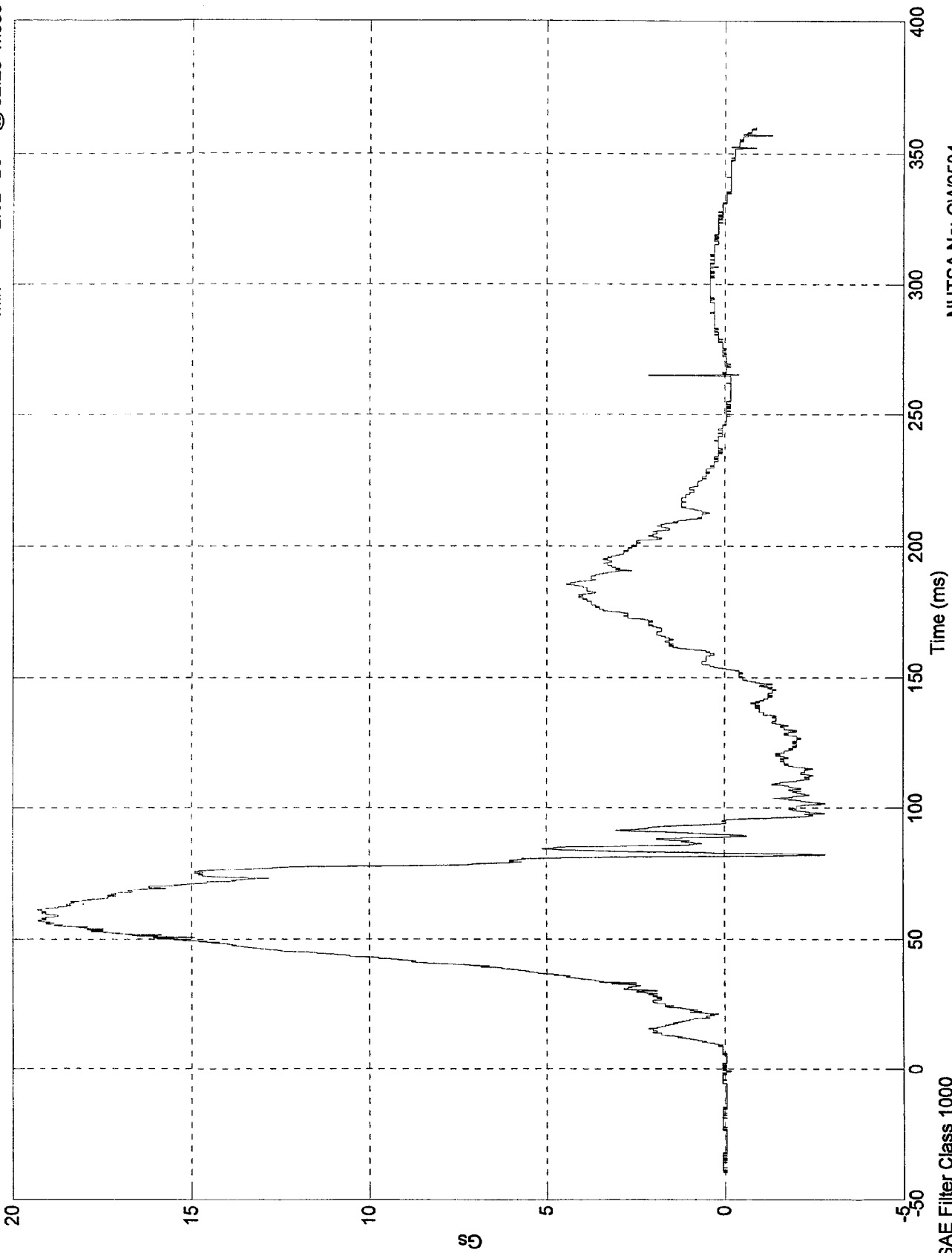
SAE Filter Class 180

NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Pos. 1 Pelvic X

Max = 19.3 Gs @ 56.70 msec
Min = -2.82 Gs @ 82.20 msec



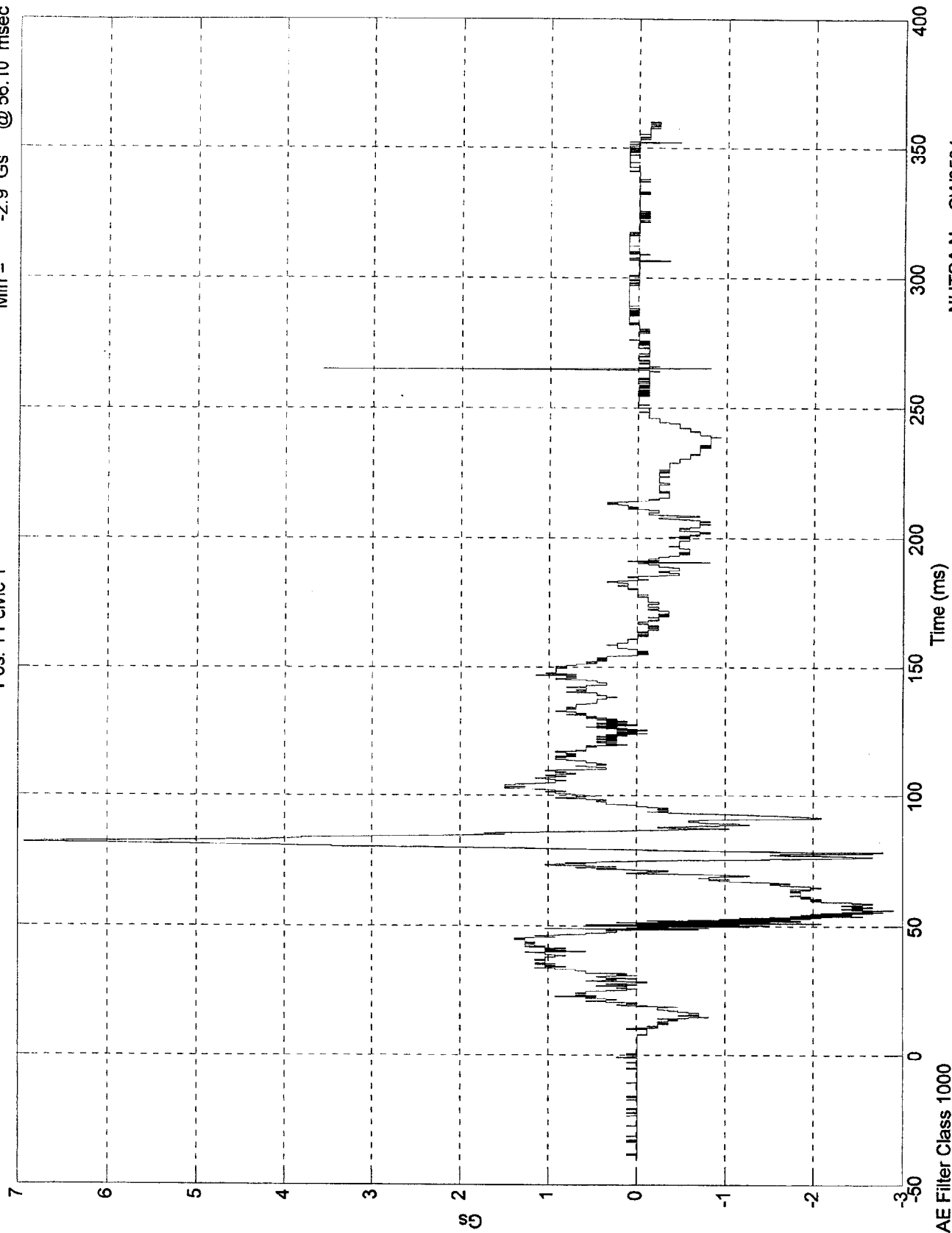
SAE Filter Class 1000

NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 6.93 Gs @ 82.00 msec
Min = -2.9 Gs @ 56.10 msec

Pos. 1 Pelvic Y

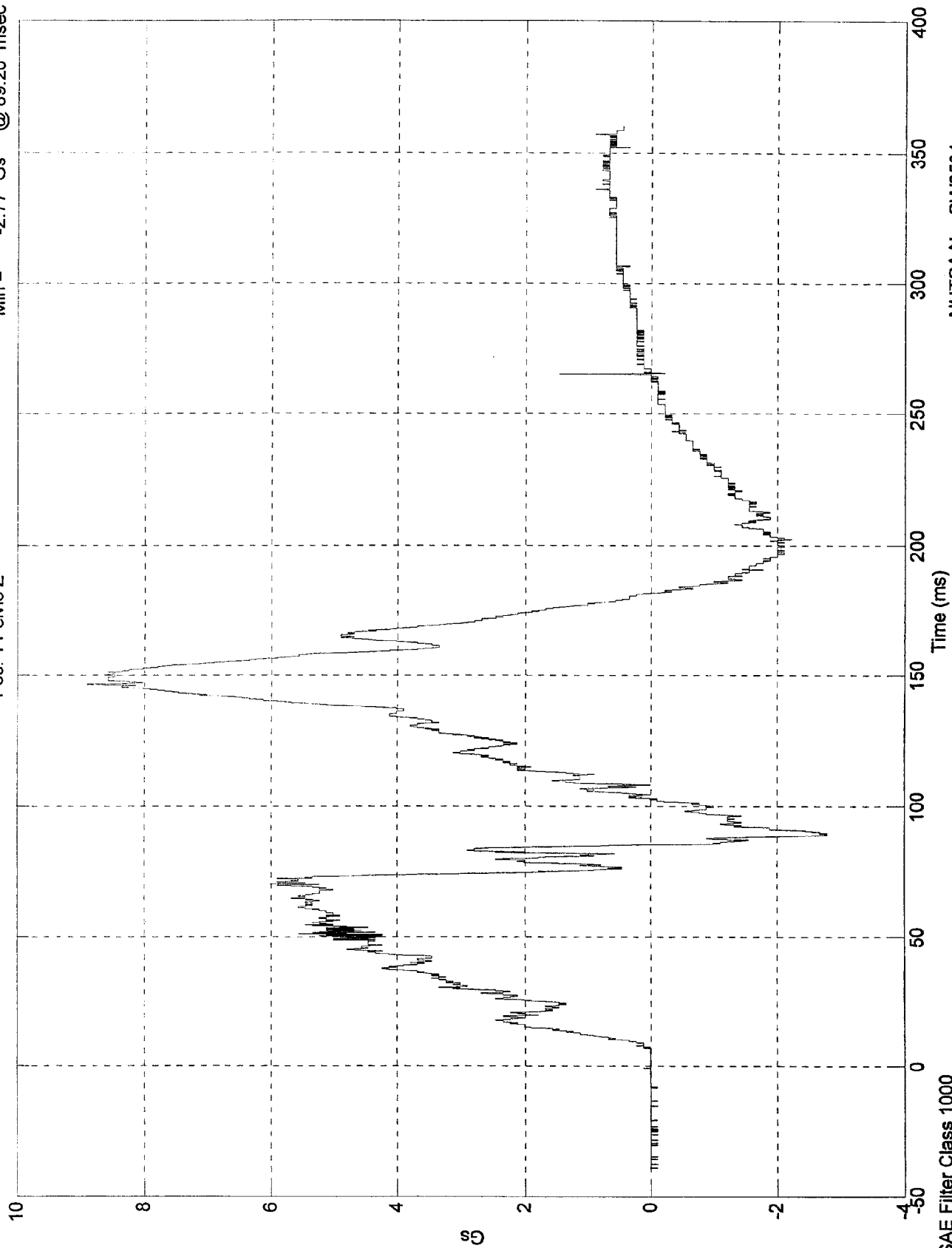


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 8.91 Gs @ 146.40 msec
Min = -2.77 Gs @ 89.20 msec

Pos. 1 Pelvic Z

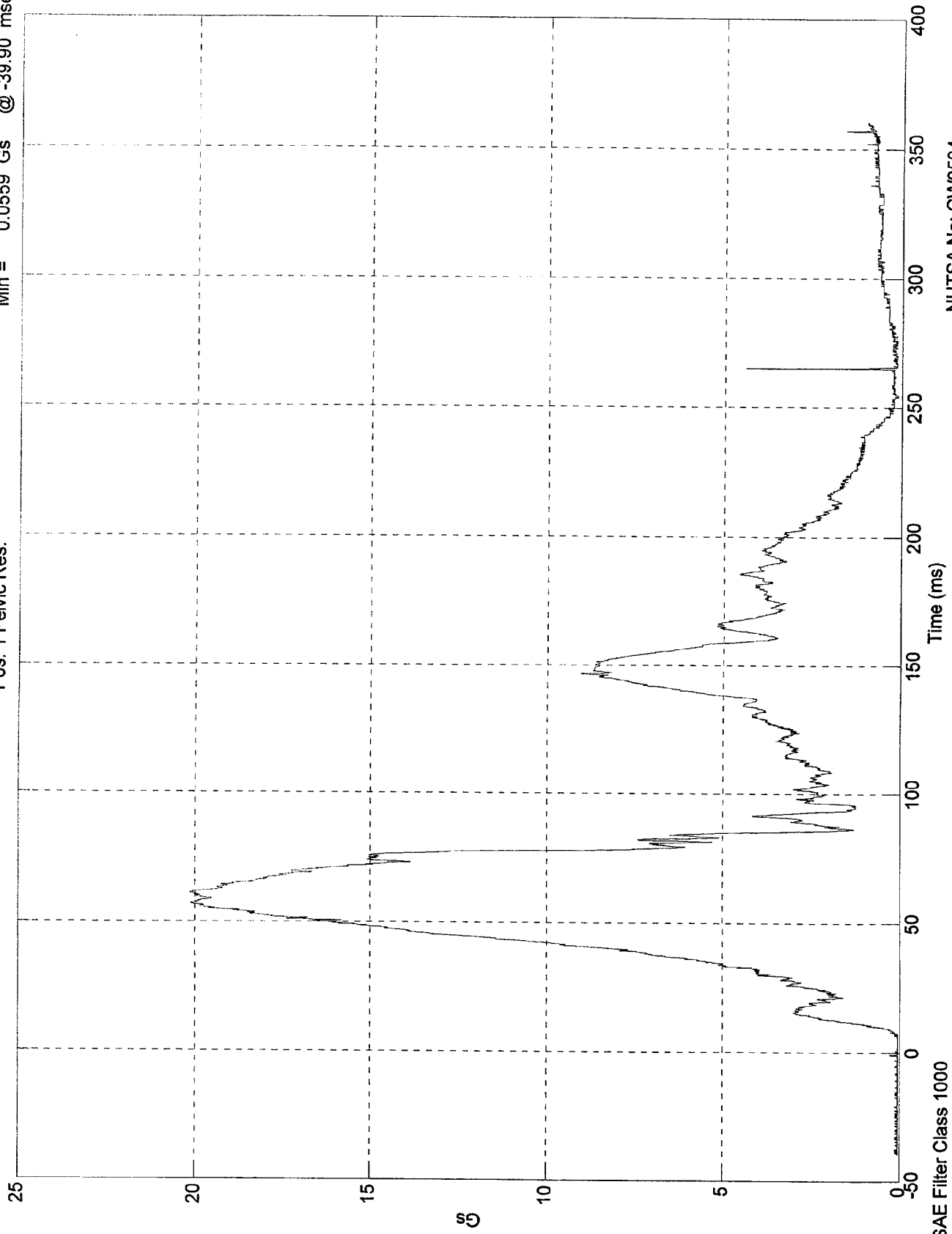


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 20.1 Gs @ 60.90 msec
Min = 0.0559 Gs @ -39.90 msec

Pos. 1 Pelvic Res.

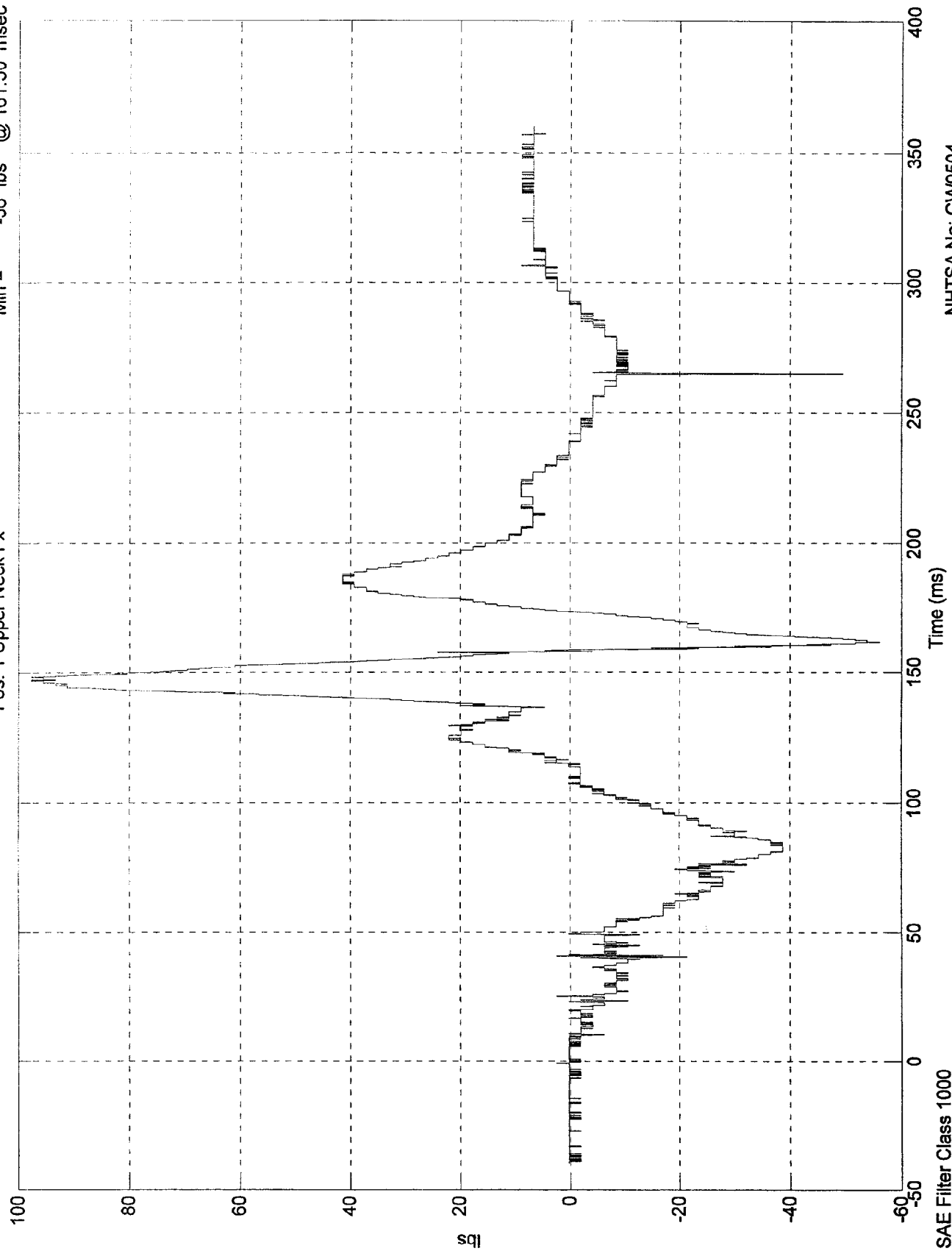


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 97.8 lbs @ 146.80 msec
Min = -56 lbs @ 161.50 msec

Pos. 1 Upper Neck Fx

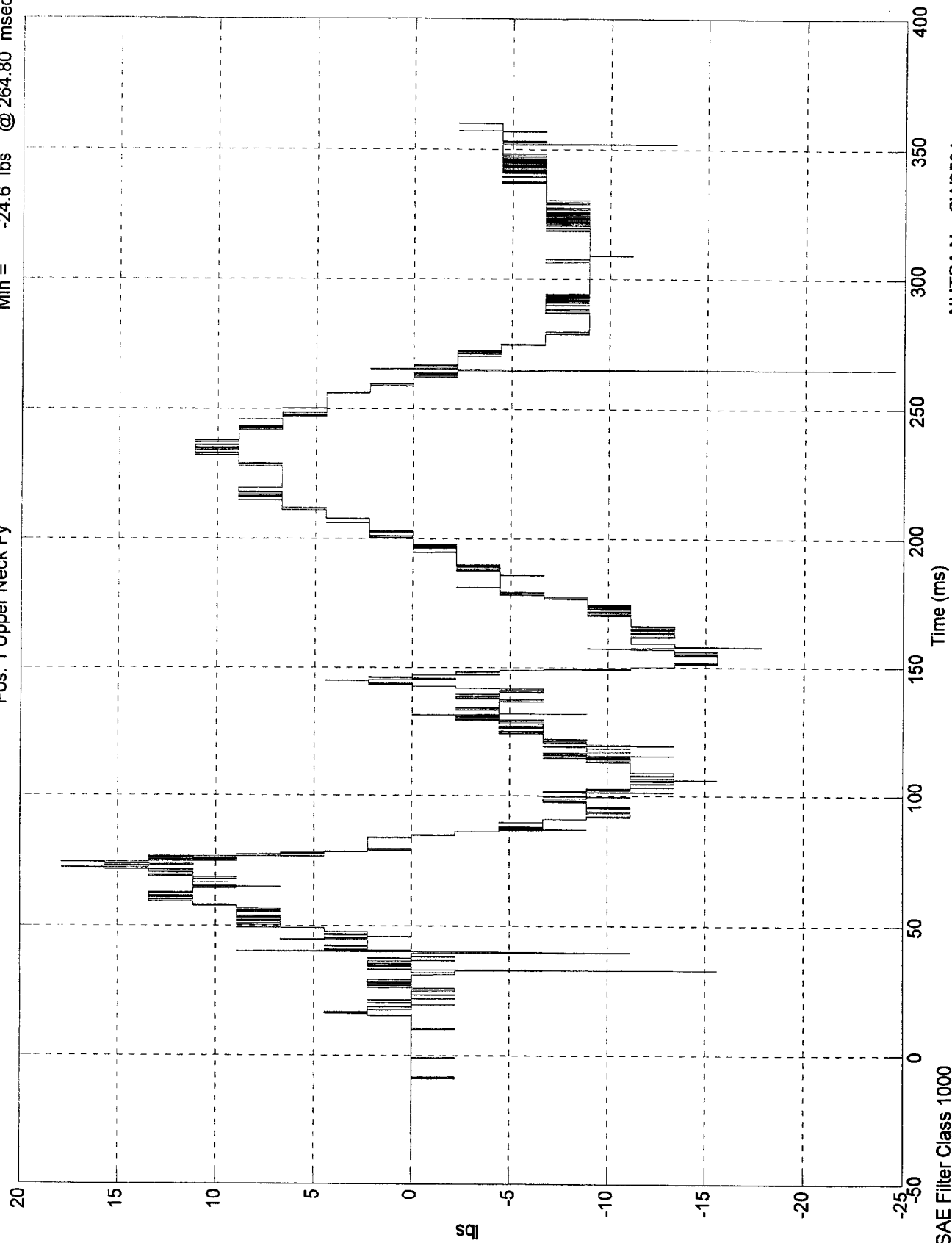


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 17.9 lbs @ 72.40 msec
Min = -24.6 lbs @ 264.80 msec

Pos. 1 Upper Neck Fy

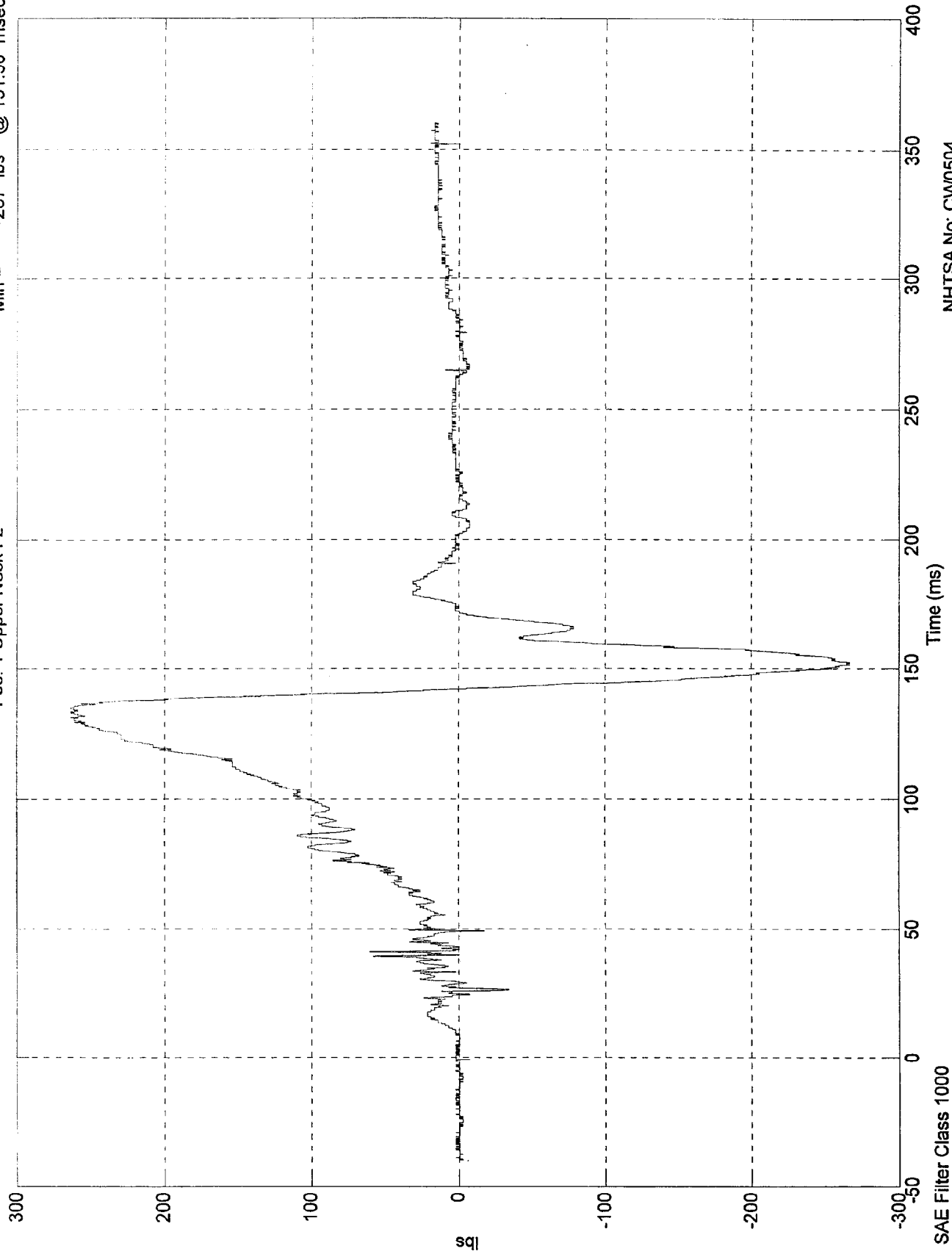


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 264 lbs @ 131.20 msec
Min = -267 lbs @ 151.50 msec

Pos. 1 Upper Neck Fz

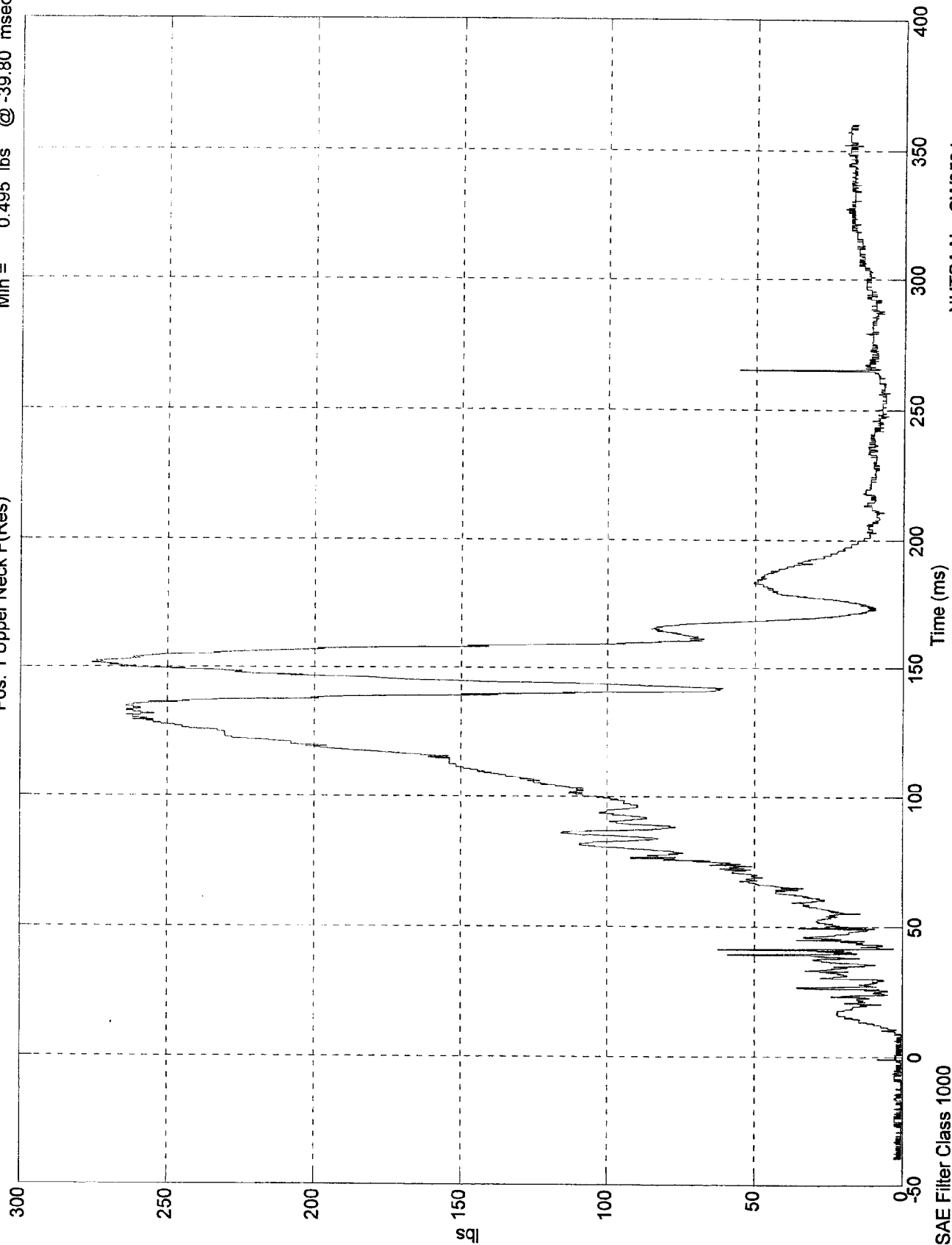


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 276 lbs @ 151.50 msec
Min = 0.495 lbs @ -39.80 msec

Pos. 1 Upper Neck F (Res)



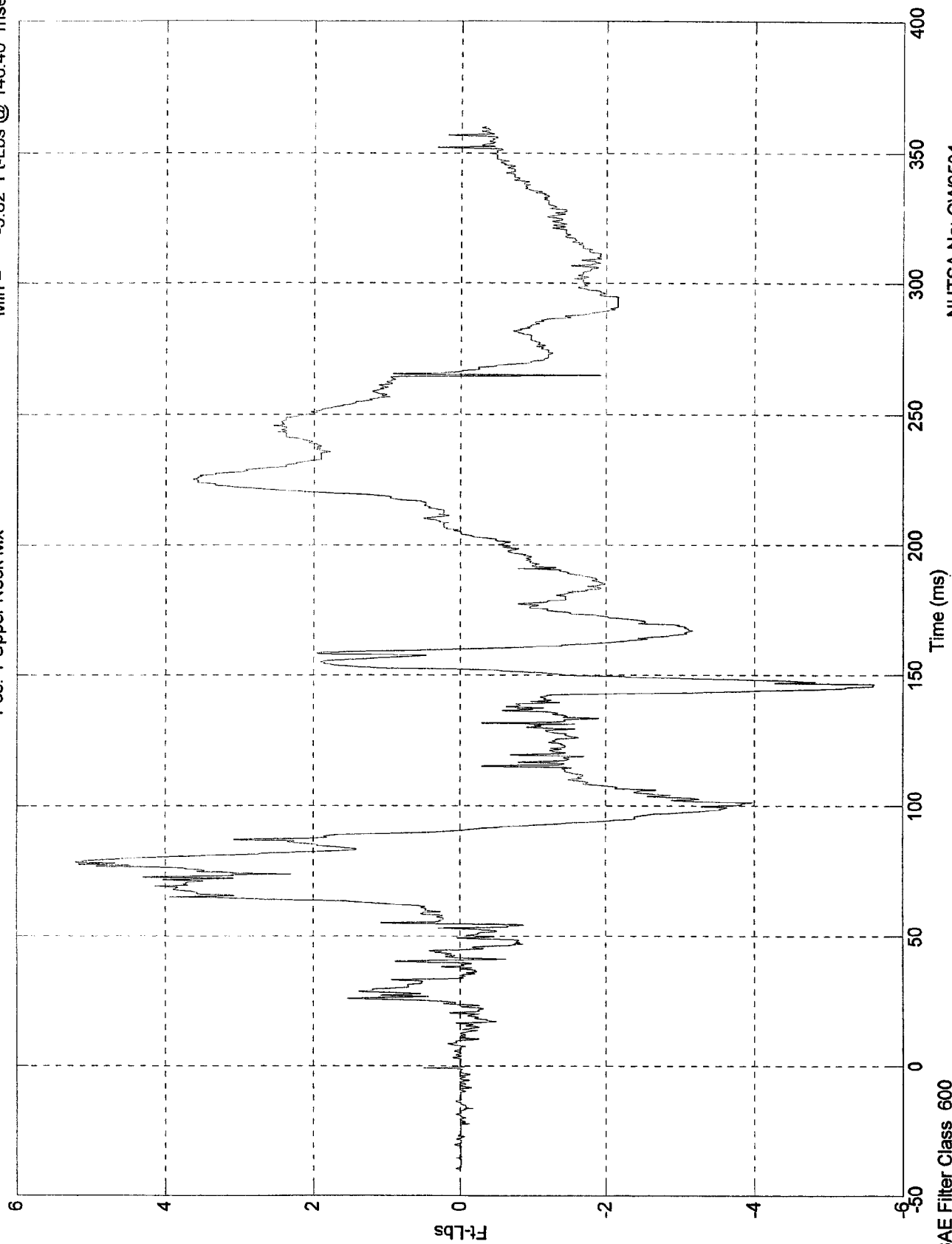
SAE Filter Class 1000

NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 5.21 Ft-Lbs @ 78.60 msec
Min = -5.62 Ft-Lbs @ 146.40 msec

Pos. 1 Upper Neck Mx



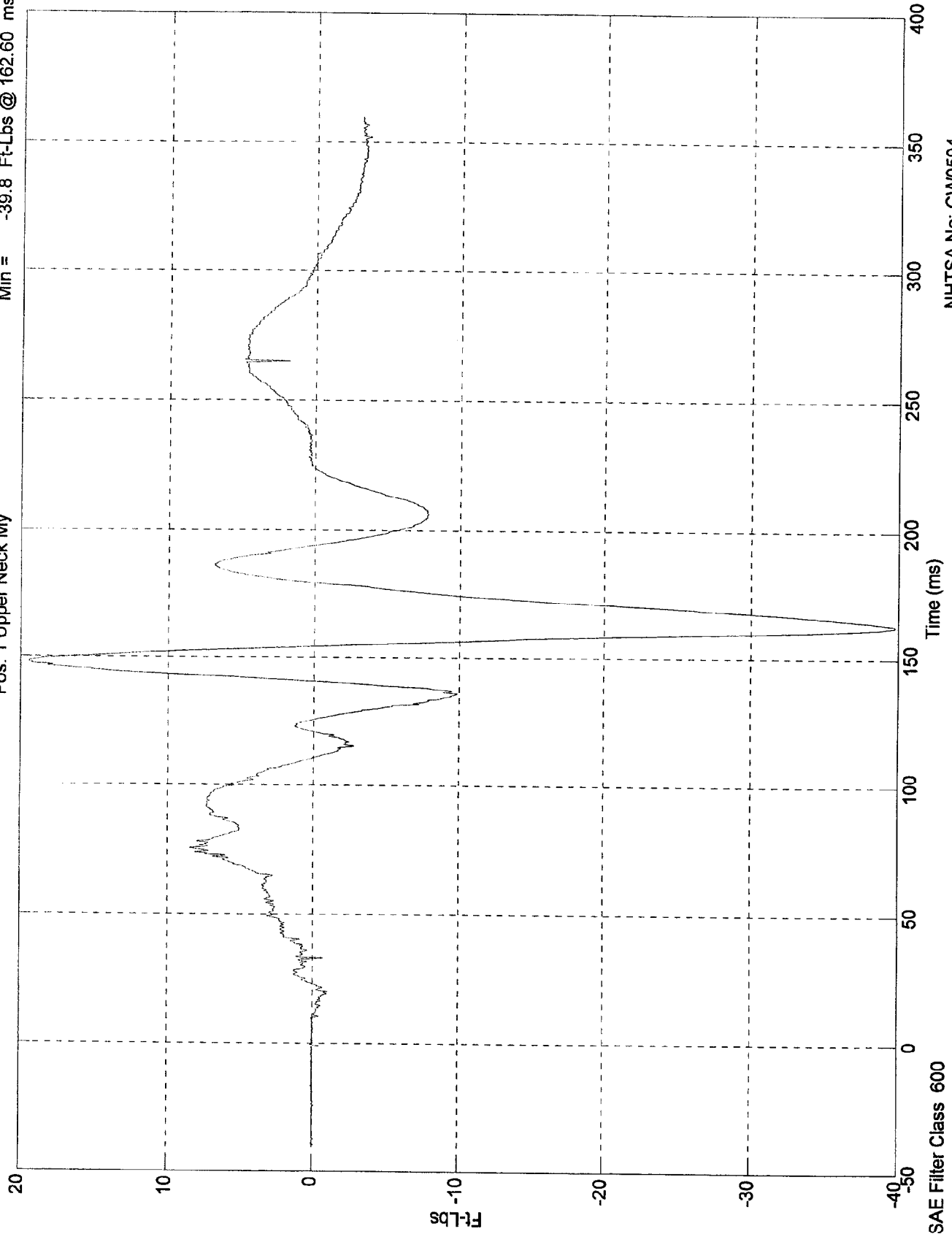
NHTSA No: CW0504
Date: 26 Feb 1998

SAE Filter Class 600

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 19.4 Ft-Lbs @ 148.20 msec
Min = -39.8 Ft-Lbs @ 162.60 msec

Pos. 1 Upper Neck My

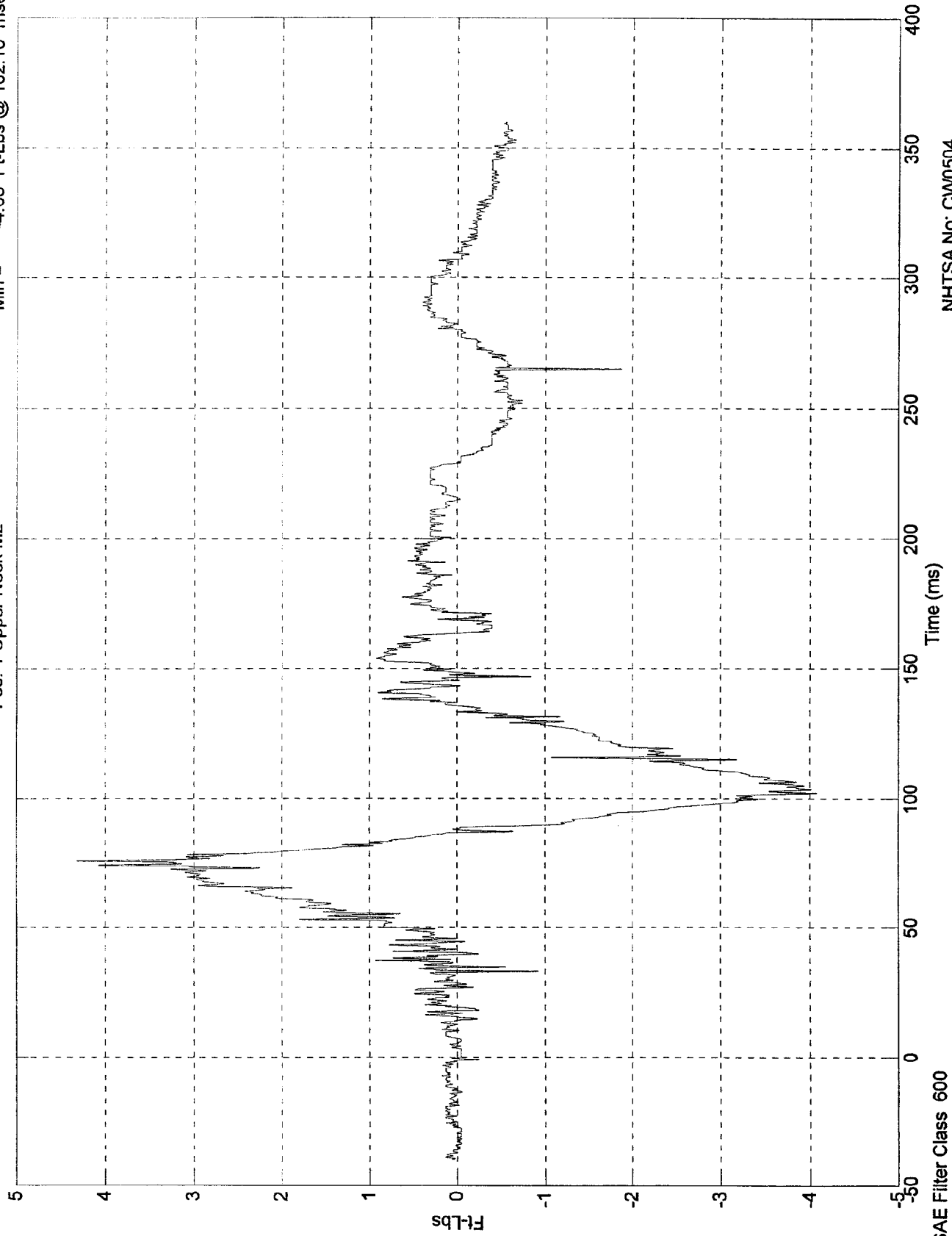


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 4.32 Ft-Lbs @ 75.60 msec
Min = -4.08 Ft-Lbs @ 102.10 msec

Pos. 1 Upper Neck Mz

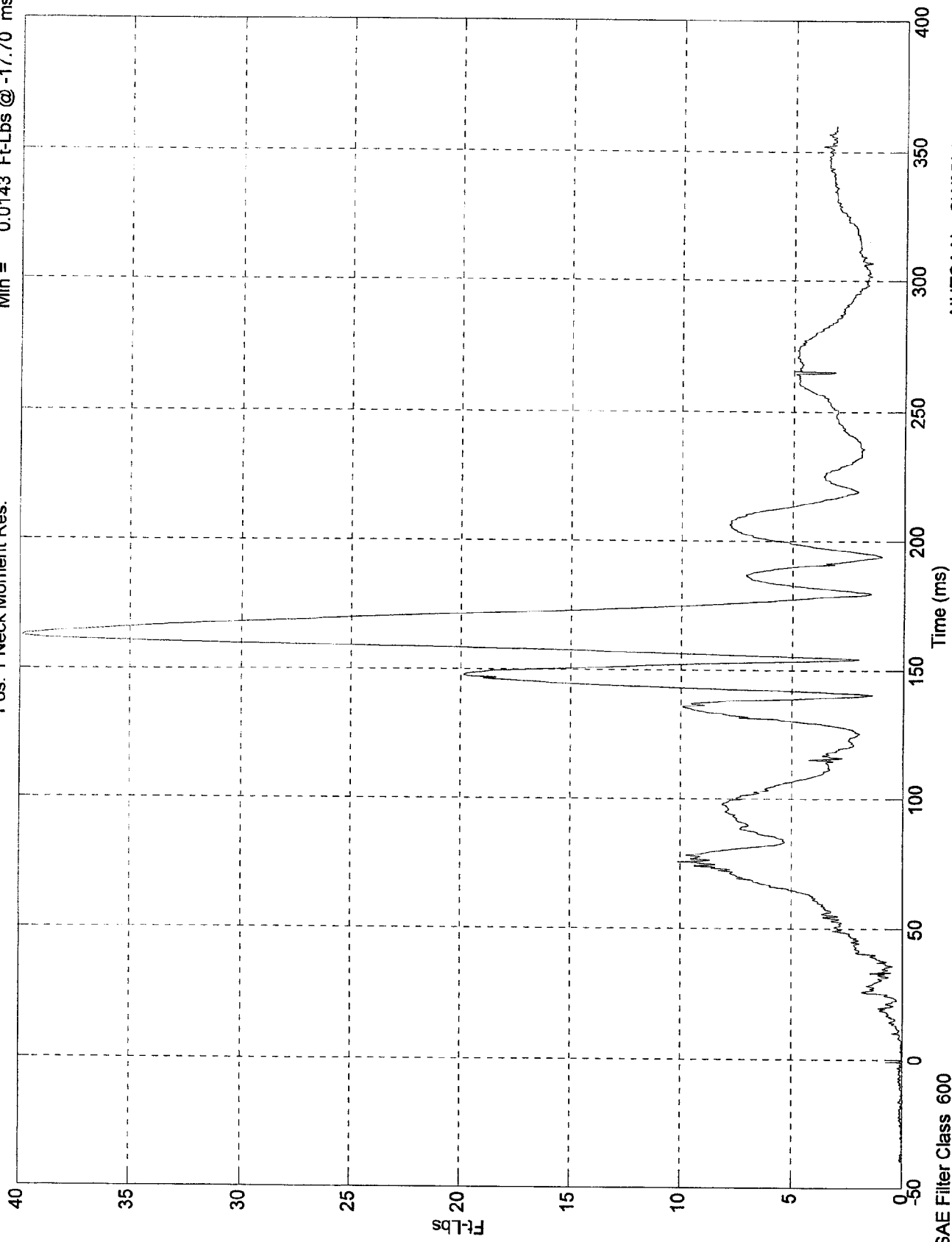


SAE Filter Class 600

NHTSA No: CW0504
Date: 26 Feb 1998

Max = 39.9 Ft-Lbs @ 162.60 msec
Min = 0.0143 Ft-Lbs @ -17.70 msec

Pos. 1 Neck Moment Res.

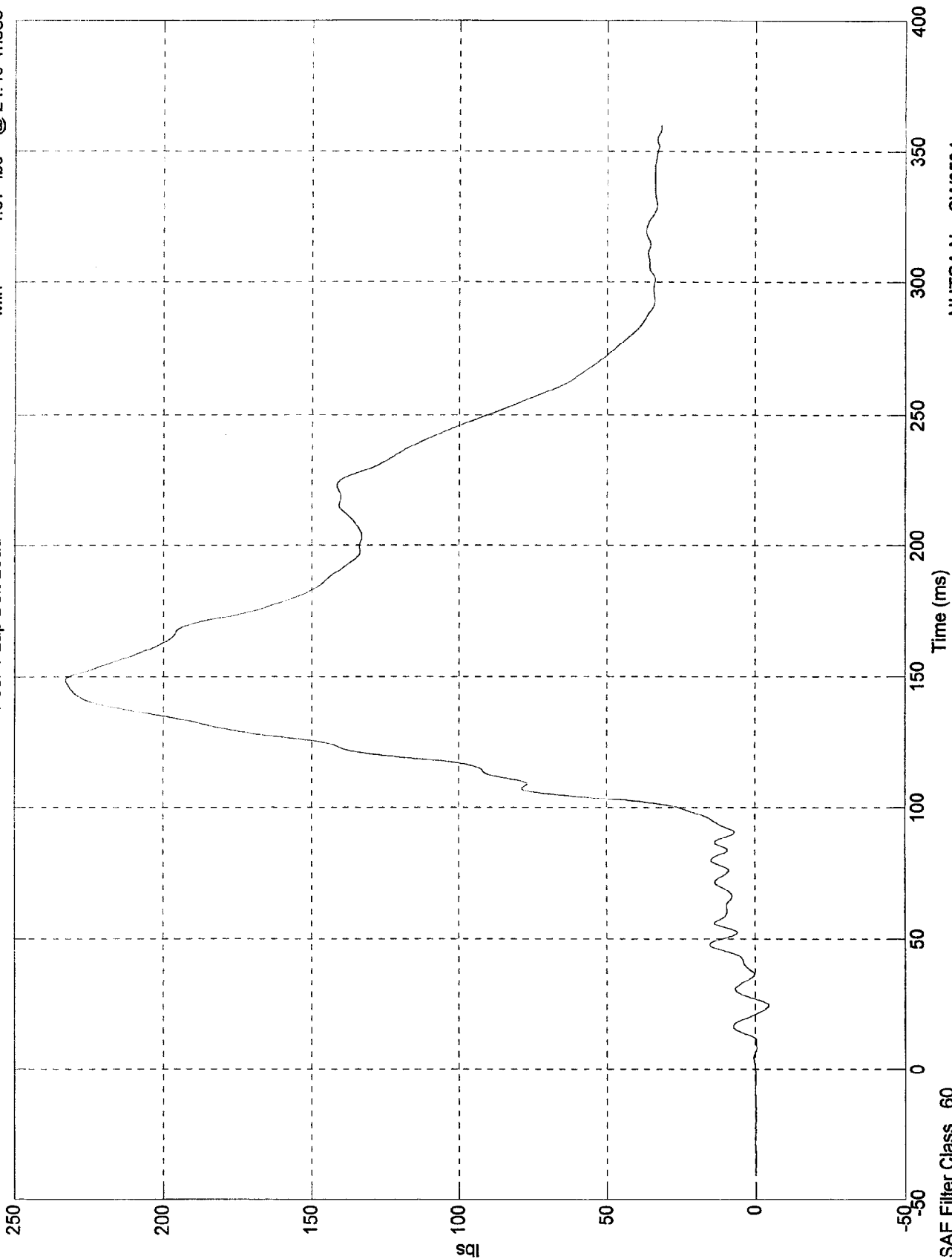


NHTSA No: CW0504
Date: 26 Feb 1998

301 Rear 30 MPH-1998 Suzuki Esteem

Max = 233 lbs @ 148.70 msec
Min = -4.67 lbs @ 24.40 msec

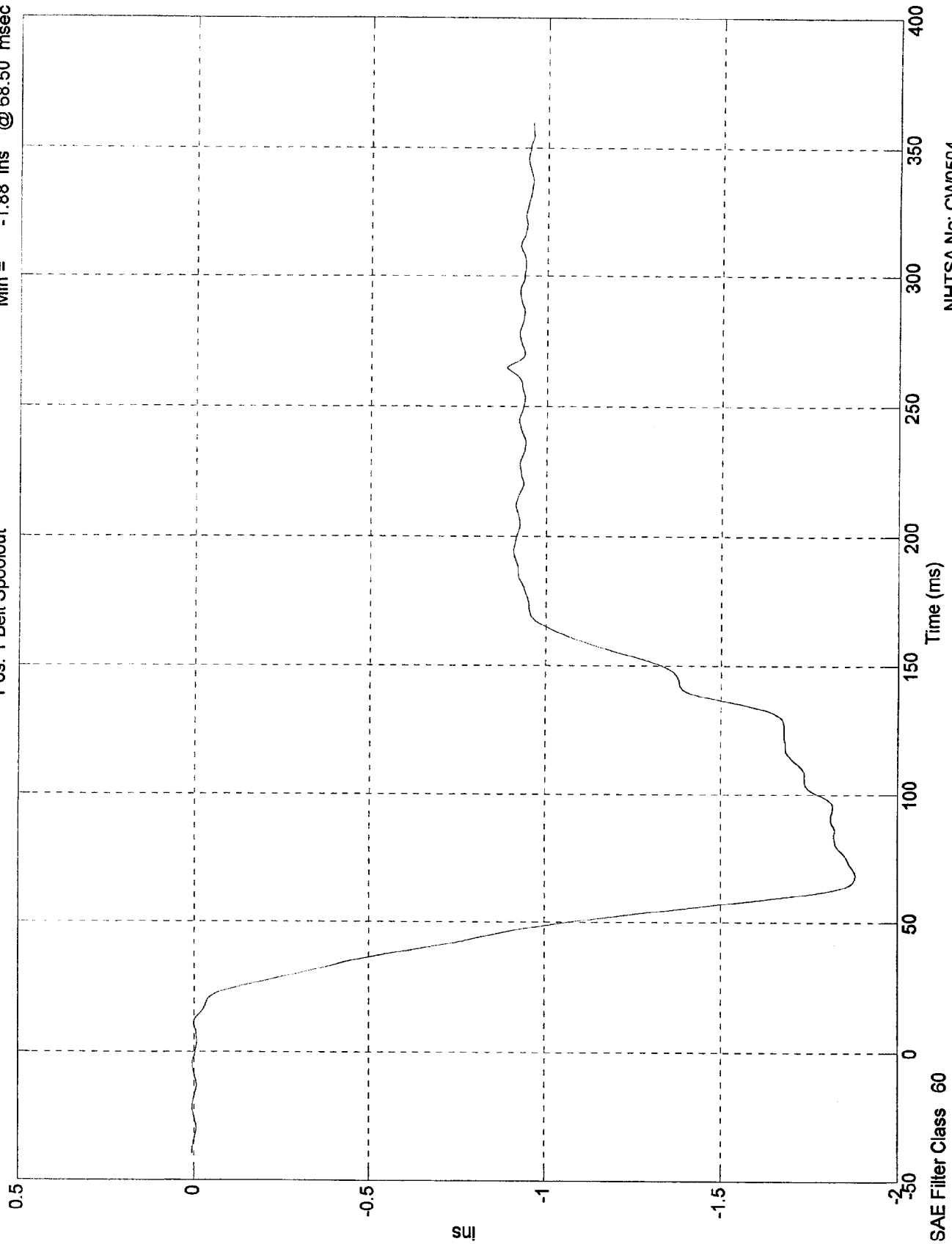
Pos. 1 Lap Belt Load



NHTSA No: CW0504
Date: 26 Feb 1998

Max = 0.00673 ins @ -38.50 msec
Min = -1.88 ins @ 68.50 msec

Pos. 1 Belt Spoolout



NHTSA No: CW0504
Date: 26 Feb 1998