

V2511

CALSPAN REPORT NUMBER: 8404-1

**VEHICLE-TO-VEHICLE
46.5 kph FRONTAL IMPACT OF A
1994 PLYMOUTH GRAND VOYAGER MPV INTO THE
LEFT SIDE OF A 1995 CHEVROLET LUMINA MPV**

CALSPAN TEST NUMBER: A109-1-1646

October 15, 1996

CALSPAN SRL CORPORATION
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FINAL REPORT

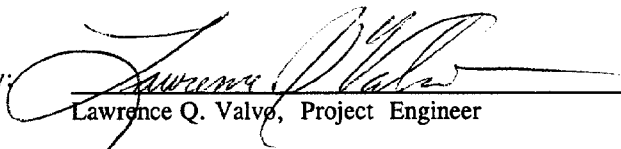
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16. Abstract A 46.5 kph vehicle to vehicle frontal impact test of a 1994 Plymouth Grand Voyager MPV into the left side of 1995 Chevrolet Lumina MPV was performed at the Calspan SRL Corporation crash facility in Buffalo, New York on October 15, 1996. The 1994 Plymouth Grand Voyager (Vehicle 1) contained a 5 th percentile Hybrid III dummy in the left front driver seating position and a 6 year old toddler Hybrid III in the right front passenger seating position. The driver dummy was fully restrained using the vehicle's driver airbag and active 3-point belt system. The right front passenger dummy was partially restrained using the vehicle's passenger airbag and the lap portion of the active 3-point belt system. The torso portion of the belt system was placed behind the dummy's back. Neither of the occupants exceeded the injury criteria set forth in the Laboratory Test Procedure FMVSS 208, Occupant Crash Protection, TP-208-09 dated March 15, 1993.			
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Section 1

PURPOSE AND TEST PROCEDURE

This Vehicle-to-Vehicle impact test is part of the Crashworthiness Testing and Analysis Program sponsored by the Research and Special Programs Administration under Contract No. DTRS57-95-C-00009. The purpose of this Technical Task Directive (TTD 3) is to obtain responses from 6 year old toddler and 5th percentile female Hybrid III Anthropomorphic Test Devices (ATDs) during various vehicle-to-vehicle crashes.

This test was performed using two vehicles, a 1994 Plymouth Grand Voyager MPV (Vehicle 1) and a 1995 Chevrolet Lumina MPV (Vehicle 2). The vehicles were aligned so the left front bumper of Vehicle 1 would impact the left side front wheel of Vehicle 2 with both vehicle traveling at the same speed. The test track was configured so that the direction of travel for Vehicle 2 was 105 degrees counter clockwise from that of Vehicle 1 (see figure 1).

The 1994 Plymouth Grand Voyager MPV contained a 5th percentile Hybrid III ATD in the left front driver seating position and a 6 year old toddler Hybrid III ATD in the right front passenger position. The 1995 Chevrolet Lumina MPV, contained two ballast 50th percentile male ATDs in the driver and right front passenger seating positions. The ATDs were restrained using the vehicle's 3-point belt system.

Section 2

SUMMARY OF TEST

A vehicle-to-vehicle frontal impact of a 1994 Plymouth Grand Voyager MPV (Vehicle 1) into the left side of a 1995 Chevrolet Lumina MPV (Vehicle 2), each traveling forward at 46.5 kph, was performed at the Calspan SRL Corporation Crash Test Facility on October 15, 1996. The vehicles were aligned so the left front bumper of Vehicle 1 would impact the left side front wheel of Vehicle 2 with both vehicle traveling at the same speed. The test track was configured so that the direction of travel for Vehicle 2 was 105 degrees counter clockwise from that of Vehicle 1.

Pre- and Post-test still photographs of the vehicles and dummies can be found in Appendix A. The impact event was documented with 1 real time movie camera and 9 high speed movie cameras. Vehicle photographic target locations can be found in Figure 5 and movie camera locations can be found in Figure 12.

The post-test condition of the vehicles involved were reviewed by a Calspan accident investigator. The forms can be found in appendix E of this report.

A 5th percentile female Anthropomorphic Test Devices (ATD) was placed in the driver seating position and a 6 year old toddler ATD was placed in the right front passenger seating position. The driver ATD was restrained using the vehicle's driver airbag and 3-point seat belt system. The passenger ATD was partially restrained using the passenger airbag and the lap portion of the 3-point belt system. The torso portion of the seat belt was located behind the passenger ATD's back.

The driver and right front passenger ATDs were instrumented with head and chest triaxial accelerometer packages; chest displacement potentiometers; and upper neck force and moment transducers packages. The driver ATD also contained left and right femur axial force load cells.

The 45 channels of vehicle and dummy transducer data were recorded on a PC based data acquisition system. The data was reduced, filtered and processed as required by the appropriate test procedures using PC based software. Appendix B contains the vehicle and the dummy response data in plotted format.

The 6 year old was positioned on the front edge of the right front passenger seat cushion prior to the test. The ATD was placed in front of the air bag and secured in place using 40 pound fishing line attached to the ATD head and wrapped behind the upper back. An electronic circuit was built and tested to sever the lines at impact. The ATD placement and method of securing were reviewed by all present at the test. Unfortunately the fishing line broke during the acceleration phase of the test (Methods of securing the ATD with fine steel wire cut by explosive cable

cutters had been rejected as being too extreme during a pre-test conference call). As a result the 6 year old ATD was leaning back in the seat at the time of impact.

The targeted impact point was the left front bumper of the Plymouth Grand Voyager contacting the left front wheel/fender area of the Chevrolet Lumina. The visible first contact points could have been either the tire, or wheel house projection. This required the impact strip to be oriented vertically as opposed to it's normal horizontal attachment to the bumper face. At the point of cable release the event time zero as well as photographic time zero flashes occurred prematurely. From film analysis, it was determined the data and film time zero occurred 46 milliseconds early. At impact, the air bags deploy (at approximately 40 milliseconds when early trigger is accounted for) and the 6 year old moves forward into a inflated air bag. The driver air bag deploys contacting the 5th female's chest. Both dummies rebound to the left with the 6 year old contacting the rear of it's head on the window frame at approximately 350 milliseconds.

The driver's (5th female) HIC was 200. The 3 millisecond chest clip was 24.7 g's with -20.6 mm. Of chest deflection. The 6 year old right front passenger's HIC was 56. The 3 millisecond chest clip was 20.8 g's.

Section 3

VEHICLE ONE AND OCCUPANT INFORMATION

Figure 1
VEHICLE-TO-VEHICLE IMPACT LAYOUT

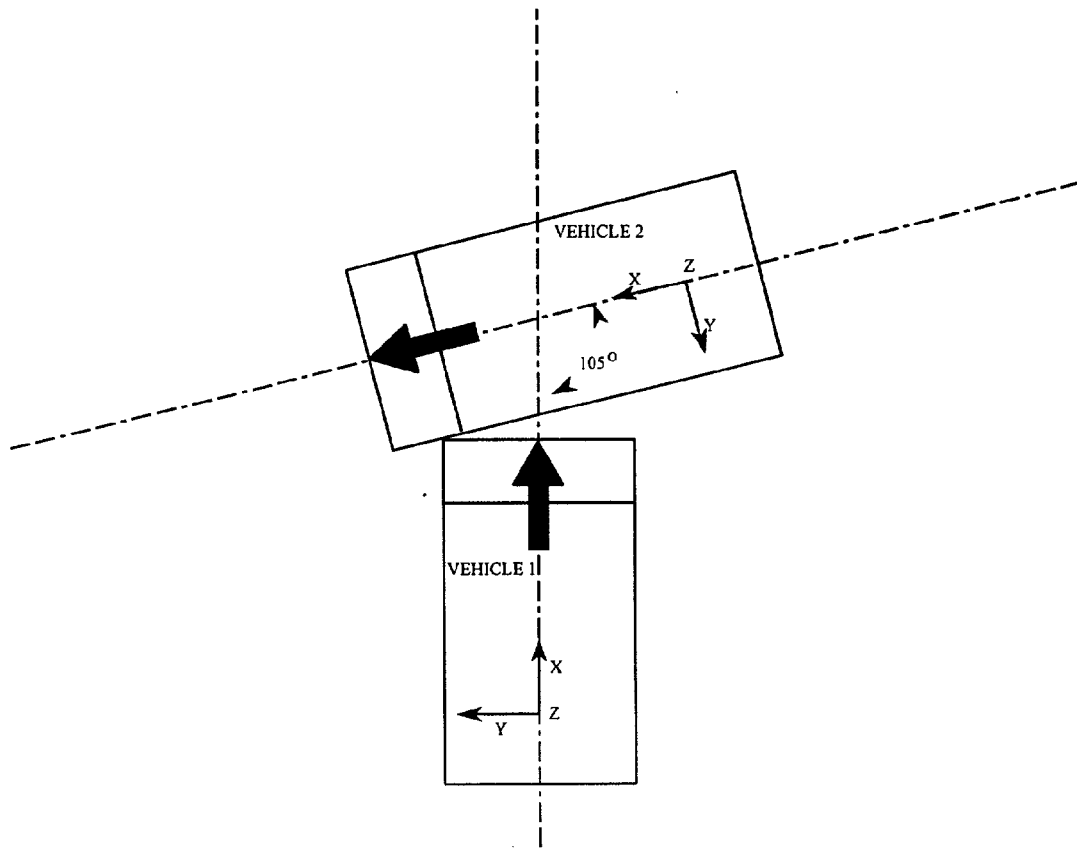


Table 1

VEHICLE 1 TEST PARAMETER DATATEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1994 Plymouth Grand Voyager MPV

NHTSA Test No.: - VIN.: 1P4GH44R8RX137713

Body Color: Green Date of Manufacture: 9/93

Engine: 6 Cylinders; - C.I.D.; 3.3 Liters; - CC
X Gas; - Diesel; - Turbocharged
X Longitudinal; - Transverse

Transmission: 3 Speed; - Manual; X Automatic; - Overdrive

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

Type of Occupant Restraint: Driver: Airbag with 3-point belt system
Passenger: Airbag with lap portion of 3-point belt system (torso portion of belt located behind the passenger)

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

Tire Pressure (at capacity): Front 241 kpa, Rear 241 kpa

Recommended Tire Size: P205/70R15

Recommended Cold Tire Pressure: Front 241 kpa, Rear 241 kpa

Tires on Vehicle: P205/70R15 ; Manufacturer: Cooper

Number of Occupants: 2 Front; 2 Rear; 3 3rd Seat; 7 TOTAL

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

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

GVWR 2359 kgs. GAWR: Front 1237 kgs. Rear 1237 kgs.

Table 1

VEHICLE 1 TEST PARAMETER DATA (continued)WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (WITH MAXIMUM FLUIDS) = UDW:

Right Front	=	<u>501</u>	kgs.	Right Rear	=	<u>345</u>	kgs.
Left Front	=	<u>502</u>	kgs.	Left Rear	=	<u>339</u>	kgs.
TOTAL FRONT WEIGHT	=	<u>1,003</u>	kgs.	(<u>59.5</u> % of Total Vehicle Weight)			
TOTAL REAR WEIGHT	=	<u>684</u>	kgs.	(<u>40.5</u> % of Total Vehicle Weight)			
TOTAL DELIVERED WEIGHT	=	<u>1,687</u>	kgs.				

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMY:

Right Front	=	<u>523</u>	kgs.	Right Rear	=	<u>331</u>	kgs.
Left Front	=	<u>514</u>	kgs.	Left Rear	=	<u>314</u>	kgs.
TOTAL FRONT WEIGHT	=	<u>1,037</u>	kgs.	(<u>61.7</u> % of Total Vehicle Weight)			
TOTAL REAR WEIGHT	=	<u>645</u>	kgs.	(<u>38.3</u> % of Total Vehicle Weight)			
TOTAL TEST WEIGHT	=	<u>1,682</u>	kgs.				
TARGET TEST WEIGHT FROM COTR	=	<u>1660</u>	kgs.				

The rear hatch and rear seat were removed from the vehicle to reach test weight.

TEST VEHICLE ATTITUDE (all dimensions in millimeters):

Test Attitude:	RF	<u>728</u>	;	LF	<u>737</u>	;	RR	<u>755</u>	;	LR	<u>765</u>
Vehicle's Wheel Base	=	<u>3035</u>	mm.								
Location of Vehicle's C.G.	=	<u>1164 mm rearward of front wheel C/L</u>									

Table 1

VEHICLE 1 TEST PARAMETER DATA (continued)POST-IMPACT DATA:

Type of Test:	<u>Vehicle-to-Vehicle Frontal</u>	Impact Angle:	<u>105 Deg.</u>
Date of Test:	<u>October 15, 1996</u>	Time of Test:	<u>14:33</u>
Ambient Temperature:	<u>18</u>	°C at impact area	
Temperature in Occupant Compartment:	<u>21</u>	°C	
Windshield Molding Temperature:	<u>21</u>	°C	
Impact Velocity:	primary = <u>46.5</u> kph, secondary = <u>46.5</u> kph		
Distance From Front Bumper to Barrier Face When			
Entering Speed Trap:	<u>132</u>	cm.	
Exiting Speed Trap:	<u>30.5</u>	cm.	

VISIBLE DUMMY CONTACT POINTS:

	<u>Driver</u>	<u>Passenger</u>
Head	Face to center of airbag and back of head to center of headrest.	Front of chin to airbag approximately 1" above bottom seam
Chest	Belt / Airbag	Airbag approximately 2" below seam
Abdomen	None	None
Left Knee	None	None
Right Knee	None	None

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

	<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	<u>None</u>	<u>None</u>	<u>-</u>	<u>-</u>
Seat Shift (mm.)	<u>0</u>	<u>0</u>	<u>-</u>	<u>-</u>

Table 2

VEHICLE 1 DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G")							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DUMMY (1)	-56.9	14.2	24.2	57.9	-25.6	7.8	5.8	24.7
DUMMY (2)	26.8	12.9	-12.8	29.3	-22.8	7.4	11.0	20.8

	MAXIMUM COMPRESSIVE FEMUR LOAD (NEWTONS)	
	RIGHT FEMUR	LEFT FEMUR
DUMMY (1)	280.6	1698.6
DUMMY (2)	-	-

	MAXIMUM LOAD (NEWTONS)		
	SHOULDER STRAP UPPER BELT LOAD	LAP STRAP RIGHT BELT LOAD	LAP STRAP LEFT BELT LOAD
DUMMY (1)	-	-	-
DUMMY (2)	-	-	-

	MAXIMUM ACCELERATION ("G")			
	HIC	t ₁ (SEC)	t ₂ (SEC)	Average Acceleration t ₁ TO t ₂
DUMMY (1)	199.8	101.64	119.04	42.1
DUMMY (2)	56.0	128.52	164.52	18.9

*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

Figure 2

VEHICLE 1 OCCUPANT CLEARANCE DIMENSIONS (mm)

	DRIVER (mm)	PASSENGER
HZ	269	235
HH	372	258
NW	650	444
NSW	287	-
NIP	408	338
NH	303	-
CD	404	321
CS	170	-
KDL	115	225
KDR	135	236
1	364	-
2	-	-
SA	21°	21°
PA	21°	-
ULA	7°	-3°
LLA	79°	86°
HZ	269	235

	DRIVER (mm)	PASSENGER
HR*	293	268
HS*	360	-
AD	123	173
HD	188	140
KK	341	194
AA	272	162
DT	21°C	21°C

* Measurements taken from intersection of nose and forehead in accordance with revised FMVSS 208 instructions.

DUMMY MEASUREMENT FOR FRONT SEAT PASSENGERS

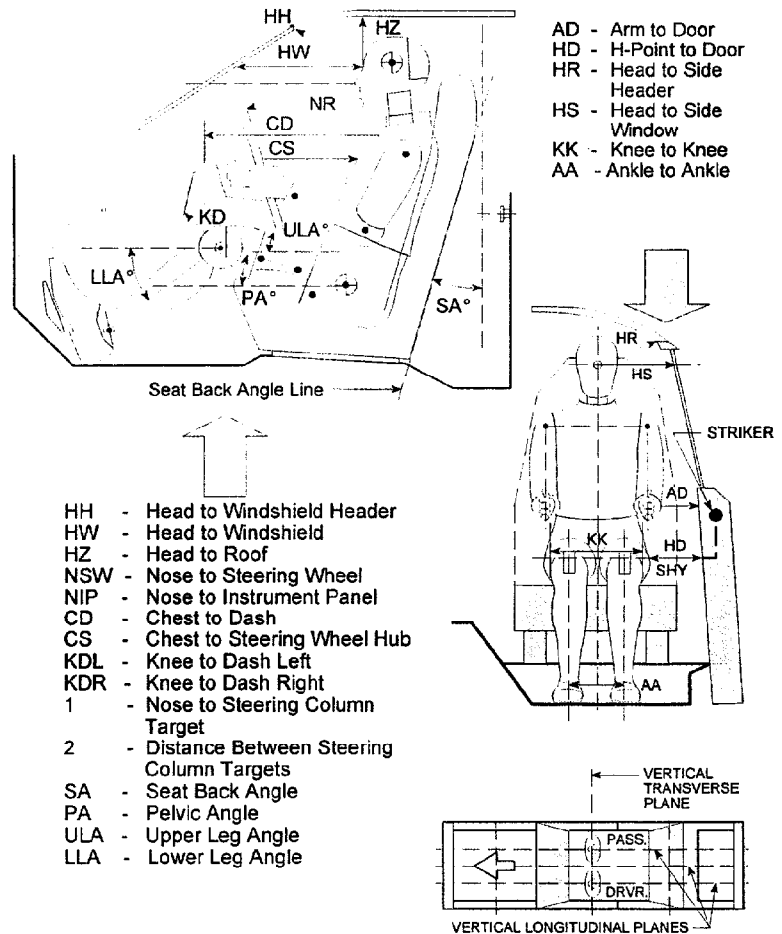
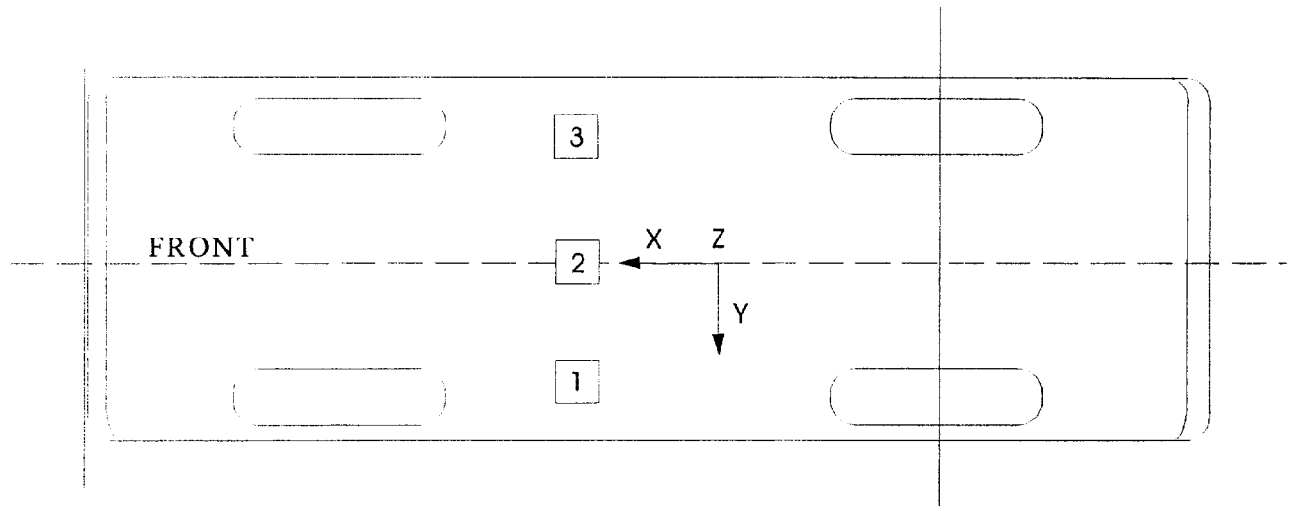


Figure 3

SUMMARY OF VEHICLE 1 ACCELEROMETER DATA



Vehicle: 1994 Plymouth Grand Voyager MPV

NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM AMP	msec	MINIMUM AMP	msec	FILTER CLASS
1	V1 Left X	Gs	1.5	-2.8	-18.3	104.0	60.0
1	V1 Left Y	Gs	6.6	106.1	-2.6	214.9	60.0
2	V1 Center X	Gs	1.3	21.1	-15.4	102.5	60.0
2	V1 Center Y	Gs	6.8	106.8	-2.1	215.8	60.0
2	V1 Center Z	Gs	14.1	108.0	-6.7	146.6	60.0
3	V1 Right X	Gs	1.3	20.0	-13.0	101.5	60.0
3	V1 Right Y	Gs	8.4	130.3	-3.3	309.6	60.0

Figure 4

VEHICLE 1 PRE-TEST ACCELEROMETER LOCATIONS

Test Description: 46.5 kph Frontal Vehicle to Vehicle Impact

Test Vehicle: 1994 Plymouth Grand Voyager MPV

Reference Plane: X: Vehicle plane at rear bumper, positive forward;
Y: Vehicle longitudinal centerline, positive to the left; Z: Ground, positive up

VEHICLE No. 1		PRE-TEST AXIS (mm)			POST-TEST AXIS (mm)		
Loc. No.	DESCRIPTION	X	Y	Z	X	Y	Z
1	LEFT "B" PILLAR	2553	579	485	2553	579	485
2	CENTER BETWEEN "B" PILLARS	2553	0	485	2553	0	485
3	RIGHT "B" PILLAR	2553	-597	485	2553	-579	485

Figure 5

VEHICLE 1 TARGET LOCATIONS

(All dimensions in millimeters)

A = 432

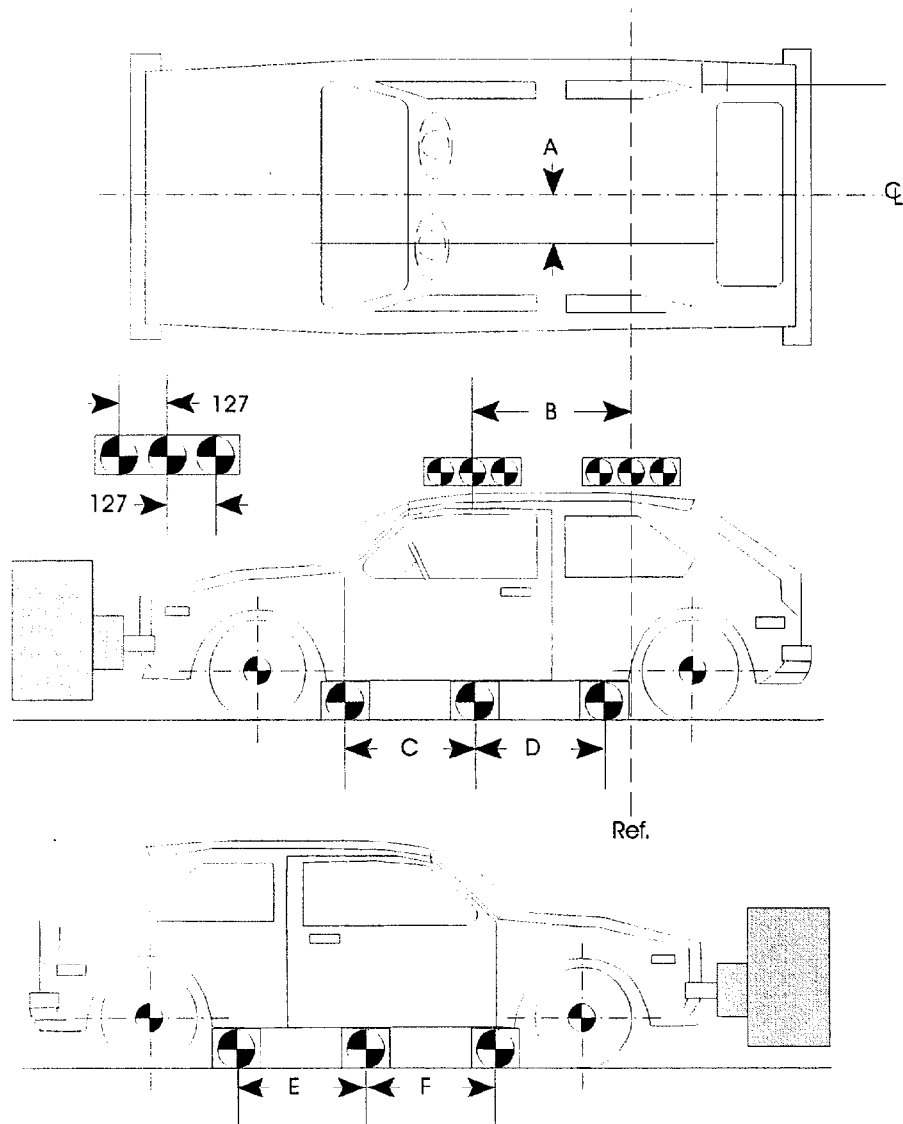
B = 1219

C = 1086

D = 1080

E = 1082

F = 1086



Section 4

VEHICLE TWO AND OCCUPANT INFORMATION

Table 3

VEHICLE 2 TEST PARAMETER DATATEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1995 Chevrolet Lumina MPV

NHTSA Test No.: - VIN.: IGNDY06D0ST110443

Body Color: White Date of Manufacture: 9/94

Engine: 6 Cylinders; - C.I.D.; 3.1 Liters; - CC
X Gas; - Diesel; - Turbocharged
X Longitudinal; - Transverse

Transmission: 3 Speed; - Manual; X Automatic; - Overdrive

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

Type of Occupant Restraint: Driver airbag with 3-point belt system

DATA RECORDED FROM VEHICLE'S TIRE PLACARD:

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

Recommended Tire Size: P205/70R15

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

Tires on Vehicle: P205/70R15; Manufacturer: General

Number of Occupants: 2 Front; 3 Rear; 2 3rd Seat; 7 TOTAL

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

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

GVWR 2325 kgs. GAWR: Front 1198 kgs. Rear 1165 kgs.

Table 3

VEHICLE 2 TEST PARAMETER DATA (continued)

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

Right Front	=	<u>493</u>	kgs.	Right Rear	=	<u>332</u>	kgs.
Left Front	=	<u>495</u>	kgs.	Left Rear	=	<u>331</u>	kgs.
TOTAL FRONT WEIGHT	=	<u>988</u>	kgs.	(<u>59.8</u> % of Total Vehicle Weight)			
TOTAL REAR WEIGHT	=	<u>663</u>	kgs.	(<u>40.2</u> % of Total Vehicle Weight)			
TOTAL DELIVERED WEIGHT	=	<u>1,651</u>	kgs.				

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMY:

Right Front	=	<u>539</u>	kgs.	Right Rear	=	<u>349</u>	kgs.
Left Front	=	<u>489</u>	kgs.	Left Rear	=	<u>367</u>	kgs.
TOTAL FRONT WEIGHT	=	<u>1,028</u>	kgs.	(<u>58.9</u> % of Total Vehicle Weight)			
TOTAL REAR WEIGHT	=	<u>716</u>	kgs.	(<u>41.1</u> % of Total Vehicle Weight)			
TOTAL TEST WEIGHT	=	<u>1,744</u>	kgs.				
TARGET TEST WEIGHT FROM COTR	=	<u>1750</u>	kgs.				

Two rear bucket seats were removed and a 25 lb. bag of shot was added to reach test weight.

Vehicle's Wheel Base = 2769 mm.

Location of Vehicle's C.G. = 1137 mm rearward of front wheel C/L

Table 3

VEHICLE 2 TEST PARAMETER DATA (continued)POST-IMPACT DATA:

Type of Test: Vehicle-to-Vehicle Frontal Impact Angle: 105 Deg.
 Date of Test: October 15, 1996 Time of Test: 14:33
 Ambient Temperature: 18 °C at impact area

Impact Velocity: primary = 46.5 kph, secondary = 46.5 kph

Distance From Front Bumper to Barrier Face When

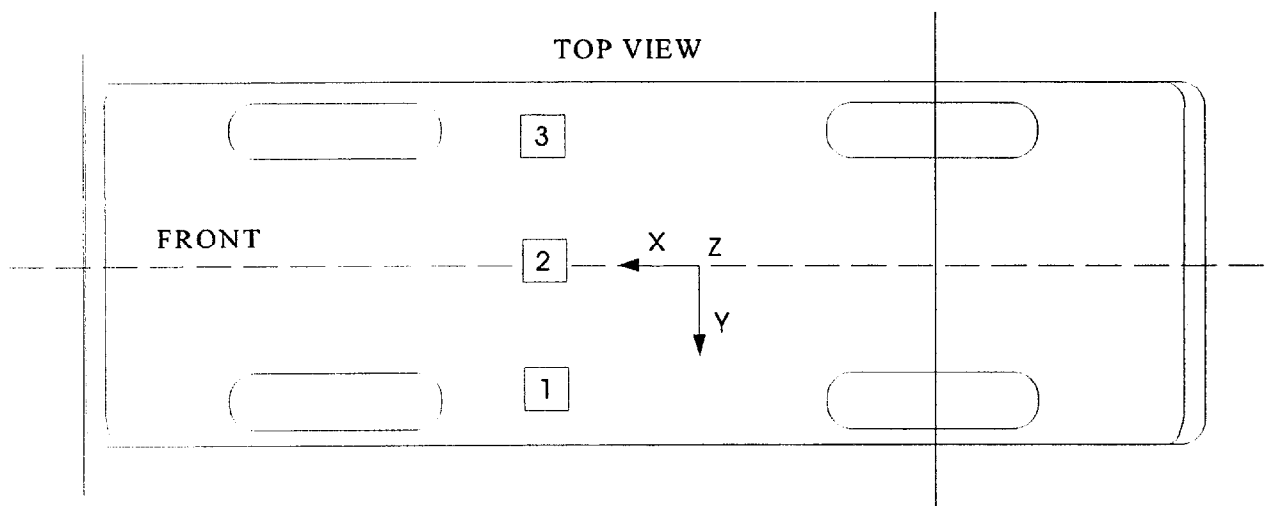
Entering Speed Trap: 132 cm.

Exiting Speed Trap: 30.5 cm.

	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
Door Opening	<u>Closed/Inoperable</u>	<u>Closed/Operable</u>	<u>-</u>	<u>Closed/Operable</u>

Figure 6

SUMMARY OF VEHICLE 2 ACCELEROMETER DATA



Vehicle: 1995 Chevrolet Lumina MPV

NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM AMP	msec	MINIMUM AMP	msec	FILTER CLASS
1	V2 Left X	Gs	2.6	-11.3	-15.5	100.9	60.0
1	V2 Left Y	Gs	6.2	106.6	-29.2	89.8	60.0
2	V2 Center X	Gs	2.9	-11.0	-8.7	88.1	60.0
2	V2 Center Y	Gs	2.9	181.4	-24.5	90.8	60.0
2	V2 Center Z	Gs	14.2	94.2	-16.6	90.4	60.0
3	V2 Right X	Gs	3.7	99.0	-8.8	83.0	60.0
3	V2 Right Y	Gs	3.6	180.5	-22.2	91.8	60.0

Figure 7

VEHICLE 2 PRE-TEST ACCELEROMETER LOCATIONS

Test Description: 46.5 kph Frontal Vehicle to Vehicle Impact

Test Vehicle: 1995 Chevrolet Lumina MPV

Reference Plane: X: Vehicle plane at rear bumper, positive forward;
Y: Vehicle longitudinal centerline, positive to the left; Z: Ground, positive up

VEHICLE No. 1		PRE-TEST AXIS (mm)			POST-TEST AXIS (mm)		
Loc. No.	DESCRIPTION	X	Y	Z	X	Y	Z
1	LEFT "B" PILLAR	2146	508	489	2146	508	489
2	CENTER BETWEEN "B" PILLARS	2146	0.0	489	2146	0	489
3	RIGHT "B" PILLAR	2146	-533	489	2146	-533	489

Figure 8

VEHICLE 2 TARGET LOCATIONS

(All dimensions in millimeters)

A = 432

B = 1219
C = 945
D = 959

E = 945
F = 959

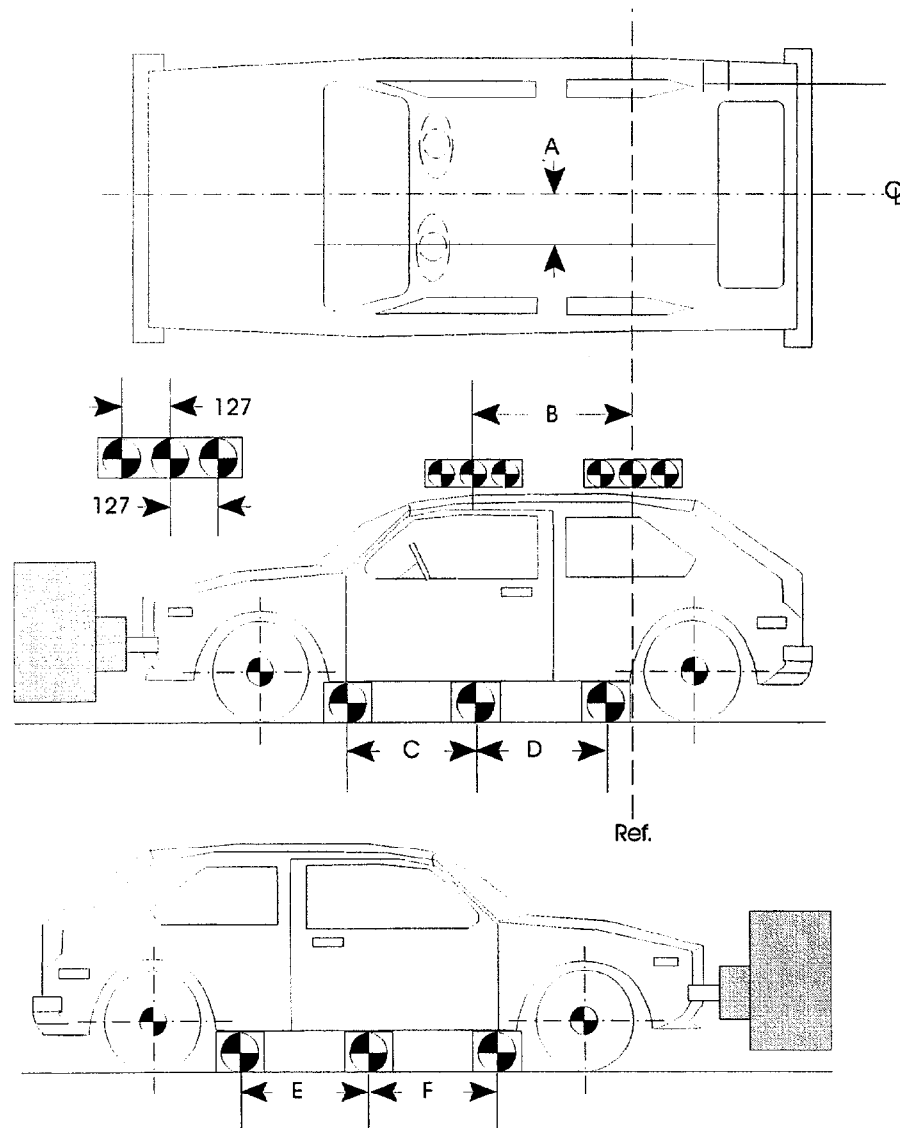


Figure 9

CAMERA POSITIONS FOR VEHICLE-TO-VEHICLE IMPACT TEST

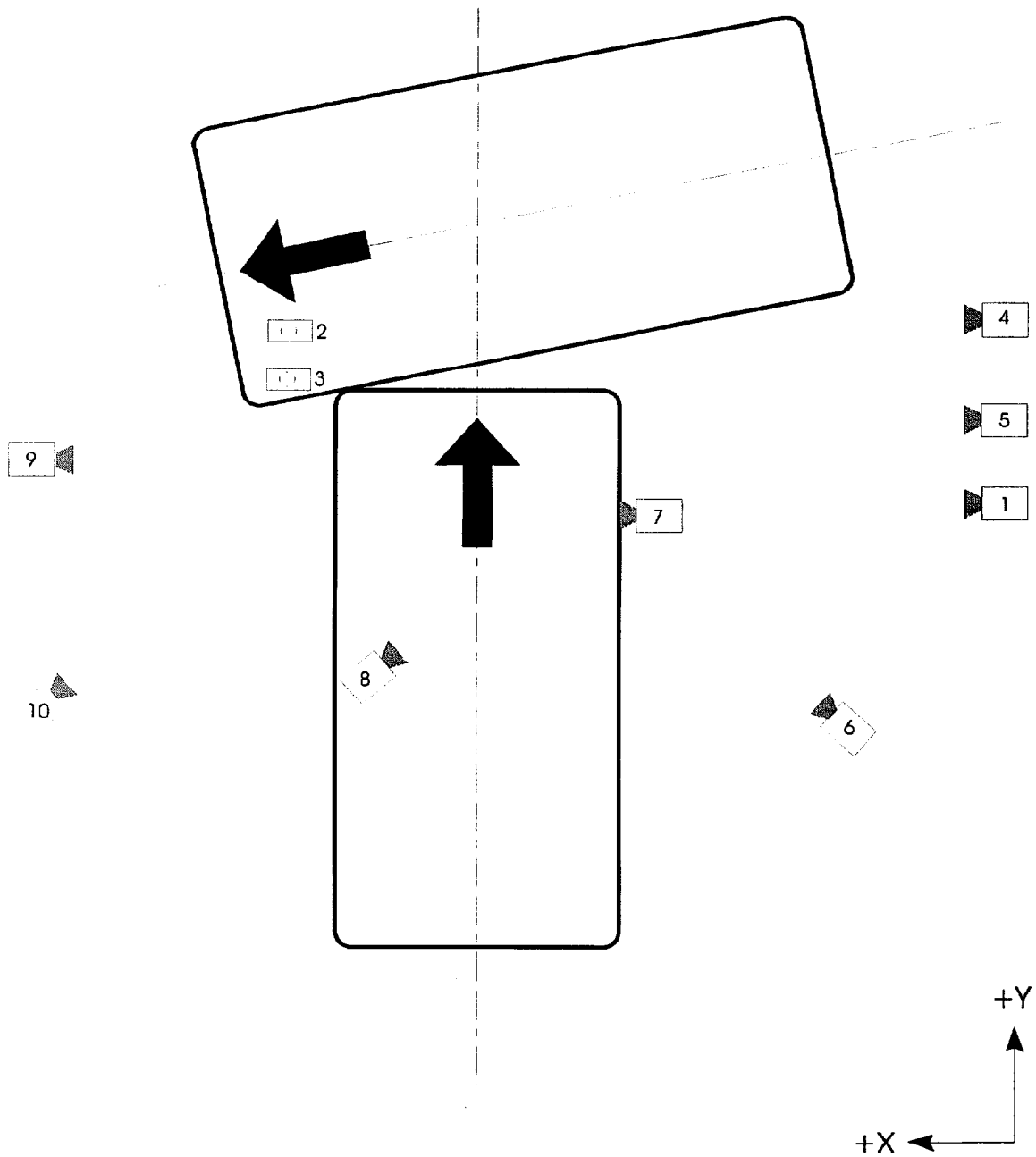


Table 4
HIGH-SPEED CAMERA LOCATIONS

Vehicle: 1994 Plymouth Grand Voyager MPV, 1995 Chevrolet Lumina MPV

Test No. A109-1-1646

CAMERA LOCATION	VIEW	CAMERA POSITIONS (mm)*			ANGLE** (deg)	LENS (mm)	SPEED (fps)
		X	Y	Z			
1	Real-Time Camera	-	-	-	-	-	24
2	Overhead Overall View	406	305	9805	-90	13	880
3	Overhead Closeup View	406	0	9805	-90	25	785
4	Overall Right Side View	-10185	1981	1829	-6	25	820
5	Right Impact Point View	-9246	152	1156	-1	35	800
6	Right Passenger View	-3353	-2464	2108	-16	13	840
7	Vehicle 1 Closeup Passenger Side View	-1321	-1854	1422	-16	8	580
8	Vehicle 1 Closeup Passenger Rear View	152	-2692	1448	-45	7.5	500
9	Overall Left Side View	7163	-3785	1232	-2	25	790
10	Left Impact Point View	5690	-7798	1194	-4	35	825

*X = film plane to Vehicle 1 longitudinal centerline, positive left

Y = film plane to impact location, positive forward

Z = film plane to ground

** = referenced to horizontal plane

APPENDIX A

PHOTOGRAPHS: OVERALL TEST SETUP

APPENDIX A

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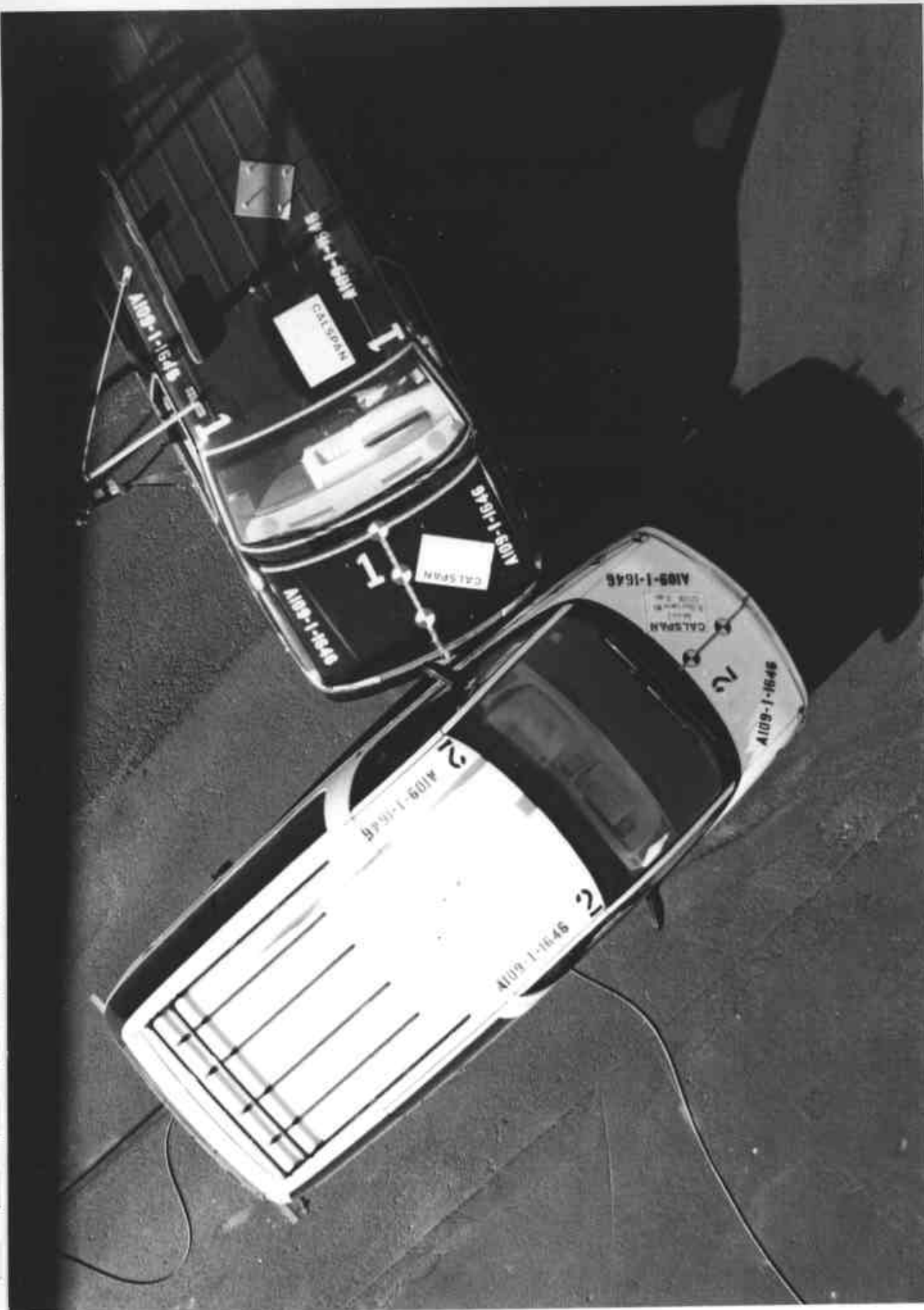


Figure A-1 PRE-TEST OVERHEAD VIEW



Figure A-2 PRE-TEST OVERALL LEFT SIDE VIEW



Figure A-3 PRE-TEST OVERALL RIGHT SIDE VIEW

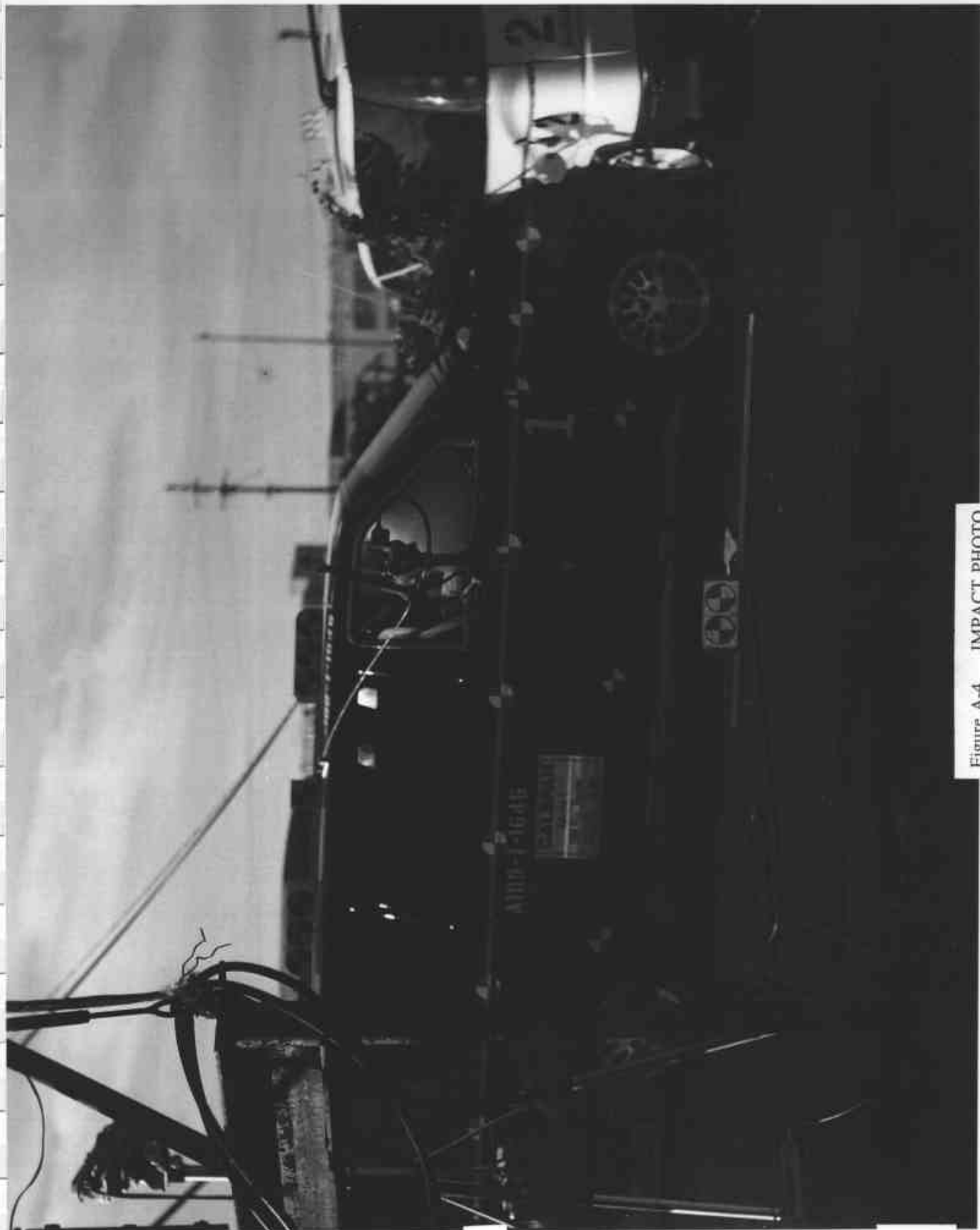


Figure A-4 IMPACT PHOTO

A-6

8404-1

APPENDIX B

PHOTOGRAPHS: VEHICLE 1 AND OCCUPANTS

APPENDIX B

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PHOTOGRAPH NOT AVAILABLE

Figure B-1 PRE-TEST FRONT VIEW
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Figure B-2 POST-TEST FRONT VIEW



Figure B-3 PRE-TEST FRONT RIGHT THREE QUARTER VIEW



Figure B-4 POST-TEST FRONT RIGHT THREE QUARTER VIEW



Figure B-5 PRE-TEST RIGHT SIDE VIEW



Figure B-6 POST-TEST RIGHT SIDE VIEW



Figure B-7 PRE-TEST REAR RIGHT THREE QUARTER VIEW



Figure B-8 POST-TEST REAR RIGHT THREE QUARTER VIEW

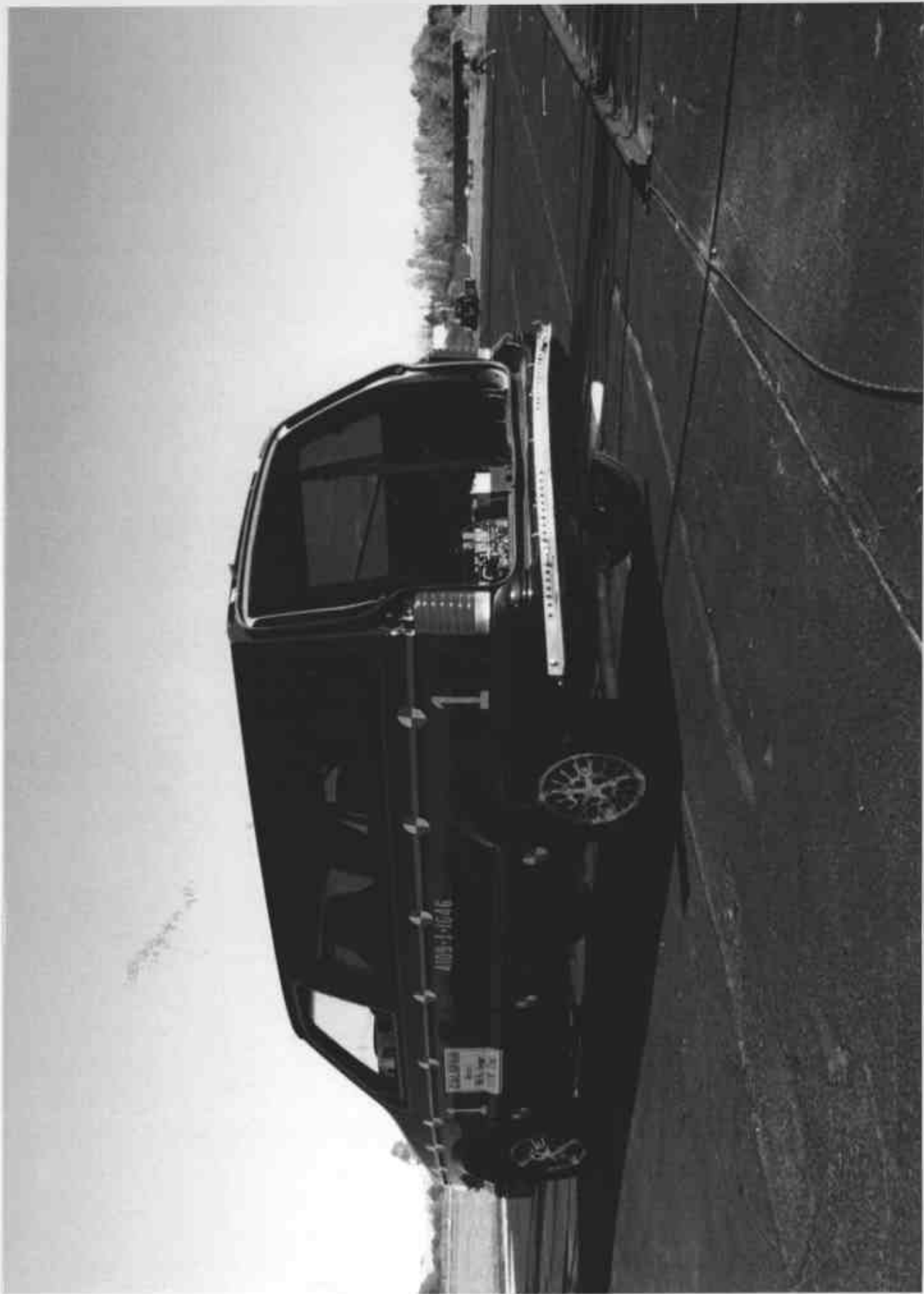


Figure B-9 PRE-TEST REAR LEFT THREE QUARTER VIEW



Figure B-10 POST-TEST REAR LEFT THREE QUARTER VIEW



Figure B-11 PRE-TEST LEFT SIDE VIEW



Figure B-12 POST-TEST LEFT SIDE VIEW



Figure B-13 PRE-TEST FRONT LEFT THREE QUARTER VIEW



Figure B-14 POST-TEST FRONT LEFT THREE QUARTER VIEW



Figure B-15 PRE-TEST WINDSHIELD VIEW



Figure B-16 POST-TEST WINDSHIELD VIEW



Figure B-17 PRE-TEST DRIVER SIDE VIEW
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Figure B-18 POST-TEST DRIVER SIDE VIEW
B-20



Figure B-19 PRE-TEST DRIVER AND INTERIOR VIEW
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Figure B-20 POST-TEST DRIVER AND INTERIOR VIEW
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Figure B-21 PRE-TEST DRIVER INSIDE VIEW
B-23



Figure B-22 POST-TEST DRIVER INSIDE VIEW

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Figure B-23 PRE-TEST PASSENGER SIDE VIEW
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Figure B-24 POST-TEST PASSENGER SIDE VIEW



Figure B-25 PRE-TEST PASSENGER AND INTERIOR VIEW
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Figure B-26 POST-TEST PASSENGER AND INTERIOR VIEW
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Figure B-27 PRE-TEST PASSENGER INSIDE VIEW
B-29

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Figure B-28 POST-TEST PASSENGER INSIDE VIEW

B-30

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Figure B-29 POST-TEST DRIVER CHEST CONTACT POINT



Figure B-30 POST-TEST DRIVER KNEE ROI STR/TOE PAN



Figure B-31 POST-TEST PASSENGER CHEST CONTACT POINT

PHOTOGRAPH NOT AVAILABLE



Figure B-33 POST-TEST TOP VIEW

MFD BY CHRYSLER CORPORATION		DATE OF MFR 9-93	GAWD 05200 LB 2359 KG
GAWD FRONT 2726 LB 1237 KG	WITH TIRES P285/70R15	RIMS AT 15X6.0	PSI COLD 35
GAWD REAR 2726 LB 1237 KG	WITH TIRES P285/70R15	RIMS AT 15X6.0	PSI COLD 35

THIS VEHICLE CONFORMS TO ALL APPLICABLE FEDERAL MOTOR VEHICLE SAFETY STANDARDS IN EFFECT ON THE DATE OF MANUFACTURE SHOWN ABOVE.

VTIN: 1P4GH4R88X137713 TYPE: MPV

MSH: 091117 637

VEHICLE MADE IN U.S.A.

46485-03

SINGLE X DUAL

Figure B-34 CERTIFICATION PLACARD

APPENDIX C
PHOTOGRAPHS: VEHICLE 2

APPENDIX C

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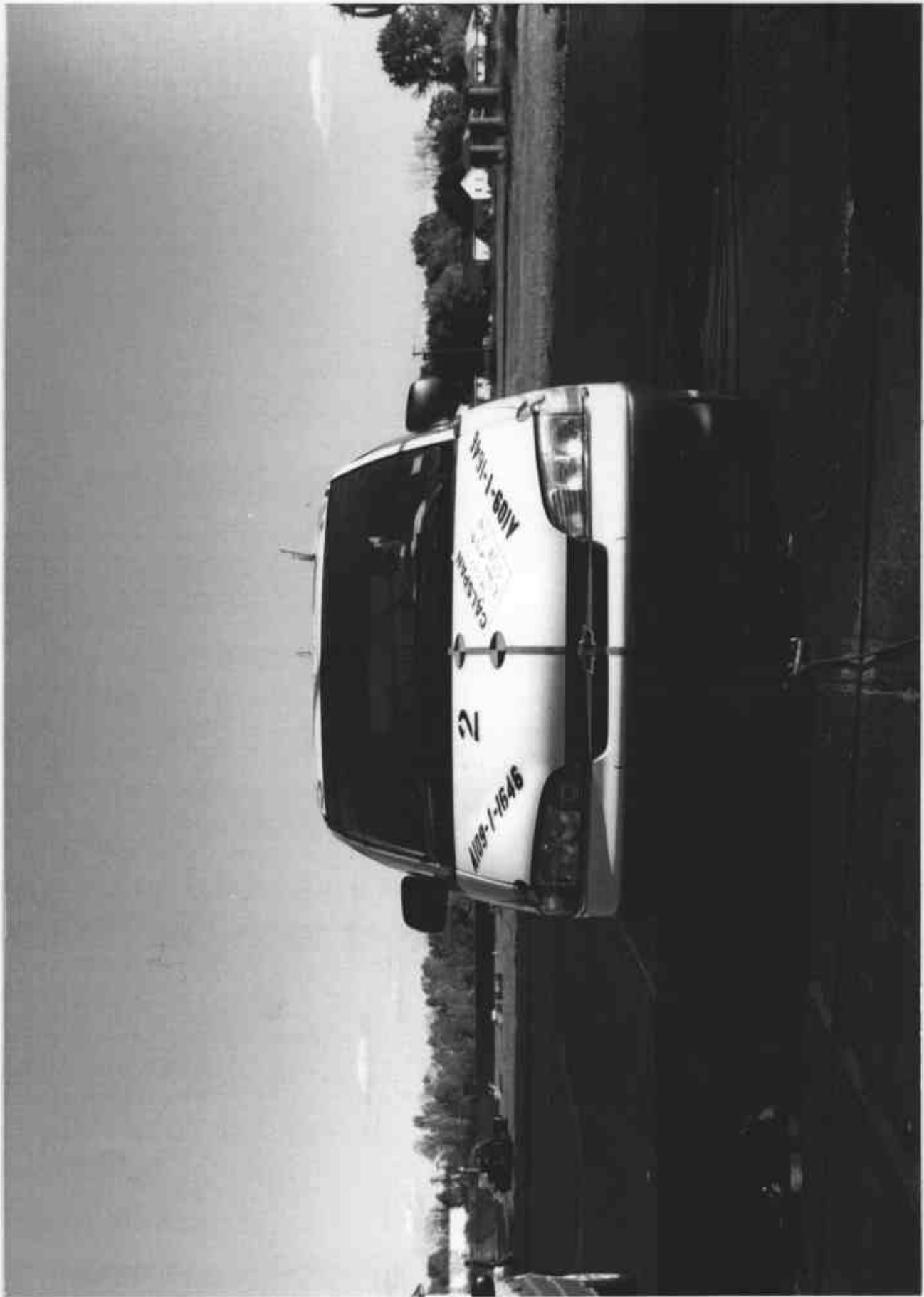


Figure C-1 PRE-TEST FRONT VIEW



Figure C-2 POST-TEST FRONT VIEW



Figure C-3 PRE-TEST FRONT RIGHT THREE QUARTER VIEW



Figure C-4 POST-TEST FRONT RIGHT THREE QUARTER VIEW



• Figure C-5 PRE-TEST RIGHT SIDE VIEW



Figure C-6 POST-TEST RIGHT SIDE VIEW



Figure C-7 PRE-TEST REAR RIGHT THREE QUARTER VIEW



Figure C-8 POST-TEST REAR RIGHT THREE QUARTER VIEW



Figure C-9 PRE-TEST REAR LEFT THREE QUARTER VIEW



Figure C-10 POST-TEST REAR LEFT THREE QUARTER VIEW



Figure C-11 PRE-TEST LEFT SIDE VIEW



Figure C-12 POST-TEST LEFT SIDE VIEW

PHOTOGRAPH NOT AVAILABLE



Figure C-14 POST-TEST FRONT LEFT THREE QUARTER VIEW

APPENDIX D

VEHICLE AND DUMMY RESPONSE DATA

Key: V1 - Vehicle 1
V2 - Vehicle 2
P1 - Driver Side Dummy (5th female)
P2 - Right Front Passenger Side Dummy (6 year old)

FACILITY: TRACK
RUN #: 1646
SERIES #: 1

TEST DATE: 15 Oct 1996
TEST TIME: 14:32:42
BOARD: c

TITLE: VTV TEST #1

CHANNEL NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM		MINIMUM		FILTER CLASS
			AMP	msec	AMP	msec	
1	V1 Center Y	Gs	6.8	106.8	-2.1	215.8	60.0
2	V1 Center Z	Gs	14.1	108.0	-6.7	146.6	60.0
3	V1 Right X	Gs	1.3	20.0	-13.0	101.5	60.0
4	V1 Right Y	Gs	8.4	130.3	-3.3	309.6	60.0
5	Timer Squib Out	Non	25.4	106.7	-662.4	145.6	1000.0
6	Vehicle Squib Out	Non	64.4	82.1	-667.6	78.7	1000.0
7	V2 Left X	Gs	2.6	-11.3	-15.5	100.9	60.0
8	V2 Left Y	Gs	6.2	106.6	-29.2	89.8	60.0
9	V2 Center X	Gs	2.9	-11.0	-8.7	88.1	60.0
10	V2 Center Y	Gs	2.9	181.4	-24.5	90.8	60.0
11	V2 Center Z	Gs	14.2	94.2	-16.6	90.4	60.0
12	V2 Right X	Gs	3.7	99.0	-8.8	83.0	60.0
13	V2 Right Y	Gs	3.6	180.5	-22.2	91.8	60.0

TEST NO. A109-1-1646

VEHICLE DATA

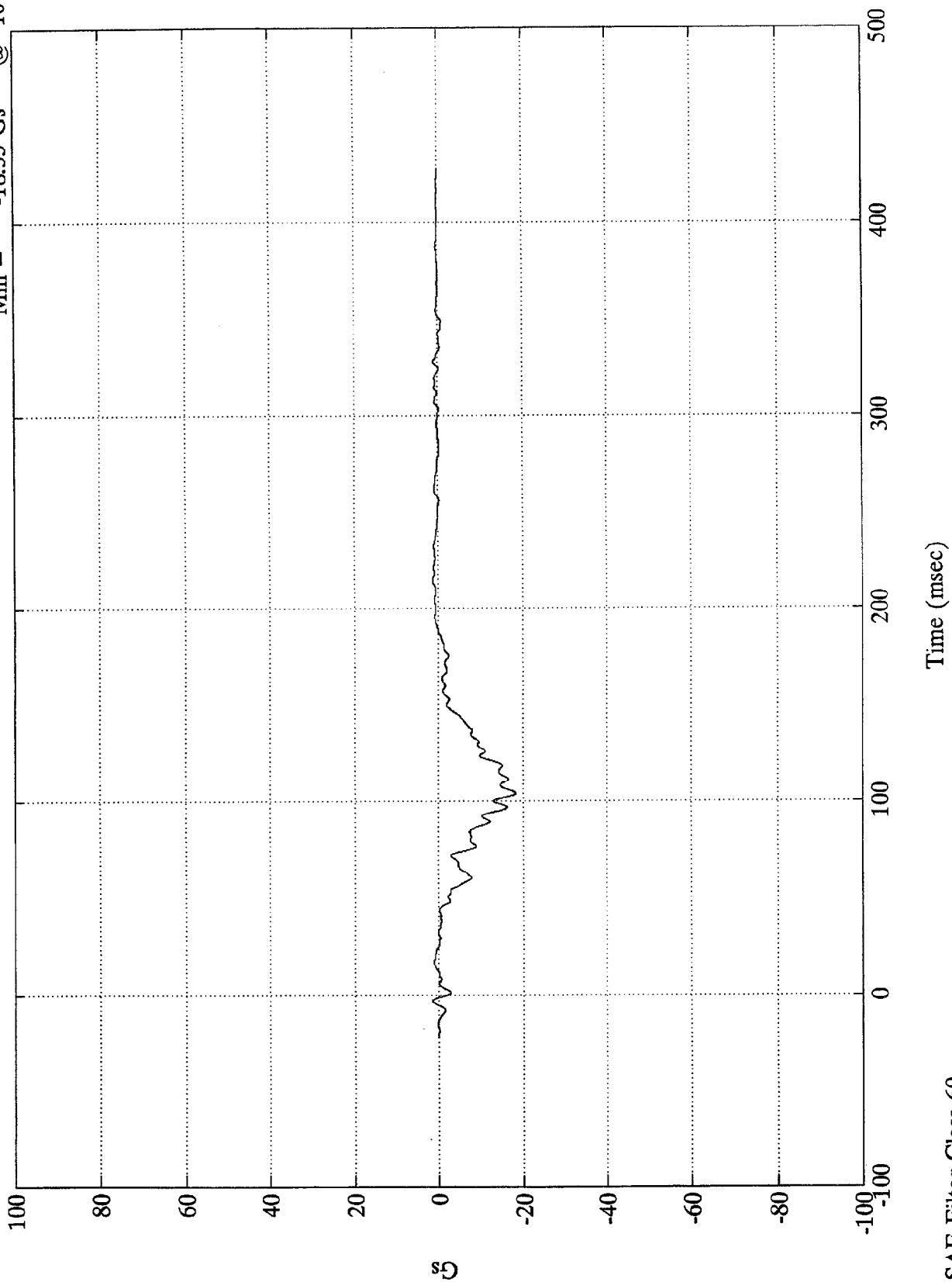
CHANNEL
Vehicle Data
Integrations

SAE FILTER CHANNEL CLASS
60
180

VTV TEST #1

Max = 1.52 Gs @ -2.76 msec
Min = -18.33 Gs @ 104.04 msec

V1 Left X

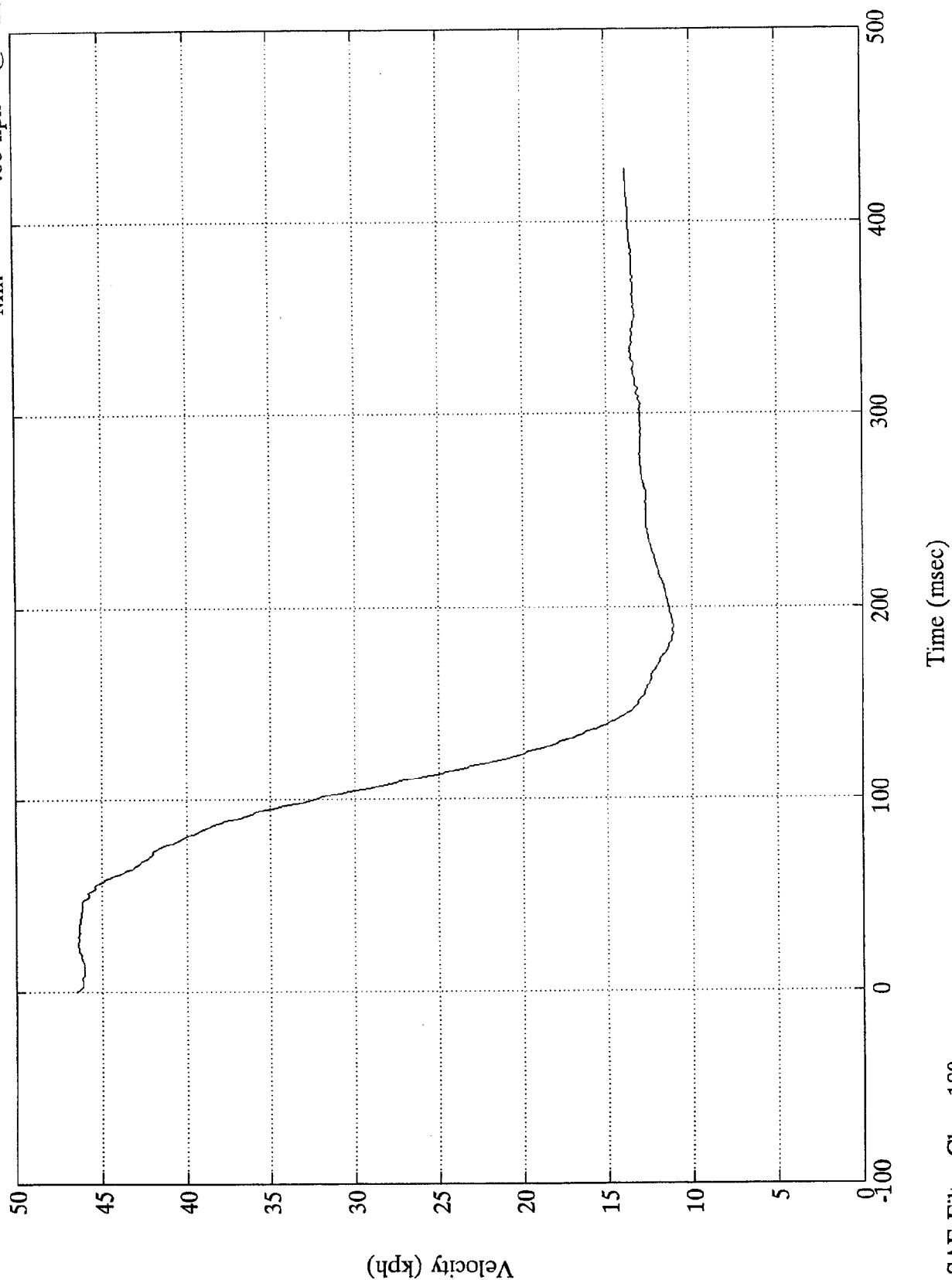


SAE Filter Class 60

VTV TEST #1

Max = 46.51 kph @ -0.00 msec
Min = .00 kph @ -22.44 msec

V1 Left X

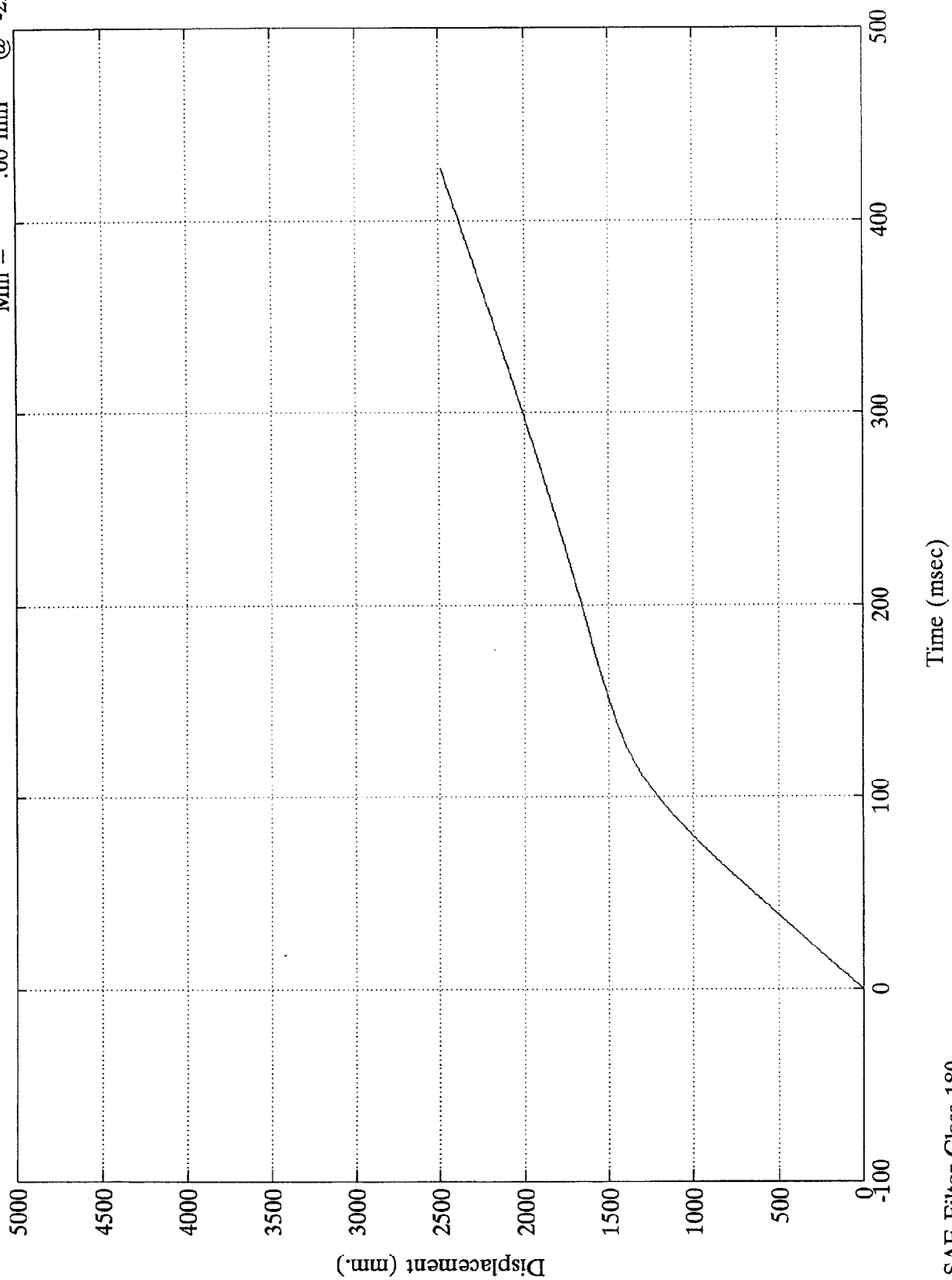


SAE Filter Class 180

VTV TEST #1

Max = 2484.93 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec

V1 Left X

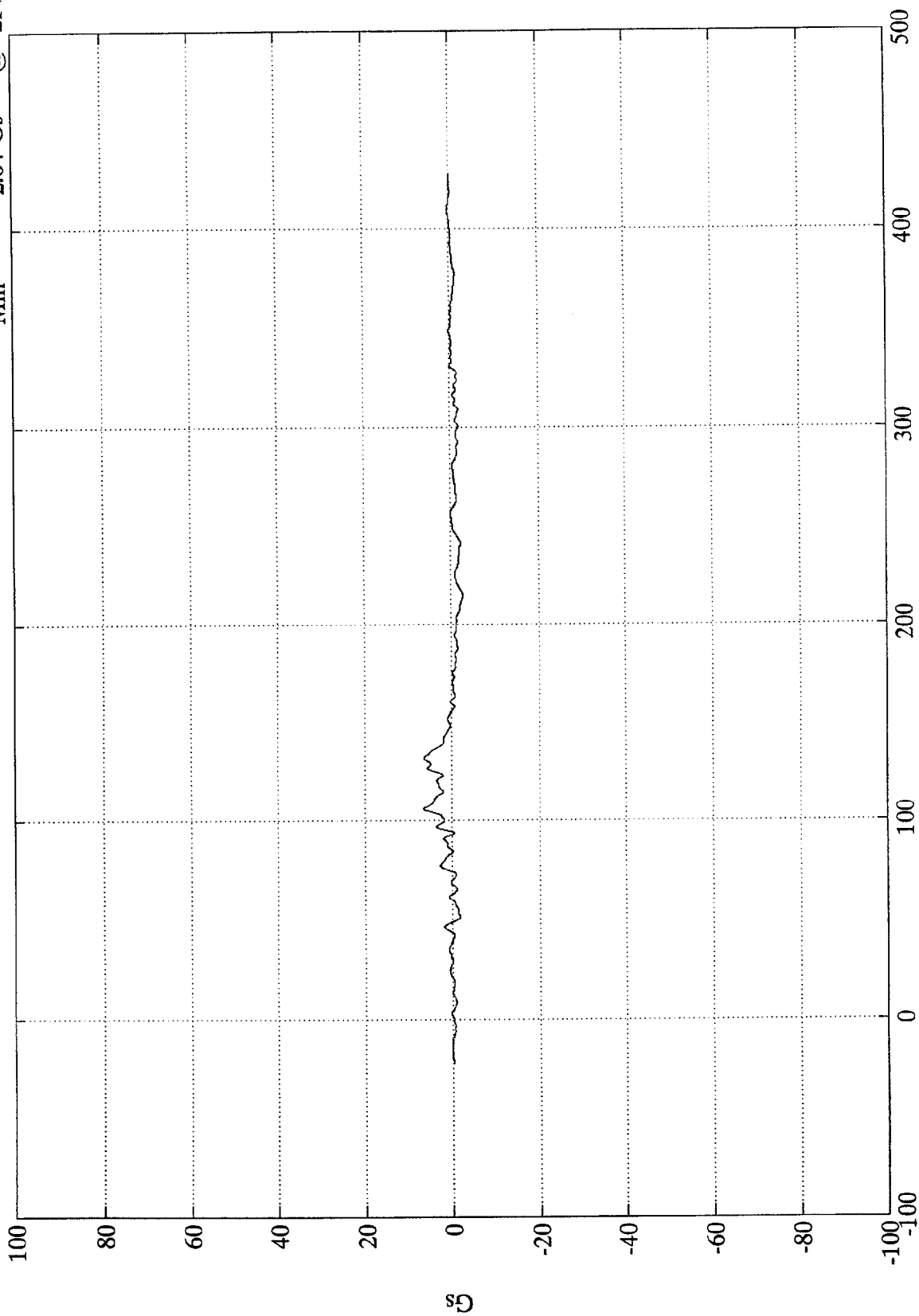


SAE Filter Class 180

VTV TEST #1

Max = 6.62 Gs @ 106.08 msec
Min = -2.64 Gs @ 214.92 msec

V1 Left Y



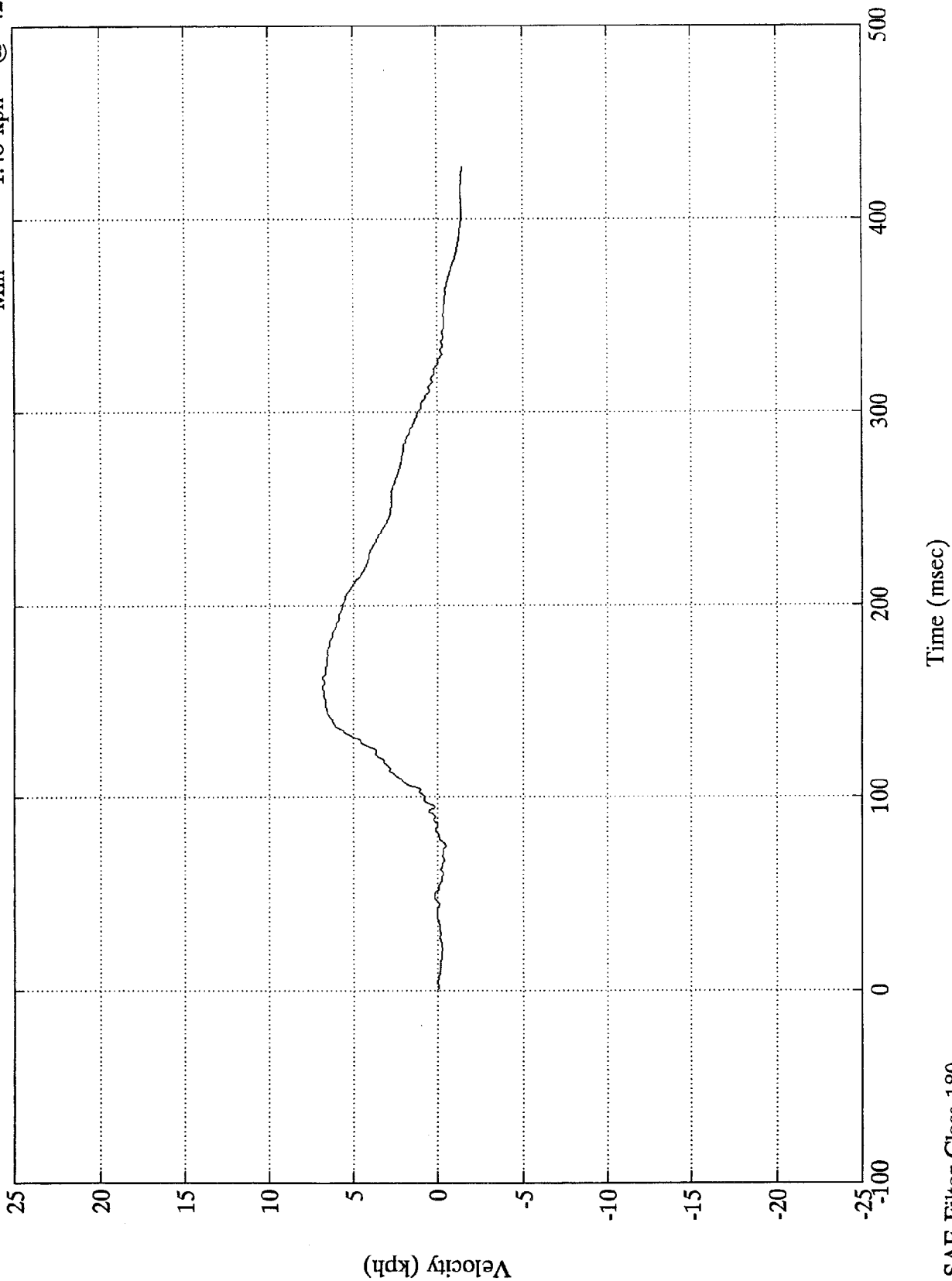
Time (msec)

SAE Filter Class 60

VTV TEST #1

Max = 6.81 kph @ 162.48 msec
Min = -1.48 kph @ 427.32 msec

V1 Left Y

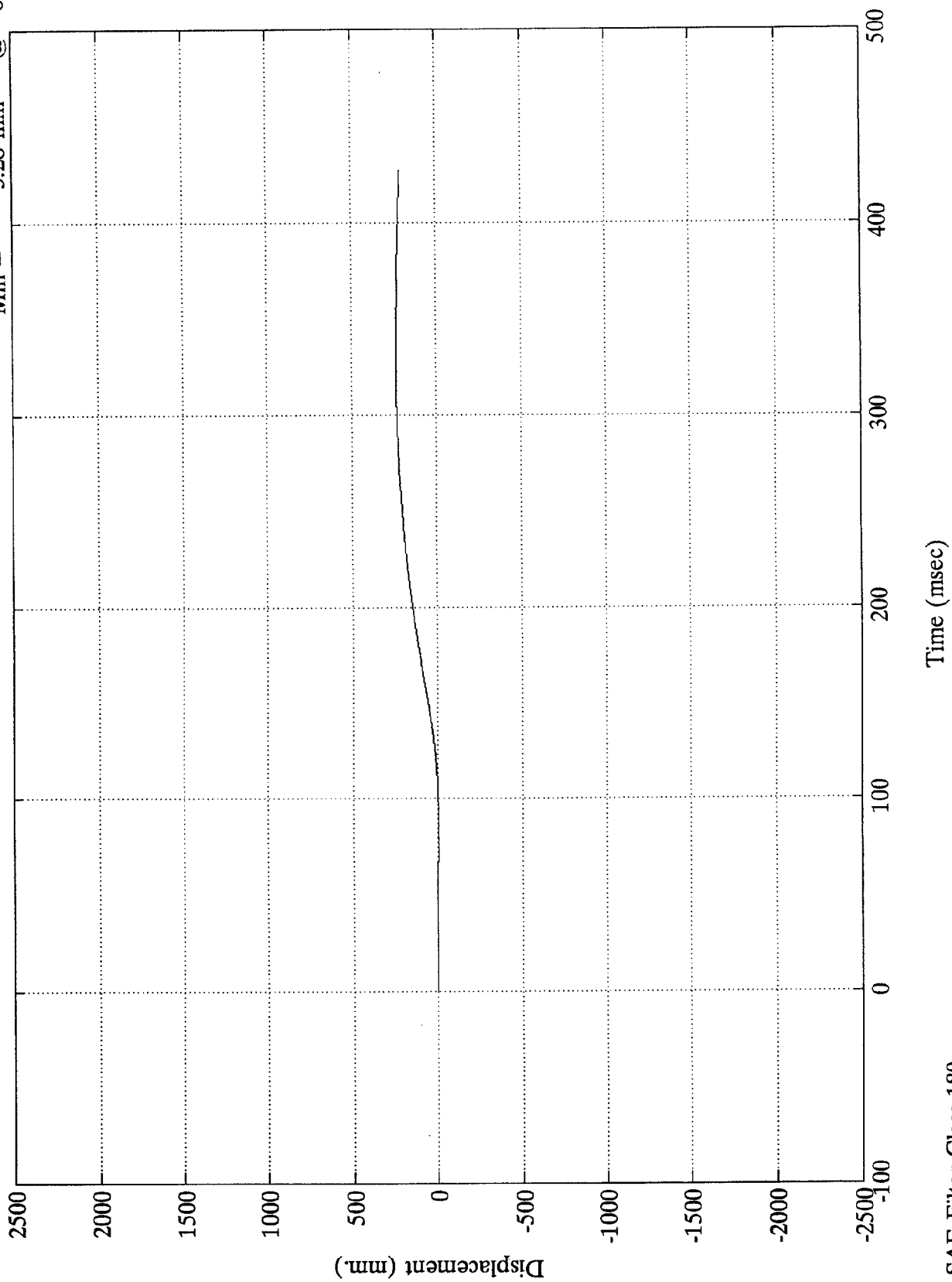


SAE Filter Class 180

VTV TEST #1

V1 Left Y

Max = 235.28 mm @ 324.12 msec
Min = -3.28 mm @ 81.72 msec

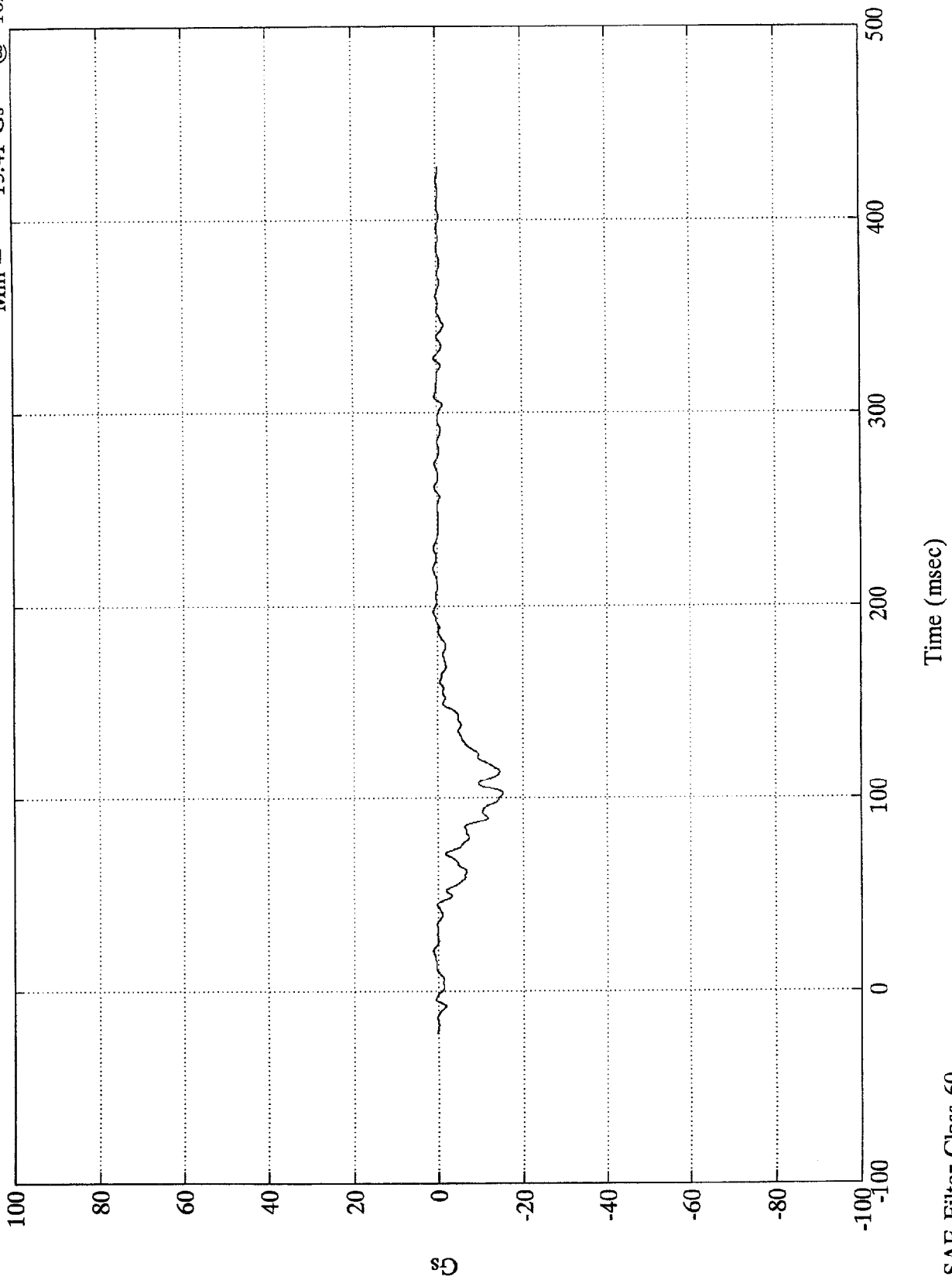


SAE Filter Class 180

VTV TEST #1

Max = 1.26 Gs @ 21.12 msec
 Min = -15.41 Gs @ 102.48 msec

V1 Center X

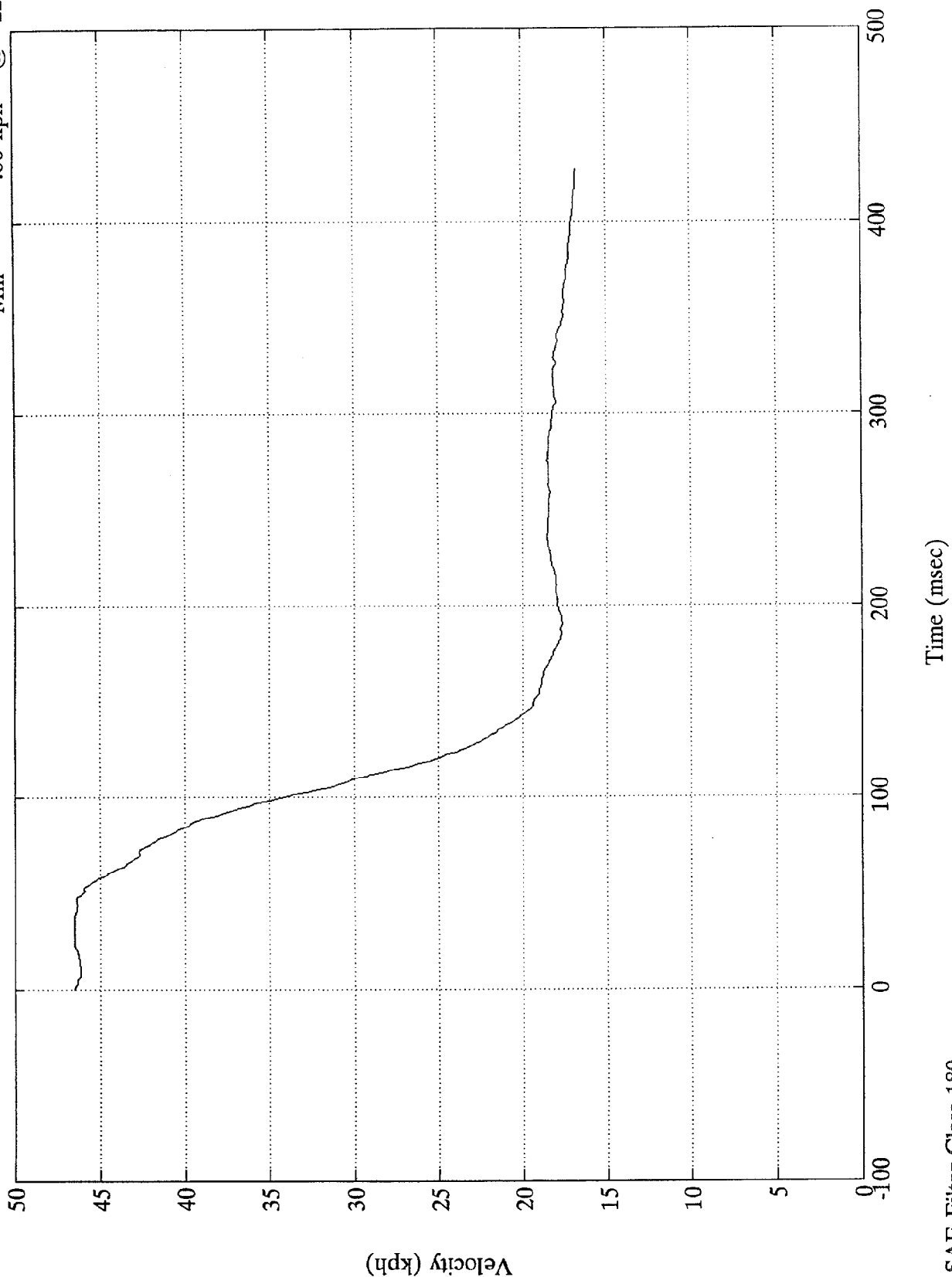


SAE Filter Class 60

VTV TEST #1

Max = 46.51 kph @ 36.35 msec
Min = .00 kph @ -22.44 msec

V1 Center X

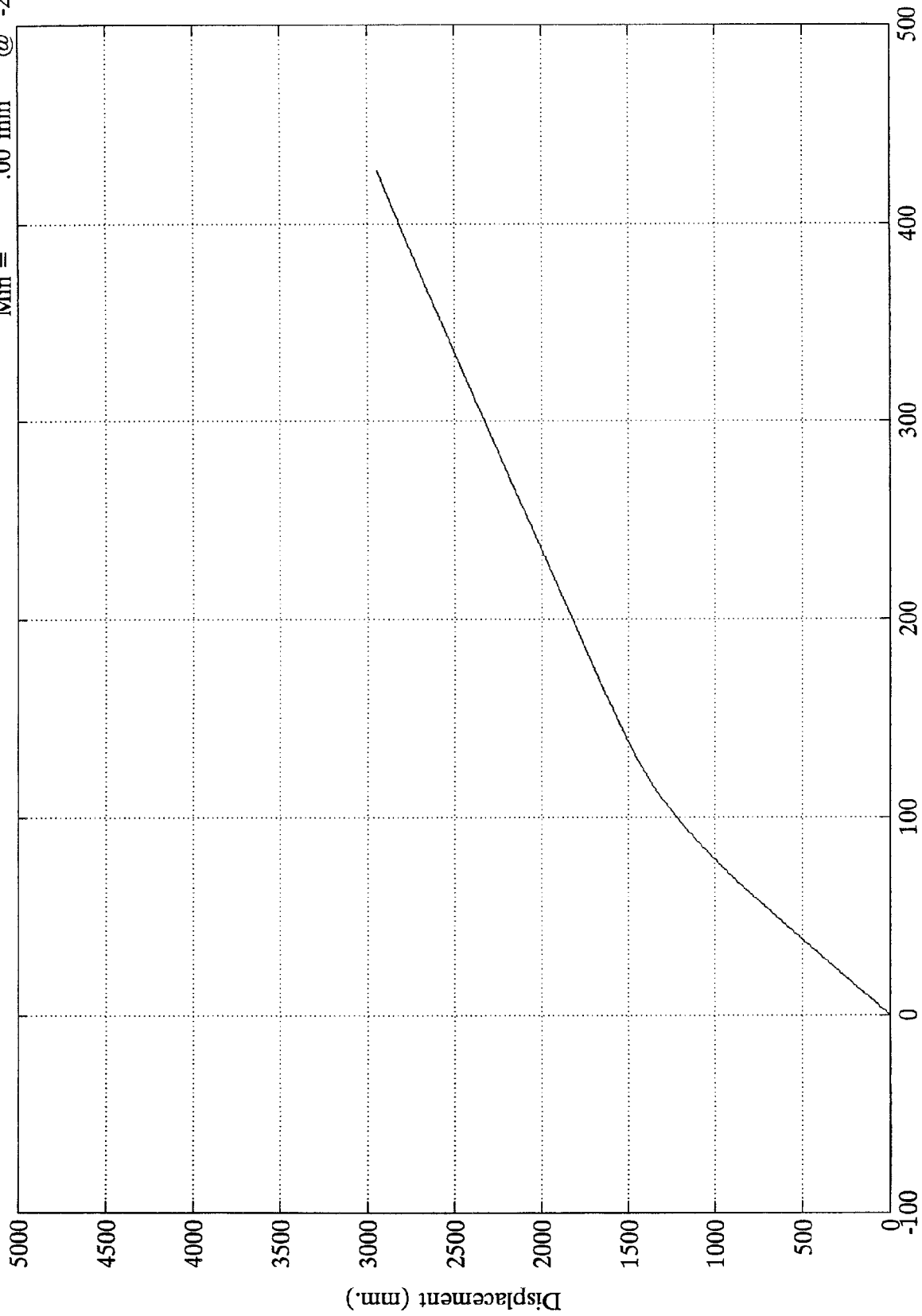


SAE Filter Class 180

VTV TEST #1

Max = 2945.11 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec

V1 Center X



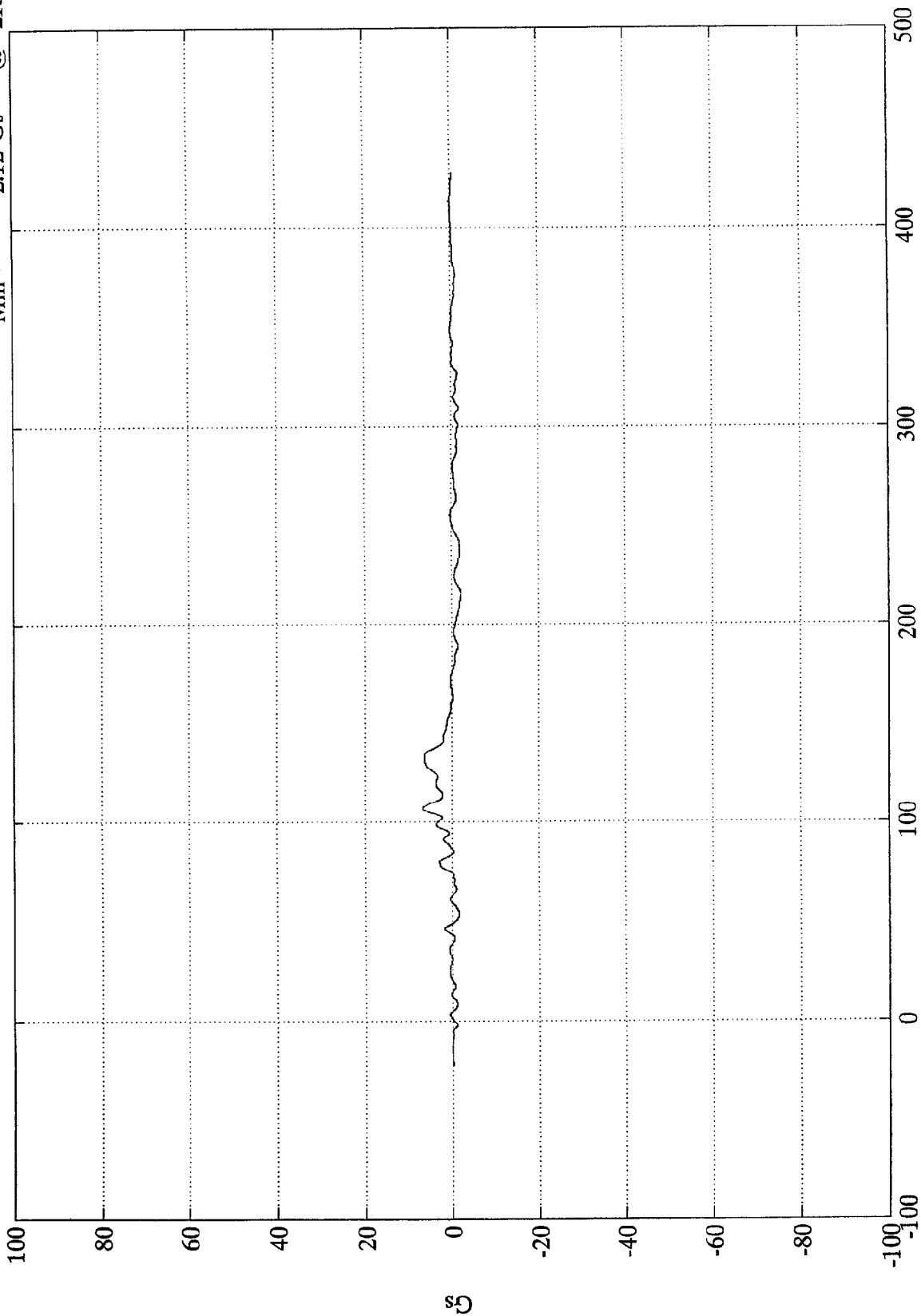
Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = 6.78 Gs @ 106.80 msec
Min = -2.12 Gs @ 215.76 msec

V1 Center Y



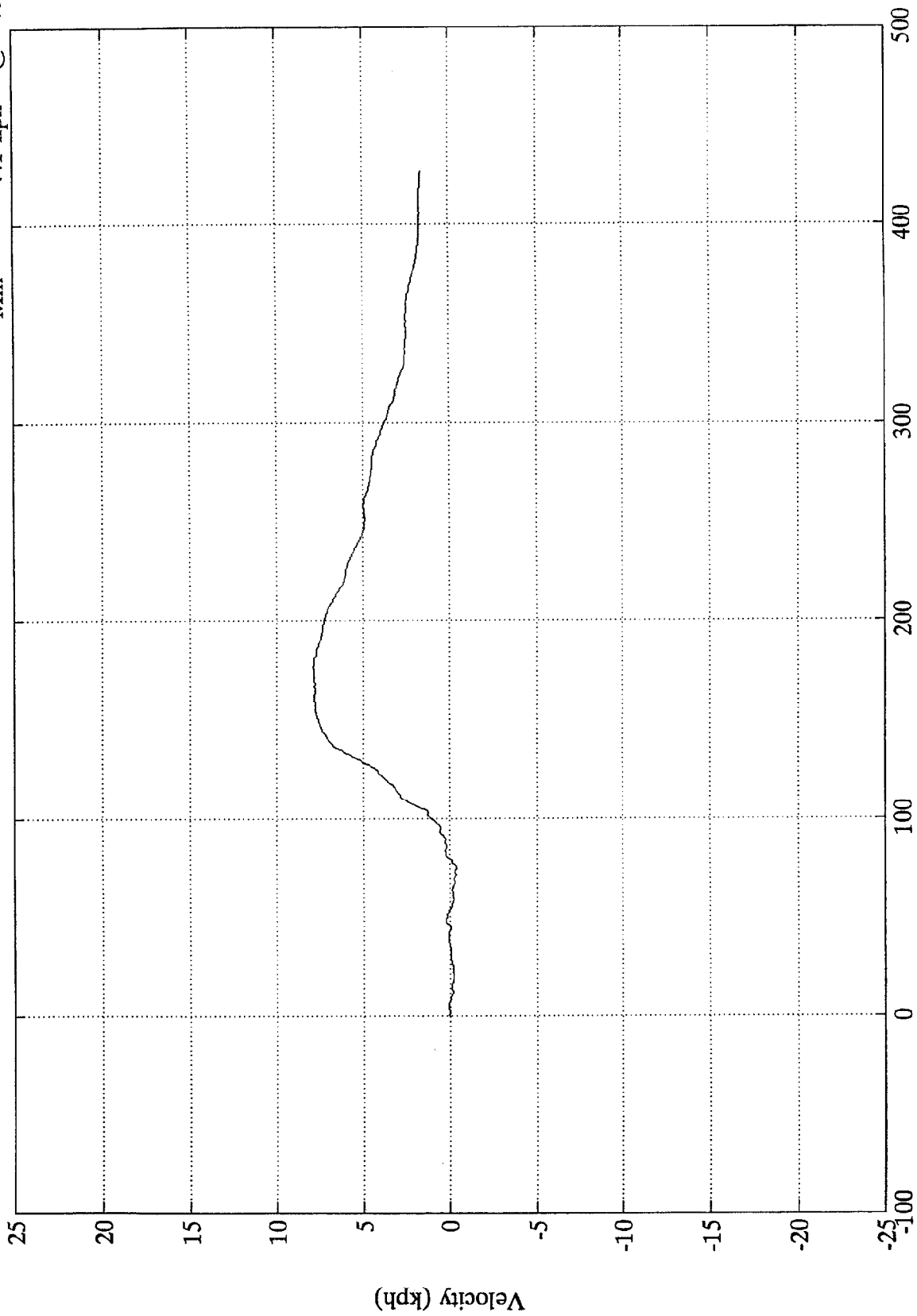
Time (msec)

SAE Filter Class 60

VTV TEST #1

Max = 7.87 kph @ 176.52 msec
Min = -.41 kph @ 75.72 msec

V1 Center Y



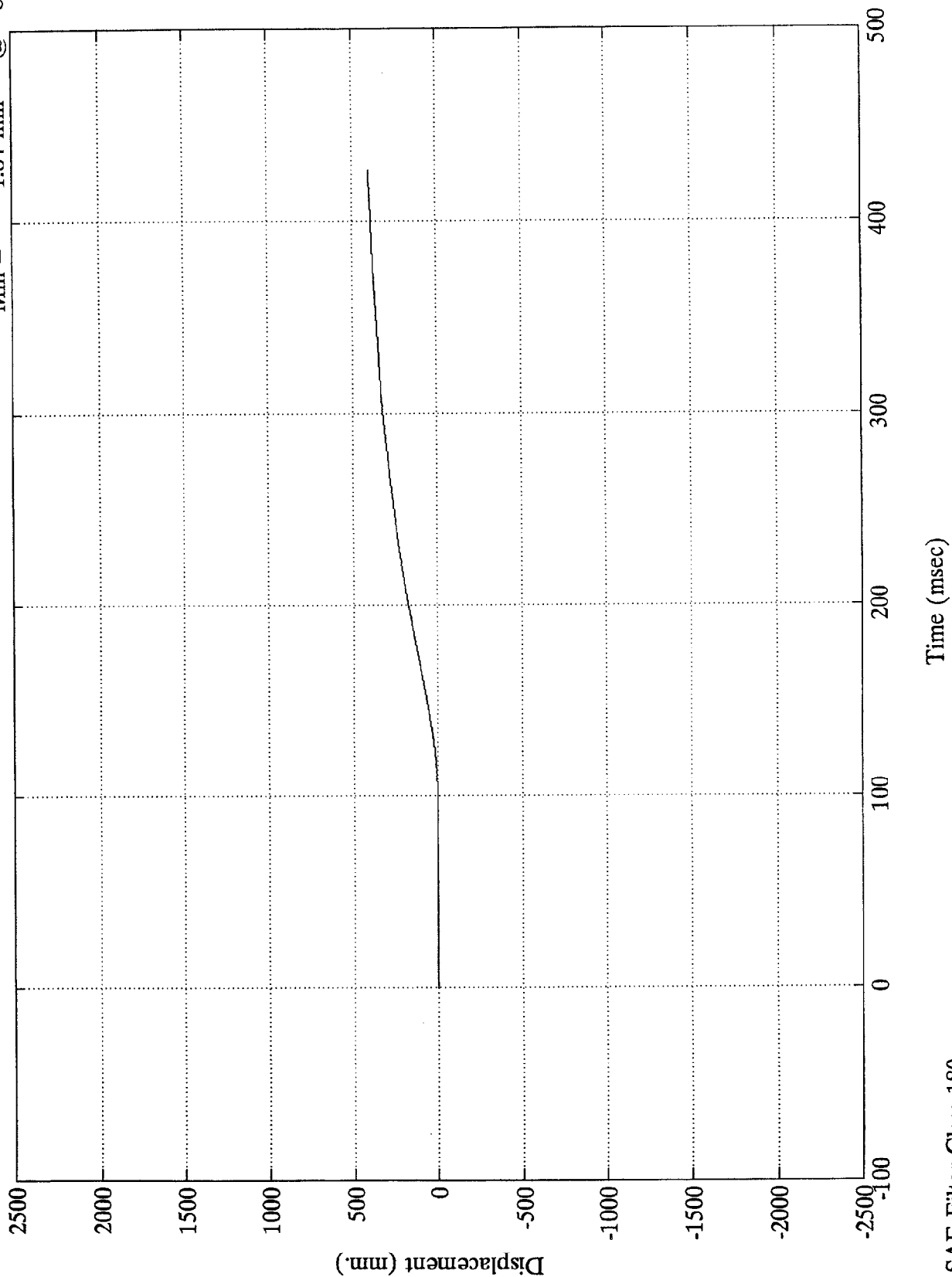
Time (msec)

SAE Filter Class 180

VTV TEST #1

V1 Center Y

Max = 399.25 mm @ 427.32 msec
Min = -1.84 mm @ 80.15 msec

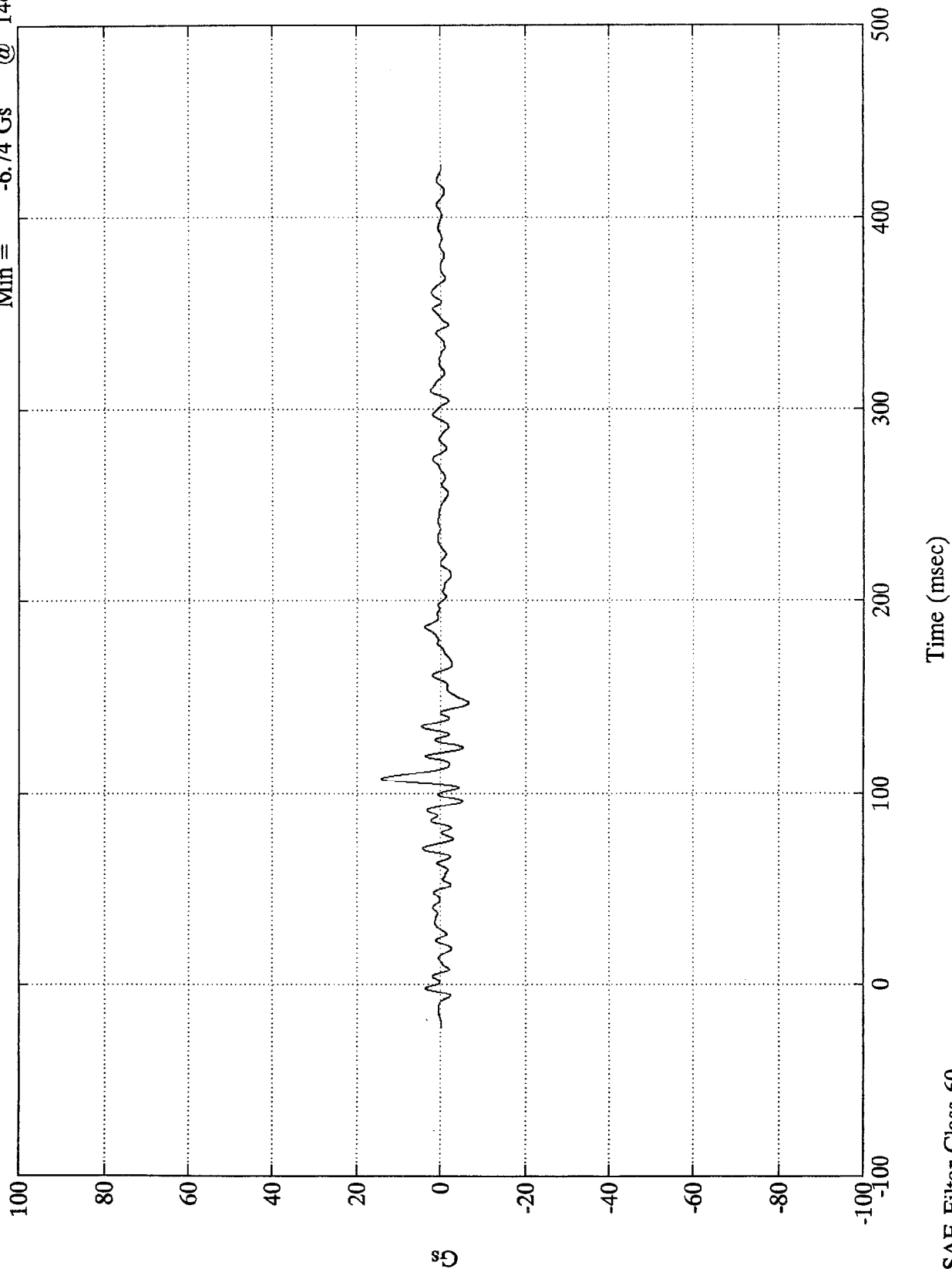


SAE Filter Class 180

VTV TEST #1

Max = 14.14 Gs @ 108.00 msec
Min = -6.74 Gs @ 146.63 msec

V1 Center Z

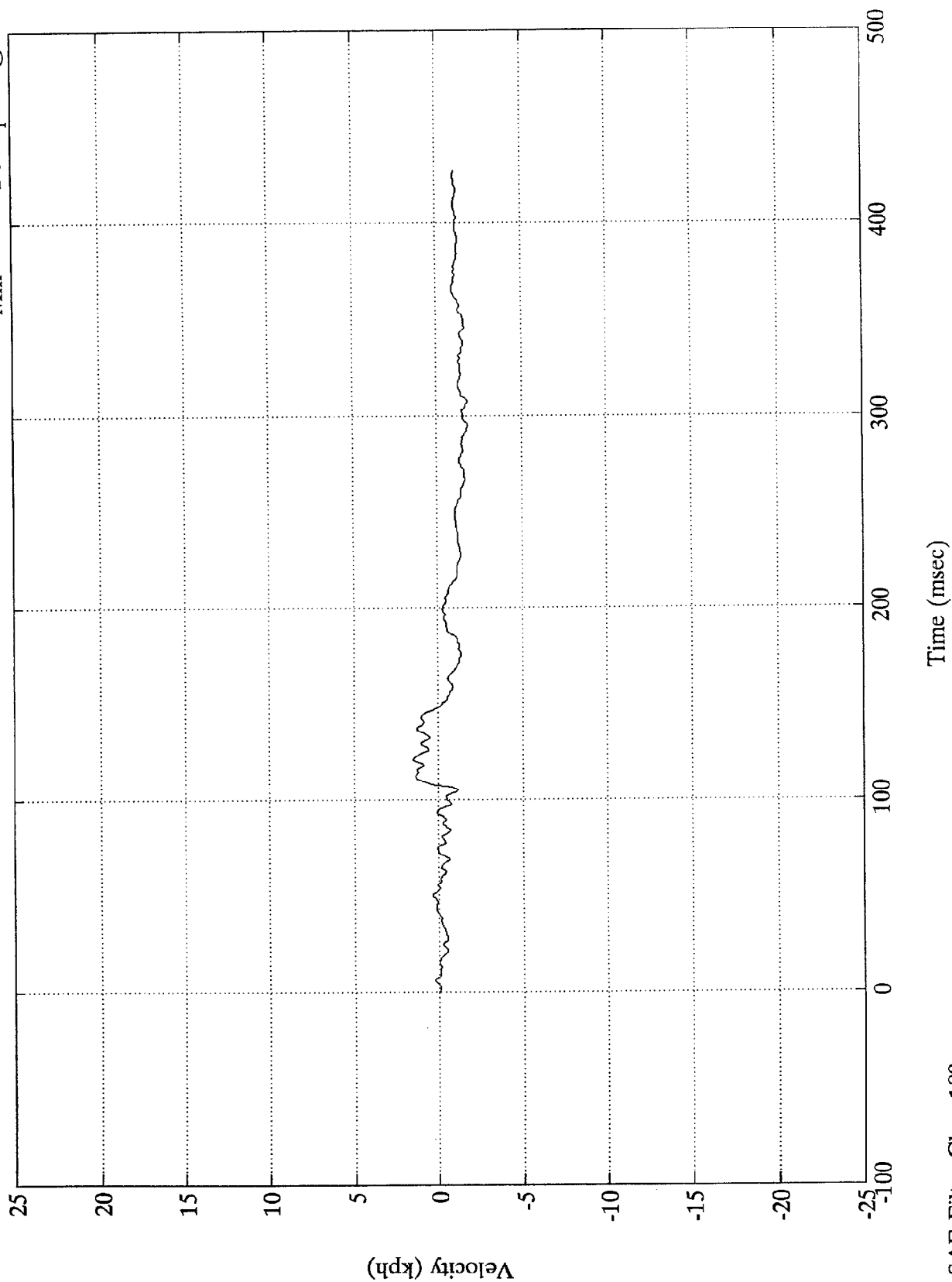


SAE Filter Class 60

VTV TEST #1

Max = 1.52 kph @ 121.32 msec
Min = -1.84 kph @ 294.96 msec

V1 Center Z

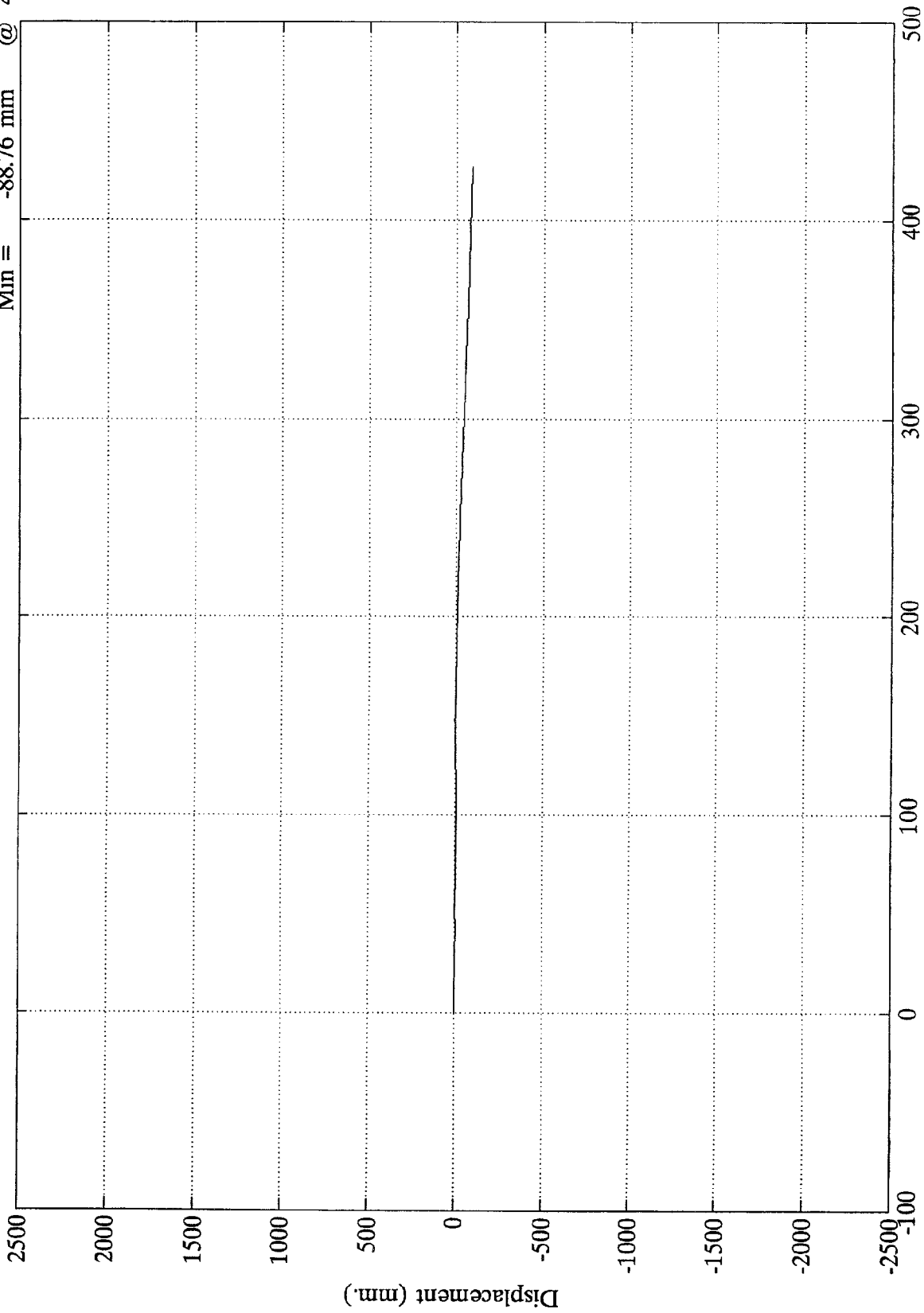


SAE Filter Class 180

VTV TEST #1

Max = 3.48 mm @ 147.96 msec
Min = -88.76 mm @ 427.32 msec

V1 Center Z



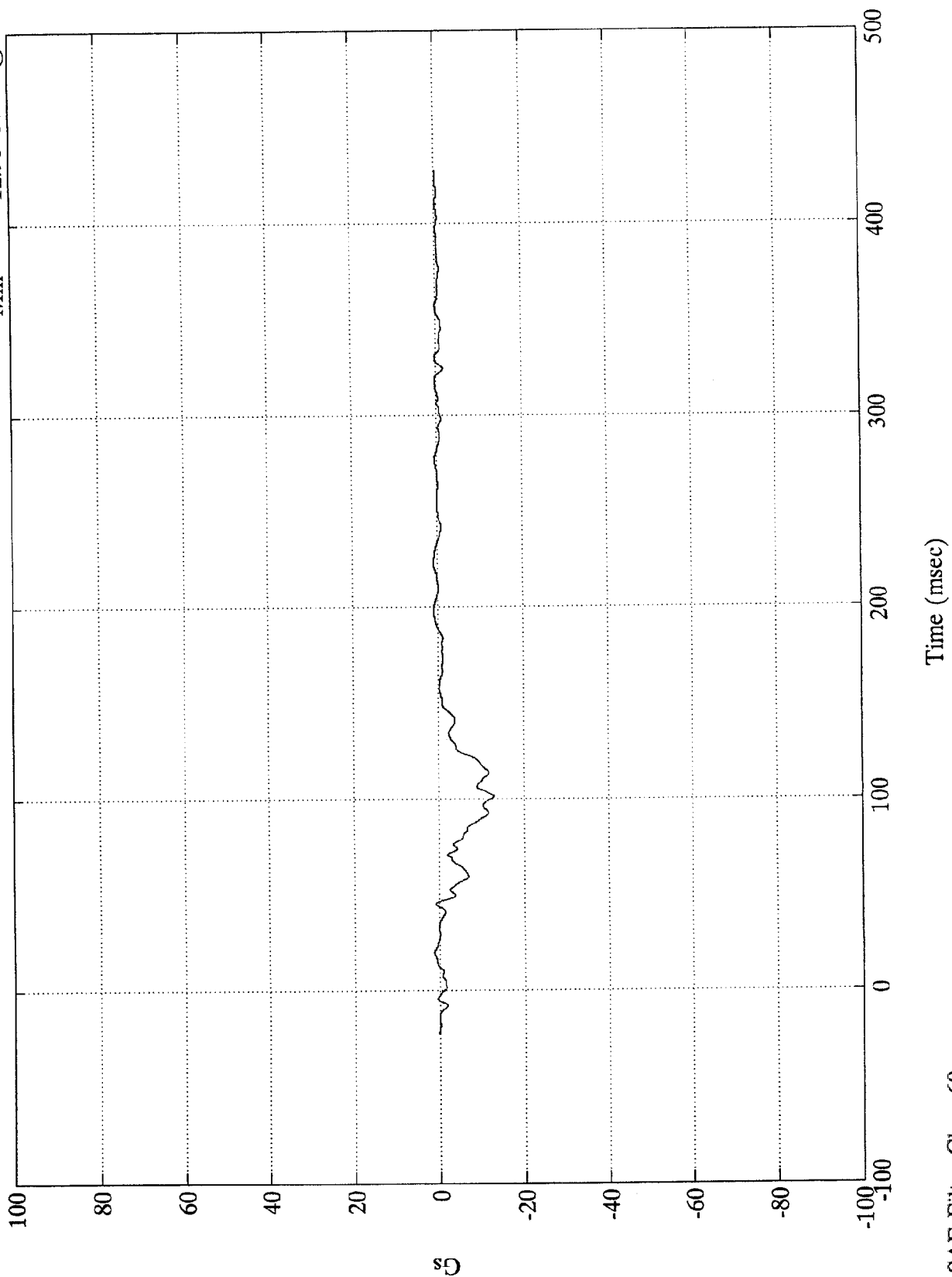
Time (msec)

SAE Filter Class 180

VTV TEST #1

V1 Right X

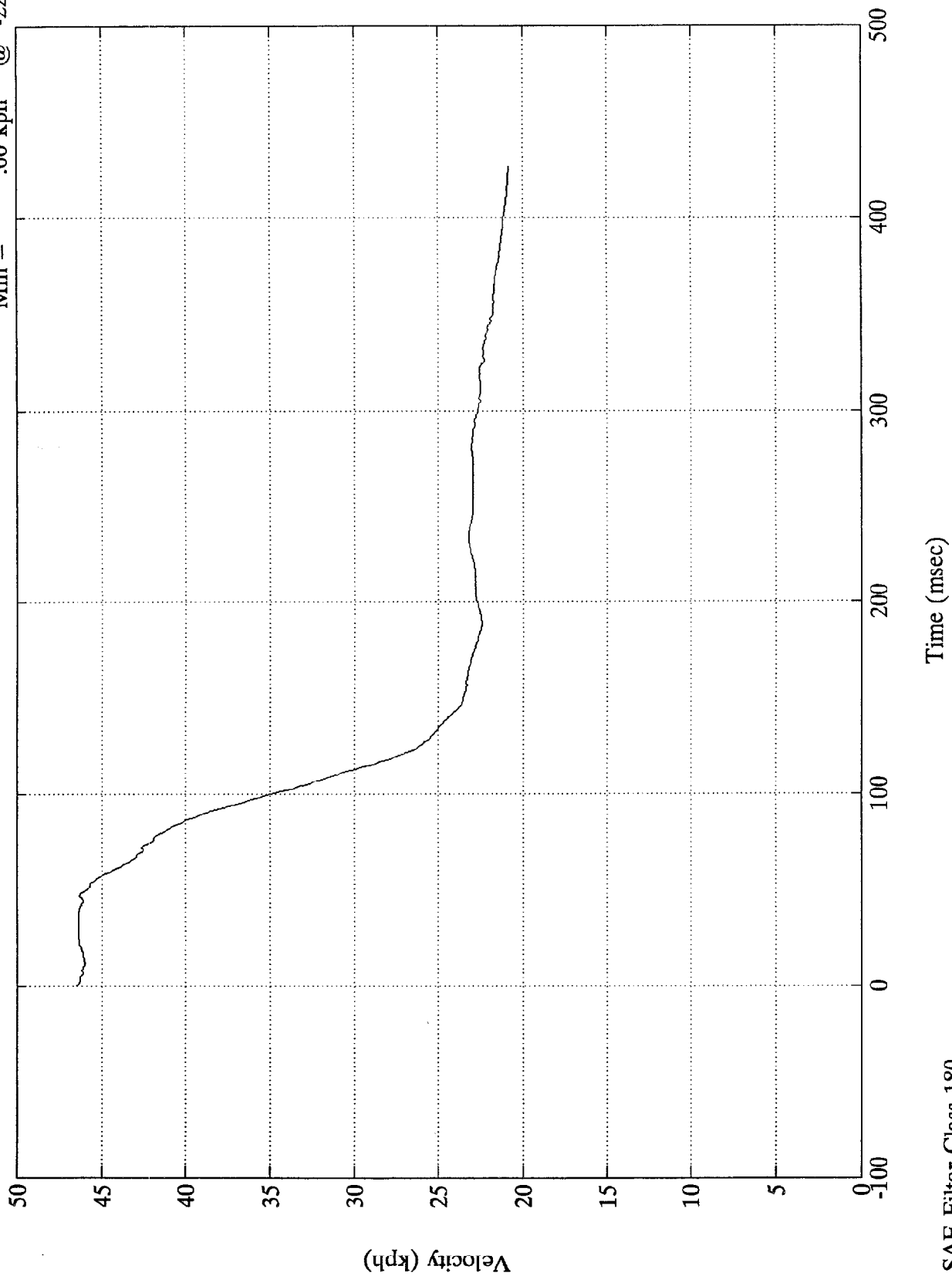
Max = 1.27 Gs @ 20.03 msec
Min = -12.98 Gs @ 101.52 msec



SAE Filter Class 60

VTV TEST #1

V1 Right X Max = 46.51 kph @ -0.00 msec
Min = .00 kph @ -22.44 msec

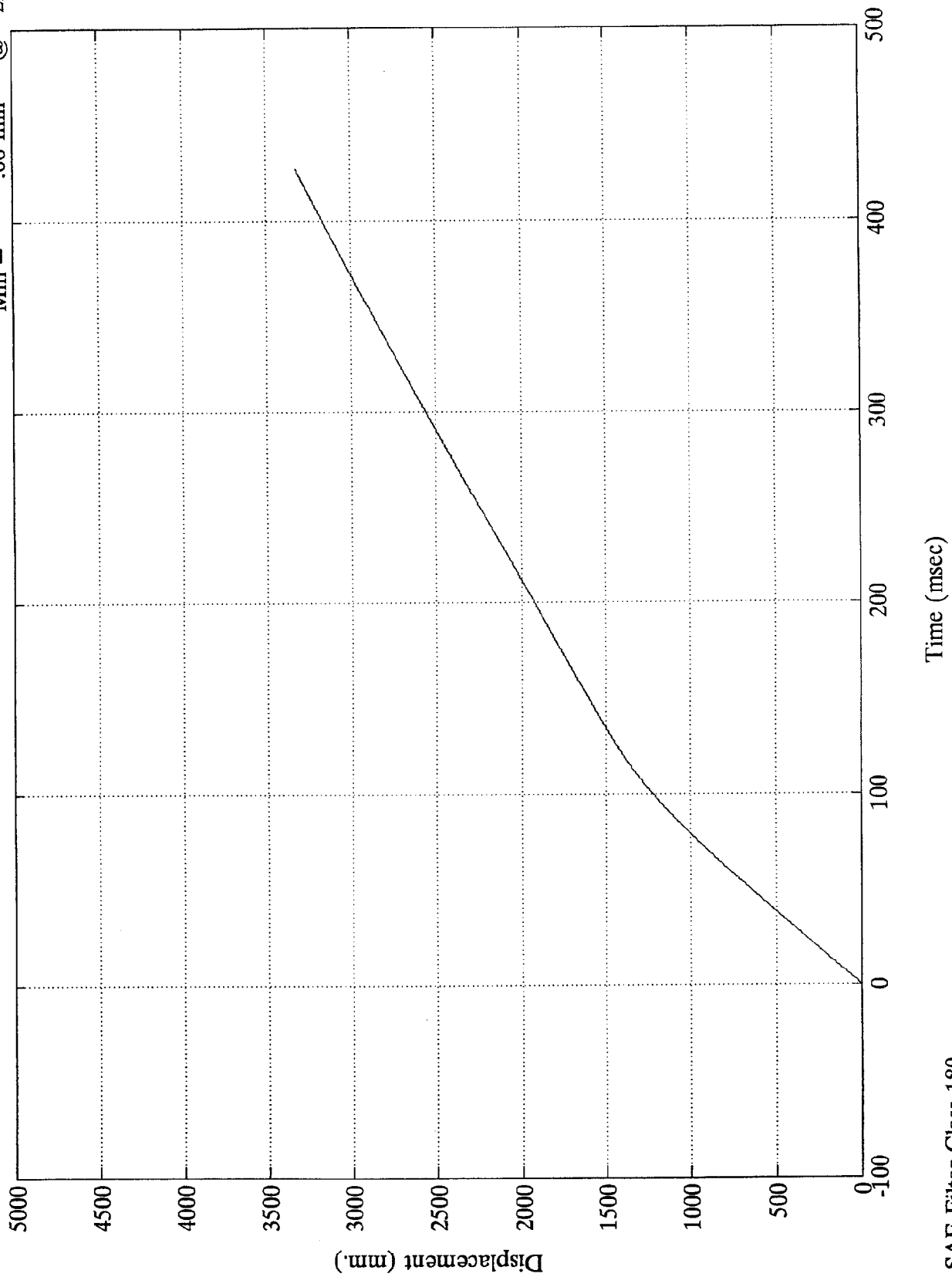


SAE Filter Class 180

VTV TEST #1

V1 Right X

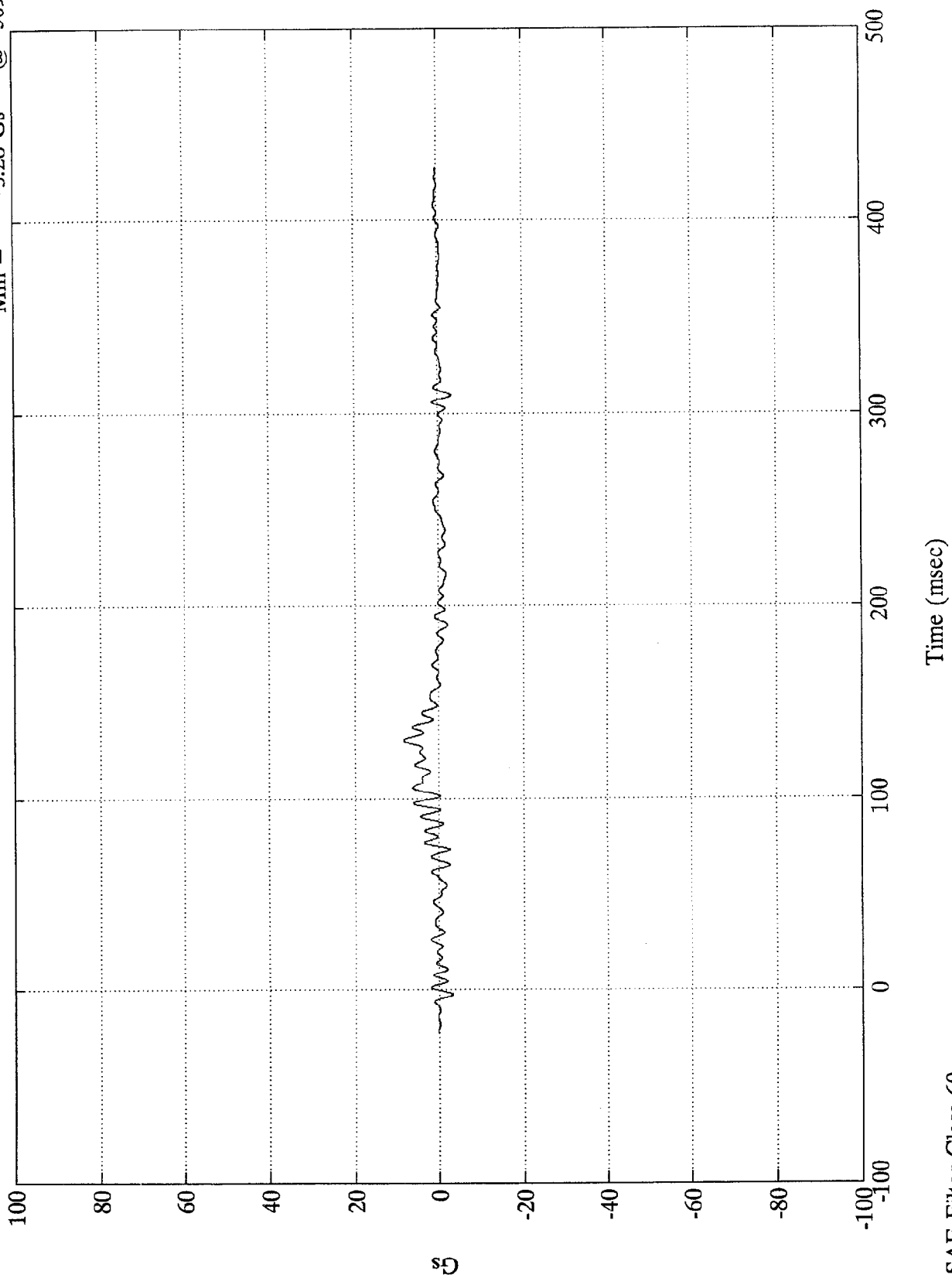
Max = 3325.62 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec



VTV TEST #1

V1 Right Y

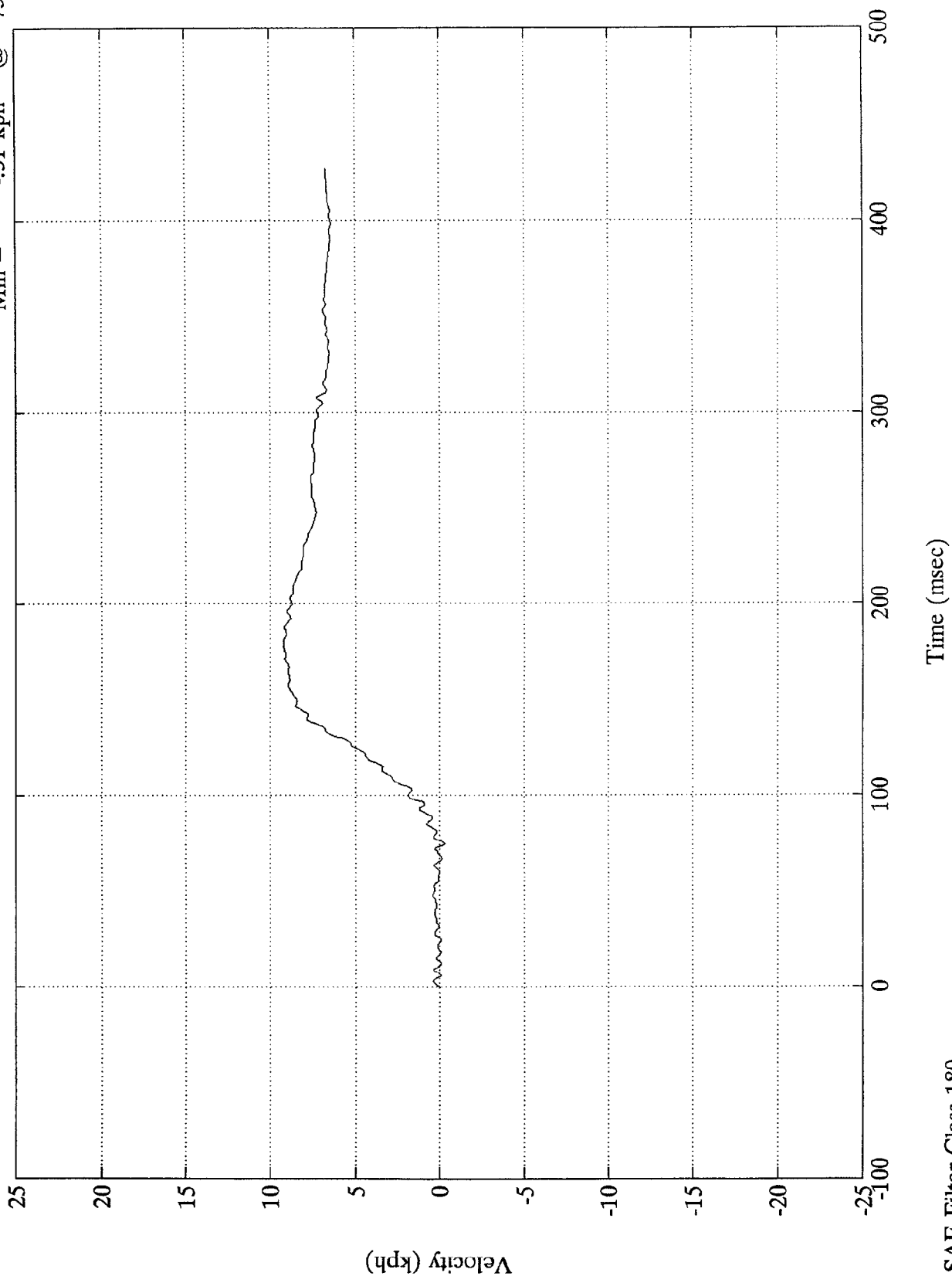
Max = 8.36 Gs @ 130.31 msec
Min = -3.28 Gs @ 309.60 msec



VTV TEST #1

Max = 9.26 kph @ 179.16 msec
Min = -.31 kph @ 75.60 msec

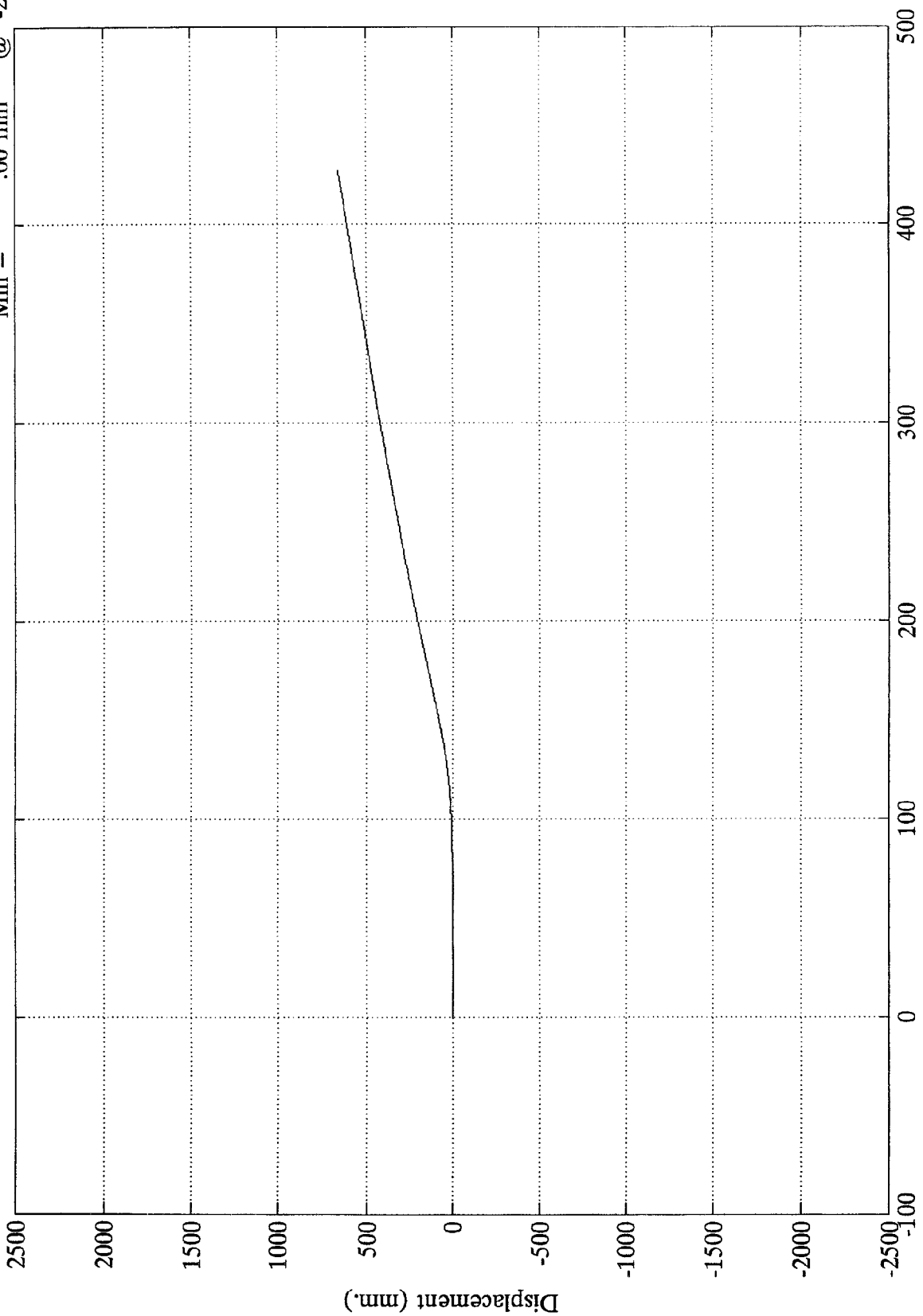
V1 Right Y



SAE Filter Class 180

VTV TEST #1

V1 Right Y
Max = 656.28 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec

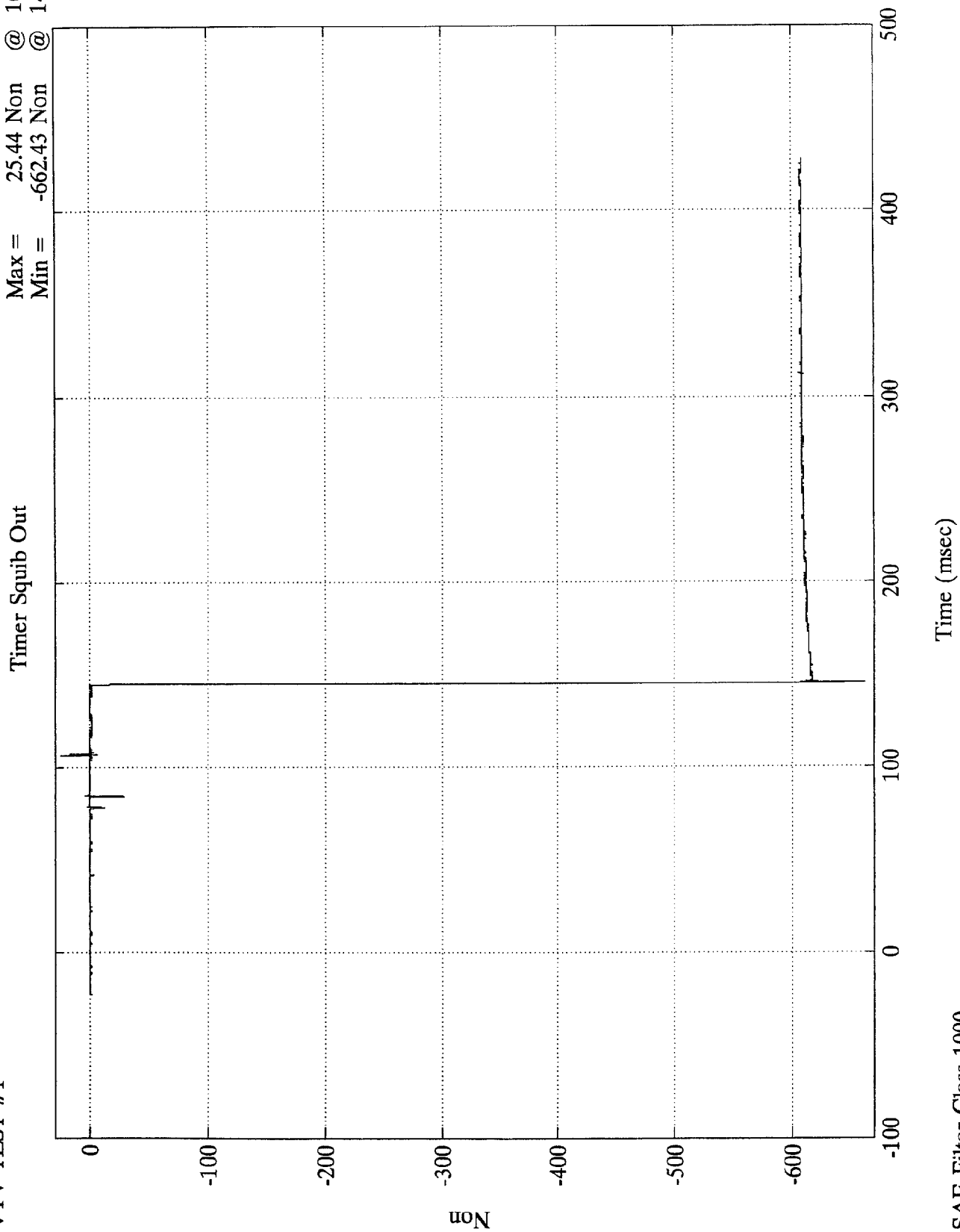


Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = 106.68 msec
 Min = 25.44 Non @ 145.56 msec
 Max = -662.43 Non @

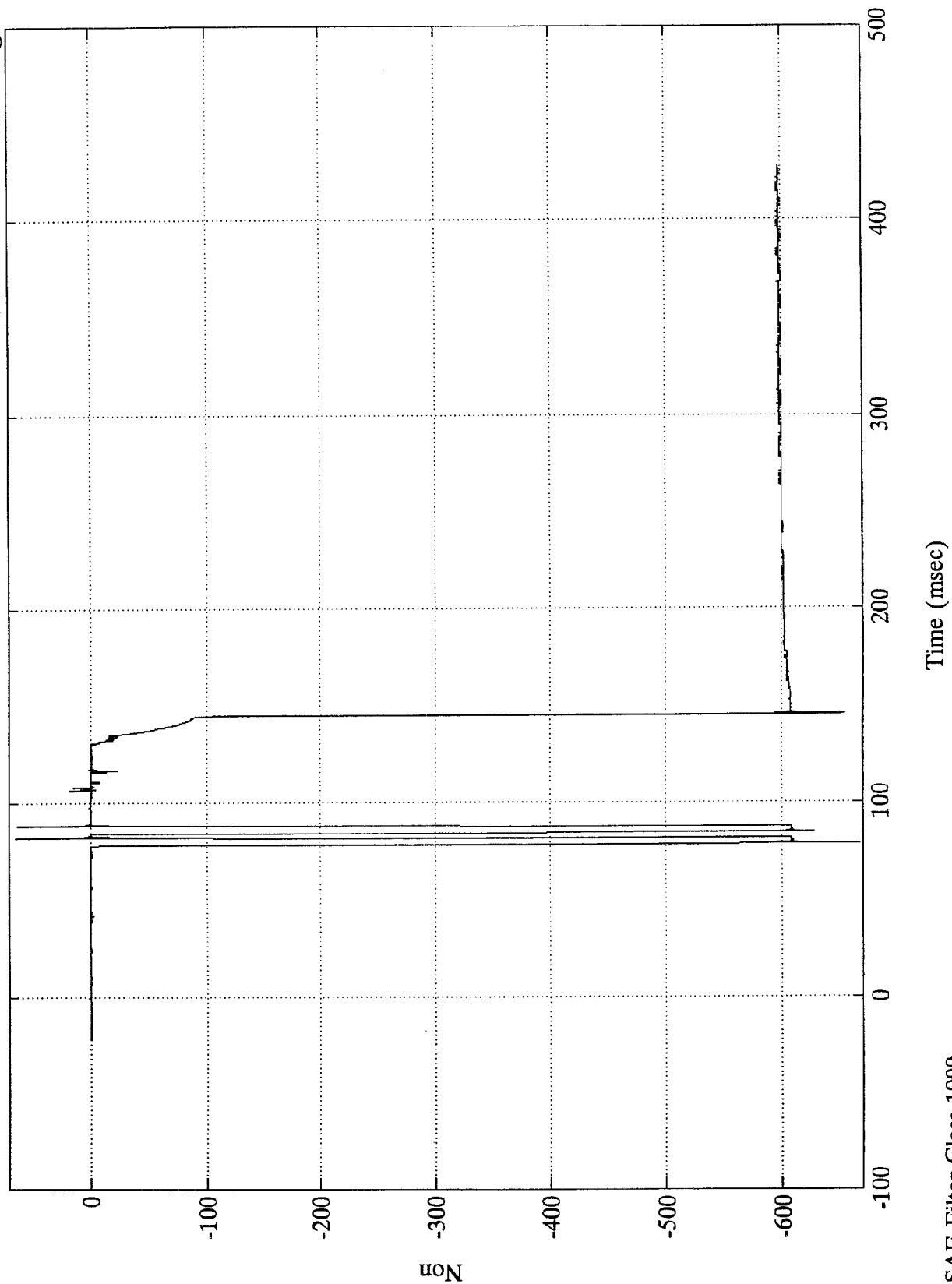


SAE Filter Class 1000

VTV TEST #1

Max = 64.41 Non @ 82.08 msec
 Min = -667.61 Non @ 78.72 msec

Vehicle Squib Out

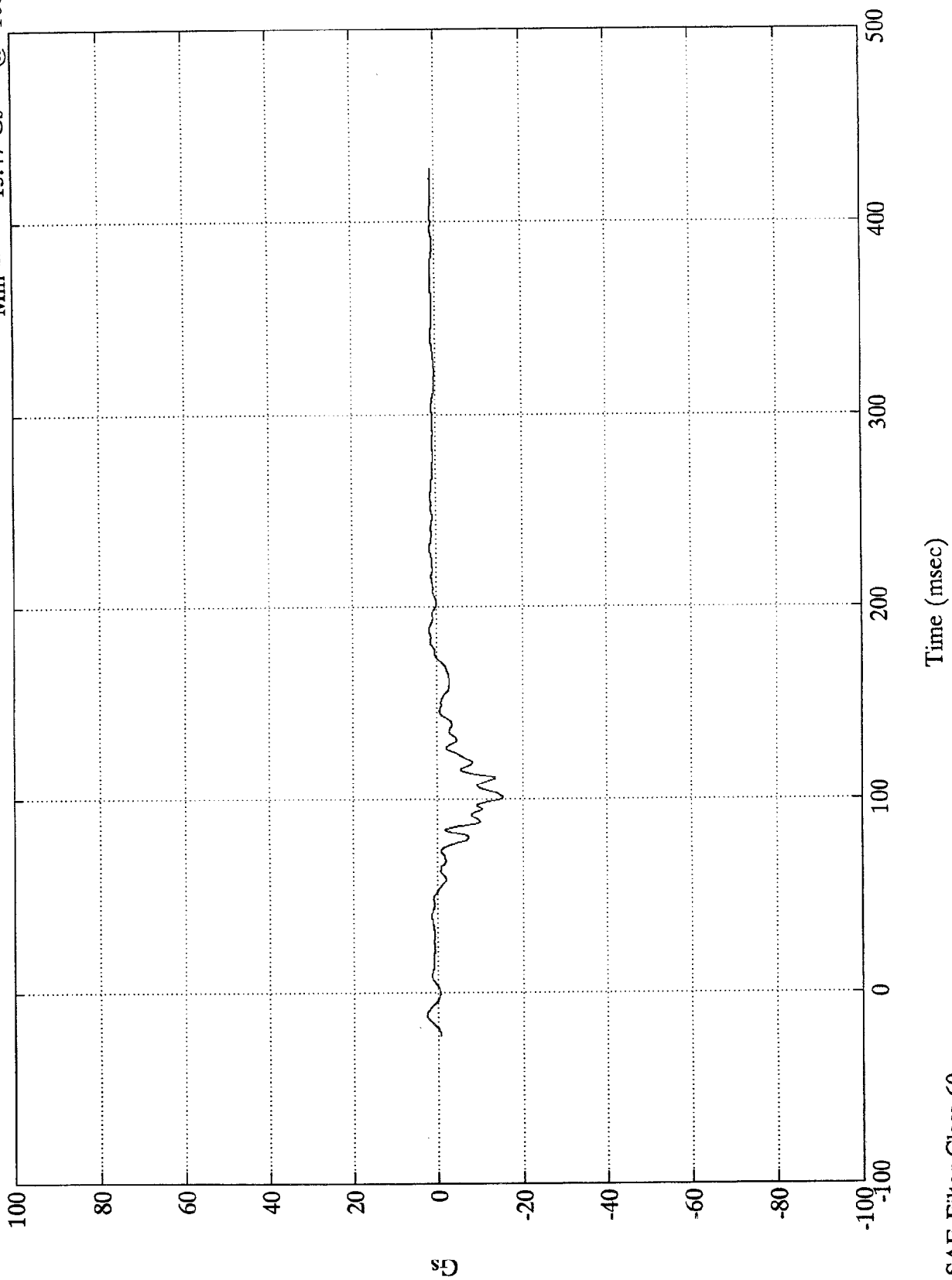


Non

VTV TEST #1

Max = 2.58 Gs @ -11.28 msec
 Min = -15.47 Gs @ 100.92 msec

V2 Left X

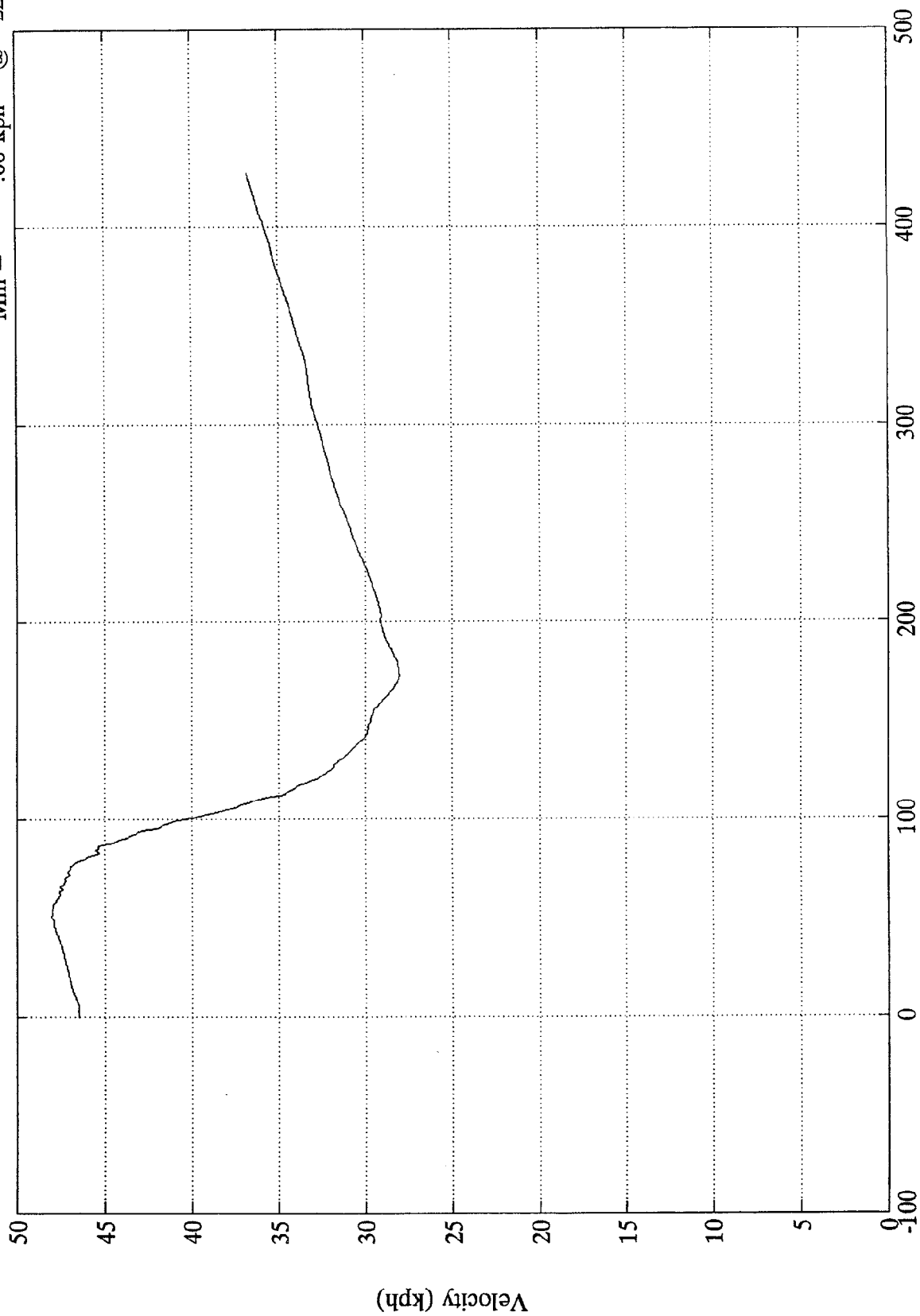


SAE Filter Class 60

VTV TEST #1

Max = 48.03 kph @ 50.52 msec
Min = .00 kph @ -22.44 msec

V2 Left X



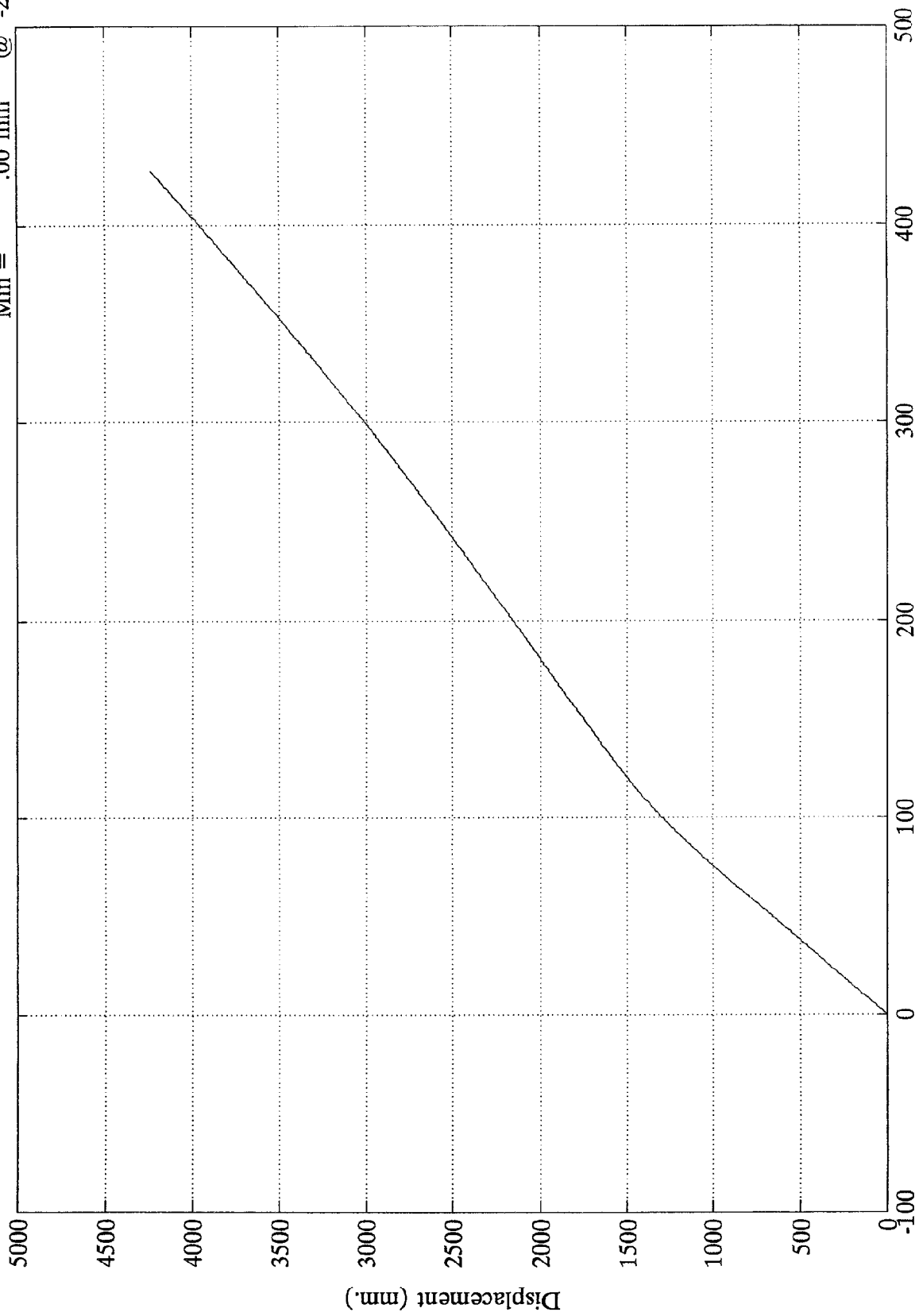
Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = 4234.69 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec

V2 Left X



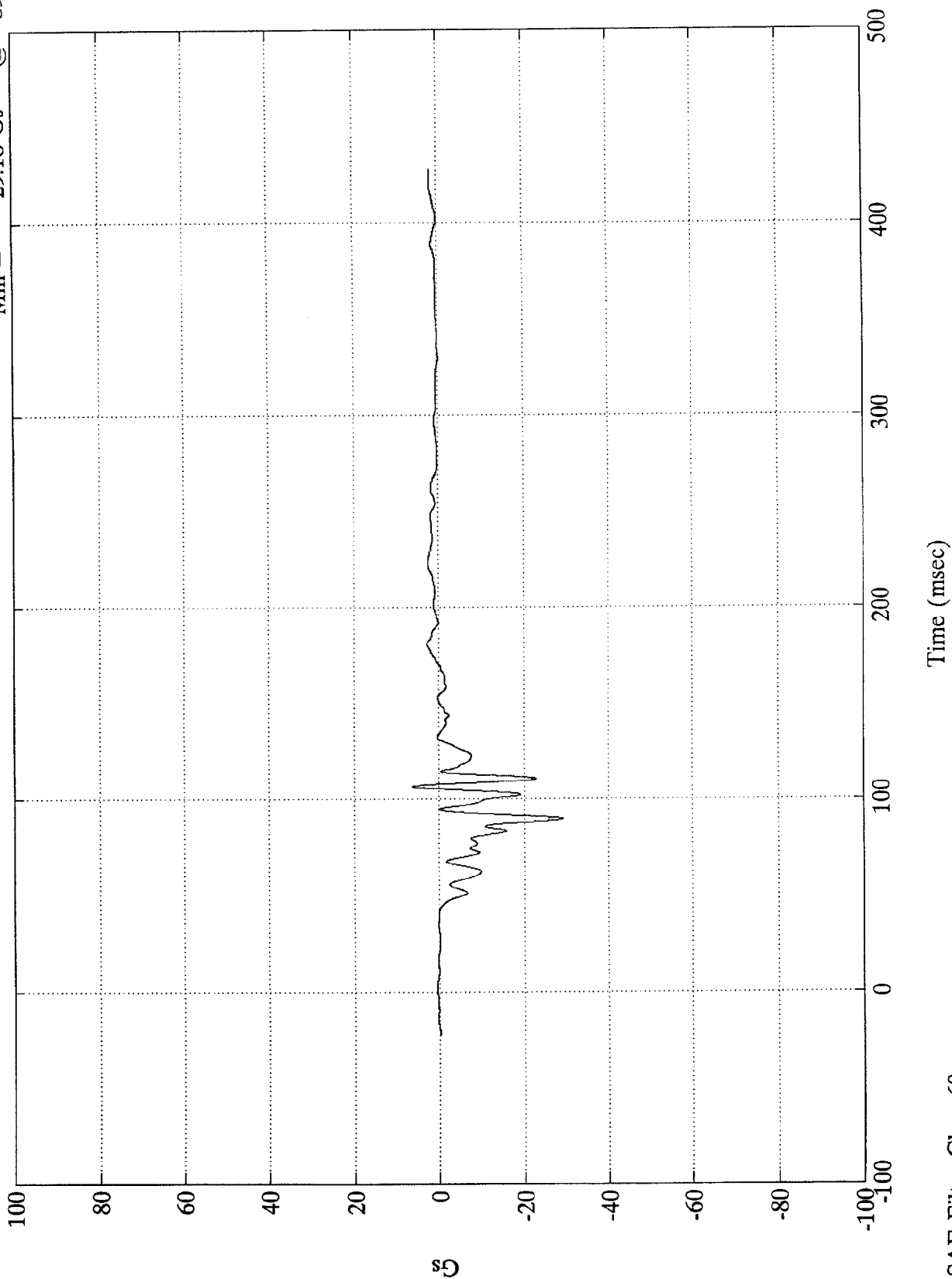
Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = 6.20 Gs @ 106.56 msec
Min = -29.18 Gs @ 89.76 msec

V2 Left Y

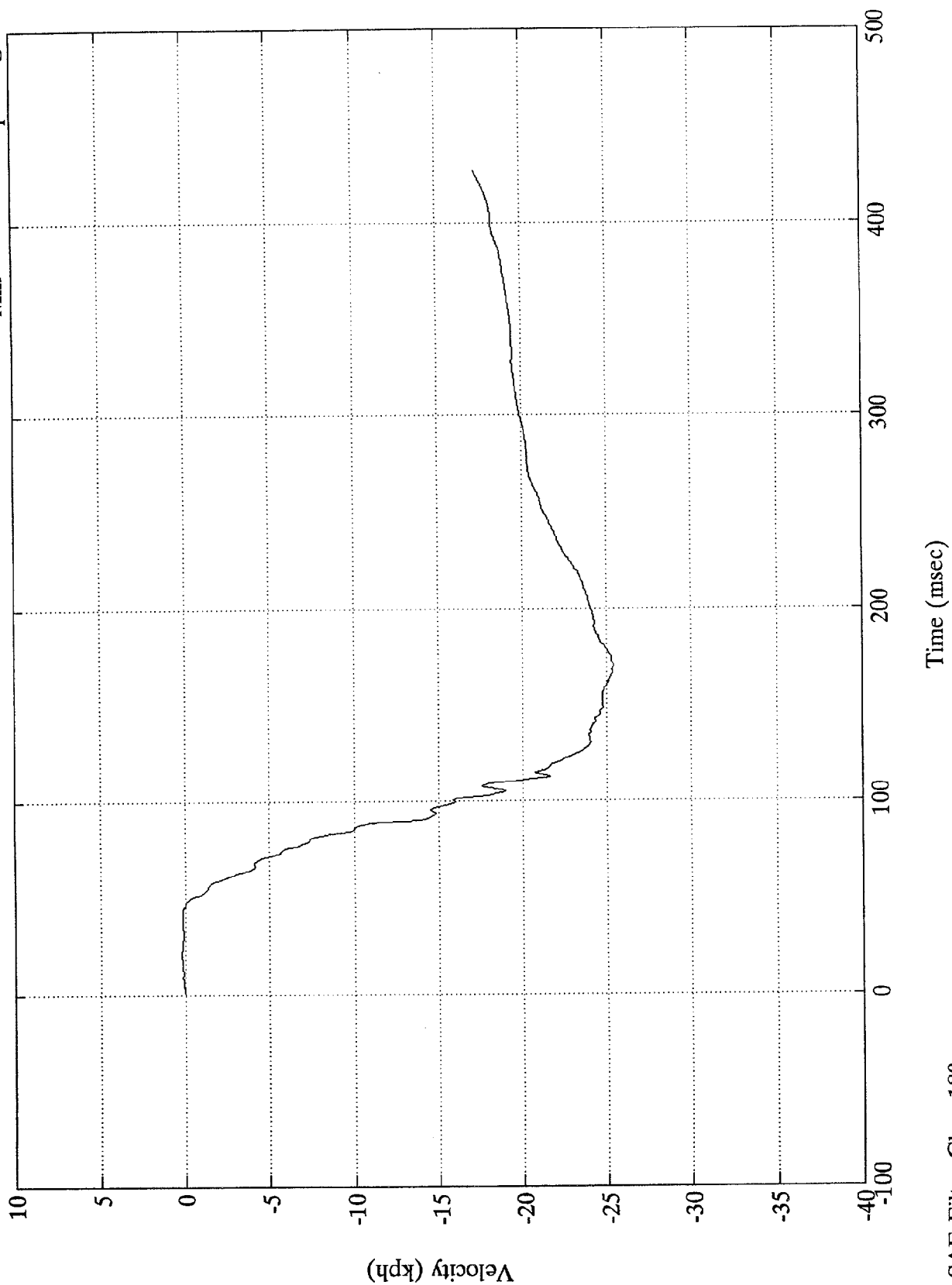


SAE Filter Class 60

VTV TEST #1

V2 Left Y

Max = .20 kph @ 20.51 msec
Min = -25.41 kph @ 171.00 msec

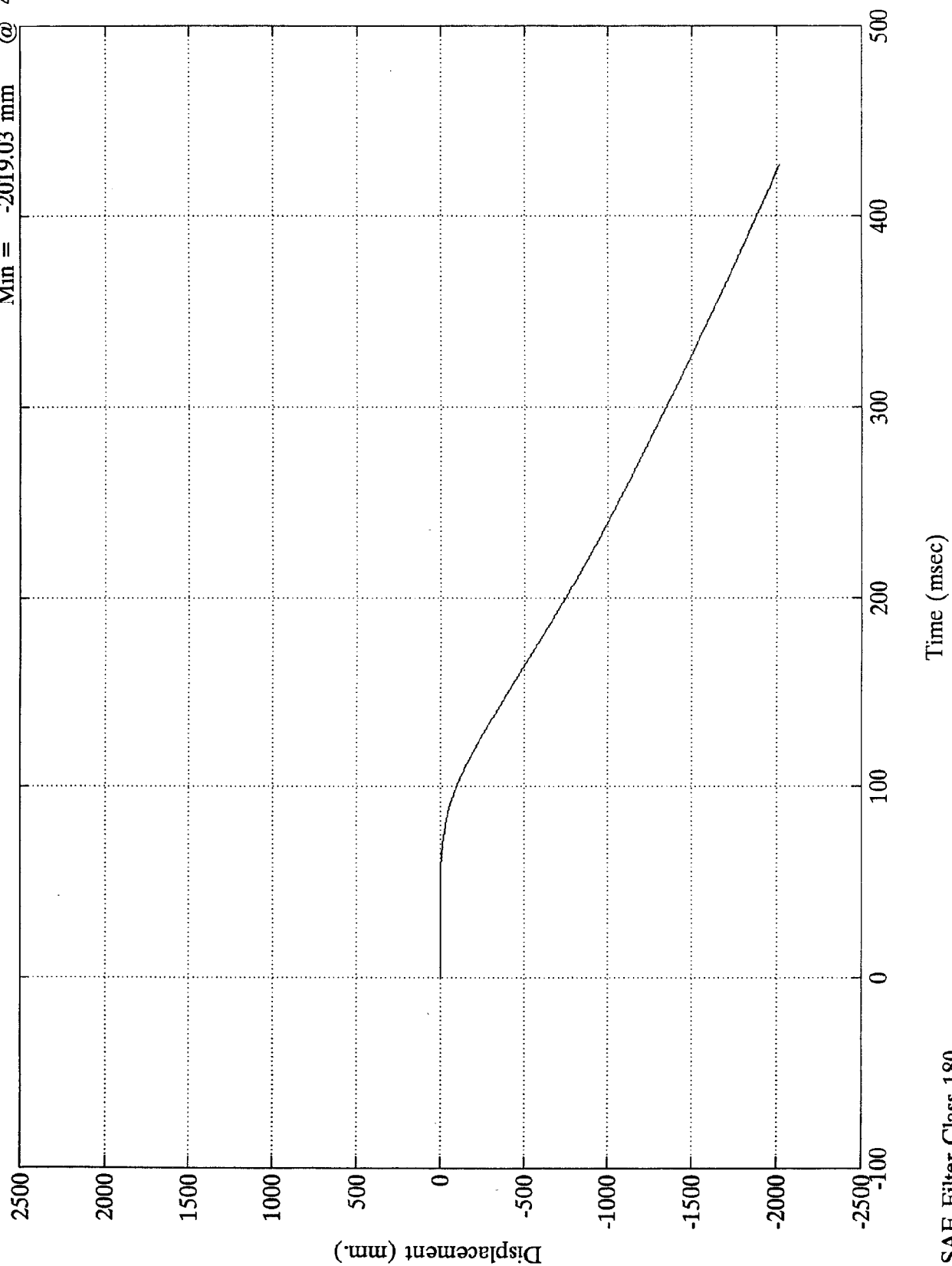


SAE Filter Class 180

VTV TEST #1

Max = 1.78 mm @ 46.92 msec
 Min = -2019.03 mm @ 427.32 msec

V2 Left Y

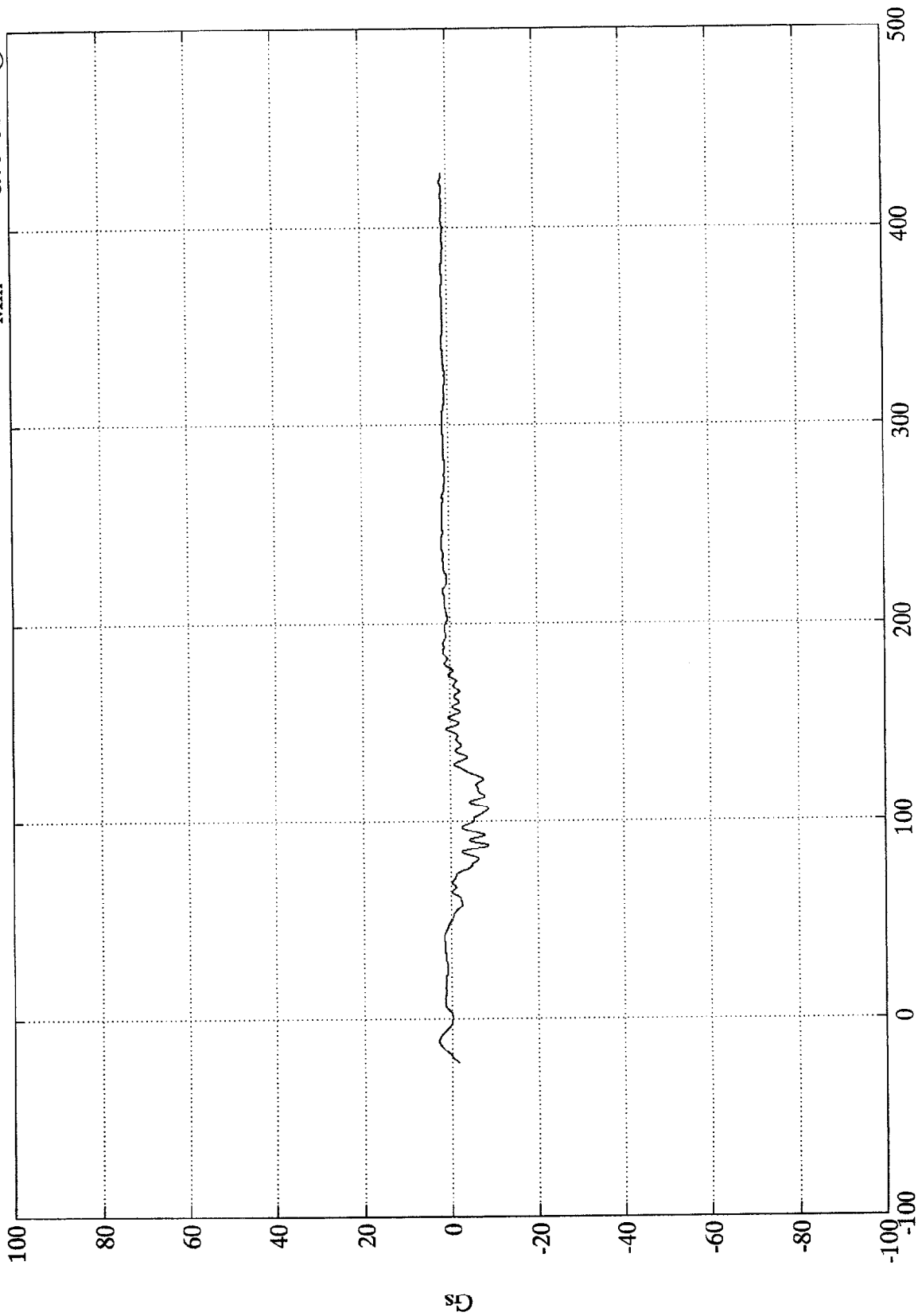


SAE Filter Class 180

VTV TEST #1

Max = 2.91 Gs @ -11.04 msec
Min = -8.70 Gs @ 88.08 msec

V2 Center X



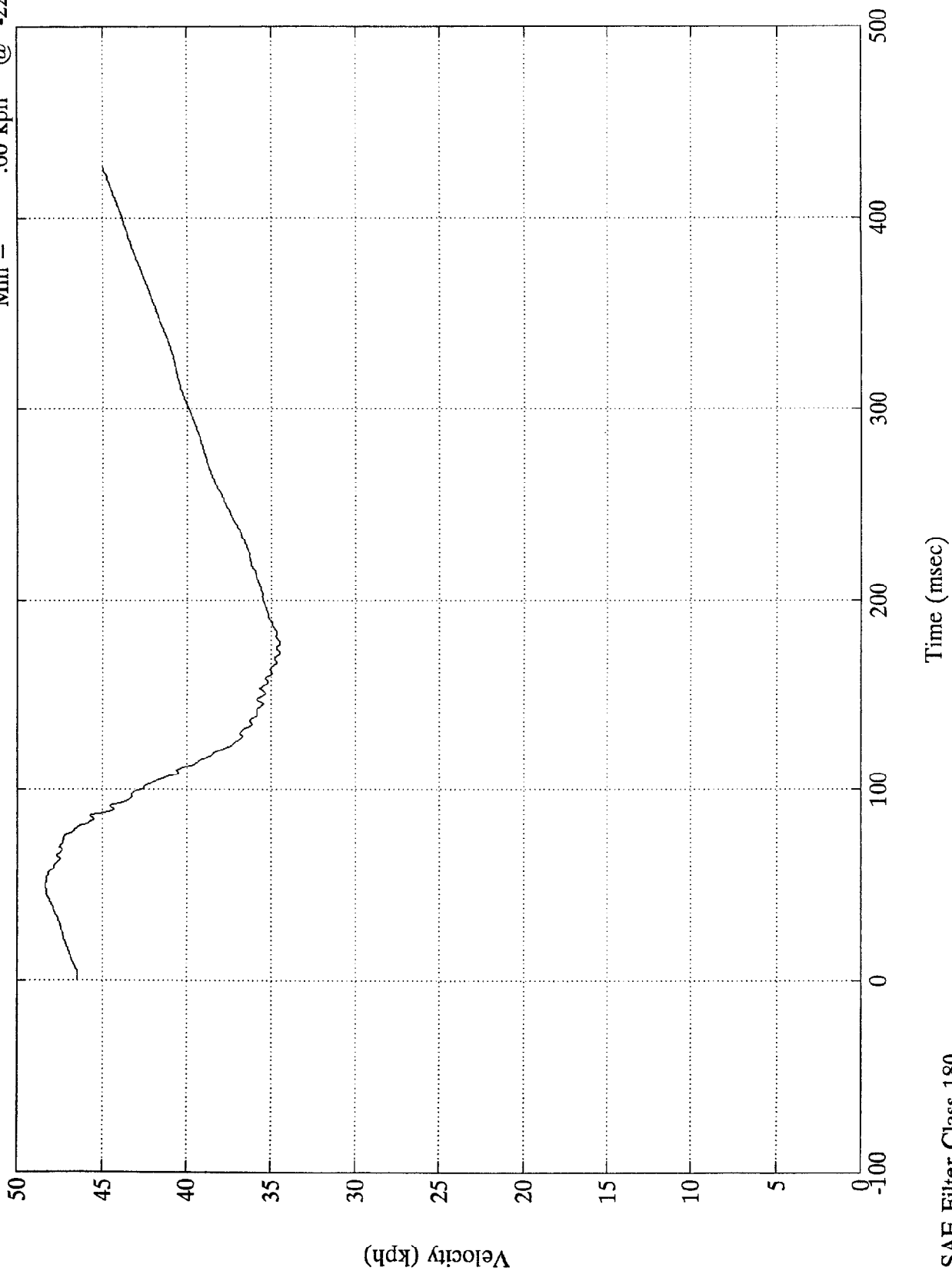
Time (msec)

SAE Filter Class 60

VTV TEST #1

Max = 48.36 kph @ 50.04 msec
Min = .00 kph @ -22.44 msec

V2 Center X

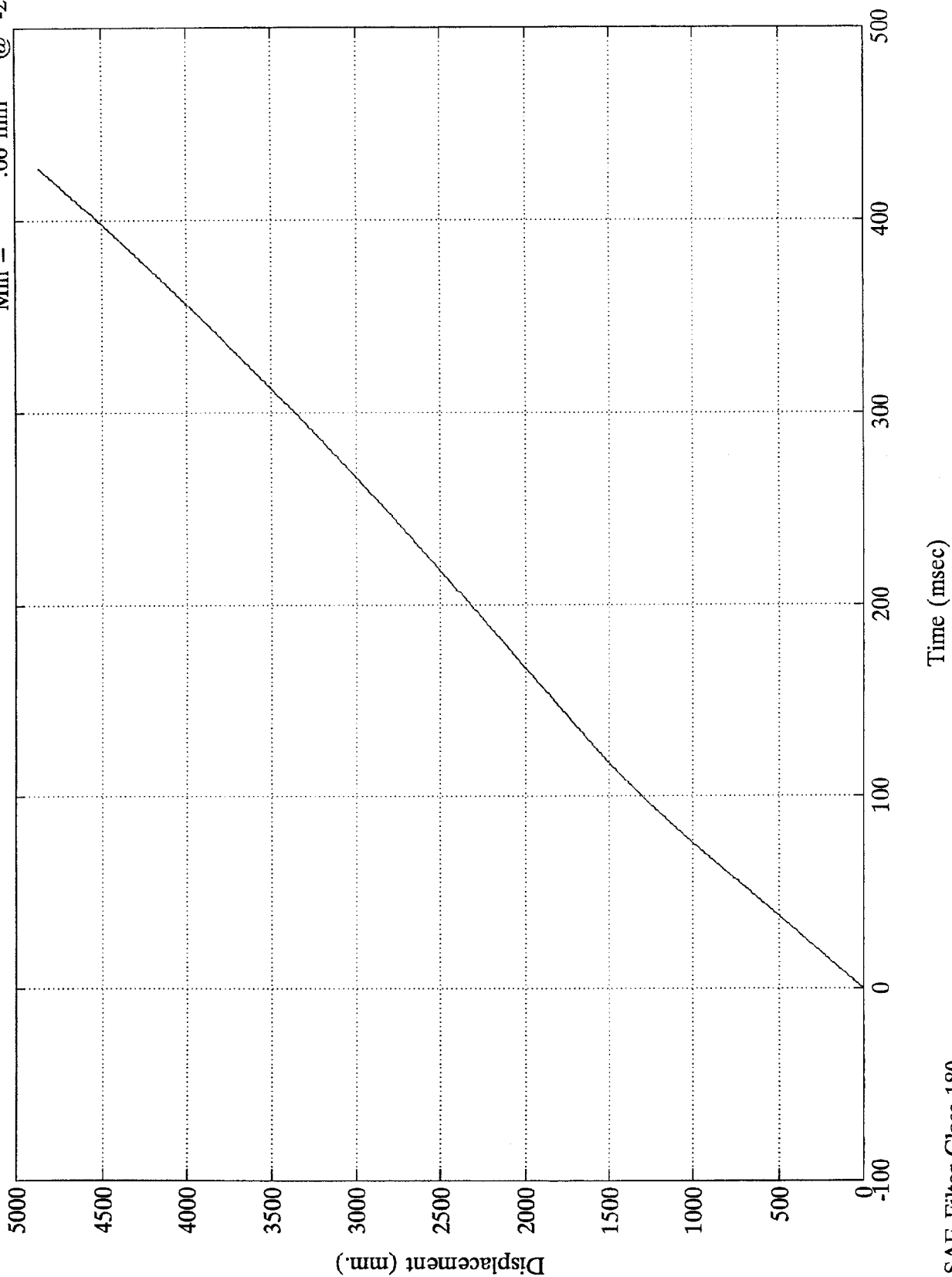


SAE Filter Class 180

VTV TEST #1

Max = 4860.97 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec

V2 Center X

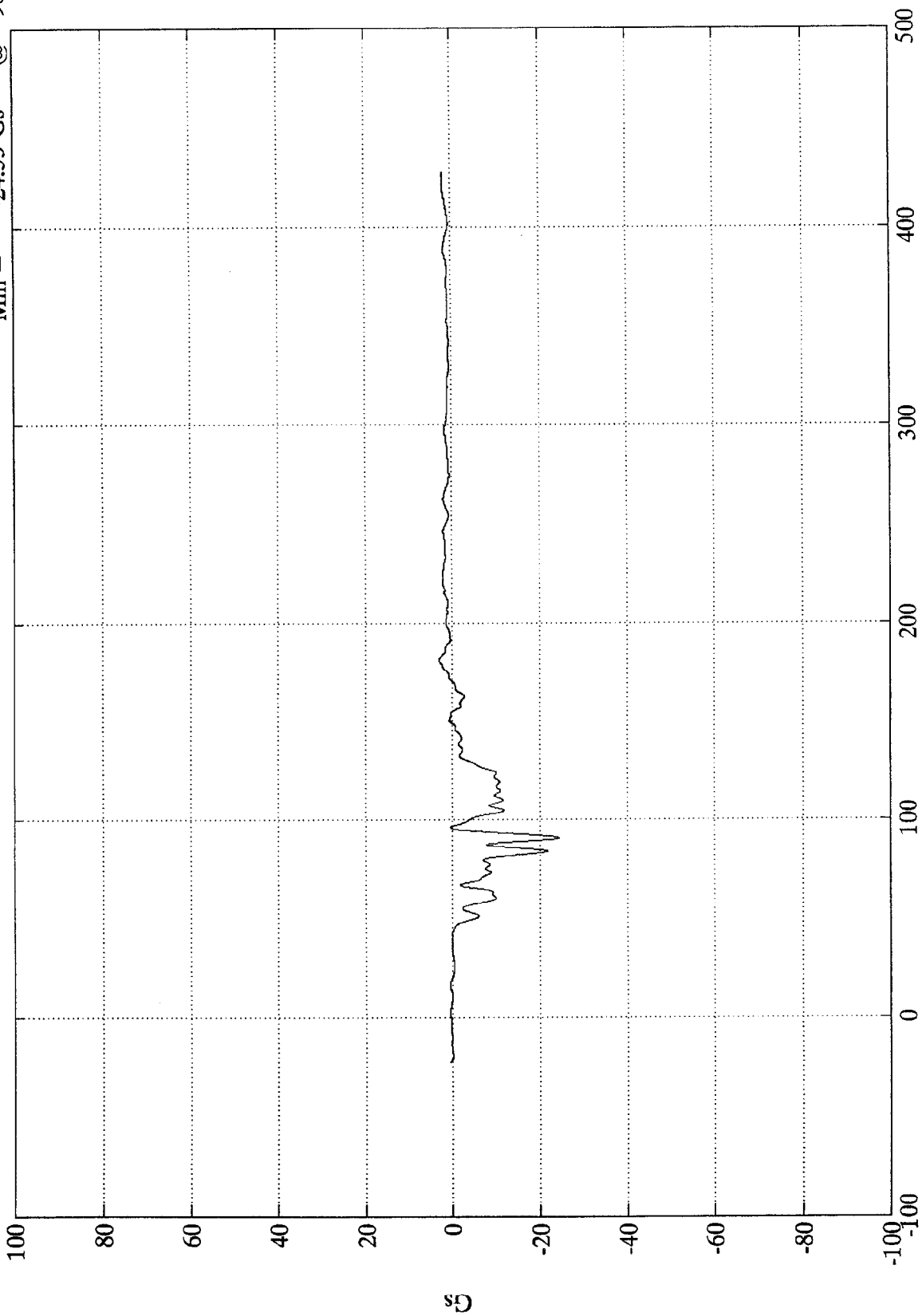


SAE Filter Class 180

VTV TEST #1

Max = 2.93 Gs @ 181.44 msec
Min = -24.53 Gs @ 90.84 msec

V2 Center Y



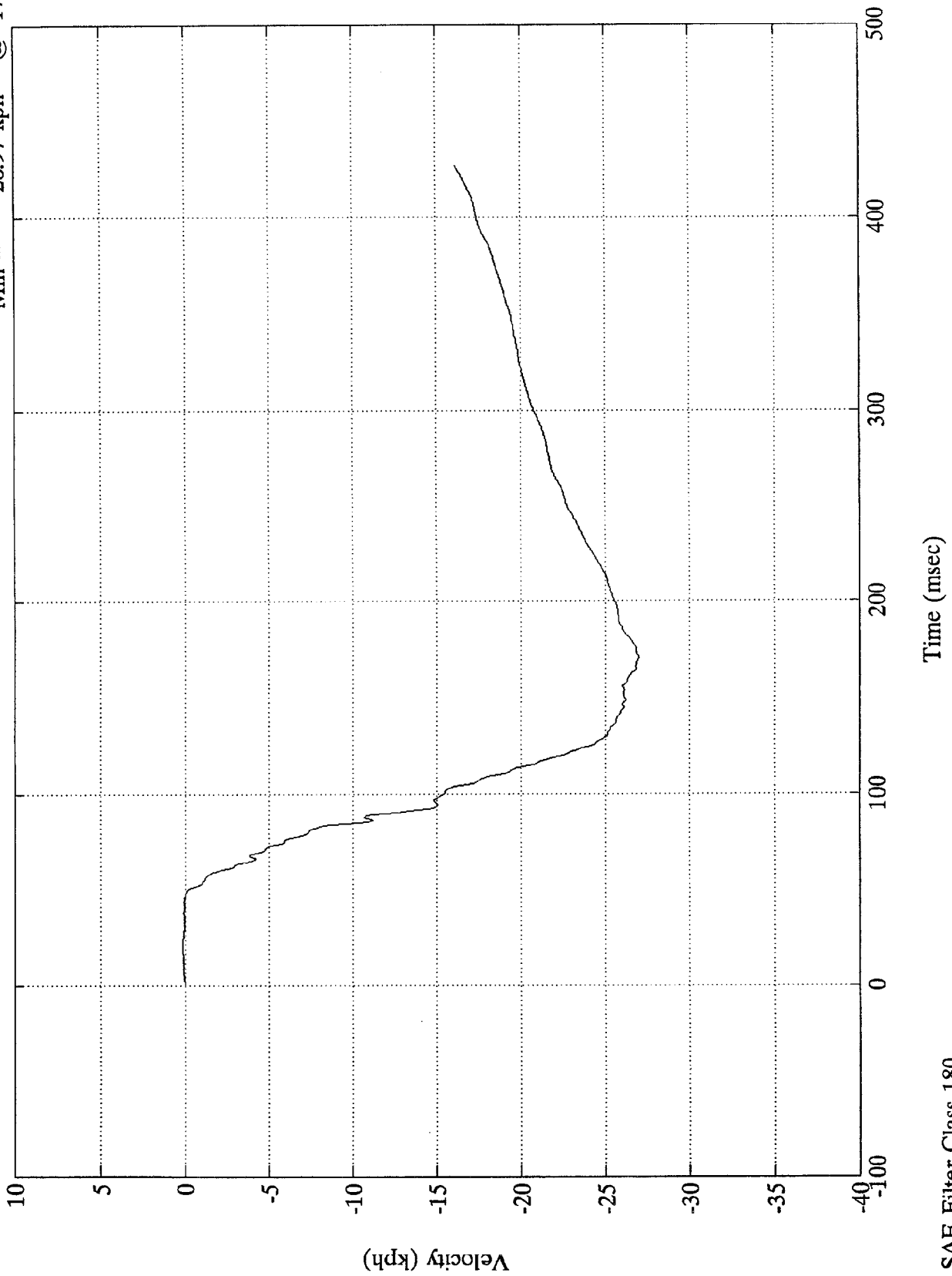
Time (msec)

SAE Filter Class 60

VTV TEST #1

Max = .19 kph @ 20.03 msec
Min = -26.97 kph @ 170.76 msec

V2 Center Y

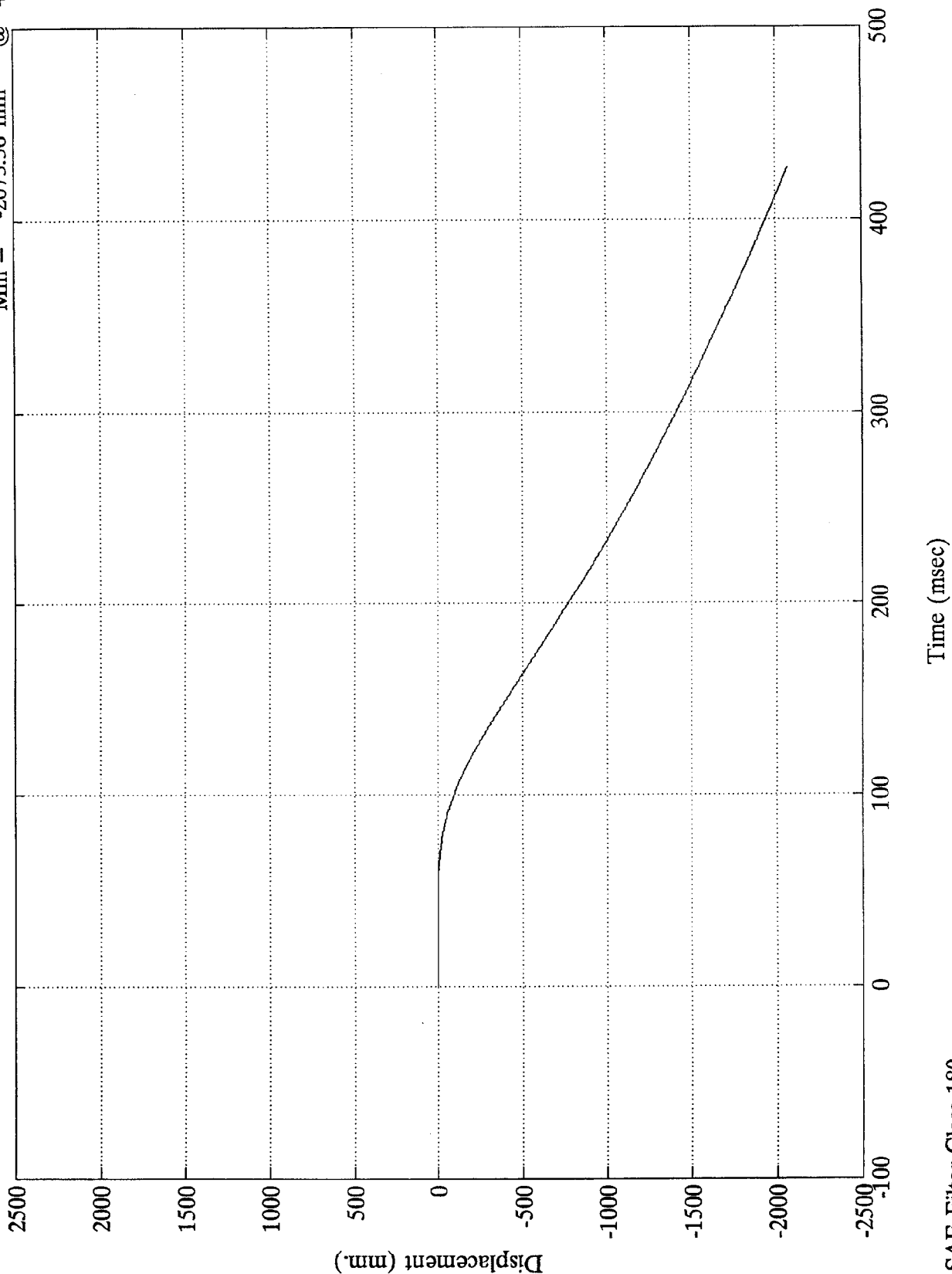


SAE Filter Class 180

VTV TEST #1

Max = 1.19 mm @ 47.15 msec
Min = -2073.36 mm @ 427.32 msec

V2 Center Y

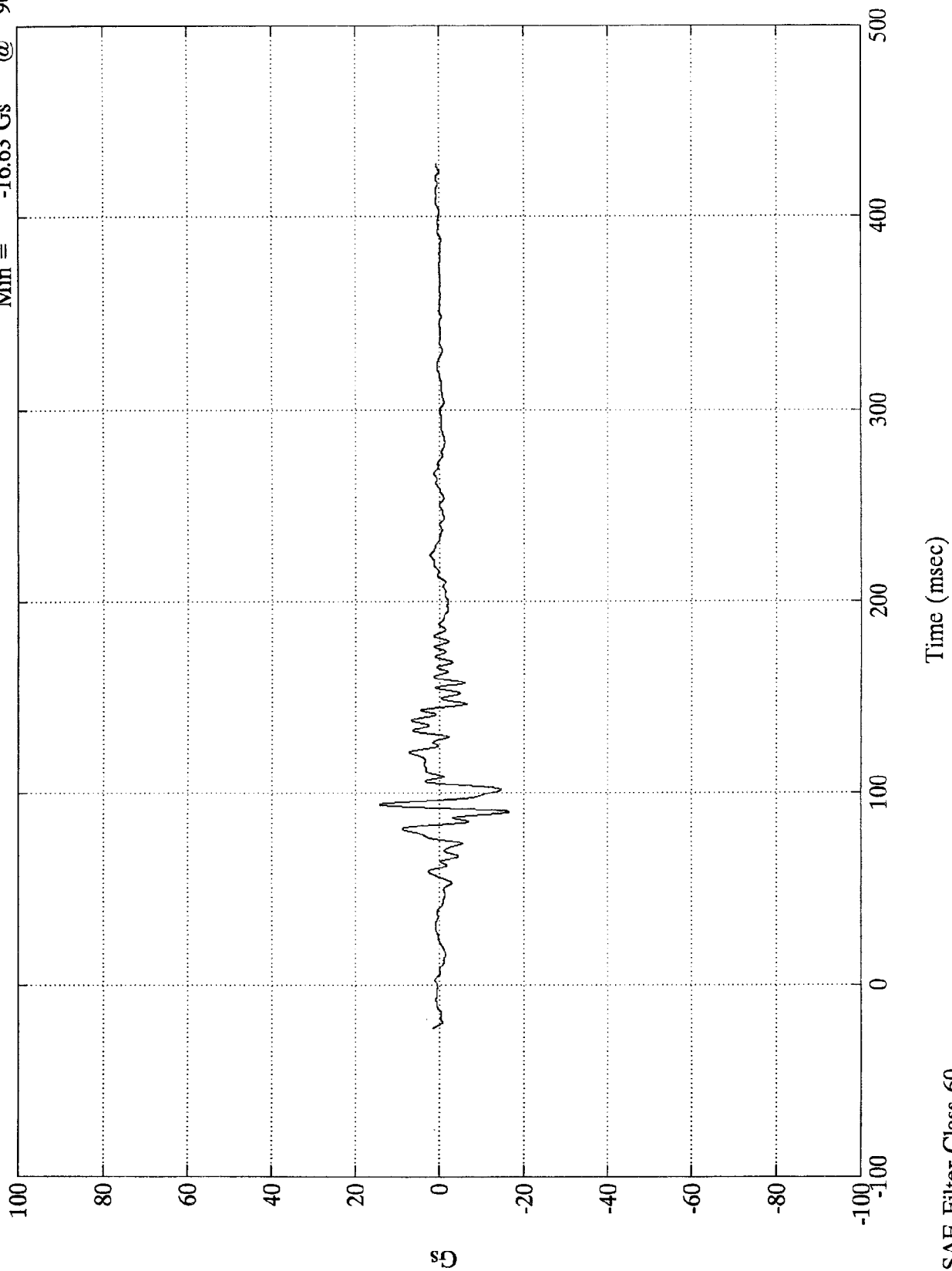


SAE Filter Class 180

VTV TEST #1

Max = 14.19 Gs @ 94.19 msec
Min = -16.63 Gs @ 90.36 msec

V2 Center Z

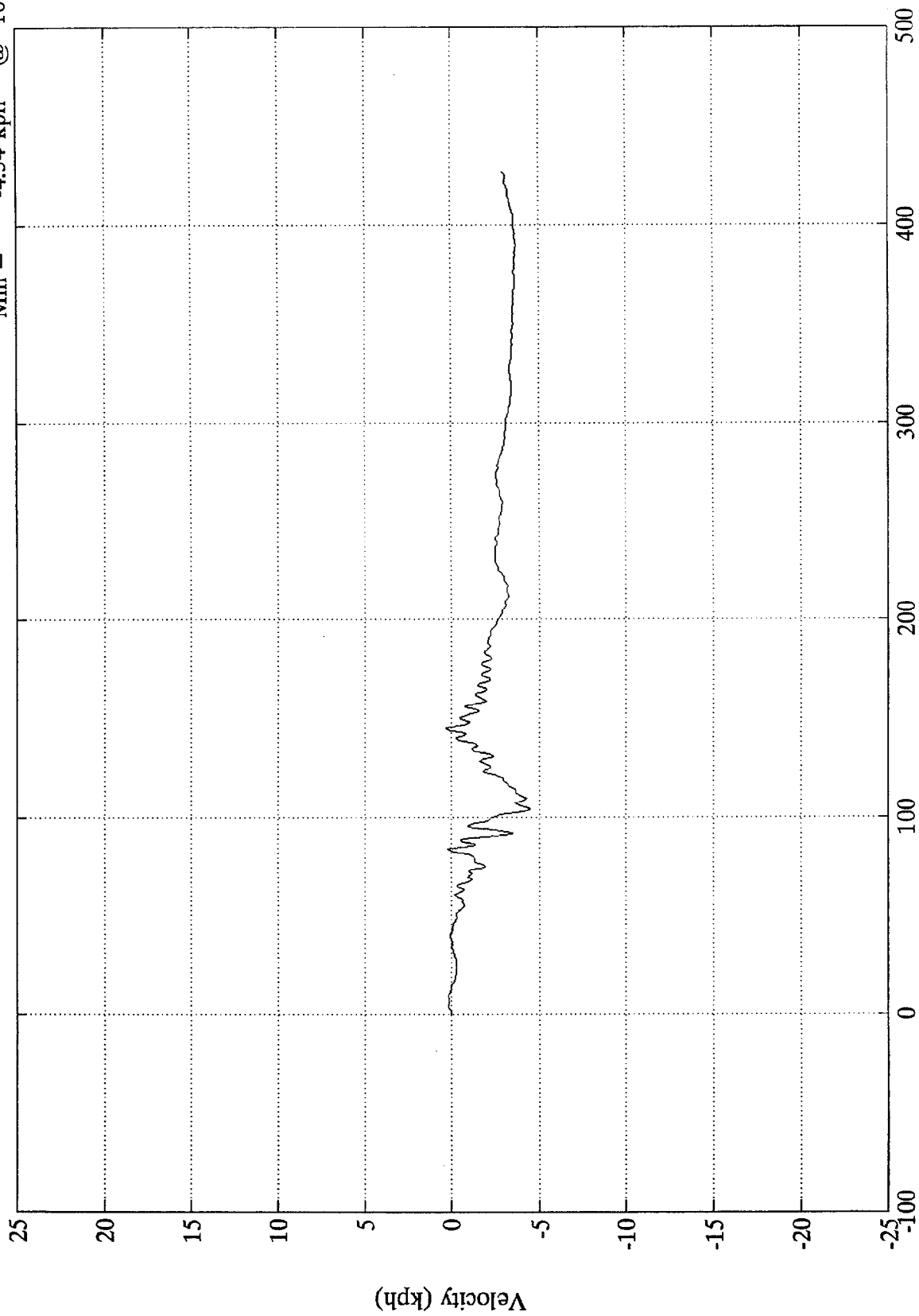


SAE Filter Class 60

VTV TEST #1

Max = .31 kph @ 144.84 msec
Min = -4.54 kph @ 104.28 msec

V2 Center Z



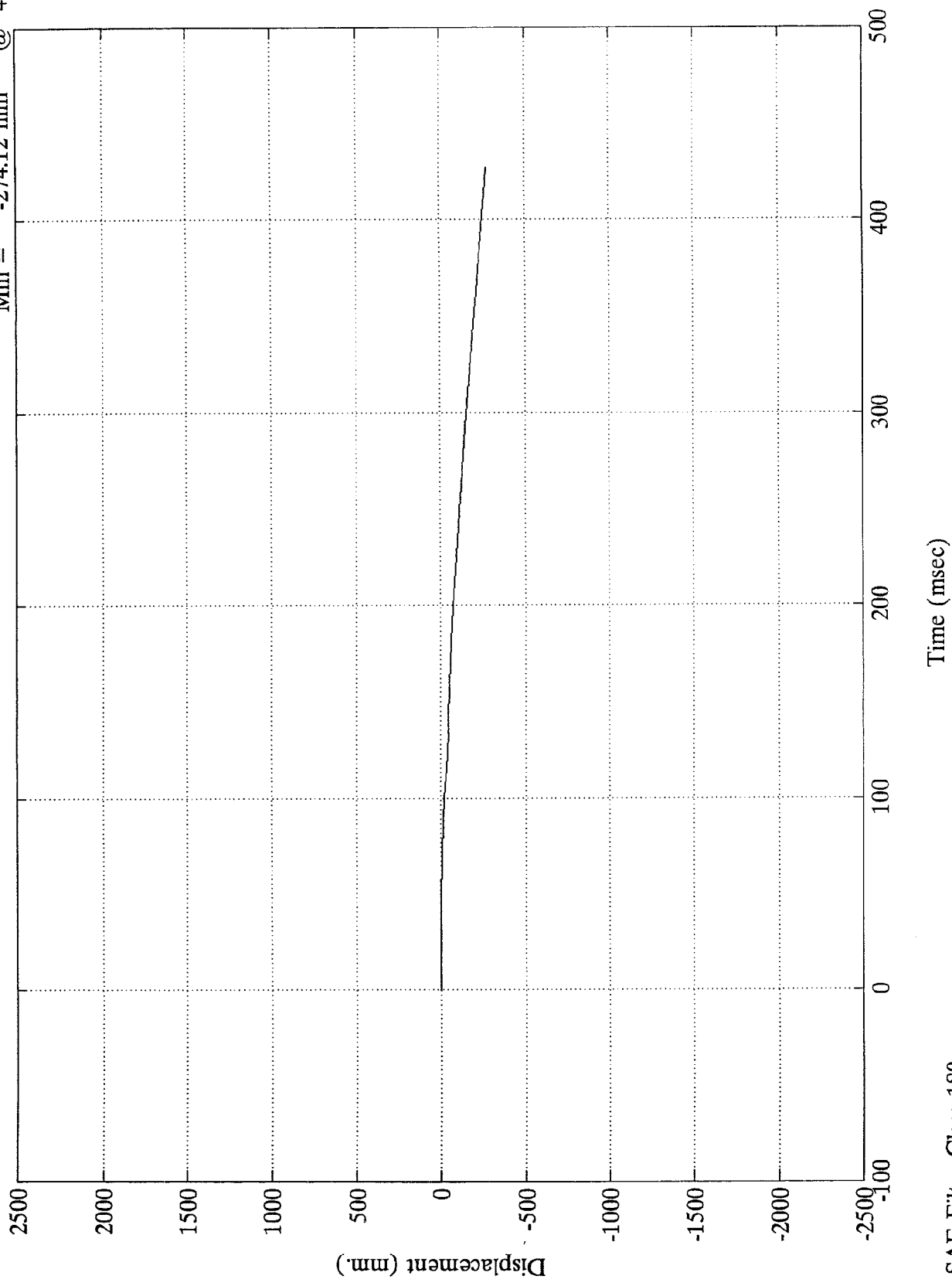
Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = .37 mm @ 14.51 msec
Min = -274.12 mm @ 427.32 msec

V2 Center Z

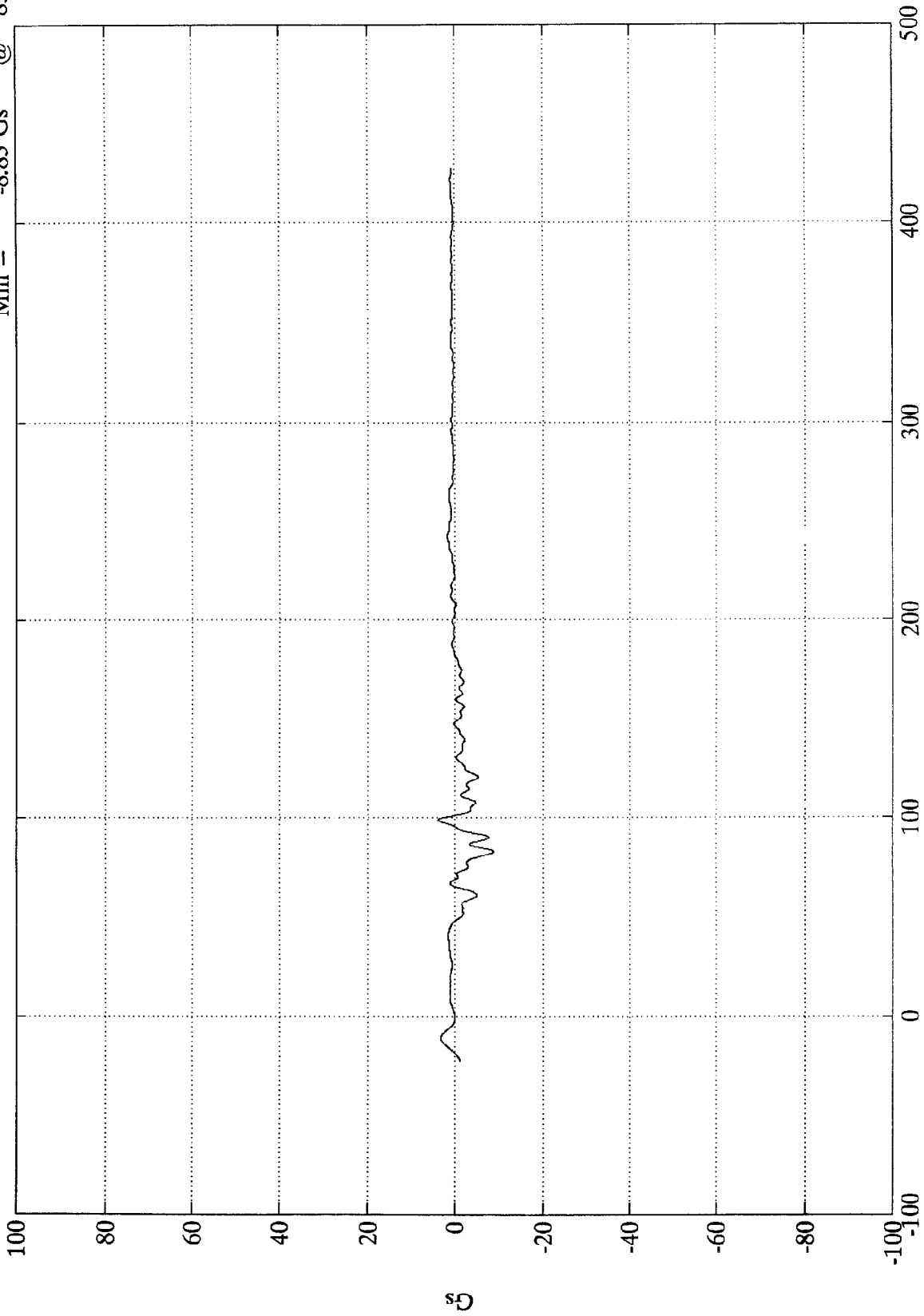


SAE Filter Class 180

VTV TEST #1

Max = 3.73 Gs @ 99.00 msec
Min = -8.83 Gs @ 83.04 msec

V2 Right X



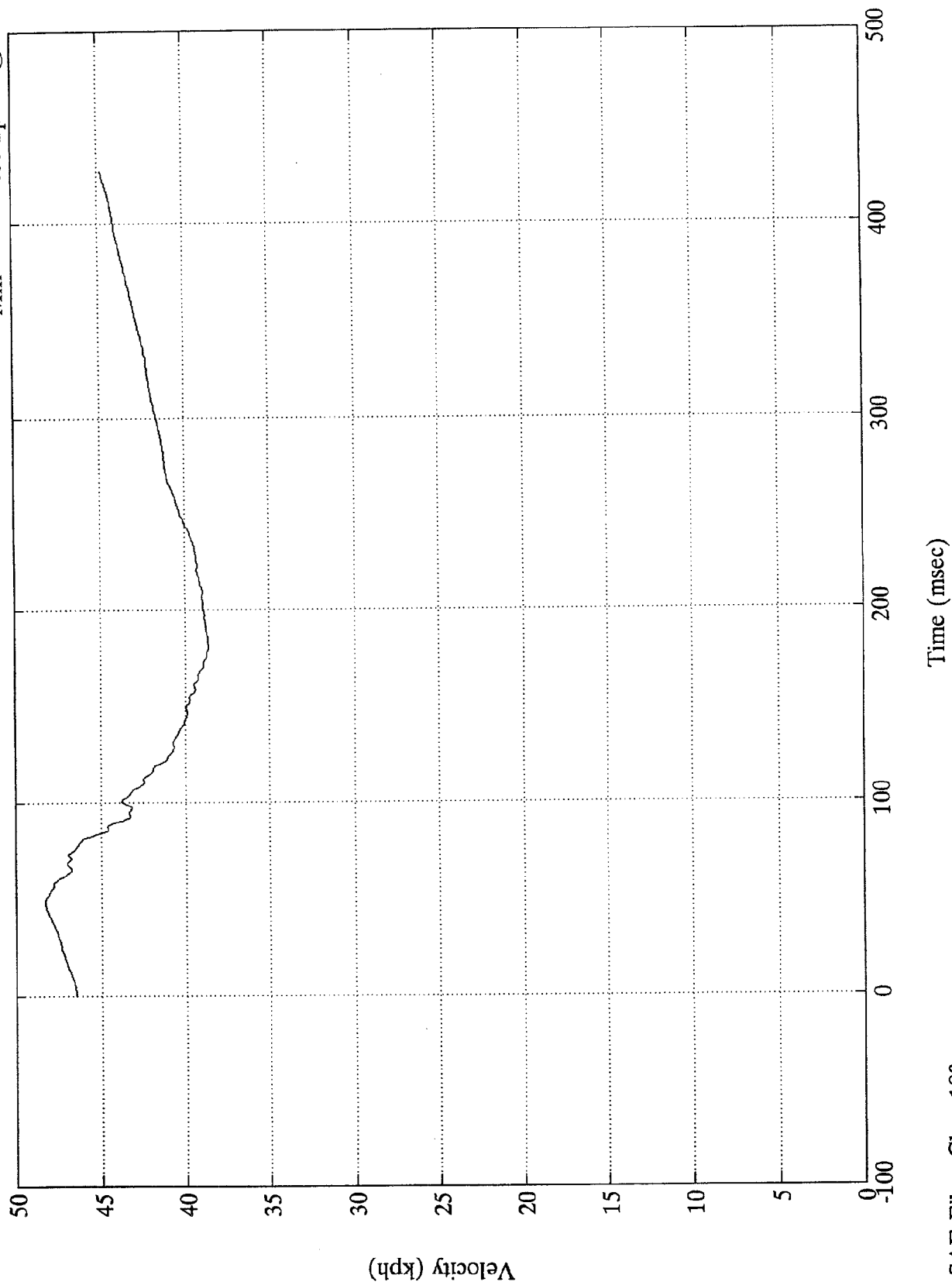
Time (msec)

SAE Filter Class 60

VTV TEST #1

Max = 48.28 kph @ 48.48 msec
Min = .00 kph @ -22.44 msec

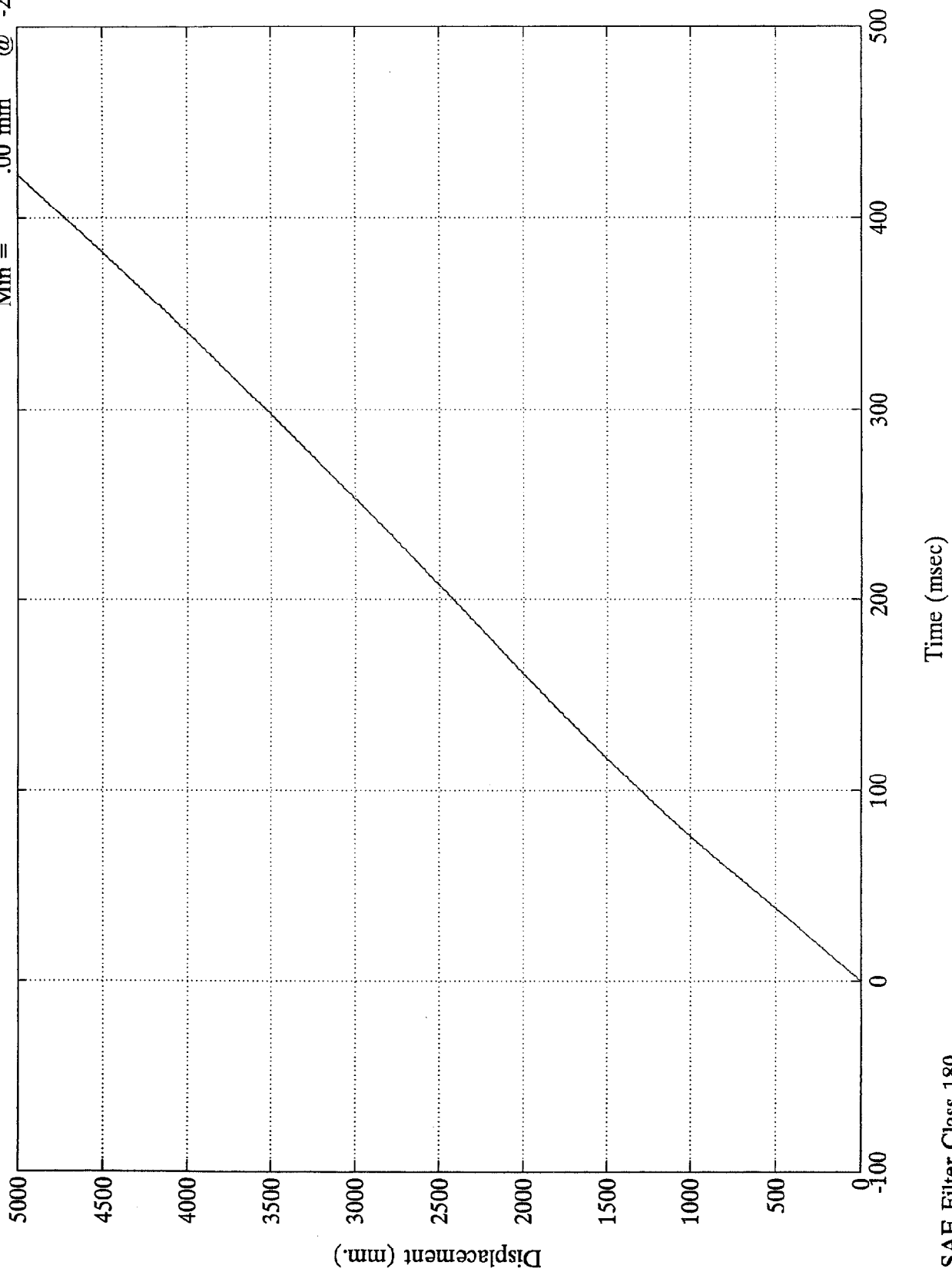
V2 Right X



VTV TEST #1

V2 Right X

Max = 5056.65 mm @ 427.32 msec
Min = .00 mm @ -22.44 msec

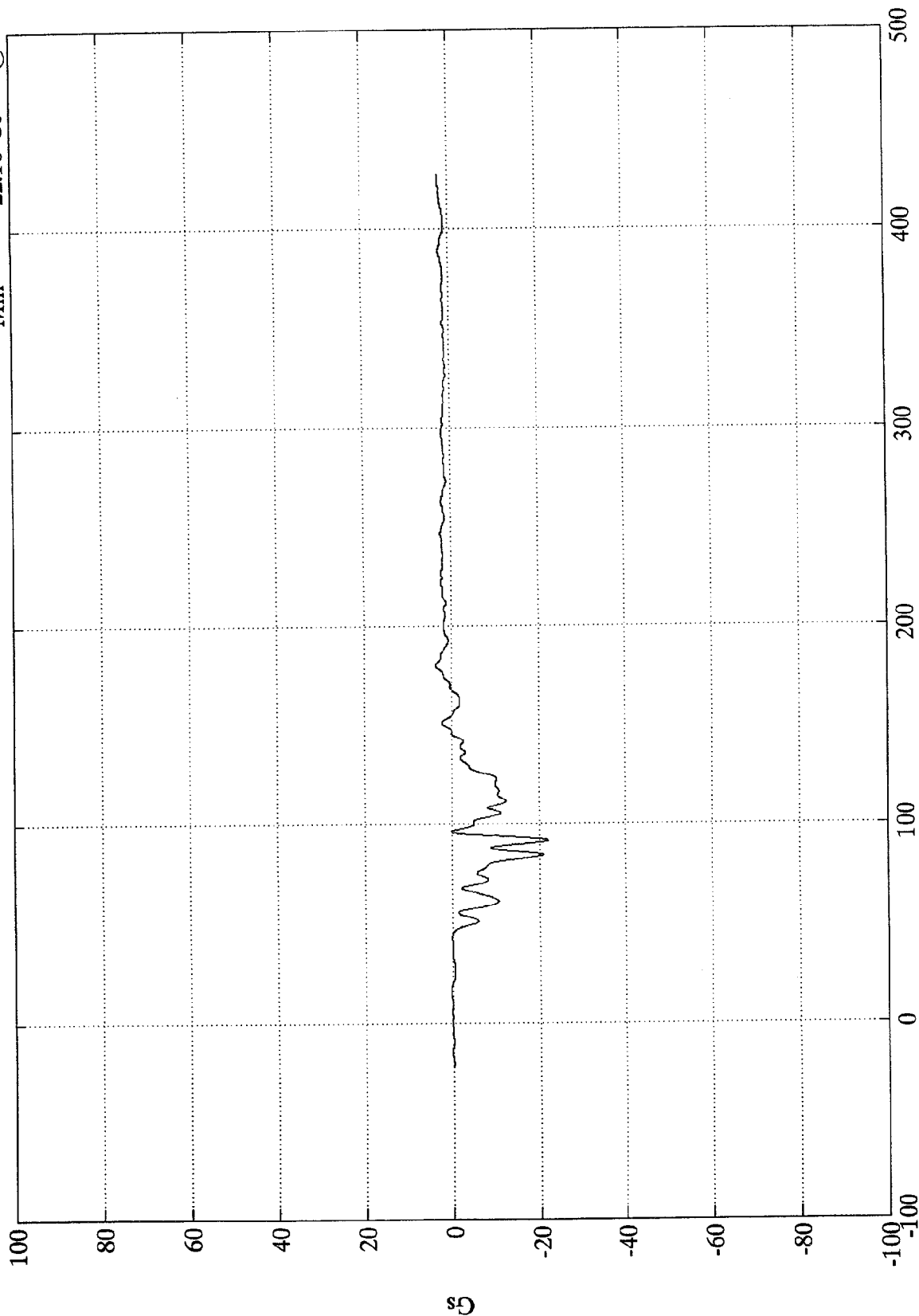


SAE Filter Class 180

VTV TEST #1

Max = 3.61 Gs @ 180.48 msec
Min = -22.16 Gs @ 91.80 msec

V2 Right Y



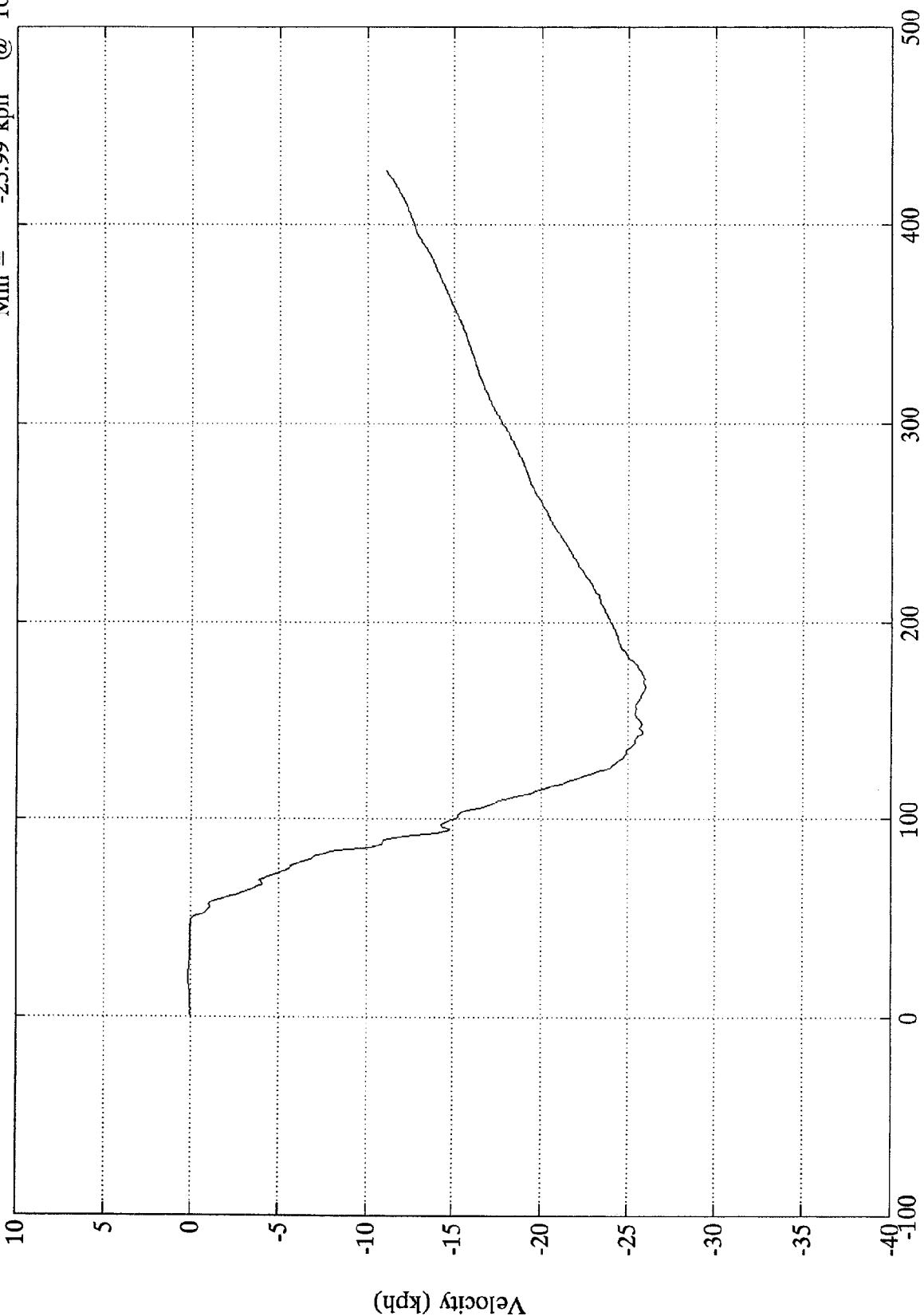
Time (msec)

SAE Filter Class 60

VTV TEST #1

Max = .19 kph @ 21.23 msec
Min = -25.99 kph @ 167.64 msec

V2 Right Y

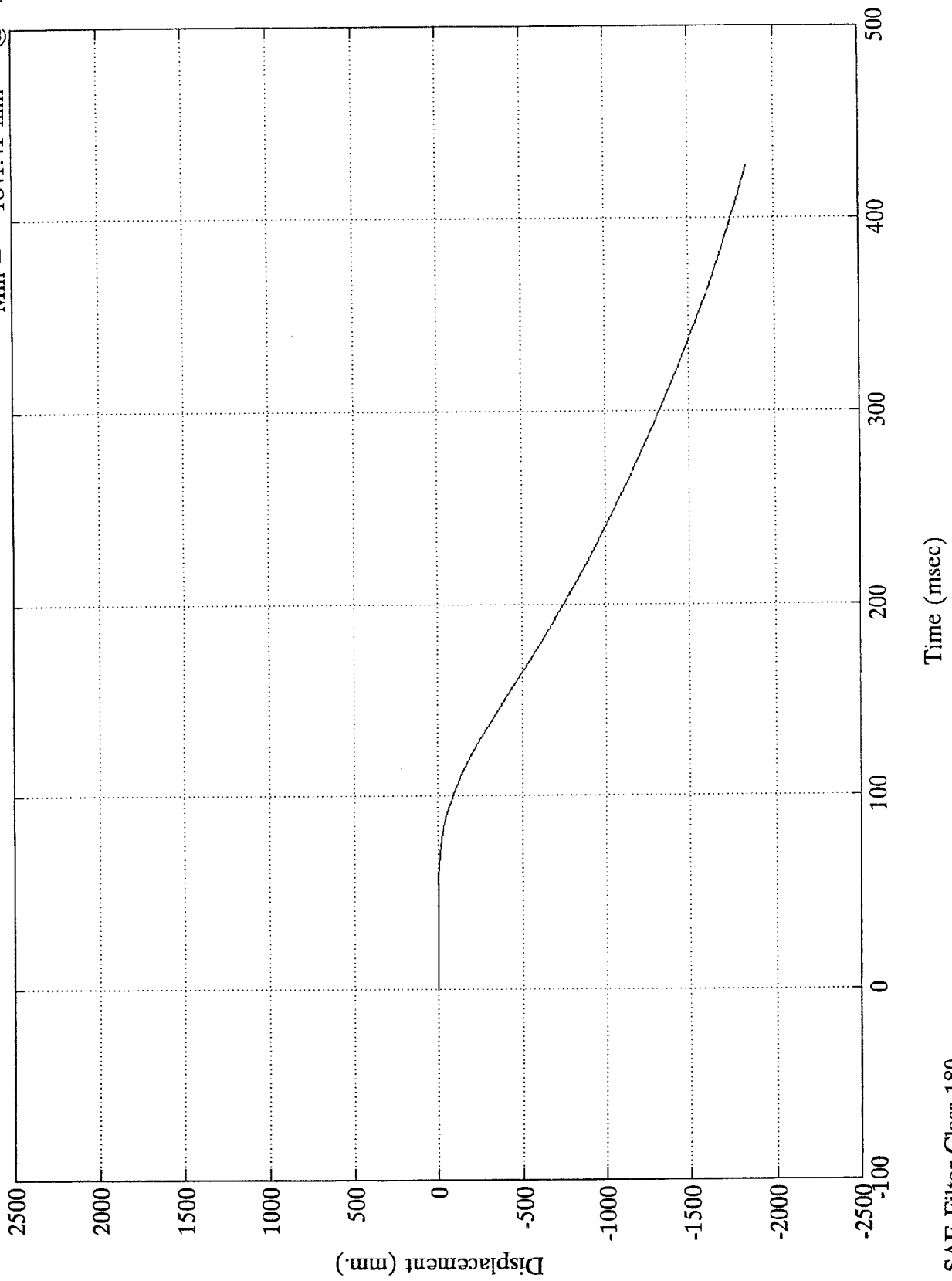


Time (msec)

SAE Filter Class 180

VTV TEST #1

V2 Right Y
Max = .97 mm @ 48.48 msec
Min = -1841.41 mm @ 427.32 msec



SAE Filter Class 180

TEST NO. A109-1-1646

VEHICLE 1 - DUMMY DATA

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

FACILITY: TRACK
 RUN #: 1646
 SERIES #: 1

TEST DATE: 15 Oct 1996
 TEST TIME: 14:32:42
 BOARD: a

TITLE: VTV TEST #1

CHANNEL NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM		MINIMUM		FILTER CLASS
			AMP	msec	AMP	msec	
1	P1 Head X	Gs	15.8	130.9	-56.9	105.5	1000.0
2	P1 Head Y	Gs	14.2	87.8	-4.7	137.8	1000.0
3	P1 Head Z	Gs	24.2	87.4	-16.4	89.9	1000.0
4	P1 Left Femur	Nwt	298.7	174.0	-1698.6	123.7	600.0
5	P1 Chest X	Gs	4.1	92.6	-25.6	121.2	180.0
6	P1 Chest Y	Gs	7.8	168.1	-5.7	128.4	180.0
7	P1 Chest Z	Gs	5.8	131.6	-4.2	113.0	180.0
8	P1 Right Femur	Nwt	791.1	122.6	-280.6	136.2	600.0
9	P1 Upper Neck Fx	Nwt	1848.8	111.0	-168.7	150.5	1000.0
10	P1 Upper Neck Fy	Nwt	221.1	96.1	-276.2	221.2	1000.0
11	P1 Upper Neck Fz	Nwt	2120.5	109.9	-190.3	148.8	1000.0
12	P1 Chest Displacement	mm	.0	8.9	-20.6	118.7	180.0
13	P1 Upper Neck Mx	Nwt-M	15.5	96.4	-15.2	175.4	600.0
14	P1 Upper Neck My	Nwt-M	7.3	170.6	-123.0	111.5	600.0
15	P1 Upper Neck Mz	Nwt-M	10.0	120.5	-8.1	210.2	600.0
16	P2 Chest Displacement	mm	.1	103.7	-10.7	143.0	180.0
17	P1 Head Resultant	Gs	57.9	105.5	.0	-14.3	1000.0
18	P1 Chest Resultant	Gs	25.8	121.2	.1	-19.1	180.0
19	P1 Upper Neck Force Res	Nwt	2787.0	110.8	3.6	-.4	1000.0
20	P1 Upper Neck Moment Res	Nwt-M	123.3	111.5	.0	-18.6	600.0

V2 36 ms Fixed Duration HIC SUMMARY: P1 Head Resultant

hic: 199.75
 t1 = 101.640 msec
 t2 = 119.040 msec
 Average G's Over Hic Duration = 42.07

CLIP V2.1 SUMMARY: P1 Chest Resultant

Peak Resultant (3 ms CLIPPED DURATION) = 24.711 G's
 Tstart = 113.5274 ms
 Tend = 116.5274 ms
 CSI = 85.198

FACILITY: TRACK TEST DATE: 15 Oct 1996
 RUN #: 1646 TEST TIME: 14:32:42
 SERIES #: 1 BOARD: b

TITLE: VTV TEST #1

CHANNEL NUMBER	DESCRIPTION	ENGR UNIT	MAXIMUM		MINIMUM		FILTER CLASS
			AMP	msec	AMP	msec	
1	P2 Head X	Gs	26.8	338.6	-25.7	152.4	1000.0
2	P2 Head Y	Gs	12.9	427.3	-2.1	126.5	1000.0
3	P2 Head Z	Gs	6.1	158.6	-12.8	110.6	1000.0
4	P2 Head Z(R)	Gs	12.5	337.6	-15.4	135.5	1000.0
5	P2 Chest X	Gs	.1	-1.3	-22.8	107.4	180.0
6	P2 Chest Y	Gs	7.4	162.6	-3.6	123.1	180.0
7	P2 Chest Z	Gs	11.0	161.8	-9.6	112.6	180.0
8	V1 Left X	Gs	1.5	-2.8	-18.3	104.0	60.0
9	P2 Upper Neck Fx	Nwt	103.2	95.5	-373.9	136.8	1000.0
10	P2 Upper Neck Fy	Nwt	137.5	175.0	-177.5	427.3	1000.0
11	P2 Upper Neck Fz	Nwt	414.7	110.9	-585.3	106.6	1000.0
12	V1 Left Y	Gs	6.6	106.1	-2.6	214.9	60.0
13	P2 Upper Neck Mx	Nwt-M	4.8	115.7	-5.7	170.0	600.0
14	P2 Upper Neck My	Nwt-M	30.4	136.7	-5.6	349.8	600.0
15	P2 Upper Neck Mz	Nwt-M	13.2	177.8	-6.3	128.8	600.0
16	V1 Center X	Gs	1.3	21.1	-15.4	102.5	60.0
17	P2 Head Resultant	Gs	29.3	338.5	.0	-12.5	1000.0
18	P2 Chest Resultant	Gs	22.9	107.4	.0	-20.0	180.0
19	P2 Upper Neck Force Res	Nwt	598.0	106.6	6.1	98.5	1000.0
20	P2 Upper Neck Moment Res	Nwt-M	30.7	136.7	.0	-20.0	600.0

V2 36 ms Fixed Duration HIC SUMMARY: P2 Head Resultant

hic: 55.97
 t1 = 128.520 msec
 t2 = 164.520 msec
 Average G's Over Hic Duration = 18.91

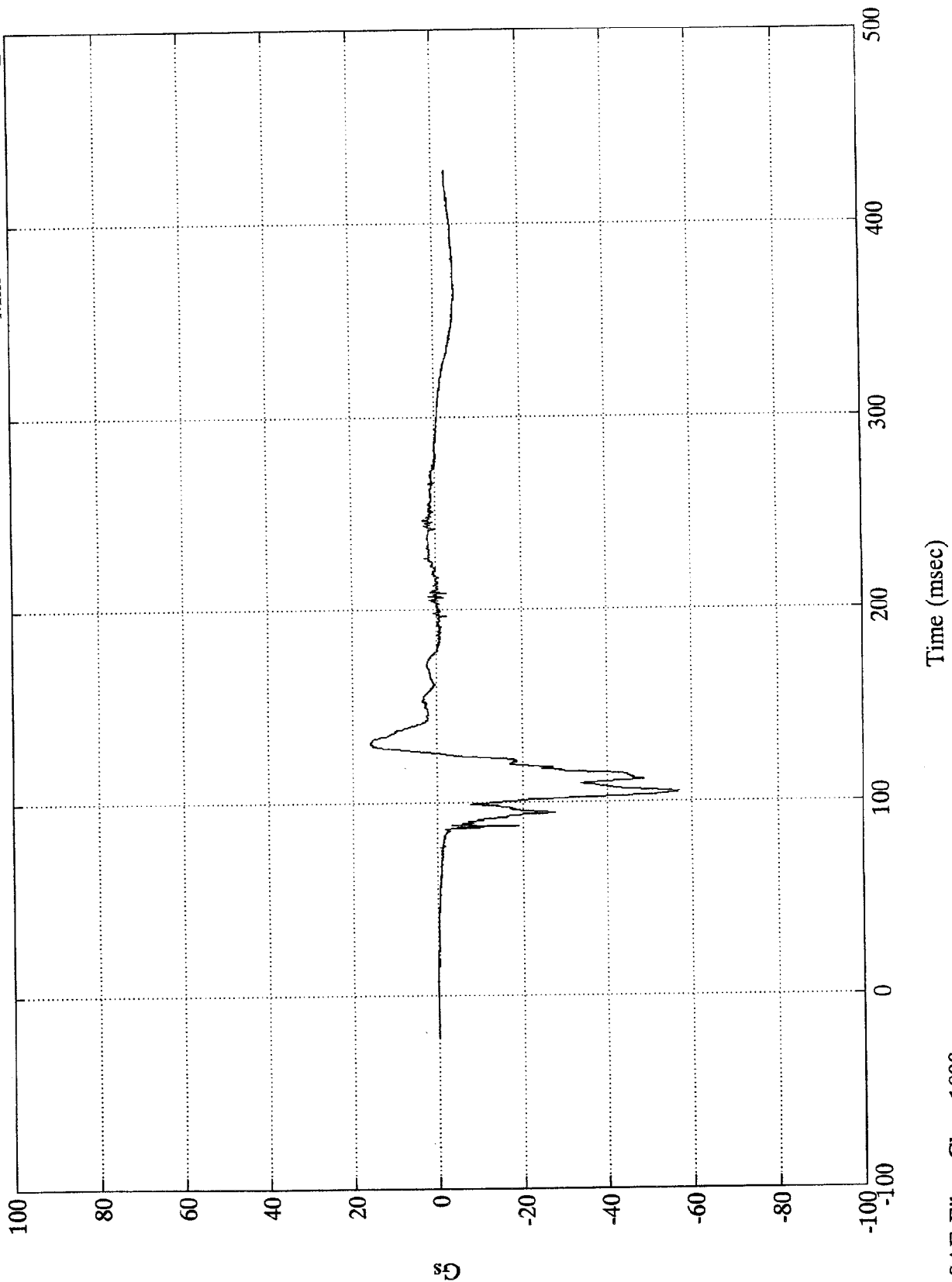
CLIP V2.1 SUMMARY: P2 Chest Resultant

Peak Resultant (3 ms CLIPPED DURATION) = 20.787 G's
 Tstart = 132.4409 ms
 Tend = 135.4409 ms
 CSI = 83.615

VTV TEST #1

Max = 15.77 Gs @ 130.92 msec
Min = -56.94 Gs @ 105.48 msec

P1 Head X

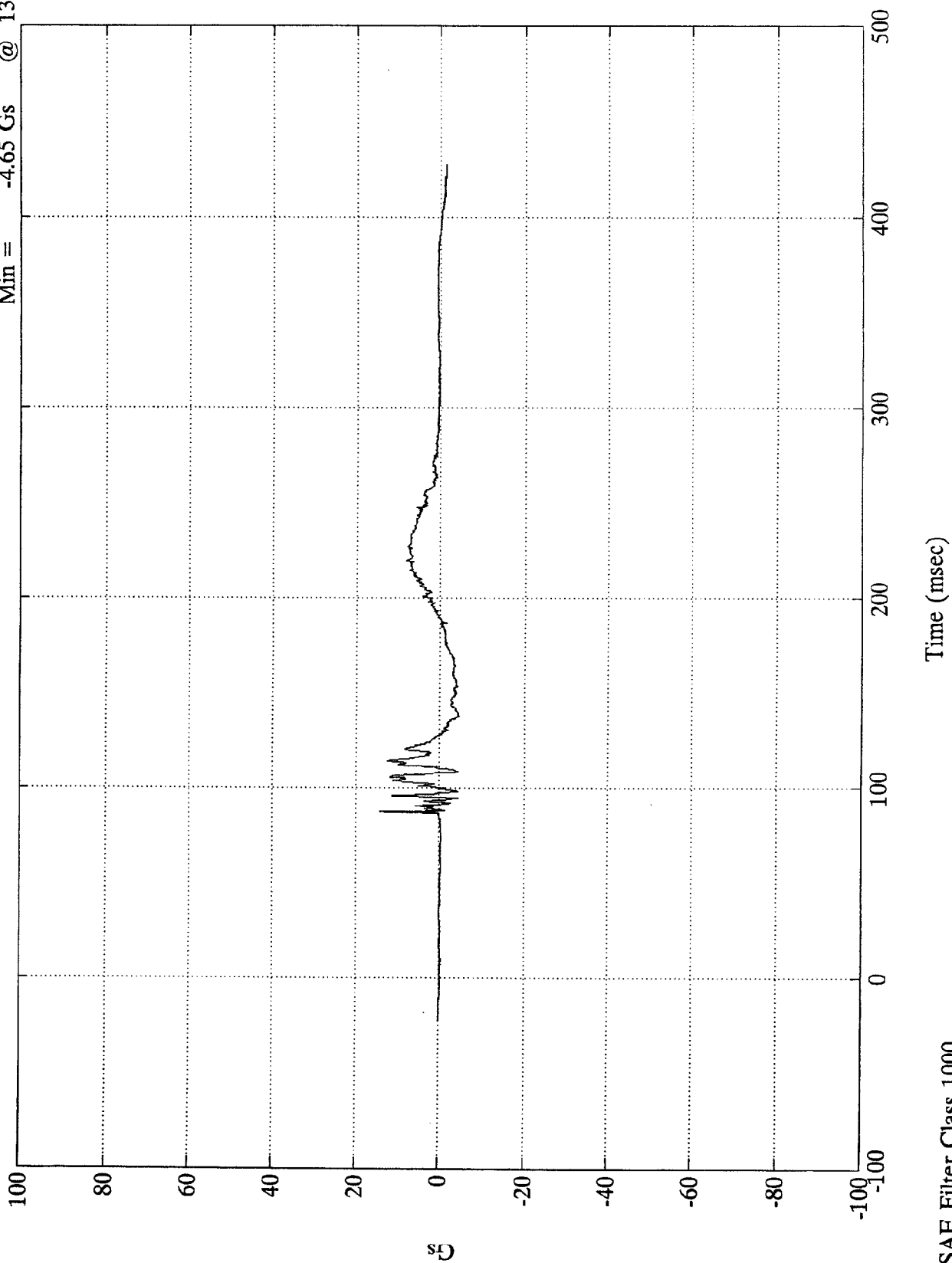


SAE Filter Class 1000

VTV TEST #1

Max = 14.16 Gs @ 87.84 msec
Min = -4.65 Gs @ 137.75 msec

P1 Head Y

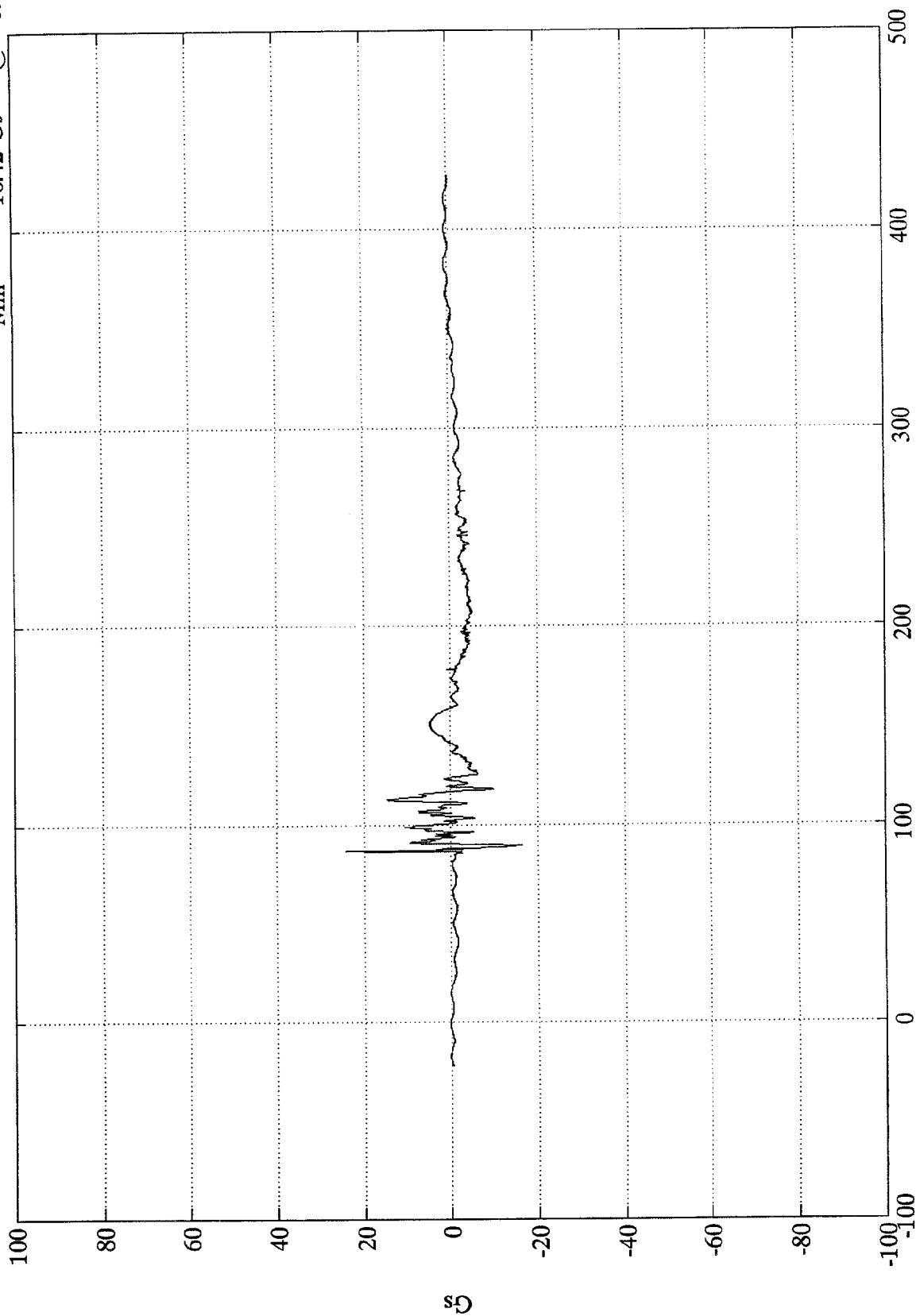


SAE Filter Class 1000

VTV TEST #1

Max = 24.24 Gs @ 87.36 msec
Min = -16.42 Gs @ 89.88 msec

P1 Head Z



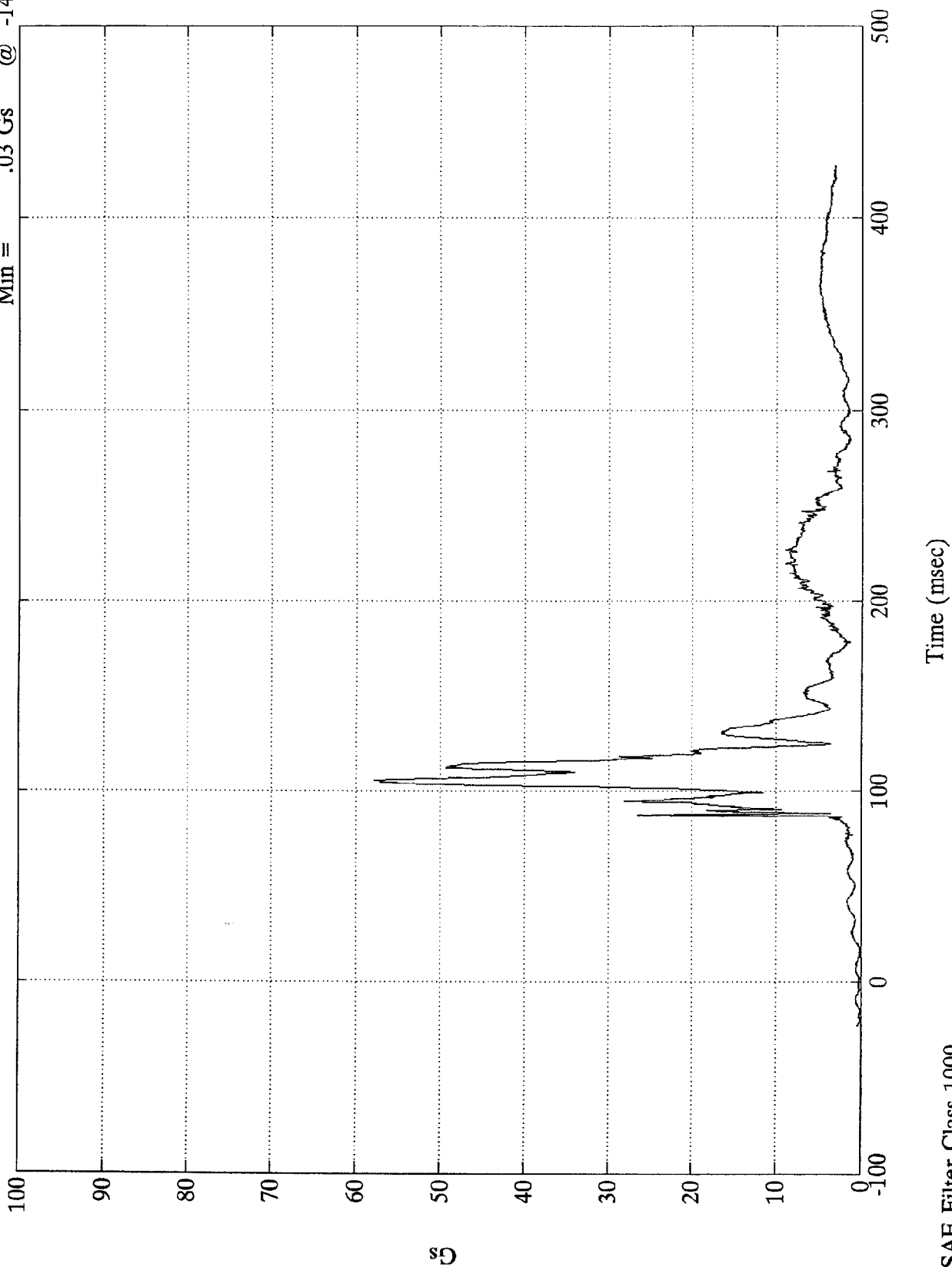
Time (msec)

SAE Filter Class 1000

VTV TEST #1

Max = 57.88 Gs @ 105.48 msec
Min = .03 Gs @ -14.28 msec

P1 Head Resultant

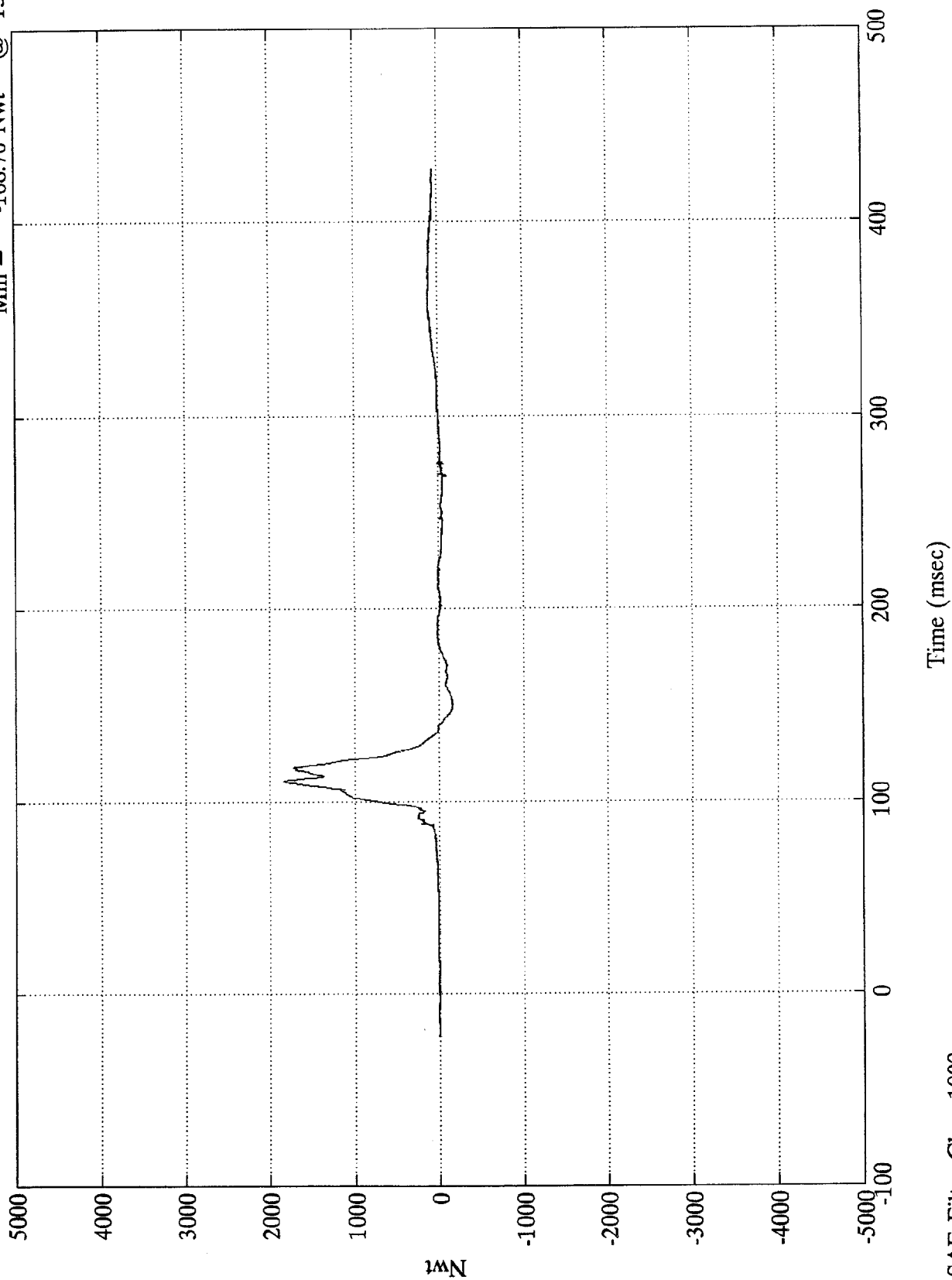


SAE Filter Class 1000

VTV TEST #1

P1 Upper Neck Fx

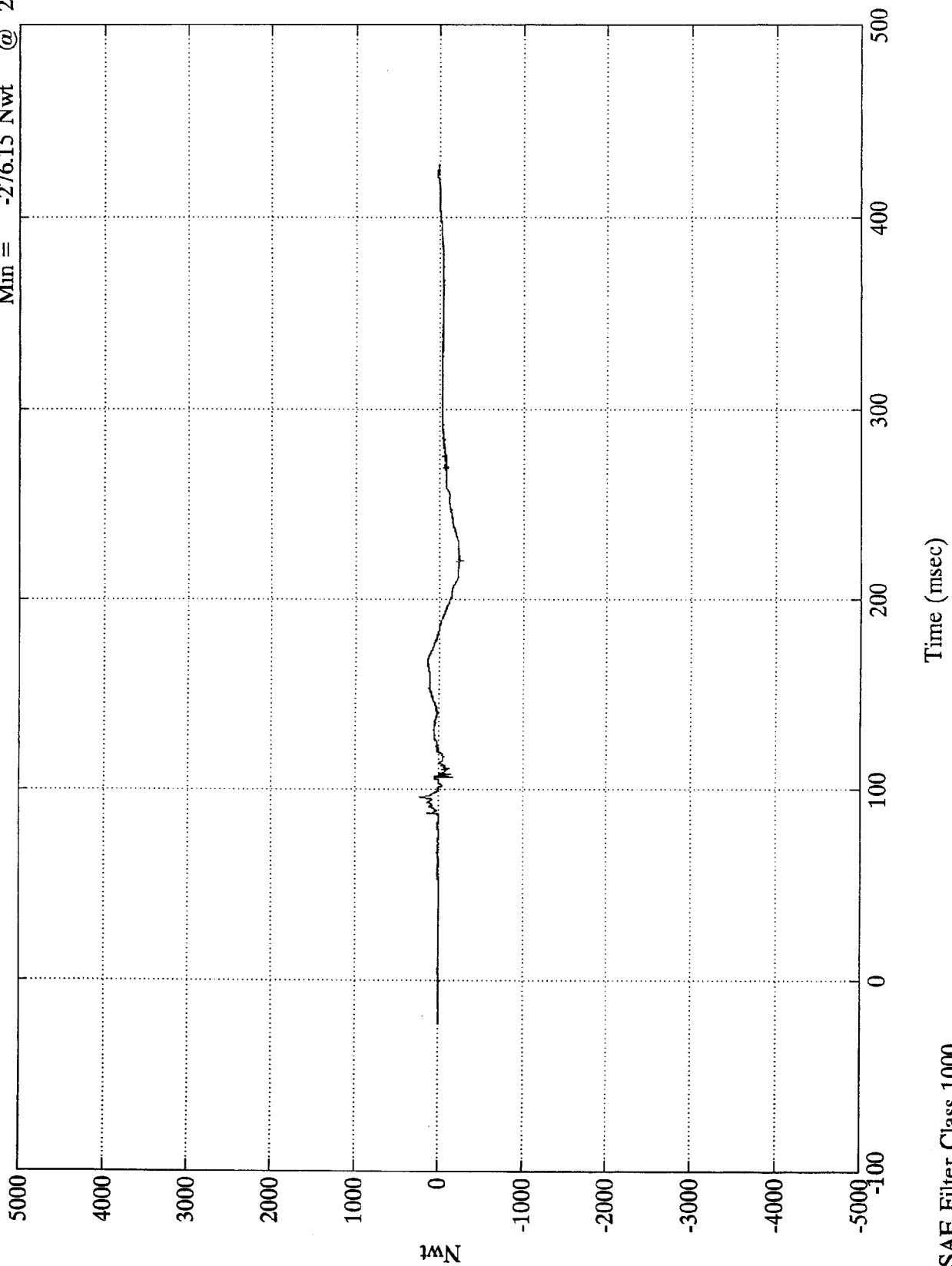
Max = 1848.80 Nwt @ 111.00 msec
Min = -168.70 Nwt @ 150.47 msec



SAE Filter Class 1000

VTV TEST #1

P1 Upper Neck Fy
Max = 221.11 Nwt @ 96.12 msec
Min = -276.15 Nwt @ 221.16 msec

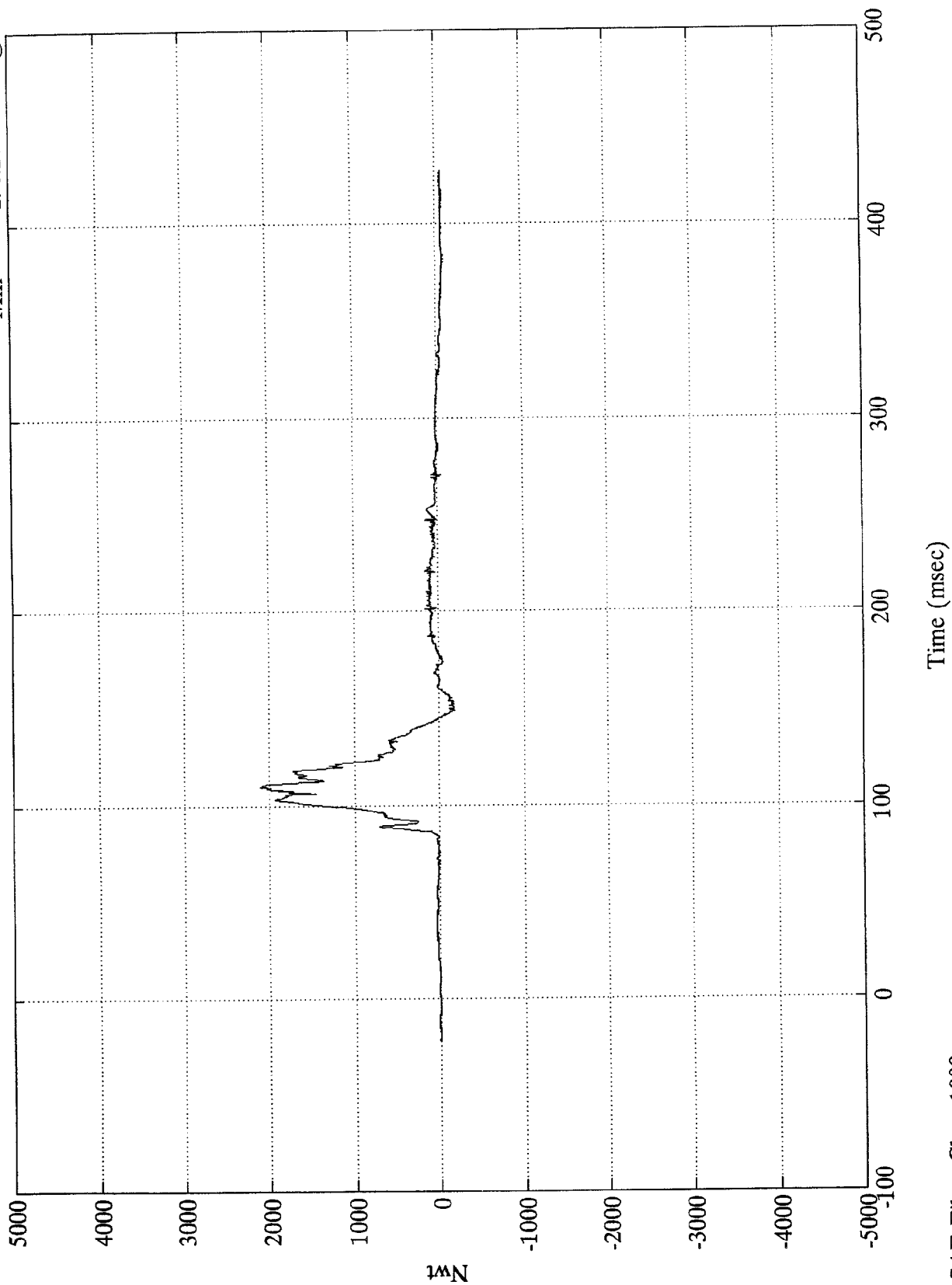


SAE Filter Class 1000

VTV TEST #1

P1 Upper Neck Fz

Max = 2120.52 Nwt @ 109.92 msec
Min = -190.27 Nwt @ 148.80 msec

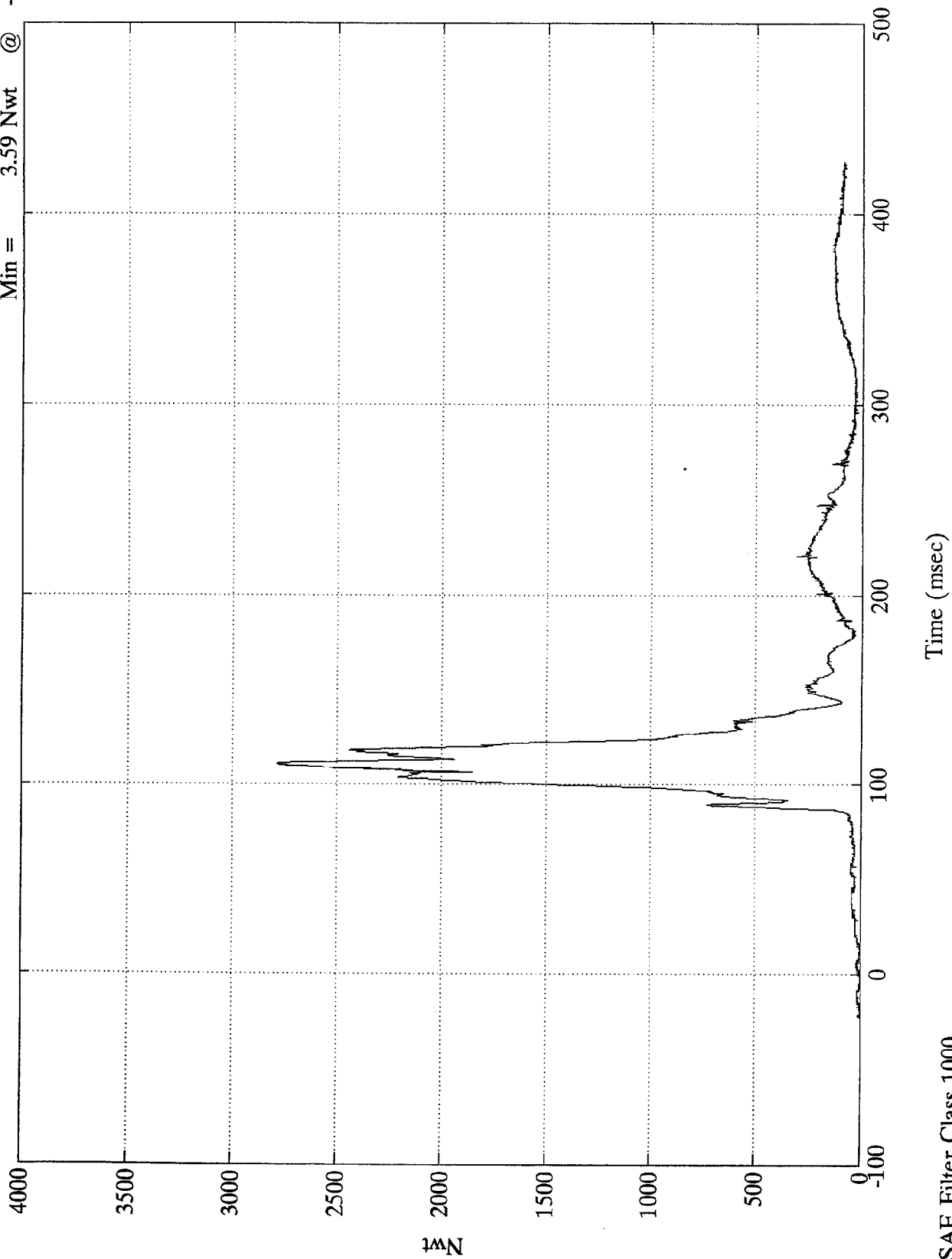


SAE Filter Class 1000

VTV TEST #1

P1 Upper Neck Force Res

Max = 2787.03 Nwt @ 110.76 msec
 Min = 3.59 Nwt @ -0.36 msec

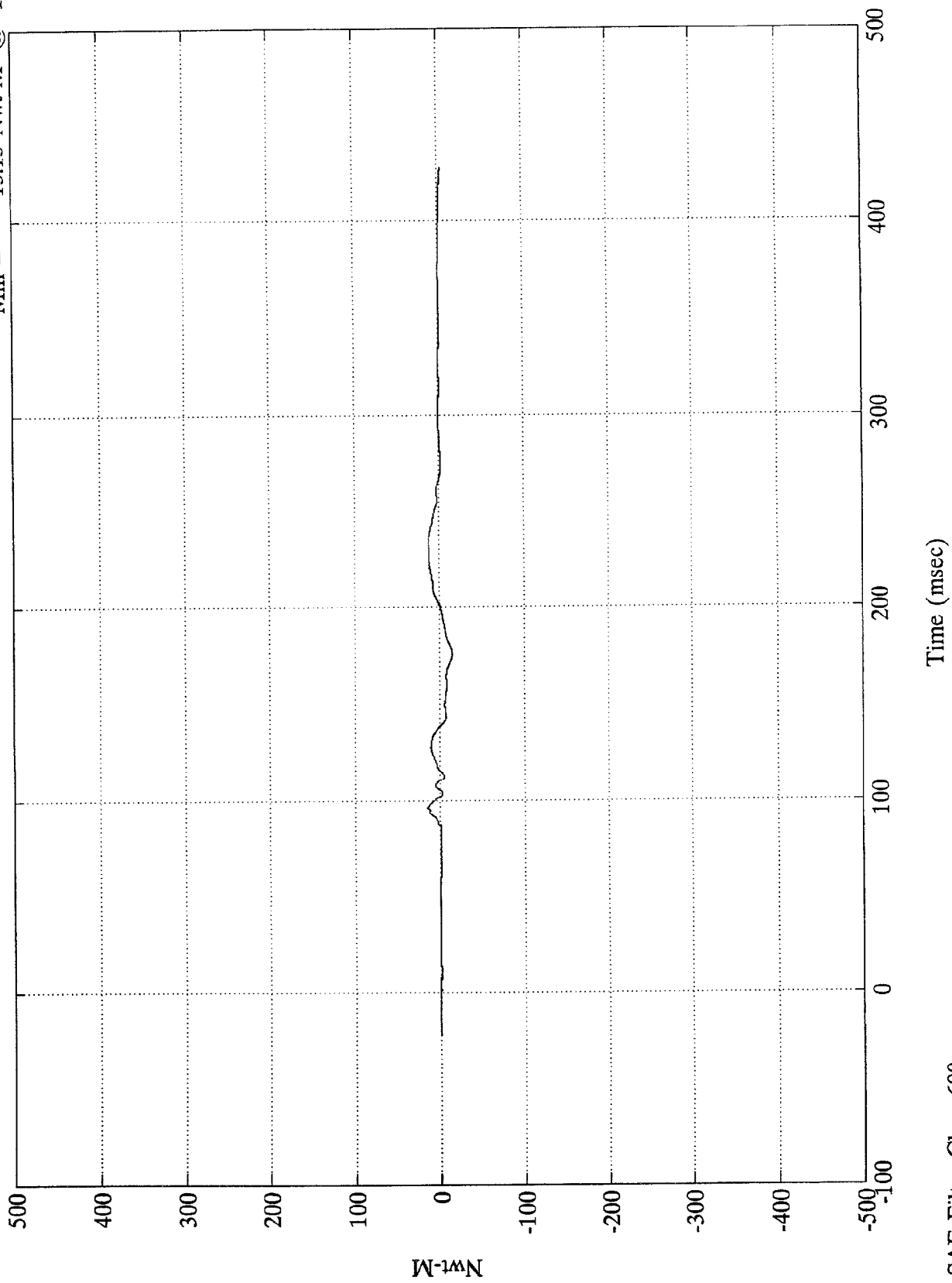


SAE Filter Class 1000

VTV TEST #1

P1 Upper Neck Mx

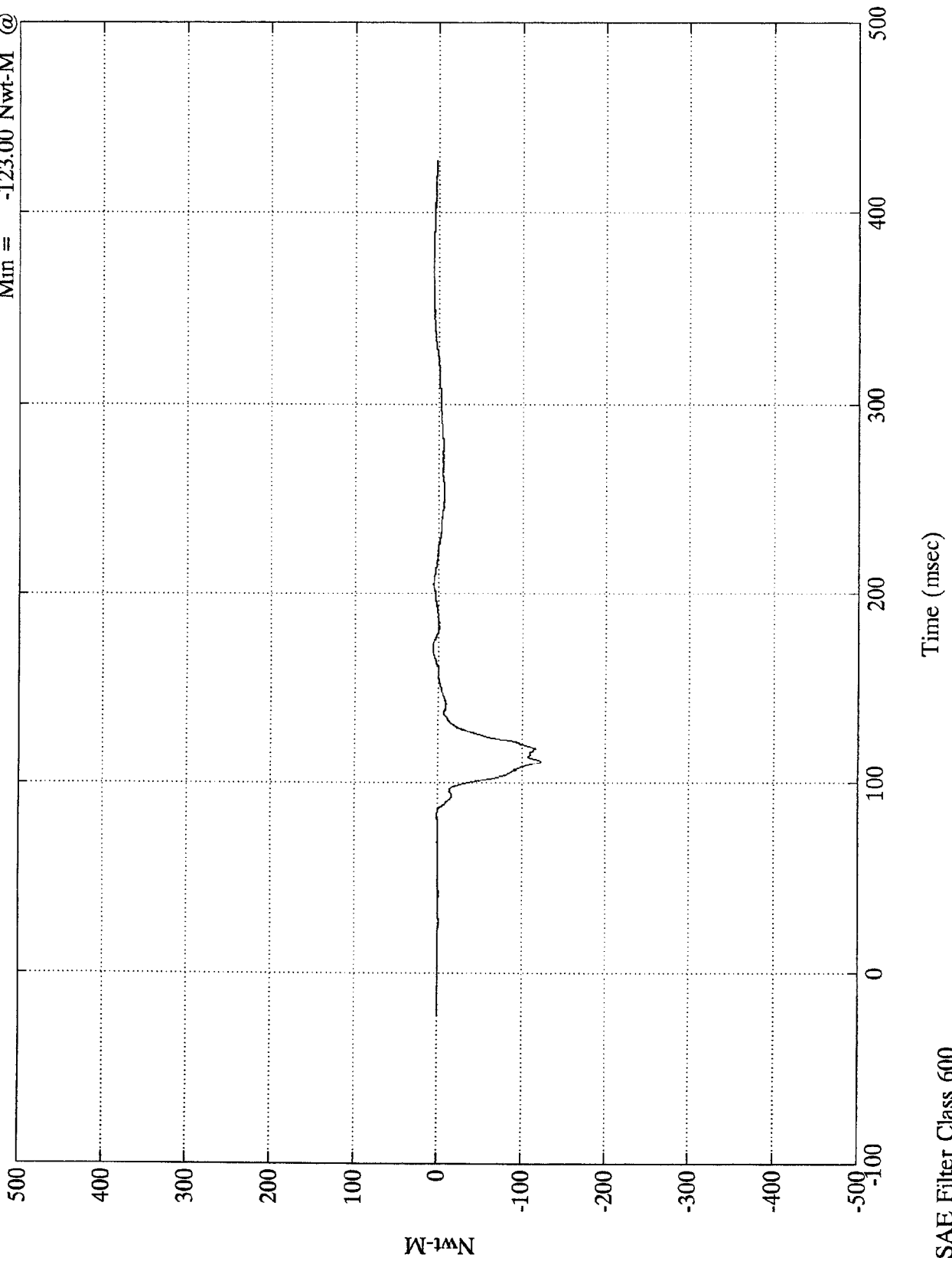
Max = 15.47 Nwt-M @ 96.36 msec
Min = -15.15 Nwt-M @ 175.44 msec



SAE Filter Class 600

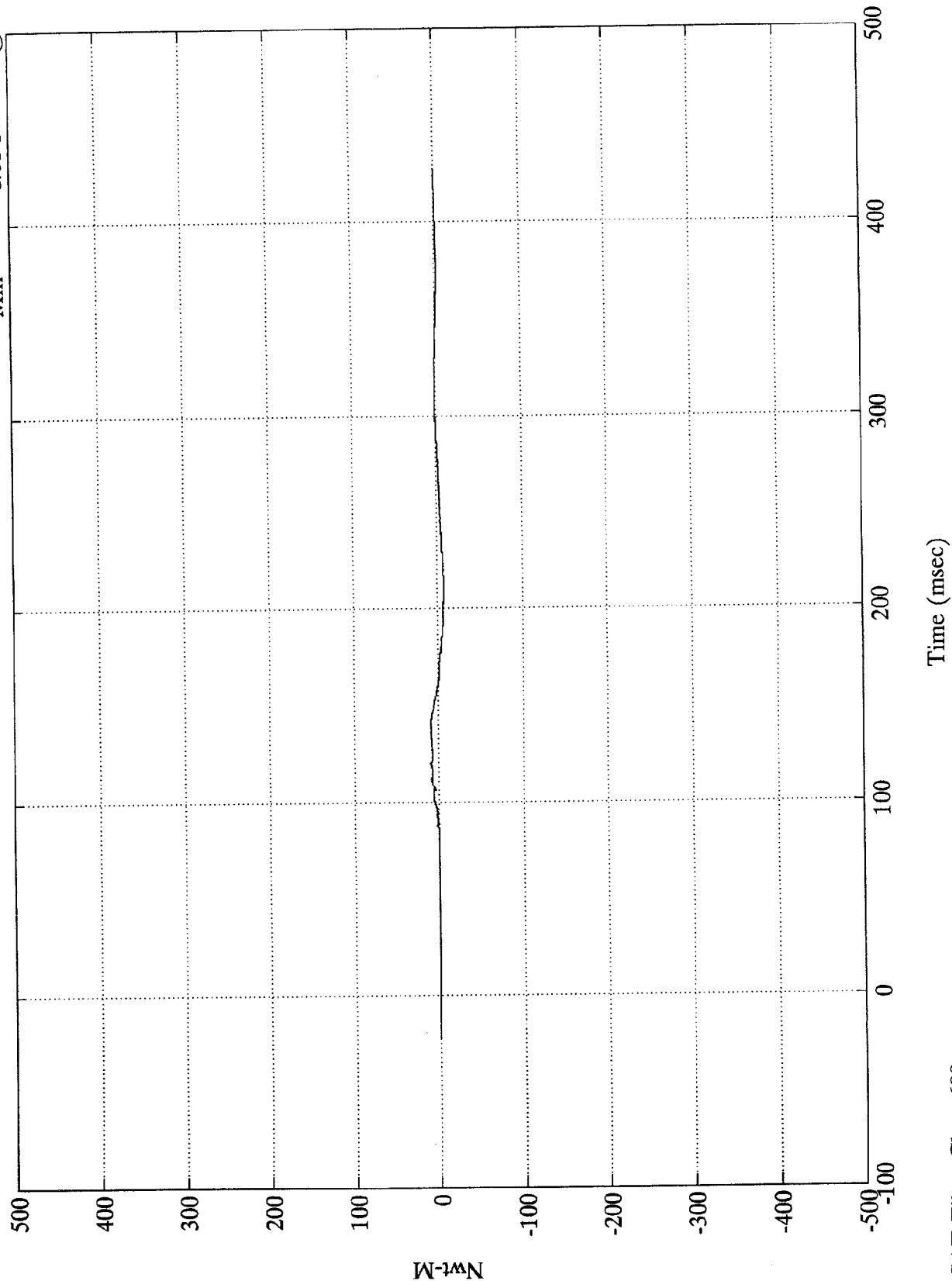
VTV TEST #1

P1 Upper Neck My
Max = 7.25 Nwt-M @ 170.63 msec
Min = -123.00 Nwt-M @ 111.48 msec



VTV TEST #1

P1 Upper Neck Mz
Max = 9.96 Nwt-M @ 120.48 msec
Min = -8.08 Nwt-M @ 210.24 msec

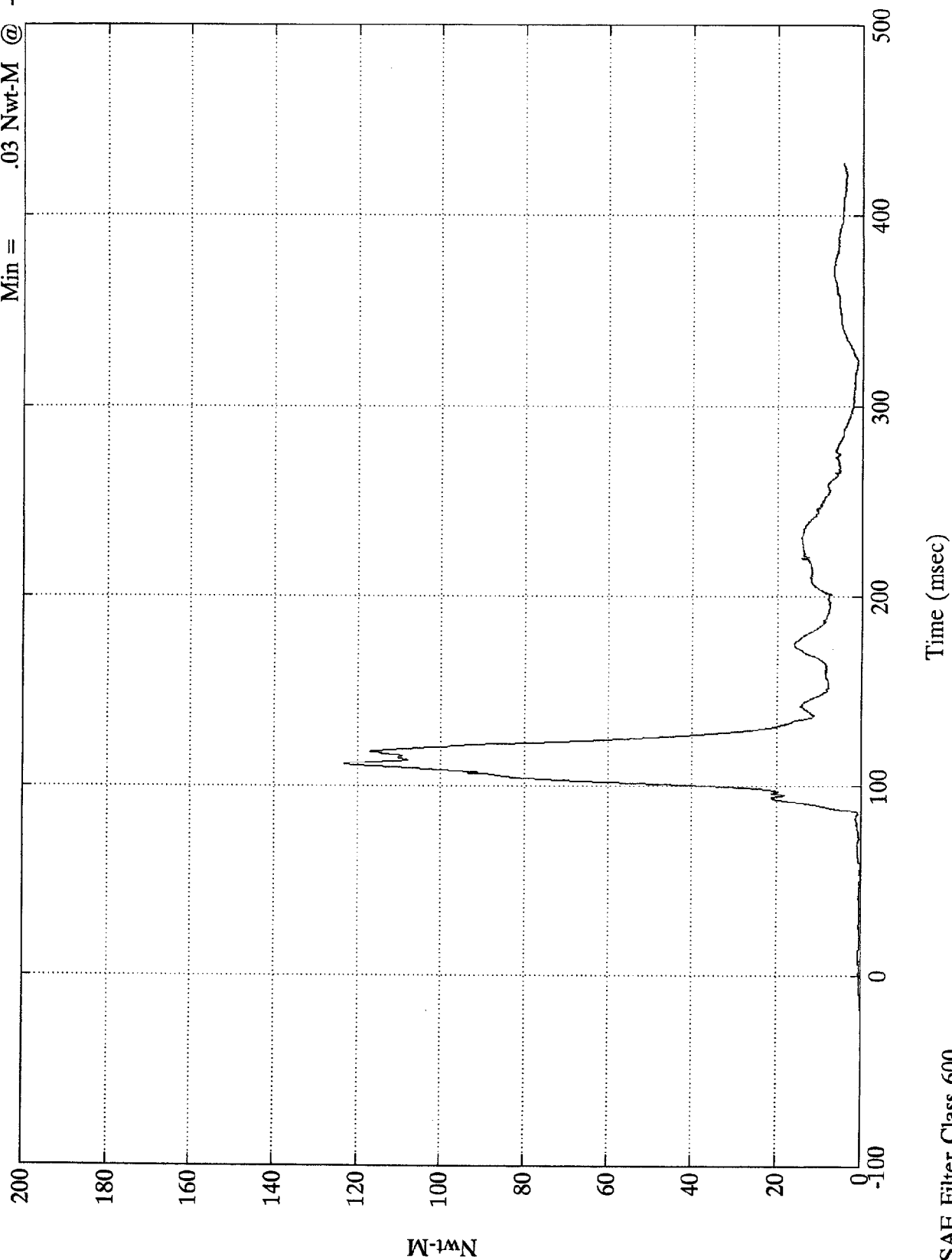


SAE Filter Class 600

VTV TEST #1

P1 Upper Neck Moment Res

Max = 123.31 Nwt-M @ 111.48 msec
Min = .03 Nwt-M @ -18.60 msec

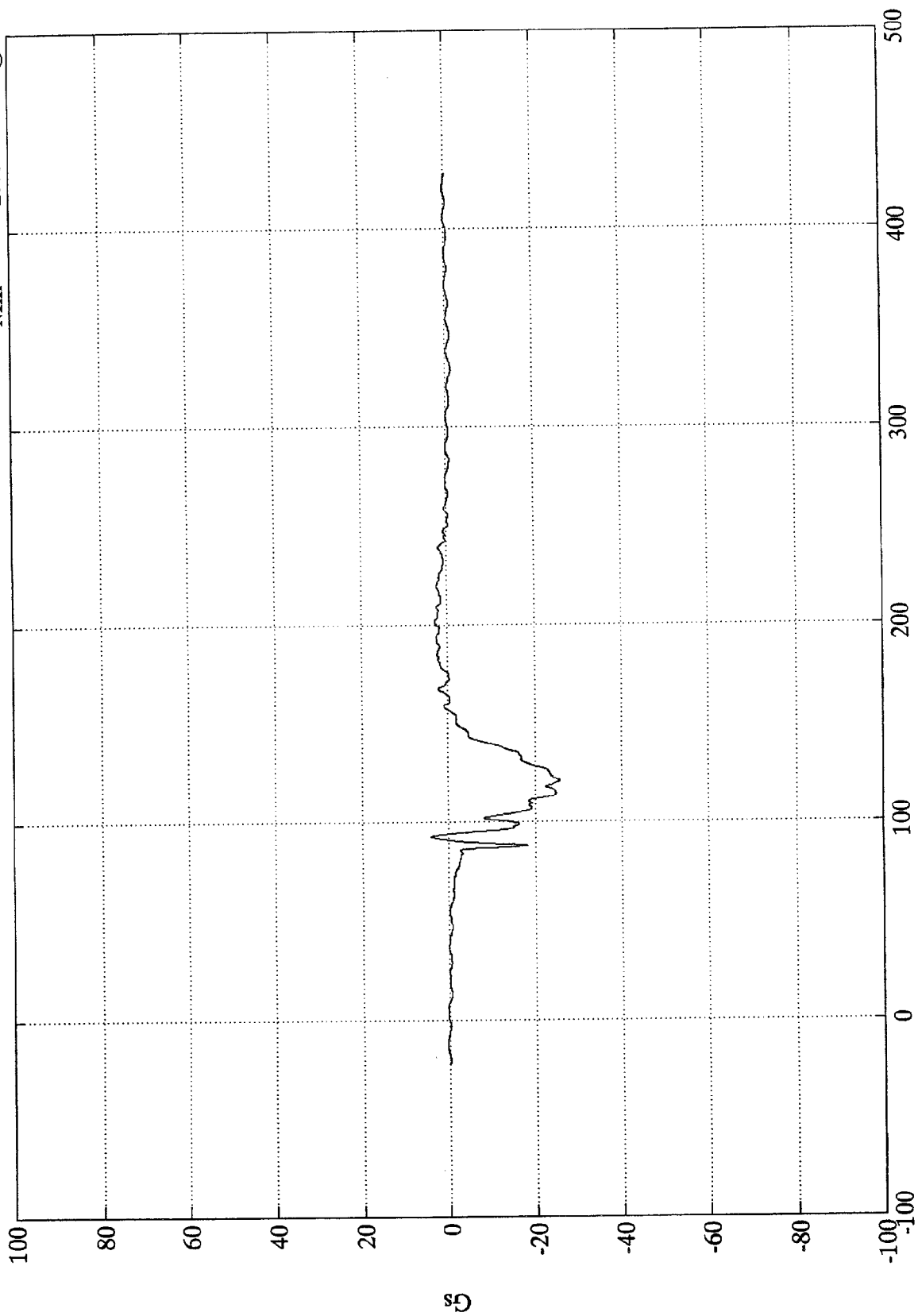


SAE Filter Class 600

VTV TEST #1

Max = 4.06 Gs @ 92.64 msec
Min = -25.62 Gs @ 121.20 msec

P1 Chest X



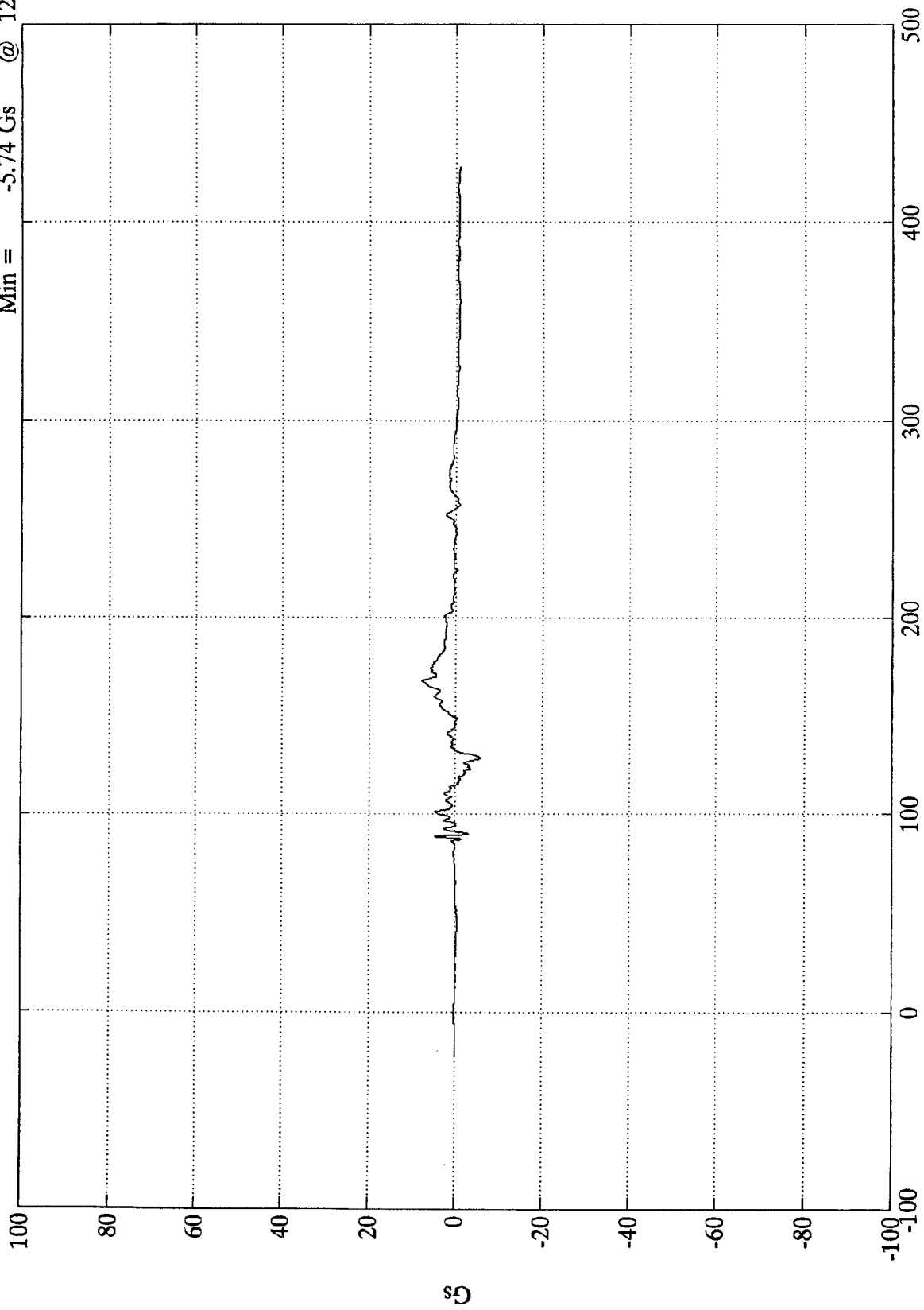
Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = 7.77 Gs @ 168.12 msec
Min = -5.74 Gs @ 128.39 msec

P1 Chest Y

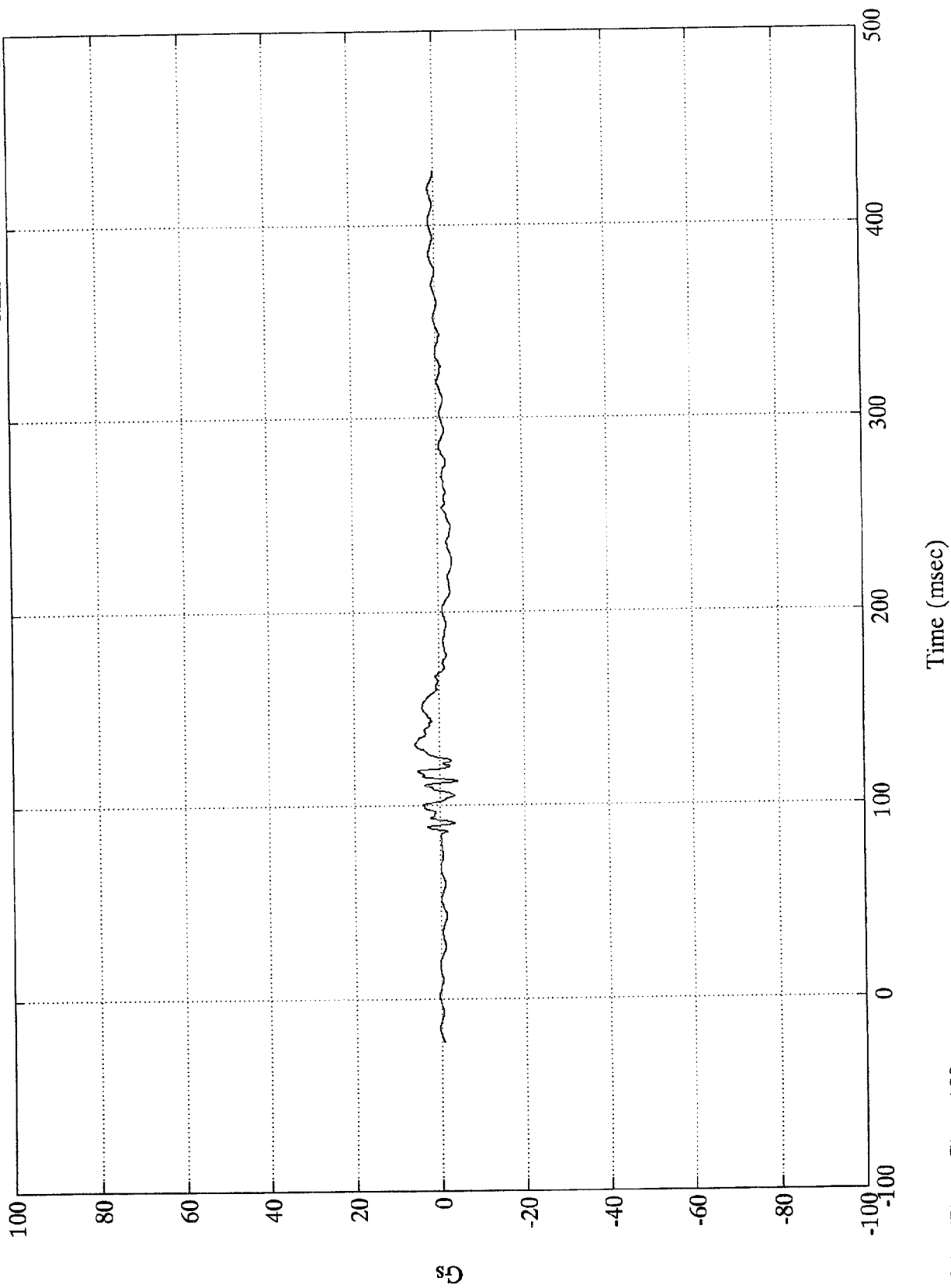


Time (msec)

SAE Filter Class 180

VIV TEST #1

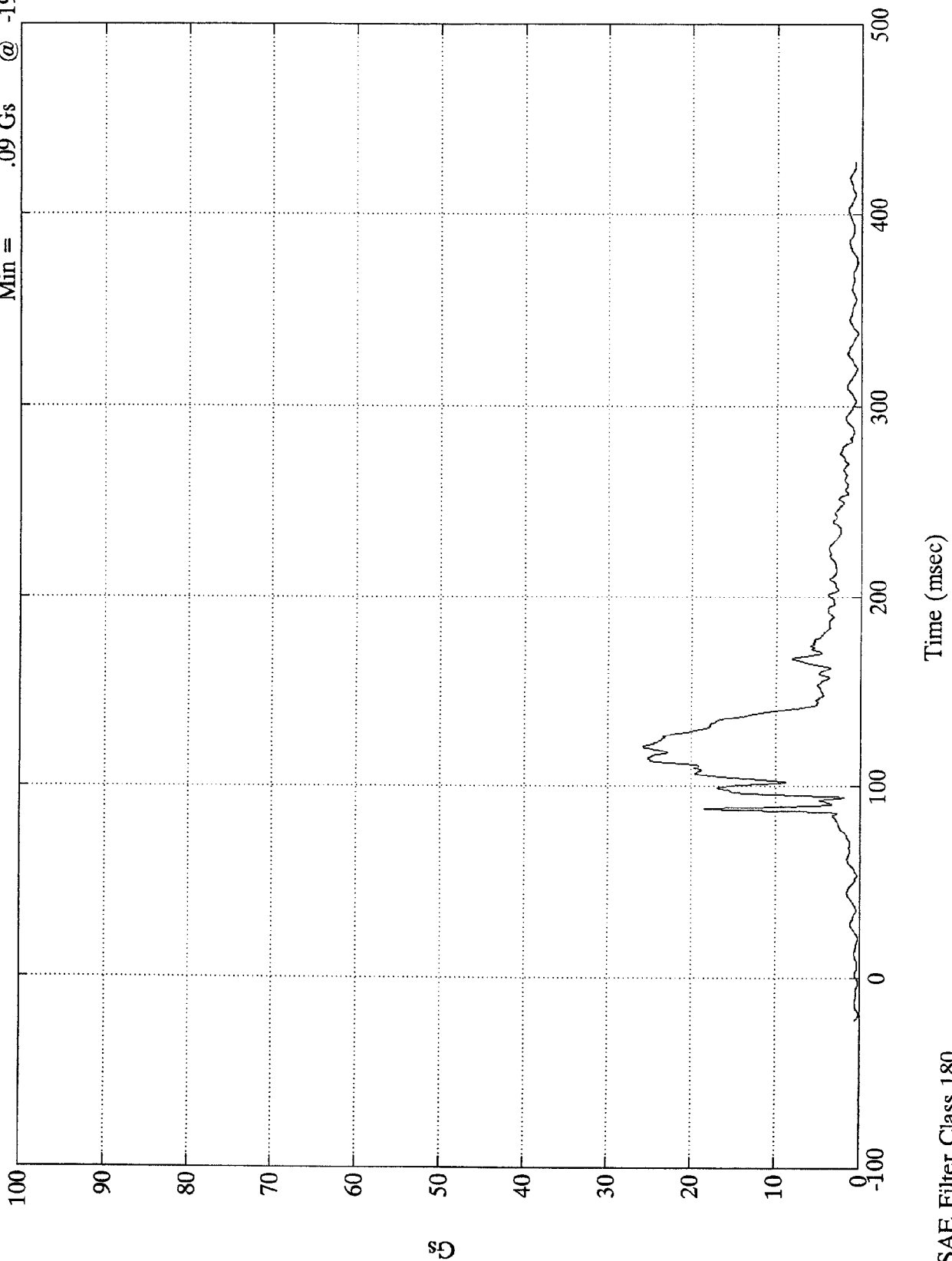
P1 Chest Z
Max = 5.81 Gs @ 131.63 msec
Min = -4.17 Gs @ 113.04 msec



SAE Filter Class 180

VTV TEST #1

P1 Chest Resultant
Max = 25.78 Gs @ 121.20 msec
Min = .09 Gs @ -19.08 msec

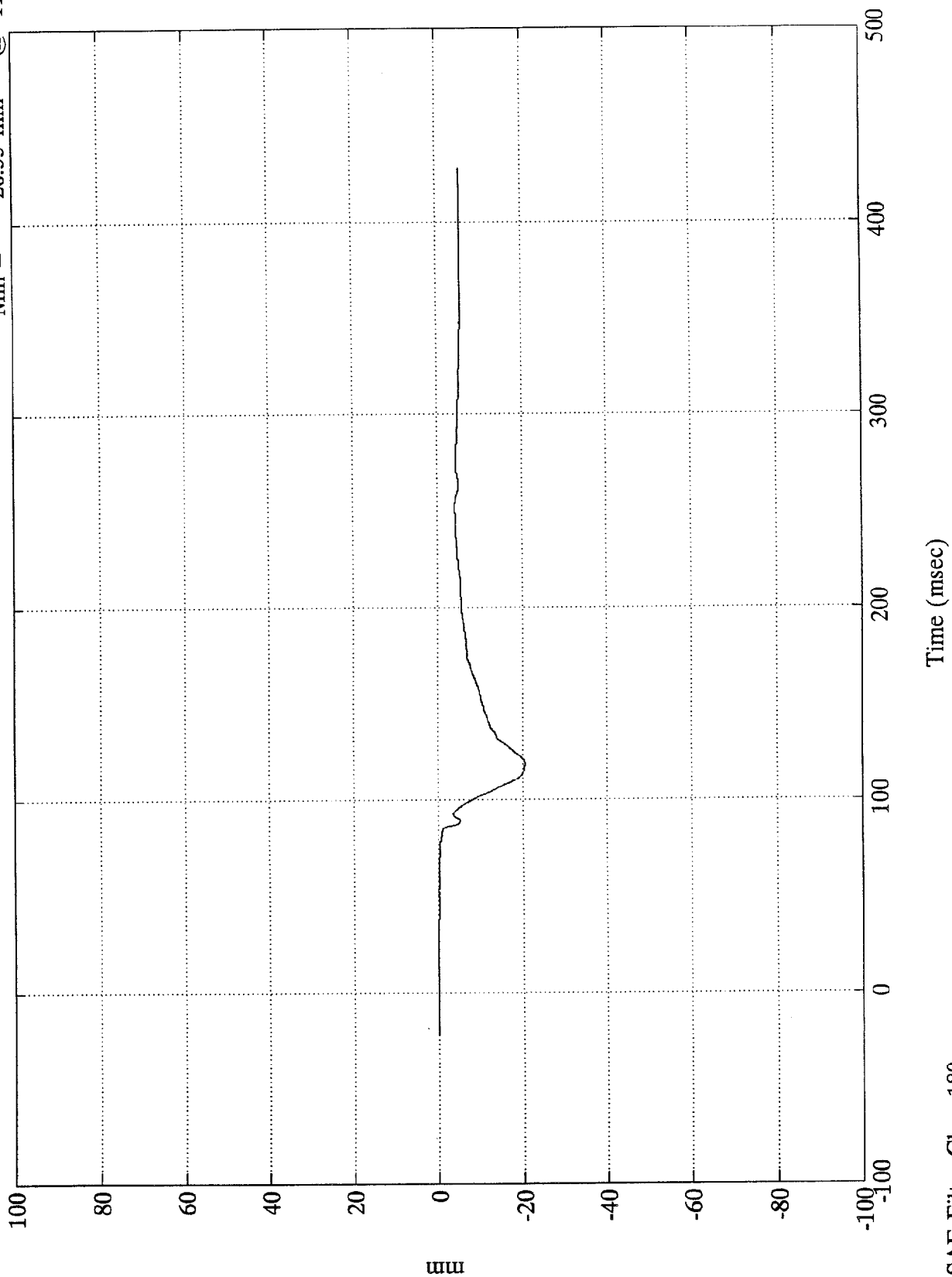


SAE Filter Class 180

VTV TEST #1

P1 Chest Displacement

Max =	.03 mm	@	8.87 msec
Min =	-20.55 mm	@	118.68 msec

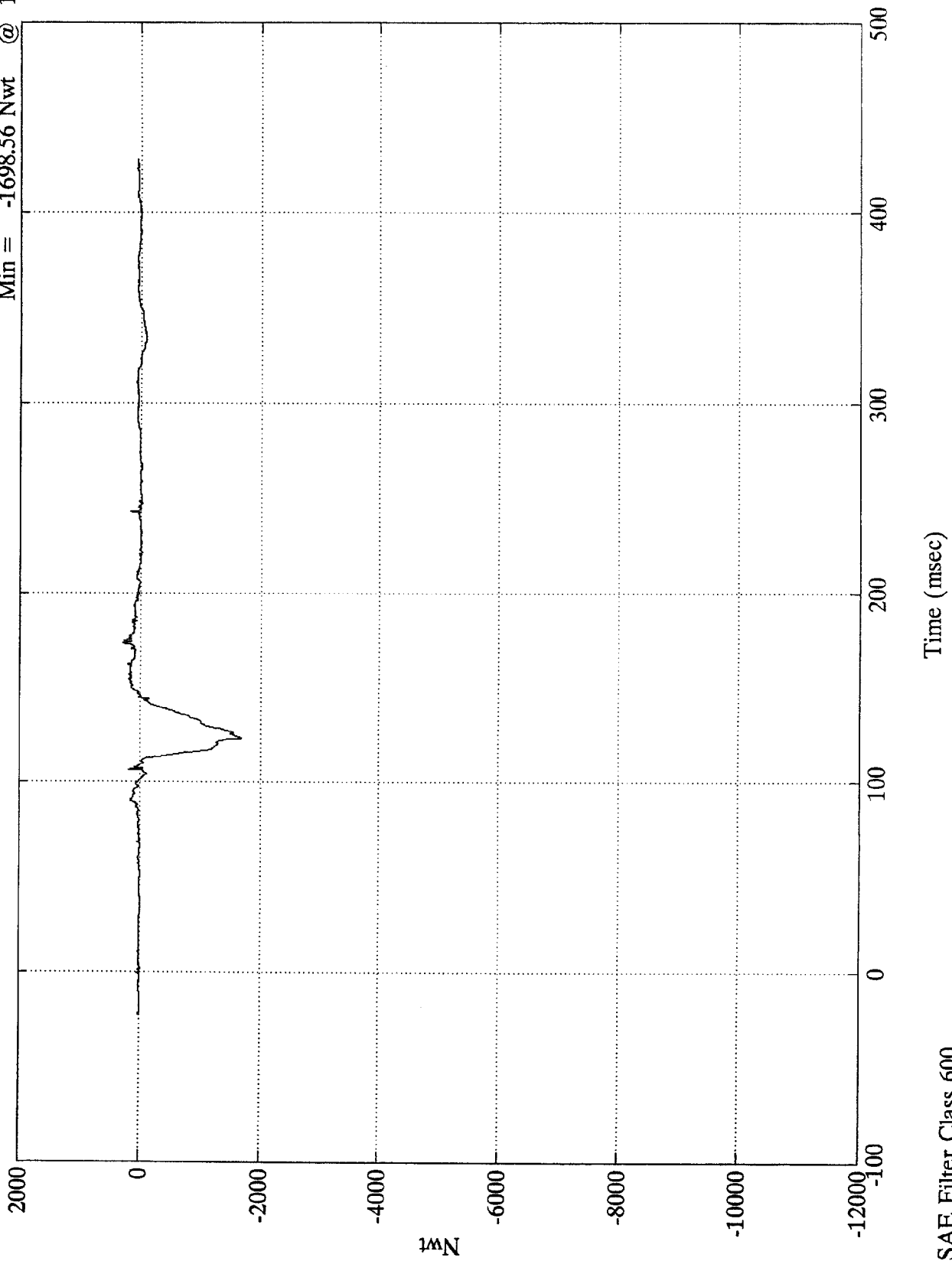


SAE Filter Class 180

VTV TEST #1

Max = 298.73 Nwt @ 174.00 msec
Min = -1698.56 Nwt @ 123.72 msec

P1 Left Femur

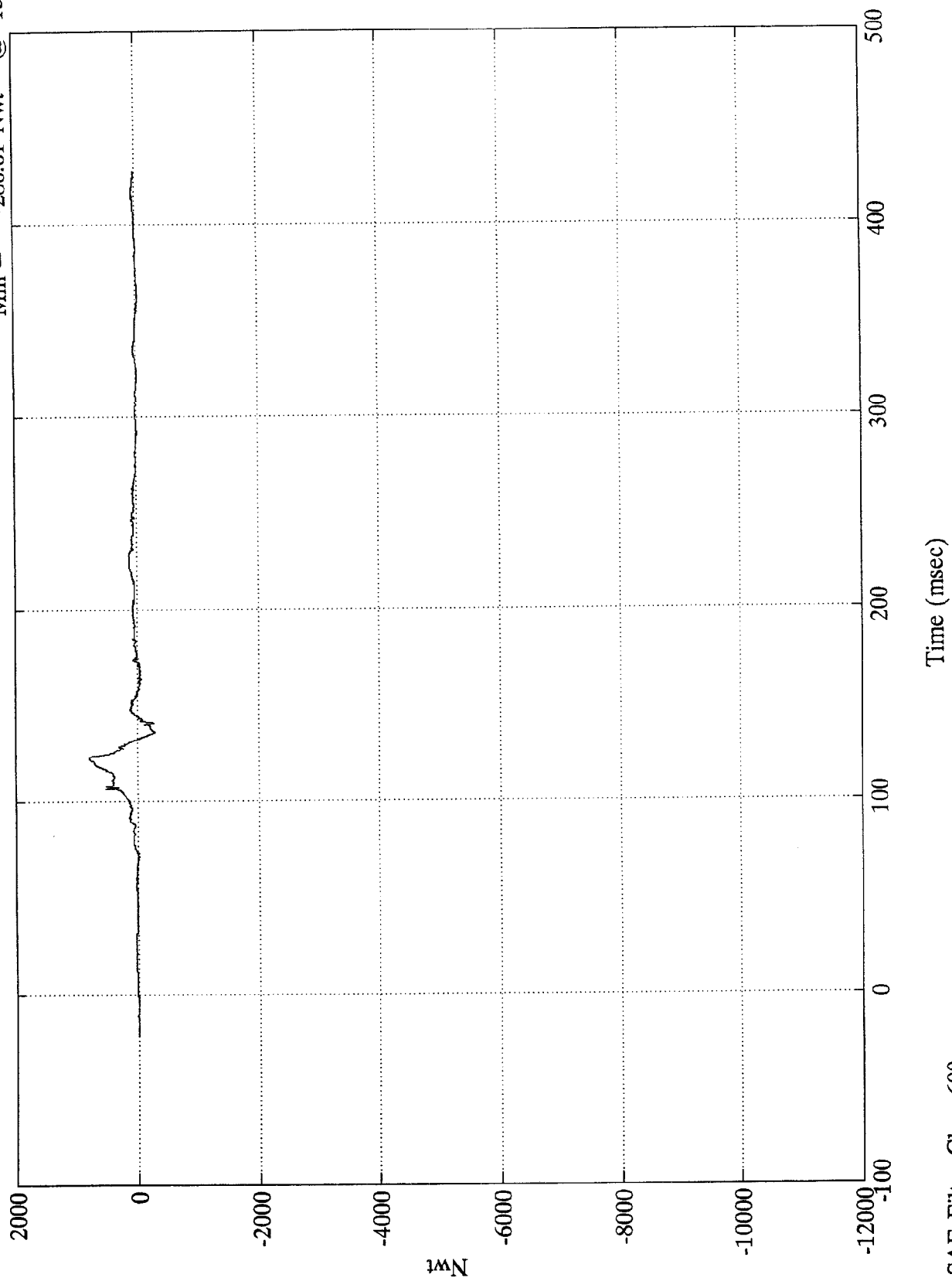


SAE Filter Class 600

VTV TEST #1

P1 Right Femur

Max = 791.09 Nwt @ 122.64 msec
Min = -280.61 Nwt @ 136.20 msec

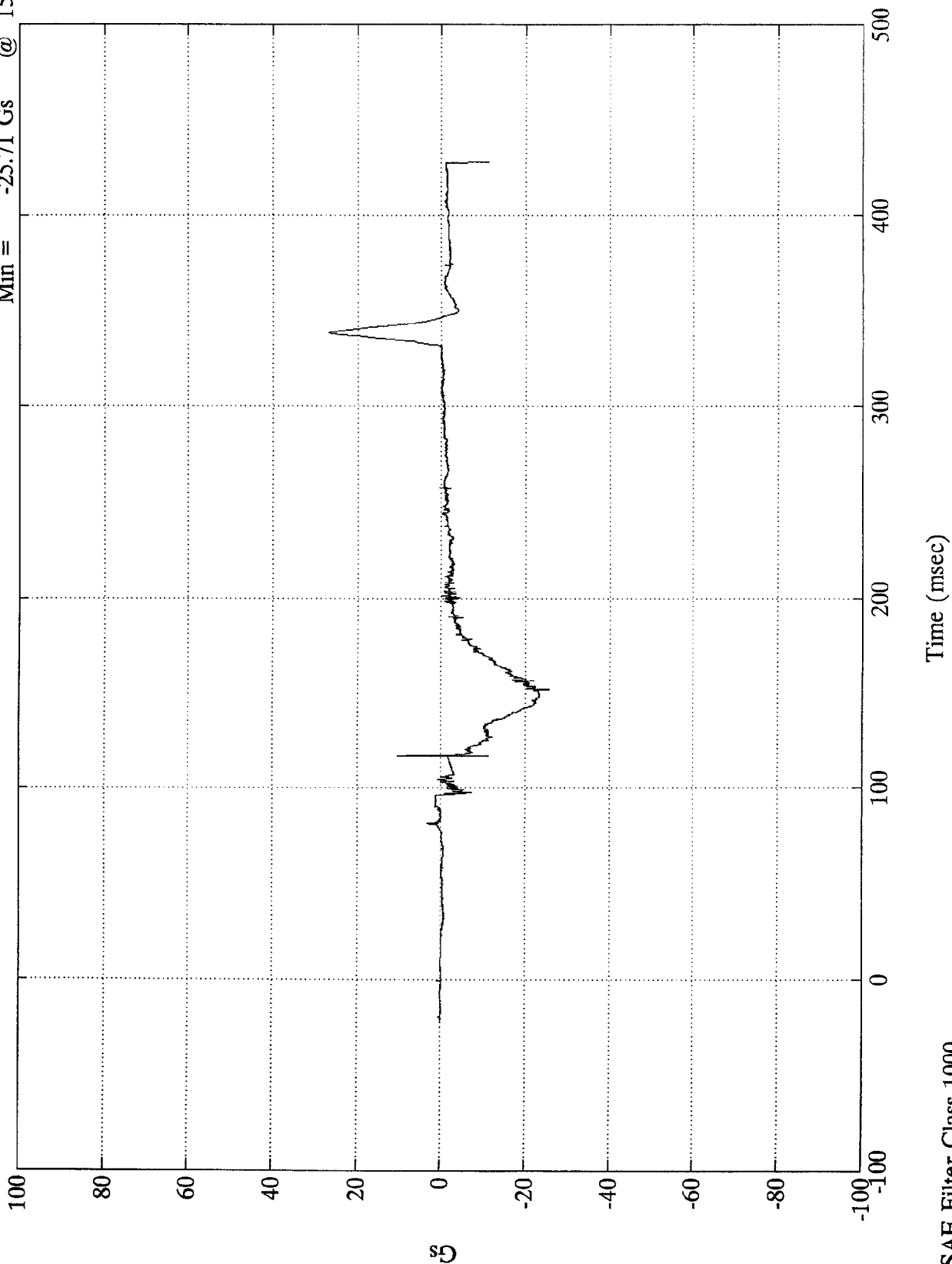


SAE Filter Class 600

VTV TEST #1

Max = 26.84 Gs @ 338.64 msec
Min = -25.71 Gs @ 152.40 msec

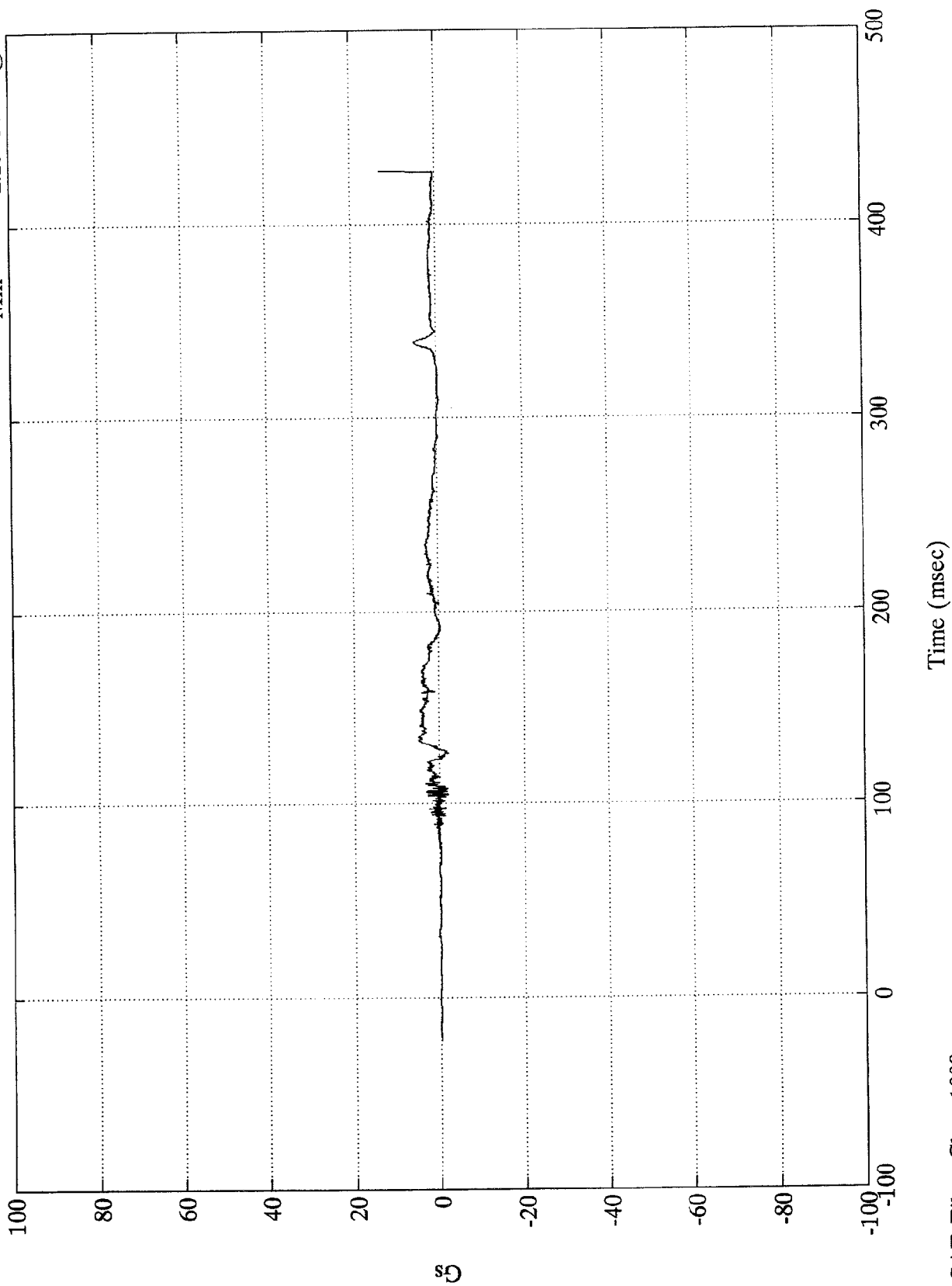
P2 Head X



SAE Filter Class 1000

VTV TEST #1

P2 Head Y
Max = 12.90 Gs @ 427.32 msec
Min = -2.13 Gs @ 126.47 msec

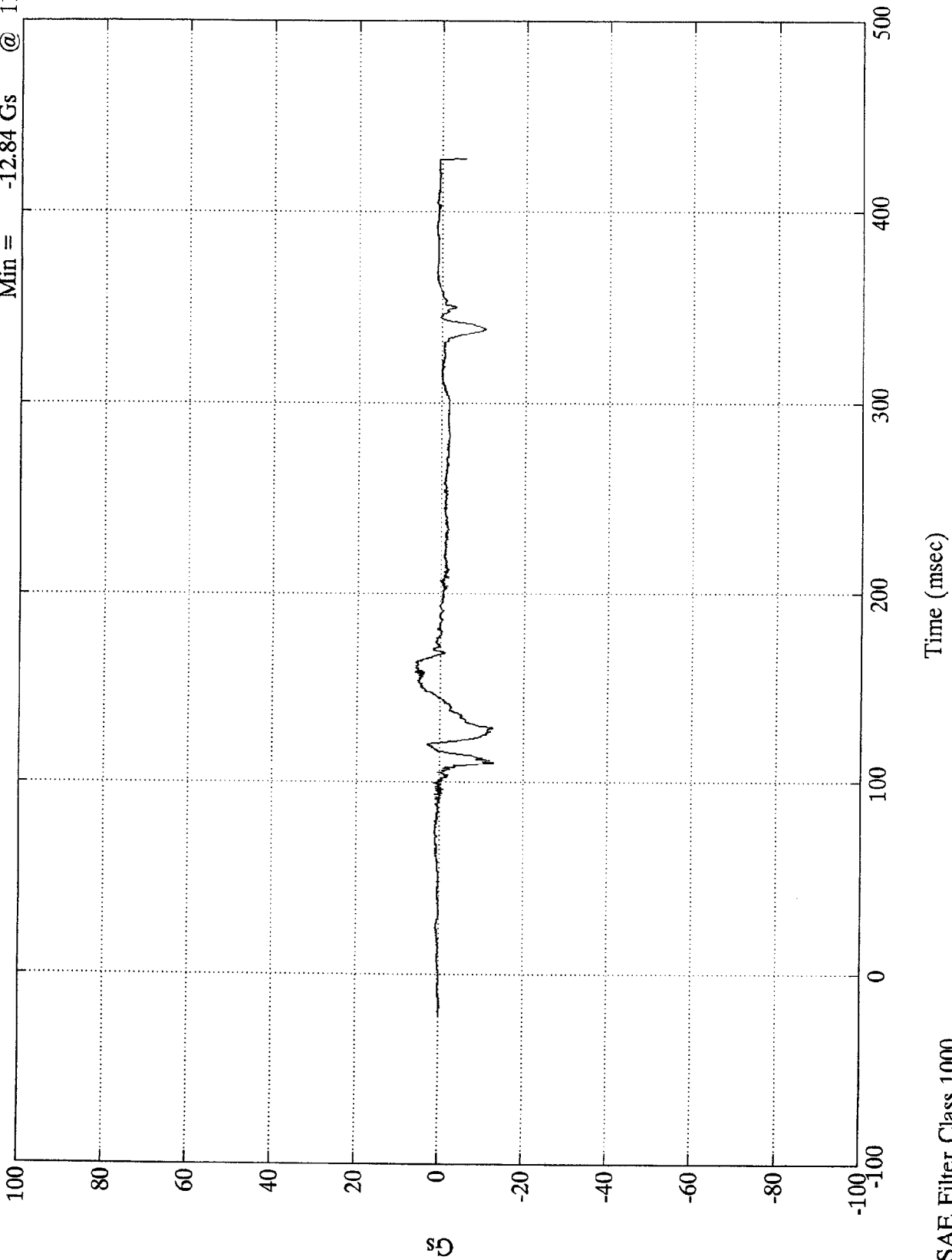


SAE Filter Class 1000

VTV TEST #1

Max = 6.13 Gs @ 158.64 msec
Min = -12.84 Gs @ 110.64 msec

P2 Head Z

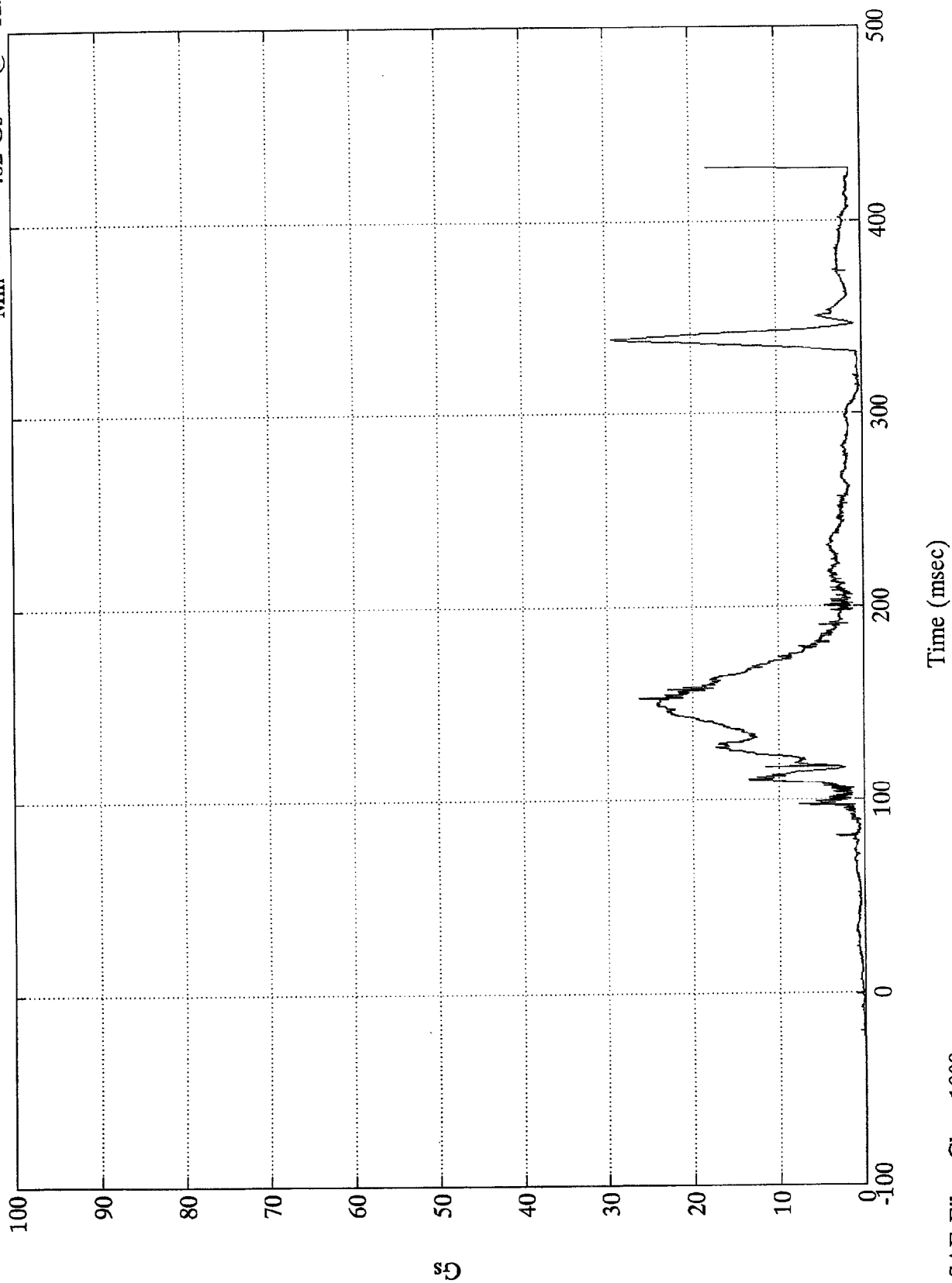


SAE Filter Class 1000

VTV TEST #1

Max = 29.27 Gs @ 338.52 msec
Min = .02 Gs @ -12.48 msec

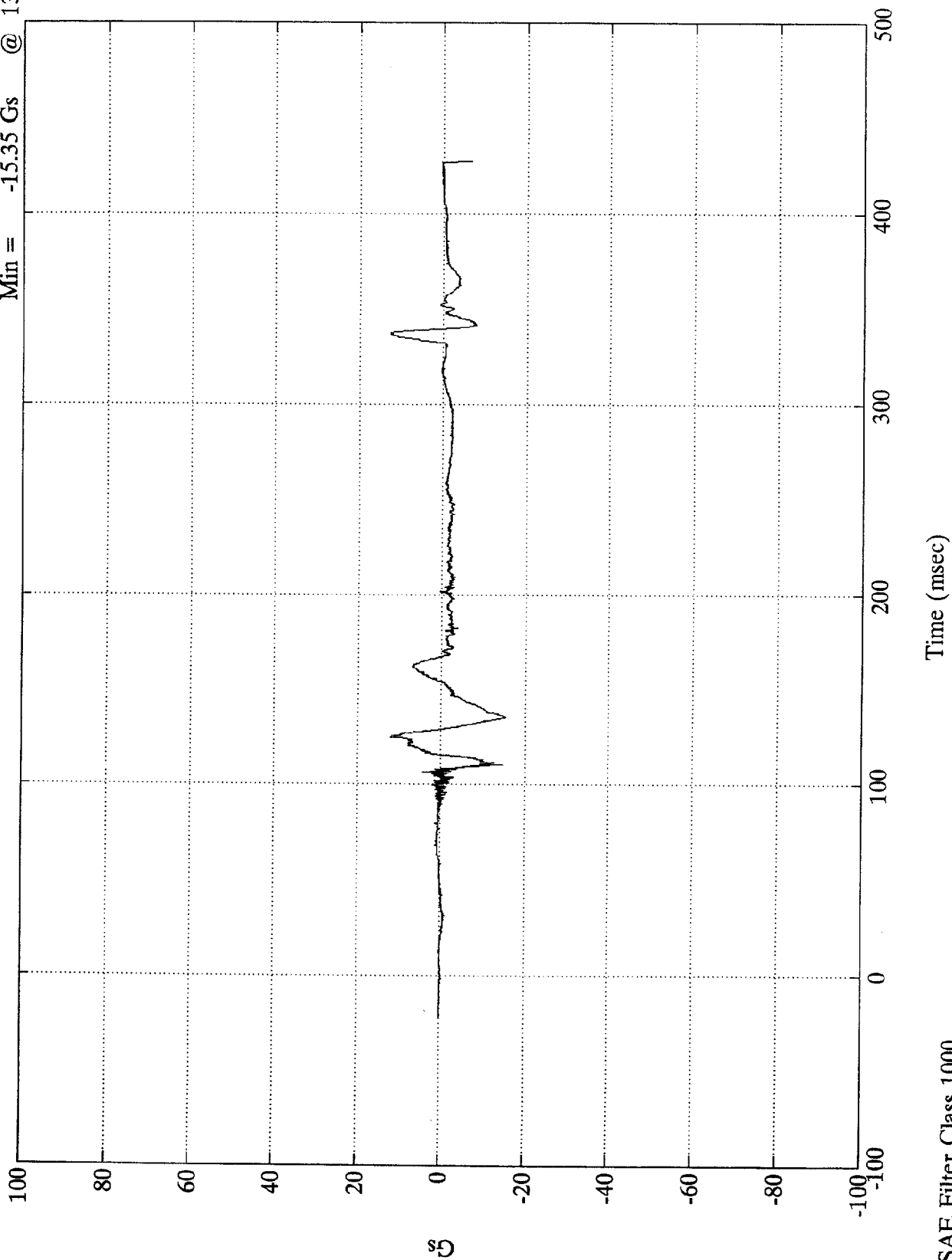
P2 Head Resultant



VTV TEST #1

Max = 12.50 Gs @ 337.55 msec
Min = -15.35 Gs @ 135.47 msec

P2 Head Z(R)

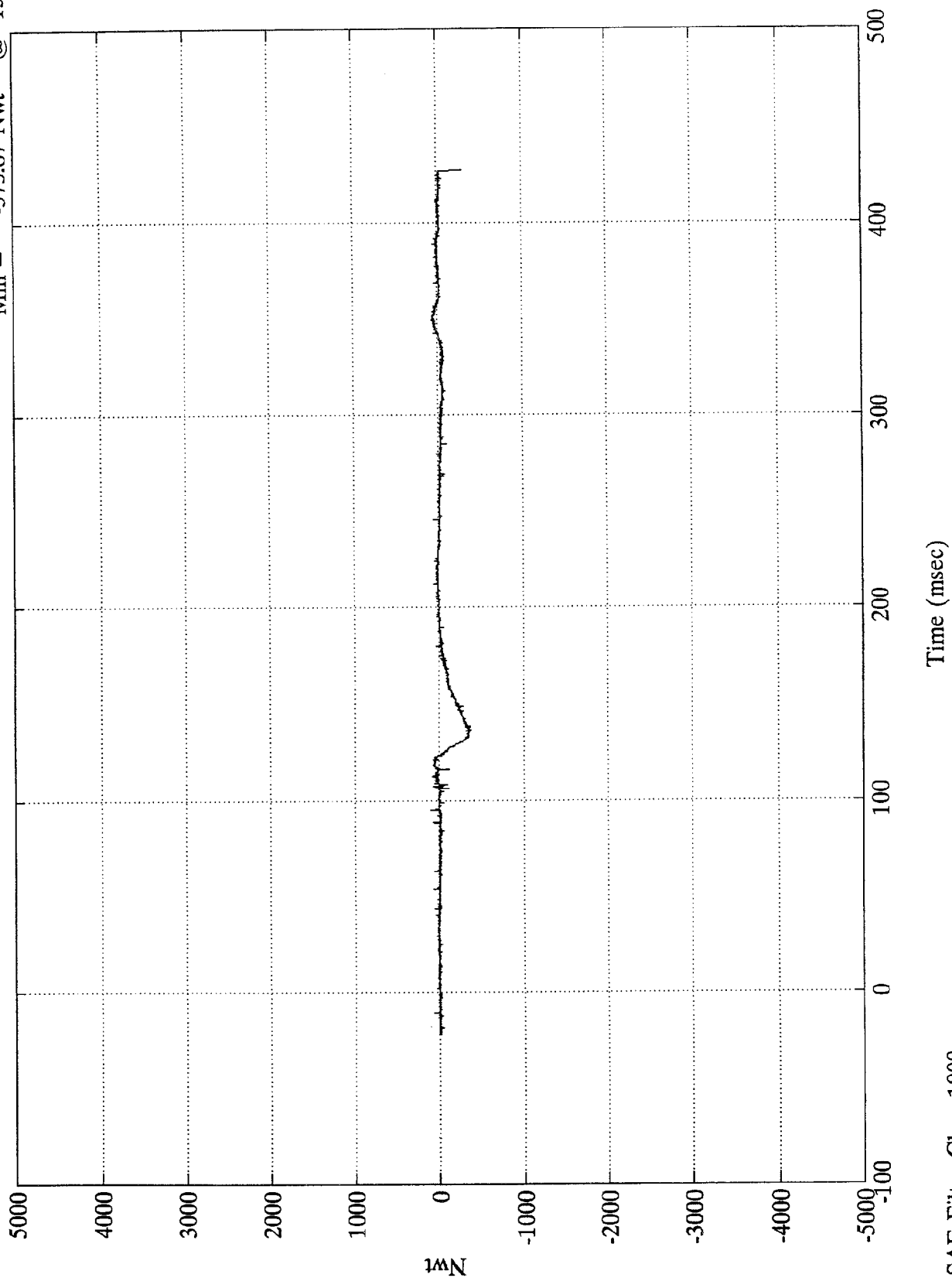


SAE Filter Class 1000

VTV TEST #1

P2 Upper Neck Fx

Max = 103.24 Nwt @ 95.52 msec
Min = -373.87 Nwt @ 136.80 msec

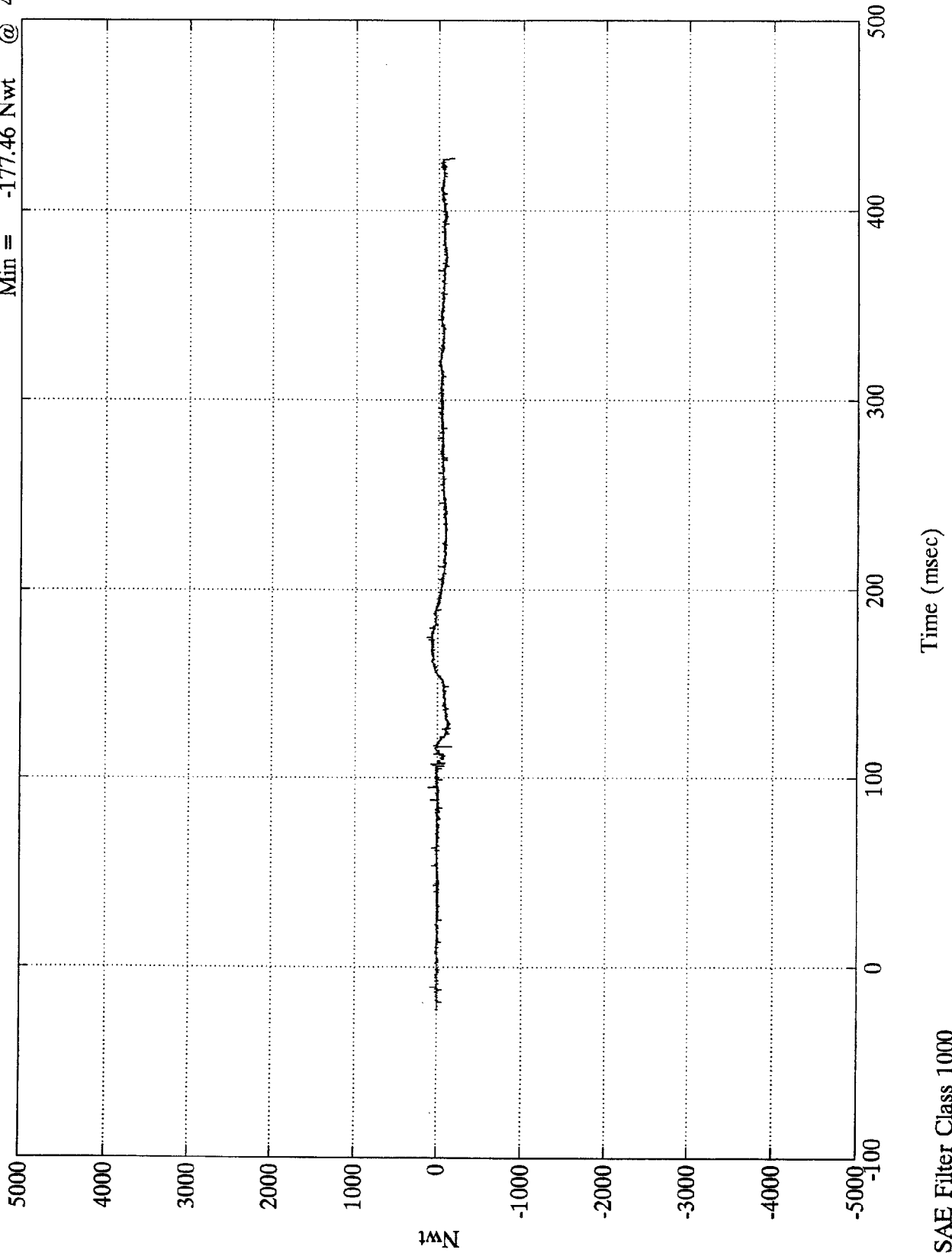


SAE Filter Class 1000

VTV TEST #1

P2 Upper Neck Fy

Max = 137.49 Nwt @ 174.96 msec
Min = -177.46 Nwt @ 427.32 msec

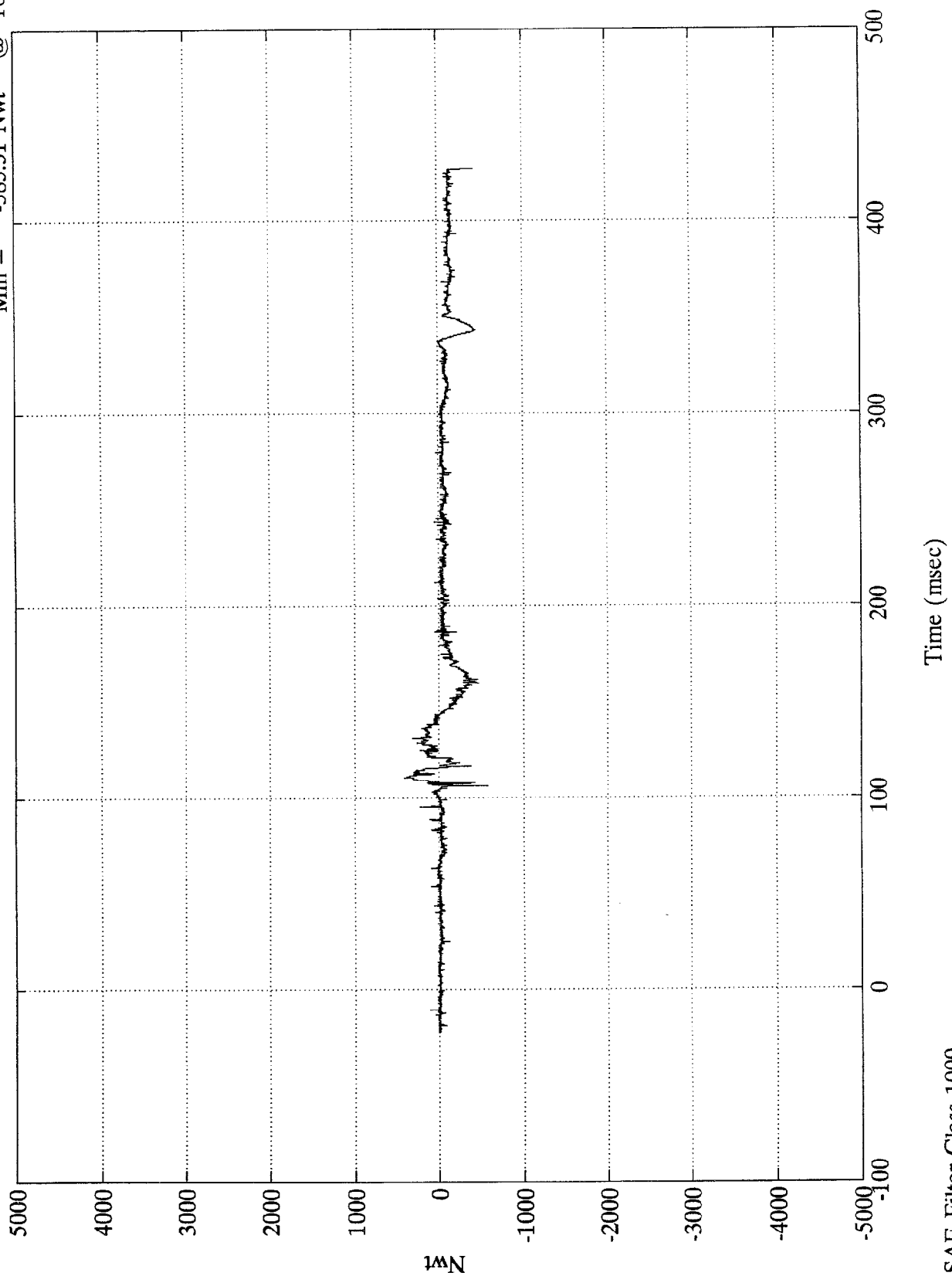


SAE Filter Class 1000

VTV TEST #1

P2 Upper Neck Fz

Max = 414.66 Nwt @ 110.88 msec
Min = -585.31 Nwt @ 106.56 msec

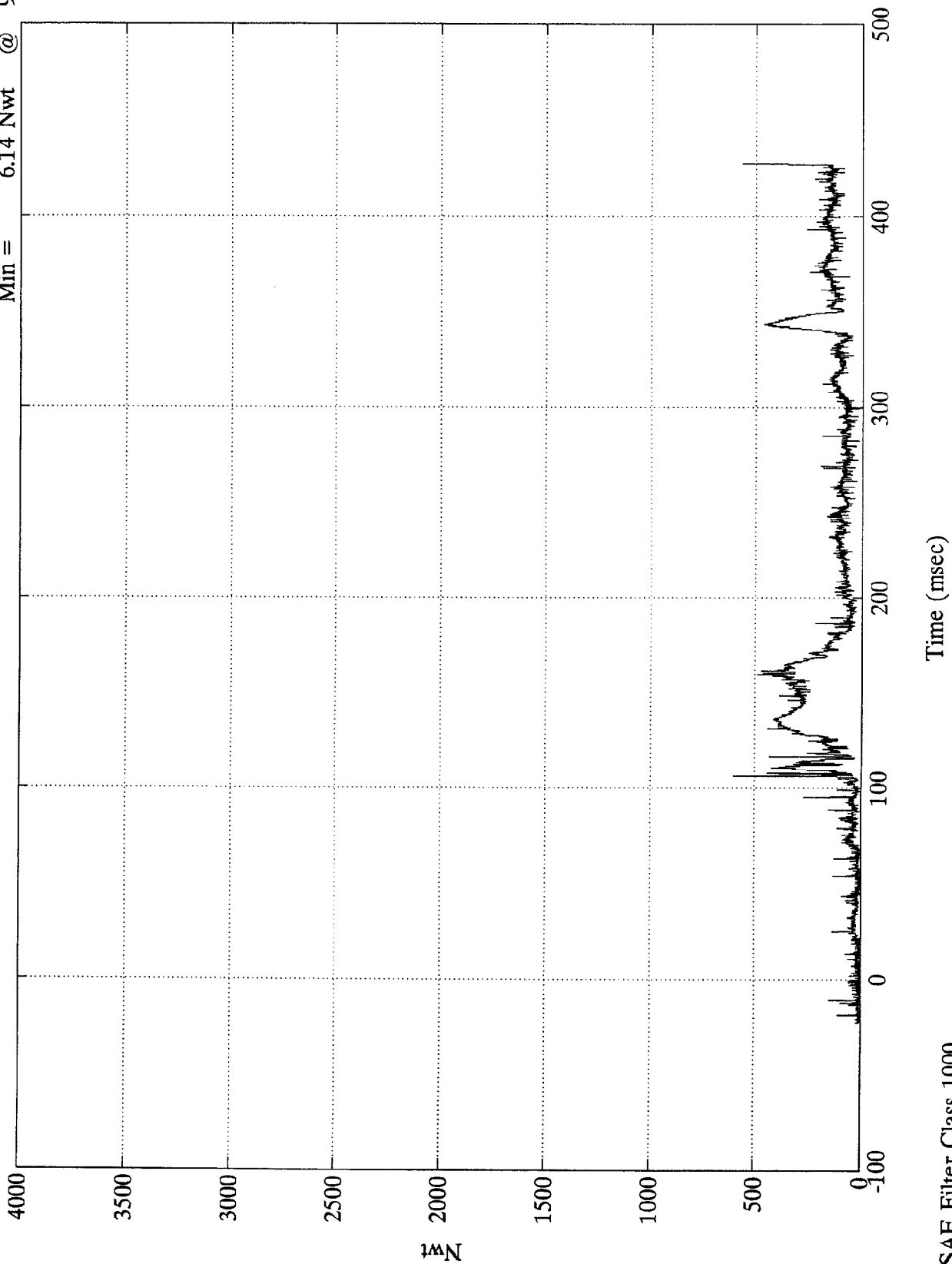


SAE Filter Class 1000

VTV TEST #1

P2 Upper Neck Force Res

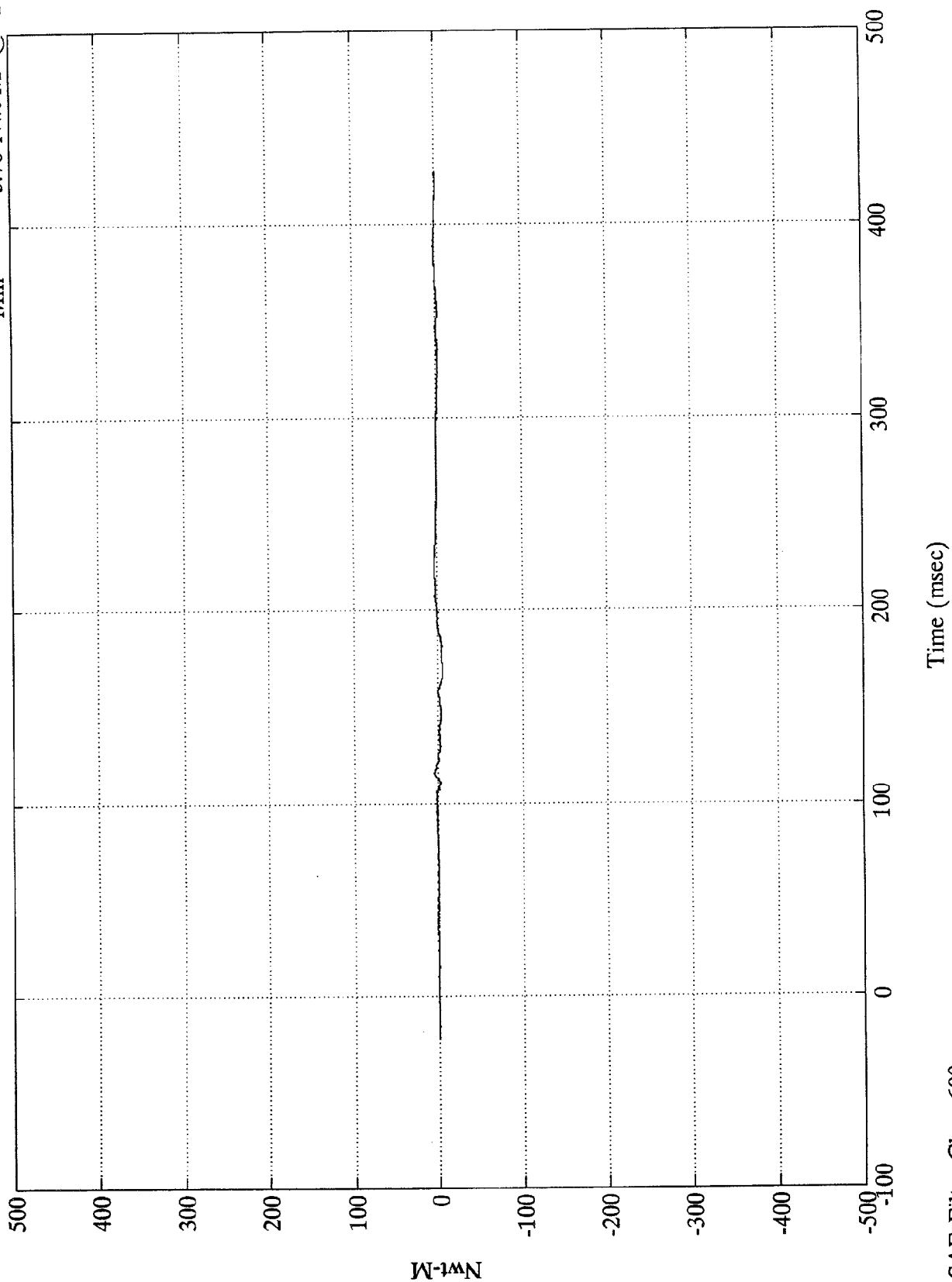
Max = 597.96 Nwt @ 106.56 msec
Min = 6.14 Nwt @ 98.52 msec



SAE Filter Class 1000

VTV TEST #1

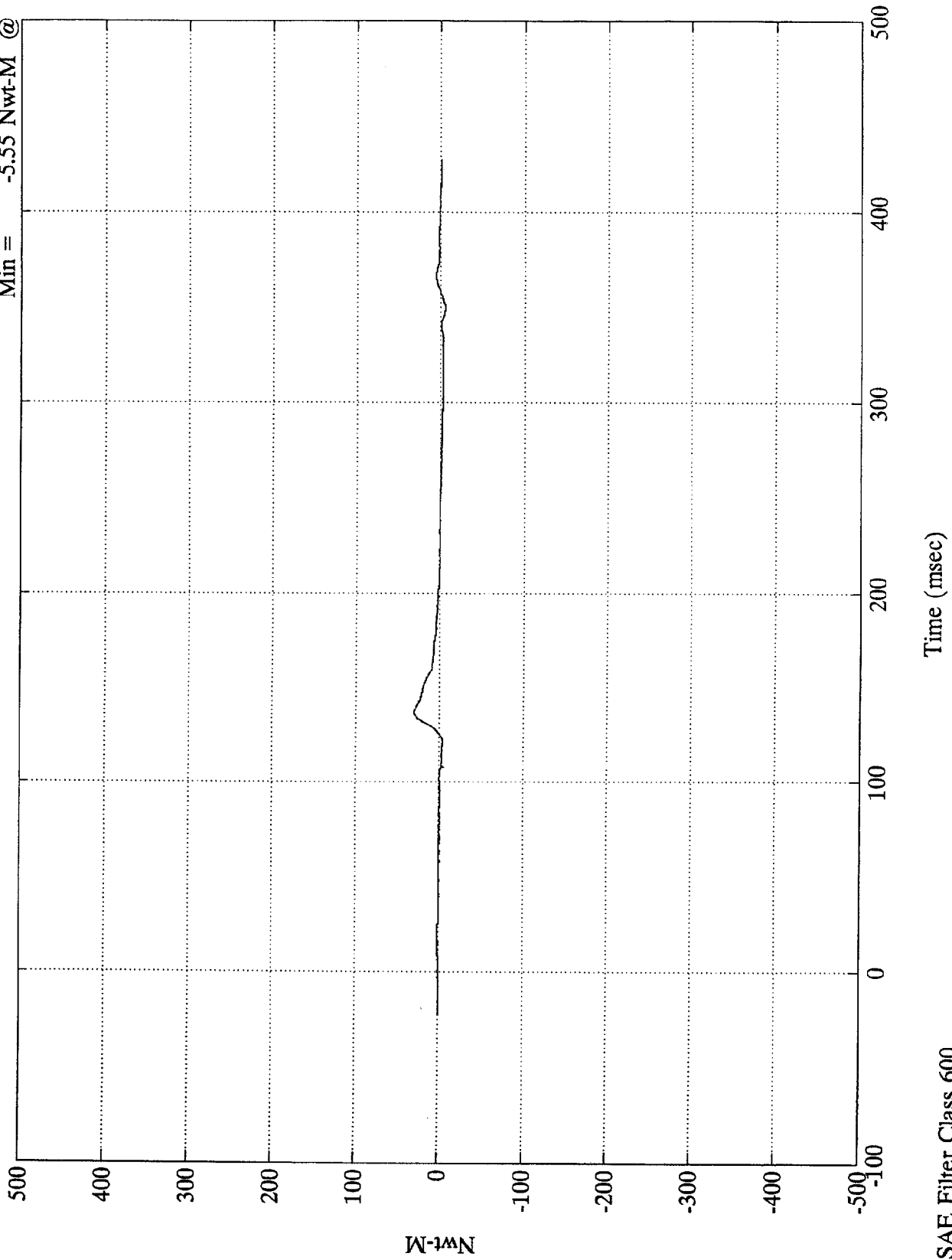
P2 Upper Neck Mx
Max = 4.76 Nwt-M @ 115.68 msec
Min = -5.70 Nwt-M @ 170.04 msec



SAE Filter Class 600

VTV TEST #1

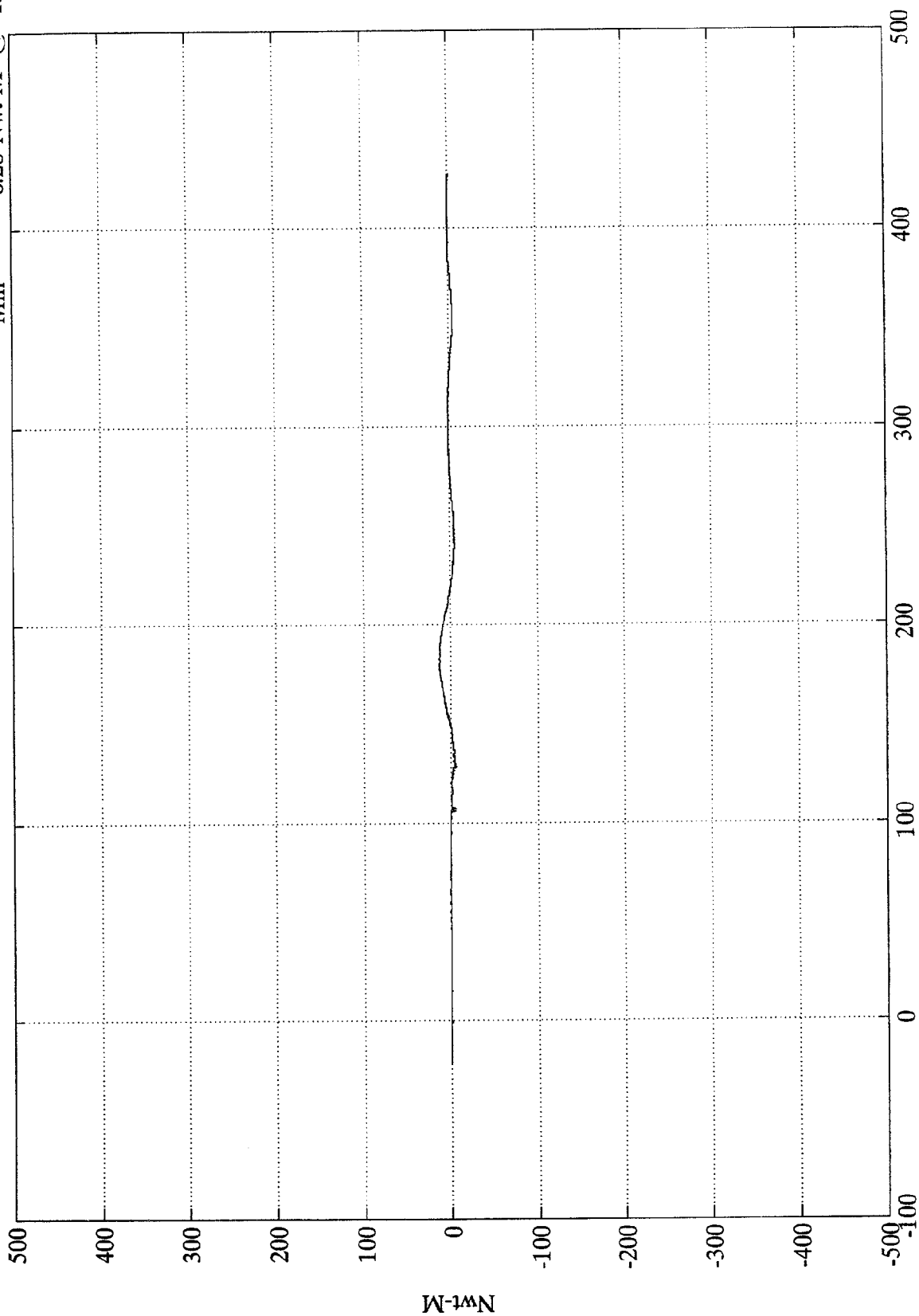
P2 Upper Neck My
Max = 30.41 Nwt-M @ 136.68 msec
Min = -5.55 Nwt-M @ 349.80 msec



VTV TEST #1

Max = 13.24 Nwt-M @ 177.84 msec
Min = -6.28 Nwt-M @ 128.76 msec

P2 Upper Neck Mz



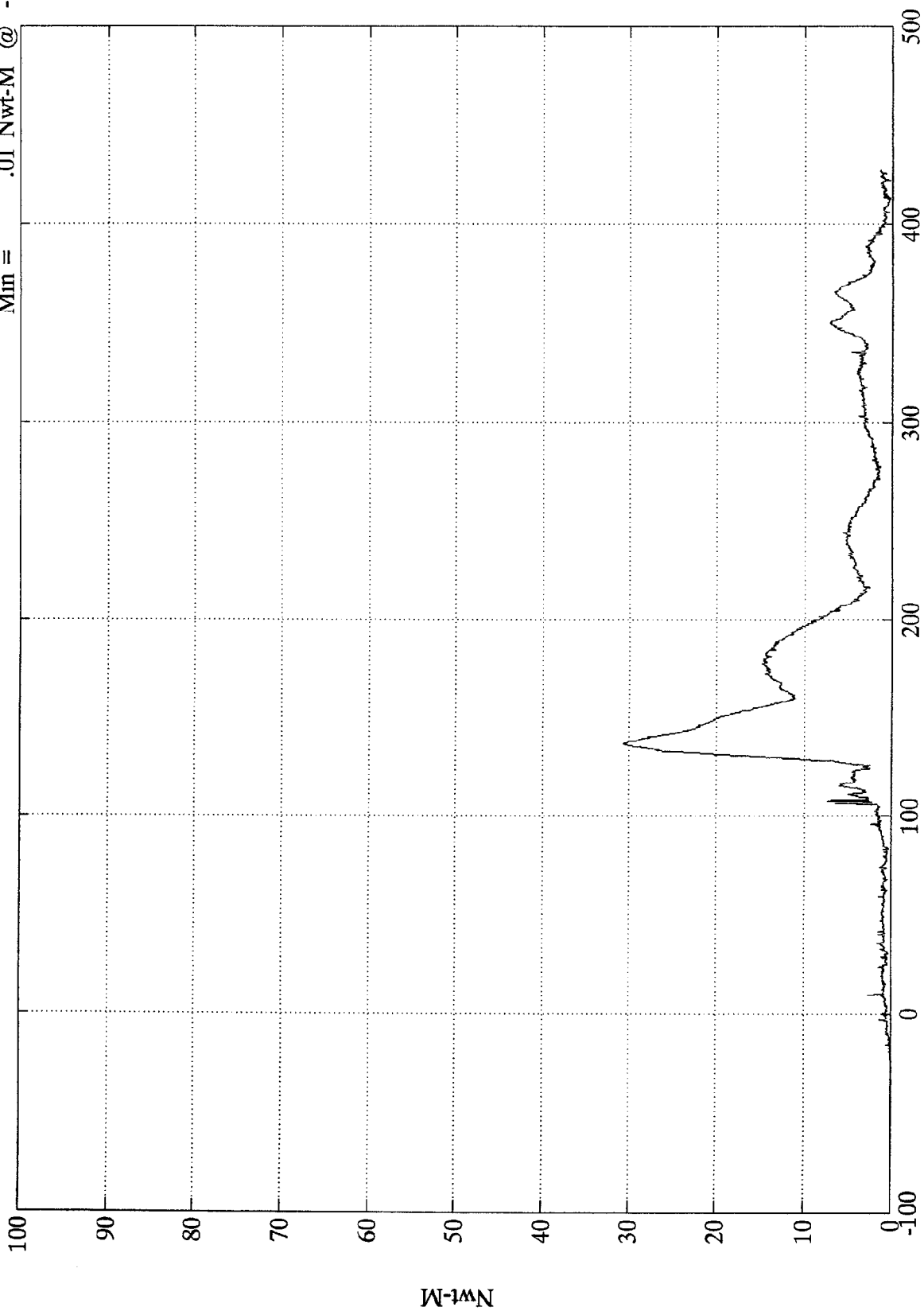
Time (msec)

SAE Filter Class 600

VTV TEST #1

P2 Upper Neck Moment Res

Max = 30.69 Nwt-M @ 136.68 msec
Min = .01 Nwt-M @ -20.04 msec



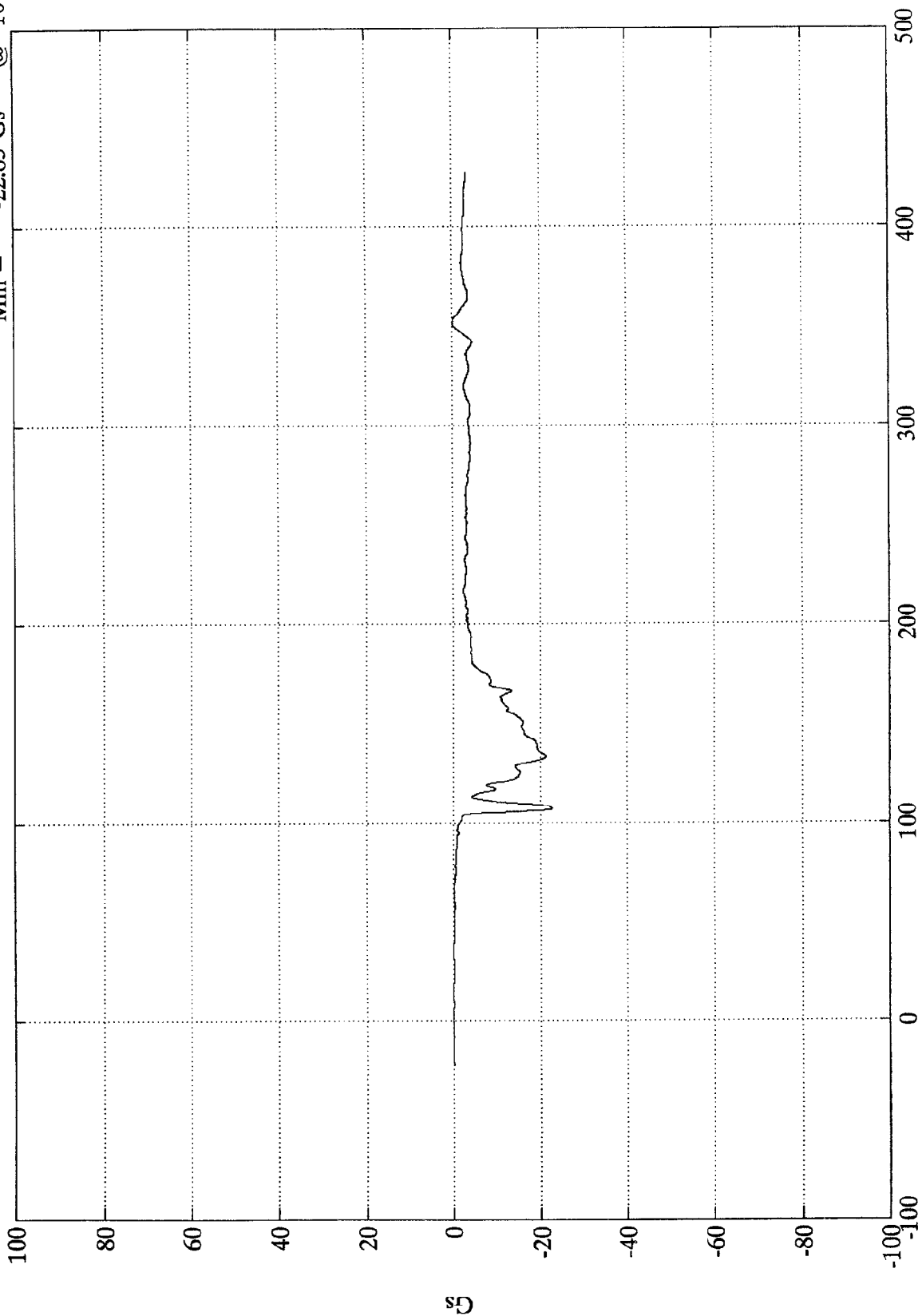
Time (msec)

SAE Filter Class 600

VTV TEST #1

Max = .13 Gs @ -1.32 msec
 Min = -22.83 Gs @ 107.40 msec

P2 Chest X



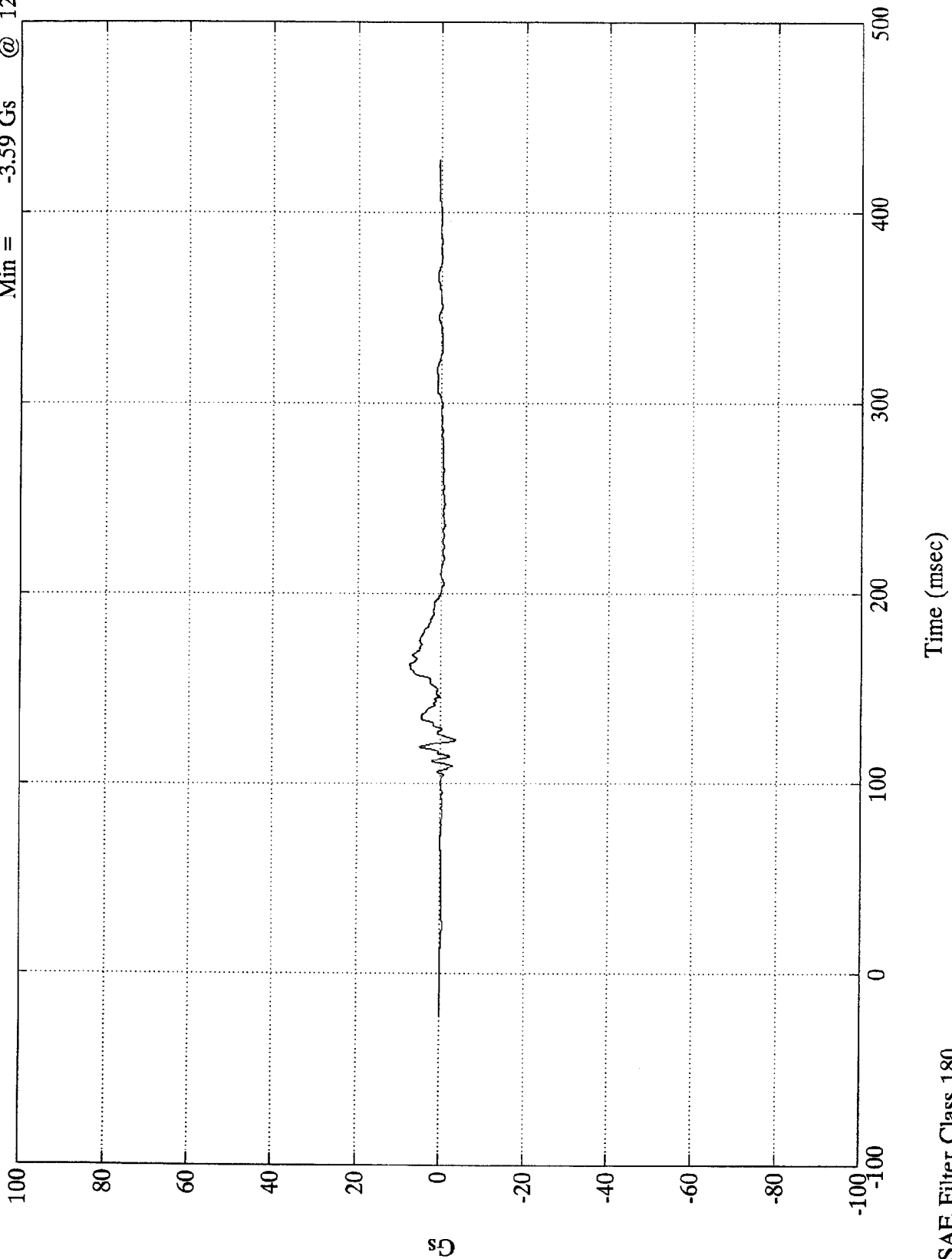
Time (msec)

SAE Filter Class 180

VTV TEST #1

Max = 7.39 Gs @ 162.60 msec
Min = -3.59 Gs @ 123.12 msec

P2 Chest Y

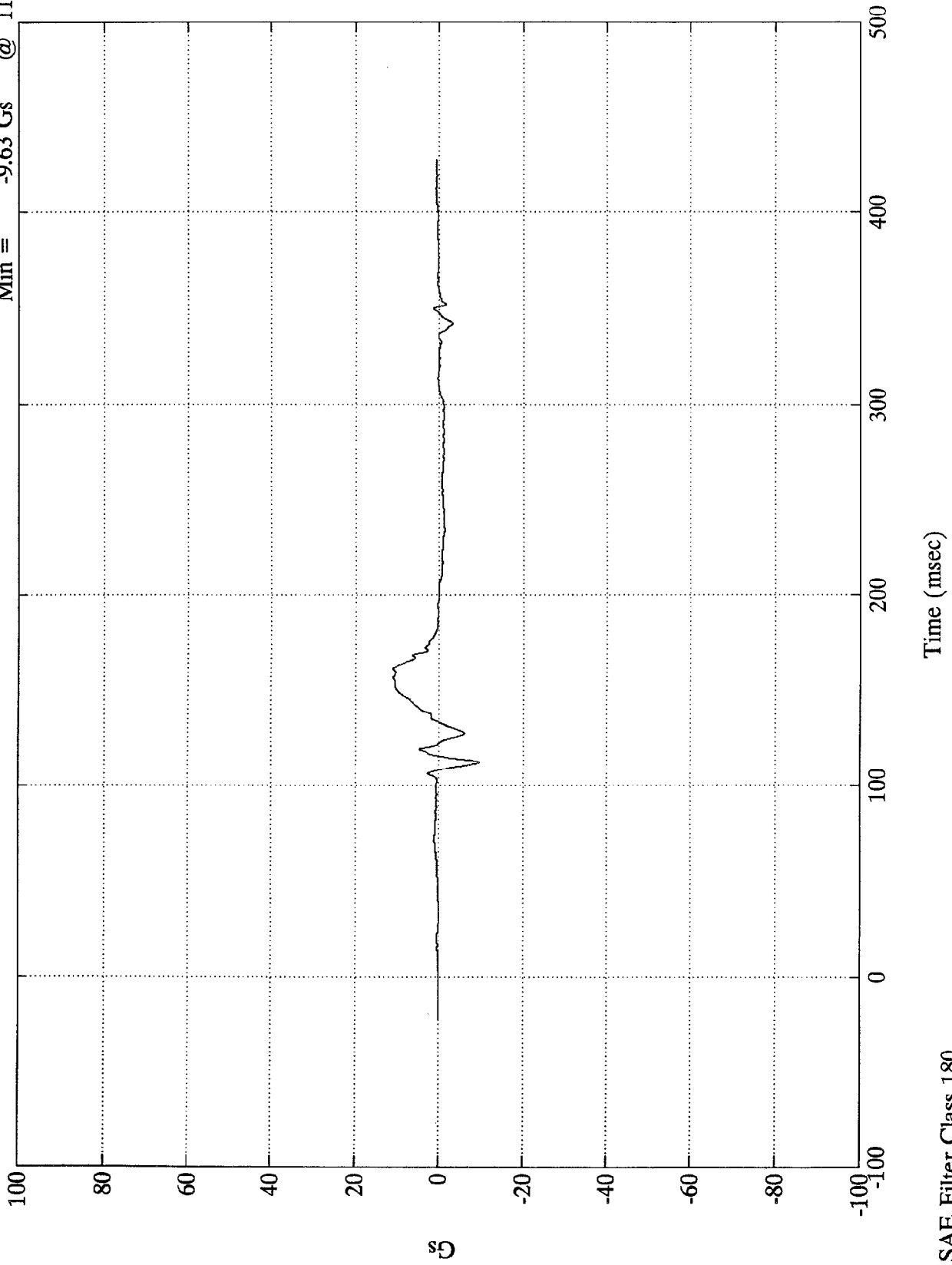


SAE Filter Class 180

VTV TEST #1

Max = 11.03 Gs @ 161.76 msec
Min = -9.63 Gs @ 112.56 msec

P2 Chest Z

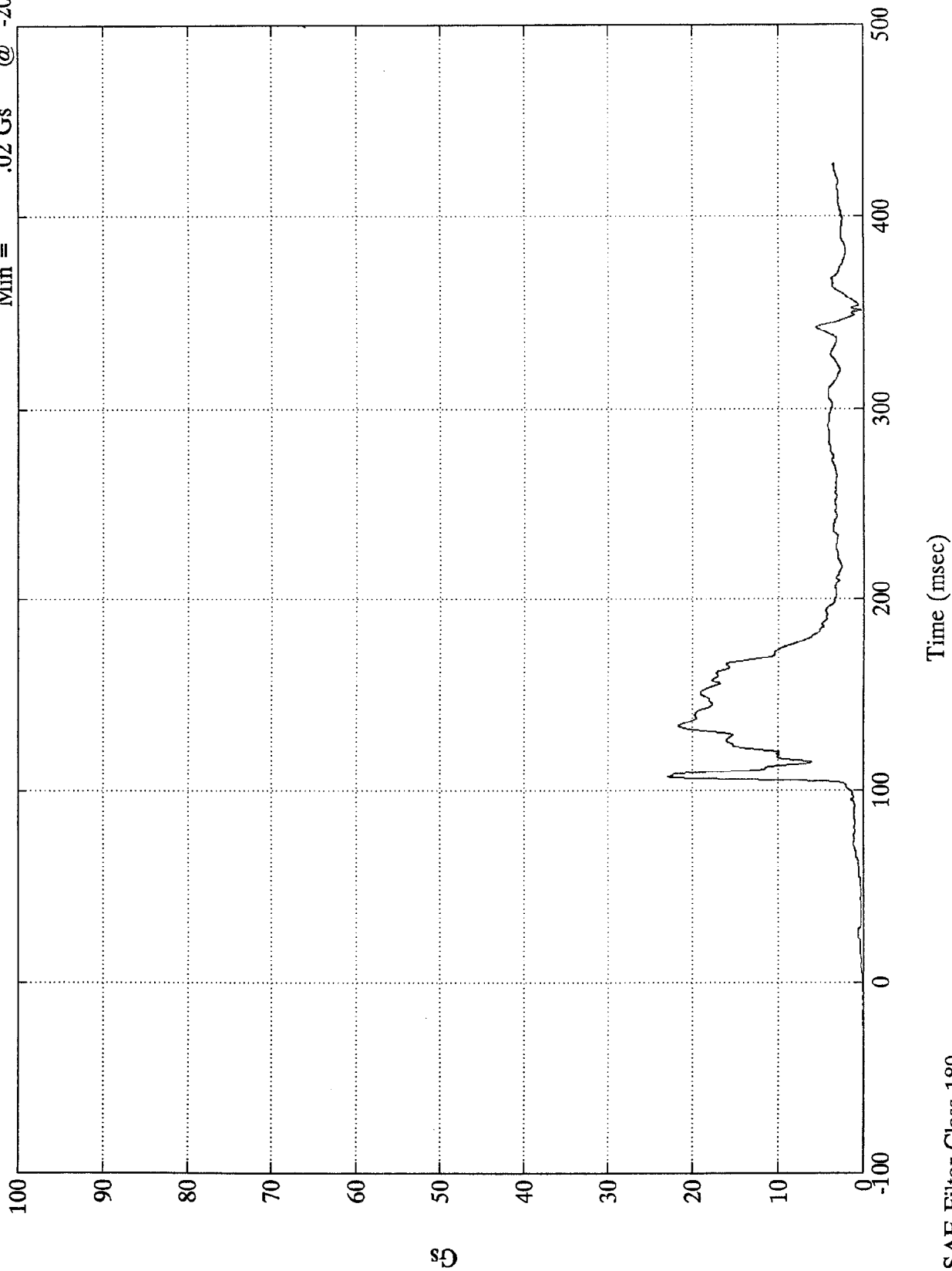


SAE Filter Class 180

VTV TEST #1

Max = 22.93 Gs @ 107.40 msec
 Min = .02 Gs @ -20.04 msec

P2 Chest Resultant

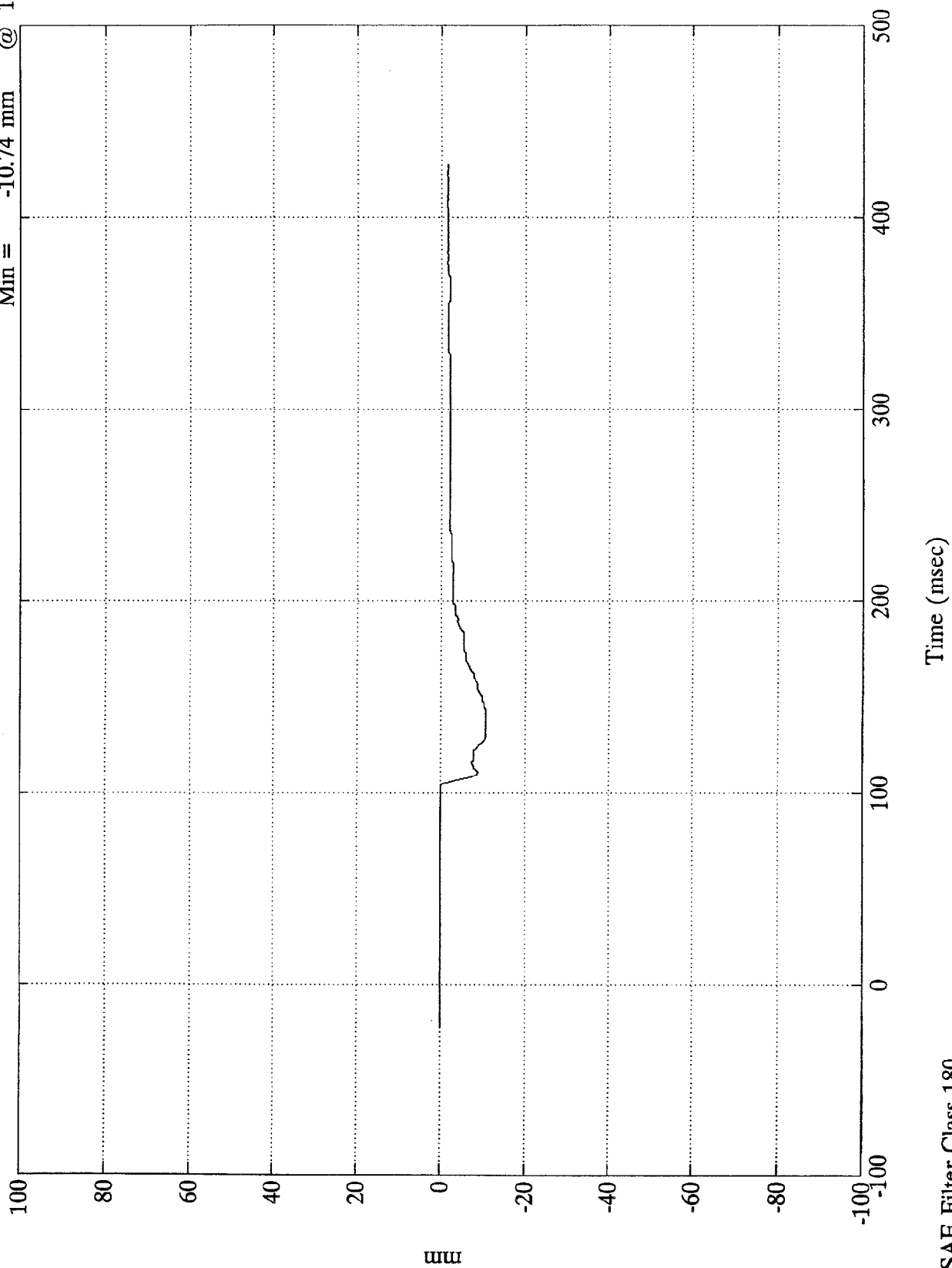


SAE Filter Class 180

VTV TEST #1

P2 Chest Displacement

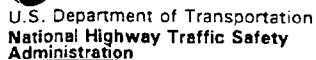
Max = .07 mm @ 103.68 msec
 Min = -10.74 mm @ 143.04 msec



SAE Filter Class 180

APPENDIX E

ACCIDENT RESEARCH DIVISION DATA



**NATIONAL ACCIDENT SAMPLING SYSTEM
CRASHWORTHINESS DATA SYSTEM**

VEHICLE IDENTIFICATION

Vehicle Make (specify): Plymouth Vehicle Model (specify): Grand Voyager

Locate the end of the damage with respect to the vehicle's damaged center point or bumper corner for end impacts or an undamaged axle for side impacts.

CRUSH PROFILE IN CENTIMETERS

Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

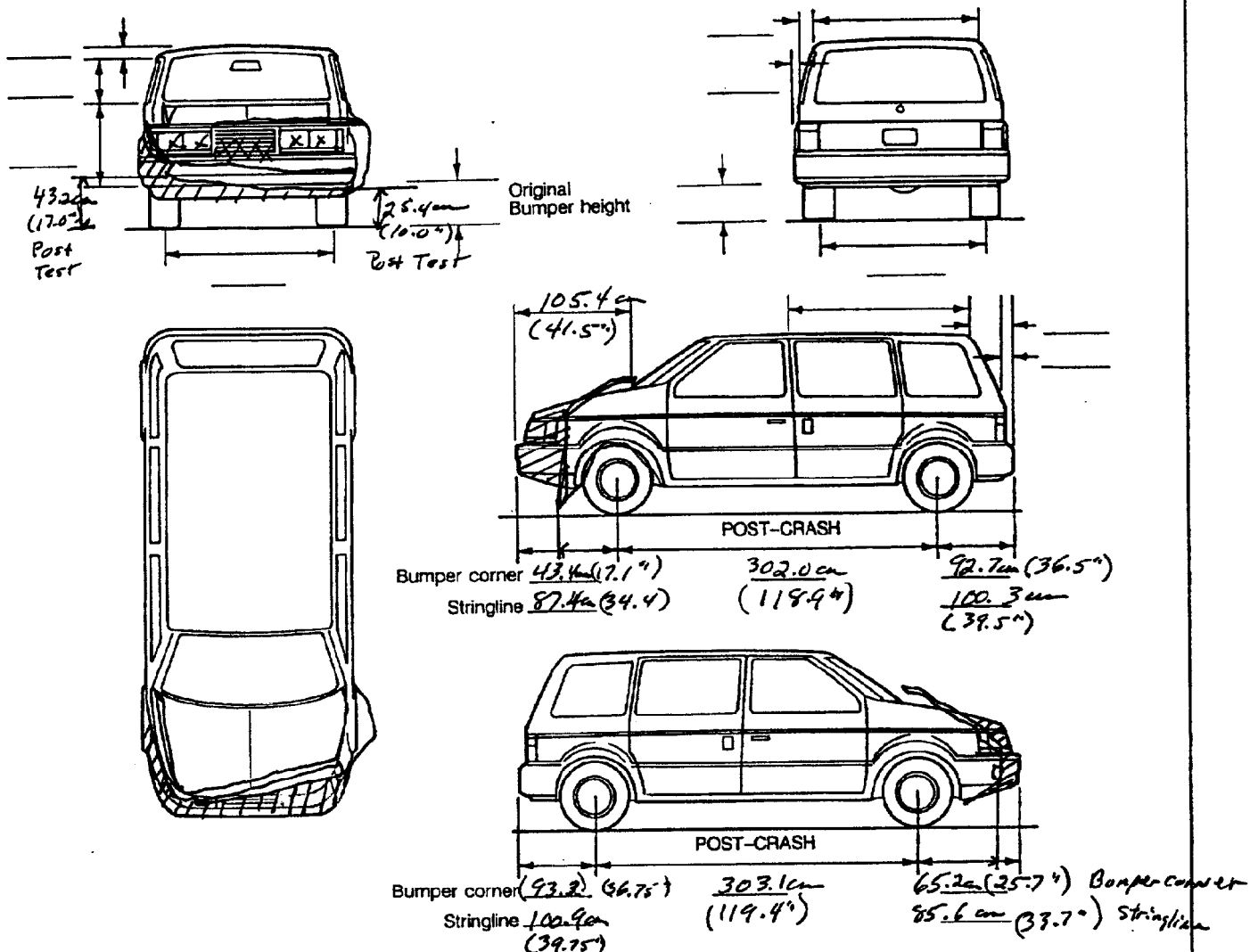
Use as many lines/columns as necessary to describe each damage profile.

HS Form 435A (Rev. 1/96)

VEHICLE DAMAGE SKETCH

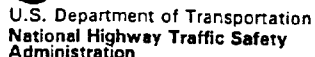
TIRE—WHEEL DAMAGE a. Rotation physically restricted RF <u>2</u> LF <u>2</u> RR <u>2</u> LR <u>2</u> (1) Yes (2) No (8) NA (9) Unk.		b. Tire deflated RF <u>2</u> LF <u>2</u> RR <u>2</u> LR <u>2</u>		ORIGINAL SPECIFICATIONS Wheelbase <u>(119.3") 303.0</u> cm Overall Length <u>(192.8") 489.7</u> cm Maximum Width <u>(72.0") 182.9</u> cm Curb Weight <u>(3660) 1,660</u> kg Average Track _____ cm Front Overhang <u>(33.9") 86.1</u> cm Rear Overhang <u>(39.6") 100.6</u> cm Undeformed End Width <u>(60.0") 152.4</u> cm Engine Size: cyl./displ. _____ L	WHEEL STEER ANGLES (For locked front wheels or displaced rear axles only) RF ± <u>NA</u> ° LF ± _____ ° RR ± _____ ° LR ± _____ ° Within ± 5 degrees
TYPE OF TRANSMISSION ☐ Manual ☒ Automatic END SHIFT ≥ 10 CM ☐ Yes ☒ No				DRIVE WHEELS ☒ FWD ☐ RWD ☐ 4WD Approximate Cargo Weight _____ kg	

MEASUREMENTS IN CENTIMETERS



NOTES: Sketch new perimeter and cross hatch direct damage and single hatch induced damage on all views. Annotate observations which might be useful in reconstructing the accident (e.g., grass in tire head, direction of striations, scuff on sidewalls, etc.). If pulling trailer, sketch type of trailer and damage received on the back of this page.

Annotate any damage caused by extrication such as component removal by torching, prying, or hydraulic shears.



**NATIONAL ACCIDENT SAMPLING SYSTEM
CRASHWORTHINESS DATA SYSTEM**

VEHICLE IDENTIFICATION

Vehicle Make (specify): Chevrolet Vehicle Model (specify): Lumina MPV
(20,071 m.p.g.)

Locate the end of the damage with respect to the vehicle's damaged center point or bumper corner for end impacts or an undamaged axle for side impacts.

CRUSH PROFILE IN CENTIMETERS

Free space value is defined as the distance between the baseline and the original body contour taken at the individual C locations. This may include the following: bumper lead, bumper taper, side protrusion, side taper, etc. Record the value for each C-measurement and maximum crush.

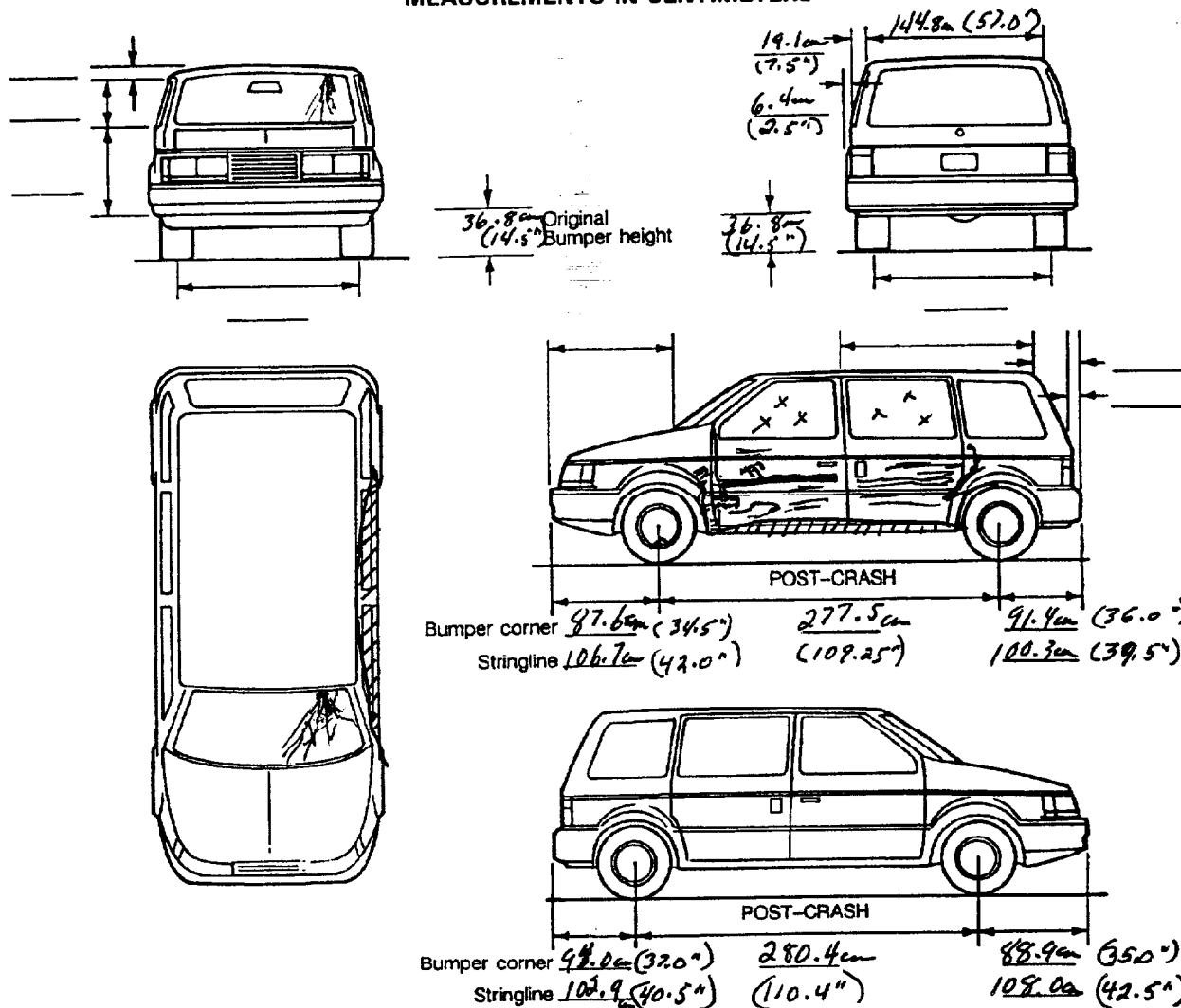
Use as many lines/columns as necessary to describe each damage profile.

HS Form 435A (Rev. 1/96)

VEHICLE DAMAGE SKETCH

TIRE—WHEEL DAMAGE a. Rotation physically restricted RF <u>2</u> LF <u>2</u> RR <u>2</u> LR <u>2</u> (1) Yes (2) No (8) NA (9) Unk.		b. Tire deflated RF <u>2</u> LF <u>2</u> RR <u>2</u> LR <u>2</u>		ORIGINAL SPECIFICATIONS Wheelbase <u>(109.8") 278.9</u> cm Overall Length <u>(191.5") 486.4</u> cm Maximum Width <u>(73.9") 187.7</u> cm Curb Weight <u>(3558) 1,750</u> kg Average Track <u>—</u> cm Front Overhang <u>(41.2") 104.6</u> cm Rear Overhang <u>(40.5") 102.9</u> cm Undeformed End Width <u>—</u> cm Engine Size: cyl./displ. <u>3.8</u> L		WHEEL STEER ANGLES (For locked front wheels or displaced rear axles only) RF ± <u>—</u> ° LF ± <u>—</u> ° RR ± <u>—</u> ° LR ± <u>—</u> ° Within ± 5 degrees	
TYPE OF TRANSMISSION ☐ Manual ☒ Automatic END SHIFT ≥ 10 CM ☐ Yes ☒ No				DRIVE WHEELS ☒ FWD ☐ RWD ☐ 4WD Approximate Cargo Weight <u>—</u> kg			

MEASUREMENTS IN CENTIMETERS



NOTES: Sketch new perimeter and cross hatch direct damage and single hatch induced damage on all views. Annotate observations which might be useful in reconstructing the accident (e.g., grass in tire bead, direction of striations, scuff on sidewalls, etc.). If pulling trailer, sketch type of trailer and damage received on the back of this page.

Annotate any damage caused by extrication such as component removal by torching, prying, or hydraulic shears.