

DOT 268
1 of 2 Pages

NEW VEHICLE
ASSESSMENT TESTING

FUJI HEAVY INDUSTRIES, LTD.
1980 SUBARU GLF
NHTSA 800569

Prepared by:

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NOVEMBER 1980

FINAL REPORT

Prepared for:

U.S. DEPARTMENT OF TRANSPORTATION
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Date

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Contract Technical Manager
Office of Vehicle Safety Compliance

Date

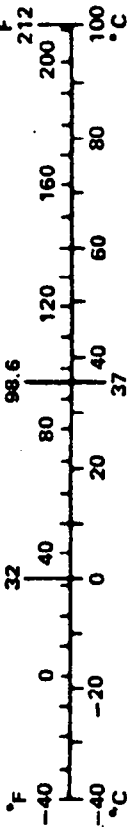
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16. Abstract A 1980 Subaru GLF was crash tested to see if it meets the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 212 "Windshield Mounting," 219, "Windshield Zone Intrusion," and 301-75, "Fuel System Integrity." The vehicle and the Part 572 dummies occupying the front seats were instrumented to acquire research data for comparison with the performance of this vehicle in a test previously conducted at 35 $\pm$0.5 mph. The front of the test vehicle impacted the fixed collision barrier at a speed of 29.47 mph. The test was conducted at the Dynamic Science, Inc. Deer Valley facility on October 22, 1980.					
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	metric ton	t
VOLUME				
tsp	teaspoons	5	milliliters	mL
Tbsp	tablespoons	15	milliliters	mL
in ³	cubic inches	16	milliliters	mL
fl oz	fluid ounces	30	milliliters	mL
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.8	liters	L
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius	°C



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares (10 000 m ²)	2.5	acres	
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton (1000 kg)	1.1	short tons	
VOLUME				
mL	milliliters	0.03	fluid ounces	fl oz
mL	milliliters	0.06	cubic inches	in ³
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F

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SECTION 1
PURPOSE AND INTRODUCTION

PURPOSE

The purpose of the test was to determine if the 1980 Subaru GLF meets the requirements of Federal Motor Vehicle Safety Standards (FMVSS) 212 "Windshield Mounting," 219, "Windshield Zone Intrusion," and 301-75, "Fuel System Integrity." The test was conducted as specified in DOT Test Plan TP-212-02, dated April 1, 1980 except that the impact speed was held to 29.4 ± 0.5 mph.

The vehicle and Part 572 dummies were instrumented to acquire research data for comparison with the performance of this vehicle in a test previously conducted at 35 ± 0.5 mph. This earlier test was conducted on June 3, 1980 and the results were reported in Dynamic Science Report No. 3102-80-122.

This report contains vehicle and dummy performance data only. All compliance related data are reported in separate volumes.

INTRODUCTION

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains test data on the vehicle and anthropomorphic dummies. Appendix A contains pre-test and post-test vehicle and dummy photographs. Appendix B contains Calcomp plots. Appendix C contains dummy certification data.

SECTION 2
GENERAL TEST AND VEHICLE PARAMETER DATA

The following data sheets and photographs describe the General Test and Vehicle Parameter Data.

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Vehicle Manufacturer: Fuji Heavy Industries, Ltd.
 Make/Model: Subaru GLF
 Body Style: 4-Door Sedan Model Year: 1980
 VIN: JF17AB21FAG213264 Build Date: 7-80
 NHTSA No.: 800569 Color: Blue
 Engine Data: 4 cylinders; 97 in.³/displacement
 Transmission Data: 5 speed (x) Manual () Automatic
 Date Vehicle Received by Laboratory: September 15, 1980
 Dealer Name & Address: Mecham Pontiac/Subaru
P.O. Box 920, Glendale, Arizona

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR B-POST:

Vehicle Manufactured By: Fuji Heavy Industries, Ltd.
 Date of Manufacture: 7-80; VIN: JF17AB21FAG213264
 GVWR: 3070 lb; GAWR: Front = 1750 lb; Rear = 1320 lb

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.:

Vehicle Load:	FRONT	REAR	RECOMMENDED	LOAD RANGE:
Up to Capacity	<u>26</u> psi	<u>26</u> psi	TIRE SIZE:	
Vehicle Capacity:			<u>175/70HR13</u>	<u>B</u>
Type of Seats -	<u> </u> Bench	Number of Occupants =	<u>2</u> Front	
	<u>x</u> Bucket	(Designated Seating	<u>2</u> Rear	
	<u> </u> Split Bench	Capacity)	<u>4</u> Total	
CARGO LOAD =	<u>60</u> lb			
TOTAL =	<u>660</u> lb			

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with max. fluids) (UDW)

Right Front =	<u>669</u> lb	Right Rear =	<u>419</u> lb
Left Front =	<u>667</u> lb	Left Rear =	<u>415</u> lb
TOTAL FRONT WEIGHT =	<u>1336</u> lb	(<u>61.6%</u> of Total Vehicle Weight)	
TOTAL REAR WEIGHT =	<u>834</u> lb	(<u>38.4%</u> of Total Vehicle Weight)	
TOTAL DELV. WEIGHT =	<u>2170</u> lb		

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 60 lb CARGO:

Right Front =	<u>738</u> lb	Right Rear =	<u>539</u> lb
Left Front =	<u>746</u> lb	Left Rear =	<u>521</u> lb
TOTAL FRONT WEIGHT =	<u>1484</u> lb	(<u>58.3%</u> of Total Vehicle Weight)	
TOTAL REAR WEIGHT =	<u>1060</u> lb	(<u>41.7%</u> of Total Vehicle Weight)	
TOTAL TEST WEIGHT =	<u>2544</u> lb		

Weight of ballast secured in vehicle trunk area = 0 lb

TARGET WEIGHT = CARGO LOAD + UDW + 164 (NO. OF DUMMIES) = 2558 lb

GENERAL TEST AND VEHICLE PARAMETER DATA (CONTD)

TEST CONDITIONS:

Date of Test: October 22, 1980 Time of Test: 1253

Ambient Temperature: 79 °F at impact area.

Temperature in Windshield Molding
Occupant Compartment: 77 °F Temperature: 77 °F

VEHICLE ATTITUDE: (all dimensions in inches)

Delivered Attitude: RF 26.0 LF 26.0 RR 26.0 LR 26.0

Test Attitude: RF 25.6 LF 25.4 RR 25.1 LR 25.0

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 26 psi
Rear = 26 psi

Recommended Tire Size: 175/70HR13

Load Range: B

Tires on Vehicle: 175/70HR13

Is Spare Tire a "Space Saver": No (yes/no)

Is Spare Tire standard equipment: Yes (yes/no)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent ; Spec. Grav.: 0.764

Kinematic Viscosity: 0.99 centistokes

*Spill Point Volume: - Gallons

Test Volume: 12.3 Gallons

Fuel System Capacity (data from Owner's Manual): 13.2 gallons

Details of Fuel System: Rectangular metal fuel tank is mounted between the rear wheels by flange bolts. Sender tubes exit front center of tank and proceed forward inside left side of body. Filler tube exits right rear corner of tank and proceeds to body wall aft of right rear wheel. Tube is sealed by a twist-type cap and is concealed by a hinged access door.

Electric Fuel Pump: Yes (yes/no); Fuel Injection: No (yes/no)

Does electric fuel pump operate with ignition switch "on" and the engine not operating: Yes (yes/no)

VEHICLE REBOUND AND CRUSH:

Overall Length of Pre-test = R 167.5 L 167.4 inches

Test Vehicle Post-test = R 148.6 L 149.9 inches

CRUSH = R 18.9 L 17.5

FOR FRONTAL IMPACTS, distance from front of test vehicle to the barrier after impact = 24.0 inches

*Spill point was not determined. Test volume is 93% of "usable capacity" as defined in the vehicle manufacturer's Part 1 submission to the EPA plus "unusable capacity." Specified capacities are supplied by the OVSC CTM.

IMPACT EFFECTS

VISIBLE DUMMY CONTACT POINTS

	<u>Driver</u>		<u>Passenger</u>	
Head	<u>Forehead: Top of steering wheel rim</u>		<u>Top of glovebox</u>	
	<u>Chin: Top of steering wheel hub</u>			
Chest	<u>Steering wheel hub & bottom of rim</u>		<u>None</u>	
Abdomen	<u>None</u>		<u>None</u>	
Left Knee	<u>Dash</u>		<u>Lower dash</u>	
Right Knee	<u>Dash and steering column</u>		<u>Lower dash</u>	
	<u>Front</u>		<u>Rear</u>	
	<u>Left</u>	<u>Right</u>	<u>Left</u>	<u>Right</u>
<u>DOOR OPENING</u>				
Easy				
Difficult	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
Tools Required				
<u>SEAT BACK</u>				
Failure	<u>None</u>			
<u>GLAZING DAMAGE</u>				
Windshield	<u>None</u>			
Backlight				
Others				

OTHER NOTABLE IMPACT EFFECTS: Both front and rear doors locked during impact. After rear doors were opened, front doors opened easily. Both seat backs rotated inward.

SECTION 3
VEHICLE AND DUMMY PERFORMANCE INFORMATION

The following pages are included in this section:

1. Dummy positional data
2. Dummy injury summaries
3. Vehicle crush data
4. Accelerometer location and data summary
5. High-speed movie camera location and specification summary.

Pertinent photographs are presented in Appendix A. Calcomp plots of dummy and vehicle accelerometer data are presented in Appendix B.

DUMMY POSITIONING

Pre-test Dummy Positions

<u>Measurement</u>	<u>Driver (in.)</u>	<u>Passenger (in.)</u>
Dummy Centerline to Vehicle Centerline	<u>14.0</u>	<u>13.0</u>
Nose to Upper Rim Steering Wheel	<u>14.3</u>	<u>N/A</u>
Nose to Windshield (Horizontal Distance)	<u>18.3</u>	<u>17.3</u>
Left Knee to Closest Point on Lower Panel	<u>5.8</u>	<u>5.2</u>
Right Knee to Closest Point on Lower Panel	<u>5.8</u>	<u>6.0</u>
Ankle Distance	<u>10.0</u>	<u>7.0</u>
Knee Distance	<u>9.0</u>	<u>10.0</u>
Head to Windshield Header	<u>12.0</u>	<u>9.5</u>
Chest to Dash	<u>19.3</u>	<u>18.0</u>
Chest to Steering Wheel	<u>11.5</u>	<u>N/A</u>
Head to Side Header	<u>4.3</u>	<u>4.5</u>
Head to Side Window	<u>6.5</u>	<u>7.5</u>
Arm to Door	<u>3.0</u>	<u>3.0</u>
Hip to Door	<u>5.0</u>	<u>7.0</u>

Additional dummy positioning information is presented in the
PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET which follows.

PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET

NHTSA No.: 800569

Manufacturer: Fuji Heavy Industries, Ltd.

Make/Model: Subaru GLF

Model Year: 1980

SEAT TYPE:

ADJUSTER TYPE:

BUCKET SEAT BACK TYPE:

☐ Bench ☒ Bucket

☒ Manual

☐ Adjustable

☐ Split Bench

☐ Power

☐ Reclining

☐ Fixed

AMBIENT TEMPERATURE: 79 °F; TIME: 1253

POSITIONING

TECHNICIANS: 1. T. Bjork

DATE: October 22, 1980

2. C. Bergman

All front seat dummies are positioned according to the procedure "OSE RECOMMENDED PROCEDURE FOR POSITIONING PART 572 DUMMIES IN TEST VEHICLE."

DRIVER DUMMY# A 0 4		PASSENGER DUMMY # 7 5 9	
HEAD TARGET 23.0 " 1 °		HEAD TARGET 24.0 " 5 °	
KNEE JOINT 20.0 " 92 °		KNEE JOINT 20.5 " 94 °	
APPROXIMATE "H" POINT 5.8 " 139 °		APPROXIMATE "H" POINT 6.0 " 120 °	
OVERALL			

*Door glass height is equal on the right and left side of vehicle.

PART 572 DUMMY DATA SUMMARY

	Driver Dummy				Passenger Dummy			
	Positive Direction*		Negative Direction**		Positive Direction*		Negative Direction**	
	Peak (G)	Time (msec)	Peak (G)	Time (msec)	Peak (G)	Time (msec)	Peak (G)	Time (msec)
Head Acceleration								
Longitudinal	9.0	121	84.4	84	4.7	197	138.3	86
Lateral	16.6	82	2.7	60	39.9	86	2.9	115
Vertical	51.8	76	7.5	104	76.8	81	9.8	113
Resultant	86.3	84			148.7	86		
HIC	797.7 between 59 and 99 msec				1682.0 between 80 and 92 msec			
Chest Acceleration								
Longitudinal	5.2	173	50.6	69	3.6	175	36.6	91
Lateral	4.5	79	6.9	91	17.8	87	4.8	35
Vertical	11.8	72	16.0	92	19.1	61	8.9	115
Resultant (Max)	51.1	69			40.1	84		
Resultant (clip)	47.3	68			39.1	90		
TIME > 60 G	0 msec				0 msec			
SEVERITY INDEX	353.2 @ 200 msec				345.7 @ 200 msec			
	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)	Peak (lb)	Time (msec)
Femur Loads								
Left			429.9	52			717.1	57
Right			930.3	73			463.5	33
Belt Loads								
Lap	1116.3	71			1243.0	70		
Torso	1314.2	78			1555.2	82		
Vehicle Impact Speed (mph): 29.47								
*Longitudinal:	Forward							
Lateral:	Rightward							
Vertical:	Downward							
**Longitudinal:	Rearward							
Lateral:	Leftward							
Vertical:	Upward							

DUMMY KINEMATIC SUMMARY

DRIVER - The steering column began to intrude rearward at ≈ 44 ms and then began to pitch upward. The dummy's lower chest struck the bottom of the intruding steering wheel at ≈ 58 ms, causing the top of the wheel to rotate rearward. At ≈ 61 ms, the dummy's head impacted the top of the steering wheel, which was still rotating rearward, with contact on the dummy's upper lip. The dummy's head then rotated forward in relation to its torso, causing the dummy's face to slide down the top of the steering wheel rim until the forehead was in contact with the rim. At ≈ 84 ms the dummy's chin came in contact with the top of the steering wheel hub, and at ≈ 89 ms, the dummy's head reached its maximum forward position in relation to the car. The dummy then began to rebound, with the forehead losing contact with the upper rim at ≈ 106 ms and the chin sliding off the column at ≈ 110 ms. The dummy's head rotated slightly counterclockwise and contacted the headrest at ≈ 176 ms. The dummy reached its maximum rearward motion in relationship to the car (rebound into the seat) at ≈ 279 ms.

PASSENGER - After impact, the dummy leaned forward at a fairly severe angle, resulting in the dummy's upper nose or lower forehead impacting the top of the dash above the glovebox at ≈ 79 ms. The dummy's head reached its maximum forward position (and maximum downward deflection of the dash) at ≈ 93 ms, and then began to rebound. The dummy's head recontacted the headrest at ≈ 216 ms and reached maximum rearward rebound at ≈ 300 ms.

OTHER COMMENTS - Although post-test observations indicated knee strikes for both occupants, there was a minimum of forward displacement of the dummies' lower torsos visible in the films. This would indicate good restraint of the lower torsos. However, both dummies did experience head strikes and the driver dummy experienced extensive chest/steering wheel contact. The steering wheel did intrude somewhat; however, the intrusion did not appear to be excessive. There was minor rearward displacement of the dash panel. The primary cause of head (and chest) strikes appeared to be an inadequate restraint of the upper torsos.

PRE-/POST-TEST STATIC MEASUREMENT DATA
(See Following Page for Dimension Definition)

Vehicle: 1980 Subaru GLF NHTSA No.: 800569

Test Date: October 22, 1980 D.S. No.: 1115

<u>Reference Dimension</u>	<u>Pre-test Measurement</u>	<u>Post-test Measurement</u>	<u>Change</u>
X ₁ *	167.9	149.5	18.4
X ₂	151.4	145.5	5.9
X ₃	118.1	116.1	2.0
X ₄	116.0	115.4	0.6
X ₅	116.0	115.4	0.6
X ₆	116.6	115.6	1.0
X ₇	116.6	115.8	0.8
X ₈ *	78.9	78.4	0.5
X ₉ *	78.9	78.6	0.3
X ₁₀	79.9	79.0	0.9
X ₁₁	79.9	79.0	0.9
X ₁₂	116.8	115.9	0.9
X ₁₃	116.8	116.2	0.6
X ₁₄	123.4	121.8	1.6
X ₁₅	125.7	123.2	2.5
X ₁₆	98.2	95.8	2.4
Y ₁₇	15.0	14.5	0.5
X ₁₈	16.5	17.5	1.0
X ₁₉ *	167.5	148.6	18.9
X ₂₀ *	167.4	149.9	17.5
X ₂₁	17.9	17.5	0.4

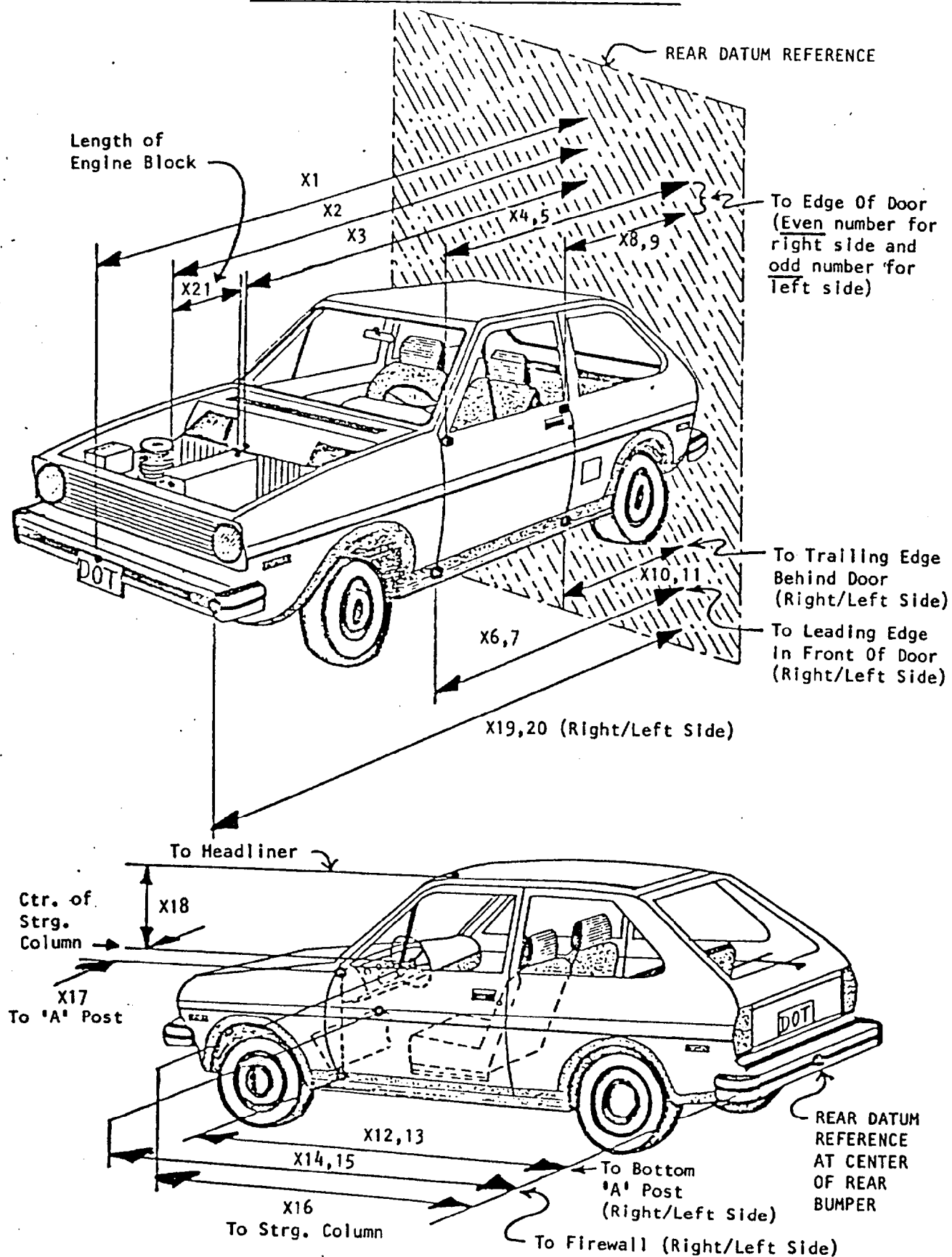
*Rear impact data requirements.

VEHICLE PROFILE DATA SHEET

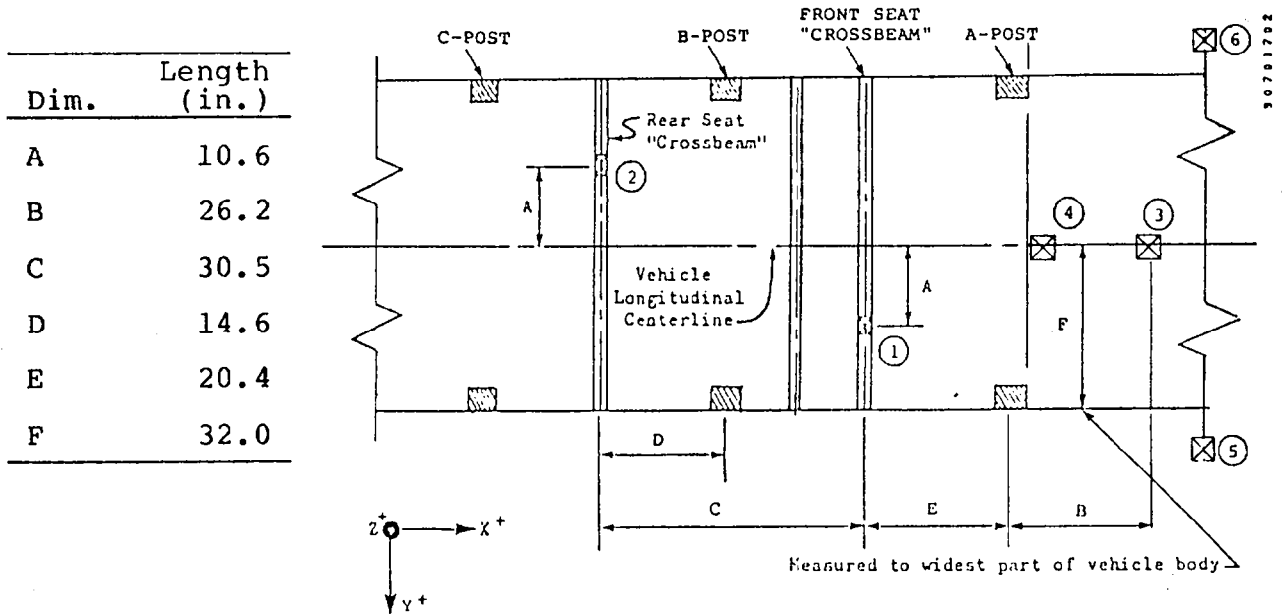
Vehicle: 1980 Subaru GFL D.S. No.: 1115 Test Date: October 22, 1980
 Measurement Date: Pre-test: October 17, 1980 Post-test October 24, 1980
 Exterior measurements referenced to plane 15 ft forward of rear bumper &

Location	Height	Vehicle Left (in.)					Vehicle Right (in.)					
		30	24	18	12	6	0	6	12	18	24	30
Pre-test Profile (in.)												
Top of Front Bumper	20.5	12.8	12.6	12.4	12.3	12.2	12.2	12.3	12.4	12.5	12.8	13.0
Front of Hood	30.5	19.9	19.3	18.5	18.2	17.9	17.9	17.9	18.2	18.5	19.4	20.0
Post-test Profile (in.)												
Top of Front Bumper	18.4	31.6	31.6	31.0	30.8	30.7	30.6	30.5	30.4	30.3	30.4	30.6
Front of Hood	26.8	32.5	30.4	30.4	30.3	30.3	30.6	30.2	30.0	29.5	29.3	29.4
Post-test Static Crush (in.)												
Top of Front Bumper	2.1	18.8	19.0	18.6	18.5	18.5	18.4	18.2	18.0	17.8	18.4	17.6
Front of Hood	3.7	12.6	11.1	11.9	12.1	12.4	12.7	12.3	11.8	11.0	9.9	9.4

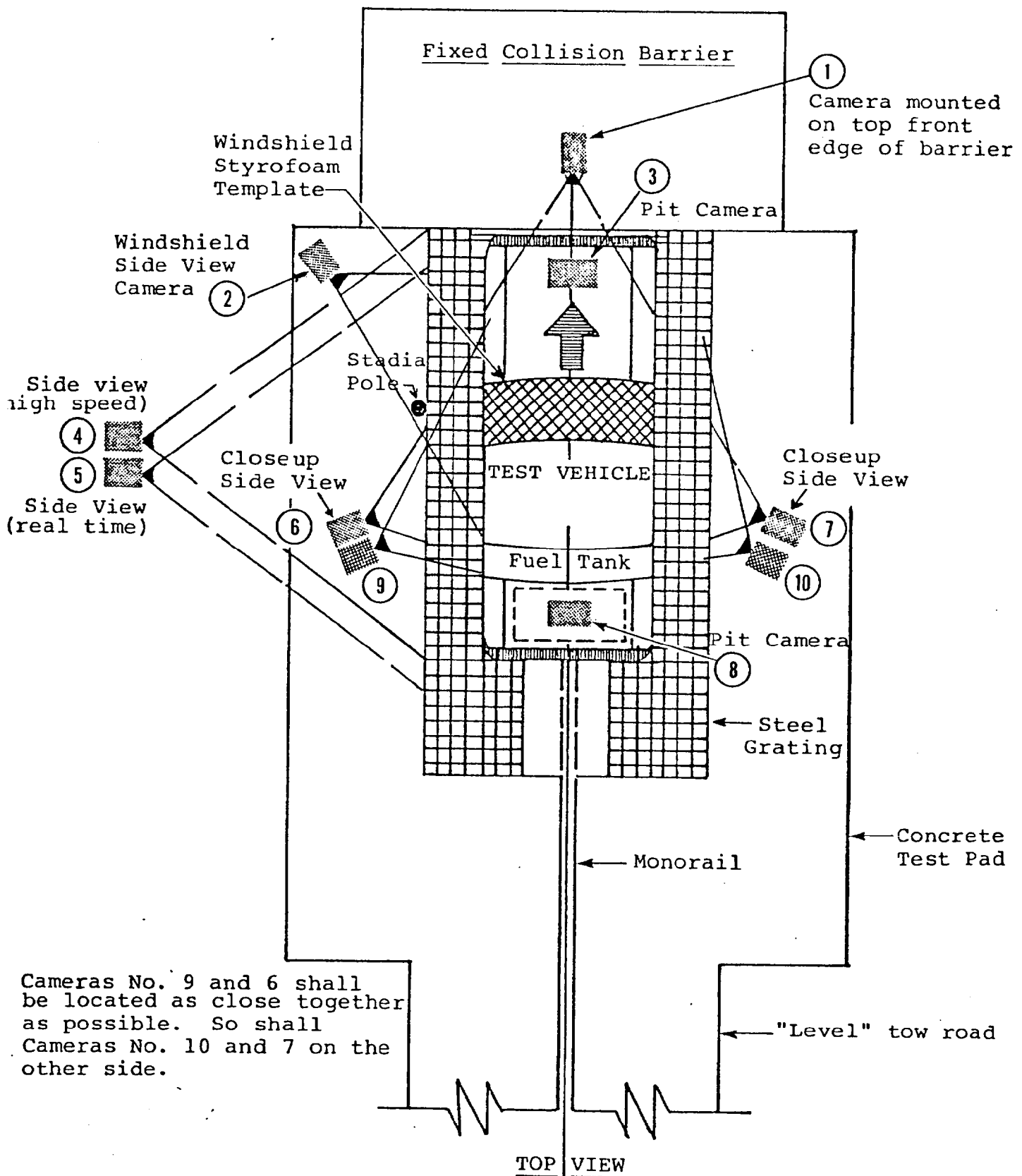
PRE-TEST AND POST-TEST MEASUREMENT POINTS



TEST VEHICLE ACCELEROMETER LOCATION DEFINITION AND DATA SUMMARY



No.	Location Description	Component Direction	Data Summary					
			Peak G @ msec					
			X		Y		Z	
		X Y Z	"+"	"-"	"+"	"-"	"+"	"-"
1	Below front seat area	✓	25.7 @ 20	45.7 @ 15				
2	Below rear seat area	✓	11.4 @ 21	35.8 @ 40				
3	Engine top	✓	39.1 @ 42	107.7 @ 33				
4	Engine bottom	✓	42.8 @ 42	136.2 @ 34				
5	RF brake caliper	✓	14.1 @ 76	38.4 @ 43				
6	LF brake caliper	✓	22.9 @ 33	58.0 @ 28				



Cameras No. 9 and 6 shall be located as close together as possible. So shall Cameras No. 10 and 7 on the other side.

CAMERA LOCATION AND SPECIFICATION SUMMARY

Loc. No.	Location	Field of View	Lens Size (mm)	Frm Rate	Tmng Spd (Hz)	Serial No.	Impact Dist-X	C.L. Dist-Y	Cam Hght
1	Overhead (Barrier)	Windshield styrofoam up to barrier-vehicle contact if possible	13	1000	100	12	-4.0	0.0	10.6
2	Ground Based (Left)	Windshield	25	1000	99	6	-2.3	-10.5	4.9
3	Pit	Engine underside and fuel pump	8	1000	101	7	2.2	0.0	-7.8
4	Ground Based (Left)	Views entire left side of vehicle	25	480	100	LC327	6.1	-4.0	4.7
5	Ground Based (Real Time)	Documentary	ZOOM	24	N/A	N/A	6.2	-4.0	4.7
6	Ground Based (Left)	Driver dummy closeup	25	1000	101	5	10.0	-13.2	5.0
7	Ground Based (Right)	Passenger dummy closeup	15	1000	101	8	9.0	10.7	5.1
8	Pit	Fuel Tank	8	1000	101	4	11.2	0.0	-7.8
9	Ground Based (Left)	Same view as camera No. 6	25	1000	100	10	11.4	-12.6	5.0
10	Ground Based (Right)	Same view as camera No. 7	15	1000	100	11	10.1	10.1	5.1

APPENDIX A
PHOTOGRAPHS

00150

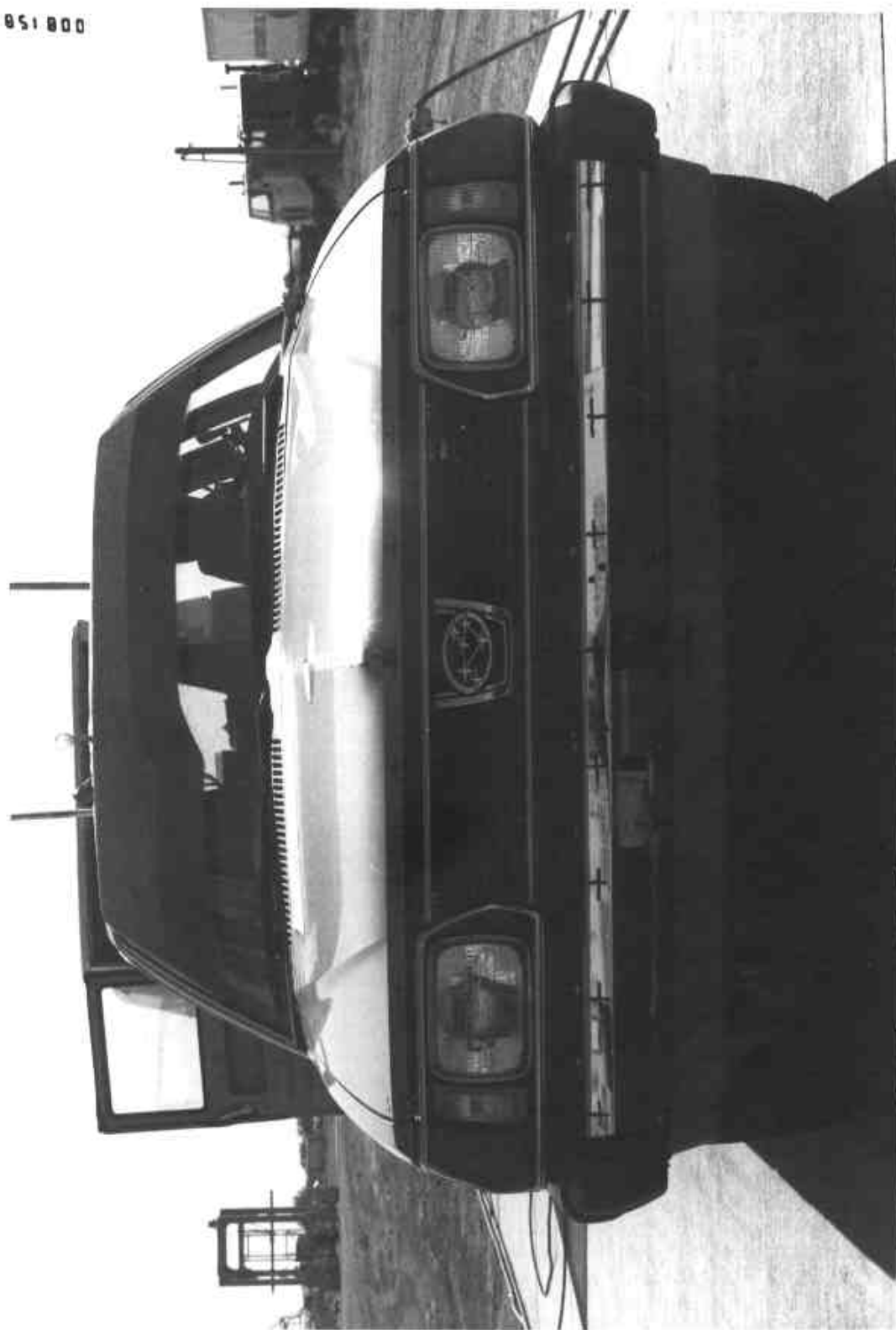


FIGURE A-1. PRE-TEST FRONT VIEW - 1980 SUBARU GLF - NHTSA 800569.

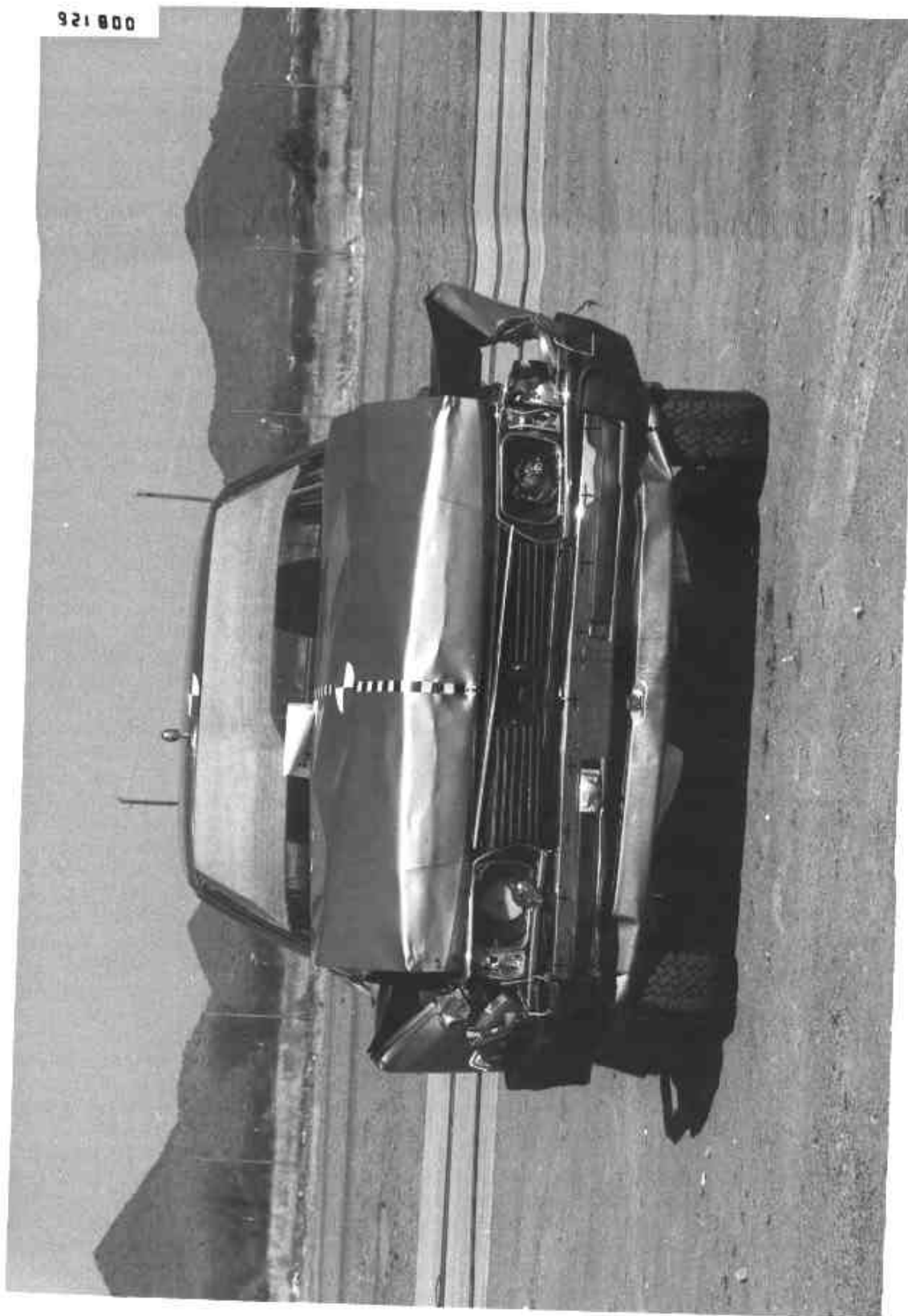


FIGURE A-2. POST-TEST FRONT VIEW - 1980 SUBARU GLF - NHTSA 80 O 569.



FIGURE A-3. PRE-TEST SIDE VIEW - 1980 SUBARU GLF - NHTSA 800 569.

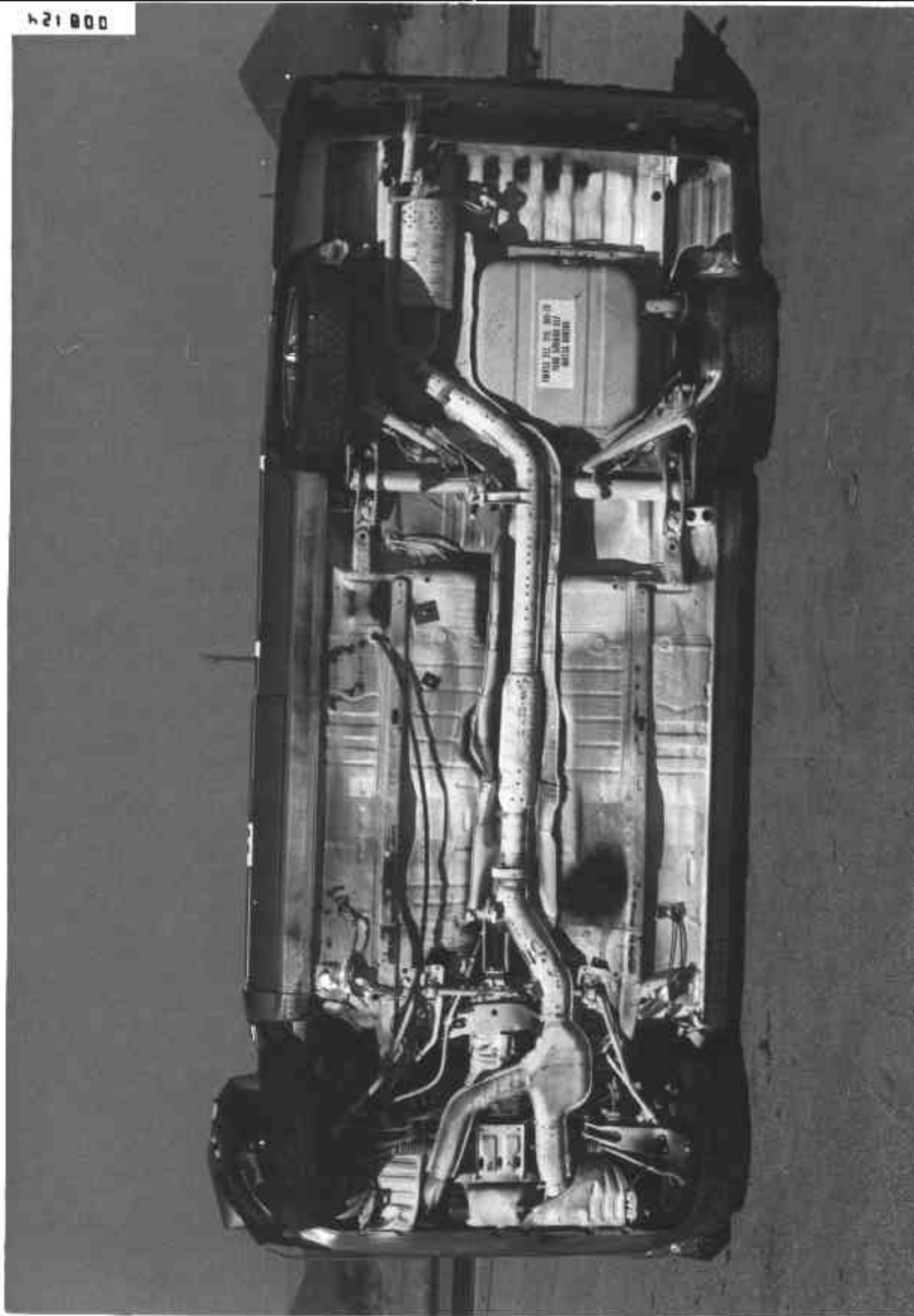


FIGURE A-5. POST-TEST OVERALL UNDERSIDE VIEW - 1980 SUBARU GLF - NHTSA 800569.



FIGURE A-6. PRE-TEST DRIVER DUMMY POSITION - 1980 SUBARU GLF - NHTSA 800569.



FIGURE A-7. POST-TEST DRIVER DUMMY POSITION - 1980 SUBARU GLF - NHTSA 800569.



FIGURE A-8. PRE-TEST PASSENGER DUMMY POSITION - 1980 SUBARU GLF - NHTSA 800569.



FIGURE A-9. POST-TEST PASSENGER DUMMY POSITION - 1980 SUBARU GLF - NHTSA 800569.

APPENDIX B
CALCOMP PLOT PRESENTATION

Calcomp plots generated from the crash test data are presented on the following pages. All data will be recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data was filtered according to SAE J211. Plot legends and test anomalies are listed below:

PLOT LEGEND

Dummy Data*

<u>Driver</u>	<u>RF Outboard Passenger</u>	<u>Data Description</u>
LF Head	RF Head	Head Acceleration (G)
LF Chest	RF Chest	Chest Acceleration (G)
LF Femurs	RF Femurs	Femur Loads (lb)
LF Belt Loads	RF Belt Loads	Belt & Torso Belt Loads (lb)

Vehicle Data**

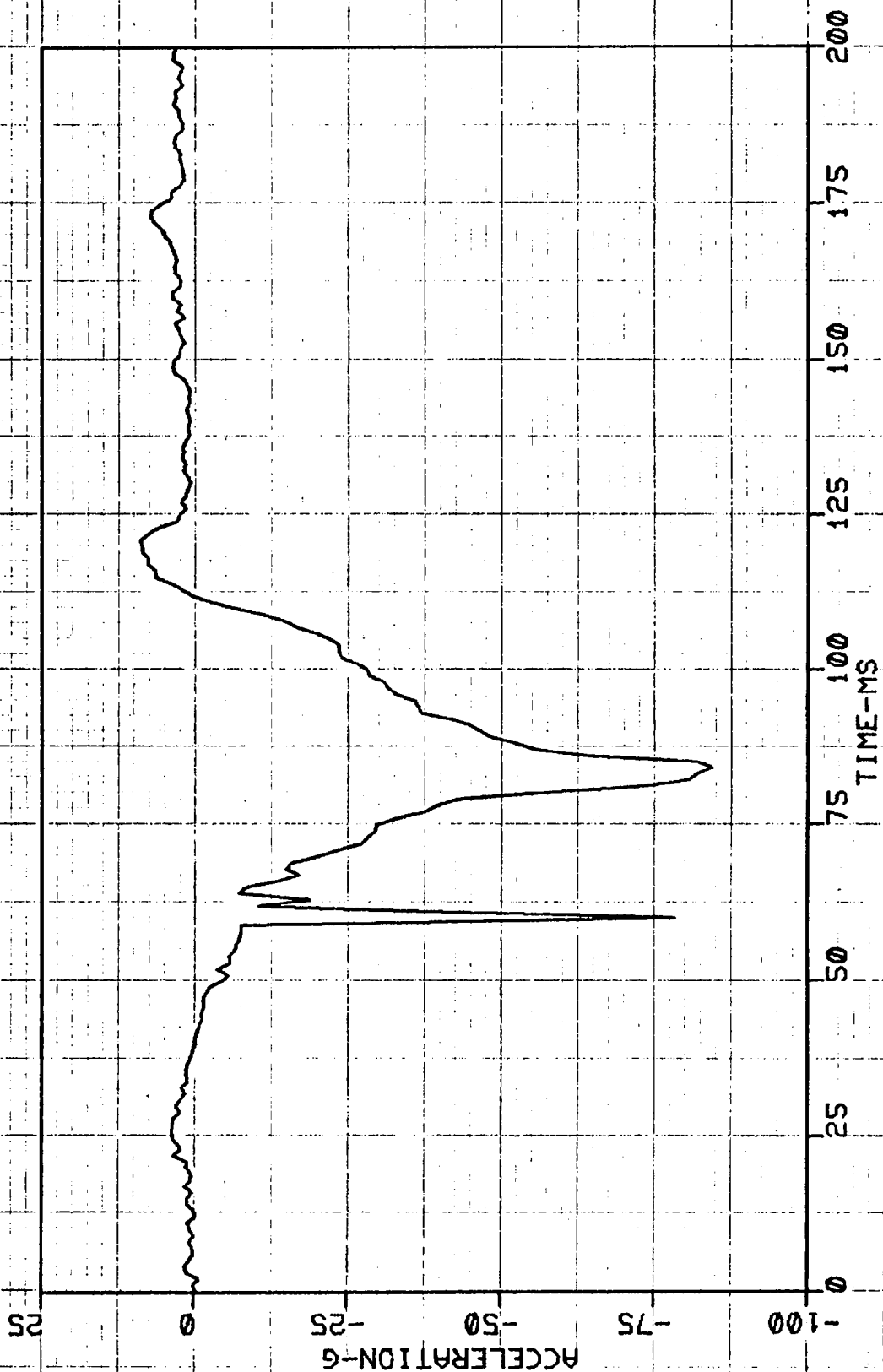
	<u>Location</u>
Loc 1	Front Seat Area Acceleration (G)
Loc 2	Rear Seat Area Acceleration (G)

*Dummy Injury Summary presented on pages 3-4 and 3-5.

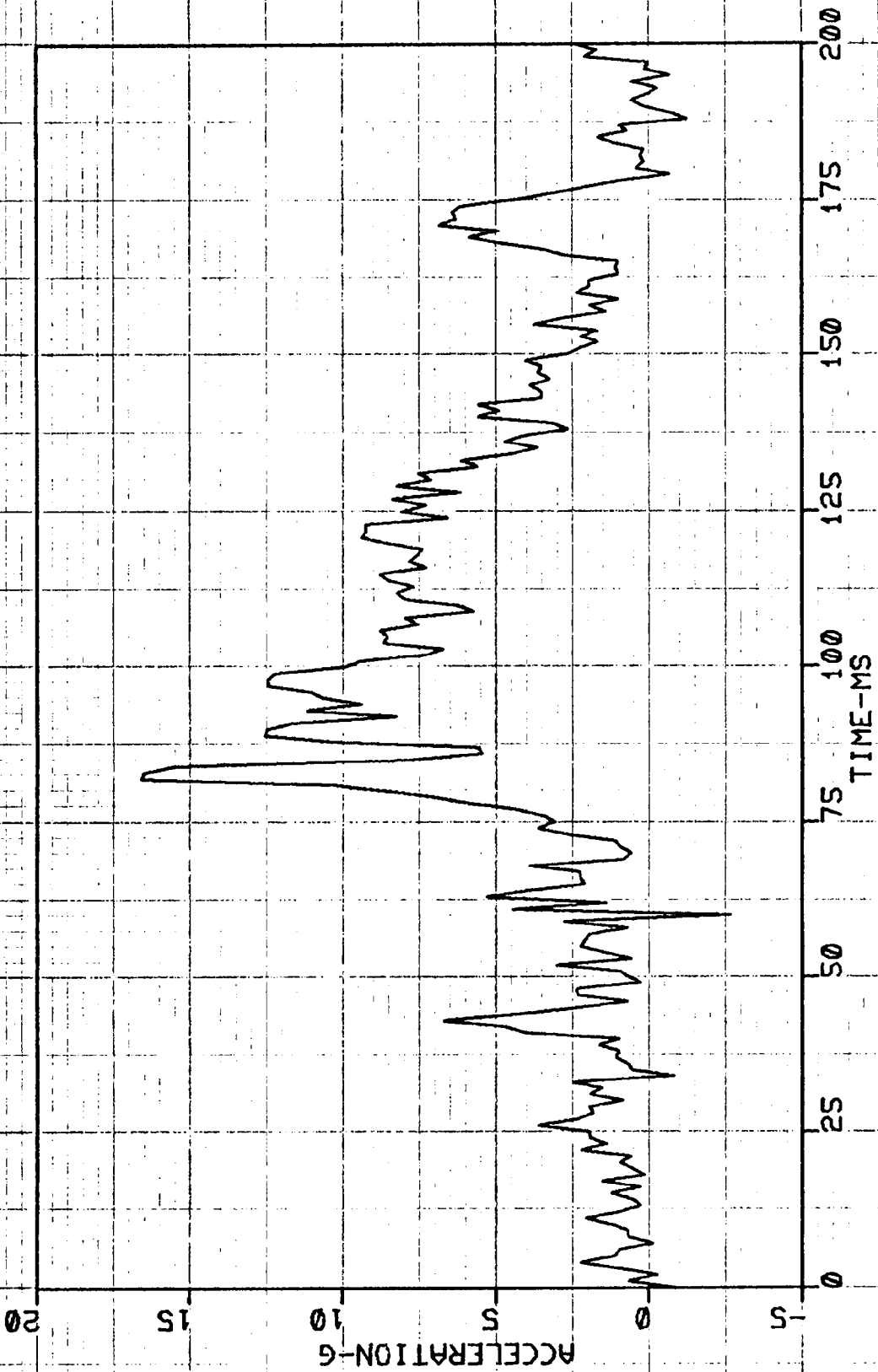
**Vehicle accelerometer location and data summarized on page 3-9.

Test Anomalies: None

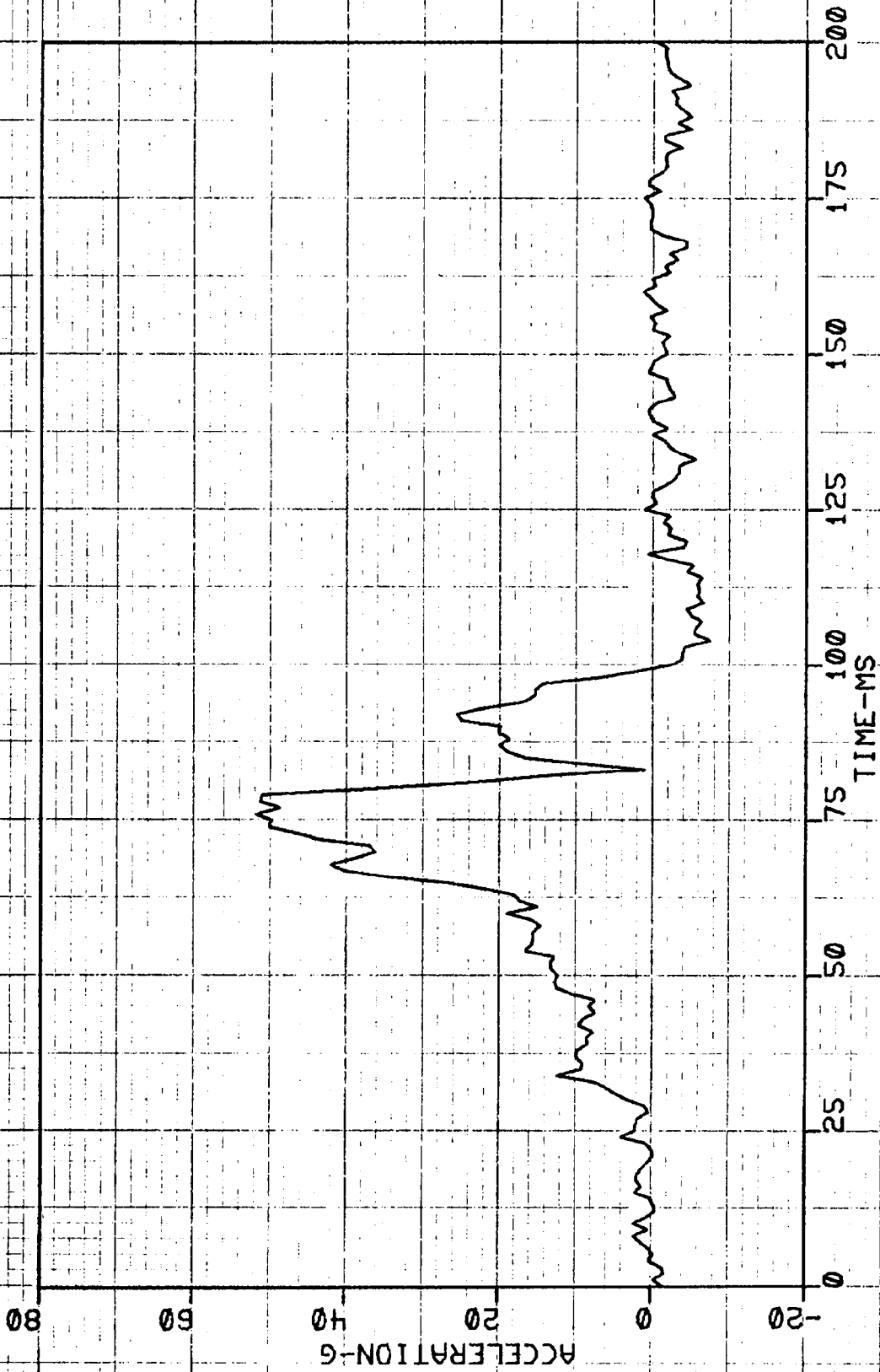
TEST#2 SUBARU GLF LF HEAD AX



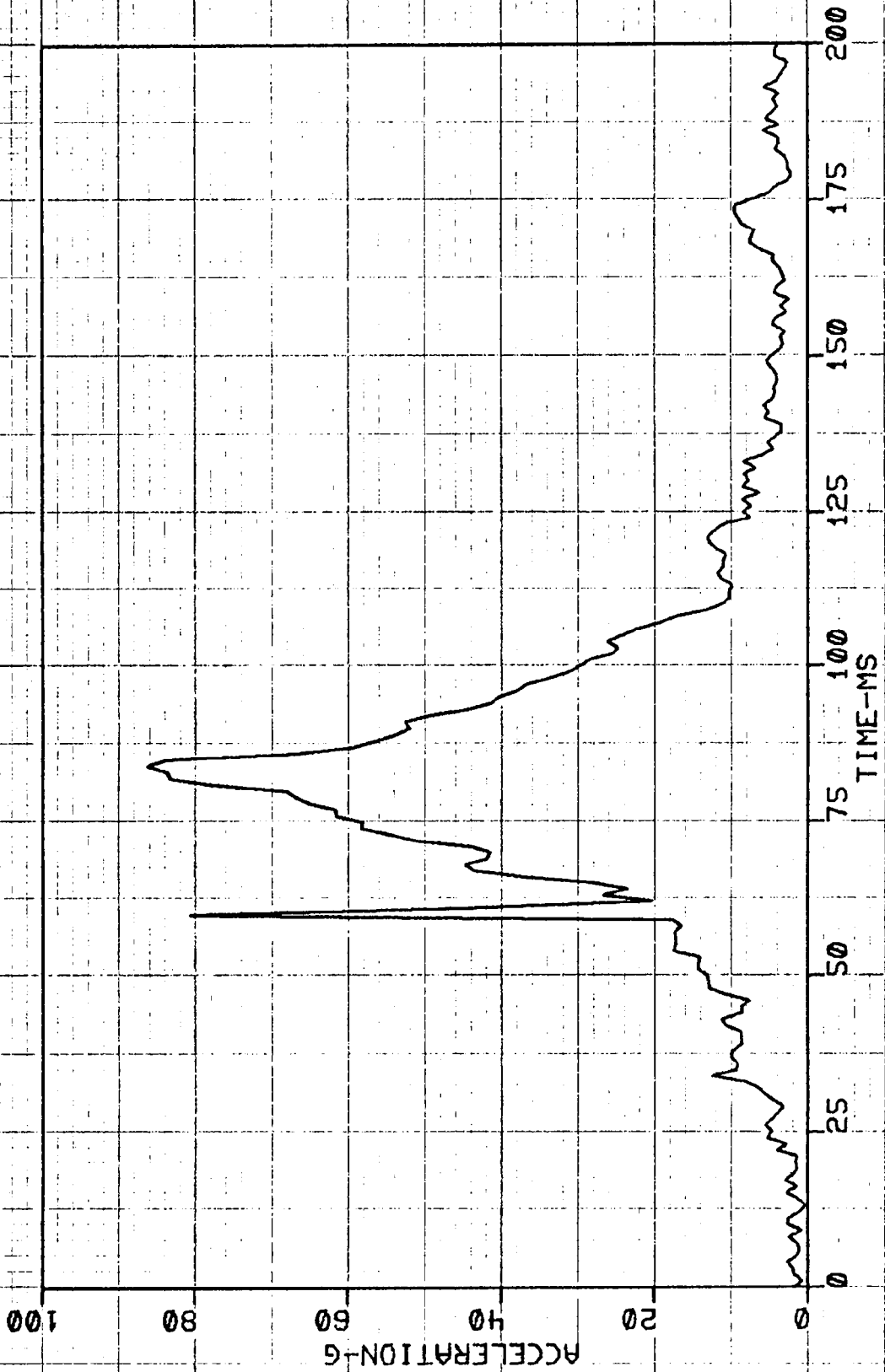
TEST#2 SUBARU GLF LF HEAD AY



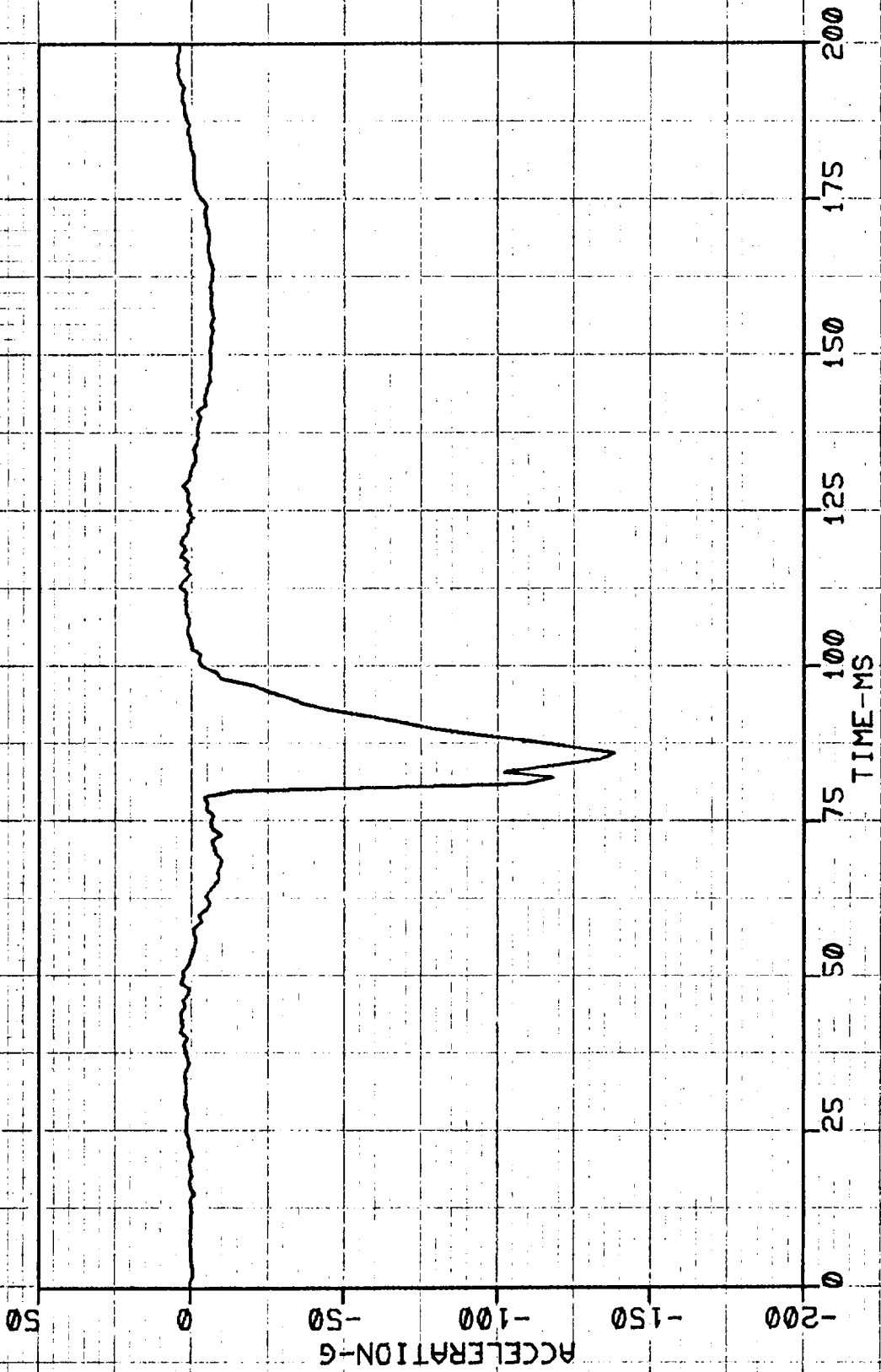
TEST#2 SUBARU GLF LF HEAD AZ



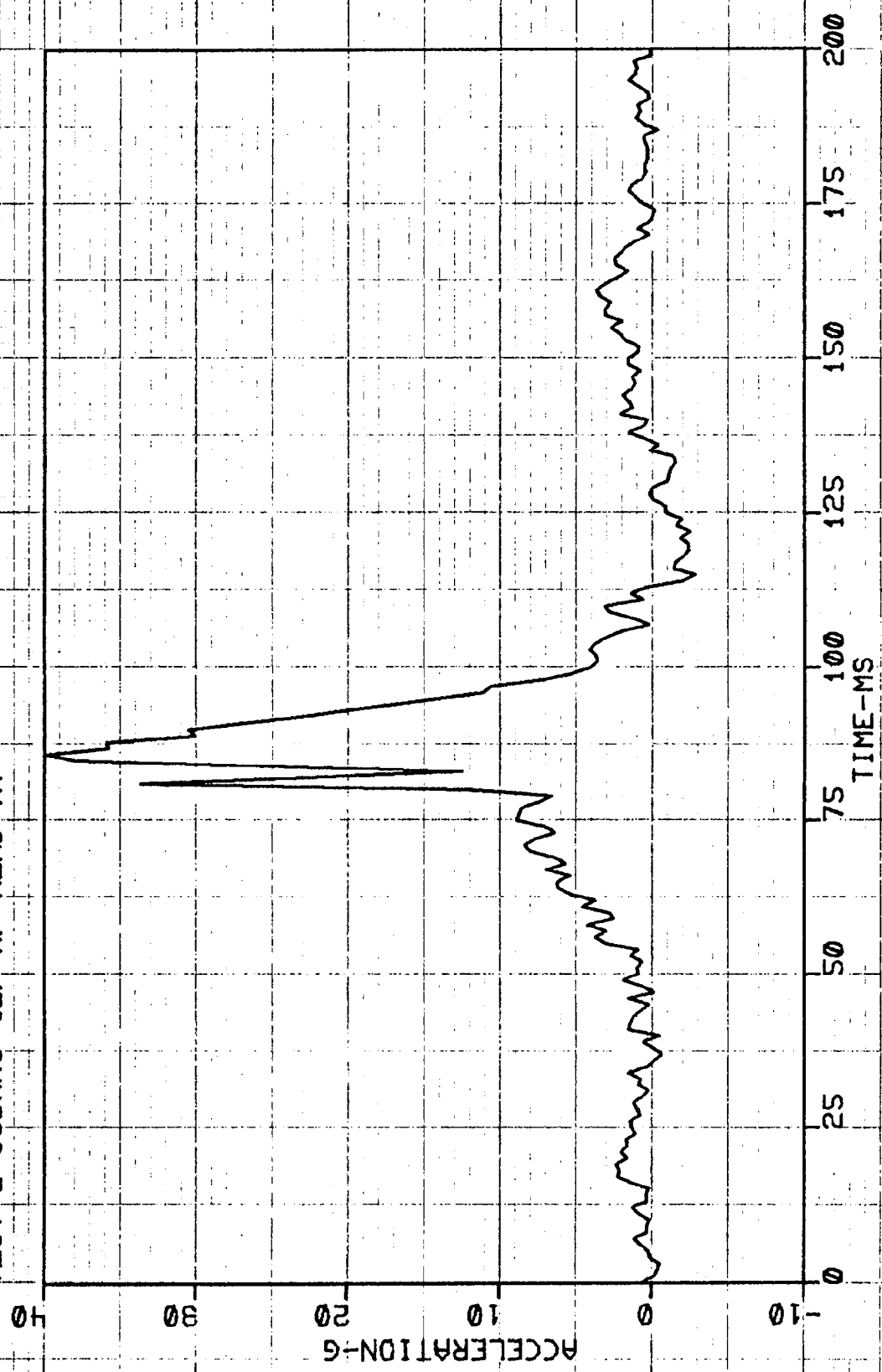
TEST#2 SUBARU GLF LF HEAD AR



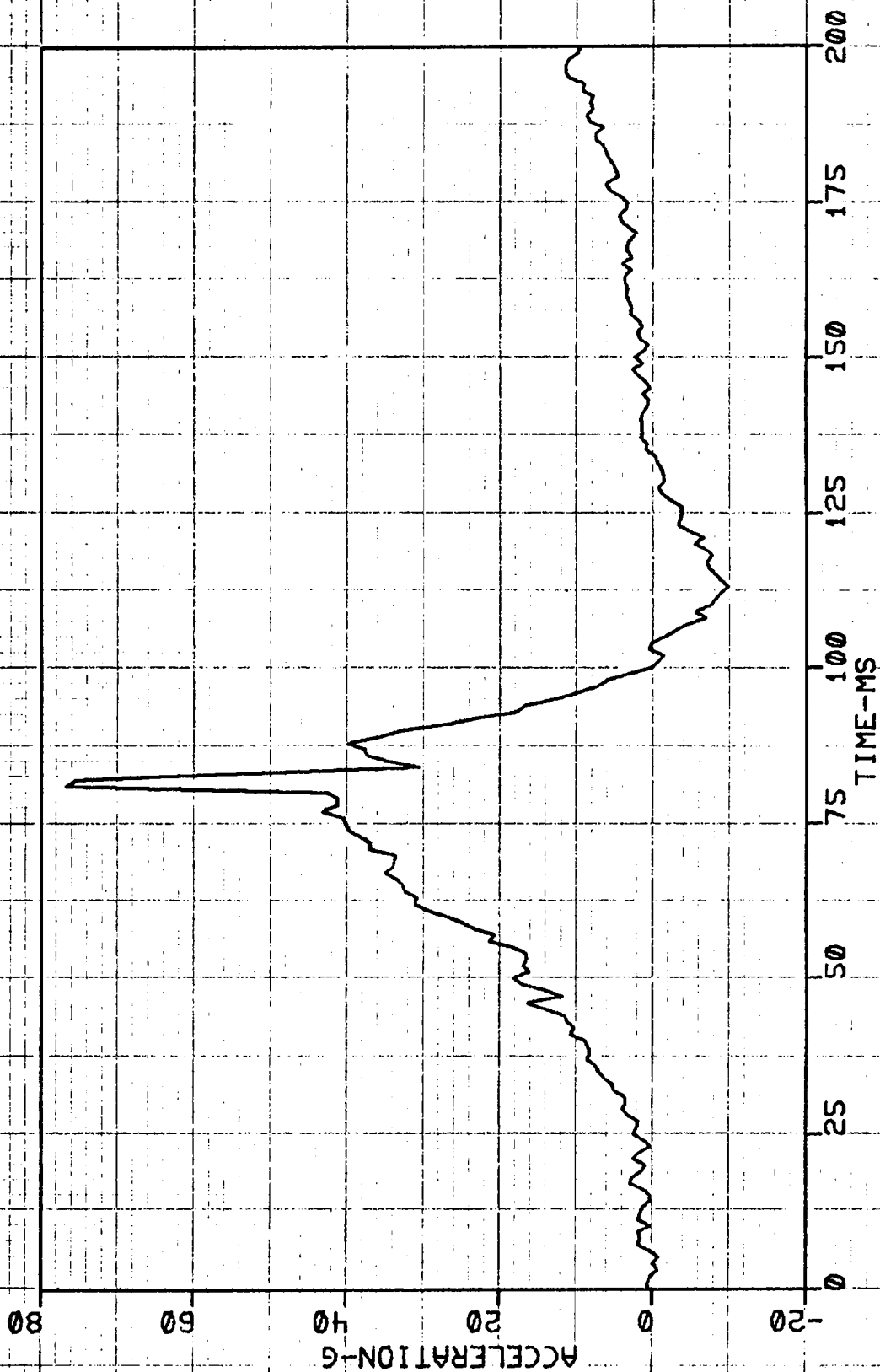
TEST#2 SUBARU GLF RF HEAD AX



TEST#2 SUBARU GLF RF HEAD AY



TEST#2 SUBARU GLF RF HEAD AZ



TEST#2 SUBARU GLF RF HEAD AR

200

160

120

80

40

0

ACCELERATION-G

0

25

50

75

100

125

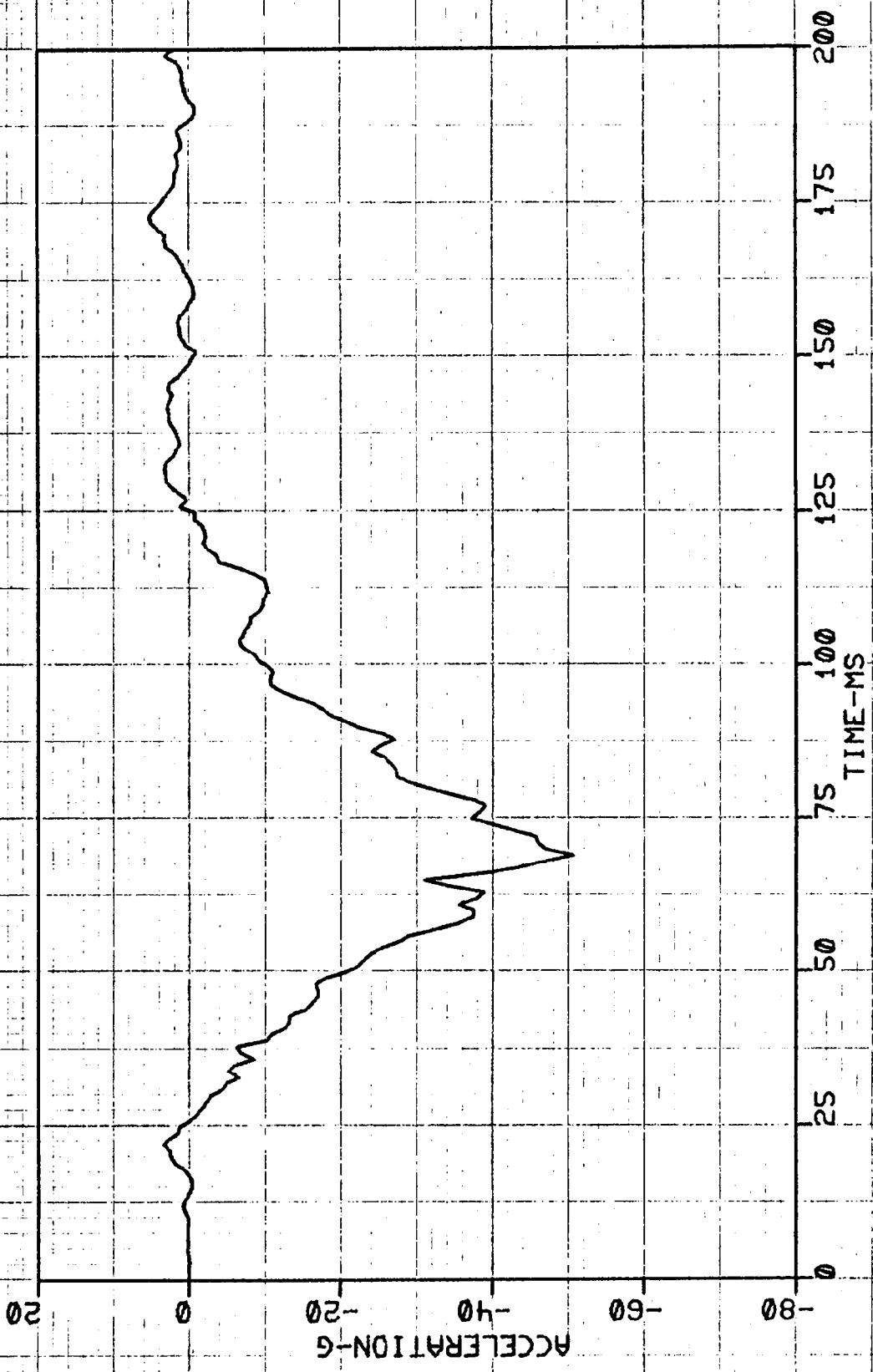
150

175

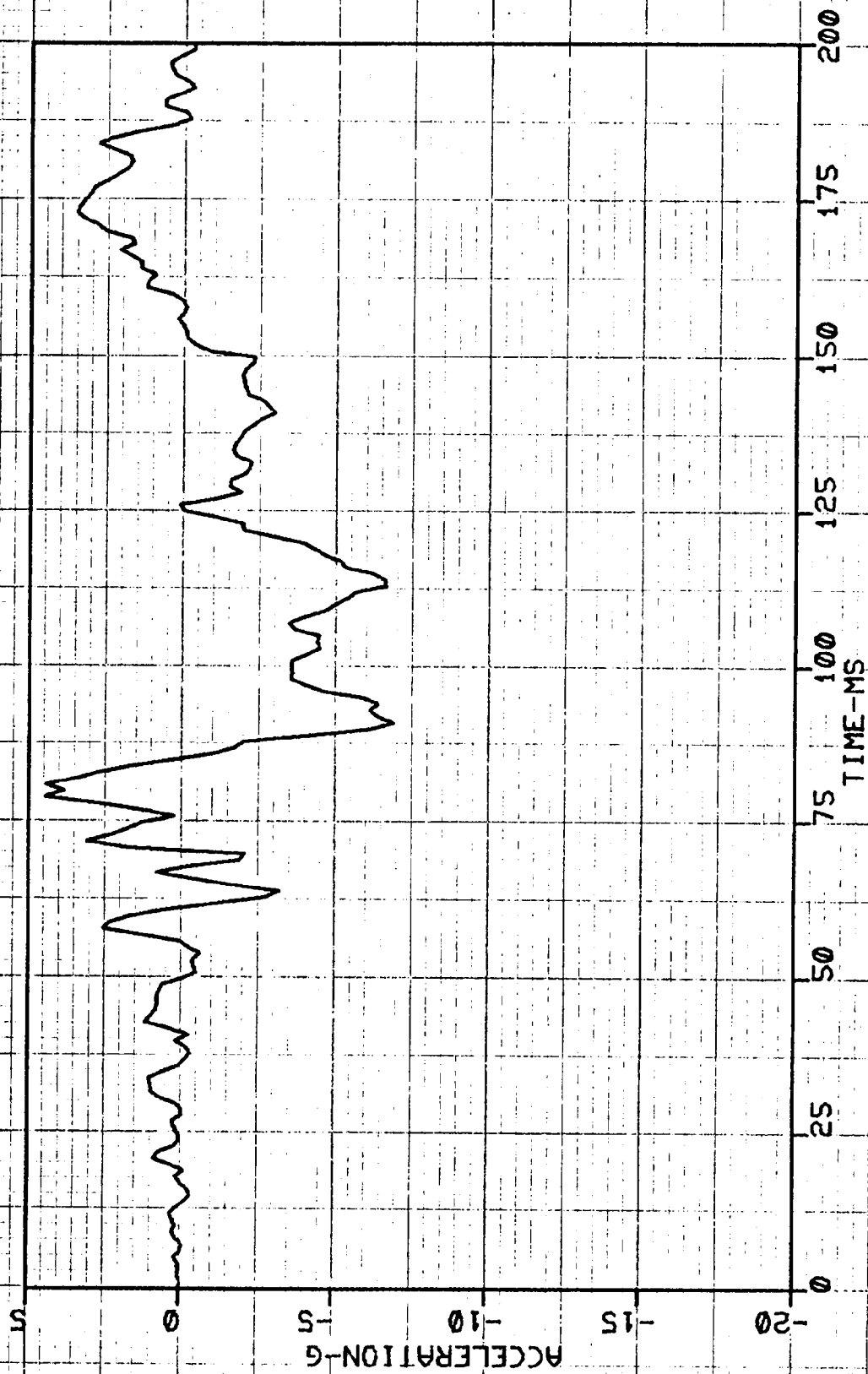
200

TIME-MS

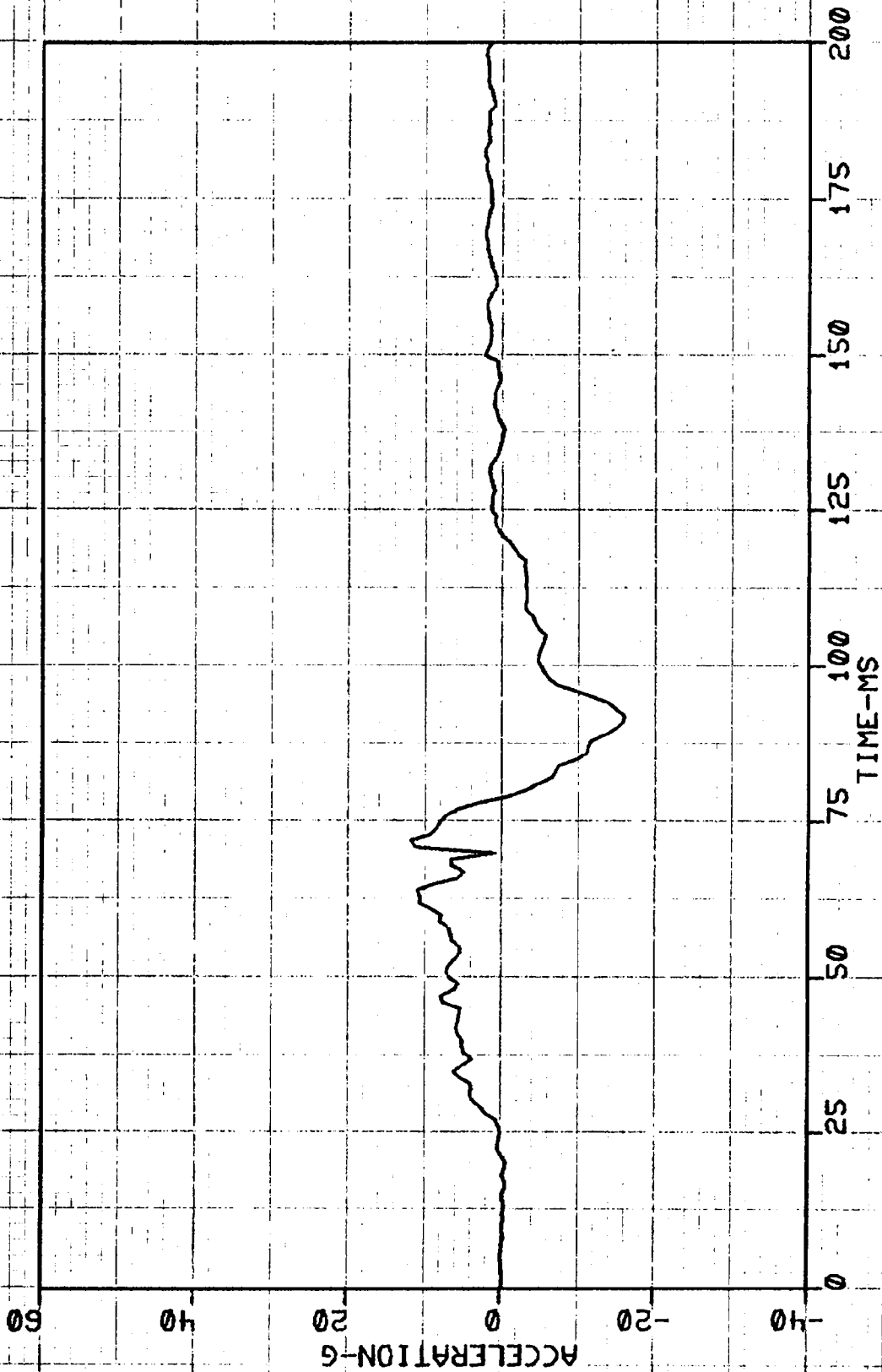
TEST#2 SUBARU GLF LF CHEST AX



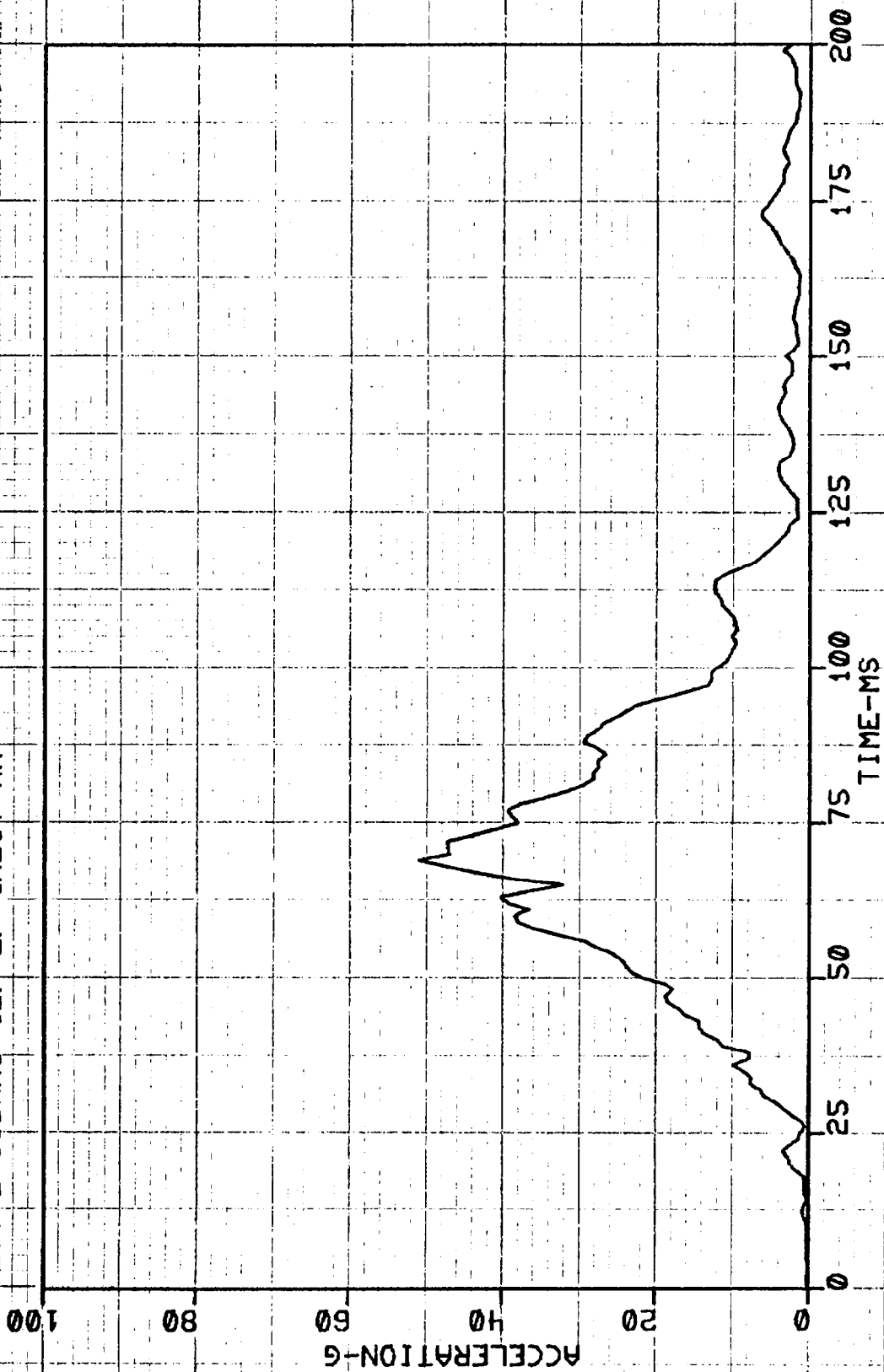
TEST#2 SUBARU GLF LF CHEST AY



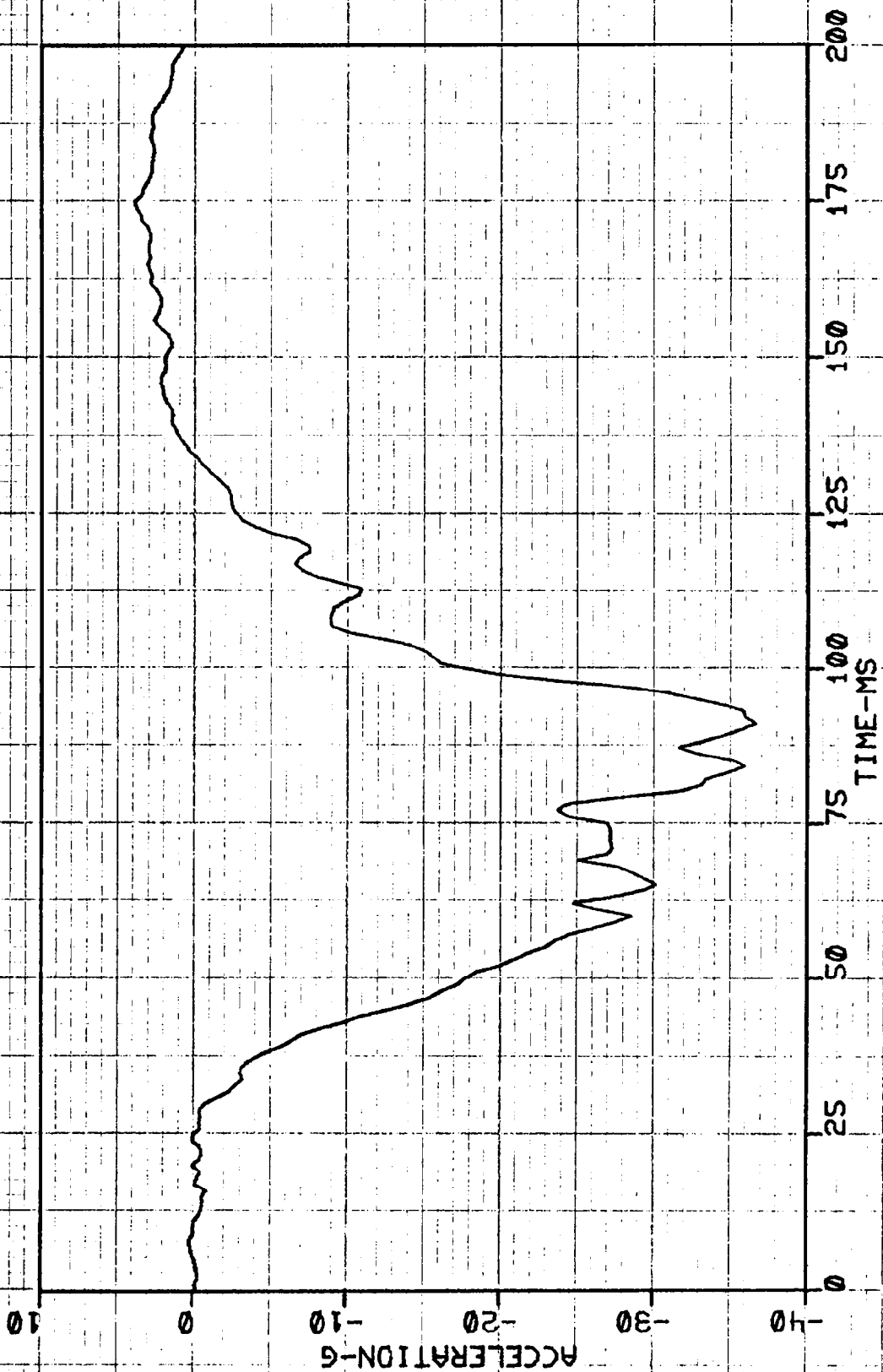
TEST#2 SUBARU GLF LF CHEST AZ



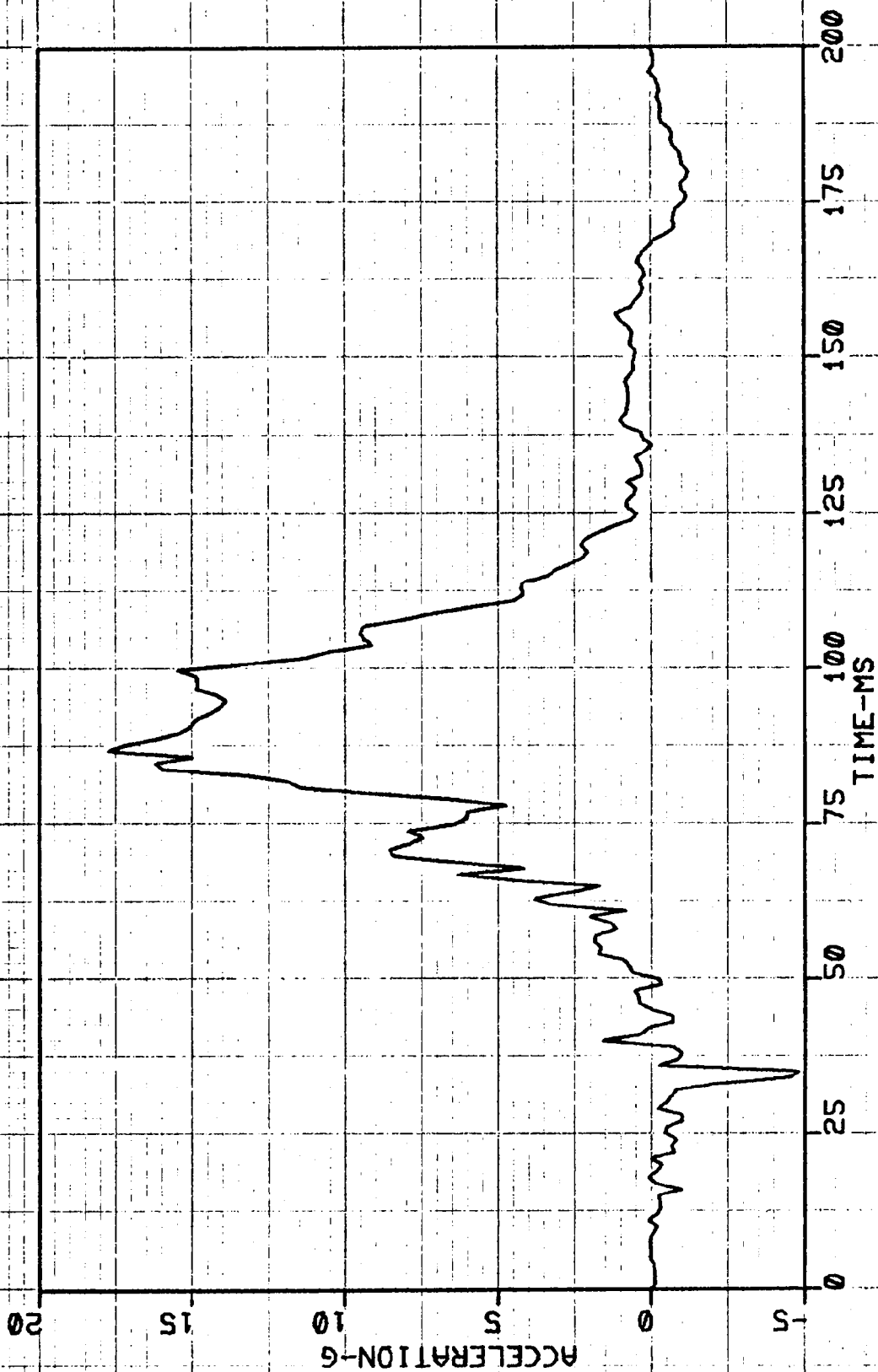
TEST#2 SUBARU GLF LF CHEST AR



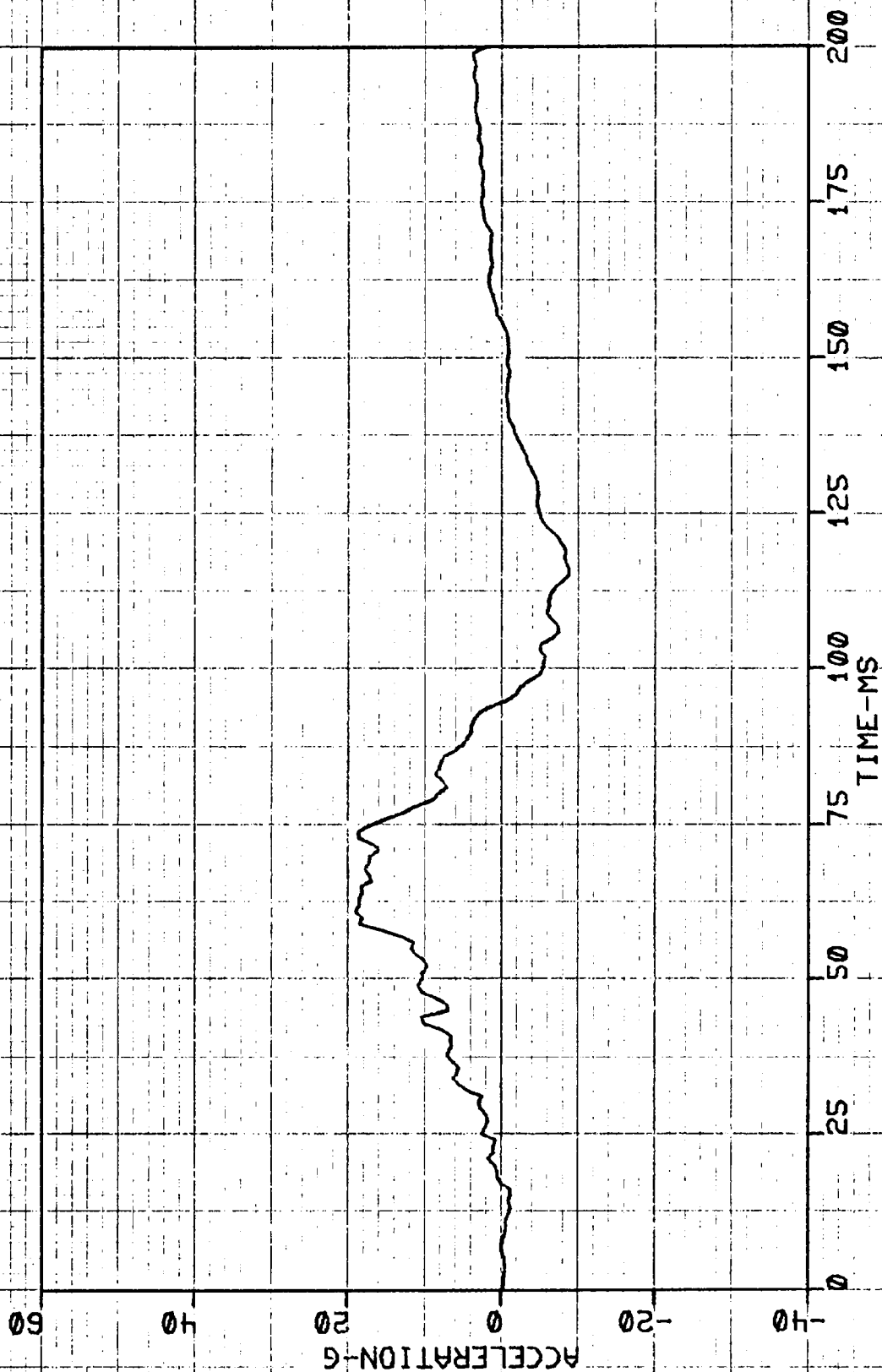
TEST#2 SUBARU GLF RF CHEST AX



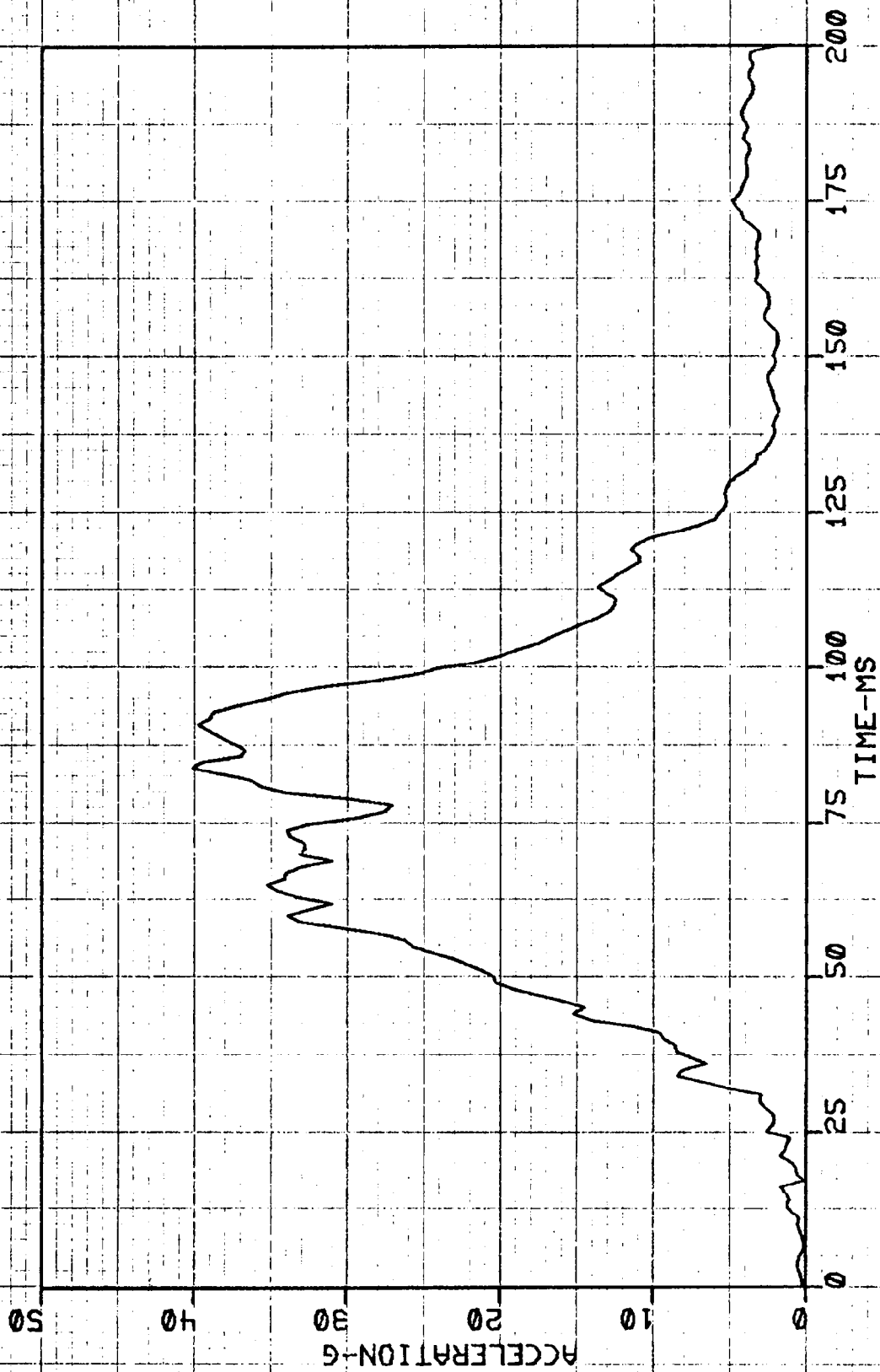
TEST#2 SUBARU GLF RF CHEST AY

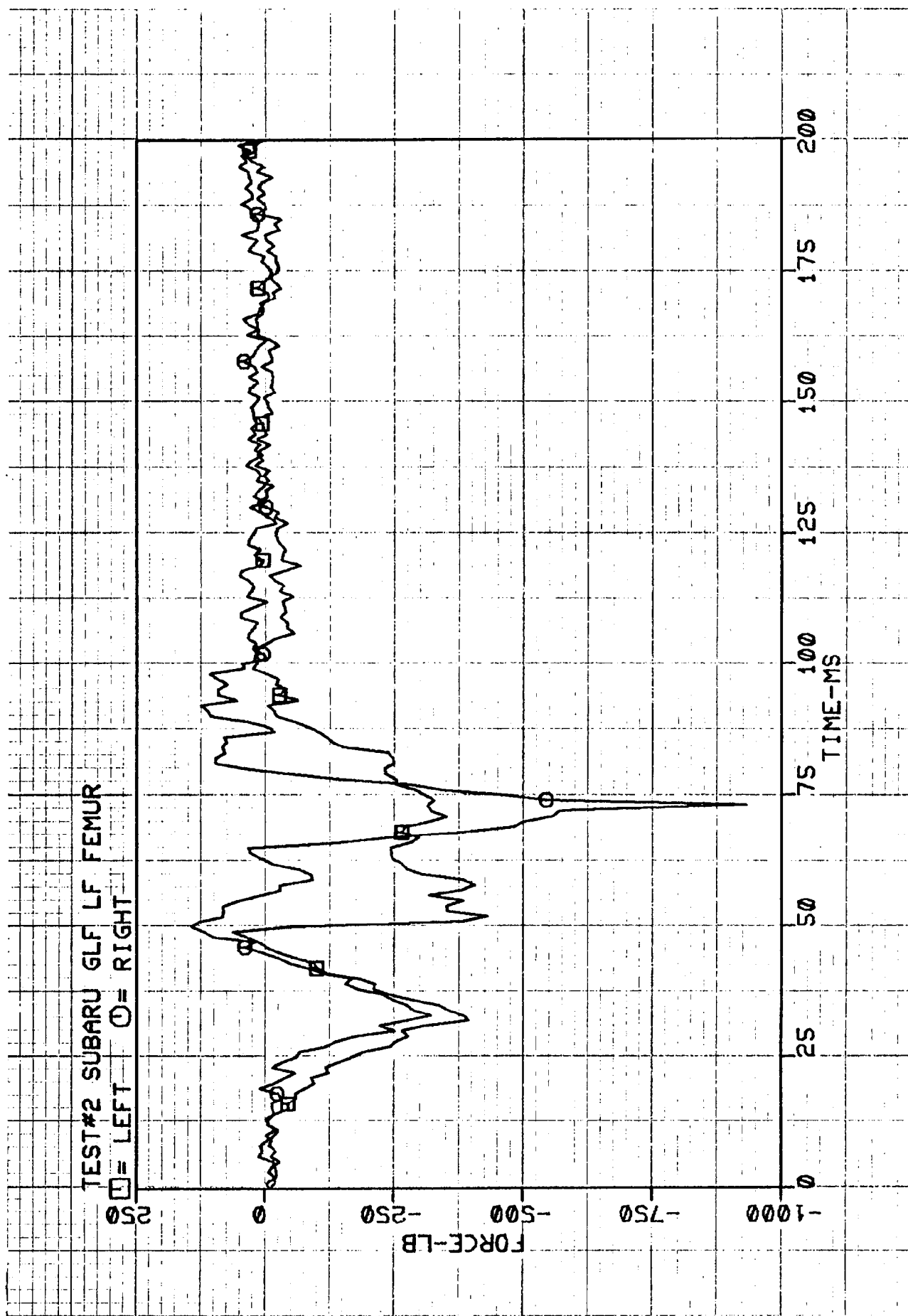


TEST#2 SUBARU GLF RF CHEST AZ



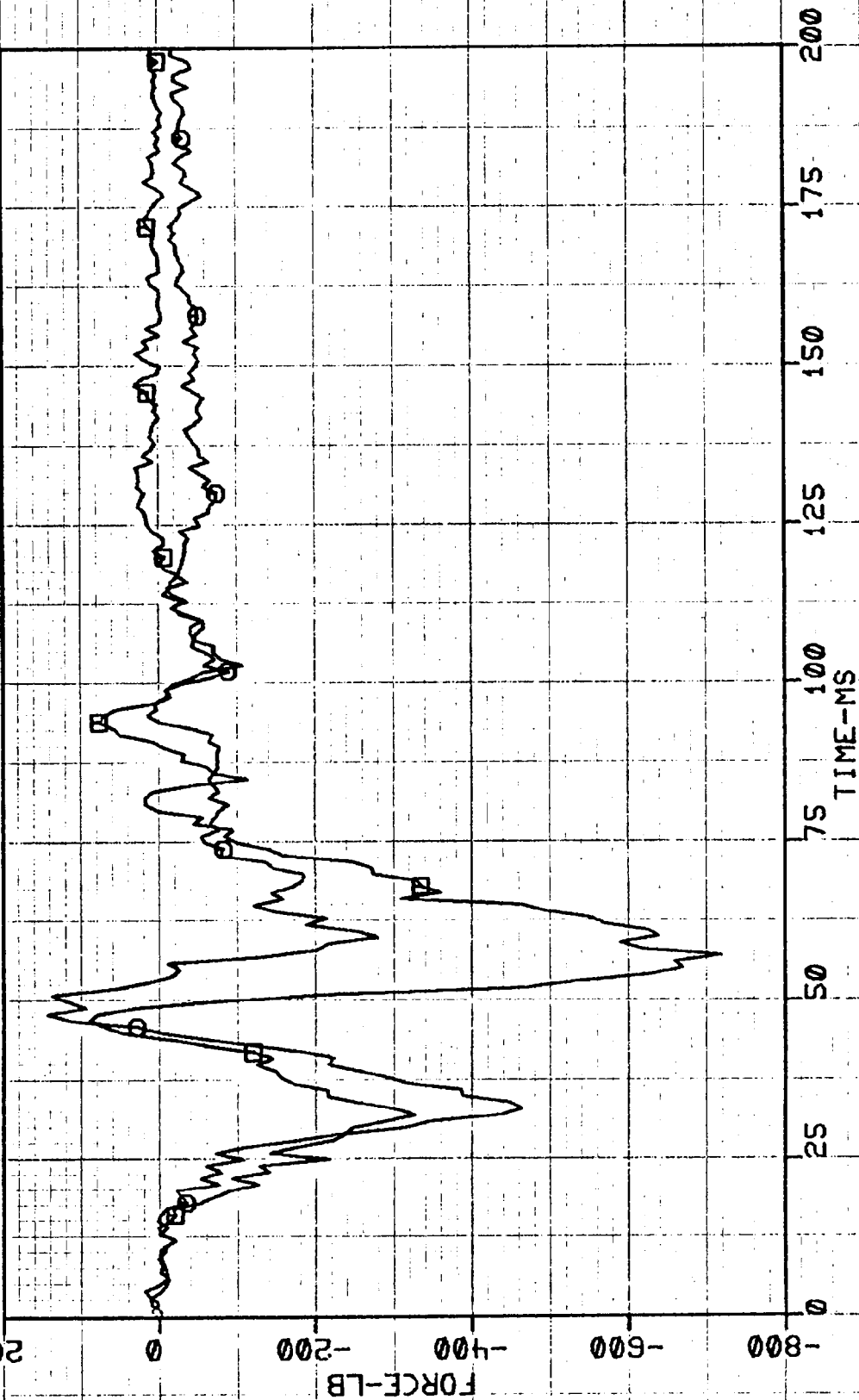
TEST#2 SUBARU GLF RF CHEST AR





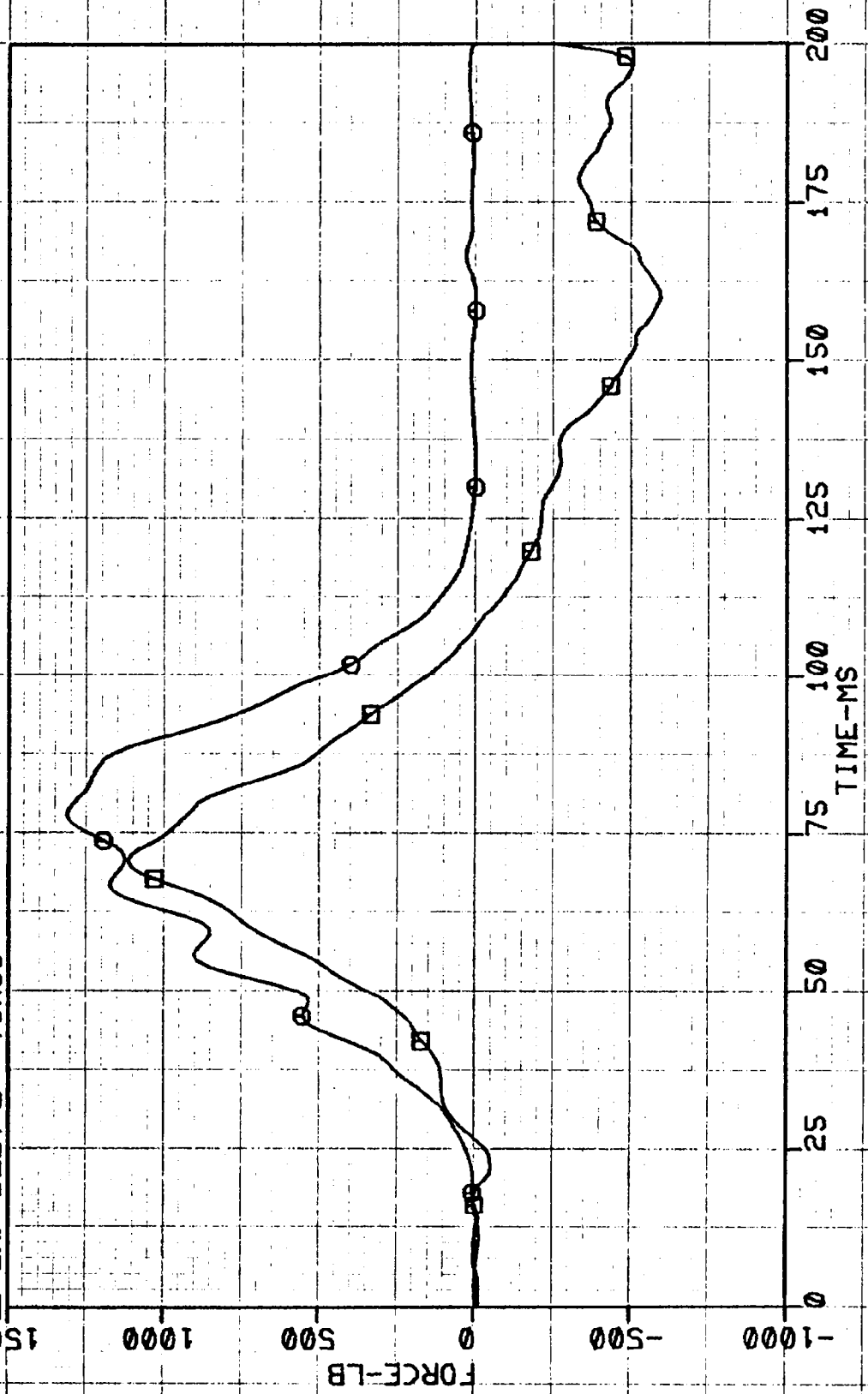
TEST#2 SUBARU GLF RF FEMUR

□ = LEFT ○ = RIGHT



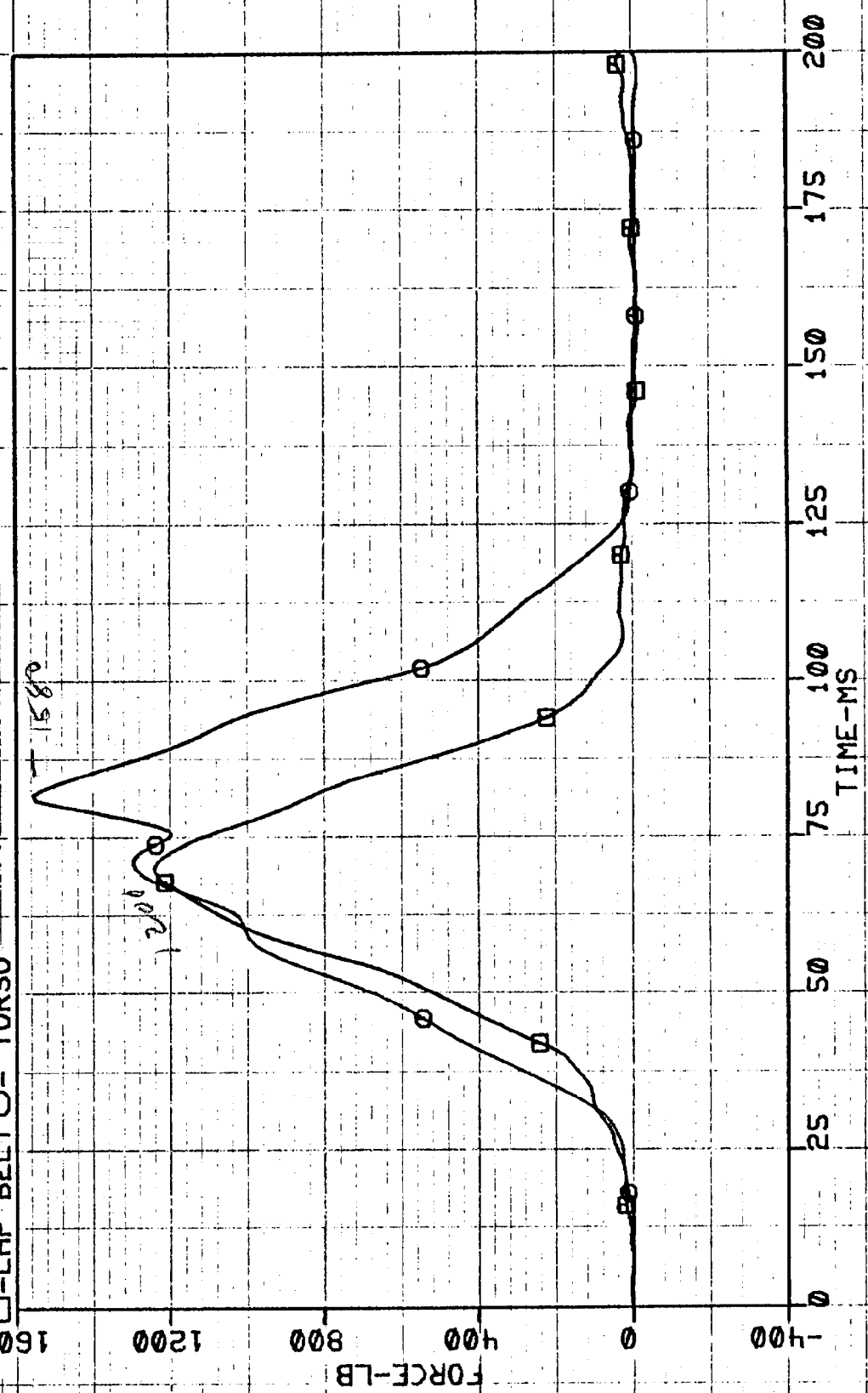
TEST#2 SUBARU GLF LF BELT LOADS

□=LAP BELT ○=TORSO

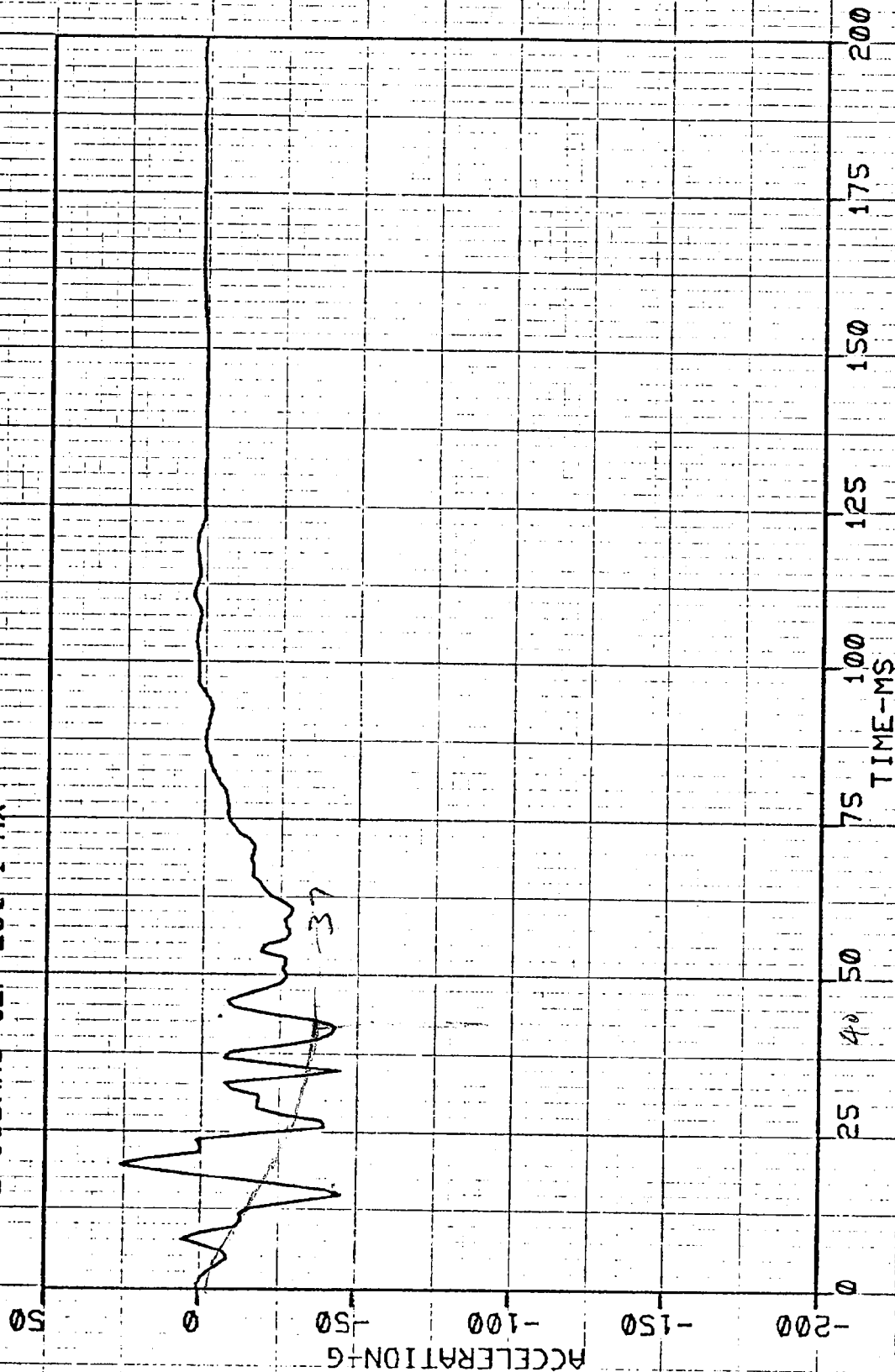


TEST#2 SUBARU GLF RF BELT LOADS

□ = LAP BELT ○ = TORSO



TEST#2 SUBARU GLF LOC 1 AX



TEST#2 SUBARU GLF LOC 1 VX

32

24

16

8

0

-8

VELOCITY-MPH

0

25

50

75

100

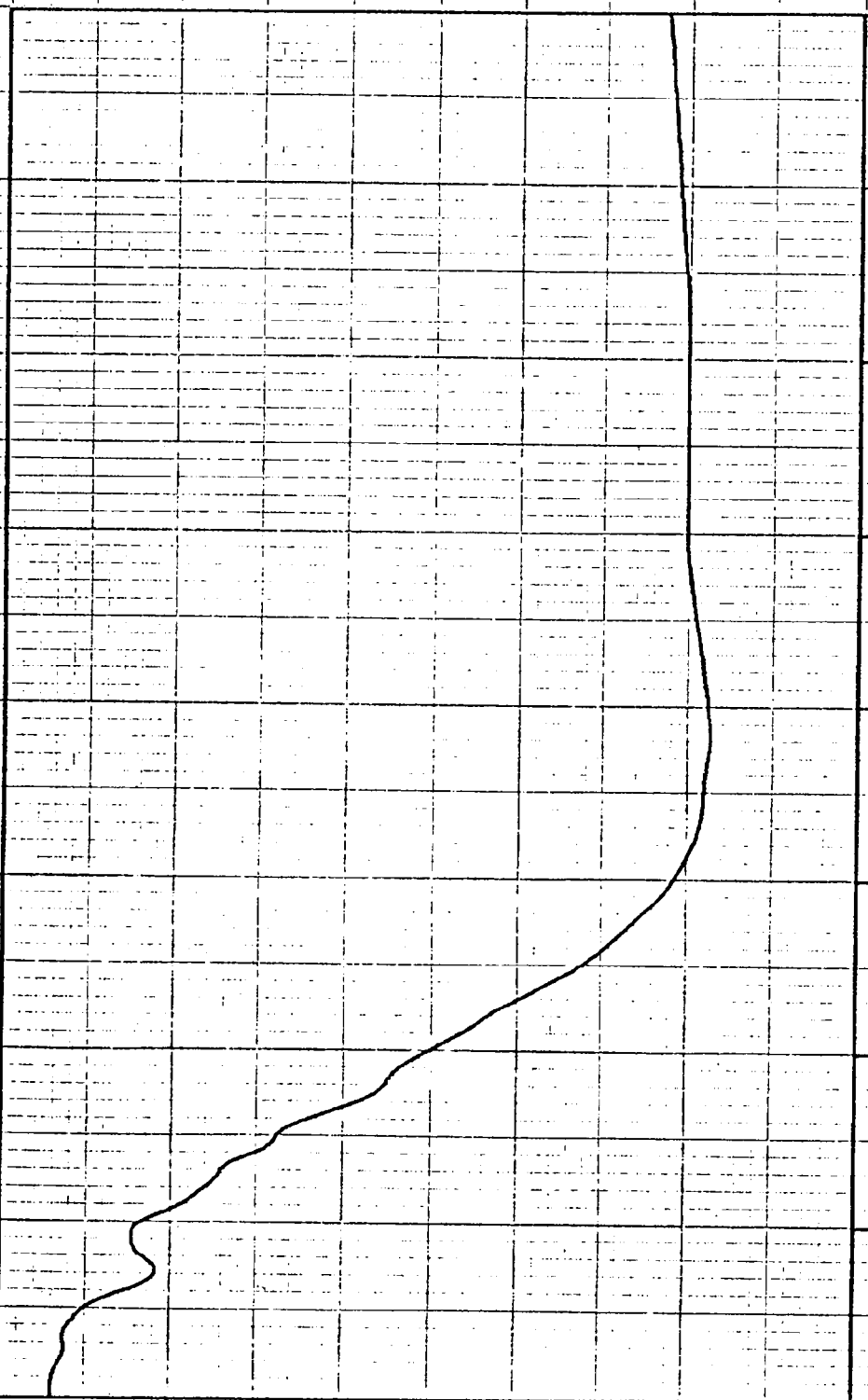
125

150

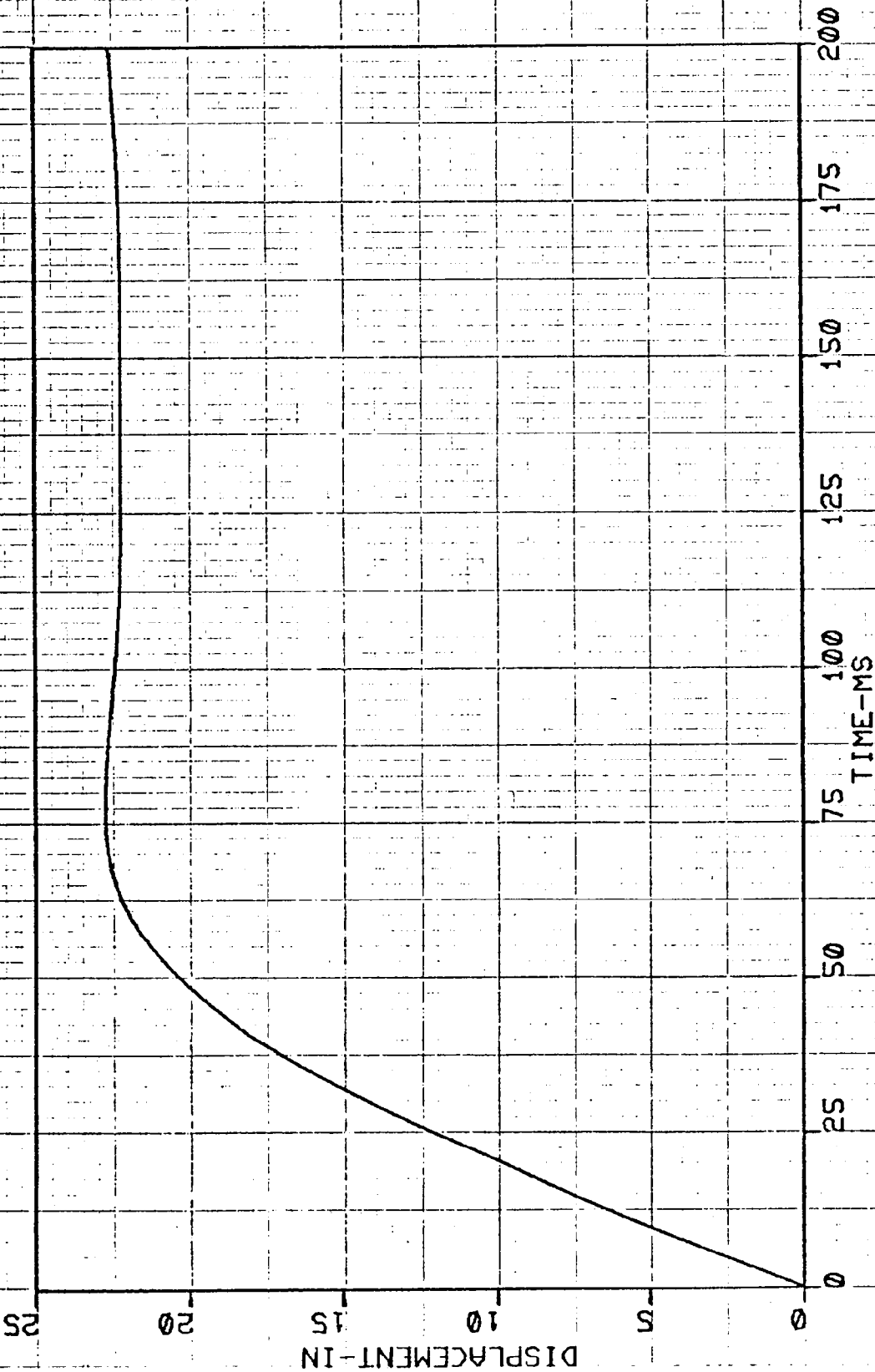
175

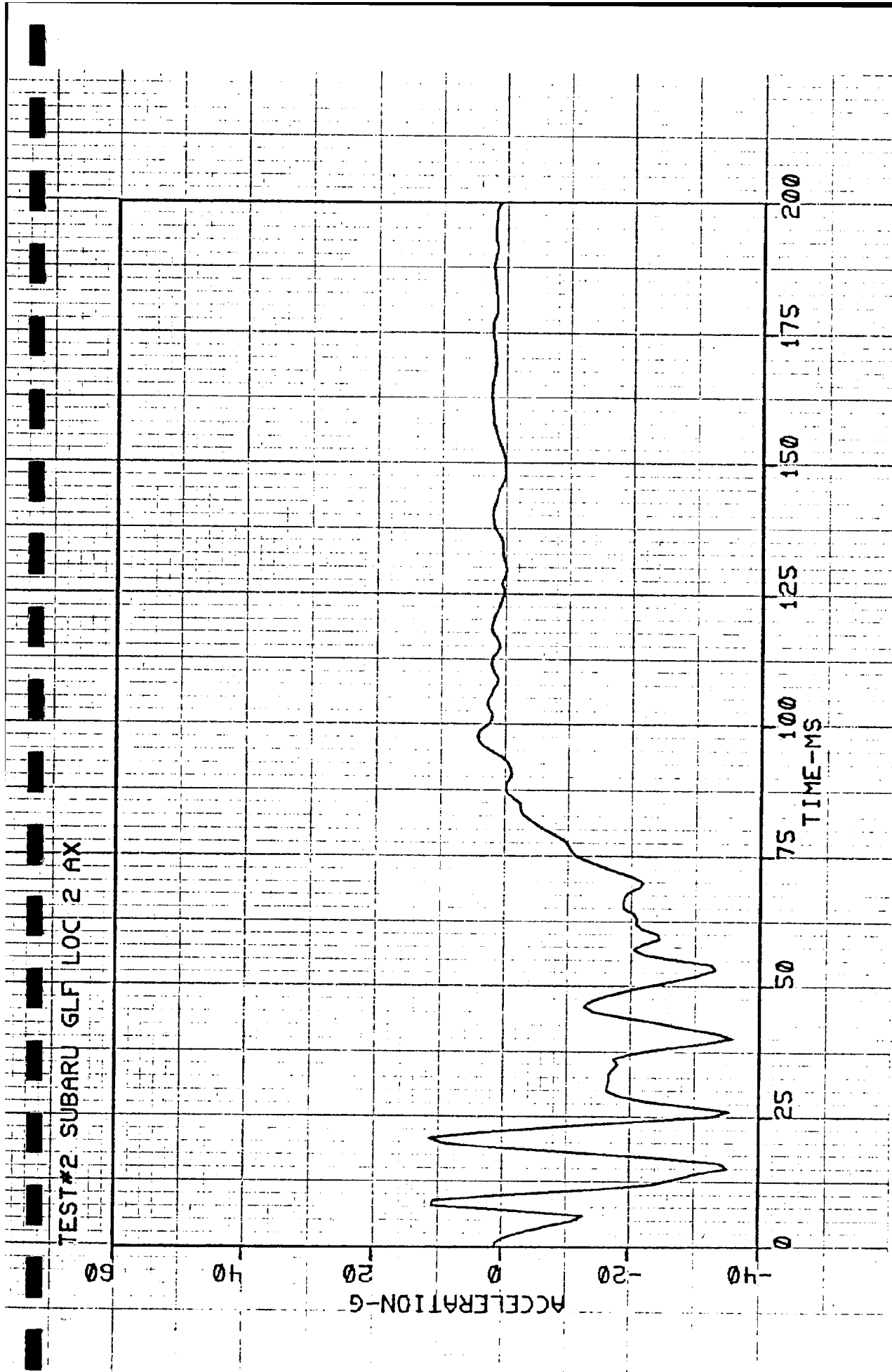
200

TIME-MS

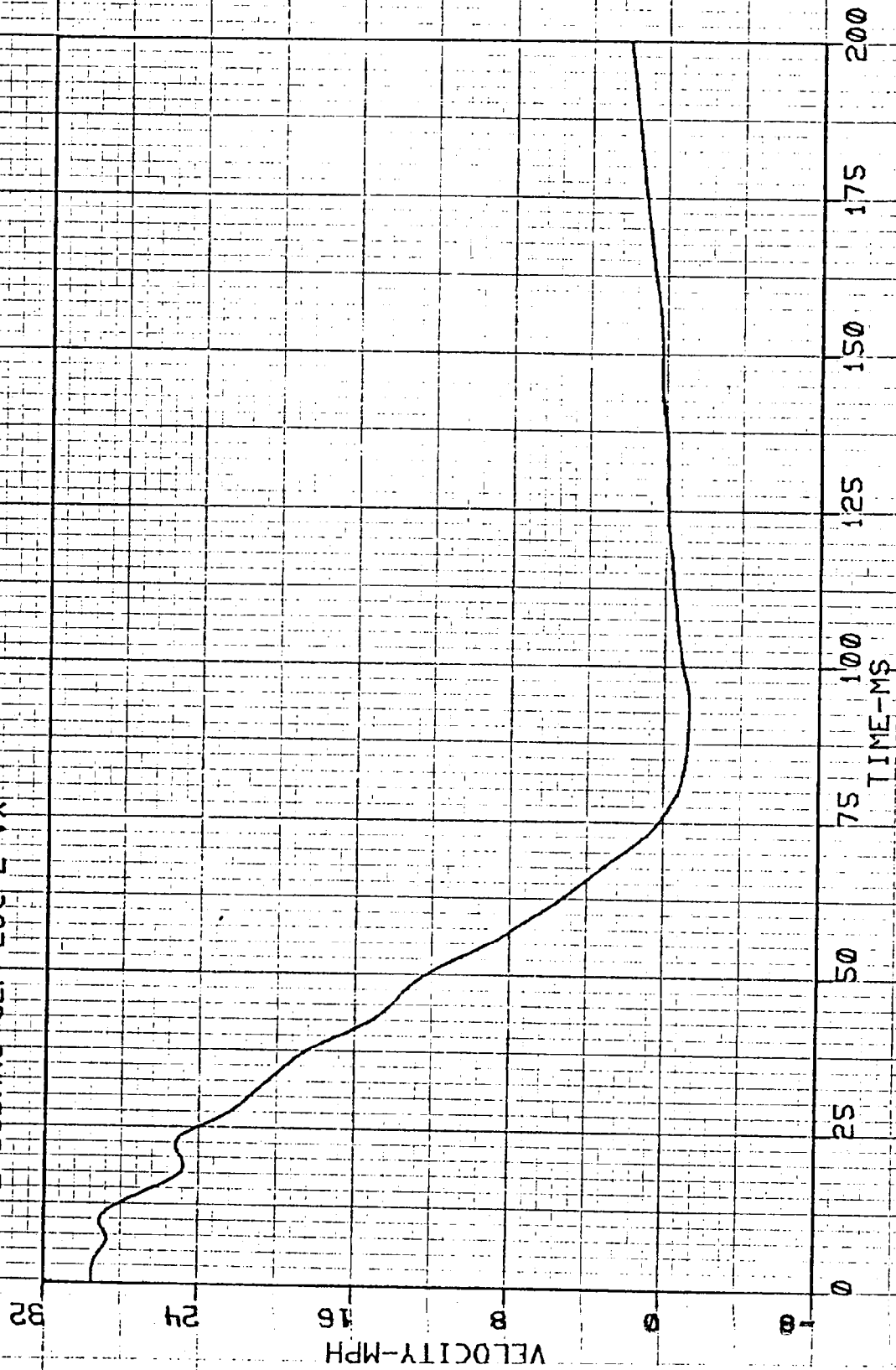


TEST#2 SUBARU GLF LOC 1 SX

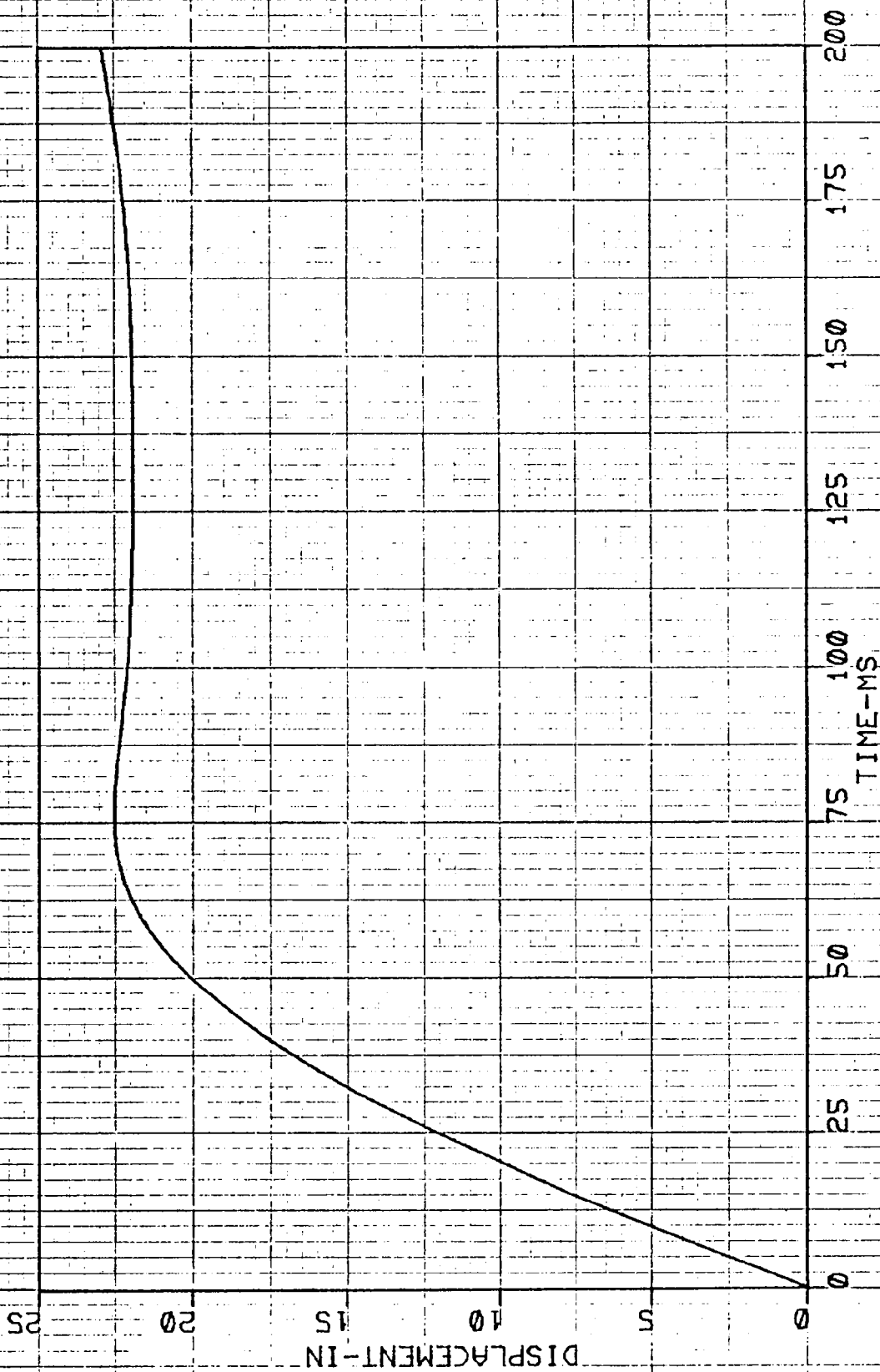




TEST#2 SUBARU GLF LOC 2 VX



TEST#2 SUBARU GLF LOC 2 SX



APPENDIX C
DUMMY CERTIFICATION DATA

PART 572 DUMMY CALIBRATION TEST DATA

NHTSA Dummy I.D. No.: A 0 4

Laboratory Technician: S. Ryan

		Pre-test Calibration	Post-test Calibration*
Date of Dummy Calibration		10-1-80	
Calibration Sequential Number for Dummy		20	
Temperature in Lab. (Spec. = 66 to 78 °F)		75	
Relative Humidity in Lab. (Spec. = 10 to 70%)		44	
Test Parameter	Specification		
1. Head Drop Test:			
a. Peak Resultant Accel	210 - 260G	246	
b. Peak Lateral Accel	≤ 10G	3	
c. Time above 100G	0.9 - 1.5 ms	1.2	
2. Neck Bending Test:			
a. Pendulum Speed	21.5 - 25.5 fps	21.9	
b. Pendulum Avg Decel (over t ₃ - t ₂)	20 - 24G	23	
c. Peak Resultant Head Acceleration	26G Maximum	22	
d. Pendulum Decel (t ₂ - t ₁)	≤ 3 ms	2	
e. Pendulum Decel (t ₃ -t ₂)	25 - 30 ms	27	
f. Pendulum Decel (t ₄ -t ₃)	≤ 10 ms	3	
g. Pendulum Direction Reversal Time	≥ 123 ms	-	
h. Maximum Head Rota- tion	63 to 73°	71	
i. Chordal Displacement:			
Head Rotation Angle			
0°	Time	-2 - 2 ms	0
	Displ	-0.5 - 0.5 in.	0
30°	Time	25.6 - 34.4 ms	27.5
	Displ	2.1 - 3.1 in.	2.6
60°	Time	40.3 - 51.7 ms	42.5
	Displ	4.3 - 5.3 in.	4.6
Maximum (73°)	Time	53.2 - 66.8 ms	58.0
	Displ	5.0 - 6.0 in.	5.3

*According to criteria established in NHTSA Laboratory Procedure TP-212-02, dated April 1, 1980, no post-test dummy calibration was required.

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 4

Test Parameter		Specification	Pre-test Calibration	Post-test Calibration
2. Neck Bending Test: (Continued)				
Head Rotation Angle				
60°	Time	67.0 - 83.0 ms	73.5	
	Displ	4.3 - 5.3 in.	4.4	
30°	Time	85.4 - 104.6 ms	89.5	
	Displ	2.1 - 3.1 in.	2.5	
0°	Time	101.0 - 123.0 ms	104.0	
	Displ	-0.5 - 0.5 in.	0.1	
3. Abdominal Compression Test: (Preload = 10 pounds)				
a. Force at 0.5 in.		14 - 26 lb	22	
b. Force at 0.75 in.		27 - 40 lb	35	
c. Force at 1.0 in.		40 - 53 lb	52	
d. Force at 1.3 in.		63 - 78 lb	75	
4. Lumbar Flexion Test:				
a. Force at 20°		22 - 34 lb	29	
b. Force at 30°		34 - 46 lb	42	
c. Force at 40°		46 - 58 lb	51	
d. Return Angle		12° Maximum	8	
5. Chest Impact Tests:				
a. High Speed				
1) Probe Speed		21.78-22.22 fps	22.02	
2) Peak Deflection		1.7 in. Maximum	1.5	
3) Peak Resistive Force		2250 lb Maximum	2110	
4) Internal Hysteresis		50 - 70%	58	
a. Low Speed				
1) Probe Speed		13.86-14.14 fps	13.97	
2) Peak Deflection		1.1 in. Maximum	0.9	
3) Peak Resistive Force		1450 lb Maximum	1307	
4) Internal Hysteresis		50 - 70%	65	

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: A 0 4

Test Parameter	Specification	Pre-test	Post-test
		Calibration	Calibration
6. Knee Impact Tests:			
a. Right Side			
1) Probe Speed	6.76 - 7.04 fps	6.88	
2) Maximum Force	1850 - 2500 lb	2419	
3) Time >1000 lb	1.7 ms Minimum	1.8	
a. Left Side			
1) Probe Speed	6.76 - 7.04 fps	6.85	
2) Maximum Force	1850 - 2500 lb	2129	
3) Time >1000 lb	1.7 ms Minimum	2.0	

PART 572 DUMMY CALIBRATION TEST DATA

NHTSA Dummy I.D. No.: 7 5 9

Laboratory Technician: R. Bishop

		Pre-test Calibration	Post-test Calibration*
Date of Dummy Calibration		9-18-80	
Calibration Sequential Number for Dummy		8	
Temperature in Lab. (Spec. = 66 to 78 °F)		72	
Relative Humidity in Lab. (Spec. = 10 to 70%)		48	
Test Parameter	Specification		
1. Head Drop Test:			
a. Peak Resultant Accel	210 - 260G	216	
b. Peak Lateral Accel	$\leq 10G$	3	
c. Time above 100G	0.9 - 1.5 ms	1.3	
2. Neck Bending Test:			
a. Pendulum Speed	21.5 - 25.5 fps	22.0	
b. Pendulum Avg Decel (over $t_3 - t_2$)	20 - 24G	22	
c. Peak Resultant Head Acceleration	26G Maximum	19	
d. Pendulum Decel ($t_2 - t_1$)	≤ 3 ms	2	
e. Pendulum Decel ($t_3 - t_2$)	25 - 30 ms	25	
f. Pendulum Decel ($t_4 - t_3$)	≤ 10 ms	9	
g. Pendulum Direction Reversal Time	≥ 123 ms	-	
h. Maximum Head Rota- tion	63 to 73°	64	
i. Chordal Displacement:			
Head Rotation Angle			
0°	Time	-2 - 2 ms	0
	Displ	-0.5 - 0.5 in.	0
30°	Time	25.6 - 34.4 ms	30.0
	Displ	2.1 - 3.1 in.	2.4
60°	Time	40.3 - 51.7 ms	49.0
	Displ	4.3 - 5.3 in.	4.5
Maximum (73°)	Time	53.2 - 66.8 ms	60.0
	Displ	5.0 - 6.0 in.	4.8

*According to criteria established in NHTSA Laboratory Procedure TP-212-02, dated April 1, 1980, no post-test dummy calibration was required.

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: 7 5 9

Test Parameter	Specification	Pre-test Calibration	Post-test Calibration
2. Neck Bending Test: (Continued)			
Head Rotation Angle			
60°	Time	67.0 - 83.0 ms	68.0
	Displ	4.3 - 5.3 in.	4.6
30°	Time	85.4 - 104.6 ms	90.5
	Displ	2.1 - 3.1 in.	2.4
0°	Time	101.0 - 123.0 ms	107.0
	Displ	-0.5 - 0.5 in.	0.0
3. Abdominal Compression Test: (Preload = 10 pounds)			
a. Force at 0.5 in.	14 - 26 lb	17	
b. Force at 0.75 in.	27 - 40 lb	28	
c. Force at 1.0 in.	40 - 53 lb	43	
d. Force at 1.3 in.	63 - 78 lb	70	
4. Lumbar Flexion Test:			
a. Force at 20°	22 - 34 lb	32	
b. Force at 30°	34 - 46 lb	43	
c. Force at 40°	46 - 58 lb	51	
d. Return Angle	12° Maximum	4	
5. Chest Impact Tests:			
a. High Speed			
1) Probe Speed	21.78-22.22 fps	22.00	
2) Peak Deflection	1.7 in. Maximum	1.4	
3) Peak Resistive Force	2250 lb Maximum	2145	
4) Internal Hysteresis	50 - 70%	67	
a. Low Speed			
1) Probe Speed	13.86-14.14 fps	13.98	
2) Peak Deflection	1.1 in. Maximum	0.9	
3) Peak Resistive Force	1450 lb Maximum	1334	
4) Internal Hysteresis	50 - 70%	70	

PART 572 DUMMY CALIBRATION TEST DATA (CONTINUED)

NHTSA Dummy I.D. No.: 7 5 9

		Pre-test	Post-test
<u>Test Parameter</u>	<u>Specification</u>	<u>Calibration</u>	<u>Calibration</u>
6. Knee Impact Tests:			
a. Right Side			
1) Probe Speed	6.76 - 7.04 fps	6.86	
2) Maximum Force	1850 - 2500 lb	2384	
3) Time >1000 lb	1.7 ms Minimum	1.8	
a. Left Side			
1) Probe Speed	6.76 - 7.04 fps	6.86	
2) Maximum Force	1850 - 2500 lb	2456	
3) Time >1000 lb	1.7 ms Minimum	1.8	

3101-041

DOT 268

Dynamic Science Report No. 3101-80-189B

2 of 2 Parts

BARRIER IMPACT LOAD DATA
FUJI HEAVY INDUSTRIES, LTD.
1980 SUBARU GLF
NHTSA 800569

Prepared by:

Dynamic Science, Inc.
A Talley Industries Company
1850 West Pinnacle Peak Road
Phoenix, Arizona 85027



NOVEMBER 1980

FINAL REPORT

Prepared for:

U.S. Department of Transportation
National Highway Traffic Safety Administration
Office of Passenger Vehicle Research
400 Seventh Street, S.W.
Washington, D.C. 20590

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1.0 INTRODUCTION	1
2.0 INSTRUMENTATION DESCRIPTION	2
2.1 LOAD CELL BARRIER	2
2.2 PLACEMENT OF VEHICLE ACCELEROMETERS	2
3.0 GENERAL TEST AND VEHICLE PARAMETER DATA	5
4.0 DATA PRESENTATION	9

1.0 INTRODUCTION

This report is an addendum to Report No. 3101-80-189A and presents the barrier load measurement data acquired in testing a 1980 Subaru GLF (NHTSA 800569).

Barrier impact speed was 29.47 mph.

Section 2.0 presents information on the load cell barrier and vehicle accelerometers.

Section 3.0 provides general test and vehicle parametric data.

Section 4.0 presents plots of load cell and accelerometer data versus time.

2.0 INSTRUMENTATION DESCRIPTION

2.1 LOAD CELL BARRIER

The load cell barrier face is pictured in Figure 2-1. The barrier consists of a 9 x 4 array of 50 klb load cells each faced with a section of 1-3/4-inch thick plywood. Plywood sections for Rows C and D (upper two rows) each measure 10 inches high and 9 inches wide. Plywood sections for Rows A and B (lower two rows) each measure 9 inches high and 9 inches wide. Overall width of the barrier is 83 inches and overall height is 38-3/4 inches. The lower edge of the barrier is 2-5/8 inches above the surface of the ground.

2.2 PLACEMENT OF VEHICLE ACCELEROMETERS

Six longitudinal accelerometers were located on the vehicle as schematically illustrated in Figure 2-2. Two instruments (Loc. 1 and 2) represent occupant compartment accelerations. Two (Loc. 3 and 4) represent engine accelerations and two (Loc. 5 and 6) represent front wheel accelerations.

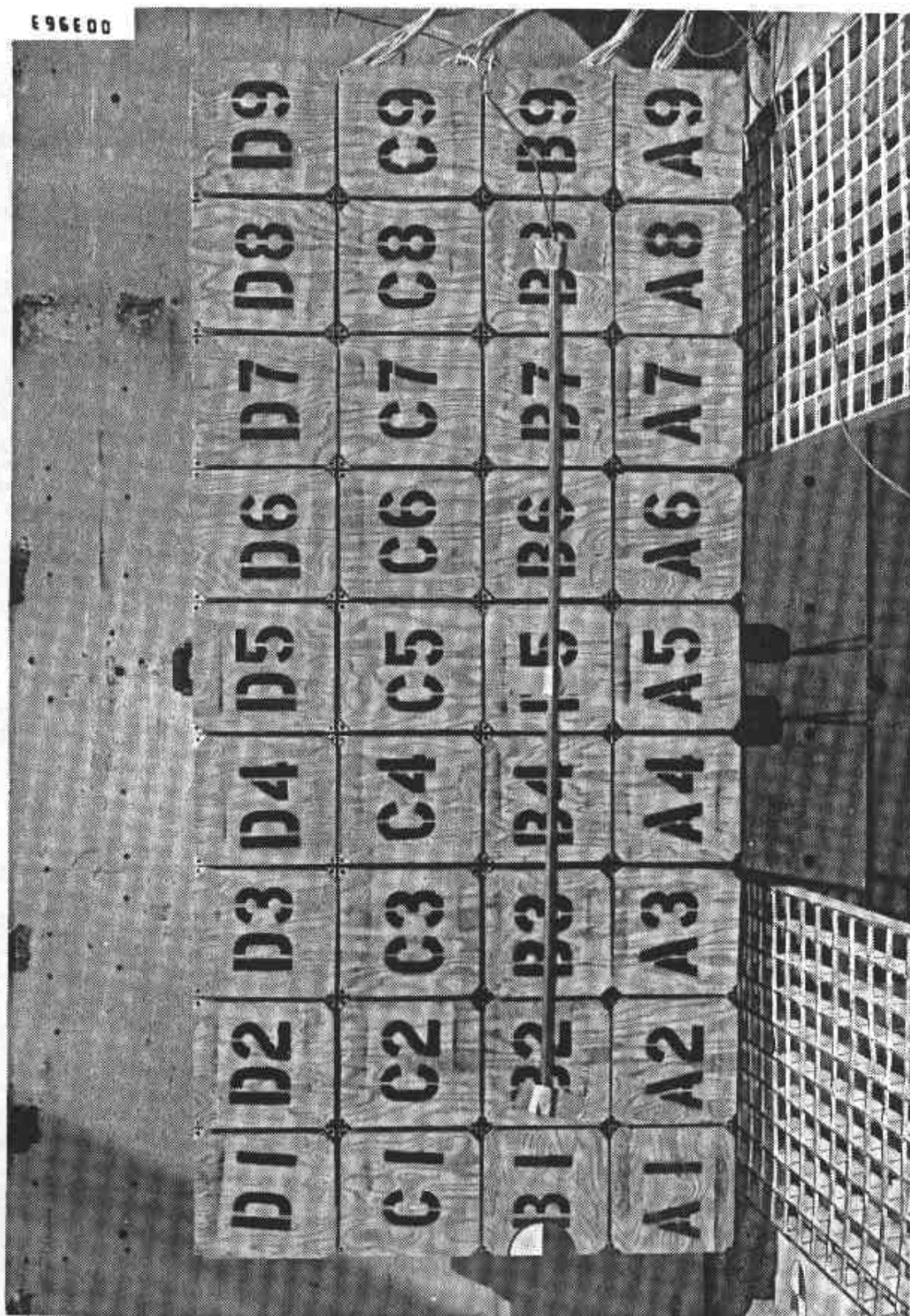
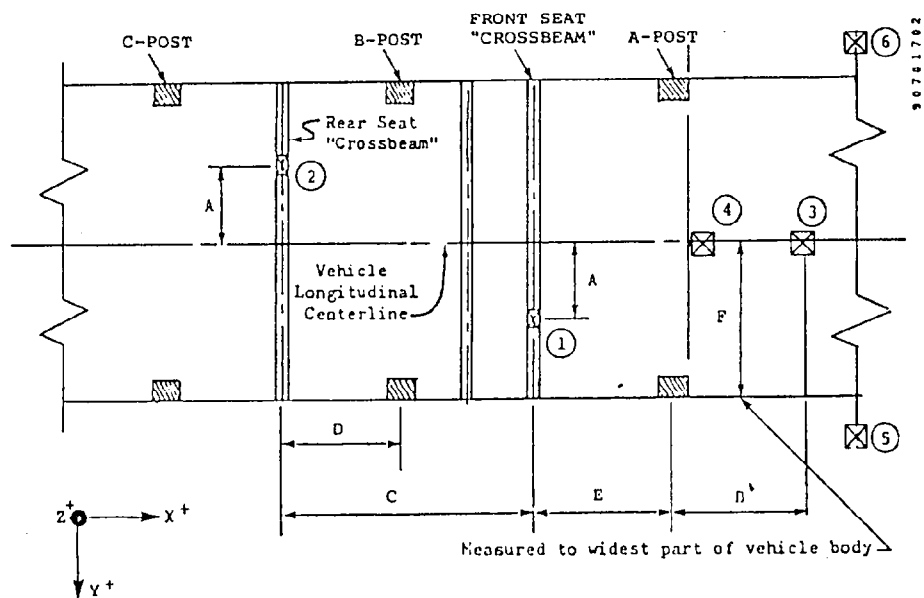


FIGURE 2-1. LOAD CELL BARRIER FACE.

Dim.	Length (in.)
A	10.6
B	26.2
C	30.5
D	14.6
E	20.4
F	32.0



No.	Location Description	Component Direction X Y Z	Data Summary Peak G @ msec					
			"+" X	"-" X	"+" Y	"-" Y	"+" Z	"-" Z
1	Below front seat area	✓	25.7 @ 20	45.7 @ 15				
2	Below rear seat area	✓	11.4 @ 21	35.8 @ 40				
3	Engine top	✓	39.1 @ 42	107.7 @ 33				
4	Engine bottom	✓	42.8 @ 42	136.2 @ 34				
5	RF brake caliper	✓	14.1 @ 76	38.4 @ 43				
6	LF brake caliper	✓	22.9 @ 33	58.0 @ 28				

FIGURE 2-2. TEST VEHICLE ACCELEROMETER LOCATION DEFINITION AND DATA SUMMARY.

3.0 GENERAL TEST AND VEHICLE PARAMETER DATA

This section consists of three tables which document vehicle information, test conditions, and the post-impact crush configuration.

GENERAL TEST AND VEHICLE PARAMETER DATA

TEST VEHICLE INFORMATION:

Vehicle Manufacturer: Fuji Heavy Industries, Ltd.
 Make/Model: Subaru GLF
 Body Style: 4-Door Sedan Model Year: 1980
 VIN: JF17AB21FAG213264 Build Date: 7-80
 NHTSA No.: 800569 Color: Blue
 Engine Data: 4 cylinders; 97 in.³ displacement
 Transmission Data: 5 speed (x) Manual () Automatic
 Date Vehicle Received by Laboratory: September 15, 1980
 Dealer Name & Address: Mecham Pontiac/Subaru
P.O. Box 920, Glendale, Arizona

DATA FROM CERTIFICATION LABEL ON LEFT DOOR REAR FACE OR B-POST:

Vehicle Manufactured By: Fuji Heavy Industries, Ltd.
 Date of Manufacture: 7-80; VIN: JF17AB21FAG213264
 GVWR: 3070 lb; GAWR: Front = 1750 lb; Rear = 1320 lb

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVE BOX, ETC.:

Vehicle Load:	FRONT	REAR	RECOMMENDED	LOAD RANGE:
Up to Capacity	<u>26</u> psi	<u>26</u> psi	TIRE SIZE:	
Vehicle Capacity:			<u>175/70HR13</u>	<u>B</u>
Type of Seats -	<u>X</u> Bench	Number of Occupants =	<u>2</u> Front	
	<u>X</u> Bucket	(Designated Seating	<u>2</u> Rear	
	<u>X</u> Split Bench	Capacity)	<u>4</u> Total	
CARGO LOAD =	<u>60</u> lb			
TOTAL =	<u>660</u> lb			

WEIGHT OF TEST VEHICLE AS RECEIVED FROM DEALER (with max. fluids) (UDW)

Right Front =	<u>669</u> lb	Right Rear =	<u>419</u> lb
Left Front =	<u>667</u> lb	Left Rear =	<u>415</u> lb
TOTAL FRONT WEIGHT =	<u>1336</u> lb	(<u>61.6%</u> of Total Vehicle Weight)	
TOTAL REAR WEIGHT =	<u>834</u> lb	(<u>38.4%</u> of Total Vehicle Weight)	
TOTAL DELV. WEIGHT =	<u>2170</u> lb		

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 60 lb CARGO:

Right Front =	<u>738</u> lb	Right Rear =	<u>539</u> lb
Left Front =	<u>746</u> lb	Left Rear =	<u>521</u> lb
TOTAL FRONT WEIGHT =	<u>1484</u> lb	(<u>58.3%</u> of Total Vehicle Weight)	
TOTAL REAR WEIGHT =	<u>1060</u> lb	(<u>41.7%</u> of Total Vehicle Weight)	
TOTAL TEST WEIGHT =	<u>2544</u> lb		

Weight of ballast secured in vehicle trunk area = 0 lb

TARGET WEIGHT = CARGO LOAD = UDW = 164 (NO. OF DUMMIES) = 2558 lb.

POST IMPACT DATA

TYPE OF TEST: X Frontal (90°) Impact
 ___ Oblique (°) Impact on ___ Left (Driver's) Side
 ___ Right Side
 ___ Lateral or Side Impact on ___ Left (Driver's) Side
 ___ Right Side
 Rear Impact

DATE OF TEST: October 22, 1980 ; TIME: 1253 ; TEMP: 79° F

NHTSA NO.: 800569 ; VIN: JF17AB21FAG213264

REQUIRED VEHICLE VELOCITY RANGE: 34.5 to 35.5 mph

IMPACT VELOCITY: (traps within 5 feet of impact event)

Primary = 29.47 mph; Secondary = 29.48 mph

Distance from the vehicle's front bumper to barrier face
entering the vehicle velocity measurement device = 5.0 ft

exiting the vehicle velocity measurement device = 1.0 ft

VEHICLE STATIC CRUSH:

(For Frontal and Rear Impacts Only)

Driver's Side = 18.8 in.; Passenger's Side = 17.6 in.

Average = 18.2 in.

Crush Details: Symmetrical crush to A pillar, deformation in
roof above each B pillar

(For Side Impacts Only)

Amount of Crush = in. on side

Crush Details:

VEHICLE REBOUND:

(From rigid barrier only)

Driver's Side = 24.0 in.; Passenger's Side = 24.0 in.

Average = 24.0 in.

REMARKS: Two 1.5- by 19-inch rubber strips are spaced 10.5 inches apart on the front of a metal bumper. The ends of the bumper are covered with 6- by 20-inch sections of the same material which extend along the side of the front fenders.

VEHICLE PROFILE DATA SHEET

Vehicle: 1980 Subaru GLF D.S. No.: 11115 Test Date: October 22, 1980
 Measurement Date: Pre-test: October 17, 1980 Post-test October 24, 1980
 Exterior measurements referenced to plane 15 ft forward of rear bumper £

Location	Height	Vehicle Left (in.)					Vehicle Right (in.)				
		30	24	18	12	6	0	6	12	18	24
Pre-test Profile (in.)											

Top of Front Bumper	20.5	12.8	12.6	12.4	12.3	12.2	12.2	12.3	12.4	12.5	12.8	13.0
Front of Hood	30.5	19.9	19.3	18.5	18.2	17.9	17.9	17.9	18.2	18.5	19.4	20.0

Post-test Profile (in.)

Top of Front Bumper	18.4	31.6	31.6	31.0	30.8	30.7	30.6	30.5	30.4	30.3	30.4	30.6
Front of Hood	26.8	32.5	30.4	30.4	30.3	30.3	30.6	30.2	30.0	29.5	29.3	29.4

Post-test Static Crush (in.)

Top of Front Bumper	2.1	18.8	19.0	18.6	18.5	18.5	18.4	18.2	18.0	17.8	18.4	17.6
Front of Hood	3.7	12.6	11.1	11.9	12.1	12.4	12.7	12.3	11.8	11.0	9.9	9.4

4.0 DATA PRESENTATION

Data plots are presented for each accelerometer and consist of the accelerometer data plus the first integral versus time (velocity) and the second integral versus time (displacement) of the acceleration data.

For the load cells, all data are summed and presented as total load versus time, upper two rows (C and D) summed versus time and lower two rows (A and B) summed versus time. Additional plots are presented for each cell multi-plotted versus time by column. A plot of total load versus vehicle crush (second integral of acceleration at Location 2) is also included. Individual loads may be difficult to discern on some of these plots. Tabular data can be provided if necessary.

TEST#2 SUBARU GLF LOC 1 AX

50

0

-50

-100

-150

-200

ACCELERATION-G

TIME-MS

75

50

25

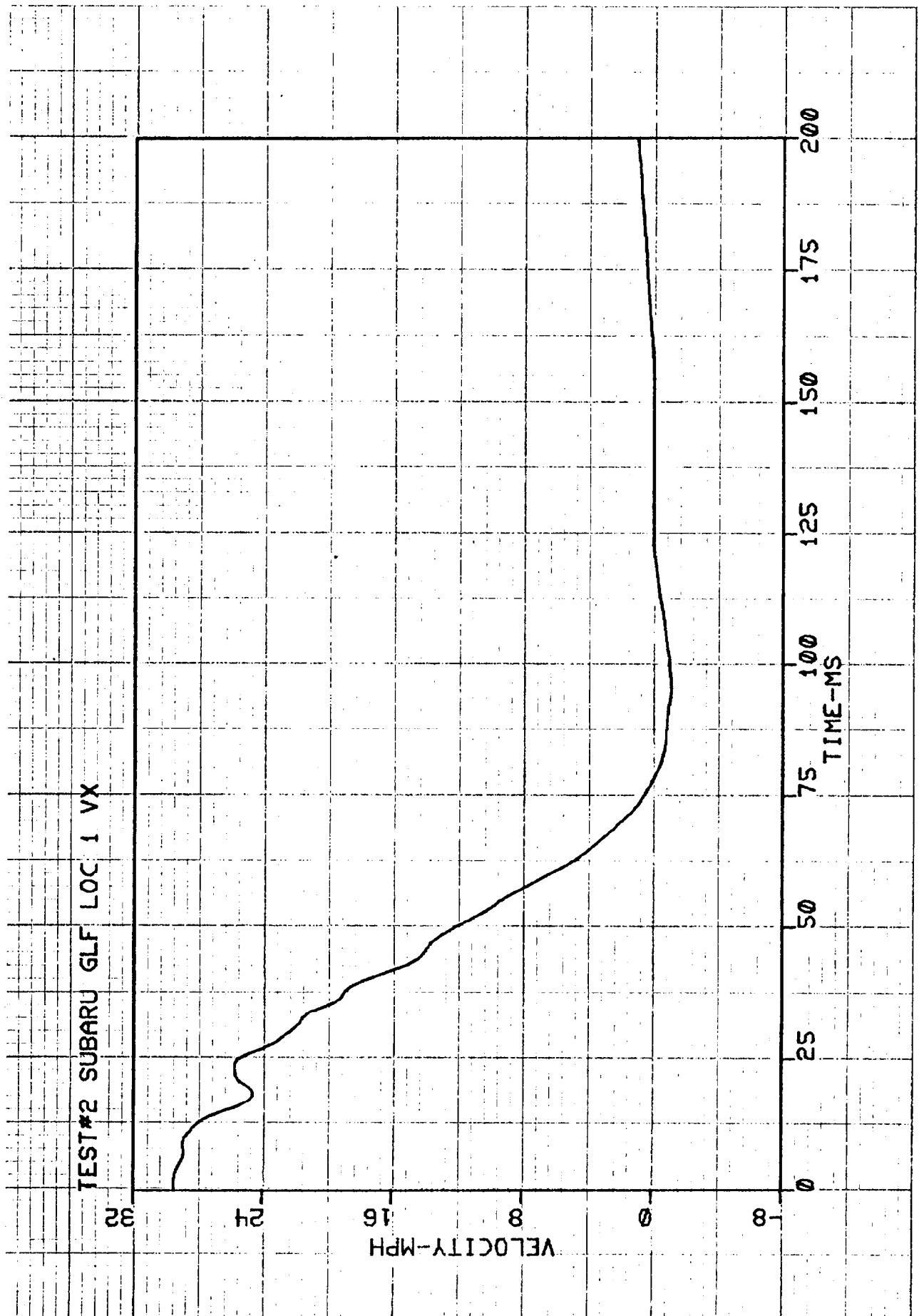
100

125

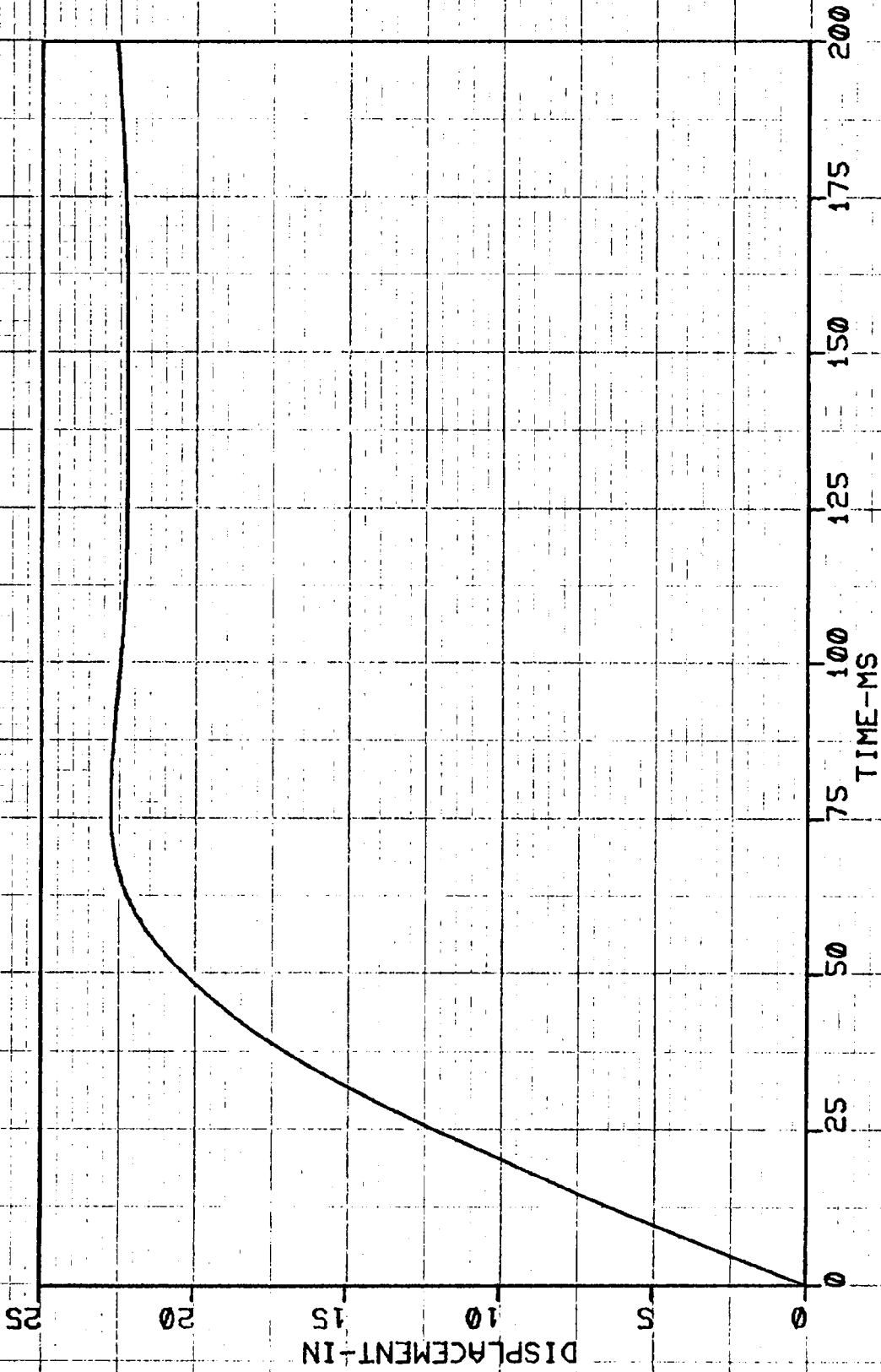
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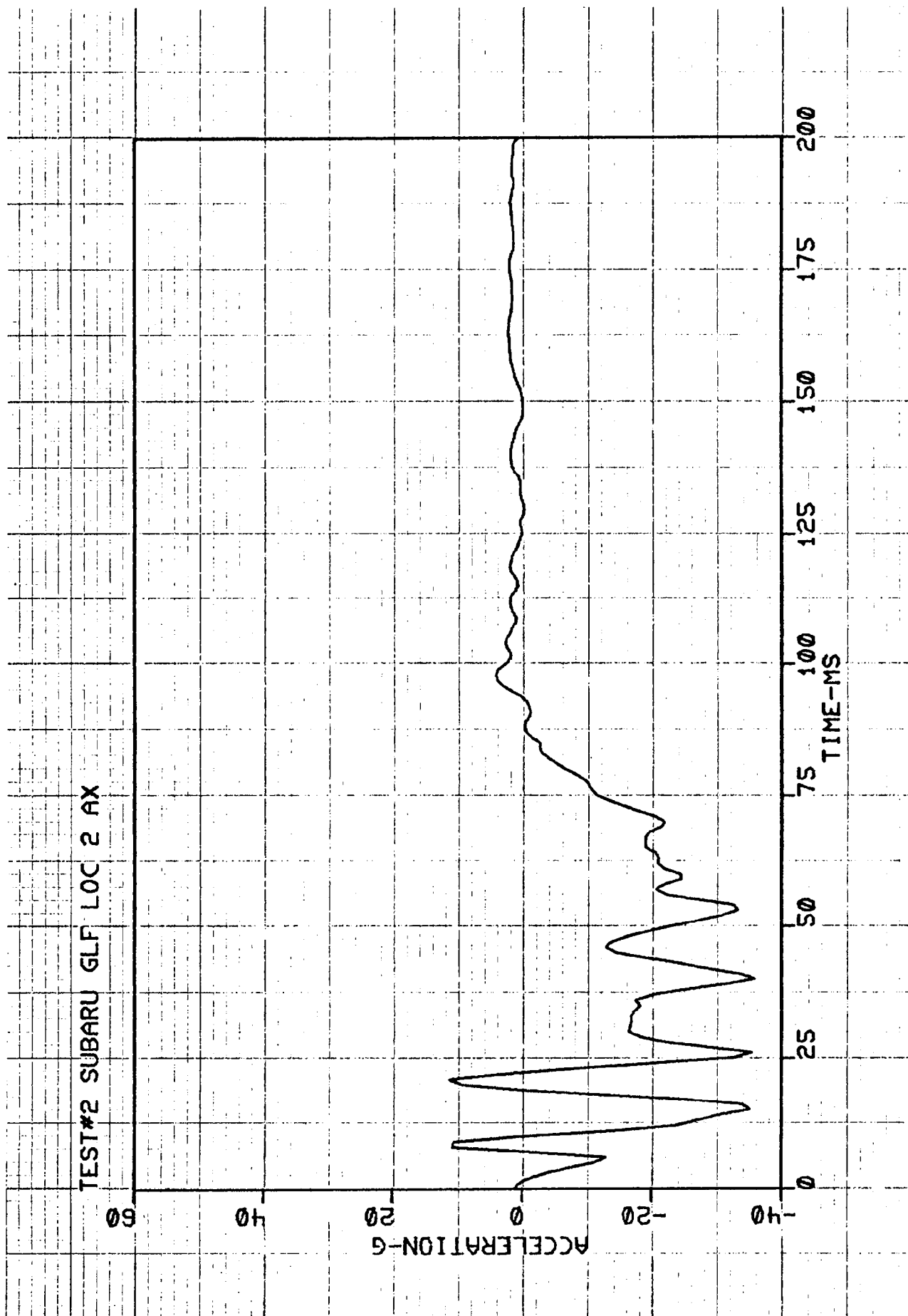
175

200

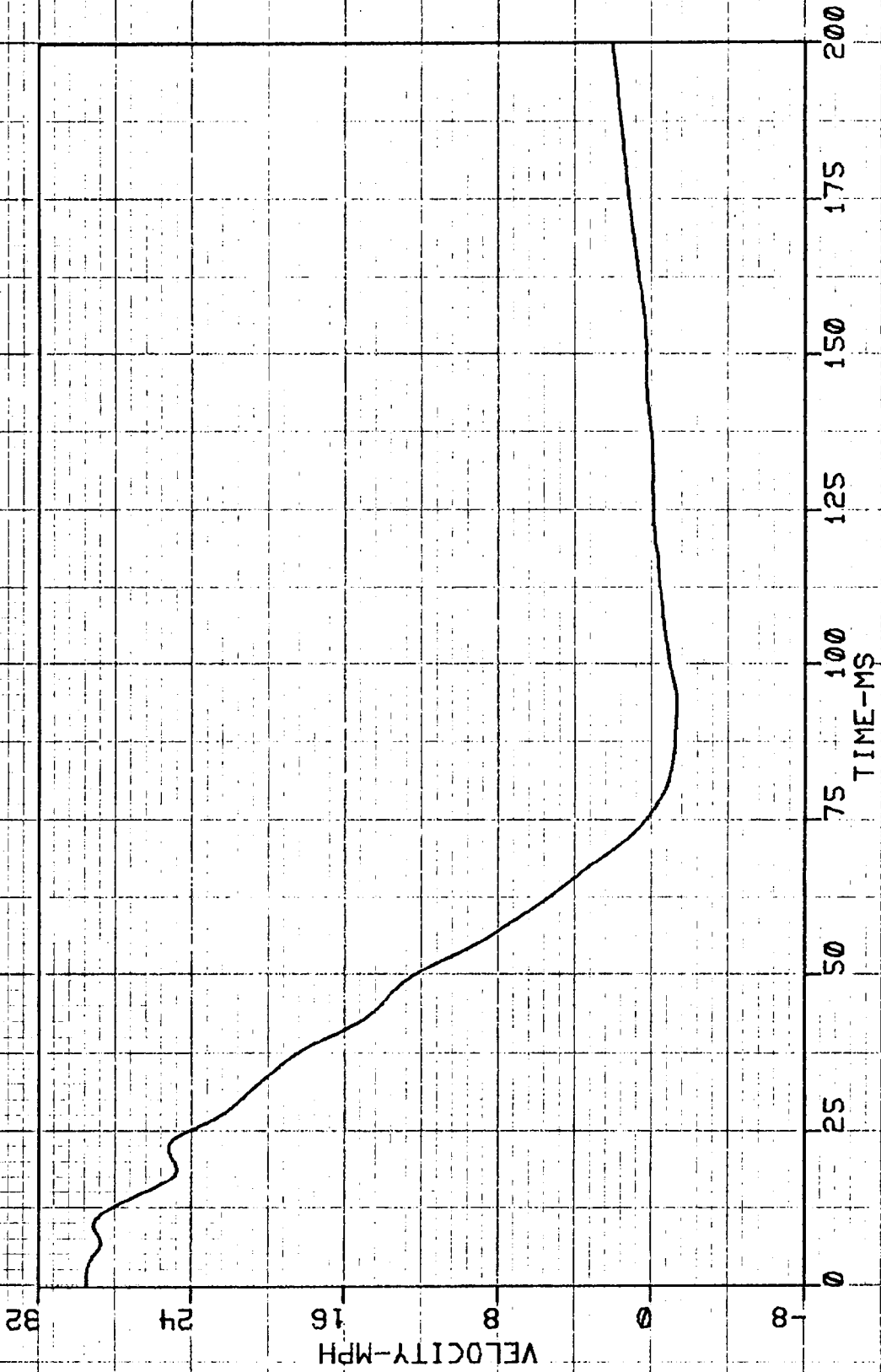


TEST#2 SUBARU GLF LOC 1 SX

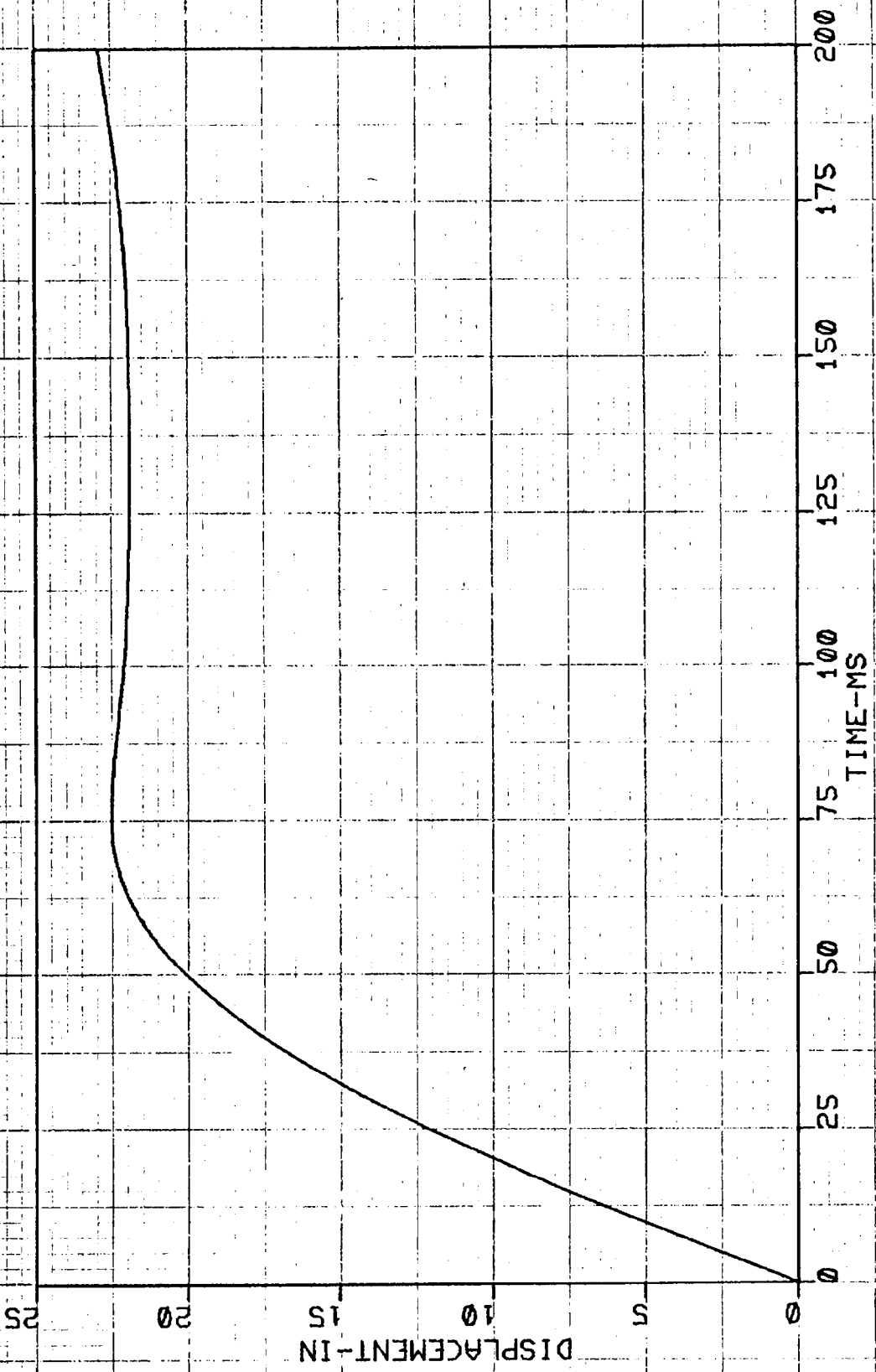




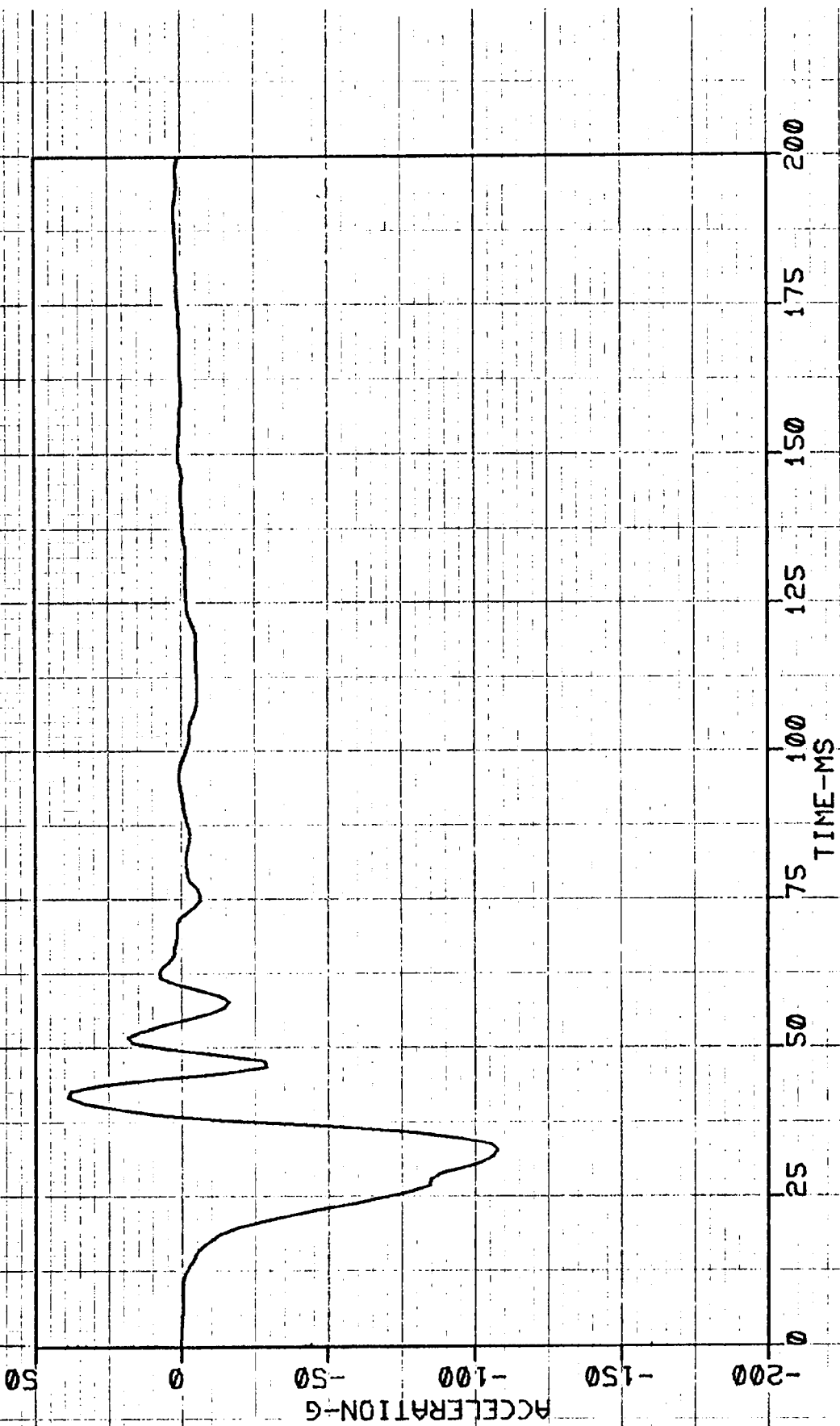
TEST#2 SUBARU GLF LOC 2 VX



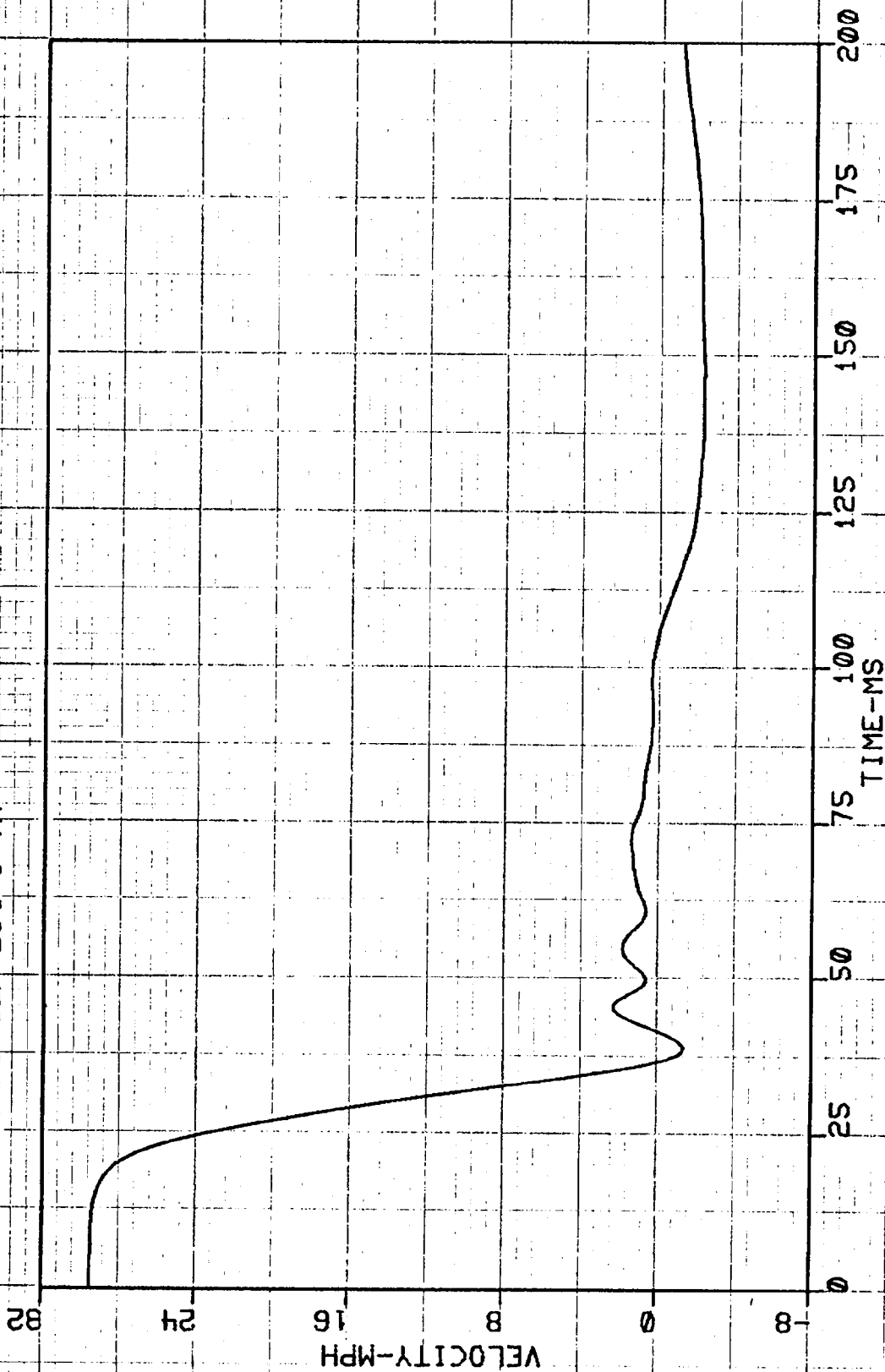
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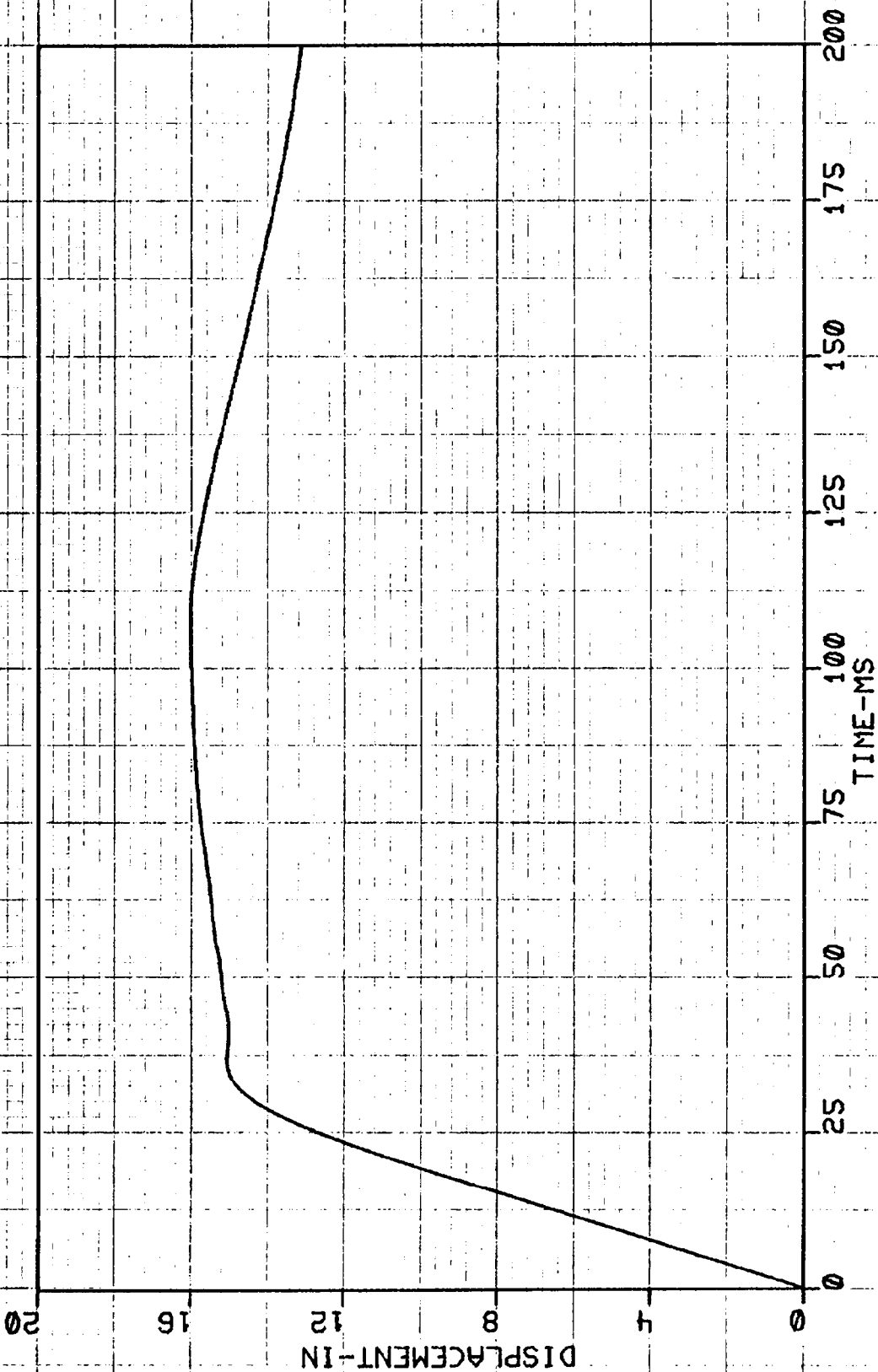
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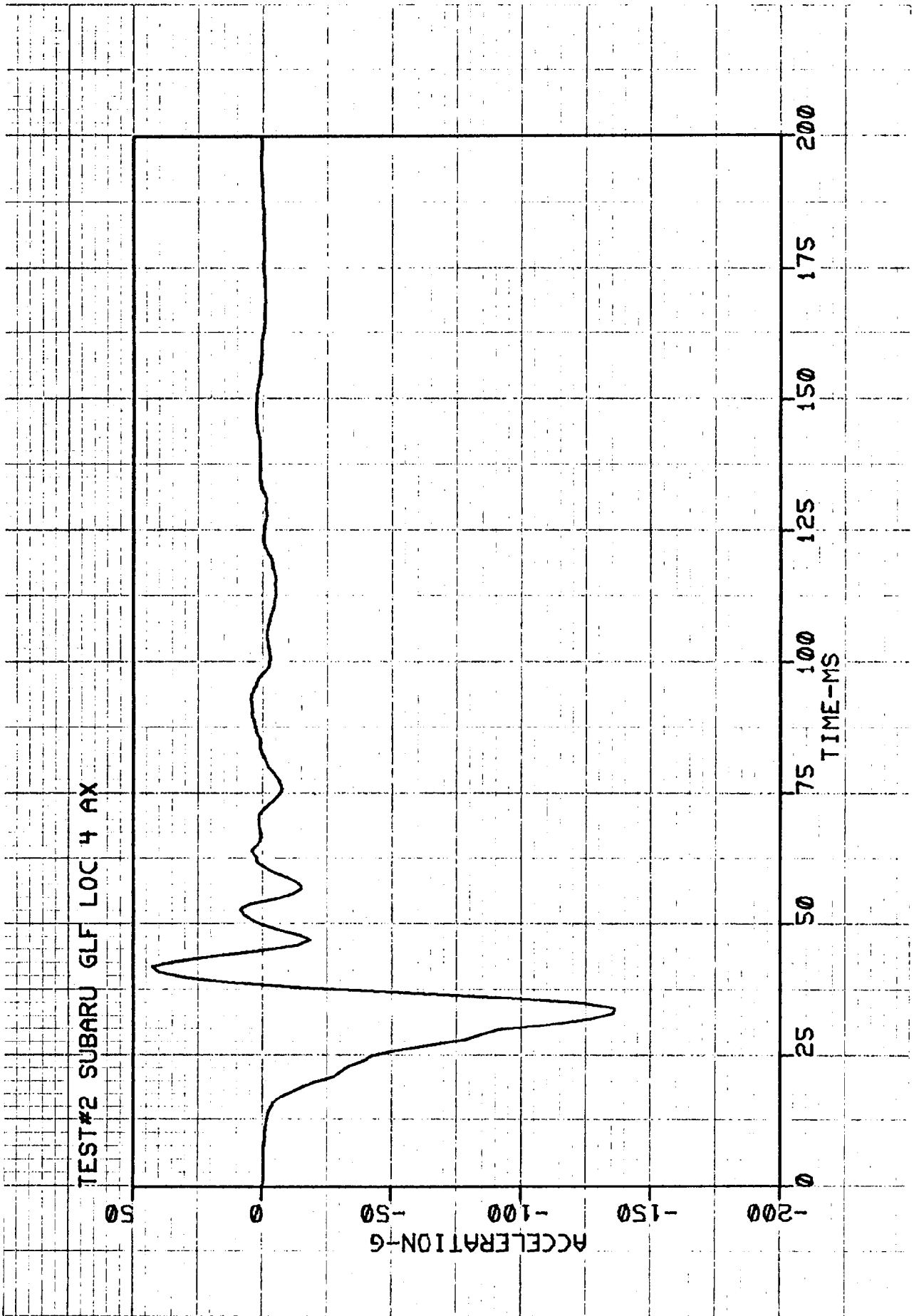


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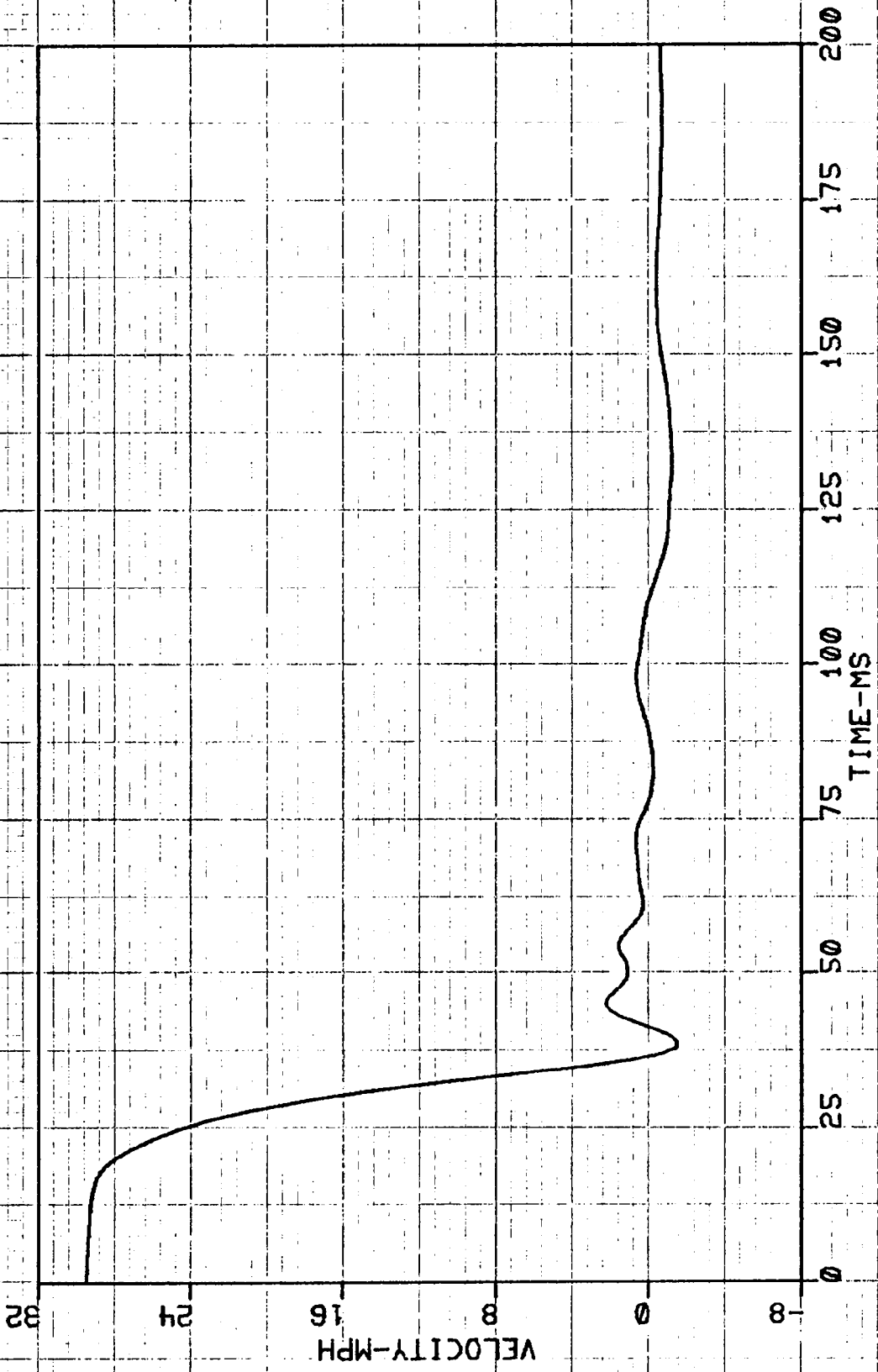


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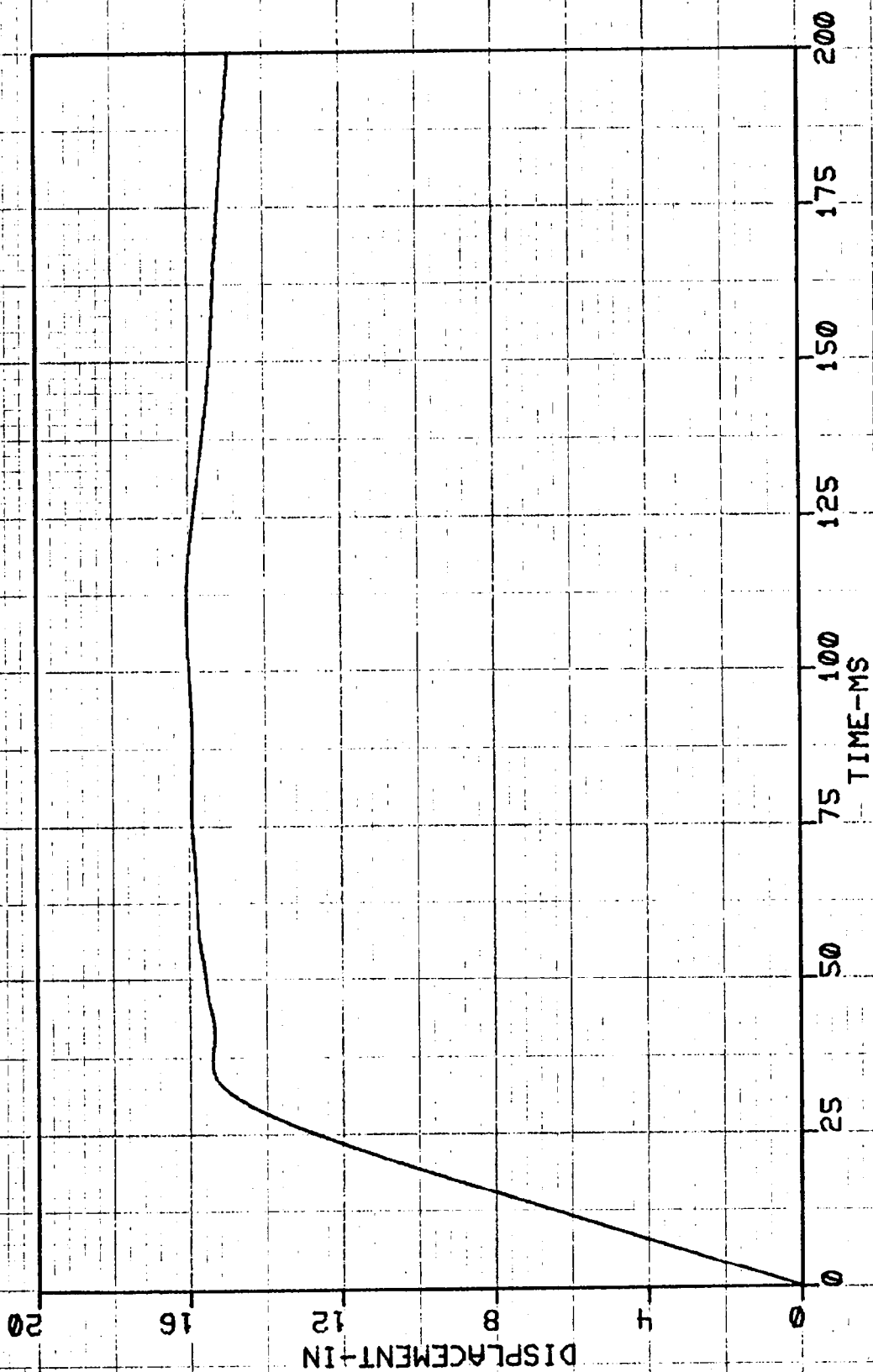




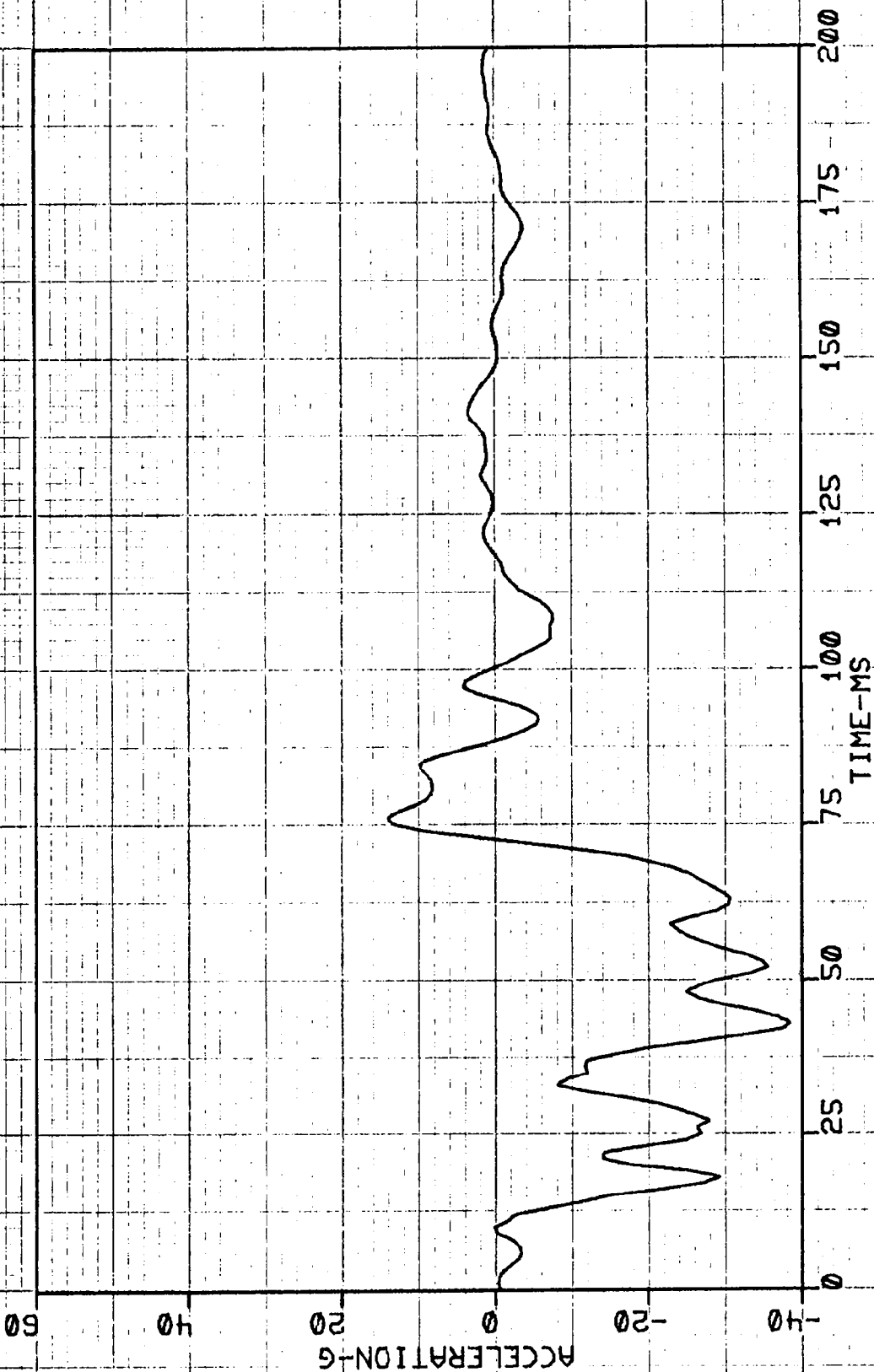
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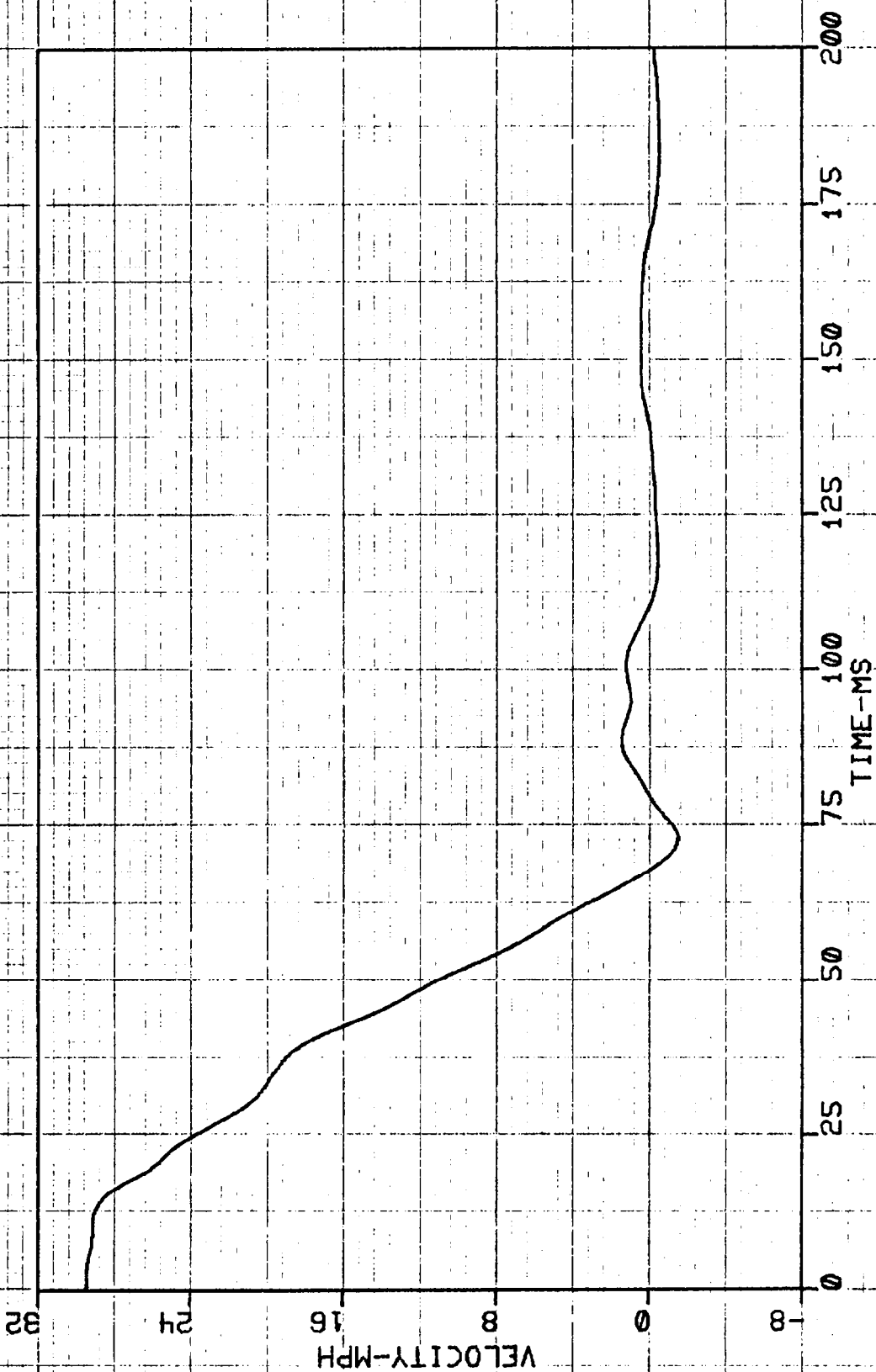
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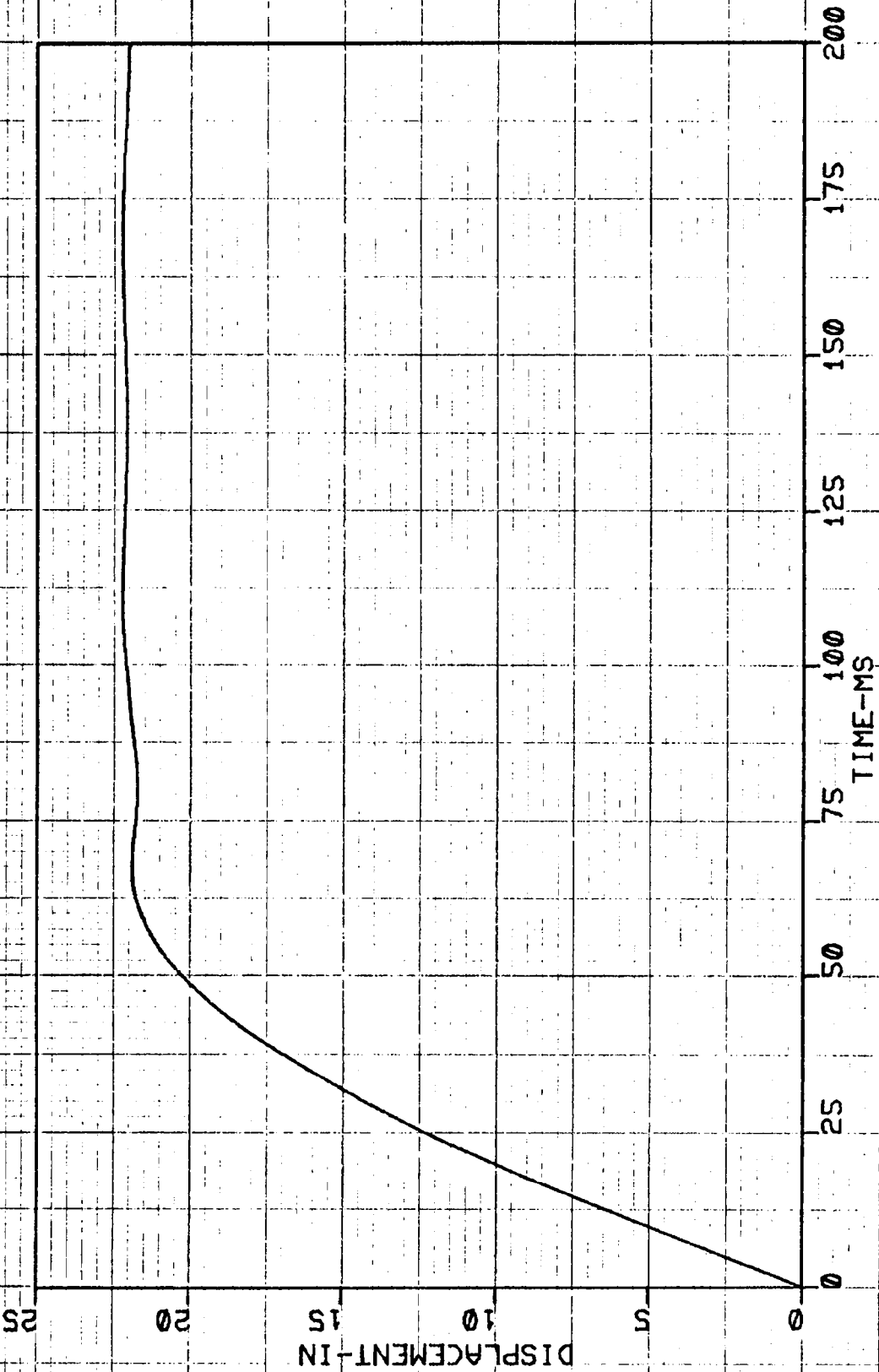
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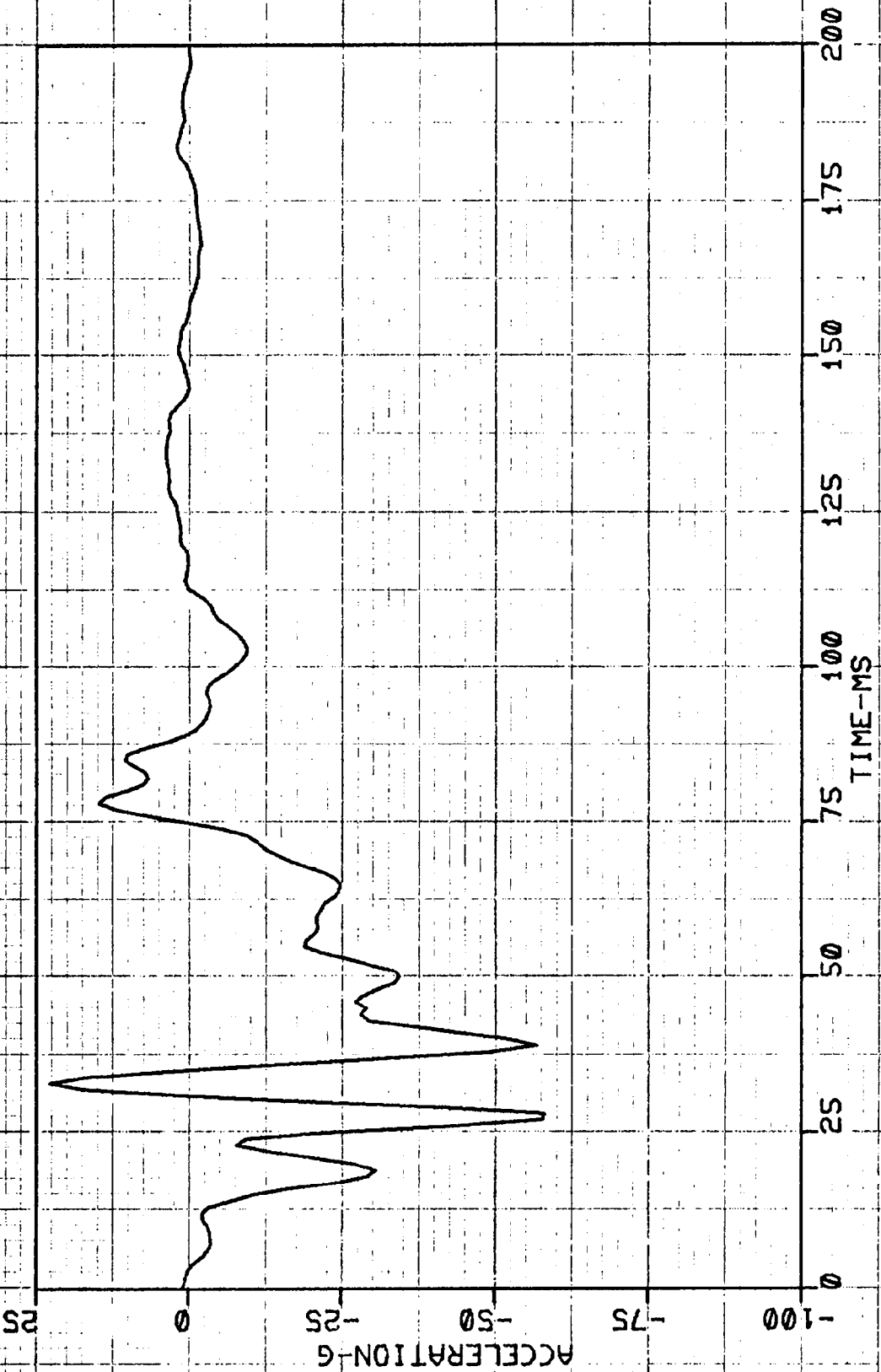
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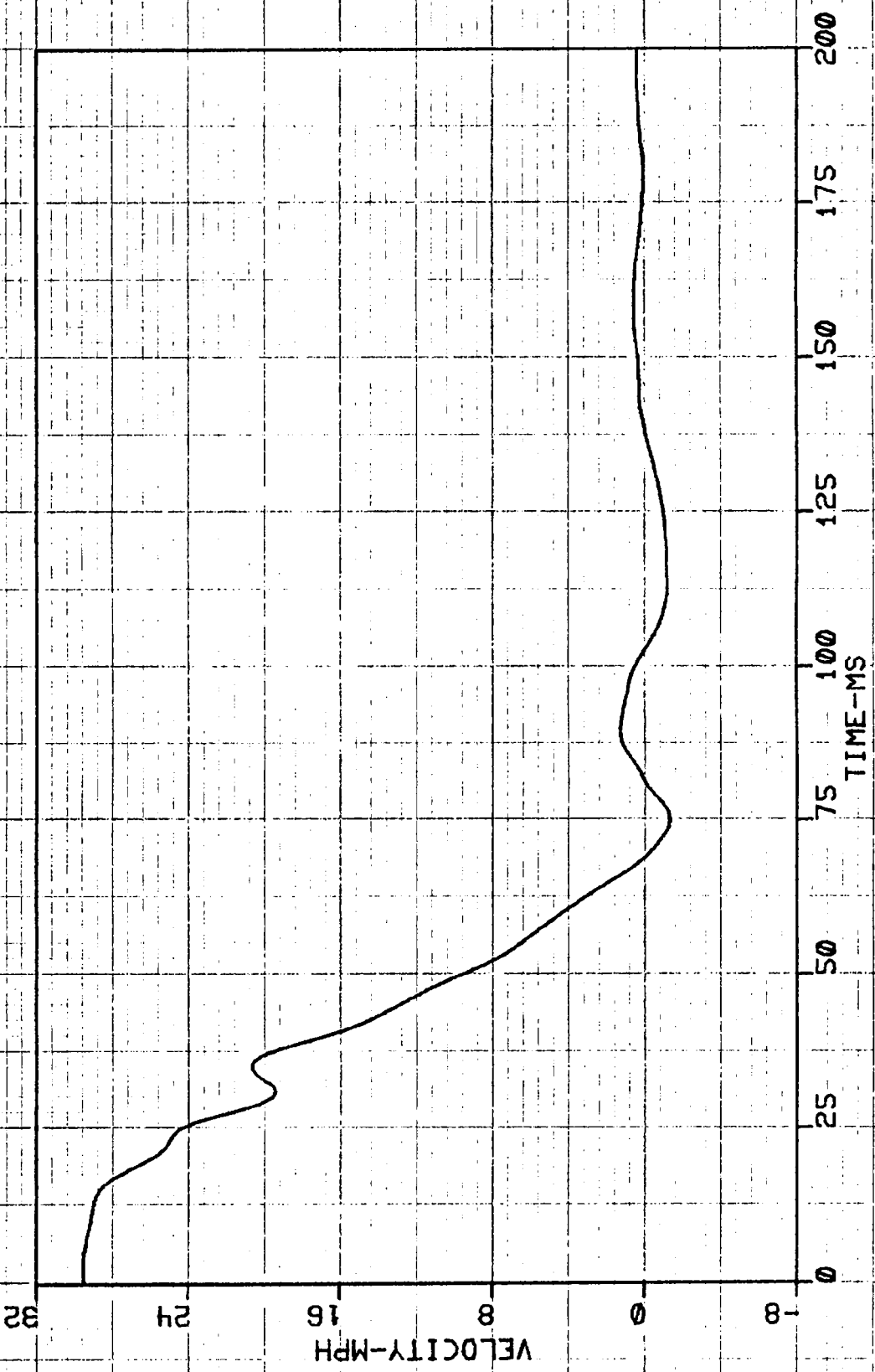
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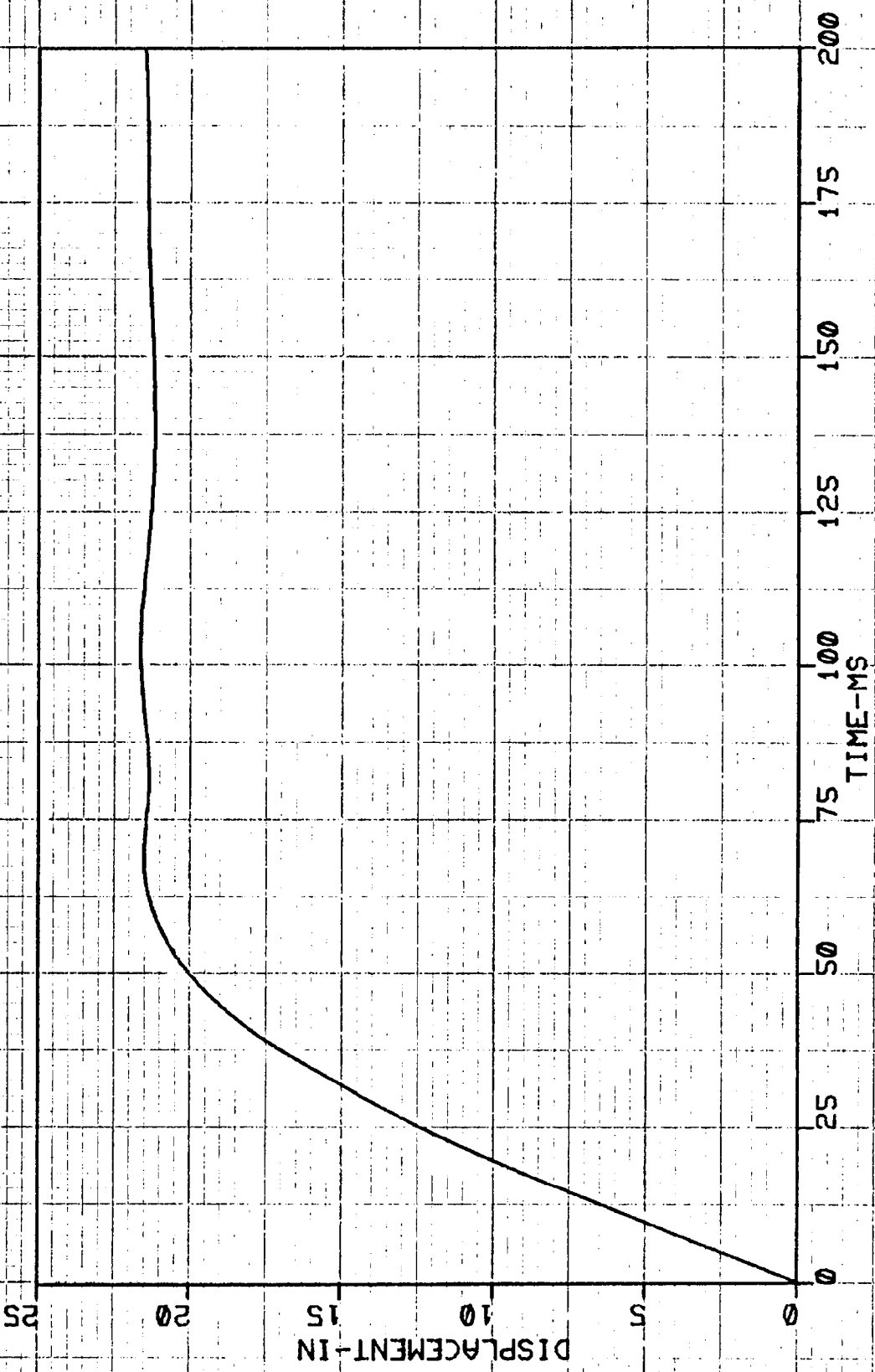
TEST#2 SUBARU GLF LOC 6 AX



TEST#2 SUBARU GLF LOC 6 VX



TEST#2 SUBARU GLF LOC 6 SX



TEST#2 SUBARU GLF LOAD CELLS

□ = A1 ○ = B1 Δ = C1 ◇ = D1

1200

800

400

FORCE-LB

-400

-800

TIME-MS

200

175

150

125

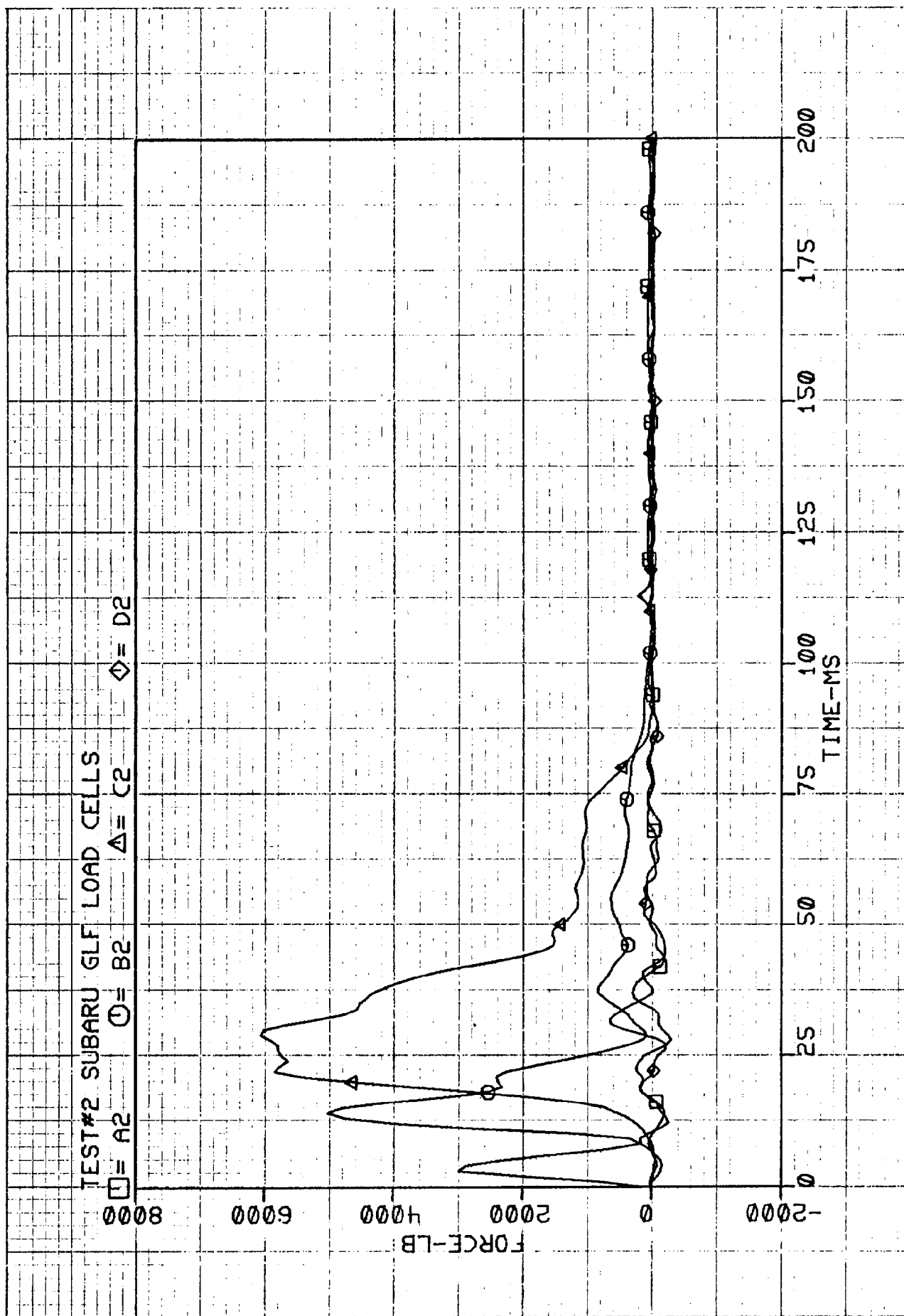
100

75

50

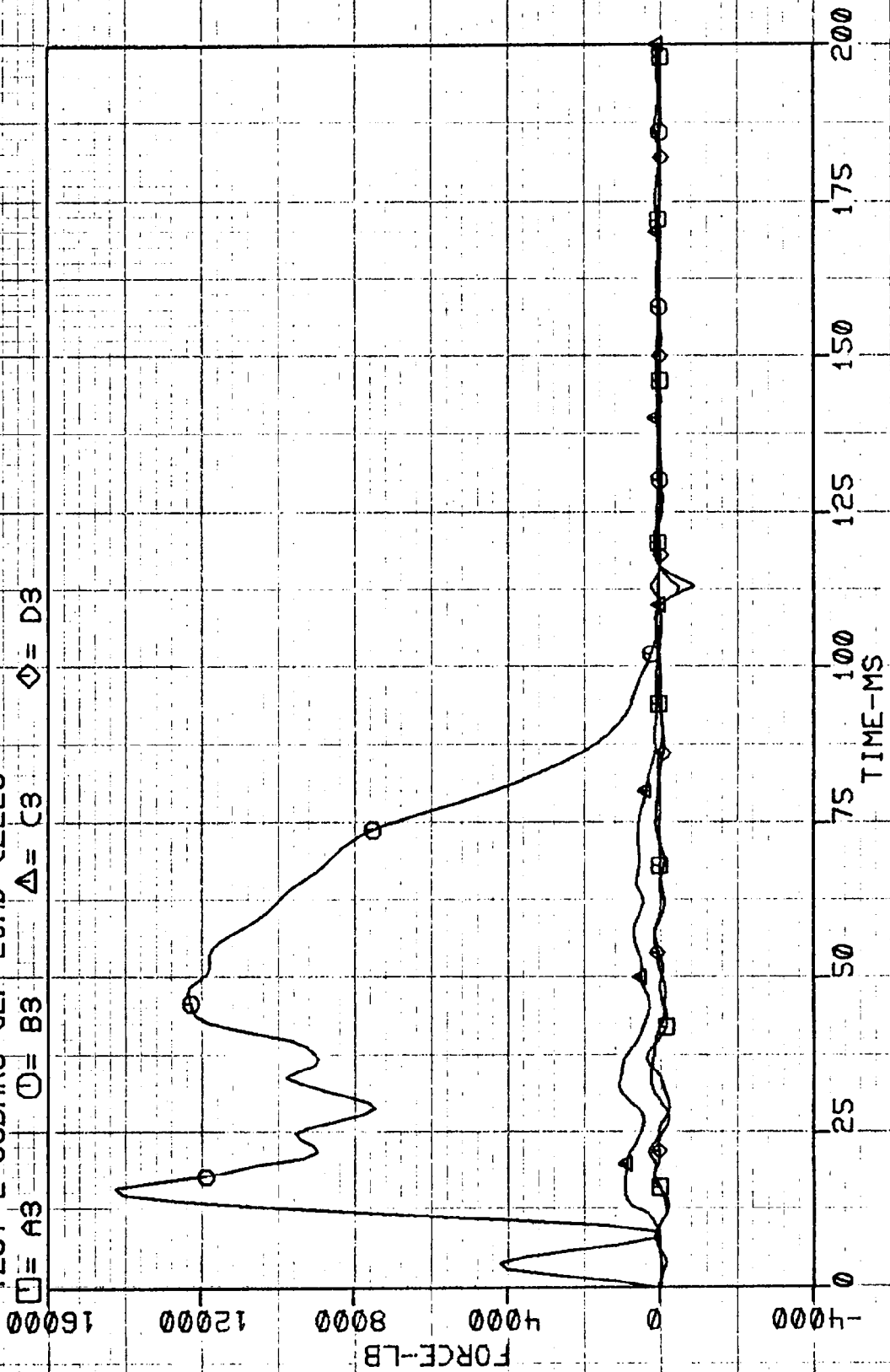
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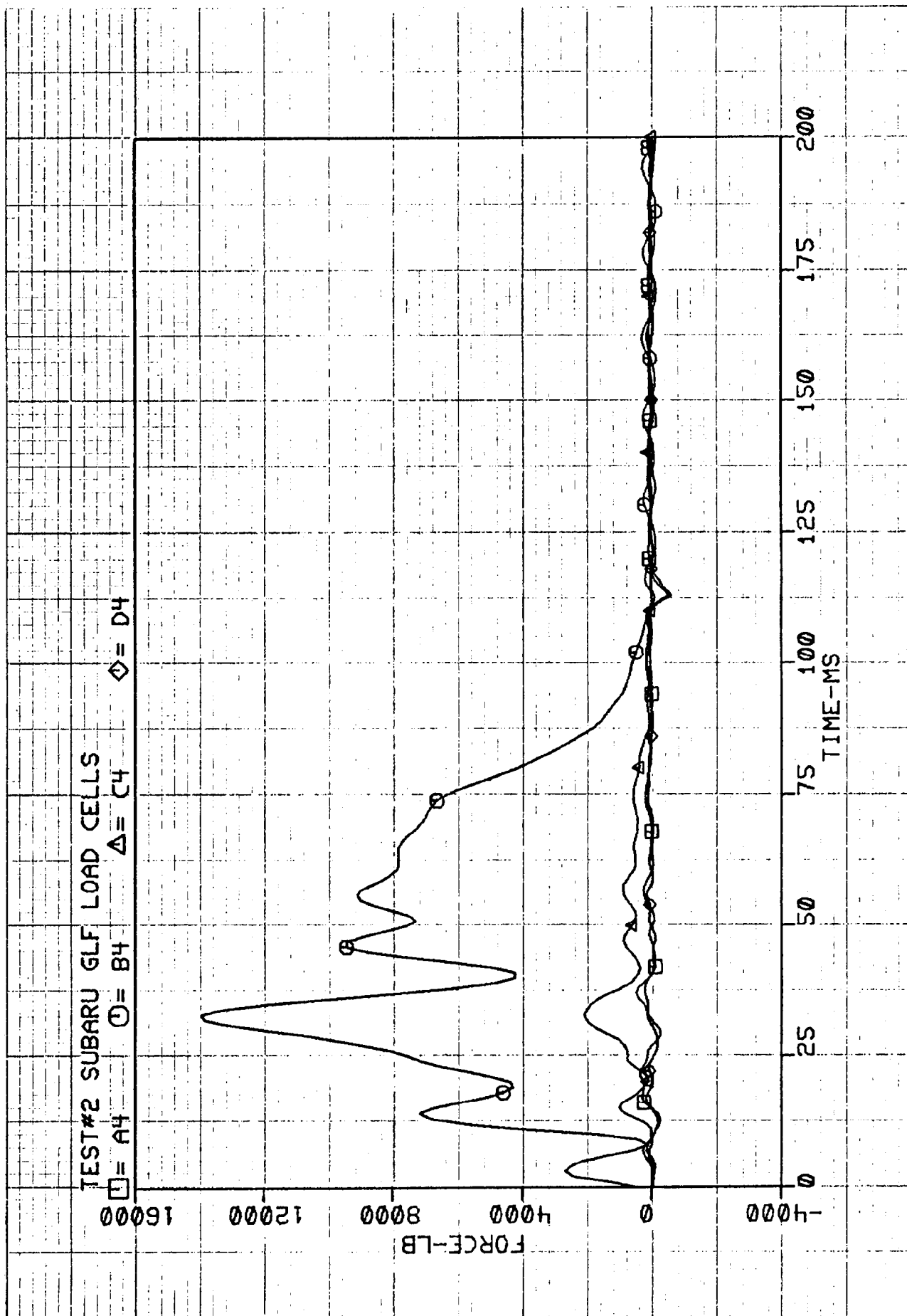
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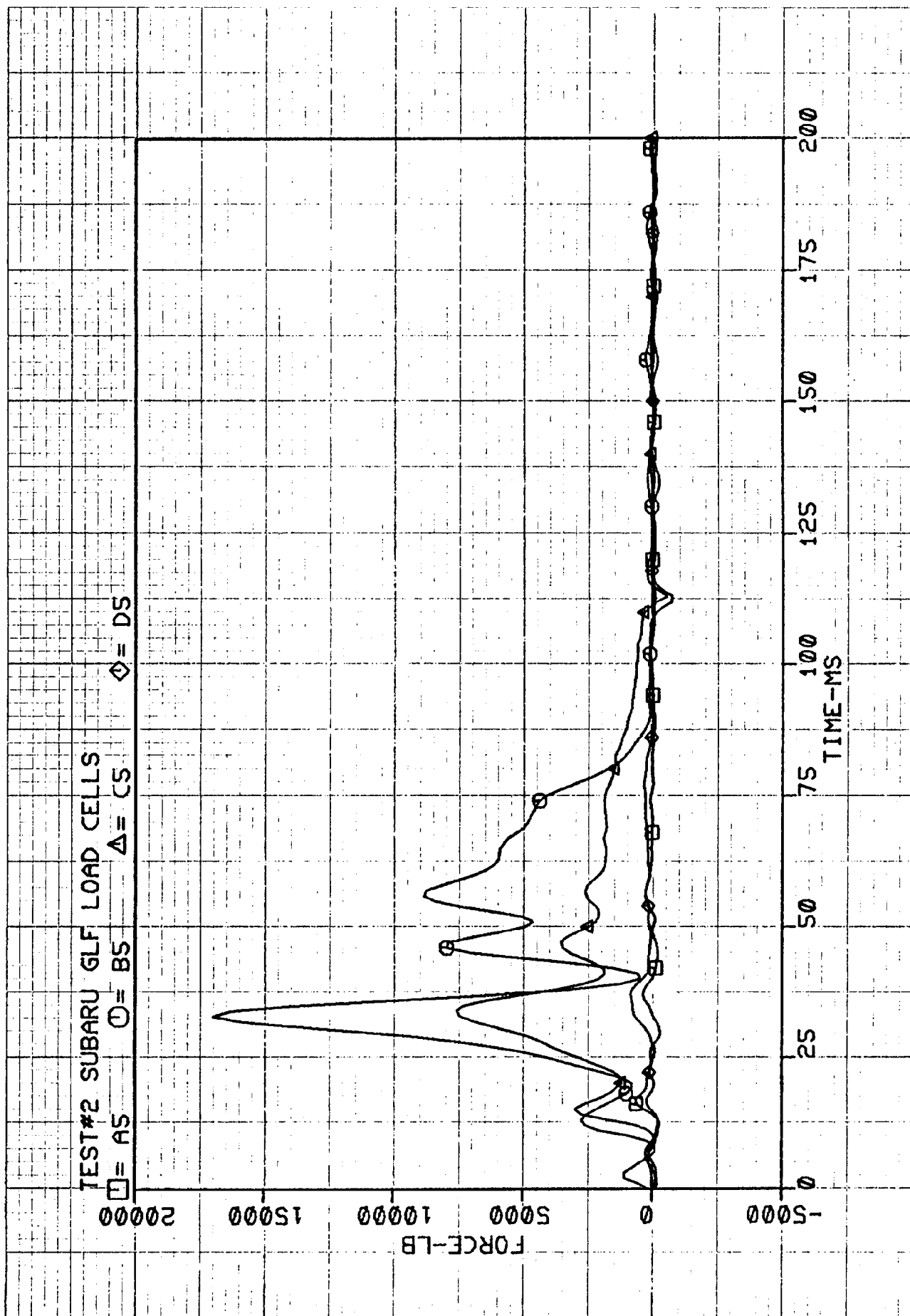


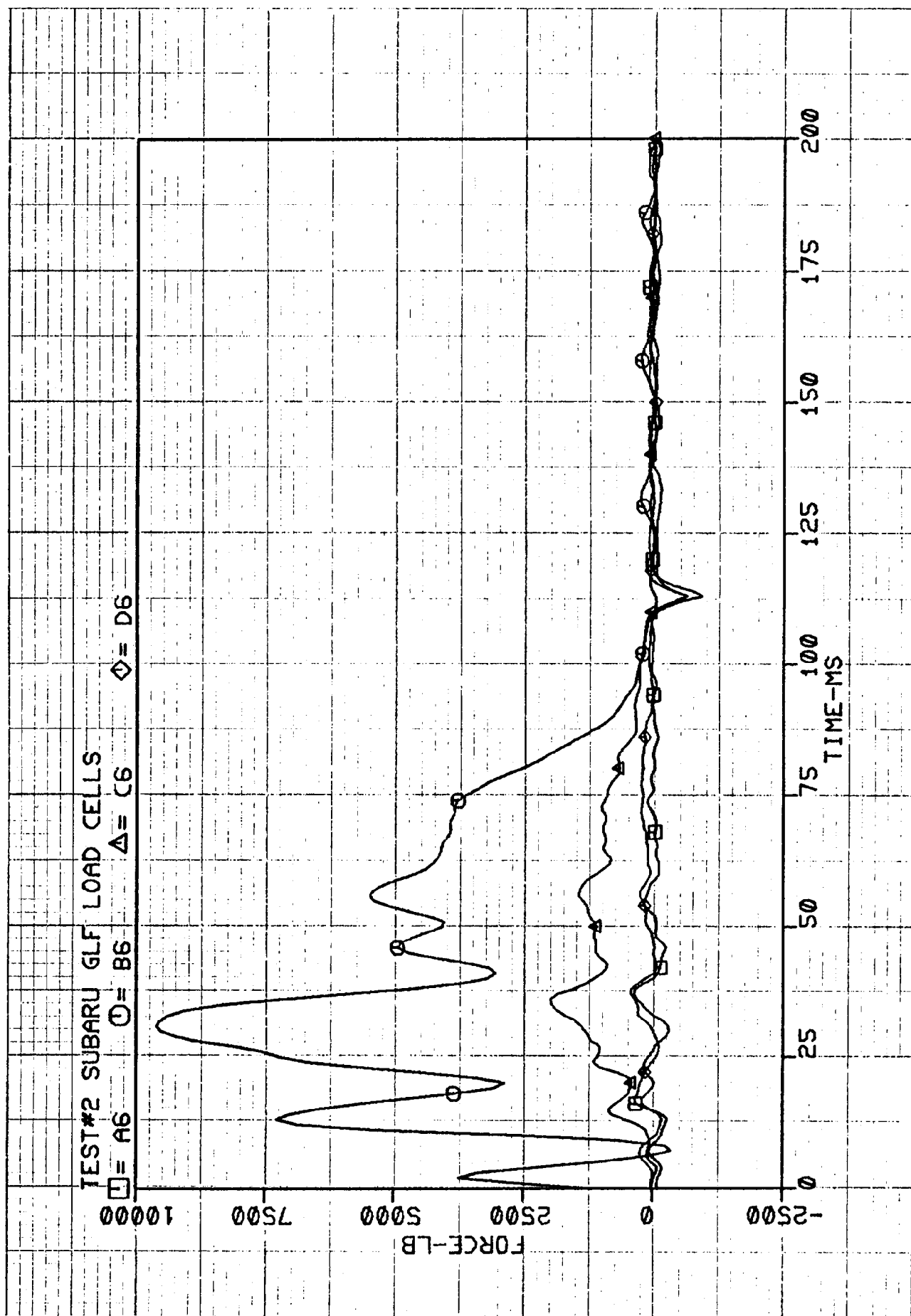
TEST#2 SUBARU GLF LOAD CELLS

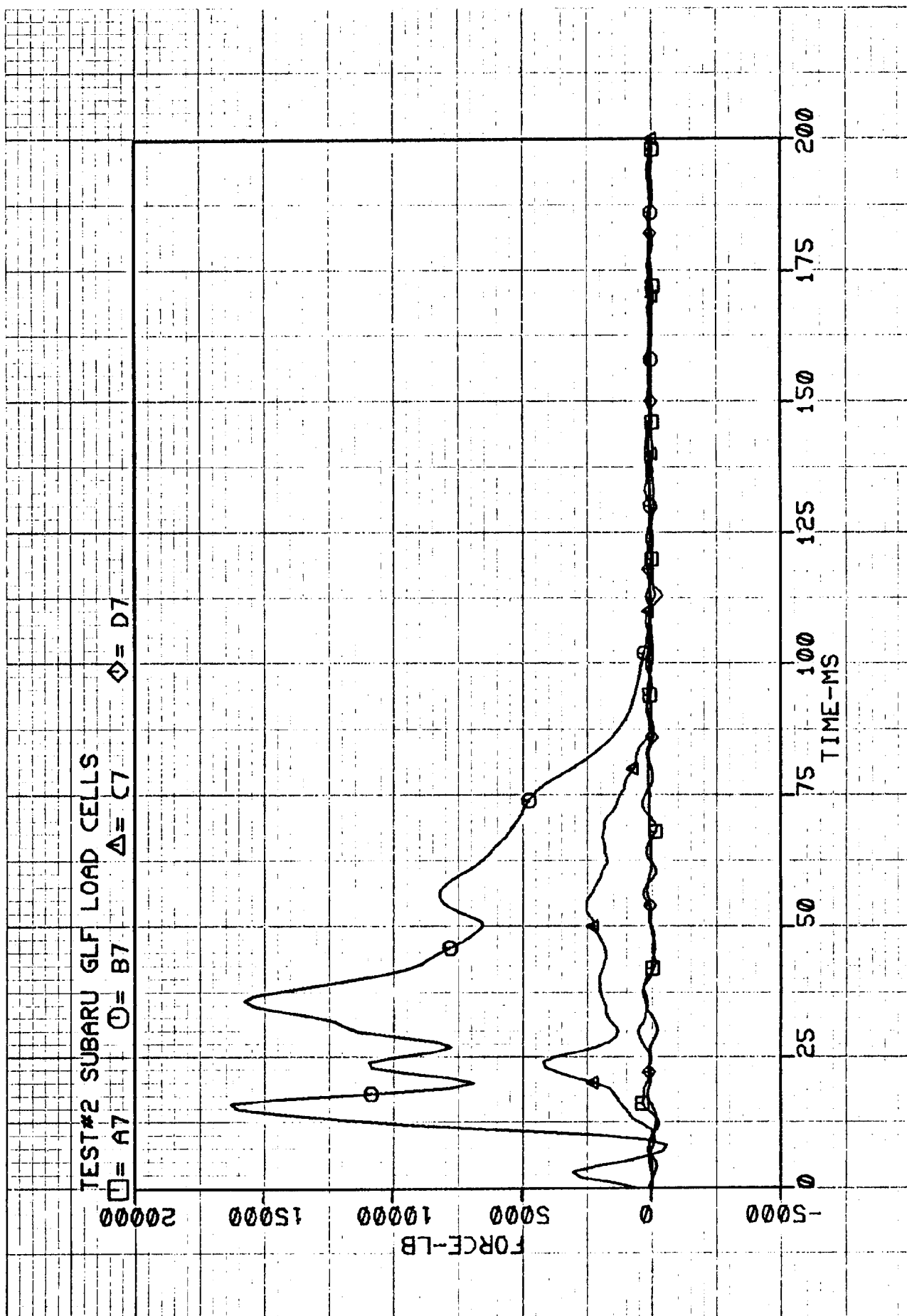
$\square = A3$ $\circ = B3$ $\Delta = C3$ $\diamond = D3$

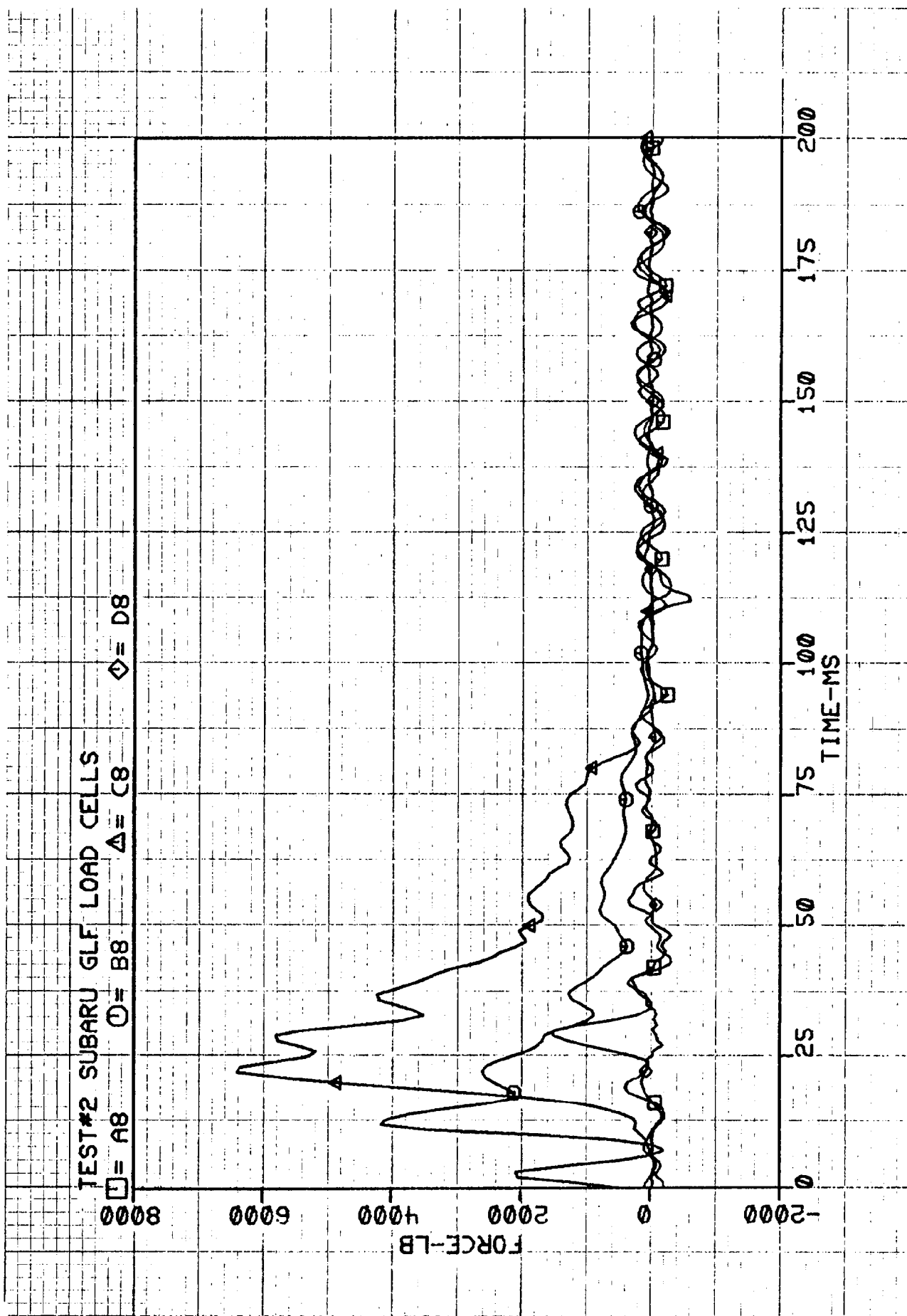


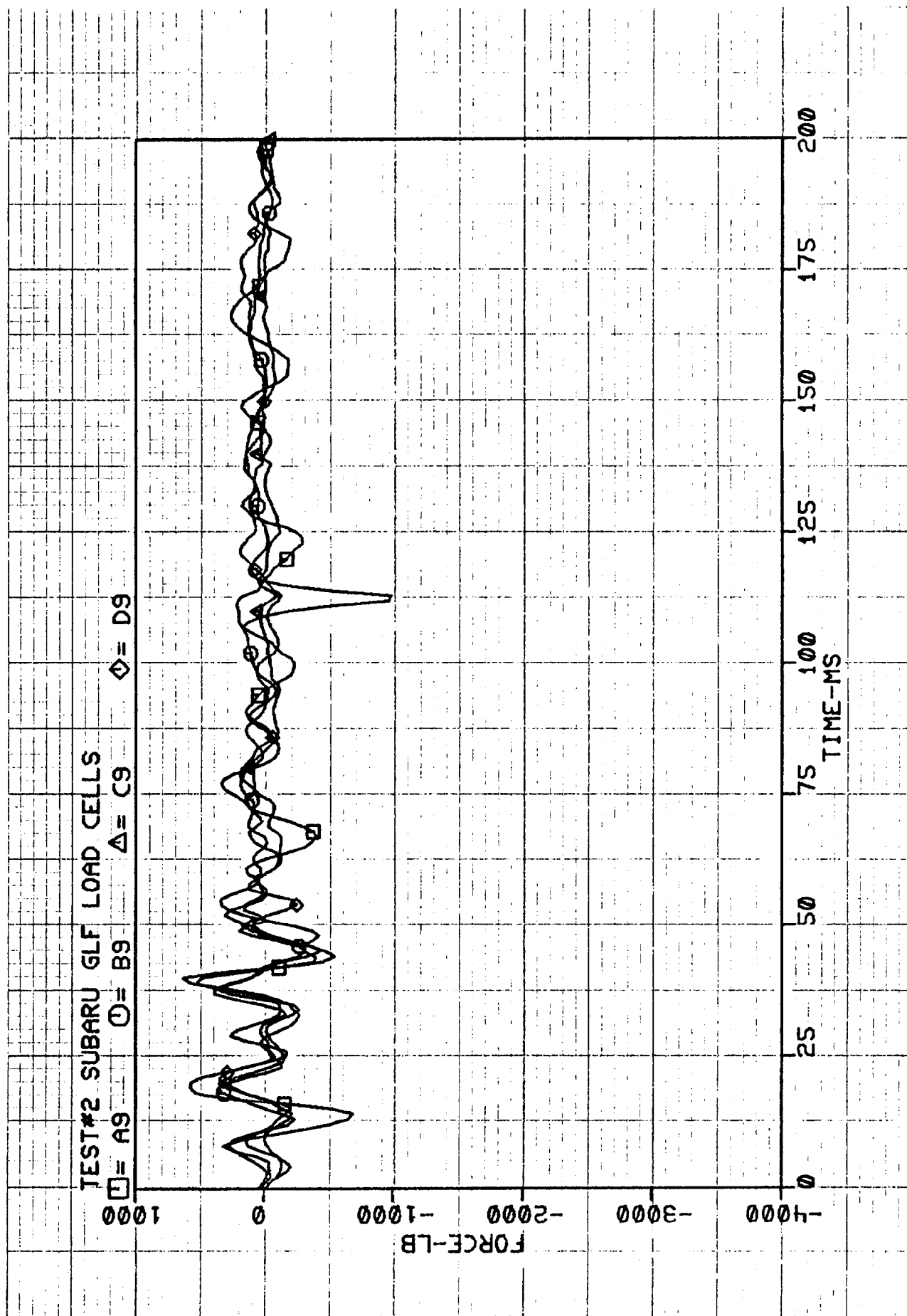




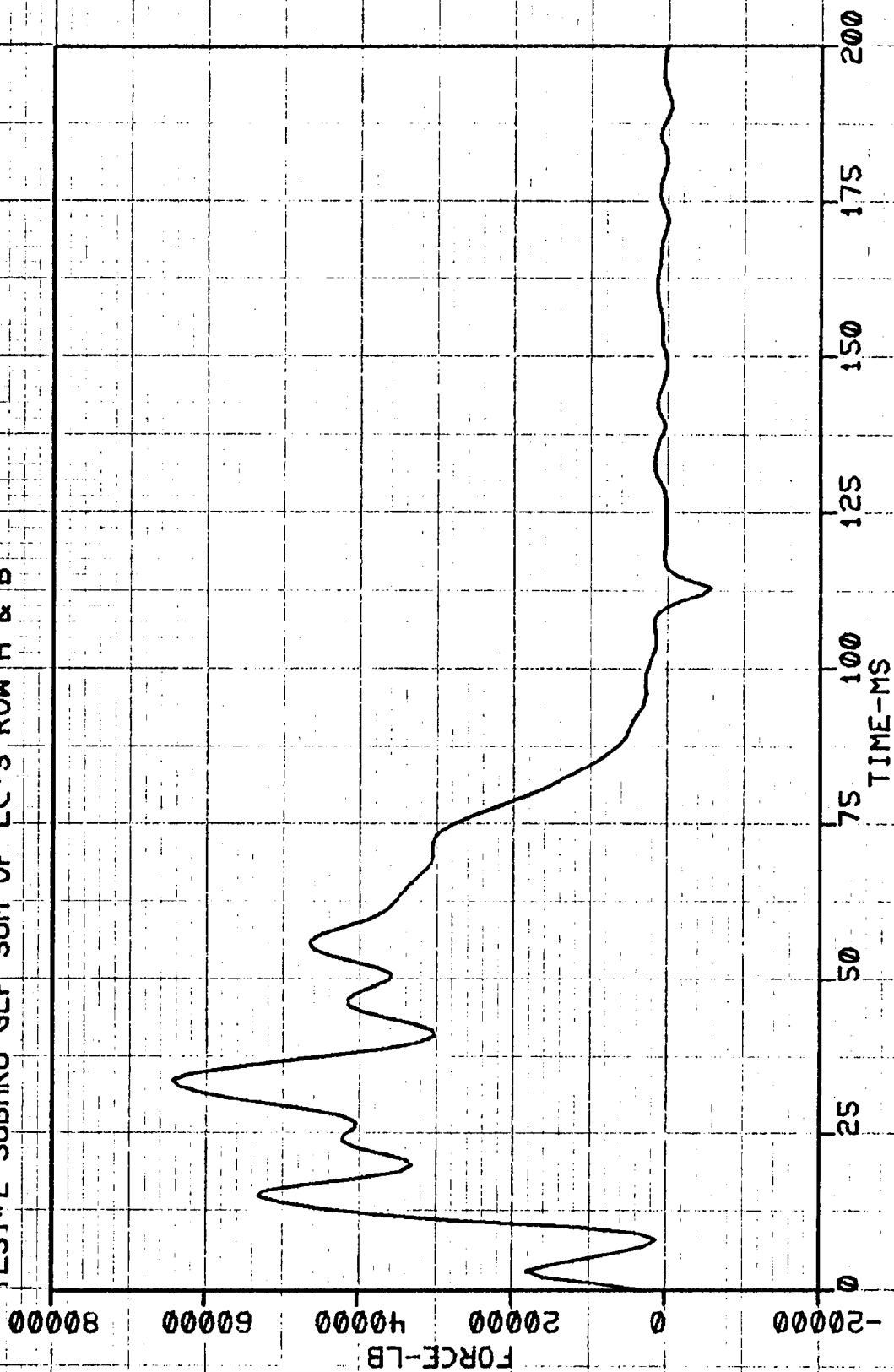




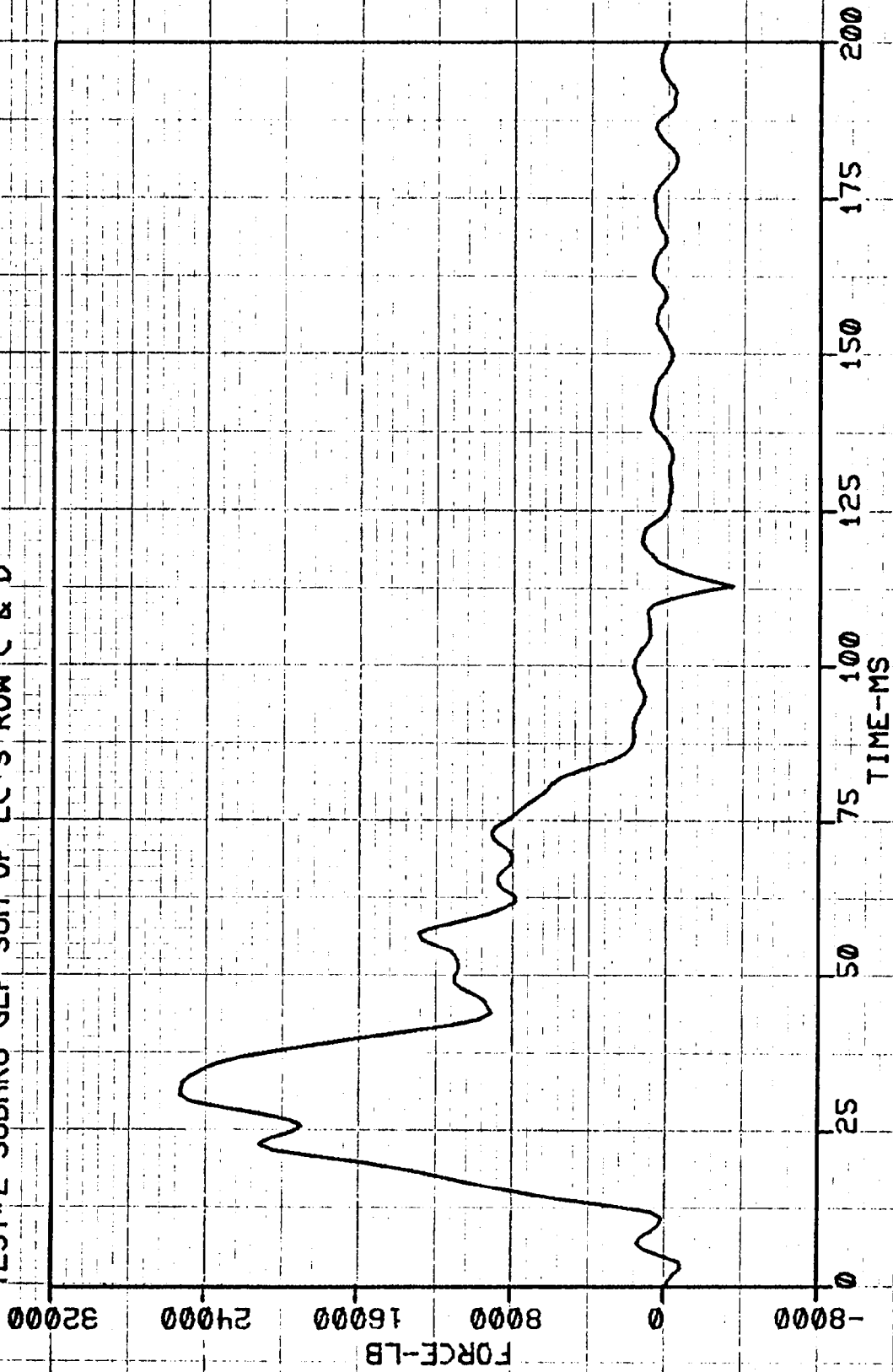




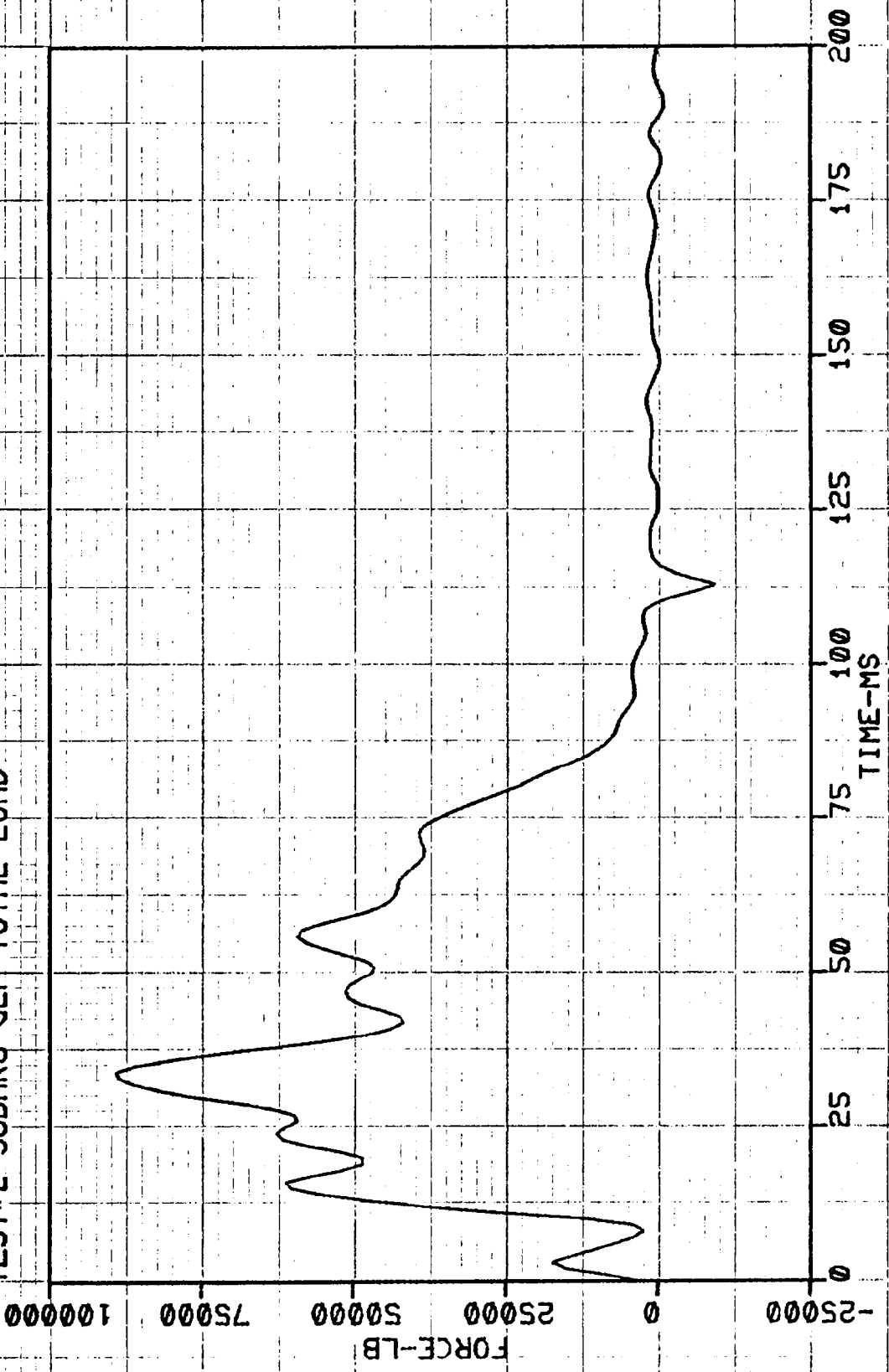
TEST#2 SUBARU GLF SUM OF LC'S ROW A & B



TEST#2 SUBARU GLF SUM OF LC'S ROW C & D



TEST#2 SUBARU GLF TOTAL LOAD



TEST#2 SUBARU GLF LOAD VS DISP

