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Final Report

April 1989

Final Report of 270° Contoured Moving Barrier Impact into a 1985 Nissan Sentra 2-Door Coupe in Support of Crash III Damage Algorithm Reformation

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16. Abstract

Three 270° contoured moving barrier impact tests were conducted for research and development in support of the crash III damage algorithm reformulation. These tests were conducted on a 1985 Nissan Sentra 2-door coupe, VIN 1N4PB1250FC753375, at the Transportation Research Center of Ohio. The following three tests were conducted on one vehicle:

TEST NO.	DATE	TIME	SPEED (mph)	AVERAGE CUMULATIVE CRUSH
890323-1	3/23/89	1110	17.6	4.9
890323-2	3/23/89	1250	26.4	10.1
890323-3	3/23/89	1340	26.4	10.9

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SECTION 1.0
PURPOSE AND TEST SUMMARY

The purpose of the three 270° contoured moving barrier impact tests was for research and development in support of the CRASH III damage algorithm reformulation.

The 1985 Nissan Sentra was equipped a 4-cylinder, transverse, gas engine with a 4-speed manual transmission. The intended total test weight of the vehicle was 1996 pounds. The actual weight was 1996 pounds.

The contoured moving barrier actual weight was 2658 pounds, frontal width was 62.5 inches, hood height was 30.0 inches, bumper width was 6.0 inches and centerline bumper height to ground was 17.0 inches. The contoured moving barrier was intended to impact the driver's side of the vehicle at 270°. The leading edge of the contact was to be 28.3 inches forward of the vehicle's center of gravity.

The crash event was recorded by three (3) high-speed cameras.

DEFINITION OF MEASUREMENTS

C1, C2, C3, C4, C5, C6 = crush at 6 points for major (bumper height) penetration.

S1, S2, S3, S4, S5, S6 = crush at 6 points for stiffer member (sill height) penetration.

F = free space distance, measured on the undeformed side of the car, between the surface at major penetration (bumper height) and minor penetration (sill height) locations.

X1, X2 = distances between points C1 and C6, repectively and the vertical plane passing through points at the extreme ends of the car which lay in the plane of the car side before deformation.

B1 = the offset of the trunk centerline from the original body center line.

B2 = the offset of the hood centerline from the original body center line.

If a door hinge or latch or pillar did not fail then:

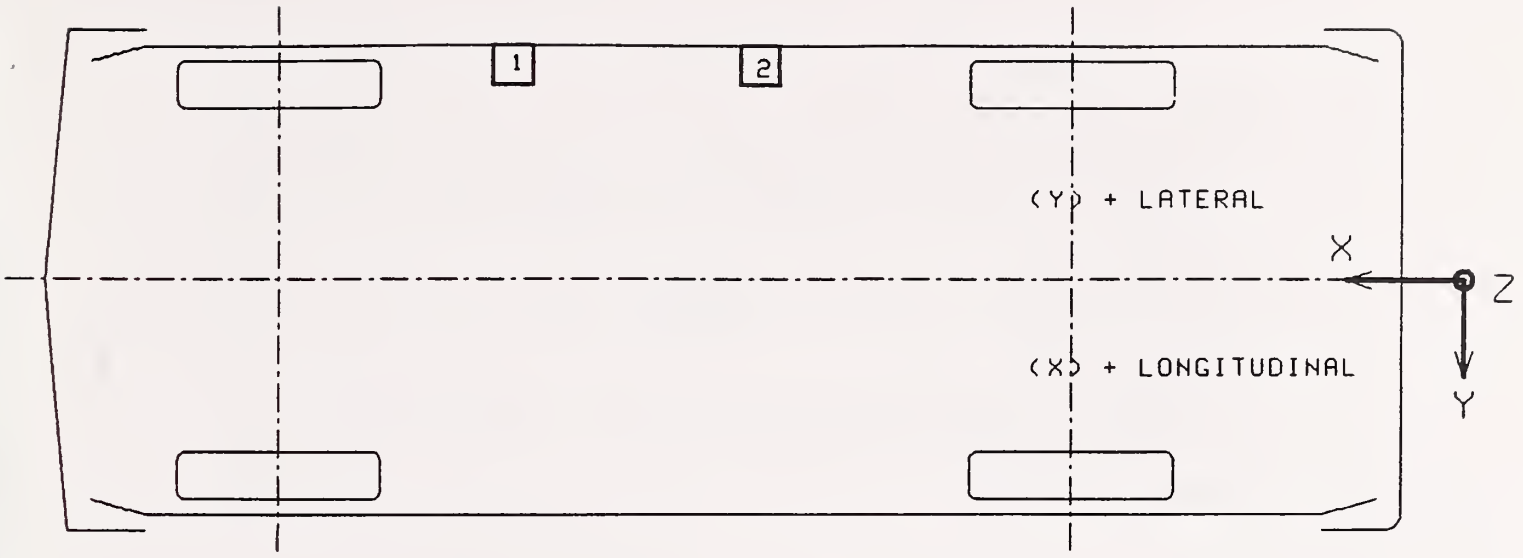
$$\text{Average crush} = \text{Bumper height crush} + \frac{X1 + X2}{2}$$

If a door hinge or latch or pillar did fail then:

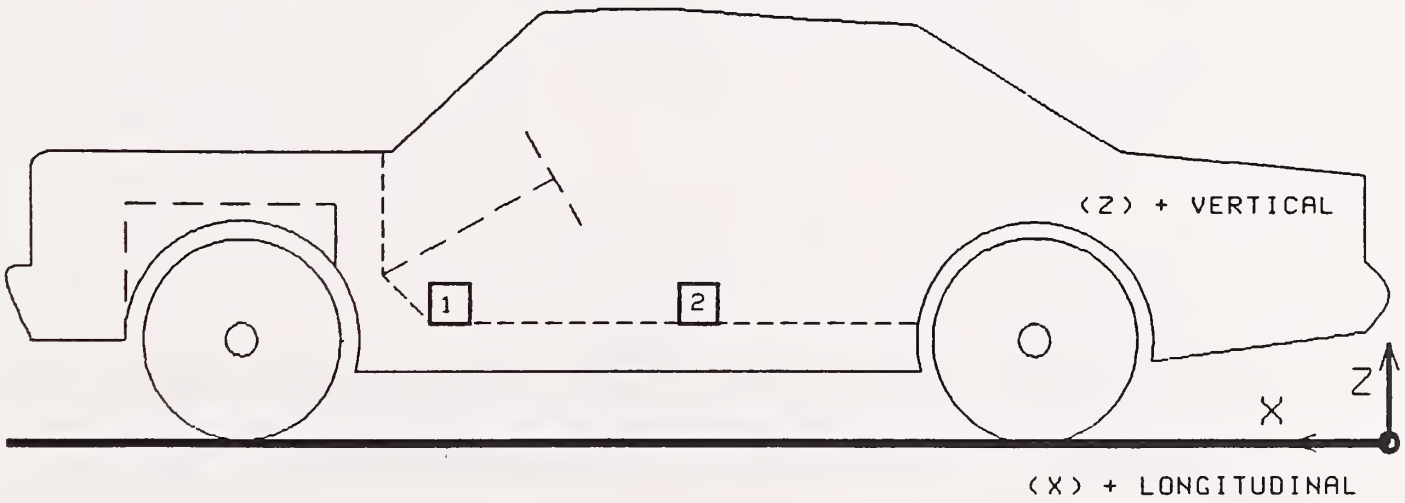
$$\text{Average crush} = \frac{\text{Bumper height crush} + \text{sill height crush as corrected}}{2} + \frac{X1 + X2}{2}$$

Sill height crush as corrected = sill height crush as measured - free space.

VEHICLE ACCELEROMETER PLACEMENT

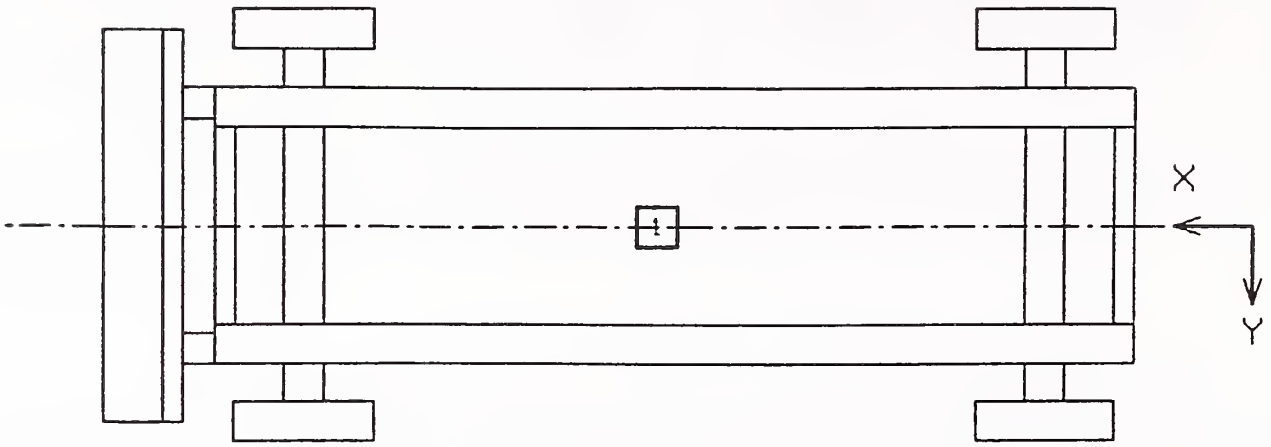


TOP VIEW

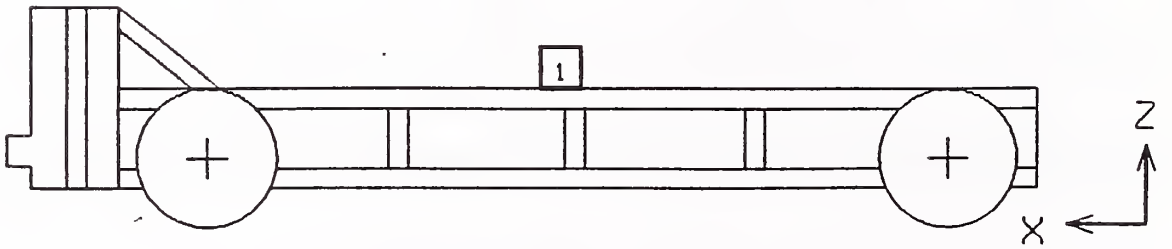


SIDE VIEW

MOVING BARRIER
ACCELEROMETER PLACEMENT



TOP VIEW



SIDE VIEW

SECTION 2.0
VEHICLE INFORMATION

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Nissan Motor Co., LTD. VIN: 1N4PB1250FC753375

MAKE/MODEL: Nissan Sentra MODEL YEAR: 1985

BODY STYLE: 2-door coupe COLOR: Red

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: NA

_X_ GAS, ___ DIESEL, ___ TURBOCHARGE

TRANSMISSION DATA: _4_ SPEED, _X_ MANUAL, ___ AUTOMATIC, _X_ FWD, ___ RWD, ___ 4WD

DATE VEHICLE RECEIVED: 3/17/89 ODOMETER READING: 60060

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

POWER STEERING	No	AUTOMATIC TRANSMISSION	No
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	Yes
OTHER	None		

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

VEHICLE MANUFACTURED BY: Nissan Motor Co. LTD.

DATE OF MANUFACTURE: 5/85

GVWR: 2908 LBS.

GAWR: FRONT 1554 LBS.; REAR 1521 LBS.

TEST VEHICLE INFORMATION, CONT'D

WHEELBASE: 94.5

MAXIMUM WIDTH: 64.0

WEIGHT OF TEST VEHICLE WITH REQUIRED OCCUPANTS AND LUGGAGE:

RIGHT FRONT	573 LBS.	RIGHT REAR	450 LBS.
LEFT FRONT	545 LBS.	LEFT REAR	428 LBS.
TOTAL FRONT WEIGHT	1118 LBS.	(56.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	878 LBS.	(44.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	1996 LBS.		

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 0 LBS.

VEHICLE TIRE DATA:

TIRES ON VEHICLE (MFR. & LINE, SIZE): Eldorado Endora P155/80R13 M&S

RECOMMENDED COLD TIRE PRESSURE: FRONT: 26 psi; REAR: 26 psi

SIDEWALL PLY RATING: 2 ply

BIAS PLY, BELTED OR RADIAL? Radial

IS SPARE TIRE "SPACE SAVER"? Yes

IS SPARE TIRE STANDARD EQUIPMENT? Yes

VEHICLE ATTITUDES:

DELIVERED:	LF:	25.5;	RF:	25.1;	LR:	24.6;	RR: 24.2
PRE-TEST:	LF:	25.9;	RF:	25.4;	LR:	23.6;	RR: 23.1
POST-TEST:	LF:	25.2;	RF:	25.5;	LR:	22.8;	RR: 23.1

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

TEST ANOMALIES

Noise in the form of spikes was observed in the plots for the contact switches OTH1, OTH2, OTH3, OTH4. * The switches were used to record the time of vehicle contact with the moving barrier, as well as the time of vehicle separation from the barrier. The switches were damaged by the crush of the moving contoured barrier against the vehicle. The switches were replaced following each test which contained spikes. This is not the standard use of such switches.

*CONTACT SWITCH MNEMONICS:

OTH1 Vehicle contact switch - Front
OTH2 Vehicle contact switch - Rear
OTH3 Barrier contact switch - Right
OTH4 Barrier contact switch - Left

Test #890323-1

Right rear sill Y-axis accelerometer, RRSYG, data contains a spike at 31.1 milliseconds, cause unknown.
Right rear sill Y-axis velocity, RFSYV, due to above.

Test #890323-2

Right front sill Y-axis accelerometer, RFSYG, data was lost between 80.5 and 160.0 milliseconds, cause unknown.
Right front sill Y-axis velocity, RFSYV, due to above.
Contoured moving barrier center of gravity X-axis accelerometer, BCGXG, data contains spikes at 194.1, 211.8 and 254.5 milliseconds, cause unknown.
Contoured moving barrier center of graivity X-axis velocity, BCGXV, due to above.

Test #890323-3

Contoured moving barrier center of gravity X-axis accelerometer, BCGXG, data contains spike at 106.9 milliseconds, cause unknown.
Contoured moving barrier center of gravity X-axis velocity, BCGXV, due to above.
Vehicle contact switch - rear, OTH2, stayed closed, due to a cut switch.

SECTION 3.0

TEST #890323-1 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 890323-1

DATE OF TEST: 3/23/89

TIME OF TEST: 1110

AMBIENT TEMPERATURE AT IMPACT AREA: 40° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
VEHICLE WEIGHT (lbs.)	1996	1996
VEHICLE ORIENTATION (deg.)	270	270
MOVING BARRIER VELOCITY (mph.)	17.6	17.5
BARRIER WEIGHT (lbs.)	2658	2658
MAXIMUM CUMULATIVE CRUSH BUMPER HEIGHT (in.)	6.6	
AVERAGE CUMULATIVE CRUSH (in.) = $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$	4.9	

TEST NUMBER 890323-1

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	SILL RIGHT FRONT LATERAL	103.8	26.5	10.5	1.8	172.4	12.7	15.0
2	SILL RIGHT REAR LATERAL	92.6	26.5	10.5	1.8	175.0 γ	11.9	14.6 γ

γ See TEST ANOMALIES

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: FORWARD FROM REAR AXLE
Y: LEFTWARD FROM VEHICLE CENTERLINE
Z: UPWARD FROM GROUND LEVEL

TEST NUMBER 890323-1

BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	BARRIER CG LONGITUDINAL	75.0	0.0	10.5	0.4	104.8	8.1	41.8

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

TEST #890323-1

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - FRONT	9.7
VEHICLE CONTACT SWITCH - REAR	24.0
BARRIER CONTACT SWITCH - RIGHT	83.2
BARRIER CONTACT SWITCH - LEFT	118.5

PSU/Case Number_____
Vehicle Number_____

TEST #890323-1
National Accident Sampling System - Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

Complete When Applicable

End Damage

Undeformed end width_____

Corner shift: A1_____

A2_____

End shift at frame (CDC)
(check one)

<4 inches X

>4 inches_____

Side Damage

Bowing: B1 0 X1 0

B2 0 X2 0

Bowing constant

$\frac{X1 + X2}{2} = 0$

NOTE: Measure C1 to C6 from Driver to Passenger side in Front or Rear impacts - Rear to Front in Side impacts.

Specific Impact Number	Plane* of C-Measurements	Direct Damage Width** (CDC)	Direct Damage Max*** Crush	Field L**	C_1	C_2	C_3	C_4	C_5	C_6	±D
	Bumper height as measured				0.0	4.0	6.6	6.4	6.4	0.0	
	Bumper height as corrected				0.0	4.3	6.9	6.7	6.7	0.0	
	Sill height as measured				0.0	1.2	3.2	3.0	3.3	0.0	
	Sill height as corrected				0.0	-1.4	0.6	0.4	0.7	0.0	
	Average Crush			94.2	0.0	4.3	6.9	6.7	6.7	0.0	-17.5

Bumper free space = -0.3 inches
Sill free space = 2.6 inches
Door latch, hinge, or pillar did not fail (See Page 1-2).

*Identify the plane at which the C-measurements are taken (e.g., at bumper, at sill, above sill, at beltline, etc.) or label adjustments (e.g., free space).

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.

**Measure and document on the vehicle diagram the beginning or end of the direct damage width and field L (e.g., side damage with respect to undamaged axle.)

***Measure and document on the vehicle diagram the location of the maximum crush.

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

TEST #890323-1

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side	Photosonic 1B	25	500	Impact overall
2	Overhead wide	Photosonic 1B	13	498	Impact wide
3	Overhead tight	Photosonic 1B	25	505	Impact closeup

SECTION 4.0

TEST #890323-2 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 890323-2

DATE OF TEST: 3/23/89

TIME OF TEST: 1250

AMBIENT TEMPERATURE AT IMPACT AREA: 49° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
VEHICLE WEIGHT (lbs.)	1996	1996
VEHICLE ORIENTATION (deg.)	270	270
MOVING BARRIER VELOCITY (mph.)	26.4	26.3
BARRIER WEIGHT (lbs.)	2658	2658
MAXIMUM CUMULATIVE CRUSH BUMPER HEIGHT (in.)	15.2	
AVERAGE CUMULATIVE CRUSH (in.) = $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$	10.1	

VEHICLE ATTITUDES:

POST-TEST: LF: 25.0 RF: 25.5 LE: 22.0 RR: 22.9

TEST NUMBER 890323-2

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	MSEC	NEGATIVE DIRECTION MAX G	MSEC
1	SILL RIGHT FRONT LATERAL	103.8	26.5	10.5	---	--- γ	28.0	15.0 γ
2	SILL RIGHT REAR LATERAL	92.6	26.5	10.5	3.8	22.8	31.8	15.8

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: FORWARD FROM REAR AXLE
Y: LEFTWARD FROM VEHICLE CENTERLINE
Z: UPWARD FROM GROUND LEVEL

γ See TEST ANOMALIES

TEST NUMBER 890323-2

BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	BARRIER CG LONGITUDINAL	75.0	0.0	10.5	---	--- γ	14.3	8.9 γ

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

γ See TEST ANOMALIES

PSU/Case Number_____
Vehicle Number_____

TEST #890323-2
National Accident Sampling System - Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

Complete When Applicable

End Damage

Undeformed end width_____

Corner shift: A1_____

A2_____

End shift at frame (CDC)
(check one)
<4 inches__X__
>4 inches_____

Side Damage

Bowing: B1__0__ X1__0__

B2__2__ X2__0__

Bowing constant

$\frac{X1 + X2}{2}$ = __0__

NOTE: Measure C1 to C6 from Driver to Passenger side in Front or Rear impacts - Rear to Front in Side impacts.

Specific Impact Number	Plane* of C-Measurements	Direct Damage Width** (CDC)	Direct Damage Max*** Crush	Field L**	C_1	C_2	C_3	C_4	C_5	C_6	±D
	Bumper height as measured				0.0	5.6	13.9	15.2	14.7	0.0	
	Bumper height as corrected				0.0	5.9	14.2	15.5	15.0	0.0	
	Sill height as measured				0.0	14.0	11.2	10.0	8.5	0.0	
	Sill height as corrected				0.0	11.4	8.6	7.4	5.9	0.0	
	Average Crush			127.0	0.0	5.9	14.2	15.5	15.0	0.0	-10.9

Bumper free space = -0.3 inches
Sill free space = 2.6 inches
Door latch, hinge, or pillar did not fail (See Page 1-2).

*Identify the plane at which the C-measurements are taken (e.g., at bumper, at sill, above sill, at beltline, etc.) or label adjustments (e.g., free space).

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.

**Measure and document on the vehicle diagram the beginning or end of the direct damage width and field L (e.g., side damage with respect to undamaged axle.)

***Measure and document on the vehicle diagram the location of the maximum crush.

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

TEST #890323-2

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side	Photosonic 1B	25	500	Impact overall
2	Overhead wide	Photosonic 1B	13	500	Impact wide
3	Overhead tight	Photosonic 1B	25	500	Impact closeup

SECTION 5.0

TEST #890323-3 SUMMARY

TEST CONDITIONS:

TEST NUMBER: 890323-3

DATE OF TEST: 3/23/89

TIME OF TEST: 1340

AMBIENT TEMPERATURE AT IMPACT AREA: 58° F

SUBJECT VEHICLE DATA:

	ACTUAL	INTENDED
VEHICLE WEIGHT (lbs.)	1996	1996
VEHICLE ORIENTATION (deg.)	270	270
MOVING BARRIER VELOCITY (mph.)	26.4	26.3
BARRIER WEIGHT (lbs.)	2658	2658
MAXIMUM CUMULATIVE CRUSH BUMPER HEIGHT (in.)	22.5	
AVERAGE CUMULATIVE CRUSH (in.) = $\{\frac{C1+C6}{2}+C2+C3+C4+C5\}/5$	10.9	

VEHICLE ATTITUDES:

POST-TEST: LF: 24.5 RF: 22.9 LR: 21.8 RR: 21.6

TEST NUMBER 890323-3

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	SILL RIGHT FRONT LATERAL	103.8	26.5	10.5	1.7	166.4	16.7	12.5
2	SILL RIGHT REAR LATERAL	92.6	26.5	10.5	2.9	211.3	18.3	12.6

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: FORWARD FROM REAR AXLE
Y: LEFTWARD FROM VEHICLE CENTERLINE
Z: UPWARD FROM GROUND LEVEL

TEST NUMBER 890323-3

BAARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G	MSEC	NEGATIVE DIRECTION MAX G	MSEC
1	BARRIER CG LONGITUDINAL	75.0	0.0	10.5	---	--- γ	9.6	23.0 γ

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR BUMPER
Y: + LEFTWARD FROM VEHICLE CENTERLINE
Z: + UPWARD FROM GROUND LEVEL

γ See TEST ANOMALIES

TEST #890323-3

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - FRONT	36.0
VEHICLE CONTACT SWITCH - REAR	--- γ
BARRIER CONTACT SWITCH - RIGHT	18.0
BARRIER CONTACT SWITCH - LEFT	39.0

γ See TEST ANOMALIES

PSU/Case Number_____
Vehicle Number_____

TEST #890323-3
National Accident Sampling System - Continuous Sampling Subsystem: Vehicle Data

FIELD MEASUREMENTS

Complete When Applicable

End Damage

Undeformed end width_____

Corner shift: A1_____

A2_____

End shift at frame (CDC)
(check one)

<4 inches X

>4 inches_____

Side Damage

Bowing: B1 0 X1 0

B2 3 X2 0

Bowing constant

$\frac{X1 + X2}{2} = 0$

NOTE: Measure C1 to C6 from Driver to Passenger side in Front or Rear impacts - Rear to Front in Side impacts.

Specific Impact Number	Plane* of C-Measurements	Direct Damage Width** (CDC)	Direct Damage Max*** Crush	Field L**	C_1	C_2	C_3	C_4	C_5	C_6	±D
	Bumper height as measured				0.0	4.3	22.2	22.1	15.2	0.0	
	Bumper height as corrected				0.0	4.6	22.5	22.4	15.5	0.0	
	Sill height as measured				0.0	7.2	13.1	18.2	15.4	0.0	
	Sill height as corrected				0.0	4.6	10.5	15.6	12.8	0.0	
	Average Crush			139.5	0.0	4.6	16.5	19.0	14.2	0.0	-19.2

Bumper free space = -0.3 inches
Sill free space = 2.6 inches
Door latch, hinge, or pillar did fail (See Page 1-2).

*Identify the plane at which the C-measurements are taken (e.g., at bumper, at sill, above sill, at beltline, etc.) or label adjustments (e.g., free space).

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.

**Measure and document on the vehicle diagram the beginning or end of the direct damage width and field L (e.g., side damage with respect to undamaged axle.)

***Measure and document on the vehicle diagram the location of the maximum crush.

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

TEST #890323-2

CONTACT SWITCH LOCATIONS AND DATA SUMMARY

LOCATION	SEPARATION TIME (MSEC)
VEHICLE CONTACT SWITCH - FRONT	45.0
VEHICLE CONTACT SWITCH - REAR	77.2
BARRIER CONTACT SWITCH - RIGHT	115.5
BARRIER CONTACT SWITCH - LEFT	80.2

TEST #890323-3

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side	Photosonic 1B	25	500	Impact overall
2	Overhead wide	Photosonic 1B	13	498	Impact wide
3	Overhead tight	Photosonic 1B	25	498	Impact closeup

APPENDIX A

PHOTOGRAPHS

TEST #890323-1

LIST OF PHOTOGRAPHS

1. PRE-TEST OVERALL FRONT VIEW
2. POST-TEST OVERALL FRONT VIEW
3. PRE-TEST OVERALL LEFT SIDE - VIEW 1
4. POST-TEST OVERALL LEFT SIDE - VIEW 1
5. PRE-TEST OVERALL LEFT SIDE - VIEW 2
6. POST-TEST OVERALL LEFT SIDE - VIEW 2
7. POST-TEST CLOSEUP LEFT SIDE VIEW
8. PRE-TEST OVERALL REAR VIEW
9. POST-TEST OVERALL REAR VIEW
10. PRE-TEST OVERALL RIGHT VIEW
11. POST-TEST OVERALL RIGHT VIEW
12. PRE-TEST LEFT FRONT VIEW
13. POST-TEST LEFT FRONT VIEW
14. PRE-TEST LEFT REAR VIEW
15. POST-TEST LEFT REAR VIEW
16. PRE-TEST CLOSE-UP LEFT FRONT VIEW
17. POST-TEST CLOSE-UP LEFT FRONT VIEW
18. PRE-TEST CLOSE-UP LEFT REAR VIEW
19. POST-TEST CLOSE-UP LEFT REAR VIEW
20. PRE-TEST MOVING BARRIER FRONT VIEW
21. PRE-TEST MOVING BARRIER SIDE VIEW

Figure A-1. PRE-TEST OVERALL FRONT VIEW

Figure A-2. POST-TEST OVERALL FRONT VIEW

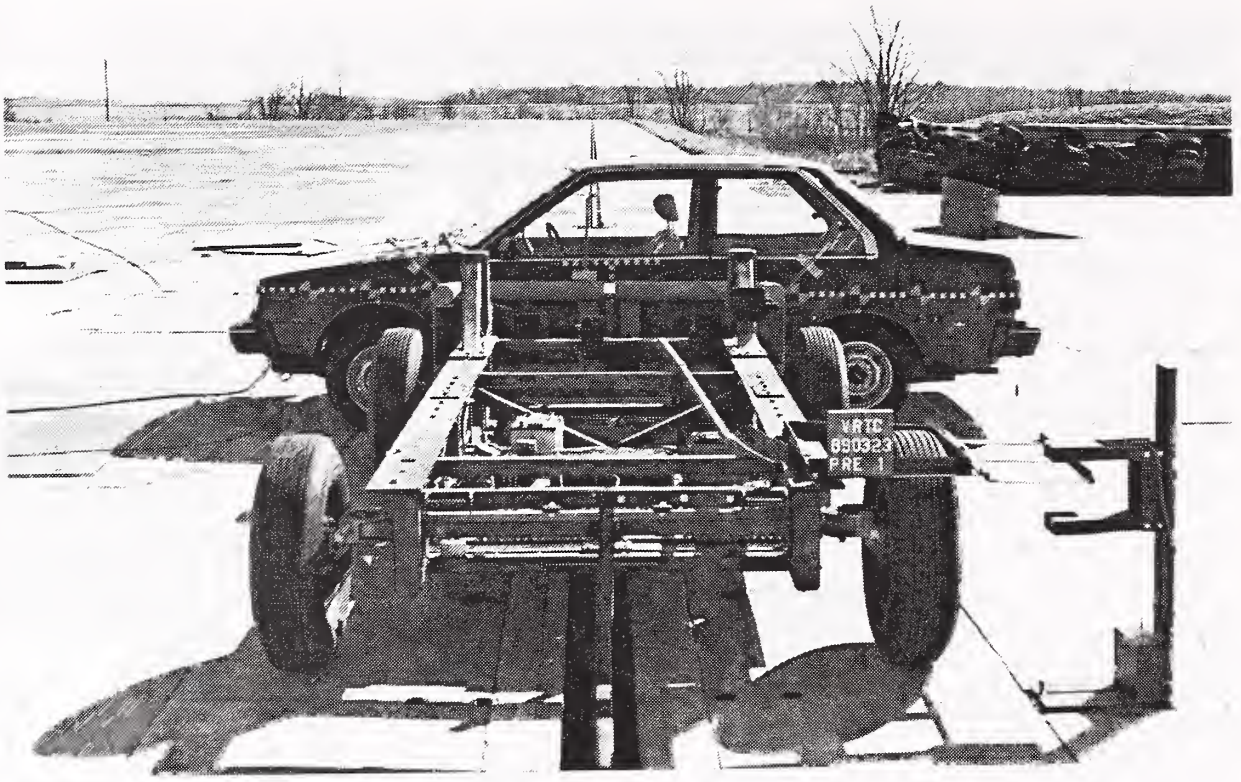


Figure A-3. PRE-TEST OVERALL LEFT SIDE - VIEW 1

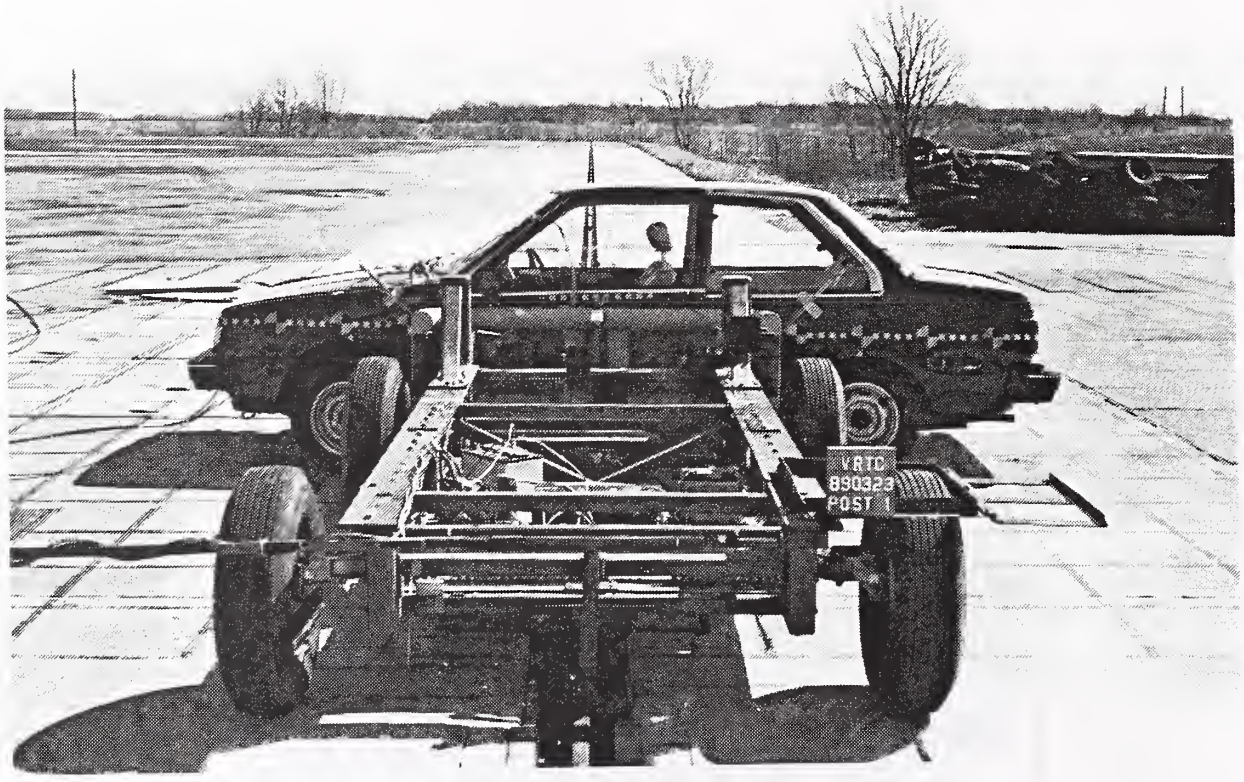


Figure A-4. POST-TEST OVERALL LEFT SIDE - VIEW 1

Figure A-5. PRE-TEST OVERALL LEFT SIDE - VIEW 2

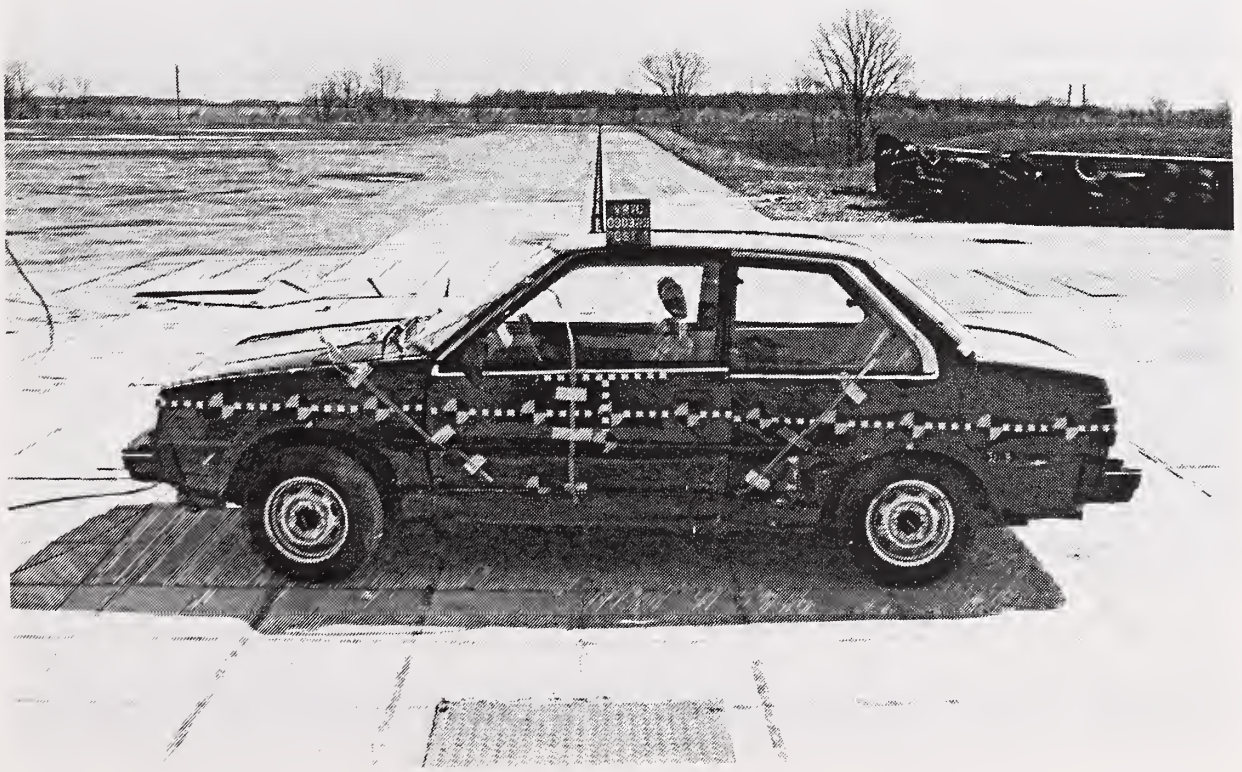


Figure A-6. POST-TEST OVERALL LEFT SIDE - VIEW 2

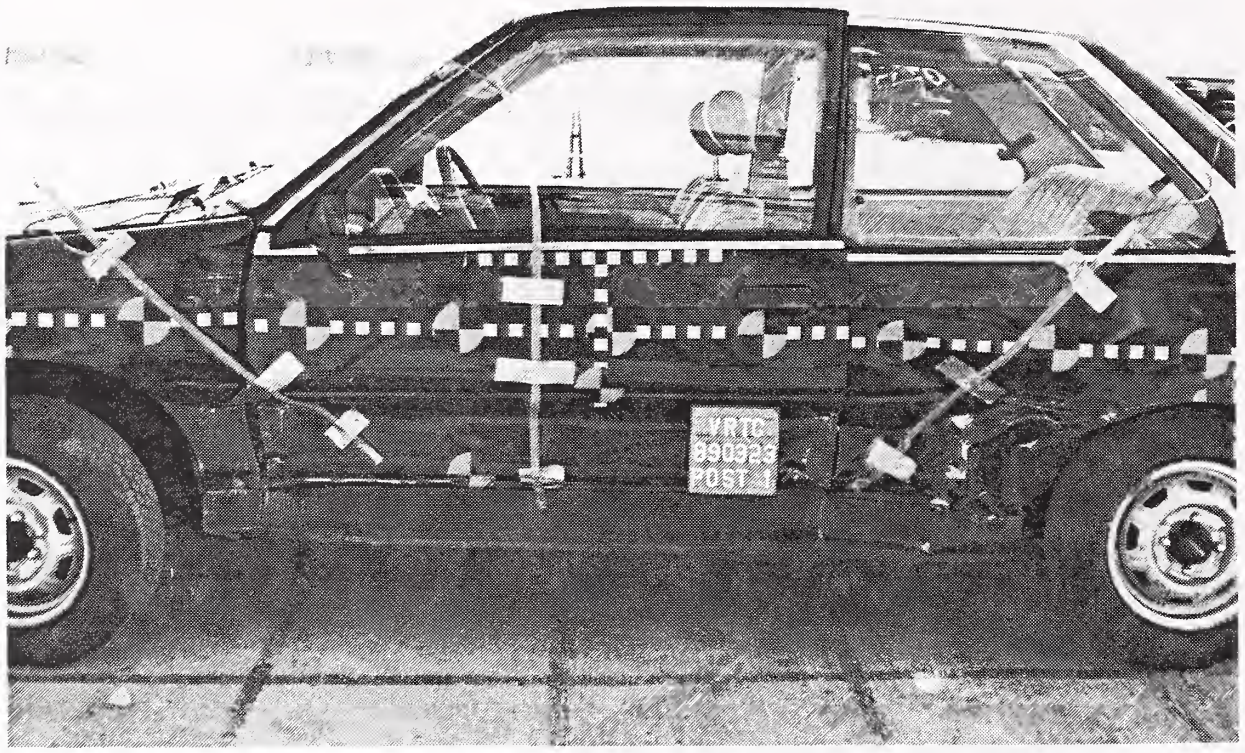


Figure A-7. POST-TEST CLOSE-UP LEFT SIDE VIEW

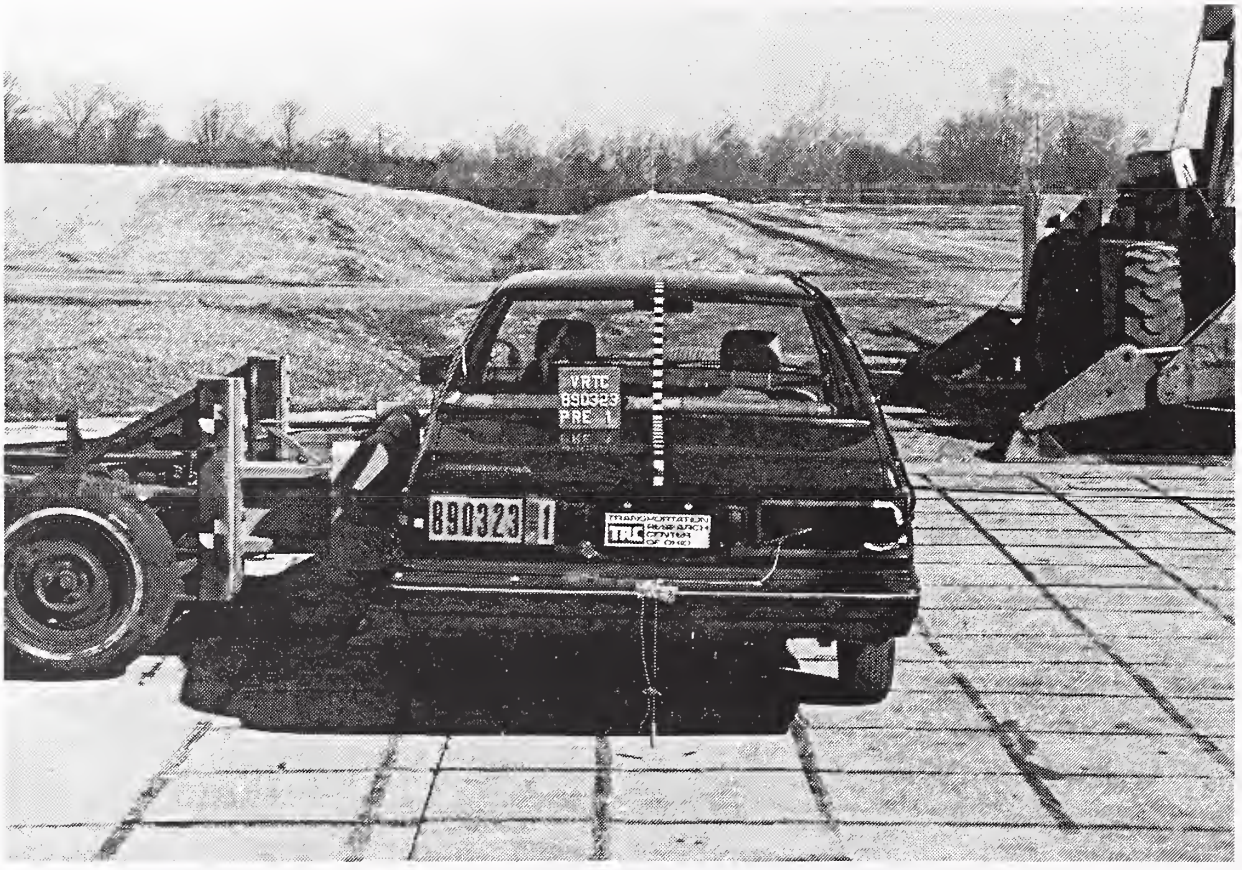


Figure A-8. PRE-TEST OVERALL REAR VIEW

Figure A-9. POST-TEST OVERALL REAR VIEW

Figure A-10. PRE-TEST OVERALL RIGHT VIEW

Figure A-11. POST-TEST OVERALL RIGHT VIEW

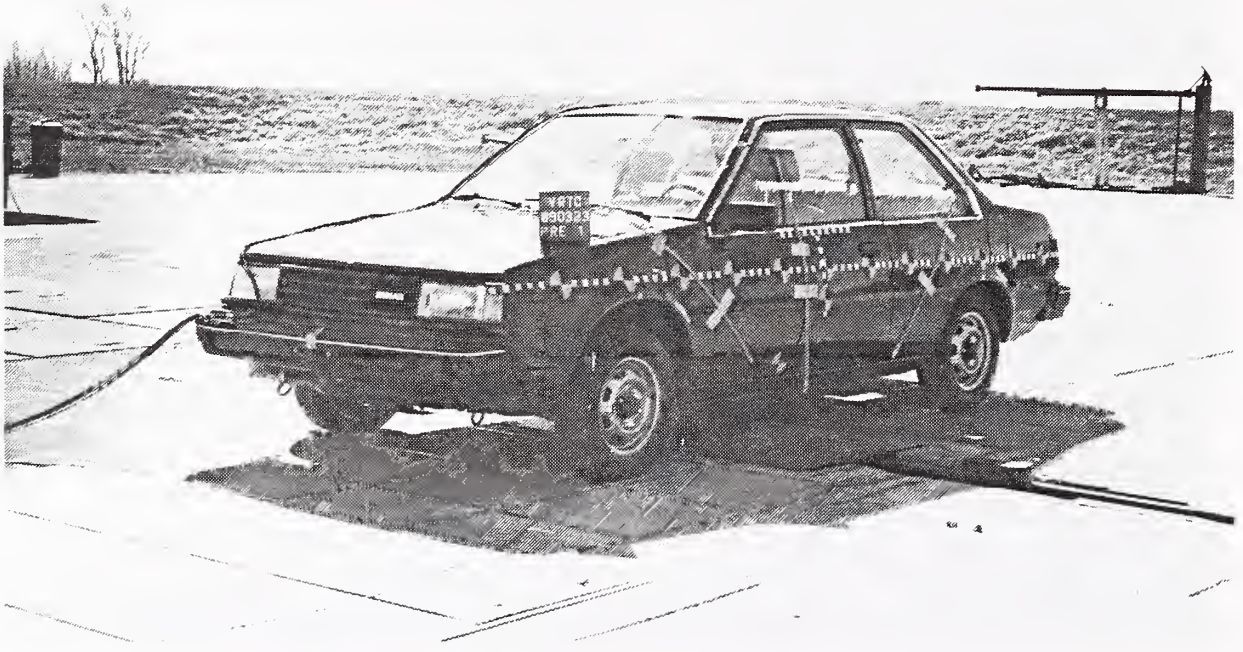


Figure A-12. PRE-TEST LEFT FRONT VIEW

Figure A-13. POST-TEST LEFT FRONT VIEW

Figure A-14. PRE-TEST LEFT REAR VIEW

Figure A-15. POST-TEST LEFT REAR VIEW

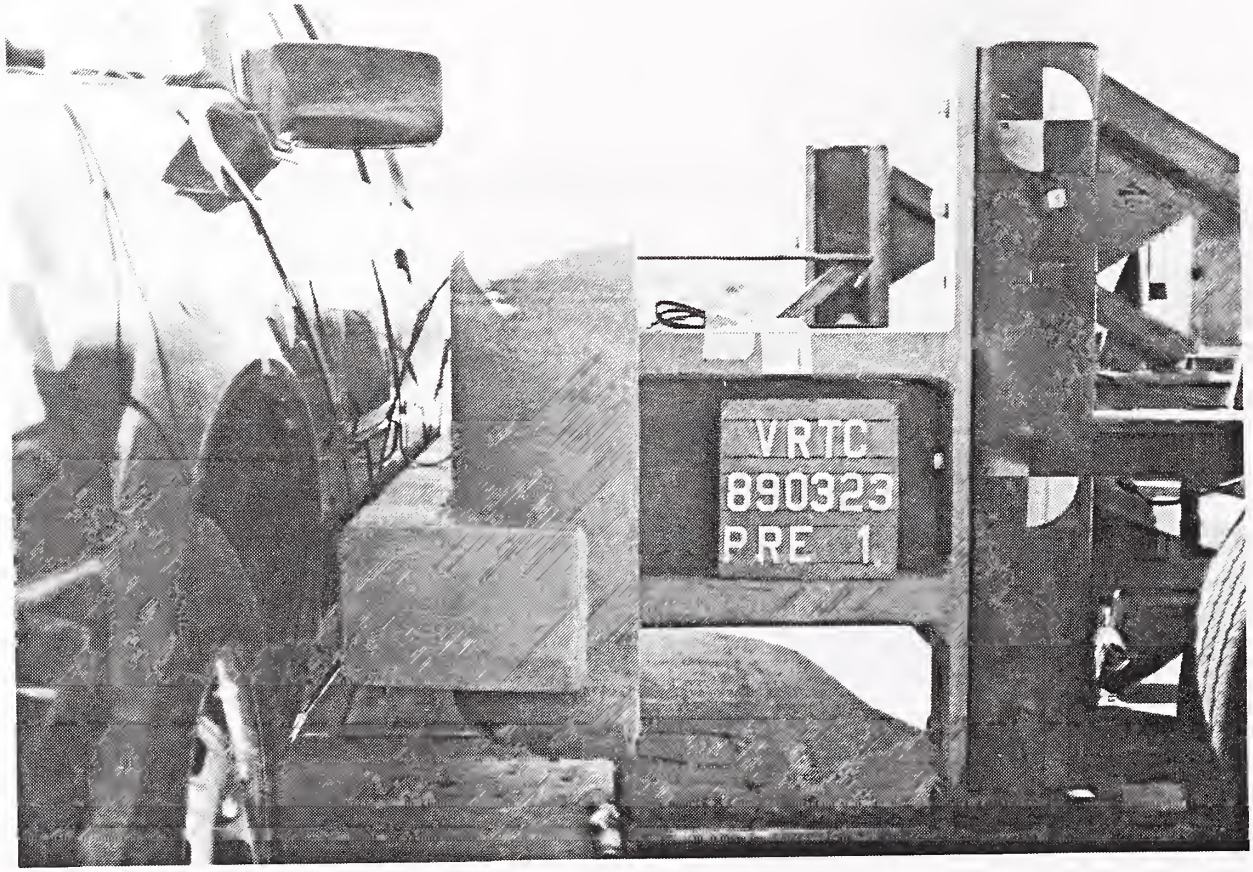


Figure A-16. PRE-TEST CLOSE-UP LEFT FRONT VIEW

Figure A-17. POST-TEST CLOSE-UP LEFT FRONT VIEW

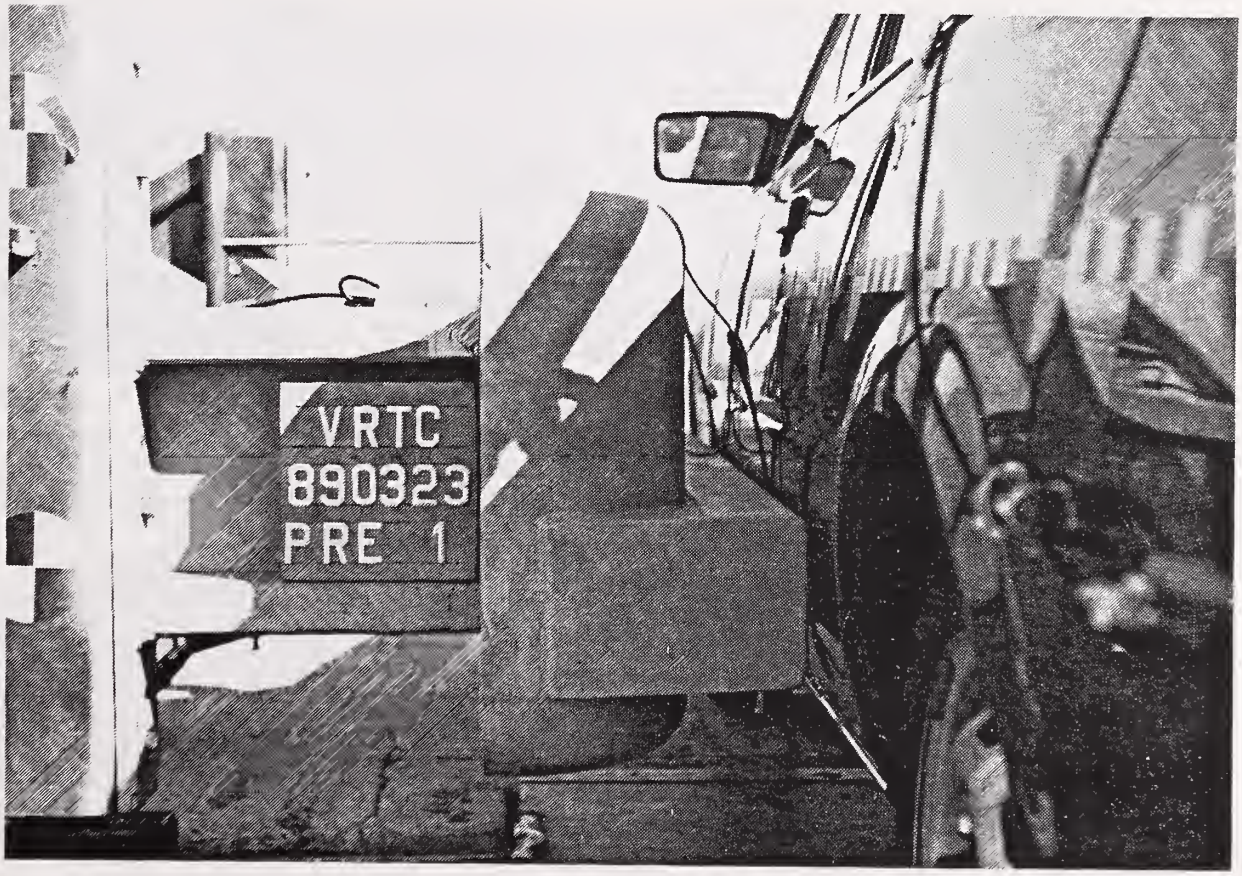


Figure A-18. PRE-TEST CLOSE-UP LEFT REAR VIEW

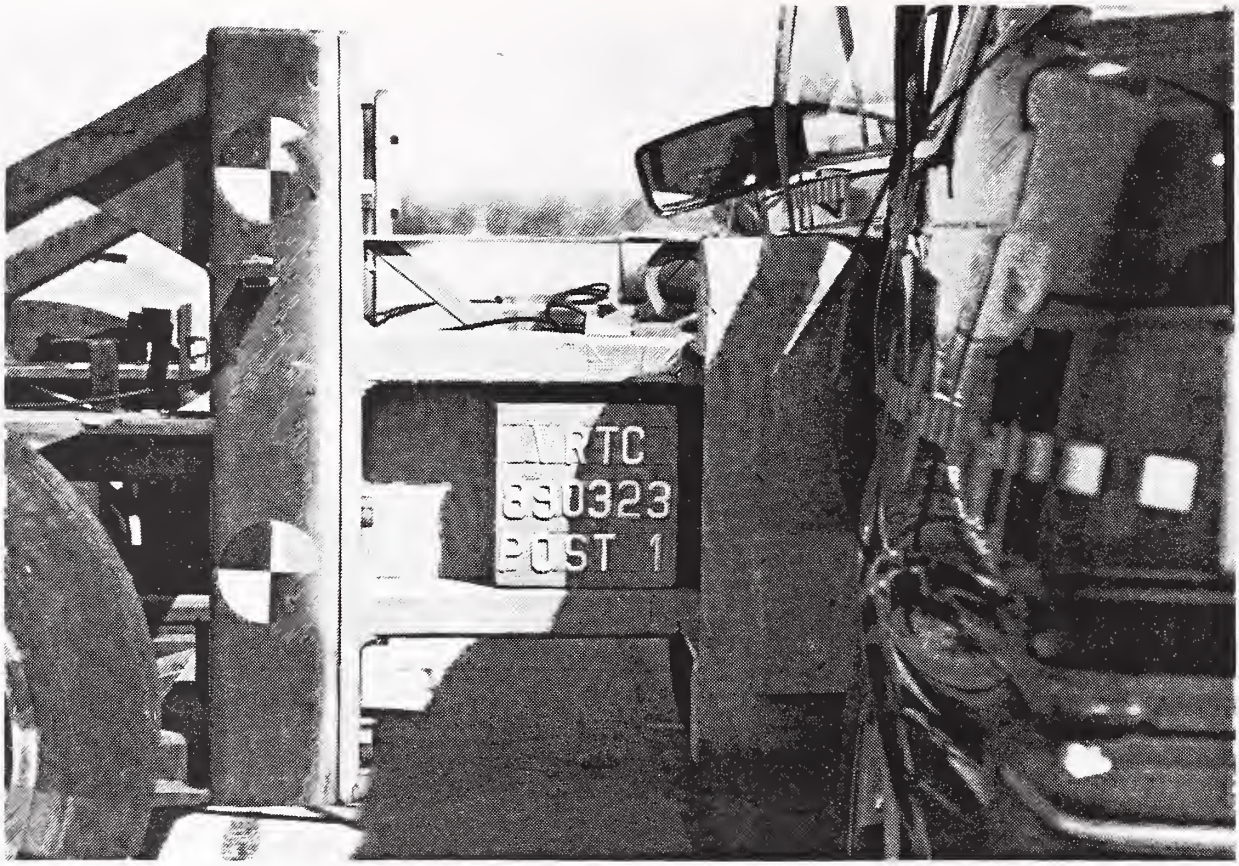


Figure A-19. POST-TEST CLOSE-UP LEFT REAR VIEW

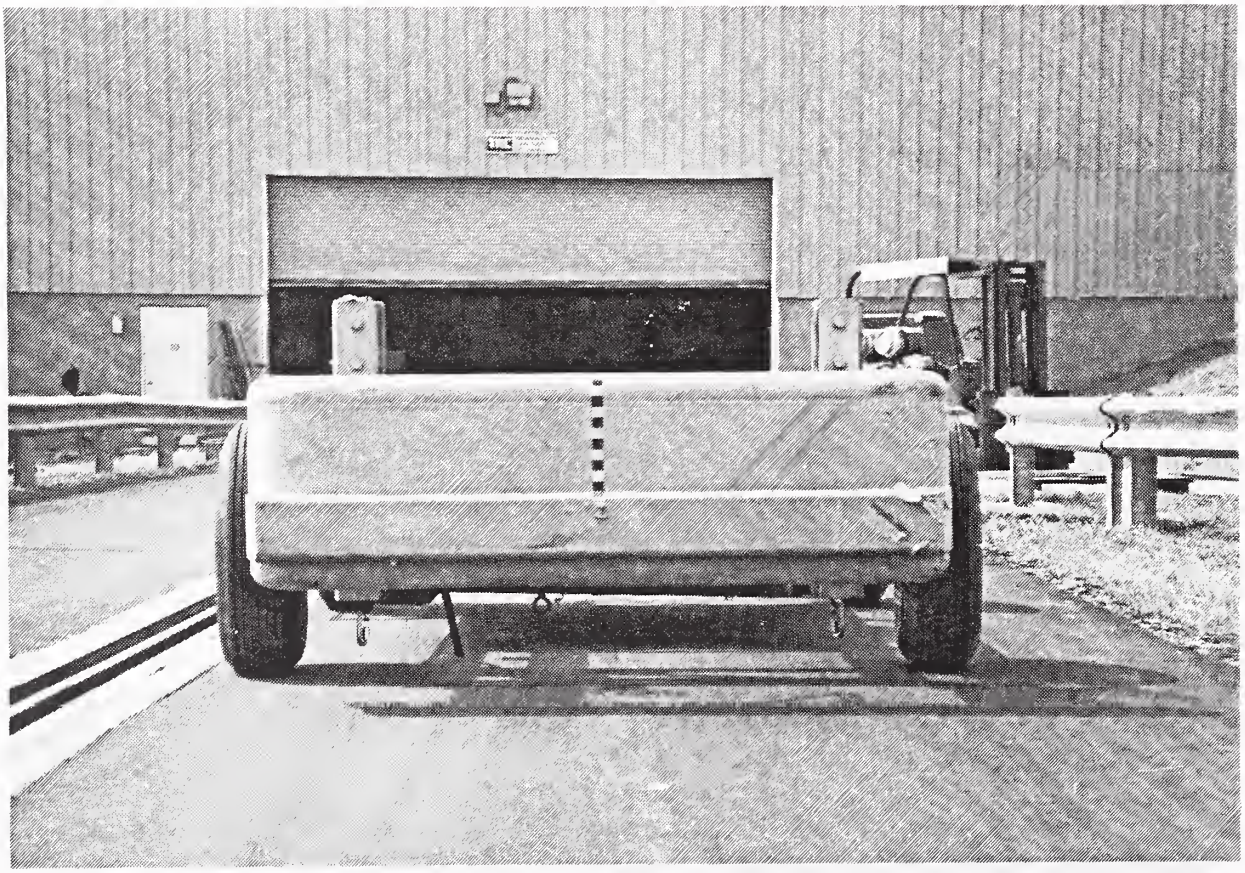


Figure A-20. PRE-TEST MOVING BARRIER FRONT VIEW

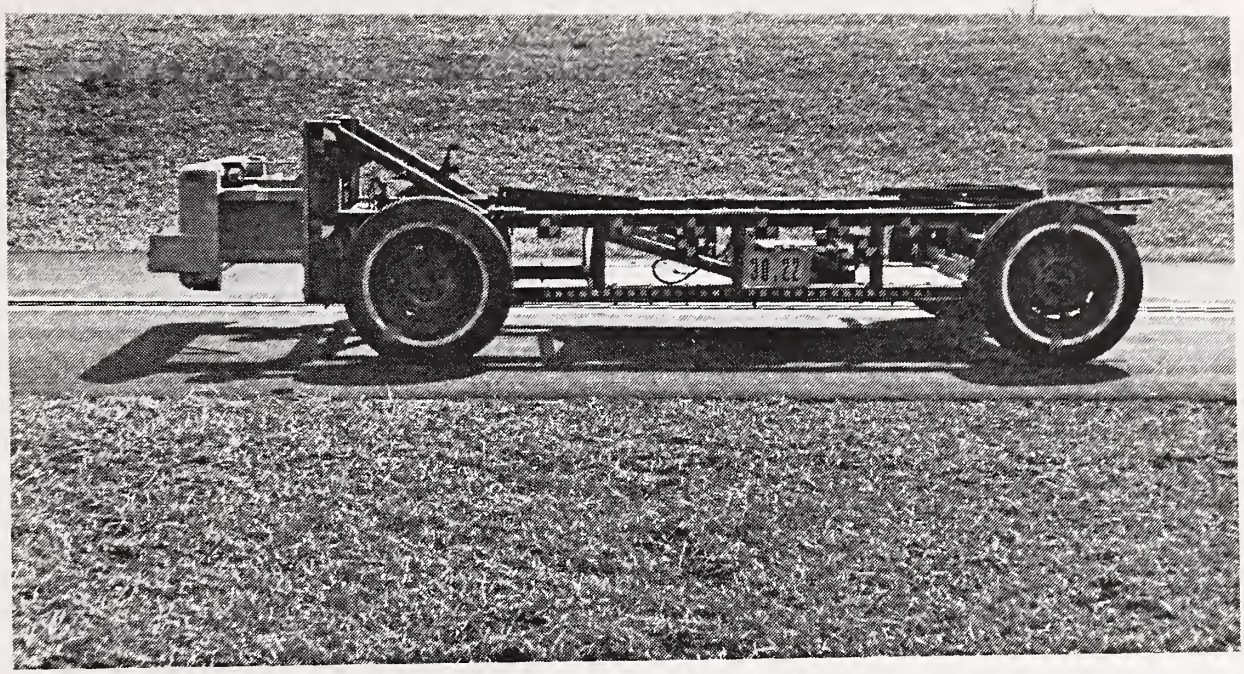


Figure A-21. PRE-TEST MOVING BARRIER SIDE VIEW

TEST #890323-2

LIST OF PHOTOGRAPHS

22. POST-TEST OVERALL FRONT VIEW
23. POST-TEST OVERALL LEFT SIDE - VIEW 1
24. POST-TEST OVERALL LEFT SIDE - VIEW 2
25. POST-TEST CLOSE-UP LEFT SIDE VIEW
26. POST-TEST OVERALL REAR VIEW
27. POST-TEST OVERALL RIGHT VIEW
28. POST-TEST LEFT FRONT VIEW
29. POST-TEST LEFT REAR VIEW
30. POST-TEST CLOSE-UP LEFT FRONT VIEW
31. POST-TEST CLOSE-UP LEFT REAR VIEW
32. POST-TEST LEFT DOOR LATCH VIEW

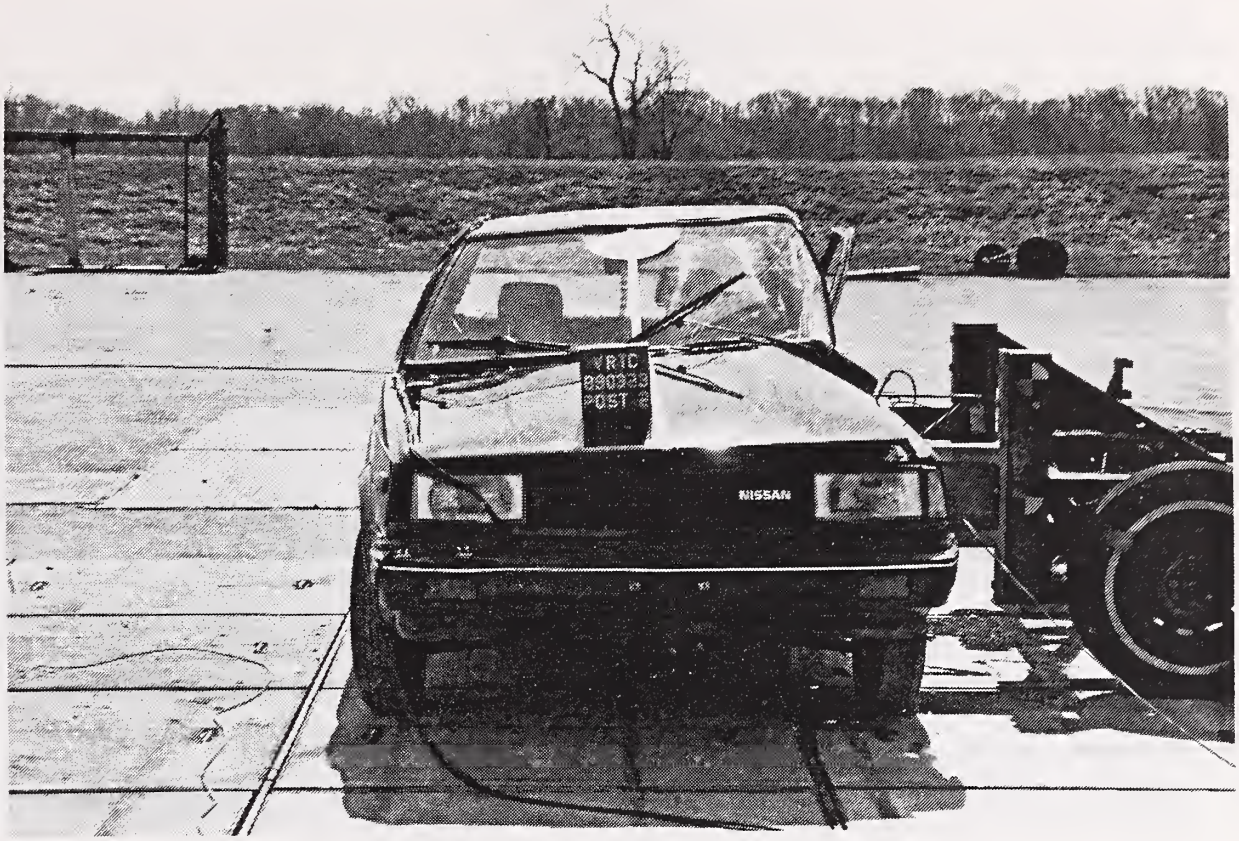


Figure A-22. POST-TEST OVERALL FRONT VIEW

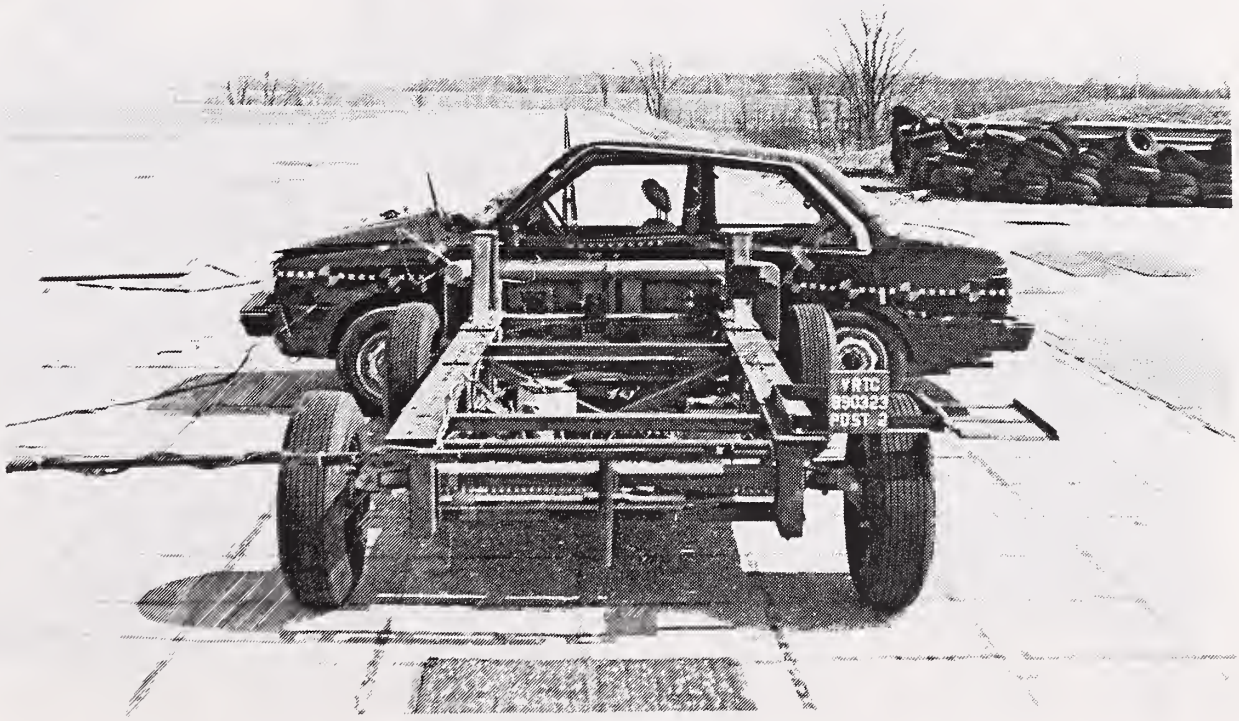


Figure A-23. POST-TEST OVERALL LEFT SIDE - VIEW 1

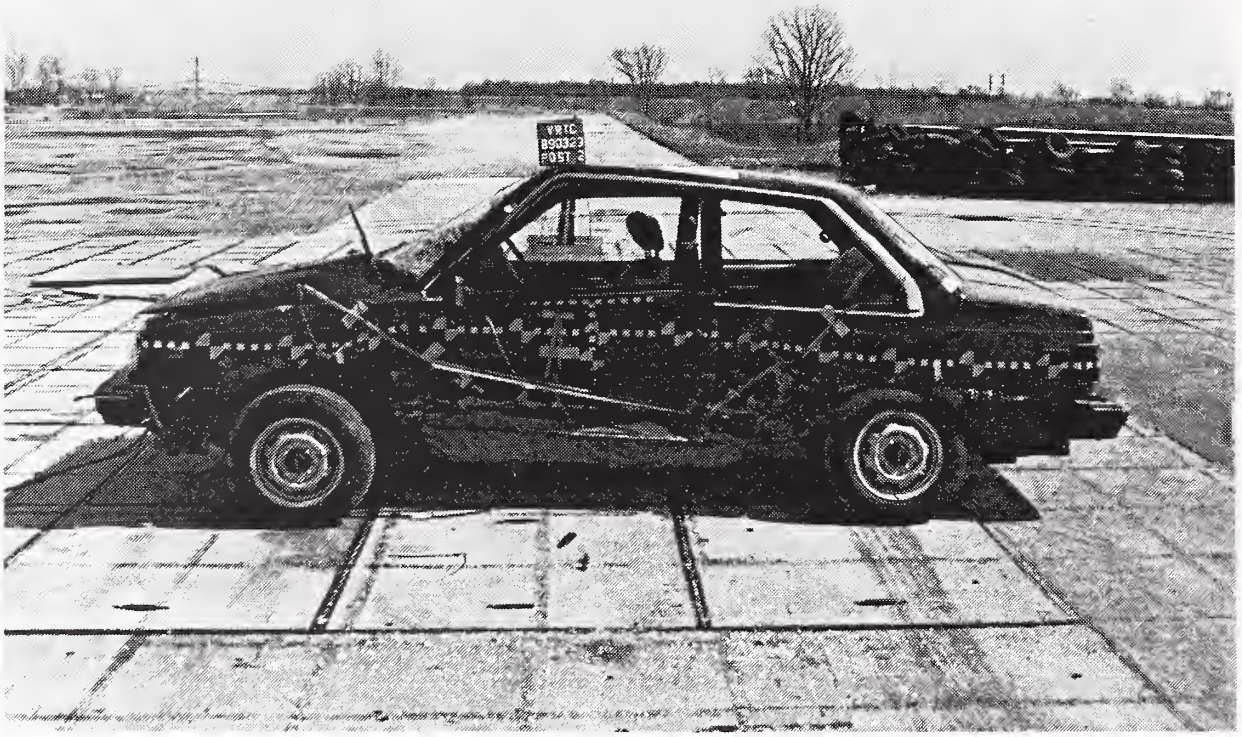


Figure A-24. POST-TEST OVERALL LEFT SIDE - VIEW 2

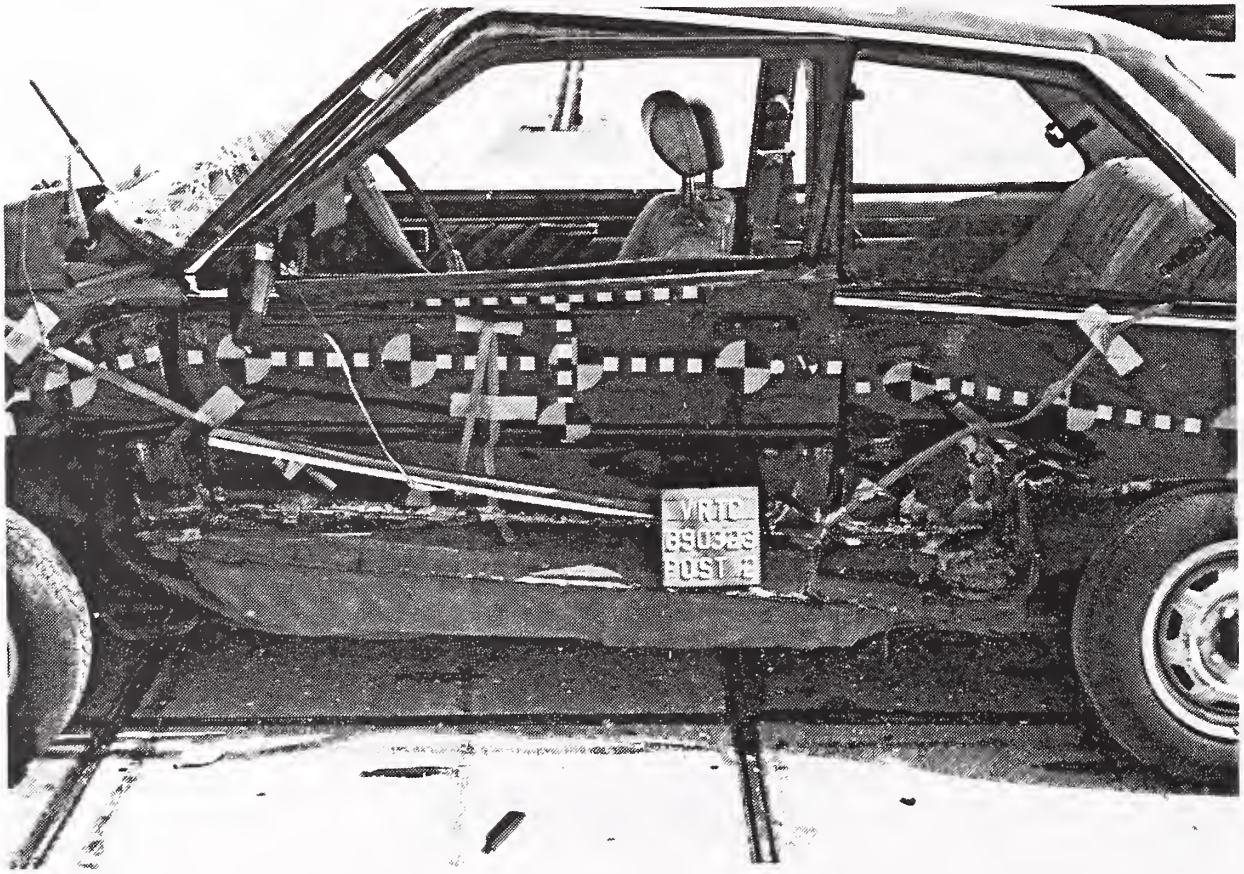


Figure A-25. POST-TEST CLOSEUP LEFT SIDE VIEW

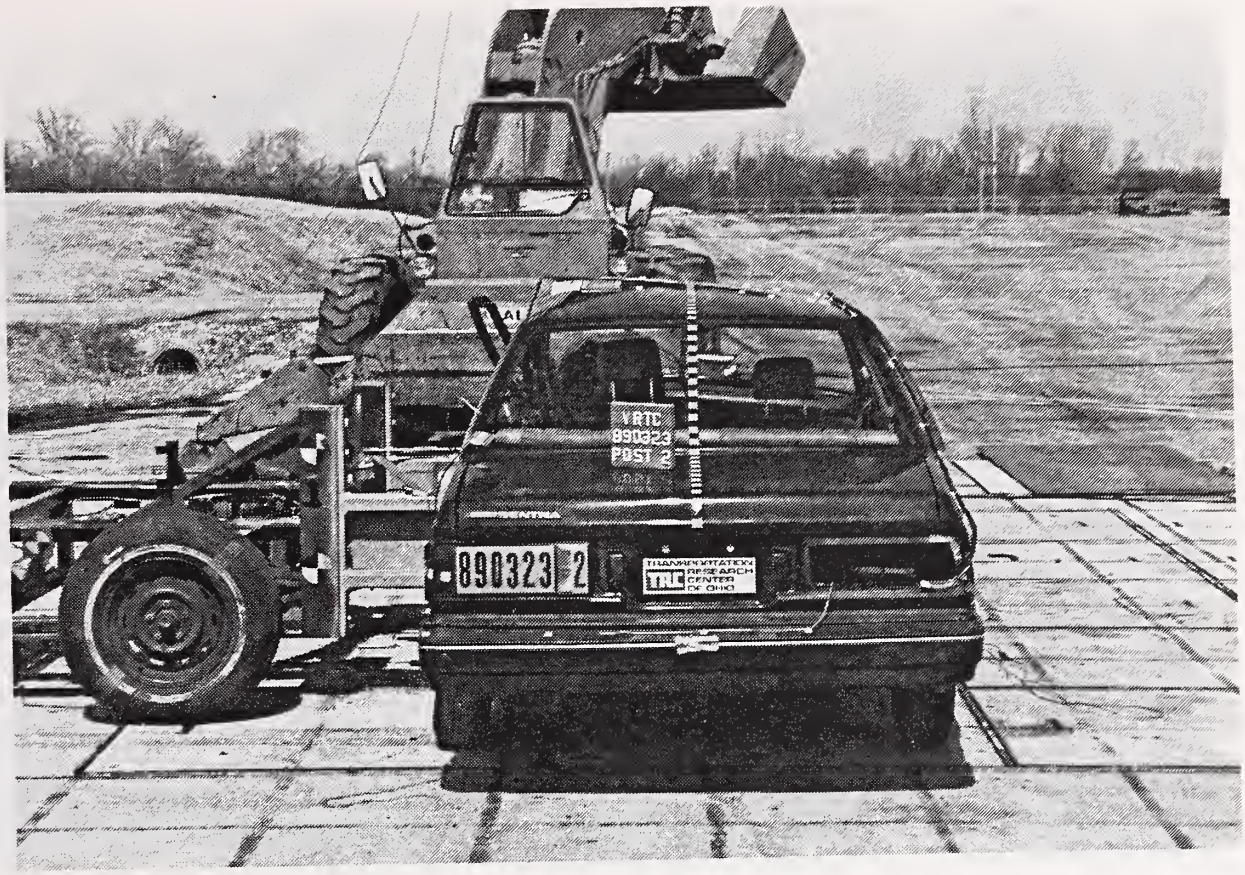


Figure A-26. POST-TEST OVERALL REAR VIEW

Figure A-27. POST-TEST OVERALL RIGHT VIEW

Figure A-28. POST-TEST LEFT FRONT VIEW

Figure A-29. POST-TEST LEFT REAR VIEW

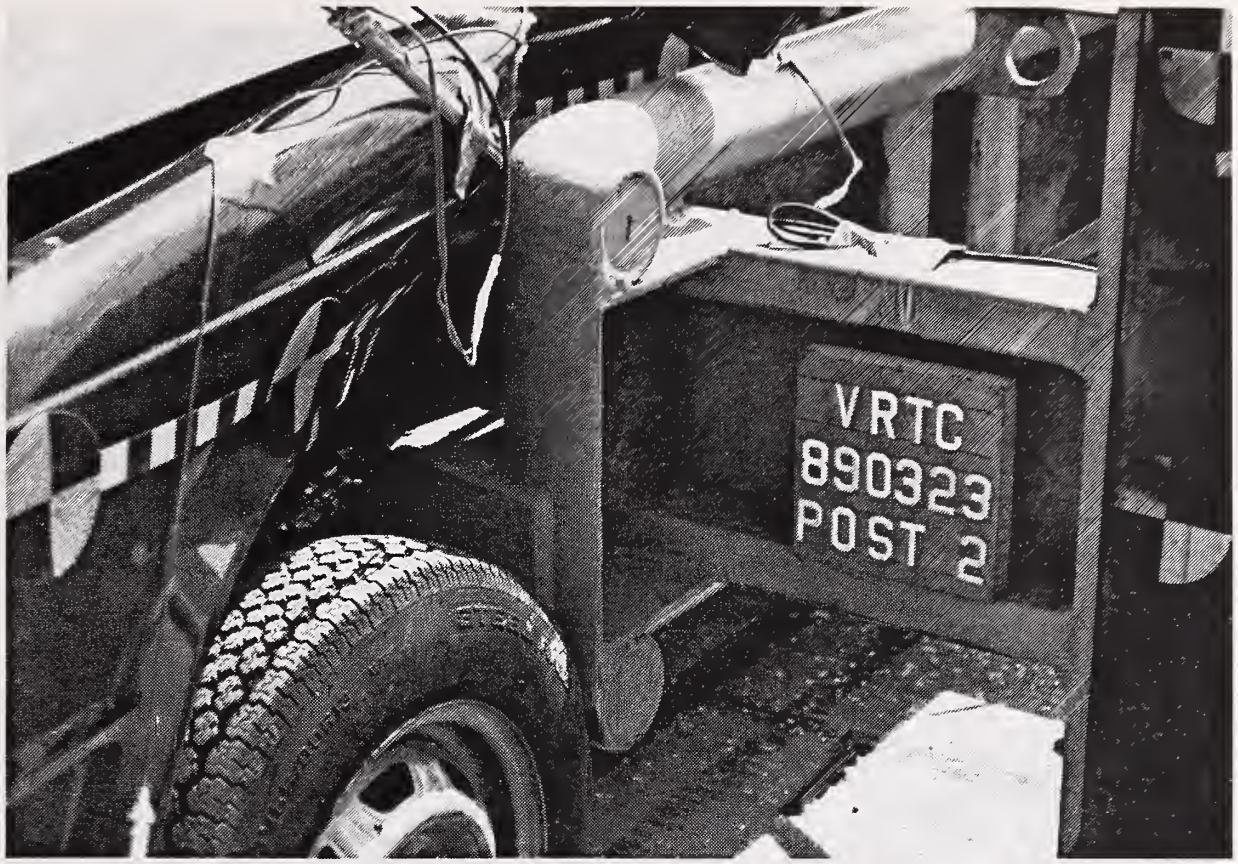


Figure A-30. POST-TEST CLOSE-UP LEFT FRONT VIEW

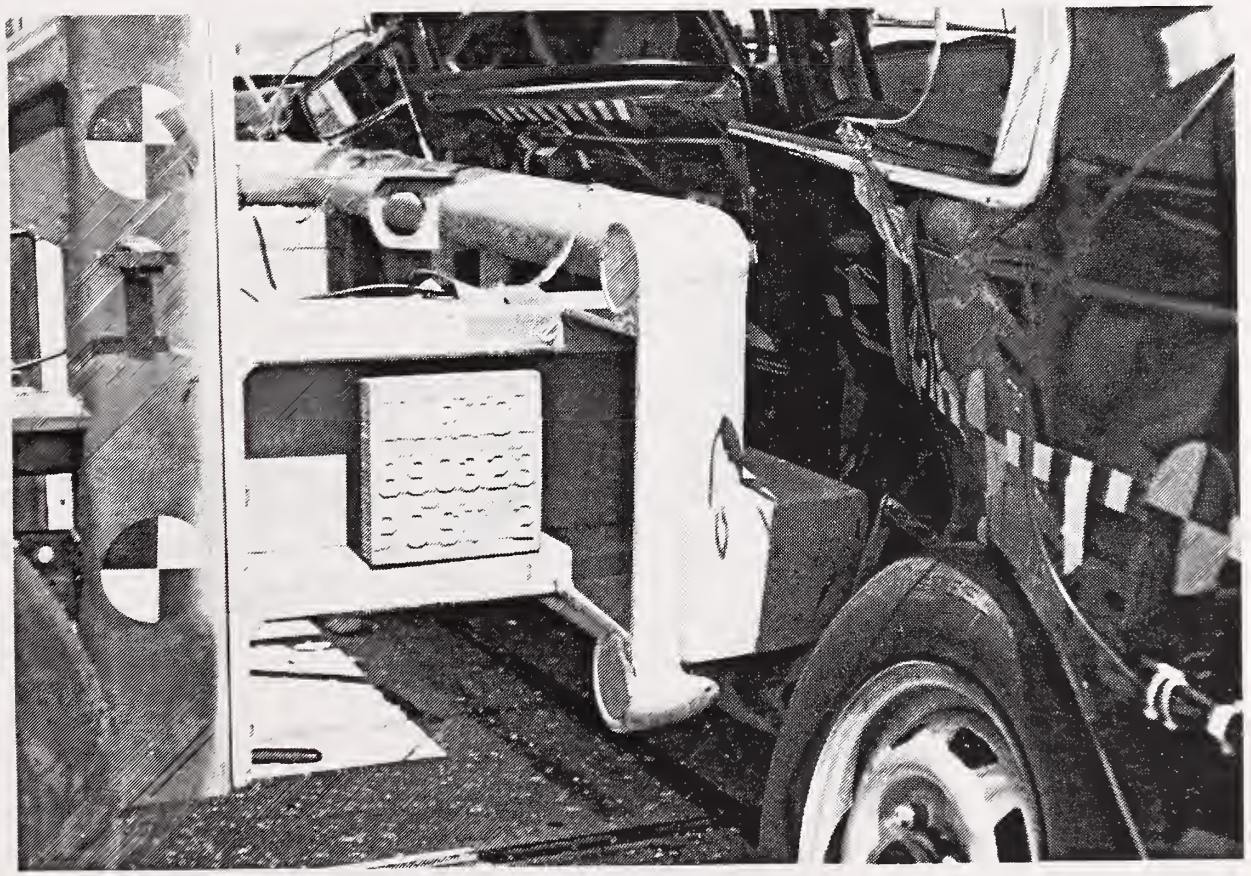


Figure A-31. POST-TEST CLOSE-UP LEFT REAR VIEW

Figure A-32. POST-TEST LEFT DOOR LATCH VIEW

TEST #890323-3

LIST OF PHOTOGRAPHS

33. POST-TEST OVERALL FRONT VIEW
34. POST-TEST OVERALL LEFT SIDE - VIEW 1
35. POST-TEST OVERALL LEFT SIDE - VIEW 2
36. POST-TEST OVERALL REAR VIEW
37. POST-TEST OVERALL RIGHT VIEW
38. POST-TEST LEFT FRONT VIEW
39. POST-TEST LEFT REAR VIEW
40. POST-TEST CLOSE-UP LEFT FRONT VIEW
41. POST-TEST CLOSE-UP LEFT REAR VIEW
42. POST-TEST LEFT DOOR LATCH VIEW
43. POST-TEST LEFT DOOR HINGES VIEW
44. POST-TEST TWO FRONT SEATS VIEW

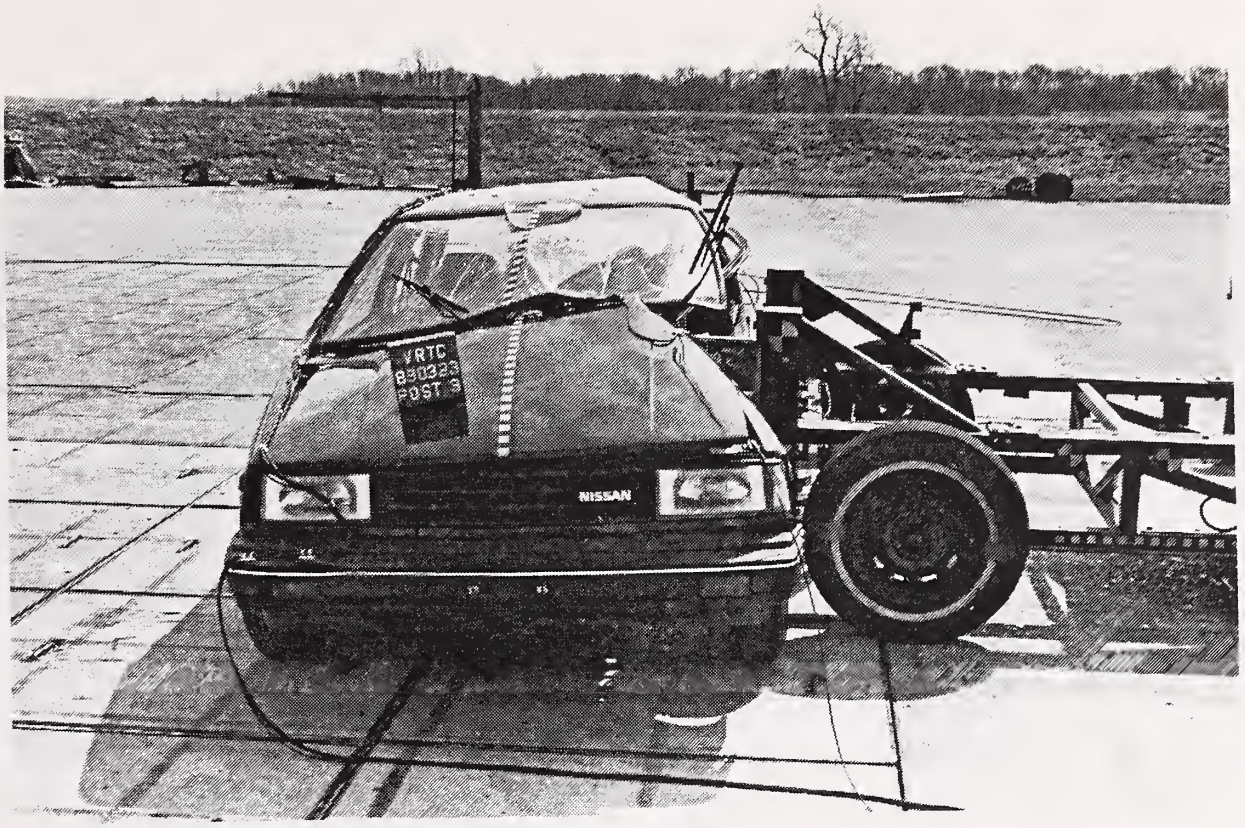


Figure A-33. POST-TEST OVERALL FRONT VIEW

Figure A-34. POST-TEST OVERALL LEFT SIDE - VIEW 1

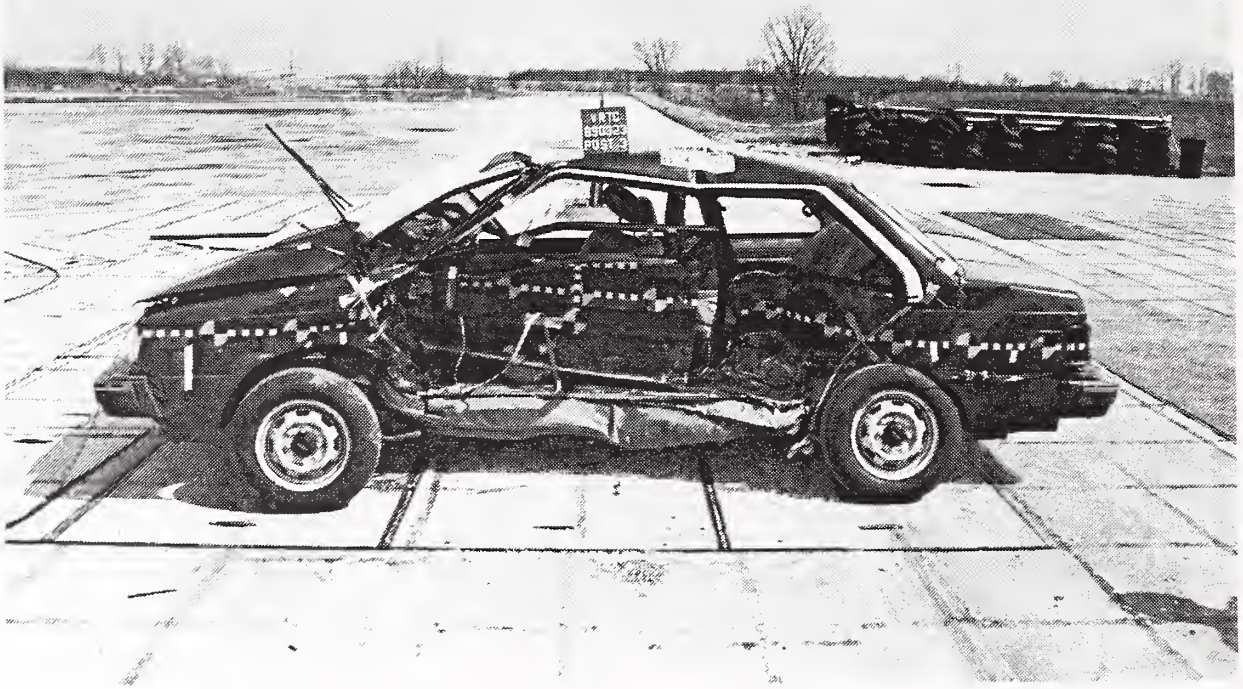


Figure A-35. POST-TEST OVERALL LEFT SIDE - VIEW 2

Figure A-36. POST-TEST OVERALL REAR VIEW

Figure A-37. POST-TEST OVERALL RIGHT VIEW

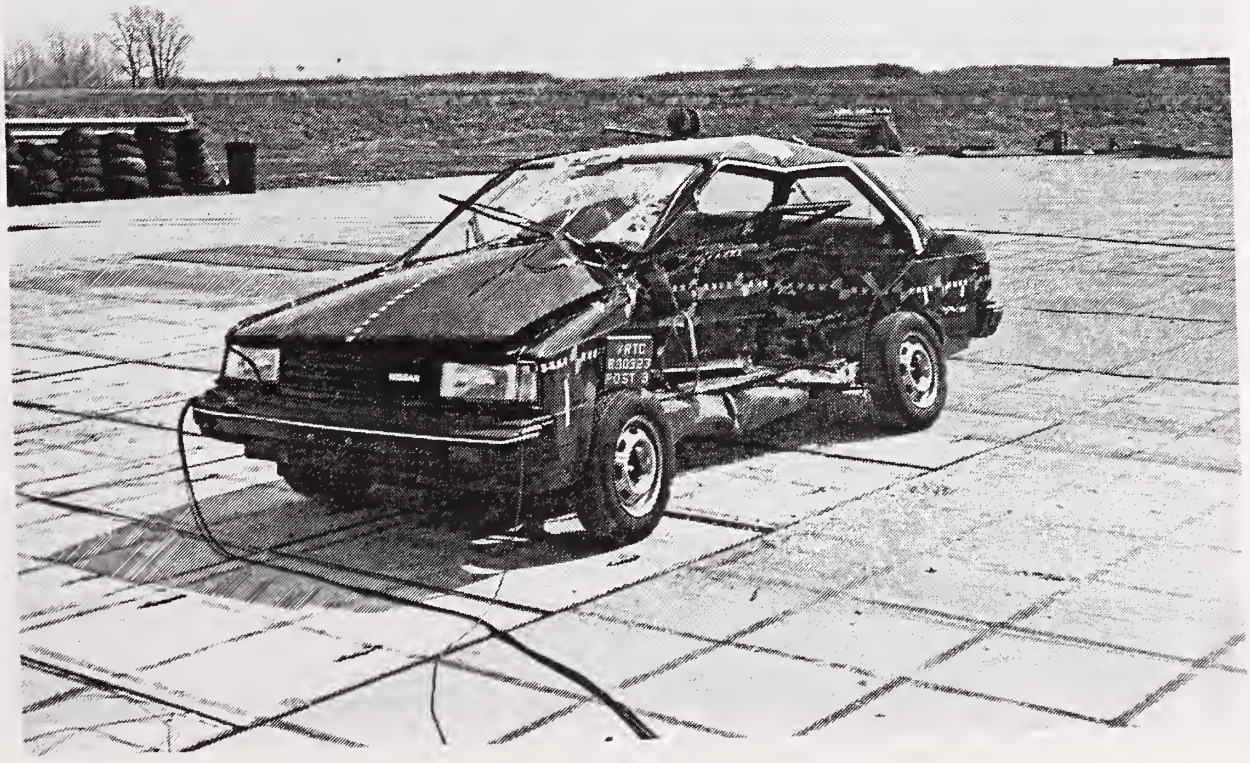


Figure A-38. POST-TEST LEFT FRONT VIEW

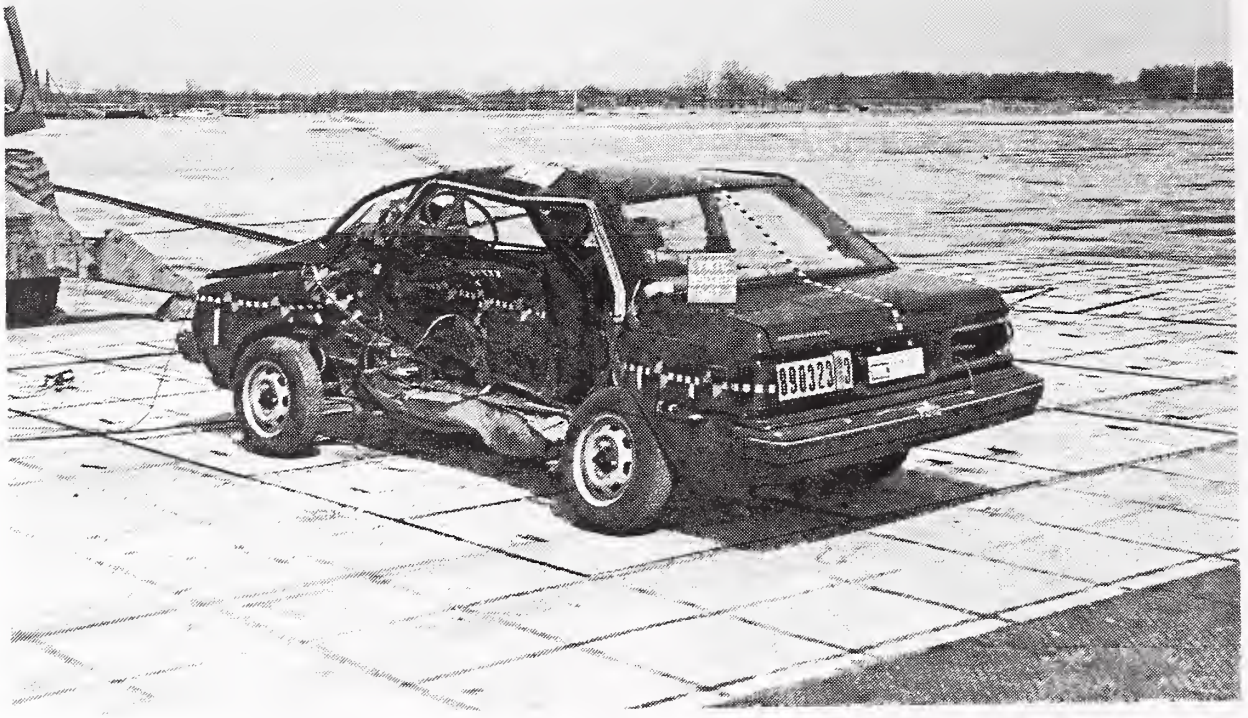


Figure A-39. POST-TEST LEFT REAR VIEW

Figure A-40. POST-TEST CLOSE-UP LEFT FRONT VIEW

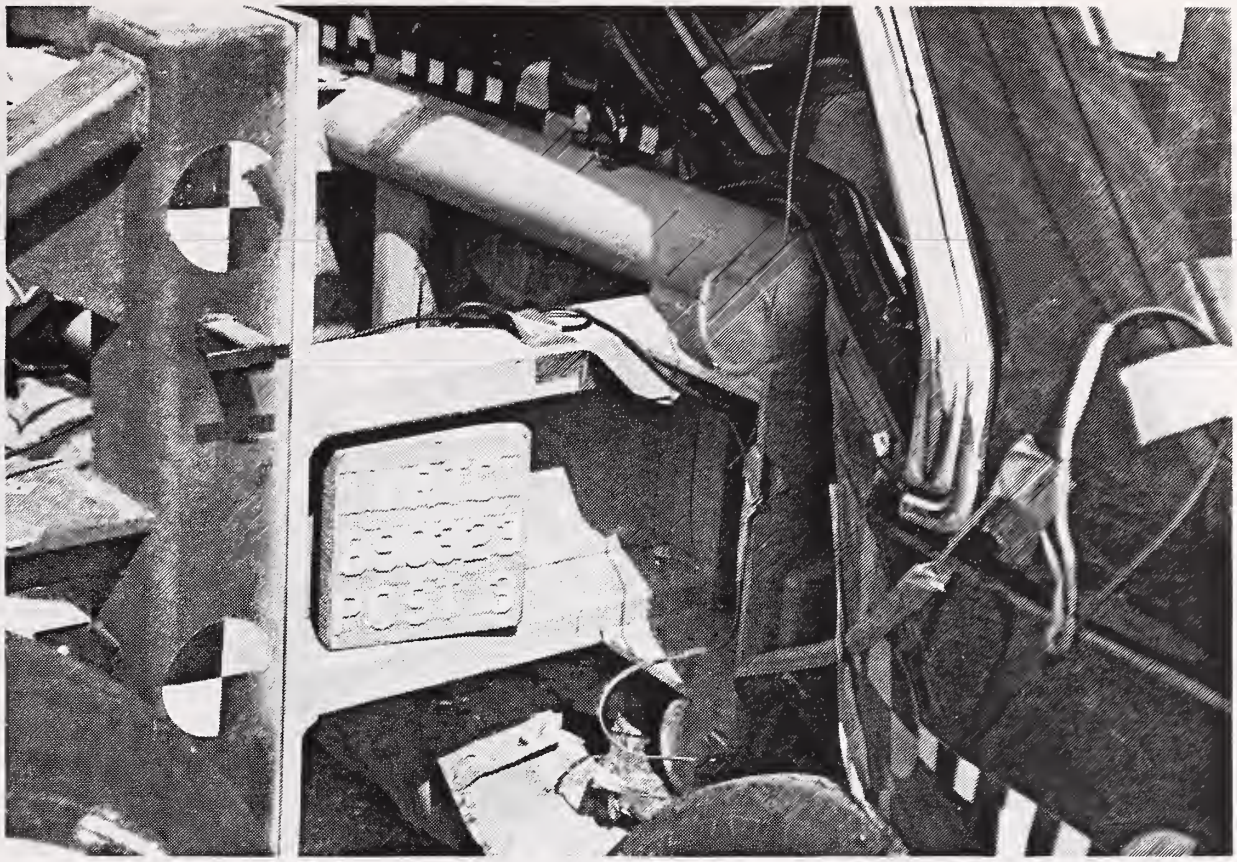


Figure A-41. POST-TEST CLOSE-UP LEFT REAR VIEW

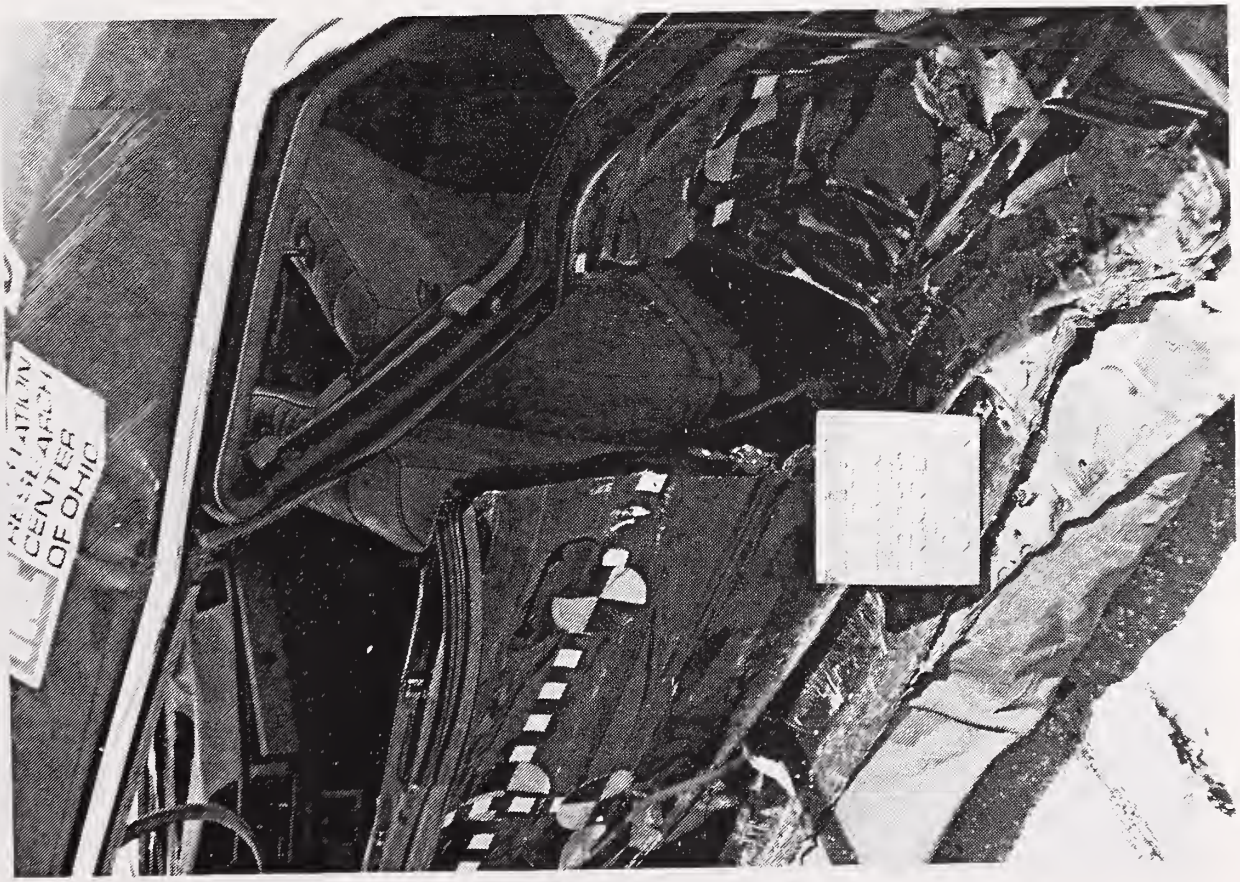


Figure A-42. POST-TEST LEFT DOOR LATCH VIEW

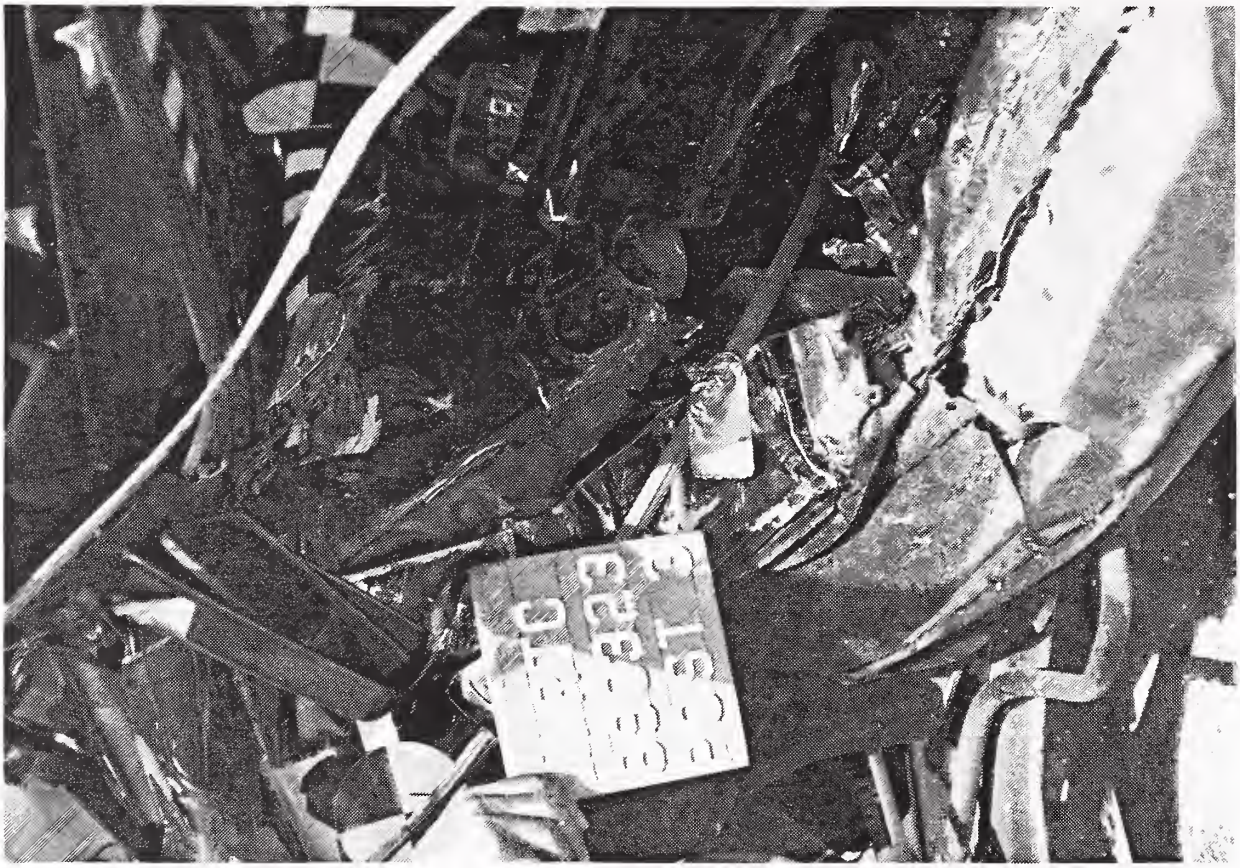


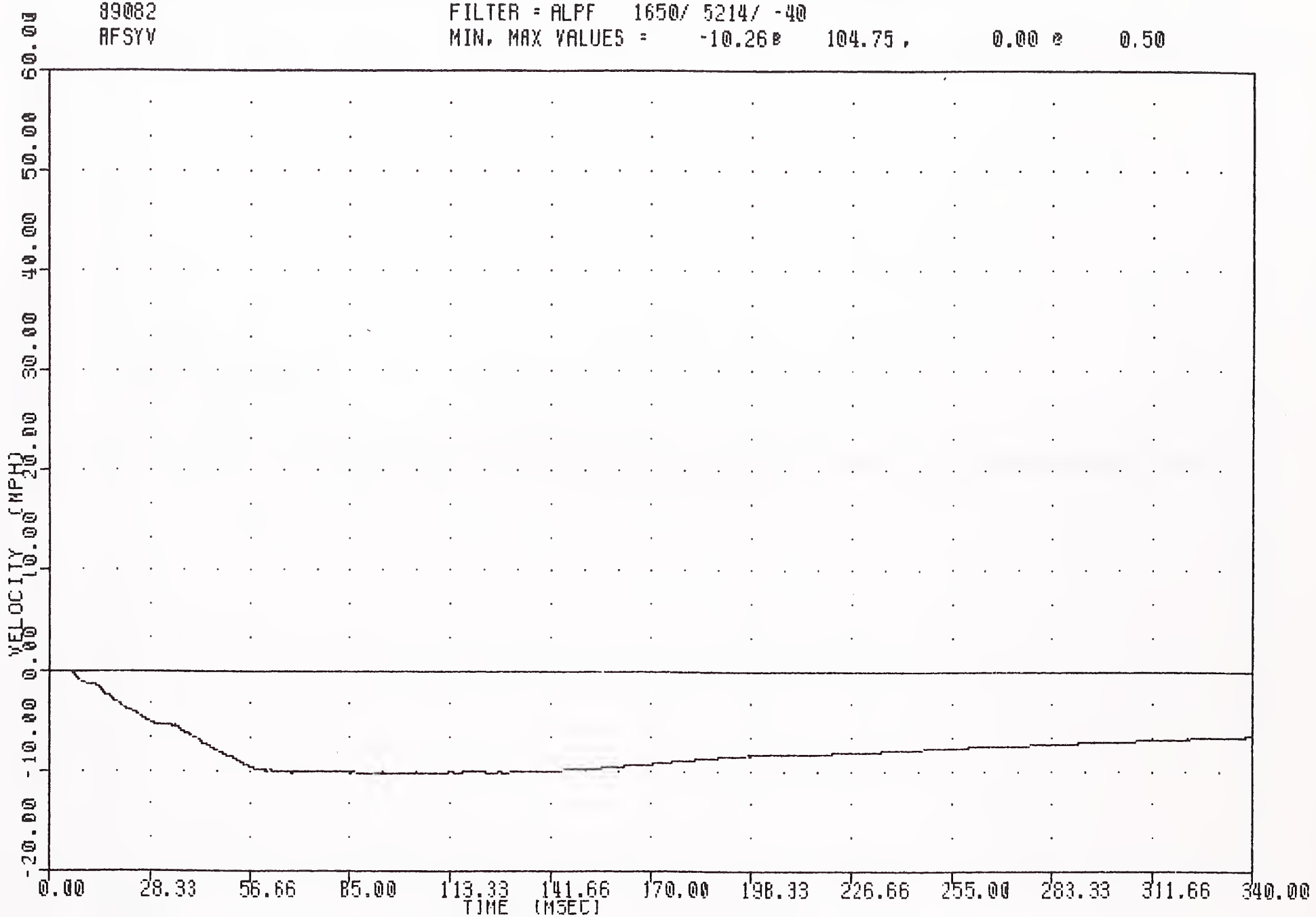
Figure A-43. POST-TEST LEFT DOOR HINGES VIEW

Figure A-44. POST-TEST TWO FRONT SEATS VIEW

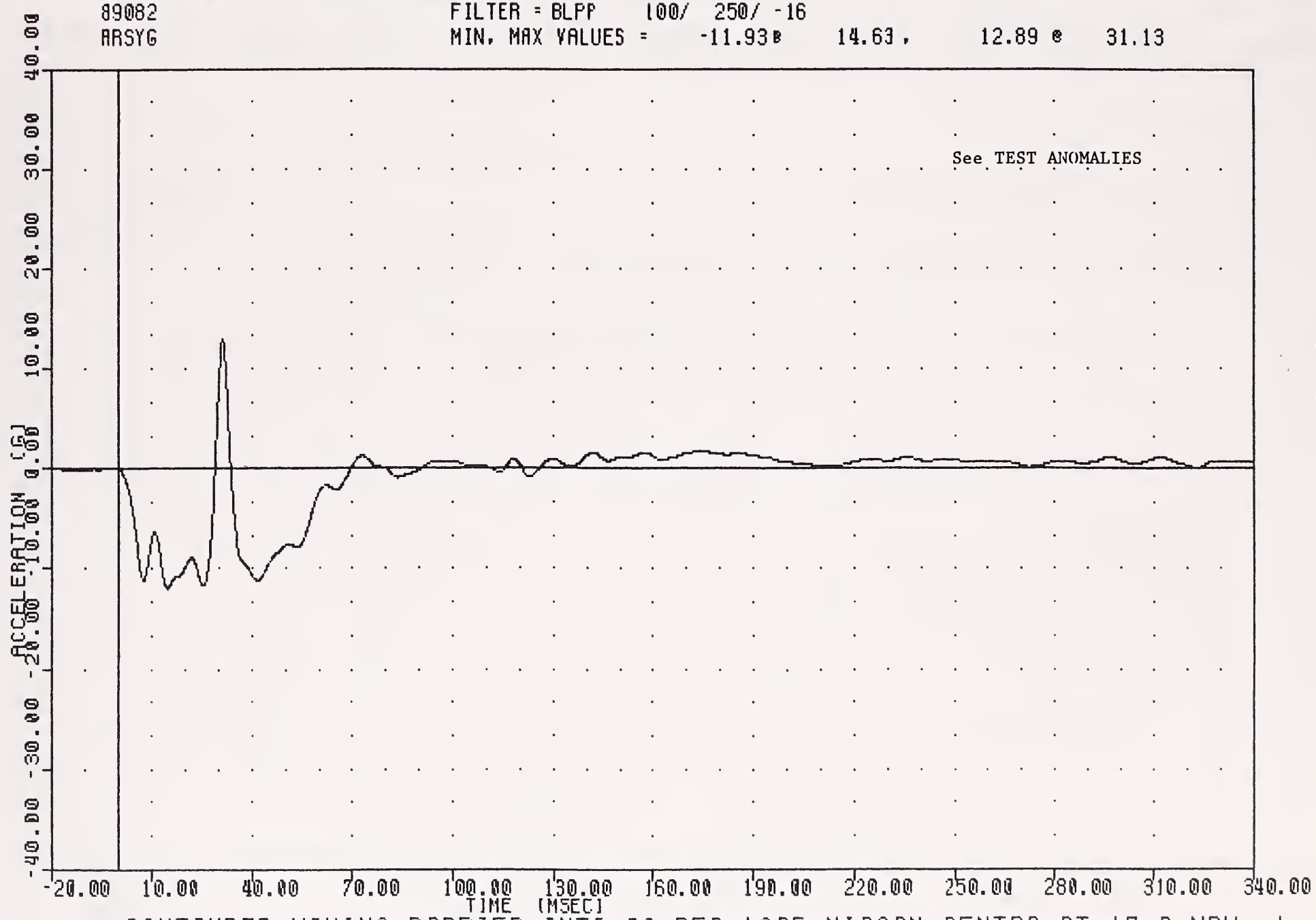
APPENDIX B

DATA PLOTS

TEST #890323-1

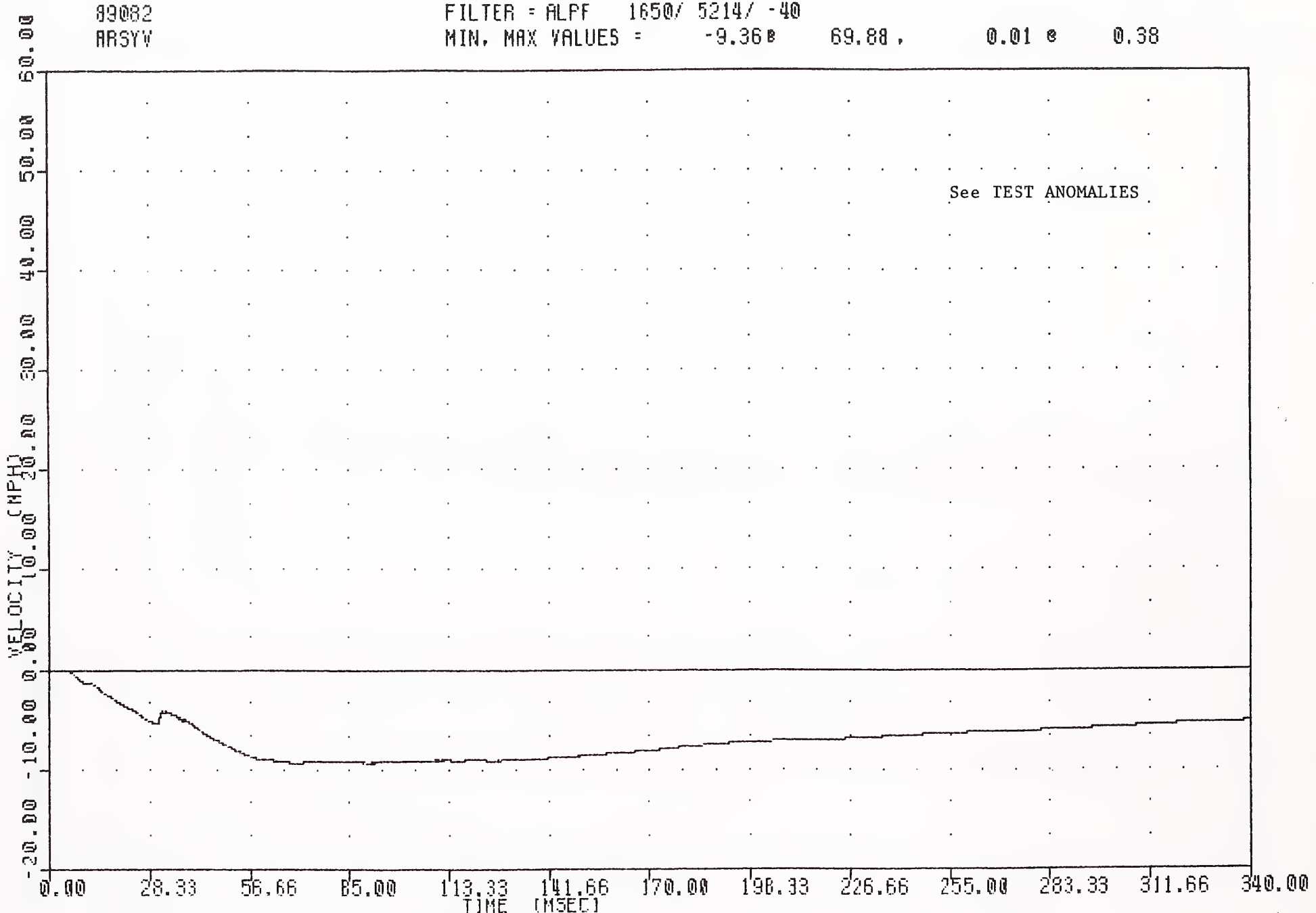


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH #1
RIGHT FRONT SILL Y AXIS VELOCITY

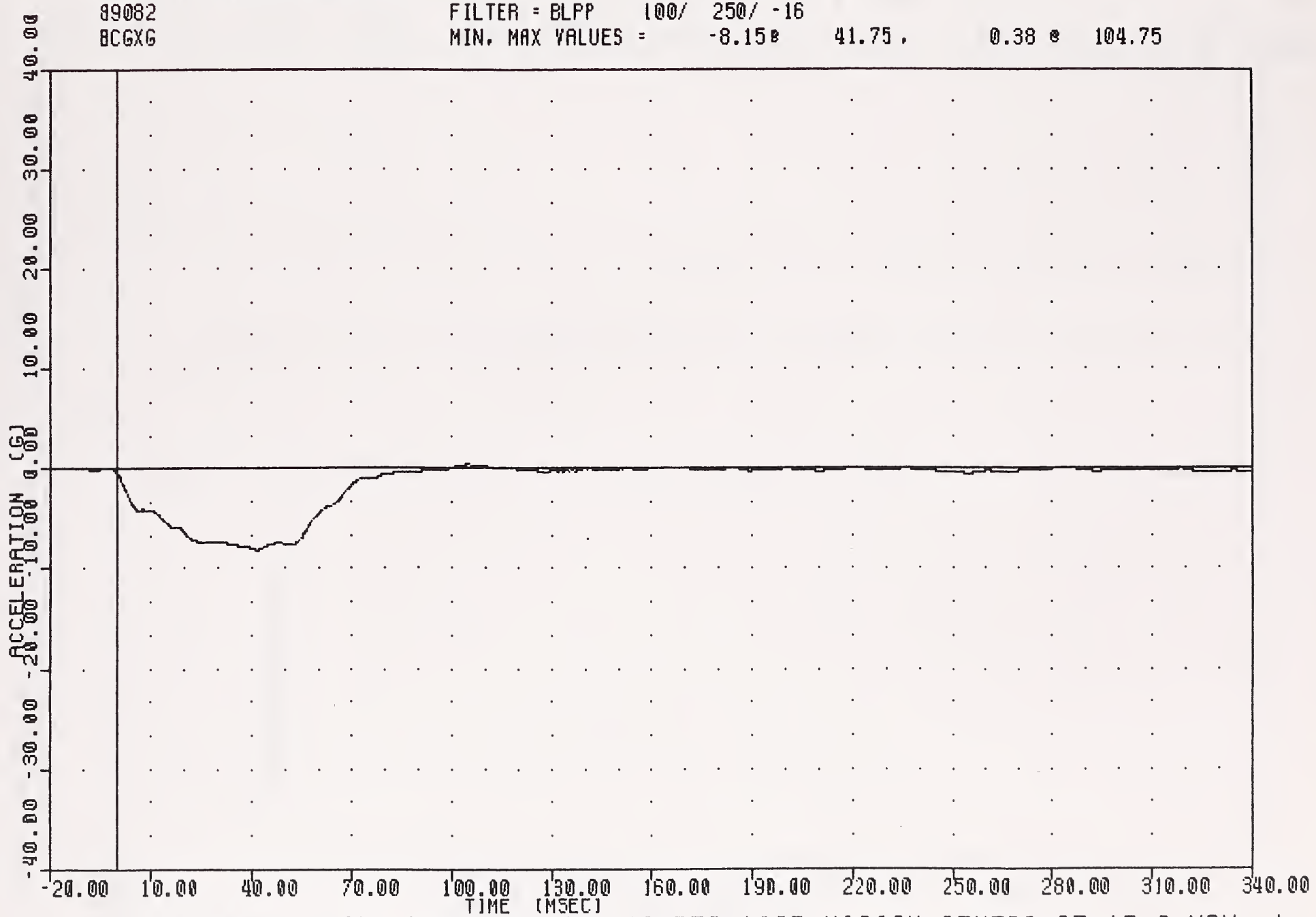


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH *1

RIGHT REAR SILL Y AXIS ACCELERATION

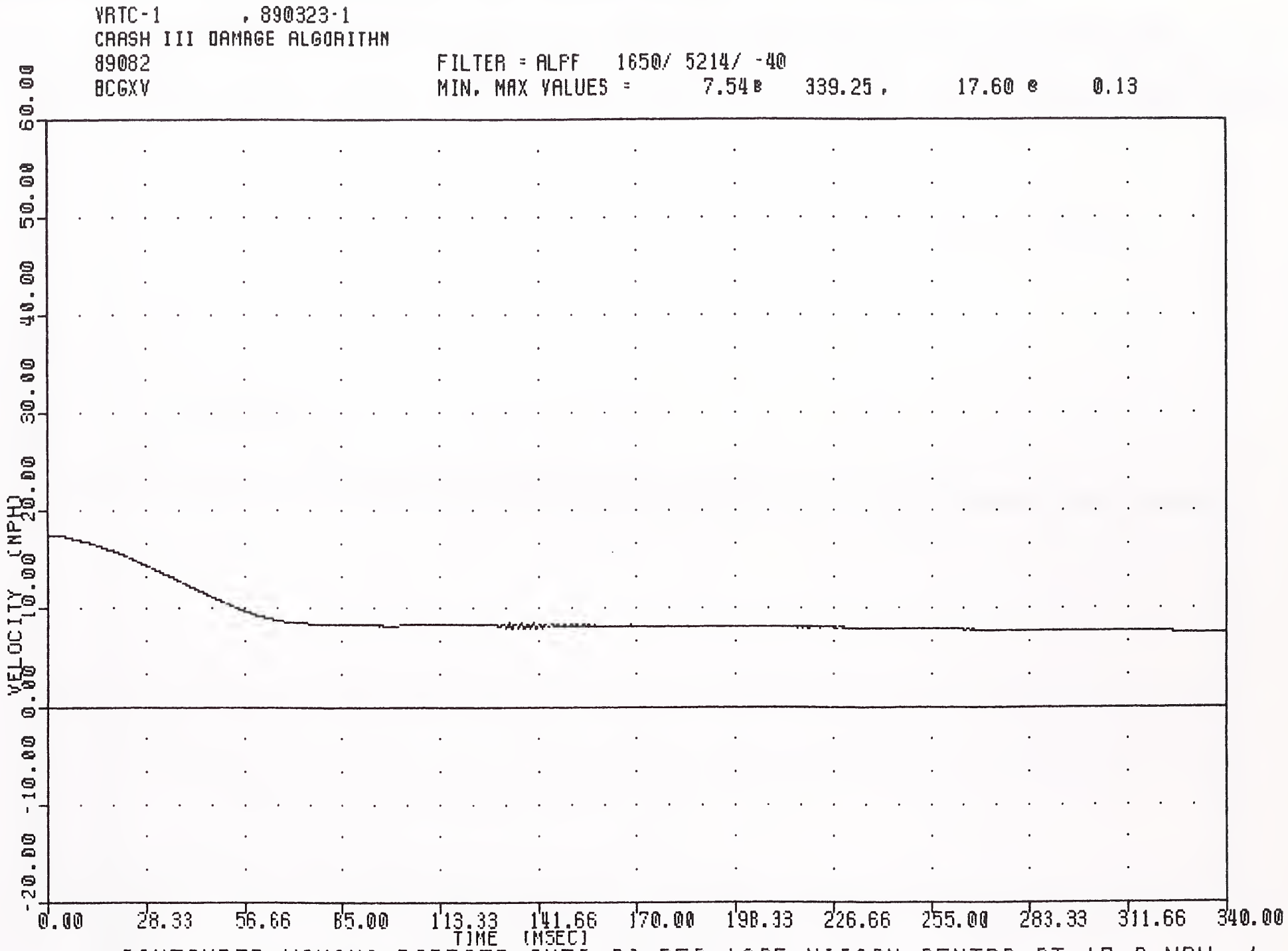


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH *1
RIGHT REAR SILL Y AXIS VELOCITY



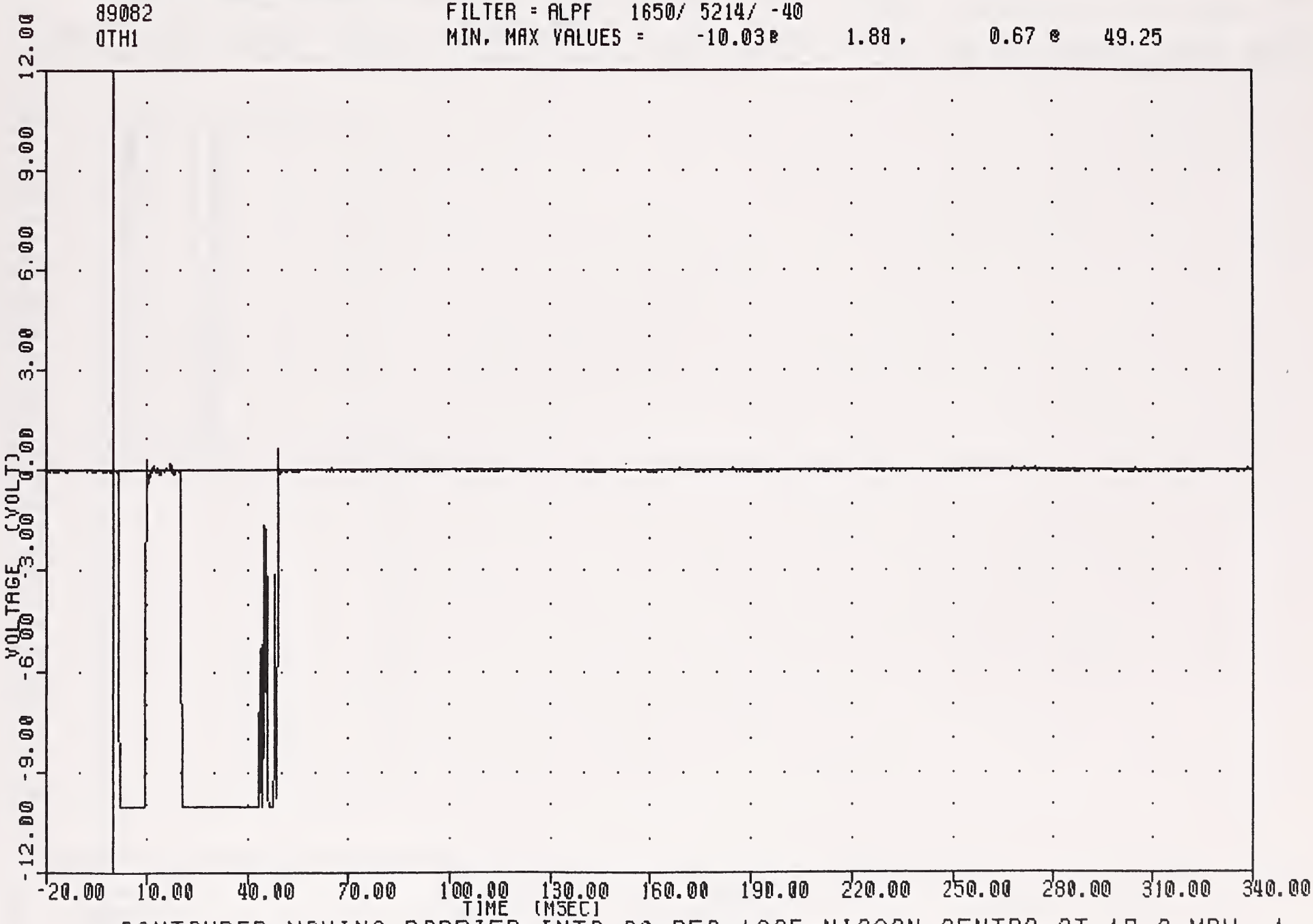
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH #1

CONTOURED MOVING BARRIER CENTER OF GRAVITY X AXIS ACCELERATION



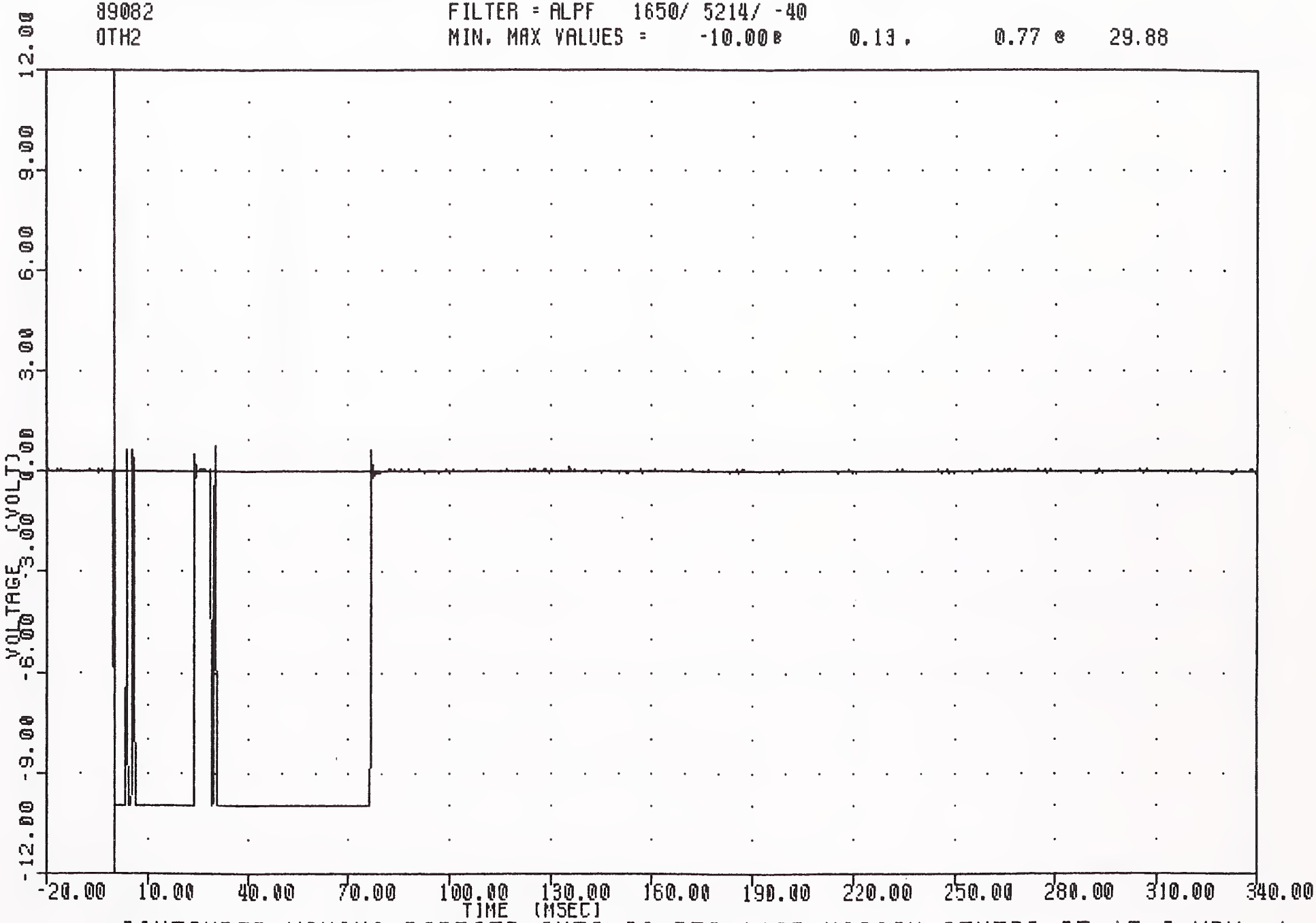
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH #1

CONTOURED MOVING BARRIER CENTER OF GRAVITY X AXIS VELOCITY



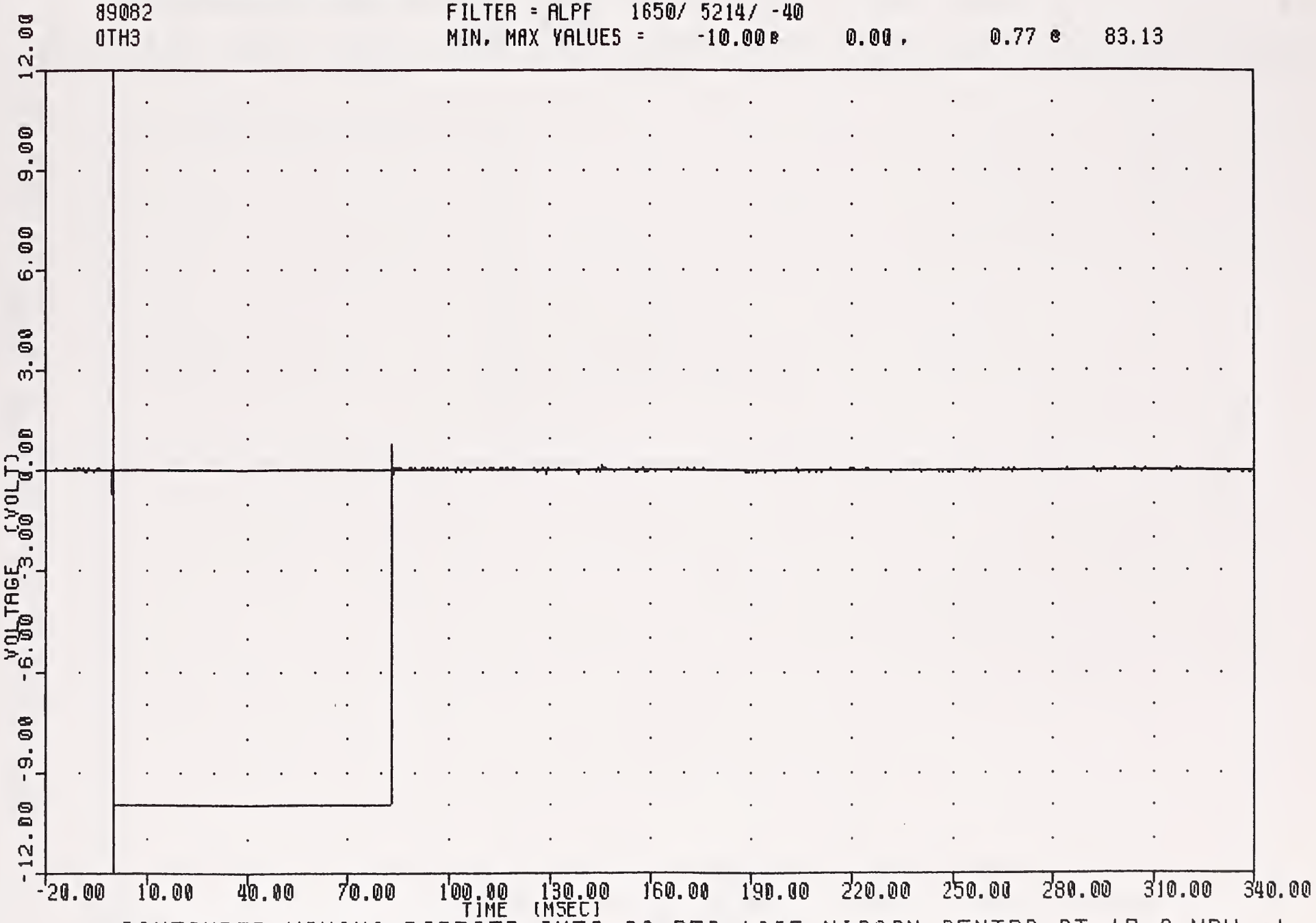
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH #1

VEHICLE CONTACT SWITCH - FRONT



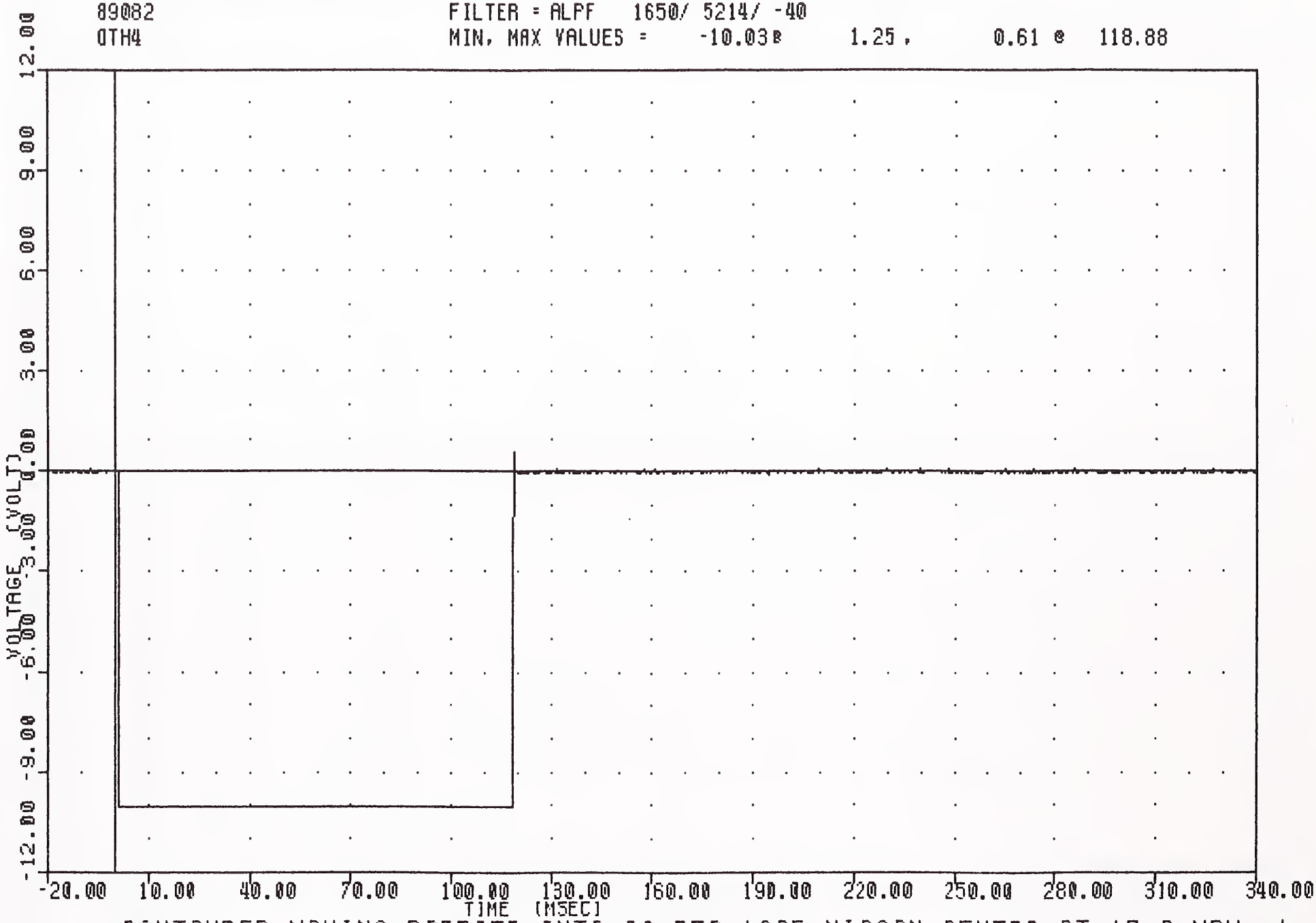
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH #1

VEHICLE CONTACT SWITCH - REAR



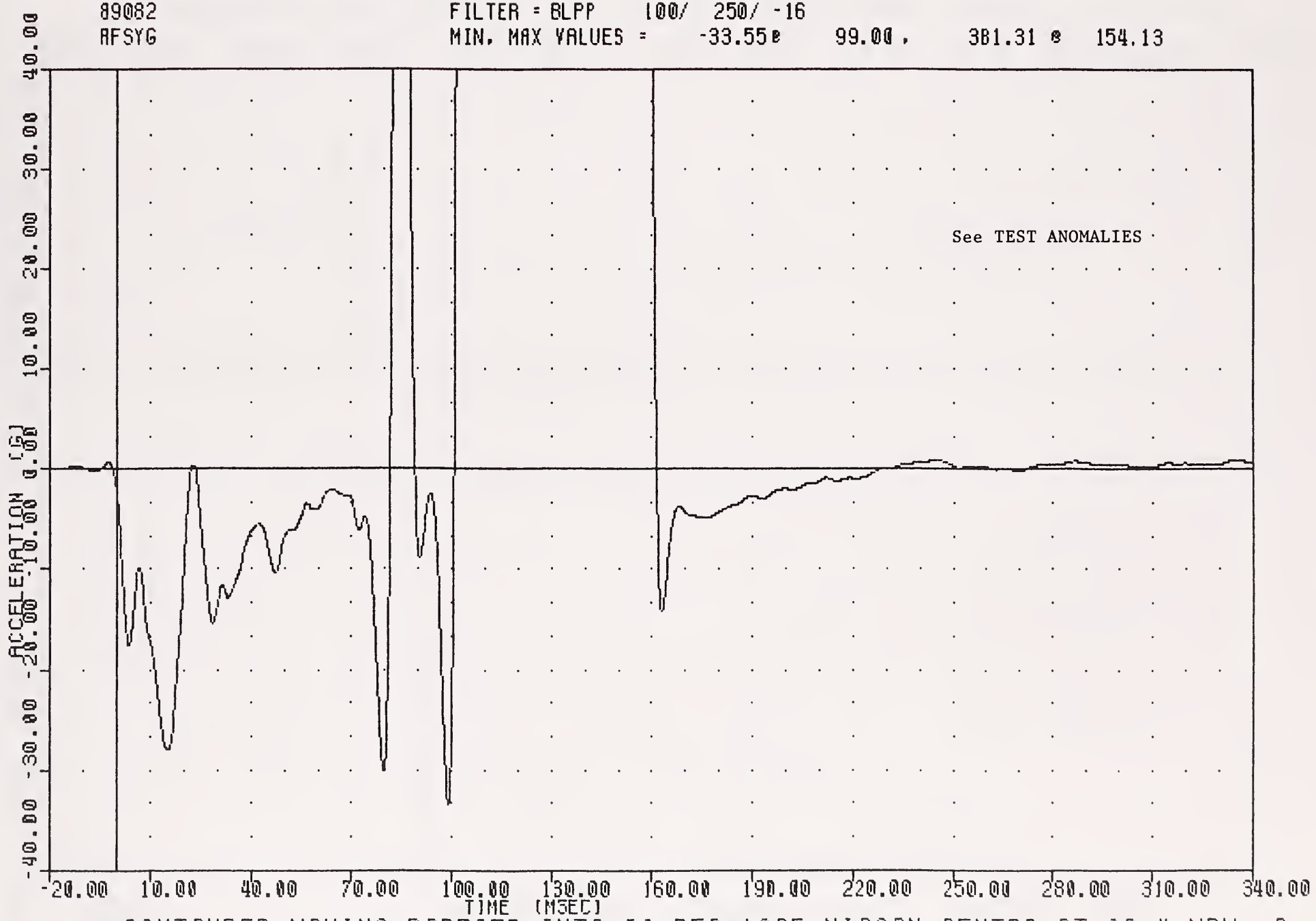
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH *1

BARRIER CONTACT SWITCH - RIGHT



CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 17.6 MPH #1
BARRIER CONTACT SWITCH - LEFT

TEST #890323-2

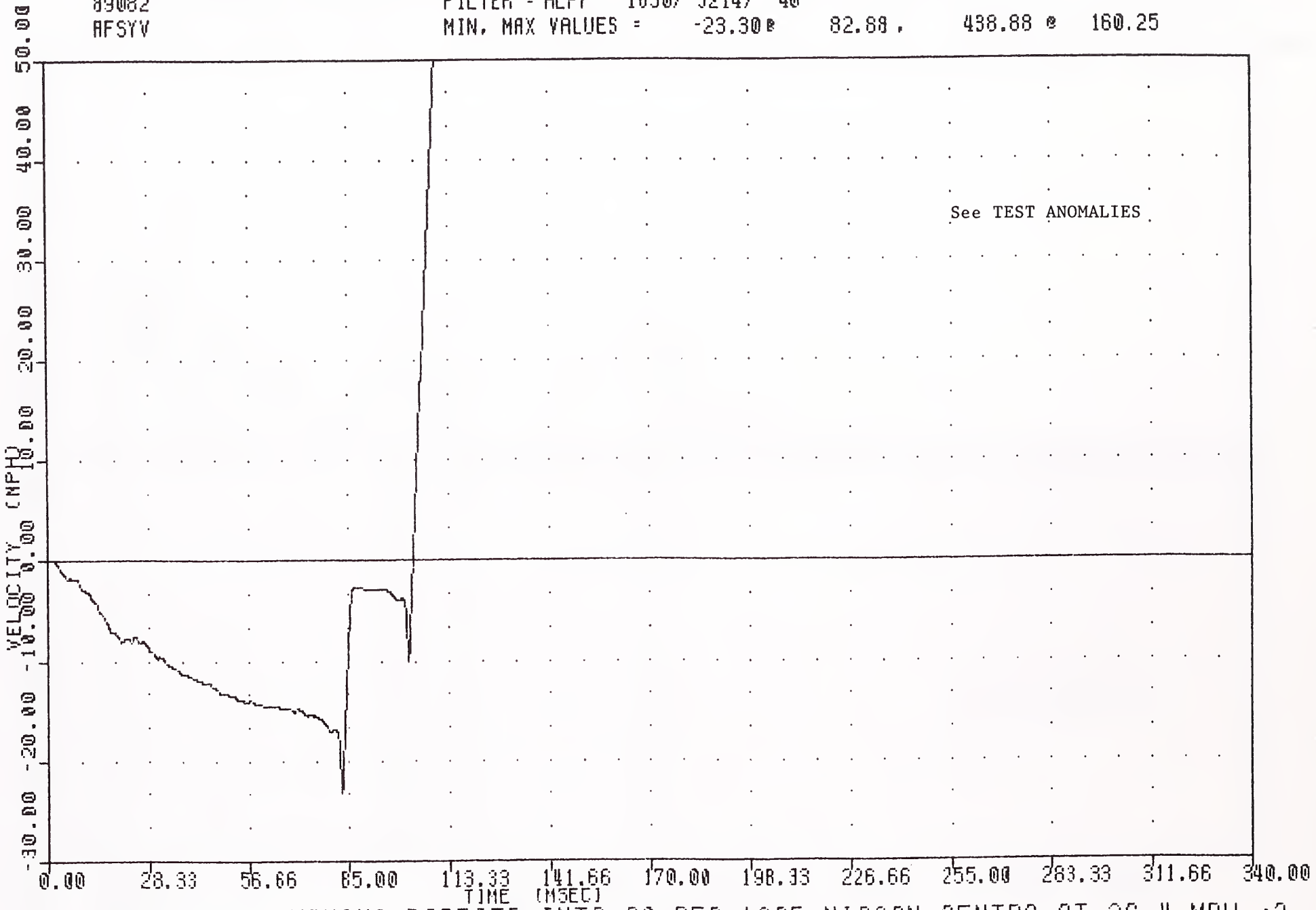


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *2

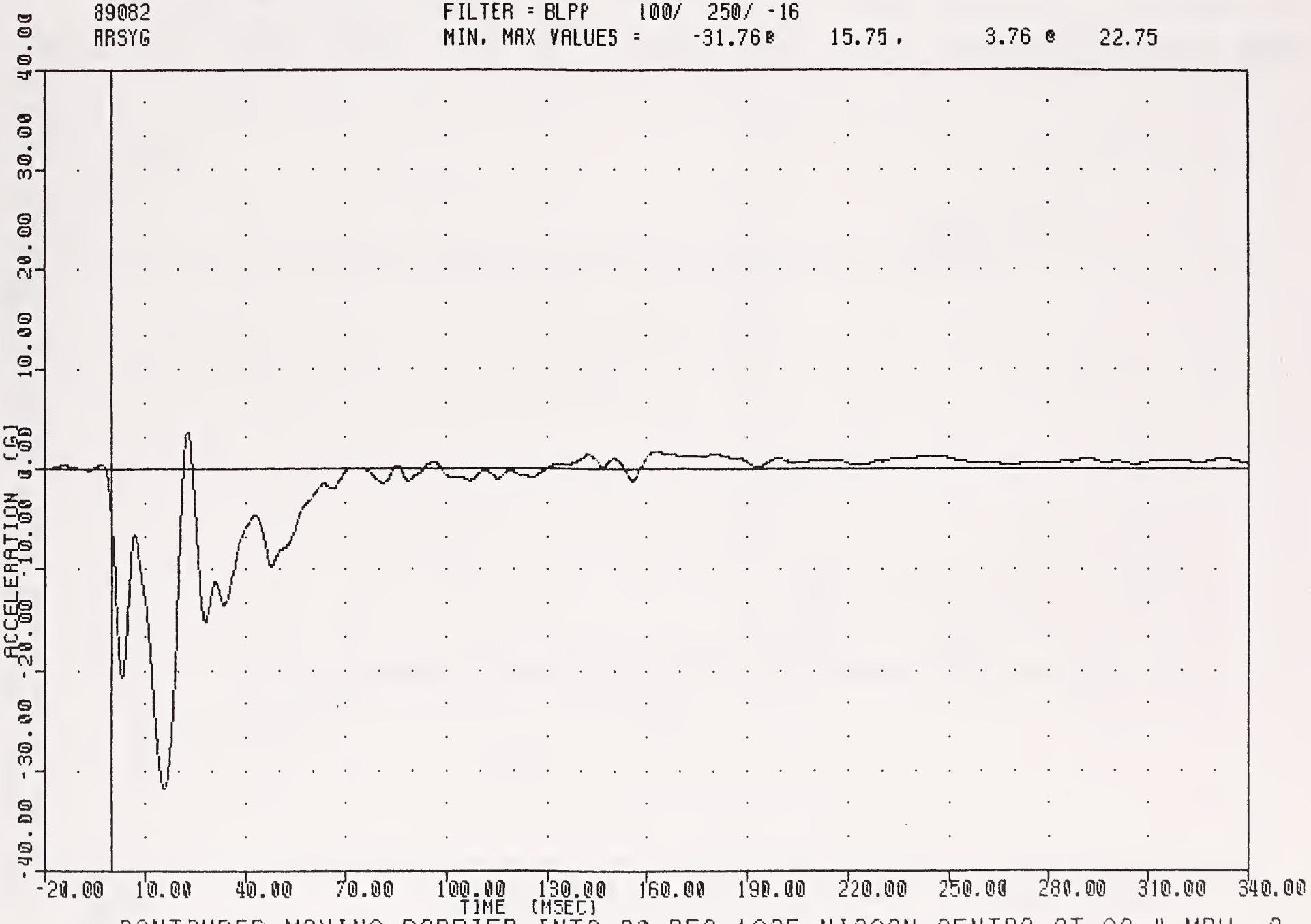
RIGHT FRONT SILL Y AXIS ACCELERATION

VRTC-2 , 890323-2
CRASH III DAMAGE ALGORITHM
89082
RFSYV

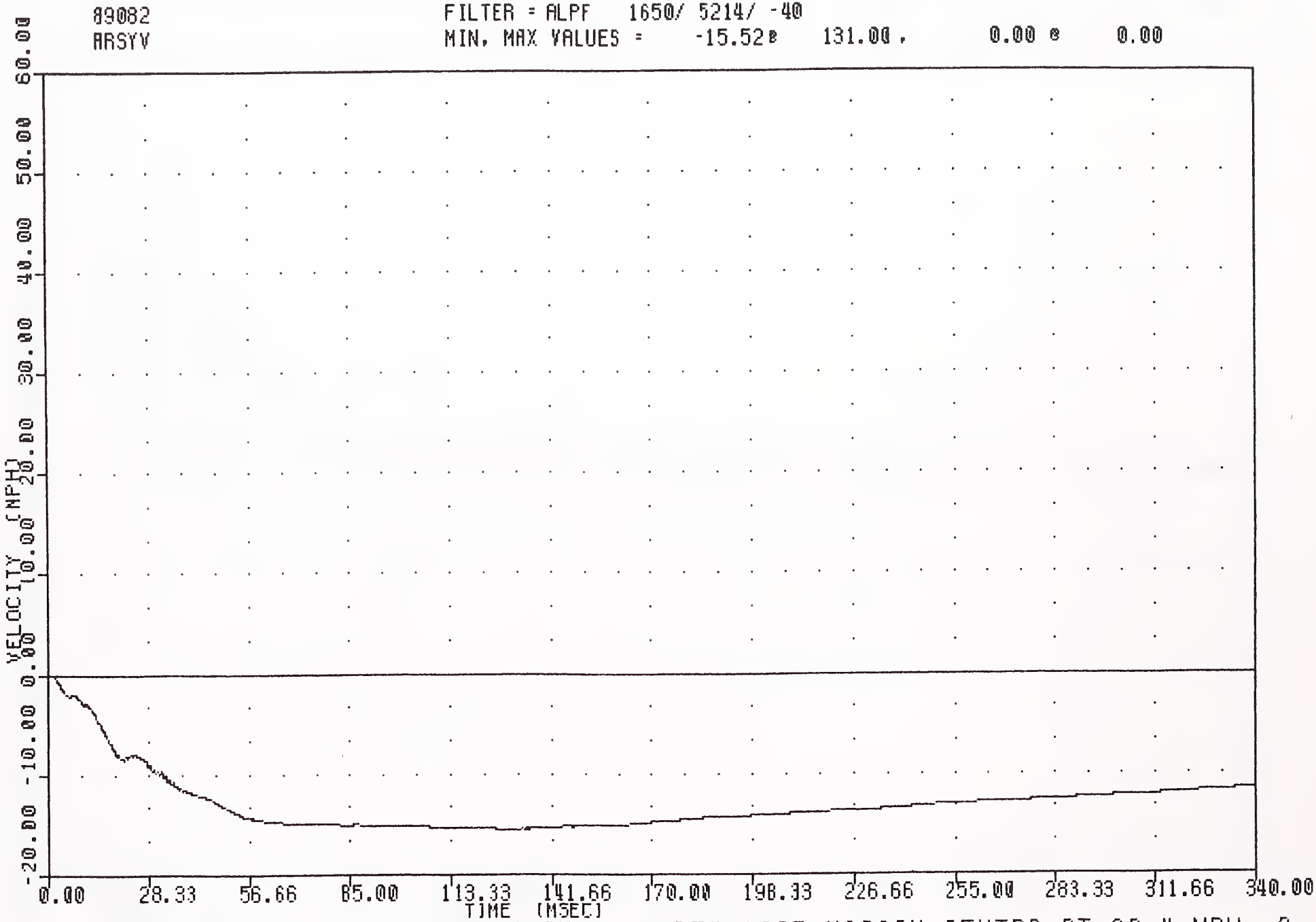
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -23.30 @ 82.88 , 438.88 @ 160.25



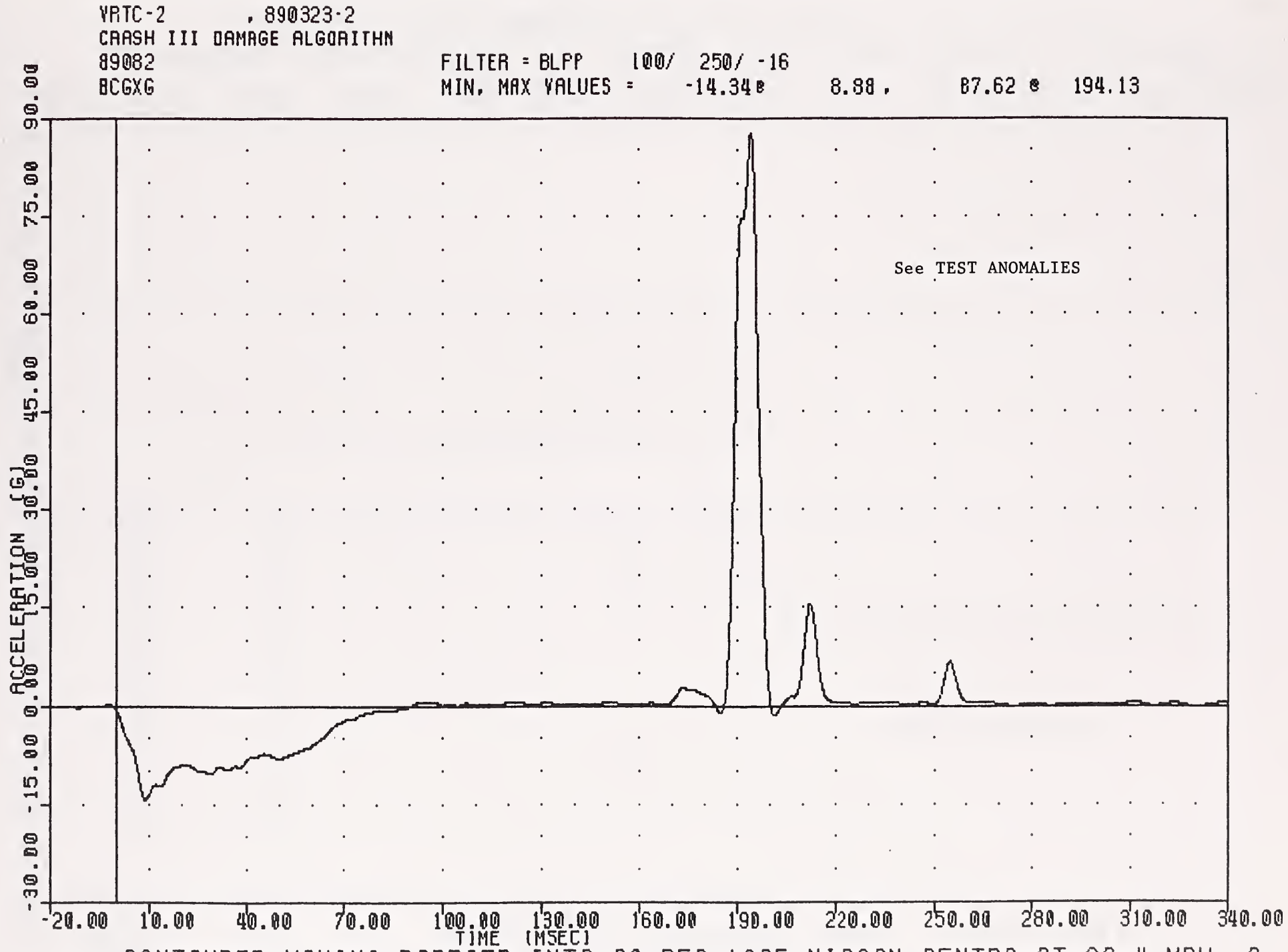
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *2
RIGHT FRONT SILL Y AXIS VELOCITY



CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 28.4 MPH *2
RIGHT REAR SILL Y AXIS ACCELERATION

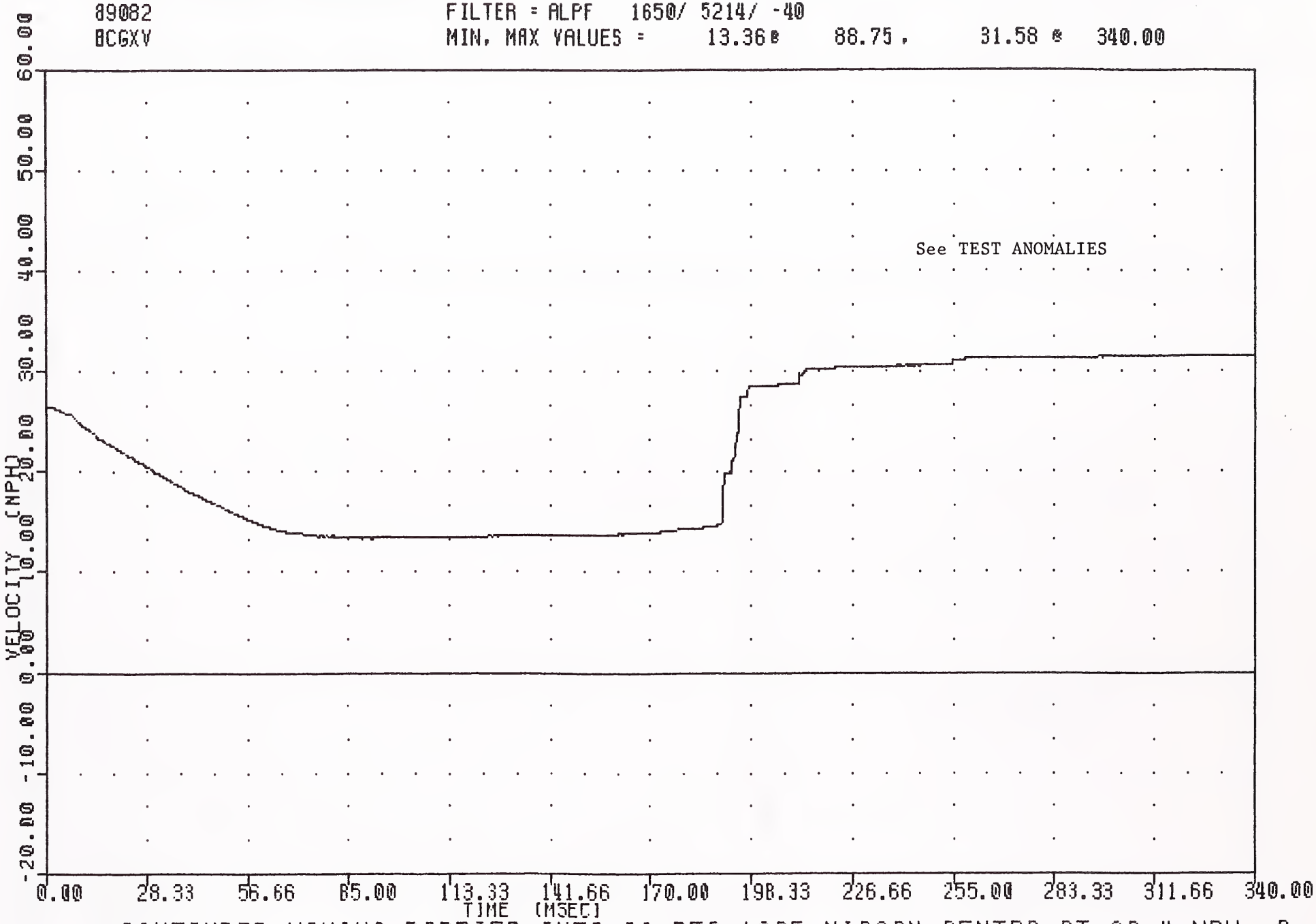


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *2
RIGHT REAR SILL Y AXIS VELOCITY



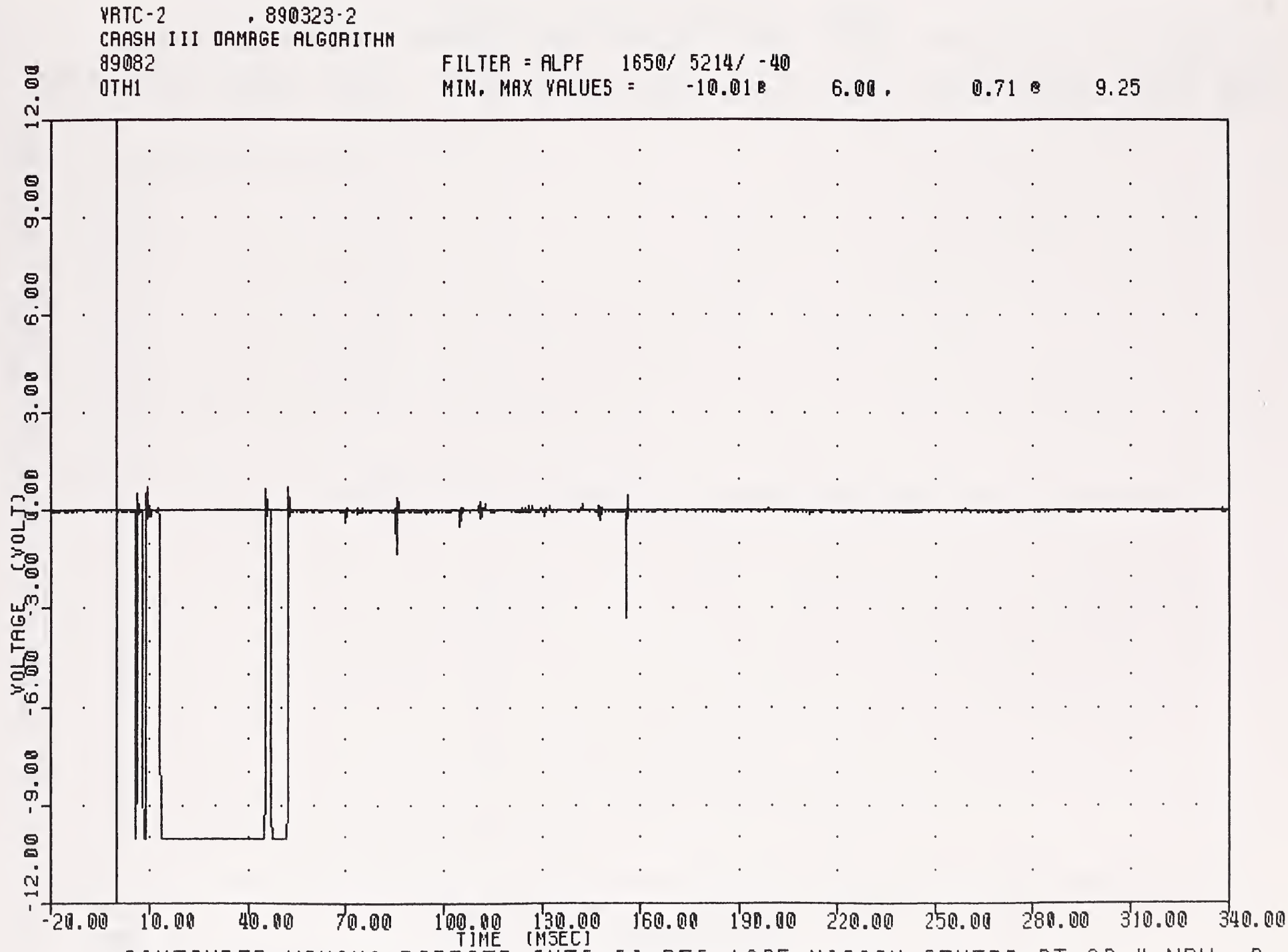
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *2

CONTOURED MOVING BARRIER CENTER OF GRAVITY X AXIS ACCELERATION



CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #2

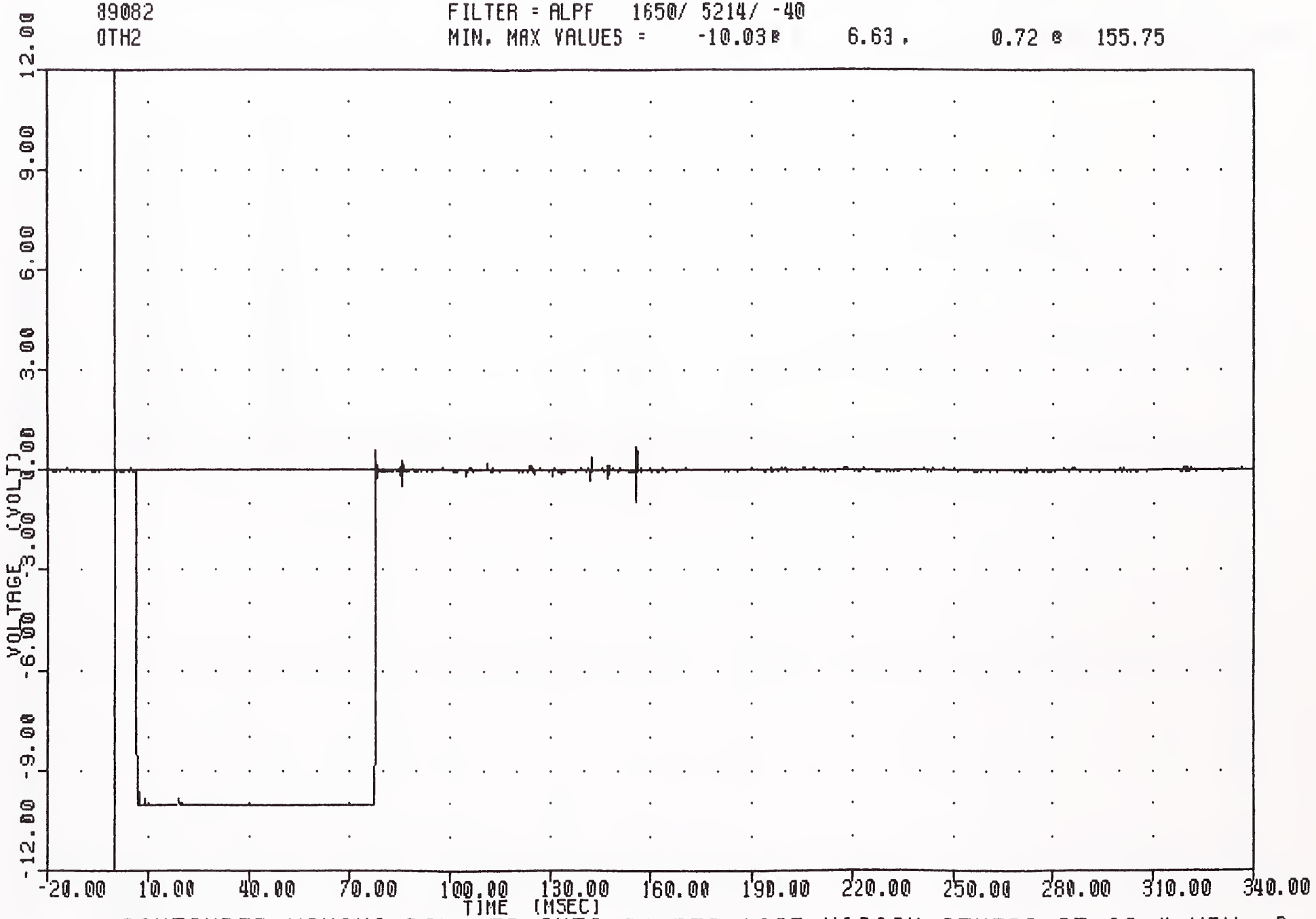
CONTOURED MOVING BARRIER CENTER OF GRAVITY X AXIS VELOCITY



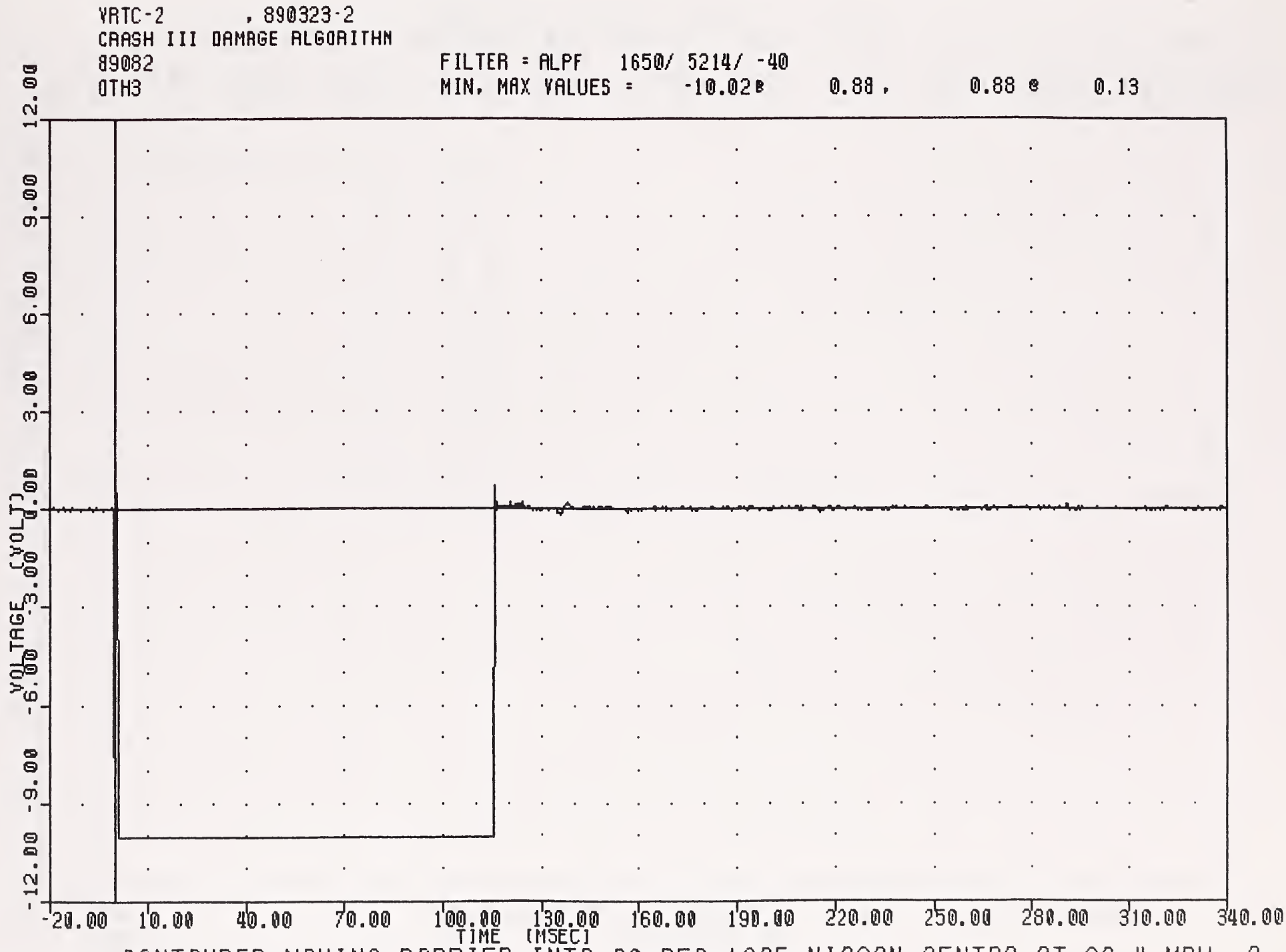
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *2

VEHICLE CONTACT SWITCH - FRONT

VRTC-2 , 890323-2
CRASH III DAMAGE ALGORITHM
89082
0TH2
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -10.03 @ 6.63 , 0.72 @ 155.75

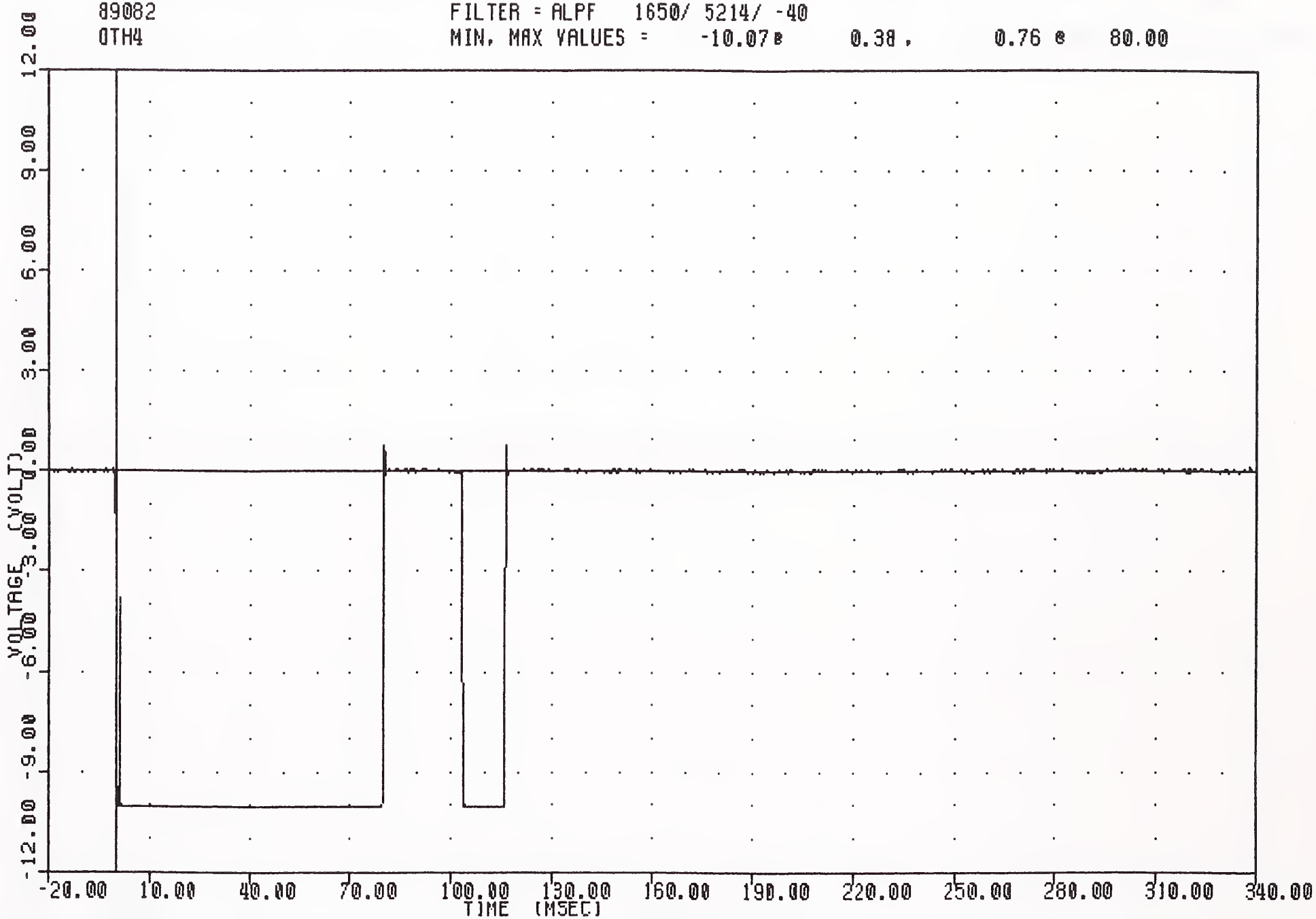


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #2
VEHICLE CONTACT SWITCH - REAR



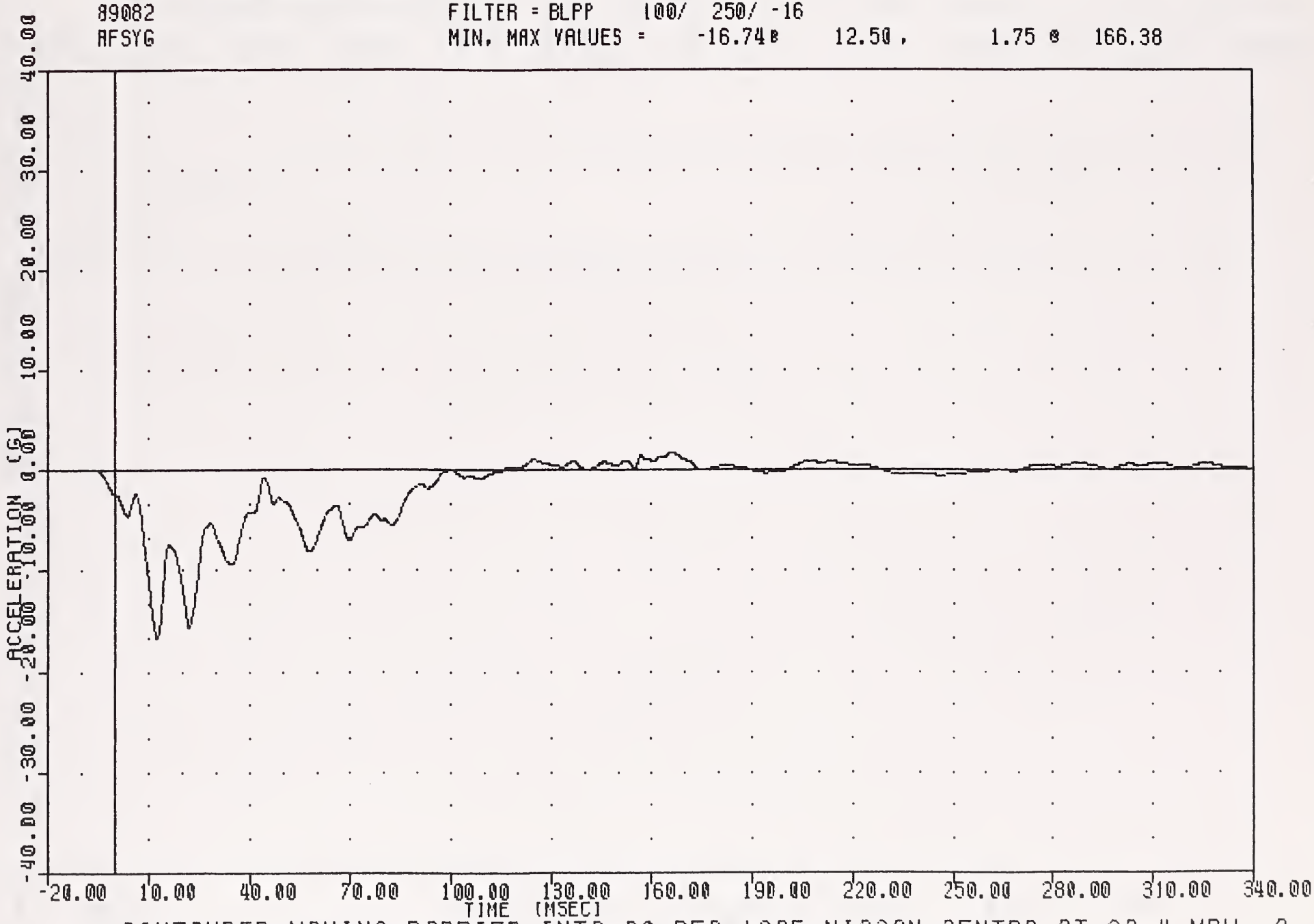
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *2

BARRIER CONTACT SWITCH - RIGHT



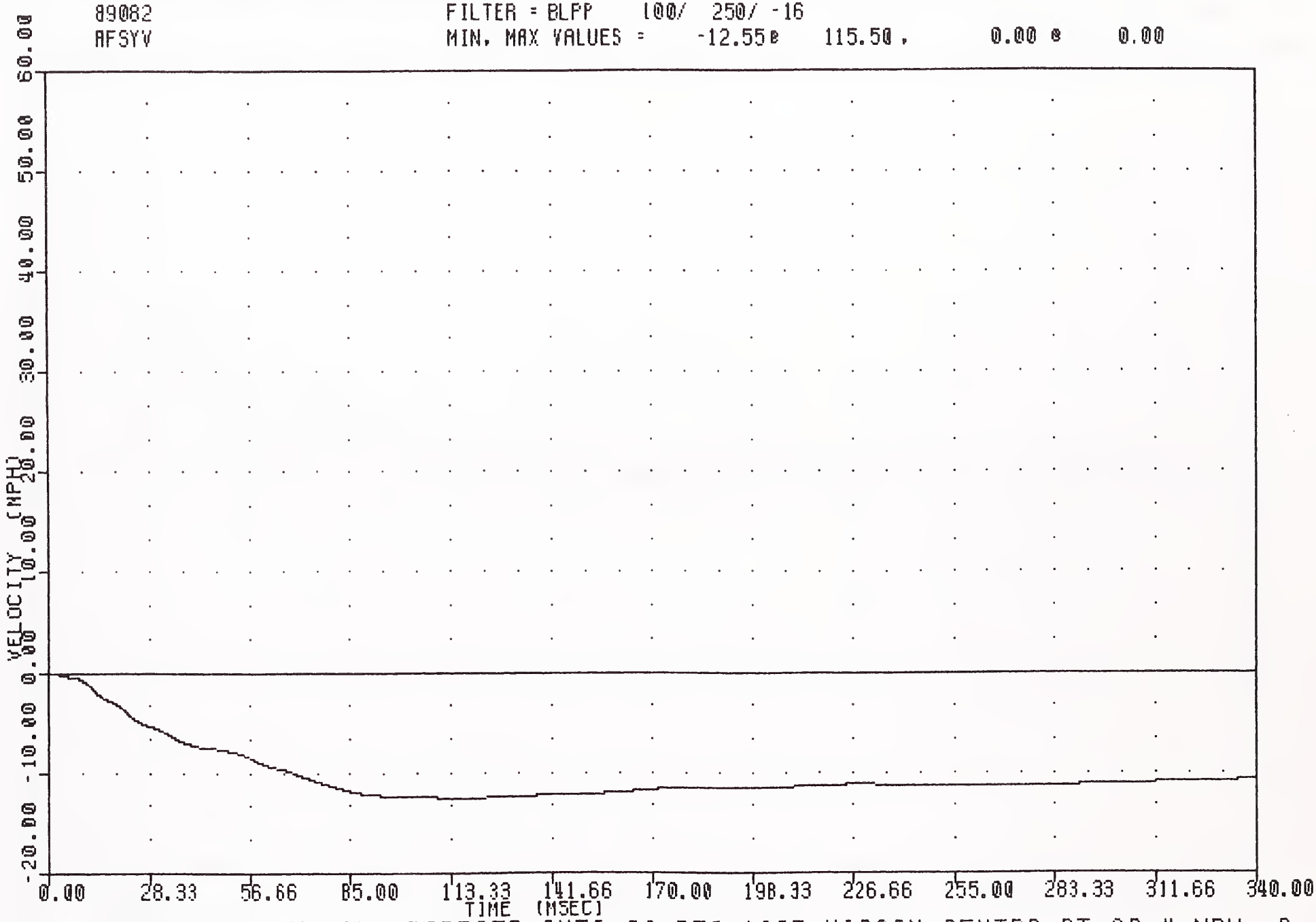
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #2
BARRIER CONTACT SWITCH - LEFT

TEST #890323-3

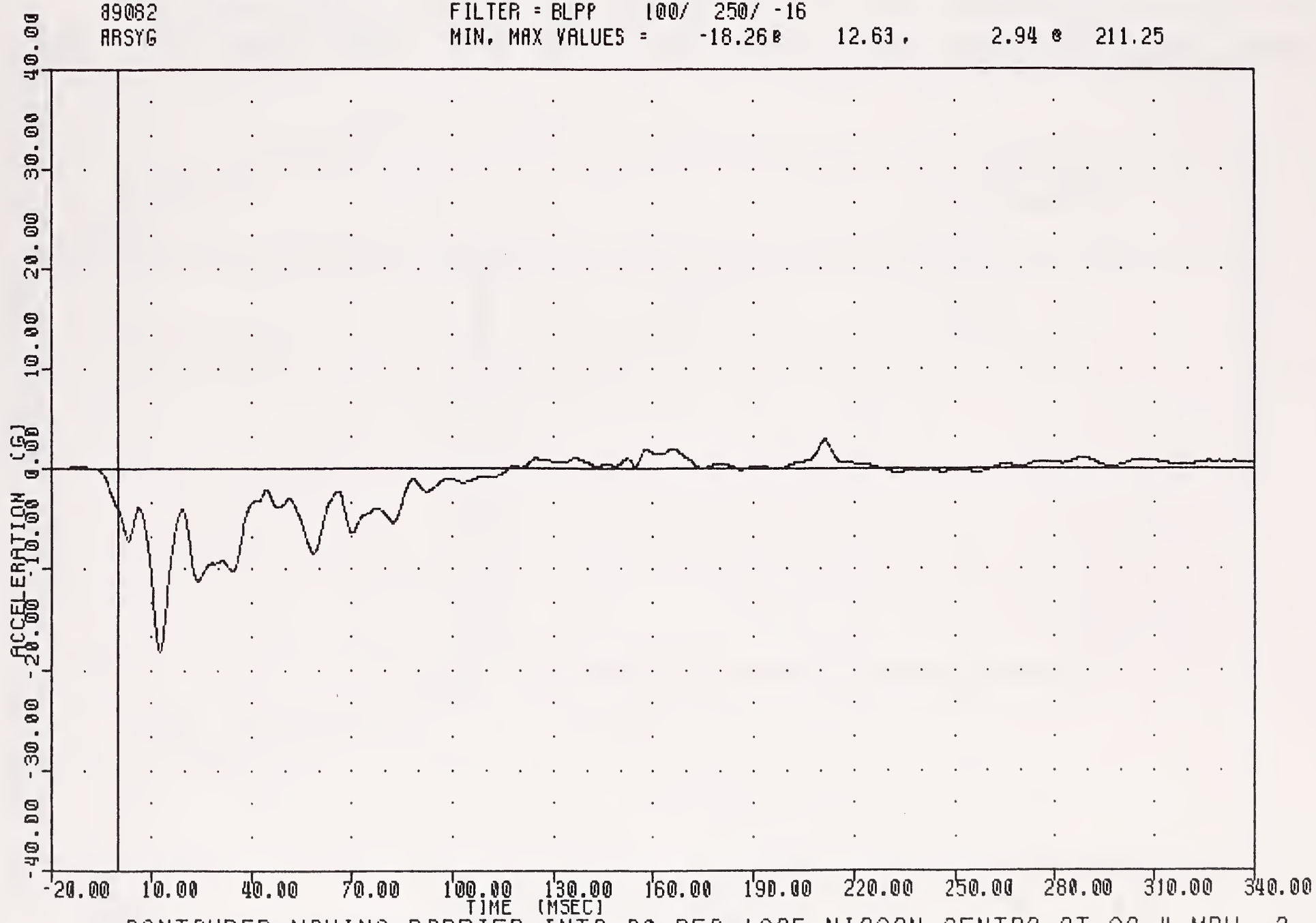


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *3

RIGHT FRONT SILL Y AXIS ACCELERATION

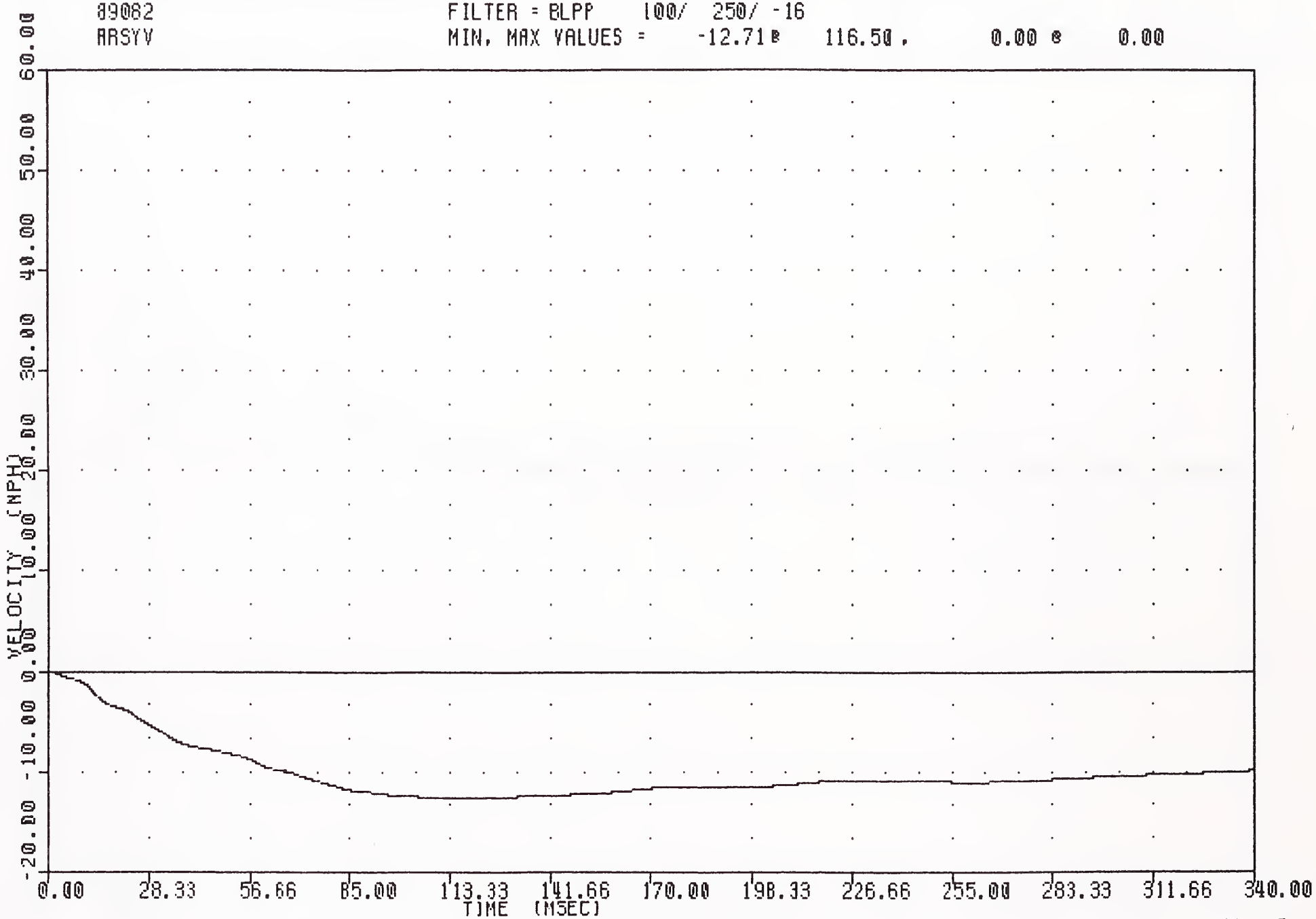


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
RIGHT FRONT SILL Y AXIS VELOCITY

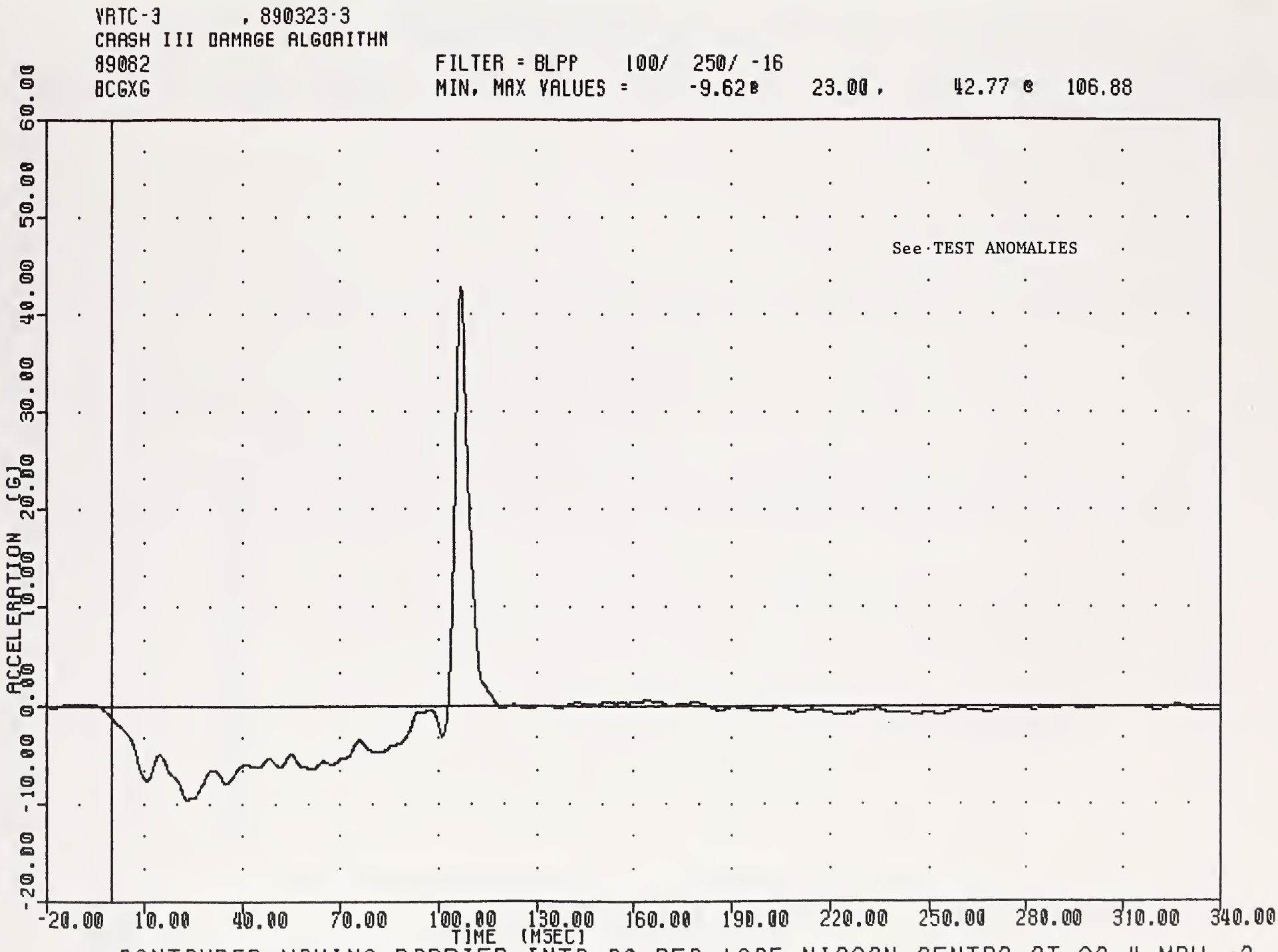


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
RIGHT REAR SILL Y AXIS ACCELERATION

VRTC-3 , 890323-3
CRASH III DAMAGE ALGORITHM
89082 FILTER = BLPP 100/ 250/ -16
ARSYV MIN, MAX VALUES = -12.71 @ 116.50 , 0.00 @ 0.00



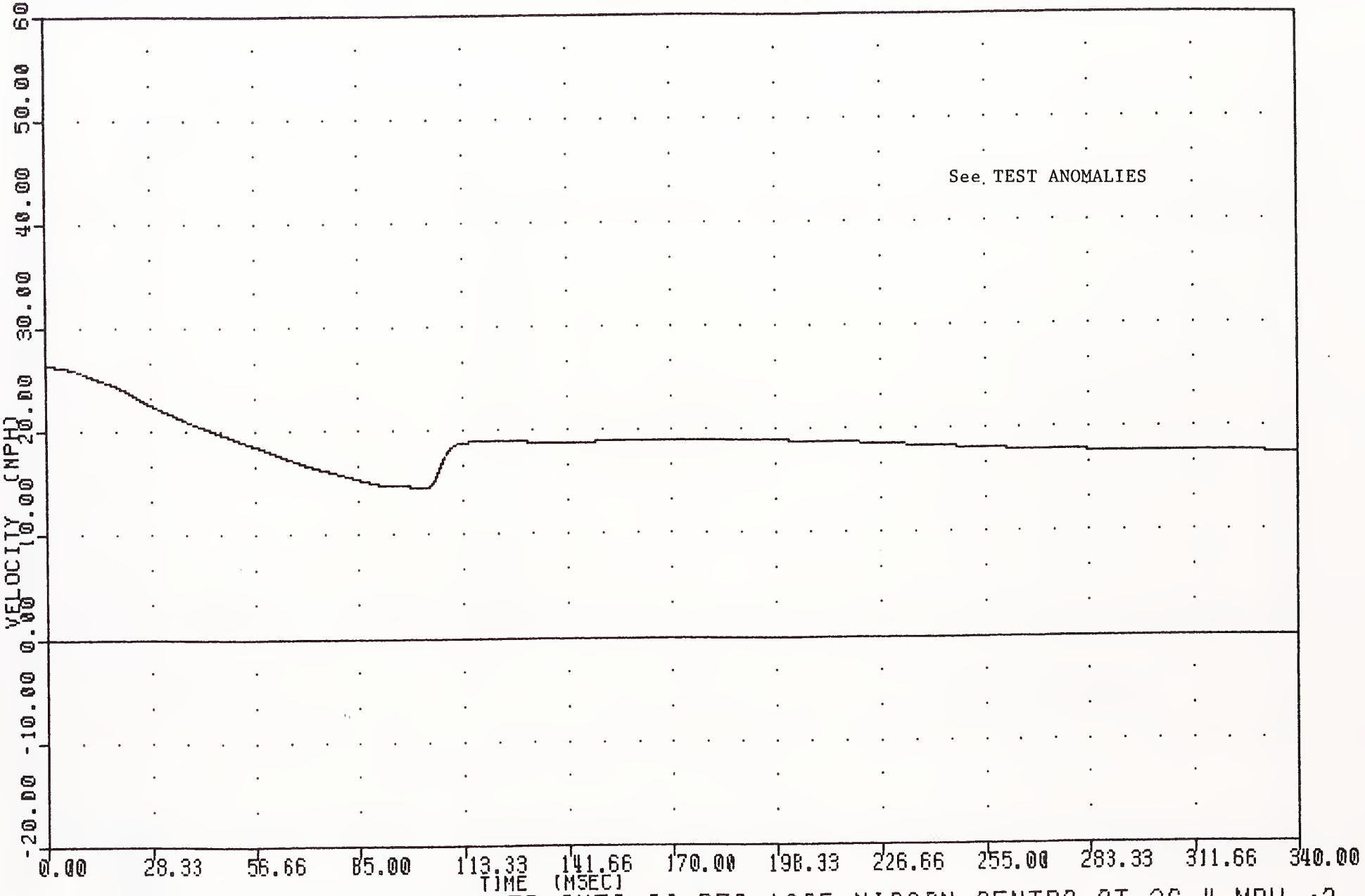
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
RIGHT REAR SILLY AXIS VELOCITY



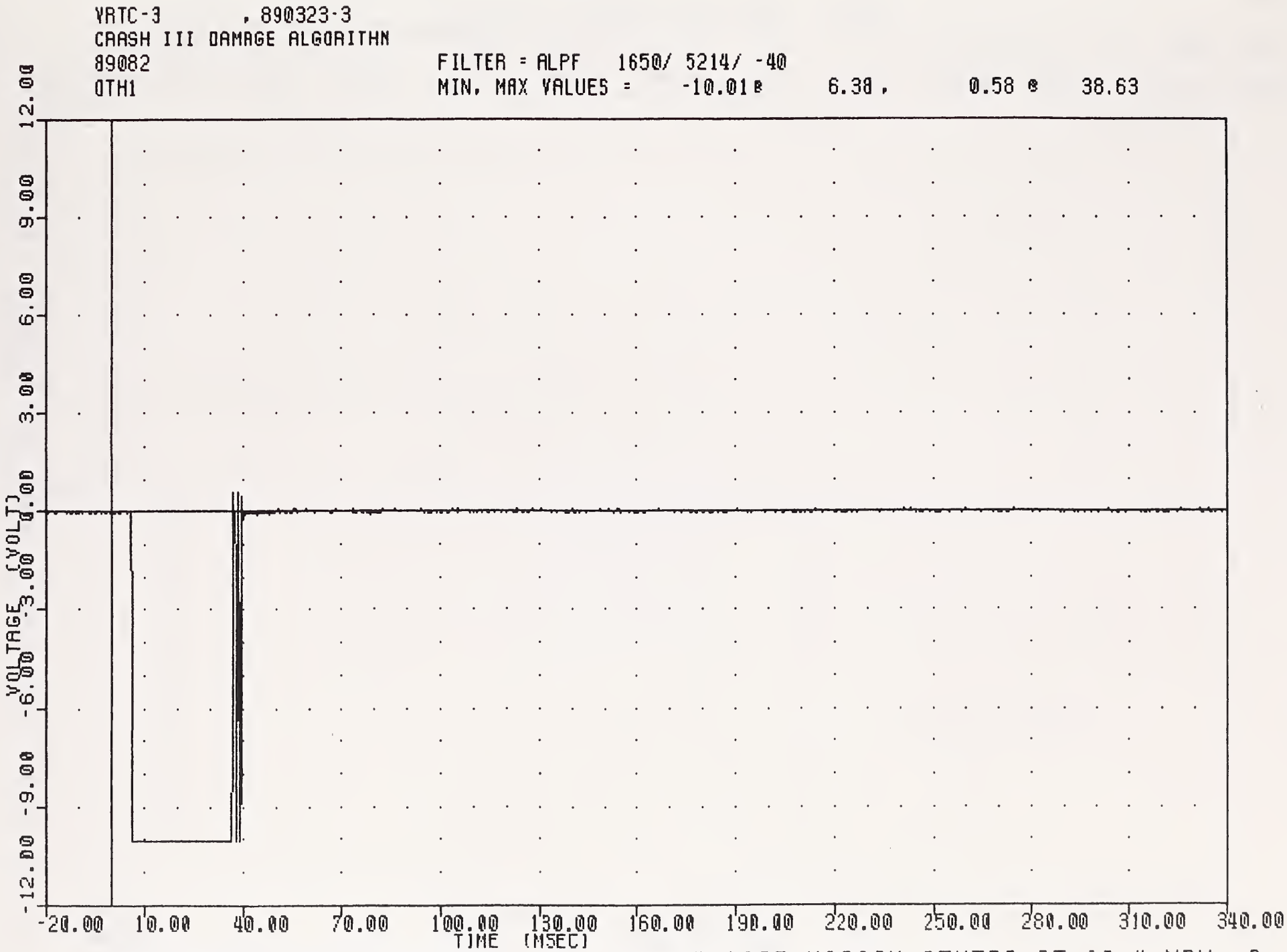
CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
CONTOURED MOVING BARRIER CENTER OF GRAVITY X AXIS ACCELERATION

VRTC-3 , 890323-3
CRASH III DAMAGE ALGORITHM
89082
BCGXV

FILTER = BLPP 100/ 250/ -16
MIN, MAX VALUES = 14.45 @ 102.88 , 26.40 @ 0.00



CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
CONTOURED MOVING BARRIER CENTER OF GRAVITY X AXIS VELOCITY

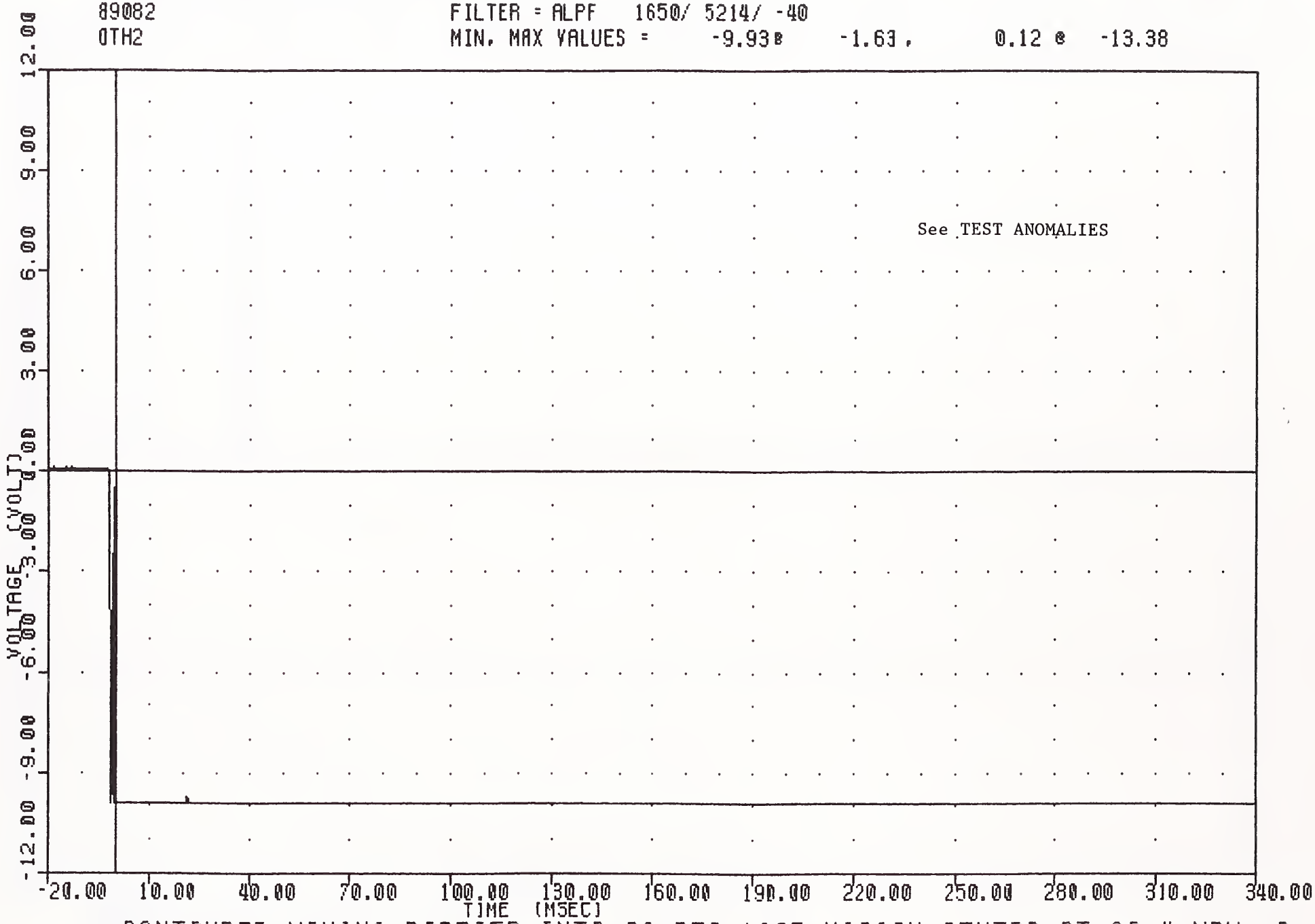


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *3

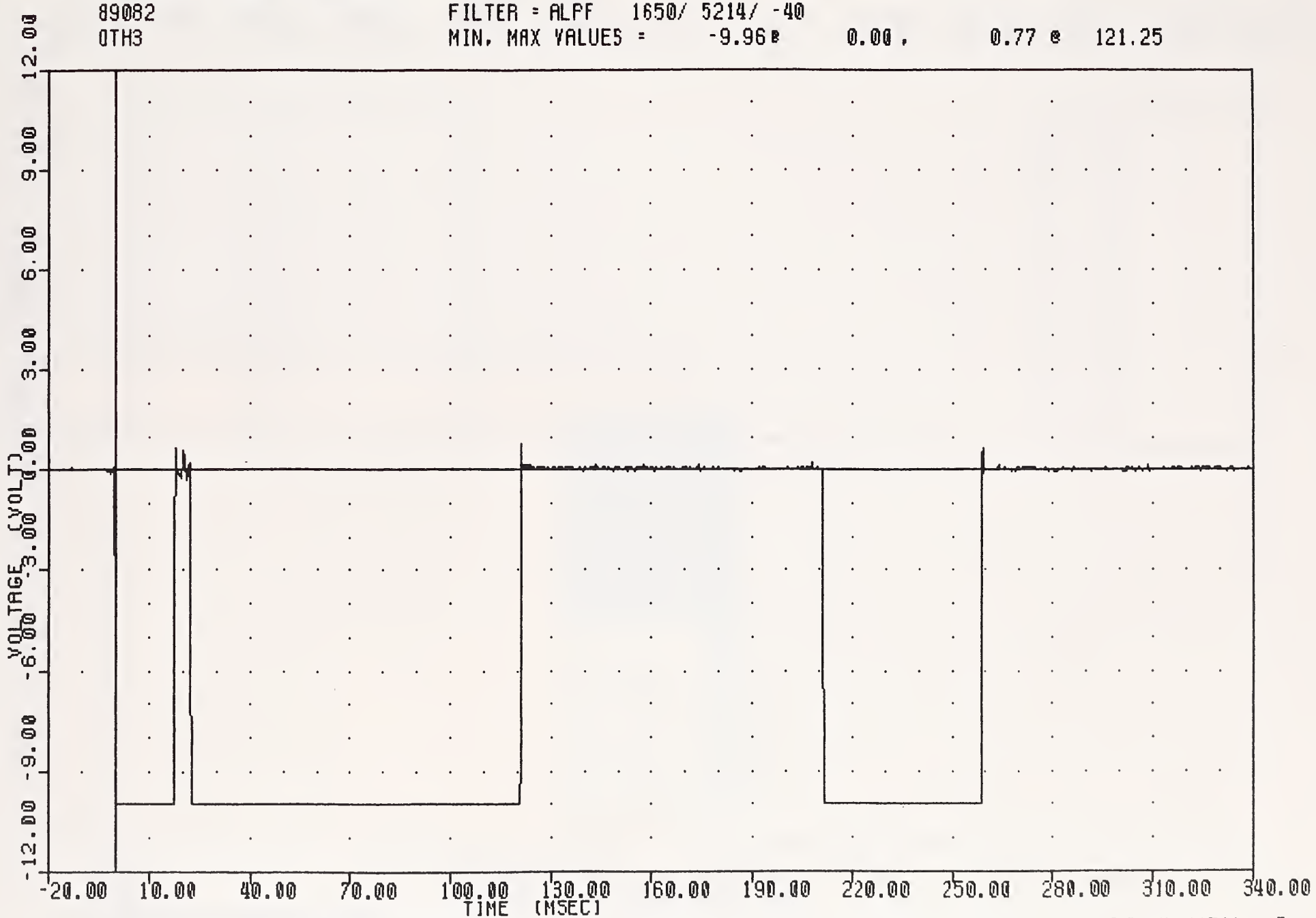
VEHICLE CONTACT SWITCH - FRONT

VRTC-3 , 890323-3
CRASH III DAMAGE ALGORITHM
89082
OTH2

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -9.93 @ -1.63 , 0.12 @ -13.38

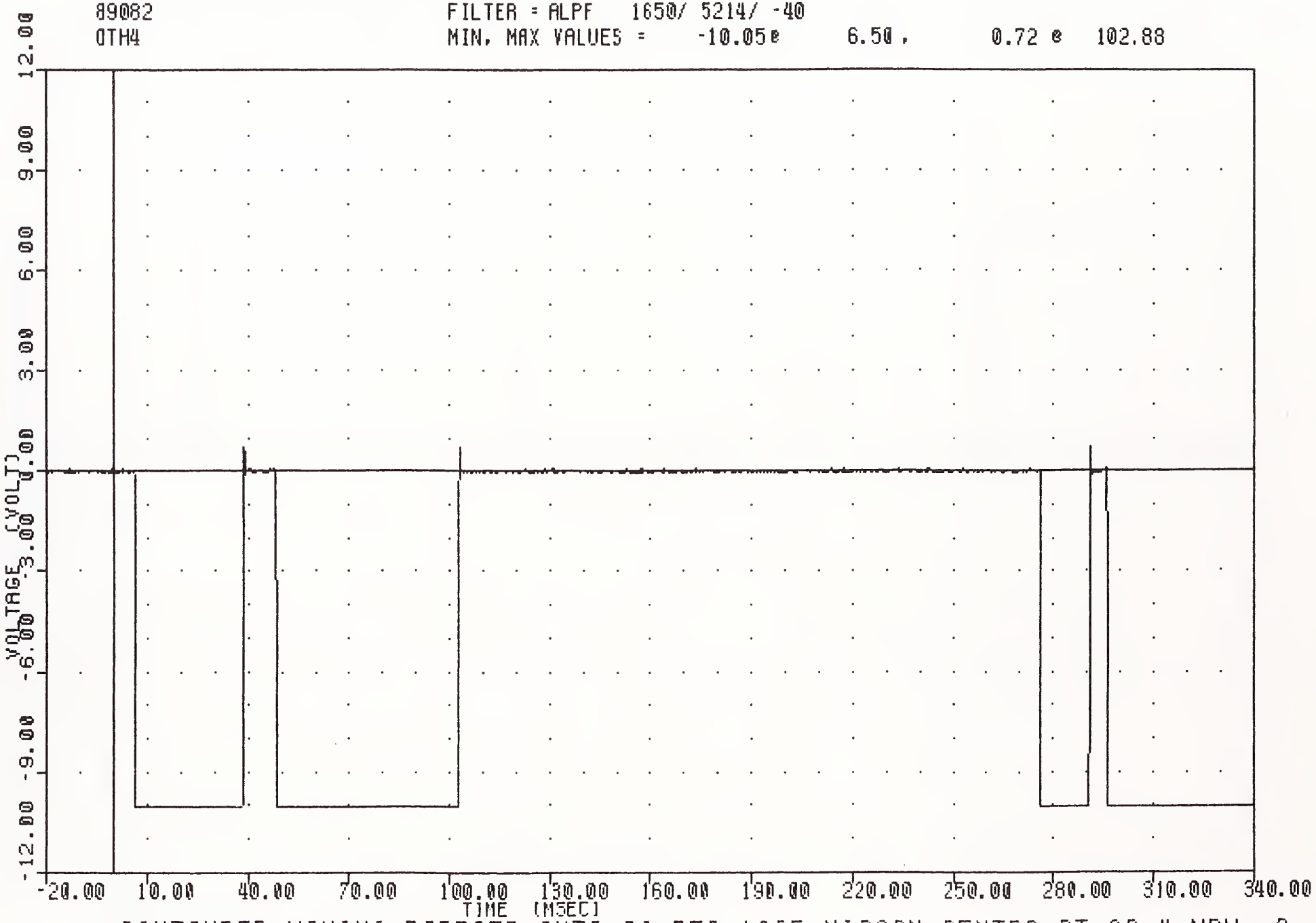


CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
VEHICLE CONTACT SWITCH - REAR



CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH *3

BARRIER CONTACT SWITCH - RIGHT



CONTOURED MOVING BARRIER INTO 90 DEG 1985 NISSAN SENTRA AT 26.4 MPH #3
BARRIER CONTACT SWITCH - LEFT

TL 242 .E65
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