DOT1145

SIDE IMPACT PROTECTION IN PRODUCTION VEHICLES

MDB-TO-CAR SIDE IMPACT TEST OF A 26° CRABBED MOVING DEFORMABLE BARRIER TO A 1987 NISSAN SENTRA AT 33.5 MPH

PREPARED BY:
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TEST REPORT
JUNE 1987

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
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WASHINGTON, D.C. 20590

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This test was conducted as part of VRTC Project No. VRTC-86-0025 Side Impact Sub-System Test Development

16. Abstract

This test report documents a crash test to evaluate side impact protection. Testing was conducted on a 1987 Nissan Sentra 2-door Sedan at the TRCO Crash Test Facility, East Liberty, Ohio. The test vehicle was impacted on the left side by a moving deformable barrier, crabbed to 26°, at 33.5 mph. The test was a simulation of a 90° intersection collision with the striking vehicle travelling at 30 mph and the struck vehicle travelling at 15 mph. Occupant responses of two side impact dummies were measured. One dummy was located in the driver's designated seating position and one was located in the left rear seating position. The test date was May 22, 1987 and the ambient temperature was 81°F.

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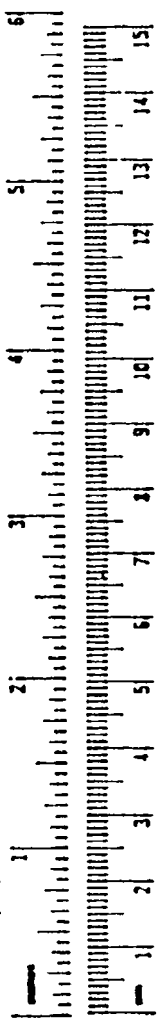
METRIC CONVERSION FACTORS

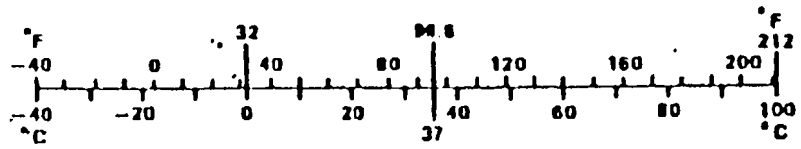
Approximate Conversions to Metric Measures

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	millilliters	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 1.0
PURPOSE AND INTRODUCTION

PURPOSE

The main purpose of this test was to evaluate side impact protection in a production vehicle. The vehicle was tested using conditions not currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A stationary 1987 Nissan Sentra 2-door sedan was impacted on the left side by a Moving Deformable Barrier (MDB) on May 22, 1987. The test was to simulate an intersection collision with the striking vehicle travelling at 30 mph and the struck vehicle travelling at 15 mph. The orientation angle of the striking vehicle was 90^{o} counterclockwise with respect to the longitudinal axis of the struck vehicle. The leading edge of contact was to be 37 inches forward of the vehicle center of gravity which is defined by accident investigation to be the midpoint of the wheelbase.

To simulate this collision, the MDB was to be towed into the stationary Nissan Sentra at 33.5 mph with the MDB's wheels crabbed clockwise to 26^{o}. The actual test speed was 33.5 mph and the actual leading edge of contact was 33.2 inches forward of the midpoint of the Nissan Sentra's wheelbase.

The vehicle was a baseline model with no structural modification.

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains data required by R & D. Appendix A contains pre-test and post-test vehicle and dummy photographs. Appendix B contains Data Plots. Appendix C contains Dummy Certification Data.

SECTION 2.0

GENERAL TEST AND VEHICLE PARAMETER DATA

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

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Nissan Motor Company, Ltd.

MAKE/MODEL: Nissan Sentra VIN: 1N4PB22S2HC834788

BODY STYLE: 2-Door Sedan MODEL YEAR: 1987

NHTSA NO.: COLOR: white

ENGINE DATA: TYPE: Transverse CYLINDERS: 4 In^3/CC DISPLACEMENT 97.5CID

TRANSMISSION DATA: 5 Speed

DATE VEHICLE RECEIVED: 5/18/87 ODOMETER READING: 59.8

DEALER'S NAME AND ADDRESS: Nissan North; Worthington, OH

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	No	AIR CONDITIONING	No
RADIO	No	ANTI-SKID BRAKE	No
CLOCK	No	REAR WINDOW DEFROSTER	Yes
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? Yes
2. DOES VEHICLE SHOW EVIDENCE OF PRIOR ACCIDENT HISTORY? No
3. DOES VEHICLE SHOW ANY SIGNIFICANT CORROSION? No
4. CONDITION OF THE FRONT/REAR BUMPER AND FRAME: Good (both)

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

VEHICLE MANUFACTURED BY: Nissan Motor Company, Ltd.

DATE OF MANUFACTURE: 4/87

GVWR: 3098 LBS.,

GAWR: FRONT 1764 LBS., REAR 1786 LBS.

TEST VEHICLE INFORMATION CONTINUED

VEHICLE TIRE DATA:

RECOMMENDED COLD TIRE PRESSURE: FRONT 35 psi; REAR 35 psi

TIRES ON VEHICLE (MFR. & LINE, SIZE): General Amerisport P155/80R13

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 1

IS SPARE TIRE "SPACE SAVER"? No

IS SPARE TIRE STANDARD EQUIPMENT? No

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

RIGHT FRONT	672 LBS.	RIGHT REAR	426 LBS.
LEFT FRONT	660 LBS.	LEFT REAR	398 LBS.
TOTAL FRONT WEIGHT	1332 LBS.	(61.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	824 LBS.	(38.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	2156 LBS.		

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	RF 25.3	;LF 25.2	;RR 24.6	;LR 24.5
PRE-TEST ATTITUDE:	RF 26.0	;LF 25.5	;RR 22.9	;LR 22.4
POST-TEST ATTITUDE:	RF 23.4	;LF 24.8	;RR 20.1	;LR 21.3

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 6 LBS. CARGO:

RIGHT FRONT	629 LBS.	RIGHT REAR	622 LBS.
LEFT FRONT	639 LBS.	LEFT REAR	620 LBS.
TOTAL FRONT WEIGHT	1268 LBS.	(50.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1242 LBS.	(49.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2510 LBS.		

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

TEST FLUID DATA

TEST FLUID TYPE: PURPLE STODDARD SOLVENT 2; SPEC. GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: NA GALLONS (FURNISHED BY CTM)

TEST VOLUME: 0 GALLONS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): NA GALLONS

DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: No FUEL INJECTION: No

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? DNA

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.

VEHICLE LOAD (UP TO CAPACITY): FRONT 26 psi; REAR 26 psi

RECOMMENDED TIRE SIZE: P155/80R13 LOAD RANGE X B, C,

VEHICLE CAPACITY: TYPES OF SEATS: Front - Bucket
Rear - Bench

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT
3 REAR
5 TOTAL

CARGO LOAD 0 LBS.

TOTAL 750 LBS.

*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL TANK THROUGH CARBURETOR BOWL.

TEST CONDITIONS

TEST NUMBER: 870522

DATE OF TEST: MAY 22, 1987 TIME OF TEST: 1305

WIND VELOCITY: 4-8 mph @ 230° SW HUMIDITY: NA

AMBIENT TEMPERATURE AT IMPACT AREA: 81° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 84° F

SUBJECT VEHICLE DATA

	ACTUAL	INTENDED
VEHICLE TEST WEIGHT (LBS.)	2510	2504
MDB TEST WEIGHT (LBS.)	3010	3000
MDB VELOCITY (MPH)*	33.5	33.5
IMPACT POINT (INCHES)**	33.2	37

DUMMIES

	DRIVER	MIDDLE PASSENGER	RT. FRONT PASSENGER	LEFT REAR PASSENGER	RT. REAR PASSENGER
TYPE:	SID			SID	
SERIAL NO.:	119			018	
INSTRUMENTATION:					
HEAD ACCEL.:	Yes			Yes	
CHEST ACCEL.:	Yes (Upper/Lower)			Yes (Upper/Lower)	
FEMUR L.C.'S:	No			No	
OTHER:	Pelvis/Ribs			Pelvis/Ribs	

RESTRAINT SYSTEM: Both dummies were unrestrained, but a loose belt was placed around the driver's pelvis to prevent damage to the right front door.

*As measured over final one foot of travel.

**As measured forward of the midpoint of the test vehicle's wheelbase.

VISIBLE DUMMY CONTACT POINTS:

	DRIVER	PASSENGER
Head	Driver's window sill and roof	Left C-Pillar
Chest	Driver's door panel	Left rear side wall
Abdomen	Driver's door panel	Left rear side wall
Left Knee	Driver's door panel	Left rear side wall
Right knee	Steering wheel rim	Left knee

DOOR OPENING:

	LEFT	RIGHT
Front	NA*	Easy
Rear	NA	NA

SEAT MOVEMENT:

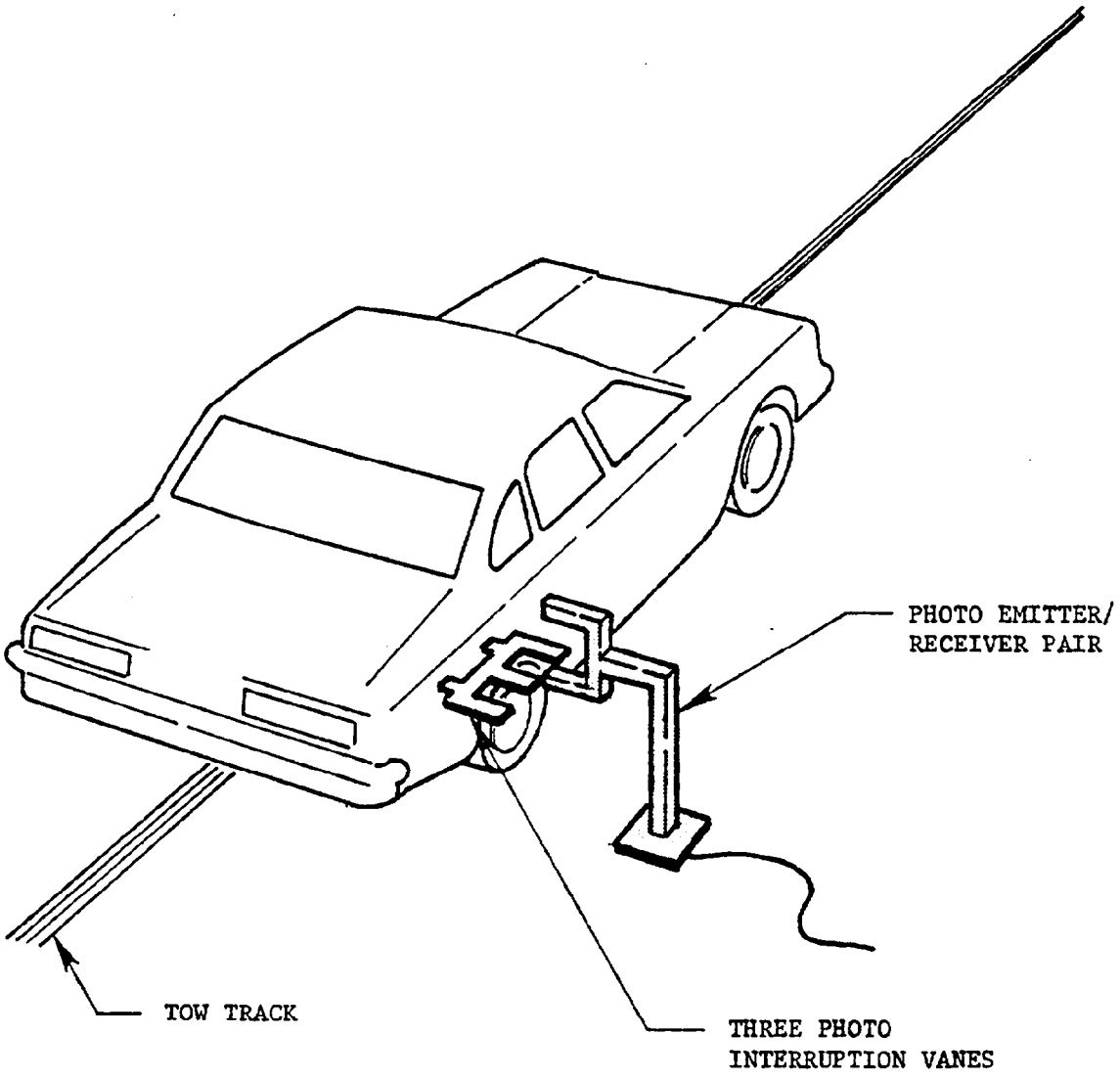
	SEAT BACK FAILURE	SEAT SHIFT
Front	None	None
Rear	None	None

GLAZING DAMAGE: Windshield cracked, left side windows shattered
No rear glass damage

OTHER NOTABLE IMPACT EFFECTS:

*Left front door to be opened later by NHTSA.

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

VEHICLE TEST WEIGHT CALCULATION

Test Weight = Unloaded Delivered Weight +
(Number of Dummies X 174 lbs.) +
Cargo Weight
= 2156 + (2 X 174) + 0 lbs.
= 2504 lbs.

To achieve test weight, the exhaust system, battery, alternator, front and rear bumpers, radiator, master cylinder, distributor, valve covers and air cleaner were removed. The fuel tank was empty. The weight of the test vehicle was measured by placing each wheel on a KJ Law Force Plate.

TEST ANOMALIES

The driver's pelvis X-axis accelerometer, PEVXG1, data contained a questionable spike at 31.2 milliseconds.

The driver's pelvis Y-axis accelerometer, PEVYG1, data contained a questionable spike at 33.5 milliseconds.

The passenger's lower spine Y-axis accelerometer, T12YG4, data contained a questionable spike at 32.6 milliseconds.

The passenger's lower spine Y-axis accelerometer #2, T12YGD, data contained questionable spikes at 32.6 and 59.5 milliseconds.

The passenger's lower spine Z-axis accelerometer, T12ZG4, data contained questionable spikes at 32.4 and 60 milliseconds.

The following data channels exceeded the maximum value the channel was scaled to record:

LFDYG1 - Vehicle left front door (position 6) Y-axis accelerometer
LFDYG2 - Vehicle left front door (position 8) Y-axis accelerometer
LFDYG3 - Vehicle left front door (position 9) Y-axis accelerometer
LFDYG4 - Vehicle left front door (position 10) Y-axis accelerometer
LFDYG5 - Vehicle left front door (position 11) Y-axis accelerometer
VCGV - Vehicle yaw rate gyro

No delta velocities are reported for LFDYG2 and LFDYG5. No Delta velocity plots are included for LFDYG2 and LFDYG5.

SECTION 3.0

DATA REQUIRED BY R&D

The following pages are included in this section:

1. Dummy temperature control and positioning data
2. Dummy kinematic summary
3. Vehicle crush data
4. Dummy and vehicle accelerometer location and data summary
5. High speed camera information
6. Transducer information

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle was kept inside the temperature controlled crash test building until approximately 2 hours prior to the test. Temperature inside the vehicle and ambient temperature at the crash area were recorded. Dummy temperature while outside the crash test building was maintained by portable air conditioning units until approximately 1 minute prior to the test.

The following Side Impact Dummy Seating Procedure summarize the steps taken to position the instrumented, calibrated dummies in the test vehicle.

SIDE IMPACT DUMMY SEATING PROCEDURE

1. Seat Positioning

A. Place seat at the longitudinal midpoint of fore to aft adjustment (forward most locking position to rear most locking position). If no locking position is available at mid-travel, use the position immediately rearward of mid-travel.

B. If the seat back angle is adjustable, place it in the manufacturer's stated nominal design location. If not specified, set it at the first detent rearward of 25°.

C. Adjustable head restraints are set such that the top surface of the restraint is level with the cg of the dummy's head.

D. If the seat is equipped with adjustable side or lumbar supports, they are set in their "released" or full back positions.

E. All other seat adjustments are positioned to their mid-travel locations. If locking positions are not available at these mid-points, use the position immediately rearward, down, left or clockwise of mid-travel. Clockwise is defined looking rear to front or left to right relative to the vehicle. This also applies to adjustable steering columns.

2. H-point Determination

A. The SAE three-dimensional H-point machine (SAE J826 APR80 - 50th percentile male configuration) is used to locate the H-point for each surrogate.

B. The H-point machine is positioned on the seat as follows:

1. Bucket or Contoured Seats - The H-point machine is centered on the bucket or contour such that its midsagittal plane is vertical and longitudinal.

2. Bench Seats

a. driver position - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and contains the steering wheel center point.

b. outboard passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical, longitudinal, and the same distance from the longitudinal vehicle centerline as that for the driver position.

c. Center passenger positions - The H-point machine is positioned such that its midsagittal plane is vertical and contains the longitudinal vehicle centerline.

C. Locate the H-point position using the steps outlined in sections 4 through 6 of SAE Standard J826 APR80, unless otherwise specified in section 1 or 2 of this document. Record the coordinates of this point, relative to the vehicle, for use in section 4 of this document.

3. Test Dummies

A. All NHTSA side impact crash tests use the NHTSA Side Impact Dummy (SID) as the surrogate(s), unless otherwise specified by the CTM.

B. All dummy joints are inspected for mobility prior to each test usage and reset to hold between 1 and 2 g's. This amount just barely restrains the weight of the individual limb when it is extended horizontally.

C. Each test dummy is clothed in form-fitting cotton stretch underwear with short sleeves and mid-calf length pants. Each foot of the dummy is equipped with a size 11EE shoe which meets the configuration, size, sole, and heel thickness specifications of MIL-S-13192 and weighs 1.25 $\pm$ 0.2 pounds. All the above items are supplied by the contractor.

4. Initial Dummy Placement

The SID dummy(s) is placed in the vehicle seat with its pelvis

positioned such that a lateral line passing through the dummy H-point is perpendicular to the longitudinal centerplane of the vehicle.

A. Bucket or Contoured Seats. The dummy is centered on the bucket or contoured seat such that its midsagittal plane is vertical and longitudinal. The legs are positioned as follows, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible.

1. driver position placement - The right foot of the dummy is placed on the undepressed accelerator pedal, with the heel resting on the floorpan as far forward as possible. The left knee is positioned such that the distance from the outer surface of the knee pivot bolt to the dummy's midsagittal plane is 6 inches.

2. passenger position placement - The knees of the dummy are initially set 11 1/2" apart, measured between the outer surfaces of the knee pivot bolt heads. If a center tunnel prevents this, place the feet on either side of the tunnel.

B. Bench seats.

1. driver position placement - The dummy is placed in the seat as outlined in section 4.A.1 except that its midsagittal plane is vertical, longitudinal and contains the steering wheel center point.

2. outboard passenger positions - The dummy is placed in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical, longitudinal, and the same distance from the vehicle centerline as that for the driver position.

3. center passenger positions - The dummy is positioned in the seat as outlined in section 4.A.2 except that its midsagittal plane is vertical and contains the vehicle centerline.

5. Initial Dummy Positioning

A. H-Point Positioning

1. With the dummy laterally positioned as in section 4, insert the pelvis angle indicator bar in the hole provided above, and to the rear of the dummy H-point. Position the longitudinal pelvis angle between 23° and 25° to the horizontal. This may be accomplished by raising the legs or flexing the upper torso forward and allowing the

pelvis to rotate. The lateral pelvis angle is to be horizontal.

2. Apply sufficient force on the lower torso in a horizontal and vertical direction to place the dummy H-point at the coordinates obtained in section 2.

3. If the H-point cannot be placed at the desired coordinates, adjust the pelvis angle within the 2^{o} band and reposition to the coordinates. After repositioning the H-point, any deviation from the desired coordinates is recorded and used to indicate actual H-point locations. This deviation is not to exceed 1/2".

B. Upper Torso Positioning. The dummy's upper torso should rest against the seat back. If not, adjust the upper torso, maintaining the H-point location and pelvis angle, so that the dummy's back rests against the seat back. If this cannot be done, modify the H-point location and/or pelvis angle within the allowable bands until the back rests against the seat.

6. Final Dummy Positioning

A. Driver Position. Without inducing pelvis or torso movement, the dummy's right foot is placed on the undepressed accelerator pedal with the heel resting as far forward as possible on the floorpan. The left foot is set perpendicular to the lower leg with the heel resting on the floorpan in the same lateral line as the right heel. If possible within these constraints, the dummy's thighs should be in contact with the seatpan.

B. Front Passenger Positions. Without inducing pelvis or torso movement, place the dummy's feet on the vehicle's toeboard with the heel resting on the floorpan as close as possible to the intersection of the toeboard and floorpan. If the feet cannot be placed on the toeboard, they are set perpendicular to the lower legs and placed as far forward as possible such that the heels rest on the floorpan.

C. Rear Passenger Positions. Without inducing pelvis or torso movement, the feet are placed flat on the floorpan and beneath the front

seat as far forward as possible without front seat interference. If necessary, change the distance between the knees as required to place the feet beneath the seat. Record the new distance.

D. Vehicles with wheelhouse projections in the passenger compartment. The foot (feet) in question is placed in the wheel of the floorpan/toeboard and not in the wheelhouse projection. This is done by twisting the foot at the ankle, maintaining the upper and lower leg positions outlined in section 4. If this does not resolve the situation, move the leg of the foot in question just enough to achieve the correct position, keeping the femur and tibia centerlines in a plane that is as near to vertical as possible. Record the new distance between the knees.

E. The knee positions are to be as outlined in section 4, unless modified as in section 6. The plane containing the femur and tibia centerlines for each leg is to be as near to vertical as possible without inducing pelvis or torso movement. Record the distance between the knees for each dummy.

F. Prior to conducting the test, the dummy position is visually checked. The dummy is to be properly positioned laterally with its midsagittal plane vertical and longitudinal, and the upper torso resting against the seat back. The H-point and pelvis angle are to be within the specified ranges and the foot, knee, and leg placements are to be as outlined. The CTM is to be satisfied with the final dummy position and any deviations from this procedure are to be approved by the CTM.

G. The final dummy position is recorded. These measurements are to include, but not be limited to, pelvis and head angles as well as actual H-point and head cg locations relative to the vehicle. The straight-line distance from the H-point to the center of the outer ankle bolt is also recorded for one of the legs (eg. left H-point to left ankle bolt).

DUMMY IN-VEHICLE POSITION RECORDING SHEET

VEHICLE NHTSA NO. R & D

MFR./MAKE/MODEL: Nissan/Sentra

FRONT SEAT TYPE: X BENCH - REAR
X BUCKET - FRONT
_____ SPLIT BENCH

ADJUSTER TYPE: X MANUAL
_____ POWER

BUCKET SEAT BACK TYPE: ____ FIXED
X ADJUSTABLE

TECHNICIANS:
1. R. Benavides
2. B. Crabtree
3. J. Clarridge

POSITIONING DATE: 5/22/87

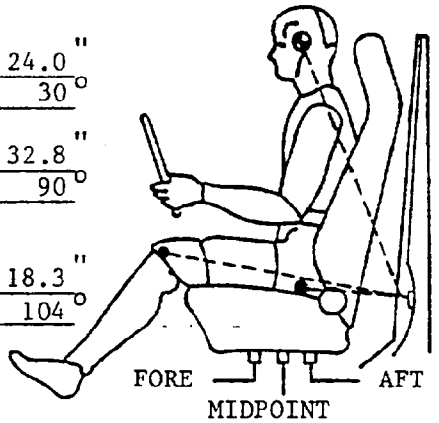
AMBIENT TEMP.: 74° F. TIME: 0900

DRIVER DUMMY # 119

HEAD 24.0 "
TARGET* 30 °

KNEE 32.8 "
JOINT 90 °

APPROX.
"H" 18.3 "
POINT 104 °

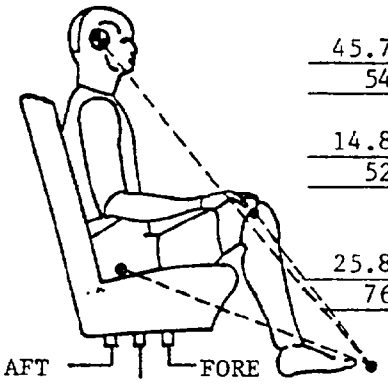


REAR PASSENGER DUMMY # 018

45.7 "HEAD
54 °TARGET**

14.8 "KNEE
52 °JOINT

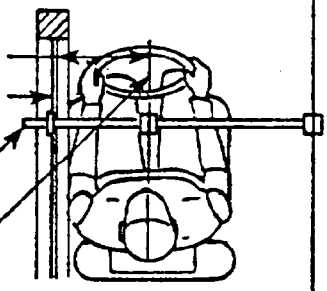
APPROX.
25.8 " "H"
76 °POINT



DOOR
GLASS
HEIGHT*** 8.6

12.0"

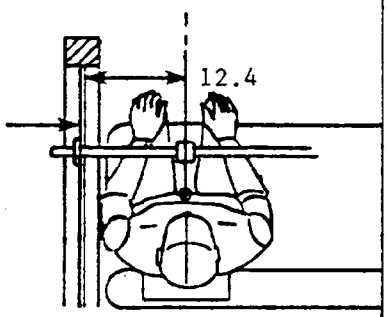
LATERAL BAR
ADJUSTABLE
POINTER



DRIVER
DUMMY # 119

DOOR
GLASS
HEIGHT Fixed

12.4

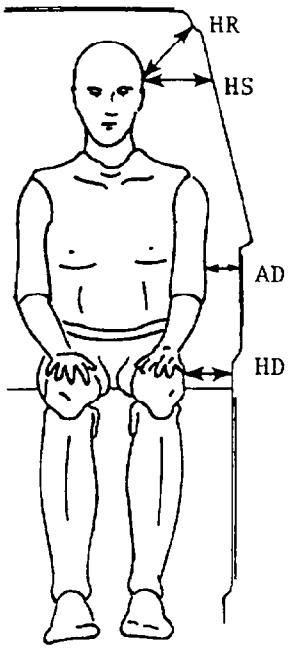


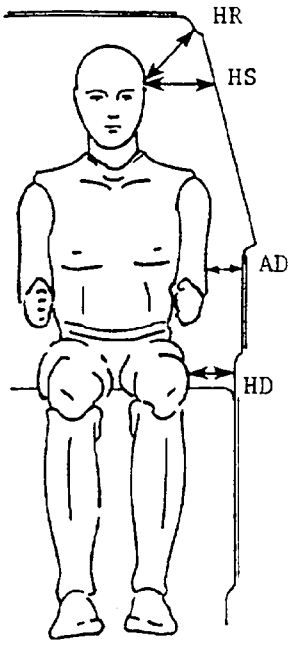
PASSENGER
DUMMY # 018

*All driver dummy dimensions referenced to top of striker bolt and all angles referenced to vertical.

**All passenger dummy dimensions referenced to front seat back latch bolt with front seat in mid-position and all angles referenced to vertical.

***Door glass height is equal on the right and left side of vehicle at dummy nose level.

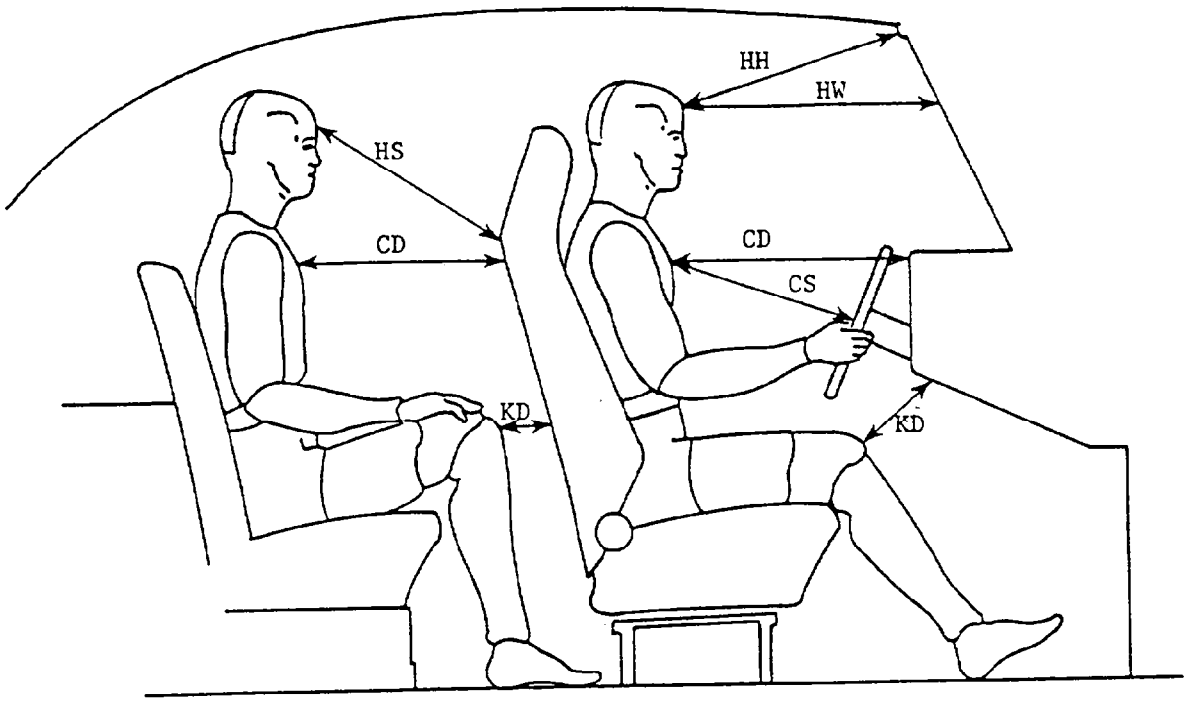




	DRIVER	PASSENGER
	119	018
HR	6.4	7.2
HS	8.0	7.5
AD	4.1	3.9
HD	6.8	6.9

ALL MEASUREMENTS IN INCHES

DUMMY LATERAL CLEARANCE DIMENSIONS



	DRIVER 119	PASSENGER 018
HH	8.9	DNA
HW	14.9	DNA
HS	DNA	31.9
CD	18.9	20.6
CS	8.9	DNA
KDL	3.6	5.4
KDR	4.4	5.4

ALL MEASUREMENTS IN INCHES

DUMMY LONGITUDINAL CLEARANCE DIMENSIONS

SAE 3D H-POINT MACHINE LOCATION AND DUMMY LOCATION DATA

	DRIVER #119*	PASSENGER #018*
SAE 3D H-POINT MACHINE LOCATION:	X = -9.25 Z = 7.25	X = -41.38 Z = 7.38
DUMMY H-POINT LOCATION:	X = -8.94 Z = 7.19	X = -41.75 Z = 7.69
DUMMY HEAD LOCATION:	X = -13.25 Z = 32.79	X = -53.62 Z = 29.58
DUMMY HEAD ANGLE:	5°	13°
DUMMY PELVIC ANGLE:	23°	24°
DUMMY H-POINT TO LEFT ANKLE BOLT DISTANCE:	28.75	25.5

*All location measurements referenced to left most front seat track bolt in two-dimensional rectangular coordinates: +X = forward, +Z = upward.

All dimensions in inches except as noted.

All angles referenced to horizontal, positive is upward.

DUMMY KINEMATIC SUMMARY

DRIVER

During impact, the dummy's torso contacted the driver's door and the head contacted the side window sill. The dummy rebounded laterally across the front occupant compartment. The buttocks was then restrained by a loose belt, the upper torso rotated and the upper back contacted the right front window sill as the rear of the dummy's head grazed the roof. The dummy came to rest leaning against the right front door.

PASSENGER

During impact, the dummy's torso contacted the left rear side wall and the head contacted the left C-pillar. The dummy rebounded laterally across the rear occupant compartment. The dummy came to rest seated upright in the right rear seat.

VEHICLE EXTERIOR PROFILES AND STATIC CRUSH

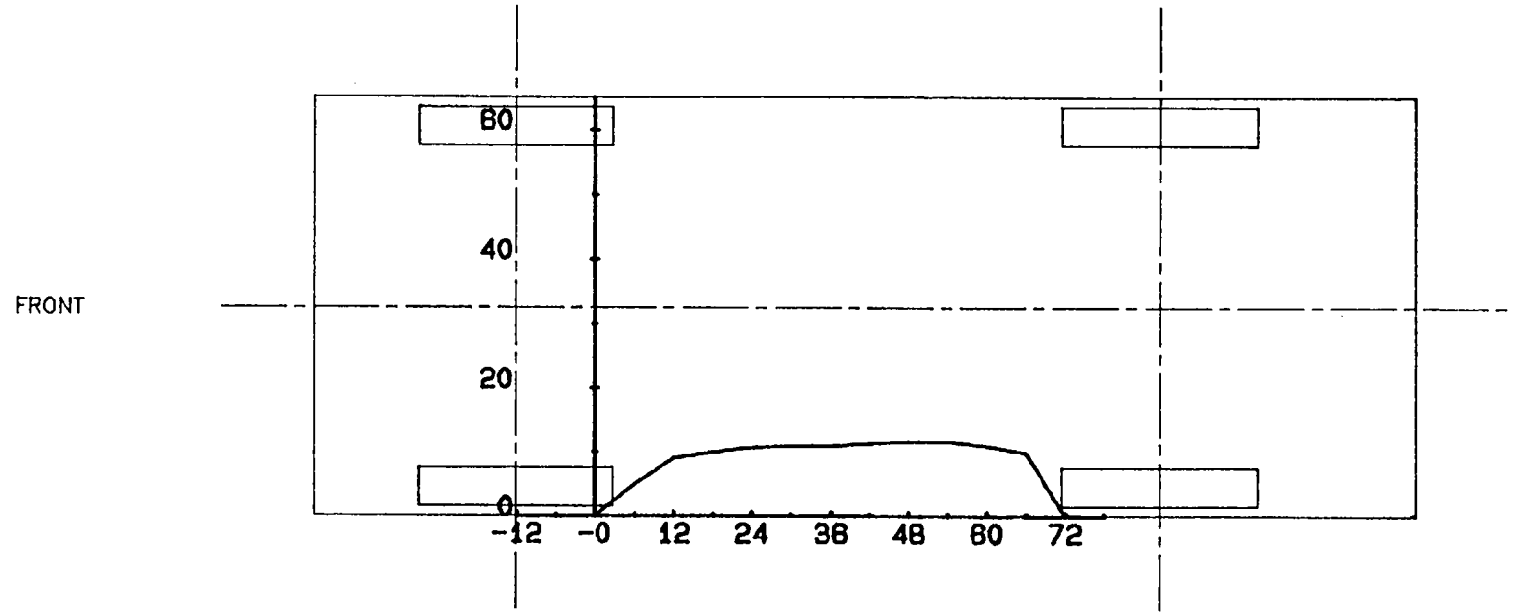
ZERO DISTANCE AT PROJECTED IMPACT POINT*

LOCATION	HEIGHT (in)	6	0	6	12	18	24	30	36	42	48	54	60	66	72	78
		PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)														
Axle Height	10.6	X	X	19.4	19.5	19.1	19.0	18.8	18.8	18.7	18.6	18.6	18.6	18.6	X	X
H-Point	21.3	X	X	16.6	16.5	16.4	16.3	16.2	16.2	16.2	16.2	16.2	16.2	16.3	16.4	X
Mid Door	23.8	X	16.6	16.5	16.3	16.2	16.1	16.1	16.1	16.0	16.0	16.0	16.1	16.1	16.2	16.0
Window Sill	34.4	18.8	18.5	18.2	18.1	18.0	17.9	17.9	17.8	17.9	17.9	17.9	17.9	18.0	18.1	18.2
Window Top	52.2	X	X	X	X	X	X	X	26.2	26.5	26.8	27.1	27.2	27.6	27.8	X
		POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)														
Axle Height	10.6	X	X	24.4	28.5	29.1	29.6	29.7	29.8	30.0	30.2	30.2	29.5	28.4	X	X
H-Point	21.3	X	X	25.8	31.6	32.1	32.2	32.5	33.2	33.3	34.6	33.5	34.4	33.9	32.8	X
Mid Door	23.8	X	21.2	24.1	29.9	29.9	30.6	30.7	31.0	31.4	31.6	32.0	32.9	32.8	32.5	29.1
Window Sill	34.4	20.7	21.0	21.4	24.8	27.4	28.2	28.5	28.8	29.3	29.6	30.0	30.5	30.8	30.8	26.6
Window Top	52.2	X	X	X	X	X	X	X	30.2	30.3	30.4	30.4	30.1	30.0	29.8	X
		STATIC CRUSH (IN)														
Axle Height	10.6	X	X	5.0	9.0	10.0	10.6	10.9	11.0	11.3	11.6	11.6	10.9	9.8	X	X
H-Point	21.3	X	X	9.2	15.1	15.7	15.9	16.3	17.0	17.1	18.4	17.3	18.2	17.6	16.4	13.1
Mid Door	23.8	X	4.6	7.6	13.6	13.7	14.5	14.6	14.9	15.4	15.6	16.0	16.8	16.7	16.3	8.4
Window Sill	34.4	1.9	2.5	3.2	6.7	9.4	10.3	10.6	11.0	11.4	11.7	12.1	12.6	12.8	12.7	X
Window Top	52.2	X	X	X	X	X	X	X	4.0	3.8	3.6	3.3	2.9	2.4	2.0	X

*Projected impact point is 37 inches forward of driver's side wheelbase midpoint. Column readings are front to rear from left to right.

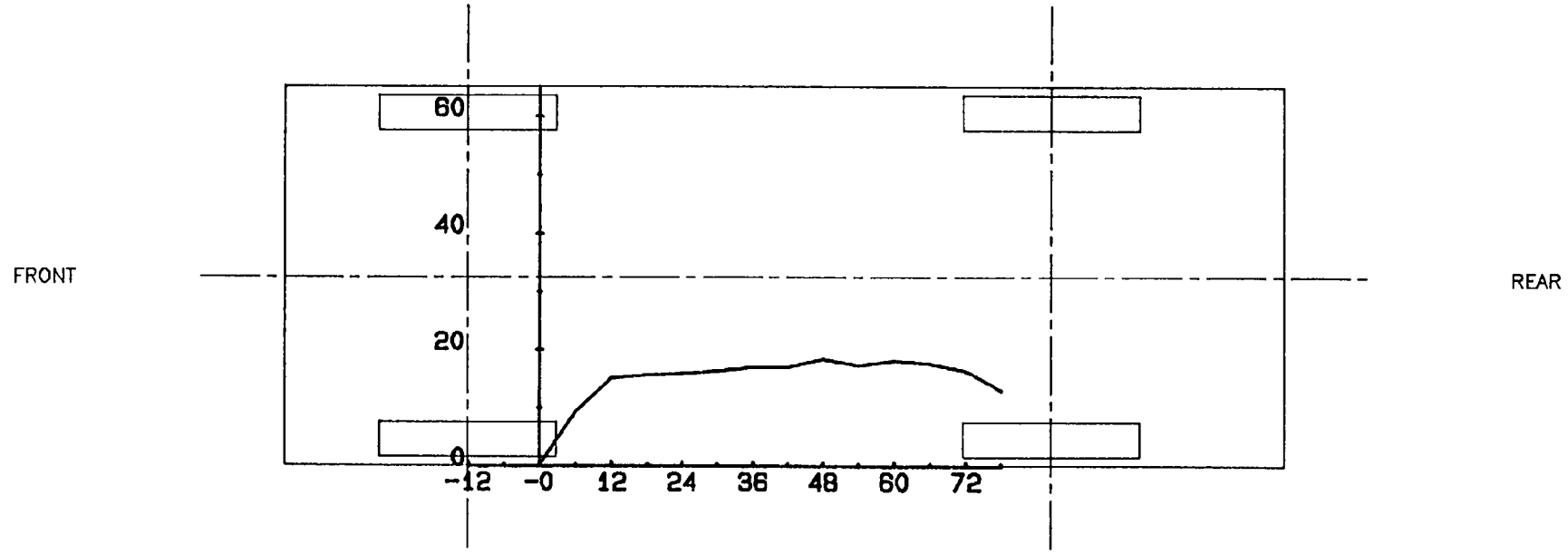
**Reference plane is parallel to and 48 inches from the vehicle longitudinal centerline.

VEHICLE EXTERIOR STATIC CRUSH PROFILE



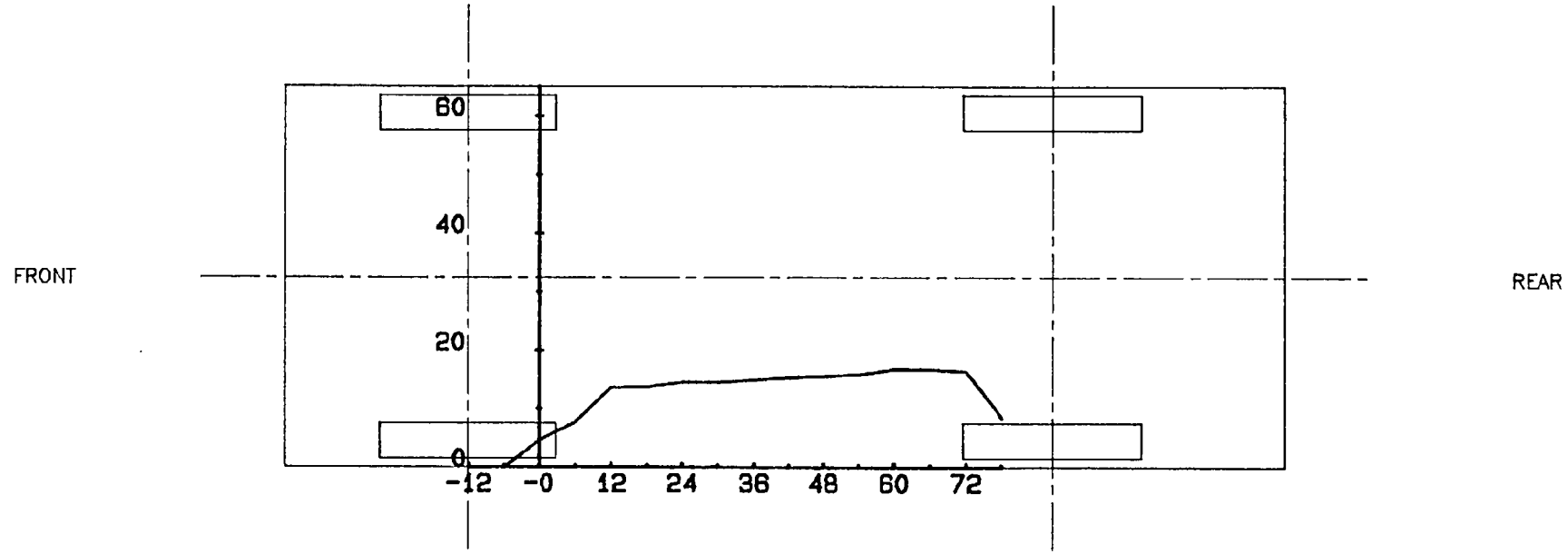
PROFILE LEVEL EQUALS AXLE HEIGHT WHICH IS 10.6 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



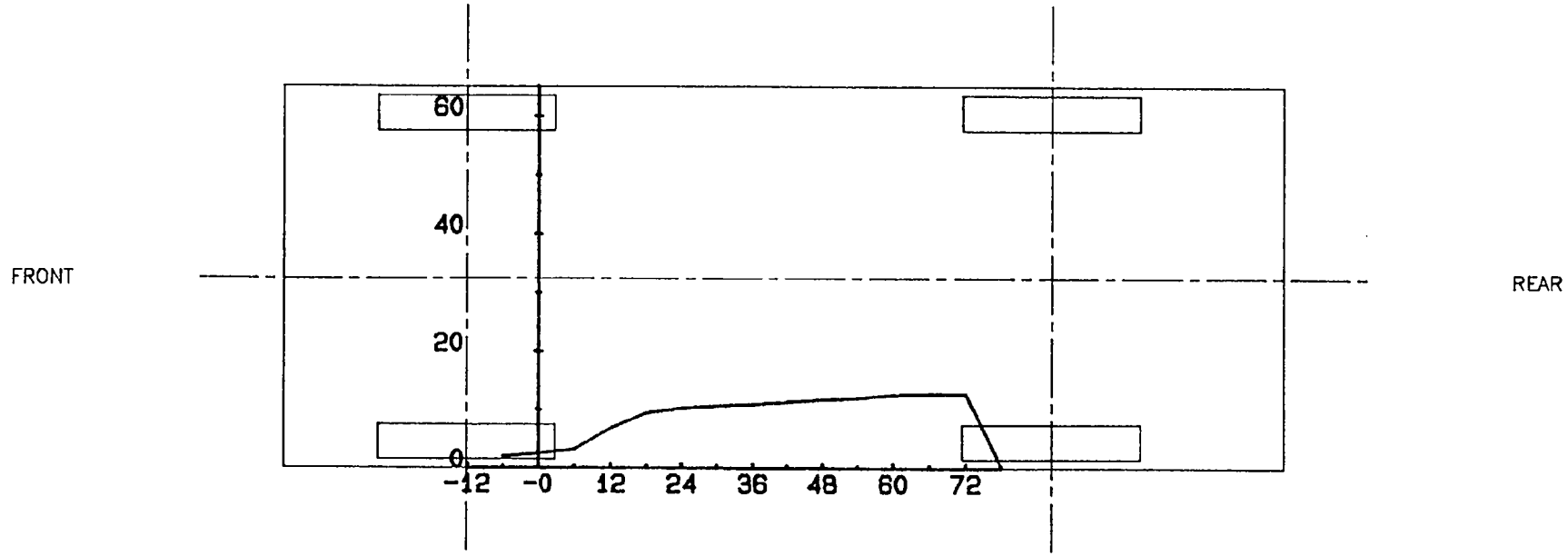
PROFILE LEVEL EQUALS H-POINT HEIGHT WHICH IS 21.3" ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



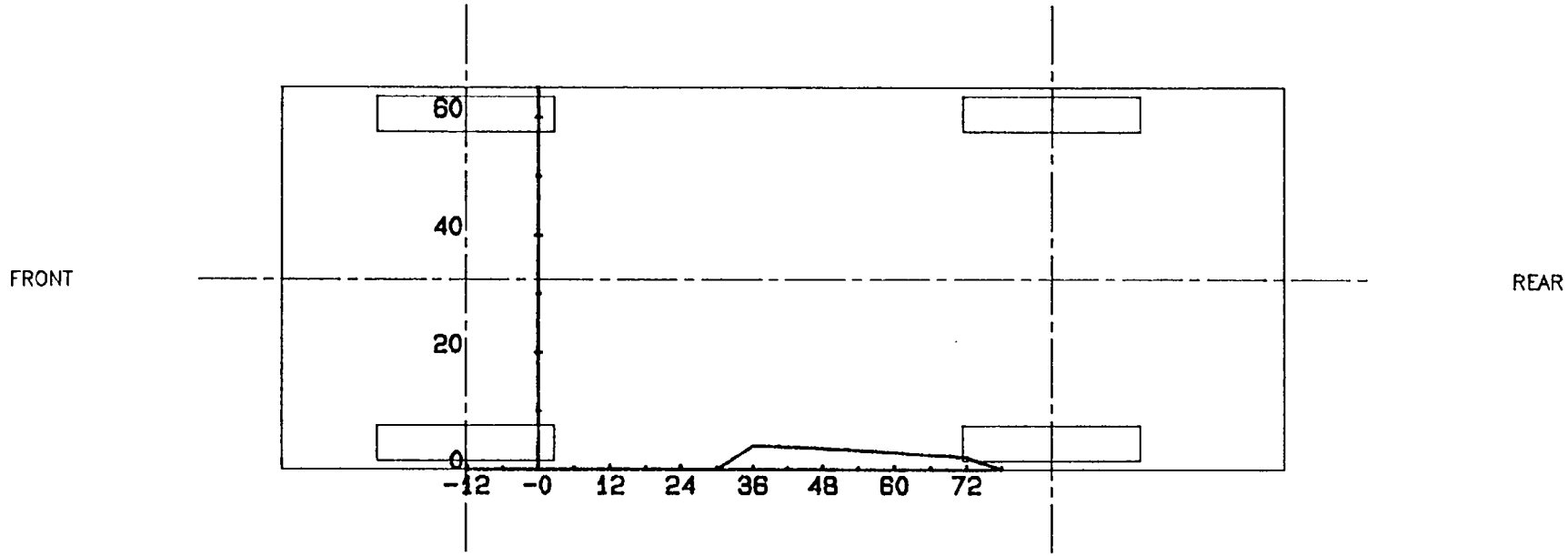
PROFILE LEVEL EQUALS MID DOOR HEIGHT WHICH IS 23.8 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW SILL HEIGHT WHICH IS 34.4 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

VEHICLE EXTERIOR STATIC CRUSH PROFILE



PROFILE LEVEL EQUALS WINDOW TOP HEIGHT WHICH IS 52.2 " ABOVE GROUND LEVEL
(0,0) EQUALS PROJECTED IMPACT POINT
SCALE FACTOR EQUALS 0.035

SIDE IMPACT DUMMY DATA SUMMARY

	DRIVER DUMMY				PASSENGER DUMMY			
	POSITIVE DIRECTION*		NEGATIVE DIRECTION**		POSITIVE DIRECTION*		NEGATIVE DIRECTION**	
	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
HEAD ACCELERATION								
LONGITUDINAL	19.16	274.13	45.28	87.25	10.63	40.13	17.57	51.13
LATERAL	77.92	86.00	29.58	63.88	159.39	55.88	17.24	71.50
VERTICAL	23.82	49.00	63.14	62.38	71.62	52.63	31.87	42.50
RESULTANT	91.20	86.00			163.20	55.88		
HIC	477.12 from 52.88 to 88.88				1731.57 from 51.50 to 60.00			
CHEST ACCELERATION								
UPPER SPINE								
LONGITUDINAL	21.78	51.25	9.15	41.87	19.97	52.50	23.76	42.50
LATERAL (P)***	122.64	40.63	37.62	65.63	107.12	42.50	26.23	66.25
LATERAL (R)***	124.95	40.63	37.20	65.63	111.86	42.50	24.40	66.25
VERTICAL	9.25	26.87	16.37	32.50	8.26	28.13	15.55	33.75
RESULTANT (P)	123.04	40.63			110.42	42.50		
RESULTANT (R)	125.34	40.63			115.03	42.50		
DELTA V (MPH)****	27.5 @ 59.38 (P)				25.9 @ 62.50 (P)			
	28.0 @ 59.38 (R)				27.3 @ 63.12 (R)			
LOWER SPINE								
LONGITUDINAL	17.95	54.38	17.11	65.63	26.78	54.38	18.18	42.50
LATERAL (P)	107.99	32.50	15.56	56.87	80.78	37.50 Y	26.41	63.75 Y
LATERAL (R)	110.35	32.50	16.43	65.00	79.01	38.75 Y	25.41	62.50 Y
VERTICAL	18.32	36.88	10.59	31.25	9.67	33.75 Y	14.05	39.38 Y
RESULTANT (P)	108.46	32.50			82.20	38.13 Y		
RESULTANT (R)	110.81	32.50			81.57	39.38 Y		
DELTA V (MPH)	29.7 @ 53.12 (P)				30.0 @ 56.25 (P) Y			
	31.6 @ 53.75 (R)				30.8 @ 56.25 (R) Y			

SIDE IMPACT DUMMY DATA SUMMARY CONTD

	DRIVER DUMMY				PASSENGER DUMMY			
	POSITIVE DIRECTION*		NEGATIVE DIRECTION**		POSITIVE DIRECTION*		NEGATIVE DIRECTION**	
	MAX (in)	TIME (msec)	MAX (in)	TIME (msec)	MAX (in)	TIME (msec)	MAX (in)	TIME (msec)
LEFT UPPER RIB								
LATERAL (P)	91.19	38.13	12.92	81.25	103.13	37.50	7.40	80.63
LATERAL (R)	89.43	38.13	13.55	81.25	104.73	37.50	7.07	80.63
DELTA V (MPH)	26.1 @ 71.87 (P)				26.5 @ 110.63 (P)			
	27.0 @ 71.87 (R)				27.1 @ 110.63 (R)			
LEFT LOWER RIB								
LATERAL (P)	78.69	33.75	13.43	70.00	121.77	36.88	18.66	59.38
LATERAL (R)	79.76	33.75	12.09	70.00	121.27	37.50	19.87	70.63
DELTA V (MPH)	27.2 @ 87.50 (P)				28.0 @ 56.25 (P)			
	27.1 @ 58.75 (R)				28.0 @ 56.25 (R)			
PELVIS ACCELERATION								
LONGITUDINAL	19.05	26.87 Y	36.56	31.88 Y	4.41	67.50	23.47	33.75
LATERAL	169.71	28.75 Y	15.52	39.38 Y	132.13	31.25	5.40	79.38
VERTICAL	26.92	31.88	2.93	81.88	28.06	32.50	7.08	38.13
RESULTANT	170.07	28.75 Y			134.94	31.25		
DELTA V (MPH)	35.4 @ 38.12 Y				26.2 @ 53.12			
RIB DEFLECTION	1.68	104.75	0.12	302.13	1.63	60.25	0.07	98.13

*LONGITUDINAL: FORWARD
LATERAL: RIGHTWARD
VERTICAL: UPWARD

**LONGITUDINAL: REARWARD
LATERAL: LEFTWARD
VERTICAL: DOWNWARD

***(P) = Primary Sensor, (R) = Redundant Sensor

****For dummy channels, Delta V is the velocity change at the approximate time of separation from the contact area.

Compression: Positive

Y See TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

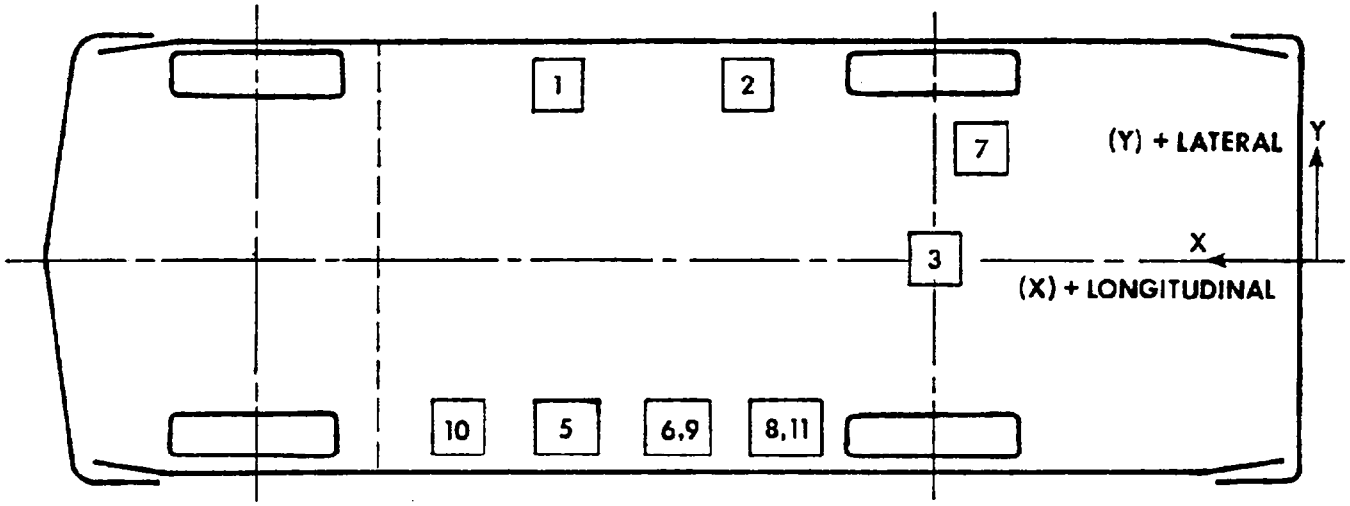
NO.	LOCATION	X*	Y*	Z*		POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	RIGHT SILL AT FRONT SEAT	109.0	25.2	12.4					
	(LONGITUDINAL)				ΔV = -2.1 mph @ 100.00 msec	2.45	64.38	6.82	22.13
	(LATERAL)				ΔV = 15.0 mph @ 100.00 msec	15.23	22.38	2.90	167.75
	(VERTICAL)					3.61	89.13	6.44	48.38
	(RESULTANT)					17.05	22.63		
2	RIGHT SILL AT REAR SEAT	76.5	25.5	12.0					
	(LONGITUDINAL)				ΔV = -0.6 mph @ 100.00 msec	2.91	64.50	5.27	22.00
	(LATERAL)				ΔV = 16.8 mph @ 100.00 msec	16.27	23.38	2.86	301.63
	(VERTICAL)					6.11	300.38	4.65	305.50
	(RESULTANT)					17.03	23.25		
3	REAR DECK OVER AXLE	35.8	-1.0	9.8					
	(LONGITUDINAL)				ΔV = -2.9 mph @ 100.00 msec	3.66	56.25	9.62	40.38
	(LATERAL)				ΔV = 20.3 mph @ 100.00 msec	20.21	30.88	3.03	113.13
	(VERTICAL)					3.76	56.38	4.59	30.25
	(RESULTANT)					20.74	30.88		
4	LEFT SILL AT REAR SEAT	75.5	25.6	11.1					
	(LATERAL)				ΔV = 12.9 mph @ 23.50 msec	58.72	15.13	21.90	19.75
5	LEFT SILL AT FRONT SEAT	108.2	25.0	11.6					
	(LATERAL)				ΔV = 14.0 mph @ 25.88 msec	99.50	9.38	17.20	32.50
6	LEFT FRONT DOOR CENTERLINE	92.9	26.2	23.1					
	(LATERAL)				ΔV = 21.7 mph @ 19.50 msecY	257.84	36.00Y	146.64	23.13Y
7	RIGHT TRUNK FLOOR	39.0	15.1	15.9					
	(LONGITUDINAL)					1.89	112.25	6.58	40.50
8	MIDREAR OF LEFT FRONT DOOR	84.4	26.2	23.6					
	(LATERAL)				ΔV = --- @ ---Y	145.91	12.00Y	122.99	20.88Y
9	UPPER LEFT FRONT DOOR CENTERLINE	92.8	26.9	28.2					
	(LATERAL)				ΔV = 21.6 mph @ 15.75 msecY	110.02	16.25Y	156.91	32.13Y
10	MIDFRONT OF LEFT FRONT DOOR	101.1	26.2	23.5					
	(LATERAL)				ΔV = 19.0 mph @ 23.88 msecY	178.41	13.63Y	104.62	24.25Y
11	UPPER REAR OF LEFT FRONT DOOR	83.2	27.3	31.8					
	(LATERAL)				ΔV = --- @ ---Y	135.81	25.88Y	111.23	31.88Y

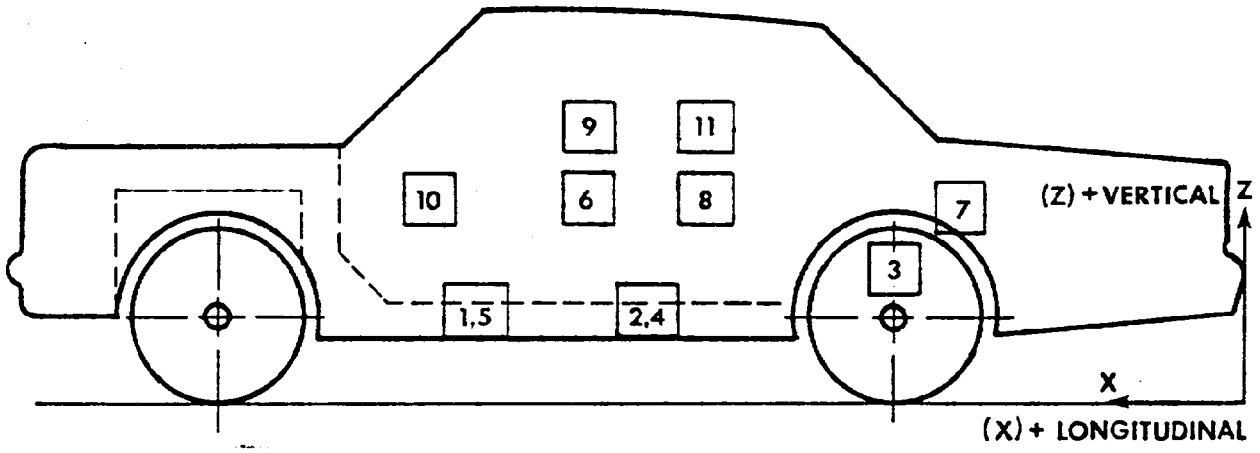
* Reference: X - Rear Bumper (+ Forward), Y - Vehicle Centerline (+ To Right), Z - Ground Level (+ Up)

All measurements of accelerometer locations in inches.

Y See TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS





YAW RATE GYRO LOCATION AND DATA SUMMARY

LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (deg/sec)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (deg/sec)	NEGATIVE DIRECTION TIME (msec)
YAW RATE GYRO	80.0	0.0	16.0	310.67	30.38 ϒ	280.83	42.00 ϒ

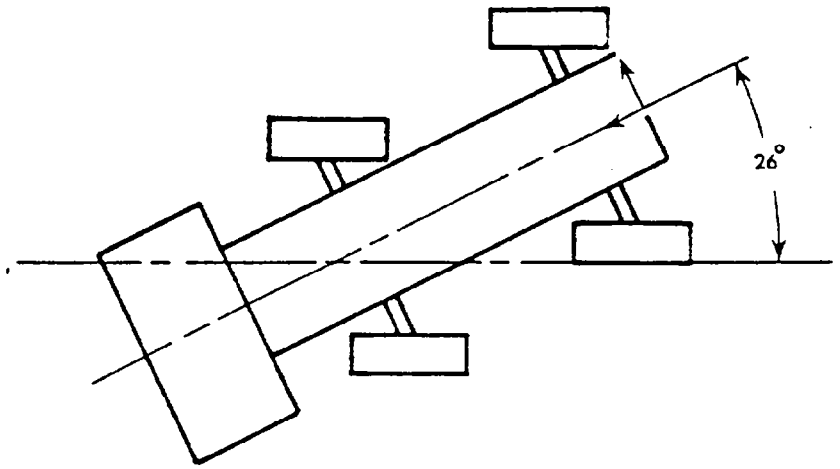
*Reference: X - Rear Bumper (+ forward), Y - Vehicle Centerline (+ to right), Z - Ground Level (+ up)

All measurements of rate gyro in inches.

Yaw rotation is positive when measured counterclockwise as viewed from above.

ϒ See TEST ANOMALIES

MOVING BARRIER ACCELEROMETER LOCATIONS AND DATA SUMMARY



NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	CENTER OF GRAVITY	78.8	0.25	12.1				
	(LONGITUDINAL)	ΔV = -16.0 mph @ 100.00 msec			1.15	162.63	15.33	45.88
	(LATERAL)	ΔV = -8.0 mph @ 100.00 msec			1.52	18.38	9.73	47.38
	(VERTICAL)				18.77	19.25	5.39	94.63
	(RESULTANT)				21.74	19.38		
2	REAR FRAME MEMBER	22.1	-17.5	13.2				
	(LONGITUDINAL)	ΔV = -15.1 mph @ 100.00 msec			14.69	21.00	18.62	45.25
	(LATERAL)	ΔV = -0.8 mph @ 100.00 msec			5.43	28.63	20.73	22.00

* Reference: X - Rear Most Point of Frame (+ To Forward)
Y - Barrier Centerline (+ To Right)
Z - Ground Level (+ To Up)

All measurements of accelerometer locations in inches.

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right side panning	Kodak	16	24	Real time documentation
2	Onboard MDB - Tight	Photosonic 1B	25	1000	Close-up of impact point
3	Onboard MDB - Wide	Photosonic 1B	13	1000	Dummy kinematics
4	Overhead - Wide	Photosonic 1B	8	999	Vehicle dynamics
5	Ground Level - Right	Photosonic 1B	25	995	Overall view
6	Ground Level - Left	Photosonic 1B	17	995	Overall view
7	Onboard Windshield	Photosonic 1B	8	998	Driver kinematics - front view
8	Onboard Roof	Photosonic 1B	8	998	Door/Driver contact velocity
9	Onboard Driver	Photosonic 1B	8	999	Driver kinematics
10	Onboard Passenger	Photosonic 1B	8	997	Passenger kinematics

LOCATIONS OF OFFBOARD HIGH SPEED CAMERAS

CAMERA NO.	X	Y	Z
4	0	0	137"
5	226"	455"	34"
6	-65"	-334"	33"

Origin of Coordinate System is Point of Impact

+X = Forward with Respect to Striking Vehicle's Velocity Vector
+Y = Rightward with Respect to Striking Vehicle's Velocity Vector
+Z = Upward with Respect to Striking Vehicle's Velocity Vector

NON-GOVERNMENT FURNISHED TRANSDUCER INFORMATION

No non-government furnished transducers were used on this test.

All dummy, moving barrier and struck vehicle accelerometers were Government furnished equipment.

APPENDIX A

PHOTOGRAPHS

Figure A-1. PRE-TEST OVERALL - VIEW 1

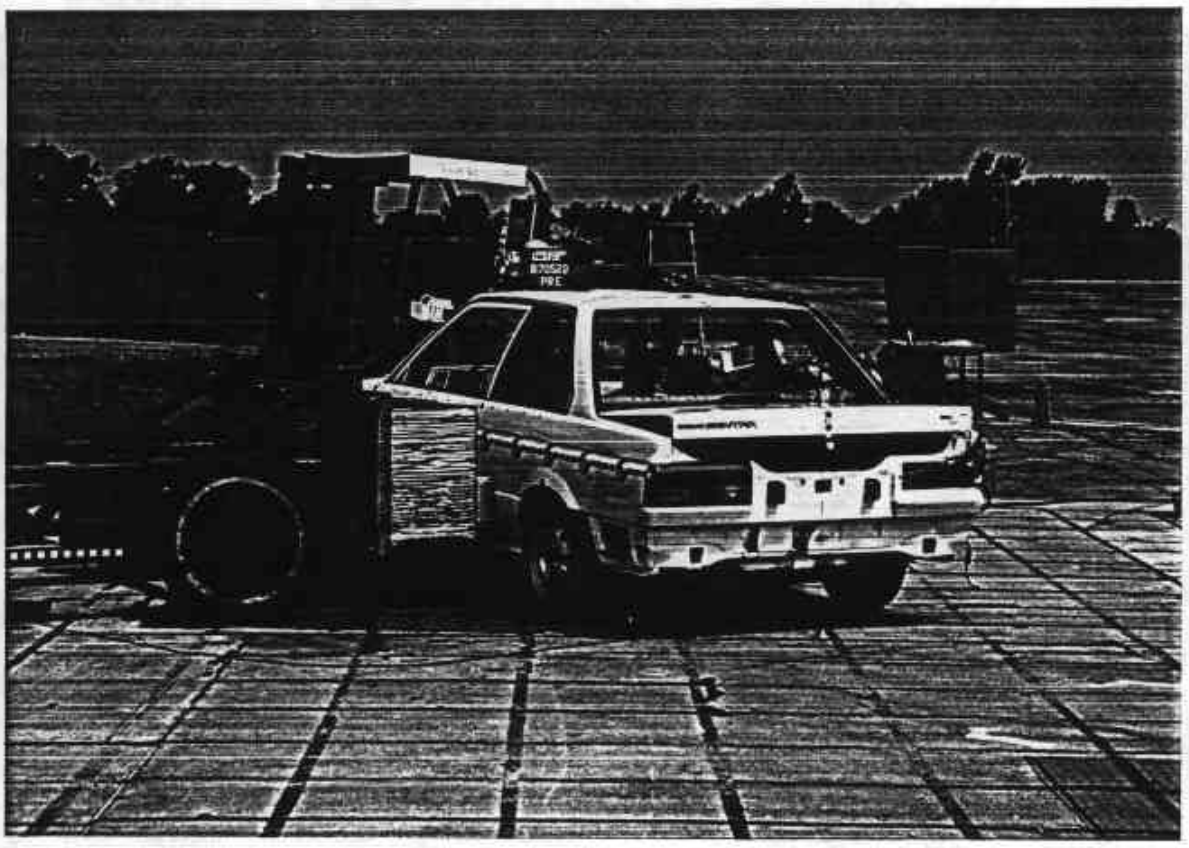


Figure A-2. PRE-TEST OVERALL - VIEW 2

Figure A-3. PRE-TEST OVERALL - VIEW 3

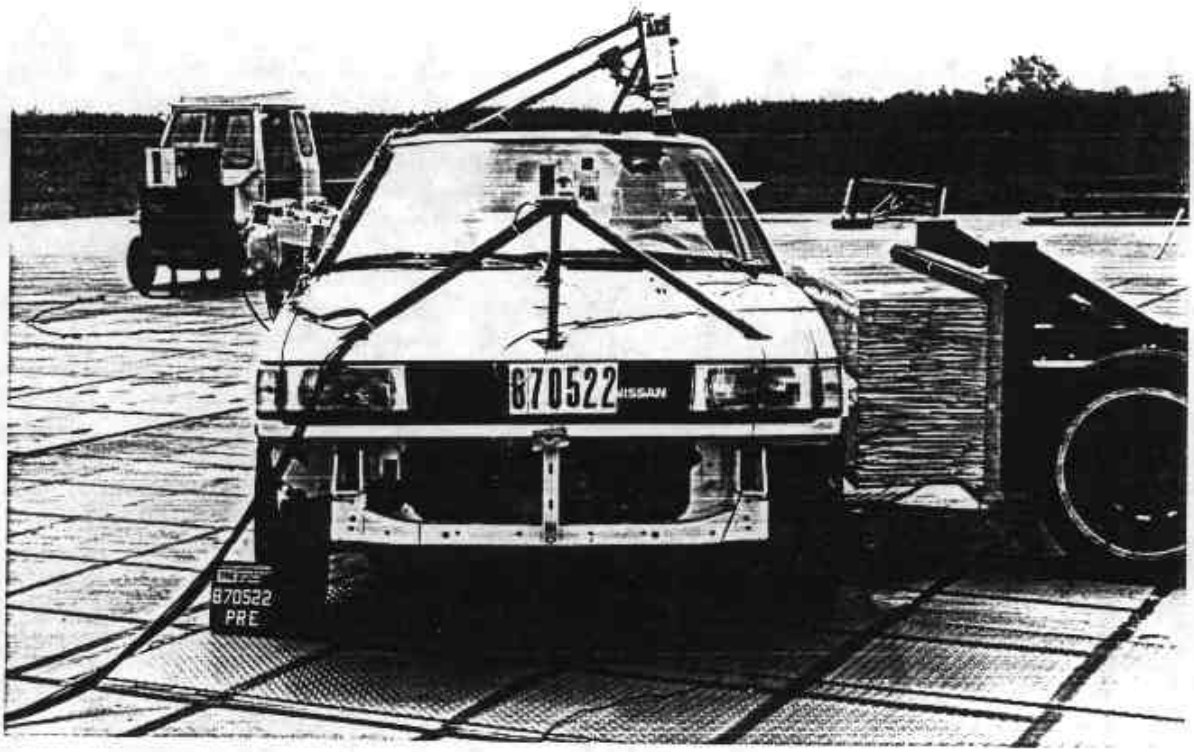


Figure A-4. PRE-TEST OVERALL - VIEW 4

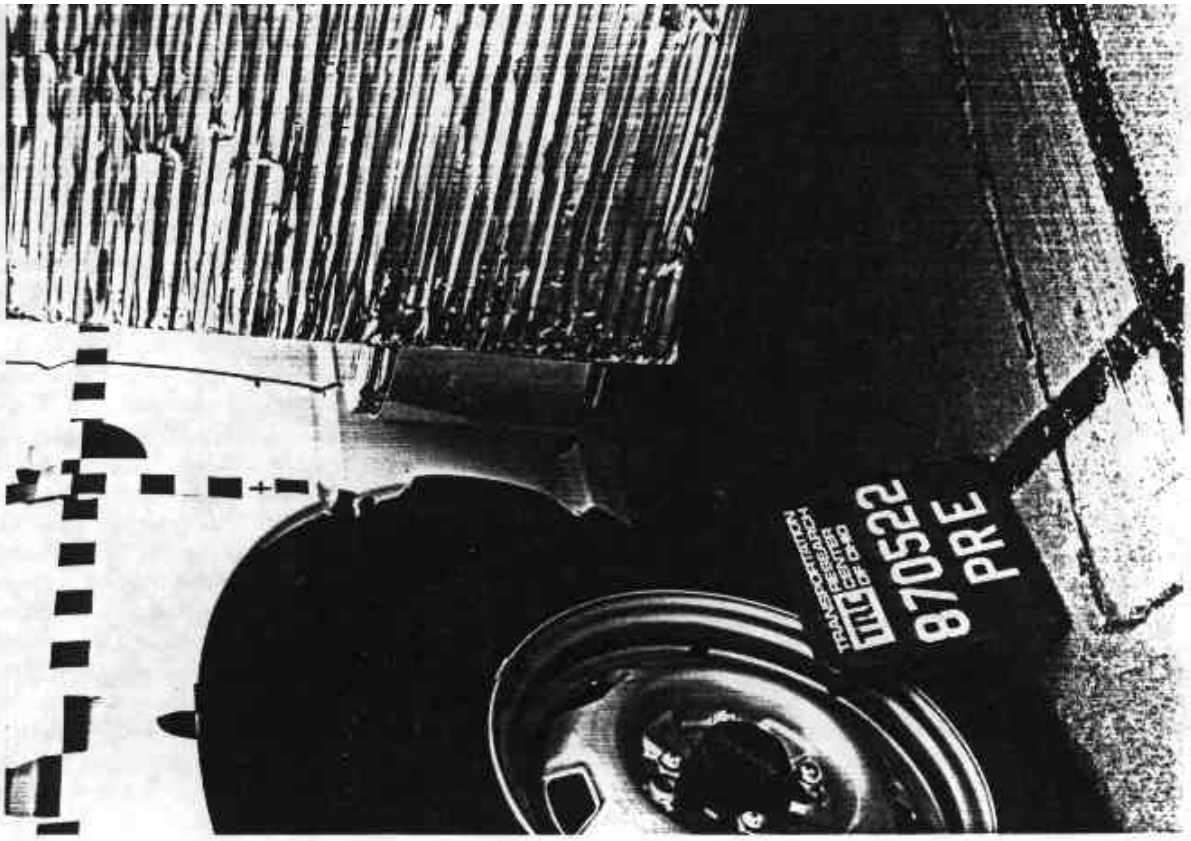


Figure A-5. PRE-TEST CLOSE-UP - VIEW 1

Figure A-6. PRE-TEST CLOSE-UP - VIEW 2

Figure A-7. PRE-TEST DRIVER DUMMY VIEW

Figure A-8. PRE-TEST PASSENGER DUMMY VIEW

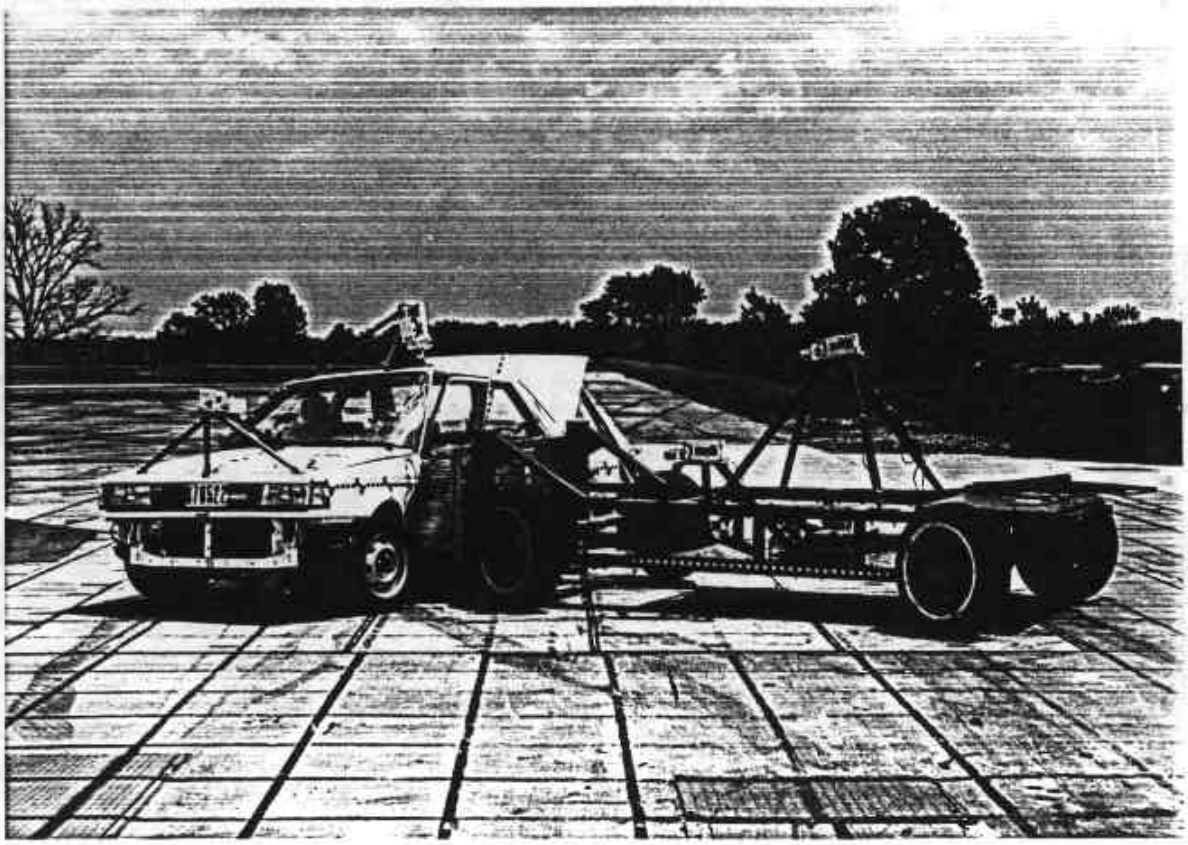


Figure A-9. POST-TEST OVERALL - VIEW 1

Figure A-10. POST-TEST OVERALL - VIEW 2

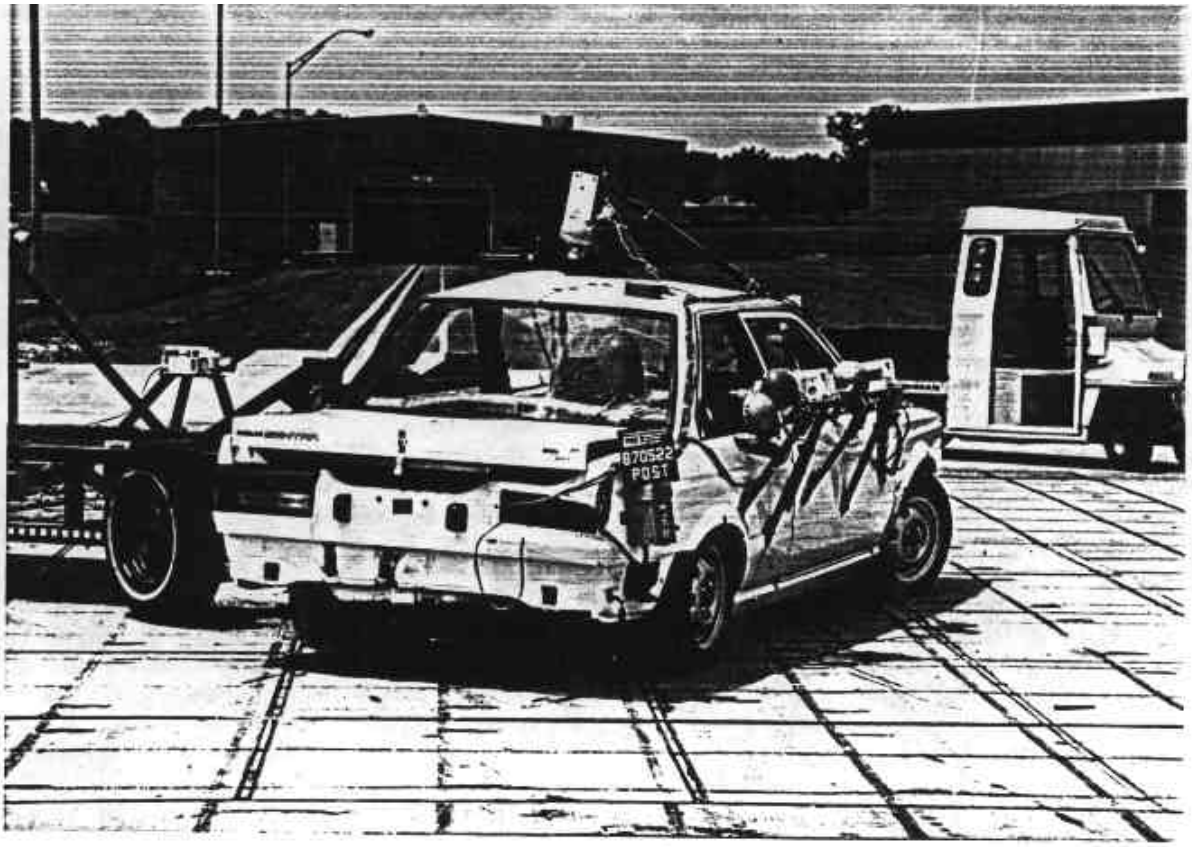


Figure A-11. POST-TEST OVERALL - VIEW 3

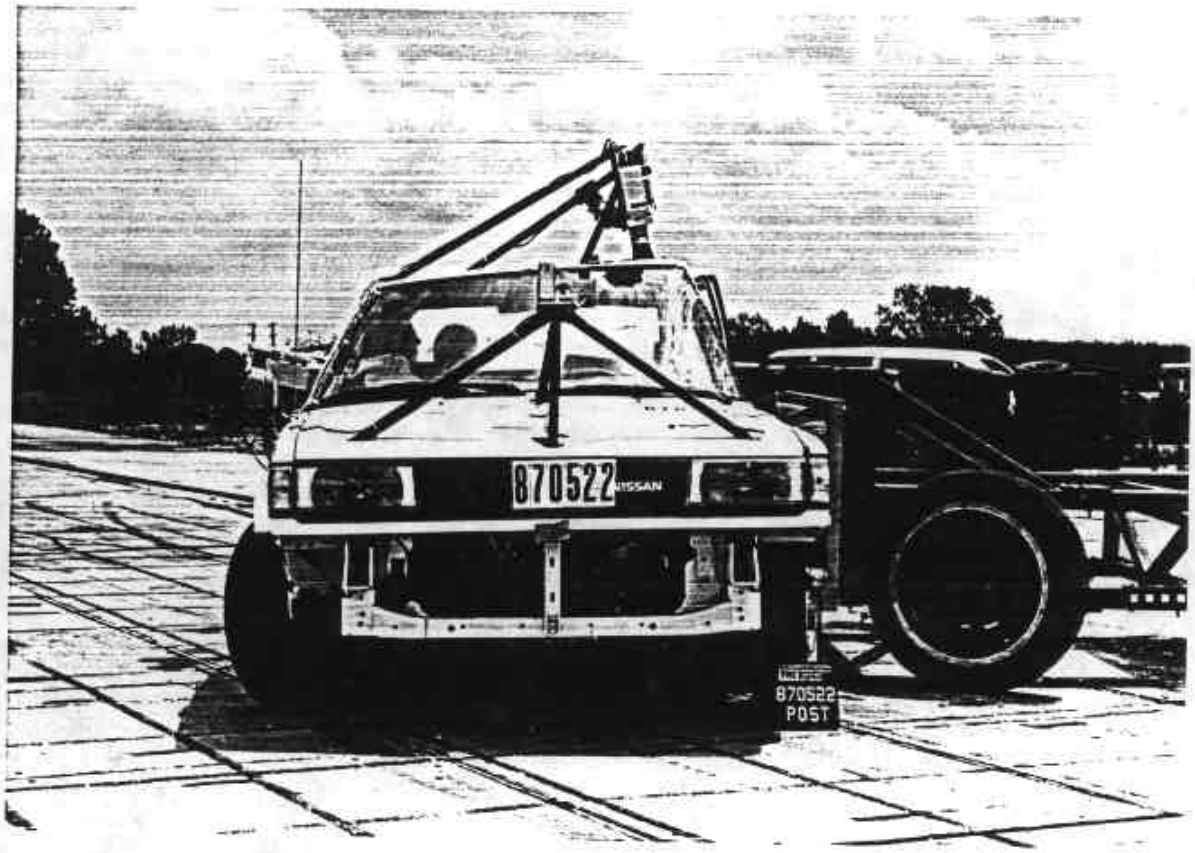


Figure A-12. POST-TEST OVERALL - VIEW 4

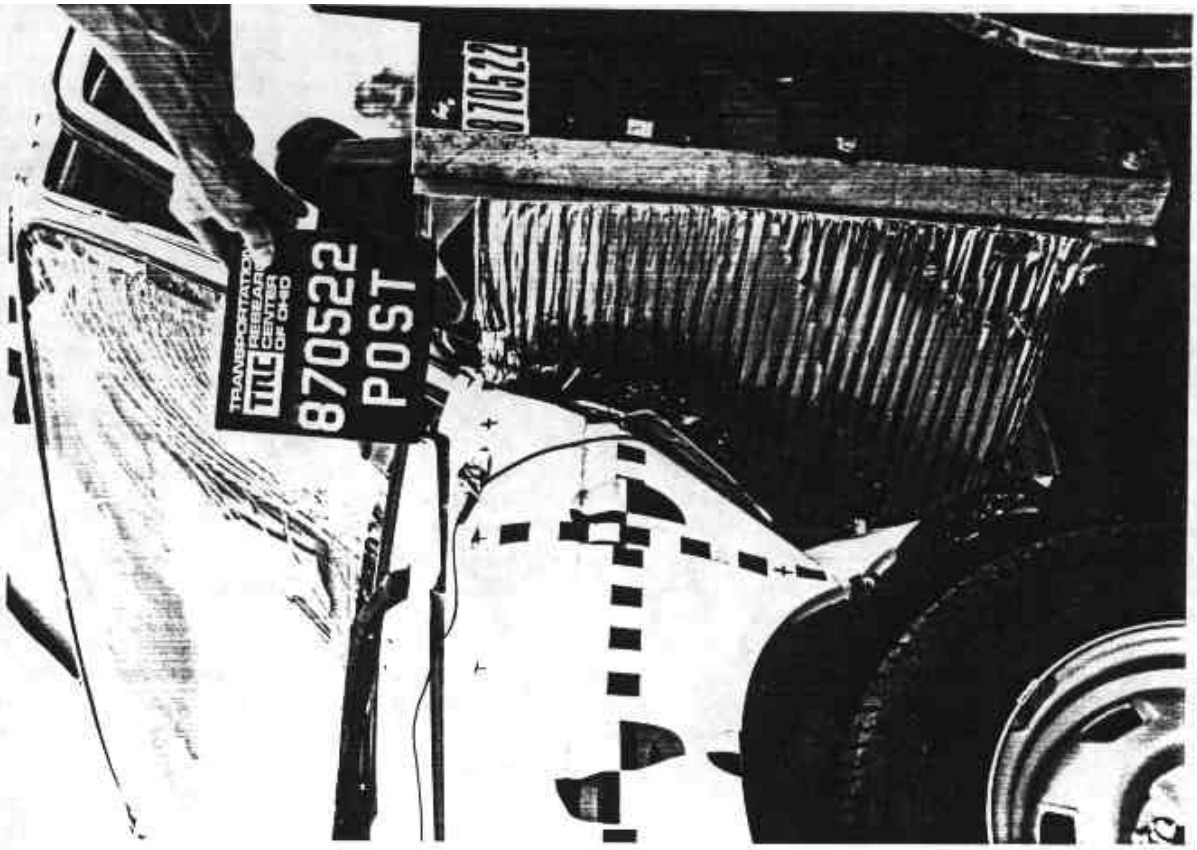


Figure A-13. POST-TEST CLOSE-UP VIEW

Figure A-14. POST-TEST DRIVER DUMMY VIEW

Figure A-15. POST-TEST PASSENGER DUMMY VIEW

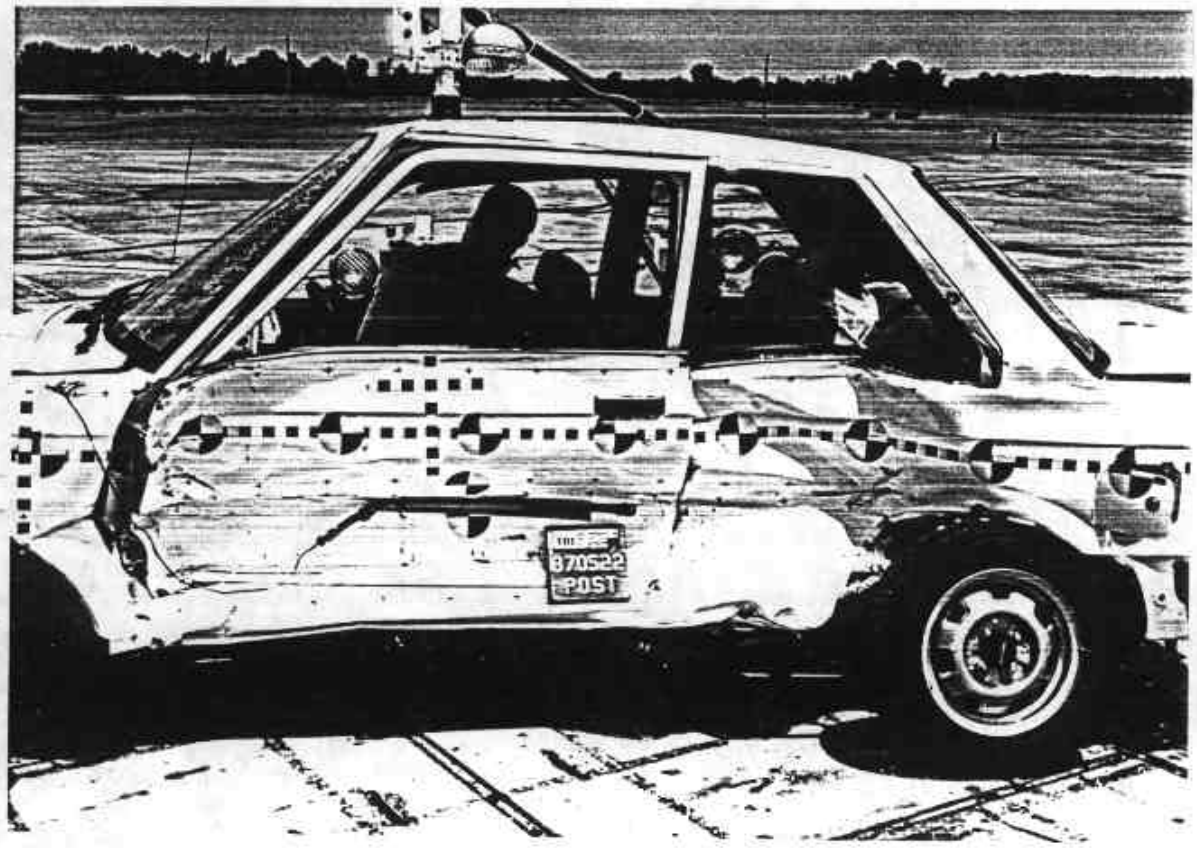


Figure A-16. POST-TEST VEHICLE DAMAGE VIEW

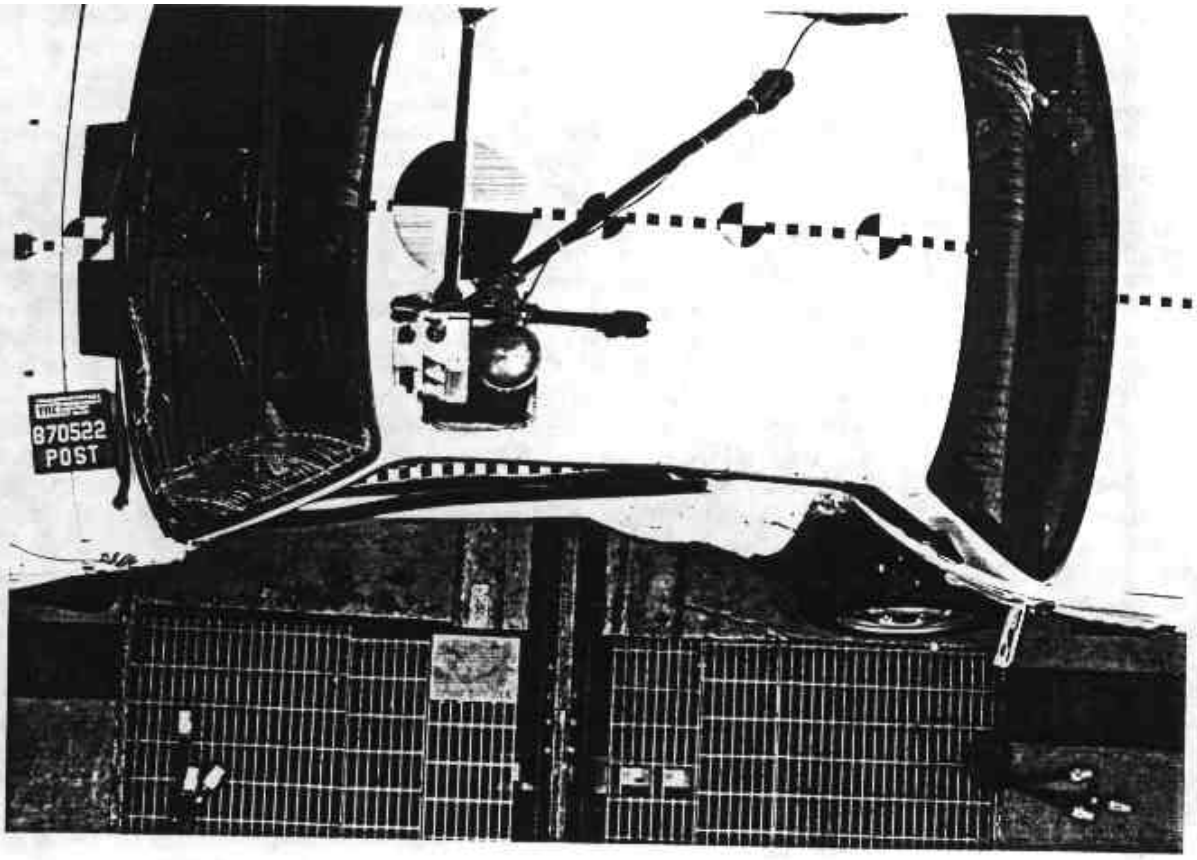


Figure A-17. POST-TEST OVERHEAD VIEW

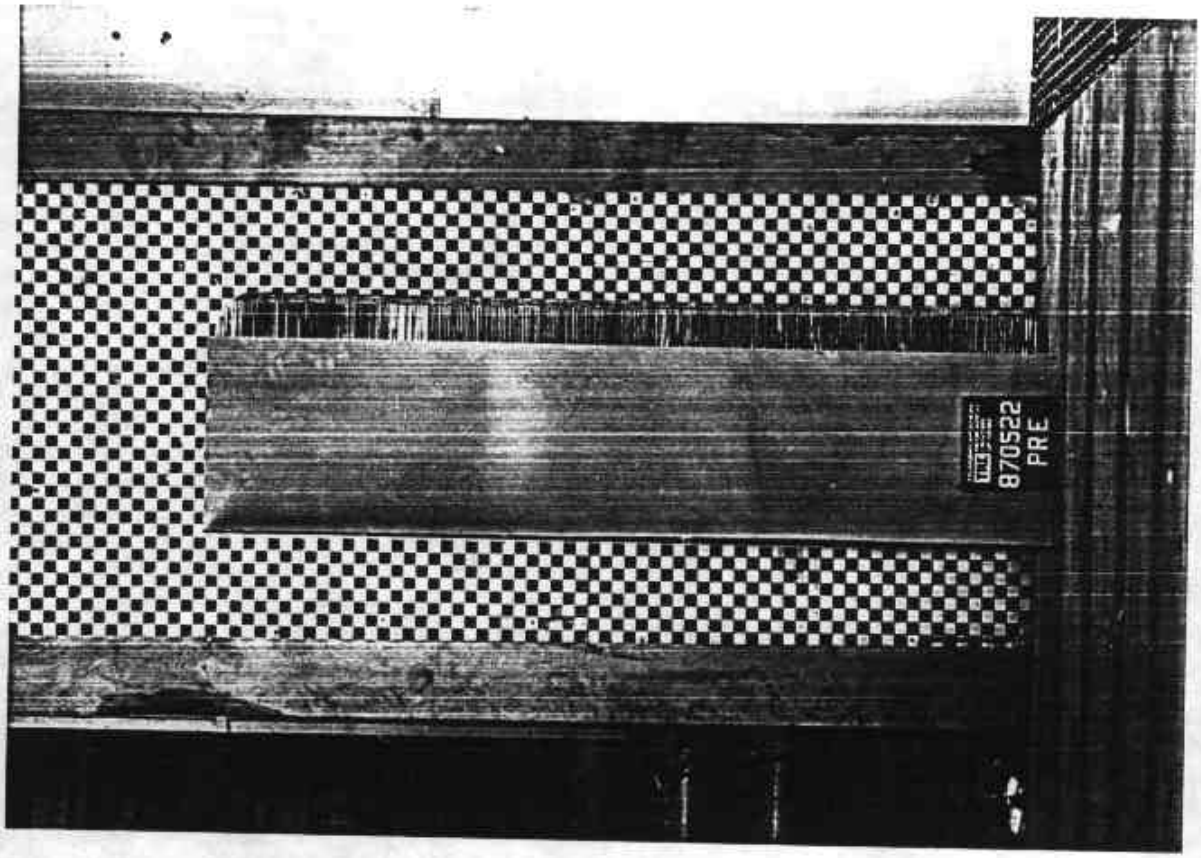


Figure A-18. PRE-TEST MDB FACE - VIEW 1

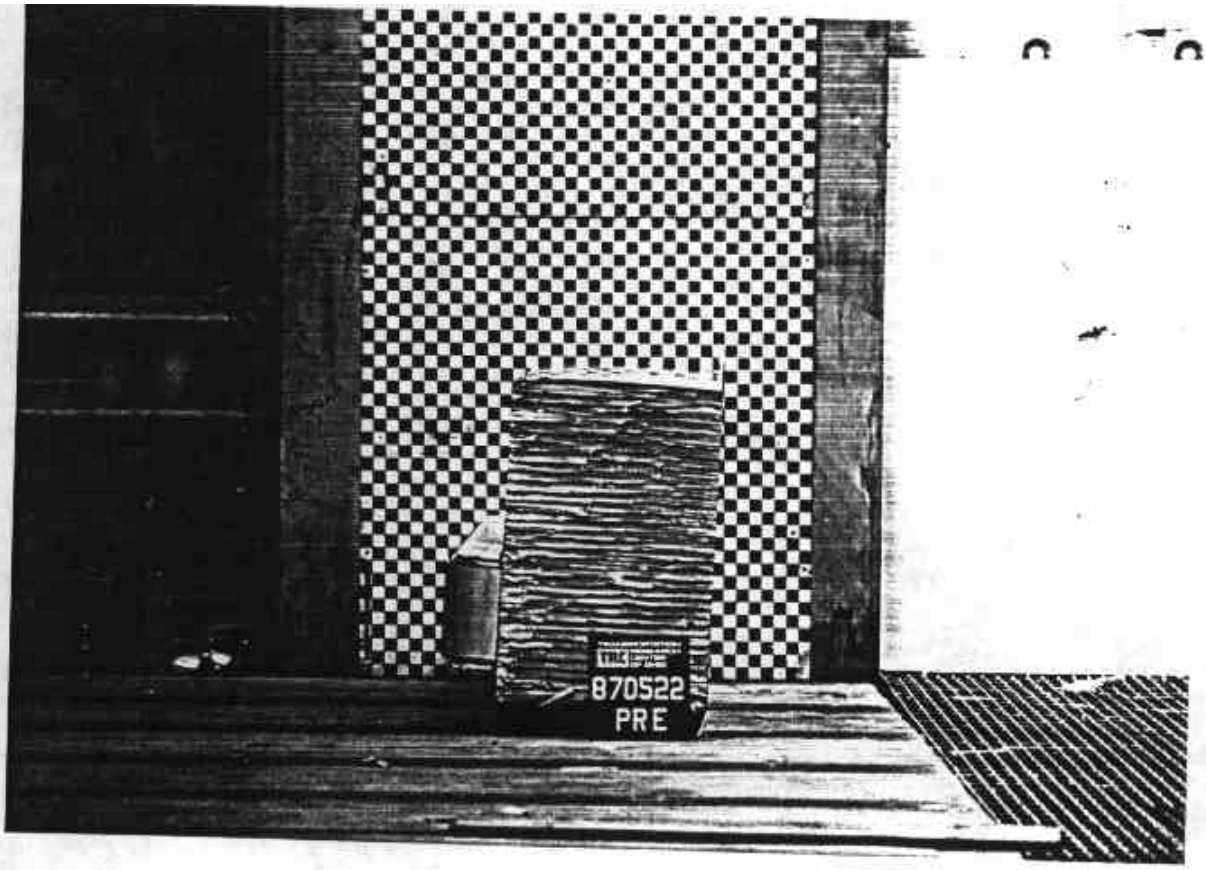


Figure A-19. PRE-TEST MDB FACE - VIEW 2

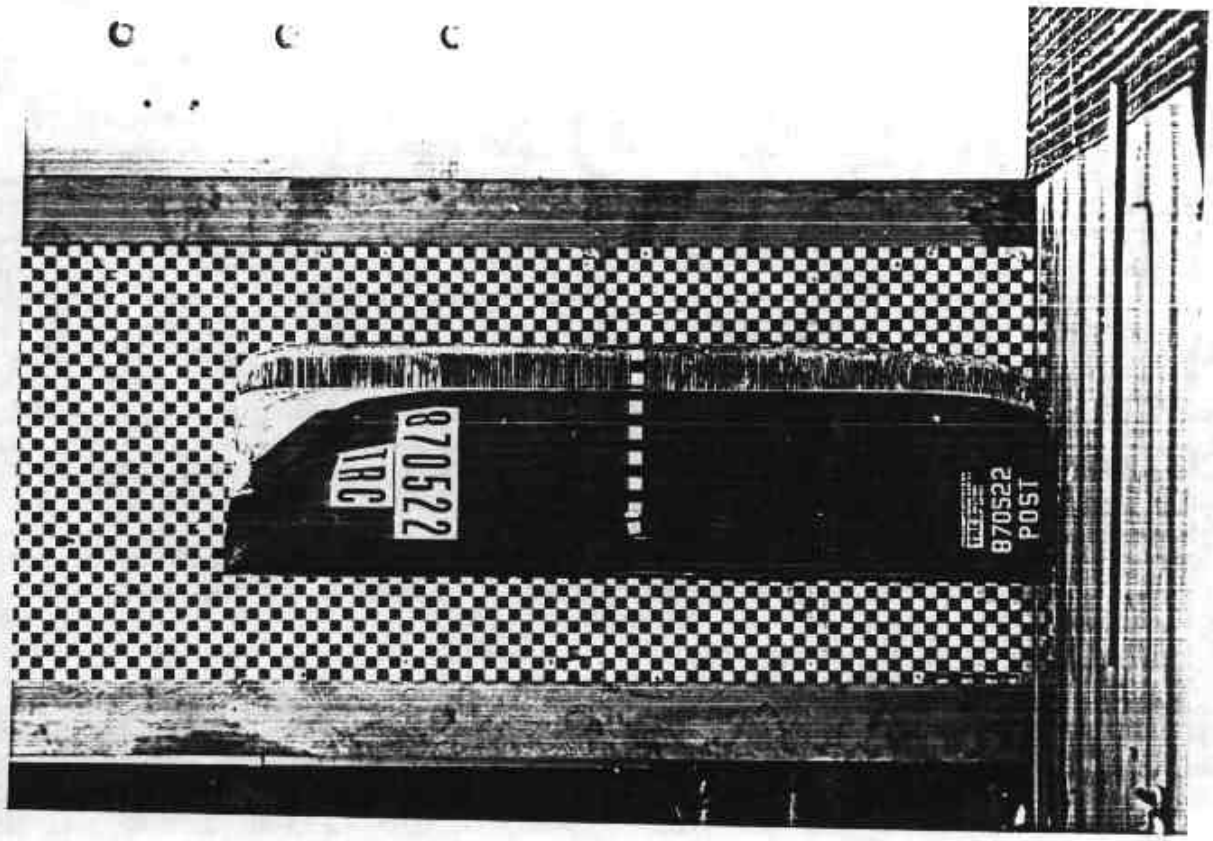


Figure A-20. POST-TEST MDB FACE - VIEW 1

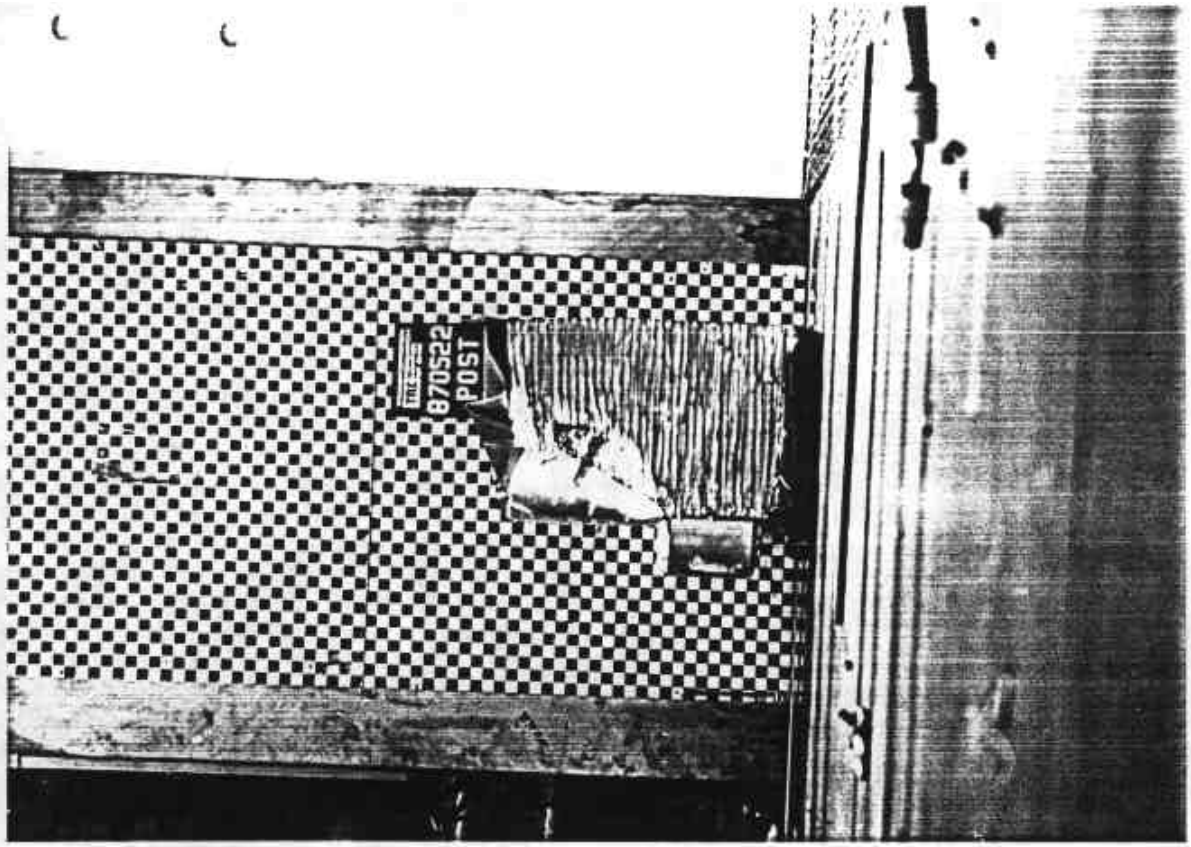


Figure A-21. POST-TEST MDB FACE - VIEW 2

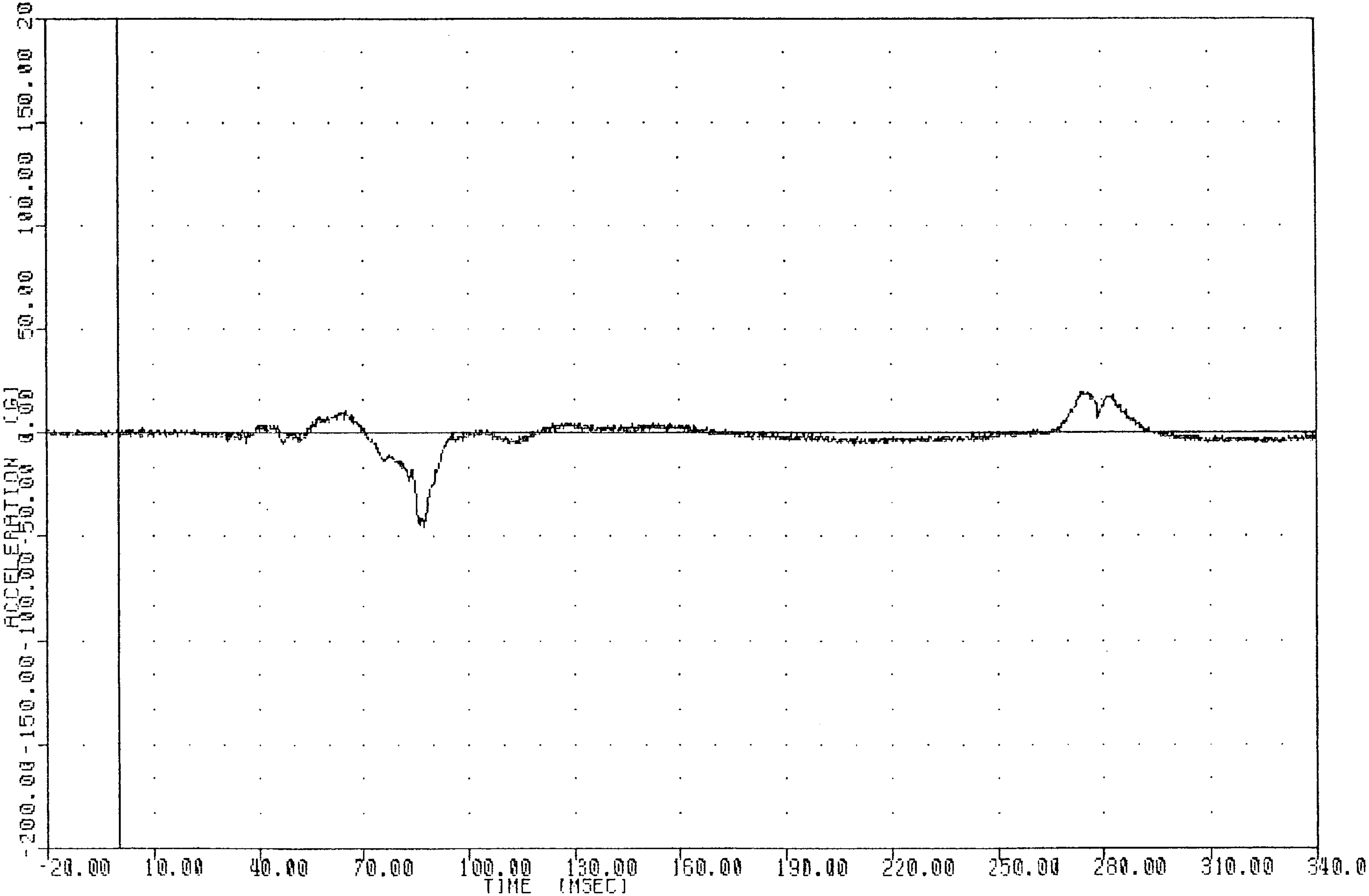
APPENDIX B

DATA PLOT PRESENTATION

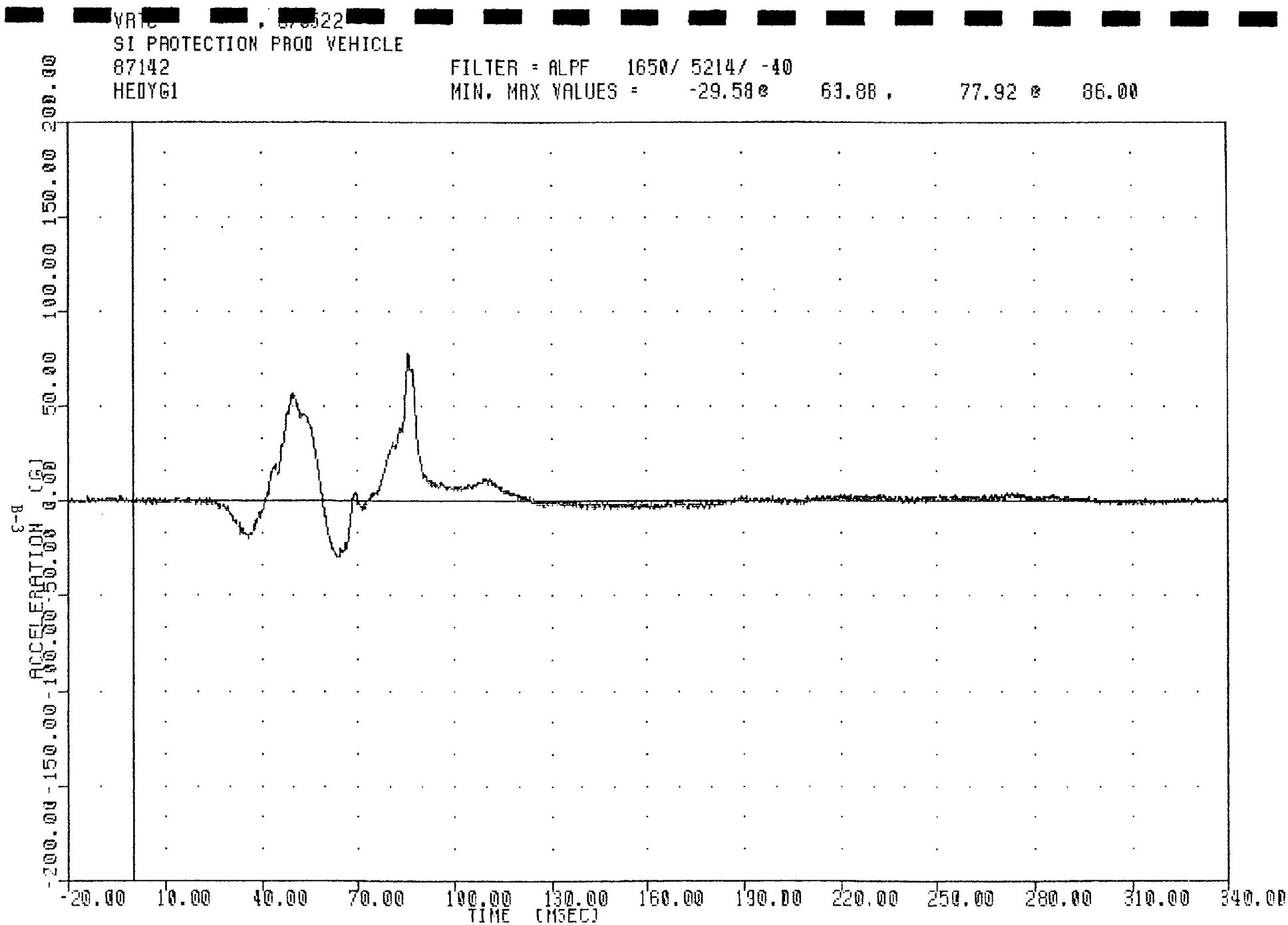
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211b, except that dummy thorax and pelvis data were filtered using the HSRI filter.

VRT[redacted], [redacted]522
SI PROTECTION PROD VEHICLE
87142
HEDXG1

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -45.28 @ 87.25 , 19.16 @ 274.13



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER HEAD ACCELERATION X AXIS



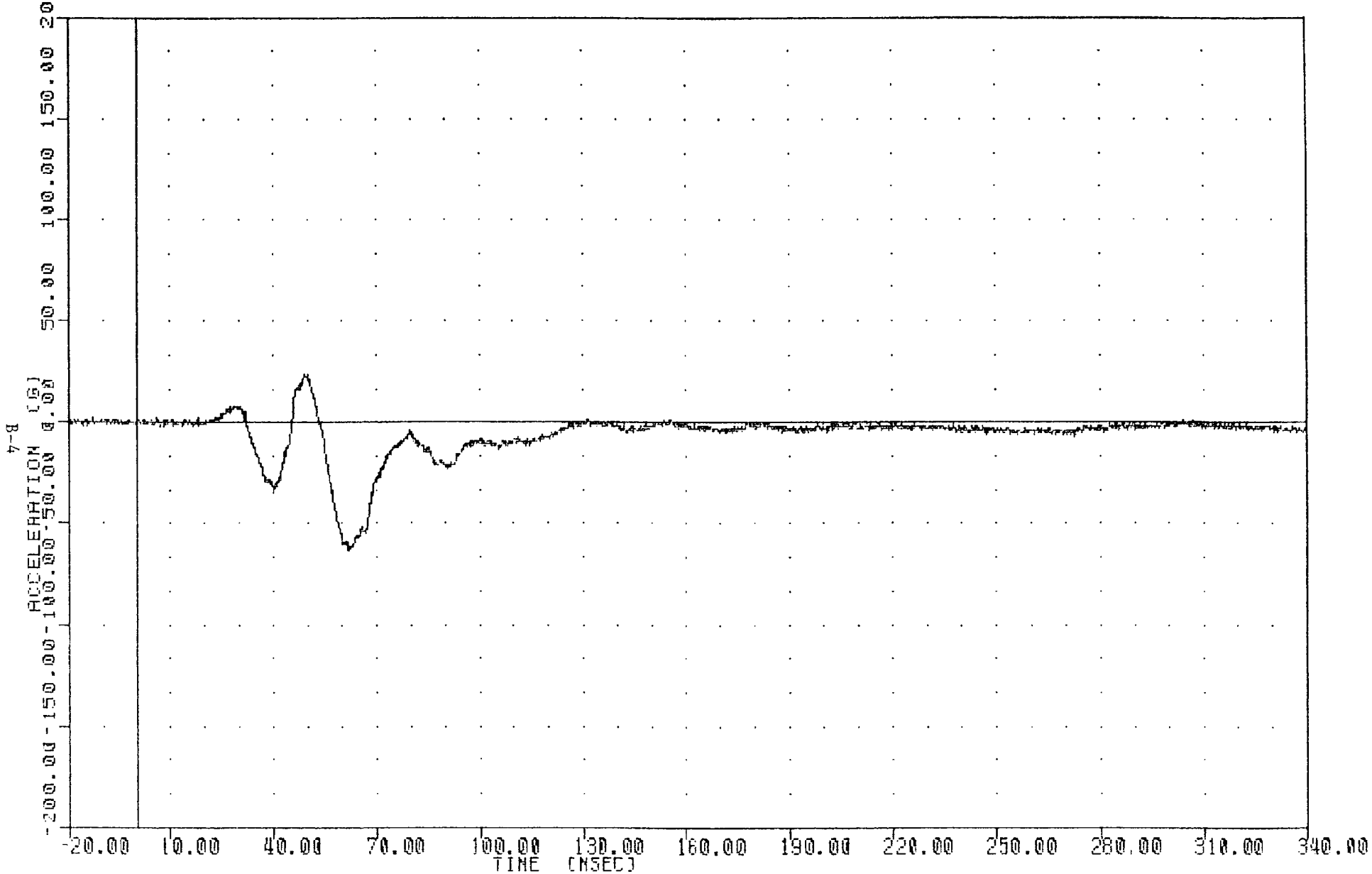
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER HEAD ACCELERATION Y AXIS

[redacted] VATC [redacted] , 87[redacted]22 [redacted]

SI PROTECTION PROD VEHICLE

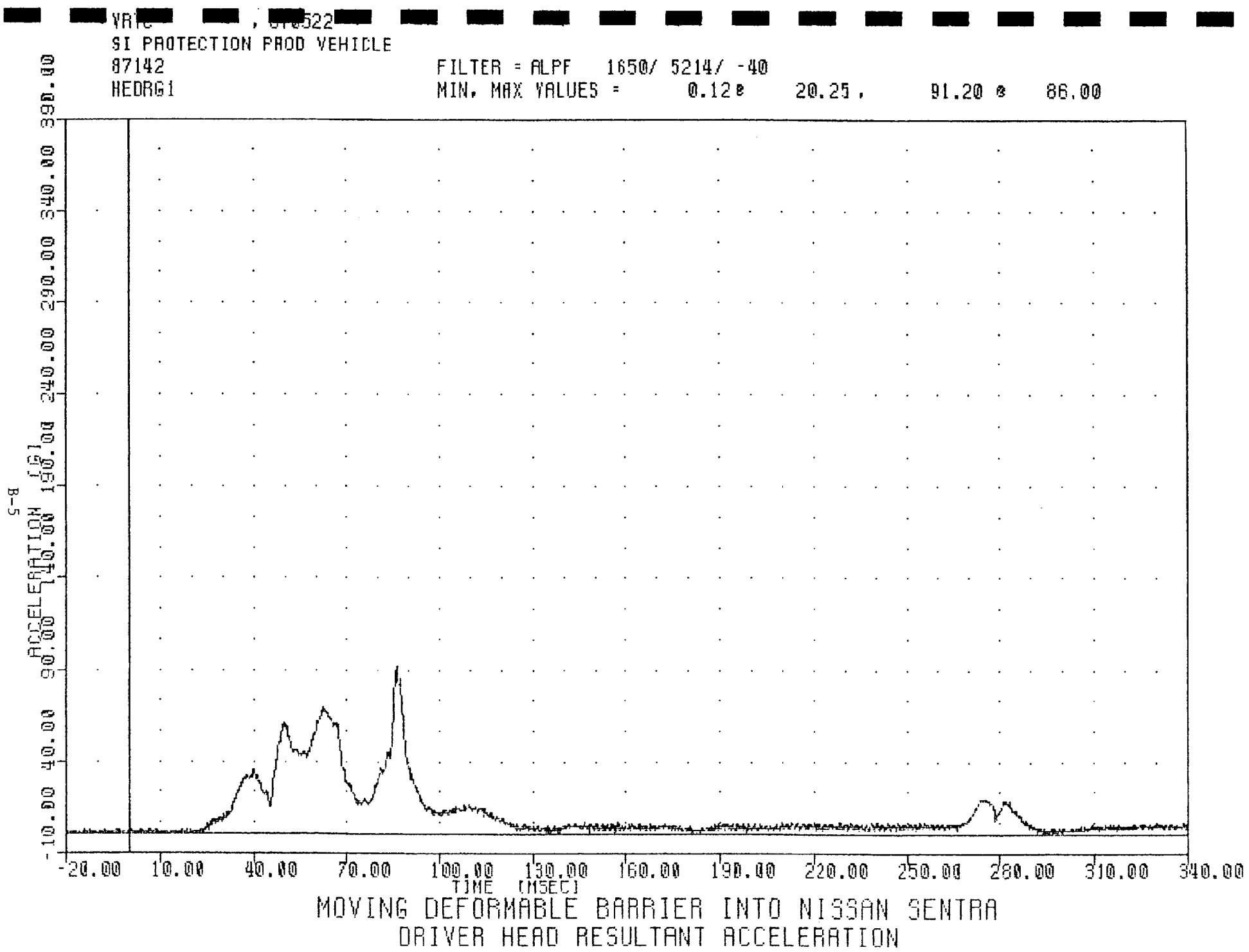
87142 FILTER = ALPF 1650/ 5214/ -40

HEDZ61 MIN, MAX VALUES = -63.14 @ 62.38 , 23.82 @ 49.00

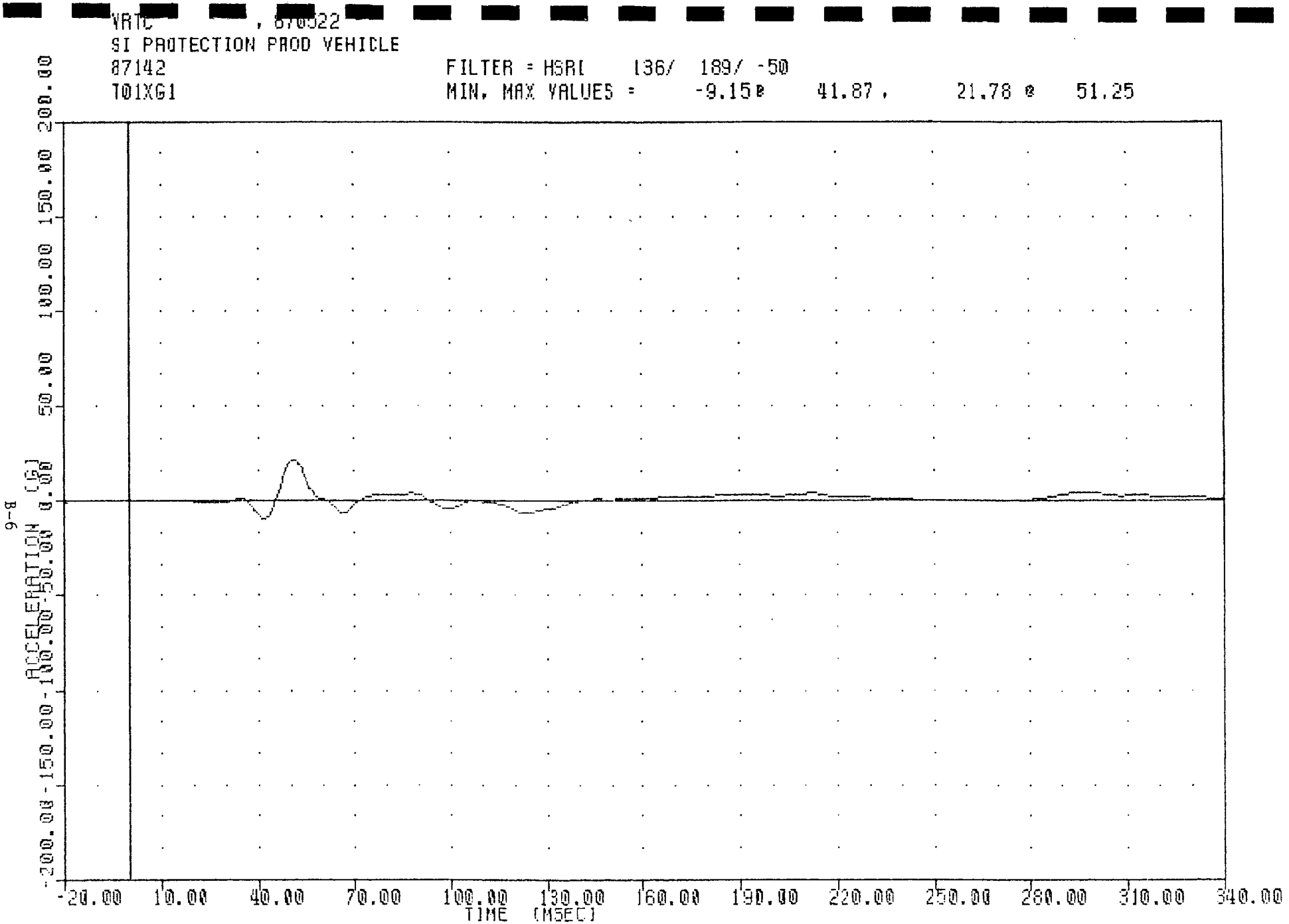


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

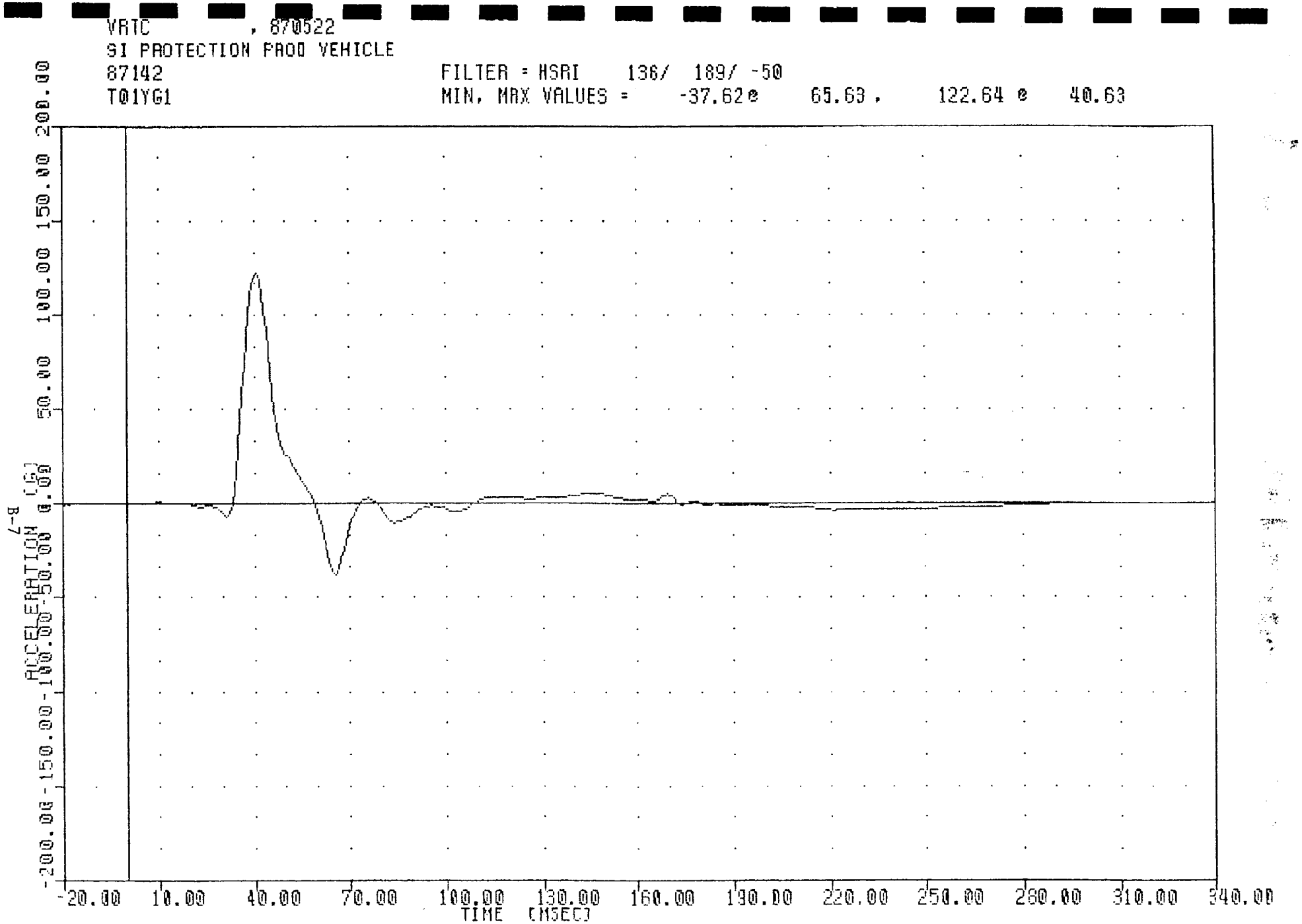
DRIVER HEAD ACCELERATION Z AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER HEAD RESULTANT ACCELERATION



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER UPPER SPINE ACCELERATION X AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER UPPER SPINE ACCELERATION Y AXIS

[redacted] VATC [redacted], 87022

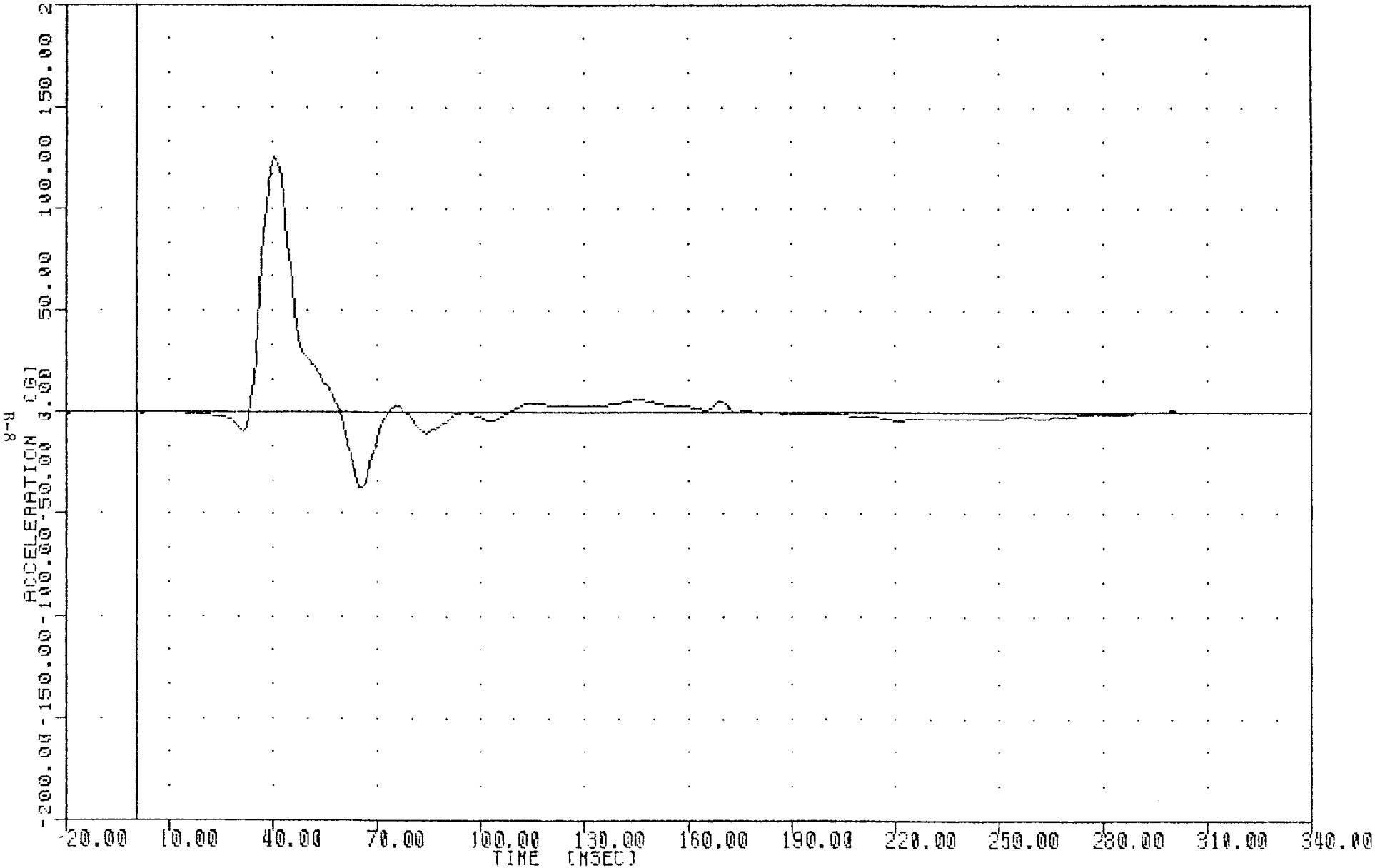
SI PROTECTION PROD VEHICLE

87142

T01Y6A

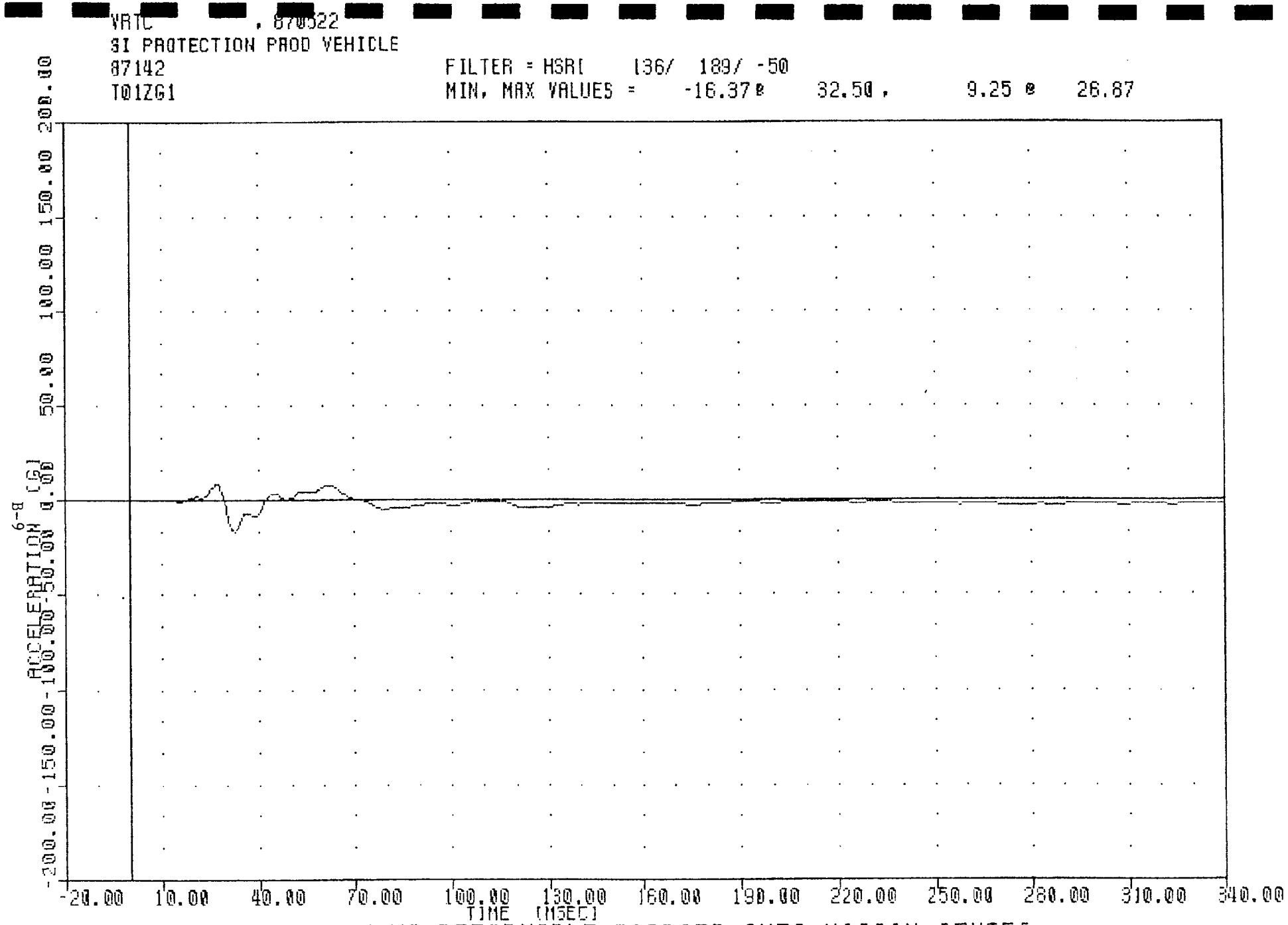
FILTER = HSRI 136/ 189/ -50

MIN, MAX VALUES = -37.20 @ 65.63 , 124.95 @ 40.63

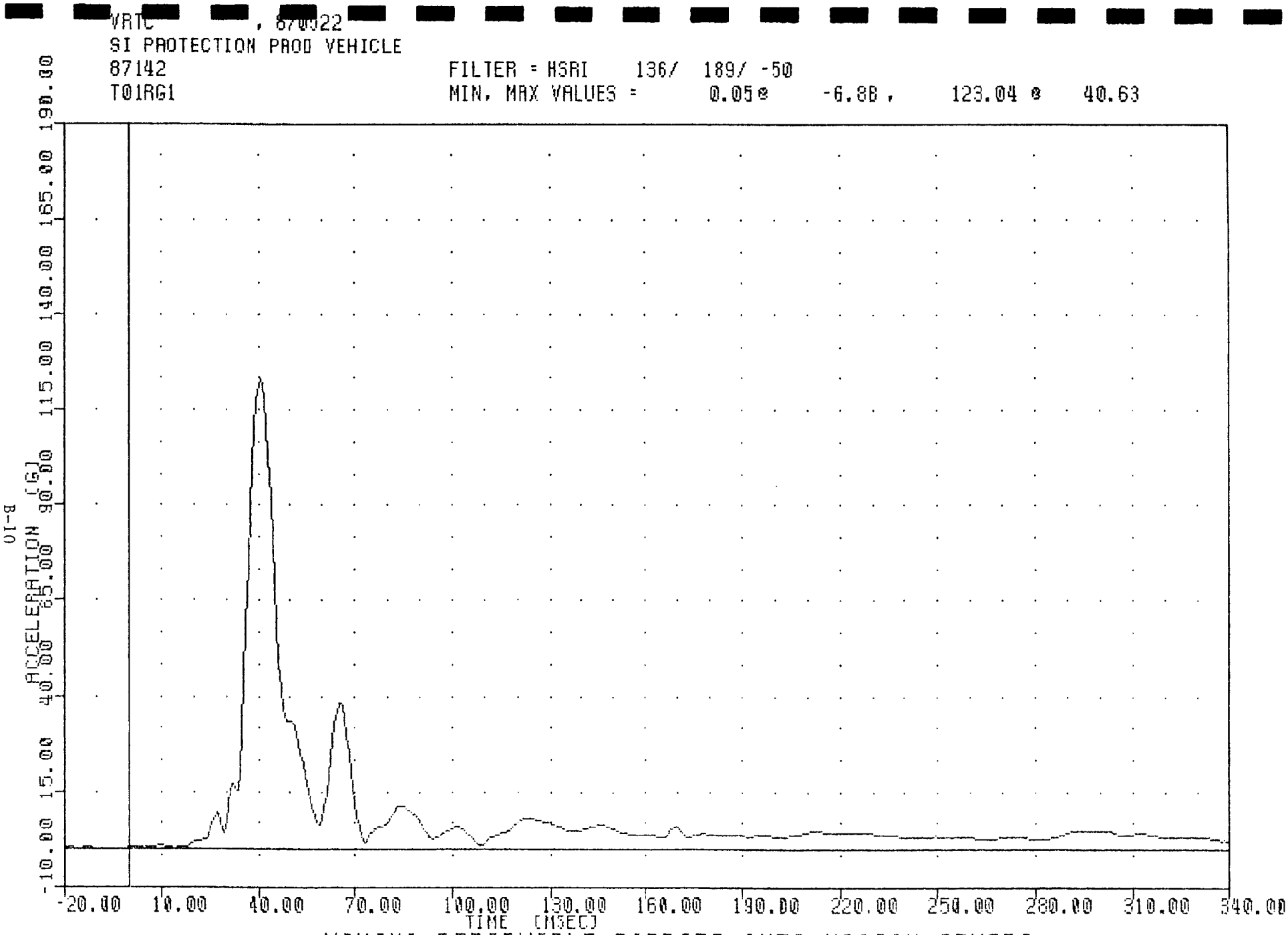


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

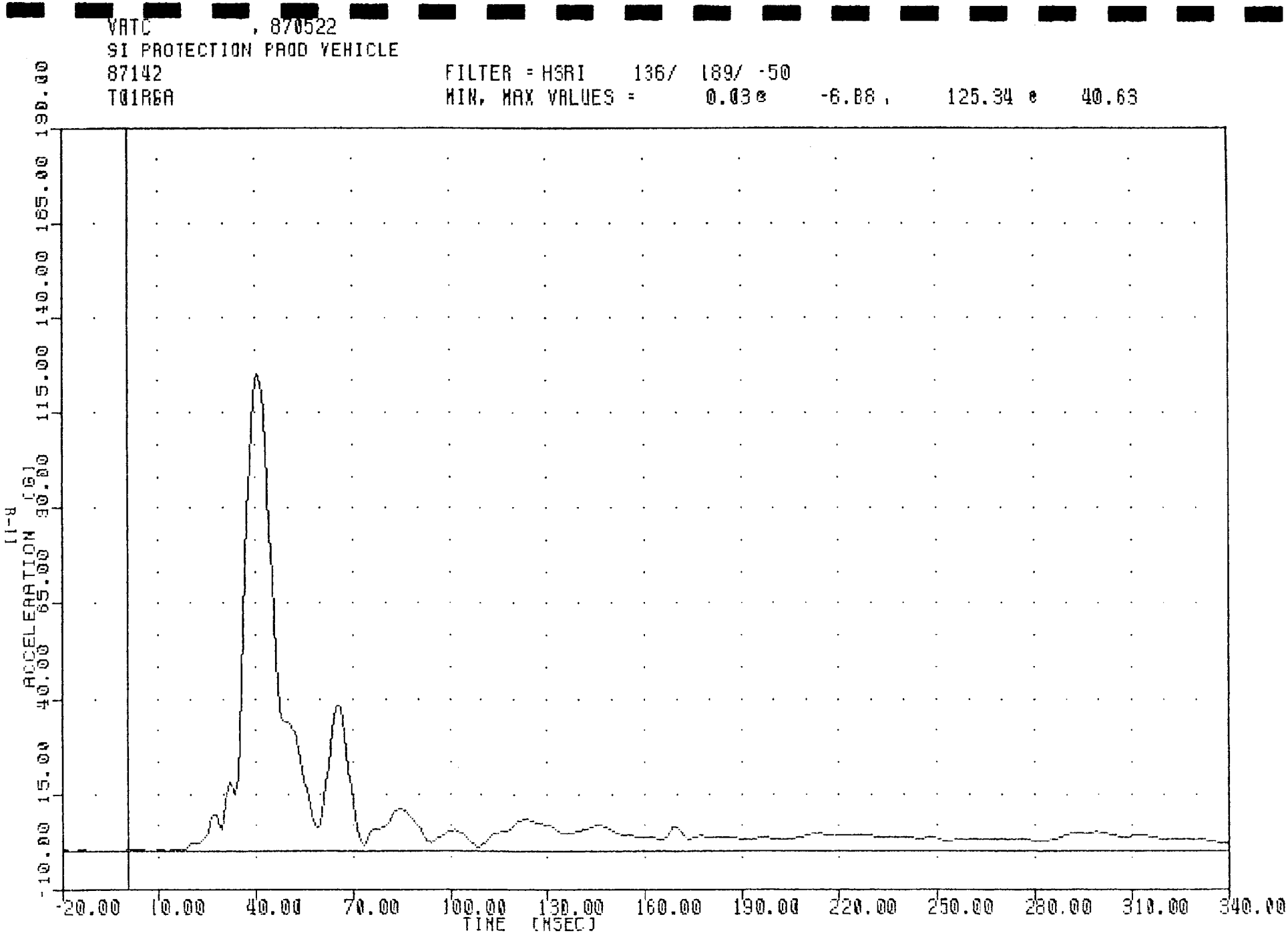
DRIVER UPPER SPINE ACCELERATION -2 Y AXIS



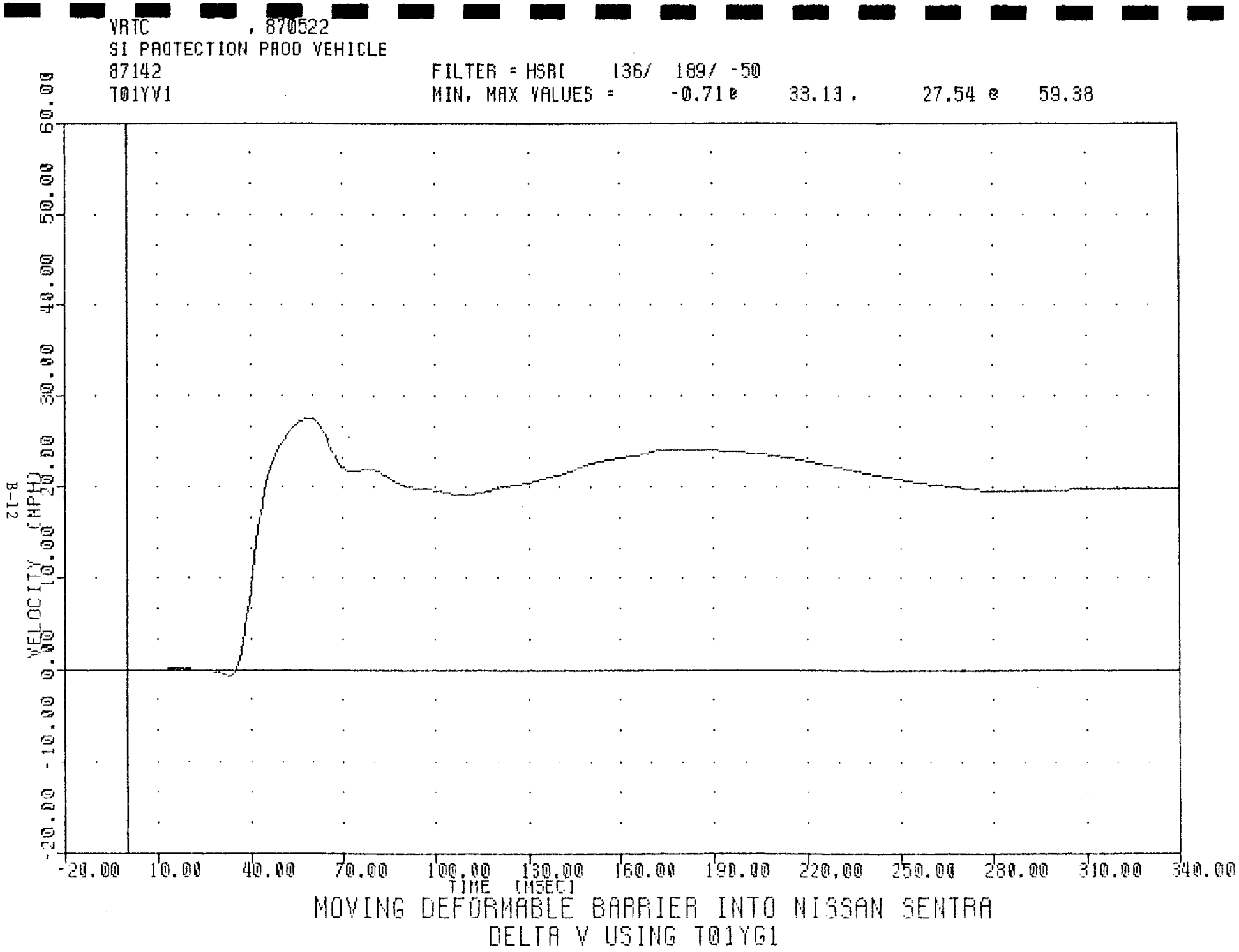
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER UPPER SPINE ACCELERATION Z AXIS



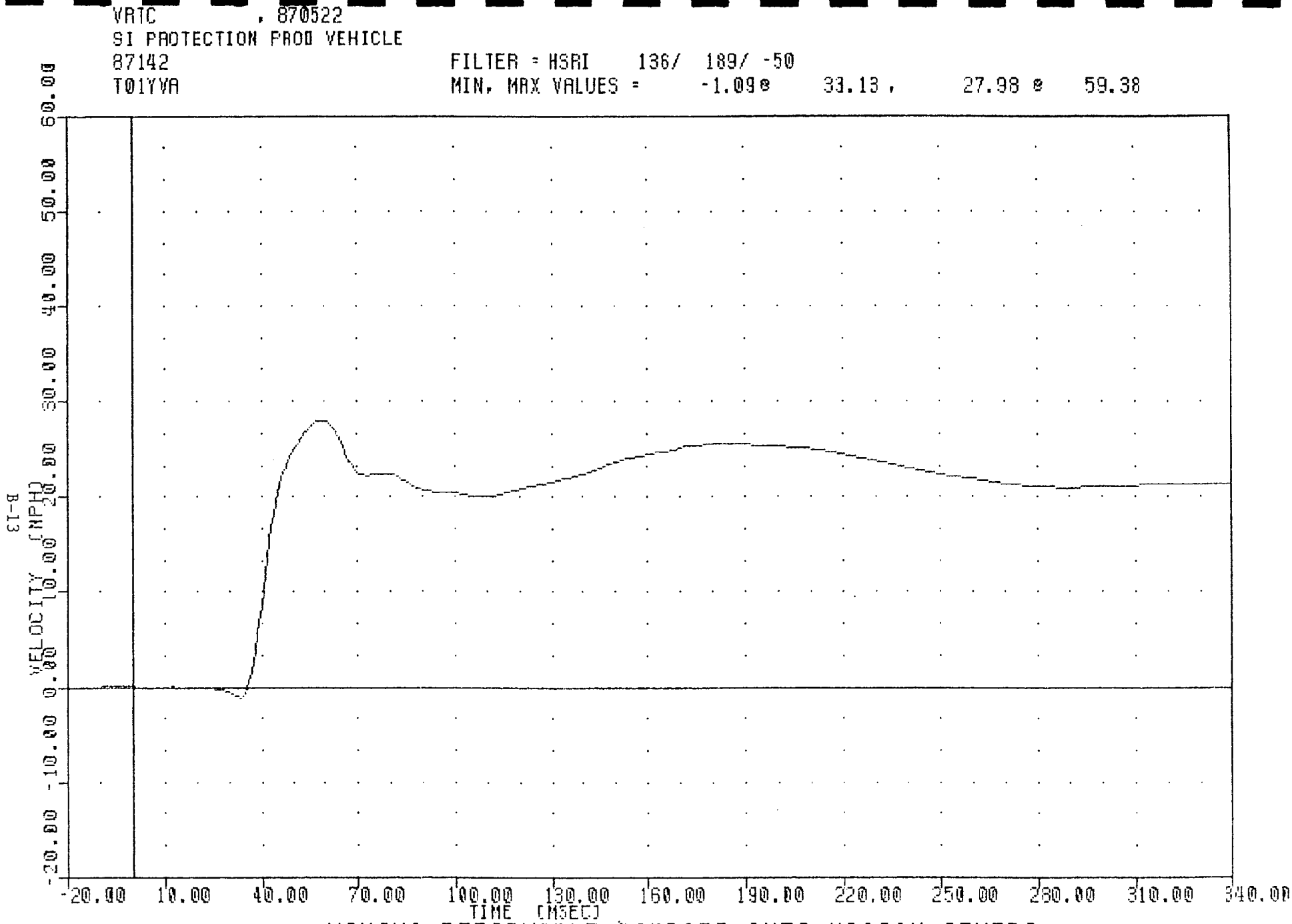
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER UPPER SPINE RESULTANT ACCELERATION



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER UPPER SPINE RESULTANT ACCELERATION USING T01YGA

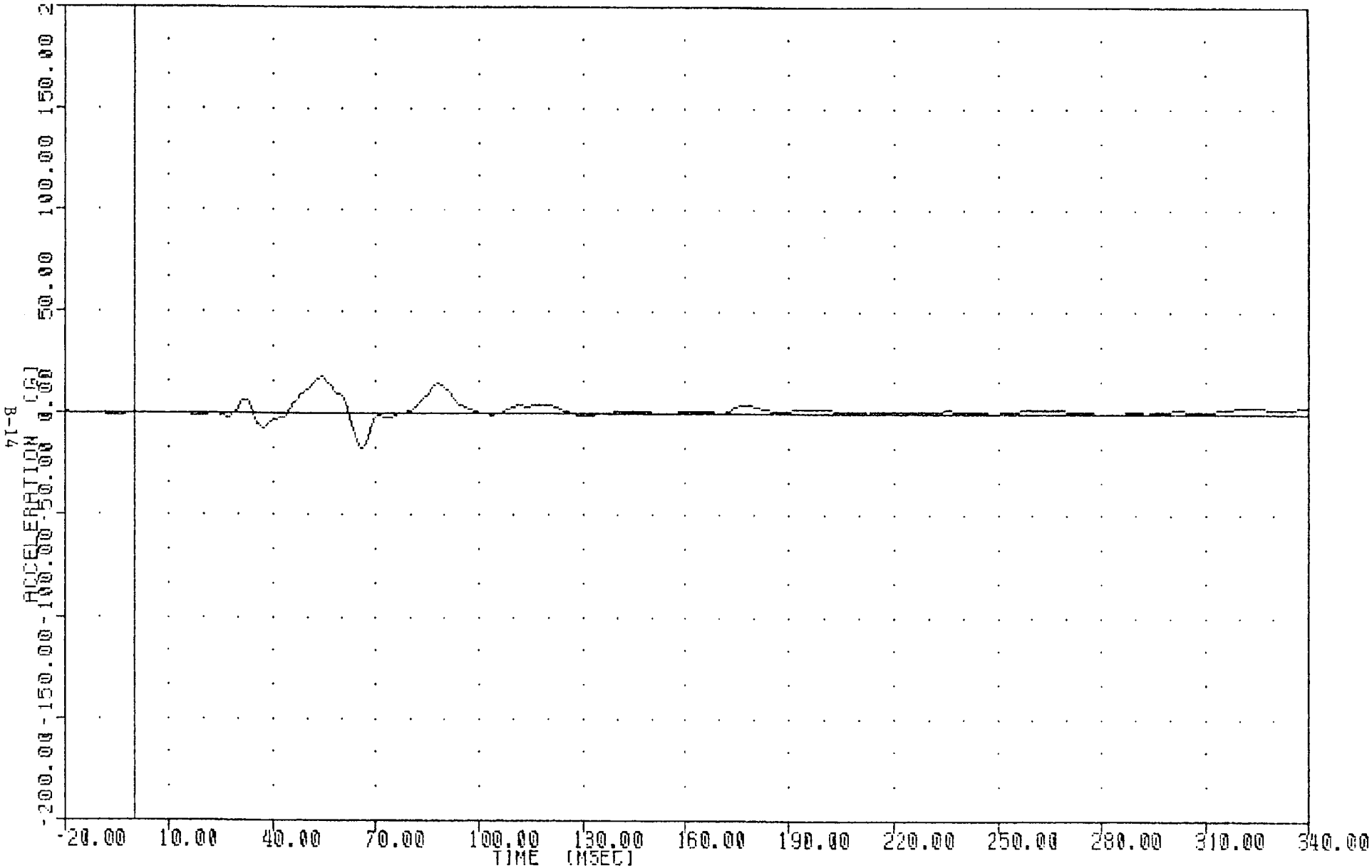


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING T01YG1

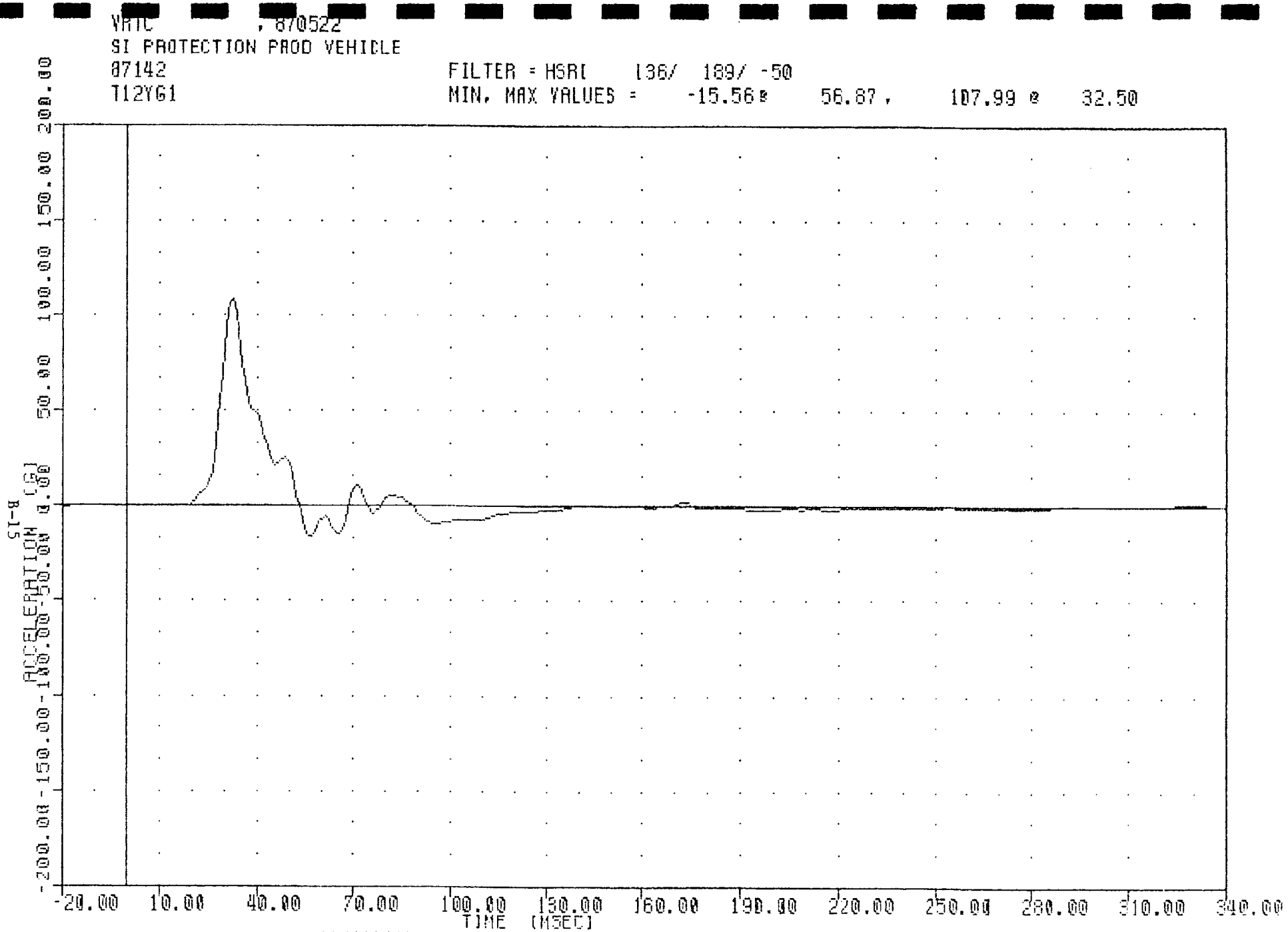


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING T01YGA

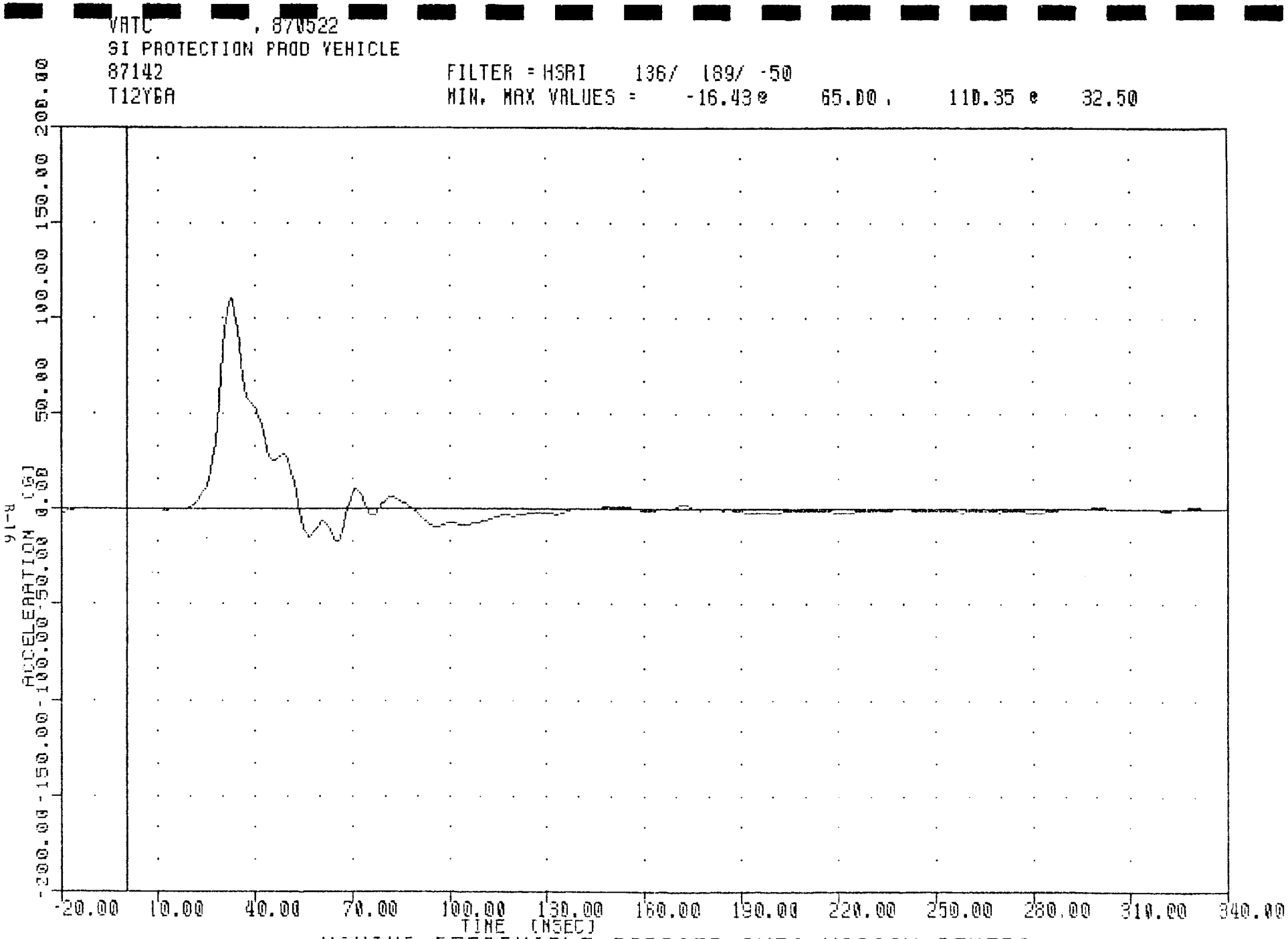
[redacted] VRTC [redacted] , 870522
SI PROTECTION PROD VEHICLE
87142
T12XG1
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -17.11 @ 65.63 , 17.95 @ 54.38



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LOWER SPINE ACCELERATION X AXIS

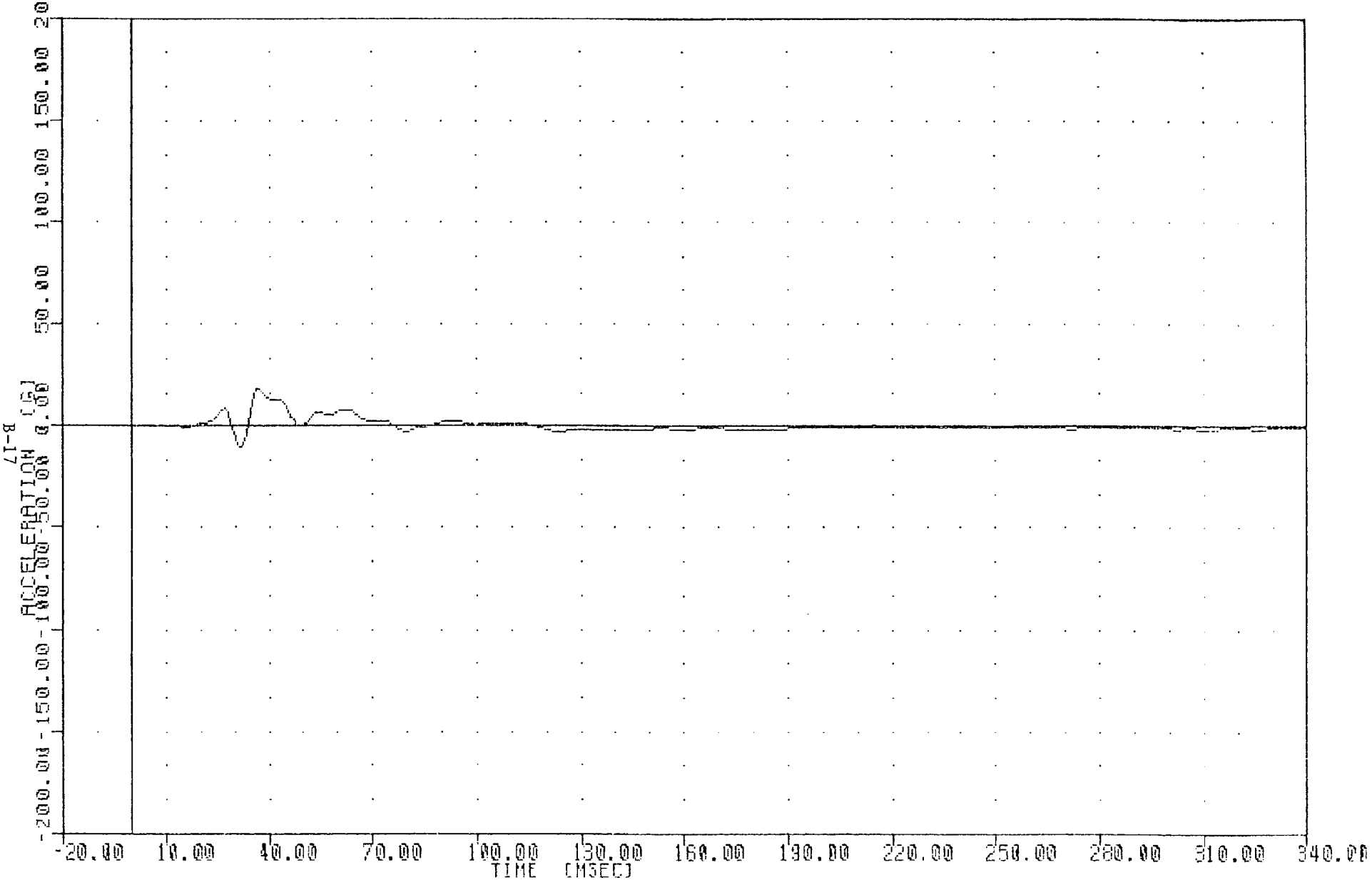


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LOWER SPINE ACCELERATION Y AXIS



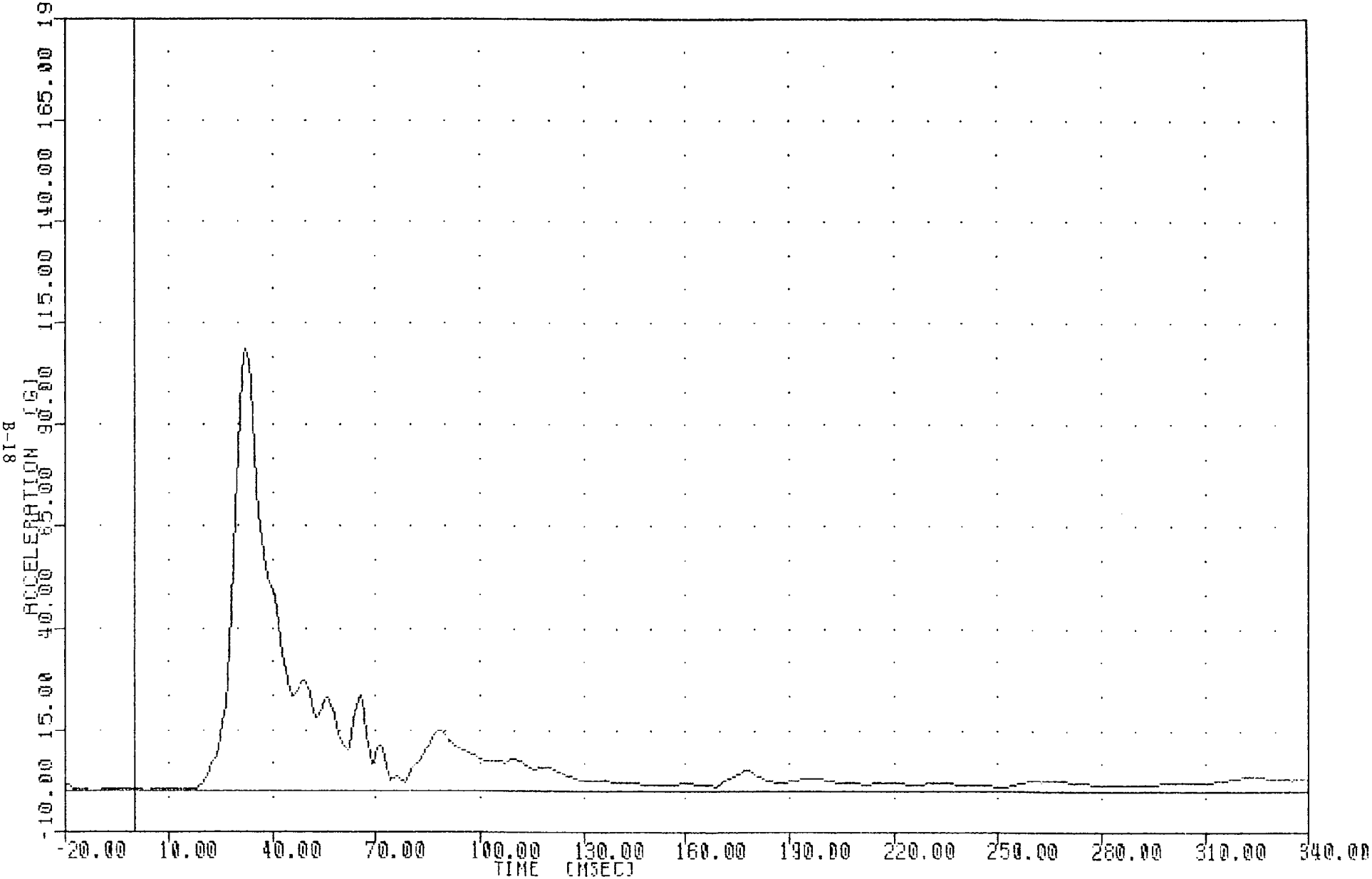
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LOWER SPINE ACCELERATION -2 Y AXIS

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = NSAI 136/ 189/ -50
T12ZG1 MIN, MAX VALUES = -10.59 @ 31.25 , 18.32 @ 36.88

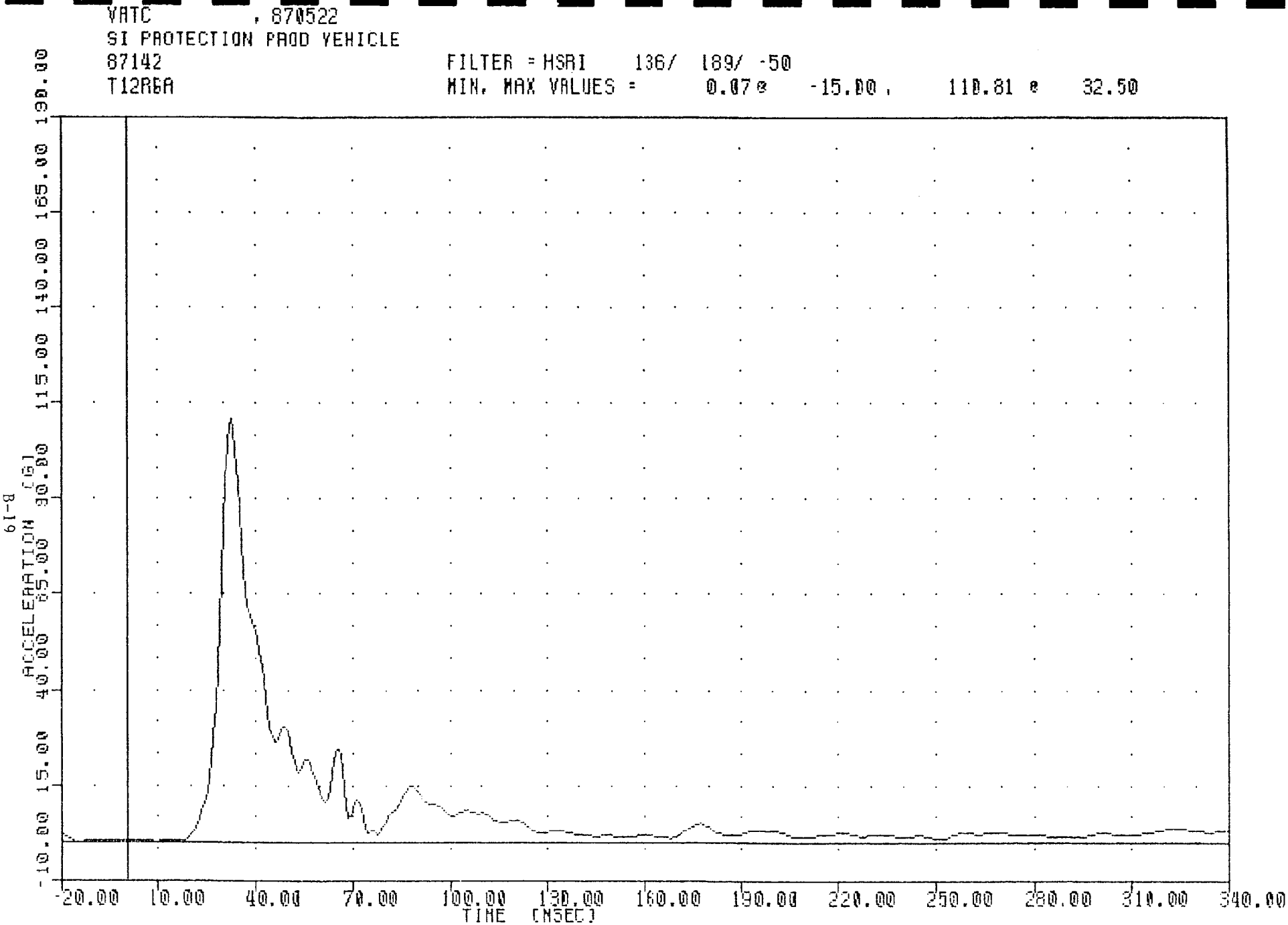


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LOWER SPINE ACCELERATION Z AXIS

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = HSRI 136/ 189/ -50
T12RG1 MIN, MAX VALUES = 0.09 @ -11.25 , 108.46 @ 32.50



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LOWER SPINE RESULTANT ACCELERATION



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LOWER SPINE RESULTANT ACCELERATION USING T12Y6A

[redacted] 052 [redacted]

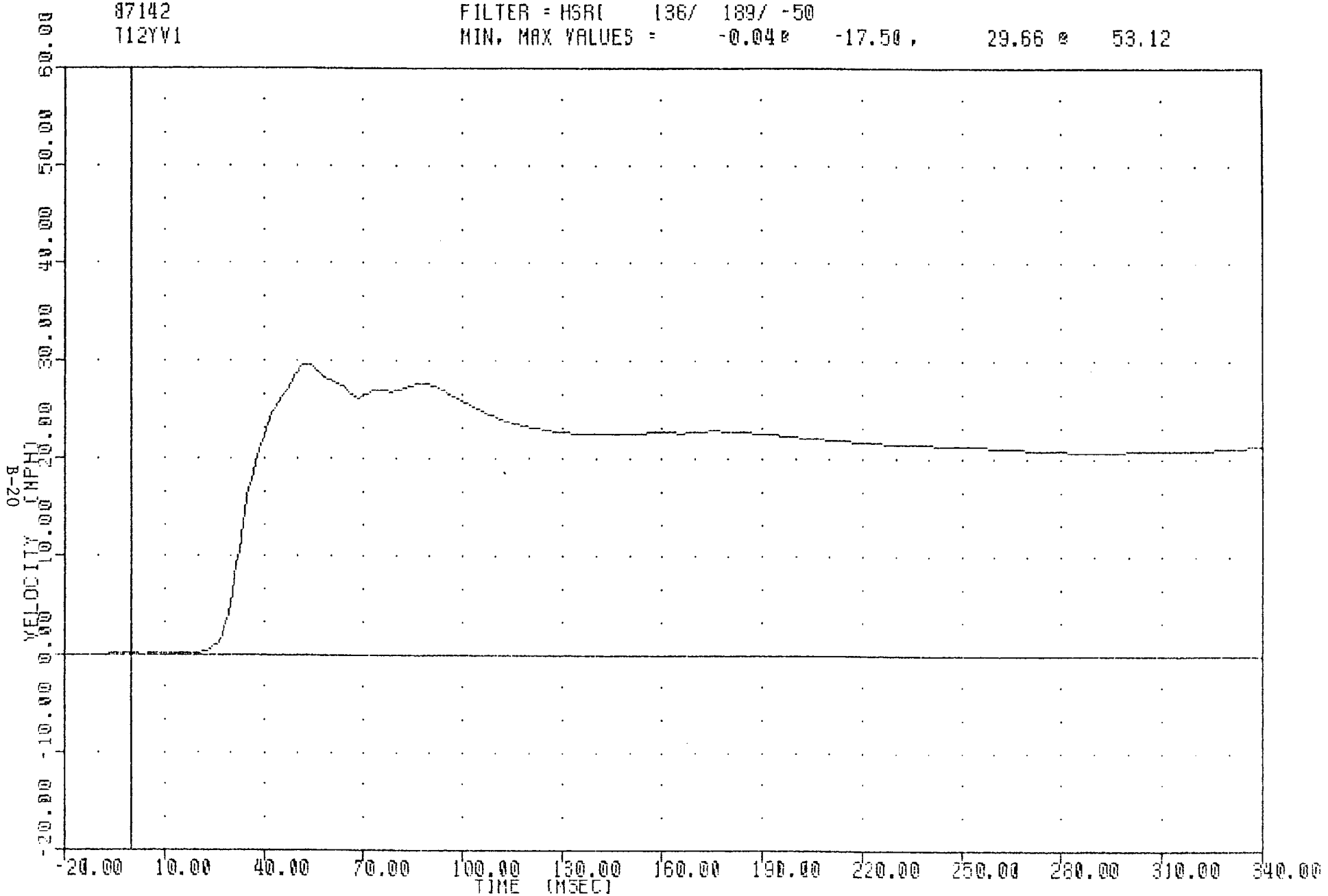
SI PROTECTION PROD VEHICLE

87142

T12YV1

FILTER = HSRI 136/ 189/ -50

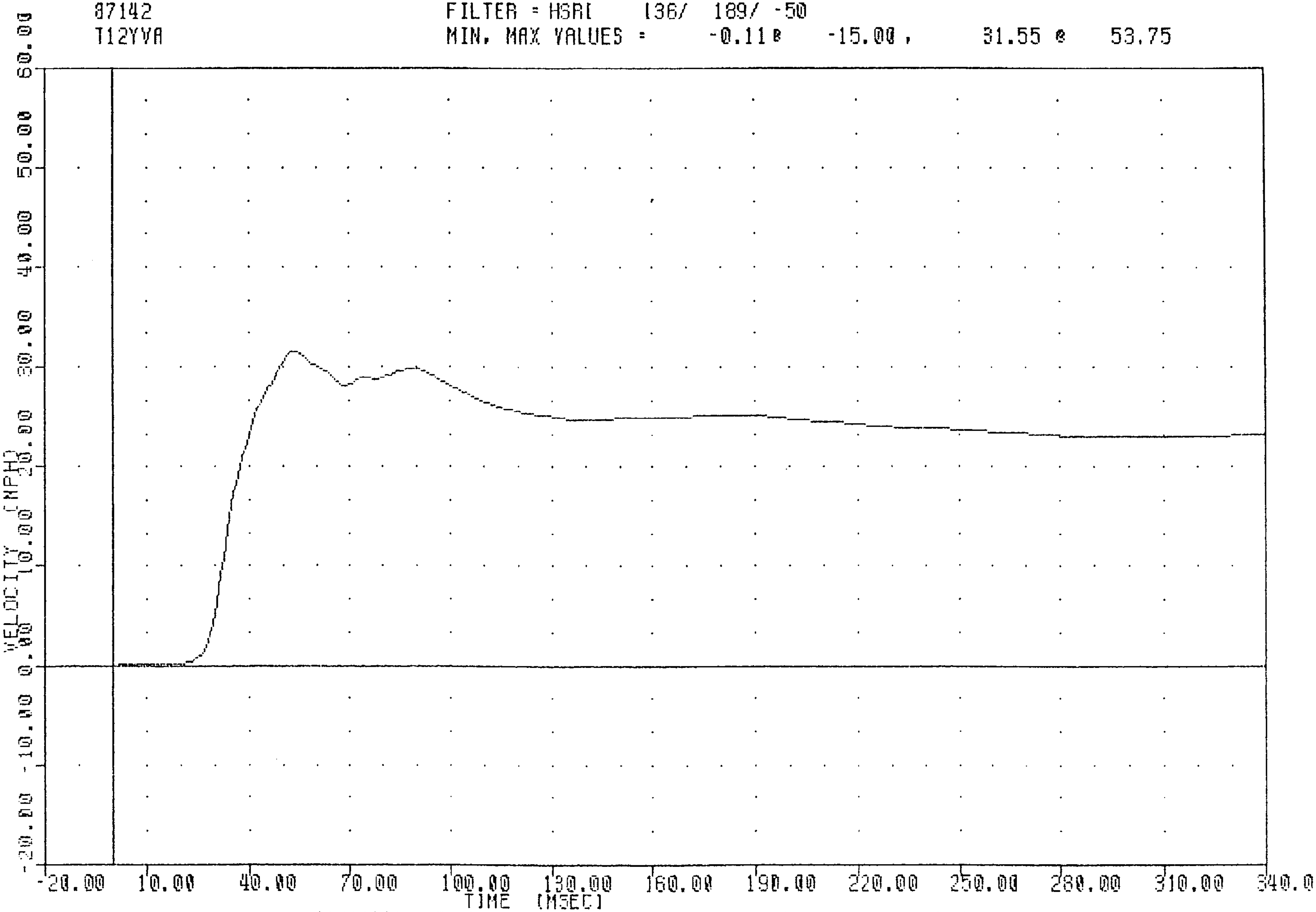
MIN, MAX VALUES = -0.04 @ -17.50 , 29.66 @ 53.12



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

DELTA V USING T12YG1

VR[redacted] , [redacted]22
SI PROTECTION PROD VEHICLE
87142 FILTER = HSRI 136/ 189/ -50
T12YVA MIN, MAX VALUES = -0.11 @ -15.00 , 31.55 @ 53.75



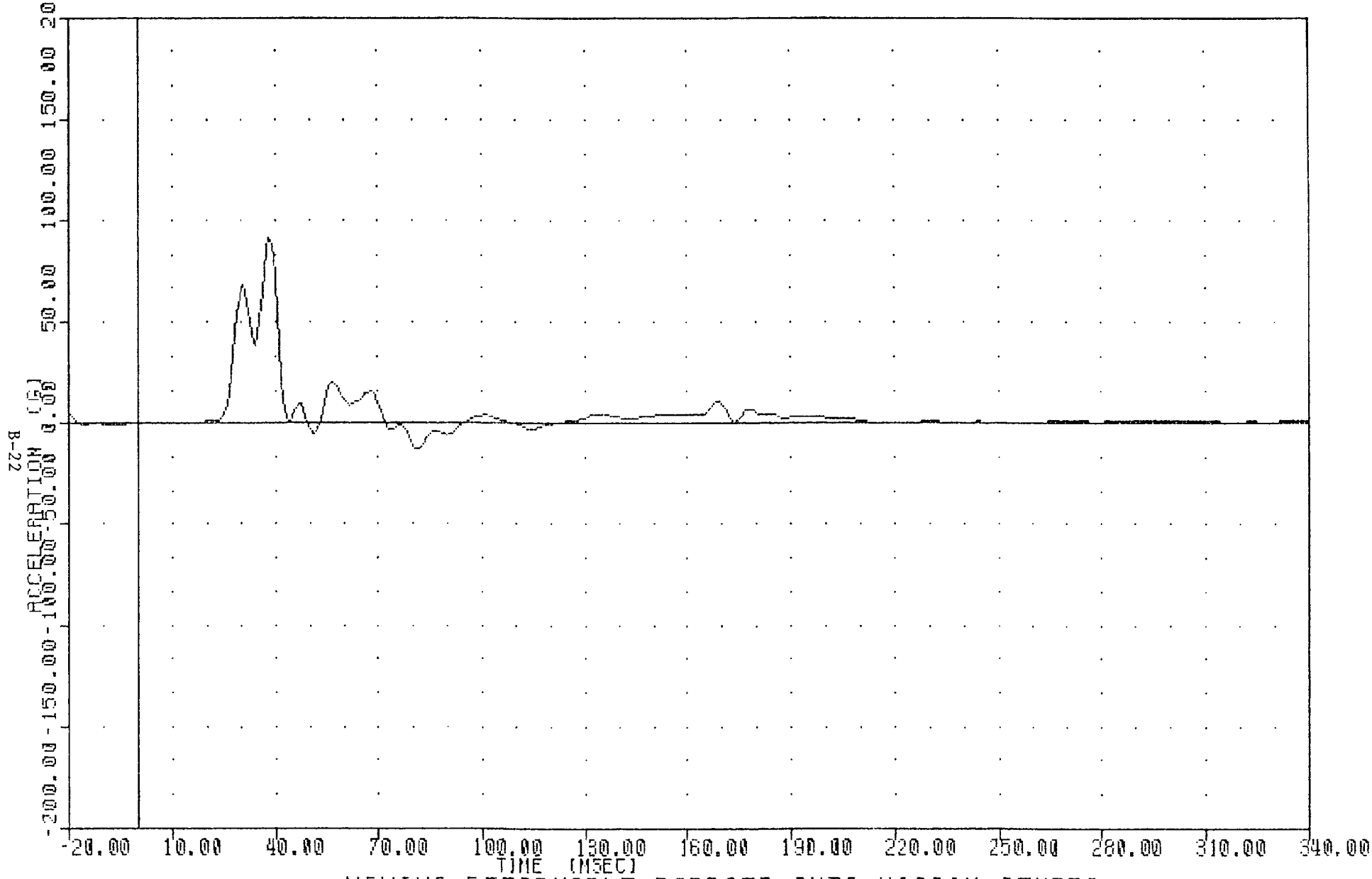
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING T12YGA

[redacted]VRT[redacted] [redacted], [redacted]22[redacted]

SI PROTECTION PROD VEHICLE

97142 FILTER = HSRI 136/ 189/ -50

LURYG1 MIN, MAX VALUES = -12.92 @ 81.25 , 91.19 @ 38.13



B-22

MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

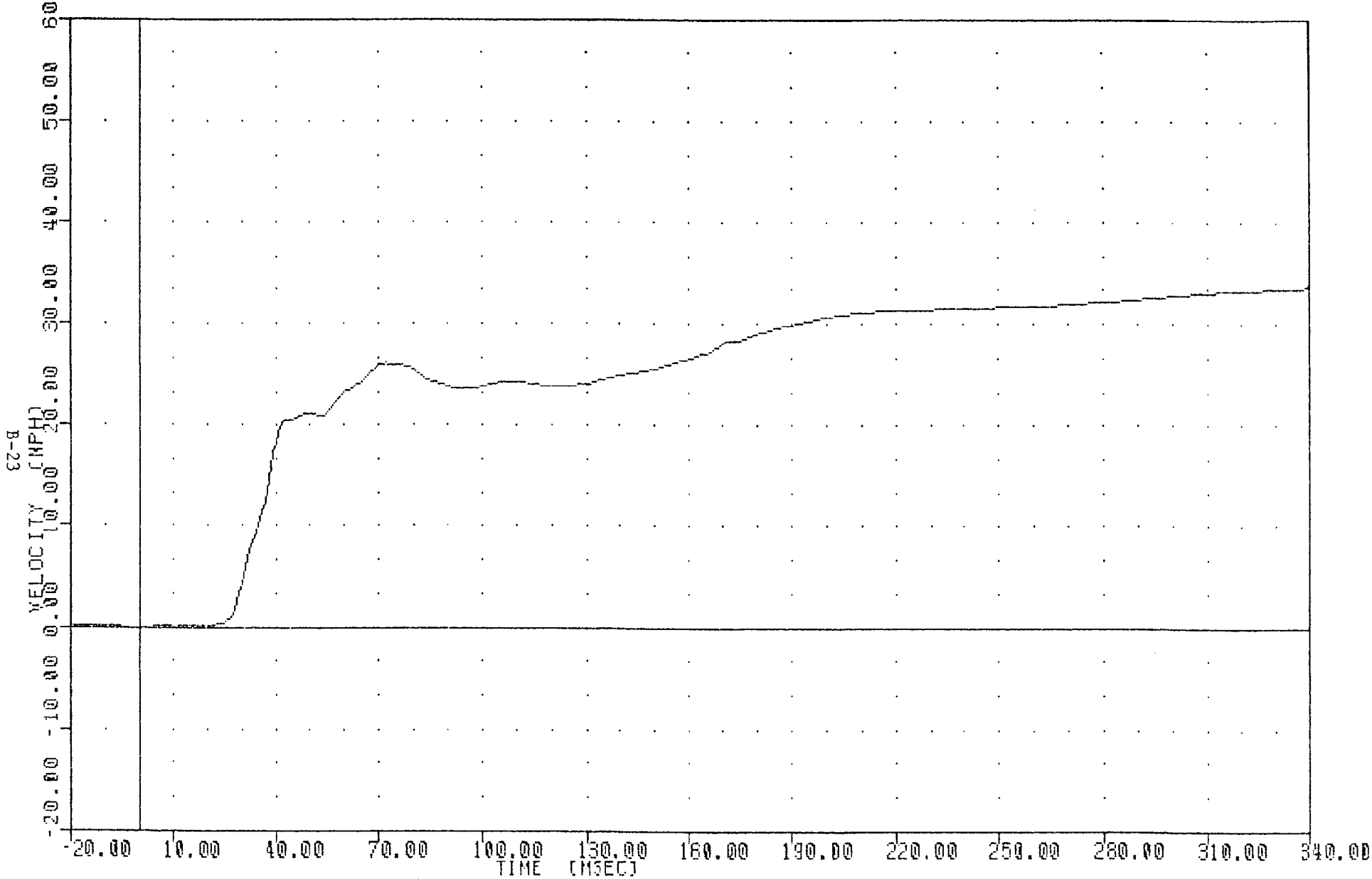
DRIVER LEFT UPPER RIB ACCELERATION Y AXIS

[redacted]VRT[redacted], [redacted]22[redacted]

SI PROTECTION PROD VEHICLE

87142 FILTER = HSRI 136/ 189/ -50

LURYV1 MIN, MAX VALUES = -0.01 @ 0.00 , 33.55 @ 340.00

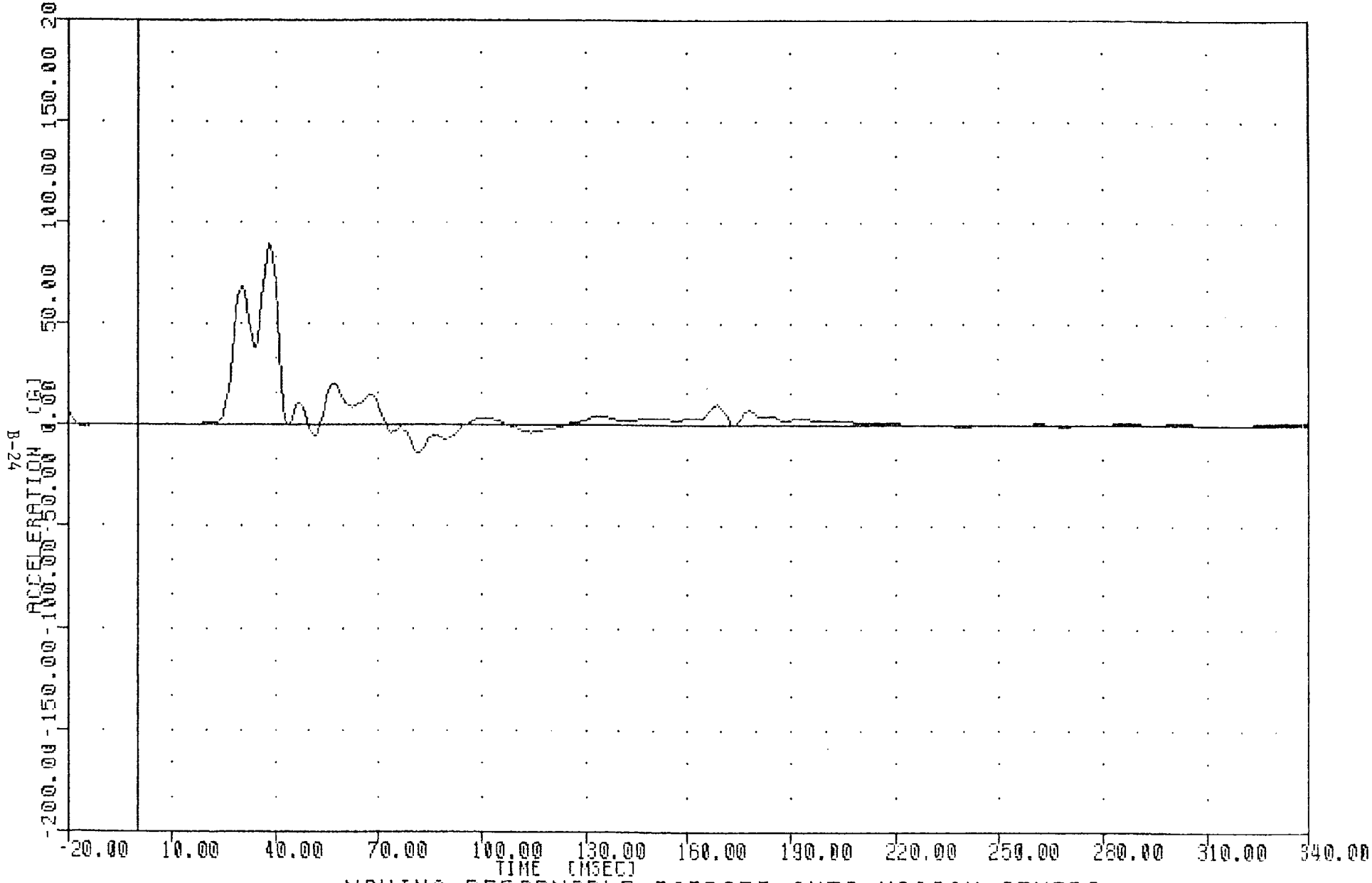


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LURYG1

[redacted] VR[redacted] [redacted] , [redacted]622[redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted]

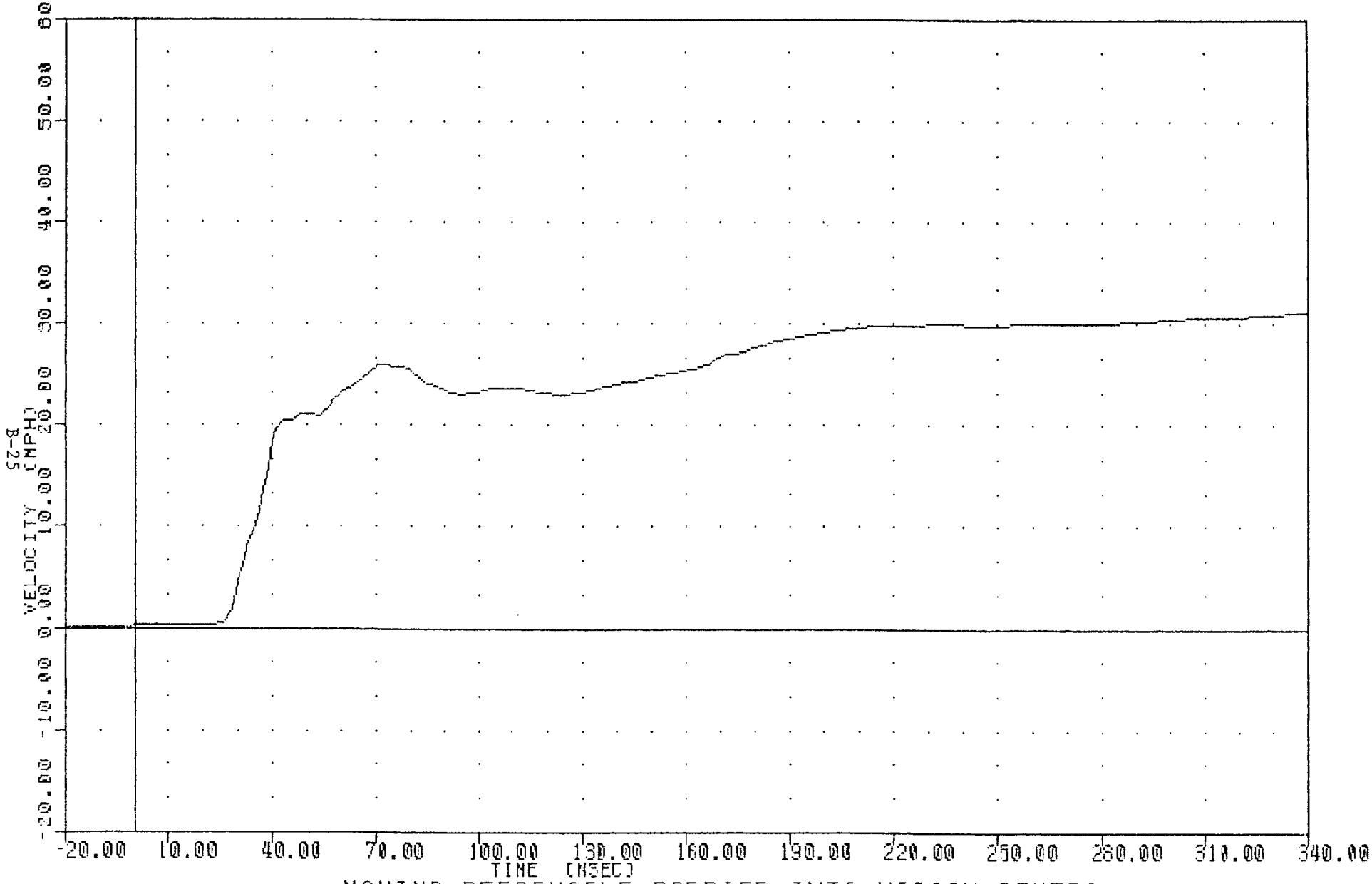
SI PROTECTION PROD VEHICLE
87142
LUAYGA

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -13.55 @ 81.25 , 89.43 @ 38.13



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LEFT UPPER RIB ACCELERATION -2 Y AXIS

[redacted]VAT[redacted], 87422
SI PROTECTION PROD VEHICLE
87142
LURYVA
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.00 @ -20.00 , 31.11 @ 340.00



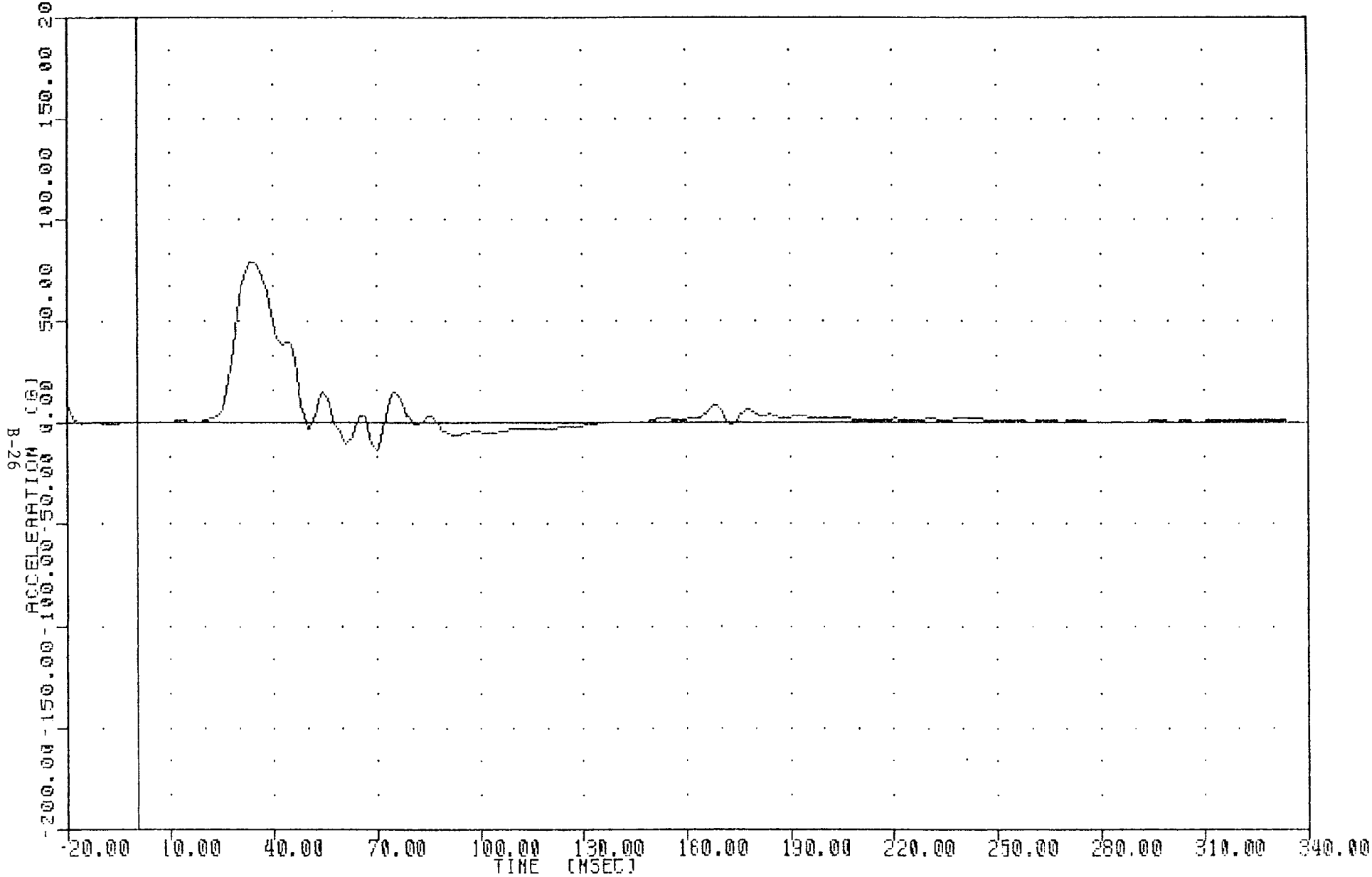
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LURYGA

[redacted]VAT[redacted], [redacted]22

SI PROTECTION PROD VEHICLE

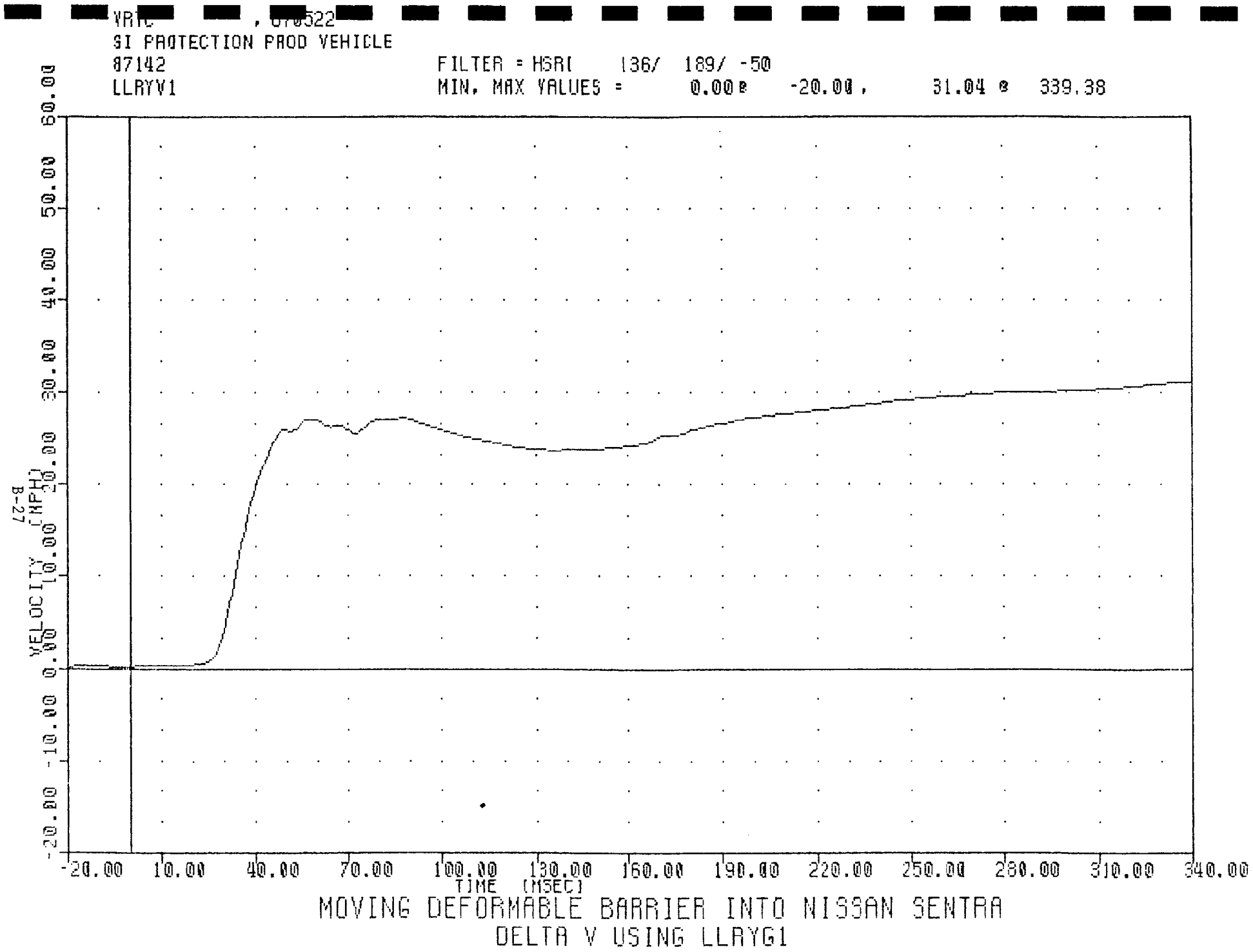
87142 FILTER = HSRI 136/ 189/ -50

LLRY61 MIN, MAX VALUES = -13.43 @ 70.00 , 78.69 @ 33.75



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

DRIVER LEFT LOWER RIB ACCELERATION Y AXIS

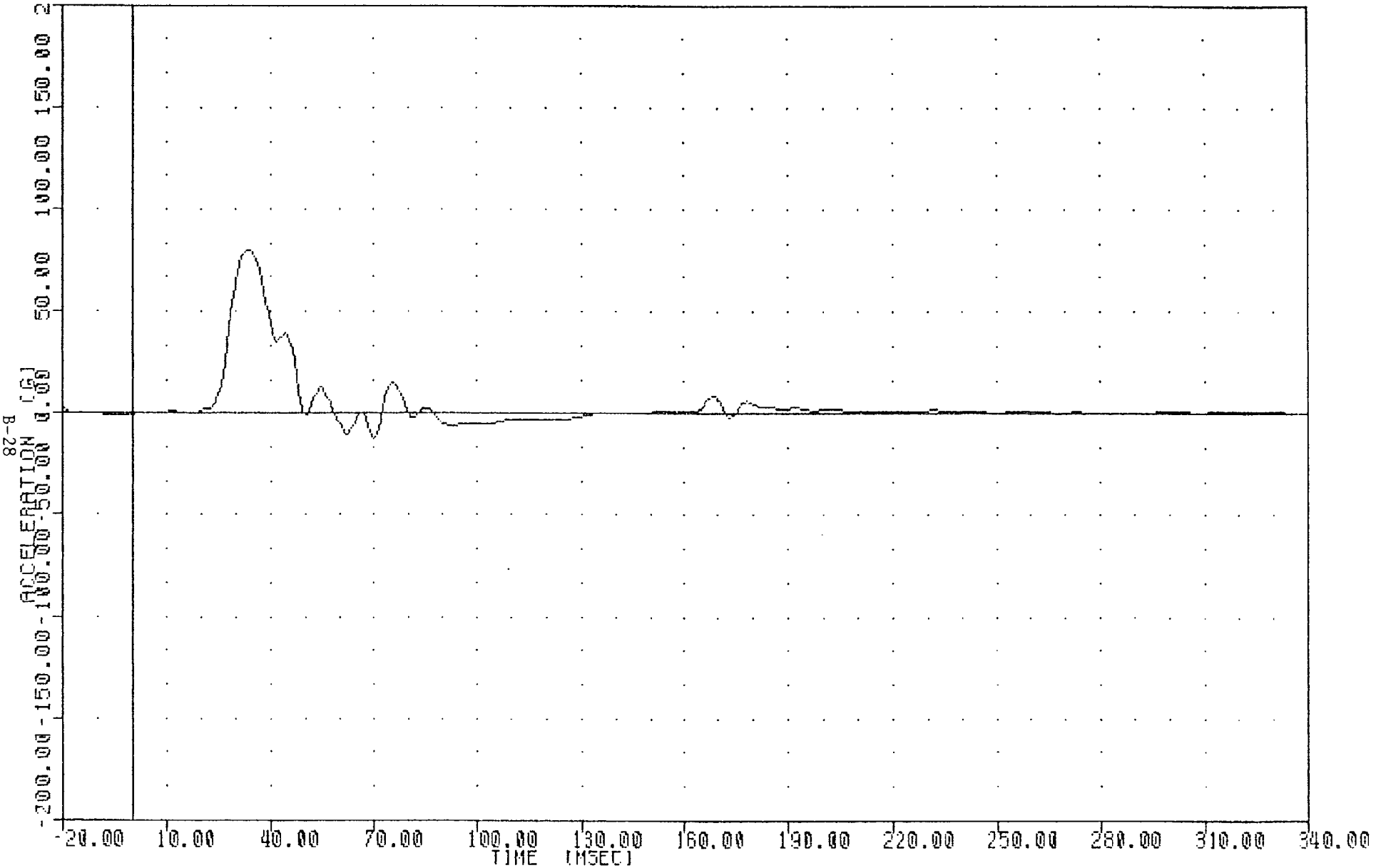


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LLRYG1

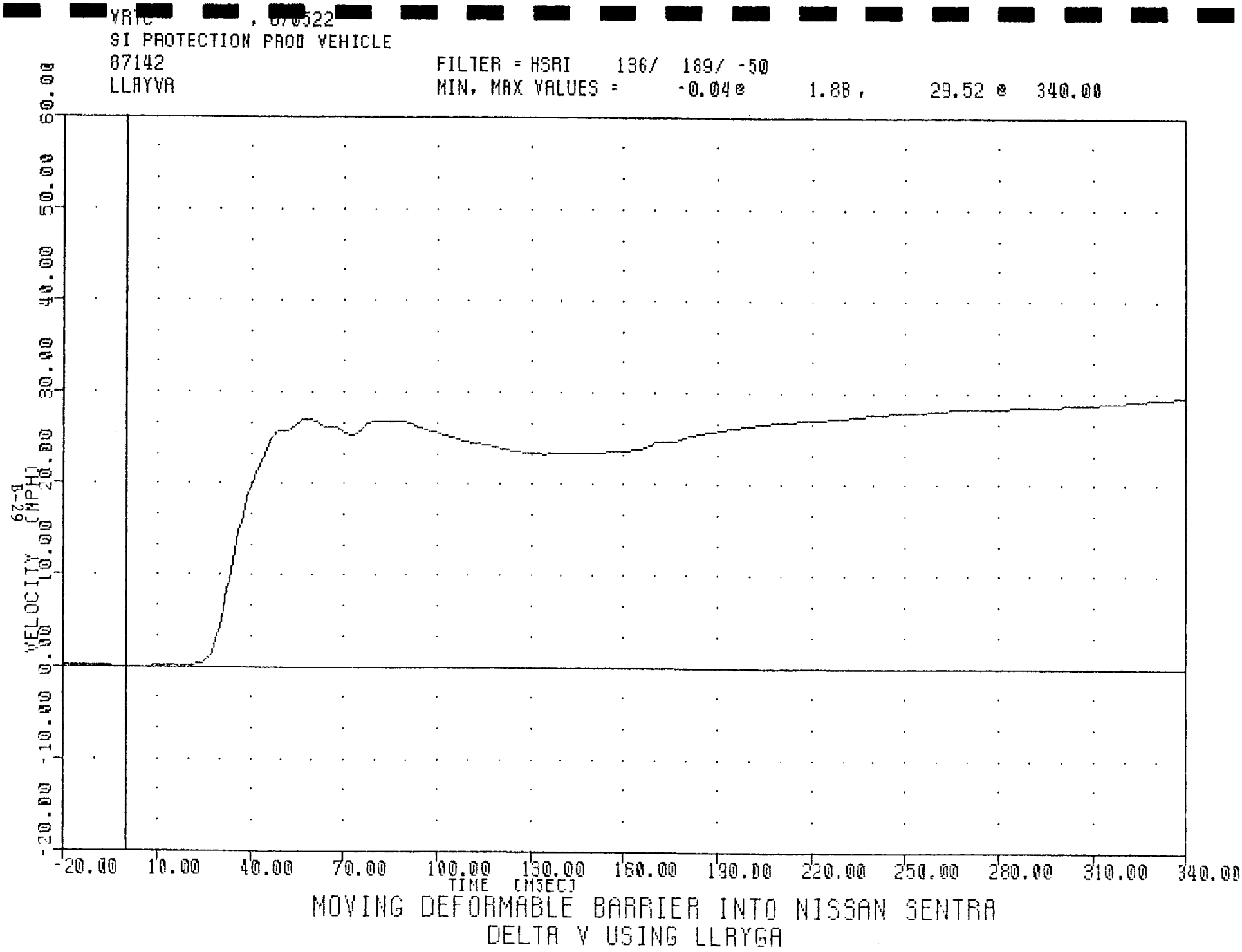
[redacted] VR[redacted] [redacted] , [redacted]522 [redacted]

SI PROTECTION PROD VEHICLE
87142
LLRYGA

FILTER = HSRI (36/ 189/ -50
MIN, MAX VALUES = -12.09 @ 70.00 , 79.76 @ 33.75



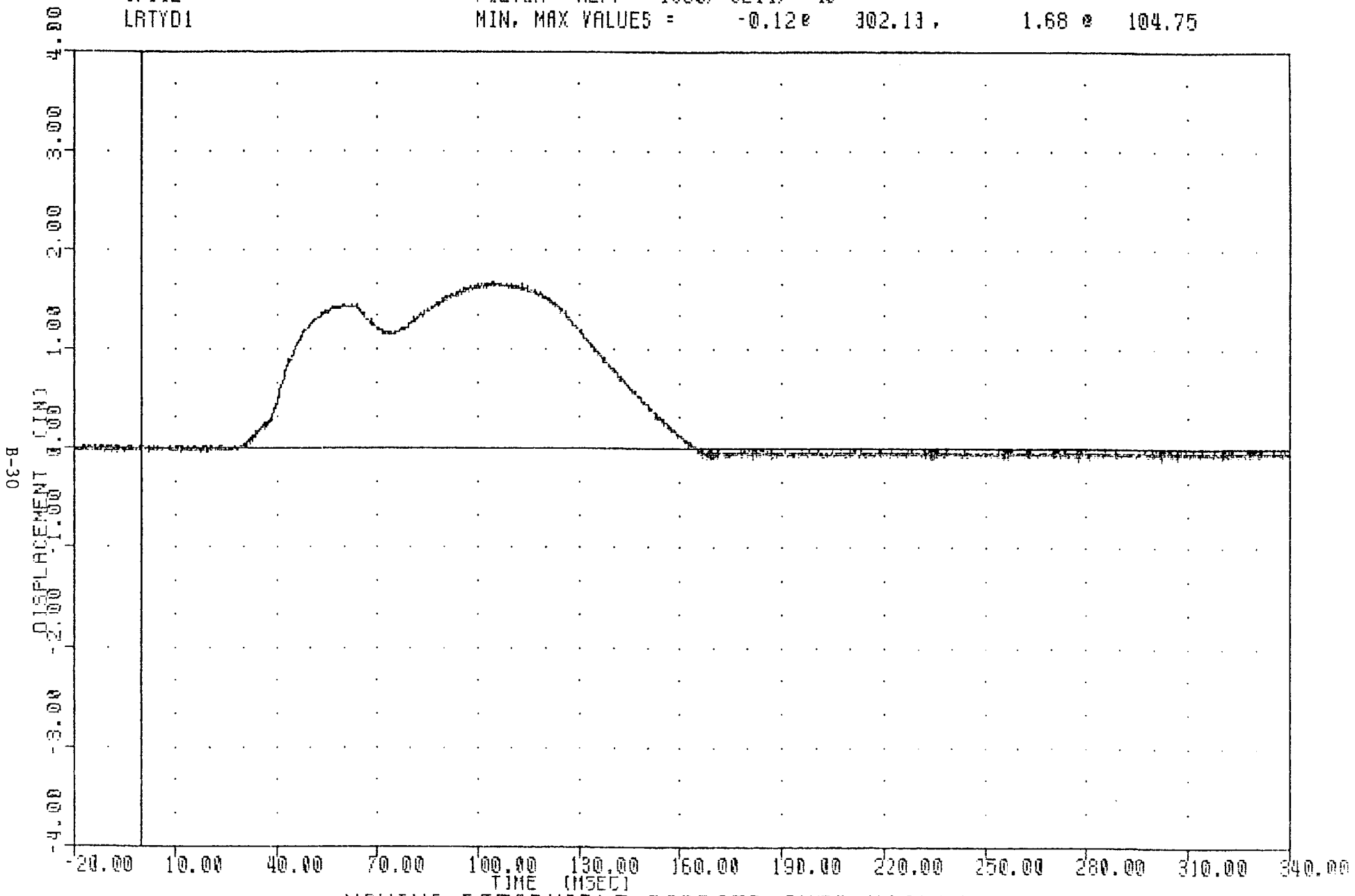
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LEFT LOWER RIB ACCELERATION -2 Y AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LLRYGA

SI PROTECTION PROD VEHICLE
87142
LRTYD1

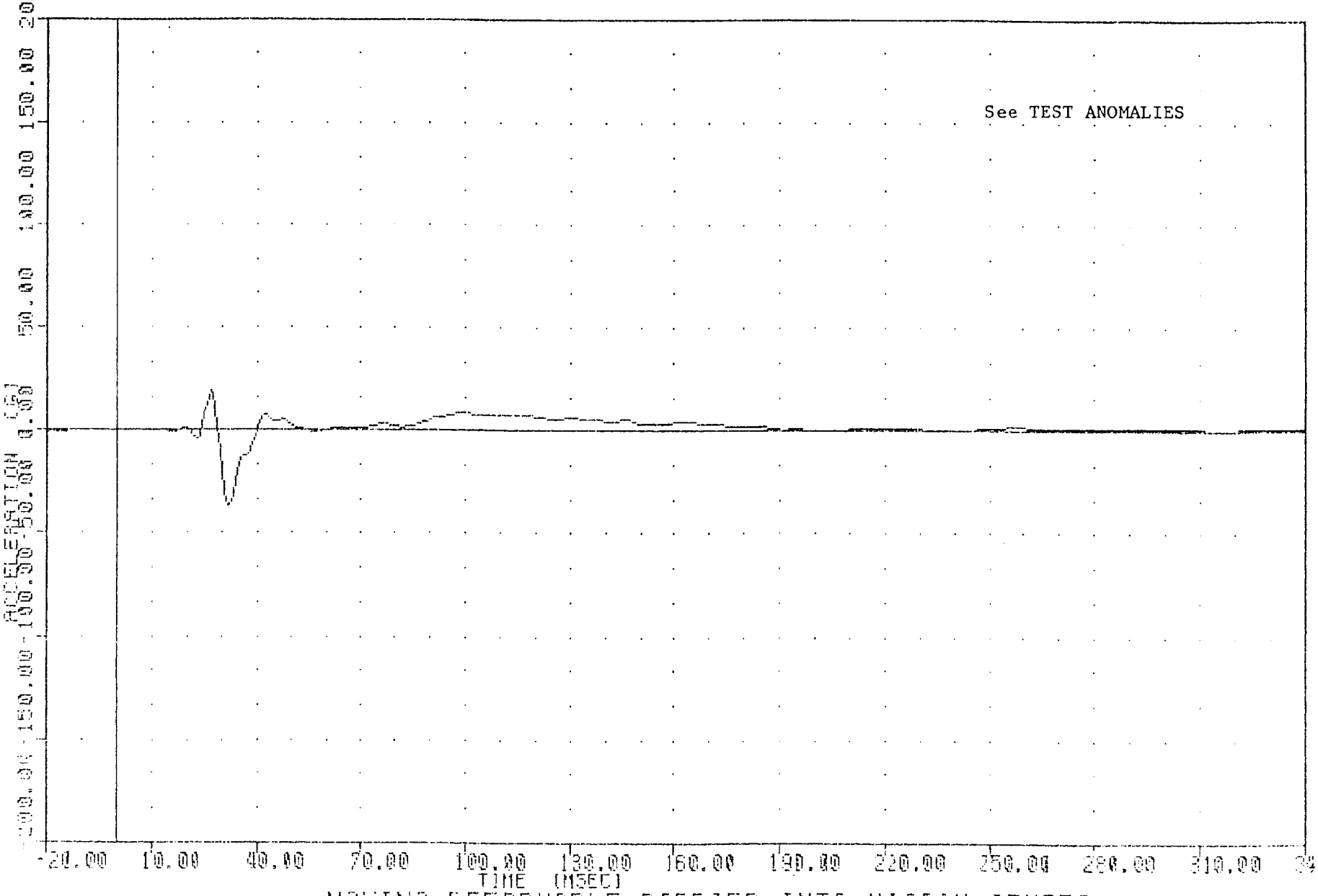
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -0.12 @ 302.13 , 1.68 @ 104.75



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER LEFT RIB TO SPINE DISPLACEMENT INCHES

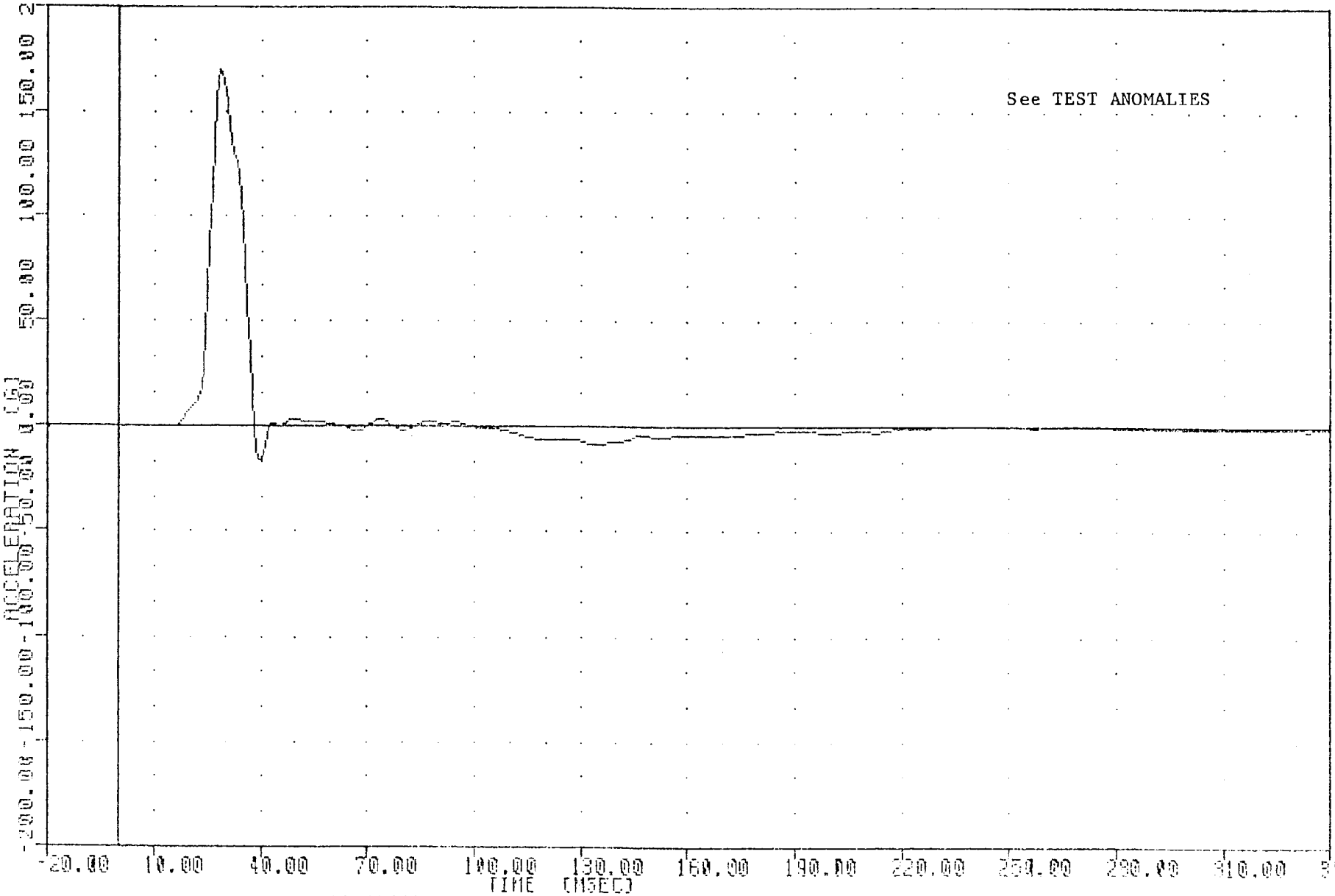
SI PROTECTION PROD VEHICLE
87142
PEVXG1

FILTER = HSRI [36/ 189/ -50
MIN, MAX VALUES = -36.56 @ 31.88 , 19.05 @ 26.87

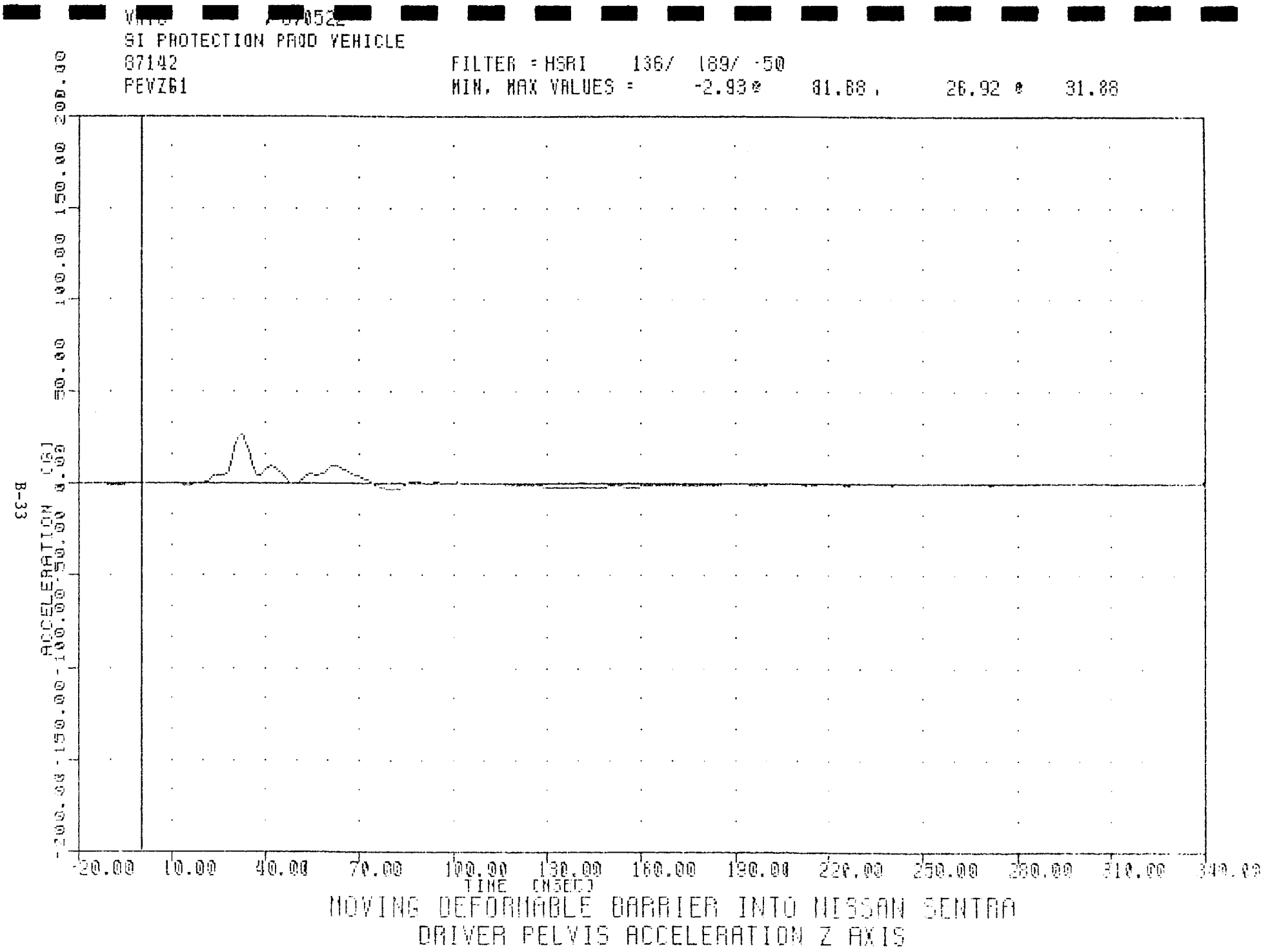


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER PELVIS ACCELERATION X AXIS

[redacted] , 070522
SI PROTECTION PROD VEHICLE
87142
PEVYG1
FILTER = MSAI 136/ 109/ -50
MIN, MAX VALUES = -15.52 @ 39.38 , 169.71 @ 28.75



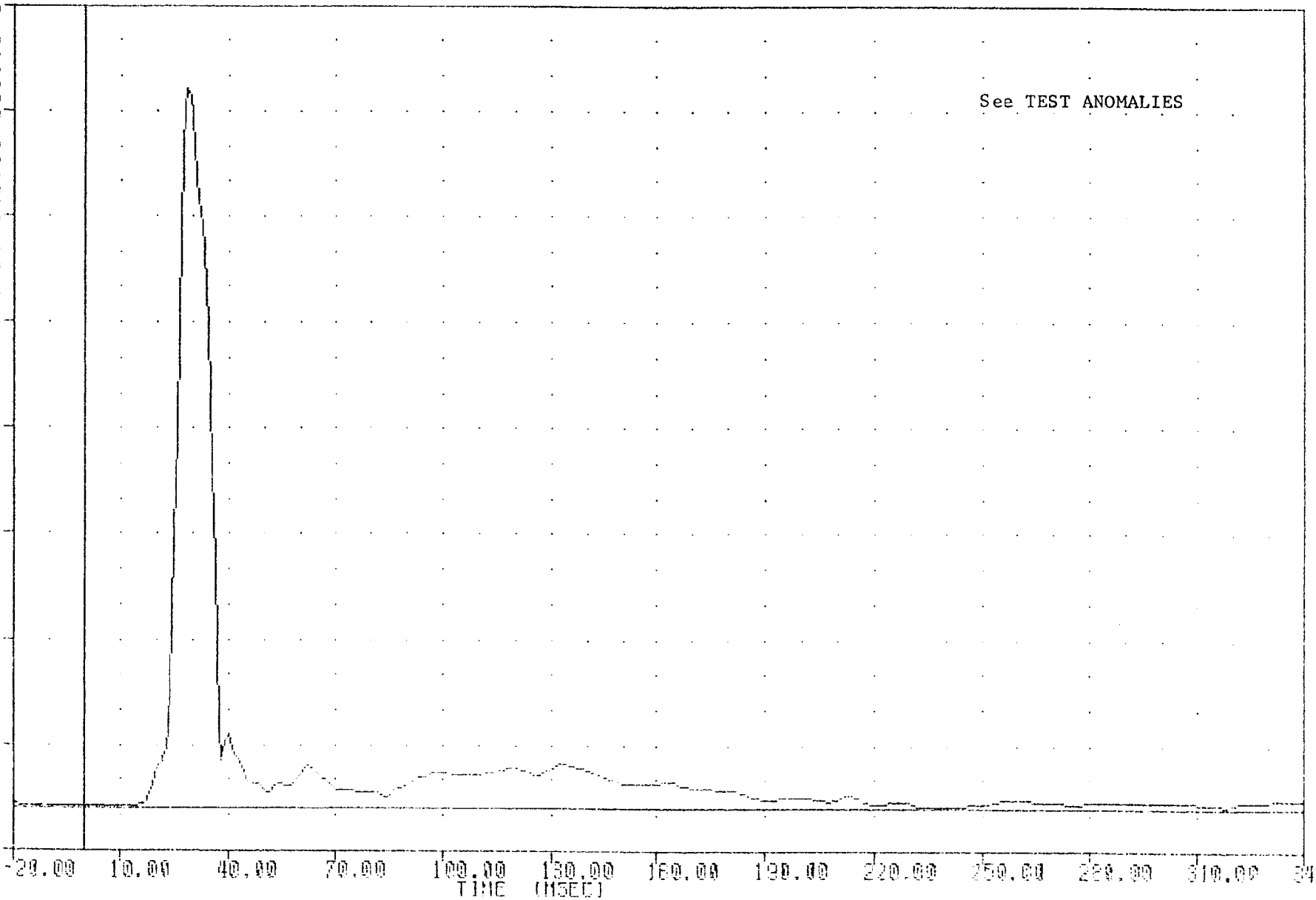
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER PELVIS ACCELERATION Y AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER PELVIS ACCELERATION Z AXIS

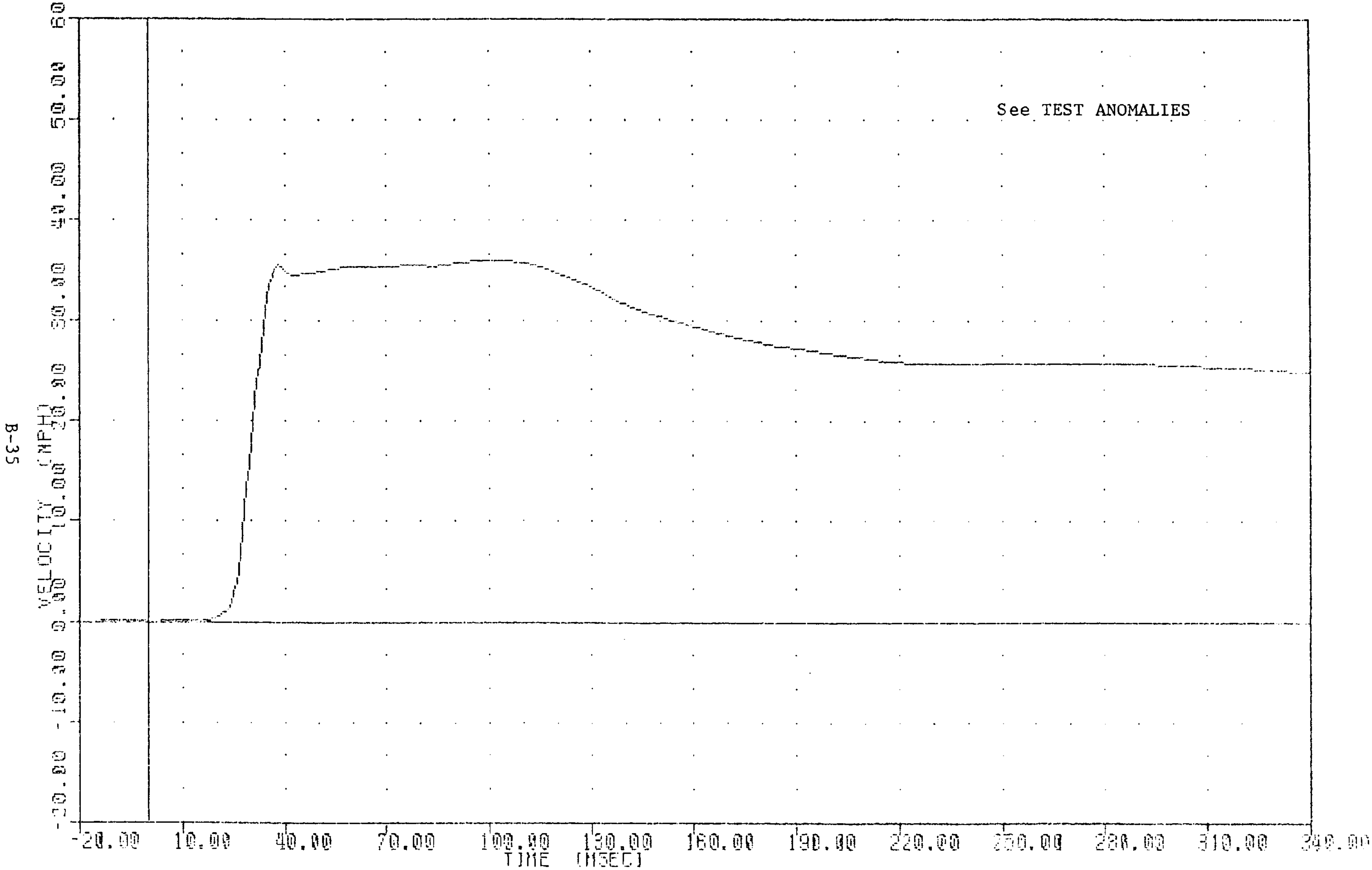
SI PROTECTION PROD VEHICLE
87142
PEVRG1

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.24 @ -11.88 , 170.07 @ 28.75



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DRIVER PELVIS RESULTANT ACCELERATION

NHTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = HSRI 136/ 189/ -50
PEVYV1 MIN, MAX VALUES = -0.01 @ -18.13 , 35.98 @ 99.37

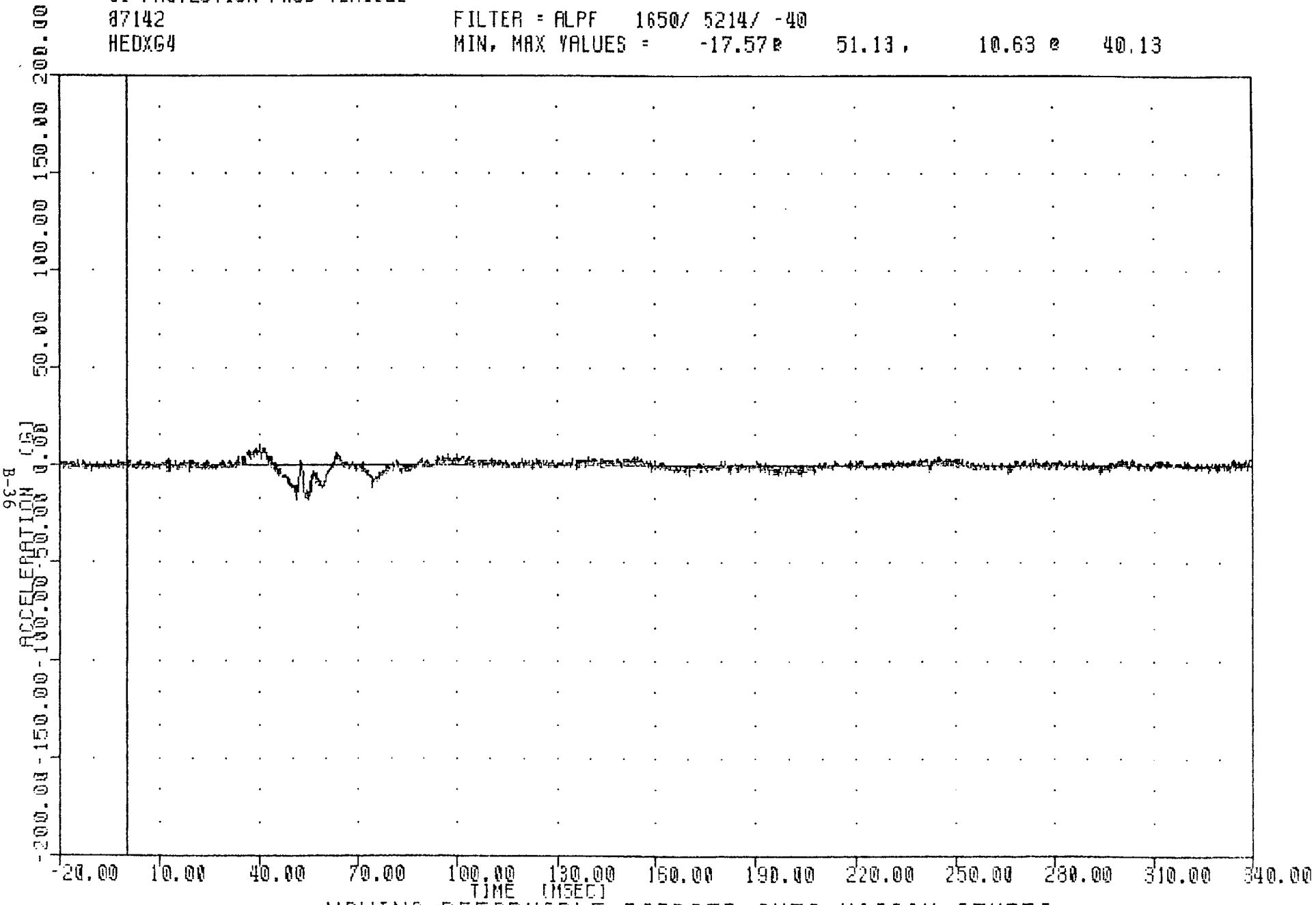


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING PEVYG1

[redacted] YR[redacted] [redacted] , [redacted]522[redacted] [redacted]

SI PROTECTION PROD VEHICLE
87142
HEDXG4

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -17.57 @ 51.13 , 10.63 @ 40.13



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER HEAD ACCELERATION X AXIS

[redacted]VR[redacted] [redacted], [redacted]22[redacted]

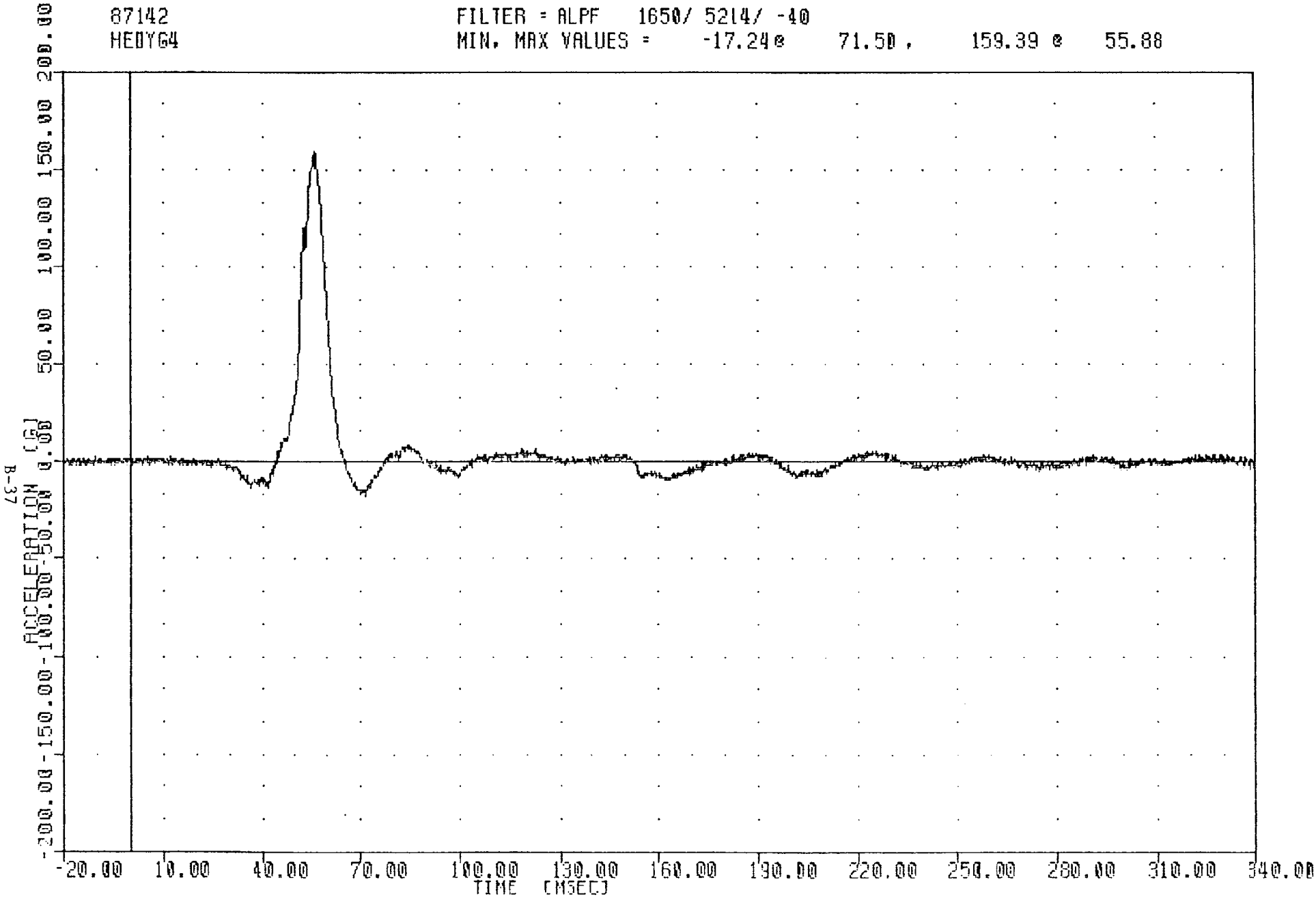
SI PROTECTION PROD VEHICLE

87142

HEDYG4

FILTER = ALPF 1650/ 5214/ -40

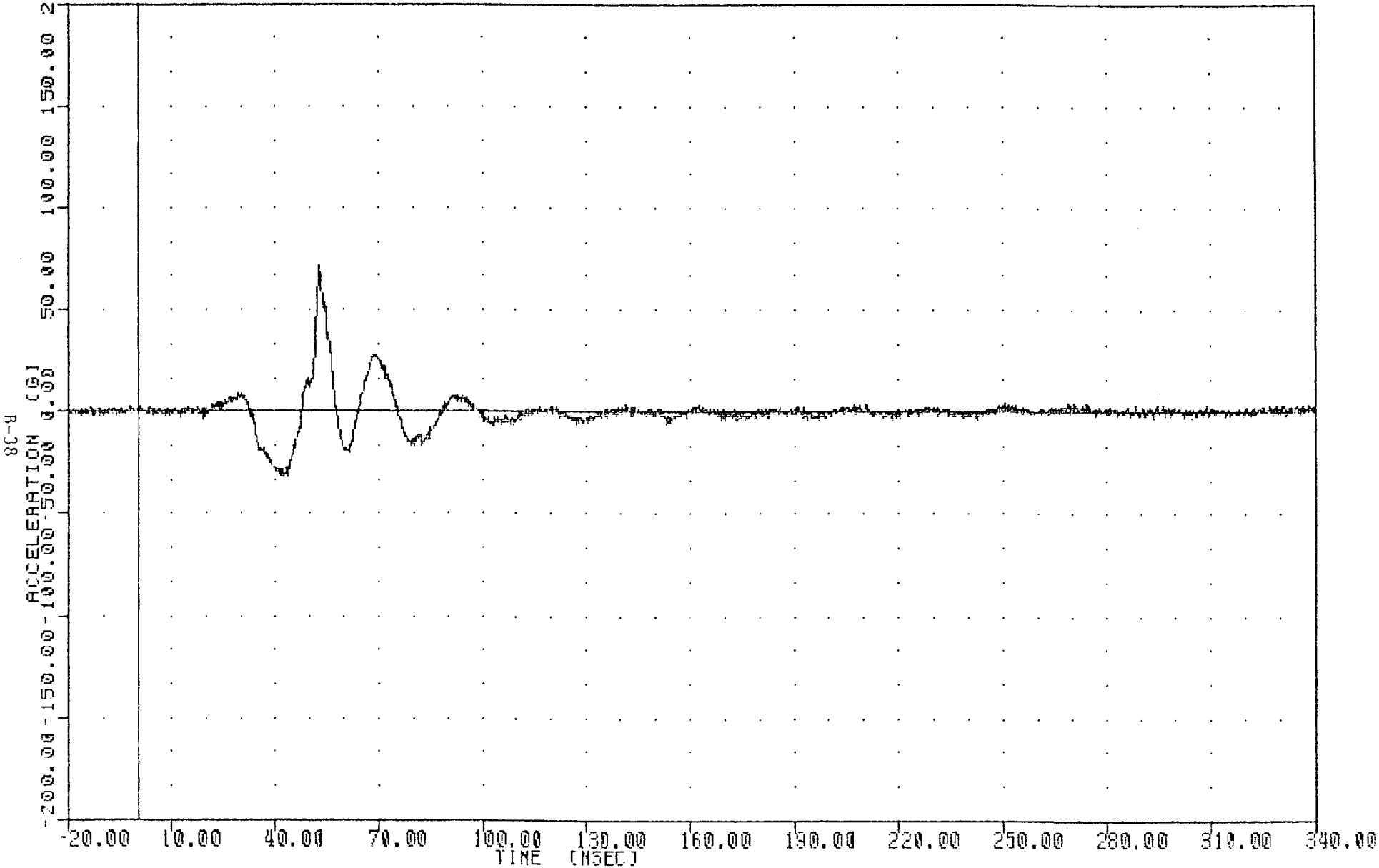
MIN, MAX VALUES = -17.24 @ 71.50 , 159.39 @ 55.88



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

PASSENGER HEAD ACCELERATION Y AXIS

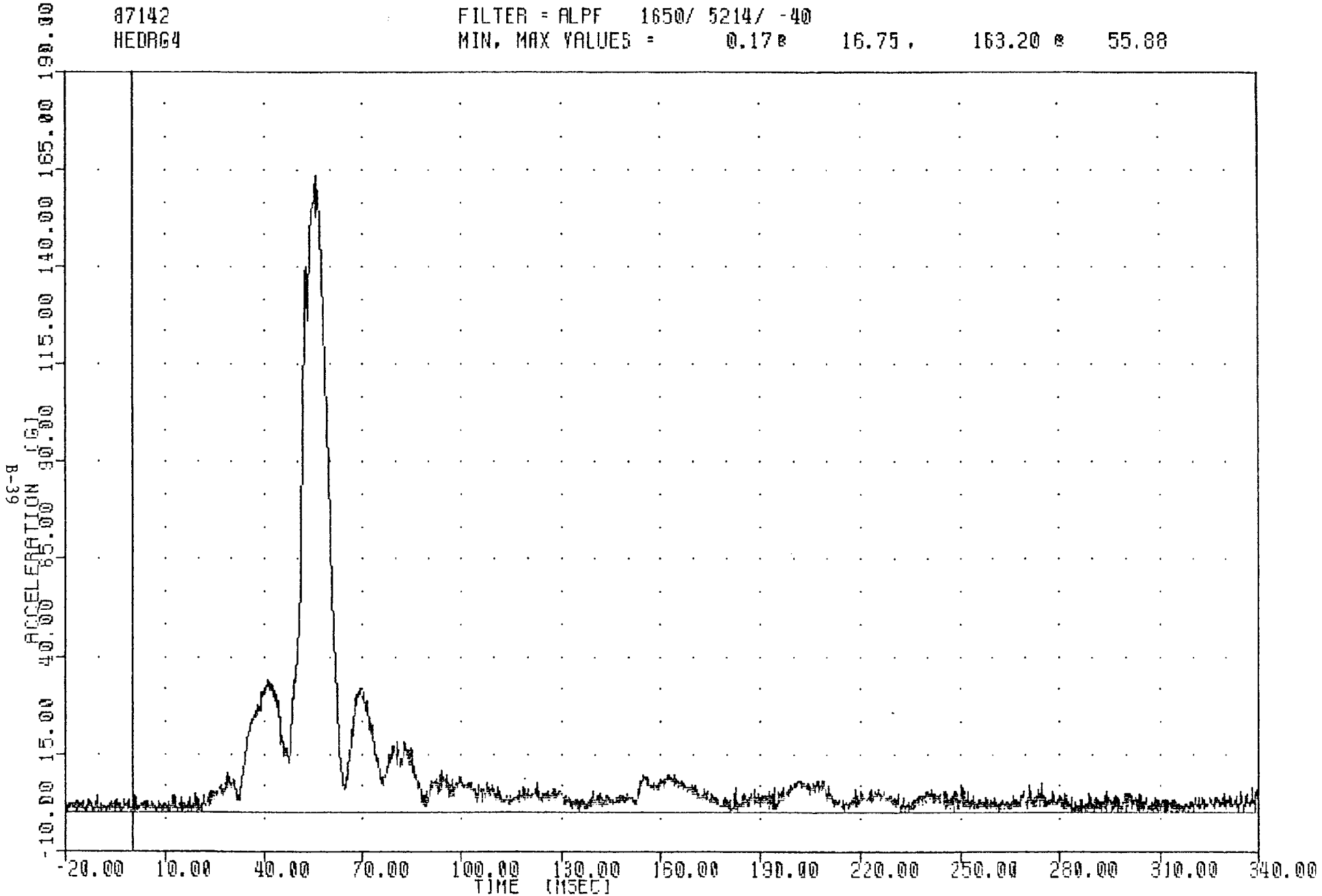
[redacted] VRTC [redacted], 87022
SI PROTECTION PROD VEHICLE
87142
HEDZ64
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -31.87 @ 42.50 , 71.62 @ 52.63



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER HEAD ACCELERATION Z AXIS

[redacted]

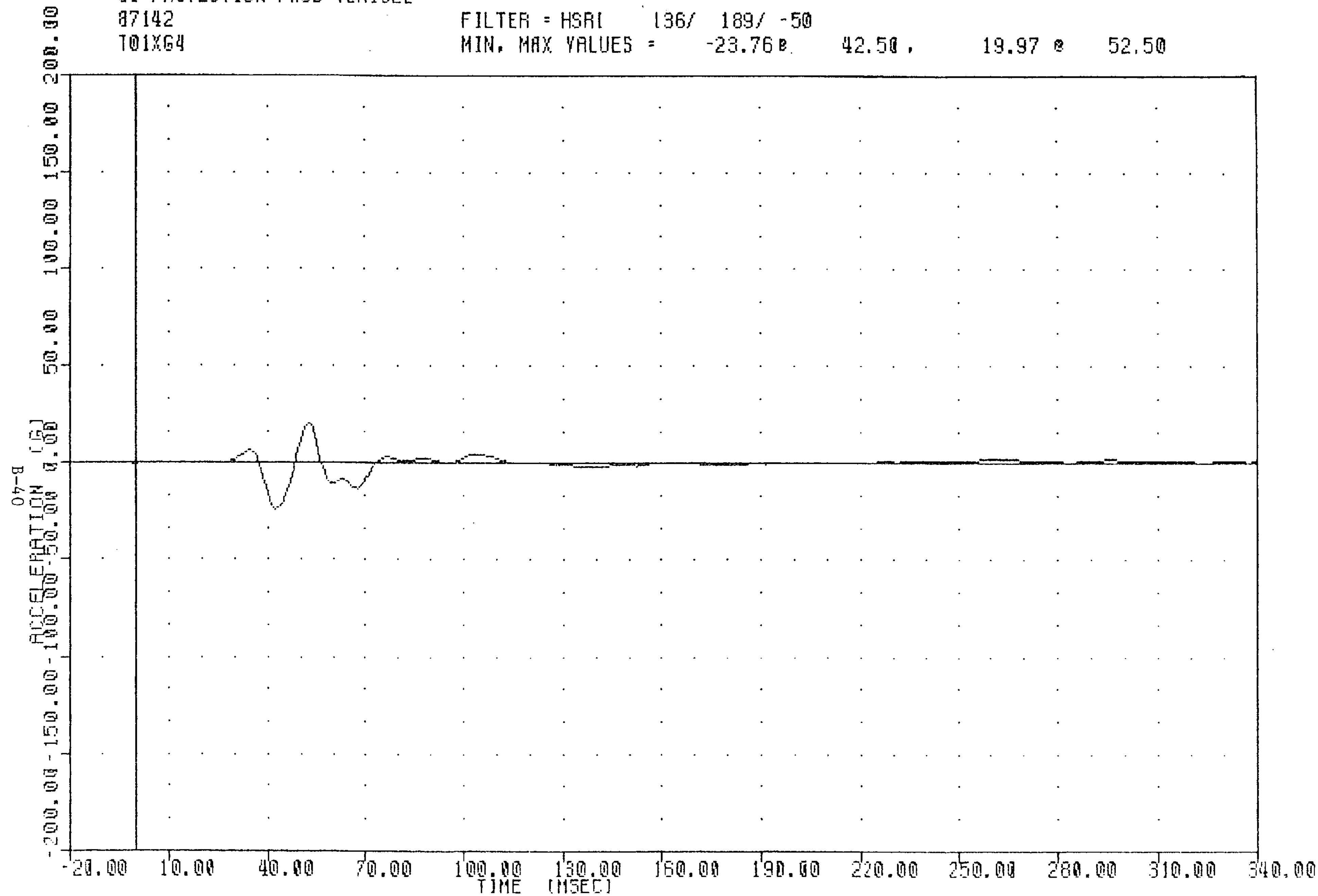
SI PROTECTION PROD VEHICLE
87142 FILTER = ALPF 1650/ 5214/ -40
HEDRG4 MIN, MAX VALUES = 0.17 @ 16.75 , 163.20 @ 55.88



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER HEAD RESULTANT ACCELERATION

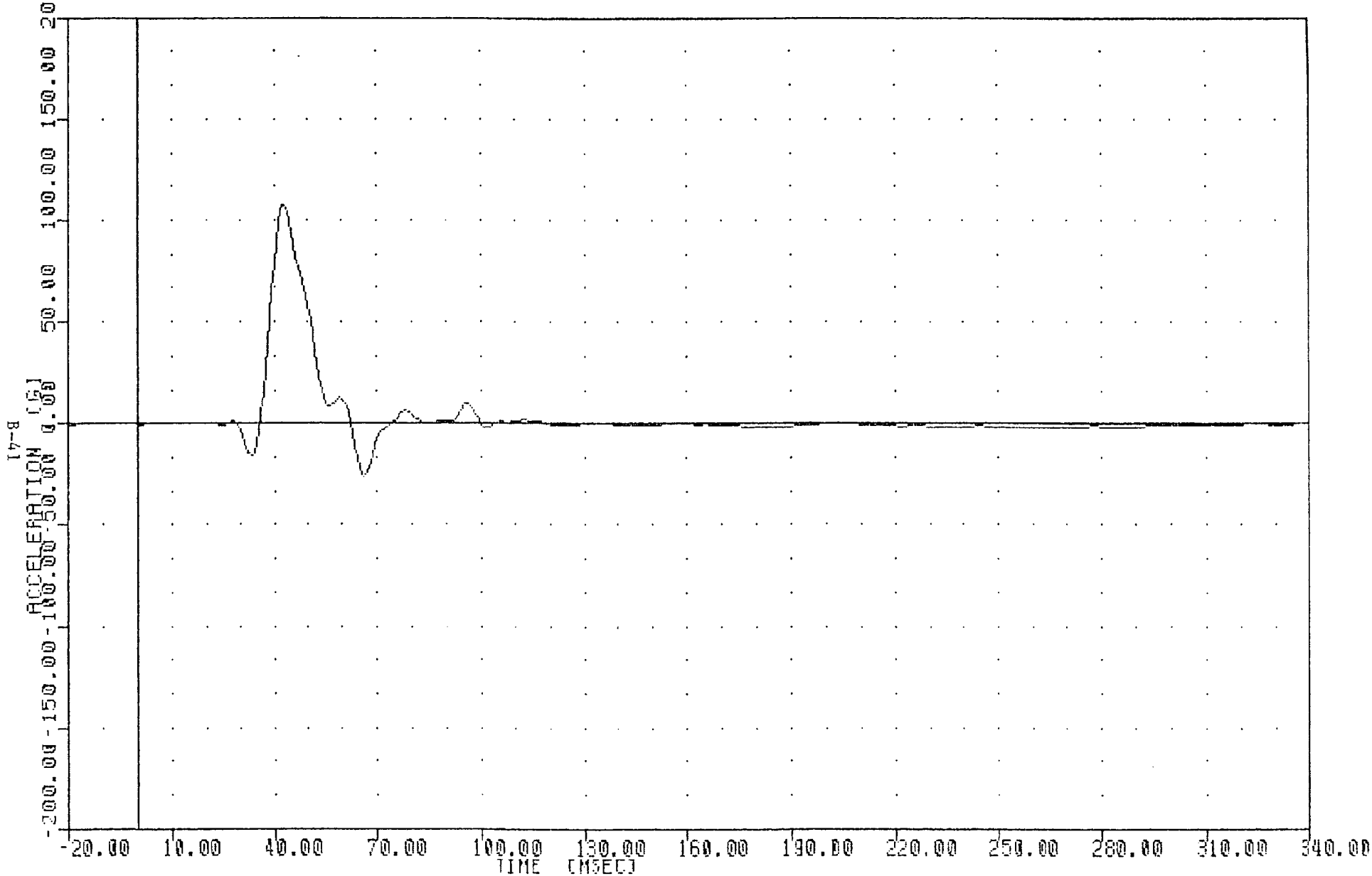
YR[redacted], [redacted]22[redacted]
SI PROTECTION PROD VEHICLE
87142
T01X64

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -23.76 @ 42.50, 19.97 @ 52.50



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER UPPER SPINE ACCELERATION X AXIS

VRTC , 070522
SI PROTECTION PROD VEHICLE
87142 FILTER = HSRI 136/ 189/ -50
T01YG4 MIN, MAX VALUES = -26.23@ 66.25 , 107.12 @ 42.50

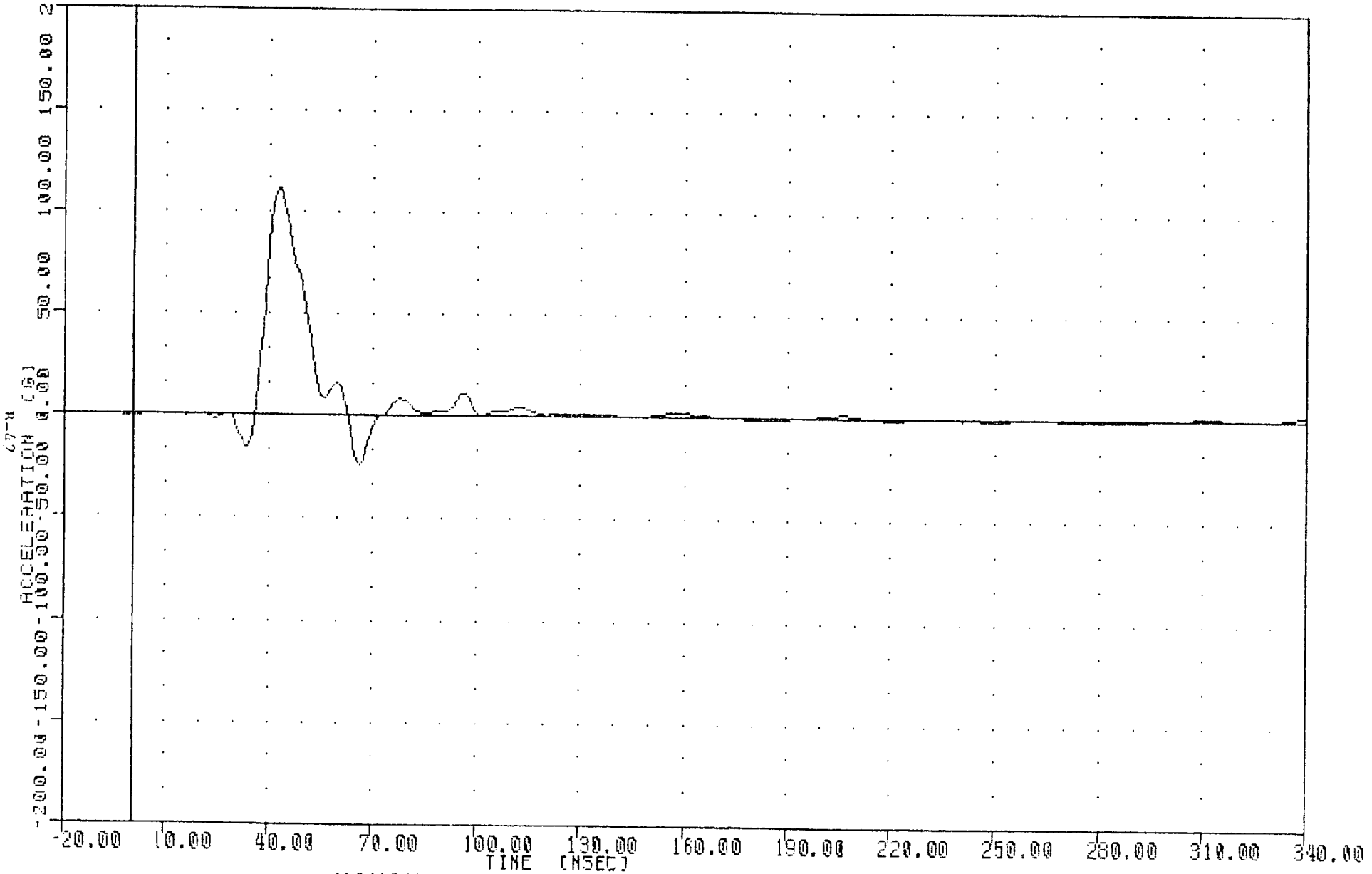


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER UPPER SPINE ACCELERATION Y AXIS

[redacted]/AT[redacted] [redacted], 8[redacted]22 [redacted]

SI PROTECTION PROD VEHICLE
87142
T01Y6D

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -24.40 @ 66.25 , 111.86 @ 42.50



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MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER UPPER SPINE ACCELERATION -2 Y AXIS

[redacted]RT[redacted], 8[redacted]22

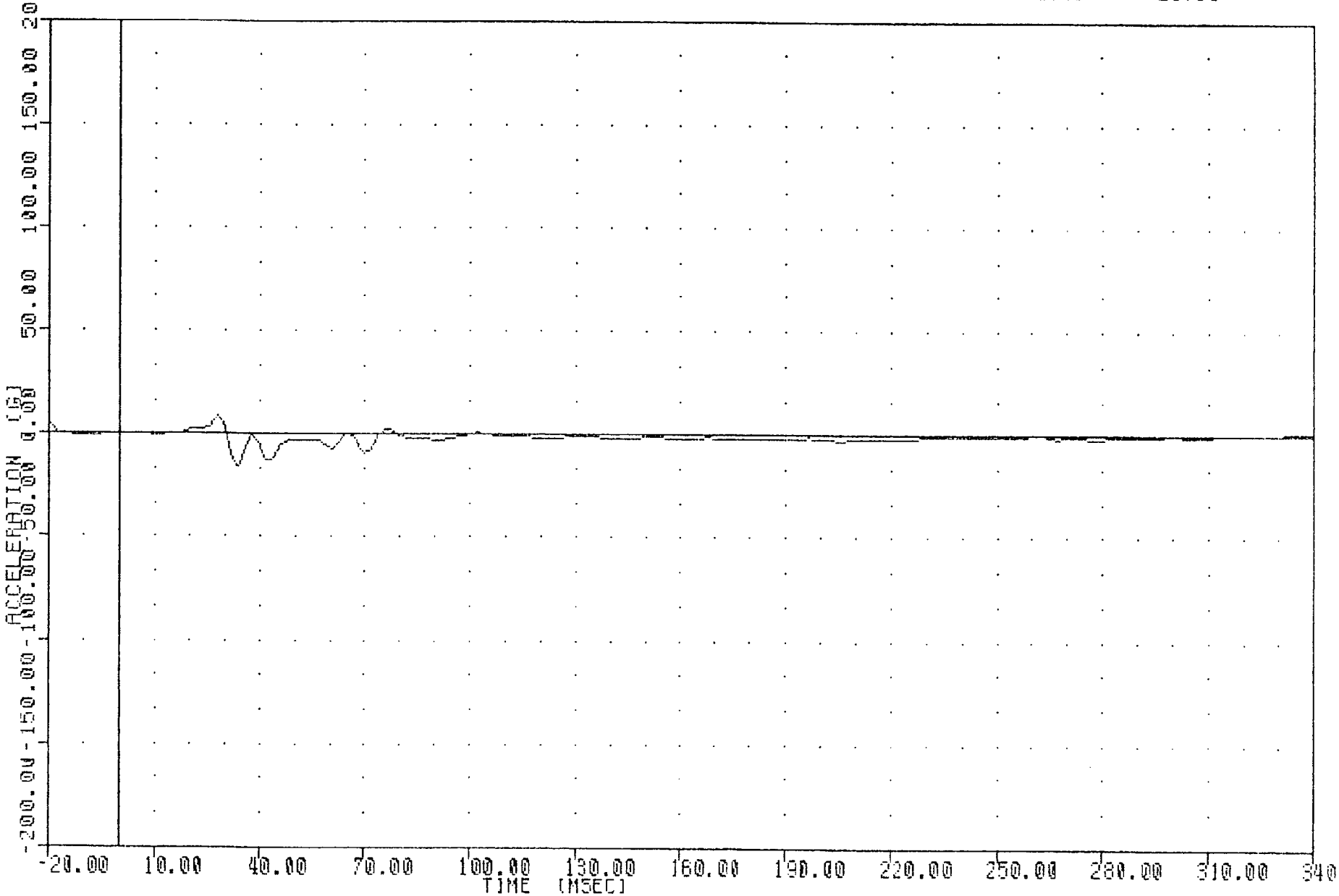
SI PROTECTION PROD VEHICLE

87142

T01ZG4

FILTER = HSRI 136/ 189/ -50

MIN, MAX VALUES = -15.55@ 33.75, 8.26@ 28.13



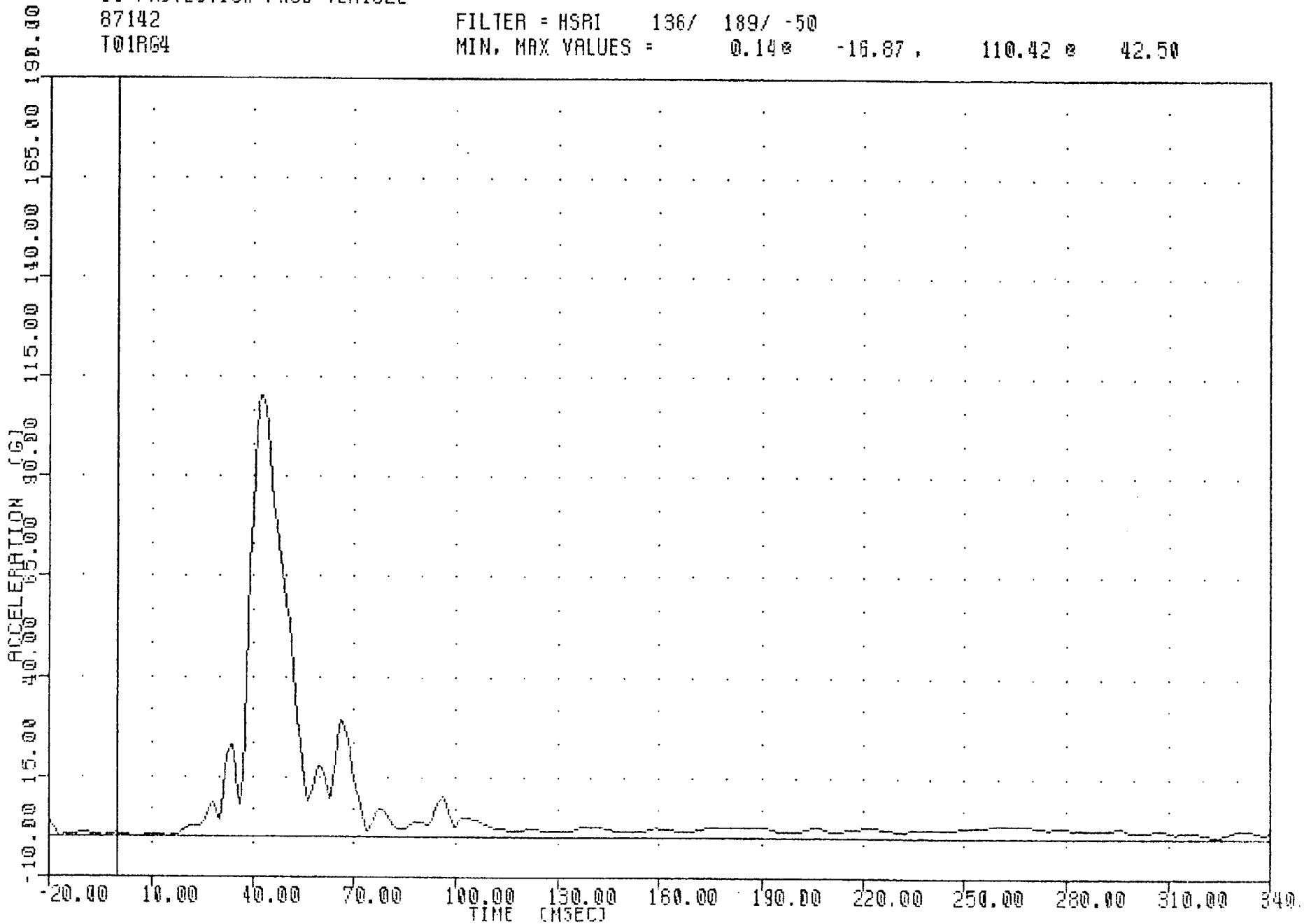
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

PASSENGER UPPER SPINE ACCELERATION Z AXIS

[redacted] RT[redacted] [redacted], 8[redacted]22 [redacted]

SI PROTECTION PROD VEHICLE
87142
T01RG4

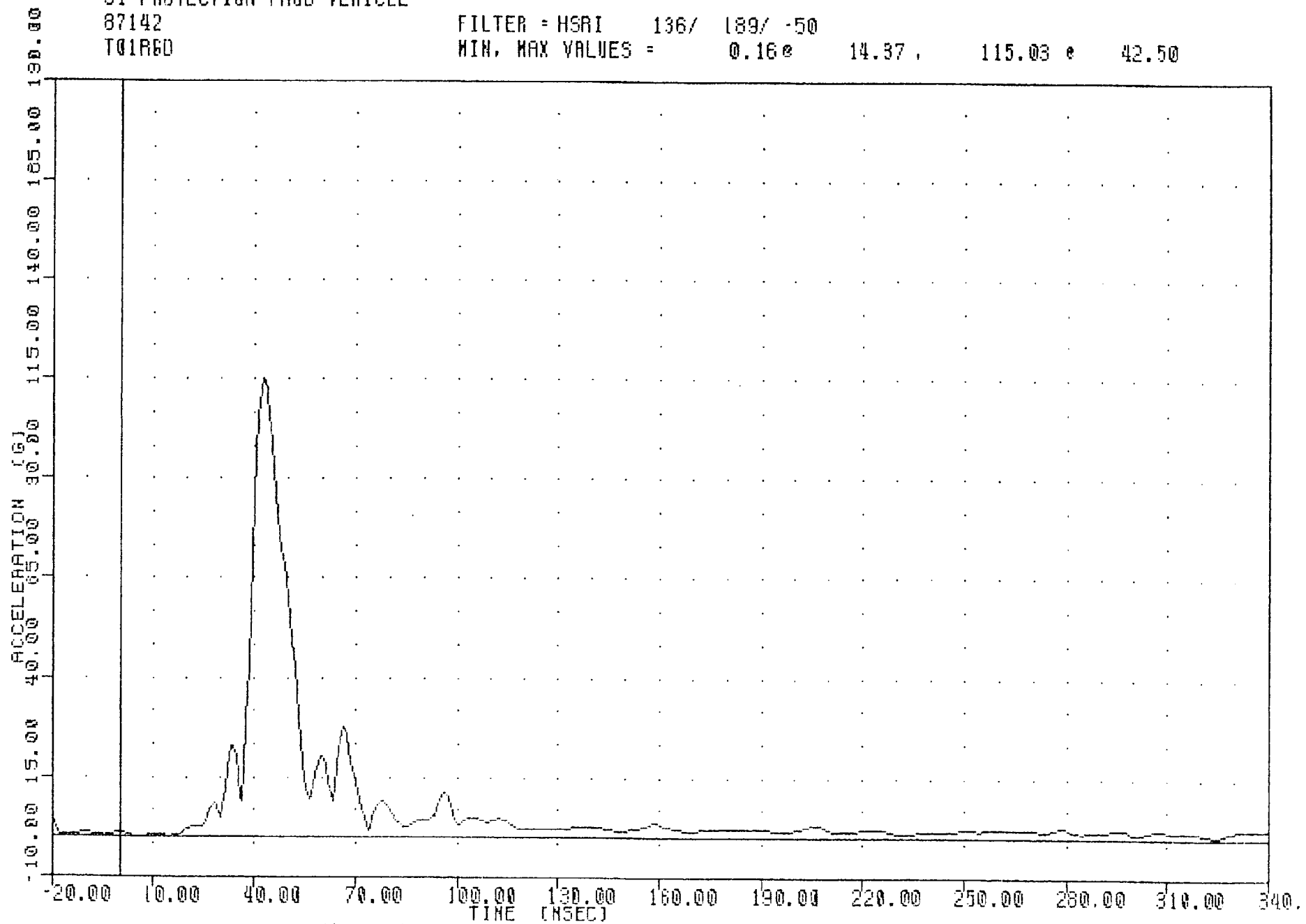
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.14@ -16.87, 110.42@ 42.50



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER UPPER SPINE RESULTANT ACCELERATION

77-8

[redacted] RT[redacted] [redacted], 87[redacted]2 [redacted]

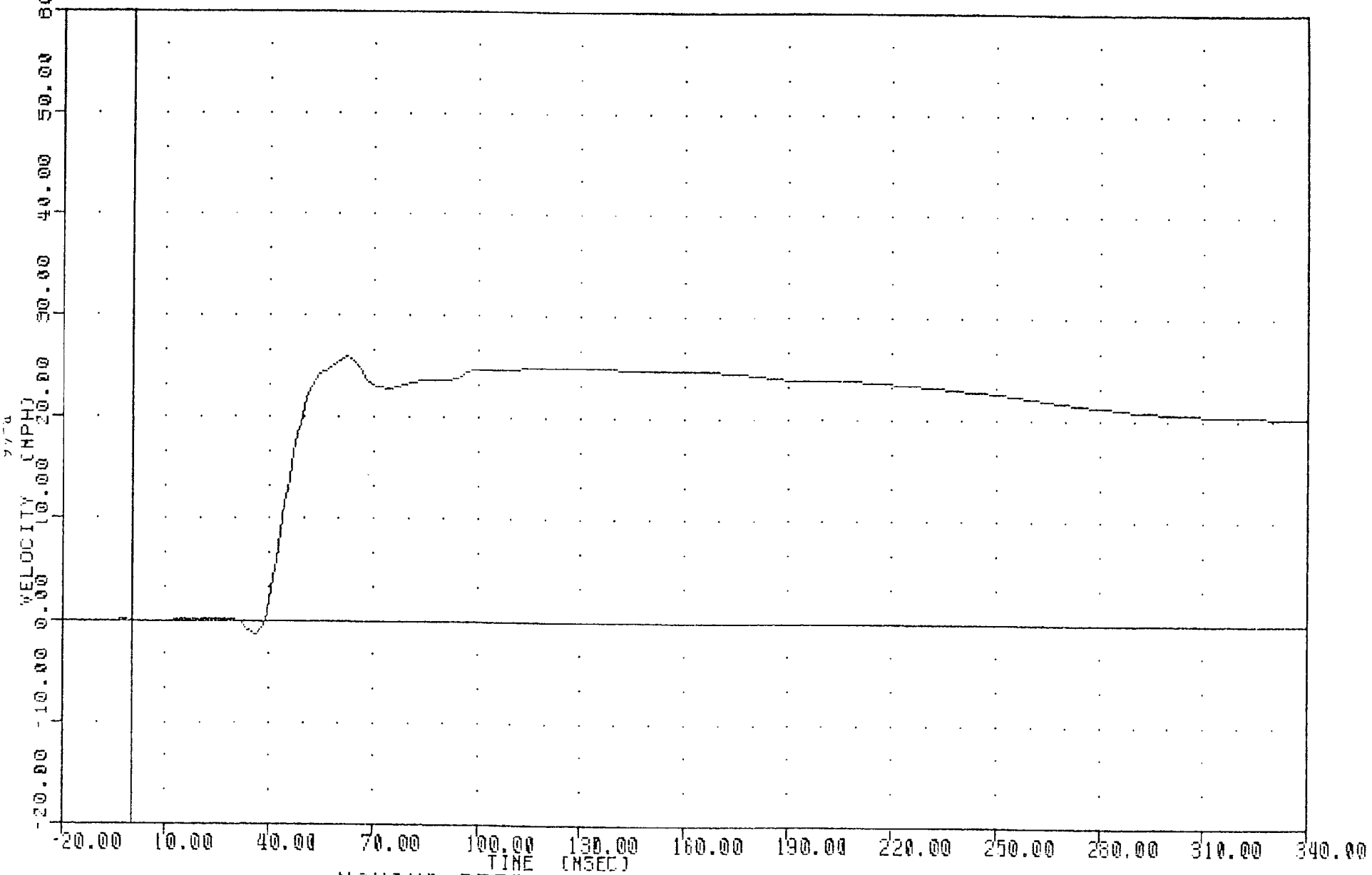


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER UPPER SPINE RESULTANT ACCELERATION USING T01YGD

[redacted]VAT[redacted], 8[redacted]22 [redacted]

SI PROTECTION PROD VEHICLE
87142
T01YY4

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -1.34 @ 35.63 , 25.92 @ 62.50



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING T01YG4

[redacted] YR[redacted] [redacted] , [redacted]622[redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted] [redacted]

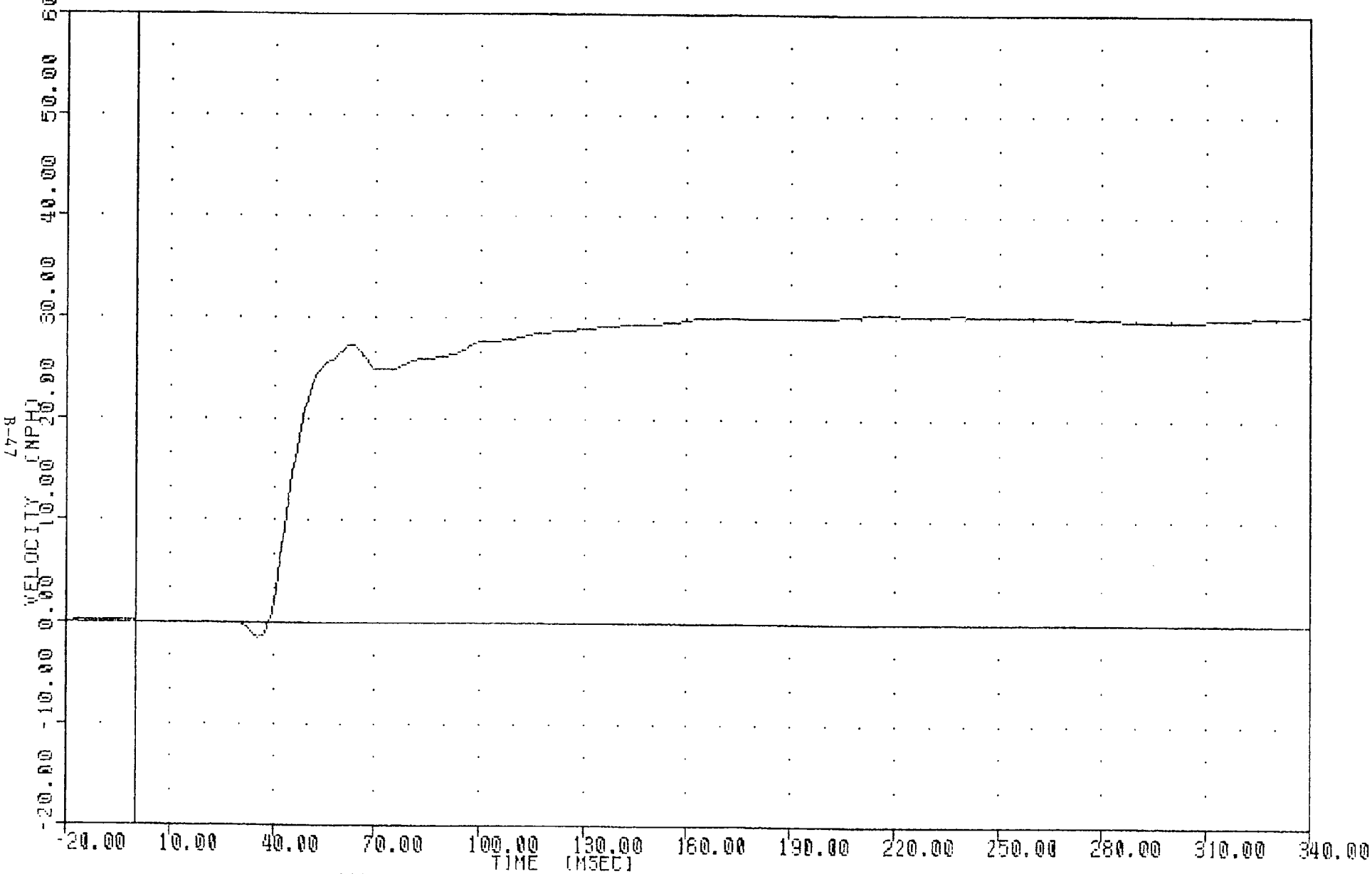
SI PROTECTION PROD VEHICLE

87142

T01YV0

FILTER = HSRI 136/ 189/ -50

MIN, MAX VALUES = -1.50 @ 35.63 , 30.46 @ 340.00



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

DELTA V USING T01YG0

[redacted]VR[redacted], [redacted]22[redacted]

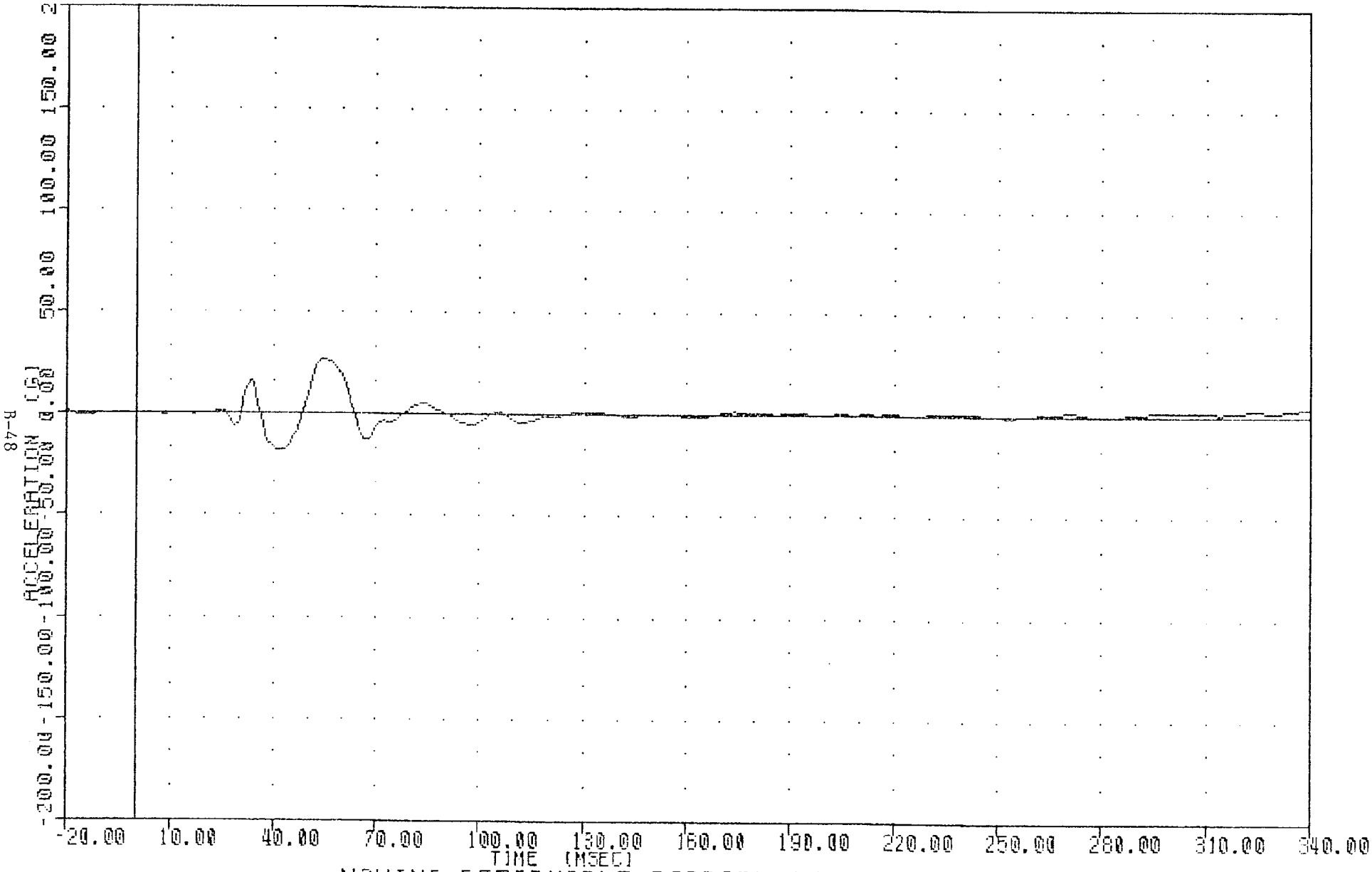
SI PROTECTION PROD VEHICLE

87142

T12XG4

FILTER = HSRI 136/ 189/ -50

MIN, MAX VALUES = -18.18 @ 42.50 , 26.78 @ 54.38



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

PASSENGER LOWER SPINE ACCELERATION X AXIS

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[redacted]VRT[redacted], [redacted]22[redacted]

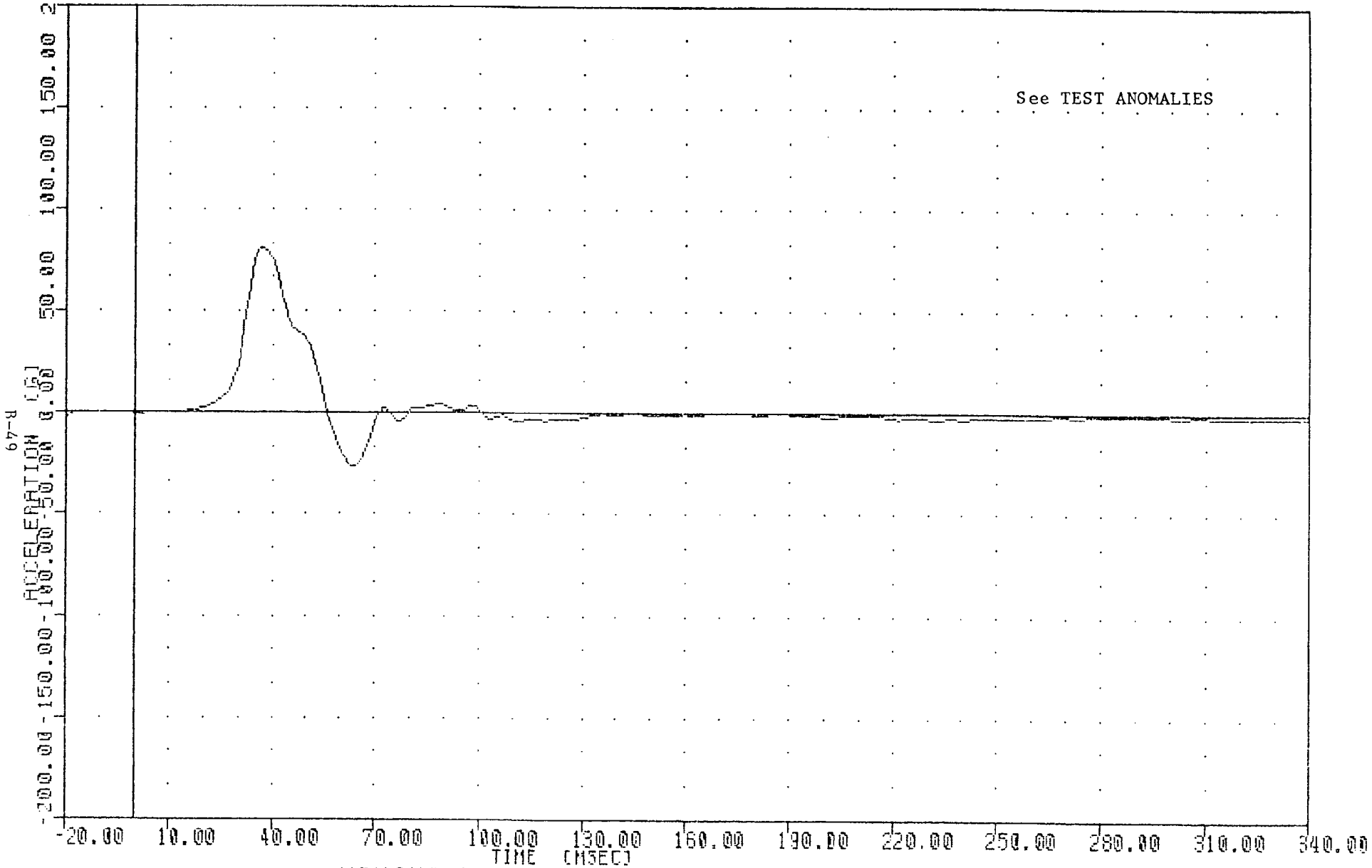
SI PROTECTION PROD VEHICLE

87142

T12YG4

FILTER = HSRI 136/ 169/ -50

MIN, MAX VALUES = -26.41@ 63.75, 80.78 @ 37.50



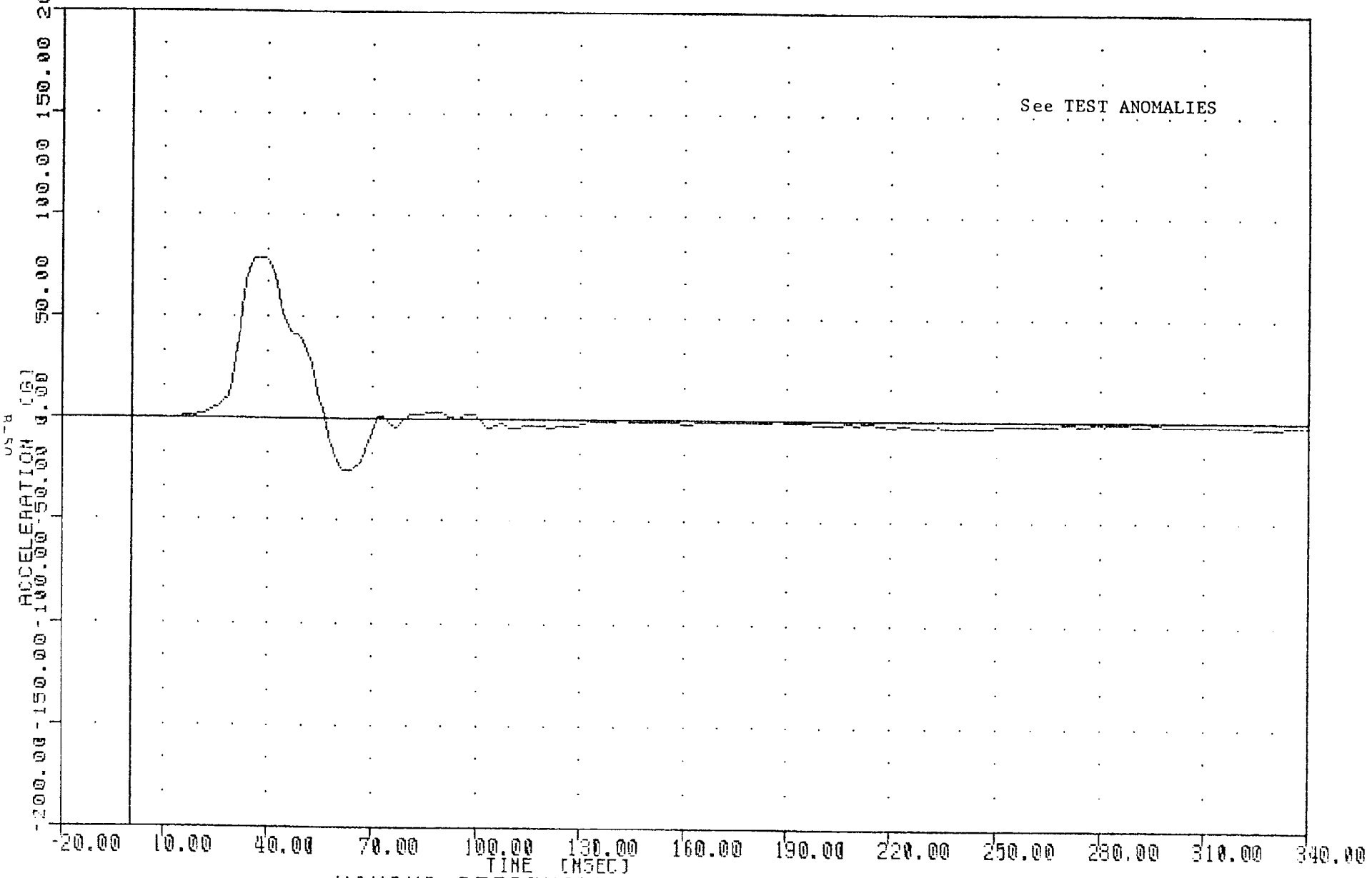
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

PASSENGER LOWER SPINE ACCELERATION Y AXIS

[redacted]VRT[redacted], 8[redacted]22

SI PROTECTION PROD VEHICLE
87142
T12Y6D

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -25.41 @ 62.50 , 79.01 @ 38.75

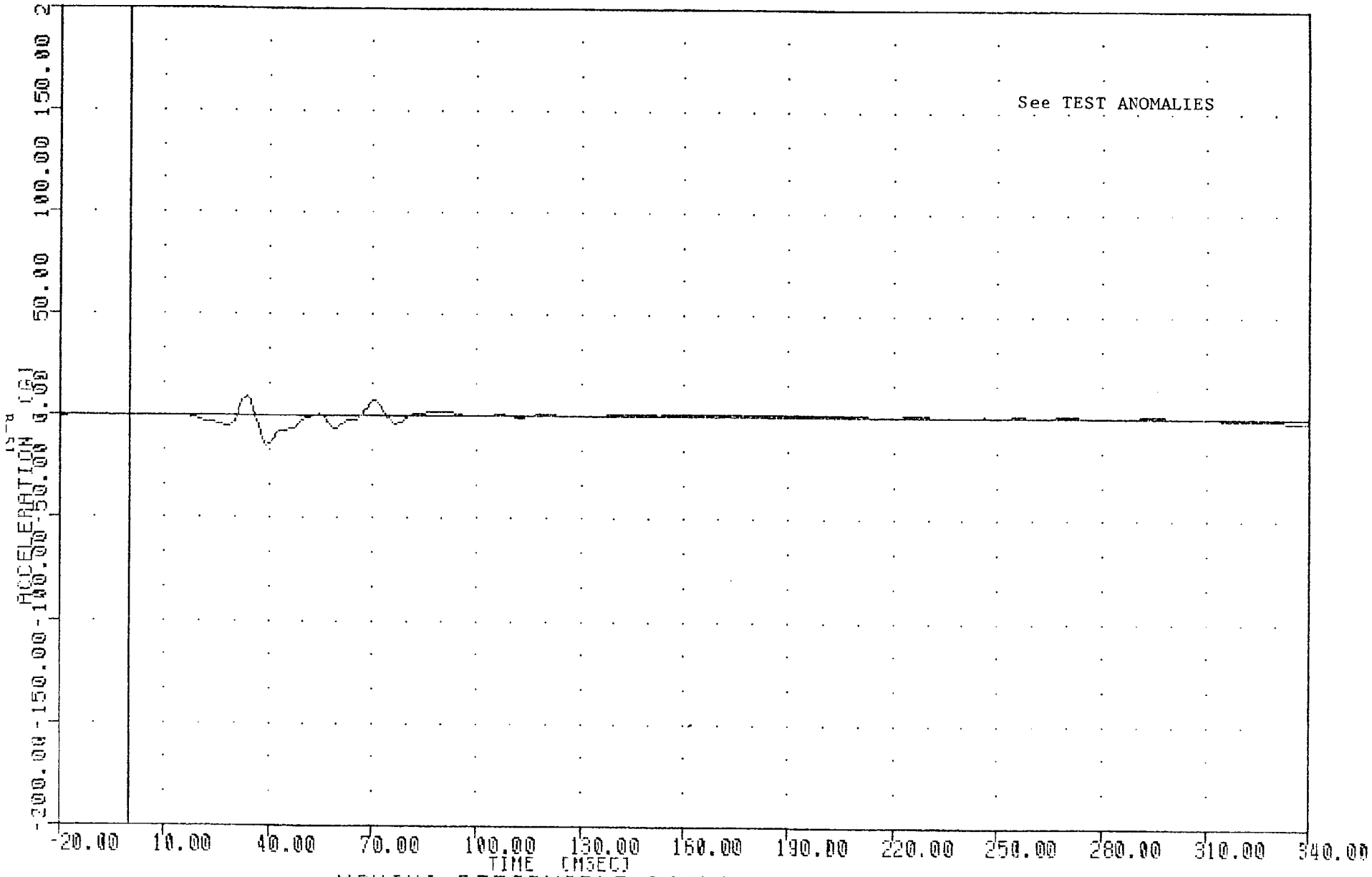


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LOWER SPINE ACCELERATION -2 Y AXIS

[redacted]

SI PROTECTION PROD VEHICLE
87142
T12ZG4

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -14.05 @ 39.38 , 9.67 @ 33.75

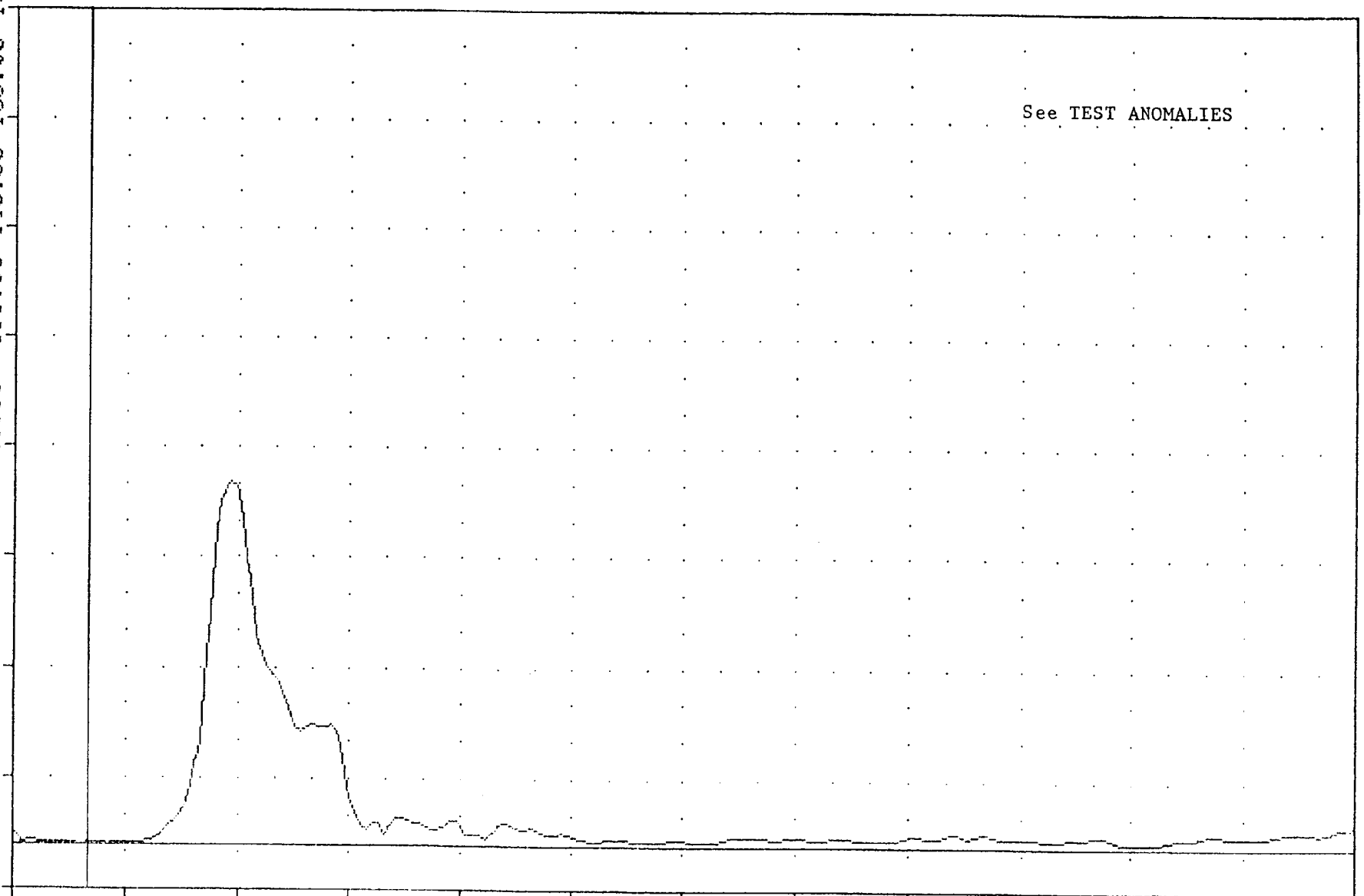


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LOWER SPINE ACCELERATION Z AXIS

[redacted] 052[redacted]

SI PROTECTION PROD VEHICLE
87142
T12RG4

FILTER = HSRI 136/ 189/ -50
MIN. MAX VALUES = 0.15 @ -1.88 , 82.20 @ 38.13

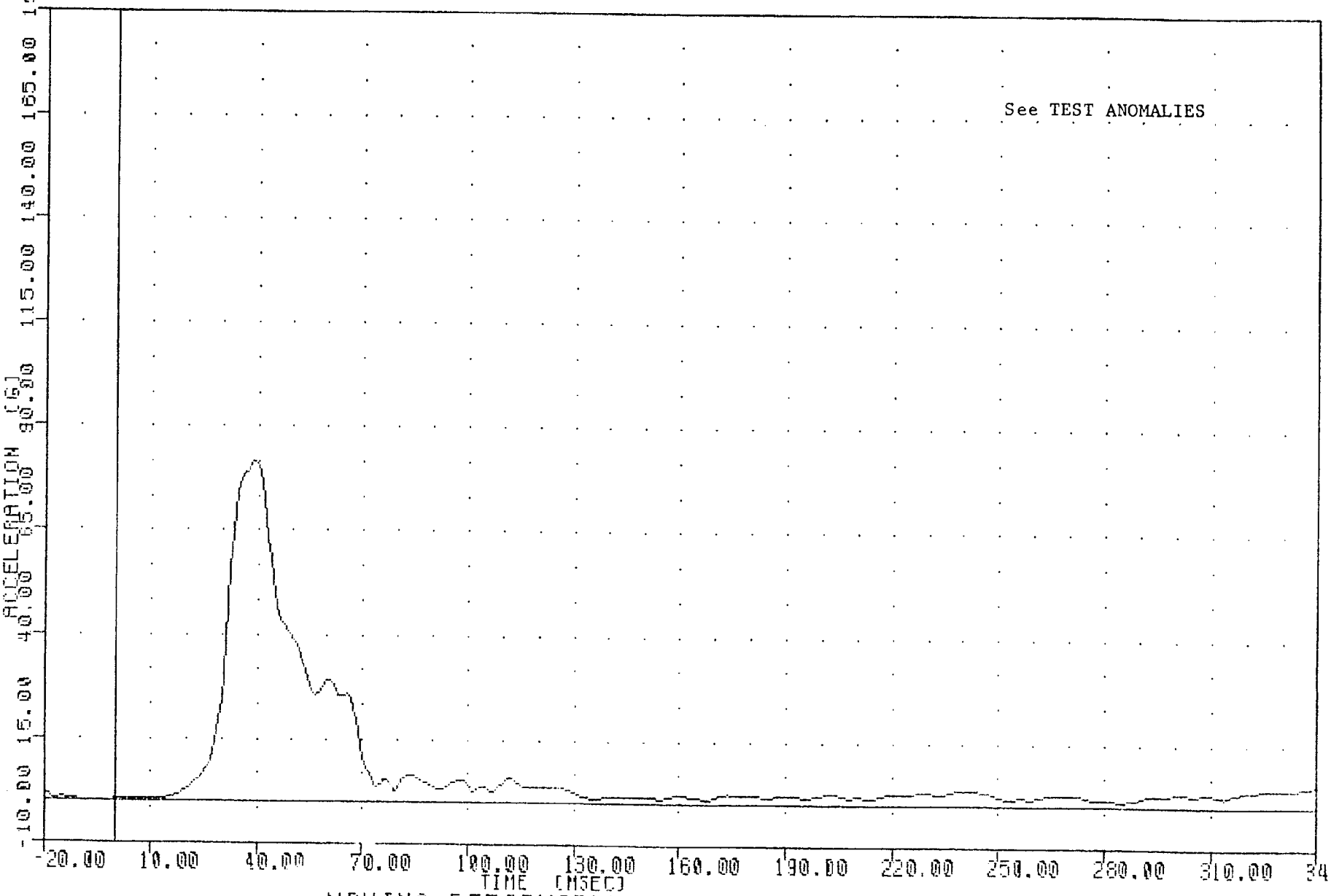


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LOWER SPINE RESULTANT ACCELERATION

[redacted] V[redacted] [redacted] [redacted]052[redacted]

SI PROTECTION PROD VEHICLE
87142
T12RGD

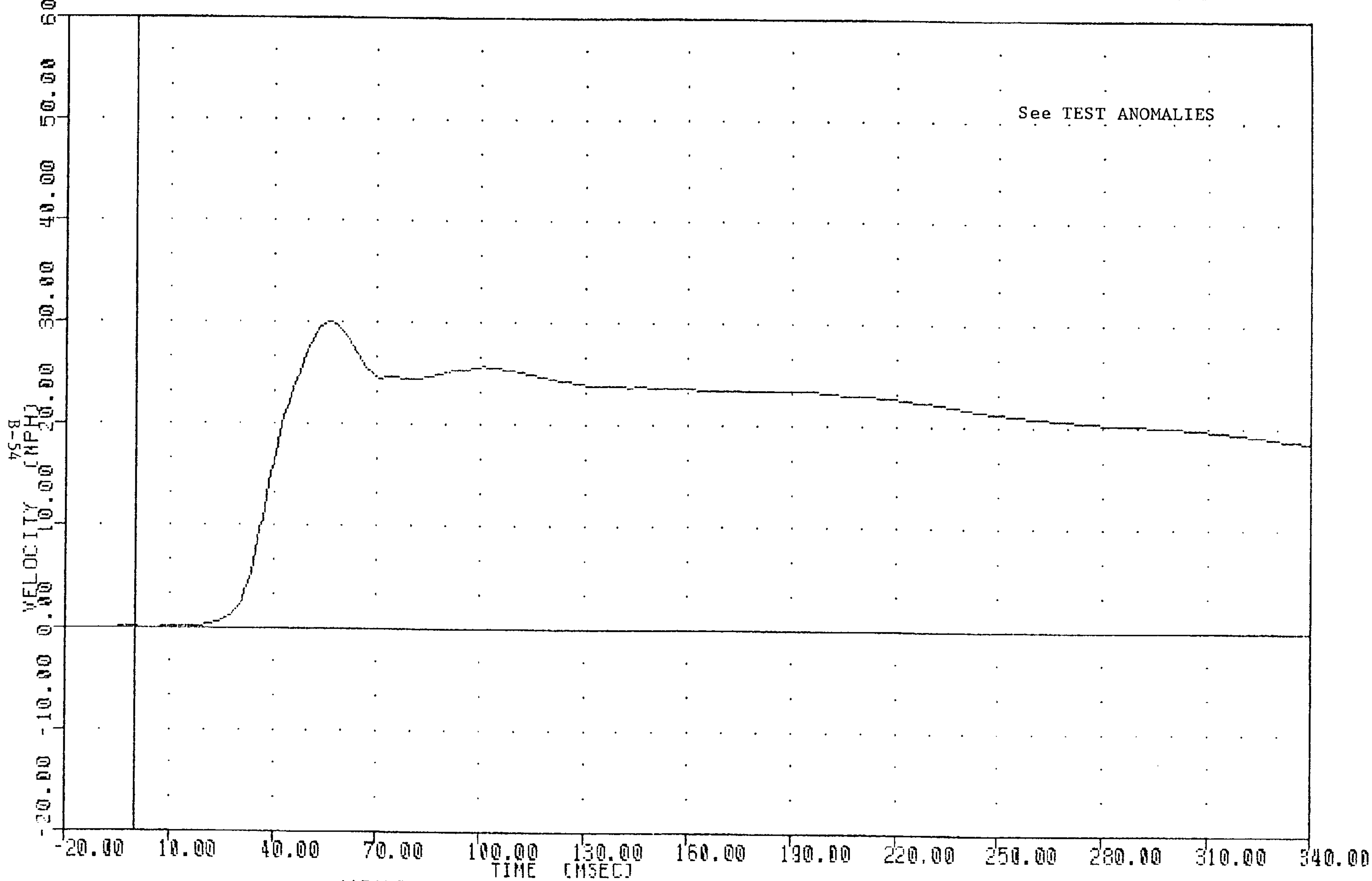
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.10@ -3.13, 81.57 @ 39.38



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LOWER SPINE RESULTANT ACCELERATION USING T12YGD

VRT[redacted], [redacted]22
SI PROTECTION PROD VEHICLE
87142
T12YV4

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -0.06 @ -16.87 , 29.98 @ 56.25

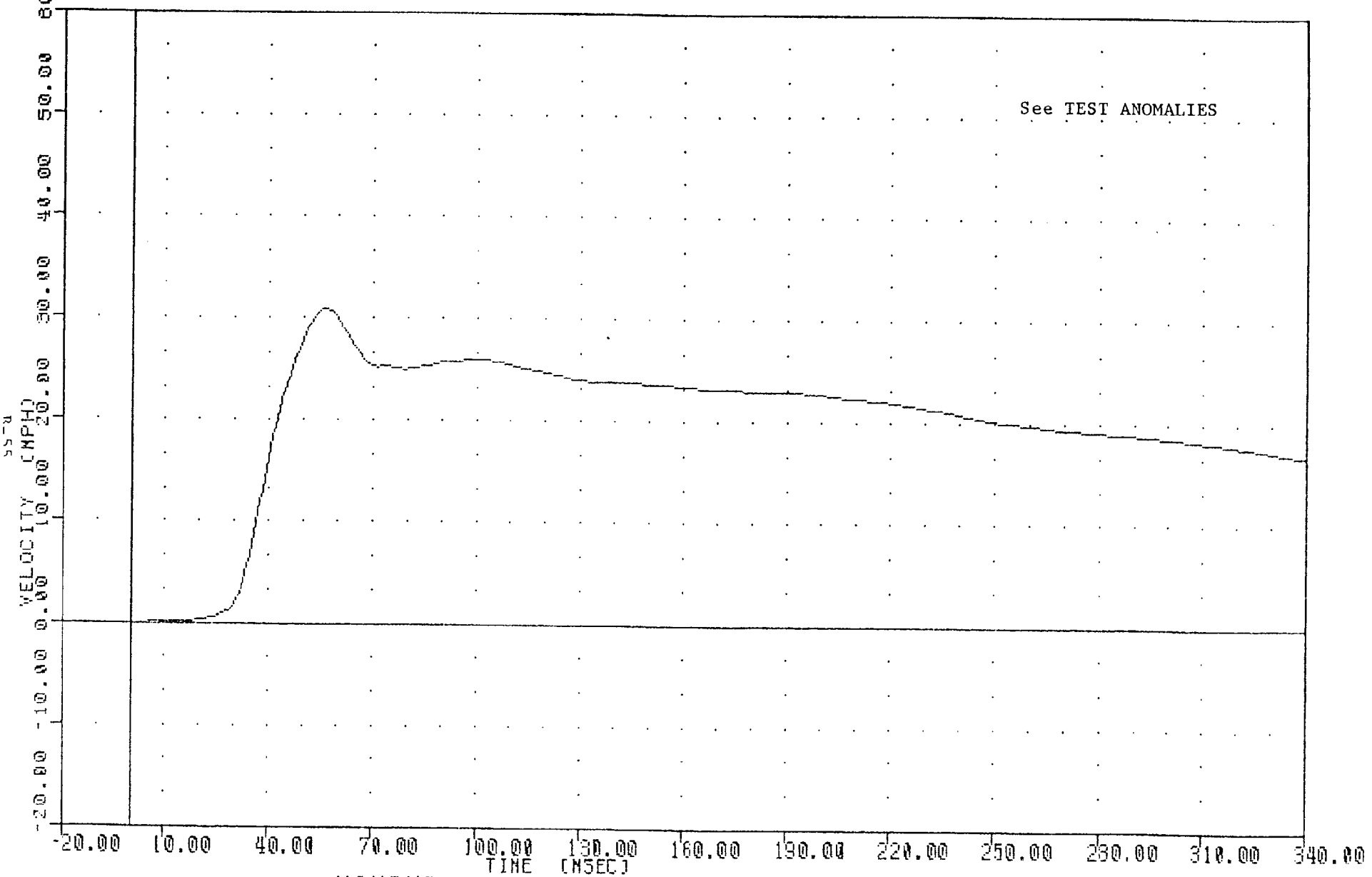


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING T12Y64

[redacted]VAT[redacted], 8[redacted]22 [redacted]

SI PROTECTION PROD VEHICLE
87142
T12YVD

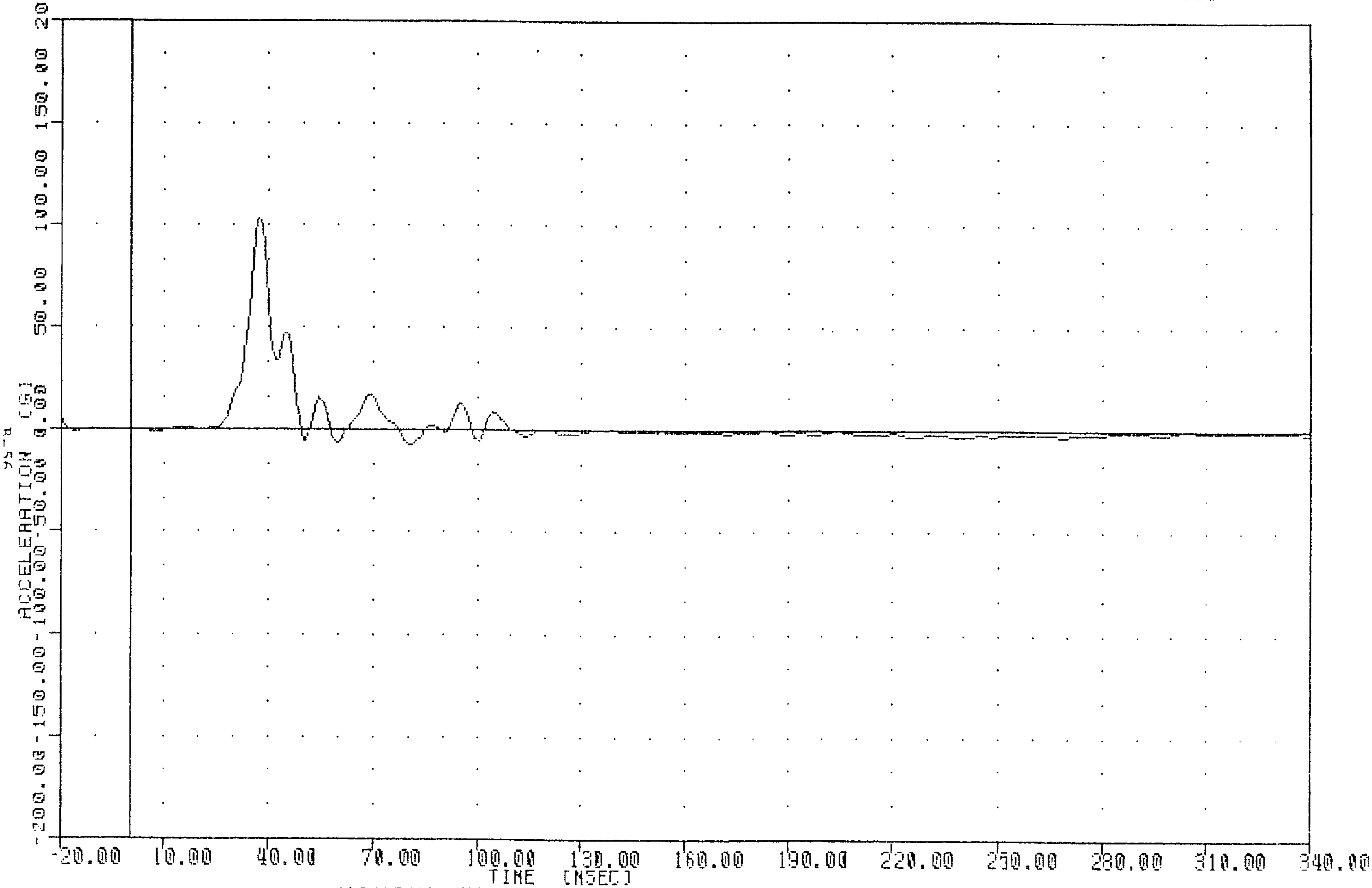
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -0.02 @ 0.63 , 30.80 @ 56.25



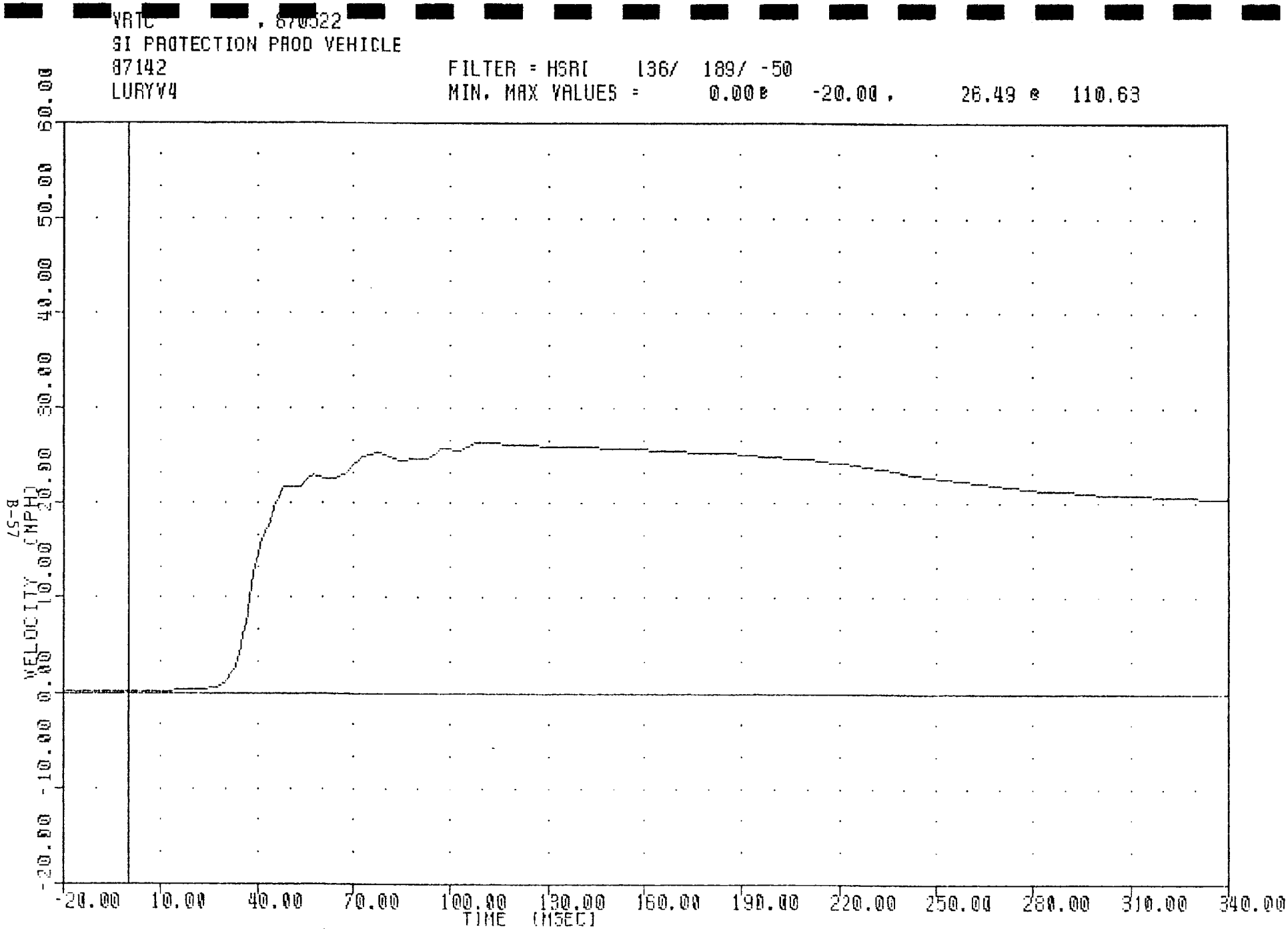
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING T12YGD

VRTC [redacted], 8[redacted]22
SI PROTECTION PROD VEHICLE
87142
LURY64

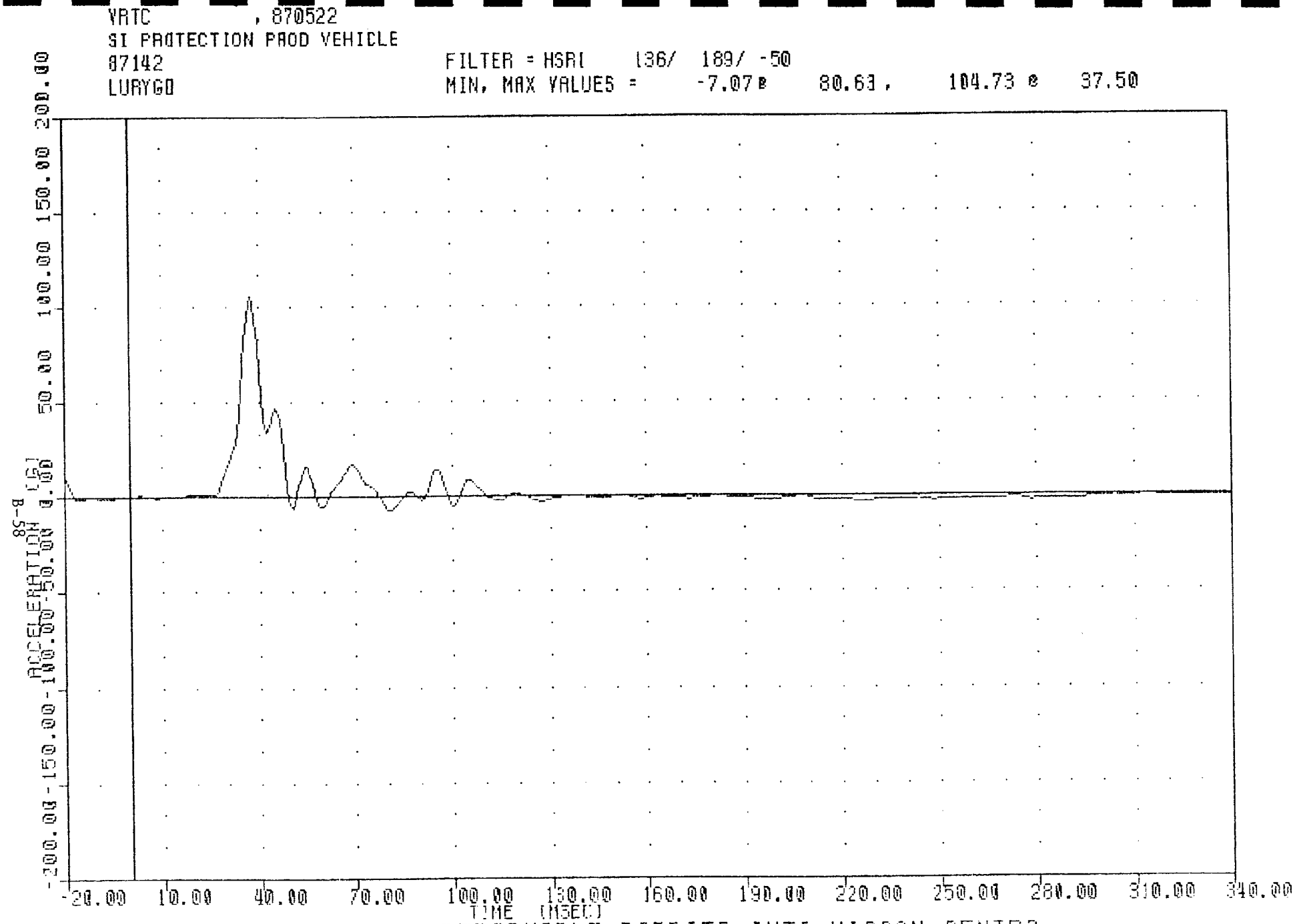
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -7.40 @ 80.63 , 103.13 @ 37.50



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LEFT UPPER RIB ACCELERATION Y AXIS



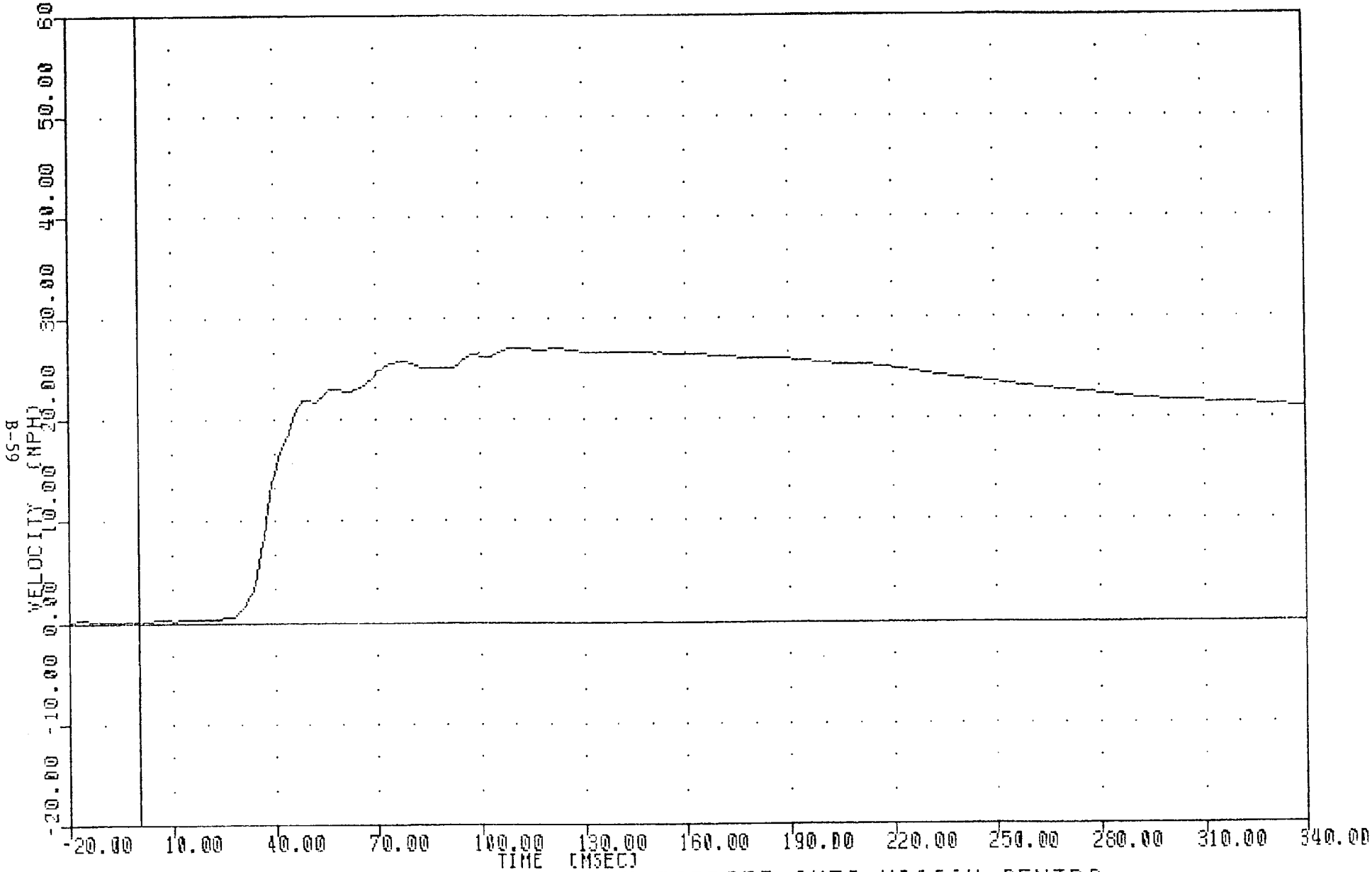
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LURYG4



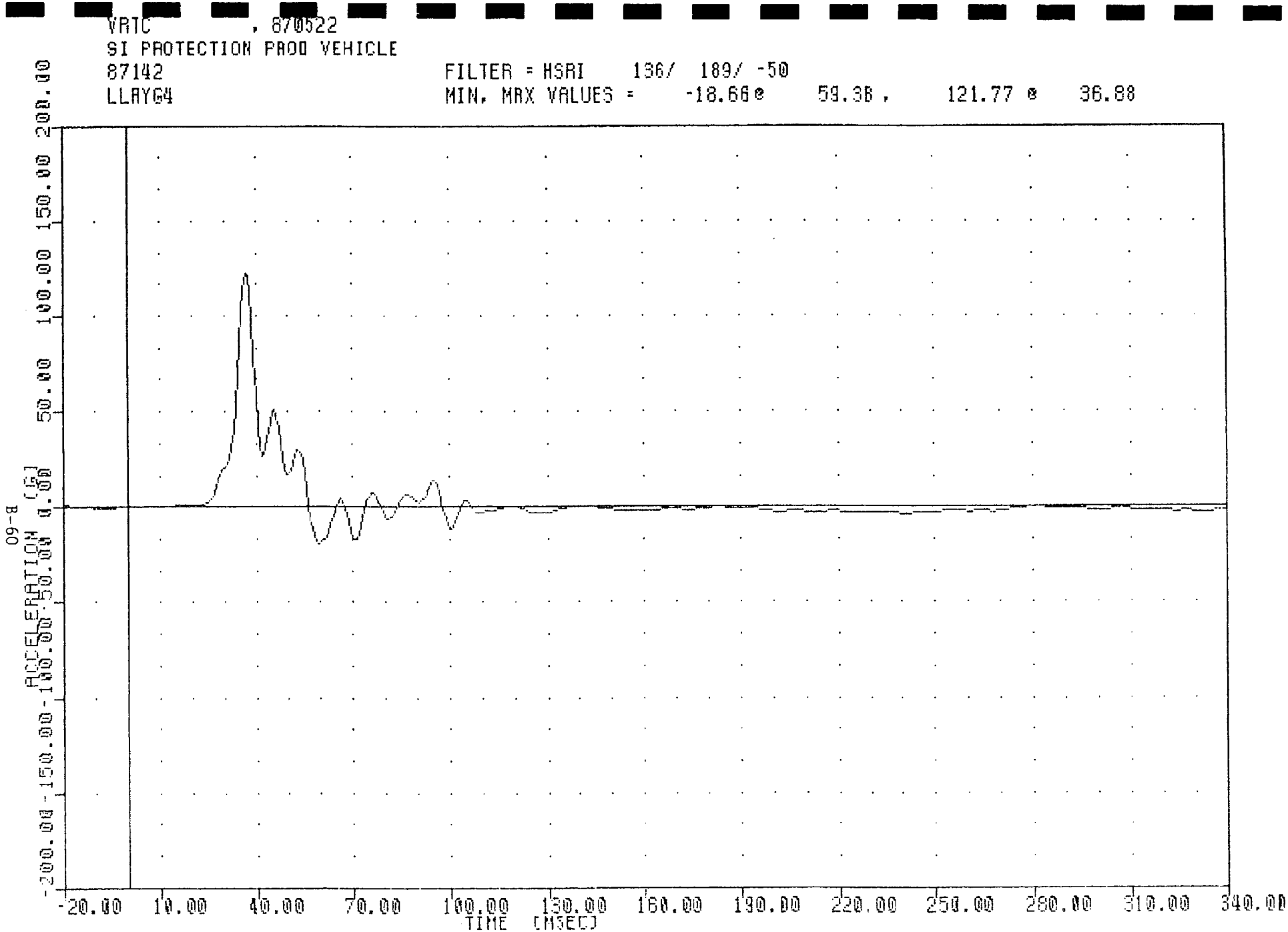
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LEFT UPPER RIB ACCELERATION -2 Y AXIS

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142
LURYVD

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = 0.00 @ -20.00 , 27.11 @ 110.63

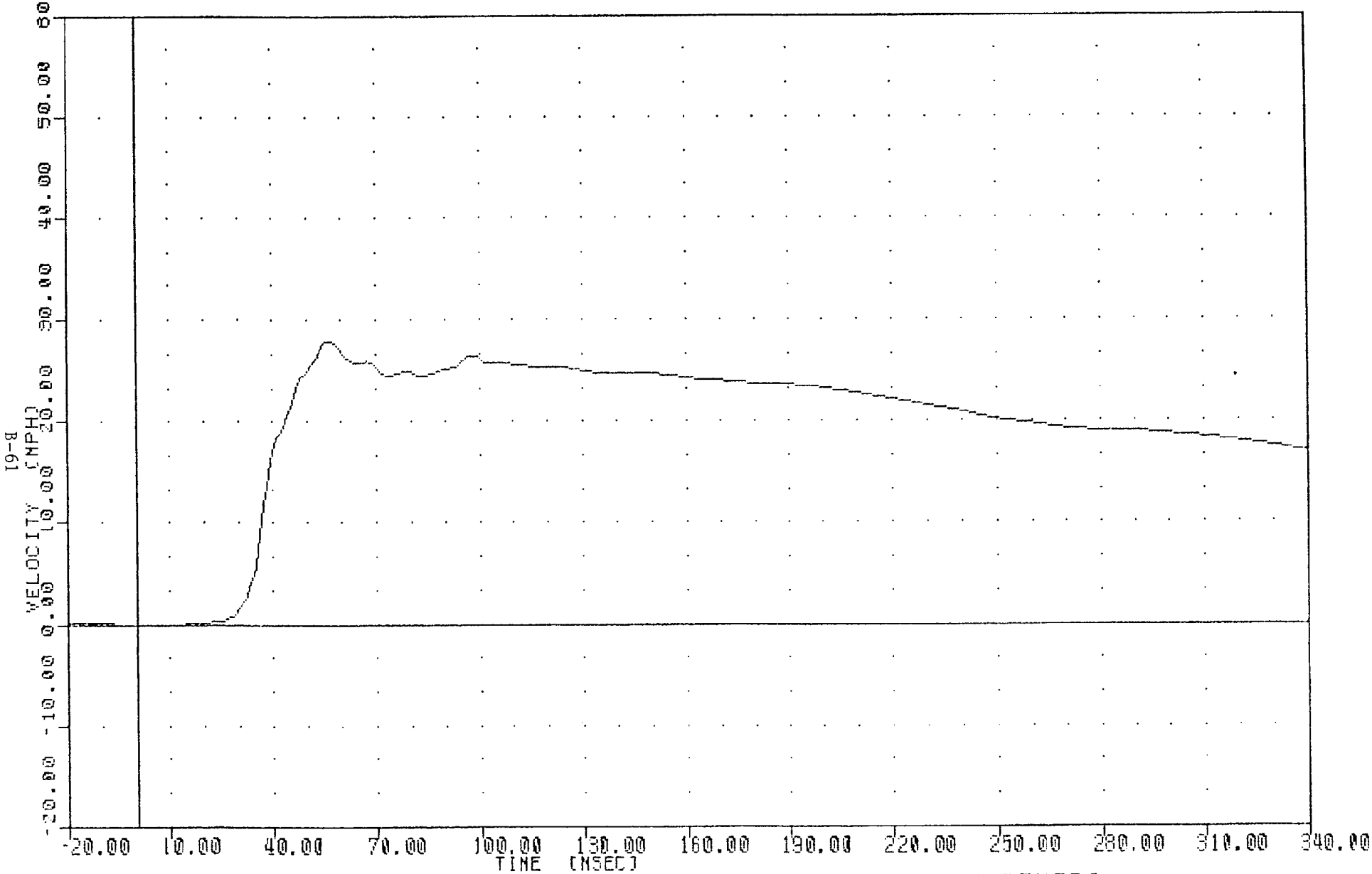


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LURYGD



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LEFT LOWER RIB ACCELERATION Y AXIS

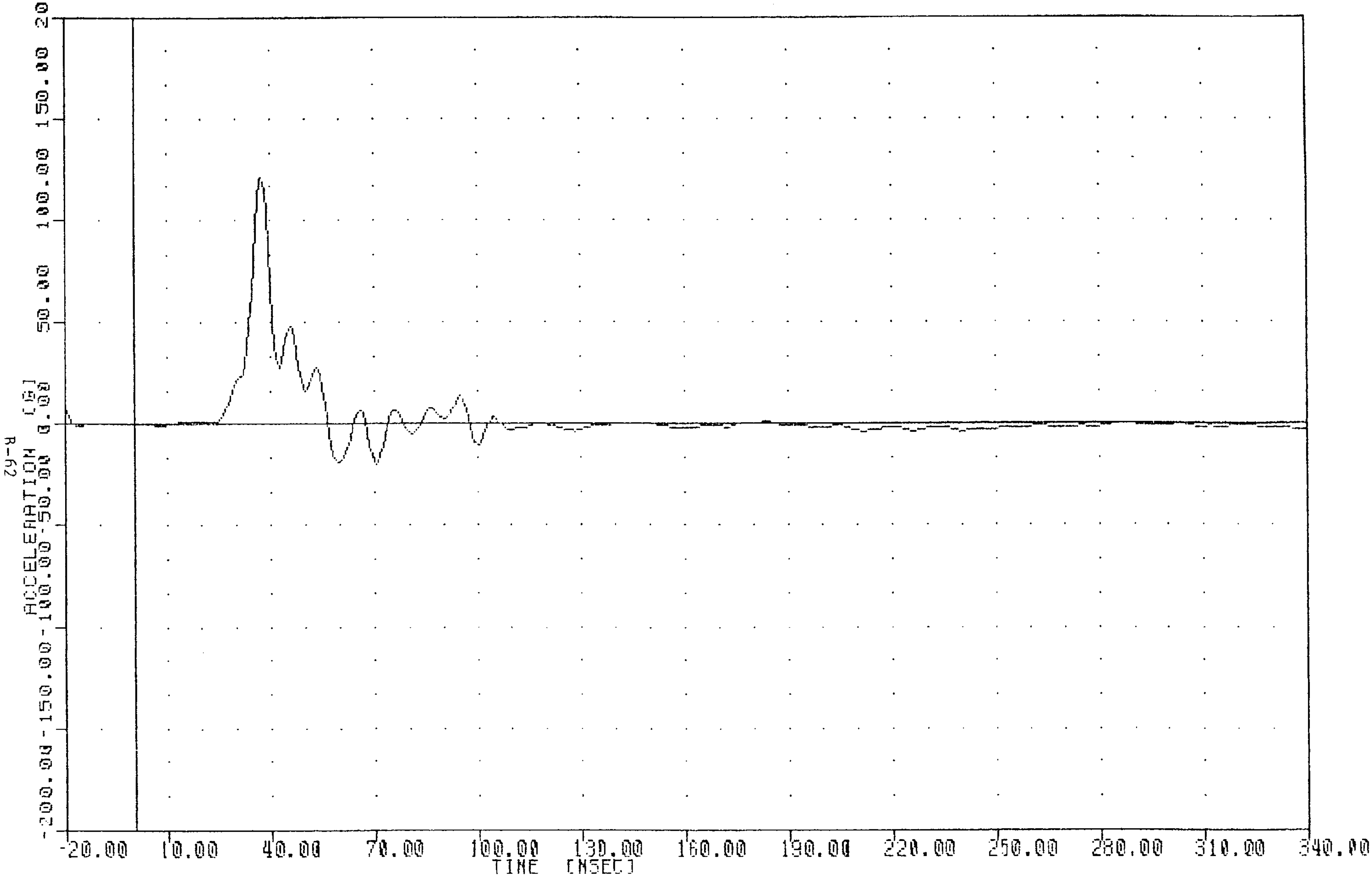
[redacted], 87[redacted]22
SI PROTECTION PROD VEHICLE
87142
LLRYY4
FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -0.03 @ -1.88 , 27.98 @ 56.25



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LLRYG4

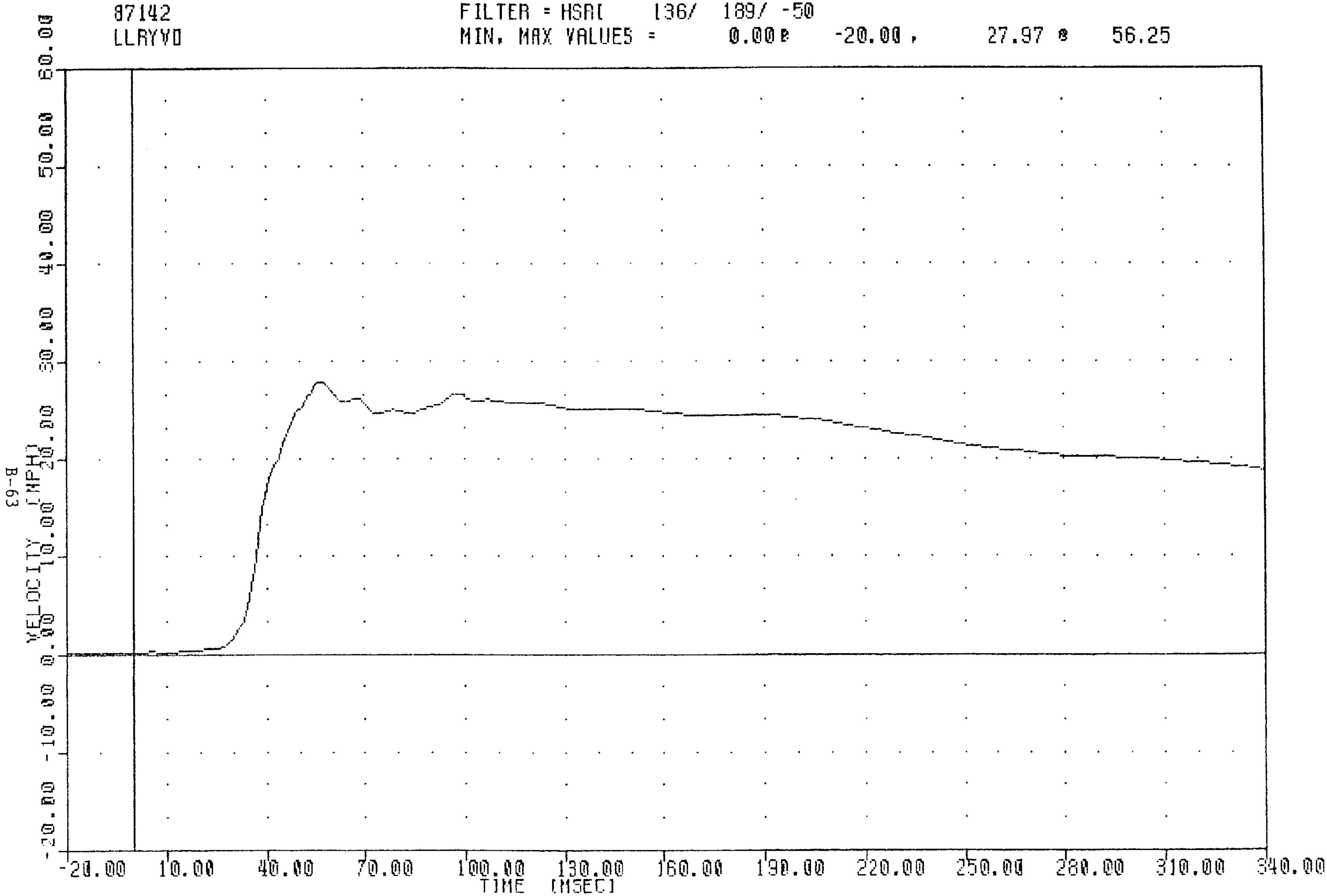
VRTC [redacted], 8[redacted]22
SI PROTECTION PROD VEHICLE
87142
LLRYGD

FILTER = HSRI 136/ 189/ -50
MIN, MAX VALUES = -19.87 @ 70.63 , 121.27 @ 37.50



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LEFT LOWER RIB ACCELERATION #2 Y AXIS

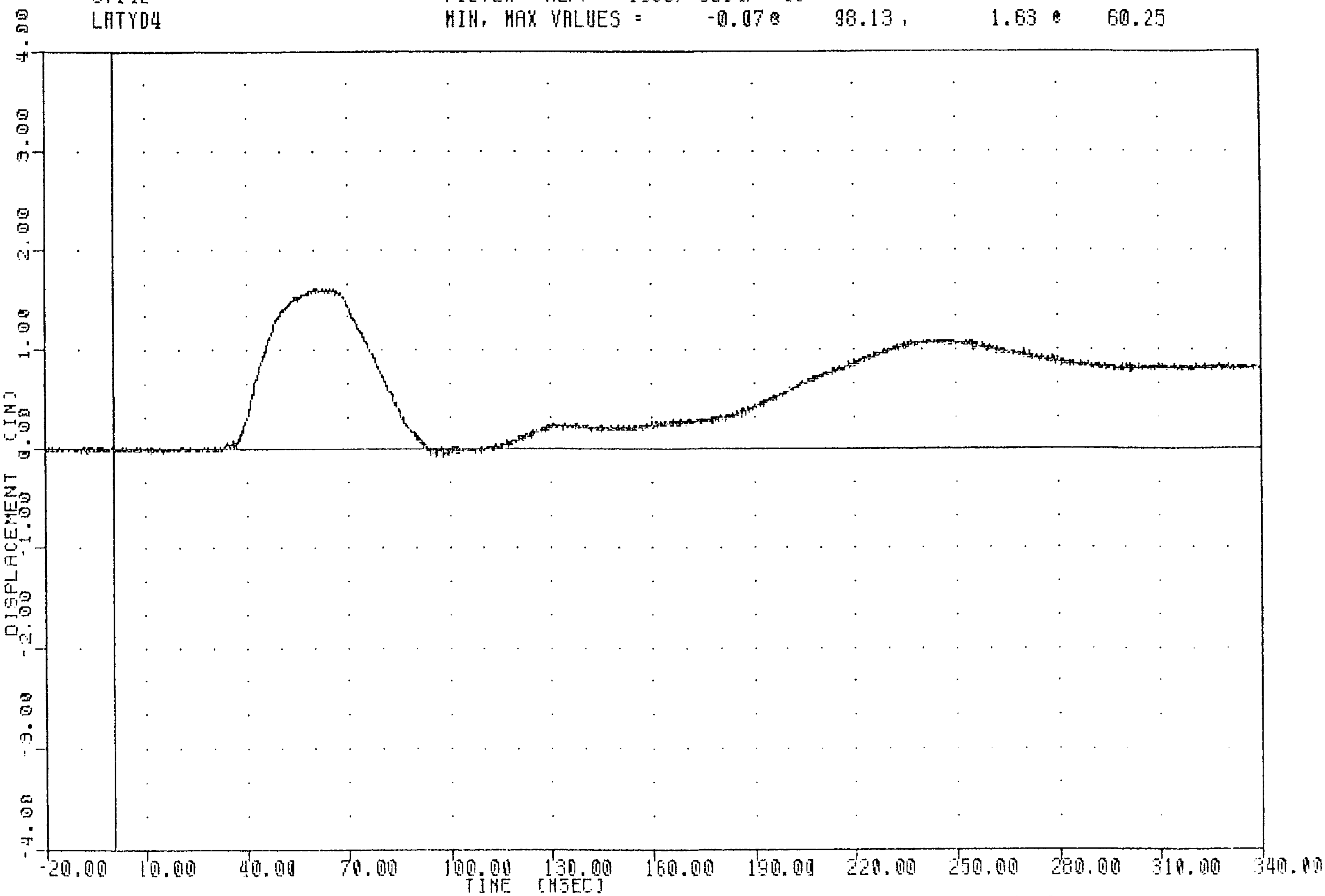
VRT[redacted] , [redacted]22
SI PROTECTION PROD VEHICLE
87142 FILTER = HSRI 136/ 189/ -50
LLRYVD MIN, MAX VALUES = 0.00 @ -20.00 , 27.97 @ 56.25



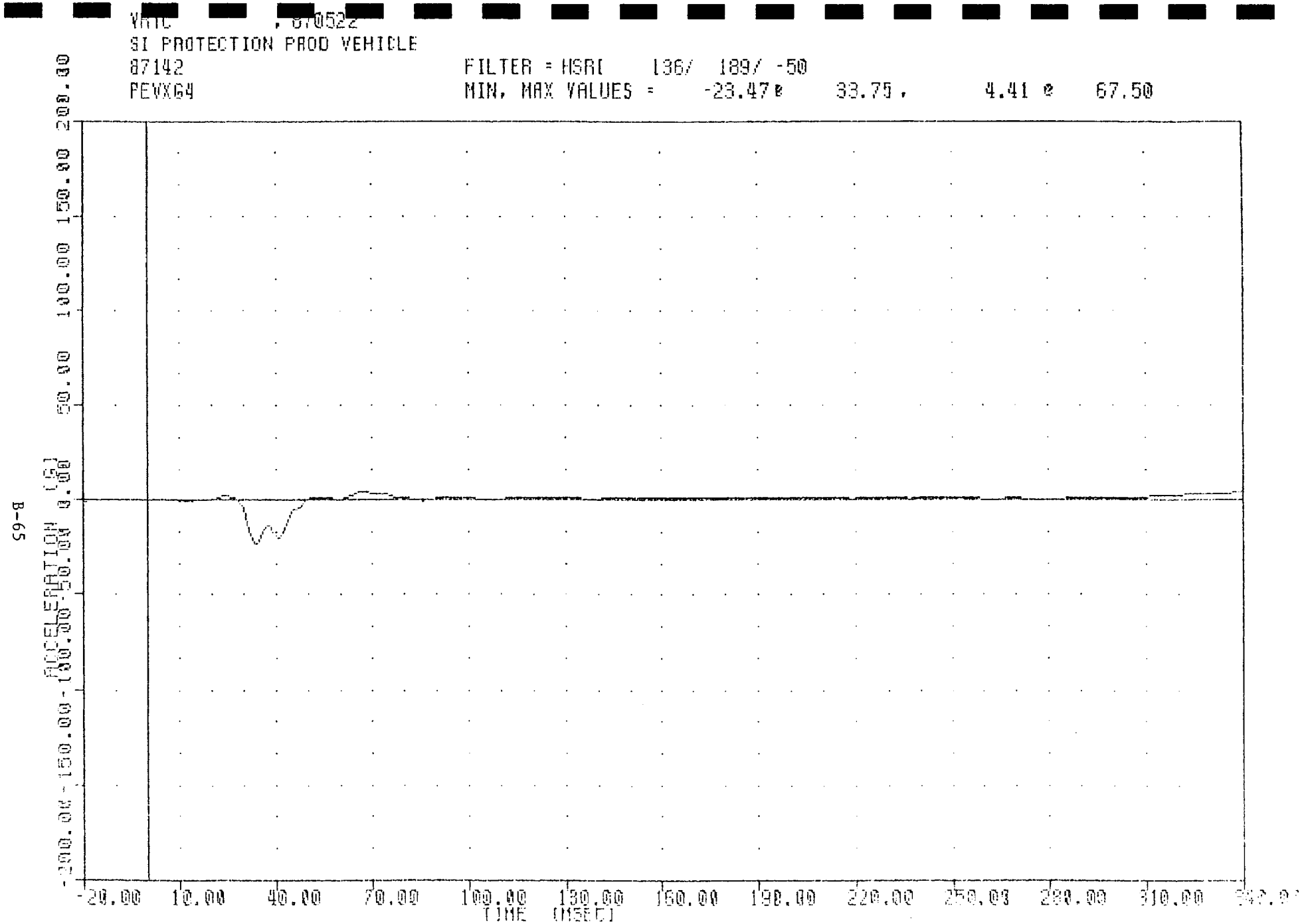
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LLRYGD

VA[redacted] , [redacted]522
SI PROTECTION PROD VEHICLE
87142
LATYD4

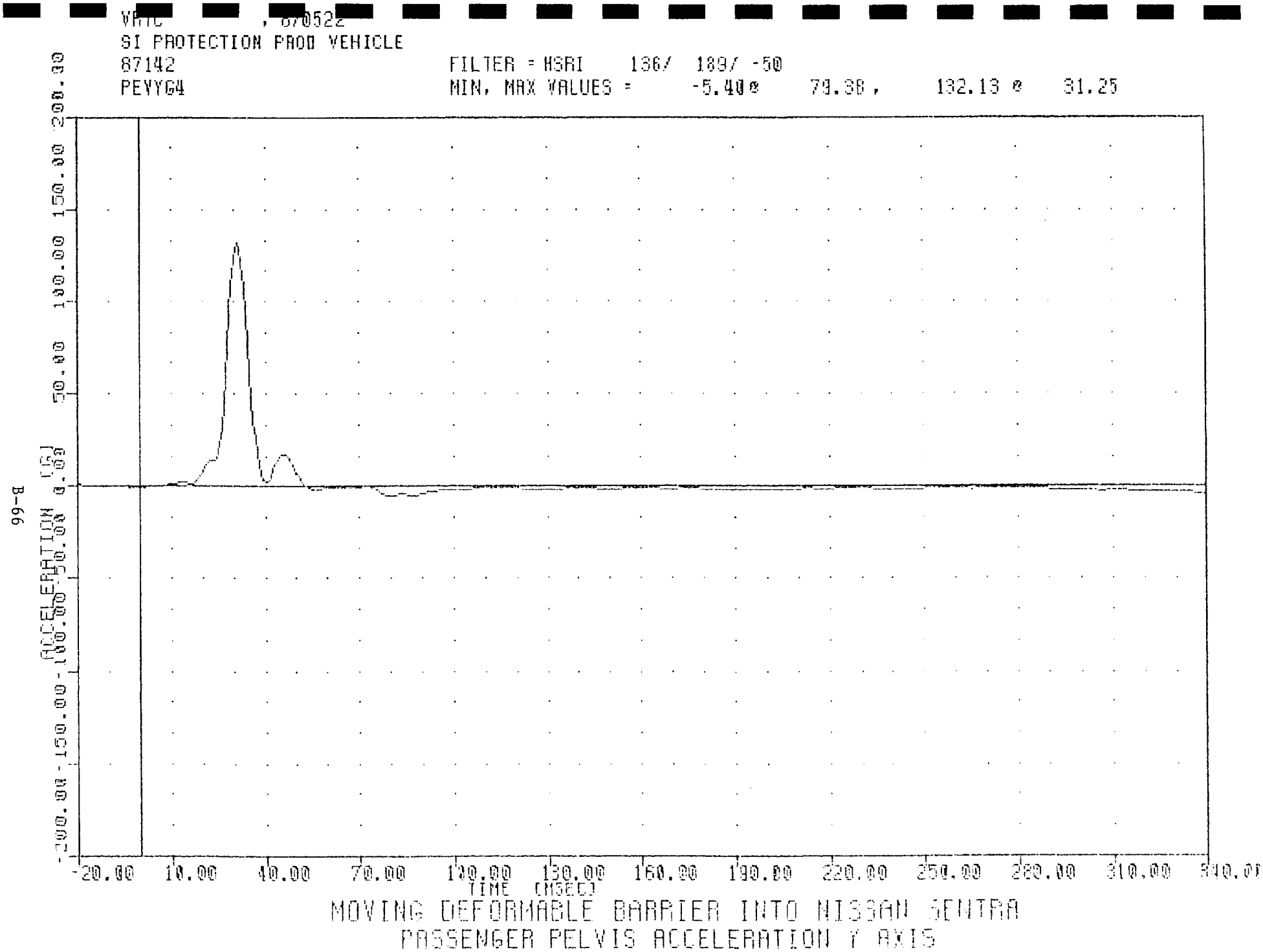
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -0.07 @ 98.13 , 1.63 @ 60.25



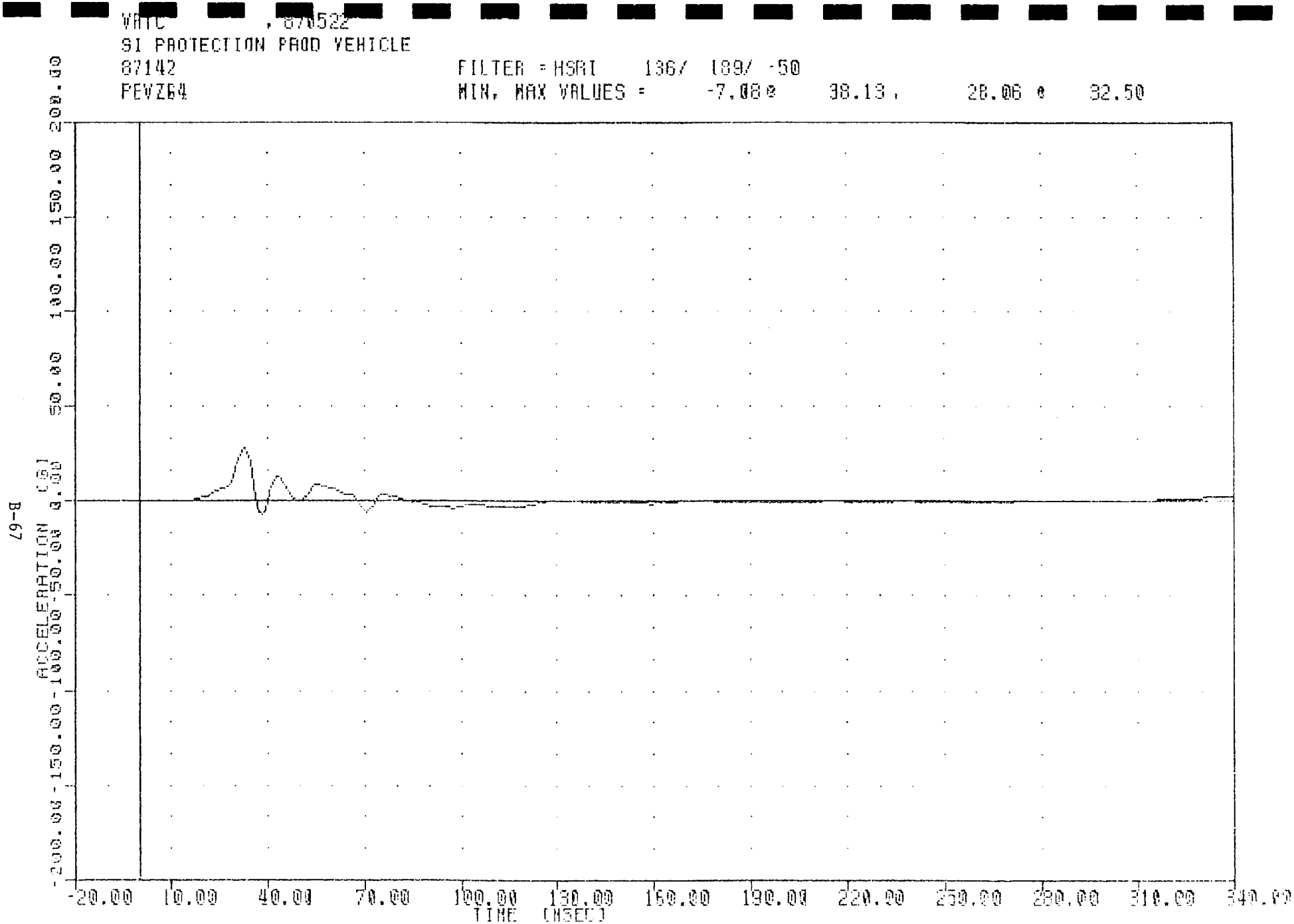
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER LEFT RIB TO SPINE DISPLACEMENT INCHES



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER PELVIS ACCELERATION X AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER PELVIS ACCELERATION Y AXIS



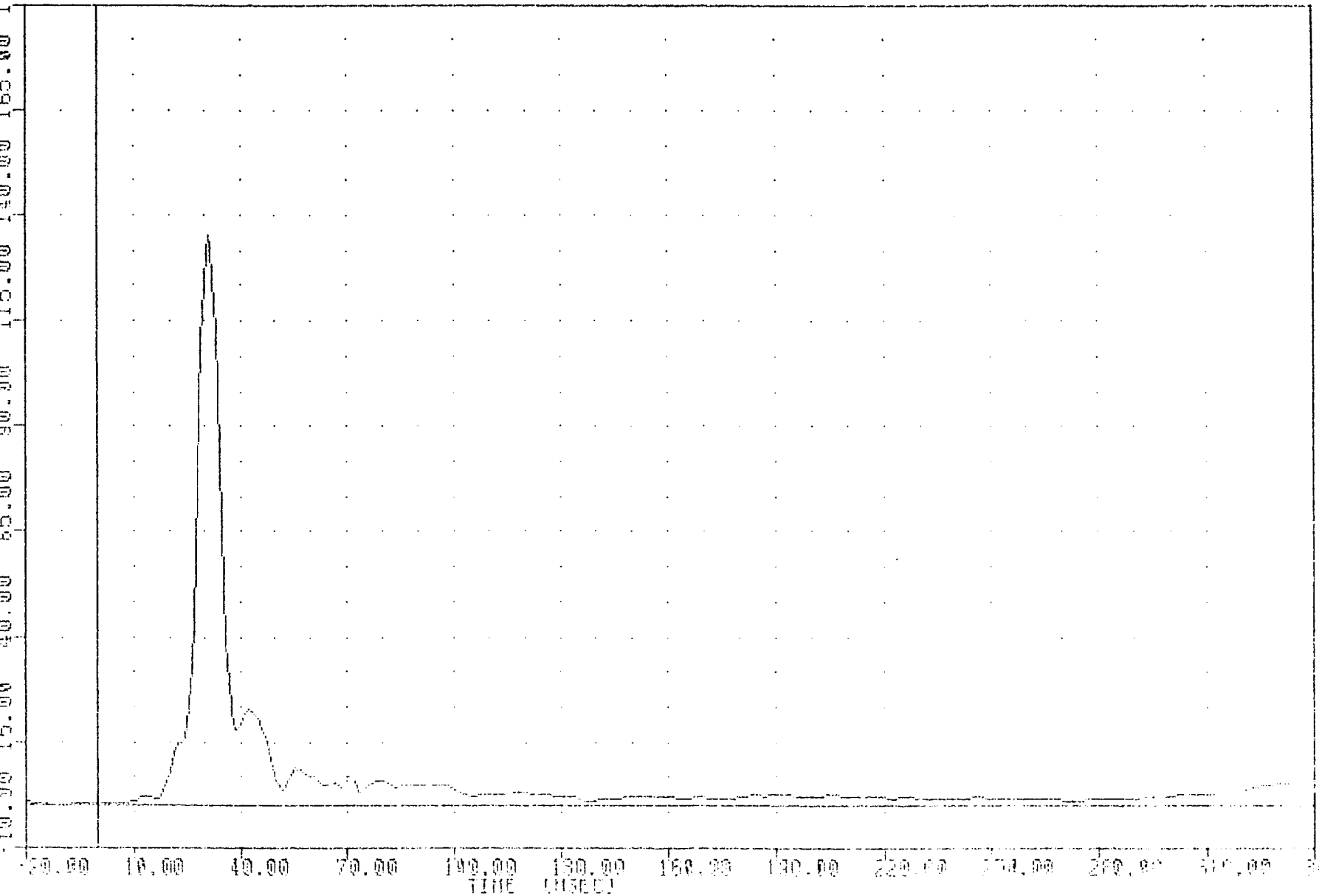
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
PASSENGER PELVIS ACCELERATION Z AXIS

[redacted] V[redacted] [redacted] [redacted] 052[redacted]

SI PROTECTION PROD VEHICLE

87142 FILTER = HSRI 136/ 189/ -50

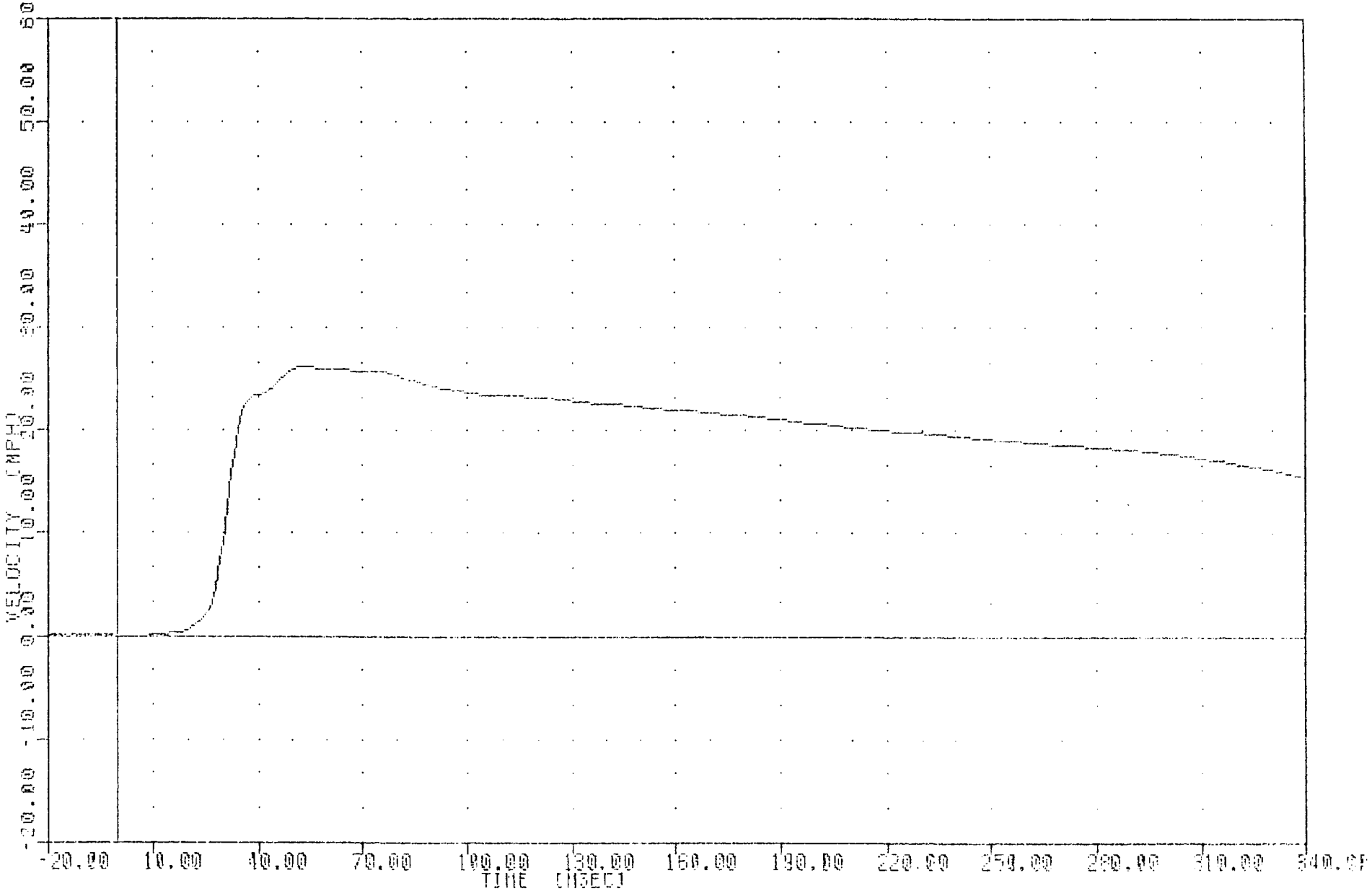
PEVR64 MIN. MAX VALUES = 0.11@ -11.25, 134.94 @ 31.25



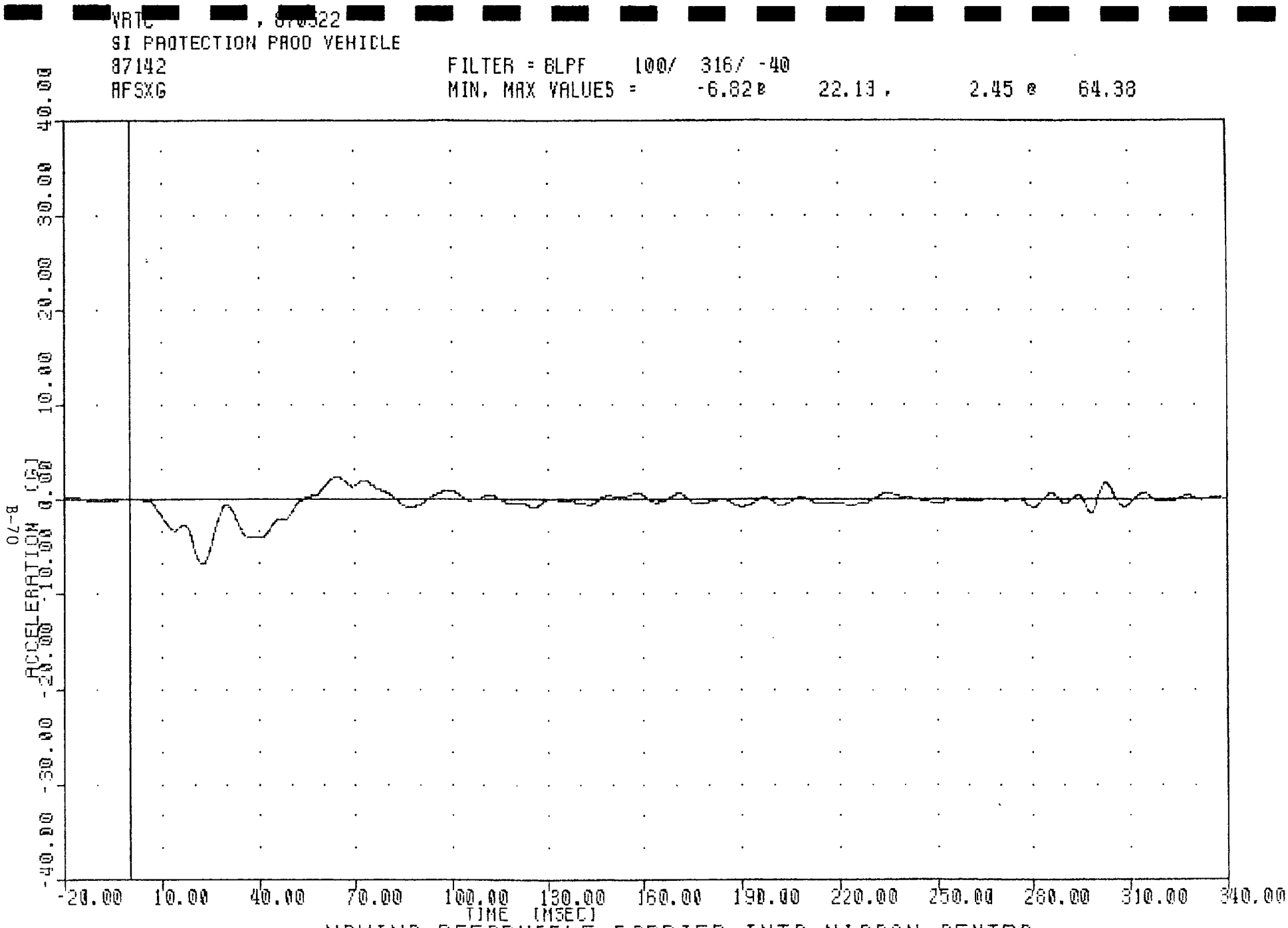
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

PASSENGER PELVIS RESULTANT ACCELERATION

VHTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = HSRI 136/ 189/ -50
PEVYV4 MIN, MAX VALUES = -0.03@ 4.38 , 26.19 @ 53.12



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING PEVYG4



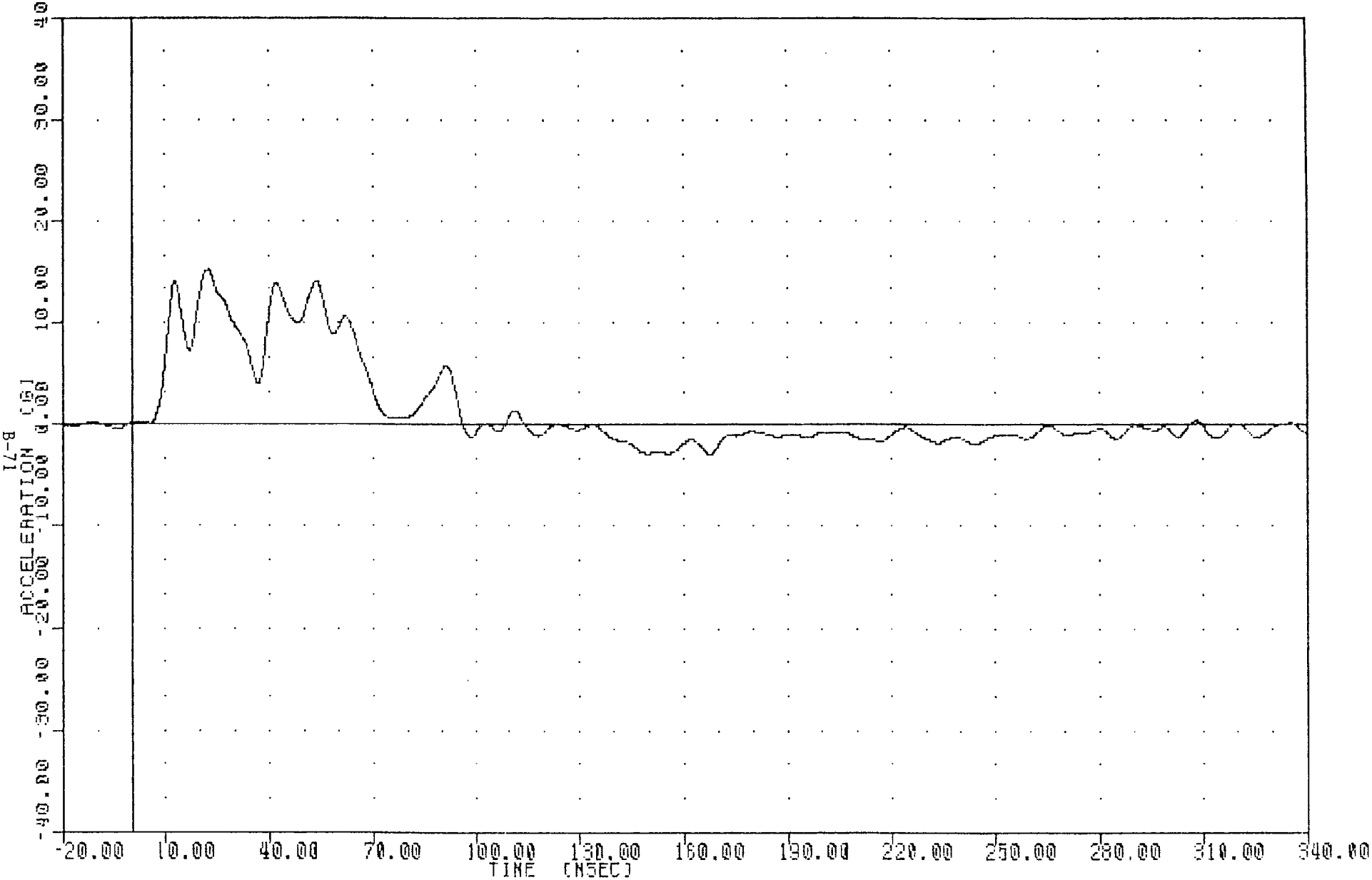
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE RIGHT FRONT SILL ACCELERATION X AXIS

[redacted]

SI PROTECTION PROD VEHICLE

87142 FILTER = BLPF 100/ 316/ -40

RFSYG MIN, MAX VALUES = -2.90 @ 167.75 , 15.23 @ 22.38



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MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

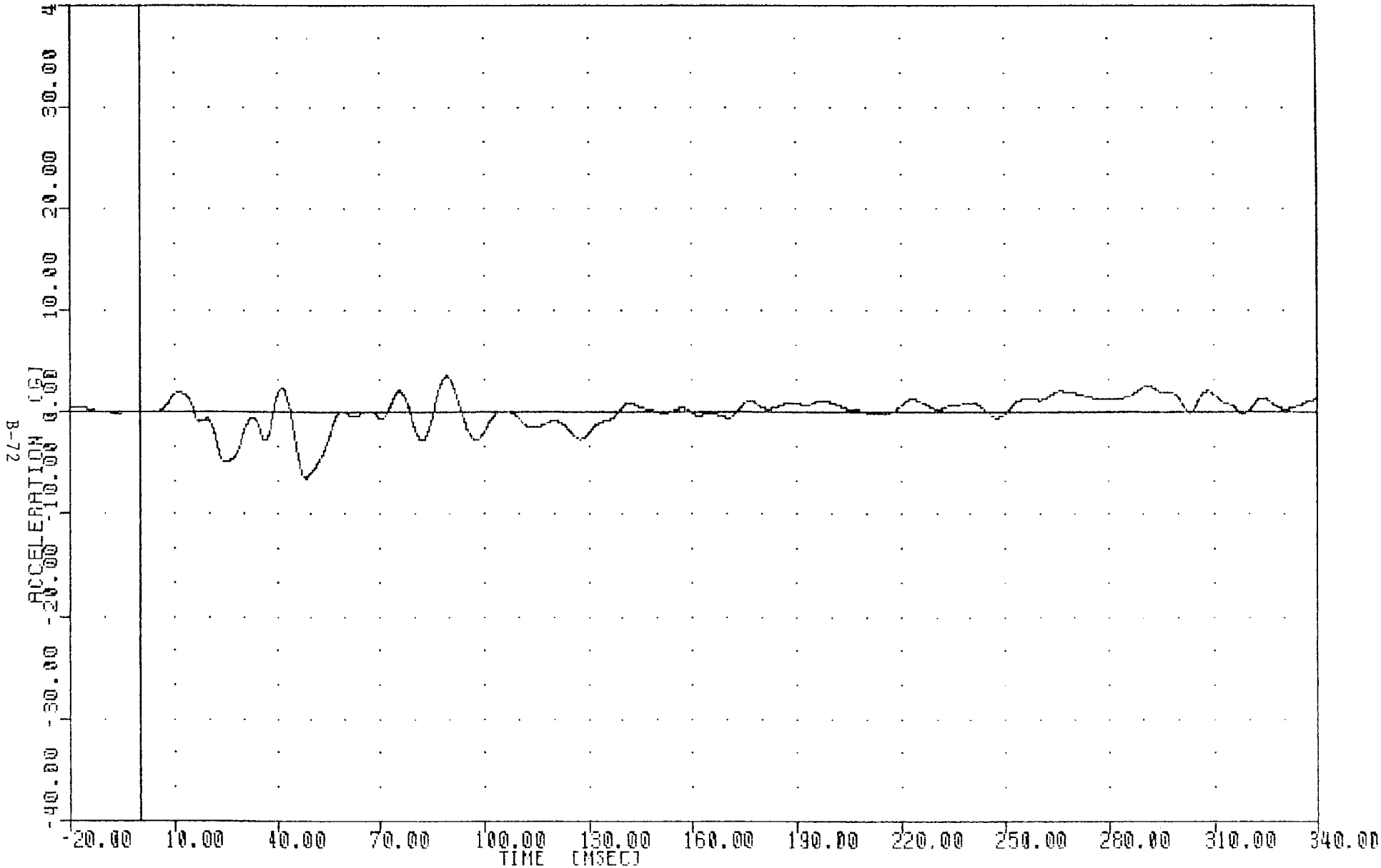
VEHICLE RIGHT FRONT SILL ACCELERATION Y AXIS

[redacted]VRT[redacted], 8[redacted]22[redacted]

SI PROTECTION PROD VEHICLE

87142 FILTER = BLPF 100/ 316/ -40

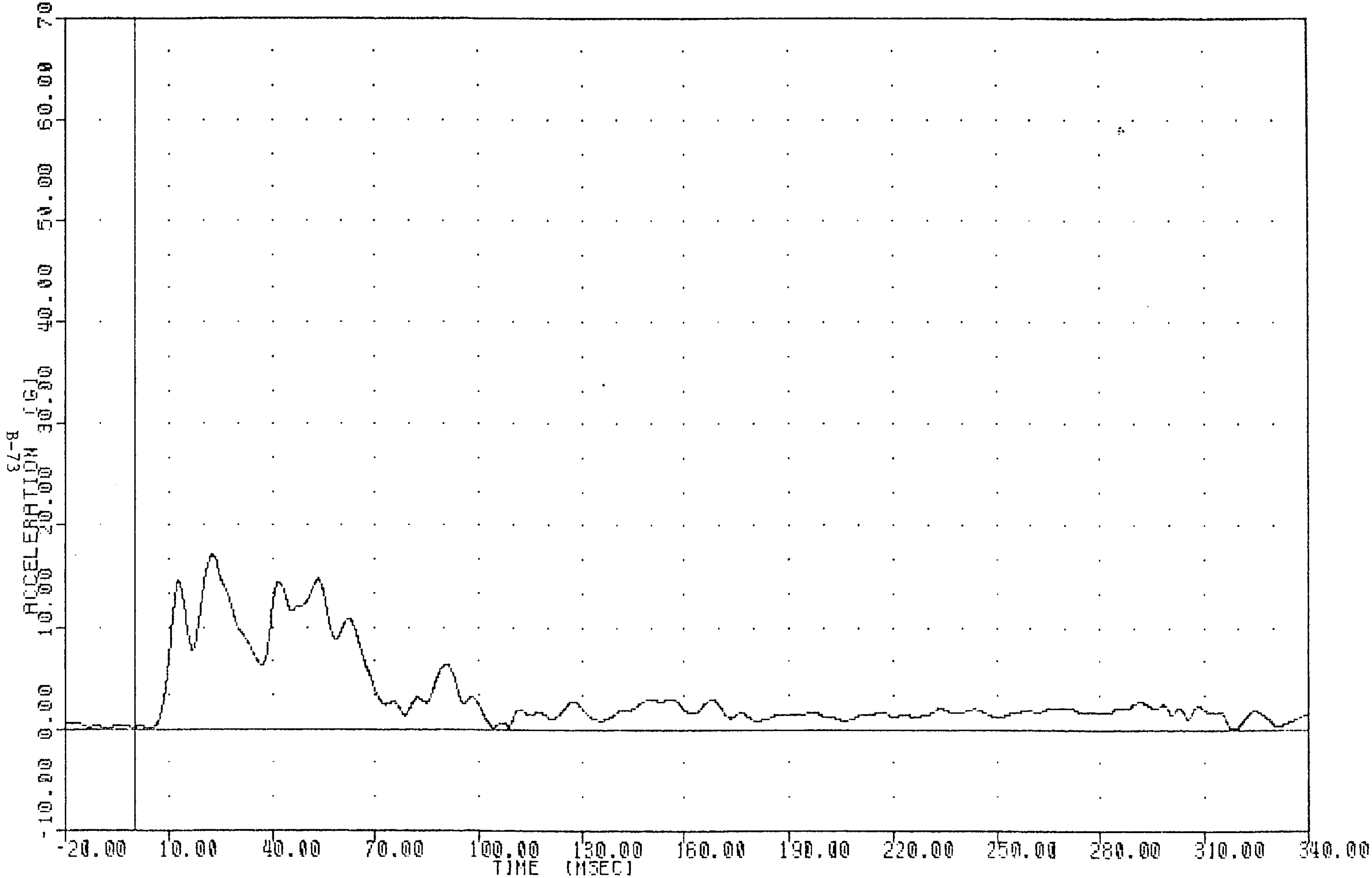
RFSZG MIN, MAX VALUES = -6.44@ 48.38, 3.61 @ 89.13



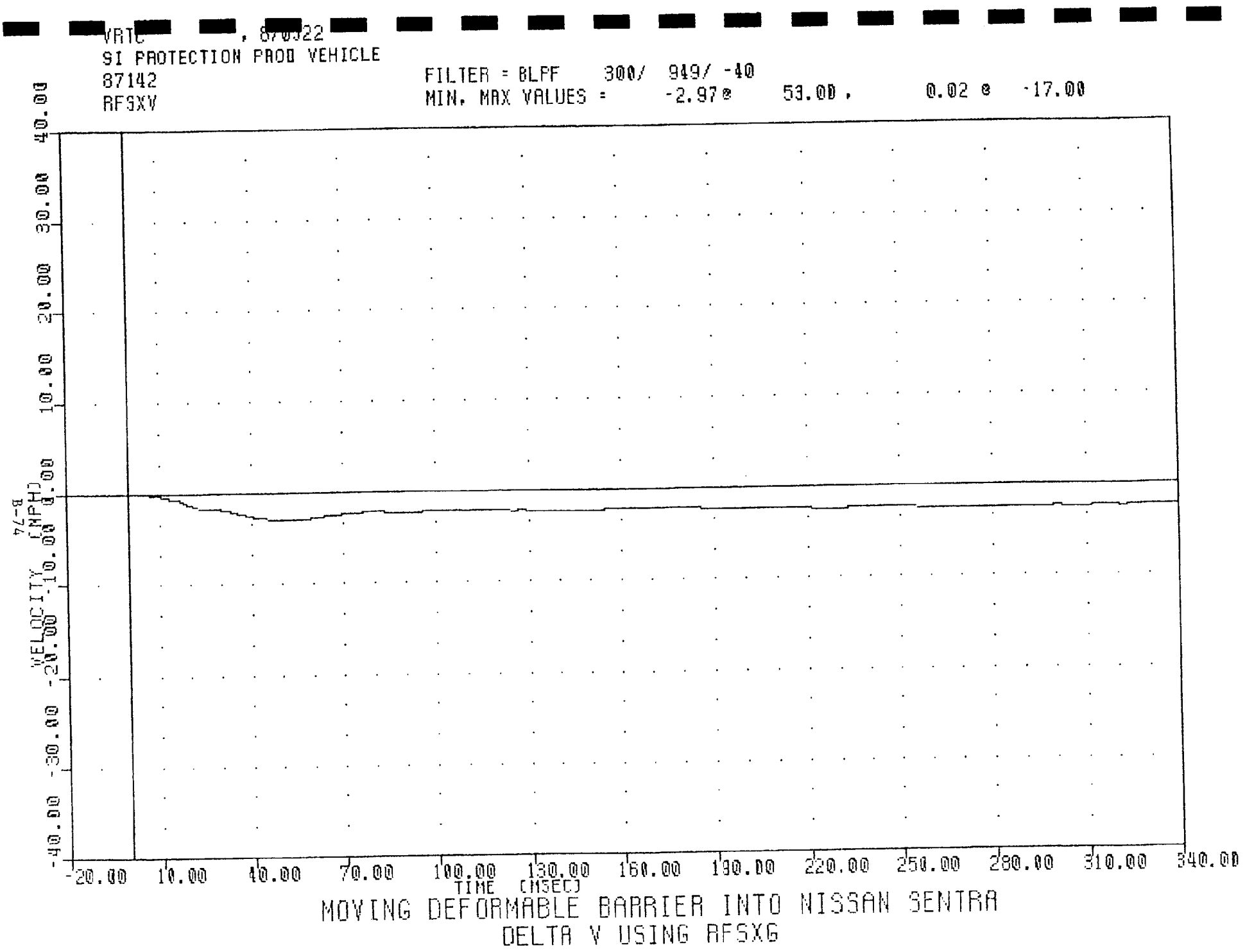
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

VEHICLE RIGHT FRONT SILL ACCELERATION Z AXIS

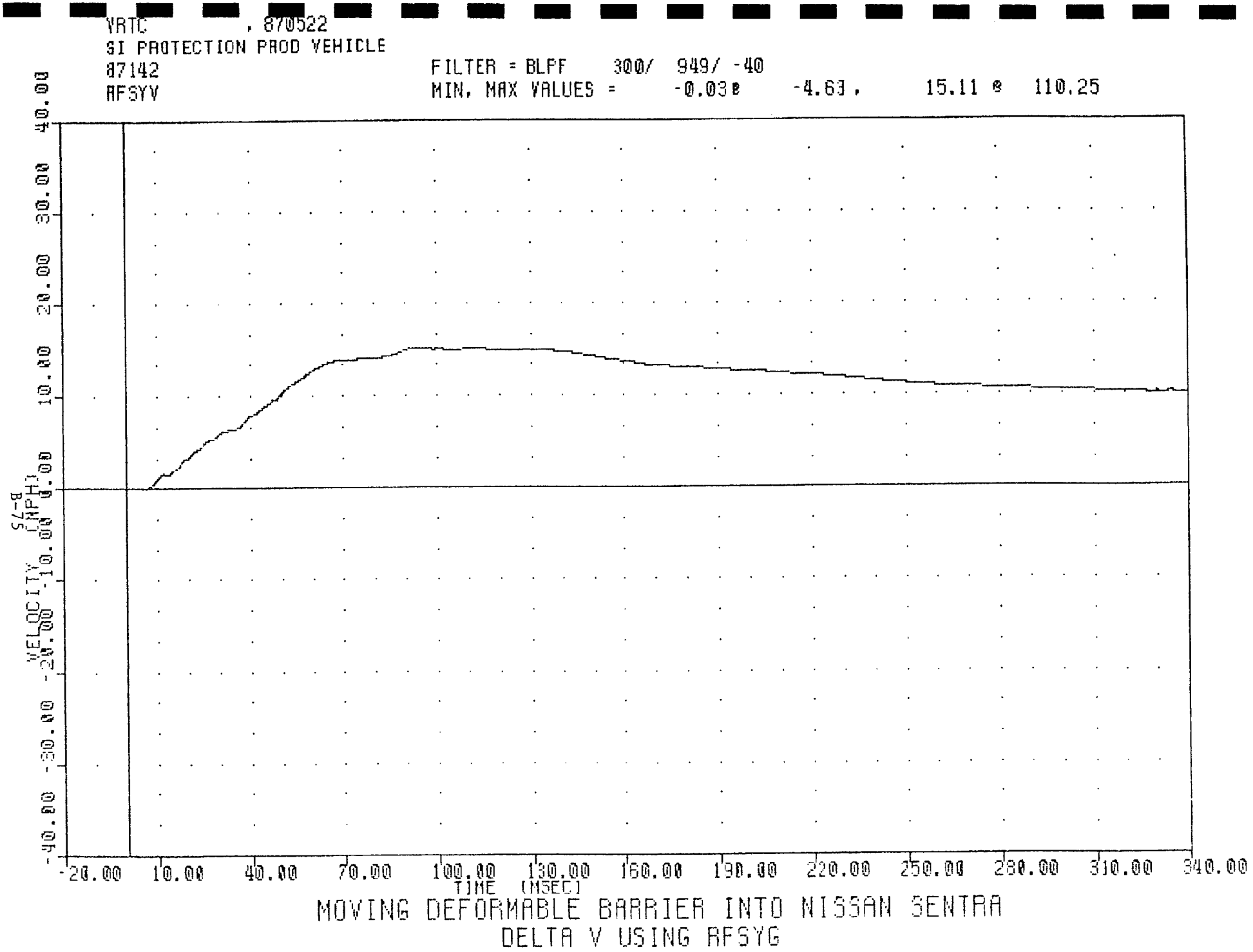
VRTC , [illegible]22
SI PROTECTION PROD VEHICLE
87142 FILTER = BLPF 100/ 316/ -40
AFSRG MIN, MAX VALUES = 0.10 @ 104.13 , 17.05 @ 22.63



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE RIGHT FRONT SILL RESULTANT ACCELERATION



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING RFSXG



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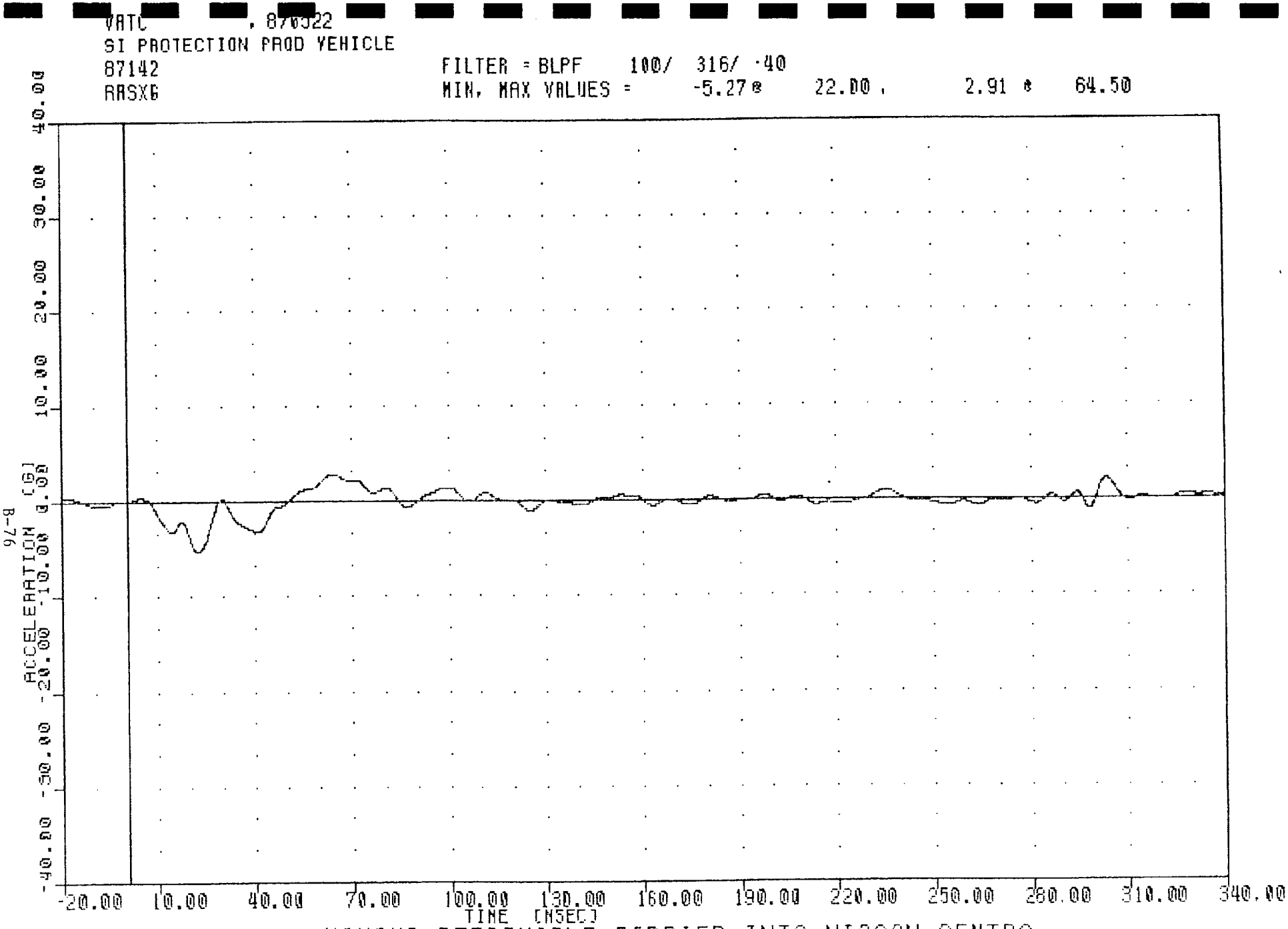
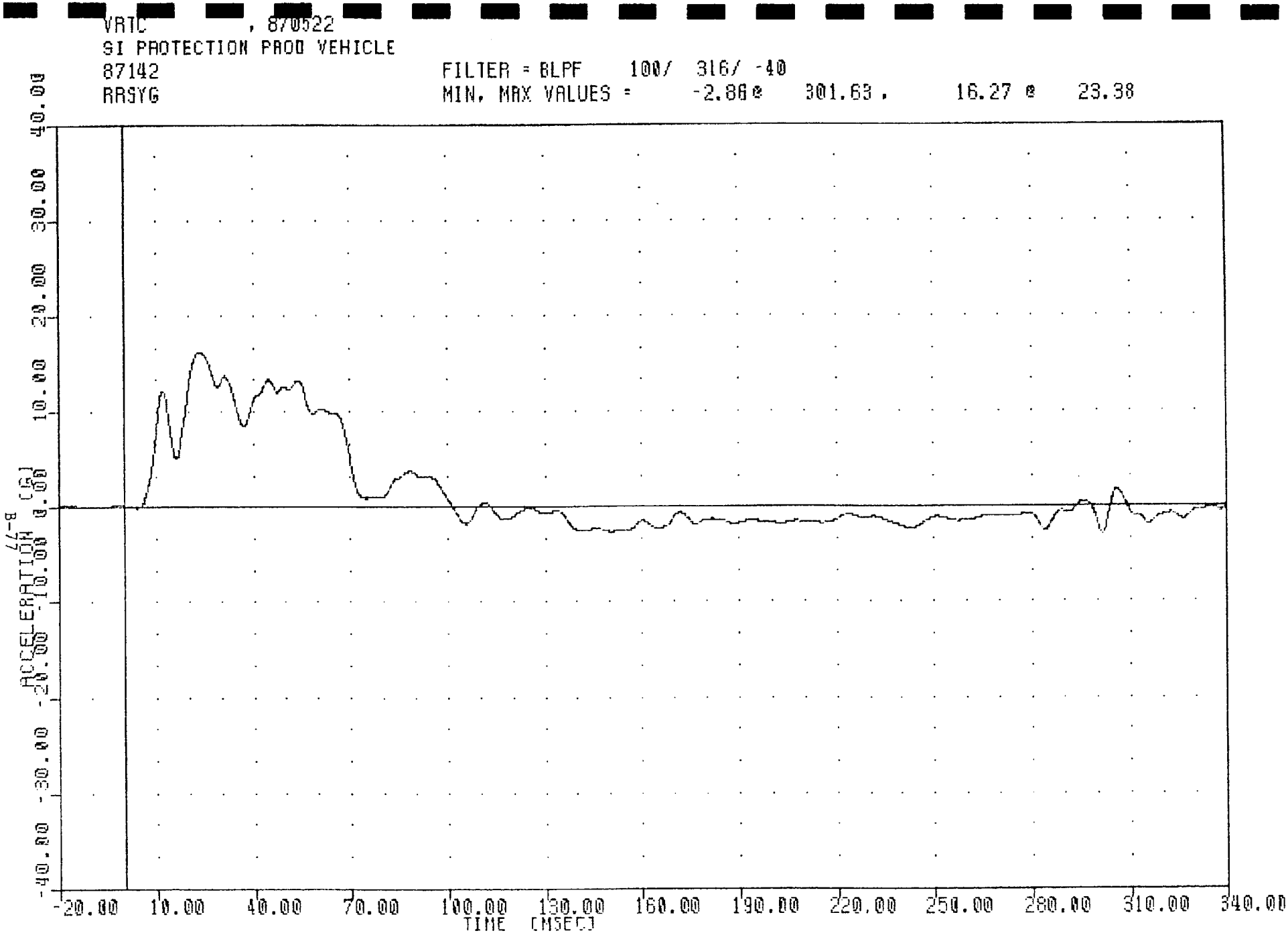
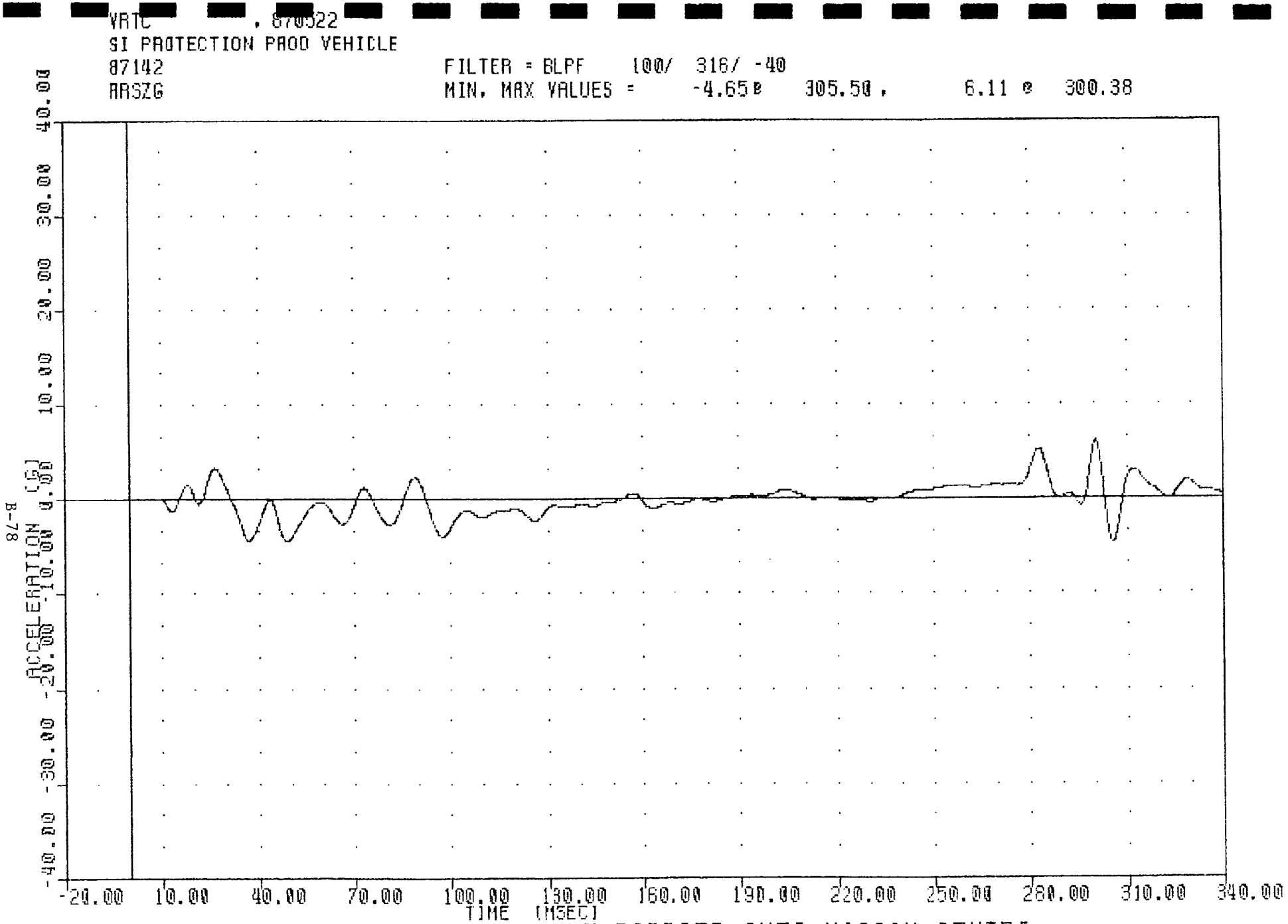
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING RFSYG



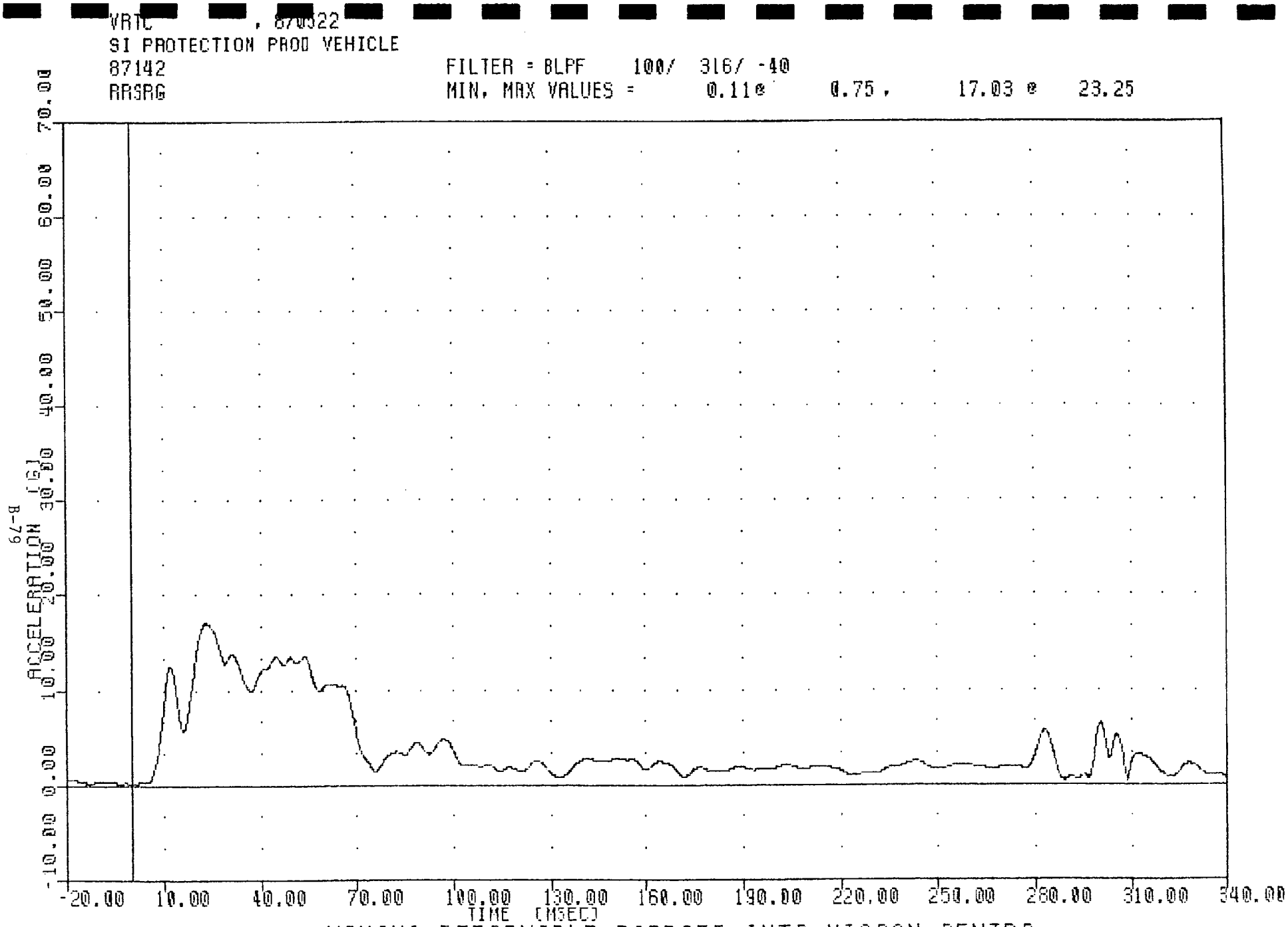
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE RIGHT REAR SILL ACCELERATION X AXIS



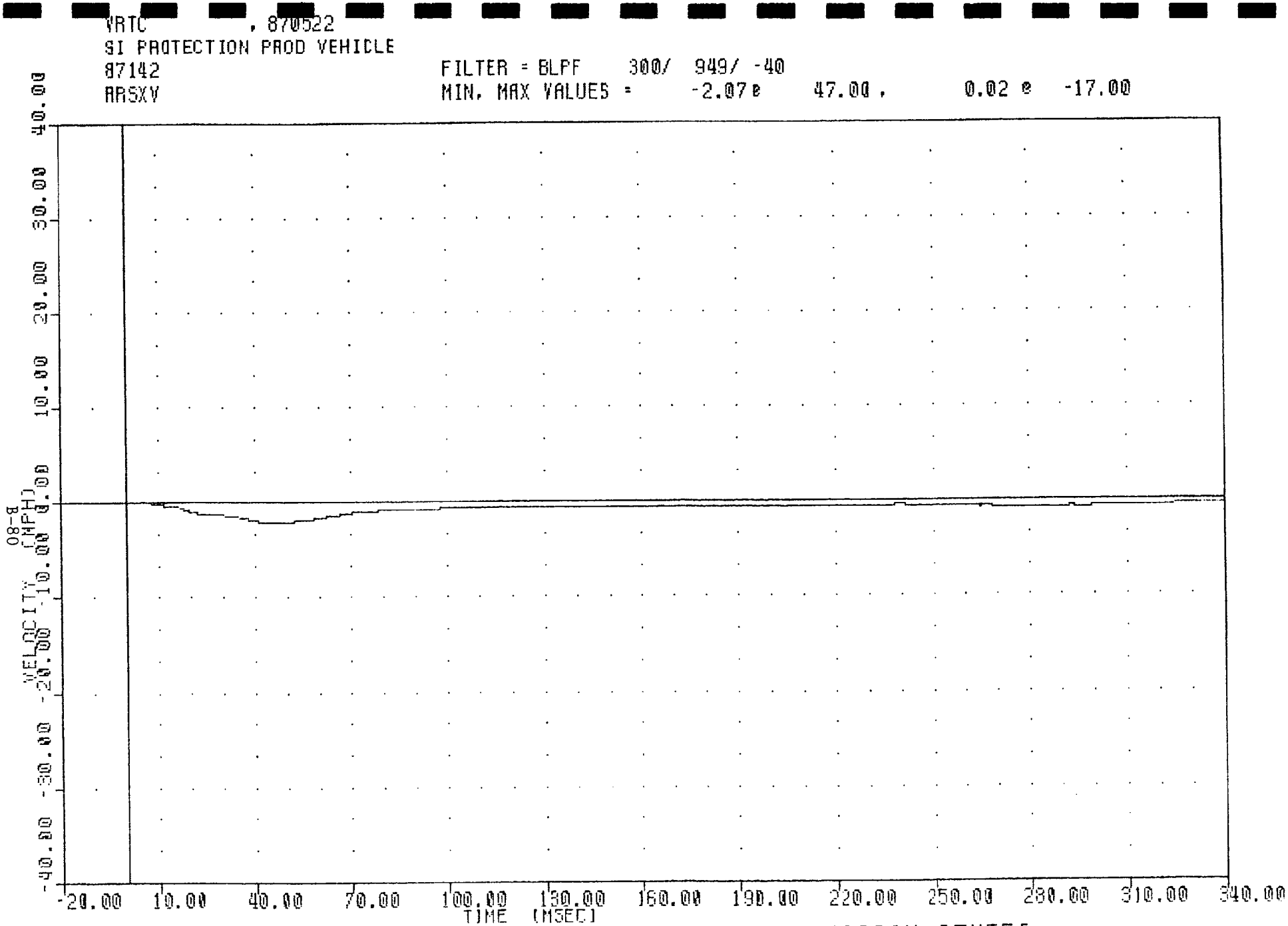
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE RIGHT REAR SILL ACCELERATION Y AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE RIGHT REAR SILL ACCELERATION Z AXIS



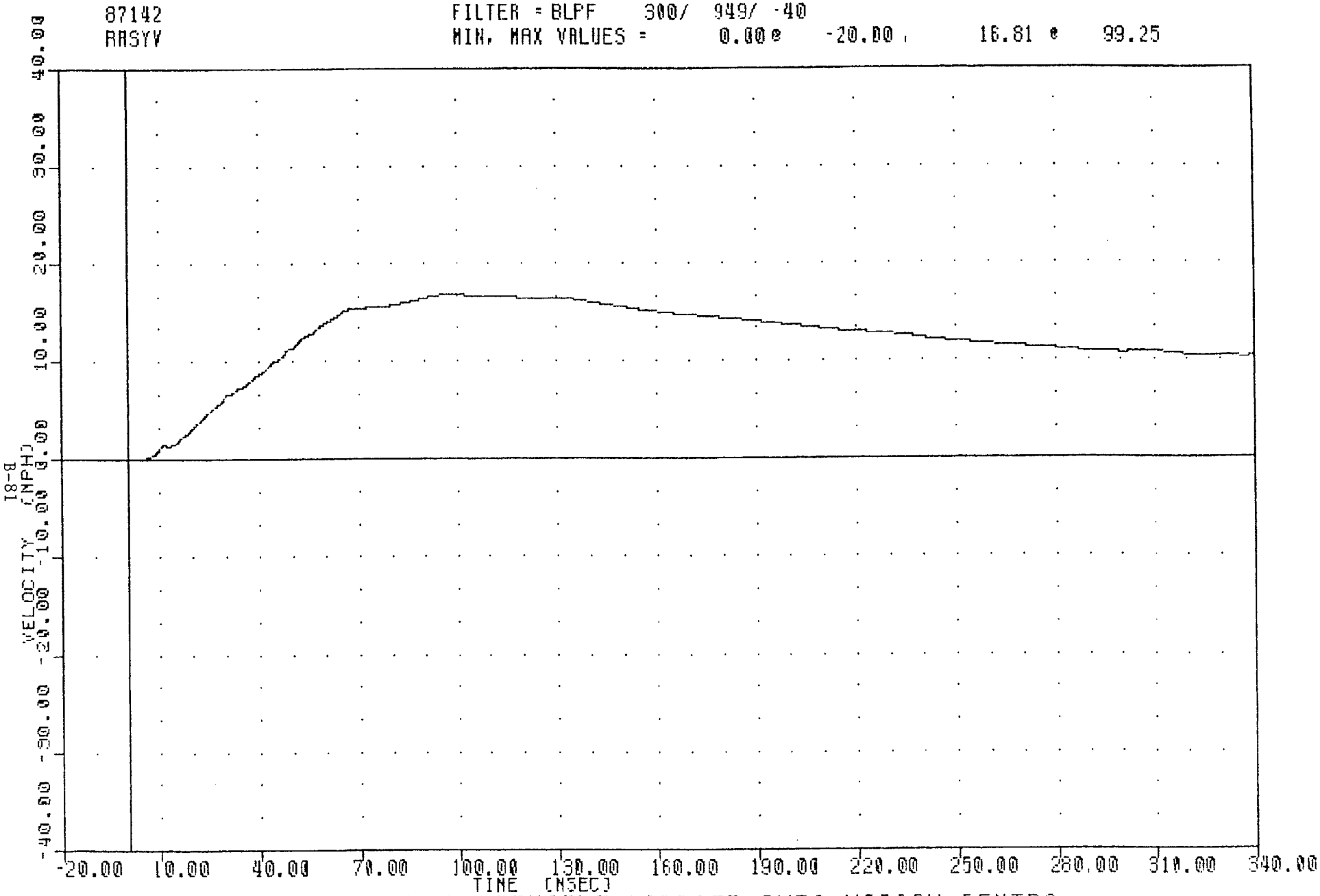
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE RIGHT REAR SILL RESULTANT ACCELERATION



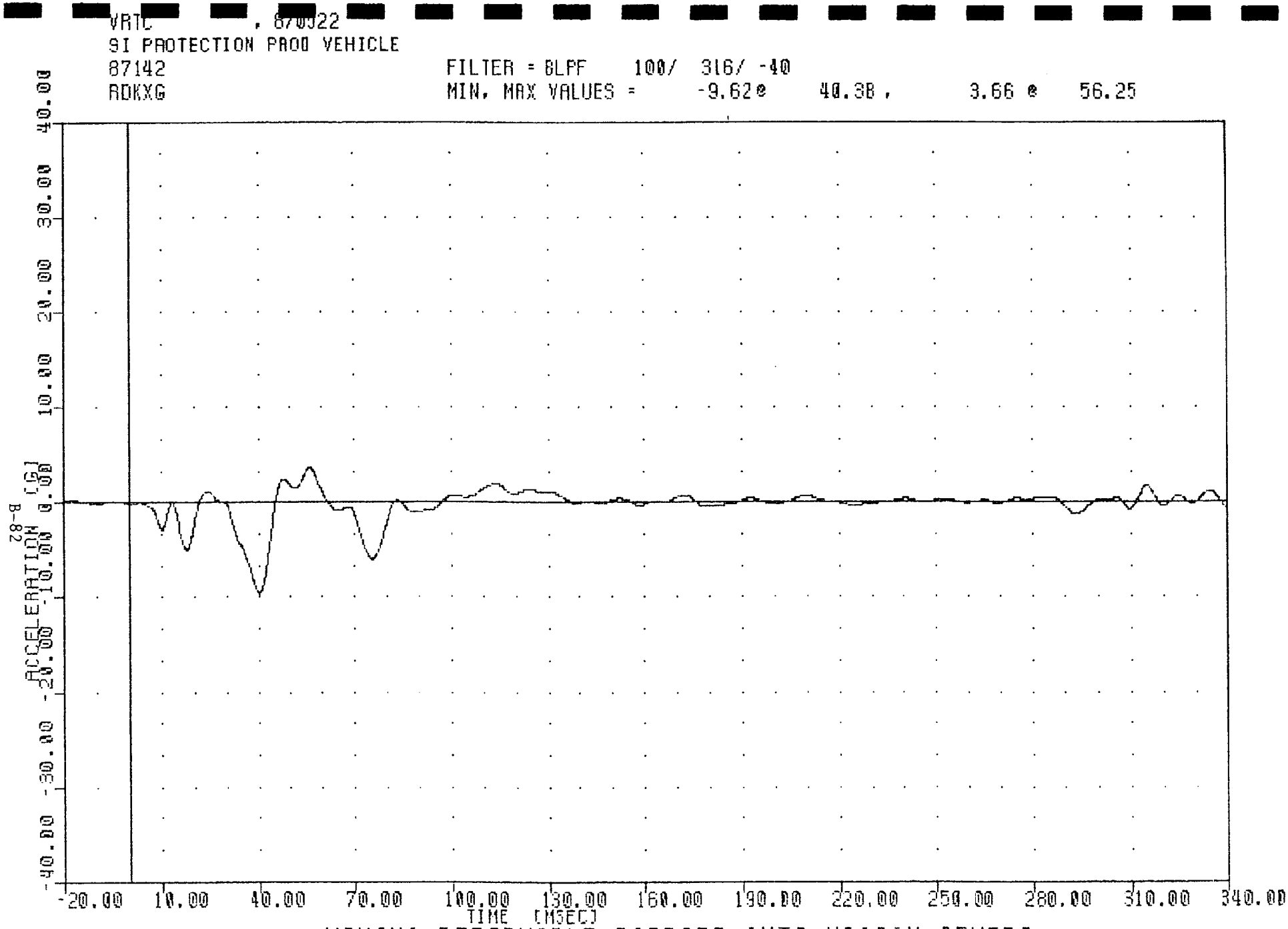
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING RRSXG

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142
RRSYV

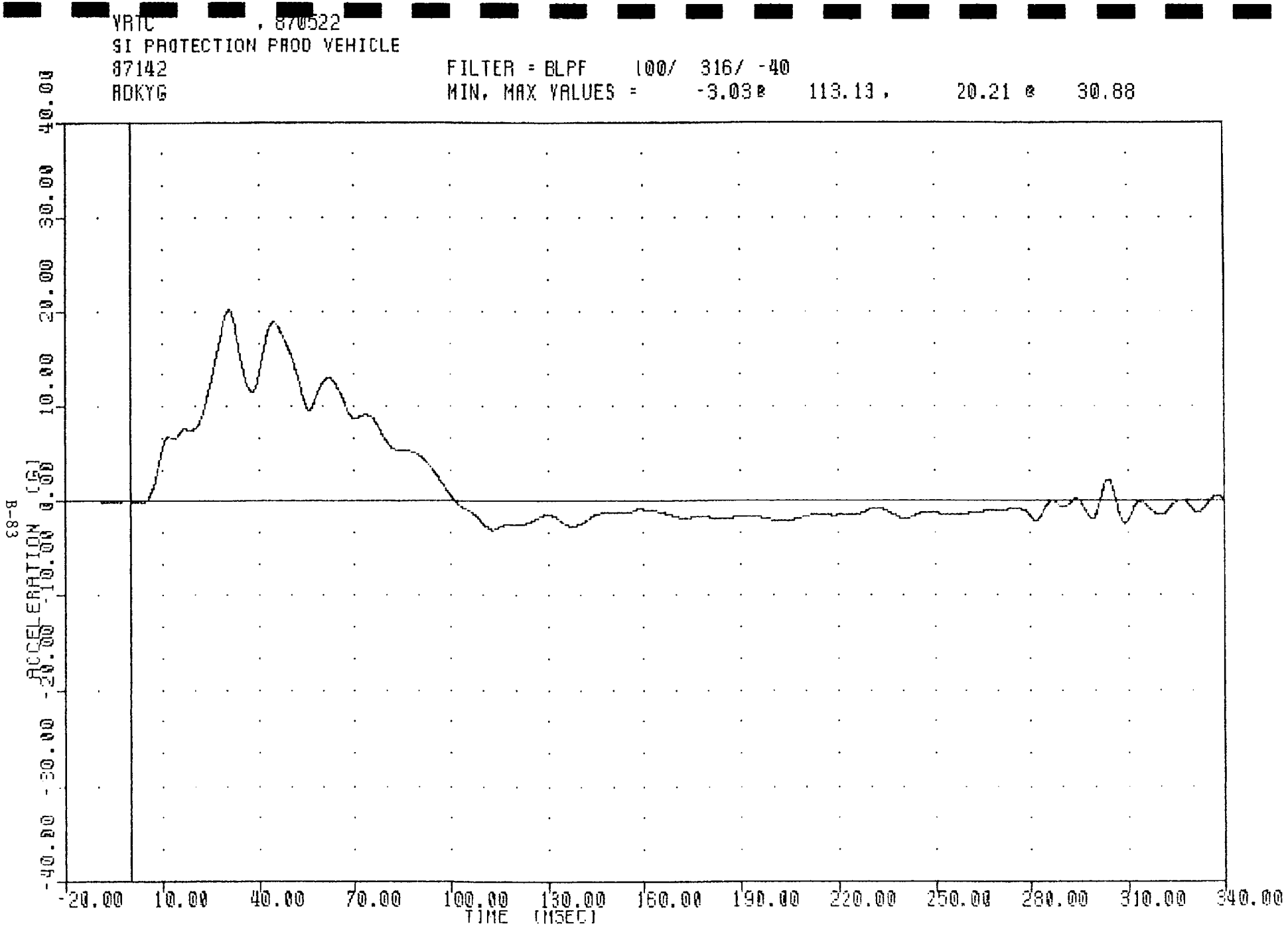
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = 0.00 @ -20.00 , 16.81 @ 99.25



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING RRSYG

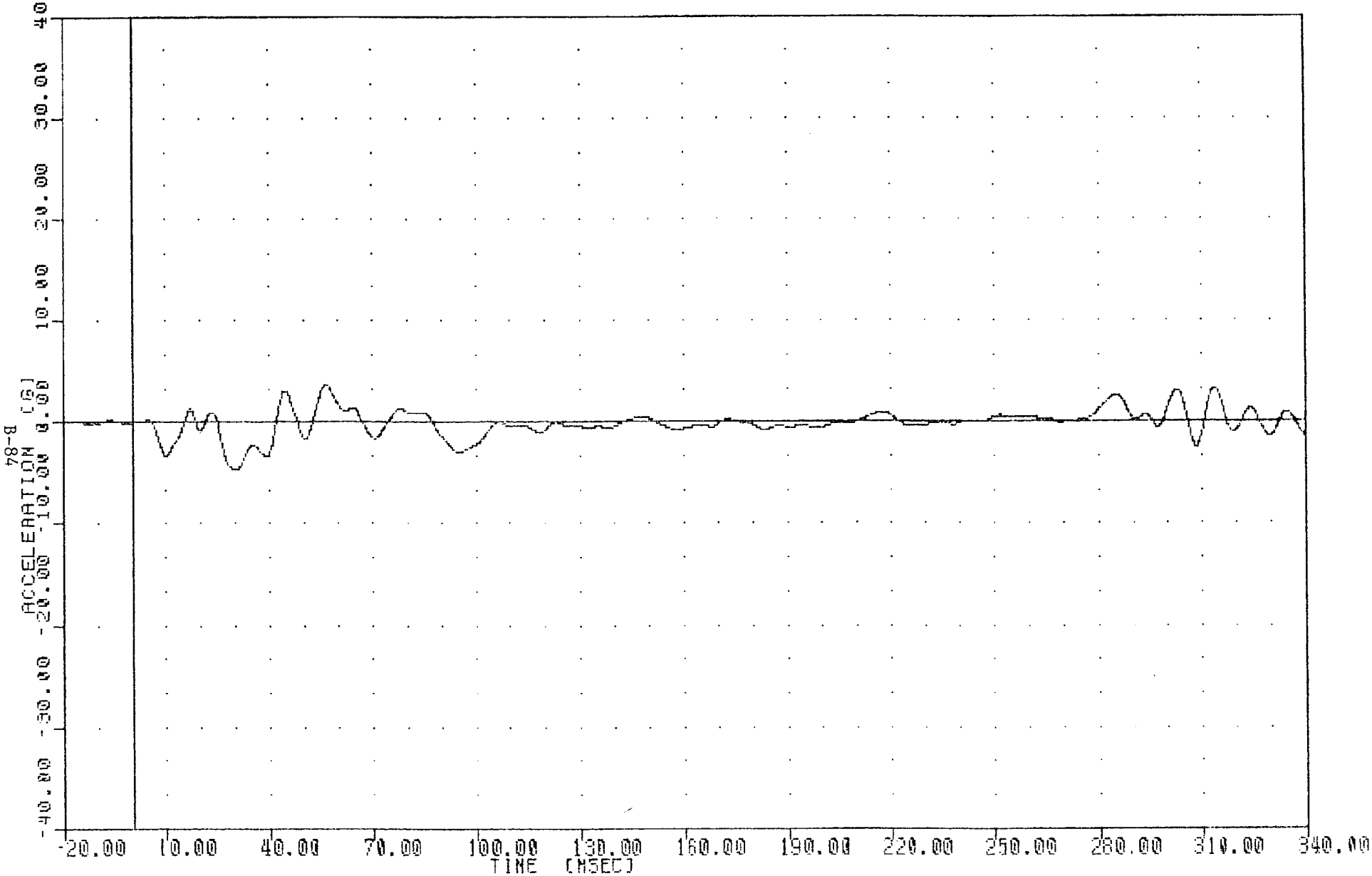


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE REAR DECK ACCELERATION X AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE REAR DECK ACCELERATION Y AXIS

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = BLFF 100/ 316/ -40
ROKZ6 MIN, MAX VALUES = -4.59 @ 30.25 , 3.76 @ 56.38

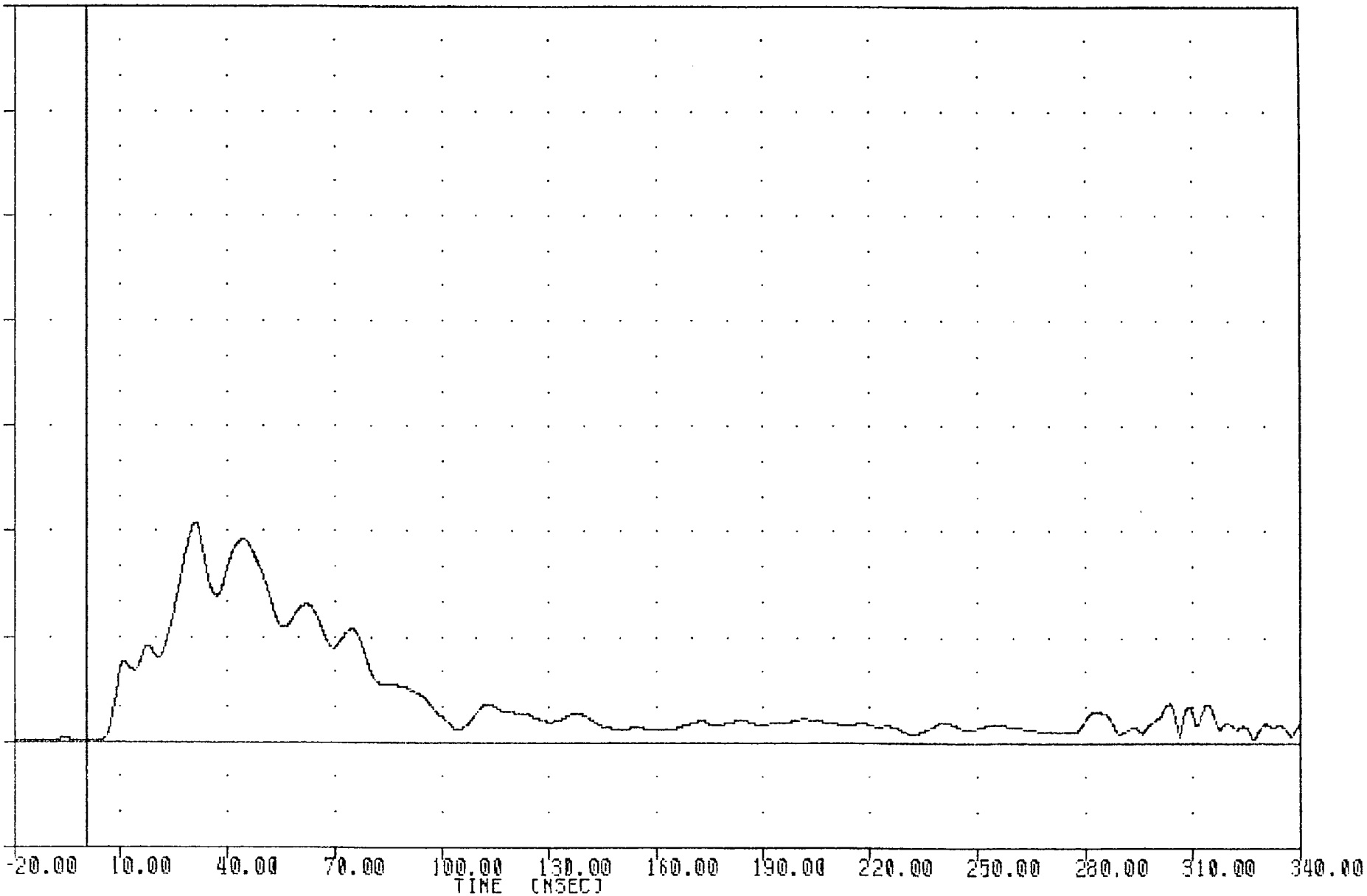


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE REAR DECK ACCELERATION Z AXIS

[redacted]

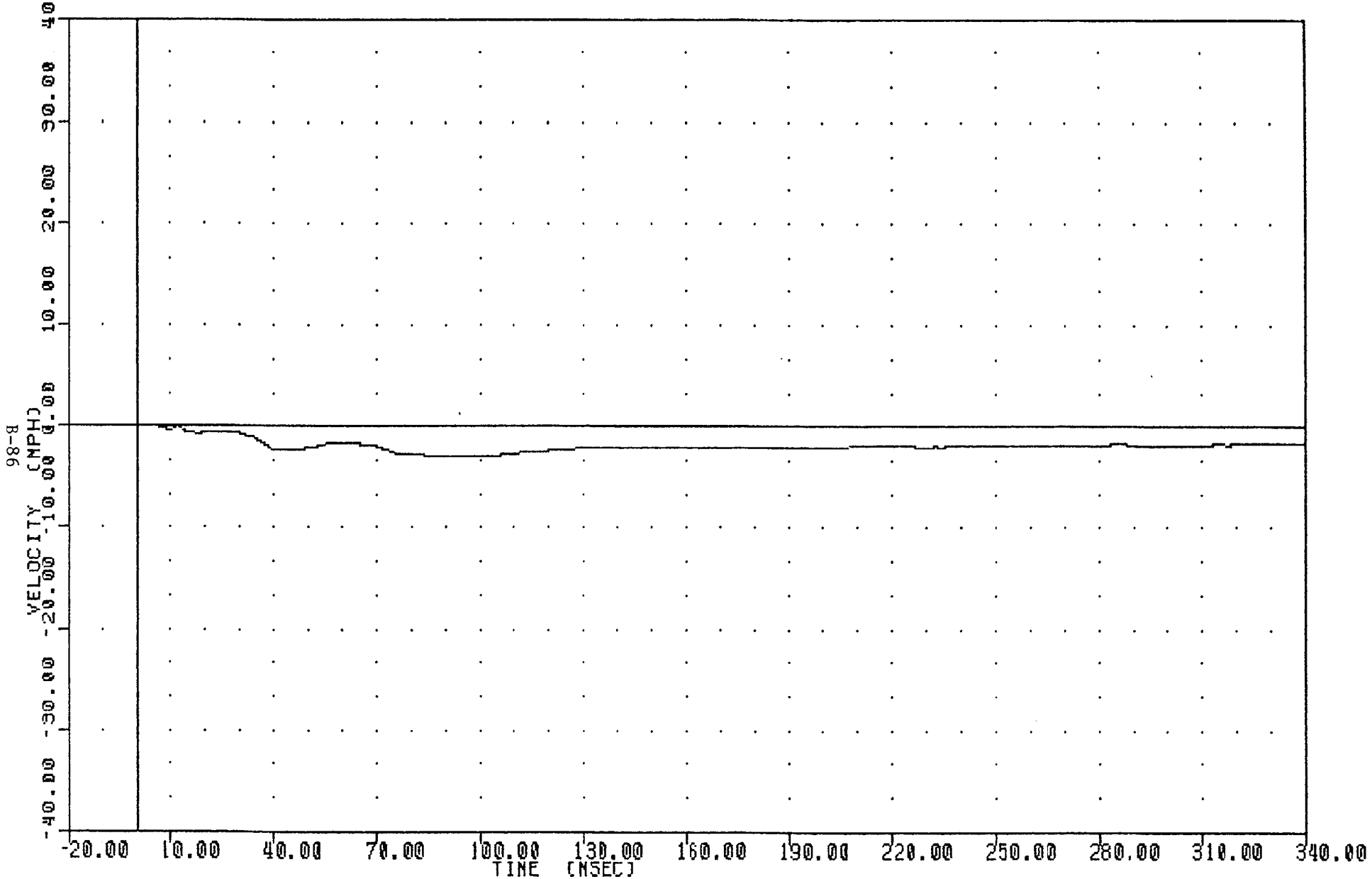
SI PROTECTION PROD VEHICLE
87142
ROKRG

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = 0.10 @ -2.63 , 20.74 @ 30.88

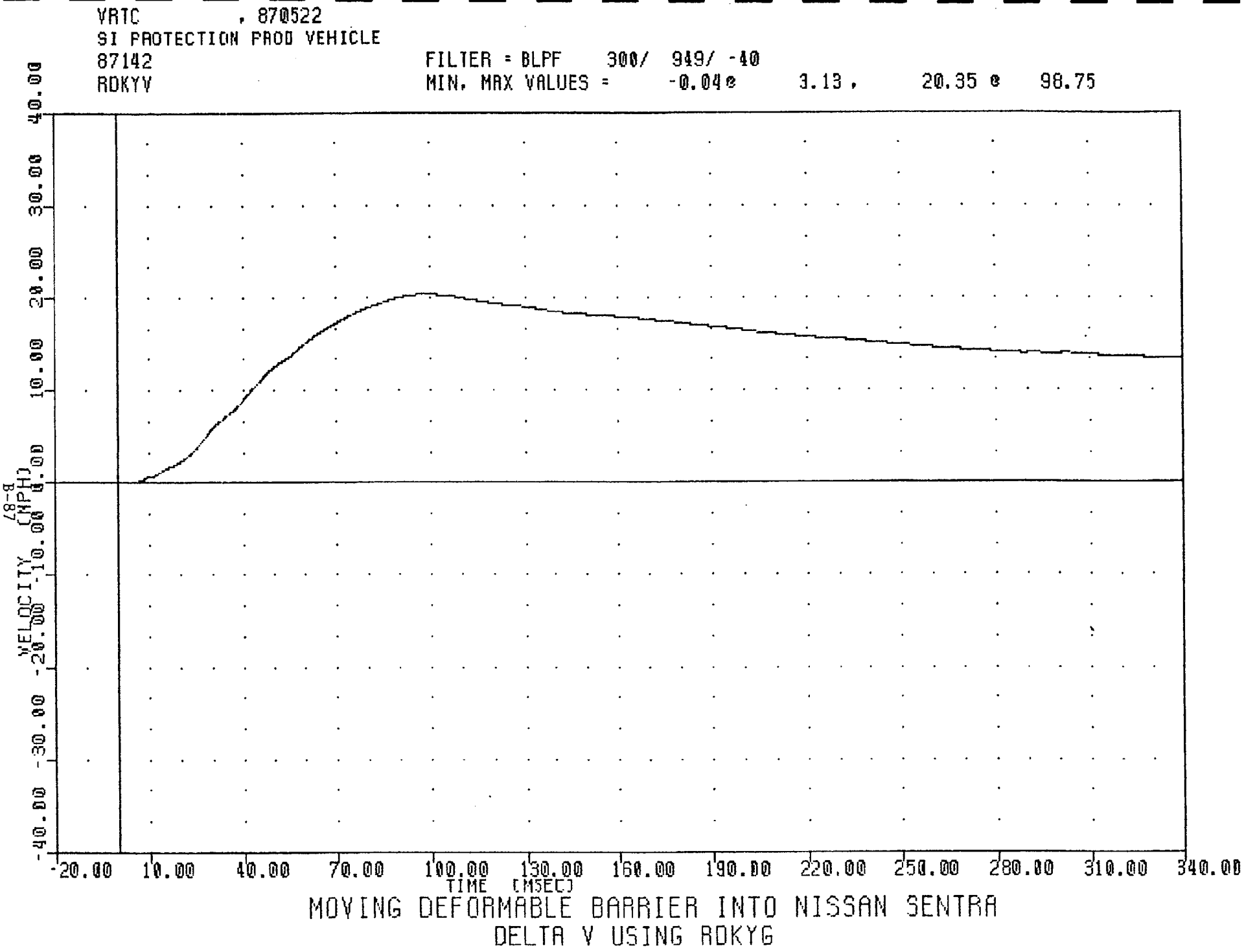


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE REAR DECK RESULTANT ACCELERATION

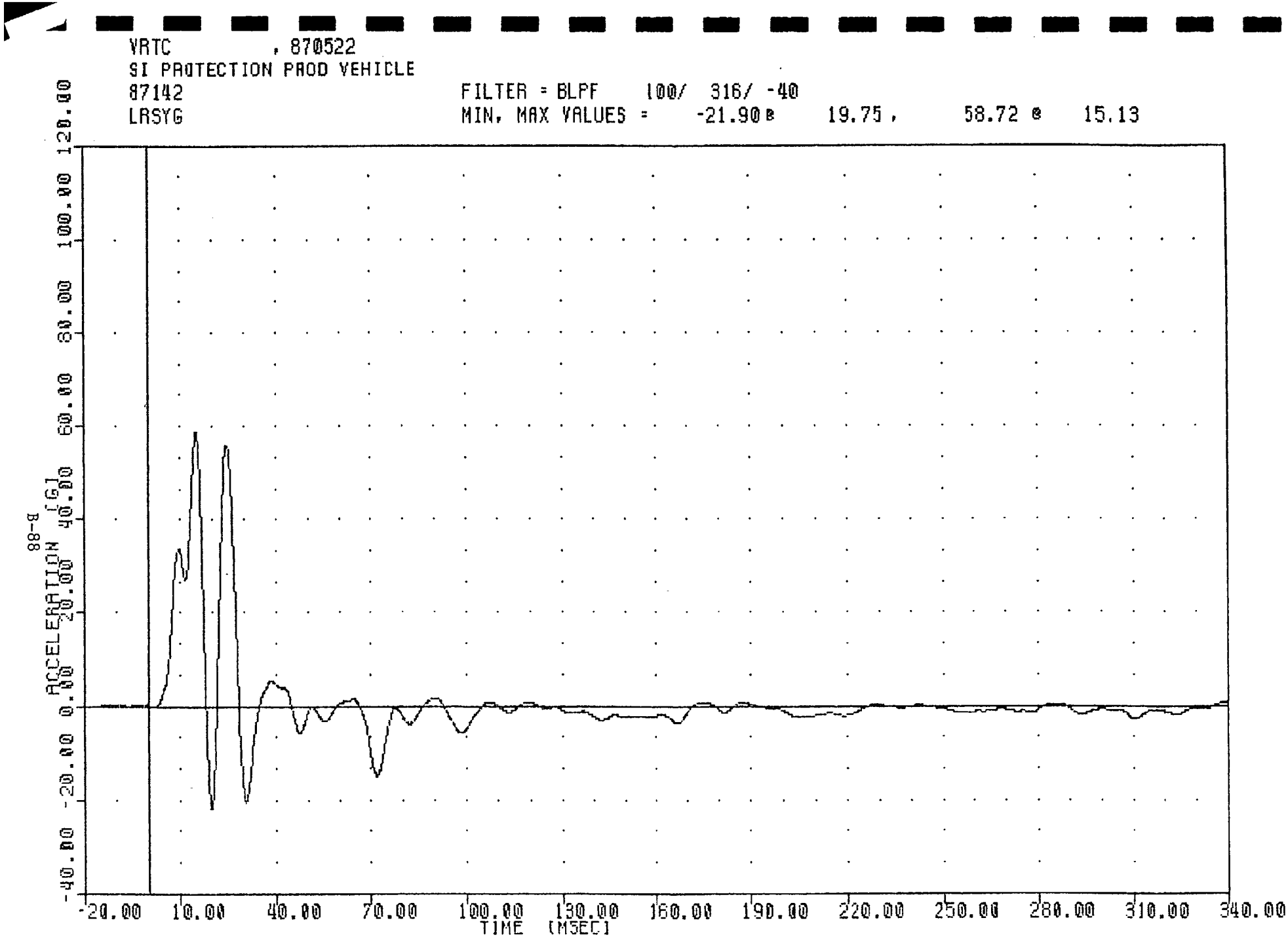
VRTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = BLPF 300/ 949/ -40
RDKXV MIN, MAX VALUES = -2.98 @ 93.63 , 0.01 @ -16.13



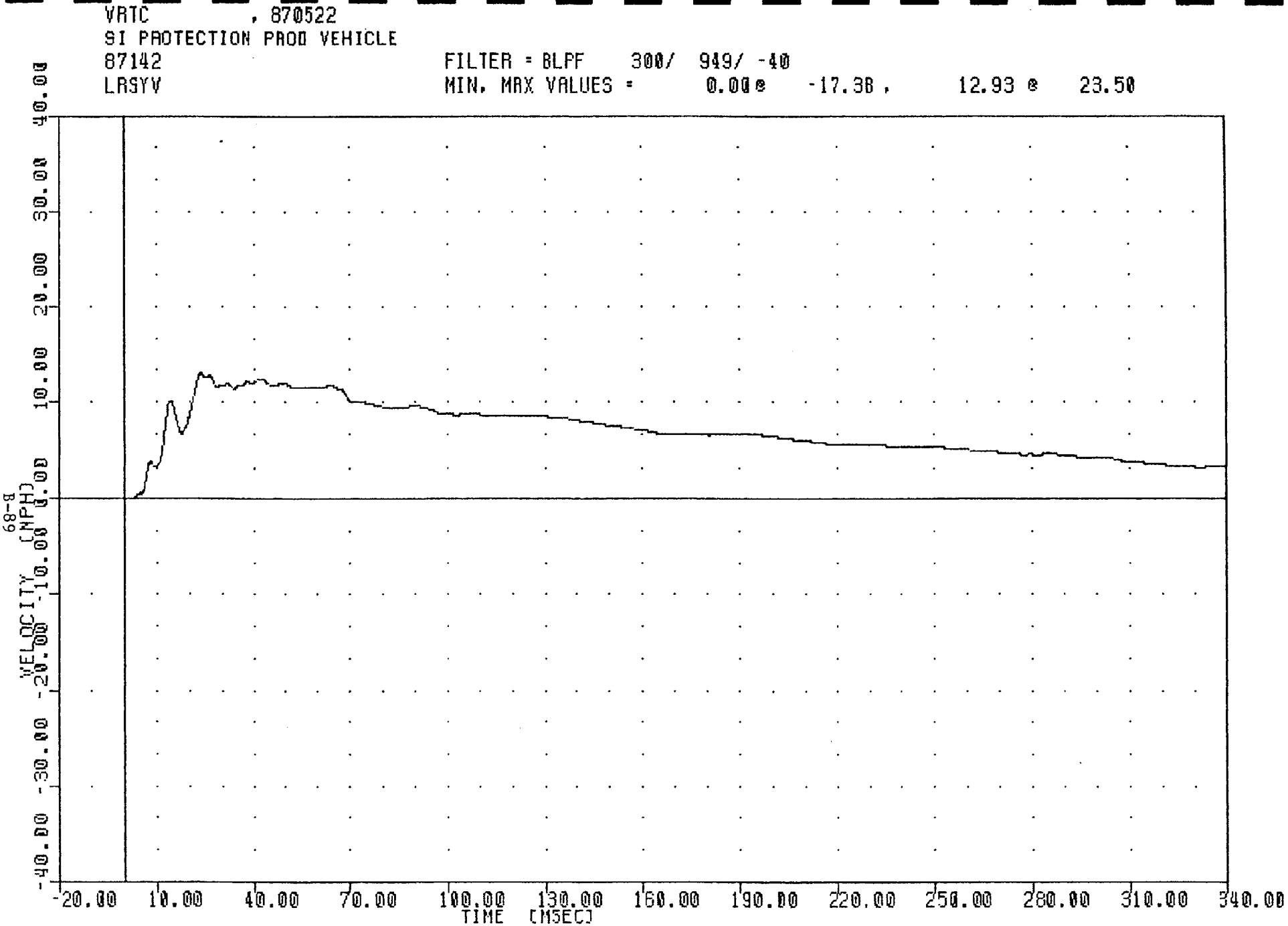
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING RDKXG



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING RDKYG

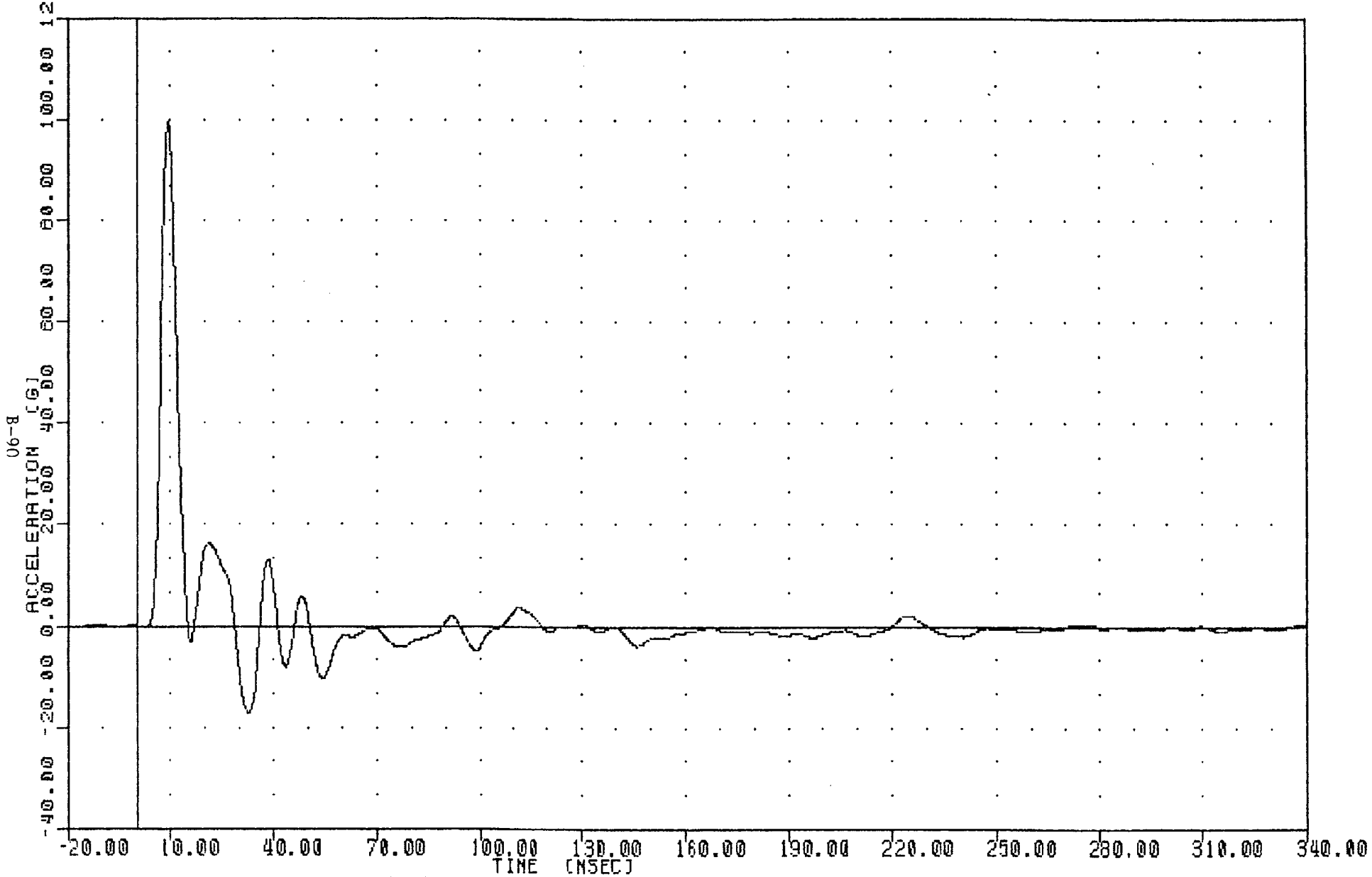


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT REAR SILL ACCELERATION Y AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LRSYG

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = BLPF 100/ 316/ -40
LFSYG MIN, MAX VALUES = -17.20 @ 32.50 , 99.50 @ 9.38



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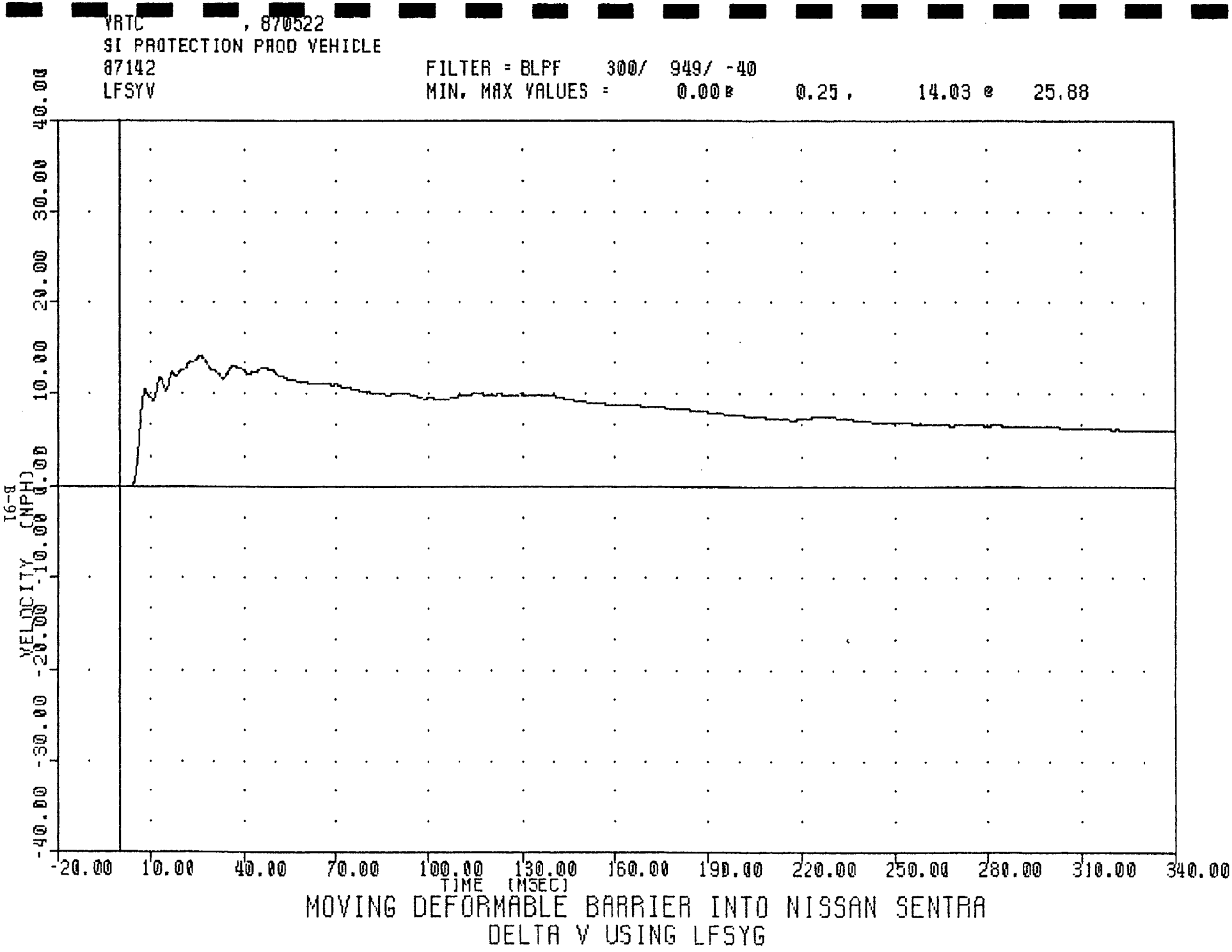
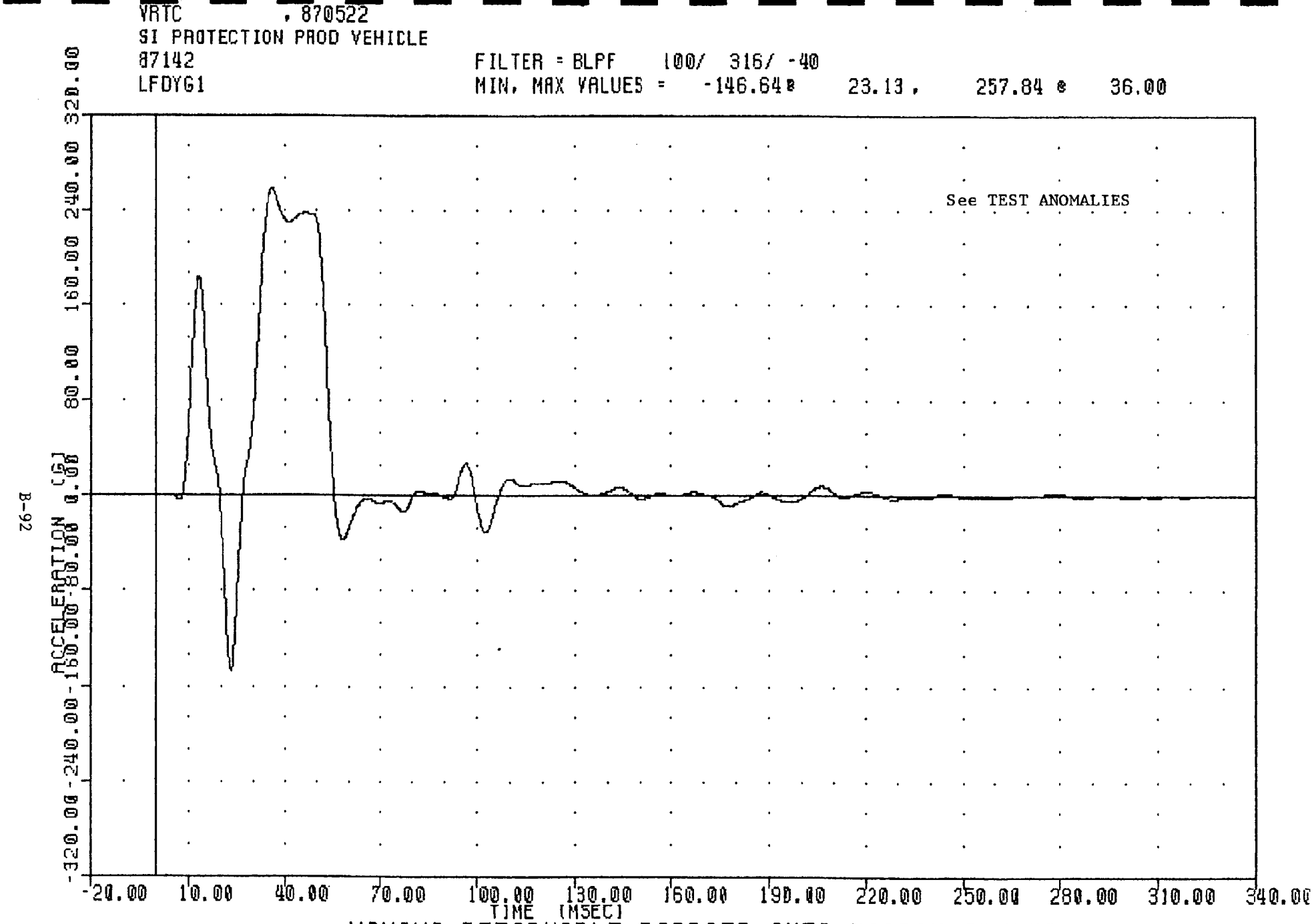
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT FRONT SILL ACCELERATION Y AXIS

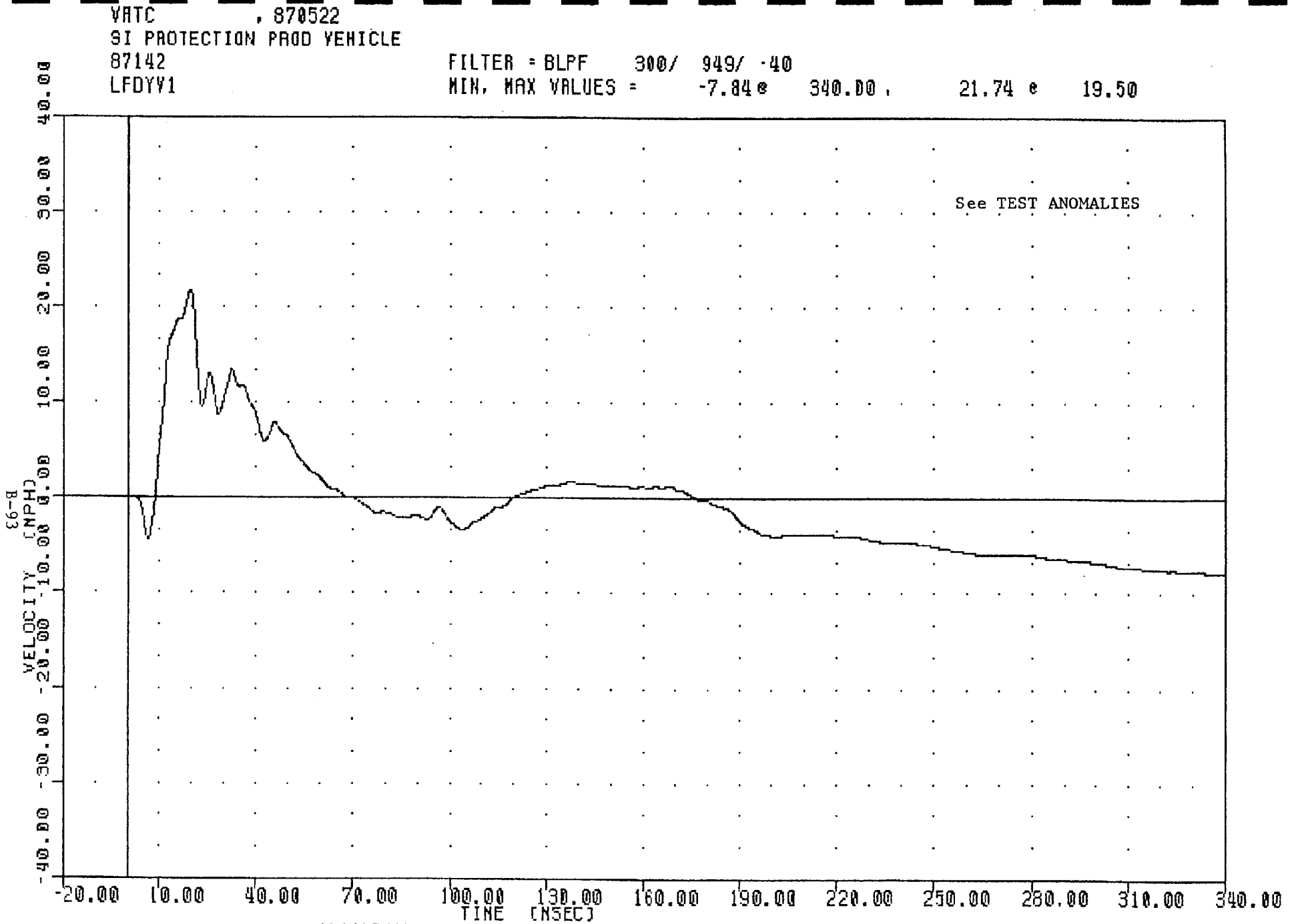


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA

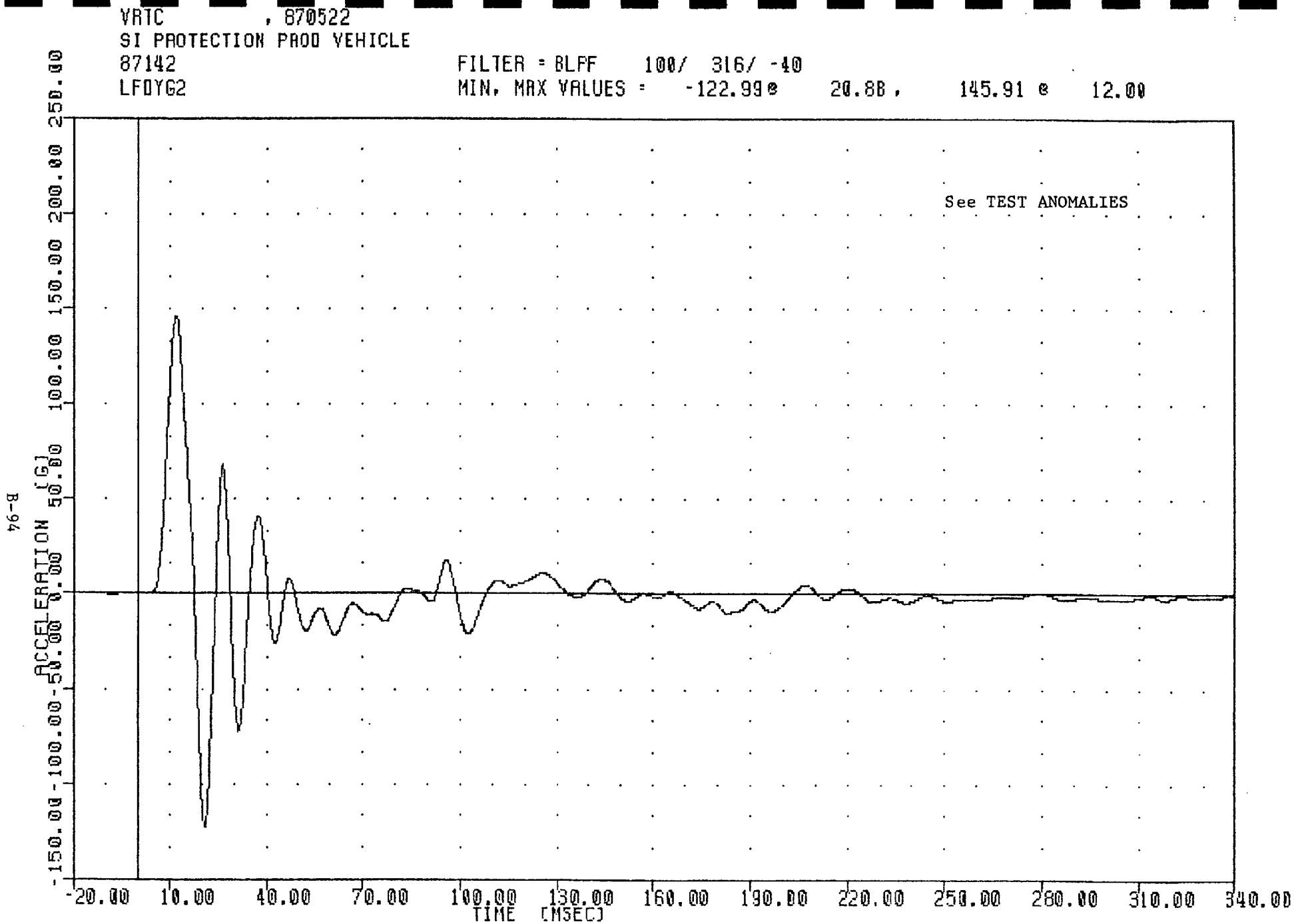
DELTA V USING LFSYG



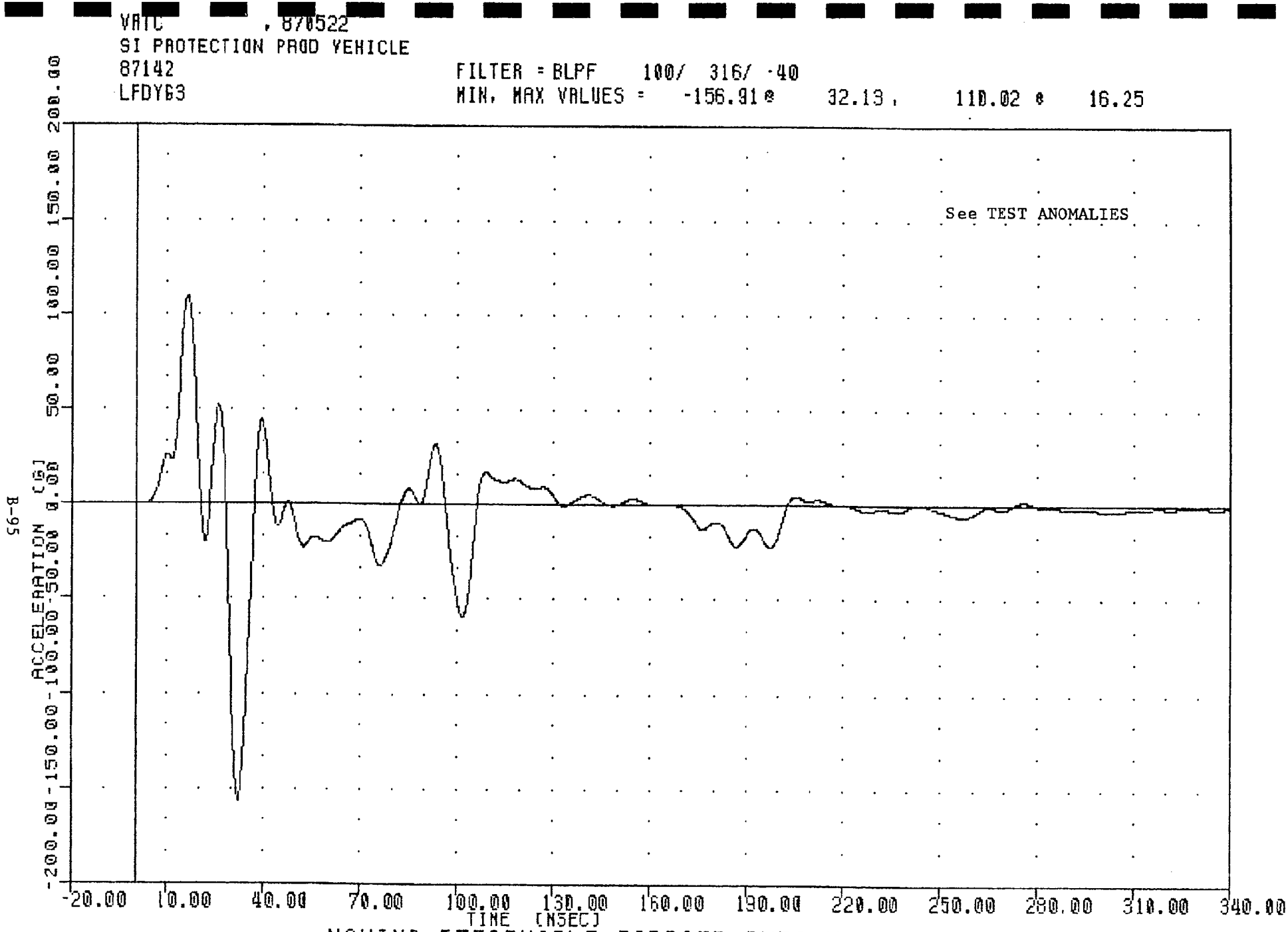
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT FRONT DOOR (POSITION 6) ACCELERATION Y AXIS



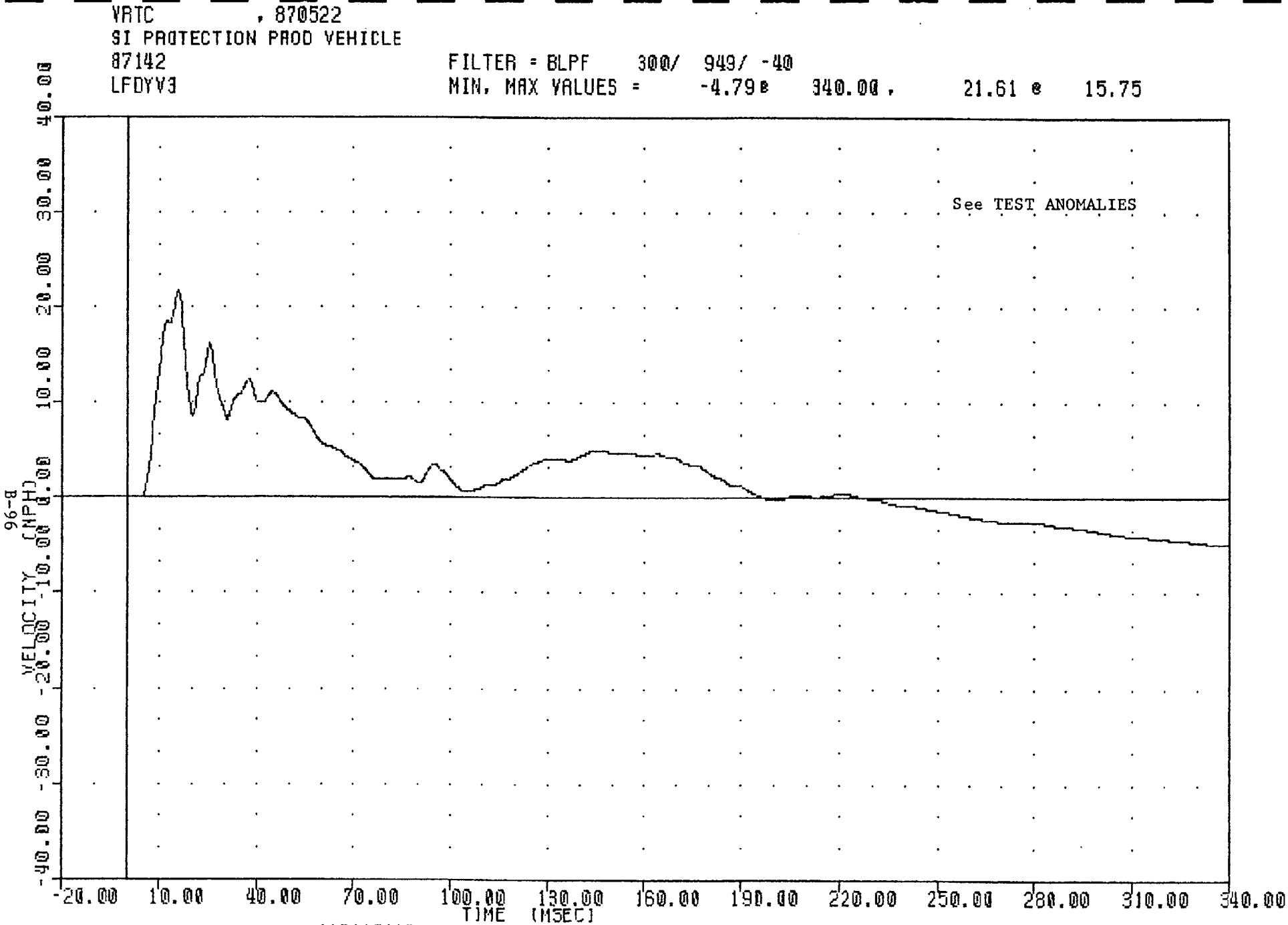
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LFDYG1



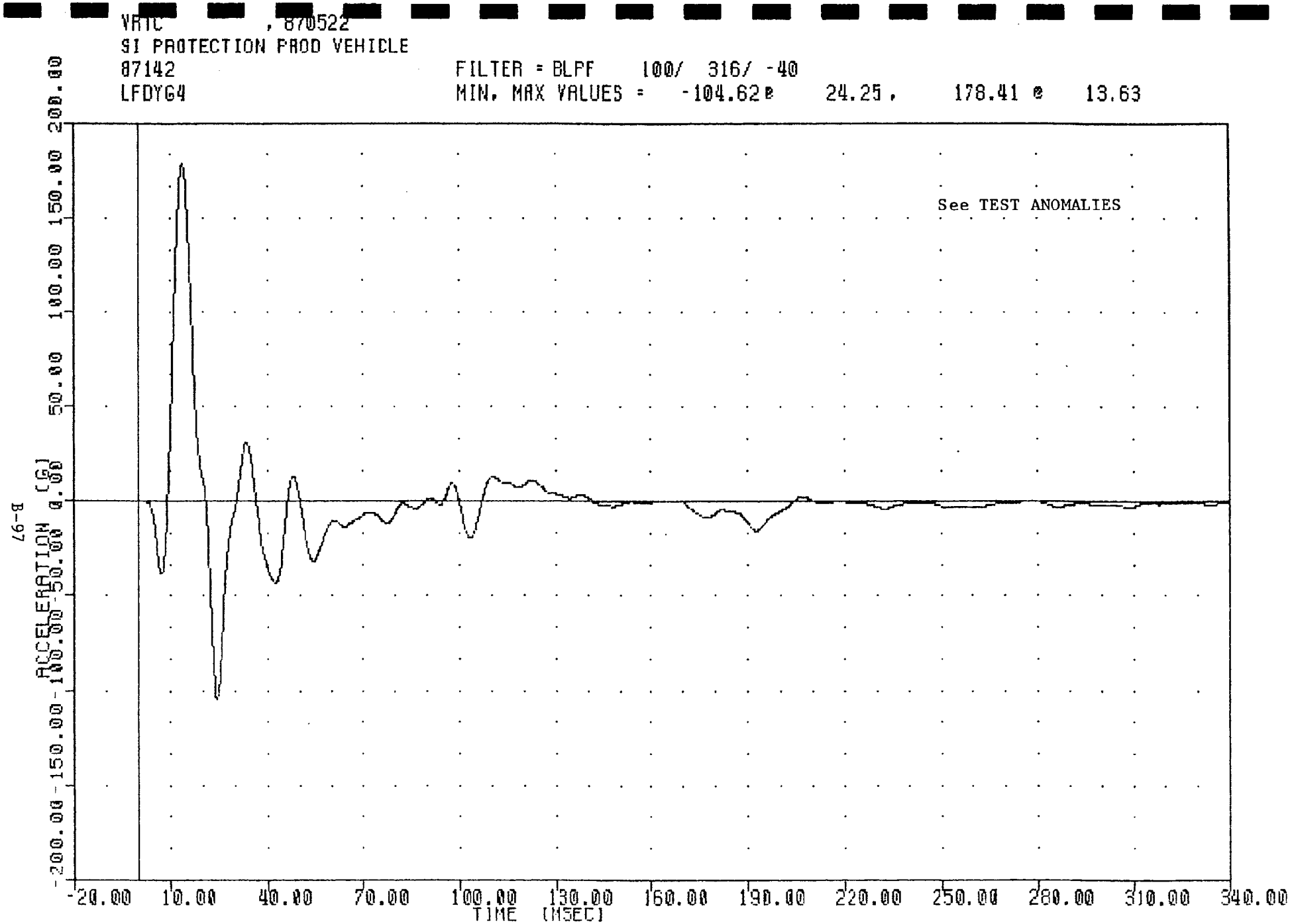
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT FRONT DOOR (POSITION 8) ACCELERATION Y AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT FRONT DOOR (POSITION 9) ACCELERATION Y AXIS



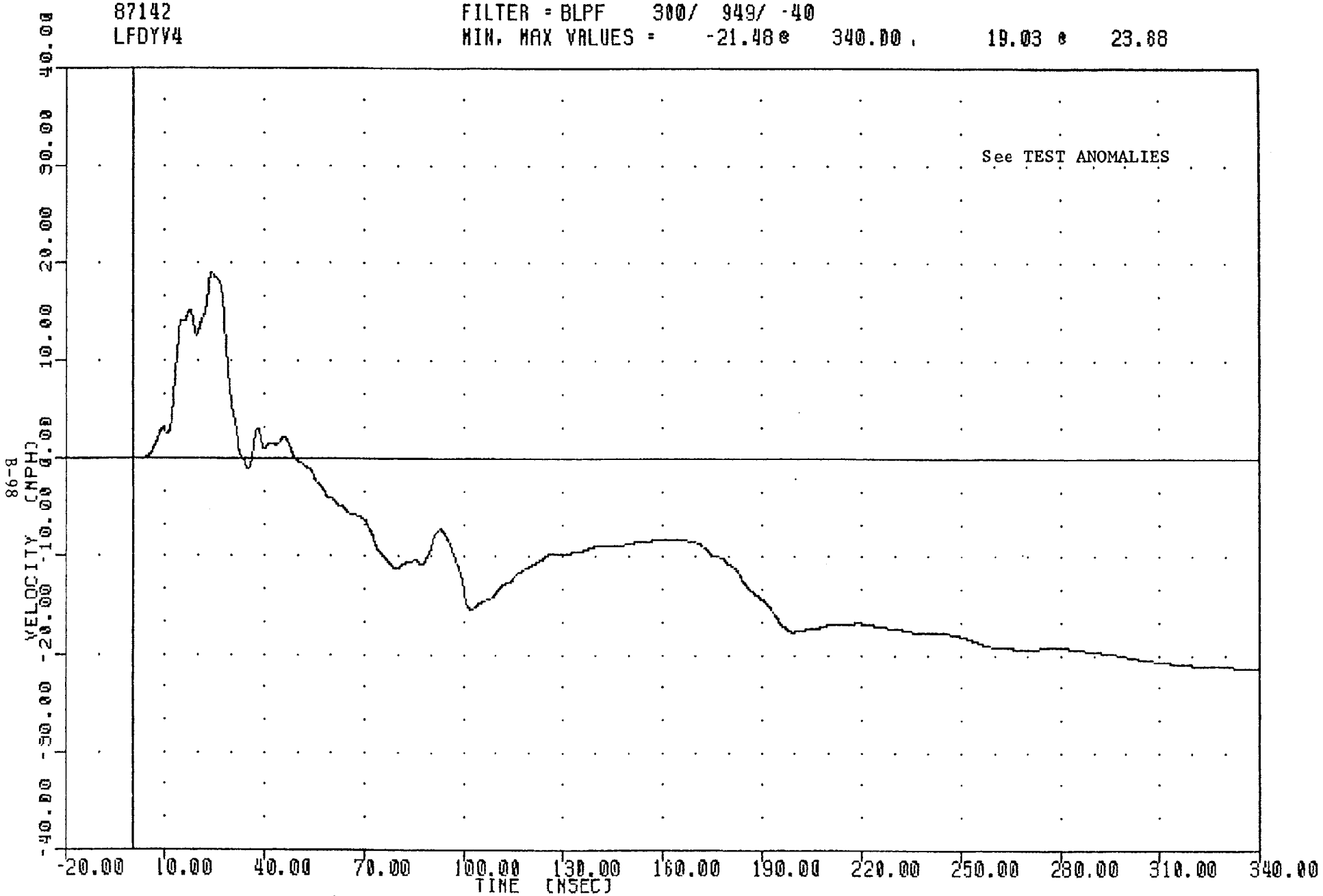
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LFDYG3



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT FRONT DOOR (POSITION 10) ACCELERATION Y AXIS

VATC , 870522
SI PROTECTION PROD VEHICLE
87142
LFDYV4

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -21.48 @ 340.00 , 19.03 @ 23.88



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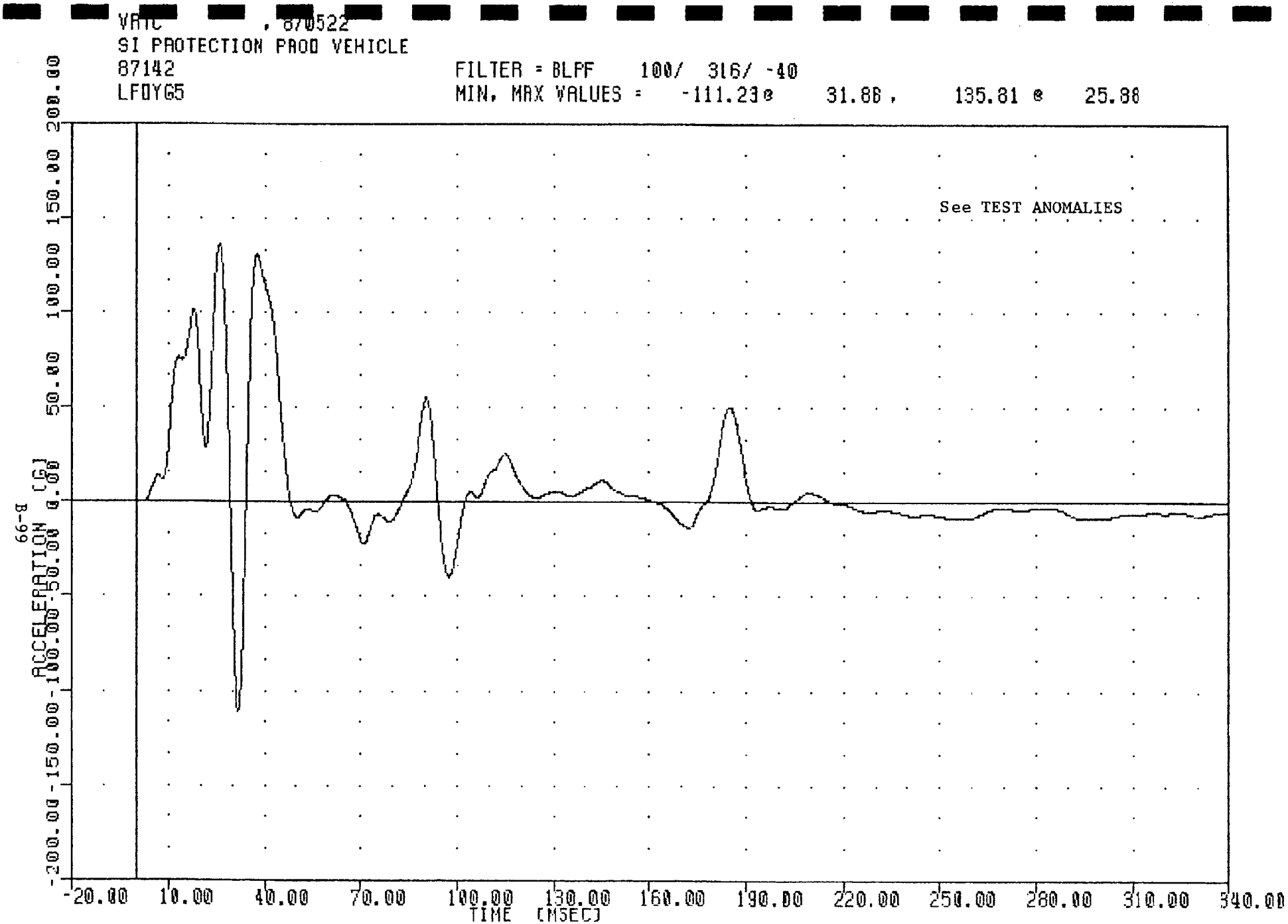
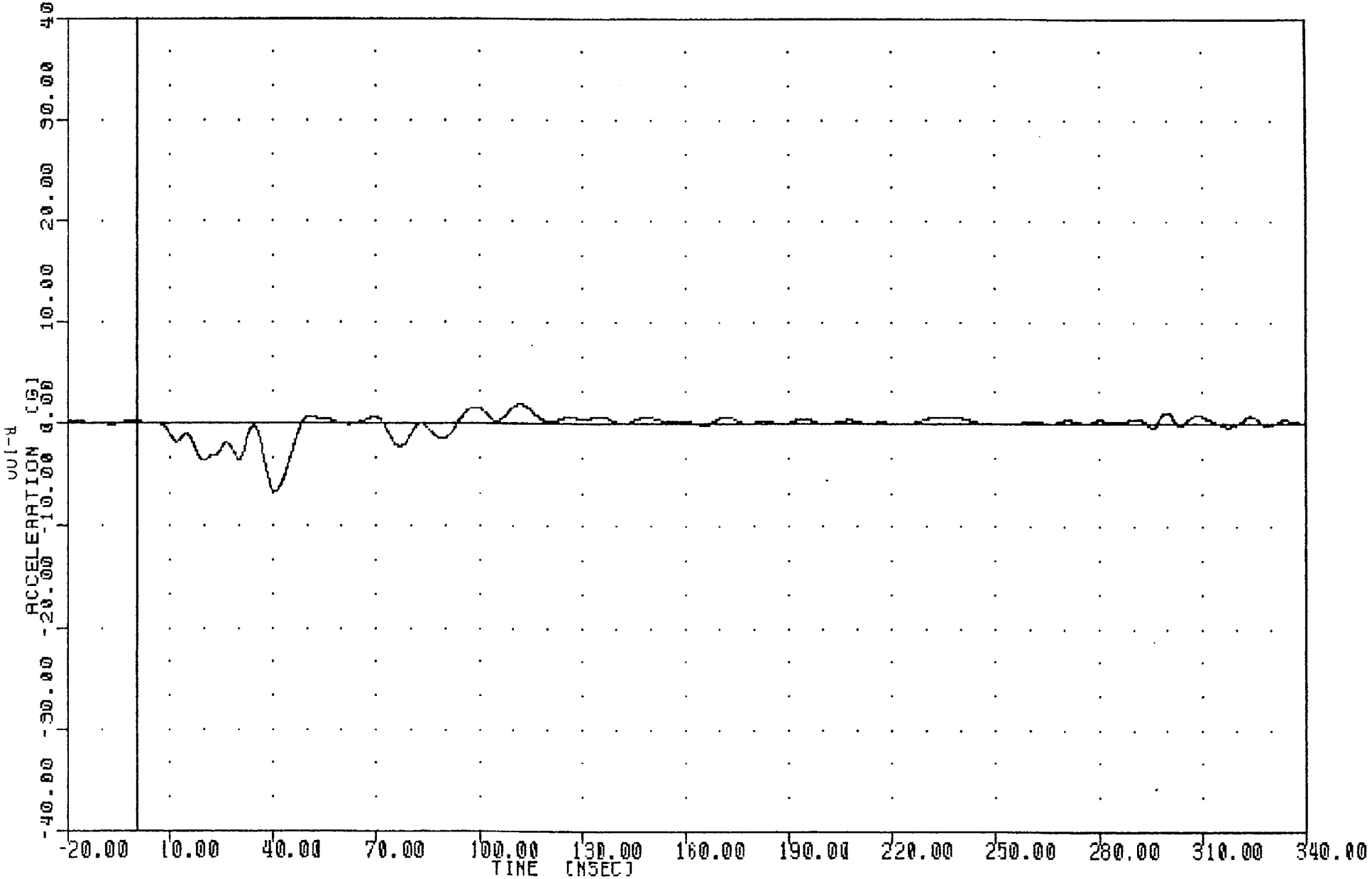
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING LFDYG4

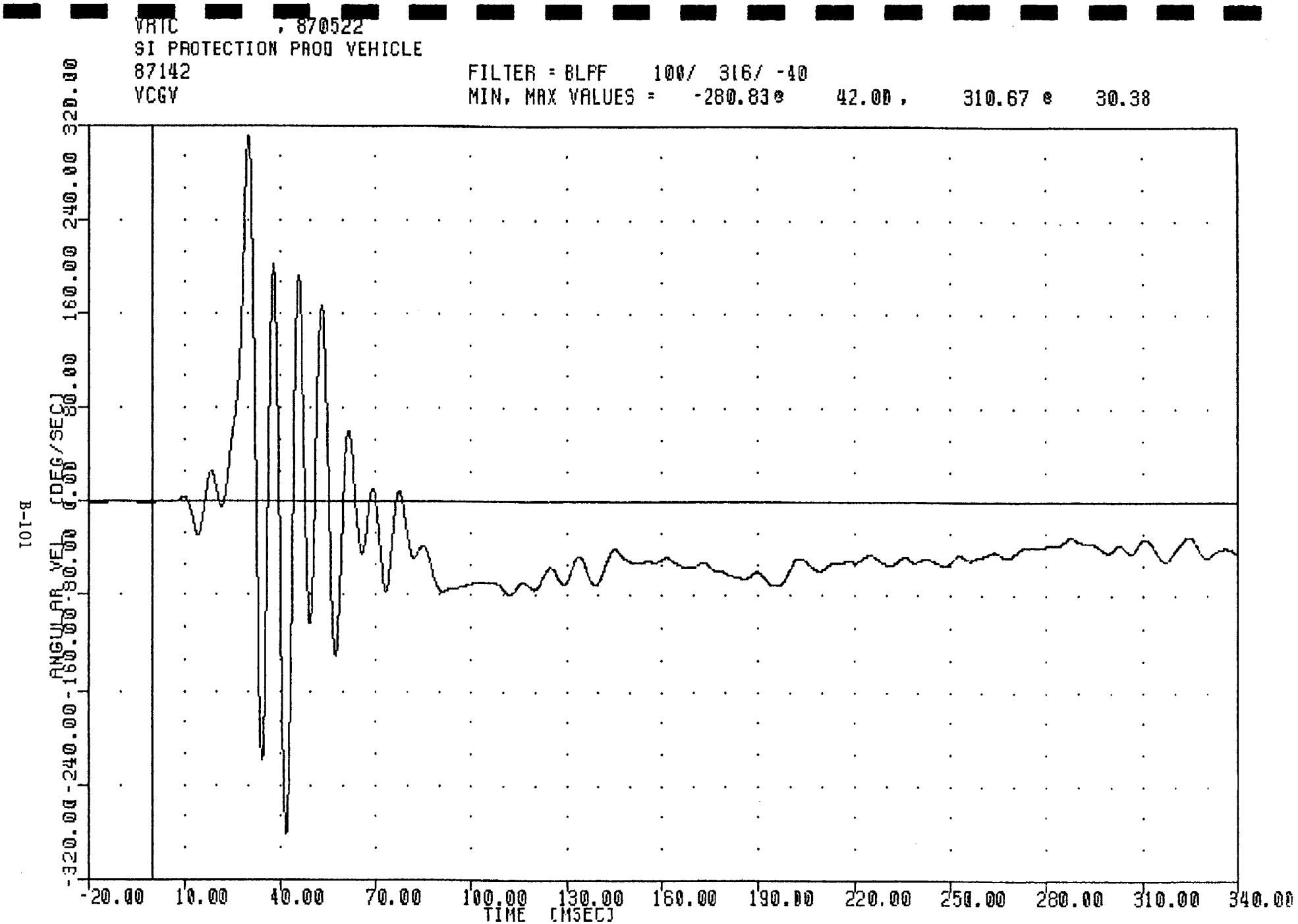


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE LEFT FRONT DOOR (POSITION 11) ACCELERATION Y AXIS

VRTC , 870522
SI PROTECTION PROD VEHICLE
87142 FILTER = BLPF 100/ 316/ -40
TFRXG MIN, MAX VALUES = -6.58 @ 40.50 , 1.89 @ 112.25

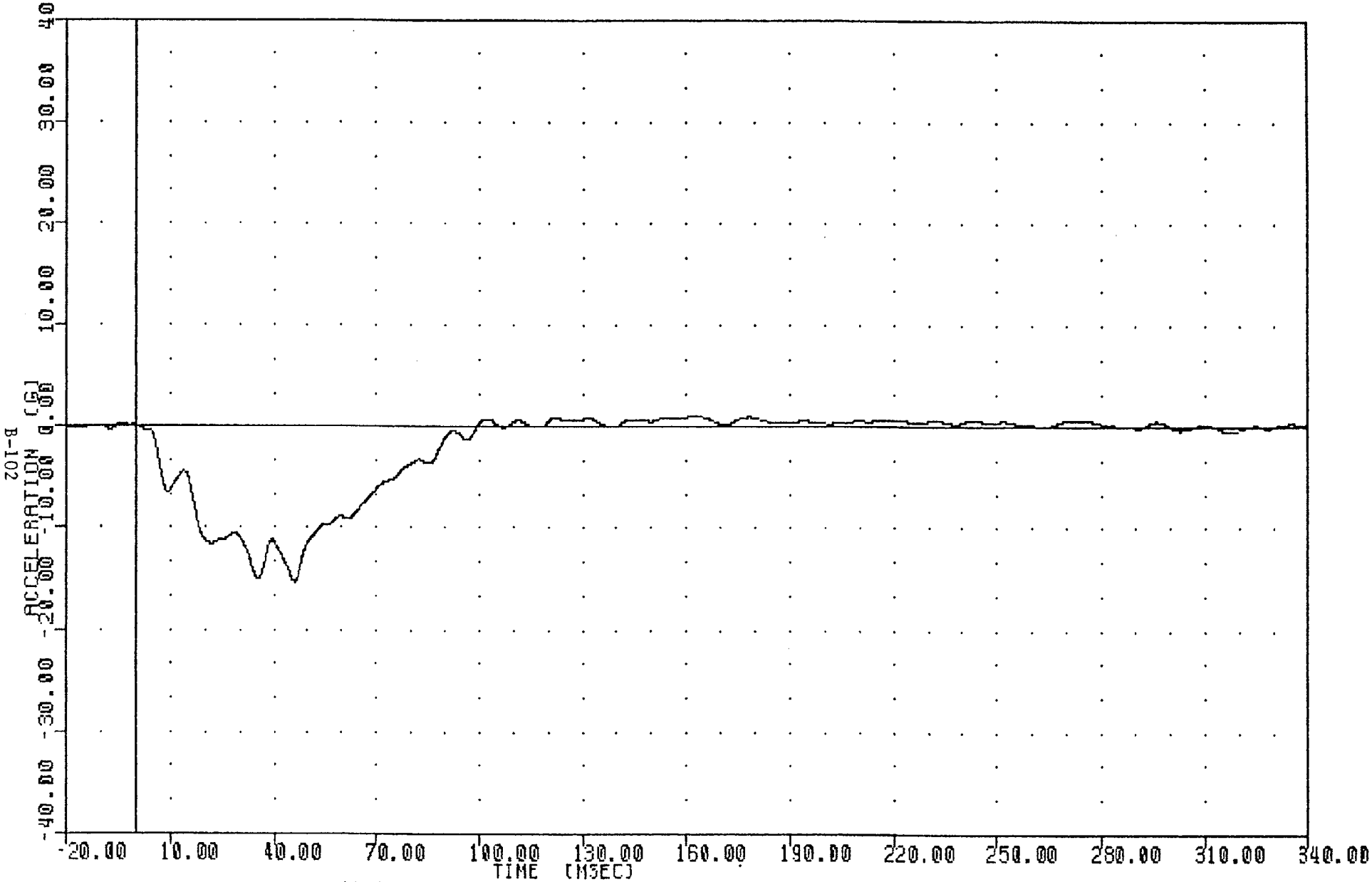


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE TRUNK FLOOR RIGHT ACCELERATION X AXIS

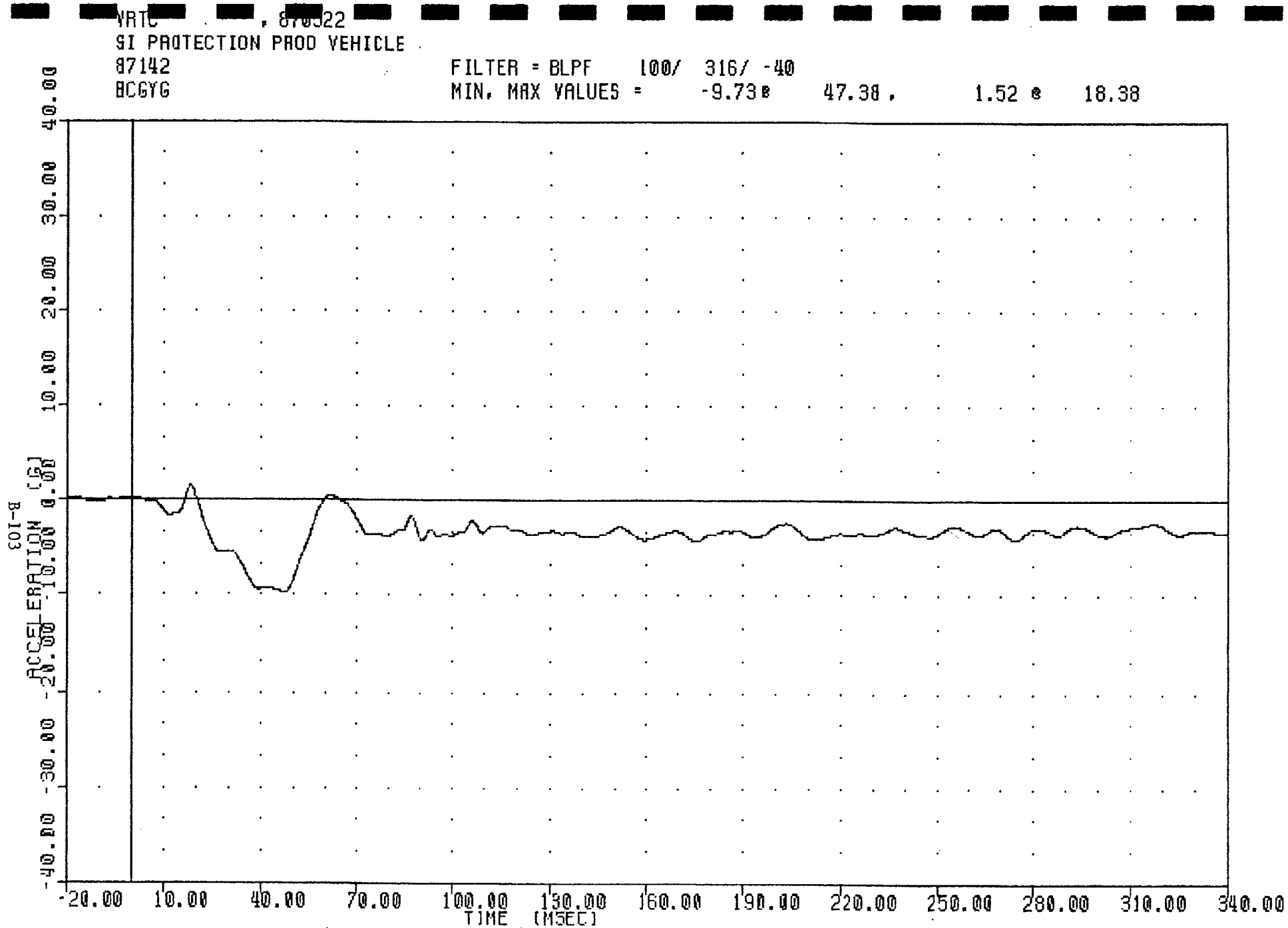


MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
VEHICLE YAW RATE DEGREES/SEC

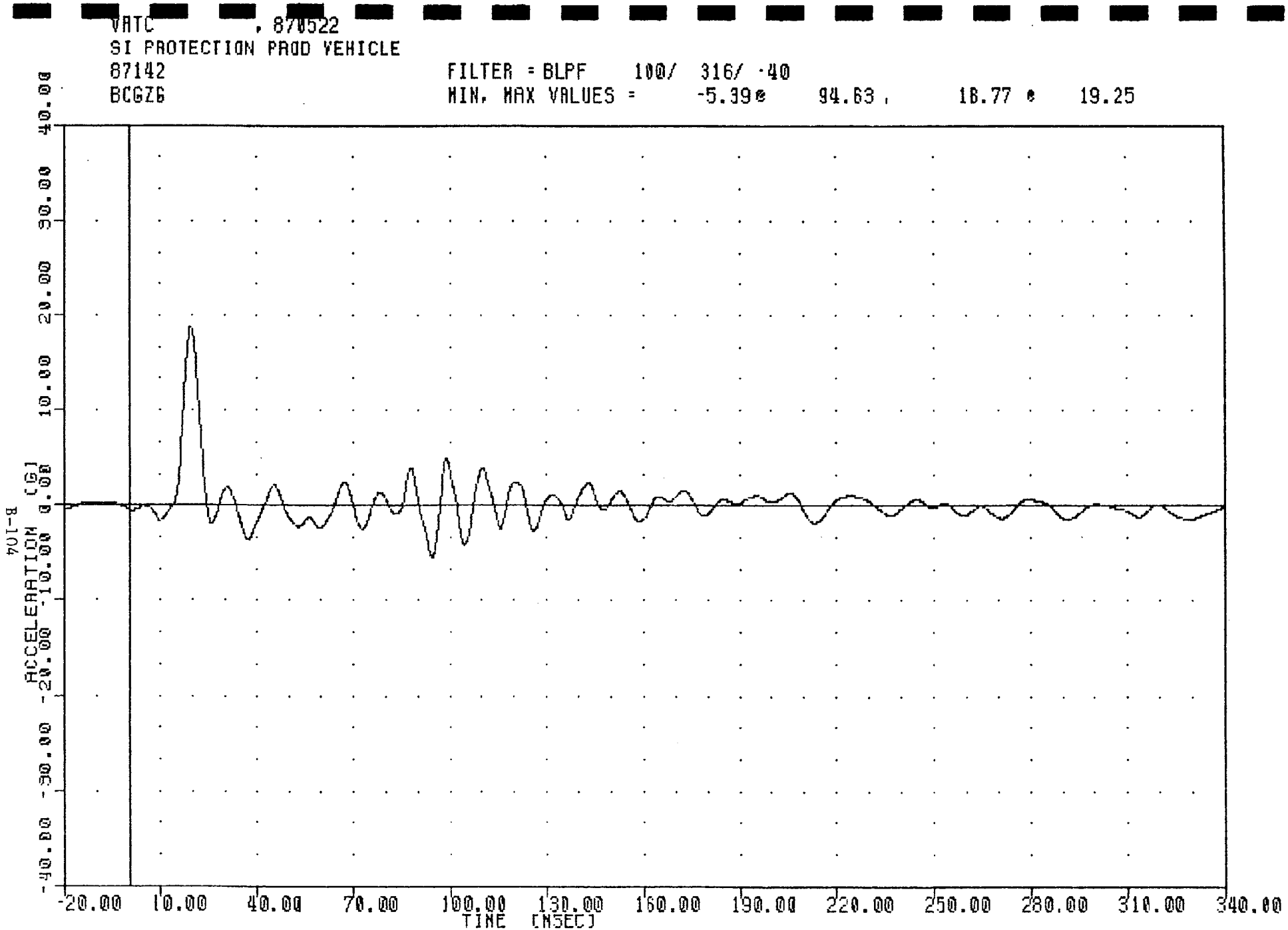
VRTC , 870522
SI PROTECTION PROD VEHICLE
87142
BCGXG
FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -15.33 @ 45.88 , 1.15 @ 162.63



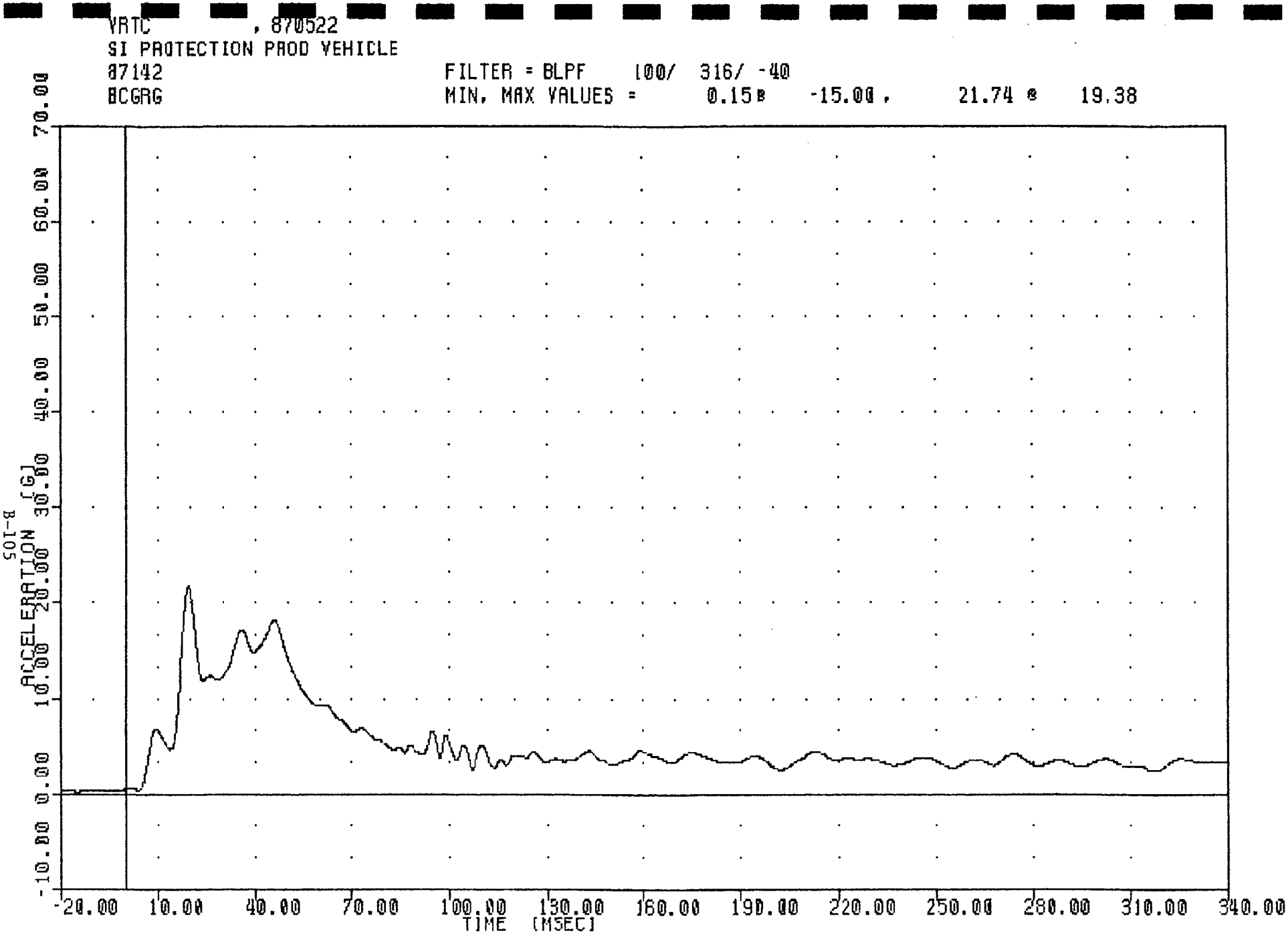
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
BARRIER CENTER OF GRAVITY X AXIS



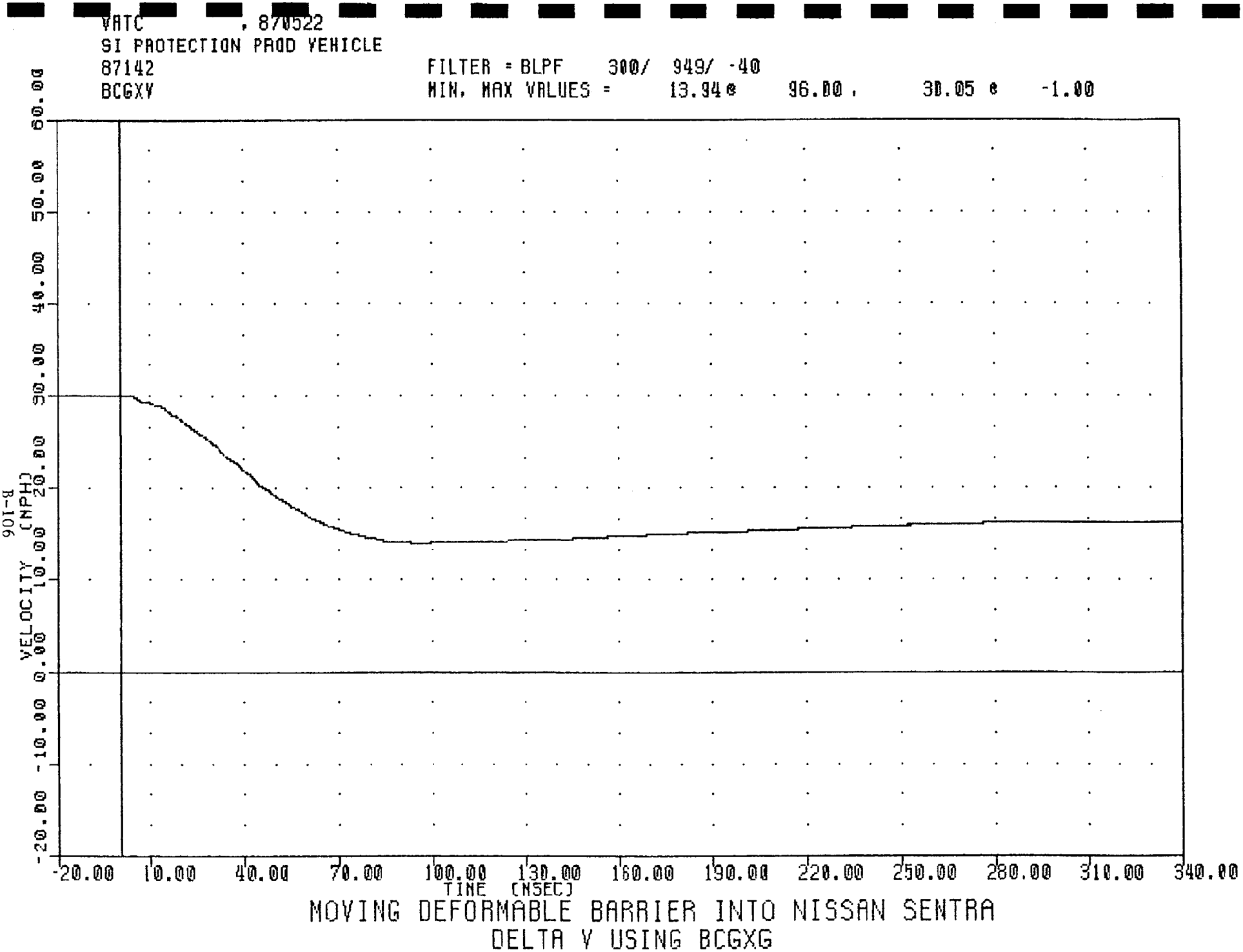
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
BARRIER CENTER OF GRAVITY Y AXIS



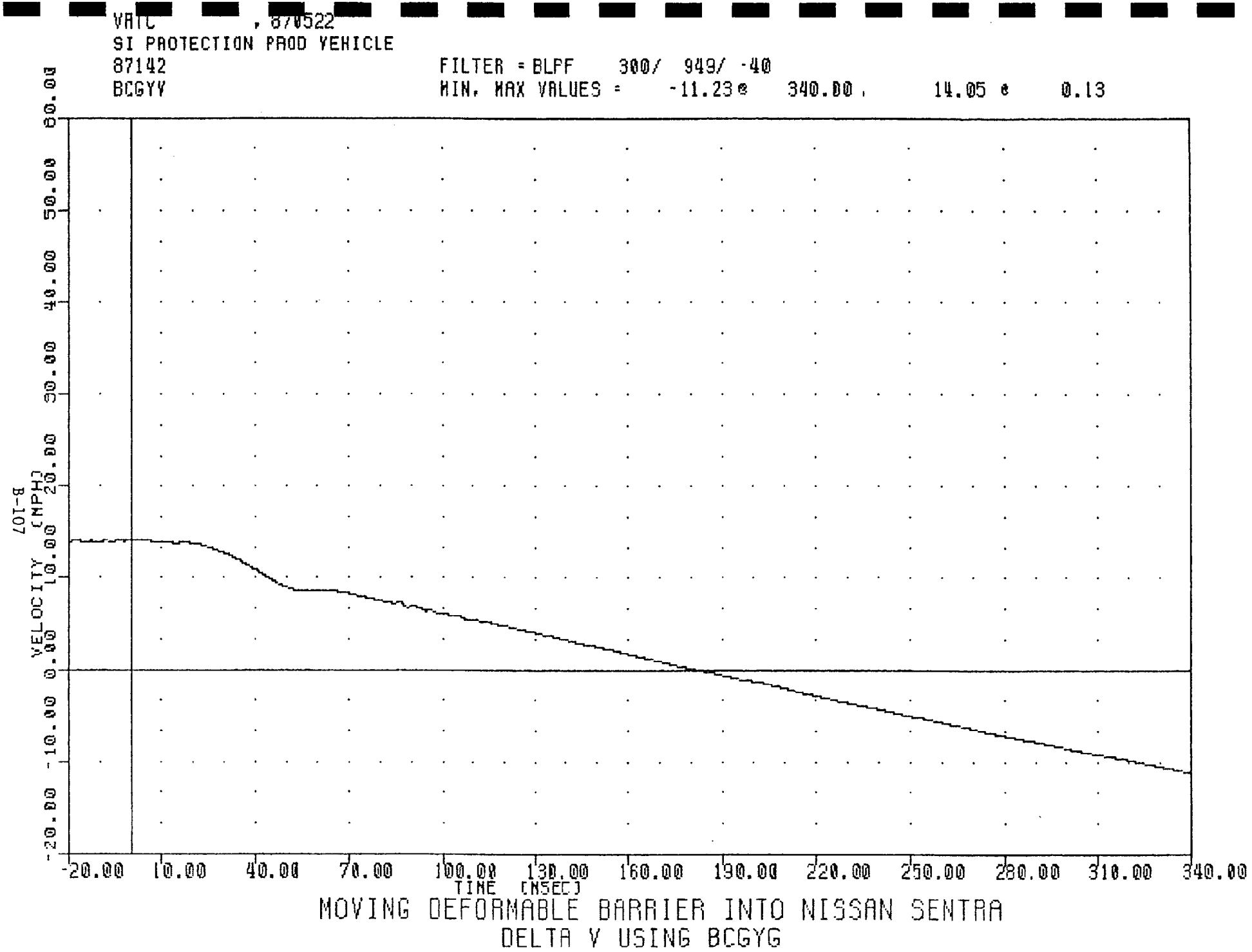
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
BARRIER CENTER OF GRAVITY Z AXIS



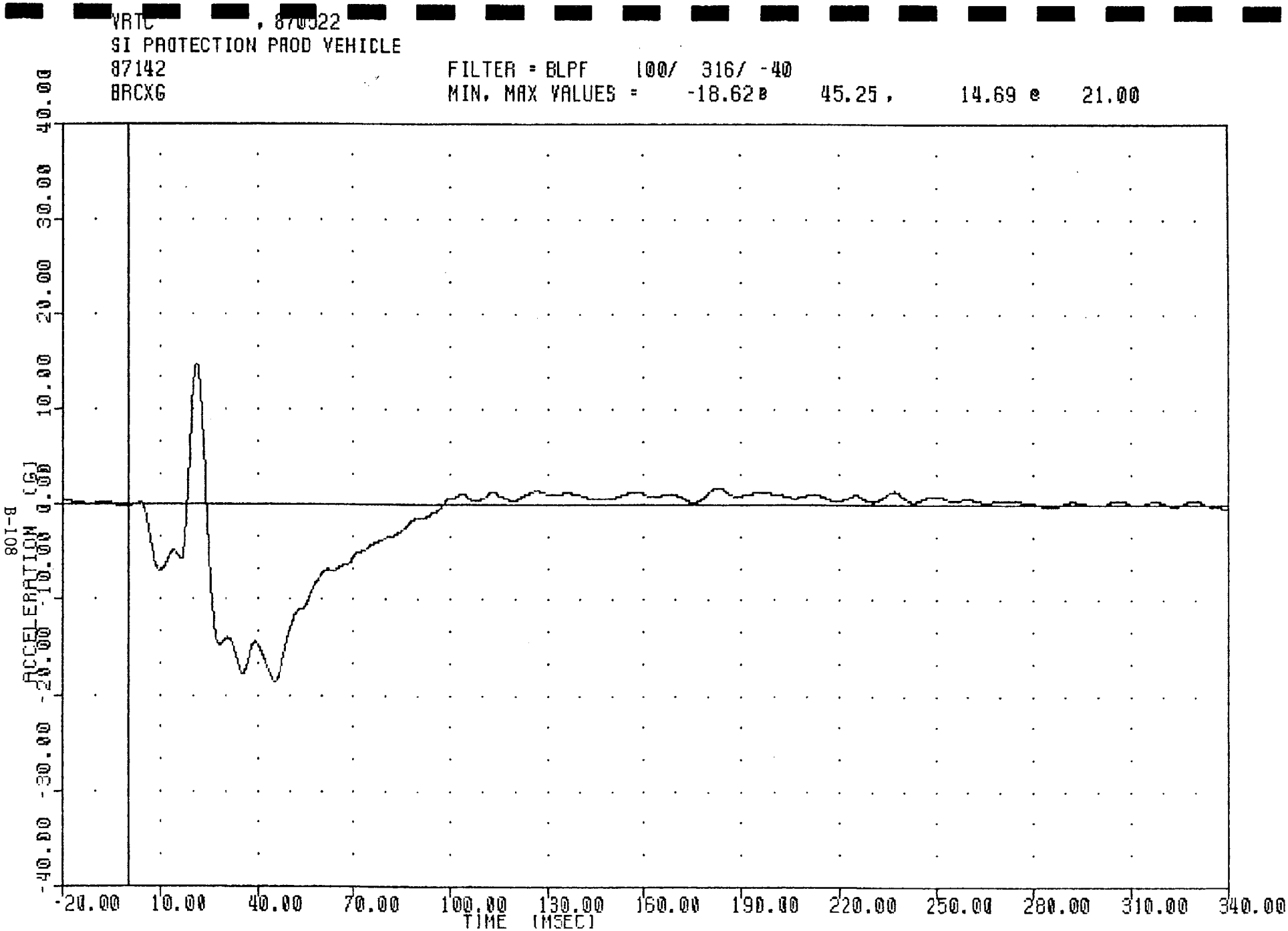
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
BARRIER CG RESULTANT ACCELERATION



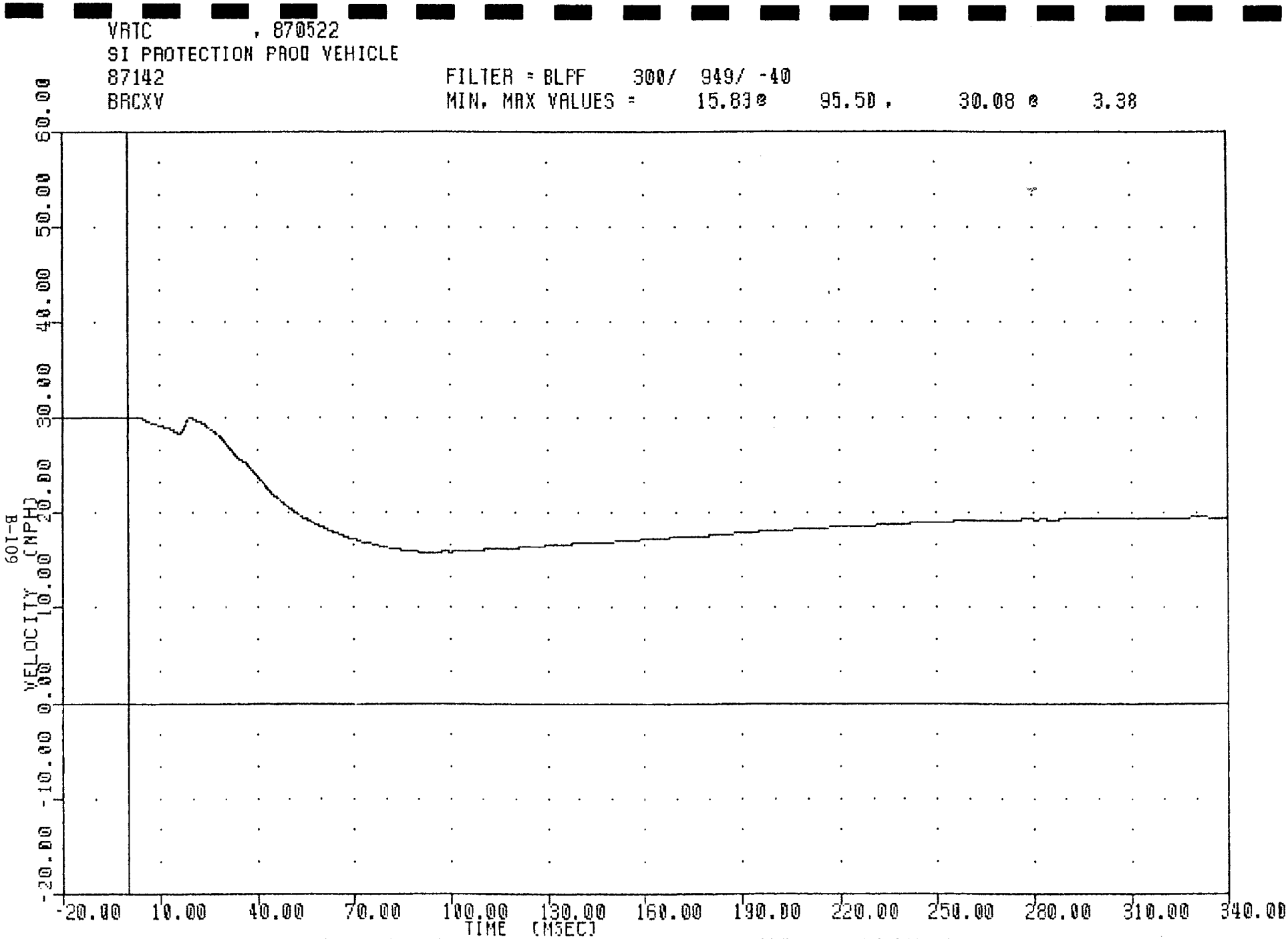
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING BCGXG



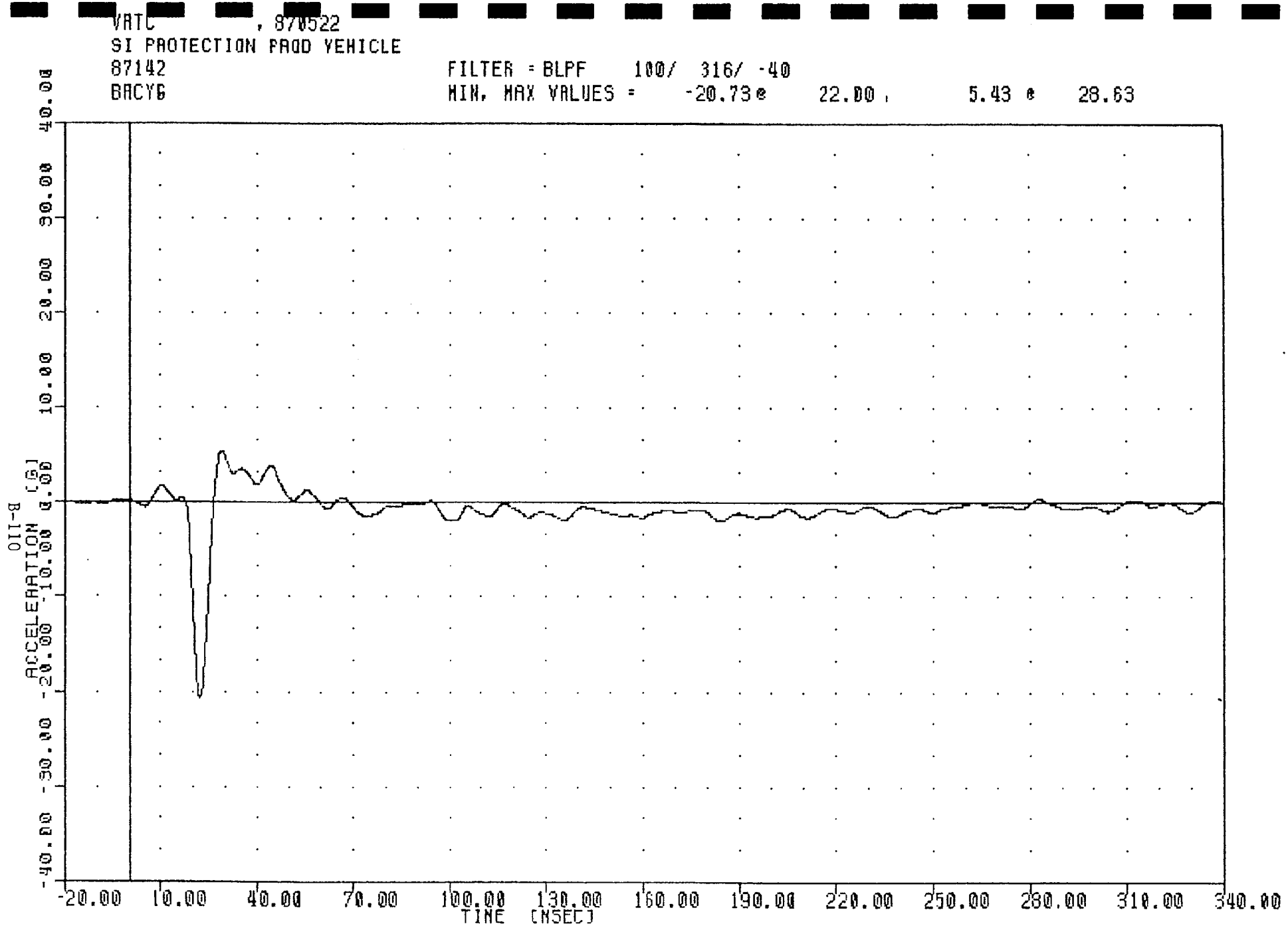
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING BCGYG



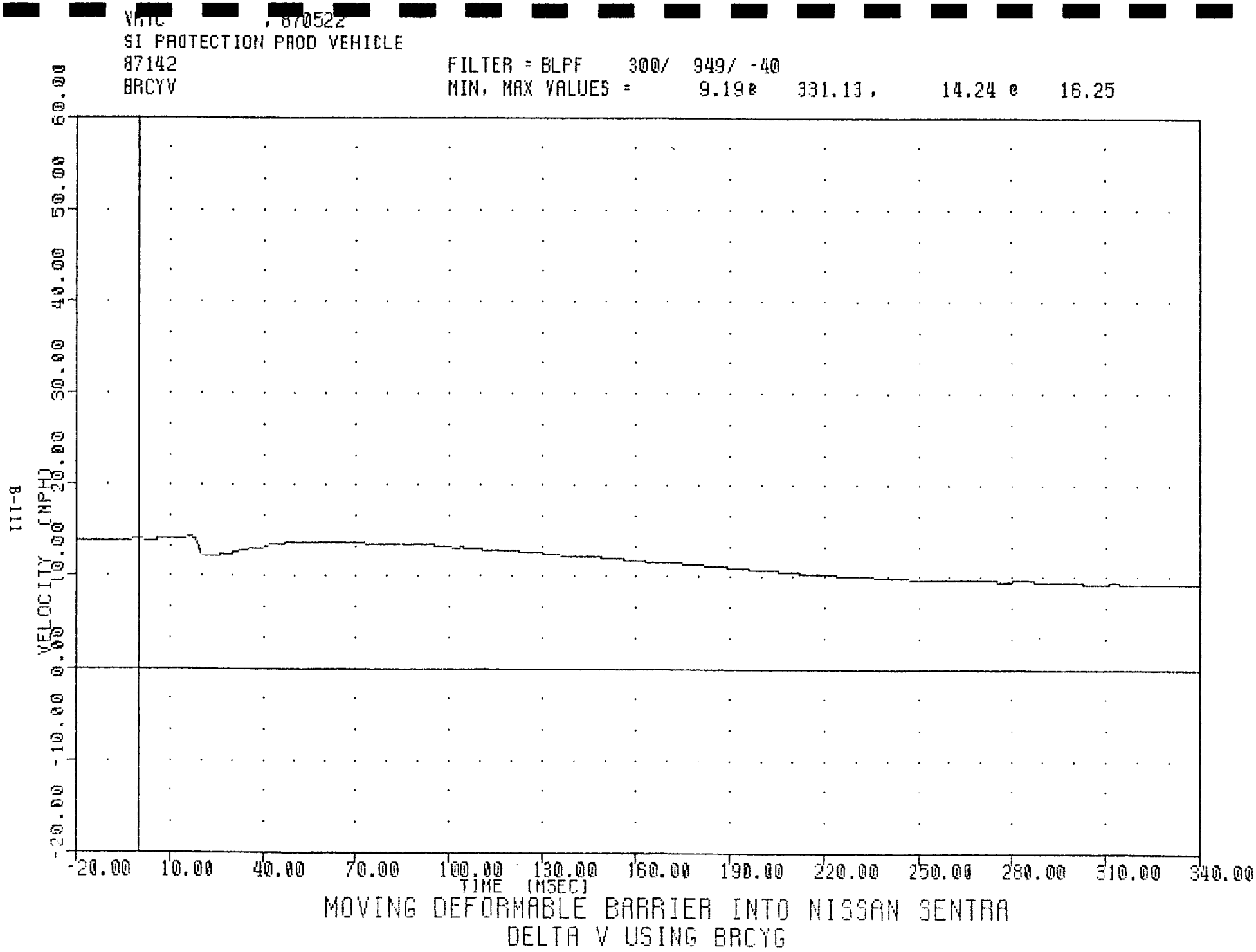
MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
BARRIER REAR CROSSMEMBER ACCELERATION X AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING BRCXG



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
BARRIER REAR CROSSMEMBER ACCELERATION Y AXIS



MOVING DEFORMABLE BARRIER INTO NISSAN SENTRA
DELTA V USING BRCYG

APPENDIX C

DUMMY CERTIFICATION

SIDE IMPACT DUMMY CALIBRATION

DUMMY SERIAL NUMBER 119

TEST/ DATE	CHANNEL	FILTER CLASS	PEAK ACCELERATION (g) SPECIFICATION	TEST RESULT
HEAD 5/20/87	HEAD Y-AXIS	1000	150-175	173.87
THORAX 5/20/87	LEFT UPPER RIB Y-AXIS			
	PRIMARY	180	36-50	45.04
	REDUNDANT	180	36-50	45.78
	UPPER SPINE Y-AXIS			
	PRIMARY	180	16-24.6	21.41
	REDUNDANT	180	16-24.6	21.80
	LOWER SPINE Y-AXIS			
	PRIMARY	180	17.6-26.4	17.19*
	REDUNDANT	180	17.6-26.4	18.20
PELVIS 5/19/87	PELVIS Y-AXIS	180	50-65	57.89

*Dummy did not meet specification.

SIDE IMPACT DUMMY DAMPER CALIBRATION

DUMMY SERIAL NUMBER 119

TEST DATE	IMPACT VELOCITY, FT/SEC SPECIFICATION	IMPACT VELOCITY, FT/SEC TEST RESULT	DAMPER FORCE, LBS SPECIFICATION	DAMPER FORCE, LBS TEST RESULT	DAMPER DISPLACEMENT, IN SPECIFICATION	DAMPER DISPLACEMENT, IN TEST RESULT
5/18/87	10	9.97	195-247	198.48	1.18-1.38	1.32
5/18/87	14	13.82	400-465	436.40	1.24-1.46	1.40
5/18/87	20	18.50*	850-1000	890.23	1.31-1.55	1.46

*Maximum capability of pendulum fixture.

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572 18-MAY-87

TEMPERATURE 72.00 F RELATIVE HUMIDITY 64.00 %
VRTC HN11921 572 SN 119 HEAD/NECK CAL 21

Test Parameter	Specification	Test Results
Pendulum velocity	21.5 to 25.5 fps	23.63 fps
Pendulum Deceleration:		
T1 - T2: 5 - 20 G	3 ms. max	2.59 ms.
T2 - T3: 20 - 20 G	25 - 30 ms.	26.56 ms.
T3 - T4: 20 - 5 G	10 ms. max	8.94 ms.
Avg. G level T2 - T3	20 - 24 G	22.29 G
Maximum Rotation Angle	63 - 73 deg.	69.76 deg.
Peak Head Resultant Accel	26 G max	22.03 G

Test Parameter	Specification		Test Results	
Rotation Angle (degrees)	Time (ms.)	Chordal Disp. (in.)	Time (ms.)	Chordal Disp. (in.)
0	-2.0 - 43.0	-0.5 - +0.5	1.38	0.04
30	25.6 - 34.4	2.1 - 3.1	32.40	2.63
60	40.3 - 51.7	4.3 - 5.3	49.47	5.01
max	53.7 - 66.8	5.0 - 6.0	65.25	5.94
60	67.0 - 83.0	4.7 - 5.3	81.68	5.07
30	85.4 - 104.6	2.1 - 3.1	100.35	2.41
0	101.0 - 123.0	-0.5 - +0.5	114.08	0.15

* DUMMY MEETS SPECIFICATIONS

TECHNICIAN

TRANSPORTATION RESEARCH CENTER OF OHIO

ABDOMINAL COMPRESSION TEST

PART 572 06-MAY-87

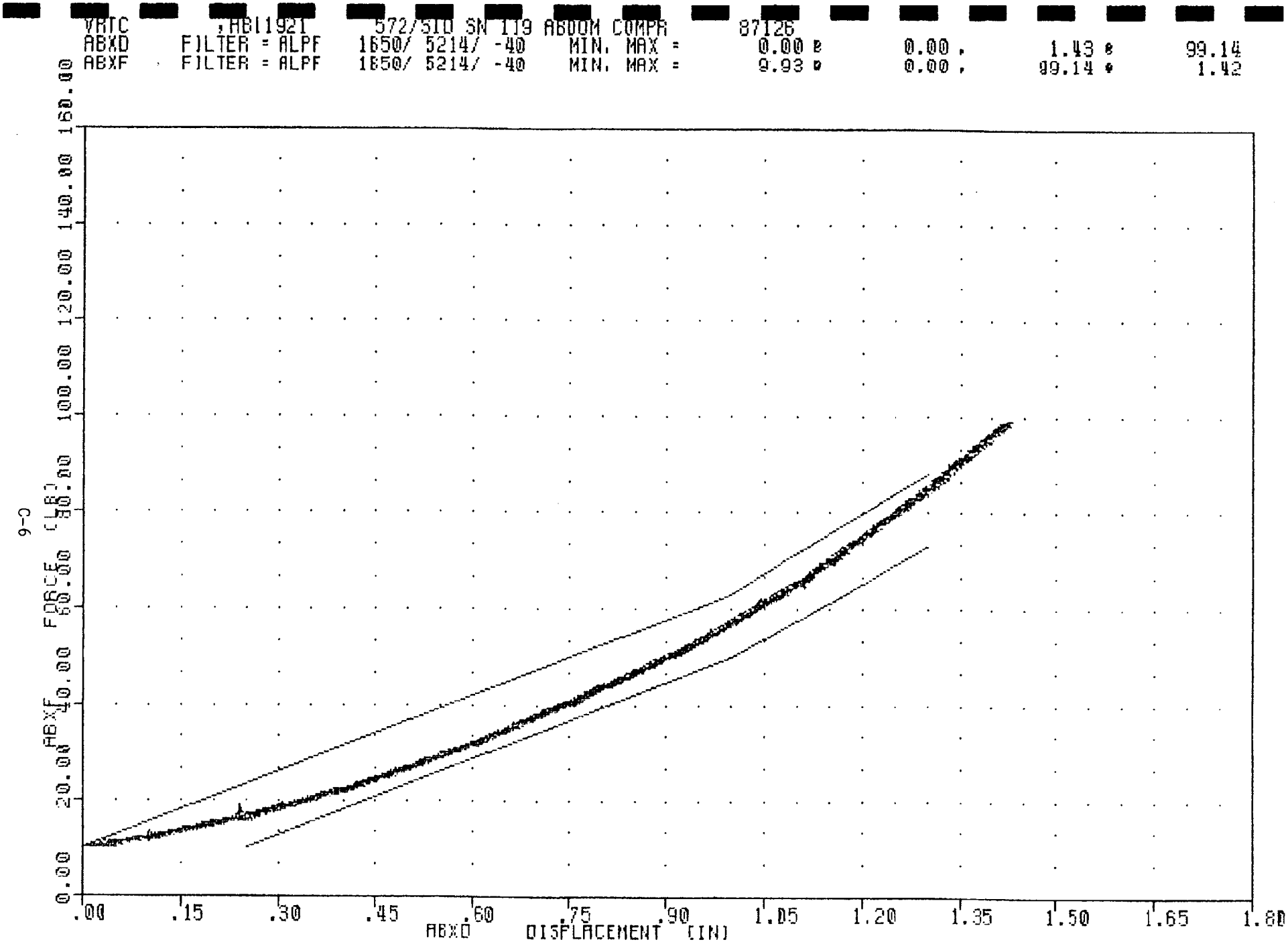
TEMPERATURE 71.00 F
VRTC AB11921

RELATIVE HUMIDITY 31.00 %
572/SID SN 119 ABDOM COMPR

TEST CORRIDORS DISPLACEMENT	FORCE	TEST RESULTS
0 IN.	10 LB	10 LB
.50 IN.	23.00 - 36.00 LB	26.14 LB
.75 IN.	36.00 - 50.00 LB	39.89 LB
1.00 IN.	50.00 - 63.00 LB	56.91 LB
1.30 IN.	73.00 - 88.00 LB	83.92 LB

DUMMY MEETS SPECIFICATIONS

TECHNICIAN 



ABDOMINAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572 06-MAY-87

TEMPERATURE 70.00 F RELATIVE HUMIDITY 32.00 %
VRTC LF11921 572 SN 119 LUMBAR FLEX CAL 01

DEFLECTION	SPECIFICATION	TEST RESULTS
0 Deg.	0 LBS	0.00 LBS
20 Deg	22.00 - 34.00 LBS	30.00 LBS
30 Deg	34.00 - 46.00 LBS	41.00 LBS
40 Deg	46.00 - 58.00 LBS	52.00 LBS
NET RETURN ANGLE	< 12 DEG	8.66 DEG

DUMMY MEETS SPECIFICATIONS

TECHNICIAN 

SIDE IMPACT DUMMY CALIBRATION

DUMMY SERIAL NUMBER 018

TEST/ DATE	CHANNEL	FILTER CLASS	PEAK ACCELERATION (g) SPECIFICATION	TEST RESULT
HEAD 5/19/87	HEAD Y-AXIS	1000	150-175	149.85*
THORAX 5/20/87	LEFT UPPER RIB Y-AXIS			
	PRIMARY	180	36-50	47.25
	REDUNDANT	180	36-50	47.92
	UPPER SPINE Y-AXIS			
	PRIMARY	180	16-24.6	23.57
	REDUNDANT	180	16-24.6	23.76
	LOWER SPINE Y-AXIS			
	PRIMARY	180	17.6-26.4	21.73
	REDUNDANT	180	17.6-26.4	21.72
PELVIS 5/19/87	PELVIS Y-AXIS	180	50-65	46.60*

*Dummy did not meet specification.

SIDE IMPACT DUMMY DAMPER CALIBRATION

DUMMY SERIAL NUMBER 018

TEST DATE	IMPACT VELOCITY, FT/SEC SPECIFICATION	IMPACT VELOCITY, FT/SEC TEST RESULT	DAMPER FORCE, LBS SPECIFICATION	DAMPER FORCE, LBS TEST RESULT	DAMPER DISPLACEMENT, IN SPECIFICATION	DAMPER DISPLACEMENT, IN TEST RESULT
5/15/87	10	9.89	195-247	210.80	1.18-1.38	1.29
5/15/87	14	14.02	400-465	424.21	1.24-1.46	1.43
5/15/87	20	18.63*	850-1000	839.20**	1.31-1.55	1.44

*Maximum capability of pendulum fixture.

**Within specification limits curve at 18.63 ft/sec impact velocity.

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572 18-MAY-87

TEMPERATURE 71.00 F RELATIVE HUMIDITY 61.00 %
VRTC HN01801 572 SN 018 HEAD/NECK CAL 01

Test Parameter	Specification	Test Results
Pendulum velocity	21.5 to 25.5 fps	23.53 fps
Pendulum Deceleration:		
T1 - T2: 5 - 20 G	3 ms. max	2.51 ms.
T2 - T3: 20 - 20 G	25 - 30 ms.	25.98 ms.
T3 - T4: 20 - 5 G	10 ms. max	9.83 ms.
Avg. G level T2 - T3	20 - 24 G	21.96 G
Maximum Rotation Angle	63 - 73 deg.	68.46 deg.
Peak Head Resultant Accel	26 G max	21.39 G

Test Parameter	Specification		Test Results	
Rotation Angle (degrees)	Time (ms.)	Chordal Disp. (in.)	Time (ms.)	Chordal Disp. (in.)
0	-2.0 - +2.0	-0.5 - +0.5	1.25	0.02
30	25.6 - 34.4	2.1 - 3.1	32.82	2.60
60	40.3 - 51.7	4.3 - 5.3	50.27	4.99
max	53.2 - 66.8	5.0 - 6.0	64.63	5.69
60	67.0 - 83.0	4.3 - 5.3	79.62	4.90
30	85.4 - 104.6	2.1 - 3.1	98.43	2.30
0	101.0 - 123.0	-0.5 - +0.5	112.13	0.15

* DUMMY MEETS SPECIFICATIONS

TECHNICAN

TRANSPORTATION RESEARCH CENTER OF OHIO

ABDOMINAL COMPRESSION TEST

PART 572 06-MAY-87

TEMPERATURE 71.00 F
VRTC AB01801

RELATIVE HUMIDITY 30.00 %
572/SID SN 018 ABDOM COMPR

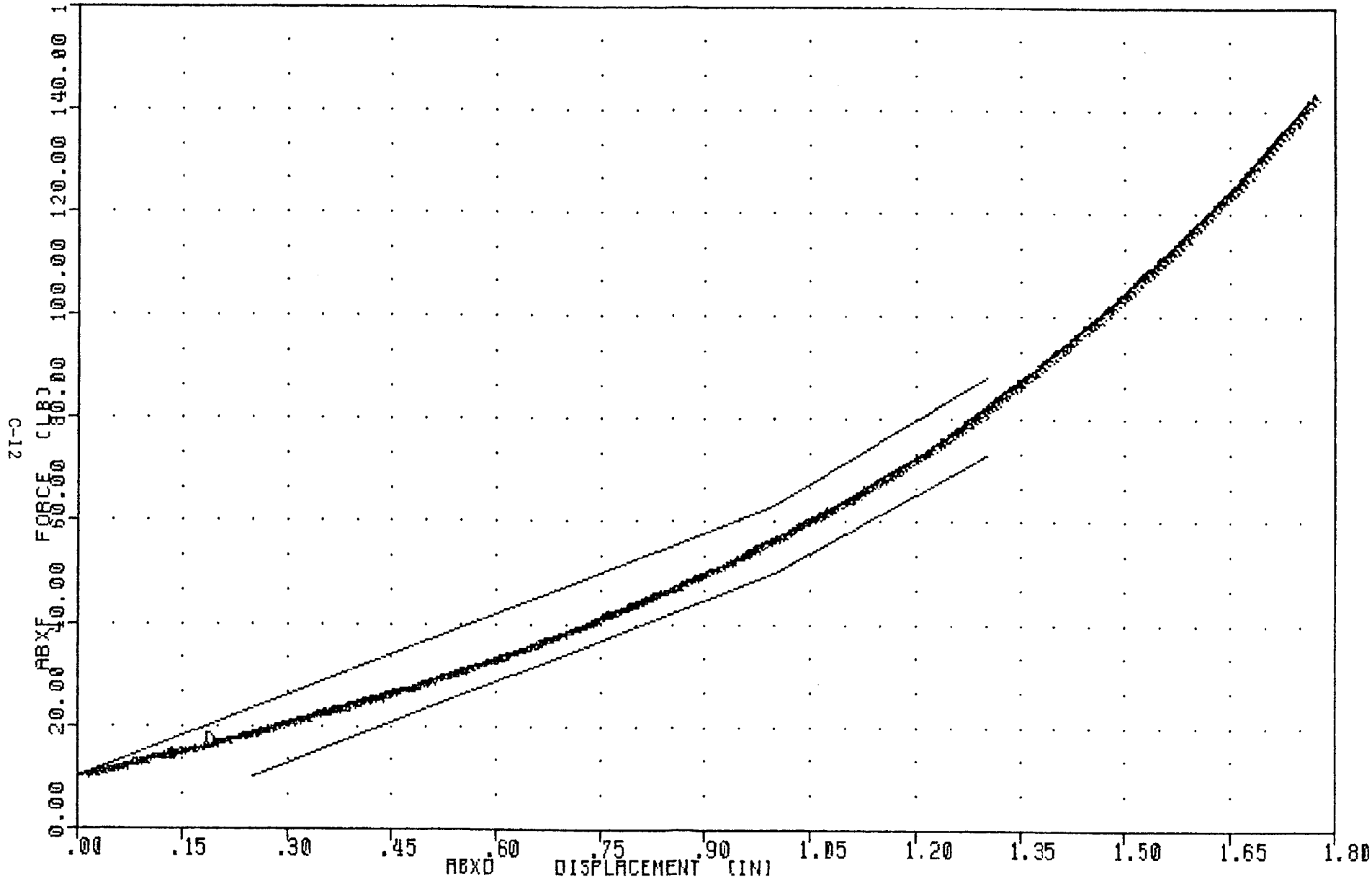
TEST CORRIDORS DISPLACEMENT	FORCE	TEST RESULTS
0 IN.	10 LB	10 LB
.50 IN.	23.00 - 36.00 LB	28.10 LB
.75 IN.	36.00 - 50.00 LB	40.24 LB
1.00 IN.	50.00 - 63.00 LB	56.30 LB
1.30 IN.	73.00 - 88.00 LB	81.05 LB

DUMMY MEETS SPECIFICATIONS

TECHNICIAN 

[redacted] VHTC [redacted] VHB01601 [redacted] 572/ 510 SN 018 ABDOM COMPR [redacted] 87128

ABXD	FILTER = ALPF	1650/ 5214/ -40	MIN, MAX =	0.00 @	0.00 ,	1.78 @ 142.20
ABXF	FILTER = ALPF	1650/ 5214/ -40	MIN, MAX =	9.74 @	0.00 ,	143.18 @ 1.77



ABDOMINAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572 06-MAY-87

TEMPERATURE 70.00 F RELATIVE HUMIDITY 33.00 %
VRTC LF01801 572 SN 018 LUMBAR FLEX CAL 01

DEFLECTION	SPECIFICATION	TEST RESULTS
0 Deg.	0 LBS	0.00 LBS
20 Deg	22.00 - 34.00 LBS	27.00 LBS
30 Deg	34.00 - 46.00 LBS	35.00 LBS
40 Deg	46.00 - 58.00 LBS	46.00 LBS
NET RETURN ANGLE	< 12 DEG	9.56 DEG

DUMMY MEETS SPECIFICATIONS

TECHNICIAN