

DOT 1319

REPORT NOS. 208-TRC-89-009  
212-TRC-89-009  
301-TRC-89-009

VEHICLE SAFETY COMPLIANCE TESTING  
FOR OCCUPANT CRASH PROTECTION,  
WINDSHIELD MOUNTING, WINDSHIELD ZONE  
INTRUSION, AND FUEL SYSTEM INTEGRITY

SAAB-SCANIA  
1989 SAAB 9000  
4-DOOR SEDAN  
NHTSA NO. CK0504  
TRC TEST NO. 890505

THE TRANSPORTATION RESEARCH CENTER OF OHIO  
U.S. RT. 33, LOGAN COUNTY  
EAST LIBERTY, OHIO 43319



MAY 23, 1989  
FINAL REPORT

PREPARED FOR:  
U.S. DEPARTMENT OF TRANSPORTATION  
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION  
OFFICE OF VEHICLE SAFETY COMPLIANCE  
400 SEVENTH STREET, S.W.  
ROOM NO. 6115 (NEF-31)  
WASHINGTON, DC 20590

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-88-C-11038. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

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1. Report No. 208-TRC-89-009 212-TRC-89-009 301-TRC-89-009		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle FINAL REPORT OF FMVSS NOS. 208, 212, 219 (PARTIAL), AND 301 COMPLIANCE TESTING OF A 1989 Saab 9000 4-DOOR SEDAN, NHTSA NO. CK0504				5. Report Date MAY 1989	
				6. Performing Organization Code	
7. Author(s) J.W. Sankey, Supervisor, Laboratory Engineering, TRC				8. Performing Organization Report No. 208-TRC-89-009, 212-TRC-89-009 301-TRC-89-009	
9. Performing Organization Name and Address Transportation Research Center of Ohio U.S. Rt. 33, Logan County East Liberty, Ohio 43319				10. Work Unit No. (TR AIS)	
				11. Contract or Grant No. DTNH22-88-C-11038	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance (NEF-31) 400 Seventh St., S.W., Washington, DC 20590				13. Type of Report and Period Covered FINAL REPORT MAY 1989	
				14. Sponsoring Agency Code DOT/NHTSA/NEF/OVSC	
15. Supplementary Notes					
16. Abstract A 30 mph flat frontal barrier impact compliance test was conducted on a 1989 Saab 9000 4-door sedan, VIN YS3CL48L8K1011912, NHTSA No. CK0504 at the Transportation Research Center of Ohio on May 5, 1989. This test was conducted to determine compliance with Federal Motor Vehicle Safety Standards:  FMVSS No. 208, "Occupant Crash Protection" FMVSS No. 212, "Windshield Mounting" FMVSS No. 219, (Partial), "Windshield Zone Intrusion" FMVSS No. 301, "Fuel System Integrity"  The barrier impact velocity was 29.6 mph. The ambient temperature was 70° F. The vehicle appears to comply with the applicable requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.					
17. Key Words Frontal Impact 30 mph Vehicle Safety Compliance Testing: FMVSS 208, "Occupant Crash Protection" FMVSS 212, "Windshield Mounting" FMVSS 219, "Windshield Zone Intrusion" FMVSS 301, "Fuel System Integrity"			18. Distribution Statement Available from: Technical Reference Division National Highway Traffic Safety Admin Nassif Building, Room 5108 400 Seventh Street, SW Washington, DC 20590		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 101	22. Price

# METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures			Approximate Conversions from Metric Measures					
Symbol	When You Know	Multiply by	To Find	Symbol	When You Know	Multiply by	To Find	Symbol
I.F.N.C.T.H.			I.F.N.C.T.H.					
in	inches	2.5	centimeters	cm	mm	millimeters	0.04	inches
ft	feet	30	centimeters	cm	cm	centimeters	0.4	inches
yd	yards	0.9	meters	m	m	meters	3.3	feet
mi	miles	1.6	kilometers	km	m	meters	1.1	yards
AREA			AREA					
in <sup>2</sup>	square inches	6.5	square centimeters	cm <sup>2</sup>	square centimeters	0.16	square inches	in <sup>2</sup>
ft <sup>2</sup>	square feet	0.09	square meters	m <sup>2</sup>	square meters	1.2	square yards	yd <sup>2</sup>
yd <sup>2</sup>	square yards	0.8	square meters	m <sup>2</sup>	square kilometers	0.4	square miles	mi <sup>2</sup>
mi <sup>2</sup>	square miles	2.6	square kilometers	km <sup>2</sup>	hectares	2.5	acres	
MASS (weight)			MASS (weight)					
oz	ounces	28	grams	g	grams	0.035	ounces	oz
lb	pounds	0.45	kilograms	kg	metric ton	2.2	pounds	lb
	short tons	0.9	metric ton	t	(1000 kg)	1.1	short tons	
VOLUME			VOLUME					
tsp	teaspoons	5	milliliters	ml.	milliliters	0.03	fluid ounces	fl oz
Tbsp	tablespoons	15	milliliters	ml.	milliliters	0.06	cubic inches	in <sup>3</sup>
in <sup>3</sup>	cubic inches	16	milliliters	ml.	liters	2.1	pints	pt
fl oz	fluid ounces	30	milliliters	ml.	liters	1.06	quarts	qt
c	cups	0.24	liters	L	liters	0.26	gallons	gal
pt	pints	0.47	liters	L	cubic meters	35	cubic feet	ft <sup>3</sup>
qt	quarts	0.95	liters	L	cubic meters	1.3	cubic yards	yd <sup>3</sup>
gal	gallons	3.8	liters	L	TEMPERATURE (exact)			
ft <sup>3</sup>	cubic feet	0.03	cubic meters	m <sup>3</sup>	degrees Celsius	9/5 (then degrees	degrees Fahrenheit	°F
yd <sup>3</sup>	cubic yards	0.76	cubic meters	m <sup>3</sup>	Fahrenheit	subtracting	Celsius	
TEMPERATURE (exact)			TEMPERATURE (exact)					
°F	degrees Fahrenheit	5	degrees Celsius	°C	32			

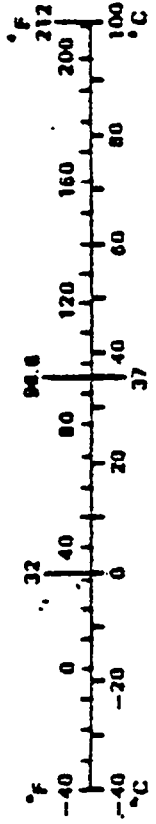


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SECTION 1.0

PURPOSE AND TEST SUMMARY

## PURPOSE

This 30 mph frontal barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 208, 212, 219 (Partial), and 301 compliance test program conducted for the National Highway Traffic Safety Administration (NHTSA) by the Transportation Research Center of Ohio (TRC) under Contract No. DTNH22-88-C-11038. The purpose of this test was to determine if the subject vehicle, a 1989 Saab 9000 4-door sedan, NHTSA No. CK0504, meets the performance requirements of FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Mounting"; FMVSS 219 (partial), "Windshield Zone Intrusion"; and FMVSS 301, "Fuel System Integrity." The test was conducted in accordance with the Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure No. TP-208-07.

## TEST SUMMARY

The 1989 Saab 9000 4-door sedan, NHTSA No. CK0504, was equipped with a 2.0 liter, transverse engine, automatic transmission, power steering, and power brakes. The test weight of the vehicle was 3654 pounds. The test vehicle appeared to comply with the performance requirements of FMVSS test Nos. 208, 212, 219 (partial), and 301. The Head Injury Criteria (HIC) calculations were less than 1000, the resultant accelerations of the thorax did not exceed 60 g's and the compressive forces transmitted through the upper legs did not exceed 2,250 pounds as measured by Part 572 B dummies seated in the driver's and right front passenger's seats. (See DATA ACQUISITION EXPLANATIONS.) There was no intrusion into the windshield. There was no fluid spillage from the fuel system following the impact or during the static rollover test.

Two Part 572 B adult male anthropomorphic test devices (ATDs) were seated in the front outboard designated seating positions. The dummies were positioned according to the dummy placement procedures specified in Appendices B and C of Laboratory Procedure TP-208-07.

Both ATDs were instrumented with head and chest accelerometers oriented to measure accelerations in the longitudinal, lateral, and vertical directions, and with right and left femur load cells.

The vehicle was instrumented with eleven (11) accelerometers oriented to measure longitudinal axis acceleration.

The crash event was recorded by one (1) real-time panning camera and fourteen (14) high-speed motion picture cameras operating at approximately 500 frames per second. The pre-test and post-test events were recorded with one (1) real-time camera.

The twenty-seven (27) channels of data were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 8000 samples per second and digitally processed per sections 12.8 and 12.9 of the Laboratory Procedure.

The vehicle was impacted into the rigid, flat frontal barrier at the Transportation Research Center of Ohio on May 5, 1989. The test vehicle's impact speed was 29.6 mph. The vehicle sustained 21.6 inches of static crush.

The FMVSS 208, 212, 219 (partial) and 301 compliance data is presented in Section 2.0. The camera information is presented in Section 3.0. Appendix A contains the still photographic prints. Appendix B contains the vehicle and dummy data plots.

TABLE 1 CRASH TEST SUMMARY

NHTSA NO.: CK0504 PROJECT: 208 Compliance  
DATE: 5/05/89 TIME: 1409 TEMP: 70° F  
VEHICLE: 1989 Saab 9000 4-door sedan  
TEST WEIGHT (LBS): 3654  
IMPACT ANGLE (DEG)\*: 0  
IMPACT VELOCITY (MPH)\*\*: PRIMARY = 29.6 SECONDARY = 29.6  
MAXIMUM STATIC CRUSH (IN): 21.6  
VEHICLE REBOUND (IN): 41.4  
DUMMIES: Driver #354 Passenger #690  
TYPE: Part 572 B Part 572 B  
LOCATION: Left front Right front  
RESTRAINT: Airbag 3-point unbelt  
NUMBER OF DATA CHANNELS: 27  
NUMBER OF HIGH SPEED CAMERAS: HIGH-SPEED: 14 REAL-TIME: 2

\*With respect to tow track centerline.

\*\*Speed trap measurement ( $\pm$  .05 mph accuracy)

TABLE 2 TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Saab-Scania

MAKE/MODEL: Saab/9000

VIN: YS3CL48L8K1011912

BODY STYLE: 4-door sedan

MODEL YEAR: 1989

NHTSA NO.: CK0504

COLOR: black

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 2.0 liter

TRANSMISSION DATA: 4 SPEED,     MANUAL, X AUTOMATIC, X FWD,     RWD,     4WD

DATE VEHICLE RECEIVED: 4/27/89

ODOMETER READING: 76.0

DEALER'S NAME AND ADDRESS: Mid Ohio Imported Cars  
4050 Morse Road  
Columbus, OH 43230

ACCESSORIES:

POWER STEERING Yes  
POWER BRAKES Yes  
POWER SEATS Yes  
POWER WINDOWS Yes  
TINTED GLASS Yes  
RADIO Yes  
CLOCK Yes  
OTHER None

AUTOMATIC TRANSMISSION Yes  
AUTOMATIC SPEED CONTROL Yes  
TILTING STEERING WHEEL No  
TELESCOPING STEERING WHEEL No  
AIR CONDITIONING Yes  
ANTI-SKID BRAKE Yes  
REAR WINDOW DEFROSTER Yes

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

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

VEHICLE MANUFACTURED BY: Saab-Scania

DATE OF MANUFACTURE: 12/88

GVWR: 4170 LBS

GAWR: FRONT 2200 LBS., REAR 2030 LBS.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

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

VEHICLE LOAD (UP TO CAPACITY): FRONT 32 psi; REAR 32 psi

RECOMMENDED TIRE SIZE: 195/65VR15 LOAD RANGE X B,      C,      D

TIRES ON VEHICLE (MFR., LINE, SIZE): Goodyear Eagle NCT2 195/65VR15

IS SPARE TIRE A "SPACE SAVER": Yes

IS SPARE TIRE STANDARD EQUIPMENT: Yes

VEHICLE CAPACITY: TYPES OF SEATS: FRONT: Bucket  
REAR: Bench

TYPE OF FRONT SEAT BACKS: Power adjustable reclining

NUMBER OF OCCUPANTS 2 FRONT 3 REAR 5 TOTAL

CARGO LOAD 170 LBS. TOTAL 920 LBS.

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

RIGHT FRONT	986 lbs.	RIGHT REAR	597 lbs.
LEFT FRONT	987 lbs.	LEFT REAR	602 lbs.
TOTAL FRONT WEIGHT	1973 lbs.	(62.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1199 lbs.	(37.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT 3172 lbs.			

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (3172 LBS)

VCW = VEHICLE CAPACITY WEIGHT (920 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

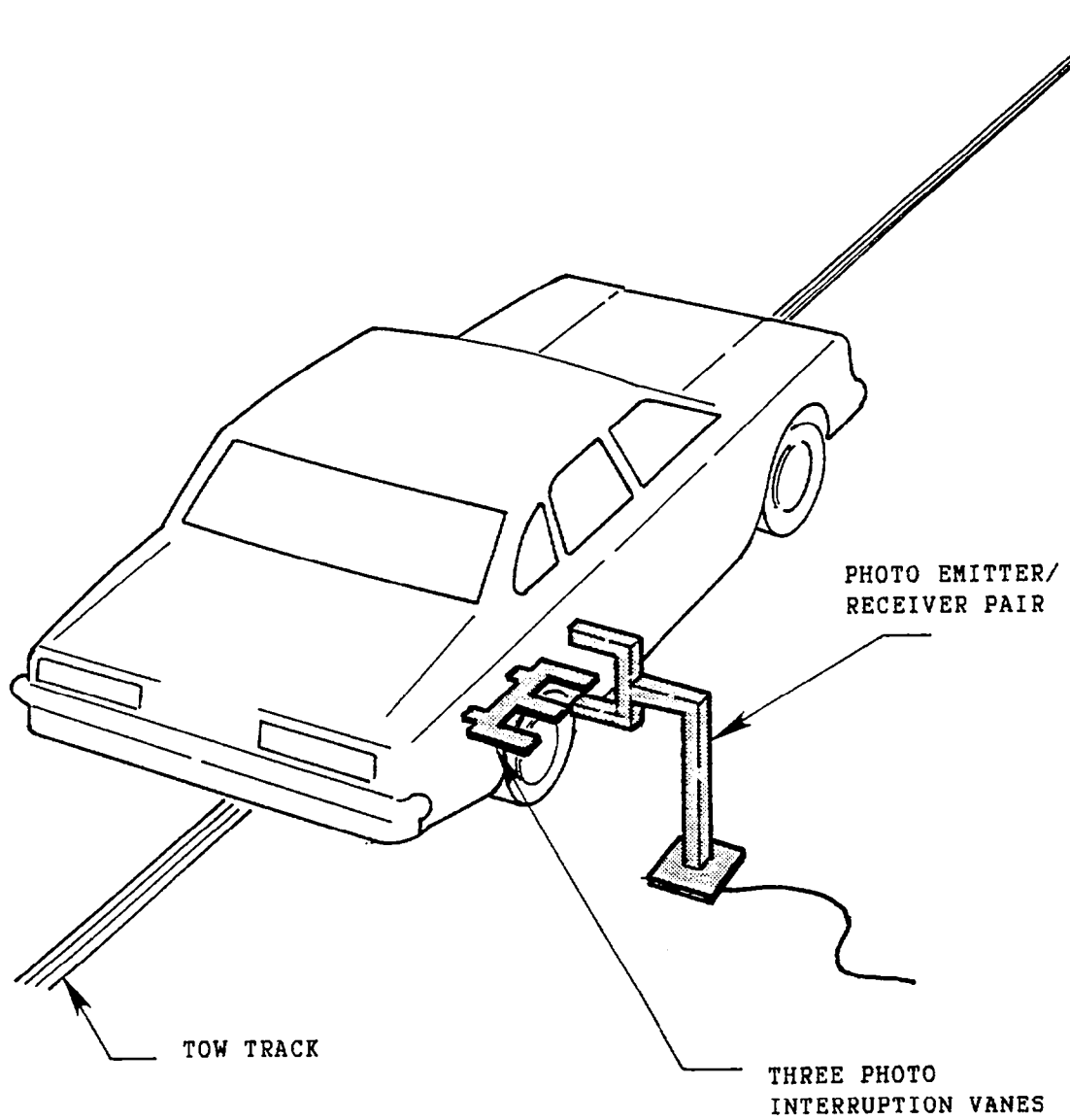
$RCLW = VCW - 150 (DCS) = 920 - 150(5) = 170 \text{ LBS}$

$TARGET \text{ TEST WEIGHT} = UDW + RCLW + (2 \text{ DUMMIES} \times 164 \text{ LBS/DUMMY})$   
 $= 3172 + 170 + 328 \text{ LBS}$

TARGET TEST WEIGHT = 3670 LBS



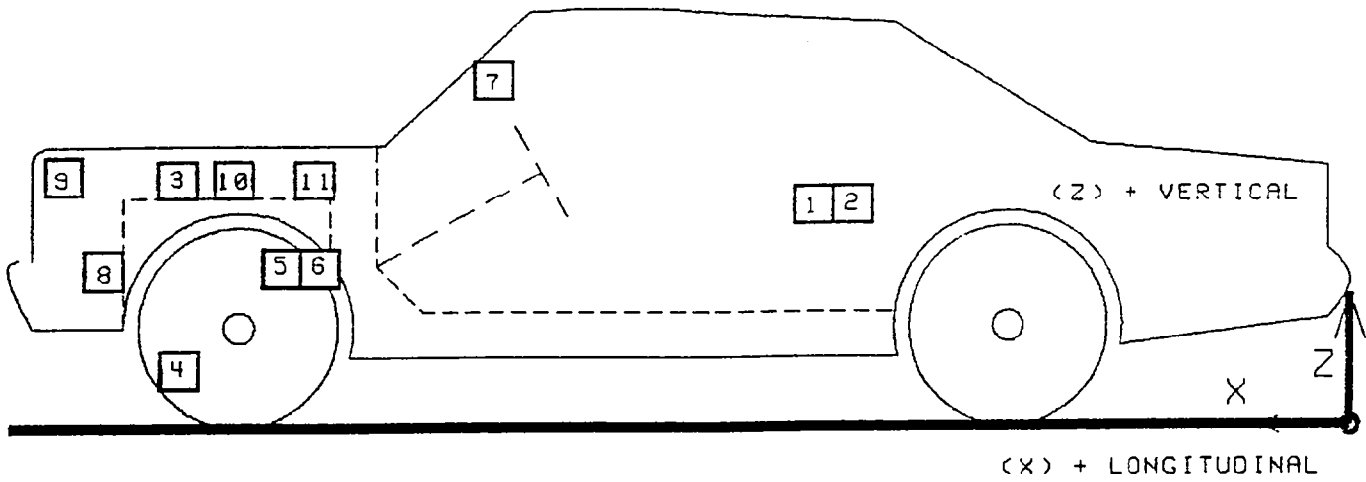
FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



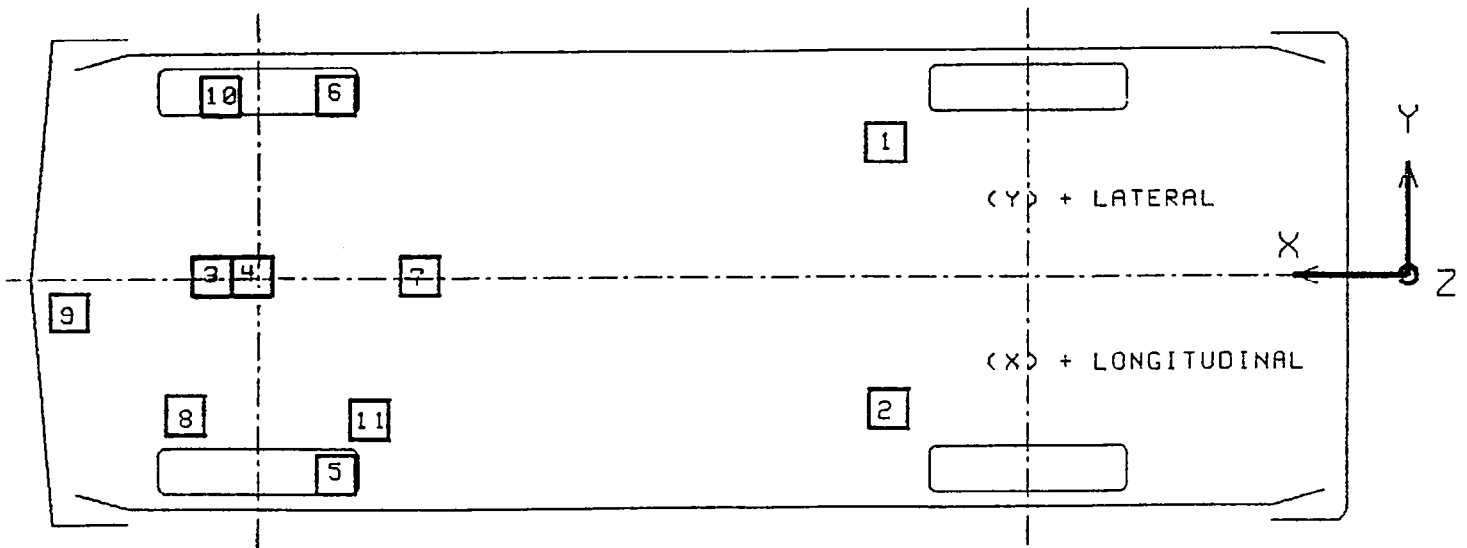
The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

FIGURE 2  
VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4  
TEST NUMBER 890505

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION		X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
						MAX G	MSEC	MAX G	MSEC
1	REAR SEAT CROSSMEMBER AT LEFT SIDE LONGITUDINAL	PRE	72.5	17.6	12.6				
		POST	74.2	17.6	15.0	3.8	144.	26.2	50.9
2	REAR SEAT CROSSMEMBER AT RIGHT SIDE LONGITUDINAL	PRE	72.5	-17.6	13.5				
		POST	73.1	-17.6	15.1	4.8	205.	26.5	51.0
3	TOP OF ENGINE BLOCK LONGITUDINAL	PRE	151.9	5.5	32.7				
		POST	143.6	4.2	33.1	41.6	43.	127.5	31.9
4	BOTTOM OF ENGINE BLOCK LONGITUDINAL	PRE	159.0	7.6	7.5				
		POST	154.2	7.6	11.1	13.1	319.	75.1	28.8
5	BRAKE CALIPER AT RIGHT SIDE LONGITUDINAL	PRE	152.6	-25.2	11.4				
		POST	148.5	-25.2	11.4	45.8	79.	63.2	53.8
6	BRAKE CALIPER AT LEFT SIDE LONGITUDINAL	PRE	152.6	25.2	11.5				
		POST	147.1	25.2	11.5	21.6	79.	50.3	57.1
7	DASH PANEL LONGITUDINAL	PRE	124.8	0.1	38.8				
		POST	124.2	0.1	40.5	5.8	41.	39.6	50.3
8	FRONT FRAME RAIL LONGITUDINAL	PRE	158.4	-17.1	7.6				
		POST	155.1	-17.2	6.6	16.5	10.	64.4	33.9
9	FRONT FRAME CROSSMEMBER LONGITUDINAL	PRE	175.1	2.5	29.8				
		POST	164.9	2.0	34.1	66.7	28.	282.1	18.4

TABLE 4 CONT'D  
TEST NUMBER 890505

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY CONTINUED

No.	LOCATION		X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
						MAX G	MSEC	MAX G	MSEC
10	LEFT FENDER WELL INSIDE LONGITUDINAL	PRE	159.9	25.9	31.0				
		POST	155.8	26.0	30.6	16.4	206.	62.6	47.6
11	RIGHT SHOCK TOWER  LONGITUDINAL	PRE	143.9	-24.9	34.0				
		POST	139.1	-22.2	35.8	19.4	325.	65.6	48.5

\* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

**FIGURE 3 ACCIDENT INVESTIGATION DIVISION DATA  
FOR 30 MPH FRONTAL BARRIER IMPACT**

VEHICLE MAKE/MODEL/BODY STYLE: Saab/9000/4-door sedan

VEH. NHTSA NO.: CK0504; VIN: YS3CL48L8K1011912

MODEL YEAR: 1989; BUILD DATE: 12/88; TEST DATE: 5/05/89

VEH. SIZE CATEGORY: Large; TEST WEIGHT: 3654

VEH. WHEELBASE: 105.5

MAX. WIDTH: 69.2

FRONT OVERHANG: 39.8

COLLISION DEFORMATION  
CLASSIFICATION (CDC) CODE: 12FDEW2

F (Frontal)  
CRUSH DEPTH  
DIMENSIONS:

C1 =	<u>19.3</u>	inches
C2 =	<u>19.9</u>	inches
C3 =	<u>21.3</u>	inches
C4 =	<u>21.3</u>	inches
C5 =	<u>20.3</u>	inches
C6 =	<u>18.8</u>	inches

MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitudinal)

LENGTH OF DAMAGED REGION: L = 58.2 inches

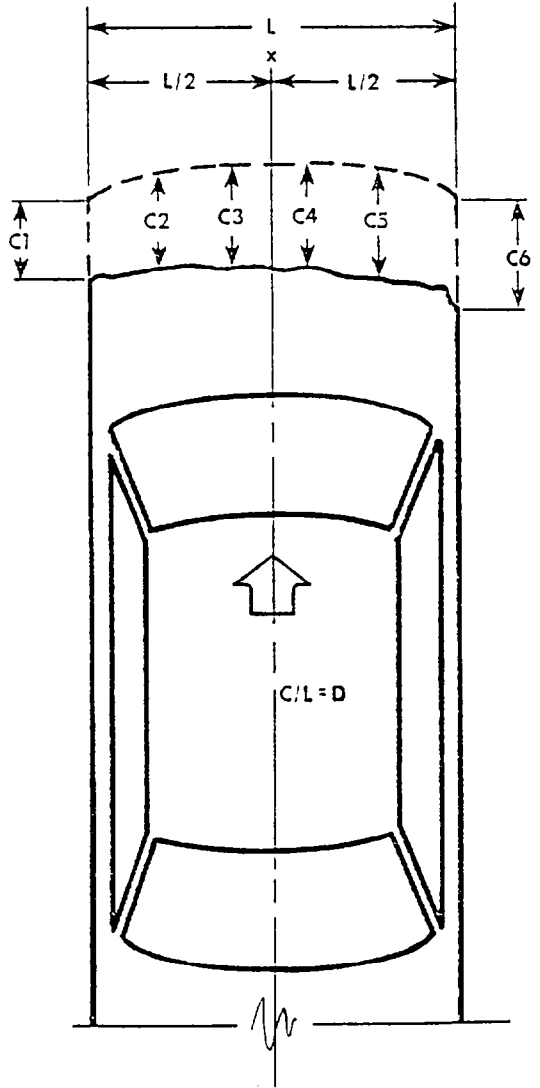


FIGURE 4

PRE-TEST AND POST-TEST MEASUREMENT POINTS

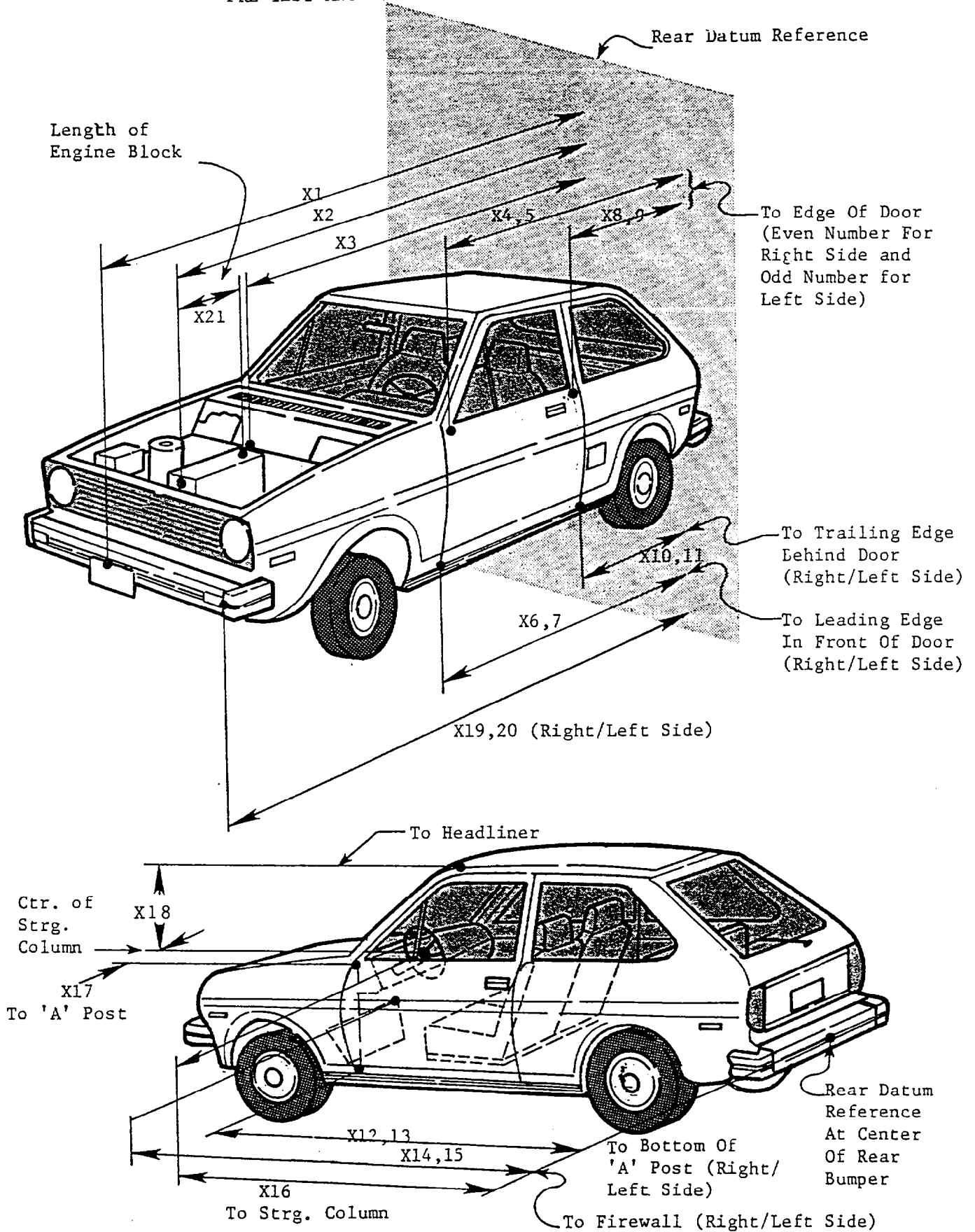
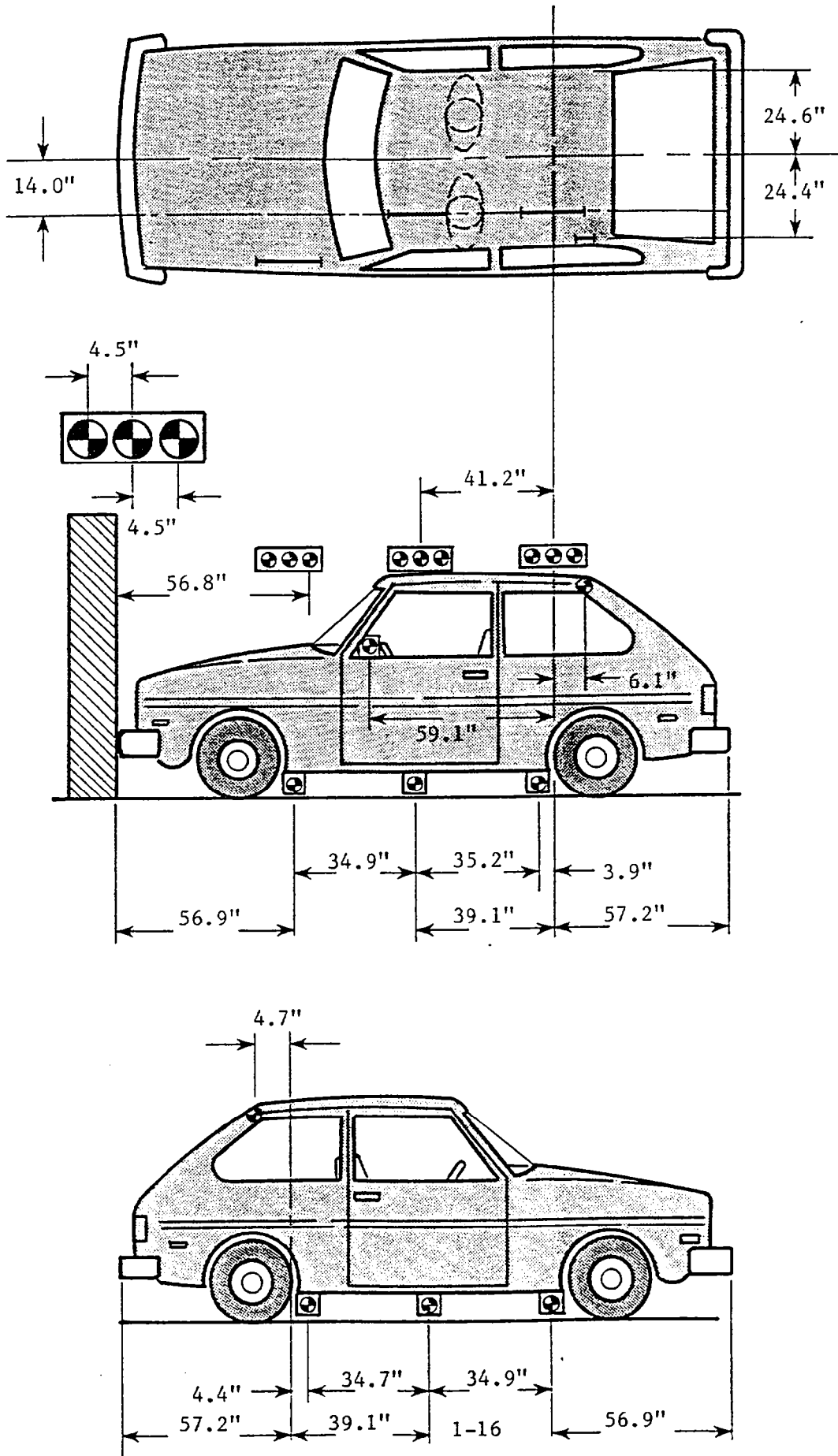


TABLE 5 IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL:	TEST NUMBER:	TEST NUMBER:	TYPE OF MEASUREMENT	DIMENSIONS IN INCHES		
				PRE-TEST	POST-TEST	DIFF.
Saab/9000	890505	890505	TOTAL LENGTH OF VEHICLE AT CENTERLINE	188.1	166.5	21.6
			REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	165.3	150.6	14.7
			REAR SURFACE OF VEHICLE TO FIREWALL	144.5	140.5	4.0
			REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	127.8	127.4	0.4
			REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	127.6	127.6	0.0
			REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	127.8	127.6	0.2
			REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	127.9	127.5	0.4
			REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	86.1	85.4	0.7
			REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	85.8	85.8	0.0
			REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	87.2	86.8	0.4
			REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	87.2	86.1	1.1
			REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	127.6	126.9	0.7
			REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	127.6	127.4	0.2
			REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	142.2	139.2	3.0
			REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	142.4	139.9	2.5
			REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	110.9	110.1	0.8
			CENTER OF STEERING COLUMN TO "A" POST	15.4	12.2	3.2
			CENTER OF STEERING COLUMN TO HEADLINER	17.6	15.8	1.8
			REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	184.2	165.4	18.8
			REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	184.2	164.9	19.3
			LENGTH OF ENGINE BLOCK	21.5	21.5	0.0

FIGURE 5

VEHICLE TARGET LOCATIONS



## DATA ACQUISITION EXPLANATIONS

The right front passenger's right femur force load cell, RFMF2, did not record data during the crash test event due to a failure of the instrumentation channel.

REPORT OF VEHICLE CONDITION AT THE  
COMPLETION OF TESTING

Contract No.: DTNH22-88-C-11038  
From: The Transportation Research Center of Ohio  
U.S. Route 33  
East Liberty, OH 43319

To: Glen Brammeier  
COTR  
Office of Vehicle Safety Compliance

The following vehicle has been subjected to testing for FMVSS 208. The vehicle was inspected upon arrival at the laboratory for the test and found to contain all of the equipment listed below. All variances have been reported within 2 working days of vehicle arrival, by letter, to the NHTSA Industrial Property Manager/NAD-30, with a carbon copy to the responsible testing office. The vehicle is again inspected, after the above test has been conducted, and all changes are noted below. The final condition of the vehicle is also noted in detail.

NHTSA NO.: CK0504  
MAKE/MODEL/BODY STYLE: Saab/9000/4-door sedan  
MODEL YEAR: 1989 BODY COLOR: black  
VIN: YS3CL48L8K1011912  
ODOMETER (ARRIVAL): 76.0 DATE: 4/27/89  
ODOMETER (COMPLETION): 81.0 DATE: 5/05/89  
COST: \$29,994.00

<input checked="" type="checkbox"/> Air Conditioner	<input type="checkbox"/> Console	Brakes: <input checked="" type="checkbox"/> Power
<input checked="" type="checkbox"/> Tinted Glass	<input type="checkbox"/> Tachometer	Front: Disc
<input checked="" type="checkbox"/> Power Steering	<input checked="" type="checkbox"/> Speed Control	Rear: Disc
<input checked="" type="checkbox"/> Power Windows	<input checked="" type="checkbox"/> Rear Window Def.	
<input type="checkbox"/> Power Door Locks	<input type="checkbox"/> Sun/Moon Roof	Front Seats: <input checked="" type="checkbox"/> Power
<input checked="" type="checkbox"/> Radio AM/FM	<input type="checkbox"/> T-Top	Seat Type: Bucket
<input checked="" type="checkbox"/> Clock	<input type="checkbox"/> Tilt Steering Wheel	No. of Seats: 5
<input type="checkbox"/> Roof Rack	<input type="checkbox"/> Other Options: _____	
	_____	
	_____	

Engine: 4 Cylinders; 2.0 LITRES  
Transmission: Automatic; Drive Type: Front wheel  
Tire Size: 195/65VR15  
Gasoline Type: Gasoline

Equipment that is no longer on the vehicle as noted above: None

Explanation: \_\_\_\_\_

Vehicle Condition: Vehicle has been subjected to a 30 mph frontal  
barrier crash test.

SECTION 2.0

SUMMARY OF RESULTS FOR:

FMVSS 208, "Occupant Crash Protection"

FMVSS 212, "Windshield Mounting"

FMVSS 219, (Partial), "Windshield Zone Intrusion"

FMVSS 301, "Fuel System Integrity"

## COMPLIANCE DATA SUMMARY

The test vehicle, a 1989 Saab 9000 4-door sedan, NHTSA No. CK0504, appeared to comply with the requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.

The driver's Head Injury Criteria (HIC) was 323. The driver's maximum chest deceleration over three milliseconds was 45.9 g. The driver's right and left compressive femur loads were 1601 pounds and 1235 pounds, respectively.

The right front passenger's Head Injury Criteria (HIC) was 232. The right front passenger's maximum chest deceleration over three milliseconds was 35.8 g. The right front passenger's left compressive femur load was 503 pounds. The right front passenger's right compressive femur load data was lost. (See DATA ACQUISITION EXPLANATIONS.)

The vehicle's restraint system met the comfort and convenience requirements of FMVSS 208.

The windshield retention was 100 percent.

There was no intrusion into the inner surface of the windshield below the protected zone.

There was no Stoddard fluid spillage following the crash test event or during any phase of the post-test static rollover.

TABLE 6 DUMMY INJURY CRITERIA

MAXIMUM ACCELERATION ('G')

	HEAD				CHEST			R*
	X	Y	Z	R	X	Y	Z	
DRIVER	-62.1	-38.6	-45.3	67.0	-46.7	-12.7	9.8	45.9
PASSENGER	-33.9	-23.5	-59.8	61.6	-36.2	-14.7	15.1	35.8

MAXIMUM FORCE-FEMUR LOAD (LBS)

	LEFT FEMUR	RIGHT FEMUR
DRIVER	1235	1601
PASSENGER	503	--- Y

HEAD INJURY CRITERIA\*\*

	HIC	TIME t <sub>1</sub> (MSEC) <sup>1</sup>	TIME t <sub>2</sub> (MSEC) <sup>2</sup>
DRIVER	323	75.5	110.5
PASSENGER	232	86.4	122.4

\*Defined as exceeding 0.003 sec. duration

\*\*As defined in FMVSS No. 208

Y See DATA ACQUISITION EXPLANATIONS

## DUMMY KINEMATIC SUMMARY

### DRIVER DUMMY

Upon impact, the driver dummy translated forward on the seat impacting both knees into the instrument panel. The dummy's head and chest were restrained by the driver's airbag. The dummy rebounded into the seat back and head restraint. The dummy came to rest seated upright in the driver's seat.

### RIGHT FRONT PASSENGER DUMMY

Upon impact, the right front passenger dummy translated forward on the seat impacting both knees into the instrument panel. The dummy's head rotated forward, contacting the dummy's chest, as the dummy's chest was restrained by the three-point unbelt. The dummy's head rotated rearward into the head restraint as the dummy rebounded into the seat back. The dummy came to rest seated upright in the right front passenger's seat, restrained by the three-point unbelt.

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #354	PASSENGER #690
Head	<u>Airbag</u>	<u>Chest</u>
Chest	<u>Airbag</u>	<u>None</u>
Abdomen	<u>None</u>	<u>None</u>
Left knee	<u>Instrument panel &amp; steering column</u>	<u>Instrument panel</u>
Right knee	<u>Instrument panel</u>	<u>Instrument panel</u>

DOOR OPENING:

	LEFT	RIGHT
Front	<u>Easy</u>	<u>Difficult, no tools required</u>
Rear	<u>Easy</u>	<u>Easy</u>

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
Front	<u>None</u>	<u>None</u>
Rear	<u>None</u>	<u>NA</u>

GLAZING DAMAGE:

Both lower corners of the windshield were cracked upon impact.

\_\_\_\_\_

\_\_\_\_\_

OTHER NOTABLE IMPACT EFFECTS:

None

\_\_\_\_\_

\_\_\_\_\_

**FIGURE 6 DUMMY POSITIONING DATA FOR 30 MPH FRONTAL BARRIER IMPACT TEST**

**PRE-IMPACT DATA:**

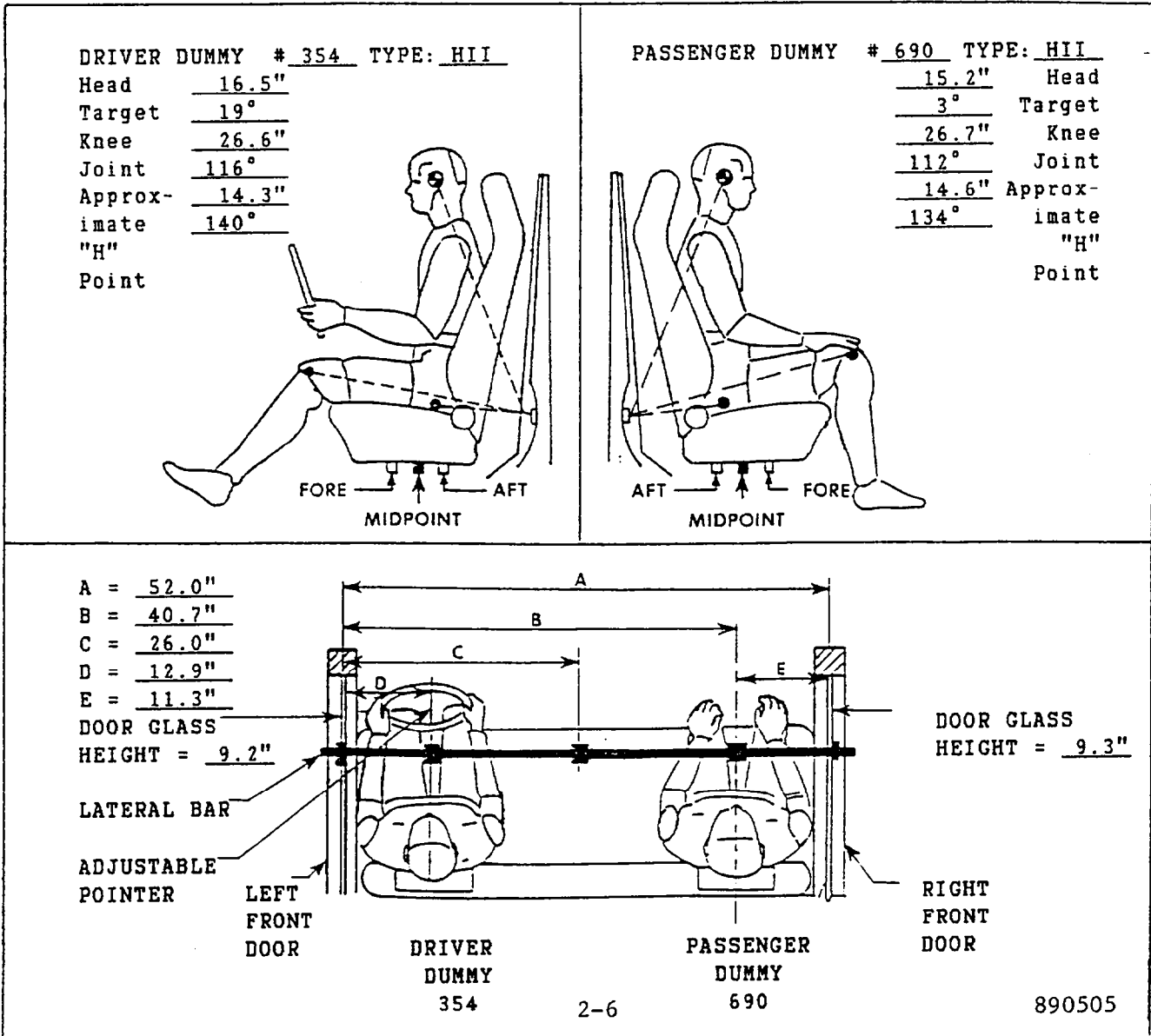
Make/Model: Saab 9000  
 Body Style: 4-door sedan Model Year: 1989  
 NHTSA No.: CK0504 Color: Black

**DATA FROM CERTIFICATION LABEL:**

Vehicle Manufacturer: Saab-Scania  
 Date of Manufacture: 12/88 VIN: YS3CL48L8K1011912  
 GVWR: 4170 lb; GAWR: Front = 2200 lb; Rear = 2030 lb

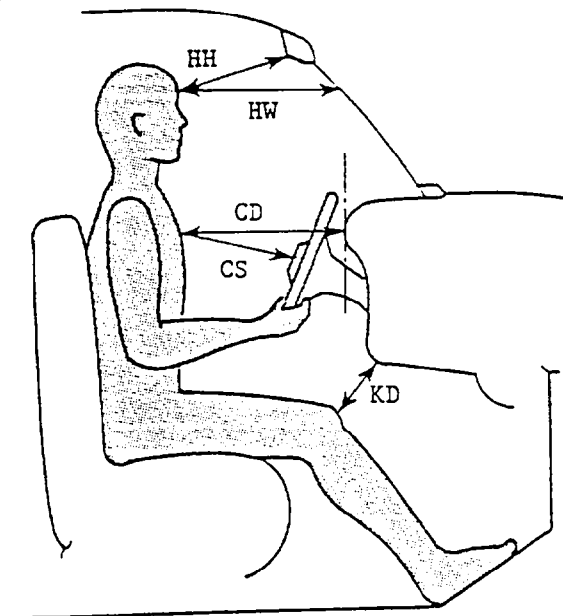
**POST-IMPACT DATA:**

Date of Test: 5/05/89 Time: 1409 Temperature: 70° F  
 Required Impact Velocity Range: 28.9 to 29.9 mph  
 Impact Velocity: Primary = 29.6 mph Secondary = 29.6 mph  
 Seat Type: Bucket Adjuster Type: Power  
 Bucket Seat Back Type: Adjustable  
 Technicians: B. Fishbaugh, S. Ericksen & R. Cribley

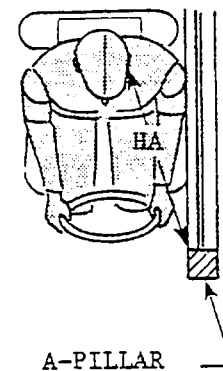
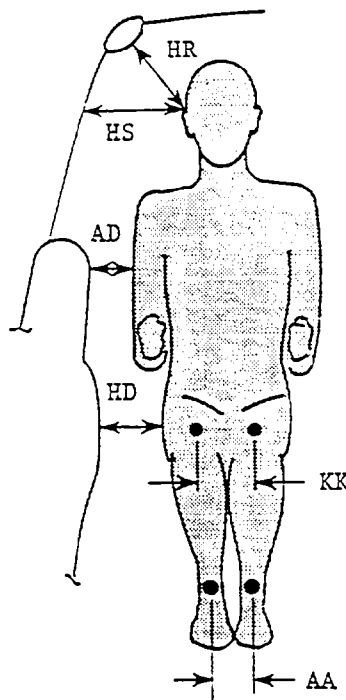


**FIGURE 7 DUMMY IN-VEHICLE POSITION RECORDING SHEET**

	DRIVER	PASSENGER
HH	12.1	14.8
HW	18.5	20.7
CD	21.9	22.3
CS	12.5	NA
KDL	4.2	4.1
KDR	4.4	4.3
TA	13°	23°
SA	21.5°	21.5°
HA	14.6	17.0



	DRIVER	PASSENGER
HR	6.6	7.2
HS	9.1	9.9
AD	5.0	5.3
HD	7.1	6.7
KK	10.1	7.6
AA	11.0	7.1



Knee outer bolt head to outer bolt head spacing:

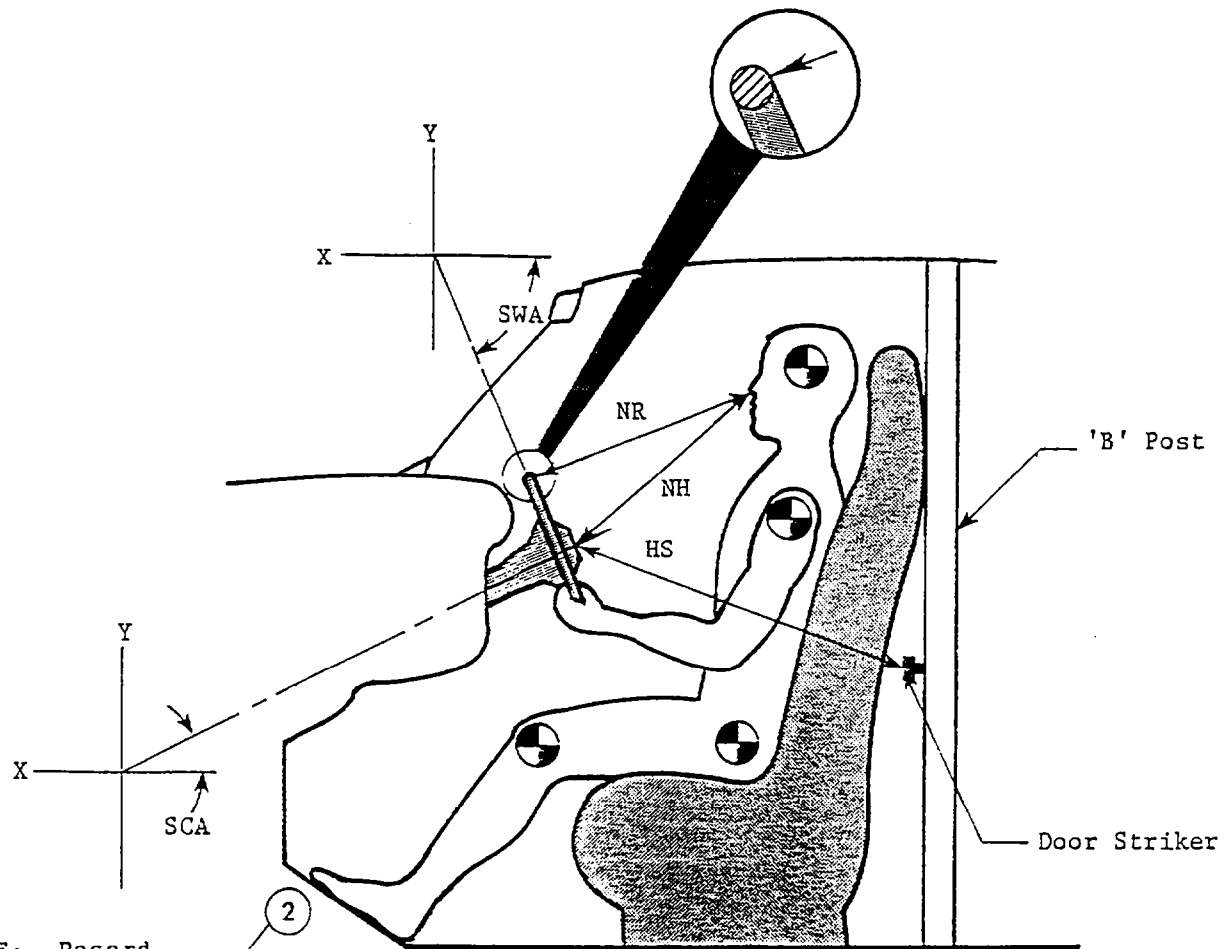
Driver = 14.5  
 Passenger = 11.8

- |                                |                          |
|--------------------------------|--------------------------|
| HH = Head to Windshield Header | HR = Head to Side Roof   |
| HW = Head to Windshield        | HS = Head to Side Window |
| CD = Chest to Dash             | AD = Arm to Door         |
| CS = Chest to Steering Wheel   | HD = Hip to Door         |
| KD = Knee to Dash              | KK = Knee to Knee        |
| TA = Torso Angle               | AA = Ankle to Ankle      |
| SA = Seat Back Angle           | HA = Head to A-Pillar    |

Torso and seat back angles are relative to vertical.

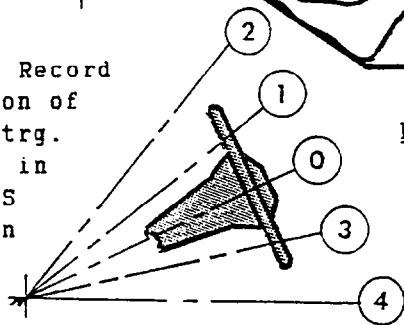
ALL DISTANCE MEASUREMENTS ARE IN INCHES.

**FIGURE 8 DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS**



NOTE: Record position of tilt strg. column in REMARKS section

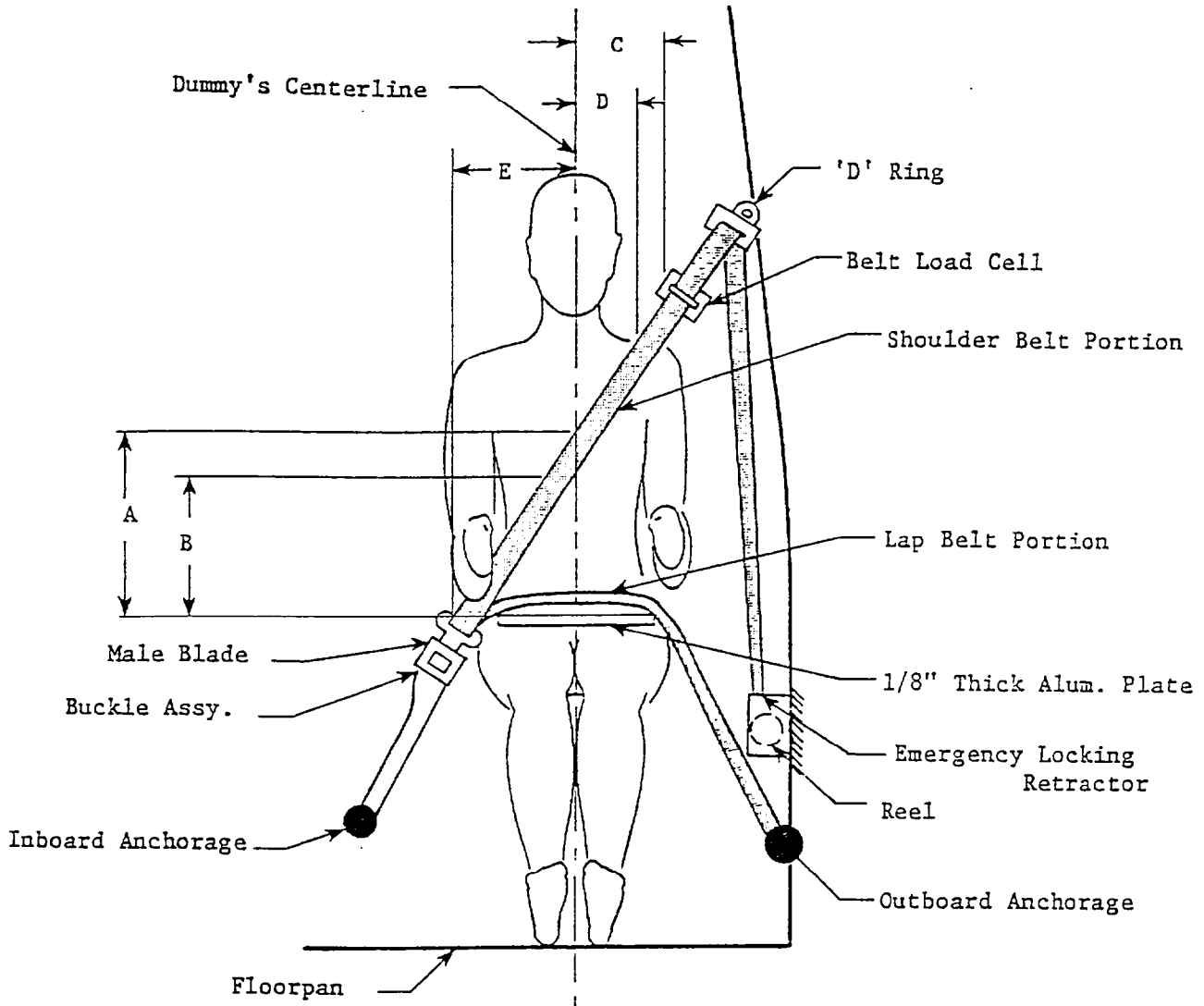
REMARKS: The steering column was a non-tilt column.



**MEASUREMENTS**

NR	- Distance from tip of dummy's nose to top rear surface of steering wheel rim. (in.)	17.1
NH	- Distance from tip of dummy's nose to center of steering column hub. (in.)	17.3
HS	- Distance from center of steering column hub to the forward surface of the door lock striker pin. (in.)	25.7
SCA	- Angle of steering column relative to the horizontal X axis	31°
SWA	- Angle of steering wheel relative to the horizontal X axis	63°

**FIGURE 9 SEAT BELT POSITIONING DATA**



	<b>PASSENGER DUMMY</b>
A - Top surface of alum. plate to belt upper edge (in)	13.9
B - Top surface of alum. plate to belt lower edge (in)	10.8
C - Dummy centerline to outer edge of belt at chest flesh top (in)	4.7
D - Dummy centerline to inner edge of belt at chest flesh top (in)	2.1
E - Dummy centerline to intersection of upper torso belt and lap belt (in)	10.8

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA

VEHICLE VIN: YS3CL48L8K1011912 NHTSA NO: CK0504

MAKE: Saab MODEL: 9000

VEHICLE BUILD DATE: 12/88 VEHICLE TYPE: 4-door sedan

FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:

(check one):  Automatic belts  
 Type 2 lap/shoulder belts  
 Other

CONVENIENCE HOOKS:

DEVICE AUTOMATICALLY RELEASES WHEN IGNITION IS TURNED TO "ON" OR "START"

AND (check one):

Vehicle's drivetrain is engaged  
 Vehicle's parking brake is in the released mode  
 Not applicable, vehicle's restraint system does not  
include convenience hooks

WEBBING TENSION - RELIEVING DEVICE:

DO OUTBOARD SEATING POSITION BELTS HAVE TENSION - RELIEVING DEVICES?

No

BELT CONTACT FORCE:

FOR BELTS WITHOUT TENSION-RELIEVING DEVICES: BELT CONTACT FORCE:

0.3 POUNDS

LATCHPLATE ACCESS:

ARE SEATBELT LATCHPLATES WITHIN REACH ENVELOPE? Yes

DOES CLEARANCE TEST BLOCK MOVE UNHINDERED TO LATCHPLATE OR BUCKLE?

Yes

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA CONT'D

VEHICLE VIN: YS3CL48L8K1011912 NHTSA NO: CK0504

MAKE: Saab MODEL: 9000

VEHICLE BUILD DATE: 12/88 VEHICLE TYPE: 4-door sedan

FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:

(check one):  Automatic belts  
 Type 2 lap/shoulder belts  
 Other

RETRACTION:

SEATBELT AUTOMATICALLY RETRACTS WHEN

(check one):  Adjacent vehicle door is open and seatbelt  
latchplate is released  
 Seatbelt latchplate is released

ARE THE STOWED WEBBING AND HARDWARE PINCHED WHEN THE DOOR IS CLOSED?

No

OPEN-BODY VEHICLE: DOES BELT SYSTEM FULLY RETRACT WHEN THE  
TENSION-RELIEVING DEVICE IS MANUALLY DEACTIVATED? NA

ACCESSIBILITY:

IS SEAT CUSHION REMOVABLE SO THE SEATBACK SERVES A FUNCTION OTHER THAN  
SEATING? No

IS SEAT REMOVABLE? No

IS SEAT MOVABLE SO THE SPACE CAN BE USED FOR A SECONDARY FUNCTION?  
No

IF WEBBING IS DESIGNED TO PASS THROUGH THE SEAT CUSHION OR BETWEEN THE  
CUSHION AND SEAT BACK ARE ONE OF THE FOLLOWING PARTS NORMALLY ON TOP OF  
OR ABOVE THE SEAT CUSHION: LATCHPLATE, BUCKLE, WEBBING? NA

ARE THE REMAINING TWO PARTS ACCESSIBLE UNDER NORMAL CONDITIONS?  
NA

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA, CONT'D

VEHICLE VIN: YS3CL48L8K1011912 NHTSA NO: CK0504

MAKE: Saab MODEL: 9000

VEHICLE BUILD DATE: 12/88 VEHICLE TYPE: 4-door sedan

FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:

(check one):  Automatic belts  
 Type 2 lap/shoulder belts  
 Other

ACCESSIBILITY, CONT'D:

DO THE LATCHPLATE AND BUCKLE PASS THROUGH THE GUIDES PROVIDED AND FALL BEHIND THE SEAT WHEN THE BELT IS COMPLETELY RETRACTED (OR UNATTACHED IF NONRETRACTABLE); THE SEAT IS MOVED TO ANY POSITION; AND THE SEAT BACK, IF FOLDABLE, IS FOLDED FORWARD AS FAR AS POSSIBLE AND THEN MOVED BACKWARD INTO POSITION? No

IS THE INBOARD RECEPTACLE END ACCESSIBLE WITH THE CENTER ARM REST IN ANY POSITION TO WHICH IT CAN BE ADJUSTED WITHOUT MOVING THE ARMREST FOR ACCESS? NA, vehicle does not contain an armrest

LATCH MECHANISM:

ARE LATCH MECHANISM COMPONENTS ACCESSIBLE TO A SEATED OCCUPANT IN THE STOWED AND OPERATIONAL POSITIONS? Yes

DOES LATCH MECHANISM RELEASE BOTH TORSO AND LAP BELTS SIMULTANEOUSLY?  
Yes

DOES LATCH MECHANISM RELEASE AT A SINGLE POINT BY A PUSH BUTTON ACTION?  
Yes

TABLE 8 FMVSS NO. 208 - SEAT BELT WARNING SYSTEM DATA

WITH OCCUPANT IN DRIVER'S POSITION AND LAP BELT IN STOWED POSITION AND  
IGNITION SWITCH PLACED IN "START/ON" POSITION:

Duration of audible warning signal = 6 sec.

Duration of reminder light operation = 6 sec.

WITH OCCUPANT IN DRIVER'S POSITION AND LAP BELT IN USE AND THE IGNITION  
SWITCH PLACED IN "START/ON" POSITION:

Duration of audible warning signal = 0 sec.

(NOTE: audible warning should not operate)

Duration of reminder light operation = 6 sec.

Wording of visual warning:

Fasten Seat Belt       

Fasten Belt     X    

Symbol 101-80     X

TABLE 9 FMVSS NO. 208 - LABELING AND DRIVER'S MANUAL DATA

DESCRIBE LOCATION OF LABEL WHICH DESCRIBES MANUFACTURER'S MAINTENANCE OR REPLACEMENT SCHEDULE FOR CRASH-DEPLOYED OCCUPANT PROTECTON SYSTEM:

The label was located on the lower, front portion of the driver's B-pillar

THE MANUFACTURER'S RECOMMENDED SCHEDULE IS TO: (check one)

replace \_\_\_ or repair \_\_\_ or inspect X this system

a. by \_\_\_ month, \_\_\_ year

b. by \_\_\_ miles

c. or after a time interval of \_\_\_ months or 10 years.

WERE APPROPRIATE INSTRUCTIONS CONCERNING MAINTENANCE AND/OR REPLACEMENT OF THIS SYSTEM PROVIDED? Yes

WAS A DESCRIPTION OF THE FUNCTIONAL OPERATION OF THE SYSTEM PROVIDED?  
Yes, in owner's manual

IS THERE A REFERENCE TO THE INSTRUCTIONS AND DESCRIPTION OF THE SYSTEM ON THE LABEL? Yes

WAS AN OWNER'S MANUAL PROVIDED? Yes

DID THE OWNER'S MANUAL CONTAIN APPROPRIATE INFORMATION CONCERNING MAINTENANCE AND/OR REPLACEMENT AND A DESCRIPTION OF THE FUNCTIONAL OPERATION OF THE SYSTEMS? Yes

TABLE 10 FMVSS NO. 208 - READINESS INDICATOR DATA

AN OCCUPANT RESTRAINT SYSTEM THAT DEPLOYS IN THE EVENT OF A CRASH SHALL HAVE A MONITORING SYSTEM WITH A READINESS INDICATOR. A TOTALLY MECHANICAL SYSTEM IS EXEMPT FROM THIS REQUIREMENT.

Is the system totally mechanical? No

IF NO:

Describe the location of the readiness indicator: The readiness indicator is a light stating "SRS" in the lower left corner of the driver's instrument cluster.

Is the readiness indicator clearly visible to the driver? Yes

Is a list of the elements in the occupant restraint system, being monitored by the readiness indicator, provided? Yes

TABLE 11 SUMMARY OF FMVSS 301 DATA

PRE-IMPACT DATA

MAKE/MODEL: Saab 9000

BODY STYLE: 4-door sedan

MODEL YEAR: 1989

NHTSA NO.: CK0504

COLOR: Black

DATA FROM CERTIFICATION LABEL

VEHICLE MANUFACTURER: Saab Scania

DATE OF MANUFACTURE: 12/88

VIN: YS3CL48L8K1011912

GVWR: 4170 LBS., GAWR: FRONT 2200 LBS., REAR 2030 LBS.

POST-IMPACT DATA

TYPE OF TEST: Frontal Barrier Impact

DATE OF TEST: 5/05/89

TIME: 1409

TEMP: 70°F

REQUIRED IMPACT VELOCITY RANGE: 28.9 MPH TO 29.9 MPH

IMPACT VELOCITY: PRIMARY = 29.6 MPH, SECONDARY = 29.6 MPH

TEST WEIGHT = 3654 LBS., STATIC CRUSH MAX. = 21.6 IN., REBOUND = 41.4 IN.

FUEL SYSTEM DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY\*: 18.0 GALLONS (FURNISHED BY COTR)

TEST VOLUME: 16.8 GALLONS (92-94% OF USEABLE)

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 17.9 GALLONS

DETAILS OF FUEL SYSTEM: The fuel tank was located in front of the rear axle. The fuel filler neck was located on the right side. The fuel lines run along the right frame rail to the front.

ELECTRIC FUEL PUMP: Yes

FUEL INJECTON: Yes

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? No

\*WITH ENTIRE FUEL SYSTEM FILLED.

FIGURE 10 FMVSS NO. 212, "WINDSHIELD MOUNTING", DATA SHEET

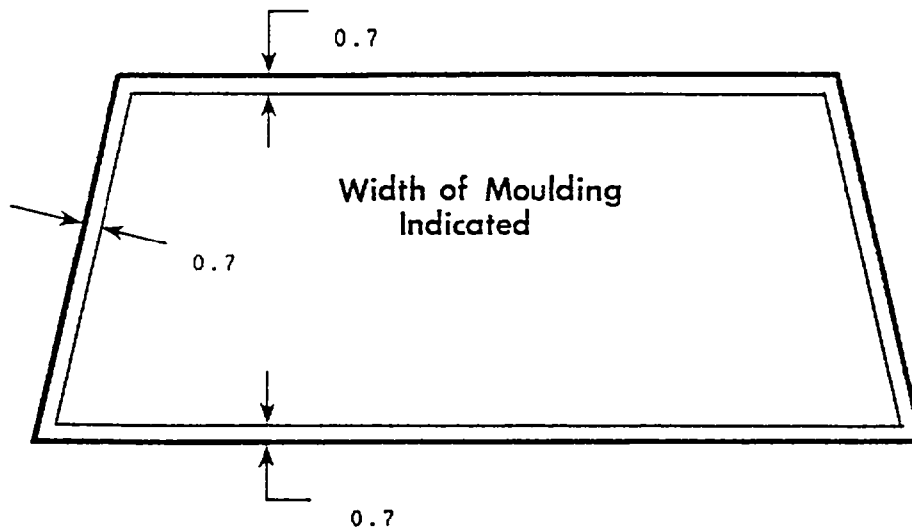
Details of windshield mounting such as retention method, trim type, etc.:

FMVSS 212 REQUIREMENTS: The post-test periphery retention amount must be at least 75% of the pre-test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

	WINDSHIELD PERIPHERY		
	PRE-TEST (in)	POST-TEST (in)	PERCENT RETENTION
RIGHT SIDE	77.2	77.2	100%
LEFT SIDE	77.2	77.2	100%
TOTAL	154.4	154.4	100%

AREA OF RETENTION FAILURE:



FAILURE DETAILS: None

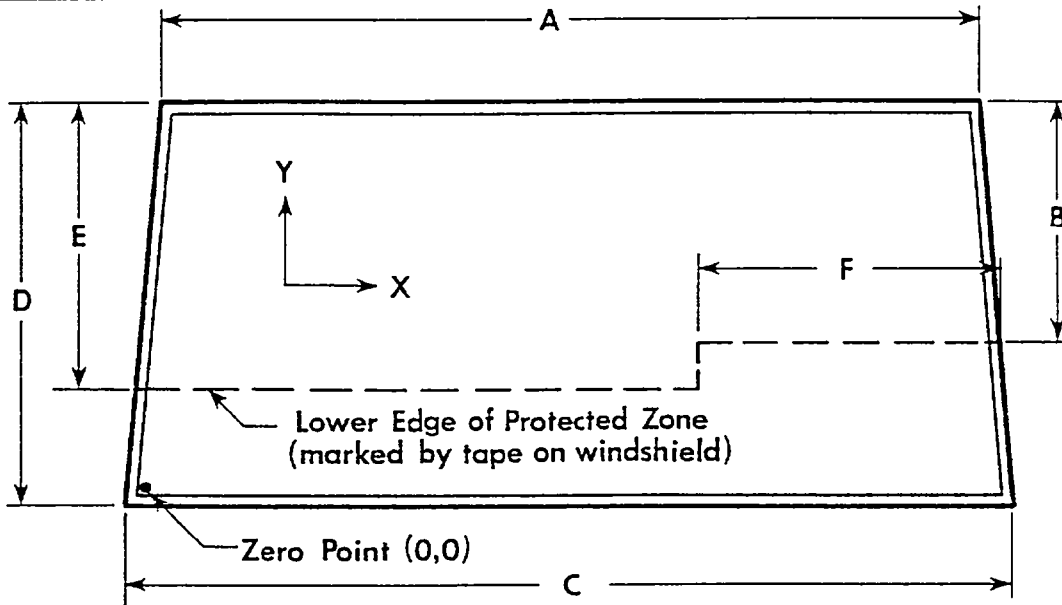
Windshield Temperature: 70° F

FIGURE 11 FMVSS NO. 219, "WINDSHIELD ZONE INTRUSION", DATA SHEET

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5" dia. rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. Draw the locus of points on the inner surface of the windshield contactable by the sphere across the width of the instrument panel. From the outermost contactable points, extend the locus line horizontally to the edges of the windshield, and then draw a line on the inner surface of the windshield below and 1/2" from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection onto the outer surface of the windshield of this line.

FMVSS 219 TEST DATA:



FRONT VIEW

A = <u>43.5</u>	C = <u>58.5</u>	E = <u>19.8</u>
B = <u>17.2</u>	D = <u>29.0</u>	F = <u>33.0</u>

DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":  
(Show location of penetration on above sketch)

COORDINATES  
X Y

None

- 1.
- 2.
- 3.
- 4.

ALL MEASUREMENTS ARE IN INCHES.

TABLE 12 "FUEL SYSTEM INTEGRITY" POST-IMPACT

TEST DATA, FMVSS NO. 301

TEST VEHICLE NHTSA NO.: CK0504; TEST DATE: 5/05/89

VEH. MFR./MAKE/MODEL: Saab-Scania/Saab/9000

Test vehicle fuel tank filled to 92 to 94% of manufacturer's "useable" capacity and with electric fuel pump operating (if it will operate without engine operation). Part 572 test dummies located at each front designated seating position.

TEST VEHICLE IMPACT TYPE:

- Frontal (30 mph)
- Oblique (30 mph) with ° barrier face  
first contacting  (driver/pass.) side.
- Rear Moving Barrier (30 mph)
- Lateral Moving Barrier (20 mph)

FUEL SPILLAGE MEASUREMENT:

	<u>ACTUAL</u>	<u>MAX. ALLOW.</u>
1. From impact until vehicle motion ceases - - -	0	1 oz.
2. For 5 min. period after veh. motion ceases- -	0	5 oz.
3. For next 25 minutes - - - - -	0	1 oz./1 min.

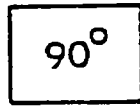
SOLVENT SPILLAGE DETAILS:

None

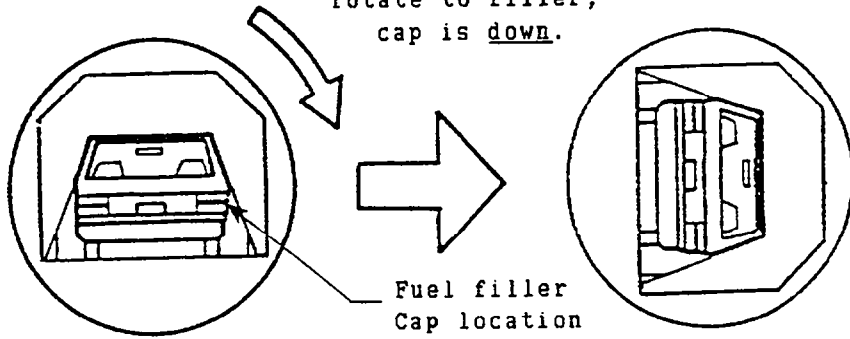
FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

NHTSA NO.: CK0504

TEST PHASE



NOTE: If side fill rotate to filler, cap is down.



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° =  2  minutes,  00  seconds  
 FMVSS 301 position hold time =  5  minutes,  00  seconds  
 TOTAL - - - - - =  7  minutes,  00  seconds  
 Next whole minute interval - - - - =  7  minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes FROM ONSET OF ROTATION	6th Minute	7th Minute
Maximum allowable solvent spillage - -	<u> 5 oz. </u>	<u> 1 oz. </u>	<u> 1 oz. </u>
0 to 90° (filler cap down) - - - - -	<u> 0 oz. </u>	<u> 0 oz. </u>	<u> 0 oz. </u>

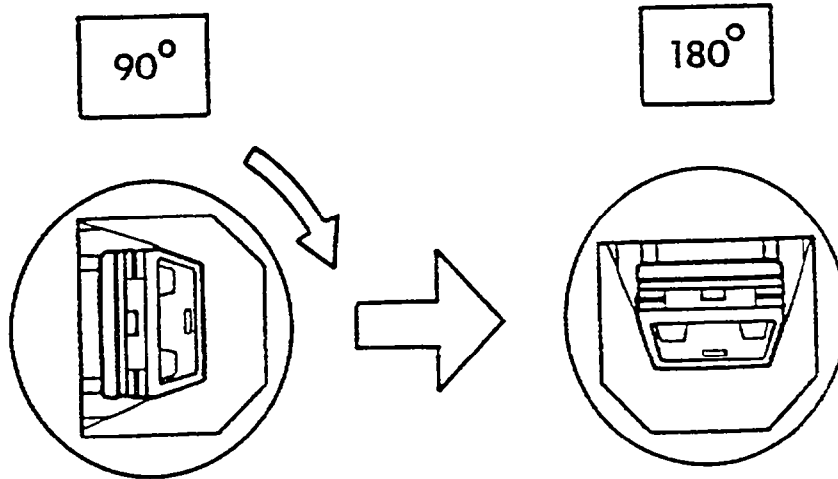
SOLVENT SPILLAGE LOCATION(S)

None  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET CONT'D

NHTSA NO.: CK0504

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° =  2  minutes,  00  seconds  
 FMVSS 301 position hold time =  5  minutes,  00  seconds  
 TOTAL - - - - - =  7  minutes,  00  seconds  
 Next whole minute interval - - - - =  14  minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes	6th	7th
	<u>FROM ONSET OF ROTATION</u>		
	Minute	Minute	Minute
Maximum allowable solvent spillage - -	<u> 5 oz. </u>	<u> 1 oz. </u>	<u> 1 oz. </u>
90° to 180° - - - - -	<u> 0 oz. </u>	<u> 0 oz. </u>	<u> 0 oz. </u>

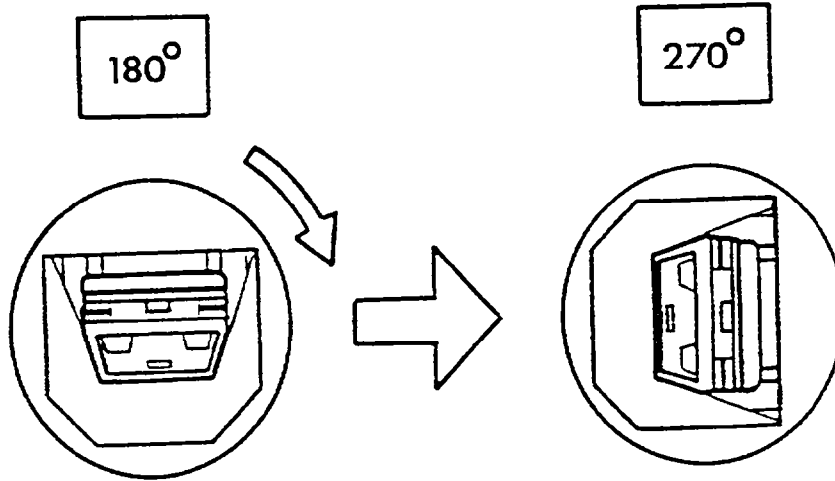
SOLVENT SPILLAGE LOCATION(S)

None  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET CONT'D

NHTSA NO.: CK0504

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° =  2  minutes,  00  seconds

FMVSS 301 position hold time =  5  minutes,  00  seconds

TOTAL - - - - - =  7  minutes,  00  seconds

Next whole minute interval - - - - =  21  minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes	6th	7th
	FROM ONSET OF ROTATION		
	Minute	Minute	Minute
Maximum allowable solvent spillage - -	<u> 5 oz. </u>	<u> 1 oz. </u>	<u> 1 oz. </u>
180° to 270° - - - - -	<u> 0 oz. </u>	<u> 0 oz. </u>	<u> 0 oz. </u>

SOLVENT SPILLAGE LOCATION(S)

None

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---

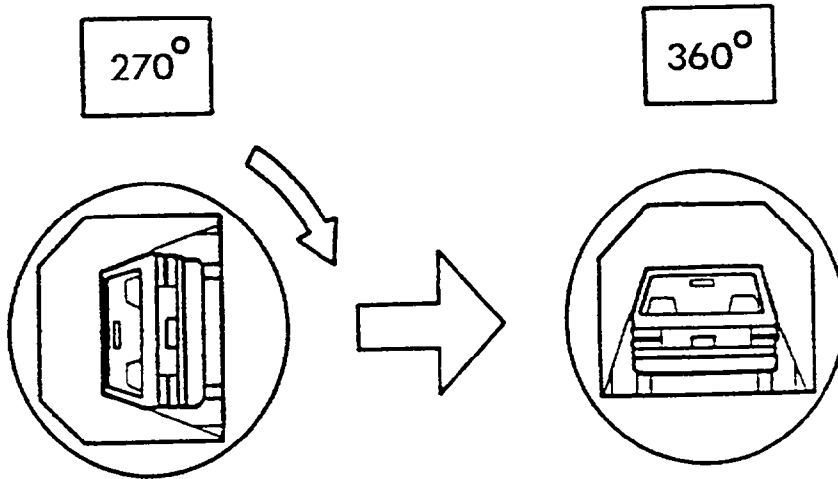


---

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET CONT'D

NHTSA NO.: CK0504

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° =  2  minutes,  00  seconds

FMVSS 301 position hold time =  5  minutes,  00  seconds

TOTAL - - - - - =  7  minutes,  00  seconds

Next whole minute interval - - - - =  28  minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes	6th	7th
	FROM ONSET OF ROTATION		
	Minute	Minute	Minute
Maximum allowable solvent spillage - -	<u> 5 oz. </u>	<u> 1 oz. </u>	<u> 1 oz. </u>
270° to 360° - - - - -	<u> 0 oz. </u>	<u> 0 oz. </u>	<u> 0 oz. </u>

SOLVENT SPILLAGE LOCATION(S)

None  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

SECTION 3.0

CAMERA INFORMATION

FIGURE 13 CAMERA POSITIONS

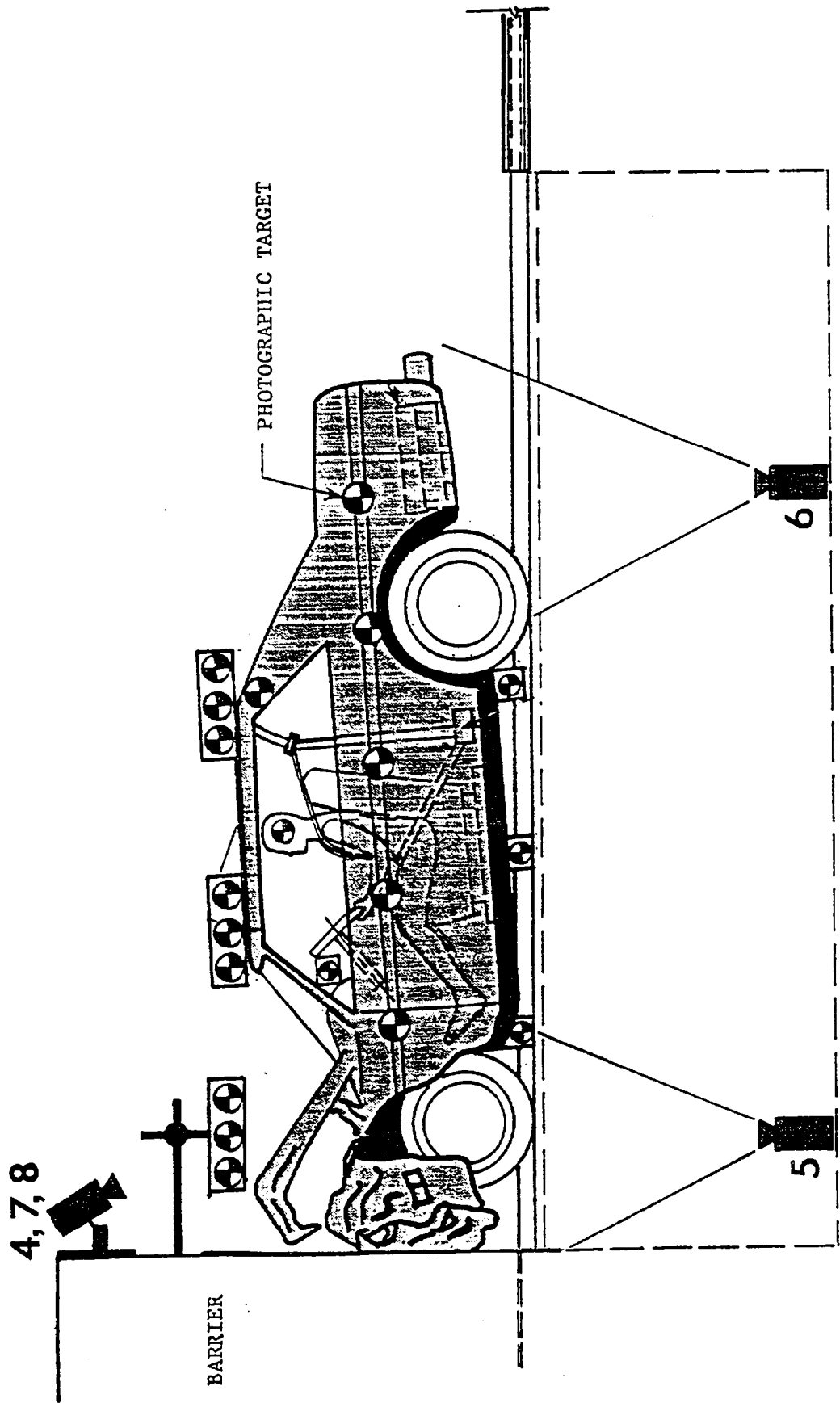


FIGURE 13 CAMERA POSITIONS CONTINUED

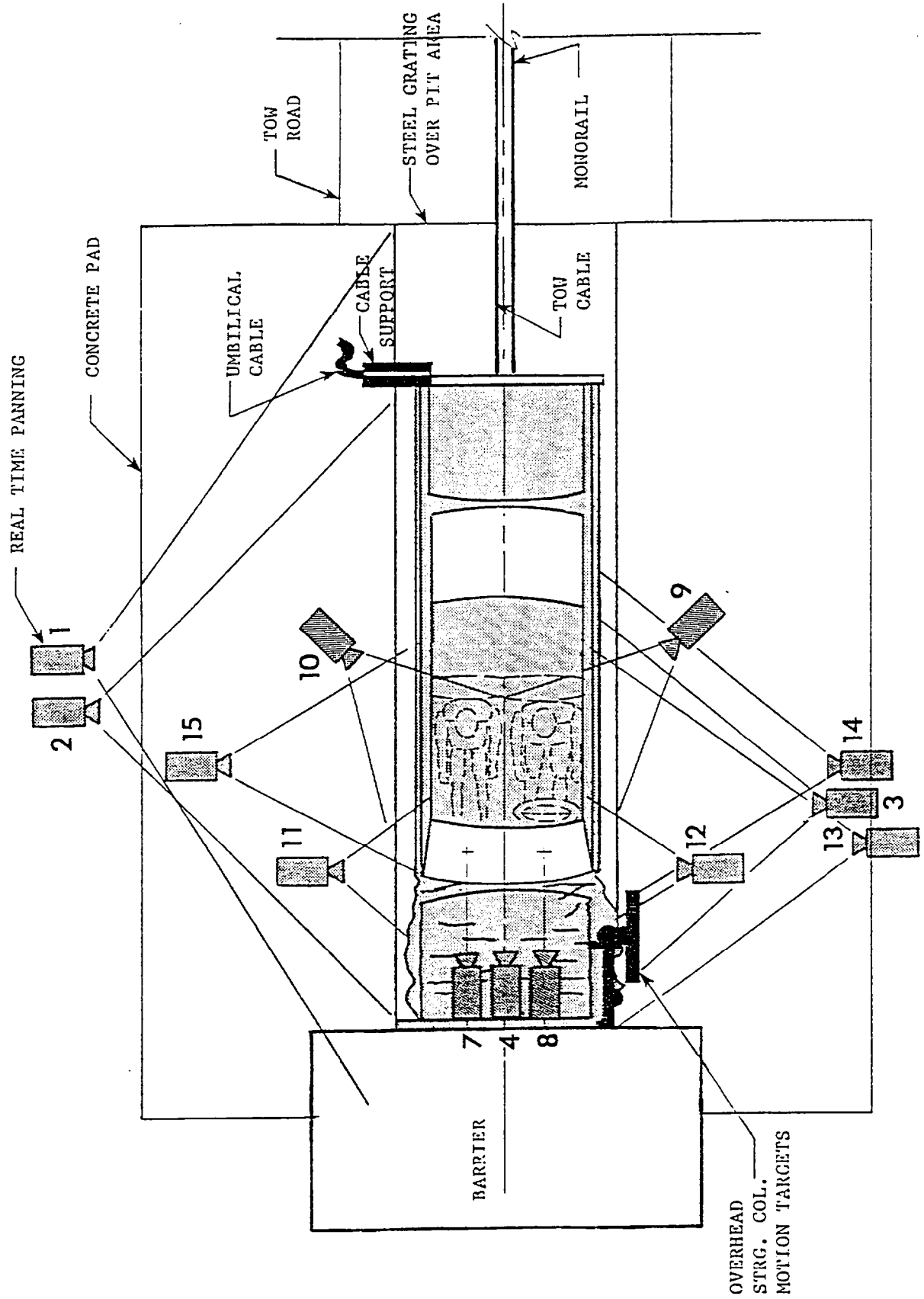


TABLE 13 HIGH SPEED CAMERA LOCATIONS

TEST NO.:	890505	VEHICLE:	1989 Saab 9000 4-door sedan			FILM PLANE			
			X	Y	Z	ANGLE** (DEG)	TO HEAD TARGET	LENS (MM)	SPEED (FPS)
CAMERA NO.	VIEW								
1	Real time panning	-142.0	-504.0	61.0	NA	NA	16	24	
2	Vehicle crush	-81.3	-266.4	37.1	-2	NA	13	495	
3	Dummy kinematics	-41.5	295.0	44.0	-4	226.0	25	493	
4	Windshield damage	-6.0	0.0	89.0	-40	NA	13	500	
5	Crush & fluid spillage	-50.5	0.0	-92.4	90	NA	13	998	
6	Fluid spillage	-99.3	0.0	-99.0	90	NA	13	998	
7	Passenger kinematics	-4.5	-13.8	93.0	-50	NA	17	498	
8	Driver kinematics	-6.8	14.5	93.0	-50	NA	17	505	
9	Driver kinematics	-157.3	116.0	87.0	-27	101.0	25	498	
10	Passenger kinematics	-152.1	-116.0	87.0	-26	107.0	25	495	
11	Windshield intrusion	-38.1	-306.1	44.0	0	NA	50	505	
12	Windshield intrusion	-53.0	309.4	42.3	0	NA	50	500	
13	Column movement	-118.0	286.0	103.0	-14	NA	25	500	
14	Column movement	-118.0	286.0	75.1	-9	NA	25	507	
15	Passenger kinematics	-38.8	-293.0	45.3	-4	237.0	25	488	

\* +X = Film plane forward of barrier face

+Y = Film plane to left of monorail centerline

+Z = Film plane above ground level

\*\* +Angle = Film plane angled upward from horizontal plane

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST FRONT VIEW

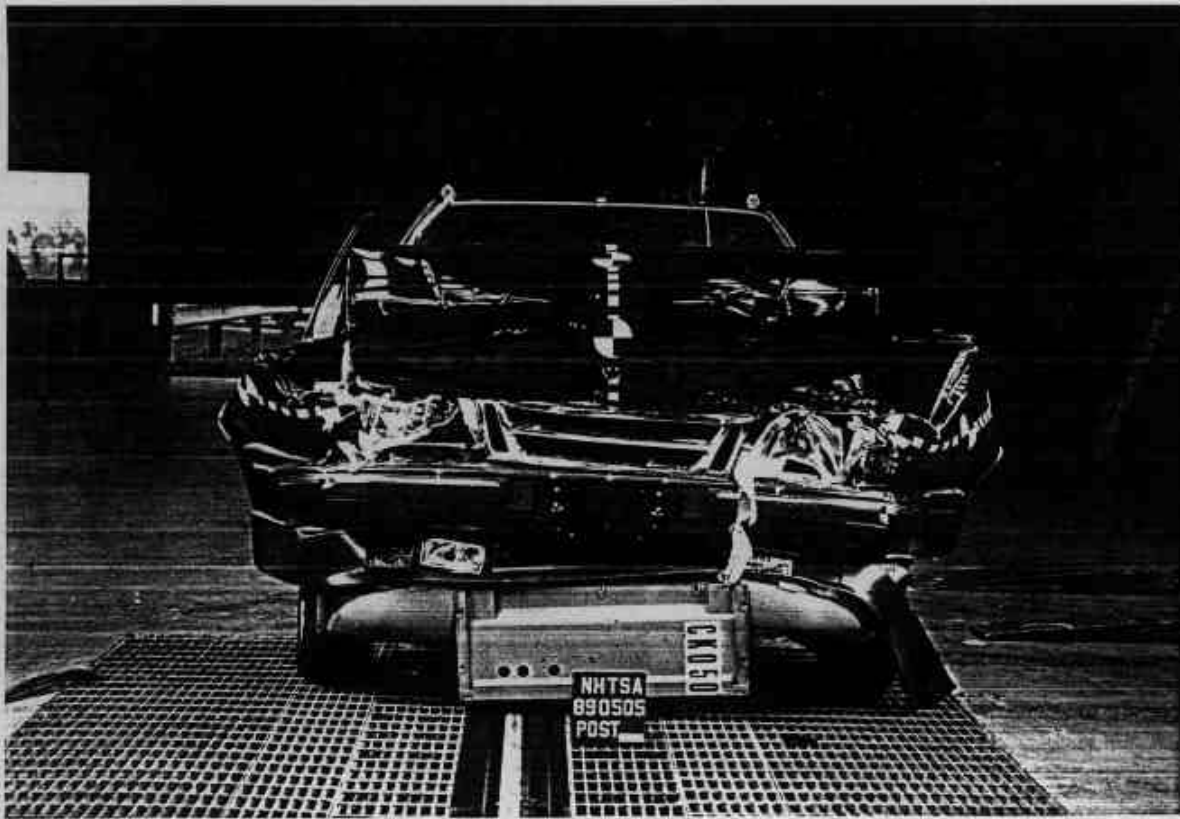


Figure A-2. POST-TEST FRONT VIEW  
A-2

890505



Figure A-3. PRE-TEST LEFT SIDE VIEW



Figure A-4. POST-TEST LEFT SIDE VIEW  
A-3

890505



Figure A-5. PRE-TEST RIGHT SIDE VIEW

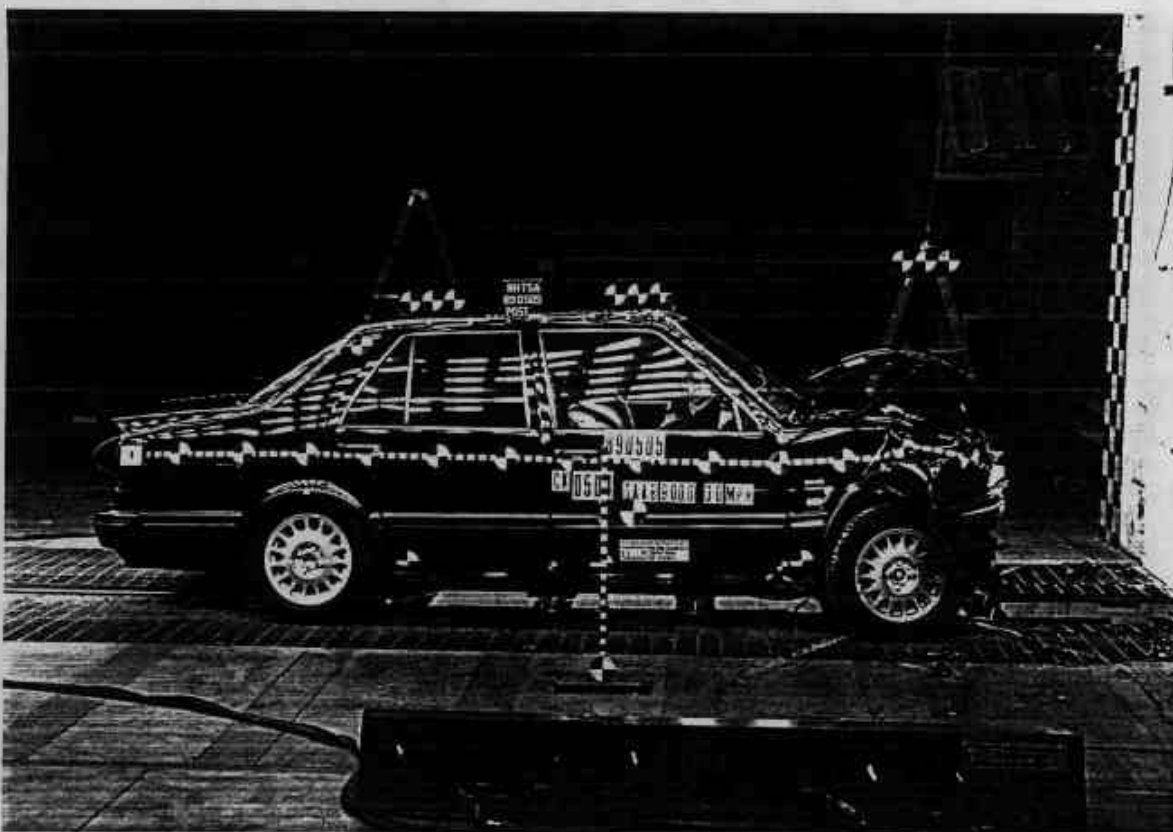


Figure A-6. POST-TEST RIGHT SIDE VIEW



Figure A-7. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW



Figure A-8. POST-TEST RIGHT FRONT THREE-QUARTER VIEW



Figure A-9. PRE-TEST LEFT REAR THREE-QUARTER VIEW



Figure A-10. POST-TEST LEFT REAR THREE-QUARTER VIEW



Figure A-11. PRE-TEST REAR VIEW



Figure A-12. POST-TEST REAR VIEW

A-7

890505



Figure A-13. PRE-TEST WINDSHIELD VIEW



Figure A-14. POST-TEST WINDSHIELD VIEW

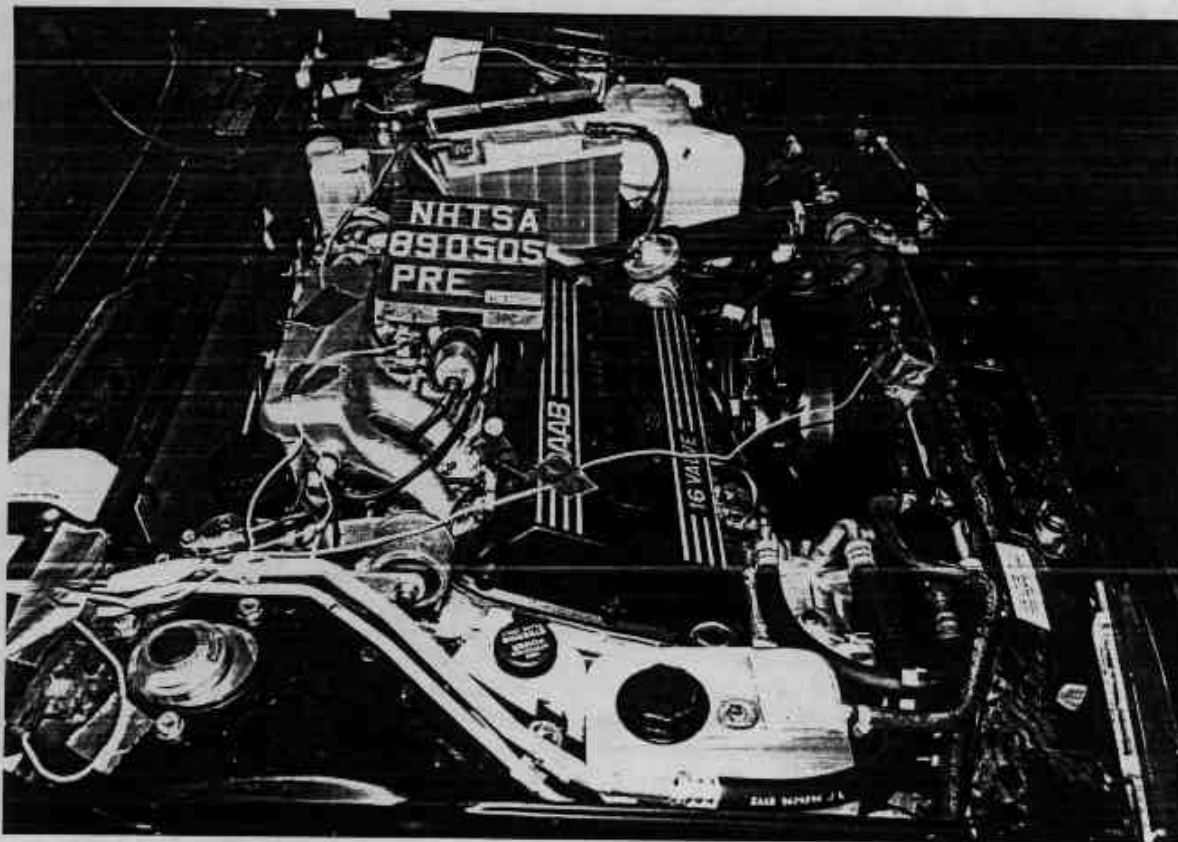


Figure A-15. PRE-TEST ENGINE COMPARTMENT VIEW

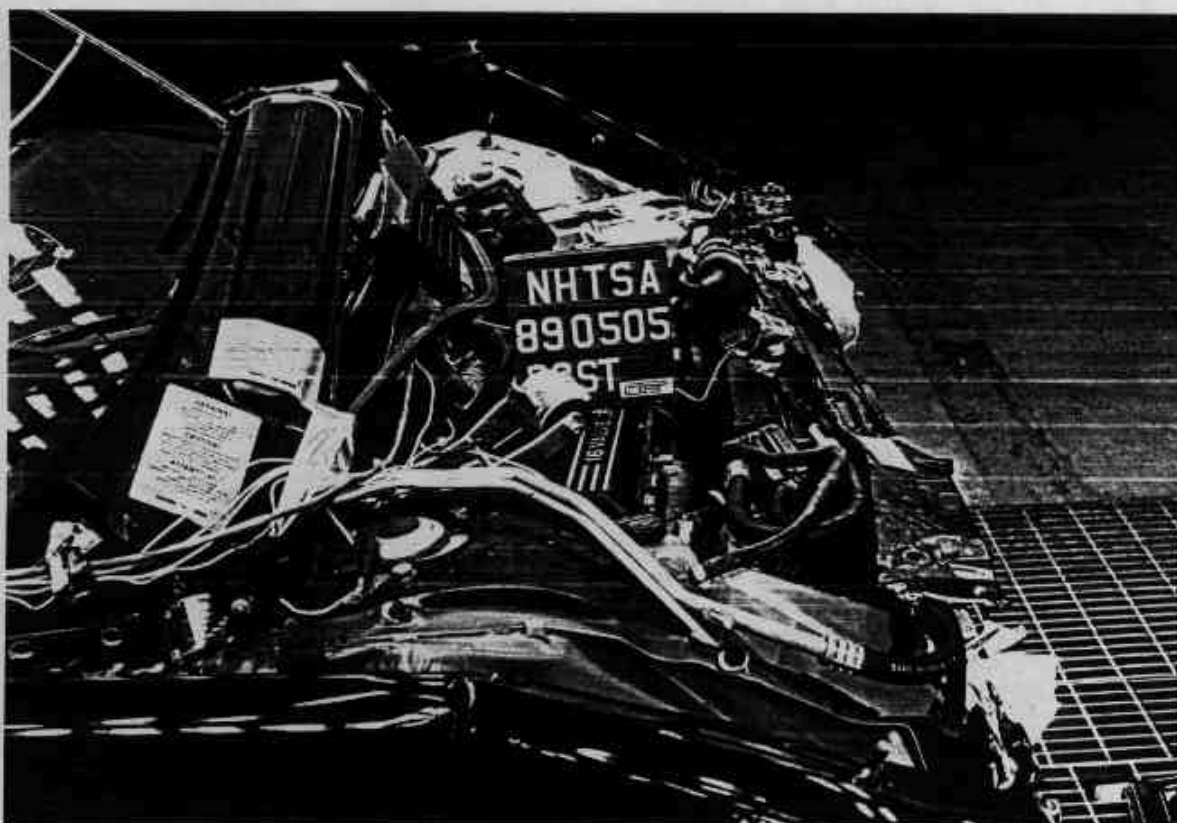


Figure A-16. POST-TEST ENGINE COMPARTMENT VIEW

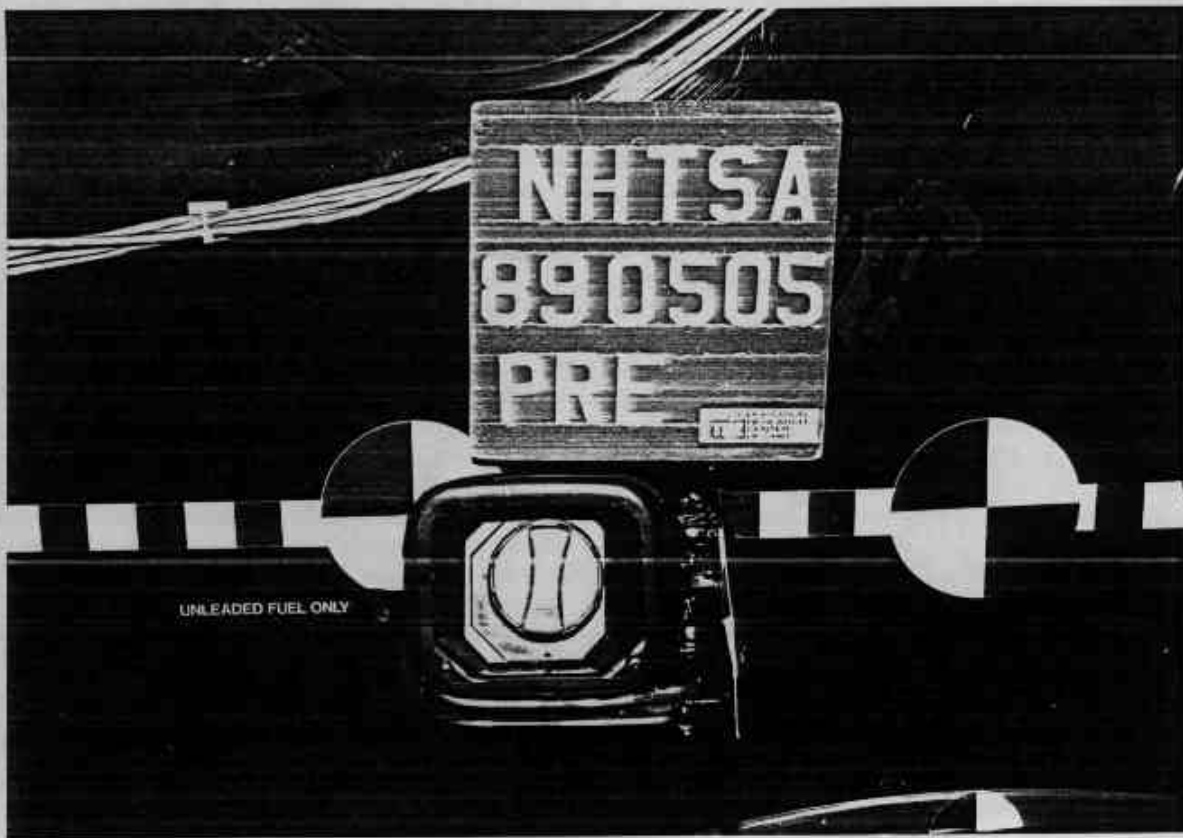


Figure A-17. PRE-TEST FUEL FILLER CAP VIEW

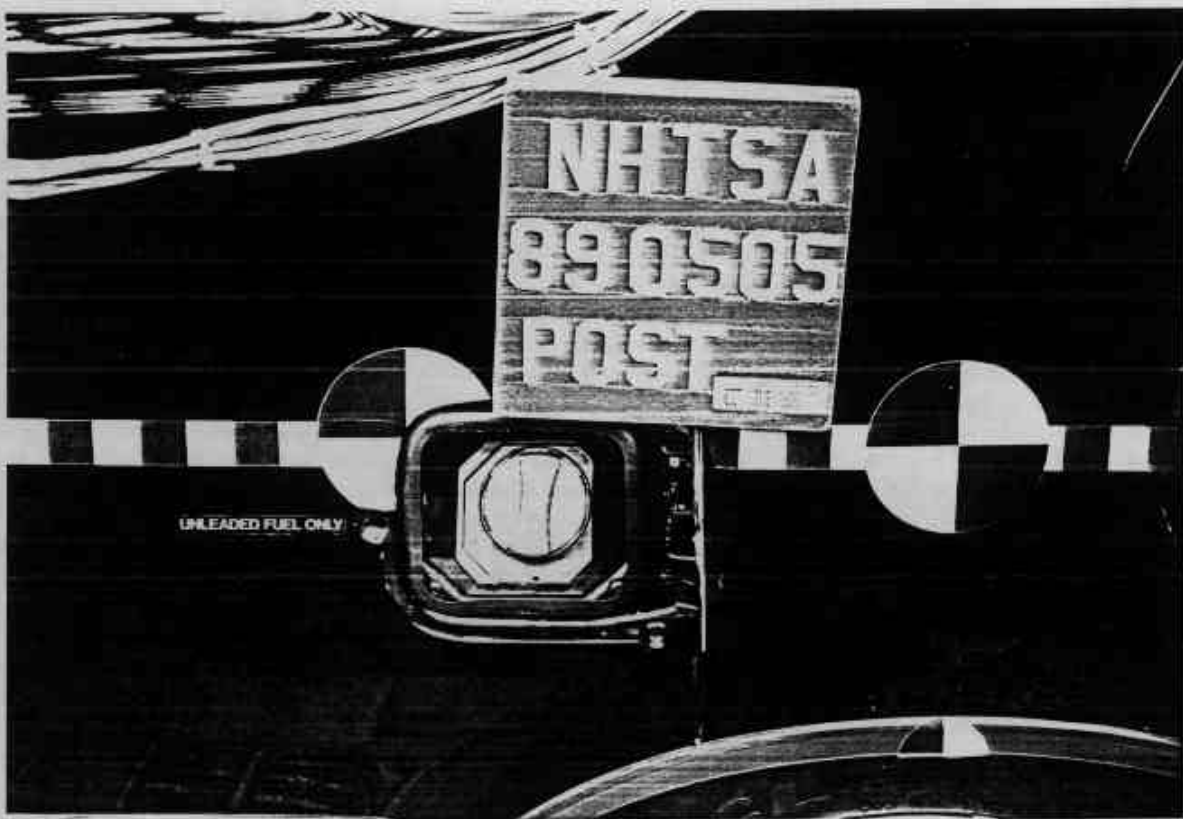


Figure A-18. POST-TEST FUEL FILLER CAP VIEW  
A-10

890505

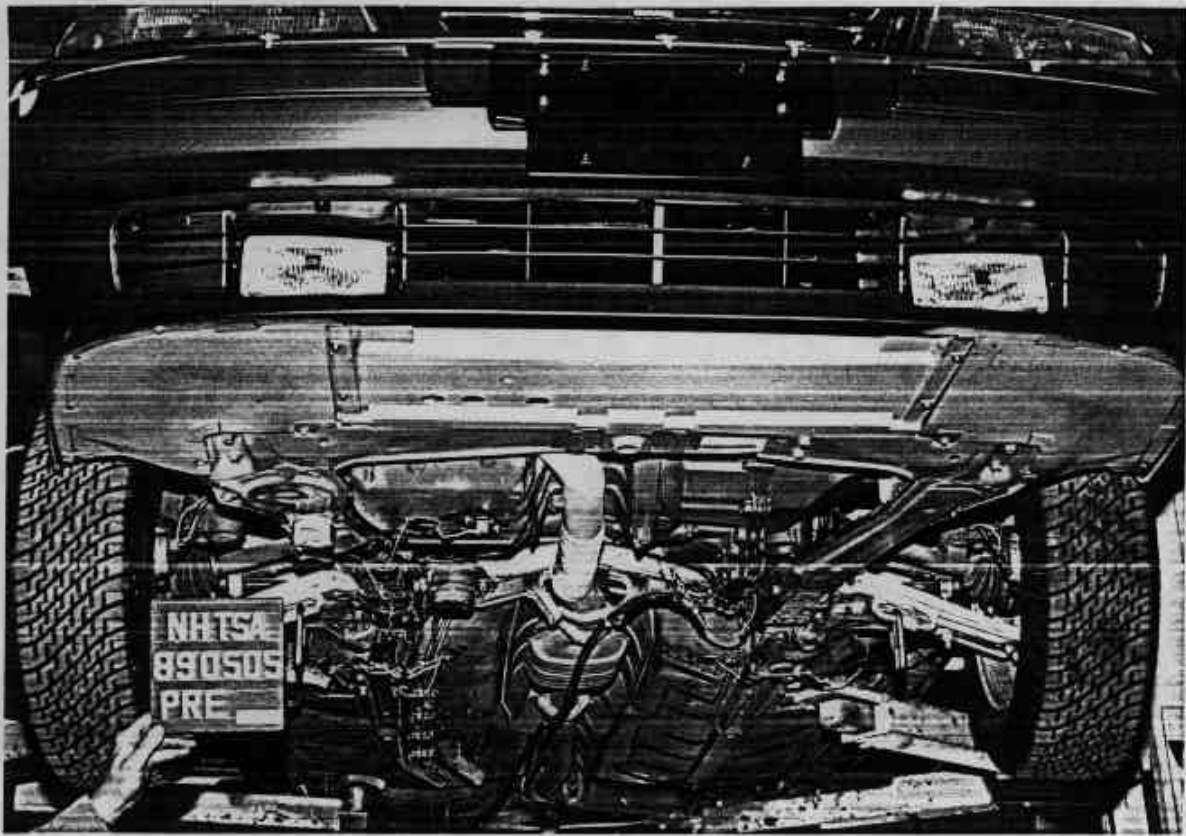


Figure A-19. PRE-TEST FRONT UNDERBODY VIEW

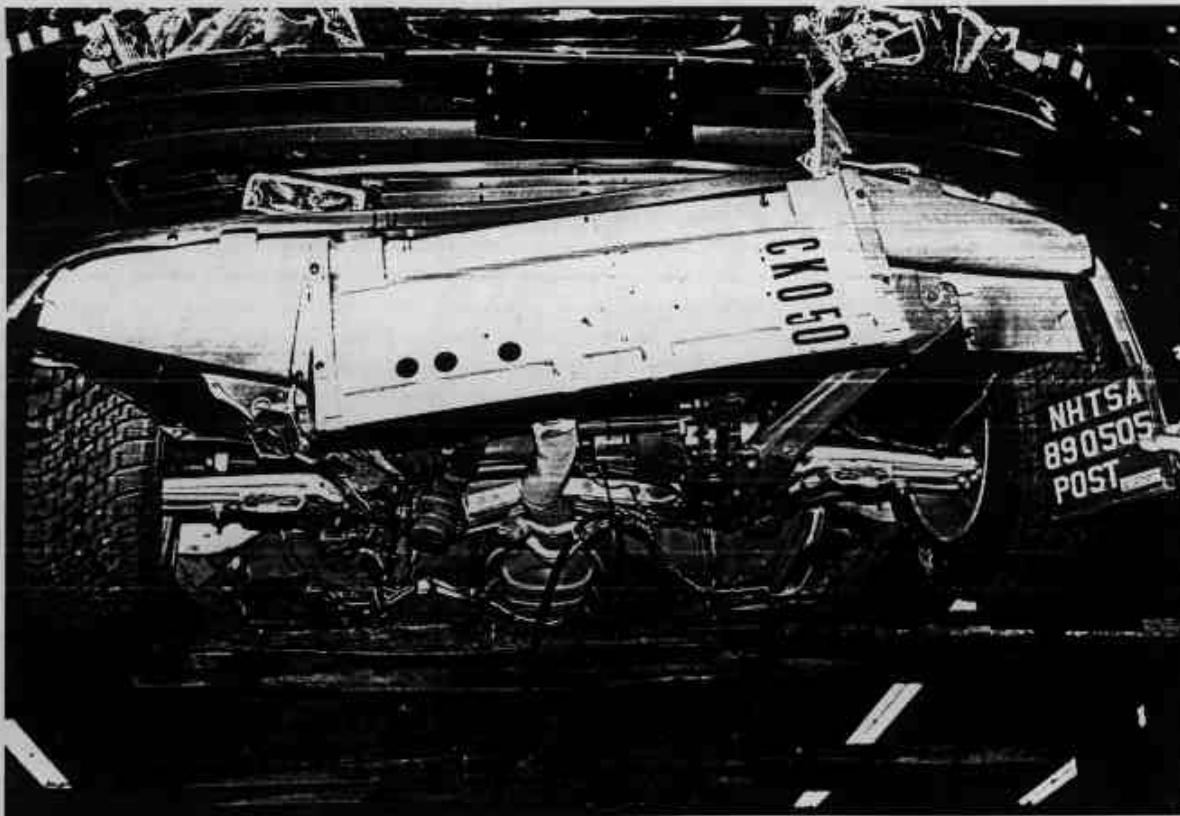


Figure A-20. POST-TEST FRONT UNDERBODY VIEW

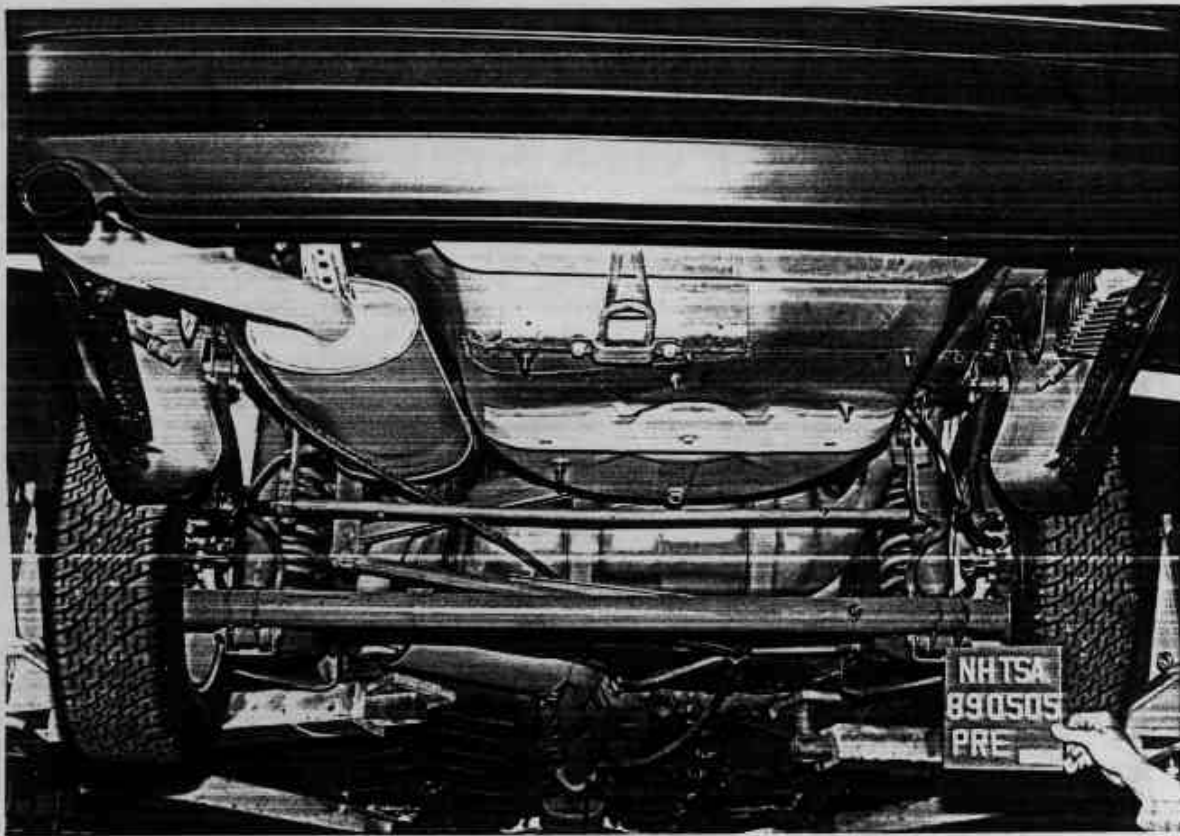


Figure A-21. PRE-TEST REAR UNDERBODY VIEW

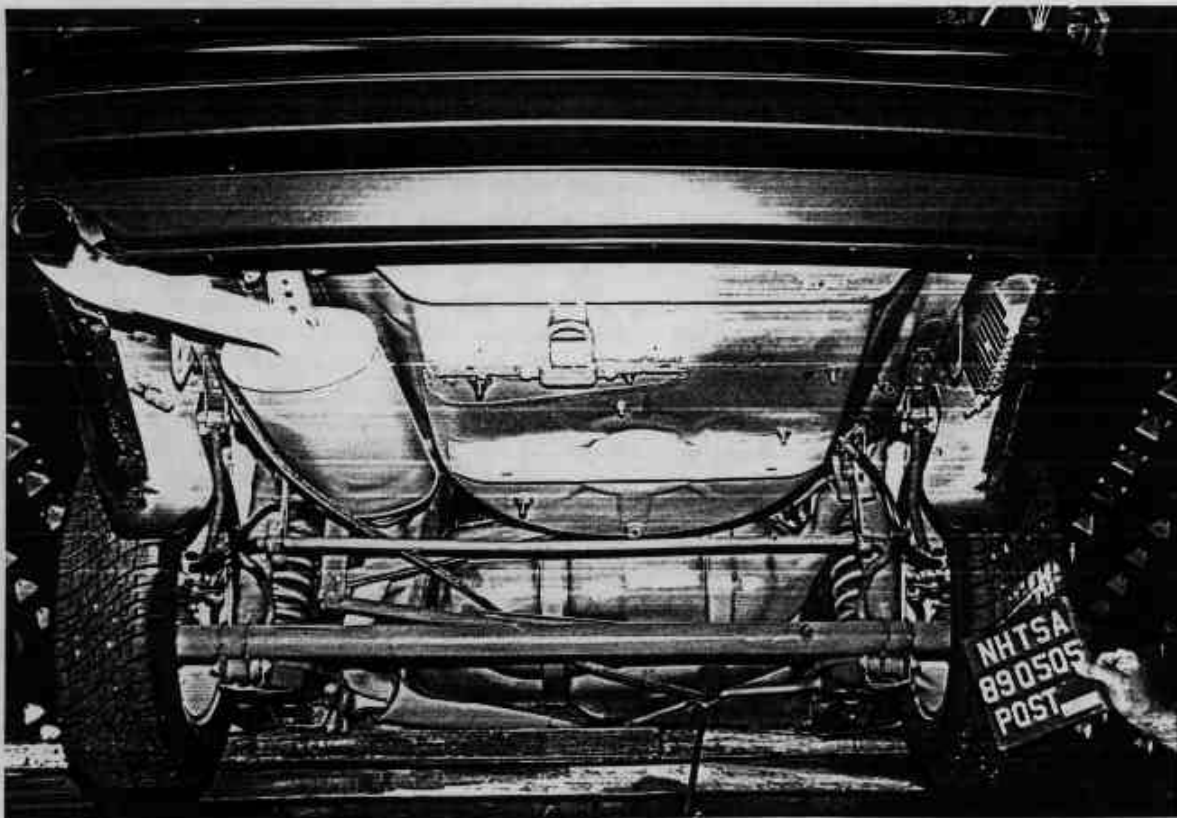


Figure A-22. POST-TEST REAR UNDERBODY VIEW  
A-12

890505



Figure A-23. PRE-TEST FUEL FILLER NECK

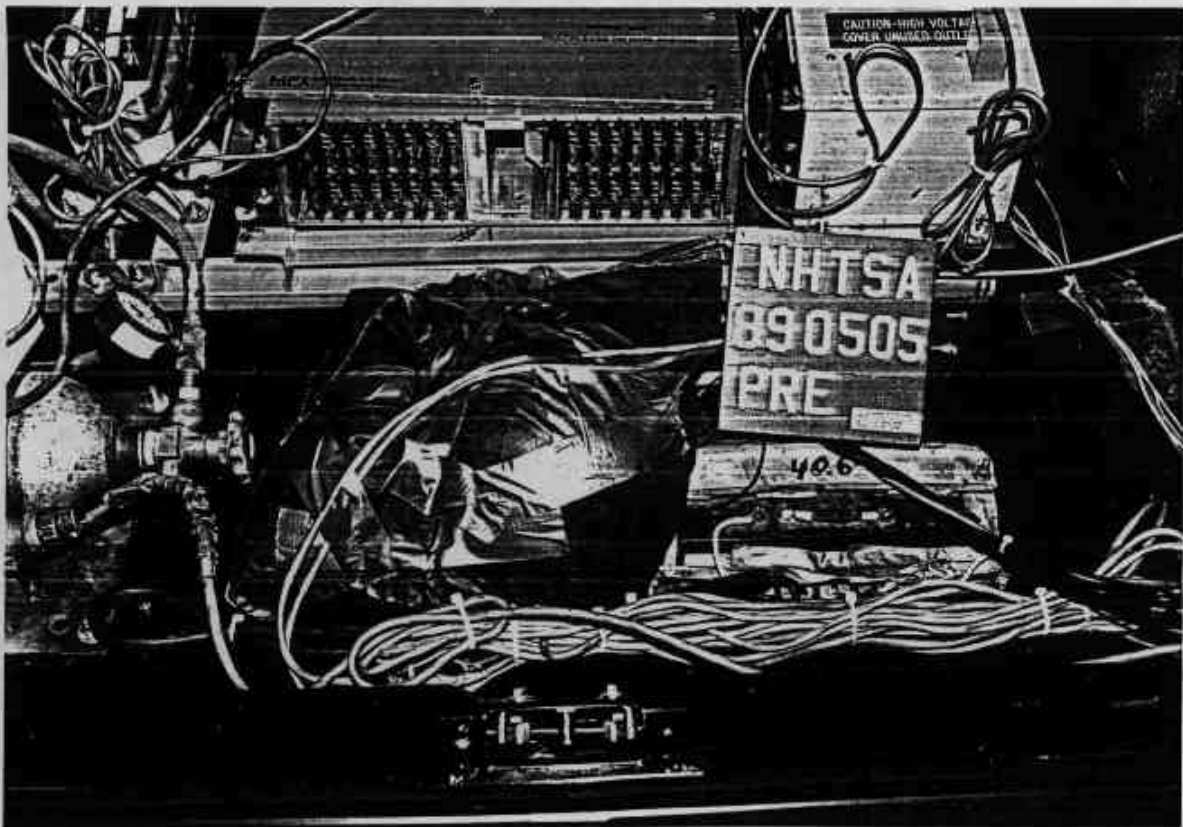


Figure A-24. PRE-TEST CARGO BALLAST VIEW  
A-13

890505



Figure A-25. PRE-TEST DRIVER DUMMY POSITION VIEW



Figure A-26. POST-TEST DRIVER DUMMY POSITION VIEW  
A-14

890505



Figure A-27. PRE-TEST PASSENGER DUMMY POSITION VIEW



Figure A-28. POST-TEST PASSENGER DUMMY POSITION VIEW

A-15

890505

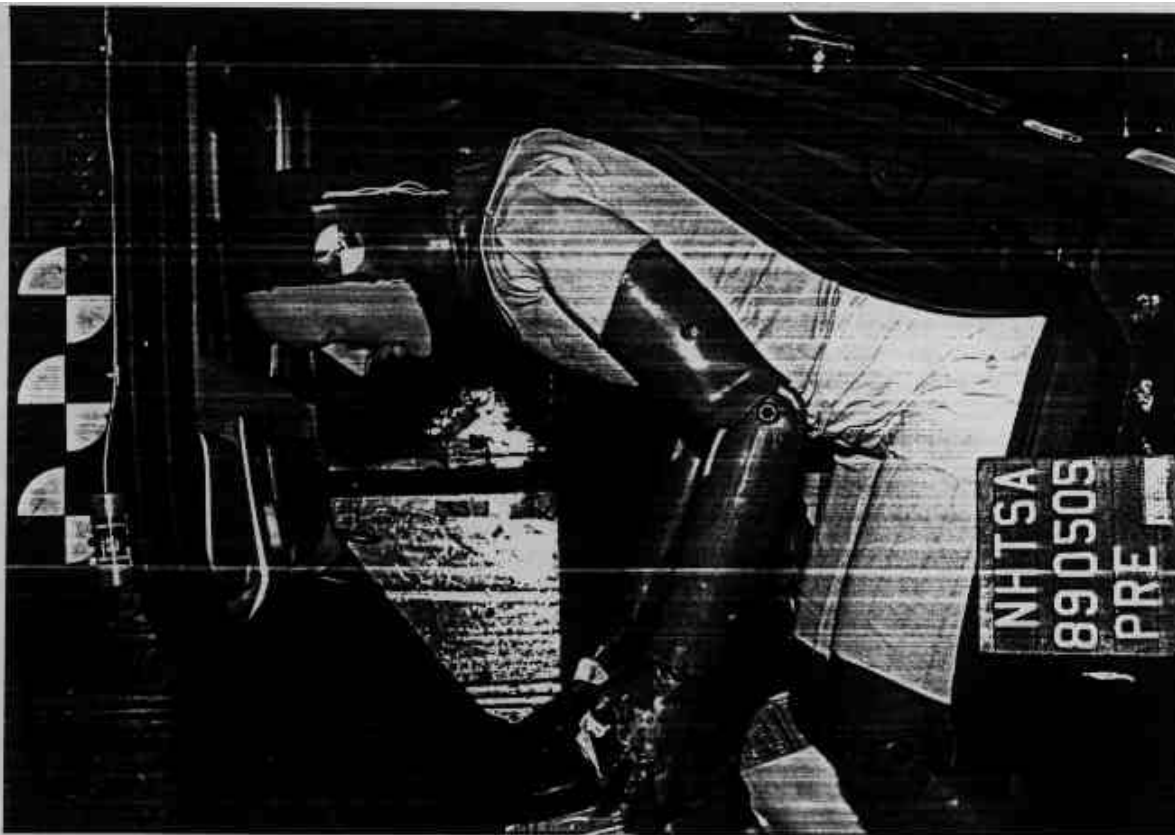


Figure A-29. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

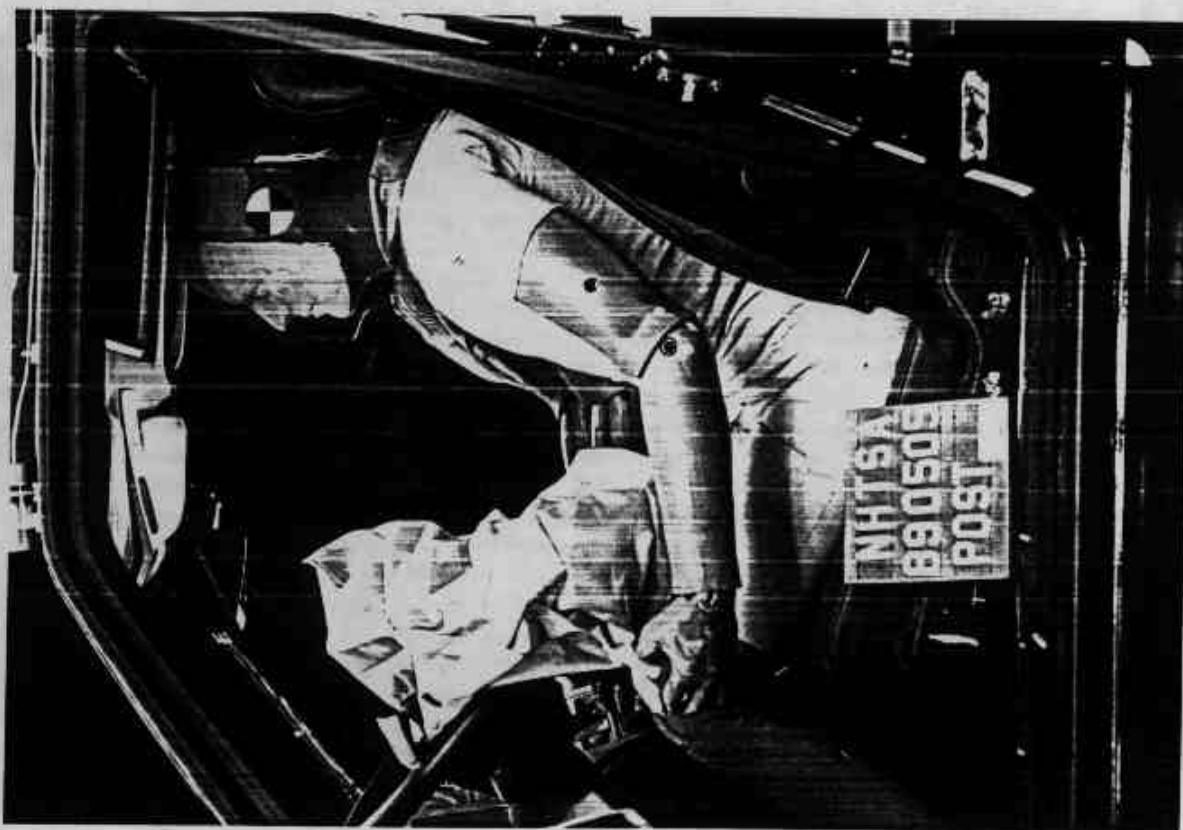


Figure A-30. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1



Figure A-31. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

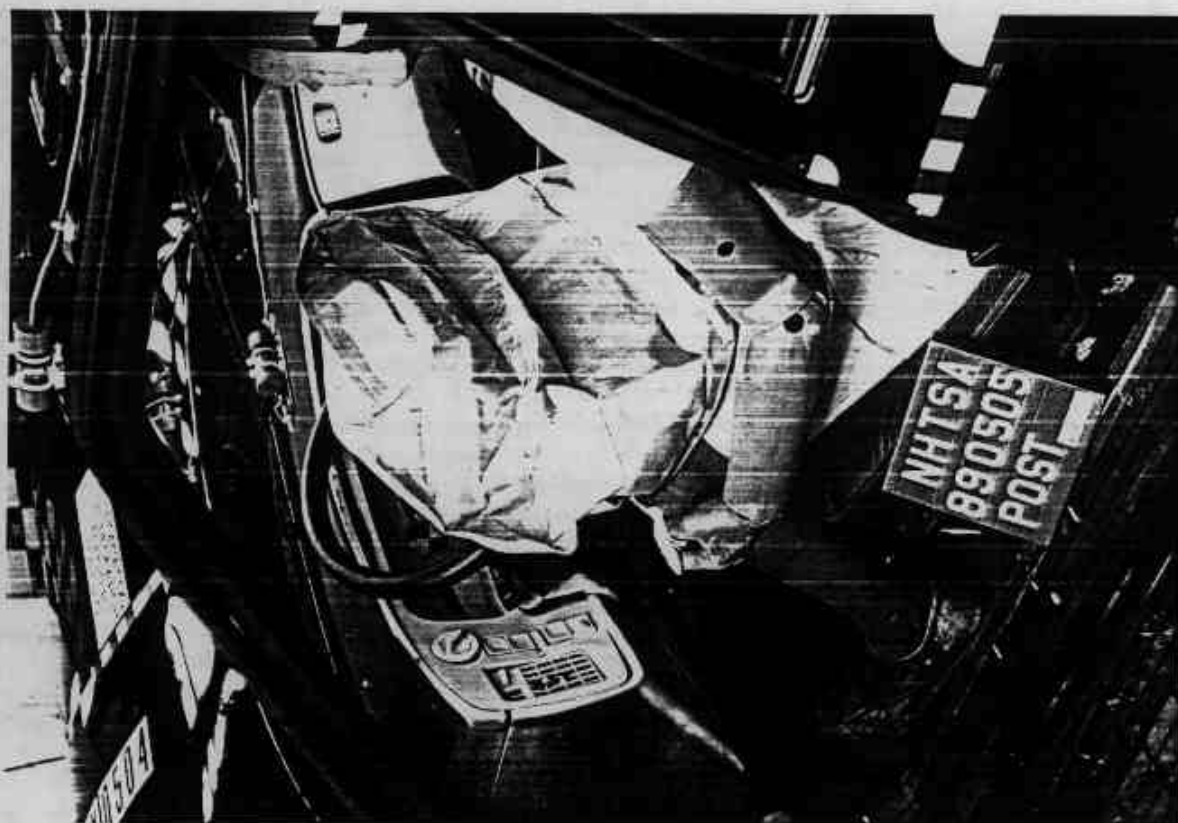


Figure A-32. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

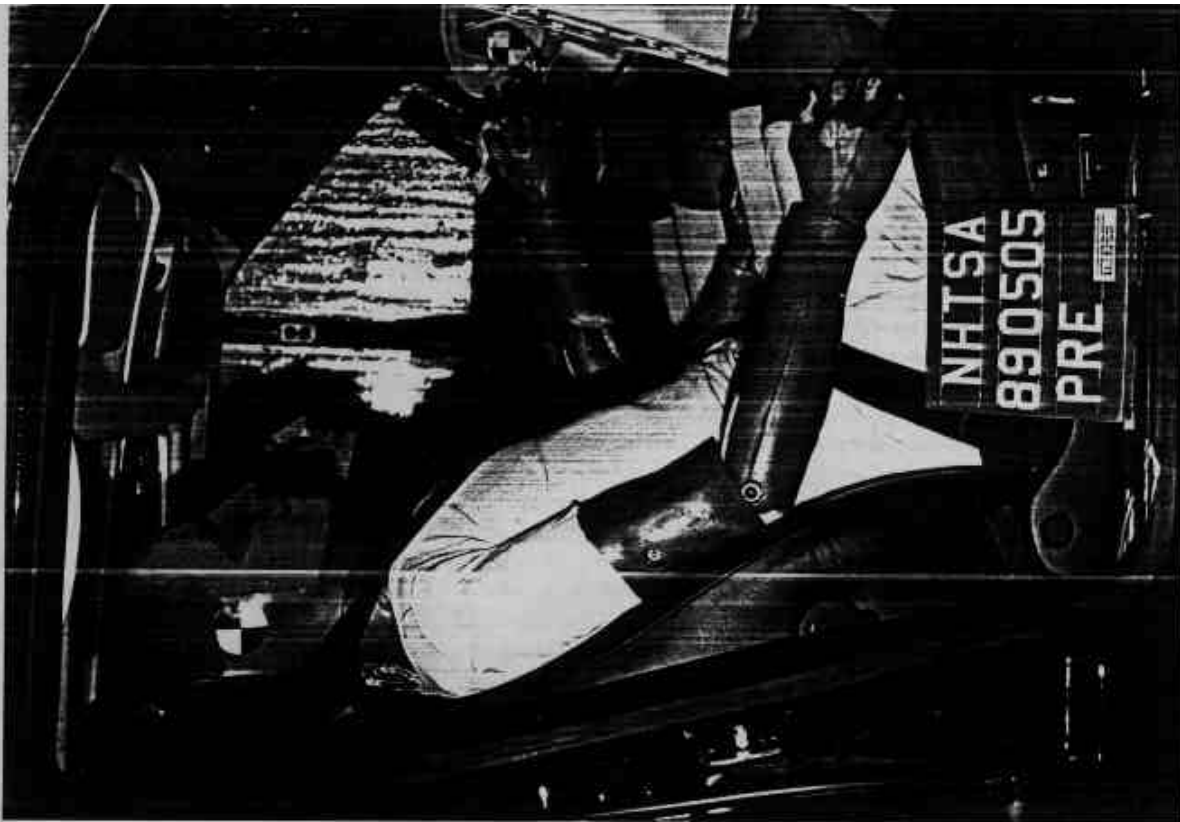


Figure A-33. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

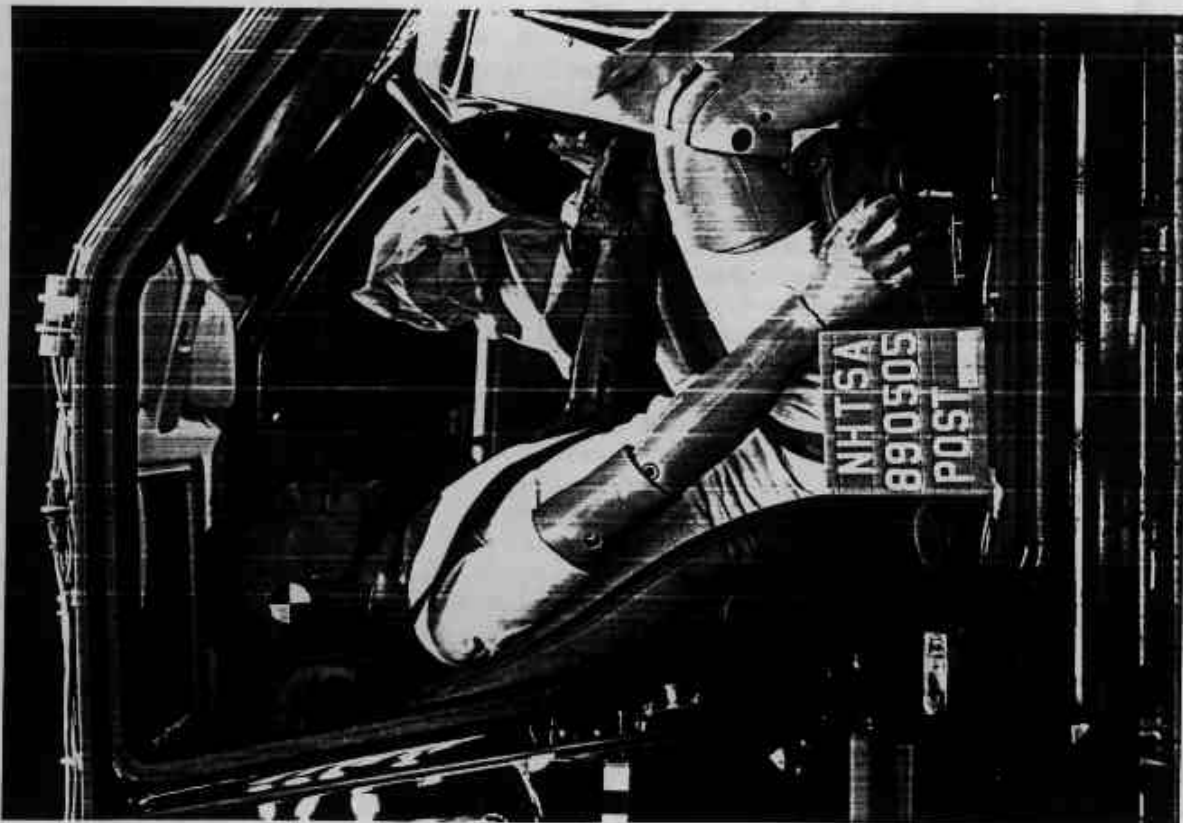


Figure A-34. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2  
A-18 890505



Figure A-35. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-36. POST-TEST PASSENGER DUMMY AND VEHICLE INTERIOR - VIEW 2

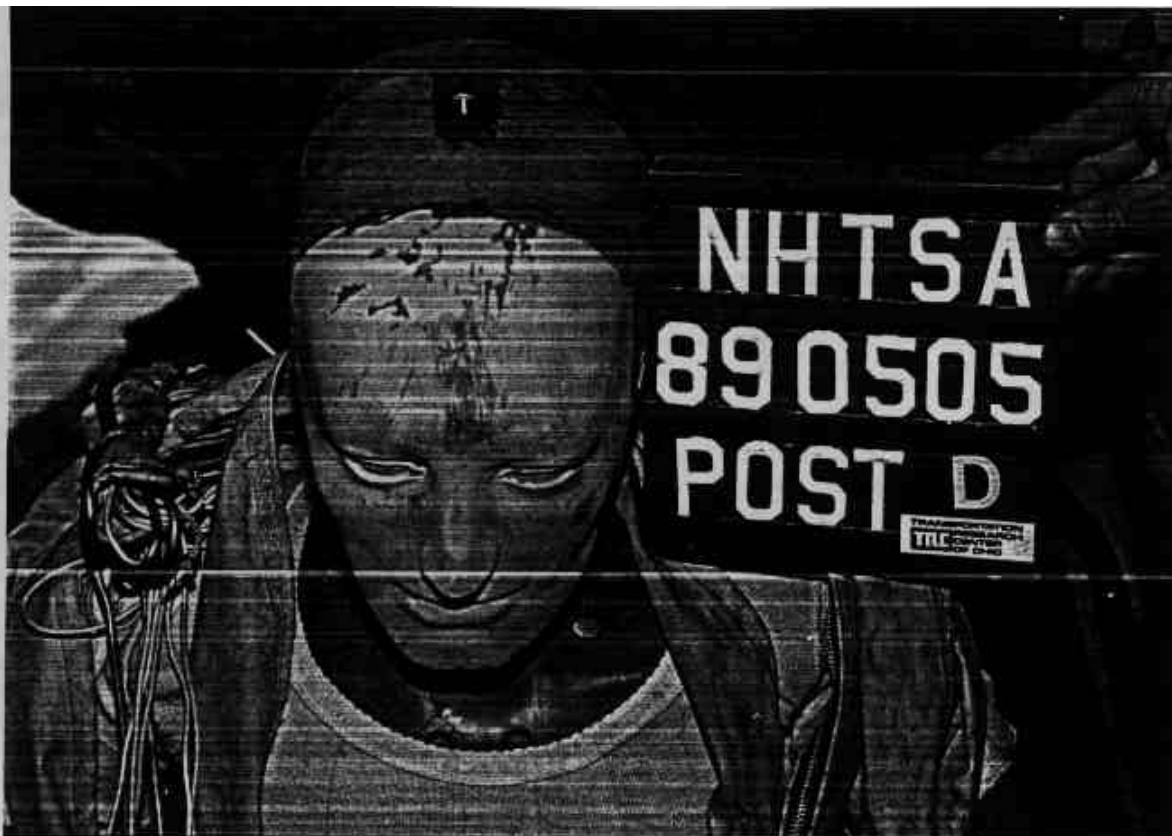


Figure A-37. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 1



Figure A-38. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 2

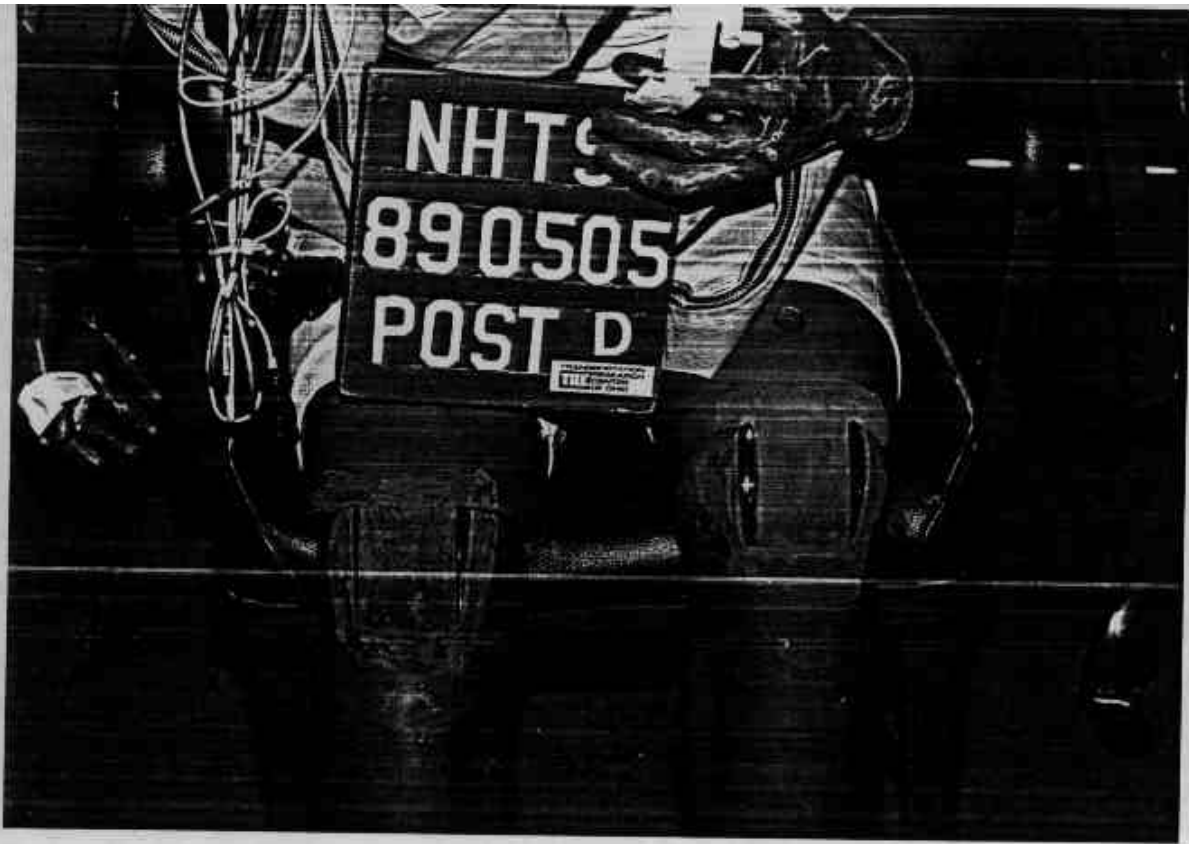


Figure A-39. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

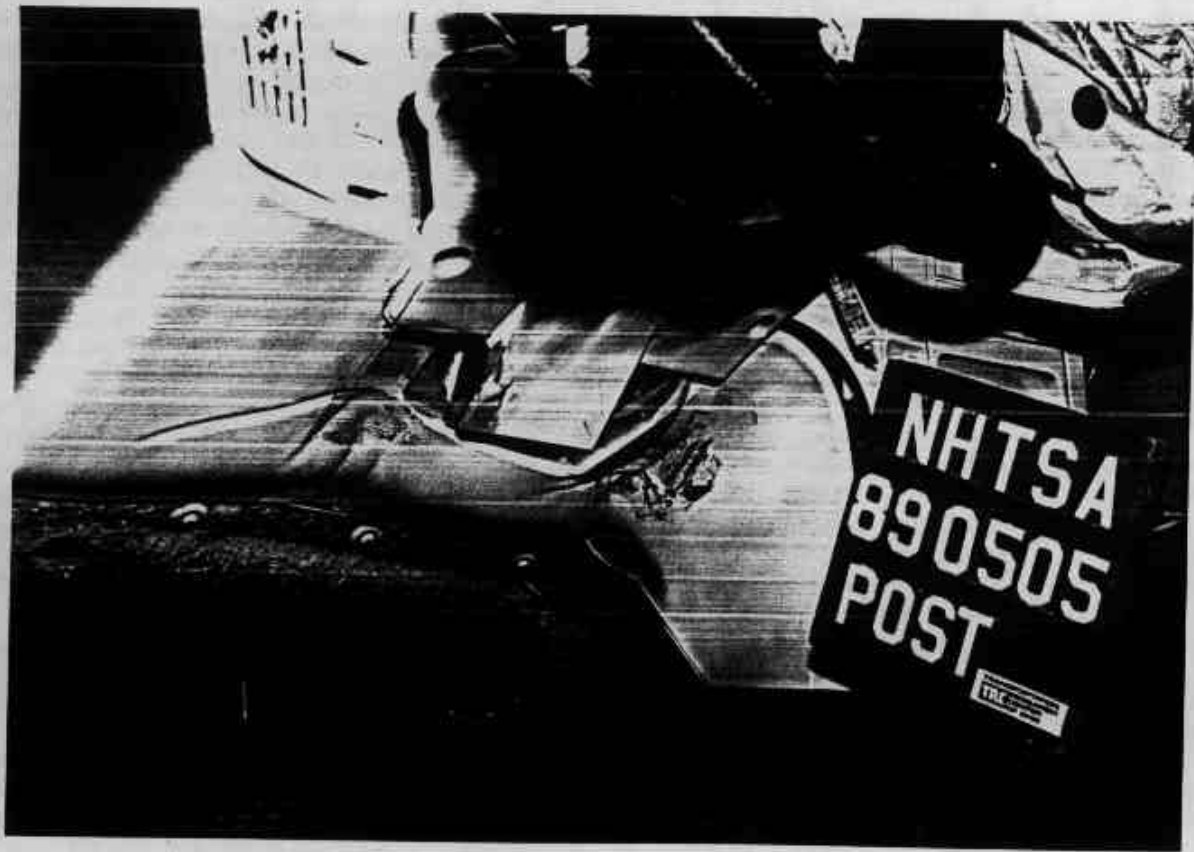


Figure A-40. POST-TEST DRIVER DUMMY KNEE CONTACT VIEW - VIEW 2

A-21

890505

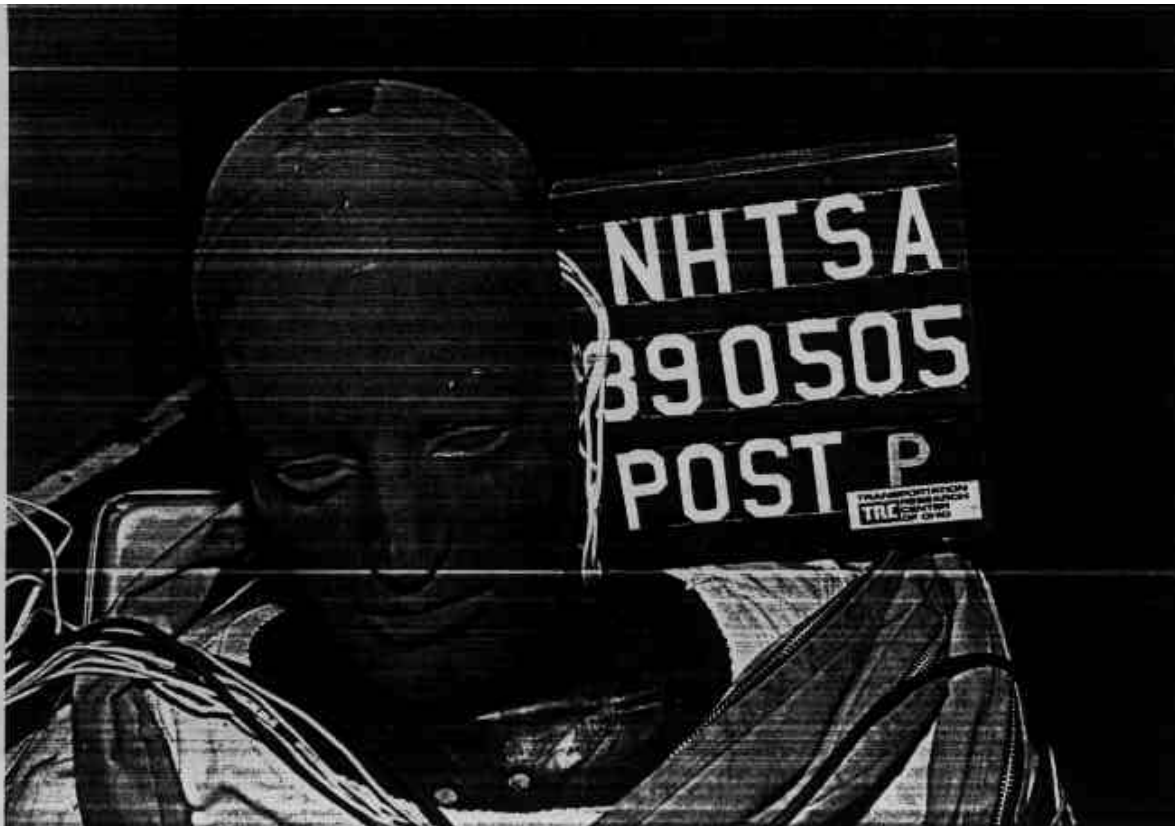


Figure A-41. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW

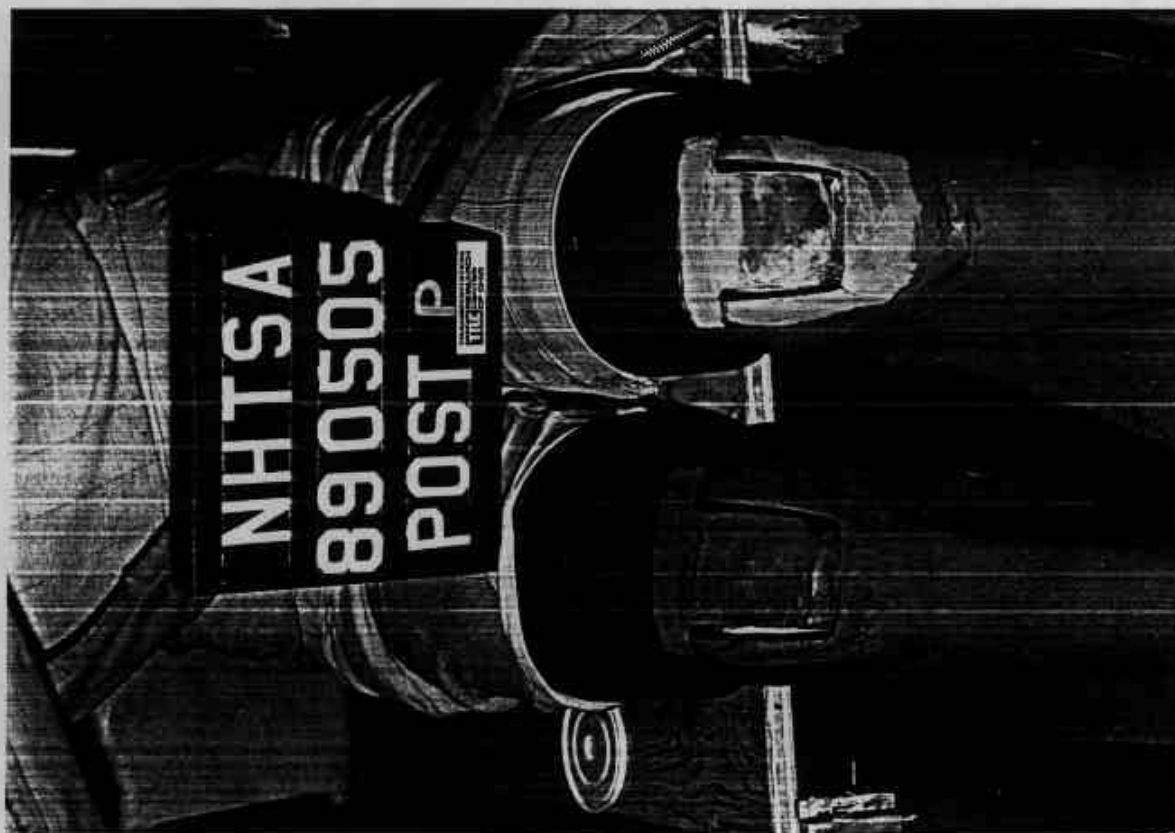


Figure A-42. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 1



Figure A-43. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 2

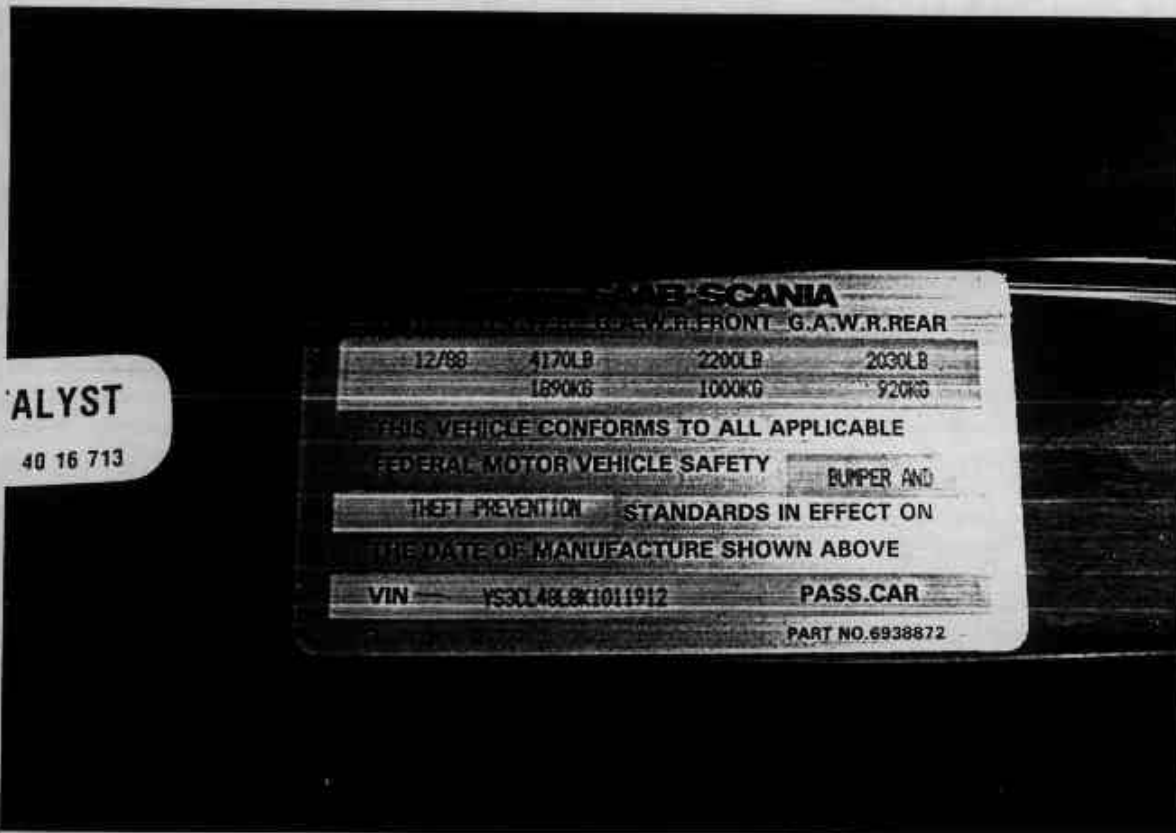


Figure A-44. PRE-TEST VEHICLE CERTIFICATION LABEL VIEW

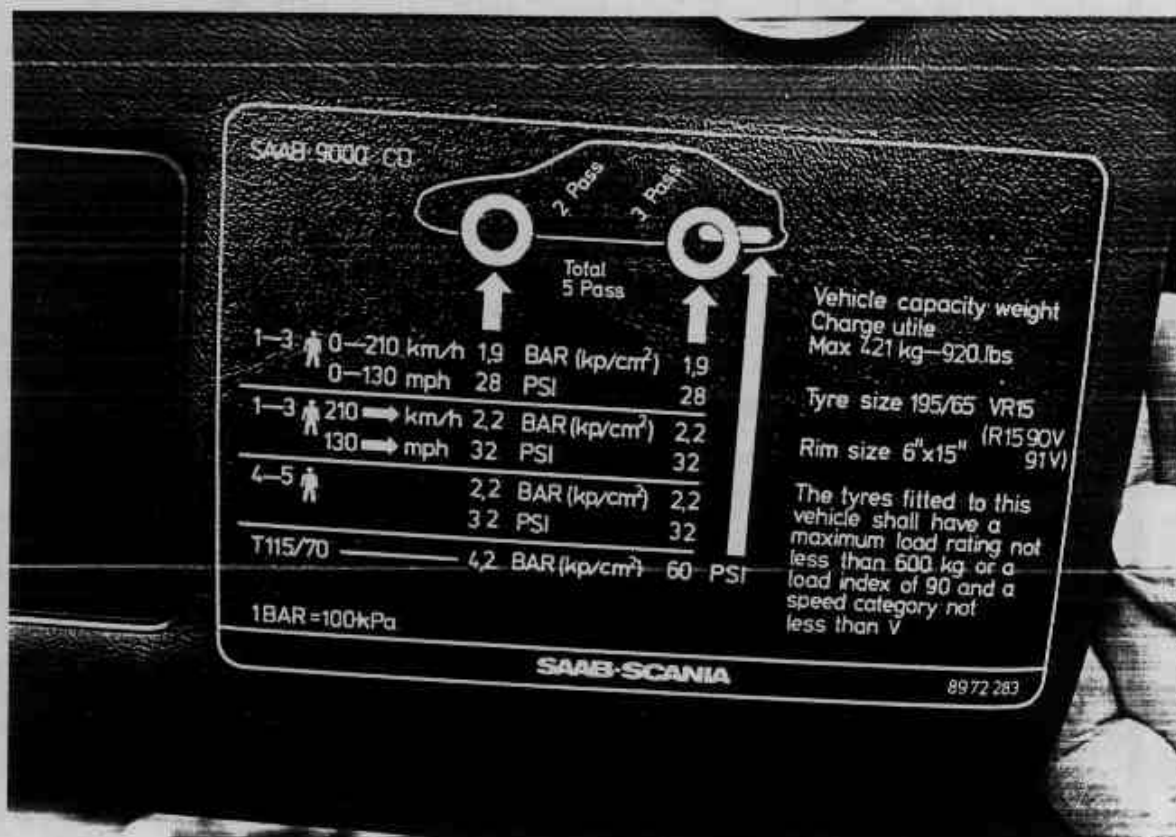


Figure A-45. PRE-TEST VEHICLE TIRE LOAD LABEL VIEW

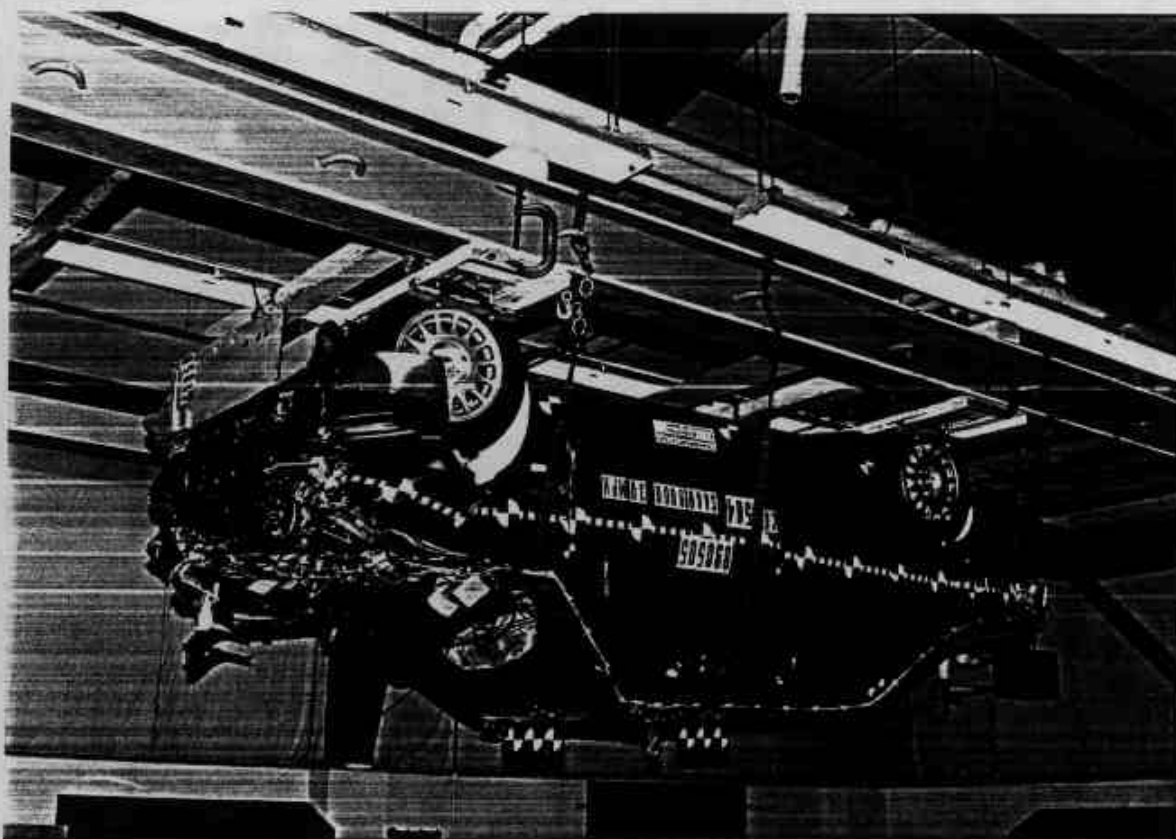


Figure A-46. POST-TEST VEHICLE ON STATIC ROLLOVER VIEW

APPENDIX B

DATA PLOTS

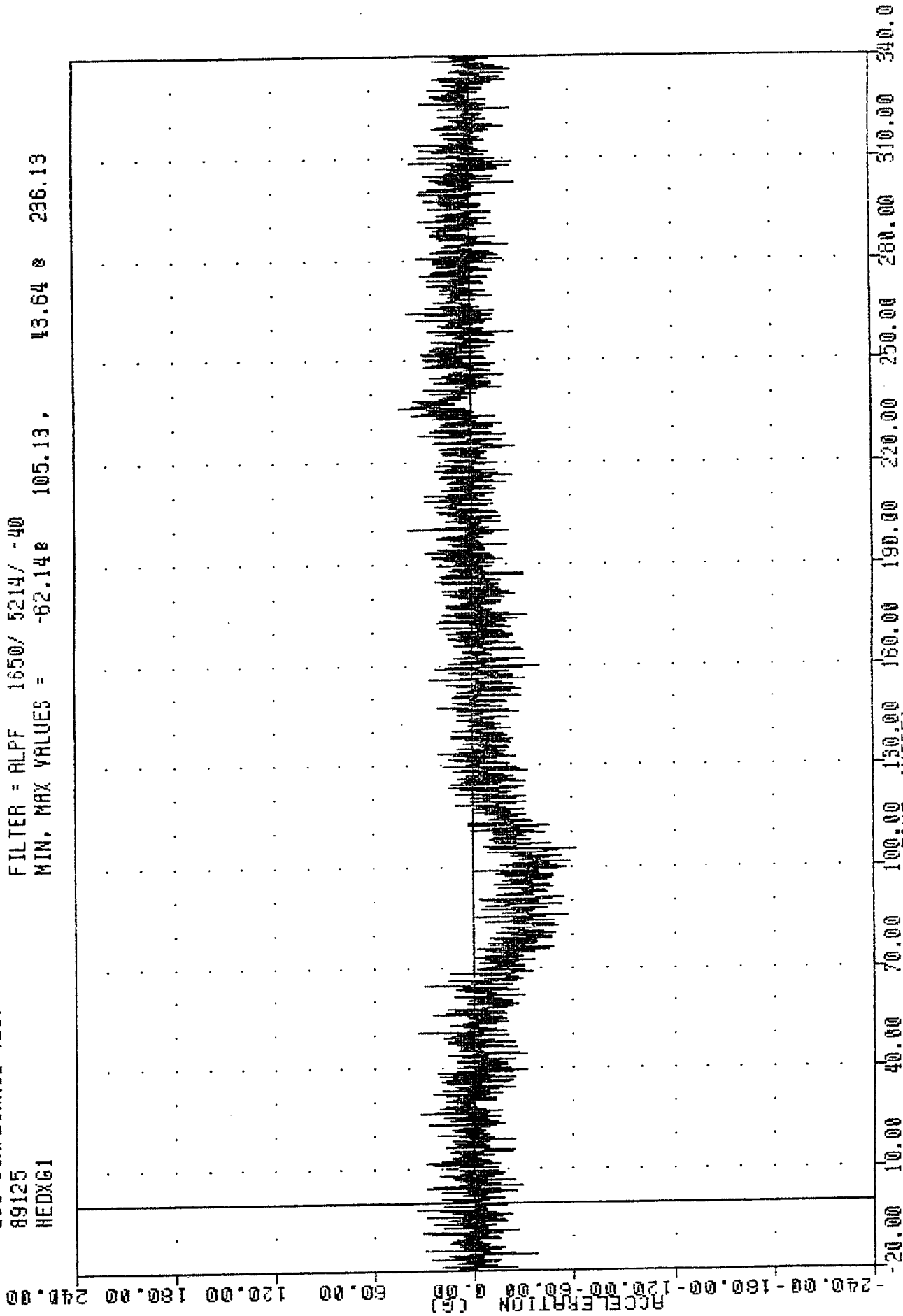
DUMMY AND VEHICLE AXES: X: FRONT/REAR

Y: LEFT/RIGHT

Z: UP/DOWN

TAC 890505  
208 COMPLIANCE TEST  
89125  
NEDX61

FILTER = ALPF 1650/ 5214/ -40  
MIN. MAX VALUES = -62.148 105.13, 43.64 236.13

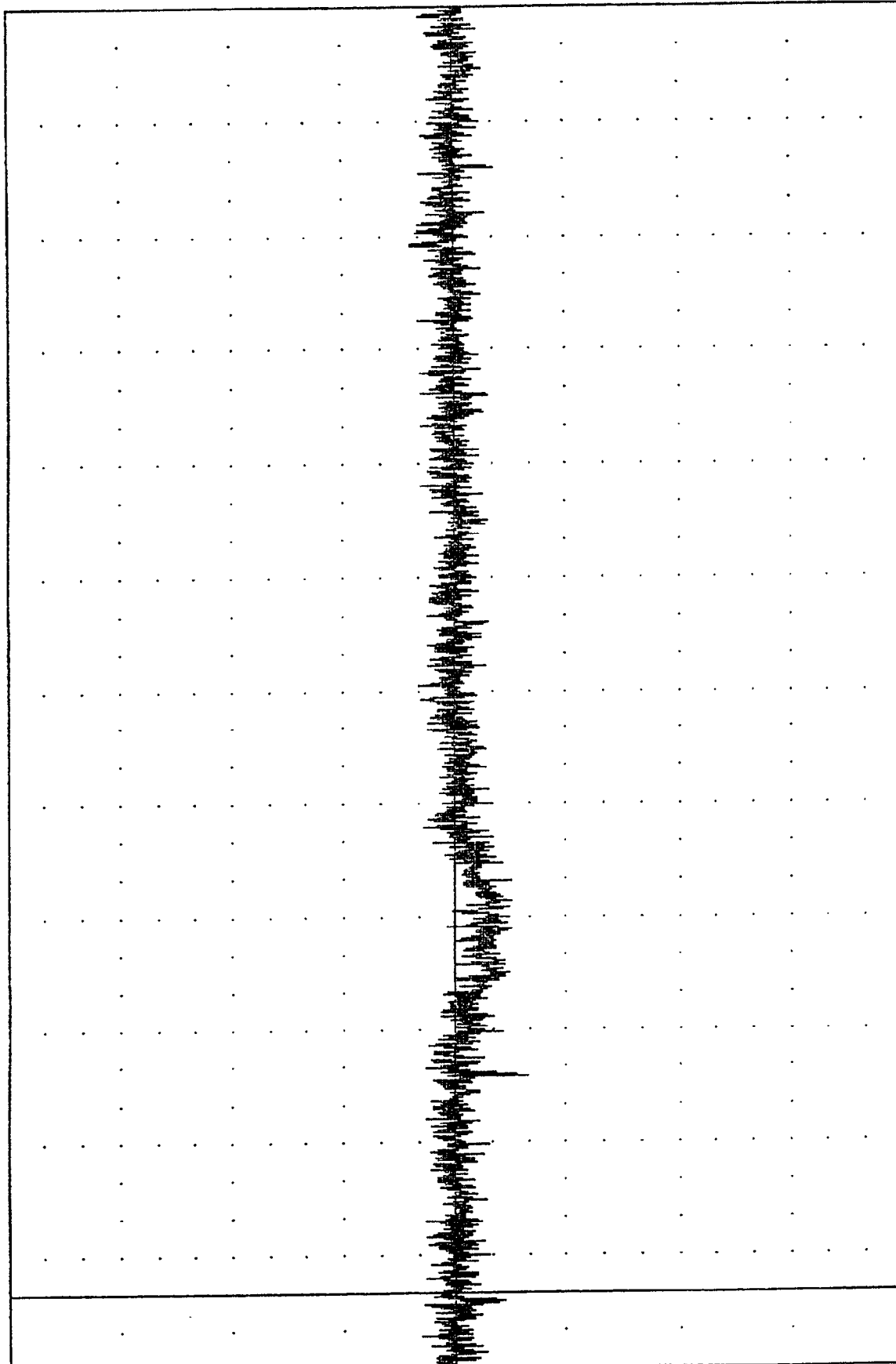


1989 SABA 9000 INTO FRONTAL BARRIER  
DRIVER HEAD X AXIS ACCELERATION

TRC  
89125  
HEDYG1  
200 COMPLIANCE TEST  
, 890505

FILTER = ALPF 1650/ 5214/ -40  
MIN, MAX VALUES = -36.55e 57.88 , 23.21 e 277.50

ACCELERATION (G)

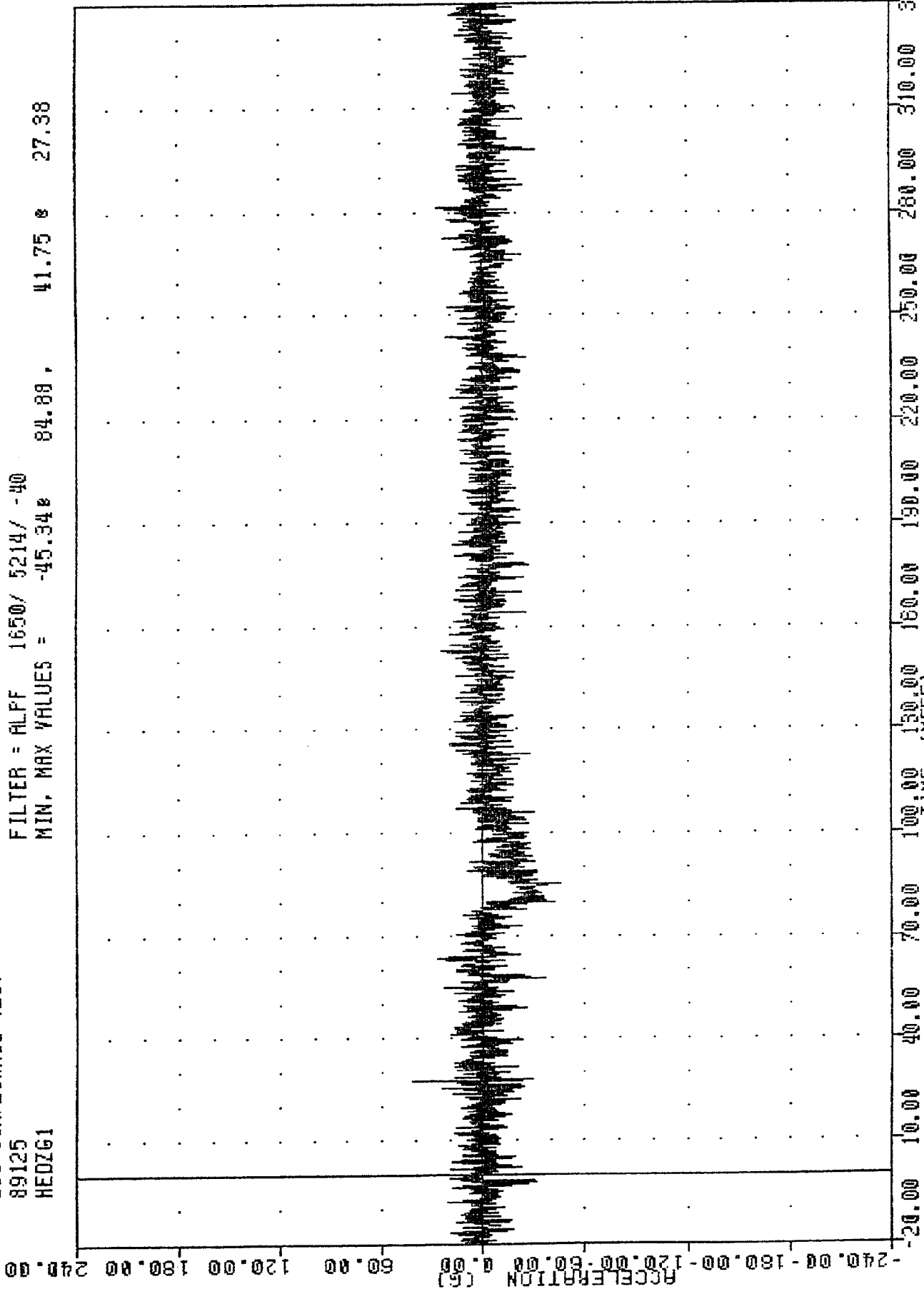


-240.00 -180.00 -120.00 -60.00 0.00 60.00 120.00 180.00 240.00  
0.00 10.00 20.00 30.00 40.00 50.00 60.00 70.00 80.00 90.00 100.00 110.00 120.00 130.00 140.00 150.00 160.00 170.00 180.00 190.00 200.00 210.00 220.00 230.00 240.00 250.00 260.00 270.00 280.00 290.00 300.00 310.00 320.00 330.00 340.00

1989 SAB 9000 INTO FRONTAL BARRIER  
DRIVER HEAD Y AXIS ACCELERATION

TRC 890505  
208 COMPLIANCE TEST  
89125  
HEDZG1

FILTER = ALFF 1650/ 5214/ -40  
MIN, MAX VALUES = -45.34g 84.8g, 41.75g 27.38

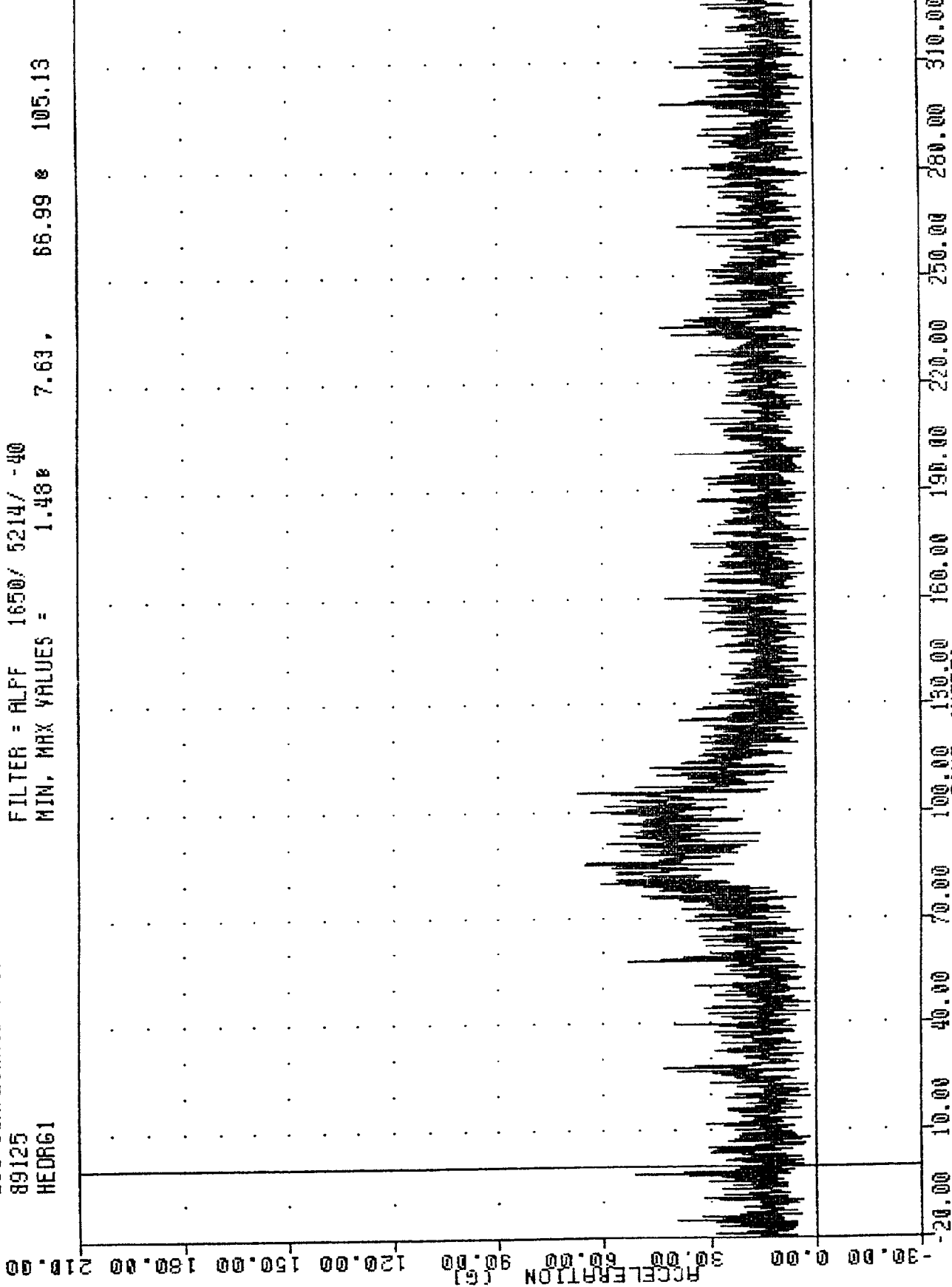


TRC  
89125  
HEDRG1

, 890505

208 COMPLIANCE TEST

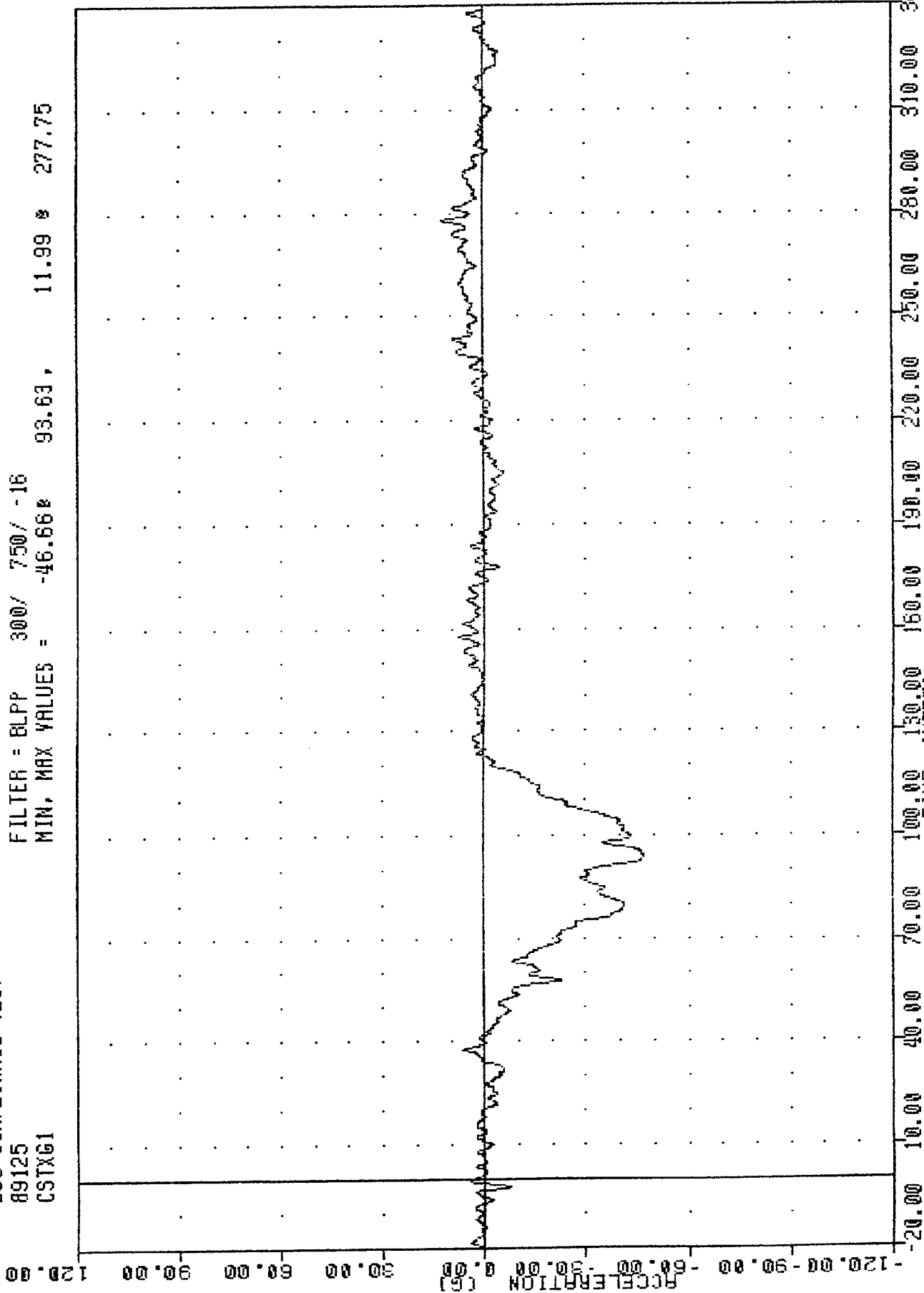
FILTER = ALPF 1650/ 5214/ -40  
MIN, MAX VALUES = 1.438 7.63, 65.99 & 105.13



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER HEAD RESULTANT ACCELERATION

TAC 890505  
206 COMPLIANCE TEST  
89125  
CSTXG1

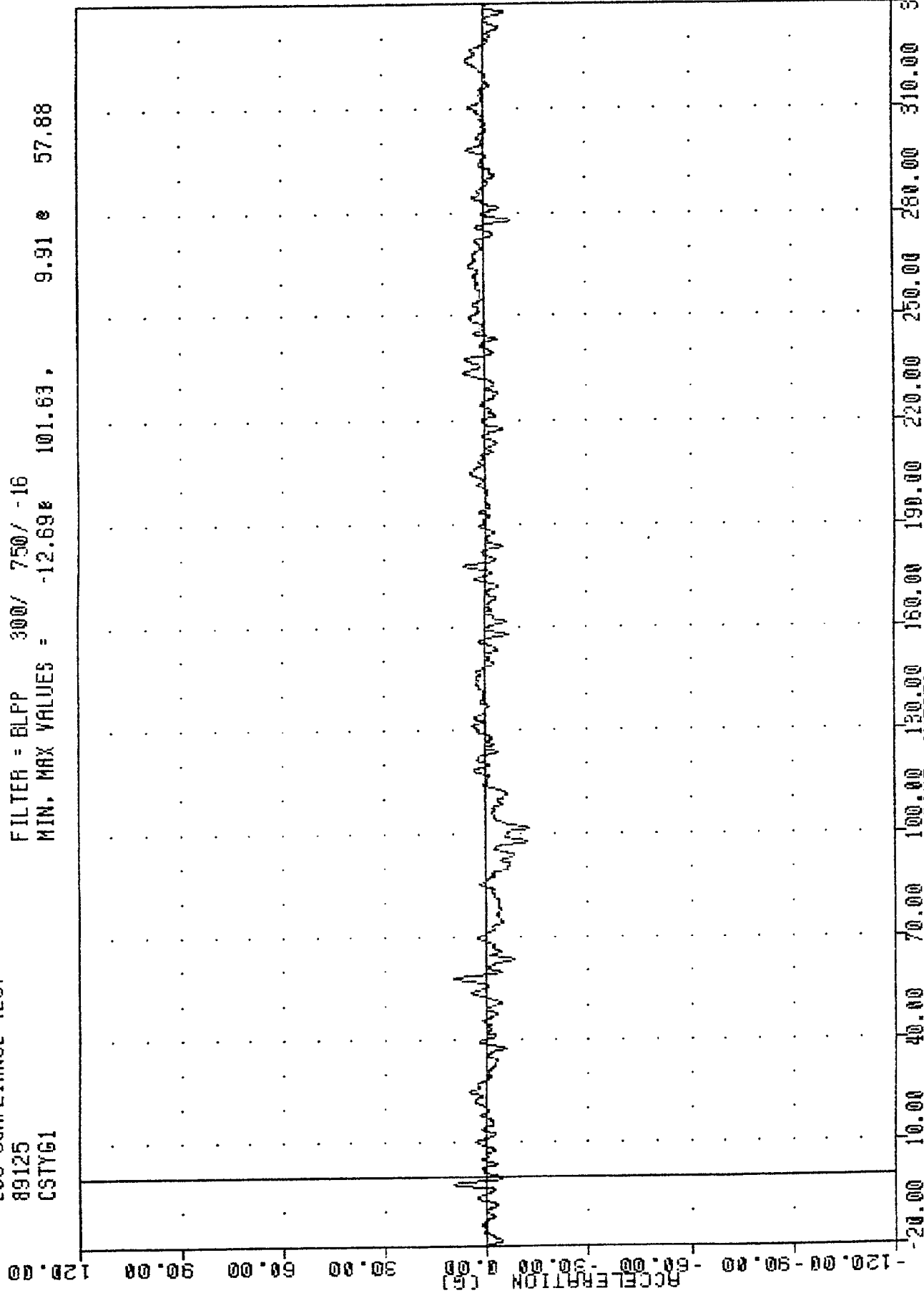
FILTER = BLPP 300/ 750/ -16  
MIN, MAX VALUES = -46.66 93.63, 11.99 \* 277.75



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER CHEST X AXIS ACCELERATION

TRC , 890505  
208 COMPLIANCE TEST  
89125  
CSTYG1

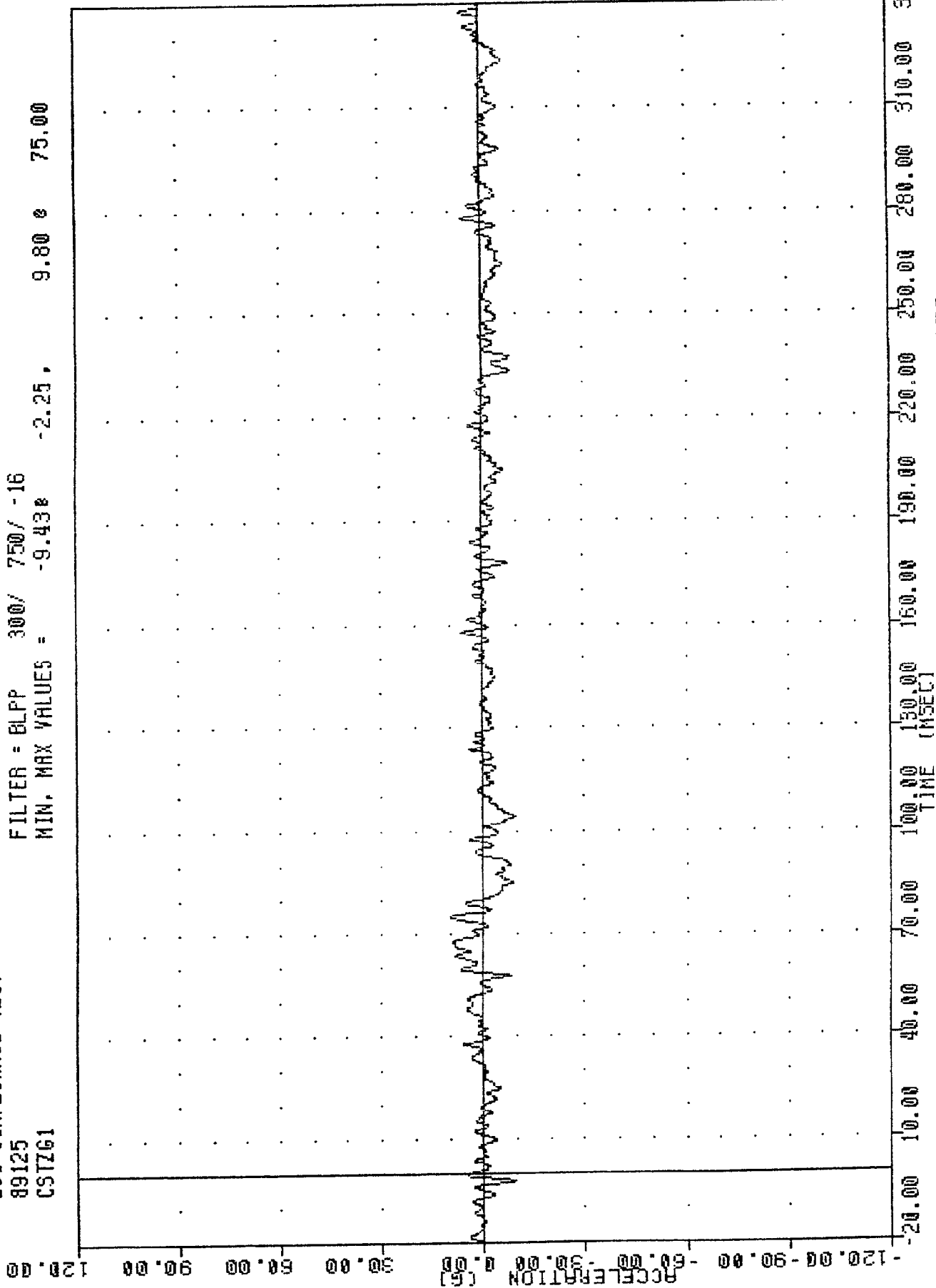
FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = -12.69% 101.63, 9.91 e 57.88



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER CHEST Y AXIS ACCELERATION

TRC , 890505  
208 COMPLIANCE TEST  
89125  
CSTZG1

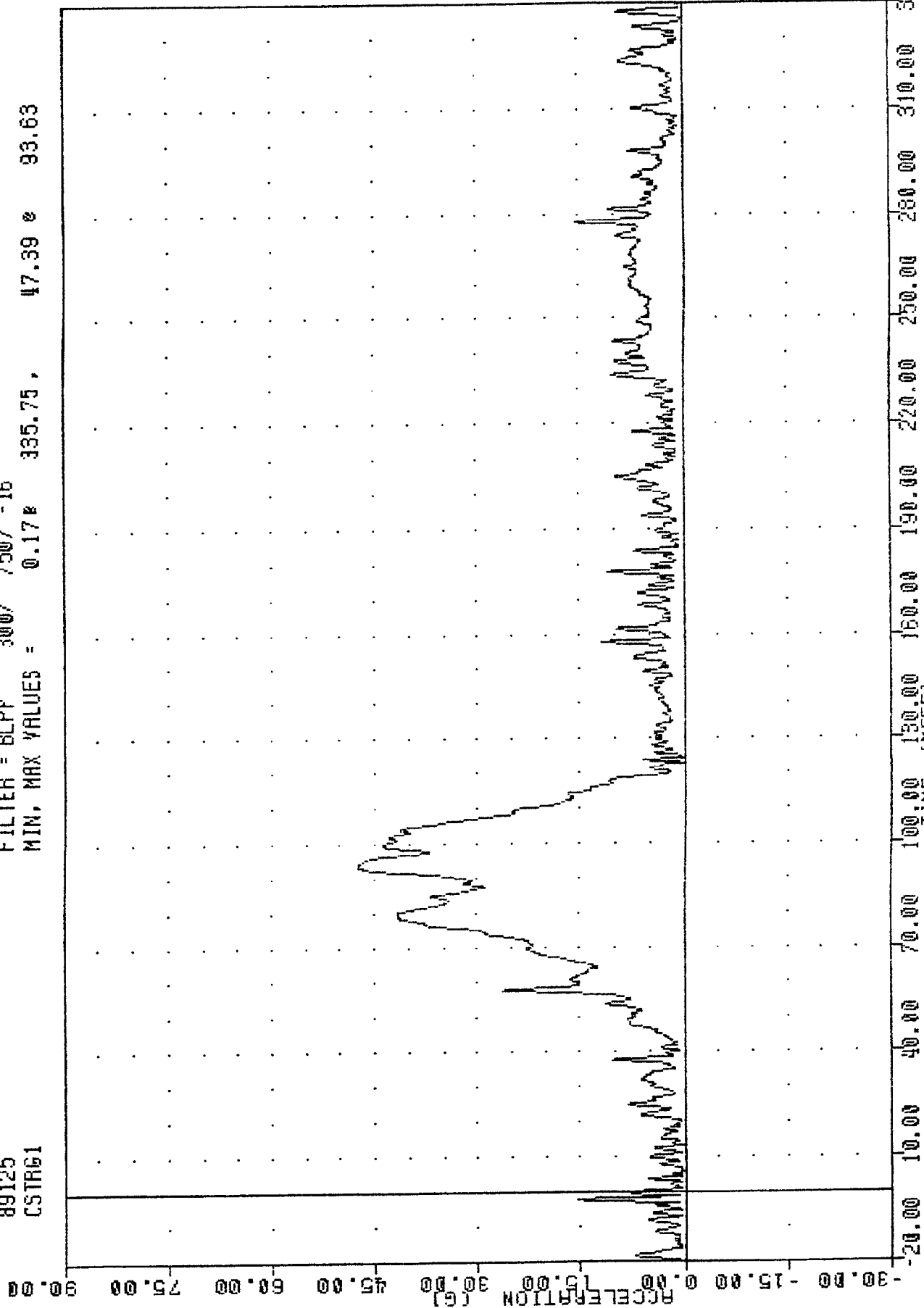
FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = -9.438 -2.25, 9.80 0 75.00



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER CHEST Z AXIS ACCELERATION

TRC  
208 COMPLIANCE TEST  
89125  
CSTRG1

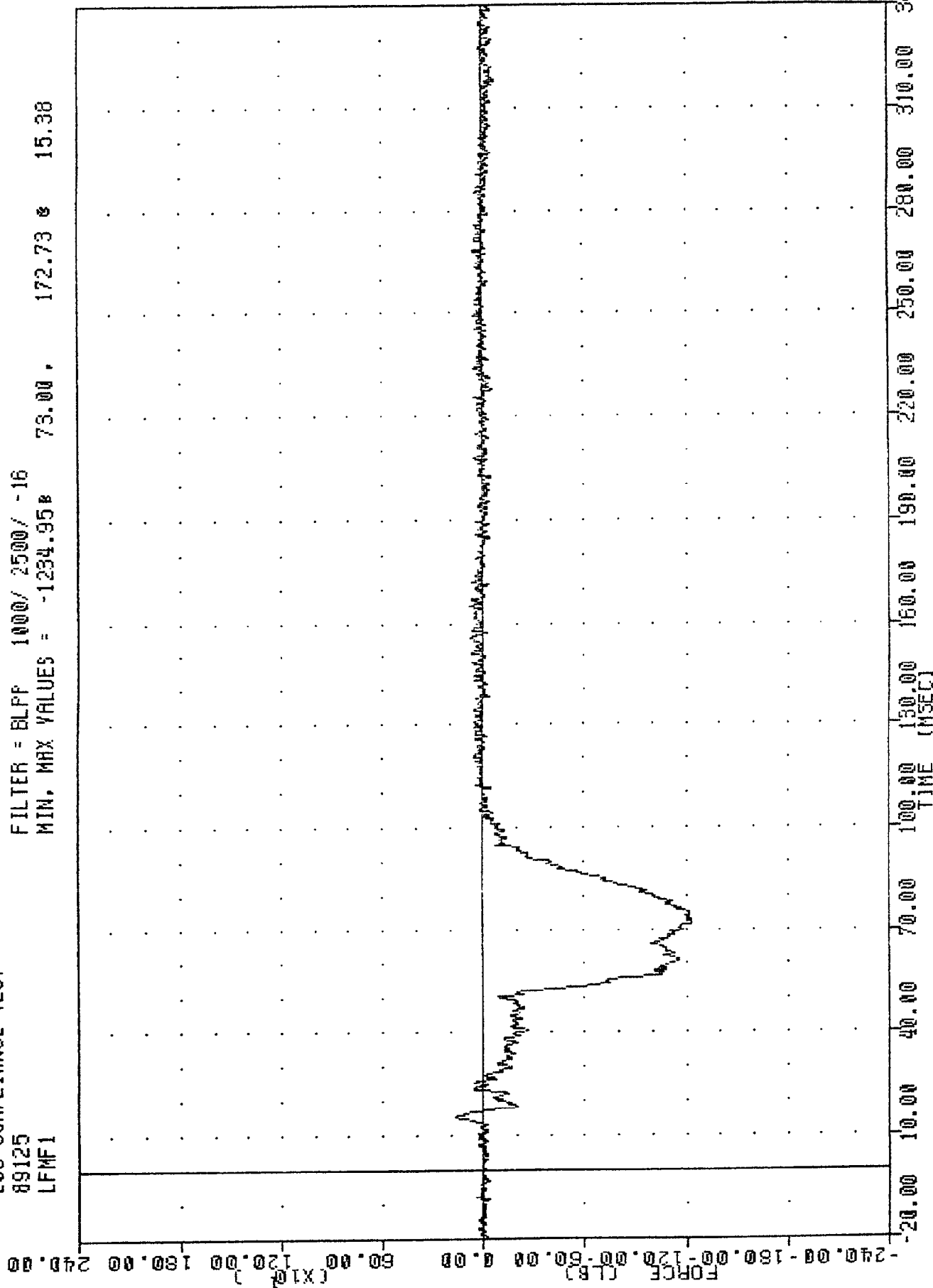
FILTER = 6LPP 300/ 750/ -16  
MIN, MAX VALUES = 0.17% 335.75, 47.39 @ 93.63



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER CHEST RESULTANT ACCELERATION

TRC , 890505  
208 COMPLIANCE TEST  
89125  
LFMF1

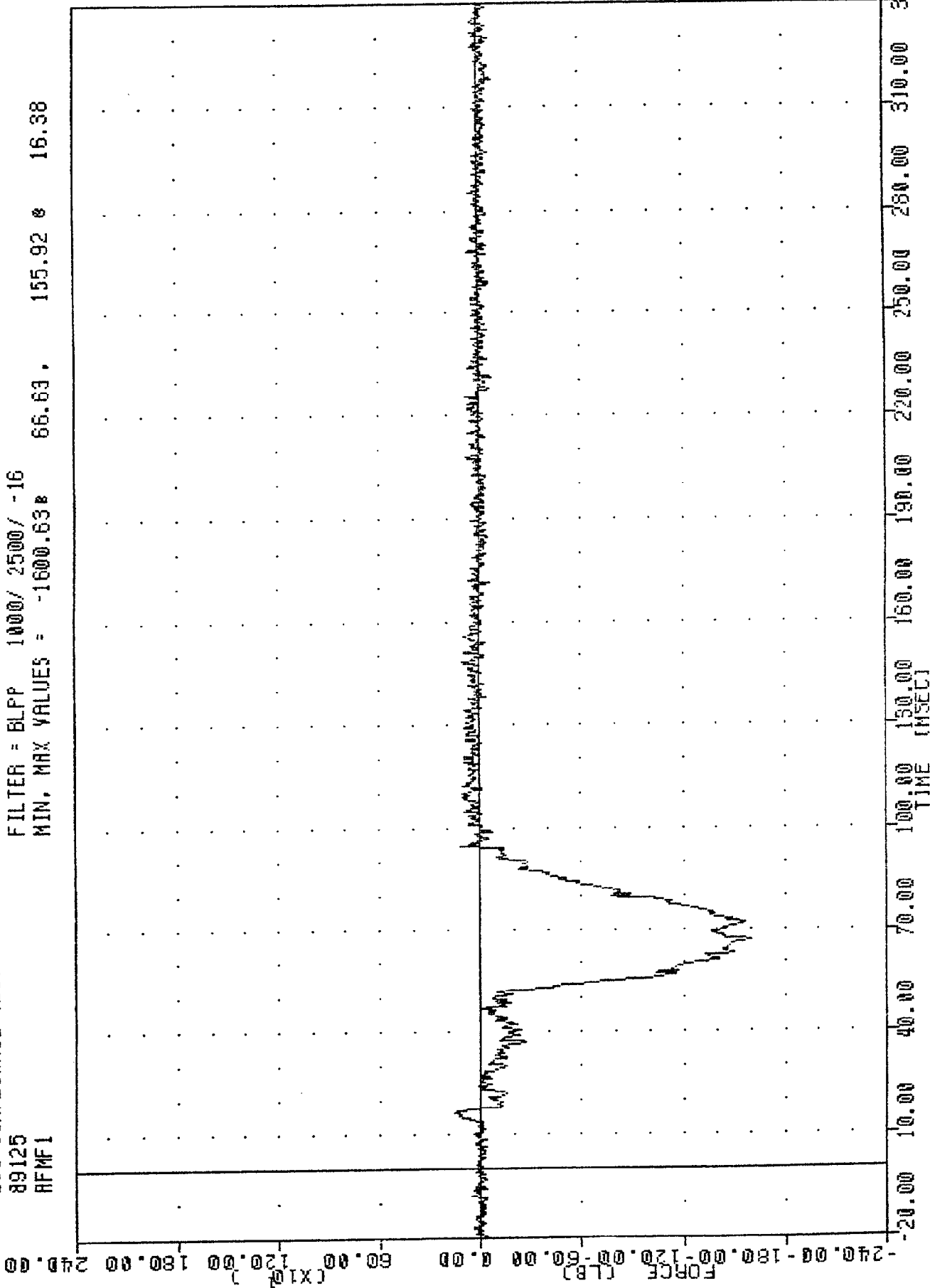
FILTER = BLFF 1000/ 2500/ -16  
MIN. MAX VALUES = -1234.95 B 73.00 , 172.73 G 15.38



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER LEFT FFMIR FORCE

TRC , 890505  
208 COMPLIANCE TEST  
89125  
AFMFI

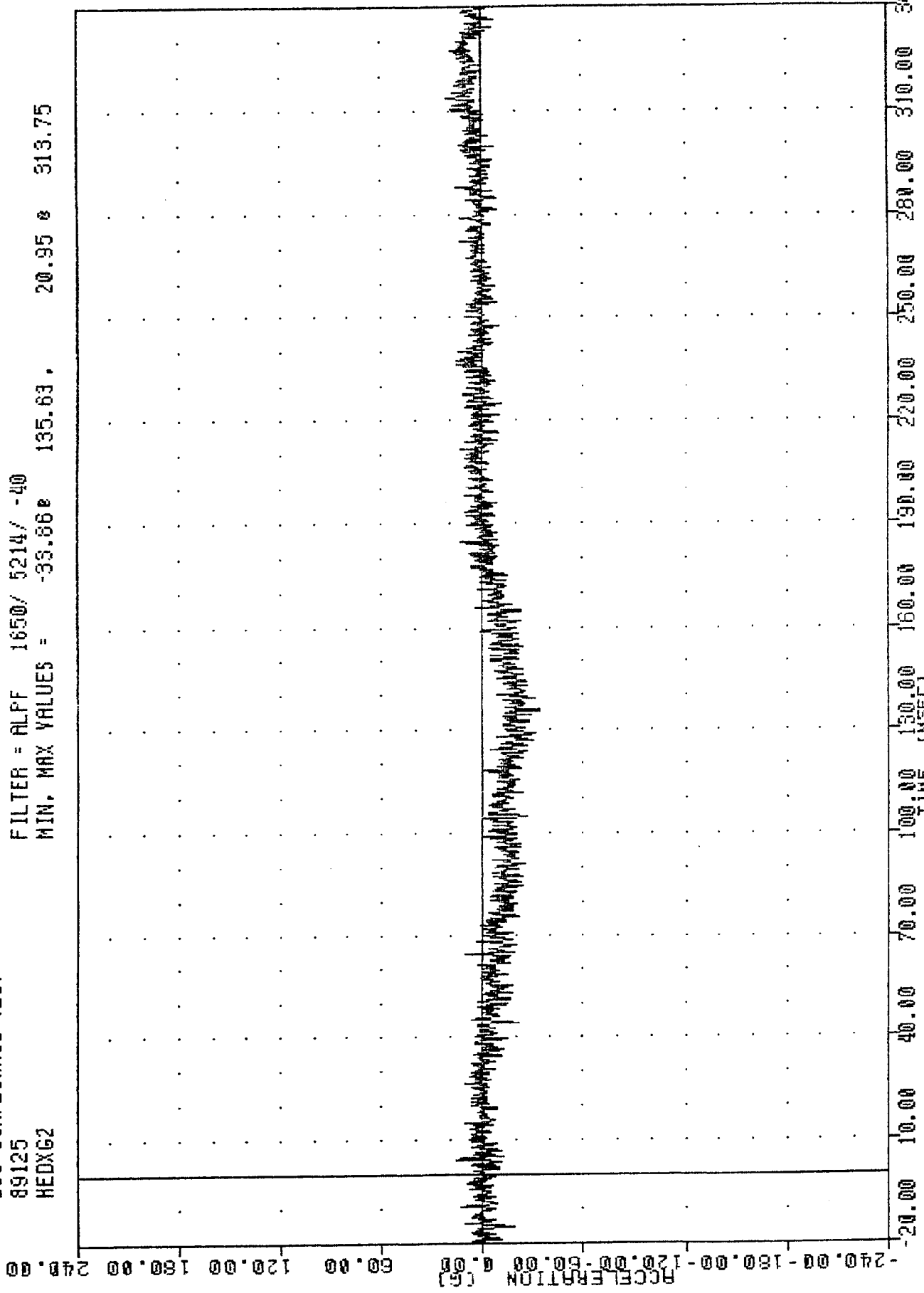
FILTER = BLPP 1000/ 2500/ -16  
MIN. MAX VALUES = -1600.63 66.63, 155.92 16.38



1989 SAAB 9000 INTO FRONTAL BARRIER  
DRIVER RIGHT FMIR FORCE

TRC  
208 COMPLIANCE TEST  
89125  
HEDX62

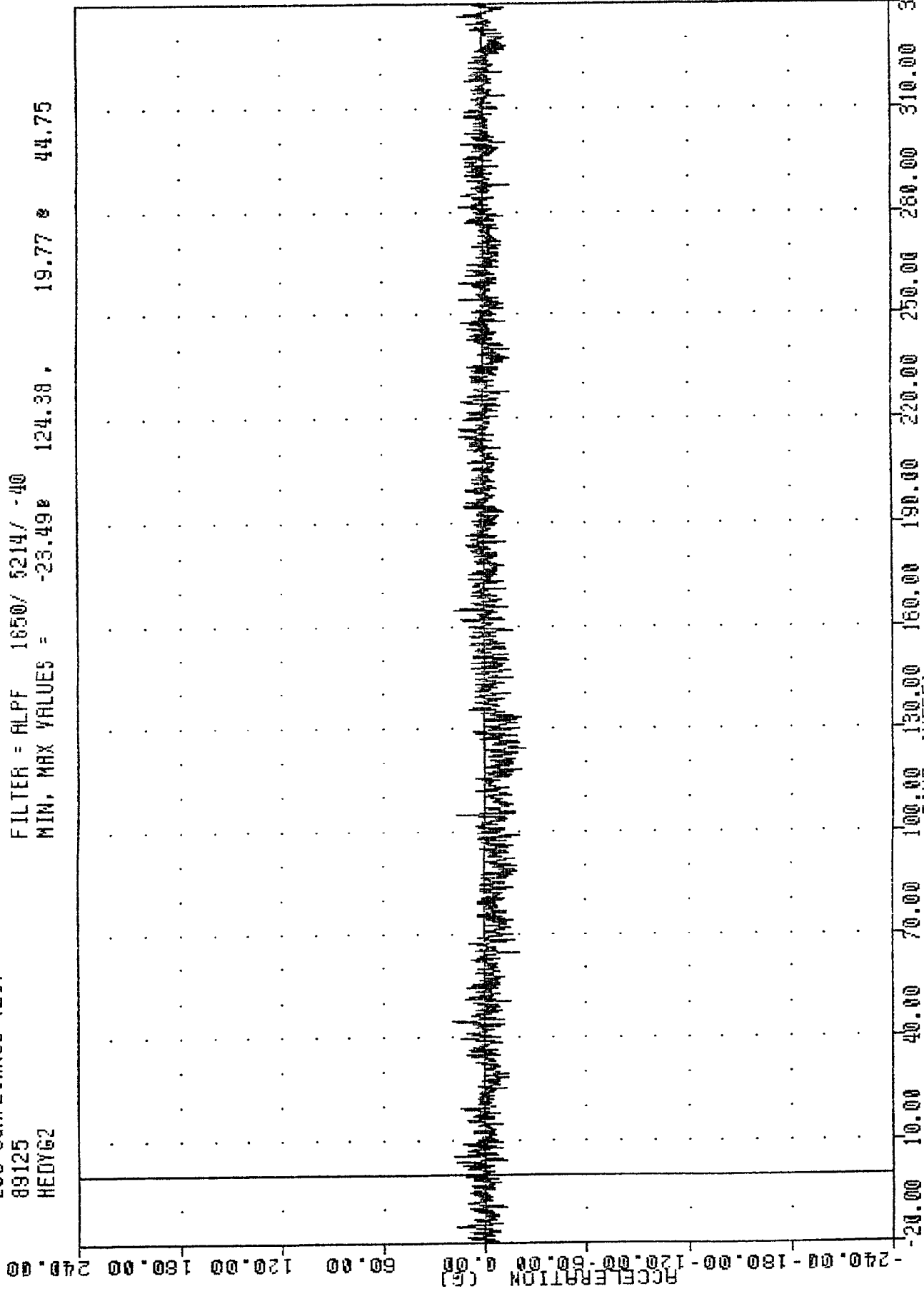
FILTER = ALPF 1650/ 5214/ -40  
MIN. MAX VALUES = -33.86 135.63 20.95 313.75



1989 SAAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER HEAD X AXIS ACCELERATION

TRC  
208 COMPLIANCE TEST  
89125  
HEDYG2

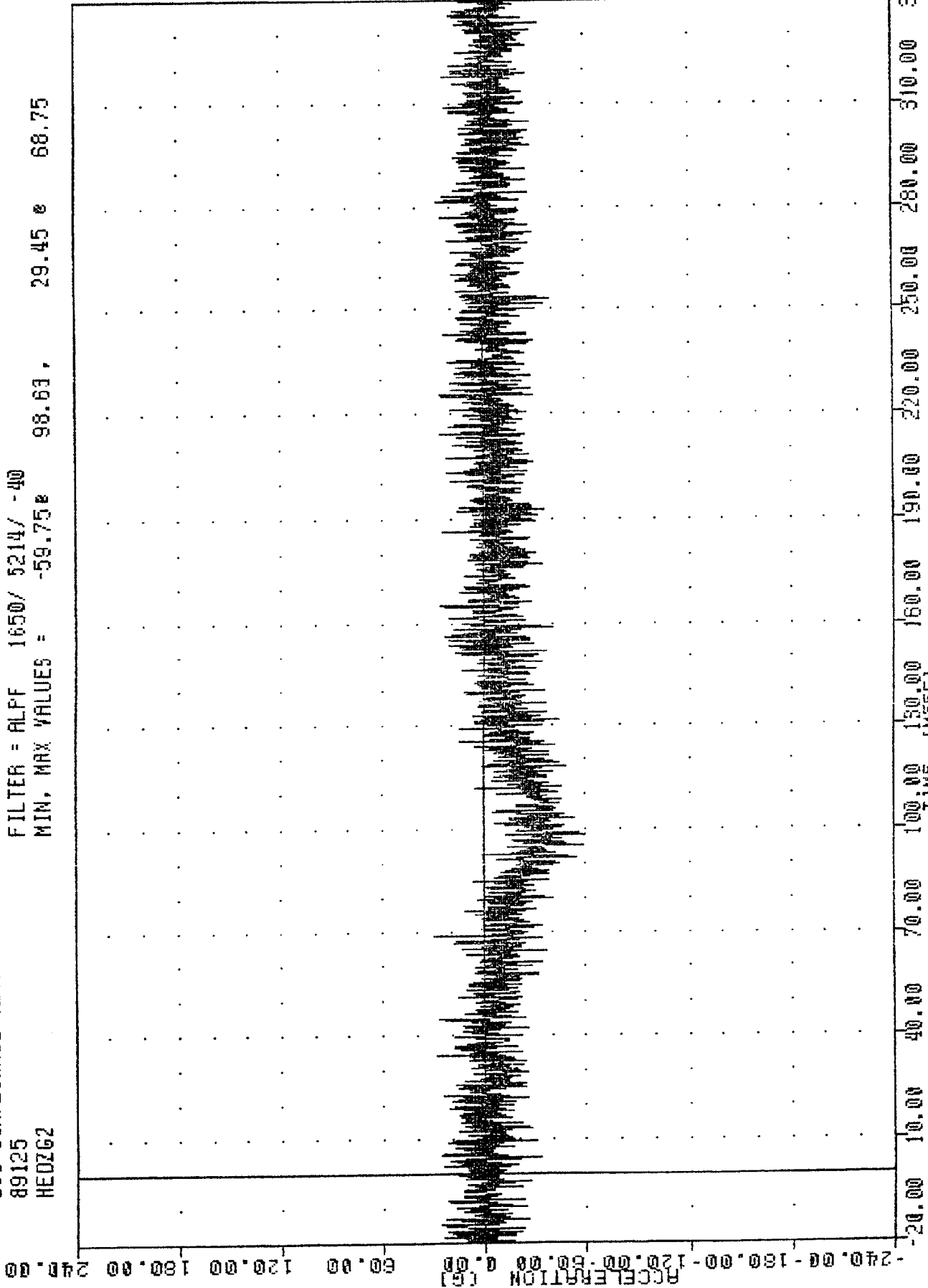
FILTER = ALPF 1650/ 5214/ -40  
MIN. MAX VALUES = -23.49 124.38 , 19.77 44.75



1989 SFRAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER HEAD Y AXIS ACCELERATION

TRC  
89125  
HEDZG2  
890505  
208 COMPLIANCE TEST

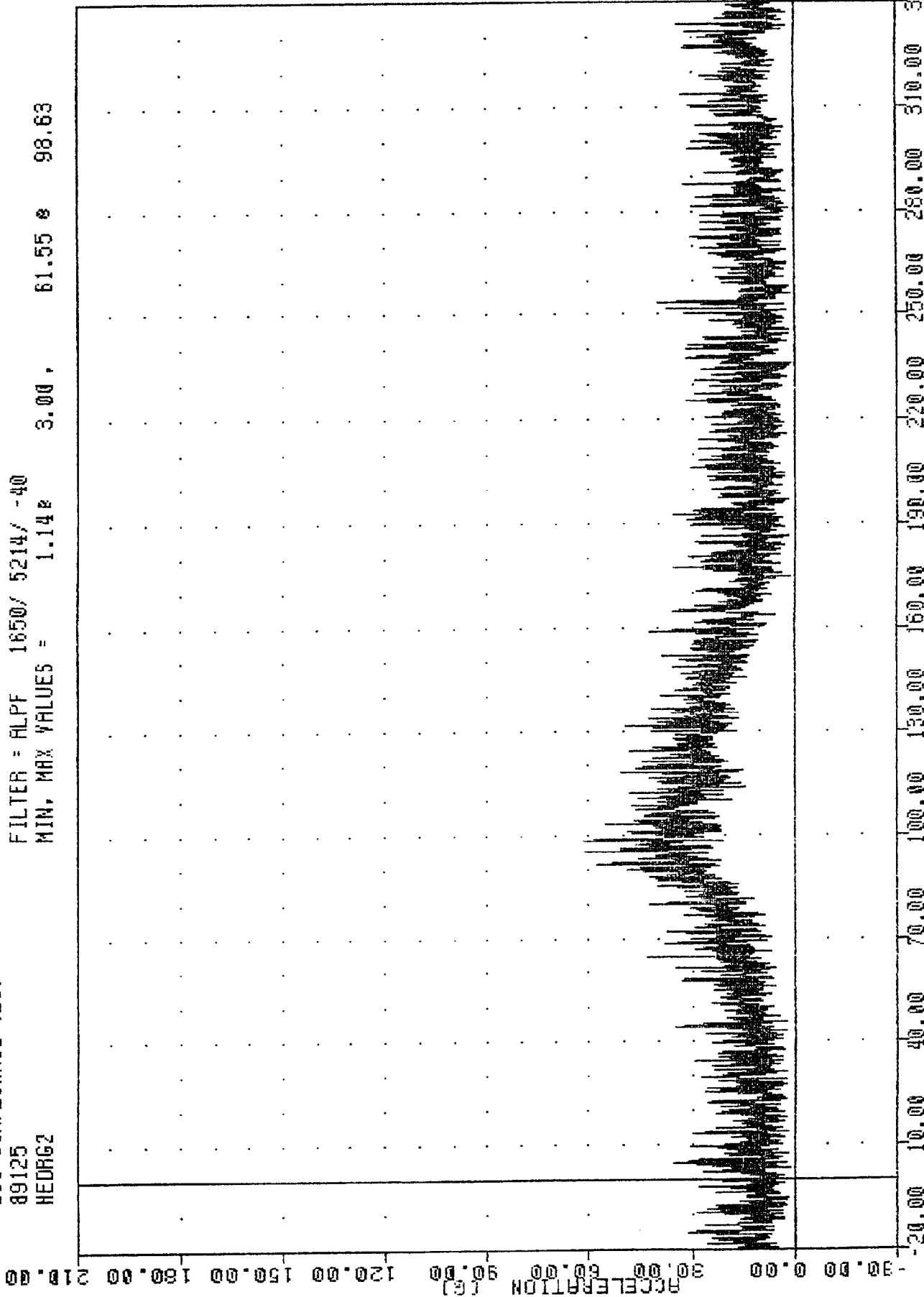
FILTER = ALPF 1650/ 5214/ -40  
MIN, MAX VALUES = -59.75e 98.63, 29.45 e 68.75



1989 SPAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER HEAD Z AXIS ACCELERATION

TRC  
206 COMPLIANCE TEST  
89125  
HEDRG2

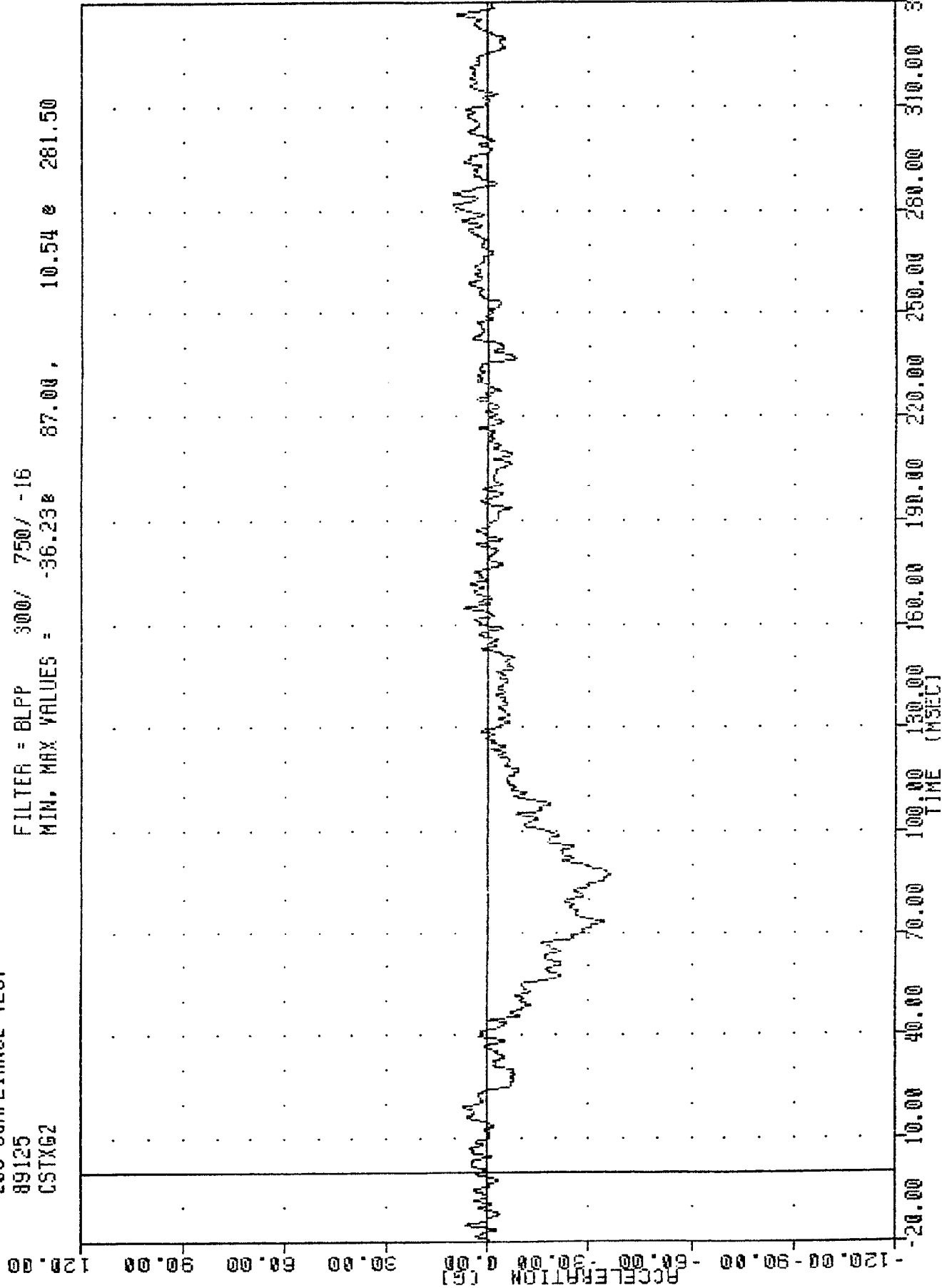
FILTER = ALPF 1650/ 5214/ -40  
MIN, MAX VALUES = 1.14e 3.00, 61.55 e 98.63



1989 SAAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

TRC . 890505  
200 COMPLIANCE TEST  
89125  
CSTXG2

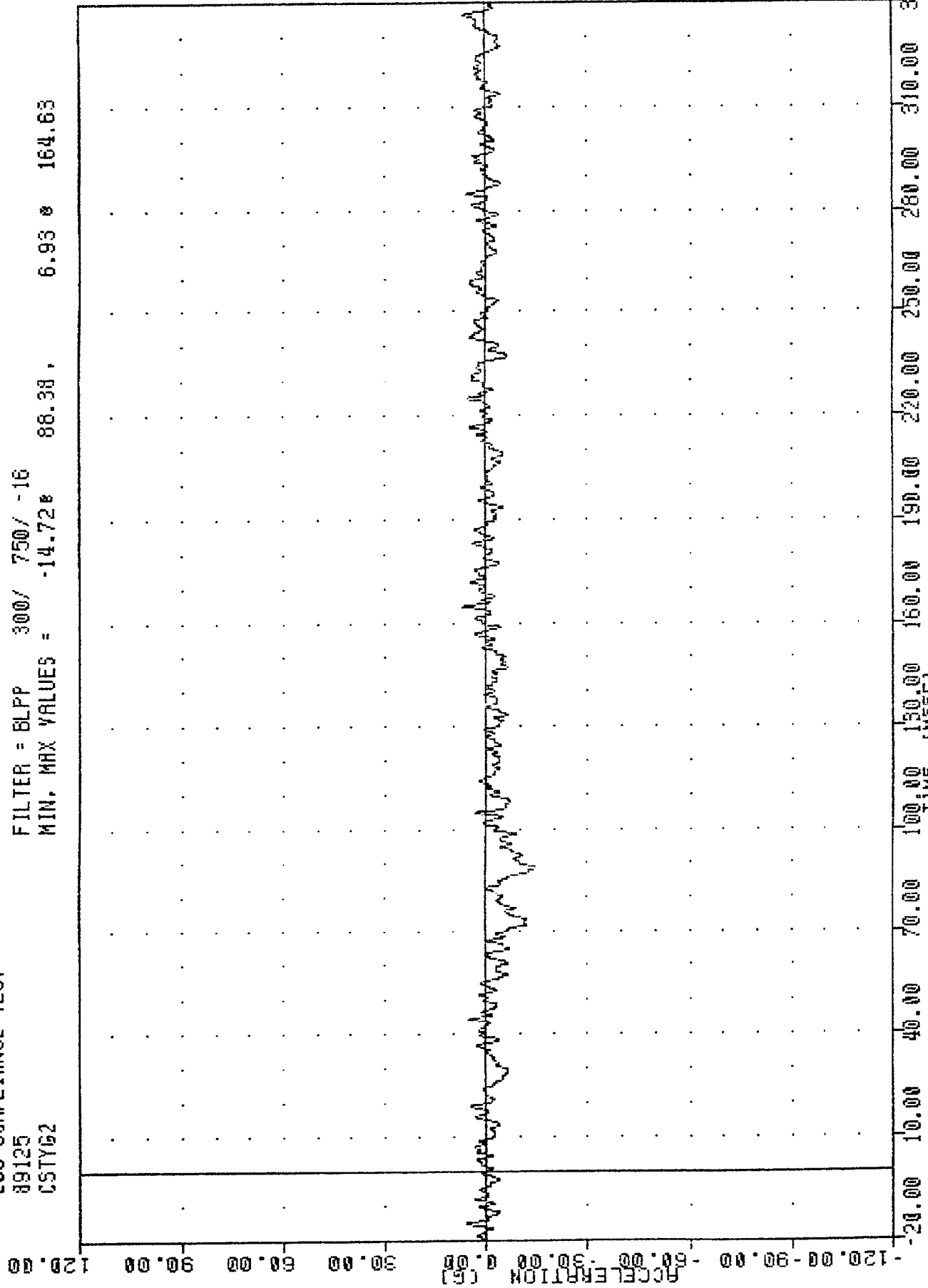
FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = -36.23e 87.00, 10.54 e 281.50



1989 SAAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER CHEST X AXIS ACCELERATION

TRC  
208 COMPLIANCE TEST  
89125  
CSTY62

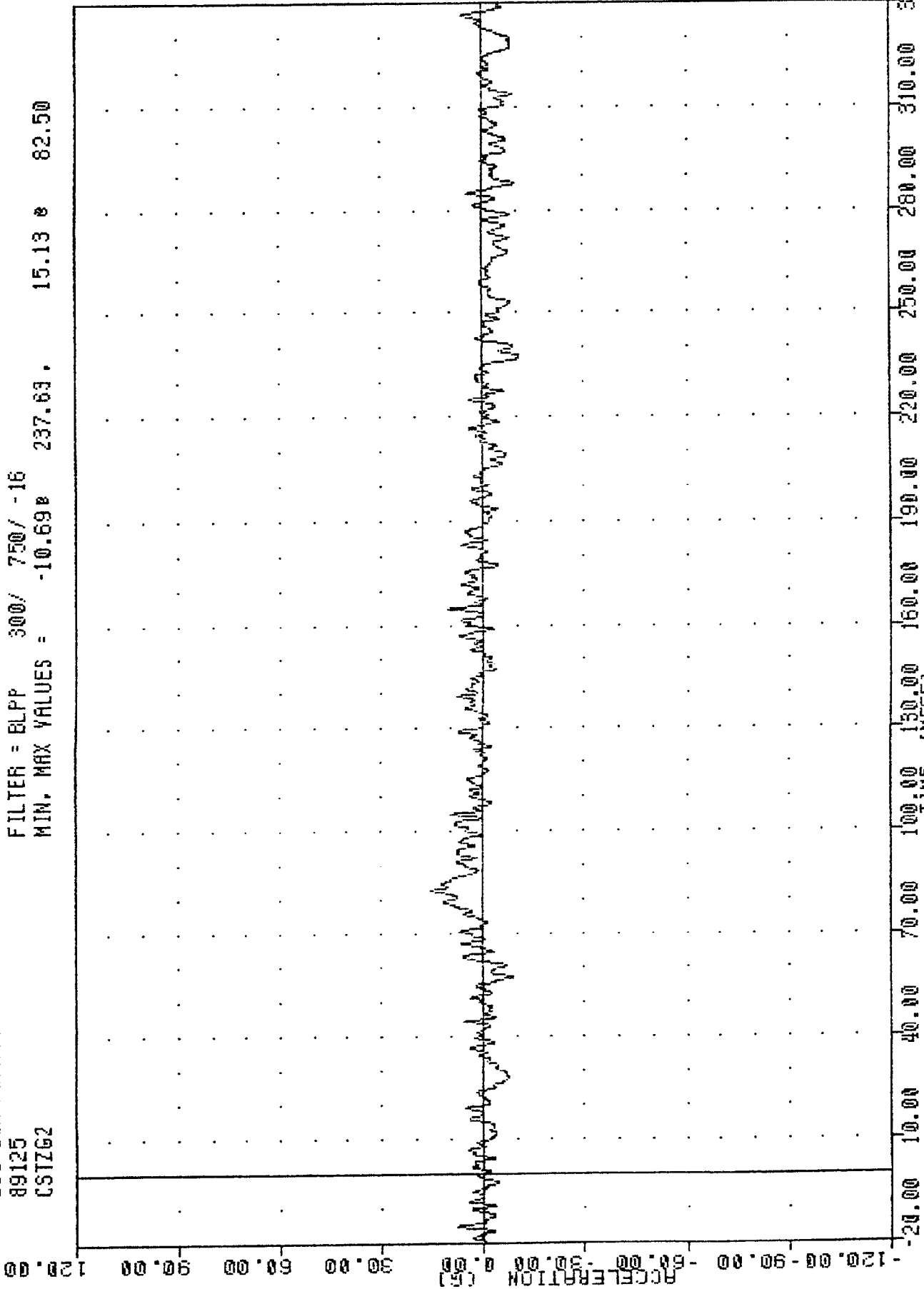
FILTER = 6LPP 300/ 750/ -16  
MIN. MAX VALUES = -14.72% 88.38 . 6.95 % 164.63



1989 SFRAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER CHEST Y AXIS ACCELERATION

TRC , 890505  
208 COMPLIANCE TEST  
89125  
CSTZG2

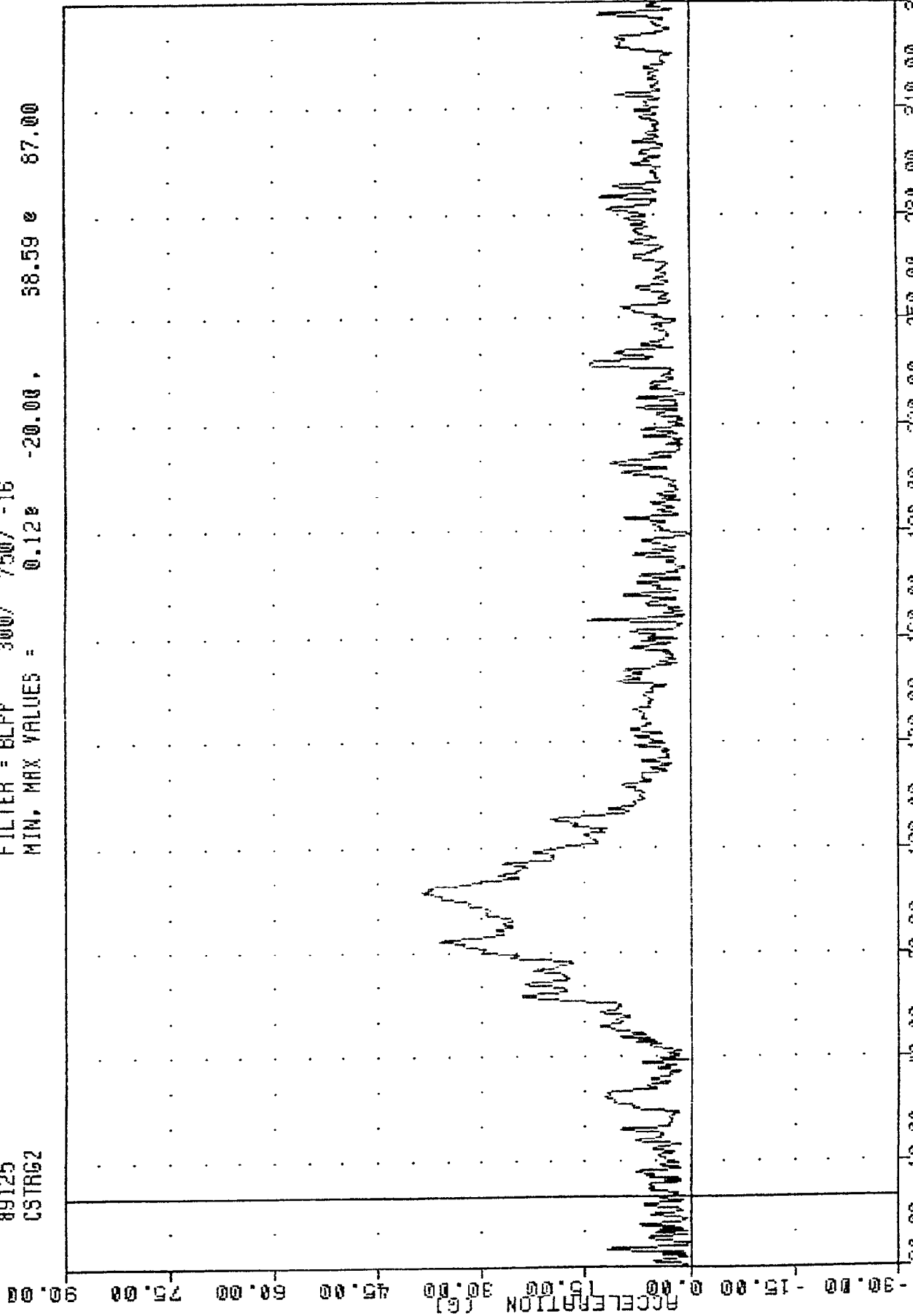
FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = -10.69# 237.63. 15.13 # 82.50



1989 SARB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER CHEST Z AXIS ACCELERATION

TRC  
208 COMPLIANCE TEST  
89125  
CSTRG2

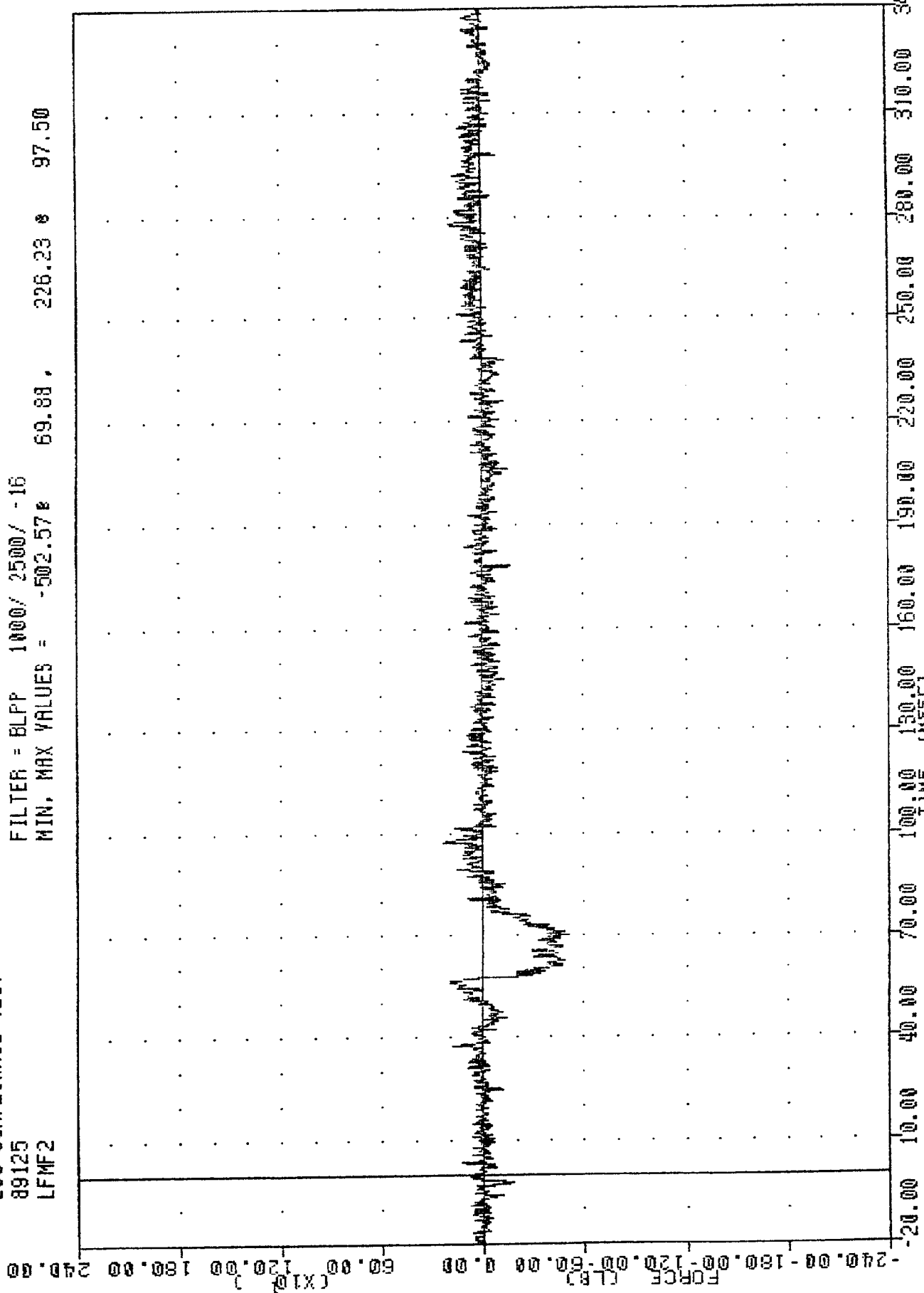
FILTER = BLPP 300/ 750/ -16  
MIN, MAX VALUES = -20.00, 58.59 e 87.00



1989 SABB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION

TRC  
208 COMPLIANCE TEST  
89125  
LFMF2

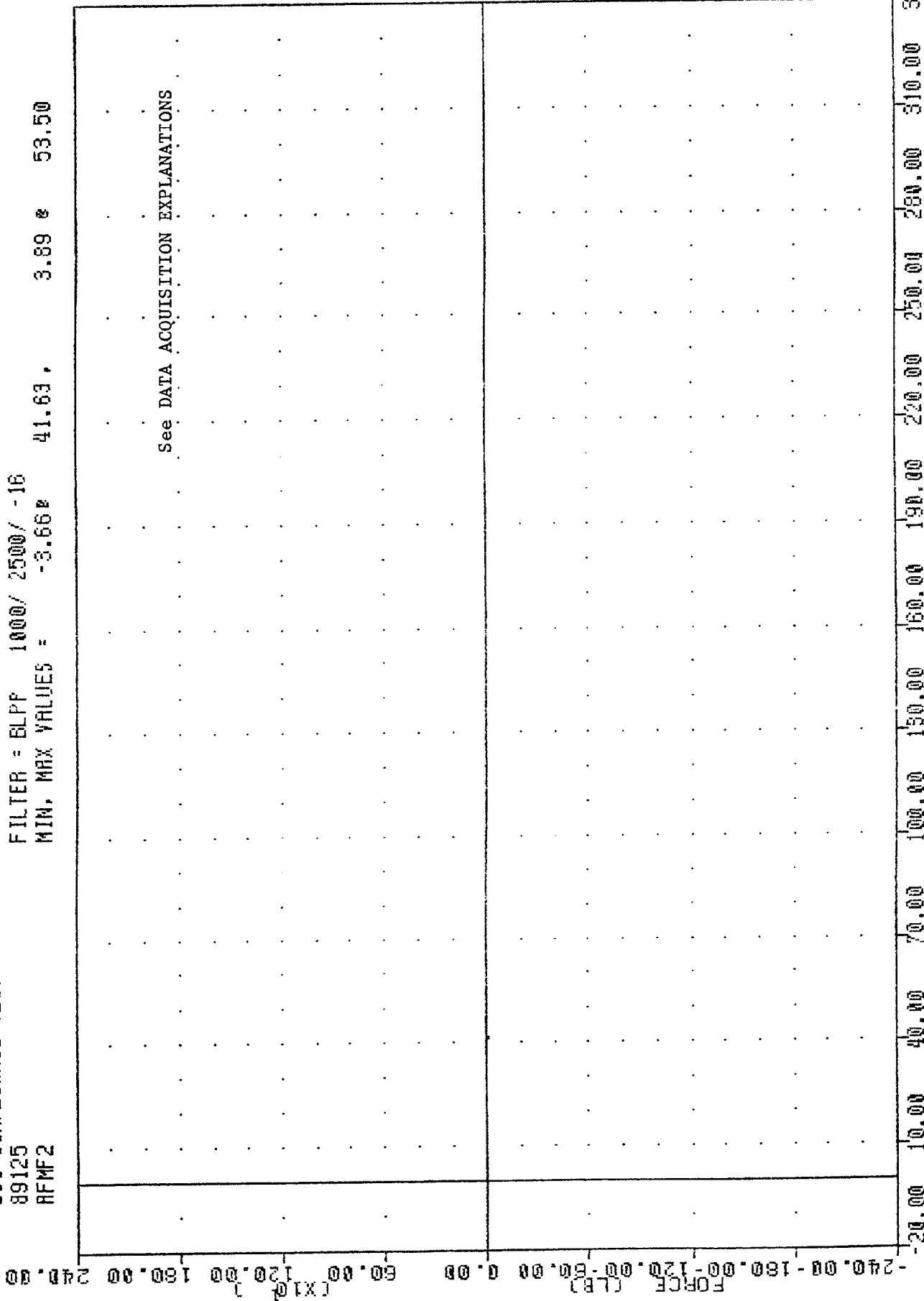
FILTER = BLPP 1000/ 2500/ -16  
MIN. MAX VALUES = -502.57 e 226.23 e 97.50



1989 SRAB 9000 INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER LEFT FEMUR FORCE

TRC , 890505  
 209 COMPLIANCE TEST  
 89125  
 RFMF2

FILTER = BLPP 1000/ 2500/ -16  
 MIN, MAX VALUES = -3.66% 41.63, 3.89 \* 53.50



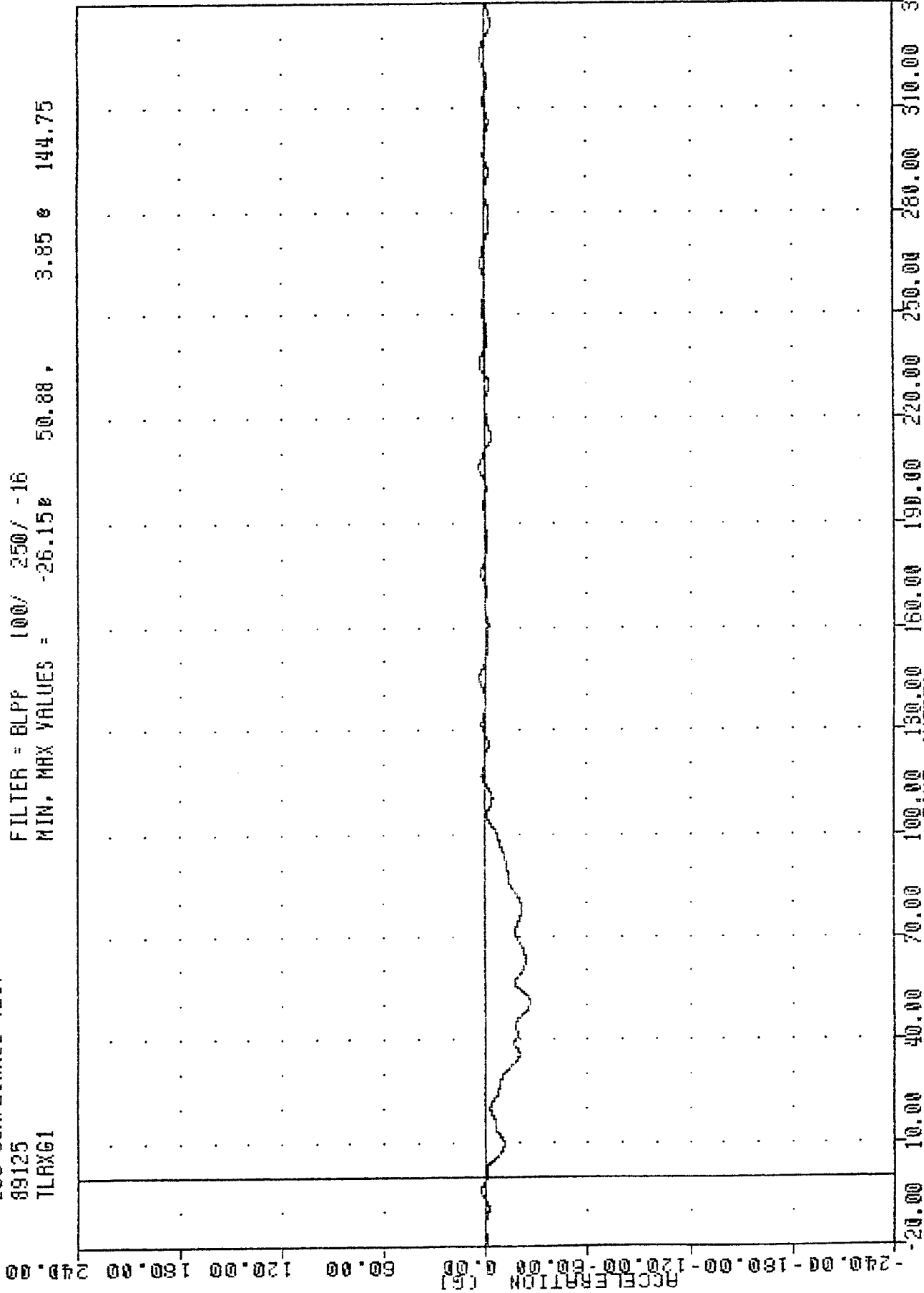
8905068

12-B

1989 SAAB 9000 INTO FRONTAL BARRIER  
 RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

TRC  
208 COMPLIANCE TEST  
89125  
TILRXG1

FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -26.15g 50.88, 3.85 g 144.75



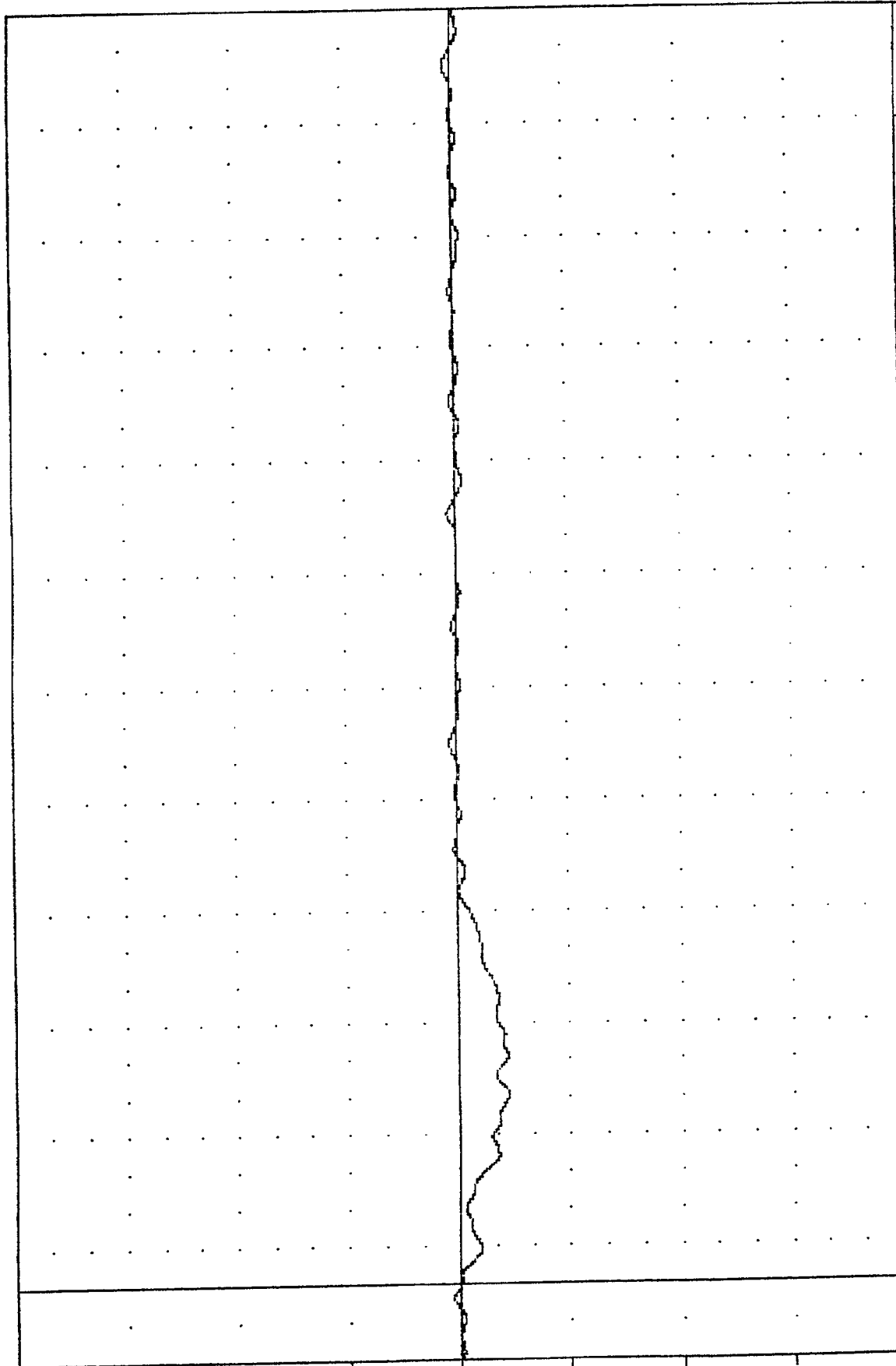
1989 SAAB 9000 INTO FRONTAL BARRIER  
LEFT REAR SEAT X AXIS ACCELERATION

TRC  
89125  
TRXG1

208 COMPLIANCE TEST

FILTER = BLFF 100/ 250/ -16  
MIN. MAX VALUES = -26.53e 51.00, 4.84 e 205.88

ACCELERATION (G)



-240.00 -180.00 -120.00 -60.00 0.00 60.00 120.00 180.00 240.00  
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00  
TIME (MSEC)

1989 SAAB 9000 INTO FRONTAL BARRIER  
RIGHT REAR SEAT X AXIS ACCELERATION

TRC 890505

208 COMPLIANCE TEST

89125

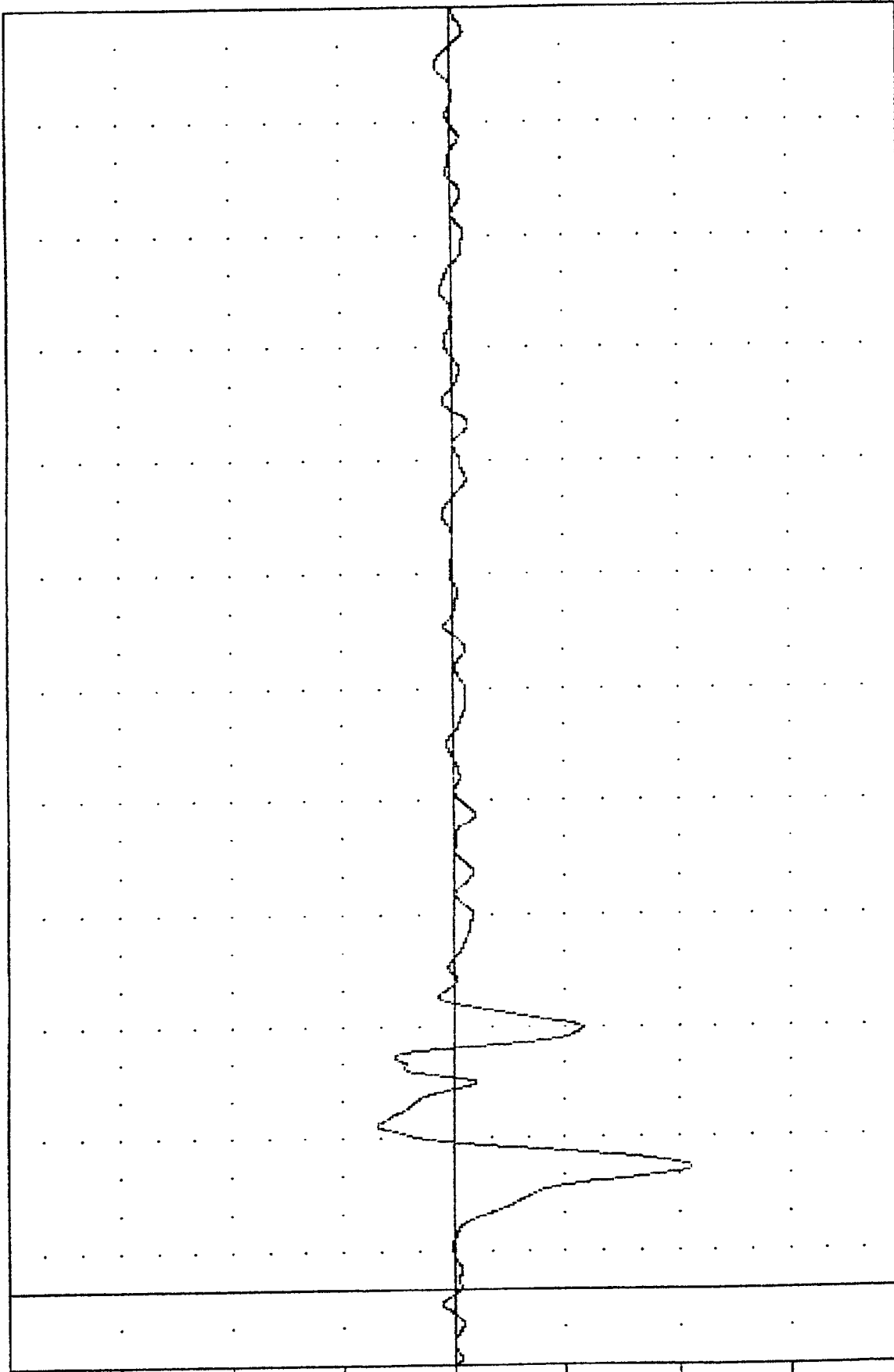
ENGXG1

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -127.50 31.88,

41.58 43.50

ACCELERATION (G)

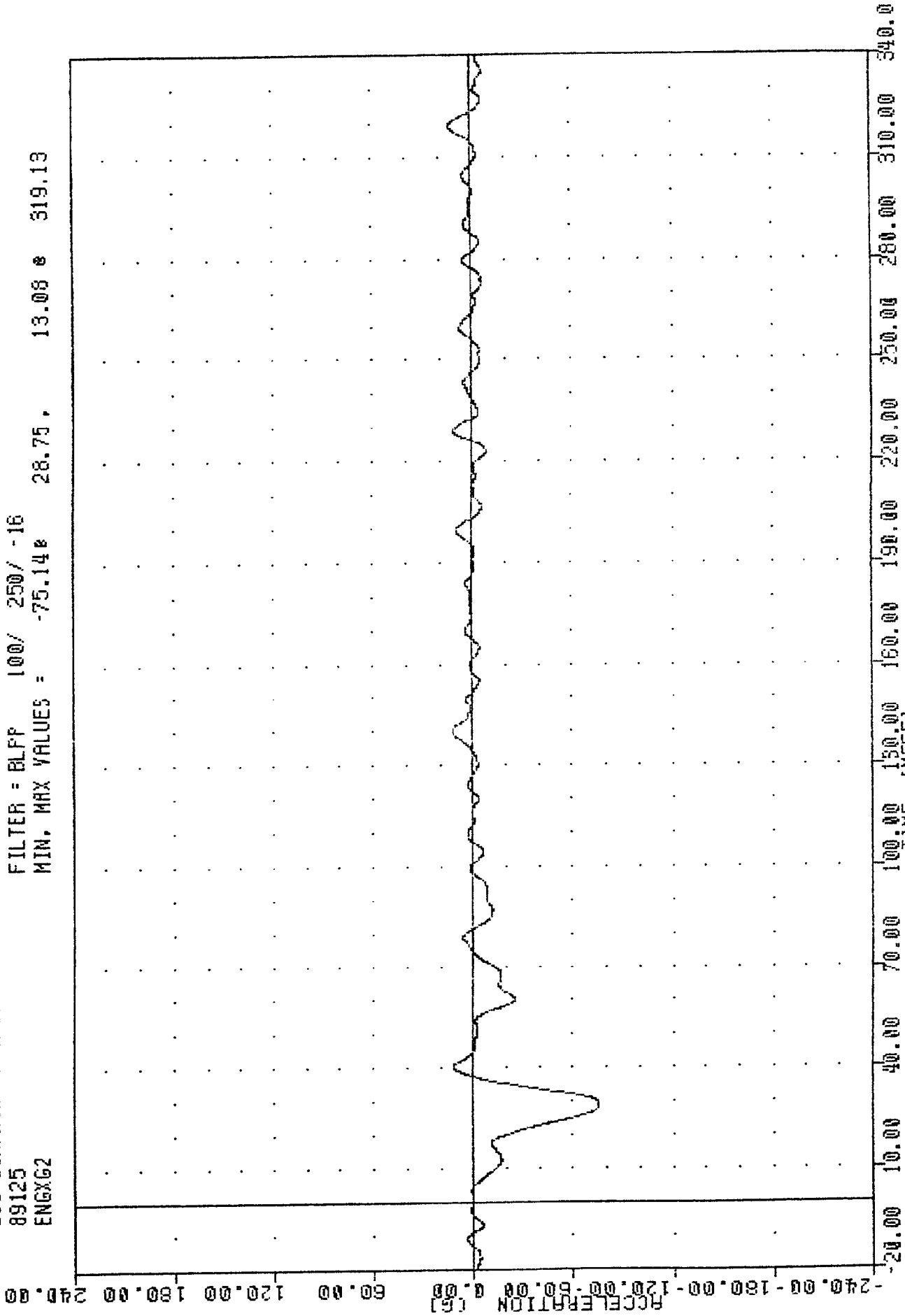


TIME (MSEC)

1989 SARB 9000 INTO FRONTAL BARRIER  
ENGINE UPPER BLOCK X AXIS ACCELERATION

TRC 890505  
208 COMPLIANCE TEST  
89125  
ENGXG2

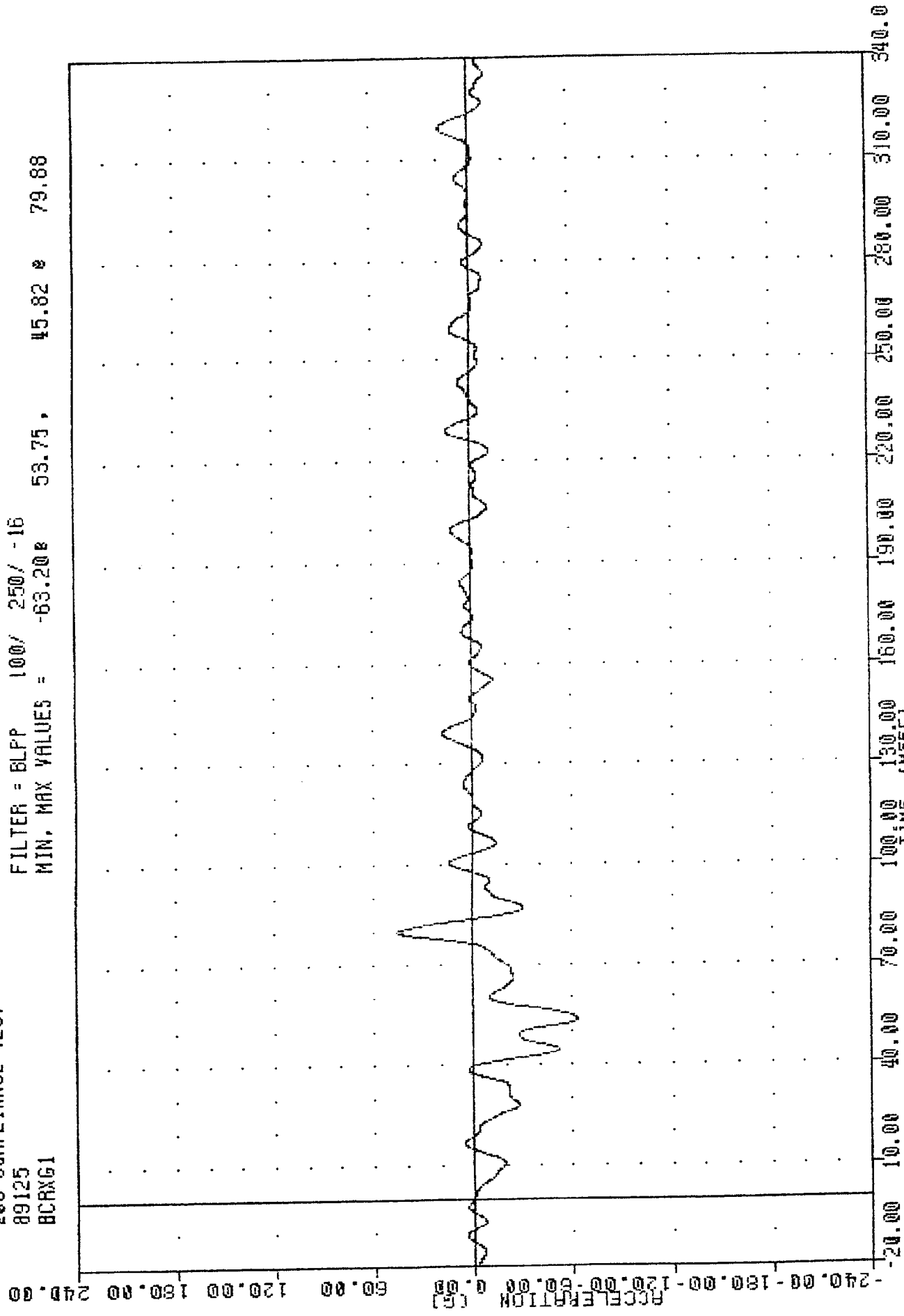
FILTER = BLFF 100/ 250/ -16  
MIN, MAX VALUES = -75.14 28.75, 13.06 319.13



1989 SARB 9000 INTO FRONTAL BARRIER  
ENGINE BOTTOM BLOCK X AXIS ACCELERATION

TRC  
890505  
208 COMPLIANCE TEST  
89125  
BCRXG1

FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -63.20e 45.82 e 79.88



1989 SAAB 9000 INTO FRONTAL BARRIER  
RIGHT BRAKE CALIPER X AXIS ACCELERATION

TAC 890505

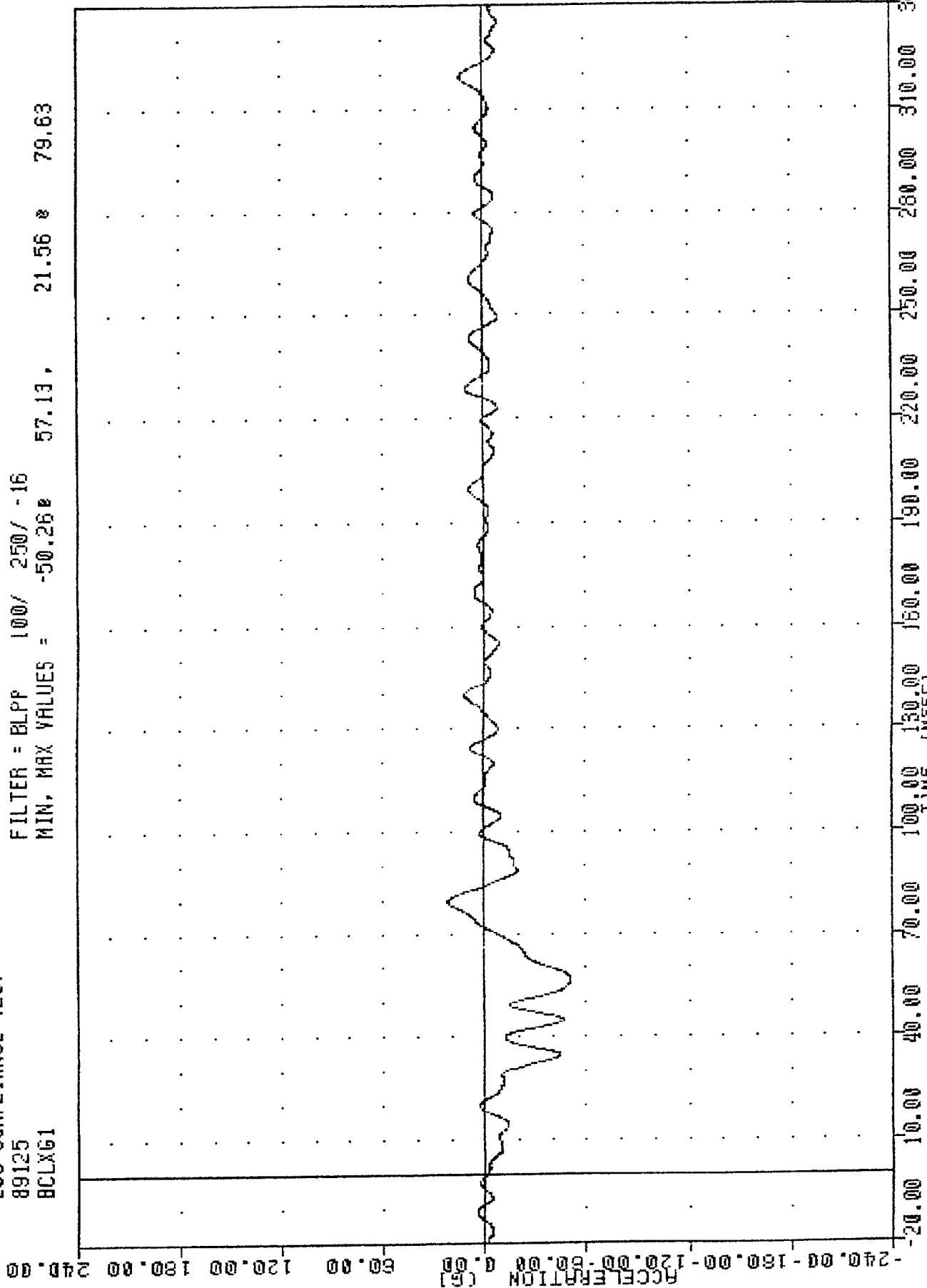
208 COMPLIANCE TEST

89125

BCLXG1

FILTER = BLPP 100/ 250/ -16

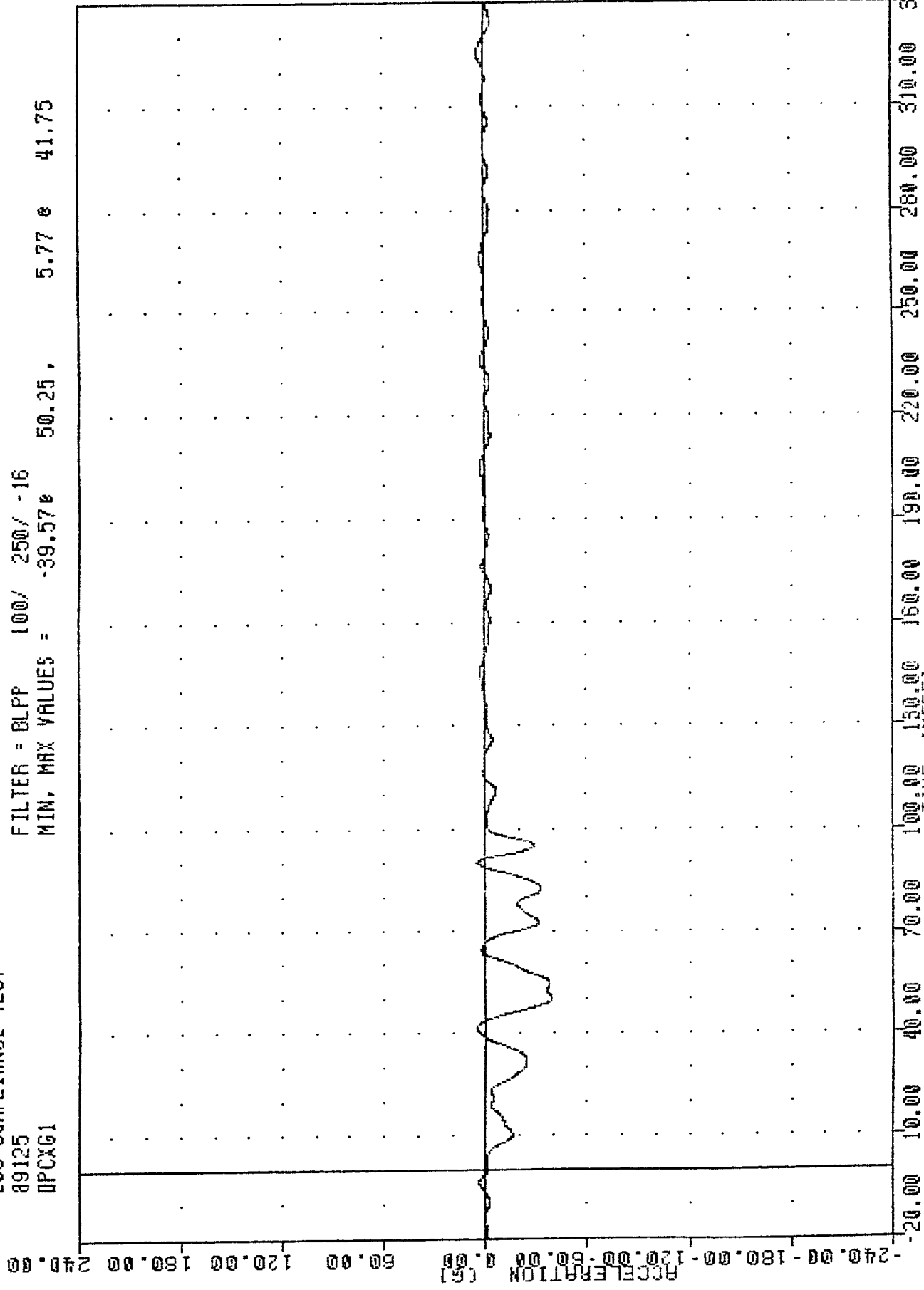
MIN, MAX VALUES = -50.26 57.13, 21.56 79.63



1989 SAAB 9000 INTO FRONTAL BARRIER  
LEFT BRAKE CALIPER X AXIS ACCELERATION

TRC , 890505  
208 COMPLIANCE TEST  
89125  
0PCXG1

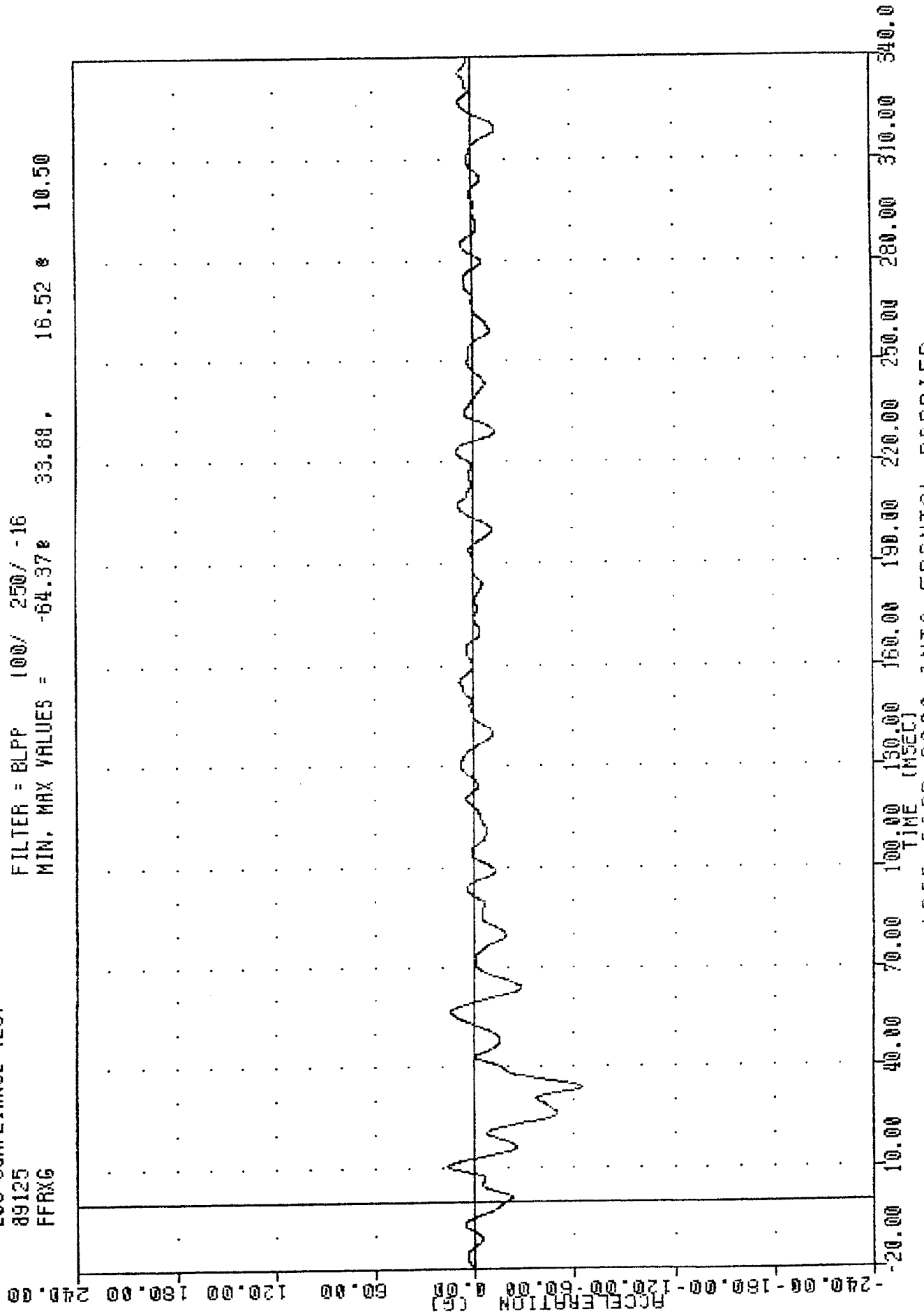
FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -39.57% 50.25, 5.77 @ 41.75



1989 SAAB 9000 INTO FRONTAL BARRIER  
DASH PANEL CENTER X AXIS ACCELERATION

TRC  
89125  
208 COMPLIANCE TEST  
FFRXG

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -64.37e 33.68. 16.52 e 10.50

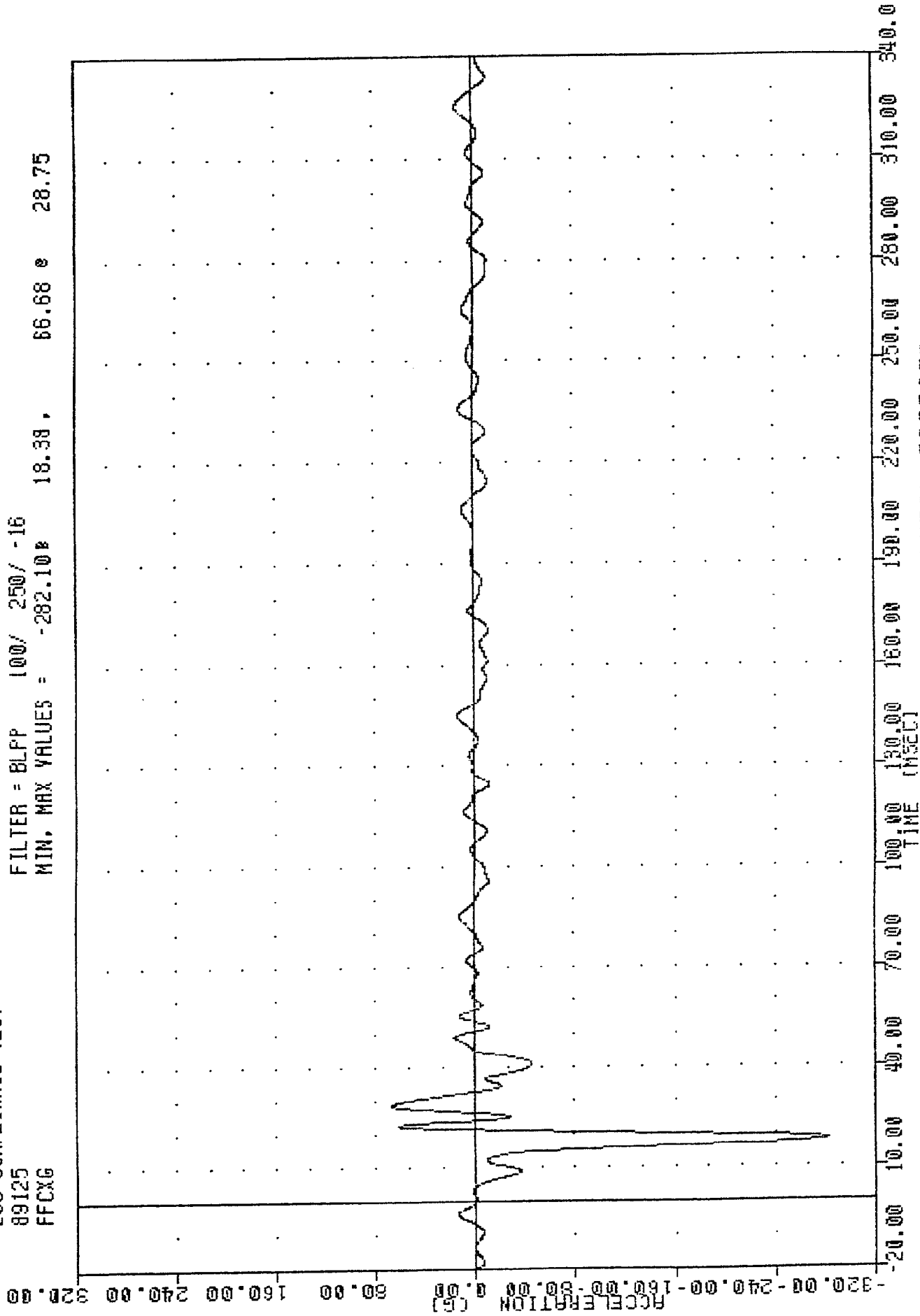


1989 SAB 9000 INTO FRONTAL BARRIER  
FRONT FRAME RAIL X AXIS ACCELERATION

TRC 890505  
208 COMPLIANCE TEST

89125  
FFCXG

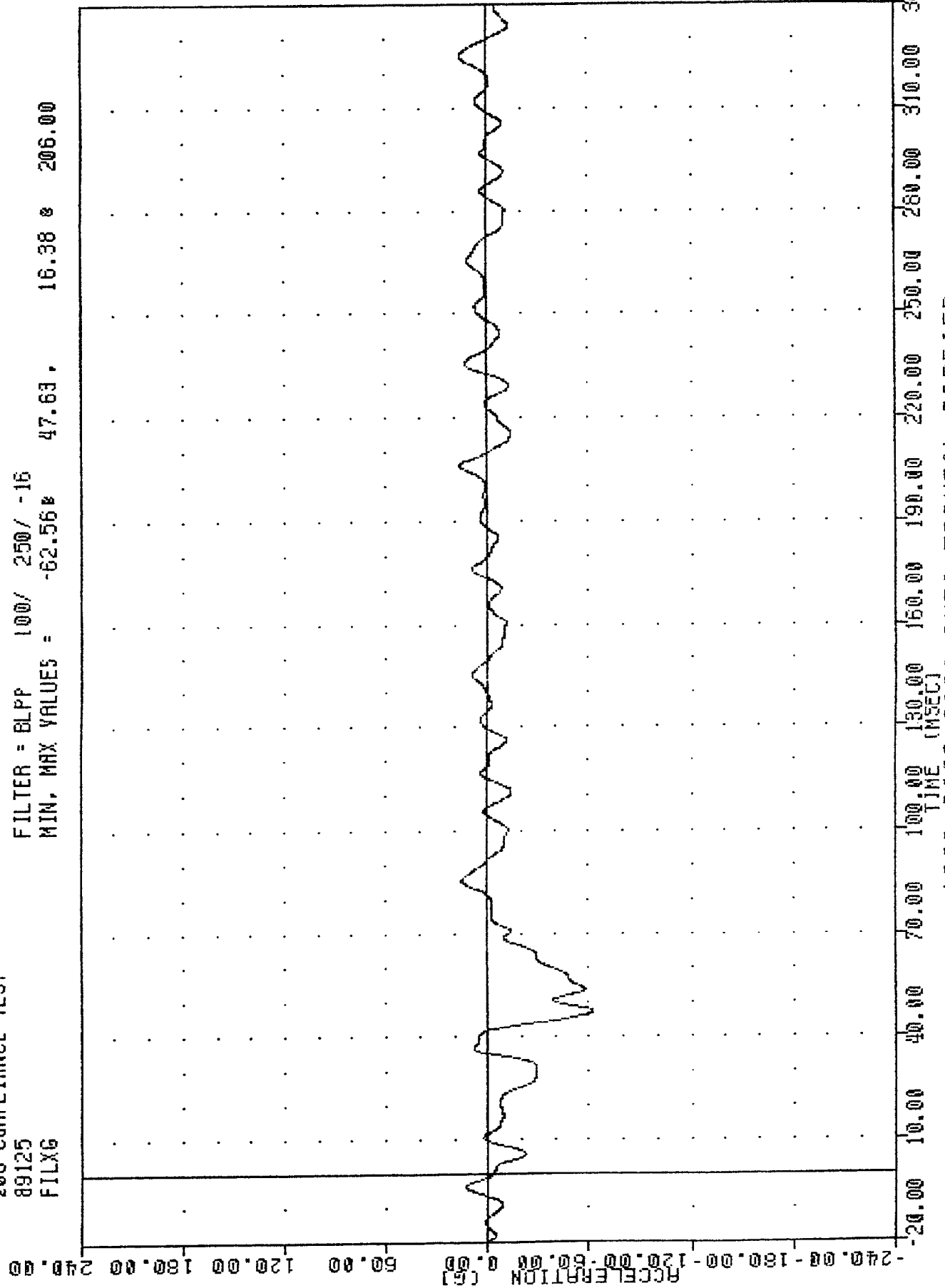
FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -282.10 18.38, 66.68 28.75



1989 SAB 9000 INTO FRONTAL BARRIER  
FRONT FRAME CROSSMEMBER X AXIS ACCELERATION

TRC 890505  
208 COMPLIANCE TEST  
89125  
FILXG

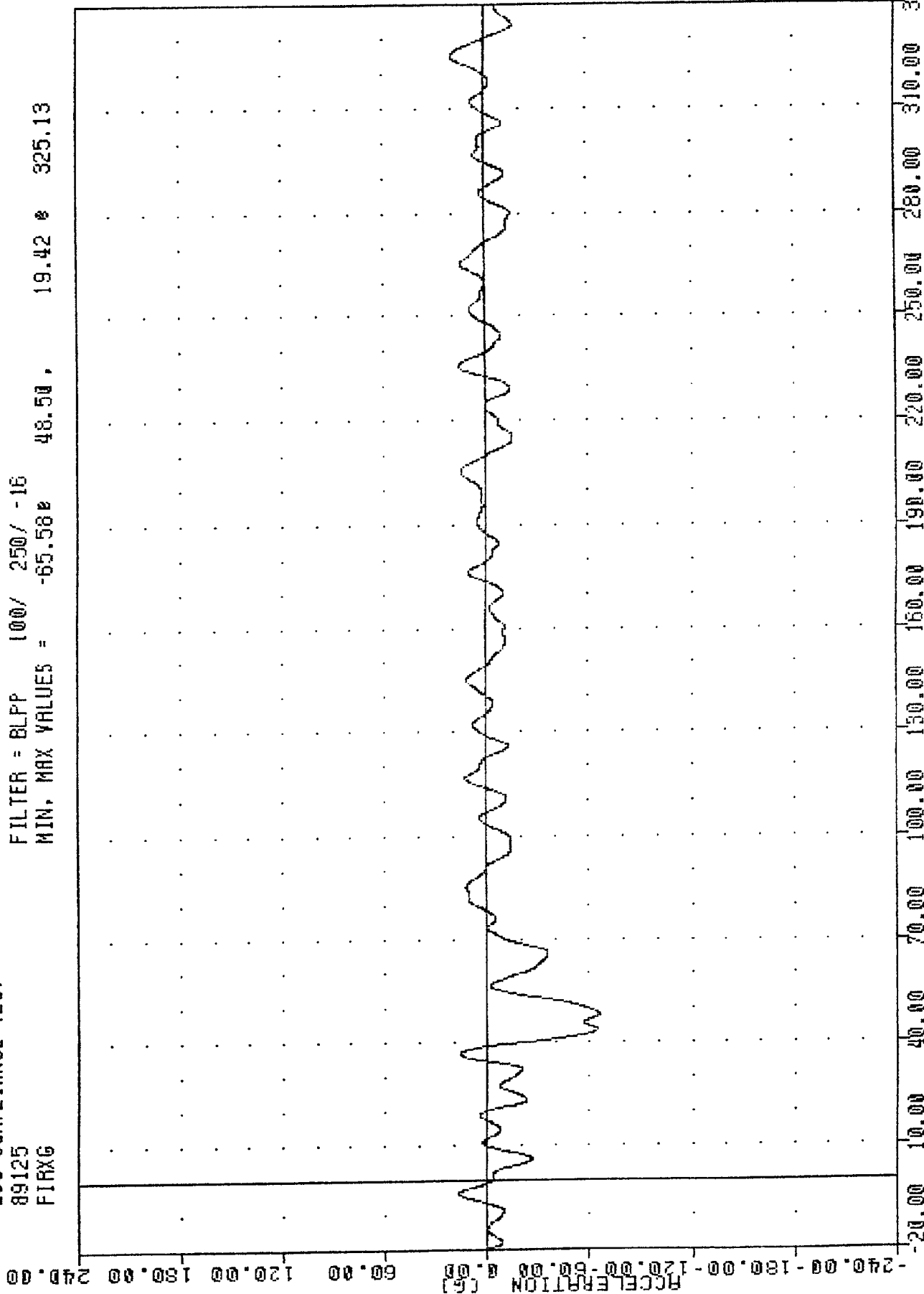
FILTER = BLPP 100/ 250/ -16  
MIN, MAX VALUES = -62.56% 47.63, 16.38 % 206.00



1989 SARB 9000 INTO FRONTAL BARRIER  
LEFT FENDER WELL INSIDE X AXIS ACCELERATION

TRC , 890505  
208 COMPLIANCE TEST  
89125  
FIRXG

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -65.58g 48.50 , 19.42 g 325.13



1989 SAAB 9000 INTO FRONTAL BARRIER  
RIGHT SHOCK TOWER X AXIS ACCELERATION