

REPORT NOS. 208-TRC-89-006  
212-TRC-89-006  
301-TRC-89-006

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

SAAB-SCANIA  
1989 SAAB 900S  
3-DOOR HATCHBACK  
NHTSA NO. CK0505  
TRC TEST NO. 890403

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



APRIL 19, 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

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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |                                                             |                                                                                                                                                                                                                 |                                                                                                   |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--|
| 1. Report No. <b>208-TRC-89-006</b><br><b>212-TRC-89-006</b><br><b>301-TRC-89-006</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  | 2. Government Accession No.                                 |                                                                                                                                                                                                                 | 3. Recipient's Catalog No.                                                                        |  |
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| 16. Abstract<br>A 30 mph flat frontal barrier impact compliance test was conducted on a 1989 Saab 900S 3-door hatchback, VIN YS3AS35D1K3009750, NHTSA No. CK0505, at the Transportation Research Center of Ohio on April 3, 1989. This test was conducted to determine compliance with Federal Motor Vehicle Safety Standards:<br>FMVSS No. 208, "Occupant Crash Protection"<br>FMVSS No. 212, "Windshield Mounting"<br>FMVSS No. 219, (Partial), "Windshield Zone Intrusion"<br>FMVSS No. 301, "Fuel System Integrity"<br>The barrier impact velocity was 29.6 mph.<br>The ambient temperature was 72° F.<br>The vehicle appears to comply with the applicable requirements of FMVSS Nos. 208, 212, 219 (partial), and 301. |  |                                                             |                                                                                                                                                                                                                 |                                                                                                   |  |
| 17. Key Words <b>Frontal Impact<br/>30 mph Vehicle Safety Compliance Testing:<br/>FMVSS 208, "Occupant Crash Protection"<br/>FMVSS 212, "Windshield Mounting"<br/>FMVSS 219, "Windshield Zone Intrusion"<br/>FMVSS 301, "Fuel System Integrity"</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |                                                             | 18. Distribution Statement <b>Available from:<br/>Technical Reference Division<br/>National Highway Traffic Safety Admin<br/>Nassif Building, Room 5108<br/>400 Seventh Street, SW<br/>Washington, DC 20590</b> |                                                                                                   |  |
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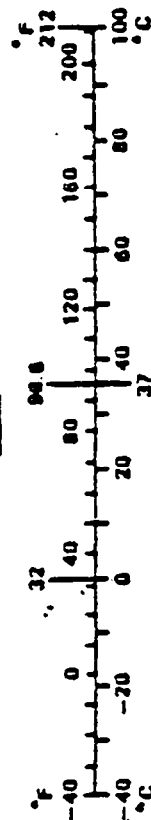
# METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

| Symbol                     | When You Know      | Multiply by                | To Find            | Symbol          |
|----------------------------|--------------------|----------------------------|--------------------|-----------------|
| <b>LENGTH</b>              |                    |                            |                    |                 |
| in                         | inches             | 2.5                        | centimeters        | cm              |
| ft                         | feet               | 30                         | centimeters        | cm              |
| yd                         | yards              | 0.9                        | meters             | m               |
| mi                         | miles              | 1.6                        | kilometers         | km              |
| <b>AREA</b>                |                    |                            |                    |                 |
| in <sup>2</sup>            | square inches      | 6.5                        | square centimeters | cm <sup>2</sup> |
| ft <sup>2</sup>            | square feet        | 0.09                       | square meters      | m <sup>2</sup>  |
| yd <sup>2</sup>            | square yards       | 0.8                        | square meters      | m <sup>2</sup>  |
| mi <sup>2</sup>            | square miles       | 2.6                        | square kilometers  | km <sup>2</sup> |
| acres                      | acres              | 0.4                        | hectares           | ha              |
| <b>MASS (weight)</b>       |                    |                            |                    |                 |
| oz                         | ounces             | 28                         | grams              | g               |
| lb                         | pounds             | 0.45                       | kilograms          | kg              |
|                            | short tons         | 0.9                        | metric ton         | t               |
|                            | (2000 lb)          |                            |                    |                 |
| <b>VOLUME</b>              |                    |                            |                    |                 |
| tsp                        | teaspoons          | 5                          | milliliters        | ml.             |
| Tbsp                       | tablespoons        | 15                         | milliliters        | ml.             |
| in <sup>3</sup>            | cubic inches       | 16                         | milliliters        | ml.             |
| fl oz                      | fluid ounces       | 30                         | milliliters        | ml.             |
| c                          | cups               | 0.24                       | liters             | L               |
| pt                         | pints              | 0.47                       | liters             | L               |
| qt                         | quarts             | 0.95                       | liters             | L               |
| gal                        | gallons            | 3.8                        | liters             | L               |
| ft <sup>3</sup>            | cubic feet         | 0.03                       | cubic meters       | m <sup>3</sup>  |
| yd <sup>3</sup>            | cubic yards        | 0.76                       | cubic meters       | m <sup>3</sup>  |
| <b>TEMPERATURE (exact)</b> |                    |                            |                    |                 |
| °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          |
|----------------------------|--------------------------|-------------------|--------------------|-----------------|
| <b>LENGTH</b>              |                          |                   |                    |                 |
| 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              |
| <b>AREA</b>                |                          |                   |                    |                 |
| cm <sup>2</sup>            | square centimeters       | 0.16              | square inches      | in <sup>2</sup> |
| m <sup>2</sup>             | square meters            | 1.2               | square yards       | yd <sup>2</sup> |
| km <sup>2</sup>            | square kilometers        | 0.4               | square miles       | mi <sup>2</sup> |
| ha                         | hectares                 | 2.5               | acres              | acres           |
|                            | (10 000 m <sup>2</sup> ) |                   |                    |                 |
| <b>MASS (weight)</b>       |                          |                   |                    |                 |
| g                          | grams                    | 0.035             | ounces             | oz              |
| kg                         | kilograms                | 2.2               | pounds             | lb              |
| t                          | metric ton               | 1.1               | short tons         |                 |
|                            | (1000 kg)                |                   |                    |                 |
| <b>VOLUME</b>              |                          |                   |                    |                 |
| ml.                        | milliliters              | 0.03              | fluid ounces       | fl oz           |
| ml.                        | milliliters              | 0.06              | cubic inches       | in <sup>3</sup> |
| L                          | liters                   | 2.1               | pints              | pt              |
| L                          | liters                   | 1.06              | quarts             | qt              |
| L                          | liters                   | 0.26              | gallons            | gal             |
| m <sup>3</sup>             | cubic meters             | 35                | cubic feet         | ft <sup>3</sup> |
| m <sup>3</sup>             | cubic meters             | 1.3               | cubic yards        | yd <sup>3</sup> |
| <b>TEMPERATURE (exact)</b> |                          |                   |                    |                 |
| °C                         | degrees Celsius          | 9/5 (then add 32) | degrees Fahrenheit | °F              |



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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 900S 3-door hatchback, NHTSA No. CK0505, 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 900S 3-door hatchback, NHTSA No. CK0505, was equipped with a 2.0 liter, inline engine, manual transmission, power steering, and power brakes. The test weight of the vehicle was 3290 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. There was 100 percent windshield retention. 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 April 3, 1989. The test vehicle's impact speed was 29.6 mph. The vehicle sustained 20.4 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.:                    | CK0505                          | PROJECT:             | 208 Compliance        |
| DATE:                         | 4/03/89                         | TIME:                | 1320      TEMP: 72° F |
| VEHICLE:                      | 1989 Saab 900S 3-door hatchback |                      |                       |
| TEST WEIGHT (LBS):            | 3290                            |                      |                       |
| IMPACT ANGLE (DEG)*:          | 0                               |                      |                       |
| IMPACT VELOCITY (MPH)**:      | PRIMARY = 29.6                  | SECONDARY =          | 29.6                  |
| MAXIMUM STATIC CRUSH (IN):    | 20.4                            |                      |                       |
| VEHICLE REBOUND (IN):         | 11.5                            |                      |                       |
| DUMMIES:                      | Driver #690                     | Passenger            | #353                  |
| TYPE:                         | Part 572 B                      | Part 572 B           |                       |
| LOCATION:                     | Left front                      | Right front          |                       |
| RESTRAINT:                    | 2-point passive belt            | 2-point passive belt |                       |
| 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 900S

VIN: YS3AS35D1K3009750

BODY STYLE: 3-door hatchback

MODEL YEAR: 1989

NHTSA NO.: CK0505

COLOR: Dark blue

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

TRANSMISSION DATA: 5 SPEED, X MANUAL,      AUTOMATIC, X FWD,      RWD,      4WD

DATE VEHICLE RECEIVED: 3/29/89

ODOMETER READING: 70.0

DEALER'S NAME AND ADDRESS: Mid-Ohio Imported Car Co.  
4050 Morse Road  
Columbus, OH 43230

ACCESSORIES:

POWER STEERING Yes  
POWER BRAKES Yes  
POWER SEATS No  
POWER WINDOWS Yes  
TINTED GLASS No  
RADIO Yes  
CLOCK Yes  
OTHER None

AUTOMATIC TRANSMISSION No  
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: 3770 LBS

GAWR: FRONT 2120 LBS., REAR 2010 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 29 psi; REAR 30 psi

RECOMMENDED TIRE SIZE: P185/65R15 LOAD RANGE X B,      C,      D

TIRES ON VEHICLE (MFR., LINE, SIZE): Pirelli P8 P185/65R15

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: Manual adjustable

NUMBER OF OCCUPANTS 2 FRONT 3 REAR 5 TOTAL

CARGO LOAD 180 LBS. TOTAL 930 LBS.

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

RIGHT FRONT 853 lbs. RIGHT REAR 540 lbs.

LEFT FRONT 828 lbs. LEFT REAR 571 lbs.

TOTAL FRONT WEIGHT 1681 lbs. (60.2% OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 1111 lbs. (39.8% OF TOTAL VEHICLE WEIGHT)

TOTAL DELIVERED WEIGHT 2792 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (2792 LBS)

VCW = VEHICLE CAPACITY WEIGHT (930 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

$RCLW = VCW - 150 (DCS) = 930 - (150)(5) = 180 \text{ LBS}$

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

$= 2792 + 180 + 328 \text{ LBS}$

TARGET TEST WEIGHT = 3300 LBS



TABLE 2 TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 170 LBS. CARGO

|                    |           |                                 |          |
|--------------------|-----------|---------------------------------|----------|
| RIGHT FRONT        | 913 lbs.  | RIGHT REAR                      | 756 lbs. |
| LEFT FRONT         | 863 lbs.  | LEFT REAR                       | 758 lbs. |
| TOTAL FRONT WEIGHT | 1776 lbs. | (54.0% OF TOTAL VEHICLE WEIGHT) |          |
| TOTAL REAR WEIGHT  | 1514 lbs. | (46.0% OF TOTAL VEHICLE WEIGHT) |          |
| TOTAL TEST WEIGHT  | 3290 lbs. | (0.3% UNDER TARGET WEIGHT)      |          |

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 125 LBS.

COMPONENTS REMOVED TO MEET TARGET WEIGHT: None

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

|                     |          |          |          |         |
|---------------------|----------|----------|----------|---------|
| DELIVERED ATTITUDE: | LF 27.5; | RF 27.4; | LR 25.9; | RR 25.8 |
| PRE-TEST ATTITUDE:  | LF 27.5; | RF 27.2; | LR 24.8; | RR 24.5 |
| POST-TEST ATTITUDE: | LF 27.9; | RF 28.4; | LR 23.8; | RR 24.6 |

WHEELBASE: 99.2 INCHES

CG = 45.7 INCHES REARWARD OF FRONT WHEEL CENTERLINE

TABLE 3 TEST CONDITIONS

TEST NUMBER: 890403

DATE OF TEST: 4/03/89

TIME OF TEST: 1320

TYPE OF TEST: Frontal barrier impact

IMPACT ANGLE: 0°

AMBIENT TEMPERATURE AT IMPACT AREA:

72° F

TEMPERATURE IN OCCUPANT COMPARTMENT:

73° F

IMPACT VELOCITY: PRIMARY = 29.6 MPH

SECONDARY = 29.6 MPH

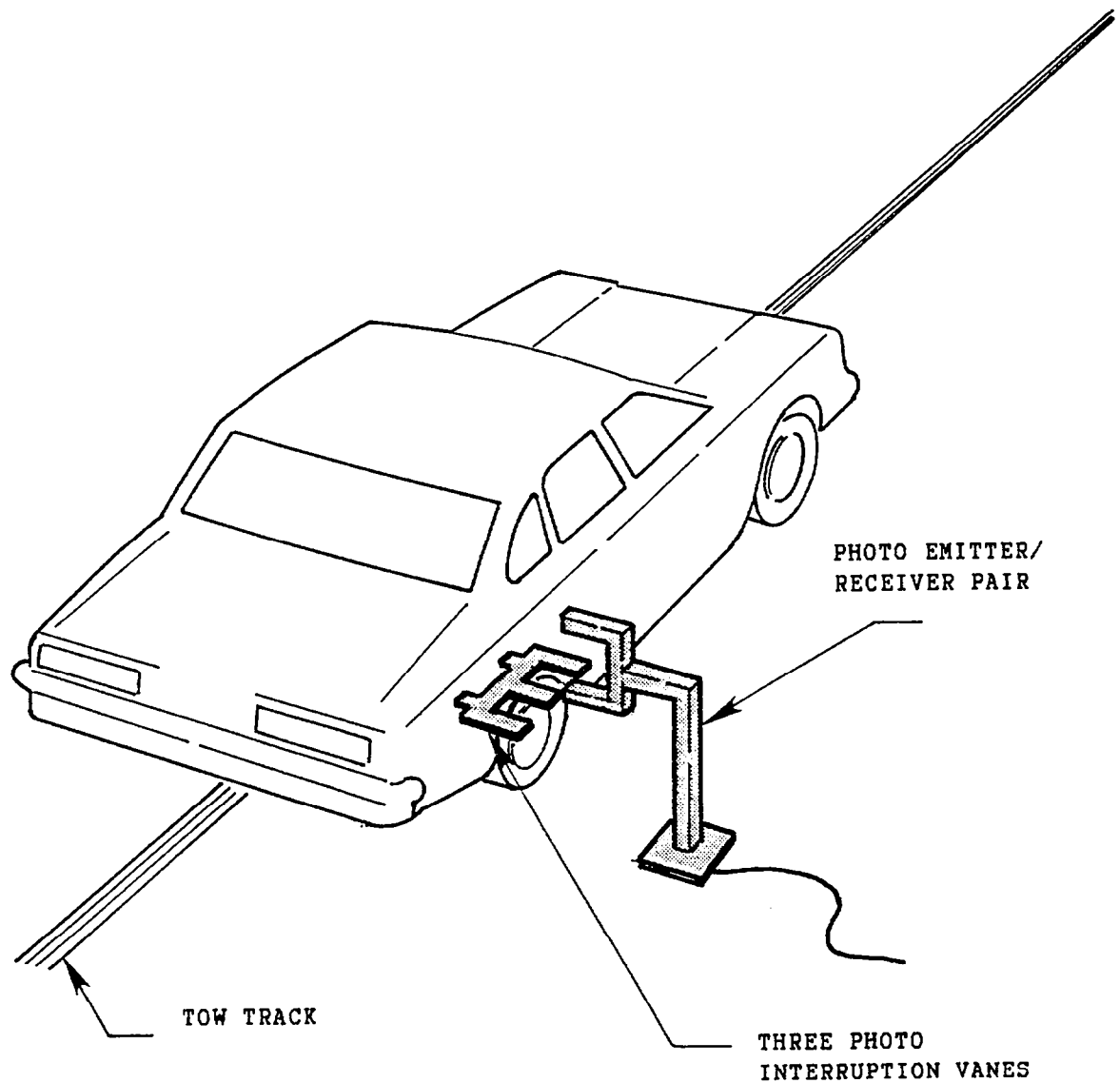
(SPECIFIED RANGE = 28.9 TO 29.9 MPH)

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES):

|                                 |              |          |          |         |
|---------------------------------|--------------|----------|----------|---------|
| OVERALL LENGTH OF TEST VEHICLE: | PRE-TEST:    | L 180.8; | C 183.8; | R 181.0 |
|                                 | POST-TEST:   | L 161.9; | C 163.4; | R 163.8 |
|                                 | TOTAL CRUSH: | L 18.9;  | C 20.4;  | R 17.2  |

FOR FRONTAL IMPACTS, DISTANCE FROM FRONT OF TEST VEHICLE TO BARRIER AFTER  
IMPACT: L: 12.2; C: 10.7; R: 11.6; AVG: 11.5

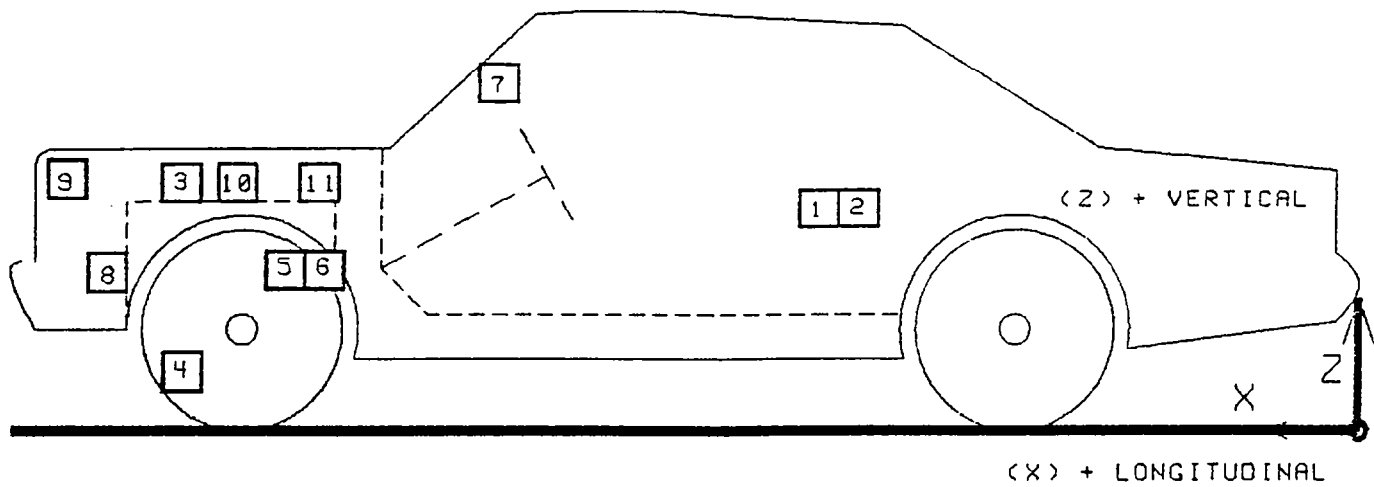
FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



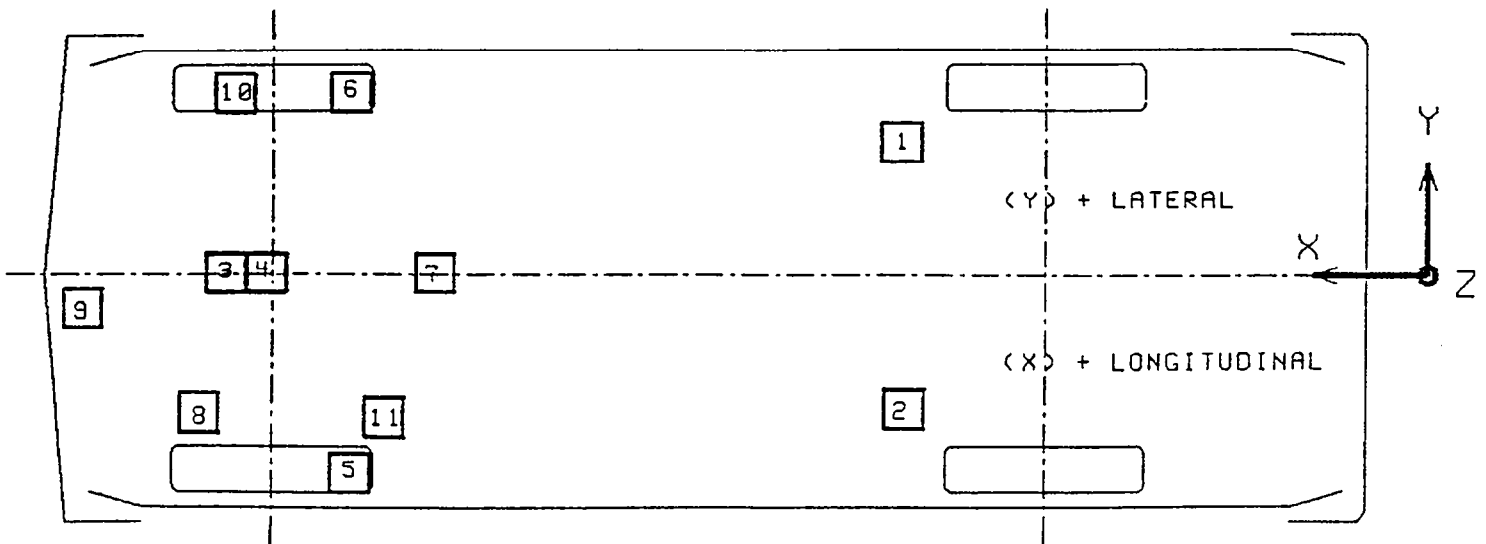
The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

FIGURE 2  
VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4  
TEST NUMBER 890403

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

| No. | LOCATION                                               |      | X*    | Y*    | Z*   | POSITIVE<br>DIRECTION |        | NEGATIVE<br>DIRECTION |        |
|-----|--------------------------------------------------------|------|-------|-------|------|-----------------------|--------|-----------------------|--------|
|     |                                                        |      |       |       |      | MAX                   | G MSEC | MAX                   | G MSEC |
| 1   | REAR SEAT CROSSMEMBER<br>AT LEFT SIDE<br>LONGITUDINAL  | PRE  | 66.6  | 24.6  | 13.8 |                       |        |                       |        |
|     |                                                        | POST | 66.0  | 24.6  | 13.8 |                       |        |                       |        |
|     |                                                        |      |       |       |      | 1.2                   | 137.0  | 27.1                  | 43.9   |
| 2   | REAR SEAT CROSSMEMBER<br>AT RIGHT SIDE<br>LONGITUDINAL | PRE  | 66.6  | -24.6 | 13.8 |                       |        |                       |        |
|     |                                                        | POST | 66.0  | -24.6 | 14.0 |                       |        |                       |        |
|     |                                                        |      |       |       |      | 1.1                   | 176.9  | 30.0                  | 50.8   |
| 3   | TOP OF ENGINE BLOCK<br>LONGITUDINAL                    | PRE  | 140.9 | 0.0   | 32.0 |                       |        |                       |        |
|     |                                                        | POST | 134.6 | -2.0  | 33.2 |                       |        |                       |        |
|     |                                                        |      |       |       |      | ---                   | ---Y   | ---                   | ---Y   |
| 4   | BOTTOM OF ENGINE BLOCK<br>LONGITUDINAL                 | PRE  | 148.5 | -3.0  | 8.7  |                       |        |                       |        |
|     |                                                        | POST | 141.2 | -3.0  | 8.9  |                       |        |                       |        |
|     |                                                        |      |       |       |      | 8.3                   | 42.8   | 73.4                  | 32.3   |
| 5   | BRAKE CALIPER<br>AT RIGHT SIDE<br>LONGITUDINAL         | PRE  | 150.2 | -24.6 | 12.0 |                       |        |                       |        |
|     |                                                        | POST | 147.1 | -24.6 | 12.7 |                       |        |                       |        |
|     |                                                        |      |       |       |      | 28.8                  | 75.9   | 71.4                  | 56.4   |
| 6   | BRAKE CALIPER<br>AT LEFT SIDE<br>LONGITUDINAL          | PRE  | 150.2 | 24.6  | 12.0 |                       |        |                       |        |
|     |                                                        | POST | 145.2 | 24.6  | 12.0 |                       |        |                       |        |
|     |                                                        |      |       |       |      | 15.2                  | 73.1   | 71.8                  | 47.6   |
| 7   | DASH PANEL<br>LONGITUDINAL                             | PRE  | 119.3 | 0.0   | 38.9 |                       |        |                       |        |
|     |                                                        | POST | 118.5 | 0.0   | 40.2 |                       |        |                       |        |
|     |                                                        |      |       |       |      | 7.1                   | 99.5   | 26.3                  | 25.6   |
| 8   | FRONT FRAME RAIL<br>LONGITUDINAL                       | PRE  | 163.6 | -10.0 | 14.0 |                       |        |                       |        |
|     |                                                        | POST | 156.0 | -11.0 | 12.0 |                       |        |                       |        |
|     |                                                        |      |       |       |      | ---                   | ---Y   | ---                   | ---Y   |
| 9   | FRONT FRAME<br>CROSSMEMBER<br>LONGITUDINAL             | PRE  | 170.9 | 4.0   | 29.1 |                       |        |                       |        |
|     |                                                        | POST | 154.6 | 4.0   | 31.2 |                       |        |                       |        |
|     |                                                        |      |       |       |      | ---                   | ---Y   | ---                   | ---Y   |

TABLE 4

TEST NUMBER 890403

## VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY CONTINUED

| No. | LOCATION          | X*         | Y*    | Z*   | POSITIVE<br>DIRECTION |        | NEGATIVE<br>DIRECTION |        |
|-----|-------------------|------------|-------|------|-----------------------|--------|-----------------------|--------|
|     |                   |            |       |      | MAX                   | G MSEC | MAX                   | G MSEC |
| 10  | LEFT FENDER       | PRE 156.4  | 23.2  | 27.2 |                       |        |                       |        |
|     | WELL INSIDE       | POST 150.9 | 21.4  | 29.2 |                       |        |                       |        |
|     | LONGITUDINAL      |            |       |      | 12.7                  | 58.5   | 81.3                  | 44.3   |
| 11  | RIGHT SHOCK TOWER | PRE 146.6  | -18.0 | 26.4 |                       |        |                       |        |
|     |                   | POST 142.2 | -17.2 | 27.8 |                       |        |                       |        |
|     | LONGITUDINAL      |            |       |      | 7.0                   | 71.5   | 59.6                  | 52.4   |

\* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

Y See DATA ACQUISITION EXPLANATIONS

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

VEHICLE MAKE/MODEL/BODY STYLE: Saab/900S/3-door hatchback

VEH. NHTSA NO.: CK0505; VIN: YS3AS35D1K3009750

MODEL YEAR: 1989; BUILD DATE: 12/88; TEST DATE: 4/03/89

VEH. SIZE CATEGORY: Compact; TEST WEIGHT: 3290

VEH. WHEELBASE: 99.2

MAX. WIDTH: 66.0

FRONT OVERHANG: 40.5

COLLISION DEFORMATION  
CLASSIFICATION (CDC) CODE: 12FDEW2

F (Frontal)

CRUSH DEPTH  
DIMENSIONS:

C1 = 18.9 inches

C2 = 19.5 inches

C3 = 20.2 inches

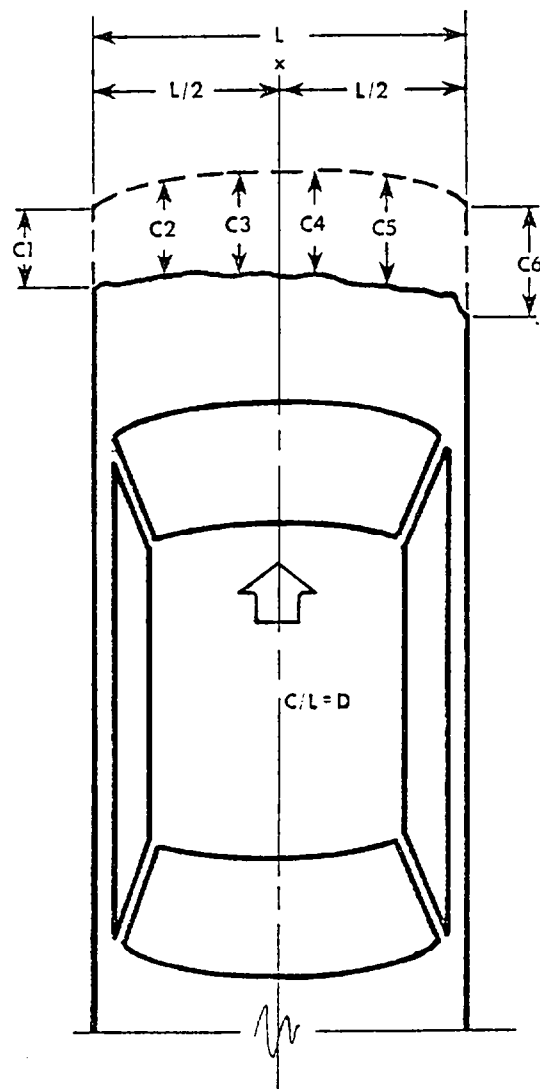
C4 = 19.7 inches

C5 = 18.6 inches

C6 = 17.2 inches

MIDPOINT OF DAMAGE: D = Vehicle Centerline  
(Longitudinal)

LENGTH OF DAMAGED  
REGION: L = 54.1 inches



**FIGURE 4**  
PRE-TEST AND POST-TEST MEASUREMENT POINTS

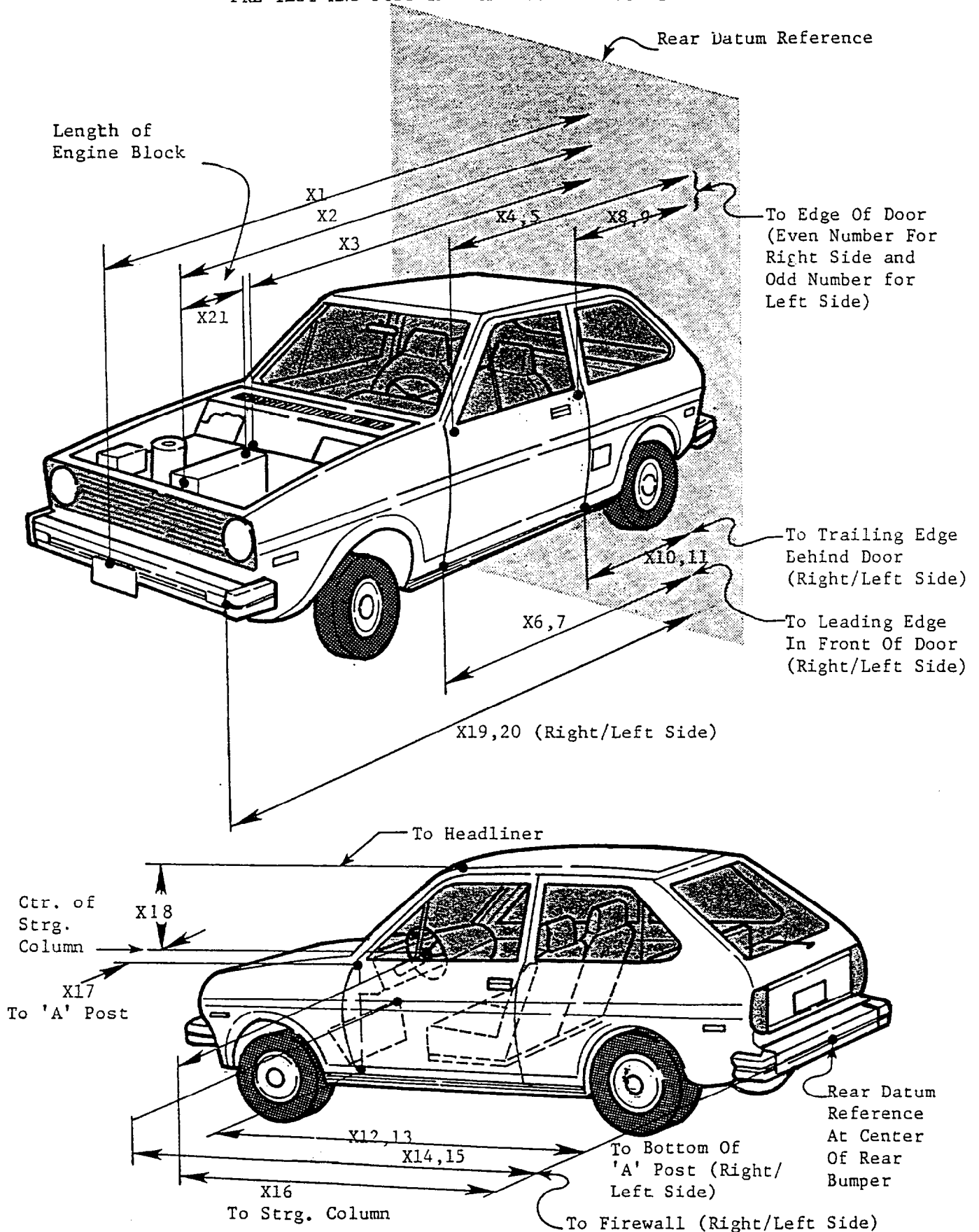
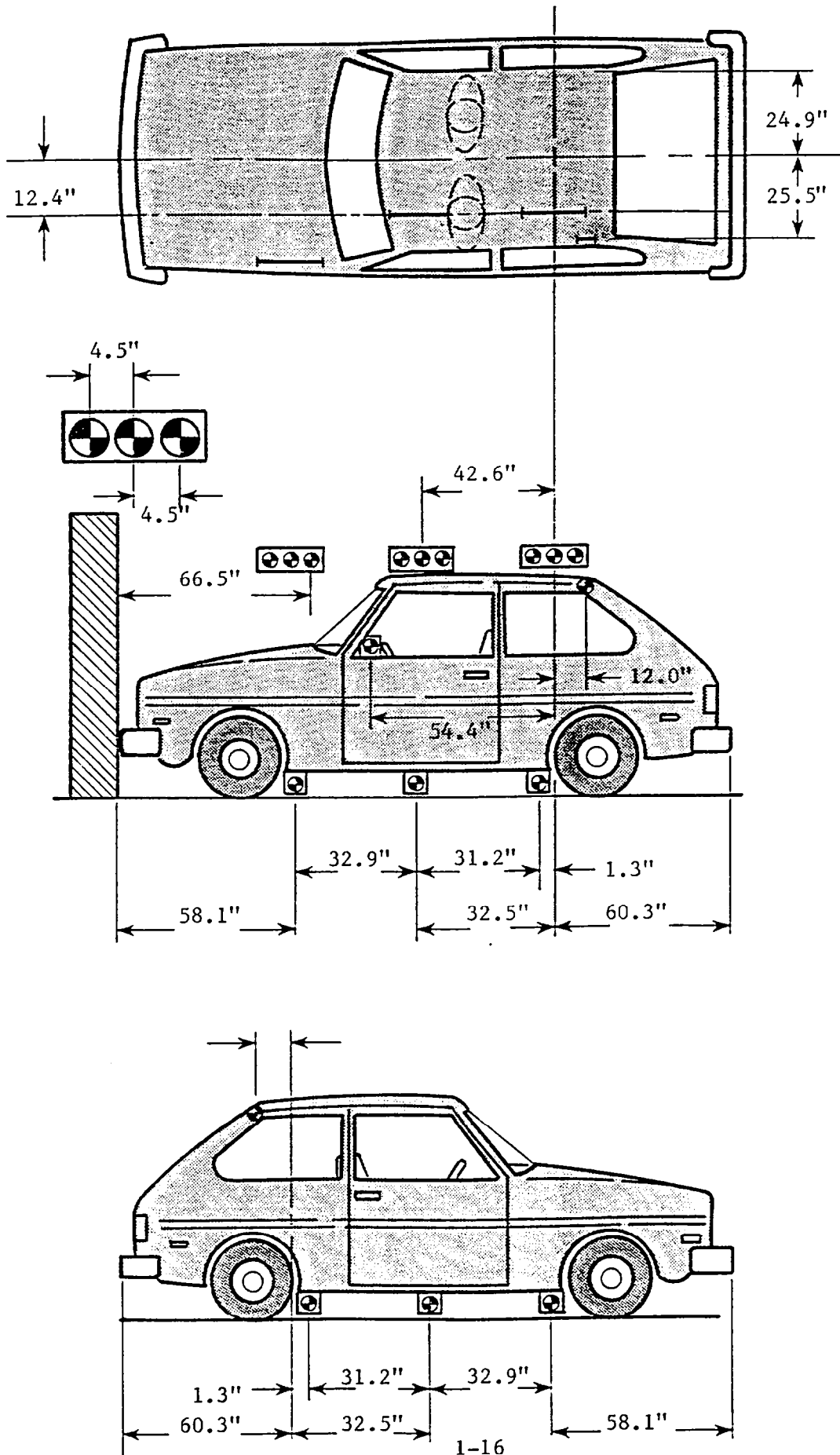


TABLE 5 IMPACTED VEHICLE MEASUREMENTS

| VEHICLE MAKE/MODEL: Saab/900S |                                                              | TEST NUMBER: 890403 | DIMENSIONS IN INCHES |           |       |  |
|-------------------------------|--------------------------------------------------------------|---------------------|----------------------|-----------|-------|--|
| NO.                           | TYPE OF MEASUREMENT                                          |                     | PRE-TEST             | POST-TEST | DIFF. |  |
| X1                            | TOTAL LENGTH OF VEHICLE AT CENTERLINE                        |                     | 183.8                | 163.4     | 20.4  |  |
| X2                            | REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK             |                     | 159.6                | 153.6     | 6.0   |  |
| X3                            | REAR SURFACE OF VEHICLE TO FIREWALL                          |                     | 129.4                | 128.4     | 1.0   |  |
| X4                            | REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR  |                     | 118.6                | 117.9     | 0.7   |  |
| X5                            | REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR   |                     | 118.7                | 117.2     | 1.5   |  |
| X6                            | REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR  |                     | 119.4                | 118.4     | 1.0   |  |
| X7                            | REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR   |                     | 119.5                | 118.0     | 1.5   |  |
| X8                            | REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR |                     | 77.1                 | 76.2      | 0.9   |  |
| X9                            | REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR  |                     | 77.1                 | 75.8      | 1.3   |  |
| X10                           | REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR |                     | 80.6                 | 79.7      | 0.9   |  |
| X11                           | REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR  |                     | 80.8                 | 79.2      | 1.6   |  |
| X12                           | REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE  |                     | 121.0                | 120.0     | 1.0   |  |
| X13                           | REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE   |                     | 121.0                | 119.6     | 1.4   |  |
| X14                           | REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE             |                     | 131.2                | 130.0     | 1.2   |  |
| X15                           | REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE              |                     | 131.2                | 129.0     | 2.2   |  |
| X16                           | REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER             |                     | 109.6                | 107.6     | 2.0   |  |
| X17                           | CENTER OF STEERING COLUMN TO "A" POST                        |                     | 13.8                 | 13.0      | 0.8   |  |
| X18                           | CENTER OF STEERING COLUMN TO HEADLINER                       |                     | 17.6                 | 16.1      | 1.5   |  |
| X19                           | REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER        |                     | 181.0                | 163.8     | 17.2  |  |
| X20                           | REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER         |                     | 180.8                | 161.9     | 18.9  |  |
| X21                           | LENGTH OF ENGINE BLOCK                                       |                     | 23.0                 | 23.0      | 0.0   |  |



FIGURE 5  
VEHICLE TARGET LOCATIONS



### DATA ACQUISITION EXPLANATIONS

The driver's left femur force load cell, LFMF1, lost data from 77 to 108 milliseconds due to momentary separation of a loose cable connection. The connection was secured during the post-test dummy inspection.

The engine upper block X-axis accelerometer, ENGXC1, lost data after 18 milliseconds due to the vehicle's crush cutting the accelerometer cable.

The front frame rail X-axis accelerometer, FFRXG, lost data after 78 milliseconds due to the vehicle's crush cutting the accelerometer cable.

The front frame crossmember X-axis accelerometer, FFCXG, recorded questionable data from 15 to 20 milliseconds due to the vehicle's crush deforming the area of the accelerometer mount.

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 900S 3-door hatchback, NHTSA No. CK0505, appeared to comply with the requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.

The driver's Head Injury Criteria (HIC) was 289. The driver's maximum chest deceleration over three milliseconds was 40.4 g. The driver's right and left compressive femur loads were 1548 pounds and 986 pounds, respectively. (See DATA ACQUISITION EXPLANATIONS.)

The right front passenger's Head Injury Criteria (HIC) was 223. The right front passenger's maximum chest deceleration over three milliseconds was 35.3 g. The right front passenger's right and left compressive femur loads were 1840 pounds and 1327 pounds, respectively.

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    | 40.1  | 10.2  | -41.0 | 44.6 | -41.2 | 10.7 | 12.1 | 40.4 |
| PASSENGER | -22.5 | -14.4 | -35.7 | 41.5 | -38.8 | 17.3 | 19.1 | 35.3 |

MAXIMUM FORCE-FEMUR LOAD (LBS)

|           | LEFT FEMUR | RIGHT FEMUR |
|-----------|------------|-------------|
| DRIVER    | 986 Y      | 1548        |
| PASSENGER | 1327       | 1840        |

HEAD INJURY CRITERIA\*\*

|           | HIC | TIME t <sub>1</sub><br>(MSEC) <sup>1</sup> | TIME t <sub>2</sub><br>(MSEC) <sup>2</sup> |
|-----------|-----|--------------------------------------------|--------------------------------------------|
| DRIVER    | 289 | 63.9                                       | 99.9                                       |
| PASSENGER | 223 | 65.6                                       | 101.6                                      |

\*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 rotated forward, contacting the dummy's chest, as the dummy's chest was restrained by the two-point passive belt. 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 driver's seat, restrained by the two-point passive belt.

### 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 two-point passive belt. 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 two-point passive belt.

VISIBLE DUMMY CONTACT POINTS:

|            | DRIVER #690             | PASSENGER #353          |
|------------|-------------------------|-------------------------|
| Head       | <u>Chest</u>            | <u>Chest</u>            |
| Chest      | <u>None</u>             | <u>None</u>             |
| Abdomen    | <u>None</u>             | <u>None</u>             |
| Left knee  | <u>Instrument panel</u> | <u>Instrument panel</u> |
| Right knee | <u>Instrument panel</u> | <u>Instrument panel</u> |

DOOR OPENING:

|       | LEFT        | RIGHT       |
|-------|-------------|-------------|
| Front | <u>Easy</u> | <u>Easy</u> |
| Rear  | <u>NA</u>   | <u>NA</u>   |

SEAT MOVEMENT:

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

GLAZING DAMAGE:

The left portion of the windshield was 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/900S  
 Body Style: 3-door hatchback Model Year: 1989  
 NHTSA No.: CK0505 Color: Dark Blue

**DATA FROM CERTIFICATION LABEL:**

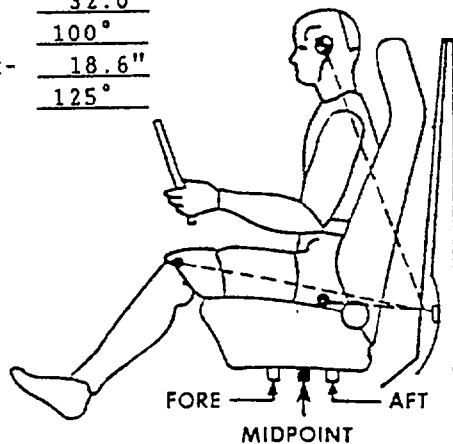
Vehicle Manufacturer: Saab-Scania  
 Date of Manufacture: 12/88 VIN: YS3AS35D1K3009750  
 GVWR: 3770 lb; GAWR: Front = 2120 lb; Rear = 2010 lb

**POST-IMPACT DATA:**

Date of Test: 4/03/89 Time: 1320 Temperature: 72° 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: Manual  
 Bucket Seat Back Type: Manual-adjustable  
 Technicians: B. Miller, D. Carpenter, & P. Cummins

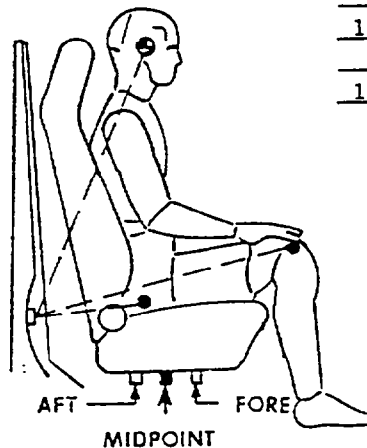
**DRIVER DUMMY # 690 TYPE: HII**

Head 19.6"  
 Target 29°  
 Knee 32.0"  
 Joint 100°  
 Approx-imate 18.6"  
 "H" Point 125°



**PASSENGER DUMMY # 353 TYPE: HII**

18.4" Head  
30° Target  
32.6" Knee  
102° Joint  
18.6" Approx-imate  
125° "H" Point



A = 50.4"  
 B = 37.9"  
 C = 25.2"  
 D = 12.5"  
 E = 12.5"

DOOR GLASS  
 HEIGHT = 10.0"

LATERAL BAR

ADJUSTABLE  
 POINTER

LEFT  
 FRONT  
 DOOR

DRIVER  
 DUMMY  
 690

PASSENGER  
 DUMMY  
 353

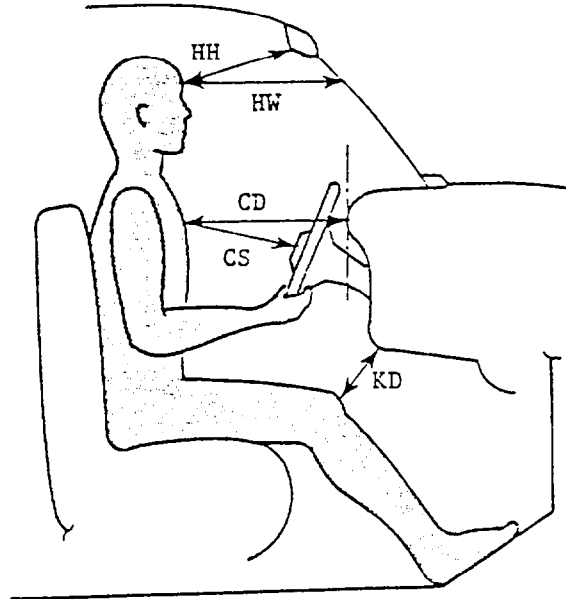
DOOR GLASS  
 HEIGHT = 10.0"

RIGHT  
 FRONT  
 DOOR

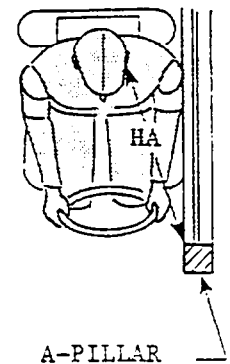
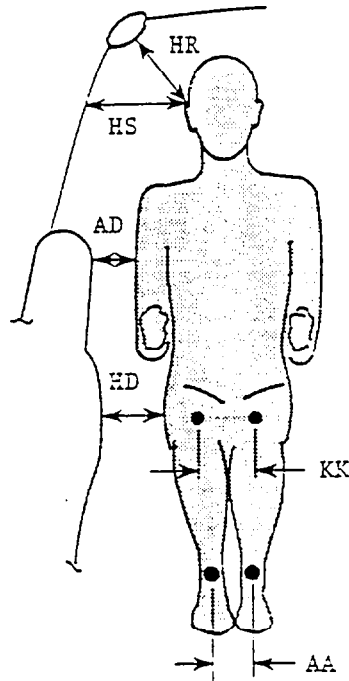


**FIGURE 7 DUMMY IN-VEHICLE POSITION RECORDING SHEET**

|     | DRIVER | PASSENGER |
|-----|--------|-----------|
| HH  | 19.4   | 20.6      |
| HW  | 22.6   | 24.2      |
| CD  | 22.6   | 22.3      |
| CS  | 15.6   | NA        |
| KDL | 5.5    | 6.1       |
| KDR | 6.4    | 6.0       |
| TA  | 18°    | 19°       |
| SA  | 21.5°  | 21.5°     |
| HA  | 14.6   | 16.4      |



|    | DRIVER | PASSENGER |
|----|--------|-----------|
| HR | 6.0    | 6.4       |
| HS | 9.4    | 9.0       |
| AD | 3.6    | 4.0       |
| HD | 7.8    | 8.1       |
| KK | 10.0   | 8.0       |
| AA | 12.6   | 6.8       |



Knee outer bolt head to outer bolt head spacing:

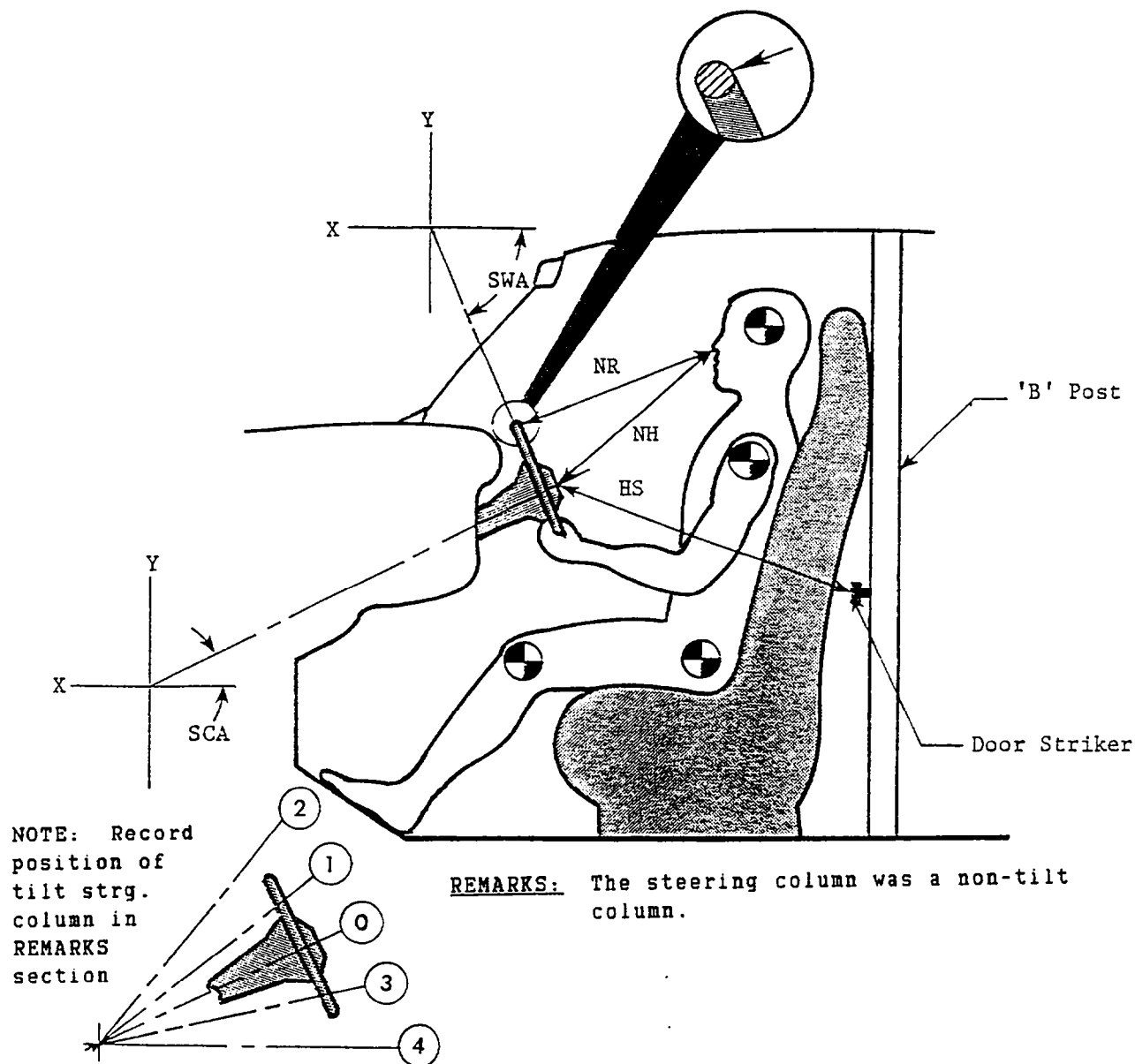
Driver = 14.5  
Passenger = 11.8

|                                |                          |
|--------------------------------|--------------------------|
| 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.

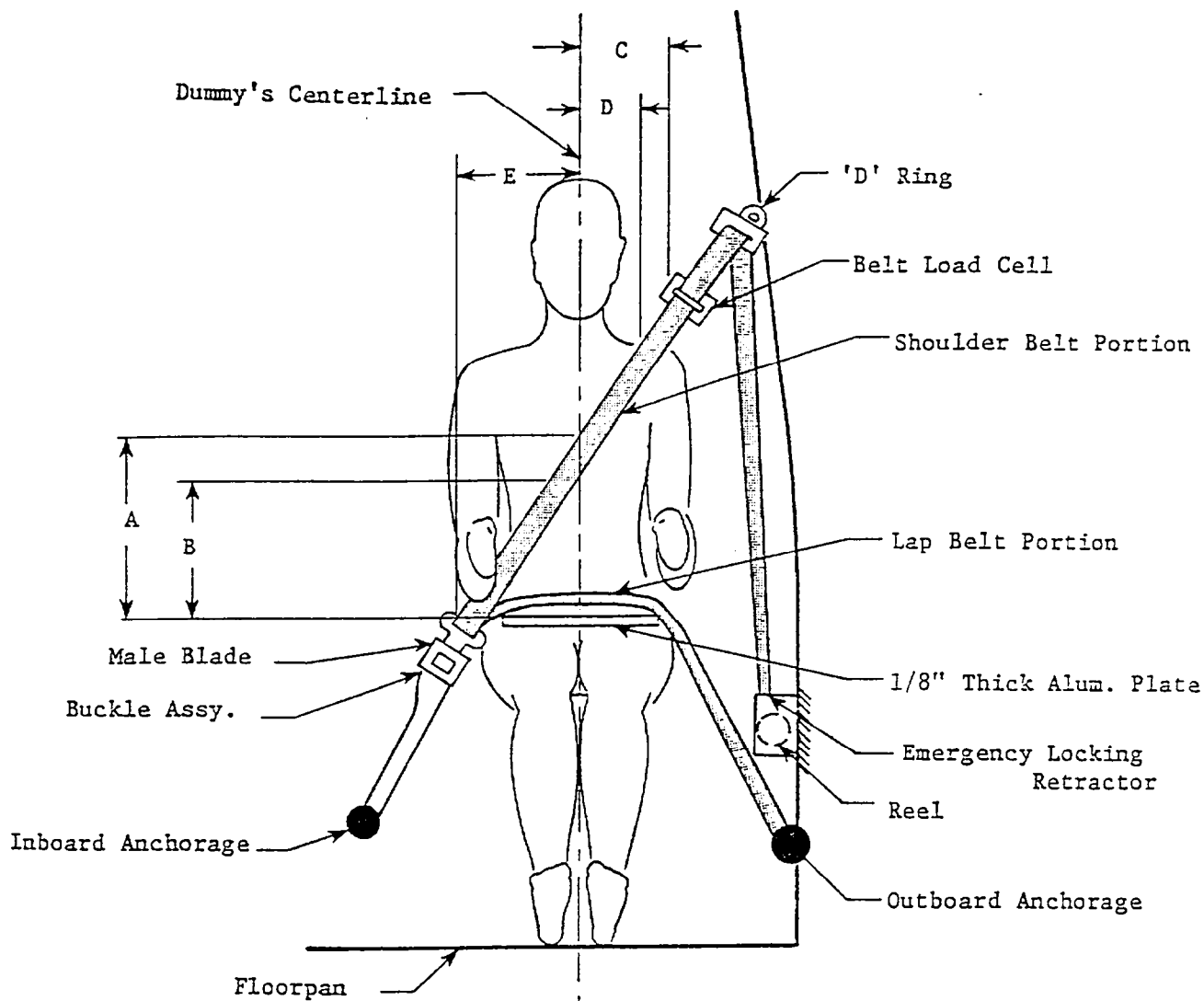
**FIGURE 8 DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS**



**MEASUREMENTS**

|     |                                                                                                          |      |
|-----|----------------------------------------------------------------------------------------------------------|------|
| NR  | - Distance from tip of dummy's nose to top rear surface of steering wheel rim. (in.)                     | 18.1 |
| NH  | - Distance from tip of dummy's nose to center of steering column hub. (in.)                              | 18.9 |
| HS  | - Distance from center of steering column hub to the forward surface of the door lock striker pin. (in.) | 30.5 |
| SCA | - Angle of steering column relative to the horizontal X axis                                             | 21°  |
| SWA | - Angle of steering wheel relative to the horizontal X axis                                              | 69°  |

**FIGURE 9 SEAT BELT POSITIONING DATA**



|                                                                            | DRIVER<br>DUMMY | PASSENGER<br>DUMMY |
|----------------------------------------------------------------------------|-----------------|--------------------|
| A - Top surface of alum. plate to belt upper edge (in)                     | 13.2            | 13.1               |
| B - Top surface of alum. plate to belt lower edge (in)                     | 9.4             | 9.8                |
| C - Dummy centerline to outer edge of belt at chest flesh top (in)         | 5.4             | 5.4                |
| D - Dummy centerline to inner edge of belt at chest flesh top (in)         | 3.0             | 3.0                |
| E - Dummy centerline to intersection of upper torso belt and lap belt (in) | NA              | NA                 |

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA

VEHICLE VIN: YS3AS35D1K3009750 NHTSA NO: CK0505  
MAKE: Saab MODEL: 900S  
VEHICLE BUILD DATE: 12/88 VEHICLE TYPE: 3-door hatchback  
FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:  
(check one): X 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  
  X   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:  
  0.1   POUNDS

LATCHPLATE ACCESS: NA

RETRACTION: NA

ACCESSIBILITY: NA

LATCH MECHANISM: NA

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 PROTECTION SYSTEM: NA,  
vehicle did not contain a crash-deployed occupant protection system.

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. NA, vehicle did not contain a crash-deployed occupant protection system.

TABLE 11 SUMMARY OF FMVSS 301 DATA

PRE-IMPACT DATA

MAKE/MODEL: Saab/900S

BODY STYLE: 3-door hatchback

MODEL YEAR: 1989

NHTSA NO.: CK0505

COLOR: Dark Blue

DATA FROM CERTIFICATION LABEL

VEHICLE MANUFACTURER: Saab-Scania

DATE OF MANUFACTURE: 12/88

VIN: YS3AS35D1K3009750

GVWR: 3770 LBS., GAWR: FRONT 2120 LBS., REAR 2010 LBS.

POST-IMPACT DATA

TYPE OF TEST: Frontal Barrier Impact

DATE OF TEST: 4/03/89

TIME: 1320

TEMP: 72°F

REQUIRED IMPACT VELOCITY RANGE: 28.9 MPH TO 29.9 MPH

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

TEST WEIGHT = 3290 LBS., STATIC CRUSH MAX. = 20.4 IN., REBOUND = 11.5 IN.

FUEL SYSTEM DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY\*: 16.65 GALLONS (FURNISHED BY COTR)

TEST VOLUME: 15.5 GALLONS (92-94% OF USEABLE)

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 16.6 GALLONS

DETAILS OF FUEL SYSTEM: The fuel tank is located behind the rear axle.

The fuel filler neck is located on the right side.

ELECTRIC FUEL PUMP: Yes

FUEL INJECTOR: 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.:

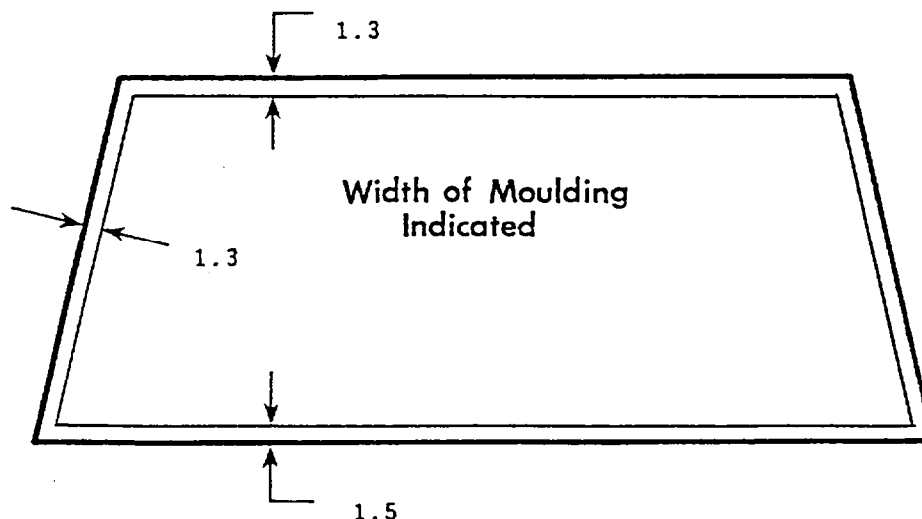
FMVSS 212 REQUIREMENTS: The post-test periphery retention amount must be at least 75% of the pre-test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

WINDSHIELD PERIPHERY

|            | PRE-TEST (in) | POST-TEST (in) | PERCENT RETENTION |
|------------|---------------|----------------|-------------------|
| RIGHT SIDE | 72.2          | 72.2           | 100%              |
| LEFT SIDE  | 72.2          | 72.2           | 100%              |
| TOTAL      | 144.4         | 144.4          | 100%              |

AREA OF RETENTION FAILURE:



FAILURE DETAILS: None

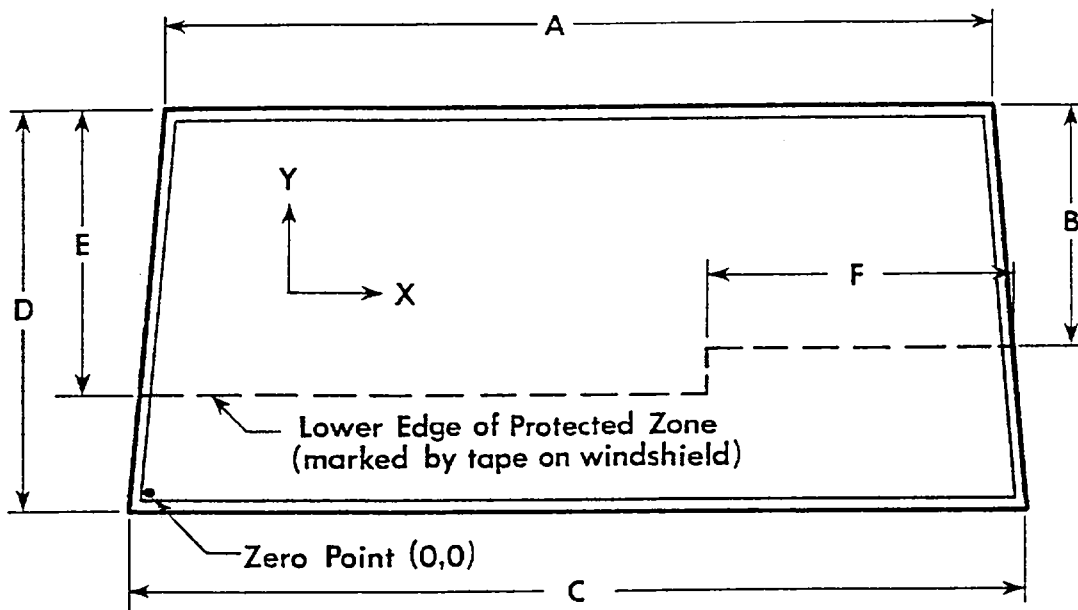
Windshield Temperature: 73° F

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>50.8</u> | C = <u>66.0</u> | E = <u>12.9</u> |
| B = <u>11.3</u> | D = <u>19.6</u> | F = <u>23.0</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.: CK0505; TEST DATE: 4/03/89

VEH. MFR./MAKE/MODEL: Saab-Scania/Saab/900S

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.       |

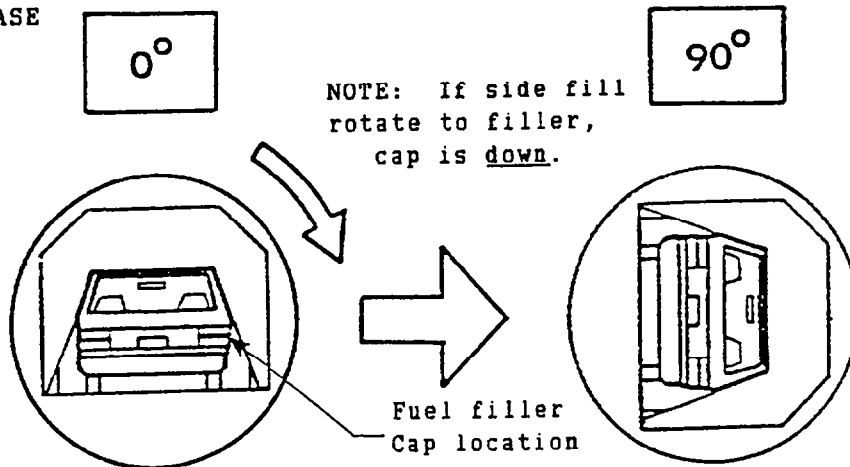
SOLVENT SPILLAGE DETAILS:

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

NHTSA NO.: CK0505

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 - - - - = 7 minutes

FMVSS 301 REQUIREMENTS

|                                        | First 5 minutes<br>FROM ONSET OF ROTATION | 6th<br>Minute | 7th<br>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

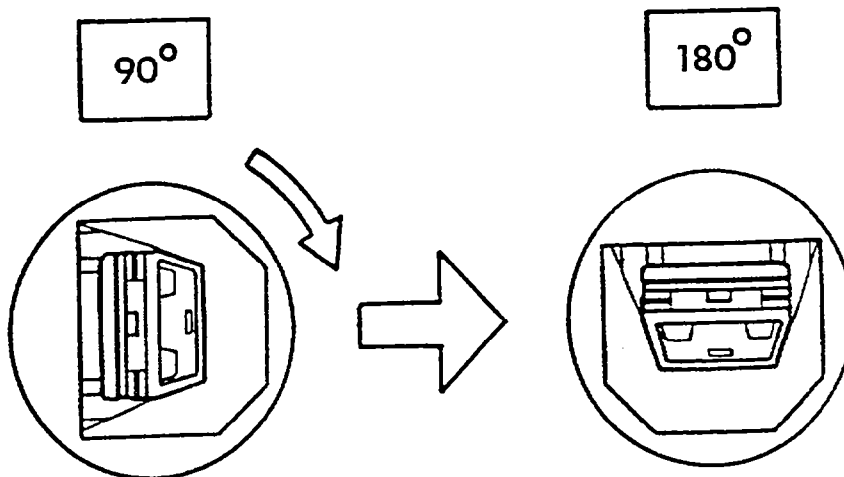
\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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

NHTSA NO.: CK0505  
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

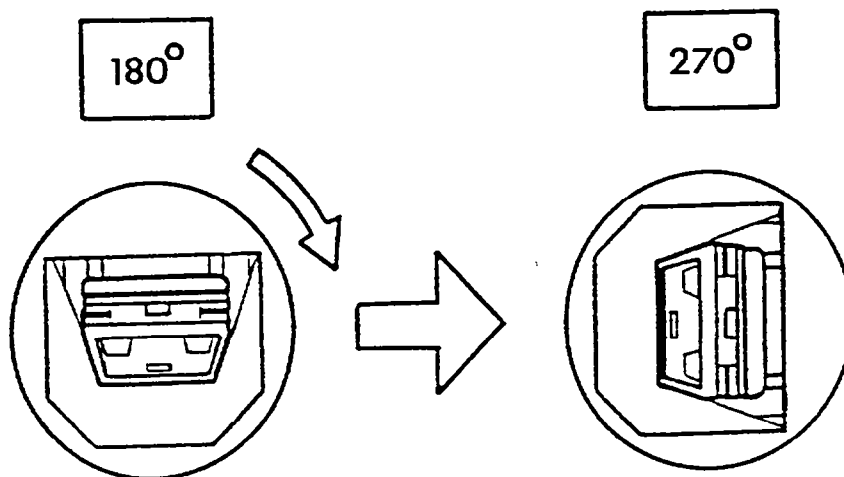
|                                        | First 5 minutes<br>FROM ONSET OF ROTATION | 6th<br>Minute | 7th<br>Minute |
|----------------------------------------|-------------------------------------------|---------------|---------------|
| Maximum allowable solvent spillage - - | <u>5 oz.</u>                              | <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.: CK0505  
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       |
| 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> |

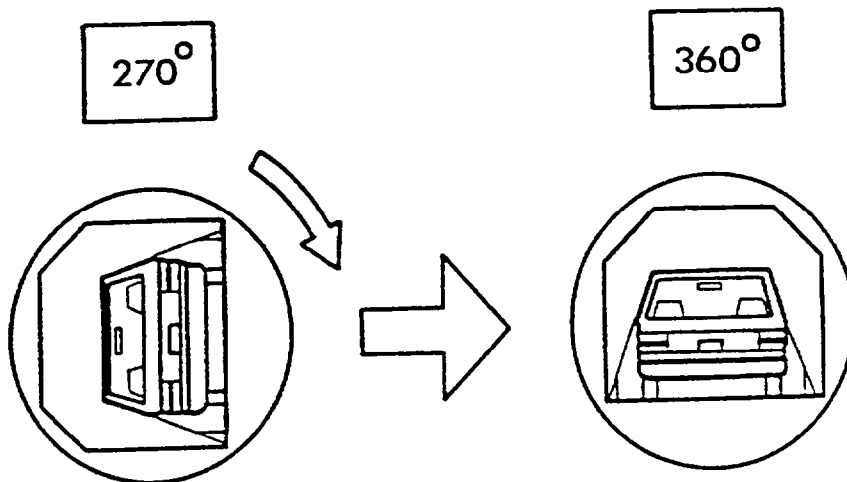
SOLVENT SPILLAGE LOCATION(S)

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

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

NHTSA NO.: CK0505

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<br>FROM ONSET OF ROTATION | 6th<br>Minute | 7th<br>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

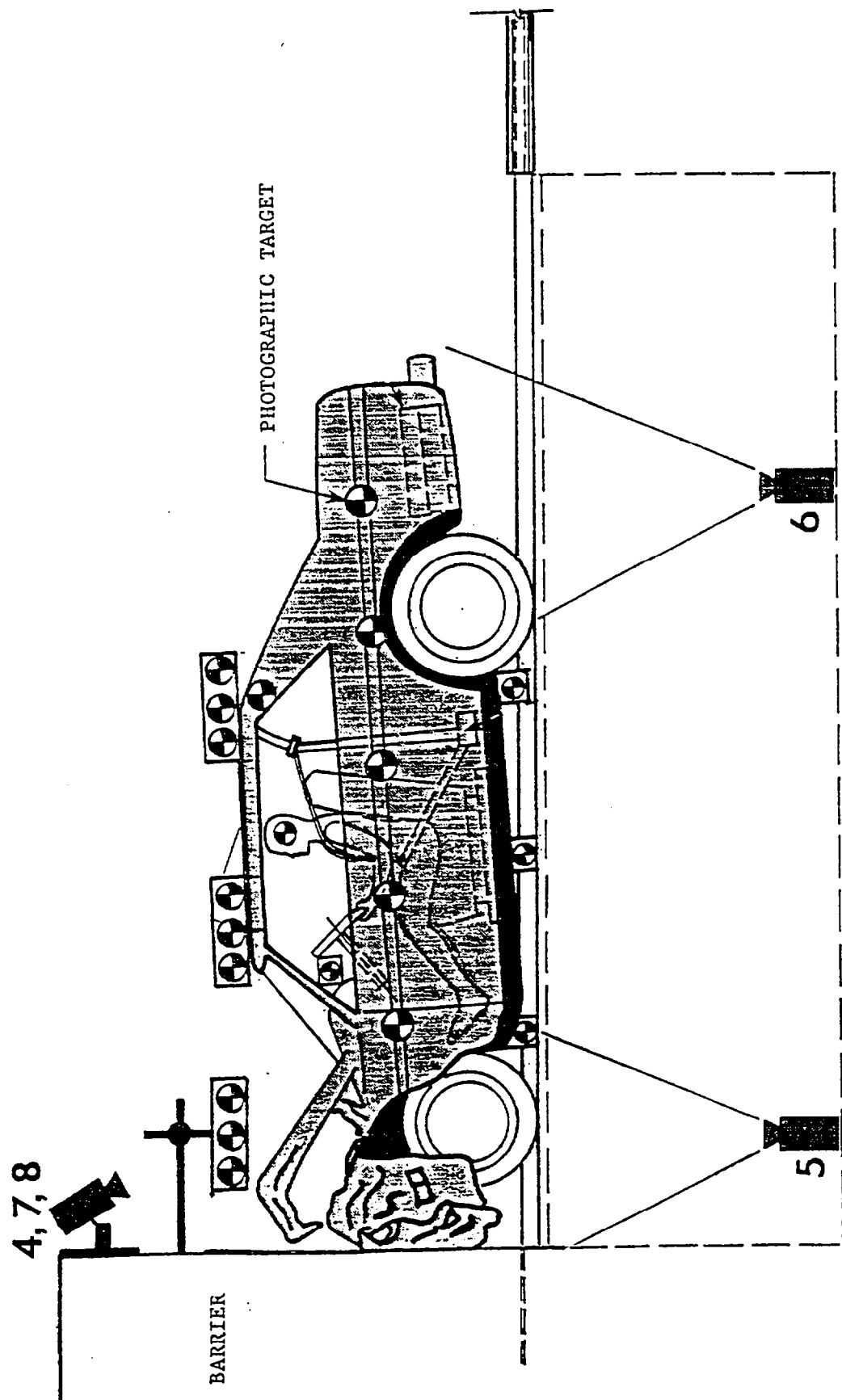


FIGURE 13 CAMERA POSITIONS CONTINUED

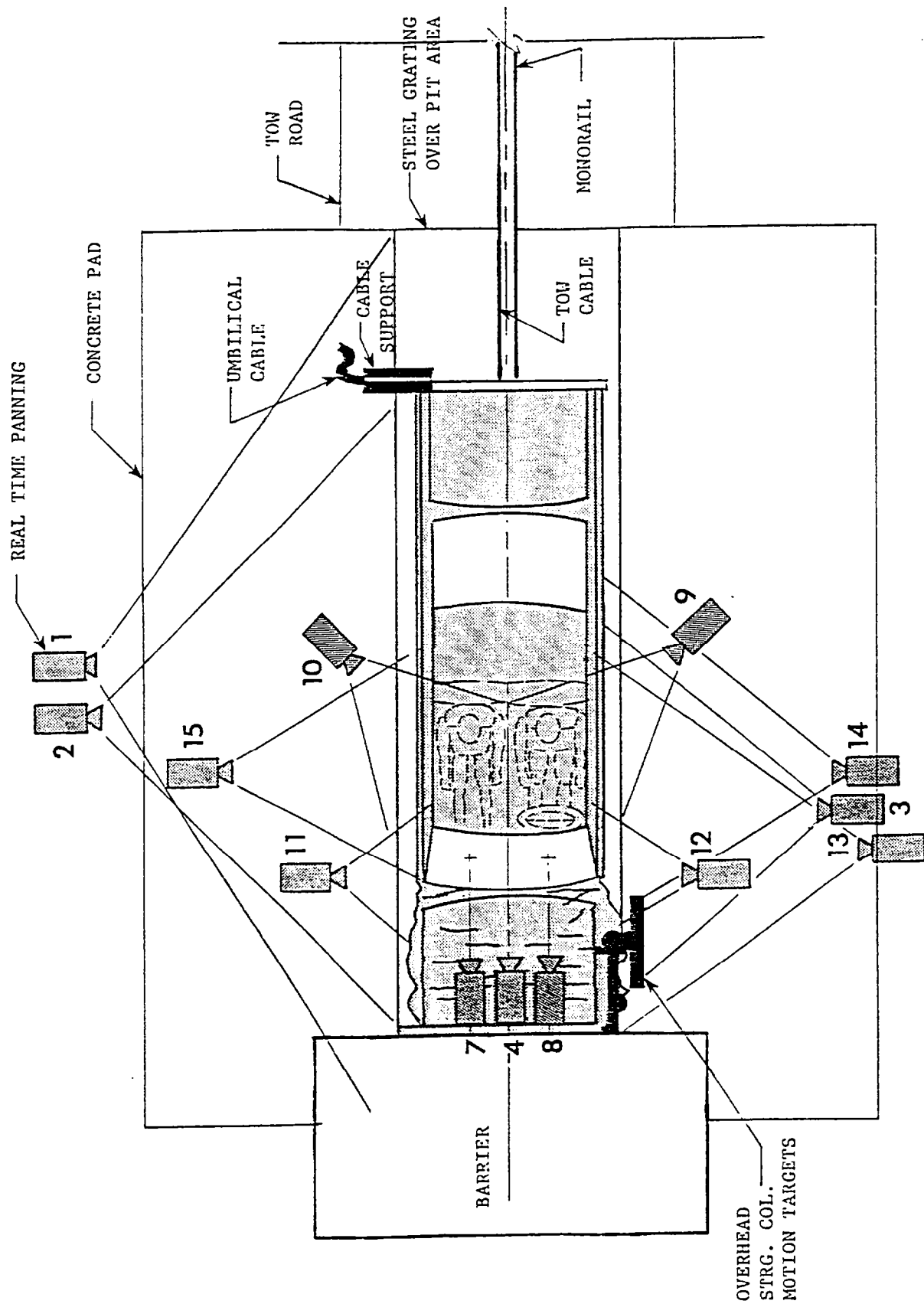


TABLE 13 HIGH SPEED CAMERA LOCATIONS

| TEST NO.: 890403 |                        | VEHICLE: 1989 Saab 900S 3-door hatchback |        |       |               |                |           |             |
|------------------|------------------------|------------------------------------------|--------|-------|---------------|----------------|-----------|-------------|
| CAMERA NO.       | VIEW                   | CAMERA POSITIONS (IN)*                   |        |       | ANGLE** (DEG) | FILM PLANE     |           | SPEED (FPS) |
|                  |                        | X                                        | Y      | Z     |               | TO HEAD TARGET | LENS (MM) |             |
| 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        | 498         |
| 3                | Dummy kinematics       | -41.5                                    | 295.0  | 44.0  | -4            | 232.0          | 25        | 498         |
| 4                | Windshield damage      | -6.0                                     | 0.0    | 89.0  | -40           | NA             | 13        | 498         |
| 5                | Crush & fluid spillage | -50.5                                    | 0.0    | -92.4 | 90            | NA             | 13        | 1005        |
| 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        | 500         |
| 8                | Driver kinematics      | -6.8                                     | 14.5   | 93.0  | -50           | NA             | 17        | 498         |
| 9                | Driver kinematics      | -157.3                                   | 116.0  | 87.0  | -27           | 118.0          | 25        | 500         |
| 10               | Passenger kinematics   | -152.1                                   | -116.0 | 87.0  | -26           | 109.5          | 25        | 500         |
| 11               | Windshield intrusion   | -38.1                                    | -306.1 | 44.0  | 0             | NA             | 50        | 500         |
| 12               | Windshield intrusion   | -53.0                                    | 309.4  | 42.3  | 0             | NA             | 50        | 490         |
| 13               | Column movement        | -178.0                                   | 286.0  | 103.0 | -14           | NA             | 25        | 495         |
| 14               | Column movement        | -178.0                                   | 286.0  | 75.1  | -9            | NA             | 25        | 502         |
| 15               | Passenger kinematics   | -38.8                                    | -293.0 | 45.3  | -4            | 241.0          | 25        | 510         |

\* +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

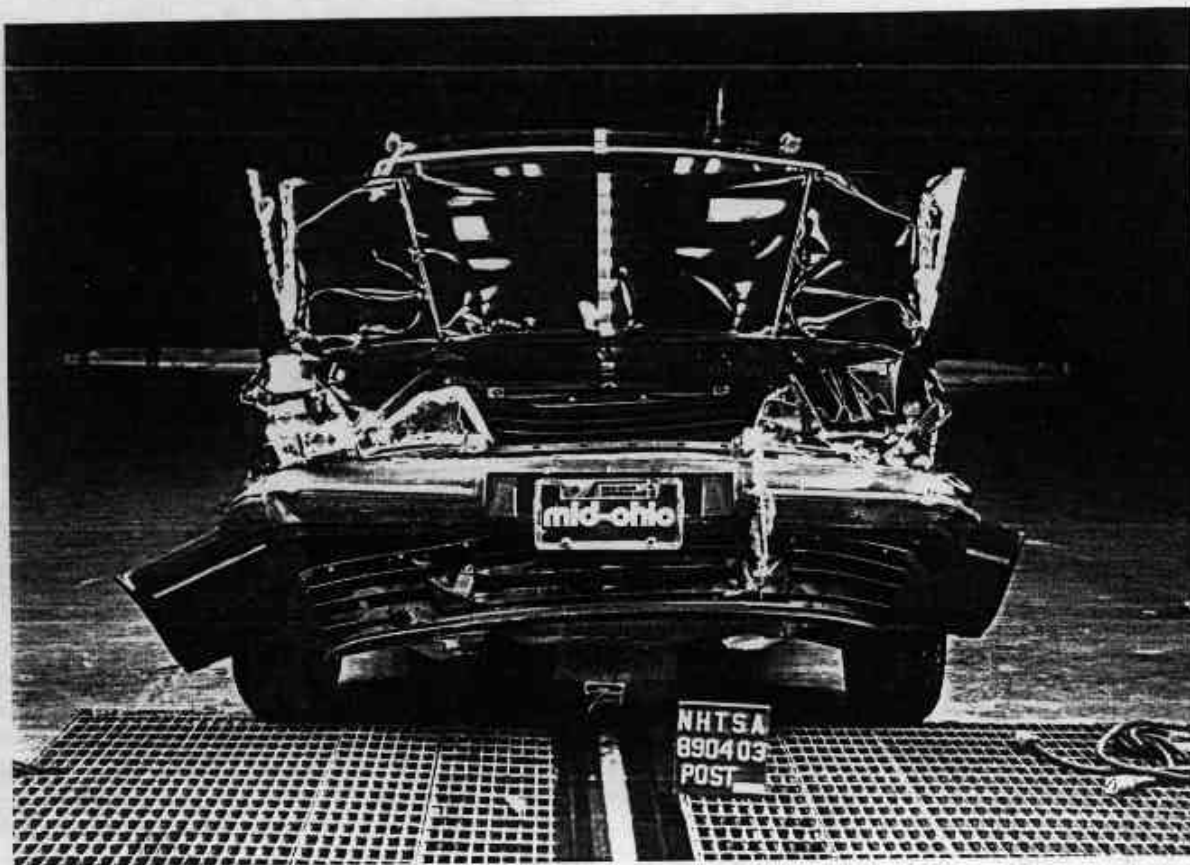


Figure A-2. POST-TEST FRONT VIEW  
A-2

890403



Figure A-3. PRE-TEST LEFT SIDE VIEW

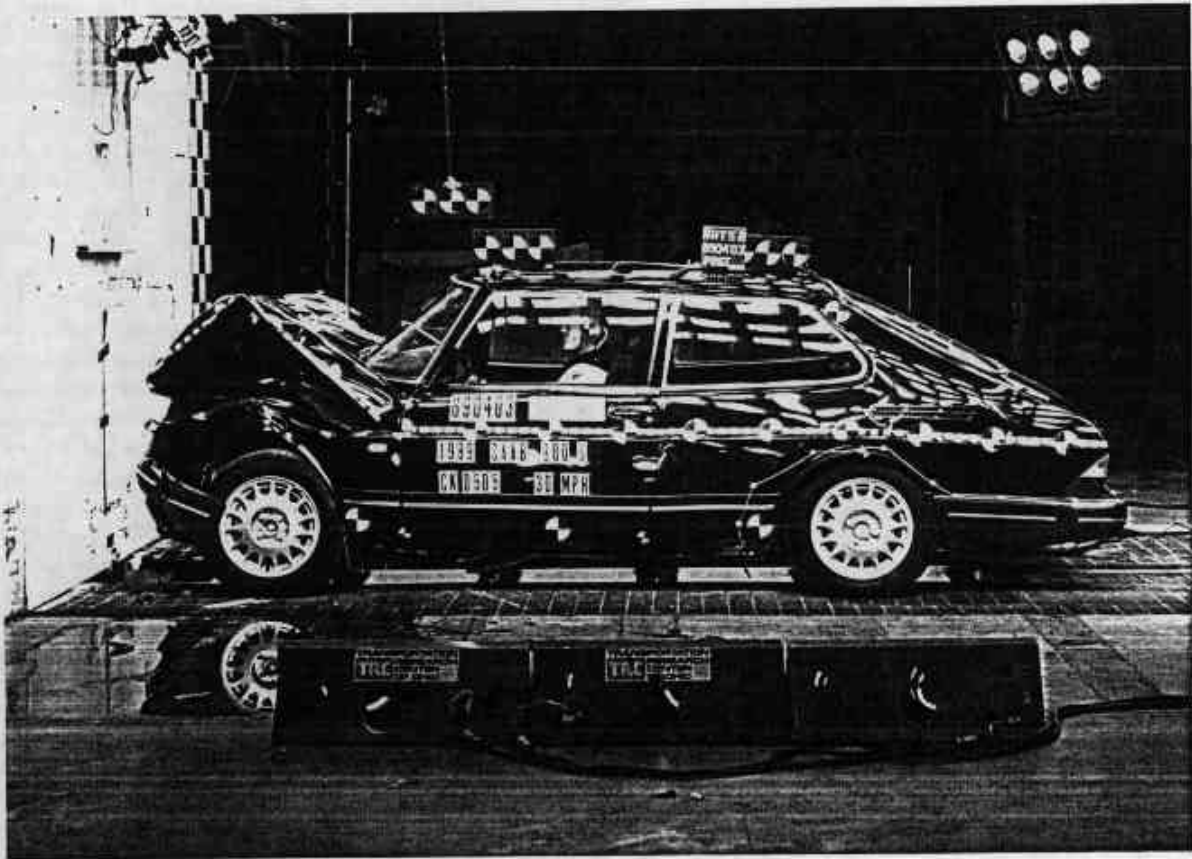


Figure A-4. POST-TEST LEFT SIDE VIEW  
A-3

890403



Figure A-5. PRE-TEST RIGHT SIDE VIEW

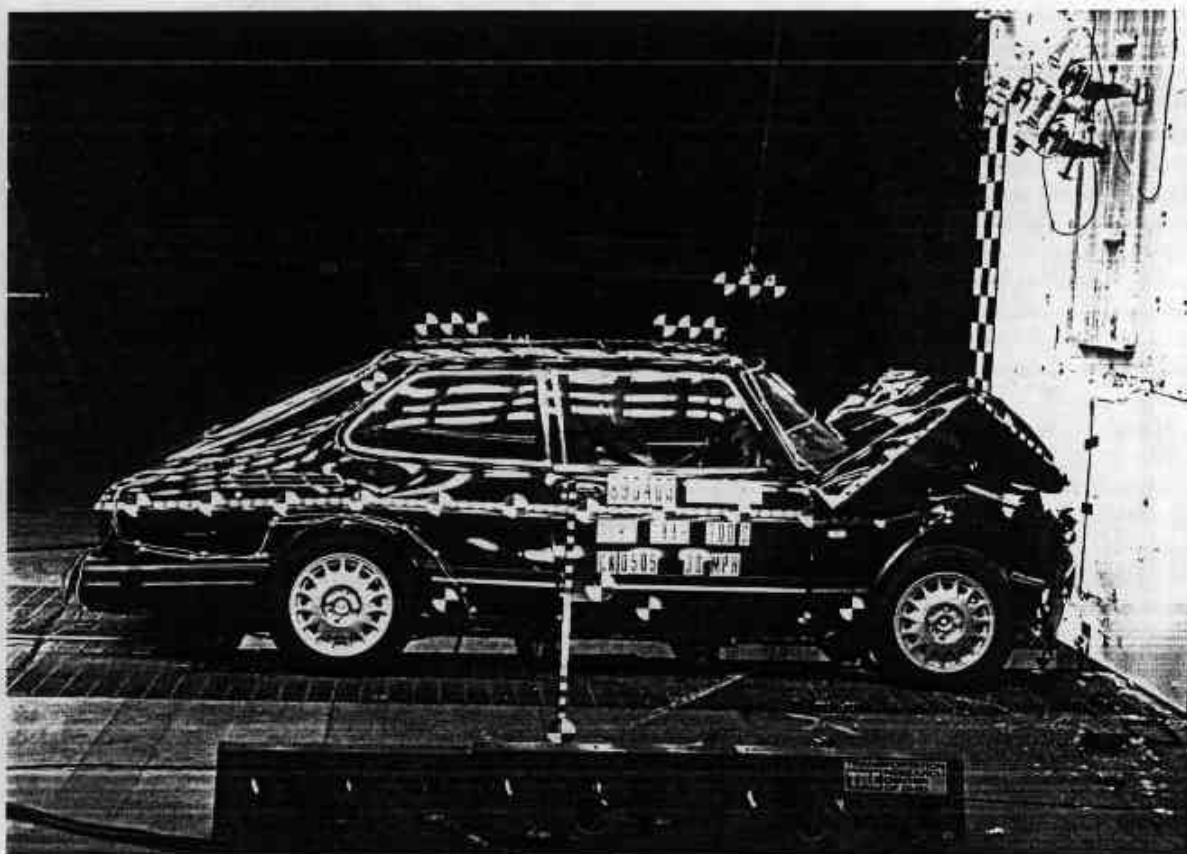


Figure A-6. POST-TEST RIGHT SIDE VIEW

A-4

890403





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



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

A-5

890403





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

890403



Figure A-13. PRE-TEST WINDSHIELD VIEW

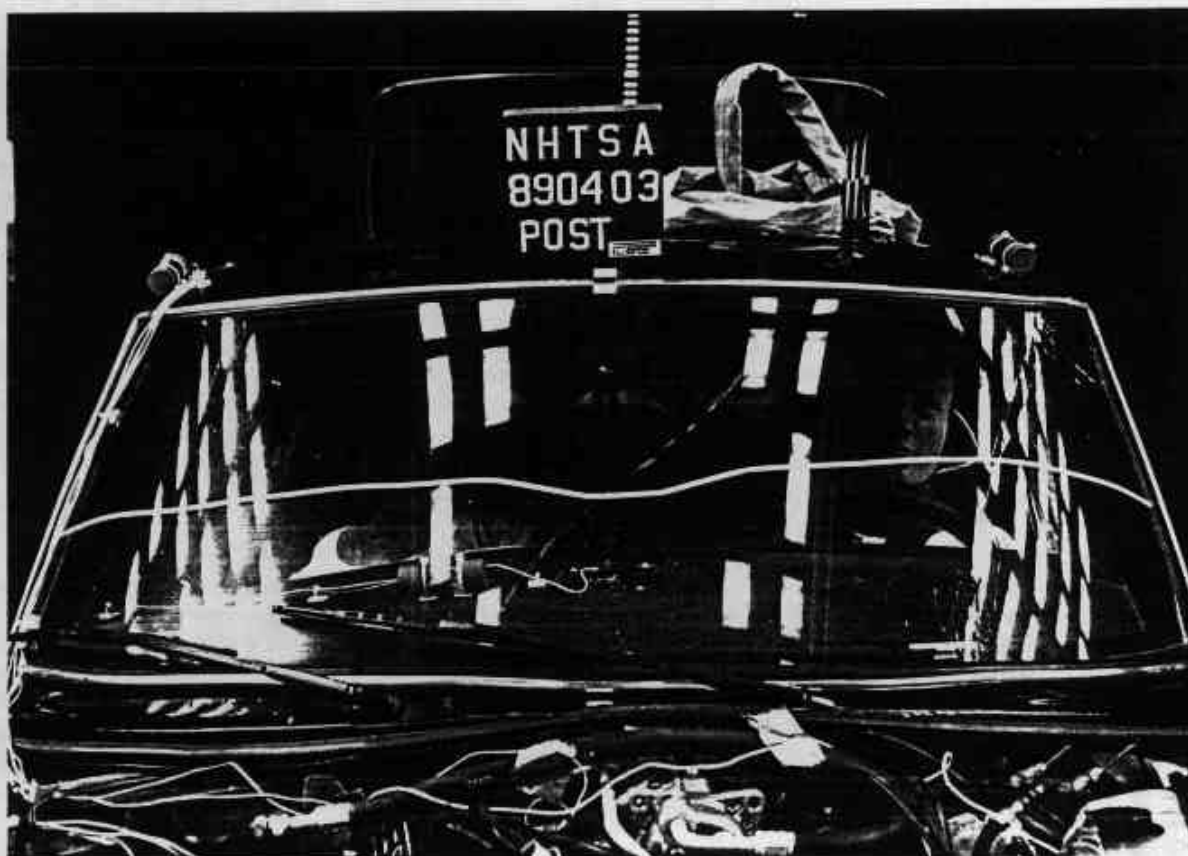


Figure A-14. POST-TEST WINDSHIELD VIEW

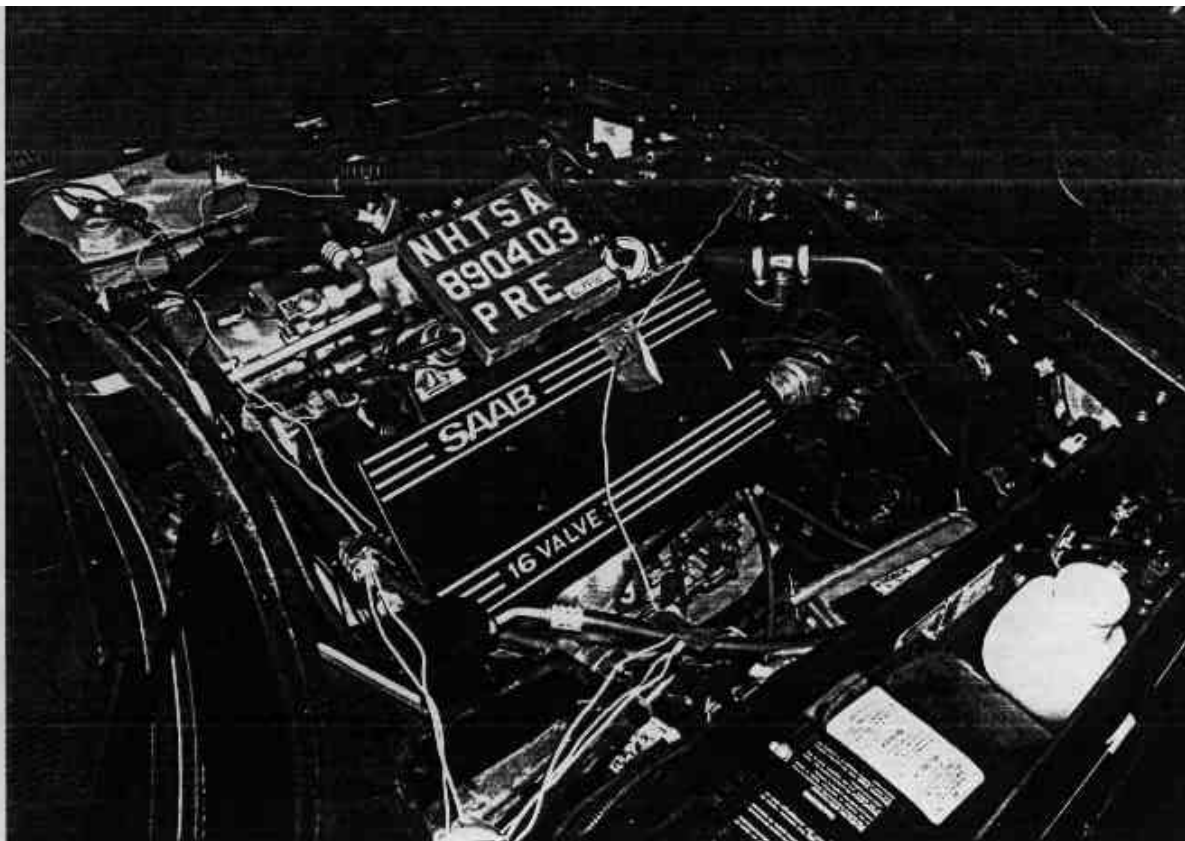


Figure A-15. PRE-TEST ENGINE COMPARTMENT VIEW

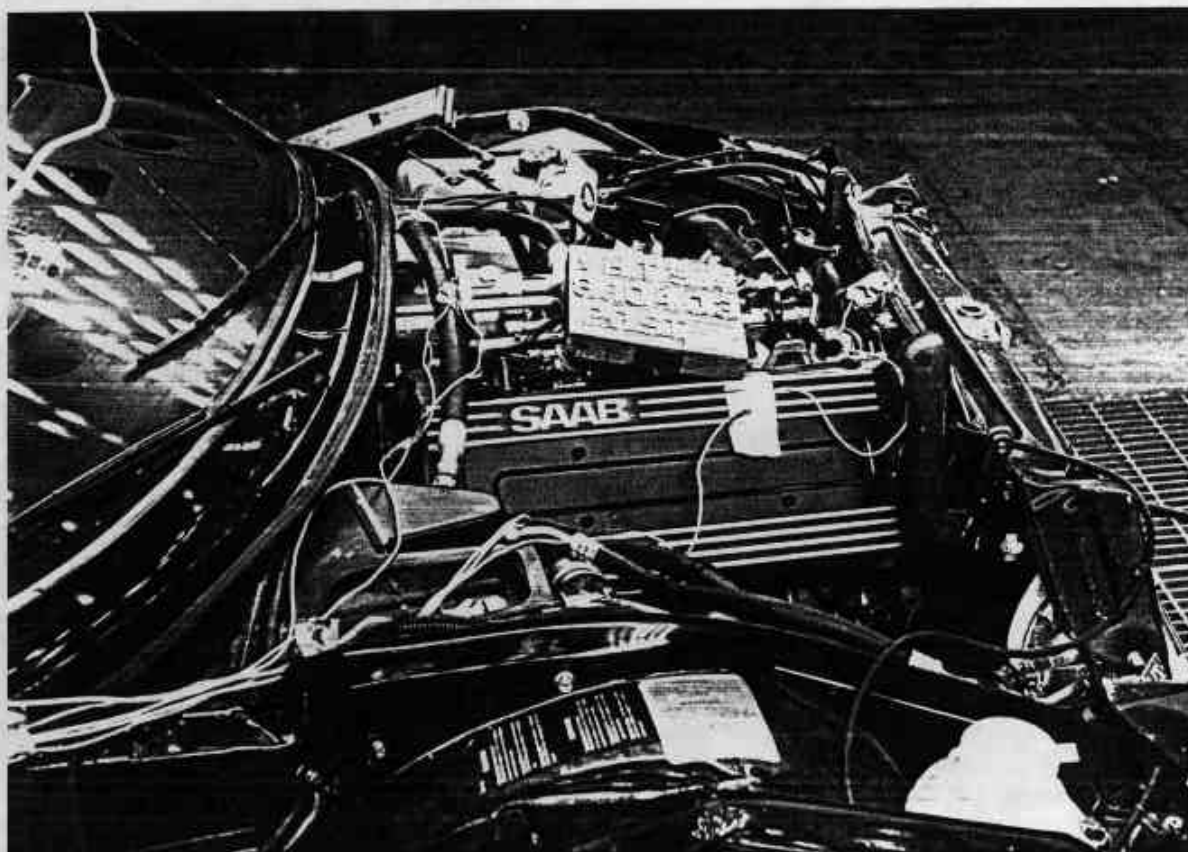


Figure A-16. POST-TEST ENGINE COMPARTMENT VIEW





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



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

890403



Figure A-19. PRE-TEST FRONT UNDERBODY VIEW

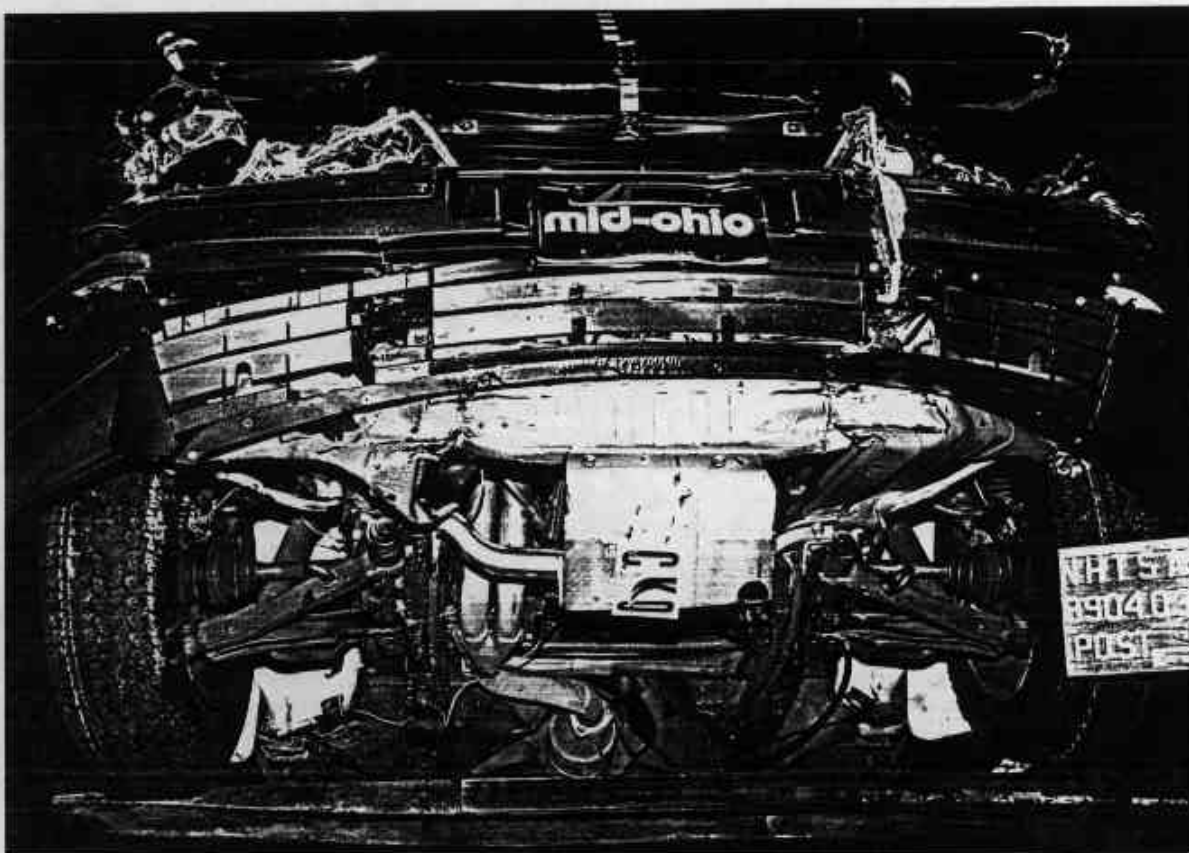


Figure A-20. POST-TEST FRONT UNDERBODY VIEW  
A-11

890403

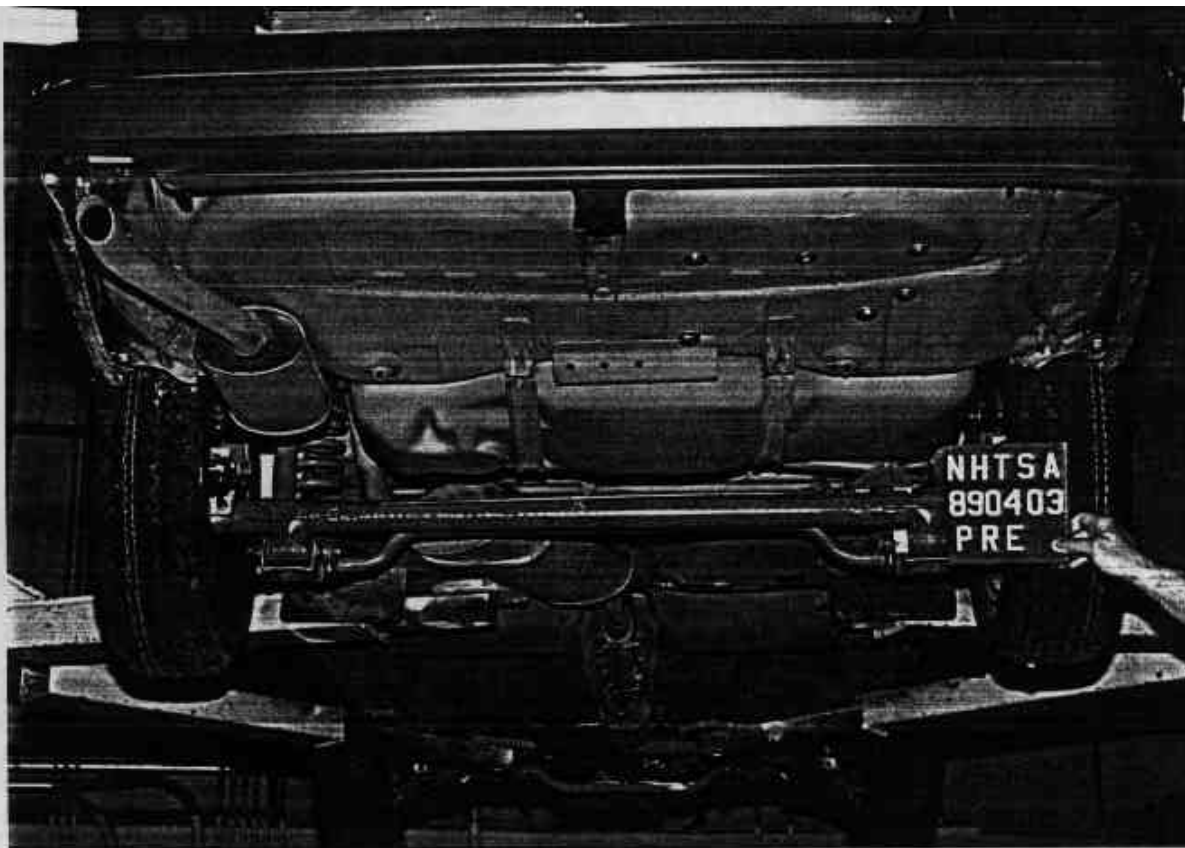


Figure A-21. PRE-TEST REAR UNDERBODY VIEW



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

890403

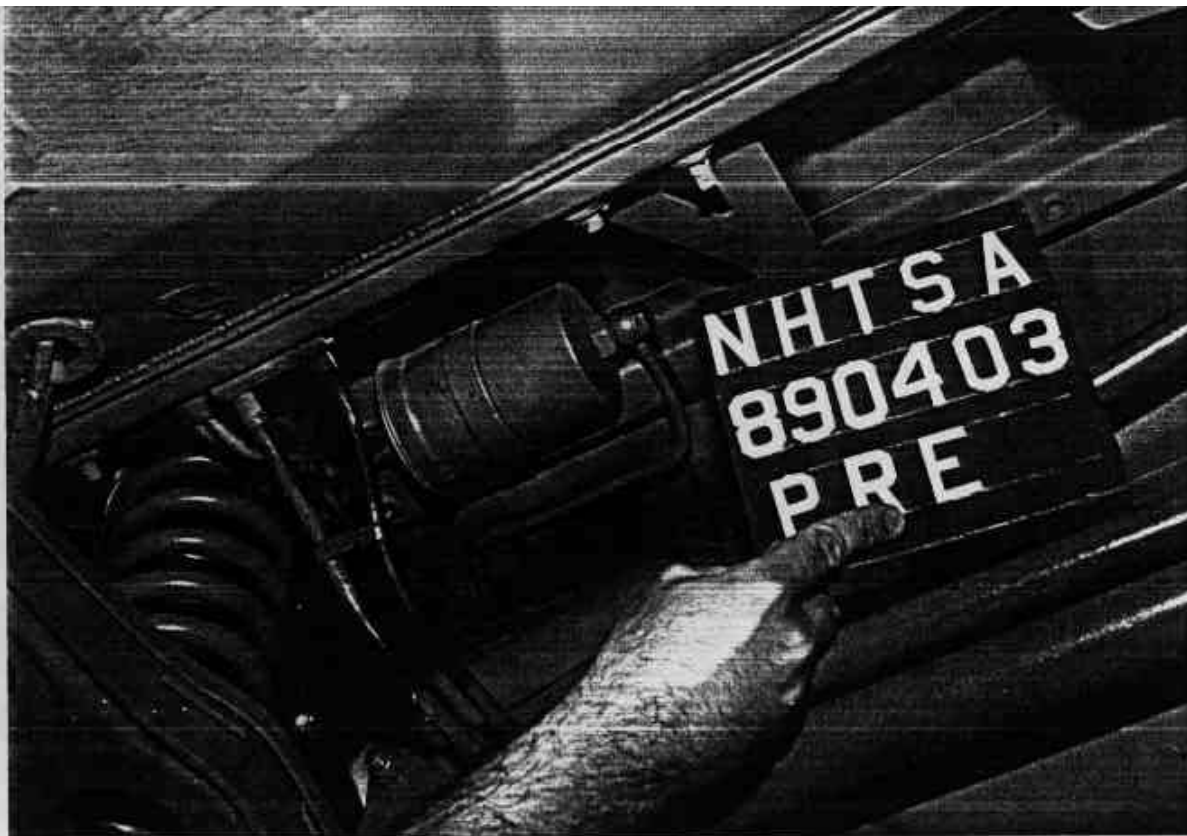


Figure A-23. PRE-TEST FUEL PUMP VIEW



Figure A-24. PRE-TEST FUEL TANK VIEW  
A-13

890403





Figure A-25. PRE-TEST CARGO BALLAST - VIEW 1



Figure A-26. PRE-TEST CARGO BALLAST - VIEW 2  
A-14

890403



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



Figure A-28. POST-TEST DRIVER DUMMY POSITION VIEW  
A-15

890403



Figure A-29. PRE-TEST PASSENGER DUMMY POSITION VIEW



Figure A-30. POST-TEST PASSENGER DUMMY POSITION VIEW



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

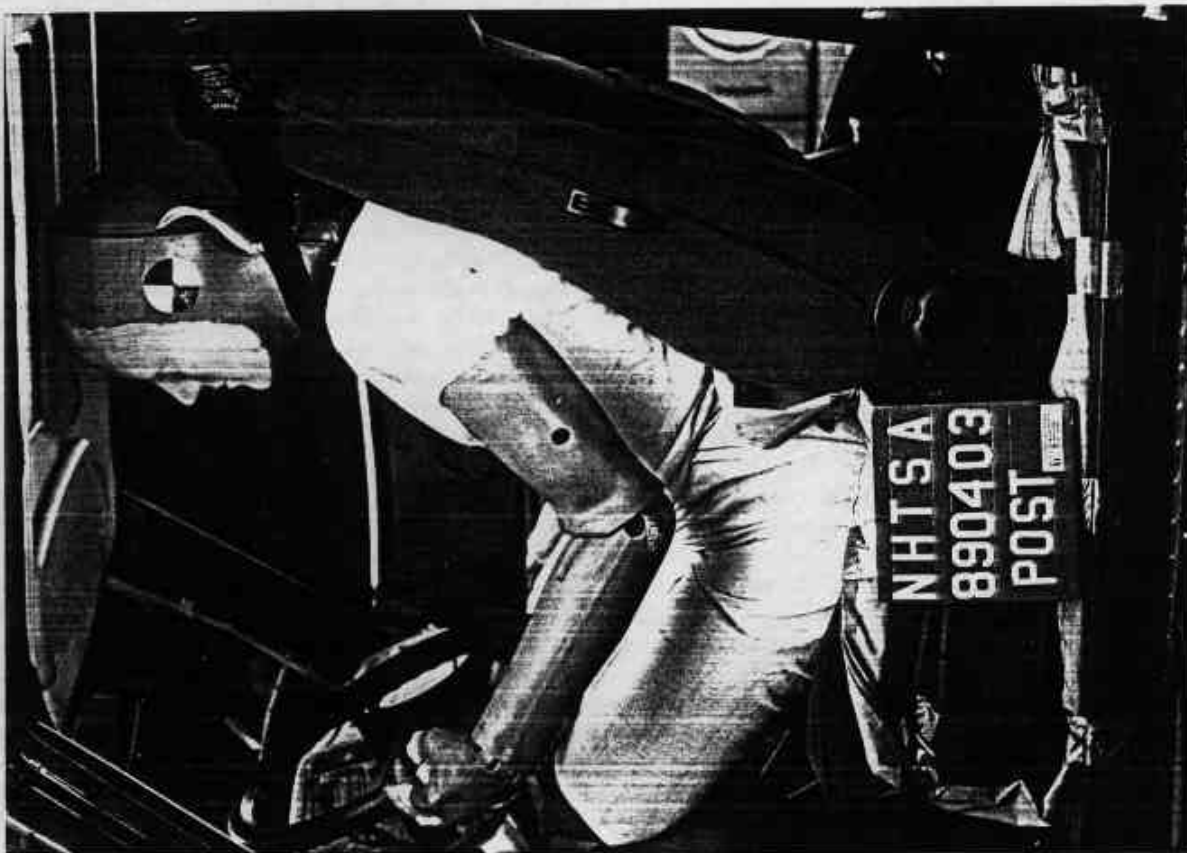


Figure A-32. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

A-17

890403



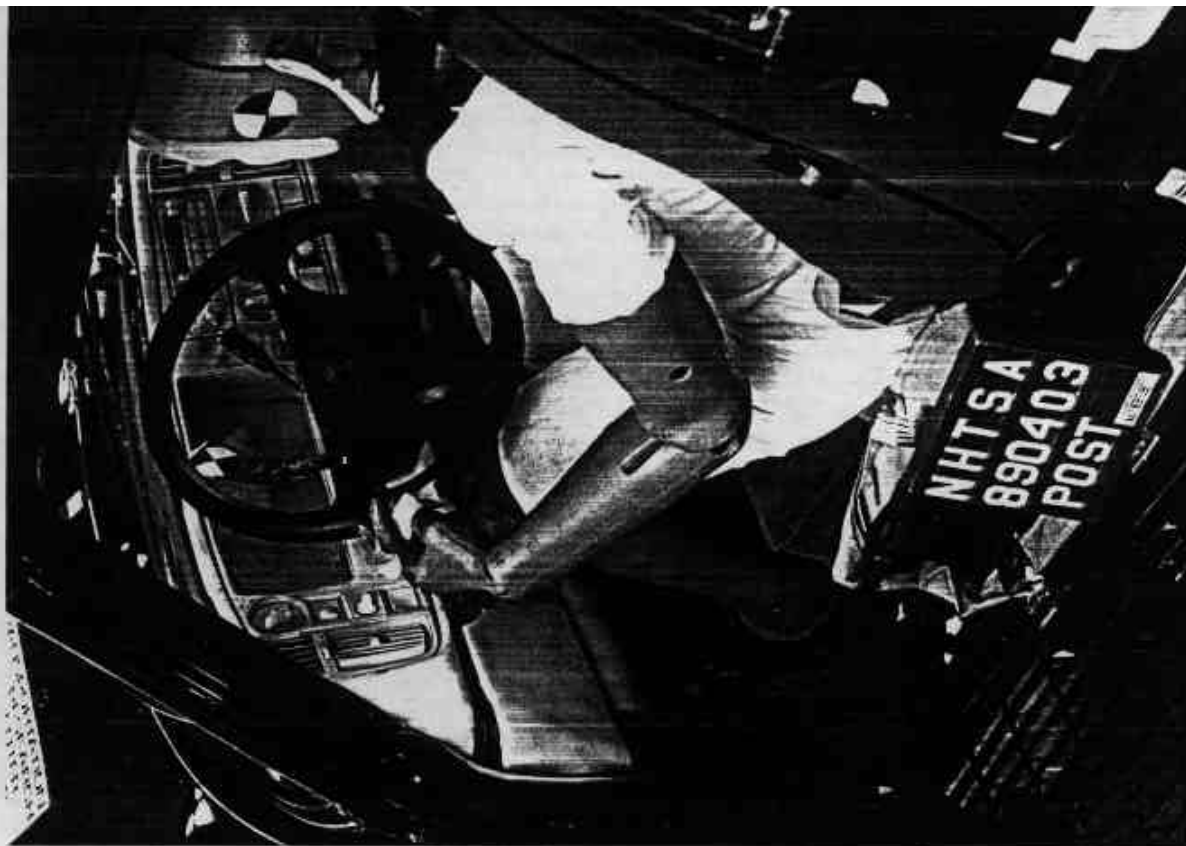


Figure A-33. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-34. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR

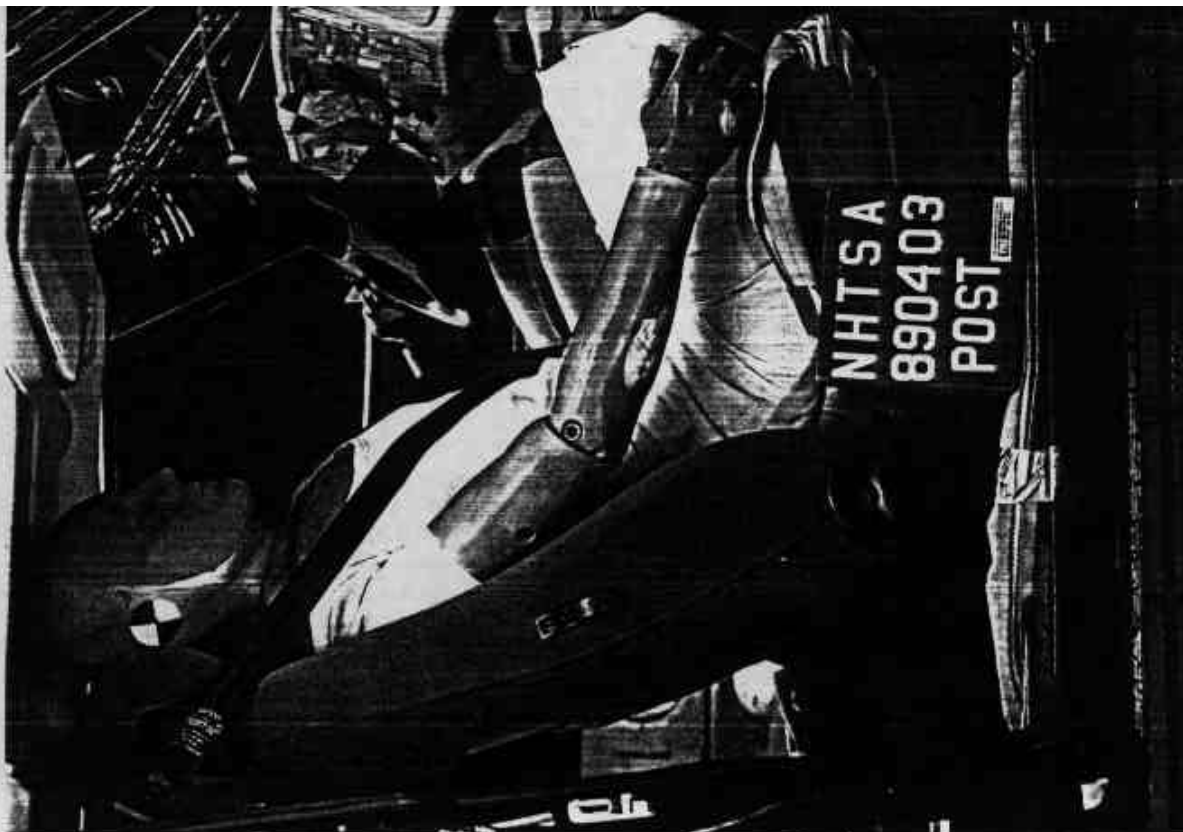


Figure A-35. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1



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



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



Figure A-38. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

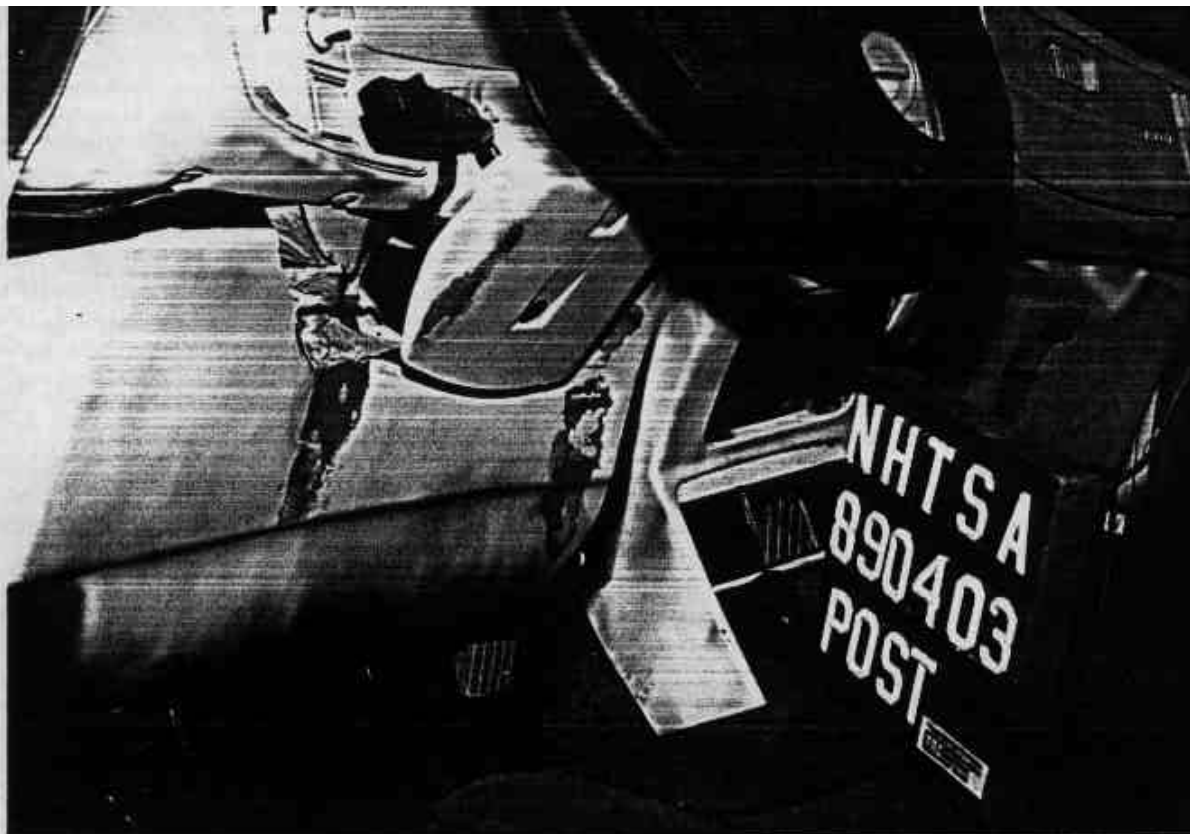


Figure A-39. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2

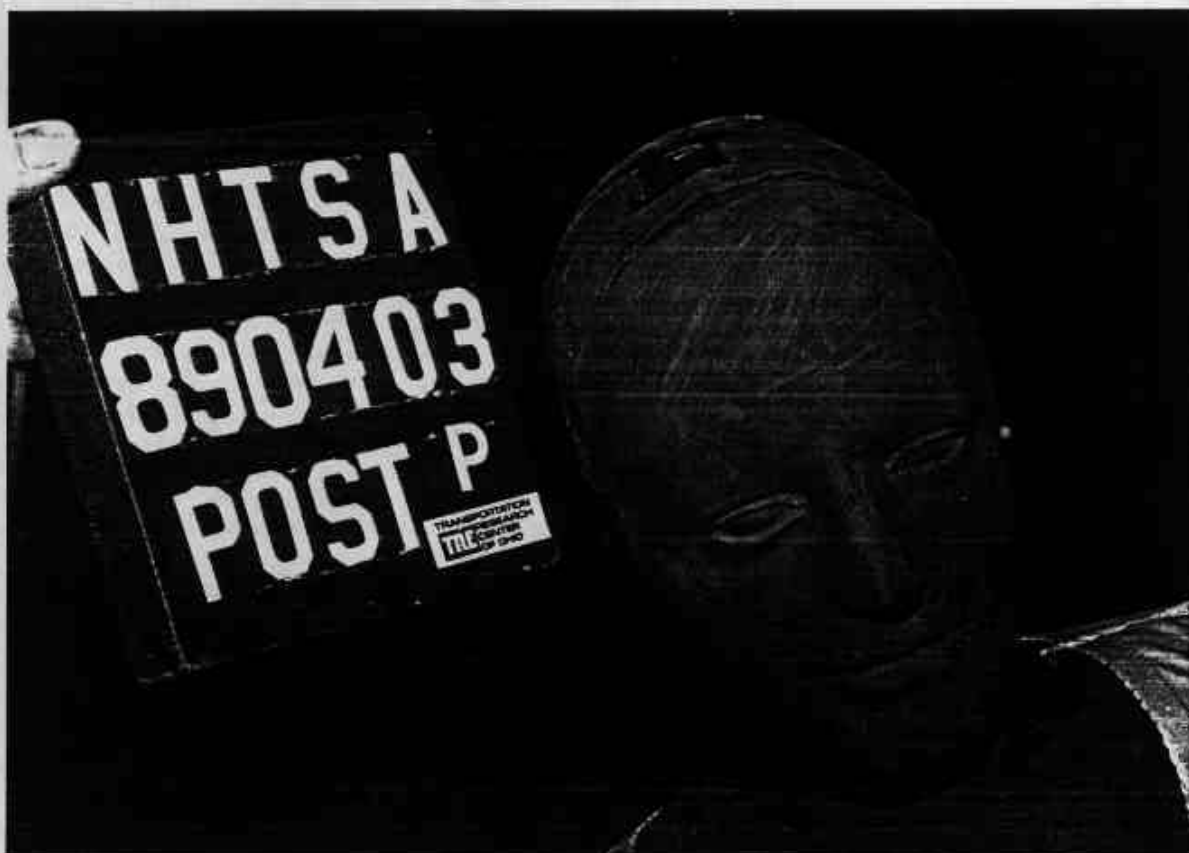


Figure A-40. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW





Figure A-41. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 1

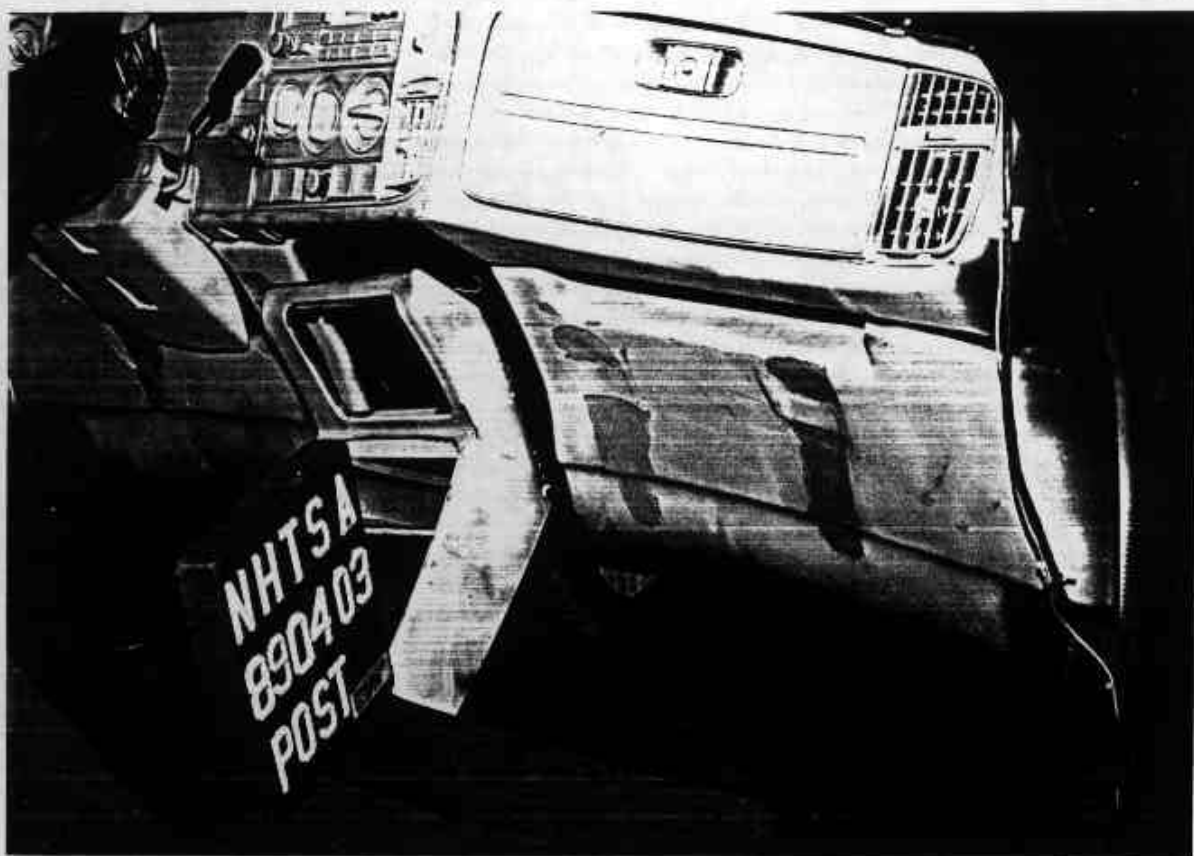


Figure A-42. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 2



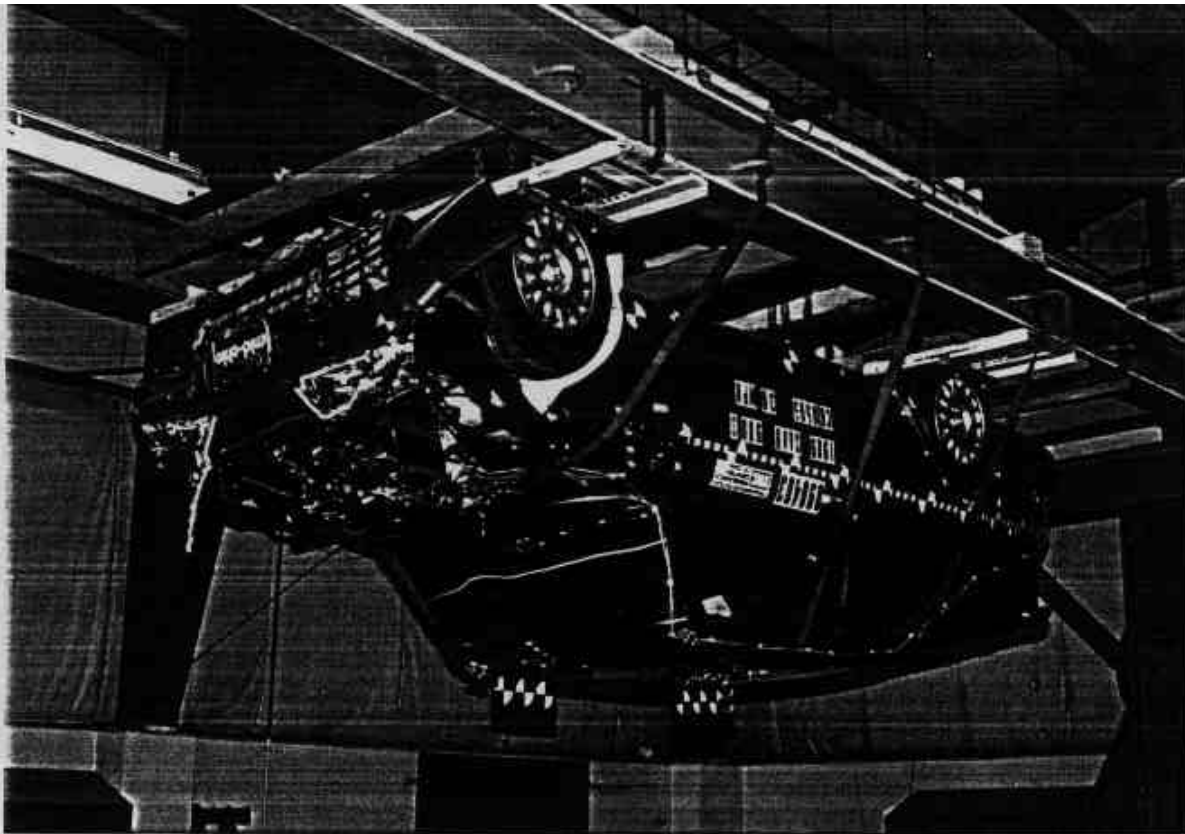


Figure A-45. POST-TEST VEHICLE ON STATIC ROLLOVER VIEW

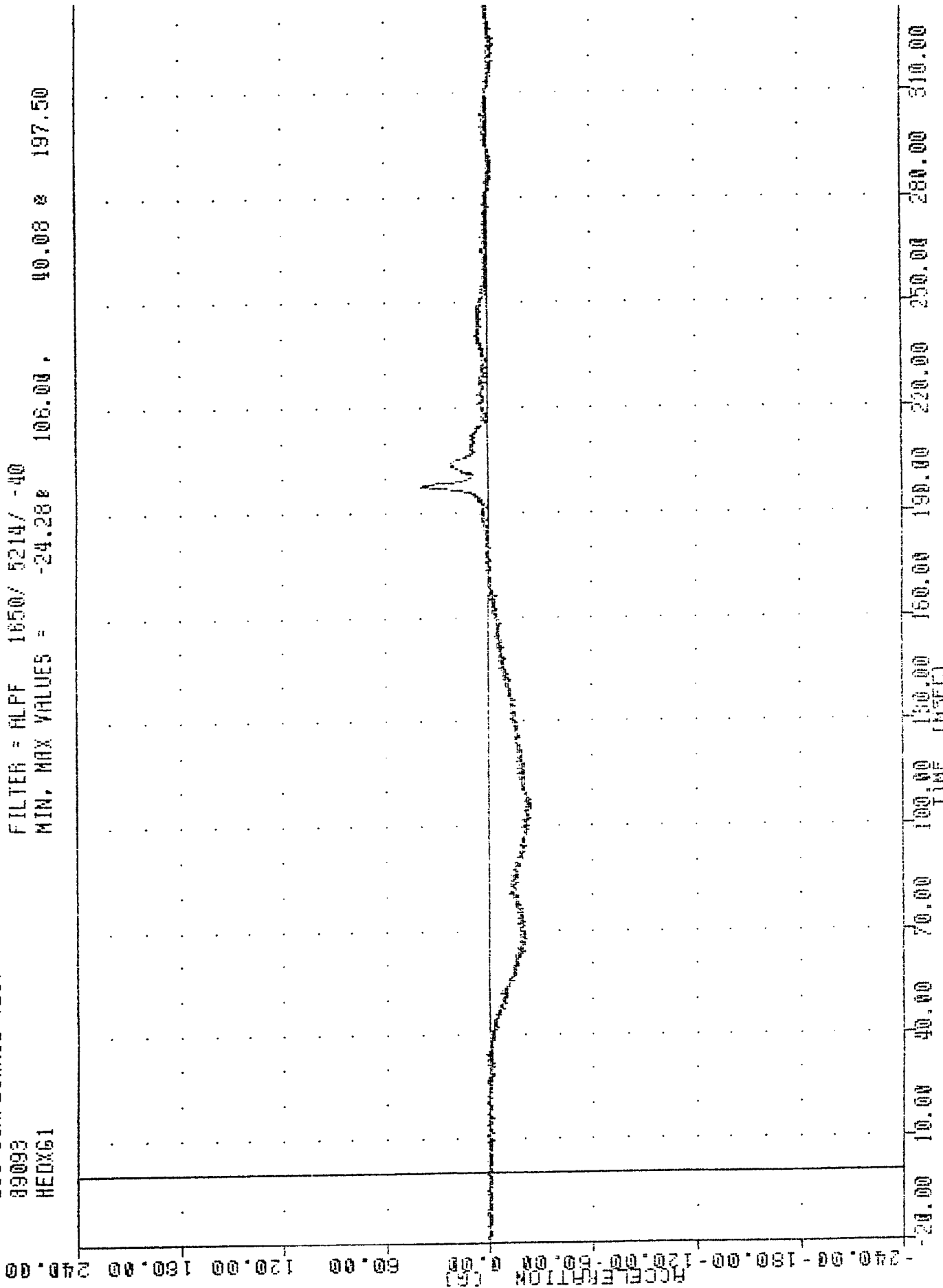
APPENDIX B

DATA PLOTS

DUMMY AND VEHICLE AXES: X: FRONT/REAR  
Y: LEFT/RIGHT  
Z: UP/DOWN

200 COMPLIANCE TEST  
 89093  
 HEDX61

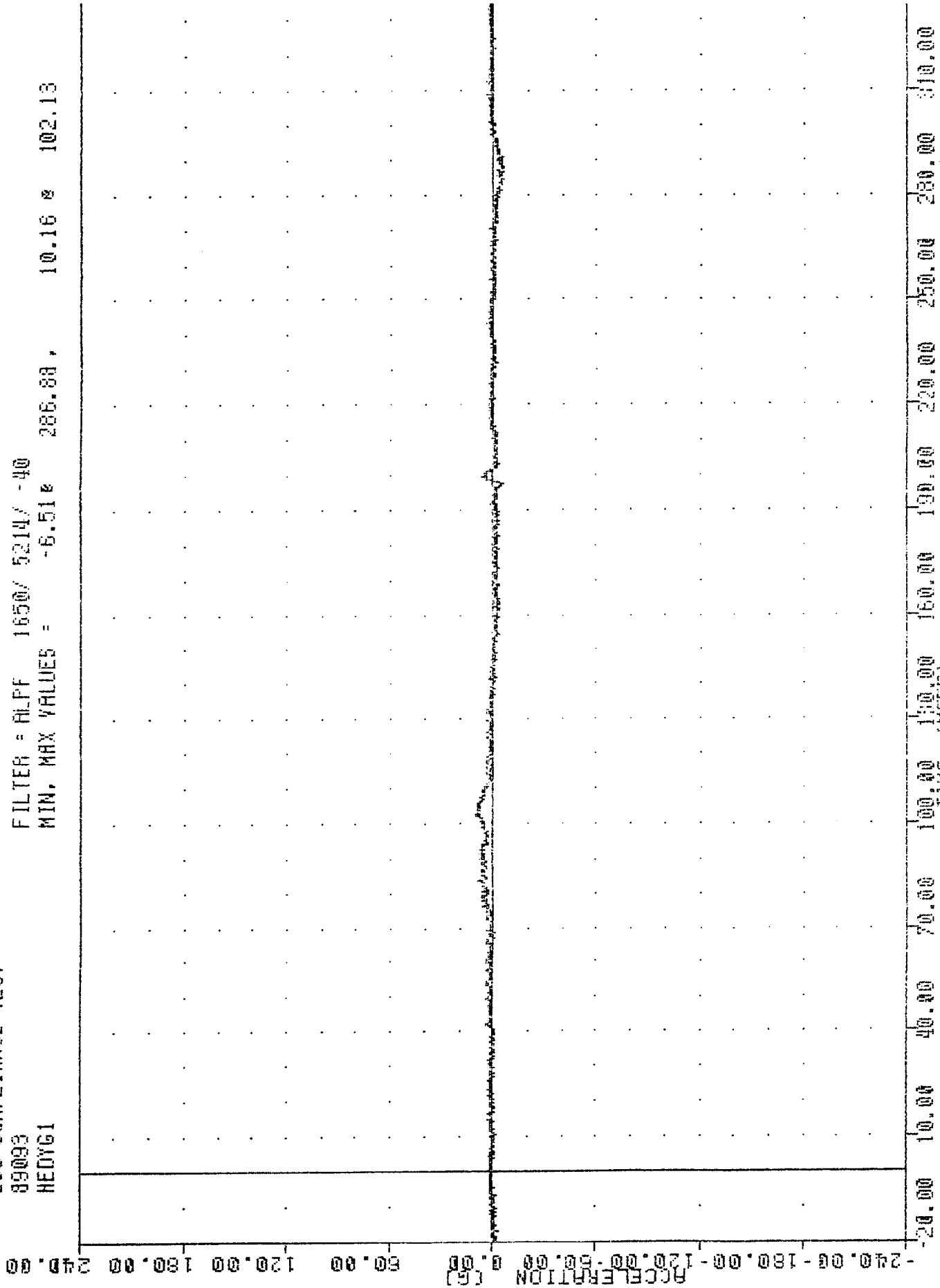
FILTER = HLPF 1650/ 5214/ -40  
 MIN. MAX VALUES = -24.28 106.00 40.08 197.50



1989 SAAB 900S INTO FRONTAL BARRIER  
 DRIVER HEAD X AXIS ACCELERATION

208 COMPLIANCE TEST  
 89093  
 HEDYG1

FILTER = ALPF 1650/ 5214/ -40  
 MIN. MAX VALUES = -6.51e 286.88 , 10.16 e 102.13



1989 SAAB 900S INTO FRONTAL BARRIER  
 DRIVER HEAD Y AXIS ACCELERATION

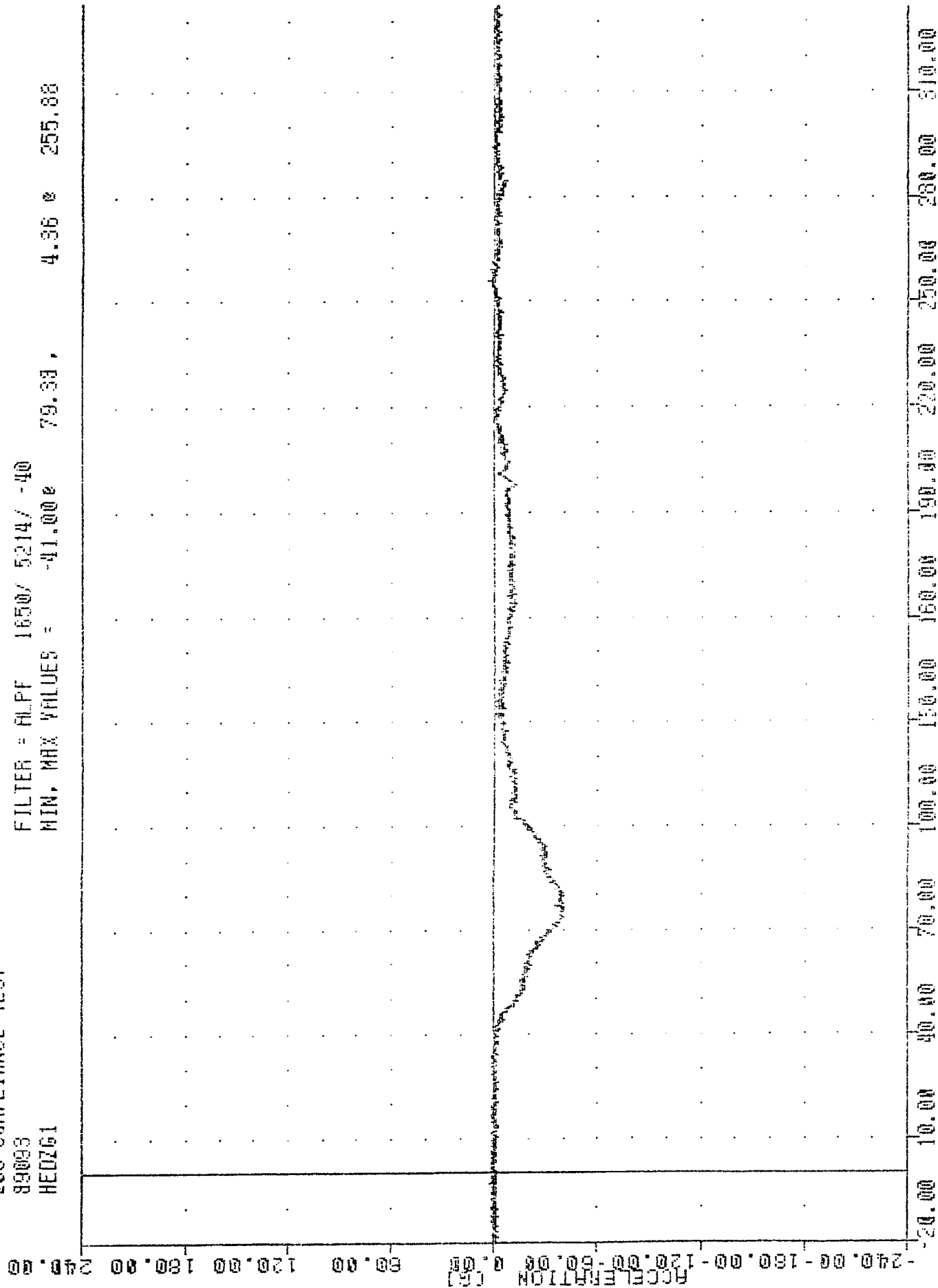
200 COMPLIANCE TEST

89003

HE0261

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -41.00e 79.33, 4.36 e 255.88

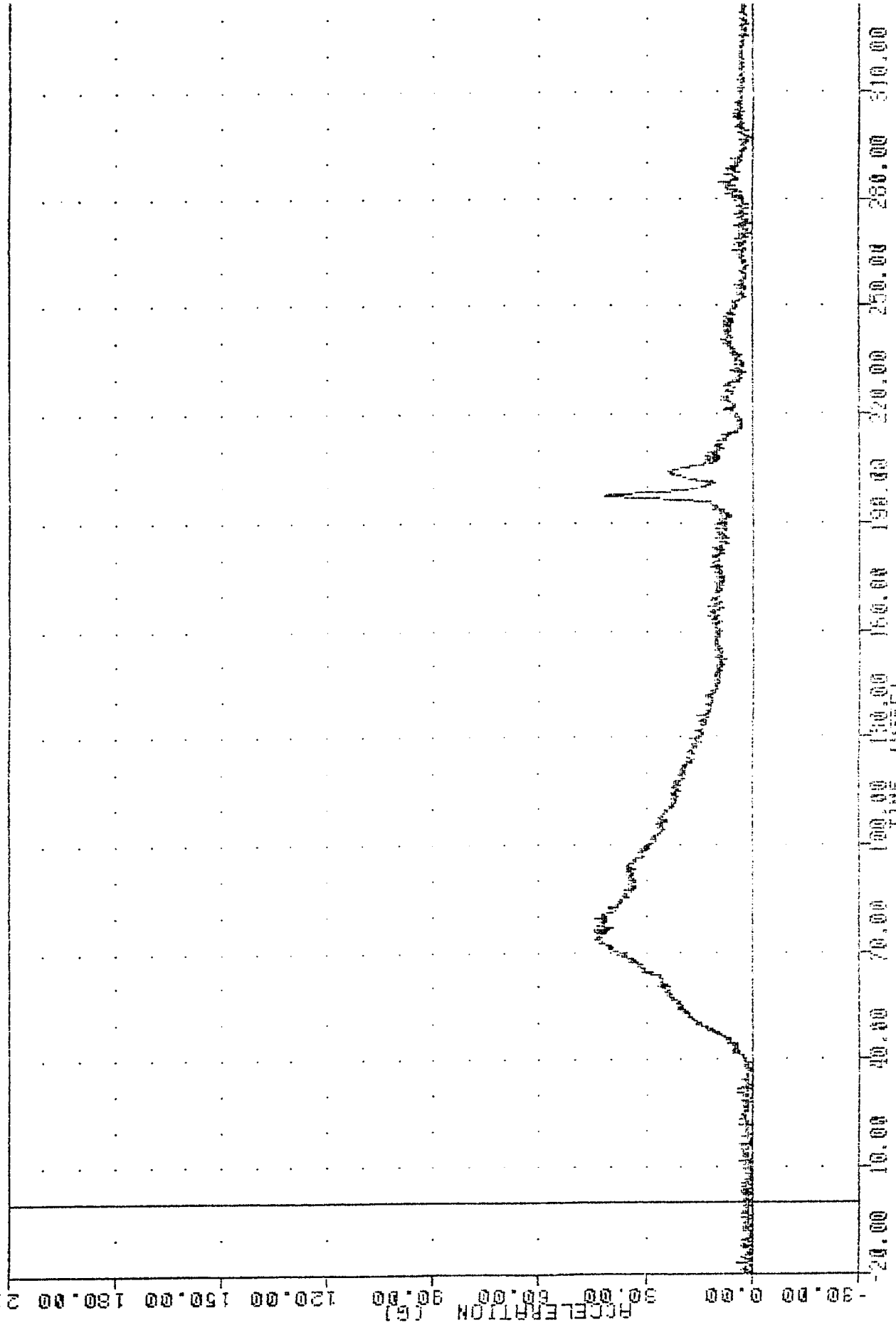


1989 SAAB 900S INTO FRONTAL BARRIER

DRIVER HEAD Z AXIS ACCELERATION

208 COMPLIANCE TEST  
 89093  
 HEDRG1

FILTER = ALPF 1650/ 5214/ -40  
 MIN, MAX VALUES = 0.08e -9.25e 44.55e 76.00



1989 SAND 900S INTO FRONTAL BARRIER  
 DRIVER HEAD RESULTANT ACCELERATION



DATA SAMPLE NO.

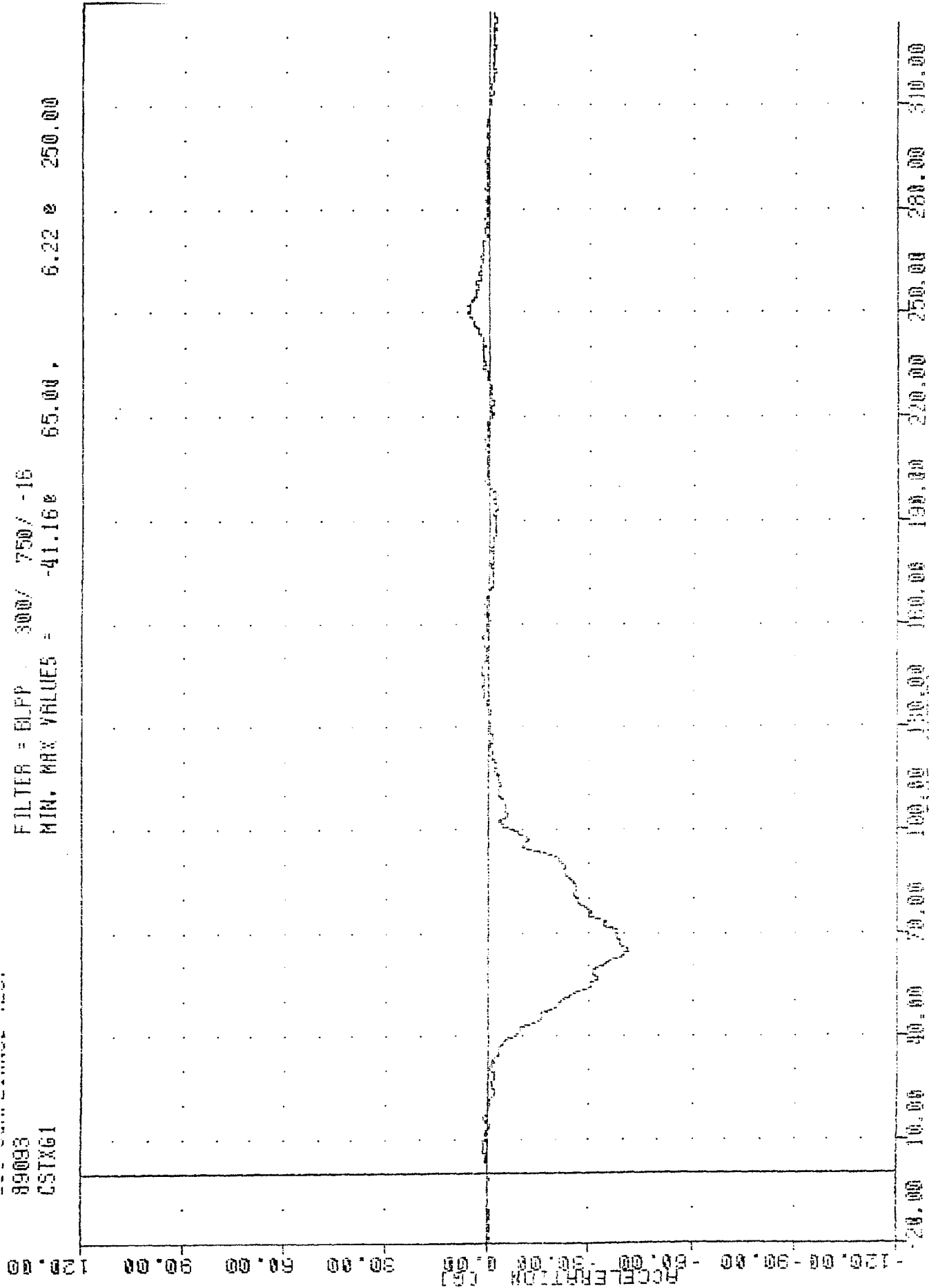
89093

CSTXG1

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = -41.16 65.00

6.22 e 250.00



1989 SABA 0008S INTO FRONTAL BARRIER  
DRIVER CHEST X AXIS ACCELERATION

208 COMPLIANCE TEST

89093

CSTY61

FILTER = BLPP 300/ 750/ -16

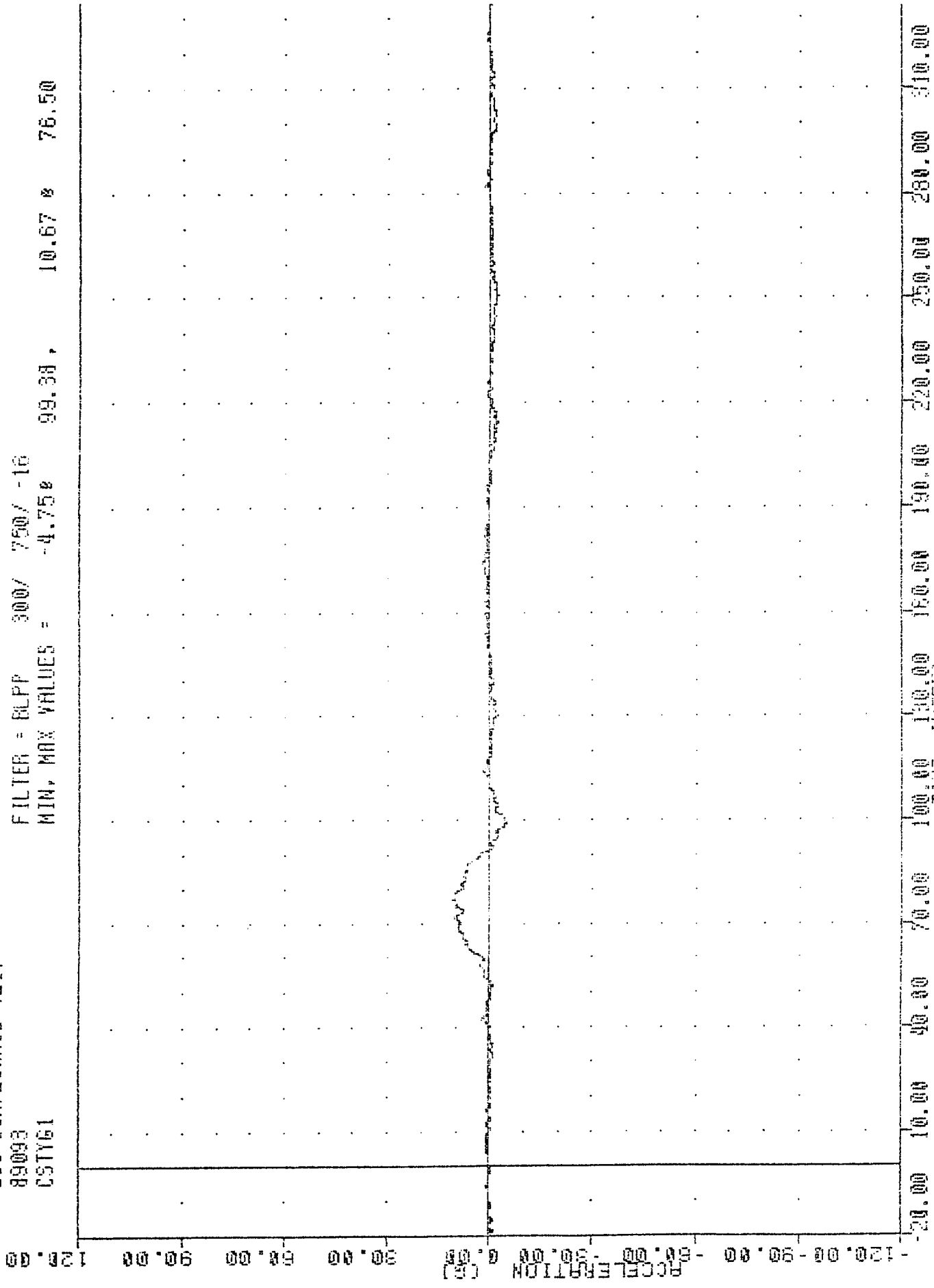
MIN, MAX VALUES =

-4.750

99.38,

10.67 \*

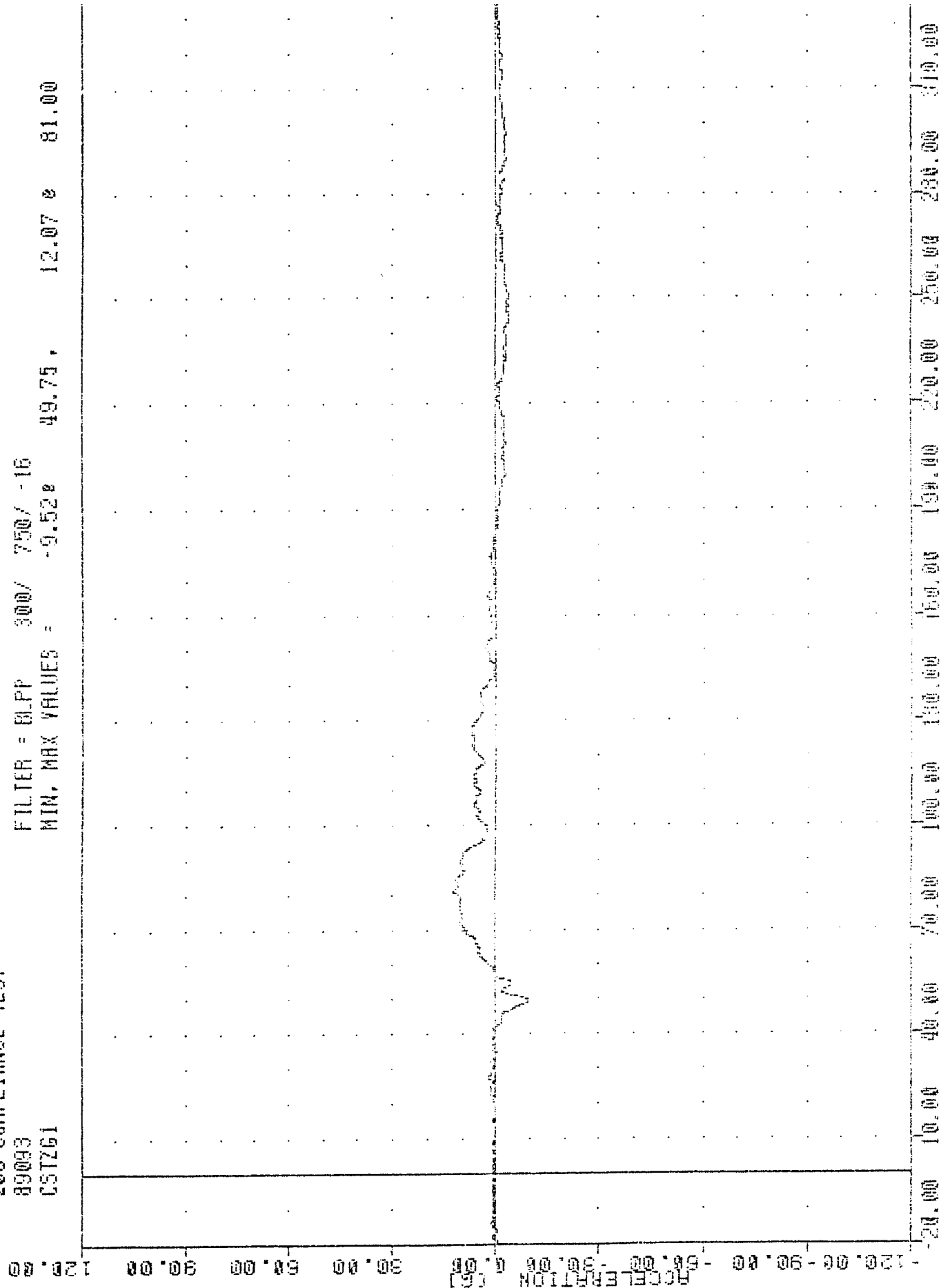
76.50



1989 SAAB 900S INTO FRONTAL BARRIER  
DRIVER CHEST Y AXIS ACCELERATION

INC  
206 COMPLIANCE TEST  
89093  
CSTZG1

FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = -9.52e 49.75, 12.07 e 81.00



1989 SHAR 3000S INTO FRONTAL BARRIER  
DRIVER CHEST Z AXIS ACCELERATION

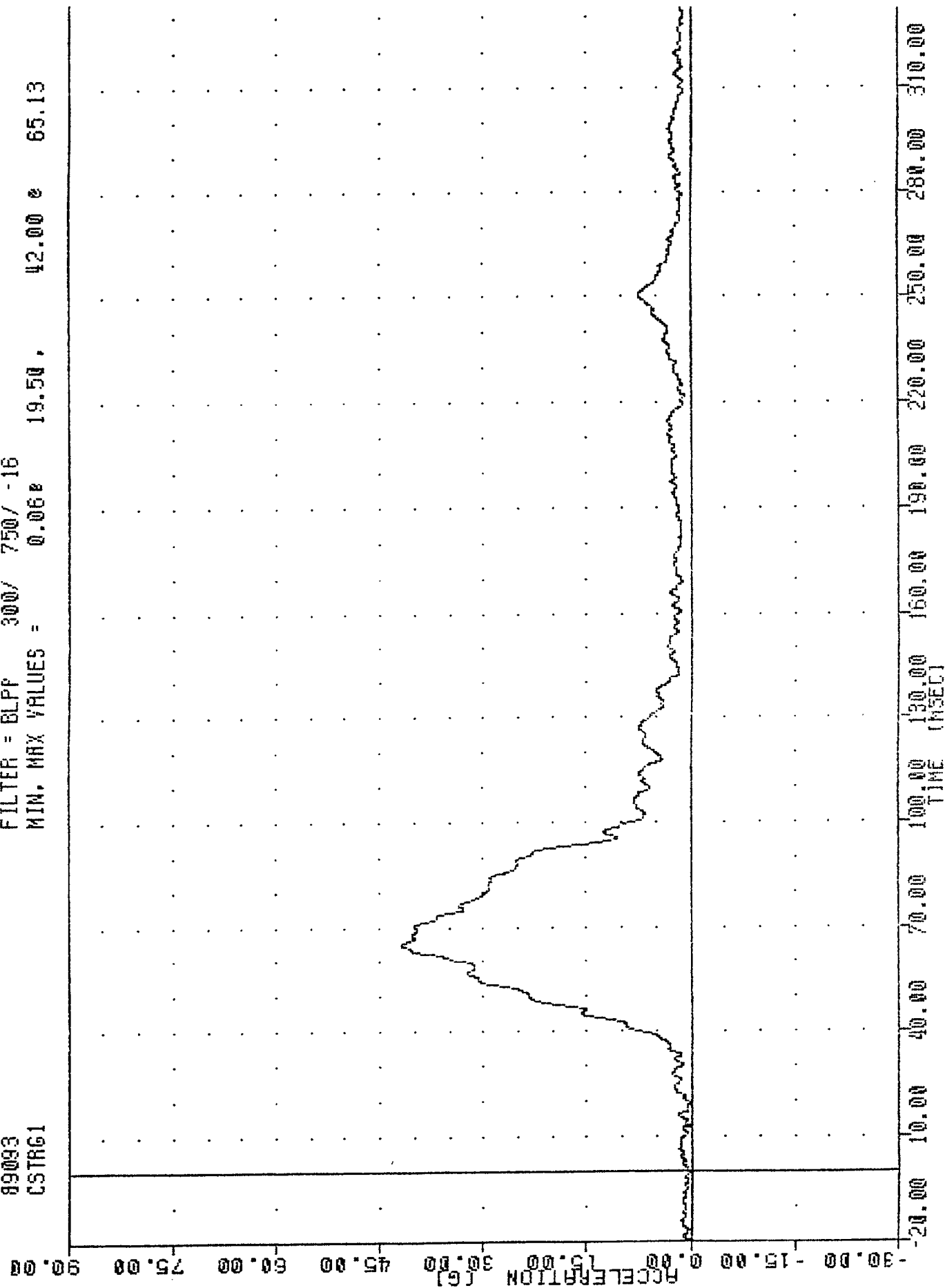
# 208 COMPLIANCE TEST

890093

CSTRG1

FILTER = BLPP 300/ 750/ -16

MIN, MAX VALUES = 0.06e 19.50, 42.00 e 65.13



1989 SAAB 900S INTO FRONTAL BARRIER  
DRIVER CHEST RESULTANT ACCELERATION

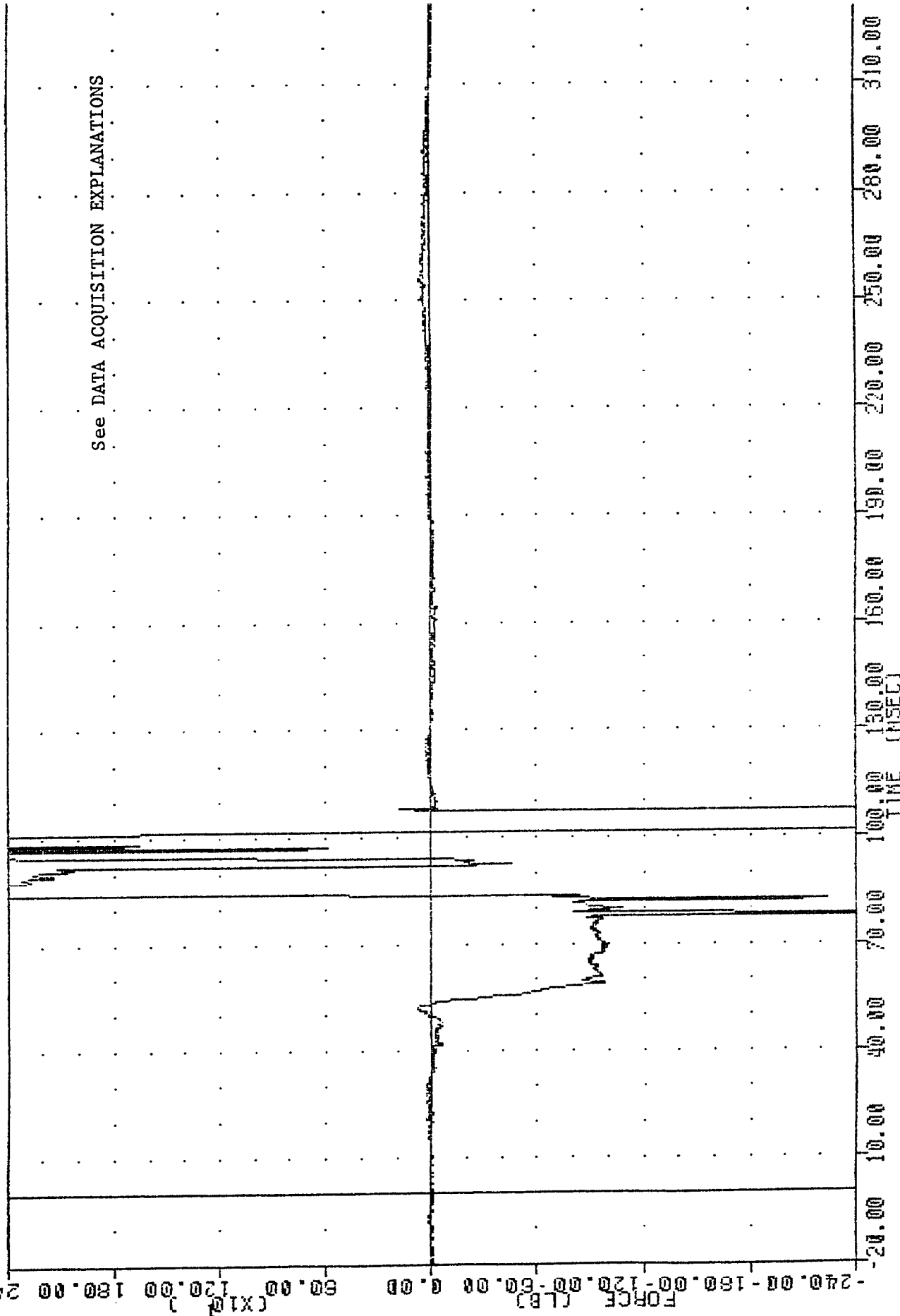
208 COMPLIANCE TEST

89093

LFMF1

FILTER = BLPP 1000/ 2500/ -16

MIN, MAX VALUES = -3372.39 106.88, 3370.12 8 96.50



1989 SAAB 900S INTO FRONTAL BARRIER  
DRIVER LEFT FEMUR FORCE

200 COMPLIANCE TEST

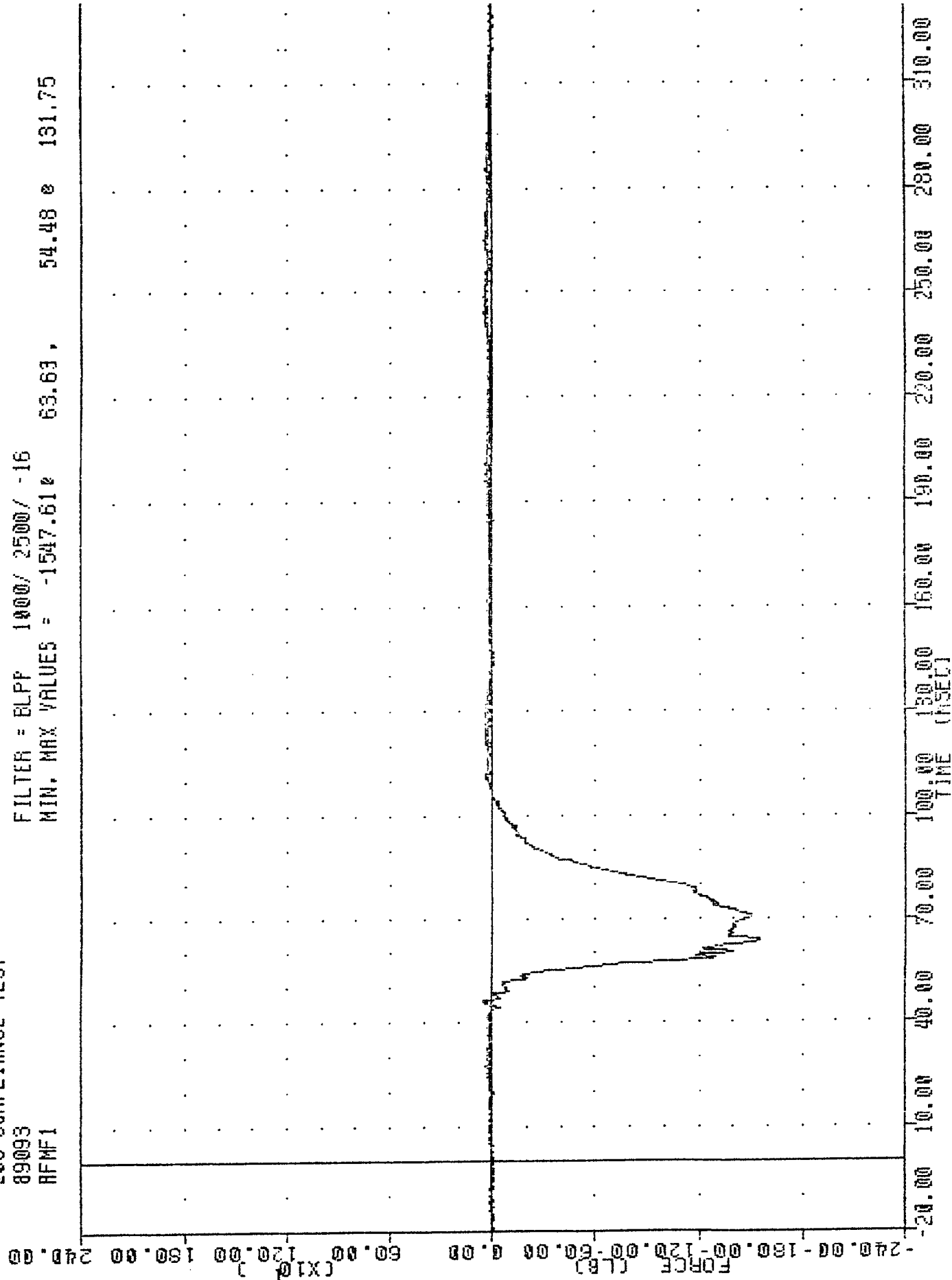
89093

RFMF1

FILTER = BLPP 1000/ 2500/ -16

MIN. MAX VALUES = -1547.61 63.63 ,

54.48 0 131.75



1989 SAAB 900S INTO FRONTAL BARRIER  
DRIVER RIGHT FEMUR FORCE

208 COMPLIANCE TEST

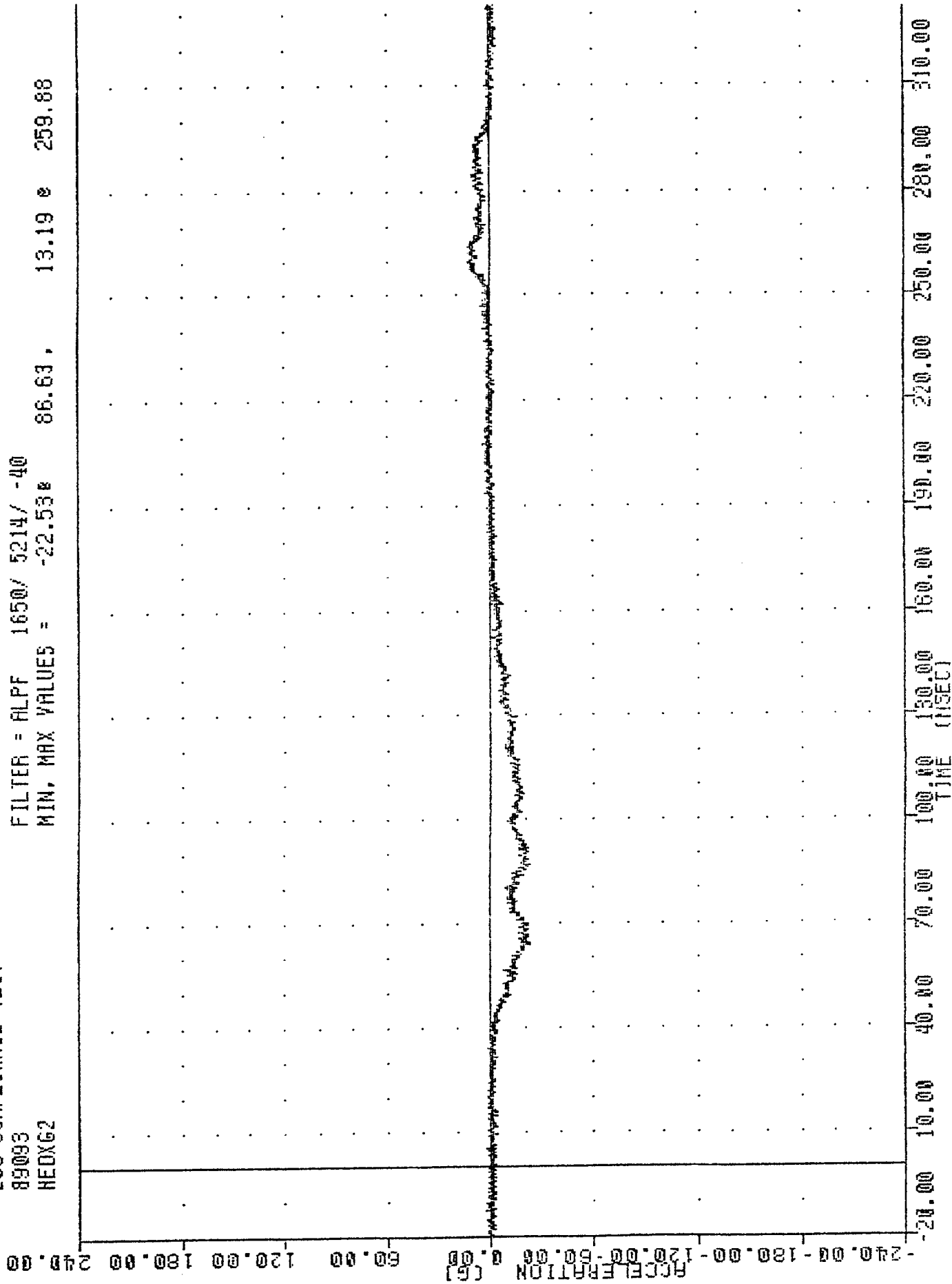
89093

HEXG2

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -22.53 86.63 ,

13.19 259.88



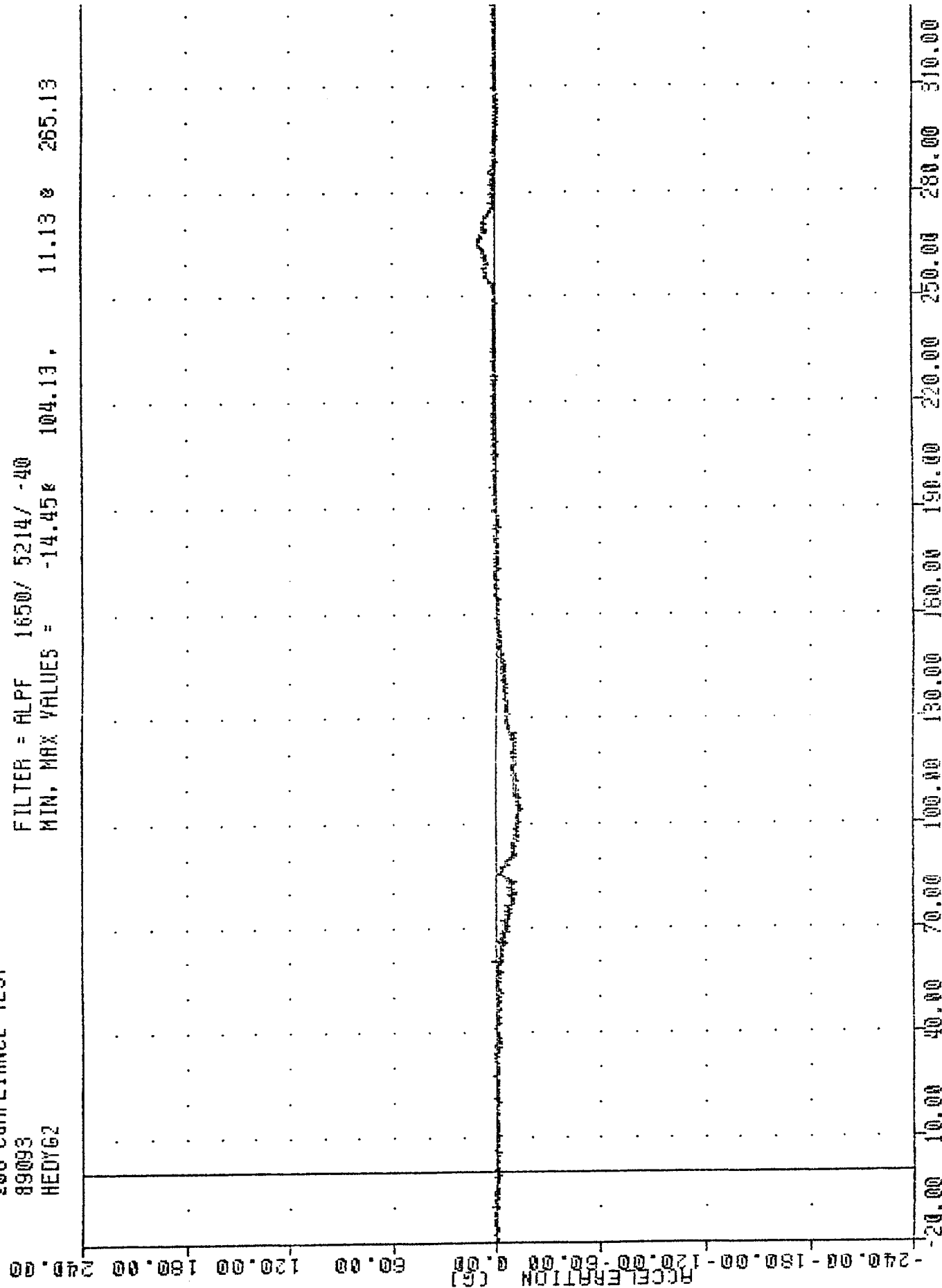
# 200 COMPLIANCE TEST

89093

HEDYG2

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -14.45 104.13 , 11.13 265.13



1989 SAAB 900S INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER HEAD Y AXIS ACCELERATION



200 COMPLIANCE TEST

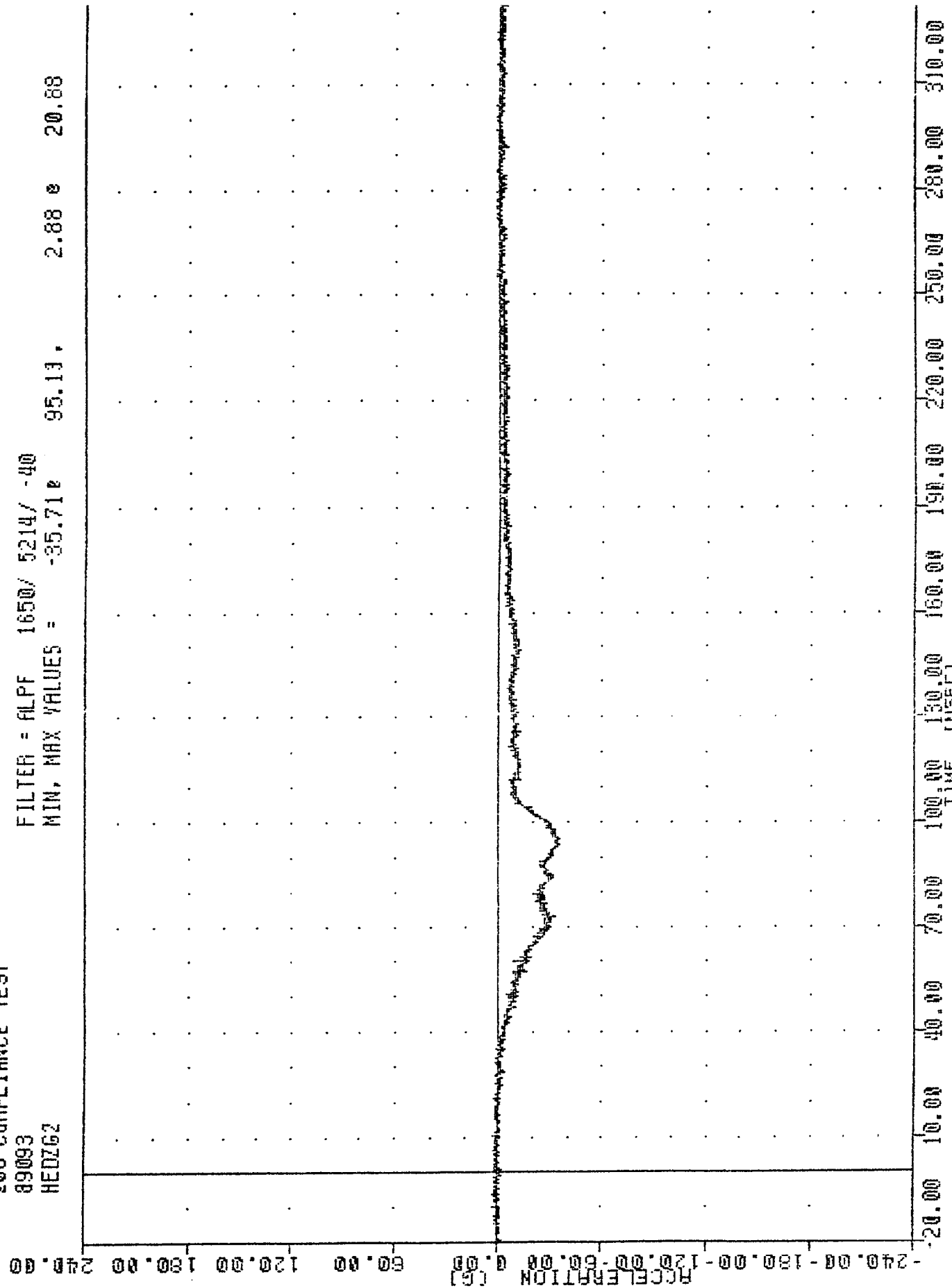
89093

HEDZ62

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -35.71 95.13

2.88 20.88

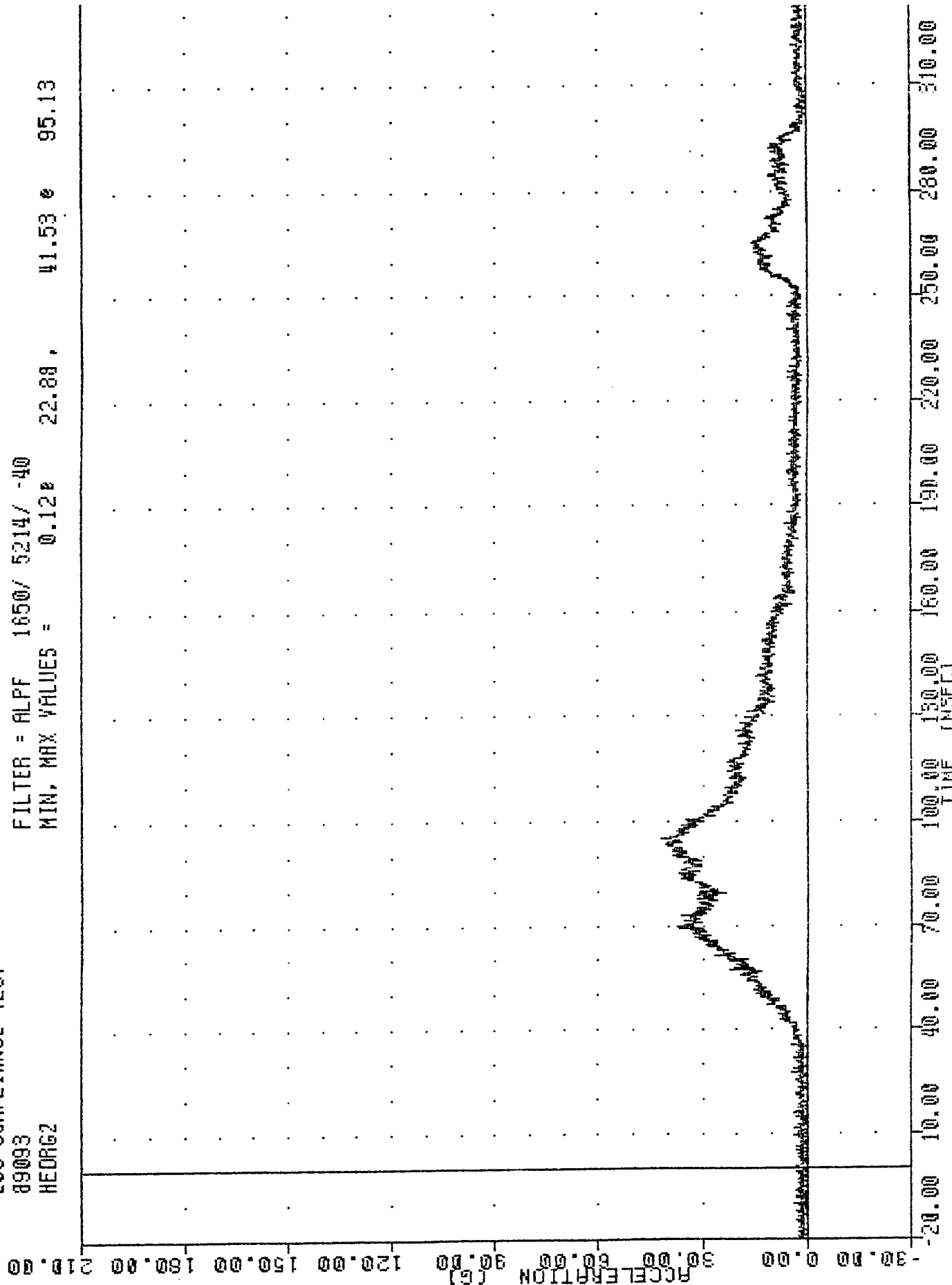


1989 SAAB 900S INTO FRONTAL BARRIER

RIGHT FRONT PASSENGER HEAD Z AXIS ACCELERATION

200 COMPLIANCE TEST  
 89093  
 HEDRG2

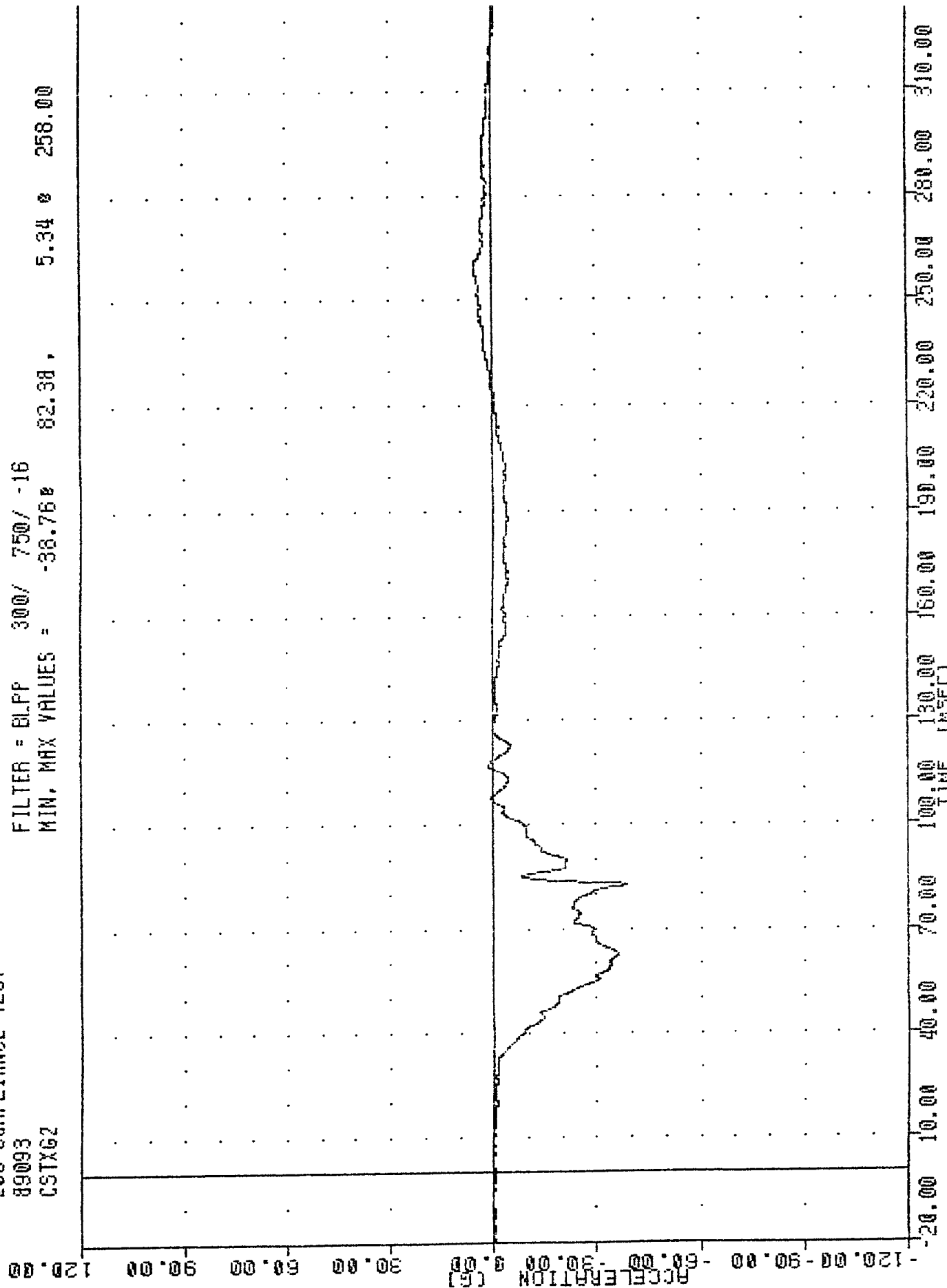
FILTER = ALPF 1650/ 5214/ -40  
 MIN, MAX VALUES = 0.120 22.88, 41.53 0 95.13



1989 SAAB 900S INTO FRONTAL BARRIER  
 RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

INL 0304400  
208 COMPLIANCE TEST  
89093  
CSTX62

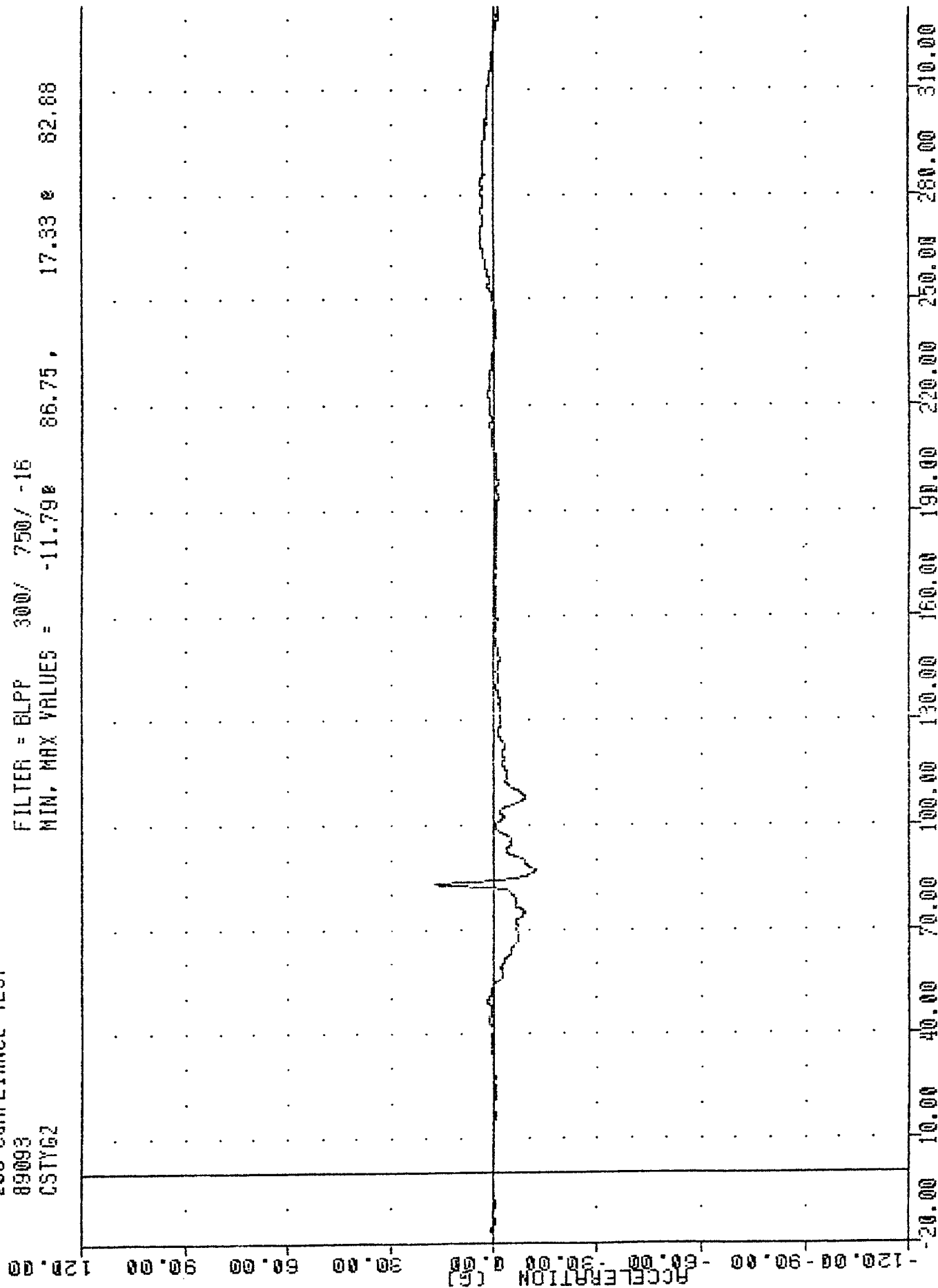
FILTER = BLPP 300/ 750/ -16  
MIN, MAX VALUES = -38.76 82.38 5.34 258.00



1989 SAB 900S INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER CHEST X AXIS ACCELERATION

200 COMPLIANCE TEST  
 89093  
 CSTY62

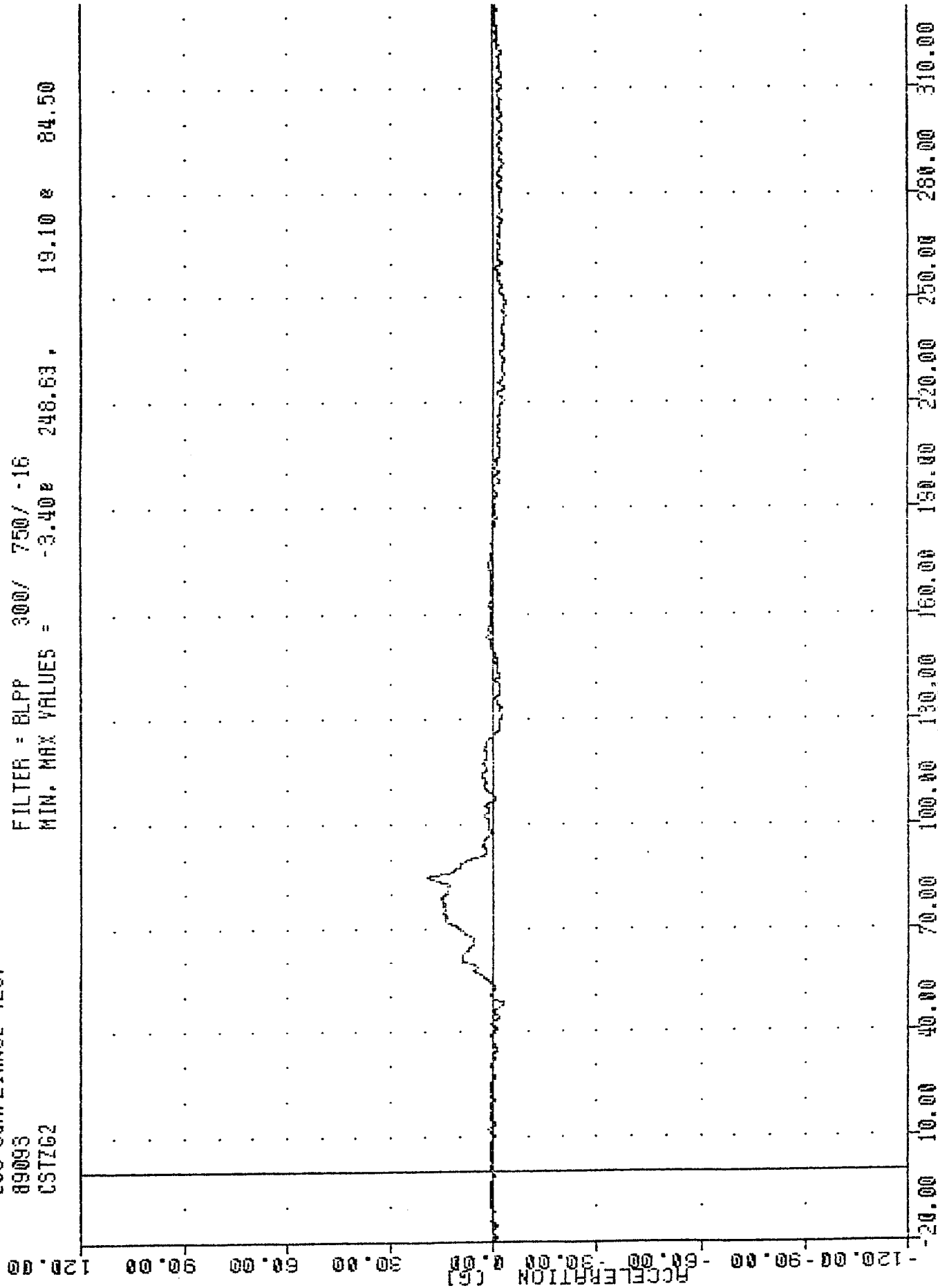
FILTER = BLPP 300/ 750/ -16  
 MIN, MAX VALUES = -11.790 86.75, 17.33 82.88



1989 SAAB 900S INTO FRONTAL BARRIER  
 RIGHT FRONT PASSENGER CHEST Y AXIS ACCELERATION

200 COMPLIANCE TEST  
 89093  
 CST262

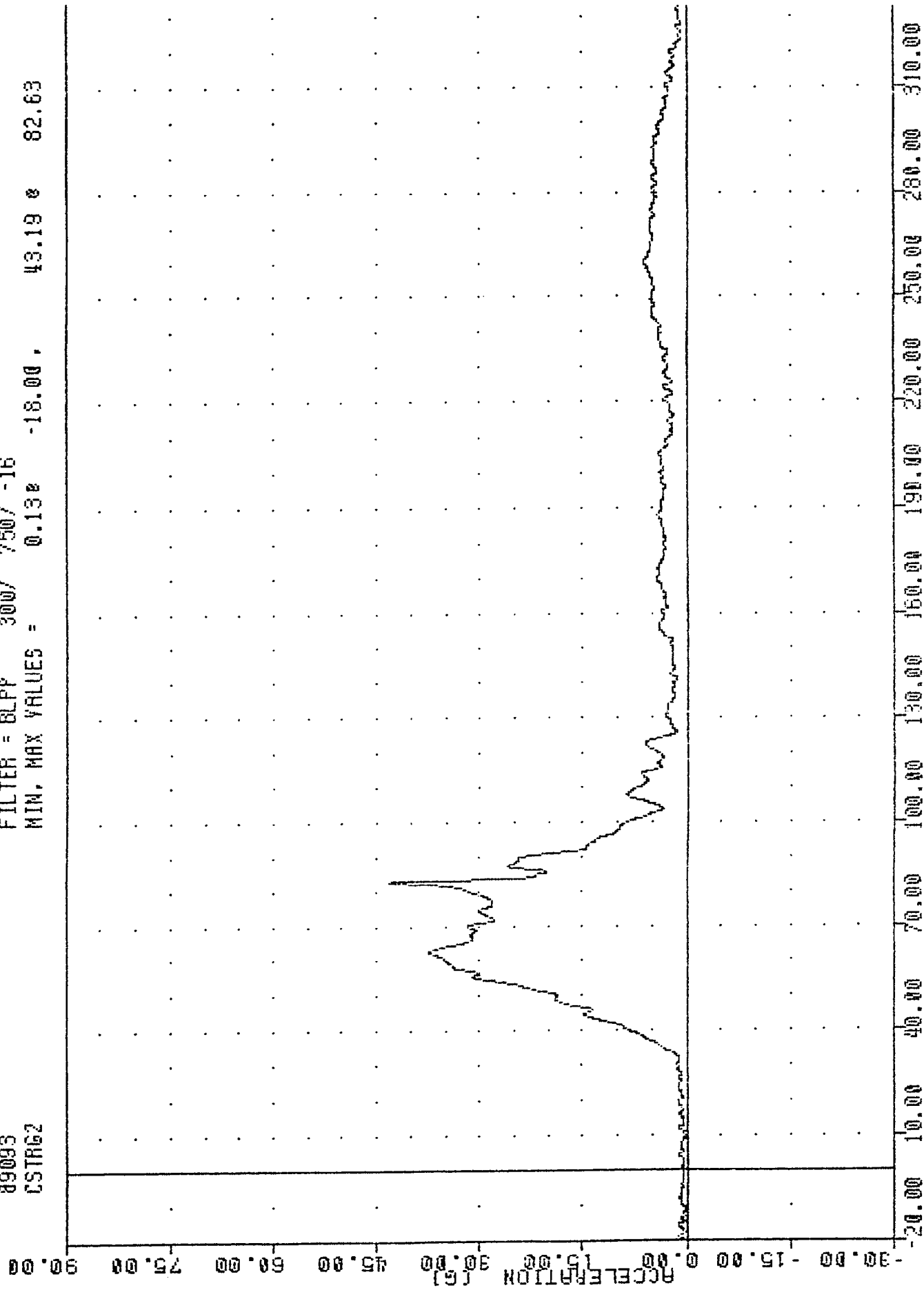
FILTER = BLPP 300/ 750/ -16  
 MIN. MAX VALUES = -3.40e 248.63, 19.10 e 84.50



1989 SAAB 900S INTO FRONTAL BARRIER  
 RIGHT FRONT PASSENGER CHEST Z AXIS ACCELERATION

208 COMPLIANCE TEST  
89093  
CSTR62

FILTER = BLPP 300/ 750/ -16  
MIN. MAX VALUES = 0.13e -18.00, 43.19 e 82.63



1989 SAB 900S INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION

# 200 COMPLIANCE TEST

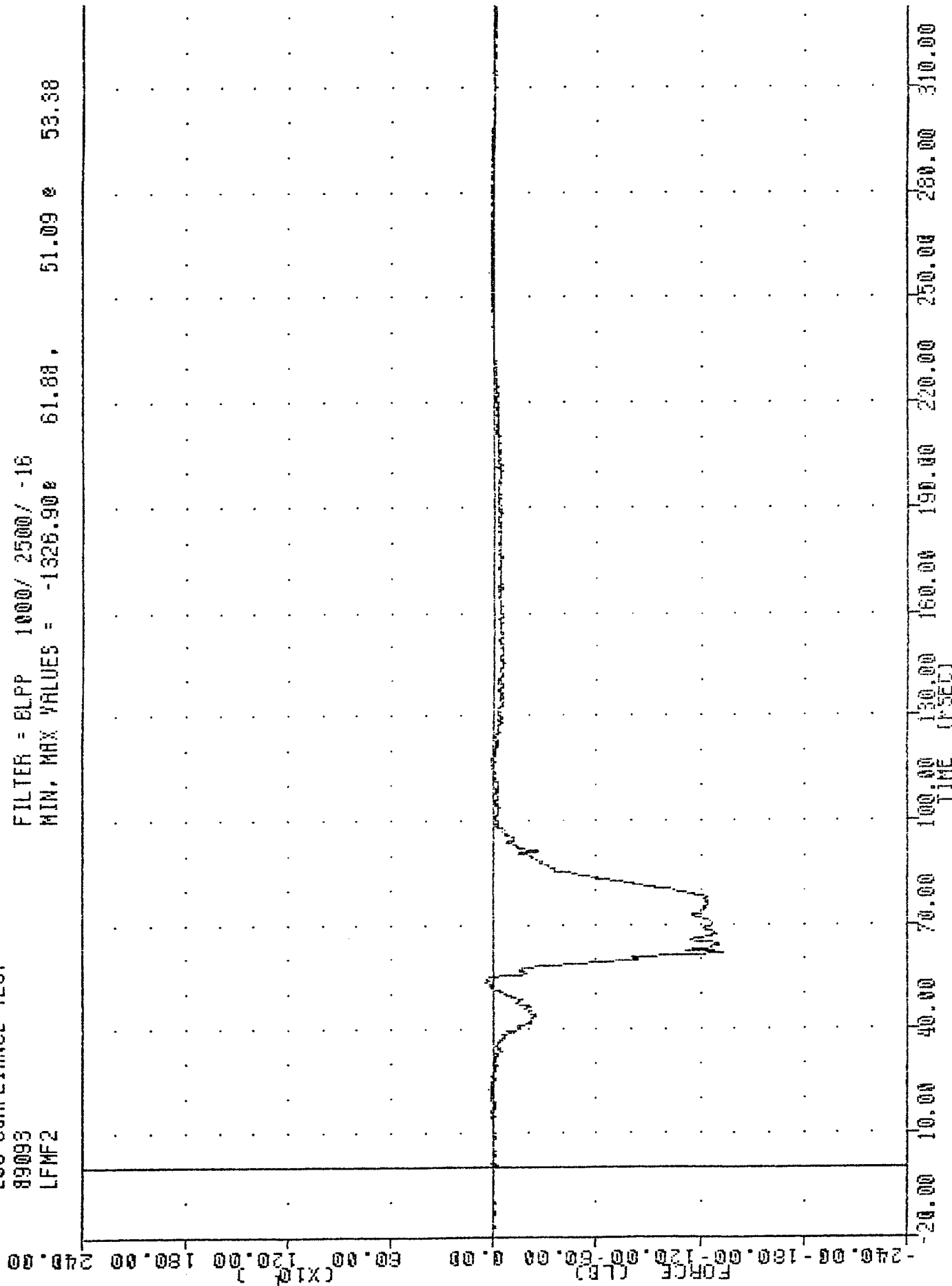
89093

LFMF2

FILTER = BLPP 1000/ 2500/ -16

MIN, MAX VALUES = -1326.900 61.88,

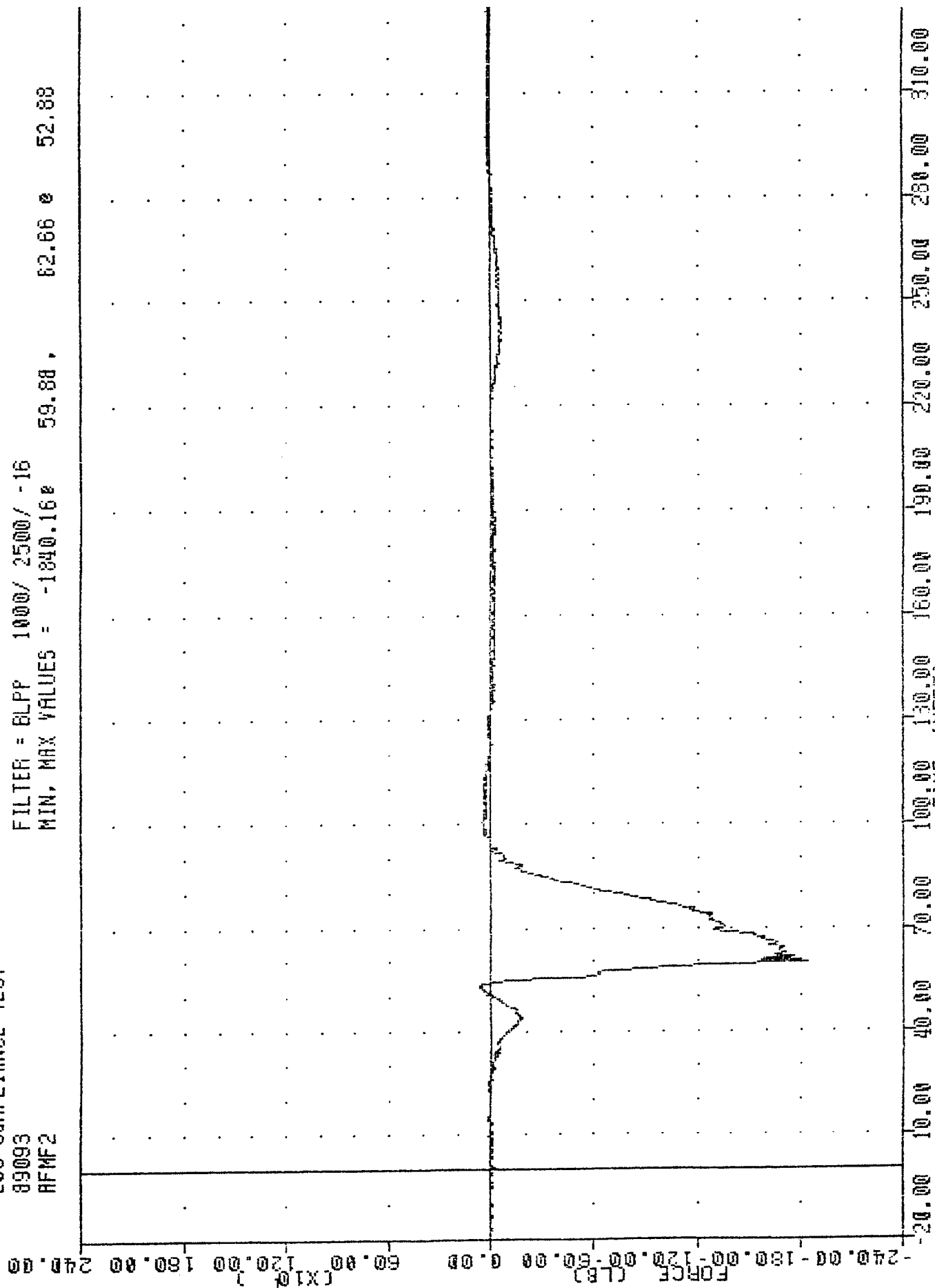
51.09 53.38



1989 SAB 900S INTO FRONTAL BARRIER  
RIGHT FRONT PASSENGER LEFT FEMUR FORCE

200 COMPLIANCE TEST  
 89093  
 RFMF2

FILTER = BLPP 1000/ 2500/ -16  
 MIN, MAX VALUES = -1840.16 59.88, 82.66 52.88



1989 SAB 900S INTO FRONTAL BARRIER  
 RIGHT FRONT PASSENGER RIGHT FEMUR FORCE



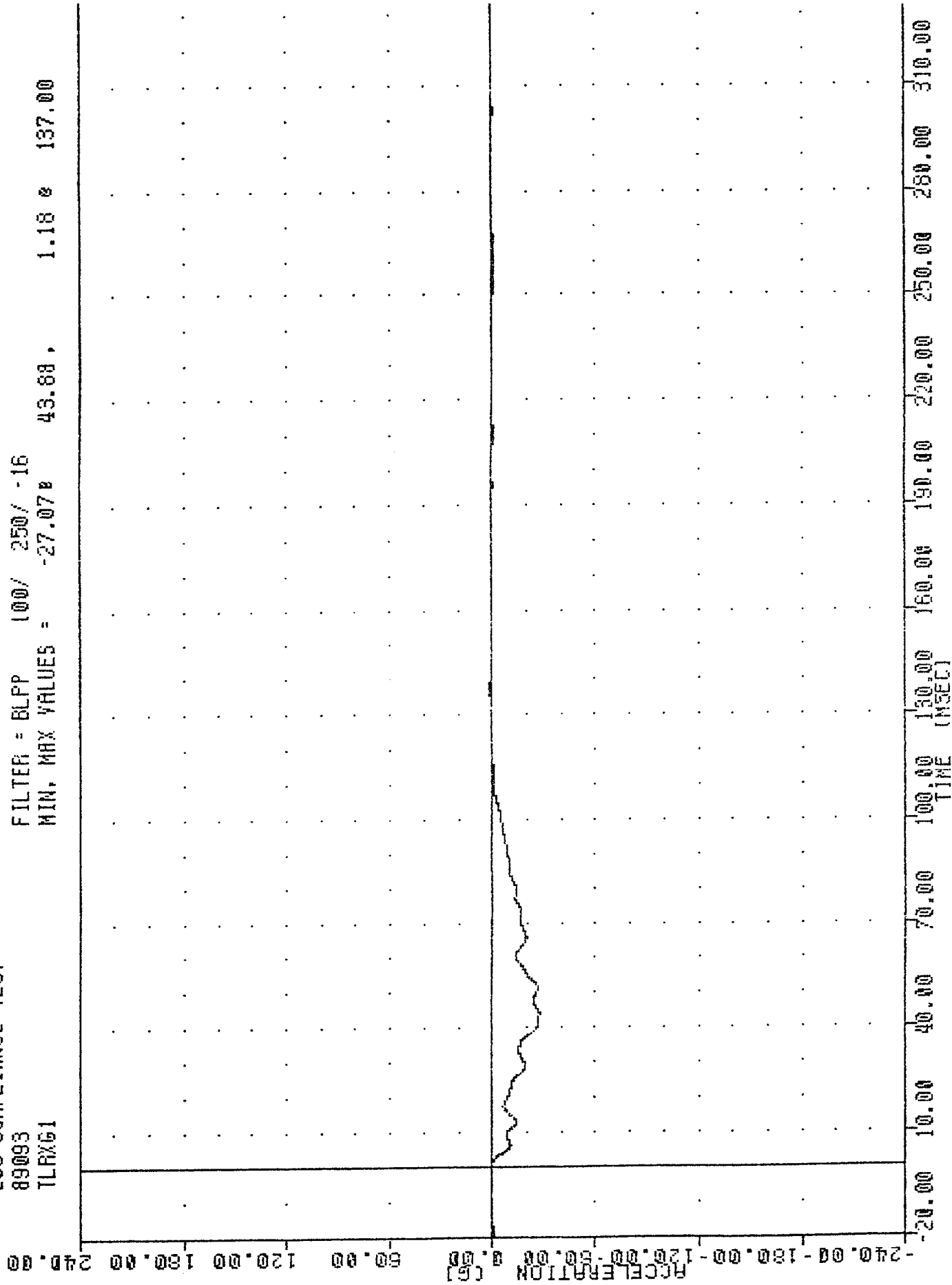
20B COMPLIANCE TEST

89093

TLRXG1

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -27.07 43.88 1.18 137.00



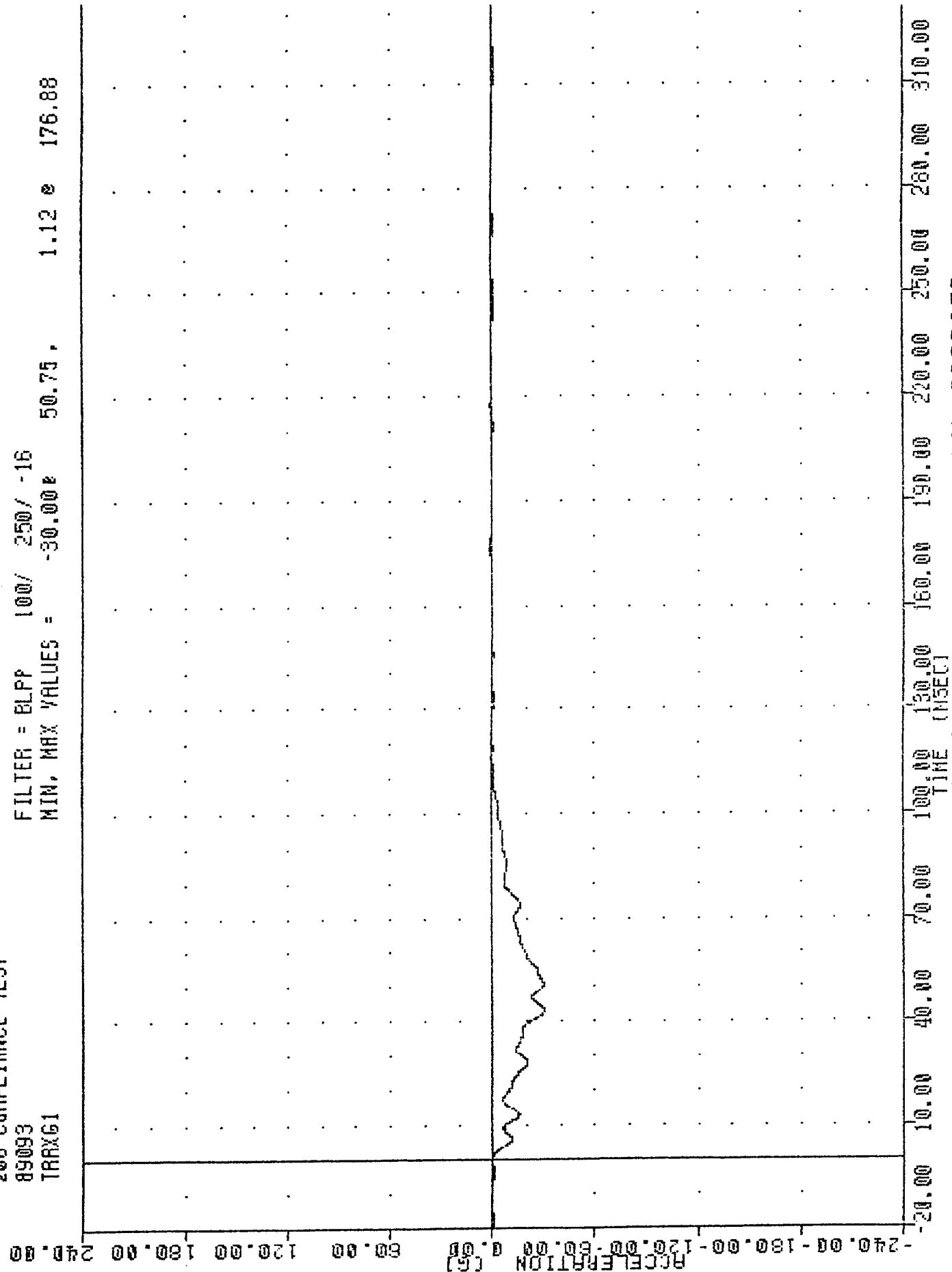
200 COMPLIANCE TEST

89093

TRAX61

FILTER = BLPP 100/ 250/ -16

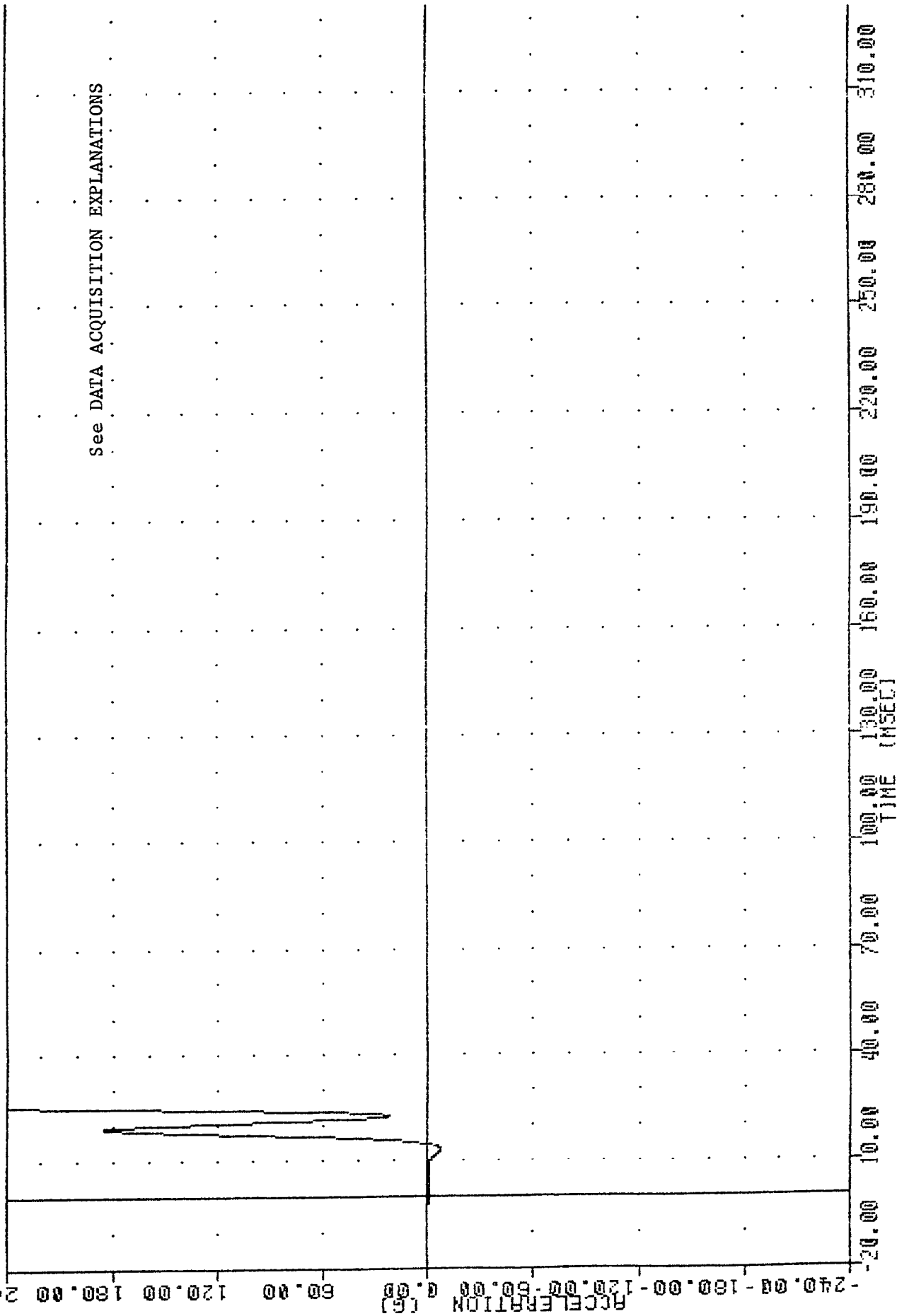
MIN, MAX VALUES = -30.00% 50.75, 1.12 @ 176.88



1989 SAAB 900S INTO FRONTAL BARRIER  
RIGHT REAR SEAT X AXIS ACCELERATION

200 COMPLIANCE TEST  
 89093  
 ENG61

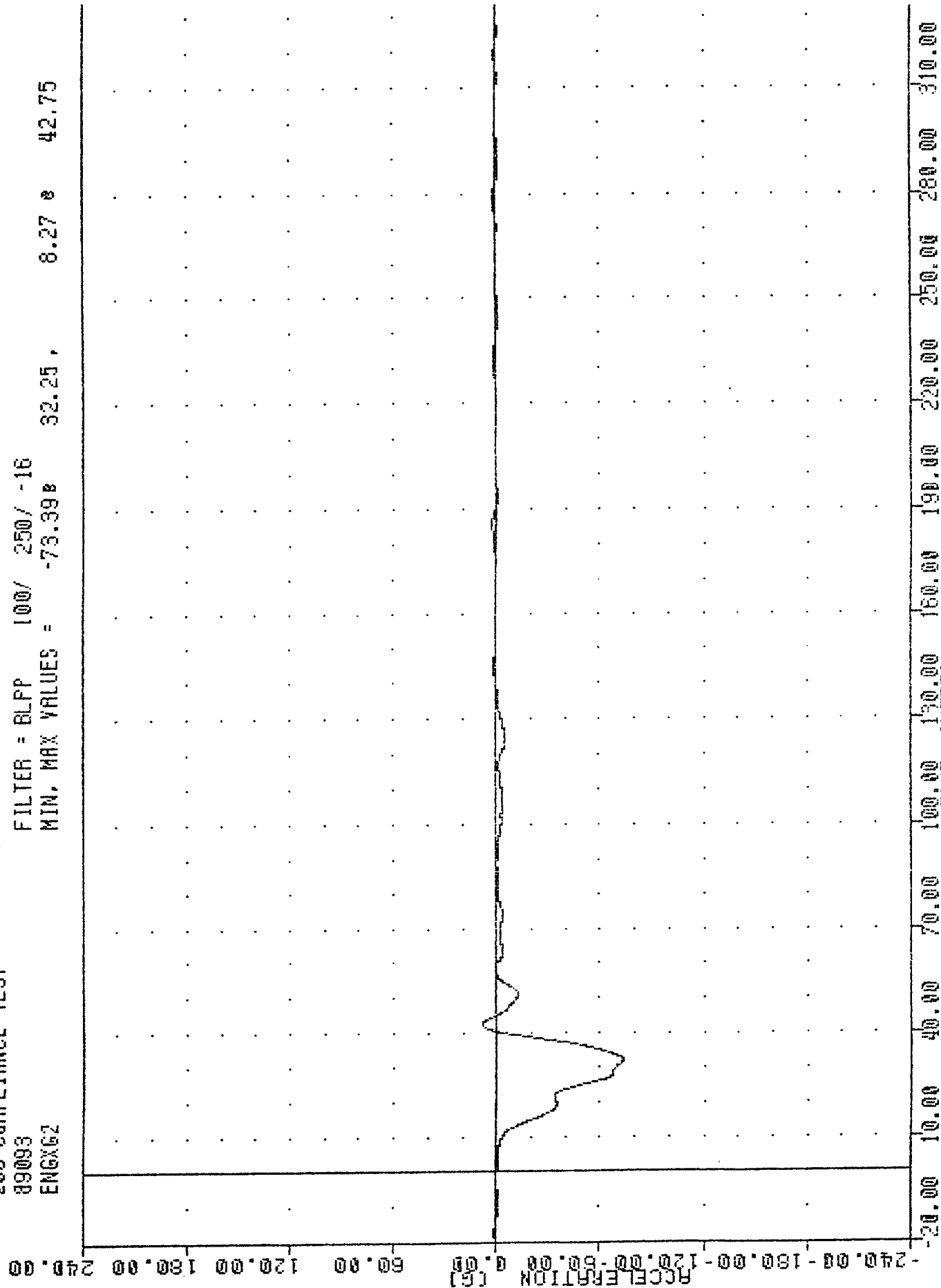
FILTER = BLPP 100/ 250/ -16  
 MIN. MAX VALUES = -7.36 13.25 540.93 29.50



1989 SAAB 900S INTO FRONTAL BARRIER  
 ENGINE UPPER BLOCK X AXIS ACCELERATION

200 COMPLIANCE TEST  
89093  
ENGX62

FILTER = BLPP 100/ 250/ -16  
MIN. MAX VALUES = -73.39 32.25 , 8.27 42.75



1989 SAAB 900S INTO FRONTAL BARRIER  
ENGINE BOTTOM BLOCK X AXIS ACCELERATION

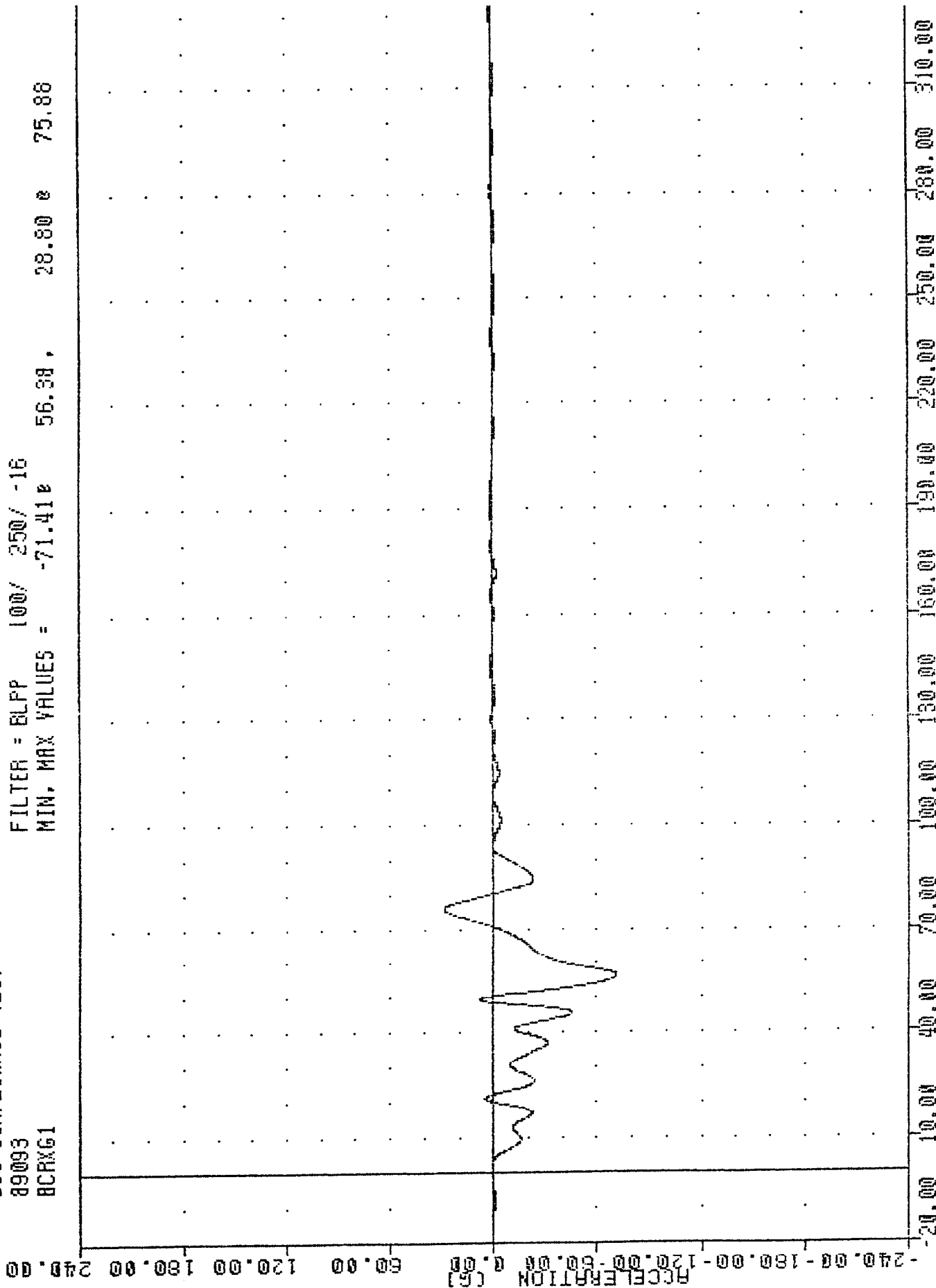
208 COMPLIANCE TEST

89093

BCRXG1

FILTER = BLPP 100/ 250/ -16

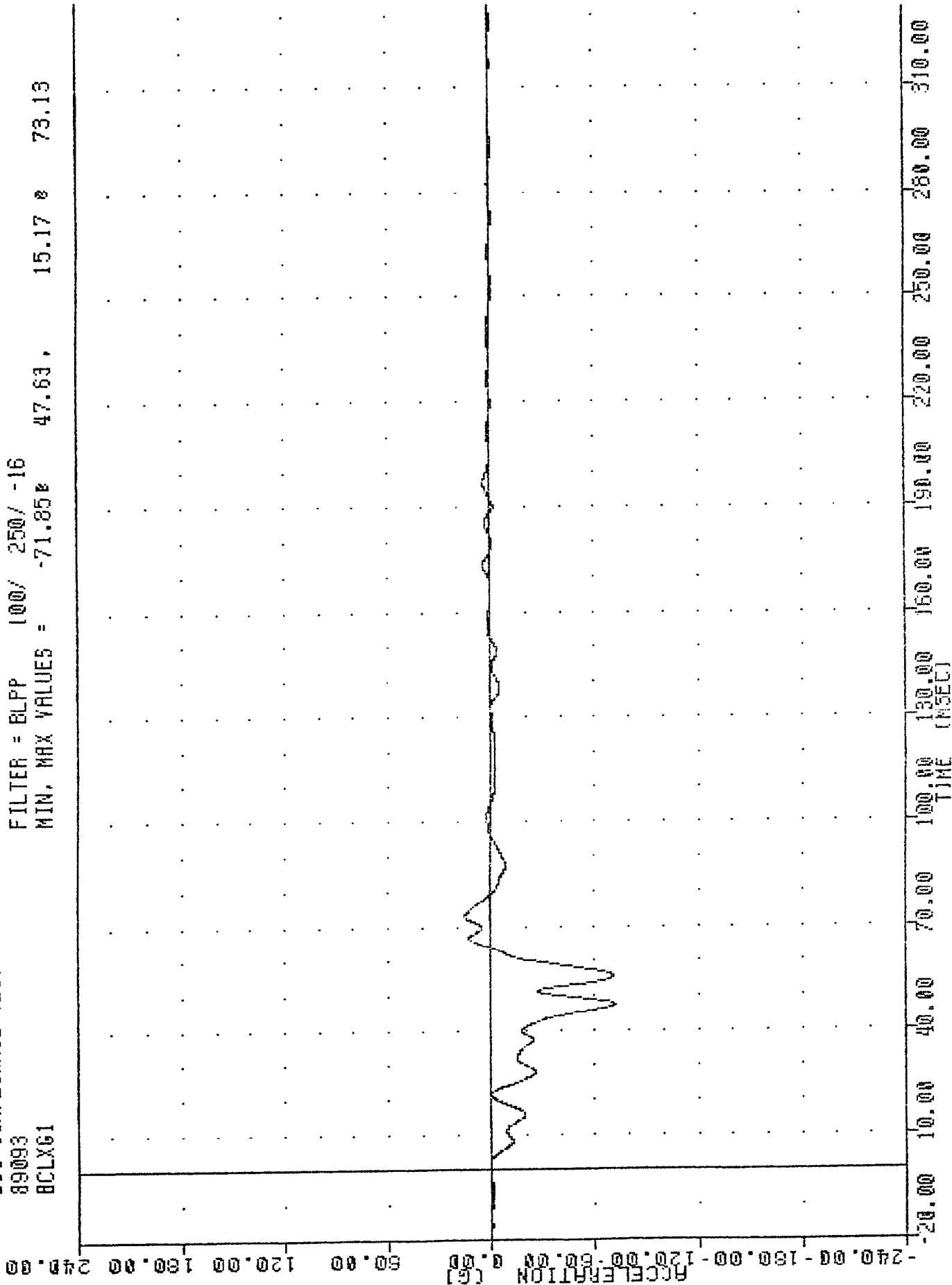
MIN. MAX VALUES = -71.41e 56.38, 28.80 e 75.88



1989 SAAB 900S INTO FRONTAL BARRIER  
RIGHT BRAKE CALIPER X AXIS ACCELERATION

208 COMPLIANCE TEST  
 89093  
 BCLX61

FILTER = BLPP 100/ 250/ -16  
 MIN, MAX VALUES = -71.85 47.63, 15.17 73.13



1989 SAAB 900S INTO FRONTAL BARRIER  
 LEFT BRAKE CALIPER X AXIS ACCELERATION

208 COMPLIANCE TEST

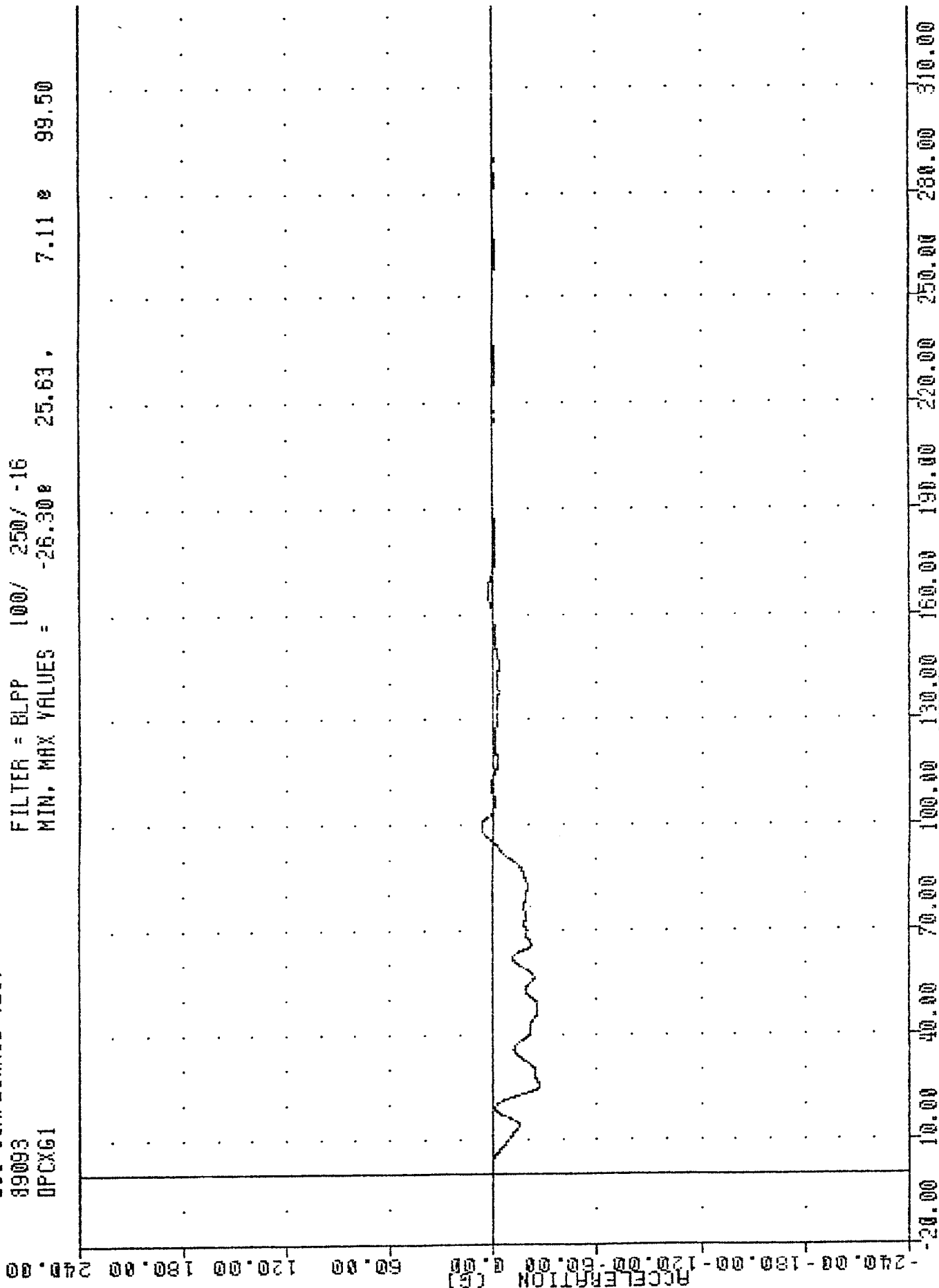
89093

DPCXG1

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -26.30 25.63,

7.11 99.50



1989 SAAB 900S INTO FRONTAL BARRIER  
DASH PANEL CENTER X AXIS ACCELERATION

# 200 COMPLIANCE TEST

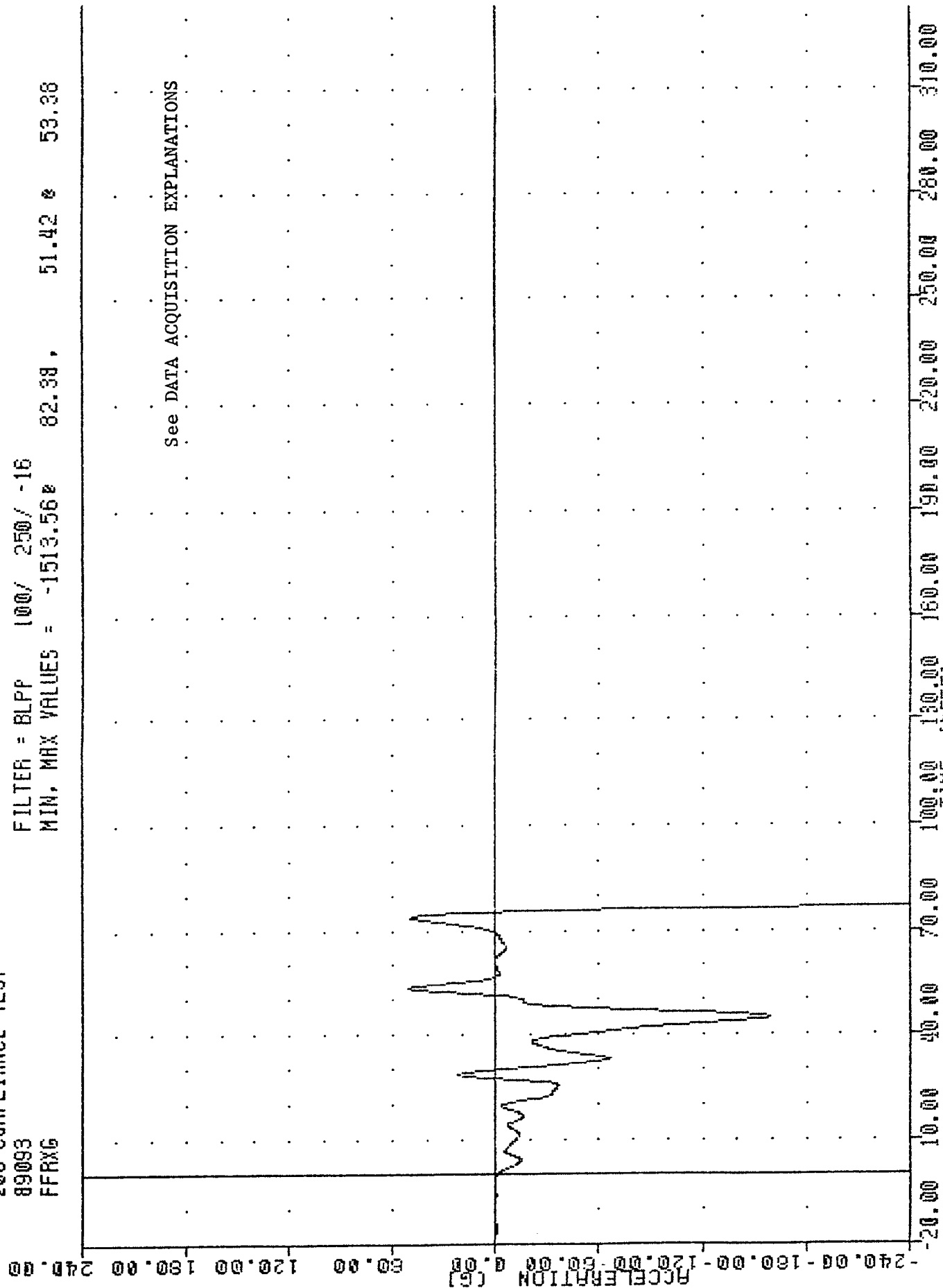
89093

FFRXG

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -1513.560 82.38 ,

51.42 \* 53.38



1989 SAAB 900S INTO FRONTAL BARRIER  
FRONT FRAME RAIL X AXIS ACCELERATION



# 200 COMPLIANCE TEST

89093

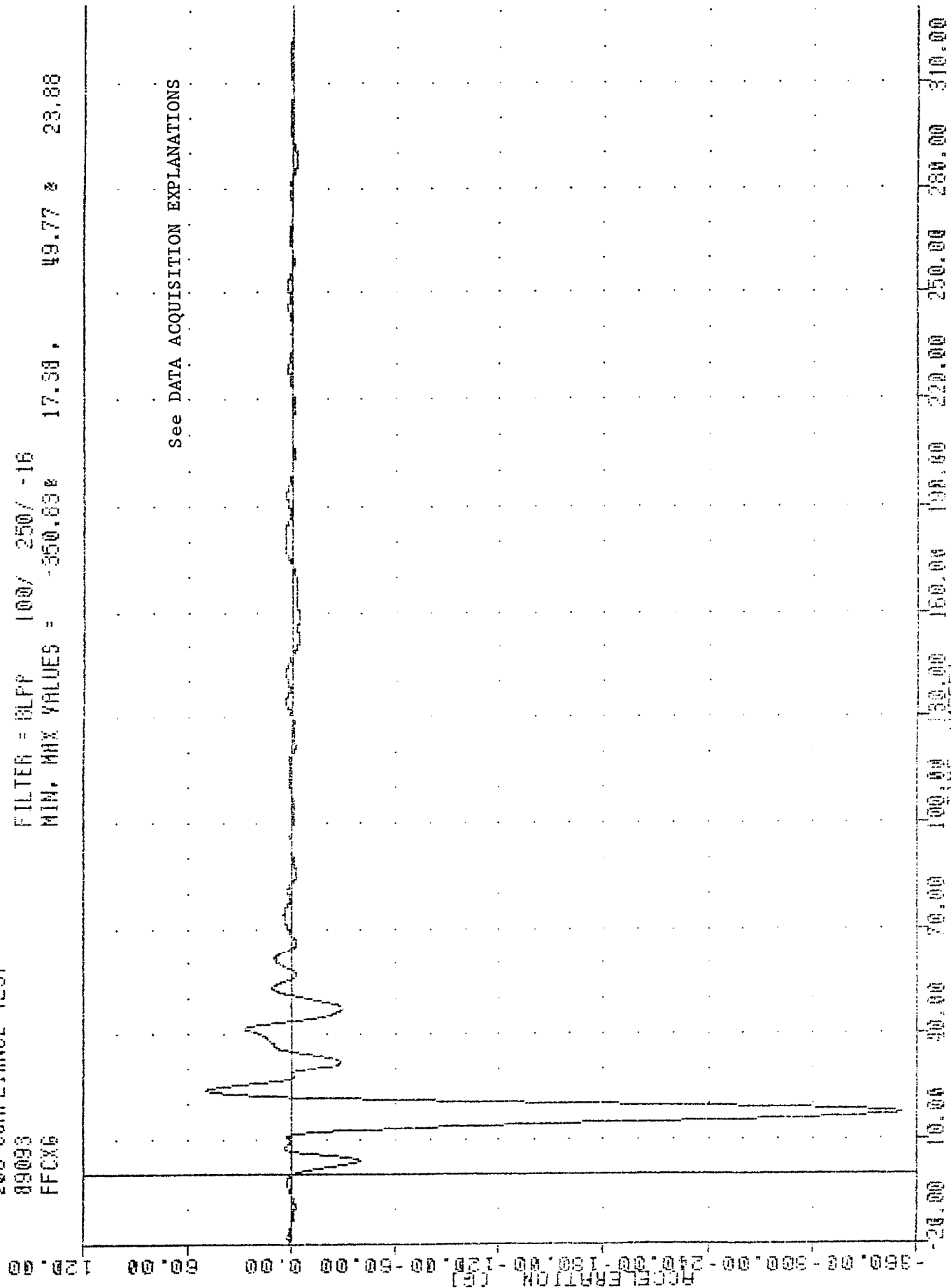
FFCX6

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -350.03%

17.30 , 49.77 % 23.88

See DATA ACQUISITION EXPLANATIONS



1989 SRA0 0005 INTO FRONTAL BARRIER

FRONT FRAME CROSSMEMBER X AXIS ACCELERATION

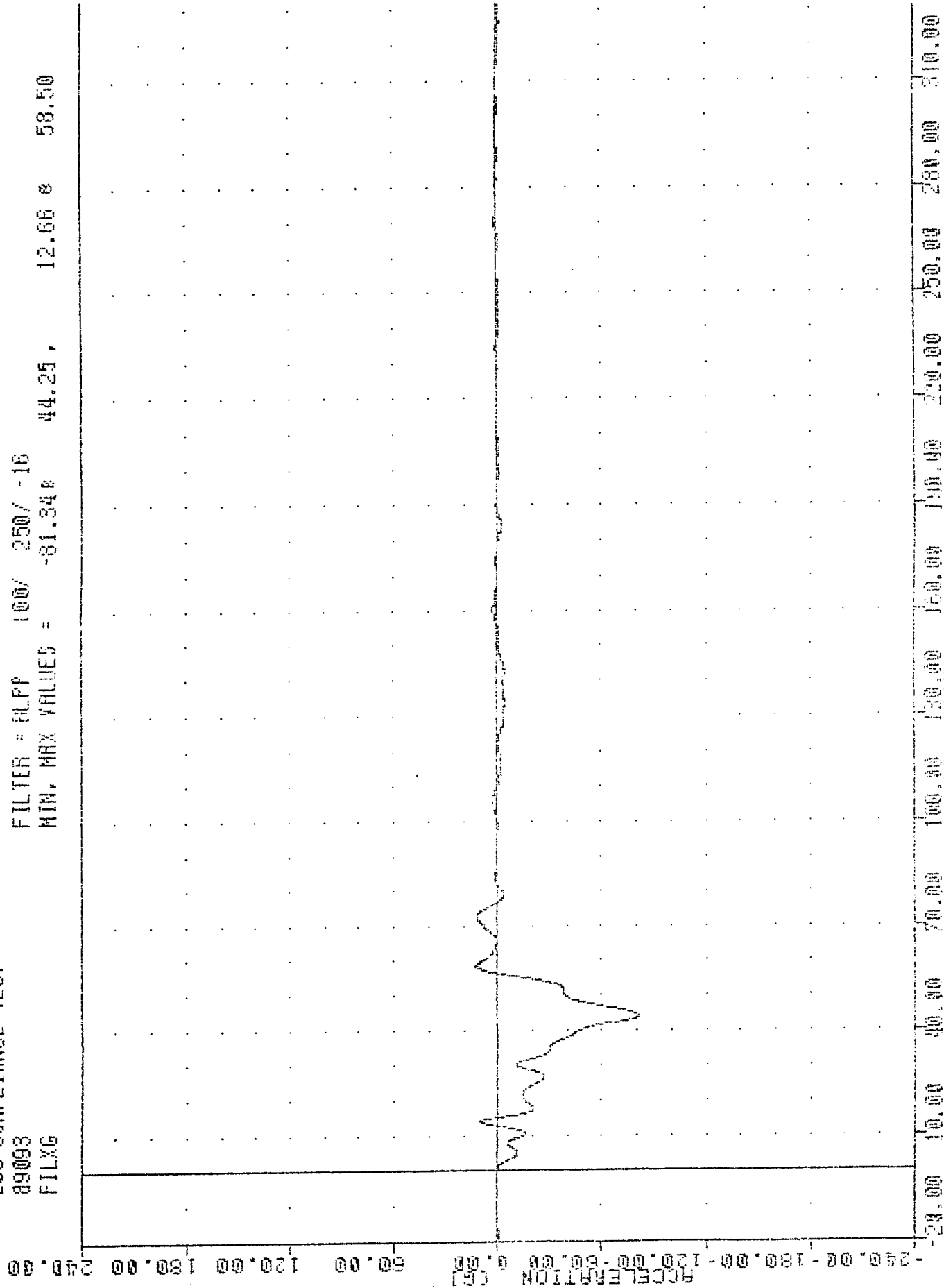
200 COMPLIANCE TEST

89093

FILXG

FILTER = RLPP 100/ 250/ -16

MIN, MAX VALUES = -81.34% 44.25, 12.66 % 58.50



1989 SARA 500S INTO FRONTAL BARRIER  
LEFT FENDER WELL INSIDE X AXIS ACCELERATION

200 COMPLIANCE TEST

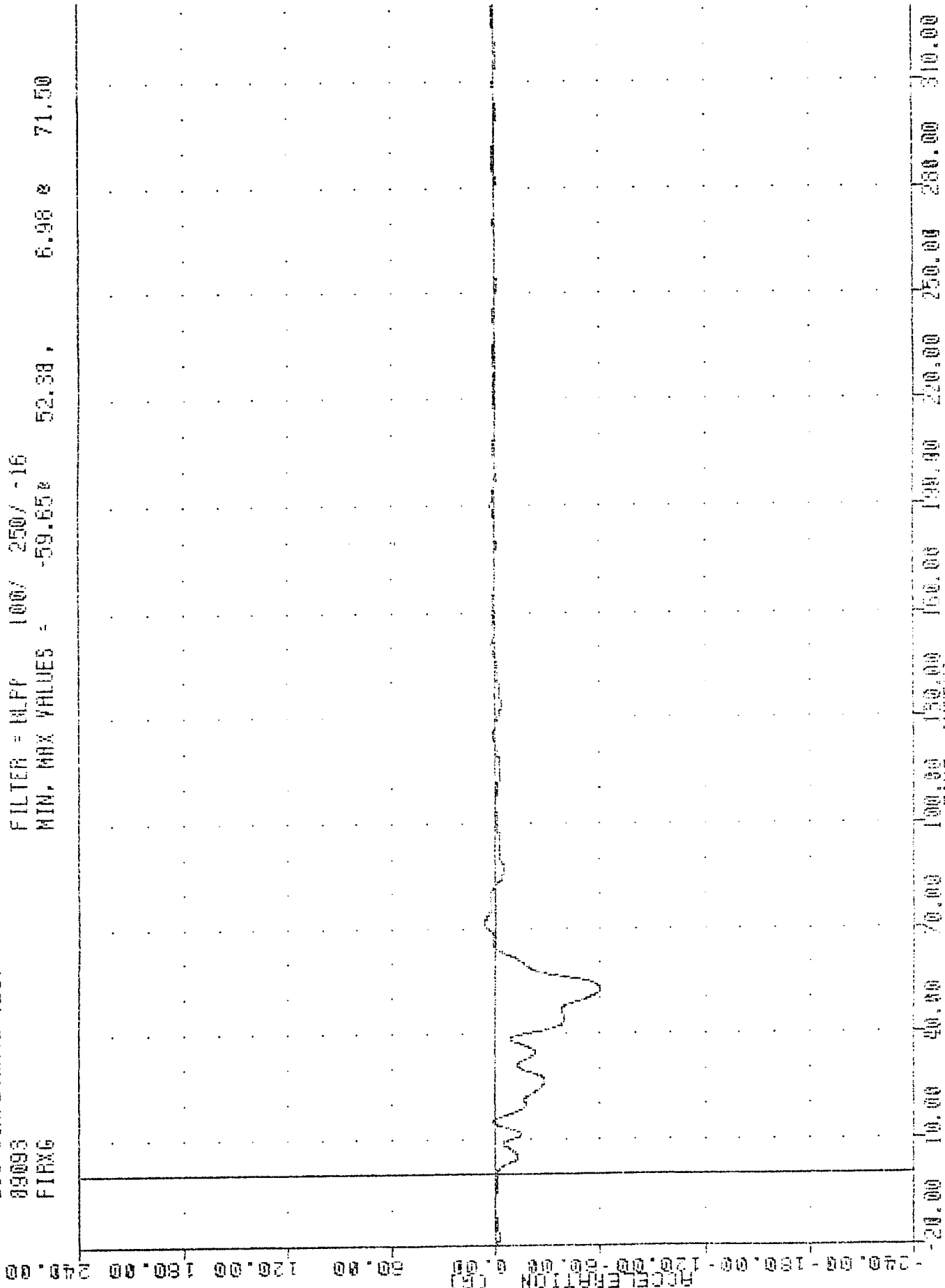
09093

FIRXG

FILTER = MLPP 100/ 250/ -16

MIN. MAX VALUES = -59.65 52.38

6.98 71.50



1989 SHAD 900S INTO FRONTAL BARRIER  
RIGHT SHOCK TOWER X AXIS ACCELERATION