

V1927

HEAVY TRUCK UNDERRIDE PROTECTION
1991 CHEVROLET CORSICA
INTO HEAVY TRUCK REAR UNDERRIDE GUARD
MOUNTED TO FRUEHAUF FBX-F2-48 SEMITRAILER
TRC TEST NO. 930420

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FINAL REPORT
APRIL - MAY 1993

PREPARED FOR:
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NOTICE

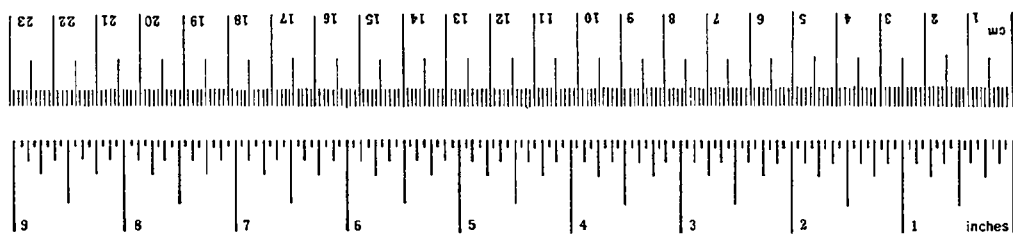
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| 16. Abstract A 1991 Chevrolet Corsica 4-door sedan was impacted into a heavy truck rear underride guard at the Transportation Research Center Inc. on April 20, 1993. This test was conducted to determine the performance of the underride guard mounted to a Fruehauf FBX-F2-48 semitrailer in the 0°, 30 mph impact mode. The actual test speed was 30.1 mph. The ambient temperature was 70° F. At maximum vehicle displacement, the rear of the truck intruded 10.5 inches beyond the vehicle's windshield. | | | | | |
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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 |
| LENGTH | | | | | | | | |
| in | inches | 2.54 | centimeters | cm | millimeters | 0.04 | inches | in |
| ft | feet | 30 | centimeters | cm | inches | 0.4 | inches | in |
| yd | yards | 0.9 | meters | m | feet | 3.3 | feet | ft |
| mi | miles | 1.6 | kilometers | km | meters | 1.1 | yards | yd |
| | | | | | kilometers | 0.6 | miles | mi |
| AREA | | | | | | | | |
| in ² | square inches | 6.5 | square centimeters | cm ² | square centimeters | 0.16 | square inches | in ² |
| ft ² | square feet | 0.09 | square meters | m ² | square meters | 1.2 | square yards | yd ² |
| yd ² | square yards | 0.8 | square meters | m ² | square kilometers | 0.4 | square miles | mi ² |
| mi ² | square miles | 2.6 | square kilometers | km ² | hectares (10,000 m ²) | 2.5 | acres | ac |
| | acres | 0.4 | hectares | ha | | | | |
| MASS (weight) | | | | | | | | |
| oz | ounces | 28 | grams | g | grams | 0.035 | ounces | oz |
| lb | pounds | 0.45 | kilograms | kg | kilograms | 2.2 | pounds | lb |
| | short tons (2000 lb) | 0.9 | tonnes | t | tonnes (1000 kg) | 1.1 | short tons | sh |
| VOLUME | | | | | | | | |
| tsp | teaspoons | 5 | milliliters | ml | milliliters | 0.03 | fluid ounces | fl oz |
| Tbsp | tablespoons | 15 | 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 ³ |
| qt | quarts | 0.95 | liters | l | cubic meters | 1.3 | cubic yards | yd ³ |
| gal | gallons | 3.8 | cubic meters | m ³ | | | | |
| ft ³ | cubic feet | 0.03 | cubic meters | m ³ | | | | |
| yd ³ | cubic yards | 0.76 | cubic meters | m ³ | | | | |
| TEMPERATURE (exact) | | | | | | | | |
| °F | Fahrenheit temperature | 5/9 (after subtracting 32) | Celsius temperature | °C | °C | 9/5 (then add 32) | Fahrenheit temperature | °F |



* 1 in = 2.54 (exact). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price \$2.25, SD Catalog No. C13.10.286.

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SECTION 1.0

PURPOSE & TEST PROCEDURE

PURPOSE

This heavy truck rear underride guard impact test was conducted for the Vehicle Research & Test Center (VRTC) by Transportation Research Center Inc. (TRC).

A rear underride guard was developed to minimally meet the proposed Federal regulatory standards for height, geometry, and static force/deflection requirements. For the initial dynamic testing, the rear underride guard was mounted to a simulated trailer rear end. This structure was a rigid test fixture (with the height and width of a semi-trailer) attached to the crash barrier wall.

This test was conducted to compare the results of the guard's performance when installed on an actual semi-trailer. The trailer was attached to a tractor unit and ballasted to simulate a loaded and parked tractor-trailer rig. Impact mode for the vehicle was 0°, 30 mph.

TEST PROCEDURE

The test vehicle was instrumented with seven (7) accelerometers to measure longitudinal, lateral, and vertical axis accelerations. The passenger's seat belt was instrumented with a load cell to measure shoulder belt force. The vehicle's specified impact velocity range was 29.5 to 30.5 mph. The vehicle impacted the heavy truck rear underride guard mounted with 1.0-inch mounting bolts to a Fruehauf FBX-F2-48 semitrailer attached to an International Harvester C0F9670 tractor at Transportation Research Center Inc.

The semitrailer was loaded with 41,620 pounds of concrete ballast weights; total pre-test tractor and semitrailer weight was 70,680 pounds. The tractor and semitrailer were parked with the parking brakes applied and transmission in neutral. The tractor and semitrailer were instrumented with one (1) and two (2) longitudinal axis accelerometers, respectively.

The test vehicle contained two (2) Part 572 E 50th percentile adult male anthropomorphic test devices (dummies). The dummies were positioned in the front outboard designated seating positions according to the dummy placement procedure specified in Appendix B and Optional Appendix C of NHTSA Laboratory Test Procedure TP-208-08.

Both dummies were instrumented with head, chest, and pelvis accelerometers to measure longitudinal, lateral, and vertical accelerations; six-axis neck load cells to measure neck moments and forces; and with left and right femur load cells to measure axial forces. Each Part 572 E dummy's instrumentation also included a chest potentiometer to measure longitudinal deflection.

The forty-seven (47) data channels were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 8000 samples per second and processed per sections 12.8 and 12.9 of NHTSA's Laboratory Test Procedure TP-208-08.

The crash event was recorded by one (1) real-time panning motion picture camera and eleven (11) high-speed motion picture cameras.

The heavy truck underride guard test data are summarized in Section 2.0. The occupant, vehicle, & camera information are presented in Section 3.0. Appendix A contains the still photographic prints. Appendix B contains the data plots. Appendix C contains dummy certification data. Appendix D contains miscellaneous test information.

SECTION 2.0

HEAVY TRUCK REAR UNDERRIDE GUARD IMPACT TEST SUMMARY

TEST RESULTS SUMMARY

This heavy truck rear underride guard impact test was conducted at TRC on April 20, 1993

The test vehicle, a 1991 Chevrolet Corsica 4-door sedan, was equipped with a 2.2 liter, transverse engine, automatic transmission, power steering, and power brakes. The vehicle's test weight was 3186 pounds. The vehicle's impact speed was 30.1 mph. At maximum vehicle displacement, the rear of the truck intruded 10.5 inches beyond the vehicle's windshield. This value was obtained from digital analysis of the high-speed film.

The driver's head injury criteria (HIC) was 37. The driver's maximum chest resultant acceleration with three (3) milliseconds minimum duration was 16.0 g. The driver's chest deflection was 0.7 inches. The driver's maximum left and right femur forces were 1070 pounds and 917 pounds, respectively.

The right front passenger's head injury criteria (HIC) was 77. The right front passenger's maximum chest resultant acceleration with three (3) milliseconds minimum duration was 19.6 g. The right front passenger's chest deflection was 1.2 inches. The right front passenger's maximum left and right femur forces were 99 pounds and 96 pounds, respectively.

TABLE 1 CRASH TEST SUMMARY

TEST TYPE: Heavy Truck Rear Underride Guard

TEST DATE: 04/20/93 TEST TIME: 1441 AMBIENT TEMP. (°F): 70

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1991/Chevrolet/Corsica/4-door sedan

VEHICLE TEST WEIGHT (LBS): 3186

IMPACT ANGLE (DEG)*: 0

IMPACT VELOCITY (MPH)**: PRIMARY = 30.1 SECONDARY = 30.1

MAXIMUM STATIC CRUSH (IN): 2.2

DUMMIES: Driver #043 Passenger #048

TYPE: Part 572 E Part 572 E

LOCATION: Left front Right front

RESTRAINT: Driver's airbag 3-point unbelt

NUMBER OF DATA CHANNELS: 47

NUMBER OF CAMERAS: HIGH-SPEED 11 REAL-TIME 1

*With respect to tow track centerline.

**Speed trap measurement ($\pm .05$ mph accuracy). The velocity measurement system contains two (2) independent photo emitter/receiver pairs (See Figure 1) which each measure the impact velocity.

TABLE 2 TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: General Motors Corporation

MAKE/MODEL: Chevrolet/Corsica VIN: 1G1LT53G4MY182862

BODY STYLE: 4-door sedan MODEL YEAR: 1991

COLOR: Blue

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 2.2 liter

TRANSMISSION DATA: 3 SPEED, MANUAL, X AUTOMATIC, X FWD, RWD, 4WD

DATE VEHICLE RECEIVED: 04/12/93 ODOMETER READING: 33,077

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

| | | | |
|----------------|--------|----------------------------|-----|
| POWER STEERING | Yes | AUTOMATIC TRANSMISSION | Yes |
| POWER BRAKES | Yes | AUTOMATIC SPEED CONTROL | Yes |
| POWER SEATS | No | TILTING STEERING WHEEL | Yes |
| POWER WINDOWS | No | TELESCOPING STEERING WHEEL | No |
| TINTED GLASS | Yes | AIR CONDITIONING | Yes |
| RADIO | Yes | ANTI-SKID BRAKE | No |
| CLOCK | Yes | REAR WINDOW DEFROSTER | No |
| OTHER | Airbag | | |

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

CERTIFICATION DATA FROM VEHICLE'S LABEL:

VEHICLE MANUFACTURED BY: General Motors Corporation

DATE OF MANUFACTURE: 03/91 VIN: 1G1LT53G4MY182862

GVWR: 3650 LBS

GAWR: FRONT: 1940 LBS., REAR: 1710 LBS.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

TIRES ON VEHICLE (MFR., LINE, SIZE): Goodyear, Invicta GS, P185/75R14

TIRE PRESSURE WITH MAXIMUM CAPACITY VEHICLE LOAD: FRONT: 44 PSI
REAR: 44 PSI

SPARE TIRE (MFR., LINE, SIZE): General, Temporary, T115/70D14

TYPE OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manually-adjustable

MAXIMUM WIDTH: 68.4 INCHES

WHEELBASE: 103.6 INCHES

LOCATION OF LABEL STATING TIRE & CAPACITY DATA:
The label was located on the driver's door.

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: P185/75R14

RECOMMENDED COLD TIRE PRESSURE: FRONT: 30 PSI; REAR: 30 PSI

DESIGNATED SEATING CAPACITY: 2 FRONT 3 REAR 5 TOTAL

VEHICLE CAPACITY WEIGHT: 891 LBS.

TEST VEHICLE ATTITUDE

(MEASURED AT THE TOP CENTER OF THE WHEEL WELL OPENING)

| | | | | | | | | |
|------------------------|----|-------|----|-------|----|-------|----|------|
| DELIVERED ATTITUDE: | LF | 26.9; | RF | 27.4; | LR | 26.8; | RR | 27.2 |
| FULLY LOADED ATTITUDE: | LF | 26.4; | RF | 26.8; | LR | 25.6; | RR | 26.1 |
| PRE-TEST ATTITUDE**: | LF | 25.1; | RF | 25.4; | LR | 25.2; | RR | 26.0 |
| POST-TEST ATTITUDE*: | LF | 22.0; | RF | NA ; | LR | 22.2; | RR | 21.9 |

*Crumpled right front fender prevented post-test attitude measurement.

**It was determined by VRTC that under heavy braking the front of the test vehicle lowered by 2.75 inches measured at the front bumper centerline and the rear of the test vehicle raised 1.0 inches measured at the rear bumper centerline. The pre-test attitudes of the test vehicle were modified to simulate these conditions.

All measurements are in inches.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE AS RECEIVED:

| | | | |
|----------------------------------|-----------|---------------------------------|----------|
| RIGHT FRONT | 840 LBS. | RIGHT REAR | 500 LBS. |
| LEFT FRONT | 886 LBS. | LEFT REAR | 490 LBS. |
| TOTAL FRONT WEIGHT | 1726 LBS. | (63.5% OF TOTAL VEHICLE WEIGHT) | |
| TOTAL REAR WEIGHT | 990 LBS. | (36.5% OF TOTAL VEHICLE WEIGHT) | |
| TOTAL DELIVERED WEIGHT 2716 LBS. | | | |

CALCULATION OF TEST VEHICLE'S TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT*

UDW = UNLOADED DELIVERED WEIGHT (2716 LBS)

VCW = VEHICLE CAPACITY WEIGHT (891 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

$RCLW^* = VCW - 150 (DSC) = 141$

TARGET TEST WEIGHT = $UDW + RCLW^* + (NO. OF HYBRID III DUMMIES \times 167 \text{ LBS PER DUMMY})$

TARGET TEST WEIGHT = $2716 + 334 + 141$

TARGET TEST WEIGHT = 3191 LBS

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 136 LBS. OF CARGO WEIGHT:

| | | | |
|--------------------|-----------|---------------------------------|----------|
| RIGHT FRONT | 877 LBS. | RIGHT REAR | 696 LBS. |
| LEFT FRONT | 948 LBS. | LEFT REAR | 665 LBS. |
| TOTAL FRONT WEIGHT | 1825 LBS. | (57.3% OF TOTAL VEHICLE WEIGHT) | |
| TOTAL REAR WEIGHT | 1361 LBS. | (42.7% OF TOTAL VEHICLE WEIGHT) | |
| TOTAL TEST WEIGHT | 3186 LBS. | (0.2% UNDER TARGET TEST WEIGHT) | |

WEIGHT OF BALLAST SECURED IN VEHICLE CARGO AREA: 0 lbs.

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: None

CG = 43.2 INCHES REARWARD OF FRONT WHEEL CENTERLINE

*Cargo weight for multi-purpose passenger vehicles, trucks, and buses is the vehicle's calculated cargo and luggage weight or 300 pounds, whichever is less.

TABLE 3 POST-IMPACT DATA

TEST NUMBER: 930420

TEST DATE: 04/20/93

TEST TIME: 1441

TEST TYPE: Heavy truck rear underride guard IMPACT ANGLE (DEG.)*: 0

AMBIENT TEMPERATURE AT IMPACT AREA: 70° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 76° F

IMPACT VELOCITY**: PRIMARY = 30.1 MPH SECONDARY = 30.1 MPH

(SPECIFIED RANGE = 29.5 TO 30.5 MPH)

DISTANCE FROM VEHICLE TO BARRIER: ENTERING VELOCITY TRAP = 14.0 IN.

EXITING VELOCITY TRAP = 2.0 IN.

TEST VEHICLE STATIC CRUSH (ALL MEASUREMENTS ARE IN INCHES):

OVERALL LENGTH OF TEST VEHICLE: PRE-TEST: L 179.1; C 183.0; R 179.0

POST-TEST: L 177.8; C 181.8; R 176.8

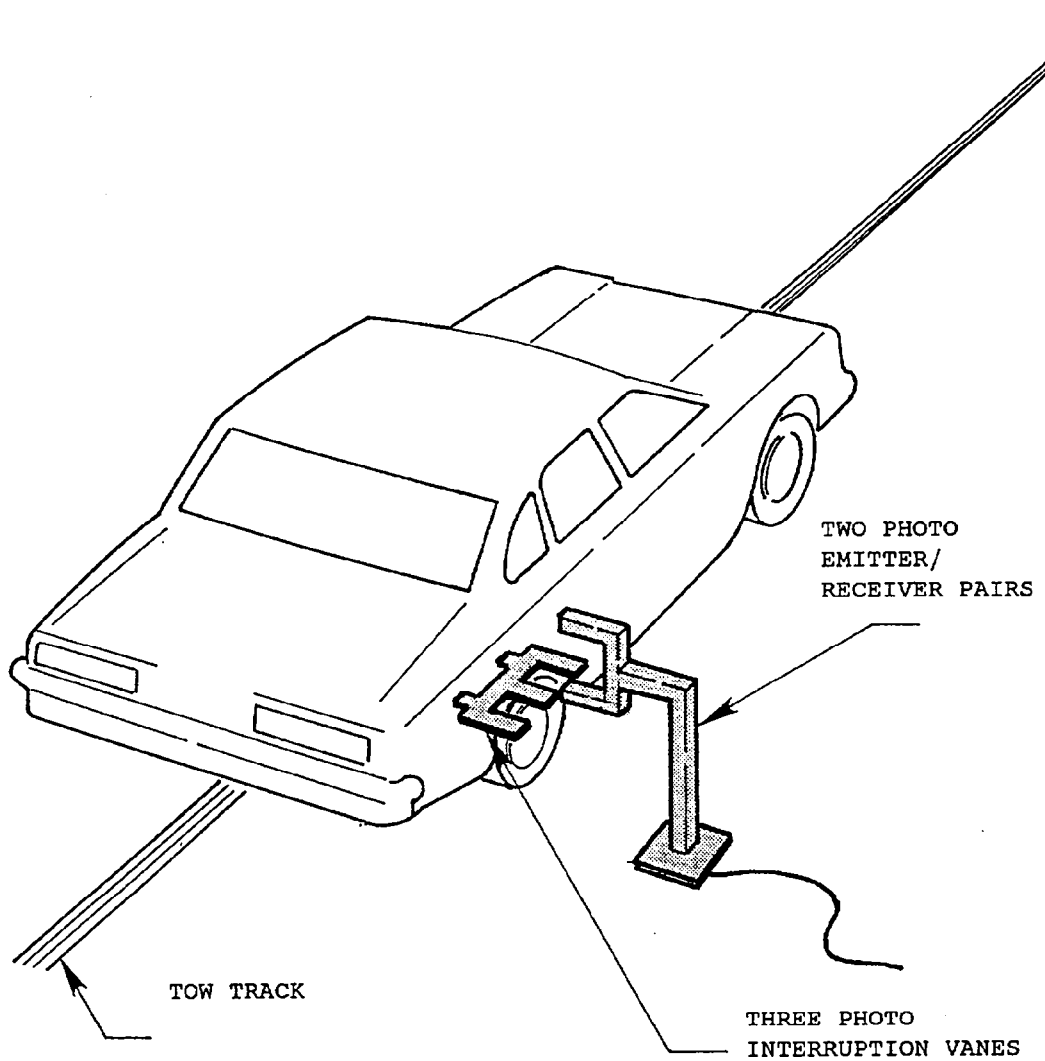
TOTAL CRUSH: L 1.3; C 1.2; R 2.2

AVERAGE CRUSH: 1.6

*With respect to tow track centerline.

**The velocity measurement system contains two (2) independent photo emitter/receiver pairs (See Figure 1) which each measure the impact velocity.

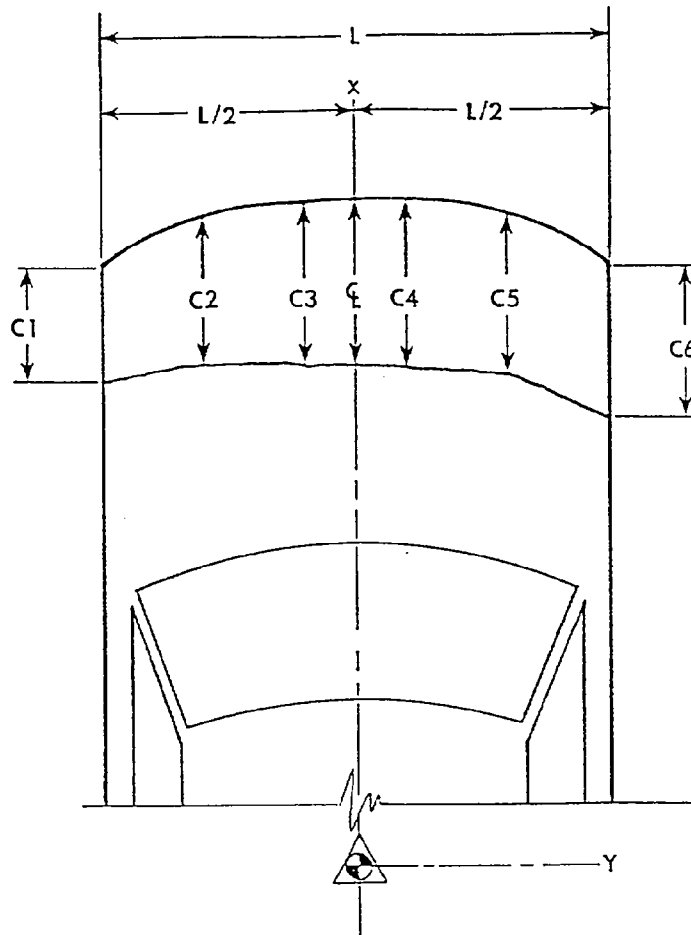
FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



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

The vanes have one foot spacing.

FIGURE 2 VEHICLE CRUSH



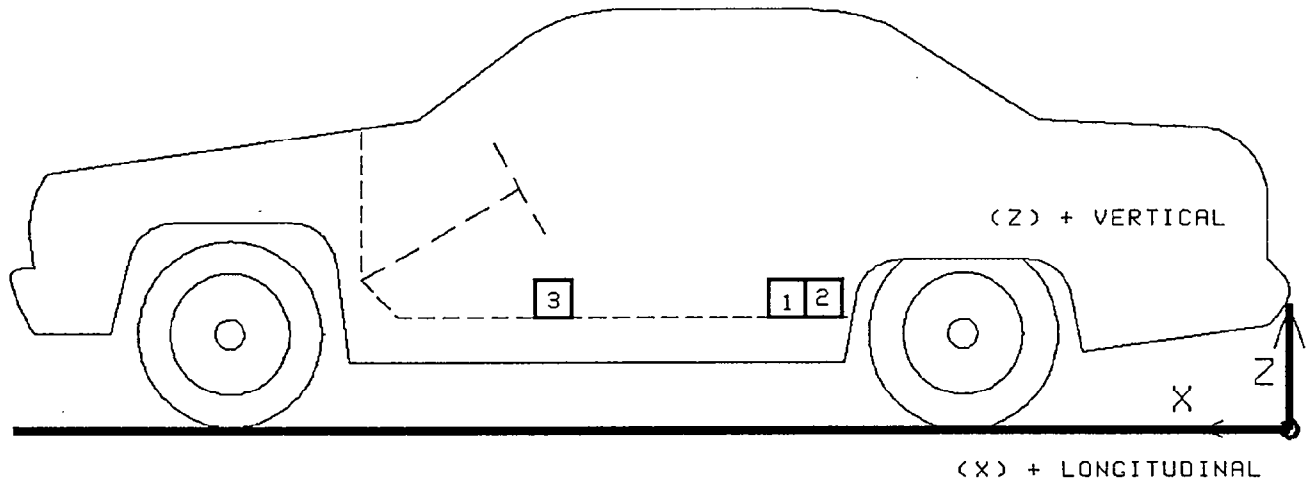
NOTES: L is pre-test length of contact surface.
 C1 through C6 are spaced equally apart.
 CL is vehicle centerline.
 All measurements are in inches.

Vehicle Chevrolet Corsica

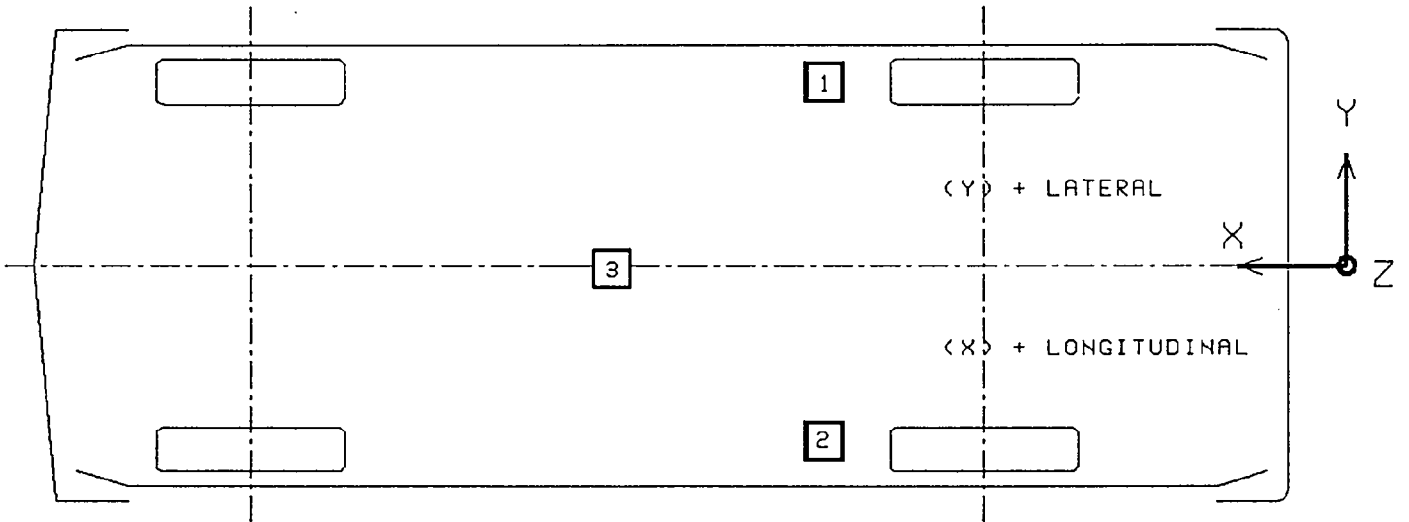
| | PRE-TEST | POST-TEST | CRUSH |
|----|--------------|-----------------|---------------|
| L | <u>52.0</u> | | |
| C1 | <u>179.1</u> | C1 <u>177.8</u> | C1 <u>1.3</u> |
| C2 | <u>181.8</u> | C2 <u>180.6</u> | C2 <u>1.2</u> |
| C3 | <u>182.9</u> | C3 <u>181.4</u> | C3 <u>1.5</u> |
| C4 | <u>182.9</u> | C4 <u>181.1</u> | C4 <u>1.8</u> |
| C5 | <u>181.8</u> | C5 <u>179.8</u> | C5 <u>2.0</u> |
| C6 | <u>179.0</u> | C6 <u>176.8</u> | C6 <u>2.2</u> |
| CL | <u>183.0</u> | CL <u>181.8</u> | CL <u>1.2</u> |

FIGURE 3

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 930420

| No. LOCATION | X* | Y* | Z* | POSITIVE DIRECTION MAX G MSEC | NEGATIVE DIRECTION MAX G MSEC |
|----------------------------------|-------|-------|------|-------------------------------------|-------------------------------------|
| 1 LEFT REAR SEAT CROSSMEMBER | 65.6 | 24.8 | 13.5 | | |
| LONGITUDINAL | | | | 1.5 184.1 | 13.7 49.4 |
| LATERAL | | | | 3.3 40.1 | 2.1 146.4 |
| 2 RIGHT REAR SEAT CROSSMEMBER | 63.8 | -24.4 | 13.0 | | |
| LONGITUDINAL | | | | 1.7 178.3 | 14.6 44.9 |
| LATERAL | | | | 3.4 28.9 | 2.9 169.6 |
| 3 VEHICLE CENTER OF GRAVITY | 101.4 | 0.8 | 13.4 | | |
| LONGITUDINAL | | | | 2.5 146.3 | 11.5 40.5 |
| LATERAL | | | | 5.3 35.0 | 2.8 78.1 |
| VERTICAL | | | | 6.4 171.9 | 7.4 41.4 |

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

TABLE 5

TRACTOR AND SEMITRAILER ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 930420

| No. LOCATION | X* | Y* | Z* | POSITIVE DIRECTION MAX G MSEC | NEGATIVE DIRECTION MAX G MSEC |
|---|-------|-------|------|-------------------------------------|-------------------------------------|
| 1 TRAILER LEFT FRAME RAIL LONGITUDINAL | 189.2 | 22.2 | 37.5 | 2.6 31.6 | 72.2 116.4 |
| 2 TRAILER RIGHT FRAME RAIL LONGITUDINAL | 191.0 | -22.2 | 37.4 | 3.7 16.1 | 70.2 120.9 |
| 3 TRACTOR FRAME LONGITUDINAL | 488.0 | -18.0 | 36.3 | 2.7 37.8 | 0.8 151.1 |

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

SECTION 3.0

OCCUPANT, VEHICLE, & CAMERA INFORMATION

TABLE 6

DUMMY DATA SUMMARY

TEST NUMBER 930420

| | | DRIVER DUMMY | | PASSENGER DUMMY | |
|-----------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|------------------------|
| | | SN: 43 | | SN: 48 | |
| | POSITIVE DIRECTION MAX MSEC | NEGATIVE DIRECTION MAX MSEC | POSITIVE DIRECTION MAX MSEC | NEGATIVE DIRECTION MAX MSEC | |
| HEAD ACCELERATION (g) | | | | | |
| LONGITUDINAL | 10.9 | 204.9 | 21.4 | 69.8 | 8.9 258.6 25.9 130.4 |
| LATERAL | 6.0 | 67.6 | 4.4 | 50.4 | 3.9 42.4 5.2 93.1 |
| VERTICAL | 9.1 | 246.6 | 8.2 | 60.6 | 2.7 15.5 21.0 97.1 |
| RESULTANT | 22.1 | 69.6 | | | 25.9 130.4 |
| HIC | 37 | FROM 59.0 TO 95.0 | | | 77 FROM 108.9 TO 144.9 |
| NECK FORCE (lb) | | | | | |
| LONGITUDINAL | 43.7 | 66.5 | 47.8 | 309.5 | 195.1 132.3 38.9 238.9 |
| LATERAL | 108.1 | 93.5 | 31.7 | 238.3 | 52.5 128.5 29.7 156.4 |
| VERTICAL | 72.5 | 288.8 | 52.7 | 131.6 | 185.3 95.3 42.9 34.1 |
| NECK MOMENT (in-lb) | | | | | |
| ABOUT X | 72.8 | 72.8 | 55.5 | 283.5 | 64.5 128.8 68.3 110.1 |
| ABOUT Y | 253.4 | 308.8 | 162.3 | 136.5 | 417.2 128.8 214.0 81.0 |
| ABOUT Z | 92.4 | 81.9 | 31.0 | 163.5 | 49.9 294.4 29.1 116.8 |

TABLE 6

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 930420

| | | DRIVER DUMMY SN: 43 | | PASSENGER DUMMY SN: 48 | |
|--------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------|
| | POSITIVE DIRECTION MAX MSEC | NEGATIVE DIRECTION MAX MSEC | POSITIVE DIRECTION MAX MSEC | NEGATIVE DIRECTION MAX MSEC | |
| CHEST ACCELERATION (g) | | | | | |
| LONGITUDINAL | 3.1 | 224.9 | 16.8 | 84.0 | 1.0 166.8 19.7 81.0 |
| LATERAL | 5.5 | 235.6 | 4.0 | 54.5 | 2.3 115.4 2.9 71.4 |
| VERTICAL | 4.1 | 169.1 | 2.9 | 245.5 | 6.4 117.4 8.5 65.9 |
| RESULTANT | 16.9 | 84.0 | | 20.2 78.3 | |
| 3 MSEC | 16.0 | | | 19.6 | |
| CHEST DEFLECTION (in) | | | | | |
| LONGITUDINAL | 0.0 | 37.4 | 0.7 | 85.4 | 0.0 18.0 1.2 97.3 |
| PELVIS ACCELERATION (g) | | | | | |
| LONGITUDINAL | 3.9 | 219.1 | 30.1 | 76.0 | 4.6 125.1 23.4 74.5 |
| LATERAL | 6.4 | 85.0 | 4.8 | 227.5 | 4.0 117.5 5.5 55.0 |
| VERTICAL | 6.9 | 101.8 | 2.9 | 168.5 | 9.3 117.5 3.5 163.1 |
| RESULTANT | 30.1 | 76.0 | | 23.9 74.5 | |
| FEMUR LOAD (lb) | | | | | |
| LEFT | 180.0 | 34.8 | 1069.6 | 78.0 | 164.3 73.1 98.6 246.4 |
| RIGHT | 156.7 | 34.8 | 917.5 | 84.9 | 165.7 70.6 96.5 257.8 |

POSITIVE DIRECTION
 LONGITUDINAL: FORWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD

NEGATIVE DIRECTION
 LONGITUDINAL: REARWARD
 LATERAL: RIGHTWARD
 VERTICAL: DOWNWARD

TABLE 7 POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

| | DRIVER #043 | PASSENGER #048 |
|------------|-------------------------------|----------------------|
| HEAD | <u>Airbag</u> | <u>Windshield</u> |
| CHEST | <u>Airbag</u> | <u>None</u> |
| ABDOMEN | <u>None</u> | <u>None</u> |
| LEFT KNEE | <u>Lower instrument panel</u> | <u>Glovebox door</u> |
| RIGHT KNEE | <u>Lower instrument panel</u> | <u>Glovebox door</u> |

DOOR OPENING:

| | LEFT | RIGHT |
|-------|-------------|-----------------------|
| FRONT | <u>Easy</u> | <u>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>NA</u> | <u>NA</u> |

GLAZING DAMAGE:

The entire windshield cracked and fractured upon impact.

OTHER NOTABLE IMPACT EFFECTS:

None

FIGURE 4

DUMMY MEASUREMENT LOCATIONS FOR FRONT SEAT OCCUPANTS

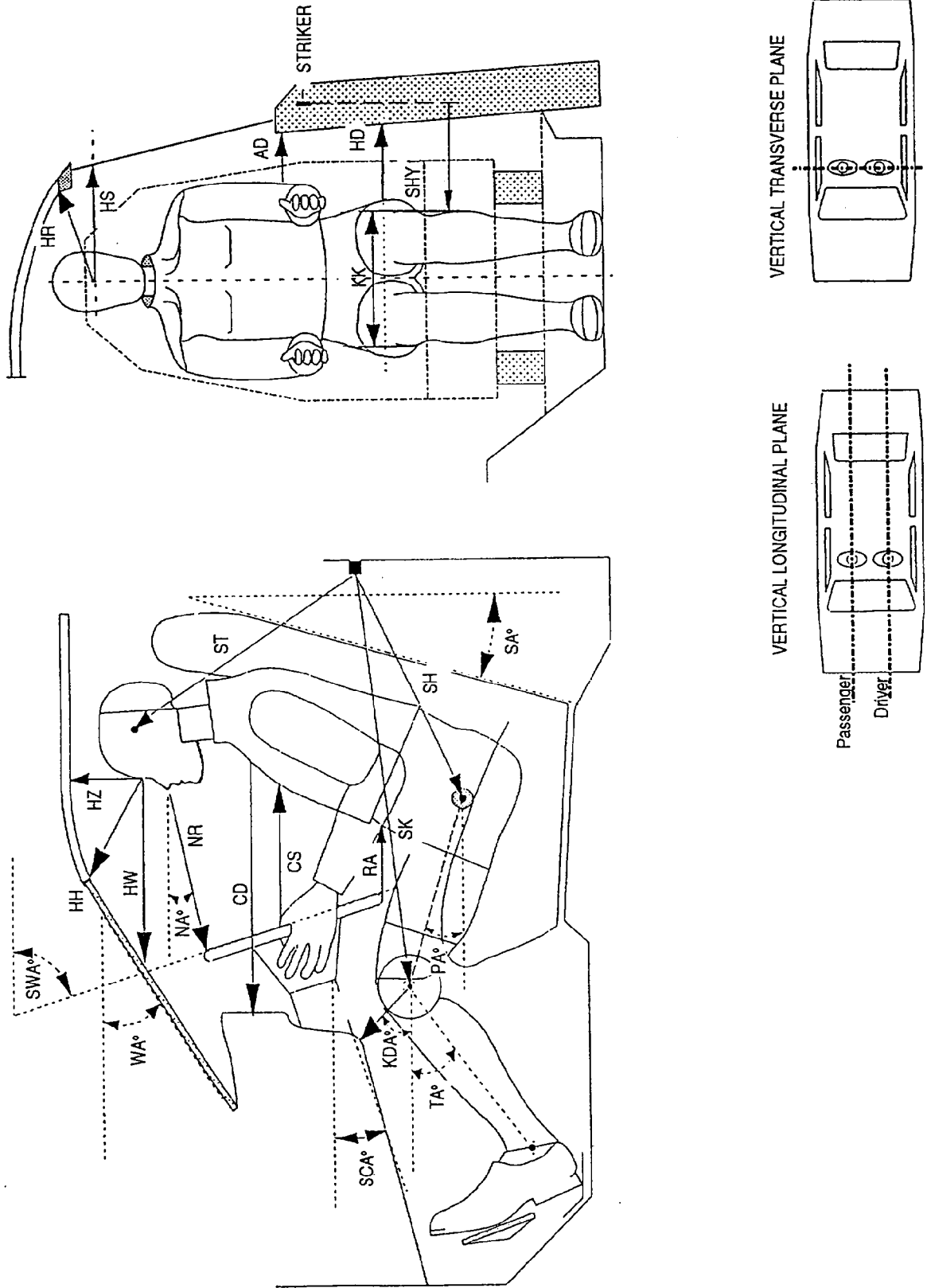


TABLE 8 DUMMY MEASUREMENT DATA FOR FRONT SEAT OCCUPANTS

| DESIGNATION | TYPE OF MEASUREMENT | DRIVER (SERIAL #043) | PASSENGER (SERIAL #048) |
|-------------|-----------------------------|-------------------------|----------------------------|
| WA | WINDSHIELD ANGLE | 30 | NA |
| SWA | STEERING WHEEL ANGLE | 67 | NA |
| SCA | STEERING COLUMN ANGLE | 25 | NA |
| SA | SEAT BACK ANGLE | 26 | 26 |
| HZ | HEAD TO ROOF | 8.2 | 8.0 |
| HH | HEAD TO HEADER | 12.4 | 12.4 |
| HW | HEAD TO WINDSHIELD | 22.9 | 20.8 |
| HR | HEAD TO SIDE HEADER | 9.6 | 9.6 |
| NR | NOSE TO RIM | 14.9 | NA |
| NA | NOSE TO RIM ANGLE | 7 | NA |
| CD | CHEST TO DASH | 20.4 | 18.8 |
| CS | STEERING WHEEL TO CHEST | 12.2 | NA |
| RA | RIM TO ABDOMEN | 7.6 | NA |
| KDL | LEFT KNEE TO DASH | 7.2 | 7.9 |
| KDR | RIGHT KNEE TO DASH | 8.2 | 7.9 |
| KDA | OUTBOARD KNEE TO DASH ANGLE | 45 | 45 |
| PA | PELVIC ANGLE | 23 | 25 |
| TA | TIBIAL ANGLE | 40 | 31 |
| KK | KNEE TO KNEE | 10.9 | 10.4 |
| ST* | STRIKER TO HEAD | 20.8 | 20.9 |
| | STRIKER TO HEAD ANGLE | -86 | -87 |
| SK* | STRIKER TO KNEE | 22.6 | 23.9 |
| | STRIKER TO KNEE ANGLE | 1 | 0 |
| SH* | STRIKER TO H-POINT | 8.9 | 9.9 |
| | STRIKER TO H-POINT ANGLE | 38 | 25 |
| SHY | STRIKER TO H-POINT (Y DIR.) | 10.4 | 9.6 |
| HS | HEAD TO SIDE WINDOW | 13.1 | 14.0 |
| HD | H-POINT TO DOOR | 4.9 | 4.9 |
| AD | ARM TO DOOR | 4.5 | 4.6 |

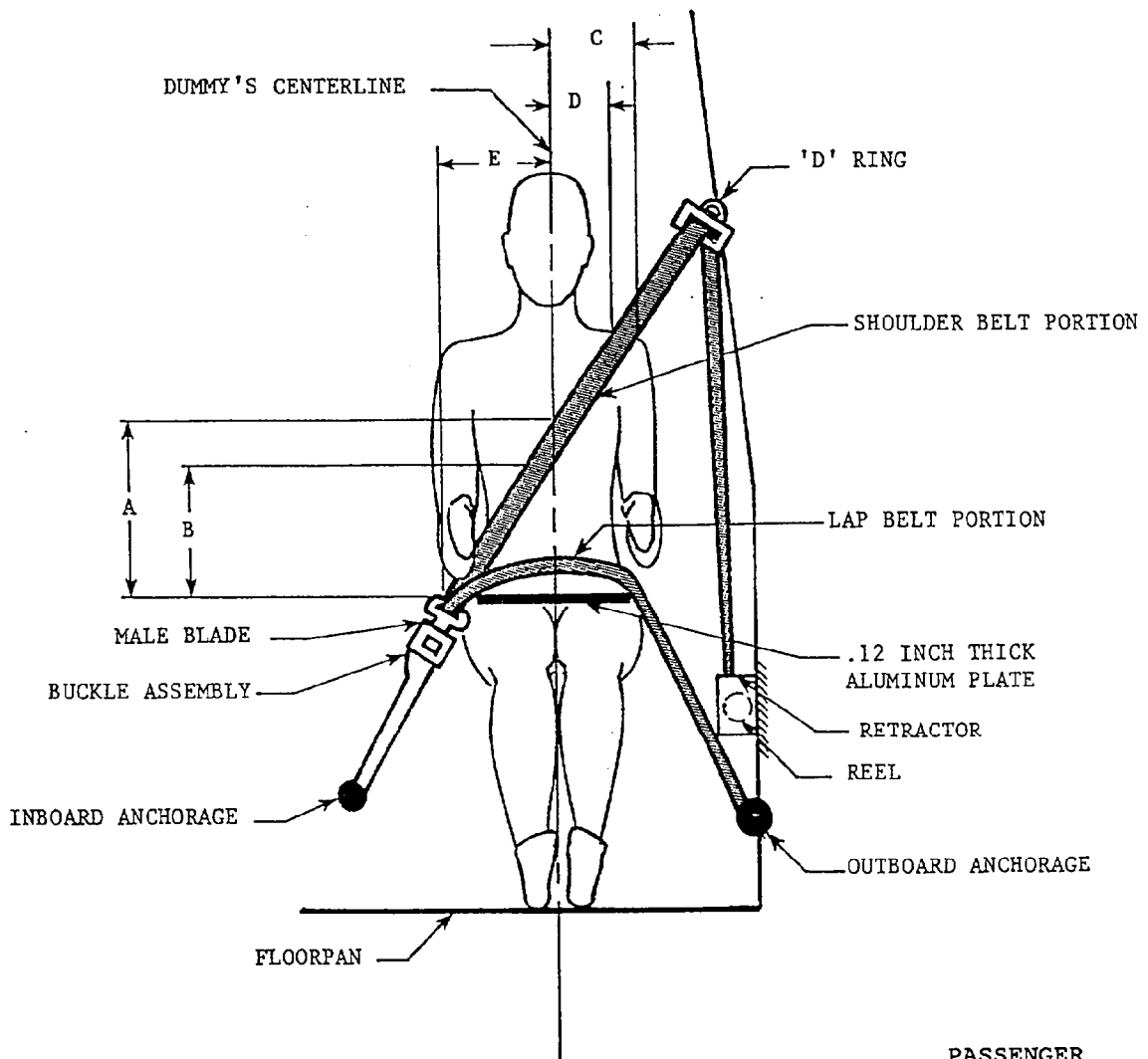
THE SEAT BACK ANGLE (SA°) IS MEASURED RELATIVE TO VERTICAL, ALL OTHER ANGLES ARE MEASURED RELATIVE TO HORIZONTAL.

*A negative angle indicates the measurement point was located above the striker.

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

ALL ANGLE MEASUREMENTS ARE IN DEGREES.

FIGURE 5 SEAT BELT POSITIONING DATA



| | PASSENGER DUMMY |
|--|--------------------|
| A - TOP SURFACE OF ALUMINUM PLATE TO BELT UPPER EDGE | 13.6 |
| B - TOP SURFACE OF ALUMINUM PLATE TO BELT LOWER EDGE | 10.0 |
| C - DUMMY CENTERLINE TO OUTER EDGE OF BELT AT CHEST FLESH TOP | 4.5 |
| D - DUMMY CENTERLINE TO INNER EDGE OF BELT AT CHEST FLESH TOP | 2.2 |
| E - DUMMY CENTERLINE TO INTERSECTION OF UPPER TORSO BELT AND LAP BELT | 7.8 |

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

FIGURE 6

PRE-TEST AND POST-TEST MEASUREMENT POINTS

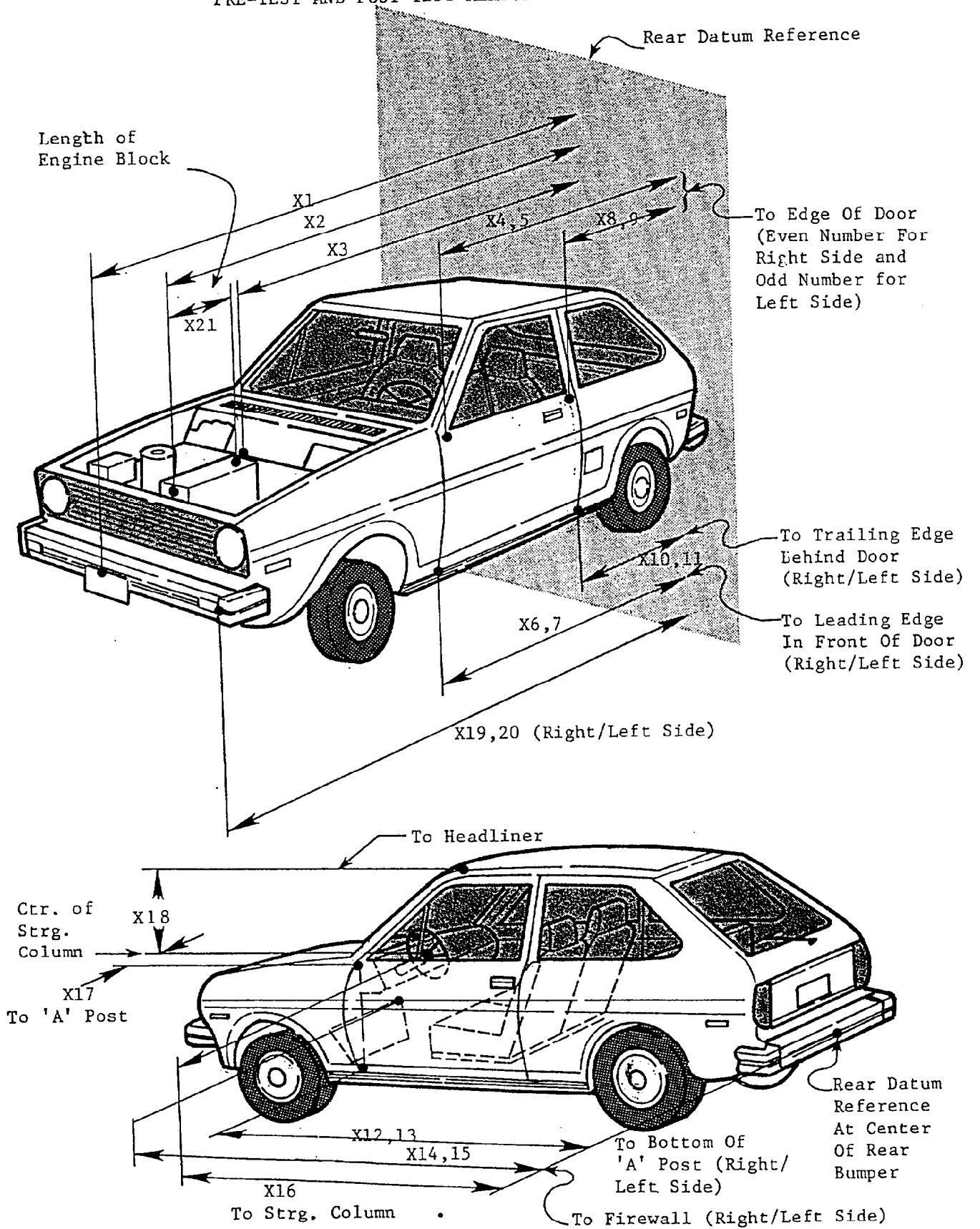


TABLE 9 IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Chevrolet/Corsica TEST NUMBER: 930420

| NO. | TYPE OF MEASUREMENT | ALL MEASUREMENTS ARE IN INCHES | | |
|-----|--|--------------------------------|-----------|-------|
| | | PRE-TEST | POST-TEST | DIFF. |
| X1 | TOTAL LENGTH OF VEHICLE AT CENTERLINE | 183.0 | 181.8 | 1.2 |
| X2 | REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK | 155.0 | 152.9 | 2.1 |
| X3 | REAR SURFACE OF VEHICLE TO FIREWALL | 137.1 | 137.1 | 0.0 |
| X4 | REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR | 124.5 | 124.5 | 0.0 |
| X5 | REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR | 124.6 | 124.3 | 0.3 |
| X6 | REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR | 123.6 | 123.1 | 0.5 |
| X7 | REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR | 124.1 | 123.6 | 0.5 |
| X8 | REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR | 84.2 | 84.5 | -0.3 |
| X9 | REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR | 84.4 | 84.1 | 0.3 |
| X10 | REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR | 85.2 | 84.8 | 0.4 |
| X11 | REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR | 85.5 | 85.1 | 0.4 |
| X12 | REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE | 122.4 | 122.1 | 0.3 |
| X13 | REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE | 122.9 | 122.5 | 0.4 |
| X14 | REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE | 145.4 | 134.8 | 10.6 |
| X15 | REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE | 145.5 | 135.9 | 9.6 |
| X16 | REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER | 105.8 | 105.5 | 0.3 |
| X17 | CENTER OF STEERING COLUMN TO "A" POST | 13.0 | 12.8 | 0.2 |
| X18 | CENTER OF STEERING COLUMN TO HEADLINER | 15.9 | 14.8 | 1.1 |
| X19 | REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER | 179.0 | 176.8 | 2.2 |
| X20 | REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER | 179.1 | 177.8 | 1.3 |
| X21 | LENGTH OF ENGINE BLOCK | 19.0 | 19.0 | 0.0 |

FIGURE 7 CAMERA POSITIONS

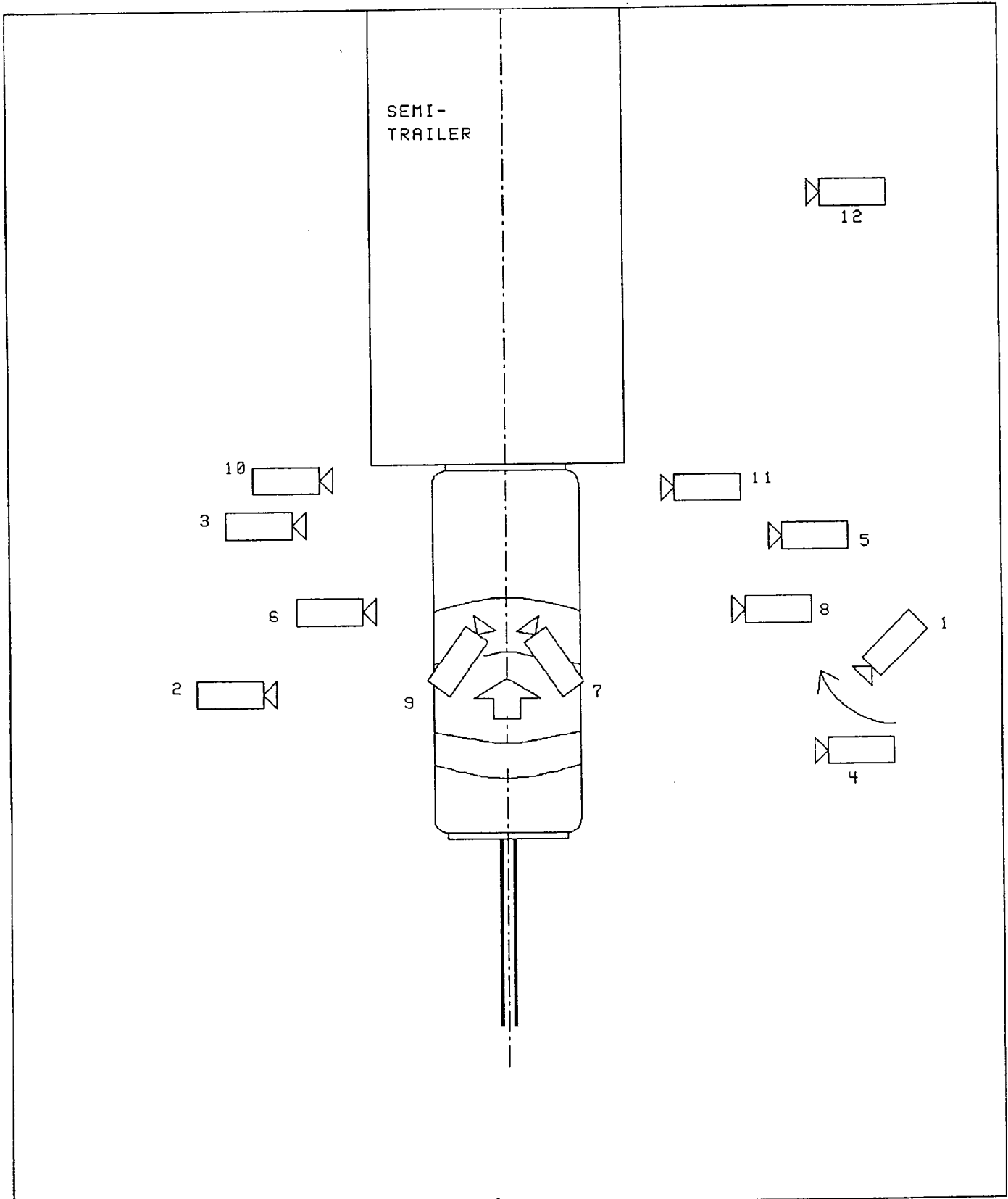


TABLE 10 CAMERA INFORMATION

| CAMERA NO. | LOCATION | TYPE | LENS (mm) | SPEED (fps) | PURPOSE OF CAMERA DATA |
|------------|------------------------|------------|-----------|-------------|-------------------------|
| 1 | Panning | Bolex | 12-120 | 24 | Vehicle dynamics |
| 2 | Left wide | Photosonic | 13 | 998 | Guard deformation/crush |
| 3 | Left front close-up | Photosonic | 25 | 1005 | Guard deformation/crush |
| 4 | Right wide | Photosonic | 13 | 465 | Guard deformation/crush |
| 5 | Right front close-up | Photosonic | 25 | 610 | Guard deformation/crush |
| 6 | Left medium tight | Photosonic | 25 | 1030 | Dummy kinematics |
| 7 | Onboard driver | Photosonic | 8 | 998 | Dummy kinematics |
| 8 | Right medium tight | Photosonic | 25 | 505 | Dummy kinematics |
| 9 | Onboard passenger view | Photosonic | 8 | 995 | Dummy kinematics |
| 10 | Left underide guard | Photosonic | 75 | 515 | Guard deformation/crush |
| 11 | Right underide guard | Photosonic | 75 | 450 | Guard deformation/crush |
| 12 | Overall wide | Photosonic | 8.5 | 380 | Vehicle dynamics |

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST RIGHT SIDE VIEW

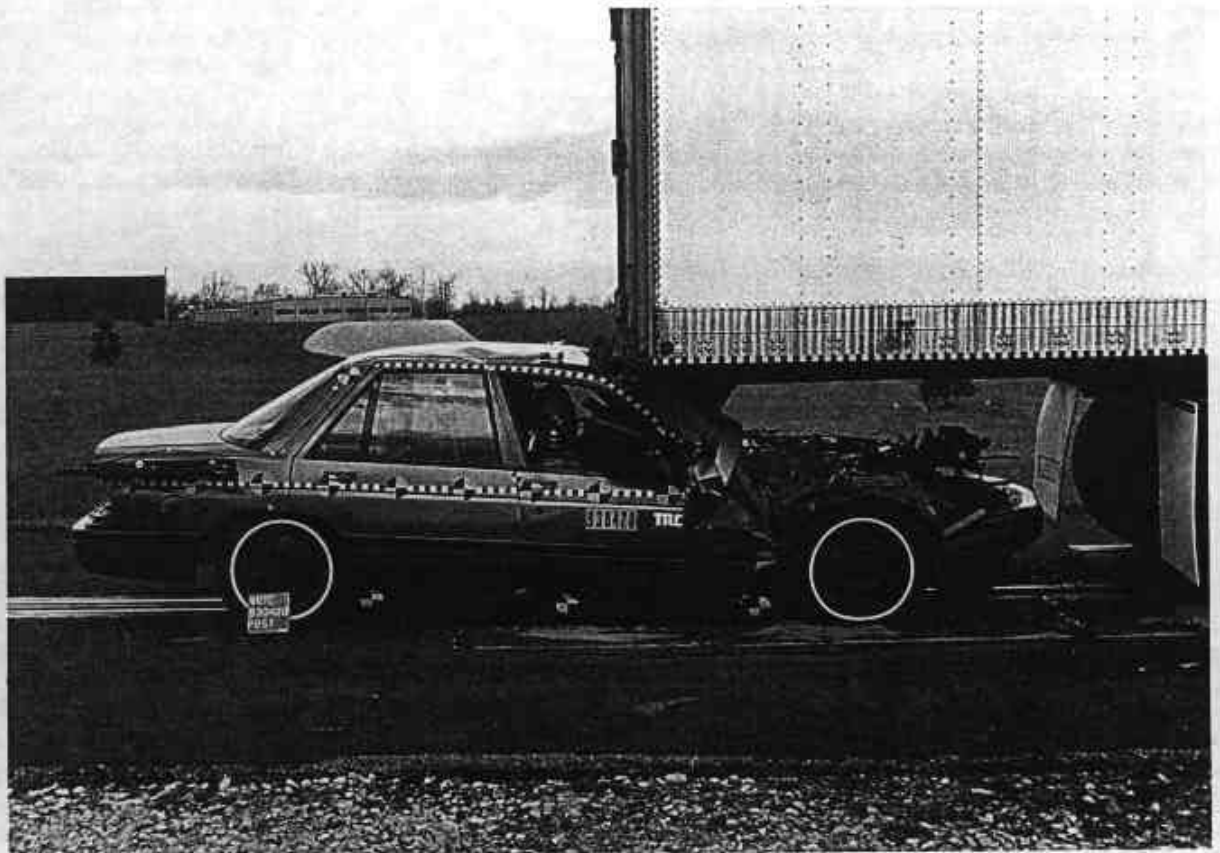


Figure A-2. POST-TEST RIGHT SIDE VIEW

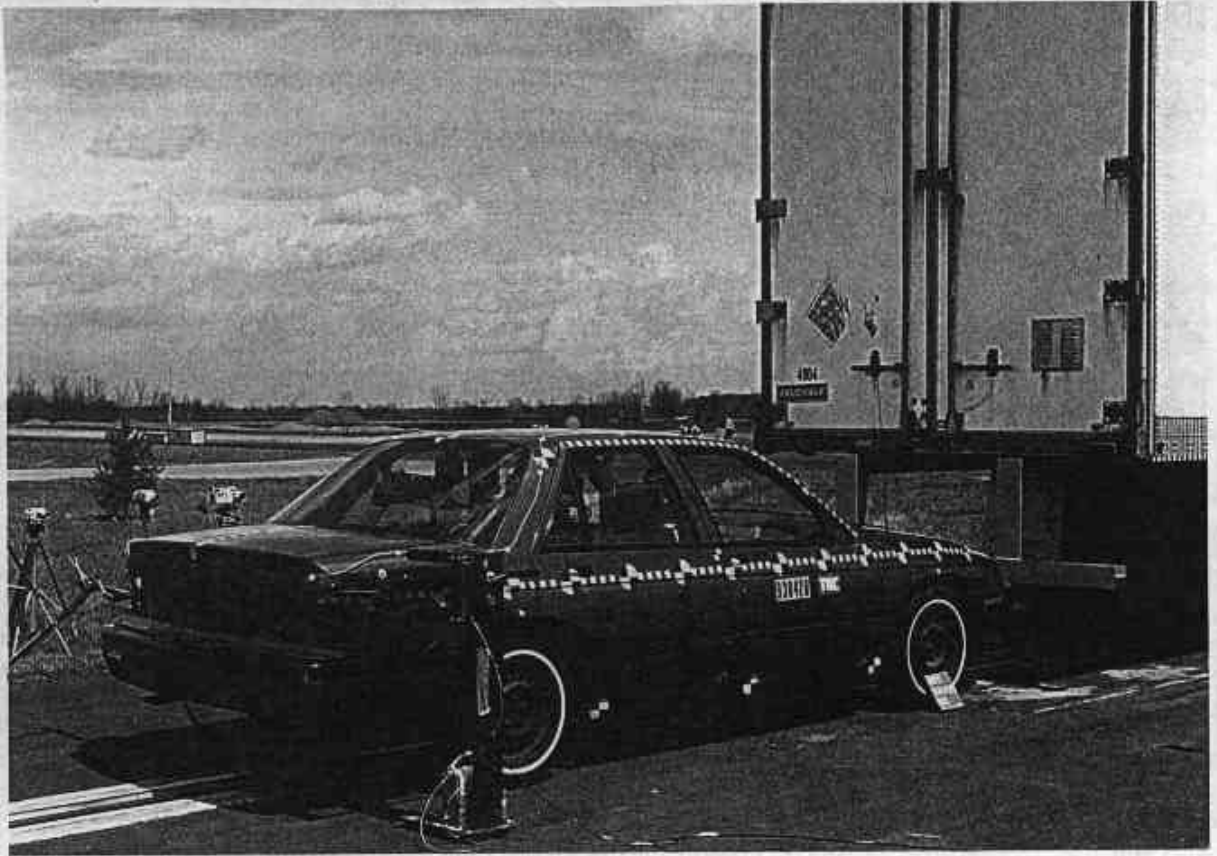


Figure A-3. PRE-TEST RIGHT REAR VIEW



Figure A-4. POST-TEST RIGHT REAR VIEW

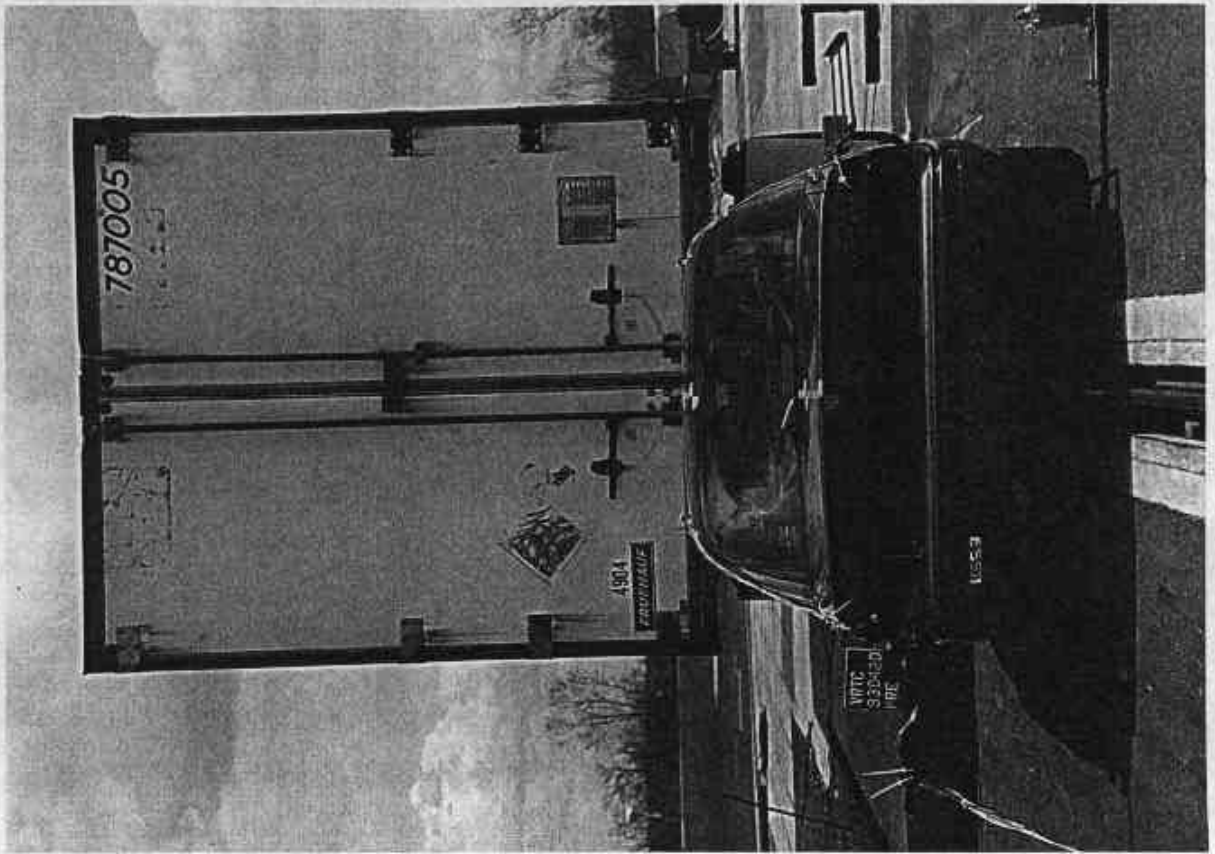


Figure A-5. PRE-TEST REAR VIEW

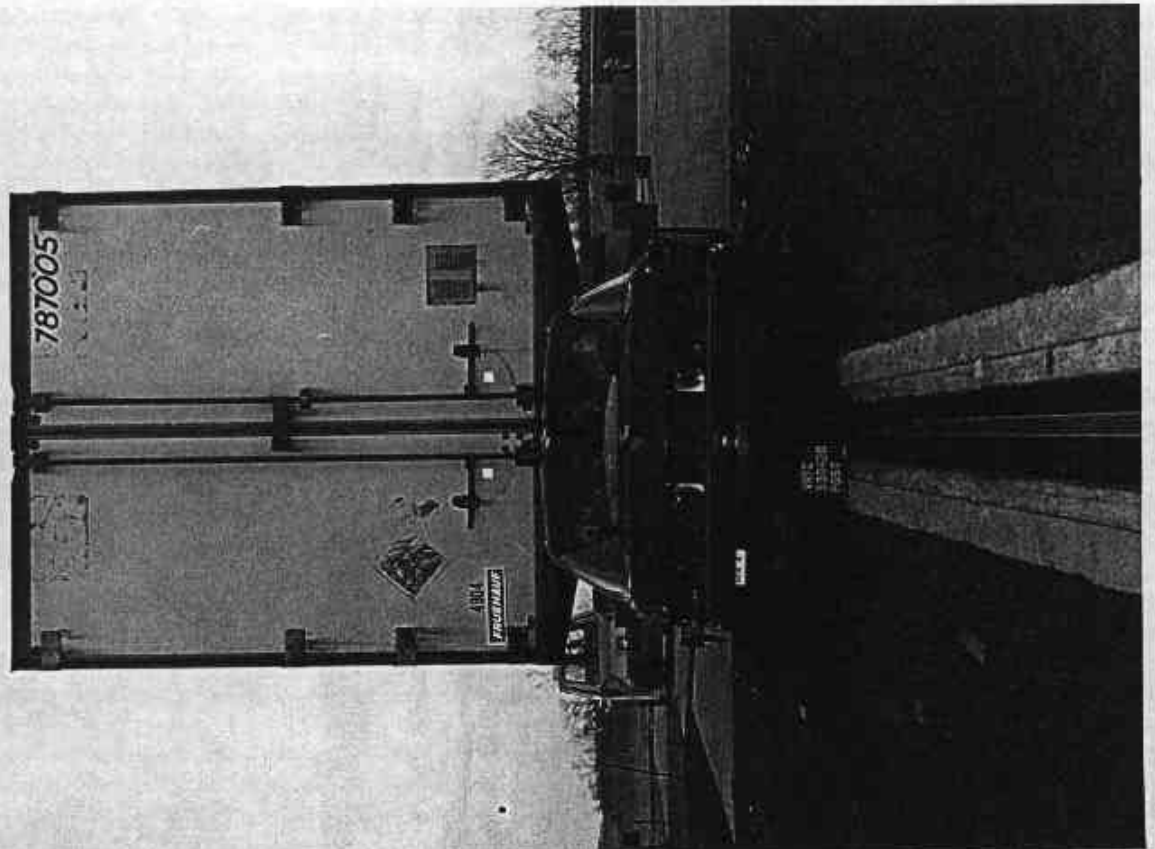


Figure A-6. POST-TEST REAR VIEW



Figure A-7. PRE-TEST LEFT REAR VIEW



Figure A-8. PRE-TEST LEFT SIDE VIEW

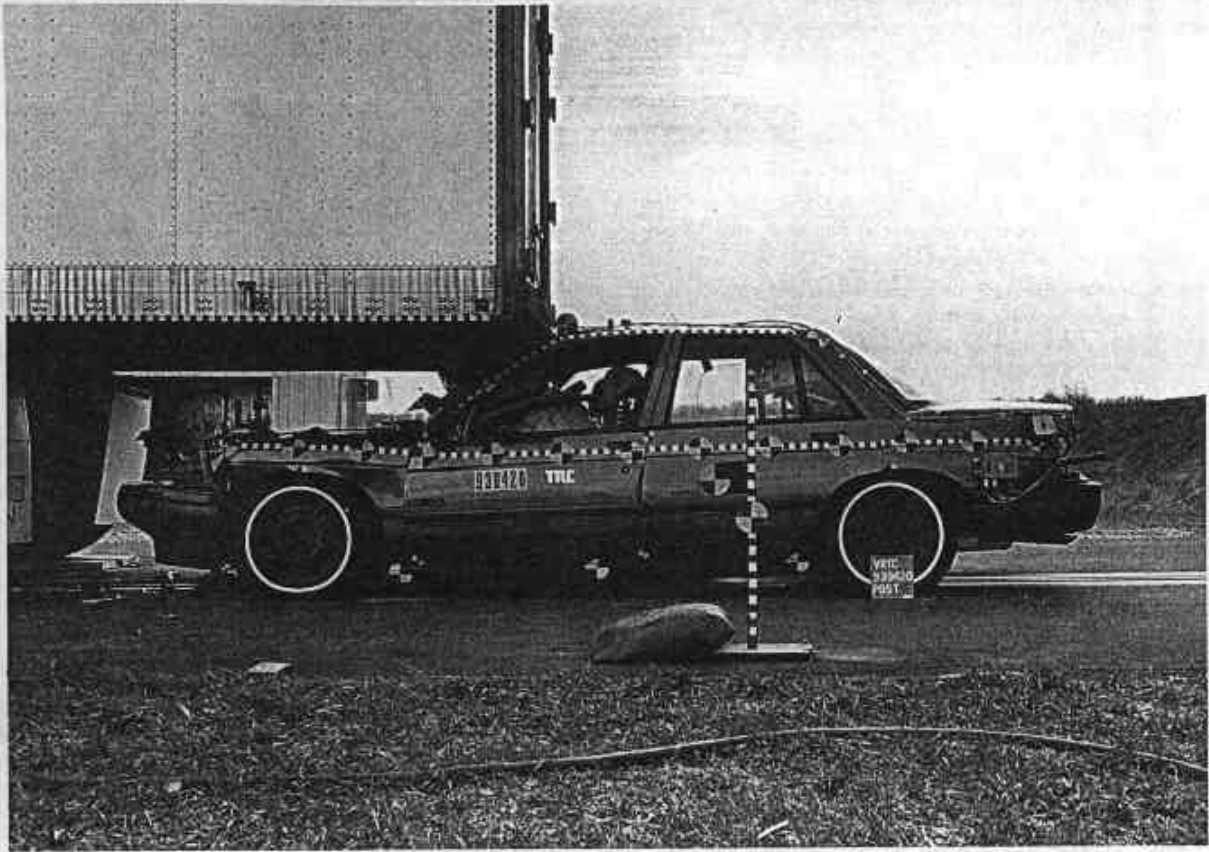


Figure A-9. POST-TEST LEFT SIDE VIEW



Figure A-10. PRE-TEST WINDSHIELD VIEW

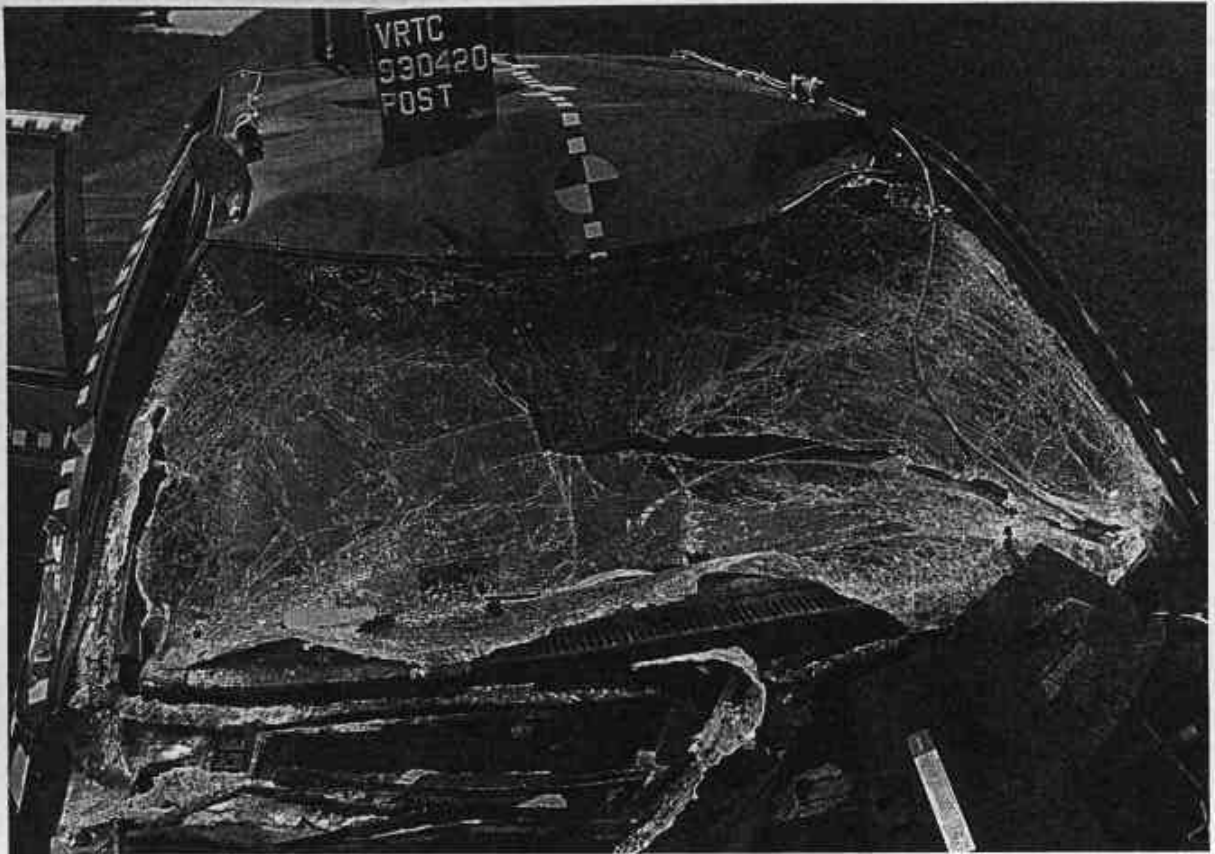


Figure A-11. POST-TEST WINDSHIELD VIEW



Figure A-12. PRE-TEST ENGINE COMPARTMENT VIEW



Figure A-13. PRE-TEST DRIVER DUMMY POSITION VIEW



Figure A-14. POST-TEST DRIVER DUMMY POSITION - VIEW 1



Figure A-15. POST-TEST DRIVER DUMMY POSITION - VIEW 2



Figure A-16. PRE-TEST PASSENGER DUMMY POSITION VIEW



Figure A-17. POST-TEST PASSENGER DUMMY POSITION - VIEW 1

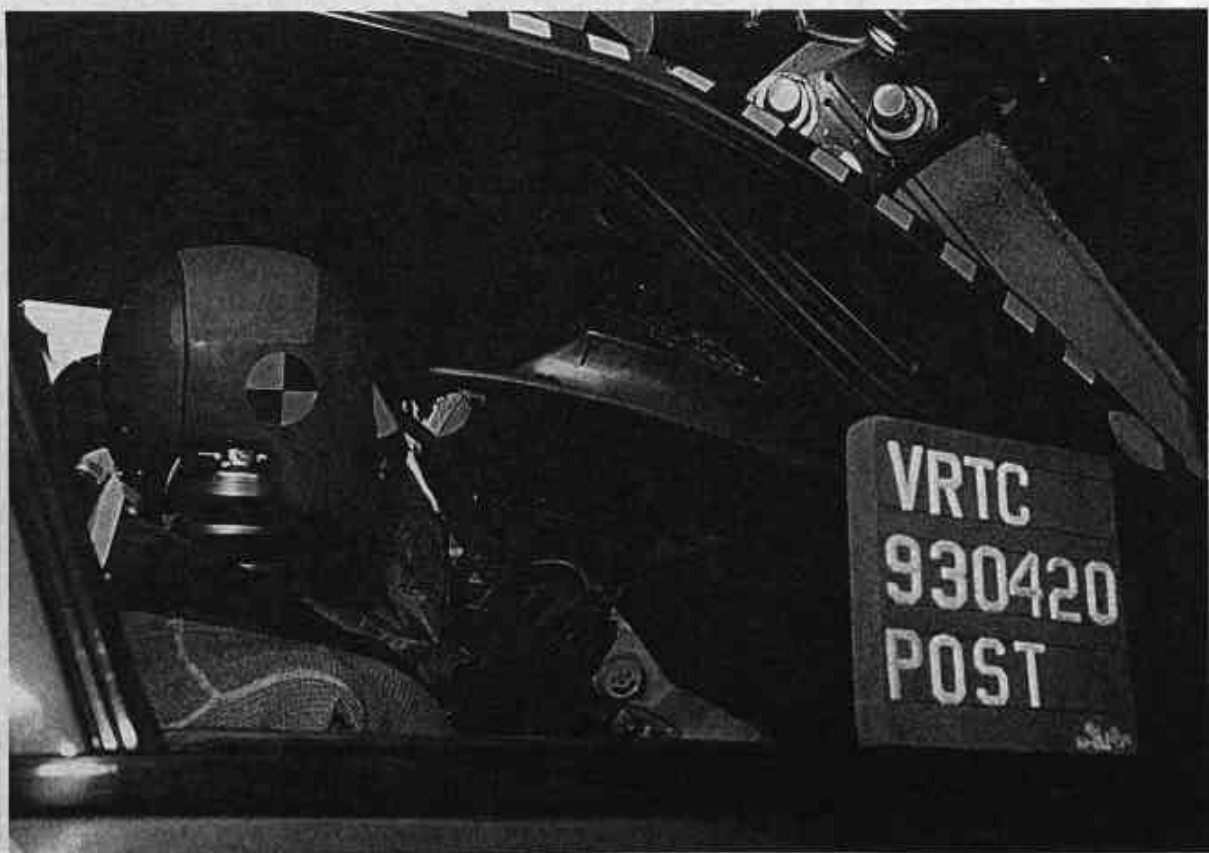


Figure A-18. POST-TEST PASSENGER DUMMY POSITION - VIEW 2

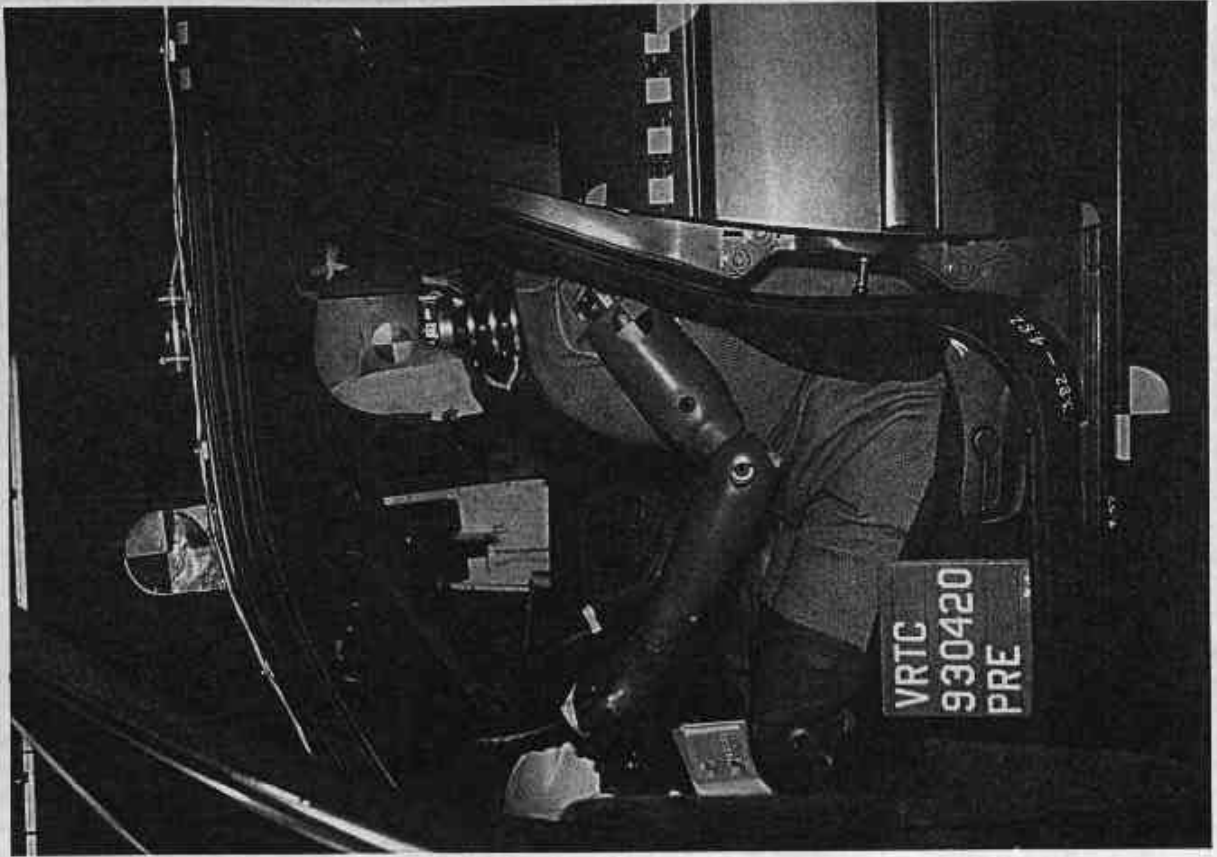


Figure A-19. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1



Figure A-20. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

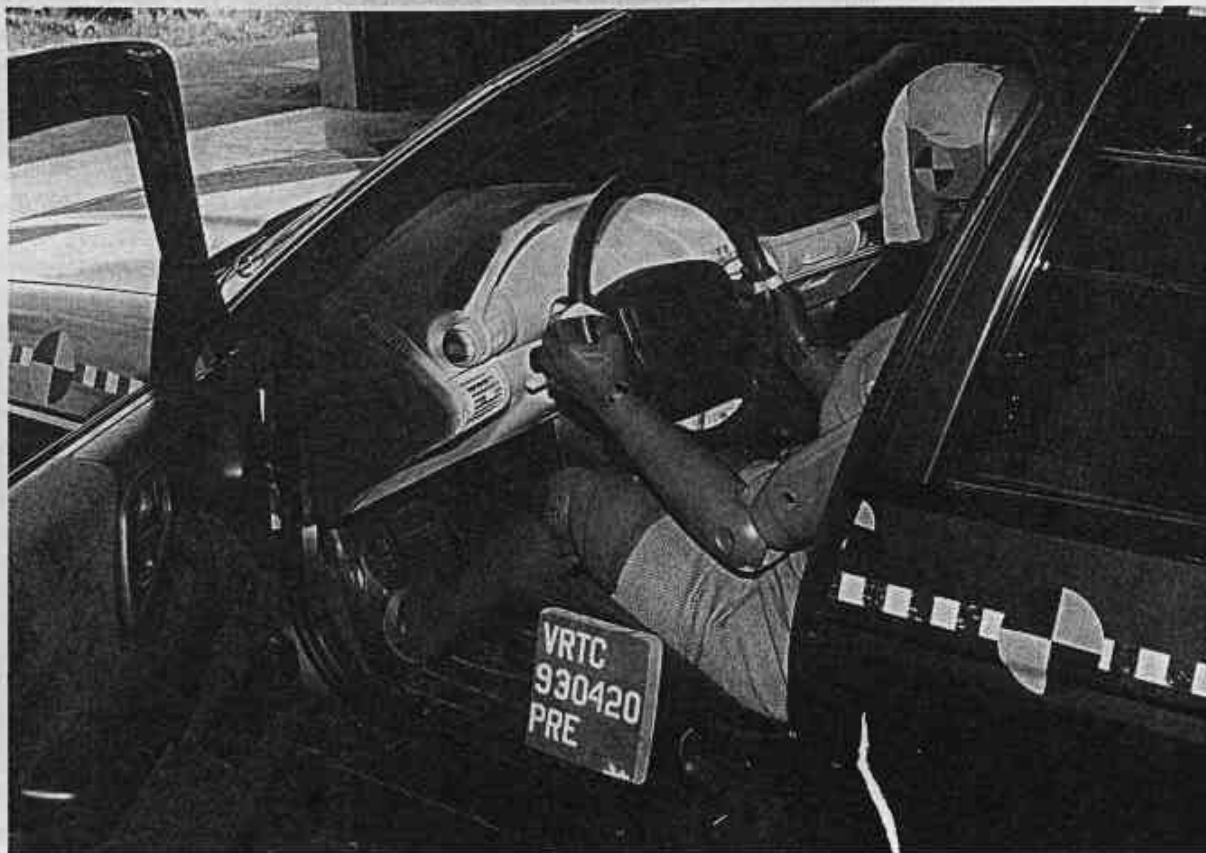


Figure A-21. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-22. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

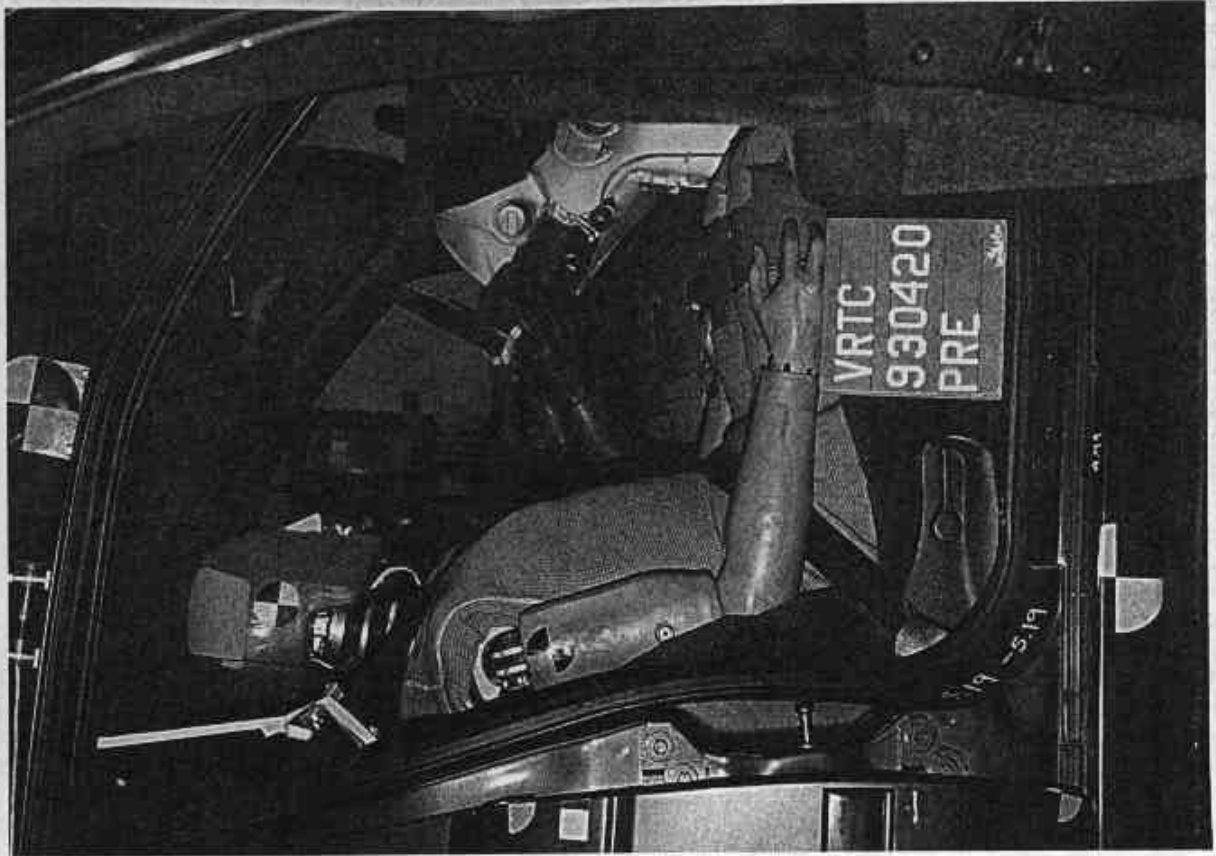


Figure A-23. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1



Figure A-24. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

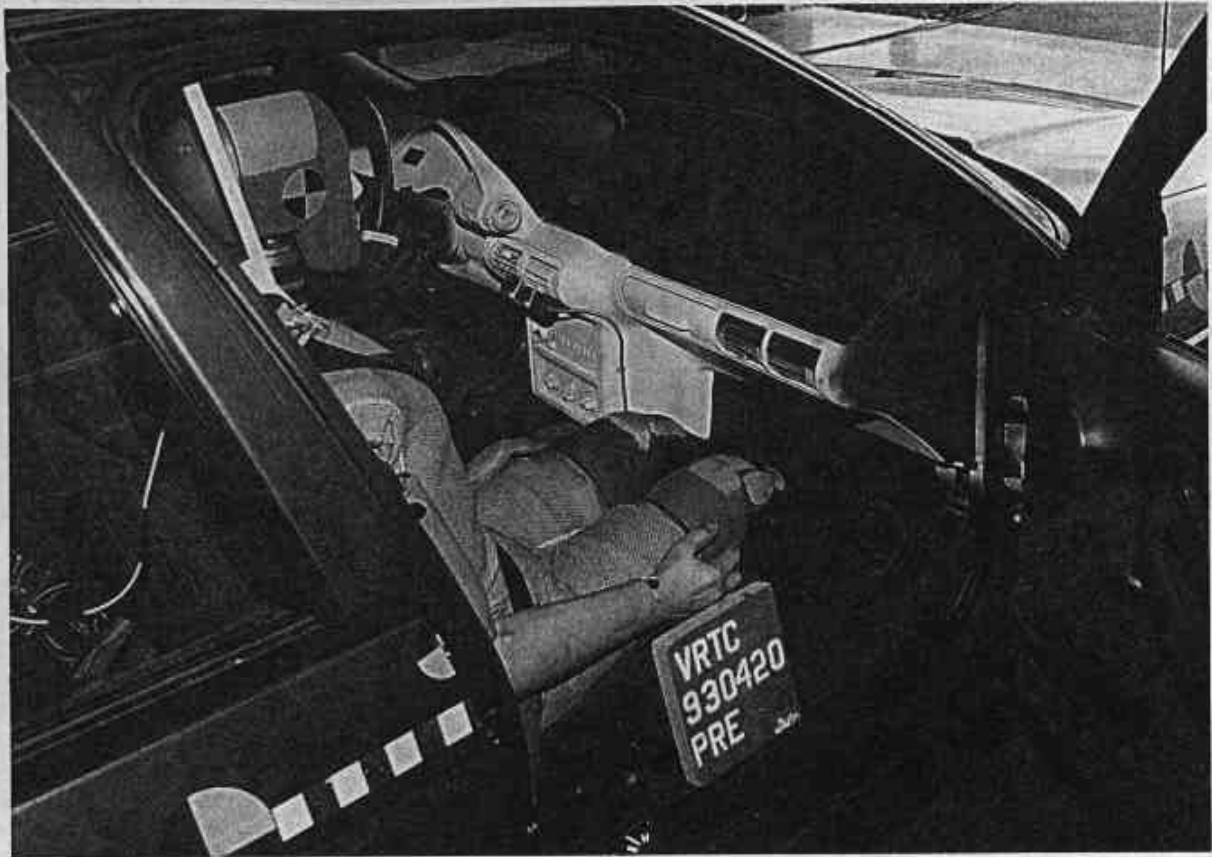


Figure A-25. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-26. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2

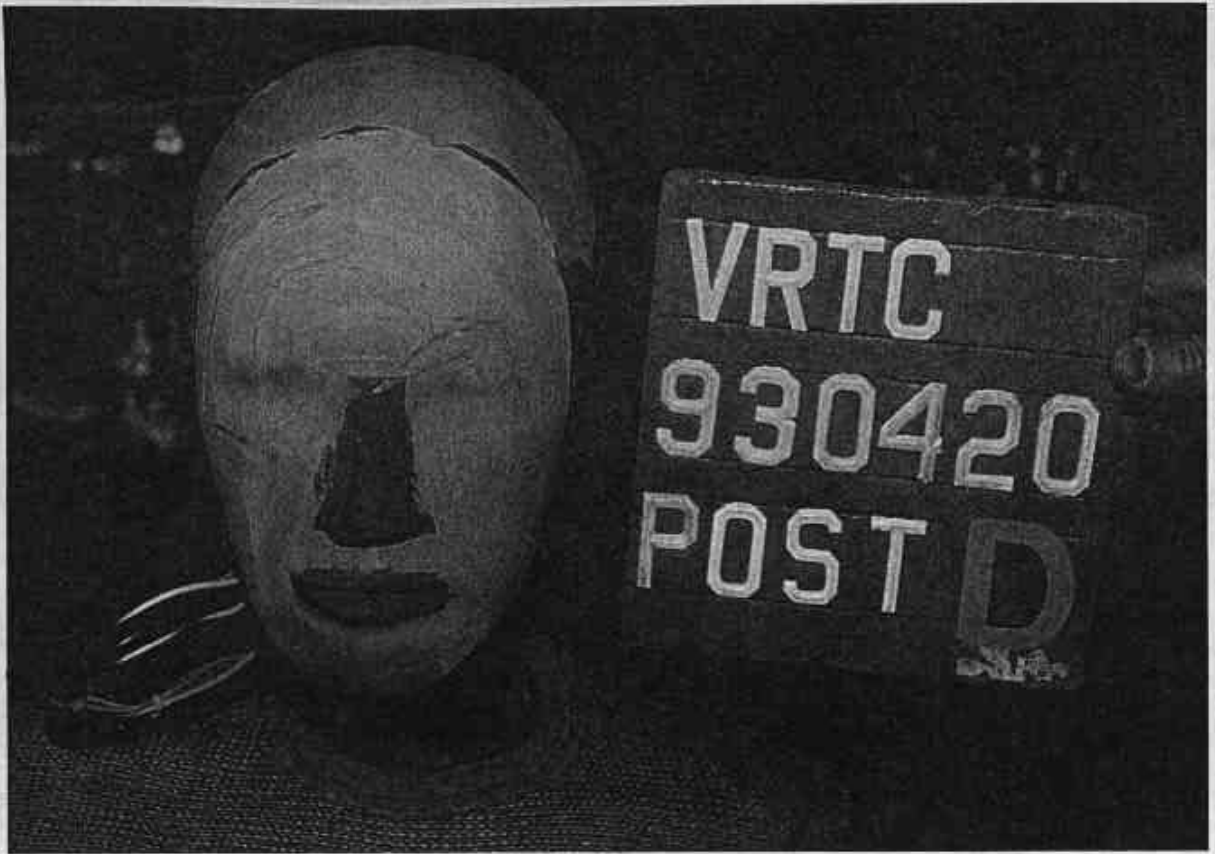


Figure A-27. POST-TEST DRIVER DUMMY HEAD CONTACT VIEW



Figure A-28. POST-TEST DRIVER DUMMY KNEE CONTACT VIEW

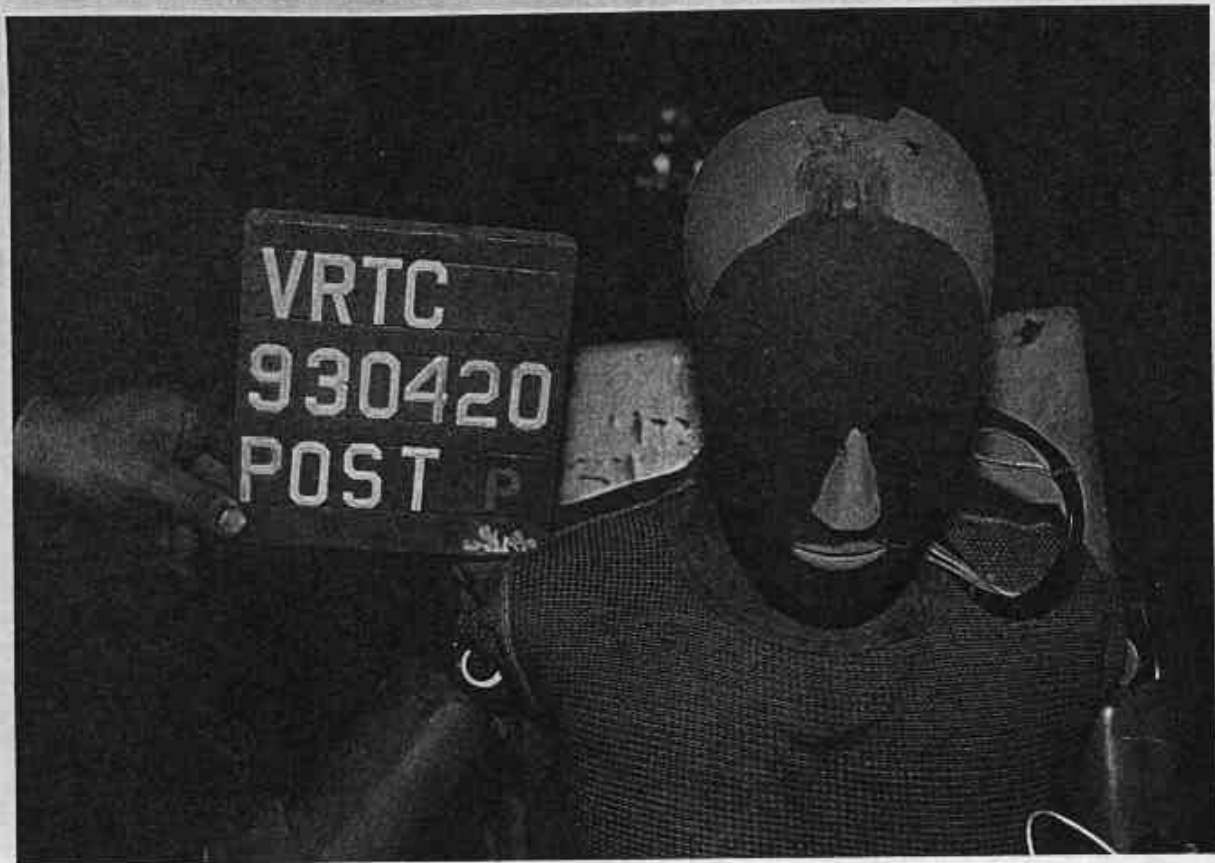


Figure A-29. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW

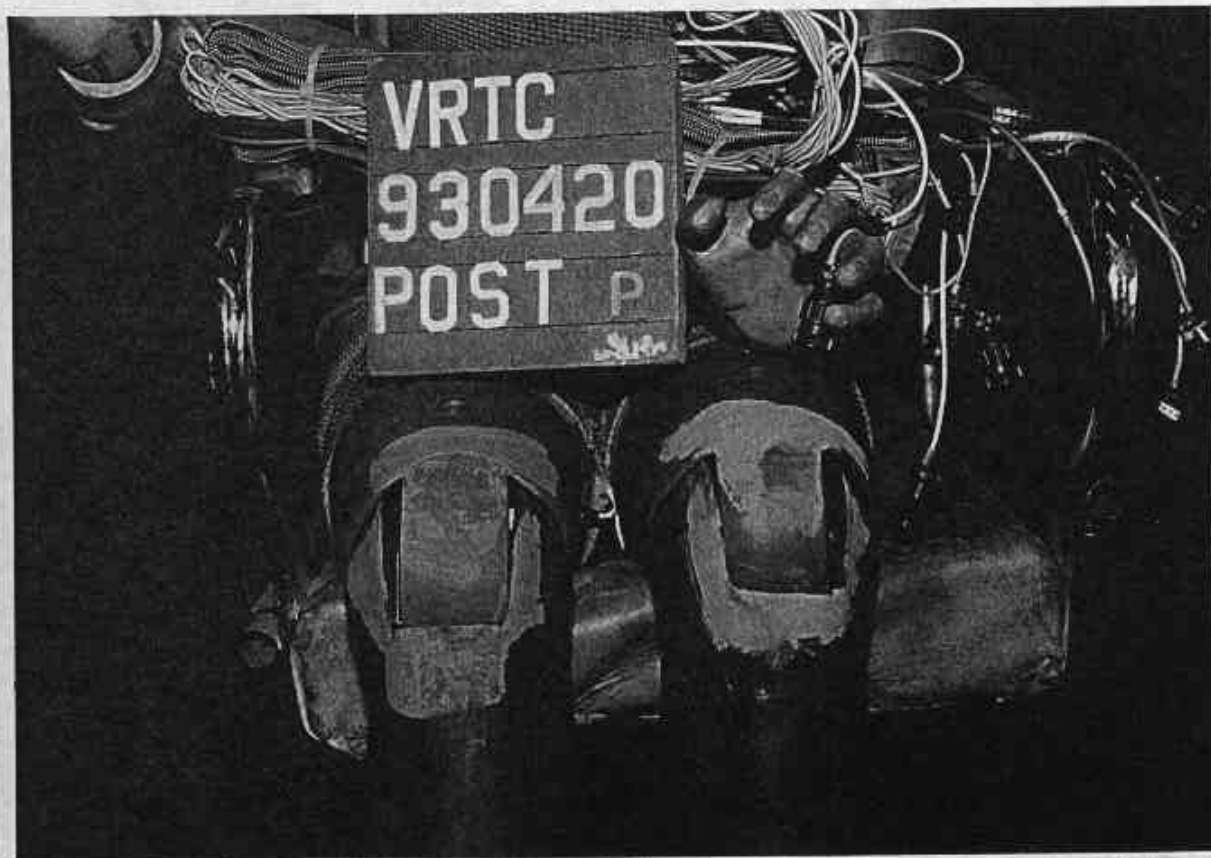


Figure A-30. POST-TEST PASSENGER DUMMY KNEE CONTACT VIEW

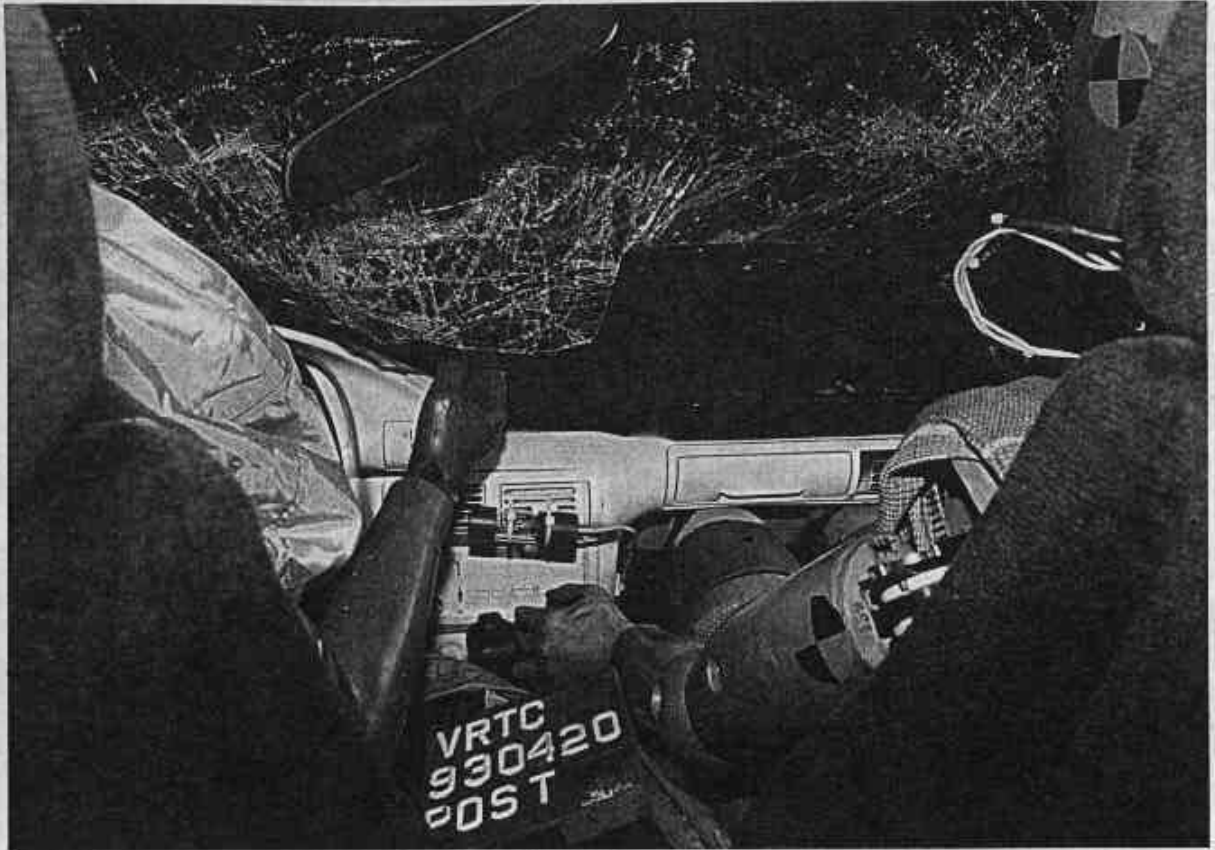


Figure A-31. POST-TEST VEHICLE INTERIOR VIEW

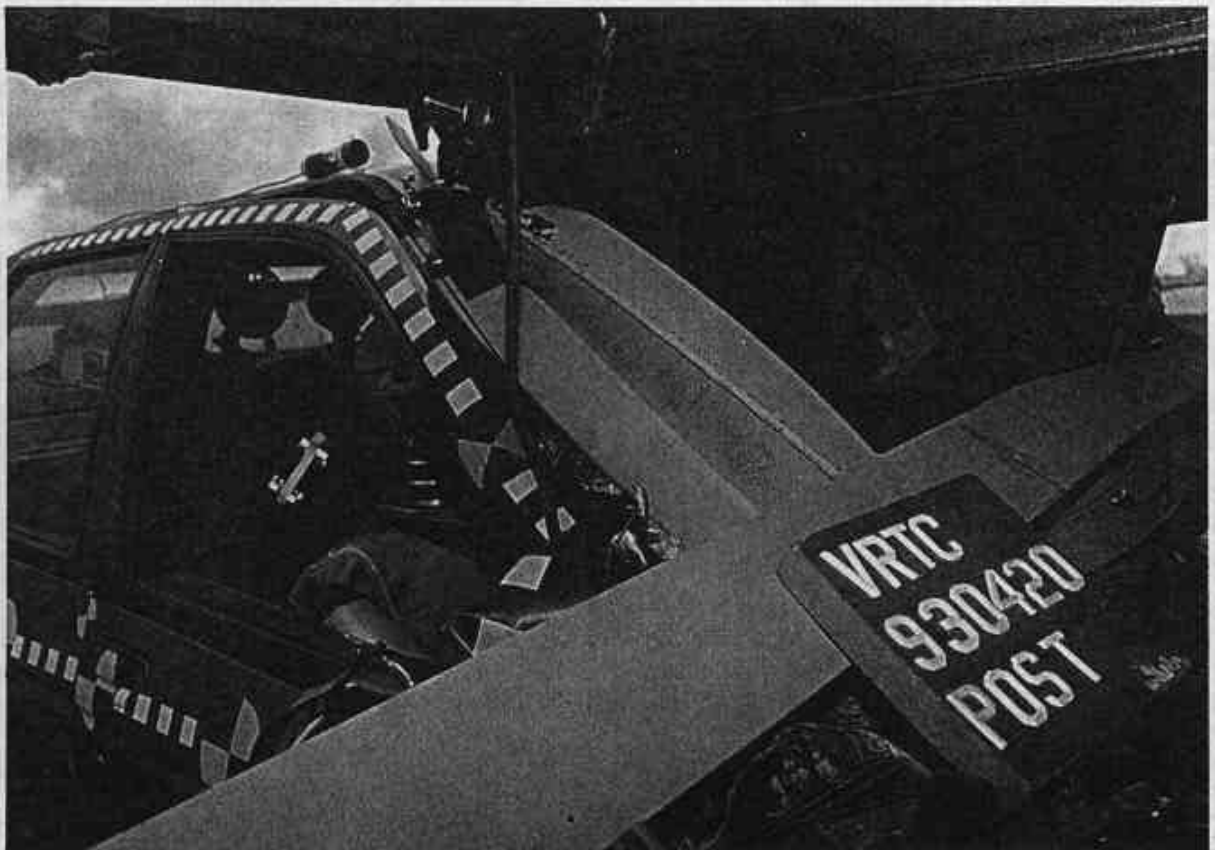


Figure A-32. POST-TEST VEHICLE AND UNDERRIDE GUARD ENGAGEMENT - VIEW 1

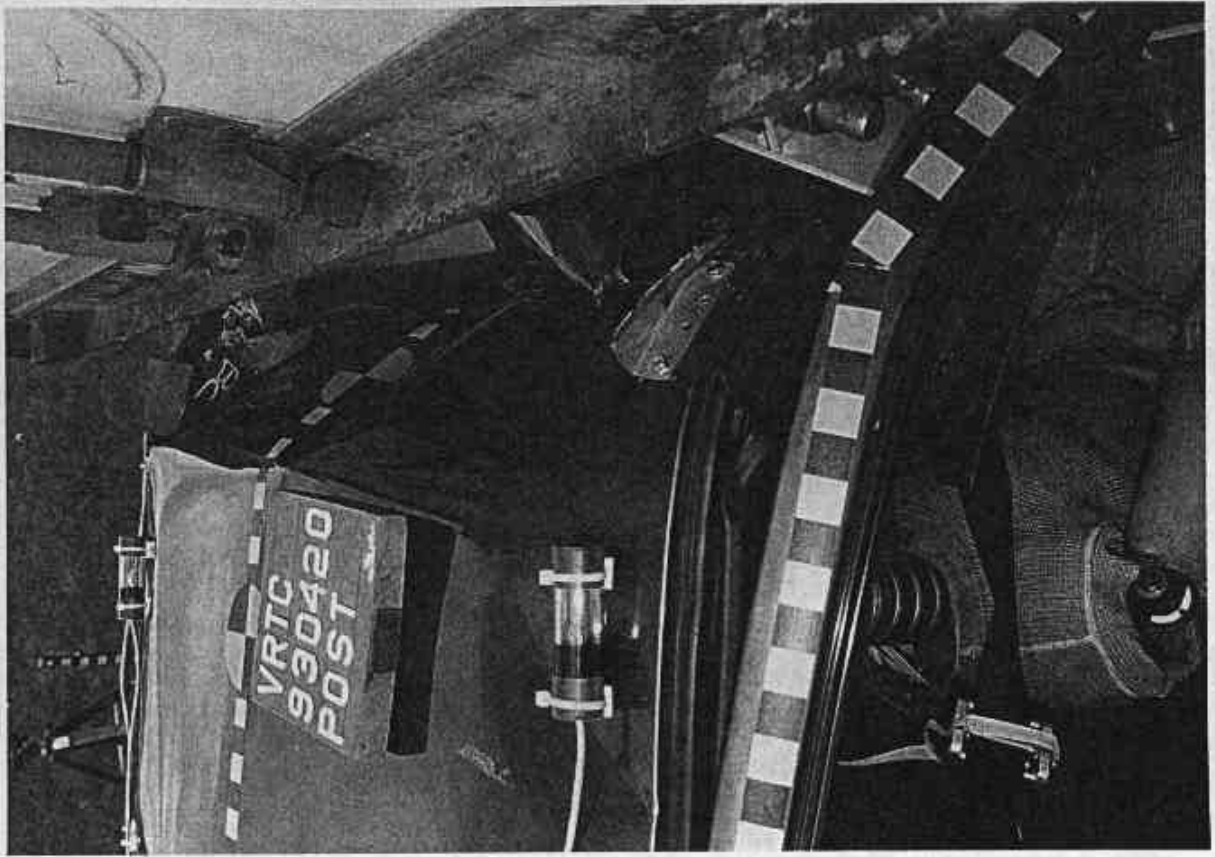


Figure A-33. POST-TEST VEHICLE AND UNDERRIDE GUARD ENGAGEMENT - VIEW 2

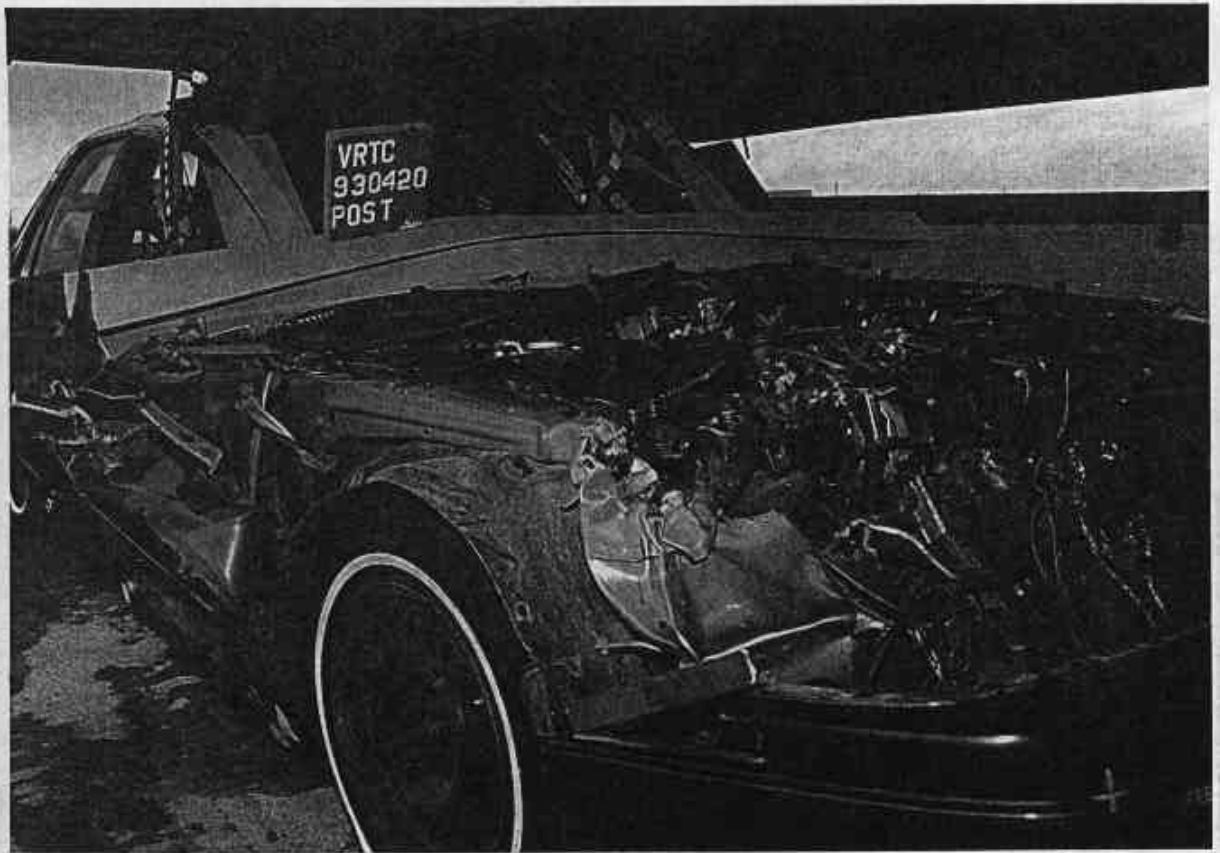


Figure A-34. POST-TEST VEHICLE AND UNDERRIDE GUARD ENGAGEMENT - VIEW 3

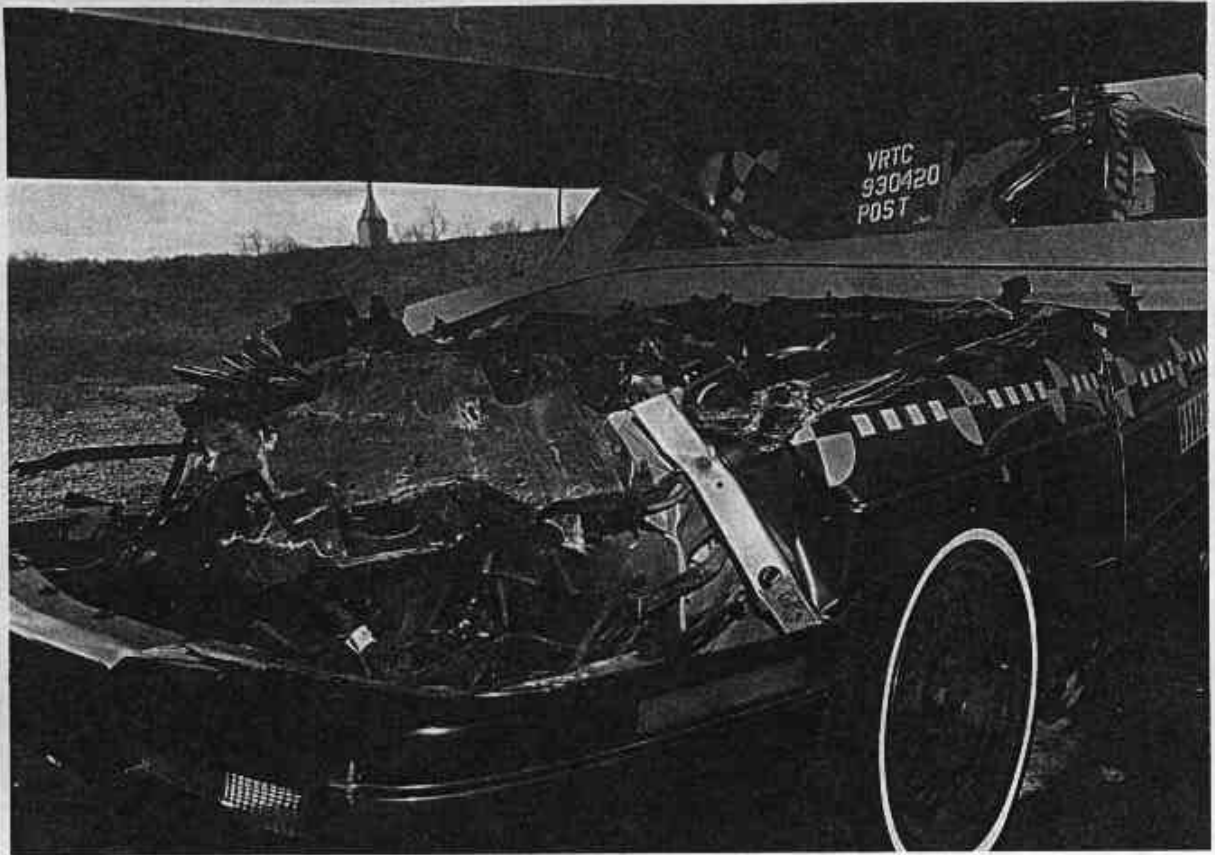


Figure A-35. POST-TEST VEHICLE AND UNDERRIDE GUARD ENGAGEMENT - VIEW 4



Figure A-36. POST-TEST VEHICLE AND UNDERRIDE GUARD ENGAGEMENT - VIEW 5

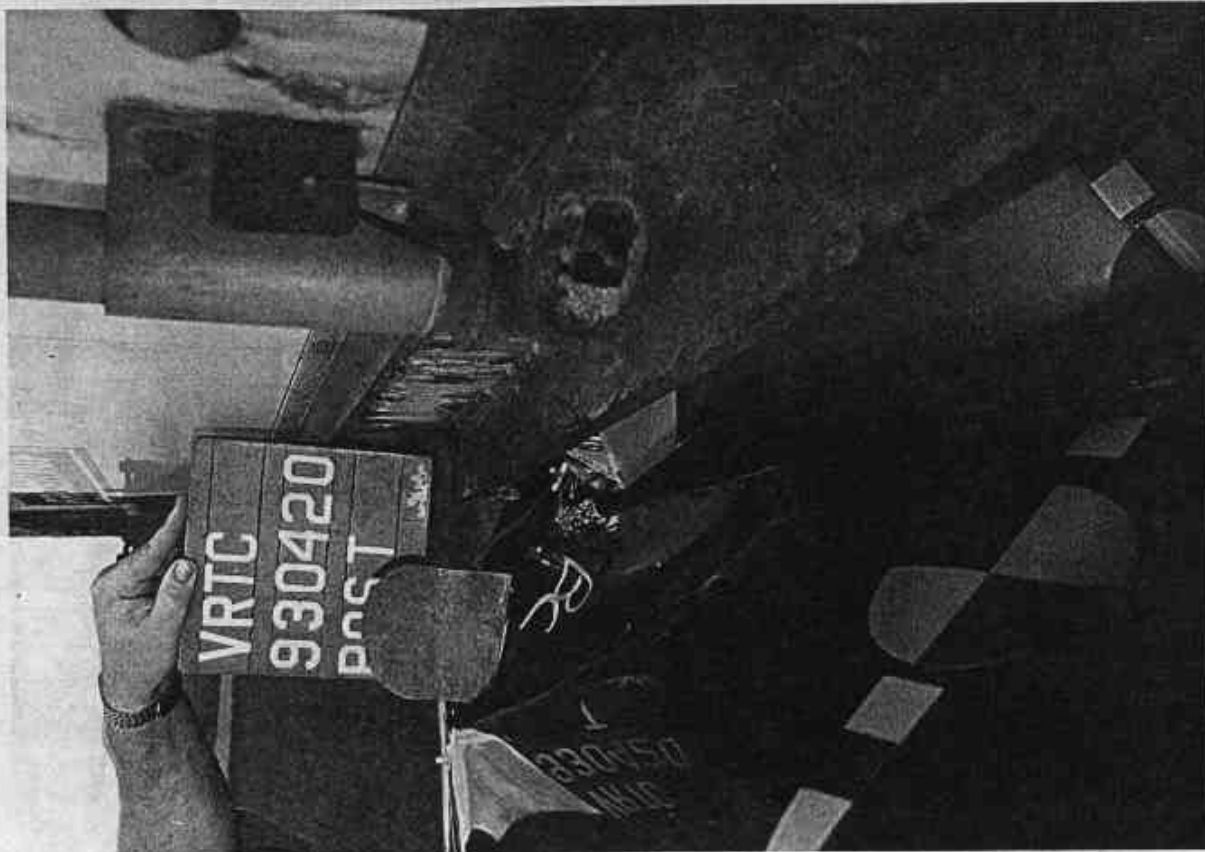


Figure A-37. POST-TEST VEHICLE AND UNDERRIDE GUARD ENGAGEMENT - VIEW 6



Figure A-38. POST-TEST UNDERRIDE GUARD - VIEW 1



Figure A-39. POST-TEST UNDERRIDE GUARD - VIEW 2



Figure A-40. POST-TEST UNDERRIDE GUARD - VIEW 3

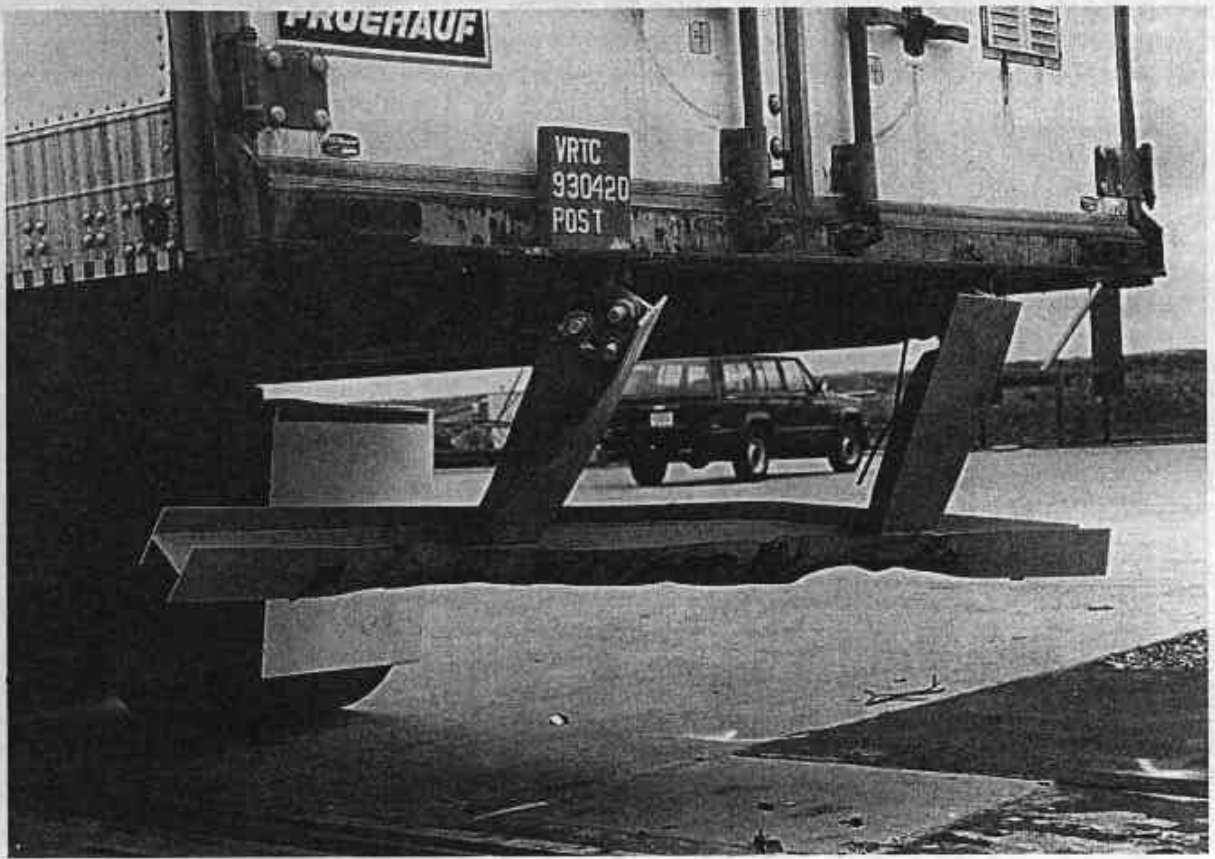


Figure A-41. POST-TEST UNDERRIDE GUARD - VIEW 4



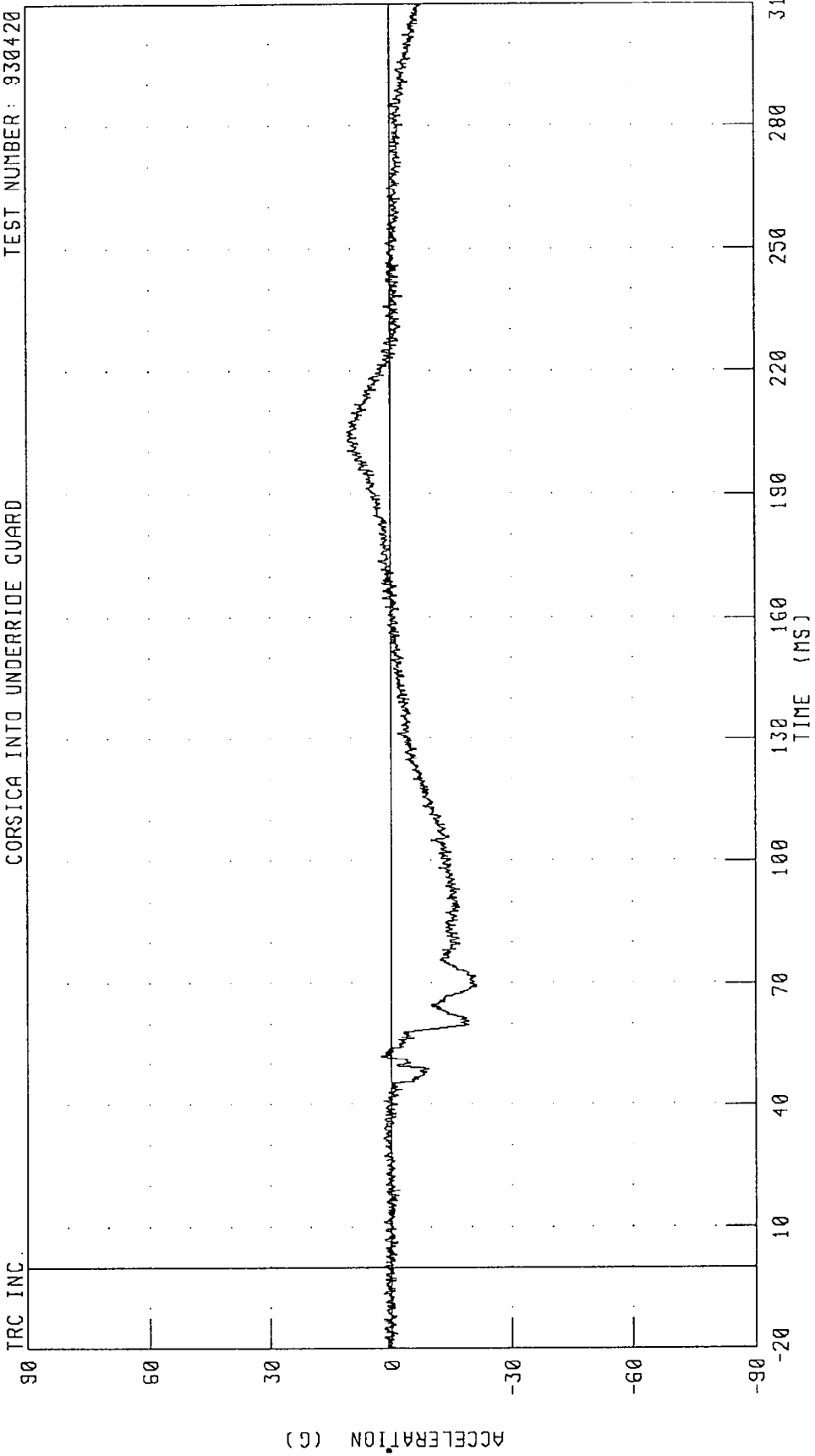
Figure A-42. POST-TEST UNDERRIDE GUARD - VIEW 5

APPENDIX B

DATA PLOTS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

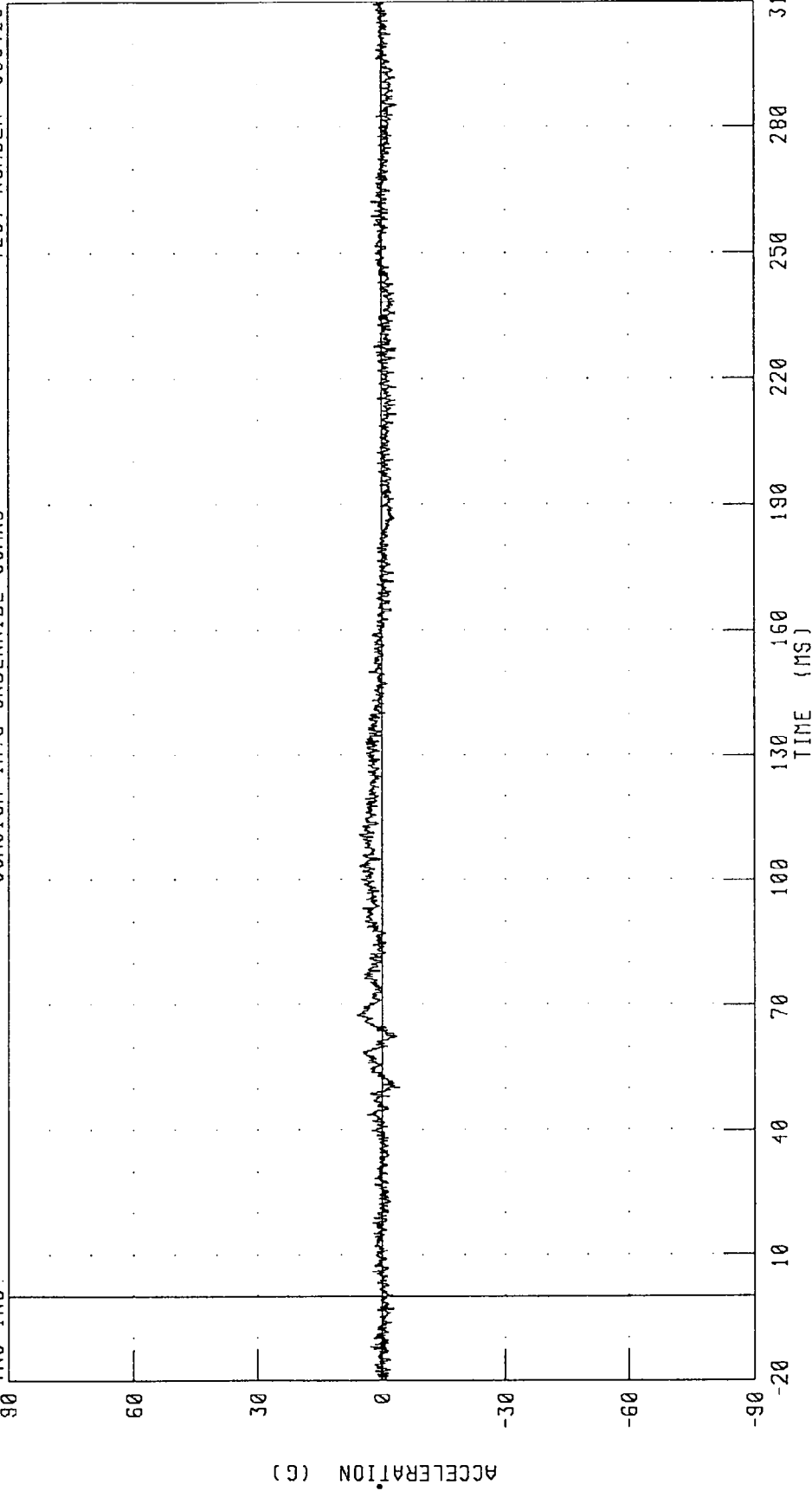


CHANNEL: HEDXG1 FILTER: CH CLASS 1000 PEAK DATA: 10 90 G @ 204.88 MS; -21.39 G @ 69.75 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

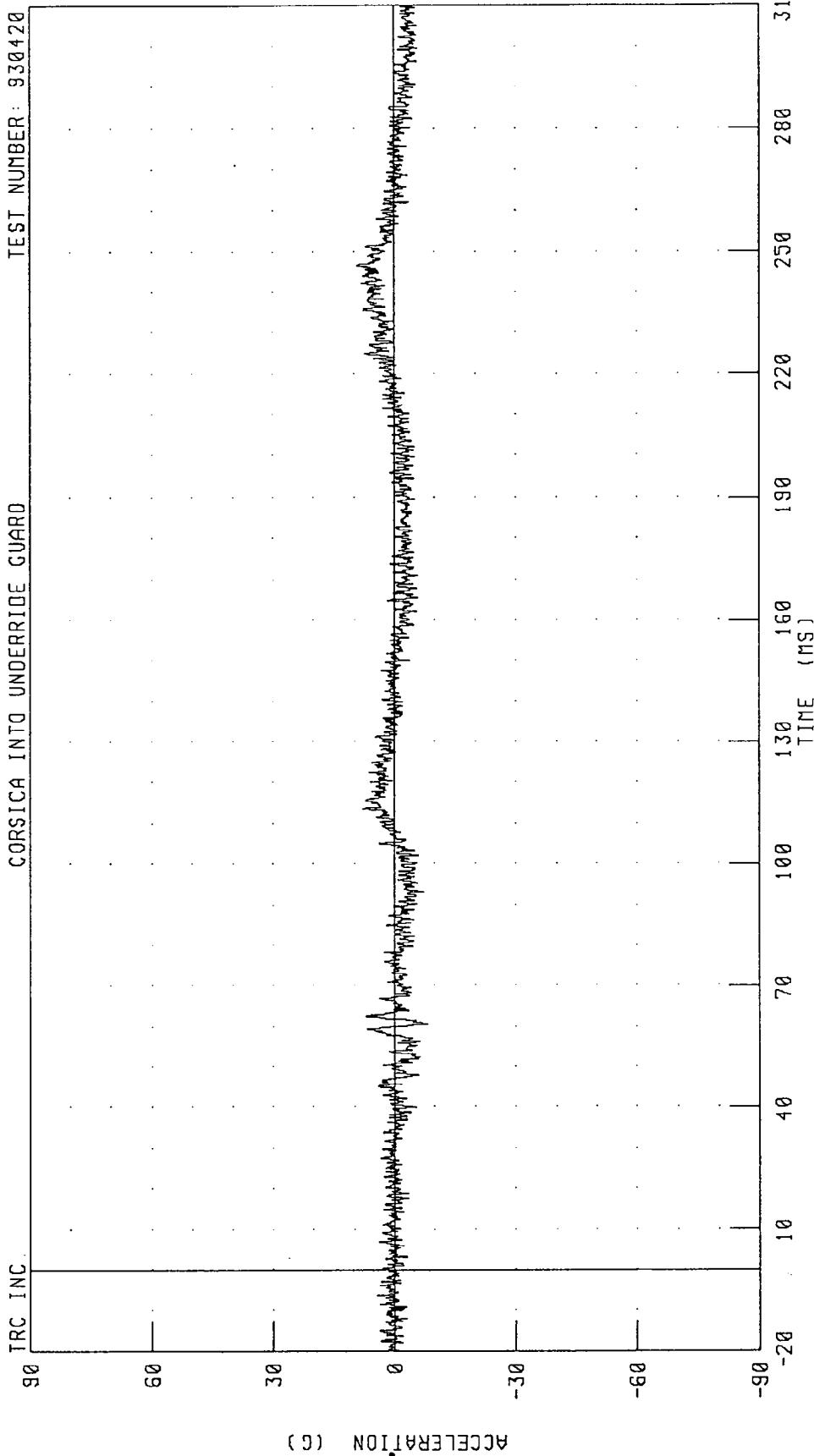


CHANNEL: HEDYGI FILTER: CH. CLASS 1000

PEAK DATA: 6.00 G @ 67.63 MS; -4.39 G @ 50.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD Z-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

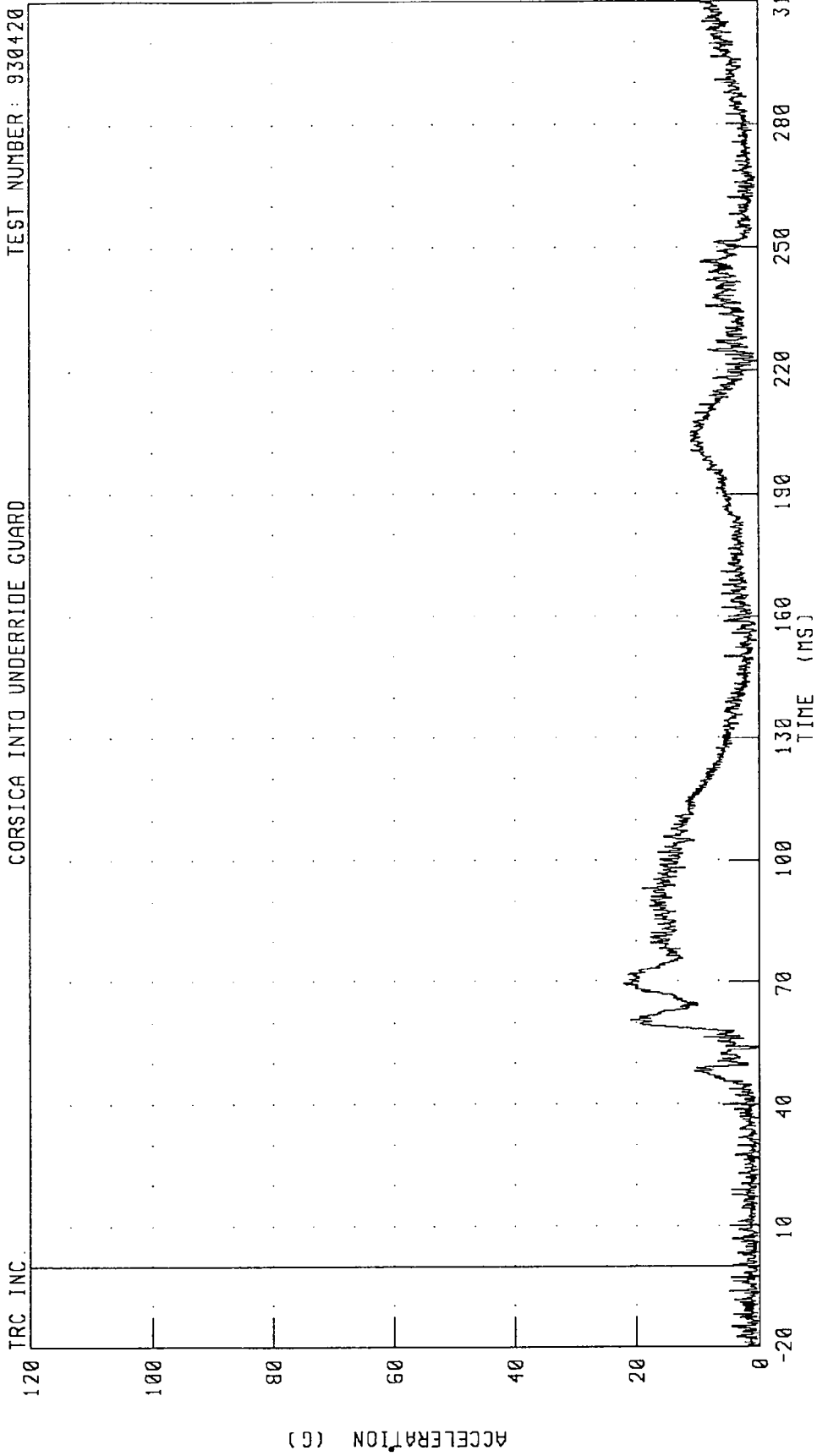


CHANNEL: HEDZG1 FILTER: CH. CLASS 1000

PEAK DATA: 9.15 G @ 246.63 MS; -8.17 G @ 60.63 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD RESULTANT ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



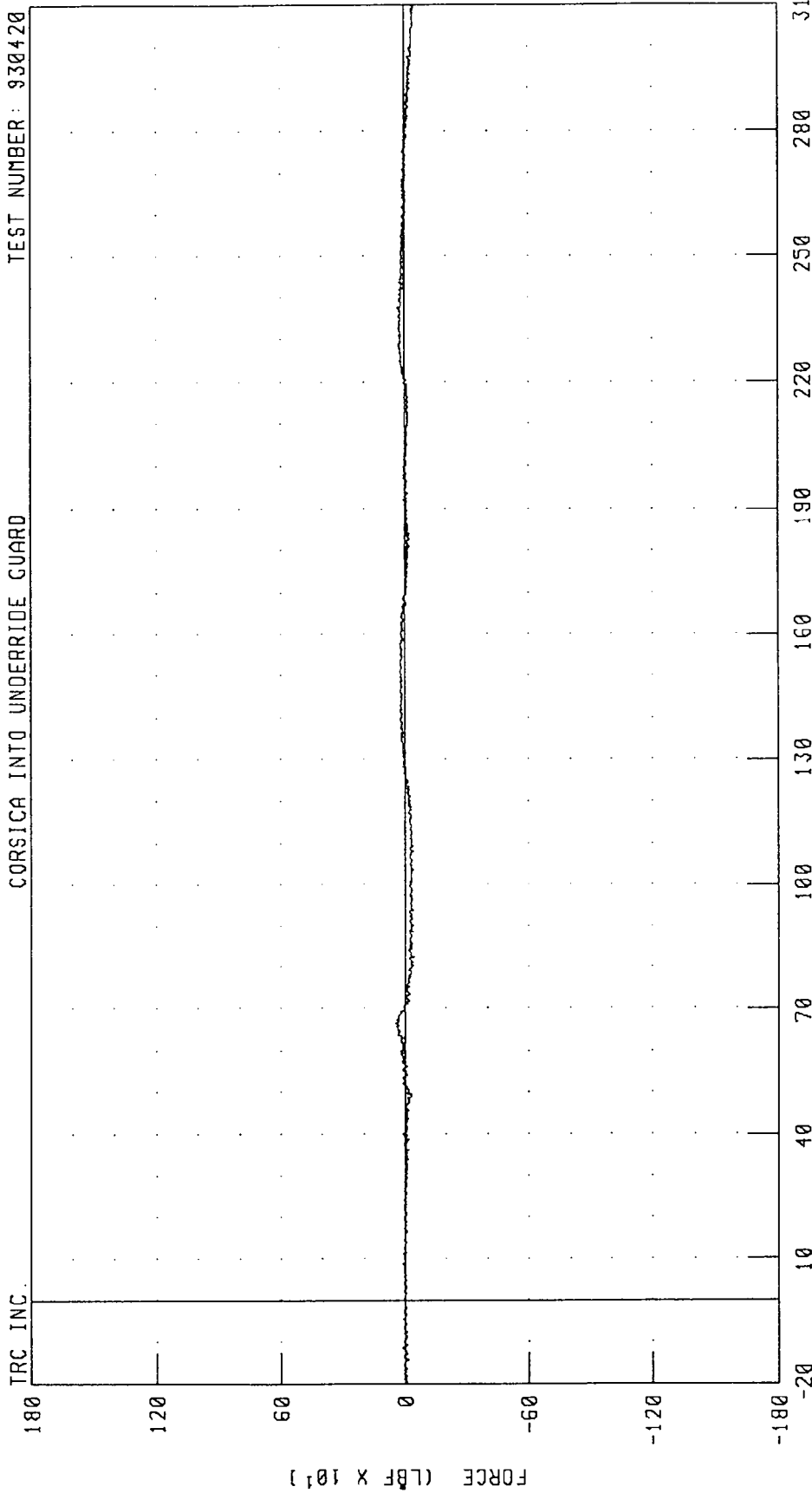
CHANNEL: HEDRG1 FILTER: CH. CLASS 1000

PEAK DATA: 22.11 G @ 69.63 MS; 0.11 G @ -19.88 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK X-AXIS SHEAR FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



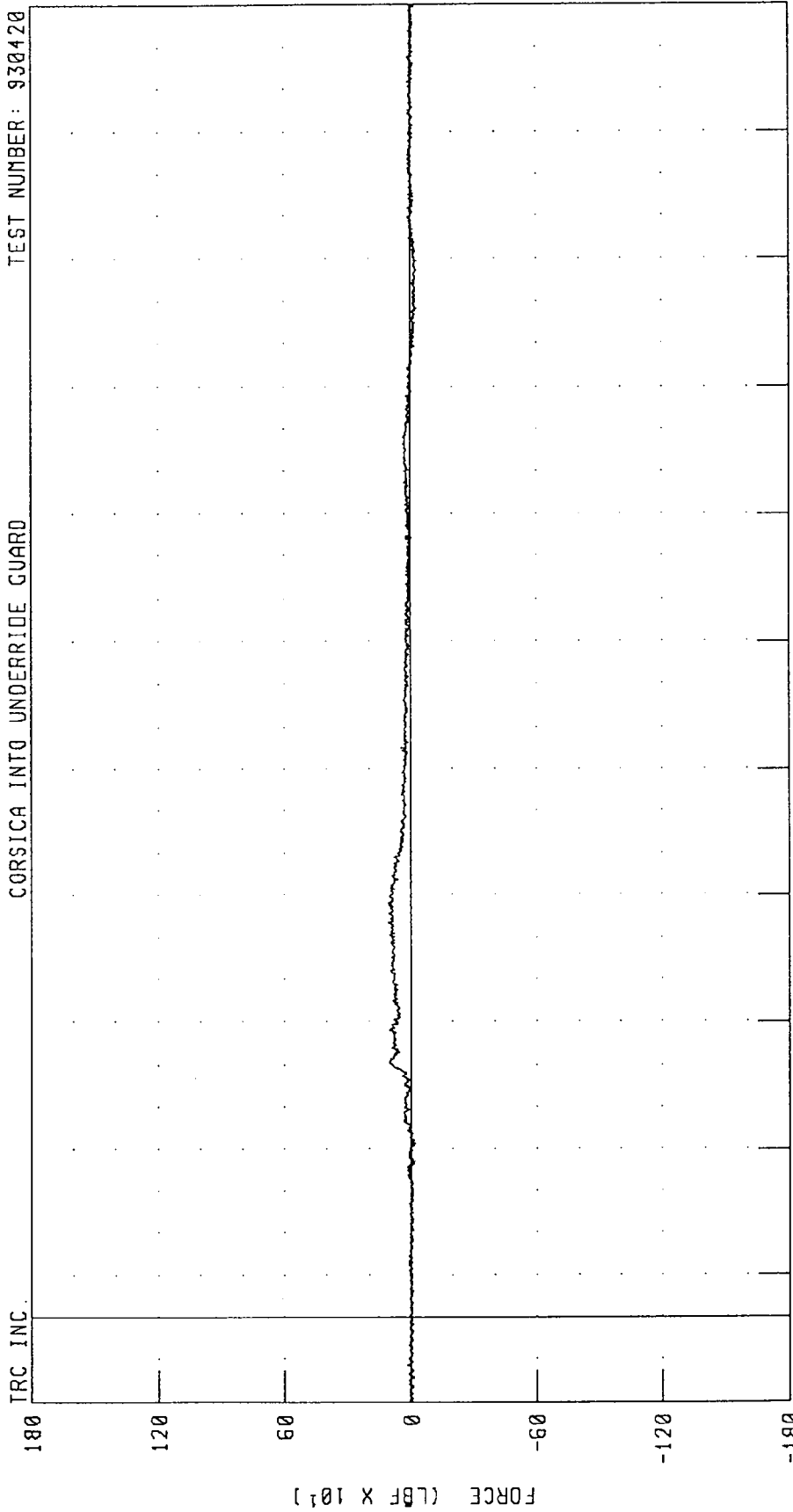
PEAK DATA: 43.72 LBF @ 66.50 MS, -47.78 LBF @ 309.50 MS

CHANNEL: NEKXF1 FILTER: CH. CLASS 1000

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK Y-AXIS SHEAR FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

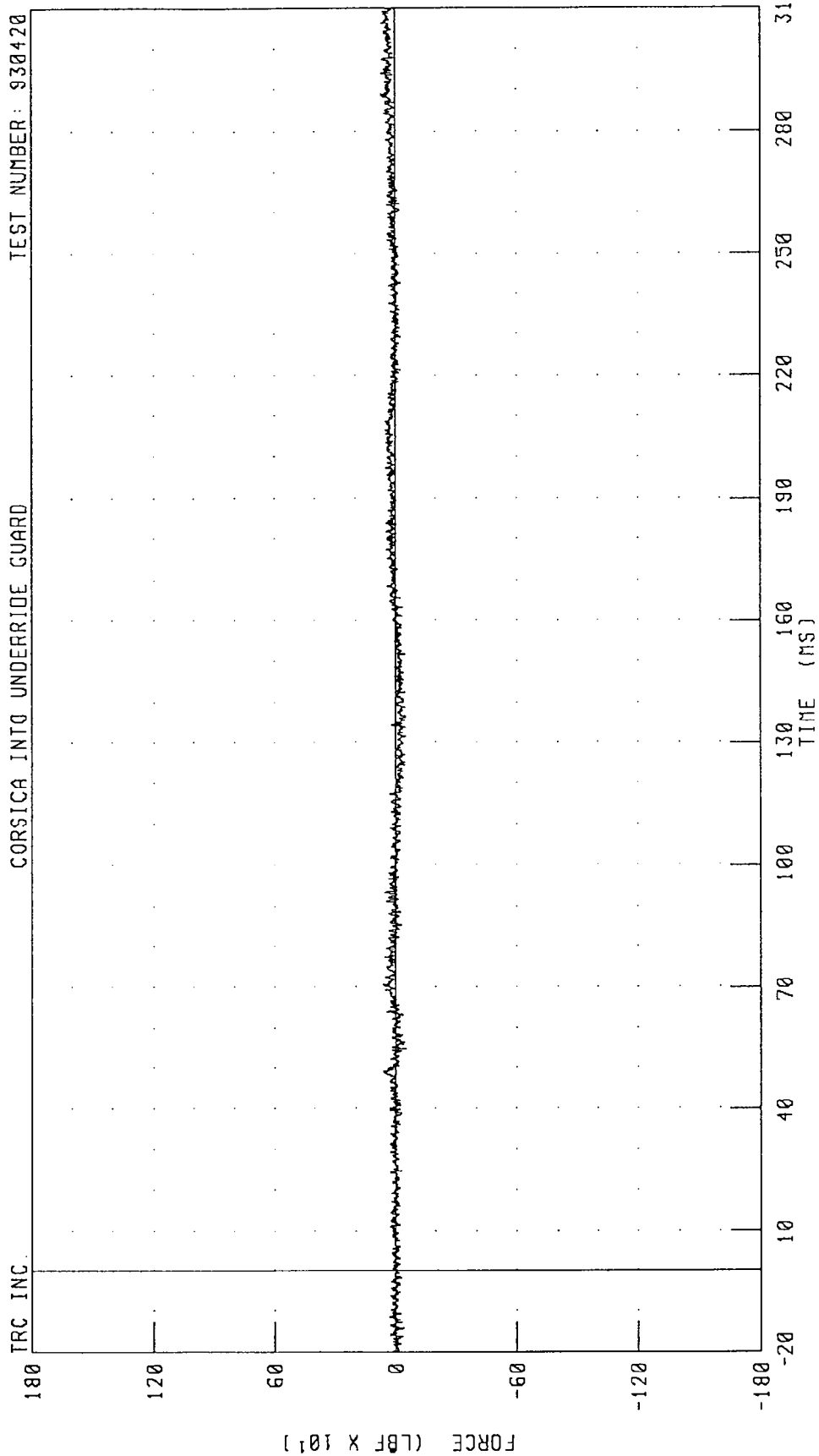


CHANNEL: NEKYF1 FILTER: CH. CLASS 1000

PEAK DATA: 108.15 LBF @ 93.50 MS; -31.72 LBF @ 238.25 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK Z-AXIS AXIAL FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



CHANNEL: NEKZF1 FILTER: CH. CLASS 1000 PEAK DATA: 72.49 LBF @ 288.75 MS, -52.73 LBF @ 131.63 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK MOMENT ABOUT X AXIS
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

180

120

TORQUE (LBF-IN X 10¹)

60

0

-60

-120

-180

-20

10

40

70

100

130

160

190

220

250

280

310

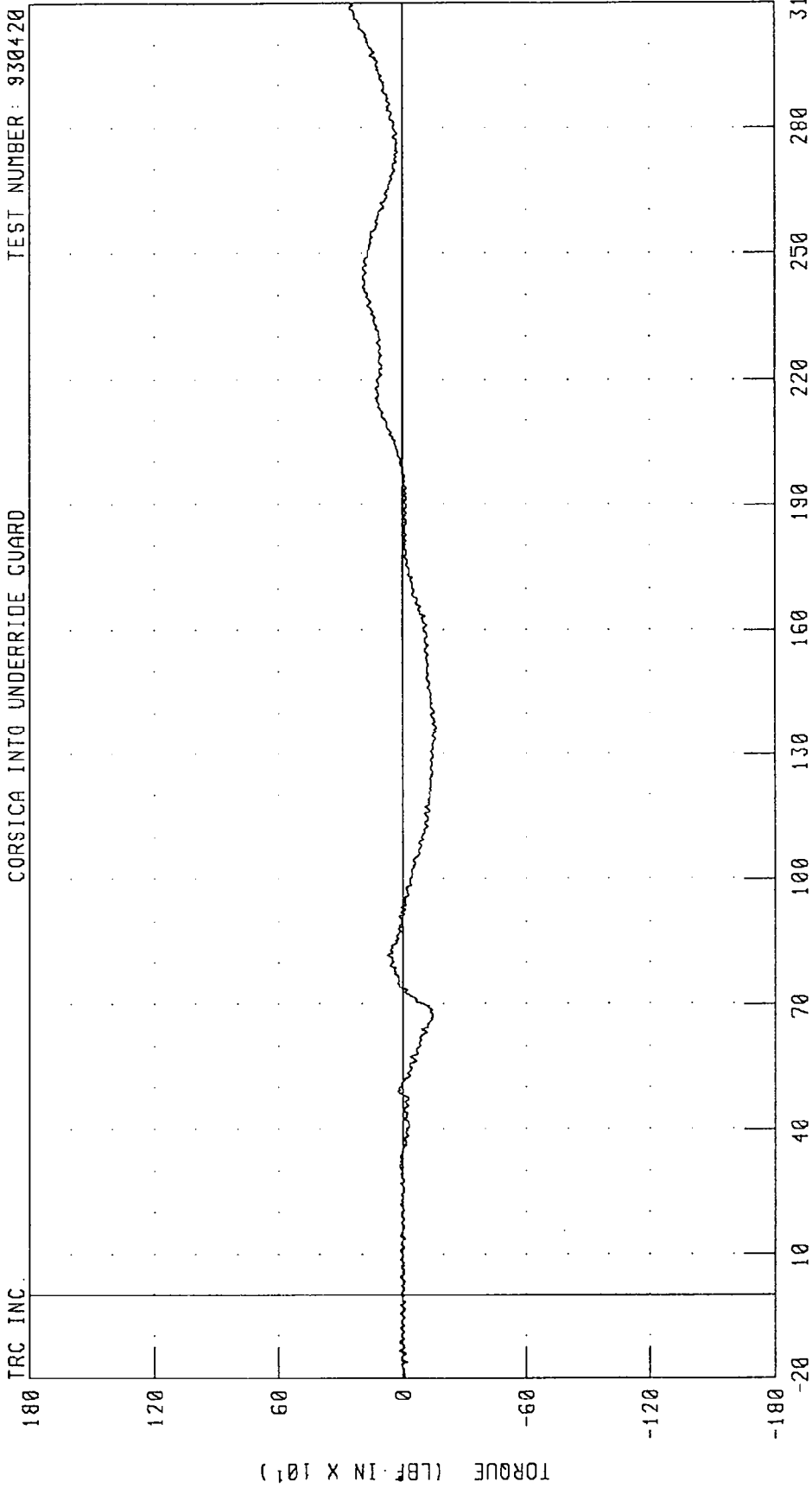
TIME (MS)

CHANNEL: NEKXMI FILTER: CH. CLASS 600

PEAK DATA: 72.78 LBF-IN @ 72.75 MS; -55.49 LBF-IN @ 283.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK MOMENT ABOUT Y AXIS
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

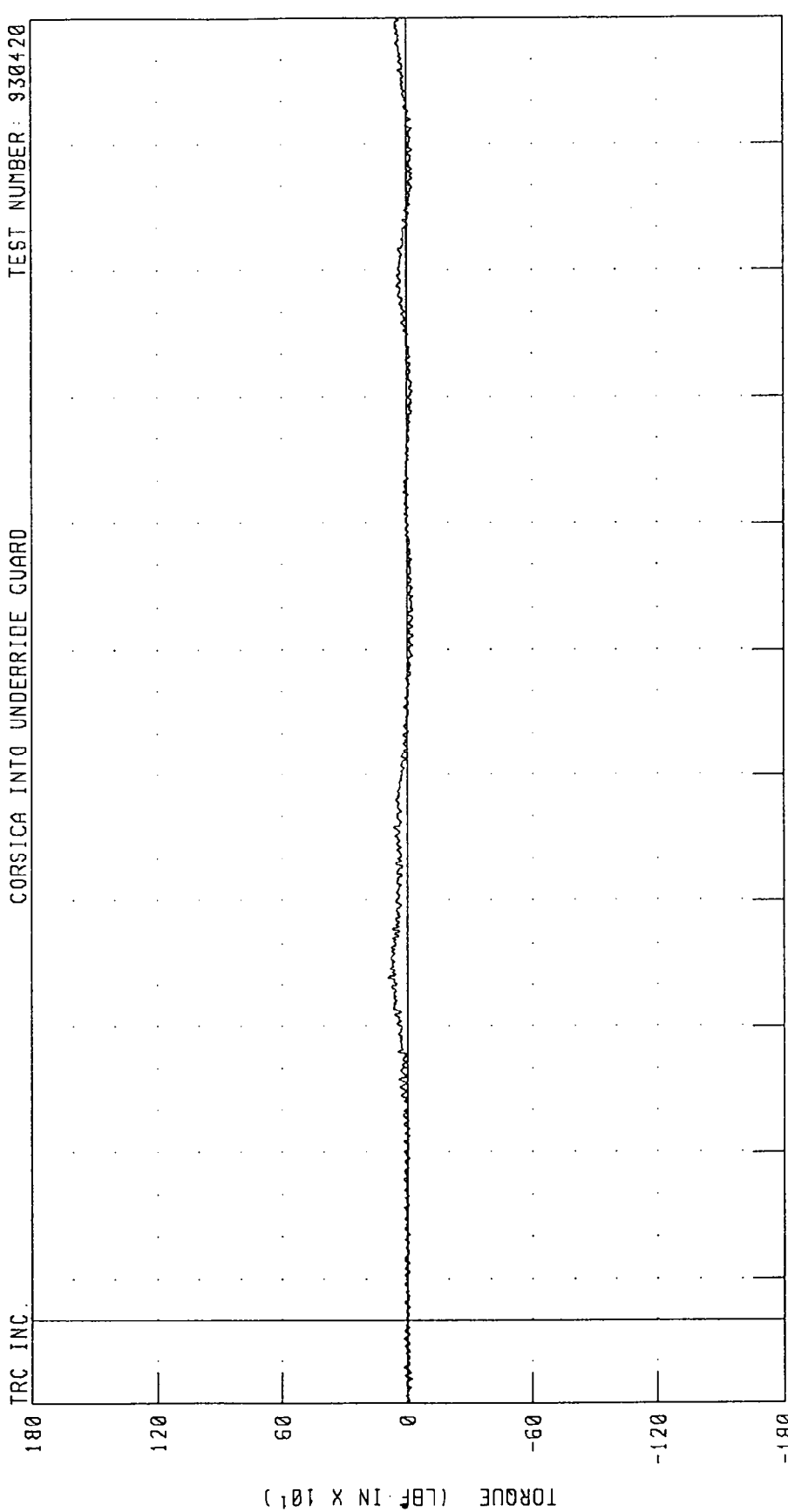


CHANNEL: NEKYM1 FILTER: CH. CLASS 600 PEAK DATA: 253.41 LBF-IN @ 308.75 MS; -162.27 LBF-IN @ 136.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK MOMENT ABOUT Z AXIS
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

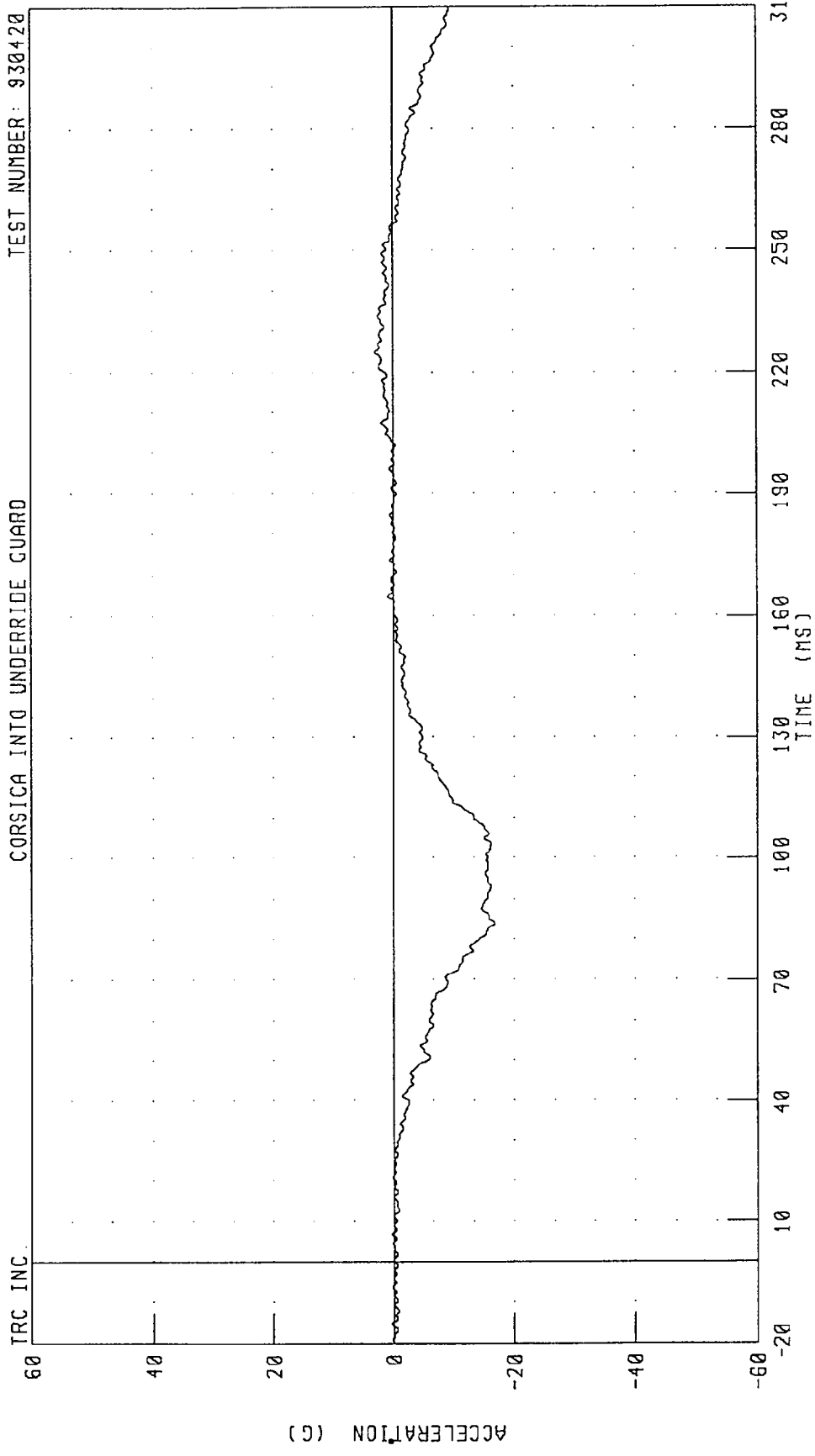
TRC INC.



CHANNEL: NEKZM1 FILTER: CH. CLASS 600
PEAK DATA: 92.44 LBF-IN @ 81.88 MS; -30.96 LBF-IN @ 163.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

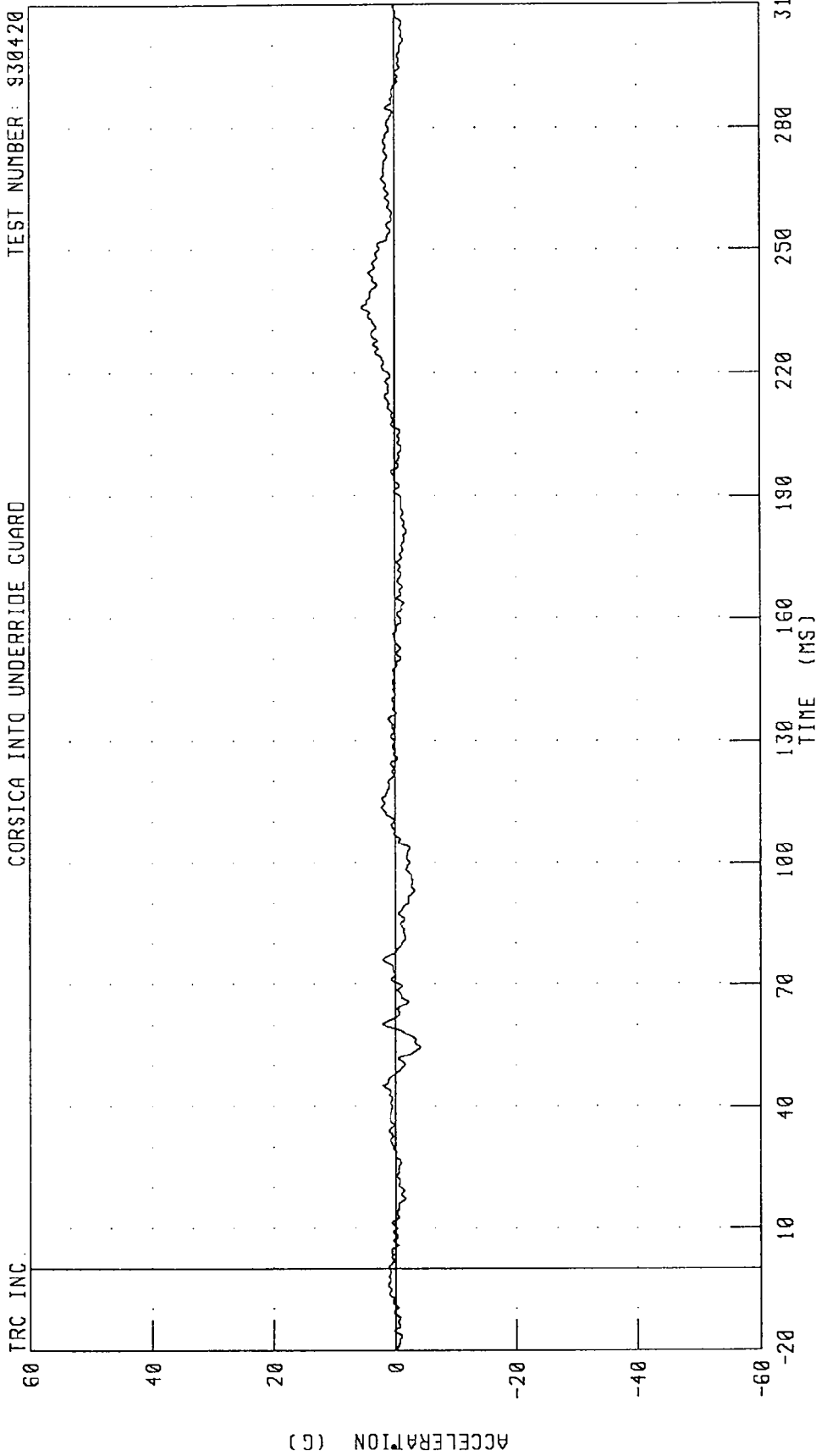


CHANNEL: CSTXG1 FILTER: CH. CLASS 180 PEAK DATA: 3.06 G @ 224.88 MS, -16.78 G @ 84.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

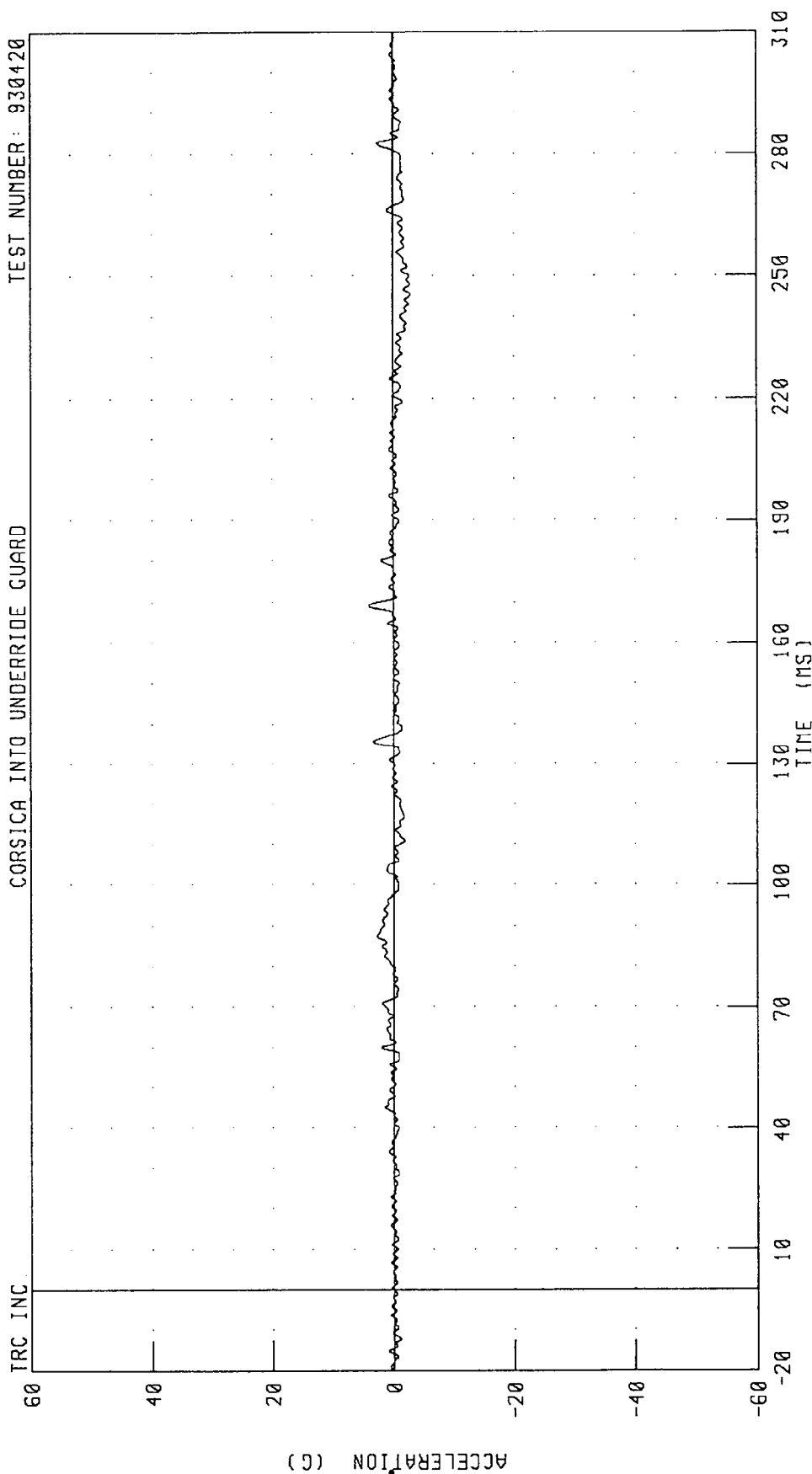


CHANNEL: CSTYG1 FILTER: CH. CLASS 180

PEAK DATA: 5.46 G @ 235.63 MS; -4.02 G @ 54.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST Z-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



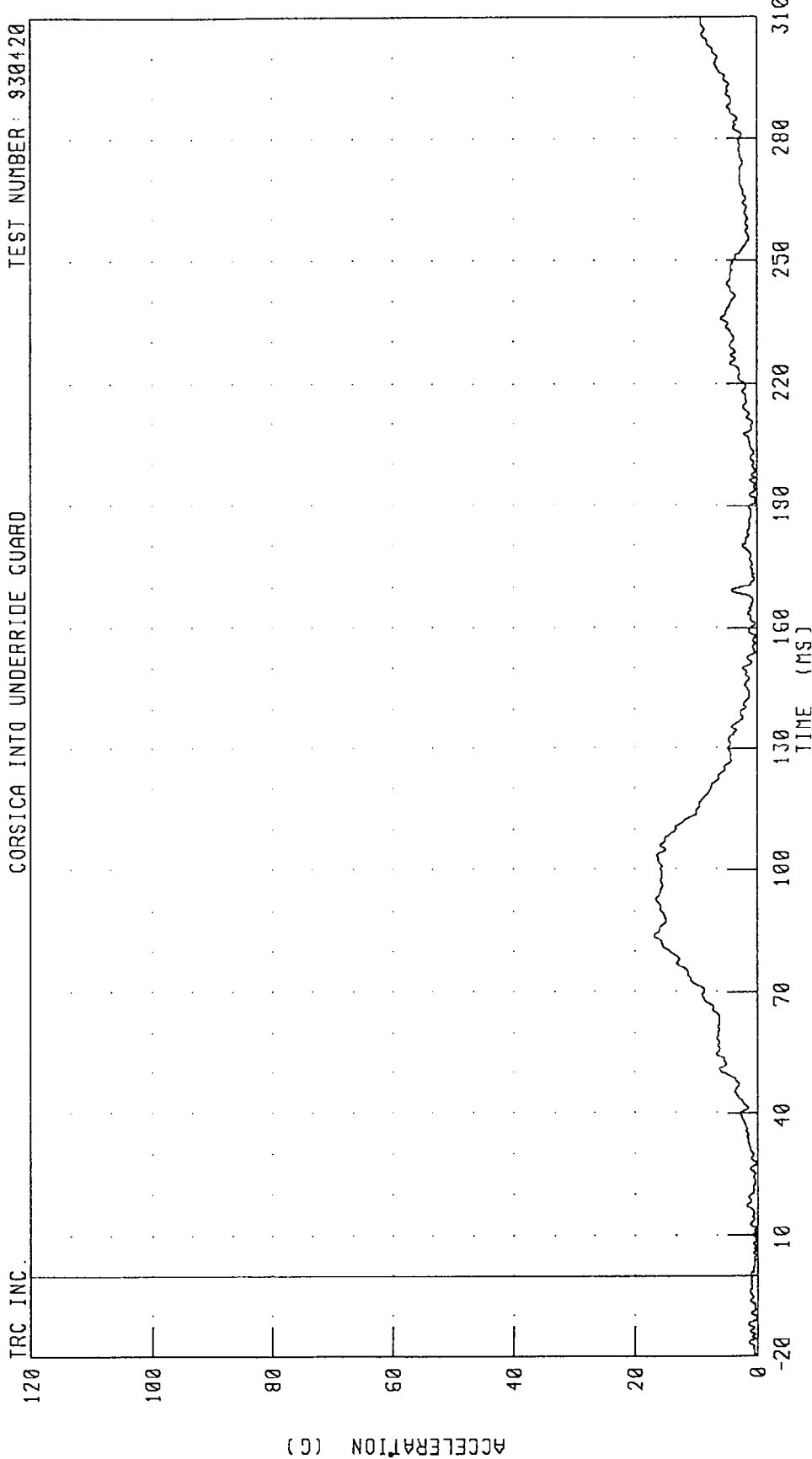
CHANNEL: CSTZG1 FILTER: CH. CLASS 180

PEAK DATA: 4.14 G @ 169.13 MS; -2.87 G @ 245.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST RESULTANT ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

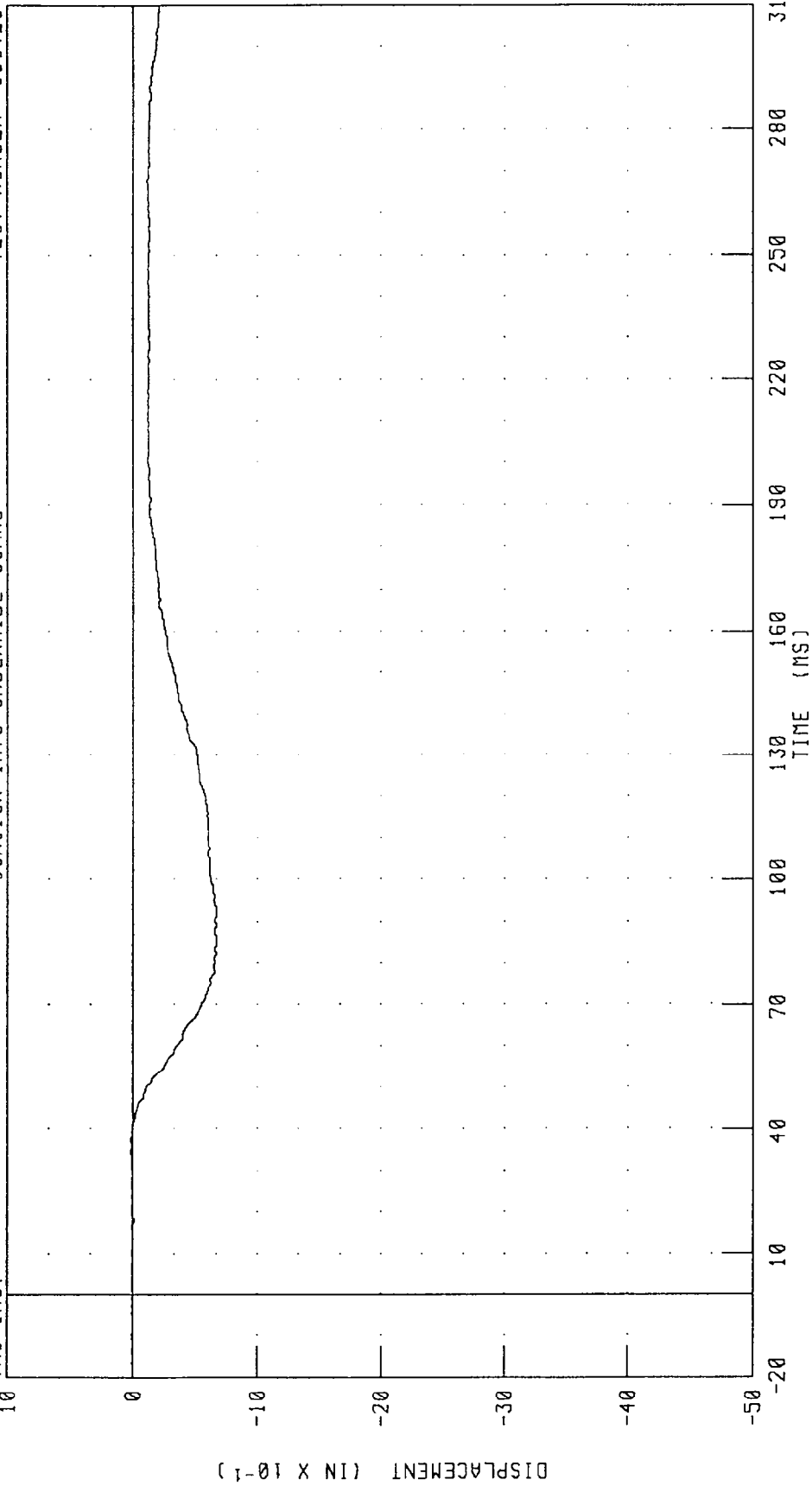


CHANNEL: CSTRG1 FILTER: CH CLASS 180 PEAK DATA: 16.87 G @ 84.00 MS, 0.02 G @ 7.25 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST DEFLECTION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



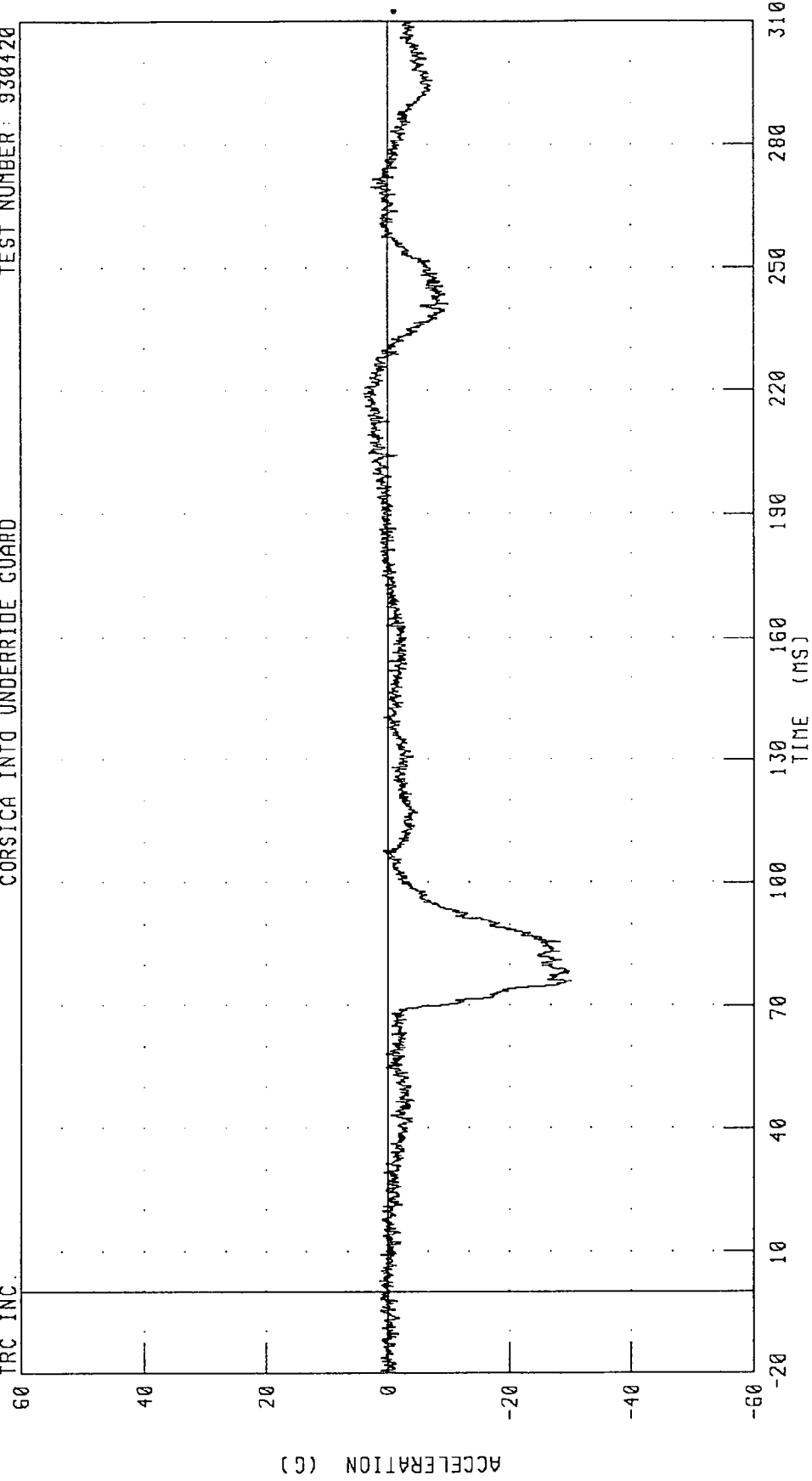
CHANNEL: CSTXD1 FILTER: CH. CLASS 180

PEAK DATA: 0.01 IN @ 37.38 MS; -0.67 IN @ 85.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



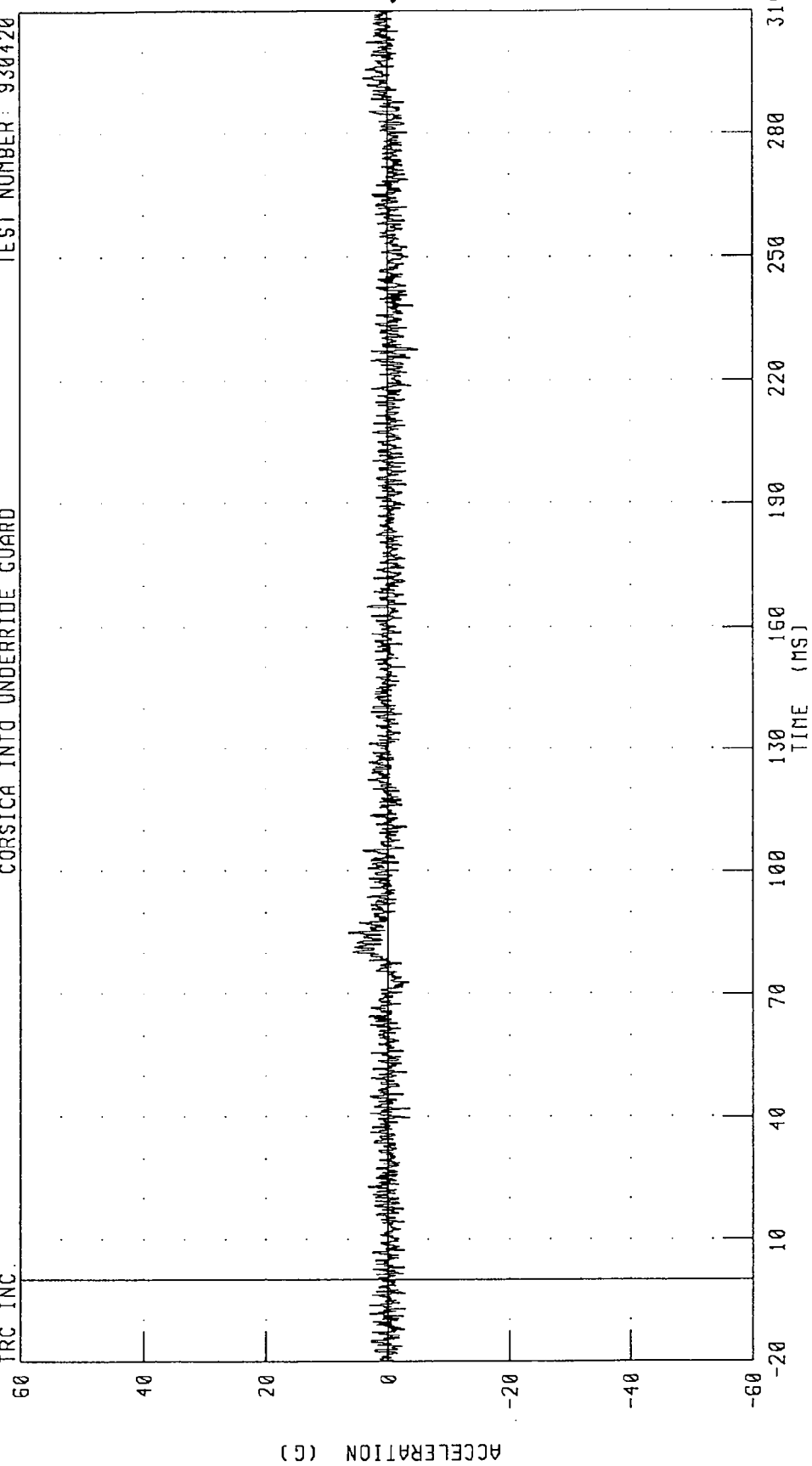
CHANNEL: PEVXG1 FILTER: CH. CLASS 1000

PEAK DATA: 3.86 G @ 219.13 MS; -30.07 G @ 76.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

IRC INC.

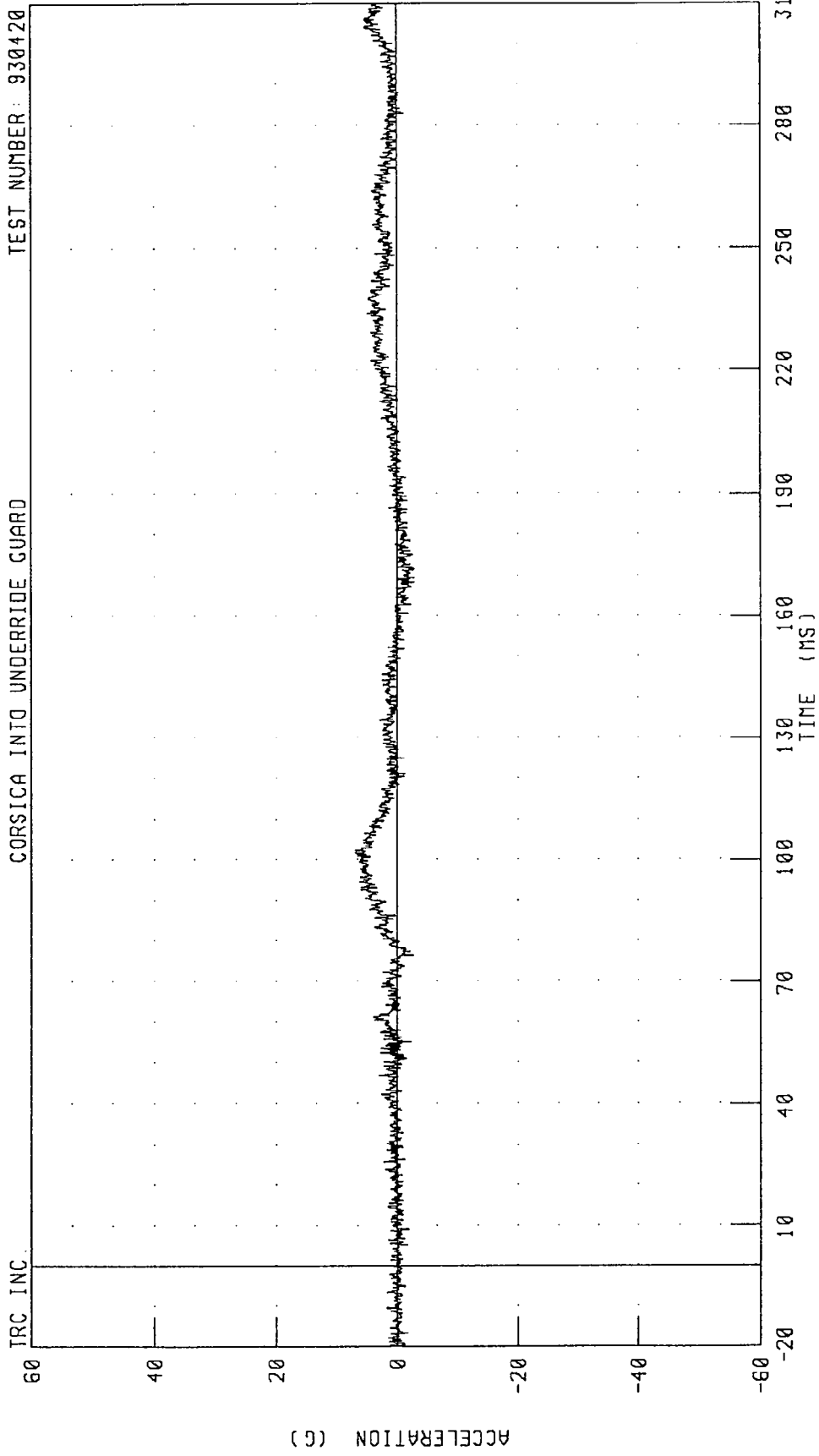


CHANNEL: PEVYGI FILTER: CH. CLASS 1000

PEAK DATA: 6.39 G @ 85.00 MS; -4.84 G @ 227.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS Z-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



CHANNEL: PEVZG1 FILTER: CH CLASS 1000

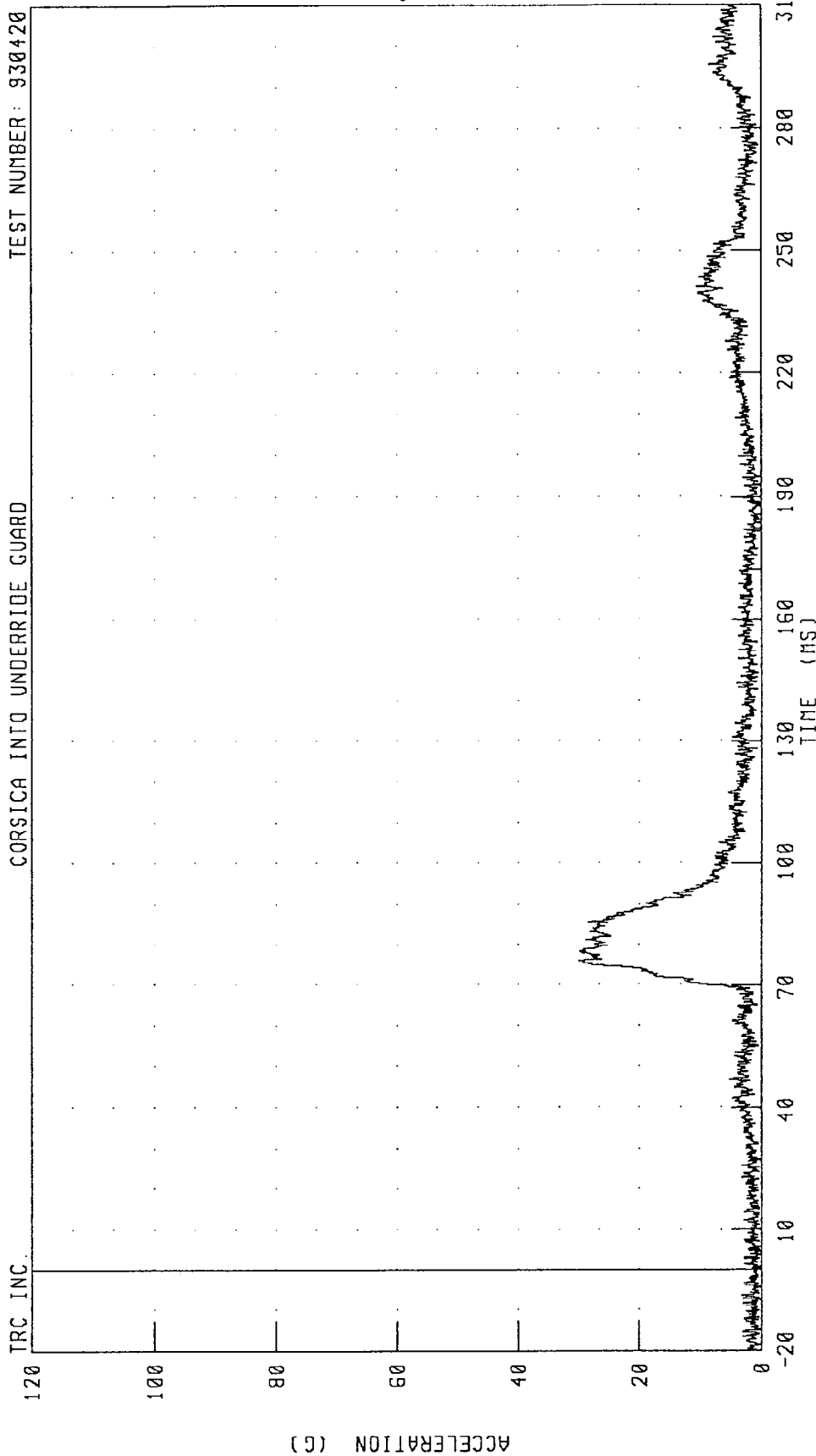
PEAK DATA: 6.88 G @ 101.75 MS; -2.89 G @ 168.50 MS

TRC INC.

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS RESULTANT ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



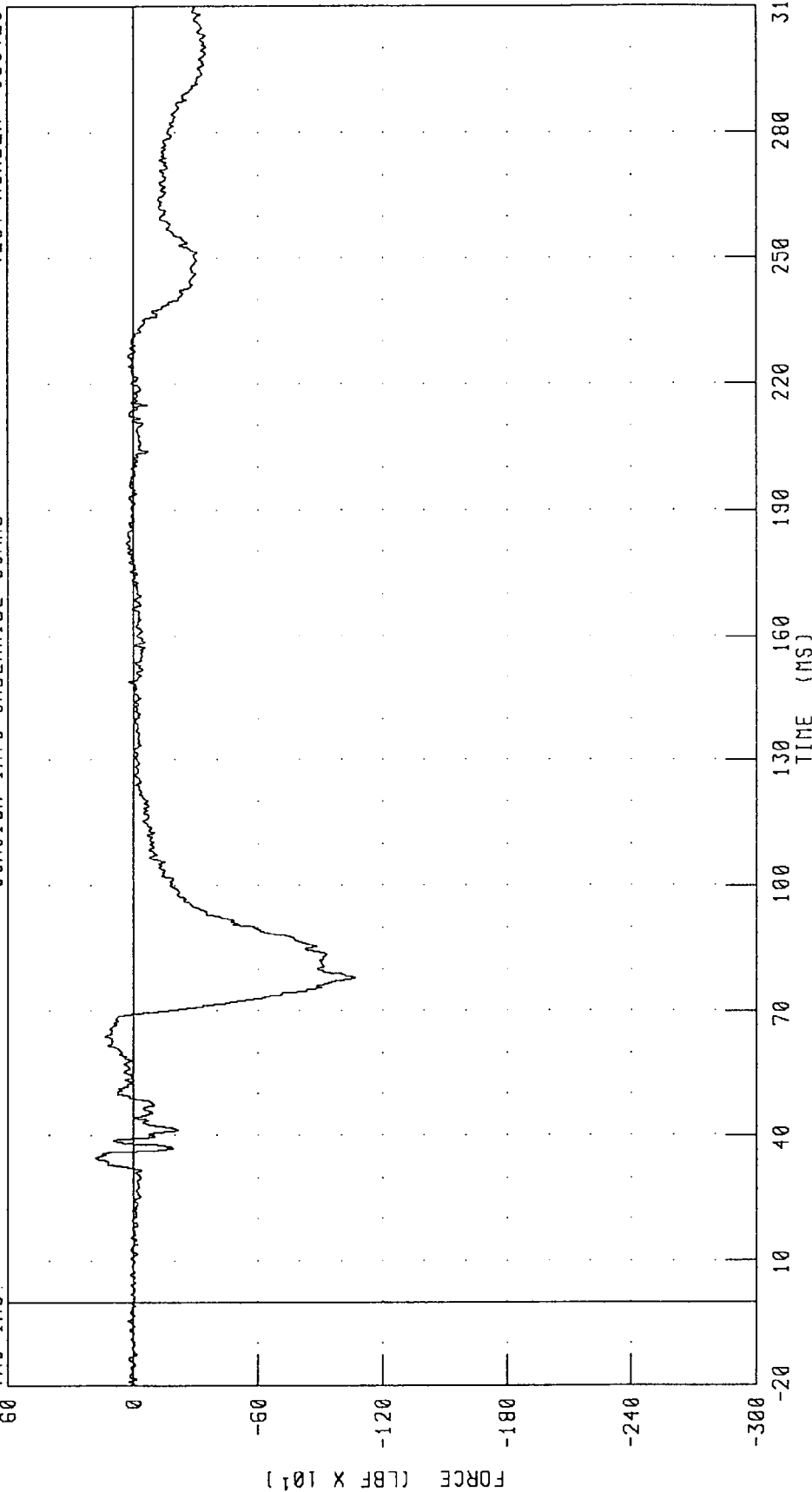
CHANNEL: PEVRG1 FILTER: CH. CLASS 1000

PEAK DATA: 30.10 G @ 76.00 MS; 0.23 G @ -7.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER LEFT FEMUR FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



CHANNEL: LFMF1 FILTER: CH. CLASS 600
PEAK DATA: 180.03 LBF @ 34.75 MS, -1069.61 LBF @ 78.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER RIGHT FEMUR FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: S38420

TRC INC.

60

0

-60

-120

-180

-240

-300

FORCE (LBF X 10¹)

10

40

70

100

130

150

180

220

250

280

310

TIME (MS)

PEAK DATA: 156.71 LBF @ 34.75 MS; -917.48 LBF @ 84.88 MS

CHANNEL: RFMF1

FILTER: CH. CLASS 600

TRC INC.

60

0

-60

-120

-180

-240

-300

FORCE (LBF X 10¹)

10

40

70

100

130

150

180

220

250

280

310

TIME (MS)

PEAK DATA: 156.71 LBF @ 34.75 MS; -917.48 LBF @ 84.88 MS

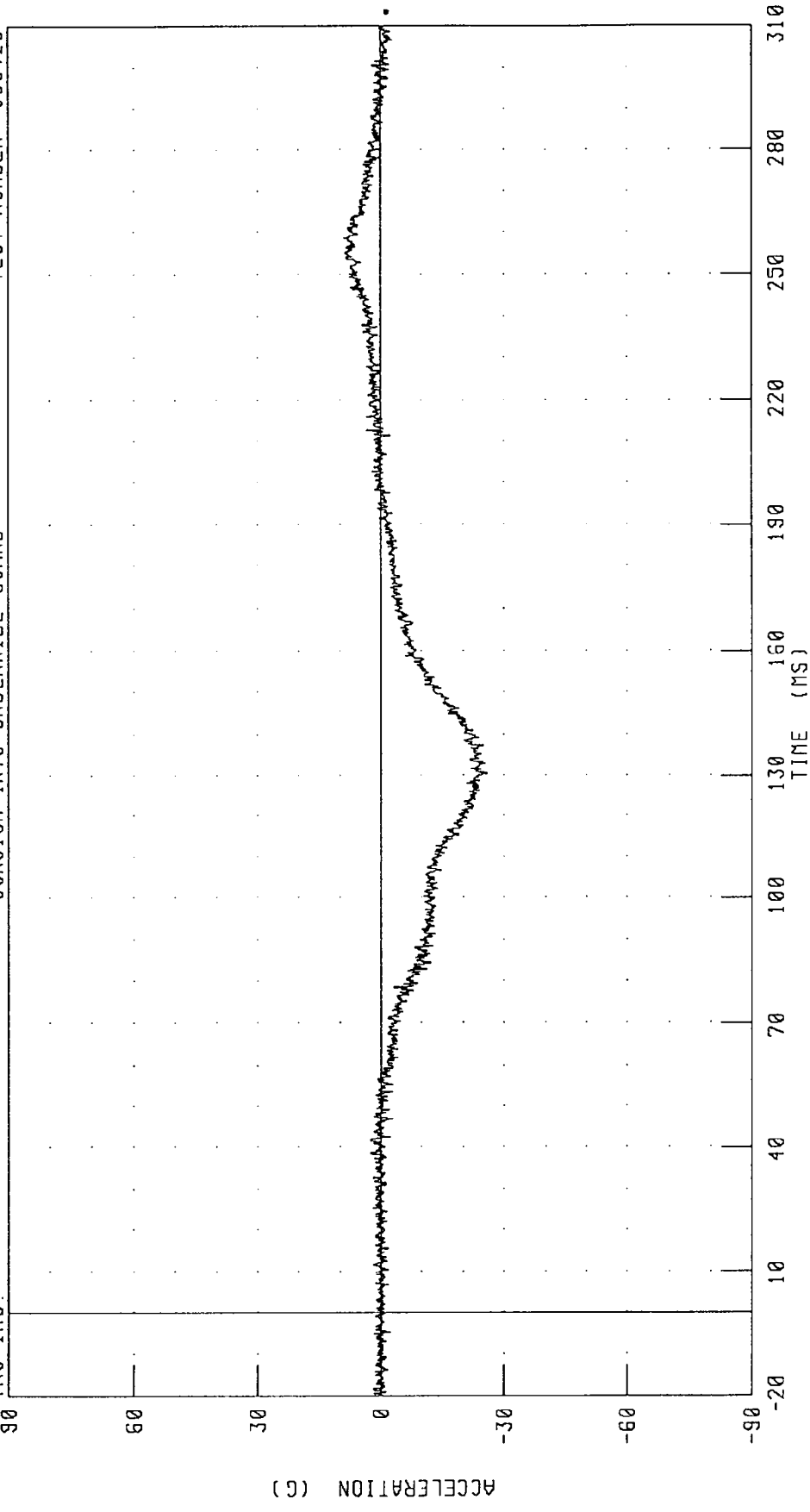
CHANNEL: RFMF1

FILTER: CH. CLASS 600

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



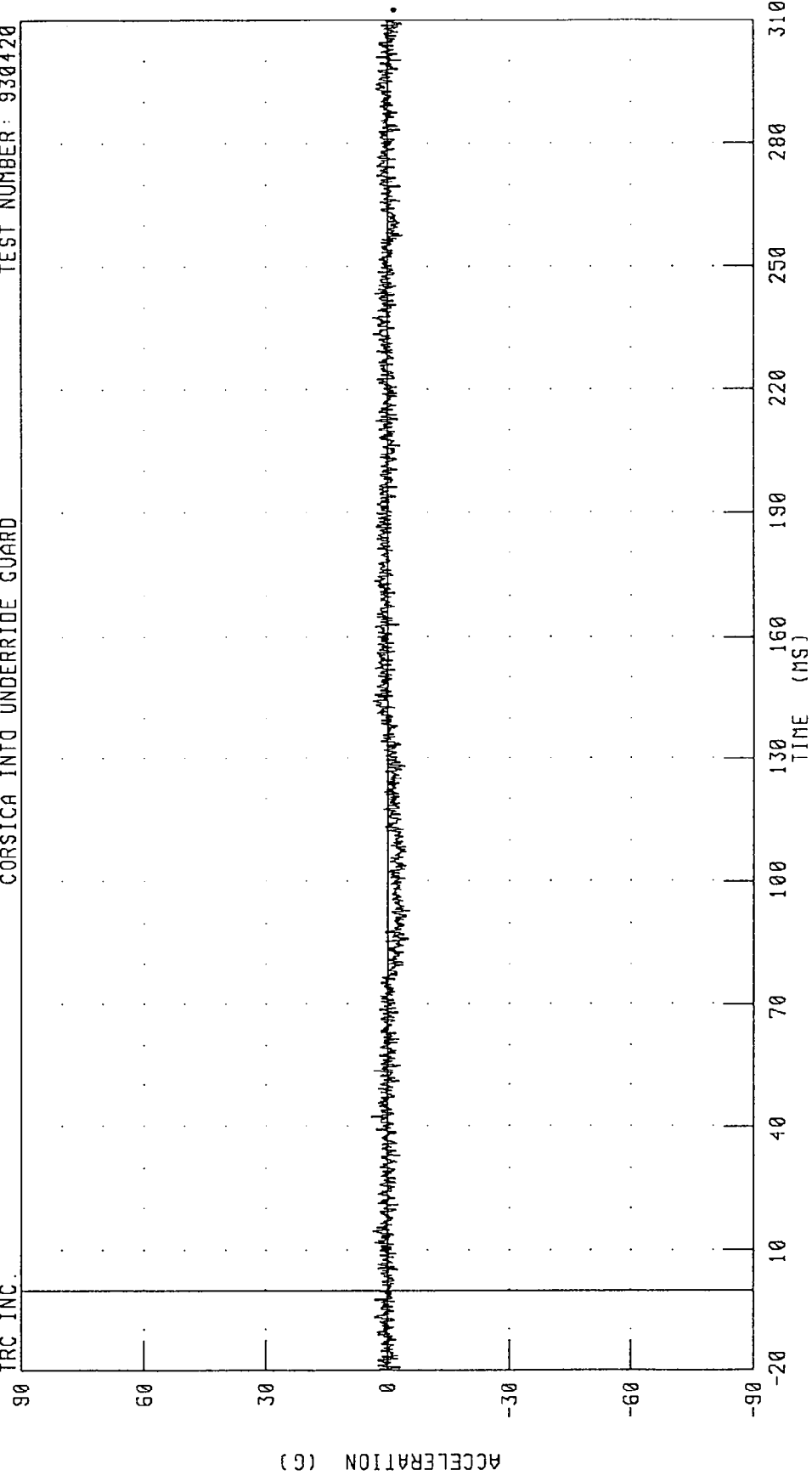
CHANNEL: HEDXG2 FILTER: CH. CLASS 1000

PEAK DATA: 8.94 G @ 258.63 MS, -25.92 G @ 130.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



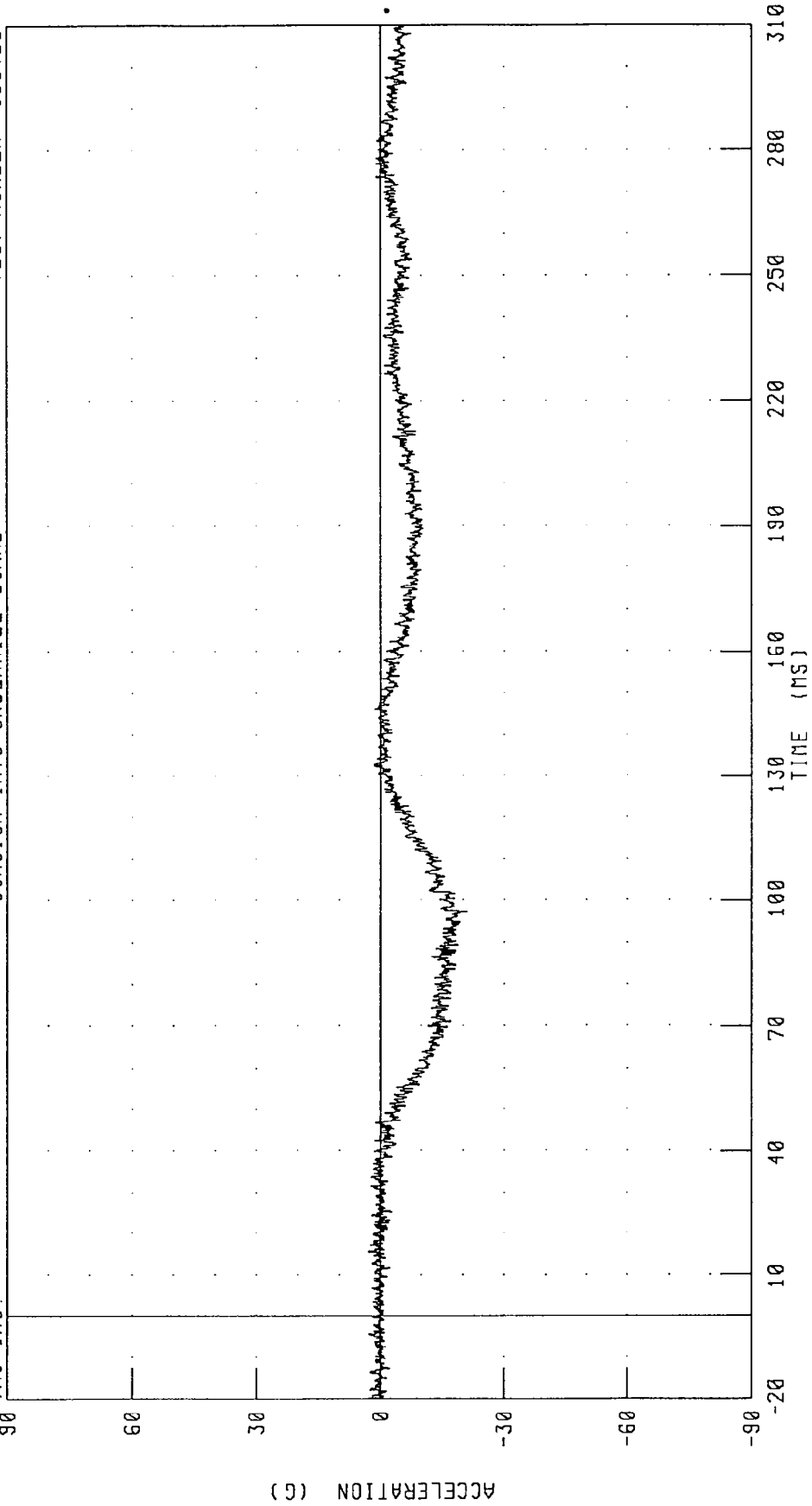
CHANNEL: HEDYG2 FILTER: CH. CLASS 1000

PEAK DATA: 3.88 G @ 42.38 MS; -5.25 G @ 93.13 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 938420

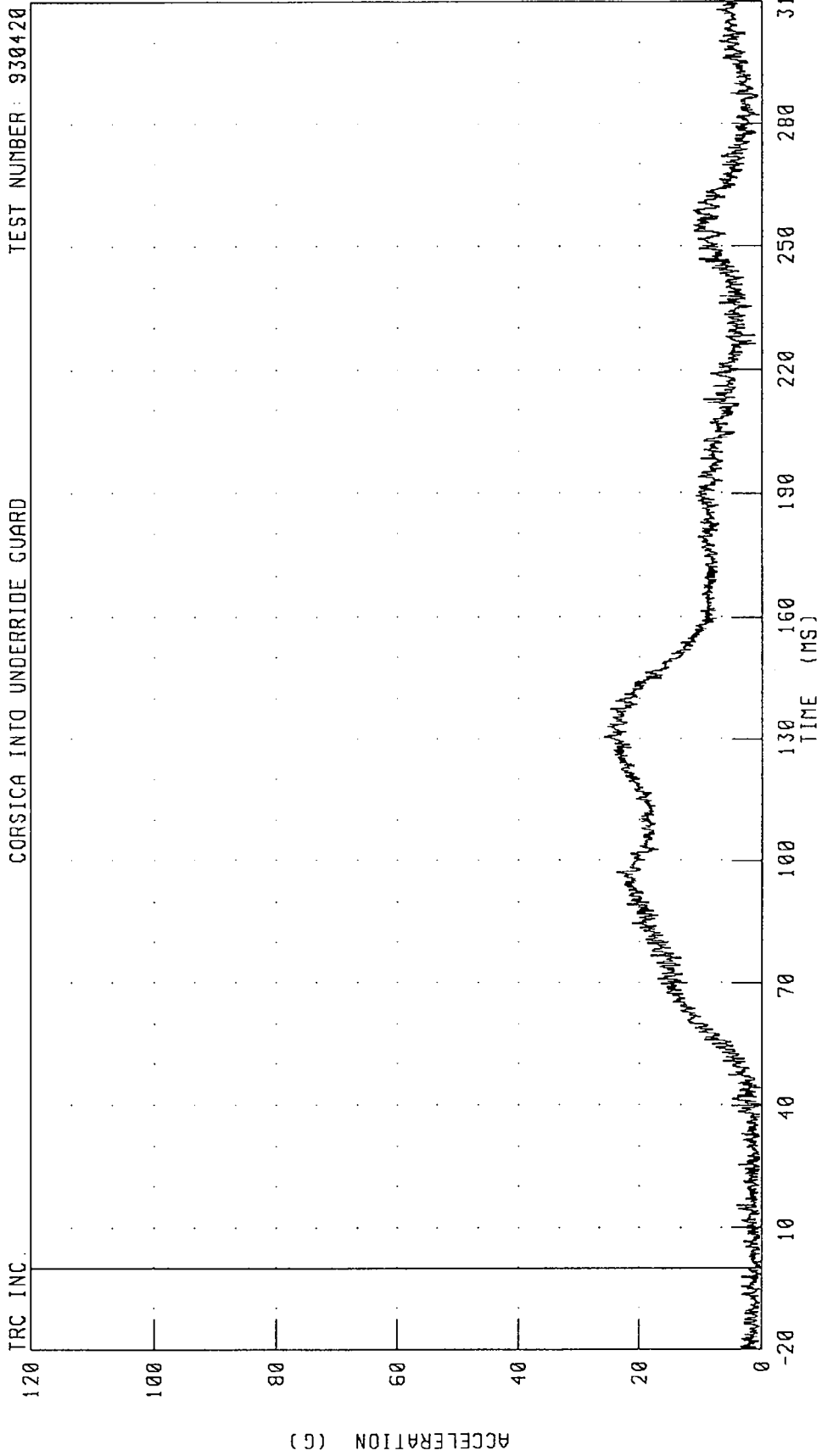
IRC INC.



CHANNEL: HEDZG2 FILTER: CH. CLASS 1000 PEAK DATA: 2.82 G @ -4.50 MS; -20.97 G @ 97.13 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



CHANNEL: HEDRG2 FILTER: CH. CLASS 1000

PEAK DATA: 25.93 G @ 130.38 MS; 0.21 G @ 1.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK X-AXIS SHEAR FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

IRC INC.

180

120

60

0

-60

-120

-180

FORCE (LBF X 10¹)

10 40 70 100 130 160 190 220 250 280 310
TIME (MS)

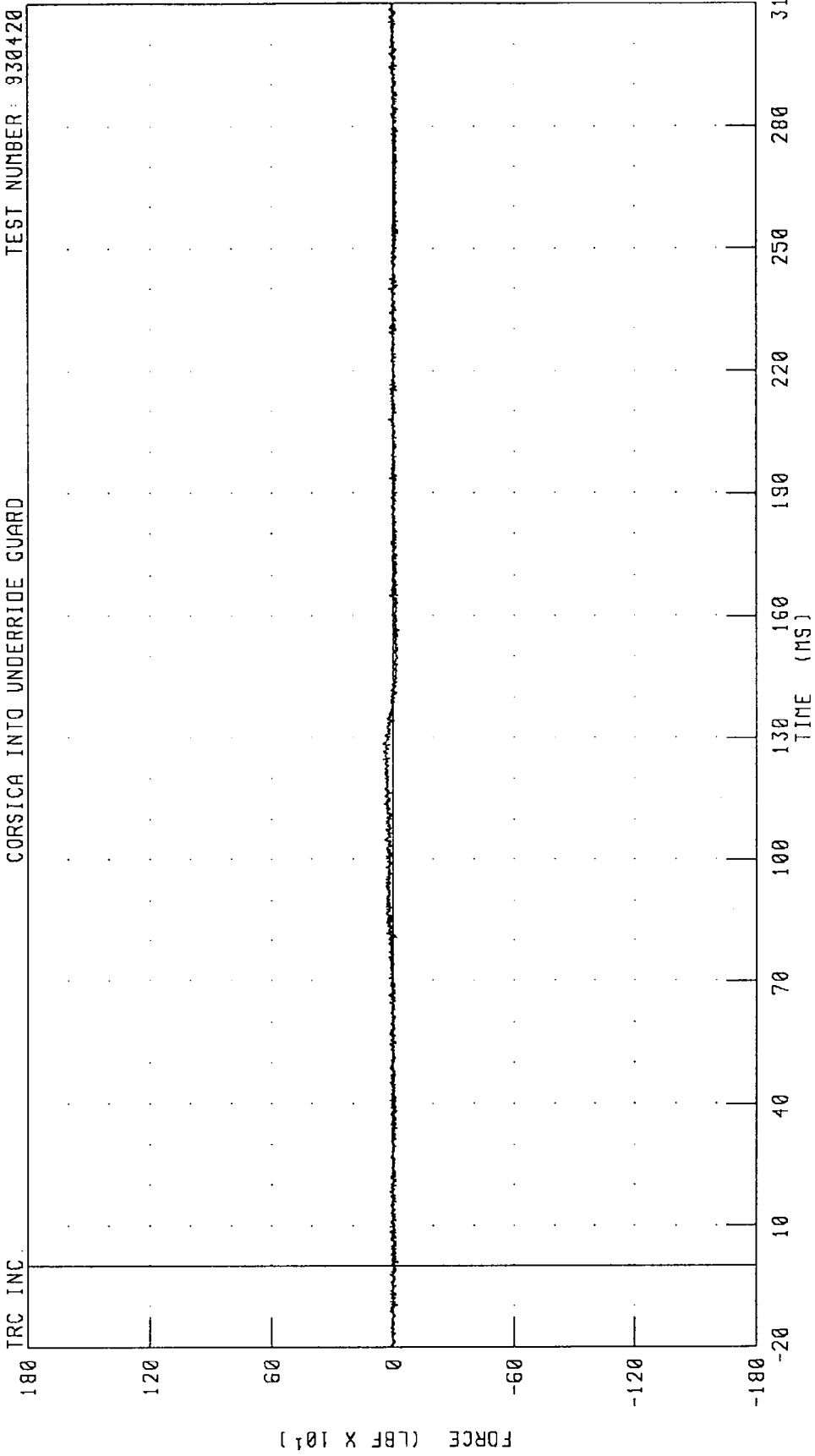
CHANNEL: NEKXF2 FILTER: CH. CLASS 1000

PEAK DATA: 195.07 LBF @ 132.25 MS, -38.91 LBF @ 238.88 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK Y-AXIS SHEAR FORCE

TRC INC. TEST NUMBER: 930420

CORSICA INTO UNDERRIDE GUARD



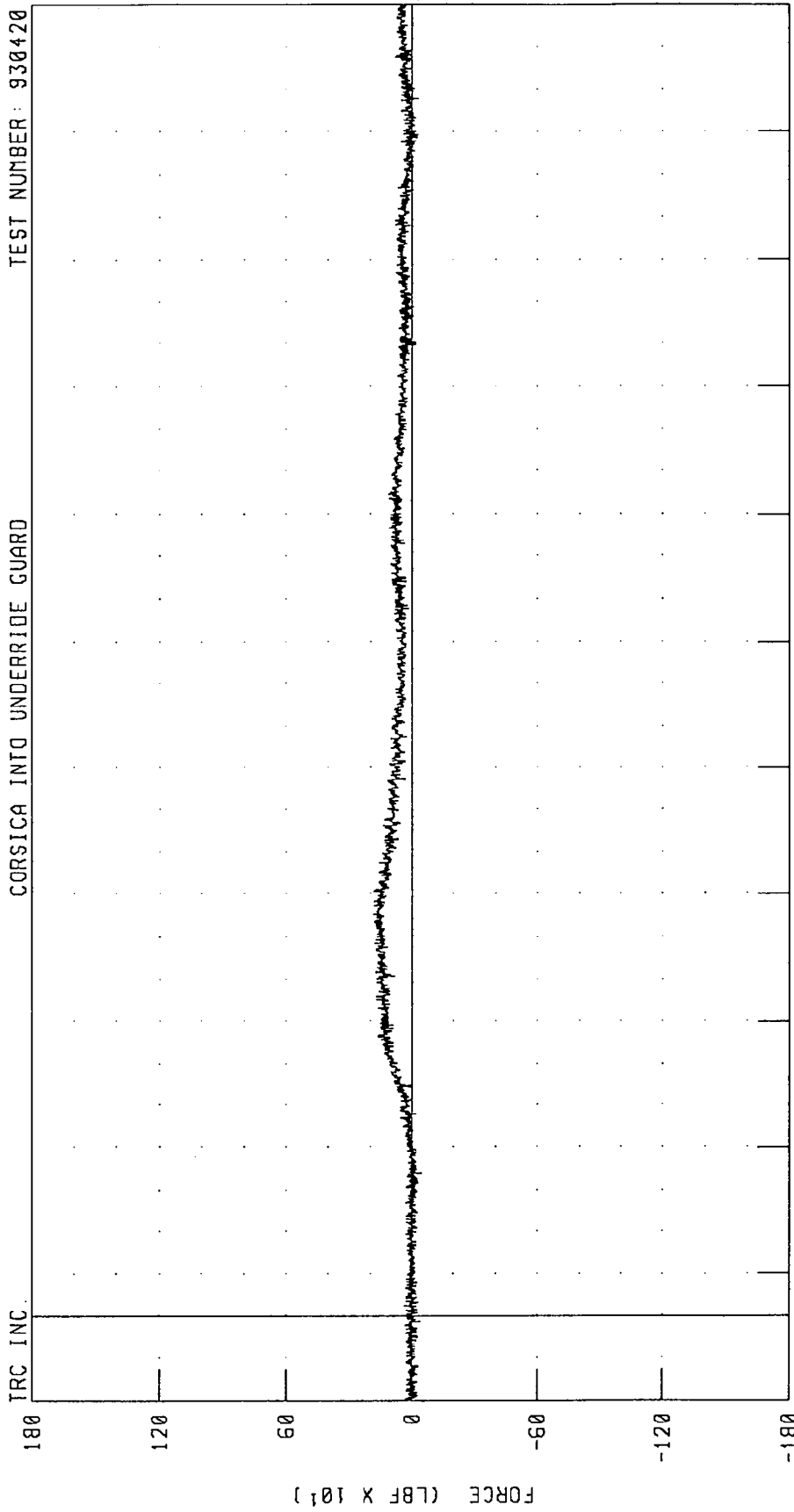
CHANNEL: NEKYF2 FILTER: CH. CLASS 1000

PEAK DATA: 52.49 LBF @ 128.50 MS; -29.70 LBF @ 156.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK Z-AXIS AXIAL FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

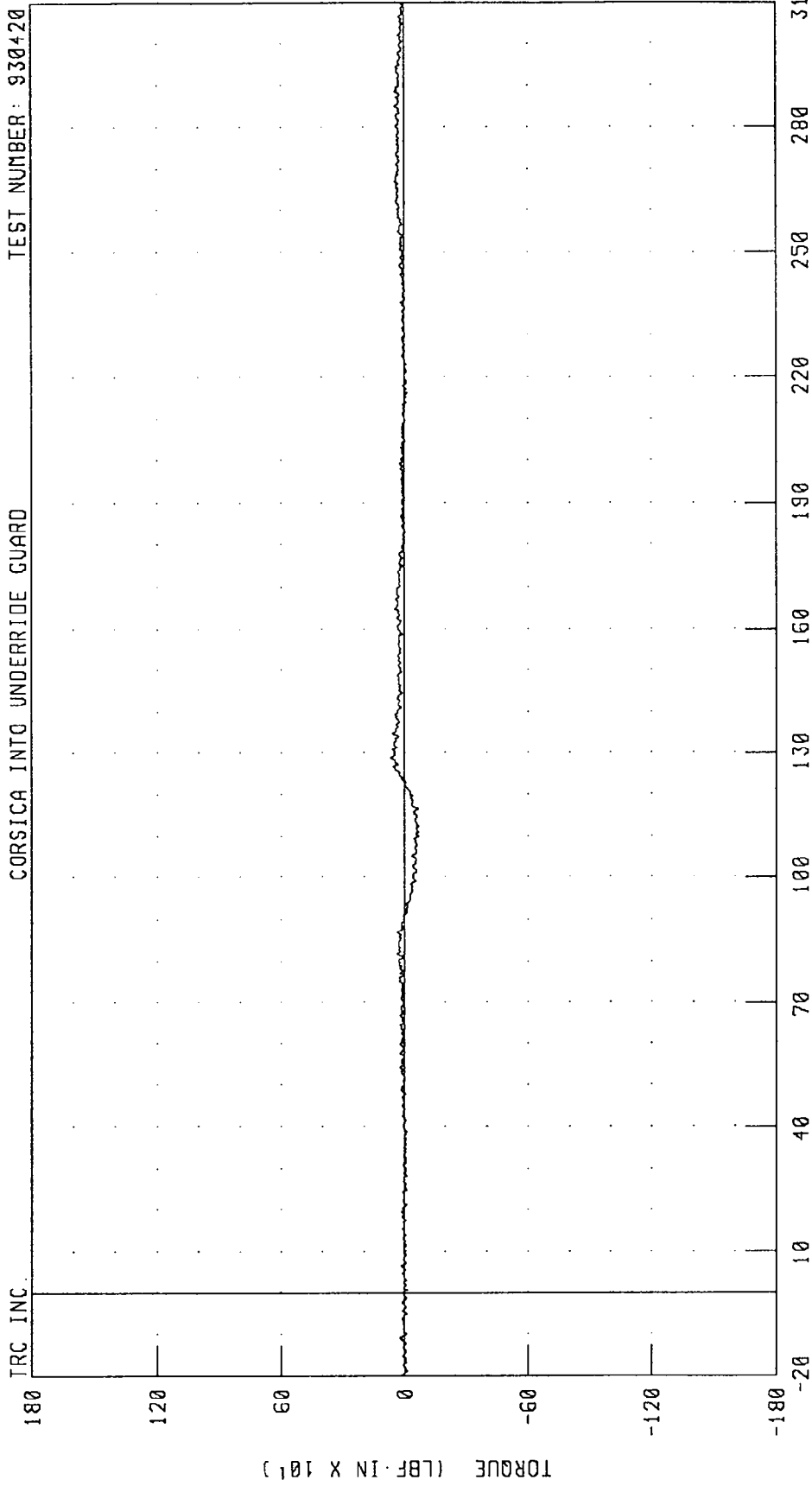


CHANNEL: NEKZF2 FILTER: CH. CLASS 1000

PEAK DATA: 185.28 LBF @ 95.25 MS, -42.88 LBF @ 34.13 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK MOMENT ABOUT X AXIS
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

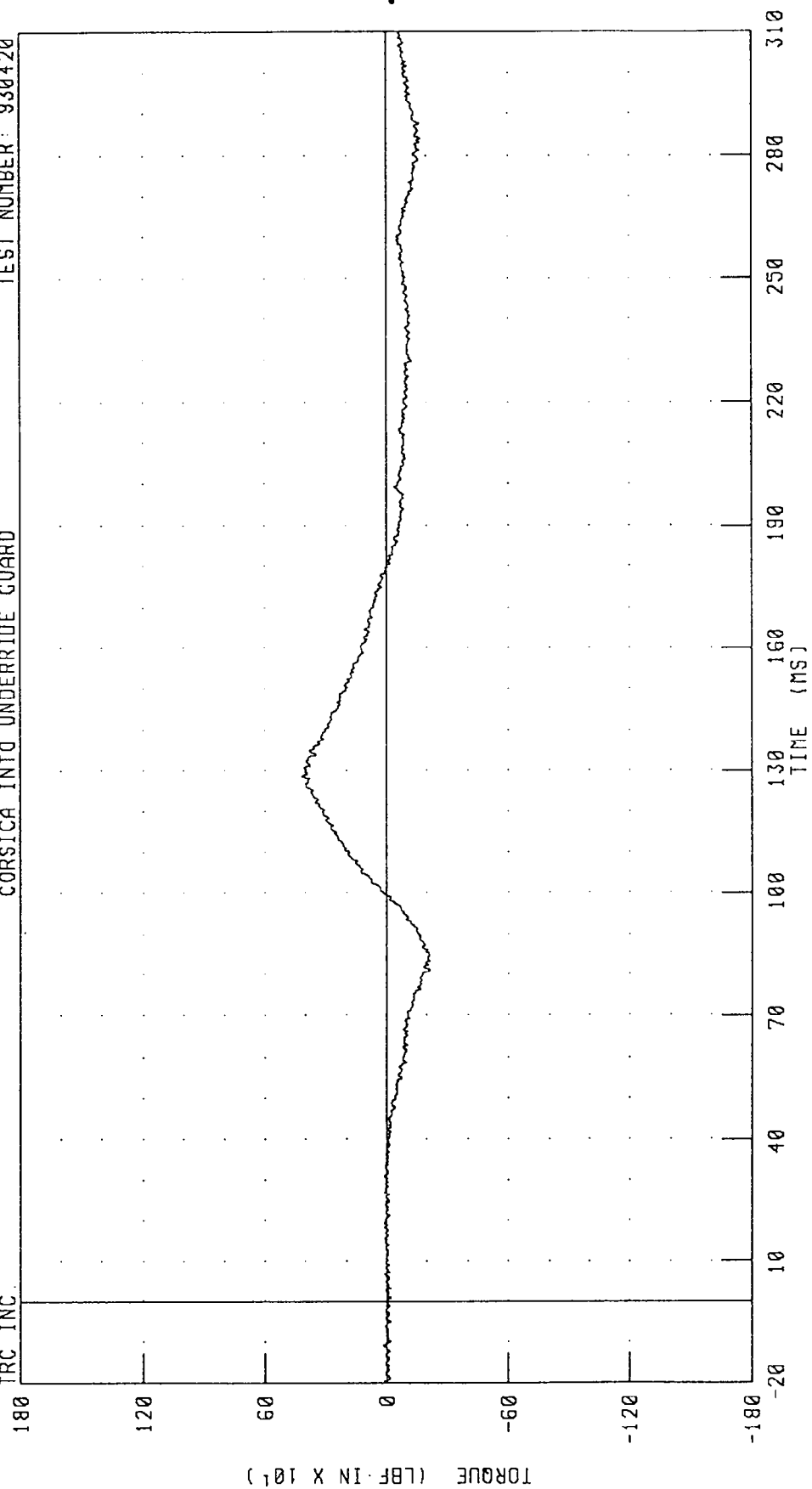


CHANNEL: NEKX12 FILTER: CH. CLASS 600 PEAK DATA: 64.53 LBF·IN @ 128.75 MS; -68.32 LBF·IN @ 110.13 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK MOMENT ABOUT Y AXIS
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



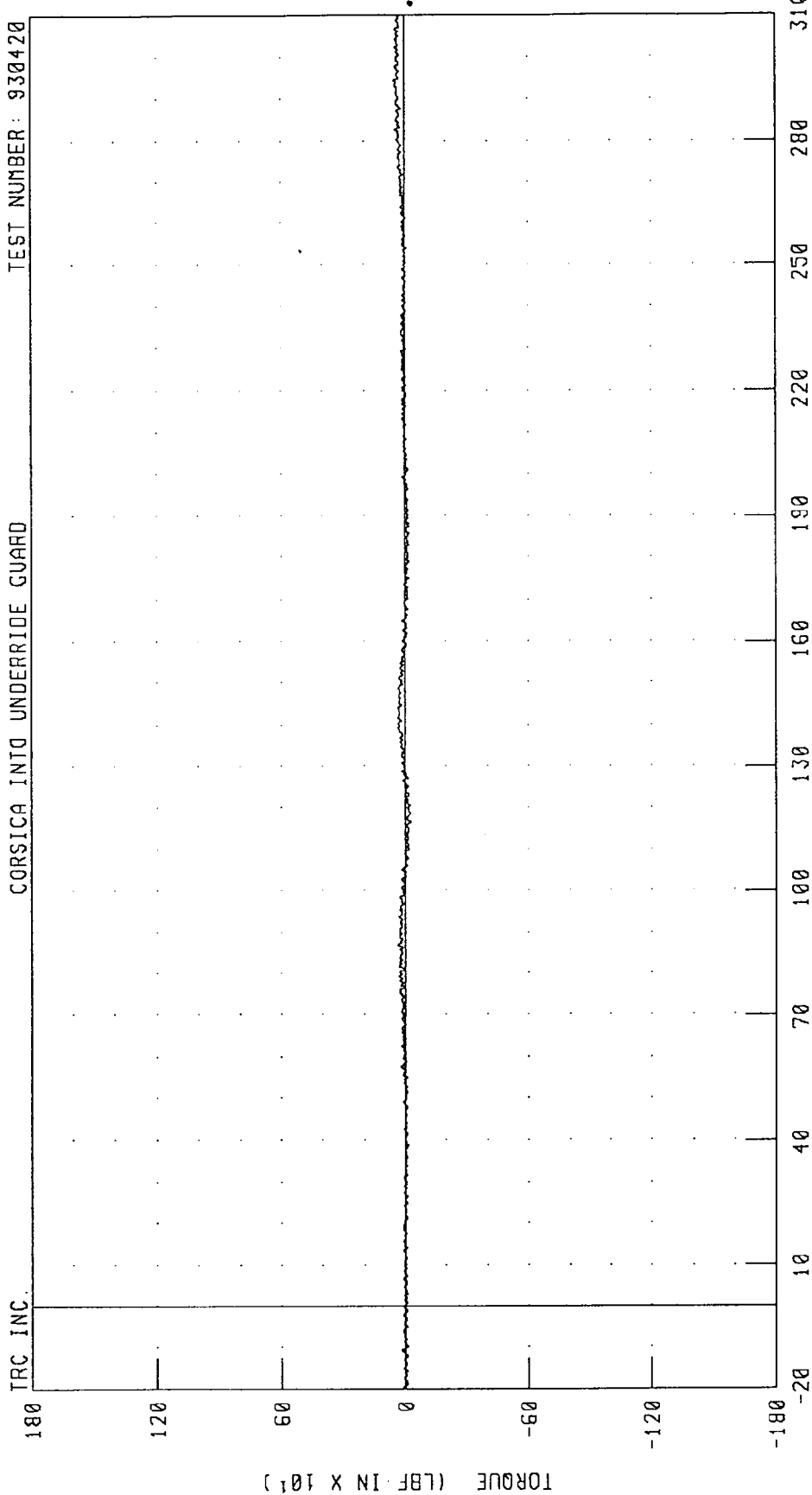
CHANNEL: NEKYM2 FILTER: CH. CLASS 600

PEAK DATA: 417.17 LBF·IN @ 128.75 MS; -213.98 LBF·IN @ 81.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK MOMENT ABOUT Z AXIS
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

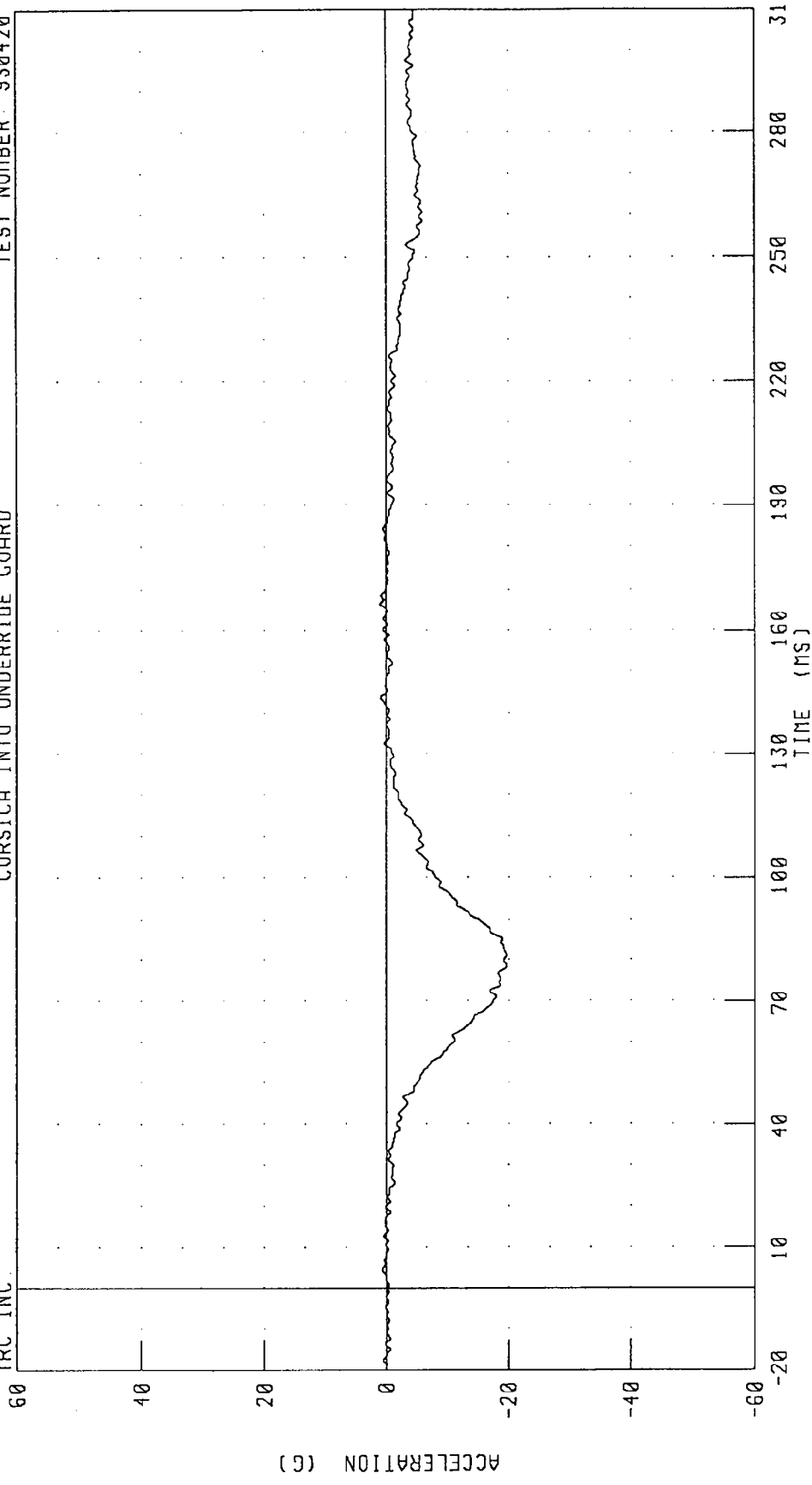


CHANNEL: NEKZM2 FILTER: CH. CLASS 600 PEAK DATA: 49.92 LBF IN @ 294.38 MS, -29.07 LBF IN @ 116.75 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



CHANNEL: CSTXG2 FILTER: CH. CLASS 180

PEAK DATA: 0.98 G @ 166.75 MS, -19.69 G @ 81.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

60

40

20

0

-20

-40

-60

ACCELERATION (G)

10 40 70 100 130 160 190 220 250 280 310
TIME (MS)

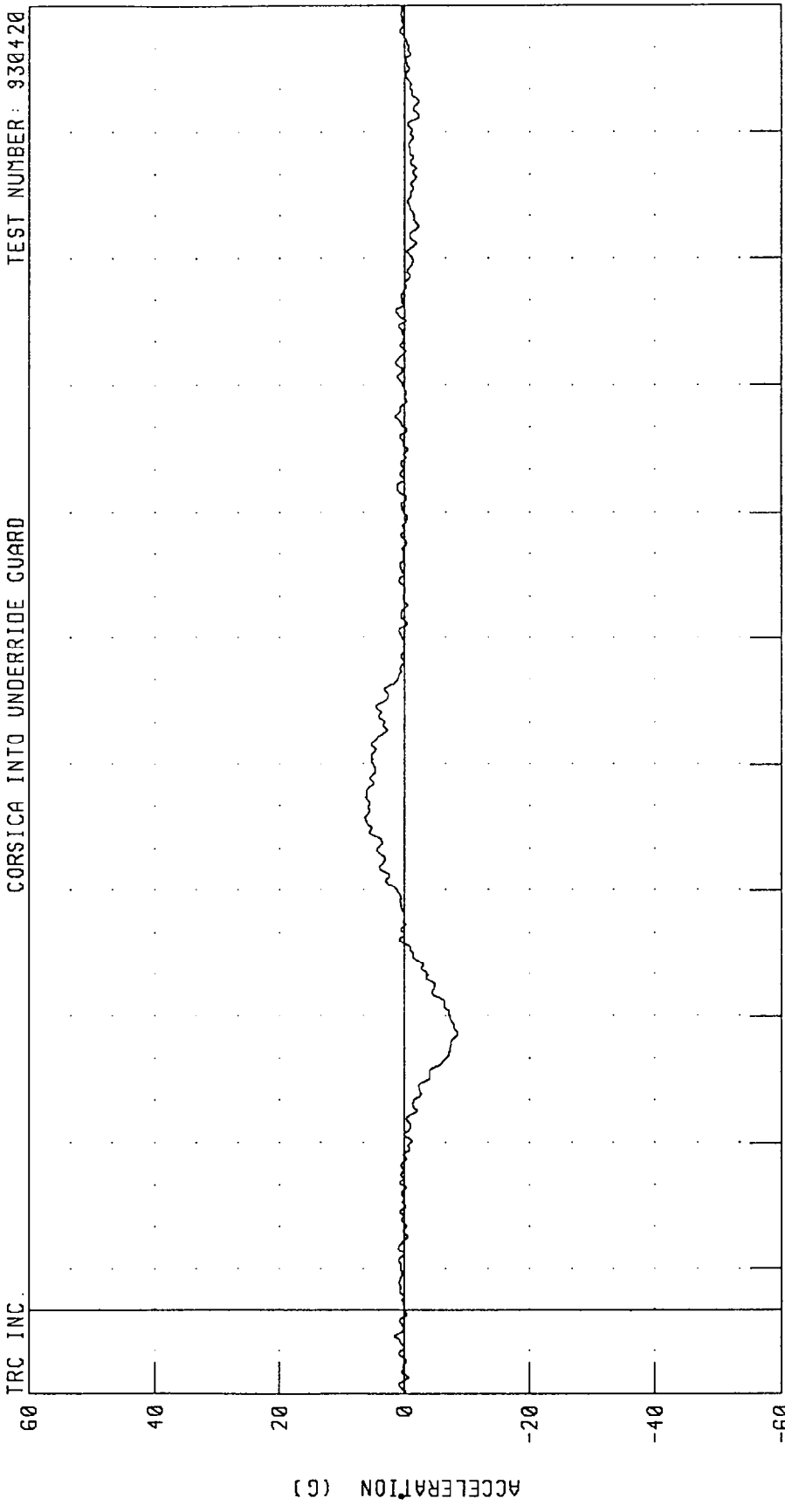
CHANNEL: CSTYG2 FILTER: CH. CLASS 180

PEAK DATA: 2.29 G @ 115.38 MS; -2.93 G @ 71.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

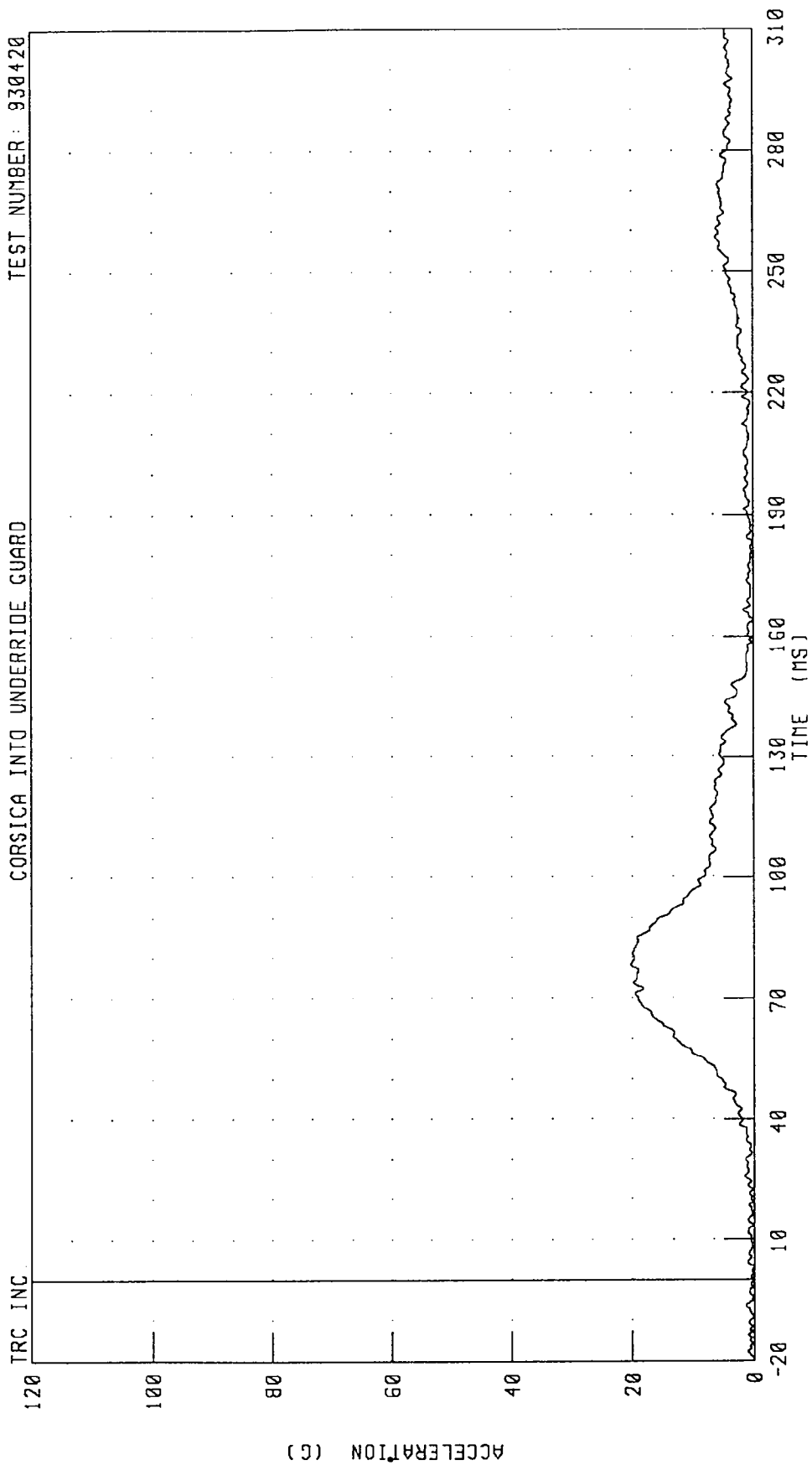


CHANNEL: CSTZG2 FILTER: CH. CLASS 180

PEAK DATA: 6.39 G @ 117.38 MS, -8.49 G @ 65.88 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

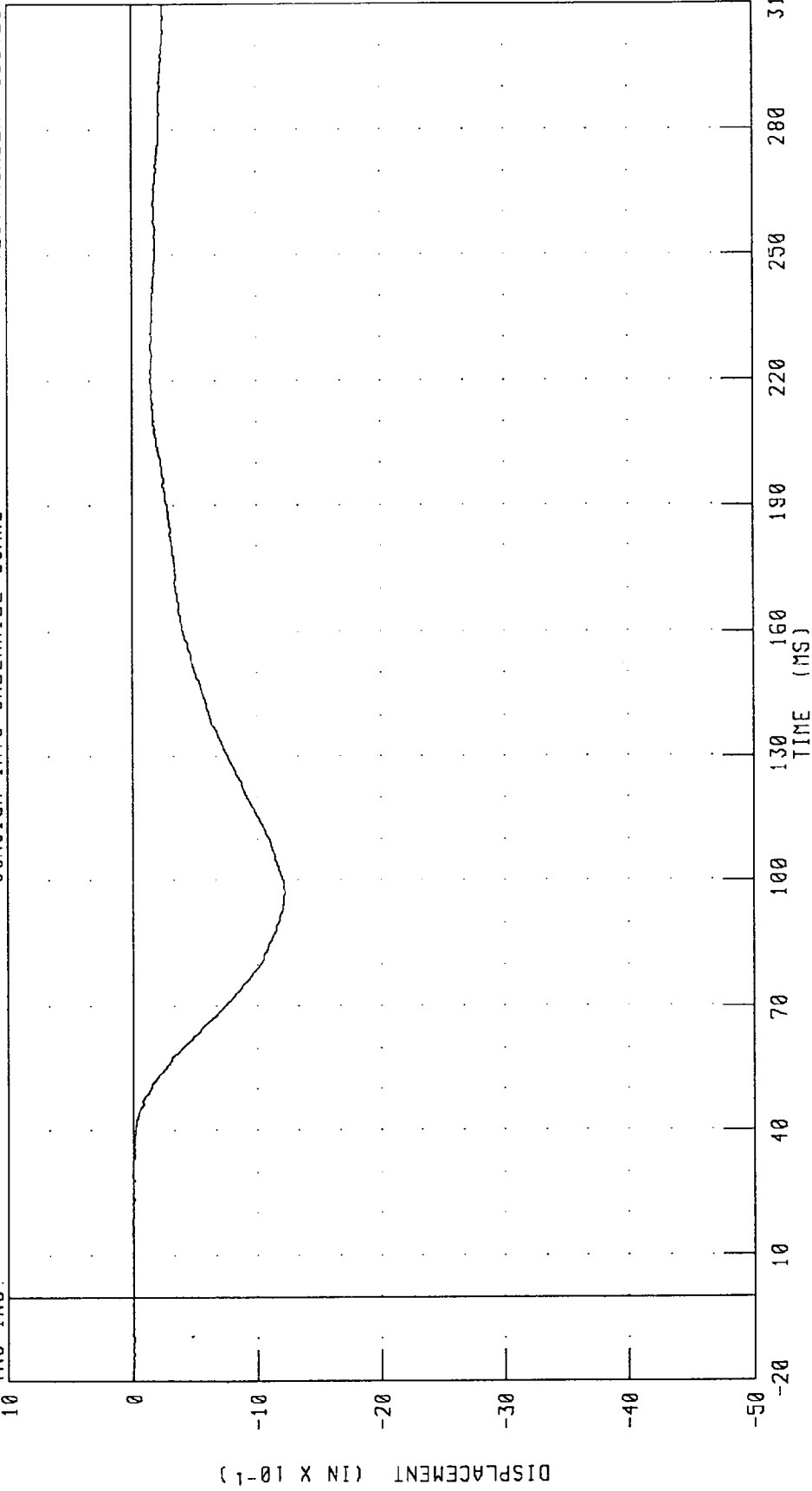


CHANNEL: CSTRG2 FILTER: CH. CLASS 180 PEAK DATA: 20.23 G @ 78.25 MS; 0.04 G @ -20.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST DEFLECTION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

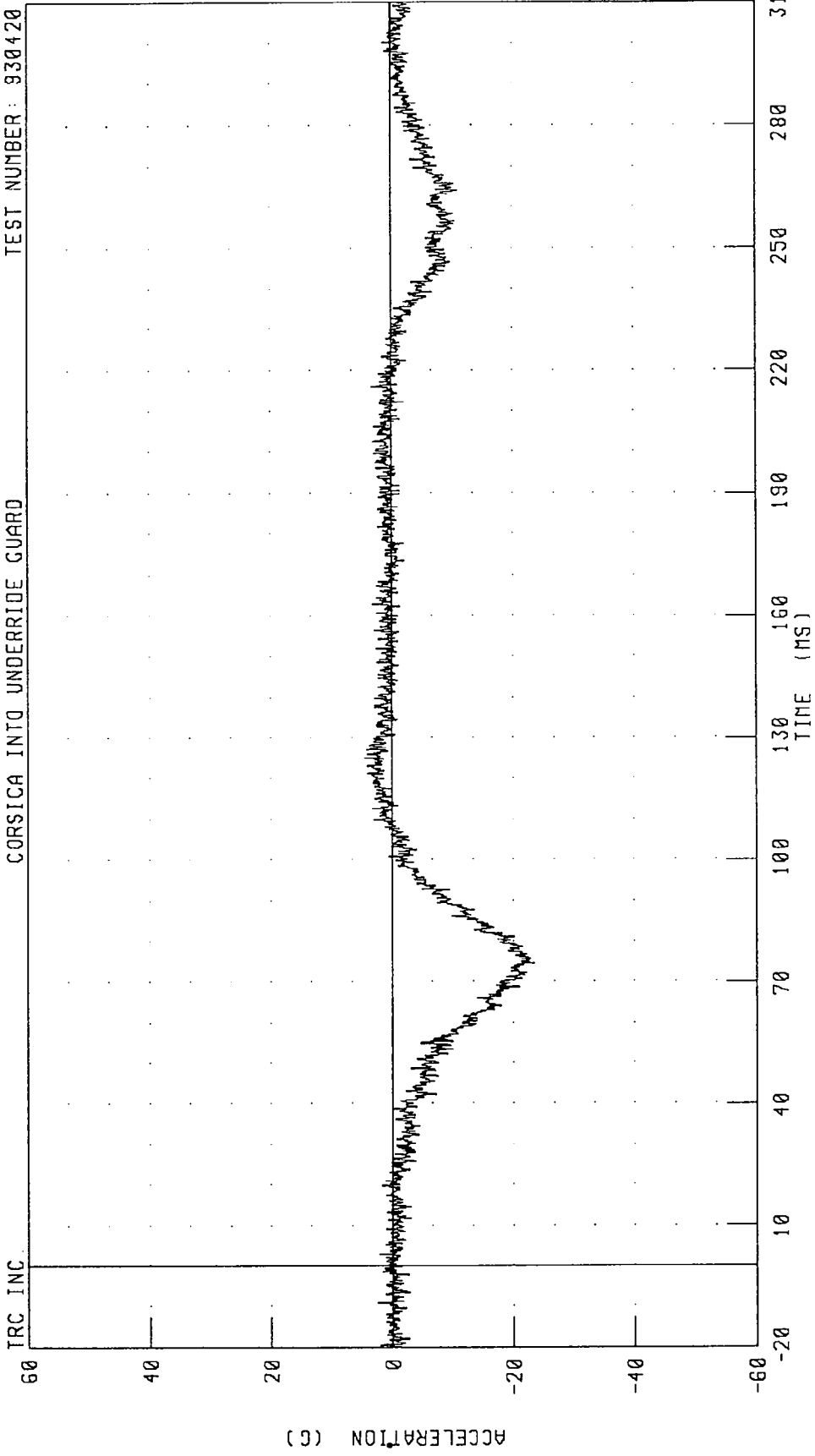


CHANNEL: CSTXD2 FILTER: CH. CLASS 180

PEAK DATA: 0.01 IN @ 18.00 MS; -1.22 IN @ 97.25 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER PELVIS X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

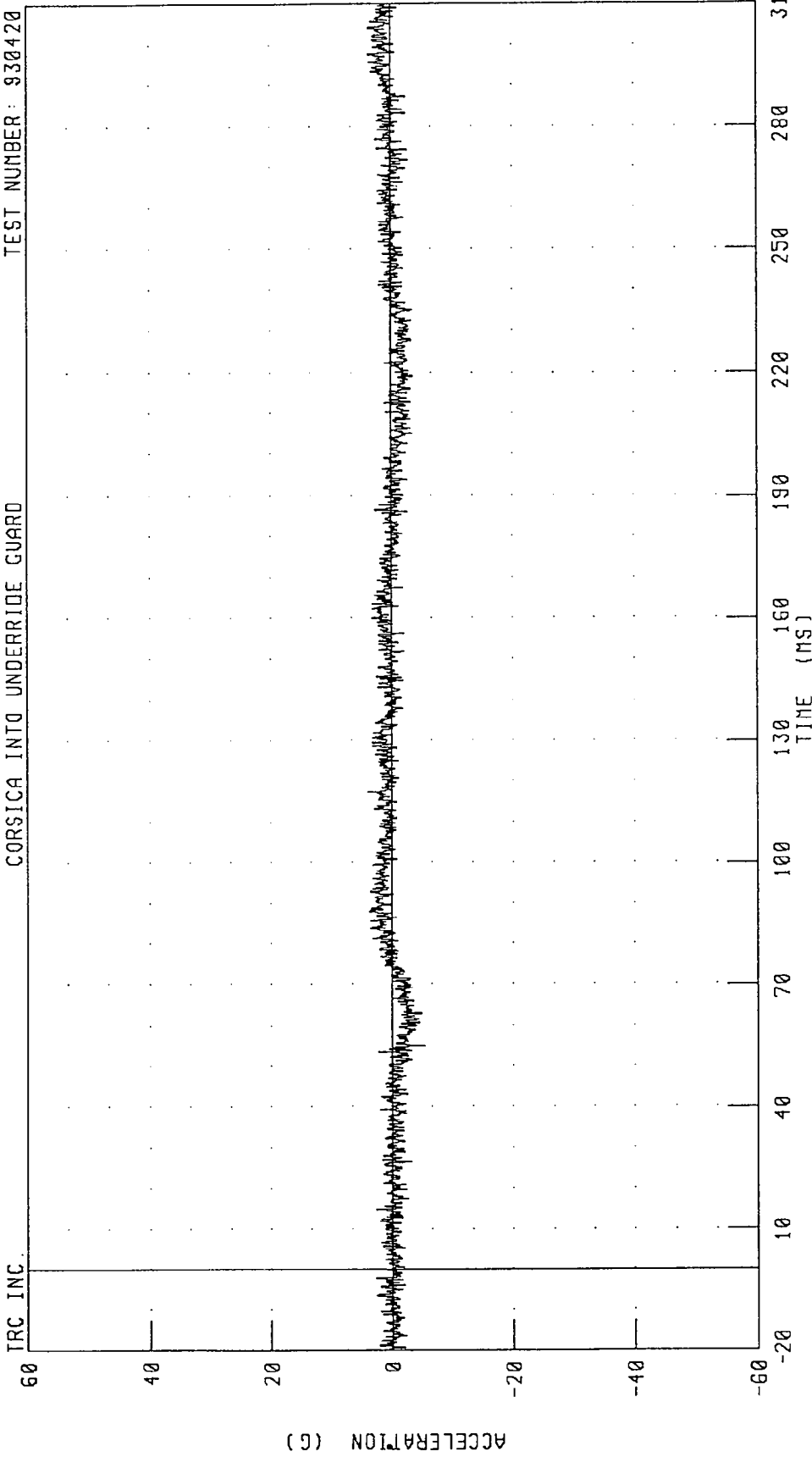


CHANNEL: PEVXG2 FILTER: CH. CLASS 1000

PEAK DATA: 4.64 G @ 125.13 MS; -23.41 G @ 74.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER PELVIS Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



TRC INC.

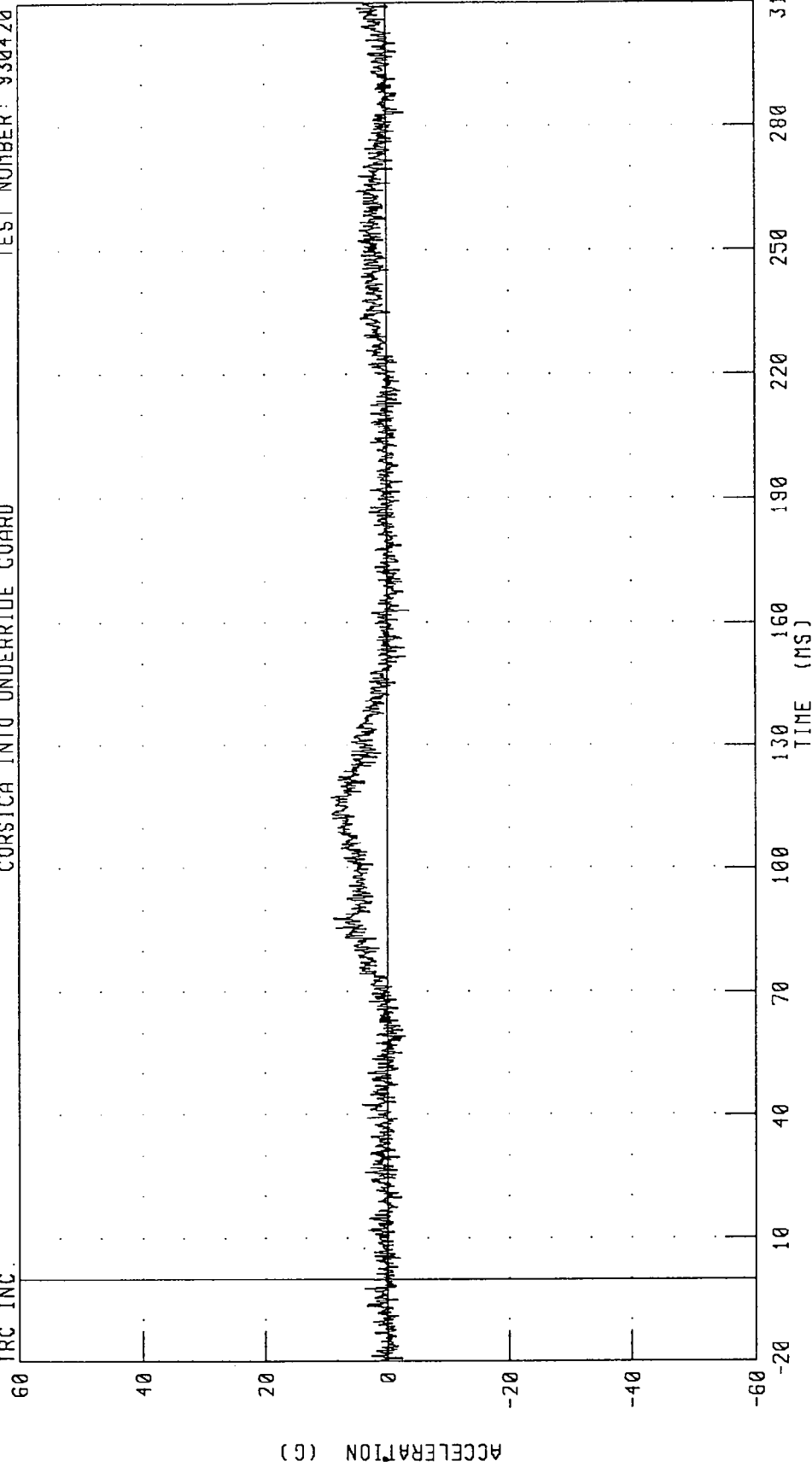
CHANNEL: PEVYG2 FILTER: CH. CLASS 1000

PEAK DATA: 4.01 G @ 117.50 MS; -5.48 G @ 55.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER PELVIS Z-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

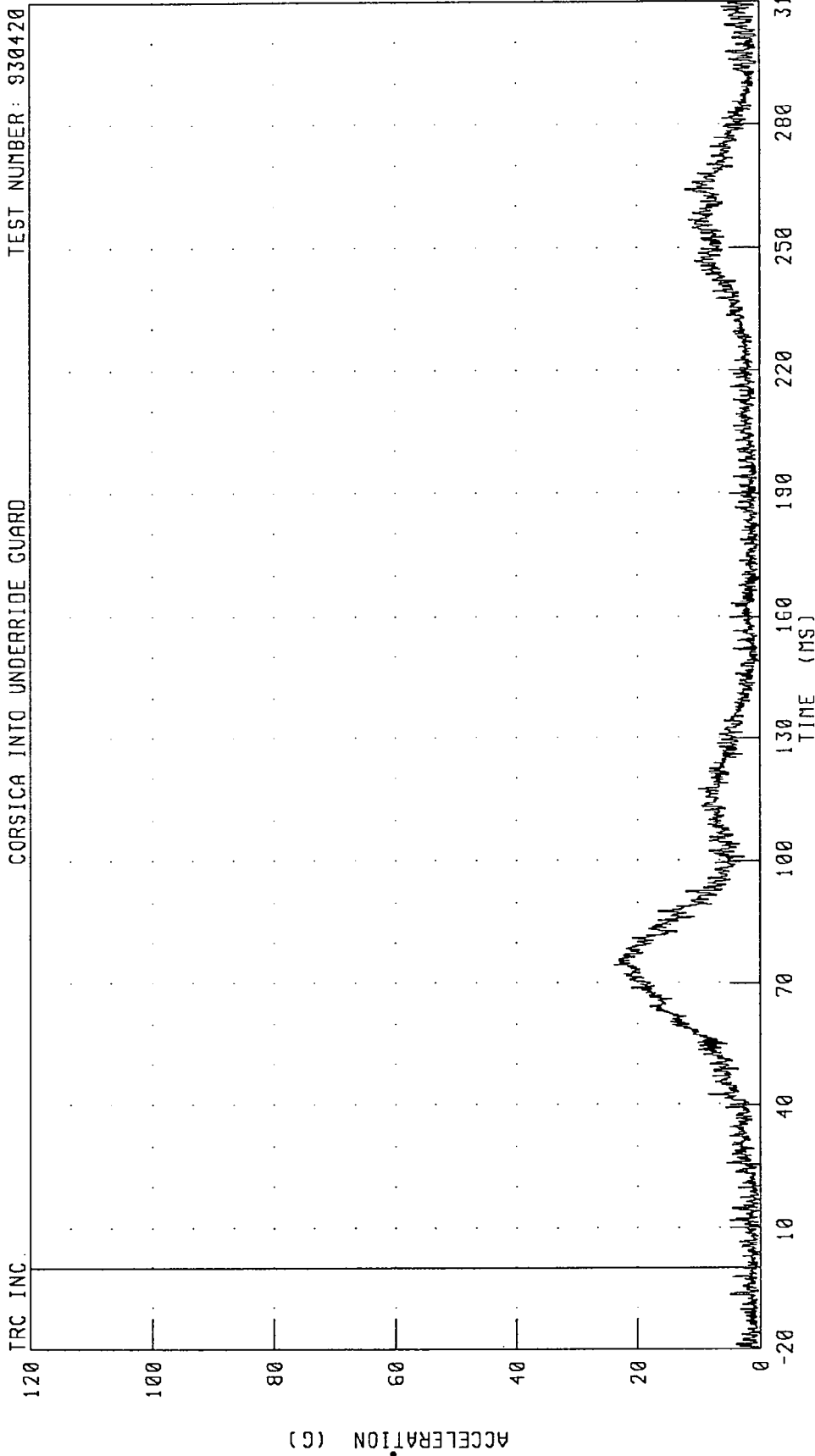


CHANNEL: PEVZ62 FILTER: CH. CLASS 1000

PEAK DATA: 9.26 G @ 117.50 MS; -3.54 G @ 163.13 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER PELVIS RESULTANT ACCELERATION

TRC INC. CORSICA INTO UNDERRIDE GUARD TEST NUMBER: 930420

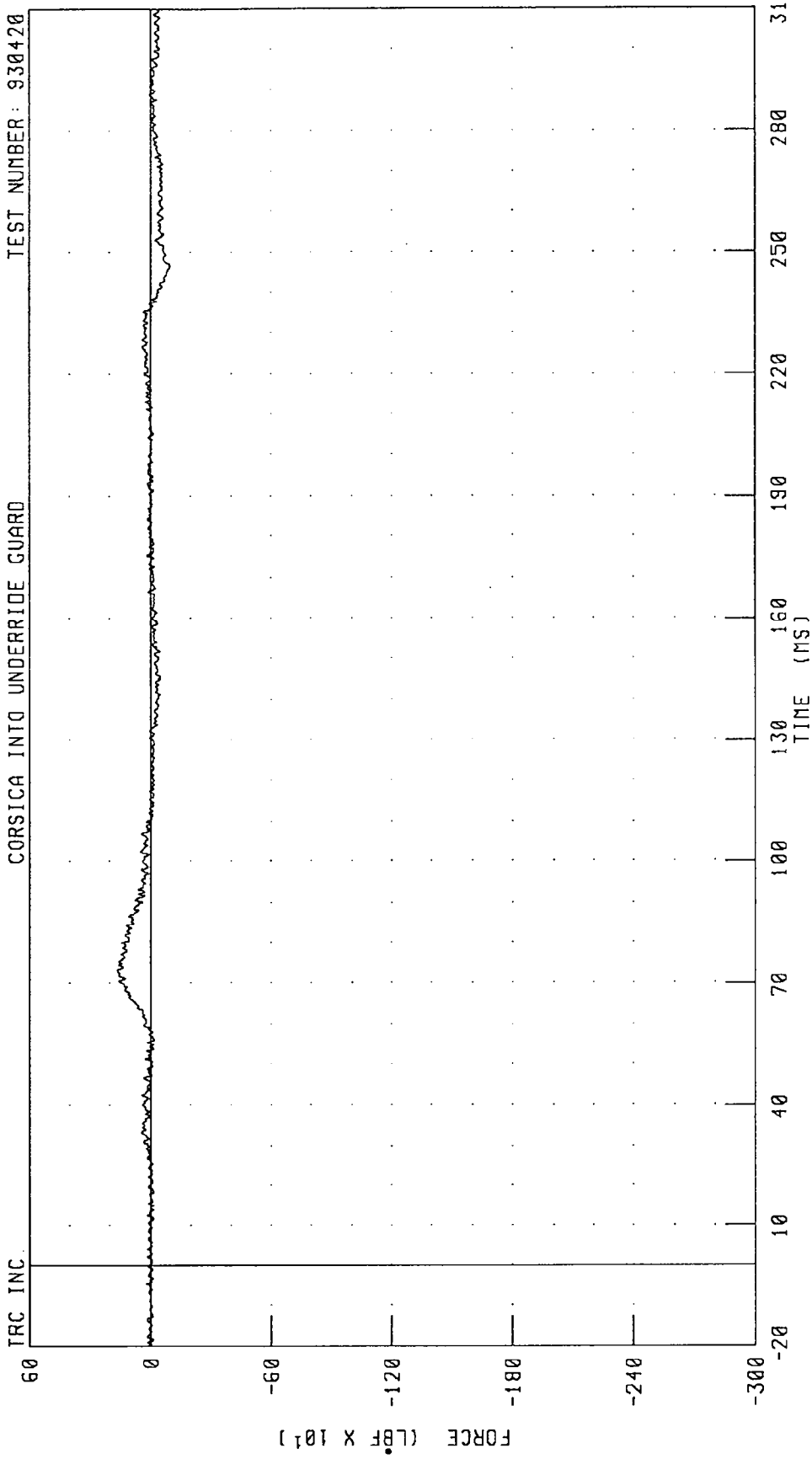


CHANNEL: PEVRG2 FILTER: CH. CLASS 1000

PEAK DATA: 23.89 G @ 74.50 MS; 0.16 G @ 3.88 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER LEFT FEMUR FORCE
CORSICA INTO UNDERRIDE GUARD

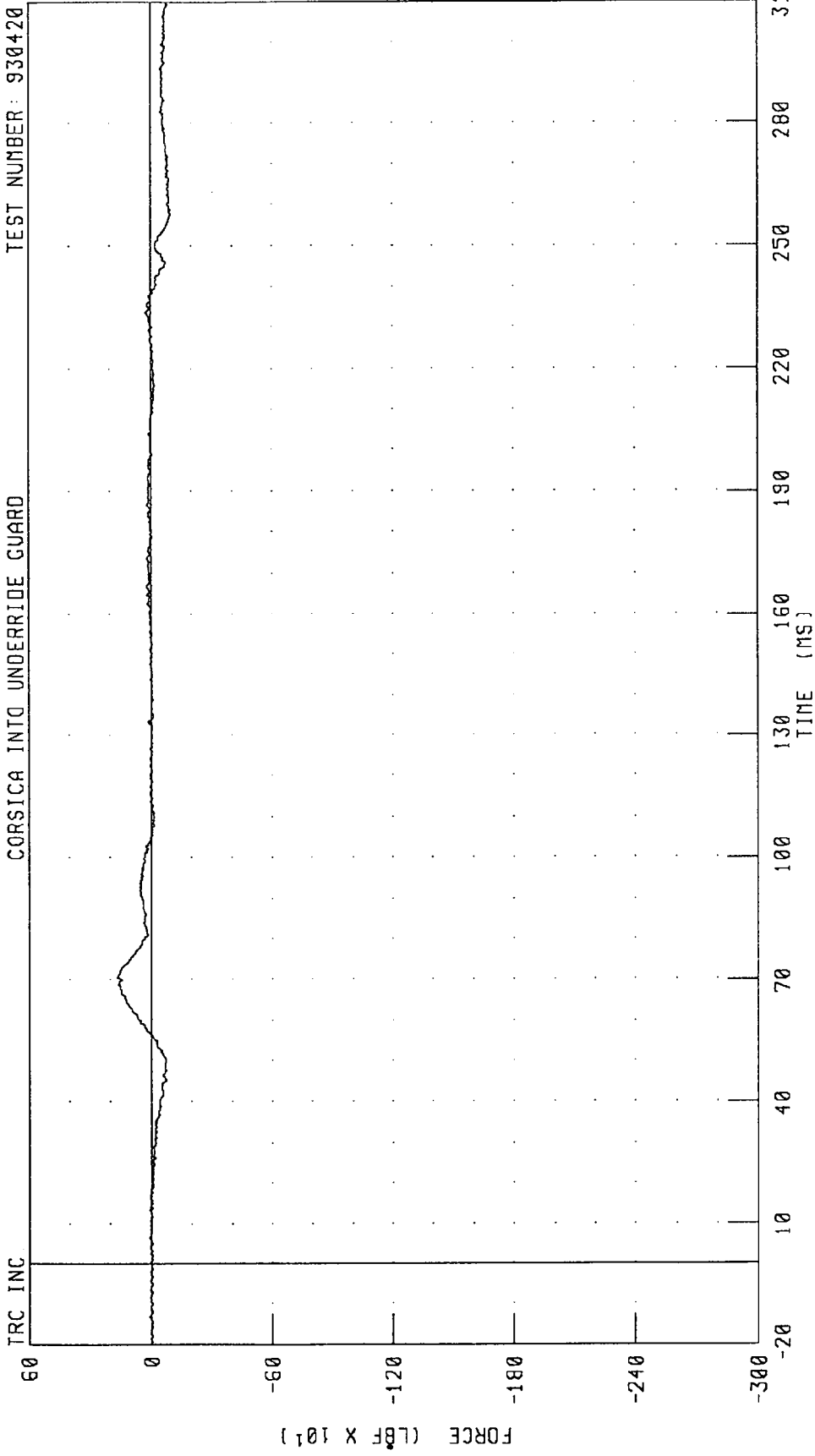
TEST NUMBER: 930420



CHANNEL: LFMF2 FILTER: CH. CLASS 600 PEAK DATA: 164.26 LBF @ 73.13 MS; -98.62 LBF @ 246.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



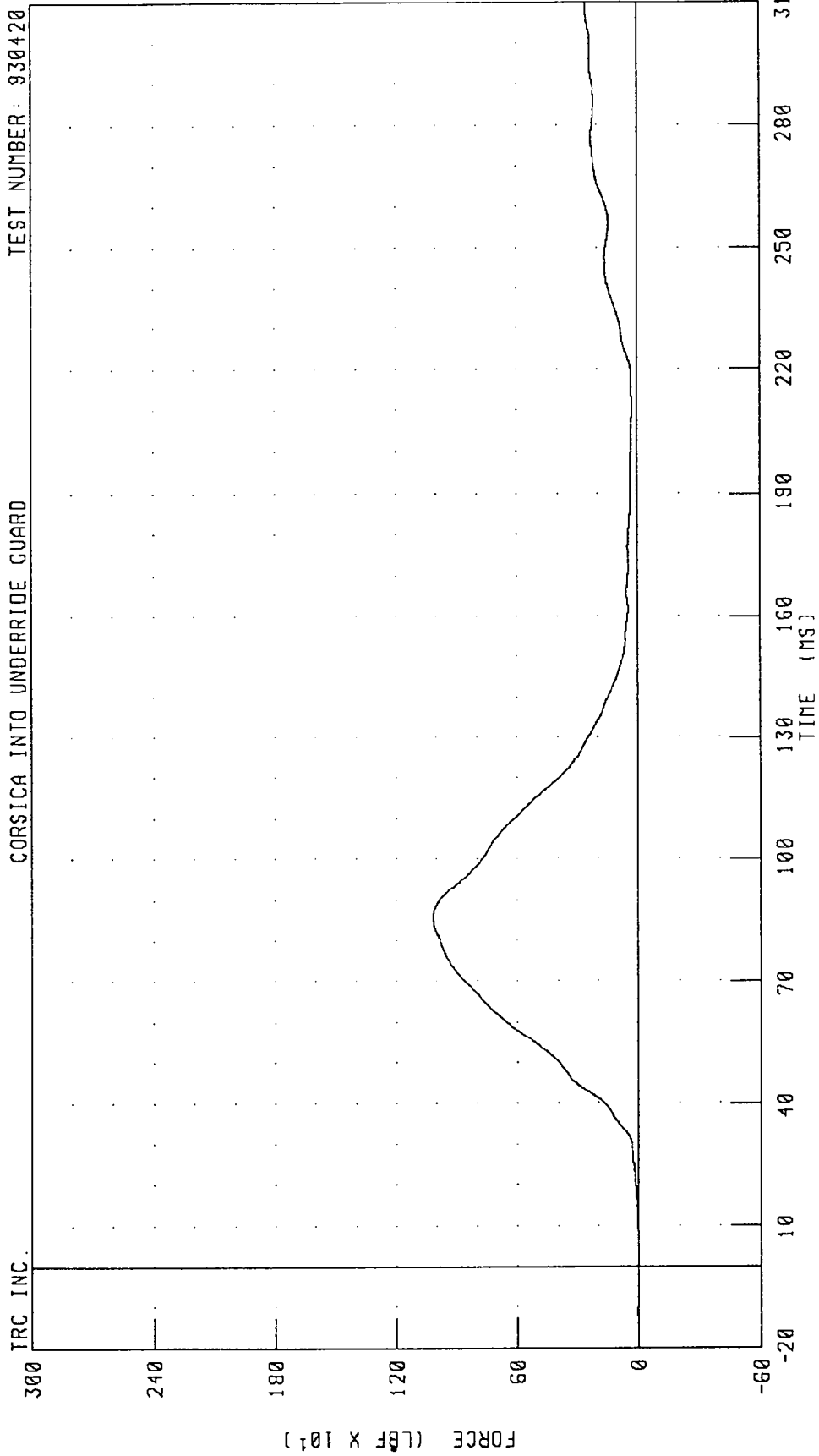
CHANNEL: RFMF2 FILTER: CH. CLASS 600

PEAK DATA: 165.71 LBF @ 70.63 MS; -96.46 LBF @ 257.75 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER SHOULDER BELT FORCE
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



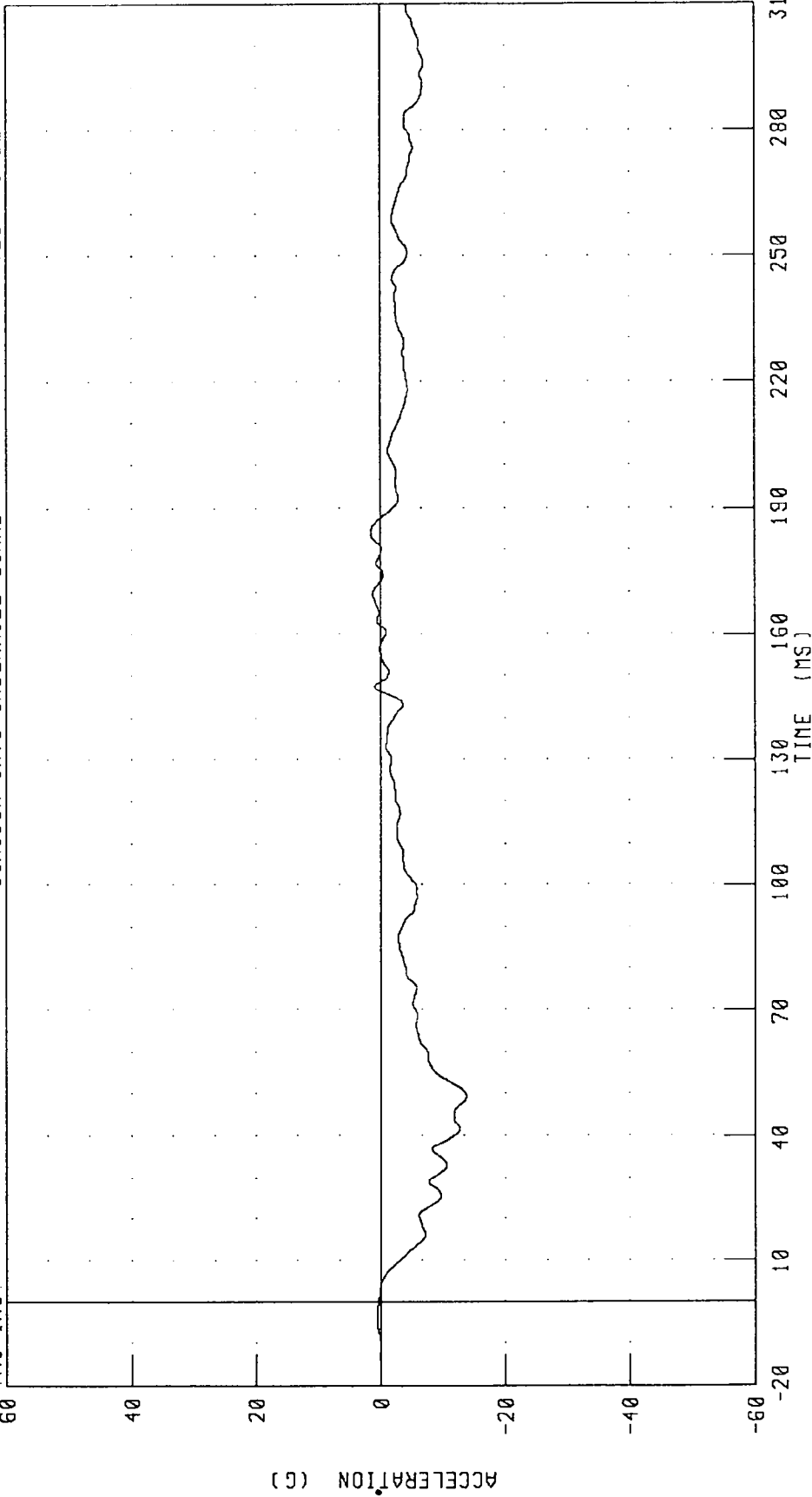
CHANNEL: SHBF2 FILTER: CH. CLASS 60

PEAK DATA: 1016.50 LBF @ 86.13 MS; -0.59 LBF @ 6.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



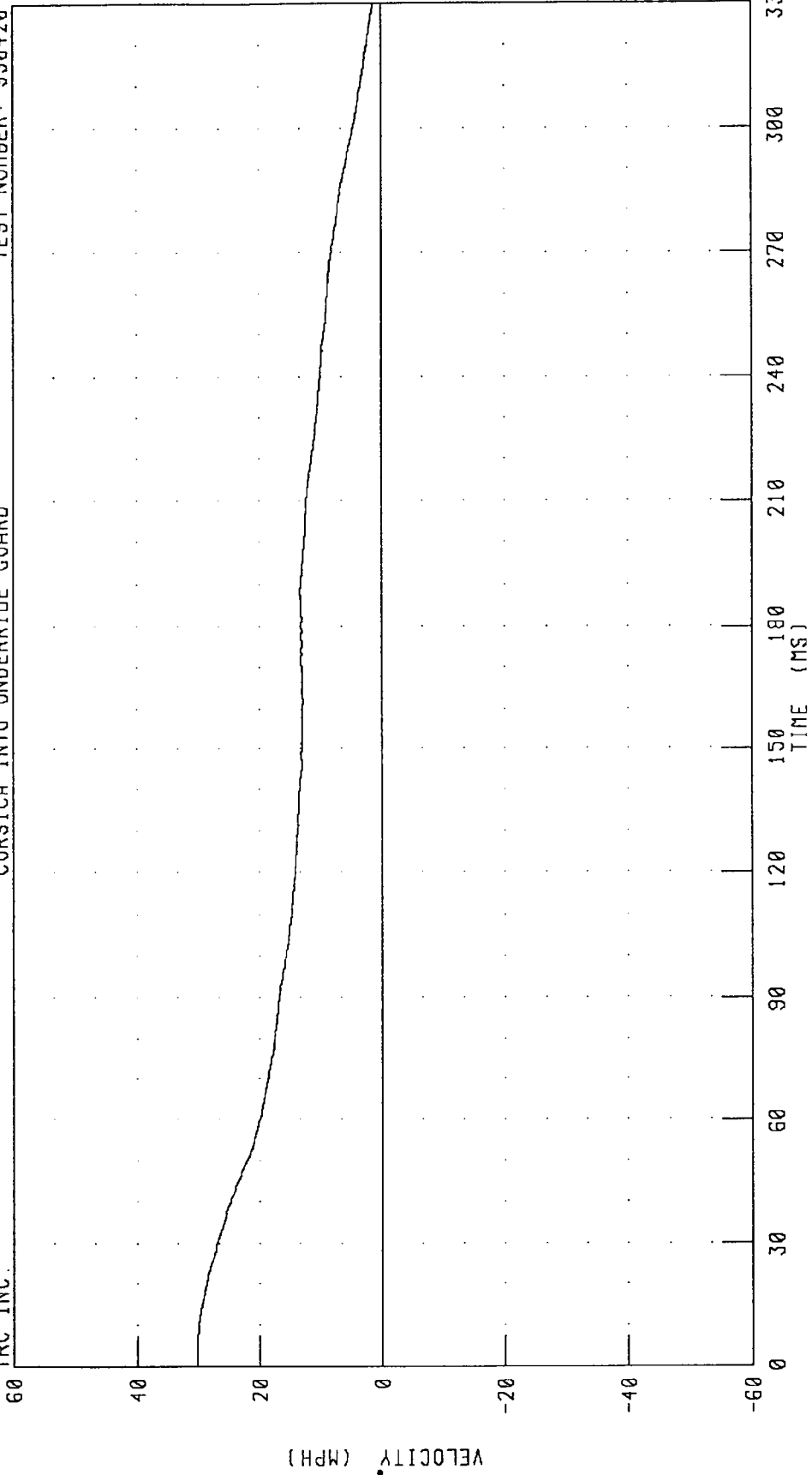
CHANNEL: TLRXG1 FILTER: CH. CLASS 60

PEAK DATA: 1.51 G @ 184.13 MS; -13.68 G @ 49.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT X-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



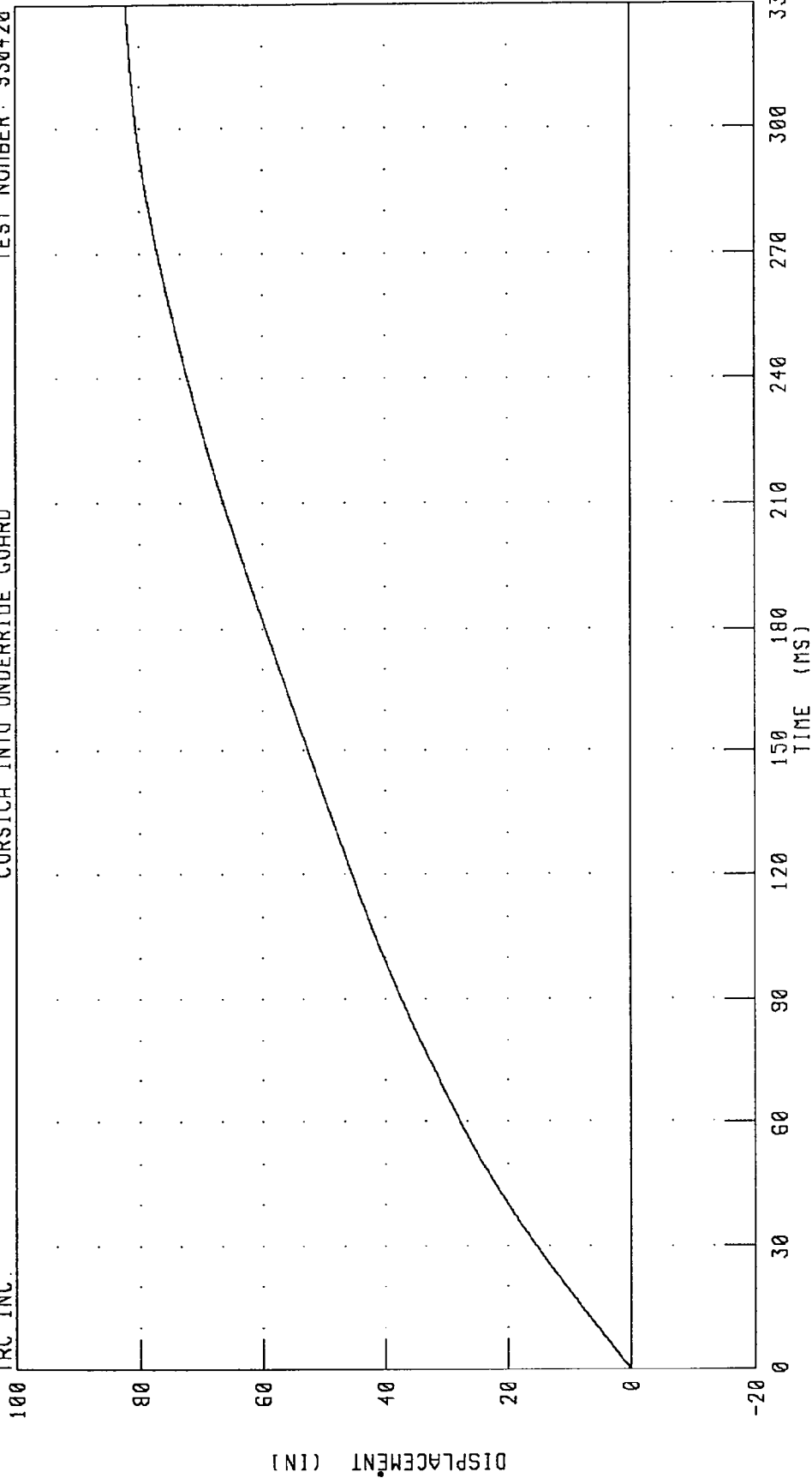
CHANNEL: TLRXV1 FILTER: CH. CLASS 1000

PEAK DATA: 30.12 MPH @ 4.88 MS; 1.29 MPH @ 330.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT X-AXIS DISPLACEMENT
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

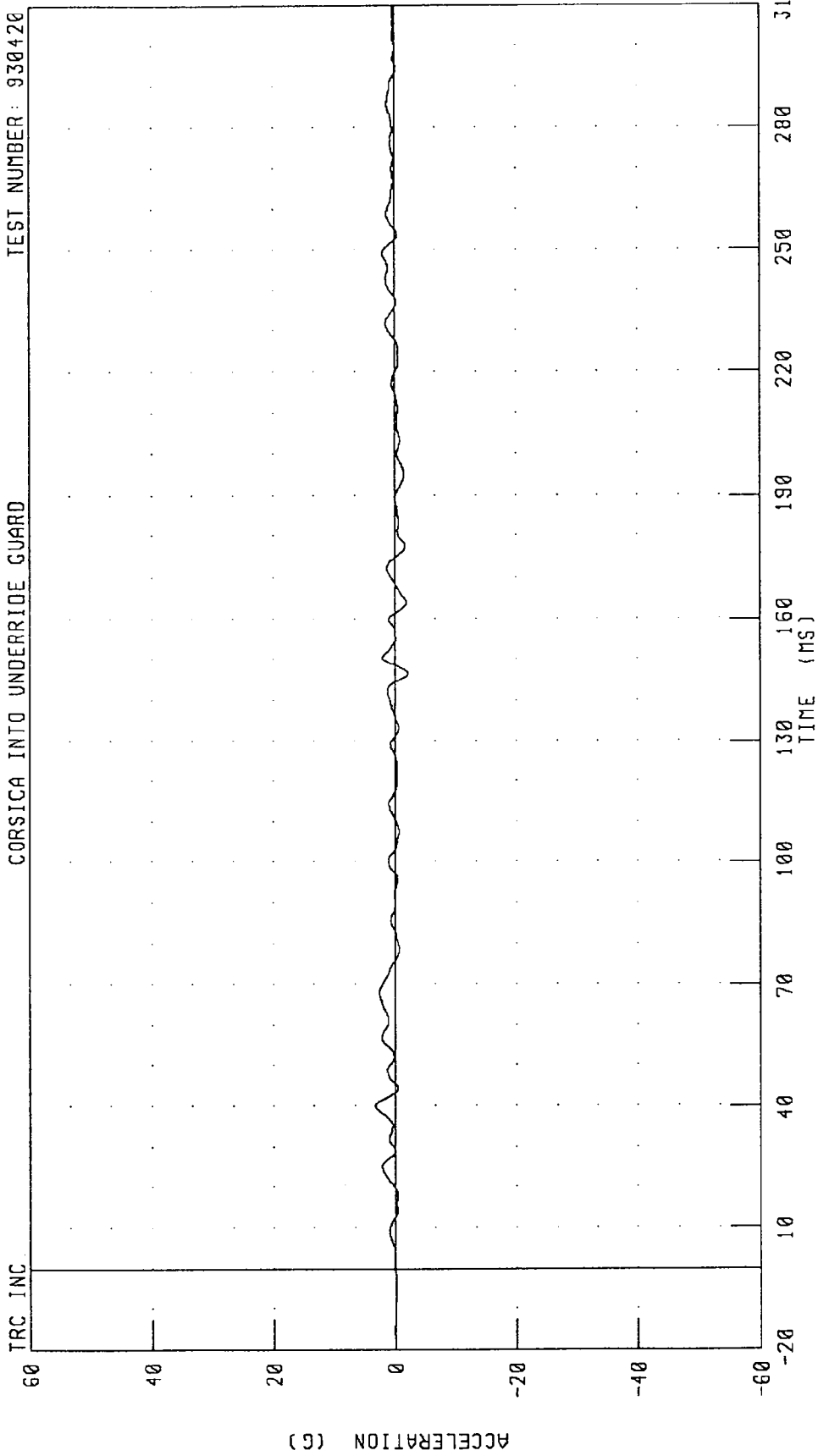


CHANNEL: TLRXD1 FILTER: CH. CLASS 1000

PEAK DATA: 82.05 IN @ 330.00 MS; 0.00 IN @ 0.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

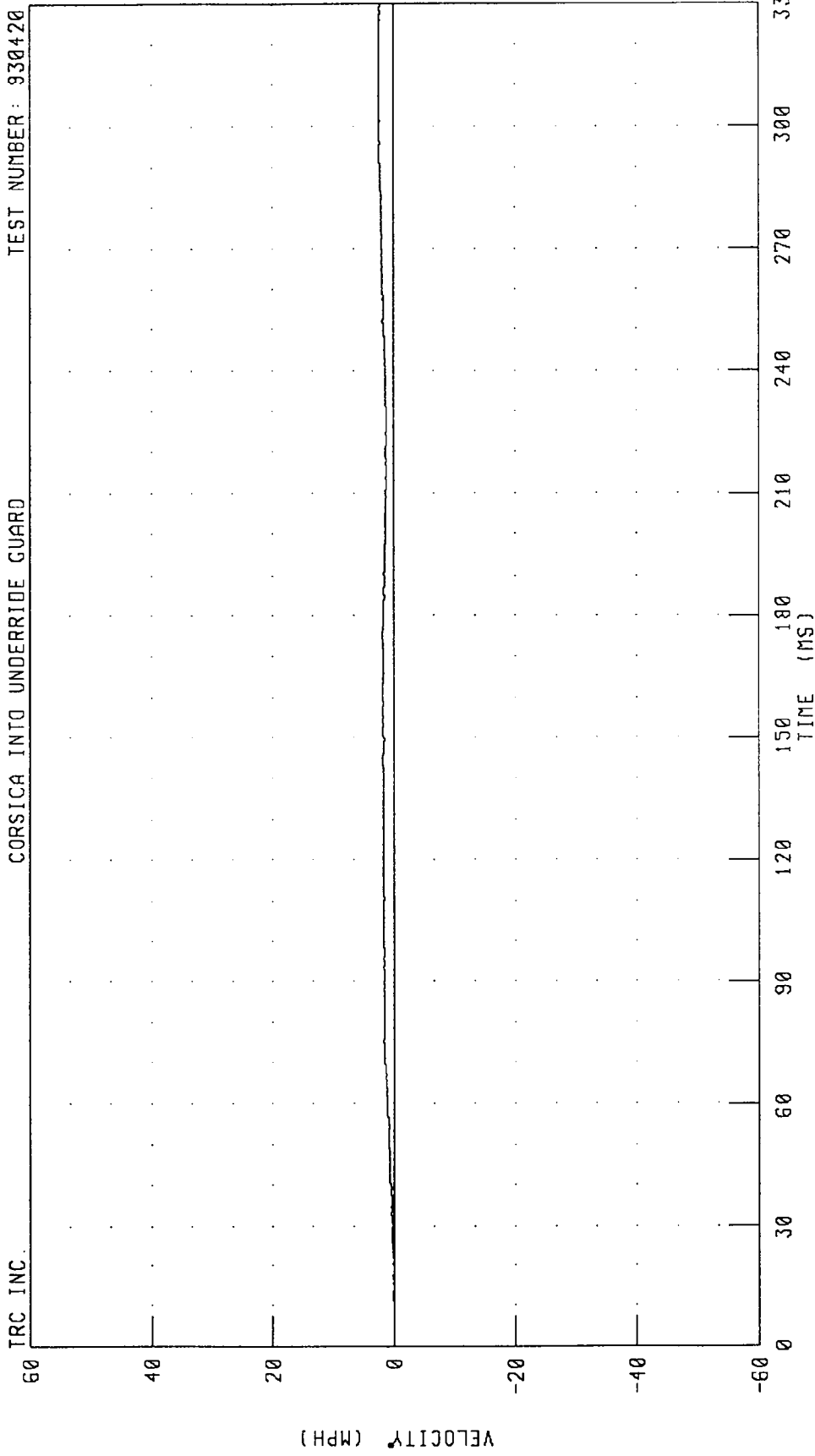


CHANNEL: TLRYG1 FILTER: CH. CLASS 60

PEAK DATA: 3.35 G @ 40.13 MS; -2.12 G @ 146.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT Y-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



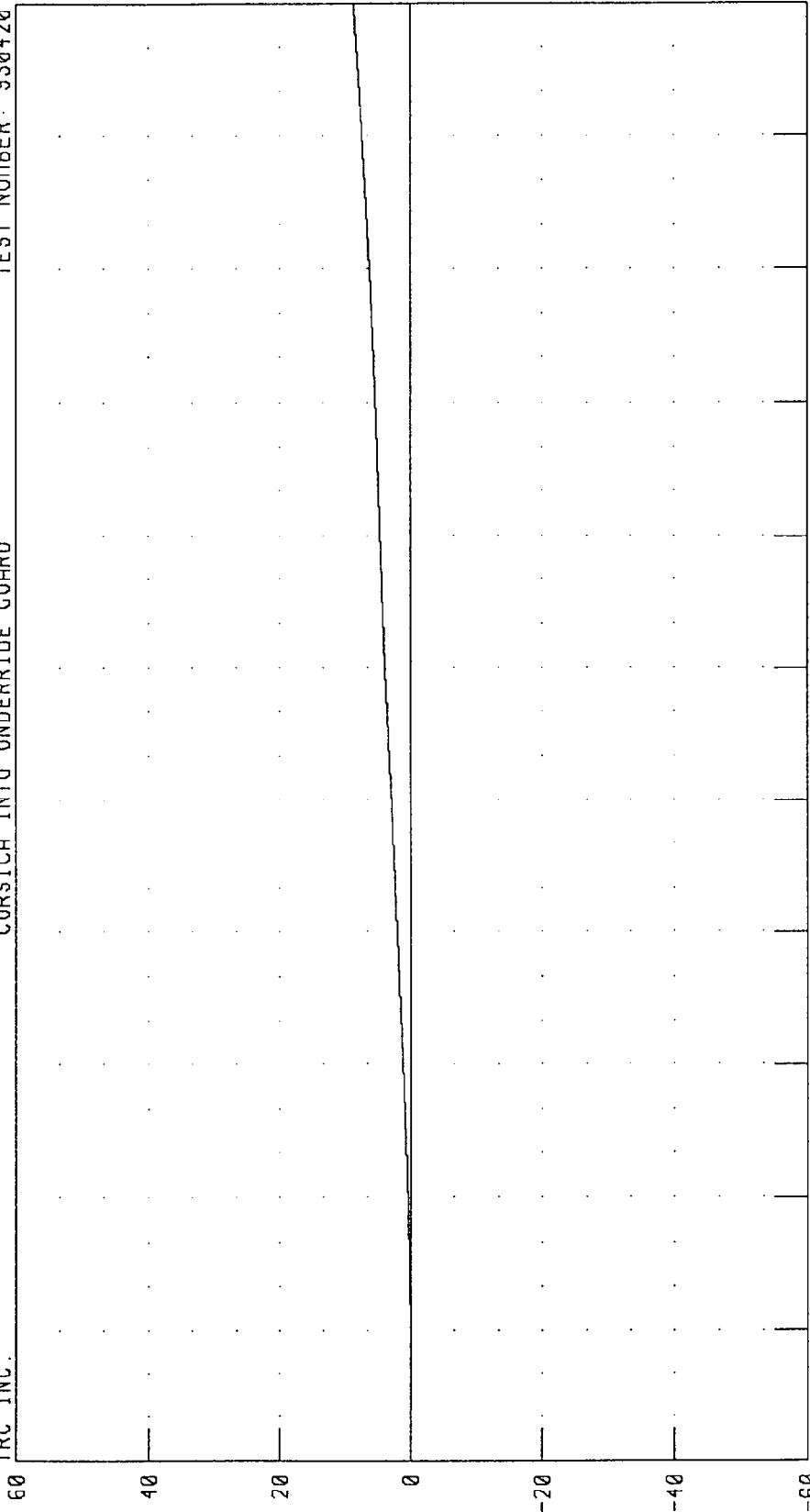
CHANNEL: TLRYV1 FILTER: CH. CLASS 1000

PEAK DATA: 2.45 MPH @ 312.63 MS; 0.00 MPH @ 0.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT Y-AXIS DISPLACEMENT
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

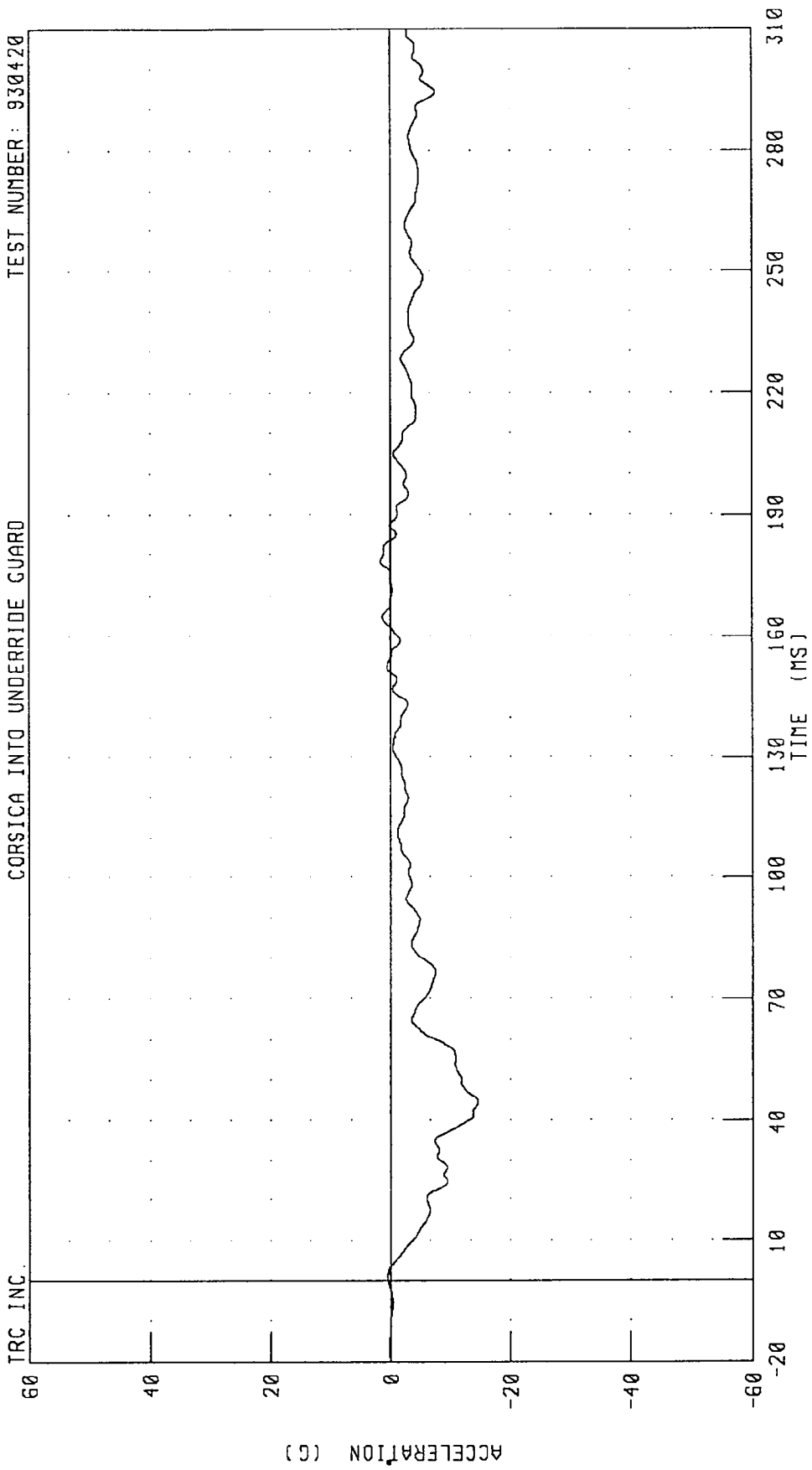


CHANNEL: TLRY01 FILTER: CH. CLASS 1000

PEAK DATA: 8.67 IN @ 330.00 MS; 0.00 IN @ 0.75 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



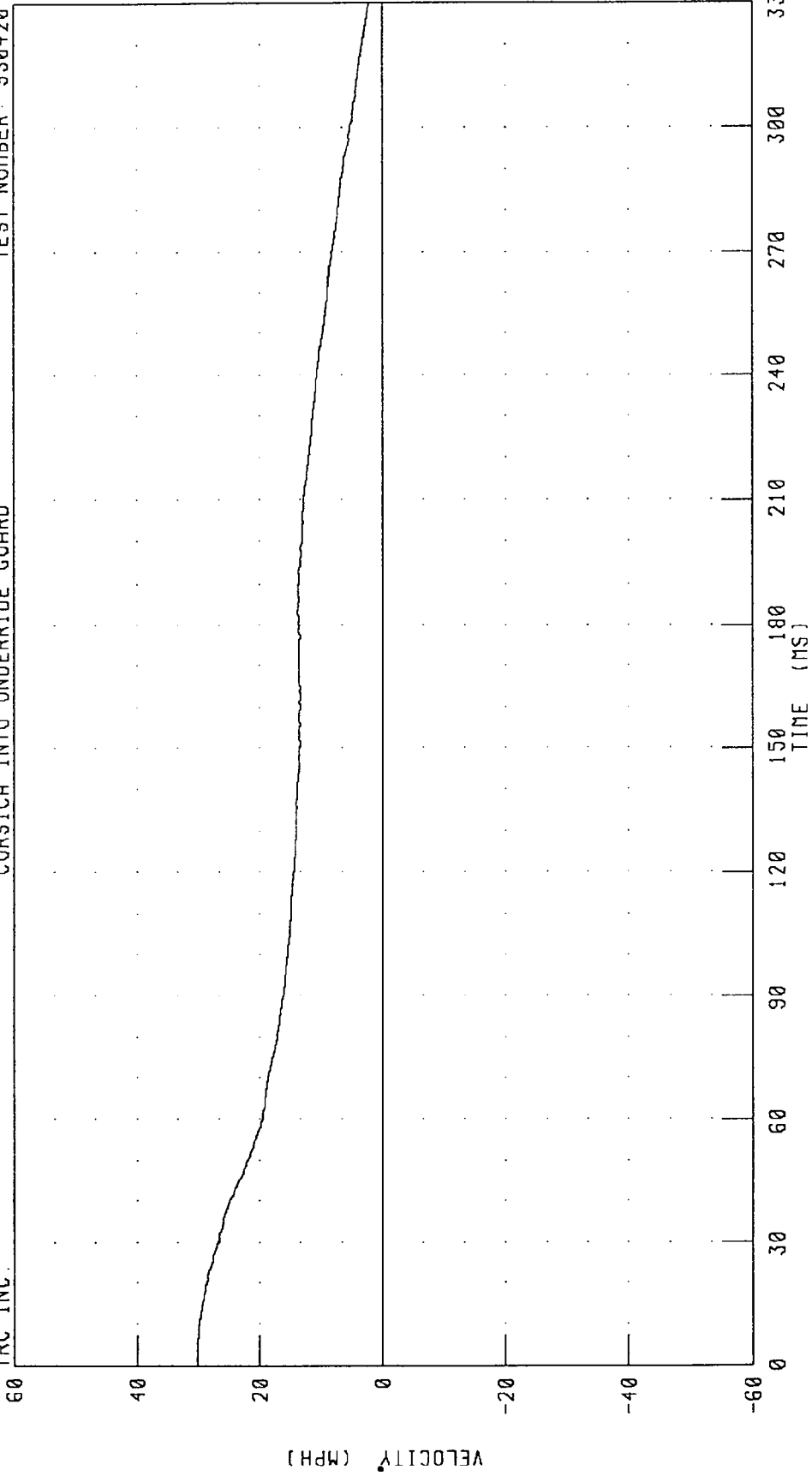
CHANNEL: TRRXG1 FILTER: CH. CLASS 60

PEAK DATA: 1.70 G @ 178.25 MS; -14.63 G @ 44.88 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT X-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



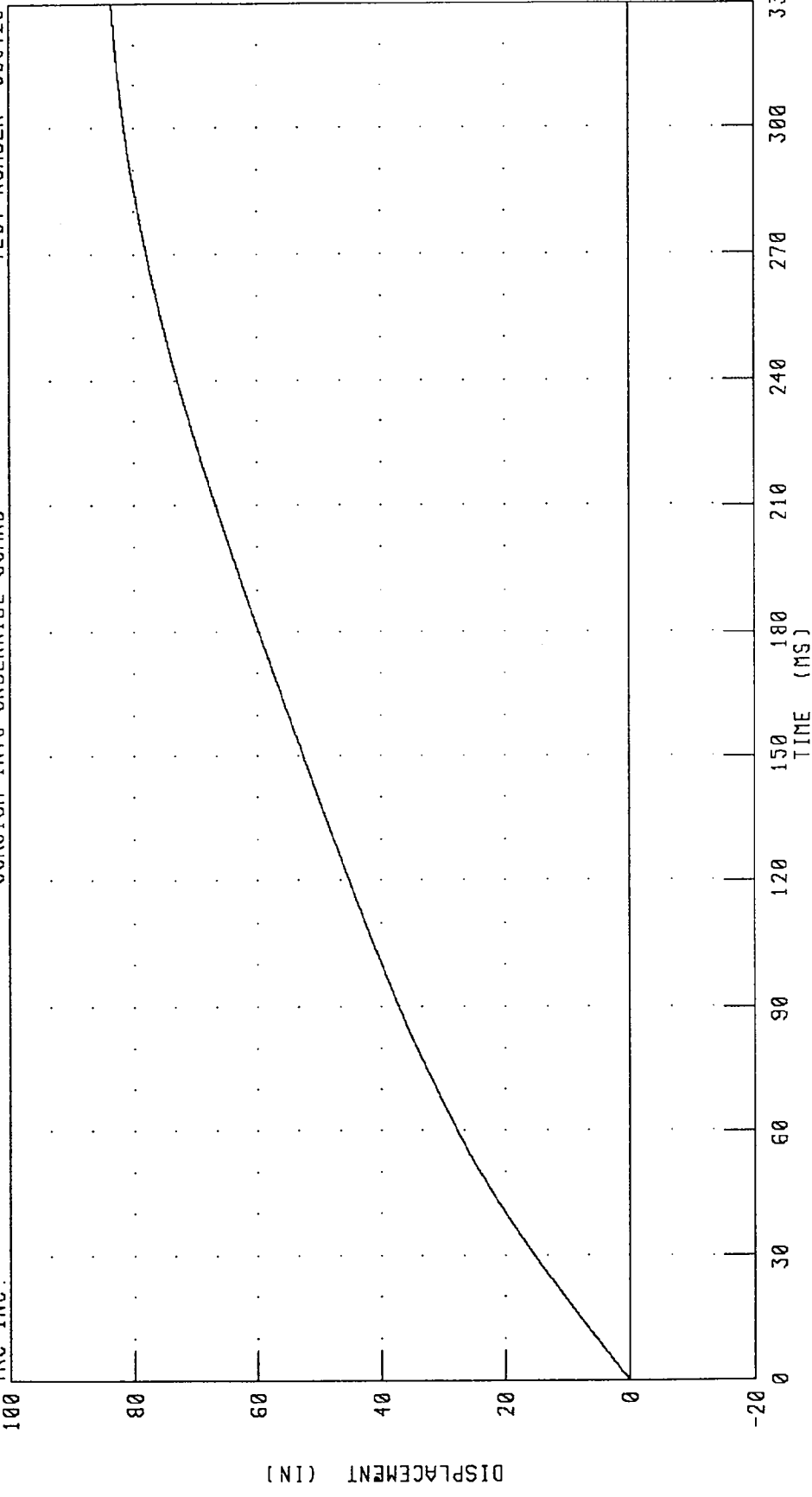
CHANNEL: TRRXV1 FILTER: CH. CLASS 1000

PEAK DATA: 30.13 MPH @ 3.75 MS; 2.23 MPH @ 330.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT X-AXIS DISPLACEMENT
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

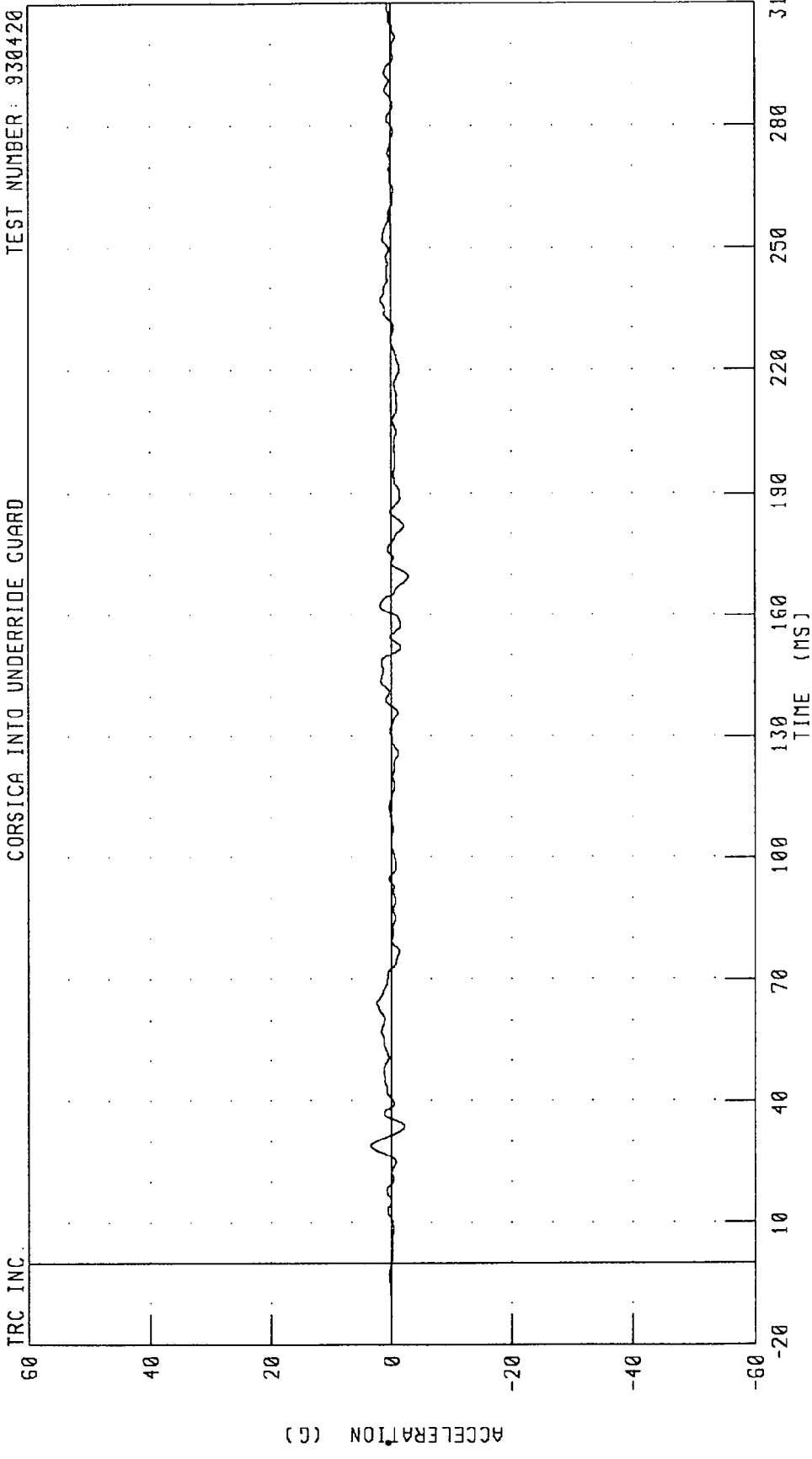


CHANNEL: TRRXD1 FILTER: CH. CLASS 1000

PEAK DATA: 83.50 IN @ 330.00 MS; 0.00 IN @ 0.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

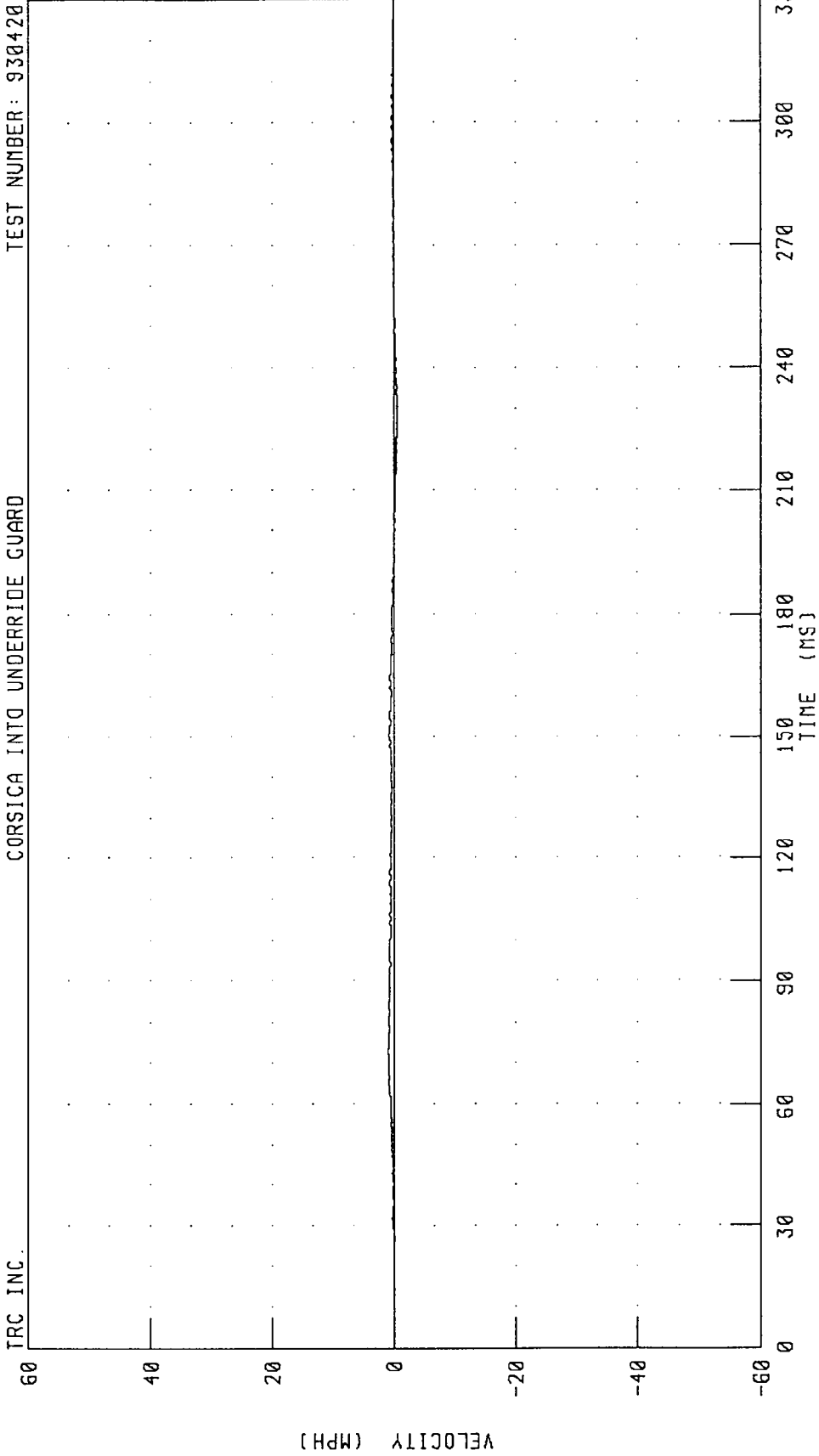
TEST NUMBER: 930420



CHANNEL: TRRYG1 FILTER: CH. CLASS 60 PEAK DATA: 3.40 G @ 28.88 MS; -2.90 G @ 169.63 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT Y-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



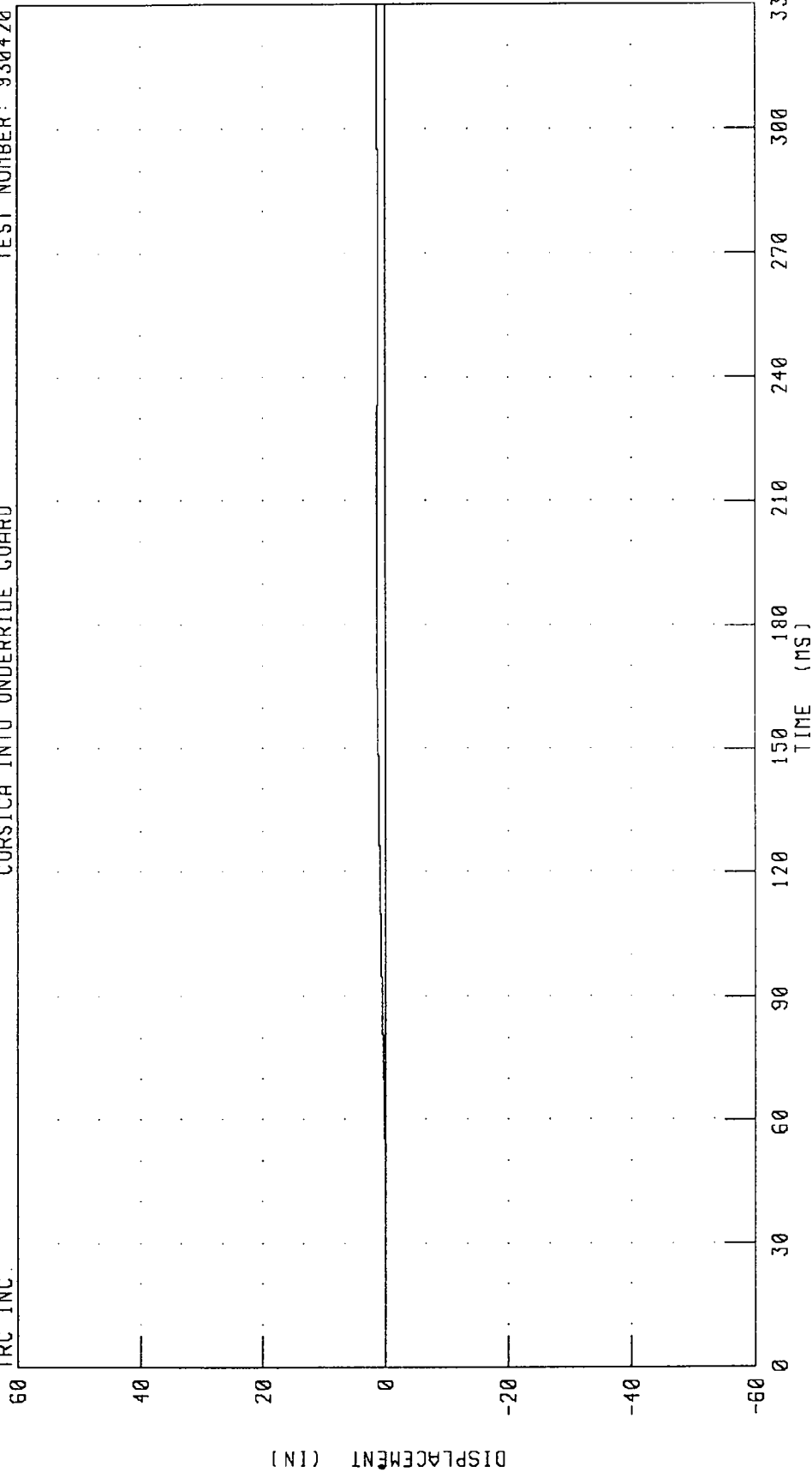
CHANNEL: TRRYV1 FILTER: CH. CLASS 1000 PEAK DATA: 0.99 MPH @ 72.75 MS; -0.53 MPH @ 232.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT Y-AXIS DISPLACEMENT

CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



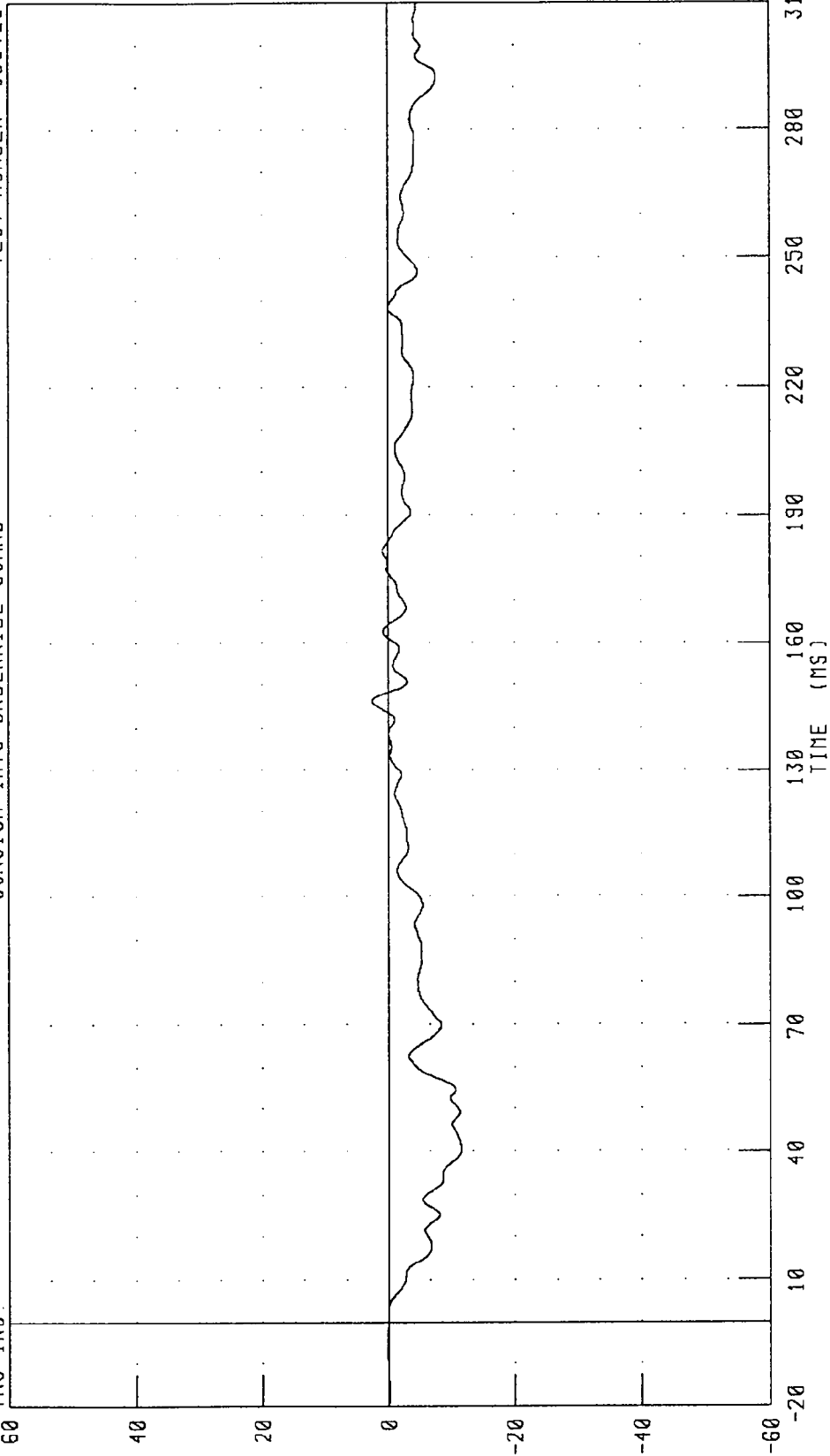
CHANNEL: TRRYD1 FILTER: CH. CLASS 1000

PEAK DATA: 1.44 IN @ 197.38 MS, -0.01 IN @ 18.25 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

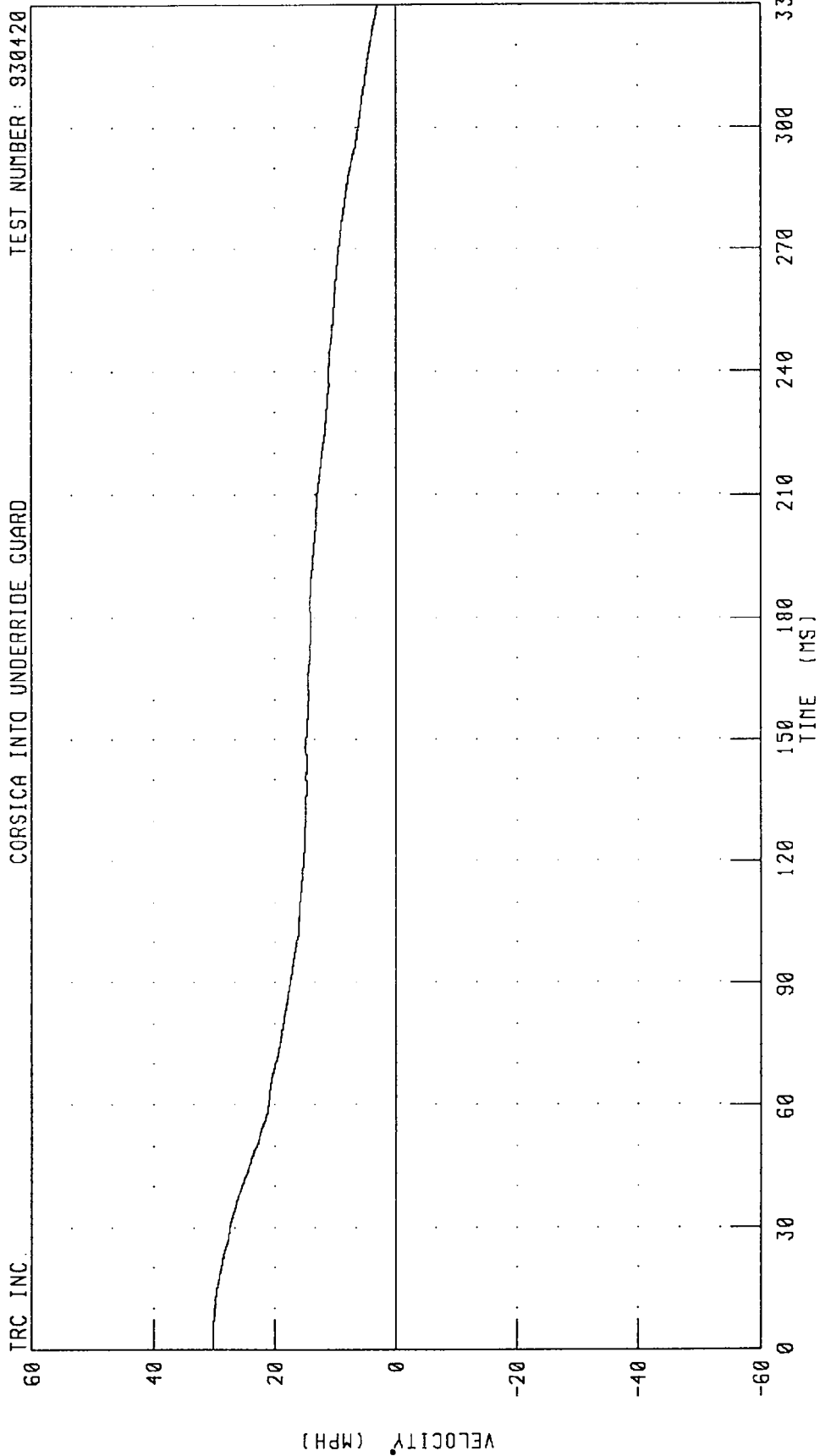


CHANNEL: VCGXG1 FILTER: CH CLASS 60

PEAK DATA: 2.55 G @ 146.25 MS; -11.50 G @ 40.50 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY X-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TRC INC. TEST NUMBER: 930420



CHANNEL: VCGXV1 FILTER: CH. CLASS 1000

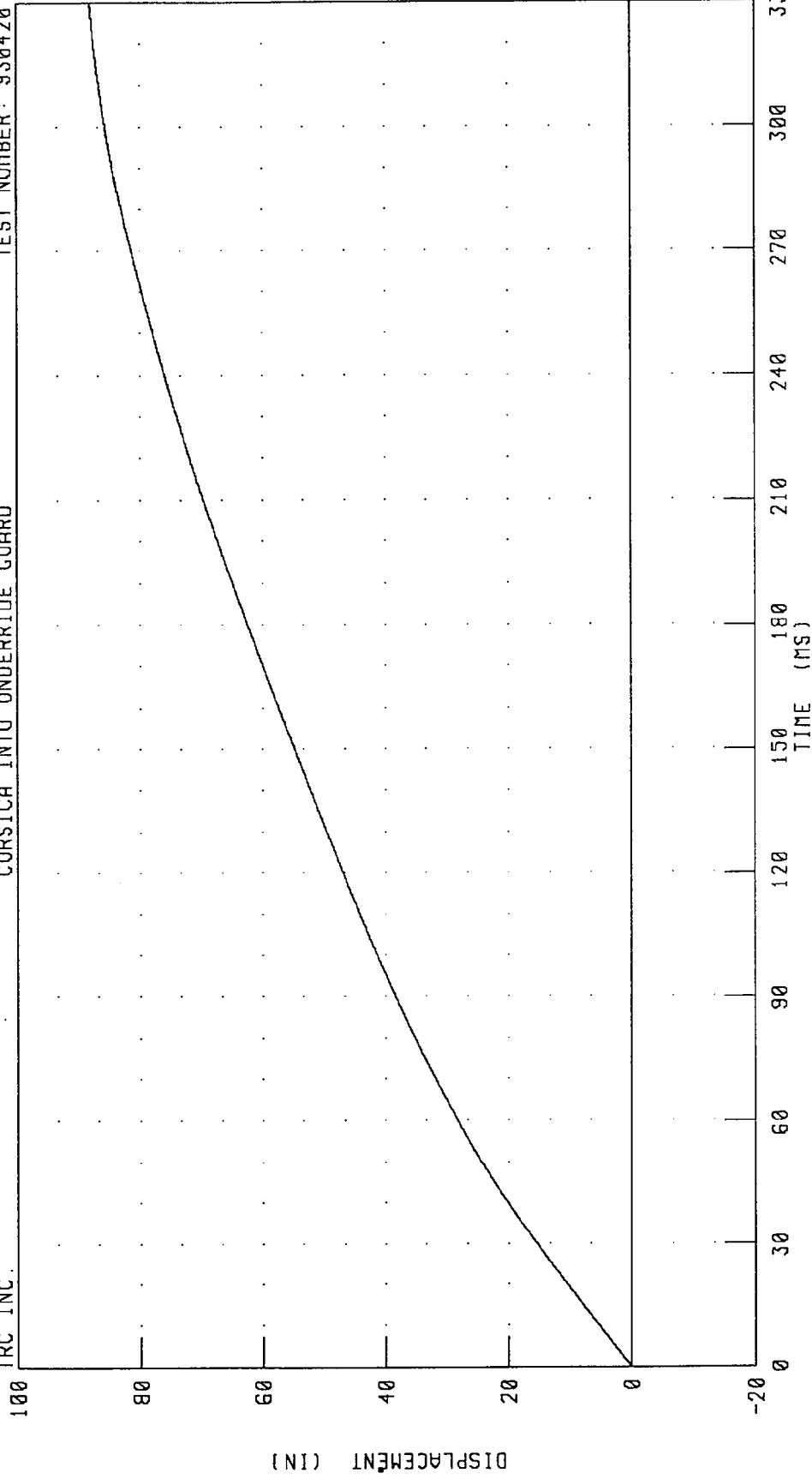
PEAK DATA: 30.11 MPH @ 4.88 MS; 3.06 MPH @ 330.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY X-AXIS DISPLACEMENT

TEST NUMBER: 930420

CORSICA INTO UNDERRIDE GUARD

TRC INC.

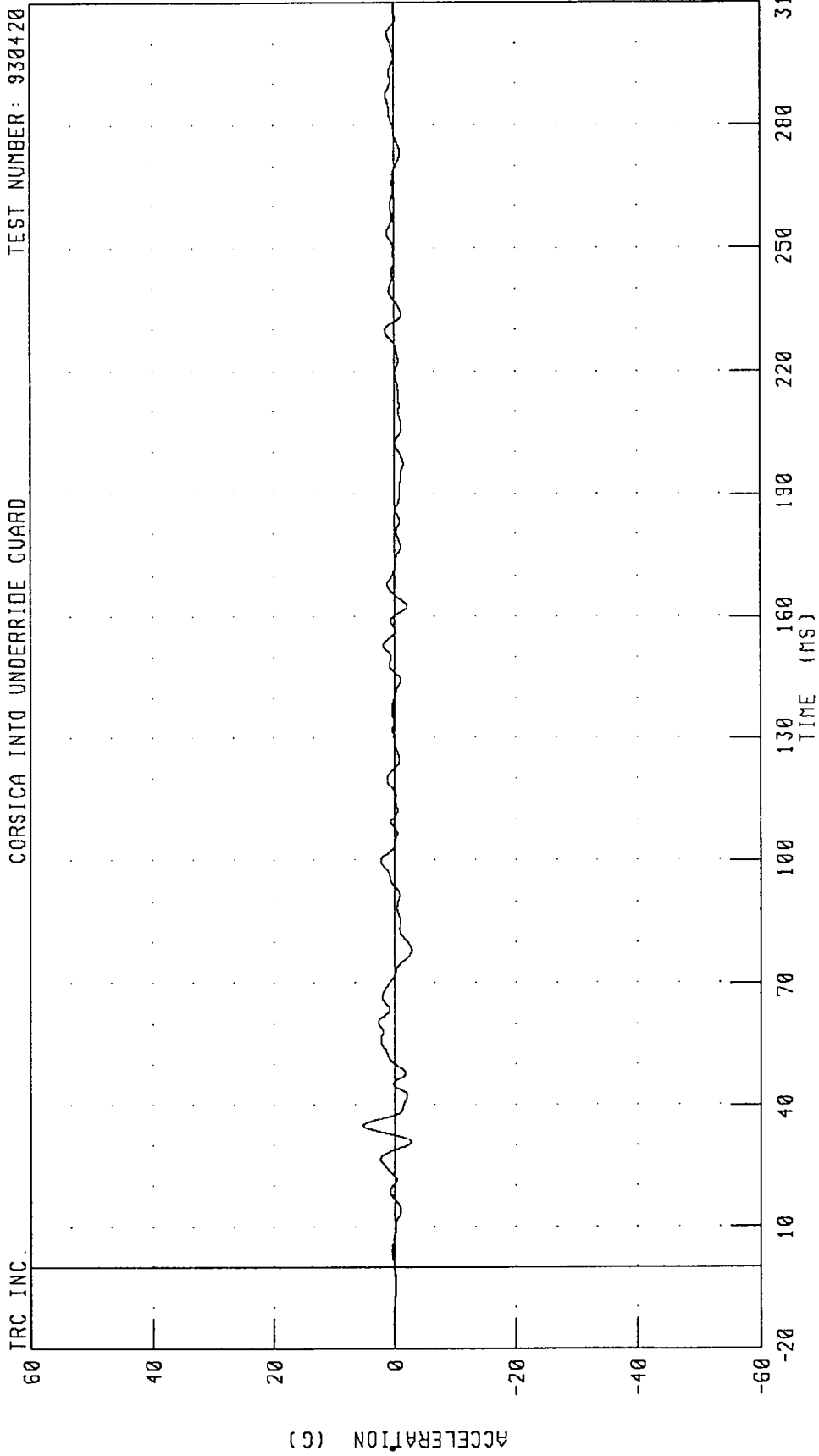


CHANNEL: VCGX01 FILTER: CH. CLASS 1000

PEAK DATA: 88.00 IN @ 330.00 MS; 0.00 IN @ 0.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Y-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



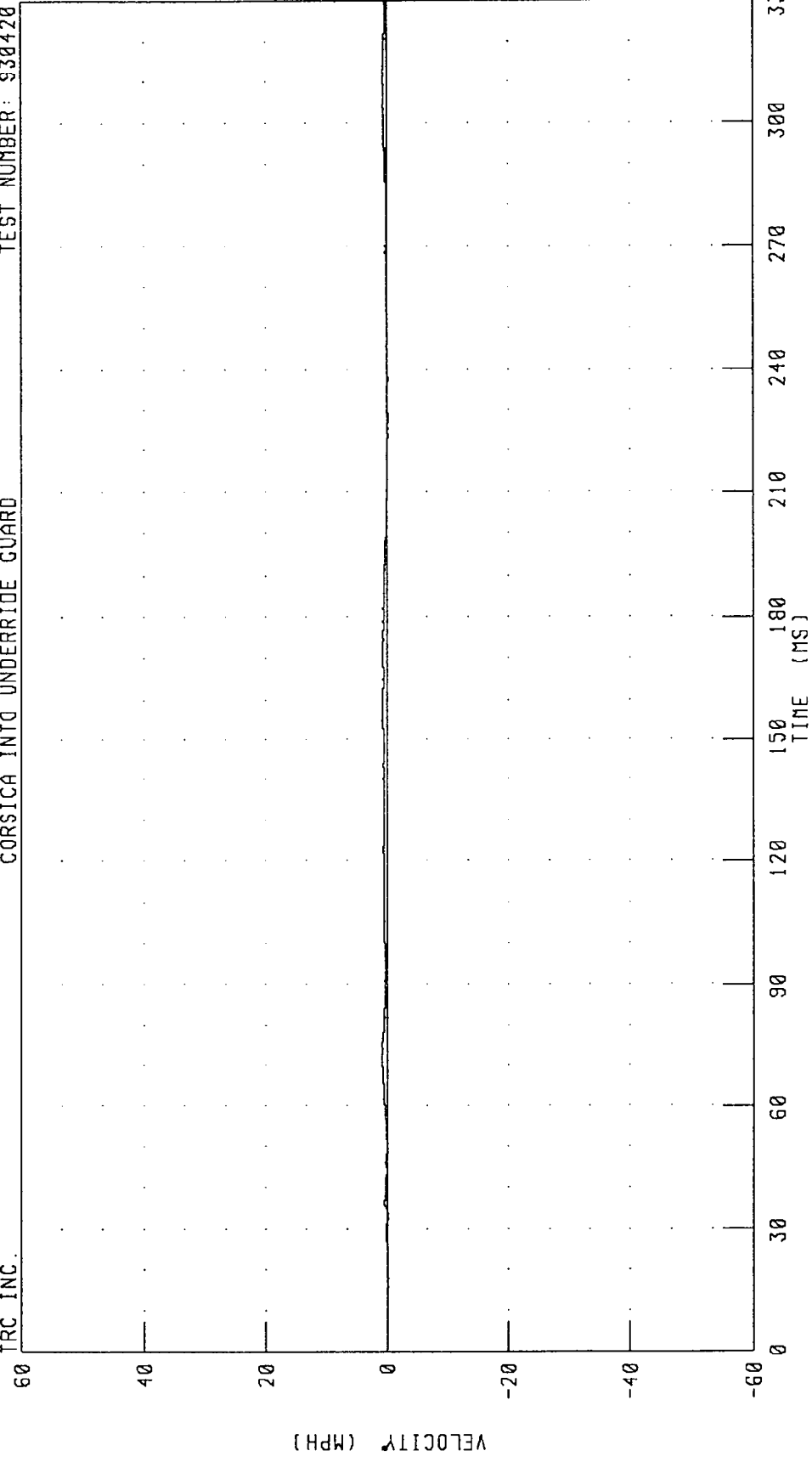
CHANNEL: YCGYG1 FILTER: CH. CLASS 60

PEAK DATA: 5.27 G @ 35.00 MS; -2.81 G @ 78.13 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Y-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



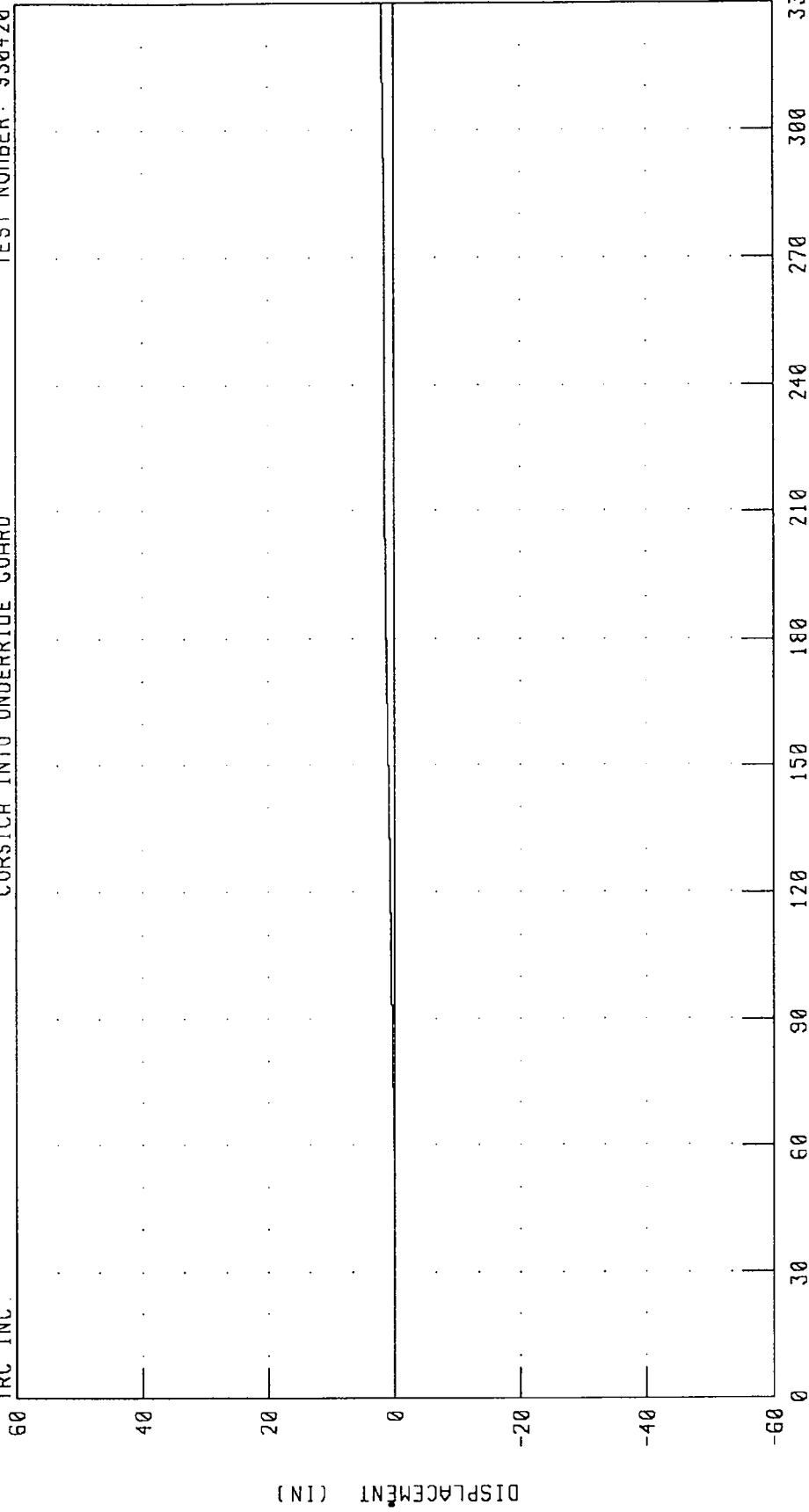
CHANNEL: VCGYV1 FILTER: CH. CLASS 1000

PEAK DATA: 0.85 MPH @ 70.63 MS; -0.12 MPH @ 227.25 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Y-AXIS DISPLACEMENT
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



CHANNEL: VCGYD1 FILTER: CH CLASS 1000

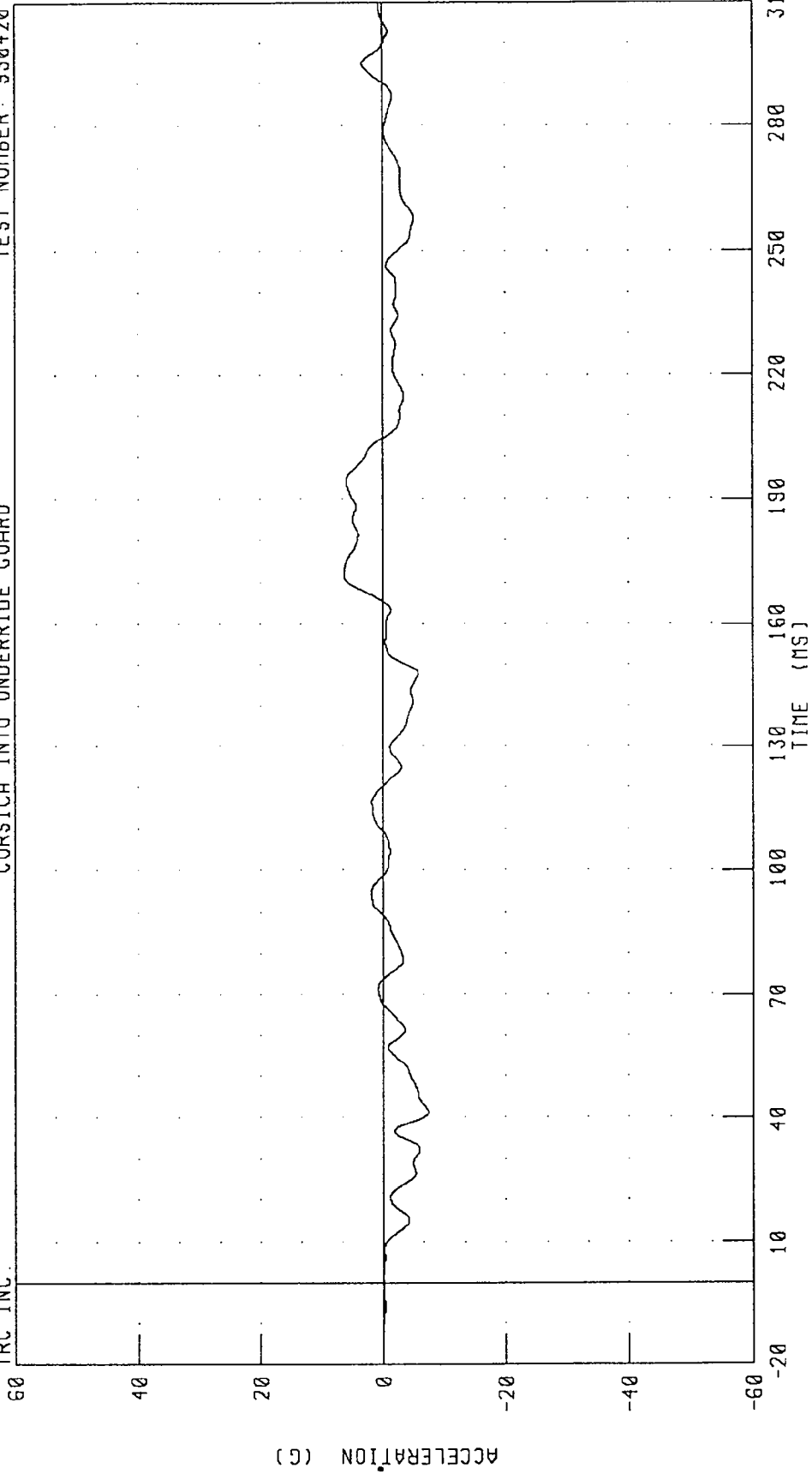
PEAK DATA: 1.94 IN @ 330.00 MS; 0.00 IN @ 24.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Z-AXIS ACCELERATION

TEST NUMBER: 930420

CORSICA INTO UNDERRIDE GUARD

TRC INC.



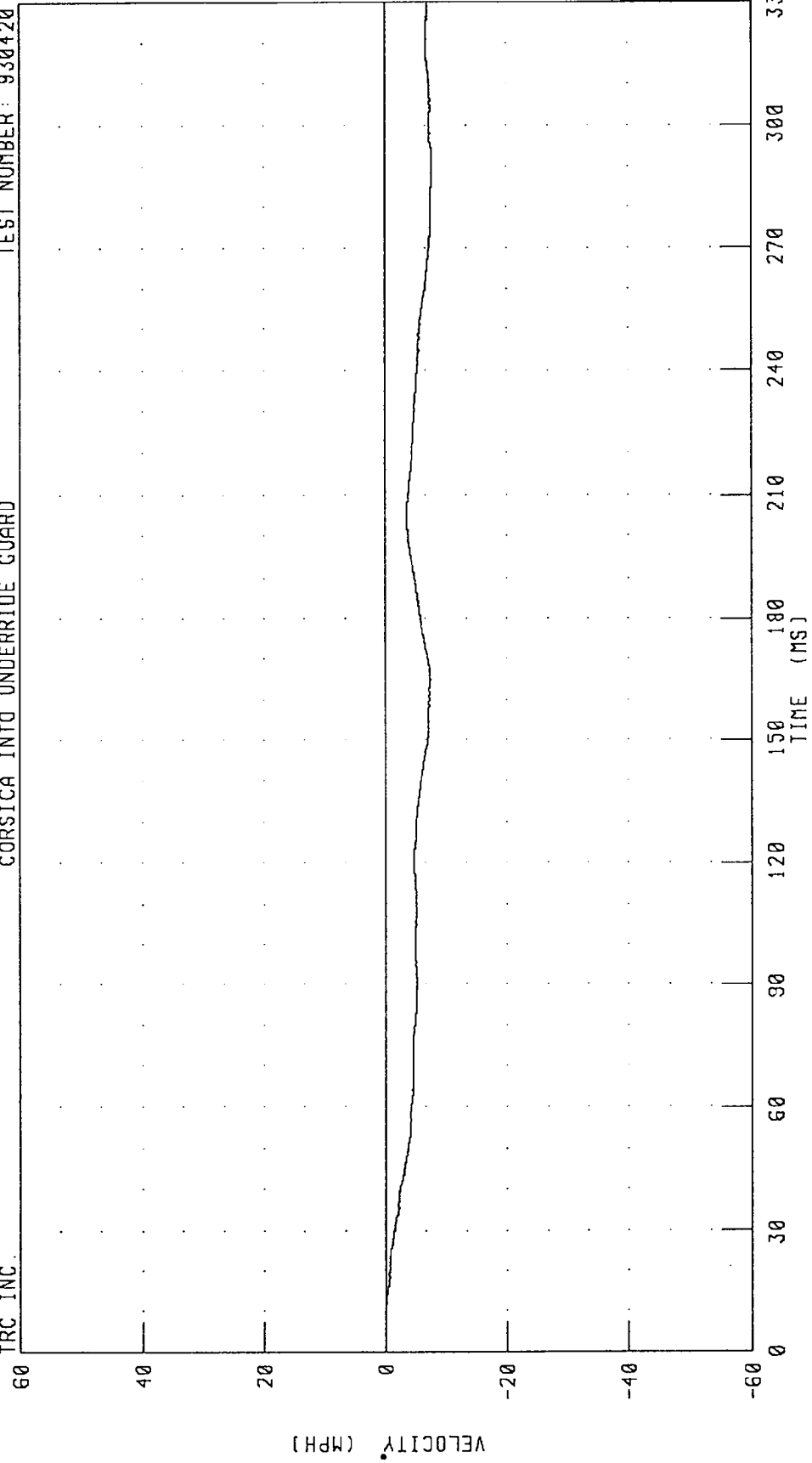
CHANNEL: VCGZG1 FILTER: CH. CLASS 60

PEAK DATA: 6.36 G @ 171.88 MS; -7.41 G @ 41.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Z-AXIS VELOCITY
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



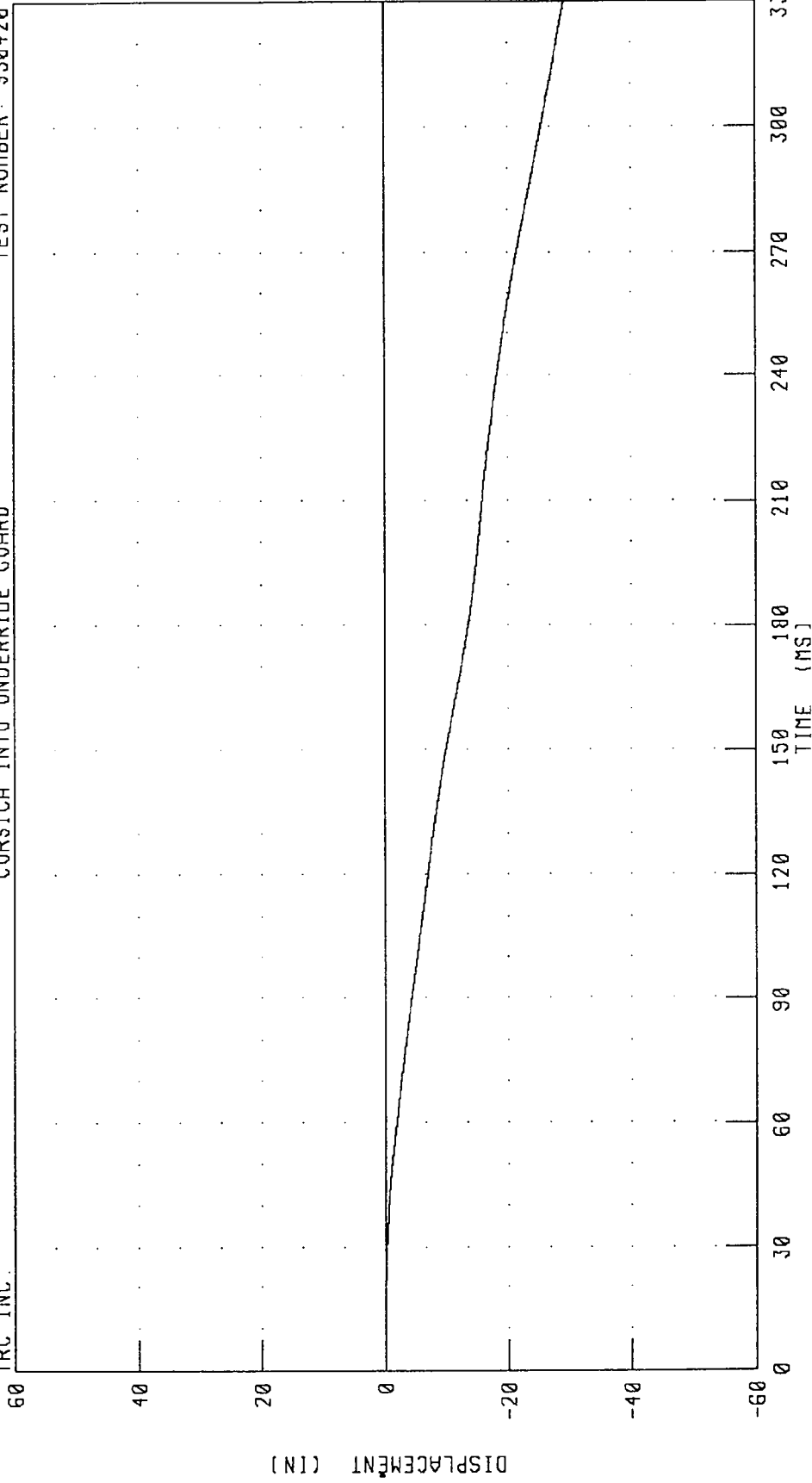
CHANNEL: VCGZV1 FILTER: CH. CLASS 1000

PEAK DATA: 0.01 MPH @ 0.75 MS; -7.70 MPH @ 290.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Z-AXIS DISPLACEMENT
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.



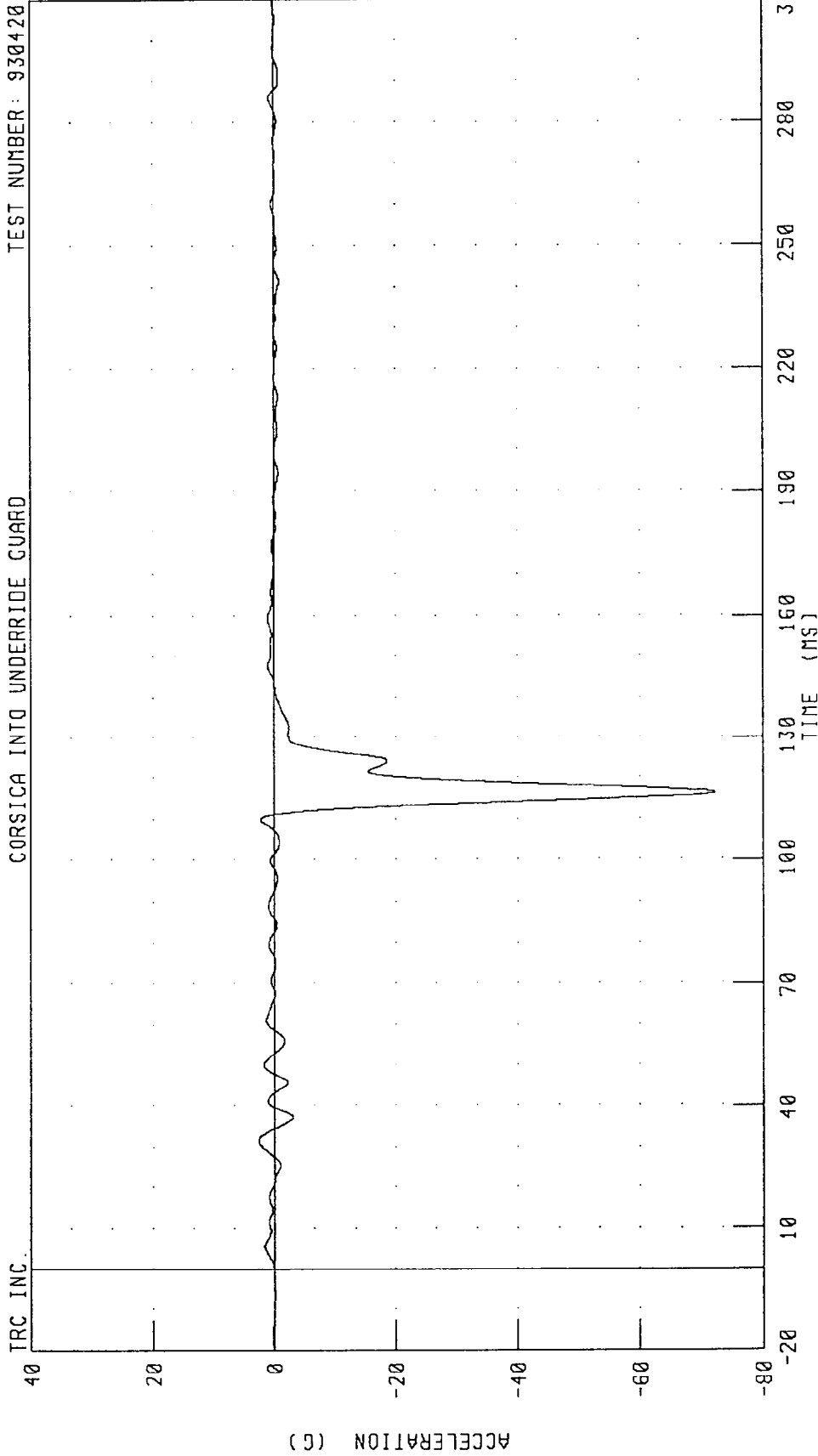
CHANNEL: YCGZD1 FILTER: CH. CLASS 1000

PEAK DATA: 0.00 IN @ 2.50 MS; -29.09 IN @ 330.00 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT SIDE OF TRAILER X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

TRC INC.

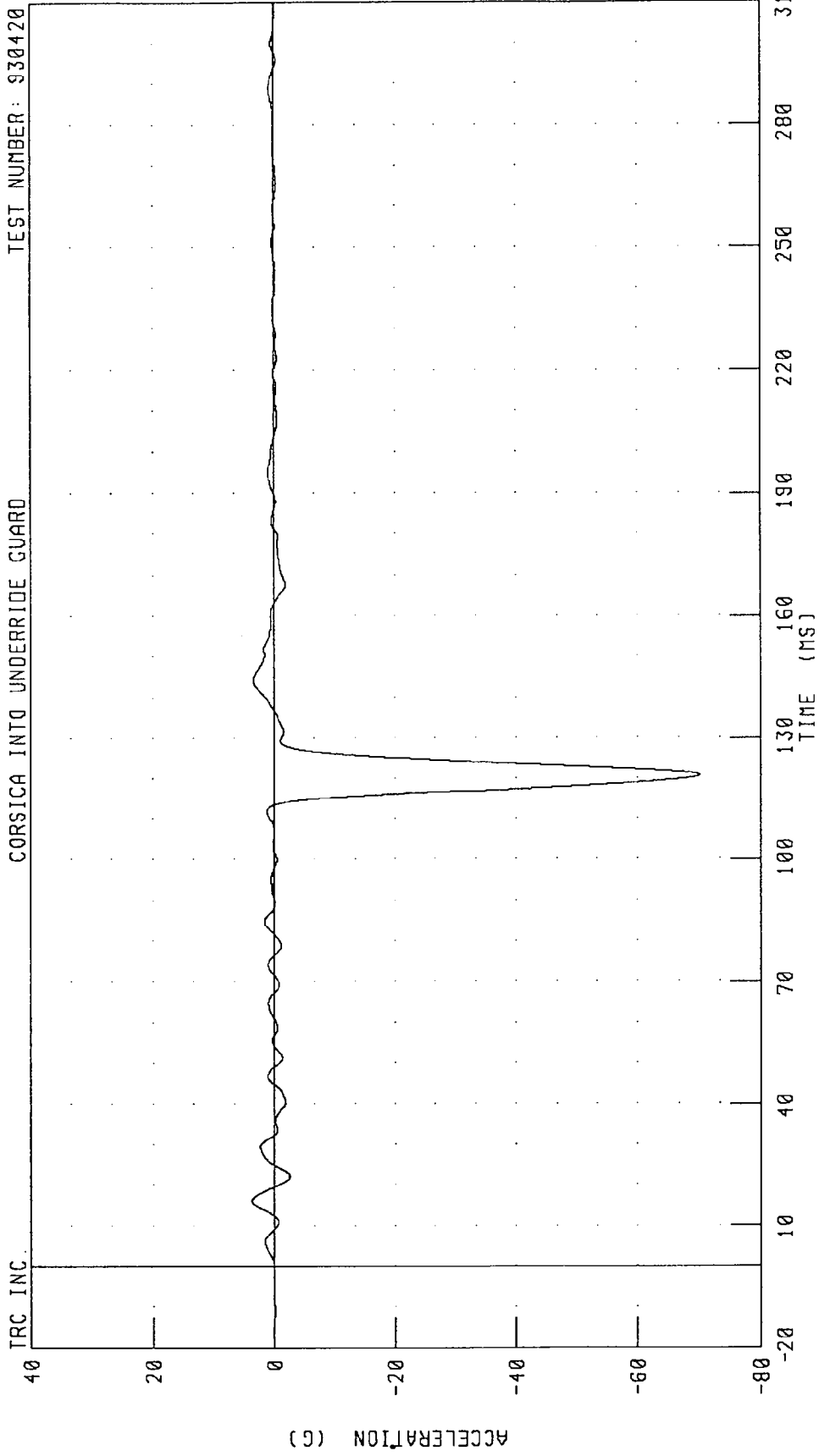


CHANNEL: 0THXG1 FILTER: CH. CLASS 60

PEAK DATA: 2.60 G @ 31.63 MS; -72.19 G @ 116.38 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT SIDE OF TRAILER X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420



CHANNEL: 0THXG2 FILTER: CH. CLASS 60

PEAK DATA: 3.67 G @ 16.13 MS, -70.16 G @ 120.88 MS

1991 CHEVROLET CORSICA INTO HEAVY TRUCK REAR UNDERRIDE GUARD
TRACTOR FRAME X-AXIS ACCELERATION
CORSICA INTO UNDERRIDE GUARD

TEST NUMBER: 930420

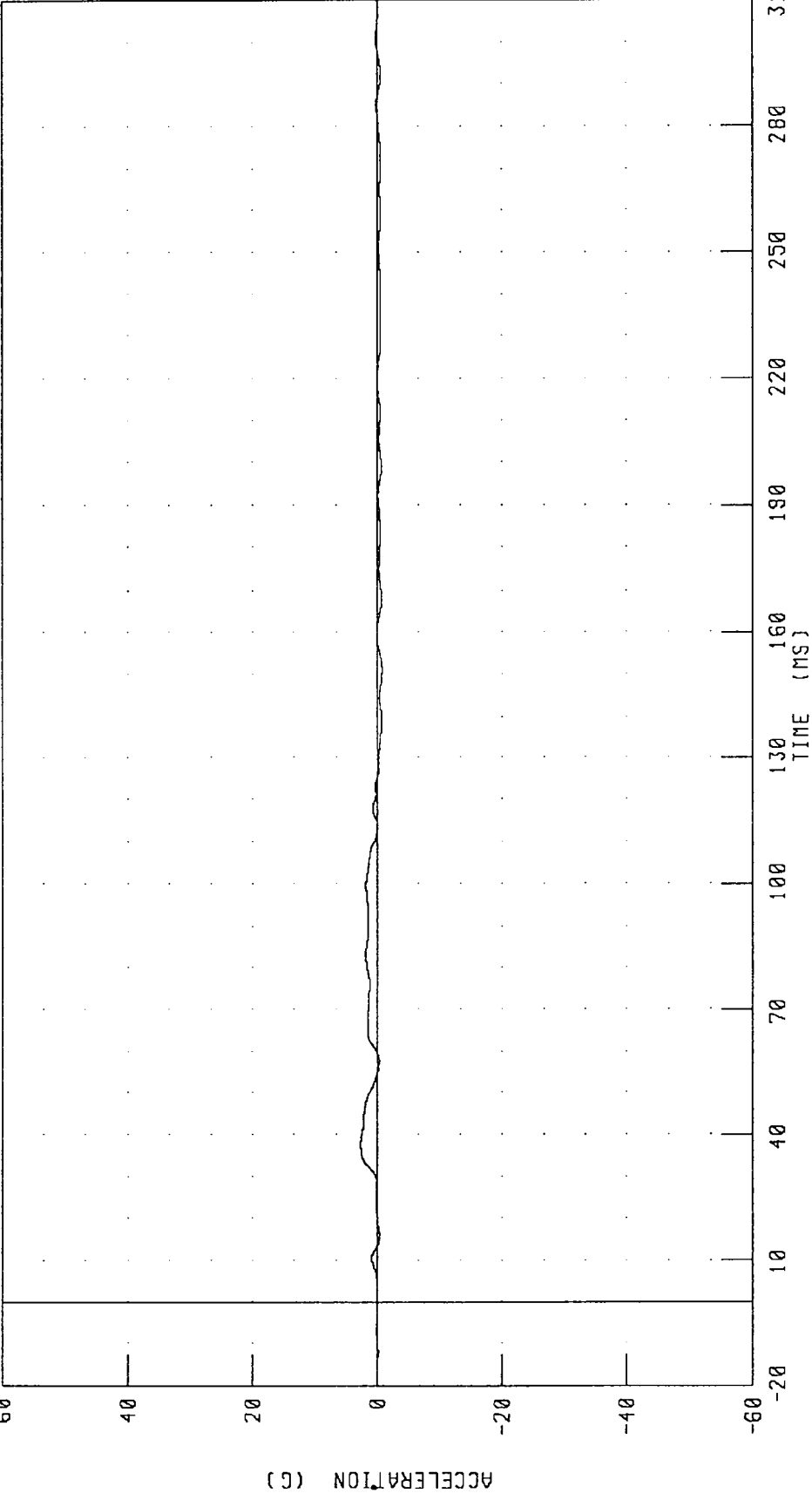
TRC INC.

ACCELERATION (G)

TIME (MS)

CHANNEL: 0THXG3 FILTER: CH. CLASS 60

PEAK DATA: 2.65 G @ 37.75 MS, -0.77 G @ 151.13 MS



APPENDIX C

DUMMY CERTIFICATION DATA

PRE-TEST CERTIFICATION DATA

DRIVER DUMMY S/N 043

TRANSPORTATION RESEARCH CENTER OF OHIO
HYBRID III EXTERNAL DIMENSIONS
43 HUMANOID

24-MAR-93

TRC 43C3ED1 572E SN43 EXT. DIMENSION CAL03

| TEST PARAMETER | (DIMEN.) | SPECIFICATION | TEST RESULTS |
|---------------------------------------|----------|---------------|--------------|
| TEMPERATURE | | | 71.0 DEG. F |
| RELATIVE HUMIDITY | | | 50.0 % |
| LOCATION FOR CHEST CIRCUMFERENCE (AA) | | 16.9-17.1 IN | 17.0 IN |
| LOCATION FOR WAIST CIRCUMFERENCE (BB) | | 8.9- 9.1 IN | 9.0 IN |
| CHEST CIRCUMFERENCE | (Y) | 38.2-39.4 IN | 39.3 IN |
| WAIST CIRCUMFERENCE | (Z) | 32.9-34.1 IN | 33.4 IN |
| CHEST DEPTH | (D) | 8.4- 9.0 IN | 8.6 IN |
| H-POINT HEIGHT | (C) | 3.3- 3.5 IN | 3.4 IN |
| H-POINT FROM SEATBACK | (D) | 5.3- 5.5 IN | 5.4 IN |
| SKULL CAP TO BACKLINE | (H) | 1.6- 1.8 IN | 1.7 IN |
| TOTAL SITTING HEIGHT | (A) | 34.6-35.0 IN | 34.8 IN |
| THIGH CLEARANCE | (F) | 5.5- 6.1 IN | 6.1 IN |
| BUTTOCK KNEE LENGTH | (K) | 22.8-23.8 IN | 23.8 IN |
| BUTTOCK POPLITEAL LENGTH | (N) | 17.8-18.8 IN | 18.7 IN |
| POPLITEAL HEIGHT | (L) | 16.9-17.9 IN | 16.9 IN |
| KNEE PIVOT HEIGHT | (M) | 19.1-19.7 IN | 19.3 IN |
| FOOT LENGTH | (P) | 9.9-10.5 IN | 10.1 IN |
| FOOT BREADTH | (W) | 3.6- 4.2 IN | 3.8 IN |
| SHOULDER PIVOT FROM BACKLINE | (E) | 3.3- 3.7 IN | 3.6 IN |
| SHOULDER BREADTH | (V) | 16.6-17.2 IN | 16.7 IN |
| SHOULDER PIVOT HEIGHT | (B) | 19.9-20.5 IN | 20.2 IN |
| ELBOW REST HEIGHT | (J) | 7.5- 8.3 IN | 7.9 IN |
| SHOULDER-ELBOW LENGTH | (I) | 13.0-13.6 IN | 13.5 IN |
| BACK OF ELBOW TO WRIST PIVOT | (G) | 11.4-12.0 IN | 11.4 IN |

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Fount

TRANSPORTATION RESEARCH CENTER INC.

HEAD DROP TEST

HYBRID III

24-MAR-93

TRC

43C3HD1

572E SN43 HEAD DROP CAL 03

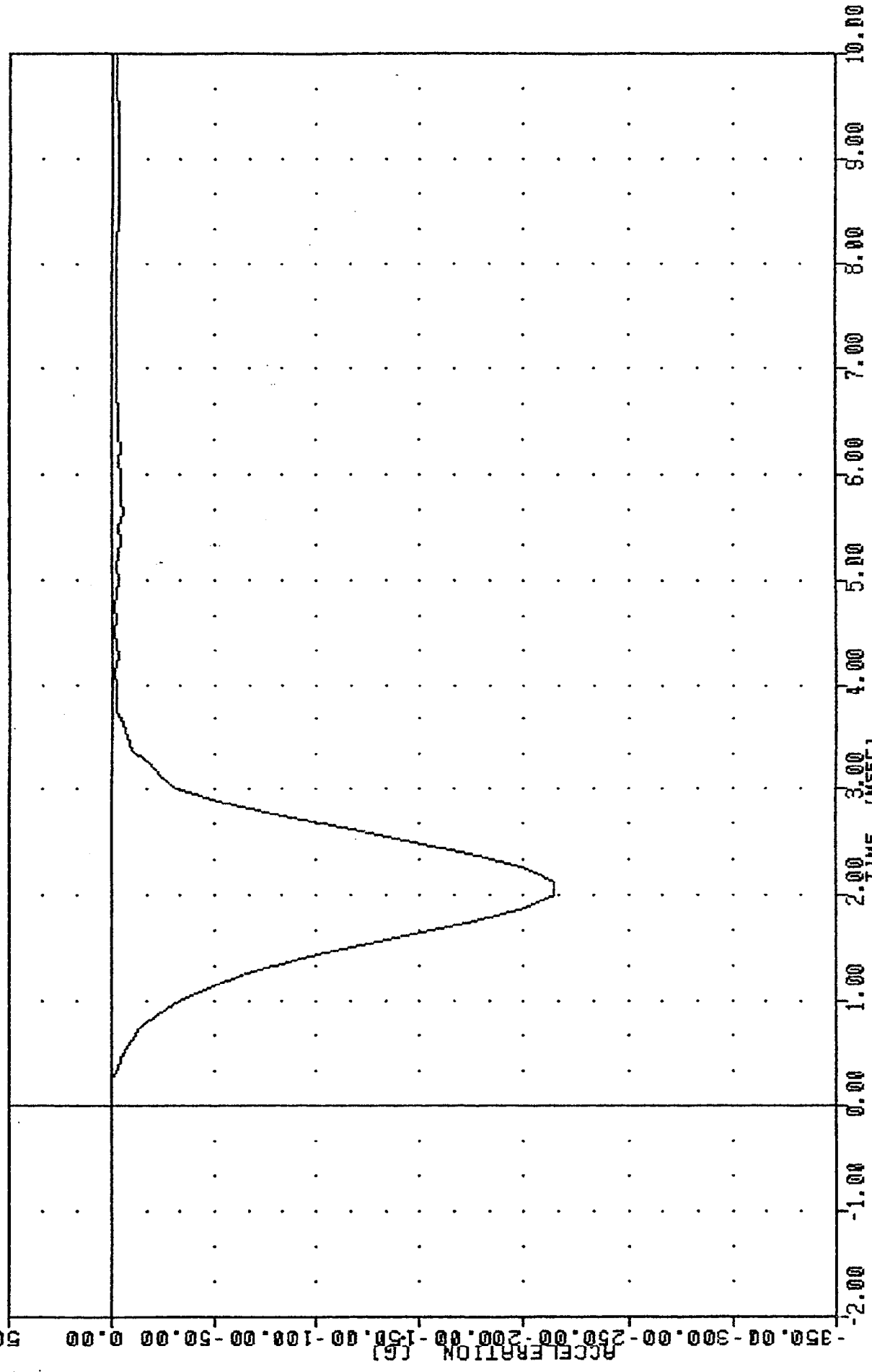
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---------------------------------|----------------|--------------|
| TEMPERATURE | 66 - 78 DEG. F | 71.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| PEAK RESULTANT ACCELERATION | 225 - 275 G | 248.87 G |
| PEAK LATERAL ACCELERATION | 15 G MAX | -3.06 G |
| IS ACCELERATION CURVE UNIMODAL? | YES | YES |

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Font

TRC
572E SN43 HEAD DROP CAL 03
93083
HEDXG

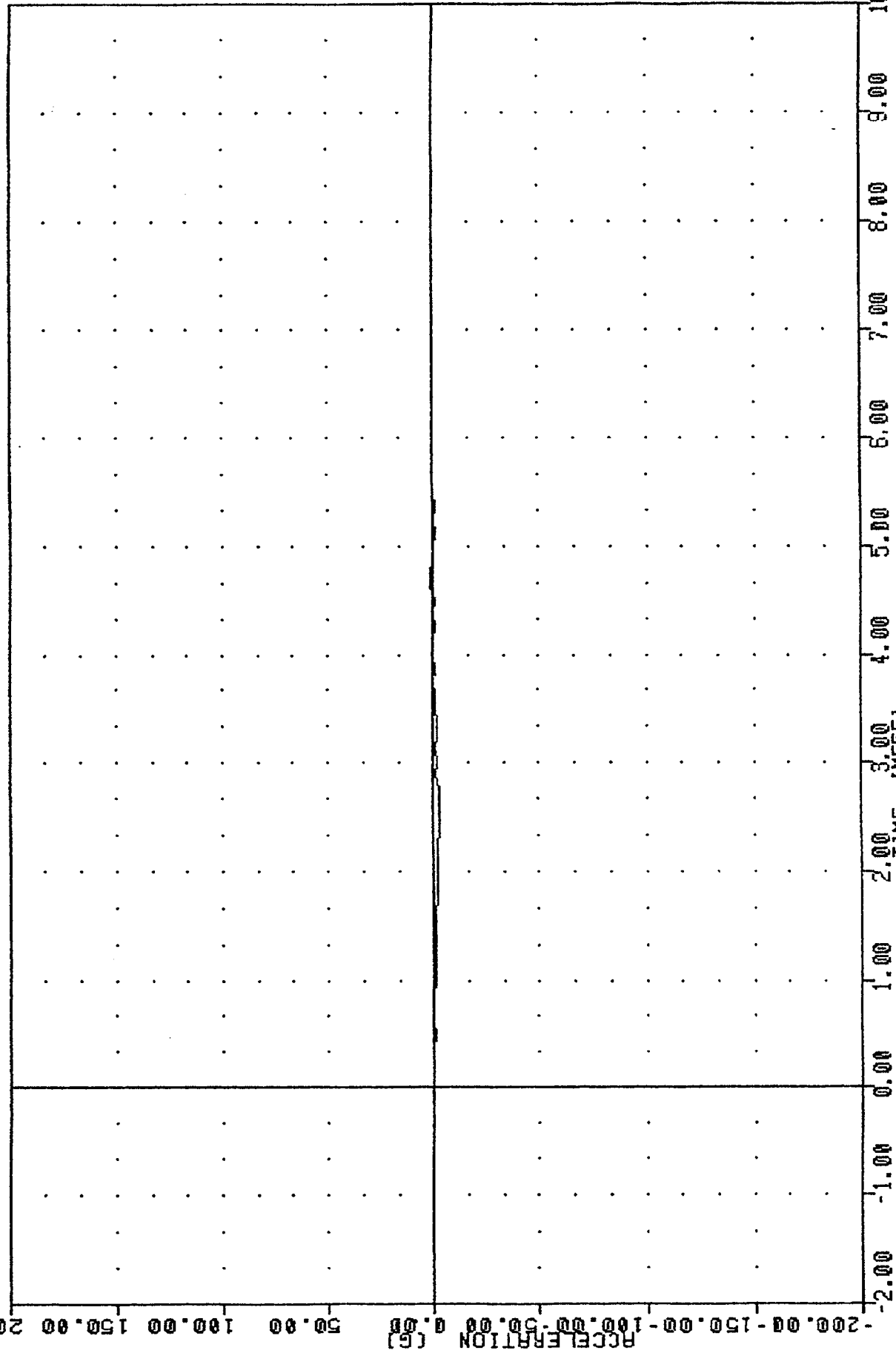
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -214.88# 2.13, 0.01 e -2.00



PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION X AXIS

TRC
 572E SN49 HEAD DROP CAL 03
 93083
 HEDYG

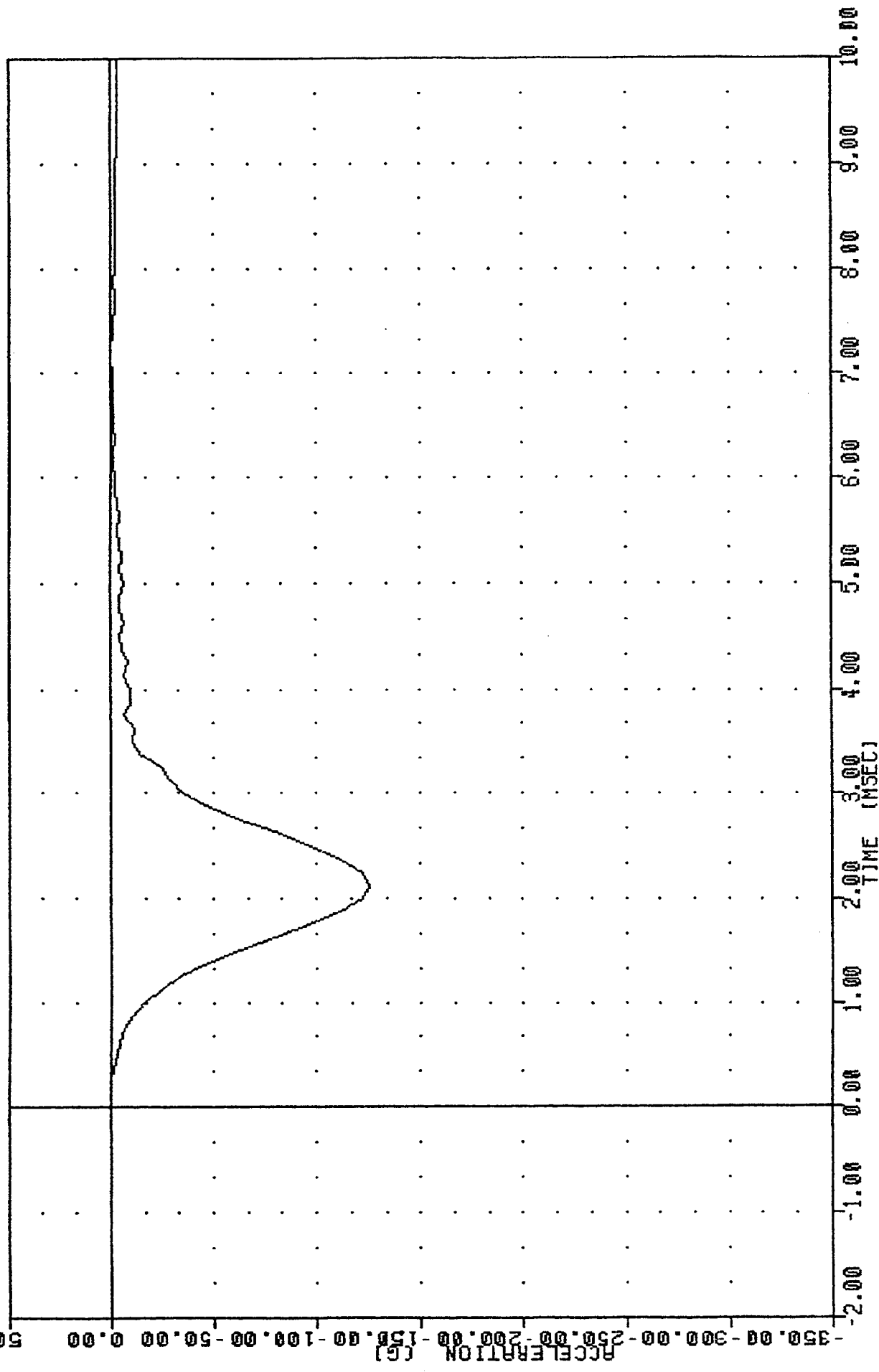
FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = -3.07e 2.63, 0.89 e 4.63



PART 572-E HYBRID III HEAD CALIBRATION
 HEAD ACCELERATION Y AXIS

TRC
572E SN43 HEAD DROP CAL 03
93083
HEDZG

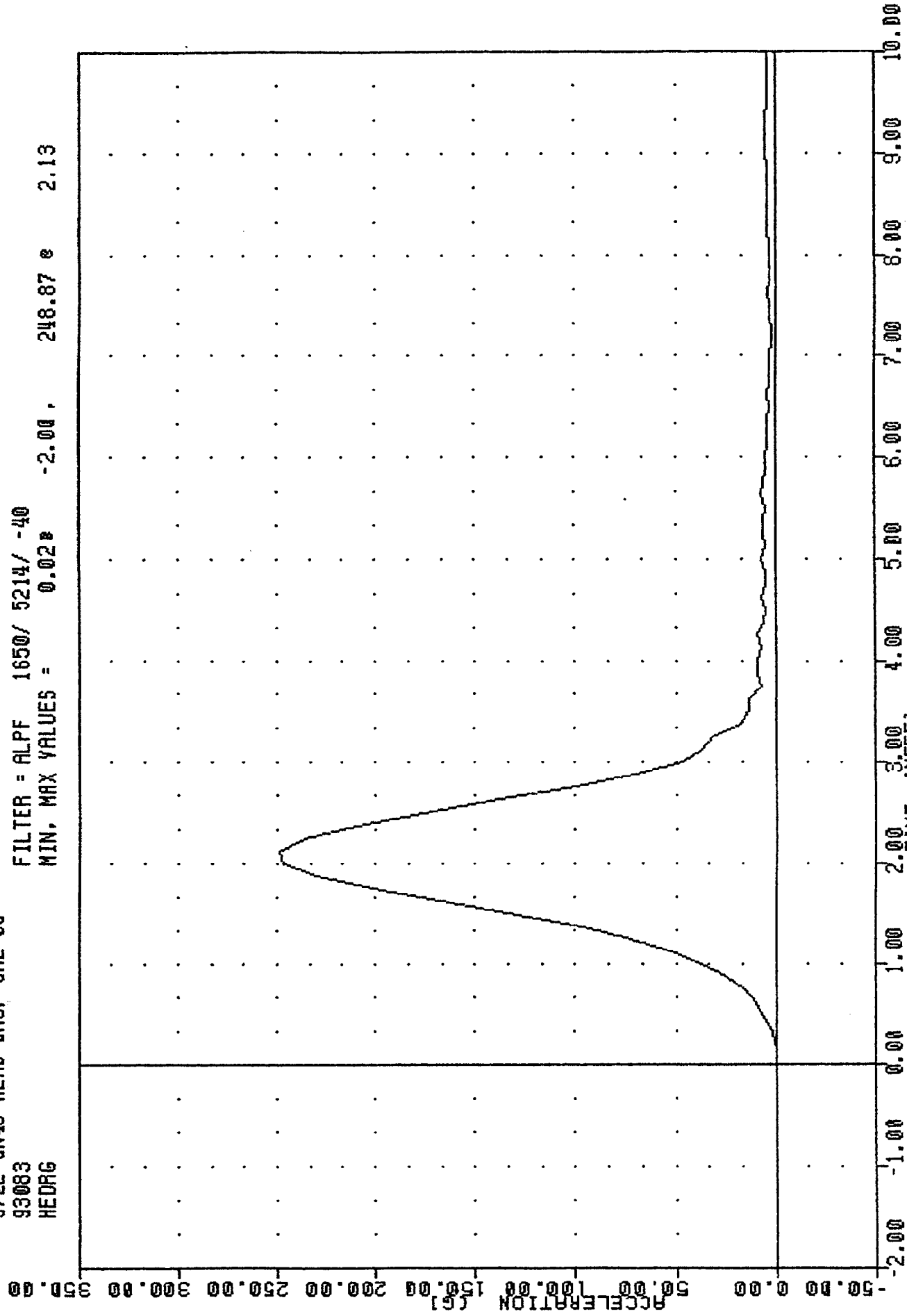
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -125.54* 2.13, 0.02 @ -2.00



PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION Z AXIS

TRC
572E SN49 HEAD DROP CAL 03
93083
HEDRG

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = 0.028 -2.00 , 248.87 e 2.13



PART 572-E HYBRID III HEAD CALIBRATION
HEAD RESULTANT ACCELERATION

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

25-MAR-93

6 AXIS NECK TRANSDUCER
TRC 43C3NF1

572E SN043 NECK FLEXION CAL03

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|--|-------------------------|--------------|
| TEMPERATURE | 69 - 72 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| IMPACT VELOCITY | 22.6 - 23.4 FT/SEC | 23.08 FT/SEC |
| PENDULUM DECELERATION | 10 MS 22.50 - 27.50 G | 22.50 G |
| | 20 MS 17.60 - 22.60 G | 21.30 G |
| | 30 MS 12.50 - 18.50 G | 15.82 G |
| MAX PENDULUM G ABOVE 30 MS | 29 G MAX | 15.75 G |
| DECELERATION-TIME CURVE DECAY TIME TO 5 G | 34 - 42 MS | 38.38 MS |
| D PLANE ROTATION | MAX 64 - 78 DEG. | 68.29 DEG. |
| | TIME 57 - 64 MS | 59.00 MS |
| MOMENT ABOUT OCCIPITAL CONDYLE | MAX 65 - 80 FT,LBS | 73.06 FT,LBS |
| | TIME 47 - 58 MS | 50.75 MS |
| ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO | 113 - 128 MS | 114.13 MS |
| POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO | 97 - 107 MS | 97.13 MS |

TEST MEETS SPECIFICATIONS

TECHNICIAN *Pete Fort*

TRC , 43C3NF1

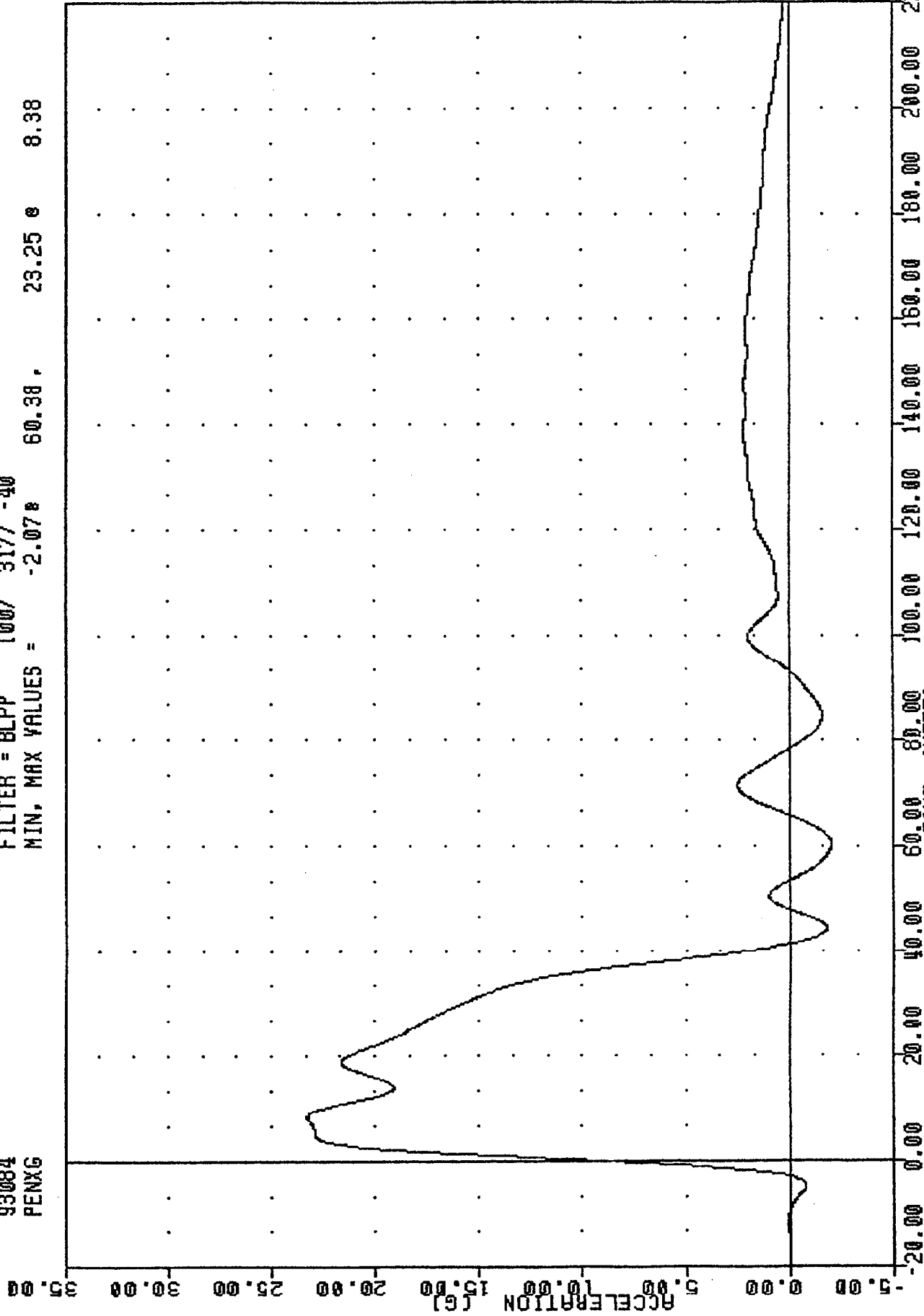
572E SN043 NECK FLEXION CAL03

93084

PENXG

FILTER = BLPP 100/ 317/ -40

MIN, MAX VALUES = -2.078 60.38, 23.25 e 8.38

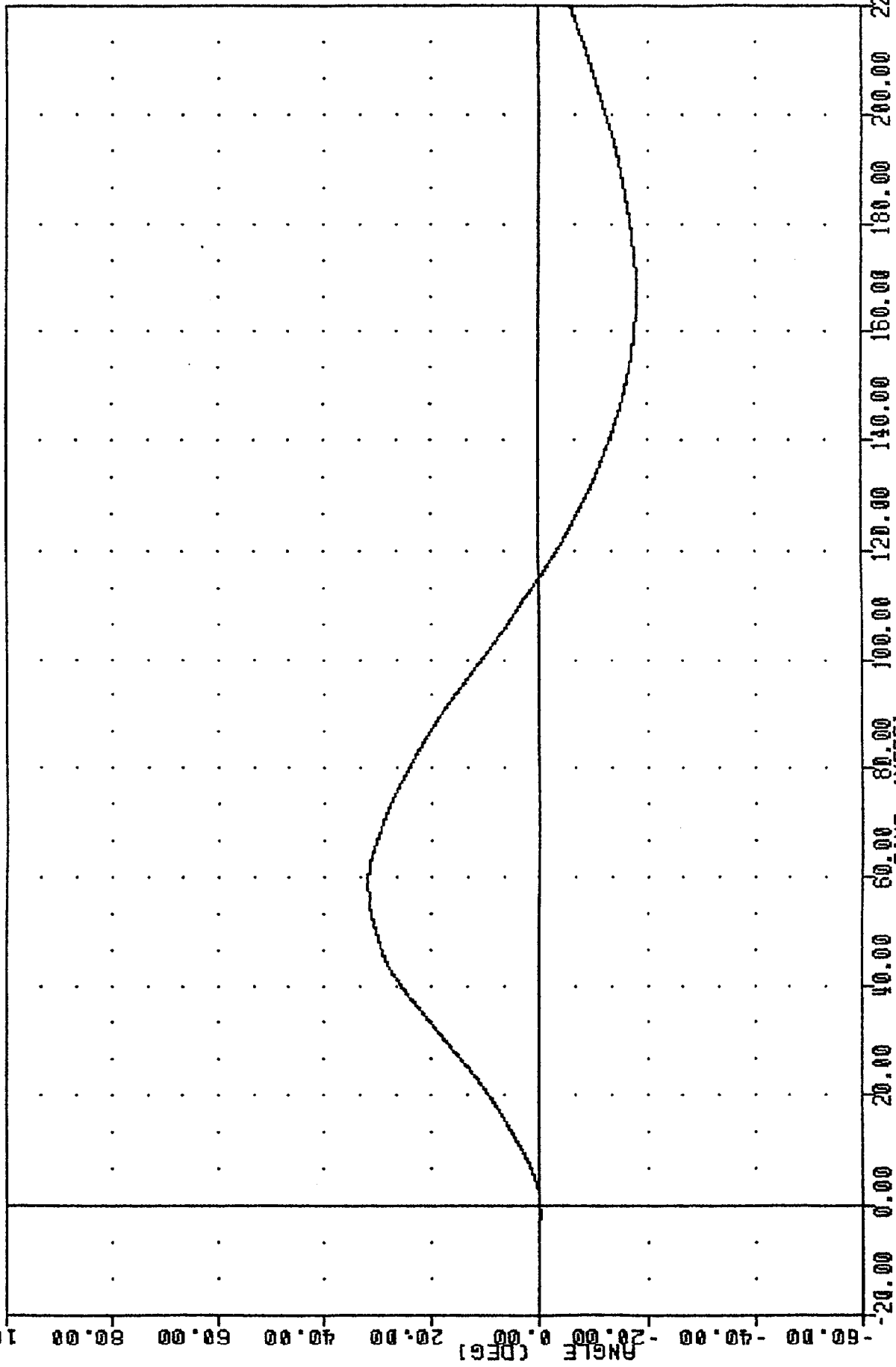


PART 572-E HYBRID III NECK FLEXION CALIBRATION

PENNIIUM PERFFIRATION

TRC
 572E SN049 NECK FLEXION CAL03
 93084
 BETA

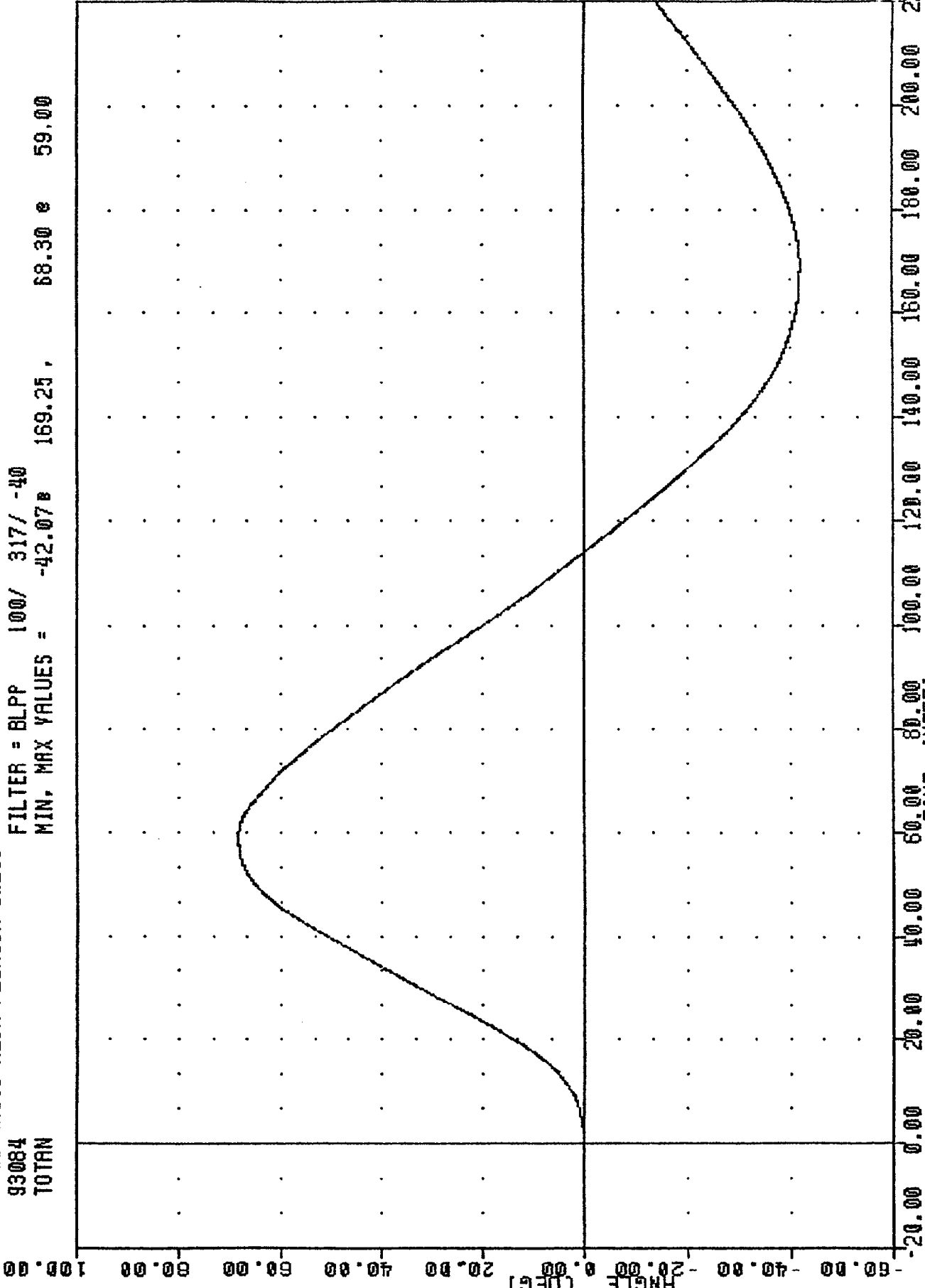
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -17.92 168.75, 31.83 59.00



PART 572-E HYBRID III NECK FLEXION CALIBRATION
 ROTATION ABOUT BASE OF NECK

TRC
572E SN049 NECK FLEXION CAL09
93084
TOTAL

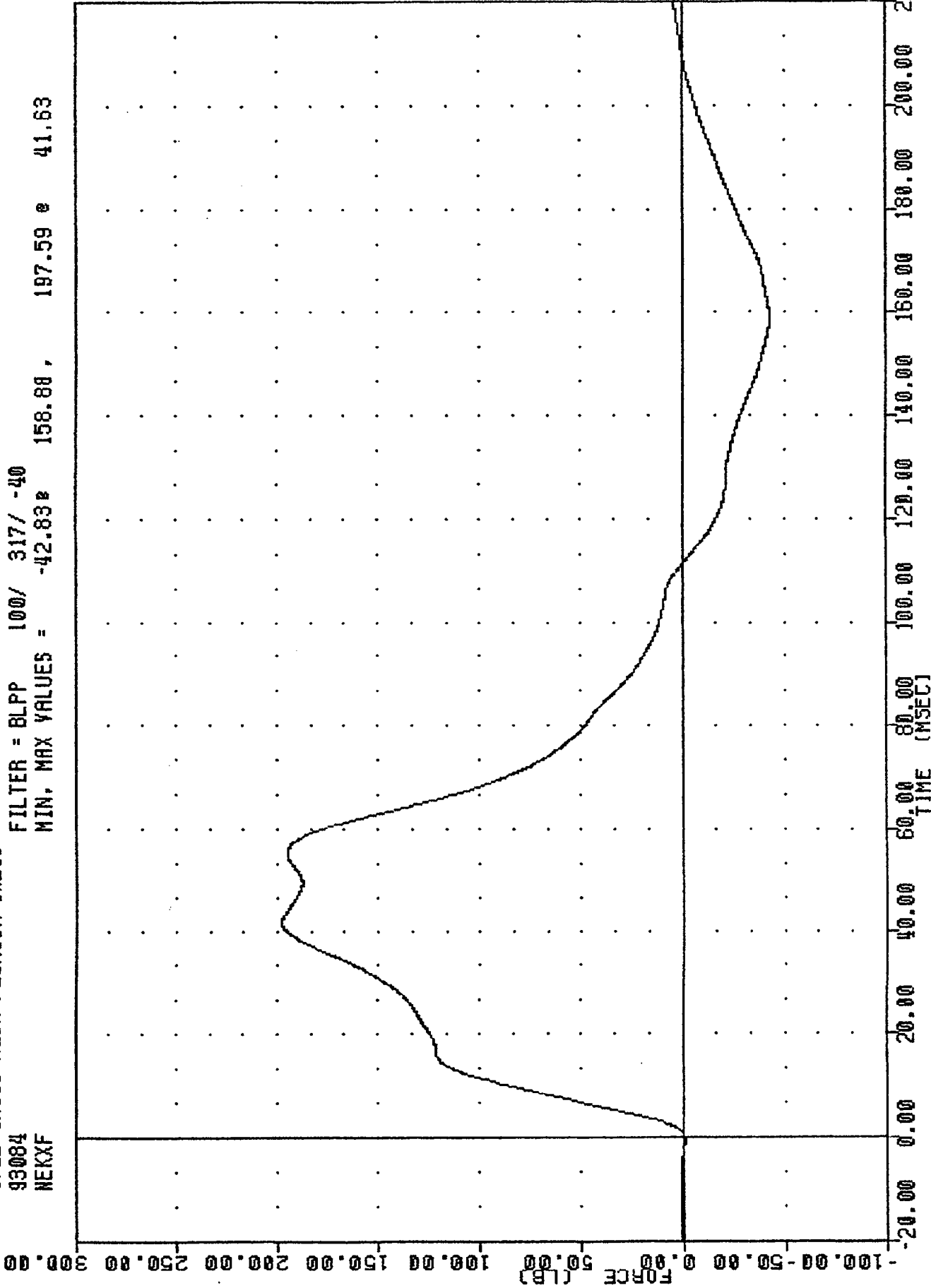
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -42.07 169.25, 68.30 e 59.00



PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL ROTATION

TRC
572E SN049 NECK FLEXION CAL09
93084
NEKXF

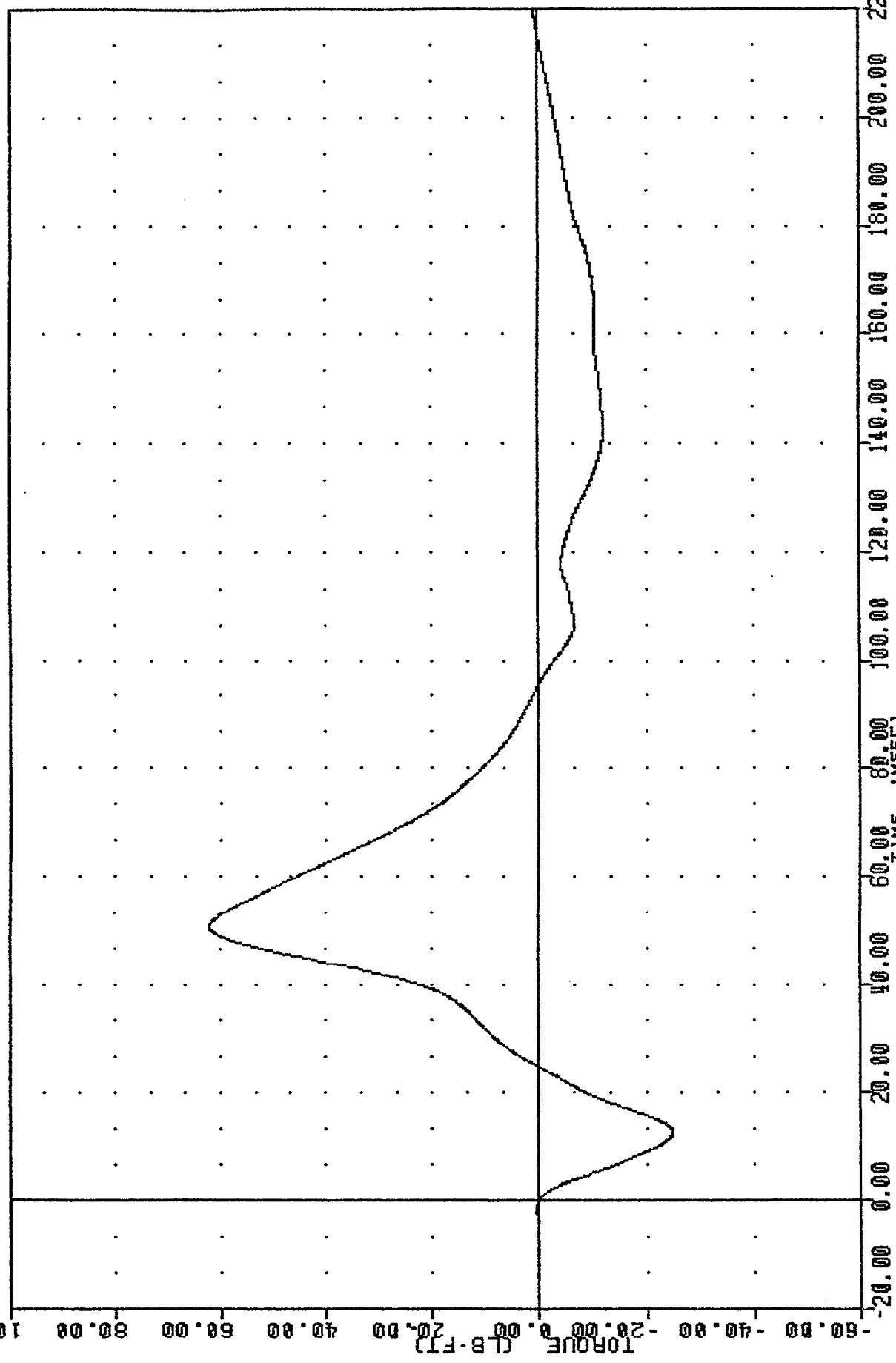
43C3NF1
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -42.83# 158.88, 197.59 e 41.63



PART 572-E HYBRID III NECK FLEXION CALIBRATION
NECK FORCE X AXIS

TAC
572E SN049 NECK FLEXION CAL03
93084
NEKYM

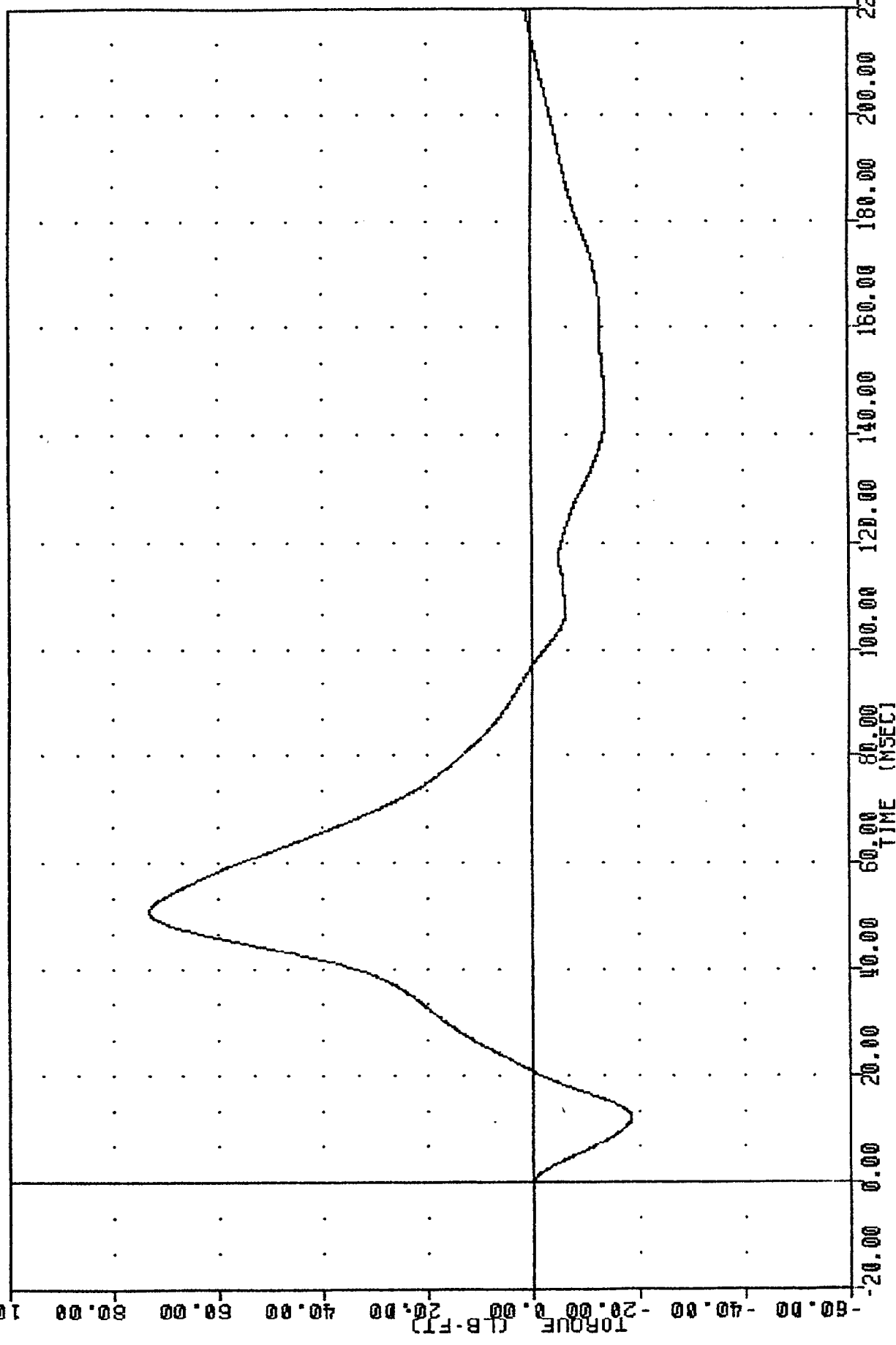
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -24.88 12.63 52.08 e 50.75



PART 572-E HYBRID III NECK FLEXION CALIBRATION
NECK MOMENT Y AXIS

TRC
 572E SN043 NECK FLEXION CAL03
 93084
 NEKOM

FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -18.59 73.06 e 50.75



PART 572-E HYBRID III NECK FLEXION CALIBRATION
 TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

25-MAR-93

6 AXIS NECK TRANSDUCER

TRC

43C3NE1

572E SN043 NECK EXT. CAL03

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|--|---|---------------------------|
| TEMPERATURE | 69 - 72 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| IMPACT VELOCITY | 19.50-20.30 FT/SEC | 19.83 FT/SEC |
| PENDULUM DECELERATION | 10 MS 17.20 - 21.20 G | 17.89 G |
| | 20 MS 14.00 - 19.00 G | 17.19 G |
| | 30 MS 11.00 - 16.00 G | 13.34 G |
| MAX PENDULUM G ABOVE 30 MS | 22 G MAX | 13.31 G |
| DECELERATION-TIME CURVE DECAY TIME TO 5 G | 38 - 46 MS | 40.25 MS |
| D PLANE ROTATION | MAX 81 - 106 DEG. TIME 72 - 82 MS | 91.83 DEG. 74.88 MS |
| MOMENT ABOUT OCCIPITAL CONDYLE | MIN -59.0/-39.0 FT,LBS TIME 65 - 79 MS | -46.90 FT,LBS 69.63 MS |
| ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO | 147 - 174 MS | 154.13 MS |
| NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO | 120 - 148 MS | 135.13 MS |

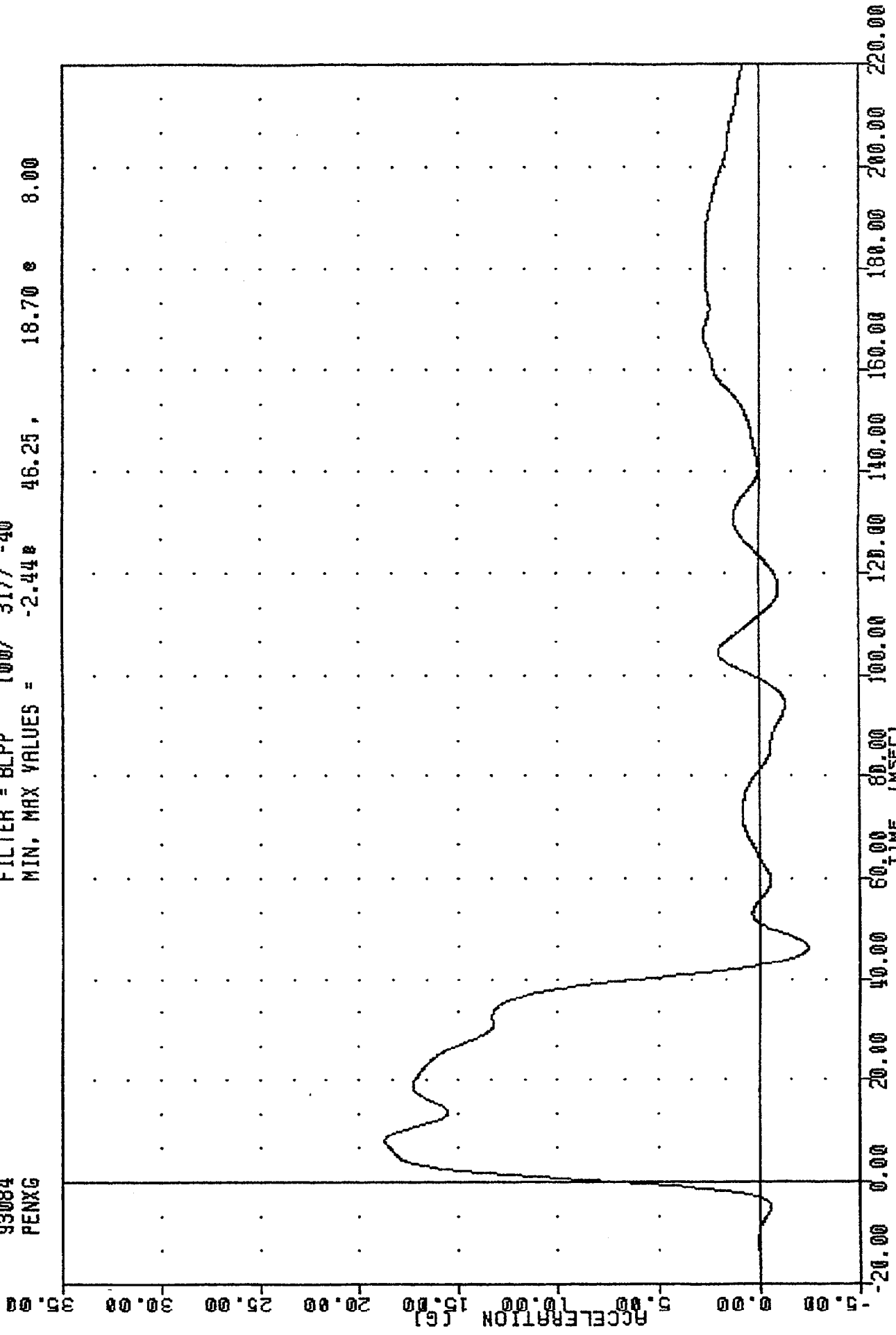
TEST MEETS SPECIFICATIONS

TECHNICIAN

Pete Smith

TRC
572E SNO43 NECK EXT. CAL03
93084
PENXG

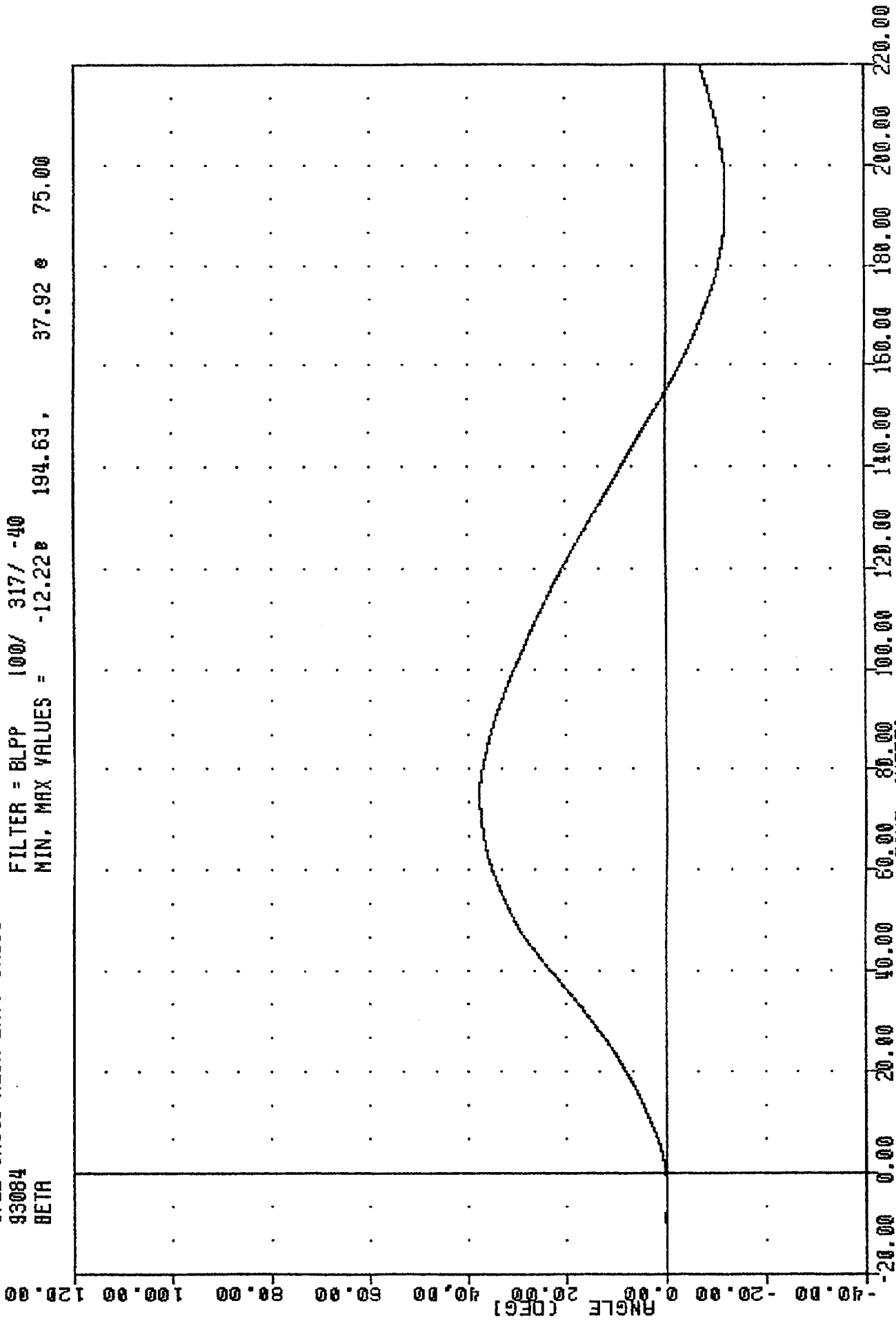
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -2.44e 46.25, 18.70 e 8.00



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
PENNYLIM RECALIBRATION

TAC
 572E SN049 NECK EXT. CAL03
 93084
 BETA

FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -12.22B 194.63, 37.92 * 75.00



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 ROTATION ABOUT BASE OF NECK

TRC 43C3NE1

572E SN043 NECK EXT. CAL03

93084

THETA

FILTER = BLPP 100/ 317/ -40

MIN, MAX VALUES = -15.84 191.25, 53.92 74.63

ANGLE [DEG]

120.00

100.00

80.00

60.00

40.00

20.00

0.00

-20.00

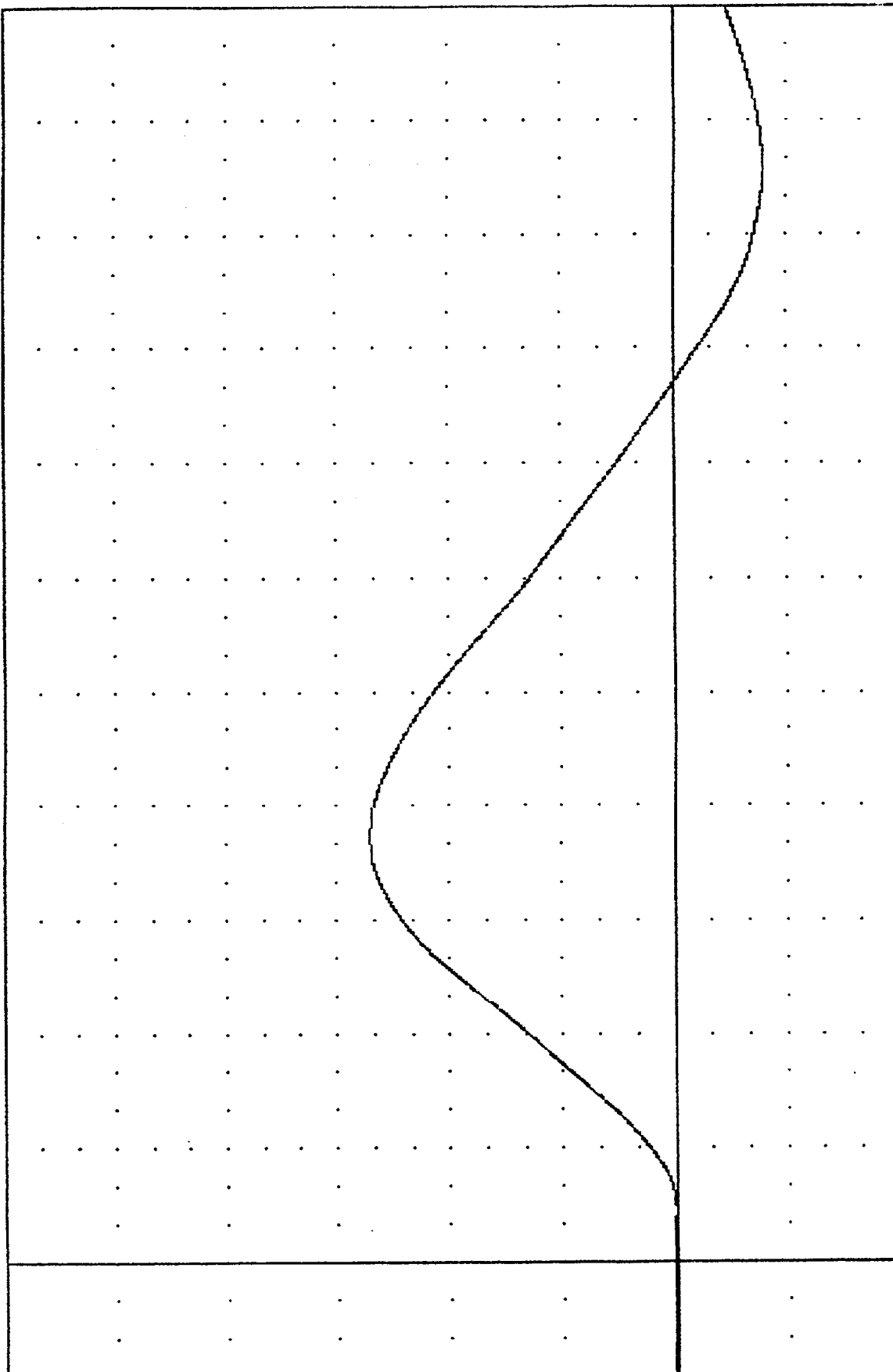
-40.00

-60.00

-80.00

-100.00

-120.00

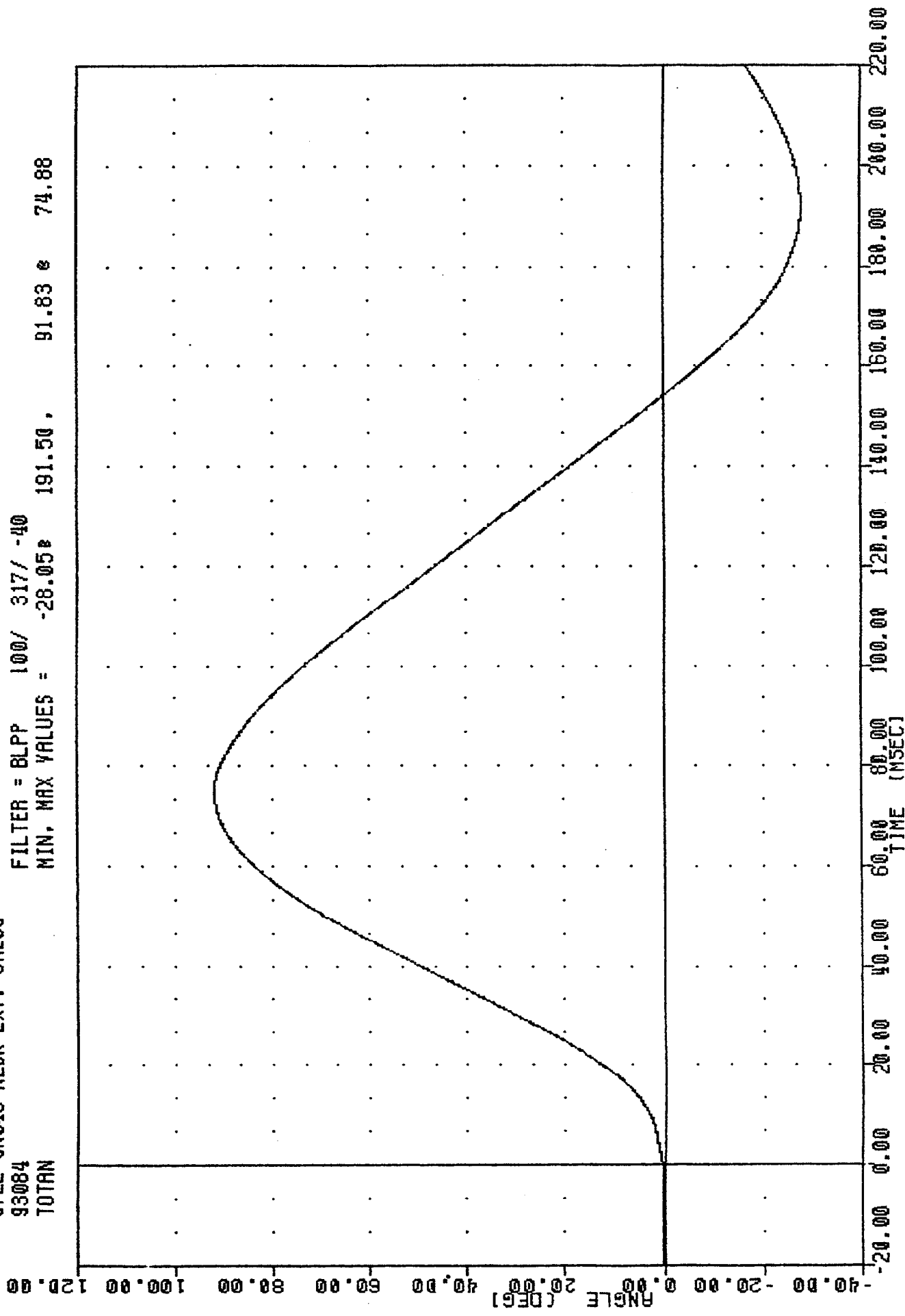


TIME [MSEC] 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00 180.00 200.00 220.00

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

TRC
 572E SN043 NECK EXT. CAL03
 93084
 TOTAL

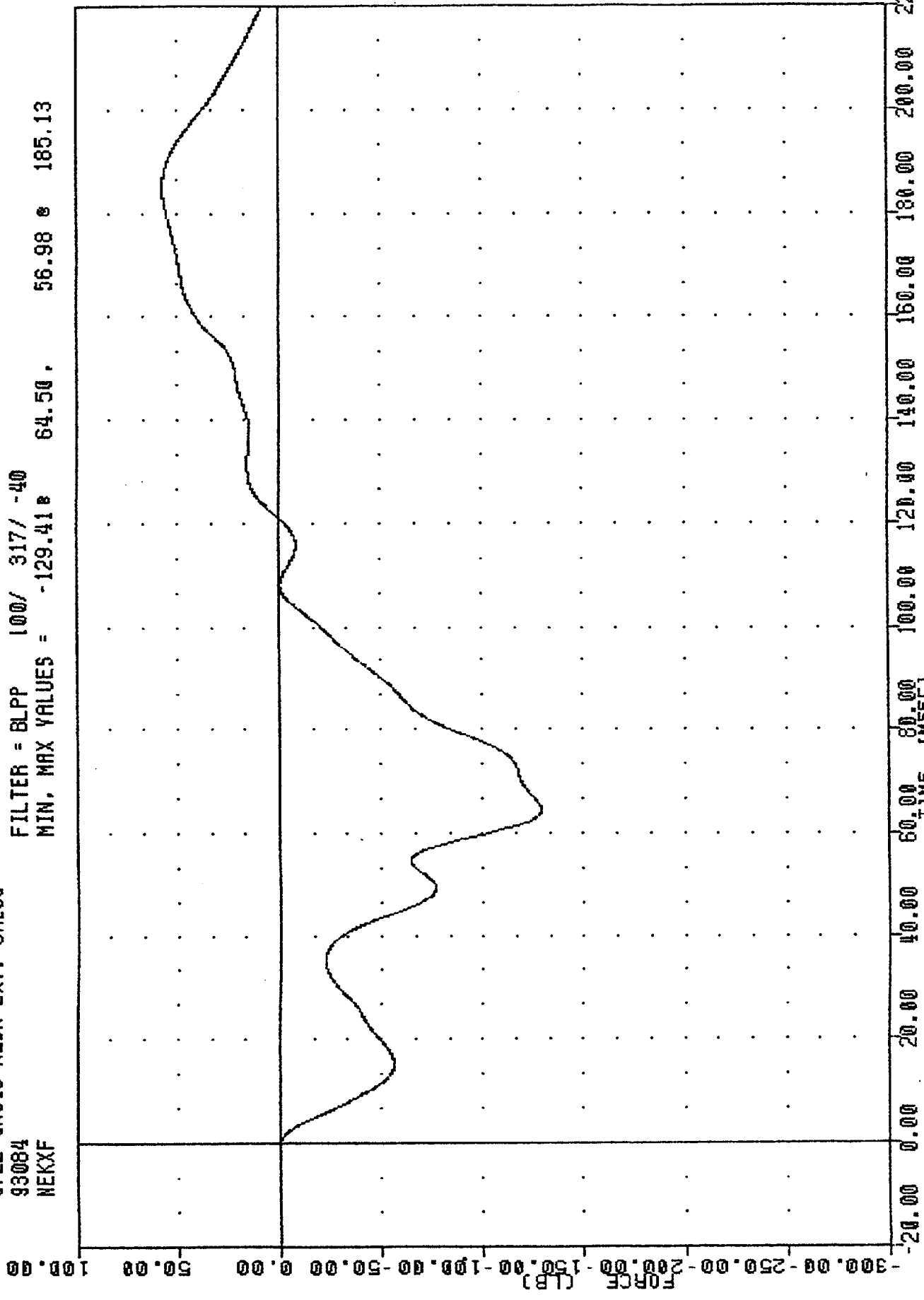
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -28.05e 91.83 e 74.88



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 TOTAL ROTATION

TRC
572E SN043 NECK EXT. CAL03
93084
NEKXF

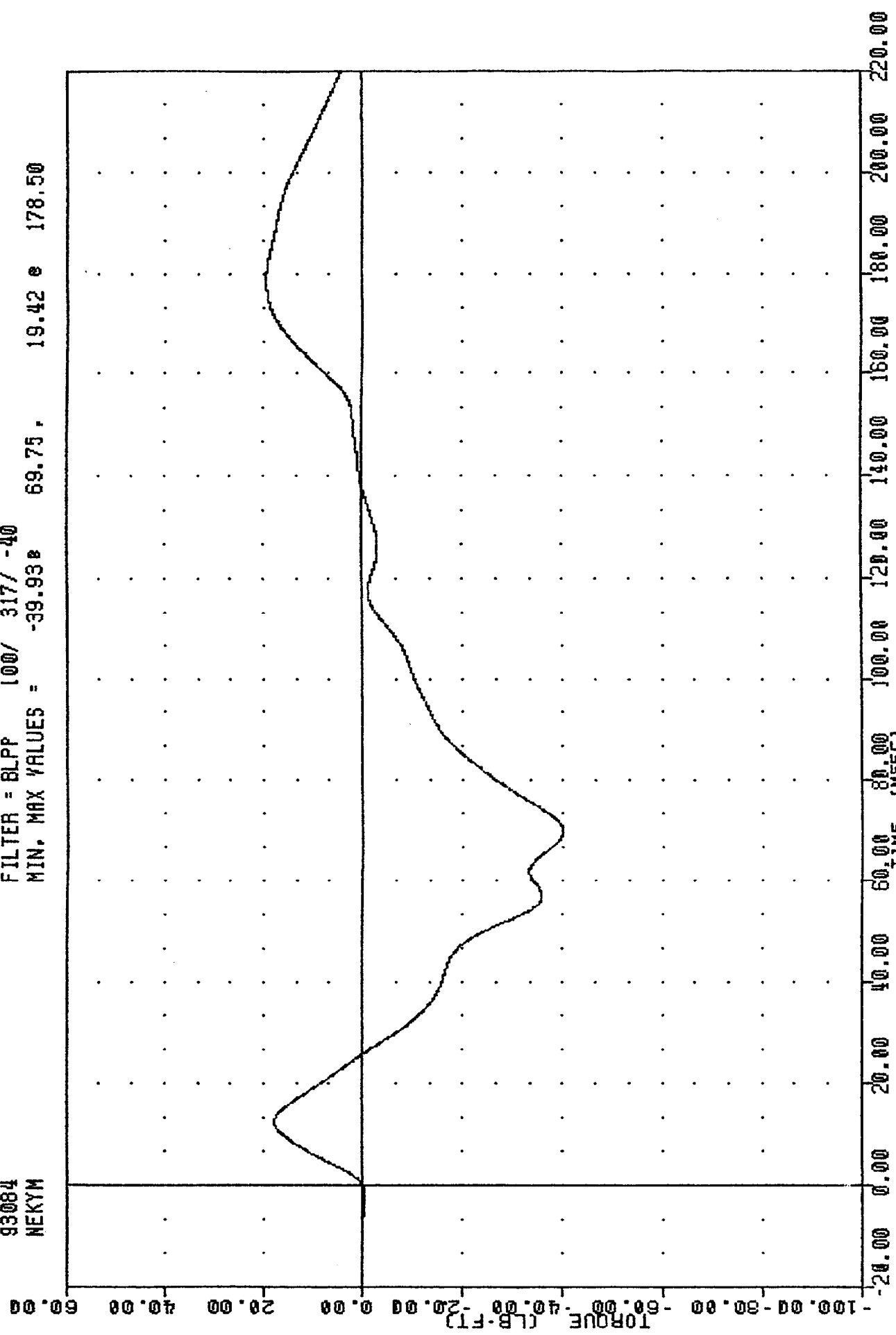
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -129.41 64.50 56.98 185.13



PART 572-E HYBRID J II NECK EXTENSION CALIBRATION
NECK FORCE X AXIS

TAC
572E SN049 NECK EXT. CAL03
93084
NEKYM

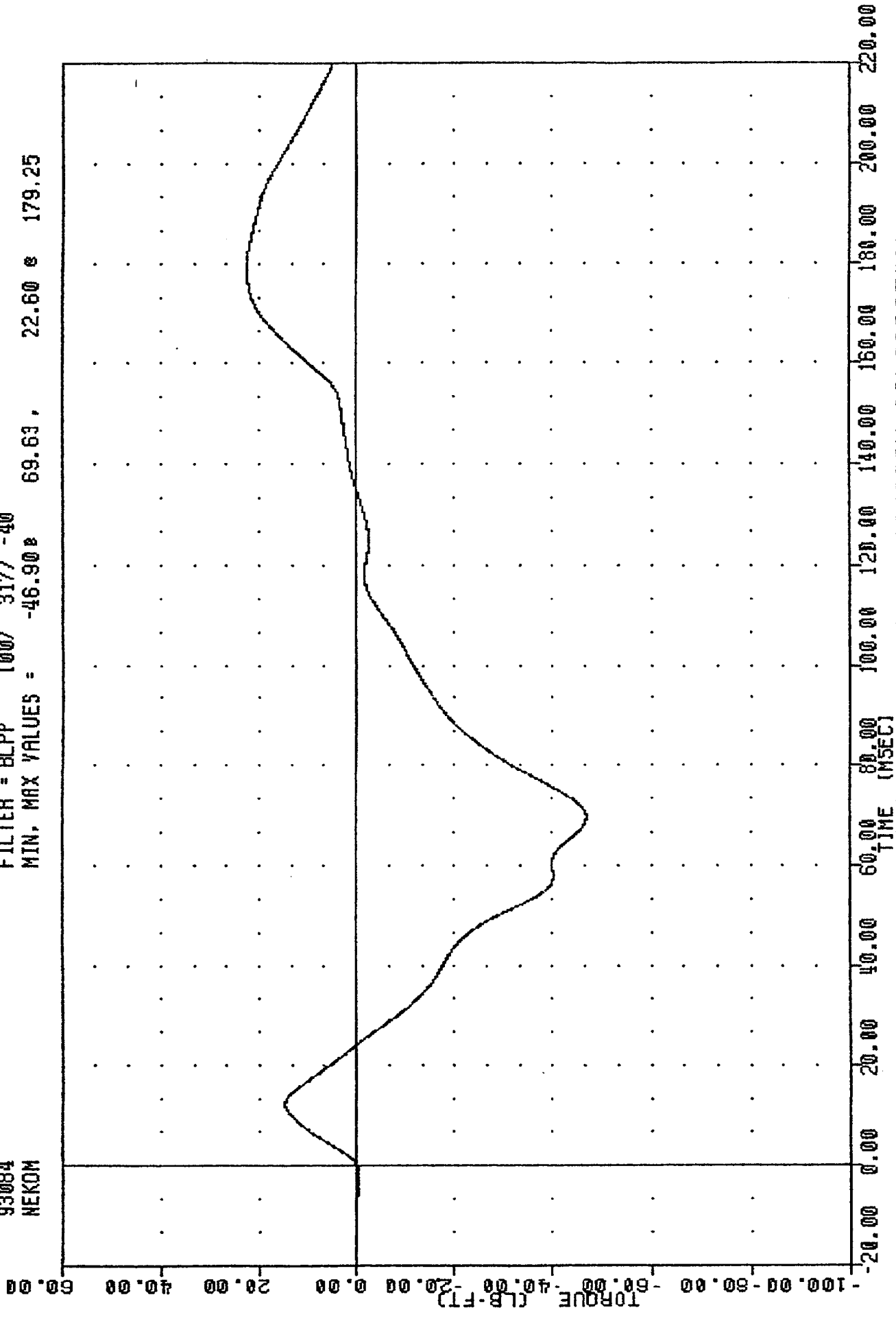
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -39.93 69.75, 19.42 e 178.50



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
NECK MOMENT Y AXIS

TRC
572E SN049 NECK EXT. CAL03
93084
NEKDM

FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -46.90e 69.63 , 22.60 e 179.25



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRANSPORTATION RESEARCH CENTER INC.

THORAX IMPACT TEST

HYBRID III

25-MAR-93

TRC

43C3TH1

572E SN43 H.S.THORAX CAL03

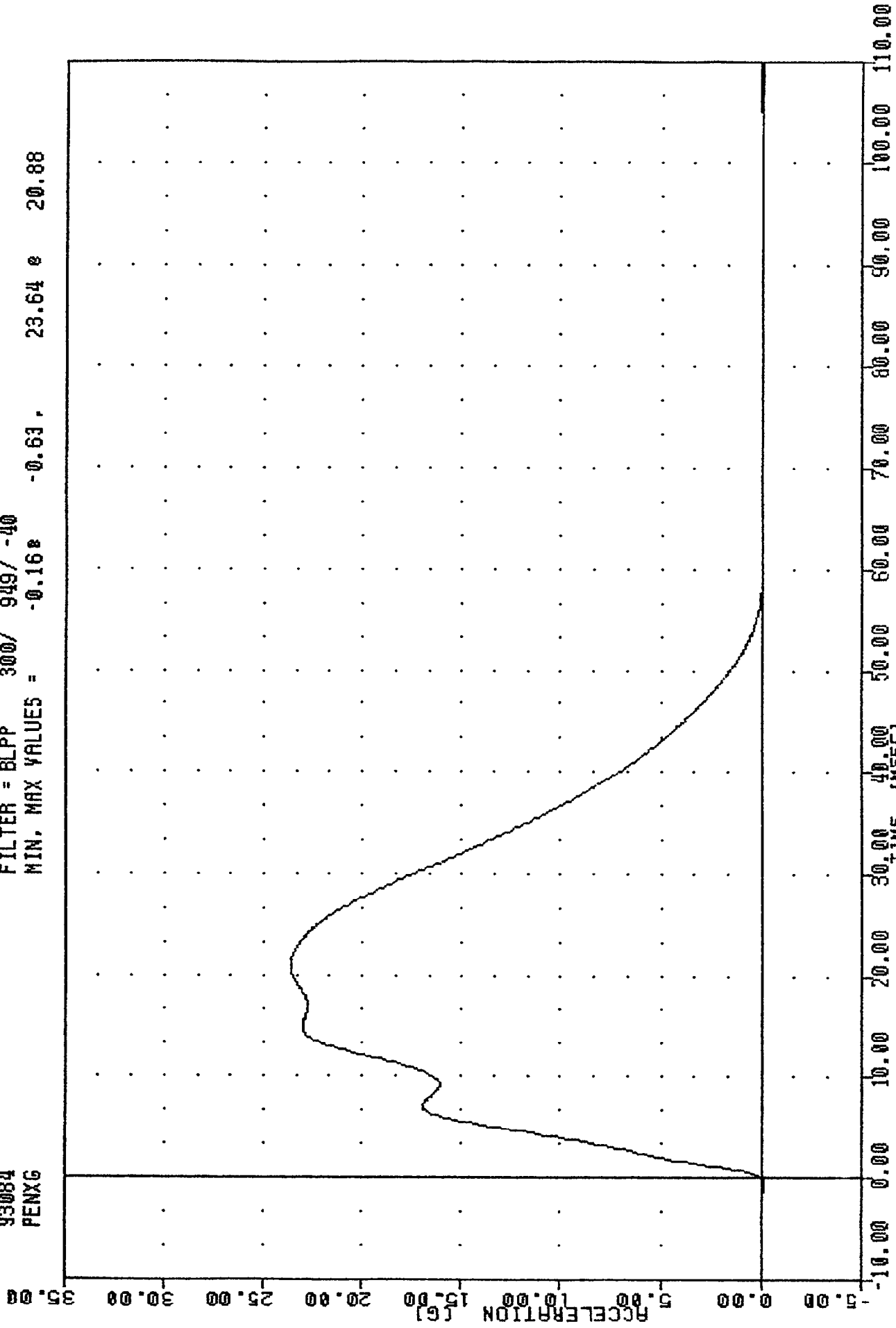
| HIGH SPEED TEST | | |
|-------------------------|------------------|--------------|
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
| TEMPERATURE | 69 - 72 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| PENDULUM VELOCITY | 21.6-22.4 FT/SEC | 21.91 FT/SEC |
| MAXIMUM DEFLECTION | 2.50 - 2.86 IN | 2.77 IN |
| MAXIMUM RESISTIVE FORCE | 1160 - 1325 LBS | 1217.4 LBS |
| INTERNAL HYSTERESIS | 69% - 85% | 74.8% |

TEST MEETS SPECIFICATIONS

TECHNICIAN *John East*

TRC
572E SN43 H.S. THORAX CAL03
93084
PENXG

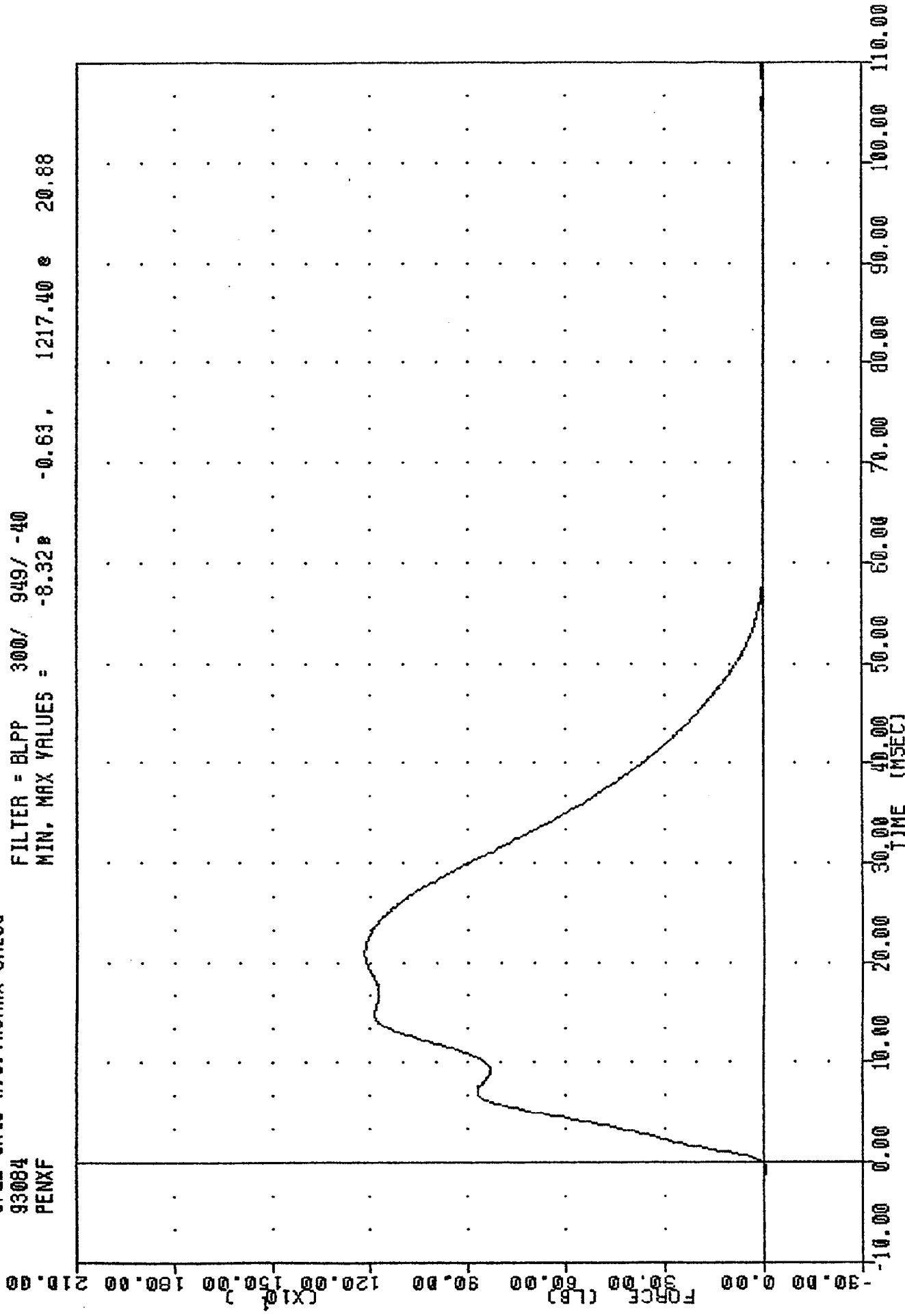
FILTER = BLPP 300/ 949/ -40
MIN, MAX VALUES = -0.168 -0.63, 23.64 e 20.88



PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM DECELERATION

TRC
572E SN49 H.S. THORAX CAL03
93084
PENXF

FILTER = BLPP 300/ 949/ -40
MIN. MAX VALUES = -8.32 1217.40 e 20.88

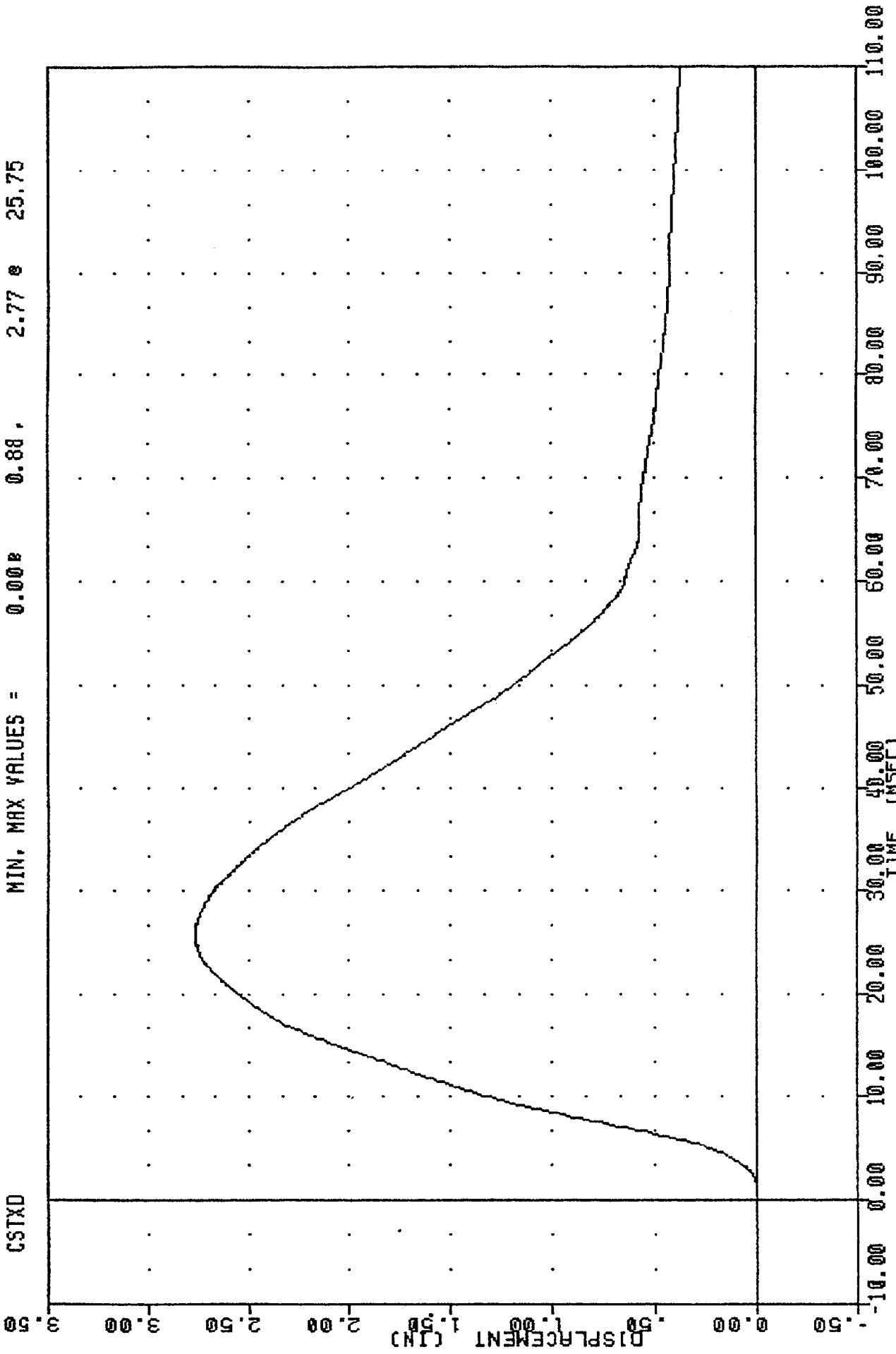


PART 572-E HYBRID III THORAX CALIBRATION
PFNNIII IM FORCE

TRC
572E SN49 H.S. THORAX CAL03
93084
CSTXD

43C3TH1

FILTER = BLPP 300/ 949/ -40
MIN, MAX VALUES = 0.00 0.88, 2.77 25.75



PART 572-E HYBRID III THORAX CALIBRATION
STERNUM DISPLACEMENT

TRC
 CSTXD
 PENXF

43C3TH1
 FILTER = BLPP
 FILTER = BLPP

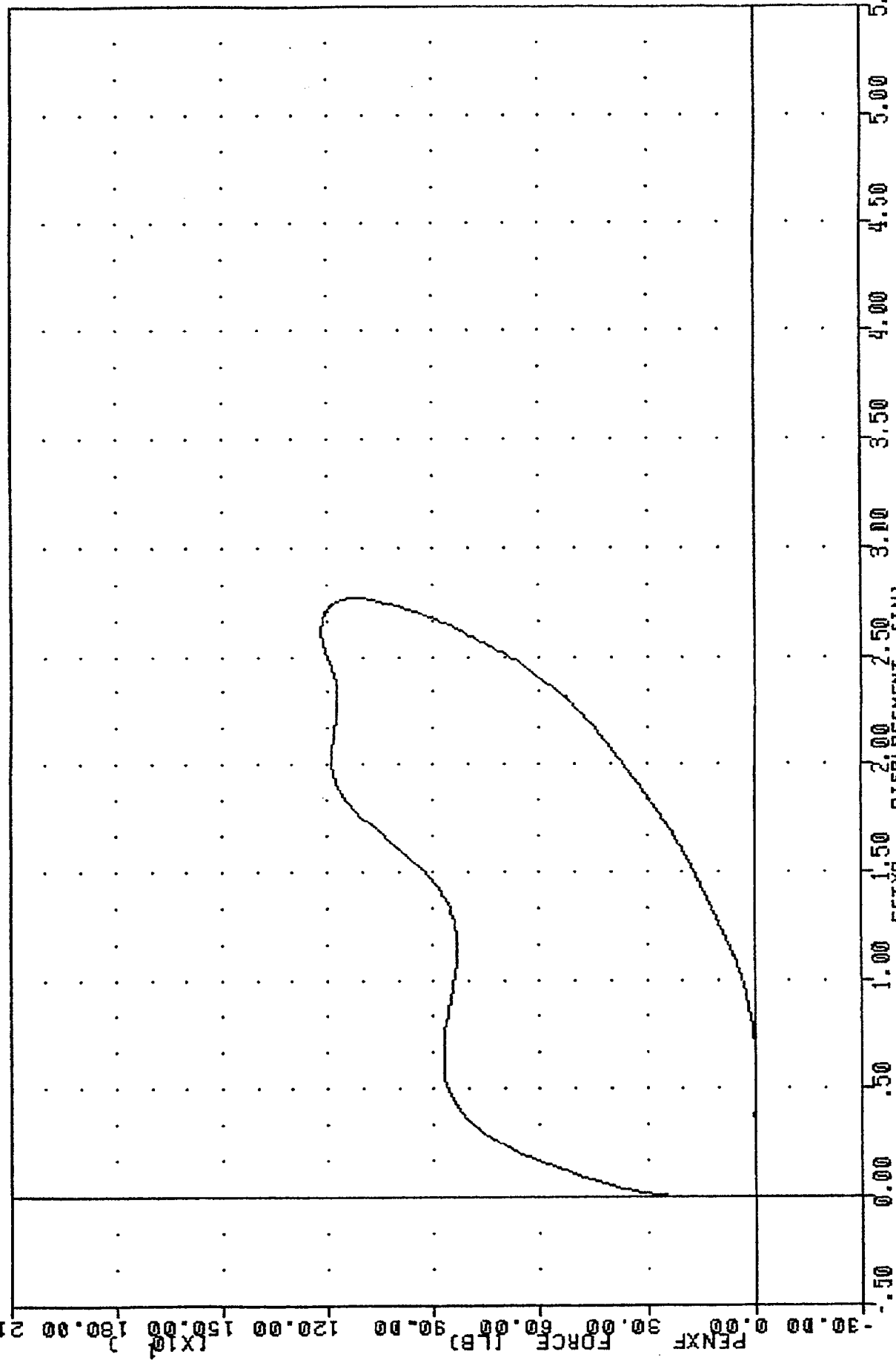
572E SNA3 H.S. THORAX CAL 03
 300/ 949/ -40
 300/ 949/ -40

93084
 0.00
 -8.32

0.88
 -0.63

2.77
 1217.40

25.75
 20.88



PART 572-E HYBRID III THORAX CALIBRATION
 CHEST DISPLACEMENT VS PENDULUM FORCE

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

24-MAR-93

RIGHT KNEE
TRC

43C3RK1

572E SN43 RIGHT KNEE CAL 03

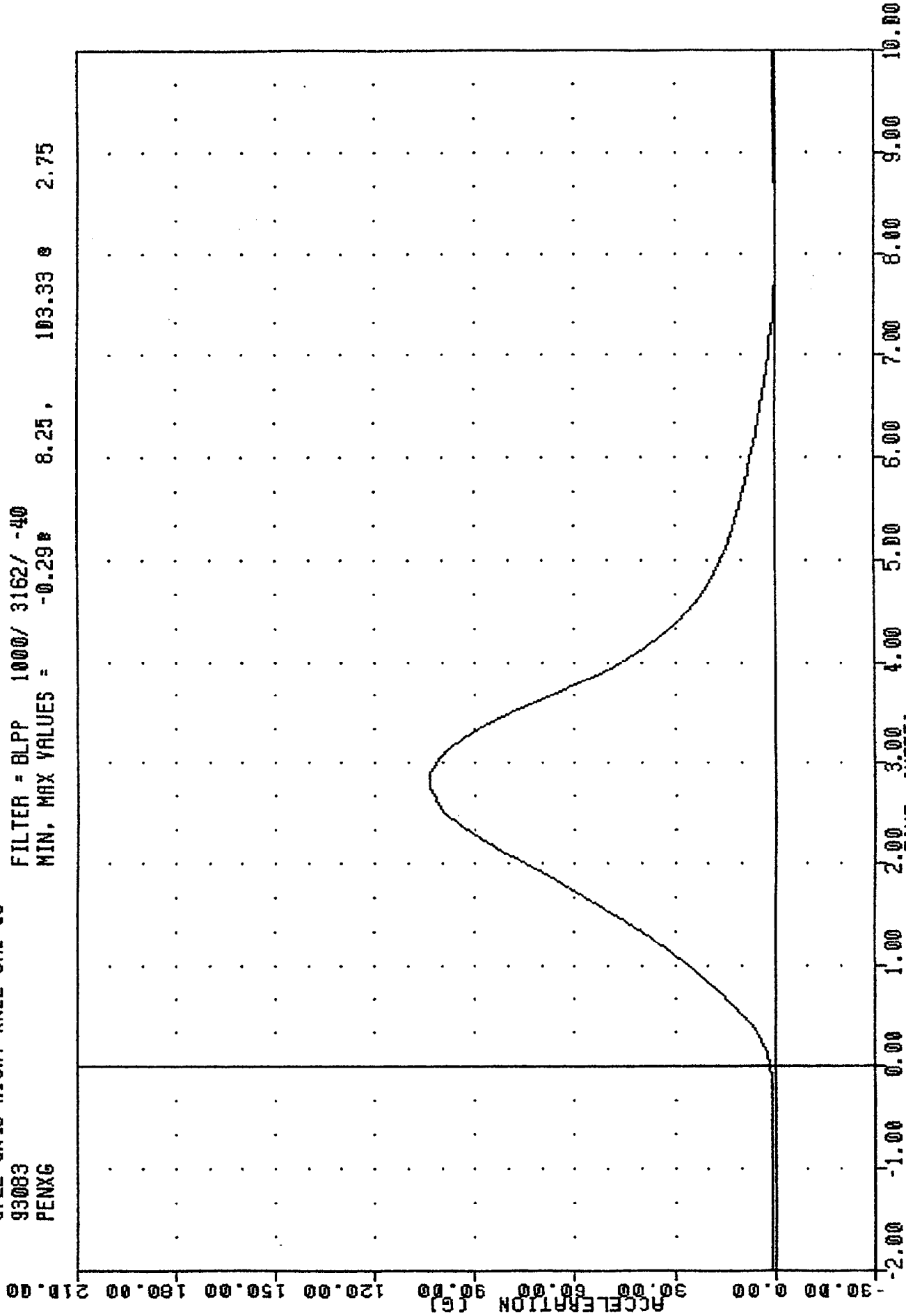
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|------------------------|------------------|--------------|
| TEMPERATURE | 66 - 78 DEG. F | 71.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| PROBE VELOCITY | 6.8 - 7.0 FT/SEC | 6.86 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1060 - 1300 LBS | 1136.67 LBS |
| PROBE WEIGHT | 11.0 LBS | |

TEST MEETS SPECIFICATIONS

TECHNICIAN *Lita Ford*

TRC
572E SN43 RIGHT KNEE CAL 03
93083
PENXG

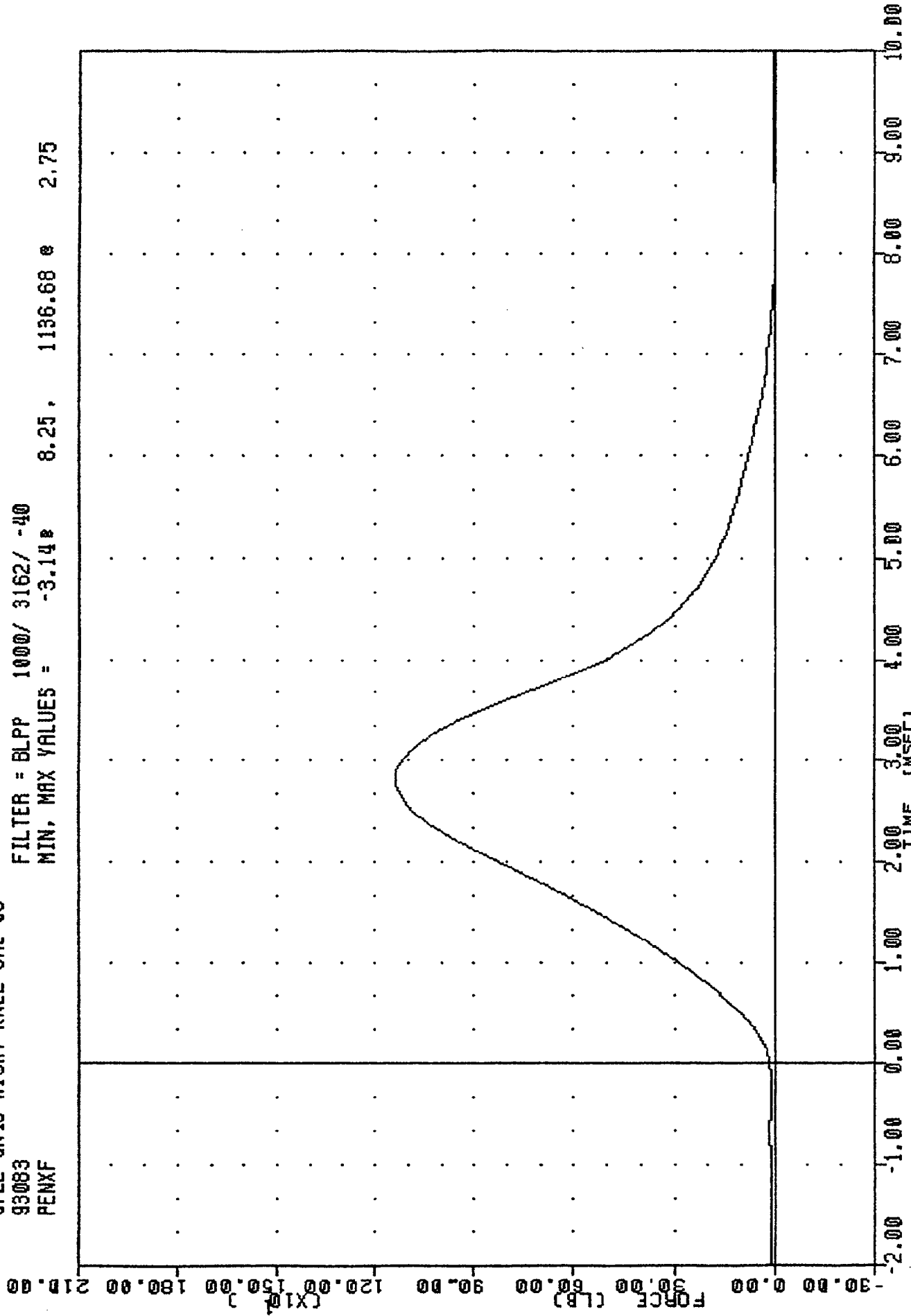
FILTER = BLPP 1000/ 3162/ -40
MIN, MAX VALUES = -0.298 8.25, 103.33 0 2.75



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
PENNUM DIFFERATION (11 18 PFND.1)

TRC
572E SN43 RIGHT KNEE CAL 03
93083
PENXF

FILTER = BLPP 1000/ 3162/ -40
MIN, MAX VALUES = -3.148 8.25, 1136.68 @ 2.75



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
PENDULUM FORCE [11 LB PEND.]

TRANSPORTATION RESEARCH CENTER INC.

KNEE IMPACT TEST

HYBRID III

24-MAR-93

LEFT KNEE

TRC

43C3LK1

572E SN43 LEFT KNEE CAL 03

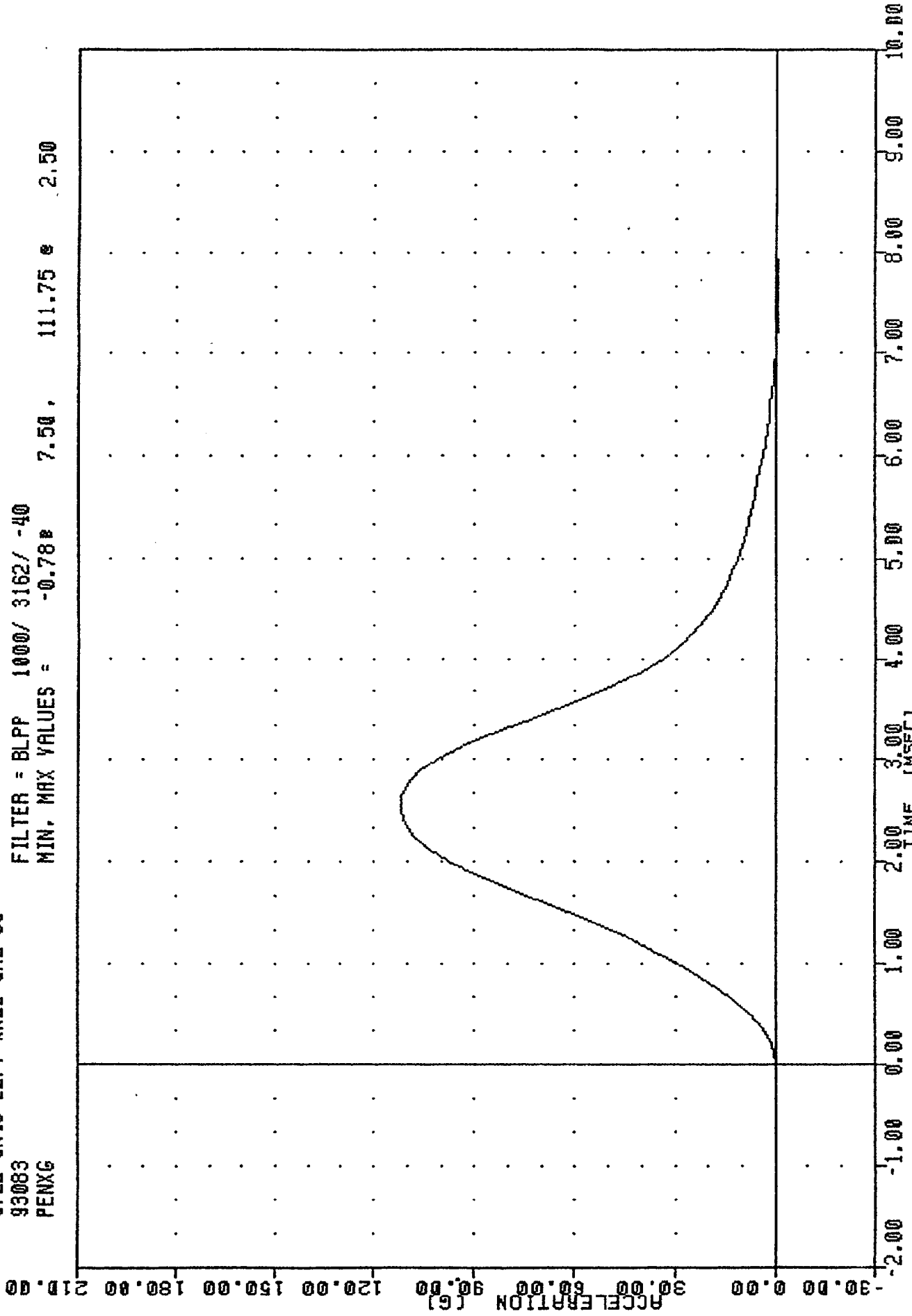
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|------------------------|------------------|--------------|
| TEMPERATURE | 66 - 78 DEG. F | 71.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| PROBE VELOCITY | 6.8 - 7.0 FT/SEC | 6.86 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1040 - 1300 LBS | 1229.25 LBS |
| PROBE WEIGHT | 11.0 LBS | |

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Post

TRC
572E SN43 LEFT KNEE CAL 03
93083
PENXG

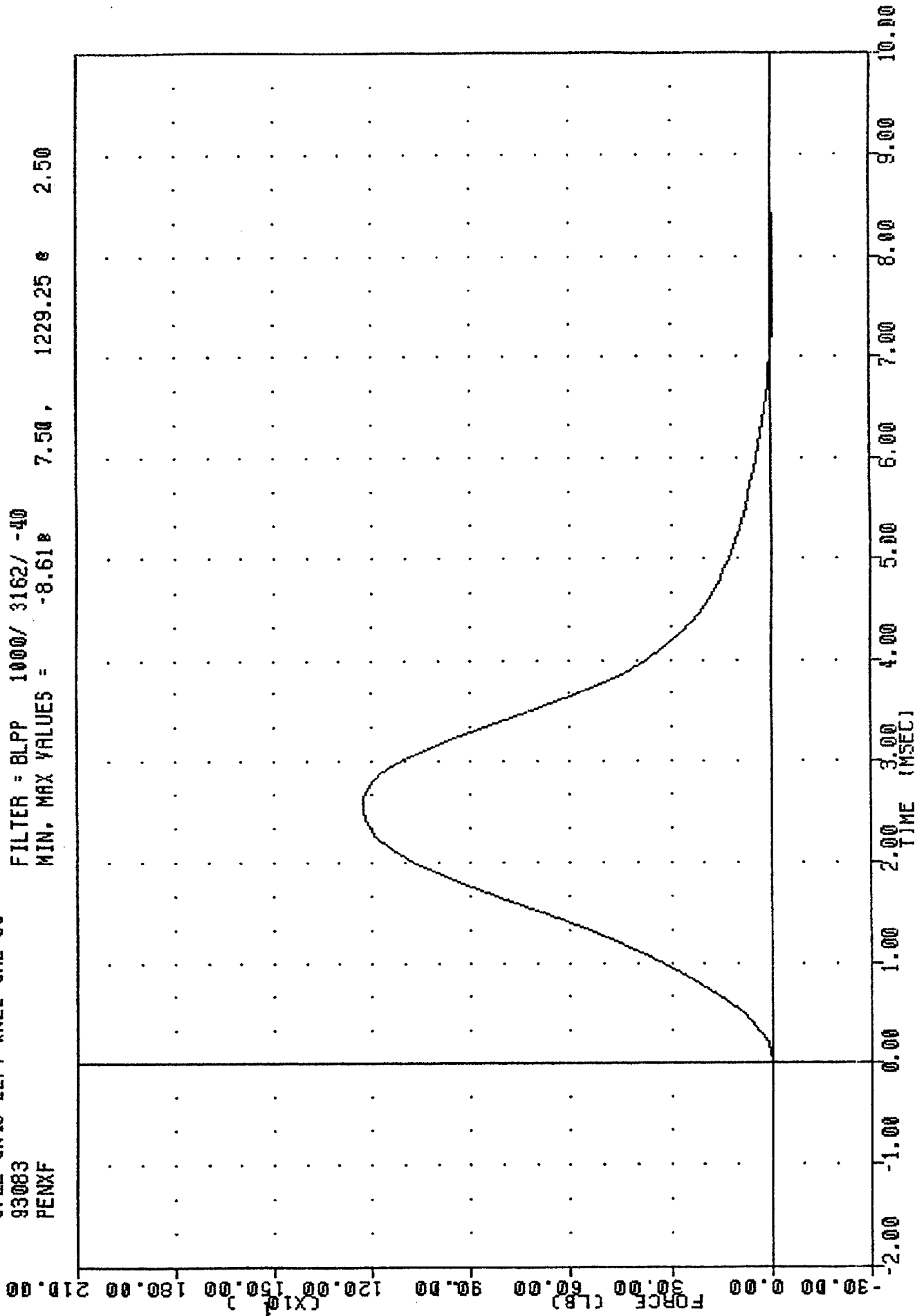
FILTER = BLPP 1000/ 3162/ -40
MIN. MAX VALUES = -0.788 7.50, 111.75 2.50



PART 572-E HYBRID III LEFT KNEE CALIBRATION
PENDULUM DECELERATION (11 LB PEND.)

TRC
572E SN43 LEFT KNEE CAL 03
93083
PENXF

FILTER = BLPP 1000/ 3162/ -40
MIN, MAX VALUES = -8.618 7.50 1229.25 e 2.50



PART 572-E HYBRID III LEFT KNEE CALIBRATION
PENDULUM FORCE (11 LB PEND.)

PRE-TEST CERTIFICATION DATA

PASSENGER DUMMY S/N 048

TRANSPORTATION RESEARCH CENTER OF OHIO
HYBRID III EXTERNAL DIMENSIONS
HUMANOID 48

24-MAR-93

TRC 48C7ED1 572E SN48 EXT. DIMENSION CAL 07

| TEST PARAMETER | (DIMEN.) | SPECIFICATION | TEST RESULTS |
|---------------------------------------|----------|---------------|--------------|
| TEMPERATURE | | | 71.0 DEG. F |
| RELATIVE HUMIDITY | | | 50.0 % |
| LOCATION FOR CHEST CIRCUMFERENCE (AA) | | 16.9-17.1 IN | 17.0 IN |
| LOCATION FOR WAIST CIRCUMFERENCE (BB) | | 8.9- 9.1 IN | 9.0 IN |
| CHEST CIRCUMFERENCE | (Y) | 38.2-39.4 IN | 38.8 IN |
| WAIST CIRCUMFERENCE | (Z) | 32.9-34.1 IN | 33.5 IN |
| CHEST DEPTH | (O) | 8.4- 9.0 IN | 8.6 IN |
| H-POINT HEIGHT | (C) | 3.3- 3.5 IN | 3.4 IN |
| H-POINT FROM SEATBACK | (D) | 5.3- 5.5 IN | 5.4 IN |
| SKULL CAP TO BACKLINE | (H) | 1.6- 1.8 IN | 1.7 IN |
| TOTAL SITTING HEIGHT | (A) | 34.6-35.0 IN | 34.8 IN |
| THIGH CLEARANCE | (F) | 5.5- 6.1 IN | 6.1 IN |
| BUTTOCK KNEE LENGTH | (K) | 22.8-23.8 IN | 23.5 IN |
| BUTTOCK POPLITEAL LENGTH | (N) | 17.8-18.8 IN | 18.5 IN |
| POPLITEAL HEIGHT | (L) | 16.9-17.9 IN | 17.0 IN |
| KNEE PIVOT HEIGHT | (M) | 19.1-19.7 IN | 19.4 IN |
| FOOT LENGTH | (P) | 9.9-10.5 IN | 10.2 IN |
| FOOT BREADTH | (W) | 3.6- 4.2 IN | 3.9 IN |
| SHOULDER PIVOT FROM BACKLINE | (E) | 3.3- 3.7 IN | 3.6 IN |
| SHOULDER BREADTH | (V) | 16.6-17.2 IN | 16.8 IN |
| SHOULDER PIVOT HEIGHT | (B) | 19.9-20.5 IN | 20.1 IN |
| ELBOW REST HEIGHT | (J) | 7.5- 8.3 IN | 7.9 IN |
| SHOULDER-ELBOW LENGTH | (I) | 13.0-13.6 IN | 13.5 IN |
| BACK OF ELBOW TO WRIST PIVOT | (G) | 11.4-12.0 IN | 11.6 IN |

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Jont

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

13-APR-93

TRC

48C7HD2

572E SN48 HEAD DROP CAL 07

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|---------------------------------|----------------|--------------|
| TEMPERATURE | 66 - 78 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 48.0 % |
| PEAK RESULTANT ACCELERATION | 225 - 275 G | 260.59 G |
| PEAK LATERAL ACCELERATION | 15 G MAX | -5.49 G |
| IS ACCELERATION CURVE UNIMODAL? | YES | YES |

TEST MEETS SPECIFICATIONS

TECHNICIAN

Chas. Middleton

TRC 48C7HD2

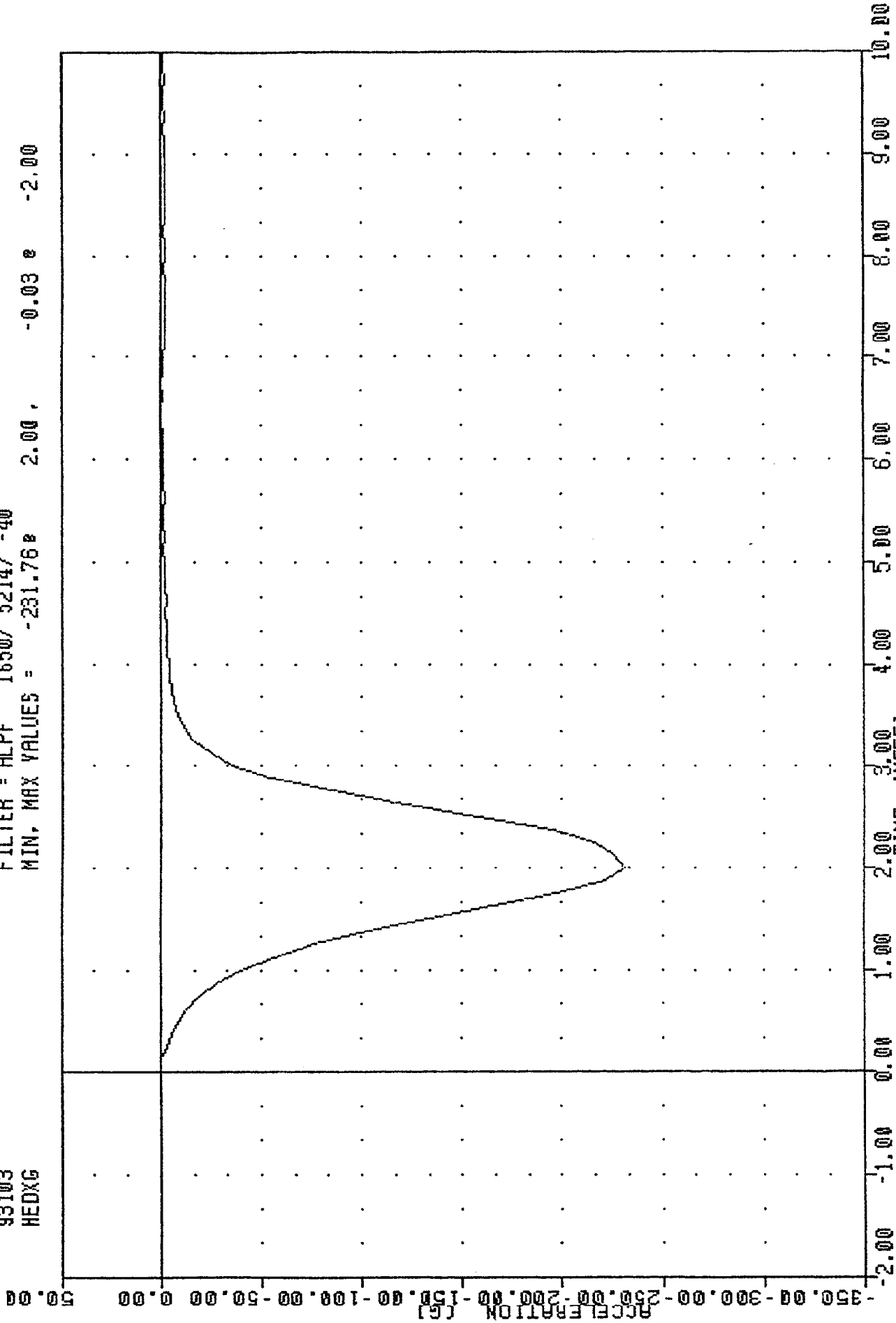
572E SN48 HEAD DRAP CAL 07

93103

HEDXG

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -231.76 2.00, -0.03 e -2.00

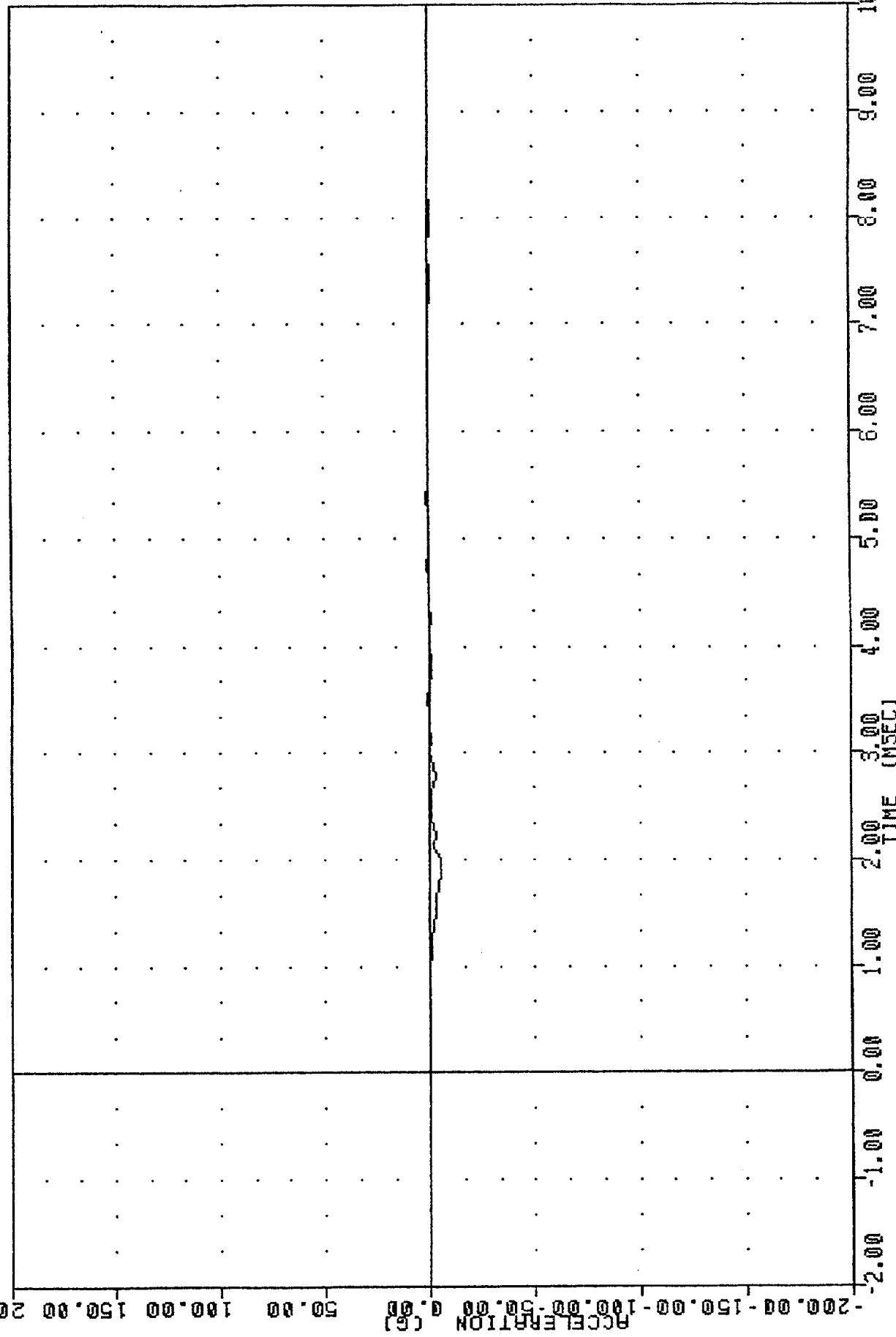


PART 572-E HYBRID III HEAD CALIBRATION

HFAN ACCELERATION X AXIS

TRC
 572E SN49 HEAD DROP CAL 07
 93103
 HEDYG

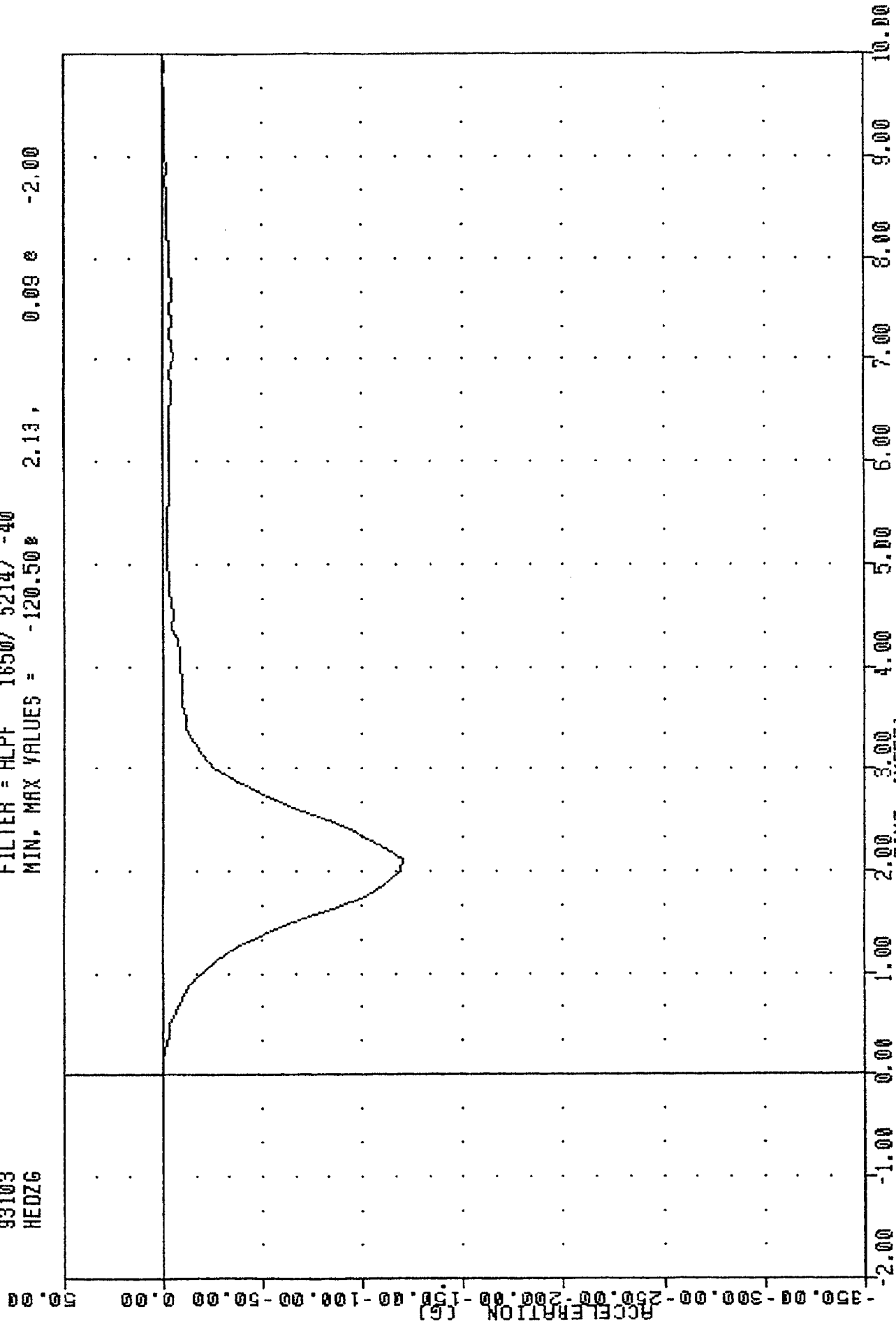
FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = -5.50E 2.00 1.04 3.50



PART 572-E HYBRID III HEAD CALIBRATION
 HEAD ACCELERATION Y AXIS

TRC
572E SN48 HEAD DROP CAL 07
93103
HEDZG

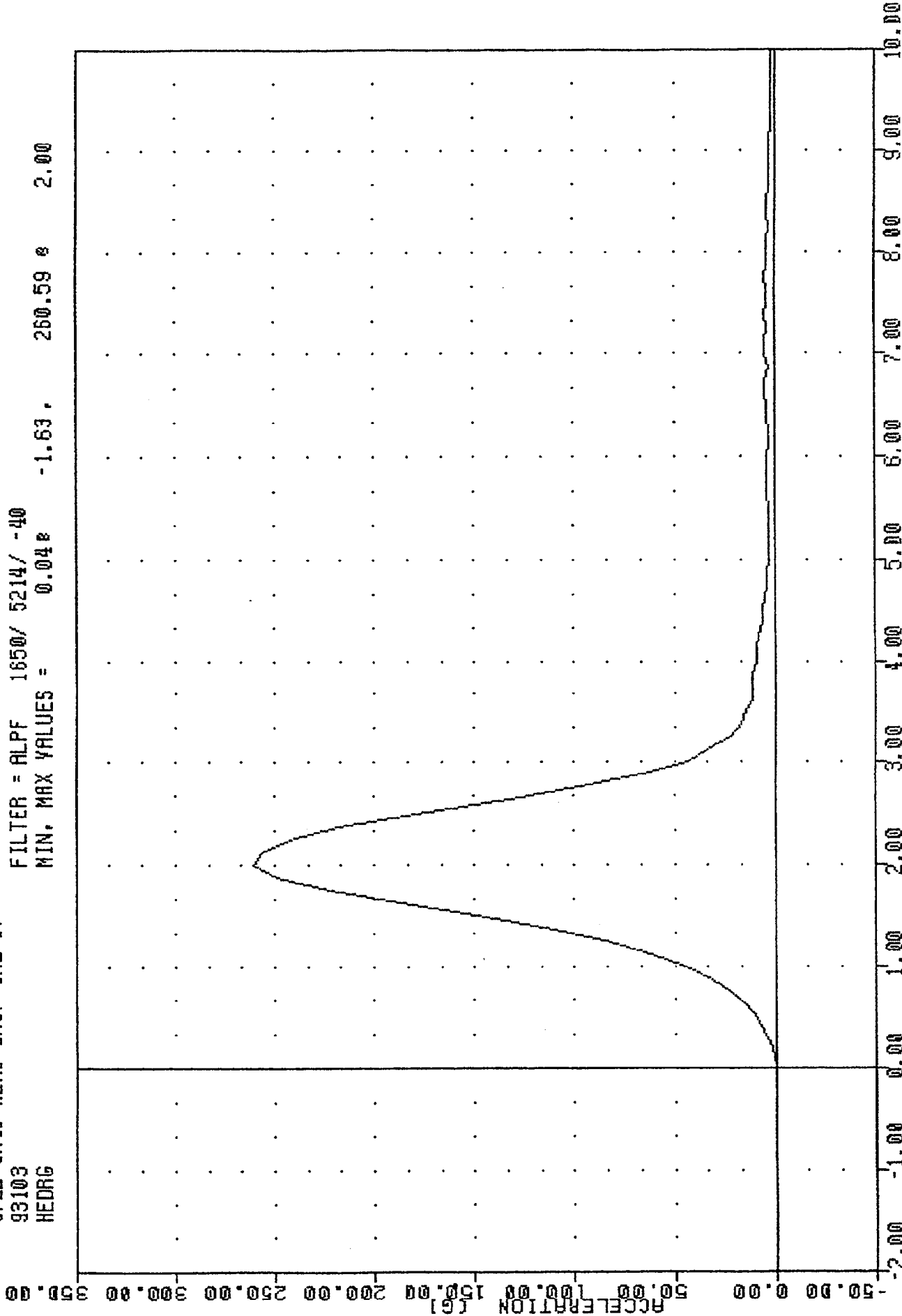
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -120.50 2.13, 0.09 e -2.00



PART 572-E HYBRID III HEAD CALIBRATION
HFAN ACCELERATION 7 AXIS

TRC
572E SN48 HEAD DROP CAL 07
93103
HEDRG

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = 0.048 -1.63, 260.59 e 2.00



PART 572-E HYBRID III HEAD CALIBRATION
HEAD RESENTANT ACCELERATION

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

24-MAR-93

6 AXIS NECK TRANSDUCER
TRC 48C7NF1

572E SN048 NECK FLEXION CAL07

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|--|-------------------------|--------------|
| TEMPERATURE | 69 - 72 DEG. F | 71.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| IMPACT VELOCITY | 22.6 - 23.4 FT/SEC | 23.30 FT/SEC |
| PENDULUM DECELERATION | 10 MS 22.50 - 27.50 G | 24.15 G |
| | 20 MS 17.60 - 22.60 G | 21.11 G |
| | 30 MS 12.50 - 18.50 G | 13.72 G |
| MAX PENDULUM G ABOVE 30 MS | 29 G MAX | 13.66 G |
| DECELERATION-TIME CURVE DECAY TIME TO 5 G | 34 - 42 MS | 38.75 MS |
| D PLANE ROTATION | MAX 64 - 78 DEG. | 73.16 DEG. |
| | TIME 57 - 64 MS | 59.88 MS |
| MOMENT ABOUT OCCIPITAL CONDYLE | MAX 65 - 80 FT.LBS | 66.18 FT.LBS |
| | TIME 47 - 58 MS | 52.13 MS |
| ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO | 113 - 128 MS | 118.63 MS |
| POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO | 97 - 107 MS | 100.25 MS |

TEST MEETS SPECIFICATIONS

TECHNICIAN *Pete Ford*

TRC

.48C7NF1

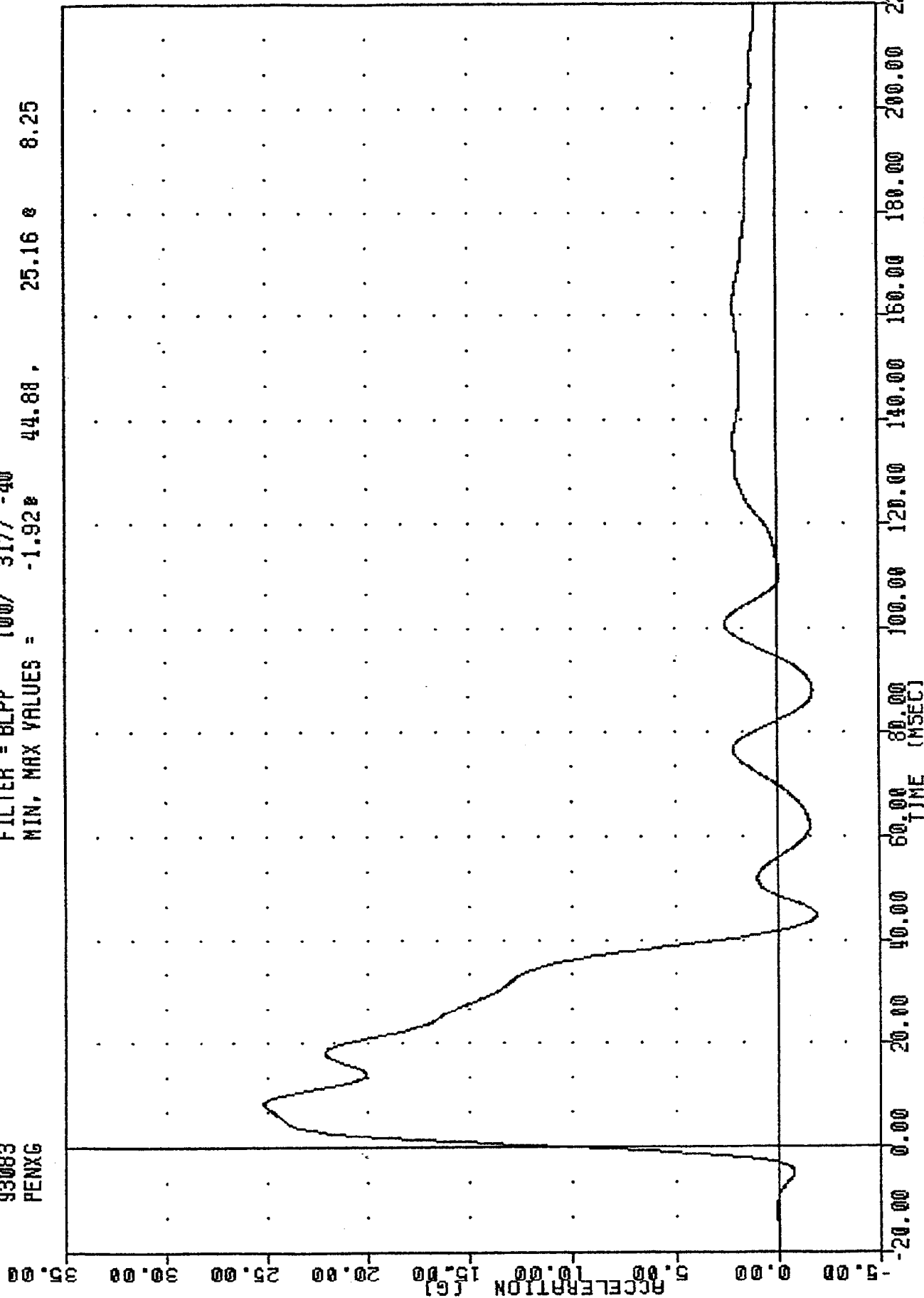
572E SNO48 NECK FLEXION CAL07

93083

PENXG

FILTER = BLPP 100/ 317/ -40

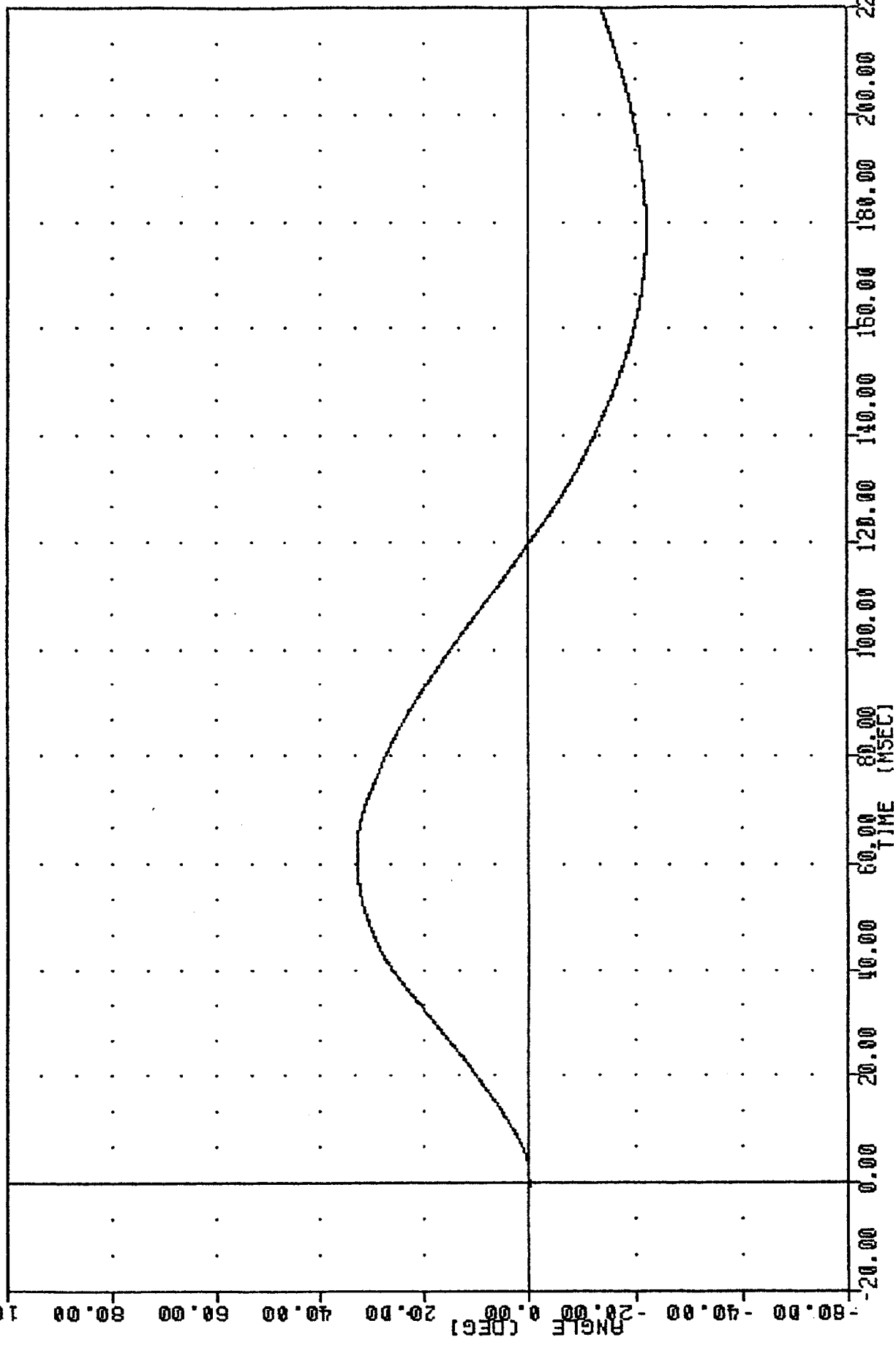
MIN, MAX VALUES = -1.92e 44.88, 25.16 e 8.25



PART 572-E HYBRID III NECK FLEXION CALIBRATION
PENDULUM DECELERATION

TRC
 572E SN048 NECK FLEXION CAL07
 93083
 BETA

FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -22.33B 178.50, 33.04 e 61.38



PART 572-E HYBRID III NECK FLEXION CALIBRATION
 ROTATION ABOUT BASE OF NECK

TRC 48C7NFJ

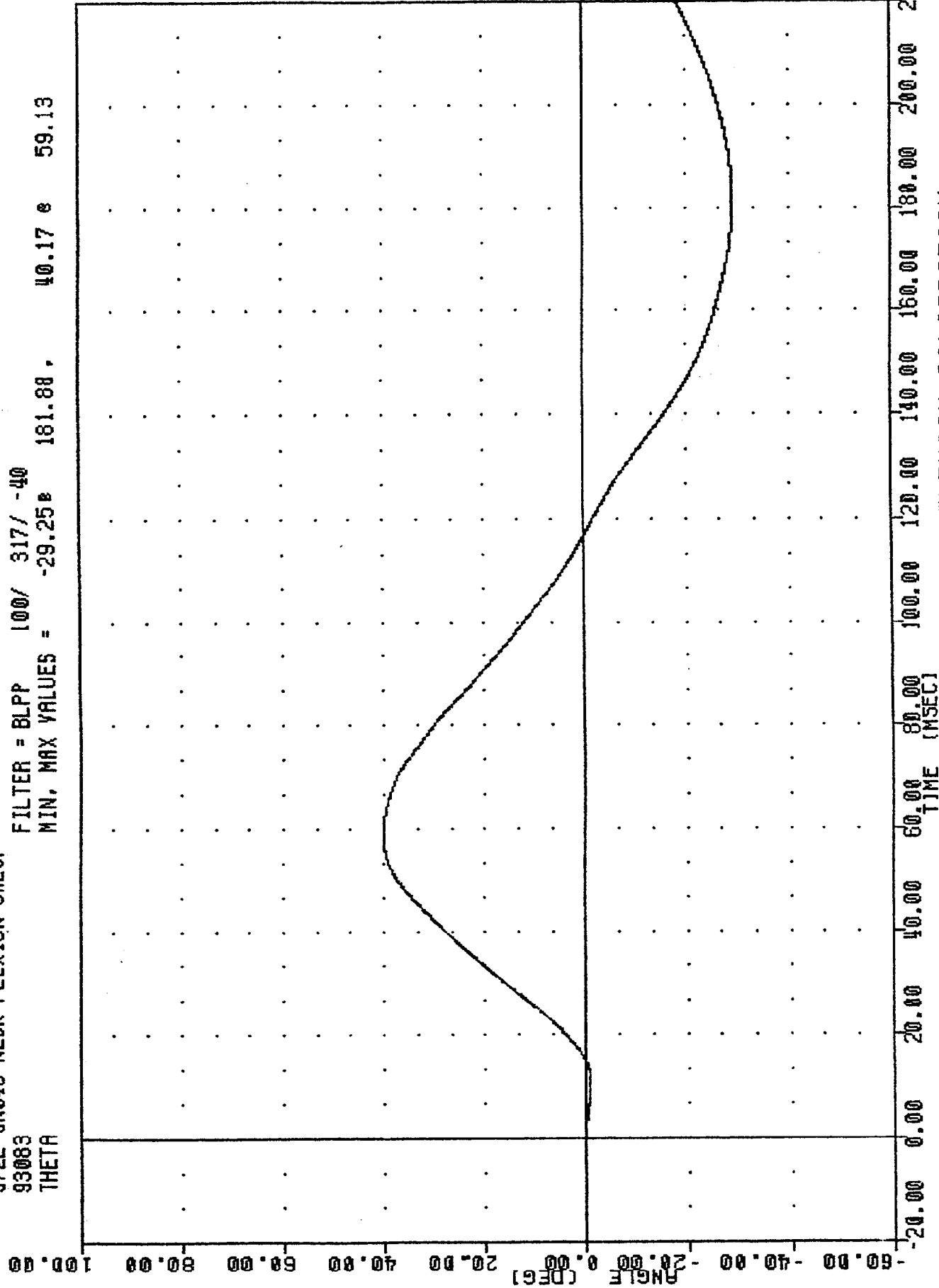
572E SN048 NECK FLEXION CAL07

93083

THETA

FILTER = BLPP 100/ 317/ -40

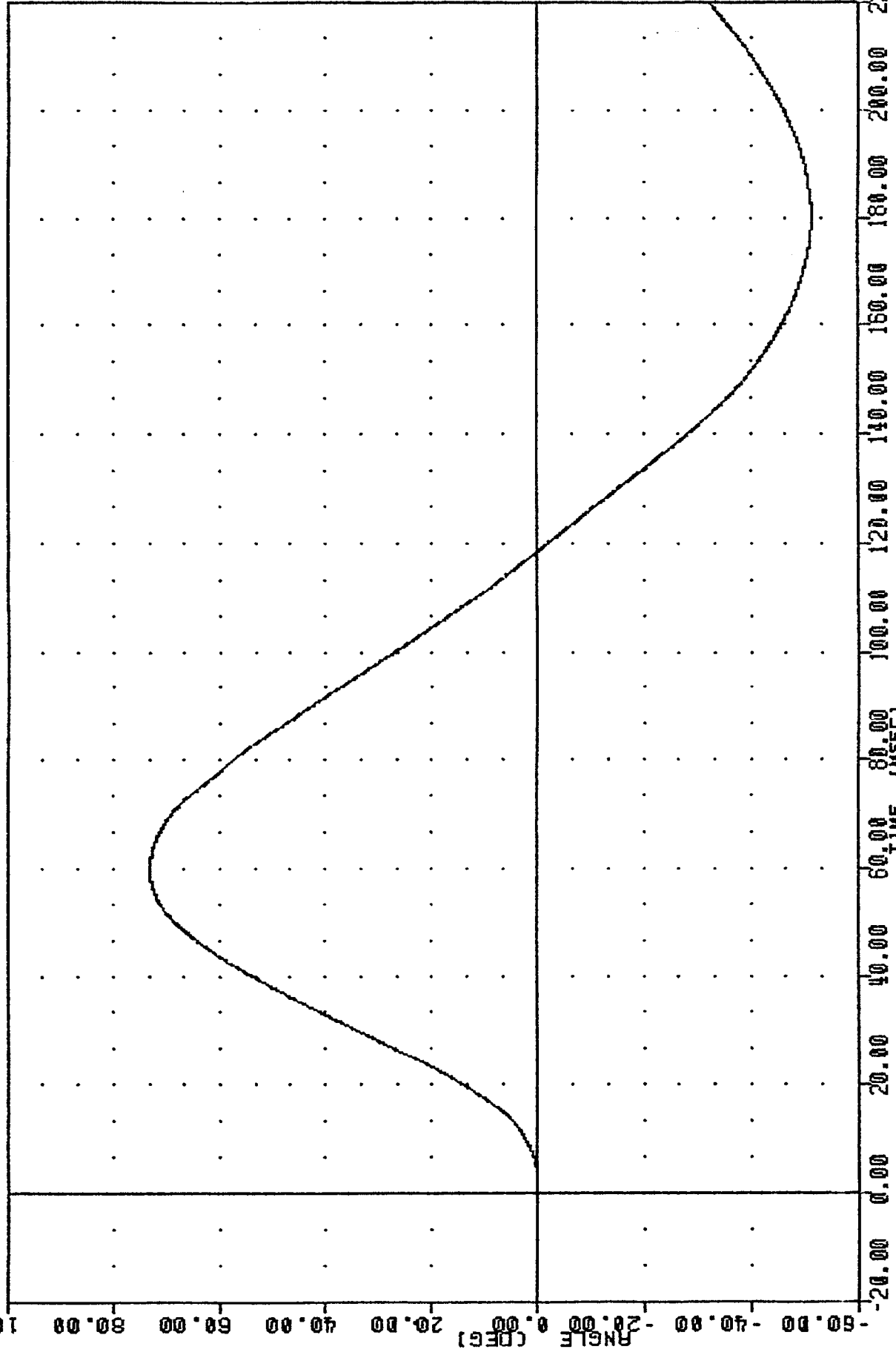
MIN, MAX VALUES = -29.25 181.88 40.17 e 59.13



PART 572-E HYBRID III NECK FLEXION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

TRC
572E SN040 NECK FLEXION CAL07
93083
TOTAL

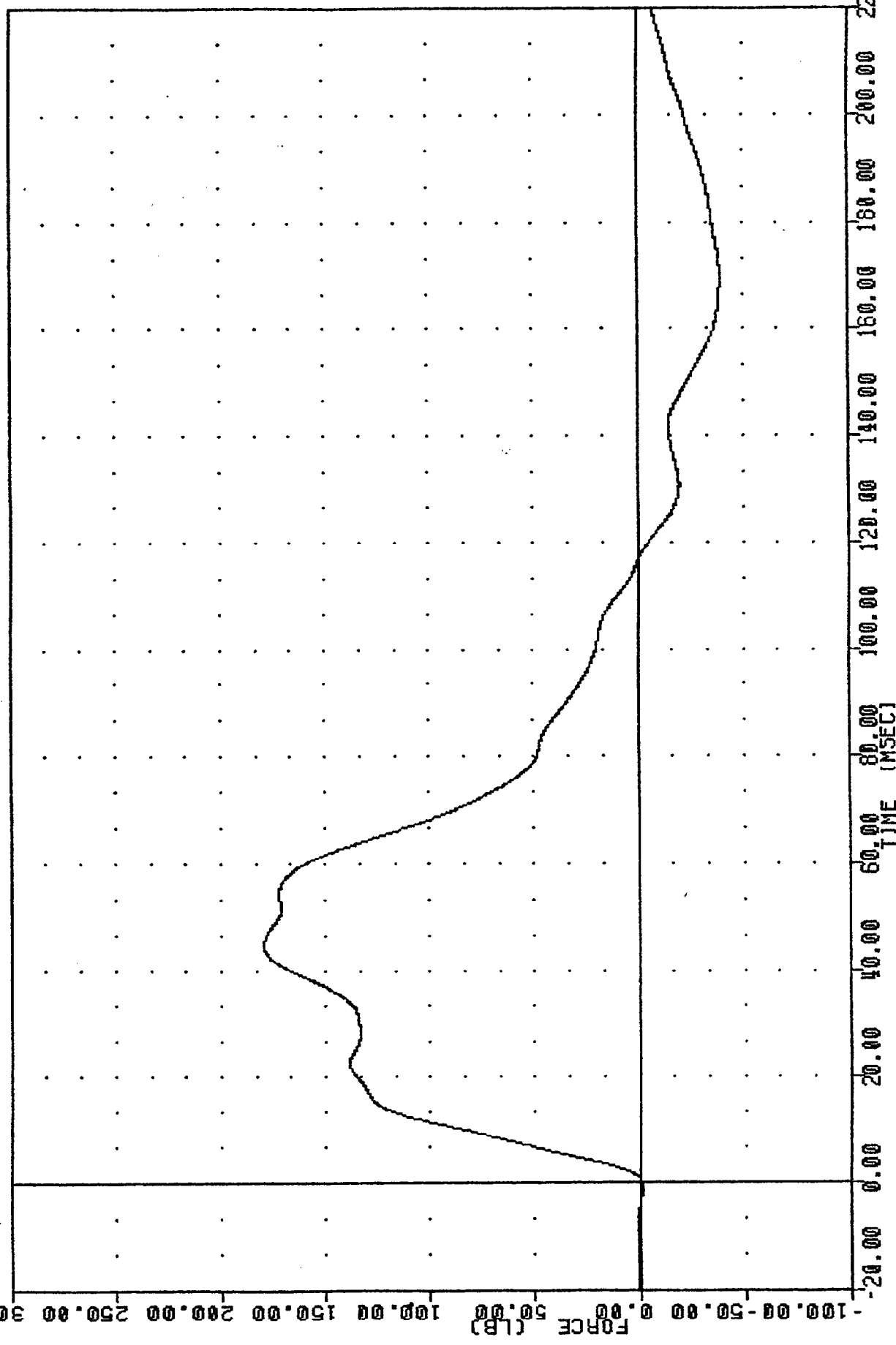
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -51.52 180.50 , 73.16 e 59.88



PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL ROTATION

TRC
 572E SN048 NECK FLEXION CAL07
 93083
 NEKXF

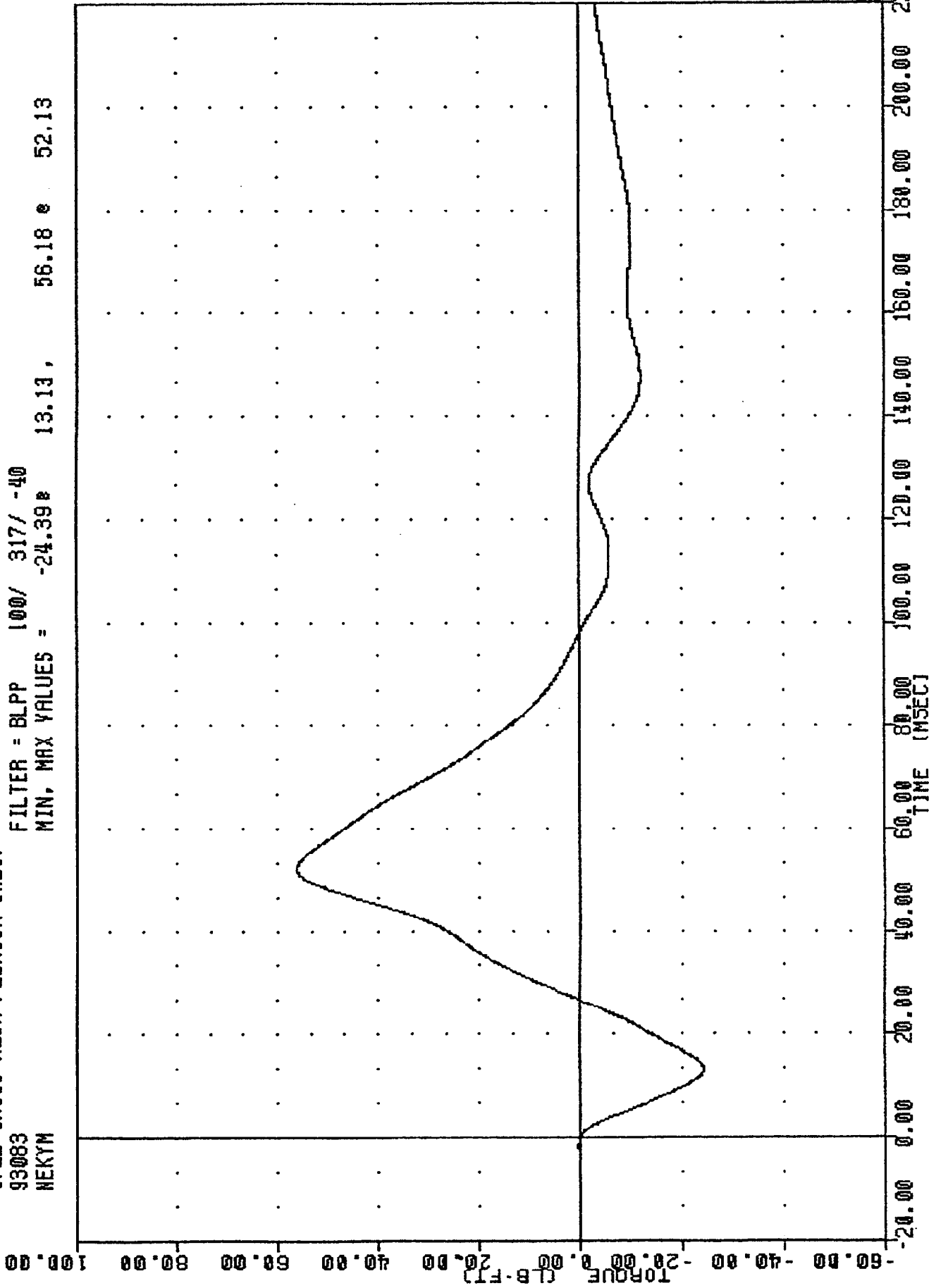
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -39.37 169.88 179.61 e 44.75



PART 572-E HYBRID III NECK FLEXION CALIBRATION
 NFCK FORCE X AXIS

TAC
 572E SN040 NECK FLEXION CAL07
 93083
 NEKYM

FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -24.39 13.13, 56.18 52.13



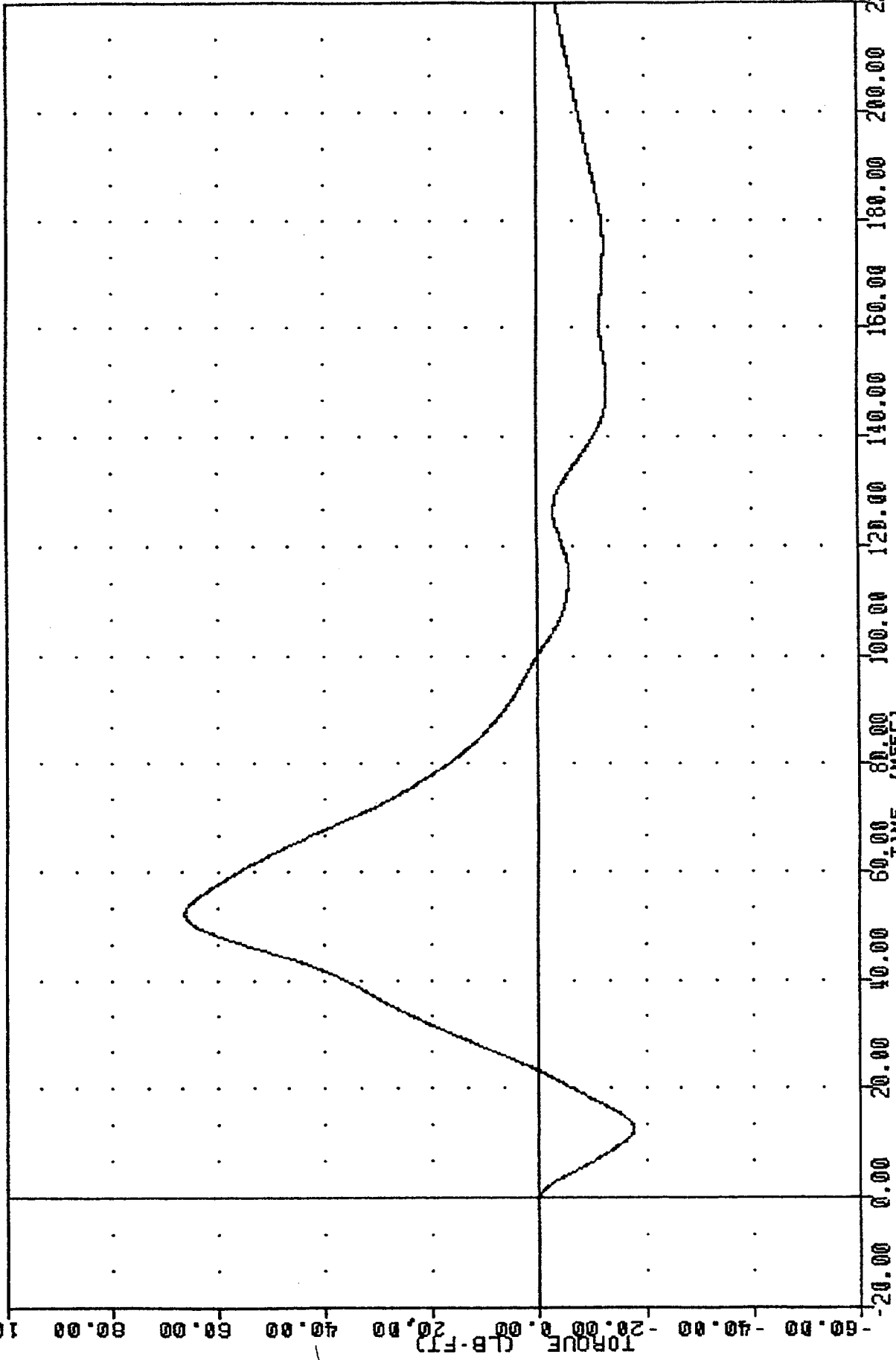
PART 572-E HYBRID III NECK FLEXION CALIBRATION
 NECK MOMENT Y AXIS

TRC
572E SN048 NECK FLEXION CAL07
93083
NEKOM

48C7NF1

FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -17.72 12.63 66.18 52.13

100.00



PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

24-MAR-93

6 AXIS NECK TRANSDUCER
TRC 48C7NE1

572E SN048 NECK EXT. CAL07

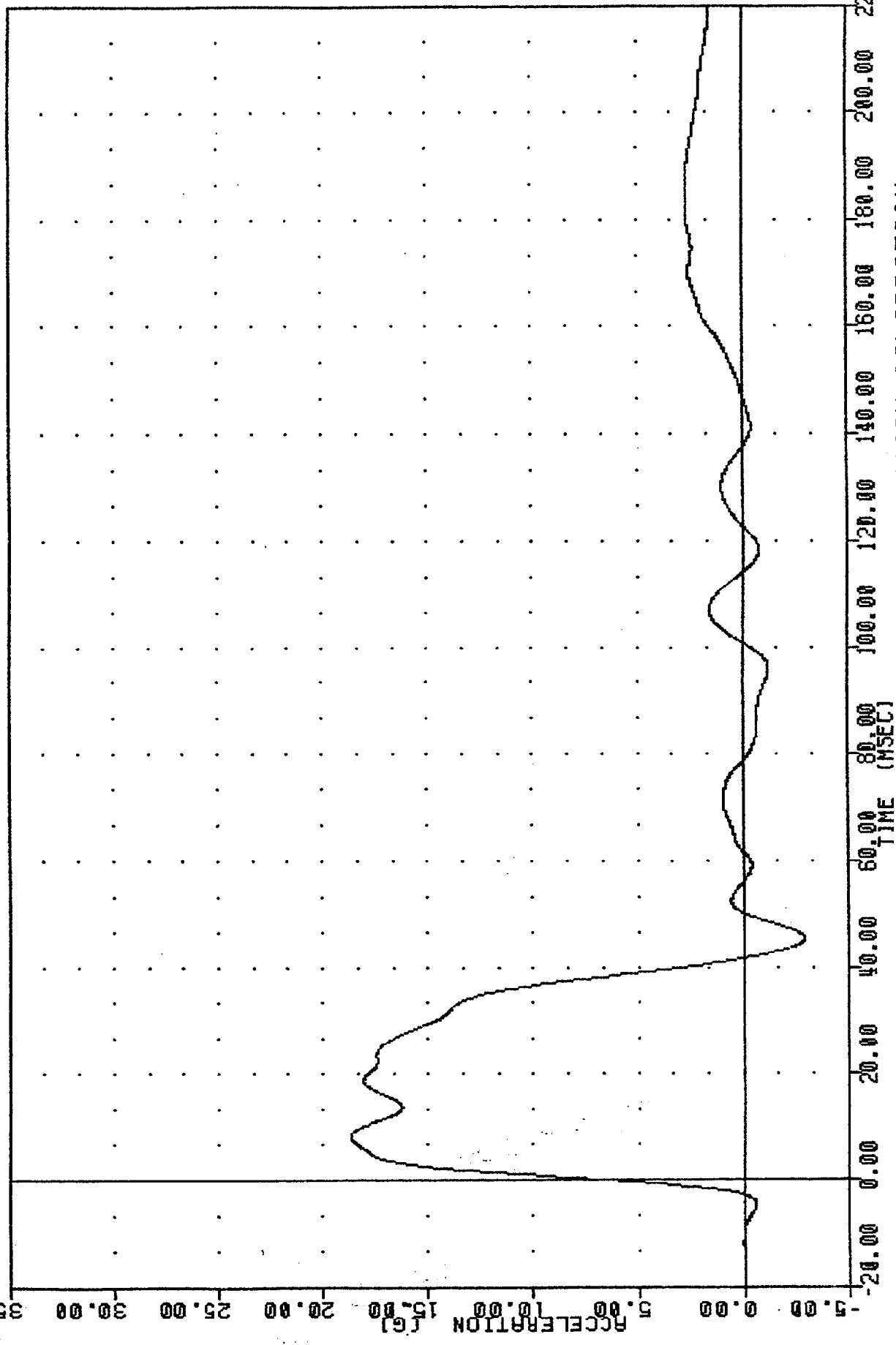
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|--|--------------------------|---------------|
| TEMPERATURE | 69 - 72 DEG. F | 71.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| IMPACT VELOCITY | 19.50-20.30 FT/SEC | 19.83 FT/SEC |
| PENDULUM DECELERATION | 10 MS 17.20 - 21.20 G | 18.12 G |
| | 20 MS 14.00 - 19.00 G | 17.84 G |
| | 30 MS 11.00 - 16.00 G | 14.69 G |
| MAX PENDULUM G ABOVE 30 MS | 22 G MAX | 14.62 G |
| DECELERATION-TIME CURVE DECAY TIME TO 5 G | 38 - 46 MS | 38.88 MS |
| D PLANE ROTATION | MAX 81 - 106 DEG. | 101.53 DEG. |
| | TIME 72 - 82 MS | 75.88 MS |
| MOMENT ABOUT OCCIPITAL CONDYLE | MIN -59.0/-39.0 FT.LBS | -52.42 FT.LBS |
| | TIME 65 - 79 MS | 70.13 MS |
| ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO | 147 - 174 MS | 157.88 MS |
| NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO | 120 - 148 MS | 146.63 MS |

TEST MEETS SPECIFICATIONS

TECHNICIAN *Pete Fount*

TRC
572E SN048 NECK EXT. CAL07
93083
PENXG

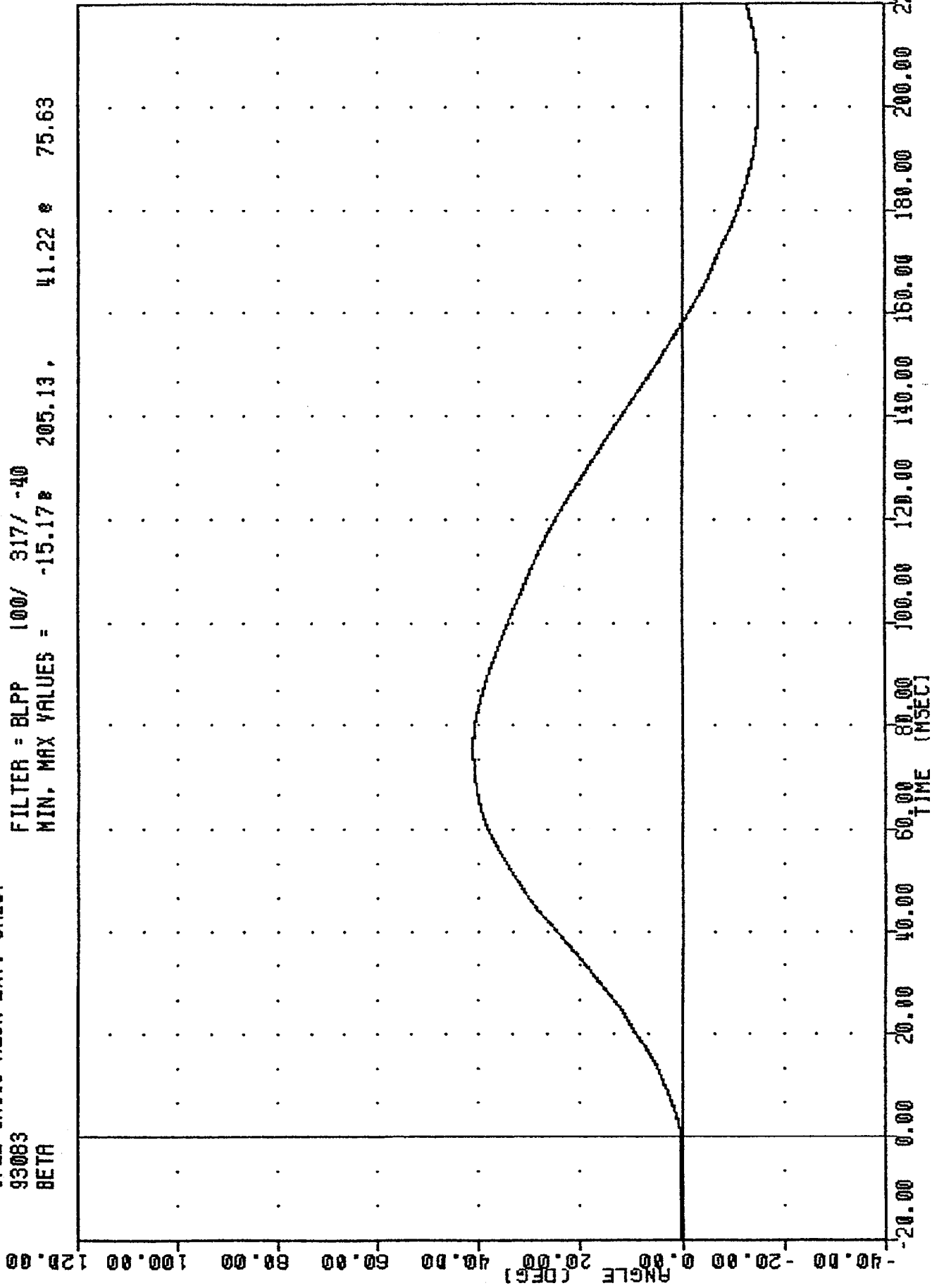
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -2.95# 45.38 , 18.67 # 8.13



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
PENDULUM DECELERATION

TRC
 572E SN048 NECK EXT. CAL07
 93083
 BETA

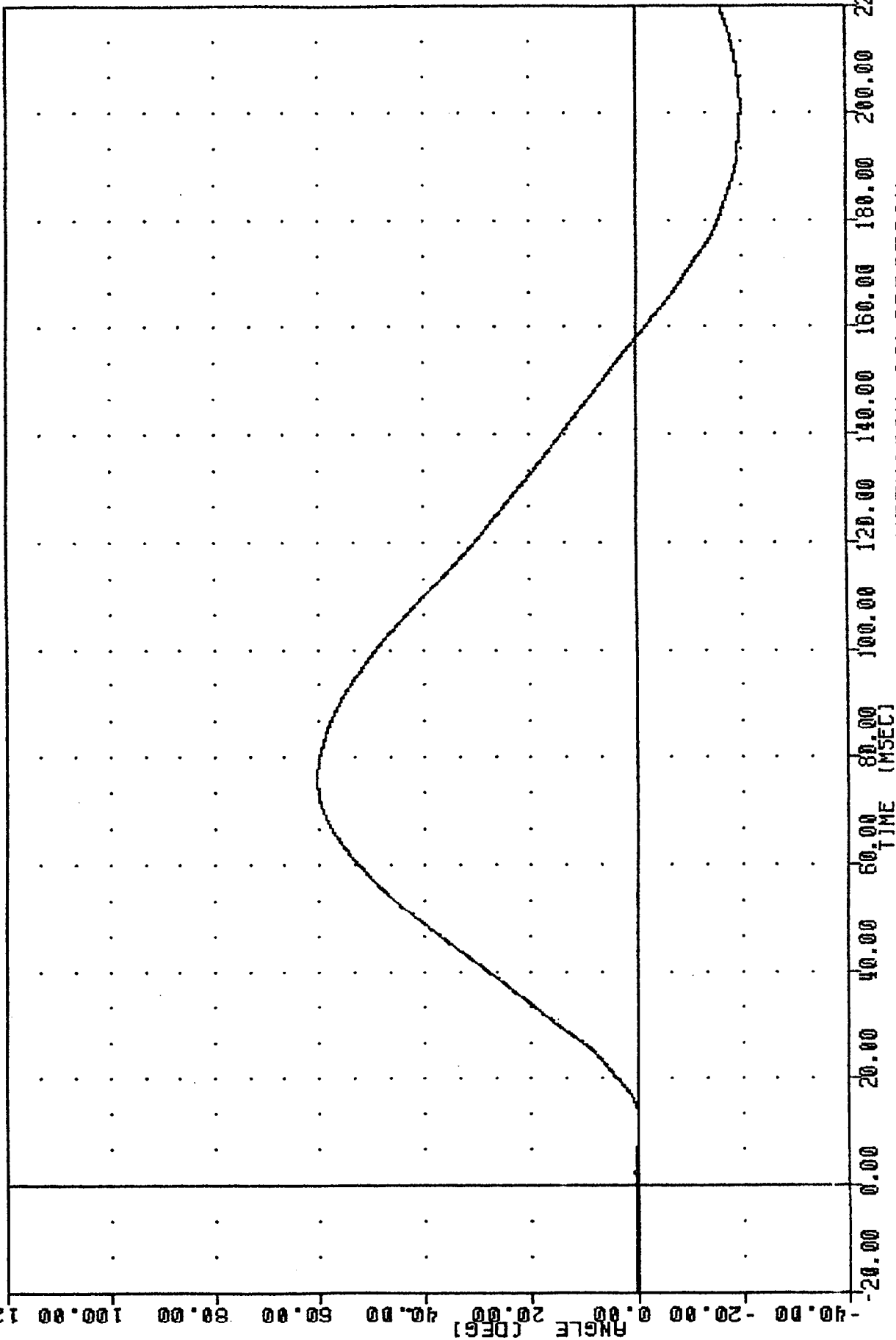
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -15.17 205.13 41.22 75.63



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 ROTATION ABOUT BASE OF NECK

TRC
572E SN048 NECK EXT. CAL07
93083
THETA

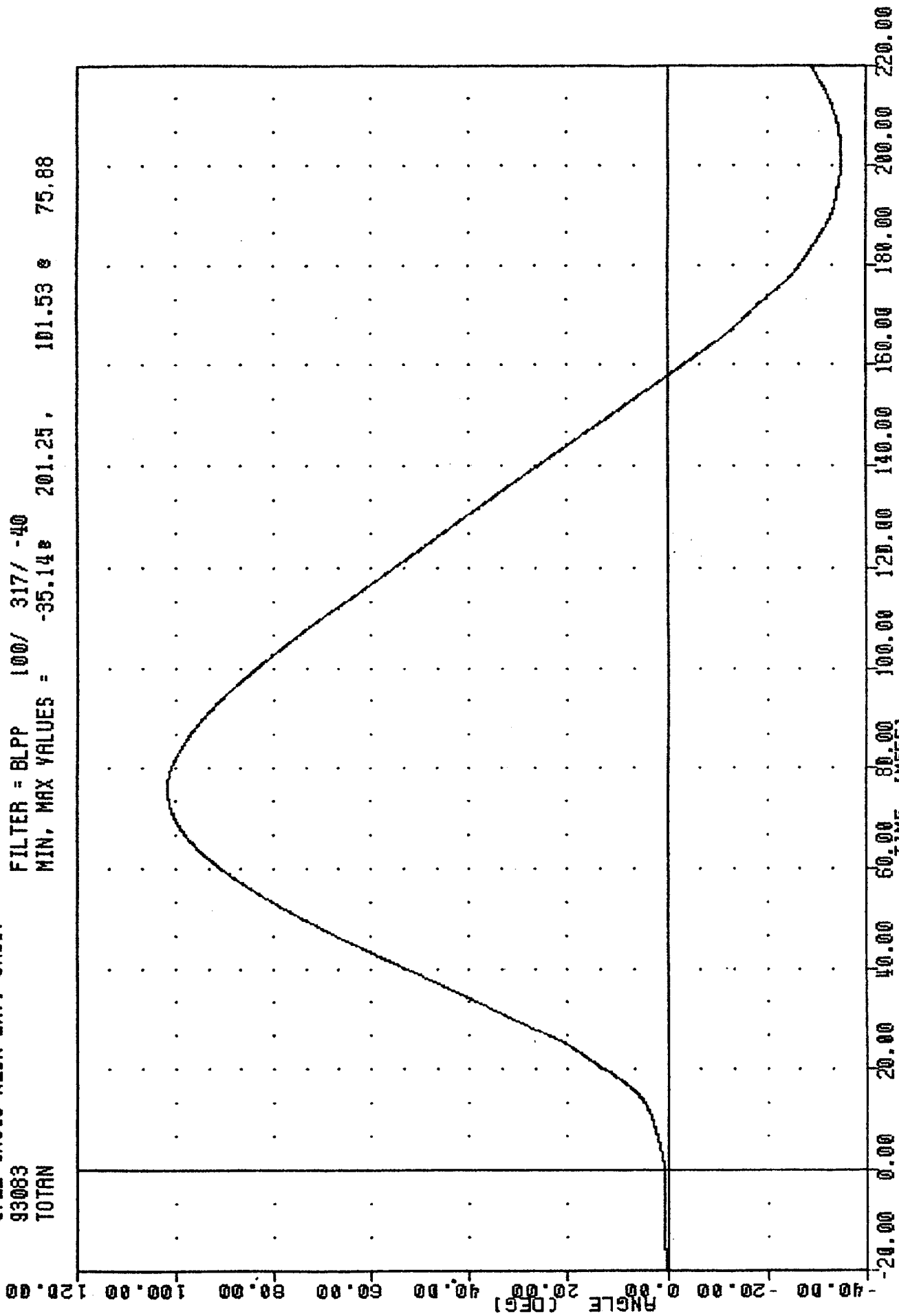
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -19.98 201.13, 50.32 e 75.88



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

TRC
572E SN048 NECK EXT. CAL07
93083
TOTAL

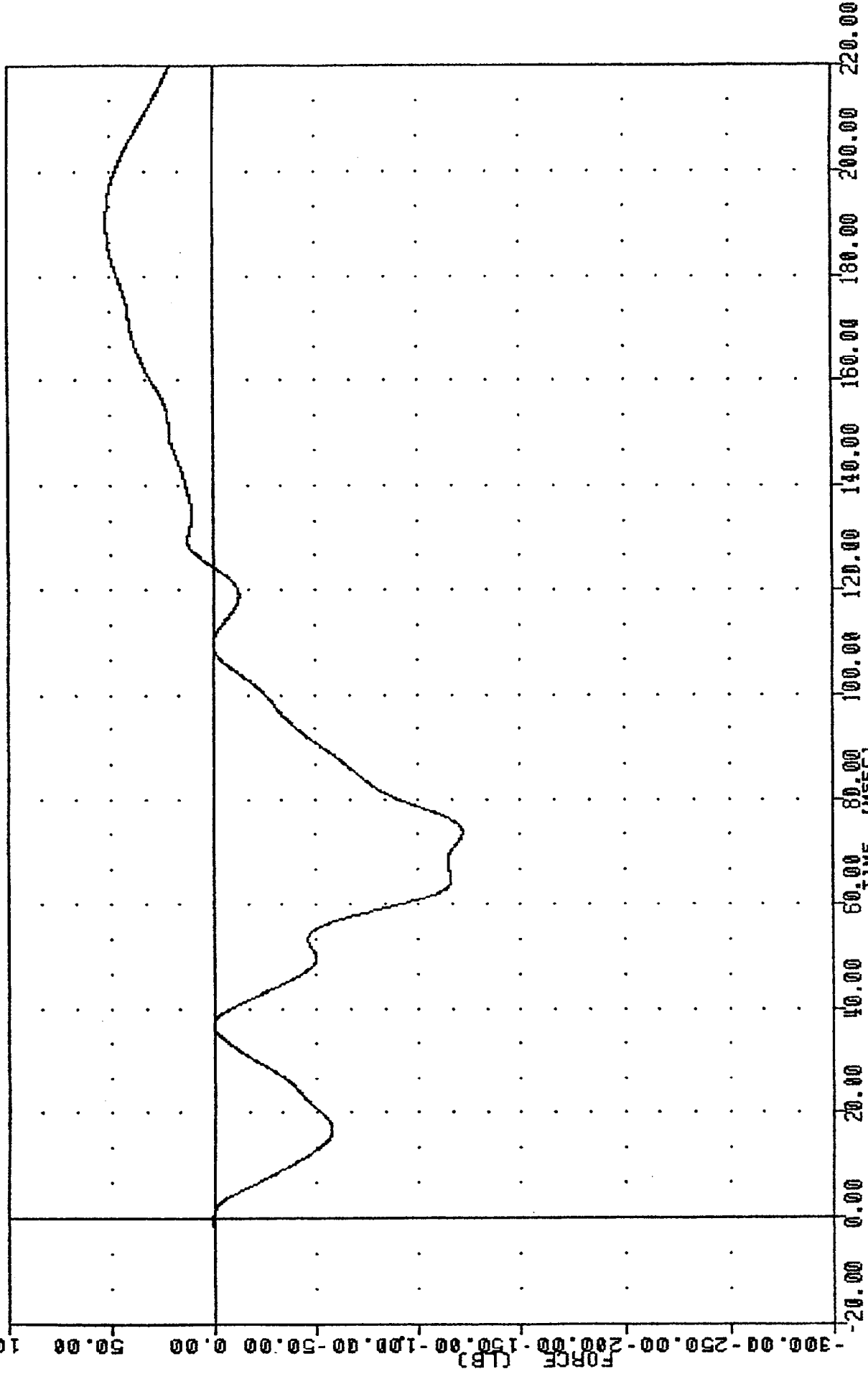
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -35.148 201.25, 101.53 75.88



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL ROTATION

TRC
572E SN048 NECK EXT. CAL07
93083
NEKXF

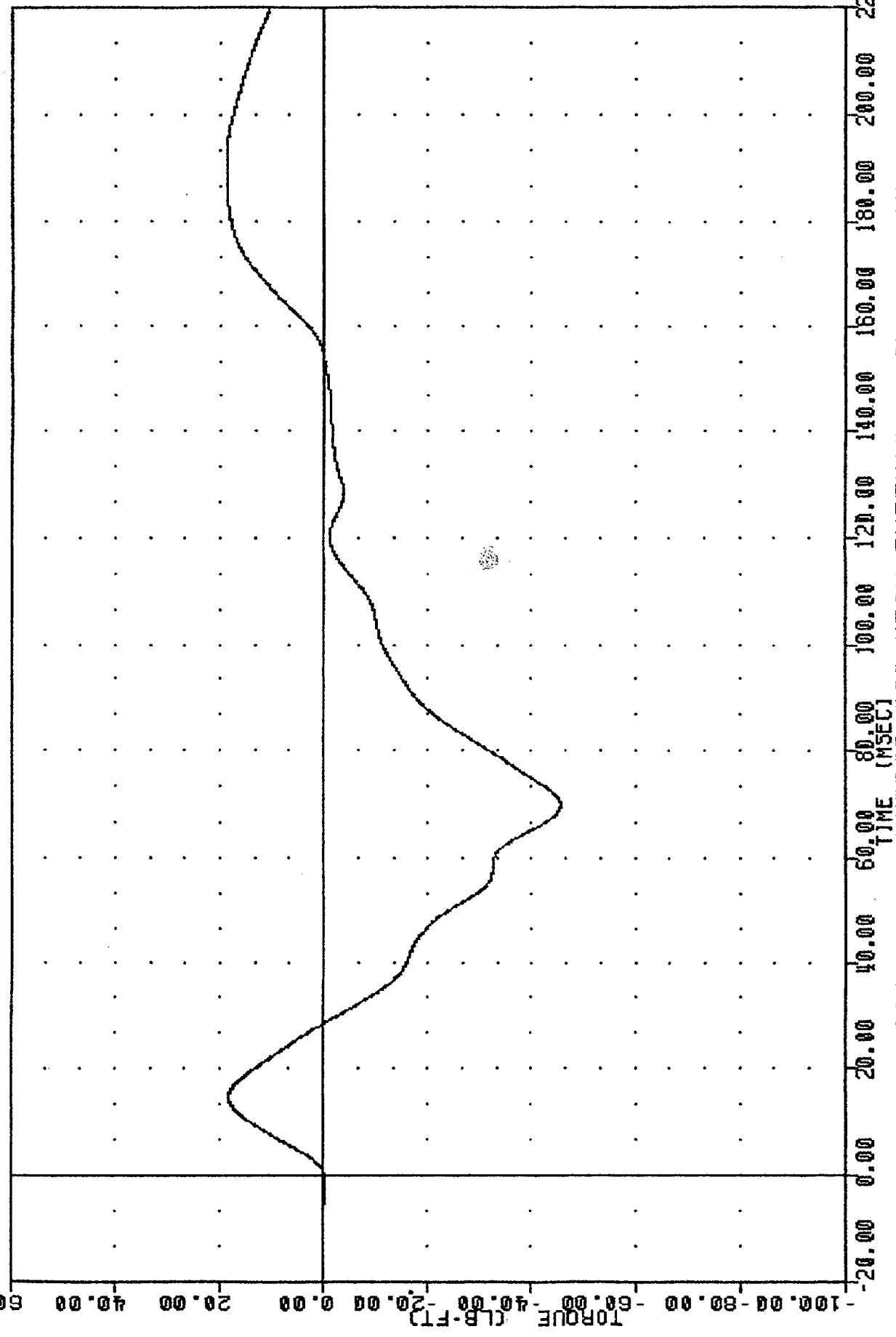
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -121.69 73.75 , 51.56 e 190.50



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
NECK FORCE X AXIS

TRC
572E SN048 NECK EXT. CAL07
93083
NEKYM

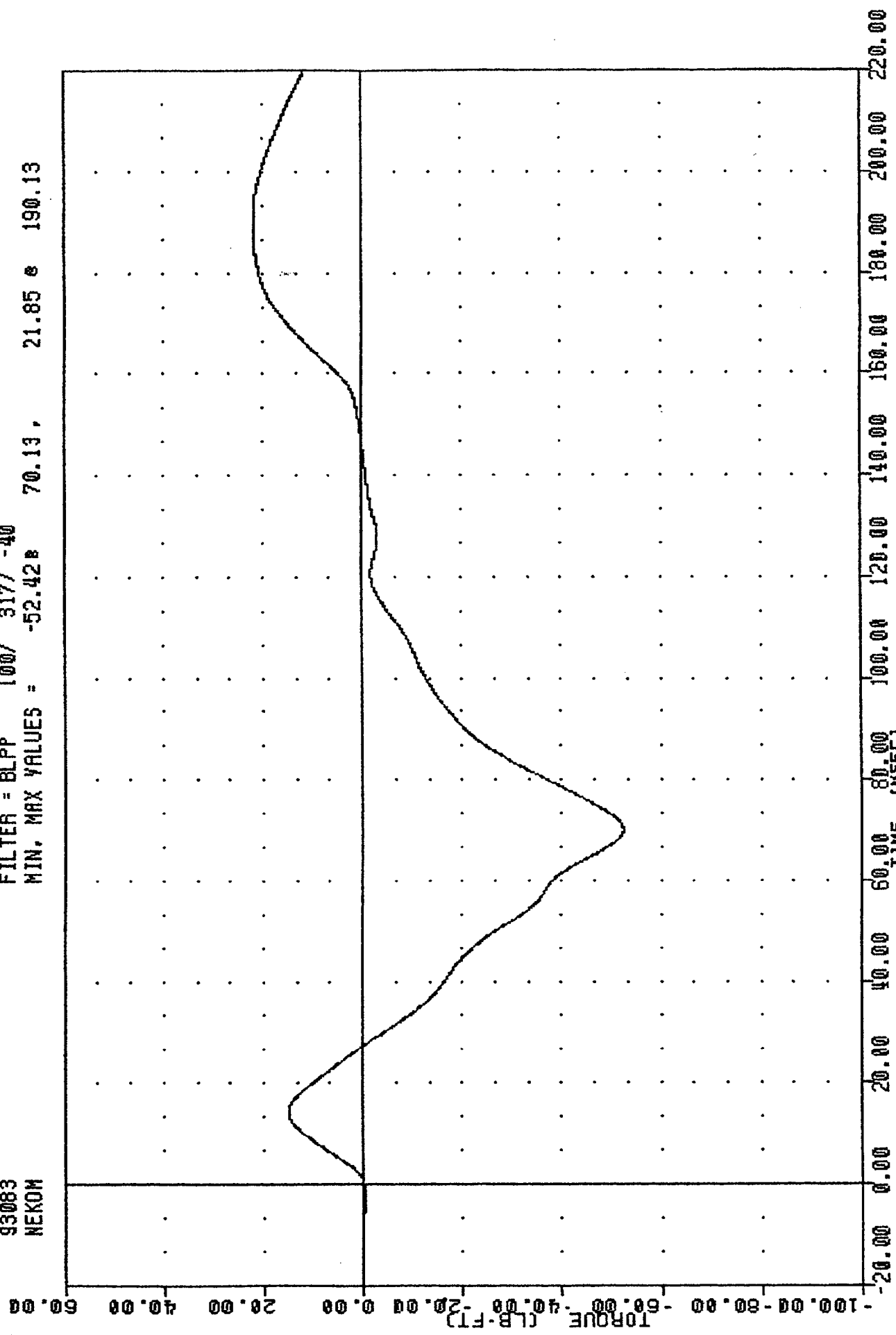
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -45.658 70.00, 18.84 e 190.13



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
NECK MOMENT Y AXIS

TAC
572E SN048 NECK EXT. CAL07
93083
NEKOM

FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -52.42 70.13 , 21.85 190.13



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRANSPORTATION RESEARCH CENTER INC.

THORAX IMPACT TEST

HYBRID III

25-MAR-93

TRC

48C7TH1

572E SN048 H.S.THORAX CAL07

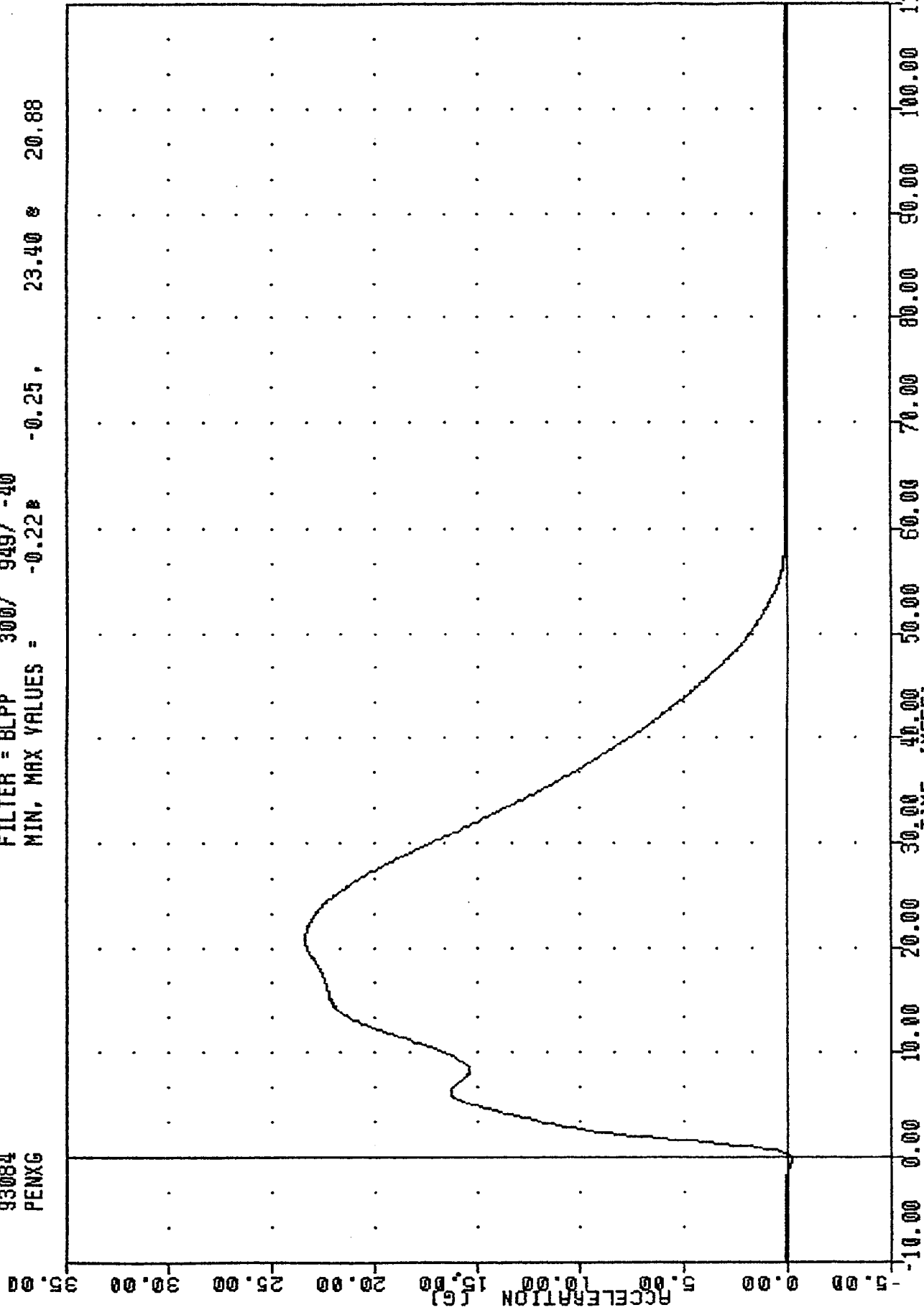
| HIGH SPEED TEST | | |
|-------------------------|------------------|--------------|
| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
| TEMPERATURE | 69 - 72 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 50.0 % |
| PENDULUM VELOCITY | 21.6-22.4 FT/SEC | 21.91 FT/SEC |
| MAXIMUM DEFLECTION | 2.50 - 2.86 IN | 2.73 IN |
| MAXIMUM RESISTIVE FORCE | 1160 - 1325 LBS | 1205.3 LBS |
| INTERNAL HYSTERESIS | 69% - 85% | 72.0% |

TEST MEETS SPECIFICATIONS

TECHNICIAN *Pete Ford*

TRC
572E SN048 H.S. THORAX CAL07
93084
PENXG

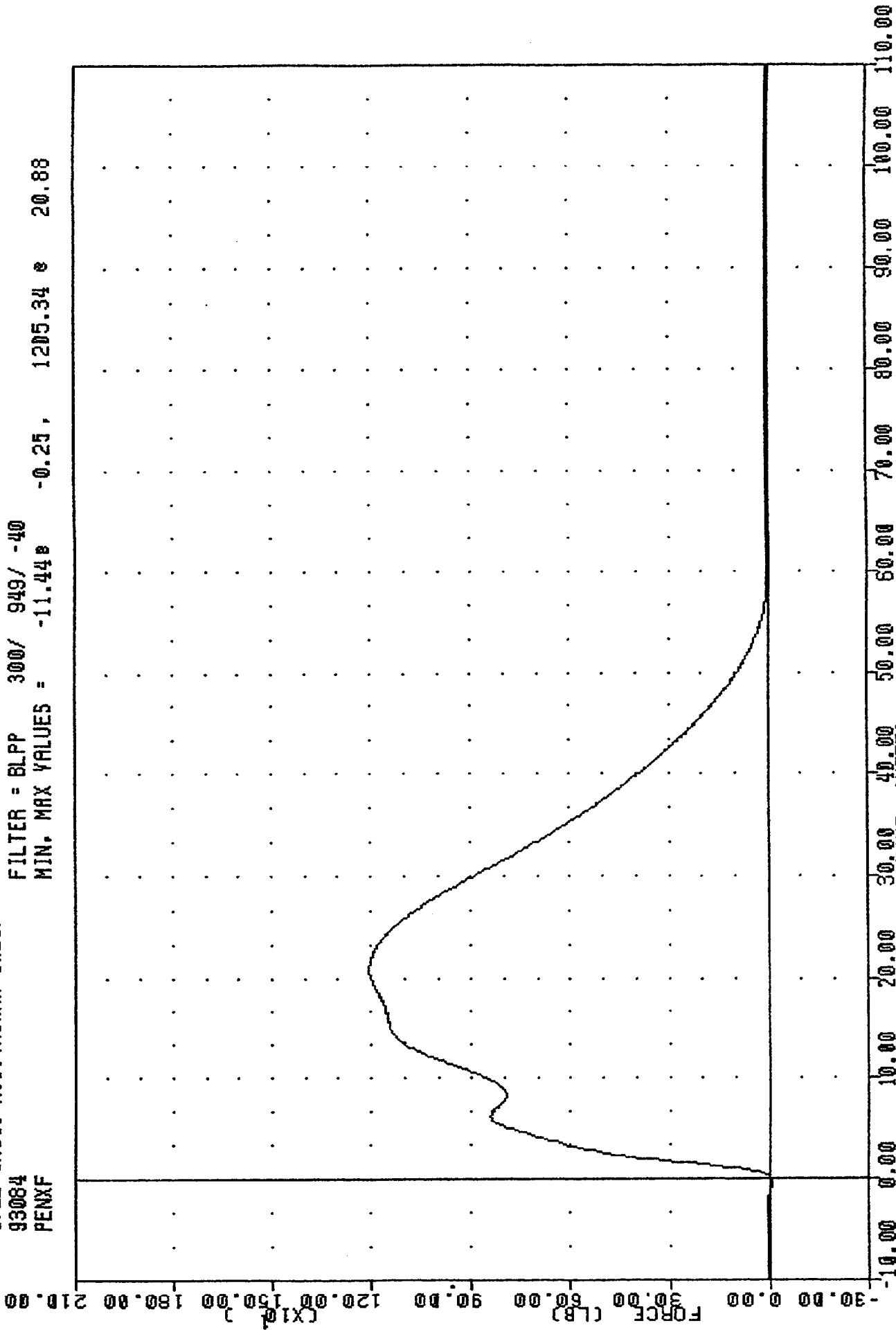
FILTER = BLPP 300/ 949/ -40
MIN, MAX VALUES = -0.228 23.40 * 20.88



PART 572-E HYBRID III THORAX CALIBRATION
PENXG IIIIIM OFFFI FRA TION

TRC
 572E SN048 H.S. THORAX CAL07
 93084
 PENXF

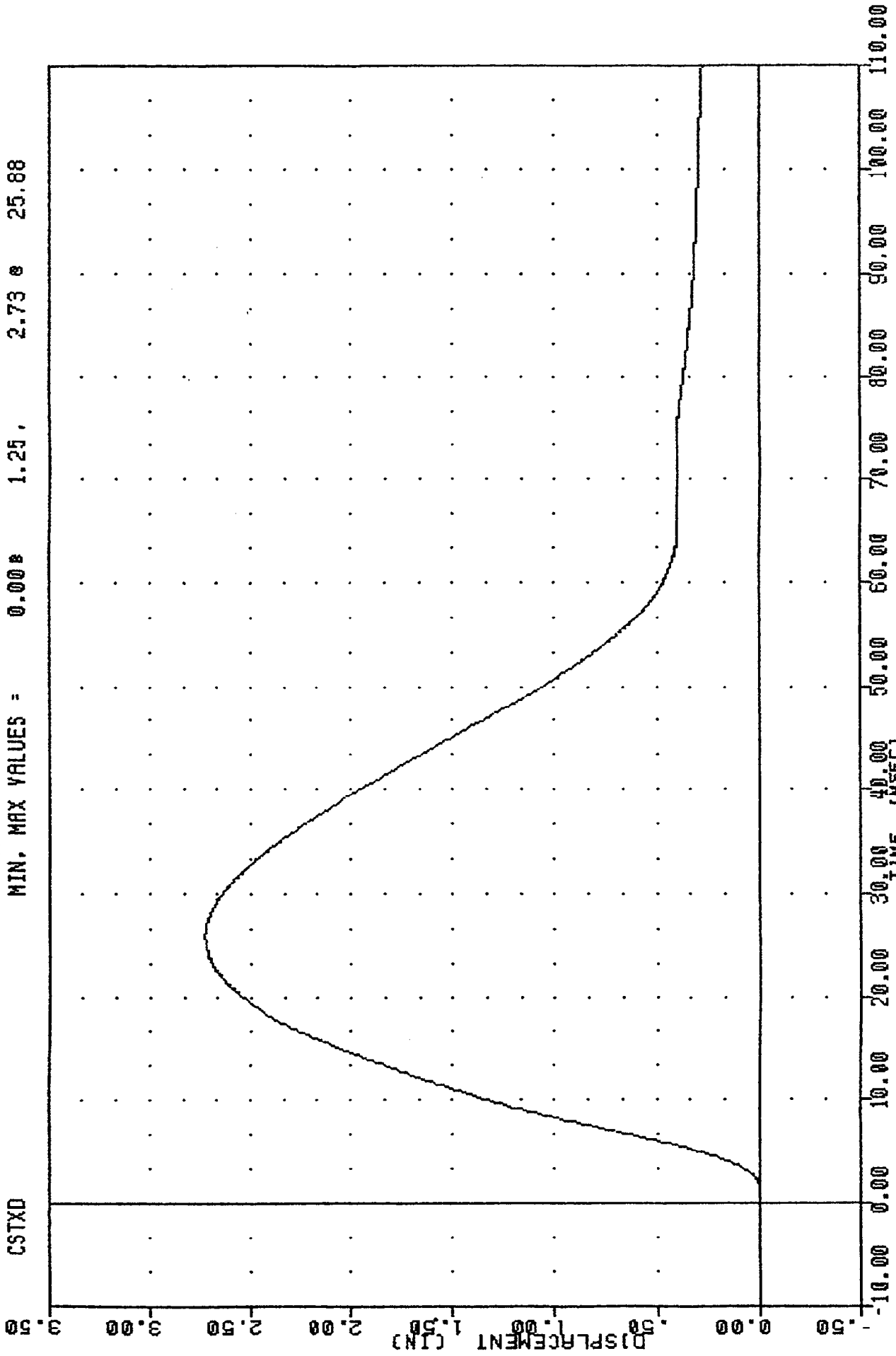
FILTER = BLPP 300/ 949/ -40
 MIN. MAX VALUES = -11.448 -0.25, 1205.34 e 20.88



PART 572-E HYBRID III THORAX CALIBRATION
 PENDULUM FORCE

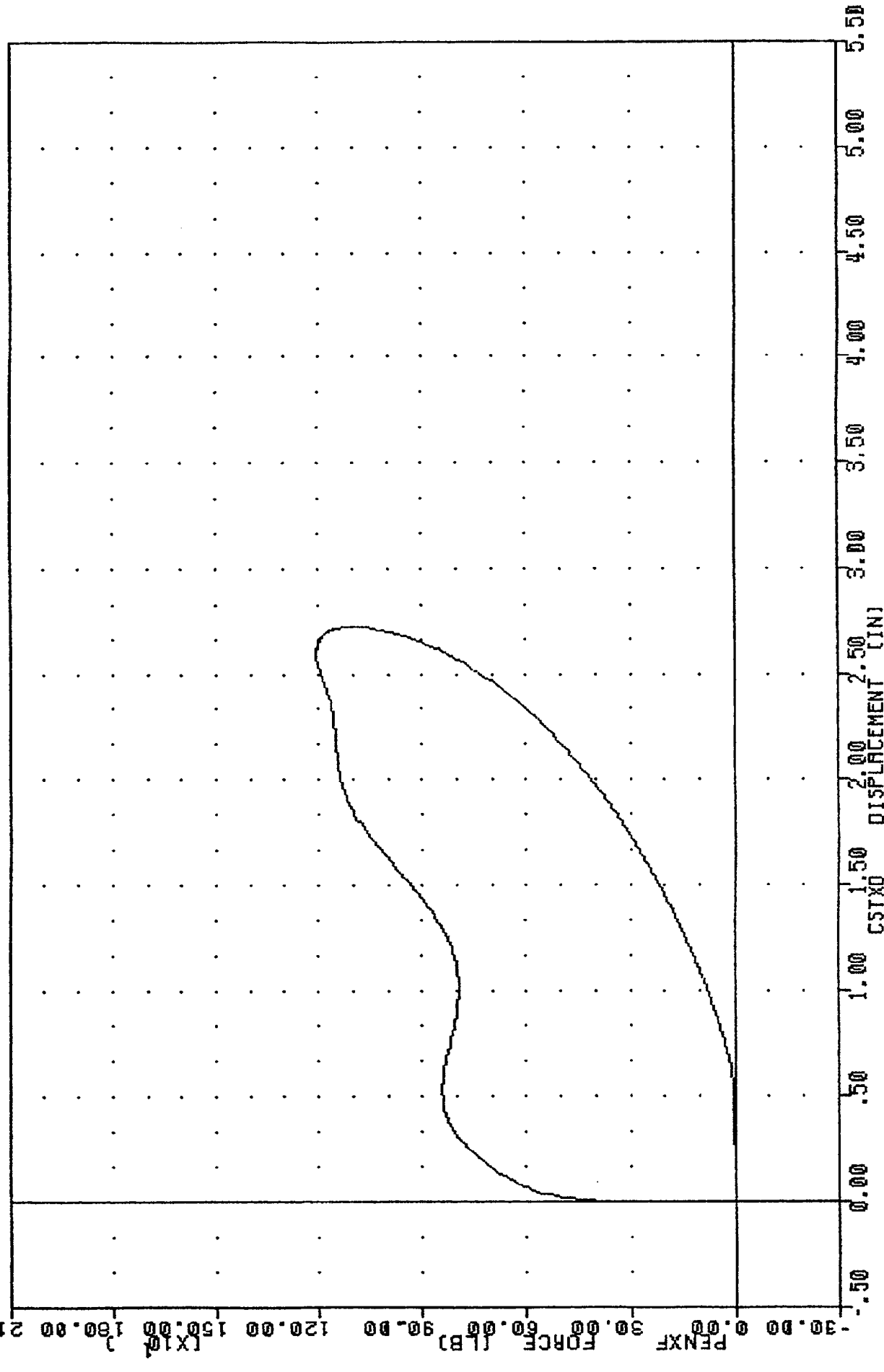
TRC
572E SN048 H.S. THORAX CAL07
93084
CSTXD

FILTER = BLPP 300/ 949/ -40
MIN. MAX VALUES = 0.00 1.25, 2.73 25.88



PART 572-E HYBRID III THORAX CALIBRATION
STERNUM DISPLACEMENT

TRC
 CSTXD
 PENXF
 48C7THI
 FILTER = BLPP
 FILTER = BLPP
 572E
 SNO48
 949/ -40
 949/ -40
 H.S. THORAX
 CHL07
 MIN. MAX =
 MIN. MAX =
 93084
 0.00
 -11.44
 1.25
 -0.25
 2.73
 1205.34
 25.88
 20.88



PART 572-E HYBRID III THORAX CALIBRATION
 CHEST DISPLACEMENT VS PENDULUM FORCE

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

13-APR-93

RIGHT KNEE
TRC

48C7RK2

572E SN048 RIGHT KNEE CAL 07

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|------------------------|------------------|--------------|
| TEMPERATURE | 66 - 78 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 48.0 % |
| PROBE VELOCITY | 6.8 - 7.0 FT/SEC | 6.83 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1060 - 1300 LBS | 1109.24 LBS |
| PROBE WEIGHT | 11.0 LBS | |

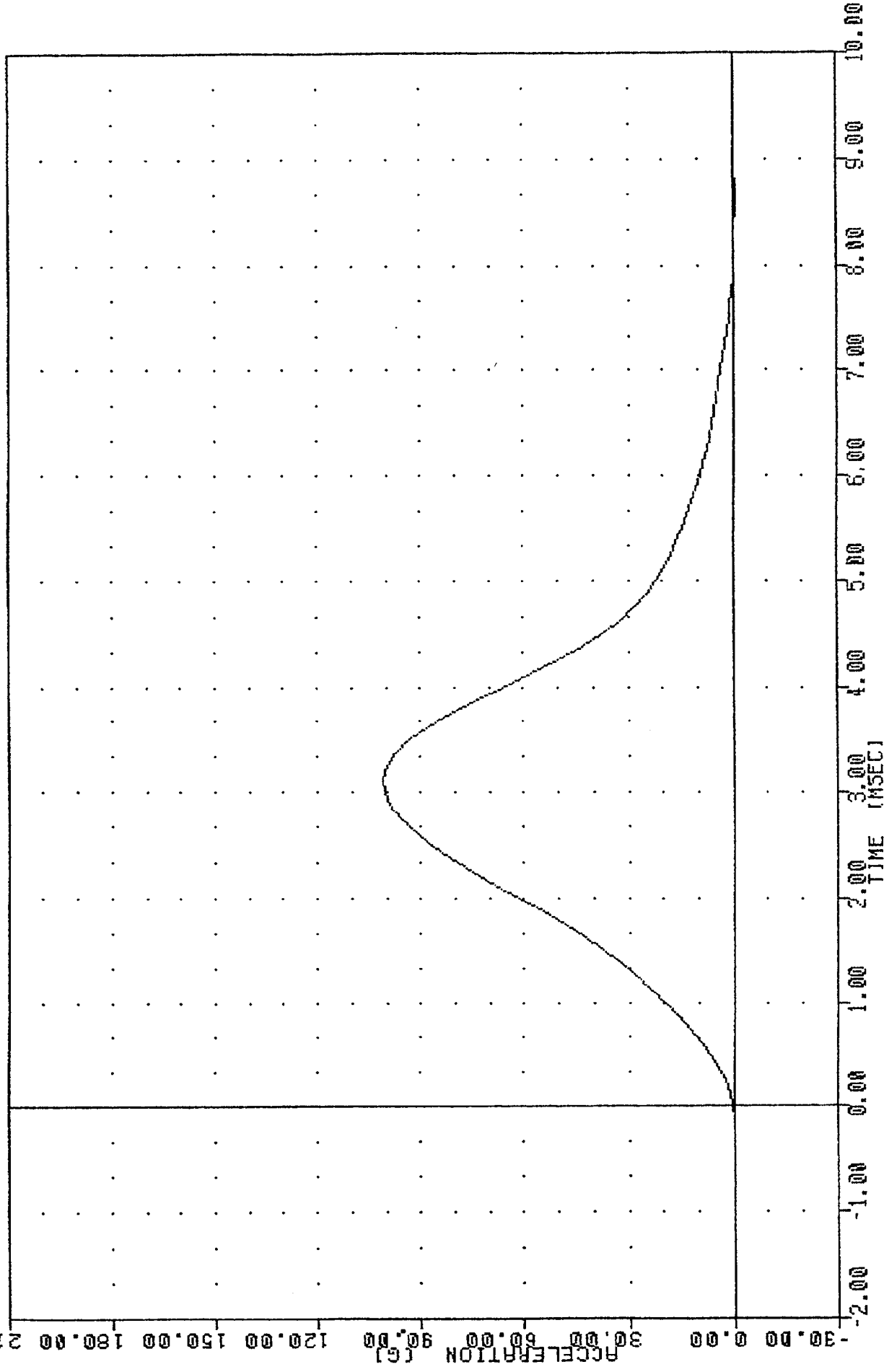
TEST MEETS SPECIFICATIONS

TECHNICIAN

Chas. Middleton

TRC
 572E SN049 RIGHT KNEE CAL 07
 93103
 PENXG

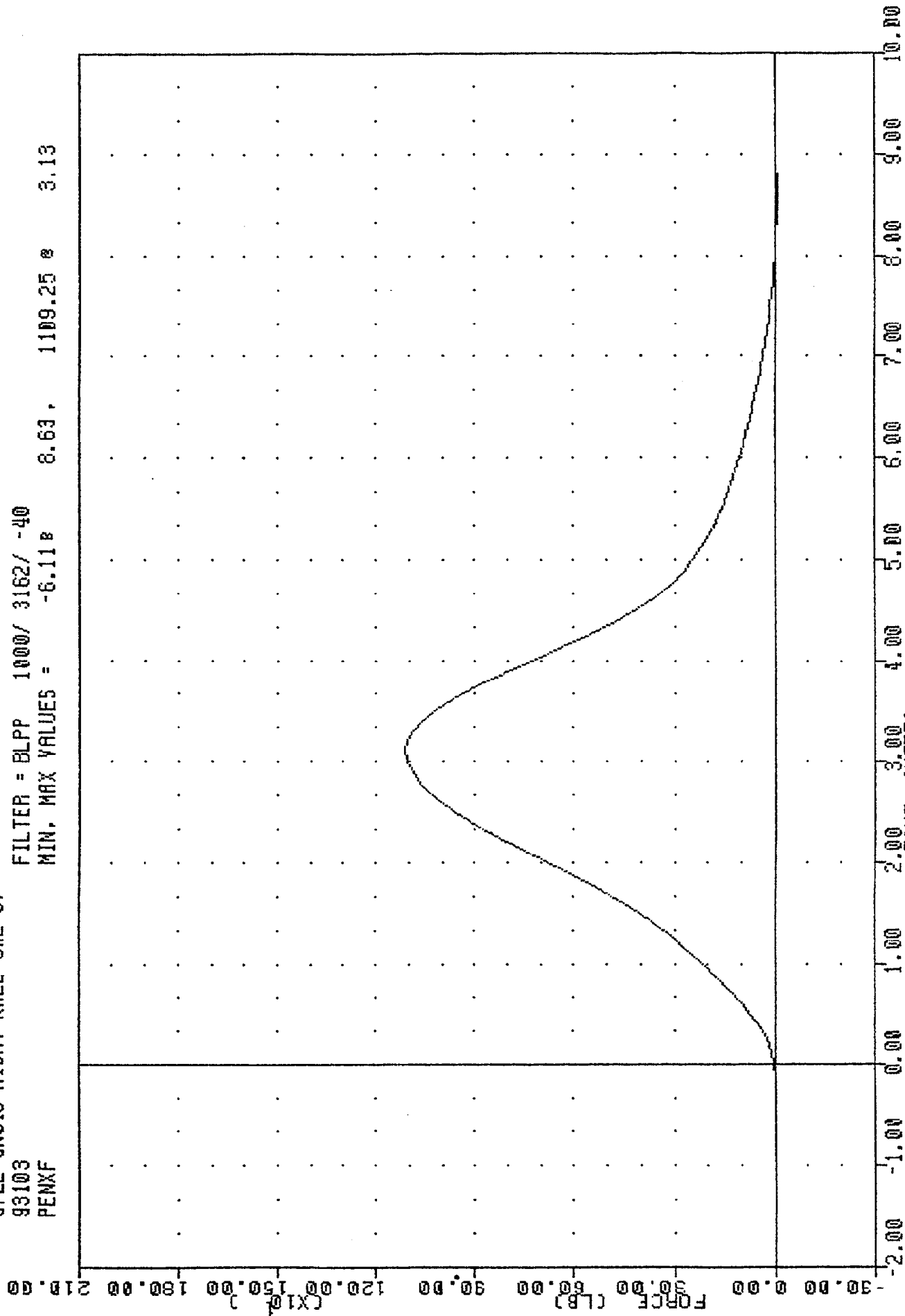
FILTER = BLPP 1000/ 3162/ -40
 MIN, MAX VALUES = -0.568 8.63, 100.84 3.13



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
 PENNIII IM ACCELERATION (11 LB PEND.)

TRC
 572E SN040 RIGHT KNEE CAL 07
 93103
 PENXF

FILTER = BLPP 1000/ 3162/ -40
 MIN. MAX VALUES = -6.118 8.63, 1109.25 @ 3.13



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
 PFNIII IM FORCF (11 12 PFND.)

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

13-APR-93

LEFT KNEE
TRC

48C7LK2

572E SN048 LEFT KNEE CAL 07

| TEST PARAMETER | SPECIFICATION | TEST RESULTS |
|------------------------|------------------|--------------|
| TEMPERATURE | 66 - 78 DEG. F | 70.0 DEG. F |
| RELATIVE HUMIDITY | 10% - 70% | 48.0 % |
| PROBE VELOCITY | 6.8 - 7.0 FT/SEC | 6.80 FT/SEC |
| PEAK KNEE IMPACT FORCE | 1060 - 1300 LBS | 1159.62 LBS |
| PROBE WEIGHT | 11.0 LBS | |

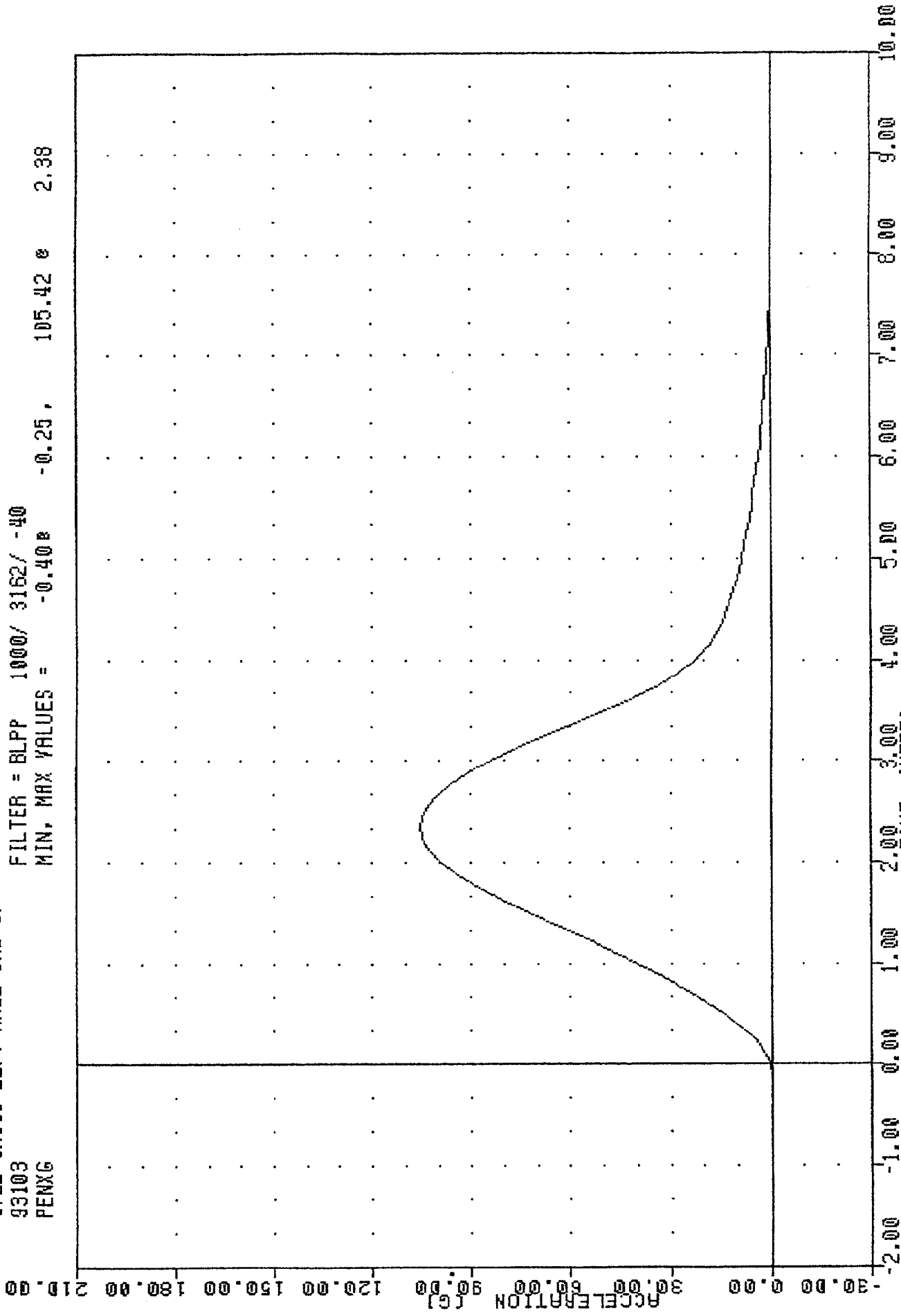
TEST MEETS SPECIFICATIONS

TECHNICIAN

Chas. Middleton

TRC
 572E 9N049 LEFT KNEE CAL 07
 93103
 PENXG

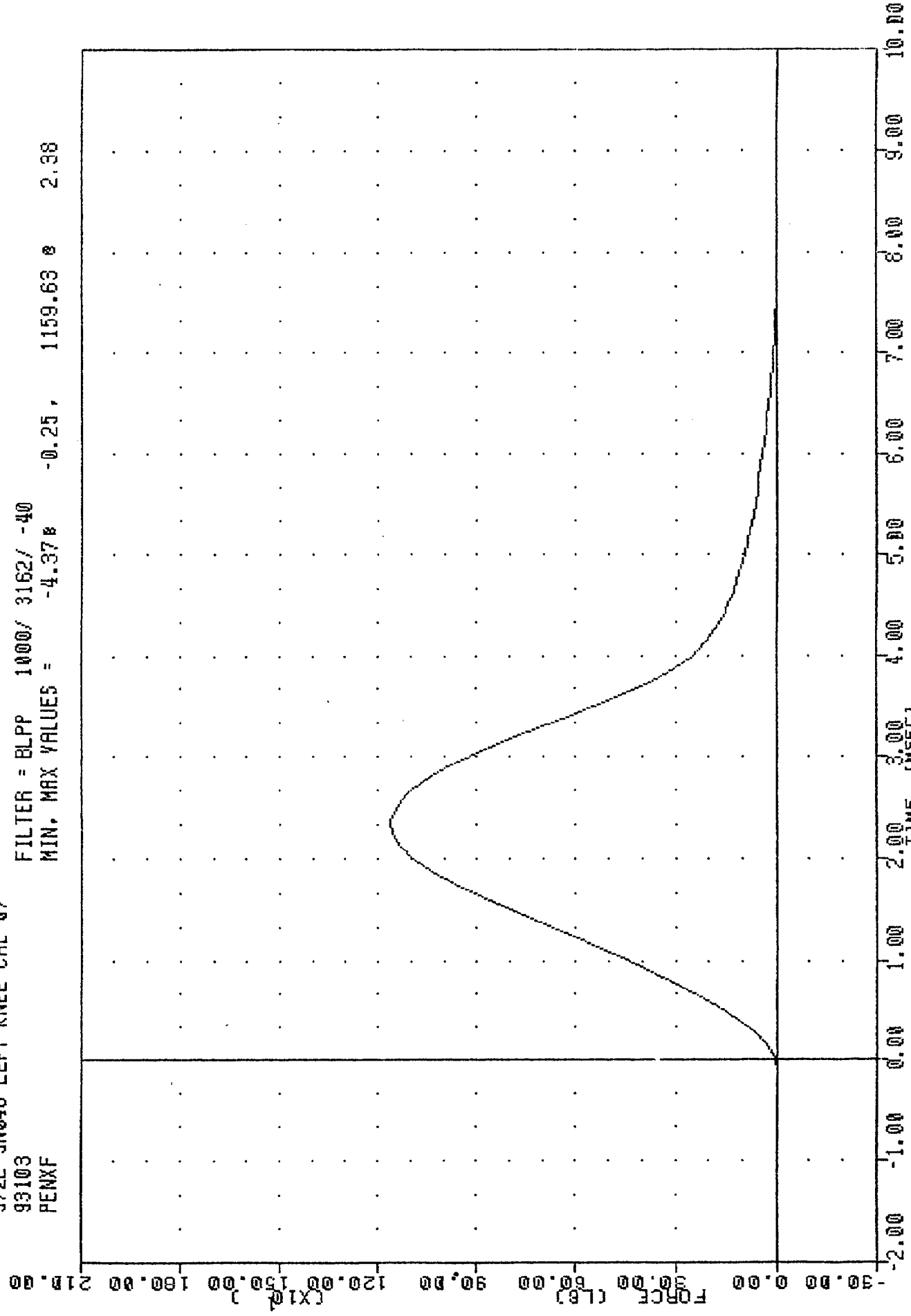
FILTER = BLPP 1000/ 3162/ -40
 MIN, MAX VALUES = -0.408 105.42 2.38



PART 572-E HYBRID III LEFT KNEE CALIBRATION
 PENNIIIM OFFFIFRATION 111 IR PFND.1

TRC
 572E SN048 LEFT KNEE CAL 07
 93103
 PENXF

FILTER = BLPP 1000/ 3162/ -40
 MIN, MAX VALUES = -4.37 0 -0.25, 1159.63 0 2.38



PART 572-E HYBRID III LEFT KNEE CALIBRATION
 PENNIII IIM FTRAFF T11 IR PFMD 7

APPENDIX D

MISCELLANEOUS TEST INFORMATION

DUMMY INSTRUMENTATION PLACEMENT

DUMMY MANUFACTURER & S/N: HUMANOID SYSTEMS #043

SEATING POSITION: DRIVER

| <u>DESCRIPTION</u> | <u>AXIS</u> | <u>MFR</u> | <u>MODEL</u> | <u>S/N</u> | <u>ORIENTATION (+ SENSING)</u> |
|---------------------|-------------|------------|--------------|------------|------------------------------------|
| HEAD ACCELERATION | X | ENDEVCO | 7264 | BG23J | FRONT |
| HEAD ACCELERATION | Y | ENDEVCO | 7264 | FG33J | RIGHT |
| HEAD ACCELERATION | Z | ENDEVCO | 7264 | DP32J | UP |
| NECK SHEAR FORCE | X | DENTON | 1716A | 0425 | HEAD REARWARD |
| NECK SHEAR FORCE | Y | DENTON | 1716A | 0425 | HEAD LEFTWARD |
| NECK AXIAL FORCE | Z | DENTON | 1716A | 0425 | HEAD UPWARD |
| NECK MOMENT | X | DENTON | 1716A | 0425 | LEFT EAR TOWARD LEFT SHOULDER |
| NECK MOMENT | Y | DENTON | 1716A | 0425 | CHIN TO CHEST |
| NECK MOMENT | Z | DENTON | 1716A | 0425 | CHIN TOWARD LEFT SHOULDER |
| CHEST ACCELERATION | X | ENDEVCO | 7264 | EJ01J | FRONT |
| CHEST ACCELERATION | Y | ENDEVCO | 7264 | DH31J | LEFT |
| CHEST ACCELERATION | Z | ENDEVCO | 7264 | FF79J | UP |
| CHEST DEFLECTION | X | BOURNS | NA | 043 | OUTWARD |
| PELVIS ACCELERATION | X | ENDEVCO | 7264 | DM72J | REAR |
| PELVIS ACCELERATION | Y | ENDEVCO | 7264 | BG11J | LEFT |
| PELVIS ACCELERATION | Z | ENDEVCO | 7264 | BH87J | UP |
| LEFT FEMUR FORCE | | GSE | 2430 | 631 | TENSION |
| RIGHT FEMUR FORCE | | GSE | 2430 | 633 | TENSION |

DUMMY INSTRUMENTATION PLACEMENT

DUMMY MANUFACTURER & S/N: HUMANOID SYSTEMS #048

SEATING POSITION: RIGHT FRONT PASSENGER

| <u>DESCRIPTION</u> | <u>AXIS</u> | <u>MFR</u> | <u>MODEL</u> | <u>S/N</u> | <u>ORIENTATION (+ SENSING)</u> |
|---------------------|-------------|------------|--------------|------------|------------------------------------|
| HEAD ACCELERATION | X | ENDEVCO | 7264 | EH78J | REAR |
| HEAD ACCELERATION | Y | ENDEVCO | 7264 | DH37J | LEFT |
| HEAD ACCELERATION | Z | ENDEVCO | 7264 | DD17J | UP |
| NECK SHEAR FORCE | X | DENTON | 1716 | 0106 | HEAD REARWARD |
| NECK SHEAR FORCE | Y | DENTON | 1716 | 0106 | HEAD LEFTWARD |
| NECK AXIAL FORCE | Z | DENTON | 1716 | 0106 | HEAD UPWARD |
| NECK MOMENT | X | DENTON | 1716 | 0106 | LEFT EAR TOWARD LEFT SHOULDER |
| NECK MOMENT | Y | DENTON | 1716 | 0106 | CHIN TO CHEST |
| NECK MOMENT | Z | DENTON | 1716 | 0106 | CHIN TOWARD LEFT SHOULDER |
| CHEST ACCELERATION | X | ENDEVCO | 7264 | EH92J | FRONT |
| CHEST ACCELERATION | Y | ENDEVCO | 7264 | CC24H | LEFT |
| CHEST ACCELERATION | Z | ENDEVCO | 7264 | FG28J | UP |
| CHEST DEFLECTION | X | SERVO | 14CB1-2897 | 9041 | OUTWARD |
| PELVIS ACCELERATION | X | ENDEVCO | 7264 | BC75J | REAR |
| PELVIS ACCELERATION | Y | ENDEVCO | 7264 | FC43J | LEFT |
| PELVIS ACCELERATION | Z | ENDEVCO | 7264 | AP87 | UP |
| LEFT FEMUR FORCE | | GSE | 2430 | 726 | TENSION |
| RIGHT FEMUR FORCE | | GSE | 2430 | 756 | TENSION |

VEHICLE INSTRUMENTATION PLACEMENT

| NO. | LOCATION | AXIS | MFR | MODEL | S/N | ORIENTATION (+ SENSING) |
|-----|--|------|---------|-------|------|----------------------------|
| 1 | LEFT REAR SEAT | X | ENDEVCO | 2264 | AS06 | FORWARD |
| | | Y | ENDEVCO | 2264 | AR49 | RIGHT |
| 2 | RIGHT REAR SEAT | X | ENDEVCO | 2264 | AR38 | REAR |
| | | Y | ENDEVCO | 2264 | AU09 | LEFT |
| 3 | CAR CENTER OF GRAVITY | X | ENDEVCO | 2264 | AG24 | FORWARD |
| | | Y | ENDEVCO | 2264 | BA68 | RIGHT |
| | | Z | ENDEVCO | 2264 | AY66 | UP |
| | RIGHT FRONT PASSENGER'S SHOULDER BELT | | LEBOW | 3419 | 613 | TENSION |

TRACTOR AND SEMITRAILER INSTRUMENTATION PLACEMENT

| NO. | LOCATION | AXIS | MFR | MODEL | S/N | ORIENTATION (+ SENSING) |
|-----|----------------------|------|---------|-------|-------|----------------------------|
| 1 | FRAME RAIL LEFT | X | ENDEVCO | 7264 | CF08H | REAR |
| 2 | FRAME RAIL RIGHT | X | ENDEVCO | 7264 | CL60H | REAR |
| 2 | TRACTOR FRAME CENTER | X | ENDEVCO | 7264 | CK16H | REAR |

SIGN CONVENTION

NHTSA DATA TAPE REFERENCE GUIDE

ACCELEROMETERS:

+X: FORWARD
+Y: LEFTWARD
+Z: UPWARD

POTENTIOMETERS:

+CHEST LONGITUDINAL DEFLECTION: OUTWARD

LOAD CELLS:

+FEMUR FORCE: TENSION
+SEAT BELT FORCE: TENSION

NECK LOAD CELLS:

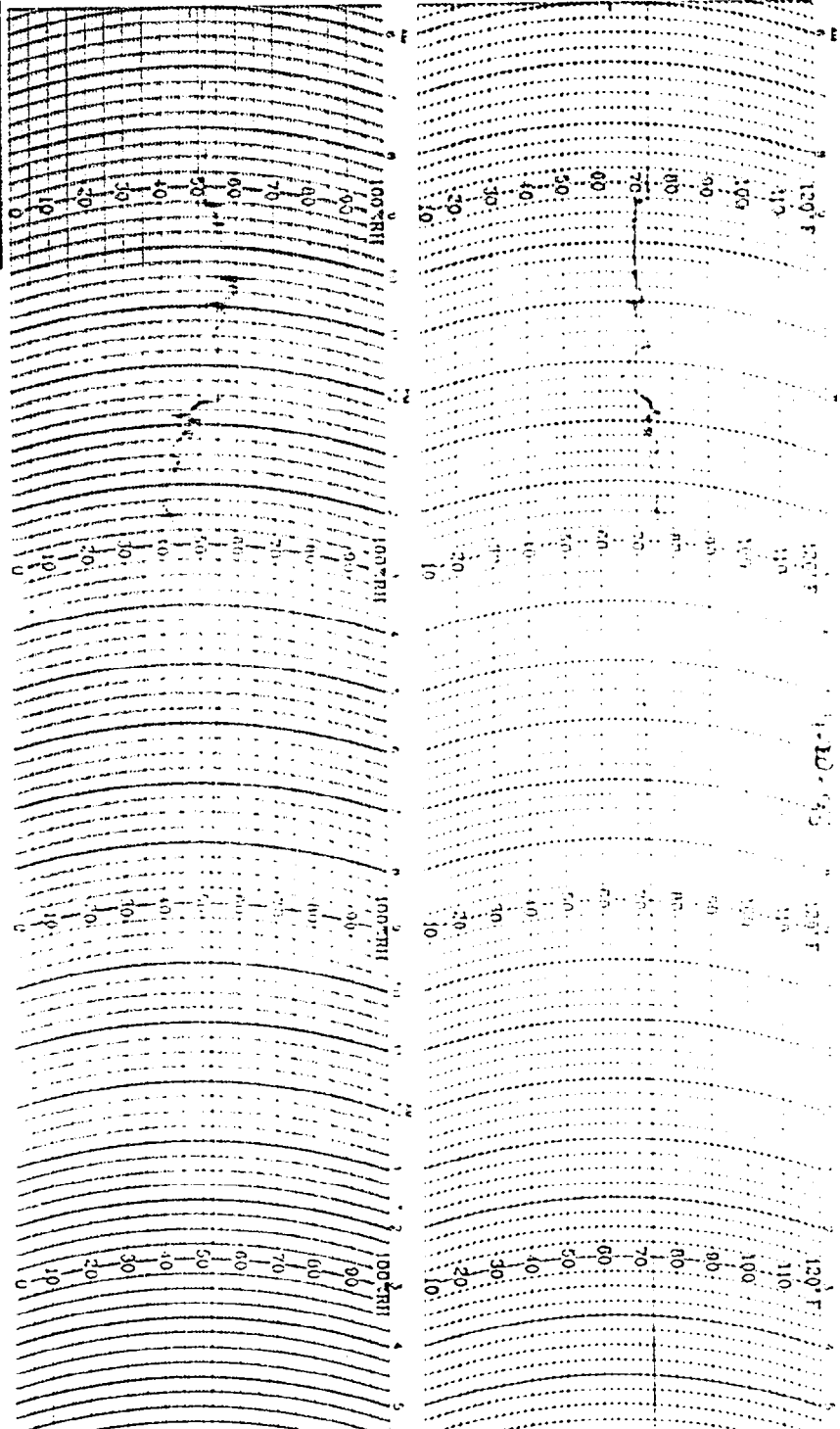
+X FORCE: HEAD PUSHED FORWARD
+Y FORCE: HEAD PUSHED LEFTWARD
+Z FORCE: HEAD PULLED UPWARD (TENSION ON NECK)
+X MOMENT: RIGHT EAR ROTATING TOWARD RIGHT SHOULDER
+Y MOMENT: CHIN ROTATING TOWARD CHEST
+Z MOMENT: CHIN ROTATING TOWARD LEFT SHOULDER

FREQUENCY RESPONSE CLASSES

NHTSA LABORATORY PROCEDURE TP-214D-01

| <u>TYPICAL TEST MEASUREMENTS</u> | <u>CHANNEL CLASS</u> |
|--|----------------------|
| Vehicle Structural Accelerations for use in: | |
| Total vehicle comparison | 60 |
| Collision simulation input | 60 |
| Component analysis | 600 |
| Integration for velocity or displacement | 180 |
| Anthropomorphic Test Device | |
| Head accelerations (linear and angular) | 1000 |
| Thorax | |
| Spine accelerations | 180* |
| Rib accelerations | 180* |
| Deflections | 180 |
| Pelvis | |
| Accelerations | 180* |

*The Channel Class 180 data is further processed by subsampling to a 1600 Hz sample rate, removing bias, and filtering with the Finite Impulse Response (FIR100) filter program.



Weather Measure WEATHERtronics Division of SEALMETER, Inc. P.O. BOX 47039 SACRAMENTO, CA 95841 PHONE (916) 923-0055
 HYGROTHERMOGRAPH CHART NO. 0679123 5-9-87

STATION 930420 DATE ON _____ DATE OFF _____
 OCCUPANT COMPARTMENT THERMOGRAPH