

NHTSA # 1871

HEAVY TRUCK UNDERRIDE PROTECTION

1993 SATURN SL
INTO HEAVY TRUCK REAR UNDERRIDE GUARD
WITH 1.0-INCH MOUNTING BOLTS
TRC TEST NO. 921228

PREPARED BY:
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FINAL REPORT
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PREPARED FOR:
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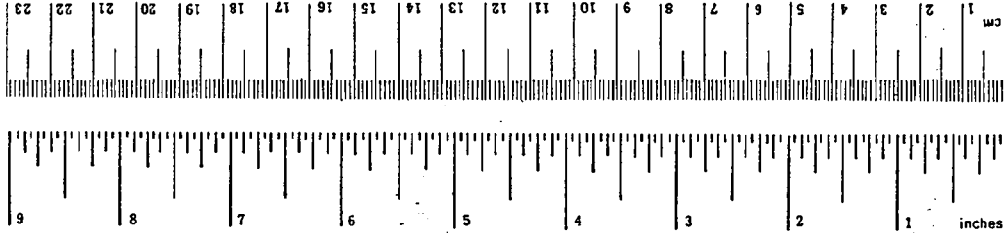
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16. Abstract A 1993 Saturn SL 4-door sedan was impacted into a heavy truck rear underride guard at Transportation Research Center Inc. on December 28, 1992. This test was conducted to determine the performance of the underride guard with 1.0-inch mounting bolts in the 0°, 30 mph impact mode. The actual test speed was 30.0 mph. The ambient temperature was 73° F. At maximum vehicle displacement, the clearance from the simulated truck rear to the vehicle's windshield was 10.1 inches.					
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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	2.5	centimeters	mm	millimeters	0.04	inches	in
ft	feet	30	centimeters	cm	centimeters	0.4	inches	in
yd	yards	0.9	meters	m	meters	3.3	feet	ft
mi	miles	1.6	kilometers	km	kilometers	1.1	yards	yd
						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 meters	0.4	square miles	mi ²
mi ²	square miles	2.6	square kilometers	km ²	square kilometers	2.5	acres	acres
	acres	0.4	hectares	ha	hectares (10,000 m ²)			
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	0.9	tonnes	t	tonnes (1000 kg)	1.1	short tons	short tons
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	liters	l				
ft ³	cubic feet	0.03	cubic meters	m ³				
yd ³	cubic yards	0.76	cubic meters	m ³				
TEMPERATURE (exact)								
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



* 1 m = 2.54 (exactly). 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 the 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. This test was conducted to determine the effectiveness of this design in preventing excessive rear underride (intrusion into the passenger compartment of the test vehicle) in a 0°, 30 mph impact mode.

TEST PROCEDURE

The test vehicle was instrumented with seven (7) accelerometers to measure longitudinal, lateral, and vertical axis accelerations. Each 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 onto a heavy truck frame surrogate attached to the rigid barrier at the Transportation Research Center Inc.

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-five (45) 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 the Laboratory Test Procedure.

The crash event was recorded by one (1) real-time panning motion picture camera and fifteen (15) high-speed motion picture cameras.

The heavy truck underride guard data are summarized in Section 2.0. The occupant, vehicle, & camera measurements 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 December 28, 1992.

The test vehicle, a 1993 Saturn SL 4-door sedan, was equipped with a 1.9 liter, transverse engine, manual transmission, power steering, and power brakes. The vehicle's test weight was 2748 pounds. The vehicle's impact speed was 30.0 mph.

The driver's head injury criteria (HIC) was 100. The driver's maximum chest resultant acceleration with three (3) milliseconds minimum duration was 27.0 g. The driver's chest deflection was 1.4 inches. The driver's maximum left and right femur forces were 1349 pounds and 1027 pounds, respectively.

The right front passenger's head injury criteria (HIC) was 117. The right front passenger's maximum chest resultant acceleration with three (3) milliseconds minimum duration was 26.9 g. The right front passenger's chest deflection was 1.8 inches. The right front passenger's maximum left and right femur forces were 1141 pounds and 1085 pounds, respectively.

At maximum vehicle displacement, the clearance from the simulated truck rear to the vehicle's windshield was 10.1 inches. This value was obtained from digital analysis of the high-speed film.

TABLE 1 CRASH TEST SUMMARY

TEST TYPE: Heavy Truck Rear Underride Guard

TEST DATE: 12/28/92 TEST TIME: 1358 AMBIENT TEMP. (°F): 73

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1993/Saturn/SL/4-door sedan

VEHICLE TEST WEIGHT (LBS): 2748

IMPACT ANGLE (DEG)*: 0

IMPACT VELOCITY (MPH)**: PRIMARY = 30.0 SECONDARY = 30.0

MAXIMUM STATIC CRUSH (IN): 2.0

DUMMIES:	Driver #043	Passenger #048
TYPE:	Part 572 E	Part 572 E
LOCATION:	Left front	Right front
RESTRAINT:	2-point passive belt and airbag	2-point passive belt

NUMBER OF DATA CHANNELS: 45

NUMBER OF CAMERAS: HIGH-SPEED 15 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: Saturn Corporation

MAKE/MODEL: Saturn/SL

VIN: 1G8ZF5591PZ185265

BODY STYLE: 4-door sedan

MODEL YEAR: 1993

COLOR: Red

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 1.9 liter

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

DATE VEHICLE RECEIVED: 12/18/92

ODOMETER READING: 10.0

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

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

DATE OF MANUFACTURE: 12/92

VIN: 1G8ZF5591PZ185265

GVWR: 3267 LBS

GAWR: FRONT: 1663 LBS., REAR: 1604 LBS.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

TIRES ON VEHICLE (MFR., LINE, SIZE): Firestone, FR480, P175/70R14

TIRE PRESSURE WITH MAXIMUM CAPACITY VEHICLE LOAD: FRONT: 35 PSI
REAR: 35 PSI

SPARE TIRE (MFR., LINE, SIZE): Firestone, Temporary, T115/70R14

TYPE OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manually-adjustable

MAXIMUM WIDTH: 65.5 INCHES

WHEELBASE: 102.5 INCHES

LOCATION OF LABEL STATING TIRE & CAPACITY DATA:
The label was located on the trunk lid.

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: P175/70R14

RECOMMENDED COLD TIRE PRESSURE: FRONT: 30 PSI; REAR: 26 PSI

DESIGNATED SEATING CAPACITY: 2 FRONT 3 REAR 5 TOTAL

VEHICLE CAPACITY WEIGHT: 864 LBS.

TEST VEHICLE ATTITUDE

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

DELIVERED ATTITUDE:	LF	27.1;	RF	27.1;	LR	26.5;	RR	26.4
FULLY LOADED ATTITUDE:	LF	26.2;	RF	26.0;	LR	25.4;	RR	25.0
PRE-TEST ATTITUDE**:	LF	26.0;	RF	26.1;	LR	28.1;	RR	28.0
POST-TEST ATTITUDE:	LF	20.1;	RF	18.6;	LR	25.1;	RR	23.8

TEST VEHICLE ATTITUDE

(MEASURED AT FRONT AND REAR BUMPER CENTERLINE) *

DELIVERED ATTITUDE:	FRONT	14.9	REAR	22.0
PRE-TEST ATTITUDE:	FRONT	12.8	REAR	24.5

*It was determined by VRTC that under heavy braking the front of the test vehicle lowered by 2.1 to 2.2 inches measured at the front bumper centerline and the rear of the test vehicle raised 2.5 to 2.8 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 (WITH MAXIMUM FLUIDS):

RIGHT FRONT	675 LBS.	RIGHT REAR	475 LBS.
LEFT FRONT	708 LBS.	LEFT REAR	446 LBS.
TOTAL FRONT WEIGHT	1383 LBS.	(60.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	921 LBS.	(40.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT 2304 LBS.			

CALCULATION OF TEST VEHICLE'S TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (2304 LBS)

VCW = VEHICLE CAPACITY WEIGHT (864 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

$RCLW* = VCW - 150 (DSC) = 114$

TARGET TEST WEIGHT = UDW + RCLW* + (NO. OF HYBRID III DUMMIES X 167 LBS PER DUMMY)

TARGET TEST WEIGHT = 2304 + 114 + 334

TARGET TEST WEIGHT = 2752 LBS

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 110 LBS. OF CARGO WEIGHT:

RIGHT FRONT	761 LBS.	RIGHT REAR	600 LBS.
LEFT FRONT	781 LBS.	LEFT REAR	606 LBS.
TOTAL FRONT WEIGHT	1542 LBS.	(56.1% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1206 LBS.	(43.9% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2748 LBS.	(0.1% UNDER TARGET TEST WEIGHT)	

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

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: Rear bumper, exhaust system

CG = 45.0 INCHES REARWARD OF FRONT WHEEL CENTERLINE

TABLE 3 POST-IMPACT DATA

TEST NUMBER: 921228

TEST DATE: 12/28/92

TEST TIME: 1358

TEST TYPE: Heavy truck rear underride guard

IMPACT ANGLE: 0°

AMBIENT TEMPERATURE AT IMPACT AREA:

73° F

TEMPERATURE IN OCCUPANT COMPARTMENT:

69° F

IMPACT VELOCITY*: PRIMARY = 30.0 MPH

SECONDARY = 30.0 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 172.0; C 177.6; R 172.2

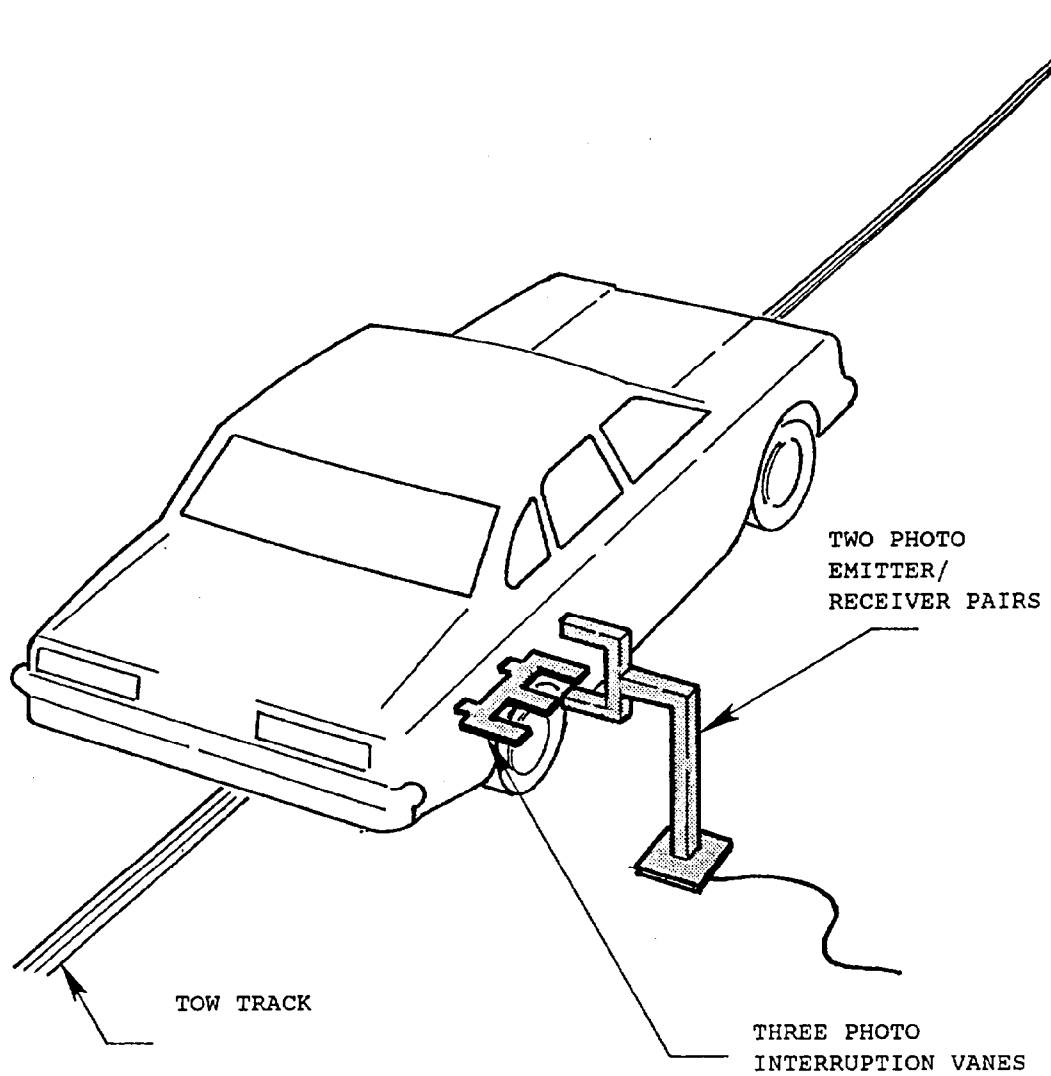
POST-TEST: L 170.0; C 176.0; R 170.5

TOTAL CRUSH: L 2.0; C 1.6; R 1.7

AVERAGE CRUSH: 1.8

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

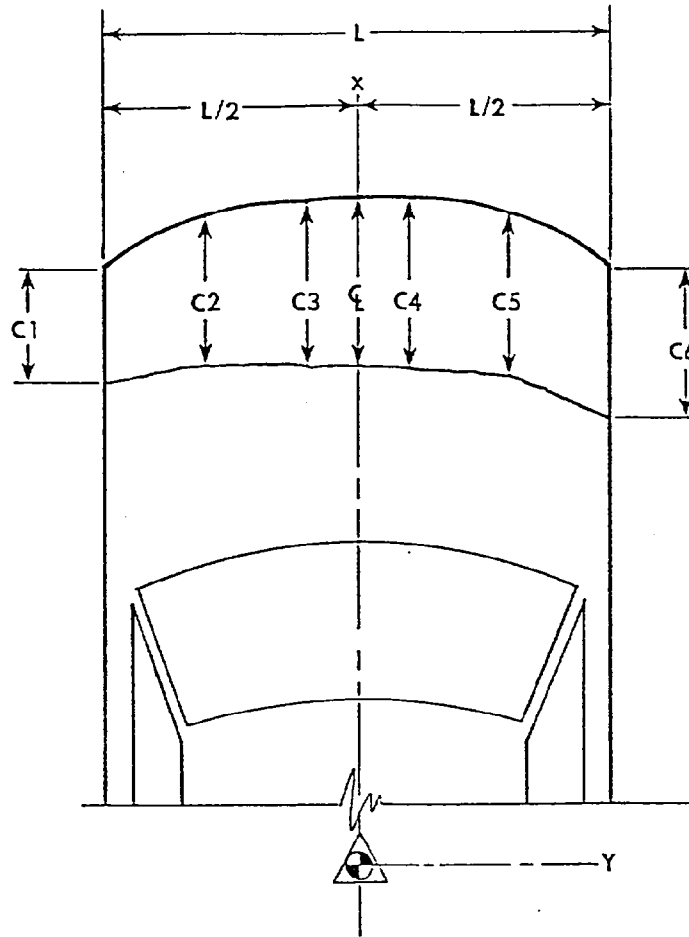
FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



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

The vanes have one foot spacing.

FIGURE 2 VEHICLE CRUSH



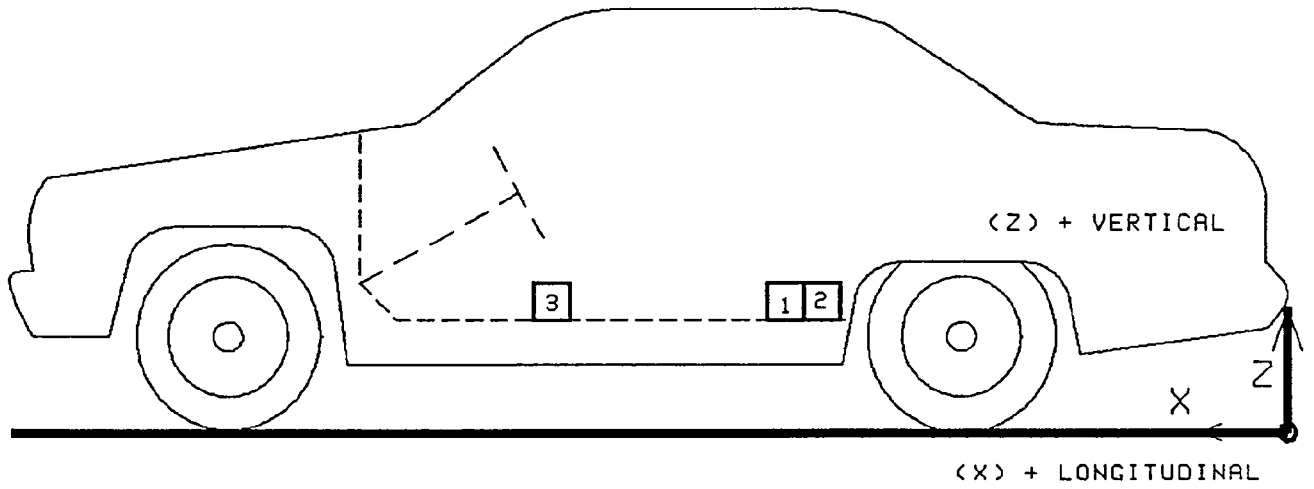
NOTES: L is pre-test length of contact surface.
 C1 through C6 are spaced equally apart.
 CL is vehicle centerline.
 All measurements are in inches.

Vehicle Saturn SL

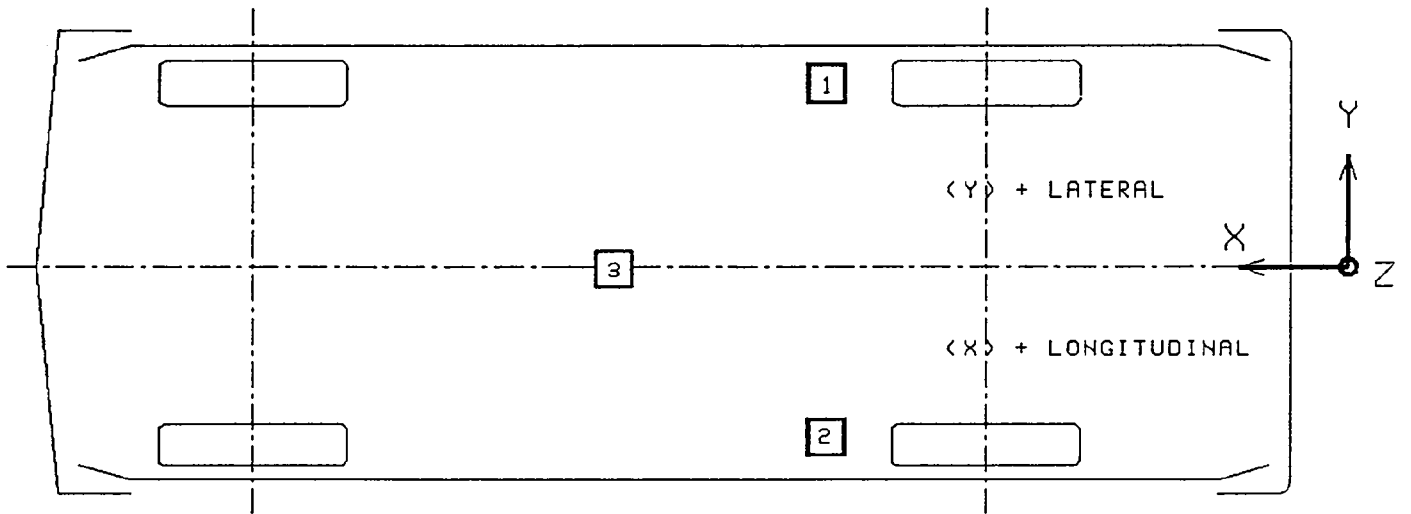
	PRE-TEST	POST-TEST	CRUSH
L	<u>47.0</u>		
C1	<u>172.0</u>	C1 <u>170.0</u>	C1 <u>2.0</u>
C2	<u>174.6</u>	C2 <u>173.2</u>	C2 <u>1.4</u>
C3	<u>177.6</u>	C3 <u>176.0</u>	C3 <u>1.6</u>
C4	<u>177.6</u>	C4 <u>176.1</u>	C4 <u>1.5</u>
C5	<u>174.9</u>	C5 <u>174.0</u>	C5 <u>0.9</u>
C6	<u>172.2</u>	C6 <u>170.5</u>	C6 <u>1.7</u>
CL	<u>177.6</u>	CL <u>176.0</u>	CL <u>1.6</u>

FIGURE 3

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 92122B

No. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
				MAX G	MSEC	MAX G	MSEC
1 LEFT REAR SEAT CROSSMEMBER	62.3	13.0	14.6				
LONGITUDINAL				0.5	148.9	18.6	66.1
LATERAL				2.8	197.8	3.1	128.5
2 RIGHT REAR SEAT CROSSMEMBER	62.3	-13.2	14.0				
LONGITUDINAL				3.0	148.4	18.5	66.4
LATERAL				2.9	201.0	3.6	81.0
3 VEHICLE CENTER OF GRAVITY	70.3	0.0	12.8				
LONGITUDINAL				2.5	148.9	18.7	66.6
LATERAL				2.7	110.8	3.4	81.3
VERTICAL				11.2	81.3	10.9	59.9

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

SECTION 3.0

OCCUPANT, VEHICLE, & CAMERA INFORMATION

TABLE 5

DUMMY DATA SUMMARY

TEST NUMBER 921228

	DRIVER DUMMY SN: 43				PASSENGER DUMMY SN: 48			
	POSITIVE DIRECTION		NEGATIVE DIRECTION		POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC	MAX	MSEC	MAX	MSEC
HEAD ACCELERATION (g)								
LONGITUDINAL	2.7	210.8	25.4	106.0	3.1	253.4	20.9	127.5
LATERAL	5.7	310.6	4.9	228.9	5.8	307.5	6.3	110.6
VERTICAL	4.4	337.1	19.1	106.0	4.6	337.4	28.7	110.5
RESULTANT	31.7	106.0			32.5	110.6		
HIC	100 FROM 92.1 TO 128.1				117 FROM 97.8 TO 133.8			
CHEST ACCELERATION (g)								
LONGITUDINAL	0.9	6.9	26.8	101.3	1.7	337.3	27.1	104.5
LATERAL	1.5	18.6	3.1	130.8	3.9	217.4	5.3	110.8
VERTICAL	4.8	134.0	7.8	95.5	4.1	181.4	4.7	107.8
RESULTANT	27.4	101.3			27.5	104.5		
3 MSEC	27.0				26.9			
CHEST DEFLECTION (in)								
LONGITUDINAL	0.0	9.5	1.4	110.5	0.0	29.0	1.8	111.9
PELVIS ACCELERATION (g)								
LONGITUDINAL	3.6	161.1	43.2	88.3	3.8	158.5	39.3	92.0
LATERAL	8.9	85.3	3.9	77.3	6.5	80.8	8.3	90.9
VERTICAL	8.6	104.0	1.9	23.5	9.6	95.0	4.9	138.0
RESULTANT	43.3	88.3			40.1	92.0		
FEMUR LOAD (lb)								
LEFT	406.5	42.6	1349.0	88.3	78.9	140.6	1141.4	93.5
RIGHT	253.6	43.4	1027.2	88.0	21.8	194.1	1085.1	91.4

POSITIVE DIRECTION

LONGITUDINAL: FORWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD
 FORCE: TENSION

NEGATIVE DIRECTION

LONGITUDINAL: REARWARD
 LATERAL: RIGHTWARD
 VERTICAL: DOWNWARD
 FORCE: COMPRESSION

TABLE 6 POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #043	PASSENGER #048
HEAD	<u>Airbag</u>	<u>None</u>
CHEST	<u>Airbag</u>	<u>None</u>
ABDOMEN	<u>None</u>	<u>None</u>
LEFT KNEE	<u>Instrument panel</u>	<u>Instrument panel</u>
RIGHT KNEE	<u>Instrument panel</u>	<u>Instrument panel</u>

DOOR OPENING:

	LEFT	RIGHT
FRONT	<u>Easy</u>	<u>Easy</u>
REAR	<u>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 upon impact.

OTHER NOTABLE IMPACT EFFECTS:

None

FIGURE 4

DUMMY MEASUREMENT LOCATIONS FOR FRONT SEAT OCCUPANTS

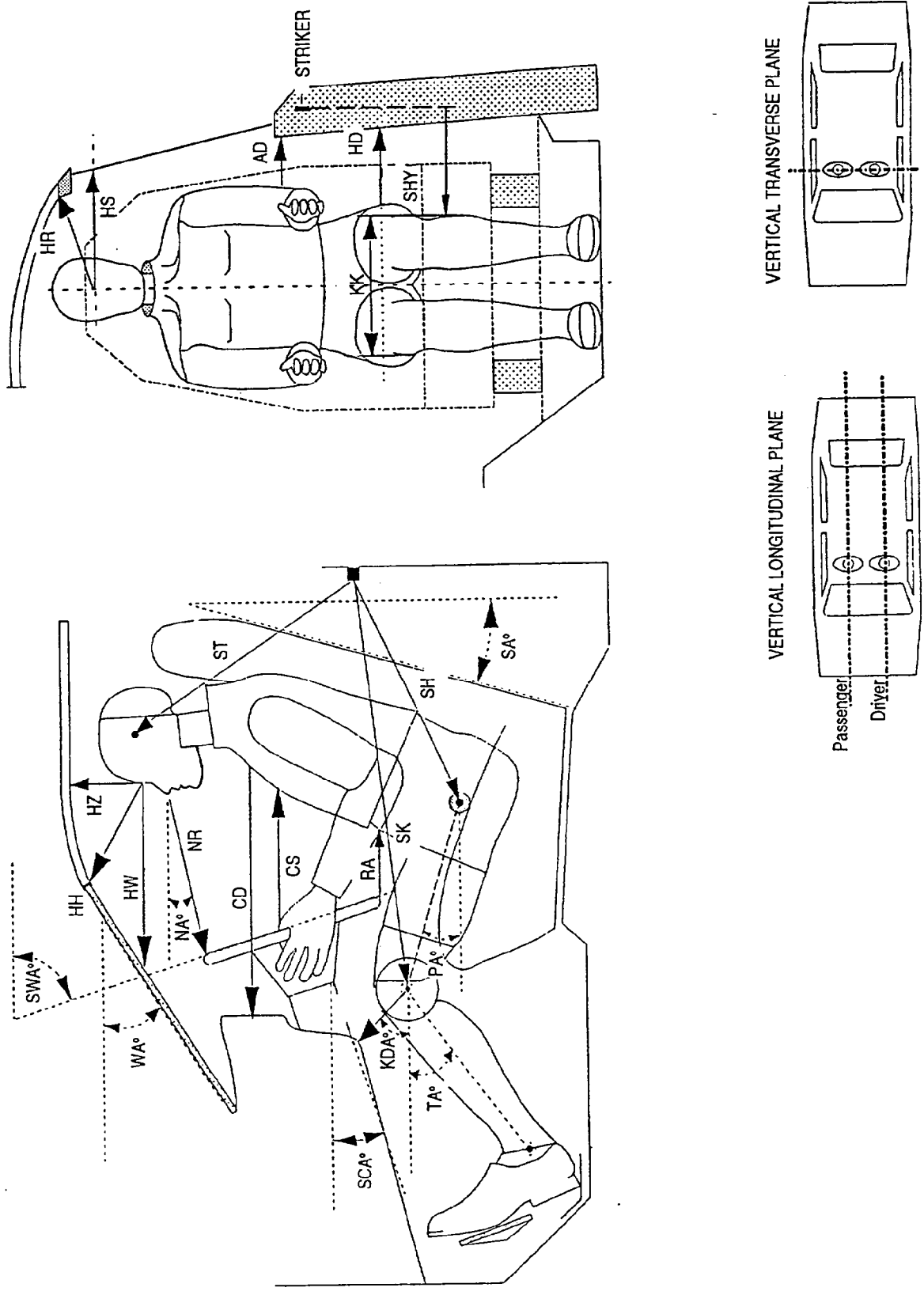


TABLE 7 DUMMY MEASUREMENT DATA FOR FRONT SEAT OCCUPANTS

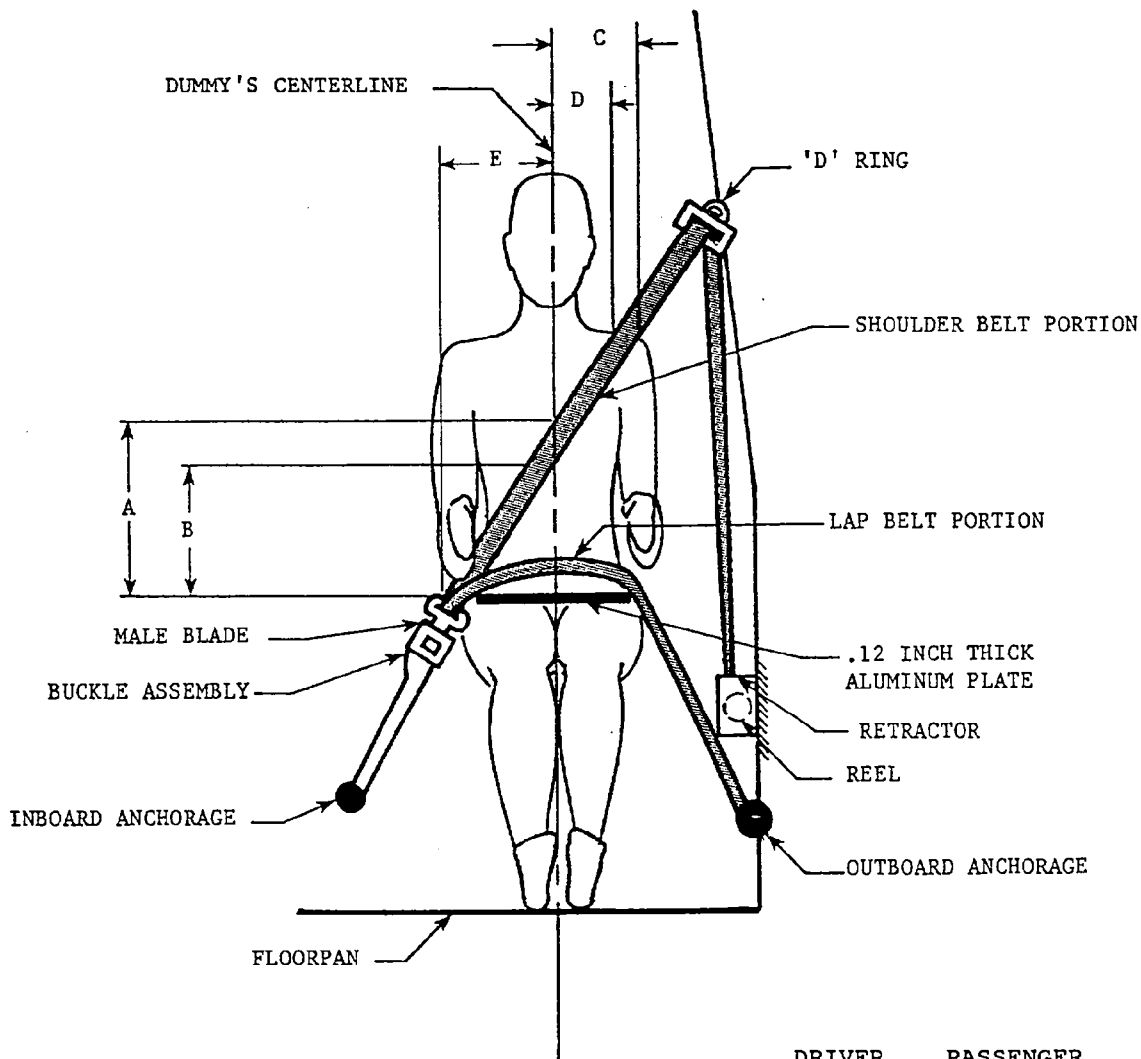
DESIGNATION	TYPE OF MEASUREMENT	DRIVER (SERIAL #043)	PASSENGER (SERIAL #048)
WA°	WINDSHIELD ANGLE	28°	28°
SWA°	STEERING WHEEL ANGLE	69°	NA
SCA°	STEERING COLUMN ANGLE	20°	NA
SA°	SEAT BACK ANGLE	10°	10°
HZ	HEAD TO ROOF	7.2	7.2
HH	HEAD TO HEADER	13.9	13.9
HW	HEAD TO WINDSHIELD	23.4	23.8
HR	HEAD TO SIDE HEADER	7.8	7.6
NR	NOSE TO RIM	14.1	NA
NA	NOSE TO RIM ANGLE	12°	NA
CD	CHEST TO DASH	19.1	22.4
CS	STEERING WHEEL TO CHEST	10.6	NA
RA	RIM TO ABDOMEN	6.9	NA
KDL	LEFT KNEE TO DASH	5.2	7.1
KDR	RIGHT KNEE TO DASH	6.1	6.4
KDA	OUTBOARD KNEE TO DASH ANGLE	36°	51°
PA°	PELVIC ANGLE	20°	18°
TA°	TIBIAL ANGLE	45°	34°
KK	KNEE TO KNEE	11.0	9.5
ST*	STRIKER TO HEAD	16.9	16.9
	STRIKER TO HEAD ANGLE	-81°	-79°
SK*	STRIKER TO KNEE	23.8	24.4
	STRIKER TO KNEE ANGLE	6°	10°
SH*	STRIKER TO H-POINT	12.8	13.1
	STRIKER TO H-POINT ANGLE	44°	44°
SHY	STRIKER TO H-POINT (Y DIR.)	6.9	7.8
HS	HEAD TO SIDE WINDOW	13.4	13.4
HD	H-POINT TO DOOR	5.7	6.2
AD	ARM TO DOOR	4.1	4.2

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.

FIGURE 5 SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
A - TOP SURFACE OF ALUM. PLATE TO BELT UPPER EDGE	12.5	11.8
B - TOP SURFACE OF ALUM. PLATE TO BELT LOWER EDGE	9.8	9.0
C - DUMMY CENTERLINE TO OUTER EDGE OF BELT AT CHEST FLESH TOP	6.1	6.4
D - DUMMY CENTERLINE TO INNER EDGE OF BELT AT CHEST FLESH TOP	3.9	4.1

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

FIGURE 6

PRE-TEST AND POST-TEST MEASUREMENT POINTS

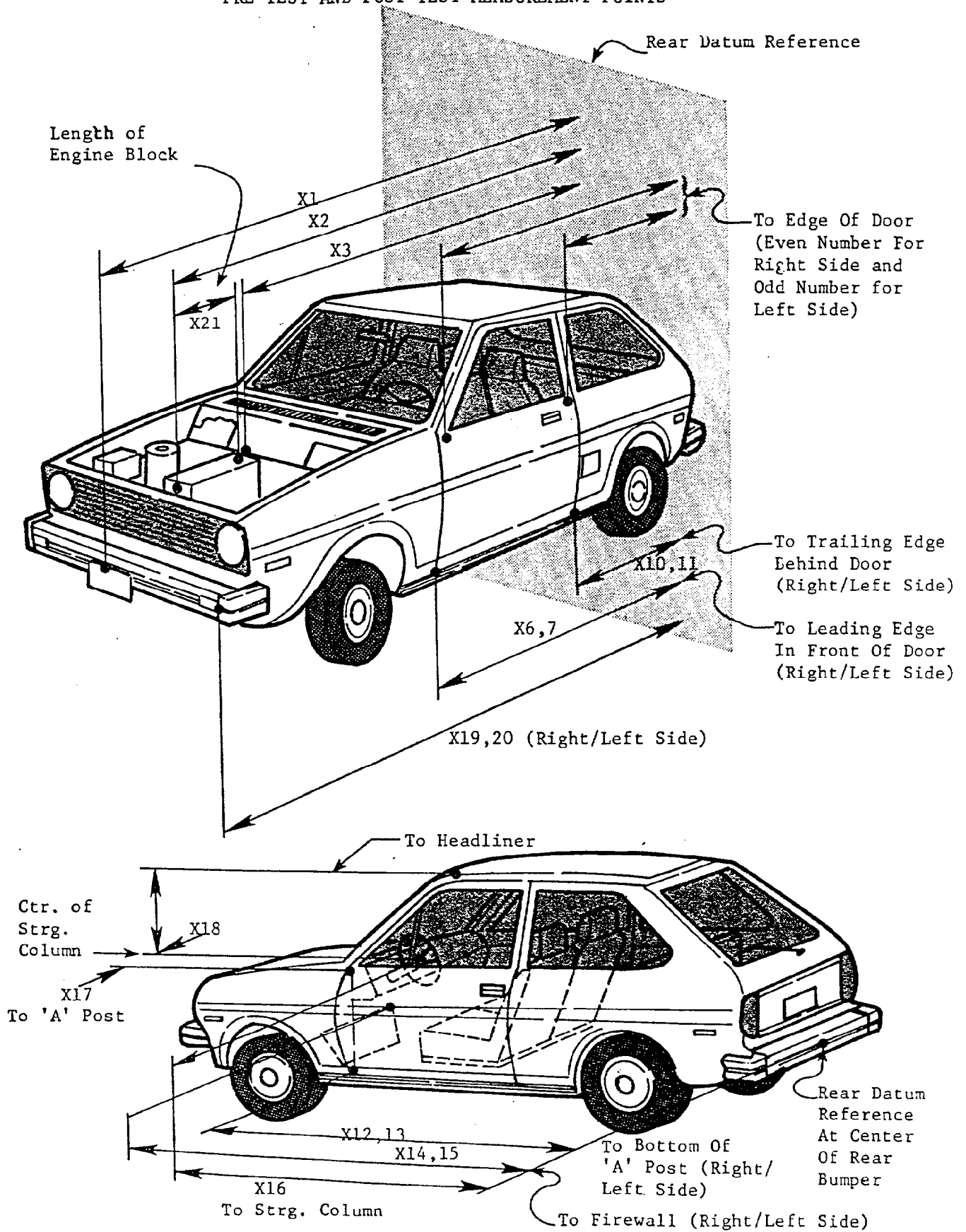


TABLE 8 IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Saturn/SL

TEST NUMBER: 921228

NO.	TYPE OF MEASUREMENT	ALL MEASUREMENTS ARE IN INCHES		
		PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	177.6	176.0	1.6
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	148.1	146.1	2.0
X3	REAR SURFACE OF VEHICLE TO FIREWALL	130.6	129.1	1.5
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	116.5	116.8	-0.3
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	116.6	116.7	-0.1
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	116.3	115.3	0.0
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	116.8	115.8	1.0
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	76.0	76.3	-0.3
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	76.0	76.2	-0.2
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	77.3	76.4	0.9
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	77.6	76.8	0.8
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	115.6	115.4	0.2
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	116.0	115.5	0.5
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	128.0	129.2	-1.2
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	127.2	128.2	-1.0
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	97.3	97.5	-0.2
X17	CENTER OF STEERING COLUMN TO "A" POST	11.3	11.0	0.3
X18	CENTER OF STEERING COLUMN TO HEADLINER	16.0	15.3	0.7
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	172.2	170.5	1.7
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	172.0	170.0	2.0
X21	LENGTH OF ENGINE BLOCK	16.5	16.5	0.0

FIGURE 7 CAMERA POSITIONS

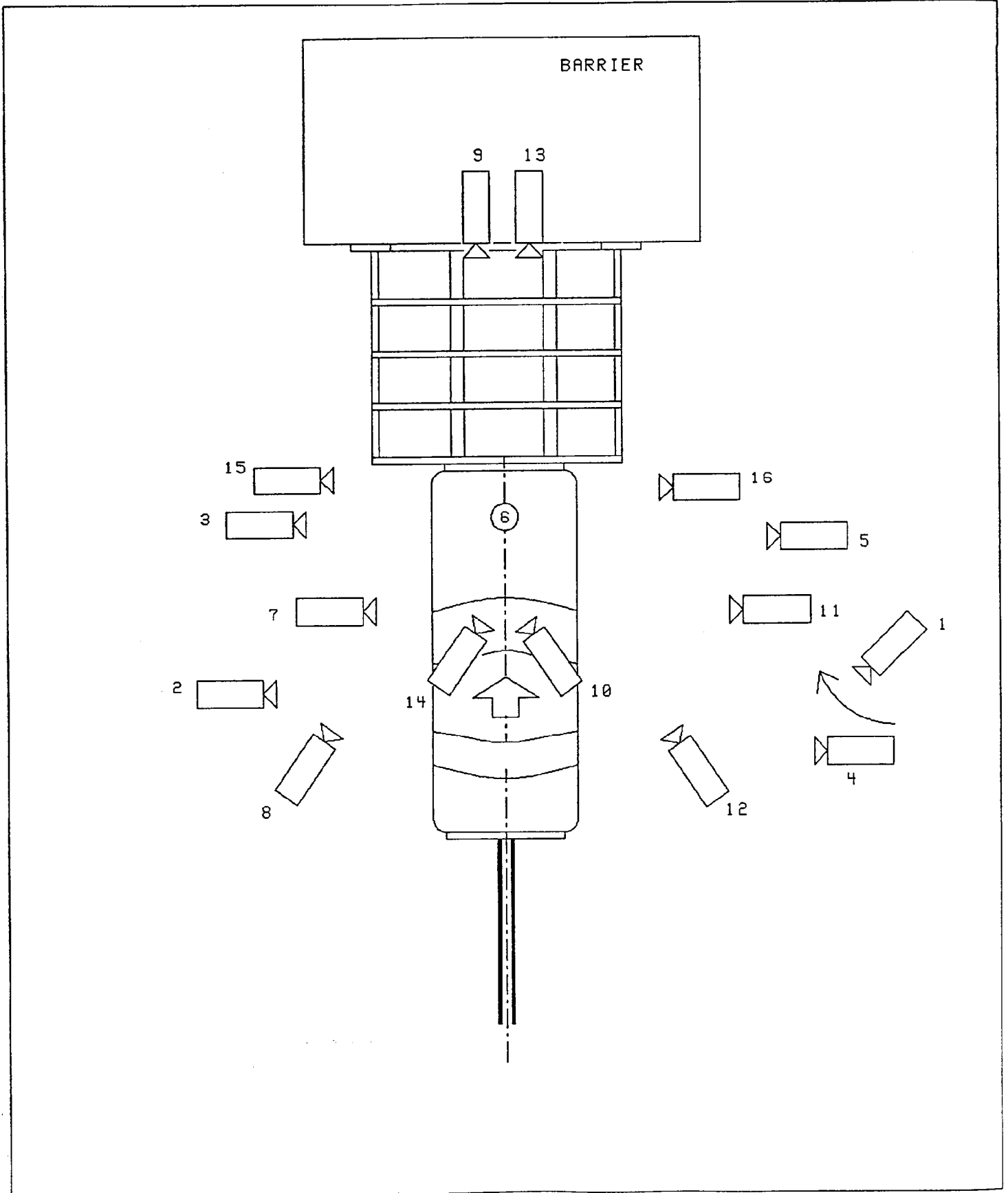


TABLE 9 CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Panning	Bolex	12-120	24	Vehicle dynamics
2	Left wide	Stalex	13	998	Barrier deformation/crush
3	Left front close-up	Photosonic	25	498	Barrier deformation/crush
4	Right wide	Stalex	13	498	Barrier deformation/crush
5	Right front close-up	Photosonic	25	498	Barrier deformation/crush
6	Overhead tight	Photosonic	25	500	Barrier deformation/crush
7	Left medium tight	Photosonic	25	505	Dummy kinematics
8	Driver angle view	Photosonic	25	500	Dummy kinematics
9	Barrier guard view	Photosonic	13	468	Barrier Deformation
10	Onboard driver	Photosonic	8	502	Dummy kinematics
11	Right medium tight	Photosonic	25	500	Dummy kinematics
12	Passenger angle view	Photosonic	25	502	Dummy kinematics
13	Barrier center view	Photosonic	17	510	Dummy kinematics
14	Onboard passenger view	Photosonic	8	505	Dummy kinematics
15	Left underride guard	Fastax II	50	505	Barrier deformation/crush
16	Right underride guard	Fastax II	50	502	Barrier deformation/crush

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST FRONT VIEW

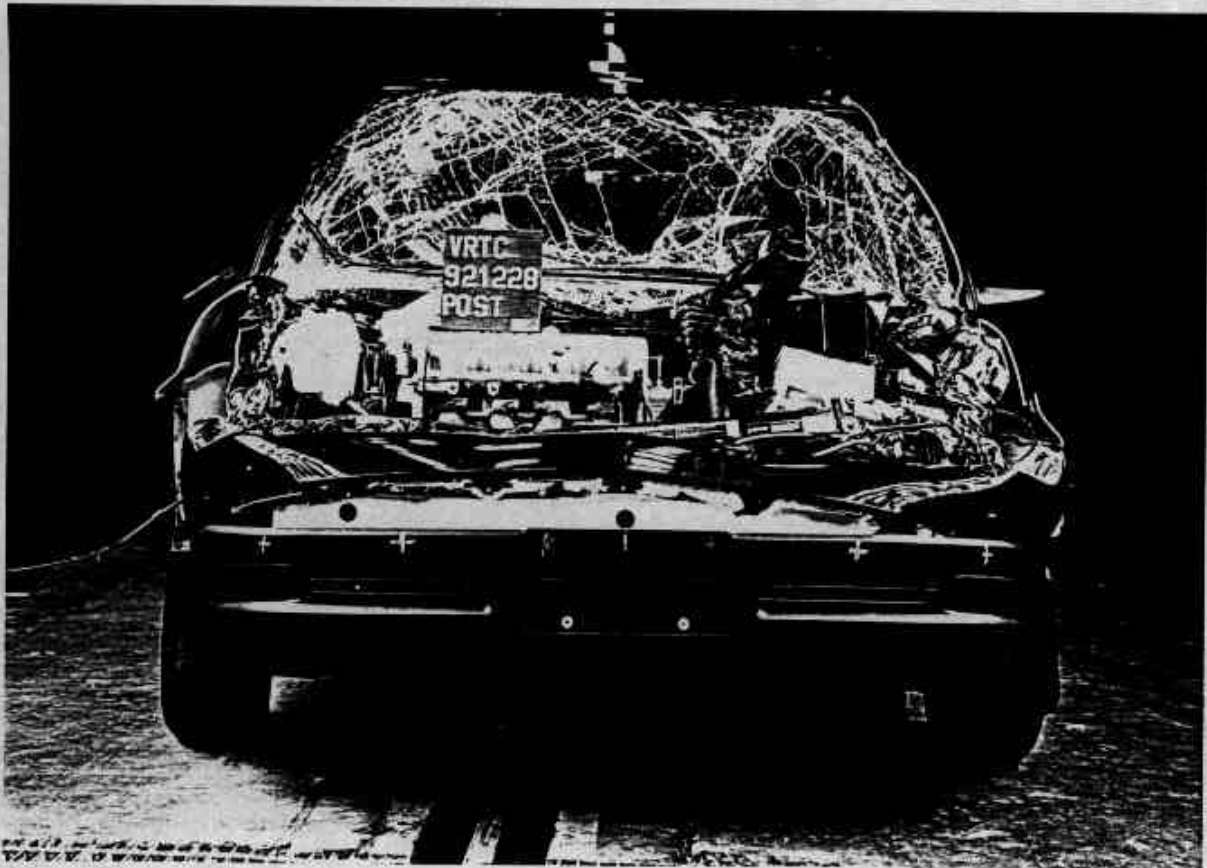


Figure A-2. POST-TEST FRONT VIEW



Figure A-3. PRE-TEST LEFT SIDE VIEW



Figure A-4. POST-TEST LEFT SIDE VIEW

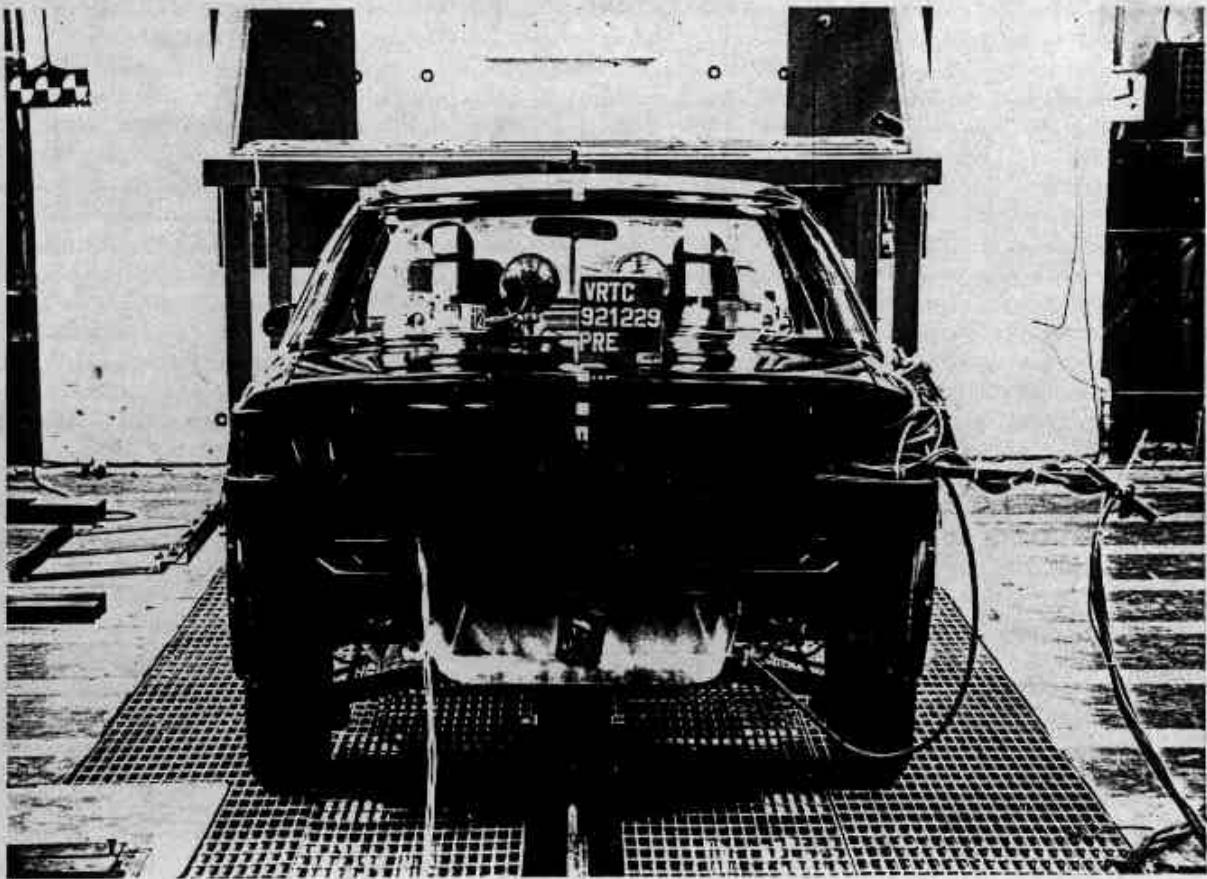


Figure A-5. PRE-TEST REAR VIEW

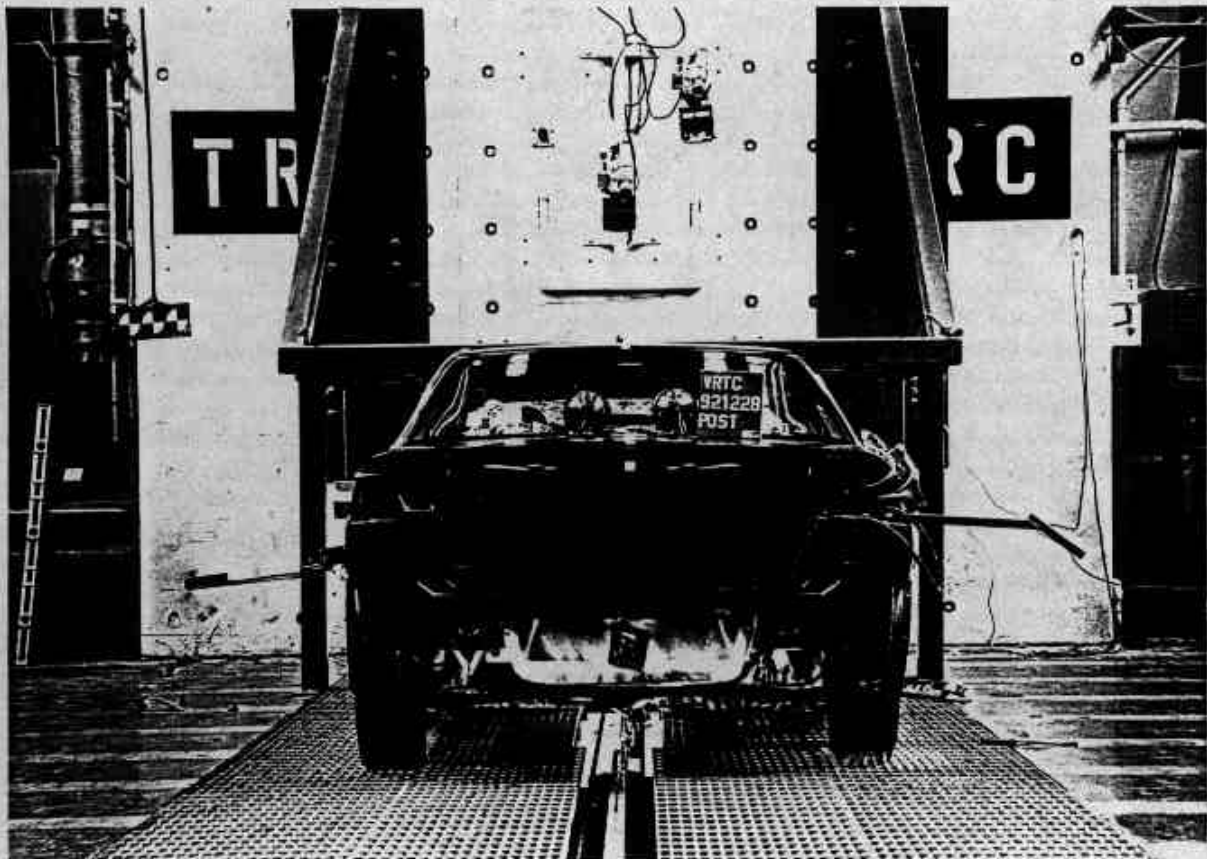


Figure A-6. POST-TEST REAR VIEW



Figure A-7. PRE-TEST RIGHT SIDE VIEW



Figure A-8. POST-TEST RIGHT SIDE VIEW



Figure A-9. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW



Figure A-10. POST-TEST RIGHT FRONT THREE-QUARTER VIEW

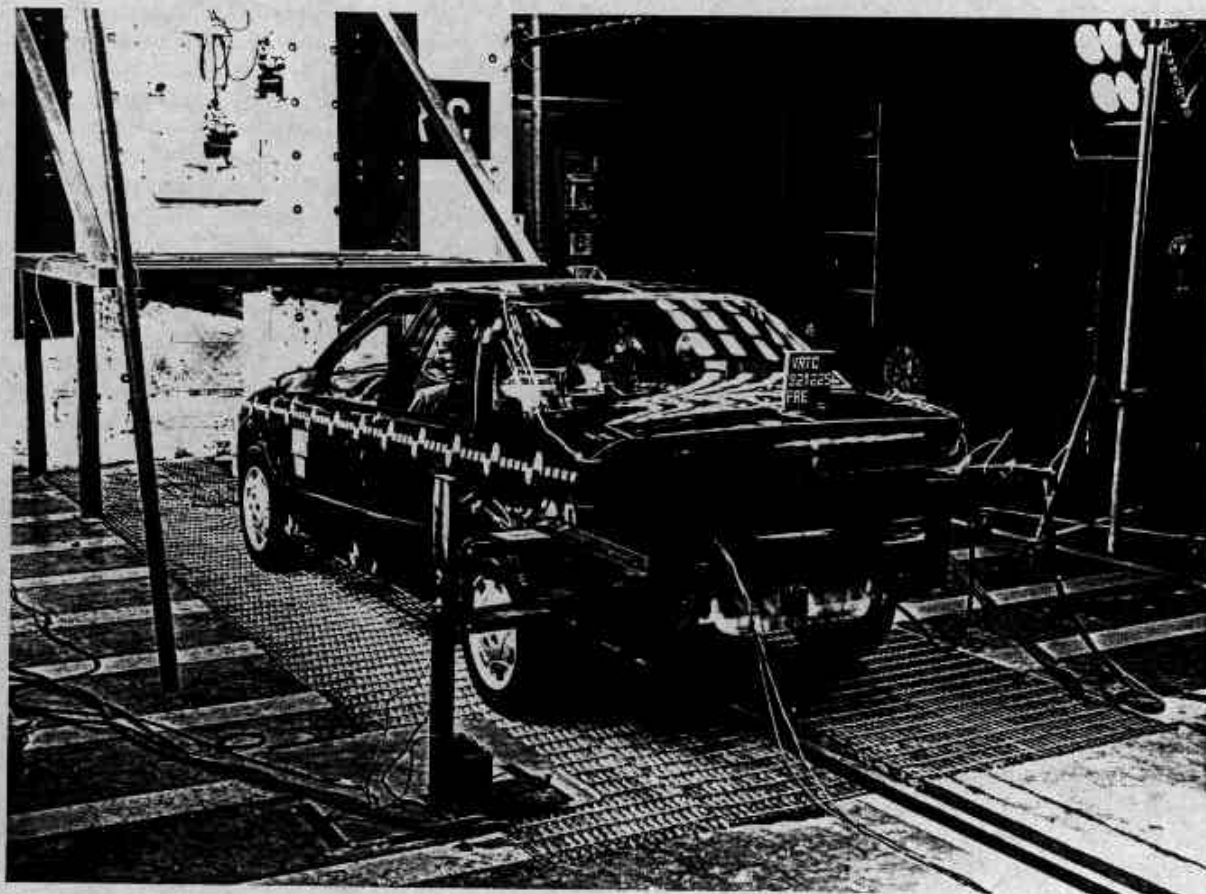


Figure A-11. PRE-TEST LEFT REAR THREE-QUARTER VIEW



Figure A-12. POST-TEST LEFT REAR THREE-QUARTER VIEW



Figure A-13. PRE-TEST WINDSHIELD VIEW

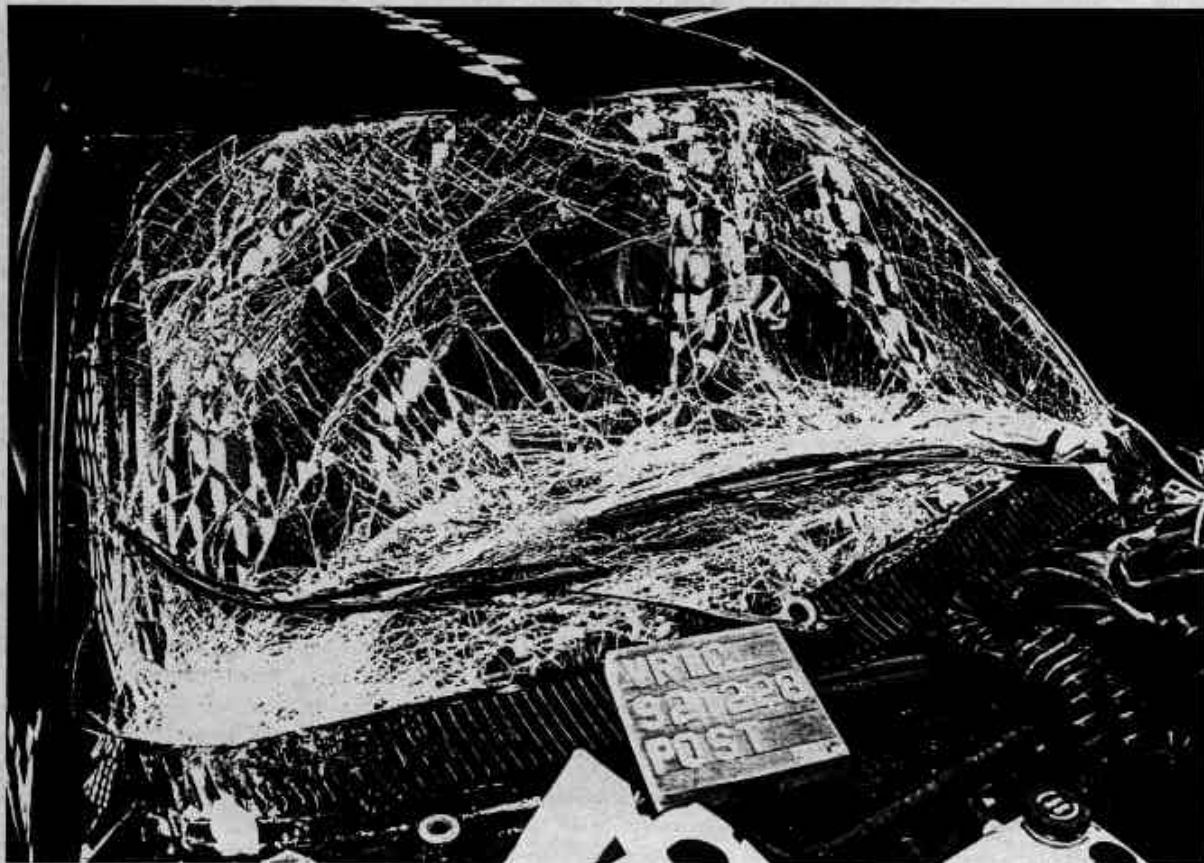


Figure A-14. POST-TEST WINDSHIELD - VIEW 1

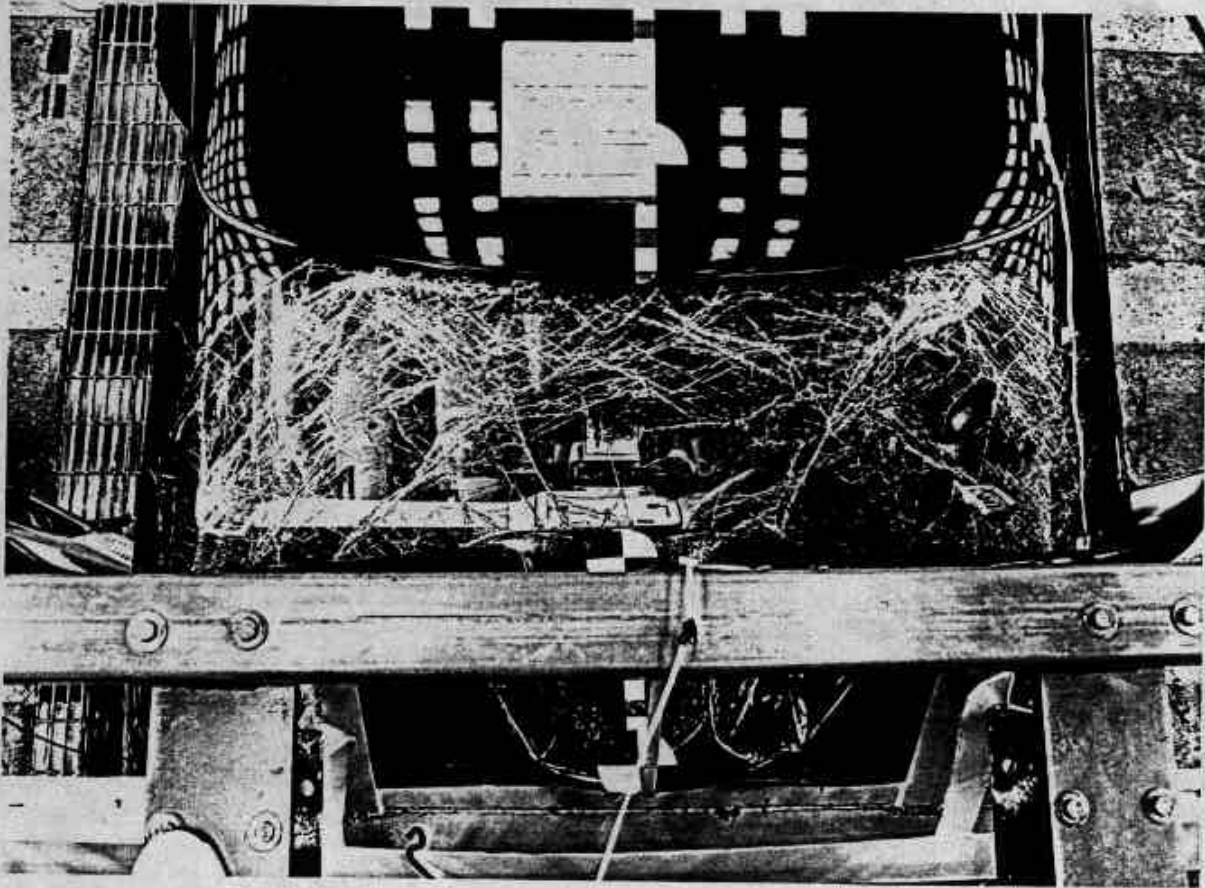


Figure A-15. POST-TEST WINDSHIELD - VIEW 2

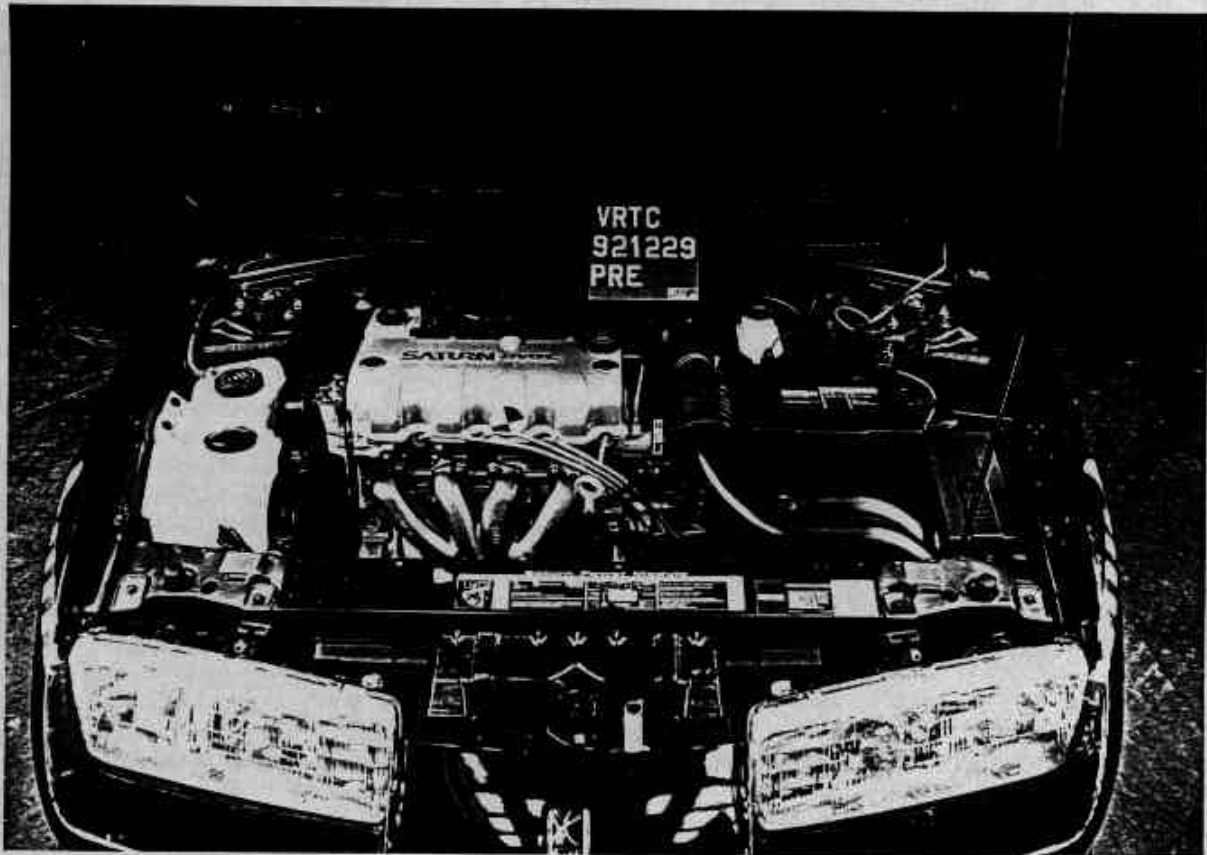


Figure A-16. PRE-TEST ENGINE COMPARTMENT VIEW

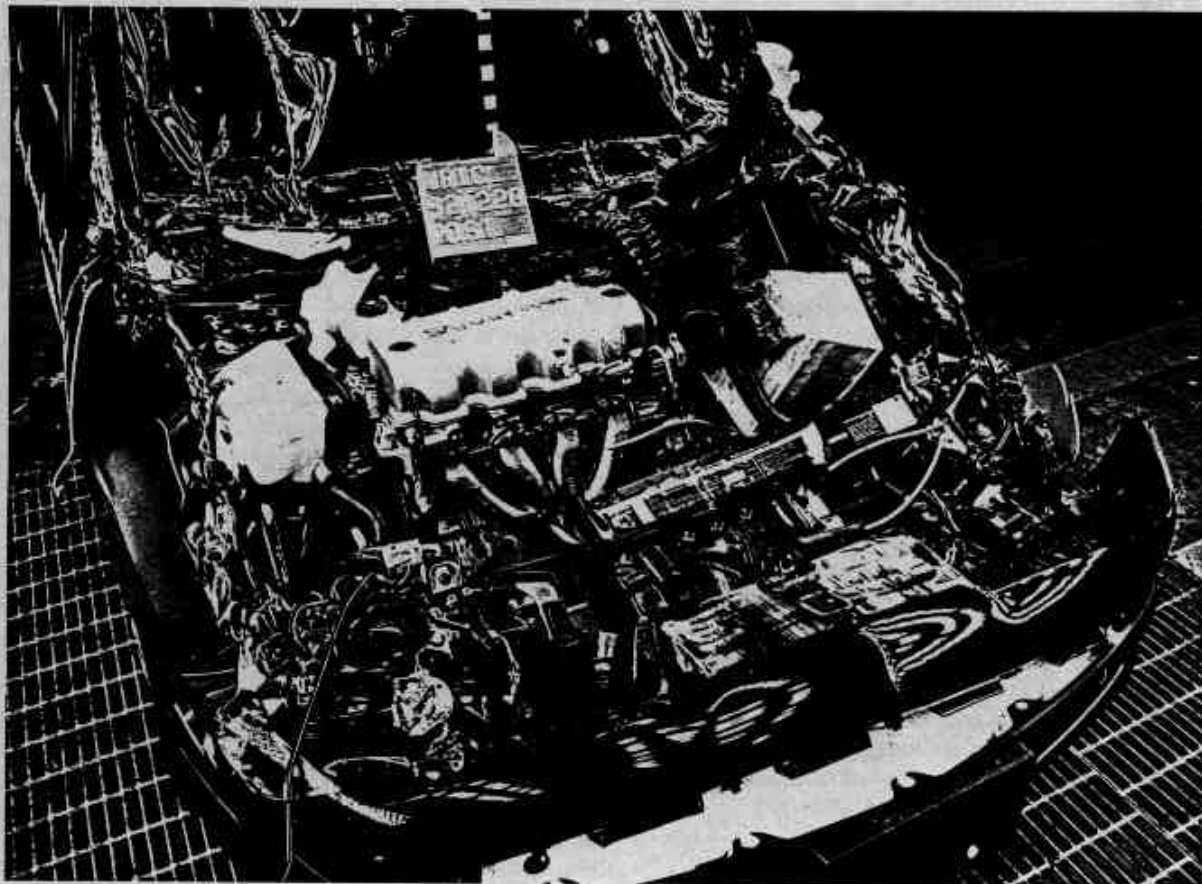


Figure A-17. POST-TEST ENGINE COMPARTMENT VIEW

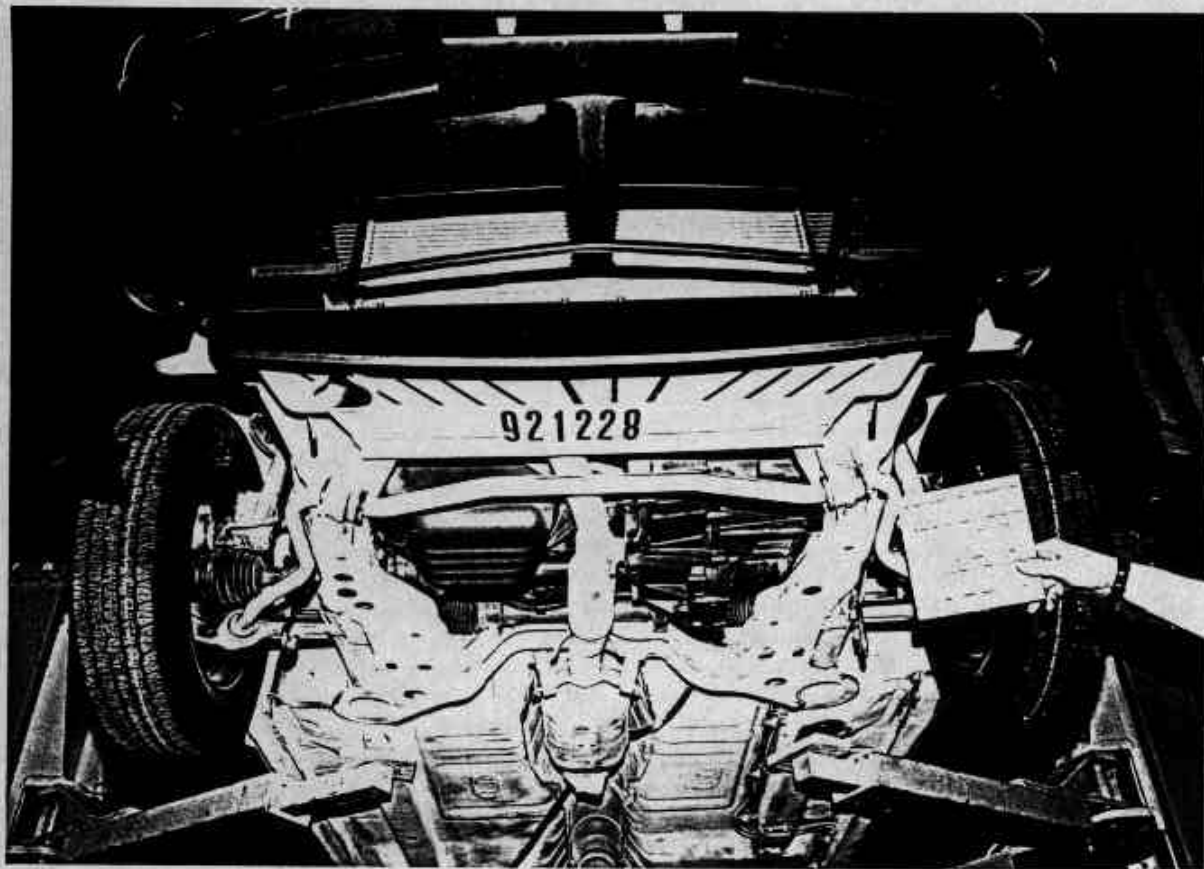


Figure A-18. PRE-TEST FRONT UNDERBODY VIEW

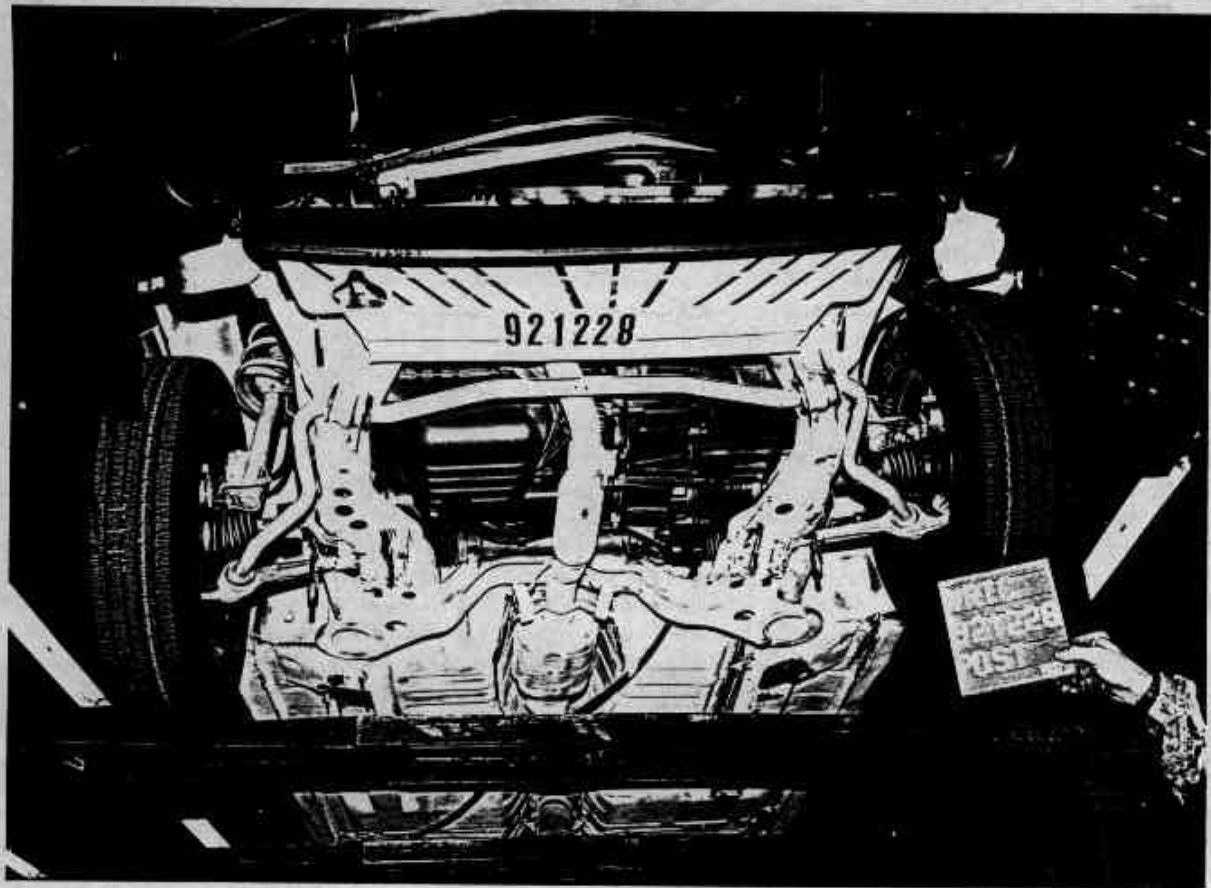


Figure A-19. POST-TEST FRONT UNDERBODY VIEW

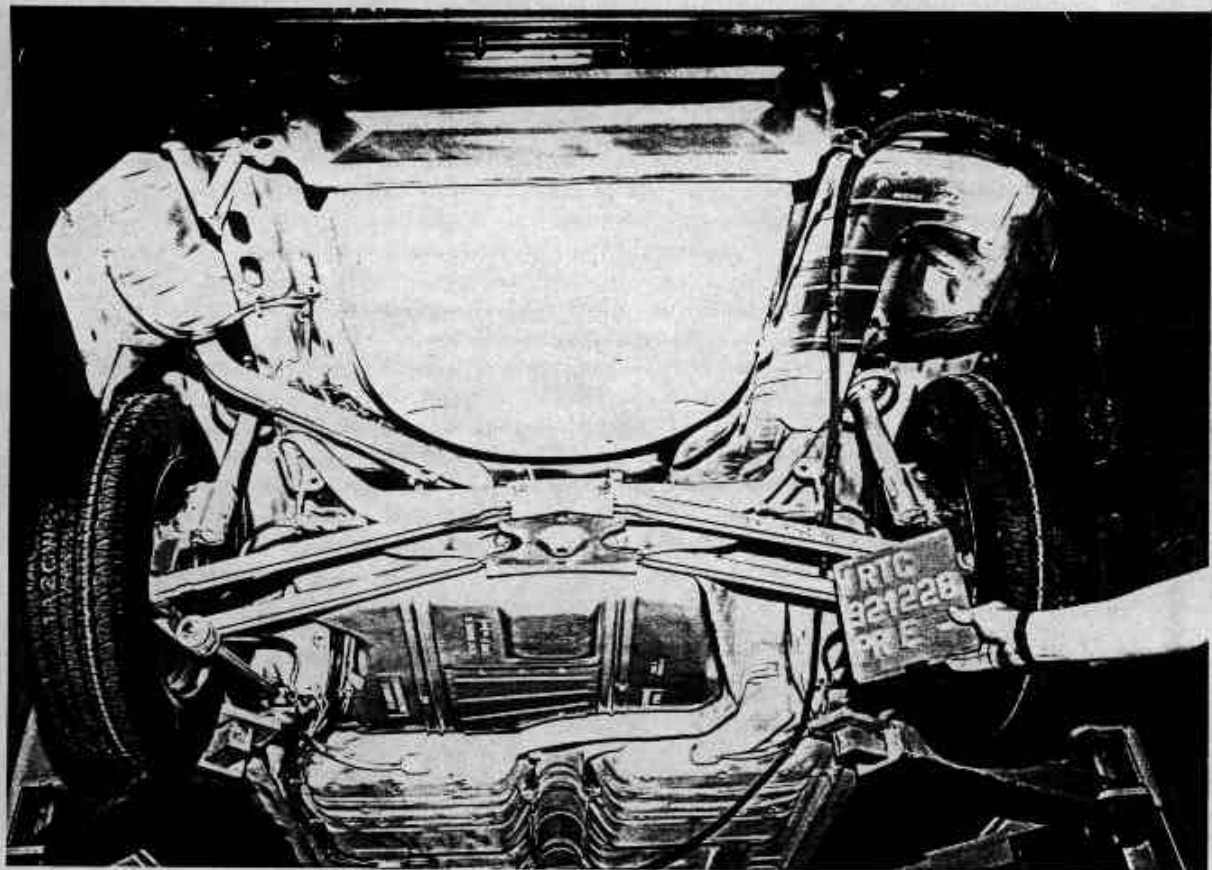


Figure A-20. PRE-TEST REAR UNDERBODY VIEW

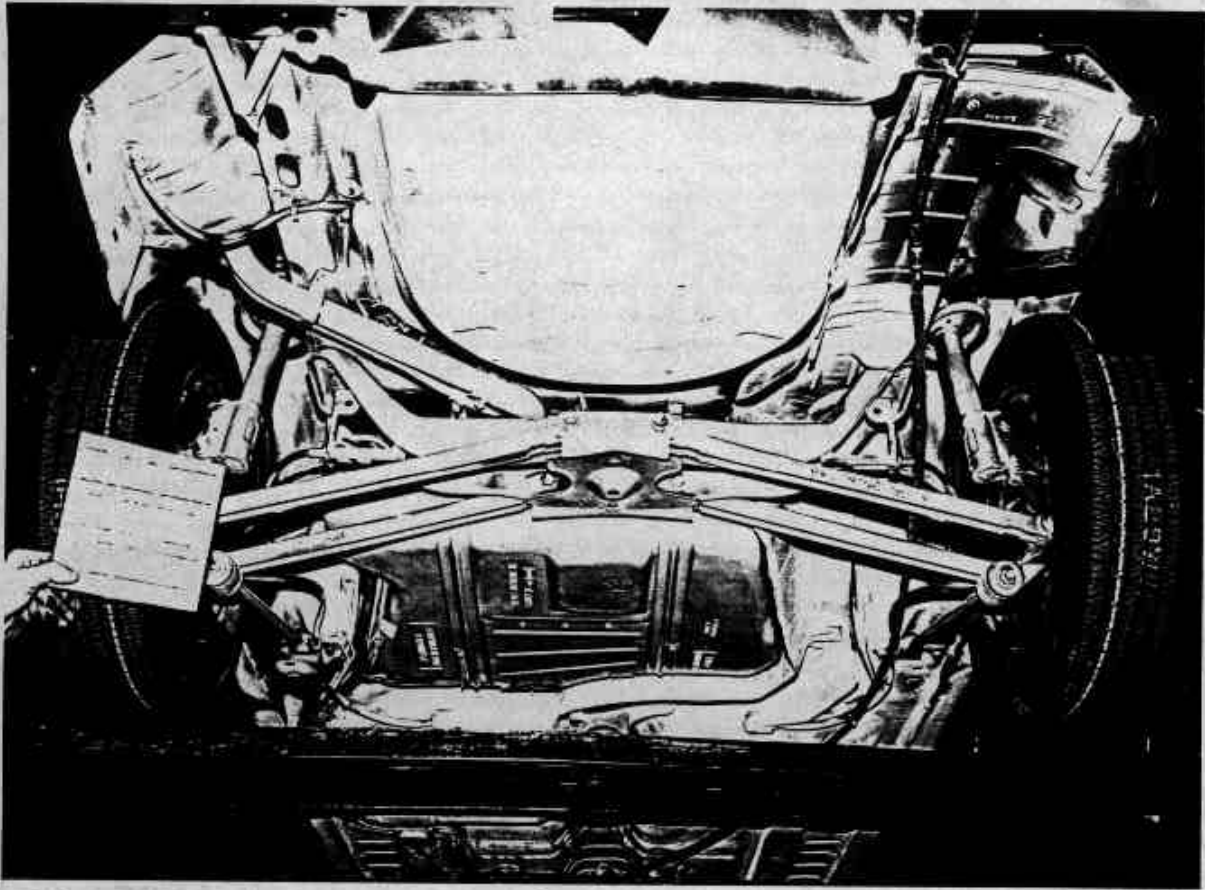


Figure A-21. POST-TEST REAR UNDERBODY VIEW



Figure A-22. PRE-TEST DRIVER DUMMY POSITION VIEW



Figure A-23. POST-TEST DRIVER DUMMY POSITION VIEW

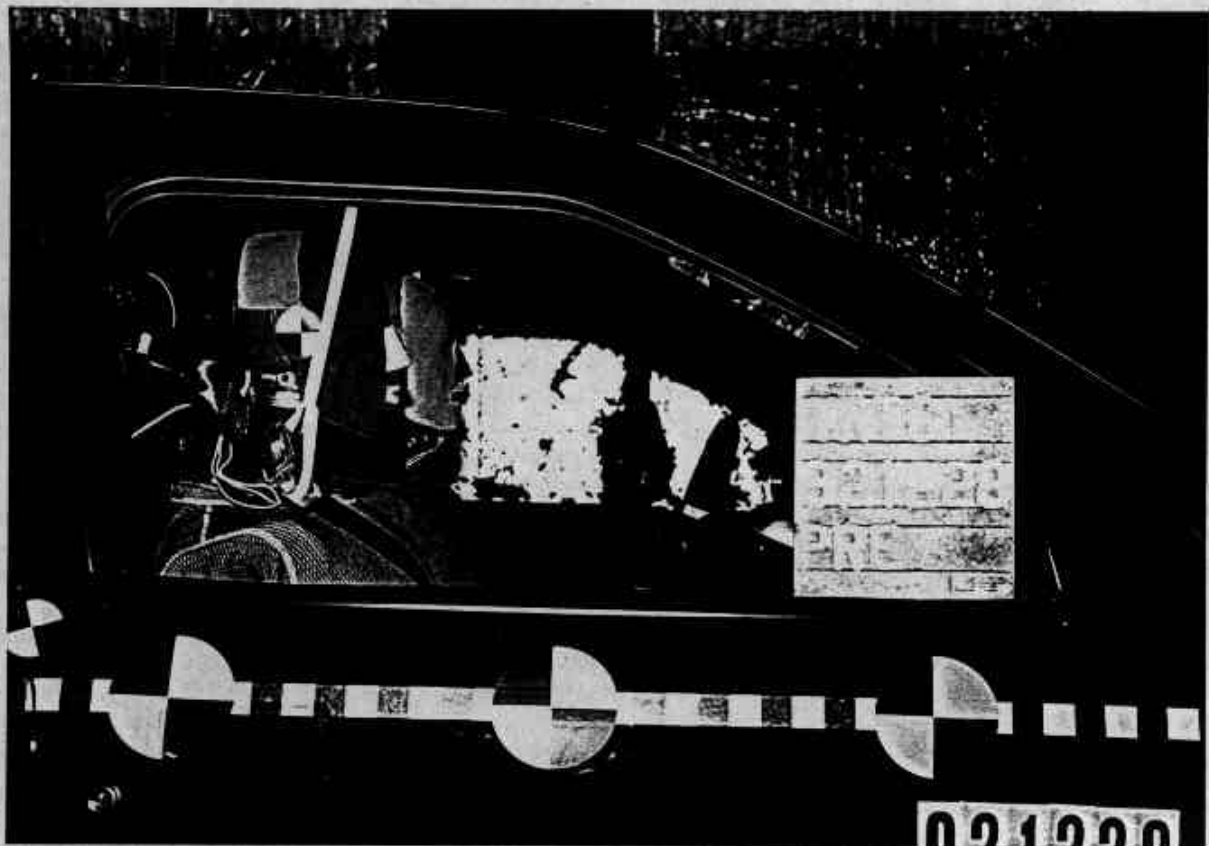


Figure A-24. PRE-TEST PASSENGER DUMMY POSITION VIEW



Figure A-25. POST-TEST PASSENGER DUMMY POSITION VIEW



Figure A-26. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

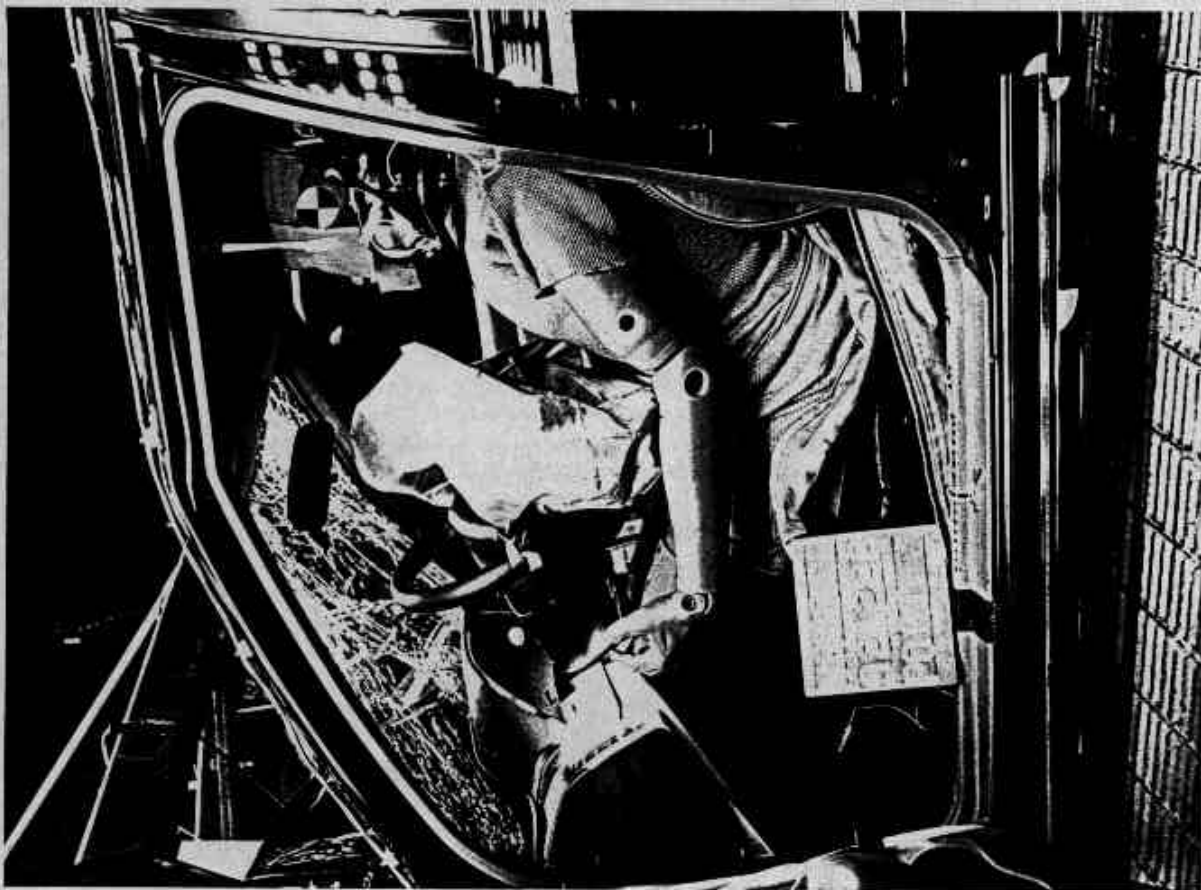


Figure A-27. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1



Figure A-28. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-29. POST-TEST DRIVER DUMMY AND VEHICLE INTERIOR - VIEW 2



Figure A-30. PRE-TEST PASSENGER DUMMY AND VEHICLE INTERIOR - VIEW 1



Figure A-33. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2

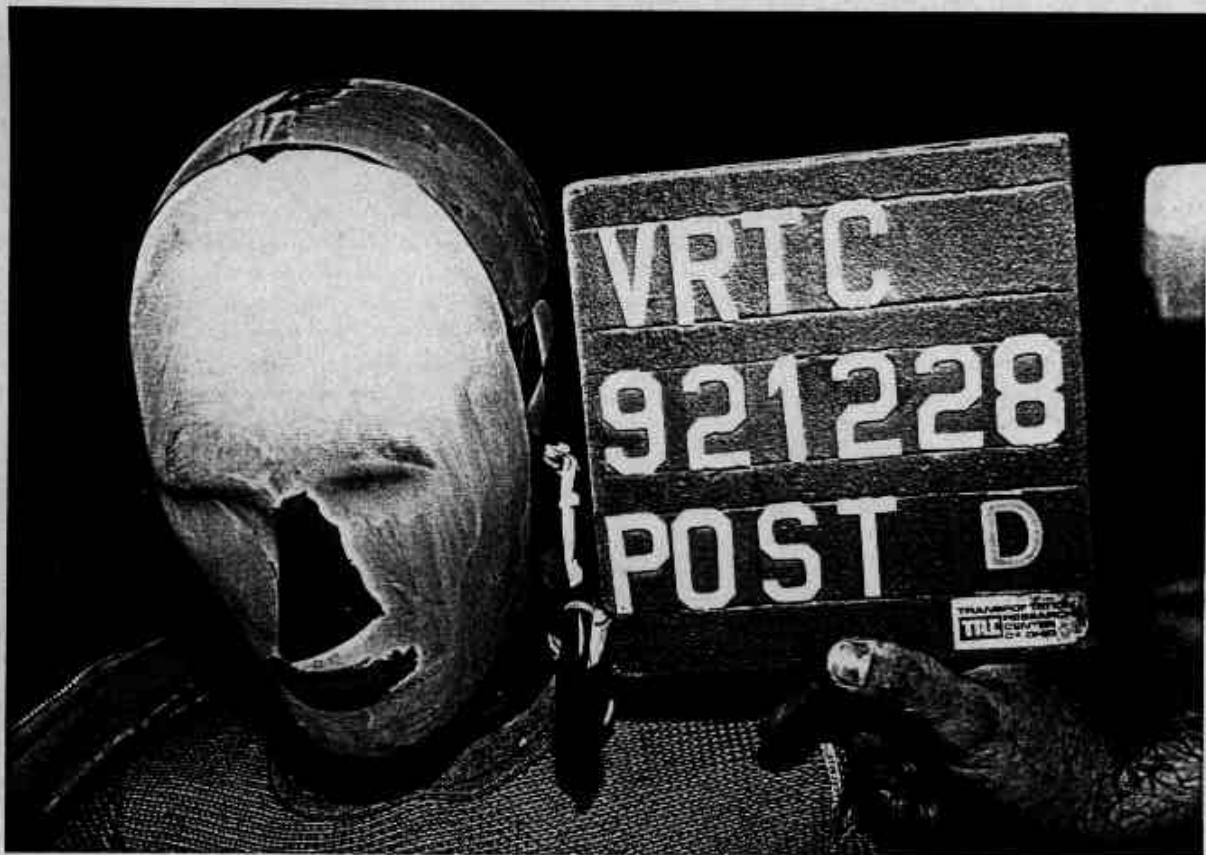


Figure A-34. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 1



Figure A-35. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 2



Figure A-36. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1



Figure A-37. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2



Figure A-38. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 3



Figure A-39. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW



Figure A-40. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 1

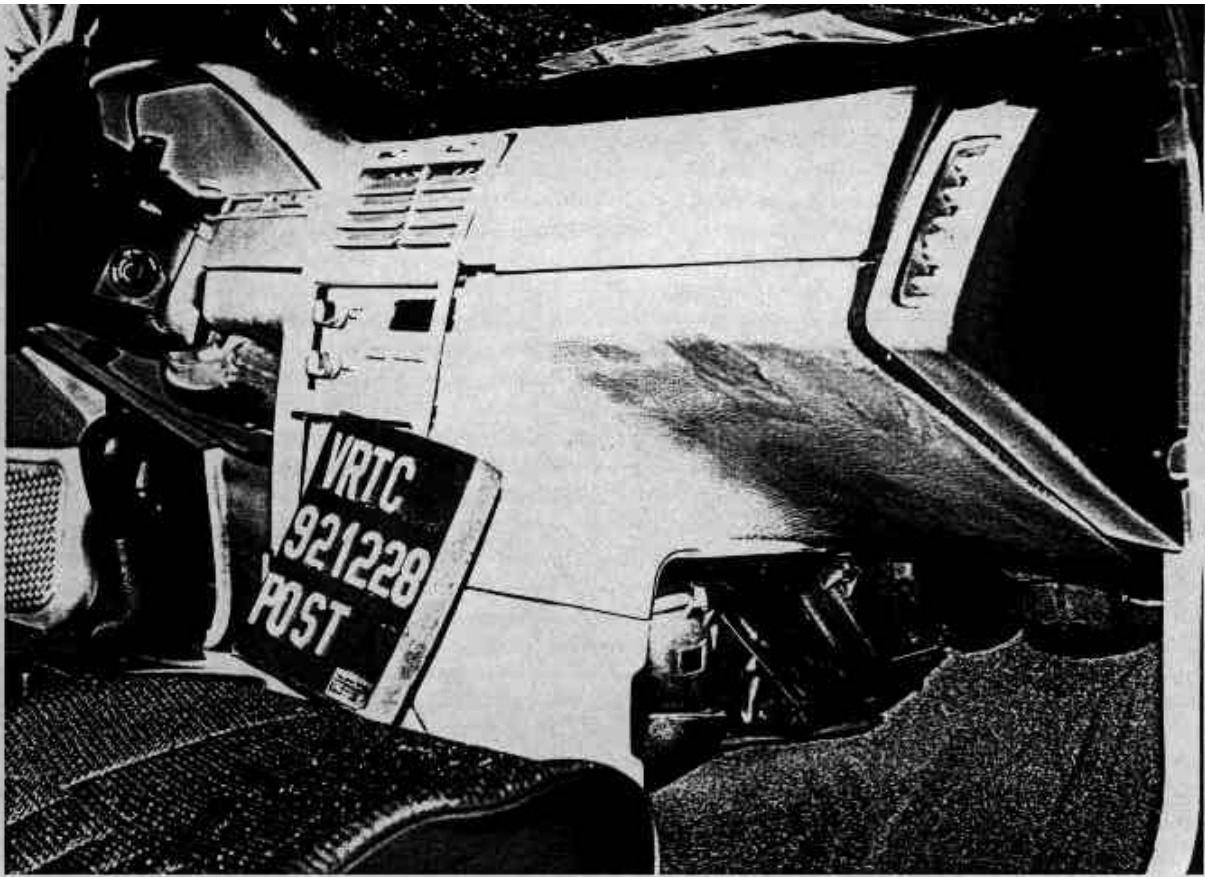


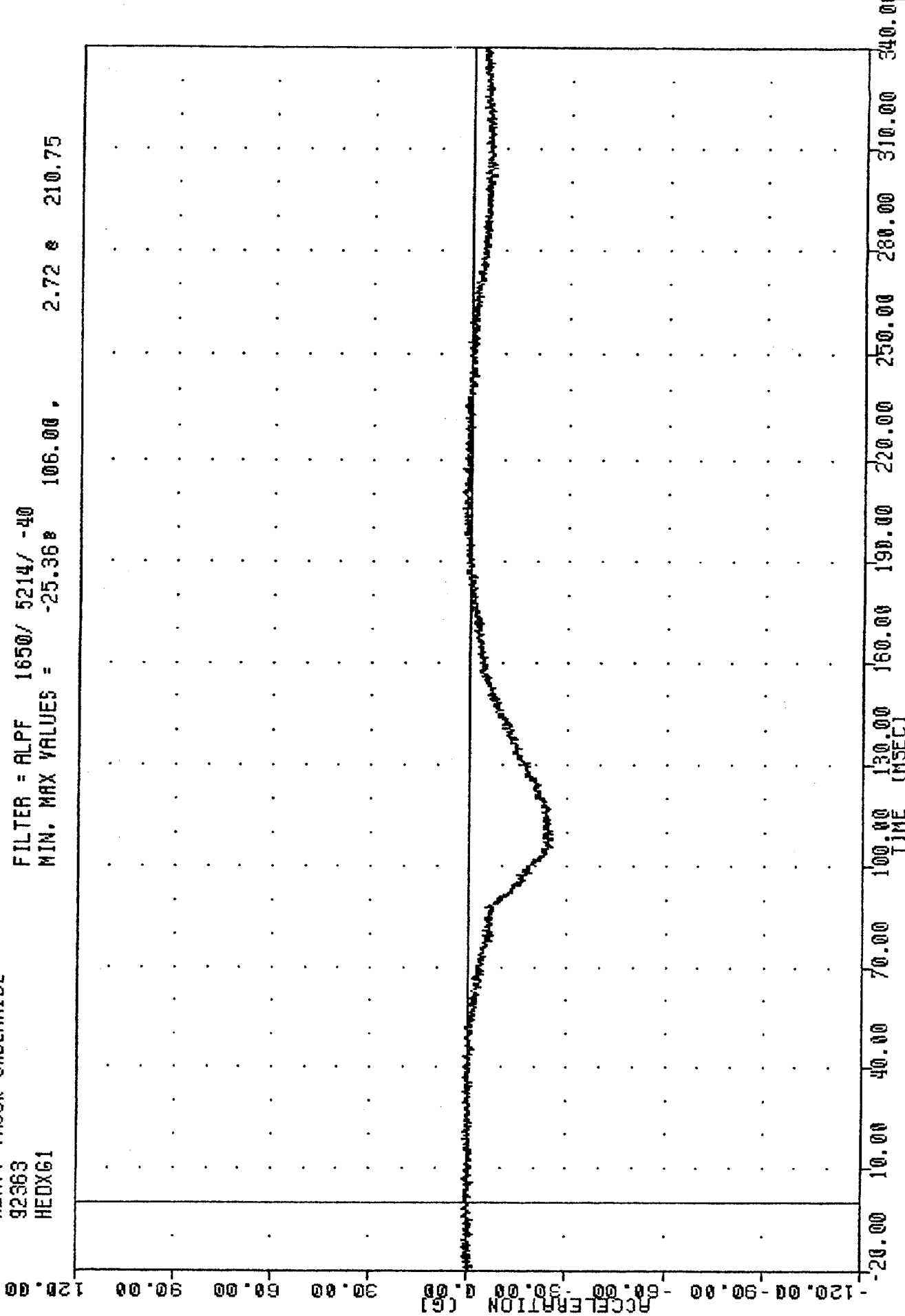
Figure A-41. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 2

APPENDIX B

DATA PLOTS

TRC
HEAVY TRUCK UNDERRIDE
92363
HEDX61

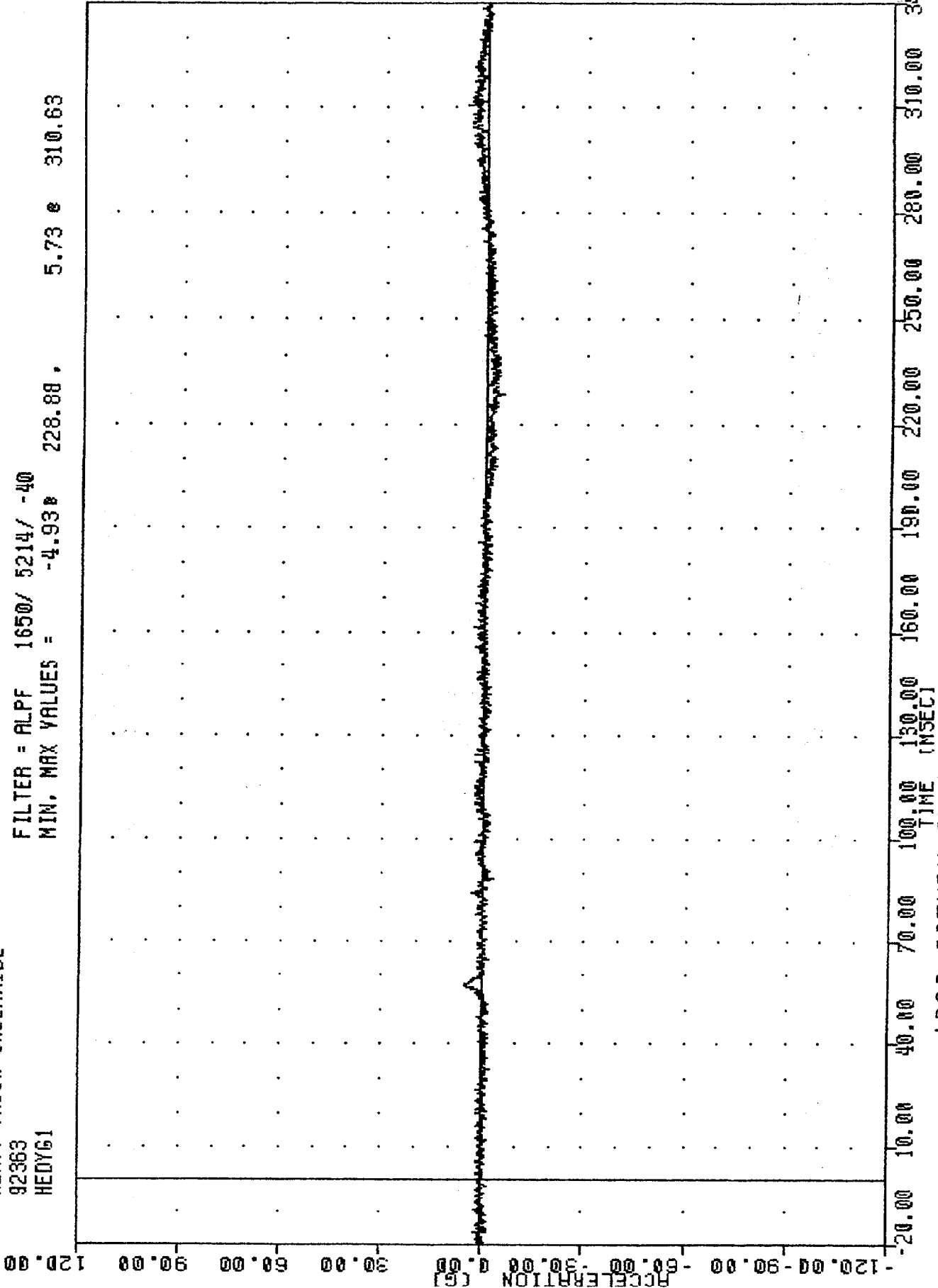
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -25.368 106.00 2.72 e 210.75



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD X-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
HEDY61

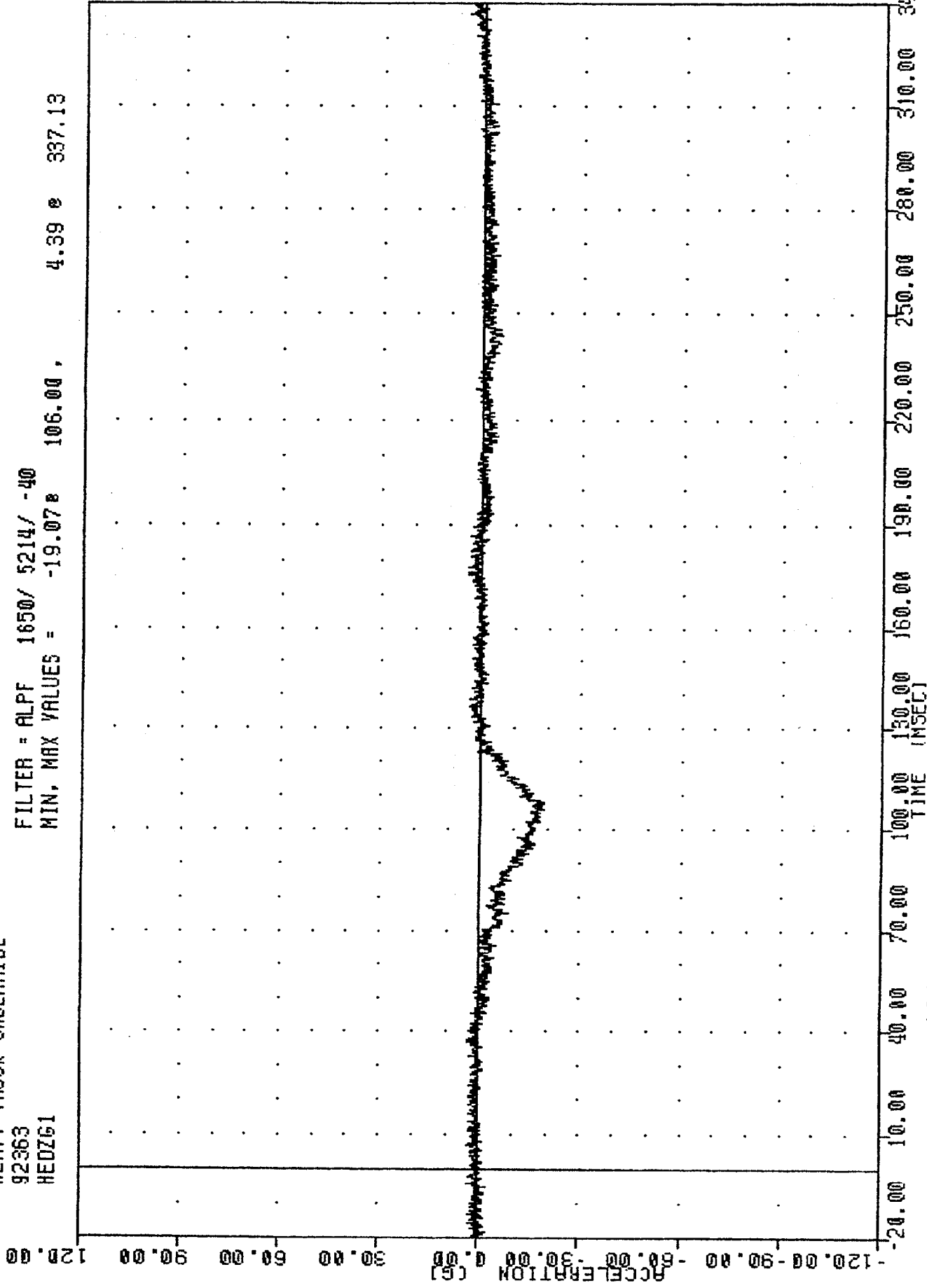
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -4.93 228.88 5.73 e 310.63



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD Y-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
HEZG1

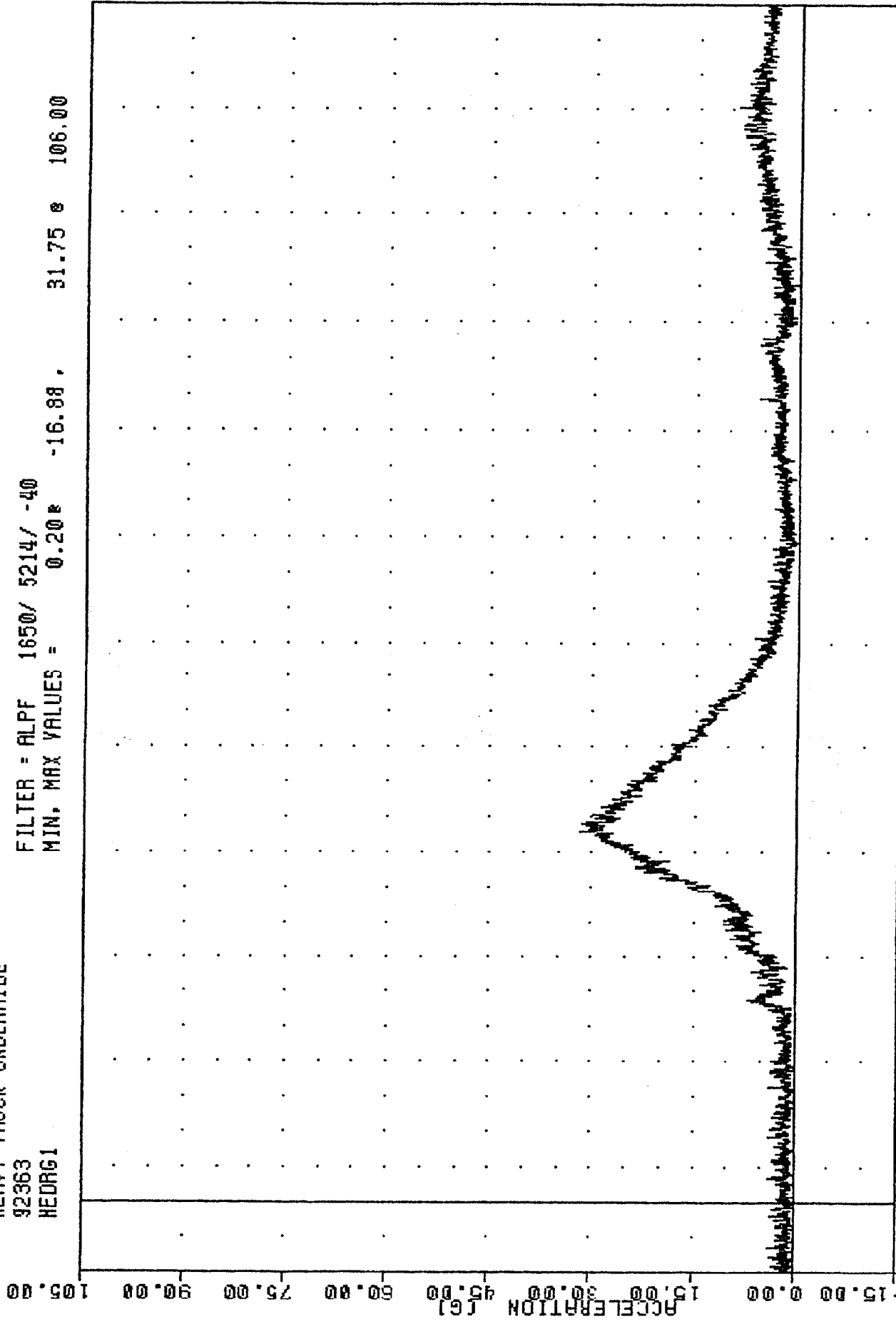
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD Z-AXIS ACCELERATION

TAC 921228
HEAVY TRUCK UNDERRIDE
92363
HEDRG1

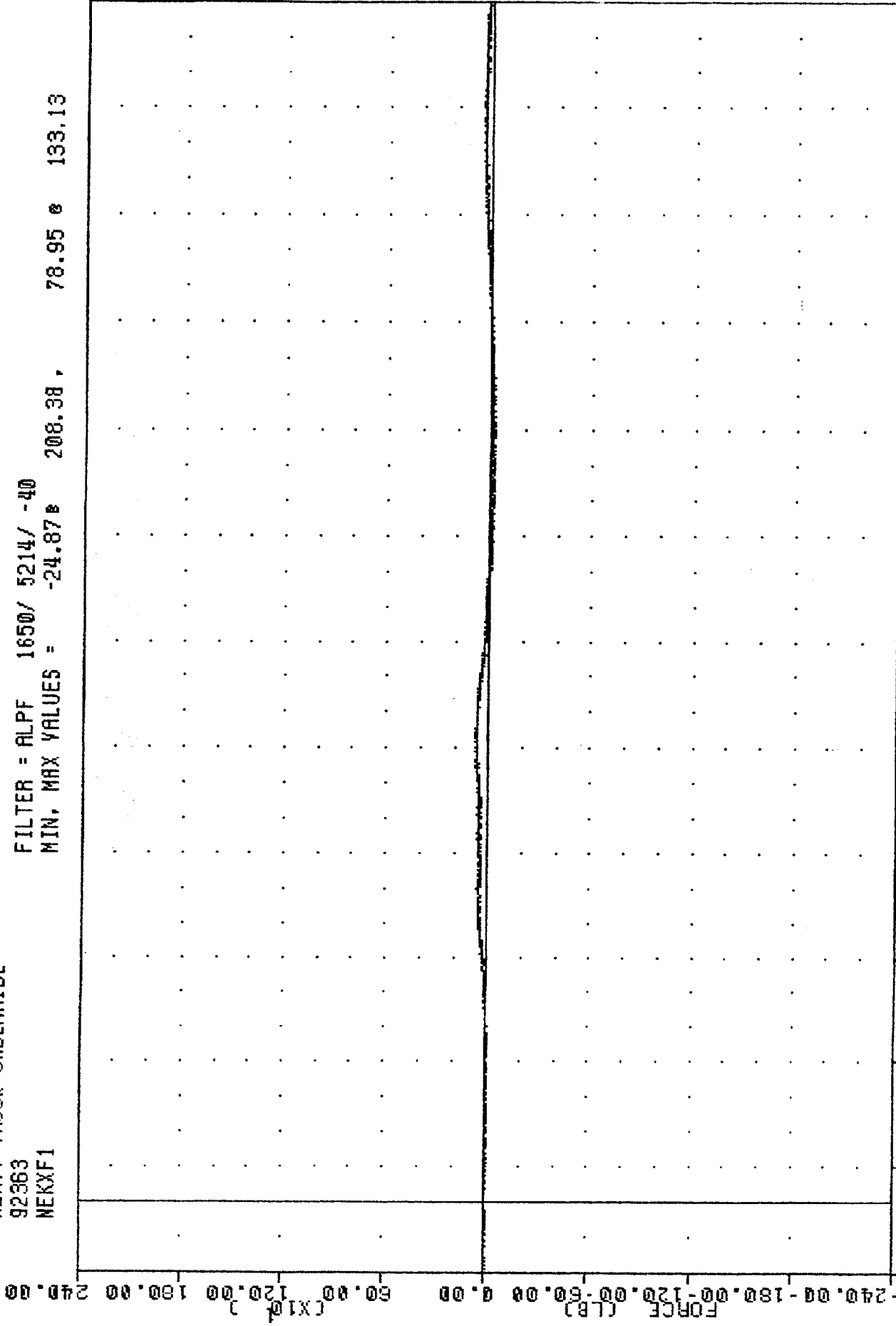
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER HEAD RESULTANT ACCELERATION

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 NEKXF1

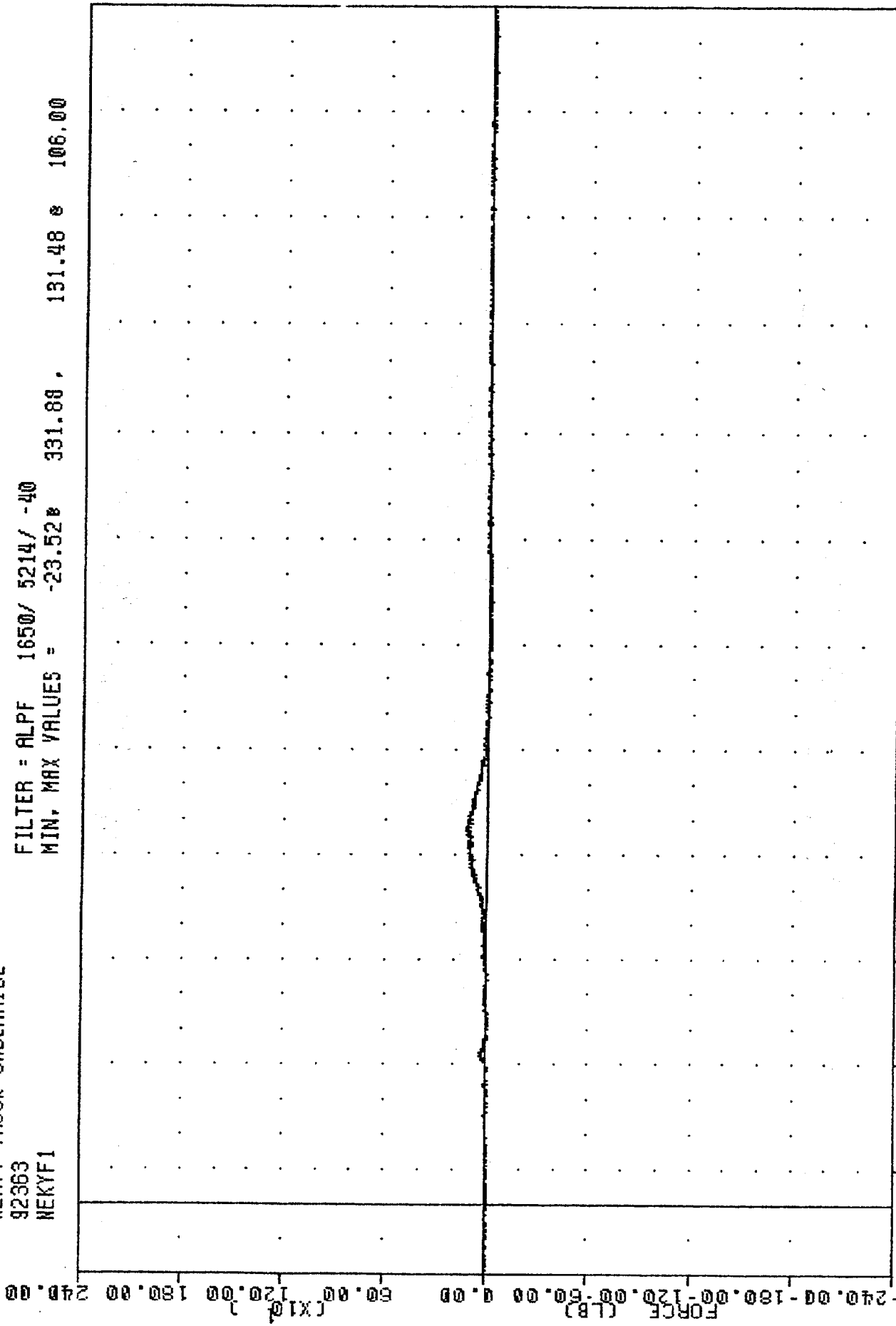
FILTER = ALPF 1650/ 5214/ -40
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-240.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
 TIME (MSEC)
 1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 DRIVER NECK X-AXIS SHEAR FORCE

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
NEKYF1

FILTER = ALPF 1650/ 5214/ -40
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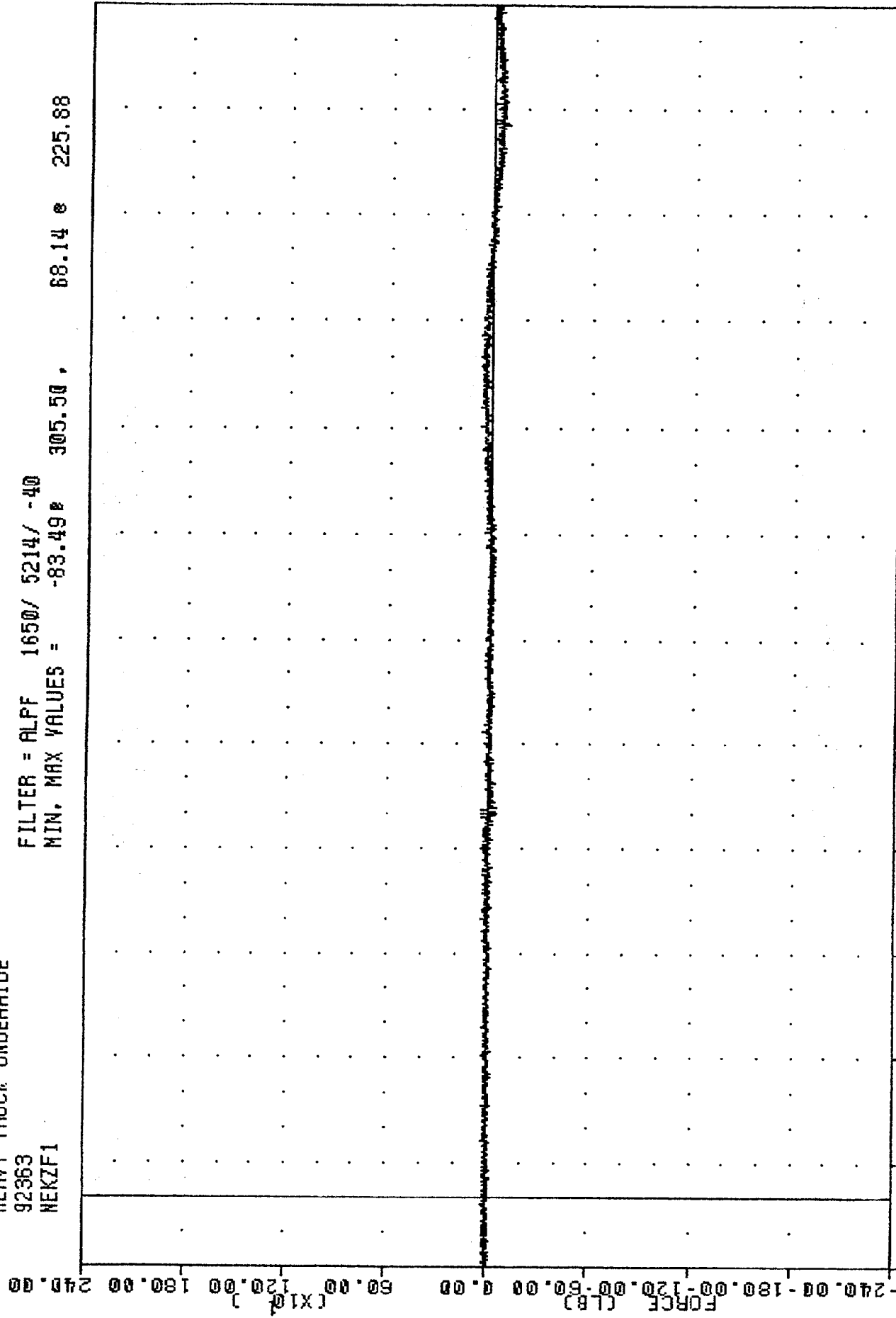
240.00
180.00
120.00
60.00
0.00
-60.00
-120.00
-180.00
-240.00

0.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00

1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK Y-AXIS SHEAR FORCE

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 NEKZF1

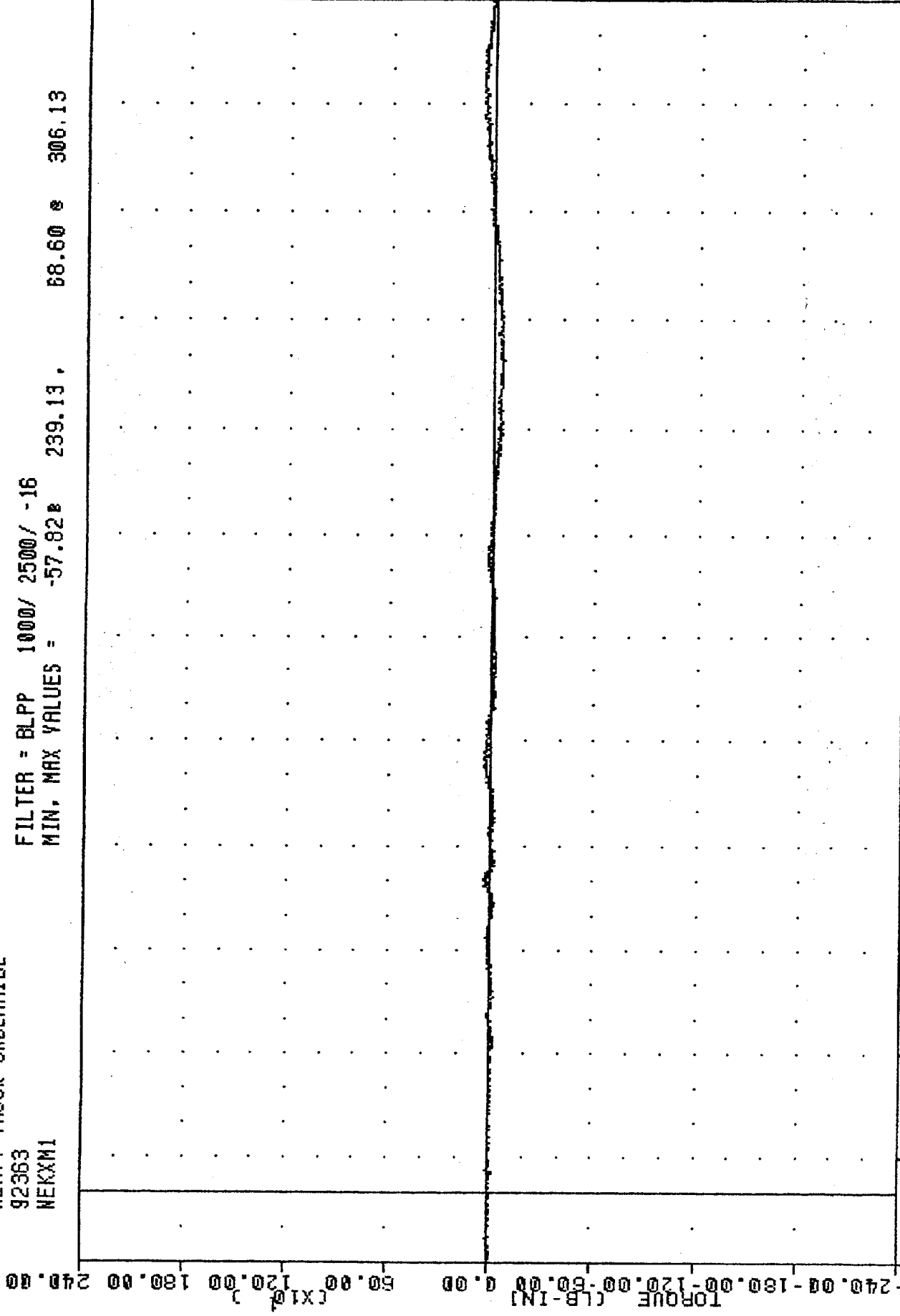
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 TIME (MSEC)
 1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 DRIVER NECK Z-AXIS AXIAL FORCE

TRC , 921228
 HEAVY TRUCK UNDERIDE
 92363
 NEKXMI

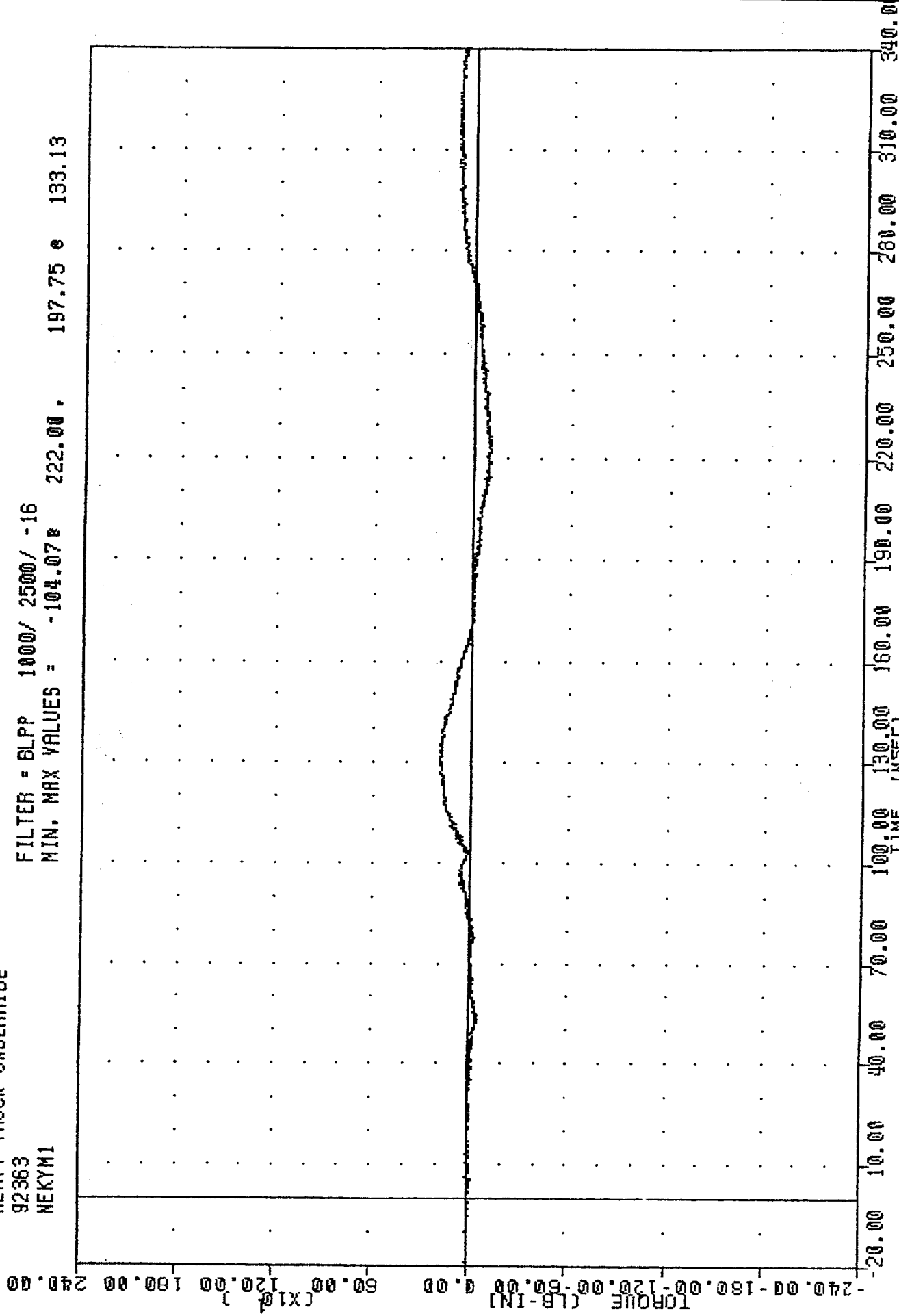
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERIDE GUARD
 DRIVER NECK MOMENT ABOUT X AXIS

TRC
HEAVY TRUCK UNDERRIDE
92363
MEKYM1

FILTER = BLPP 1000/ 2500/ -16
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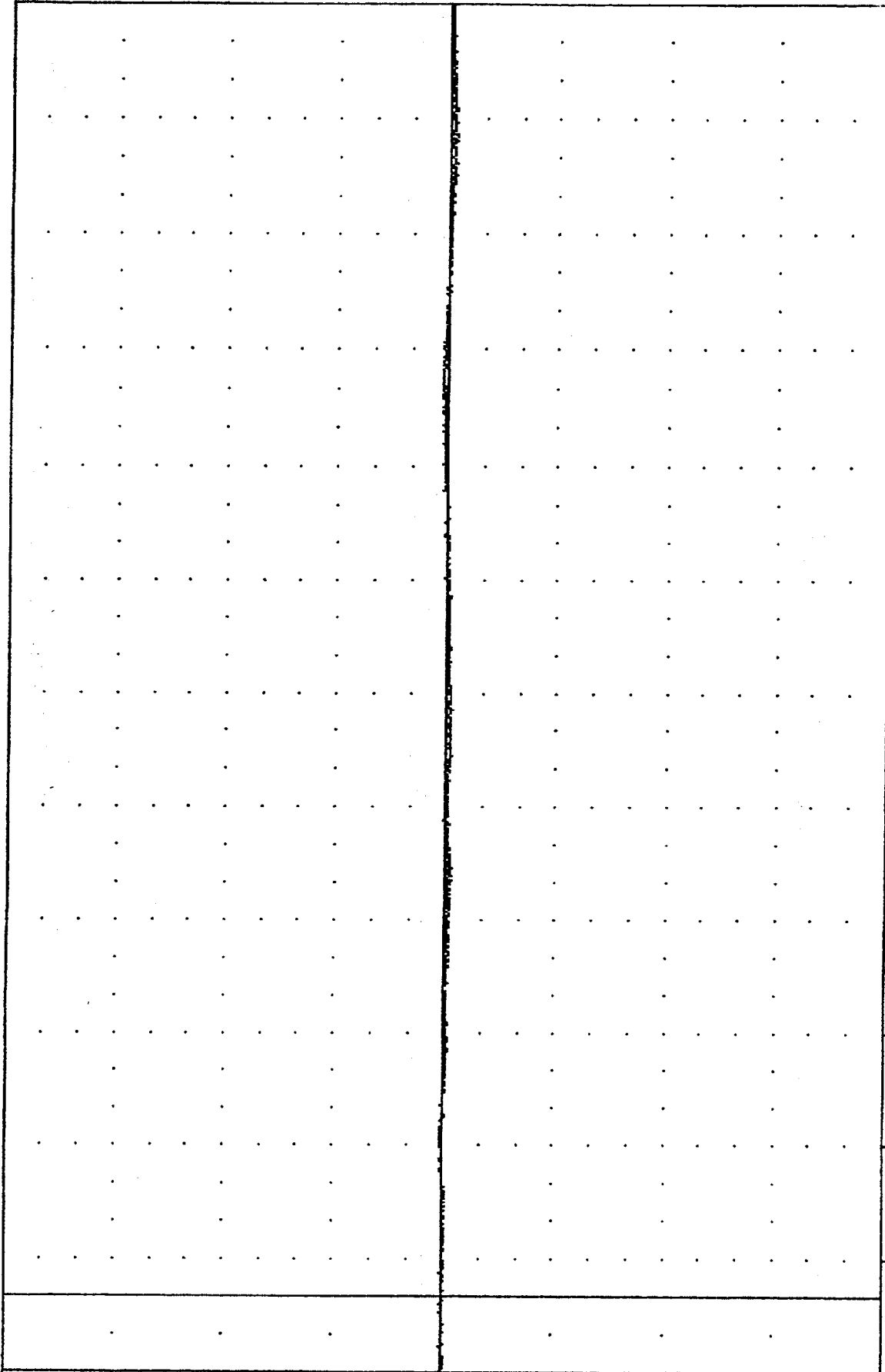


1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER NECK MOMENT ABOUT Y AXIS

TRC , 921228
 HEAVY TRUCK UNDERRAIDE
 92363
 WEKZM1

FILTER = BLPP 1000/ 2500/ -16
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TORQUE (LB-IN) (X10³)
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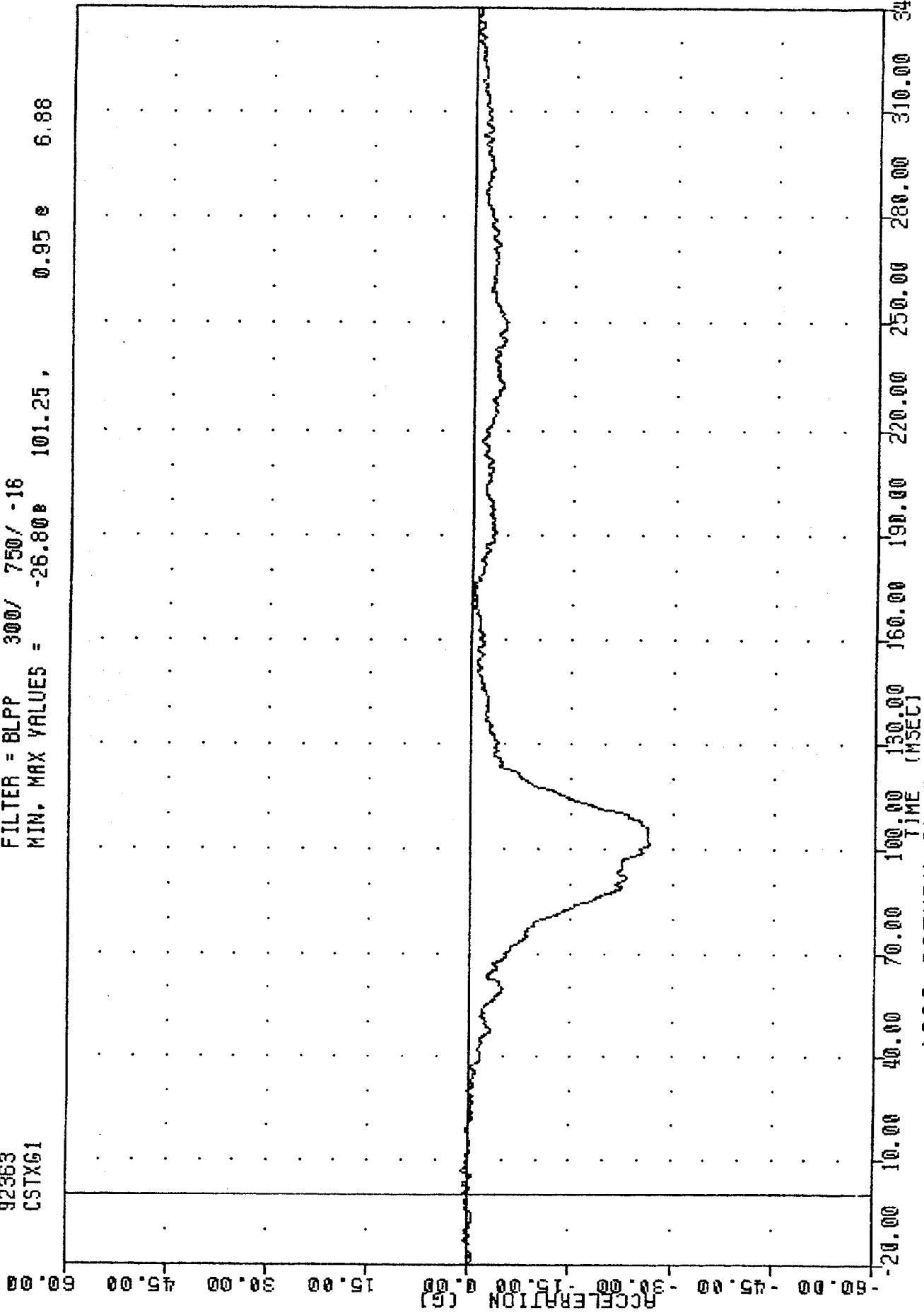


-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
 TIME (MSEC)

1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRAIDE GUARD
 DRIVER NECK MOMENT ABOUT Z AXIS

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTXG1

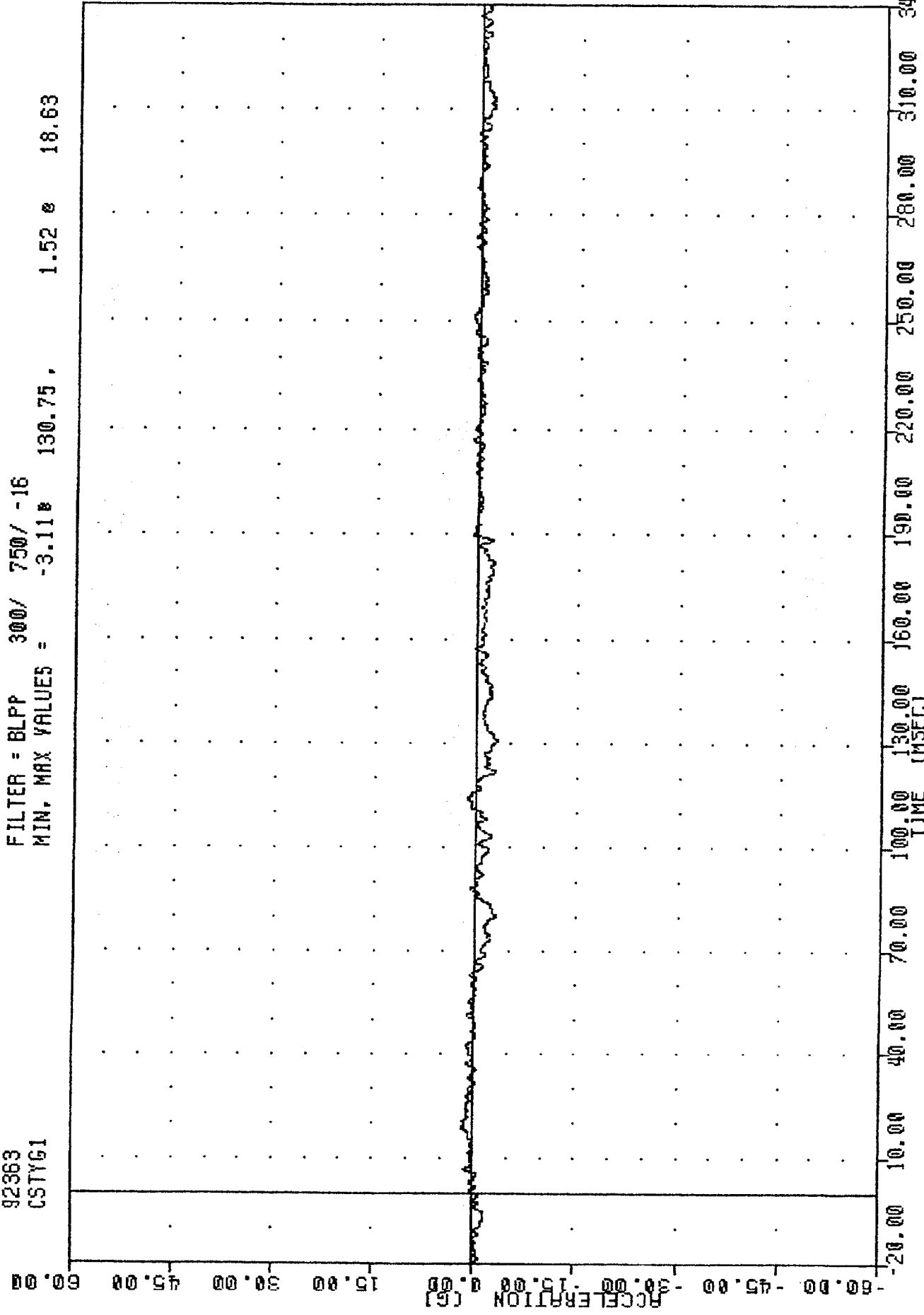
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST X-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTYG1

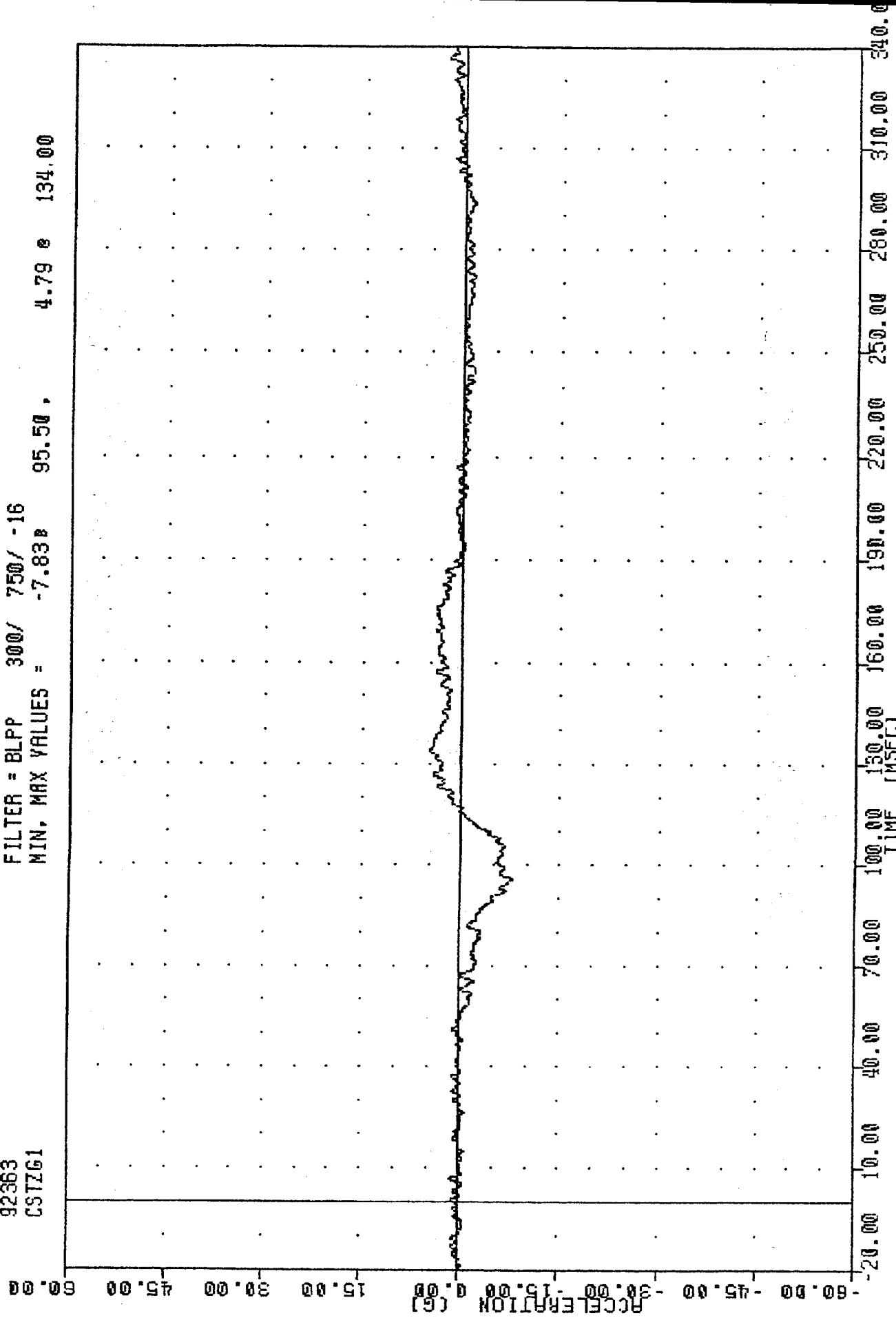
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST Y-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTZ61

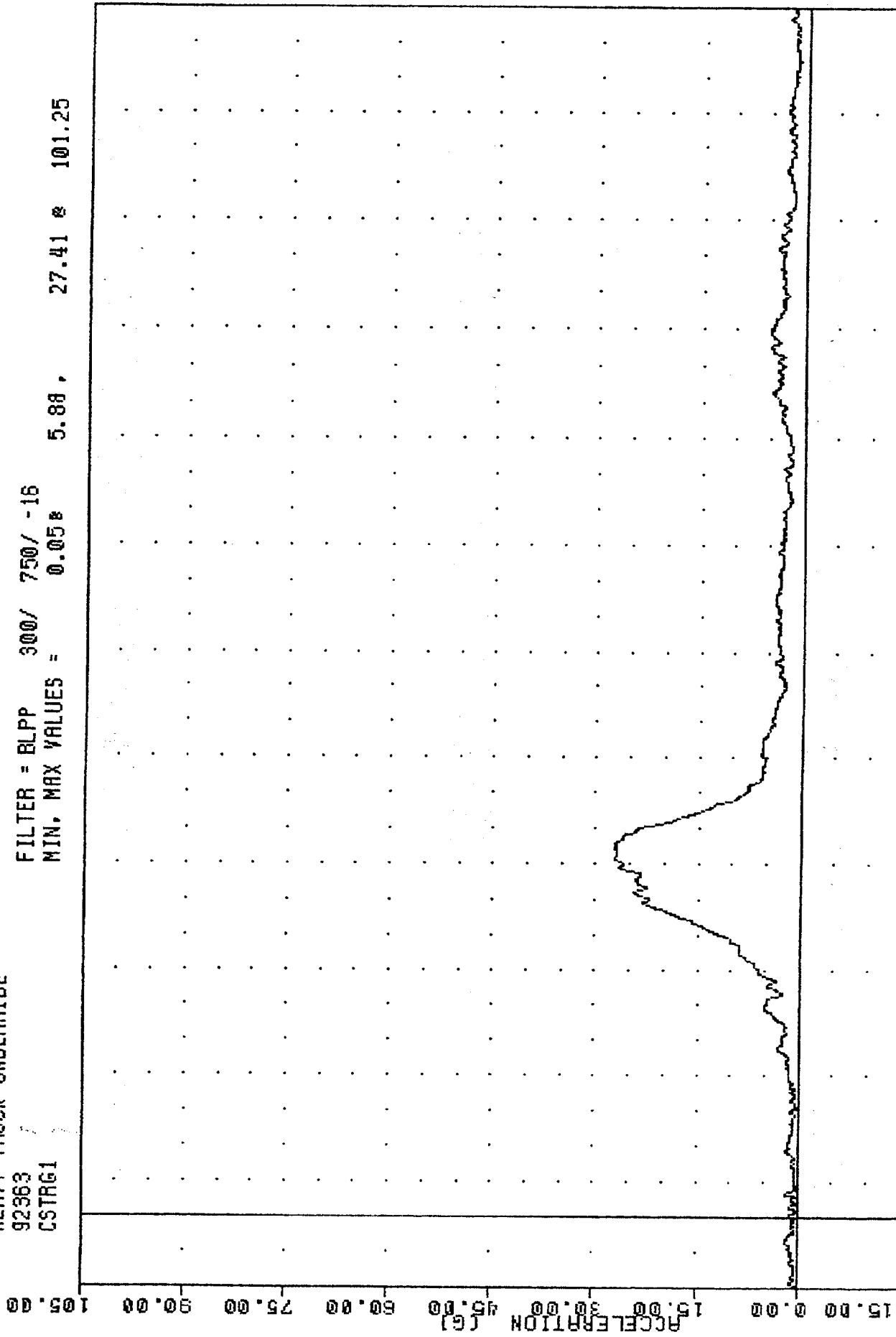
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST Z-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTRG1

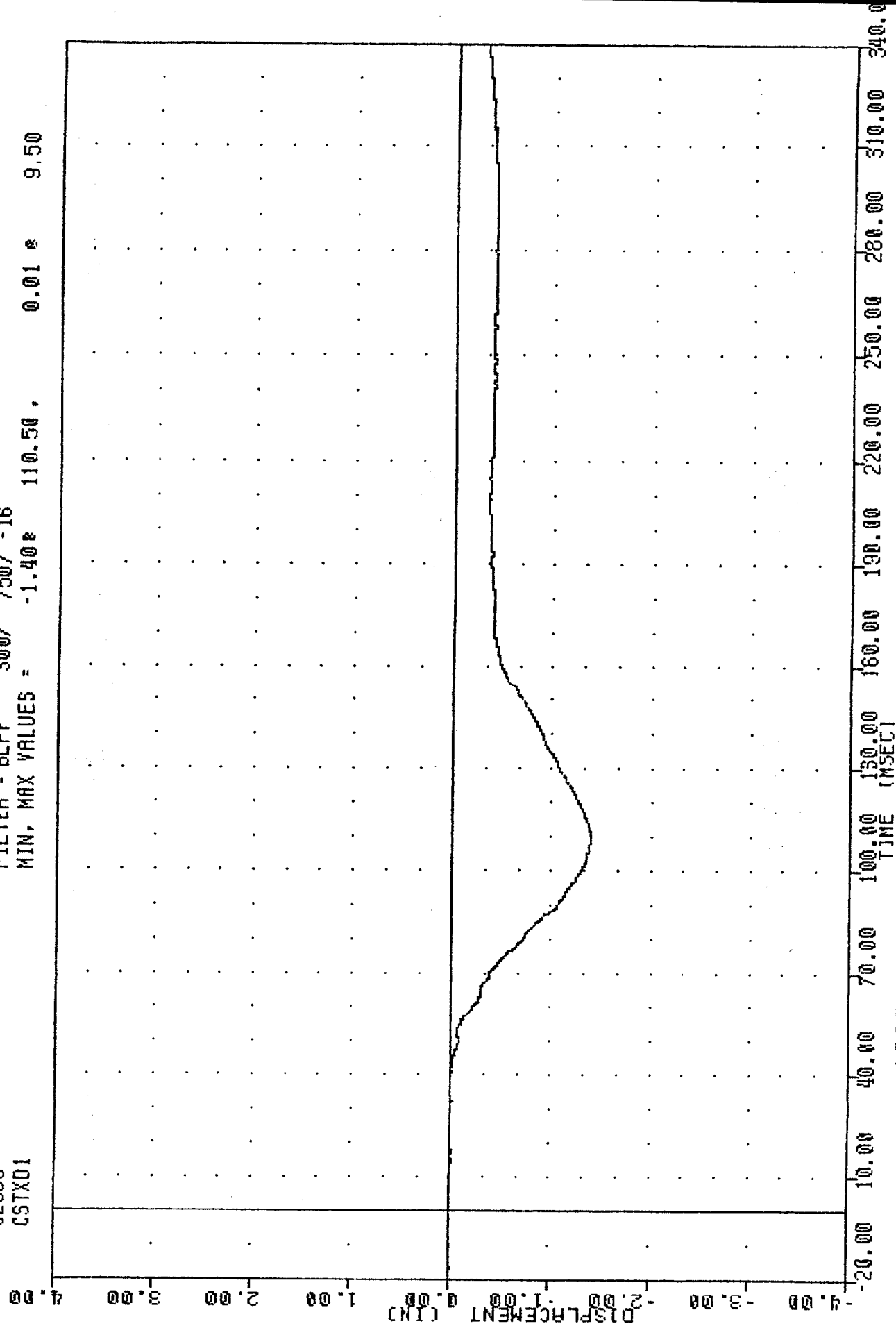
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST RESULTANT ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTXD1

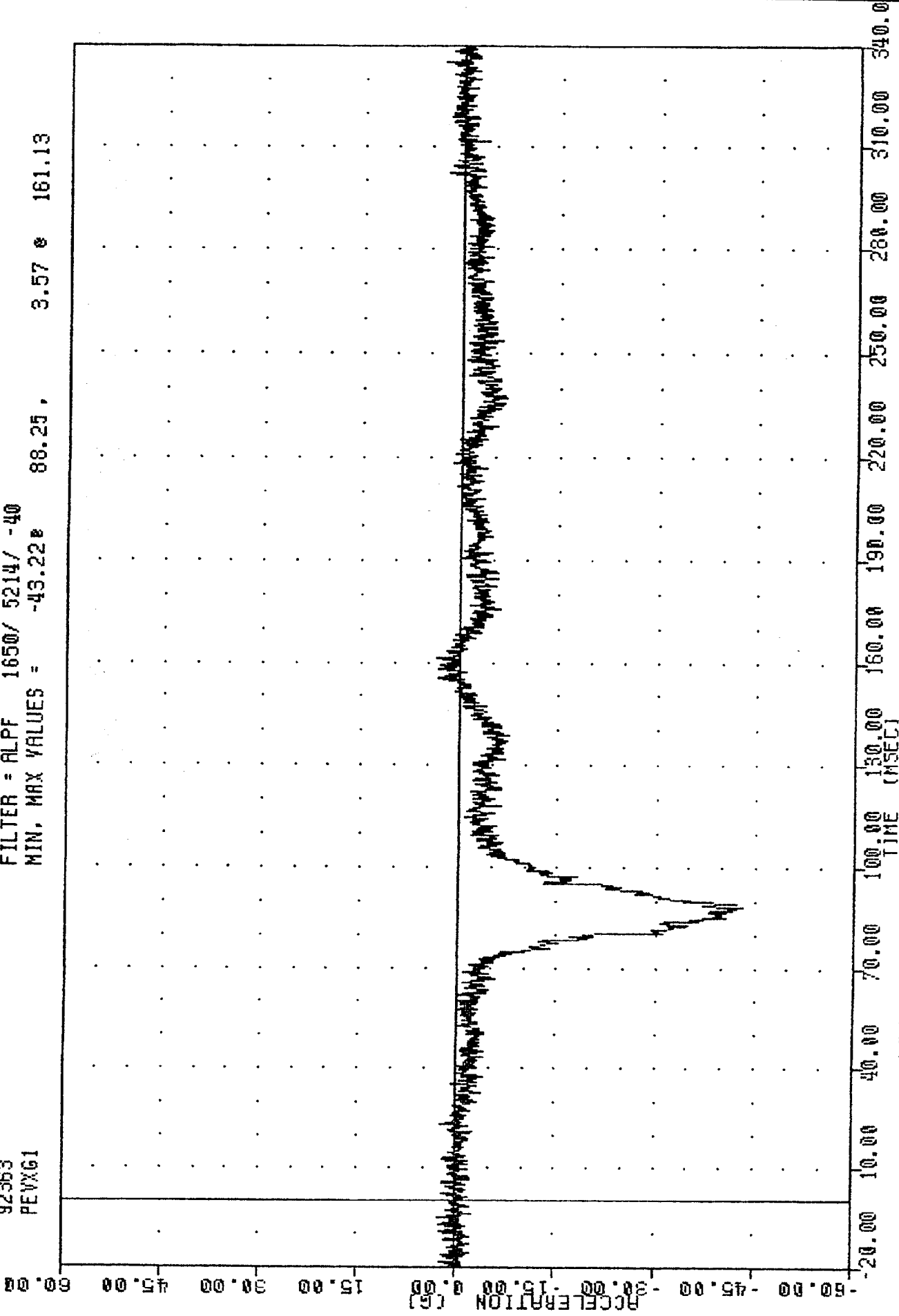
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1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER CHEST DEFLECTION

TRC . 921228
HEAVY TRUCK UNDERRIDE
92363
PEVXG1

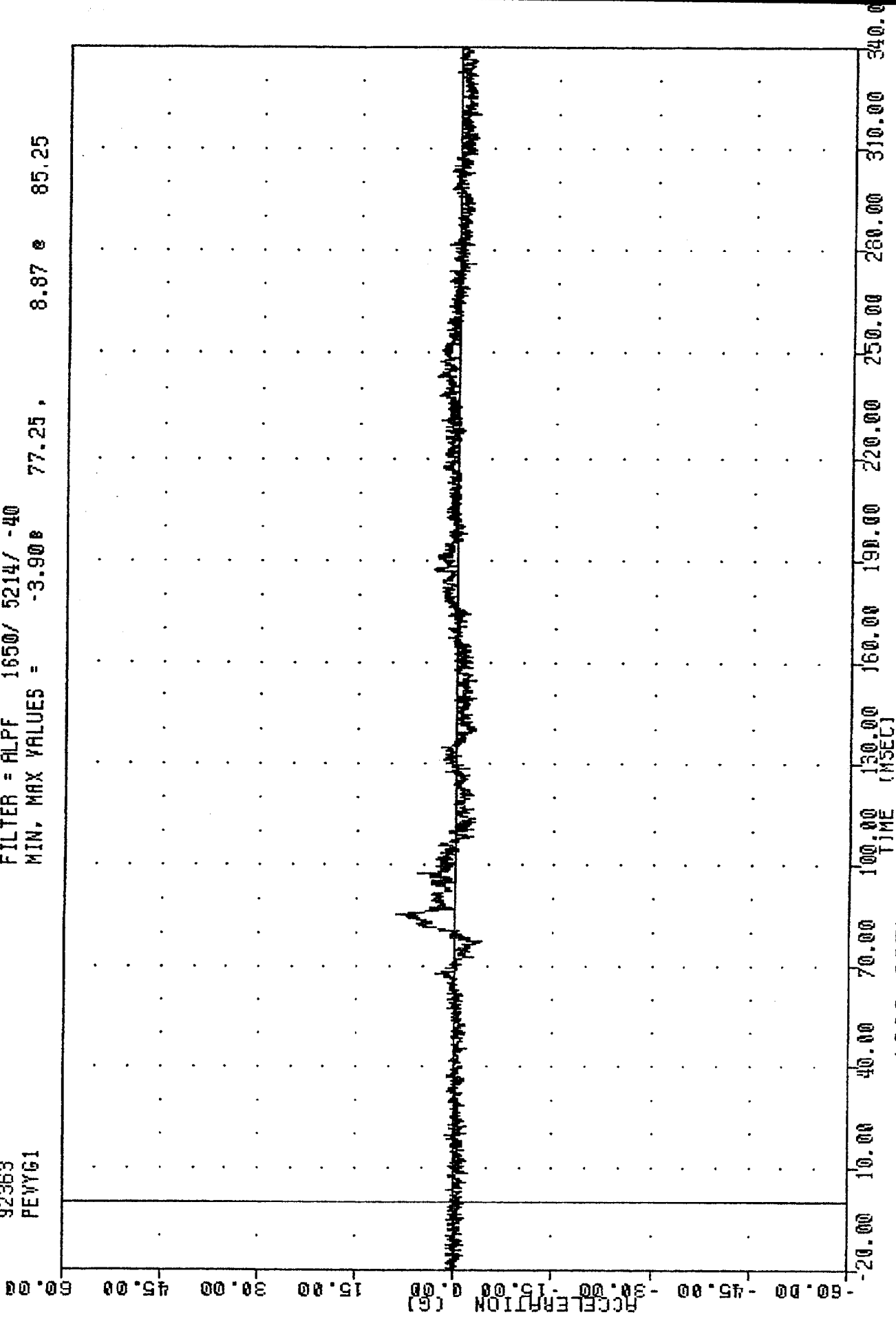
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -43.22 88.25, 3.57 161.13



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS X-AXIS ACCELERATION

TRC 921228
HEAVY TRUCK UNDERRIDE
92363
PEYVG1

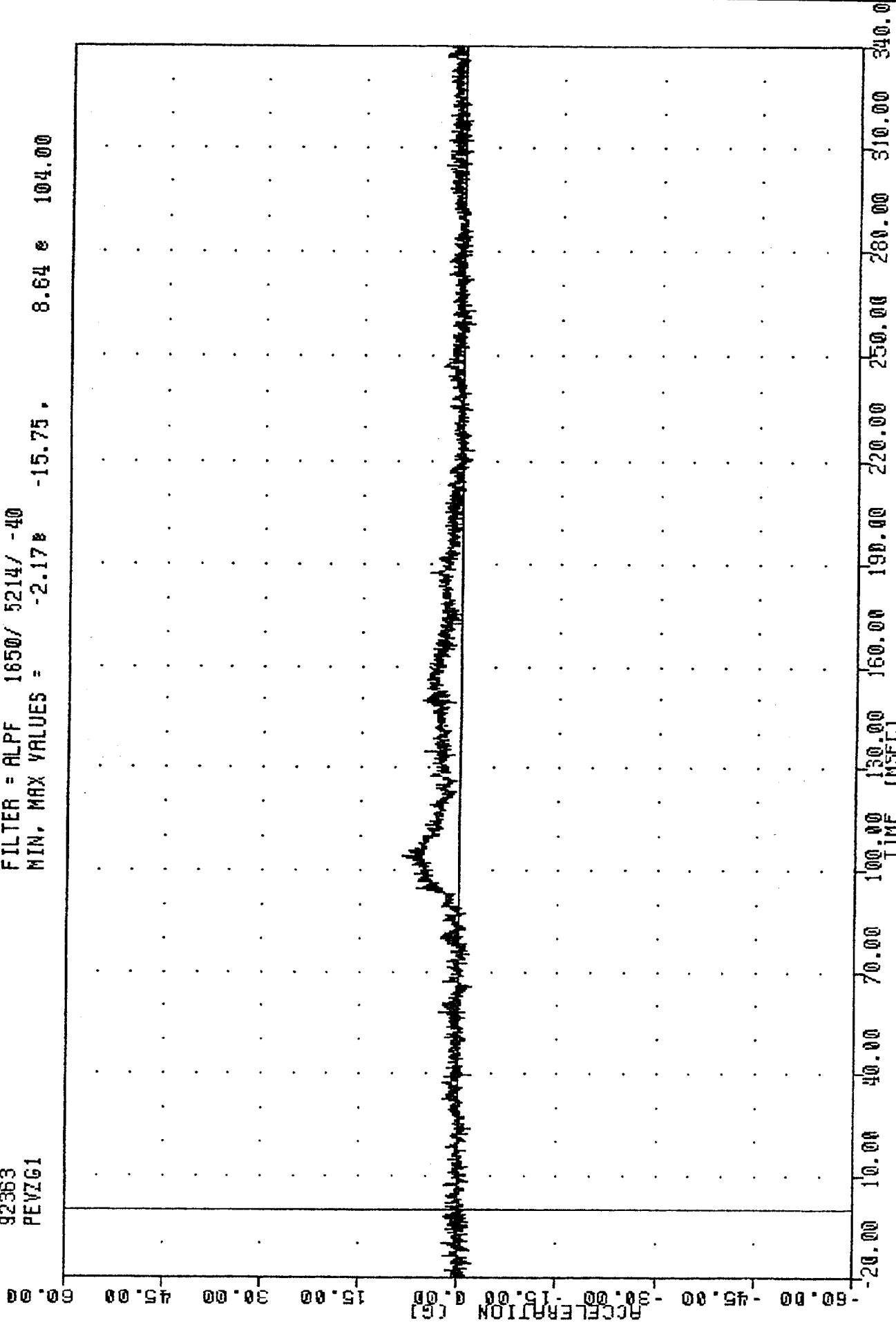
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -3.908 77.25, 8.87 e 85.25



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS Y-AXIS ACCELERATION

TRC
HEAVY TRUCK UNDERRIDE
92363
PEVZG1

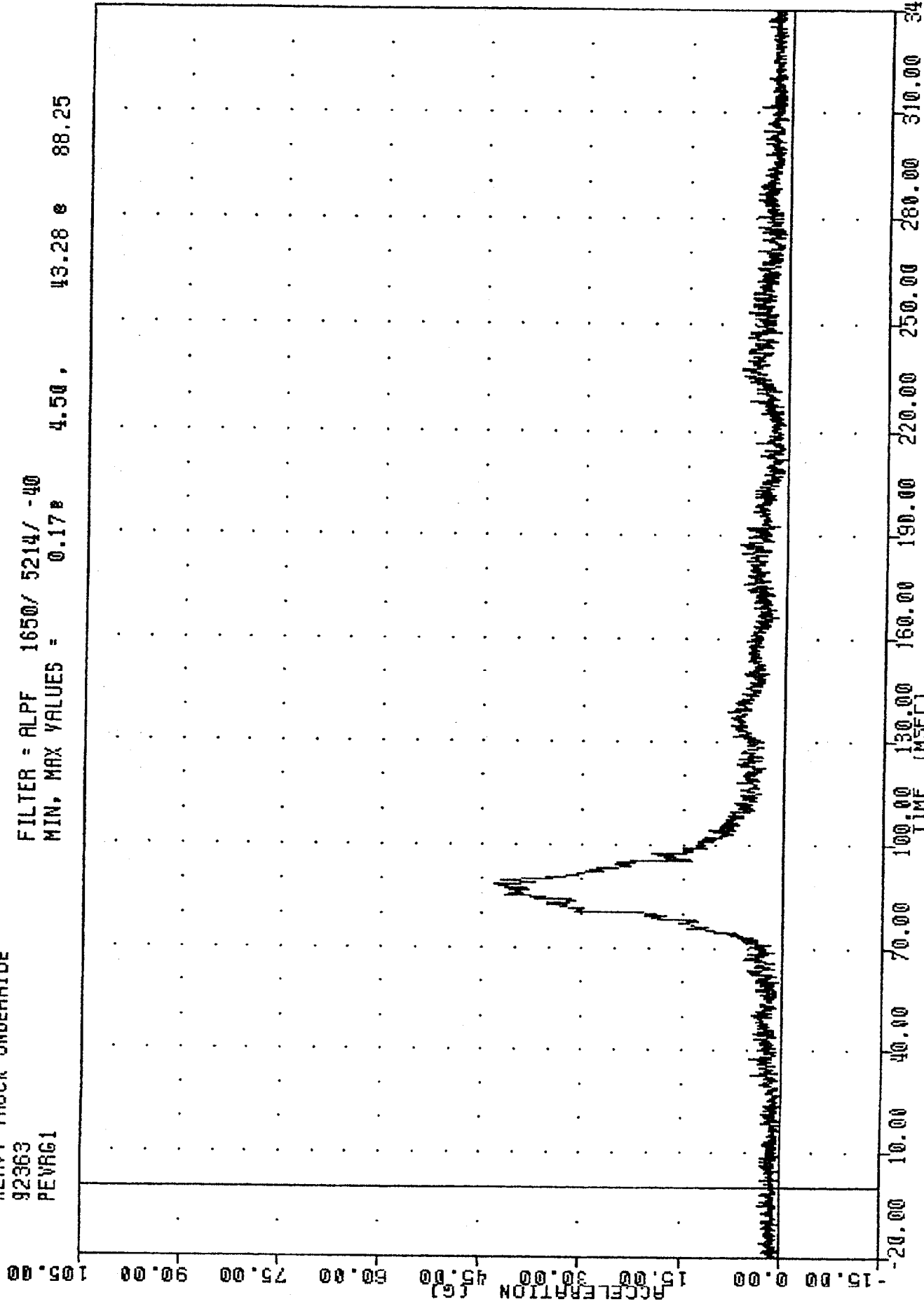
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -2.17e -15.75e 8.64e 104.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS Z-AXIS ACCELERATION

TRC
HEAVY TRUCK UNDERRIDE
92363
PEVR61

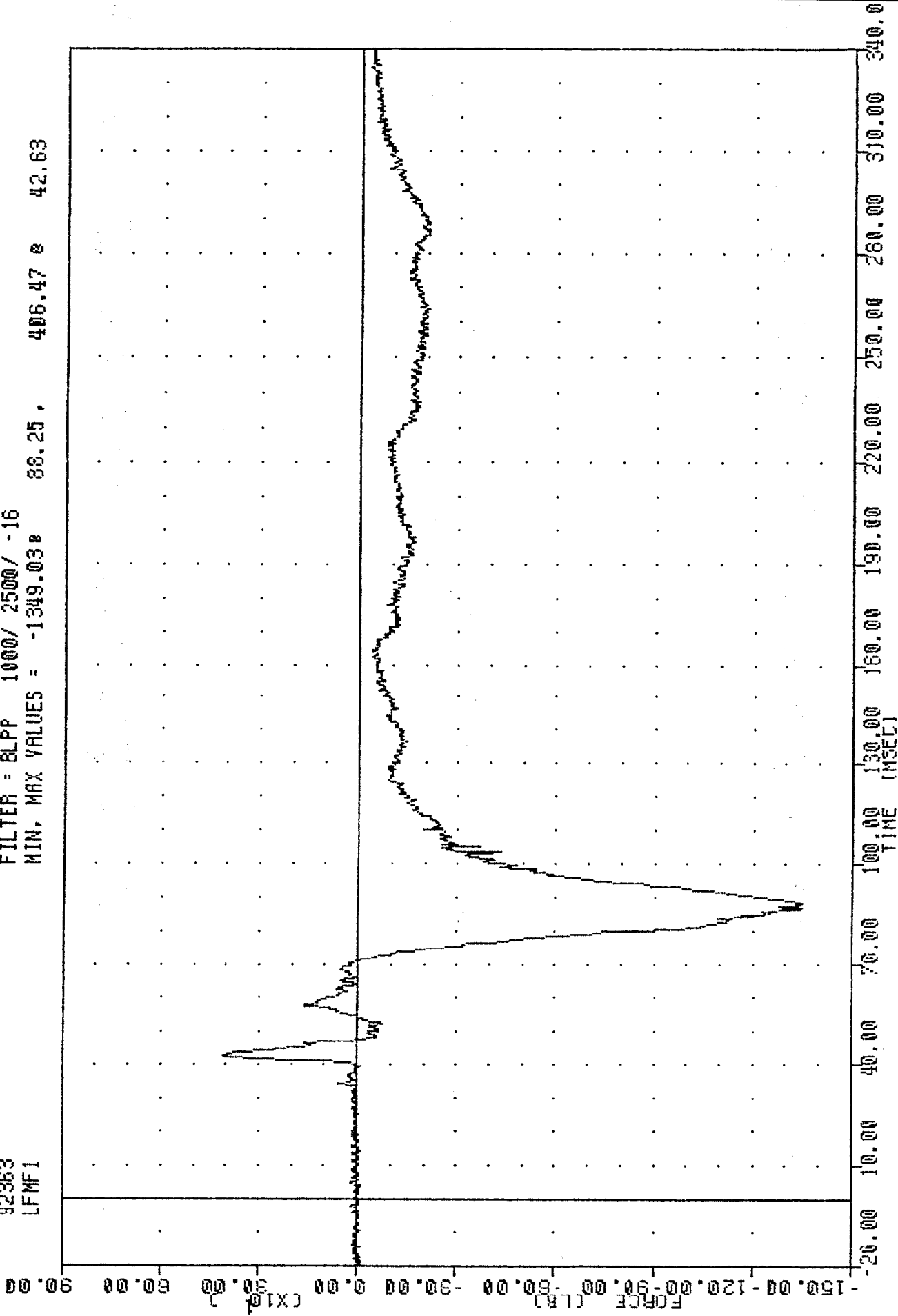
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = 0.17 43.28 e 88.25



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER PELVIS RESULTANT ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
LFMF1

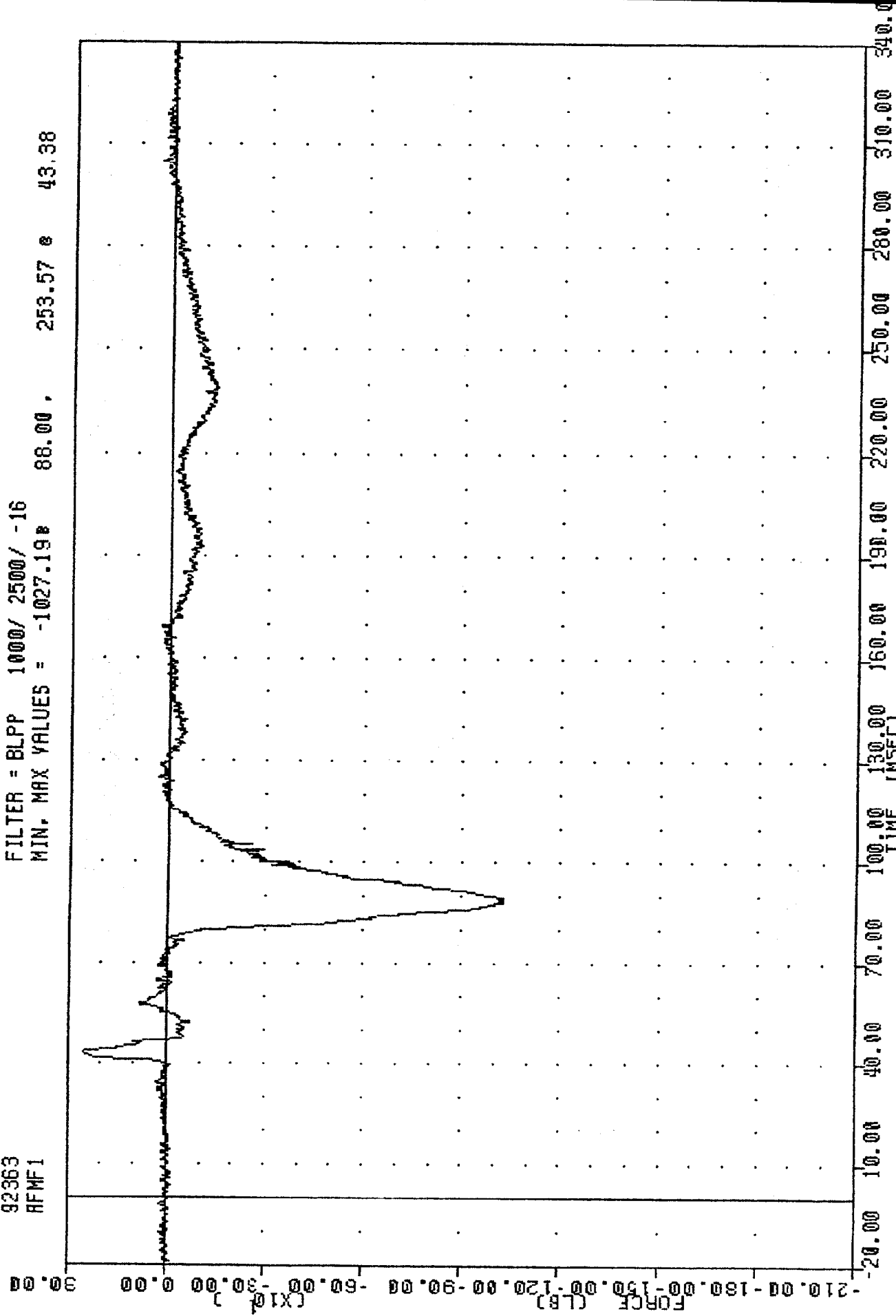
FILTER = BLPP 1000/ 2500/ -16
MIN, MAX VALUES = -1349.03 88.25 , 406.47 42.63



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER LEFT FEMUR FORCE

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
AFMF1

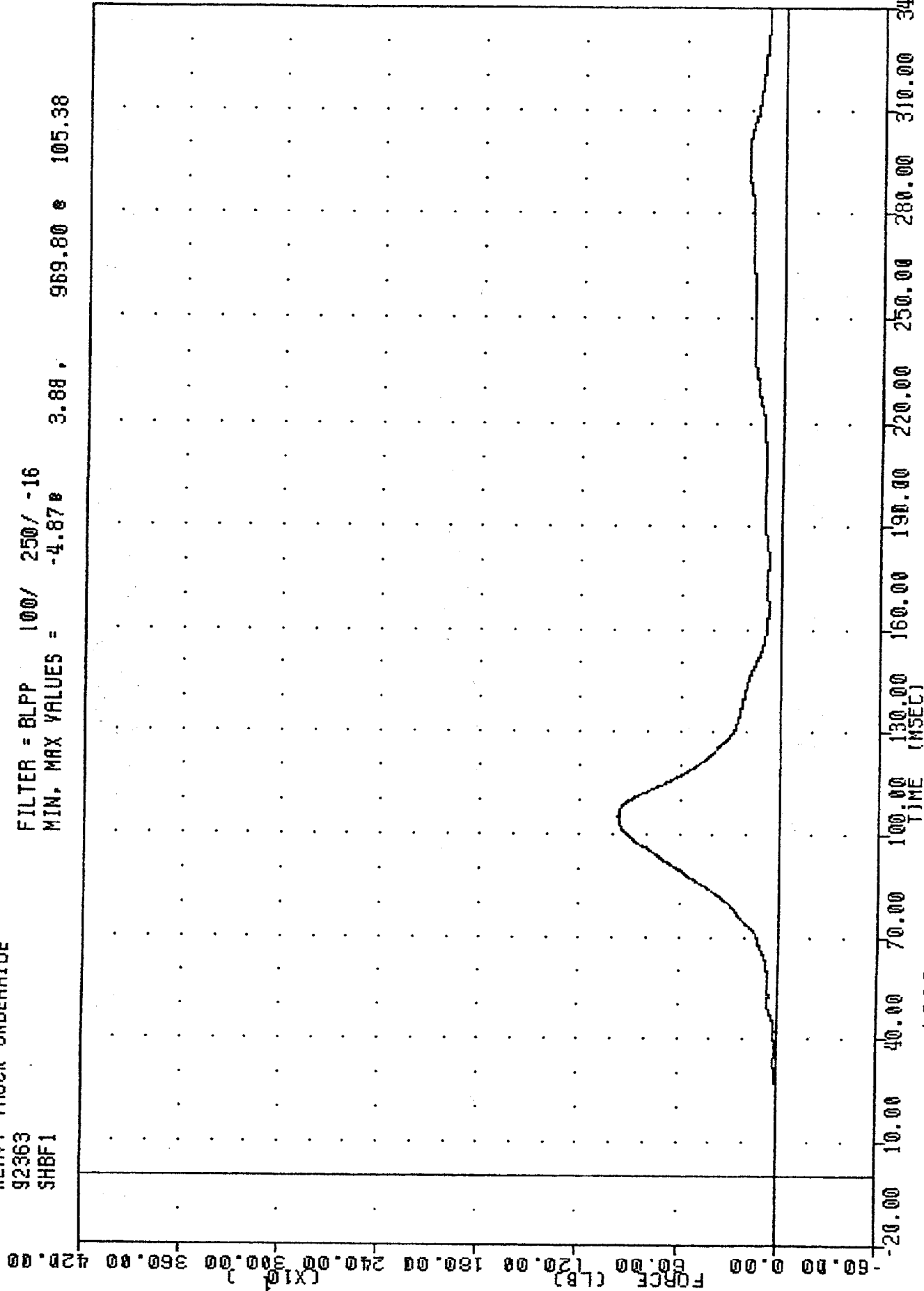
FILTER = BLPP 1000/ 2500/ -16
MIN, MAX VALUES = -1027.19# 88.00 , 253.57 e 43.38



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER RIGHT FEMUR FORCE

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
SHBF1

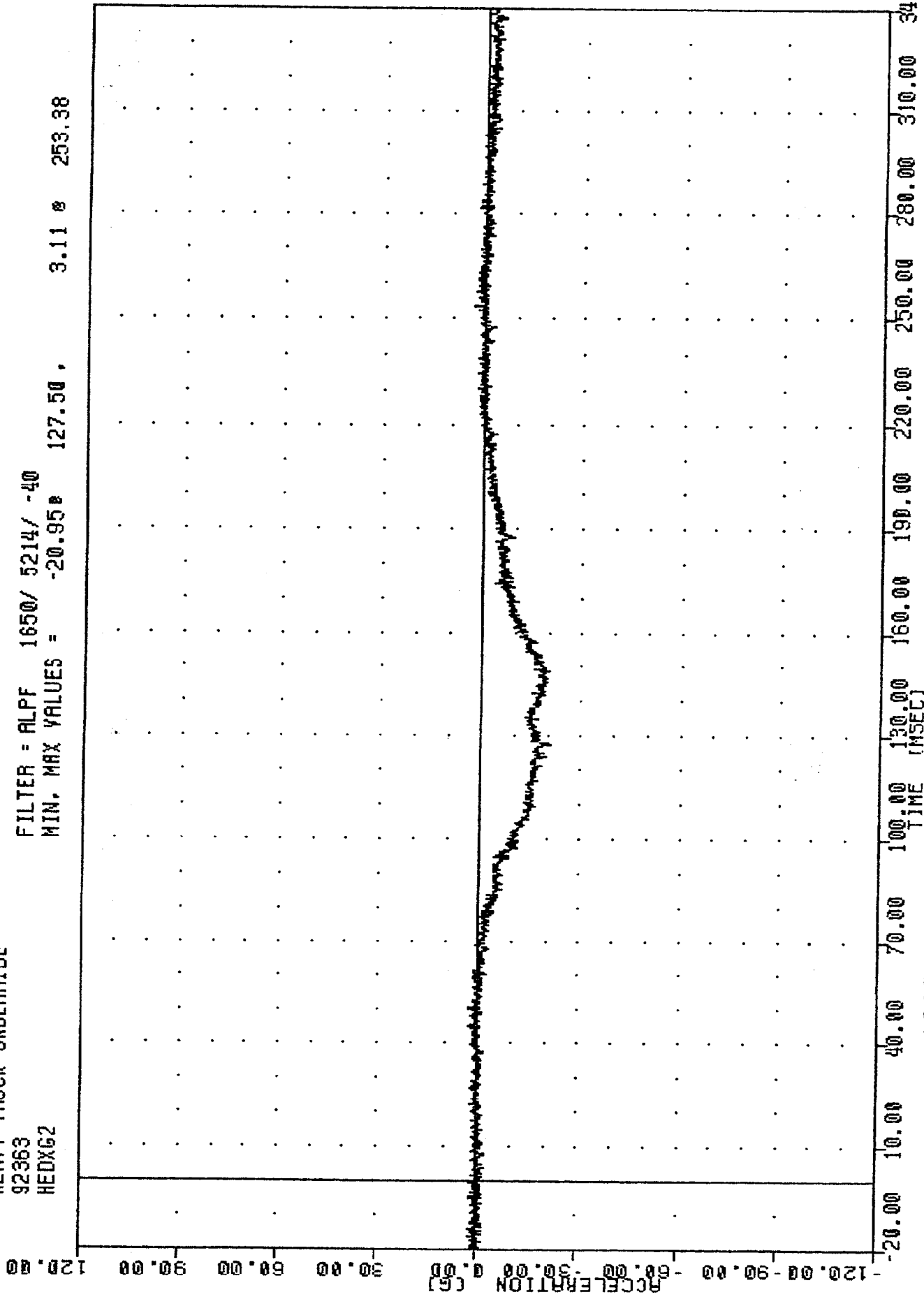
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -4.87 3.88 969.80 105.38



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
DRIVER SHOULDER BELT FORCE

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
HDXG2

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -20.95 127.50 , 3.11 253.38

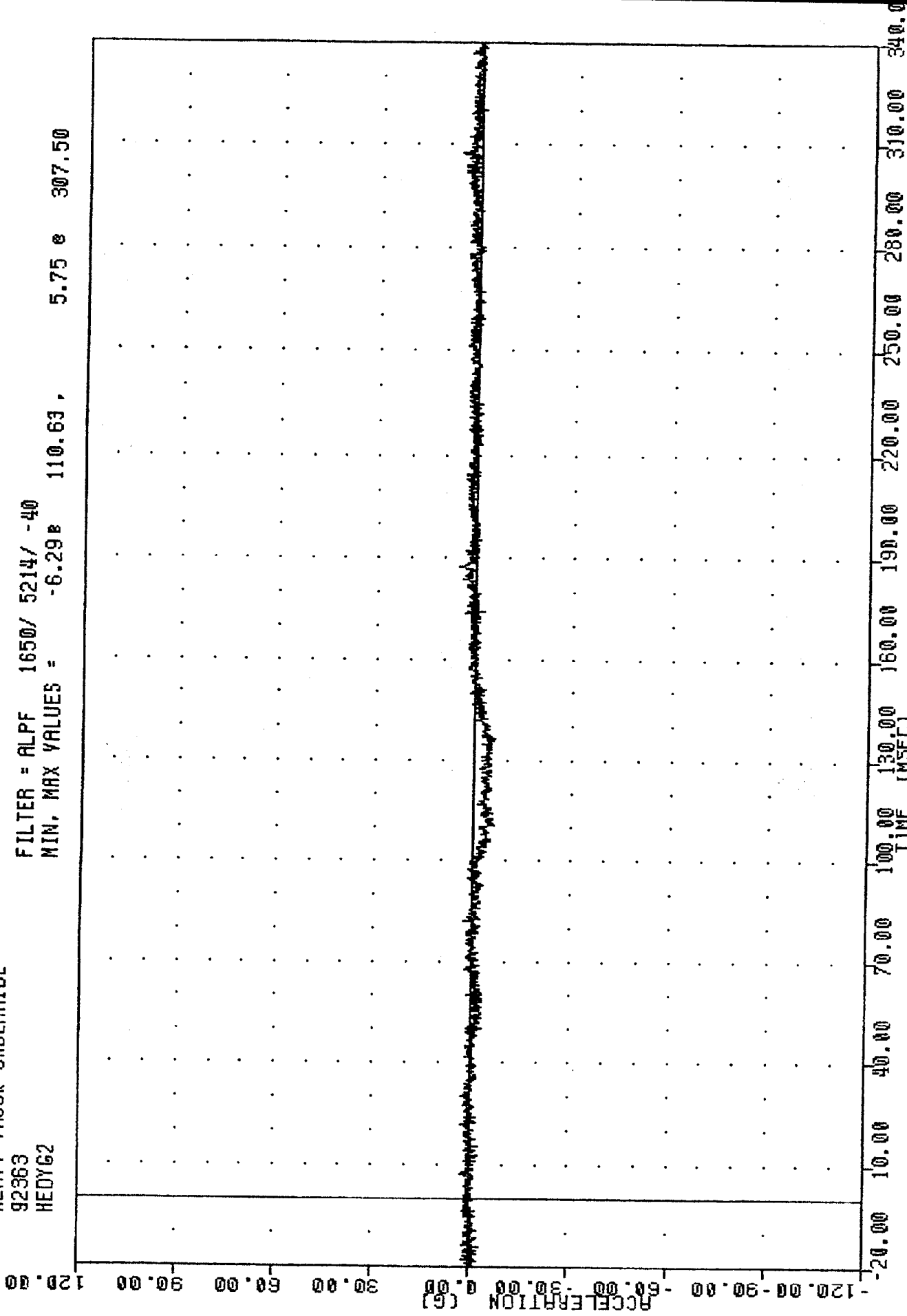


1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION

TRC
HEAVY TRUCK UNDERRAIDE
92363
HEDY62

, 921228

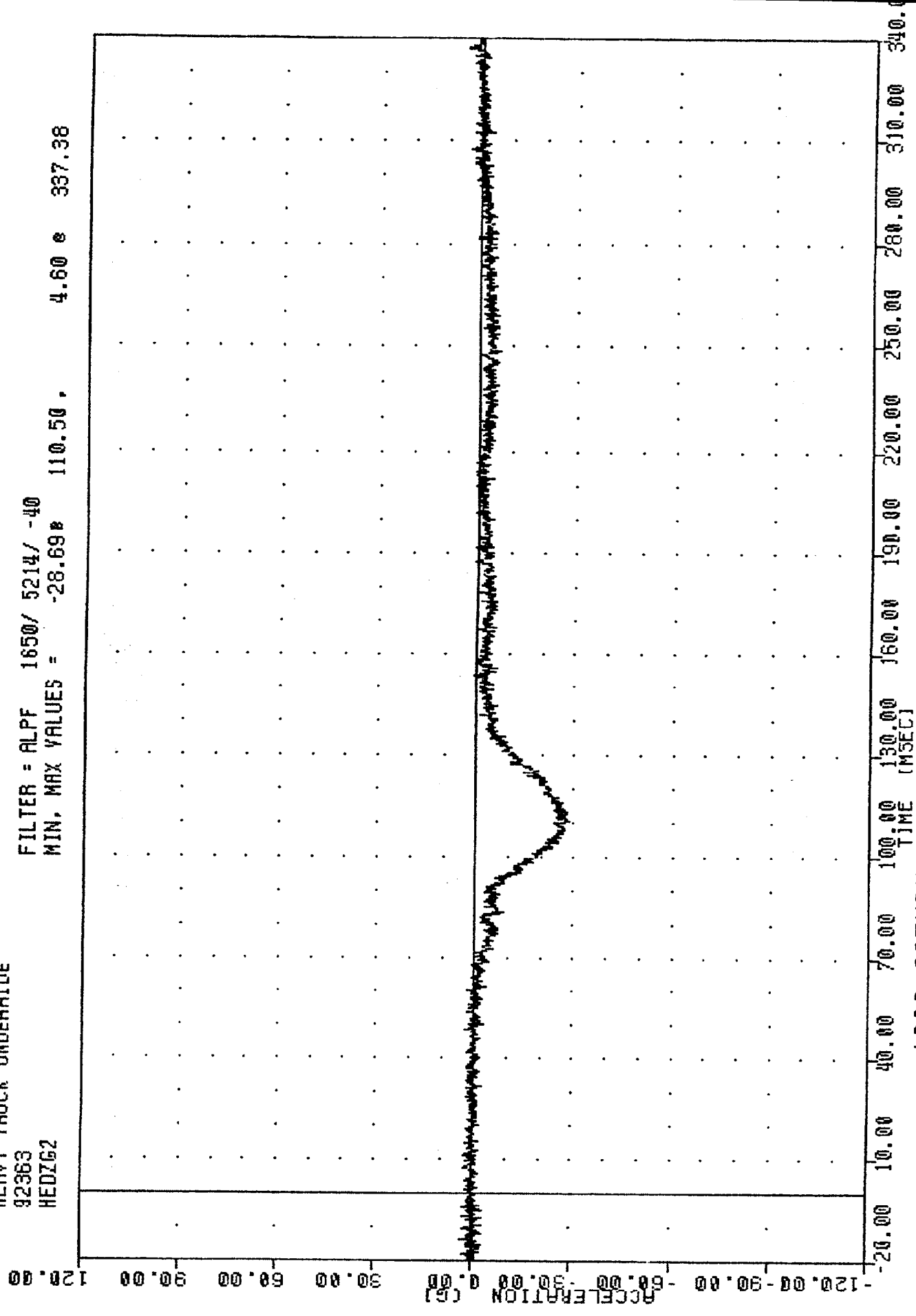
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -6.29B 110.63, 5.75 e 307.50



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRAIDE GUARD
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION

TRC
HEAVY TRUCK UNDERRIDE
92363
HEDZG2

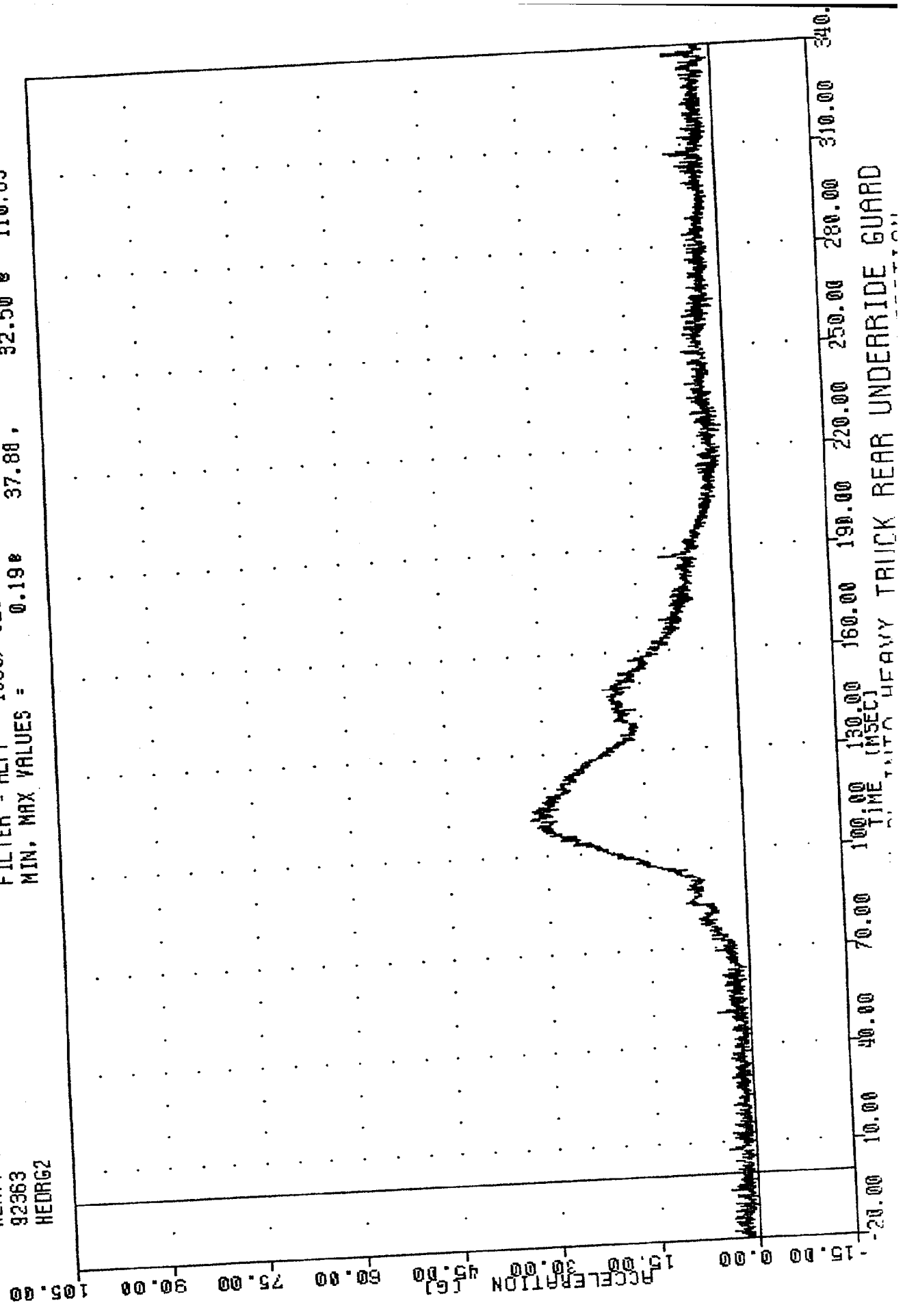
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -28.69B 110.50 , 4.60 e 337.38



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
HEDRG2

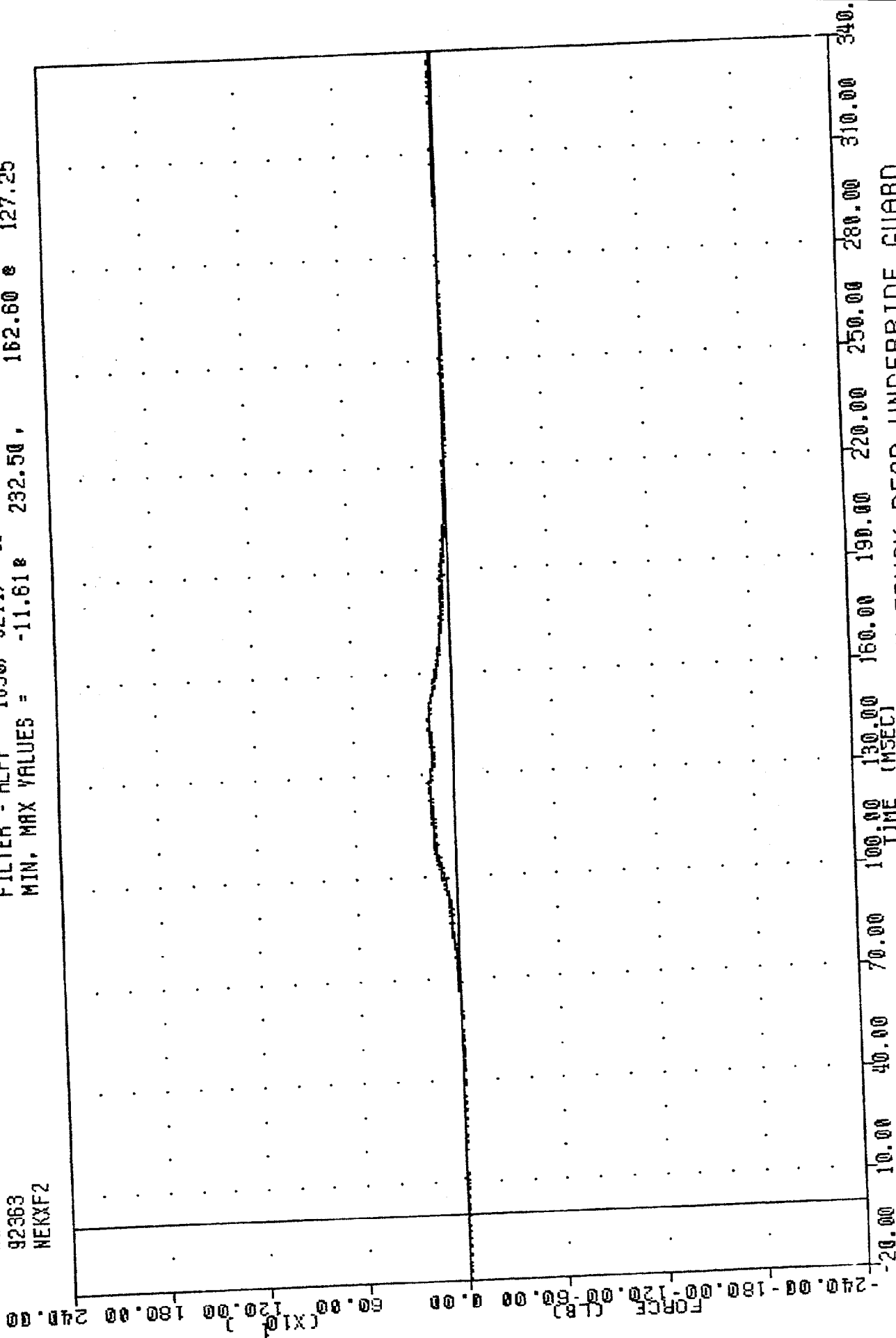
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = 0.19e 37.88, 32.50 e 110.63



HEAVY TRUCK REAR UNDERRIDE GUARD

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
HEXF2

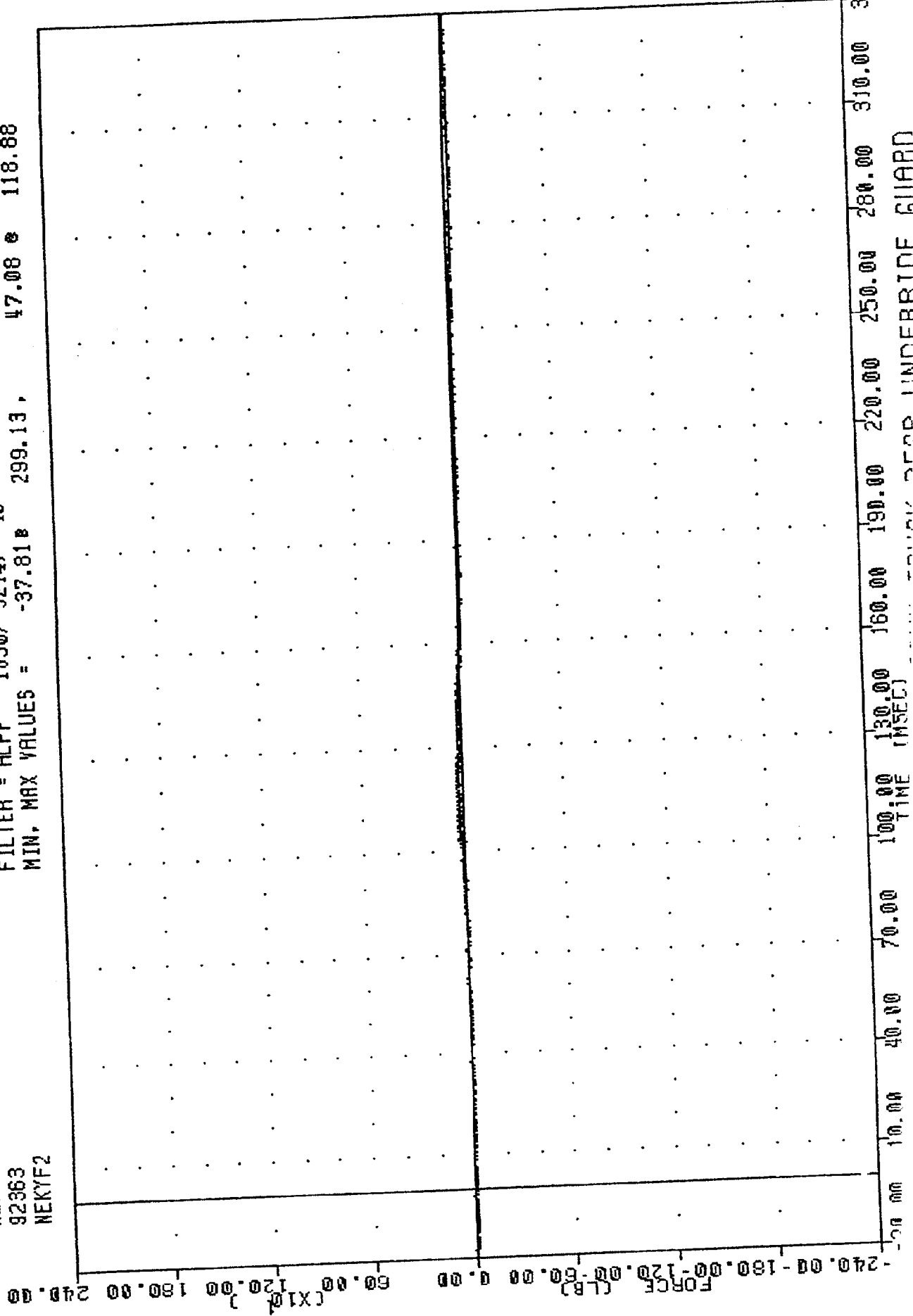
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -11.61e 232.50 , 162.60 e 127.25



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER NECK X-AXIS SHEAR FORCE

TRC , 921228
 HEVY TRUCK UNDERRIDE
 92363
 MEKVF2

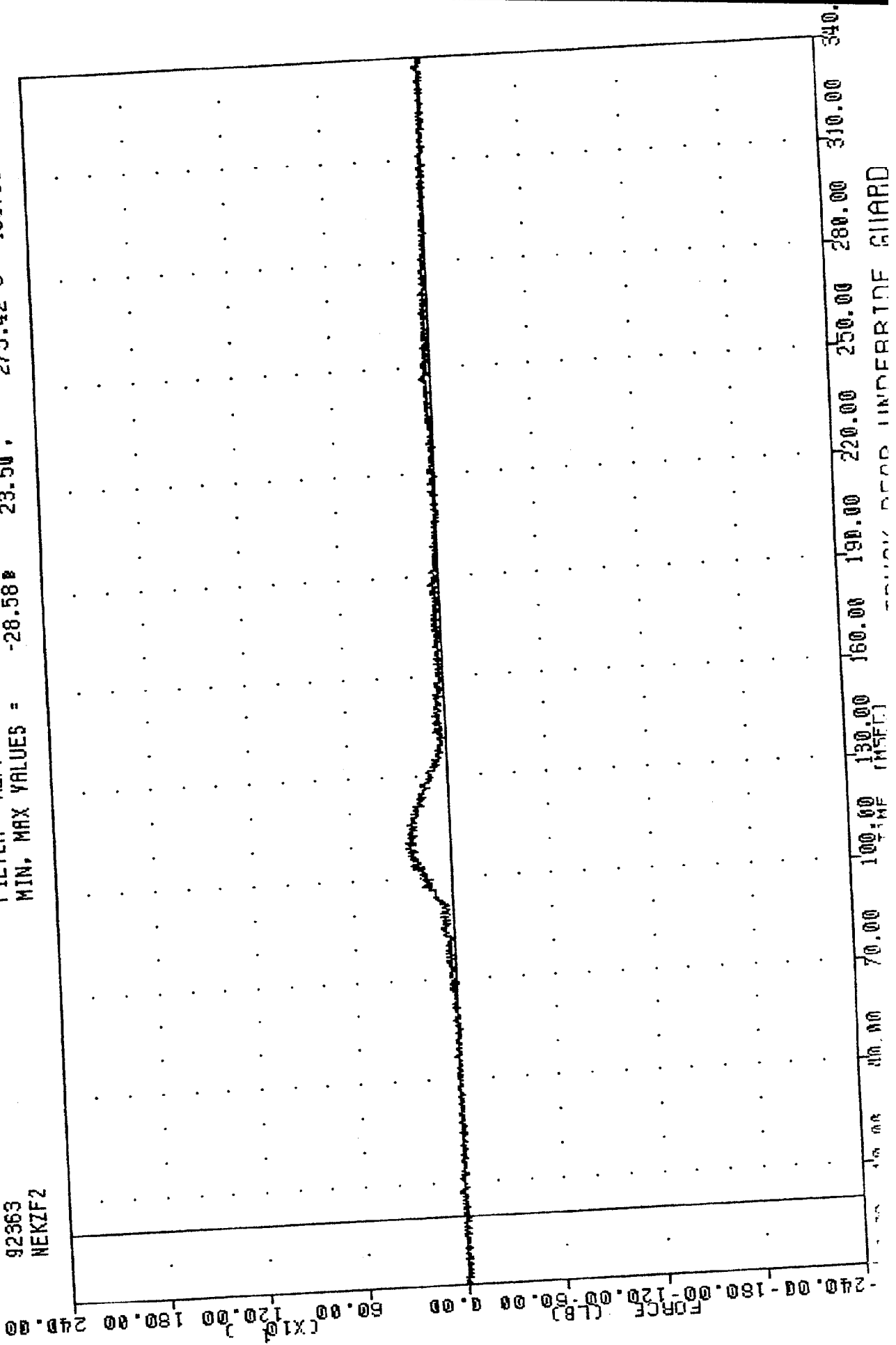
FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = -37.81 299.13 47.08 118.88



20 mm 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
 TIME (MSEC) UNDERRIDE ALLIARD

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 NEKZF2

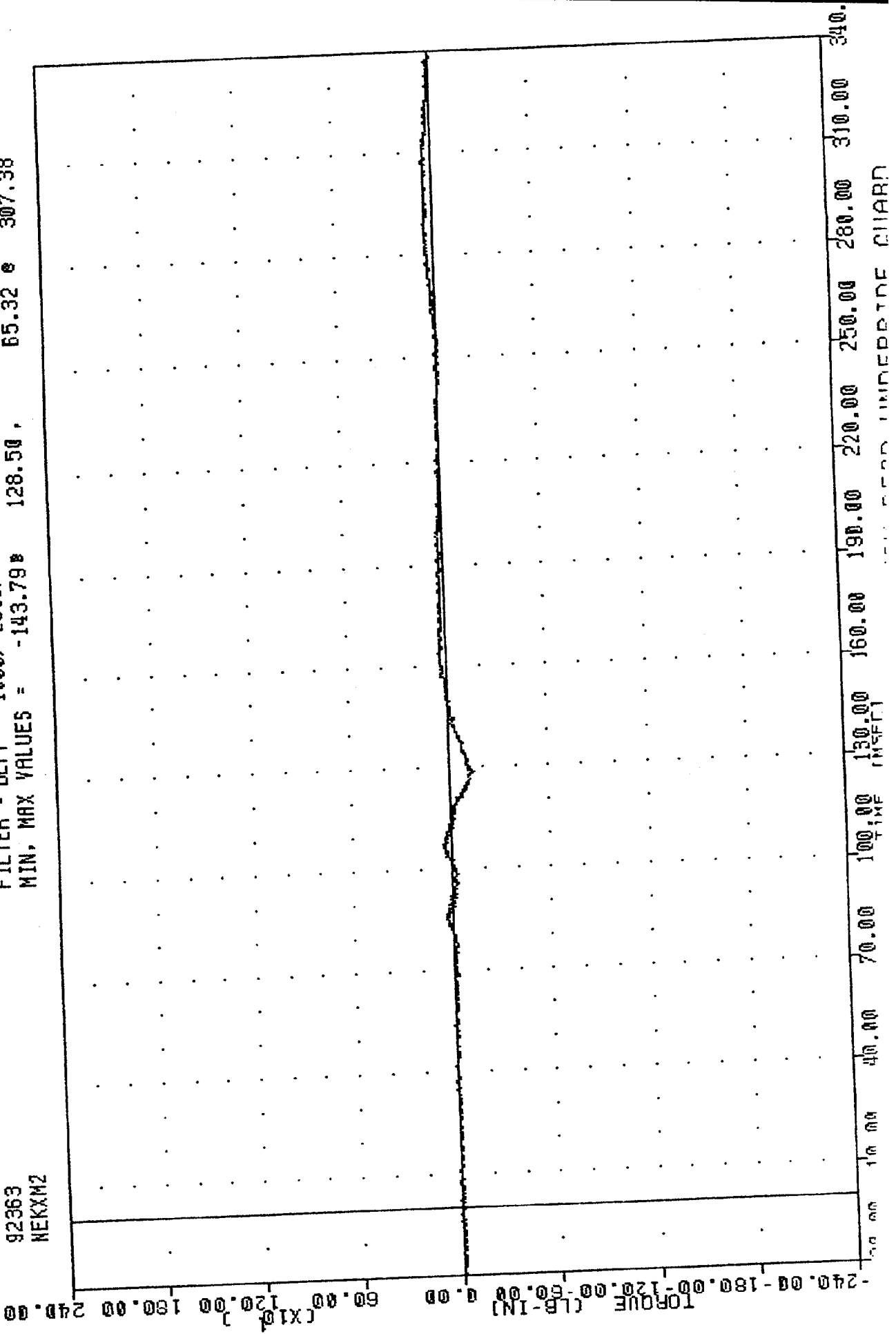
FILTER = ALPF 1650/ 5214/ -40
 MIN, MAX VALUES = -28.58 23.50 , 273.42 e 109.00



SHOULD BE UNDERRIDE GUARD

TRC . 921228
 HEAVY TRUCK UNDERRIDE
 92363
 NEKXM2

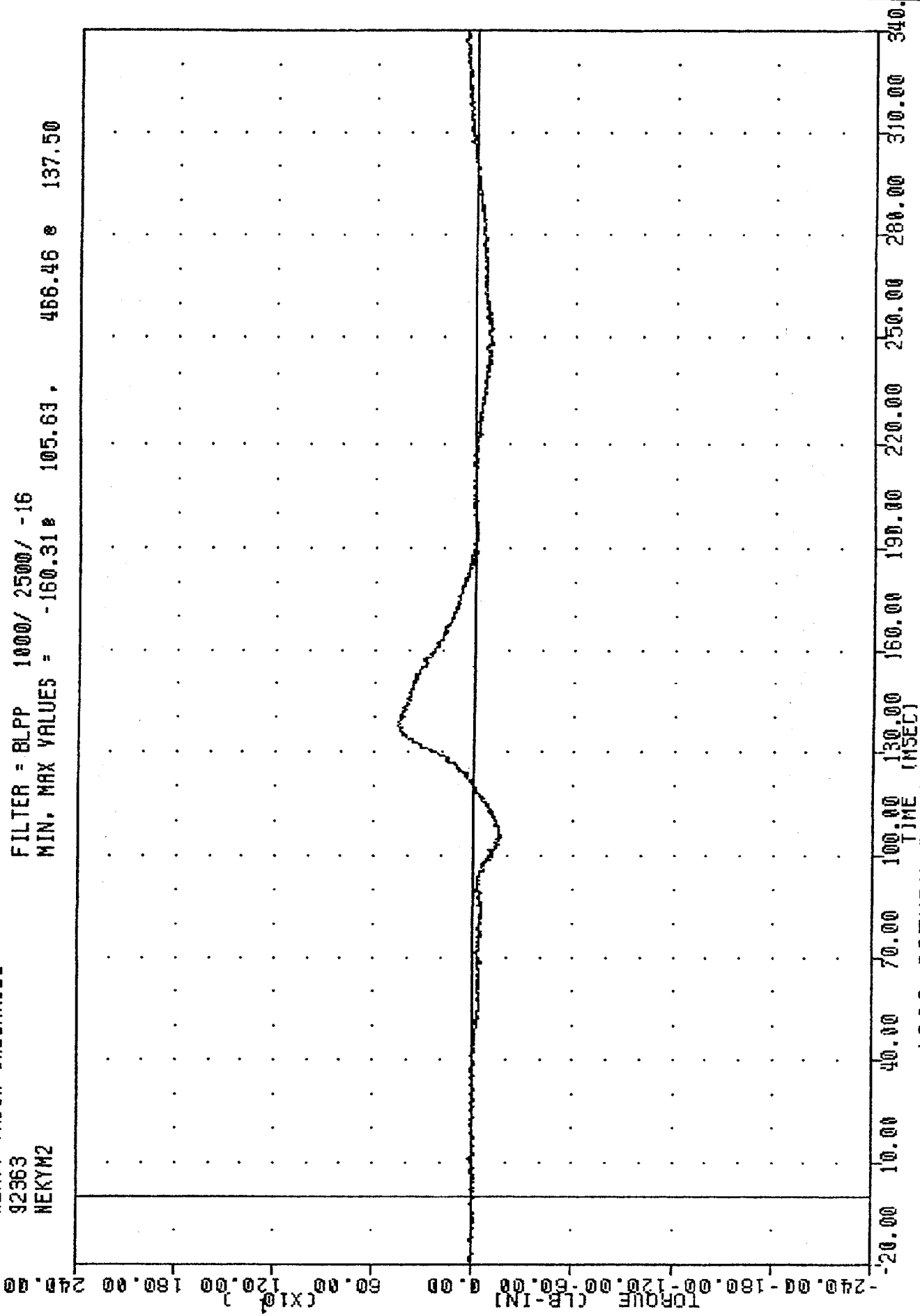
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -143.79 128.50 , 65.32 e 307.38



INSERTE UNDETRINE CIIARD

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 NEKYM2

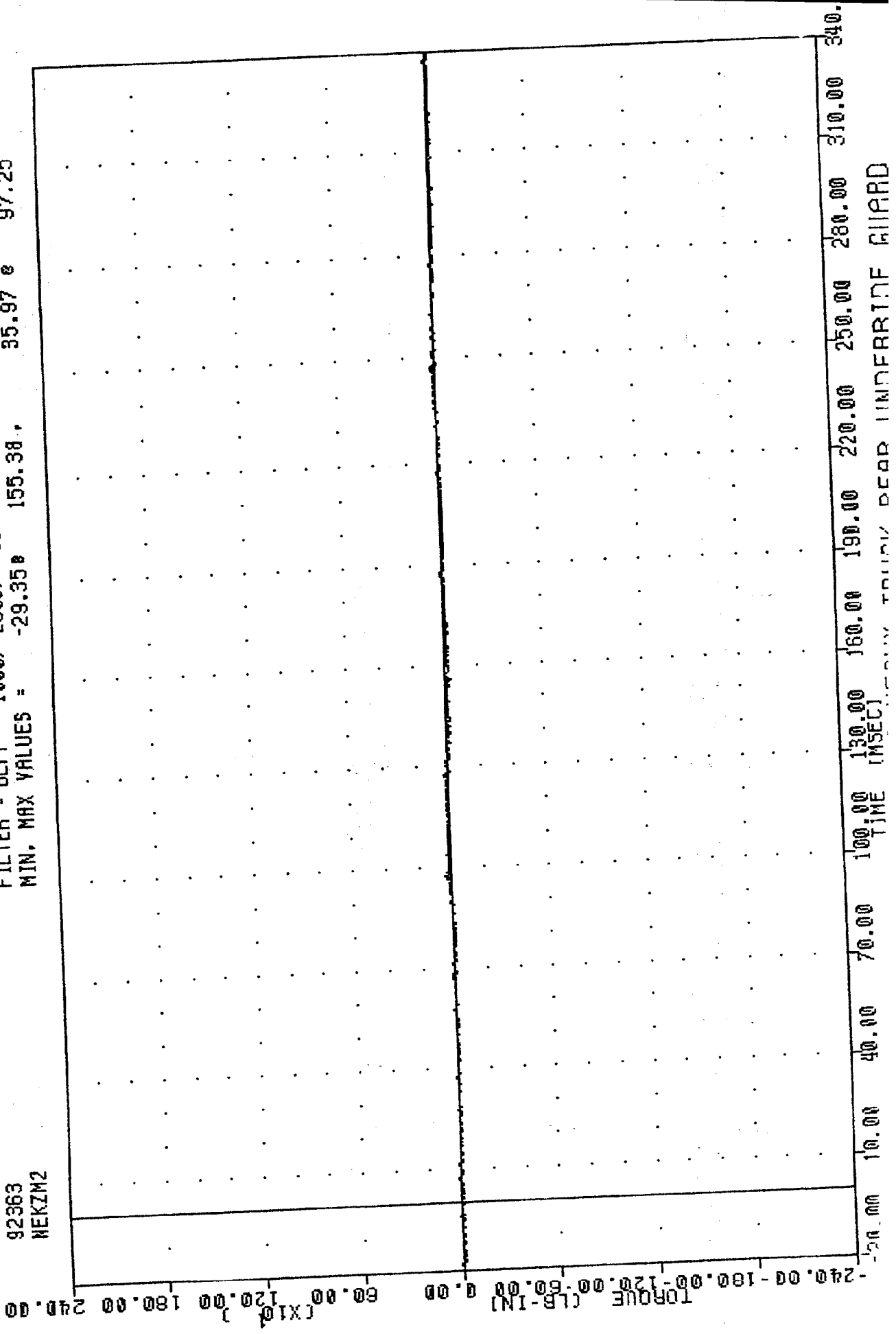
FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -160.31# 105.63# 466.46 # 137.50



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 RIGHT FRONT PASSENGER NECK MOMENT ABOUT Y AXIS

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 NEKZM2

FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -29.35 155.38 35.97 97.25

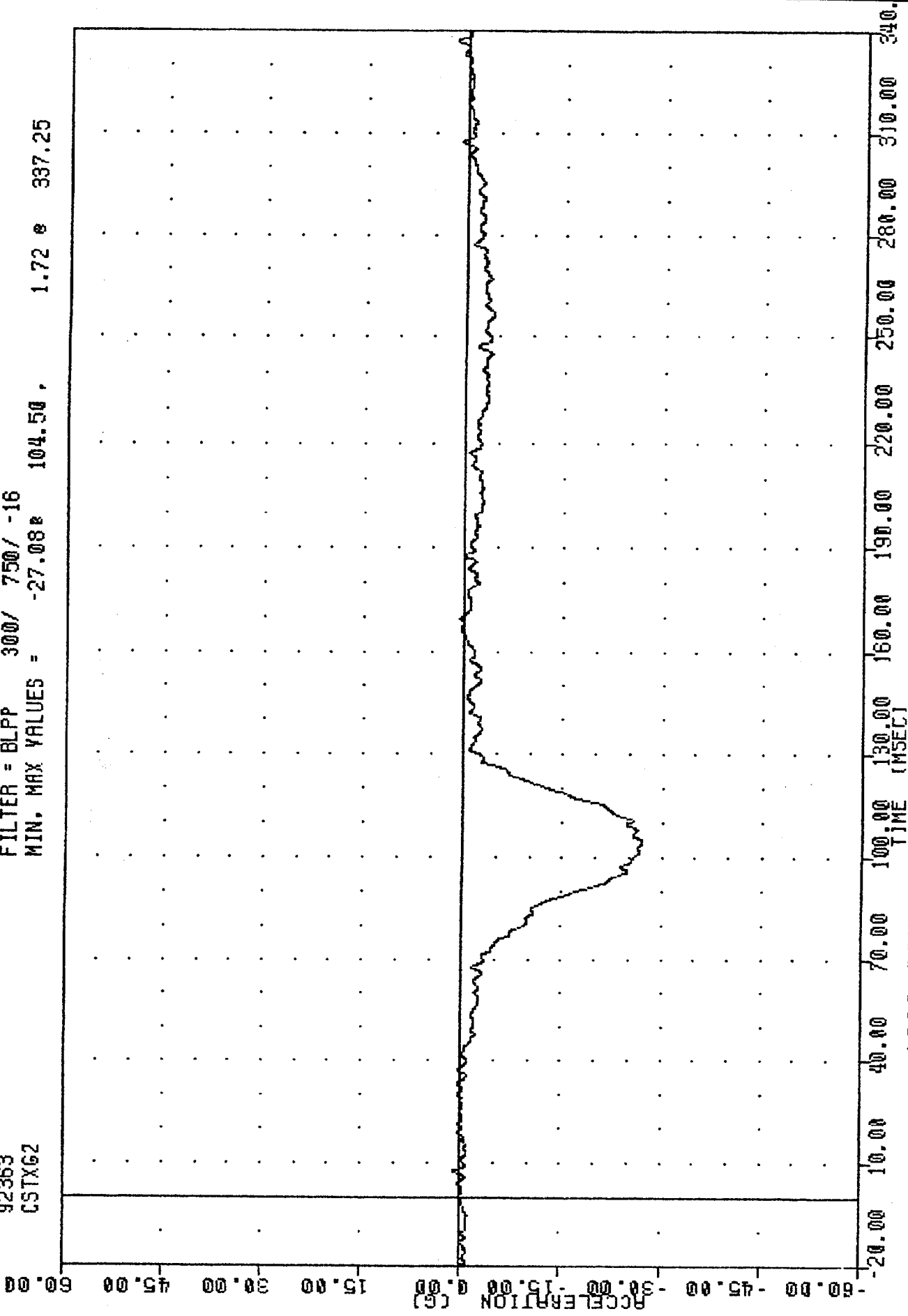


240.00
180.00
120.00
60.00
0.00
-60.00
-120.00
-180.00
-240.00
 TORQUE (LB-IN) (X10³)

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

TRC . 921228
HEAVY TRUCK UNDERRIDE
92363
CSTX62

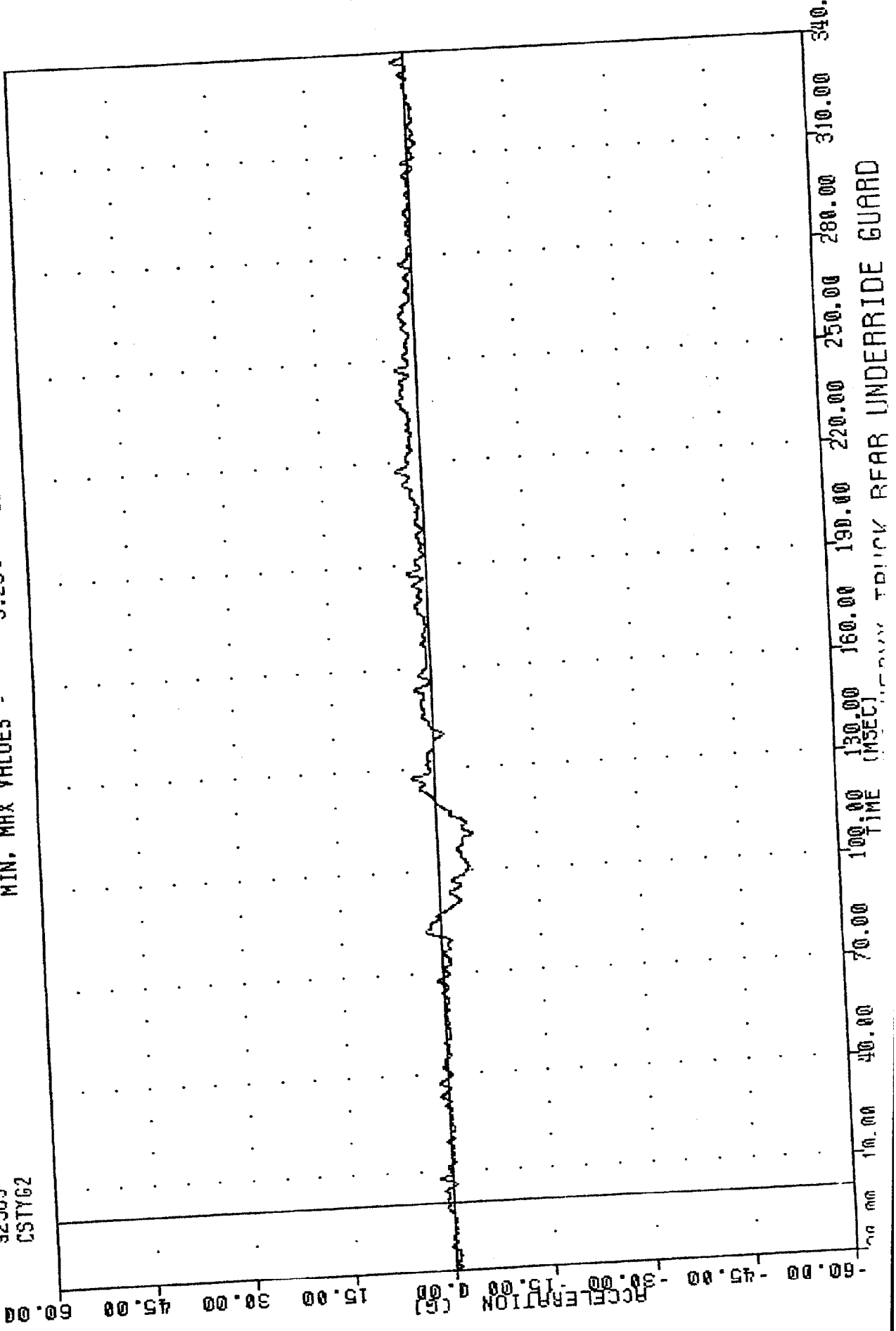
FILTER = BLPP 300/ 750/ -16
MIN. MAX VALUES = -27.08e 104.50 , 1.72 e 337.25



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTY62

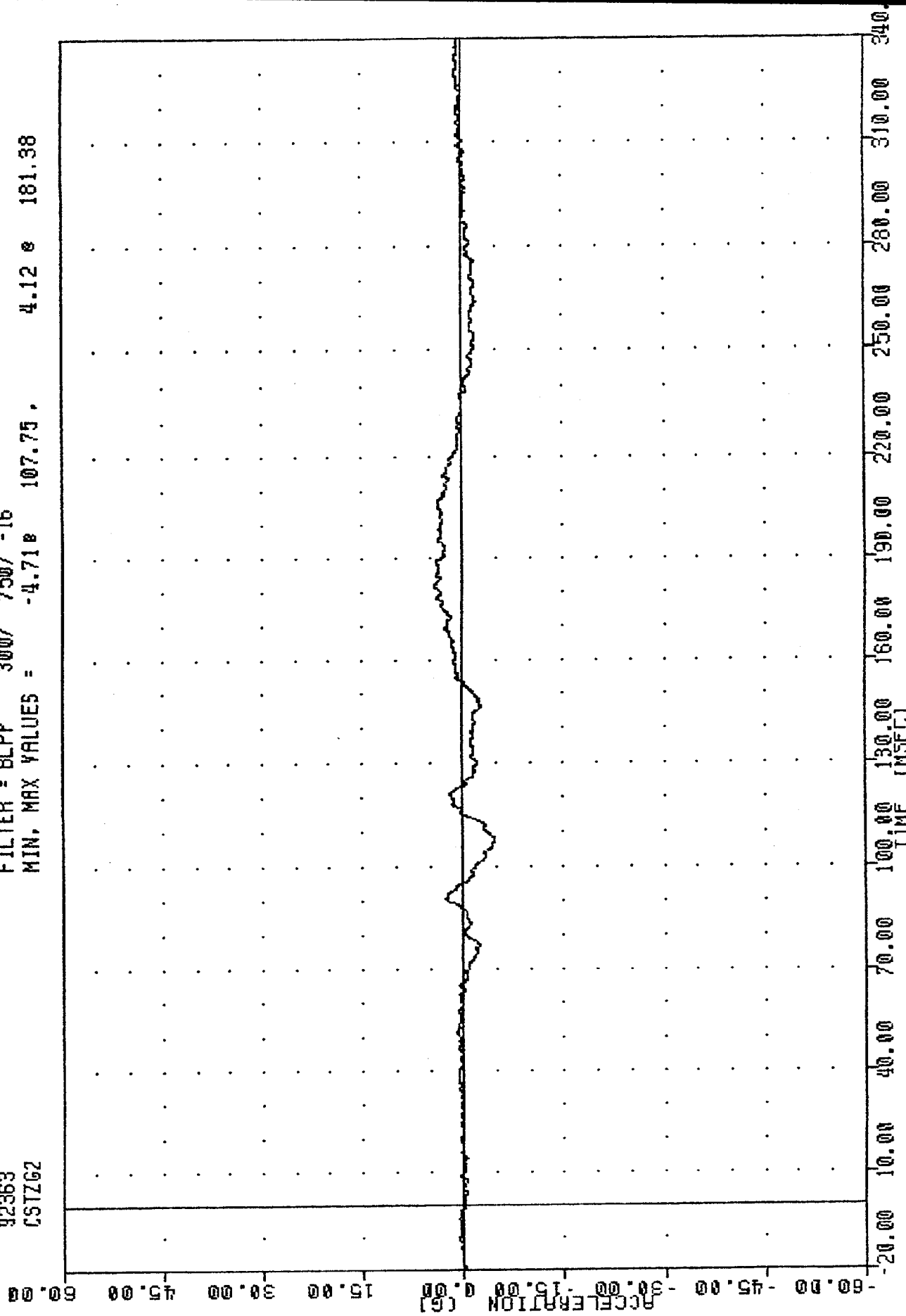
FILTER = BLPP 300/ 750/ -16
MIN. MAX VALUES = -5.25 110.75 , 3.89 217.38



HEAVY TRUCK UNDERRIDE GUARD

TRC . 921228
 HEAVY TRUCK UNDERRIDE
 92363
 CSTZG2

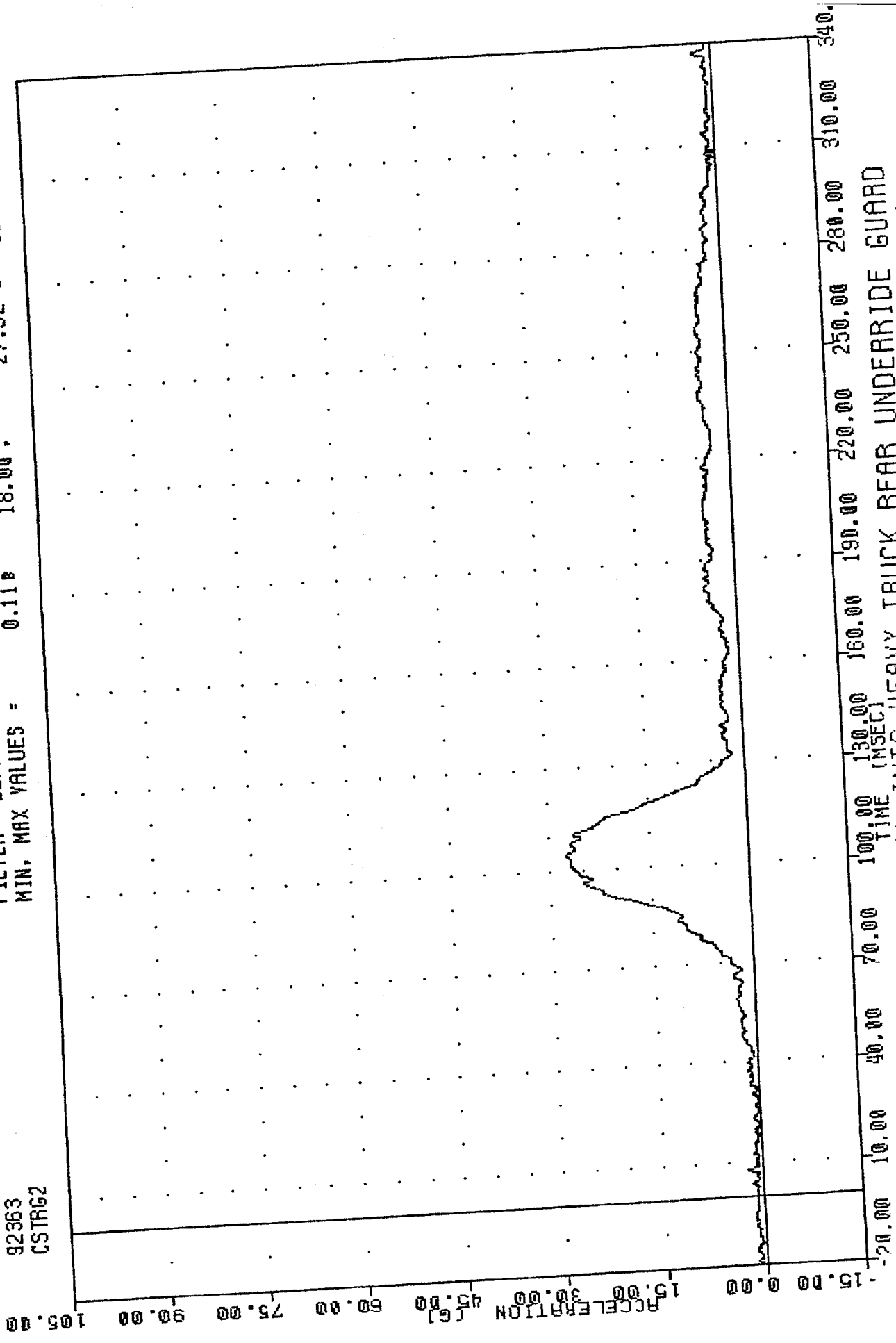
FILTER = BLPP 300/ 750/ -16
 MIN. MAX VALUES = -4.71 107.75, 4.12 181.38



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
CSTRG2

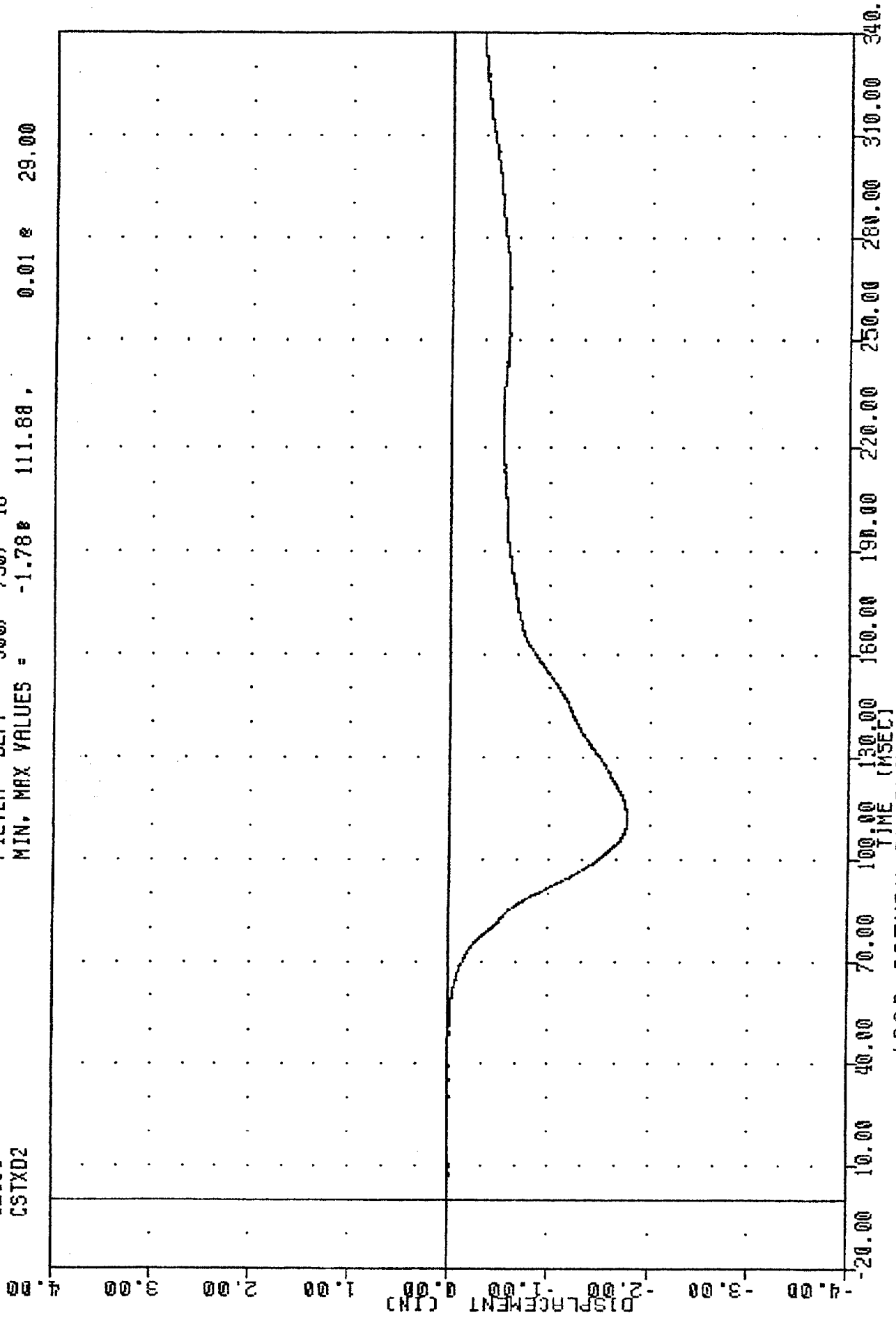
FILTER = BLPP 300/ 750/ -16
MIN, MAX VALUES = 0.118 18.00 , 27.52 @ 104.50



HEAVY TRUCK REAR UNDERRIDE GUARD

TAC . 921228
HEAVY TRUCK UNDERRIDE
92363
CSTXD2

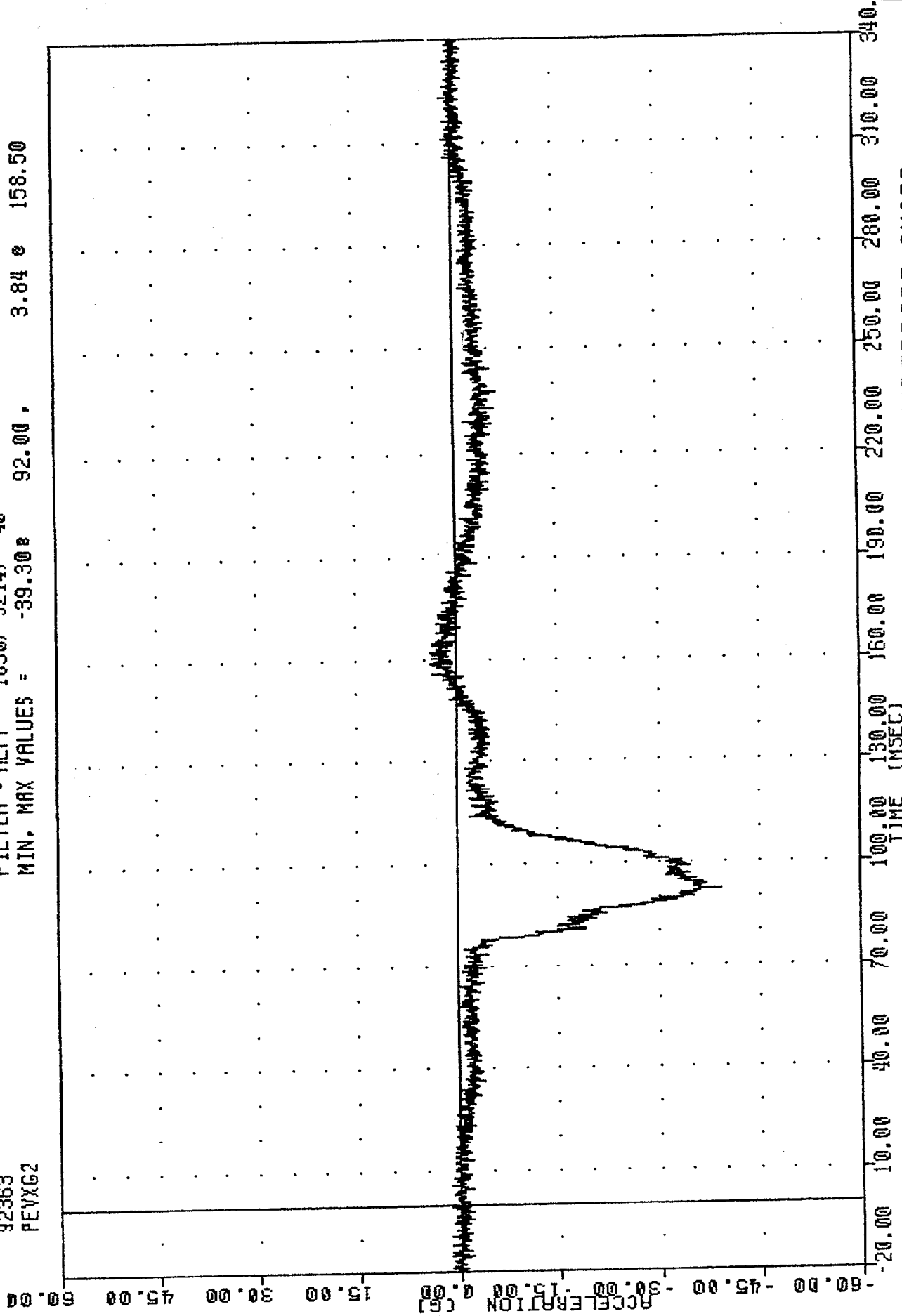
FILTER = BLPP 300/ 750/ -16
MIN, MAX VALUES = -1.78e 111.88, 0.01 e 29.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER CHEST DEFLECTION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
PEVXG2

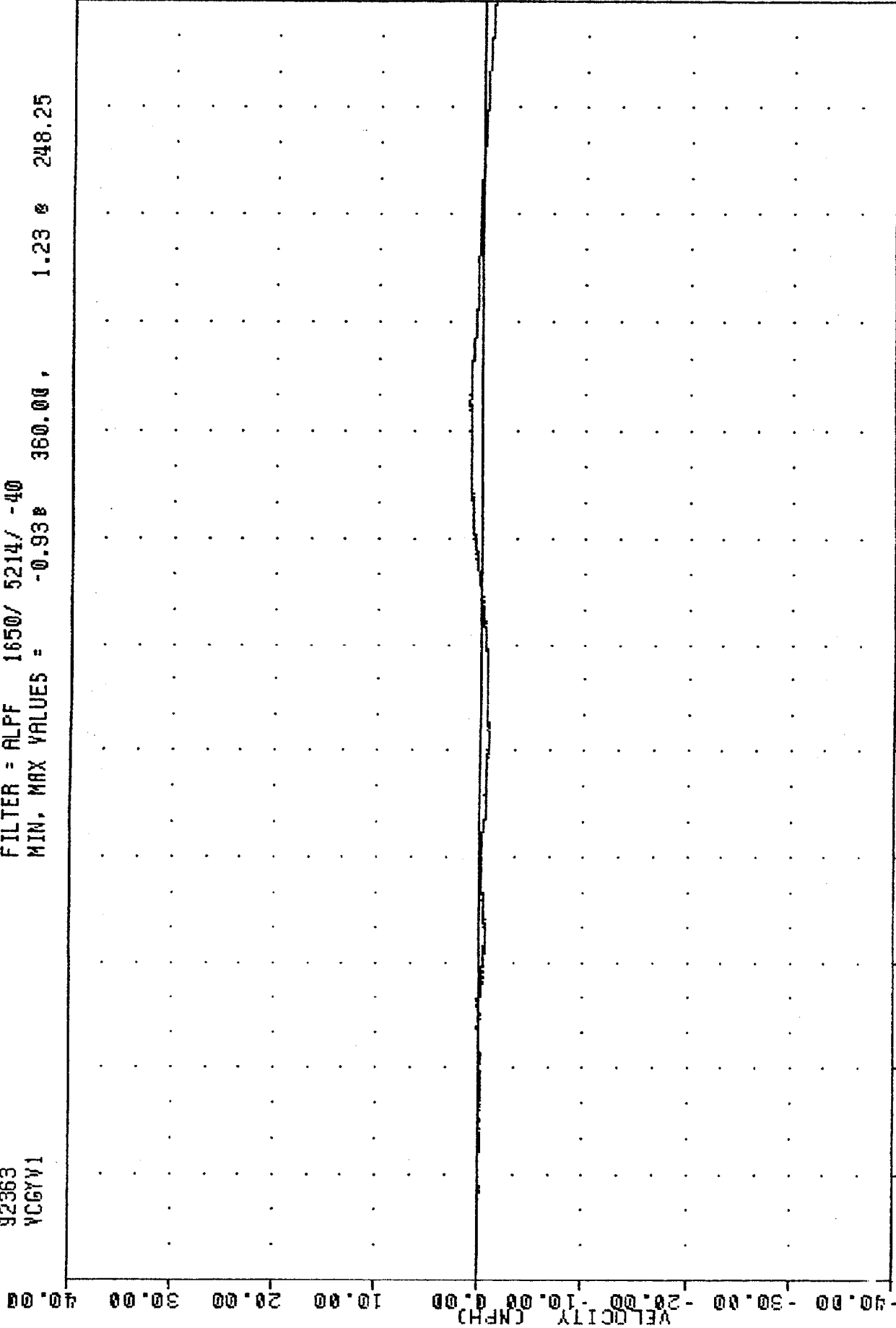
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -39.30e 92.00 , 3.84 e 158.50



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER PELVIS X-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
YC6YV1

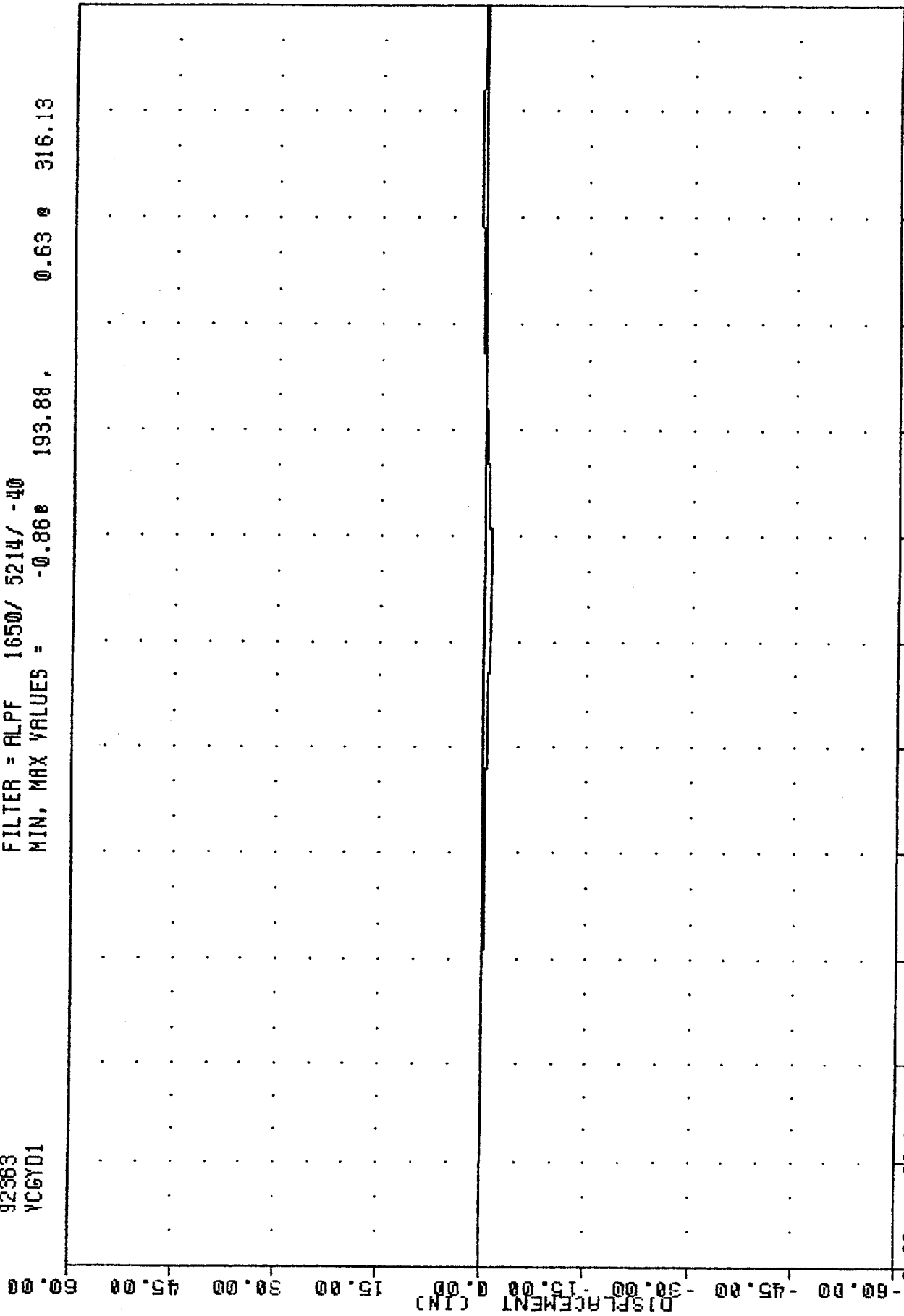
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -0.93 360.00, 1.23 248.25



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00 360.00
TIME (MSEC)
1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Y-AXIS VELOCITY

TRC
 921228
 HEAVY TRUCK UNDERRIDE
 92363
 YCGYD1

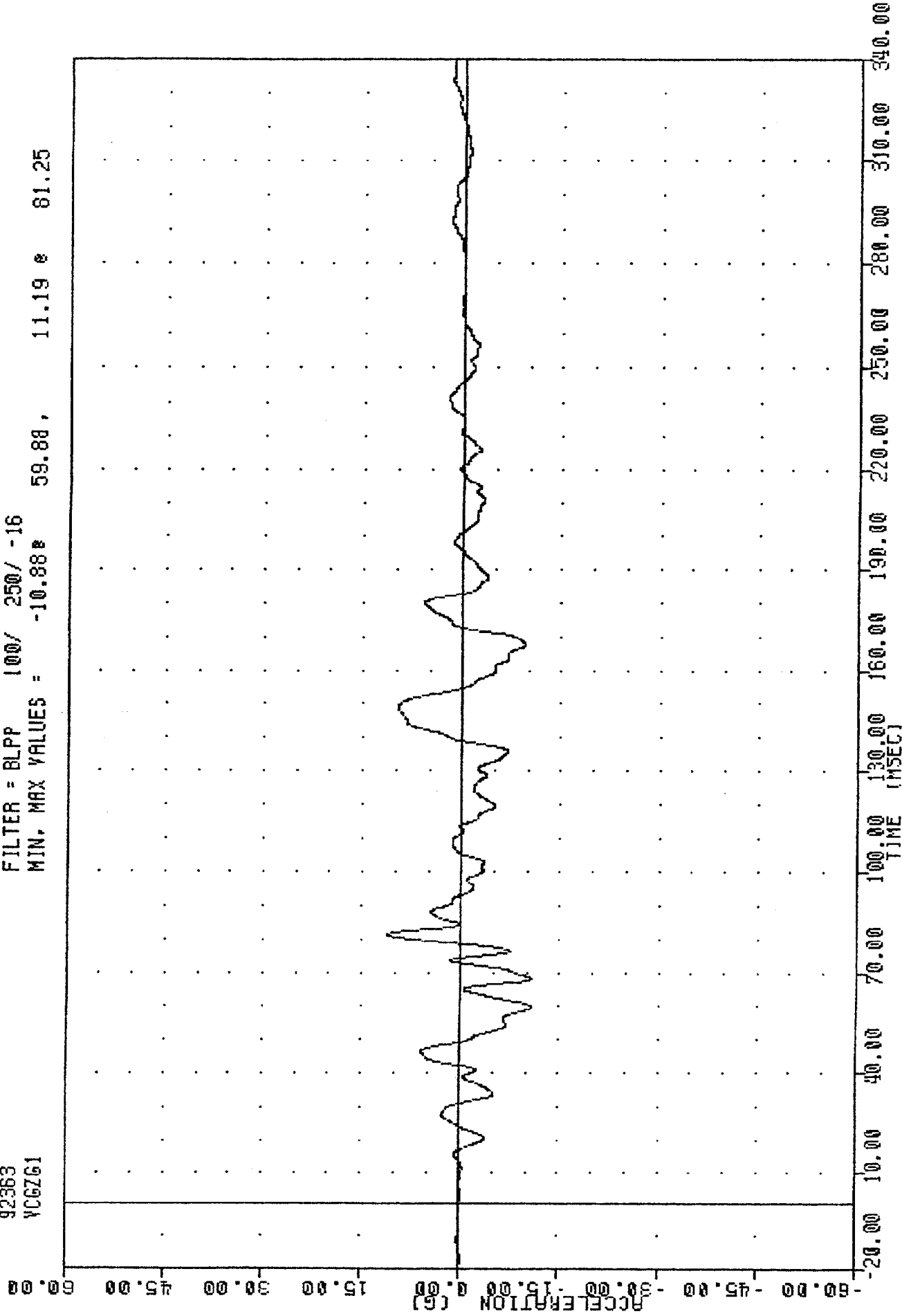
FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = -0.86 193.88, 0.63 316.13



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 CAR CENTER OF GRAVITY Y-AXIS DISPLACEMENT

TRC , 921228
HEVY TRUCK UNDERRIDE
92363
YCGZG1

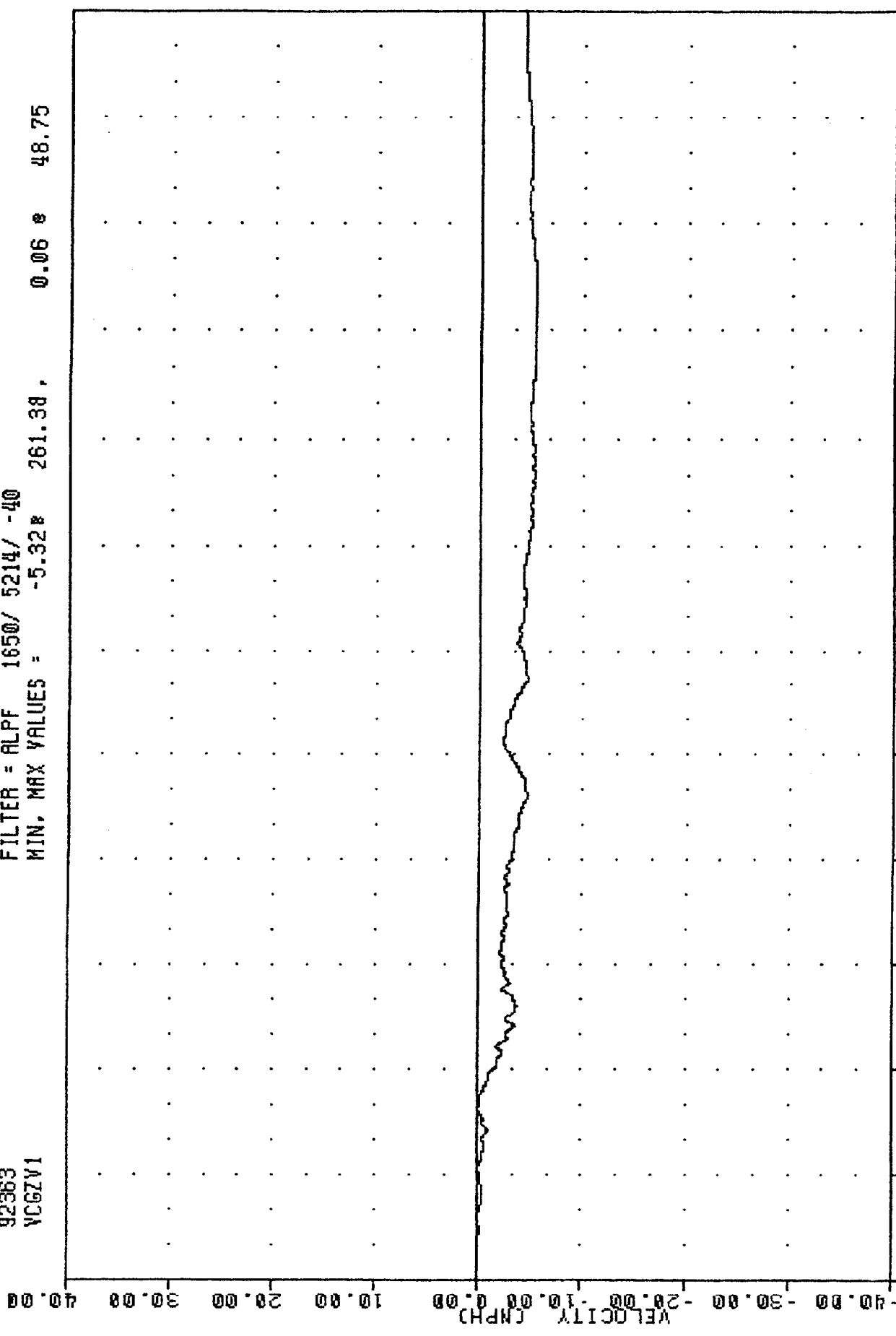
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -10.88 59.88, 11.19 81.25



1993 SATURN SL INTO HEVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Z-AXIS ACCELERATION

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 YCGZV1

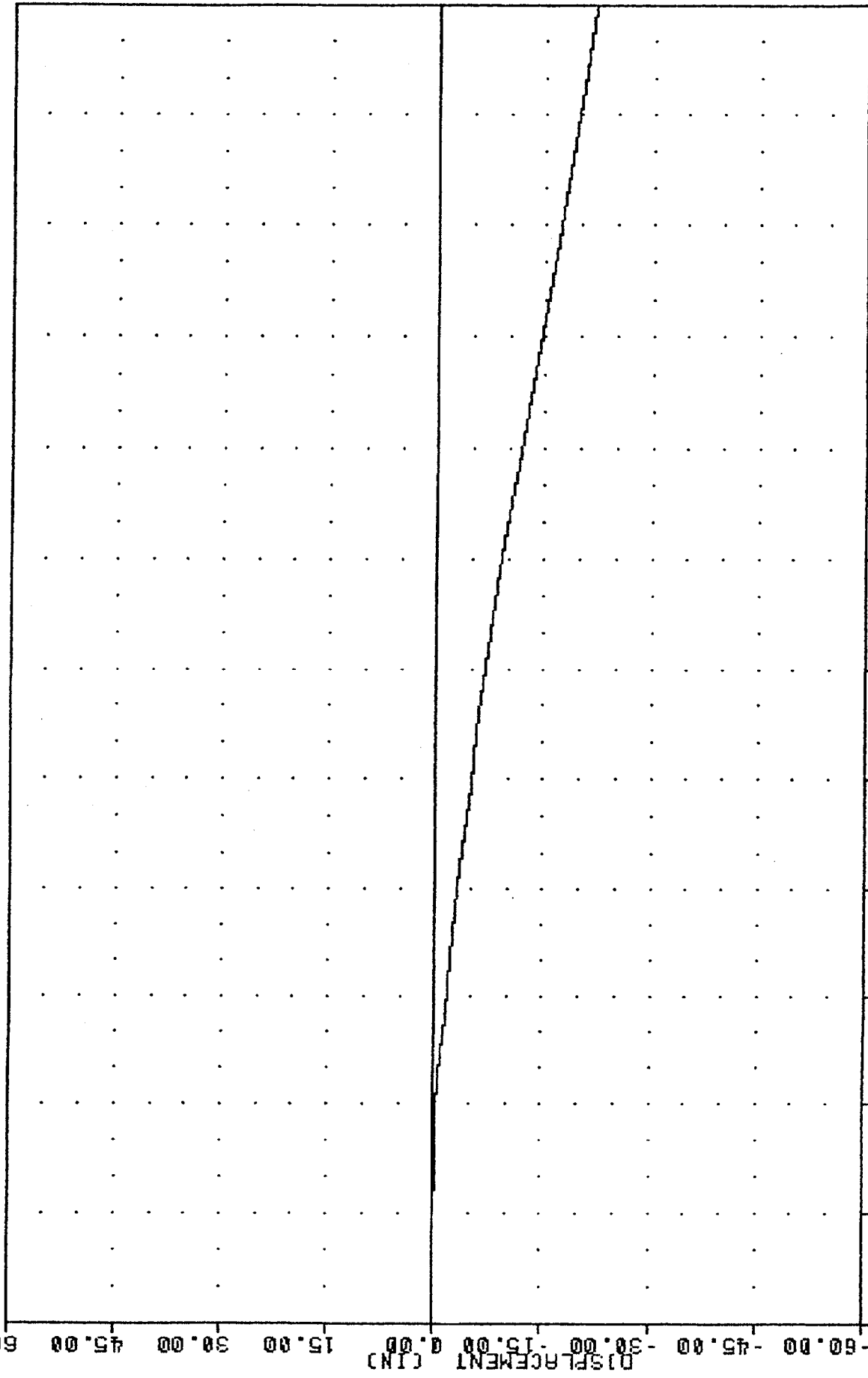
FILTER = ALPF 1650/ 5214/ -40
 MIN, MAX VALUES = -5.328 261.38, 0.06 e 48.75



0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00 240.00 270.00 300.00 330.00 360.00
 1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 CAR CENTER OF GRAVITY Z-AXIS VELOCITY

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
YCGZD1

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -21.95 360.00 , 0.00 1.50



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY Z-AXIS DISPLACEMENT

APPENDIX C

DUMMY CERTIFICATION DATA

PRE-TEST CERTIFICATION DATA

DRIVER DUMMY S/N 043

TRANSPORTATION RESEARCH CENTER OF OHIO
HYBRID III EXTERNAL DIMENSIONS
HUMANOID 043

1-DEC-92

TRC 43C2ED1 572E SN43 EXT. DIMENSION CAL02

TEST PARAMETER	(DIMEN.)	SPECIFICATION	TEST RESULTS
TEMPERATURE			70.0 DEG. F
RELATIVE HUMIDITY			48.0 %
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 Jones

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

01-DEC-92

TRC

43C2HD1

572E SN43 HEAD DROP CAL02

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	32.0 %
PEAK RESULTANT ACCELERATION	225 - 275 G	254.15 G
PEAK LATERAL ACCELERATION	15 G MAX	2.33 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

TEST MEETS SPECIFICATIONS

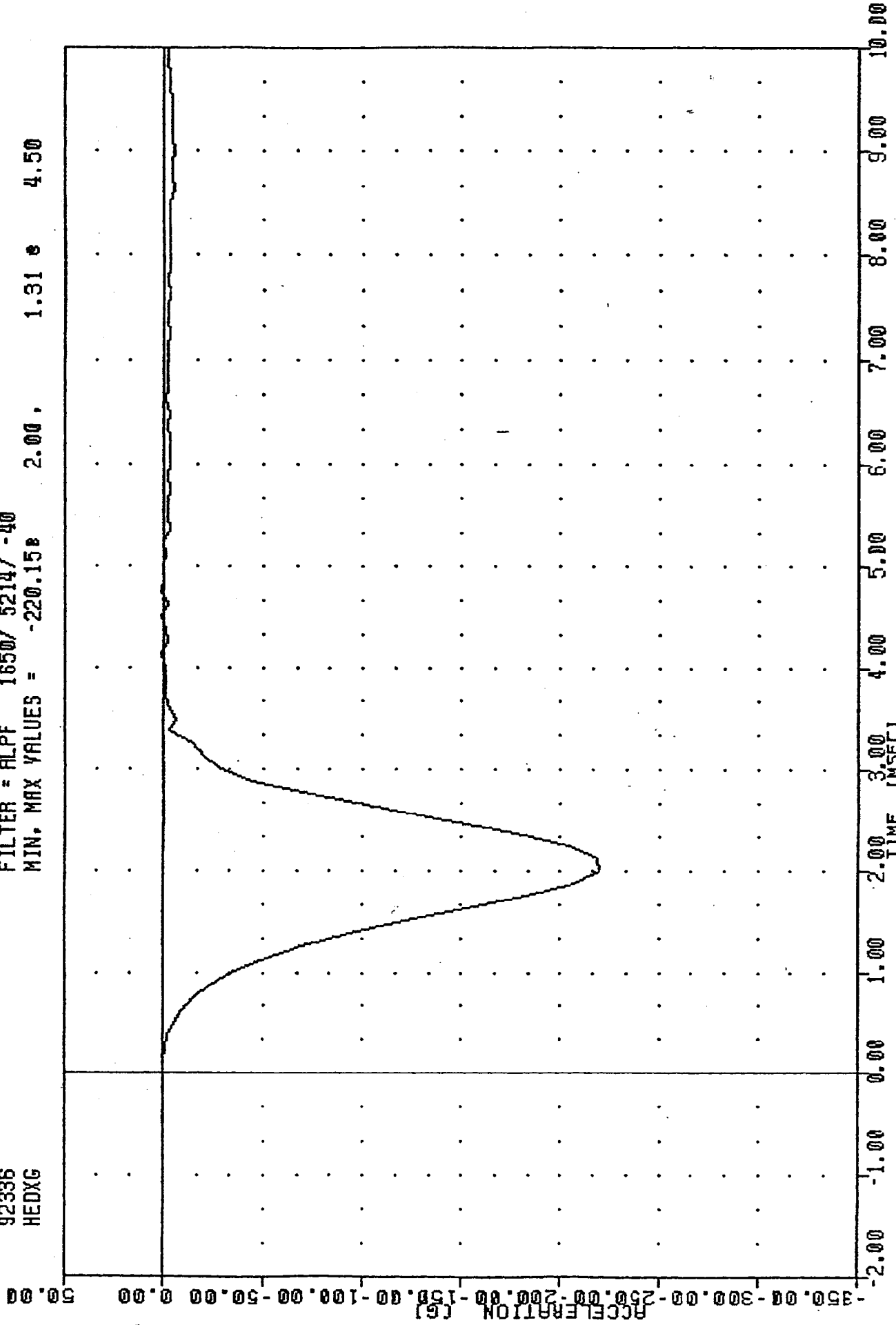
TECHNICIAN

Pete Fount

TRC
572E SN49 HEAD DROP CALD2
92336
HDXG

43C2HD1

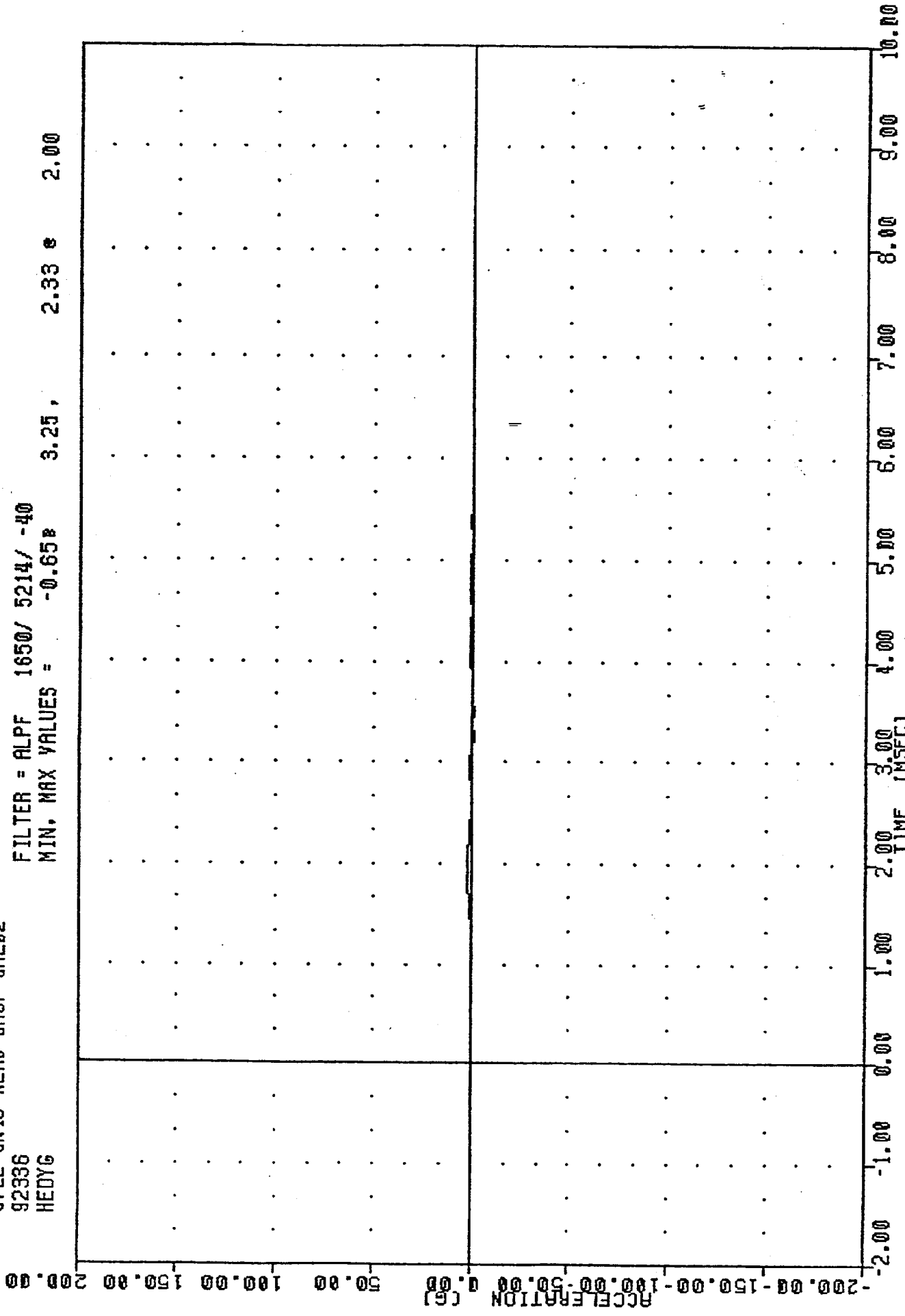
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -220.15e 2.00 , 1.31 e 4.50



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

TRC , 43C2HD1
 572E SN43 HEAD DROP CAL02
 92336
 HEDYG

FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = -0.65# 3.25, 2.33 # 2.00

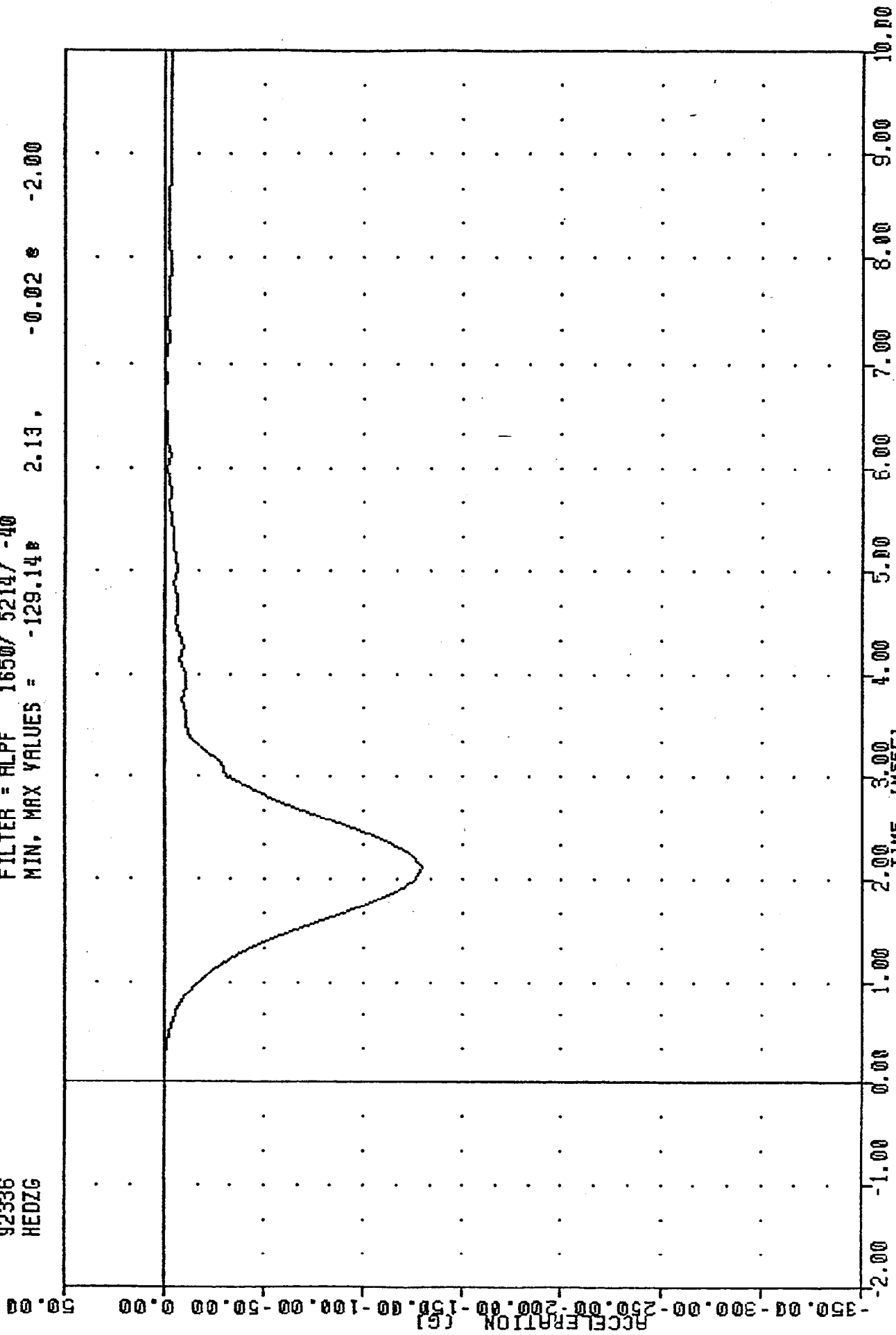


PART 572-E HYBRID III HEAD CALIBRATION
 HEAD ACCELERATION Y AXIS

TRC
572E SN43 HEAD DROP CALD2
92336
HEADZG

43C2HD1

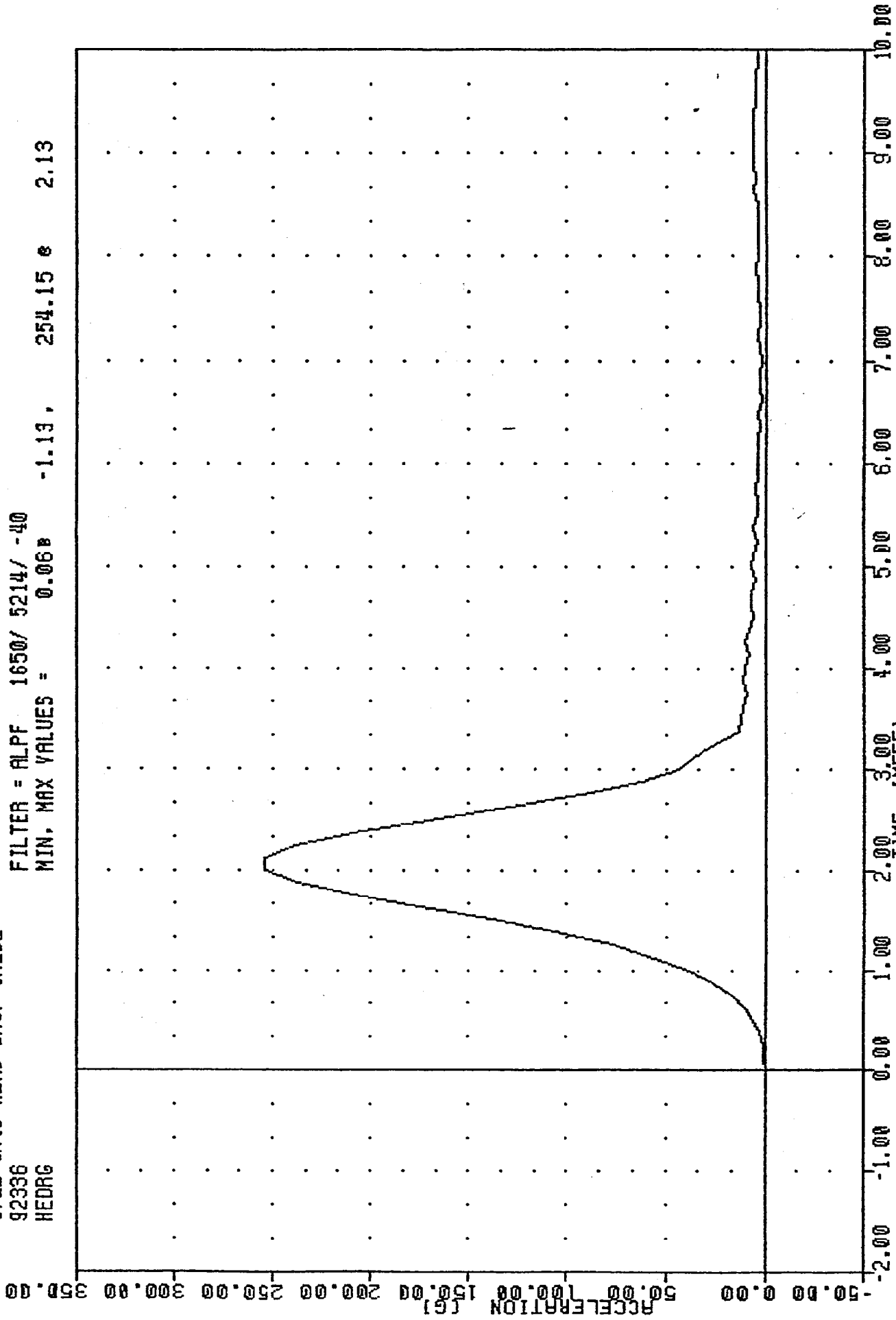
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -129.14B 2.13, -0.02 e -2.00



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

TRC
572E SN49 HEAD DROP CALD2
92336
HEDRG

FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = 0.06B -1.13, 254.15 e 2.13



PART 572-E HYBRID III HEAD CALIBRATION
HEAD RESULTANT ACCELERATION

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

01-DEC-92

6 AXIS NECK TRANSDUCER
TRC 43C2NF1

572E SN43 NECK FLEXION CAL02

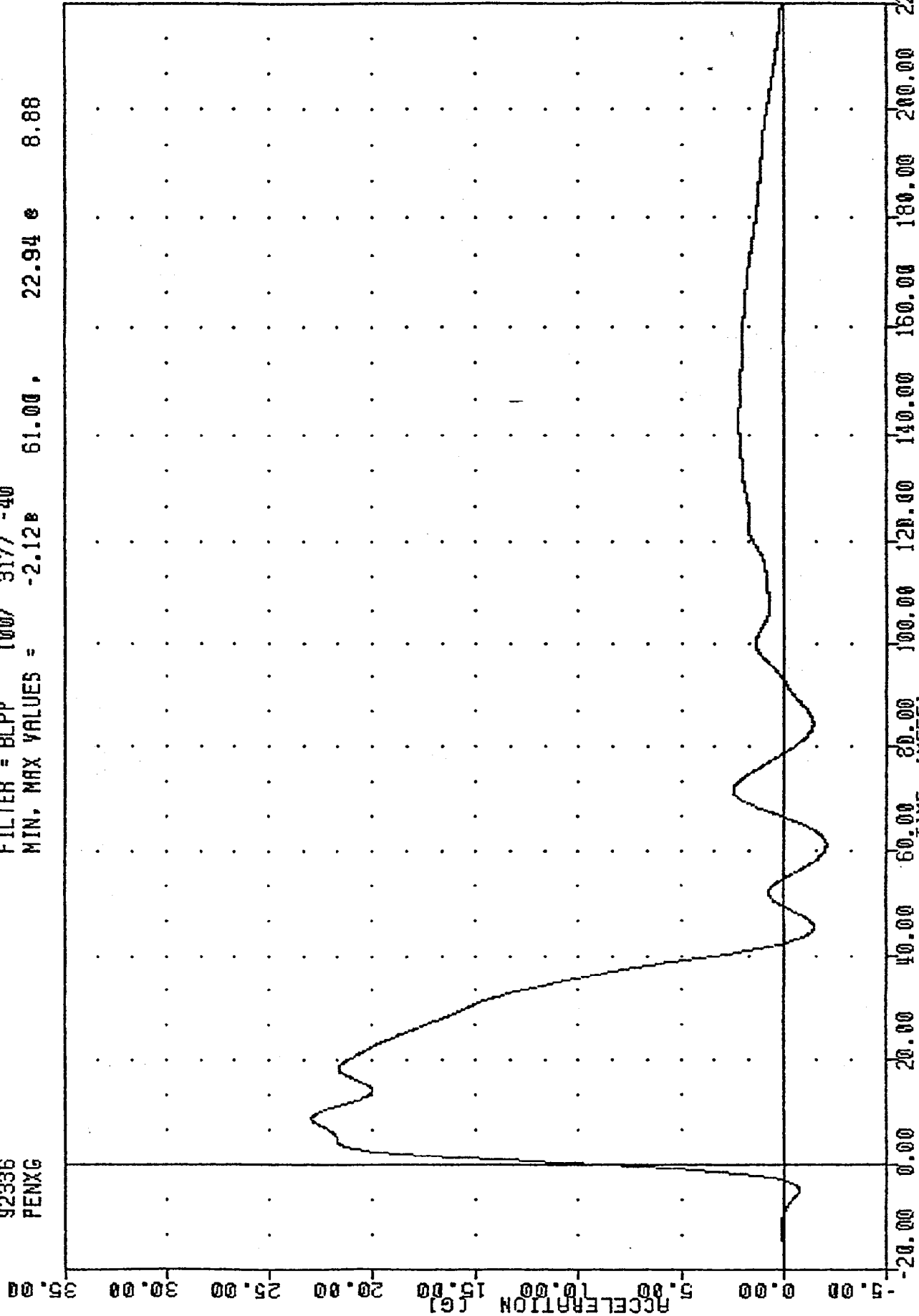
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	32.0 %
IMPACT VELOCITY	22.6 - 23.4 FT/SEC	23.08 FT/SEC
PENDULUM DECELERATION	10 MS 22.50 - 27.50 G	22.64 G
	20 MS 17.60 - 22.60 G	21.24 G
	30 MS 12.50 - 18.50 G	15.42 G
MAX PENDULUM G ABOVE 30 MS	29 G MAX	15.35 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G	34 - 42 MS	38.88 MS
D PLANE ROTATION	MAX 64 - 78 DEG.	64.74 DEG.
	TIME 57 - 64 MS	57.25 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX 65 - 80 FT.LBS	73.34 FT.LBS
	TIME 47 - 58 MS	51.88 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO	113 - 128 MS	113.75 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO	97 - 107 MS	98.25 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Fout

TRC
572E SN43 NECK FLEXION CAL02
92336
PENXG

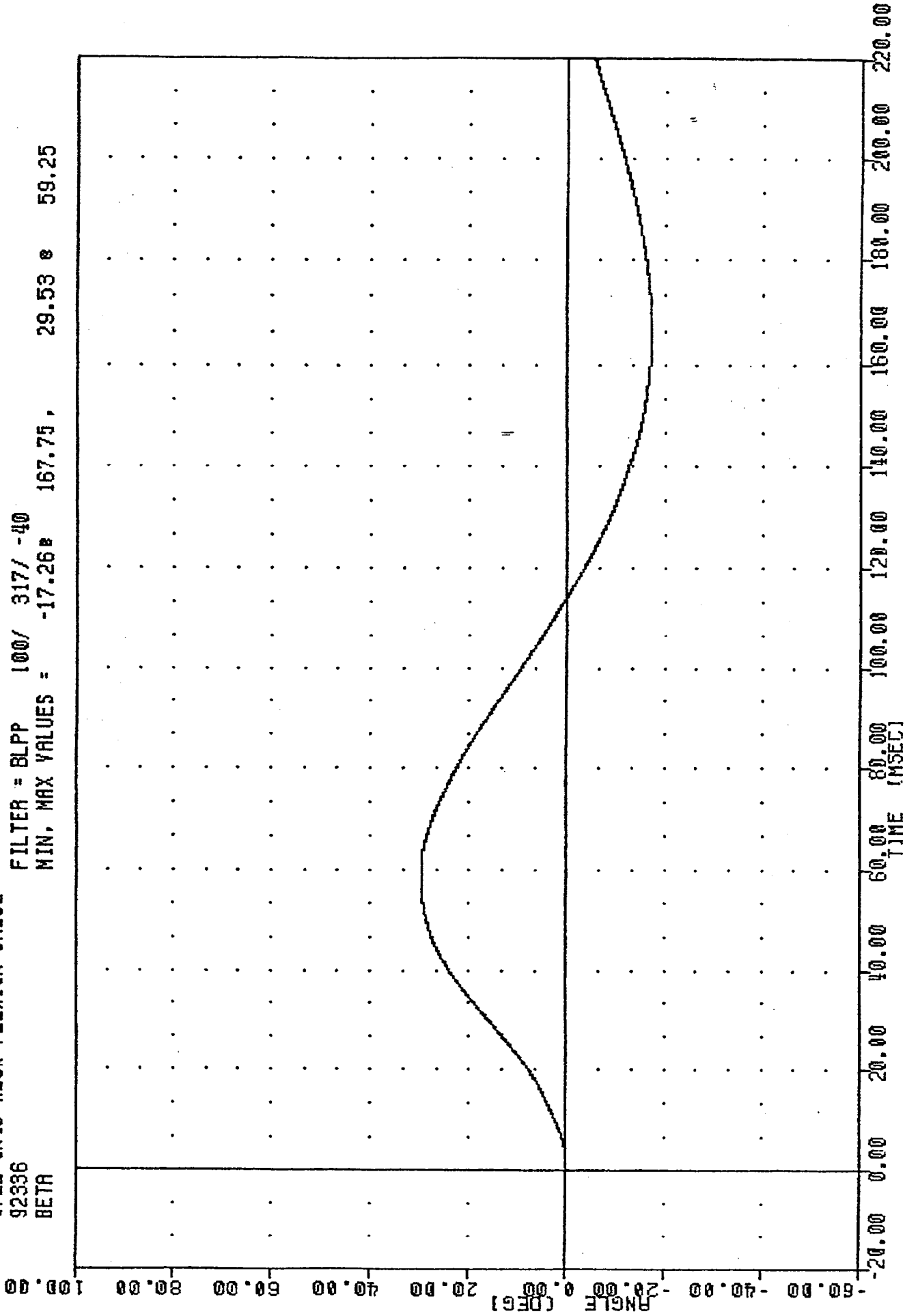
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -2.12B 61.00 . 22.94 e 8.88



PART 572-E HYBRID III NECK FLEXION CALIBRATION
PENDULUM DECELERATION

TRC , 43C2NF1
 572E SN49 NECK FLEXION CAL02
 92336
 BETA

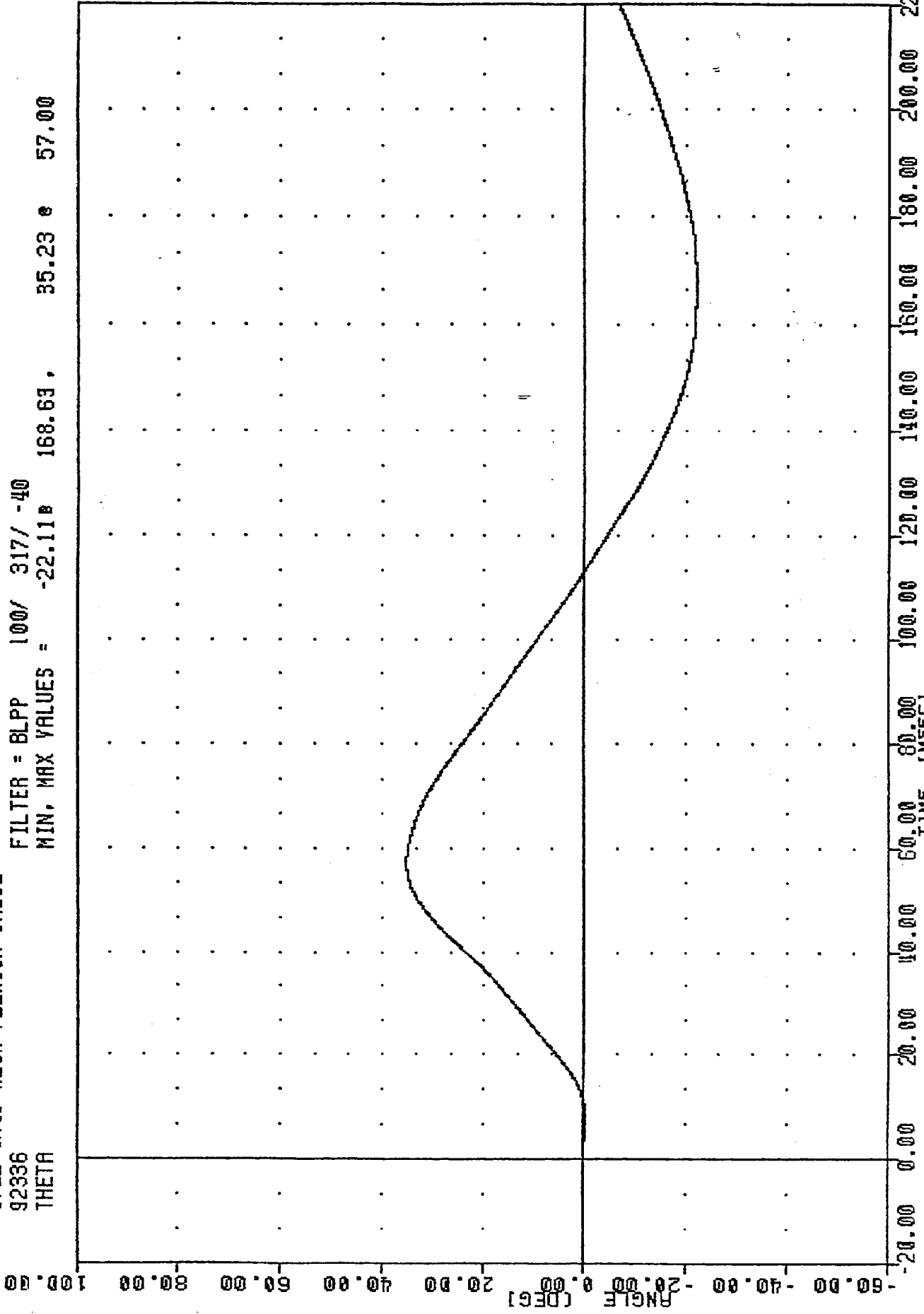
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -17.26# 167.75, 29.53 # 59.25



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

TRC , 43C2NF1
 572E SN43 NECK FLEXION CAL02
 92336
 THETA

FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -22.11 168.63 , 35.23 e 57.00

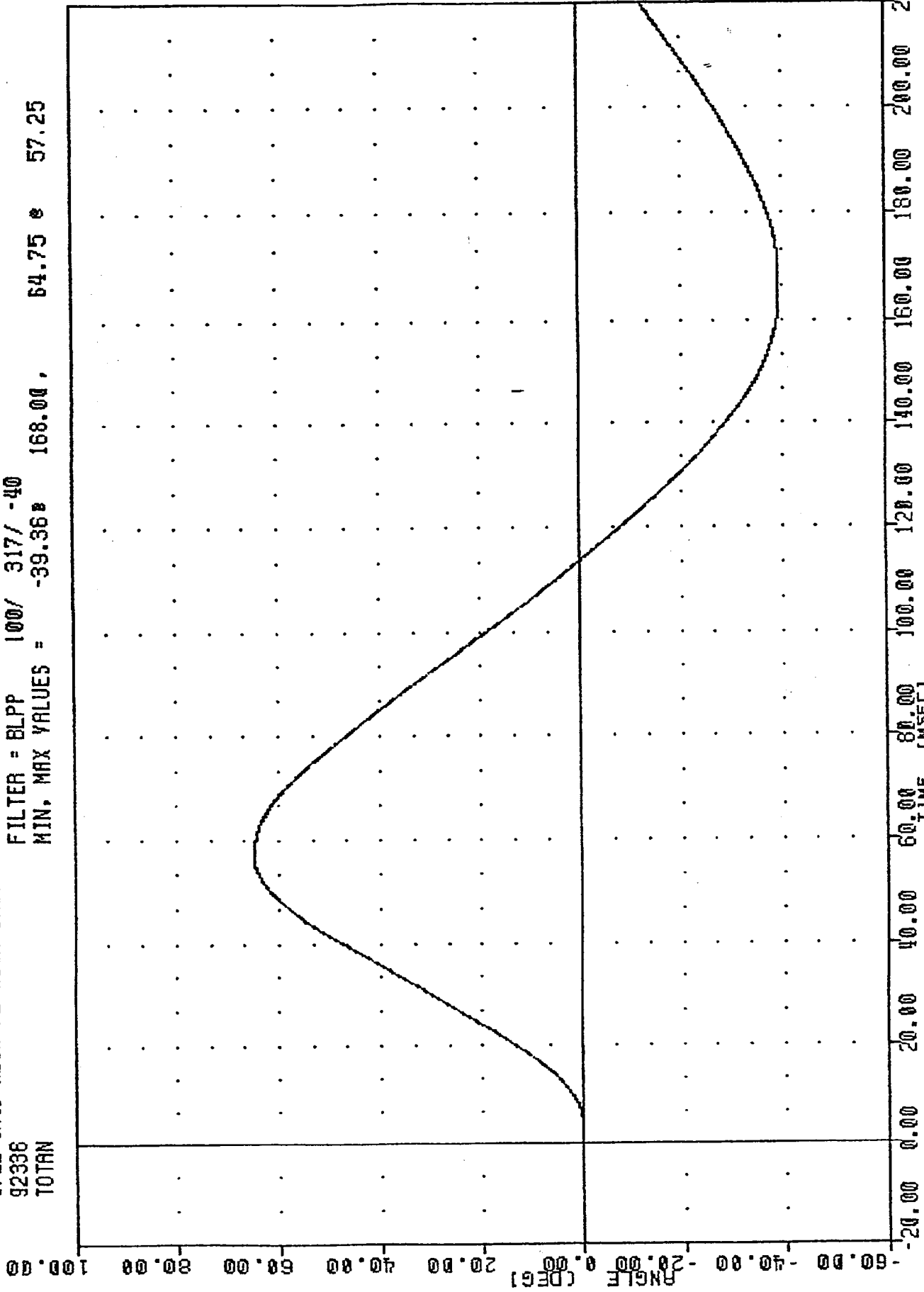


PART 572-E HYBRID III NECK FLEXION CALIBRATION
 ROTATION ABOUT OCCIPITAL CONDYLE

TRC
572E SN43 NECK FLEXION CAL02
92336
TOTAN

, 43C2NF1

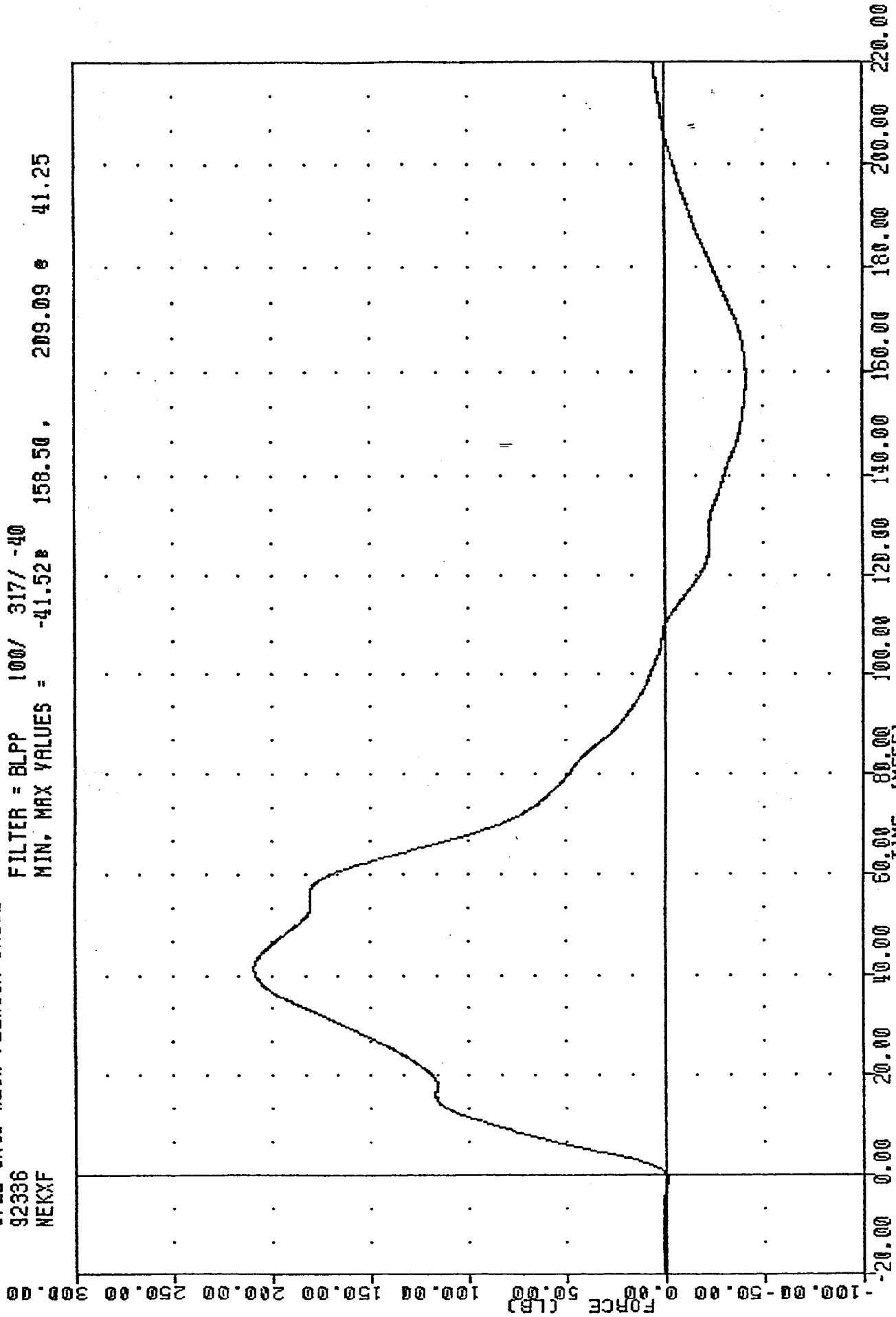
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -39.36 168.00 , 64.75 57.25



PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL ROTATION

TRC 43C2NF1
572E 5N49 NECK FLEXION CAL02
92336
NEKXF

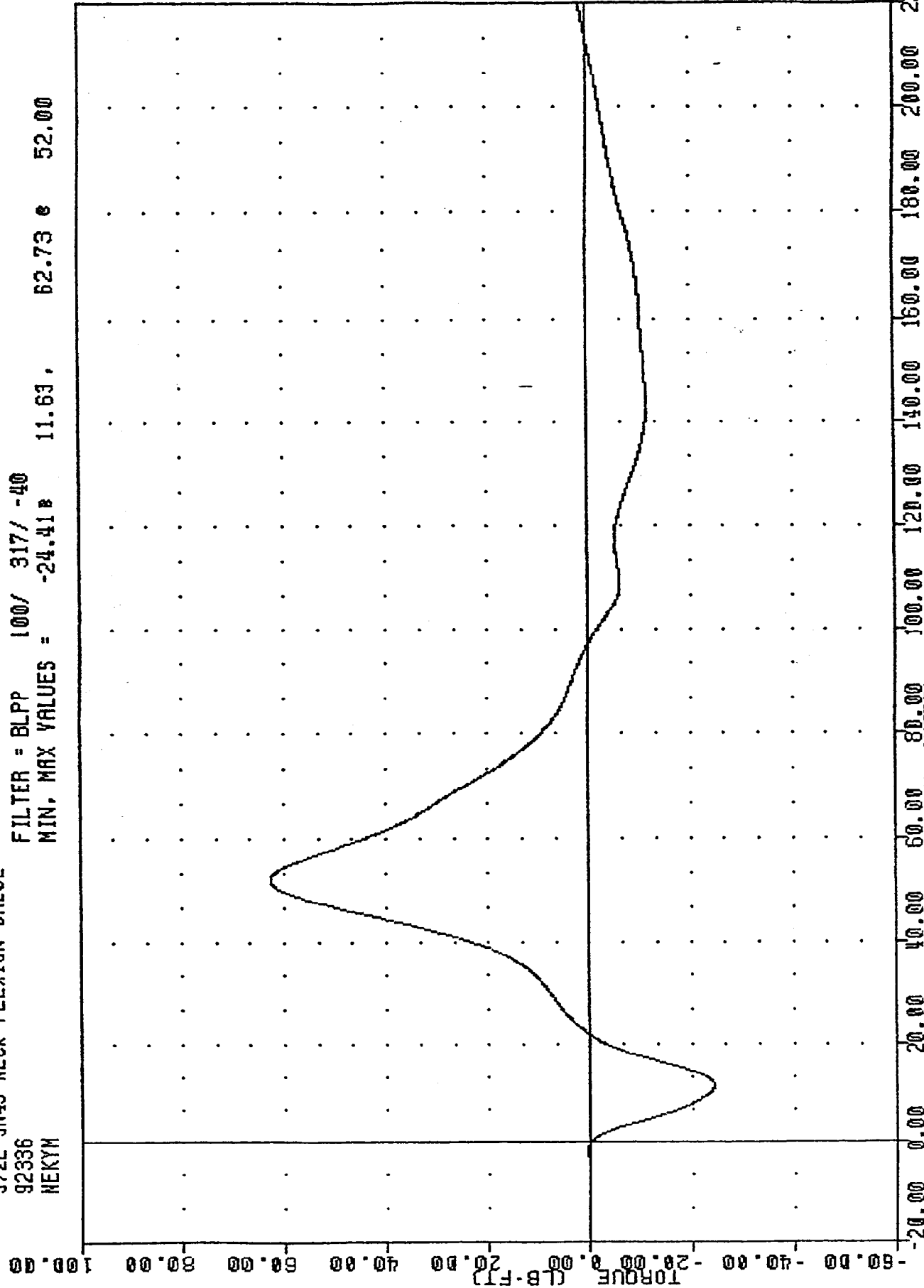
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -41.52 158.50 209.09 41.25



PART 572-E HYBRID III NECK FLEXION CALIBRATION
NECK FORCE Y AYTS

TRC , 43C2NF1
572E 9N49 NECK FLEXION CAL02
92336
NEKYM

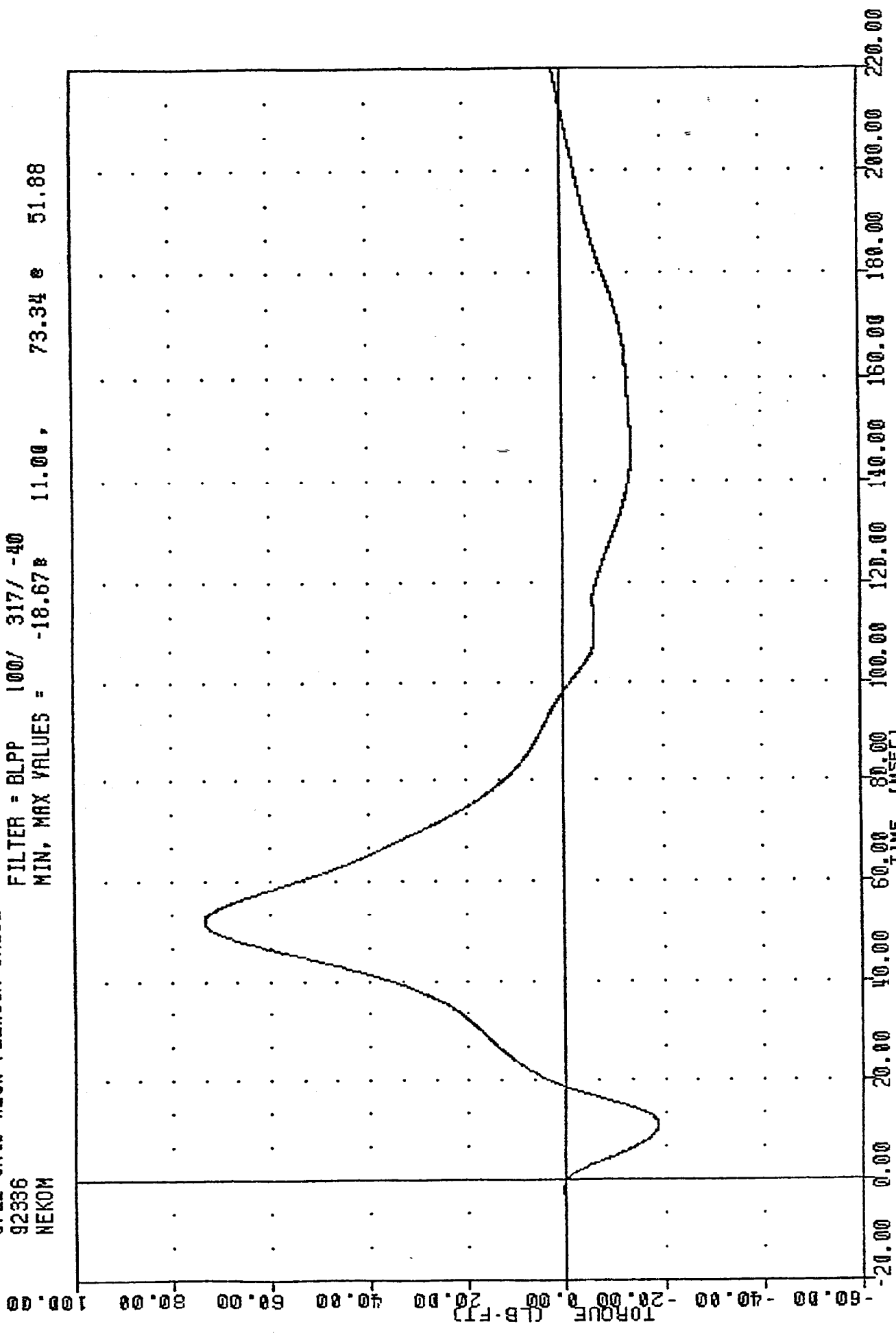
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -24.41 11.63, 62.73 e 52.00



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

TRC , 43C2NF1
 572E SM49 NECK FLEXION CAL02
 92336
 NEKOM

FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -18.67 11.00, 73.34 e 51.88



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

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

01-DEC-92

6 AXIS NECK TRANSDUCER
TRC 43C2NE1

572E SN43 NECK EXT. CAL02

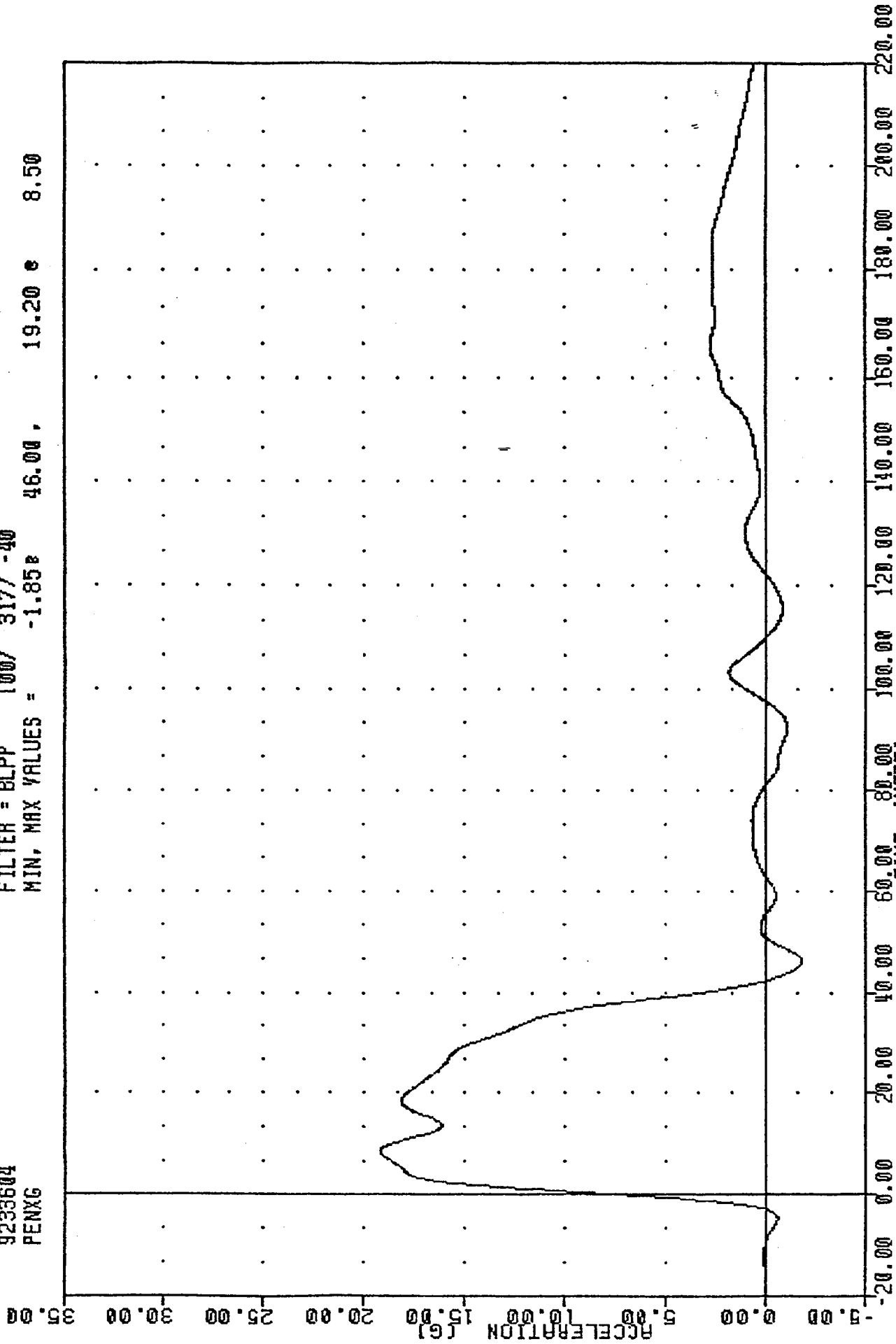
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	48.0 %
IMPACT VELOCITY	19.50-20.30 FT/SEC	19.83 FT/SEC
PENDULUM DECELERATION	10 MS 17.20 - 21.20 G	18.63 G
	20 MS 14.00 - 19.00 G	17.85 G
	30 MS 11.00 - 16.00 G	14.60 G
MAX PENDULUM G ABOVE 30 MS	22 G MAX	14.52 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G	38 - 46 MS	39.00 MS
D PLANE ROTATION	MAX 81 - 106 DEG.	88.71 DEG.
	TIME 72 - 82 MS	72.88 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MIN -59.0/-39.0 FT.LBS	-46.88 FT.LBS
	TIME 65 - 79 MS	68.25 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO	147 - 174 MS	153.25 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO	120 - 148 MS	133.25 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN *Pete Faust*

TRC , 43C2NE1
572E SN49 NECK EXT. CAL02
9233604
PENXG

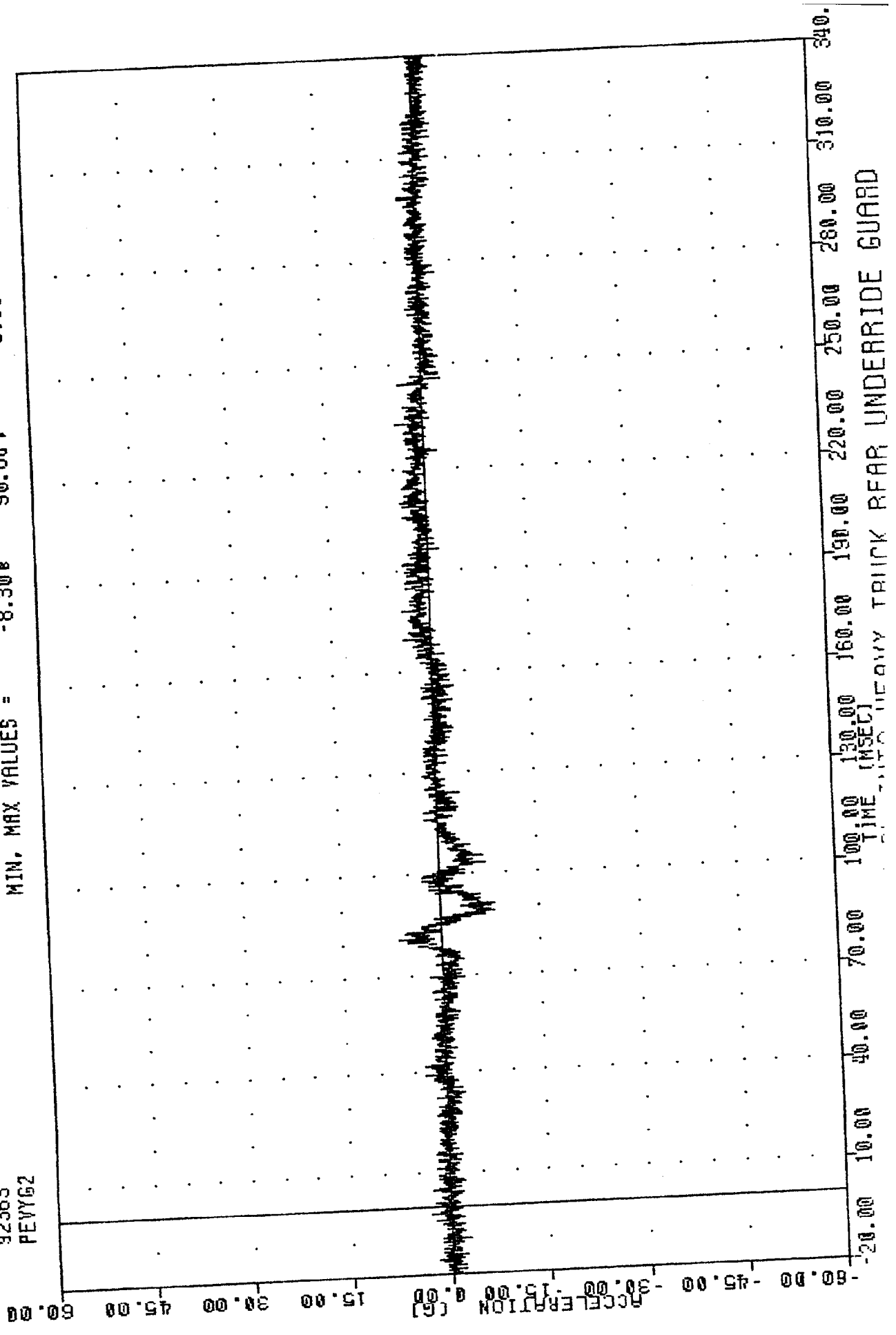
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -1.85g 19.20 g 8.50



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
PENXG IN DIFFERENTIATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
PEVY62

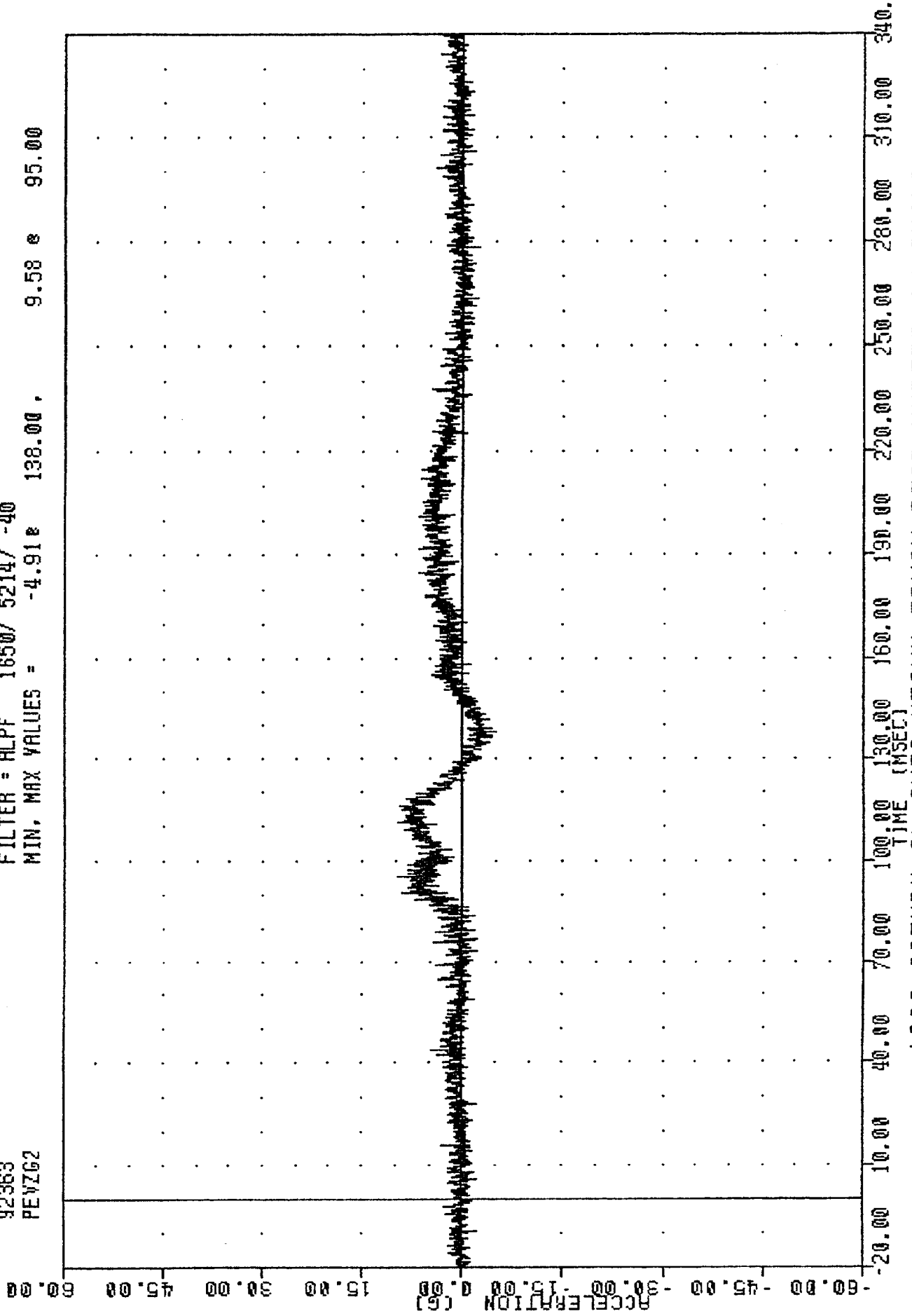
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -8.30B 90.88 6.50 e 80.75



HEAVY TRUCK REAR UNDERRIDE GUARD

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
PEVZ62

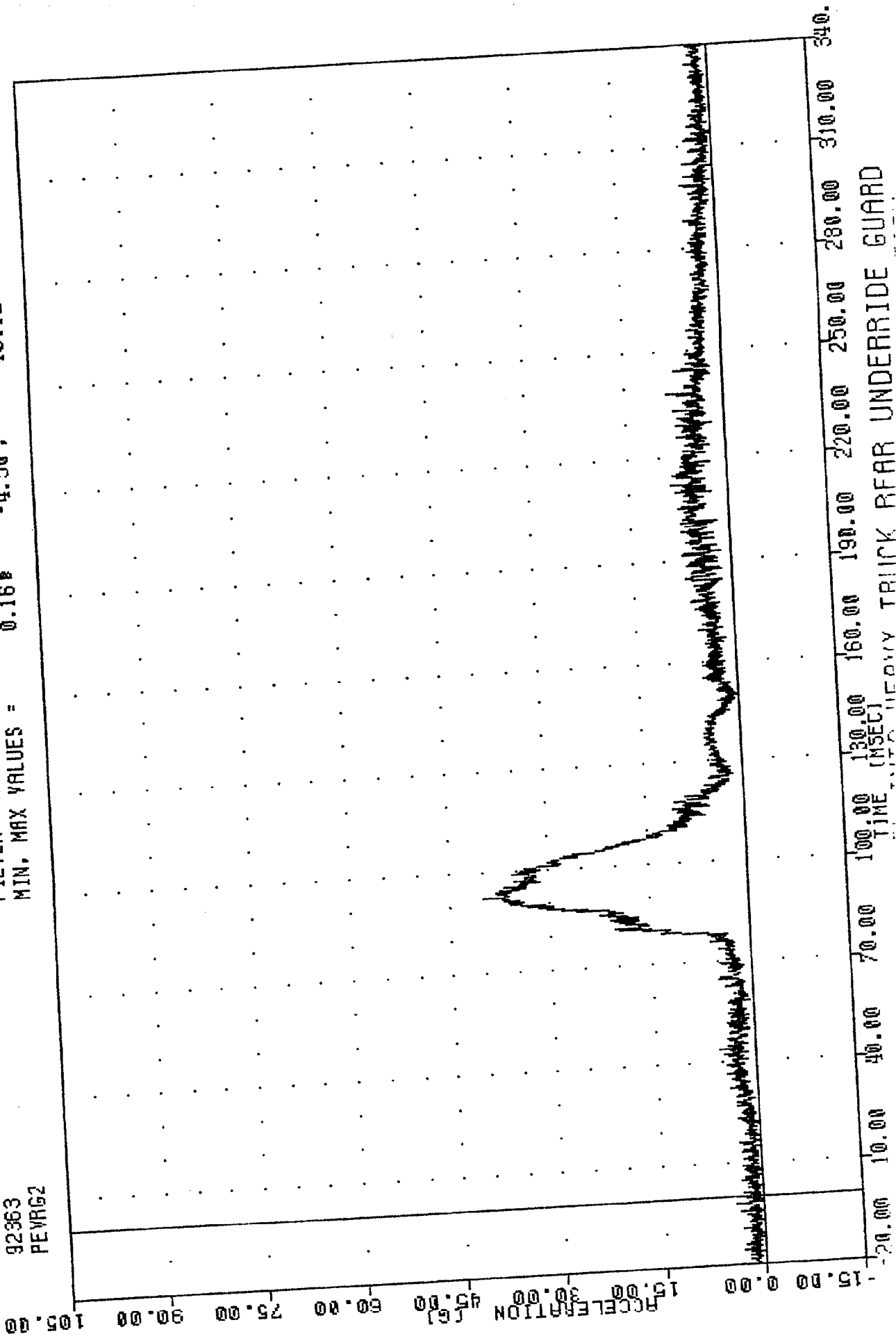
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -4.91e 138.00 , 9.58 e 95.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT FRONT PASSENGER PELVIS Z-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
PEYRG2

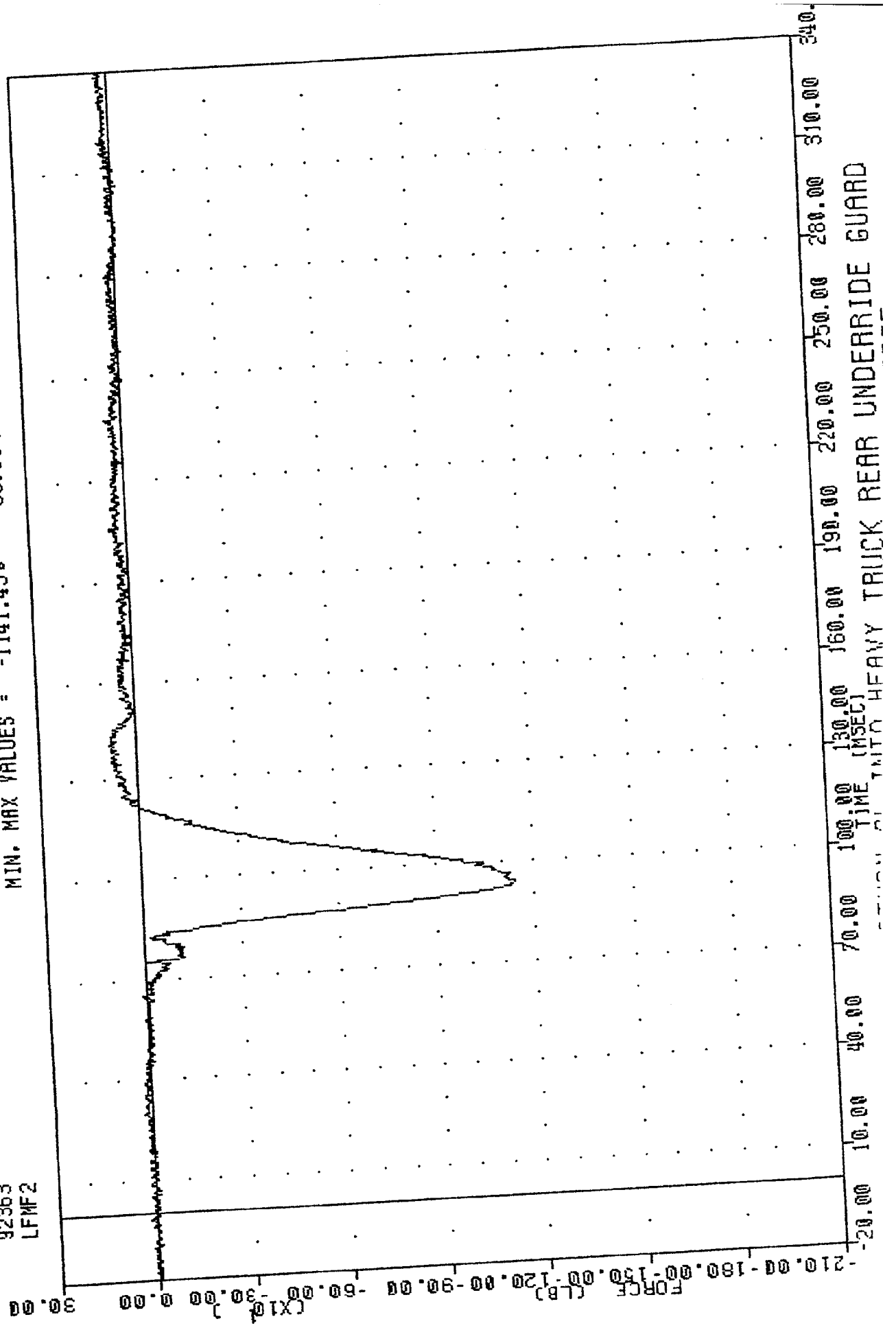
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = 0.168 -4.50 40.12 e 92.00



HEAVY TRUCK RIFAR UNDERRIDE GUARD

TRC 921228
 HEAVY TRUCK UNDERRIDE
 92363
 LFMF2

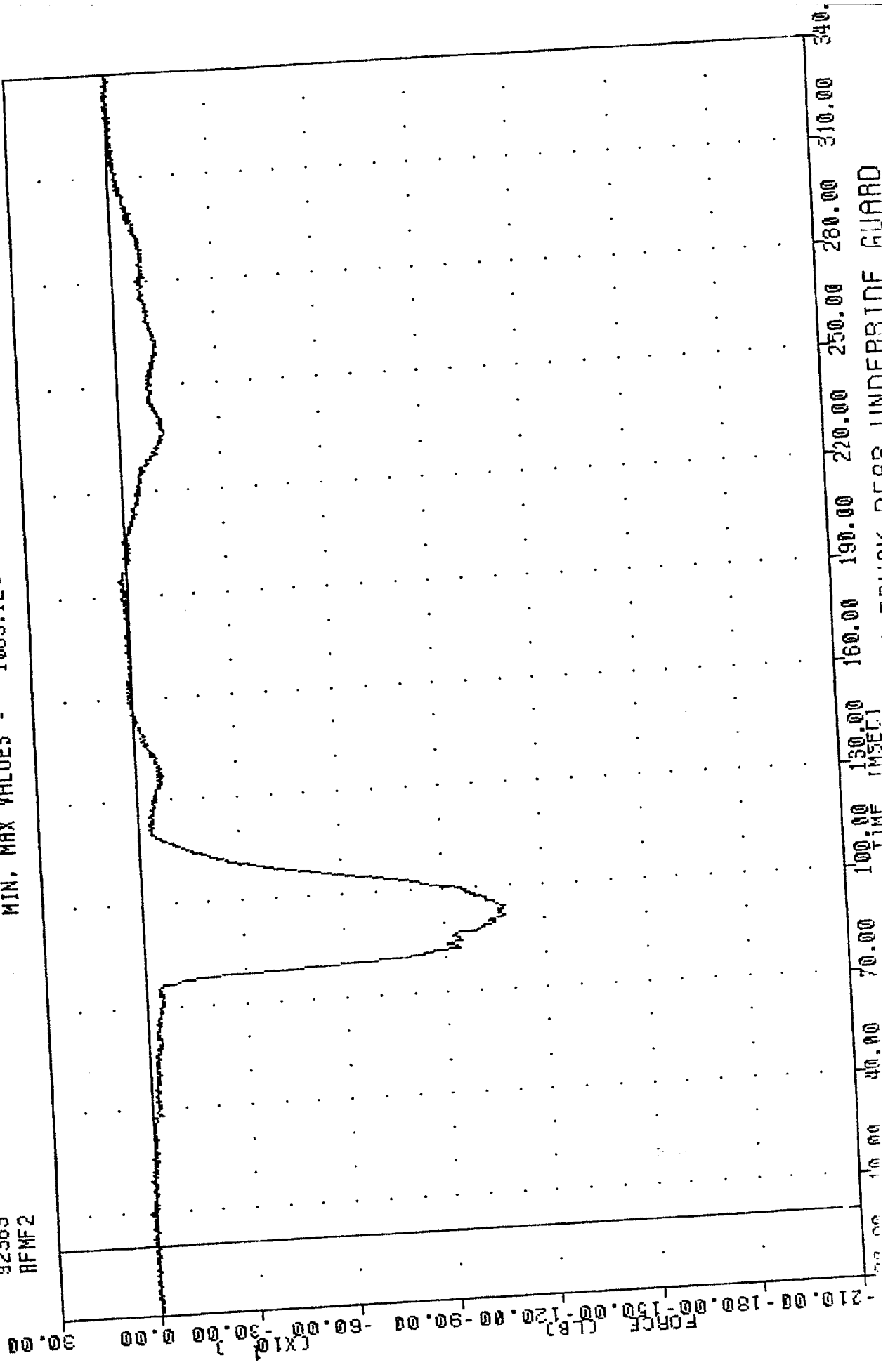
FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -1141.43# 93.50 , 78.92 # 140.63



HEAVY TRUCK REAR UNDERRIDE GUARD

TRC 921228
HEAVY TRUCK UNDERRIDE
92363
AFMF2

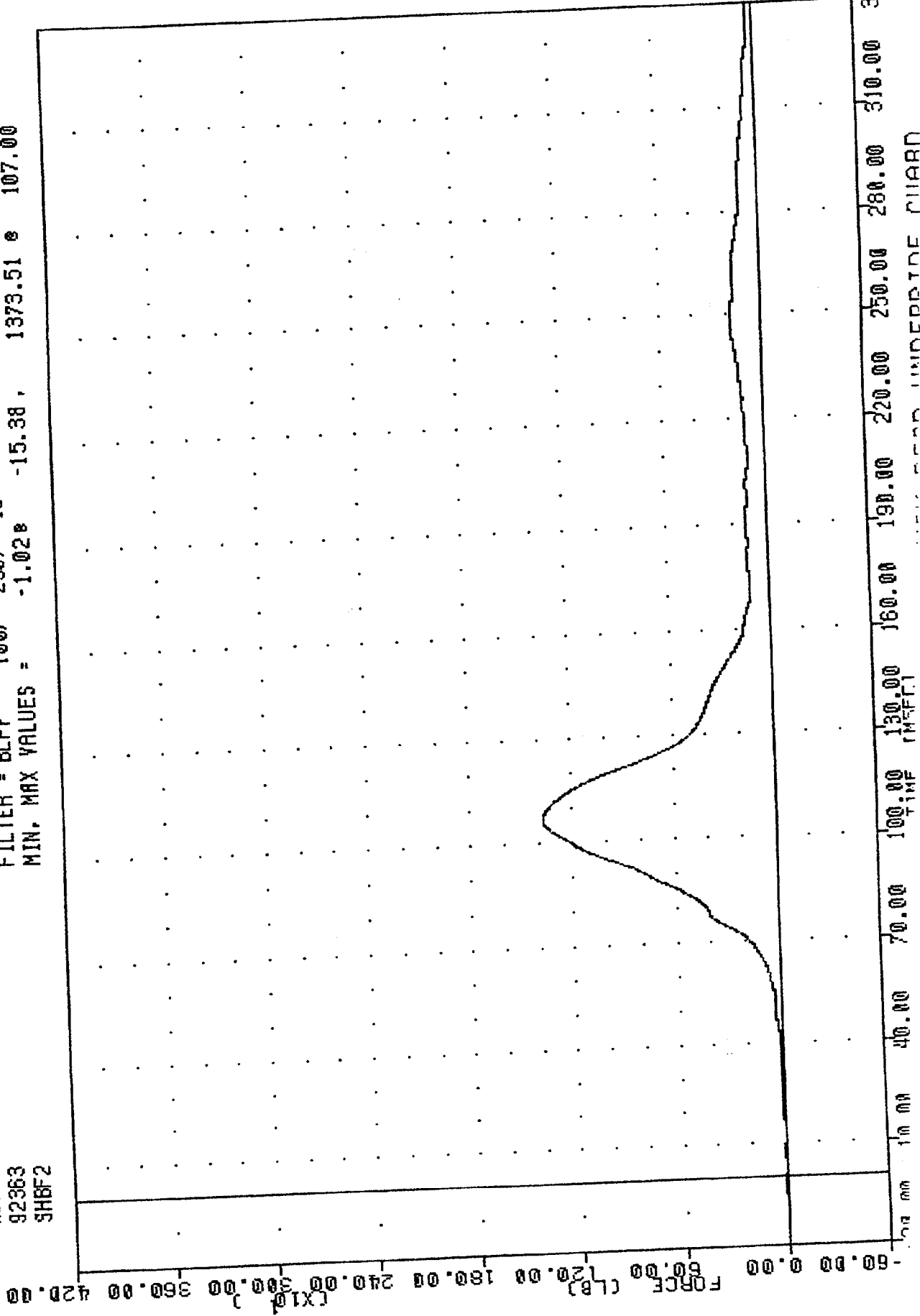
FILTER = BLPP 1000/ 2500/ -16
MIN, MAX VALUES = -1085.12 91.38, 21.76 194.13



UNDEFINITE GUARD

TRC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 SHBF2

FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -1.028 -15.38 , 1373.51 8 107.00



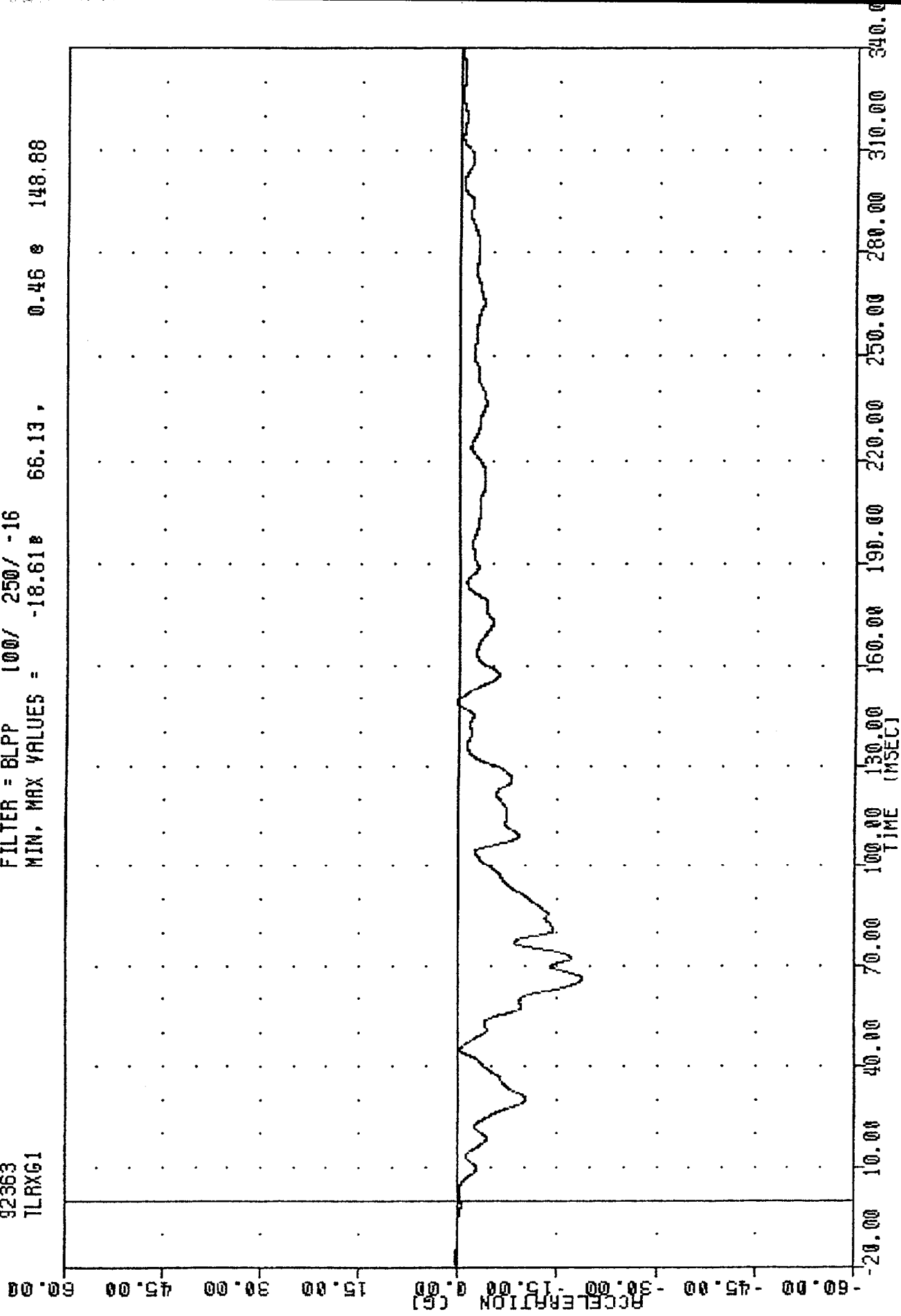
TIME (MSEC)

FORCE (LB)

UNDETRIDE

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
TLRXG1

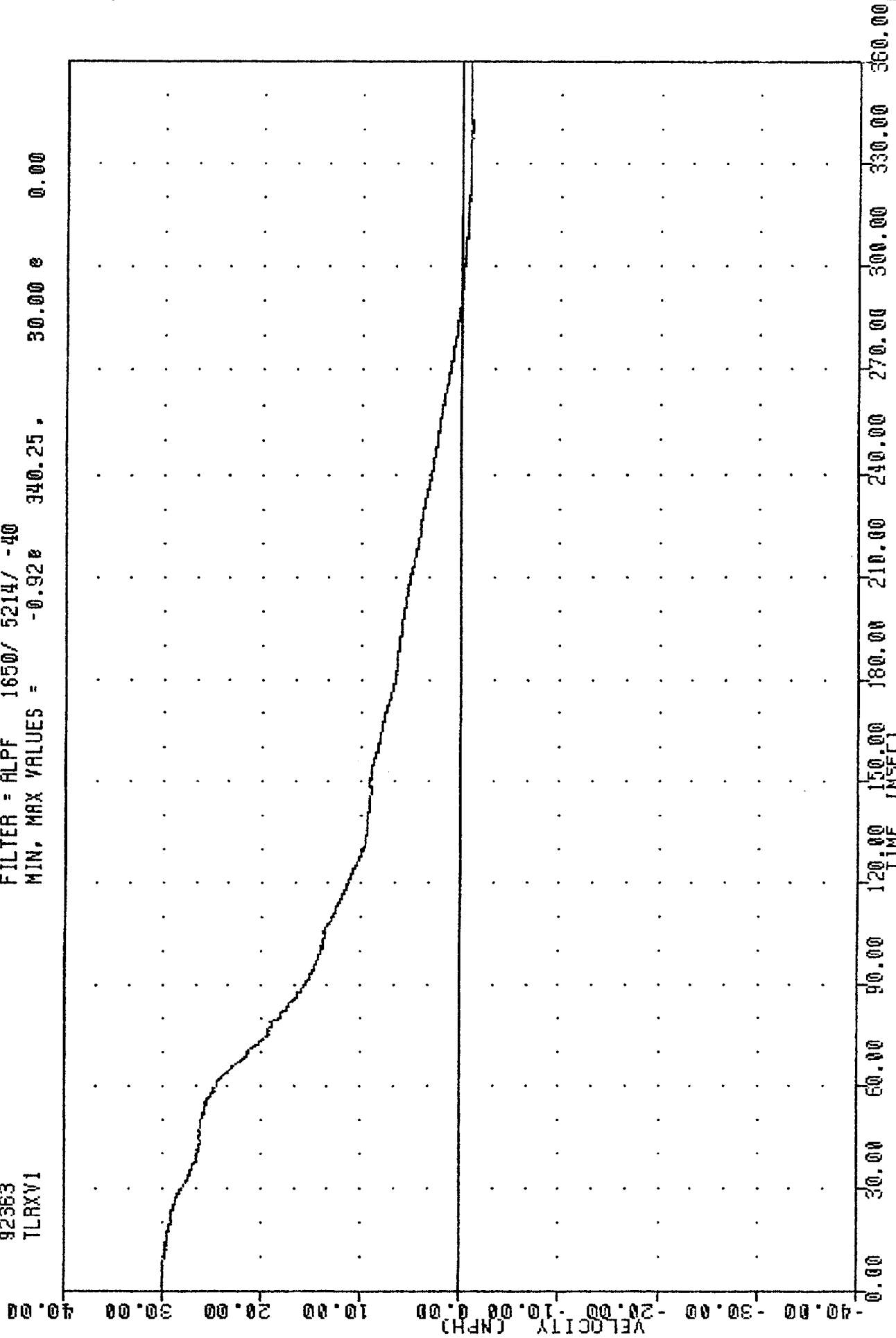
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -18.61 66.13 , 0.46 e 148.88



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT X-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
TLRXV1

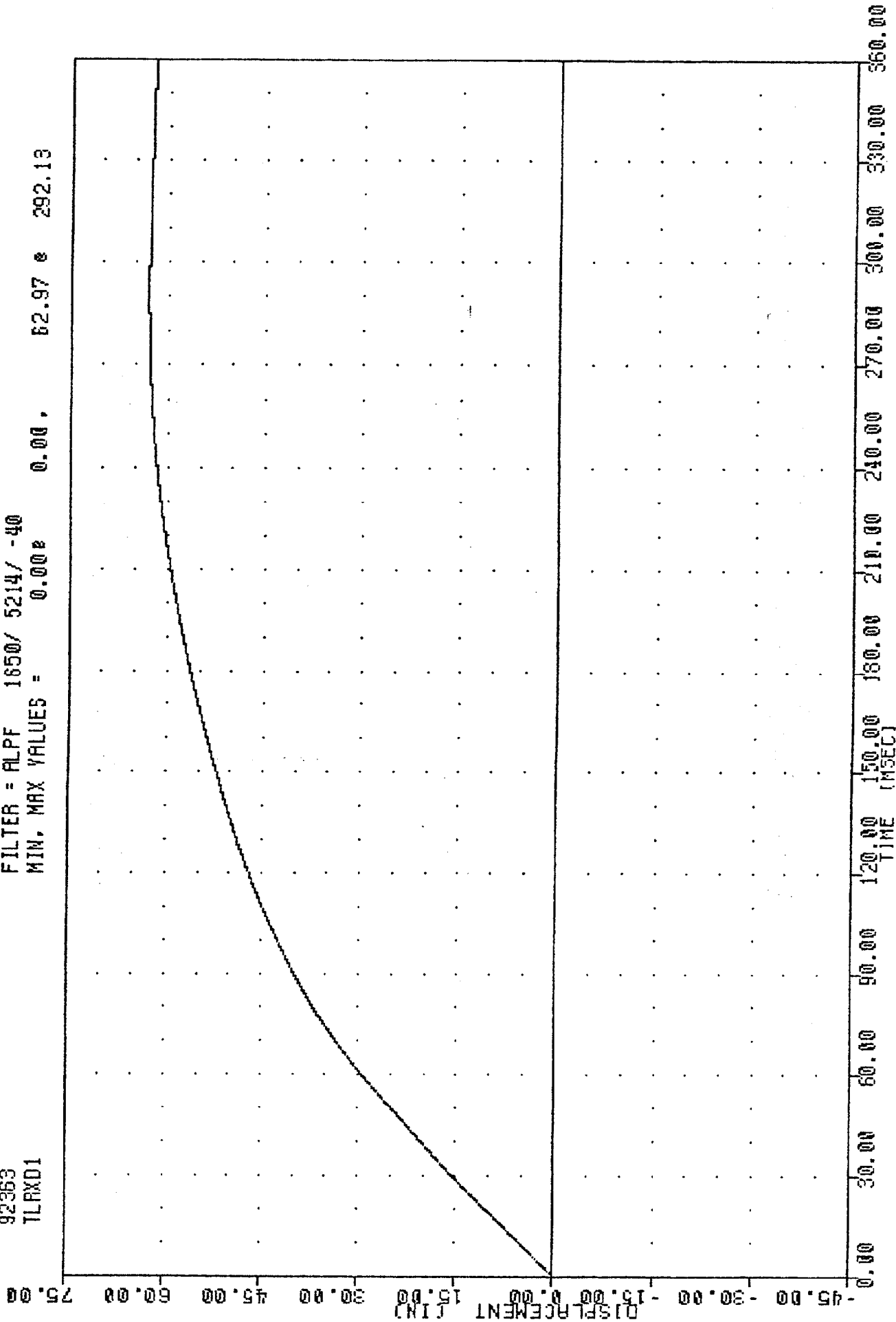
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -0.92 e 340.25 , 30.00 e 0.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT X-AXIS VELOCITY

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
TLRXD1

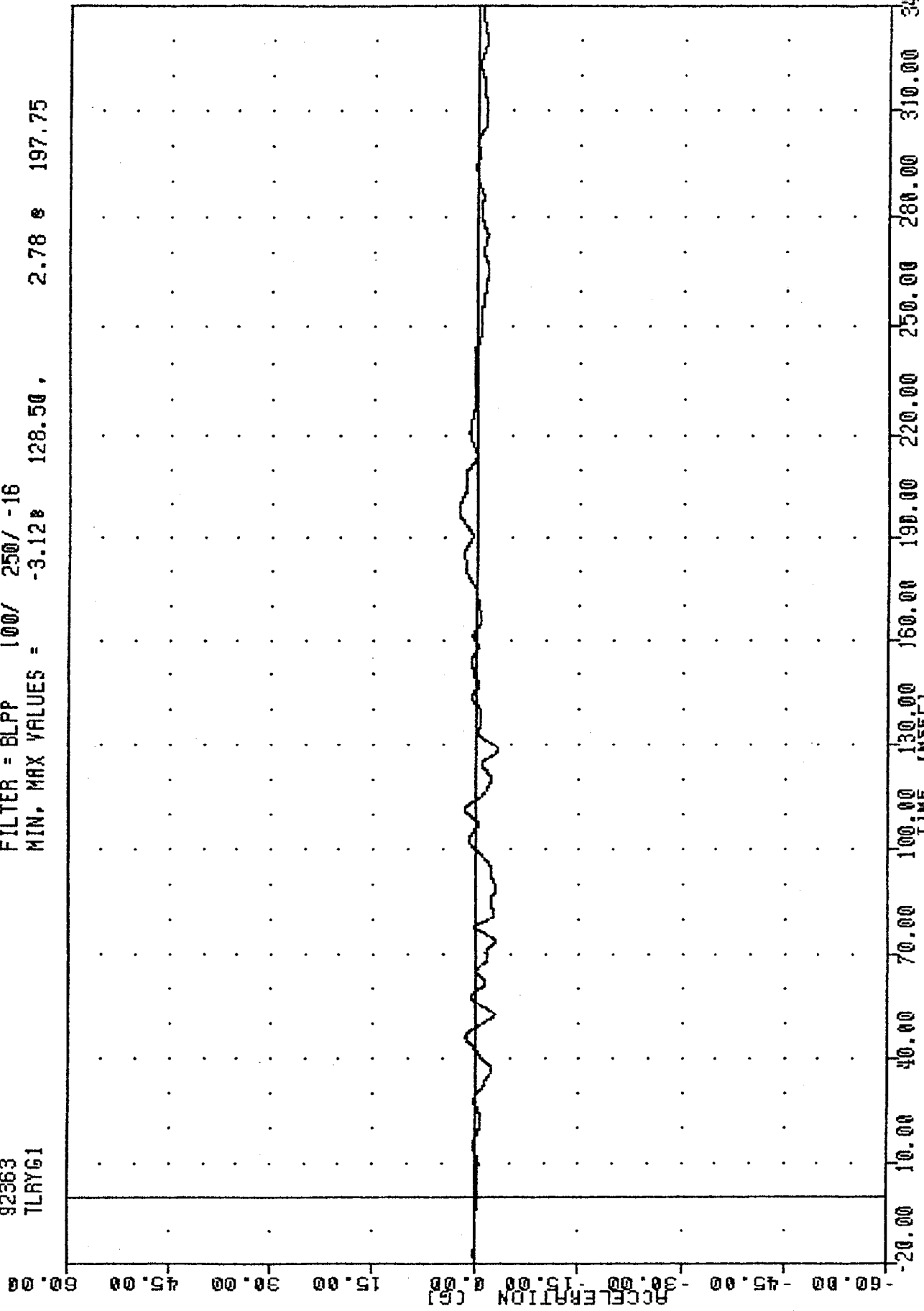
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = 0.00e 62.97 e 292.13



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT X-AXIS DISPLACEMENT

TAC
HEAVY TRUCK UNDERRIDE
92363
TLAY61

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -3.12e 128.50, 2.78 e 197.75



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT Y-AXIS ACCELERATION

TRC
HEAVY TRUCK UNDERRIDE

92363
TLRYV1

FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -2.42B 142.38 , 0.00 e 0.00

40.00

30.00

20.00

10.00

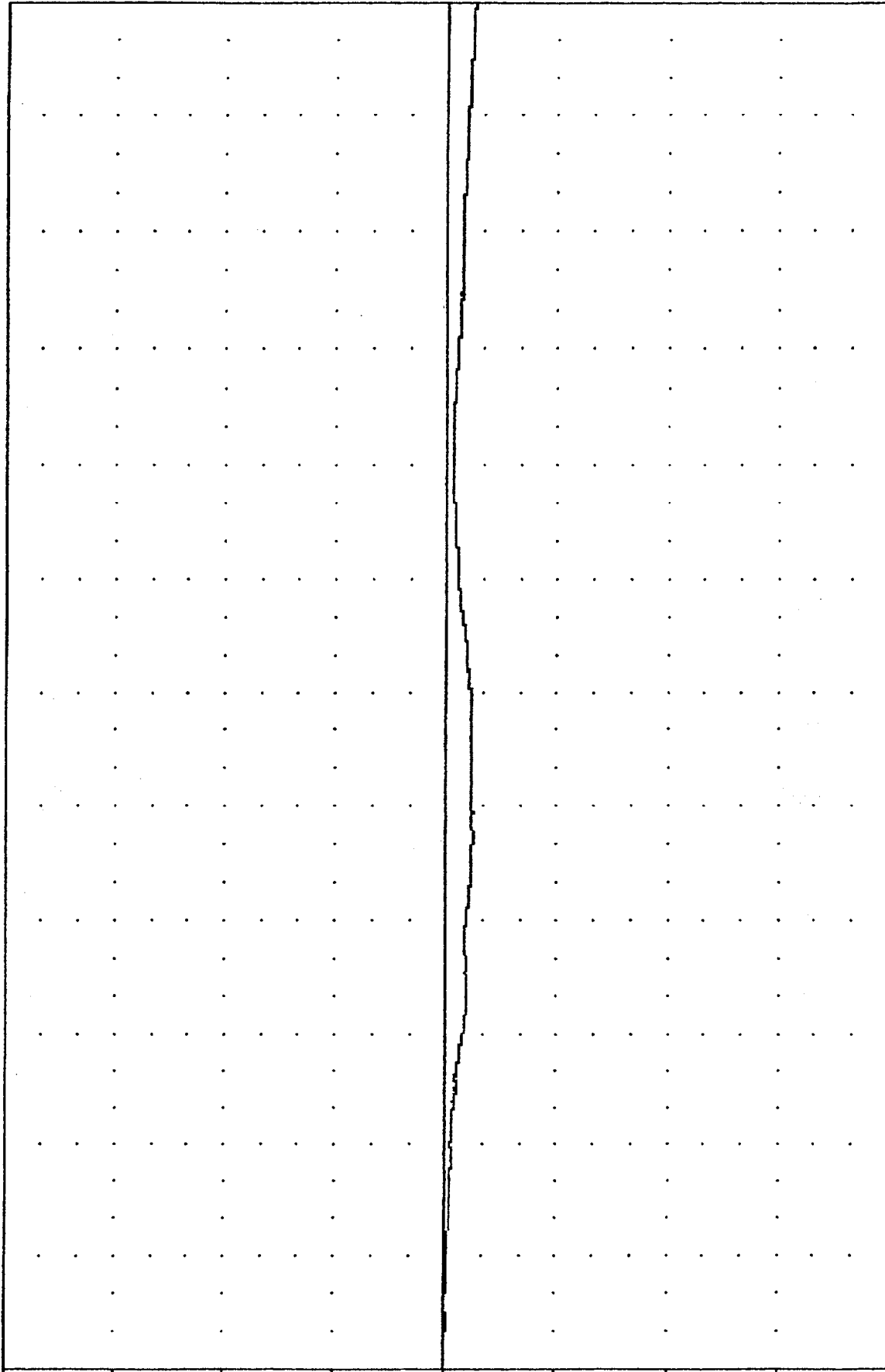
0.00

-10.00

-20.00

-30.00

-40.00



0.00

30.00

60.00

90.00

120.00

150.00

180.00

210.00

240.00

270.00

300.00

330.00

360.00

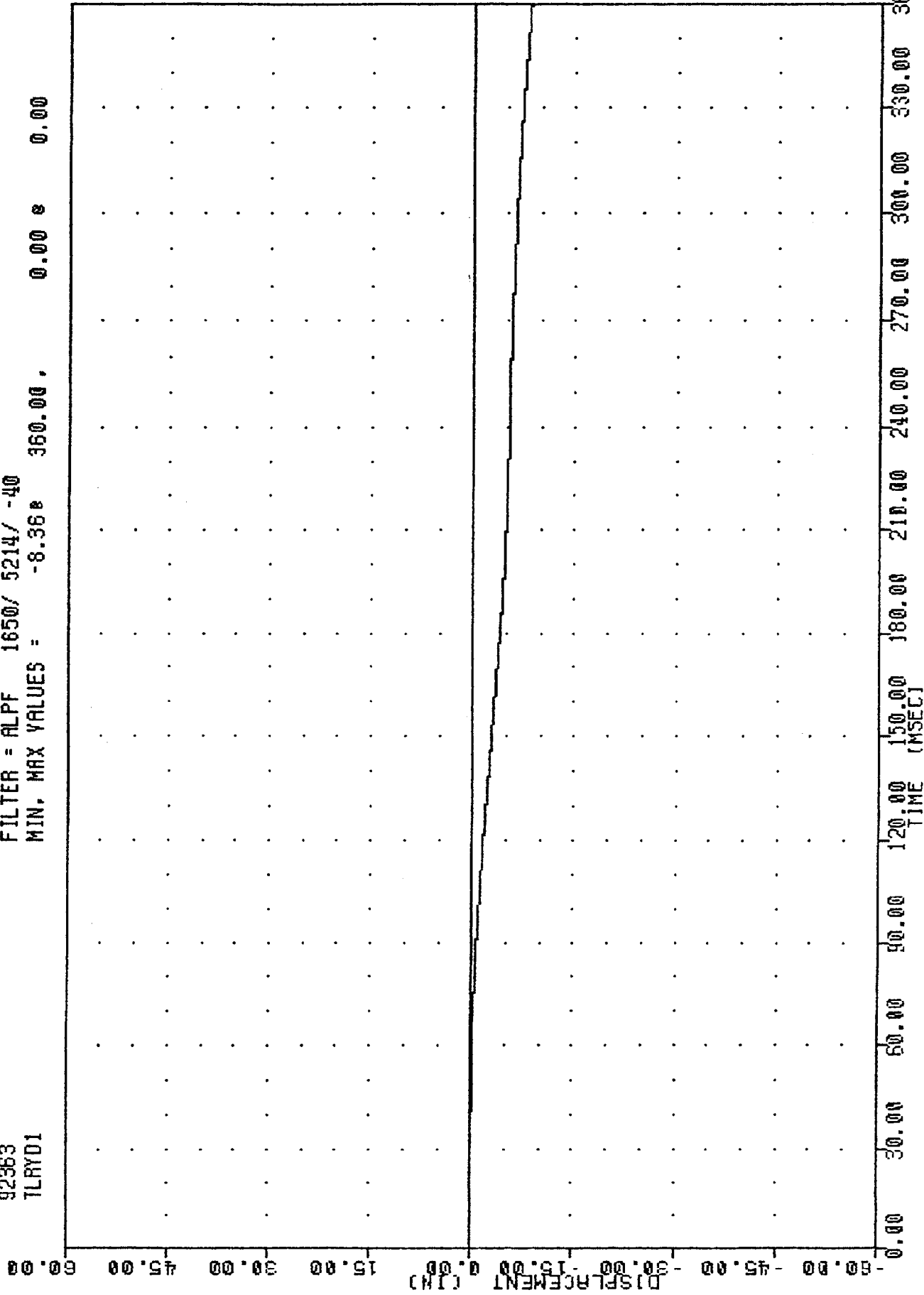
TIME (MSEC)

1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT Y-AXIS VELOCITY

TRC , 921228
HEAVY TRUCK UNDERRIDE

92363
TLRYD1

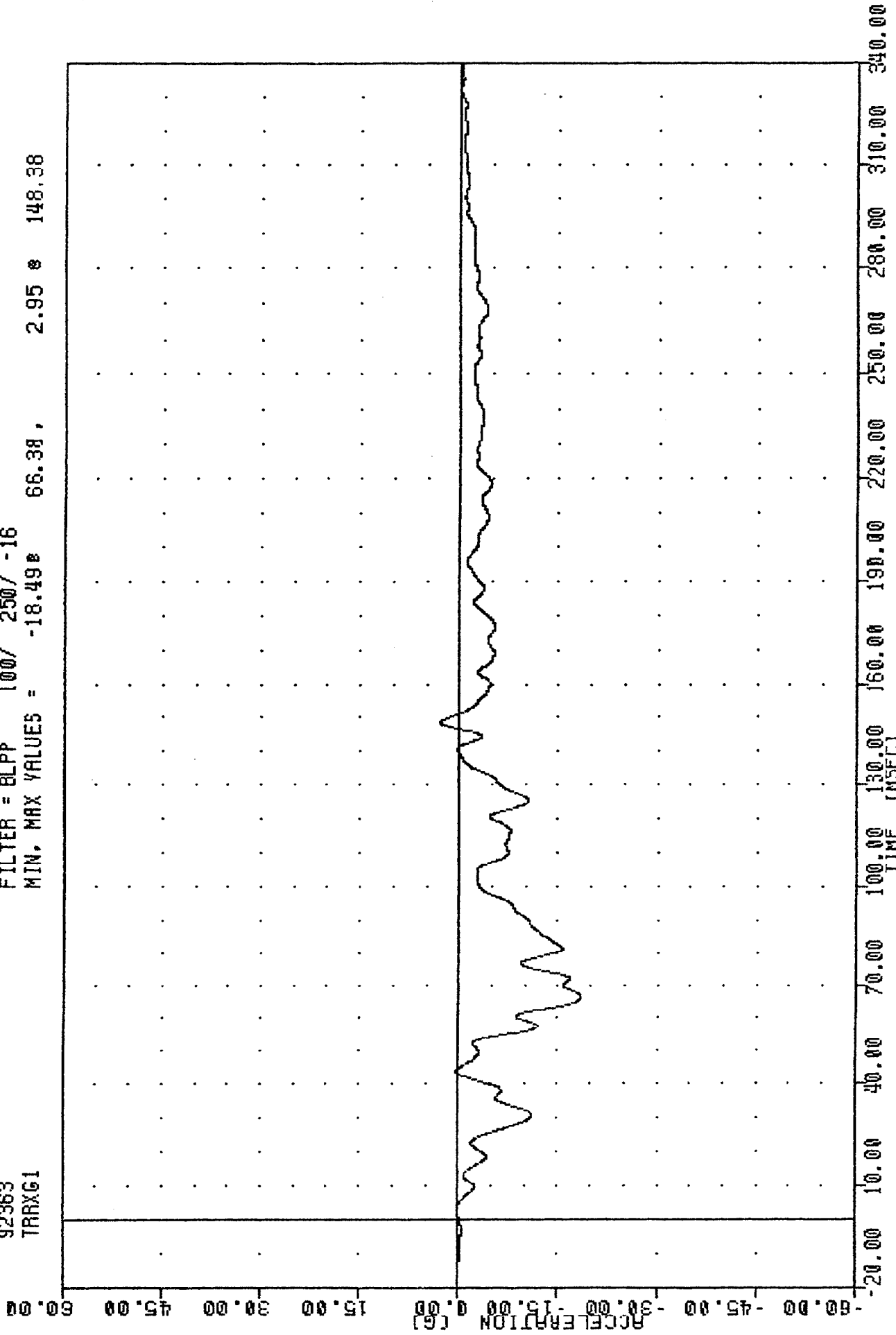
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -8.36 360.00 , 0.00 0.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
LEFT REAR SEAT Y-AXIS DISPLACEMENT

TRC 921228
HEAVY TRUCK UNDERRIDE
92363
TRRXG1

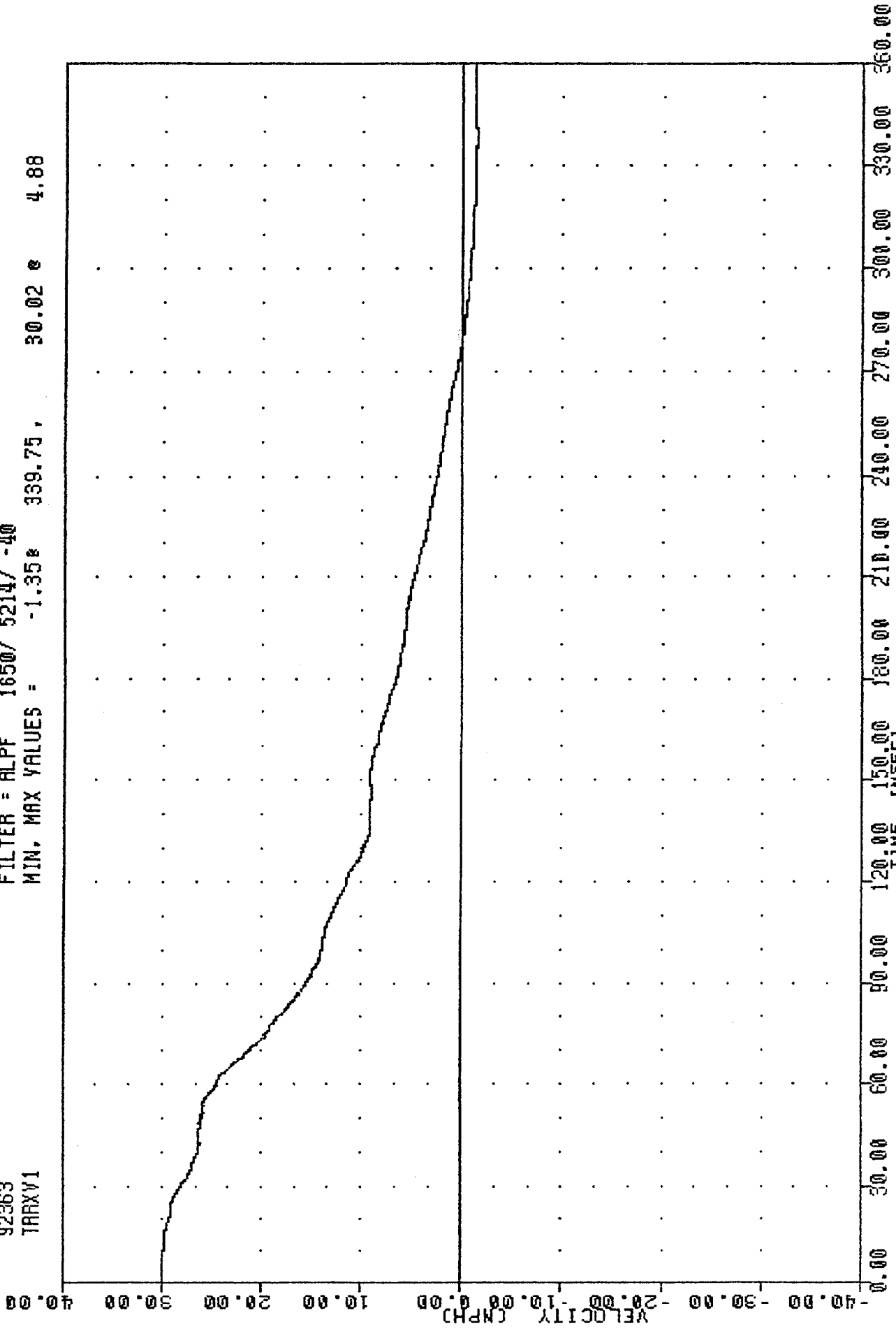
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -18.49e 66.38, 2.95 e 148.38



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT X-AXIS ACCELERATION

TAC , 921228
HEAVY TRUCK UNDERRIDE
92363
TRRXV1

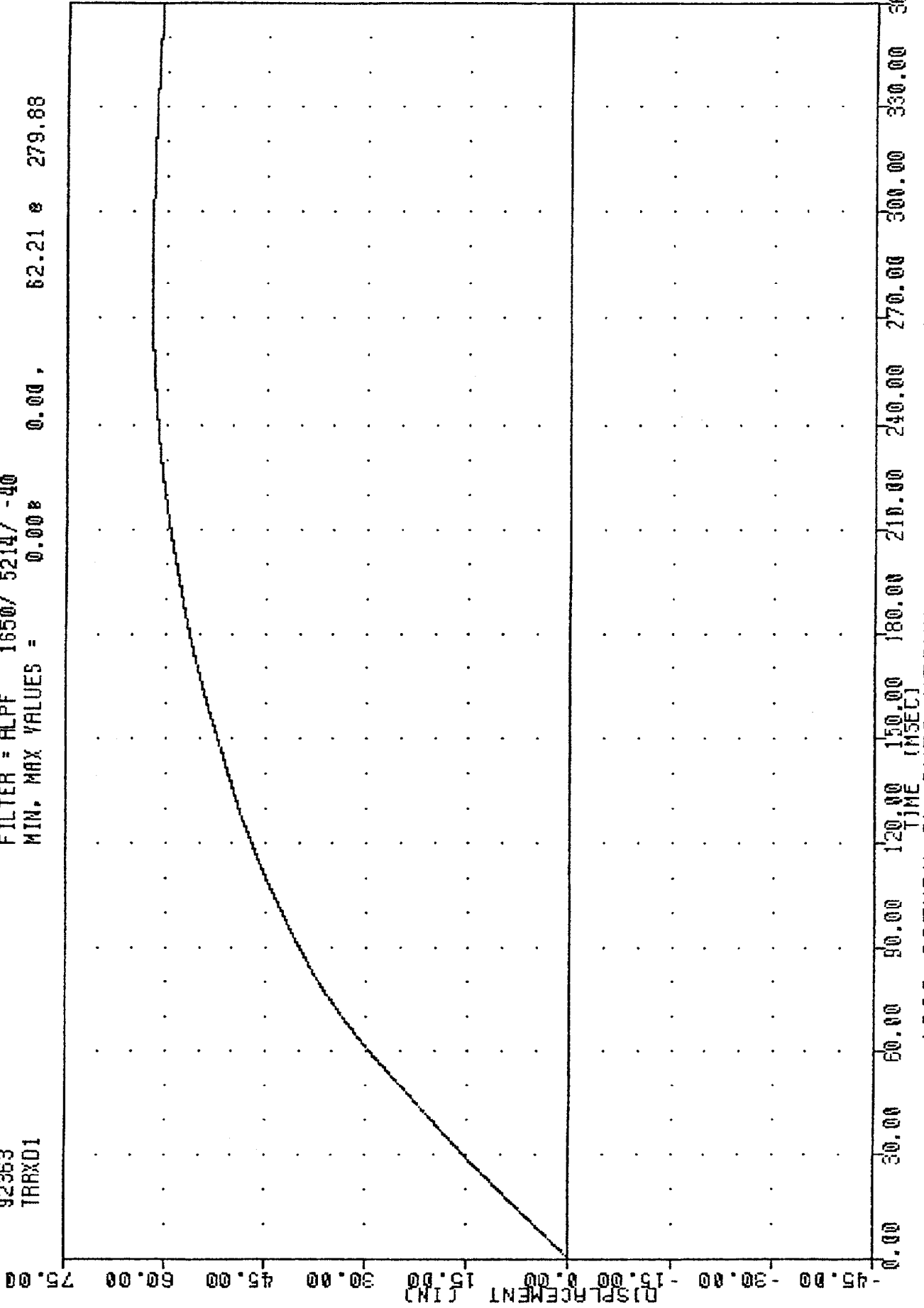
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -1.358 339.75 , 30.02 e 4.88



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT X-AXIS VELOCITY

TRC
HEAVY TRUCK UNDERTRIDE
92363
TRAXD1

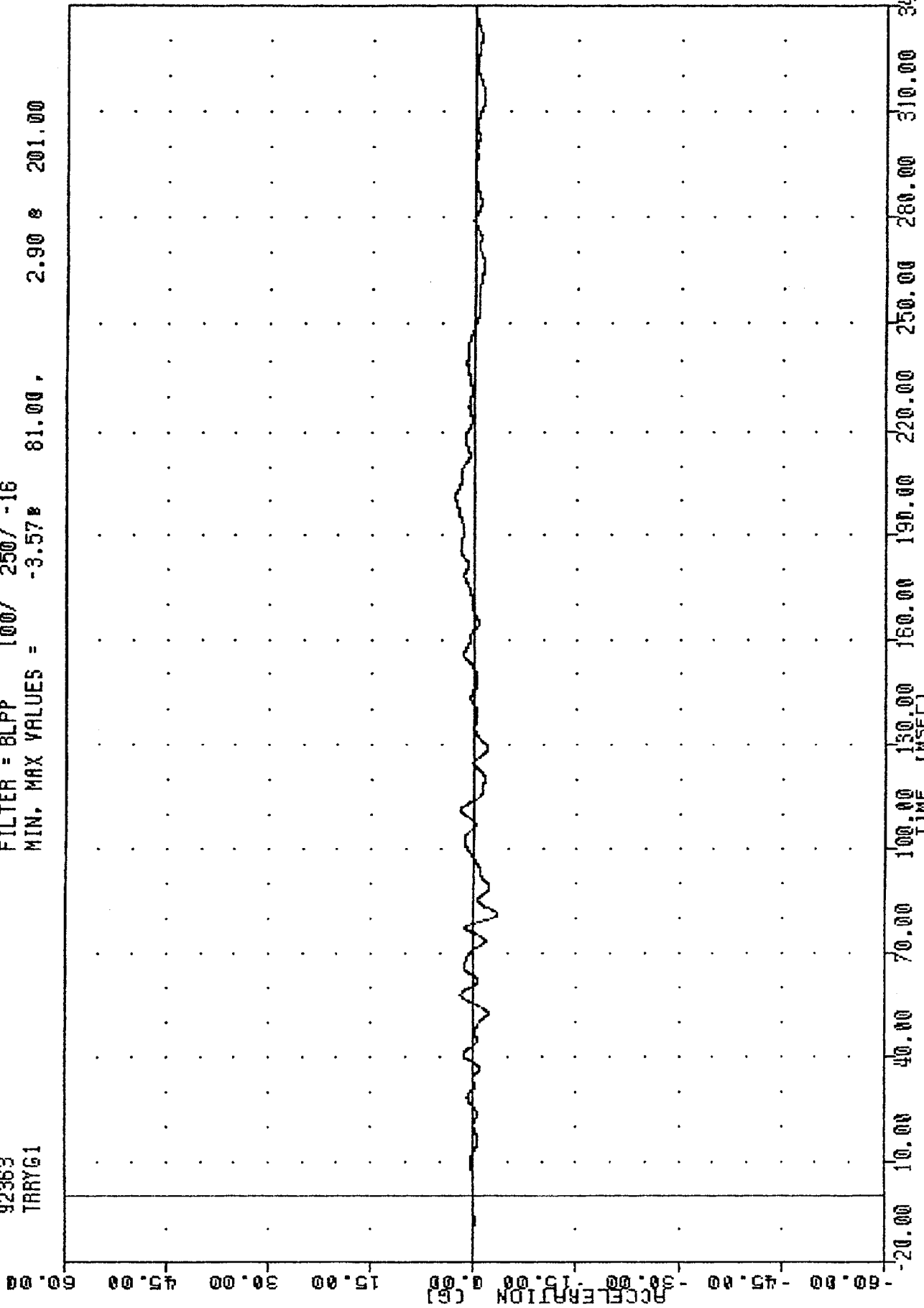
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = 0.008 0.00 , 62.21 e 279.88



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERTRIDE GUARD
RIGHT REAR SEAT X-AXIS DISPLACEMENT

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
TRRYG1

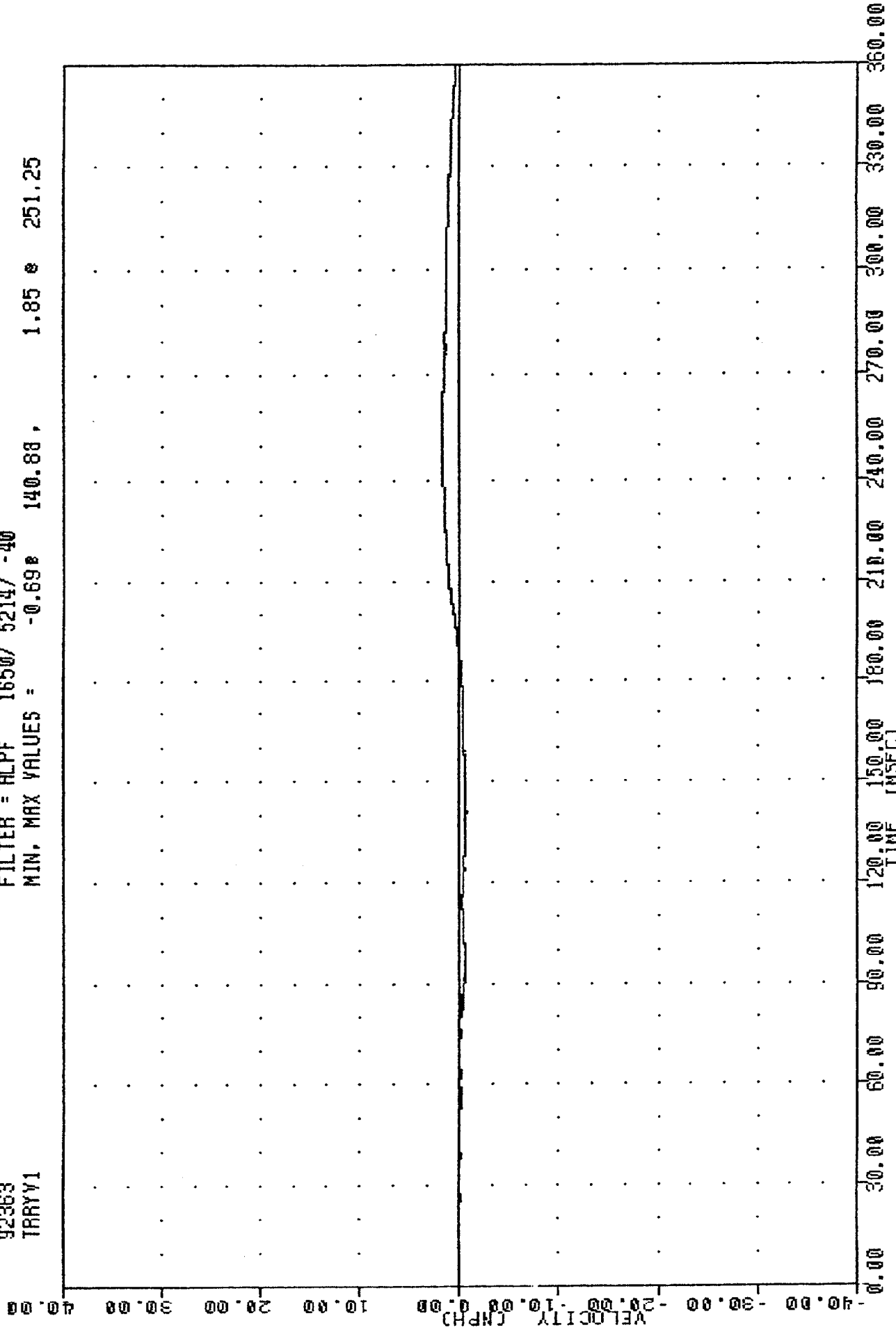
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -3.57# 81.00, 2.90 # 201.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
RIGHT REAR SEAT Y-AXIS ACCELERATION

TRC 921228
 HEAVY TRUCK UNDERRIDE
 92363
 TRAY1

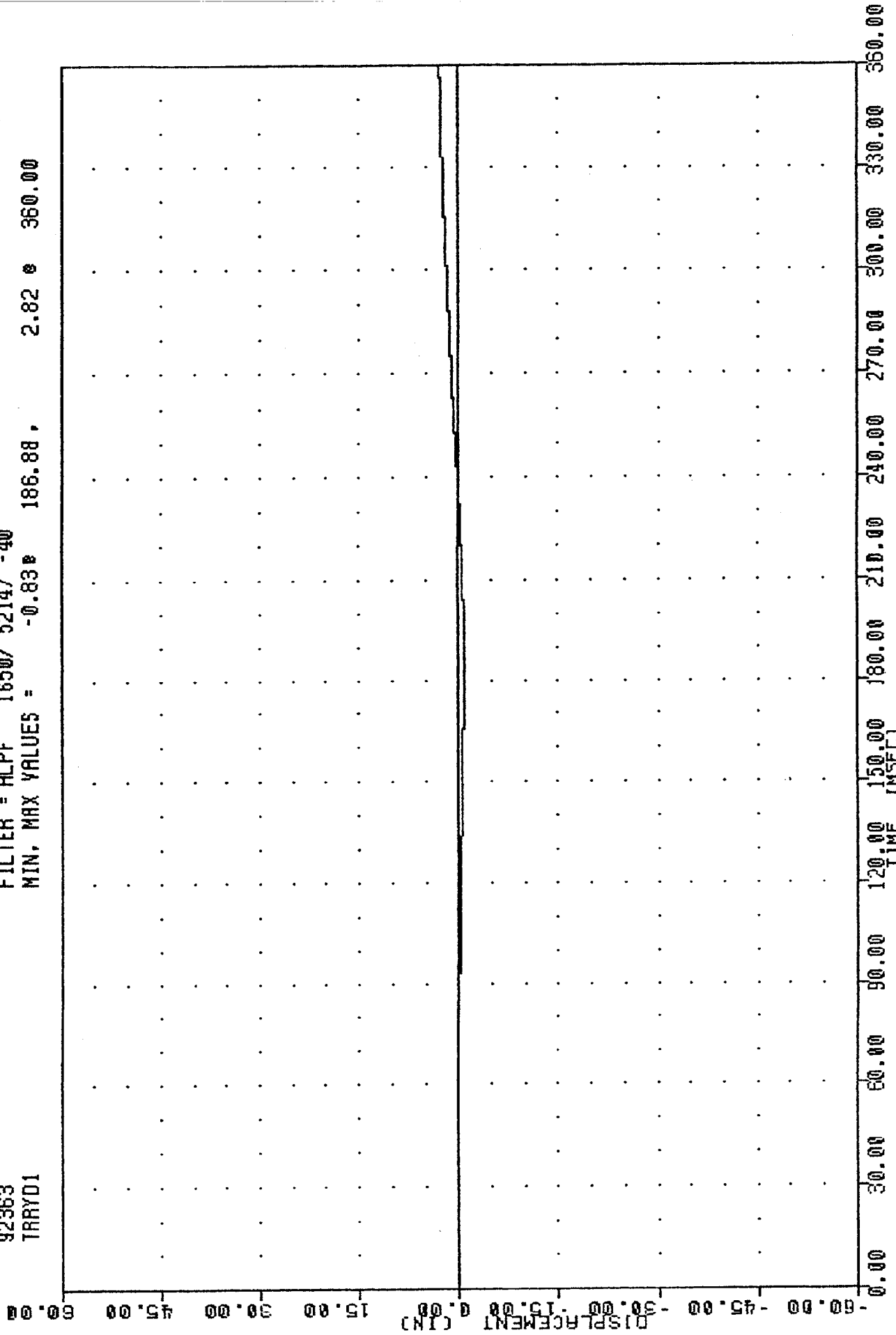
FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = -0.698 140.88 1.85 e 251.25



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 RIGHT REAR SEAT Y-AXIS VELOCITY

TRC . 921228
 HEAVY TRUCK UNDERRIDE
 92363
 TRRYD1

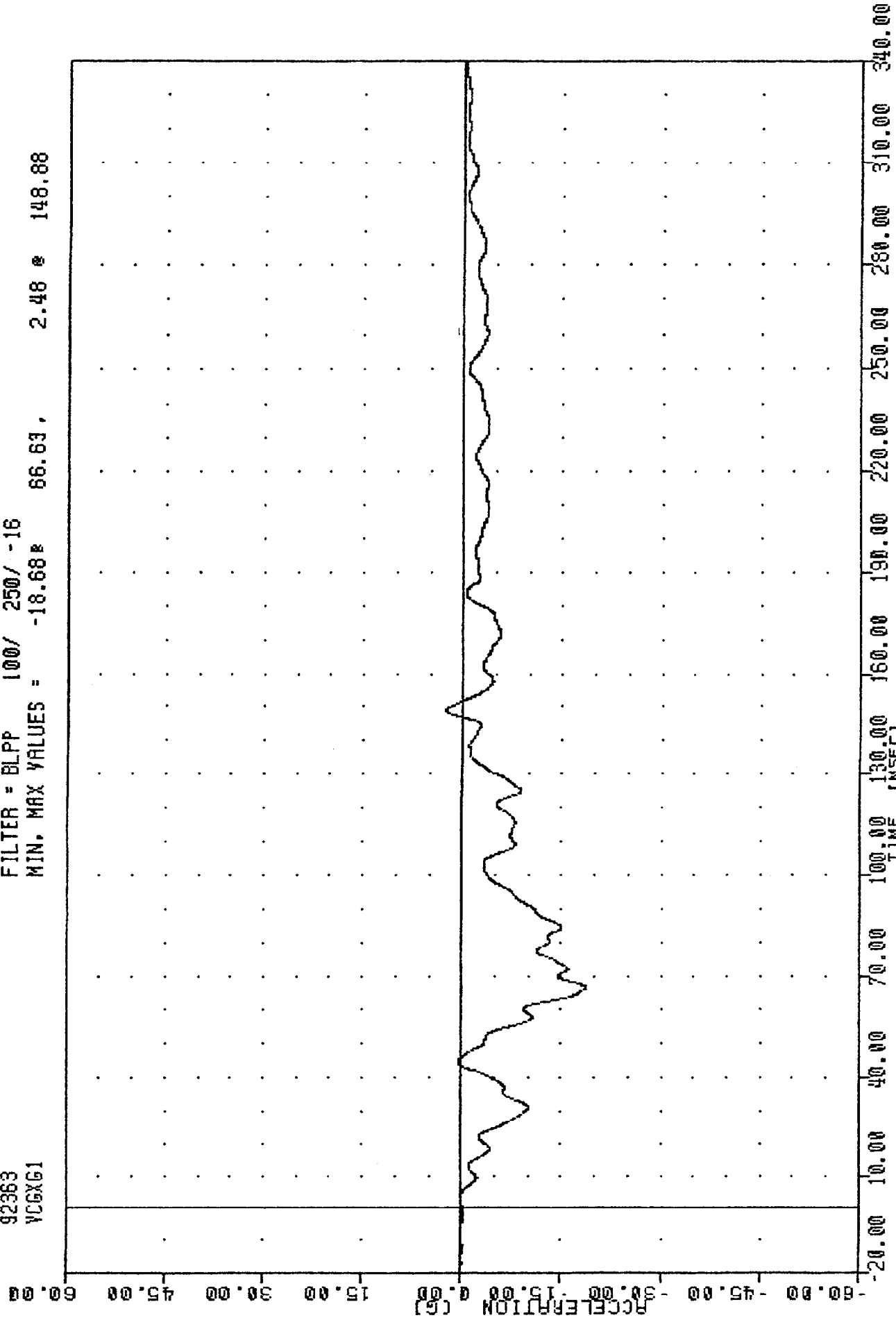
FILTER = ALPF 1650/ 5214/ -40
 MIN, MAX VALUES = -0.83 186.88 , 2.82 360.00



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 RIGHT REAR SEAT Y-AXIS DISPLACEMENT

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
VCGXG1

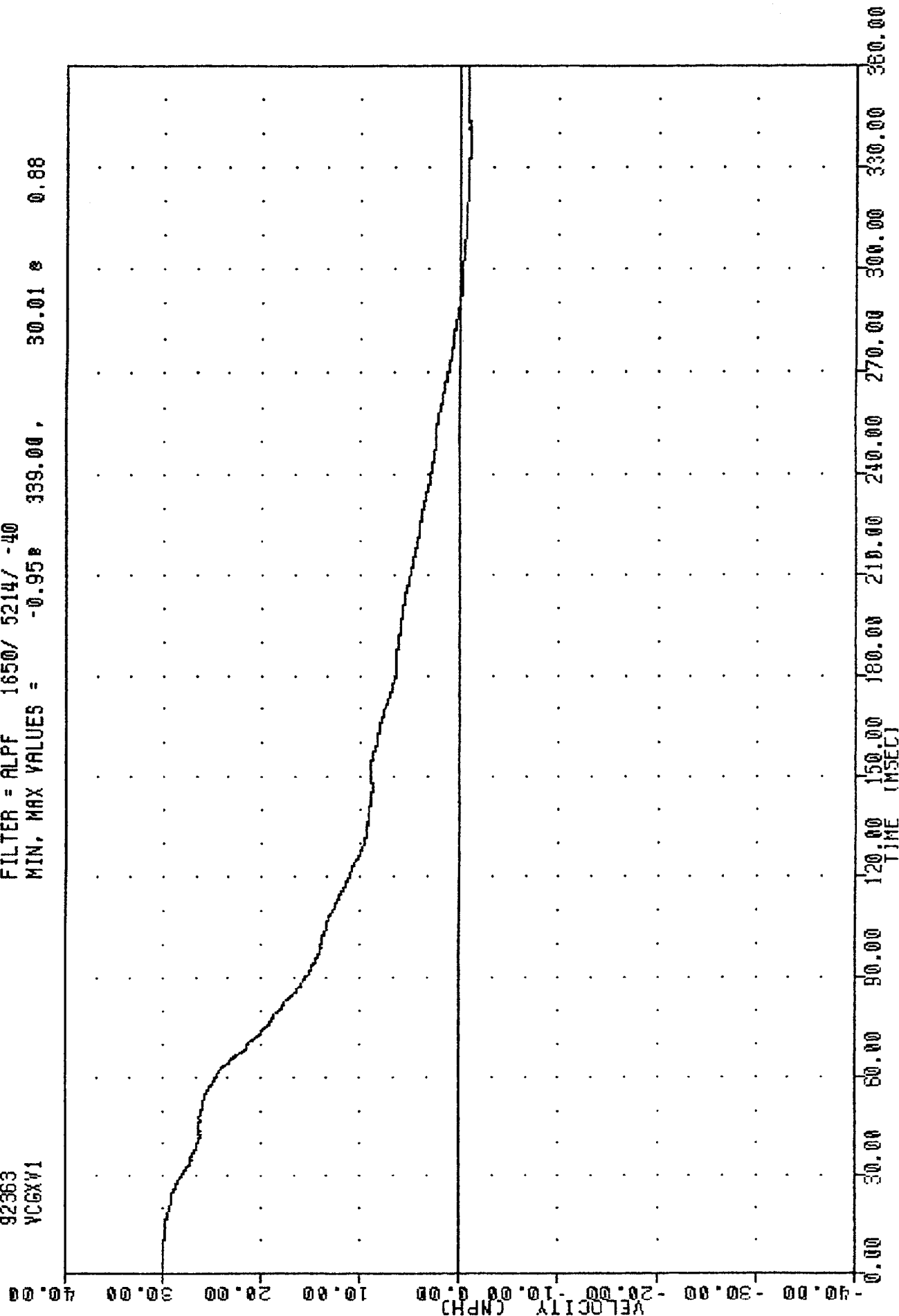
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -18.68 66.63, 2.48 148.88



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY X-AXIS ACCELERATION

TRC , 921228
HEAVY TRUCK UNDERRIDE
92363
YCGXV1

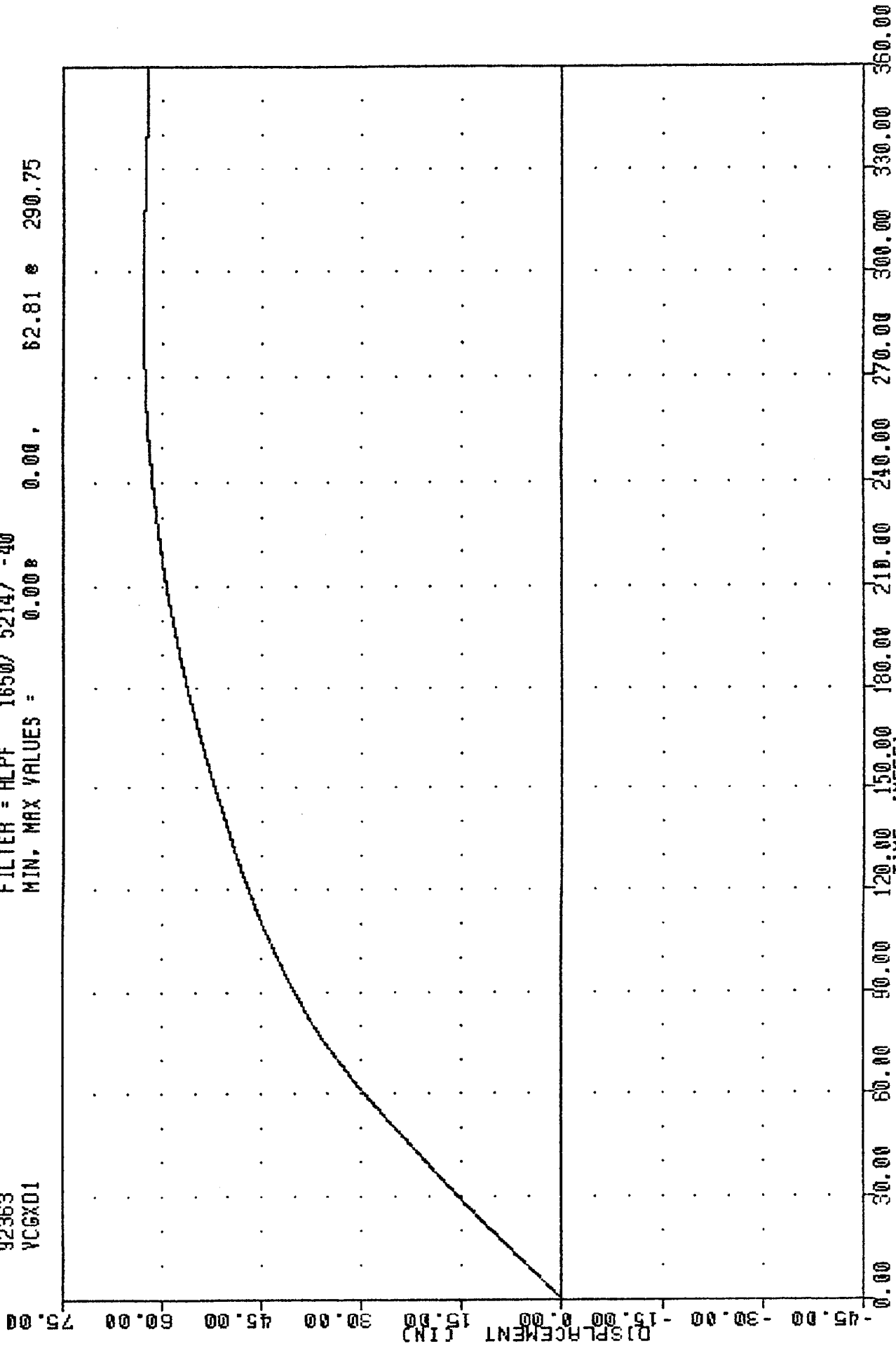
FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -0.95 339.00, 30.01 0.88



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY X-AXIS VELOCITY

TRC
HEAVY TRUCK UNDERRIDE
92363
YCGXD1

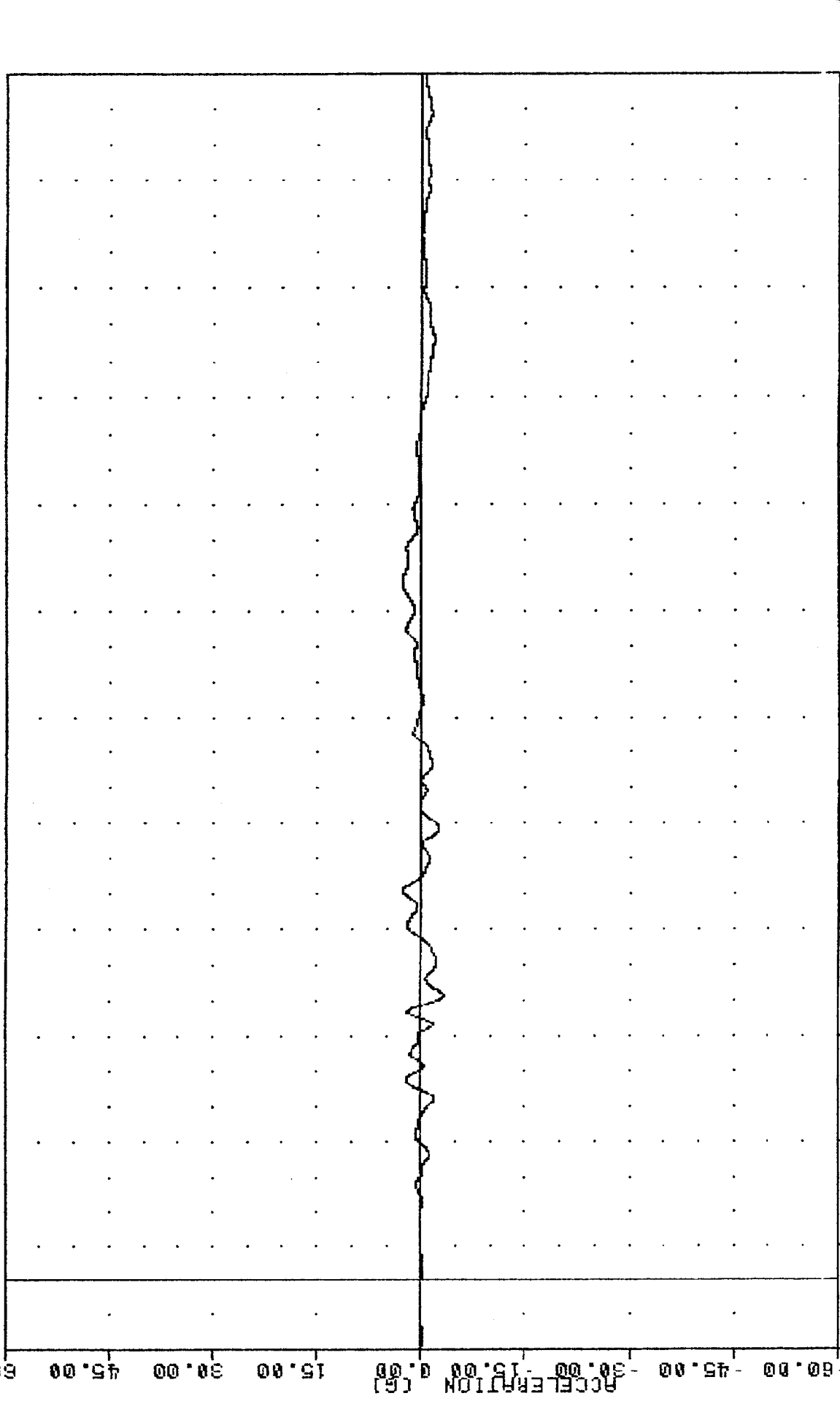
921228
1650/ 5214/ -40
MIN. MAX VALUES = 0.00 0.00 62.81 290.75



1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
CAR CENTER OF GRAVITY X-AXIS DISPLACEMENT

TAC , 921228
 HEAVY TRUCK UNDERRIDE
 92363
 YCGYG1

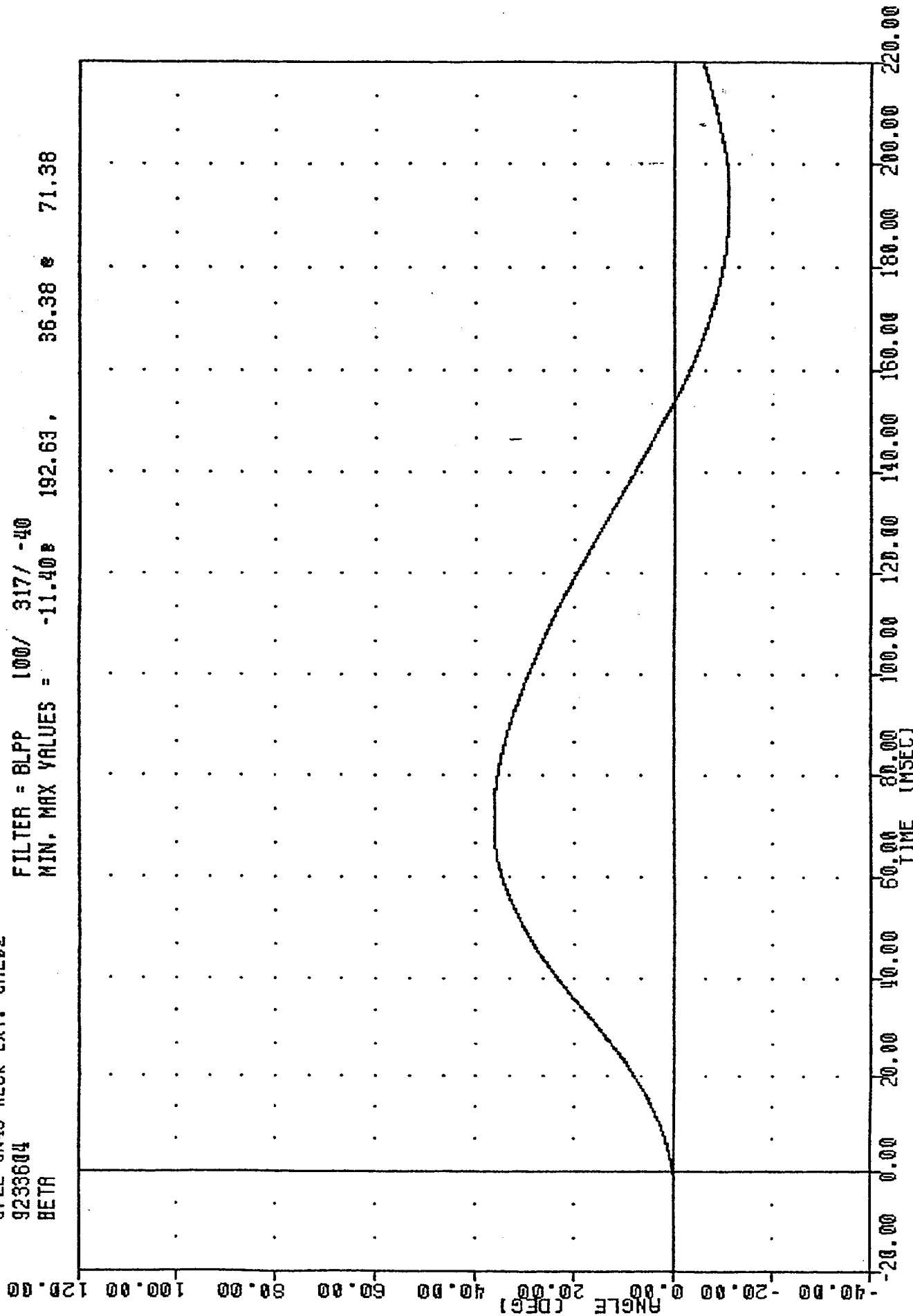
FILTER = BLPP 100/ 250/ -16
 MIN, MAX VALUES = -3.38 81.25, 2.67 e 110.75



-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00
 TIME (MSEC)
 1993 SATURN SL INTO HEAVY TRUCK REAR UNDERRIDE GUARD
 CAR CENTER OF GRAVITY Y-AXIS ACCELERATION

TRC , 43C2NEJ
 572E SN49 NECK EXT. CALD02
 9233604
 BETA

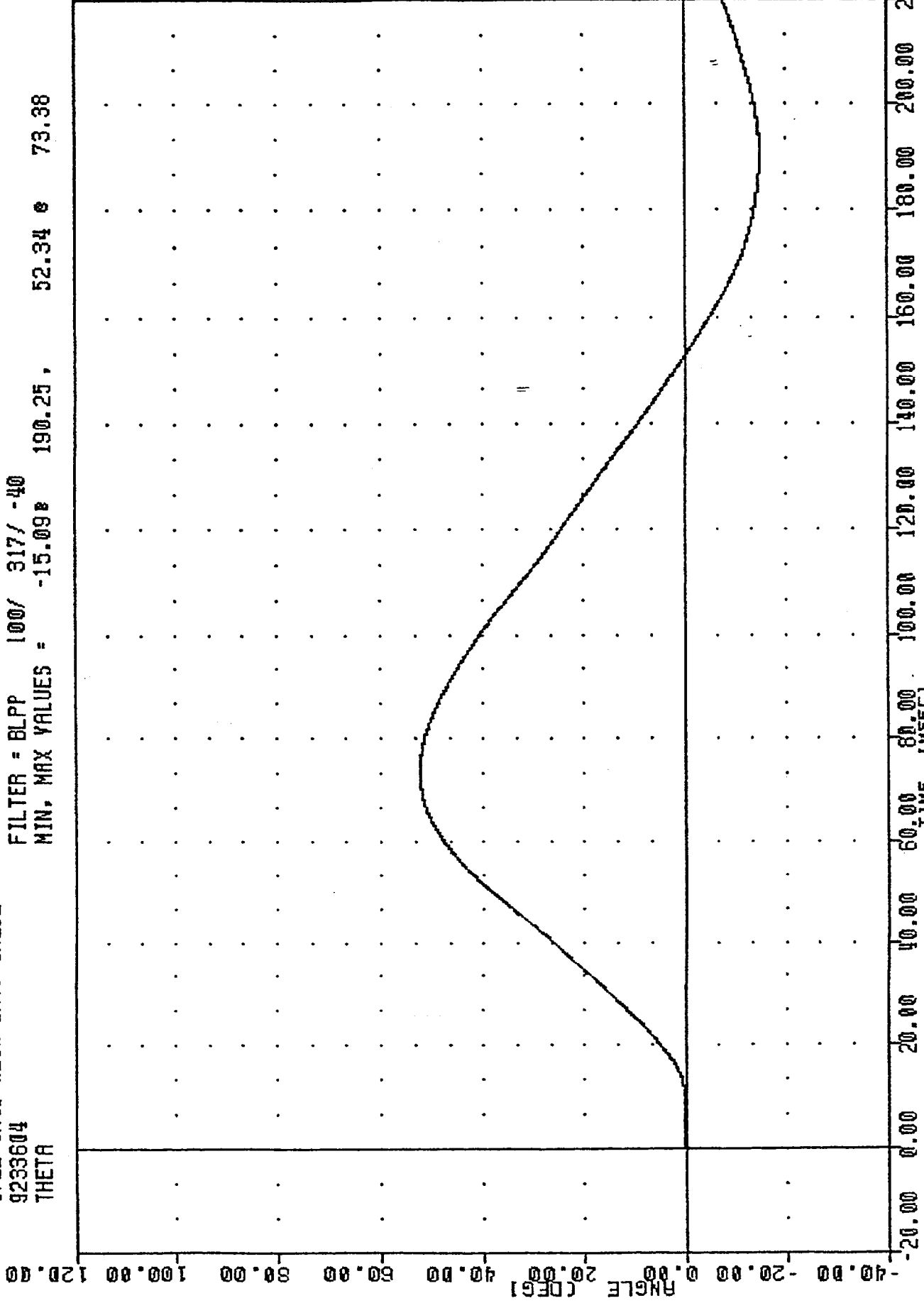
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -11.40 192.63 , 36.38 e 71.38



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

TRC
 572E SN43 NECK EXT. CAL02
 9233604
 THETA

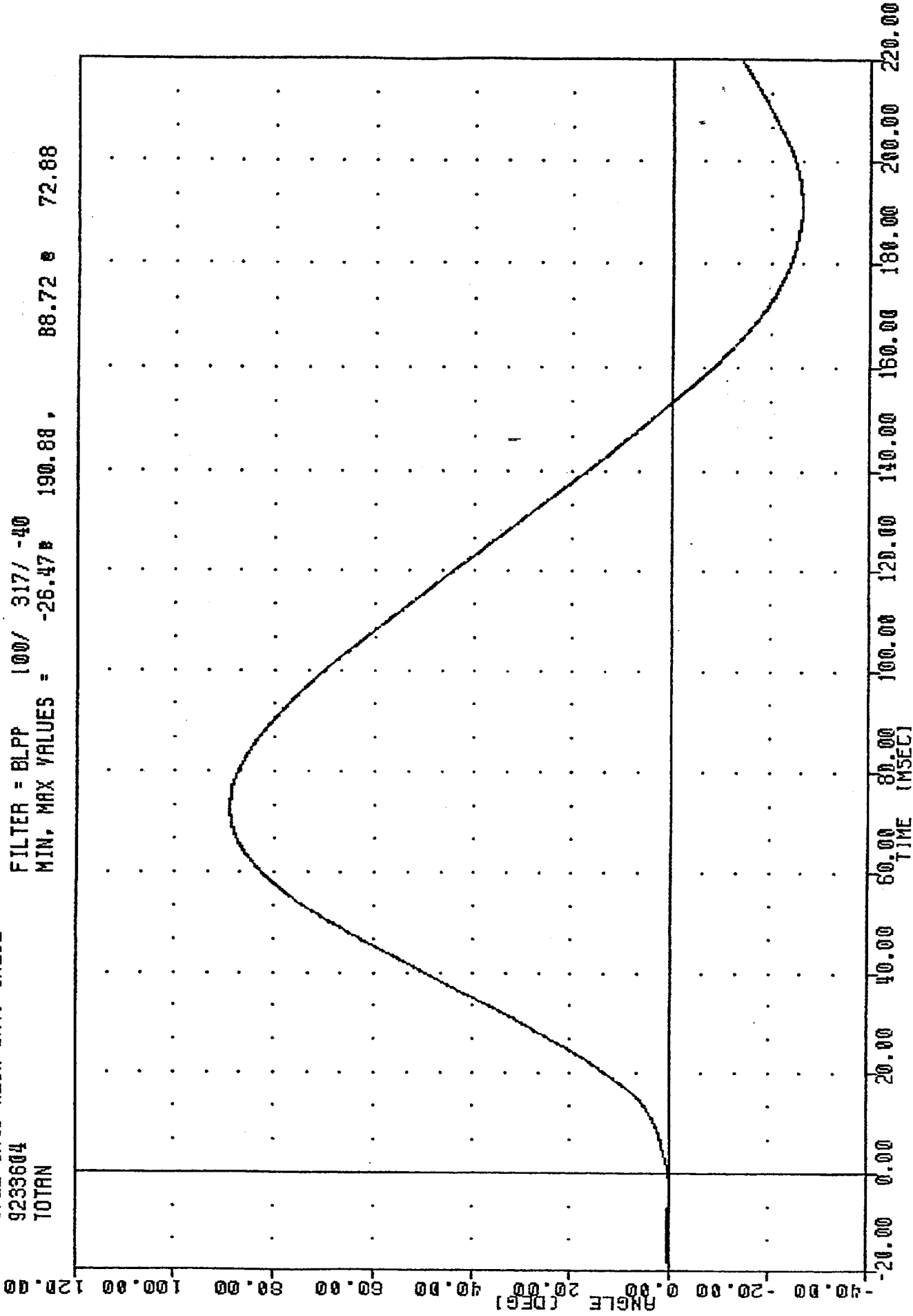
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -15.098 190.25, 52.34 73.38



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 ANIMATION ARBITRARY CONDYF

TRC , 43C2NE1
572E SN49 NECK EXT. CALD2
9233604
TOTAN

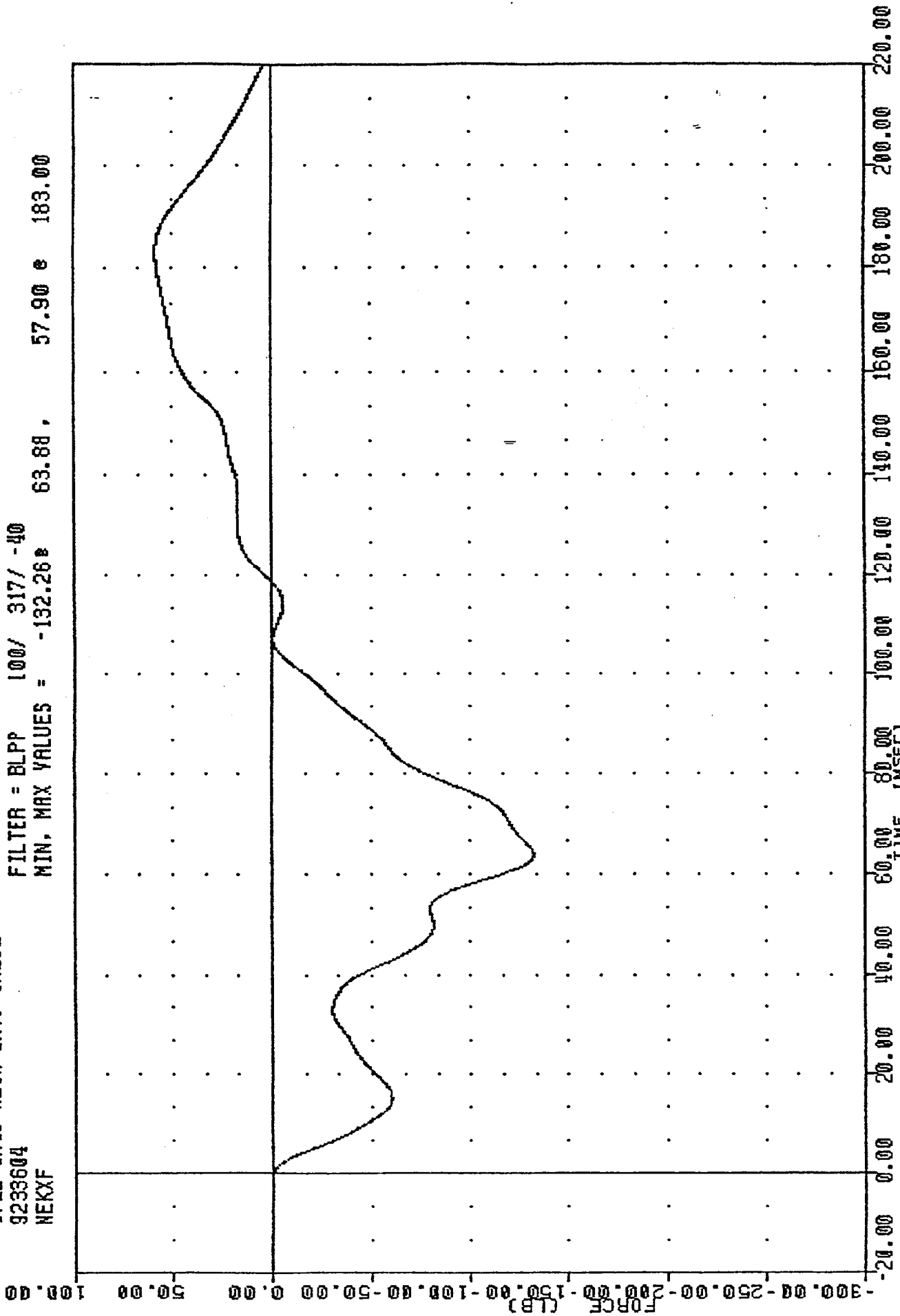
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -26.47# 190.88, 88.72# 72.88



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL ROTATION

TRC
572E SN49 NECK EXT. CALD2
9233604
NEKYF

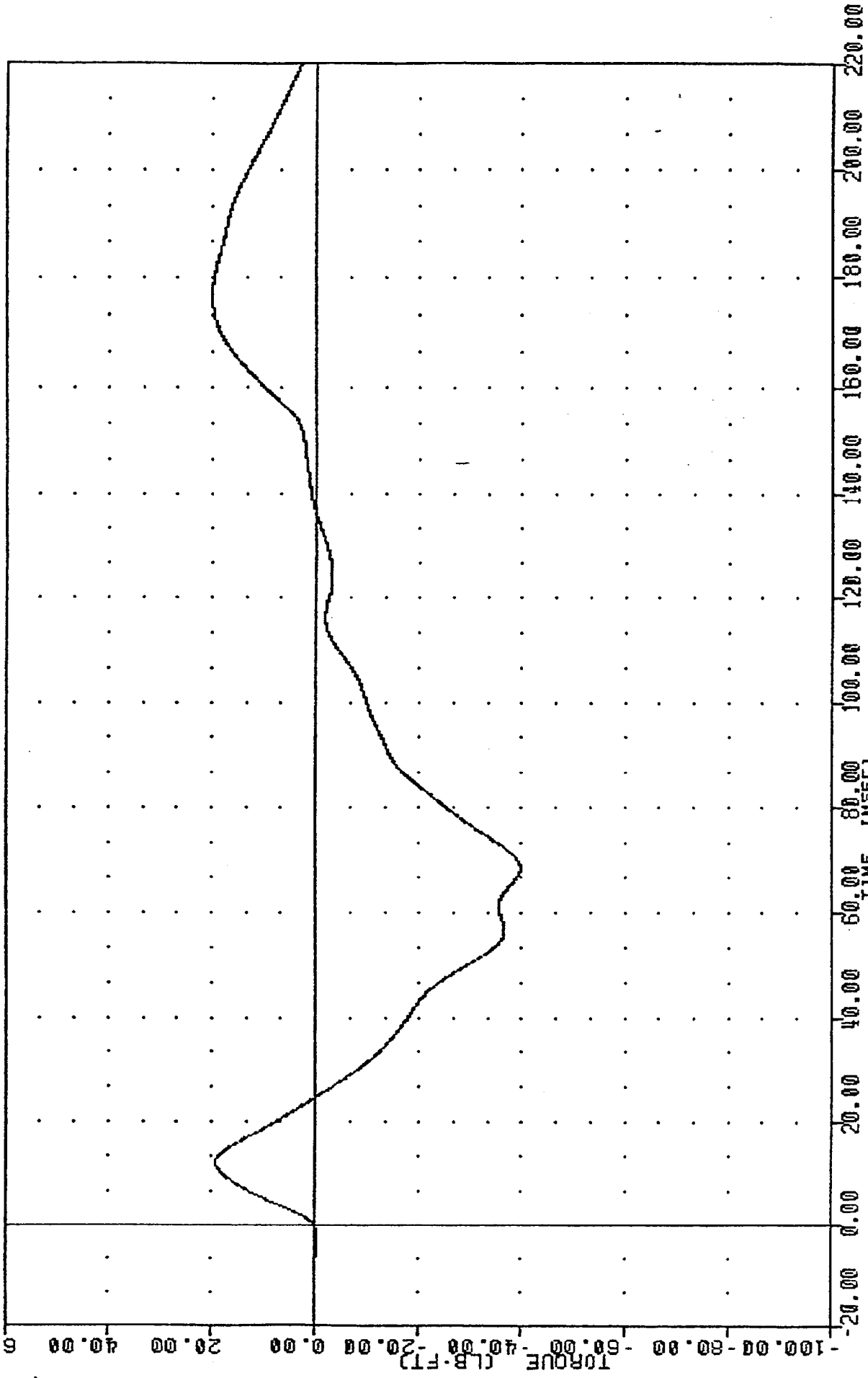
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -132.26 63.88 . 57.90 e 183.00



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

TRC
572E SN49 NECK EXT. CALD2
9233604
NEKYM

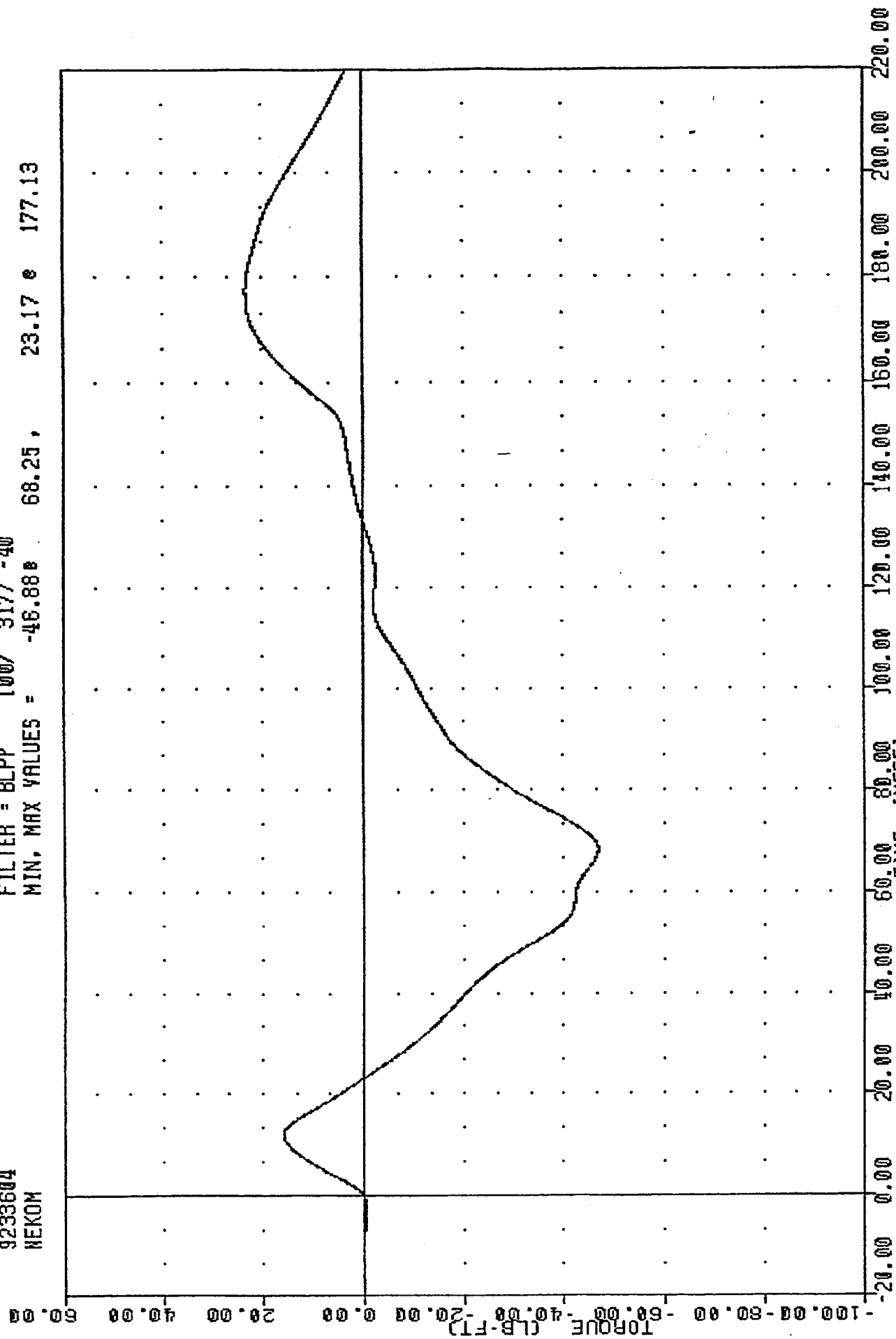
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -39.71 68.50 19.90 176.63



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

TRC
572E SN43 NECK EXT. CALIB2
9233604
NEKOM

FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -46.88 68.25, 23.17 177.13



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

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

HYBRID III

01-DEC-92

TRC

43C2TH1

572E SN43 H.S.THORAX CAL02

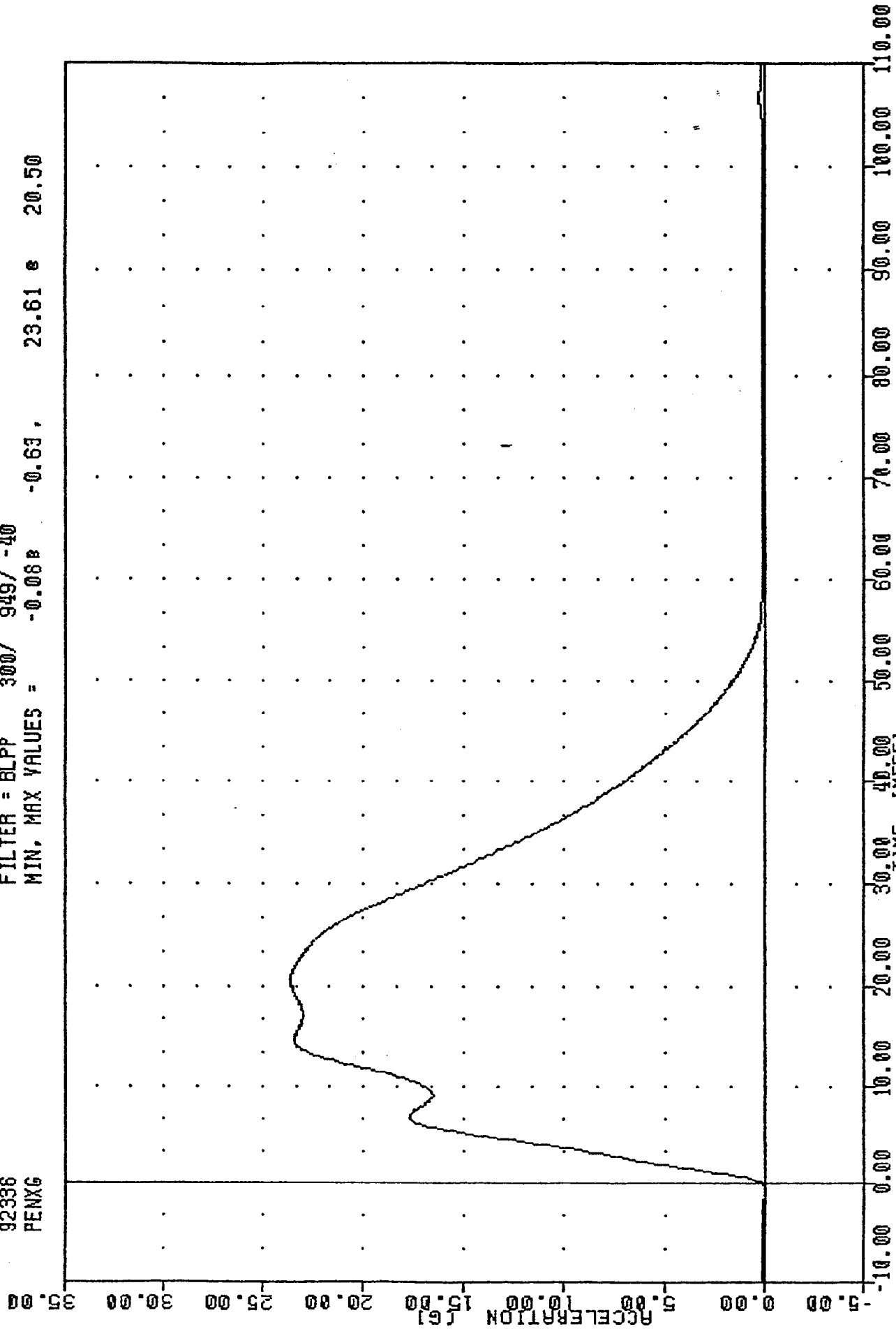
HIGH SPEED TEST		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	48.0 %
PENDULUM VELOCITY	21.6-22.4 FT/SEC	21.91 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 IN	2.70 IN
MAXIMUM RESISTIVE FORCE	1160 - 1325 LBS	1215.9 LBS
INTERNAL HYSTERESIS	69% - 85%	74.9%

TEST MEETS SPECIFICATIONS

TECHNICIAN *Pete Faust*

TRC
572E SN43 H.S. THORAX CAL02
92336
PENXG

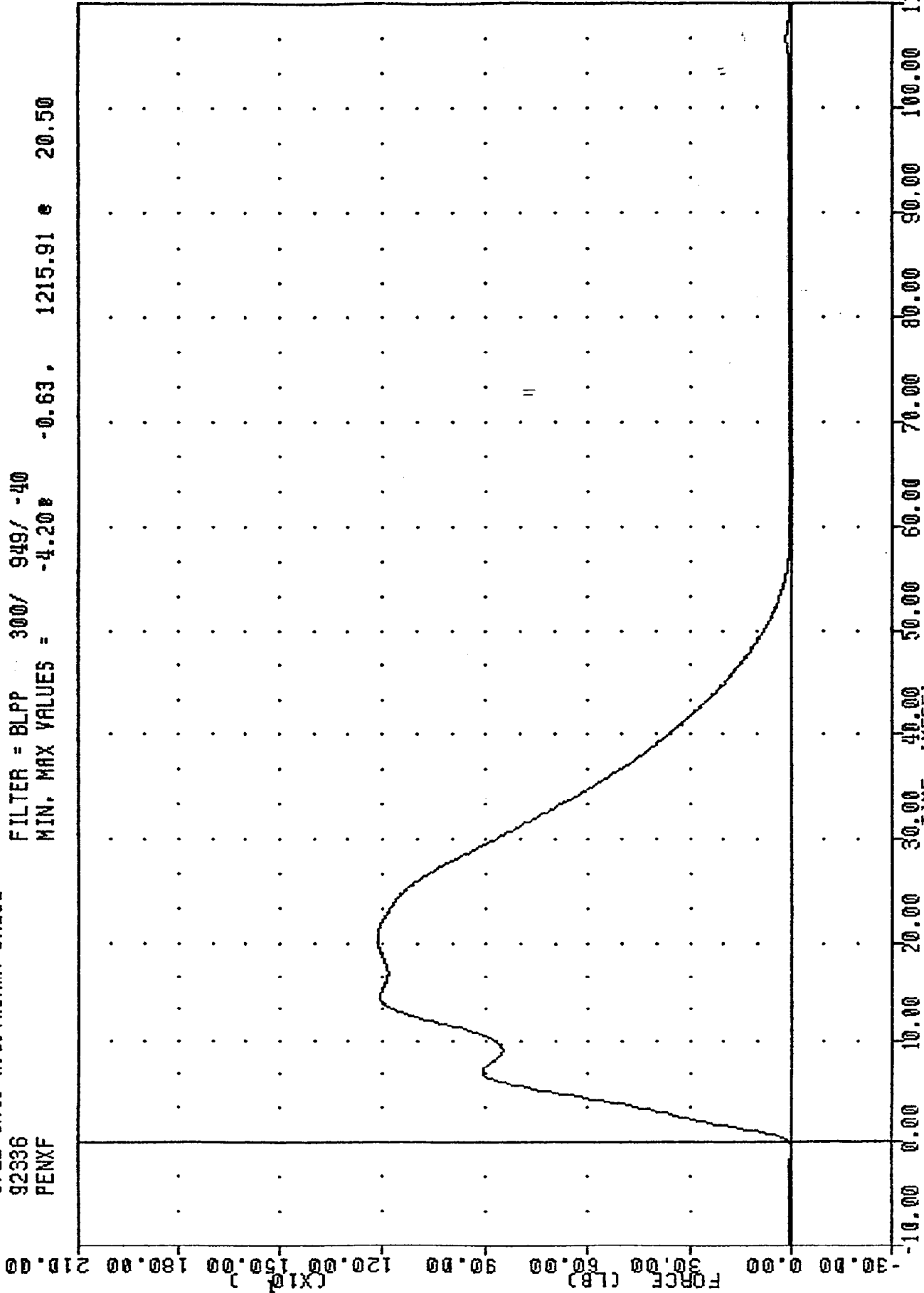
FILTER = BLPP 300/ 949/ -40
MIN. MAX VALUES = -0.088 -0.63 , 23.61 e 20.50



PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM DECELERATION

TRC
 572E SN43 H.S. THORAX CAL02
 92336
 PENXF

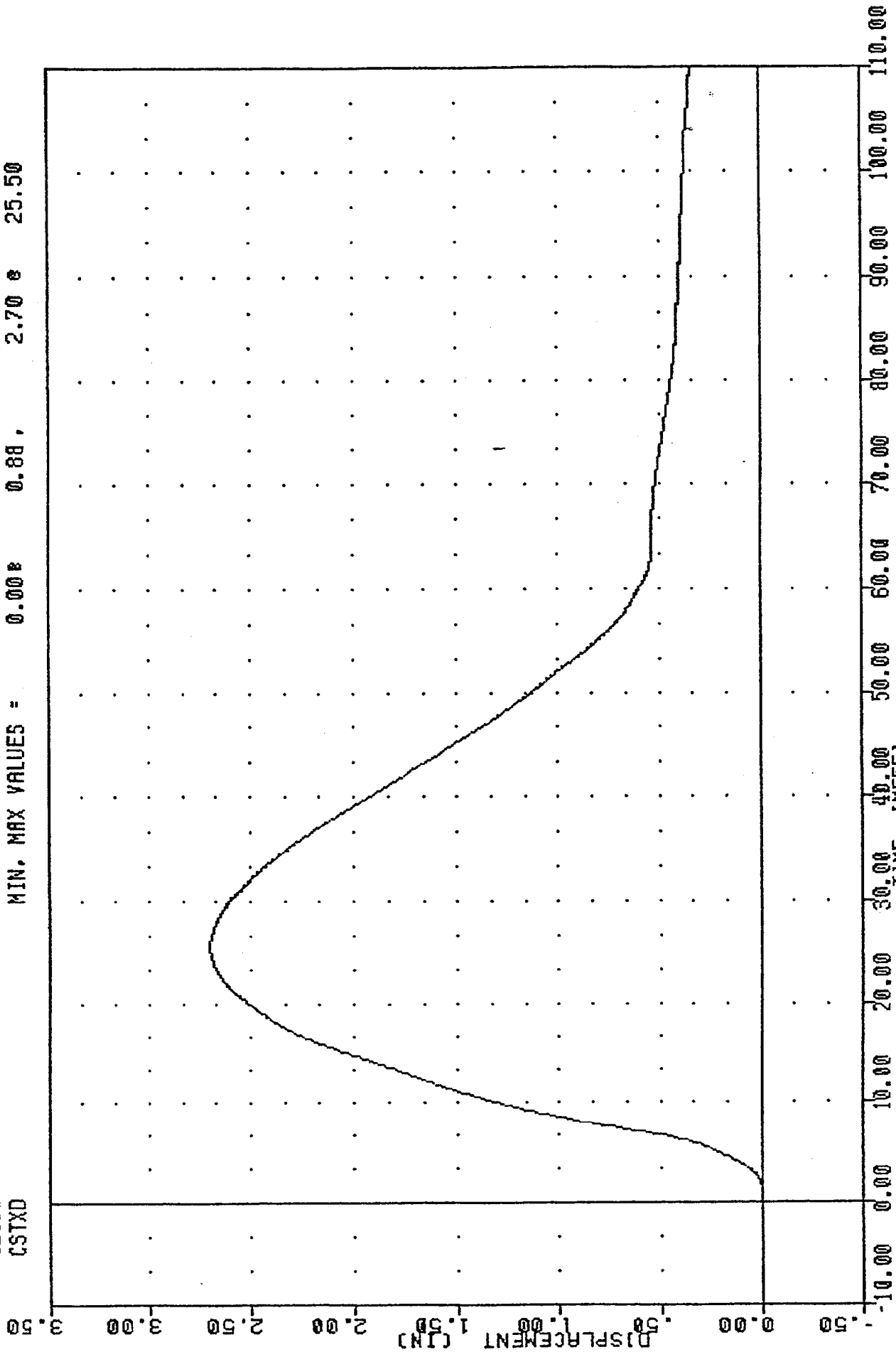
FILTER = BLPP 300/ 949/ -40
 MIN. MAX VALUES = -4.20* -0.63. 1215.91 e 20.50



PART 572-E HYBRID III THORAX CALIBRATION
 PENDULUM FORCE

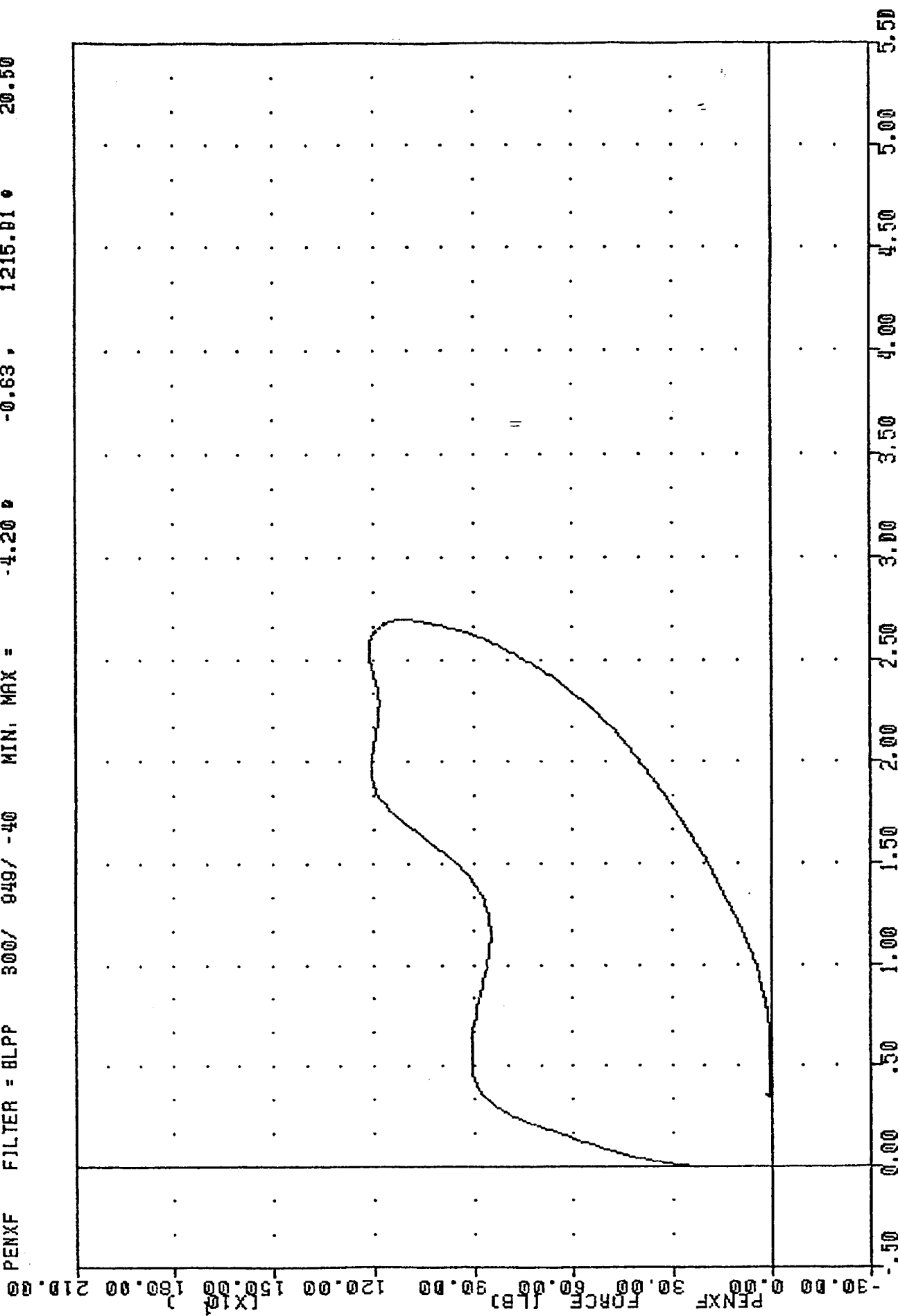
TRC
 572E SN49 H.S. THORAX CAL02
 92336
 CSTXD

FILTER = 8LPP 300/ 949/ -40
 MIN. MAX VALUES = 0.00 e 2.70 e 25.50



PART 572-E HYBRID III THORAX CALIBRATION
 STERNUM DISPLACEMENT

TRC 43C2TH1 572E SN43 H.S. THORAX CAL02 92335
 CSTXD FILTER = BLPP 300/ 949/ -40 MIN, MAX = 0.00 0.88 2.70 25.50
 PENXF FILTER = BLPP 300/ 949/ -40 MIN, MAX = -4.20 -0.63 1215.91 20.50



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

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

01-DEC-92

RIGHT KNEE

TRC

43C2RK1

572E SN43 RIGHT KNEE CAL02

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	32.0 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.86 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1211.70 LBS
PROBE WEIGHT	11.0 LBS	

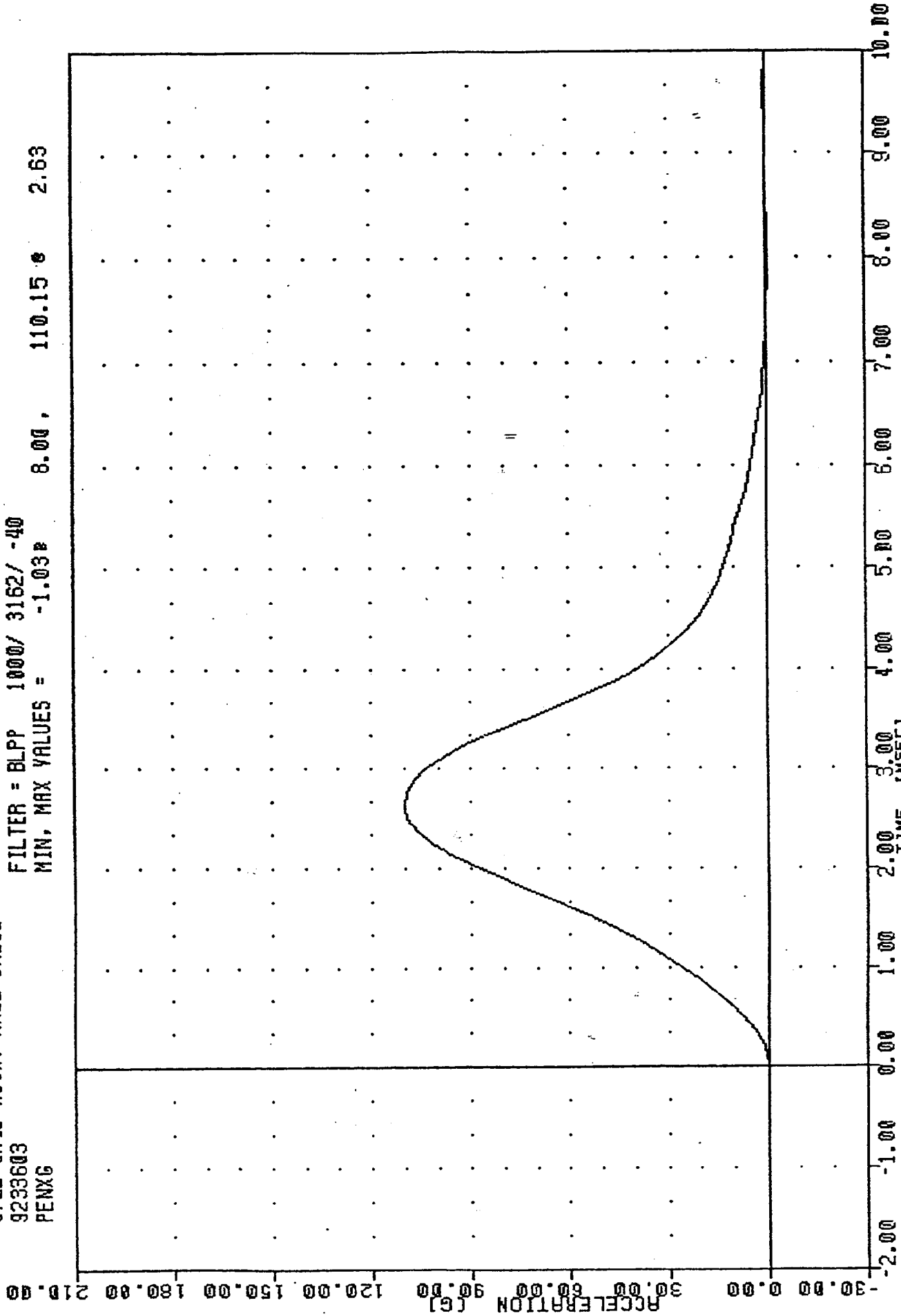
TEST MEETS SPECIFICATIONS

TECHNICIAN

Pete Font

TRC
572E SN49 RIGHT KNEE CAL02
9233603
PENXG

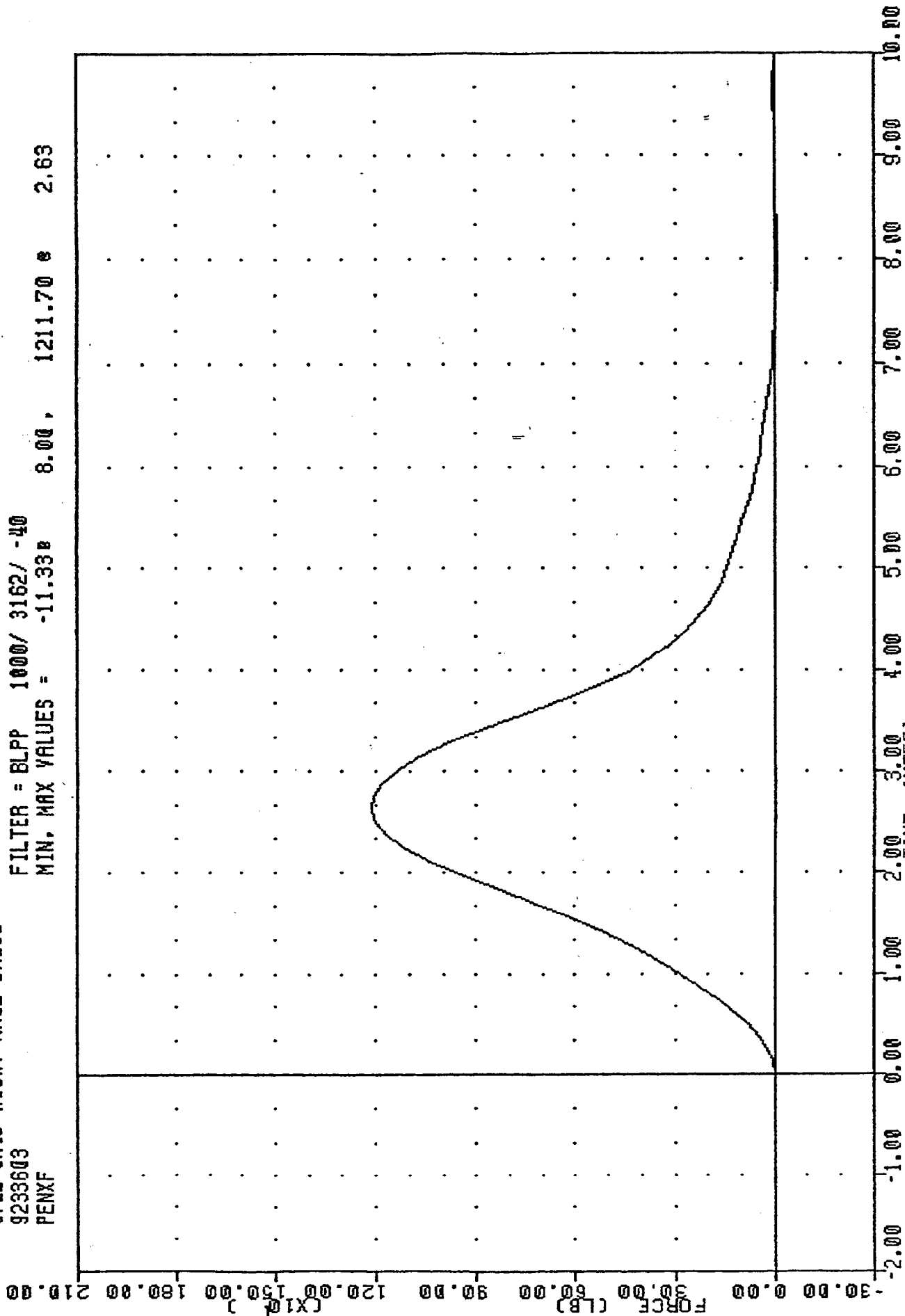
FILTER = BLPP 1000/ 3162/ -40
MIN, MAX VALUES = -1.038 8.00, 110.15 2.63



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

TRC
 572E SN43 RIGHT KNEE CAL02
 9233603
 PENXF

FILTER = BLPP 1000/ 3162/ -40
 MIN. MAX VALUES = -11.33# 8.00, 1211.70 # 2.63



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

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

01-DEC-92

LEFT KNEE

TRC

43C2LK1

572E SN43 LEFT KNEE CAL02

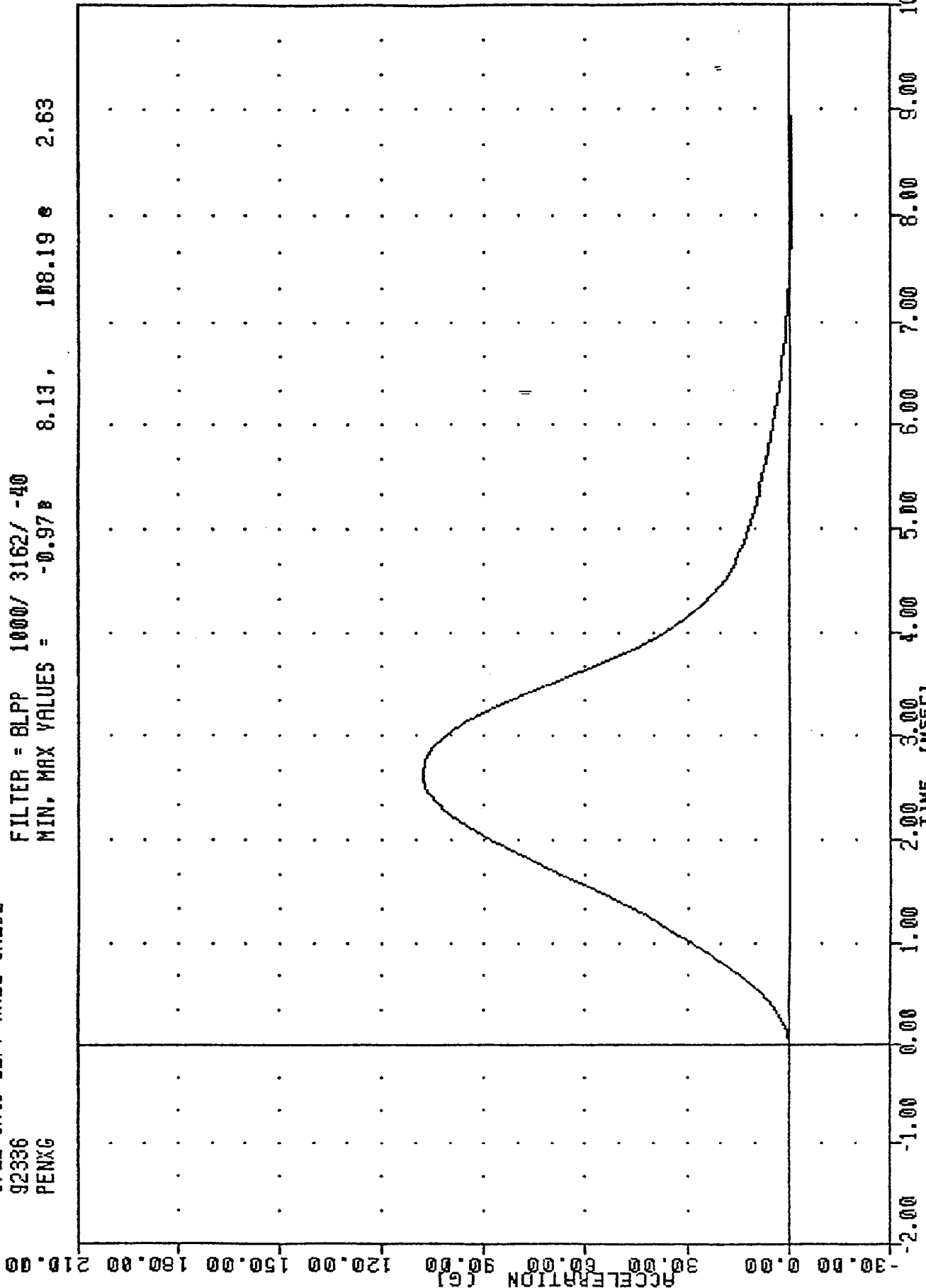
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	32.0 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.89 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1190.09 LBS
PROBE WEIGHT	11.0 LBS	

TEST MEETS SPECIFICATIONS

TECHNICIAN *Steve Fount*

TRC
 572E SN43 LEFT KNEE CALD2
 92336
 PENXG

FILTER = BLPP 1000/ 3162/ -40
 MIN. MAX VALUES = -0.97 8.13, 108.19 e 2.63

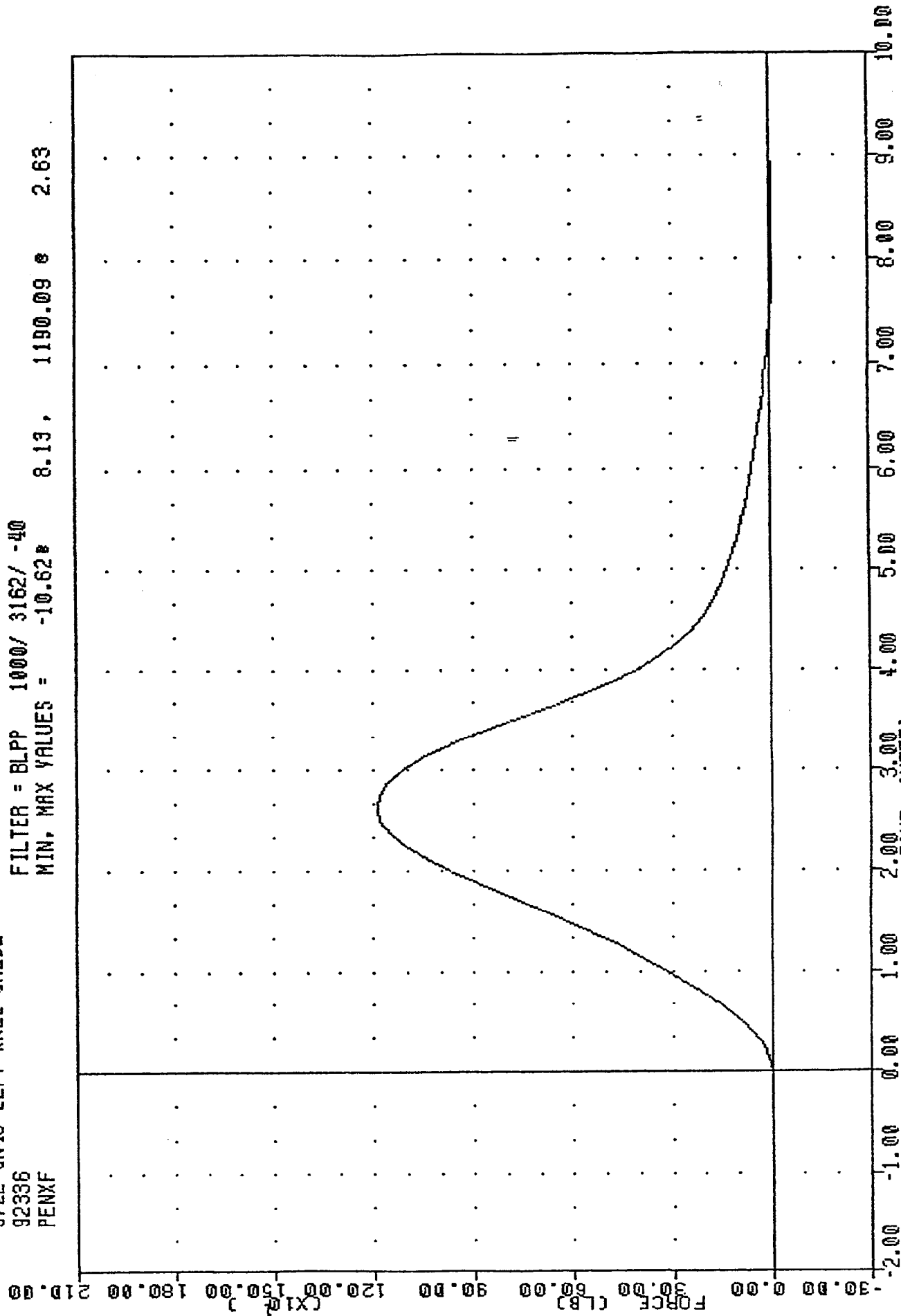


PART 572-E HYBRID III LEFT KNEE CALIBRATION
 PENNILLUM DECELERATION (11 LB PEND.)

TRC
 572E SN49 LEFT KNEE CALD2
 92336
 PENXF

43C2LK1

FILTER = BLPP 1000/ 3162/ -40
 MIN, MAX VALUES = -10.62 8.13, 1190.09 2.63



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

PRE-TEST CERTIFICATION DATA

PASSENGER DUMMY S/N 048

TRANSPORTATION RESEARCH CENTER OF OHIO
HYBRID III EXTERNAL DIMENSIONS
48C5ED1 HUMANOID

16-DEC-92

TRC	48C5ED1	572E SN48 EXT. DIMENSION CAL05
TEST PARAMETER	(DIMEN.)	SPECIFICATION TEST RESULTS
TEMPERATURE		70.0 DEG. F
RELATIVE HUMIDITY		45.0 %
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 (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 23.5 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 Fount

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

17-DEC-92

TRC

48C5HD1

572E SN48 HEAD DROP CAL 05

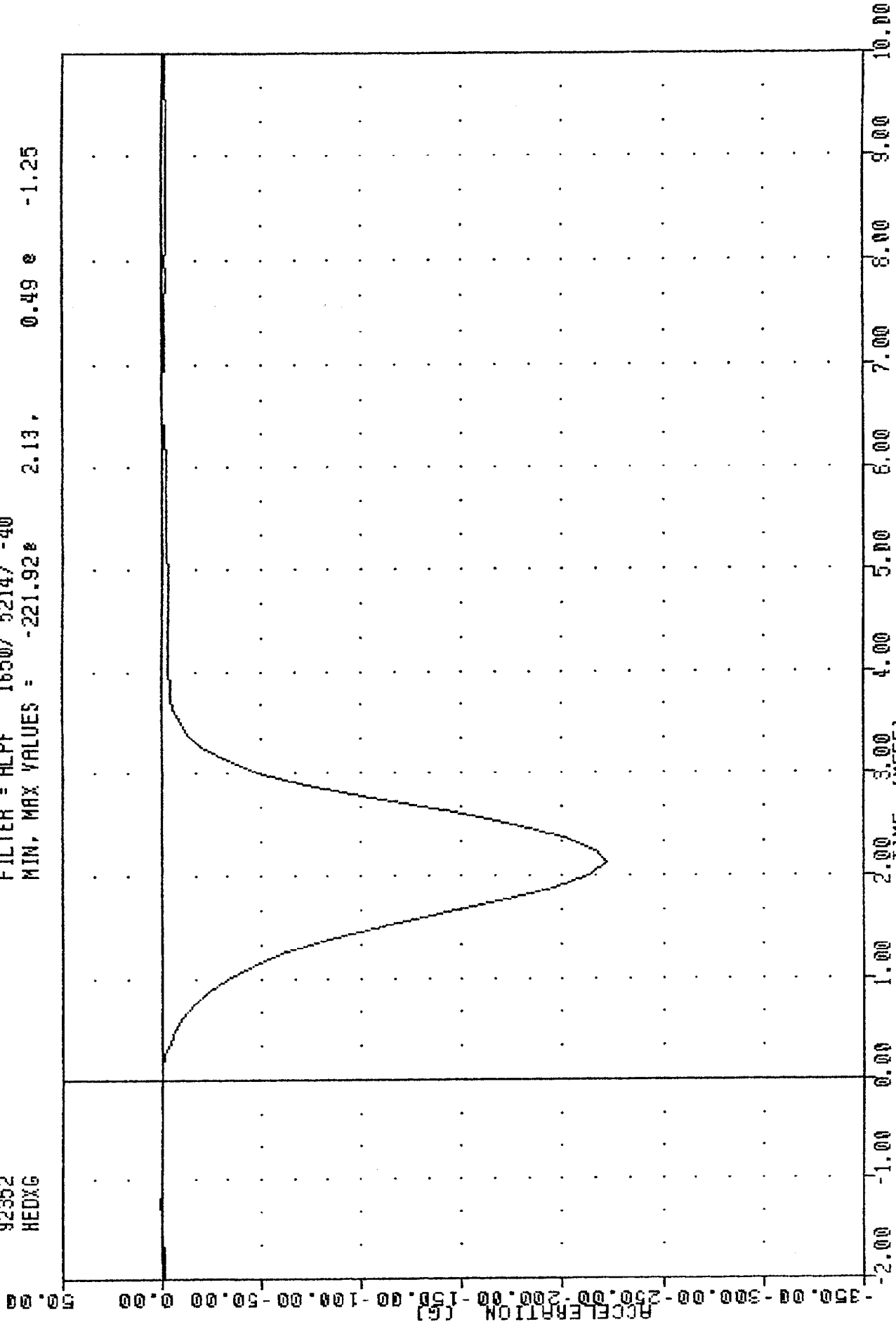
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	45.0 %
PEAK RESULTANT ACCELERATION	225 - 275 G	252.07 G
PEAK LATERAL ACCELERATION	15 G MAX	-4.70 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

TEST MEETS SPECIFICATIONS

TECHNICIAN *John Font*

TRC , 48C5HD1
572E SN48 HEAD DROP CAL 05
92352
HEDXG

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -221.92e 2.13, 0.49 e -1.25



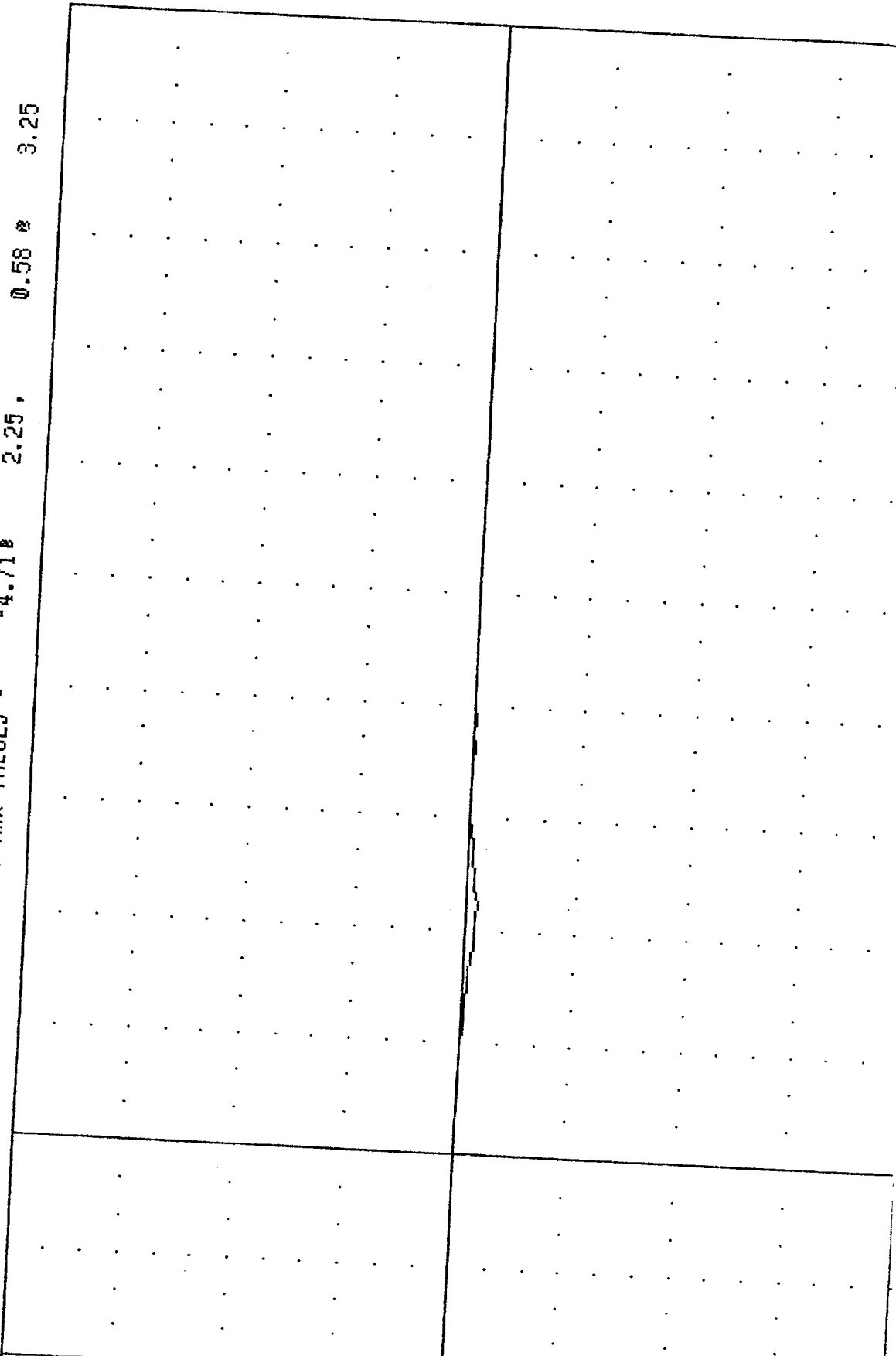
PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION X AXIS

TRC
572E SN48 HEAD DROP CAL 05
92352
HEDYG

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -4.718

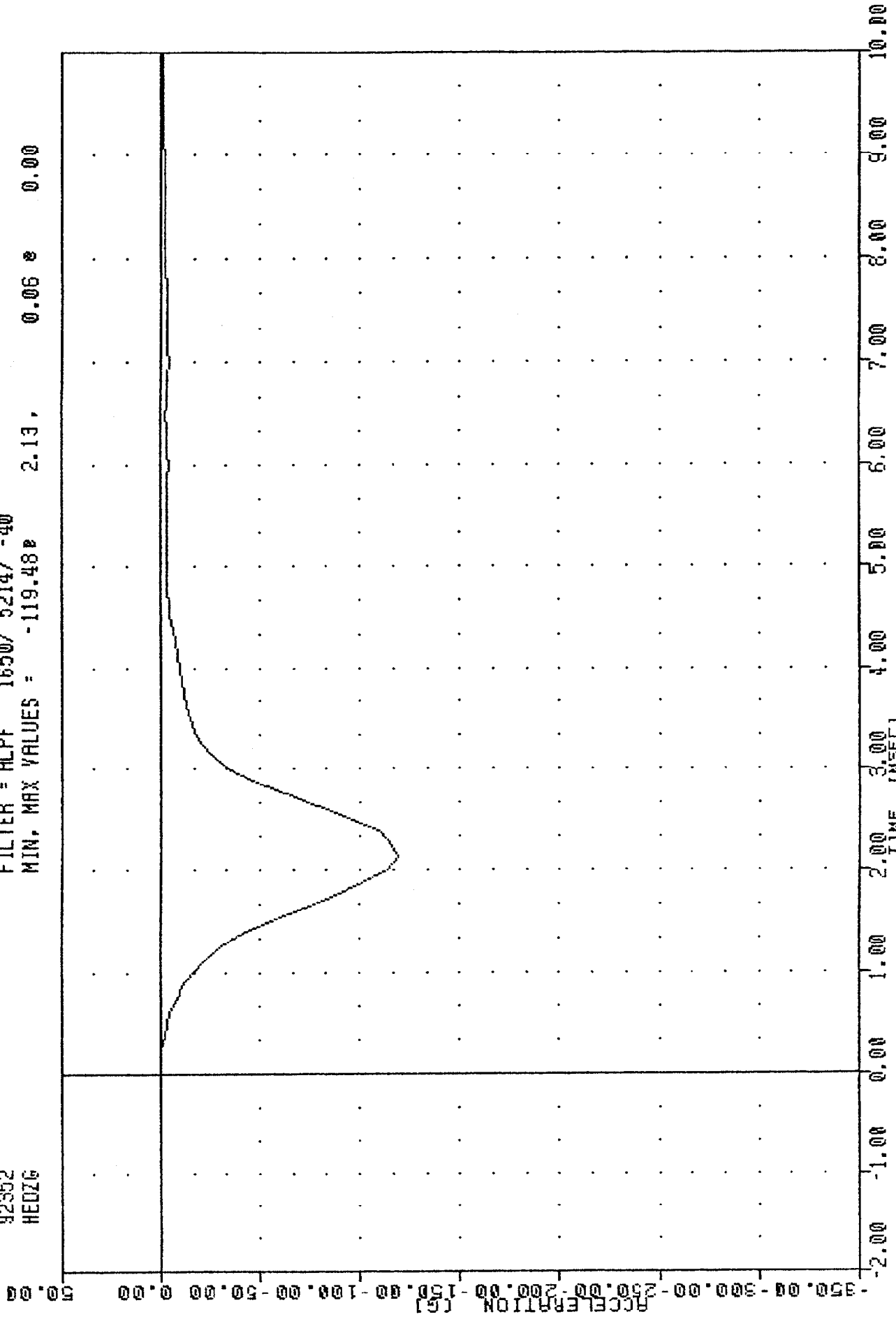
2.25, 0.58 3.25

ACCELERATION (G)
-200.00 -150.00 -100.00 -50.00 0.00 50.00 100.00 150.00 200.00



TRC , 48C5HD1
 572E SN48 HEAD DROP CAL 05
 92352
 HEADZ6

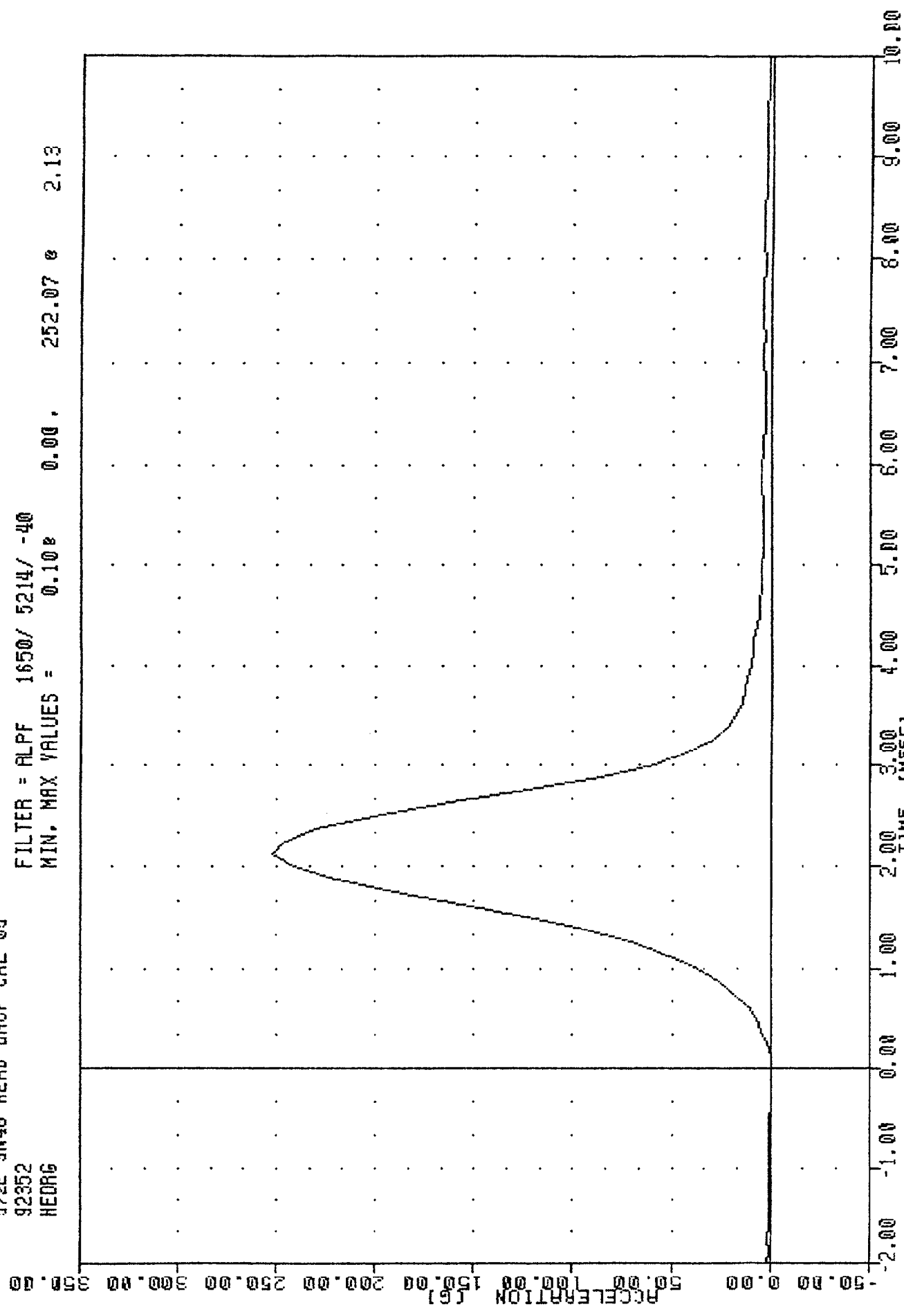
FILTER = ALPF 1650/ 5214/ -40
 MIN, MAX VALUES = -119.488 2.13, 0.06 * 0.00



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

TRC , 48C5HD1
 572E SN48 HEAD DROP CAL 05
 92352
 HEADG

FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = 0.10% 0.00 , 252.07 % 2.13



PART 572-E HYBRID III HEAD CALIBRATION
 HEAD RESONANT ACCELERATION

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

17-DEC-92

6 AXIS NECK TRANSDUCER
TRC 48C5NF1

572E SN48 NECK FLEXION CALOS

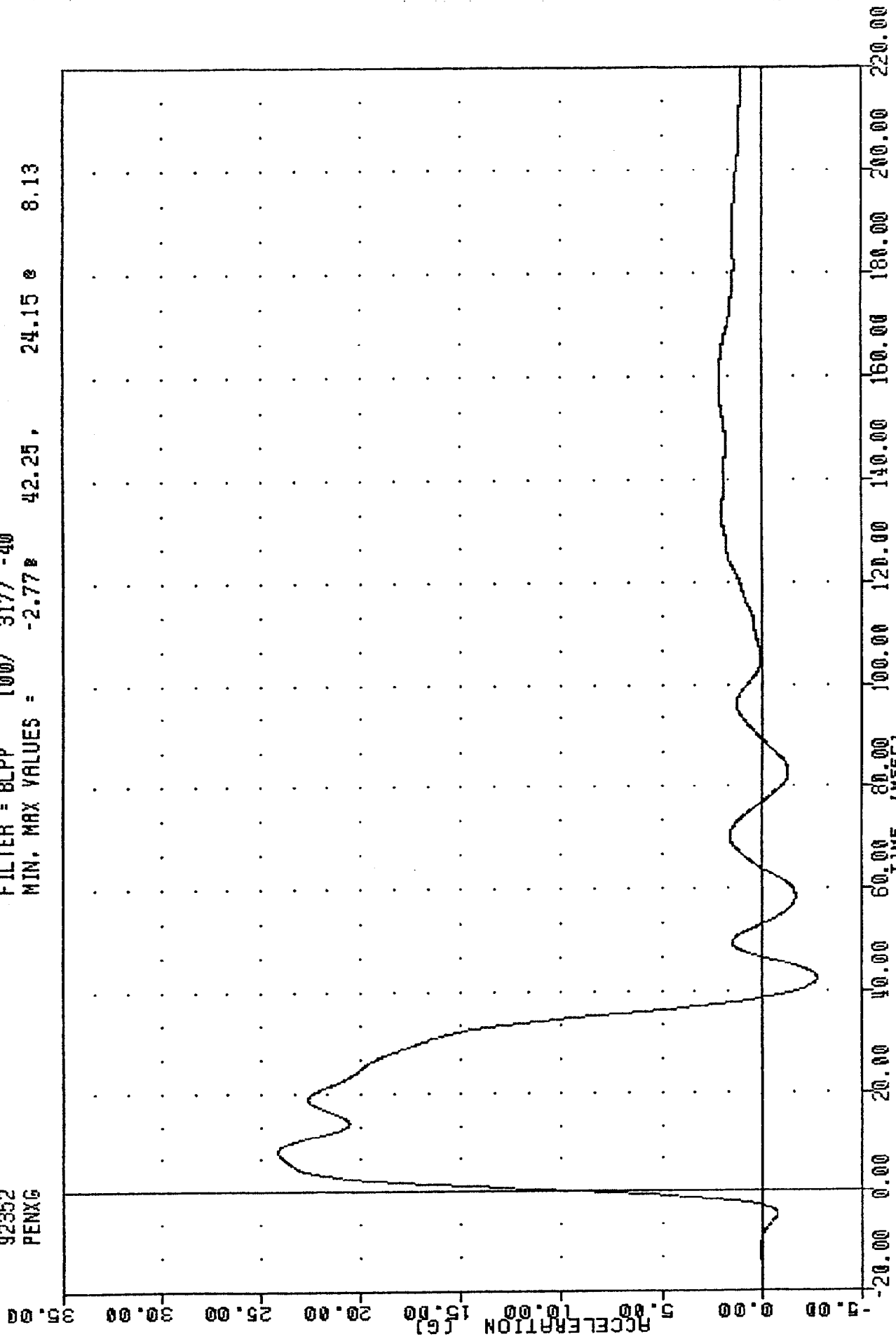
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	45.0 %
IMPACT VELOCITY	22.6 - 23.4 FT/SEC	23.08 FT/SEC
PENDULUM DECELERATION	10 MS 22.50 - 27.50 G	23.45 G
	20 MS 17.60 - 22.60 G	22.46 G
	30 MS 12.50 - 18.50 G	17.12 G
MAX PENDULUM G ABOVE 30 MS	29 G MAX	17.03 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G	34 - 42 MS	36.25 MS
D PLANE ROTATION	MAX 64 - 78 DEG.	72.73 DEG.
	TIME 57 - 64 MS	58.50 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX 65 - 80 FT. LBS	69.51 FT. LBS
	TIME 47 - 58 MS	49.63 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO	113 - 128 MS	115.88 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO	97 - 107 MS	98.00 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Font

TRC , 48C5NF1
572E SN48 NECK FLEXION CAL05
92352
PENXG

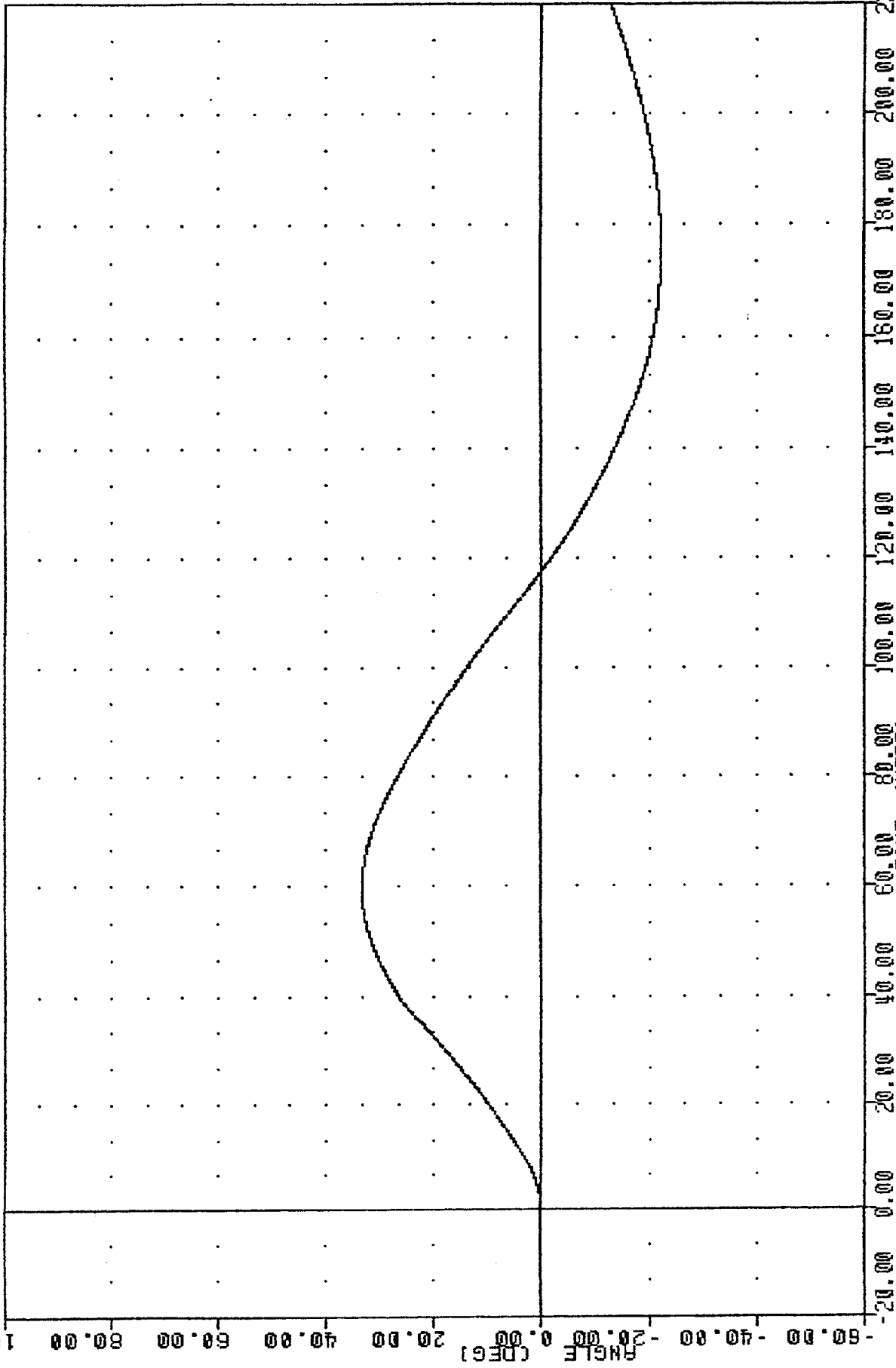
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -2.77 42.25 24.15 8.13



PART 572-E HYBRID III NECK FLEXION CALIBRATION
PENXG IM DIFFERENTIATION

TAC .48C5NF1
 572E SN48 NECK FLEXION CAL05
 92352
 BETA

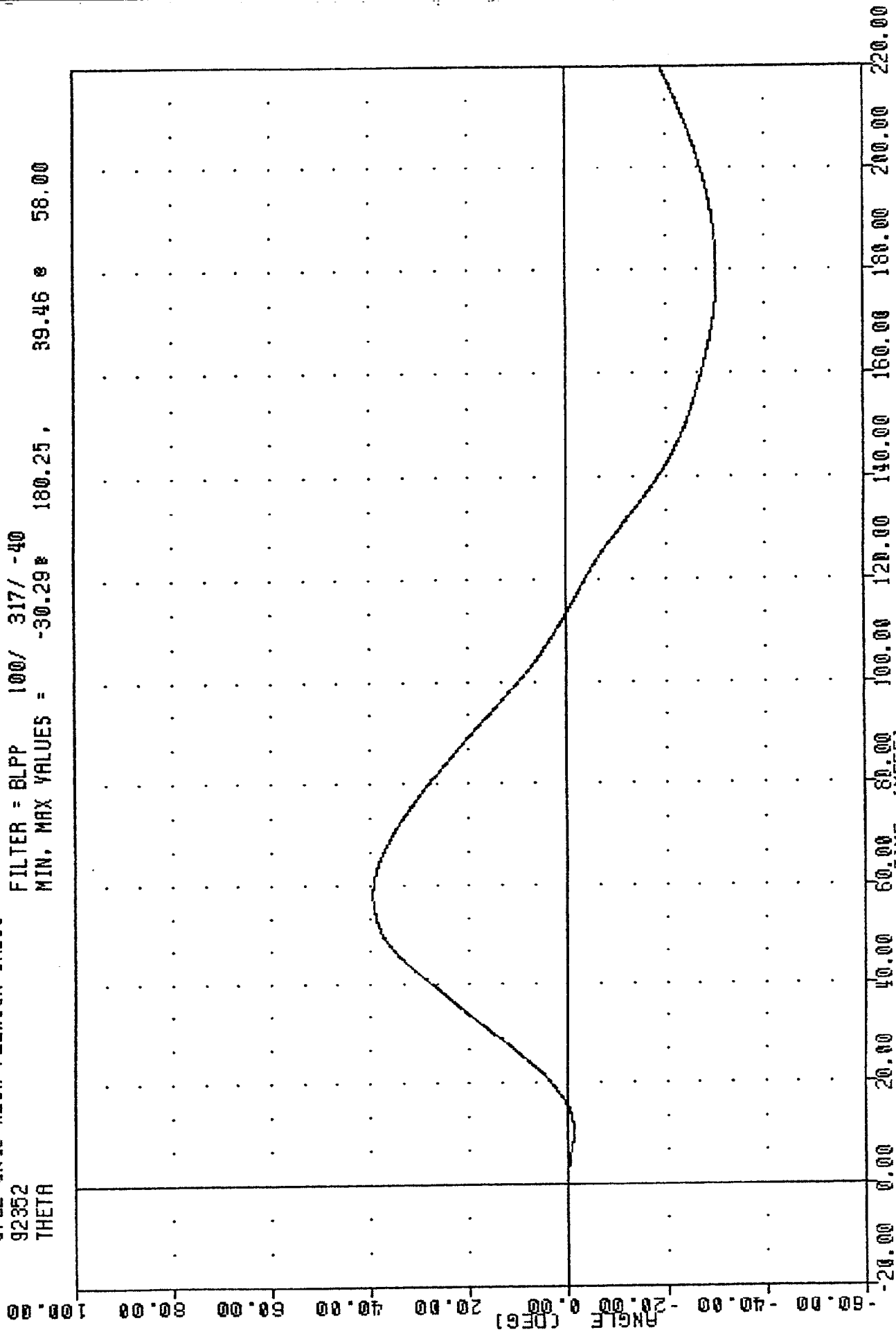
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -22.40 175.38, 33.31 59.88



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

TAC 48C5NF1
572E SN48 NECK FLEXION CAL05
92352
THETA

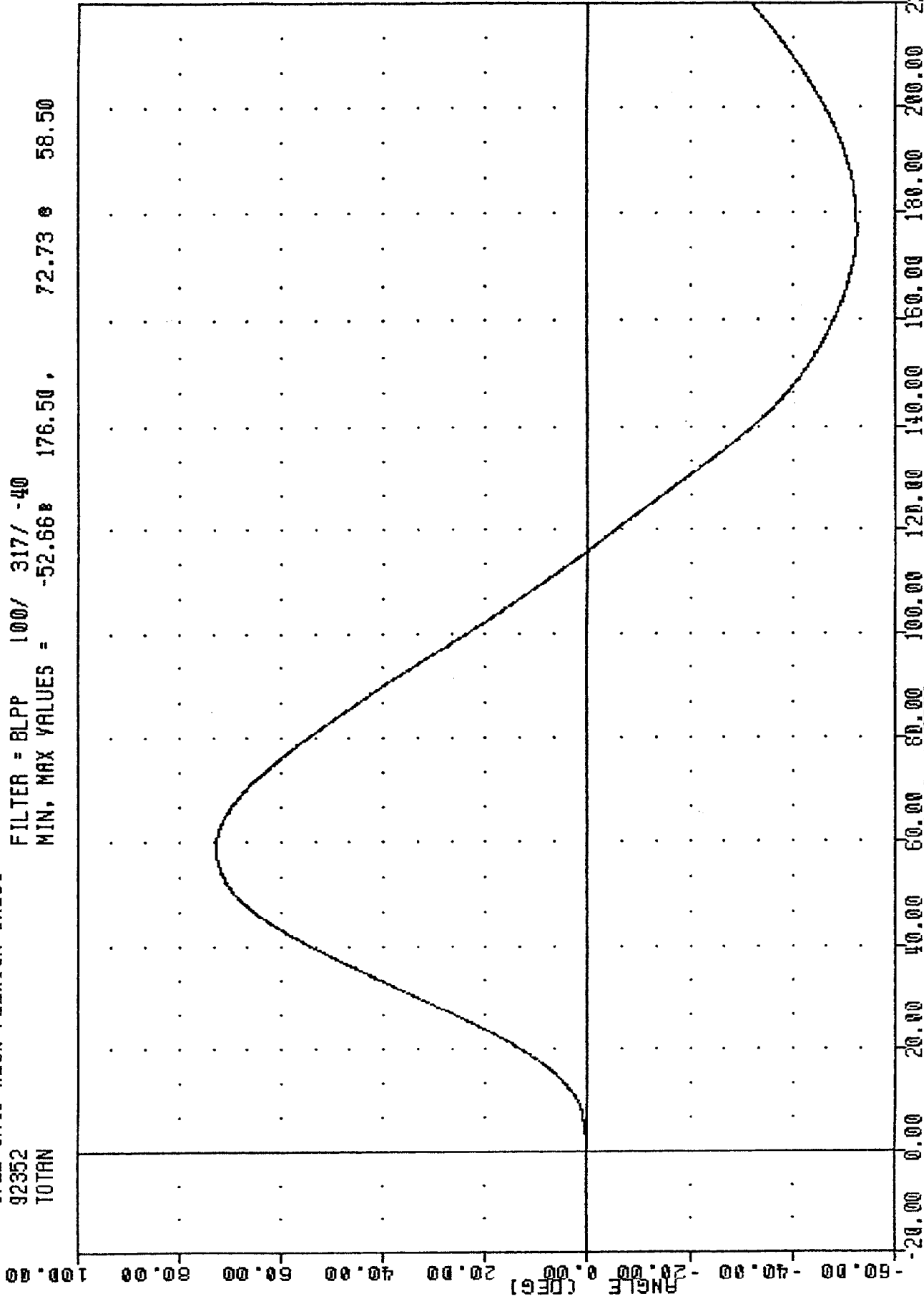
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -30.29# 180.25, 39.46 # 58.00



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

TRC 48C5NF1
 572E SN48 NECK FLEXION CAL05
 92352
 TOTAN

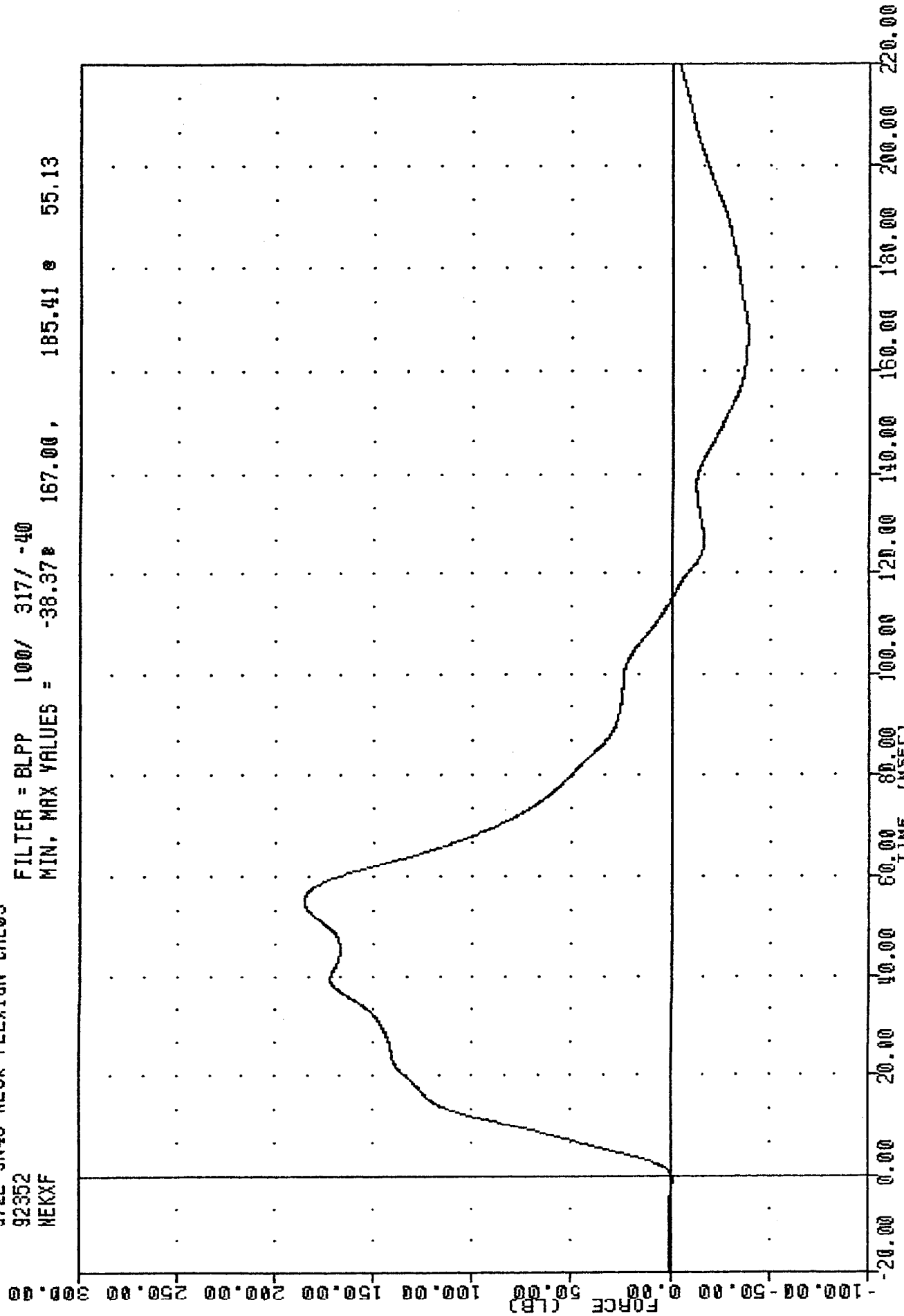
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -52.66 176.50, 72.73 58.50



PART 572-E HYBRID III NECK FLEXION CALIBRATION
 TOTAL ROTATION

TRC , 48C5NF1
572E SN48 NECK FLEXION CAL05
92352
MEKXF

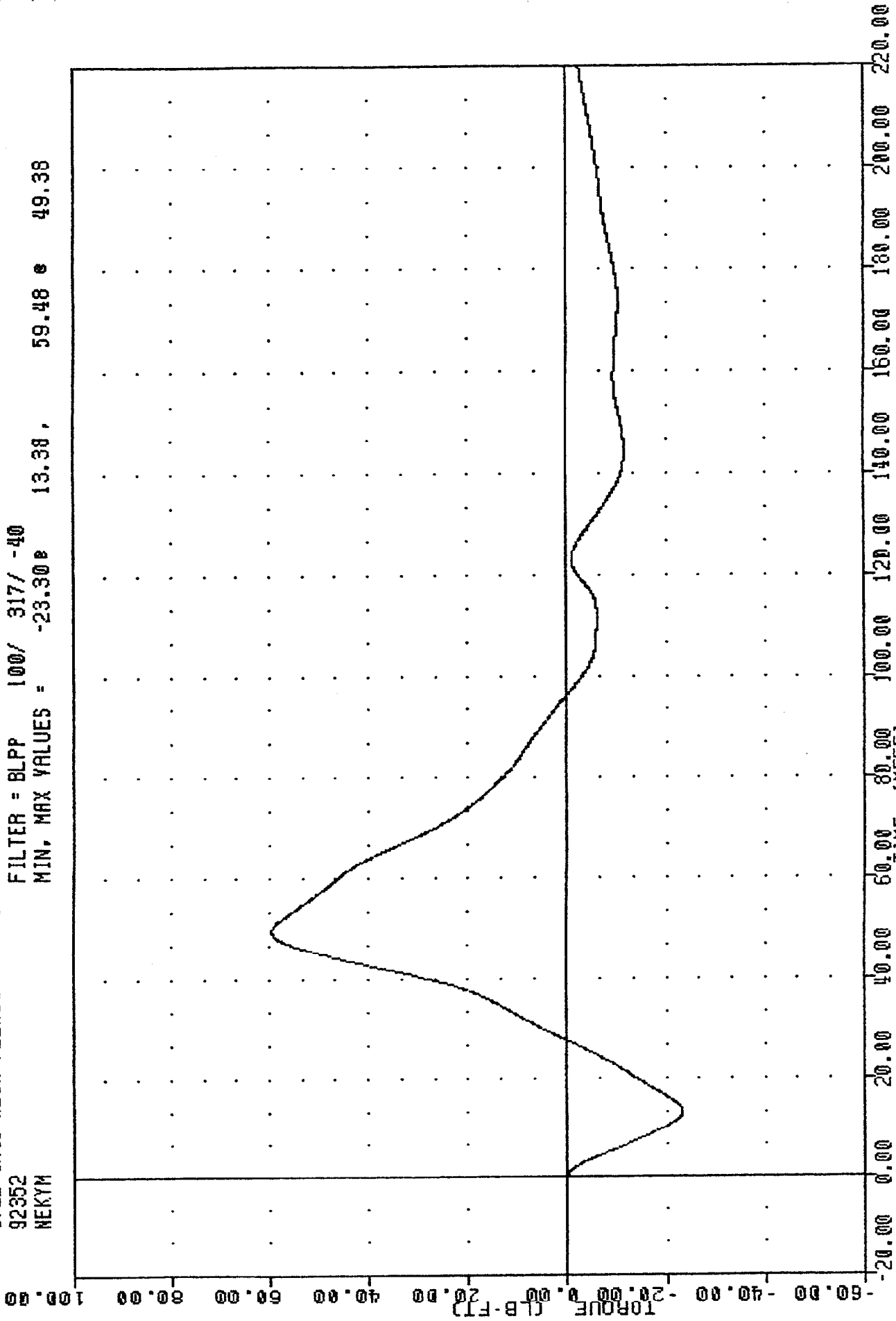
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -38.37 167.00 , 185.41 55.13



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

TRC * 48C5NF1
 572E SN48 NECK FLEXION CAL05
 92352
 NEKYM

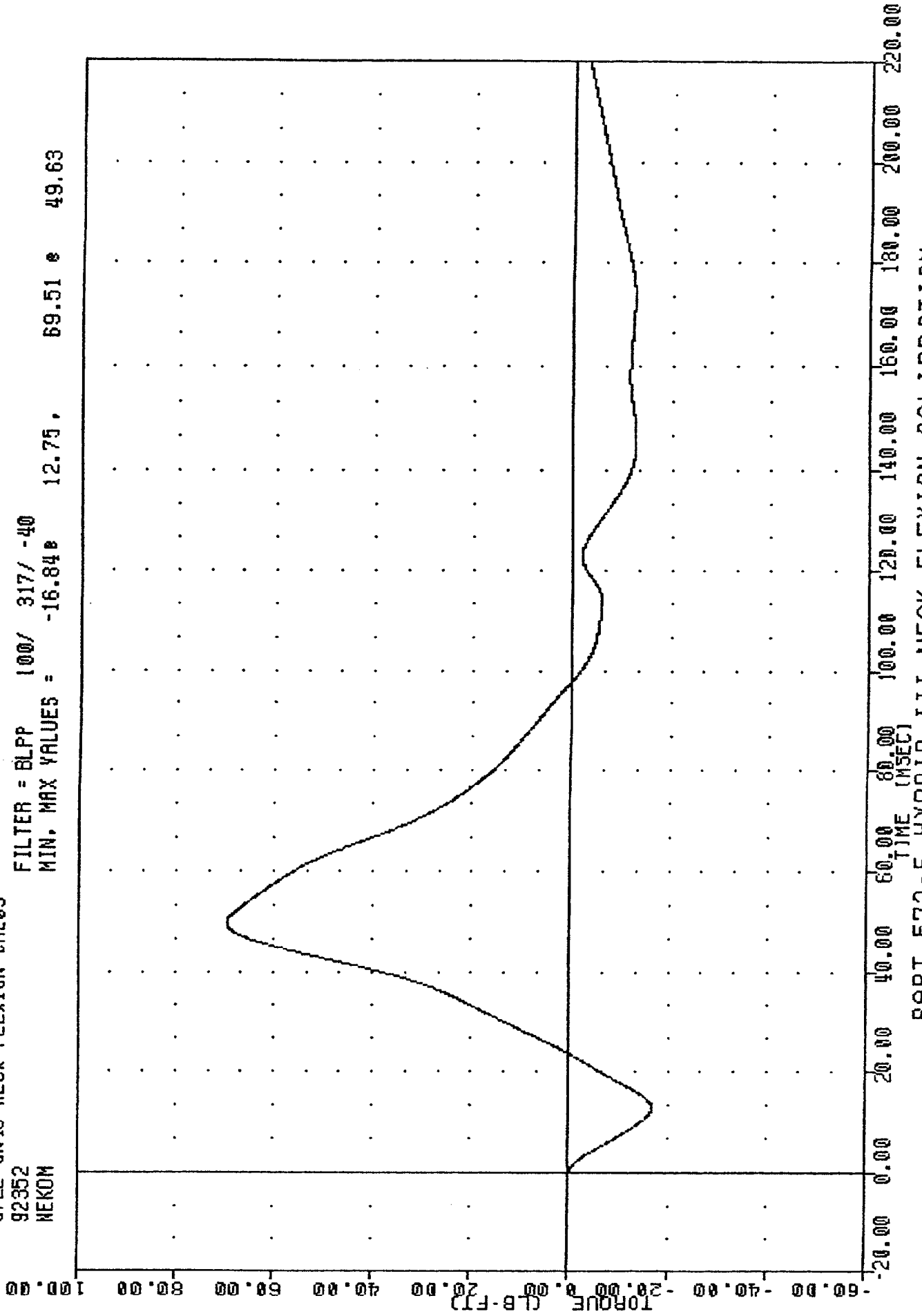
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -23.30 13.38, 59.48 49.38



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

TRC
572E SN48 NECK FLEXION CAL05
92352
NEKOM

FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -16.848 12.75 69.51 e 49.63



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

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

17-DEC-92

6 AXIS NECK TRANSDUCER
TRC 48C5NE1

572E SN48 NECK EXT. CAL05

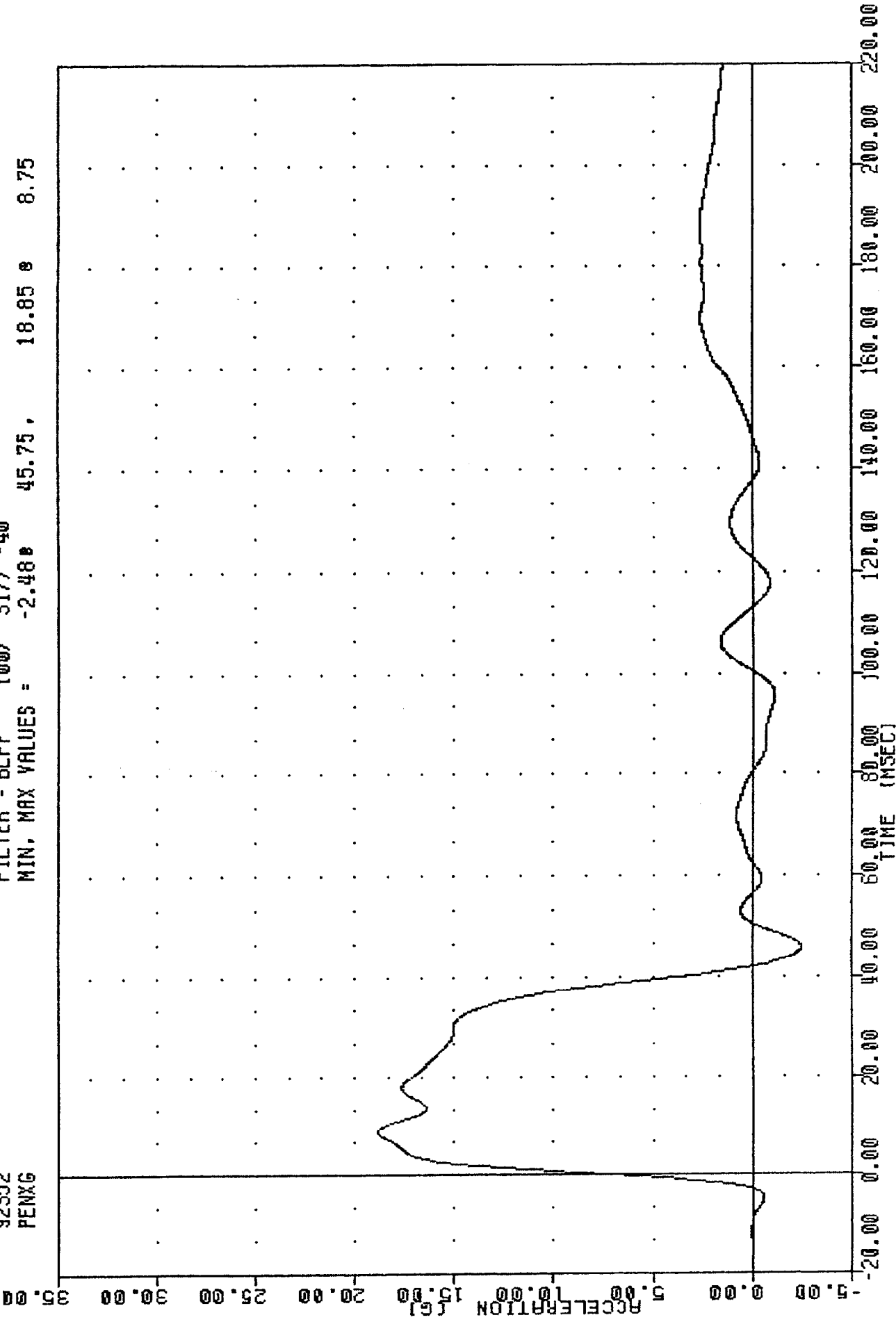
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	45.0 %
IMPACT VELOCITY	19.50-20.30 FT/SEC	20.00 FT/SEC
PENDULUM DECELERATION	10 MS 17.20 - 21.20 G	18.49 G
	20 MS 14.00 - 19.00 G	17.19 G
	30 MS 11.00 - 16.00 G	15.03 G
MAX PENDULUM G ABOVE 30 MS	22 G MAX	15.03 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G	38 - 46 MS	39.25 MS
D PLANE ROTATION	MAX 81 - 106 DEG.	100.83 DEG.
	TIME 72 - 82 MS	75.50 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MIN -59.0/-39.0 FT. LBS	-51.95 FT. LBS
	TIME 65 - 79 MS	69.88 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO	147 - 174 MS	157.75 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO	120 - 148 MS	144.38 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Jant

TRC
572E SN48 NECK EXT. CAL05
92552
PENXG

FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -2.48e 45.75, 18.85 e 8.75

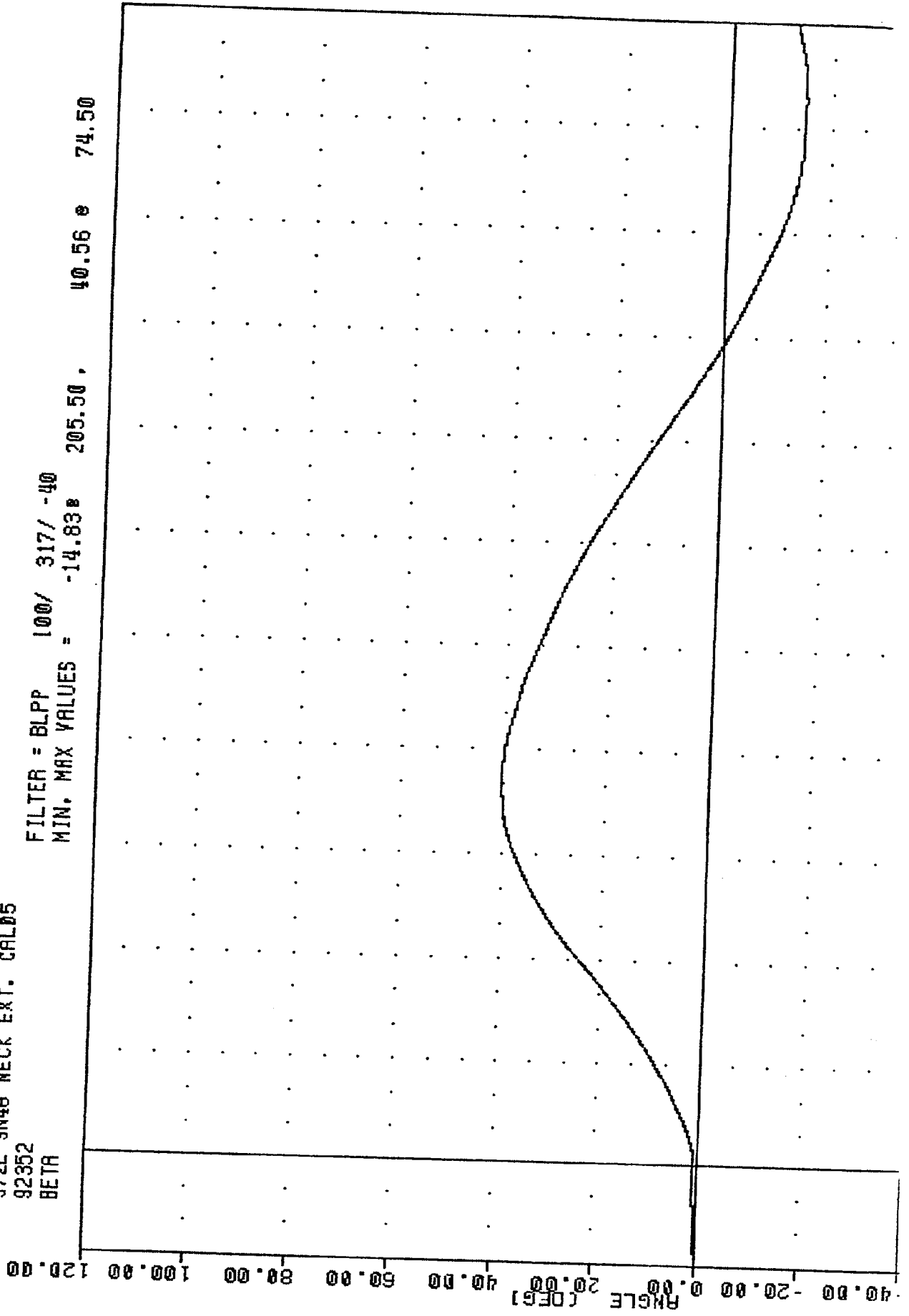


PART 572-E HYBRID III NECK EXTENSION CALIBRATION
PENXG III IM DEFFI BRATION

TRC
572E SN48 NECK EXT. CAL05
92352
BETA

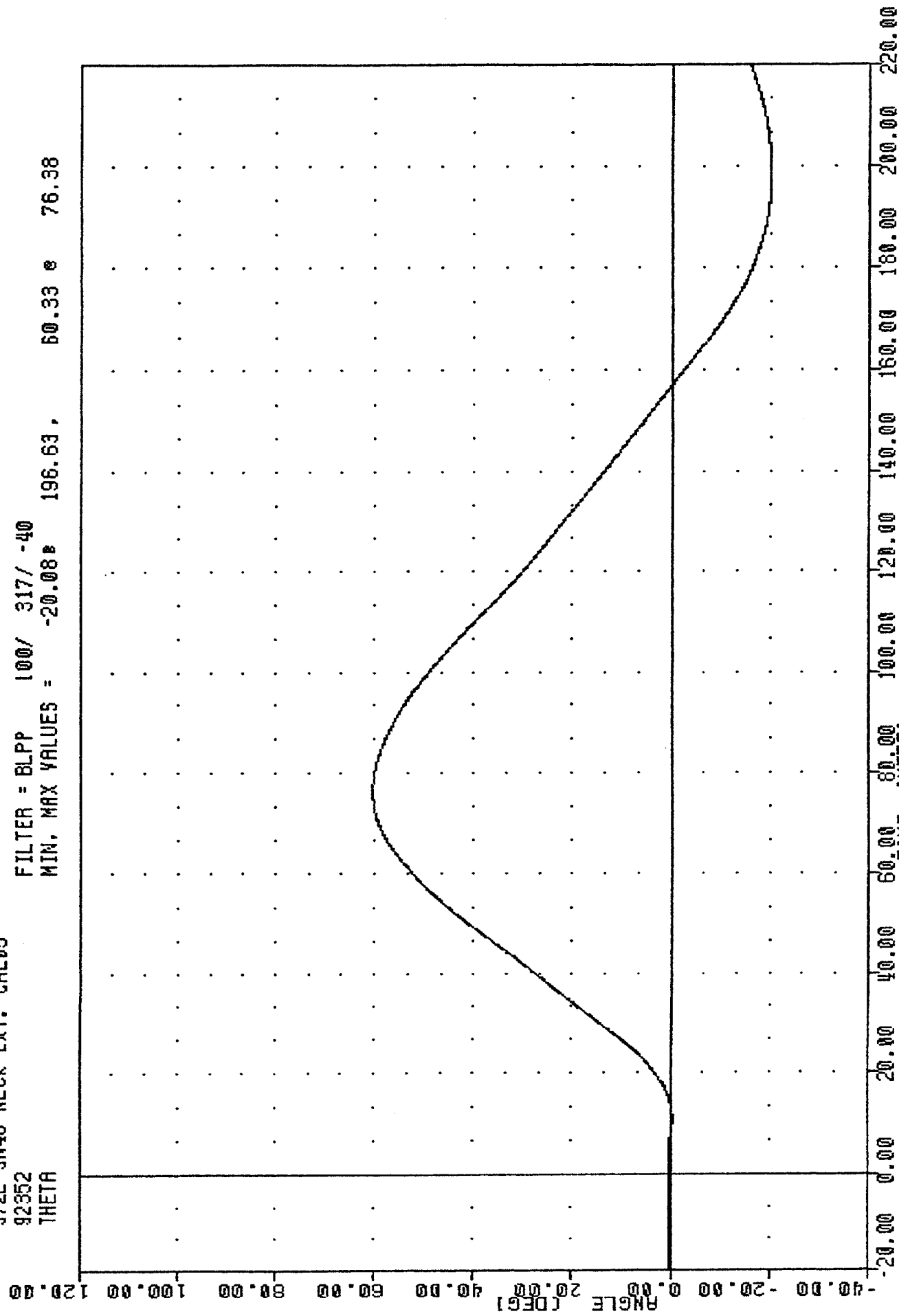
, 48C5NE1

FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -14.83 205.50 , 40.56 74.50



TRC
572E SN48 NECK EXT. CALD5
92352
THETA

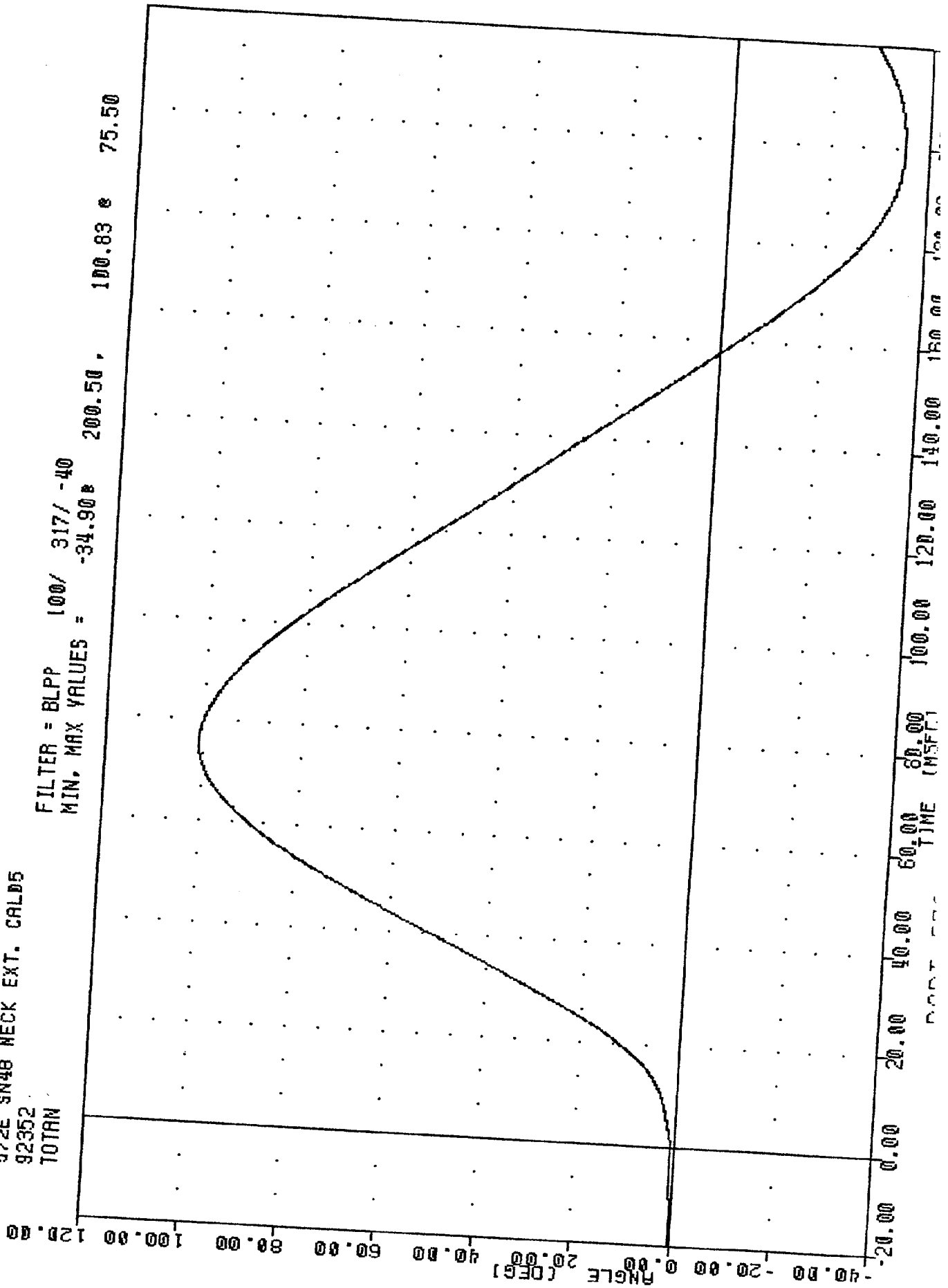
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -20.08 196.63, 60.33 76.38



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

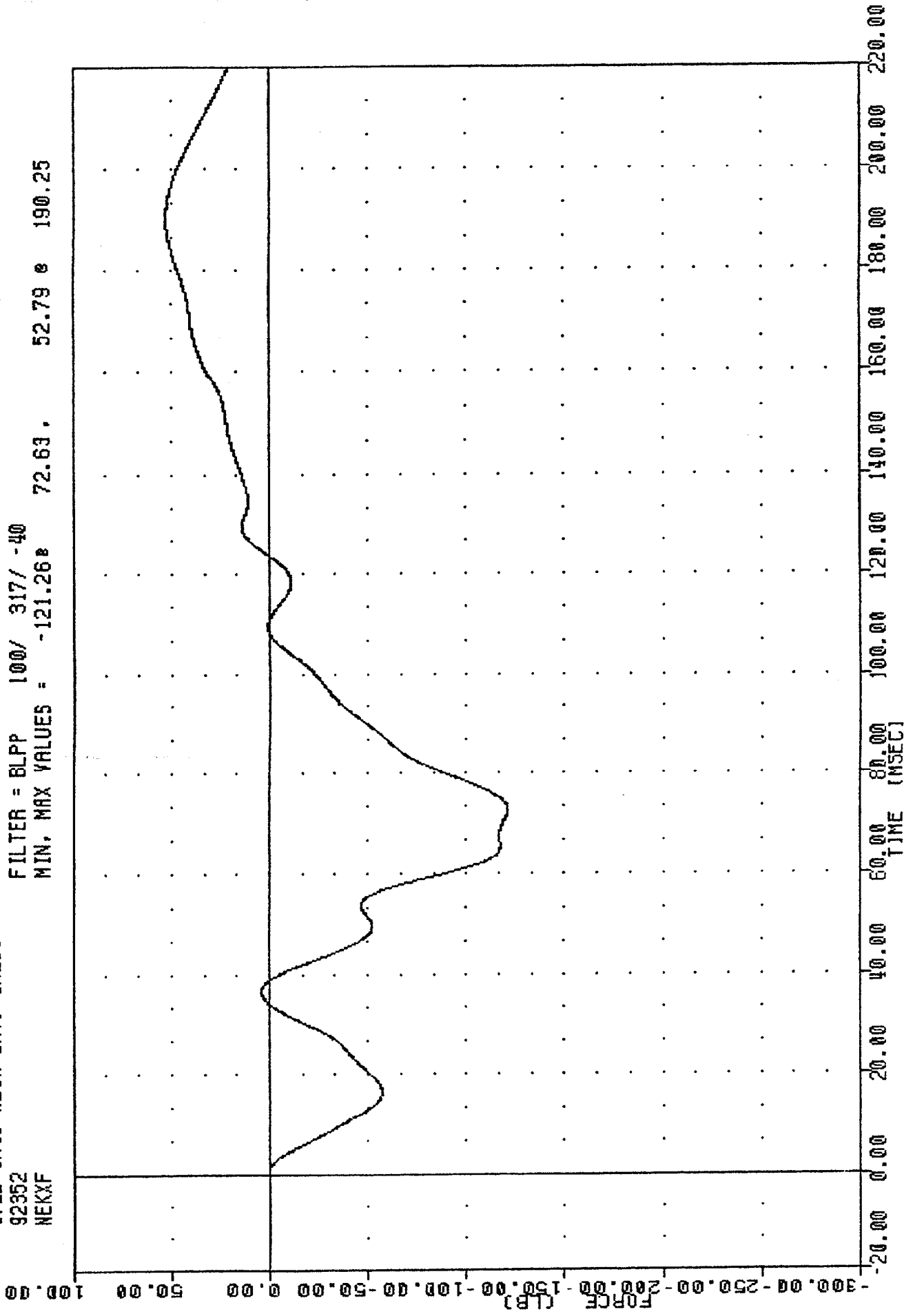
TRC
572E SN48 NECK EXT. CALD5
92352
TOTAL

FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -34.90 200.50 , 100.83 75.50



TRC
572E SN48 NECK EXT. CAL05
92352
NEKXF

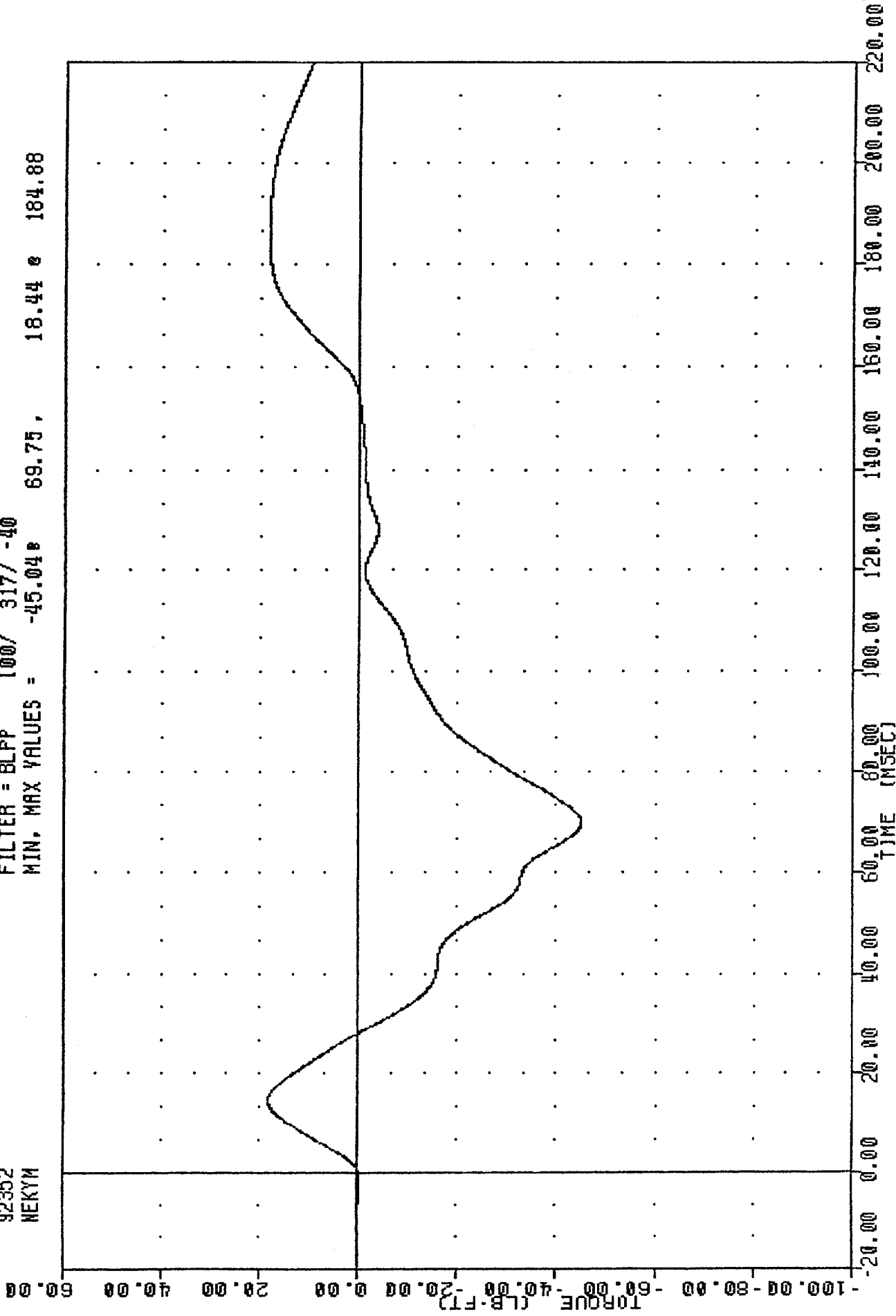
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -121.26 e 72.63 e 52.79 e 190.25



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

TRC
572E SN48 NECK EXT. CAL05
92352
NEKYM

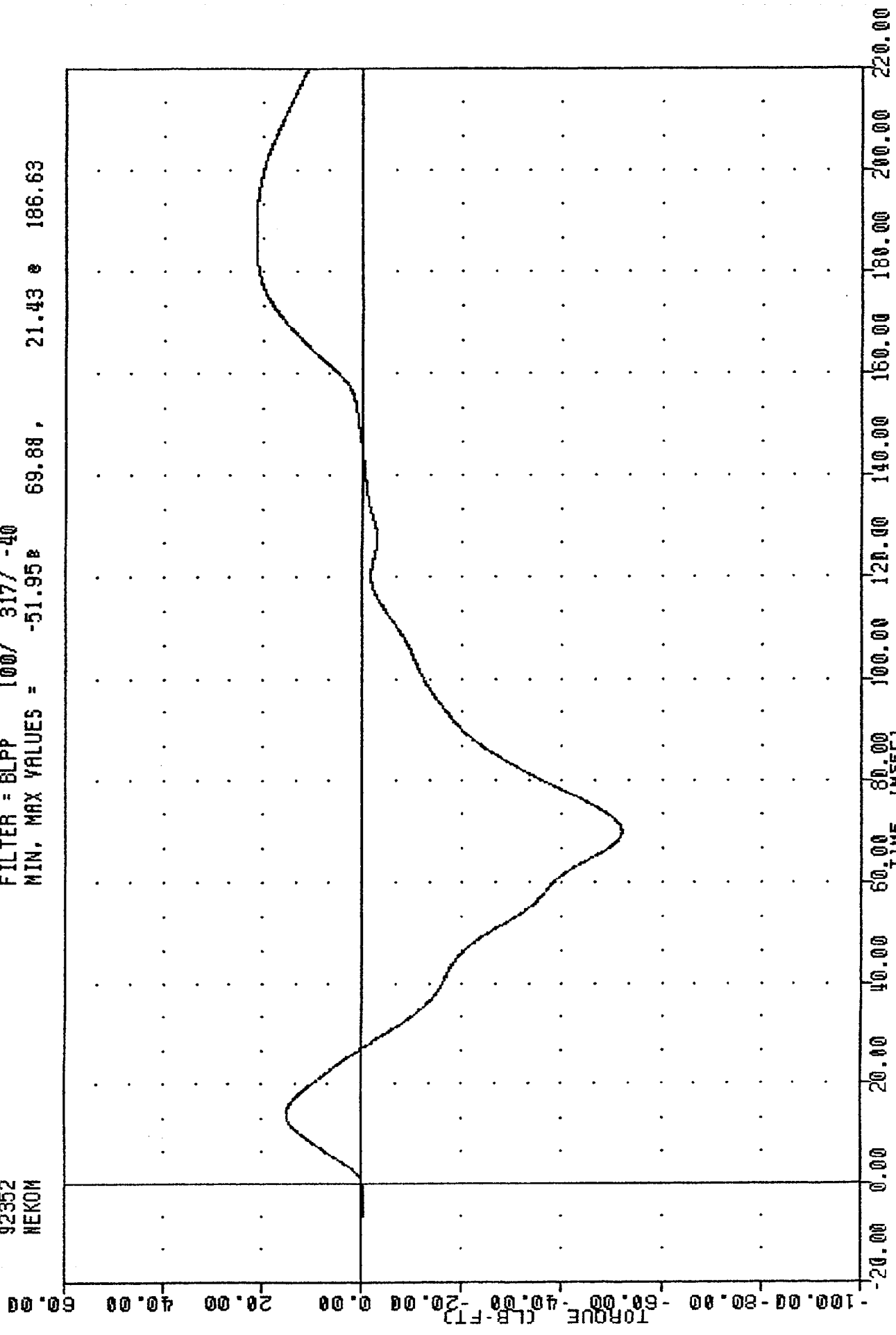
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -45.04 69.75 , 16.44 184.88



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

TRC
 572E SN48 NECK EXT. CAL05
 92352
 NEKOM

FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -51.95B 69.88, 21.43 e 186.63



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 TOTAL MOMENT ABOUT ORIGINAI POINT

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

HYBRID III

17-DEC-92

TRC

48C5TH1

572E SN48 H. S. THORAX CAL05

HIGH SPEED TEST		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	45.0 %
PENDULUM VELOCITY	21.6-22.4 FT/SEC	21.91 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 IN	2.83 IN
MAXIMUM RESISTIVE FORCE	1160 - 1325 LBS	1190.3 LBS
INTERNAL HYSTERESIS	69% - 85%	70.6%

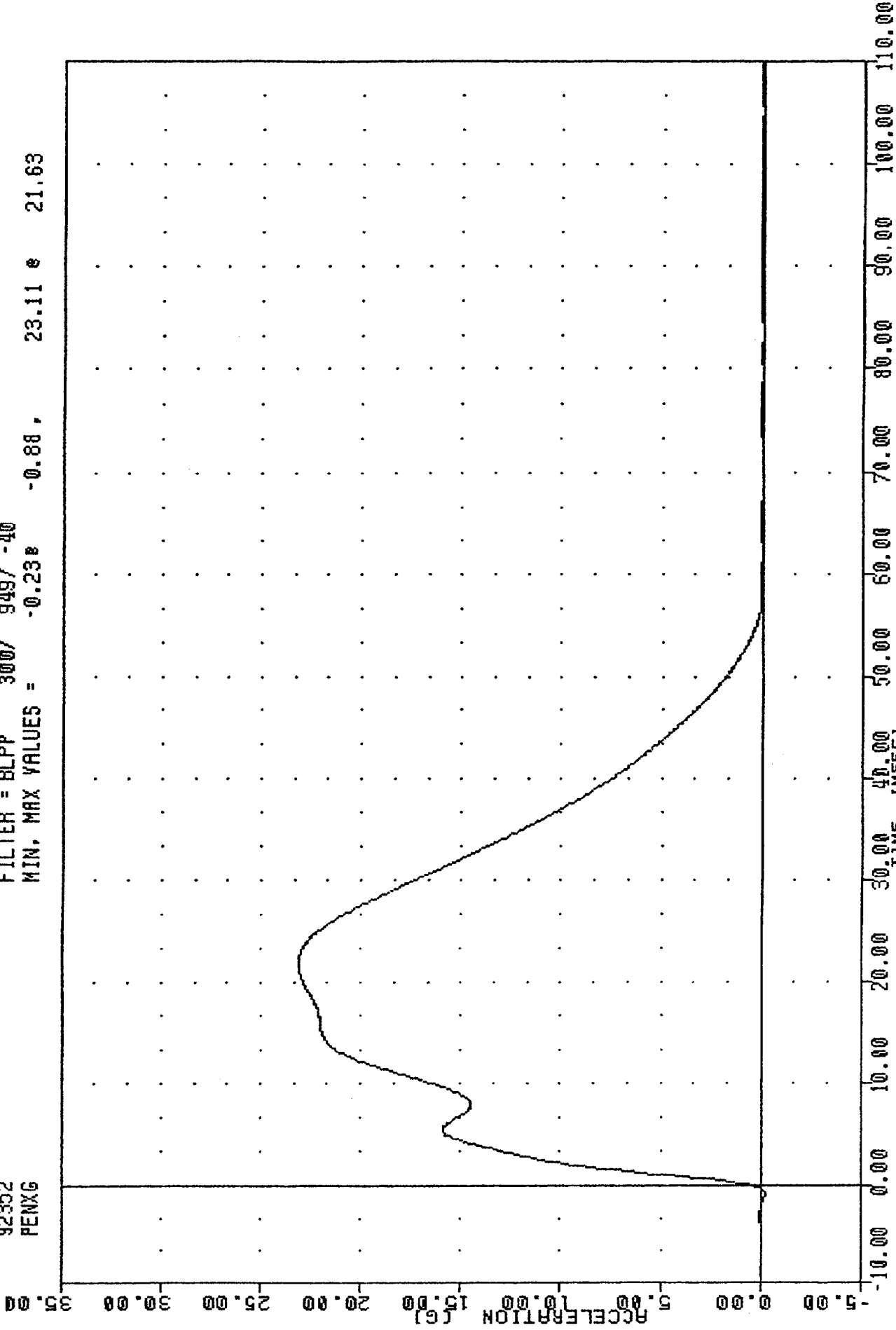
TEST MEETS SPECIFICATIONS

TECHNICIAN

Pete Font

TRC
 572E SN48 H.S. THORAX CAL05
 92352
 PENXG

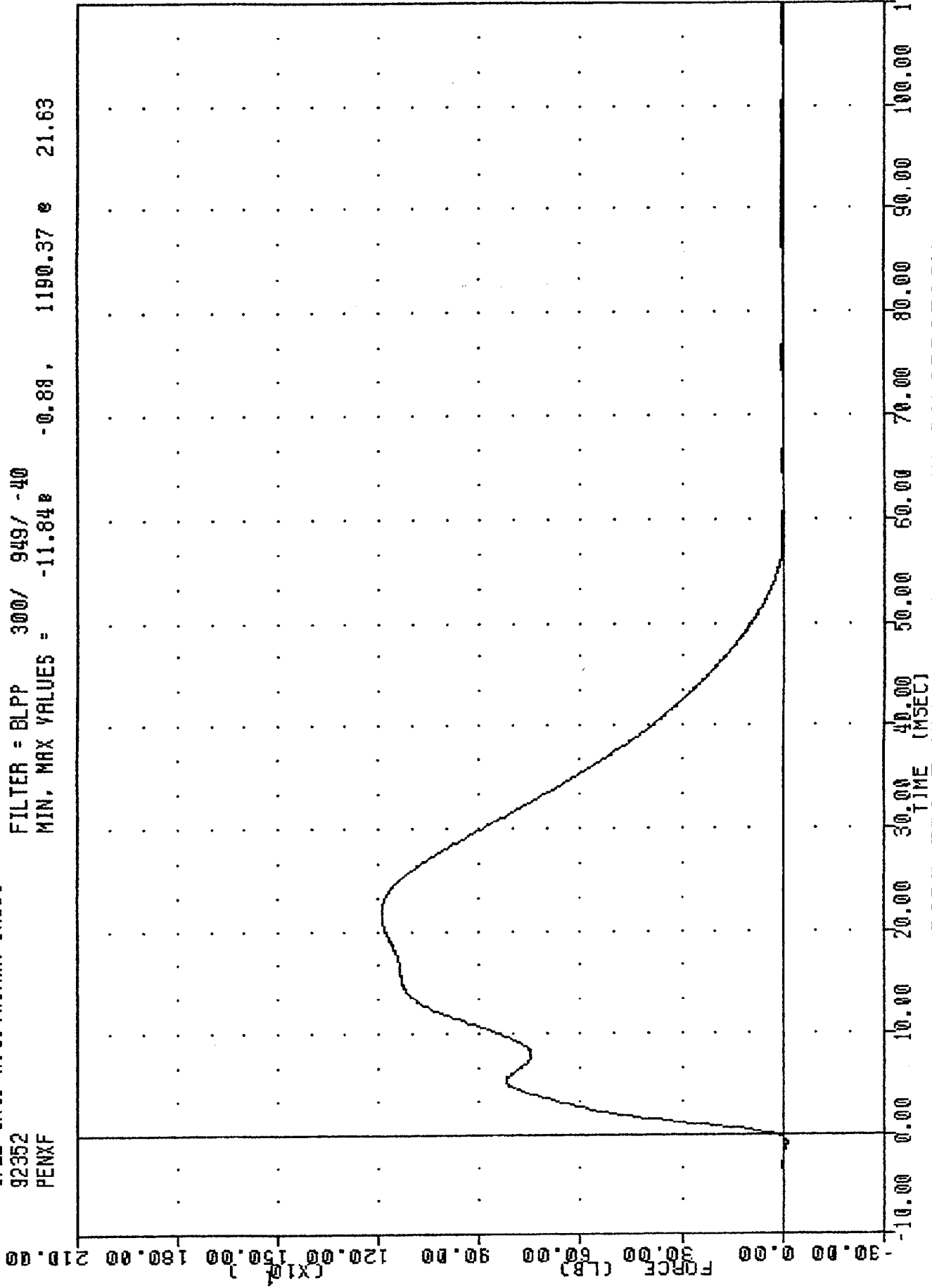
FILTER = BLPP 300/ 949/ -40
 MIN, MAX VALUES = -0.238 -0.88, 23.11 e 21.63



PART 572-E HYBRID III THORAX CALIBRATION
 PENDULUM DECELERATION

TRC
572E SN48 H.S. THORAX CAL05
92352
PENXF

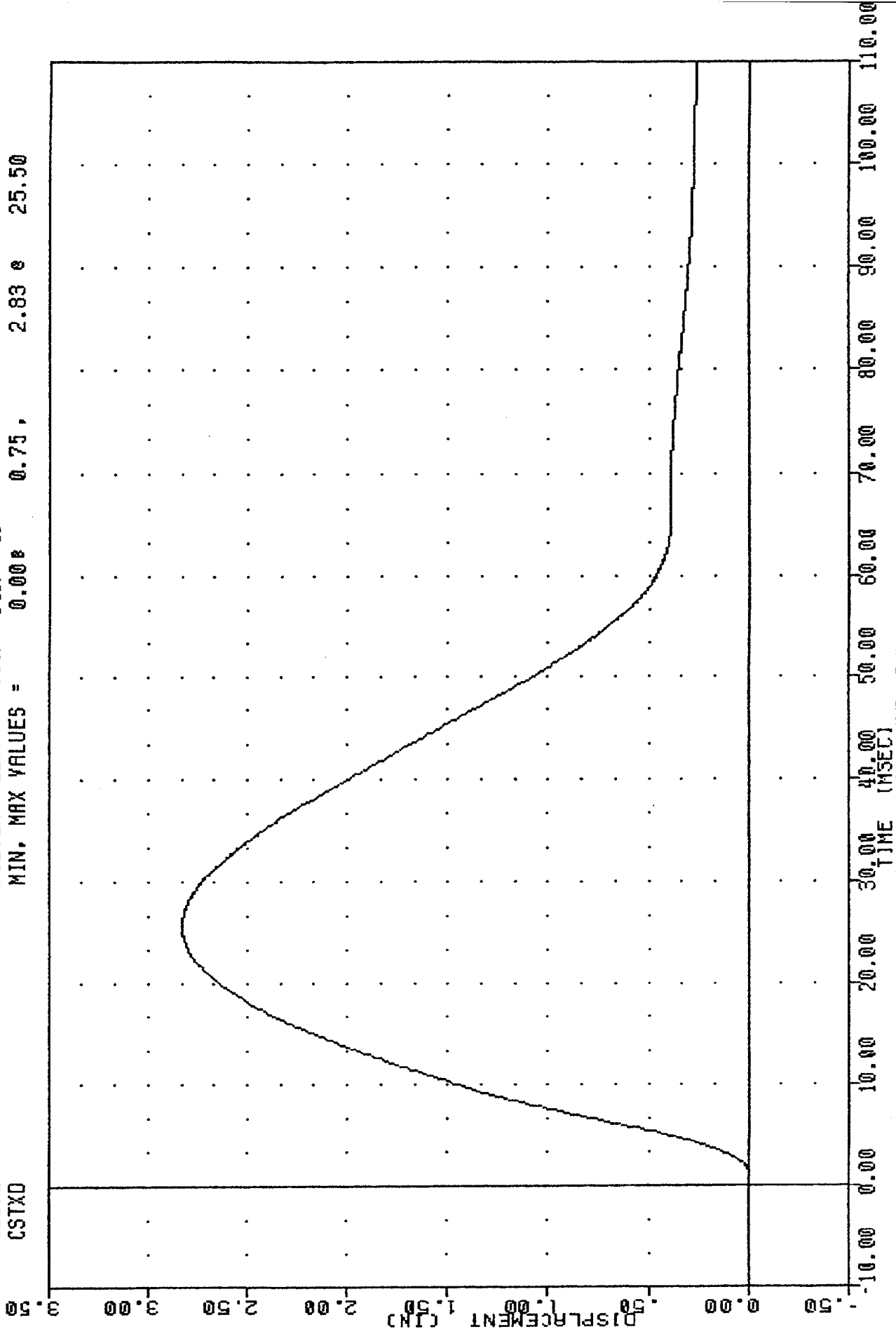
FILTER = BLPP 300/ 949/ -40
MIN. MAX VALUES = -11.84e 1190.37 e 21.63



PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM FORCE

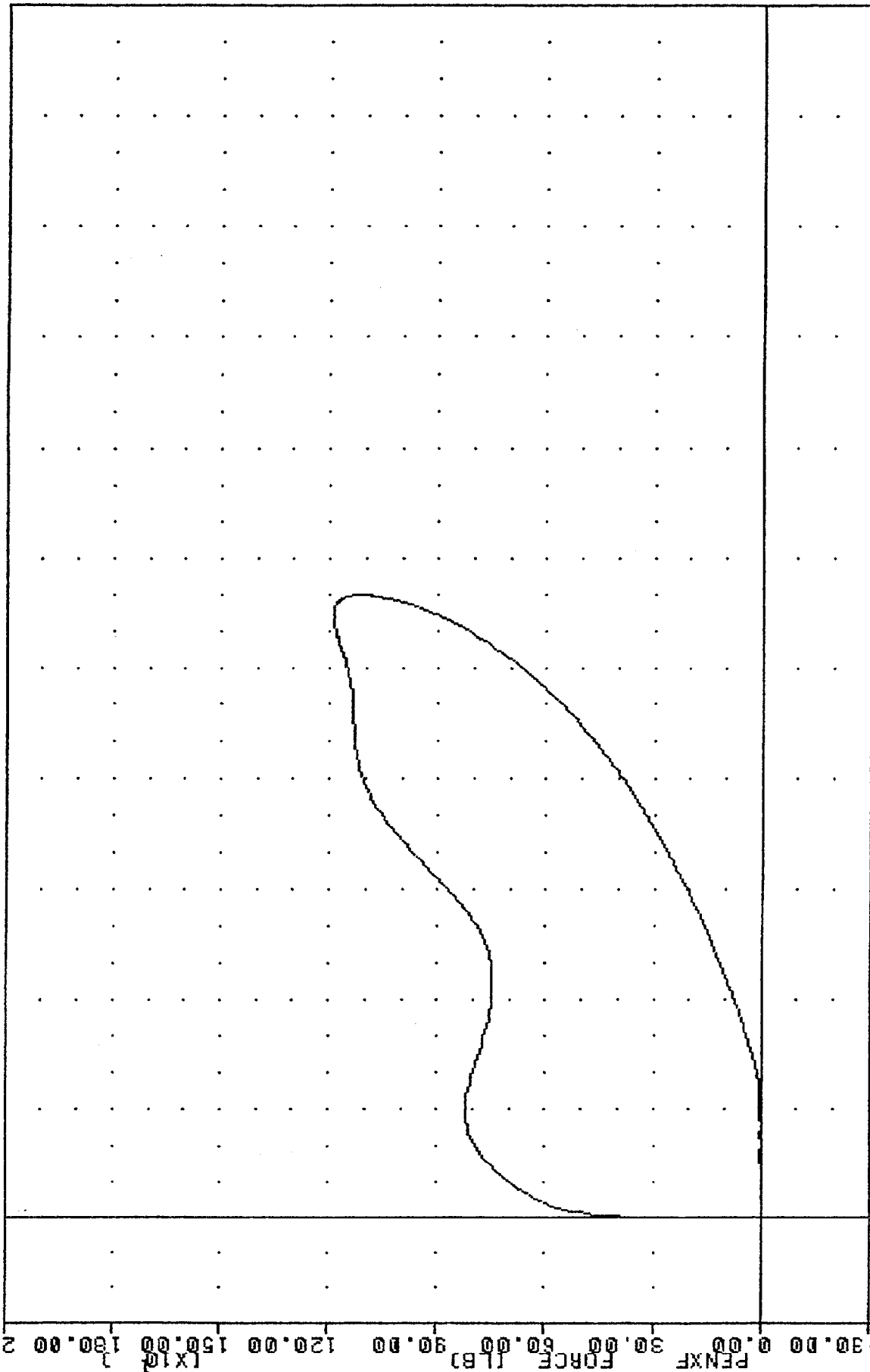
TRC
572E SN48 H.S. THORAX CAL05
92352
CSTXD

FILTER = BLPP 300/ 949/ -40
MIN, MAX VALUES = 0.00E 0.75, 2.83E 25.50



PART 572-E HYBRID III THORAX CALIBRATION
STERNIUM DISPLACEMENT

TRC 48C5TH1 572E SN48 H-S. THORAX CAL 05 92352
 CSTXD FILTER = BLPP 500/ 949/ -40 MIN, MAX = -0.00 * 0.75 ; 2.83 * 25.50
 PENXF FILTER = BLPP 300/ 949/ -40 MIN, MAX = -11.84 * -0.88 ; 1190.37 * 21.63



-30.00 0.00 30.00 60.00 90.00 120.00 150.00 180.00 210.00
 (X10)
 FORCE (LB)
 PENXF
 0.00 0.50 1.00 1.50 2.00 2.50 3.00 3.50 4.00 4.50 5.00 5.50
 CSTXD DISPLACEMENT (CIN)
 PART 572-E HYBRID III THORAX CALIBRATION
 CHEST DISPLACEMENT VS PENIUM FORCE

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

17-DEC-92

RIGHT KNEE

TRC

4805RK1

572E SN48 RIGHT KNEE CAL 05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	45.0 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.92 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1189.10 LBS
PROBE WEIGHT	11.0 LBS	

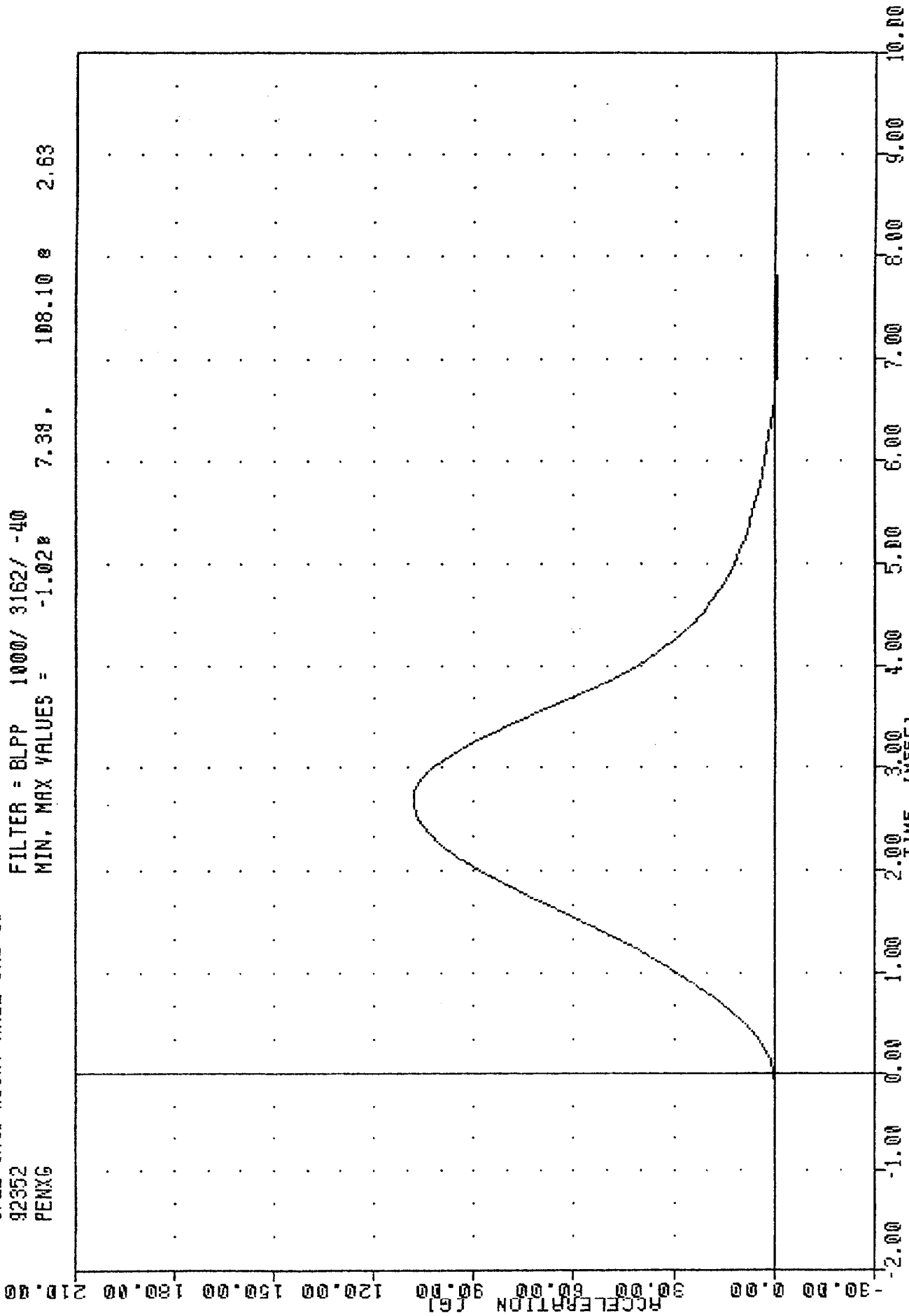
TEST MEETS SPECIFICATIONS

TECHNICIAN

Pete Font

TRC
572E SN48 RIGHT KNEE CAL 05
92352
PENXG

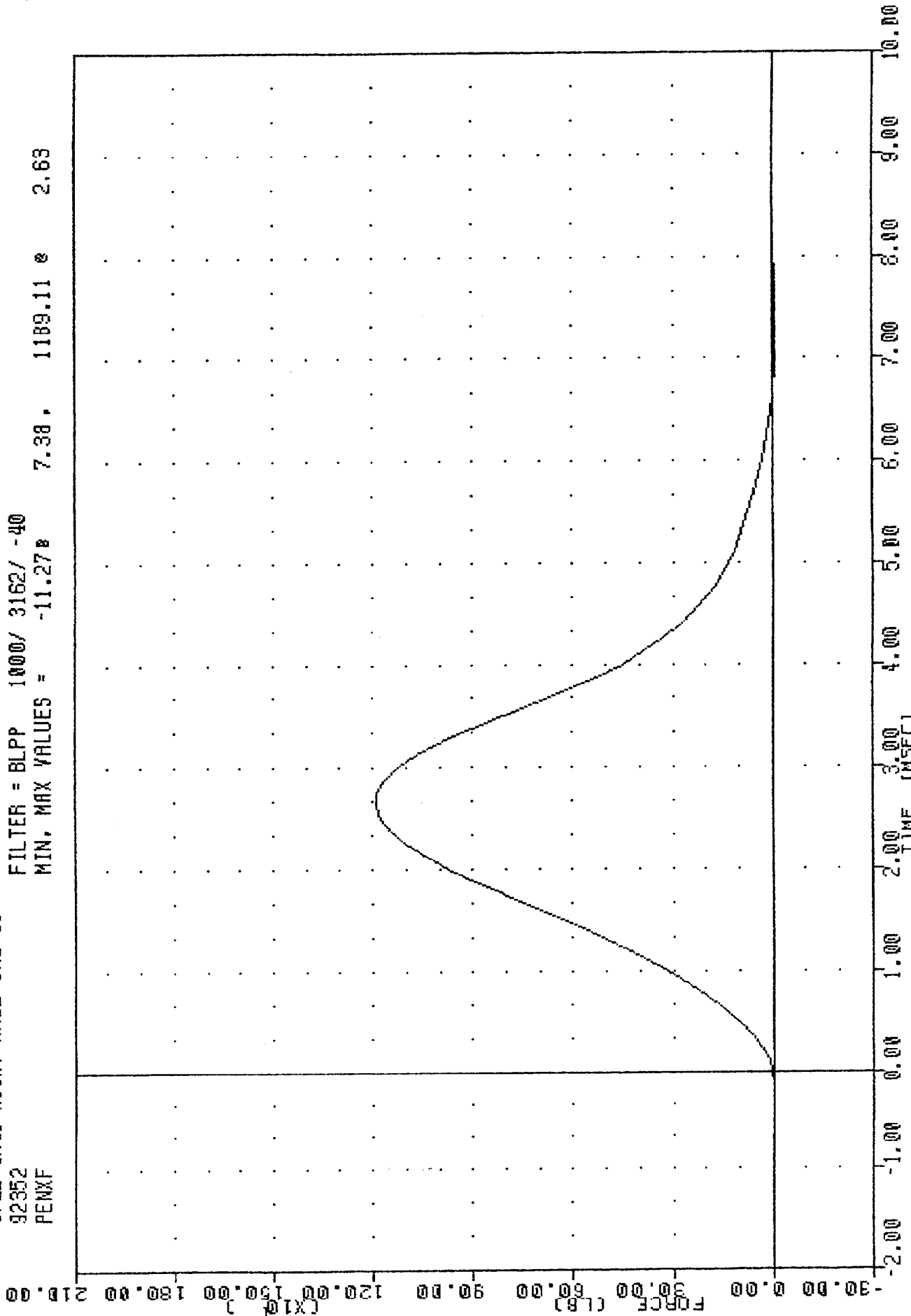
FILTER = BLPP 1000/ 3162/ -40
MIN. MAX VALUES = -1.028 7.38 108.10 2.63



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
PENXG (11 LB PEND.)

TRC
572E SN48 RIGHT KNEE CAL 05
92352
PENXF

FILTER = BLPP 1000/ 3162/ -40
MIN. MAX VALUES = -11.27 7.38 1189.11 2.63



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

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

17-DEC-92

LEFT KNEE

TRC

48C5LK1

572E SN48 LEFT KNEE CAL 05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	45.0 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.89 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1276.24 LBS
PROBE WEIGHT	11.0 LBS	

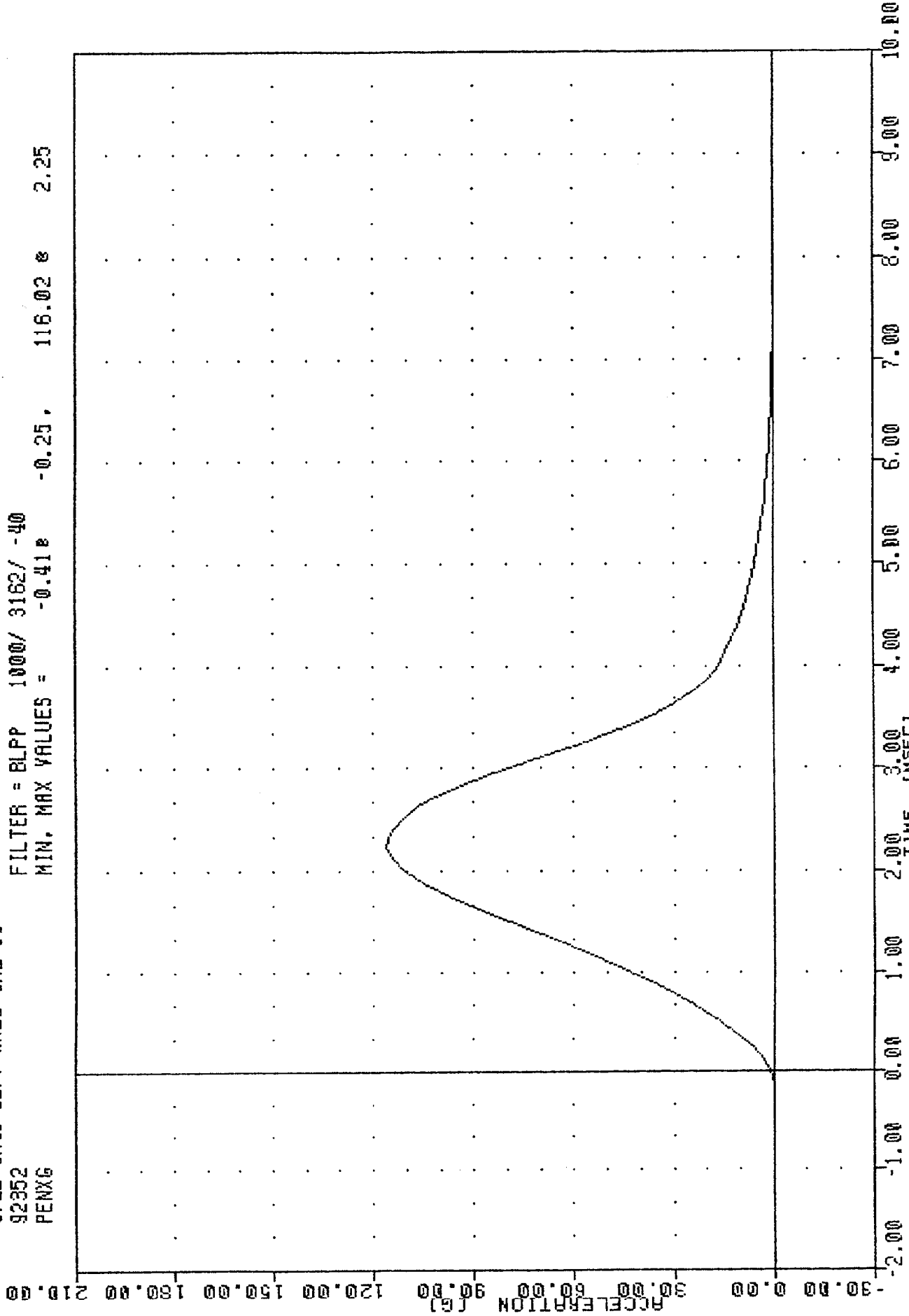
TEST MEETS SPECIFICATIONS

TECHNICIAN *Lite Fort*

\$

TRC
572E SN48 LEFT KNEE CAL 05
92352
PENX6

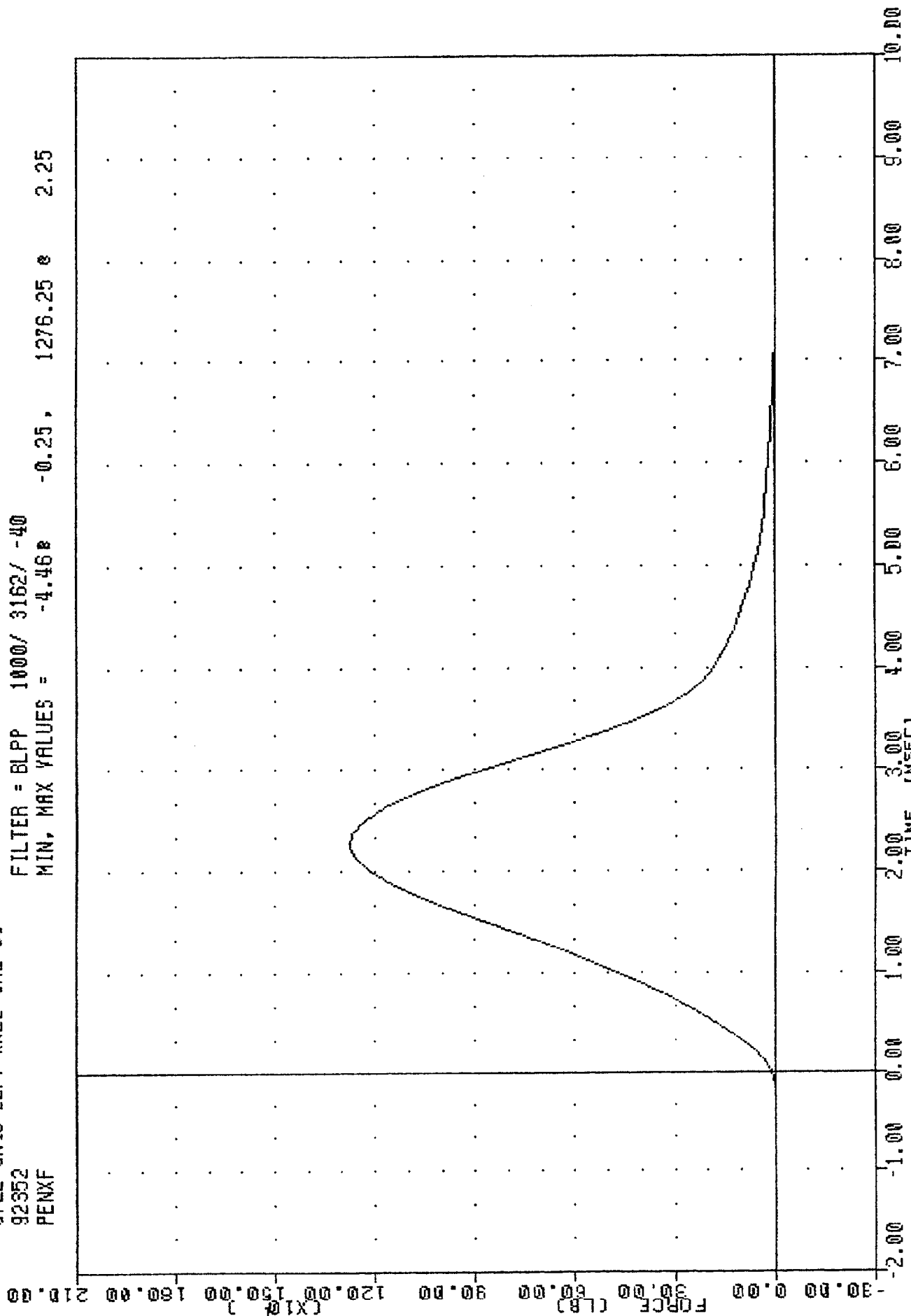
FILTER = BLPP 1000/ 3162/ -40
MIN. MAX VALUES = -0.41e 116.02 e 2.25



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

TRC
572E SN48 LEFT KNEE CAL 05
92352
PENXF

FILTER = BLPP 1000/ 3162/ -40
MIN, MAX VALUES = -4.46 e -0.25, 1276.25 e 2.25



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

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	RF79J	UP
CHEST DISPLACEMENT	X	BOURNS	NA	043	OUTWARD
PELVIS ACCELERATION	X	ENDEVCO	7264	DM72J	REAR
PELVIS ACCELERATION	X	ENDEVCO	7264	BG11J	LEFT
PELVIS ACCELERATION	X	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 DISPLACEMENT	X	SERVO	14CB1-2897	9041	OUTWARD
PELVIS ACCELERATION	X	ENDEVCO	7264	BC75J	REAR
PELVIS ACCELERATION	X	ENDEVCO	7264	FC43J	LEFT
PELVIS ACCELERATION	X	ENDEVCO	7264	AP87	UP
LEFT FEMUR FORCE		GSE	2430	014	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	AK21	REAR
		Y	ENDEVCO	2264	AN06	RIGHT
2	RIGHT REAR SEAT	X	ENDEVCO	2264	AN45	REAR
		Y	ENDEVCO	2264	AS95	LEFT
3	CAR CENTER OF GRAVITY	X	ENDEVCO	2264	AG24	REAR
		Y	ENDEVCO	2264	BA68	LEFT
		Z	ENDEVCO	2264	AY66	UP
	DRIVER'S SHOULDER BELT		LEBOW	3419	615	TENSION
	RIGHT FRONT PASSENGER'S SHOULDER BELT		LEBOW	3419	616	TENSION

