

VEHICLE AND DUMMY KINEMATICS
IN A CONTROLLED ROLLOVER CRASH
1991 VOLVO 740 4-DOOR SEDAN

PREPARED BY:
THE TRANSPORTATION RESEARCH CENTER OF OHIO
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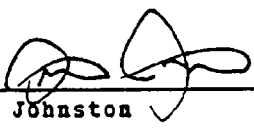
OCTOBER - NOVEMBER 1991
TEST REPORT

PREPARED FOR:
SYSTEMS RESEARCH LABORATORIES, INC.
2800 INDIAN RIPPLE ROAD
DAYTON, OHIO 45440

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SECTION 1.0

PURPOSE AND TEST SUMMARY

This rollover crash test has the main objective to investigate both vehicle and occupant dynamics during automobile rollover crashes.

This test was conducted with a 1991 Volvo 740 4-door sedan on the NHTSA rollover cart moving at 30 mph, releasing the vehicle with its roll axis perpendicular to the direction of rollover cart motion, and first contacting the vehicle's driver's side. The test vehicle contained an instrumented Part 572E dummy restrained with a three-point unbelt.

SECTION 2.0

SUMMARY OF ROLLOVER CRASH TEST

A 1991 Volvo 740 4-door sedan, containing one instrumented Part 572E test dummy, was placed upon the rollover test device at 30 degrees above the horizontal and was released at 30 mph. The device was attached to the tow cable of the drive system. After the vehicle had been released the device was brought to a stop with an auxiliary brake system. After release the vehicle impacted the ground on its left side. The vehicle made two rolls and came to rest on its wheels. The rollover crash test was conducted by the Transportation Research Center of Ohio in East Liberty, Ohio, on October 21, 1991.

The Part 572E 50th percentile adult male anthropomorphic test device (dummy) was placed in the driver's designated seating position according to the seating procedure in FMVSS 208 Notice 60. The dummy was instrumented with head, chest, and pelvis triaxial accelerometers, a six-axis neck load cell, and a chest displacement potentiometer. The crash event was recorded by thirty-four (34) channels of data on one 14-track tape drive. The analog data was digitally sampled at 1500 samples per second. The data was digitally filtered per SAE J211 OCT88.

The crash event was filmed by seven (7) high-speed motion picture cameras operating at approximately 500 frames per second and one real-time panning motion picture camera.

Section 1.0 contains the purpose and test summary. Section 2.0 contains a summary of the rollover crash test. Section 3.0 contains the general test and vehicle parameter data. Section 4.0 contains the occupant information. Appendix A contains the pre-test and post-test still photographs. Appendix B contains the final data plots. Appendix C contains the post-test dummy calibrations. Appendix D contains the pre-test and post-test IPMD vehicle data sheets.

ROLLOVER CART INSTRUMENTATION LOCATIONS AND DATA SUMMARY

TEST NUMBER 911021

No. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
				MAX	G MSEC	MAX	G MSEC
1 CENTER OF GRAVITY	39.2	3.5	8.2				
ACCELERATION (g)							
LONGITUDINAL				1.0	625.3	2.3	1004.7
LATERAL				1.2	366.0	2.6	184.0
VERTICAL				11.1	187.3	4.1	383.3
RESULTANT				11.2	187.3		
2 PLATFORM DISPLACEMENT	24.6	24.5	47.3				
(in)							
LEFT SIDE				23.8	1598.0	0.0	22.0
RIGHT SIDE				24.6	611.3	0.0	62.0
3 VEHICLE/ROLLOVER	28.5	22.0	76.2				
UPPER SWITCH					314.0		
LOWER SWITCH					296.7		

* ALL MEASUREMENTS OF INSTRUMENTATION LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR BEAM OF ROLLOVER CART
Y: + LEFTWARD FROM ROLLOVER CART CENTERLINE
Z: + UPWARD FROM THE GROUND LEVEL
DISPLACEMENT: + OUTWARD

FINAL RESTING PLACE OF VEHICLE, PARTS, AND ROLLOVER CART

<u>DESCRIPTION OF VEHICLE</u>	<u>X, DISTANCE*</u>	<u>Y, DISTANCE*</u>
Left rear corner	101.0	1.5
Right rear corner	96.2	-1.1
Left front corner	96.5	-9.5
Right front corner	7.7	-6.8

DESCRIPTION OF PARTS

Headrest cushion	101.8	6.1
------------------	-------	-----

DESCRIPTION OF ROLLOVER CART

Left rear corner	51.4	5.4
Right rear corner	49.4	-4.3
Left front corner	57.8	5.4
Right front corner	55.2	-6.8

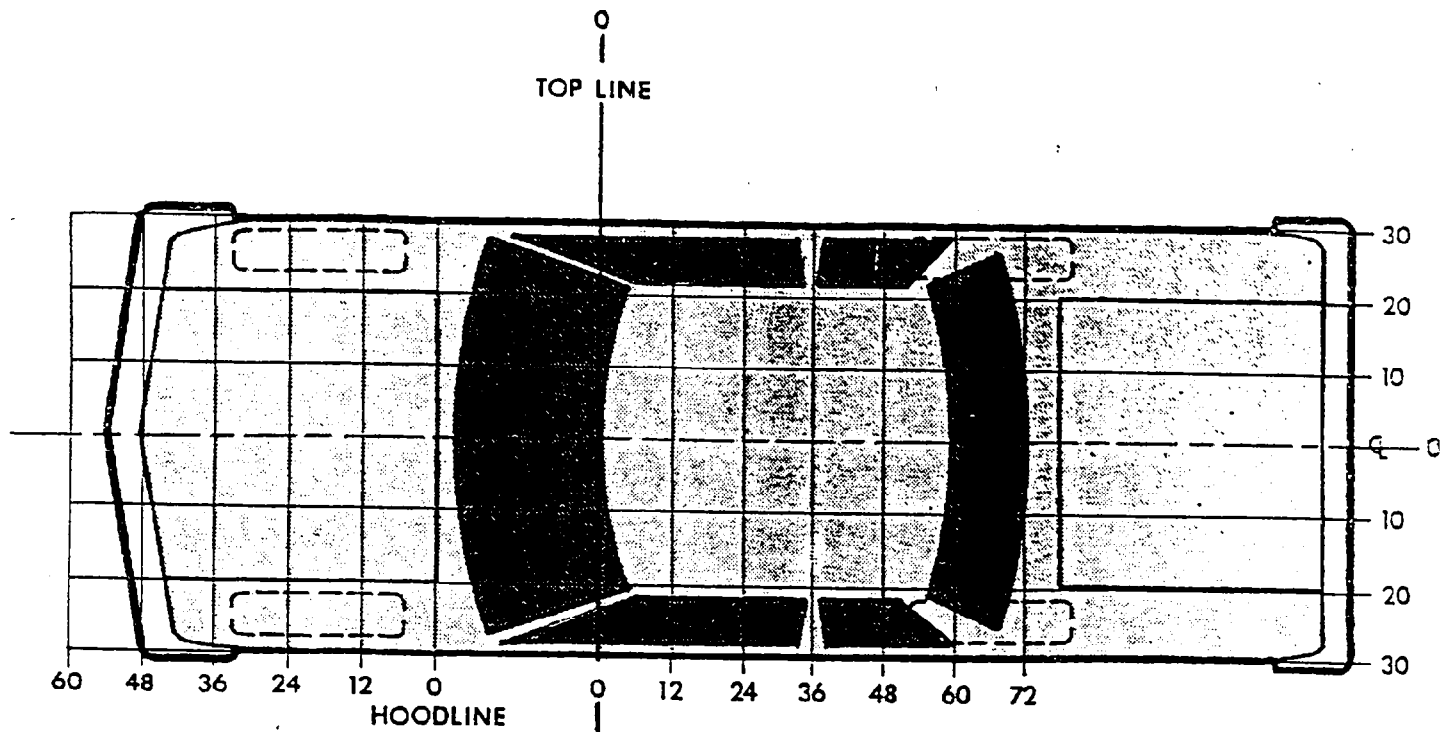
*REFERENCE: +X: FORWARD FROM RELEASE BLOCK
+Y: LEFTWARD FROM CENTER RELEASE BLOCK

ALL MEASUREMENTS ARE IN FEET.

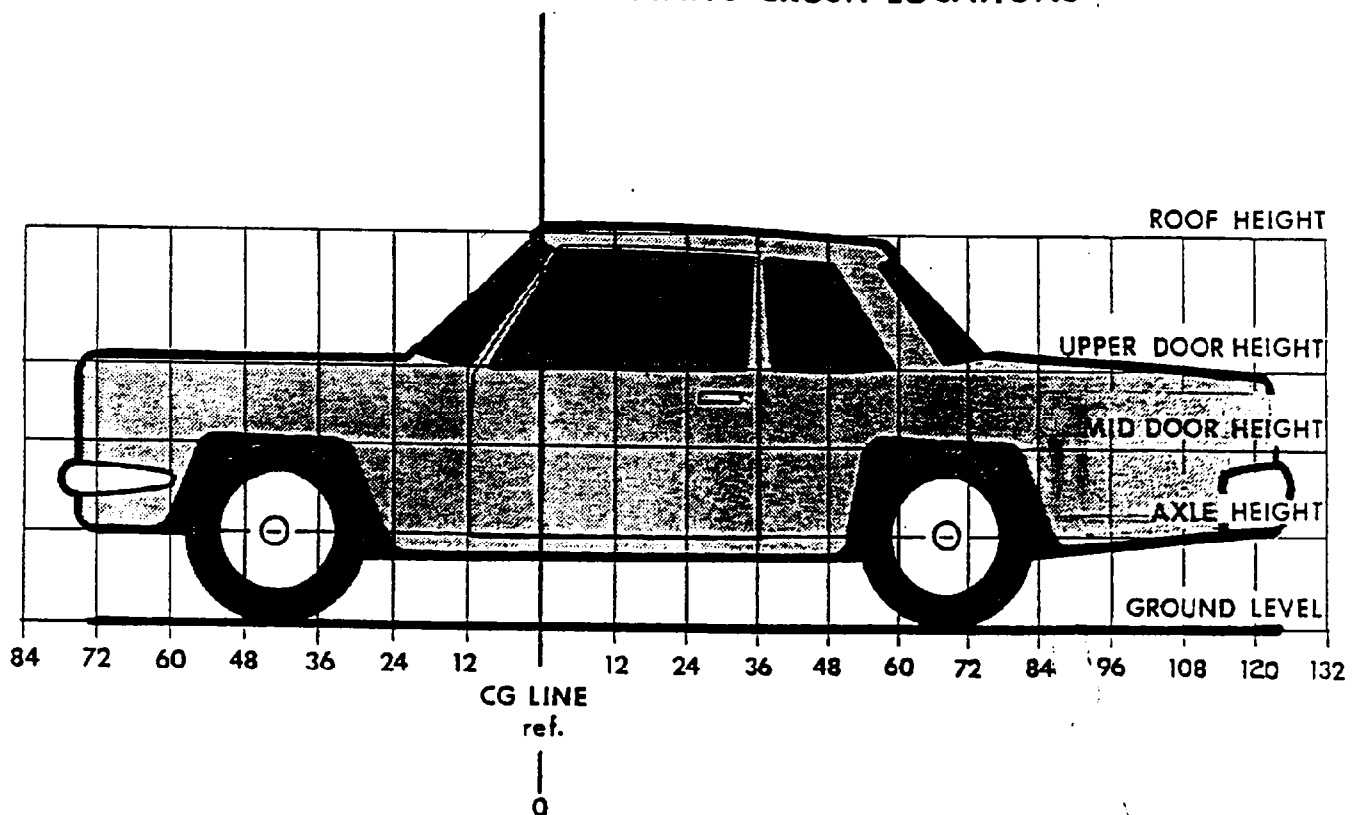
VEHICLE INTERIOR MEASUREMENTS

<u>DESCRIPTION</u>	<u>PRE-TEST</u>	<u>POST-TEST</u>	<u>DIFFERENCE</u>
Floor board to top of left "A" post	42.4	37.4	5.0
Floor board to top of right "A" post	42.1	34.9	7.2
Door sill to top of left "B" post	39.0	37.8	1.2
Door sill to top of right "B" post	39.0	40.1	-1.1
Door sill to top of left door opening	39.2	35.2	4.0
Door sill to top of right door opening	39.0	31.6	7.4
Floor tunnel to windshield header	34.1	27.4	6.7
Floor tunnel to center of roof	40.1	33.8	6.3
Rear of floor tunnel to roof	38.8	35.6	3.2
Maximum width at "B" post	62.8	65.0	-2.2
Maximum width at "A" post	61.5	61.1	0.4
Maximum width at top of door opening	48.5	49.9	-1.4

ALL MEASUREMENTS ARE IN INCHES



HOOD AND ROOF STATIC CRUSH LOCATIONS



LEFT AND RIGHT SIDE STATIC CRUSH LOCATIONS

VEHICLE HOOD EXTERIOR PROFILES
ZERO DISTANCE AT VEHICLE HOOD CENTERLINE*

LOCATION	30	20	10	0	10	20	30
<u>PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>							
Trailing edge of cowl at centerline	36.5	37.5	38.4	38.4	38.1	37.6	36.9
Trailing edge of cowl + 12 inches***	35.4	36.4	36.9	37.4	37.0	36.2	35.4
Trailing edge of cowl + 24 inches	33.4	34.6	35.5	35.8	35.4	34.6	33.6
Trailing edge of cowl + 36 inches	X	32.1	32.9	33.2	32.9	32.2	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X
<u>POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>							
Trailing edge of cowl at centerline	36.1	38.7	40.0	40.6	40.1	37.8	35.1
Trailing edge of cowl + 12 inches	35.0	37.1	38.4	39.0	38.4	35.8	34.0
Trailing edge of cowl + 24 inches	33.5	35.1	36.4	36.9	35.8	33.8	31.9
Trailing edge of cowl + 36 inches	X	32.6	33.9	34.2	33.8	31.5	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X
<u>STATIC CRUSH (IN)</u>							
Trailing edge of cowl at centerline	-0.4	1.2	1.6	2.2	2.0	0.2	-1.8
Trailing edge of cowl + 12 inches	-0.4	0.7	1.5	1.6	1.4	-0.4	-1.4
Trailing edge of cowl + 24 inches	0.1	0.5	0.9	1.1	0.4	-0.8	-1.7
Trailing edge of cowl + 36 inches	X	0.5	1.0	1.0	0.9	-0.7	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X

- * Column readings are left to right from left to right on vehicle.
- ** Reference plane is a horizontal plane at ground level.
- ***Longitudinal distance from trailing edge of cowl at centerline forward to measurement plane.
- + Static crush means vehicle structure is bowed upward.
- Static crush means vehicle structure is crushed.

VEHICLE ROOF EXTERIOR PROFILES
ZERO DISTANCE AT VEHICLE ROOF CENTERLINE*

LOCATION	20	10	0	10	20
<u>PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>					
Longitudinal Center of Gravity	54.8	55.4	55.8	55.2	54.6
Longitudinal Center of Gravity + 12 inches***	55.1	55.6	55.9	55.6	55.1
Longitudinal Center of Gravity + 24 inches	55.0	55.6	56.0	55.8	55.2
Longitudinal Center of Gravity + 36 inches	55.0	55.8	55.9	55.6	55.0
Longitudinal Center of Gravity + 48 inches	54.6	55.4	55.2	55.2	54.7
Longitudinal Center of Gravity + 60 inches	X	X	X	X	X
<u>POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)</u>					
Longitudinal Center of Gravity	50.8	51.5	49.4	46.1	45.0
Longitudinal Center of Gravity + 12 inches	51.8	53.0	49.5	48.3	46.8
Longitudinal Center of Gravity + 24 inches	52.8	53.9	52.0	49.9	48.6
Longitudinal Center of Gravity + 36 inches	53.3	54.0	51.2	50.9	50.3
Longitudinal Center of Gravity + 48 inches	54.0	52.5	53.0	51.9	50.5
Longitudinal Center of Gravity + 60 inches	X	X	X	X	X
<u>STATIC CRUSH (IN)</u>					
Longitudinal Center of Gravity	-4.0	-3.9	-6.4	-9.1	-9.6
Longitudinal Center of Gravity + 12 inches	-3.3	-2.6	-6.4	-7.3	-8.3
Longitudinal Center of Gravity + 24 inches	-2.2	-1.7	-4.0	-5.9	-6.6
Longitudinal Center of Gravity + 36 inches	-1.7	-1.8	-4.7	-4.7	-4.7
Longitudinal Center of Gravity + 48 inches	-0.6	-2.9	-2.2	-3.3	-4.2
Longitudinal Center of Gravity + 60 inches	X	X	X	X	X

* Column readings are left to right from left to right on vehicle.

** Reference plane is a horizontal plane at ground level.

*** Longitudinal distance from center of gravity rearward to measurement plane.

+ Static crush means vehicle structure is bowed upward.

- Static crush means vehicle structure is crushed.

VEHICLE LEFT SIDE EXTERIOR PROFILES AND STATIC CRUSH
ZERO DISTANCE AT VEHICLE LONGITUDINAL CENTER OF GRAVITY*

LOCATION	HEIGHT(IN)	72	60	48	36	24	12	0	12	24	36	48	60	72	84	96
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	54.2	X	X	X	X	X	X	22.6	22.5	22.5	22.4	22.6	X	X	X	X
Upper Door	33.8	X	16.5	15.8	15.5	14.9	14.4	15.0	14.6	14.5	14.5	14.7	14.9	14.9	15.3	X
Mid Door	24.5	16.1	X	X	14.1	13.9	13.6	13.6	13.4	13.3	13.3	12.9	X	13.9	14.4	X
Axle Height	11.5	X	X	X	X	16.1	16.1	16.2	16.1	16.1	16.1	X	X	X	X	X
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	54.2	X	X	X	X	X	X	19.6	19.5	19.1	19.4	19.4	X	X	X	X
Upper Door	33.8	X	16.0	15.2	14.6	14.1	12.6	11.3	10.5	10.8	11.5	12.2	15.4	14.4	15.3	X
Mid Door	24.5	15.5	X	X	13.5	13.4	12.4	11.0	10.1	11.5	12.2	12.6	X	13.9	14.7	X
Axle Height	11.5	X	X	X	X	16.5	16.4	15.9	16.0	16.3	16.9	X	X	X	X	X
STATIC CRUSH (IN)																
Roof Height	54.2	X	X	X	X	X	X	-3.0	-3.0	-3.4	-3.0	-3.2	X	X	X	X
Upper Door	33.8	X	-0.5	-0.6	-0.9	-0.8	-1.8	-3.7	-4.1	-3.7	-3.0	-2.5	0.5	-0.5	0.0	X
Mid Door	24.5	-0.6	X	X	-0.6	-0.5	-1.2	-2.6	-3.3	-1.8	-1.1	-0.3	X	0.0	0.3	X
Axle Height	11.5	X	X	X	X	0.4	0.3	-0.3	-0.1	0.2	0.8	X	X	X	X	X

*Center of gravity is located 51.2 inches rearward of vehicle front wheels. Column readings are left to right from front to rear on vehicle.

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

* Static crush means that vehicle structure is crushed.

- Static crush means that vehicle structure is bowed outward.

VEHICLE RIGHT SIDE EXTERIOR PROFILES AND STATIC CRUSH
ZERO DISTANCE AT VEHICLE LONGITUDINAL CENTER OF GRAVITY*

LOCATION	HEIGHT(IN)	72	60	48	36	24	12	0	12	24	36	48	60	72	84	96
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	54.2	X	X	X	X	X	X	22.6	22.5	22.5	22.4	22.6	X	X	X	X
Upper Door	33.8	X	16.5	15.8	15.5	14.9	14.4	15.0	14.6	14.5	14.5	14.7	14.9	14.9	15.3	X
Mid Door	24.5	16.1	X	X	14.1	13.9	13.6	13.6	13.4	13.3	13.3	12.9	X	13.9	14.4	X
Axle Height	11.5	X	X	X	X	16.1	16.1	16.2	16.1	16.1	16.1	X	X	X	X	X
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE**)																
Roof Height	54.2	X	X	X	X	X	X	19.6	19.5	19.1	19.4	19.4	X	X	X	X
Upper Door	33.8	X	16.0	15.2	14.6	14.1	12.6	11.3	10.5	10.8	11.5	12.2	15.4	14.4	15.3	X
Mid Door	24.5	15.5	X	X	13.5	13.4	12.4	11.0	10.1	11.5	12.2	12.6	X	13.9	14.7	X
Axle Height	11.5	X	X	X	X	16.5	16.4	15.9	16.0	16.3	16.9	X	X	X	X	X
STATIC CRUSH (IN)																
Roof Height	54.2	X	X	X	X	X	X	-3.0	-3.0	-3.4	-3.0	-3.2	X	X	X	X
Upper Door	33.8	X	-0.5	-0.6	-0.9	-0.8	-1.8	-3.7	-4.1	-3.7	-3.0	-2.5	0.5	-0.5	0.0	X
Mid Door	24.5	-0.6	X	X	-0.6	-0.5	-1.2	-2.6	-3.3	-1.8	-1.1	-0.3	X	0.0	0.3	X
Axle Height	11.5	X	X	X	X	0.4	0.3	-0.3	-0.1	0.2	0.8	X	X	X	X	X

* Center of gravity is located 51.2 inches rearward of vehicle front wheels. Column readings are left to right from front to rear on vehicle.

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

* Static crush means that vehicle structure is crushed.

- Static crush means that vehicle structure is bowed outward.

IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Volvo/740

TEST NUMBER: 911021

NO.	TYPE OF MEASUREMENT	ALL MEASUREMENTS ARE IN INCHES		
		PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	189.5	189.0	0.5
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	162.8	162.6	0.2
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	127.0	126.8	0.2
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	127.4	127.9	-0.5
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	127.2	127.1	0.1
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	127.6	127.1	0.5
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	86.6	86.8	-0.2
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	86.8	87.5	-0.7
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	87.1	86.9	0.2
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	87.5	87.5	0.0
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	125.8	125.9	-0.1
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	125.8	126.4	-0.6
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	138.8	138.8	0.0
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	138.8	138.8	0.0
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	105.4	108.4	-3.0
X17	CENTER OF STEERING COLUMN TO "A" POST	15.8	15.8	0.0
X18	CENTER OF STEERING COLUMN TO HEADLINER	18.0	13.0	5.0
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	186.0	185.6	-0.4
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	186.0	185.4	0.6
X21	LENGTH OF ENGINE BLOCK	23.8	23.8	0.0

TEST ANOMALIES

The driver shoulder belt displacement, SHBD1, data was affected by movement of the shoulder belt anchor due to vehicle crush.

The vehicle center of gravity Z-axis acceleration, VCGZG1, data did not return to zero at the end of the event.

The vehicle center of gravity resultant acceleration, VCGRG1, data channel was affected by the above anomaly.

EVENT TIMES

TEST DATE: 10/21/91

EVENT DESCRIPTION	TIME, SEC.
CONTACT RELEASE BLOCK	0.0
START COLLECTING DATA	-0.2
STOP COLLECTING DATA	4.9
ZERO TIME FOR DATA	0.0
STROBE LIGHTS FLASH	0.0
CAMERA L E D GOES OFF	0.0 *
PIN RELEASES (ROLLOVER CART)	-0.429 **
CYLINDERS START (ROLLOVER CART)	0.112

*Locate frame where event LED stripe ends. Put projector into reverse mode and go backwards 4 frames. This frame is T-zero for the data.

**Release time as setup on rollover cart control panel and as setup by position of rollover cart cycle start switch and release block. Cycle start switch was 20 feet in front of release block.

SECTION 3.0

GENERAL TEST AND VEHICLE PARAMETER DATA

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

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Volvo MAKE/MODEL: Volvo 740
BODY STYLE: 4-door sedan VIN: YV1FA884XM2525343
MODEL YEAR: 1991 COLOR: Maroon
ENGINE DATA: TYPE: Inline CYLINDERS: 4 DISPLACEMENT: 2.3
TRANSMISSION DATA: 3 SPEED, MANUAL, X AUTOMATIC, FWD, X RWD, 4WD
DATE VEHICLE RECEIVED: 09/13/91 ODOMETER READING: 31.0
DEALER'S NAME AND ADDRESS: Segna Motors, Inc.
2265 W. Dublin-Granville
Columbus, OH 43085

ACCESSORIES:

POWER STEERING	Yes	AUTOMATIC TRANSMISSION	Yes
POWER BRAKES	Yes	AUTOMATIC SPEED CONTROL	No
POWER SEATS	No	TILTING STEERING WHEEL	No
POWER WINDOWS	Yes	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	Yes
RADIO	Yes	ANTI-SKID BRAKE	No
CLOCK	Yes	REAR WINDOW DEFROSTER	No
OTHER	None		

REMARKS:

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

CERTIFICATION DATA FROM VEHICLE'S LABEL:

VEHICLE MANUFACTURED BY: Volvo
DATE OF MANUFACTURE: 04/91 VIN: YV1FA884XM2525343
GVWR: 4110 LBS
GAWR: FRONT: 2010 LBS., REAR: 2125 LBS.

TEST VEHICLE INFORMATION CONT'D

TIRES ON VEHICLE (MFR., LINE, SIZE): Michelin MXL 185/65R15

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

SPARE TIRE (MFR., LINE, SIZE): Firestone Radial Special Spare 155/R15

TYPE OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manually Adjustable

MAXIMUM WIDTH: 69.1 INCHES

WHEELBASE: 109.5 INCHES

WIDTH OF TOP: 51.5

LOCATION OF LABEL STATING TIRE & CAPACITY DATA:

The label was located on the passenger door.

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: 185/65R15

RECOMMENDED COLD TIRE PRESSURE: FRONT: 36 PSI; REAR: 36 PSI

DESIGNATED SEATING CAPACITY: 2 FRONT 3 REAR 5 TOTAL

VEHICLE CAPACITY WEIGHT: 990 LBS.

TEST VEHICLE ATTITUDE (ALL MEASUREMENTS ARE IN INCHES):

DELIVERED ATTITUDE: LF 26.6; RF 26.8; LR 26.2; RR 26.2

FULLY LOADED ATTITUDE: LF 26.2; RF 26.4; LR 24.5; RR 24.2

PRE-TEST ATTITUDE: LF 26.5; RF 26.9; LR 25.2; RR 25.5

POST-TEST ATTITUDE: LF 26.4; RF 26.8; LR 23.6; RR 25.2

TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE AS RECEIVED (WITH 1/4 TANK OF GAS):

RIGHT FRONT	839 LBS.	RIGHT REAR	620 LBS.
LEFT FRONT	834 LBS.	LEFT REAR	622 LBS.
TOTAL FRONT WEIGHT	1673 LBS.	(57.4% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1242 LBS.	(42.6% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	2915 LBS.		

CALCULATION OF TEST VEHICLE'S TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT*

UDW = UNLOADED DELIVERED WEIGHT (2915 LBS)

VCW = VEHICLE CAPACITY WEIGHT (990 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

$RCLW^* = VCW - 150 (DSC) = 990 - 150(5) = 240$

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

TARGET TEST WEIGHT = 2915 + 240 + 167

TARGET TEST WEIGHT = 3322 LBS

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 232 LBS. OF CARGO WEIGHT:

RIGHT FRONT	860 LBS.	RIGHT REAR	781 LBS.
LEFT FRONT	903 LBS.	LEFT REAR	770 LBS.
TOTAL FRONT WEIGHT	1763 LBS.	(53.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1551 LBS.	(46.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	3314 LBS.	(0.2% UNDER TARGET TEST WEIGHT)	

WEIGHT OF BALLAST SECURED IN VEHICLE CARGO AREA: 62 LBS.

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: NONE

CG = 51.2 INCHES REARWARD OF FRONT WHEEL CENTERLINE

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

TEST CONDITIONS

TEST NUMBER: 911021

TEST DATE: 10/21/91

TEST TEMPERATURES:

IMPACT AREA: 69° F;

OCCUPANT COMPARTMENT: 72° F

DRIVER DUMMY: 72° F;

PASSENGER DUMMY: NA F

VEHICLE AND ROLL CART DATA

	ACTUAL	INTENDED
VEHICLE TEST WEIGHT (LBS.):	3314	3322
VEHICLE ORIENTATION (DEG.) ROLL*:	30	30
IMPACT SIDE:	Left	Left
ROLL CART WEIGHT (LBS.):	3347	3347
ROLL CART CRABBED ANGLE (DEG.)**:	0	0
ROLL CART VELOCITY (MPH)***:	30.0	30.0

VEHICLE MEASUREMENTS

MAX. LENGTH: 189.5	WHEELBASE: 109.5
MAX. WIDTH: 69.1	TOP WIDTH: 51.5
C.G. REARWARD OF FRONT WHEEL CENTERLINE: 51.2	
C.G. HEIGHT ABOVE GROUND LEVEL: 20.9	

VEHICLE TEST CONDITIONS

LEFT FRONT:	DOOR - unlocked	WINDOW - Up
LEFT REAR:	DOOR - unlocked	WINDOW - Up
RIGHT FRONT:	DOOR - unlocked	WINDOW - Up
RIGHT REAR:	DOOR - unlocked	WINDOW - Up
EMERGENCY BRAKE:	Off	TRANSMISSION: Neutral
HEADRESTS:	DRIVER - Fixed	PASSENGER - Fixed
TIRE PRESSURE:	FRONT - 36 PSI;	REAR - 36 PSI

DUMMY INFORMATION

TYPE:	Part 572E
POSITION:	Driver
SERIAL NO.:	907
INSTRUMENTATION:	
HEAD ACCELS.:	3
NECK LOAD CELLS:	6
CHEST ACCELS.:	3
CHEST DISPLACEMENT	
POTENTIOMETER:	1
PELVIS ACCELS.:	3
RIB DISPLACEMENT	
POTENTIOMETER:	
RESTRAINT SYSTEM:	Three-point unbelt and driver's airbag

ALL DISTANCE MEASUREMENTS ARE IN INCHES.
*AS MEASURED ON THE ROLL CART WITH CYLINDER IN REST POSITION.
**AS MEASURED FROM ROLL CART'S CENTERLINE TO DIRECTION OF TRAVEL
(POSITIVE IS CLOCKWISE)

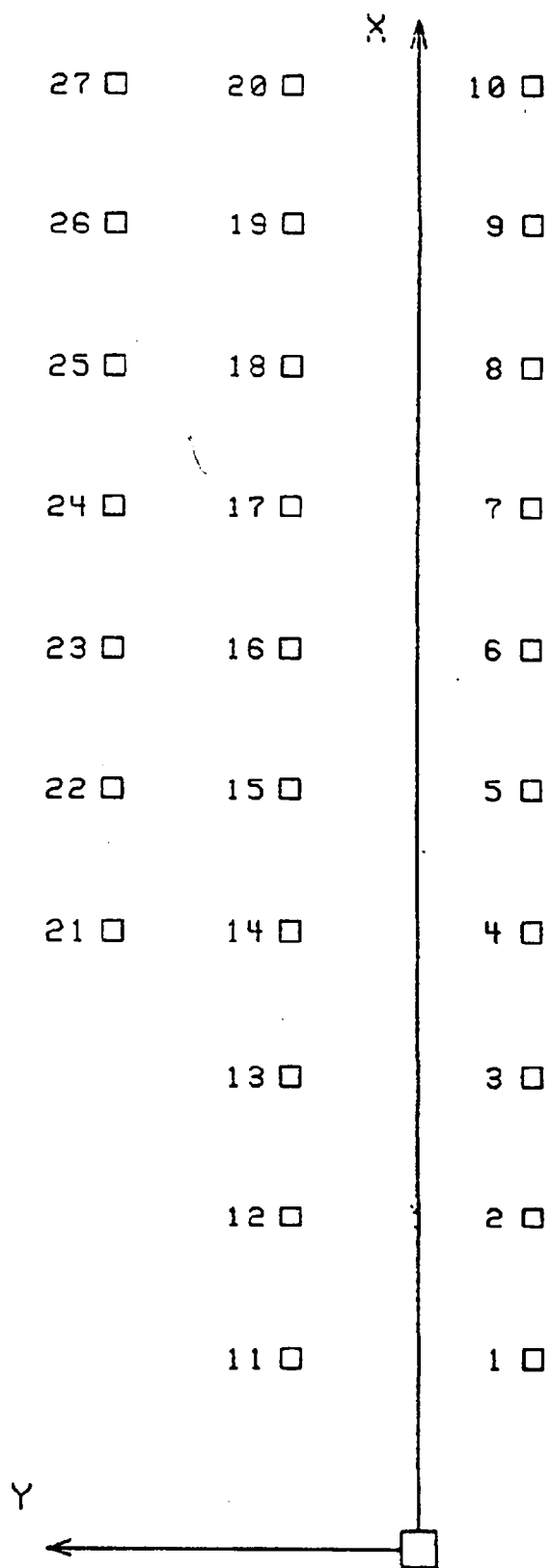
VEHICLE INSTRUMENTATION LOCATIONS AND DATA SUMMARY

TEST NUMBER 911021

No.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
					MAX G	MSEC	MAX G	MSEC
1	CENTER OF GRAVITY ACCELERATION (g)	84.0	0.0	15.2				
	LONGITUDINAL				3.9	3404.0	4.4	997.3
	LATERAL				9.6	1556.7	8.5	1998.7
	VERTICAL				7.6	3357.3	15.2	2489.3
	RESULTANT				16.5	2489.3		
2	CENTER OF GRAVITY ROLL (X-AXIS)	81.8	0.0	17.2	123.5	4626.0	432.4	928.0
	PITCH (Y-AXIS)				108.7	3362.7	98.3	964.7
	YAW (Z-AXIS)				75.1	2523.3	80.4	3361.3
3	LEFT FRONT SUSPENSION DISPLACEMENT (in)	158.8	19.6	32.5				
	VERTICAL				5.4	3378.0	0.4	2116.0
4	RIGHT FRONT SUSPENSION DISPLACEMENT (in)	157.8	-21.4	33.2				
	VERTICAL				4.9	4736.7	0.1	980.0
5	LEFT REAR SUSPENSION DISPLACEMENT (in)	41.8	14.5	29.8				
	VERTICAL				7.1	1978.0	0.3	1780.0
6	RIGHT REAR SUSPENSION DISPLACEMENT (in)	41.4	-14.6	30.1				
	VERTICAL				8.2	4703.3	0.2	170.0

* ALL MEASUREMENTS OF INSTRUMENTATION LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM VEHICLE'S REAR BUMPER
Y: + LEFTWARD FROM VEHICLE'S CENTERLINE
Z: + UPWARD FROM GROUND LEVEL
ROLL: + TO RIGHT
PITCH: + NOSE DOWNWARD
YAW: + COUNTERCLOCKWISE
DISPLACEMENT: + UPWARD



STADIA POLE LAYOUT AND NUMBERING SYSTEM

STADIA POLE LOCATIONS

POLE NO.	X DISTANCE*	Y DISTANCE*
1	35.0	8.0
2	43.0	8.0
3	51.0	8.0
4	59.0	8.0
5	67.0	8.0
6	75.0	8.0
7	83.0	8.0
8	91.0	8.0
9	99.0	8.0
10	107.0	8.0
11	35.0	-10.0
12	43.0	-10.0
13	51.0	-10.0
14	59.0	-10.0
15	67.0	-10.0
16	75.0	-10.0
17	83.0	-10.0
18	91.0	-10.0
19	99.0	-10.0
20	107.0	-10.0
21	59.0	-20.0
22	67.0	-20.0
23	75.0	-20.0
24	83.0	-20.0
25	91.0	-20.0
26	99.0	-20.0
27	107.0	-20.0

*REFERENCE: +X: FORWARD FROM RELEASE BLOCK

+Y: LEFTWARD FROM CENTER RELEASE BLOCK

ALL MEASUREMENTS ARE IN FEET.

HIGH-SPEED CAMERAS LOCATION

OFFBOARD

CAMERA			
NO.	X*	Y*	Z*
2	95.0	195.4	2.7
3	240.6	124.3	2.7
4	209.0	0.0	3.6
5	56.0	-72.2	2.9

*Reference:

- +X: Forward from release block
- +Y: Leftward from the centerline of the release block
- +Z: Upward from the ground level

ONBOARD

CAMERA			
NO.	X**	Y**	Z**
7	1.4	-1.2	1.5
8	4.2	-1.2	2.9

**Reference:

- +X: Forward from the C.G. of vehicle
- +Y: Leftward from centerline of vehicle
- +Z: Upward from the ground level

ALL MEASUREMENTS ARE IN FEET.

CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Left panning	Bolex	16	24	Real-time documentary
2	Left wide	Photosonic	13	500	Vehicle Dynamics
3	Left angle	Photosonic	25	495	Vehicle Dynamics
4	Downstream	Photosonic	50	495	Vehicle Dynamics
5	Right wide	Photosonic	13	493	Vehicle Dynamics
6	Overhead	Photosonic	8	495	Vehicle Dynamics
7	Onboard - front	Photosonic	8	470	Dummy kinematics
8	Onboard - rear	Photosonic	8	493	Dummy kinematics

SECTION 4.0

OCCUPANT INFORMATION

POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #907	PASSENGER #NA
HEAD	<u>Roof</u>	<u></u>
CHEST	<u>None</u>	<u></u>
ABDOMEN	<u>None</u>	<u></u>
LEFT KNEE	<u>Dash panel</u>	<u></u>
RIGHT KNEE	<u>Dash panel</u>	<u></u>

DOOR OPENING:

	LEFT	RIGHT
FRONT	<u>Tools required</u>	<u>With difficulty</u>
REAR	<u>Tools required</u>	<u>With difficulty</u>

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	<u>No</u>	<u>No</u>
REAR	<u>No</u>	<u>No</u>

GLAZING DAMAGE:

The windshield, side glass, and rear window cracked
during the rollover.

OTHER NOTABLE IMPACT EFFECTS:

The outside rear view mirrors broke off during the
rollover.

DUMMY KINEMATIC SUMMARY

The vehicle struck the ground at the junction of the roof and the driver's side A, B, and C pillars. The dummy's knees then rose and struck the dash panel as the dummy's hands and arms rose and struck the roof. Simultaneously, the roof collapsed onto the dummy's head. The vehicle then rolled fully onto its top collapsing the passenger side of the roof. The vehicle next rolled onto its passenger's side and then bounced onto the driver's side wheels as the roll cart came to a stop. The vehicle next bounced onto the roof again. The dummy's head, arms, and hands struck the roof a second time. The vehicle then rolled onto the passenger's side and then up on the driver's side wheels. The dummy then landed in the driver's seat. The car then rolled back onto all 4 wheels. The vehicle rolled forward approximately 750° total. The dummy was restrained with a 3-point unbelt. The dummy's head injury criteria, HIC, was 241, its maximum chest acceleration resultant over 3 milliseconds was 36.7 g.

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle and dummy were left inside the temperature controlled building eight hours prior to the time the dummy was loaded into the vehicle. After the vehicle had been positioned on the rollover device it was towed outside for launch. The temperature was controlled to the last minute before launching of the vehicle.

One Part 572E dummy was instrumented for this test. The dummy instrumentation consisted of triaxial accelerometers in the head, chest, and pelvis, a displacement potentiometer in the chest, and six (6) load cells in the neck. Prior to seating the dummy, the driver's seat was positioned in the mid-adjustment notch of the seat track. The seat back angle was adjusted to 23°. The dummy was positioned in the seat using NHTSA's Notice #60 seating procedure. The H-point location of the seat was obtained by using the SAE J211 OCT88 H-point machine as specified in the Notice #60. The driver dummy was restrained with a three-point unbelt and an airbag.

DUMMY DATA SUMMARY

TEST NUMBER 911021

- DRIVER DUMMY
SN: 907

	POSITIVE DIRECTION		NEGATIVE DIRECTION	
	MAX	MSEC	MAX	MSEC
HEAD ACCELERATION (g)				
LONGITUDINAL	12.0	1003.3	17.4	951.3
LATERAL	30.6	858.0	77.3	3407.3
VERTICAL	20.5	2031.3	81.3	845.3
RESULTANT	97.0	845.3		
HIC	241 FROM 842.7 TO 847.3			
NECK FORCES (lbs)				
LONGITUDINAL	97.8	990.0	196.0	964.0
LATERAL	90.6	894.7	283.5	845.3
VERTICAL	125.2	997.3	2065.5	849.3
NECK MOMENT (in-lbs)				
ABOUT LONG.	56.8	3410.7	235.1	854.0
ABOUT LATERAL	30.1	3416.0	65.1	952.0
ABOUT VERTICAL	28.4	858.7	17.1	932.0
CHEST ACCELERATION (g)				
LONGITUDINAL	18.8	2028.7	14.4	848.7
LATERAL	7.7	1608.7	72.8	2029.3
VERTICAL	13.2	3389.3	38.3	847.3
RESULTANT	74.2	2029.3		
3 MSEC	36.7			
CHEST DISPLACEMENT (in)				
LONGITUDINAL	0.1	851.3	0.5	2030.0
PELVIS ACCELERATION (g)				
LONGITUDINAL	10.7	3378.0	8.1	873.3
LATERAL	6.6	871.3	10.7	2010.7
VERTICAL	11.7	3376.7	26.9	849.3
RESULTANT	27.1	849.3		

POSITIVE DIRECTION
LONGITUDINAL: FORWARD
LATERAL: LEFTWARD
VERTICAL: UPWARD
FORCE: OUTWARD

NEGATIVE DIRECTION
LONGITUDINAL: REARWARD
LATERAL: RIGHTWARD
VERTICAL: DOWNWARD
FORCE: INWARD

See APPENDIX D for neck load cell polarities.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

MFR./MAKE/MODEL: Volvo/740

SEAT TYPE: Bench

X Bucket

Split bench

ADJUSTER TYPE: X Manual

Power

Non-adjustable

TECHNICIANS:

BUCKET SEAT BACK TYPE: Non-adjustable

X Adjustable reclining

1. B. Miller

2.

3.

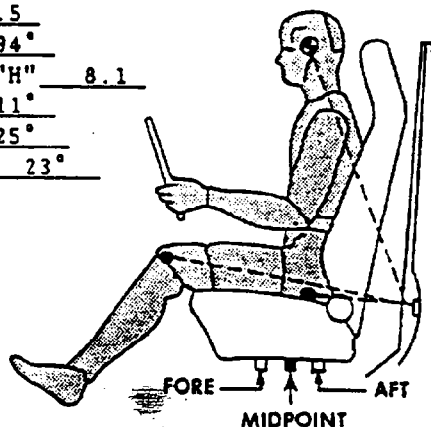
4.

POSITIONING DATE: 10/21/91

AMBIENT TEMP. 69° F TIME: 1603

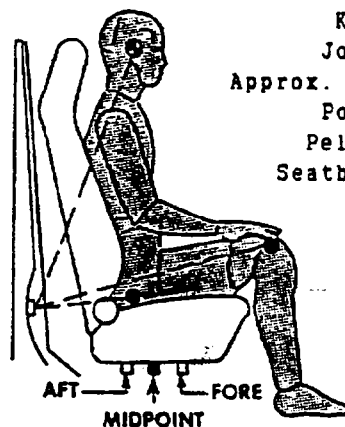
DRIVER DUMMY* # 907 TYPE: HILL

Head 23.4
Target 10°
Knee 22.5
Joint 94°
Approx. "H" 8.1
Point 111°
Pelvis 25°
Seatback 23°



PASSENGER DUMMY* # NA TYPE:

Head
Target
Knee
Joint
Approx. "H"
Point
Pelvis
Seatback



A = 56.2
B = NA
C = 14.0
D = NA

DOOR GLASS
HEIGHT = 10.2

LATERAL BAR

ADJUSTABLE
POINTER

LEFT
FRONT
DOOR

DRIVER
DUMMY

PASSENGER
DUMMY

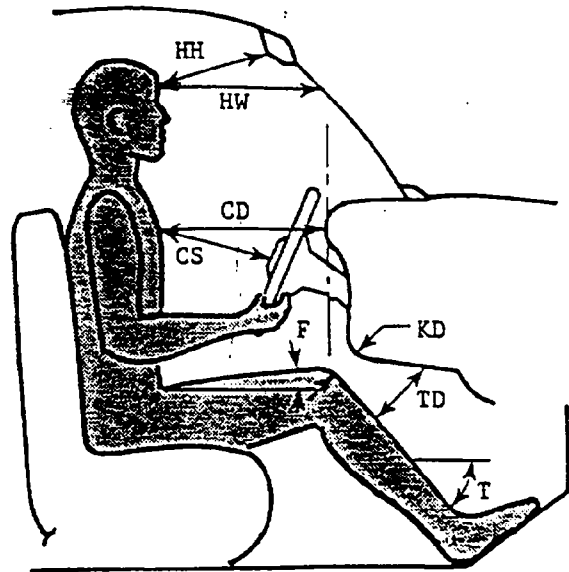
DOOR GLASS
HEIGHT = NA

RIGHT
FRONT
DOOR

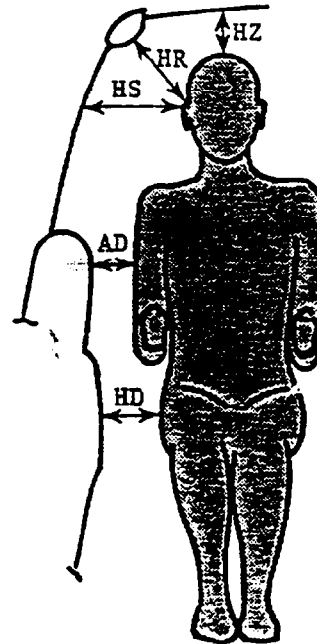
*Dummy measurements are referenced to top of striker bolt and all angles are referenced to vertical.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

	DRIVER	PASSENGER
		NA
HH	14.8	
HW	20.2	
CD	20.9	
CS	10.9	
KDL	4.9	
KDR	4.9	
FL	16°	
FR	17°	
TDL	3.2	
TDR	3.9	
TL	43°	
TR	47°	



	DRIVER	PASSENGER
HR	6.4	
HS	10.2	
AD	4.4	
HD	5.9	
HZ	3.6	



ALL DISTANCE MEASUREMENTS ARE IN INCHES.

APPENDIX A

PHOTOGRAPHS

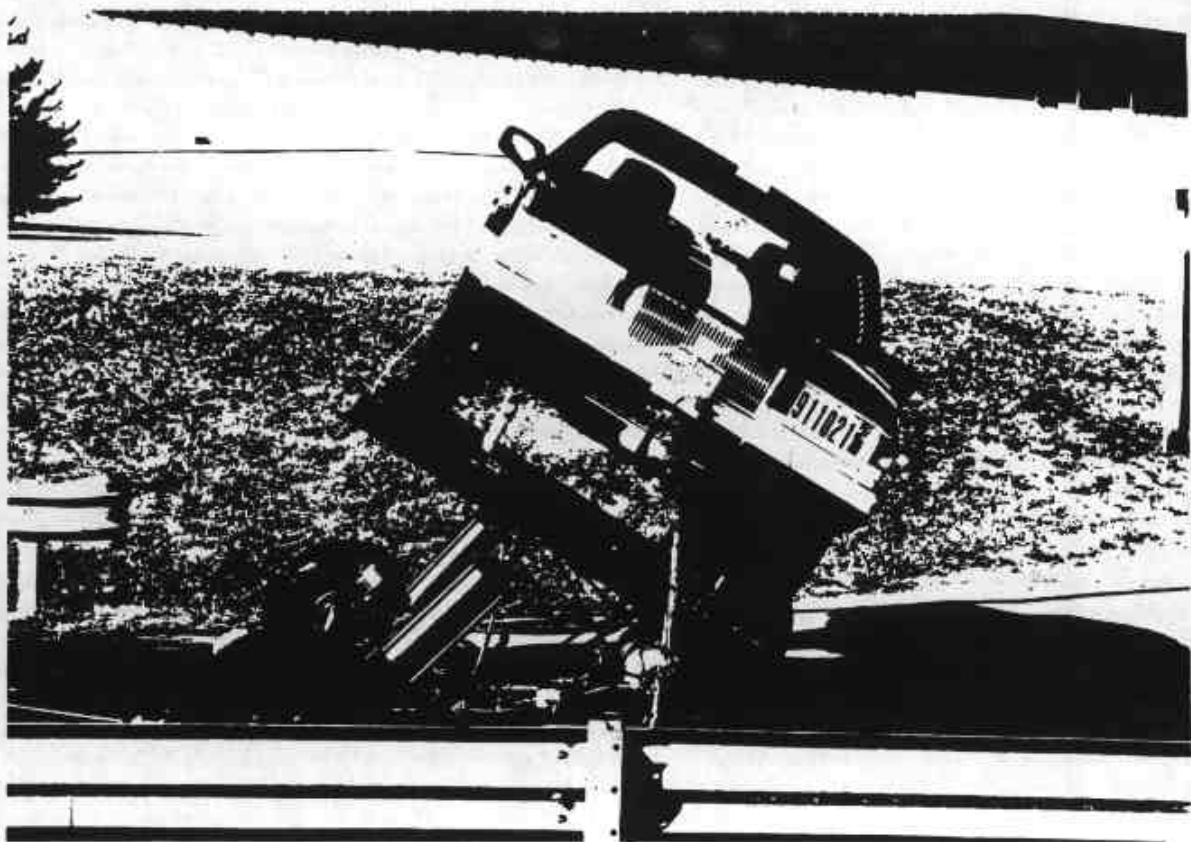


Figure A-1. PRE-TEST FRONT VIEW



Figure A-2. PRE-TEST LEFT SIDE VIEW

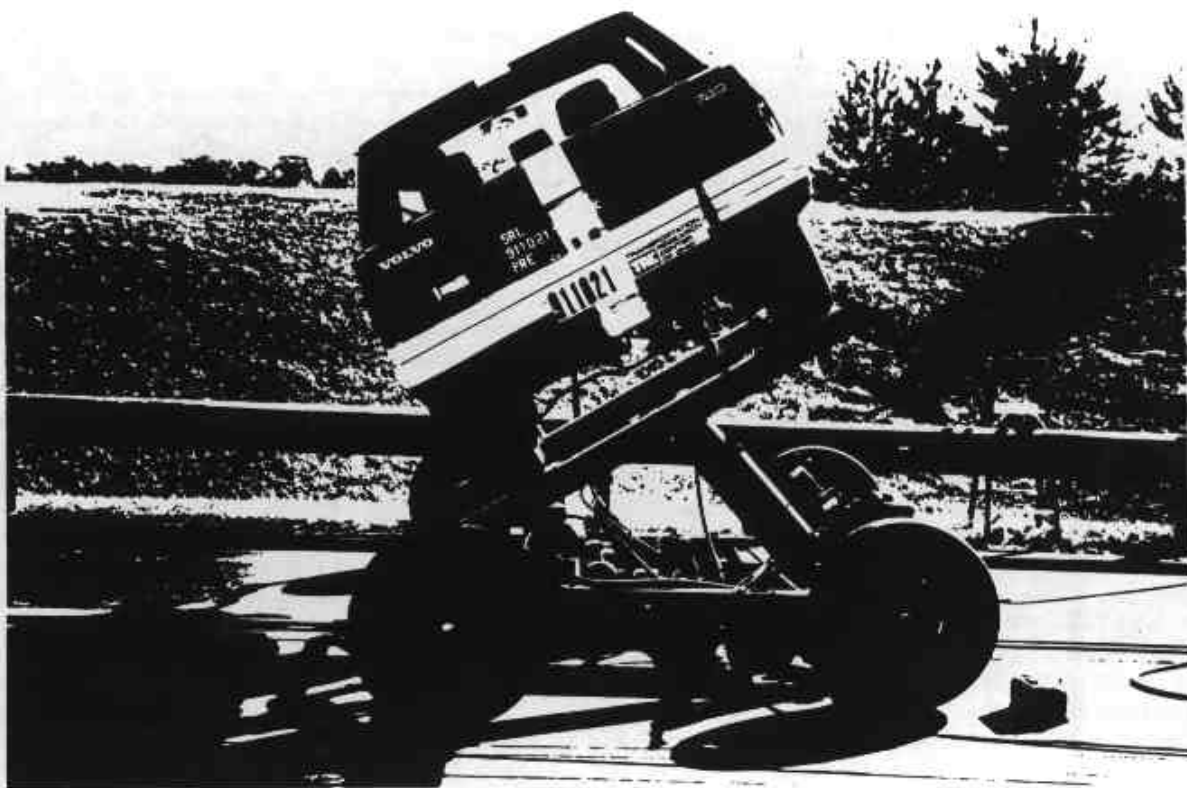


Figure A-3. PRE-TEST REAR VIEW

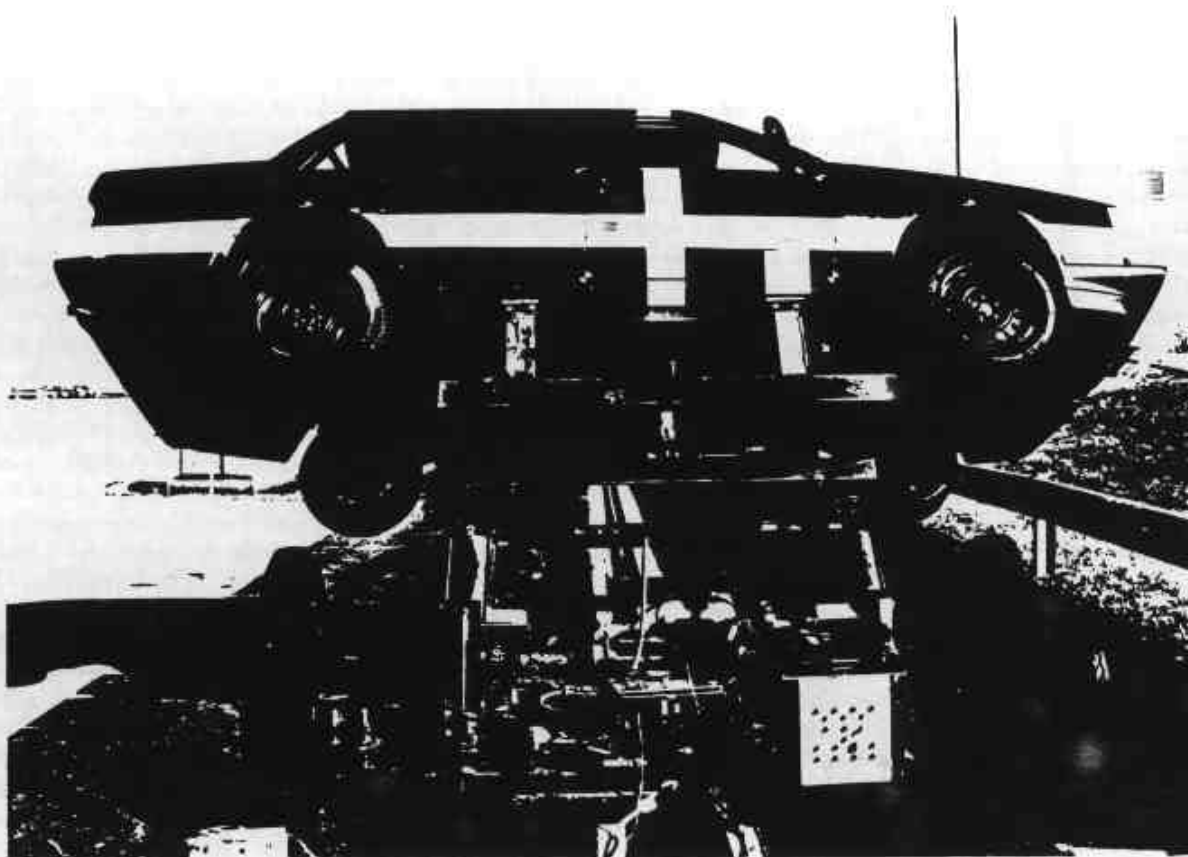


Figure A-4. PRE-TEST RIGHT SIDE VIEW



Figure A-5. PRE-TEST DRIVER DUMMY - VIEW 1

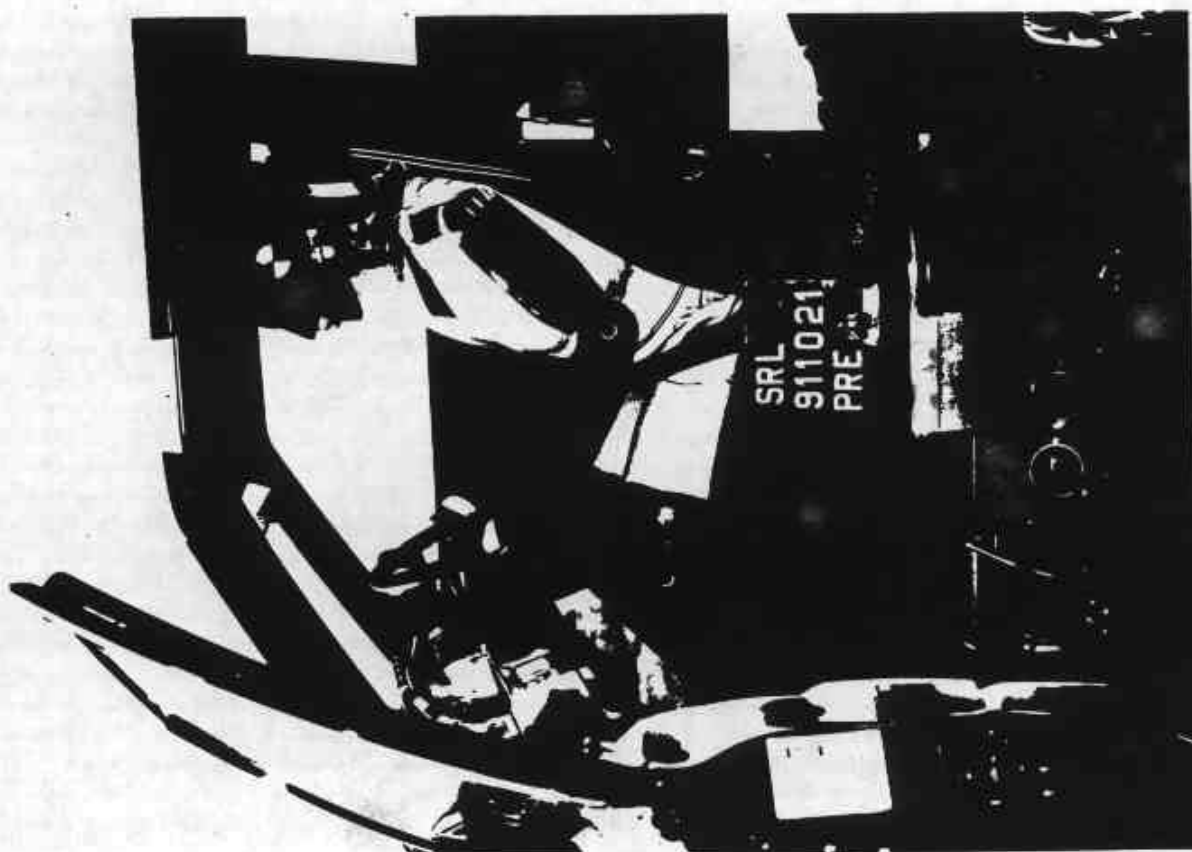


Figure A-6. PRE-TEST DRIVER DUMMY - VIEW 2

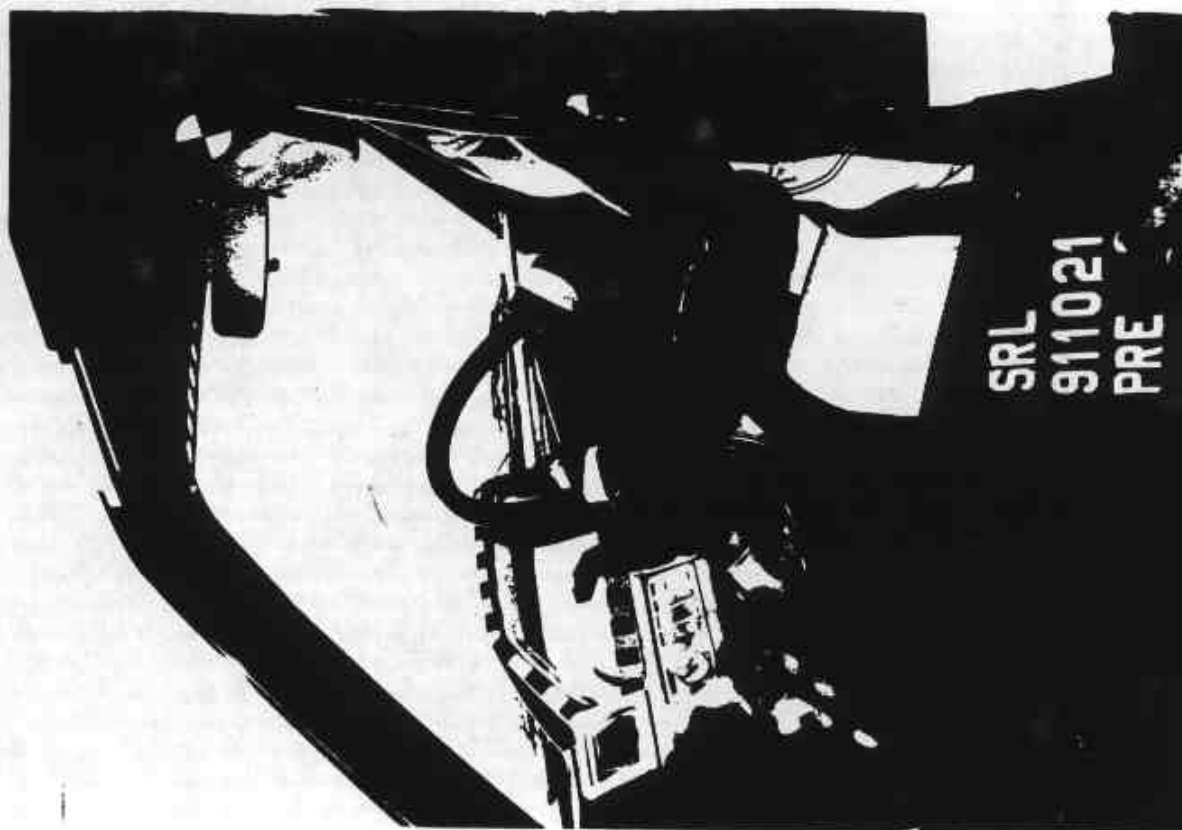


Figure A-7. PRE-TEST DRIVER DUMMY - VIEW 3

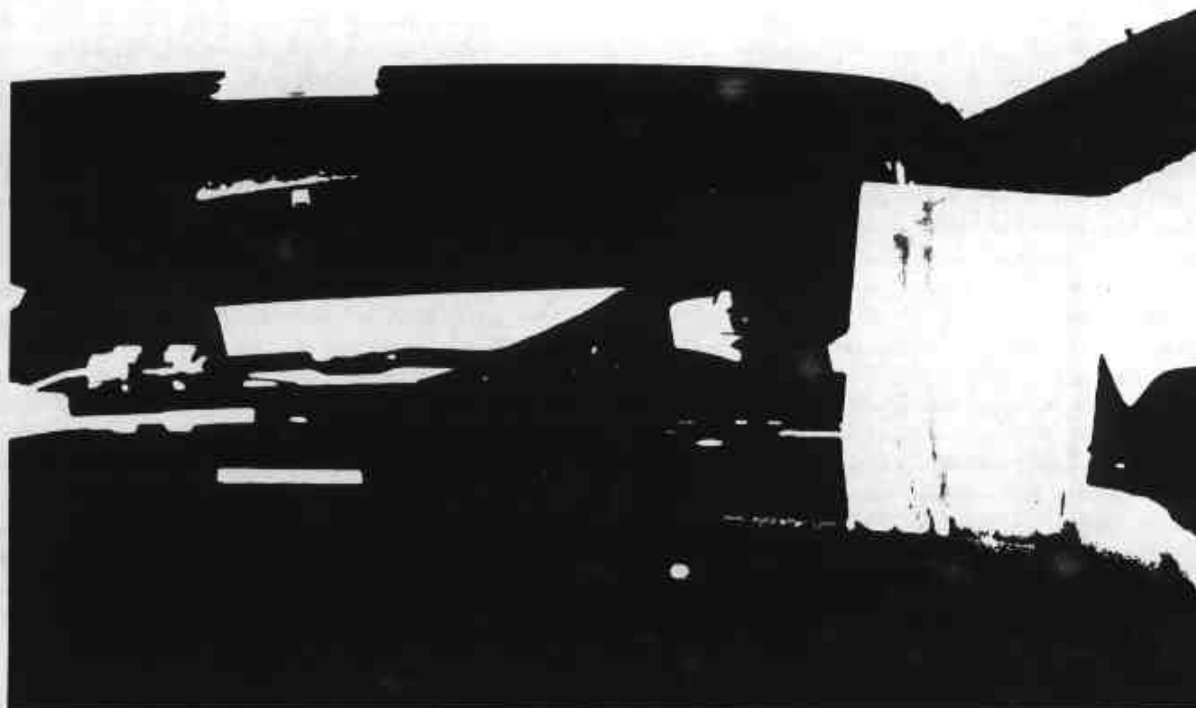


Figure A-8. PRE-TEST DRIVER DUMMY - VIEW 4

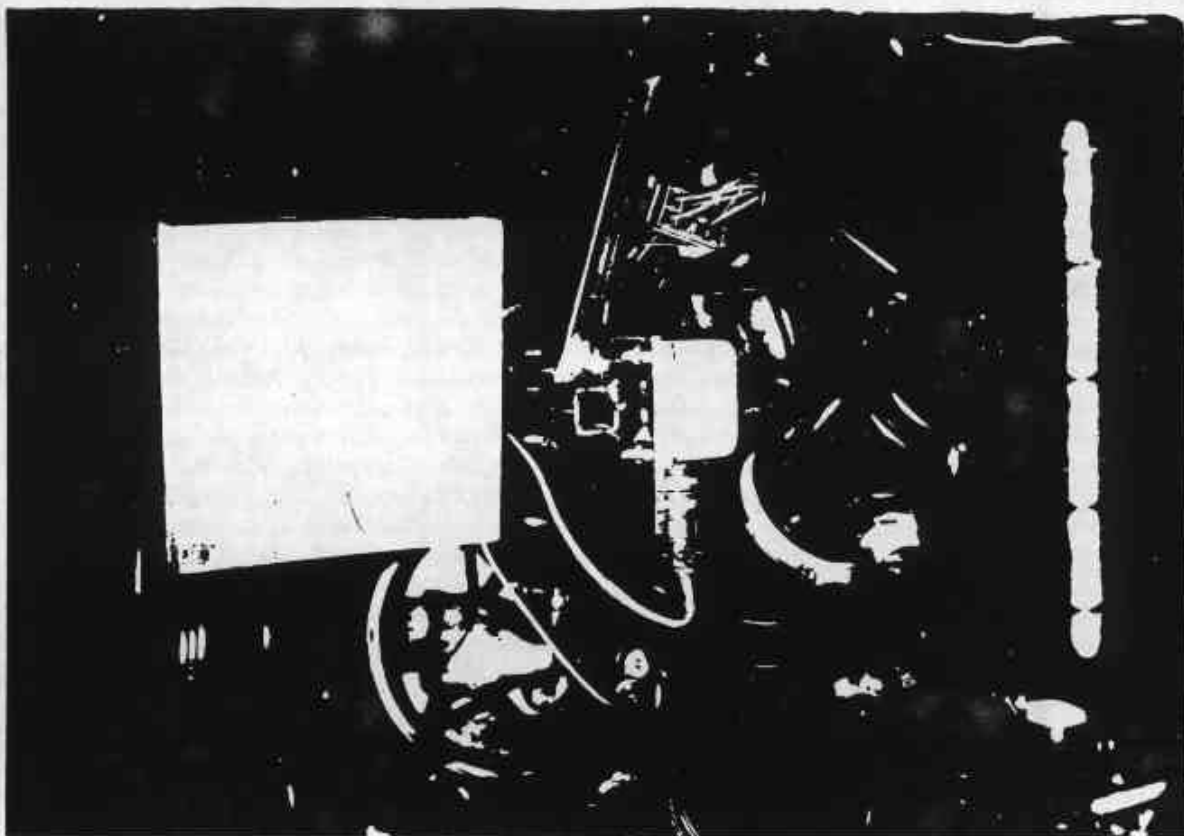


Figure A-9. PRE-TEST LEFT FRONT SUSPENSION STRING POTENTIOMETER - VIEW 1

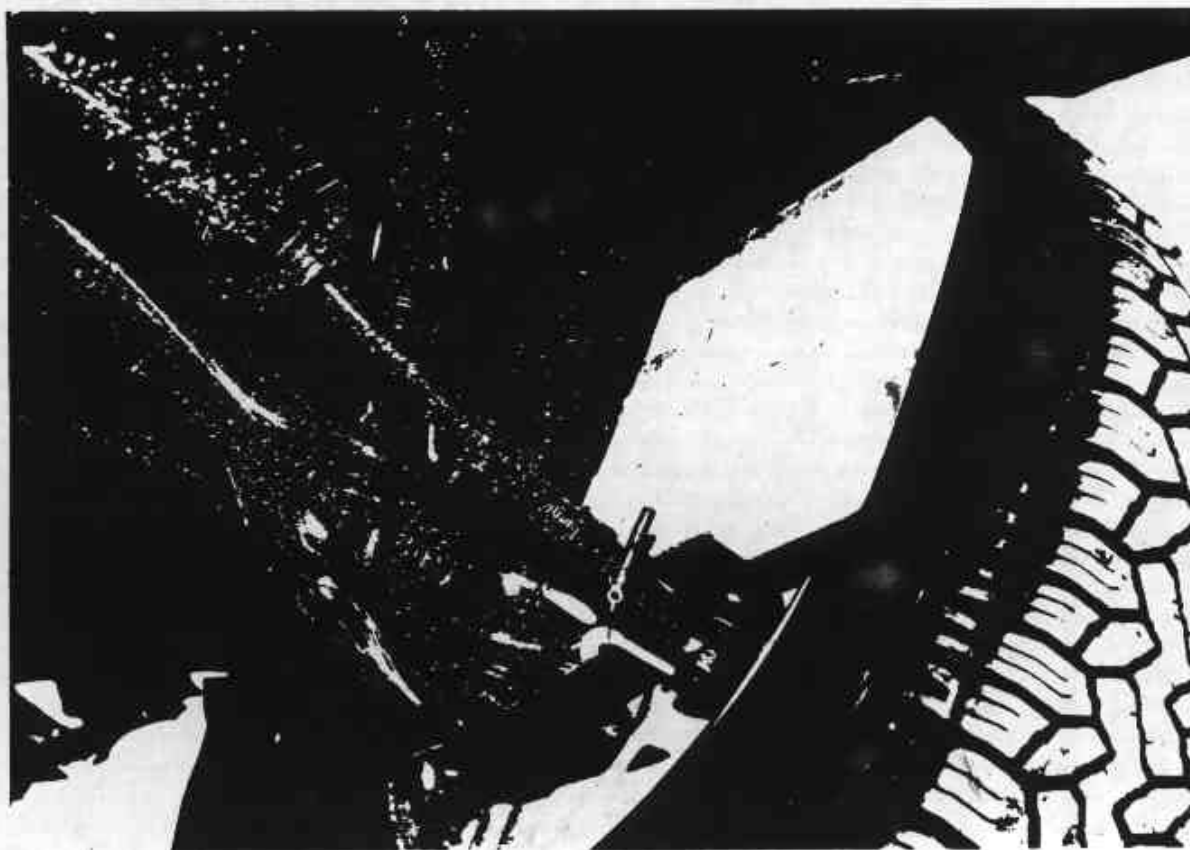


Figure A-10. PRE-TEST LEFT FRONT SUSPENSION STRING POTENTIOMETER - VIEW 2

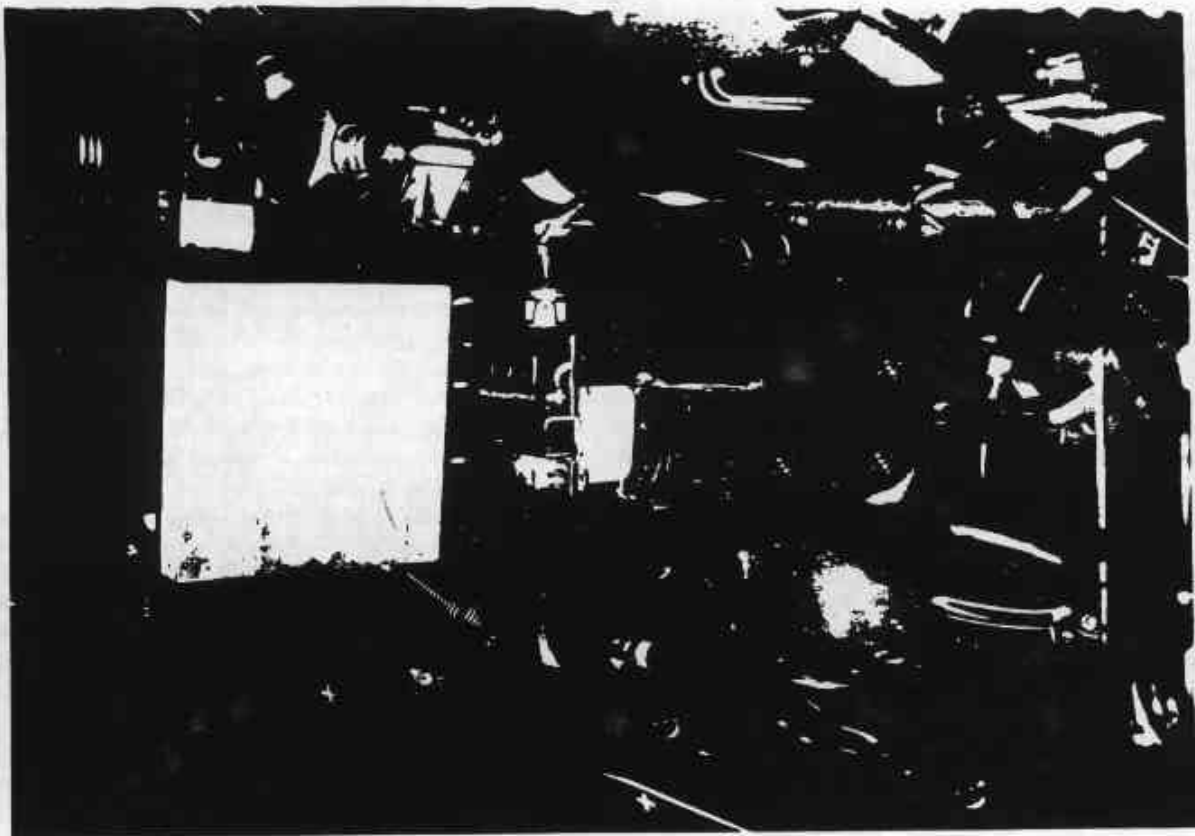


Figure A-11. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER - VIEW 1

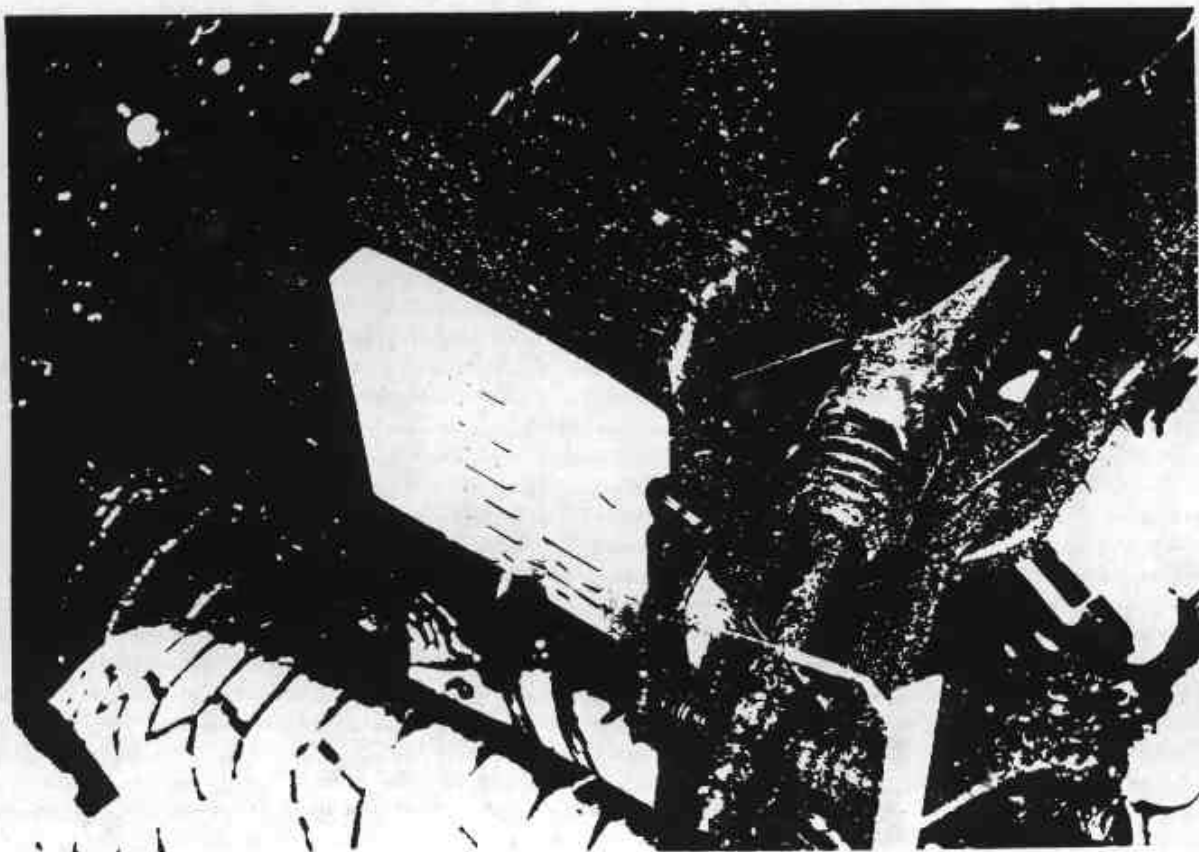


Figure A-12. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER - VIEW 2

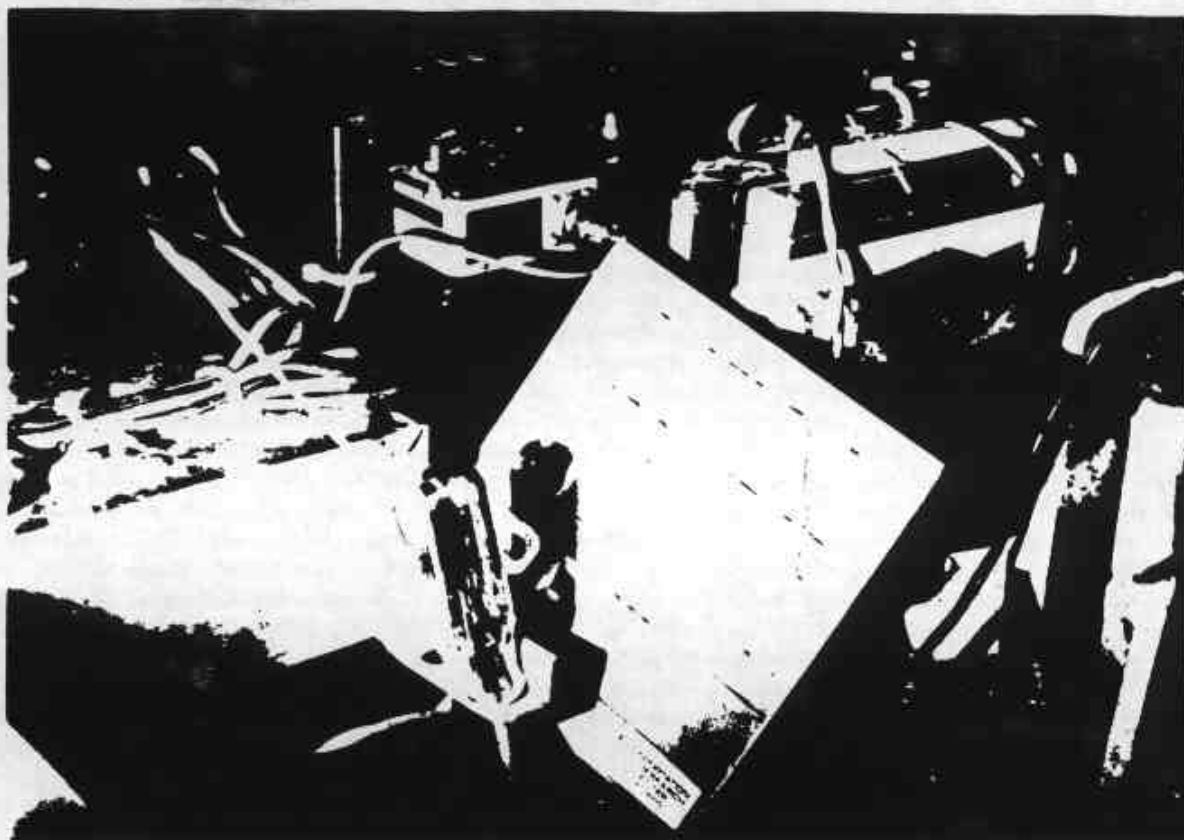


Figure A-13. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER - VIEW 1



Figure A-14. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER - VIEW 2

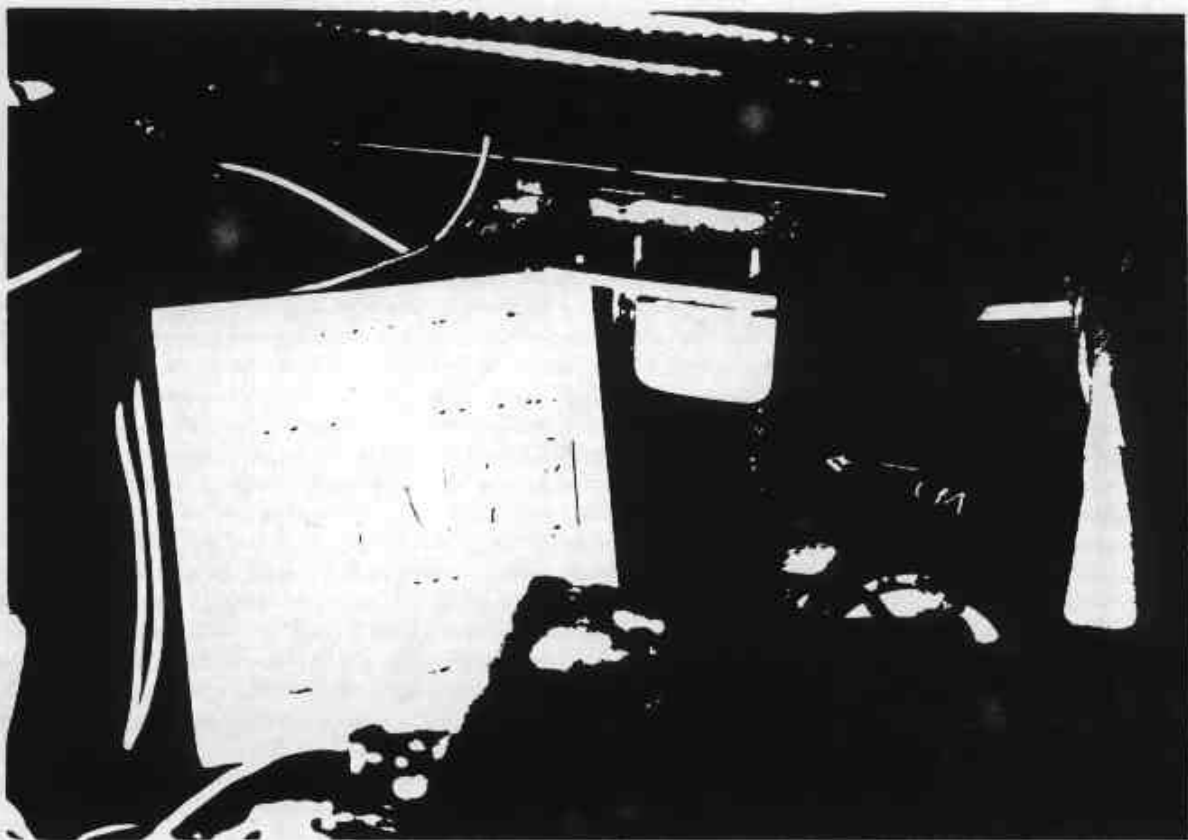


Figure A-15. PRE-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER - VIEW 1

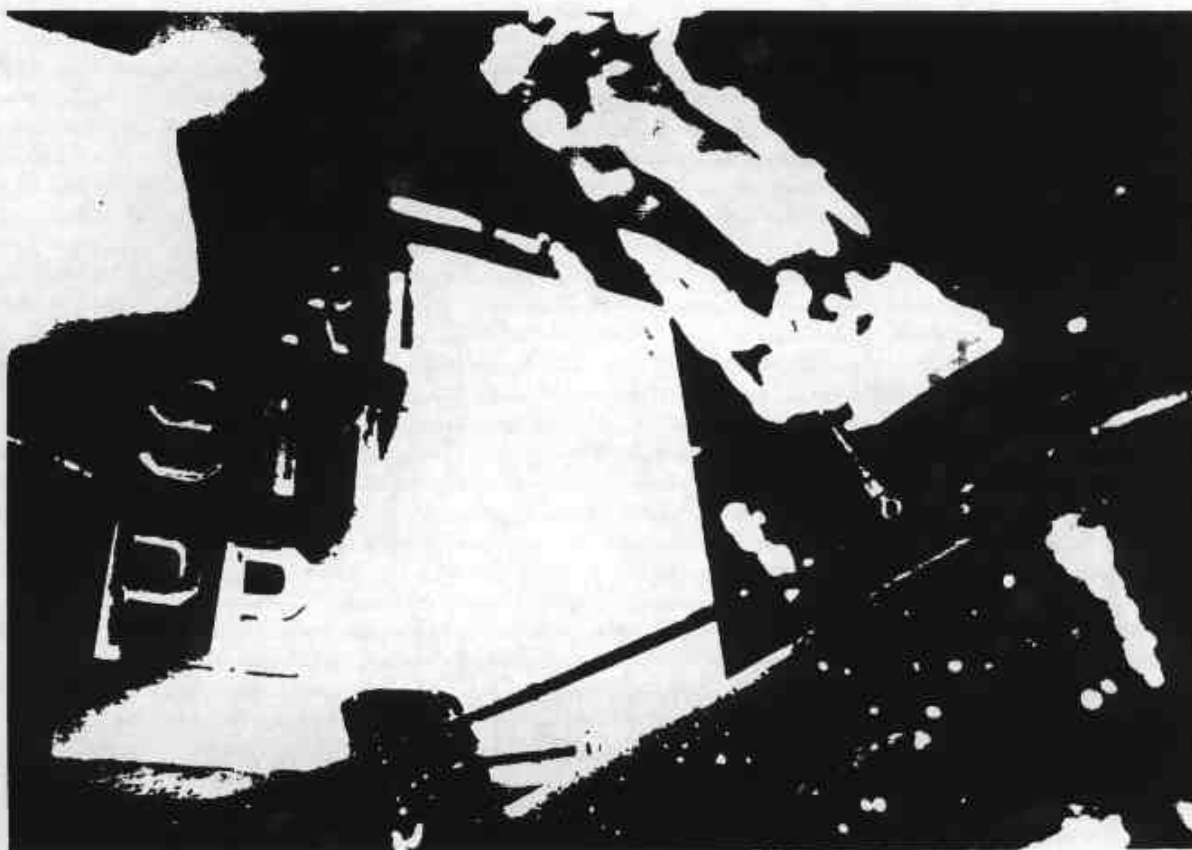


Figure A-16. PRE-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER - VIEW 2

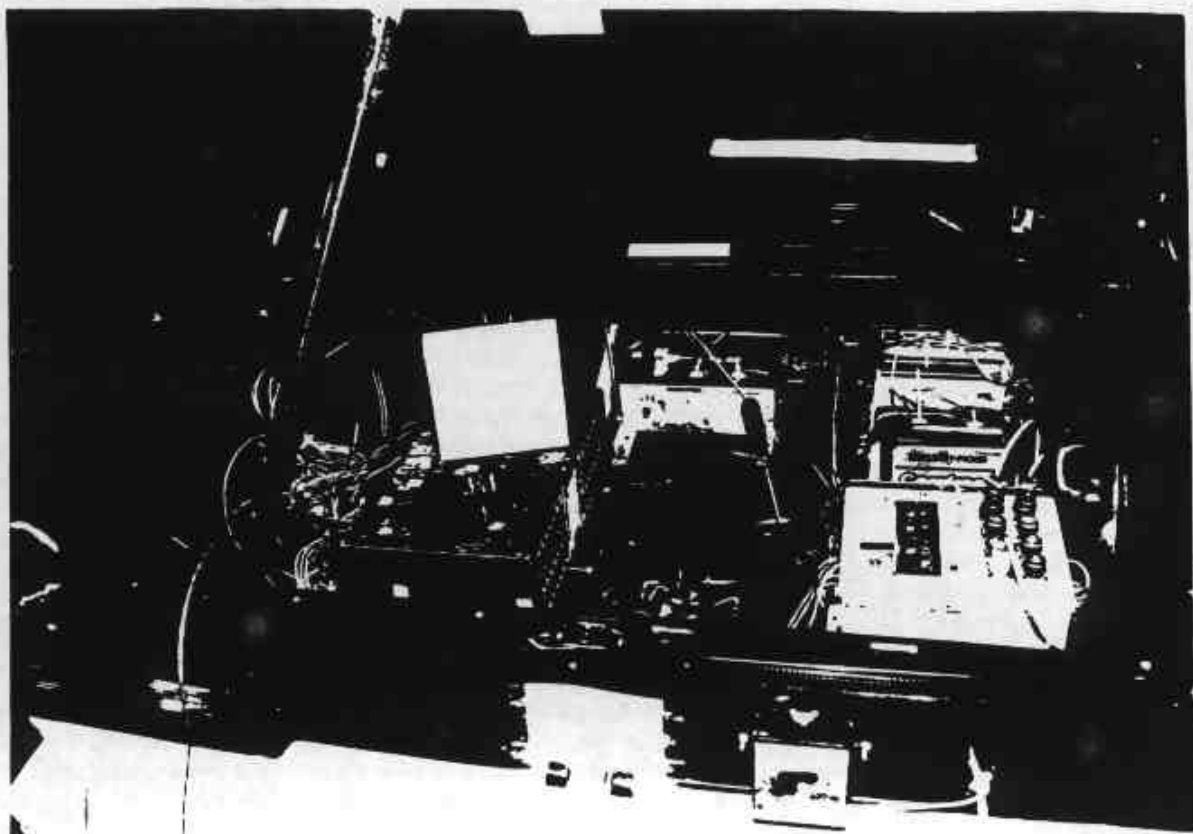


Figure A-17. PRE-TEST VEHICLE INSTRUMENTATION AND BALLAST LOCATION - VIEW 1

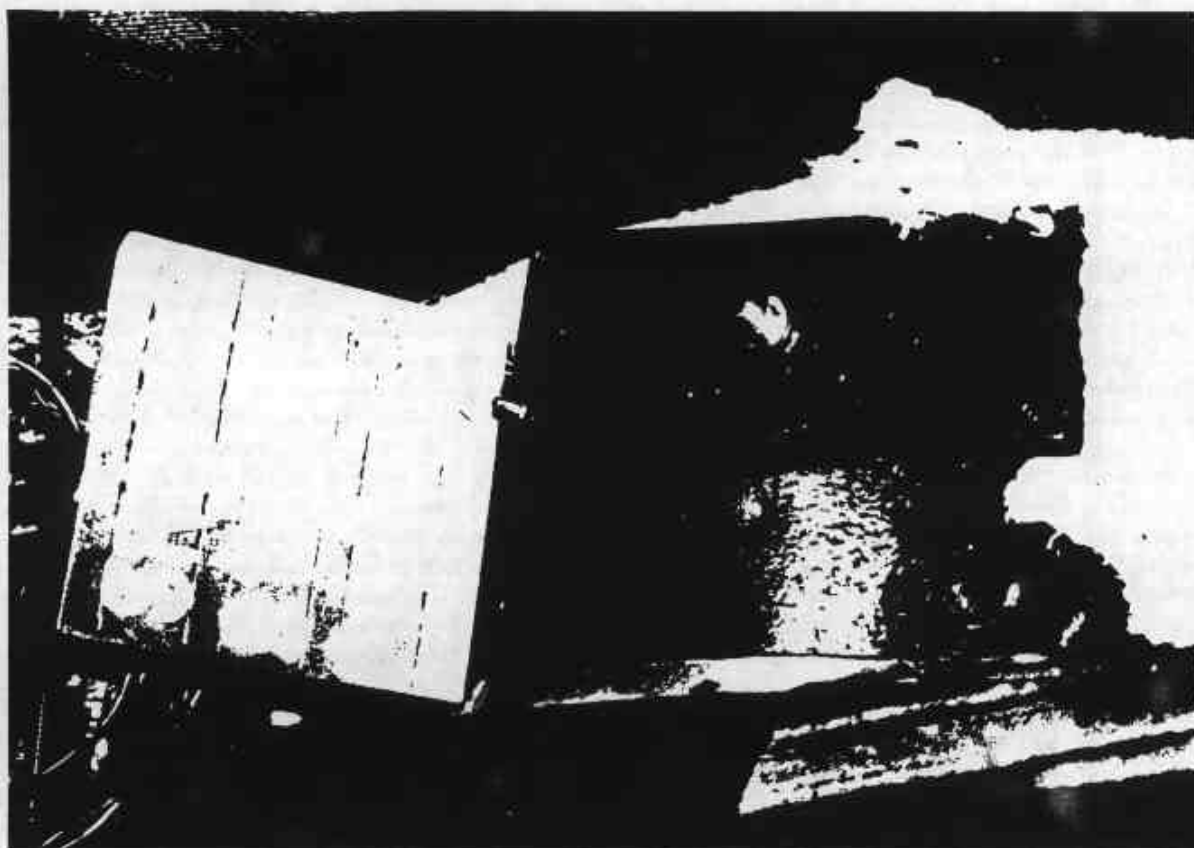


Figure A-18. PRE-TEST VEHICLE INSTRUMENTATION AND BALLAST LOCATION - VIEW 2

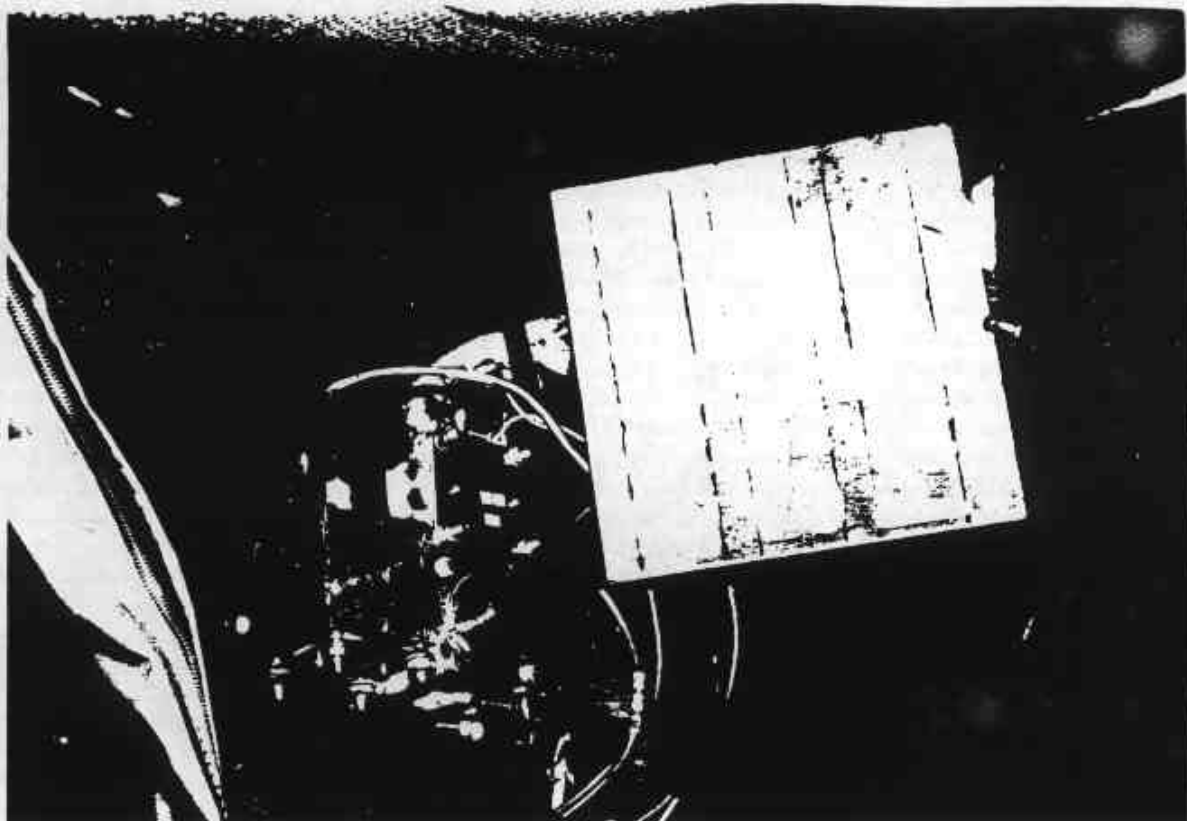


Figure A-19. PRE-TEST GYROSCOPE PLACEMENT VIEW

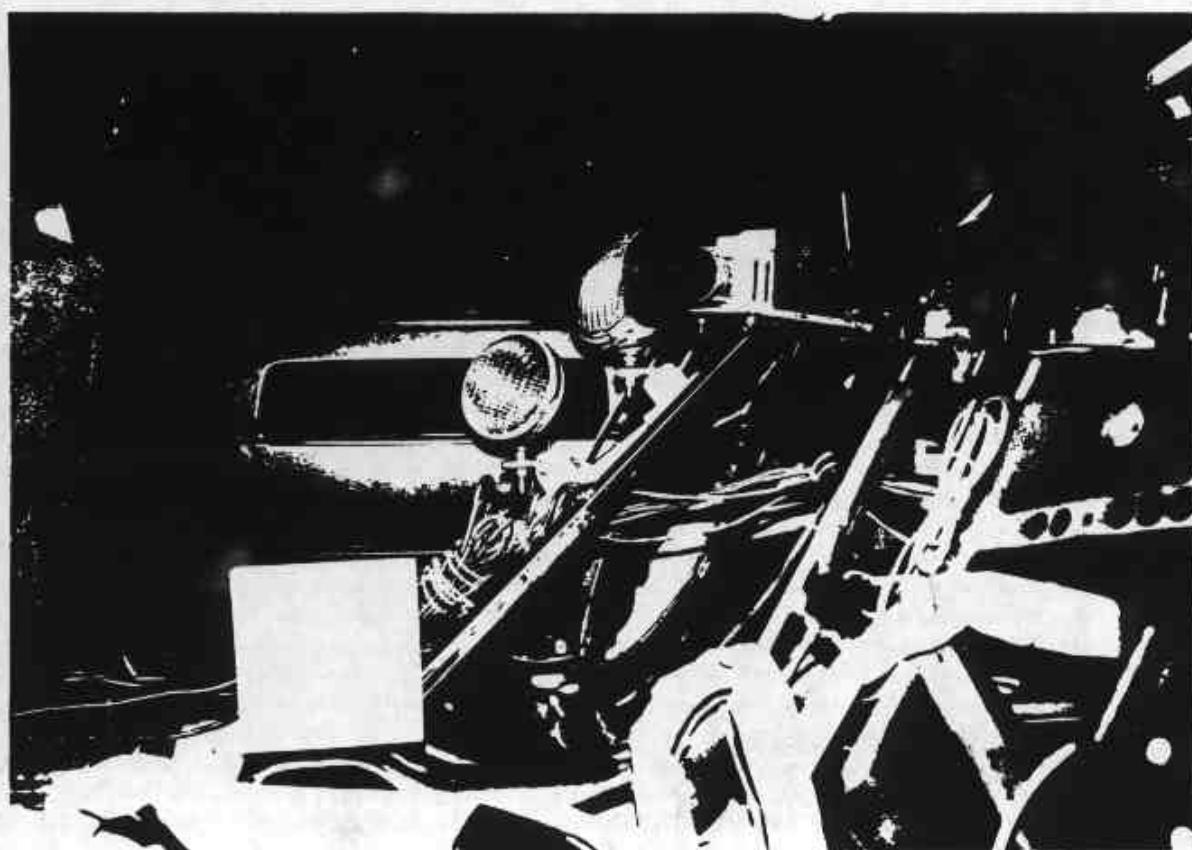


Figure A-20. PRE-TEST CAMERA LOCATION - VIEW 1

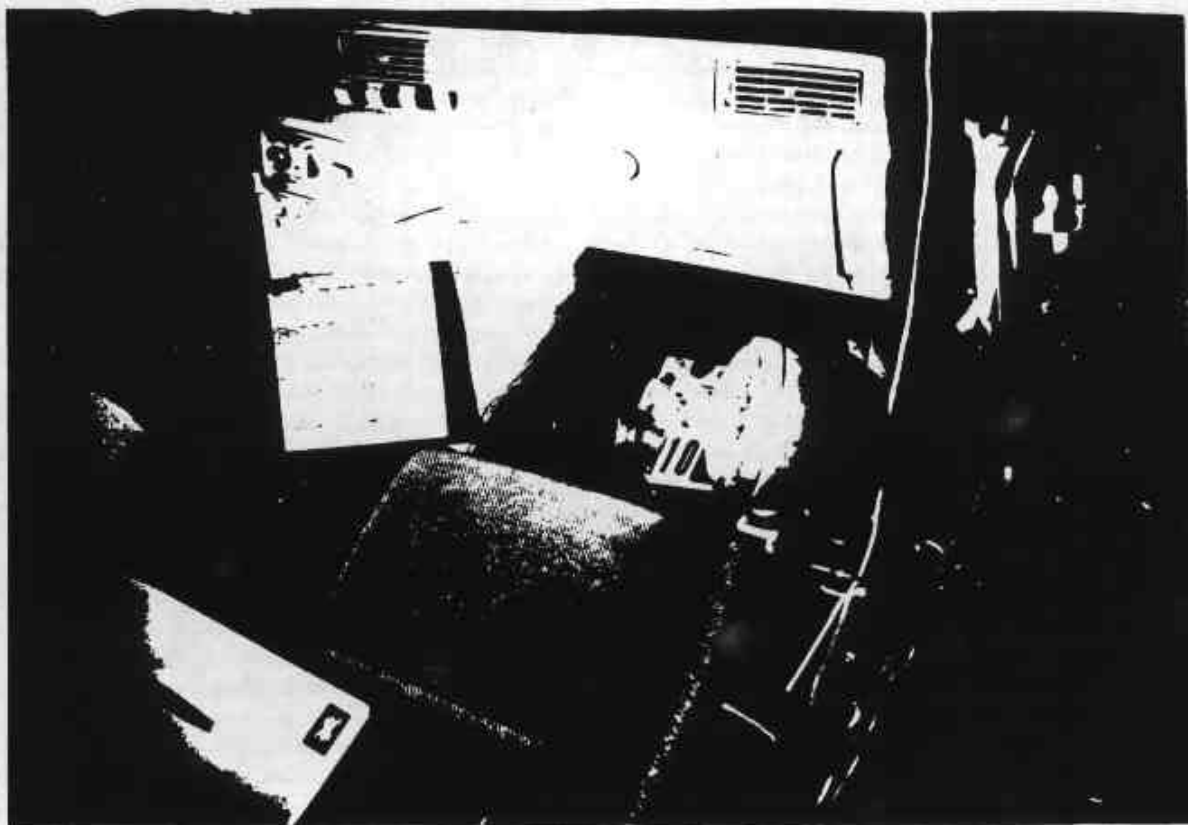


Figure A-21. PRE-TEST CAMERA LOCATION - VIEW 2



Figure A-22. PRE-TEST SEAT BELT STRING POTENTIOMETER VIEW



Figure A-23. PRE-TEST VEHICLE ENGINE COMPARTMENT VIEW

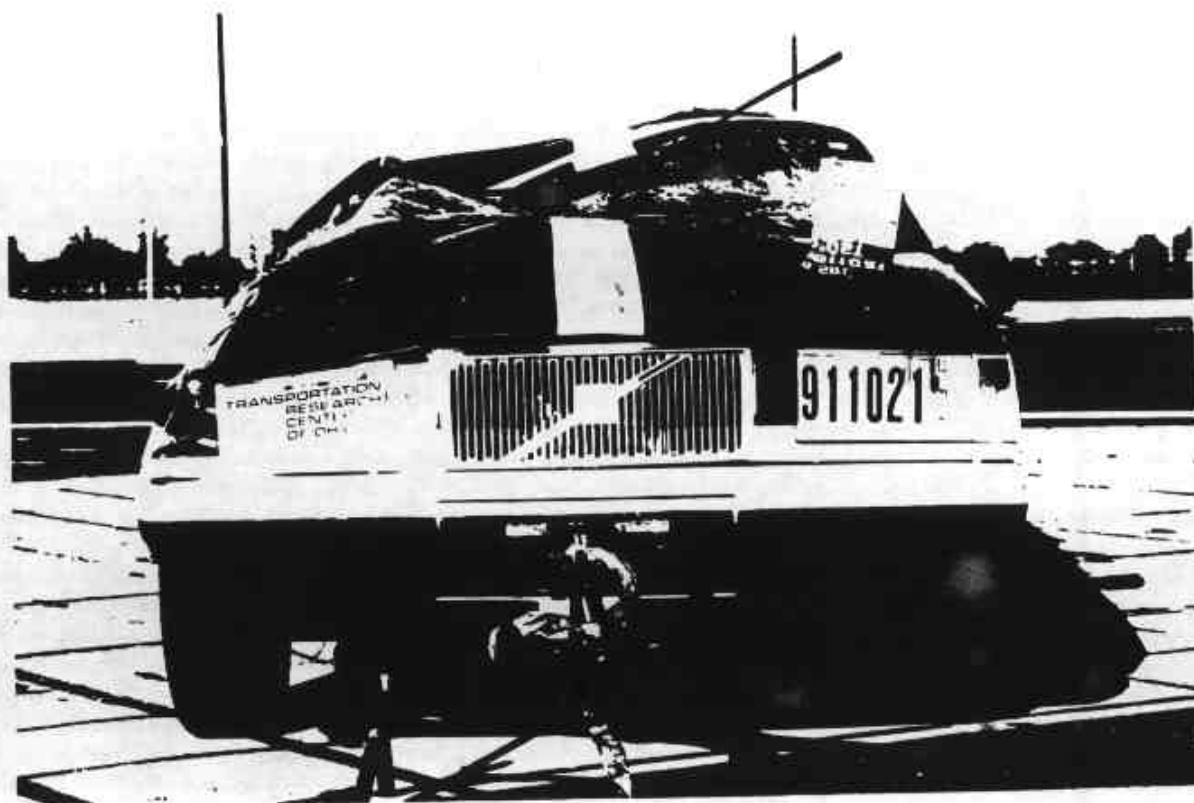


Figure A-24. POST-TEST FRONT VIEW

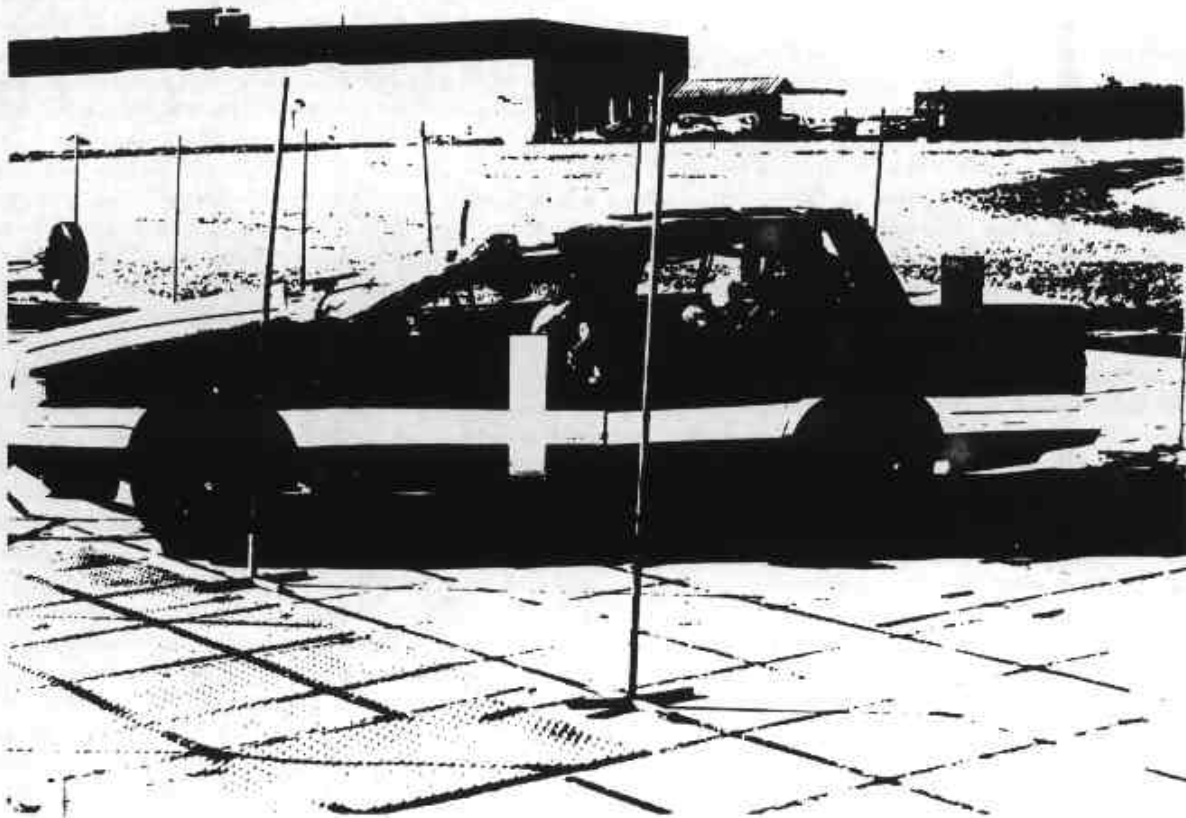


Figure A-25. POST-TEST LEFT SIDE VIEW



Figuer A-26. POST-TEST REAR VIEW



Figure A-27. POST-TEST RIGHT SIDE VIEW



Figure A-28. POST-TEST DUMMY AND VEHICLE VIEW



Figure A-29. POST-TEST VEHICLE DAMAGE CLOSE-UP

APPENDIX B

DATA PLOTS

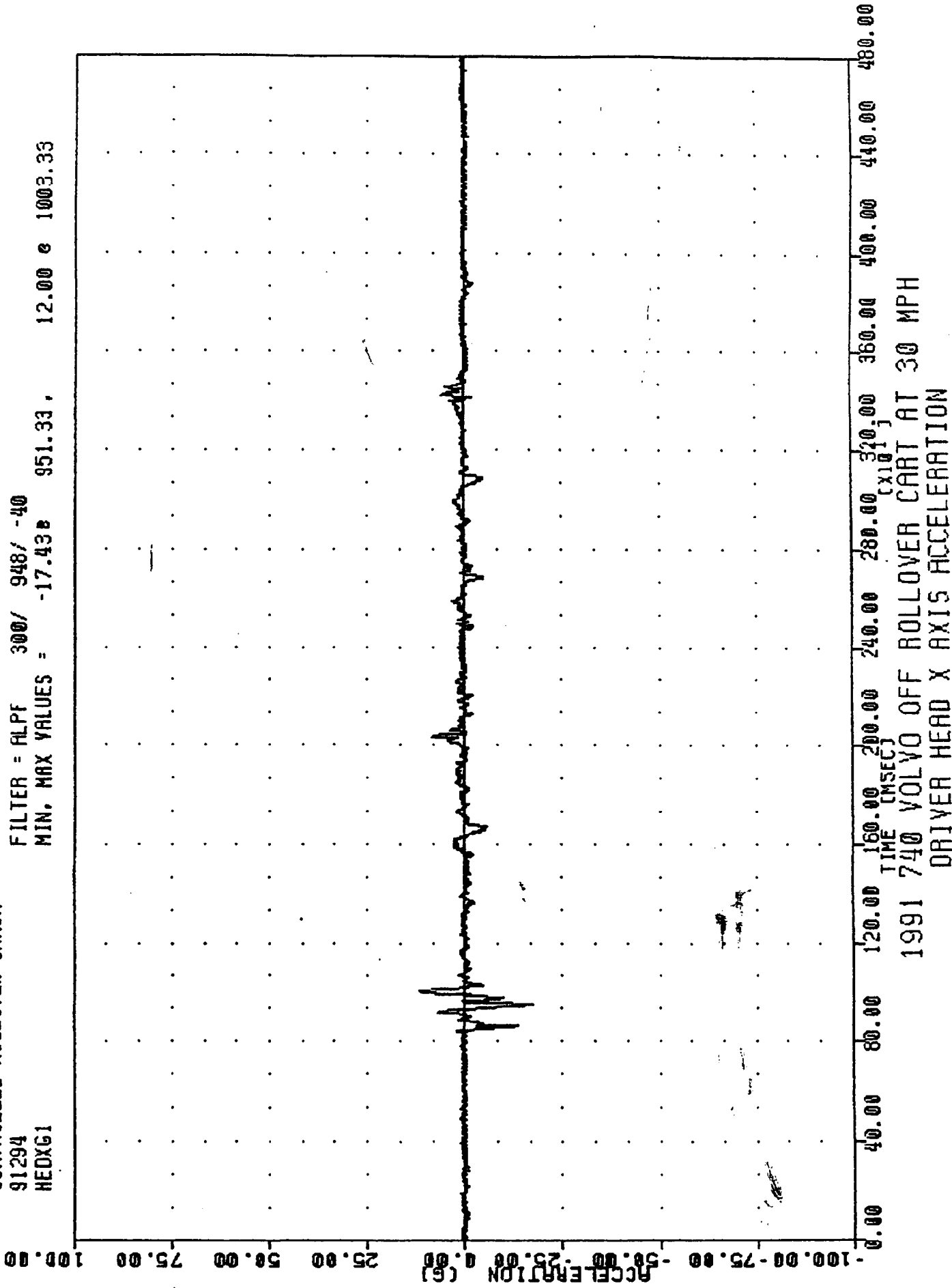
TRC
CONTROLLED ROLLOVER CRASH

91294

HEDXG1

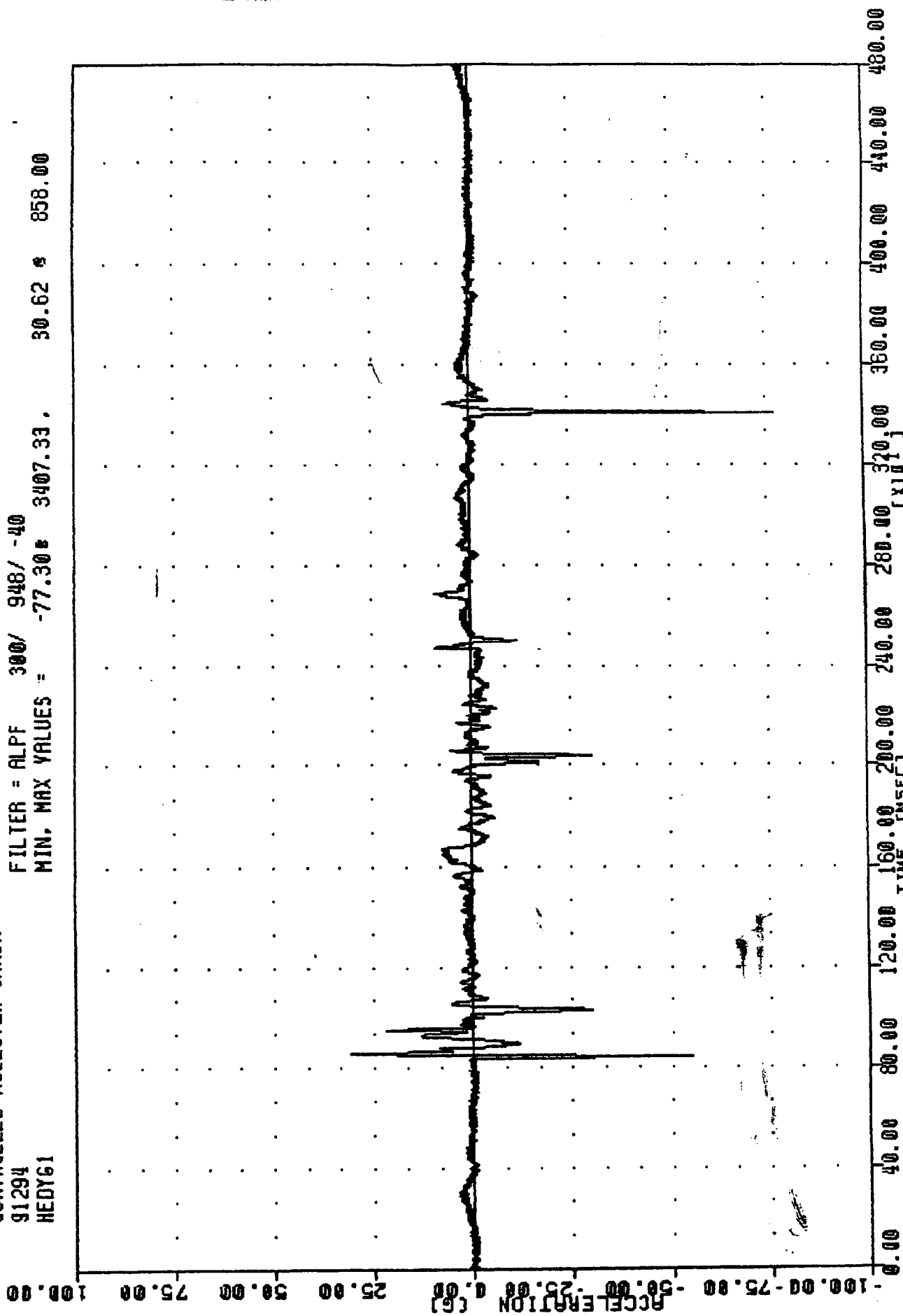
FILTER = ALPF 300/ 948/ -40

MIN, MAX VALUES = -17.438 951.33, 12.00 e 1003.33



TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
HEDY61

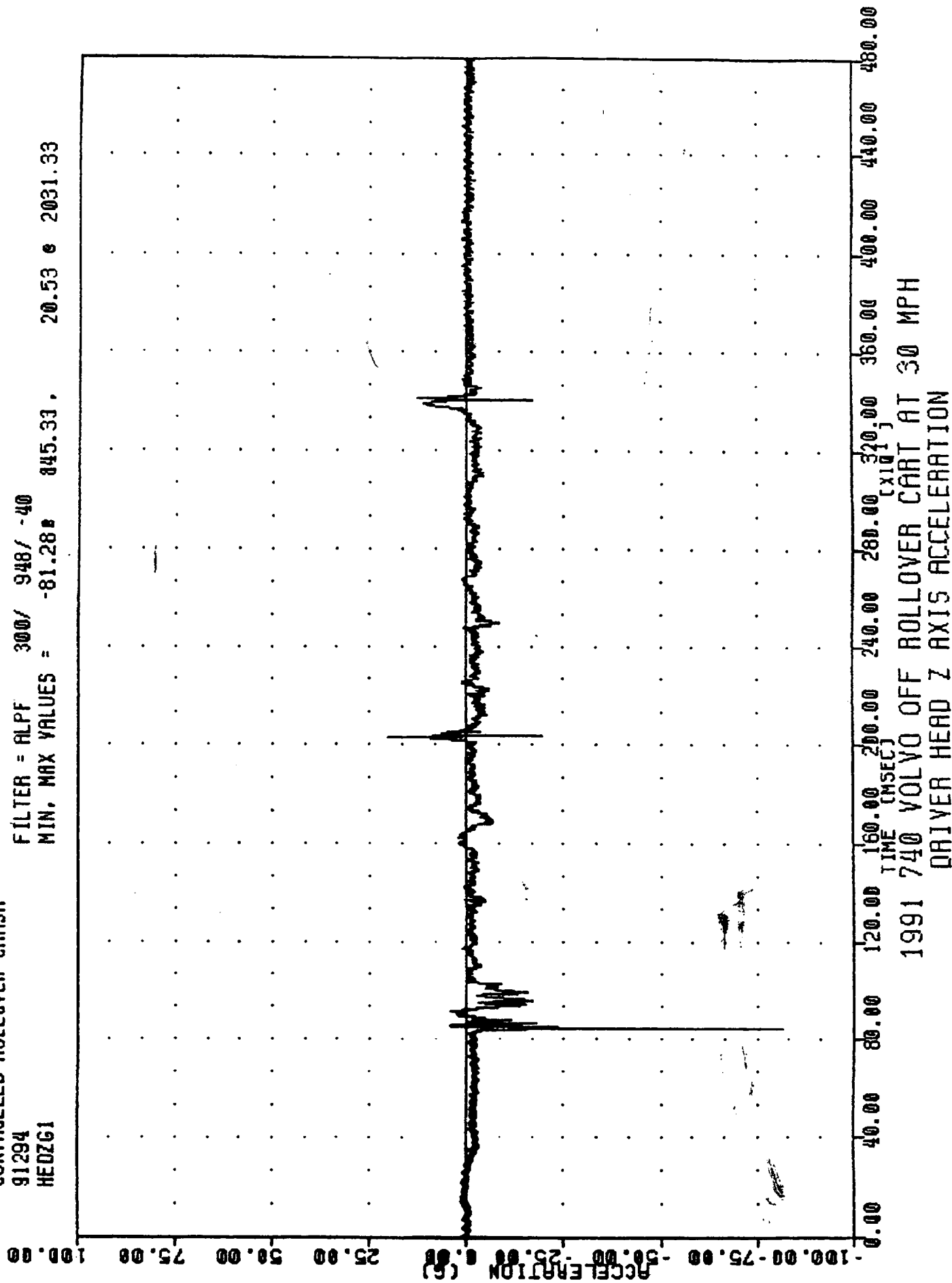
FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -77.30 3407.33 30.62 858.00



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER HEAD Y AXIS ACCELERATION

TRC
911021
CONTROLLED ROLLOVER CRASH
91294
HEDZG1

FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -81.28 845.33 20.53 2031.33



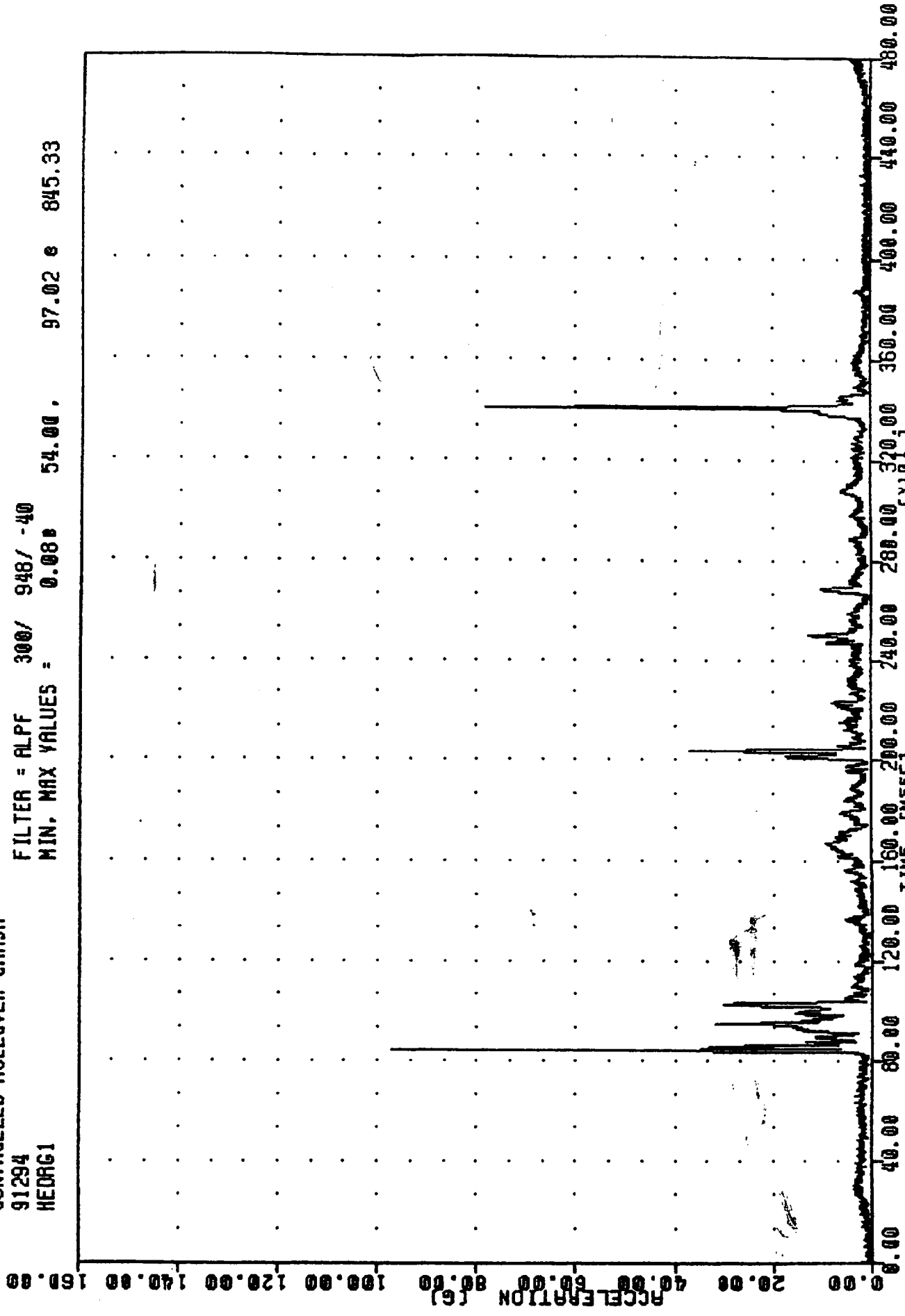
TRC
91294
HEDRG1

911021

CONTROLLED ROLLOVER CRASH

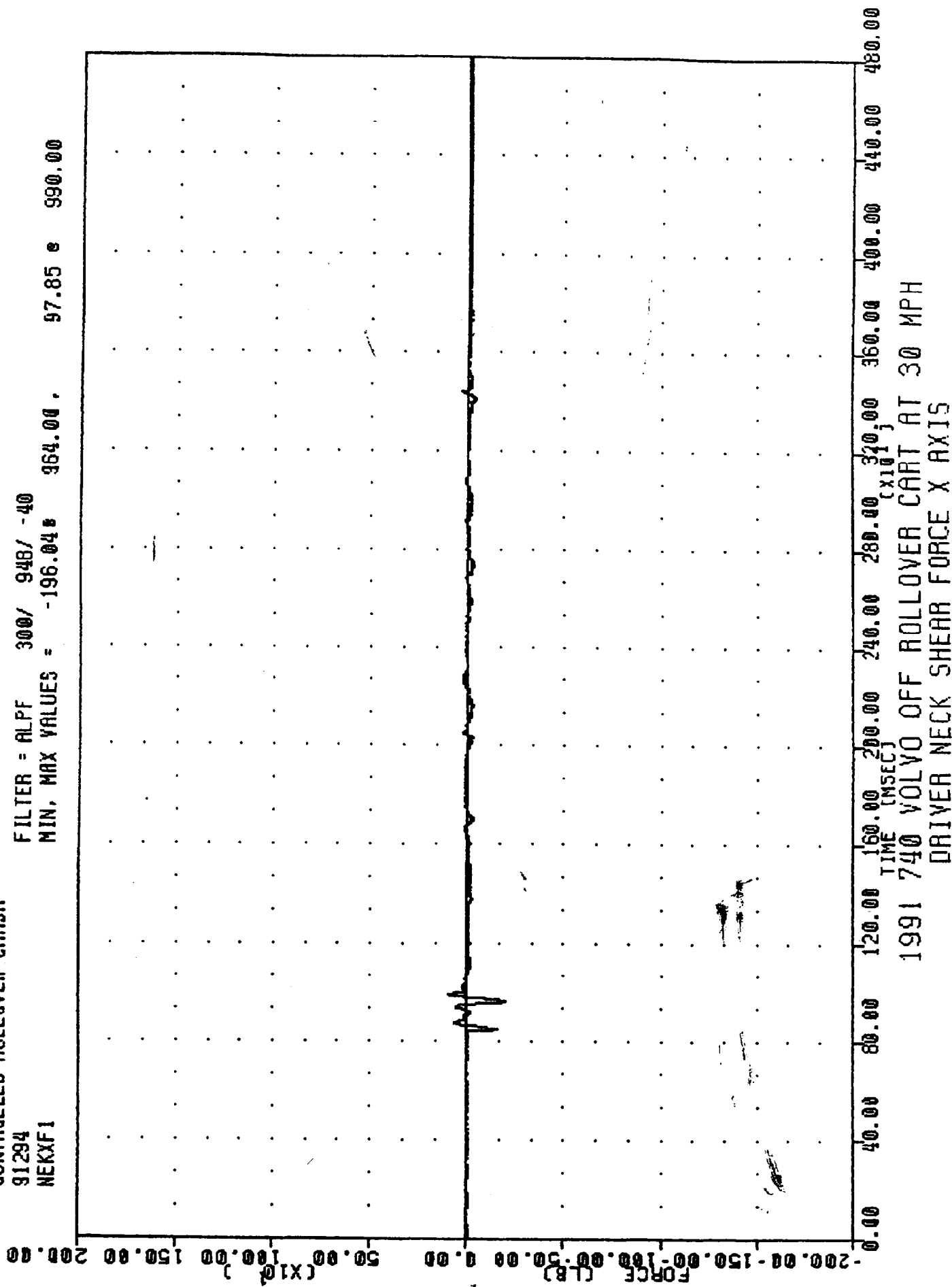
FILTER = ALPF 300/ 948/ -40

MIN. MAX VALUES = 0.080 54.00 97.02 e 845.33



TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
NEKXF1

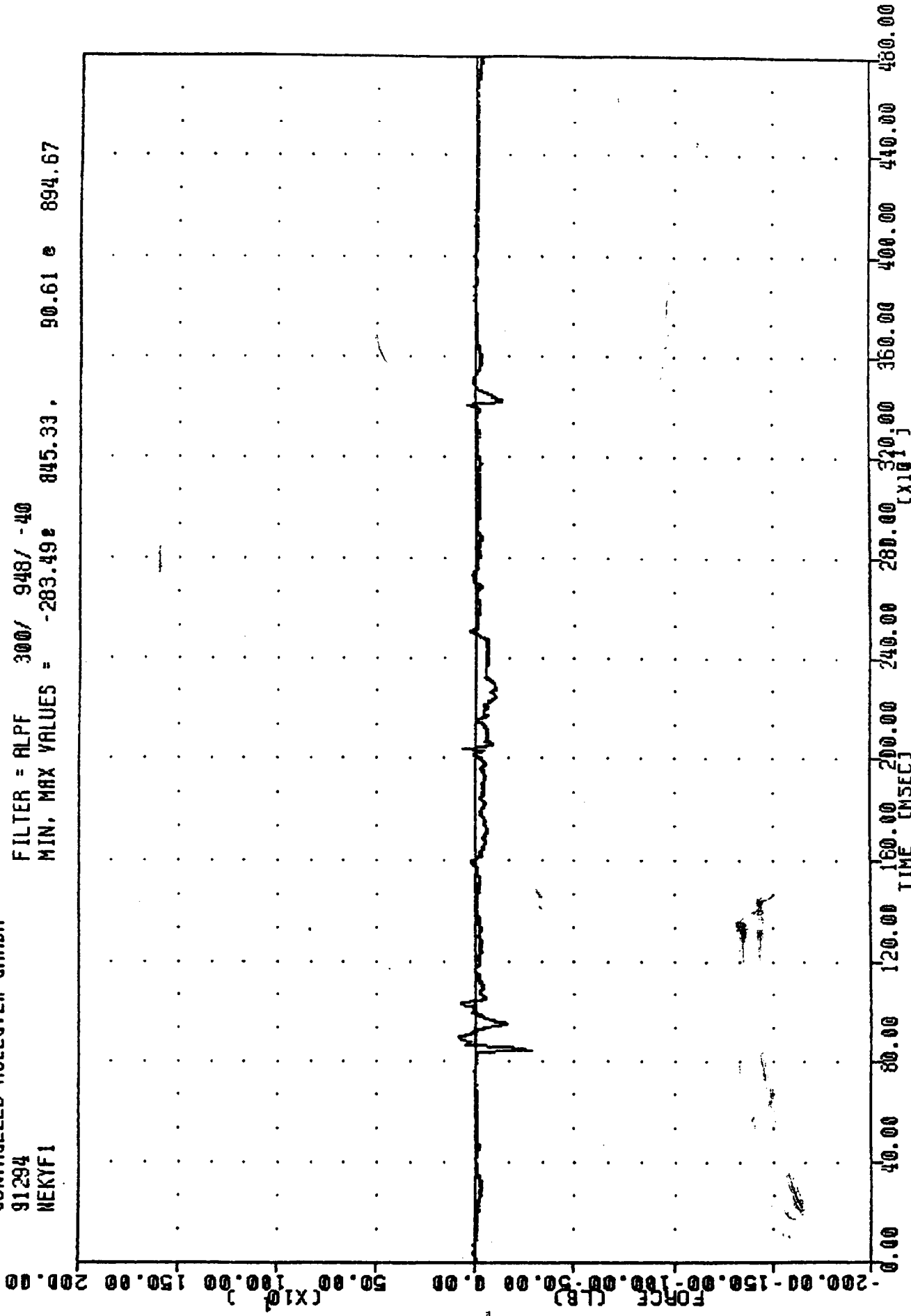
FILTER = ALPF 300/ 948/ -40
MIN, MAX VALUES = -196.04 364.00, 97.85 990.00



TRC
CONTROLLED ROLLOVER CRASH
91294
NEKYF1

, 911021

FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -283.49 845.33 90.61 894.67

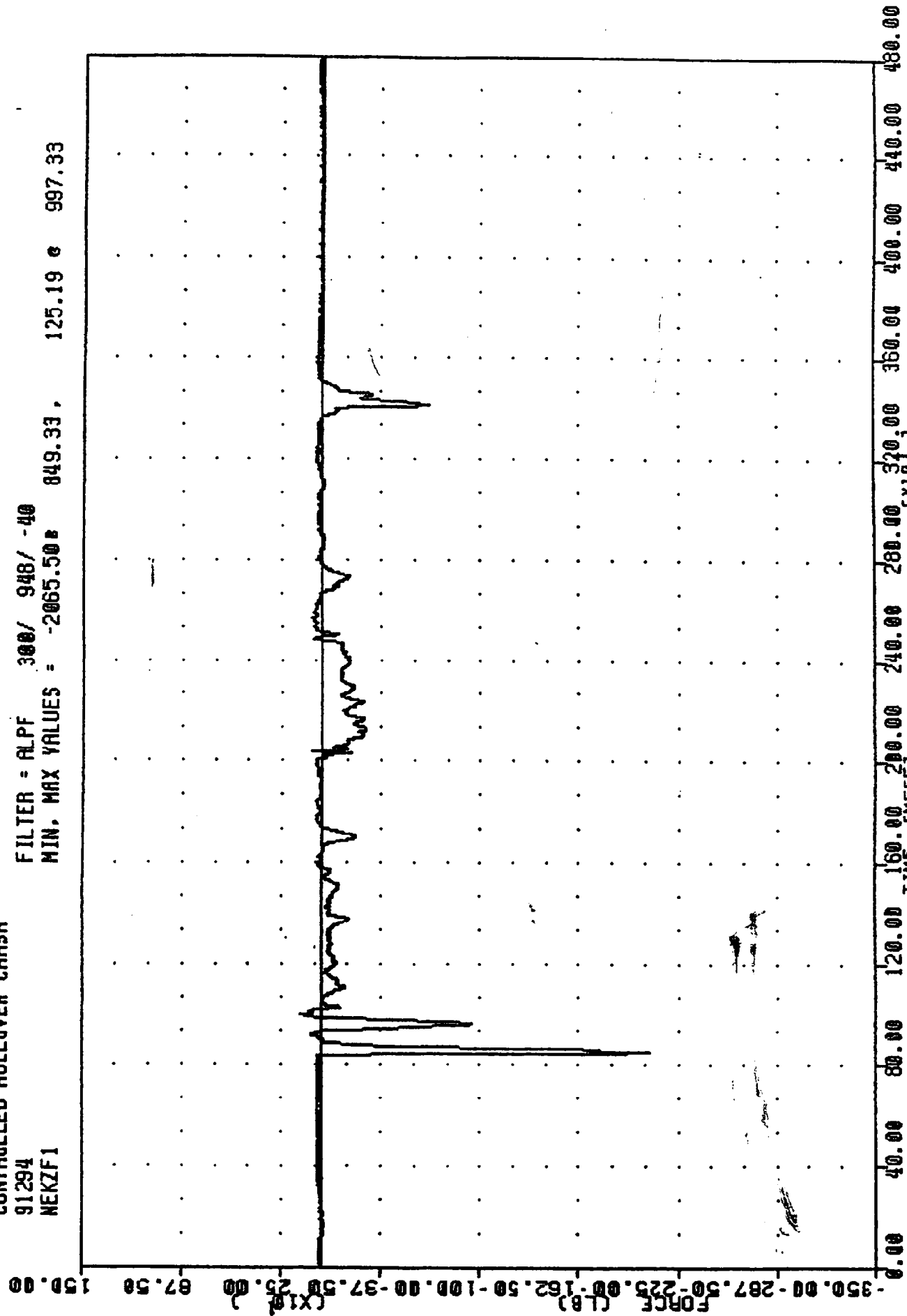


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER NECK SHEAR FORCE Y AXIS

TRC
CONTROLLED ROLLOVER CRASH
91294
NEKZF1

911021

FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -2065.50 849.33, 125.19 e 997.33



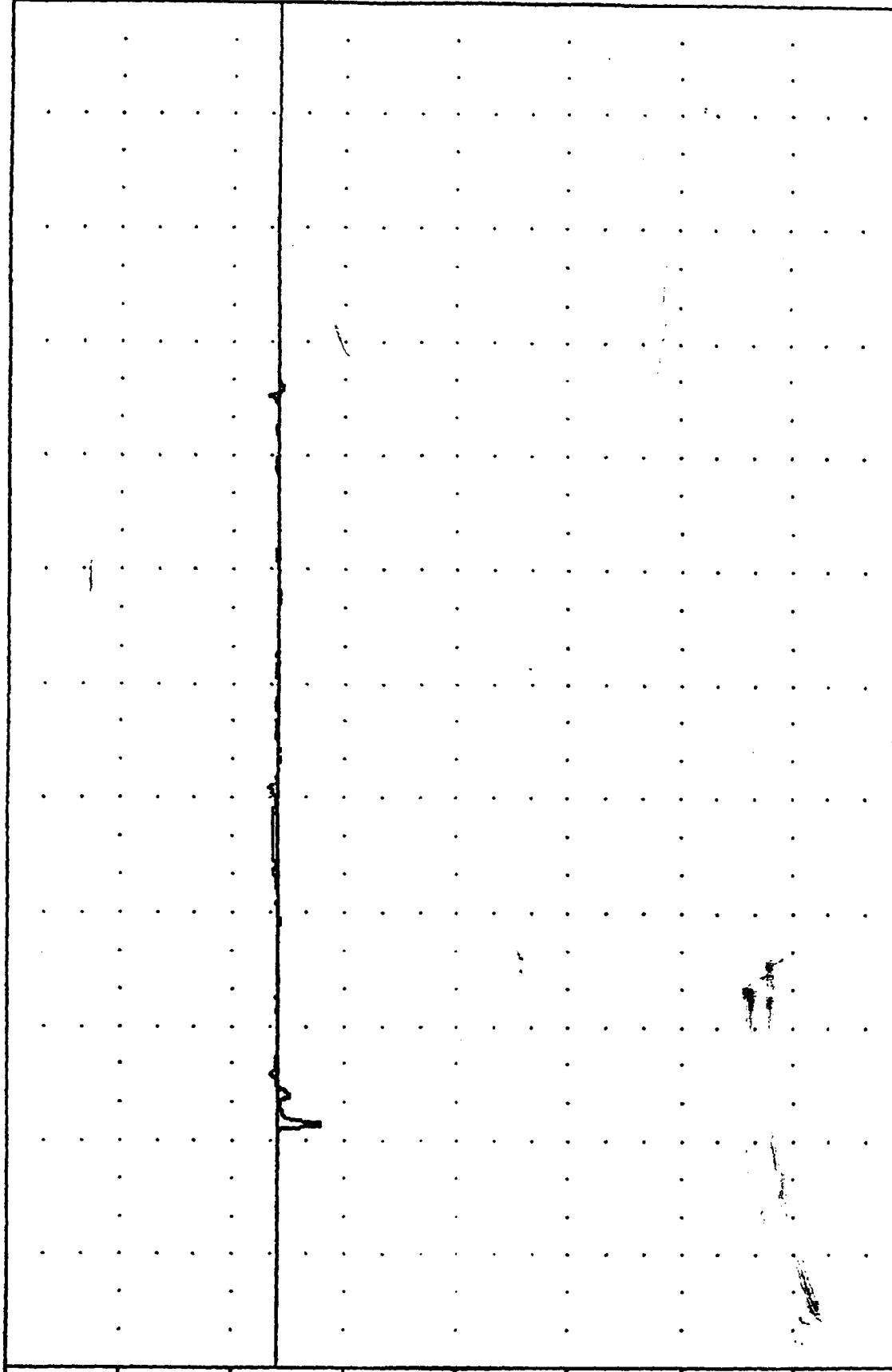
1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER NECK AXIAL FORCE Z AXIS

IHC
 CONTROLLED ROLLOVER CRASH
 91294
 NEKXM1

, 911021

FILTER = ALPF 300/ 948/ -40
 MIN. MAX VALUES = -235.09 854.00, 56.79 3410.67

TORQUE (LB-IN) (X10²)
 -350.00 -287.50 -225.00 -162.50 -100.00 -37.50 25.00 87.50 150.00

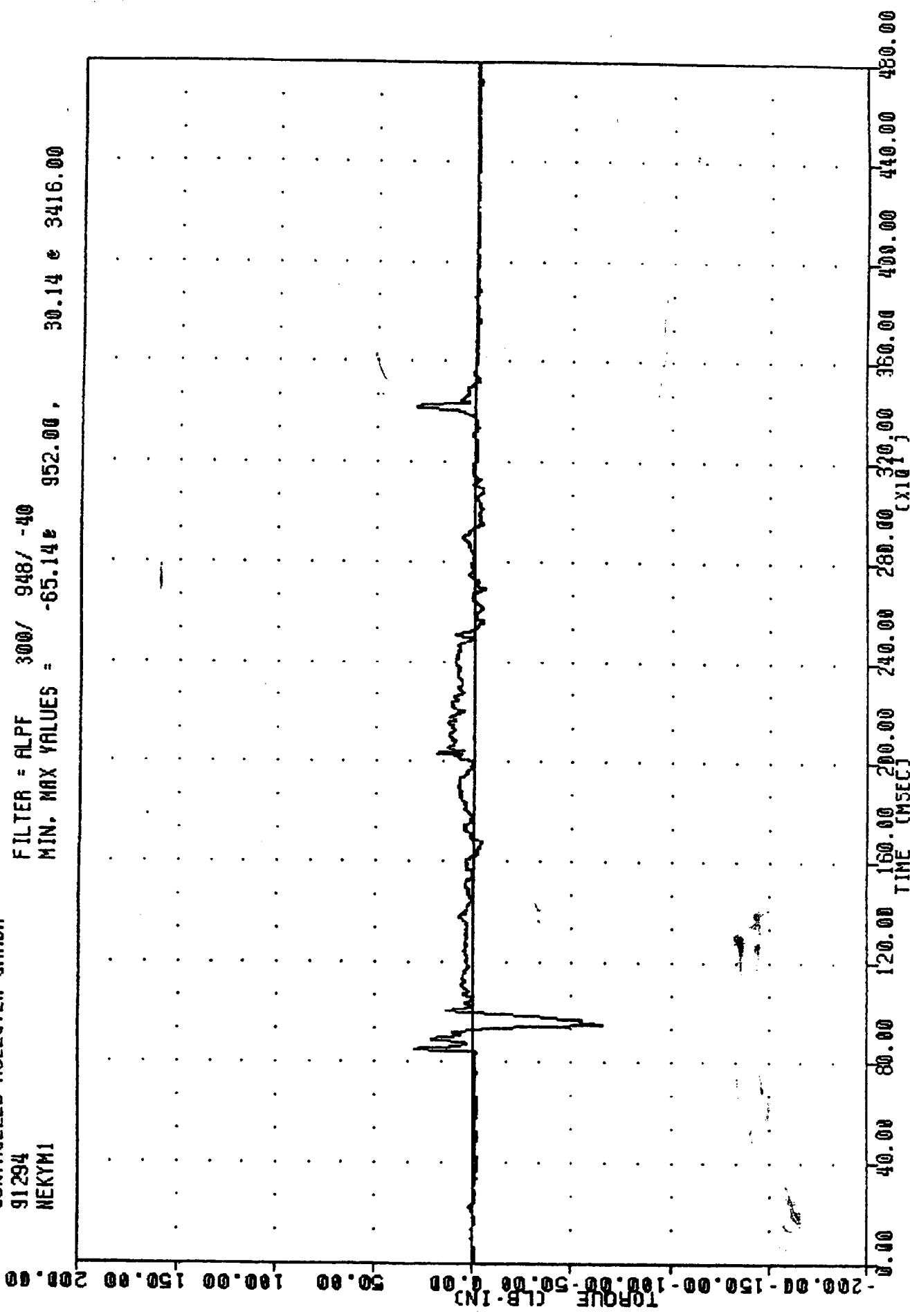


0.00 40.00 80.00 120.00 160.00 200.00 240.00 280.00 320.00 360.00 400.00 440.00 480.00
 TIME (msec) (X10¹)

1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
 DRIVER NECK MOMENT ABOUT X AXIS

TFLC
 CONTROLLED ROLLOVER CRASH
 91294
 NEKYM1

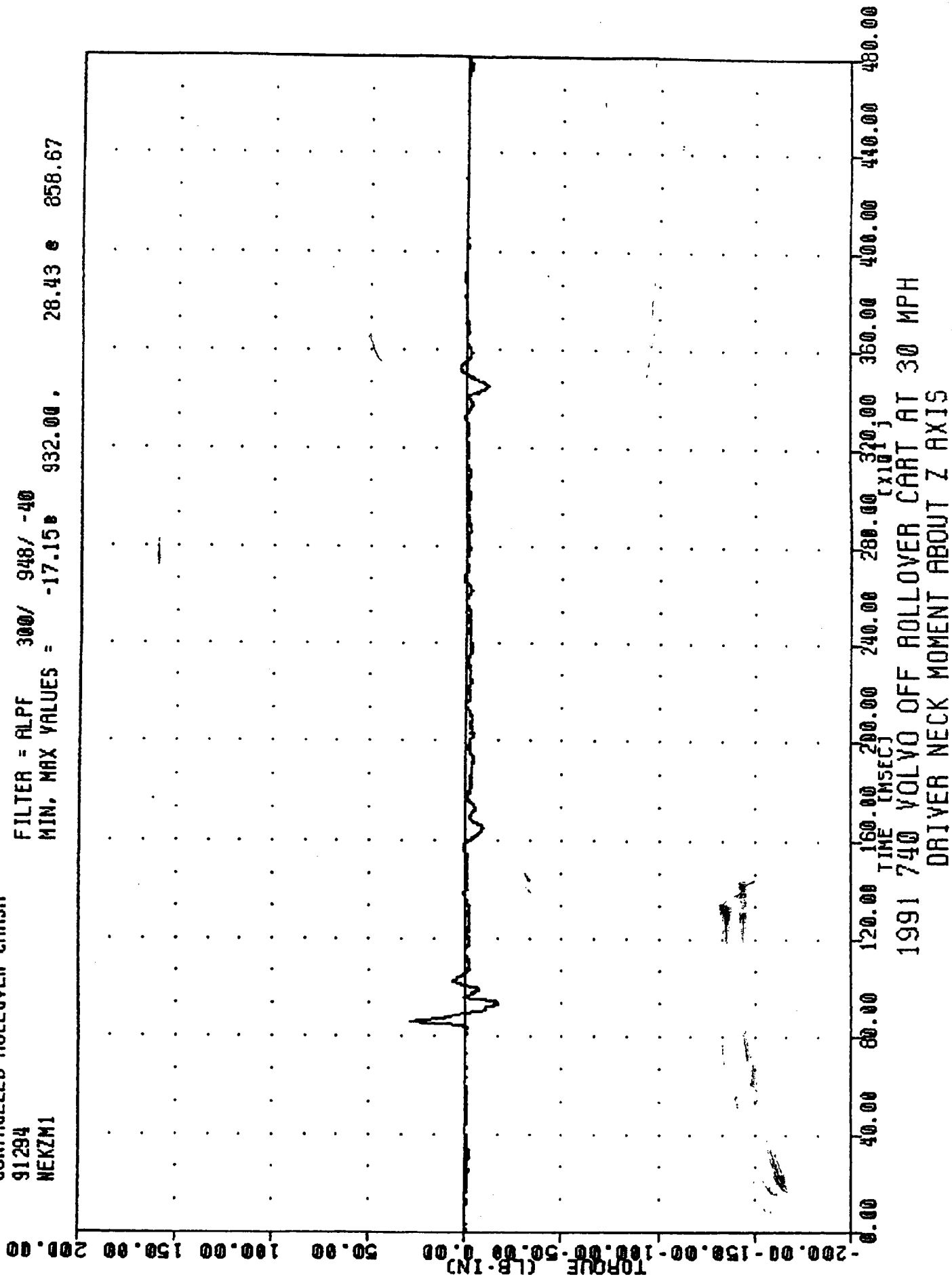
FILTER = ALPF 300/ 948/ -40
 MIN. MAX VALUES = -65.14e 952.00, 30.14 e 3416.00



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
 DRIVER NECK MOMENT ABOUT Y AXIS

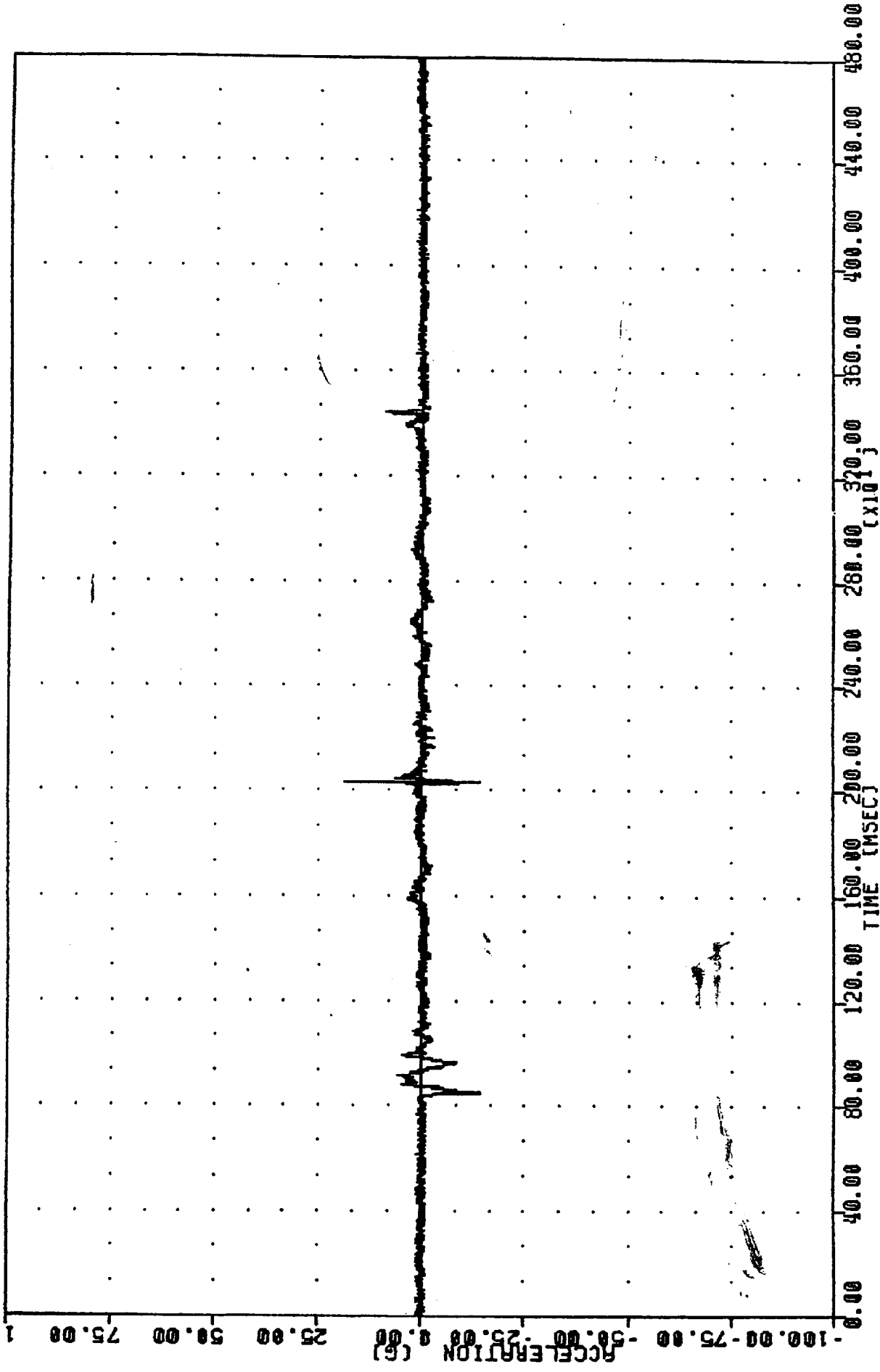
TRC
 CONTROLLED ROLLOVER CRASH
 91294
 NEKZM1

FILTER = ALPF 300/ 948/ -40
 MIN, MAX VALUES = -17.15 932.00 28.43 858.67



TRC
CONTROLLED ROLLOVER CRASH
91294
CSTXG1

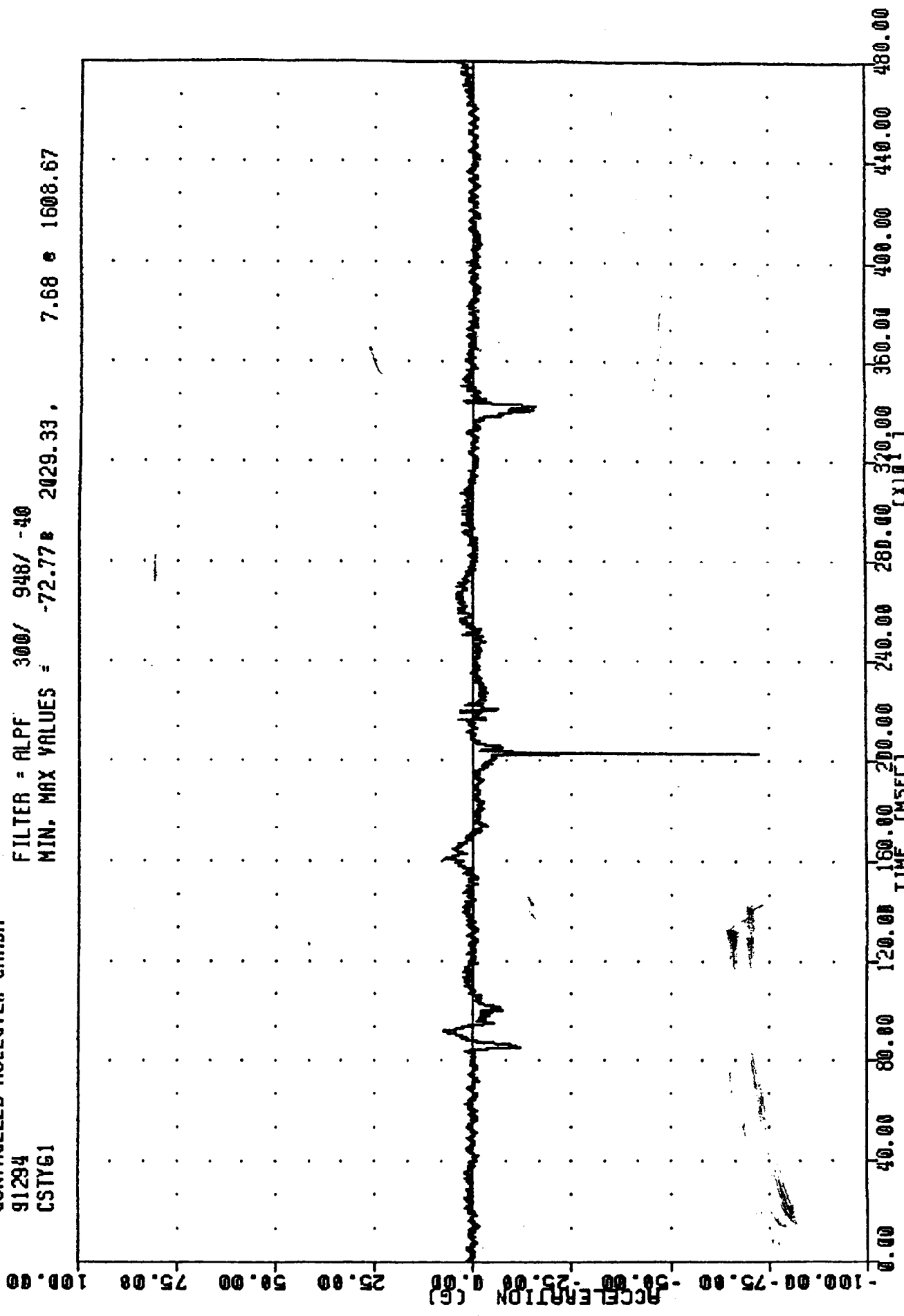
FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -14.37 848.67 18.81 2028.67



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST X AXIS ACCELERATION

TRC
 CONTROLLED ROLLOVER CRASH
 91294
 CSTYG1

FILTER = ALPF 300/ 948/ -40
 MIN. MAX VALUES = -72.77 2029.33 7.68 1608.67

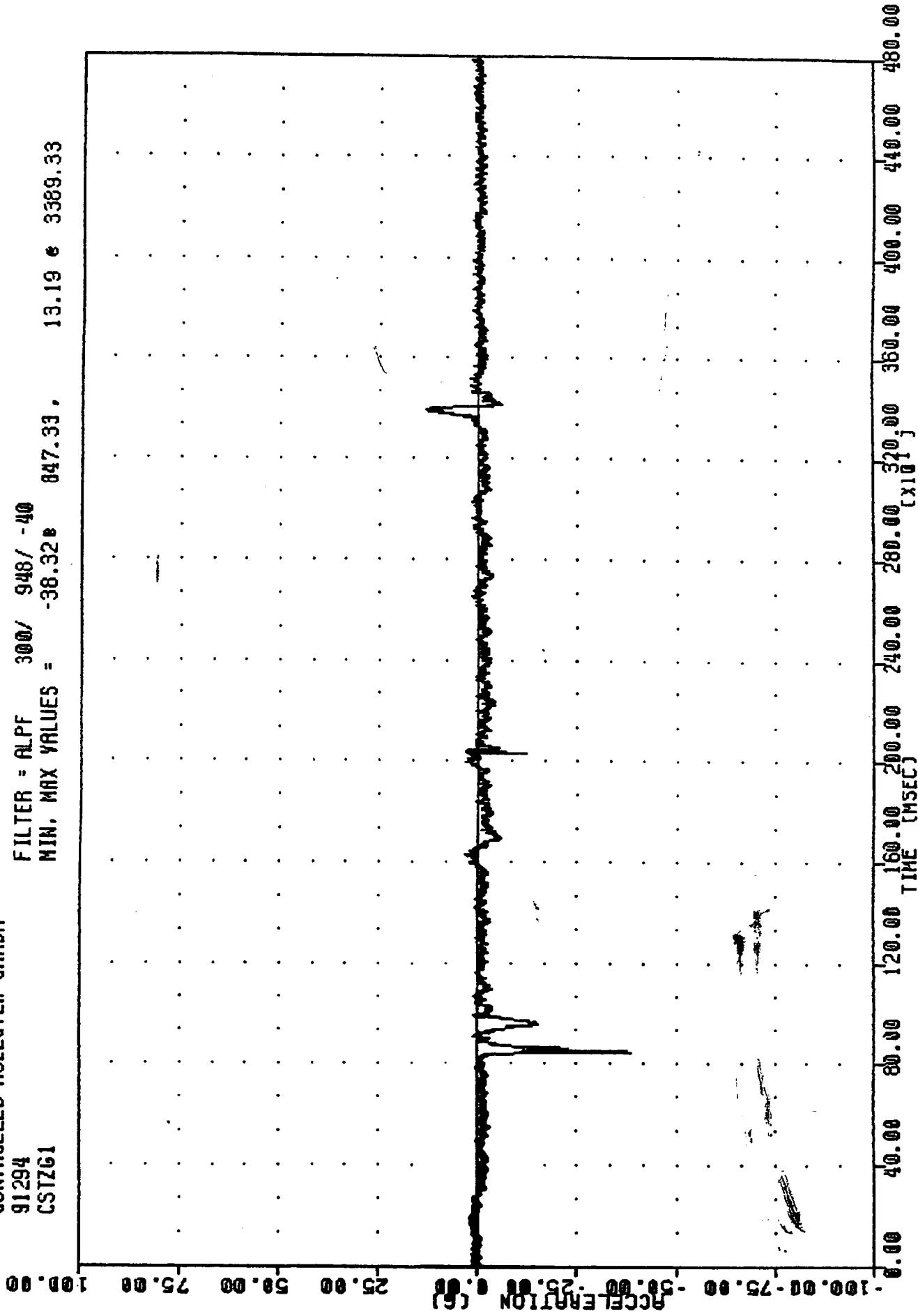


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
 DRIVER CHEST Y AXIS ACCELERATION

TRC
CONTROLLED ROLLOVER CRASH
91294
CS1261

, 911021

FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -38.32 847.33 13.19 3389.33



1991 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST Z AXIS ACCELERATION

TRC
91294
CSTRG1

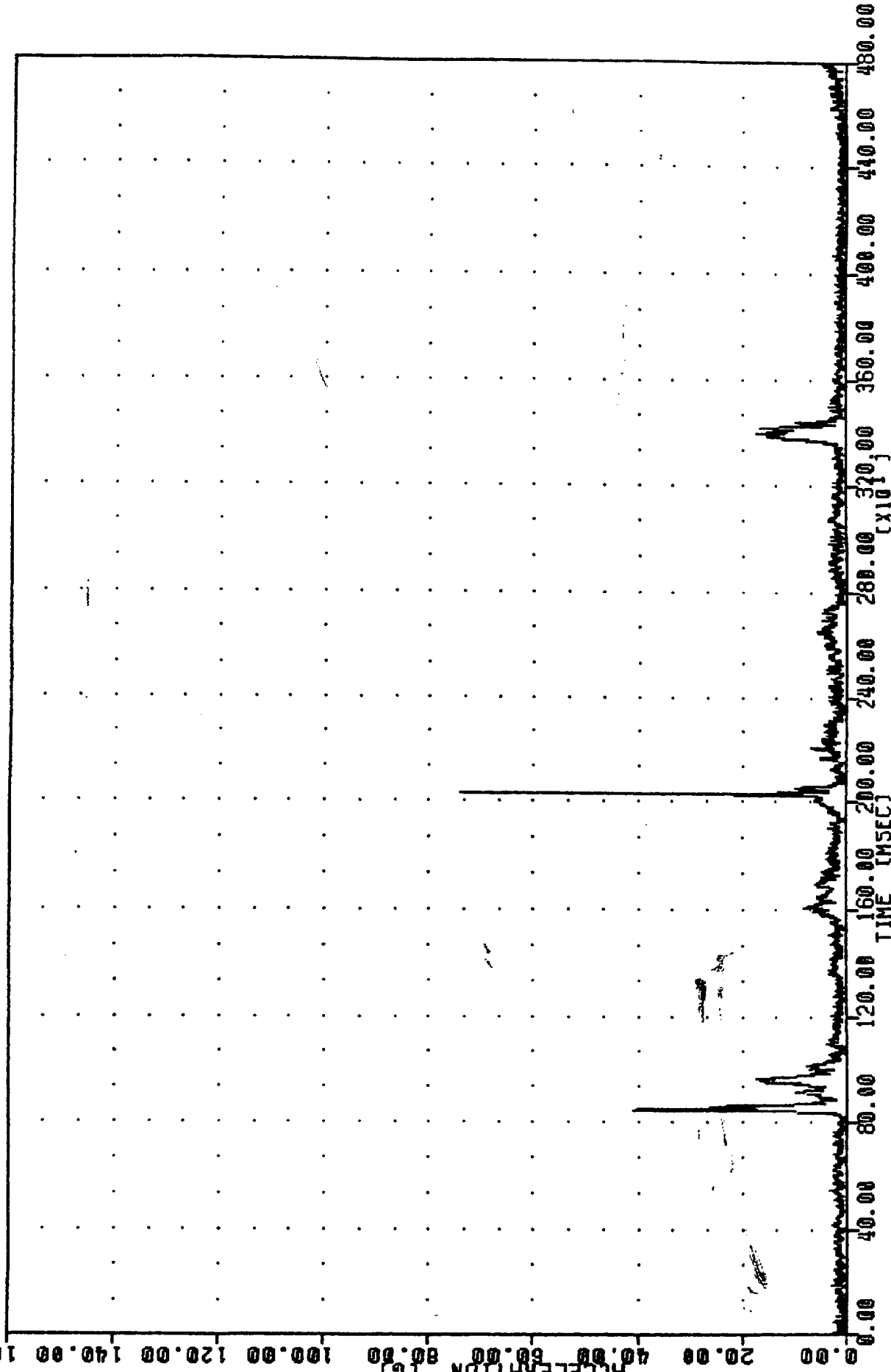
911021

CONTROLLED ROLLOVER CRASH

FILTER = ALPF 300/ 948/ -40

MIN. MAX VALUES = 0.10 3258.67, 74.19 2029.33

ACCELERATION (G)



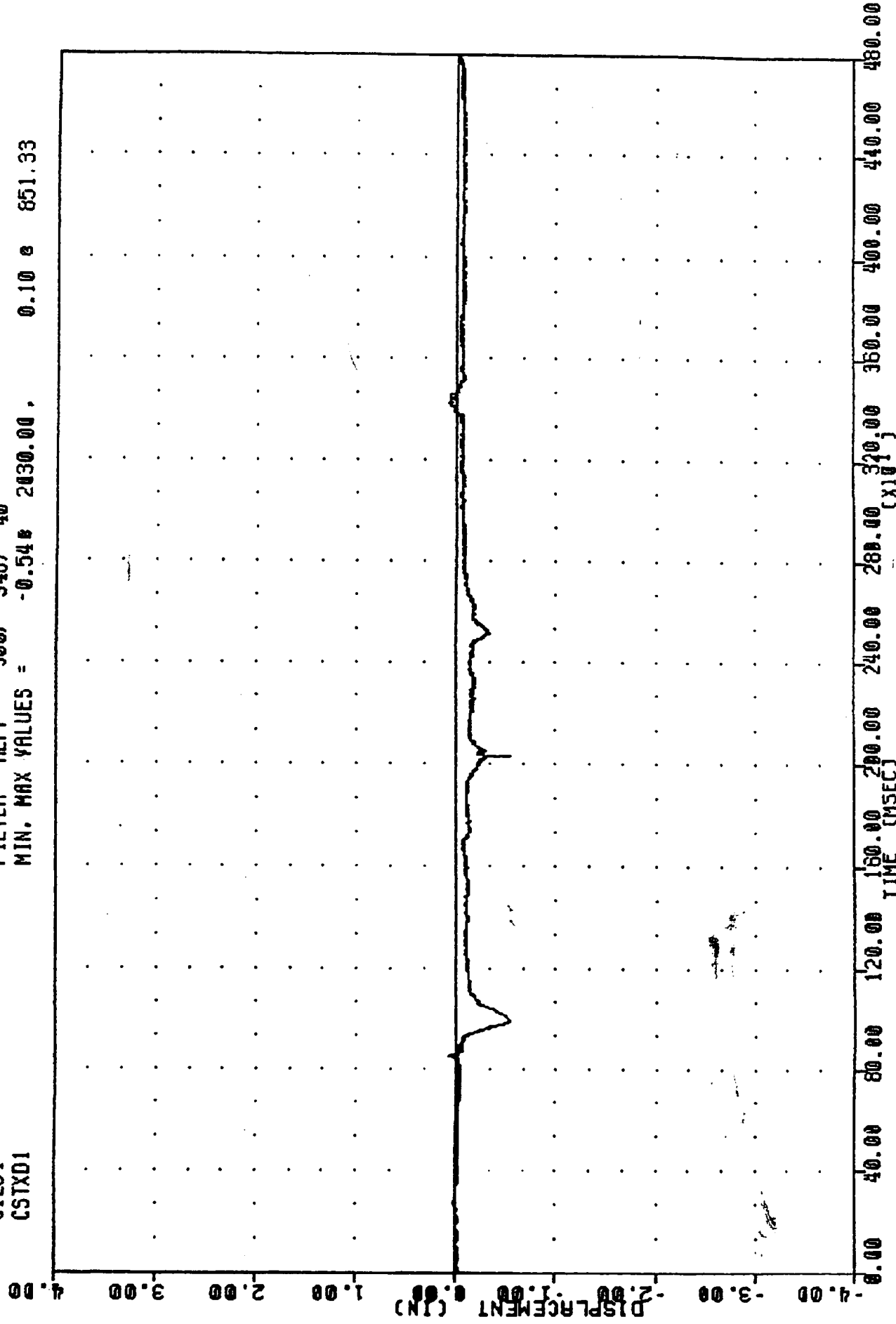
TRC
91294
CSTXD1

911021

CONTROLLED ROLLOVER CRASH

FILTER = ALPF 300/ 948/ -40

MIN. MAX VALUES = -0.548 2030.00, 0.10 8 851.33



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER CHEST X AXIS DISPLACEMENT

TRC
91294
PEVXG1

911021

CONTROLLED ROLLOVER CRASH

FILTER = ALPF 300/ 948/ -40
MIN. MAX VALUES = -8.11e 873.33, 10.72 e 3378.00

100.00

75.00

50.00

25.00

0.00

ACCELERATION (G)

-25.00

-50.00

-75.00

0.00 40.00 80.00 120.00 160.00 200.00 240.00 280.00 320.00 360.00 400.00 440.00 480.00

TIME (MSEC)

(x10¹)

1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH

DRIVER PELVIS X AXIS ACCELERATION

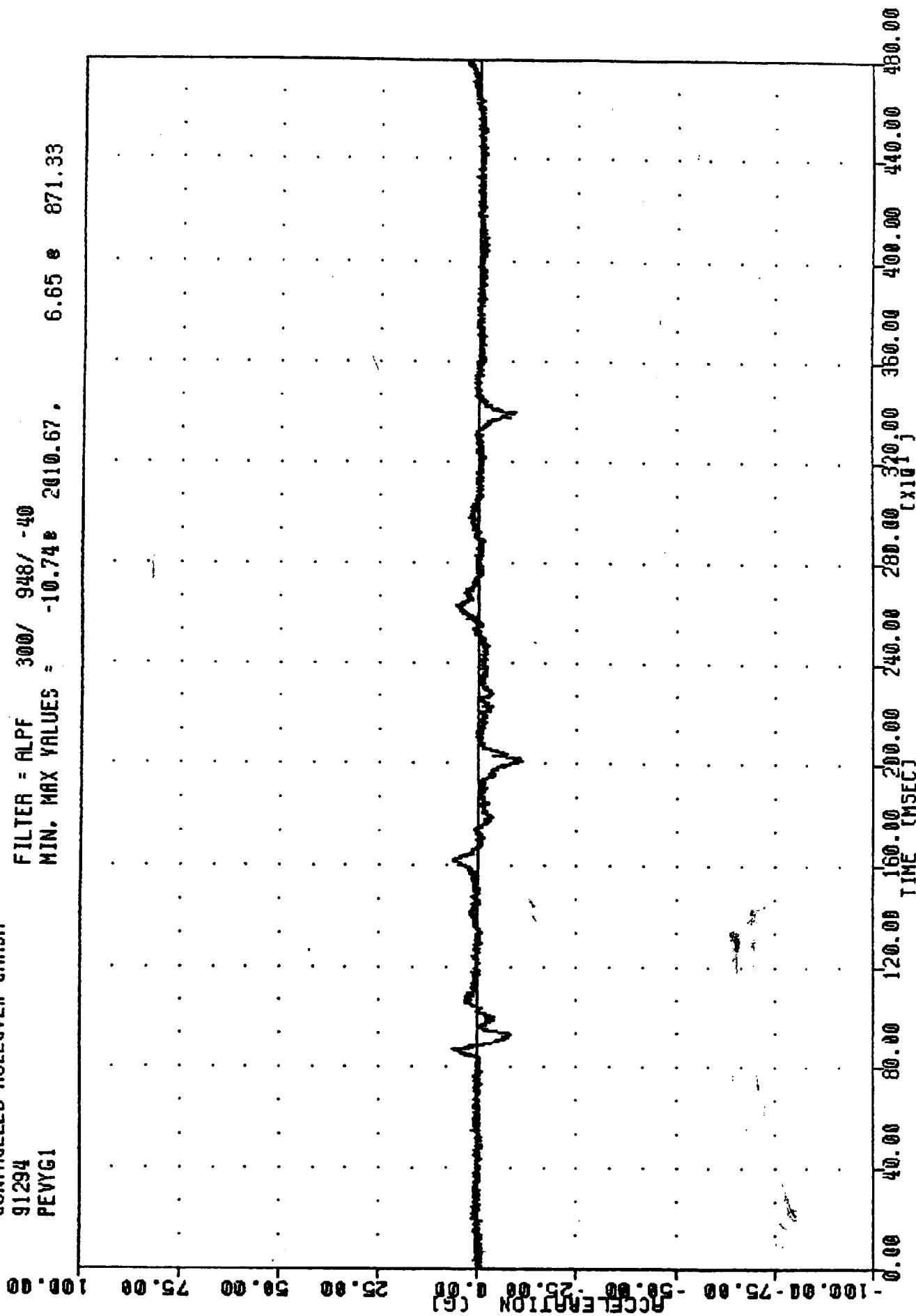
TRC
91294
PEVYG1

, 911021

CONTROLLED ROLLOVER CRASH

FILTER = ALPF 300/ 948/ -40

MIN. MAX VALUES = -10.74e 2010.67, 6.65 e 871.33

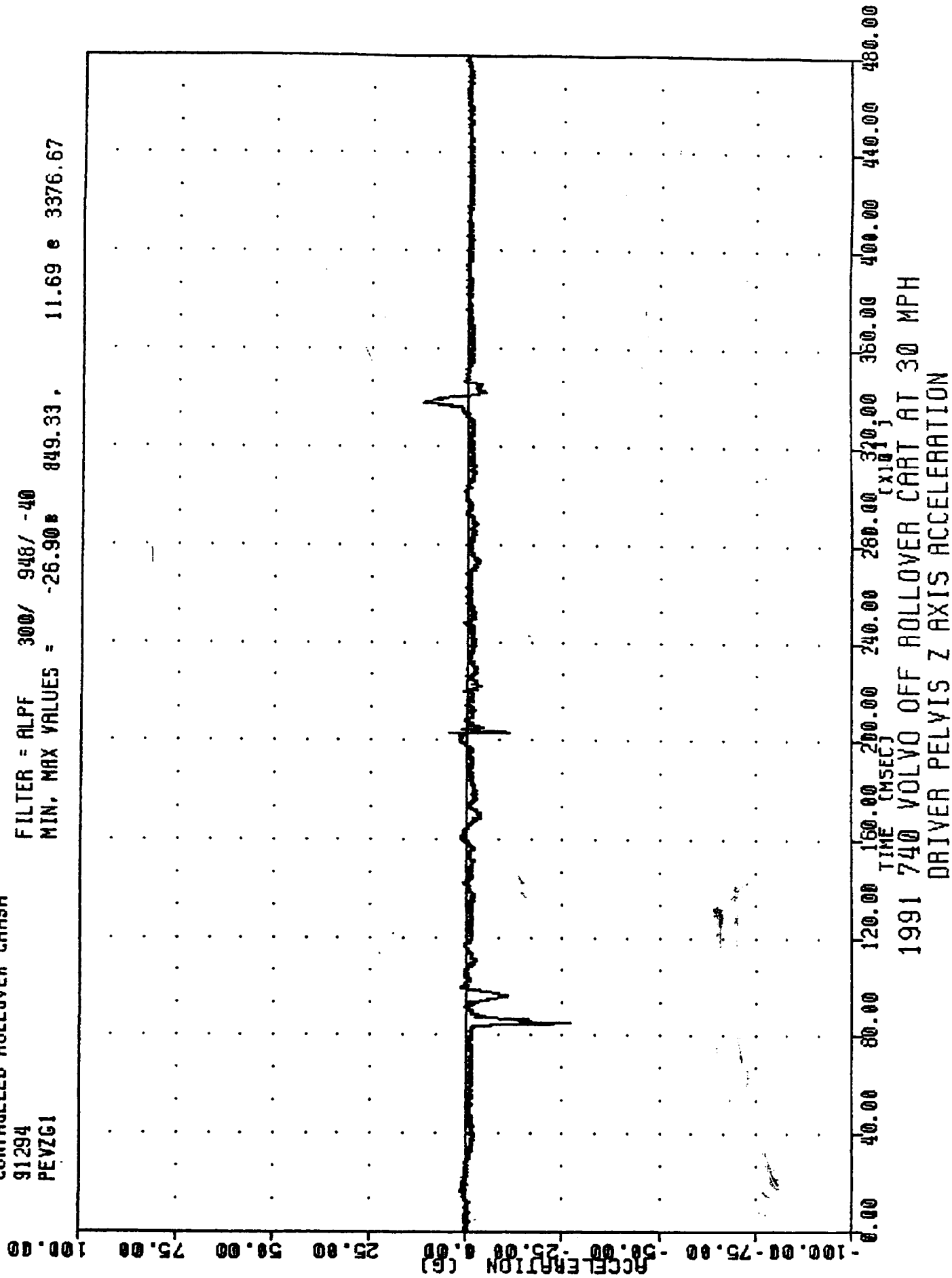


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH

DRIVER PELVIS Y AXIS ACCELERATION

TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
PEVZG1

FILTER = ALPF 300/ 948/ -40
MIN, MAX VALUES = -26.90 849.33, 11.69 e 3376.67



TRC
91294
PEVRG1

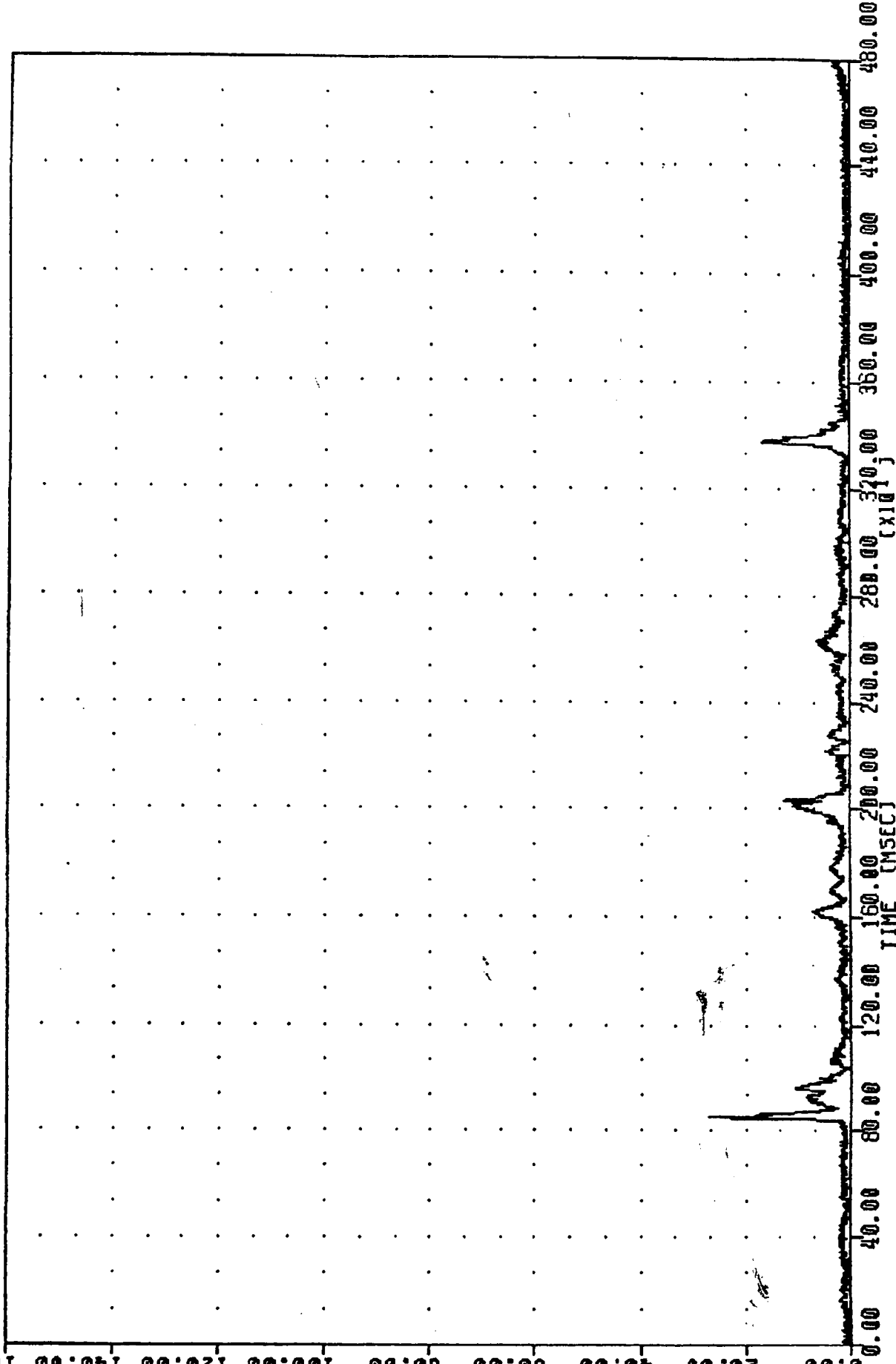
, 911021

CONTROLLED ROLLOVER CRASH

FILTER = ALPF 300/ 948/ -40

MIN, MAX VALUES = 0.018 11.33, 27.11 e 849.33

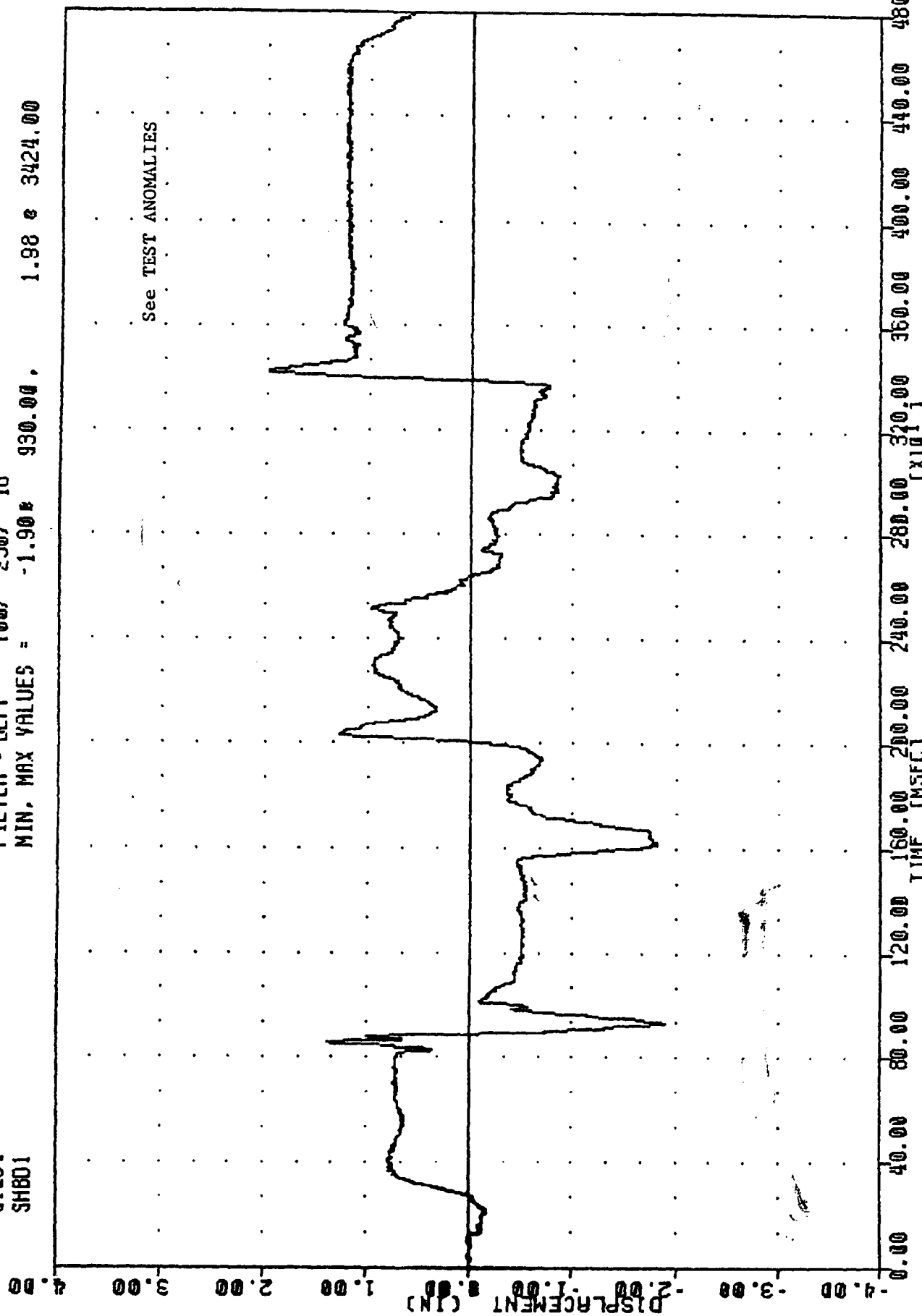
ACCELERATION (G)



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER PELVIS RESULTANT ACCELERATION

TRC
CONTROLLED ROLLOVER CRASH
91294
SHB01

FILTER = BLPP 100/ 250/ -16
MIN, MAX VALUES = -1.90 930.00, 1.98 e 3424.00

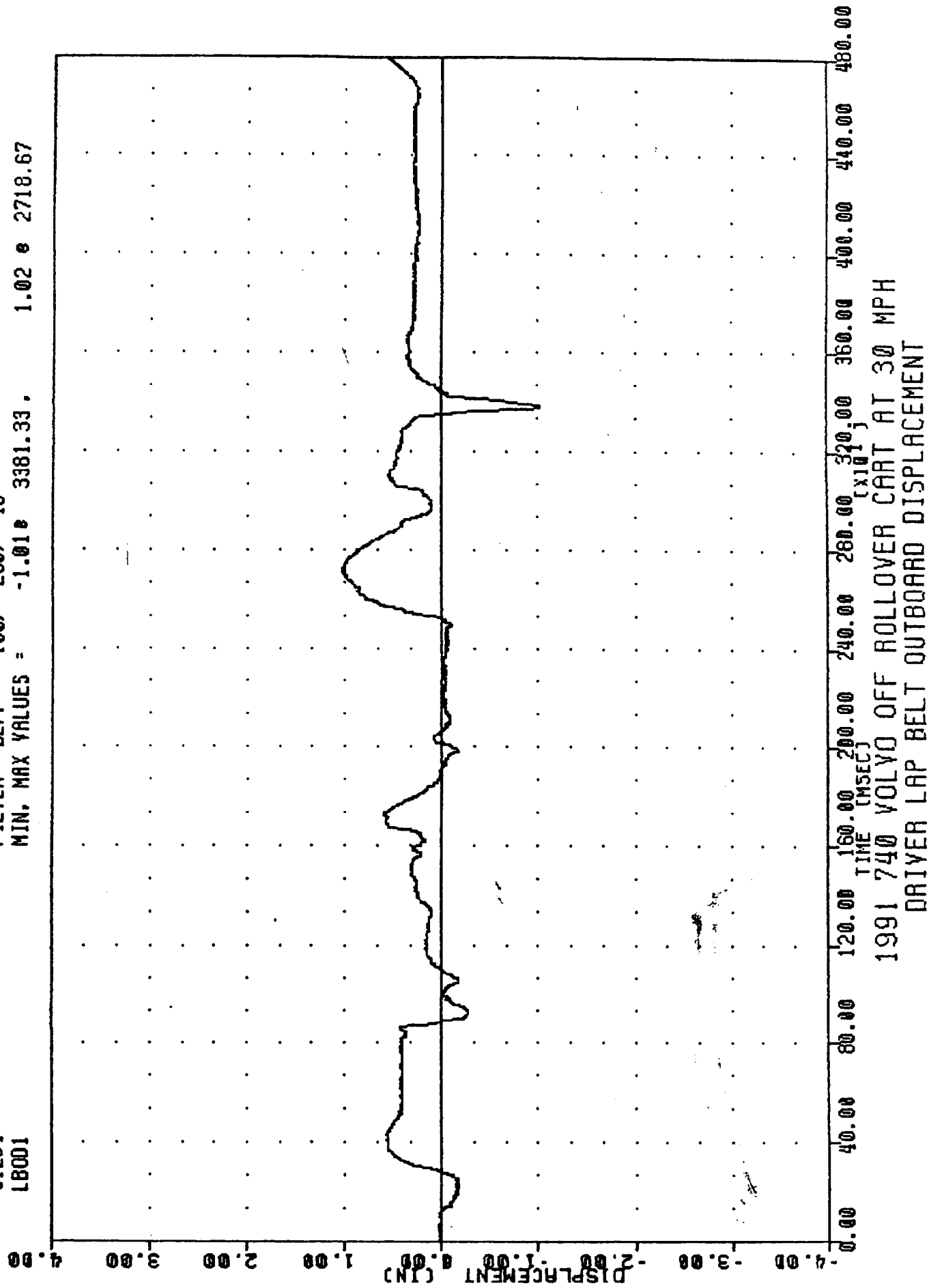


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
DRIVER SHOULDER BELT DISPLACEMENT

TRC
CONTROLLED ROLLOVER CRASH
91294
LB001

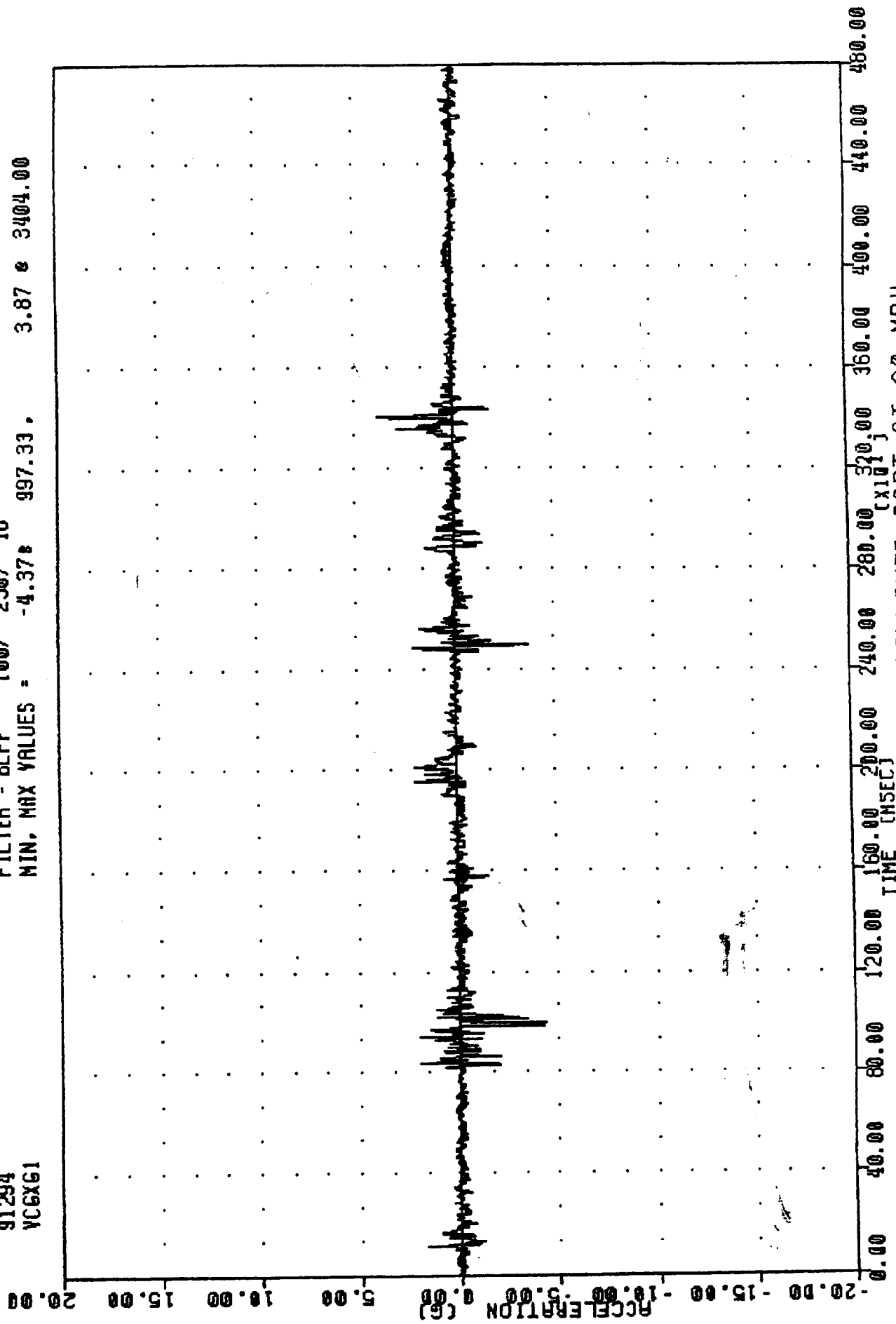
, 911021

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -1.01 3381.33 1.02 2718.67



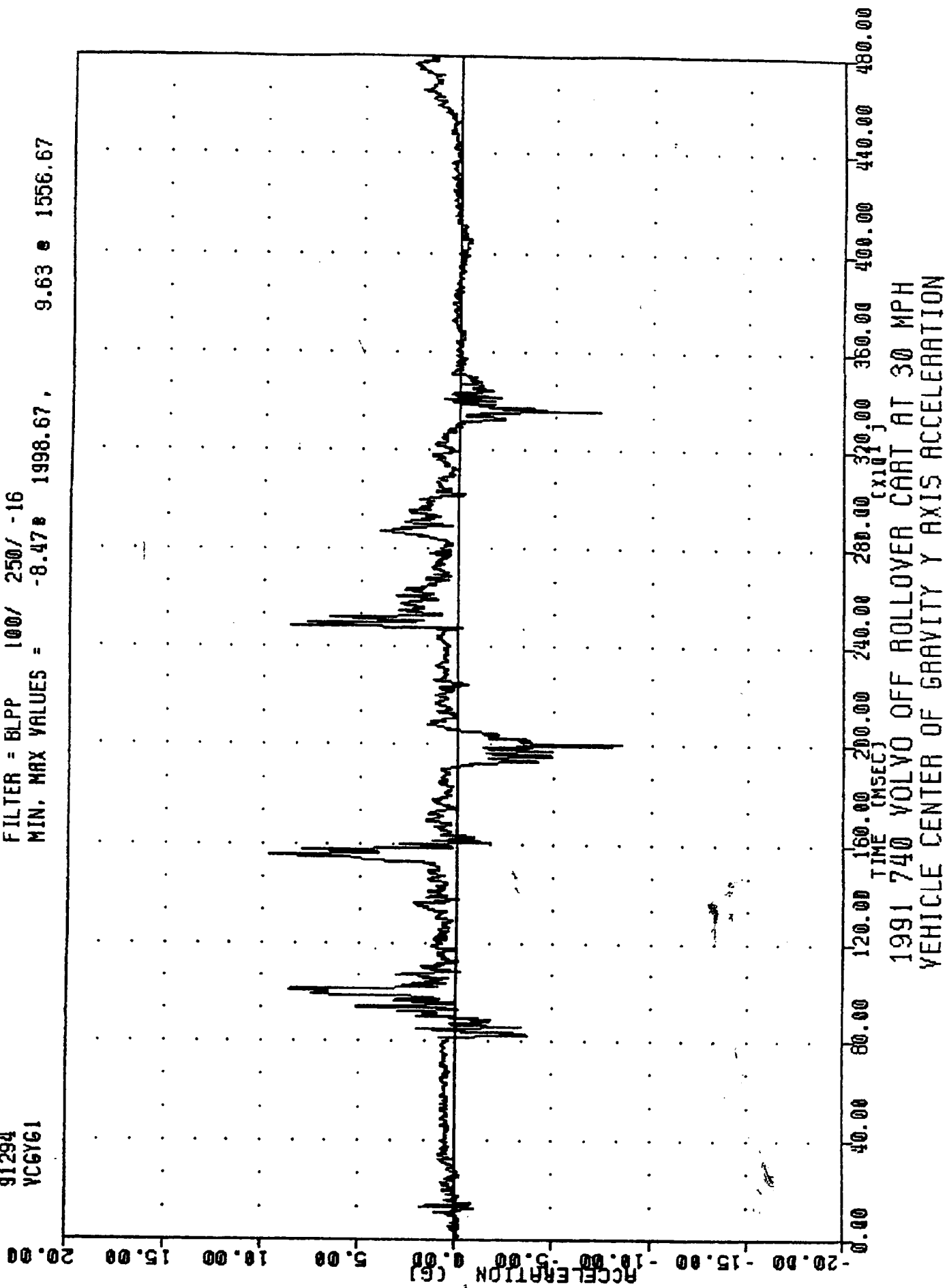
TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
VCGXG1

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -4.37 997.33 3.87 3404.00



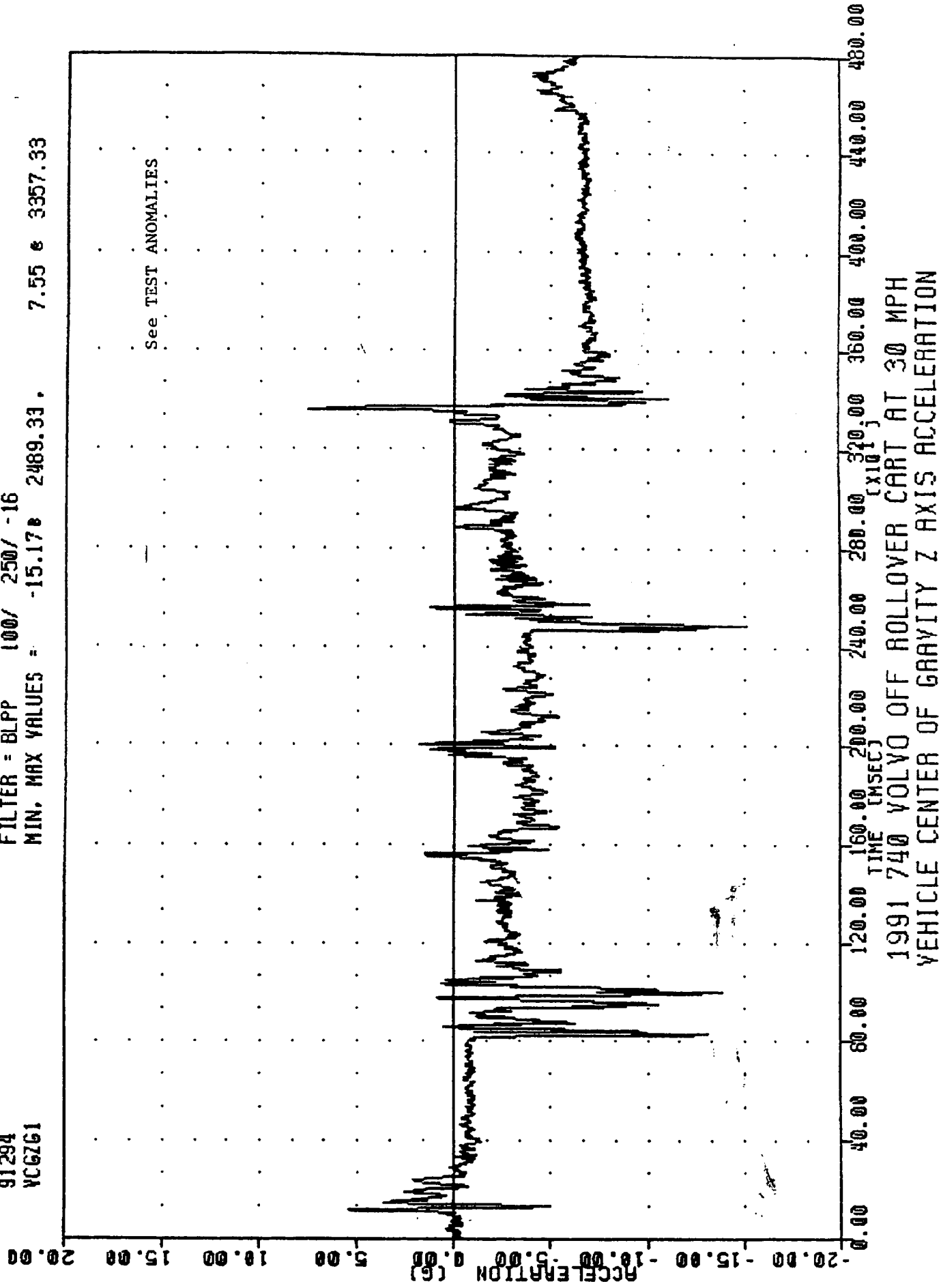
TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
YCGY61

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -8.47 1998.67 , 9.63 1556.67



TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
VCGZG1

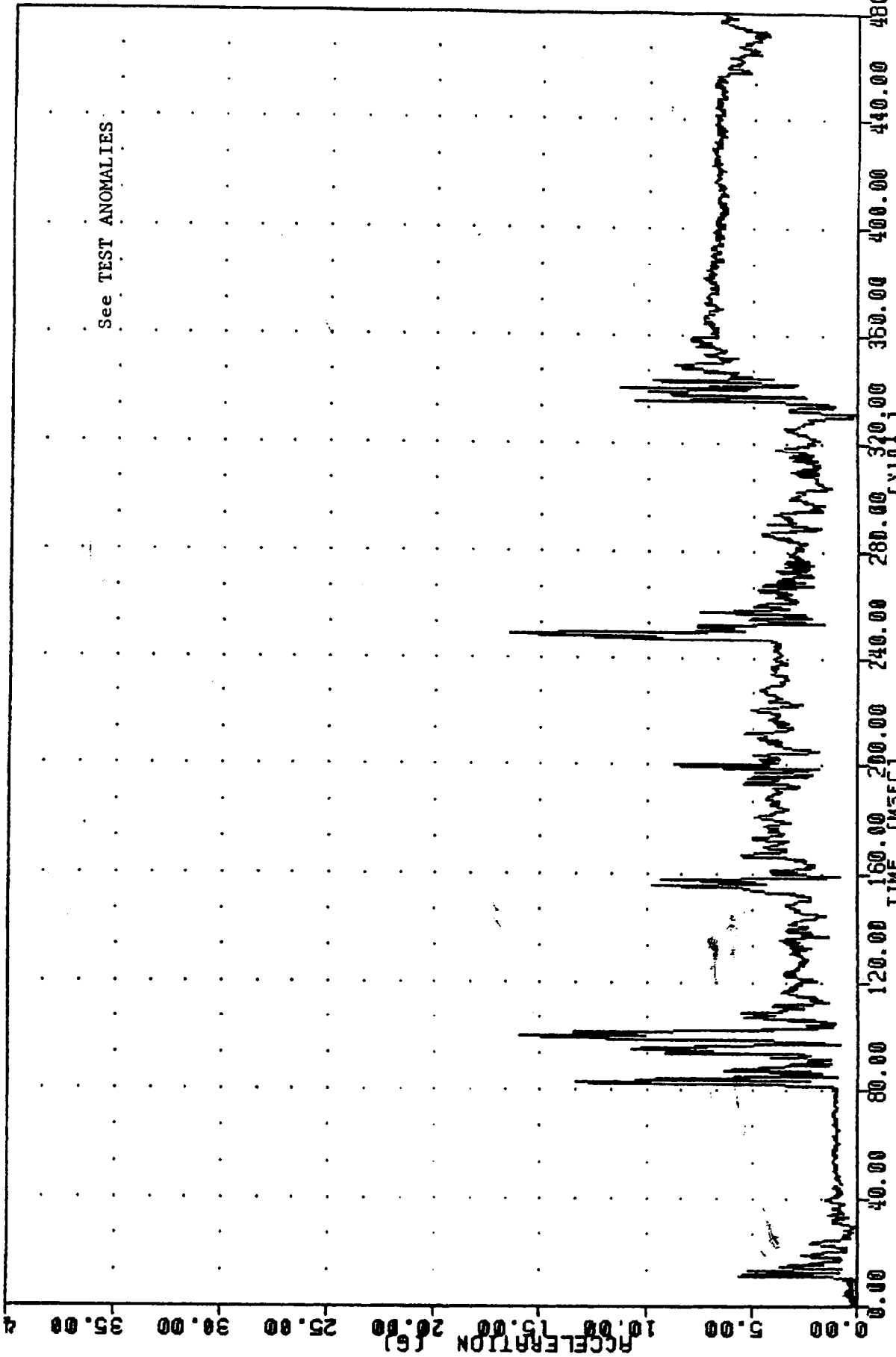
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -15.17 2489.33 7.55 3357.33



TRC
CONTROLLED ROLLOVER CRASH
91294
VCGRG1

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = 0.04 27.33, 16.53 e 2489.33

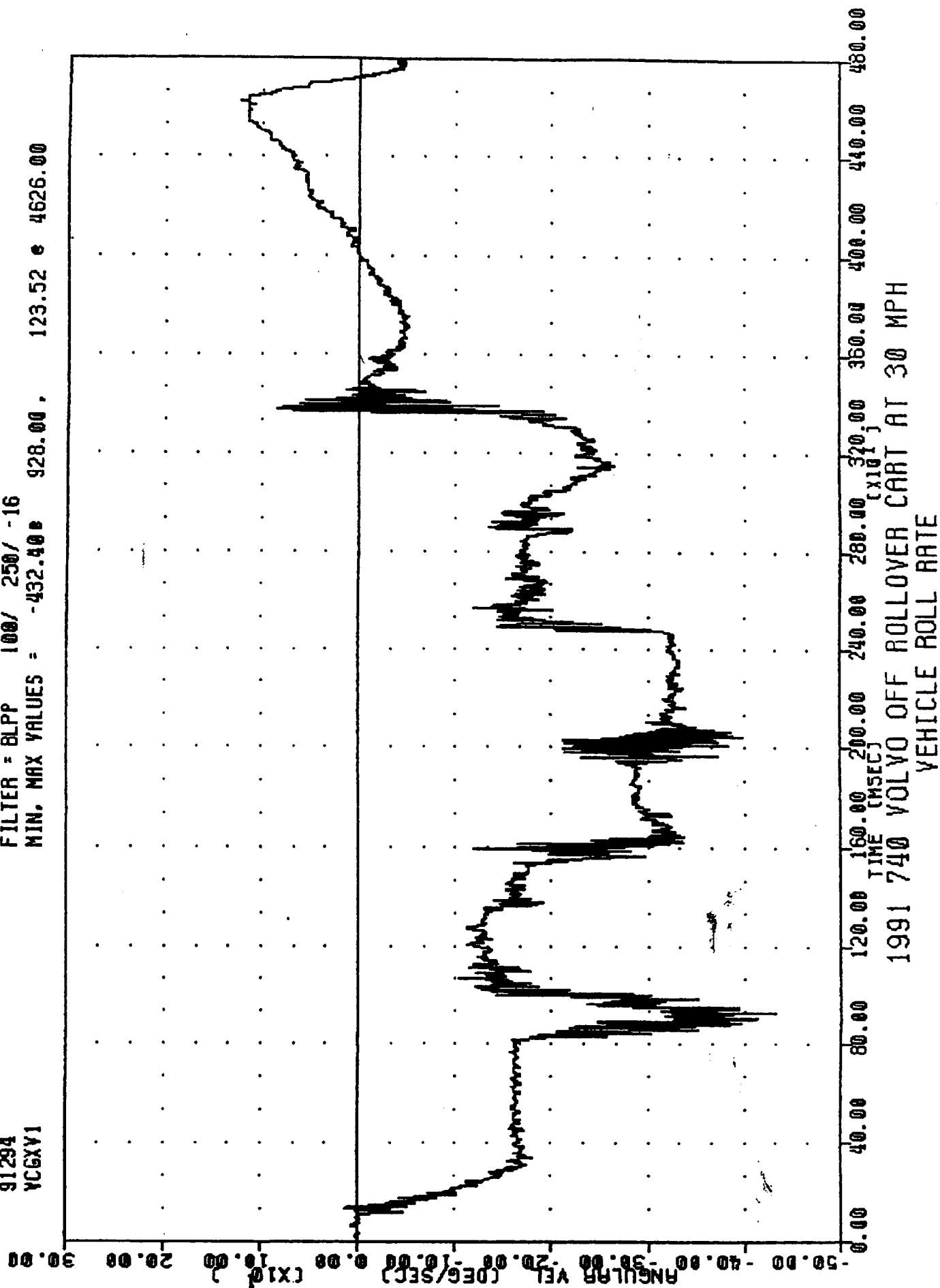
40.00



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY RESULTANT ACCELERATION

TRC
CONTROLLED ROLLOVER CRASH
91294
VCXYV1

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -432.40 928.00 123.52 4626.00

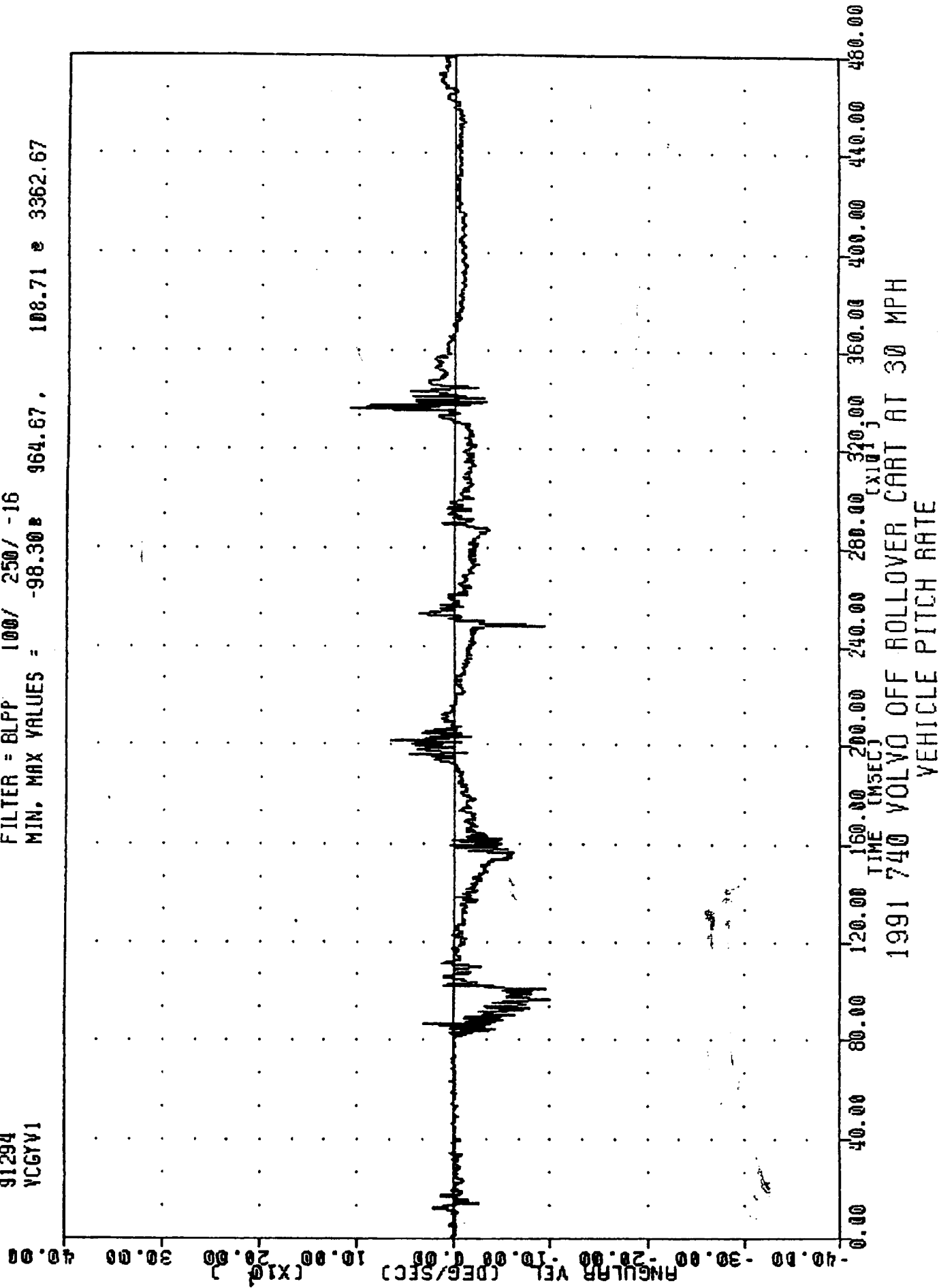


TRC
CONTROLLED ROLLOVER CRASH

91294
VCGYV1

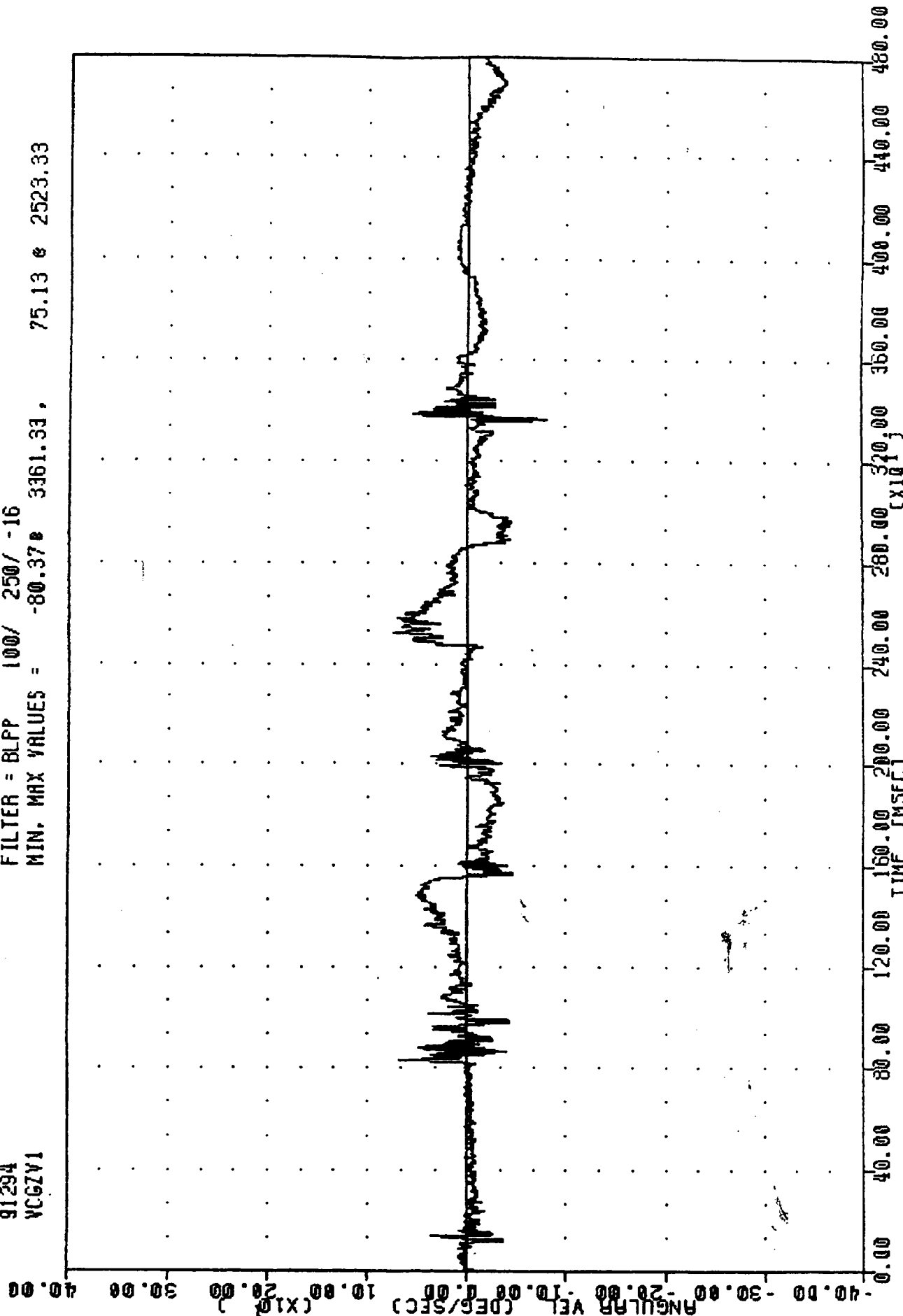
FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -98.30 964.87, 108.71 3362.67



TRC
 CONTROLLED ROLLOVER CRASH
 91294
 VCGZV1

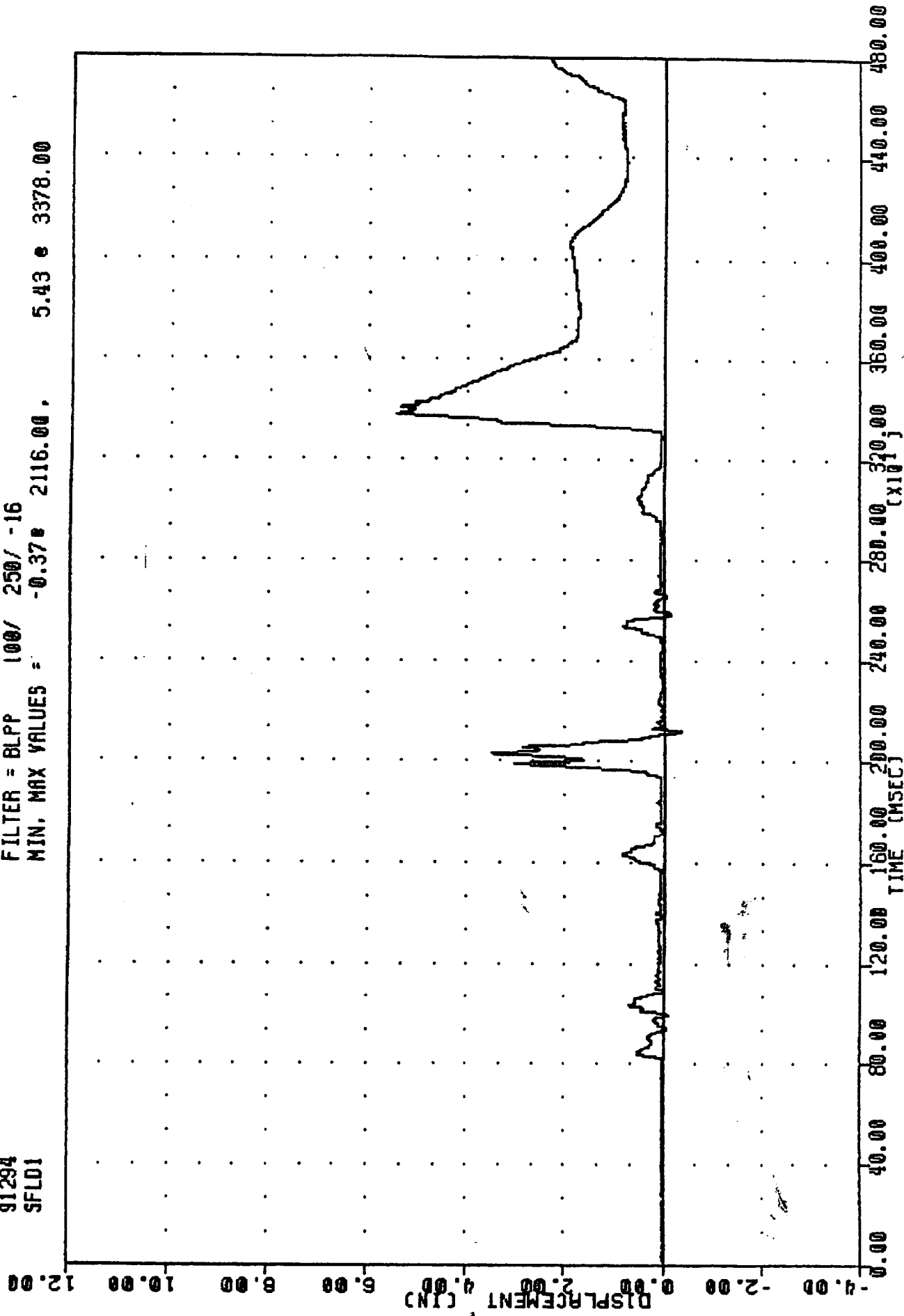
FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -80.37 3361.33, 75.13 2523.33



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
 VEHICLE YAW RATE

TAC , 911021
CONTROLLED ROLLOVER CRASH
91294
SFLD1

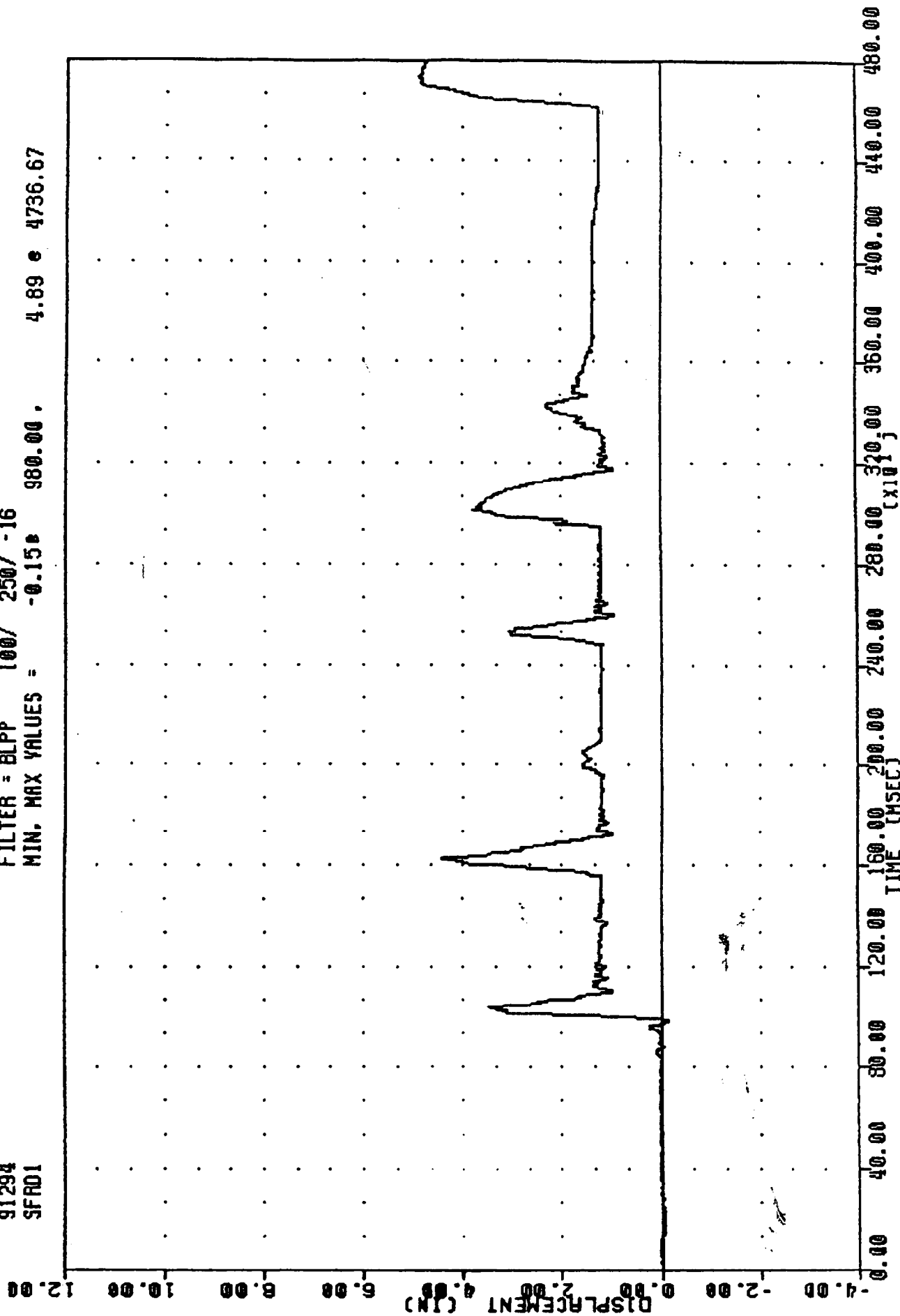
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -0.37 2116.00, 5.43 3378.00



TRC
91294
SFRD1
CONTROLLED ROLLOVER CRASH

, 911021

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -0.15 980.00 4.89 e 4736.67



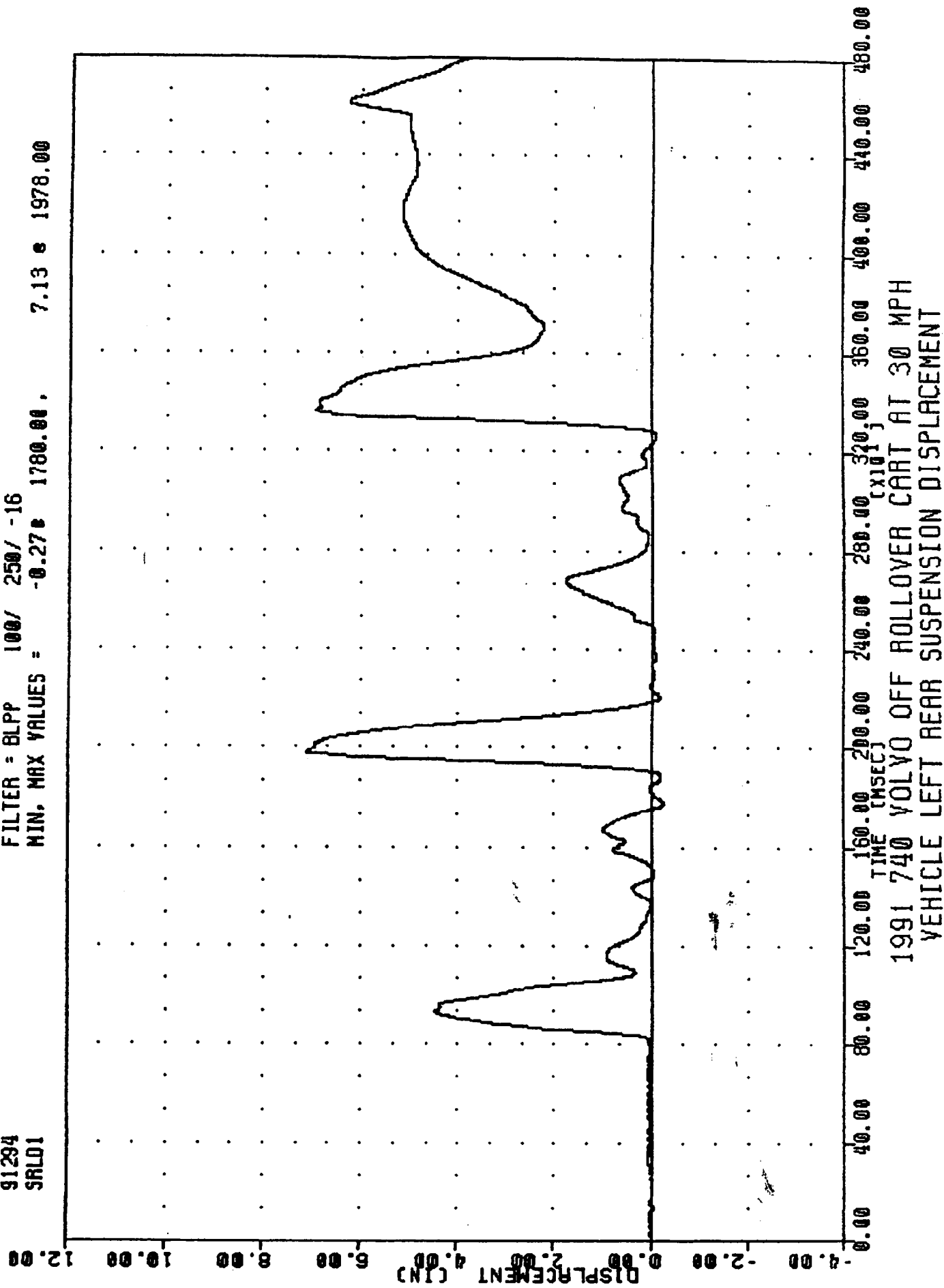
1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
VEHICLE RIGHT FRONT SUSPENSION DISPLACEMENT

TRC
CONTROLLED ROLLOVER CRASH
91294
SRLO1

, 911021

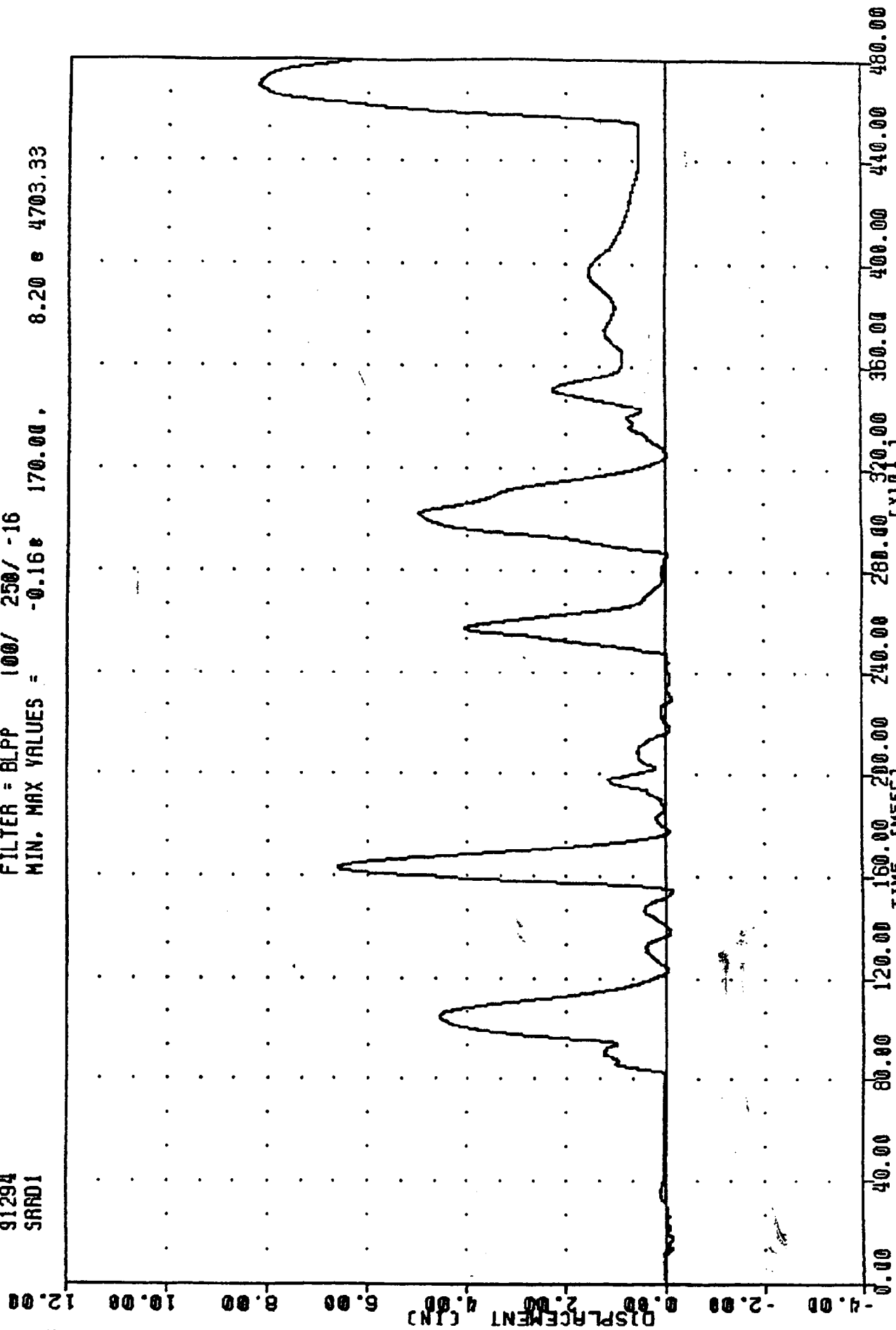
FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -0.278 1780.00, 7.13 e 1978.00



TAC
 CONTROLLED ROLLOVER CRASH
 91294
 SARD1

FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -0.16 170.00 8.20 e 4703.33

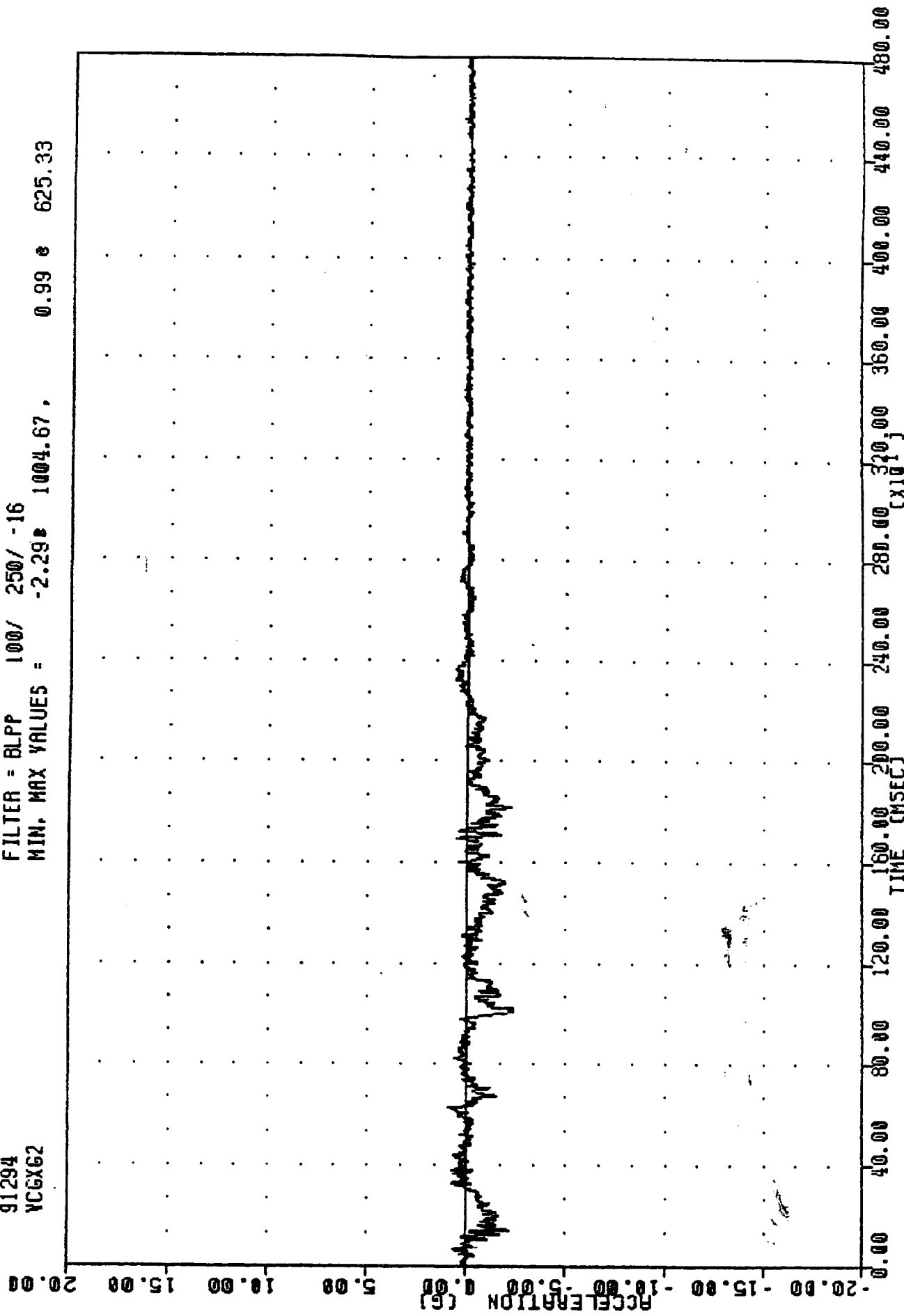


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
 VEHICLE RIGHT REAR SUSPENSION DISPLACEMENT

TRC
CONTROLLED ROLLOVER CRASH
91294
VCGX62

, 811021

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -2.29 1004.67, 0.99 625.33

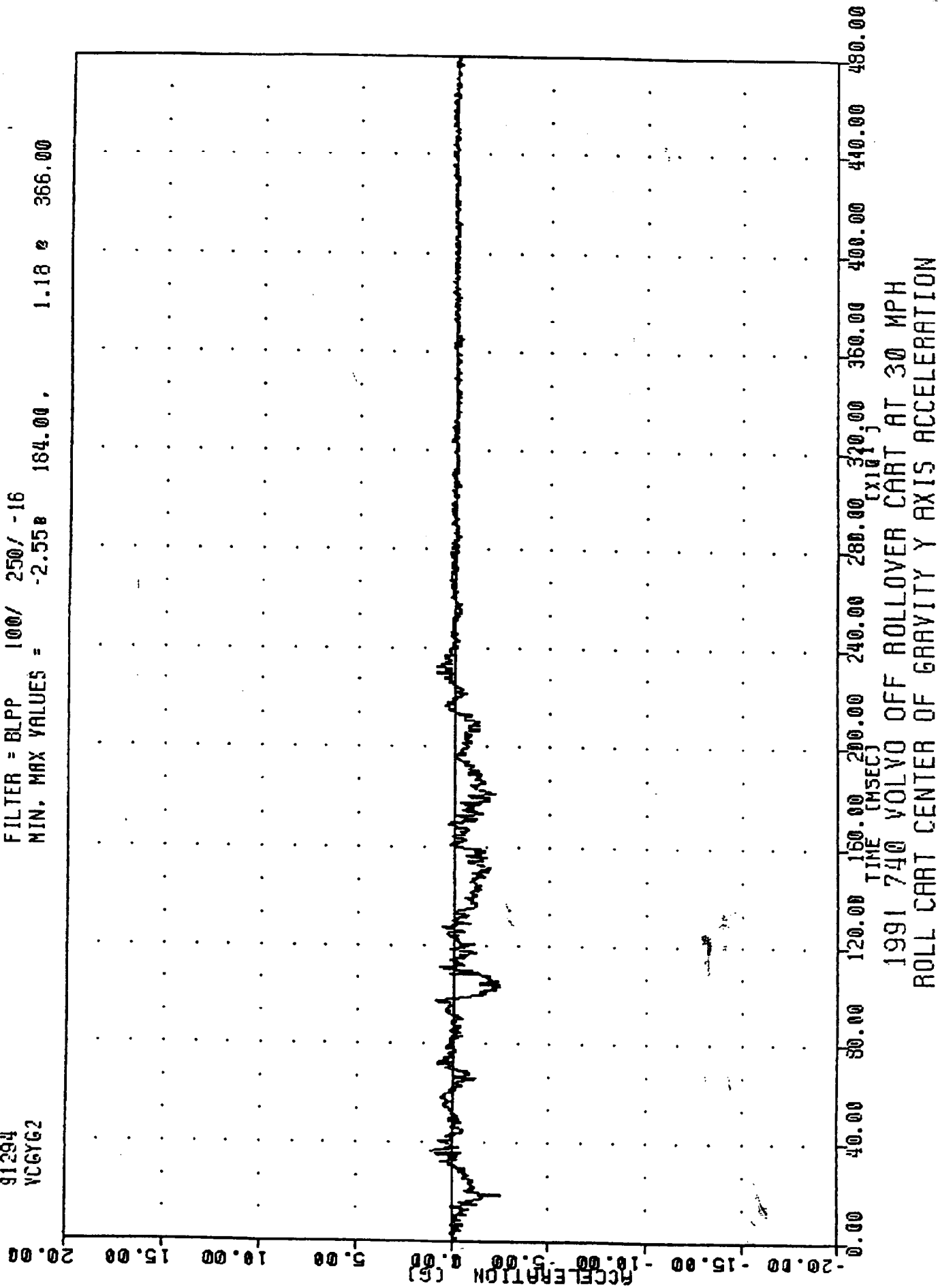


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY X AXIS ACCELERATION

TRC
CONTROLLED ROLLOVER CRASH
91294
VCGYG2

, 911021

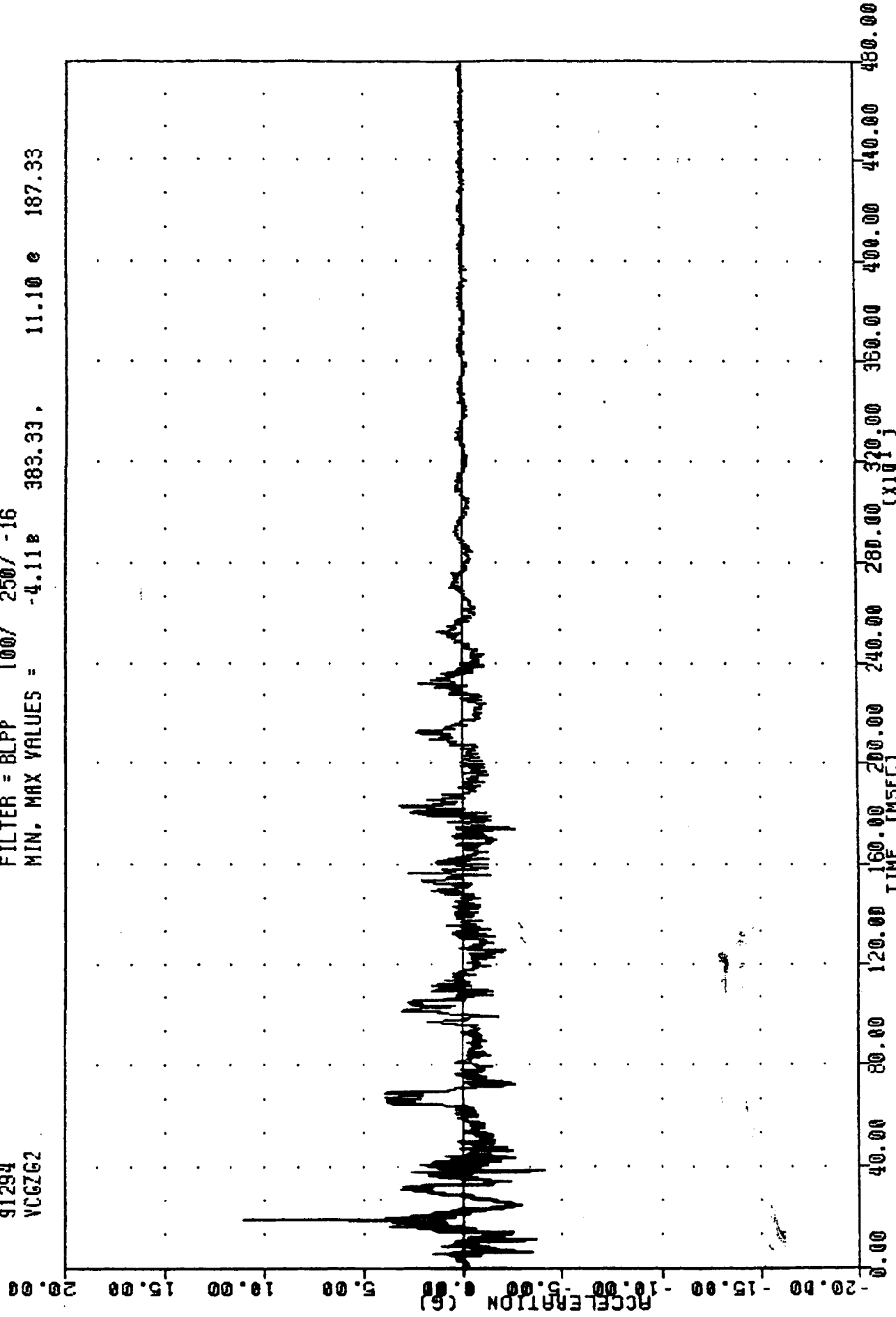
FILTER = BLPP 100/ 250/ -16
MIN, MAX VALUES = -2.55 184.00 1.18 366.00



TRC
CONTROLLED ROLLOVER CRASH
91294
VCGZG2

, 911021

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -4.118 383.33, 11.10 e 187.33

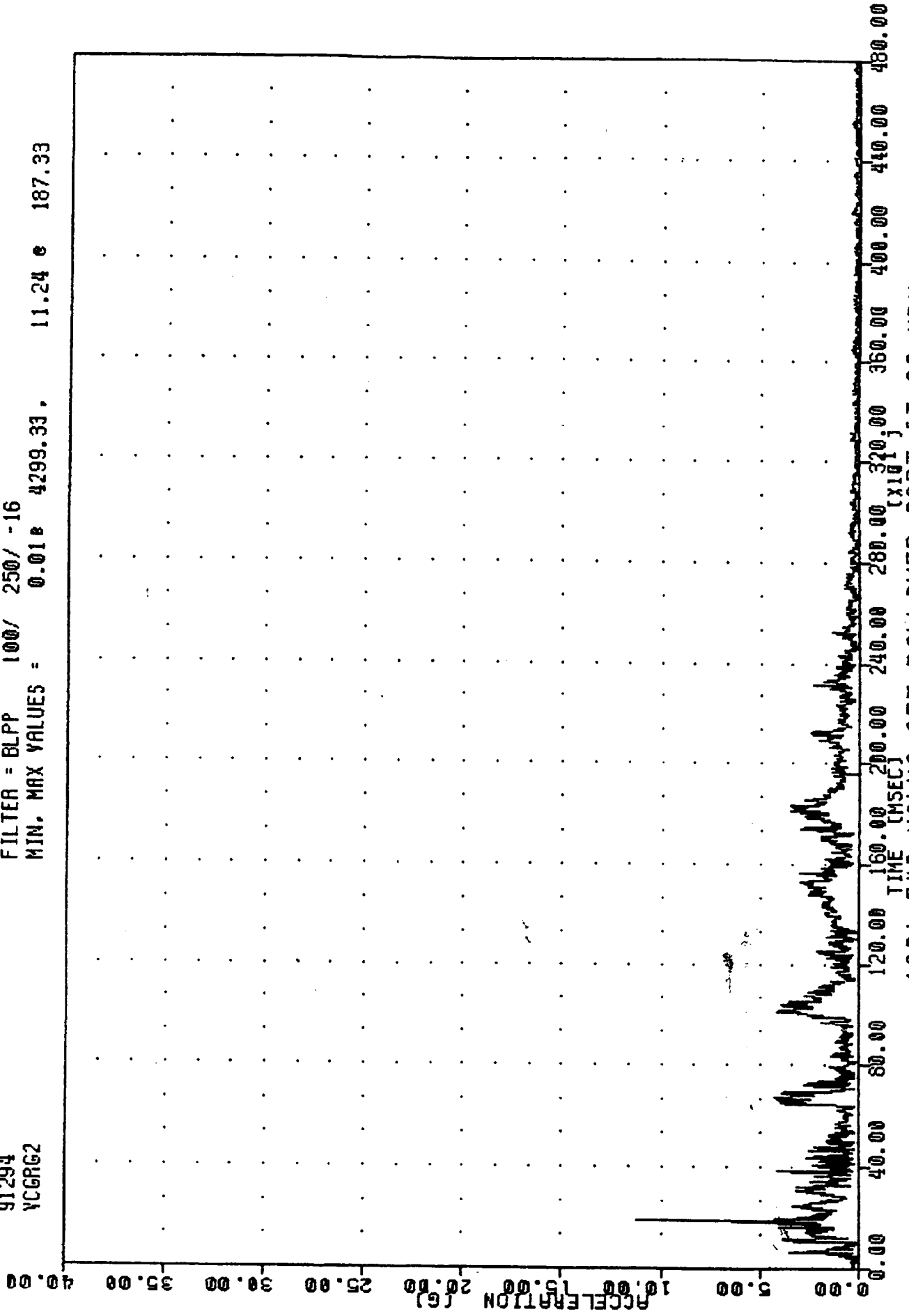


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY Z AXIS ACCELERATION

TRC
CONTROLLED ROLLOVER CRASH
91294
YCGRG2

, 911021

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = 0.018 4299.33, 11.24 e 187.33

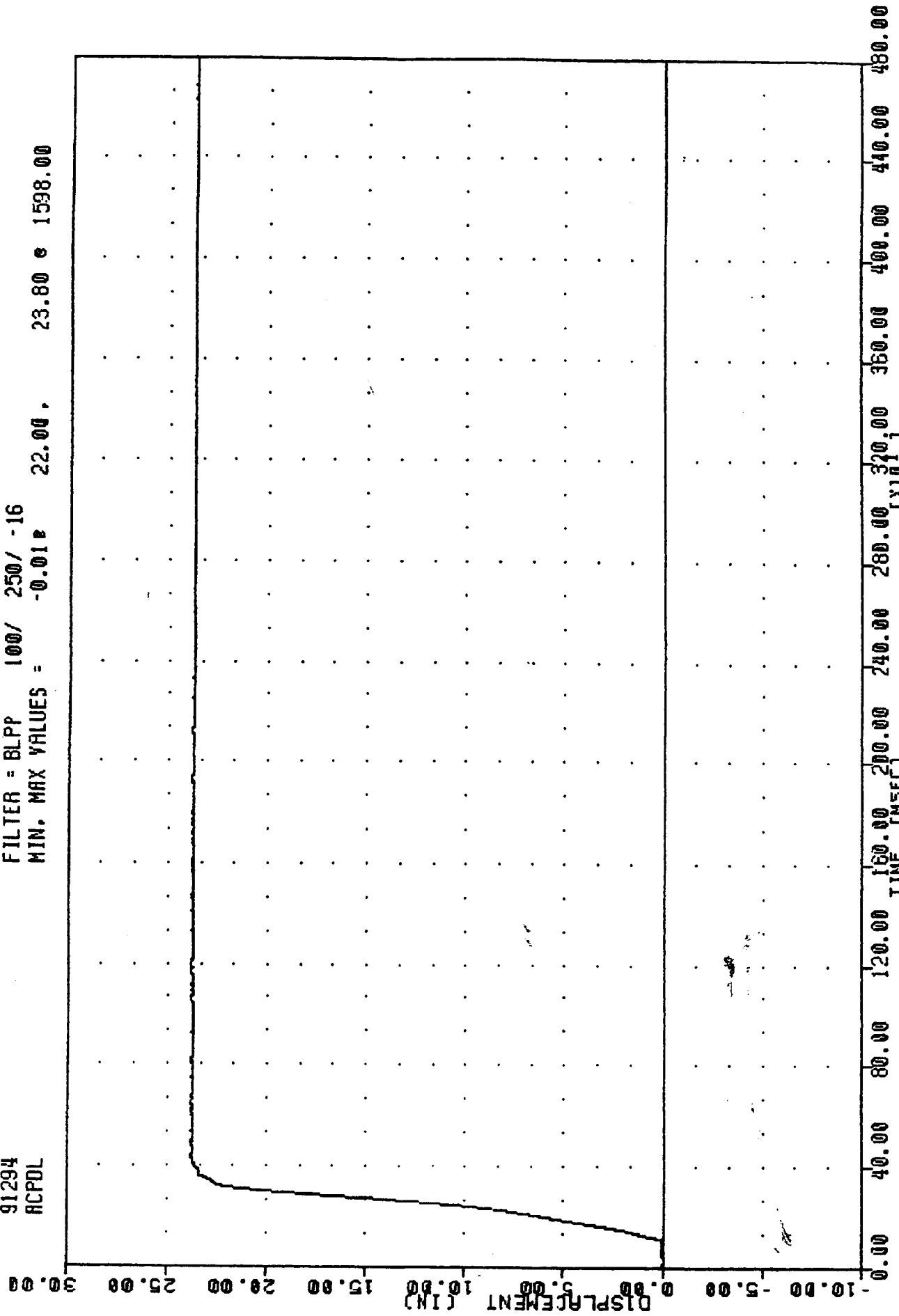


1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY RESULTANT ACCELERATION

TRC
91294
RCPDL
CONTROLLED ROLLOVER CRASH

911021

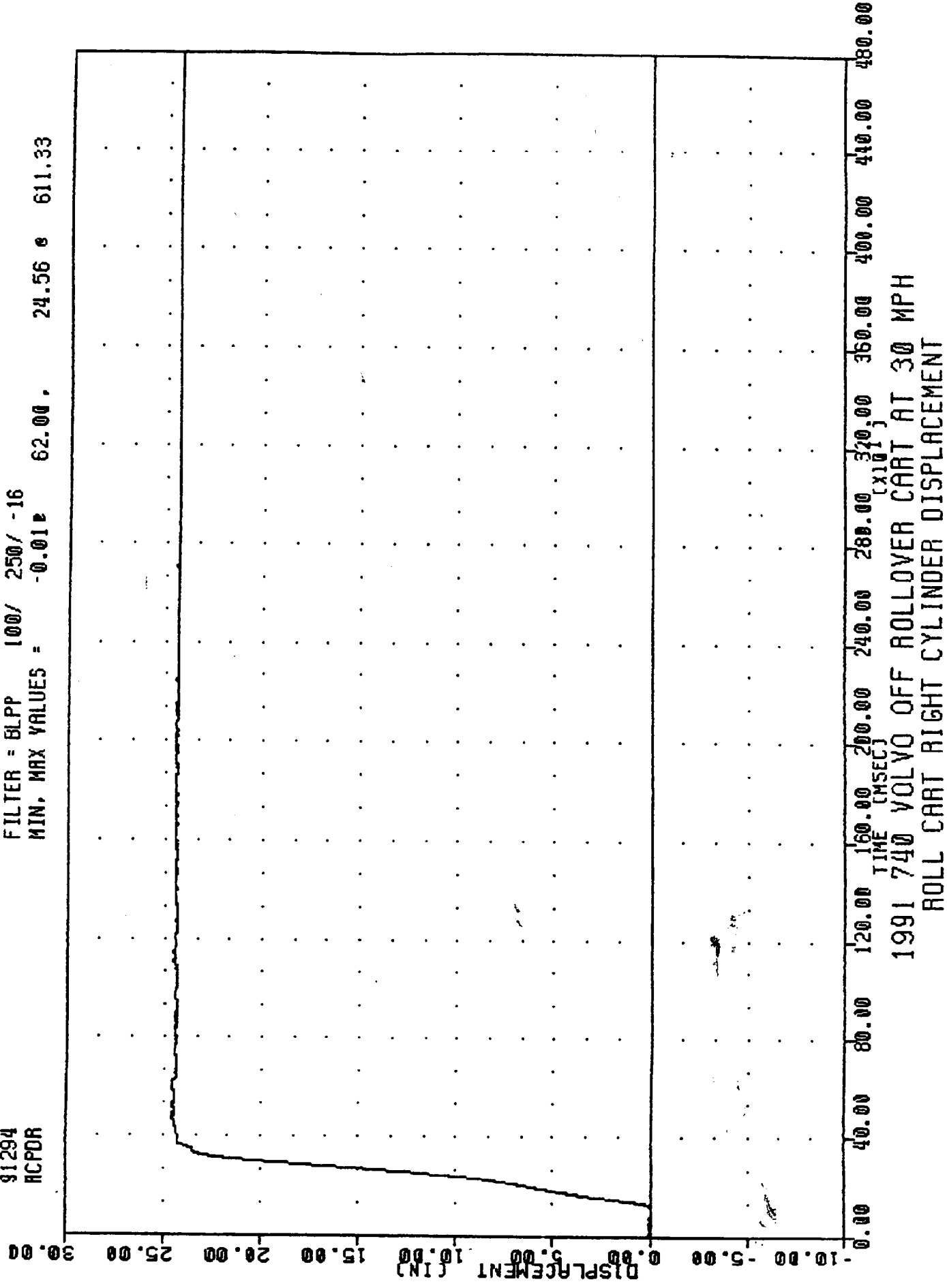
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -0.01 22.00 23.80 1598.00



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
ROLL CART LEFT CYLINDER DISPLACEMENT

TRC , 911021
CONTROLLED ROLLOVER CRASH
91294
ACPOR

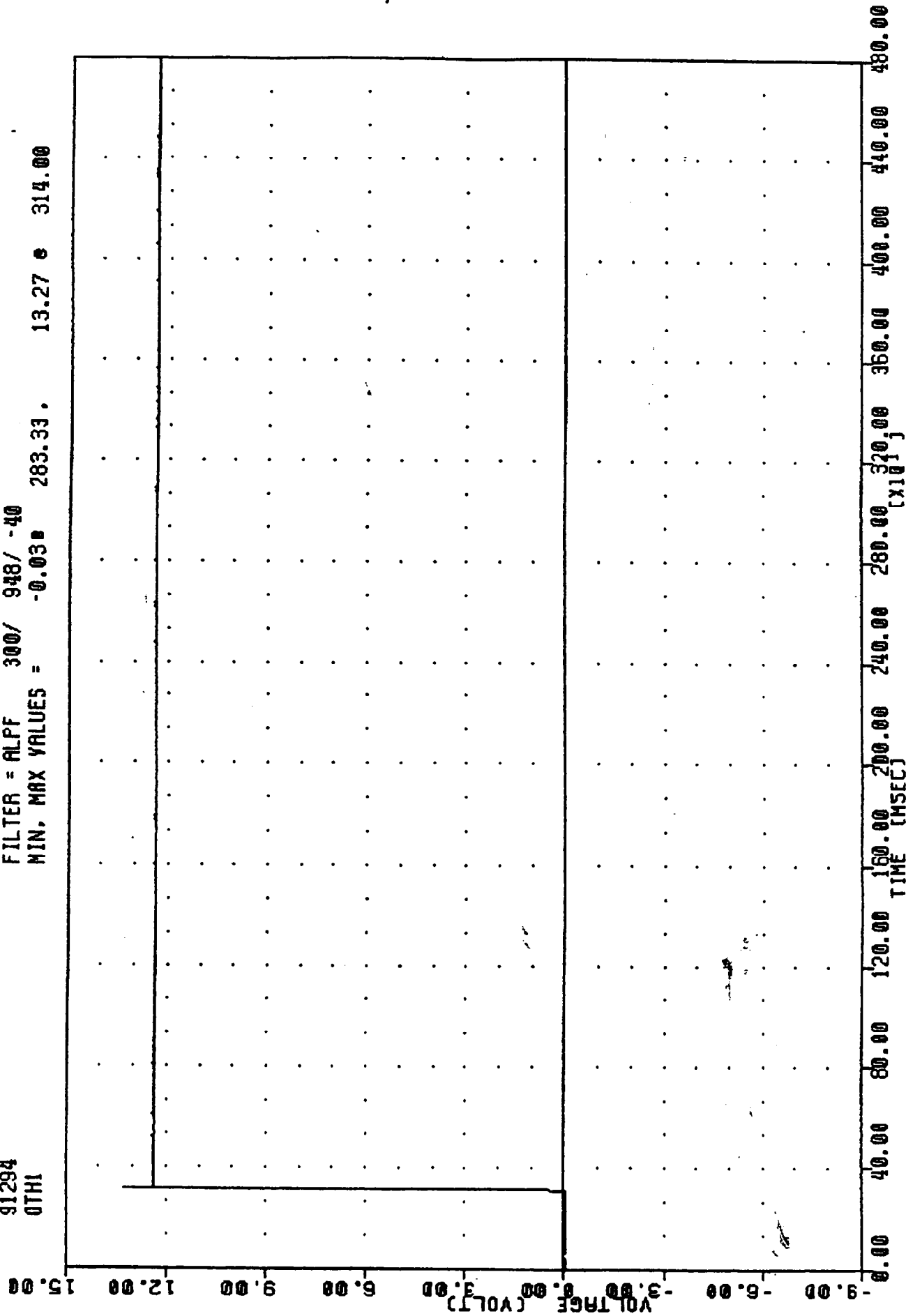
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -0.012 62.00 , 24.56 6 611.33



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
ROLL CART RIGHT CYLINDER DISPLACEMENT

TRC , 911021
 CONTROLLED ROLLOVER CRASH
 91294
 0TH1

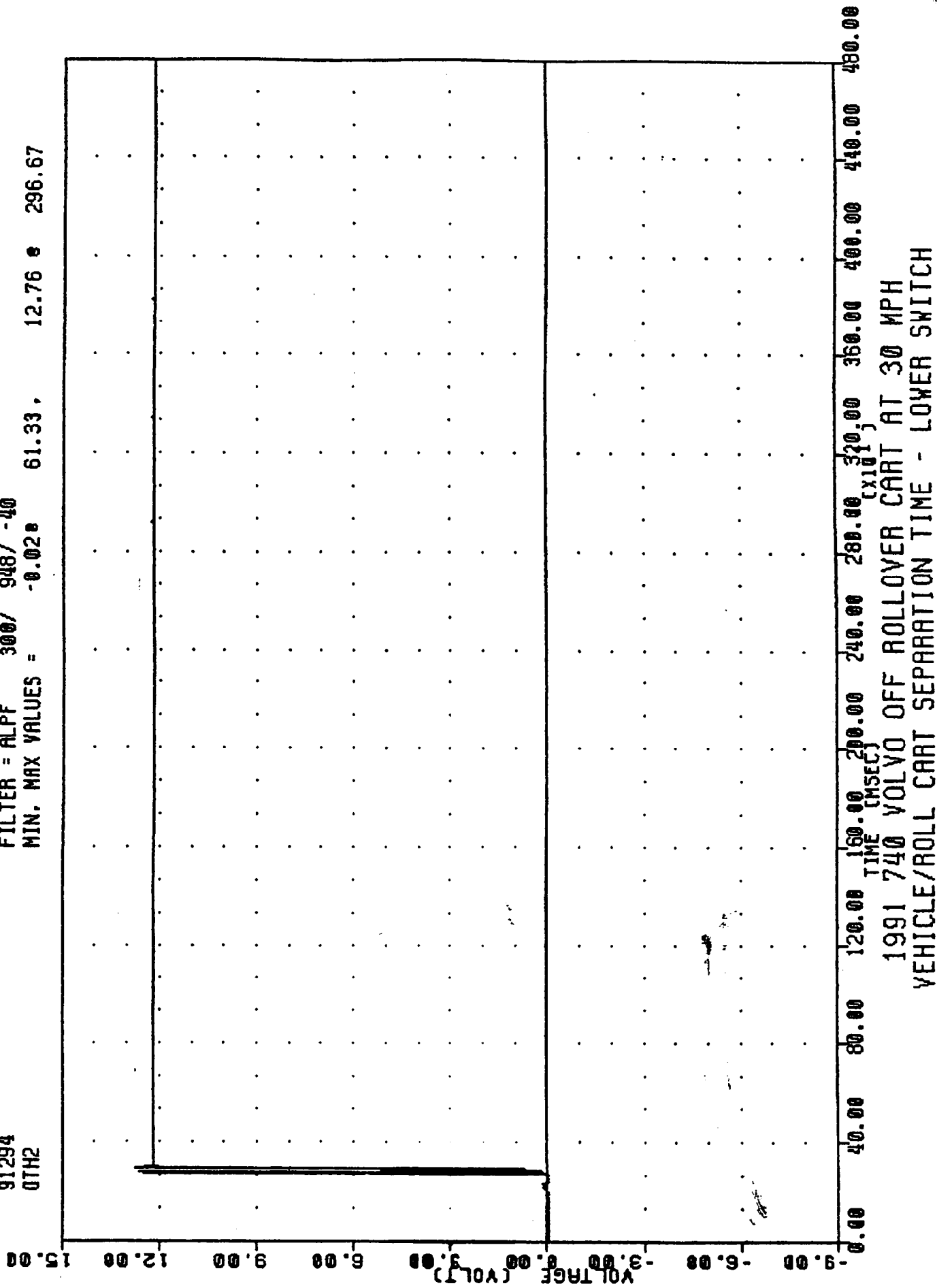
FILTER = ALPF 300/ 948/ -40
 MIN. MAX VALUES = -0.03 283.33 13.27 314.00



1991 740 VOLVO OFF ROLLOVER CART AT 30 MPH
 VEHICLE/ROLL CART SEPARATION TIME - UPPER SWITCH

TRC
 CONTROLLED ROLLOVER CRASH
 91294
 0TH2

FILTER = ALPF 300/ 948/ -40
 MIN. MAX VALUES = -0.020 61.33 12.76 296.67



SIGN CONVENTION

ACCELEROMETERS:

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

POTENTIOMETERS:

+CHEST DISPLACEMENT: OUTWARD
+SEAT BELT DISPLACEMENT: OUTWARD
+SEAT BELT EXTENSION: ENLONGATION
+VEHICLE SUSPENSION
DISPLACEMENT: UPWARD

LOAD CELLS:

+FEMUR FORCE: TENSION
+SEAT BELT FORCE: TENSION
+BARRIER FORCE: TENSION

NECK LOAD CELLS:

+X FORCE: HEAD FORWARD
+Y FORCE: HEAD RIGHTWARD
+Z FORCE: HEAD UPWARD (TENSION ON NECK)
+X MOMENT: RIGHT EAR TO RIGHT SHOULDER
+Y MOMENT: HEAD ROTATING FORWARD
+Z MOMENT: HEAD ROTATING LEFTWARD

GYROSCOPES:

+X ROLL: TO RIGHT
+Y PITCH: FRONT DOWN
+Z YAW: COUNTERCLOCKWISE

APPENDIX C

DUMMY CERTIFICATION DATA

POST-TEST CERTIFICATION DATA

DRIVER DUMMY S/N: 907

TRANSPORTATION RESEARCH CENTER OF OHIO
HYBRID III EXTERNAL DIMENSIONS
907 HUMANOID

25-OCT-91

SRL

907C5ED1

572E SN907 EXT. DIMENSION CAL5

TEST PARAMETER	(DIMEN.)	SPECIFICATION	TEST RESULTS
TEMPERATURE			71.0 DEG. F
RELATIVE HUMIDITY			52.0 %
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	38.7 IN
WAIST CIRCUMFERENCE (Z)		32.9-34.1 IN	33.6 IN
CHEST DEPTH (O)		8.4- 9.0 IN	8.6 IN
H-POINT HEIGHT (C)		3.3- 3.5 IN	3.5 IN
H-POINT FROM SEATBACK (D)		5.3- 5.5 IN	5.5 IN
SKULL CAP TO BACKLINE (H)		1.6- 1.8 IN	1.7 IN
TOTAL SITTING HEIGHT (A)		34.6-35.0 IN	34.7 IN
THIGH CLEARANCE (F)		5.5- 6.1 IN	6.0 IN
BUTTOCK KNEE LENGTH (K)		22.8-23.8 IN	23.6 IN
BUTTOCK POPLITEAL LENGTH (N)		17.8-18.8 IN	18.5 IN
POPLITEAL HEIGHT (L)		16.9-17.9 IN	17.5 IN
KNEE PIVOT HEIGHT (M)		19.1-19.7 IN	19.4 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	3.7 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	13.4 IN
BACK OF ELBOW TO WRIST PIVOT (G)		11.4-12.0 IN	11.5 IN

TEST MEETS SPECIFICATIONS

TECHNICIAN

Chas. Middleton

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

25-Oct-91

SRL

907C5HD1

572E SN907 HEAD DROP CAL 05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	52.00 %
PEAK RESULTANT ACCELERATION	225 - 275 G	247.79 G
PEAK LATERAL ACCELERATION	15 G MAX	7.71 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

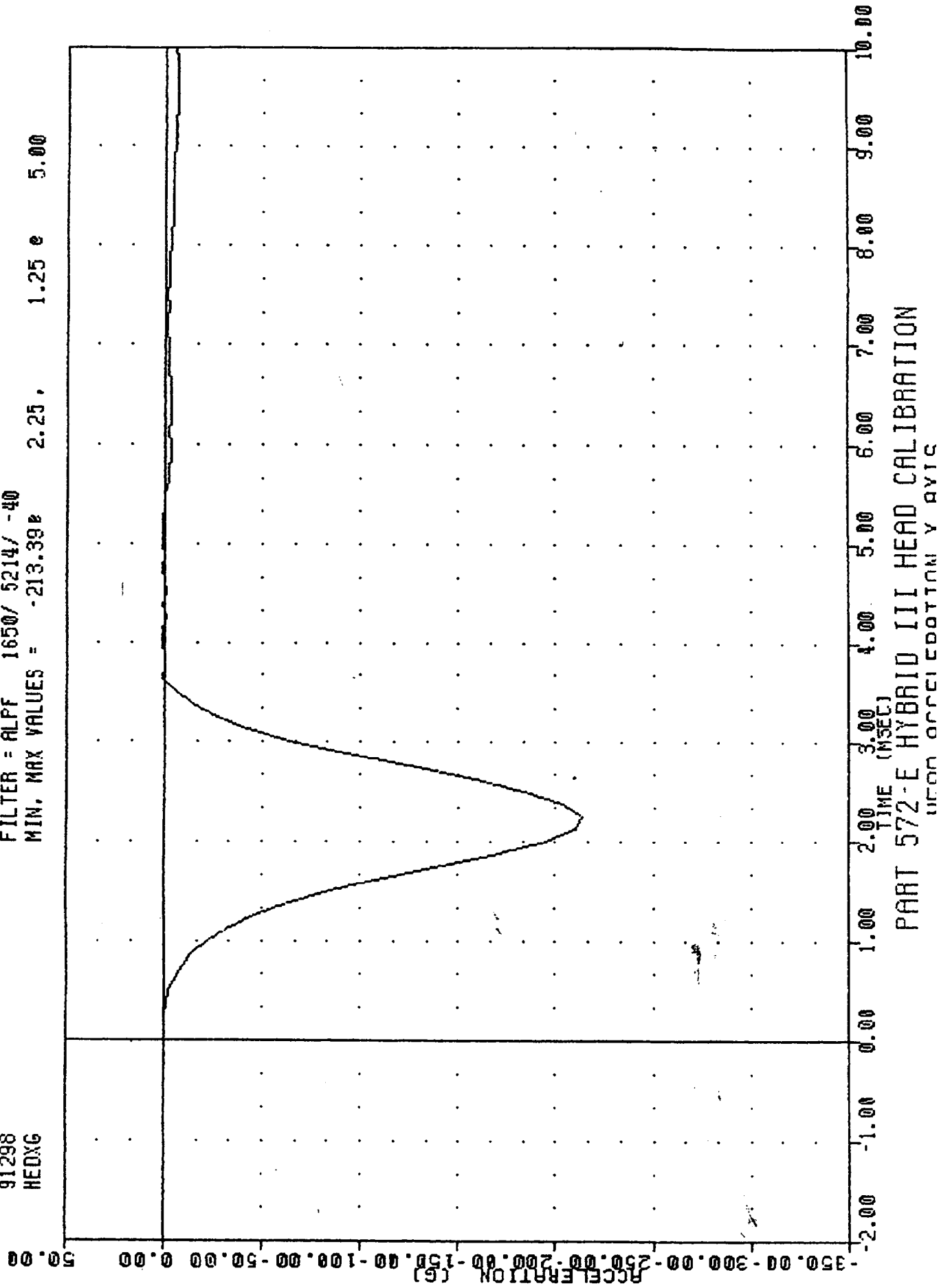
TEST MEETS SPECIFICATIONS

TECHNICIAN

Chris Middleton

SRL .907C5HD1
572E SN907 HEAD DROP CAL 05
91298
HEDXG

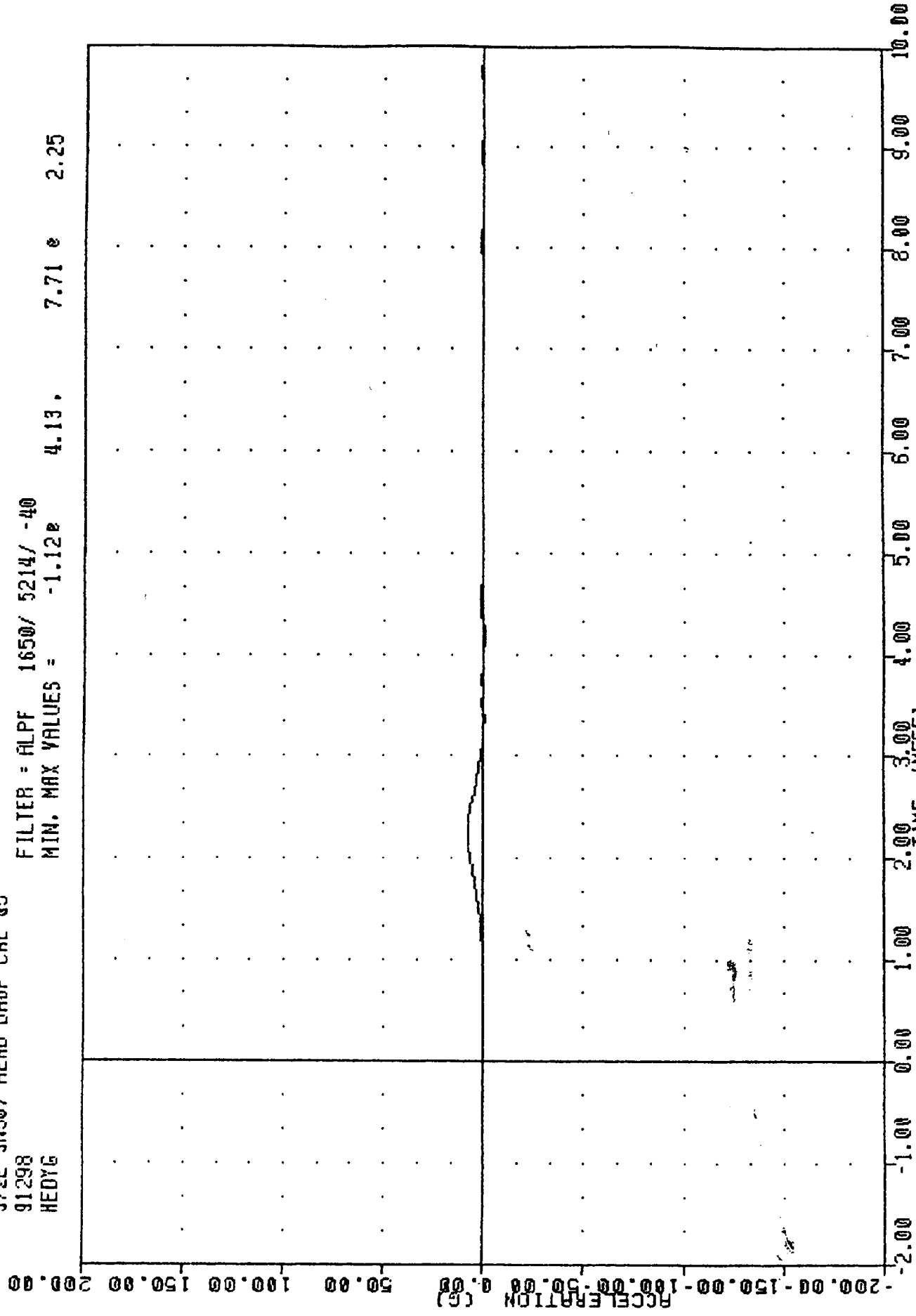
FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -213.39e 2.25, 1.25 e 5.00



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

SRL
572E SN907 HEAD DRDP CAL 05
91298
HEDYG

FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -1.12e 4.13, 7.71 e 2.25

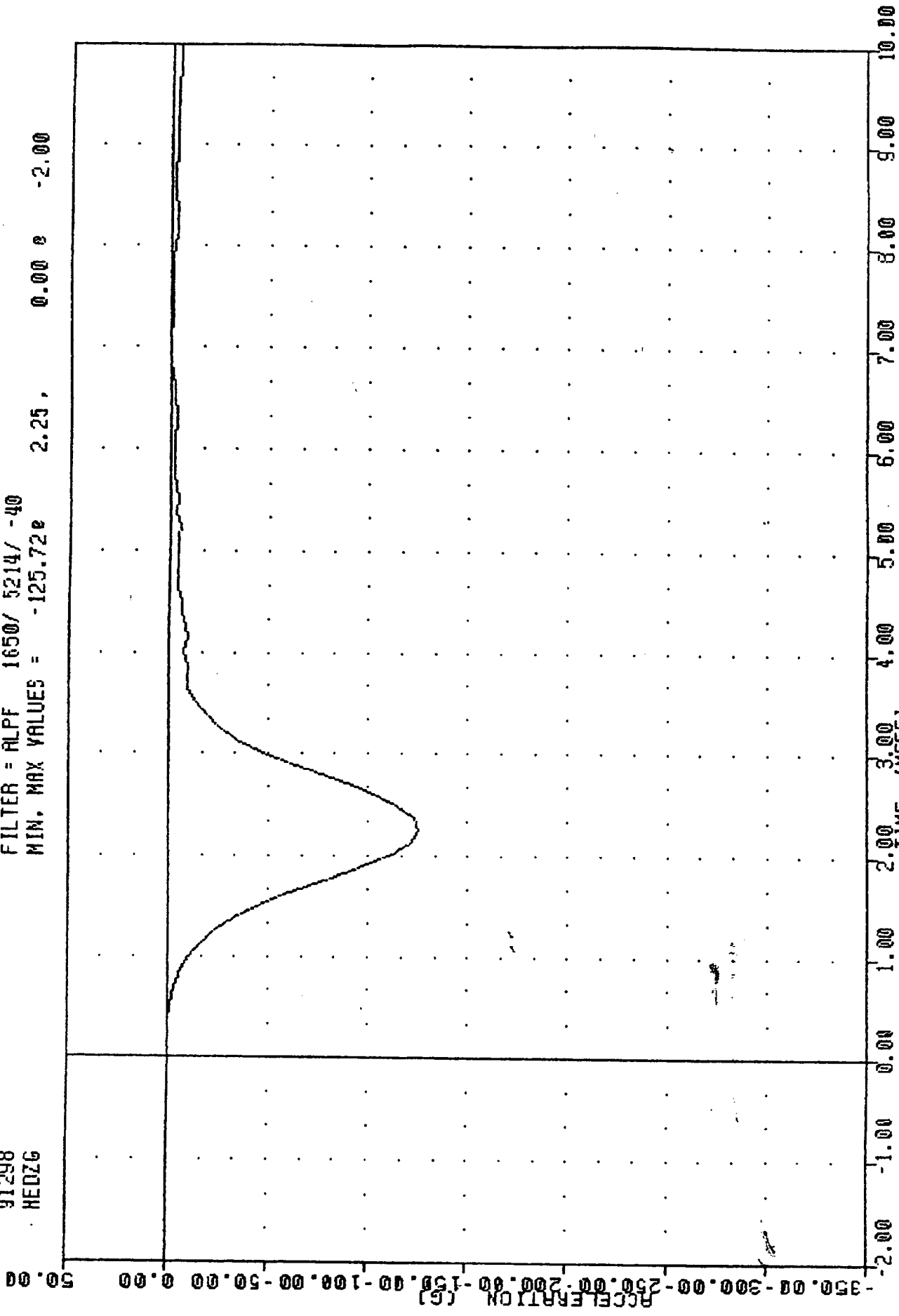


PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION Y AXIS

SRL 907C5HD1
572E SN907 HEAD DROP CAL 05
91298
HEDZG

FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -125.72e 2.25,

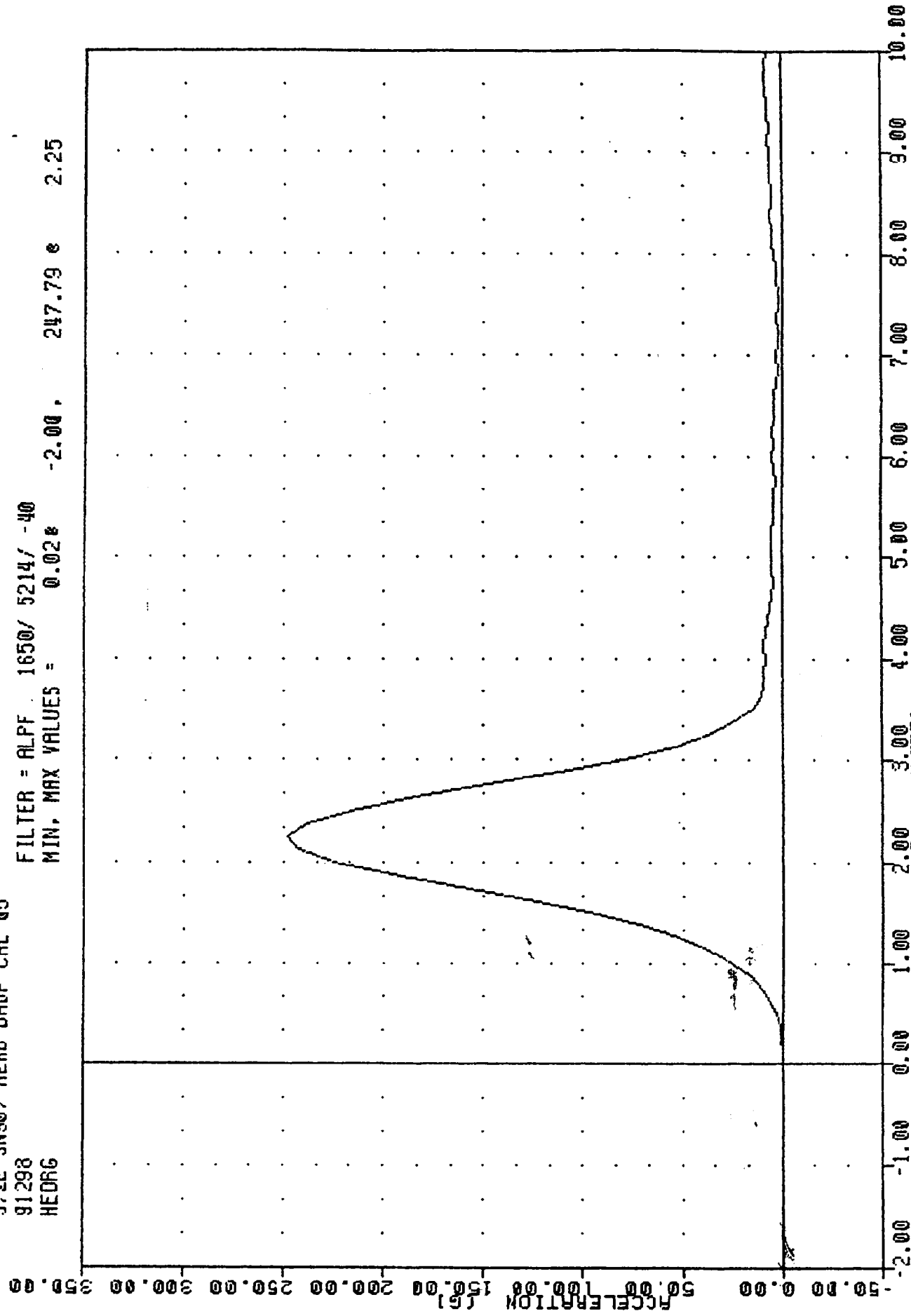
0.00 e -2.00



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

SRL , 907C5HD1
 572E SN907 HEAD DROP CAL 05
 91298
 HEDRG

FILTER = ALPF 1650/ 5214/ -40
 MIN, MAX VALUES = 0.028 -2.00 , 247.79 e 2.25



PART 572-E HYBRID III HEAD CALIBRATION
 HEAD RESONANT ACCELERATION

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

28-Oct-91

6 AXIS NECK TRANSDUCER
SRL 907C5NF1

572E SN907 NECK FLEXION CAL05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	54.00 %
IMPACT VELOCITY	22.6-23.4 FT/SEC	23.30 FT/SEC
PENDULUM	10 MS 22.50 - 27.50 G	22.63 G
DECELERATION	20 MS 17.60 - 22.60 G	19.48 G
	30 MS 12.50 - 18.50 G	16.58 G
MAX PENDULUM G ABOVE 30 MS	29 G MAX	16.54 G
DECELERATION-TIME CURVE		
DECAY TIME TO 5 G	34 - 42 MS	37.25 MS
D PLANE	MAX 64 - 78 DEG.	65.45 DEG.
ROTATION	TIME 57 - 64 MS	59.00 MS
MOMENT ABOUT OCCIPITAL	MAX 65 - 80 FT.LBS	67.24 FT.LBS
CONDYLE	TIME 47 - 58 MS	49.25 MS
ROTATION ANGLE-TIME CURVE		
DECAY TIME TO ZERO	113 - 128 MS	113.38 MS
POSITIVE MOMENT-TIME CURVE		
DECAY TIME TO ZERO	97 - 107 MS	99.25 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN *Chris Middleton*

3RL
572E SN907 NECK FLEXION CAL05
31301
PENXG

, 90705NF1

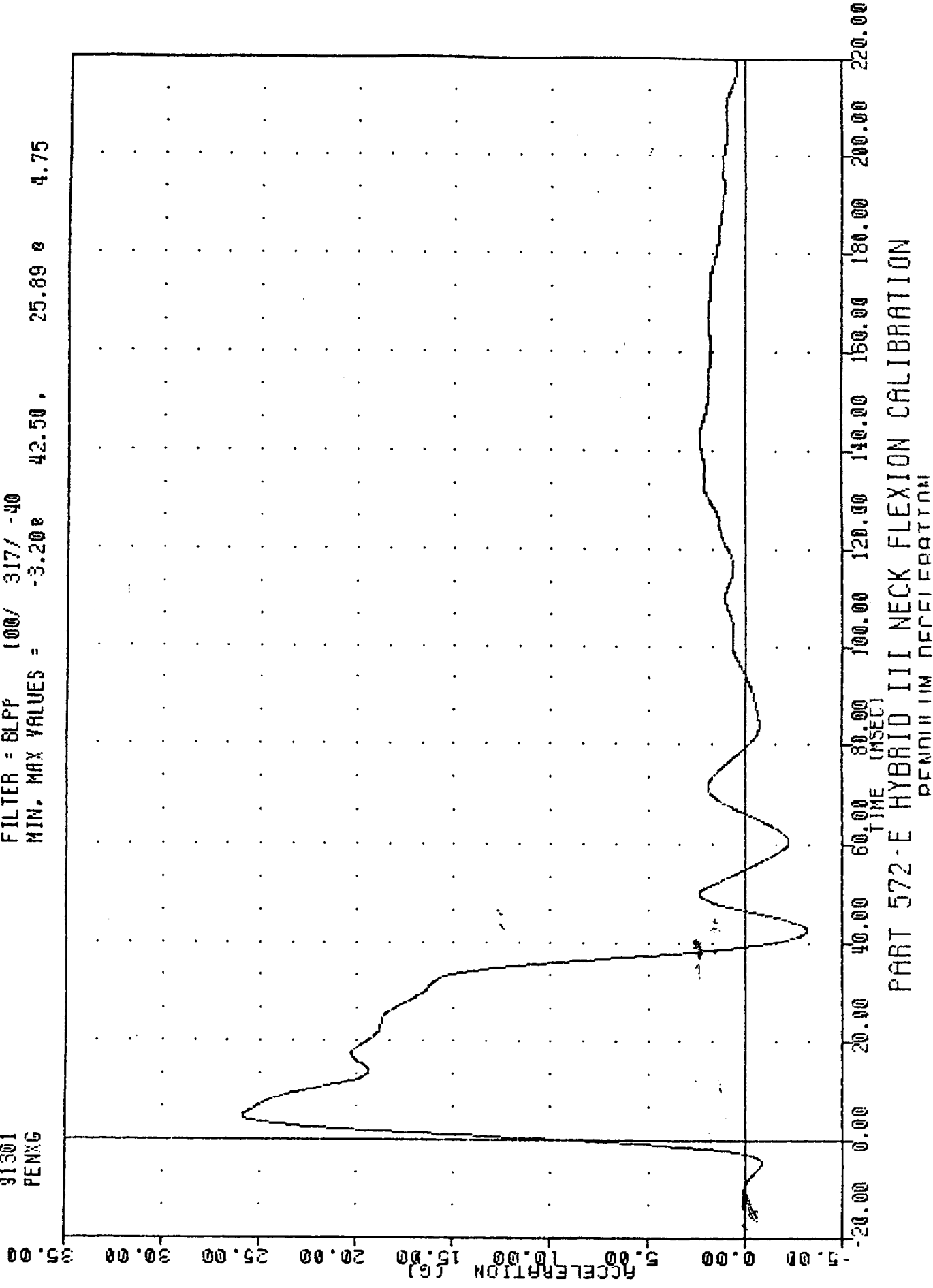
FILTER = BLPP 100/ 317/ -40

MIN. MAX VALUES = -3.20e

42.50.

25.89 e

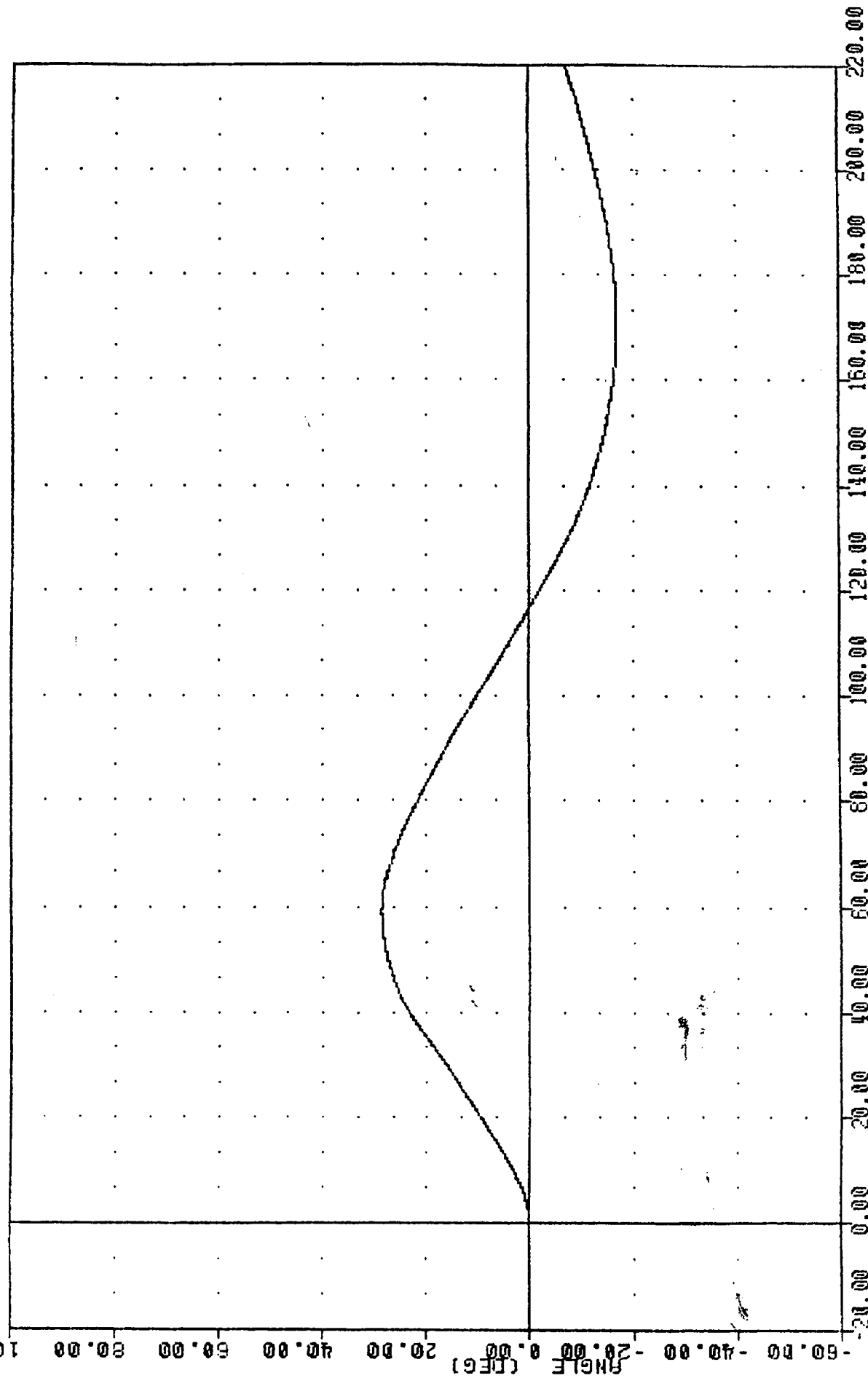
4.75



PART 572-E HYBRID III NECK FLEXION CALIBRATION
PENXG MIN DECELERATION

SRL , 90705NF1
 572E SN907 NECK FLEXION CAL05
 91301
 BETA

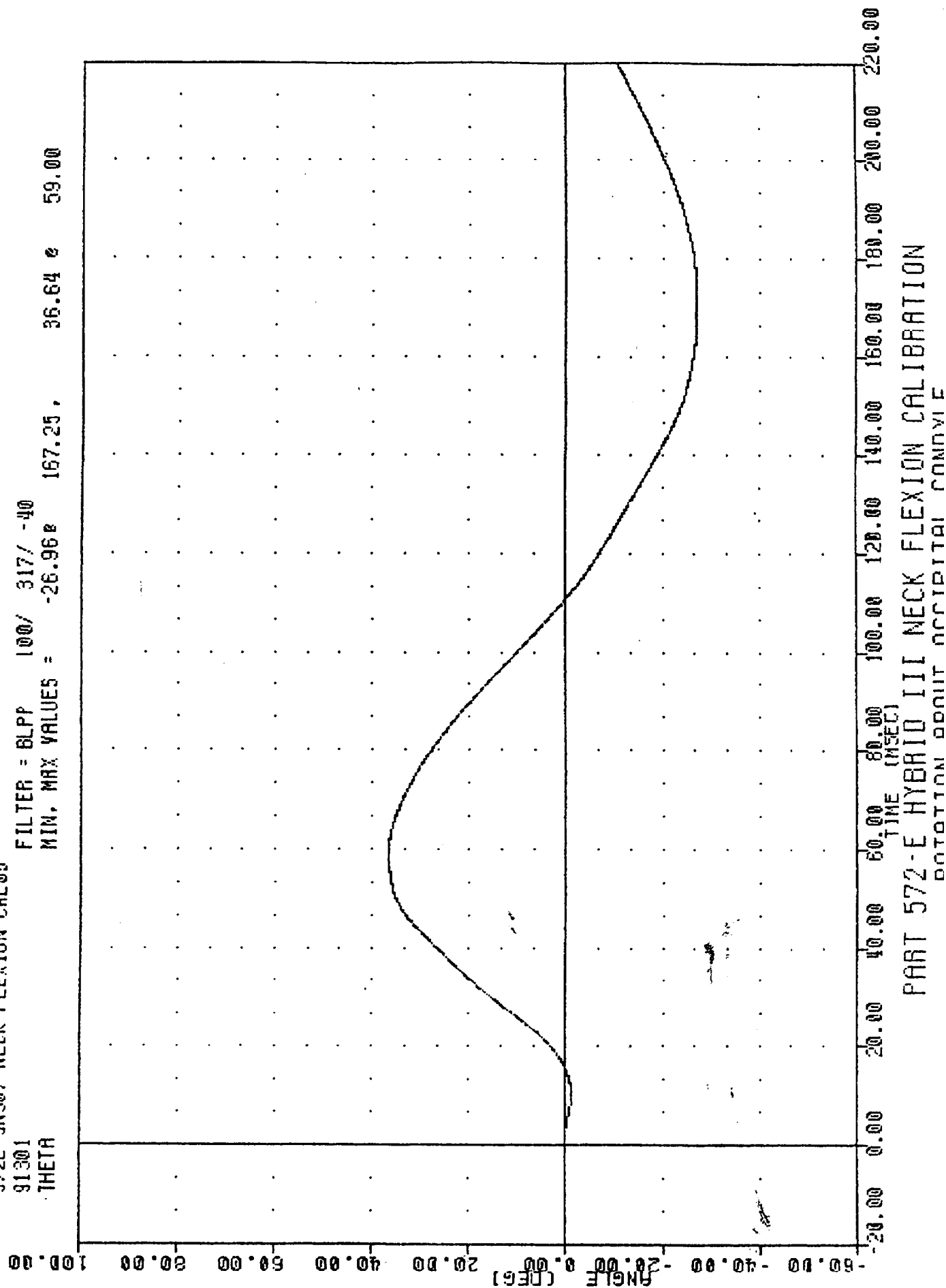
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -16.94e 170.88, 28.81 e 59.00



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

3RL , 907C5NF1
 572E 3N907 NECK FLEXION CAL05
 91301
 THETA

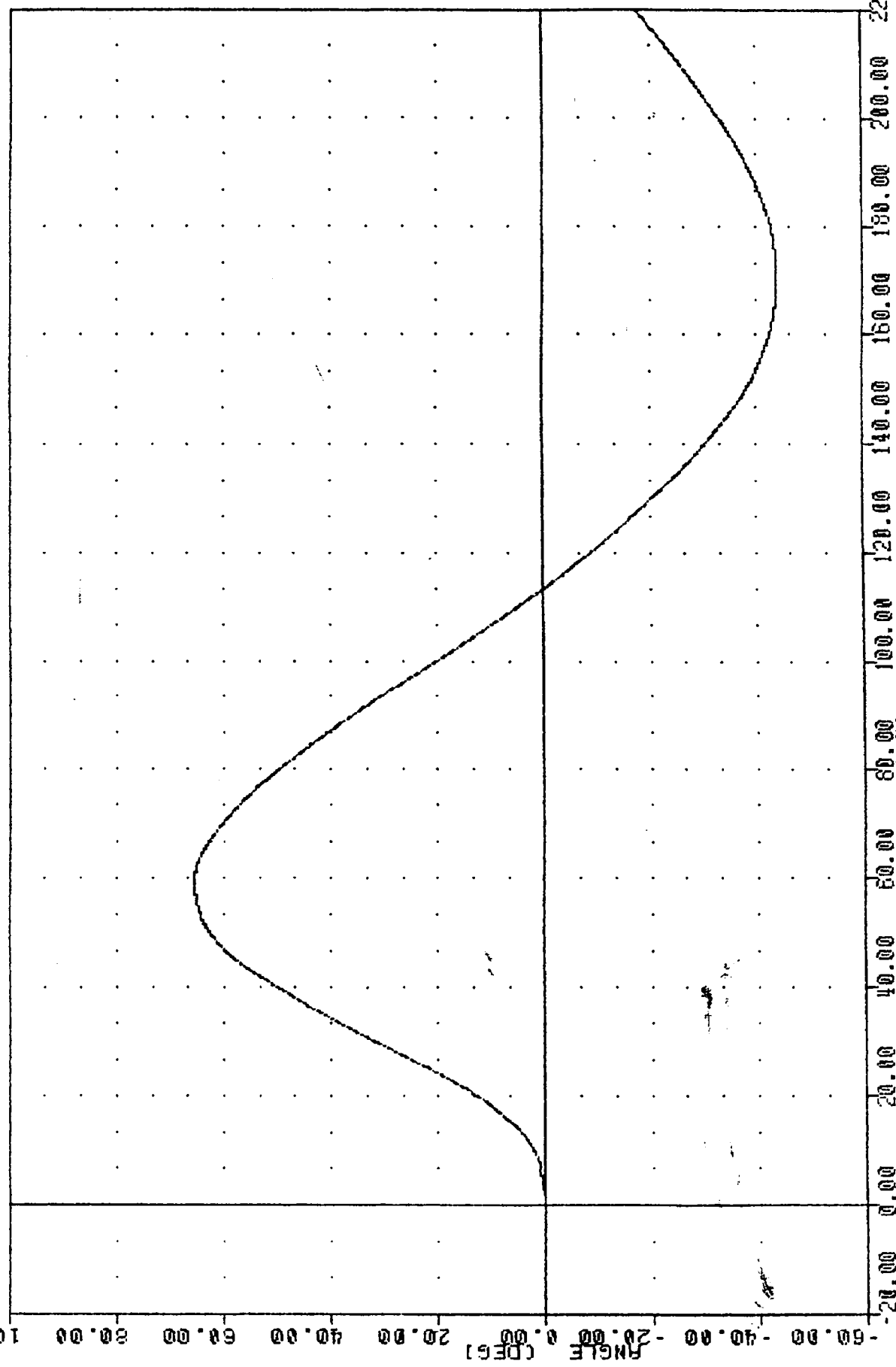
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -26.96 167.25, 36.64 59.00



PART 572-E HYBRID III NECK FLEXION CALIBRATION
 DATOTATION OMNIT OCCIPITAL COMPLEX

SRL 90705NF1
572E SN907 NECK FLEXION CAL05
91301
TOTAL

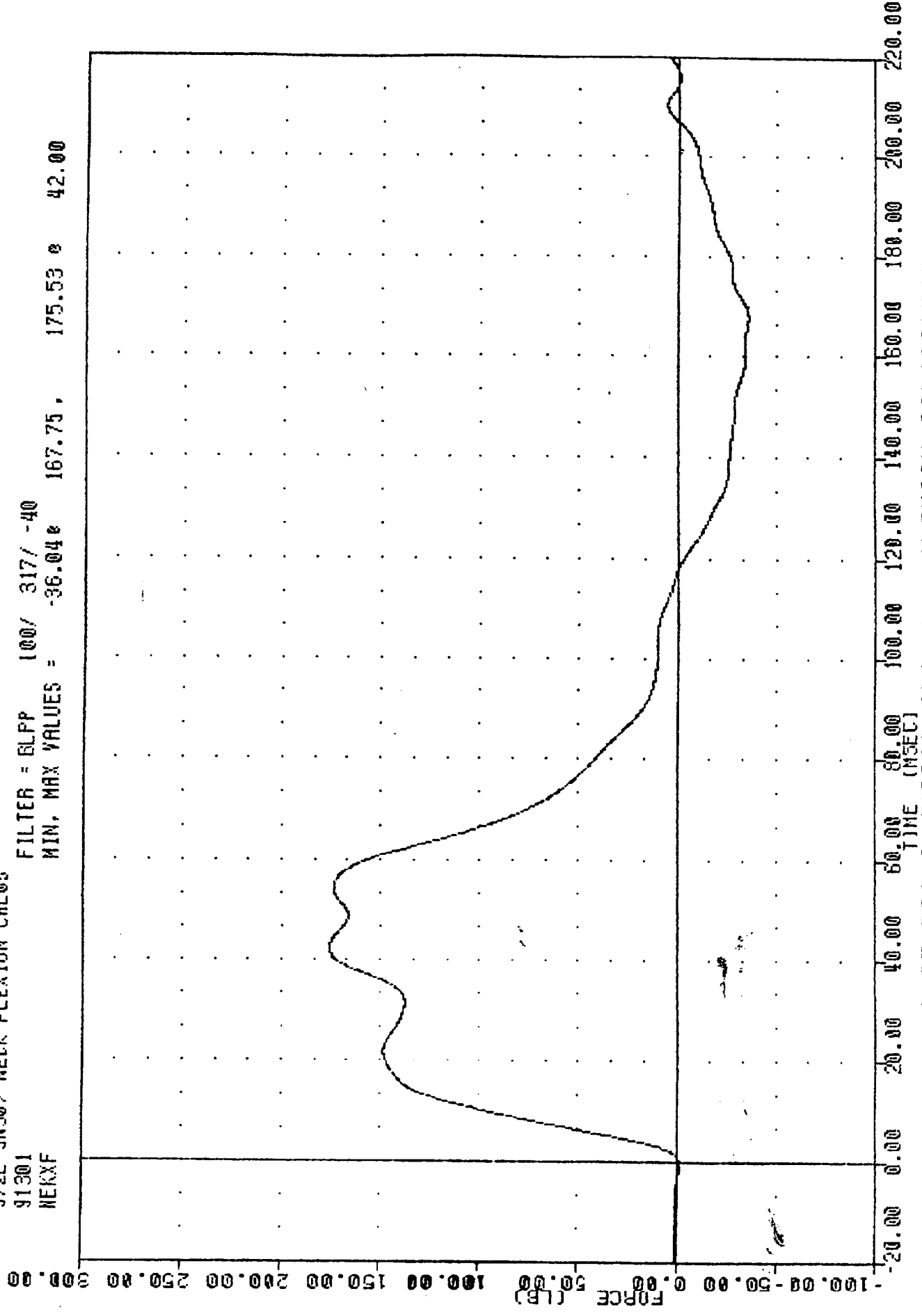
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -43.89 170.75 65.45 59.00



PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL ROTATION

SRL 90705NF1
 572E SN907 NECK FLEXION CAL05
 91301
 NEKXF

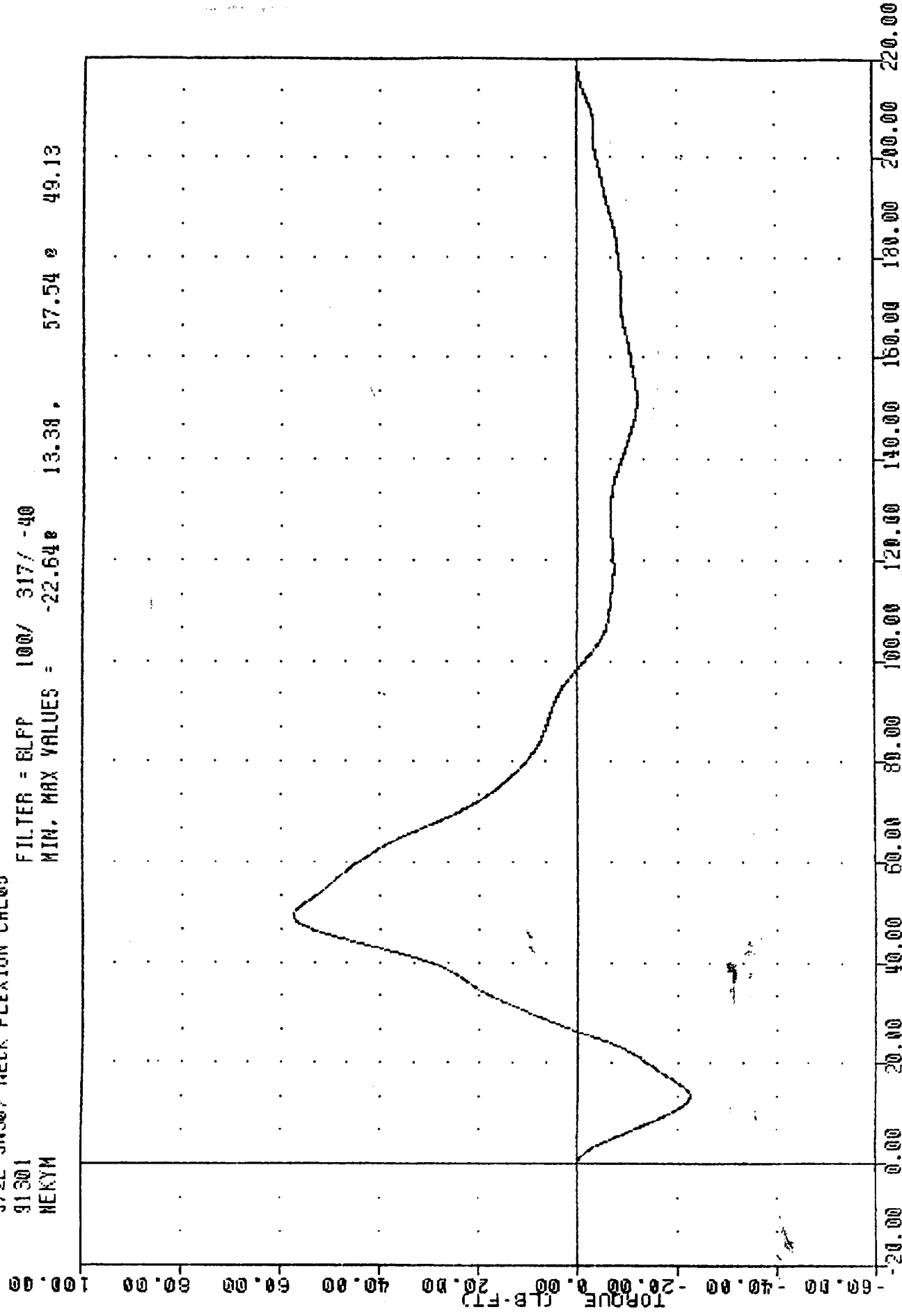
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -36.04e 167.75, 175.53 e 42.00



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

9RL
 572E SN907 NECK FLEXION CAL05
 91301
 HEKYM

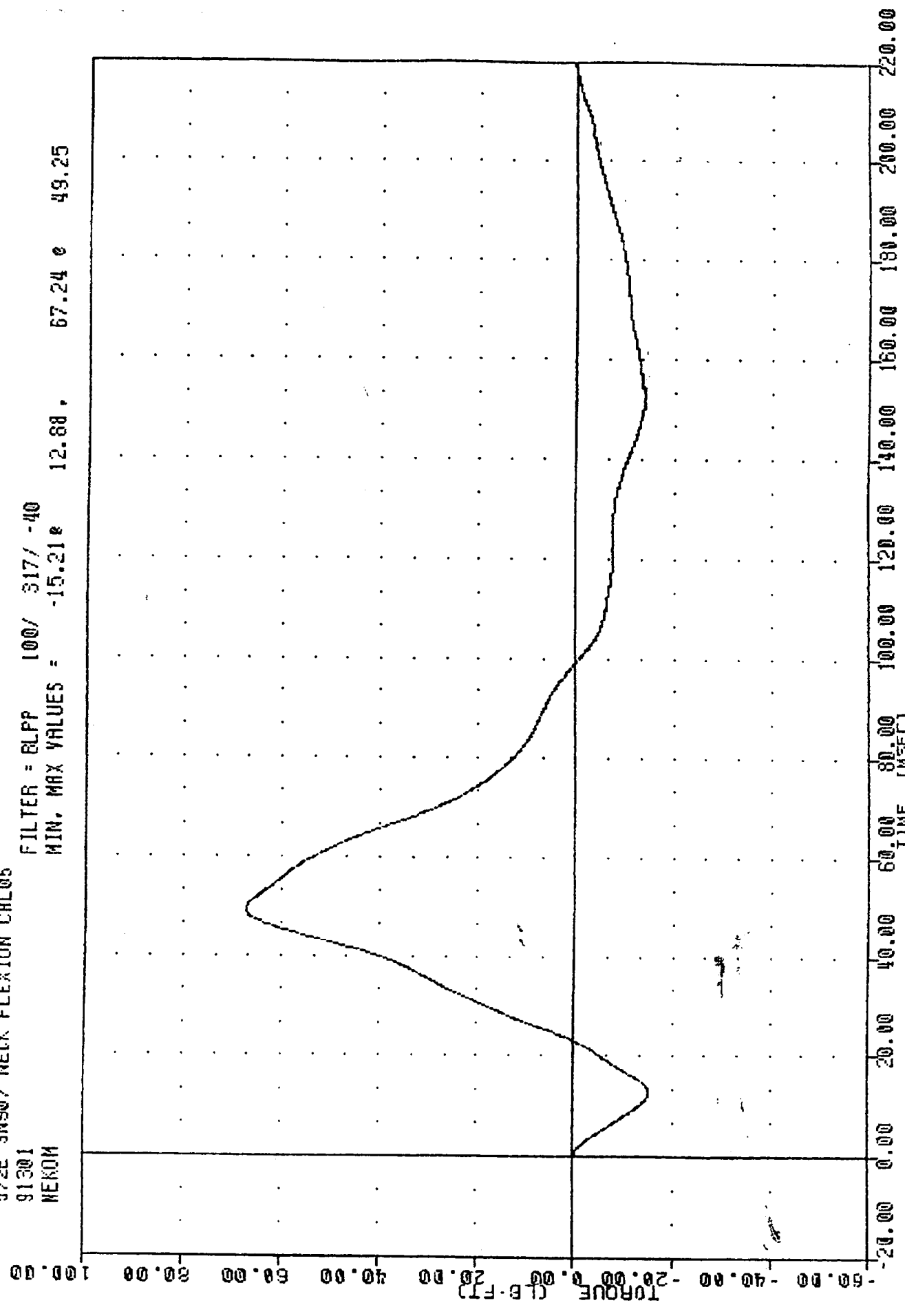
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -22.64e 13.38e 57.54e 49.13



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

SRL 90705NF1
 572E SN907 NECK FLEXION CAL05
 91301
 NEKOM

FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -15.21 12.68 67.24 49.25



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

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

28-Oct-91

6 AXIS NECK TRANSDUCER
SRL 907C5NE1

572E SN907 NECK EXT. CAL05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	70.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	54.00 %
IMPACT VELOCITY	19.50-20.30 FT/SEC	19.67 FT/SEC
PENDULUM	10 MS 17.20 - 21.20 G	18.95 G
DECELERATION	20 MS 14.00 - 19.00 G	16.59 G
	30 MS 11.00 - 16.00 G	14.12 G
MAX PENDULUM G ABOVE 30 MS	22 G MAX	14.11 G
DECELERATION-TIME CURVE		
DECAY TIME TO 5 G	38 - 46 MS	38.50 MS
D PLANE	MAX 81 - 106 DEG.	94.72 DEG.
ROTATION	TIME 72 - 82 MS	76.75 MS
MOMENT ABOUT OCCIPITAL	MIN -59.0/-39.0 FT.LBS	-43.03 FT.LBS
CONDYLE	TIME 65 - 79 MS	70.30 MS
ROTATION ANGLE-TIME CURVE		
DECAY TIME TO ZERO	147 - 174 MS	159.50 MS
NEGATIVE MOMENT-TIME CURVE		
DECAY TIME TO ZERO	120 - 148 MS	136.63 MS

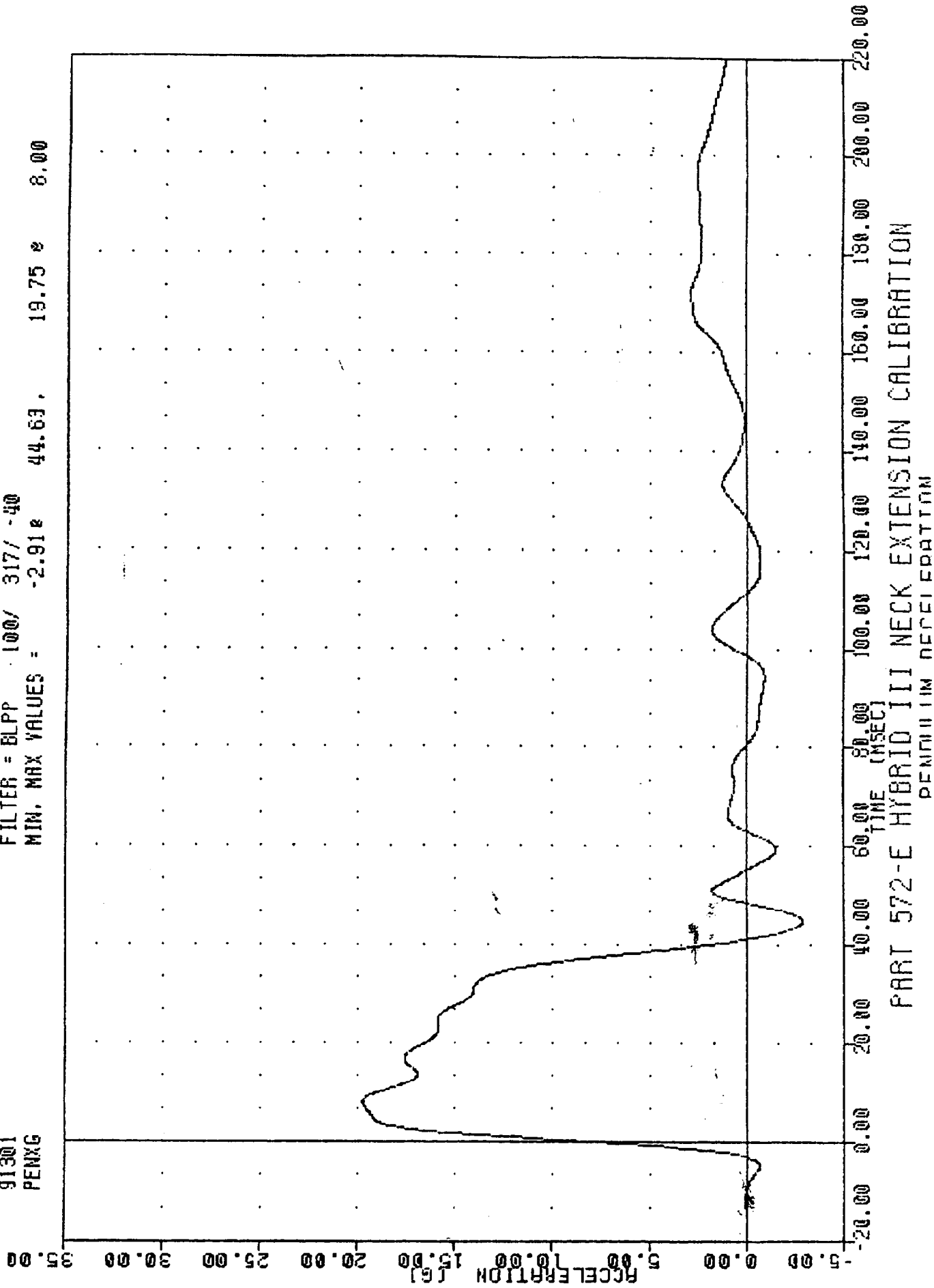
TEST MEETS SPECIFICATIONS

TECHNICIAN

Chas. Middleton

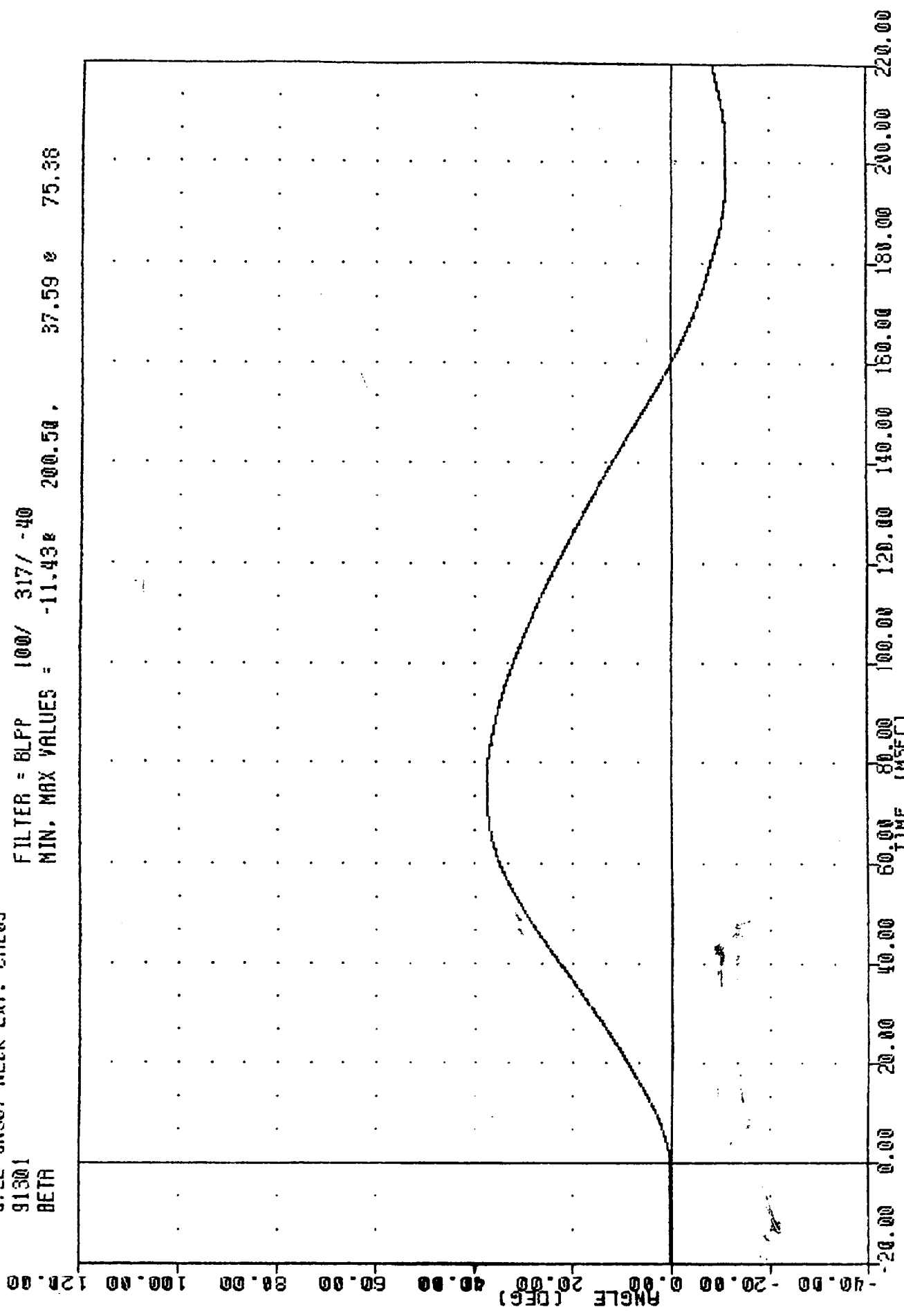
SRL , 90705NE1
572E SNG07 NECK EXT. CAL05
91301
PENXG

FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -2.91e 44.63, 19.75 e 8.00



3RL
 572E SN907 NECK EXT. CAL05
 91301
 BETA

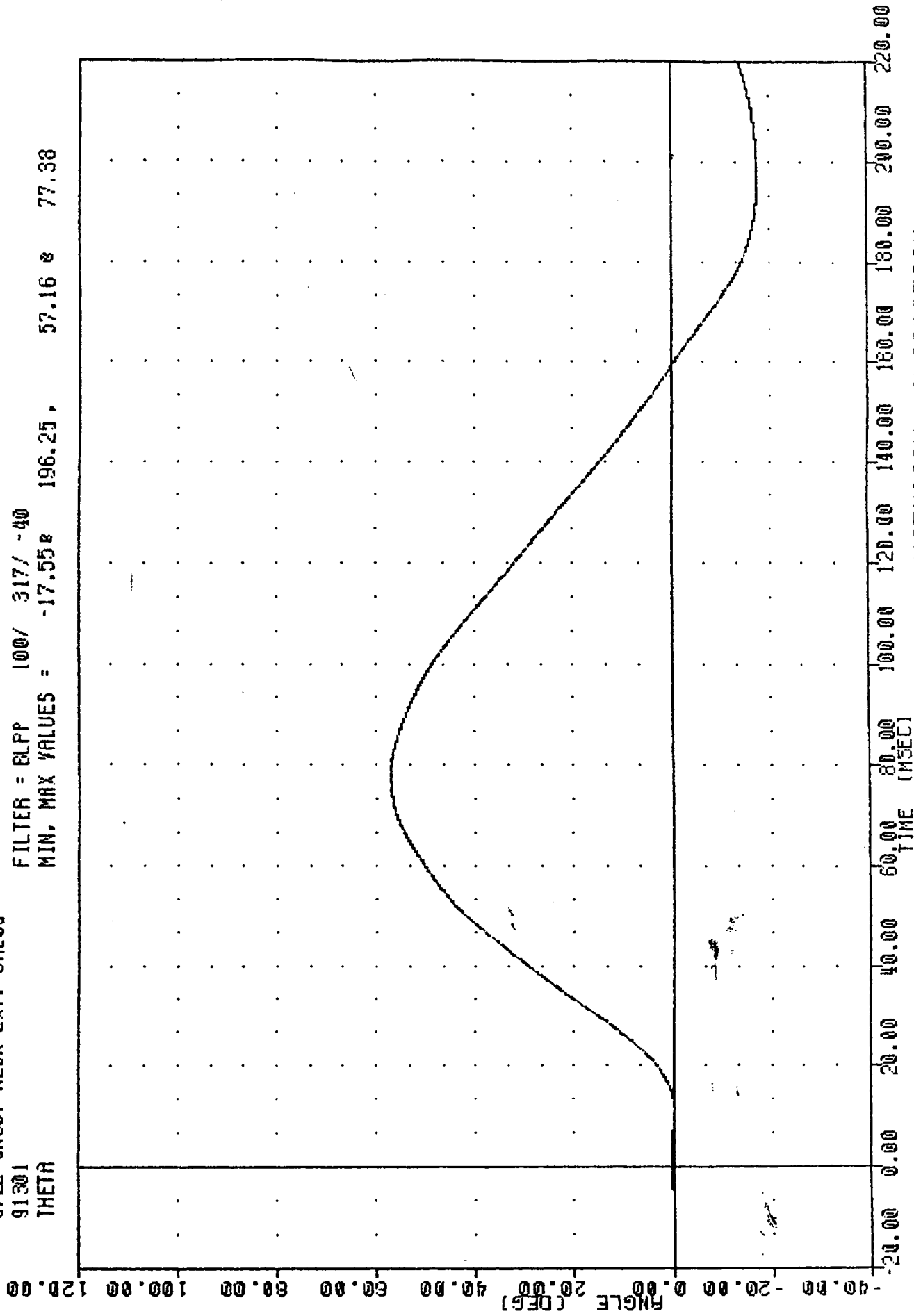
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -11.43e 200.50. 37.59 e 75.38



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

SRL , 907C5NE1
 572E SN907 NECK EXT. CHL05
 91301
 THETA

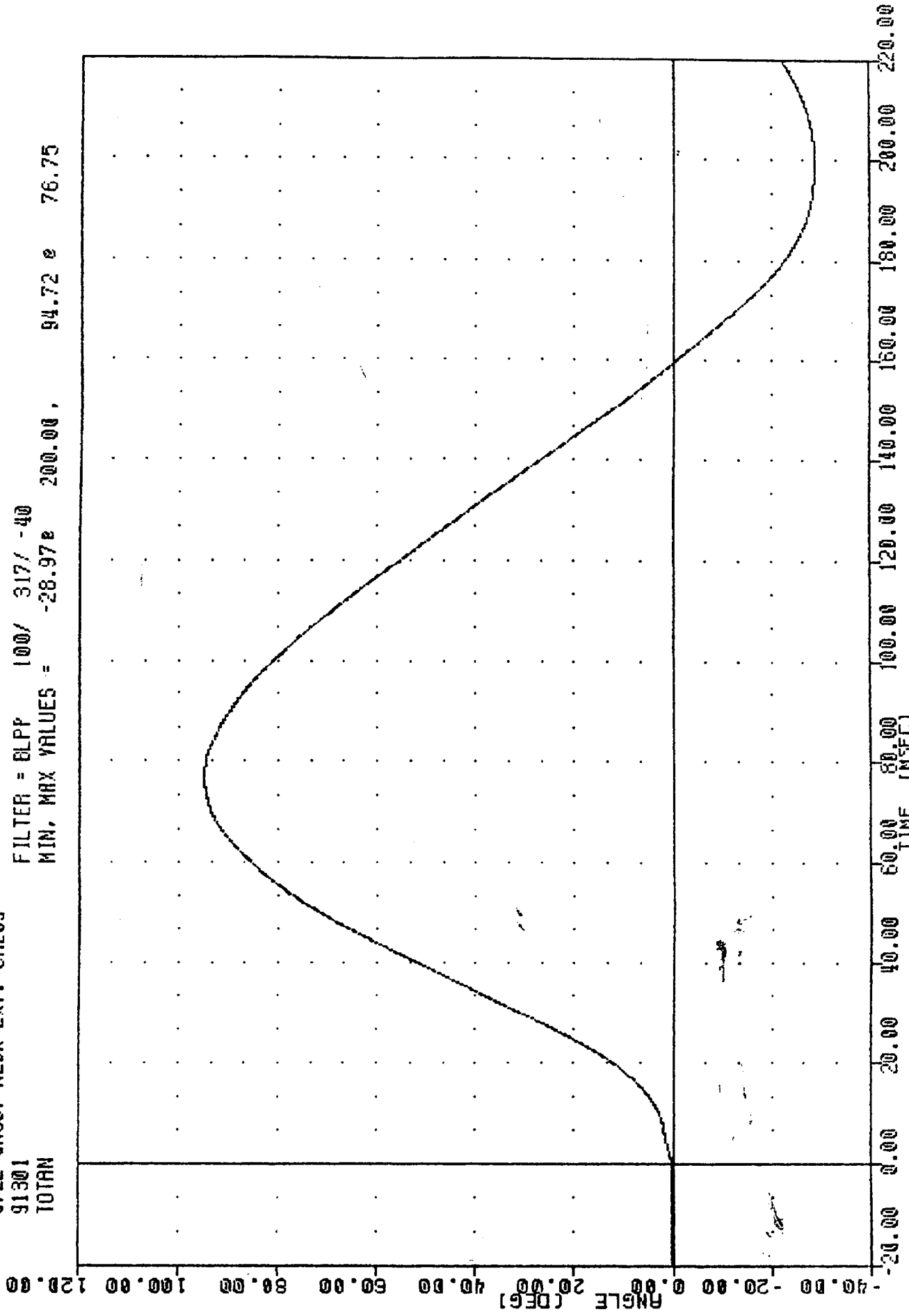
FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -17.55e 196.25e 57.16 e 77.38



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 NOTATION ABOUT ACCELERATION COMMANDS

SRL 90705NE1
 572E SN907 NECK EXT. CAL05
 91301
 TOTAL

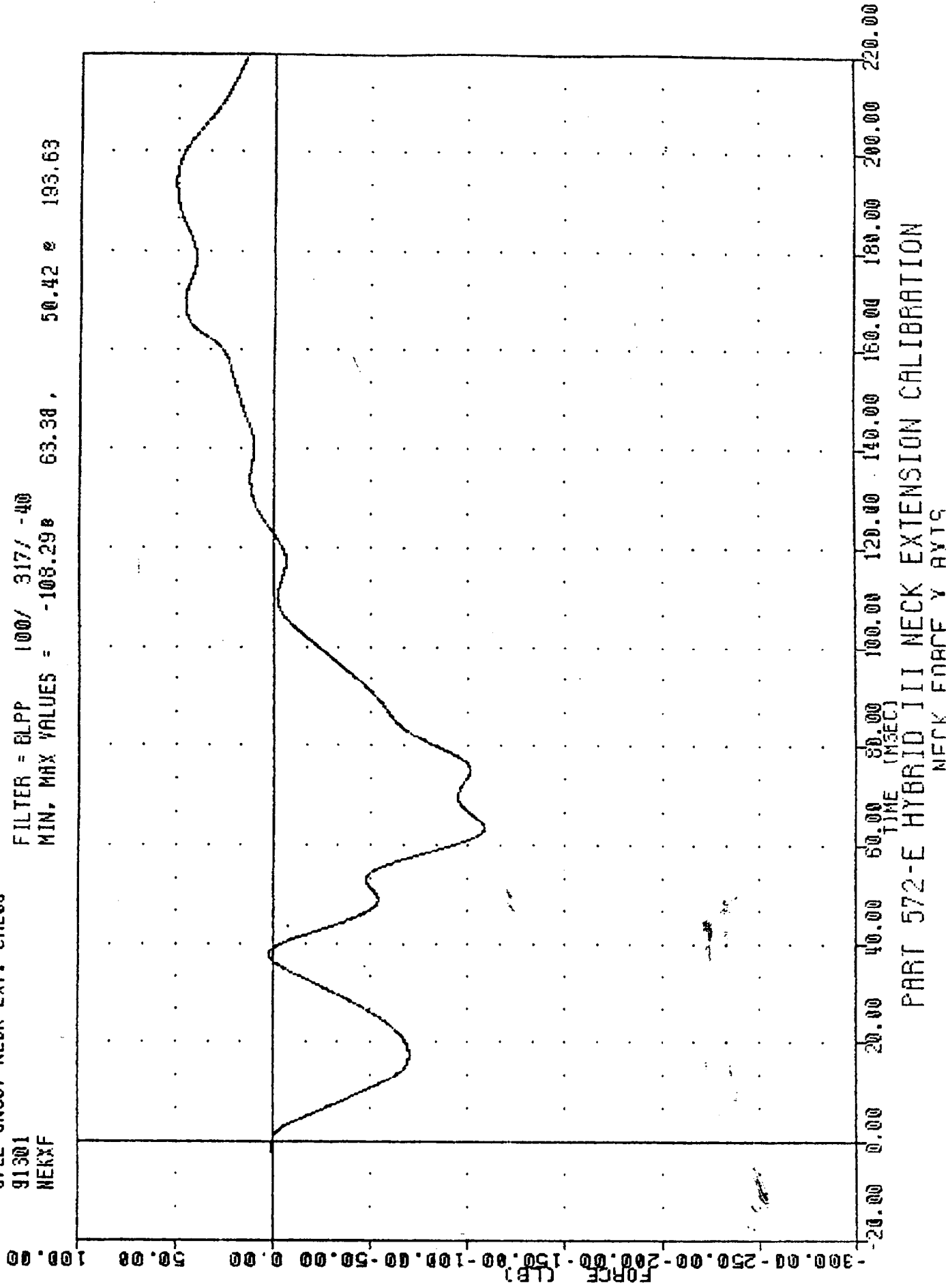
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -28.97e 200.00, 94.72 e 76.75



PART 572-E HYBRID III NECK EXTENSION CALIBRATION
 TOTAL ANTIATION

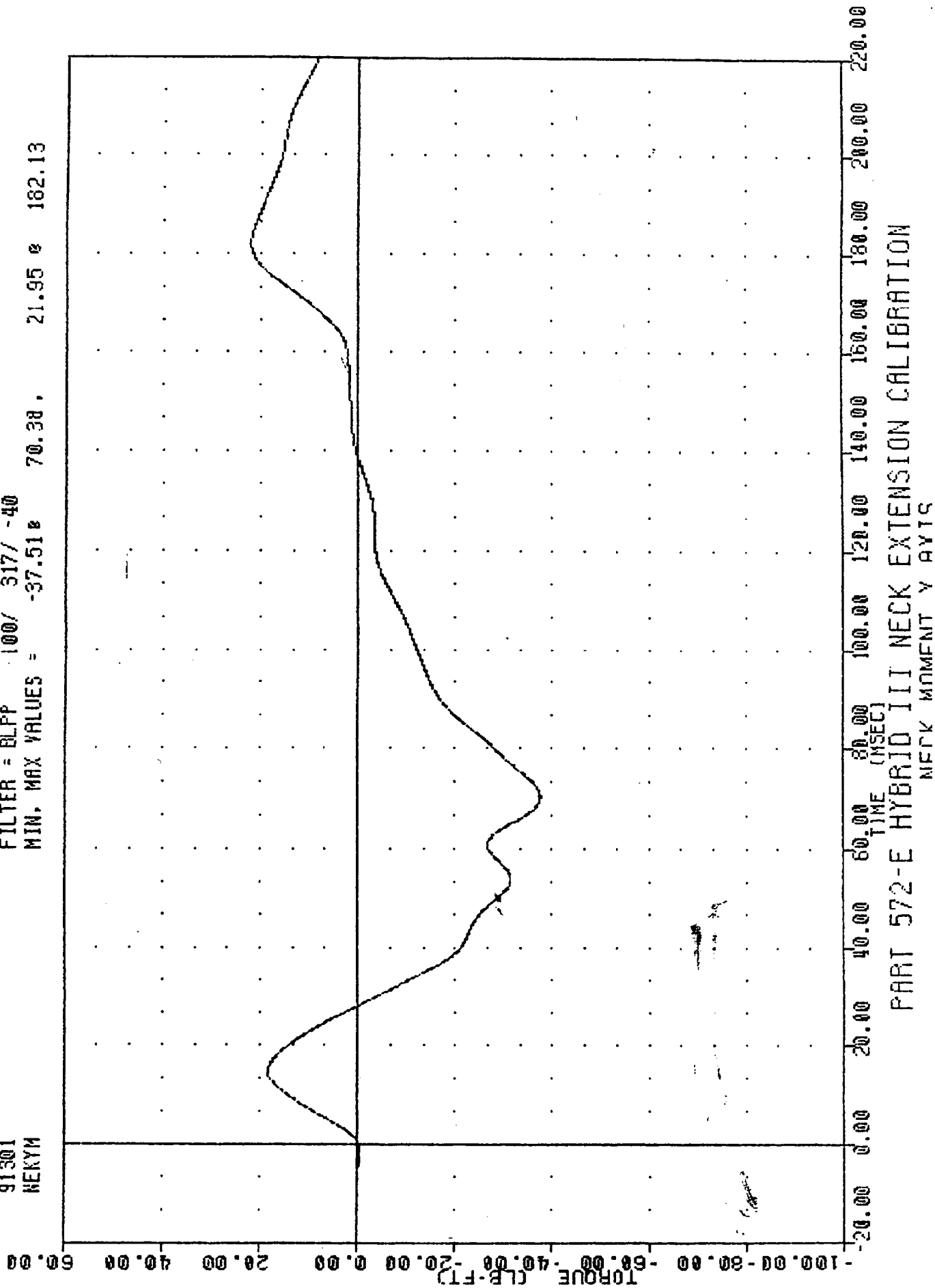
SRL 907C5NE1
572E SN907 NECK EXT. CAL05
91301
NEKXF

FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -108.290 63.30, 50.42 0 193.63



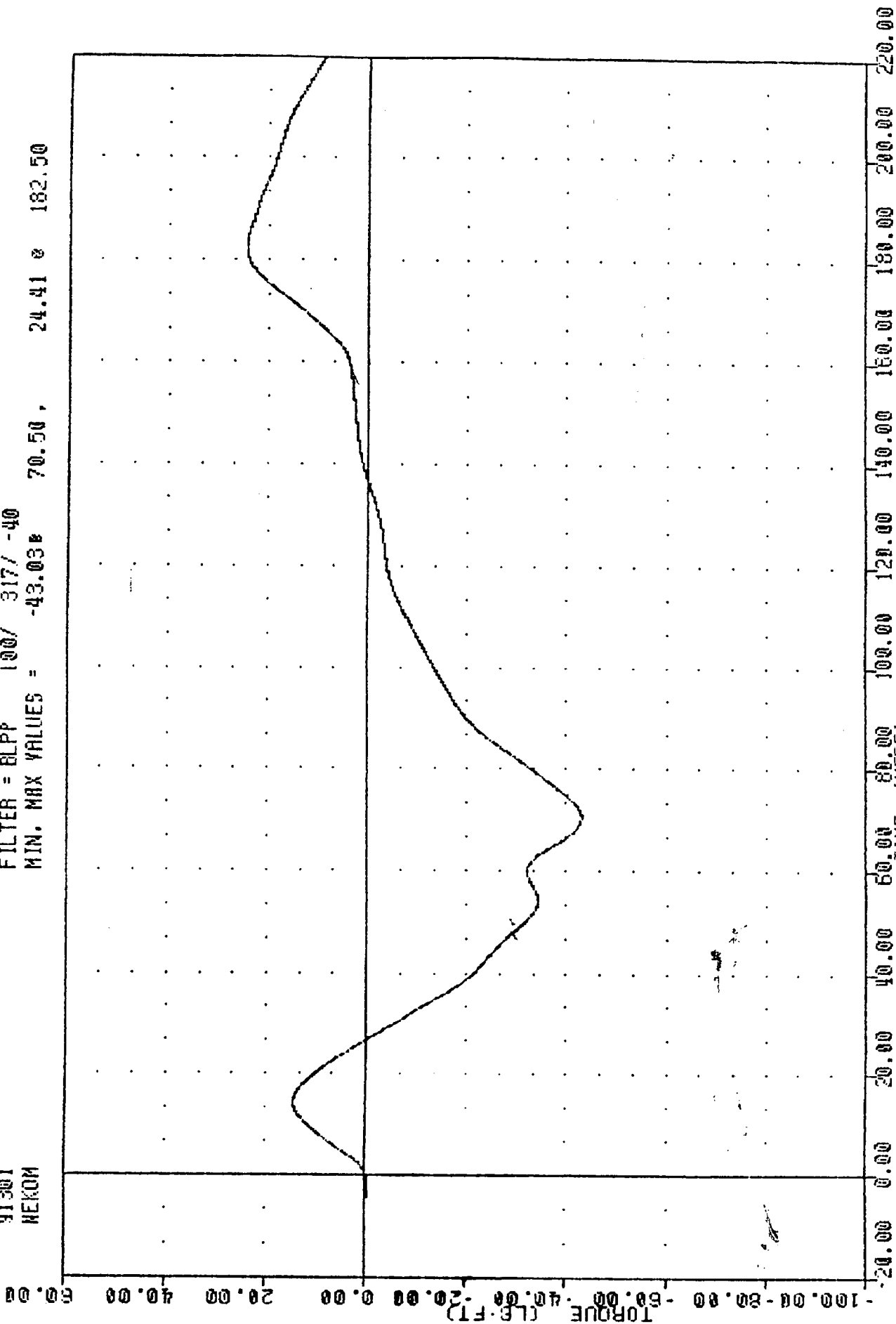
SRL 90705NE1
 572E SN907 NECK EXT. CAL05
 91301
 NEKYM

FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -37.51 70.38 21.95 182.13



5RL
 572E SN907 NECK EXT. CAL05
 91301
 HEKOM

FILTER = BLPP 100/ 317/ -40
 MIN. MAX VALUES = -43.03 70.50 , 24.41 @ 182.50



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

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

HYBRID III

28-Oct-91

SRL

907C5TH1

572E SN907 H.S.THORAX CAL05

	HIGH SPEED TEST	
TEST PARAMETER	SPECIFICATION	TEST RESULTS
=====		
TEMPERATURE	69 - 72 DEG. F	69.00 DEG. F

RELATIVE HUMIDITY	10% - 70%	54.00 %

PENDULUM VELOCITY	21.6-22.4 FT/SEC	22.07 FT/SEC

MAXIMUM DEFLECTION	2.50 - 2.86 IN	2.51 IN

MAXIMUM RESISTIVE FORCE	1160 - 1325 LBS	1324.5 LBS

INTERNAL HYSTERESIS	69% - 85%	75.1%

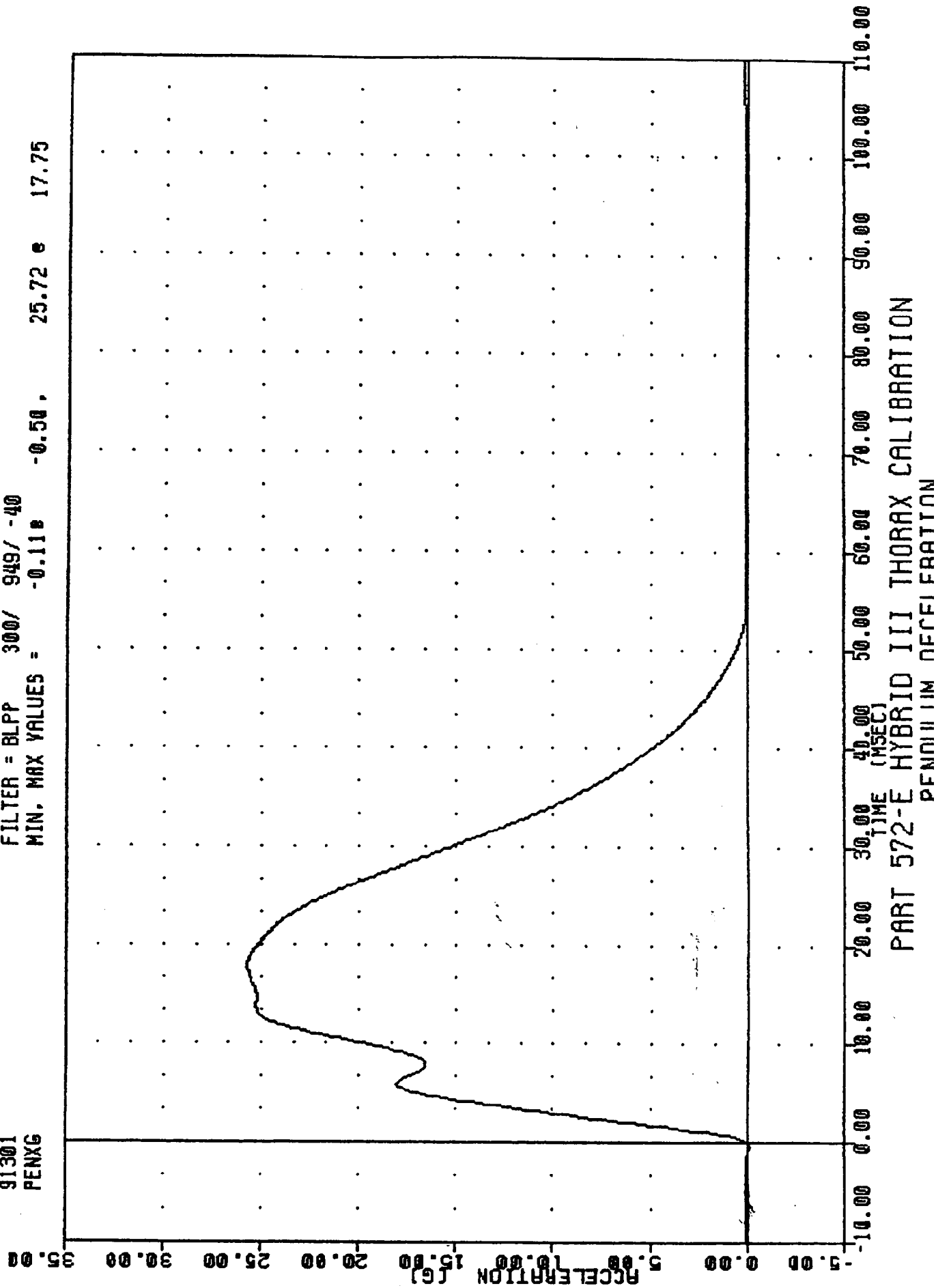
TEST MEETS SPECIFICATIONS

TECHNICIAN

Chris Middleton

SRL , 907C5TH1
 572E SN907 H.S.THORAX CAL05
 91301
 PENXG

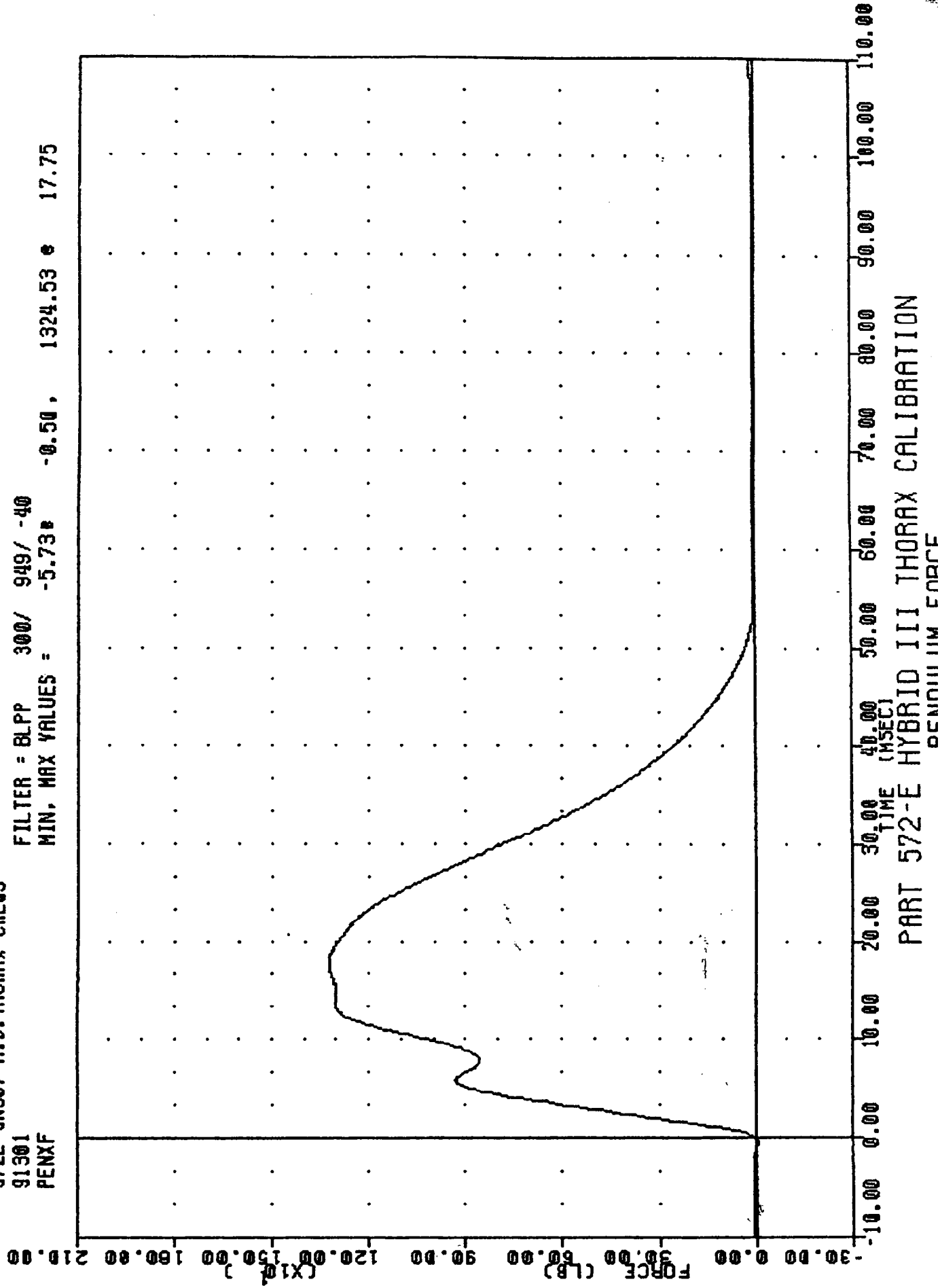
FILTER = BLPP 300/ 949/ -40
 MIN. MAX VALUES = -0.118 -0.50. 25.72 e 17.75



PART 572-E HYBRID III THORAX CALIBRATION
 PENIXG CALIBRATION

SRL 907C5TH1
 572E SN907 H.S. THORAX CAL05
 91301
 PENXF

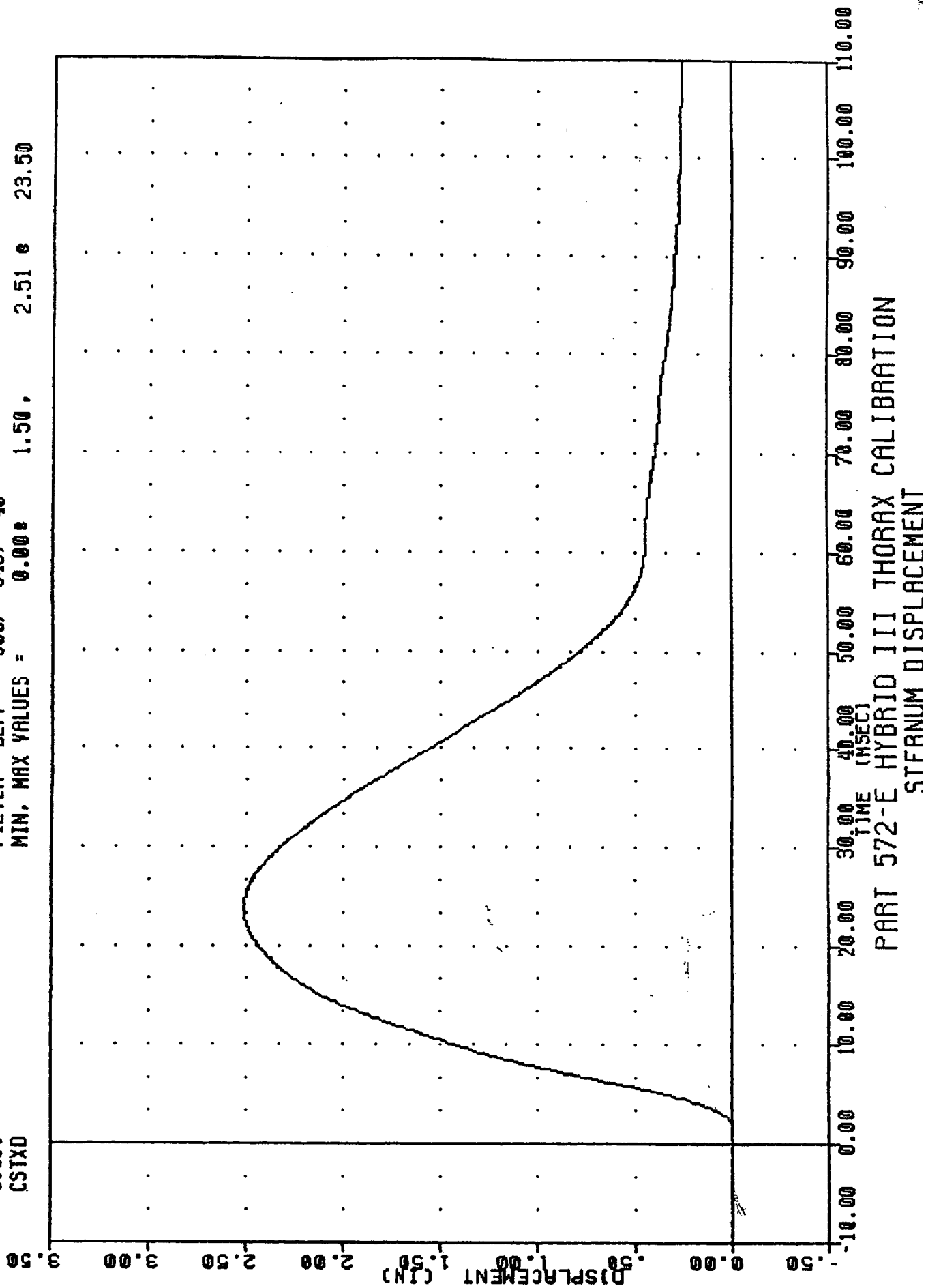
FILTER = BLPP 300/ 949/ -40
 MIN, MAX VALUES = -5.73 -0.50, 1324.53 e 17.75



PART 572-E HYBRID III THORAX CALIBRATION
 DENNIIIM ENRGE

SRL 907C5TH1
572E SN907 H.S. THORAX CAL05
91301
CSTXD

FILTER = BLPP 300/ 949/ -40
MIN. MAX VALUES = 0.00 1.50 2.51 23.50



SRI
 CSTXD
 PENXF

907C5THI
 FILTER = BLPP
 FILTER = BLPP

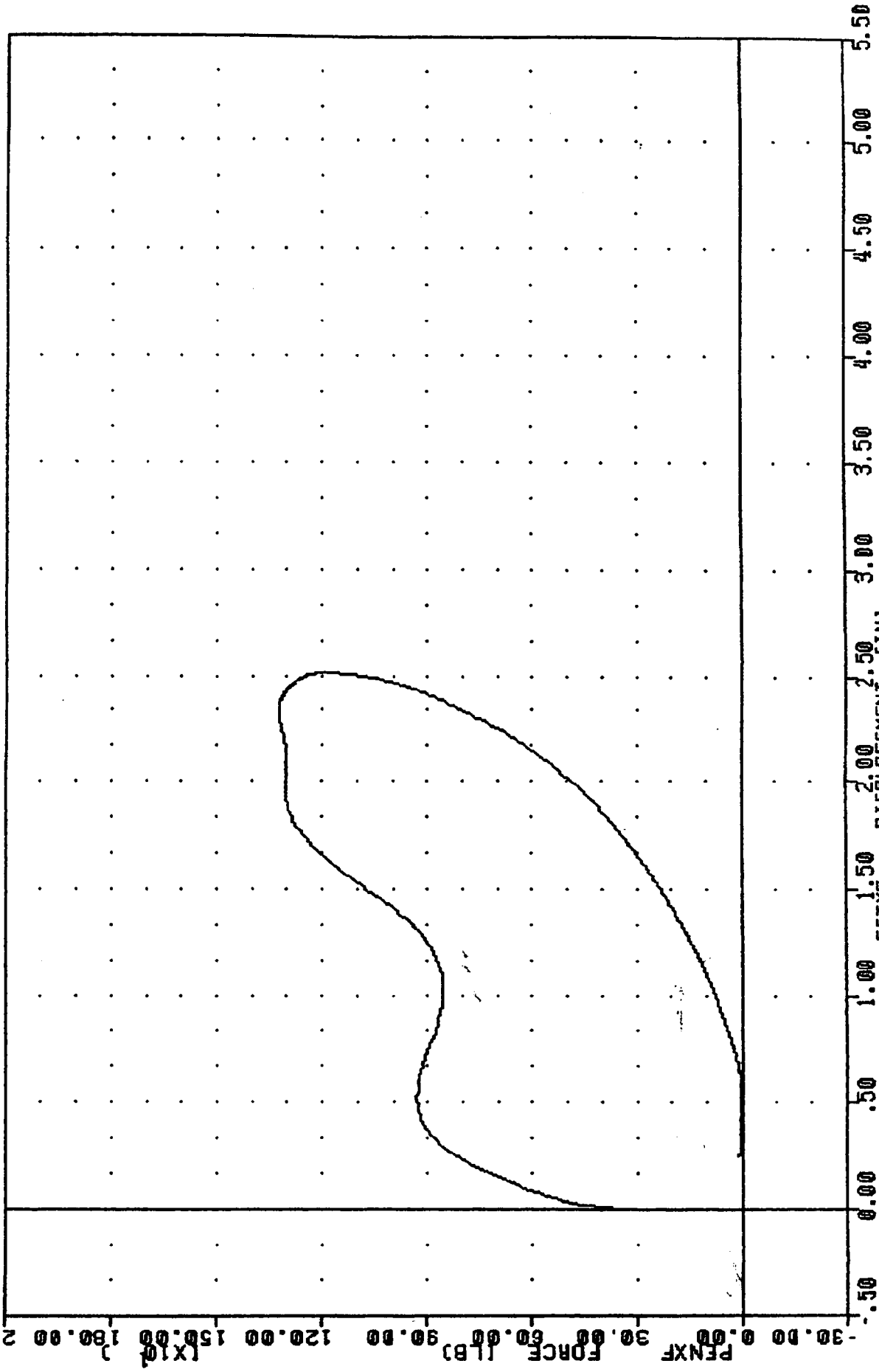
572E SN907 H.S. THORAX CAL05
 300/ 949/ -40 MIN. MAX =
 300/ 949/ -40 MIN. MAX =

91301
 0.00
 -5.73

1.50
 -0.50

2.51
 1324.53

23.50
 17.75



PART 572-E HYBRID III THORAX CALIBRATION
 CURVE DISPLACEMENT VS DEMONSTRATION FORCE

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

25-Oct-91

RIGHT KNEE
SRL 907C5RK1

572E SN907 R.KNEE 11LB CAL 05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	52.00 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.85 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1225.23 LBS
PROBE WEIGHT	11.0 LBS	

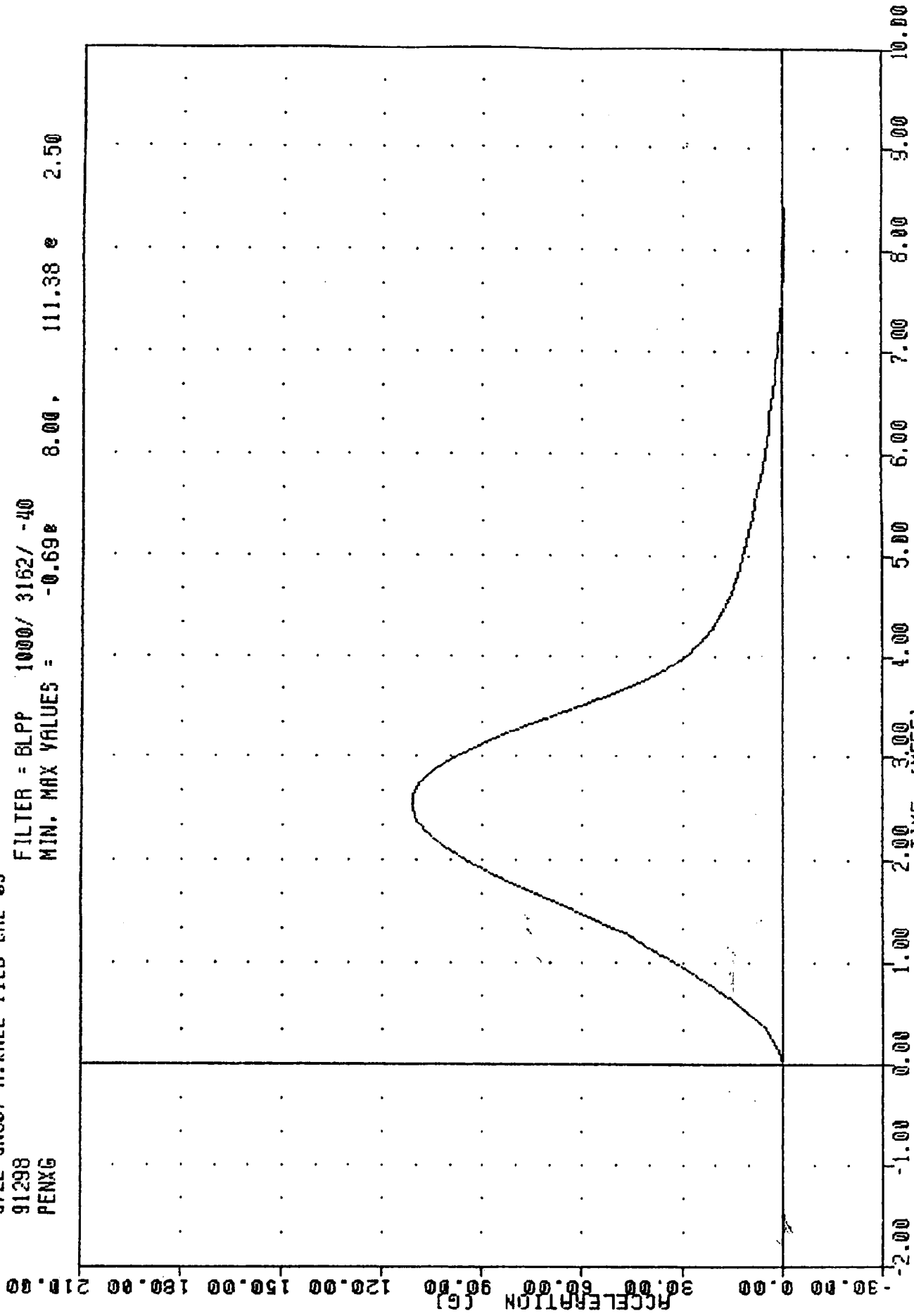
TEST MEETS SPECIFICATIONS

TECHNICIAN

Chas. Middleton

SRL 907C5RK1
 572E SN907 R.KNEE 11LB CAL 05
 91298
 PENXG

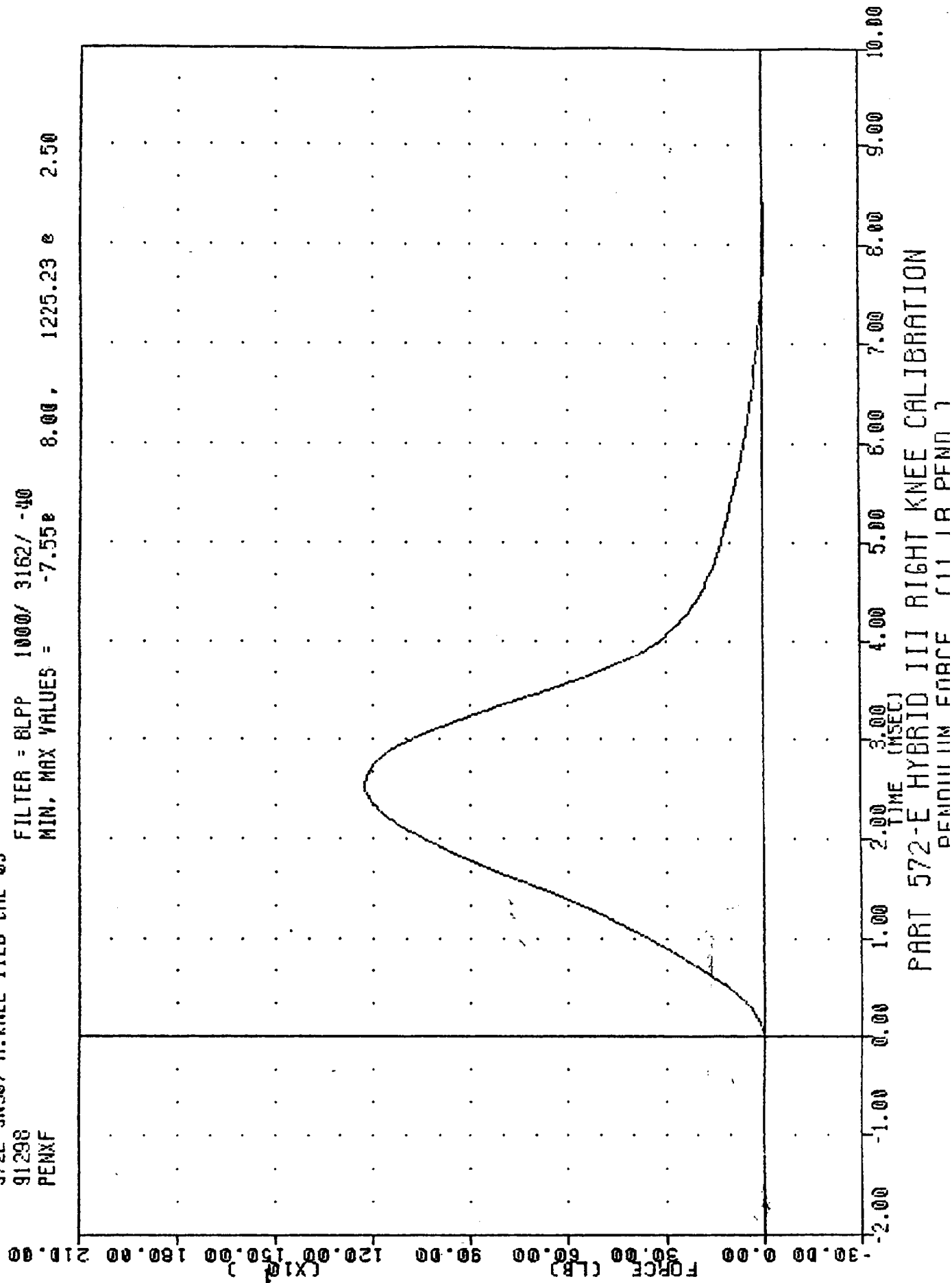
FILTER = BLPP 1000/ 3162/ -40
 MIN. MAX VALUES = -0.69e 8.00 111.38 e 2.50



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
 PENNIIIM PERFIARATION (111 R PENN)

SRL , 90705RK1
 572E SN907 R.KNEE 11LB CAL 05
 91298
 PENXF

FILTER = BLPP 1000/ 3162/ -40
 MIN, MAX VALUES = -7.55e 8.00, 1225.23 e 2.50



PART 572-E HYBRID III RIGHT KNEE CALIBRATION
 PENNIM F0RCE (11 IR PFND)

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

25-Oct-91

LEFT KNEE
SRL 907C5LK1

572E SN907 L.KNEE 11LB CAL 05

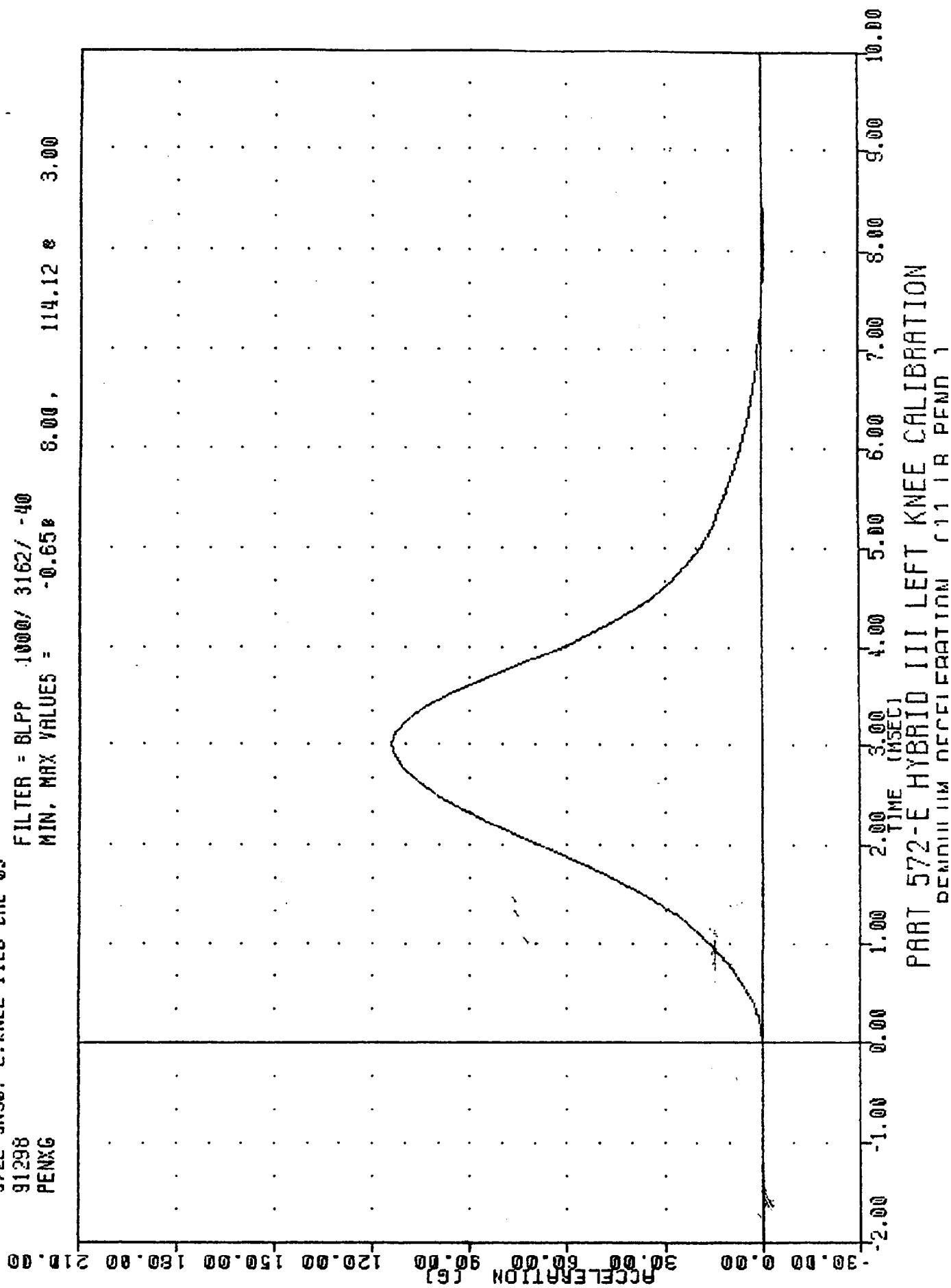
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	71.00 DEG. F
RELATIVE HUMIDITY	10% - 70%	52.00 %
PROBE VELOCITY	6.8 - 7.0 FT/SEC	6.85 FT/SEC
PEAK KNEE IMPACT FORCE	1060 - 1300 LBS	1255.28 LBS
PROBE WEIGHT	11.0 LBS	

TEST MEETS SPECIFICATIONS

TECHNICIAN Chas. Middleton

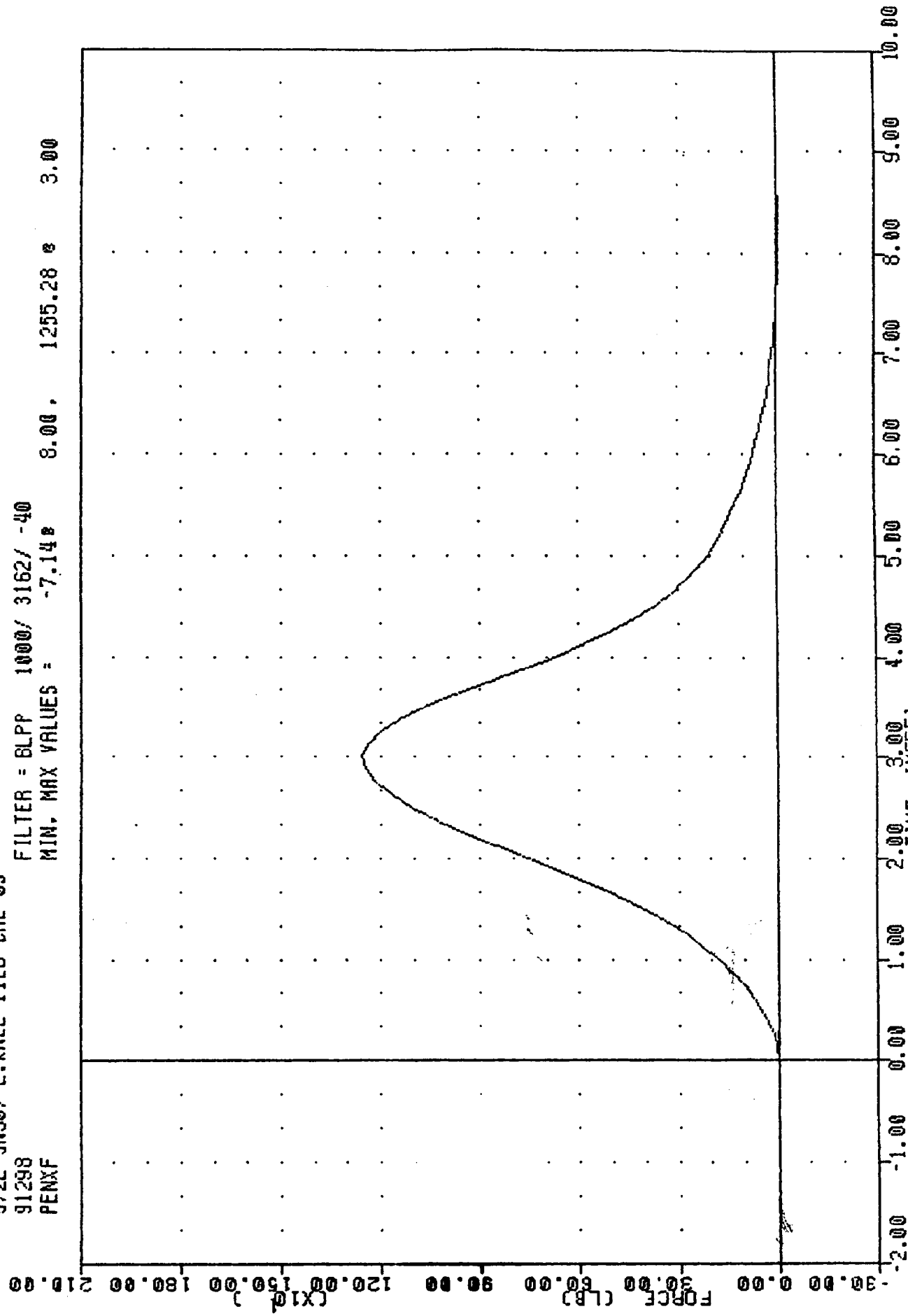
3RL , 907C5LK1
 572E SNG07 L.KNEE 11LB CAL 05
 91298
 PENXG

FILTER = BLPP 1000/ 3162/ -40
 MIN, MAX VALUES = -0.658 8.00, 114.12 e 3.00



SRL , 907C5LK1
 572E SN907 L.KNEE 11LB CAL 05
 91298
 PENXF

FILTER = BLPP 1000/ 3162/ -40
 MIN. MAX VALUES = -7.14 8.00 1255.28 3.00



PART 572-E HYBRID III LEFT KNEE CALIBRATION
 PENNIIUM FORCE (11 IR PENN)

APPENDIX D

MISCELLANEOUS TEST INFORMATION

DUMMY INSTRUMENTATION PLACEMENT
DUMMY MANUFACTURER & S/N: HUMANOID #907
SEATING POSITION: DRIVER

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
HEAD ACCELERATION	X	ENDEVCO	7264	FG97J	FRONT
HEAD ACCELERATION	Y	ENDEVCO	7264	FF79J	LEFT
HEAD ACCELERATION	Z	ENDEVCO	7264	FF73J	UP
NECK FORCE	X	DENTON	1716	0106-FX	**
NECK FORCE	Y	DENTON	1716	0106-FY	**
NECK FORCE	Z	DENTON	1716	0106-FZ	**
NECK MOMENT	X	DENTON	1716	0106-MX	**
NECK MOMENT	Y	DENTON	1716	0106-MY	**
NECK MOMENT	Z	DENTON	1716	0106-MZ	**
CHEST ACCELERATION	X	ENDEVCO	7264	FG28J	FRONT
CHEST ACCELERATION	Y	ENDEVCO	7264	FG33J	LEFT
CHEST ACCELERATION	Z	ENDEVCO	7264	FG43J	UP
CHEST DISPLACEMENT		VERNITECH	81422-A	CP56	OUTWARD
PELVIS ACCELERATION	X	ENDEVCO	7264	FC20J	REAR
PELVIS ACCELERATION	Y	ENDEVCO	7264	FG33J	RIGHT
PELVIS ACCELERATON	Z	ENDEVCO	7264	FC60J	UP

**See SIGN CONVENTION sheet for positive sensing orientation of neck load channels.

VEHICLE INSTRUMENTATION PLACEMENT

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
CENTER OF GRAVITY ACCEL	X	ENDEVCO	7264	BP34J	FRONT
CENTER OF GRAVITY ACCEL	Y	ENDEVCO	7264	CH35H	LEFT
CENTER OF GRAVITY ACCEL	Z	ENDEVCO	7264	CJ60H	UP
CENTER OF GRAVITY ROLL	X	HUMPHREY	RG28-0128-1	H-14	RIGHT
CENTER OF GRAVITY PITCH	Y	HUMPHREY	RG28-0128-1	H-16	UP
CENTER OF GRAVITY YAW	Z	HUMPHREY	RG28-0128-1	H-21	LEFT
DRIVER'S SHOULDER BELT DISPLACEMENT		CELESCO	PT-101-0040-111-5110	A02465	OUTWARD
DRIVER'S LAP BELT OUTBOARD DISPLACEMENT		CELESCO	PT-101-50A	0275534	OUTWARD
LEFT FRONT SUSPENSION DISPLACEMENT		CELESCO	PT-101-50A	A02465	OUTWARD
RIGHT FRONT SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	A12898	OUTWARD
LEFT REAR SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	A12899	OUTWARD
RIGHT REAR SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	0586135	OUTWARD

ROLL CART INSTRUMENTATION PLACEMENT

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
CENTER OF GRAVITY	X	ENDEVCO	7264	CH46H	FRONT
CENTER OF GRAVITY	Y	ENDEVCO	7264	CJ66H	RIGHT
CENTER OF GRAVITY	Z	ENDEVCO	7264	CM07H	UP
LEFT CYLINDER DISPLACEMENT		CELESCO	PT-101-60A	A23305	UP
RIGHT CYLINDER DISPLACEMENT		CELESCO	PT-101-60A	A23306	UP

PRE-TEST
IPMD VEHICLE DATA SHEET

Filled Out By: B. Dotson Date: 10/07/91
Checked By: _____ Date: _____

VEHICLE DATA

Vehicle Make and Model (written out): Volvo 740

NHTSA ID Code (7 characters): _____ /Model Year (2 digits): 91

Vehicle Make (2 characters): 20

11 - American	02 - Ford	64 = Nissan
12 = Audi	40 = GMC	48 = Odyssey
53 = Battronics	23 = Honda	06 = Oldsmobile
27 = BMW	34 = Hyundai	14 = Peugeot
04 = Buick	41 = IH	05 = Plymouth
10 = Cadillac	42 = Isuzu	03 = Pontiac
35 = Champion	44 = Jeep	17 = Renault
36 = Checker	54 = Jet	30 = Saab
01 = Chevrolet	22 = Lectra	26 = Subaru
37 = Chinook	59 = Lectric	33 = Suzuki
21 = Chrysler	13 = Lincoln	16 = Toyota
29 = Comuta	18 = Mazda	31 = Triumph
15 = Datsun	28 = Mercedes	56 = UM
38 = Delorean	09 = Mercury	08 = Volkswagen
07 = Dodge	25 = MG	20 = Volvo
58 = Eva	62 = Mitsubishi	60 = Winnebago
19 = Fiat	32 = NHTSA	24 = Yugo
99 = Other: _____		

Vehicle Model (2 characters = see Appendix B): _____

Body Style (2 characters): 4S

2C = 2 Door Coupe
2S = 2 Door Sedan
3H = 3 Door Hatchback
4S = 4 Door Sedan
5H = 5 Door Hatchback
OH = Other: _____

SW = Stationwagon
PU = Pickup Truck
TR = Truck
VN = Van
BU = Bus
MP = Multipurpose
UT = Utility

VIN (20 characters): YV1FA884XM2525343

Odometer Reading: <u>35.0</u>	Thousands of Miles: _____
Overall Length: <u>190.6</u>	(in) x 25.4 =: <u>4841</u> (mm)
Wheelbase: <u>109.4</u>	(in) x 25.4 =: <u>2779</u> (mm)
Front Track: <u>57.9</u>	(in) x 25.4 =: <u>1471</u> (mm)
Rear Track: <u>57.4</u>	(in) x 25.4 =: <u>1458</u> (mm)
Roof Height: <u>55.6</u>	(in) x 25.4 =: <u>1412</u> (mm)

PRE-TEST

IPMD VEHICLE DATA SHEET

G.V.W.R.: 4110 (lbs) x 4.45 =: 18290 (N)
FRONT G.A.W.R.: 2010 (lbs) x 4.45 =: 8944 (N)
REAR G.A.W.R.: 2125 (lbs) x 4.45 =: 9456 (N)

The following tire loadings are measured with the vehicle at Curb Weight.

Weight on RF Tire: 842 (lbs) x 4.45 =: 3747 (N)
Weight on LF Tire: 901 (lbs) x 4.45 =: 4009 (N)
Weight on LR Tire: 793 (lbs) x 4.45 =: 3529 (N)
Weight on RR Tire: 772 (lbs) x 4.45 =: 3435 (N)
Vehicle Test Weight: 3308 (lbs) x 4.45 =: 14721 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 51.76 (in) x 25.4 =: 1315 (mm)
From Center Line: -0.69 (in) x 25.4 =: -18 (mm)
Engine Displacement: 141 (cu in) x 0.0164 =: 2.3 (L)

Engine Type (2 characters): L4

L3 F4 L4
V4 F6 L6
V6 V8 RT = Rotary
L5 OT = Other: _____

Engine Location (1 character): F

F = Front M = Mid R = Rear

Engine Orientation (1 character): L

L = Longitudinal T = Transverse

Transmission Type: (1 character): A

M = Manual A = Automatic

Drive Axle (1 character): R

F = Front R = Rear 4 = Four Wheel Drive

Vehicle Comments (30 characters): tested at curb & driver pre-rollover

PRE-TEST
IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Suspension Number (4 digits): _____

Front/Rear Flag (1 character): F

Axle Type (1 character): I

I = Independent

S = Solid

Suspension Type (1 character): S

A = Unequal A Arm

T = Semi-Trailing Arm

L = Leaf

W = Twist

M = Multiple Link

4 = 4 Link

Q = Torque Arm

3 = 3 Link

S = Strut

I = Twin I Beam

O = Other: _____

Spring Type (2 characters): CO

CO = Coil

TB = Torsion Bar

LL = Longitudinal Leaf

TL = Transverse Leaf

OT = Other: _____

Brake Type (2 characters): DI

DI = Disk

LT = Leading-Trailer Shoe

DS = Duo-Servo Shoe

OT = Other: _____

Suspension Modified (1 character): N

N = No

Y = Yes

Suspension Modification

R = Raised

L = Lowered

S = Stiffened

W = Widened

O = Other

1 = _____

2 = _____

PRE-TEST
IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Tire Manufacturer (10 characters): Michelin

Tire Size Code (10 characters): 185/65R15

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: _____

Tire Rim width: 5.5 (in) X 25.4 =: 140 (mm)

Axle Height: 11.2 (in) X 25.4 =: 284 (mm)

Tire Pressure: 36.0 (psi) X 6.897 =: 248 (kpa)

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Suspension Number (4 digits): _____

Front/Rear Flag (1 character): R

Axle Type (1 character): S

I = Independent

S = Solid

Suspension Type (1 character): T

A = Unequal A Arm

T = Semi-Trailing Arm

L = Leaf

W = Twist

M = Multiple Link

4 = 4 Link

Q = Torque Arm

3 = 3 Link

S = Strut

I = Twin I Beam

O = Other: _____

Spring Type (2 characters): CO

CO = Coil

TB = Torsion Bar

LL = Longitudinal Leaf

TL = Transverse Leaf

OT = Other: _____

Brake Type (2 characters): DI

DI = Disk

LT = Leading-Trailer Shoe

DS = Duo-Servo Shoe

OT = Other: _____

Suspension Modified (1 character): N

N = No

Y = Yes

Suspension Modification

R = Raised

L = Lowered

S = Stiffened

W = Widened

O = Other

1 = _____

2 = _____

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Tire Manufacturer (10 characters): Michelin

Tire Size Code (10 characters): 185/65R15

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: _____

Tire Rim Width: 5.5 (in) X 25.4 =: 140 (mm)

Axle Height: 11.2 (in) X 25.4 =: 284 (mm)

Tire Pressure: 36.0 (psi) X 6.897 =: 248 (kpa)

IPMD MEASURED DATA

Distance between ramps (in): 48.00

String Pot Offset from platform center (in): 15.50

IPMD Calibration Check (no vehicle):

<u>Applied Weight (lbs)</u>	<u>Schaevitz Output (Deg.)</u>	<u>System C.G. Pivot</u>
0	<u>0.03</u>	<u>0.00</u>
+100	<u>-5.27</u>	<u>32.69</u>
+200	<u>-10.46</u>	<u>32.81</u>
0	<u>0.01</u>	<u>0.00</u>
-100	<u>5.31</u>	<u>32.80</u>
-200	<u>10.55</u>	<u>32.72</u>
0	<u>0.03</u>	<u>0.00</u>

Average System C.G. Pivot (in): 32.75

C.G. HEIGHT:

<u>Applied Weight (lbs.)</u>	<u>Schaevitz Output (Deg.)</u>	<u>Resultant Longitudinal Movement (mv)</u>	<u>Individual C.G. Values</u>
0	<u>0.01</u>	<u>0.000</u>	<u>0.00</u>
+100	<u>-3.14</u>	<u>0.058</u>	<u>20.92</u>
+200	<u>-6.36</u>	<u>0.151</u>	<u>20.96</u>
0	<u>-0.04</u>	<u>0.026</u>	<u>0.00</u>
-100	<u>3.14</u>	<u>-0.056</u>	<u>20.86</u>
-200	<u>6.35</u>	<u>-0.138</u>	<u>20.95</u>
0	<u>0.07</u>	<u>-0.025</u>	<u>0.00</u>

Calculated C.G. Height (in): 20.92

IPMD MEASURED DATA

Pitch Inertia:

Run	Period (sec)	Platform Motion Amplitude (Deg)	Relative Motion Amplitude (In.)	Individual Pitch Calcu. (Ft Lb Sec ²)
1	3.895	10.58	0.175	2030.4
2	3.895	10.35	0.170	2031.1
3	3.890	10.45	0.174	2022.3

Pitch Inertia (ft. lb. sec²): 2027.9

Roll Inertia:

Run	Period (sec)	Platform Motion Amplitude (Deg)	Relative Motion Amplitude (In.)	Individual Roll Calcu. (Ft Lb Sec ²)
1	2.330	9.10	0.124	359.0
2	2.330	9.20	0.128	358.5
3	2.330	9.09	0.123	359.1

Roll Inertia (ft. lb. sec²): 358.9

Yaw Inertia:

Run	Period (sec)	Platform Motion Amplitude (Deg)	Relative Motion Amplitude (In.)	Individual Yaw Calcu. (Ft Lb Sec ²)
1	2.500	10.36	0.10	2100.9
2	2.505	10.65	0.10	2111.3
3	2.505	10.01	0.10	2110.9

Yaw Inertia (ft. lb. sec²): 2107.7

POST-TEST
IPMD VEHICLE DATA SHEET

Filled Out By: B. Dotson Date: 11/01/91
Checked By: _____ Date: _____

VEHICLE DATA

Vehicle Make and Model (written out): Volvo 740

NHTSA ID Code (7 characters): 91T5041 /Model Year (2 digits): 91

Vehicle Make (2 characters): 20

11 - American	02 - Ford	64 = Nissan
12 = Audi	40 = GMC	48 = Odyssey
53 = Battronic	23 = Honda	06 = Oldsmobile
27 = BMW	34 = Hyundai	14 = Peugeot
04 = Buick	41 = IH	05 = Plymouth
10 = Cadillac	42 = Isuzu	03 = Pontiac
35 = Champion	44 = Jeep	17 = Renault
36 = Checker	54 = Jet	30 = Saab
01 = Chevrolet	22 = Lectra	26 = Subaru
37 = Chinook	59 = Lectric	33 = Suzuki
21 = Chrysler	13 = Lincoln	16 = Toyota
29 = Comuta	18 = Mazda	31 = Triumph
15 = Datsun	28 = Mercedes	56 = UM
38 = Delorean	09 = Mercury	08 = Volkswagen
07 = Dodge	25 = MG	20 = Volvo
58 = Eva	62 = Mitsubishi	60 = Winnebago
19 = Fiat	32 = NHTSA	24 = Yugo
99 = Other: _____		

Vehicle Model (2 characters = see Appendix B): _____

Body Style (2 characters): 4S

2C = 2 Door Coupe	SW = Stationwagon
2S = 2 Door Sedan	PU = Pickup Truck
3H = 3 Door Hatchback	TR = Truck
4S = 4 Door Sedan	VN = Van
5H = 5 Door Hatchback	BU = Bus
OH = Other: _____	MP = Multipurpose
	UT = Utility

VIN (20 characters): YV1FA884XM2525343

Odometer Reading: <u>35.0</u>	Thousands of Miles: _____
Overall Length: <u>190.6</u>	(in) x 25.4 =: <u>4841</u> (mm)
Wheelbase: <u>109.7</u>	(in) x 25.4 =: <u>2786</u> (mm)
Front Track: <u>56.9</u>	(in) x 25.4 =: <u>1445</u> (mm)
Rear Track: <u>56.8</u>	(in) x 25.4 =: <u>1443</u> (mm)
Roof Height: <u>55.6</u>	(in) x 25.4 =: <u>1412</u> (mm)

POST-TEST
IPMD VEHICLE DATA SHEET

G.V.W.R.: 4110 (lbs) x 4.45 =: 18290 (N)
FRONT G.A.W.R.: 2010 (lbs) x 4.45 =: 8944 (N)
REAR G.A.W.R.: 2125 (lbs) x 4.45 =: 9456 (N)

The following tire loadings are measured with the vehicle at Curb Weight.

Weight on RF Tire: 784 (lbs) x 4.45 =: 3489 (N)
Weight on LF Tire: 942 (lbs) x 4.45 =: 4192 (N)
Weight on LR Tire: 797 (lbs) x 4.45 =: 3547 (N)
Weight on RR Tire: 744 (lbs) x 4.45 =: 3311 (N)
Vehicle Test Weight: 3267 (lbs) x 4.45 =: 14538 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 51.60 (in) x 25.4 =: 1311 (mm)
From Center Line: -1.87 (in) x 25.4 =: -48 (mm)
Engine Displacement: 141 (cu in) x 0.0164 =: 2.3 (L)

Engine Type (2 characters): L4

L3 F4 L4
V4 F6 L6
V6 V8 RT = Rotary
L5 OT = Other: _____

Engine Location (1 character): F

F = Front M = Mid R = Rear

Engine Orientation (1 character): L

L = Longitudinal T = Transverse

Transmission Type: (1 character): A

M = Manual A = Automatic

Drive Axle (1 character): R

F = Front R = Rear 4 = Four Wheel Drive

Vehicle Comments (30 characters): Curb & driver Post-rollover

POST-TEST
IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Suspension Number (4 digits): _____

Front/Rear Flag (1 character): F

Axle Type (1 character): I

I = Independent

S = Solid

Suspension Type (1 character): S

A = Unequal A Arm

T = Semi-Trailing Arm

L = Leaf

W = Twist

M = Multiple Link

4 = 4 Link

Q = Torque Arm

3 = 3 Link

S = Strut

I = Twin I Beam

O = Other: _____

Spring Type (2 characters): CO

CO = Coil

TB = Torsion Bar

LL = Longitudinal Leaf

TL = Transverse Leaf

OT = Other: _____

Brake Type (2 characters): DI

DI = Disk

LT = Leading-Trailer Shoe

DS = Duo-Servo Shoe

OT = Other: _____

Suspension Modified (1 character): N

N = No

Y = Yes

Suspension Modification

R = Raised

L = Lowered

S = Stiffened

W = Widened

O = Other

1 = _____

2 = _____

POST-TEST
IPMD VEHICLE DATA SHEET

FRONT SUSPENSION

Tire Manufacturer (10 characters): Michelin

Tire Size Code (10 characters): 185/65R15

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: _____

Tire Rim width: 5.5 (in) X 25.4 =: 140 (mm)

Axle Height: 11.2 (in) X 25.4 =: 284 (mm)

Tire Pressure: 36.0 (psi) X 6.897 =: 248 (kpa)

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Suspension Number (4 digits): _____

Front/Rear Flag (1 character): R

Axle Type (1 character): S

I = Independent

S = Solid

Suspension Type (1 character): T

A = Unequal A Arm

T = Semi-Trailing Arm

L = Leaf

W = Twist

M = Multiple Link

4 = 4 Link

Q = Torque Arm

3 = 3 Link

S = Strut

I = Twin I Beam

O = Other: _____

Spring Type (2 characters): CO

CO = Coil

TB = Torsion Bar

LL = Longitudinal Leaf

TL = Transverse Leaf

OT = Other: _____

Brake Type (2 characters): DI

DI = Disk

LT = Leading-Trailer Shoe

DS = Duo-Servo Shoe

OT = Other: _____

Suspension Modified (1 character): N

N = No

Y = Yes

Suspension Modification

R = Raised

L = Lowered

S = Stiffened

W = Widened

O = Other

1 = _____

2 = _____

IPMD VEHICLE DATA SHEET

REAR SUSPENSION

Tire Manufacturer (10 characters): Michelin

Tire Size Code (10 characters): 185/65R15

Tire Construction (2 characters): SB

BB = Bias Belted

GP = Glass Belted Radial

BP = Bias Ply

SB = Steel Belted Radial

OT = Other: _____

Tire Rim Width: 5.5 (in) X 25.4 =: 140 (mm)

Axle Height: 11.2 (in) X 25.4 =: 284 (mm)

Tire Pressure: 36.0 (psi) X 6.897 =: 248 (kpa)

IPMD MEASURED DATA

Distance between ramps (in): 46.50

String Pot Offset from platform center (in): 13.50

IPMD Calibration Check (no vehicle):

<u>Applied Weight (lbs)</u>	<u>Schaevitz Output (Deg.)</u>	<u>System C.G. Pivot</u>
0	<u>-0.47</u>	<u>0.00</u>
+100	<u>-5.76</u>	<u>32.81</u>
+200	<u>-10.93</u>	<u>32.92</u>
0	<u>-0.48</u>	<u>0.00</u>
-100	<u>4.82</u>	<u>32.77</u>
-200	<u>10.04</u>	<u>32.75</u>
0	<u>-0.48</u>	<u>0.00</u>

Average System C.G. Pivot (in): 32.81

C.G. HEIGHT:

<u>Applied Weight (lbs.)</u>	<u>Schaevitz Output (Deg.)</u>	<u>Resultant Longitudinal Movement (mv)</u>	<u>Individual C.G. Values</u>
0	<u>-0.03</u>	<u>0.000</u>	<u>0.00</u>
+100	<u>-3.16</u>	<u>0.070</u>	<u>20.39</u>
+200	<u>-6.35</u>	<u>0.174</u>	<u>20.36</u>
0	<u>-0.09</u>	<u>0.021</u>	<u>0.00</u>
-100	<u>3.06</u>	<u>-0.053</u>	<u>20.38</u>
-200	<u>6.28</u>	<u>-0.159</u>	<u>20.46</u>
0	<u>0.01</u>	<u>-0.015</u>	<u>0.00</u>

Calculated C.G. Height (in): 20.40

IPMD MEASURED DATA

Pitch Inertia:

Run	Period (sec)	Platform Motion Amplitude (Deg)	Relative Motion Amplitude (In.)	Individual Pitch Calcu. (Ft Lb Sec ²)
1	3.905	10.02	0.233	2040.4
2	3.900	9.98	0.226	2036.6
3	3.900	10.03	0.223	2038.7

Pitch Inertia (ft. lb. sec²): 2038.5

Roll Inertia:

Run	Period (sec)	Platform Motion Amplitude (Deg)	Relative Motion Amplitude (In.)	Individual Roll Calcu. (Ft Lb Sec ²)
1	2.310	9.03	0.138	347.2
2	2.310	9.13	0.142	346.7
3	2.305	8.81	0.132	343.3

Roll Inertia (ft. lb. sec²): 345.8

Yaw Inertia:

Run	Period (sec)	Platform Motion Amplitude (Deg)	Relative Motion Amplitude (In.)	Individual Yaw Calcu. (Ft Lb Sec ²)
1	2.510	10.03	0.11	2119.2
2	2.515	10.56	0.12	2129.0
3	2.515	9.54	0.10	2129.4

Yaw Inertia (ft. lb. sec²): 2125.9