

TEST V-1925
JUNE 23, 1993

VEHICLE AND DUMMY KINEMATICS
IN A CONTROLLED ROLLOVER CRASH
1990 NISSAN PICKUP TRUCK

PREPARED BY:
TRANSPORTATION RESEARCH CENTER INC.
10820 STATE ROUTE 347
EAST LIBERTY, OHIO 43319

JUNE - JULY 1993
TEST REPORT

PREPARED FOR:
SYSTEMS RESEARCH LABORATORIES
2800 INDIAN RIPPLE ROAD
DAYTON, OH 45440

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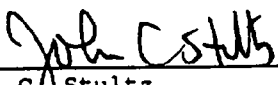
Report Prepared By:



Scott A. Johnston
Project Engineer

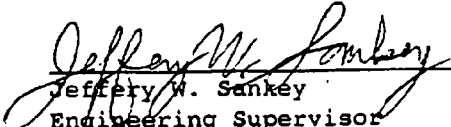
Date 8/4/93

Report Approved By:



John C. Stultz
Chief Engineer, Impact Laboratory

Date 8/5/93



Jeffery W. Sankey
Engineering Supervisor

Date 8/5/93

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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 1990 Nissan pickup truck 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 passenger's side. The test vehicle contained an instrumented Part 572 E dummy restrained with a three-point unbelt.

SECTION 2.0

SUMMARY OF ROLLOVER CRASH TEST

A 1990 Nissan pickup truck, containing one instrumented Part 572 E 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 right side. The vehicle made two rolls and came to rest on its wheels. The rollover crash test was conducted by Transportation Research Center Inc. (TRC) in East Liberty, Ohio, on June 23, 1993.

The Part 572 E 50th percentile adult male anthropomorphic test device (dummy) was placed in the driver's designated seating position according to the placement procedure specified in Appendix B and Optional Appendix C of Laboratory Procedure TP-208-09. The dummy was instrumented with head, chest, and pelvis triaxial accelerometers, a six-axis neck load cell, and a chest displacement potentiometer. The head and chest were also instrumented with angular velocity sensors. The head was instrumented with six (6) additional accelerometers to form a 9-accelerometer array.

The crash event was recorded by forty-eight (48) channels of data on a 14-track tape drive. The analog data was digitally sampled at 8000 samples per second. The data was digitally filtered as 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 (1) real-time panning motion picture camera.

Section 3.0 contains the general test and vehicle parameter data. Section 4.0 contains the occupant information. Appendix A contains the pre- and post-test still photographs. Appendix B contains the final test data plots. Appendix C contains the post-test dummy certification data. Appendix D contains miscellaneous test information which includes the pre-test and post-test IPMD vehicle data sheets.

ROLL CART INSTRUMENTATION LOCATIONS AND DATA SUMMARY

TEST NUMBER 930623

No. LOCATION	X*	Y*	Z*	POSITIVE		NEGATIVE	
				DIRECTION	MAX G MSEC	DIRECTION	MAX G MSEC
1 CENTER OF GRAVITY	39.2	3.5	8.2				
ACCELERATION (g)							
LONGITUDINAL				1.8	84.5	1.9	80.9
LATERAL				6.2	76.0	3.9	71.4
VERTICAL ¹				9.9	68.7	21.4	74.8
RESULTANT ¹				22.0	74.9		
2 PLATFORM DISPLACEMENT	24.6	24.5	47.3				
(in)							
LEFT SIDE				24.7	657.5	0.0	6.5
RIGHT SIDE				25.0	1141.6	0.1	81.6
3 VEHICLE/ROLLOVER	28.5	22.0	76.2				
UPPER SWITCH					316.0		
LOWER SWITCH					---		

* ALL MEASUREMENTS OF INSTRUMENTATION LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM ROLLOVER CART

Y: + LEFTWARD FROM ROLLOVER CART CENTERLINE

Z: + UPWARD FROM THE GROUND LEVEL

DISPLACEMENT: + OUTWARD

¹See DATA ACQUISITION EXPLANATIONS

FINAL RESTING PLACE OF VEHICLE, PARTS, AND ROLLOVER CART

<u>DESCRIPTION OF VEHICLE</u>	<u>X, DISTANCE¹</u>	<u>Y, DISTANCE¹</u>
Left rear corner	74.2	5.1
Right rear corner	79.1	-6.3
Left front corner	76.4	3.4
Right front corner	81.4	-2.1

DESCRIPTION OF PARTS

Rear window	56.6	-8.4
Rear window gasket	55.0	-5.7

DESCRIPTION OF ROLLOVER CART

Left rear corner	74.2	5.1
Right rear corner	79.1	-6.3
Left front corner	76.4	3.4
Right front corner	81.4	-2.1

<u>POINT OF FIRST CONTACT</u>	25.3	0.0
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¹REFERENCE: +X: FORWARD FROM RELEASE BLOCK

+Y: LEFTWARD FROM CENTER RELEASE BLOCK

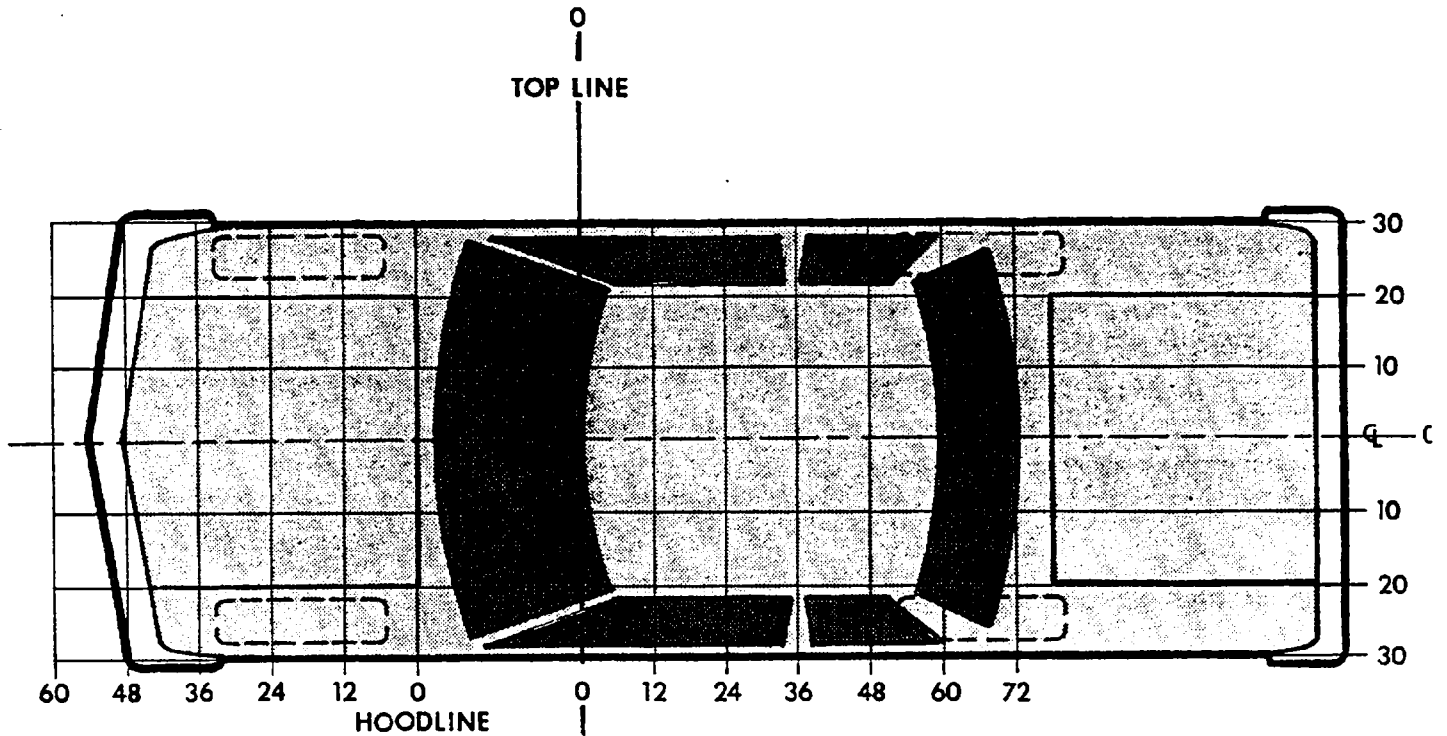
All measurements are in feet.

VEHICLE INTERIOR MEASUREMENTS

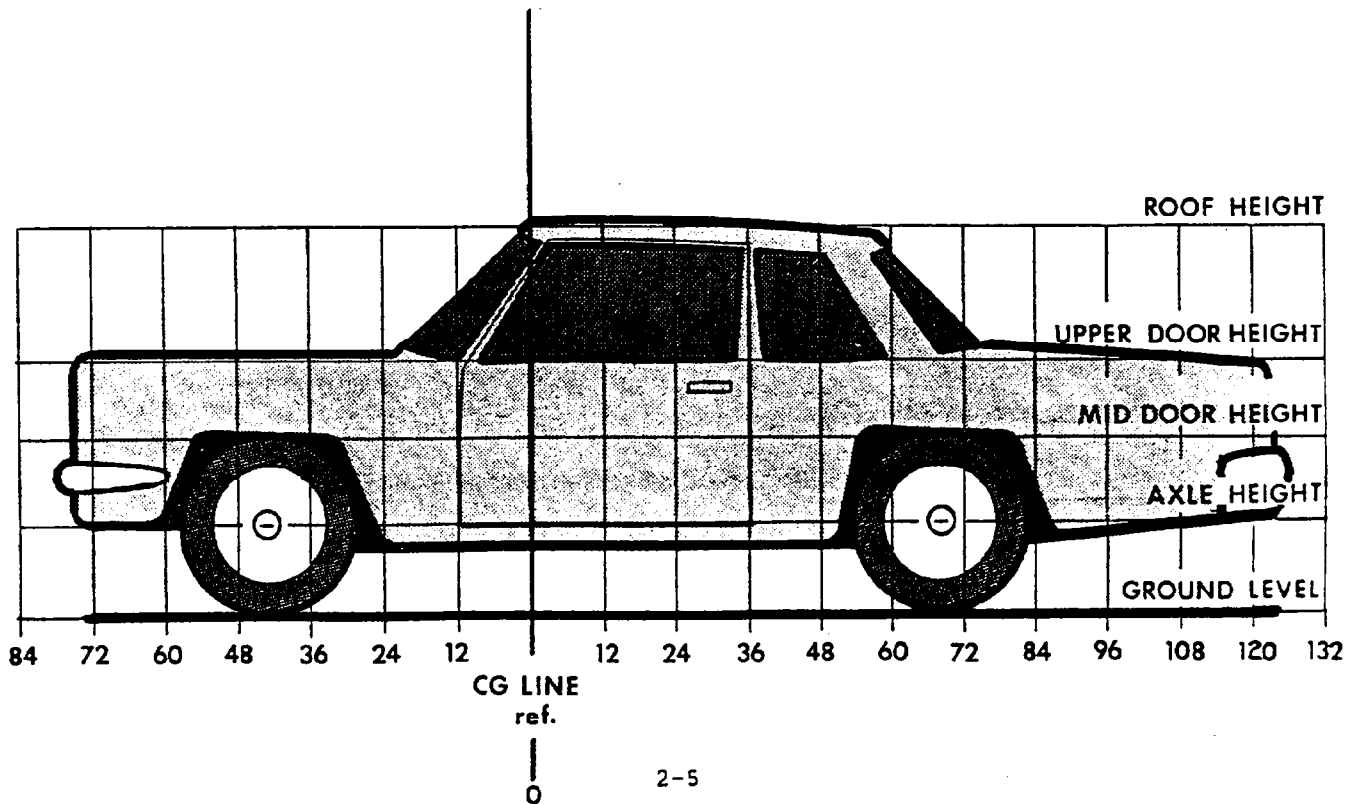
DESCRIPTION	PRE-TEST	POST-TEST	DIFFERENCE
Floor board to top of left "A" post	41.2	30.4	10.8
Floor board to top of right "A" post	42.2	30.6	11.6
Door sill to top of left "B" post	43.6	37.4	6.2
Door sill to top of right "B" post	42.6	33.6	9.0
Door sill to top of left door opening	42.5	36.2	6.3
Door sill to top of right door opening	42.1	31.2	10.9
Floor tunnel to windshield header	34.8	26.0	8.8
Floor tunnel to center of roof	40.1	29.0	11.1
Rear of floor tunnel to roof	41.3	32.9	8.4
Maximum width at "B" post	53.0	62.8	-9.8
Maximum width at "A" post	54.5	53.5	1.0
Maximum width at top of door opening	46.6	48.2	-1.6

All measurements are in inches.

LEFT AND RIGHT SIDE STATIC CRUSH LOCATIONS



HOOD AND ROOF STATIC CRUSH LOCATIONS



VEHICLE HOOD EXTERIOR PROFILES
ZERO DISTANCE AT VEHICLE HOOD CENTERLINE¹

LOCATION	30	20	10	0	10	20	30
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE ²)							
Trailing edge of cowl at centerline	45.1	46.1	46.4	47.1	46.4	46.0	45.0
Trailing edge of cowl + 12 inches ³	X	44.5	45.0	45.2	45.2	44.6	X
Trailing edge of cowl + 24 inches	X	42.5	42.4	43.0	42.9	42.8	X
Trailing edge of cowl + 36 inches	X	37.8	37.9	38.4	37.9	37.9	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X

POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE ²)							
Trailing edge of cowl at centerline	42.9	43.8	44.1	43.6	42.9	42.0	38.2
Trailing edge of cowl + 12 inches ³	X	42.2	42.8	42.6	42.8	40.6	X
Trailing edge of cowl + 24 inches	X	40.9	40.9	40.8	40.1	39.2	X
Trailing edge of cowl + 36 inches	X	37.2	37.2	37.0	36.6	35.4	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X

STATIC CRUSH (IN.)							
Trailing edge of cowl at centerline	-2.2	-2.3	-2.3	-3.5	-3.5	-4.0	-6.8
Trailing edge of cowl + 12 inches ³	X	-2.3	-2.2	-2.6	-2.4	-4.0	X
Trailing edge of cowl + 24 inches	X	-1.6	-1.5	-2.2	-2.8	-3.6	X
Trailing edge of cowl + 36 inches	X	-0.6	-0.7	-1.4	-1.3	-2.5	X
Trailing edge of cowl + 48 inches	X	X	X	X	X	X	X

¹ Column readings are left to right from left to right on vehicle.

² Reference plane is a horizontal plane at ground level.

³ 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 CENTERLINE¹

LOCATION	20	10	0	10	20
PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE ²)					
Longitudinal center of gravity	65.5	65.8	65.7	65.2	64.7
Longitudinal center of gravity + 12 inches ³	65.8	66.2	66.1	66.0	65.1
Longitudinal center of gravity + 24 inches	X	X	X	X	X
Longitudinal center of gravity + 36 inches	X	X	X	X	X
Longitudinal center of gravity + 48 inches	X	X	X	X	X
Longitudinal center of gravity + 60 inches	X	X	X	X	X
POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE ²)					
Longitudinal center of gravity	52.0	51.2	48.5	48.2	47.4
Longitudinal center of gravity + 12 inches ³	54.1	53.6	53.0	51.9	50.2
Longitudinal center of gravity + 24 inches	X	X	X	X	X
Longitudinal center of gravity + 36 inches	X	X	X	X	X
Longitudinal center of gravity + 48 inches	X	X	X	X	X
Longitudinal center of gravity + 60 inches	X	X	X	X	X
STATIC CRUSH (IN.)					
Longitudinal center of gravity	-13.5	-14.6	-17.2	-17.0	-17.3
Longitudinal center of gravity + 12 inches ³	-11.7	-12.6	-13.1	-14.1	-14.9
Longitudinal center of gravity + 24 inches	X	X	X	X	X
Longitudinal center of gravity + 36 inches	X	X	X	X	X
Longitudinal center of gravity + 48 inches	X	X	X	X	X
Longitudinal center of gravity + 60 inches	X	X	X	X	X

¹ Column readings are left to right from left to right on vehicle.

² Reference plane is a horizontal plane at ground level.

³ 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 GRAVITY¹

LOCATION	HEIGHT	72	60	48	36	24	12	0	12	24	36	48	60	72	84	96
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PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE²)

Roof height	65.2	X	X	X	X	X	25.8	25.6	X	X	X	X	X	X	X	X
Upper door	44.2	X	18.6	18.0	17.6	17.2	17.0	17.0	16.9	17.0	17.0	17.0	17.0	16.9	17.2	17.6
Mid door	32.1	X	16.1	X	15.0	15.9	15.8	16.0	15.9	16.0	X	X	X	16.0	16.3	16.5
Axle height	19.5	X	X	X	X	18.1	18.1	18.4	18.4	18.8	X	X	X	X	X	X

POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE²)

Roof height	65.2	X	X	X	X	X	36.9	37.8	X	X	X	X	X	X	X	X
Upper door	44.2	X	25.2	24.8	23.9	23.5	22.3	20.8	20.5	17.6	23.1	23.0	22.4	23.9	21.9	21.3
Mid door	32.1	X	19.5	X	17.2	17.5	16.1	15.8	14.9	17.1	16.9	X	X	19.4	18.2	18.4
Axle height	19.5	X	X	X	X	16.9	17.1	17.2	17.8	17.3	17.7	X	X	X	X	X

STATIC CRUSH (IN)

Roof height	65.2	X	X	X	X	X	11.1	12.2	X	X	X	X	X	X	X	X
Upper door	44.2	X	6.6	6.8	6.3	6.3	5.3	3.8	3.5	0.7	6.1	6.0	5.4	7.0	4.7	3.7
Mid door	32.1	X	3.4	X	2.2	1.6	0.3	0.0	-1.1	1.2	0.9	X	X	3.4	1.9	1.9
Axle height	19.5	X	X	X	X	-1.2	-1.0	-1.2	-0.6	-1.1	-1.1	X	X	X	X	X

¹Center of gravity is located 47.4 inches rearward of vehicle front wheels.

Column readings are left to right from front to rear on vehicle.

²Reference plane is parallel to and 48.0 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 GRAVITY¹

LOCATION	HEIGHT	72	60	48	36	24	12	0	12	24	36	48	60	72	84	96
<u>PRE-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE²)</u>																
Roof height	65.2	X	X	X	X	X	X	25.5	25.6	X	X	X	X	X	X	X
Upper door	44.2	X	18.0	17.6	17.0	16.8	17.0	17.1	17.0	17.0	17.0	17.0	17.0	17.0	17.1	17.5
Mid door	32.1	X	16.0	X	14.9	15.6	15.8	15.8	16.0	16.0	16.0	X	X	16.1	16.2	16.3
Axle height	19.5	X	X	X	X	18.0	18.1	18.2	18.6	18.8	18.7	X	X	X	X	X

POST-TEST PROFILE (DISTANCE IN INCHES FROM REFERENCE PLANE²)

Roof height	65.2	X	X	X	X	X	X	15.1	14.1	X	X	X	X	X	X	X
Upper door	44.2	X	15.2	14.5	12.6	10.1	7.6	5.4	3.6	16.0	16.0	15.6	15.6	14.6	14.6	14.9
Mid door	32.1	X	14.4	X	13.8	12.4	9.9	8.9	8.2	15.8	15.8	X	X	15.1	15.1	15.1
Axle height	19.5	X	X	X	X	20.1	20.2	19.8	19.6	19.3	19.4	X	X	X	X	X

STATIC CRUSH (IN)

Roof height	65.2	X	X	X	X	X	X	-10.4	-11.5	X	X	X	X	X	X	X
Upper door	44.2	X	-2.8	-3.1	-4.4	-6.7	-9.4	-11.7	-13.4	-1.0	-1.0	-1.4	-1.4	-2.4	-2.5	-2.6
Mid door	32.1	X	-1.6	X	-1.1	-3.2	-5.9	-6.9	-7.6	-0.2	-0.2	X	X	-1.0	-1.1	-1.2
Axle height	19.5	X	X	X	X	2.1	2.1	1.6	1.0	0.5	0.7	X	X	X	X	X

¹Center of gravity is located 47.4 inches rearward of vehicle front wheels.

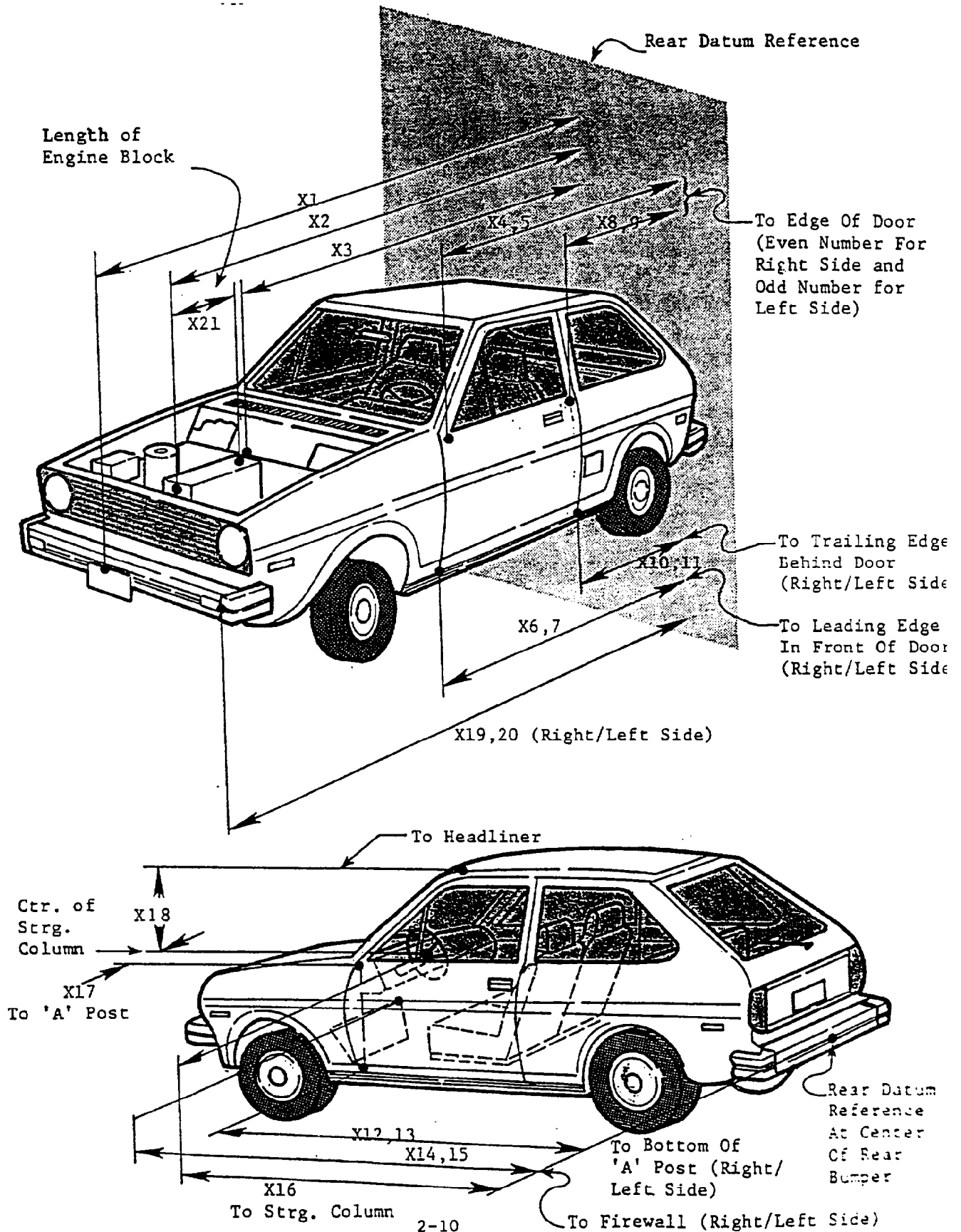
Column readings are left to right from front to rear on vehicle.

²Reference plane is parallel to and 48.0 inches from the vehicle longitudinal centerline.

+ Static crush means that vehicle structure is crushed.

- Static crush means that vehicle structure is bowed outward.

VEHICLE PRE-TEST AND POST-TEST MEASUREMENT POINTS



IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: <u>Nissan/pickup truck</u>		TEST NUMBER: <u>930623</u>		
NO.	TYPE OF MEASUREMENT	PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	179.6	179.9	-0.3
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	160.4	161.9	-1.5
X3	REAR SURFACE OF VEHICLE TO FIREWALL	142.4	140.7	1.7
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	132.9	132.2	0.7
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	132.4	130.5	1.9
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	131.4	131.1	0.3
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	131.2	130.0	1.2
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	87.0	88.5	-1.5
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	87.5	86.2	1.3
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	87.1	87.0	0.1
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	86.9	85.8	1.1
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	131.8	132.2	-0.4
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	131.6	131.0	0.6
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	142.0	141.5	0.5
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	141.0	139.5	1.5
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	112.4	111.5	0.9
X17	CENTER OF STEERING COLUMN TO "A" POST	11.0	10.4	0.6
X18	CENTER OF STEERING COLUMN TO HEADLINER	7.8	10.9	-3.1
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	178.5	178.0	0.5
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	178.2	178.0	0.2
X21	LENGTH OF ENGINE BLOCK	19.0	19.0	0.0

All distance measurements are in inches.

DATA ACQUISITION EXPLANATIONS

The driver head array 1 Z-axis acceleration, HD1ZG1, lost data at 960 milliseconds.

The following data channels recorded anomalous spikes at 1030 and 1710 milliseconds and between 2890 and 3000 milliseconds:

The driver neck X-axis shear force, NEKXF1
The driver neck Y-axis shear force, NEKYF1
The driver neck Z-axis axial force, NEKZF1
The driver neck X-axis moment, NEKXM1
The driver neck Y-axis moment, NEKYM1
The driver neck Z-axis moment, NEKZM1
The driver lap belt outboard force, LBOF1
The vehicle center of gravity X-axis acceleration, VCGXG1
The vehicle center of gravity Y-axis acceleration, VCGYG1
The vehicle center of gravity Z-axis acceleration, VCGZG1
The vehicle center of gravity resultant acceleration, VCGRG1
The vehicle pitch rate, VCGYV1
The vehicle yaw rate, VCGZV1

The driver shoulder belt force, SHBF1, recorded anomalous spikes at 1030 and 1710 milliseconds and between 1055 and 1140 milliseconds and between 2890 and 3000 milliseconds.

The roll cart center of gravity Z-axis acceleration, VCGZG2, did not return to zero after the crash test. The roll cart center of gravity resultant acceleration, VCGRG2, was affected by this anomaly.

EVENT TIMES

TEST DATE: June 23, 1993

EVENT DESCRIPTION	TIME, SEC.
CONTACT RELEASE BLOCK	0.0
START COLLECTING DATA	-0.3
STOP COLLECTING DATA	3.0
ZERO TIME FOR DATA	0.0
STROBE LIGHTS FLASH	0.0
CAMERA L E D GOES OFF	0.0 ¹
PIN RELEASES (ROLLOVER CART)	-0.429 ²
CYLINDERS START (ROLLOVER CART)	0.112

¹ Locate frame where event LED stripe ends. Put projector into reverse and go backwards four frames. This frame is T-zero for the data.

² 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 & Vehicle parameter data.

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Nissan Motor Co., Ltd.

MAKE/MODEL: Nissan/pickup truck

VIN: 1N6SD11YXLC418900

BODY STYLE: pickup truck

MODEL YEAR: 1990

COLOR: Red

ENGINE DATA: TYPE: inline CYLINDERS: 4 DISPLACEMENT: 2.4 liters

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

DATE VEHICLE RECEIVED: 06/14/93

ODOMETER READING: 34,759

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	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	No
RADIO	Yes	ANTI-SKID BRAKE	No
CLOCK	Yes	REAR WINDOW DEFROSTER	No
OTHER	None		

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? No, modified B-pillars
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: Nissan Motor Co., Ltd.

DATE OF MANUFACTURE: 08/90

VIN: 1N6SD11YXLC418900

GVWR: 5100 LBS

GAWR: FRONT: 2500 LBS., REAR: 2750 LBS.

TEST VEHICLE INFORMATION, CONT'D.

TIRES ON VEHICLE (MFR., LINE, SIZE): Firestone, ATX, 215/75R15

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

SPARE TIRE (MFR., SIZE): Firestone, tempa spare, T155/90D16

TYPE OF SEATS: FRONT: Bench
REAR: NA

TYPE OF FRONT SEAT BACKS: Non-adjustable

MAXIMUM WIDTH: 66.5 INCHES

WHEELBASE: 104.2 INCHES

LOCATION OF LABEL STATING TIRE & CAPACITY DATA:¹

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:¹

RECOMMENDED TIRE SIZE:

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

DESIGNATED SEATING CAPACITY: ____FRONT ____REAR ____TOTAL

VEHICLE CAPACITY WEIGHT: _____ LBS.

TEST VEHICLE ATTITUDE (ALL MEASUREMENTS ARE IN INCHES):

DELIVERED ATTITUDE: LF 34.4; RF 34.2; LR 35.9; RR 36.0

PRE-TEST ATTITUDE: LF 33.8; RF 33.8; LR 34.4; RR 34.5

POST-TEST ATTITUDE: LF 31.6; RF 24.3; LR 36.4; RR 28.8

¹The vehicle did not contain a label stating tire and capacity data.

TEST VEHICLE INFORMATION, CONT'D.

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

RIGHT FRONT	933 LBS.	RIGHT REAR	691 LBS.
LEFT FRONT	981 LBS.	LEFT REAR	666 LBS.
TOTAL FRONT WEIGHT	1914 LBS.	(58.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1357 LBS.	(41.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT 3271 LBS.			

CALCULATION OF TEST VEHICLE'S TARGET TEST WEIGHT:

RCLW¹ = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED ELIVERED WEIGHT (3271 LBS.)

VCW¹ = VEHICLE CAPACITY WEIGHT (LBS.)

DSC¹ = DESIGNATED SEATING CAPACITY ()

RCLW¹ = VCW - 150 (DSC) = 300 LBS.

TARGET TEST WEIGHT = UDW + RCLW¹ + (NO. OF HYBRID III DUMMIES X 167 LBS./DUMMY)

TARGET TEST WEIGHT = 3271 + 300 + 167

TARGET TEST WEIGHT = 3738 LBS.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 292 LBS. OF CARGO WEIGHT:

RIGHT FRONT	1003 LBS.	RIGHT REAR	840 LBS.
LEFT FRONT	1030 LBS.	LEFT REAR	857 LBS.
TOTAL FRONT WEIGHT	2033 LBS.	(54.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1697 LBS.	(45.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	3730 LBS.	(0.2% UNDER TARGET TEST WEIGHT)	

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

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: None

CG = 47.4 INCHES REARWARD OF FRONT WHEEL CENTERLINE

¹Cargo weight for multi-purpose passenger vehicles, trucks, and buses is the vehicle's calculated cargo and luggage weight or 300 pounds, whichever is less.

TEST CONDITIONS

TEST NUMBER: 930623

TEST DATE: 06/23/93

TEST TEMPERATURES:

IMPACT AREA: 77° F
OCCUPANT COMPARTMENT: 90° F
DRIVER DUMMY: 80° F

VEHICLE AND ROLL CART DATA:

	<u>ACTUAL</u>	<u>INTENDED</u>
VEHICLE TEST WEIGHT (LBS.):	3730	3738
VEHICLE ORIENTATION (DEG.) ROLL ¹ :	30	30
IMPACT SIDE:	Right	Right
ROLL CART WEIGHT (LBS.):	3347	3347
ROLL CART CRABBED ANGLE (DEG.) ² :	0	0
ROLL CART VELOCITY (MPH) ³ :	30.0	30.0

VEHICLE MEASUREMENTS:

MAXIMUM LENGTH: 179.6
MAXIMUM WIDTH: 66.5
WHEELBASE: 104.2
TOP WIDTH: 48.8
C.G. REARWARD OF
FRONT WHEEL CENTERLINE: 47.4
C.G. HEIGHT ABOVE
GROUND LEVEL: 25.4

- ¹ As measured on the roll cart with cylinder in rest position.
² As measured from roll cart's centerline to direction of travel
(positive is clockwise).
³ As measured over final one foot of travel.

All measurements are in inches.

VEHICLE TEST CONDITIONS

LEFT FRONT:	DOOR	-	UNLOCKED	WINDOW	-	UP
LEFT REAR:	DOOR	-	NA	WINDOW	-	NA
RIGHT FRONT	DOOR	-	UNLOCKED	WINDOW	-	UP
RIGHT REAR	DOOR	-	NA	WINDOW	-	NA
EMERGENCY BRAKE:	OFF					
TRANSMISSION:	NEUTRAL					
HEADRESTS:	DRIVER	-	UPMOST	PASSENGER	-	UPMOST
TIRE PRESSURE:	FRONT	-	29 PSI	REAR	-	29 PSI

DUMMY INFORMATION:

TYPE:	PART 572 E
POSITION:	LEFT FRONT
SERIAL NO.:	907

INSTRUMENTATION:

HEAD ACCELEROMETERS:	9
HEAD ANGULAR VELOCITY	
SENSORS:	3
NECK LOAD CELLS:	6
CHEST ACCELEROMETERS:	3
CHEST DISPLACEMENT	
POTENTIOMETERS:	1
CHEST ANGULAR VELOCITY	
SENSORS:	3
PELVIS ACCELEROMETERS:	3
RIB DISPLACEMENT	
POTENTIOMETERS:	NA
RESTRAINT SYSTEM:	THREE-POINT UNIBELT

VEHICLE INSTRUMENTATION LOCATIONS AND DATA SUMMARY

TEST NUMBER 930623

No. LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX G MSEC	NEGATIVE DIRECTION MAX G MSEC
1 CENTER OF GRAVITY ACCELERATION (g) LONGITUDINAL ¹ LATERAL ¹ VERTICAL ¹ RESULTANT ¹	107.5	0.0	26.8	7.3 921.7 13.0 776.0 15.6 1722.9 26.8 893.5	10.8 2545.6 18.1 2528.7 25.4 893.4
2 CENTER OF GRAVITY (°/sec) ROLL (X-AXIS) PITCH (Y-AXIS) ¹ YAW (Z-AXIS) ¹	72.0	0.4	35.0	23.3 85.3 138.6 951.2 124.5 924.7	449.1 1587.5 180.1 923.8 74.8 1746.2
3 LEFT FRONT SUSPENSION DISPLACEMENT (in) VERTICAL	148.8	22.2	40.9	0.6 162.1	7.6 1535.6
4 RIGHT FRONT SUSPENSION DISPLACEMENT (in) VERTICAL	147.2	-22.4	41.0	0.1 239.7	6.9 1757.2

VEHICLE INSTRUMENTATION LOCATIONS AND DATA SUMMARY CONTINUED

TEST NUMBER 930623

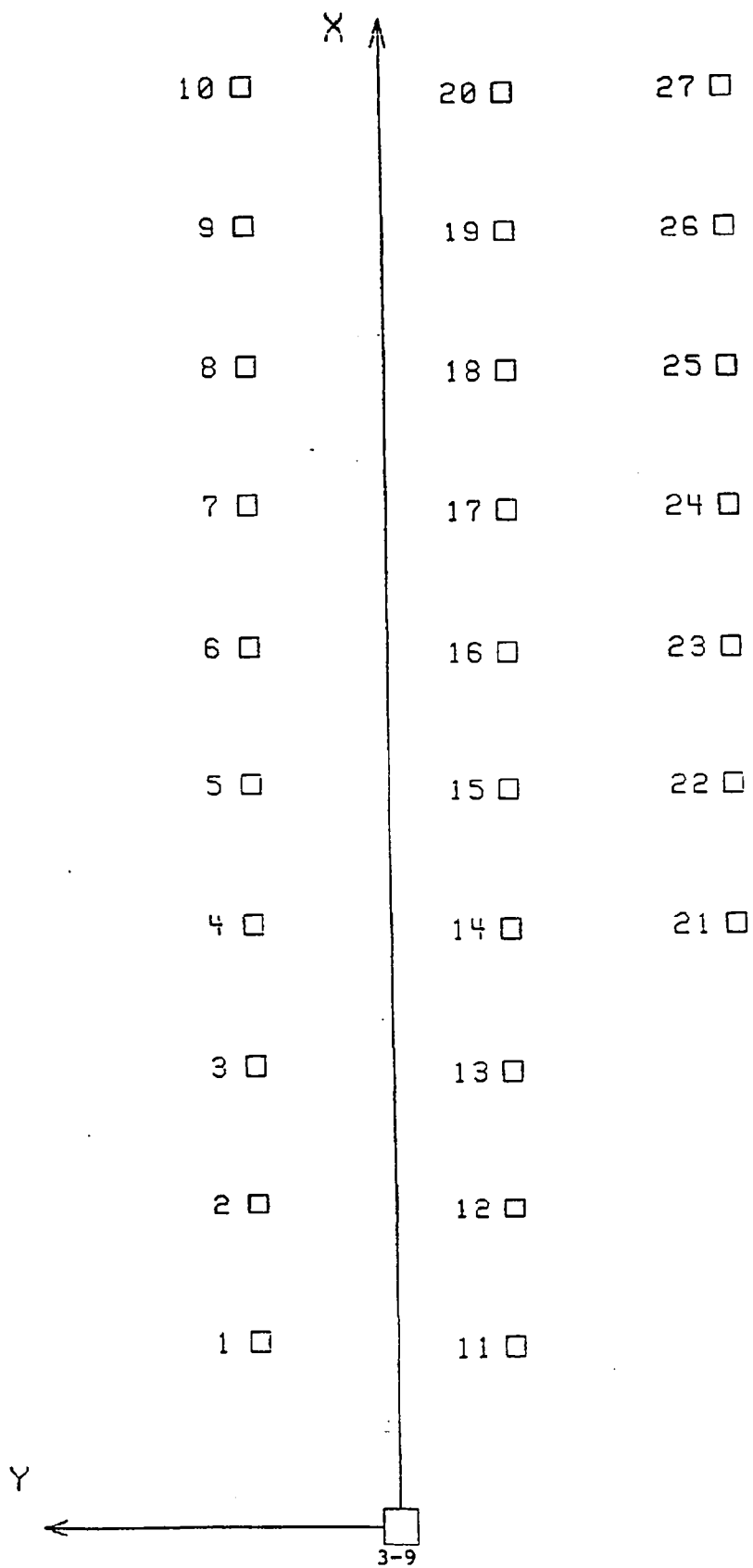
No. LOCATION	X*	Y*	Z*	POSITIVE		NEGATIVE	
				DIRECTION	MAX G MSEC	DIRECTION	MAX G MSEC
5 LEFT REAR SUSPENSION DISPLACEMENT (in) VERTICAL	47.8	21.5	46.0	1.2	1749.3	8.3	1552.7
6 RIGHT REAR SUSPENSION DISPLACEMENT (in) VERTICAL	46.5	-22.0	45.9	1.5	1622.9	10.5	1763.6

* 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: + OUTWARD

¹See DATA ACQUISITION EXPLANATIONS

STADIA POLE LAYOUT AND NUMBERING SYSTEM



STADIA POLE LOCATIONS

POLE NO.	X DISTANCE ¹	Y DISTANCE ¹
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	-8.0
12	43.0	-8.0
13	51.0	-8.0
14	59.0	-8.0
15	67.0	-8.0
16	75.0	-8.0
17	83.0	-8.0
18	91.0	-8.0
19	99.0	-8.0
20	107.0	-8.0
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

¹ REFERENCE: +X: FORWARD FROM RELEASE BLOCK

+Y: LEFTWARD FROM CENTER RELEASE BLOCK

All measurements are in feet.

HIGH-SPEED CAMERA LOCATIONS

<u>OFFBOARD</u>			
CAMERA NO.	X ¹	Y ¹	Z ¹
2	88.8	174.3	3.3
3	199.5	105.4	3.7
4	193.0	0.0	3.6
5	NA	NA	NA

¹REFERENCE:

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

<u>ONBOARD</u>			
CAMERA NO.	X ²	Y ²	Z ²
7	1.0	-1.2	2.5
8	0.8	-1.1	3.5

²REFERENCE:

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

All measurements are in feet.

MOTION PICTURE CAMERA INFORMATION

CAMERA NUMBER	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Left panning	Bolex	16	24	Real-time documentation
2	Left wide	Photosonic	13	498	Vehicle dynamics
3	Left angle	Photosonic	13	508	Vehicle dynamics
4	Downstream	Photosonic	25	498	Vehicle dynamics
5	Right wide	Photosonic	13	500	Vehicle dynamics
6	Overhead	Photosonic	8	495	Vehicle dynamics
7	Onboard-front	Photosonic	8	500	Dummy kinematics
8	Onboard-rear	Photosonic	8	502	Dummy kinematics

SECTION 4.0

OCCUPANT INFORMATION

POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	<u>DRIVER #043</u>	<u>PASSENGER # NA</u>
HEAD	<u>Head liner</u>	<u></u>
CHEST	<u>None</u>	<u></u>
ABDOMEN	<u>None</u>	<u></u>
LEFT KNEE	<u>Instrument panel</u>	<u></u>
RIGHT KNEE	<u>Instrument panel</u>	<u></u>

DOOR OPENING:

	<u>LEFT</u>	<u>RIGHT</u>
FRONT	<u>Tools required</u>	<u>Tools required</u>
REAR	<u>NA</u>	<u>NA</u>

SEAT MOVEMENT:

	<u>SEAT BACK FAILURE</u>	<u>SEAT SHIFT</u>
FRONT	<u>None</u>	<u>None</u>
REAR	<u>NA</u>	<u>NA</u>

GLAZING DAMAGE:

All vehicle glazing was broken during the crash test.

OTHER NOTABLE IMPACT EFFECTS:

The right front and rear tires deflated during the

crash test.

KINEMATIC SUMMARY

The vehicle struck the ground at the junction of the roof and the passenger's side A- and B-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 vehicle then rolled fully onto its top collapsing the driver side of the roof onto the dummy's head. The vehicle next rolled onto its driver's side and then bounced onto all four wheels as the roll cart came to a stop. The vehicle next bounced onto the passenger's side. The dummy's head, arms, and hands translated to the right. The vehicle then rolled onto all four wheels. The dummy then landed in the driver's seat. The vehicle rolled forward approximately 700° total. The dummy was restrained with a three-point unbelt. The dummy's Head Injury Criteria, HIC, was 765, its maximum chest acceleration resultant over three milliseconds was 70.3 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.

One Part 572 E 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 load cells in the neck. The head and chest were also instrumented with angular velocity sensors. The head was instrumented with six (6) additional accelerometers to form a 9-accelerator array. 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 not adjustable. The dummy was positioned in the seat according to the dummy placement procedure specified in Appendix B and Optional Appendix C of Laboratory Procedure TP-208-09. The H-point location of the seat was obtained by using the SAE J211 OCT88 H-point machine. The driver dummy was restrained with a three-point unbelt.

DUMMY DATA SUMMARY

TEST NUMBER 930623

DRIVER DUMMY

SN: 043

POSITIVE DIRECTION MAX	NEGATIVE DIRECTION MAX	MSEC	MSEC
------------------------------	------------------------------	------	------

HEAD ACCELERATION (g)

LONGITUDINAL	32.4	904.5	63.0	896.5
LATERAL	56.8	899.7	60.9	907.4
VERTICAL	21.5	978.4	112.9	896.4
RESULTANT	131.1	896.4		
HIC		765	FROM 890.7	TO 908.4

HEAD ARRAY 1 (g)

LONGITUDINAL	41.3	930.0	47.5	891.9
VERTICAL	---	---	---	---

HEAD ARRAY 2 (g)

LATERAL	38.9	898.6	50.1	904.7
VERTICAL	28.5	977.8	140.8	898.4

HEAD ARRAY 3 (g)

LONGITUDINAL	61.0	930.2	227.5	954.4
LATERAL	105.0	891.7	129.6	888.1

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 930623

DRIVER DUMMY
SN: 043

	POSITIVE DIRECTION MAX	NEGATIVE DIRECTION MAX	MSEC
--	------------------------------	------------------------------	------

HEAD ANGULAR VELOCITY (RAD/S)			
LONGITUDINAL	30.5	910.3	16.5 2556.0
LATERAL	27.0	897.1	22.6 1806.1
VERTICAL	15.5	893.2	16.1 1810.4
NECK FORCES (lbs)			
LONGITUDINAL ¹	200.2	976.5	835.5 900.8
LATERAL ¹	323.1	977.8	2147.2 901.6
VERTICAL ¹	1774.4	900.0	--- ---
NECK MOMENT (ft-lbs)			
ABOUT LONG. ¹	232.9	902.3	132.1 979.6
ABOUT LATERAL ¹	230.7	902.7	6.0 2685.1
ABOUT VERTICAL ¹	39.8	982.3	13.1 1875.0
CHEST ACCELERATION (g)			
LONGITUDINAL	17.9	919.0	19.7 903.9
LATERAL	8.0	1568.0	76.6 899.1
VERTICAL	9.1	920.9	20.1 902.0
RESULTANT	78.6	899.1	
3 MSEC	70.3		

CORRECTED

DUMMY DATA SUMMARY CONTINUED

TEST NUMBER 930623

DRIVER DUMMY
SN: 043

POSITIVE DIRECTION MAX	NEGATIVE DIRECTION MAX	MSEC
------------------------------	------------------------------	------

CHEST ANGULAR VELOCITY (RAD/S)

LONGITUDINAL	20.1	912.2	8.9	1807.4
LATERAL	13.3	903.0	9.3	934.9
VERTICAL	9.3	904.1	8.8	976.0

CHEST DEFLECTION (in)

LONGITUDINAL	0.2	908.8	0.3	825.3
--------------	-----	-------	-----	-------

PELVIS ACCELERATION (g)

LONGITUDINAL	10.8	941.8	21.2	2548.3
LATERAL	10.9	1831.9	14.8	991.3
VERTICAL	15.6	943.8	46.7	900.9
RESULTANT	46.9	900.9		

POSITIVE DIRECTION

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

NEGATIVE DIRECTION

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

1500 DATA ACQUISITION EXPLANATIONS

DUMMY AND SEAT POSITIONING DATA

MAKE/MODEL/BODY STYLE: Nissan/Pickup truck

SEAT TYPE: Bench
 X Bucket
 Split bench

ADJUSTER TYPE: X Manual
 Power
 Non-adjustable

SEAT BACK TYPE: X Non-adjustable
 Adjustable reclining

TECHNICIANS:

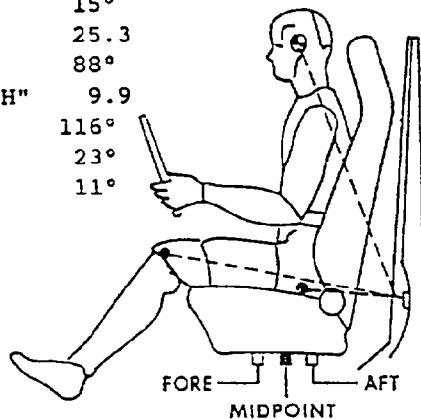
1. R. Branham
2. B. Crabtree
3.

POSITIONING DATE: 06/23/93

TIME: 1406 TEMPERATURE: 77° F

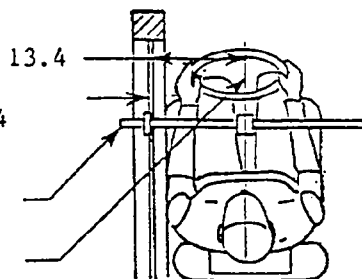
DRIVER DUMMY¹ # 043 TYPE: SID

HEAD 22.3
TARGET 15°
KNEE 25.3
JOINT 88°
APPROX. "H" 9.9
POINT 116°
PELVIS 23°
SEATBACK 11°



DOOR GLASS
HEIGHT = 9.4

LATERAL BAR
ADJUSTABLE
POINTER



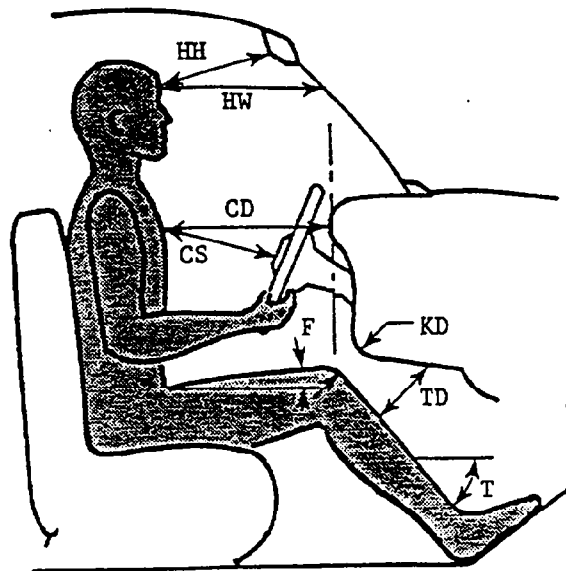
¹Driver dummy measurements are referenced to top of front door striker for 4-door vehicles.

ALL ANGLES ARE REFERENCED TO VERTICAL.

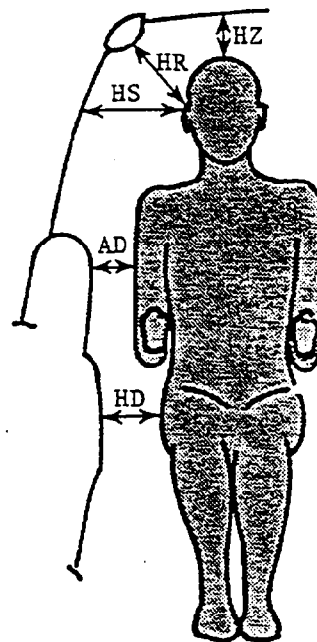
ALL DISTANCE MEASUREMENTS ARE IN INCHES.

DUMMY IN-VEHICLE POSITIONING DATA

	DRIVER 043	PASSENGER NA
HH	16.9	
HW	23.4	
CD	23.2	
CS	12.8	
KDL	6.4	
KDR	4.6	
FL	14°	
FR	15°	
TDL	5.8	
TDR	5.3	
TL	40°	
TR	42°	



	DRIVER 043	PASSENGER NA
HR	8.1	
HS	9.8	
AD	3.1	
HD	5.9	
HZ	4.6	



All distance measurements are in inches.

APPENDIX A

PHOTOGRAPHS

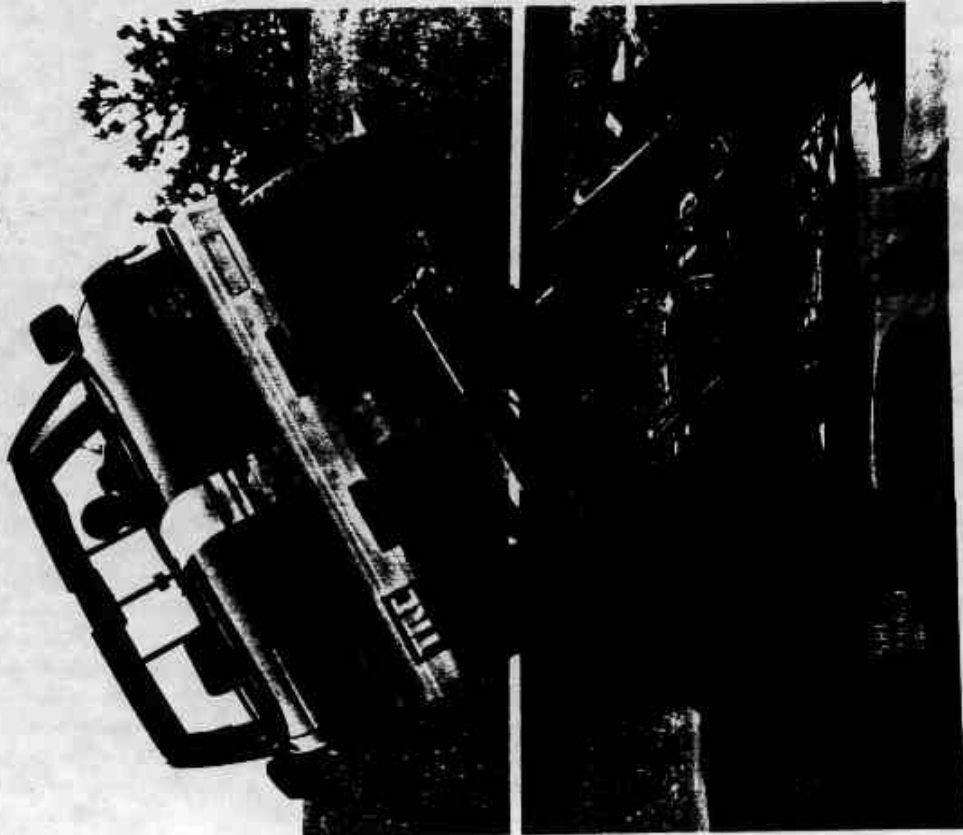


Figure A-1. PRE-TEST FRONT VIEW

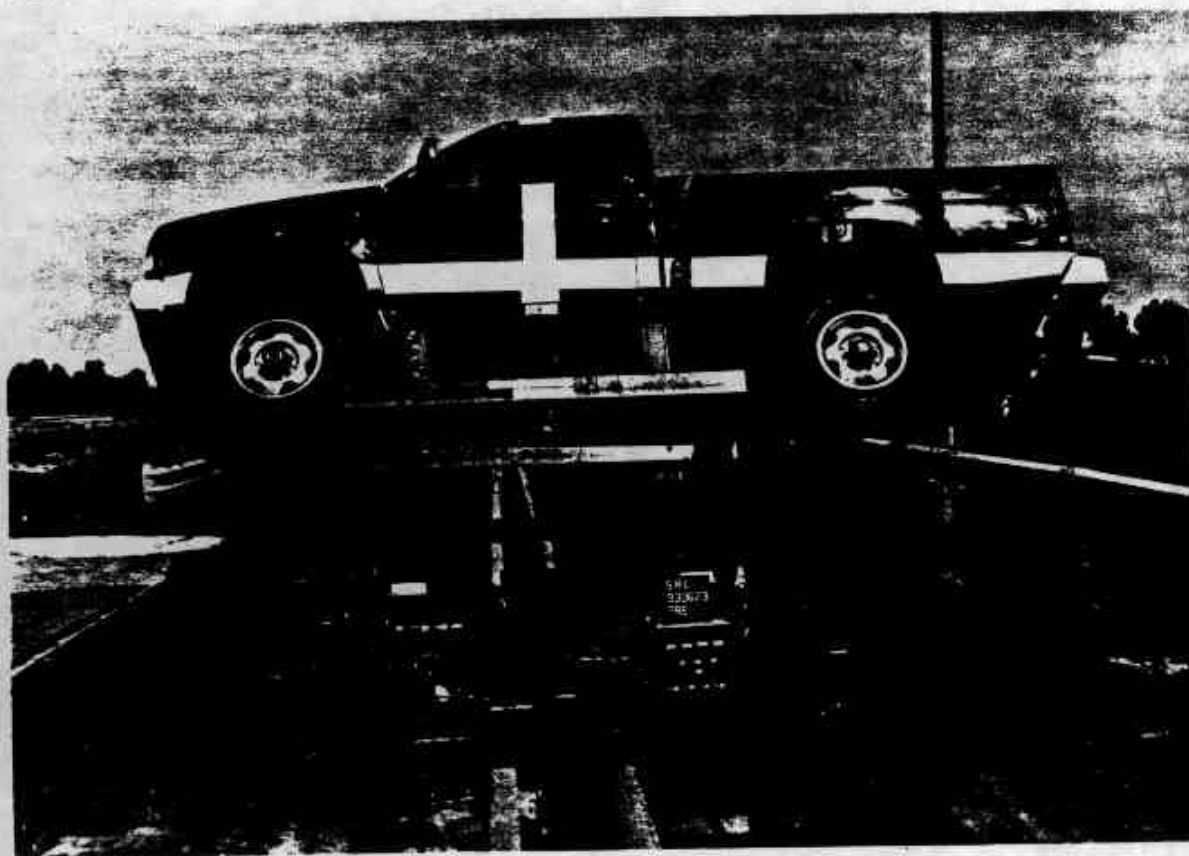


Figure A-2. PRE-TEST LEFT SIDE VIEW

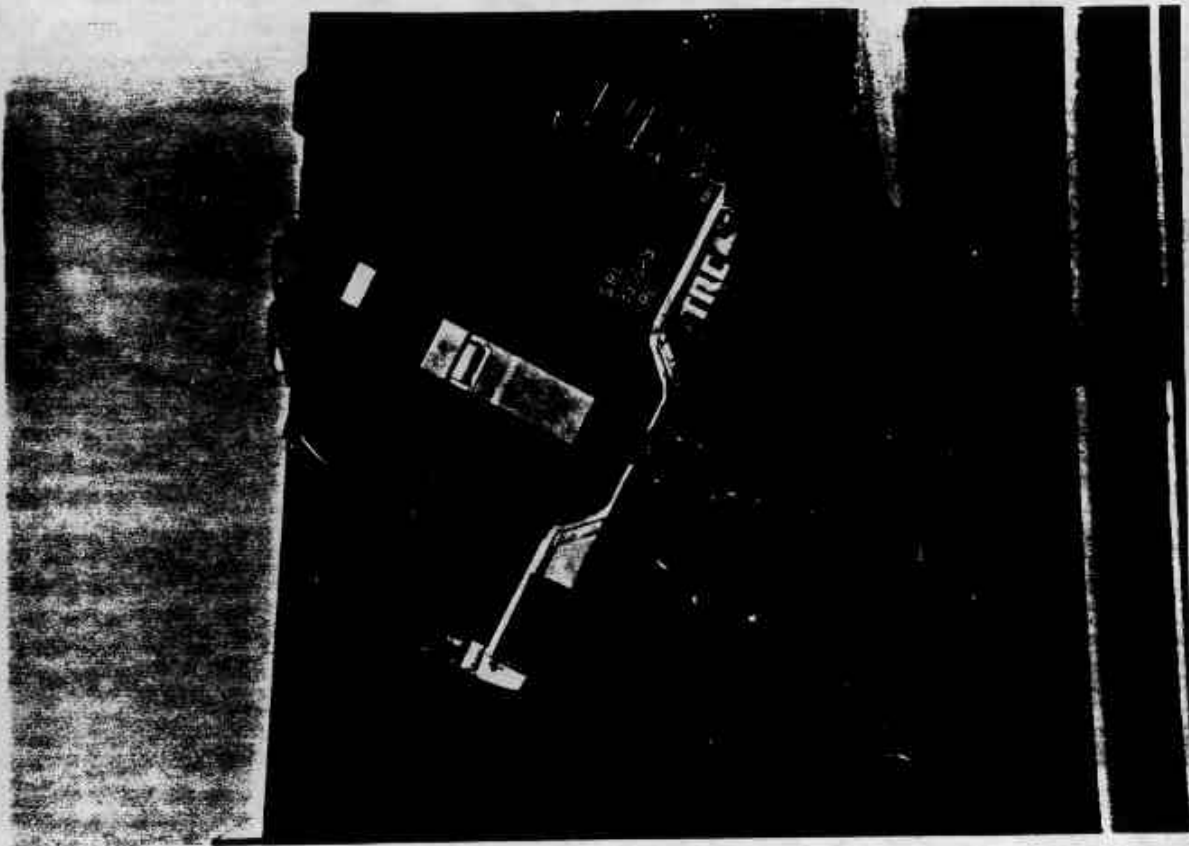


Figure A-3. PRE-TEST REAR VIEW



Figure A-4. PRE-TEST RIGHT SIDE VIEW



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

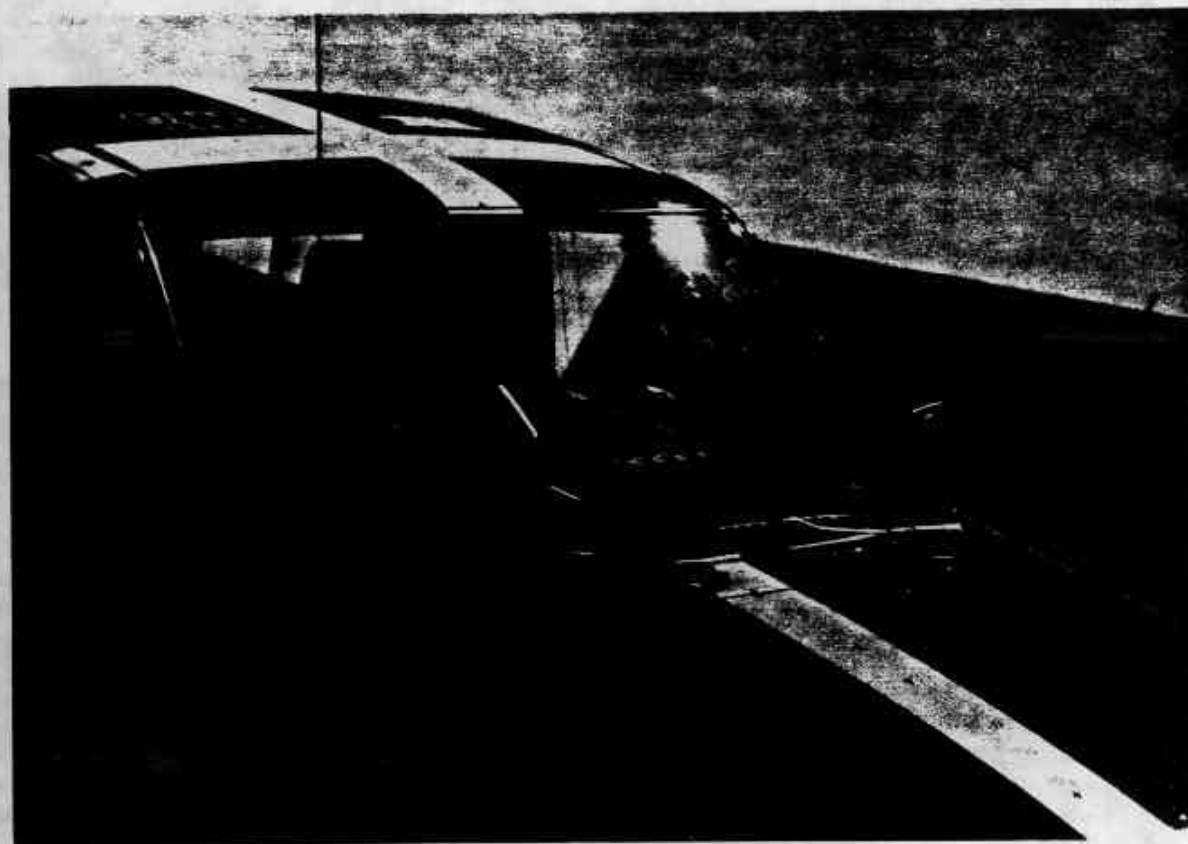


Figure A-6. PRE-TEST DRIVER DUMMY - VIEW 2

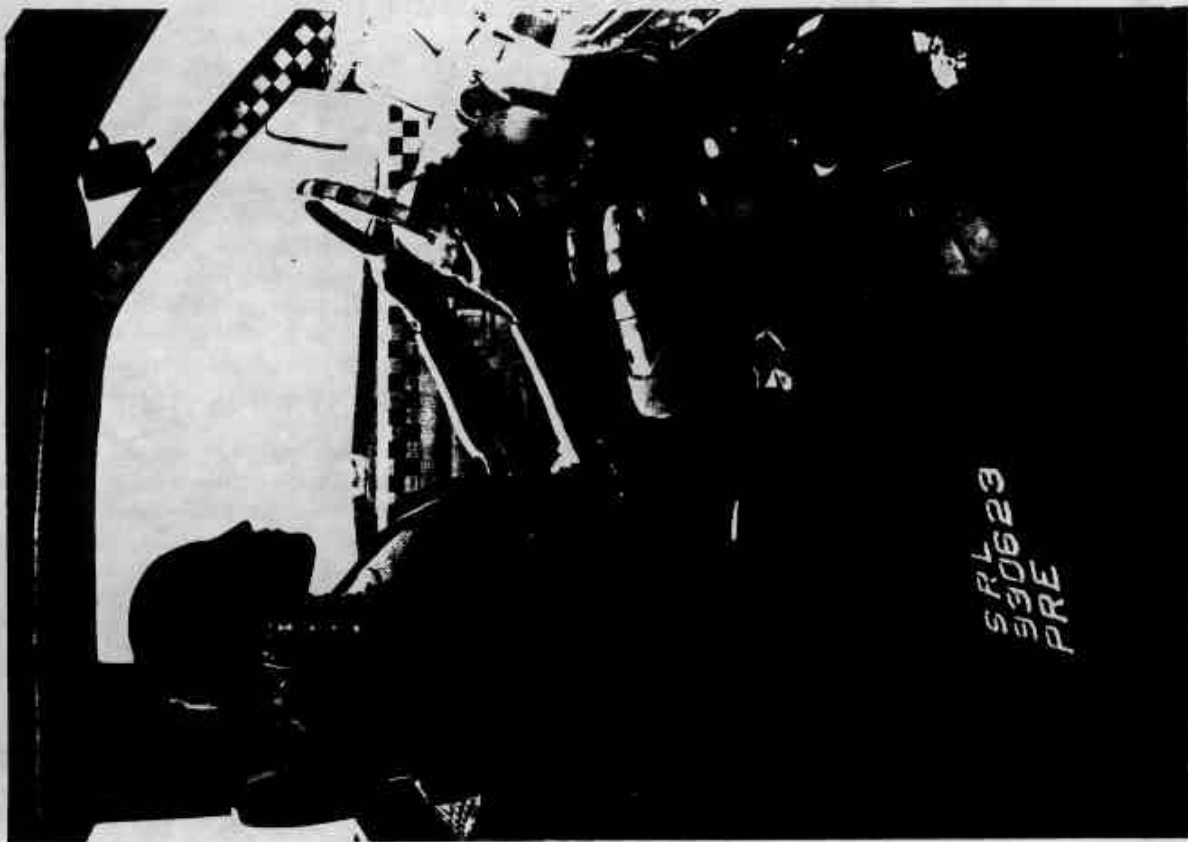


Figure A-7. PRE-TEST DRIVER DUMMY - VIEW 3

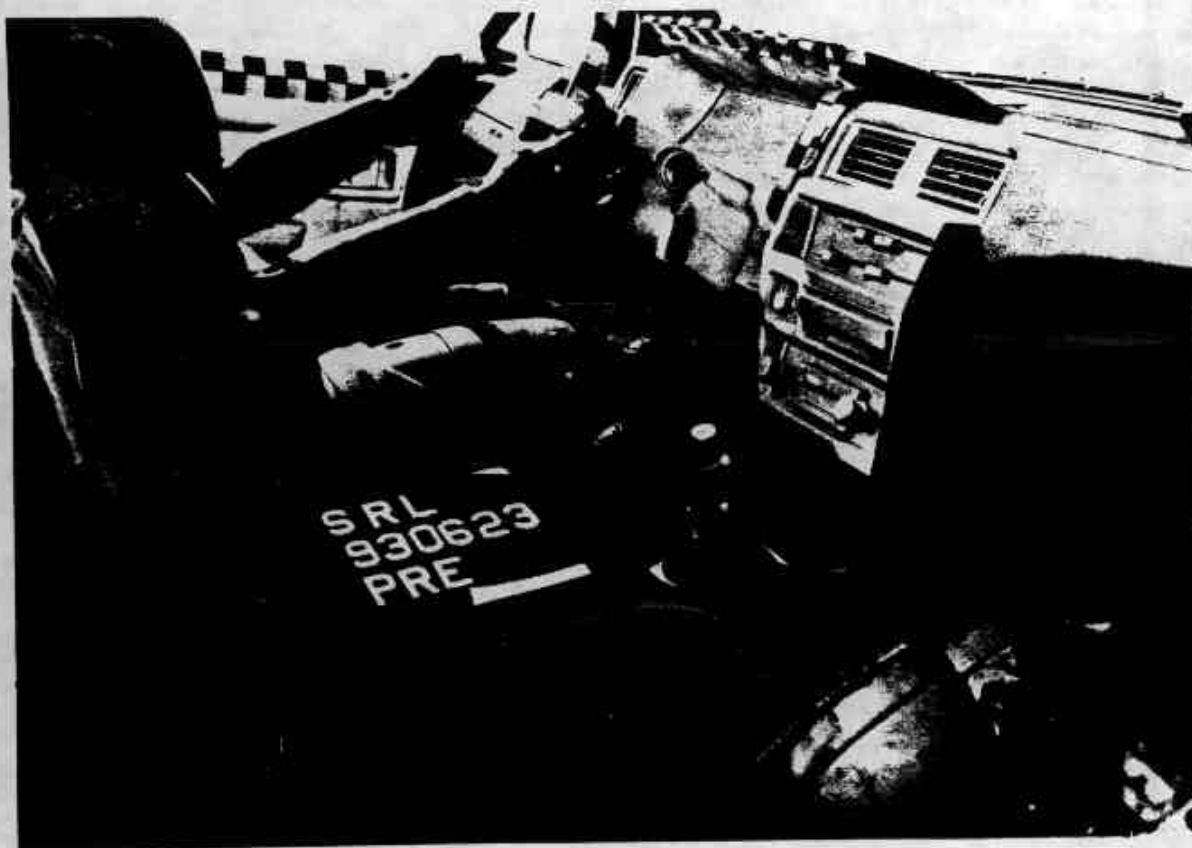


Figure A-8. PRE-TEST DRIVER DUMMY - VIEW 4



Figure A-9. PRE-TEST DRIVER DUMMY - VIEW 5

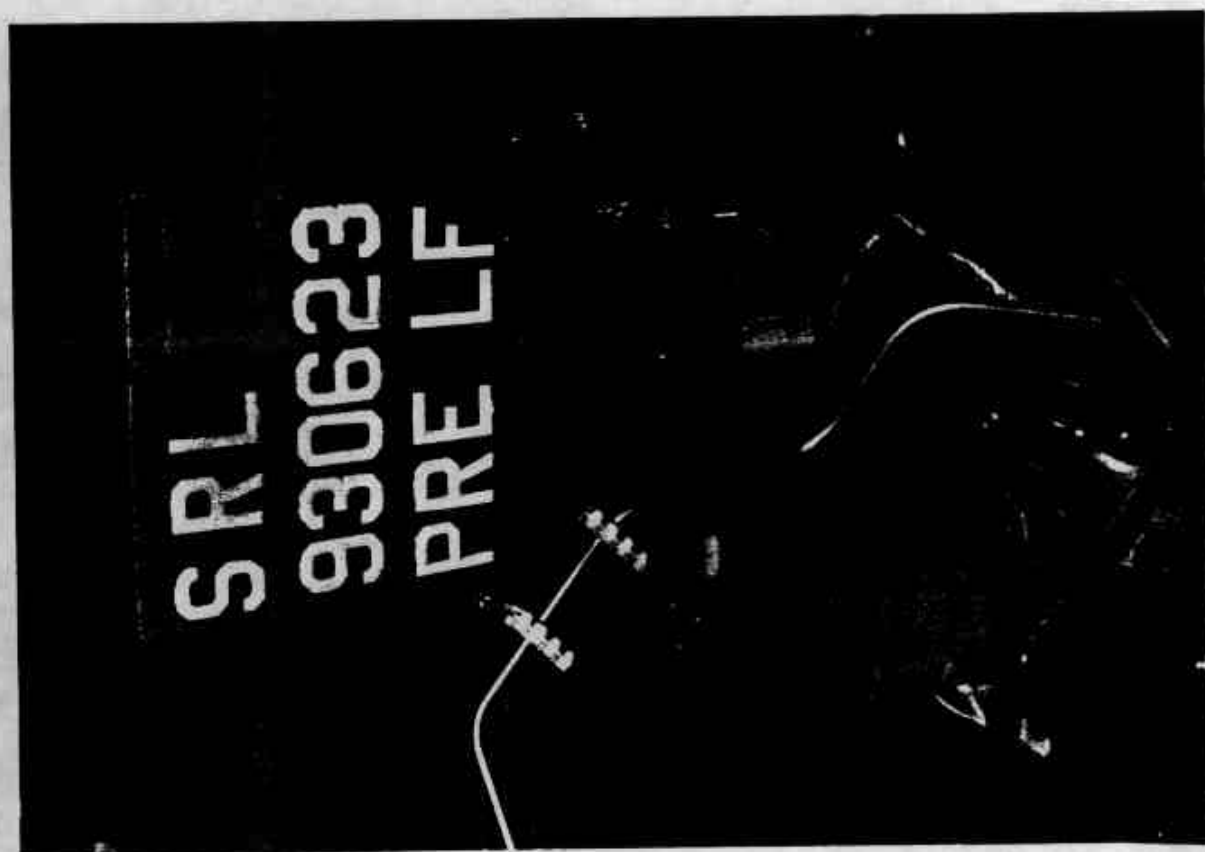


Figure A-10. PRE-TEST LEFT FRONT SUSPENSION STRING POTENTIOMETER-VIEW 1



Figure A-11. PRE-TEST LEFT FRONT SUSPENSION STRING POTENTIOMETER-VIEW 2



Figure A-12. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER-VIEW 1



Figure A-13. PRE-TEST RIGHT FRONT SUSPENSION STRING POTENTIOMETER-VIEW 2

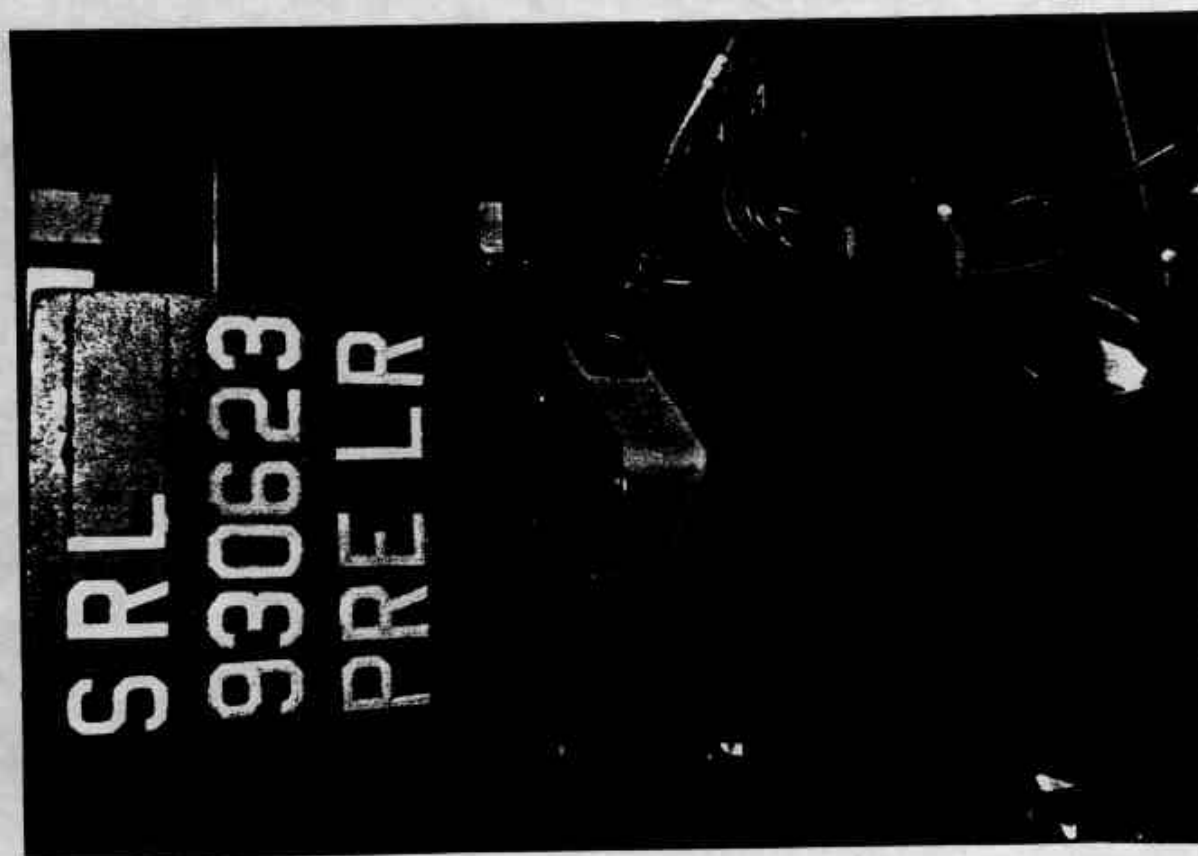


Figure A-14. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER-VIEW 1

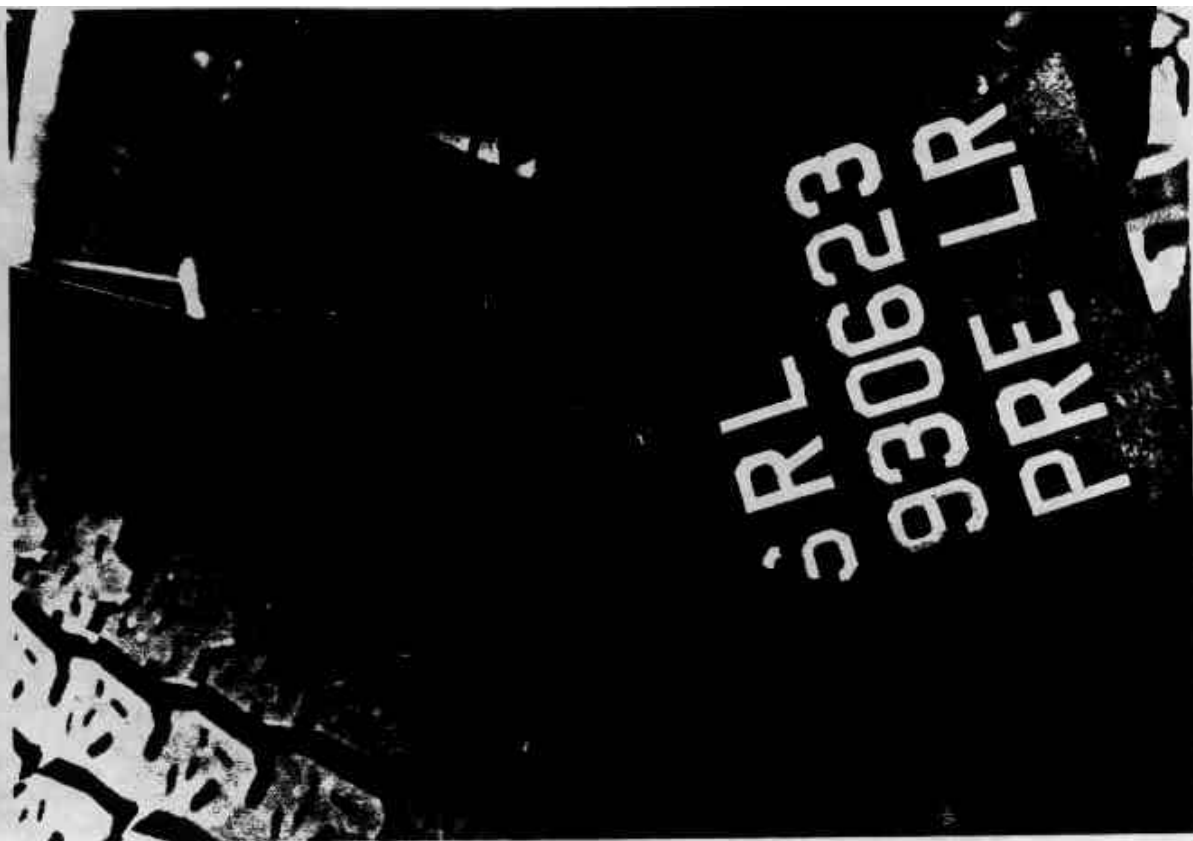


Figure A-15. PRE-TEST LEFT REAR SUSPENSION STRING POTENTIOMETER-VIEW 2

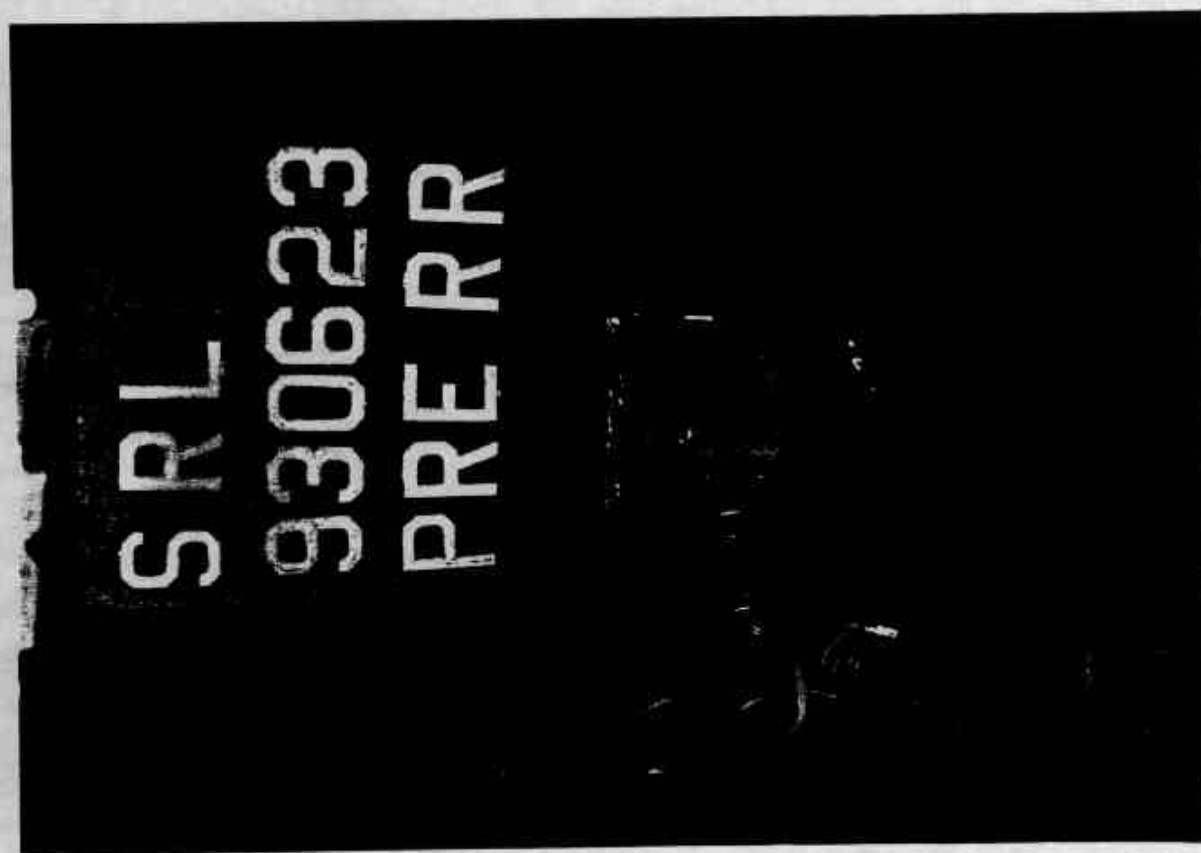


Figure A-16. PRE-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER-VIEW 1

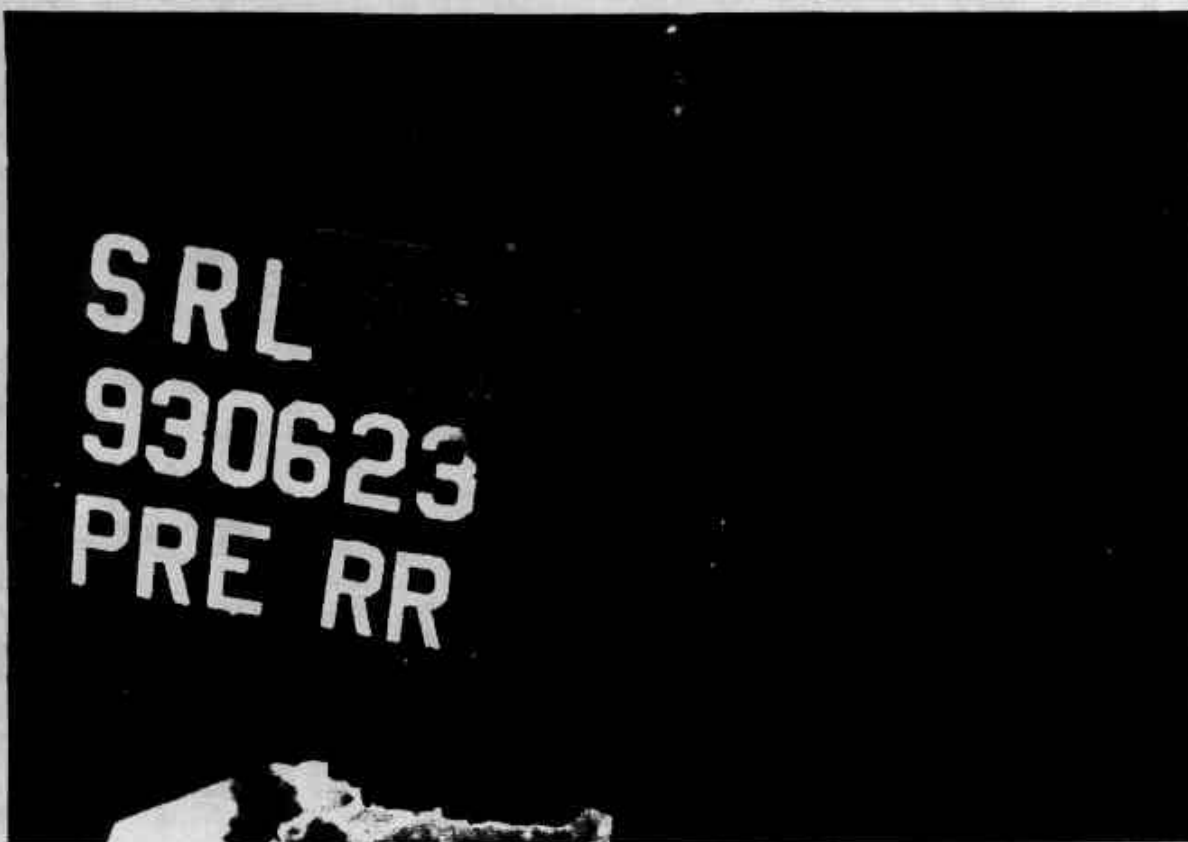


Figure A-17. POST-TEST RIGHT REAR SUSPENSION STRING POTENTIOMETER-VIEW 2

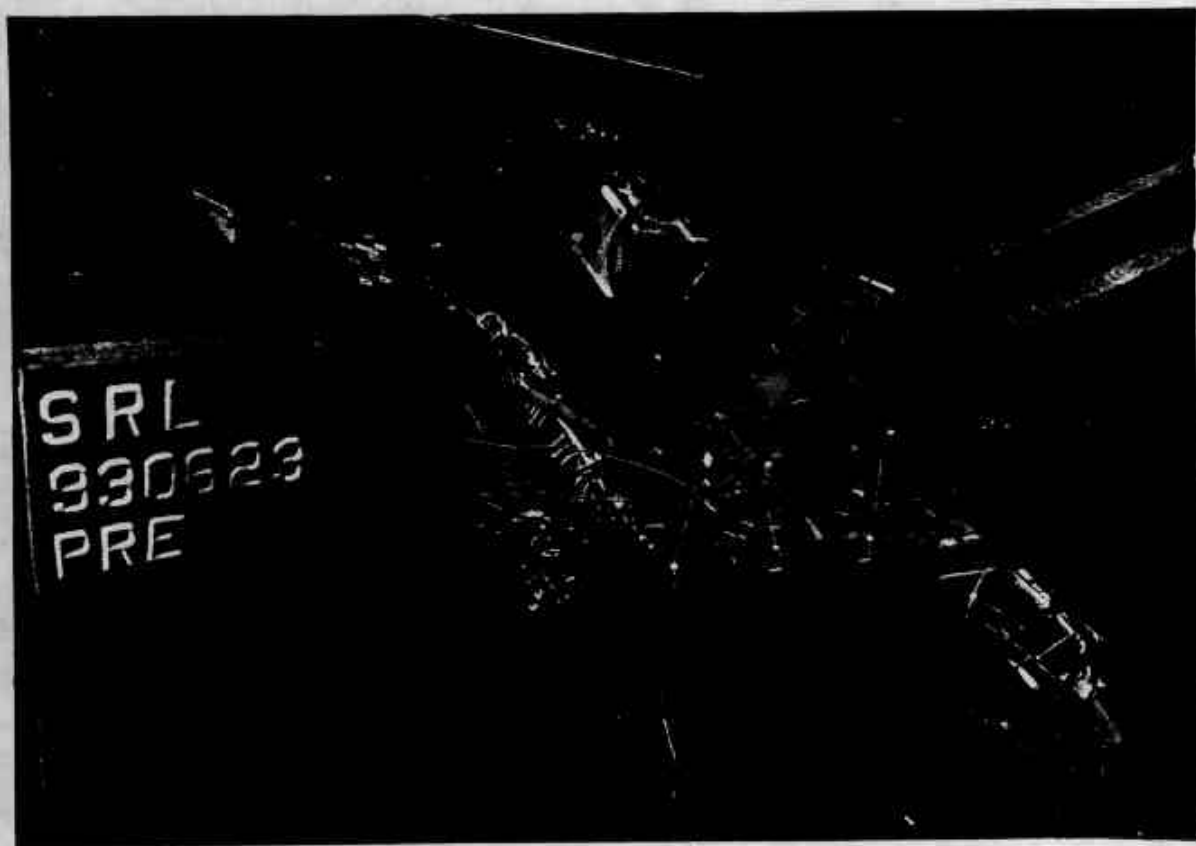


Figure A-18. PRE-TEST VEHICLE INSTRUMENTATION & BALLAST LOCATION VIEW

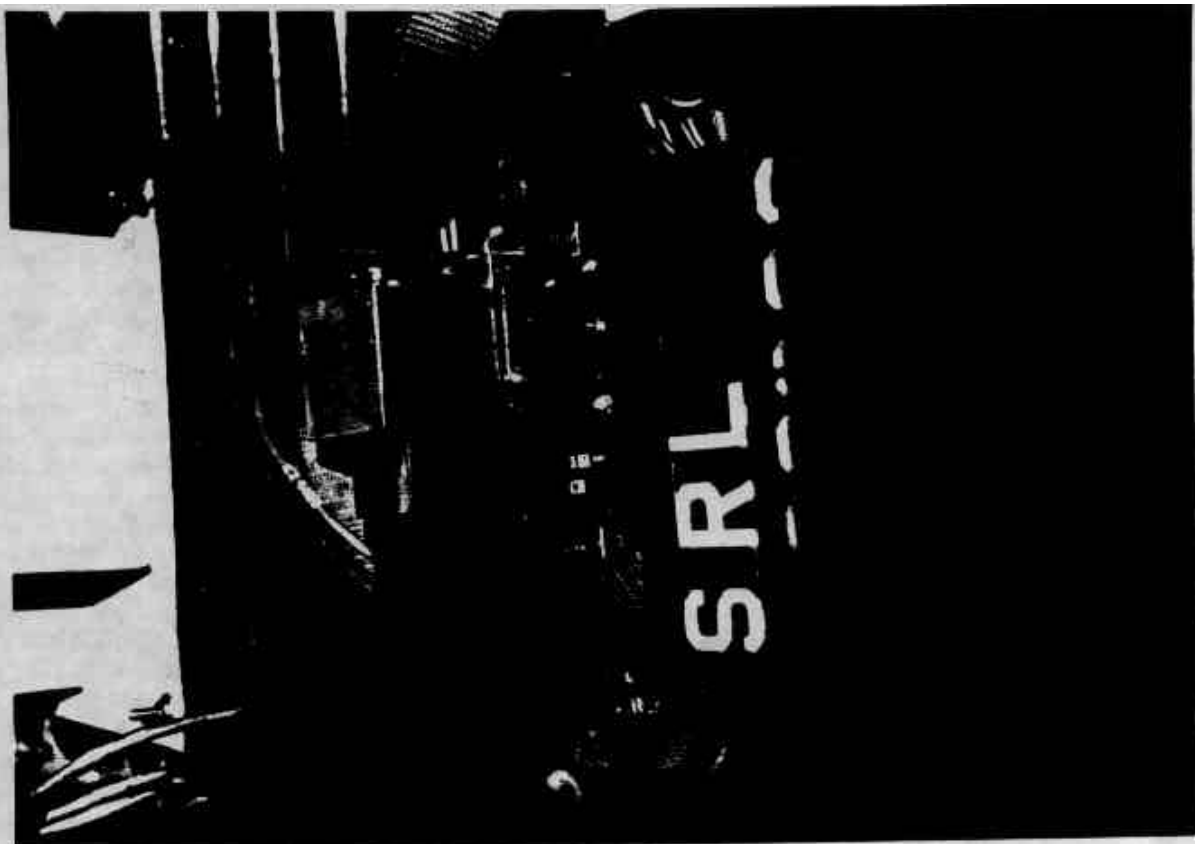


Figure A-19. PRE-TEST GYROSCOPE PLACEMENT VIEW

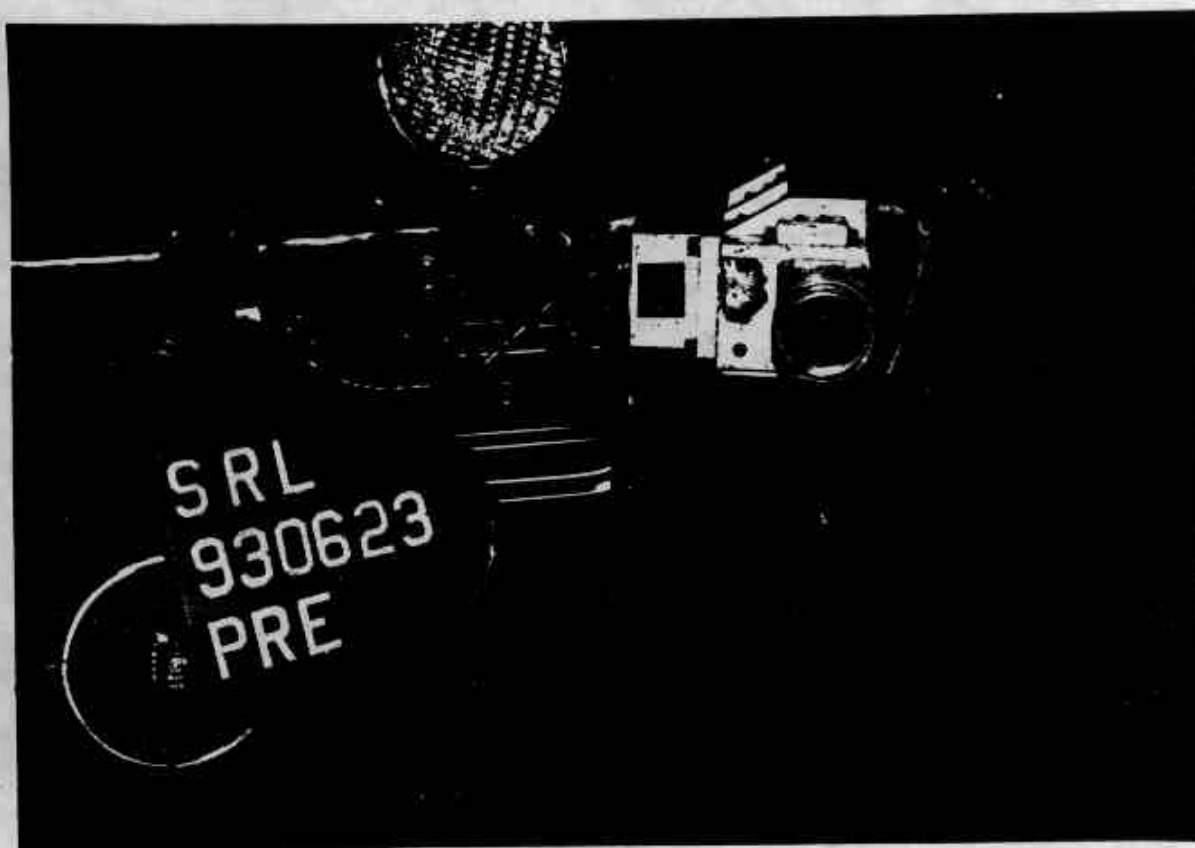


Figure A-20. PRE-TEST CAMERA LOCATION - VIEW 1



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

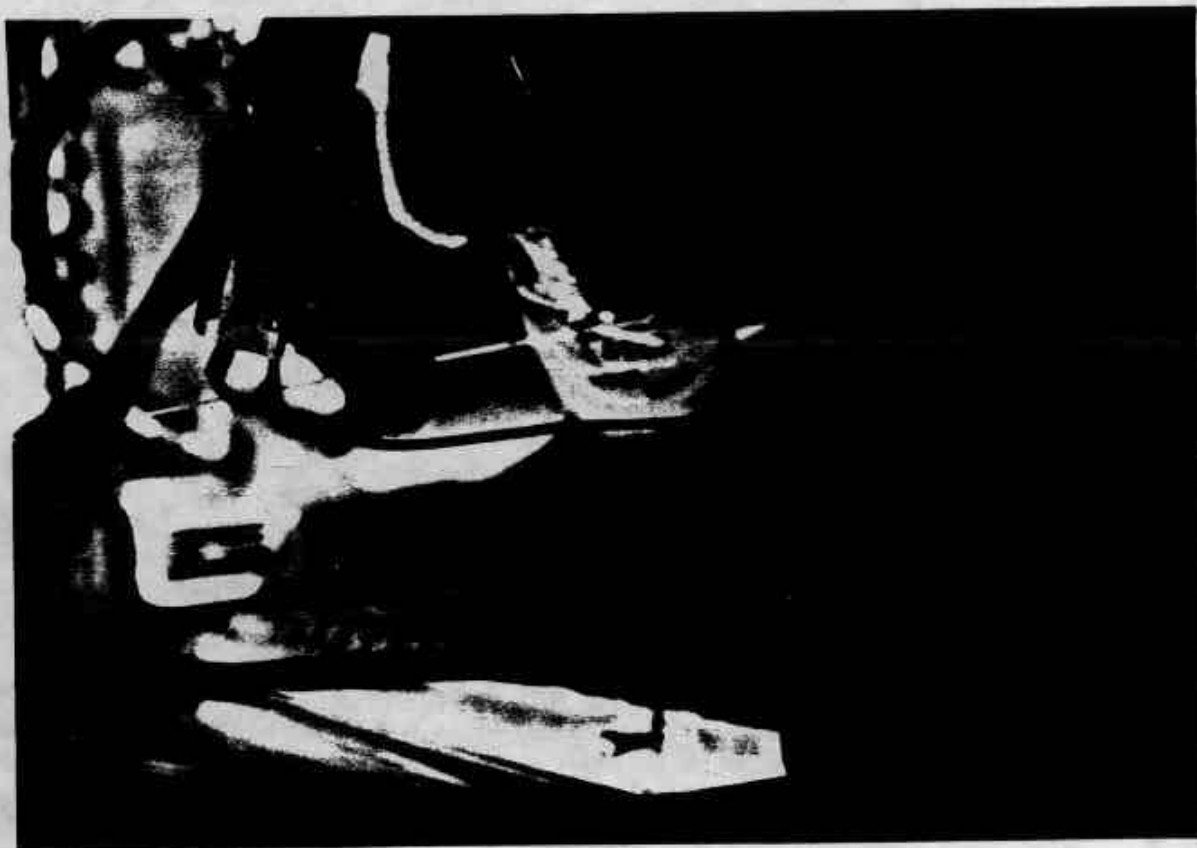


Figure A-22. PRE-TEST SEAT BELT STRING POTENTIOMETER VIEW



Figure A-23. POST-TEST FRONT VIEW

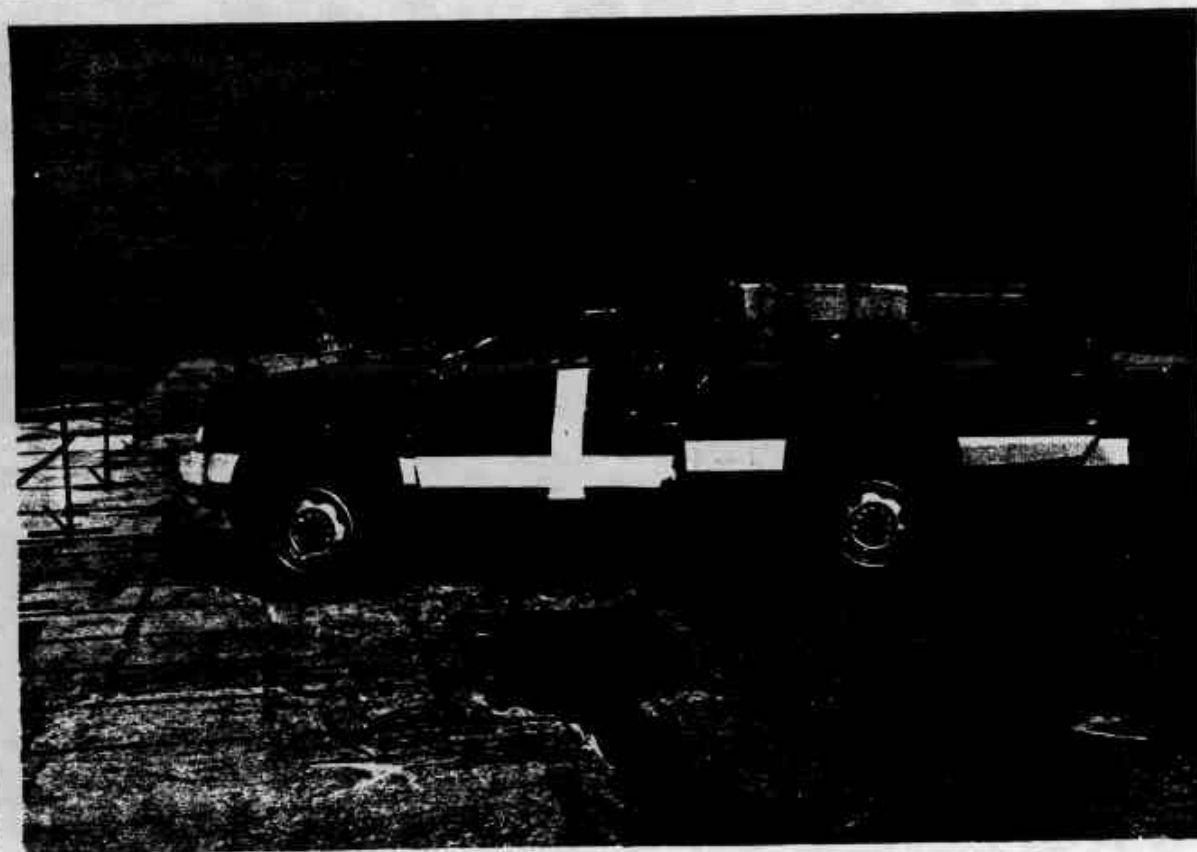


Figure A-24. POST-TEST LEFT SIDE VIEW

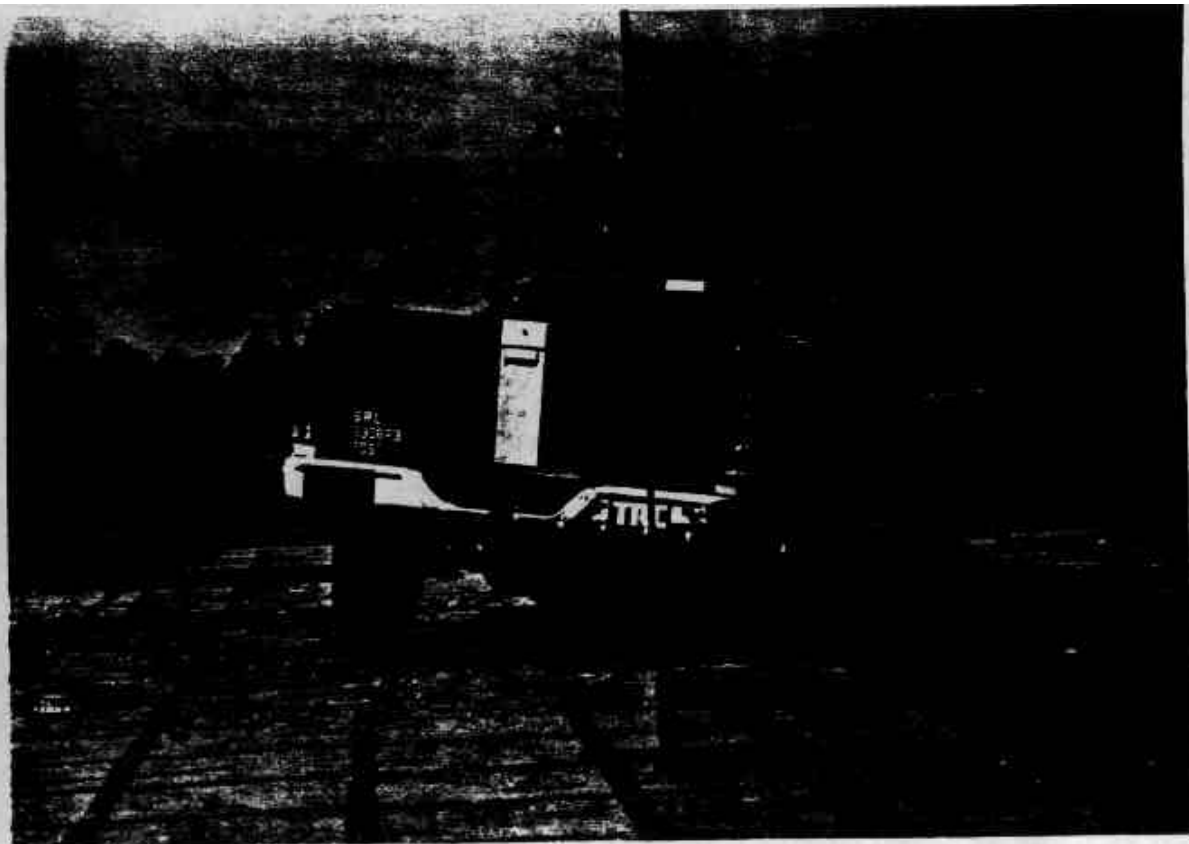


Figure A-25. POST-TEST REAR VIEW

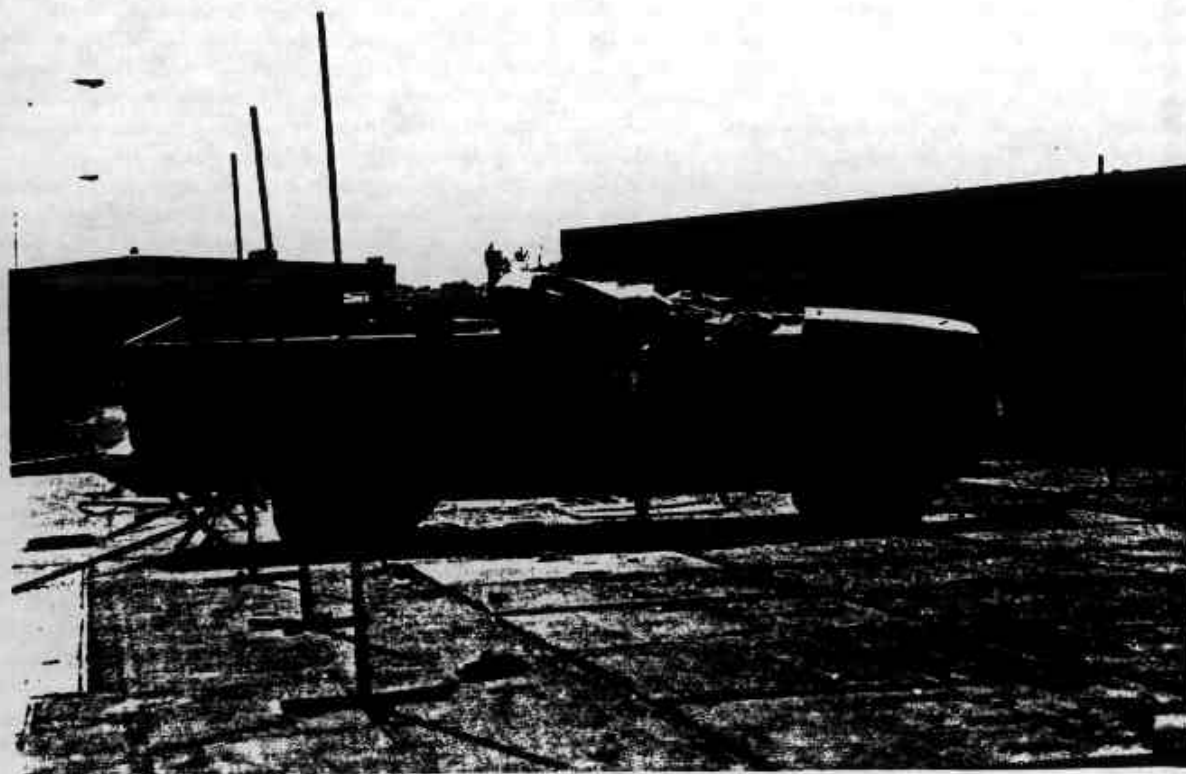


Figure A-26. POST-TEST RIGHT SIDE VIEW



Figure A-27. POST-TEST WINDSHIELD VIEW

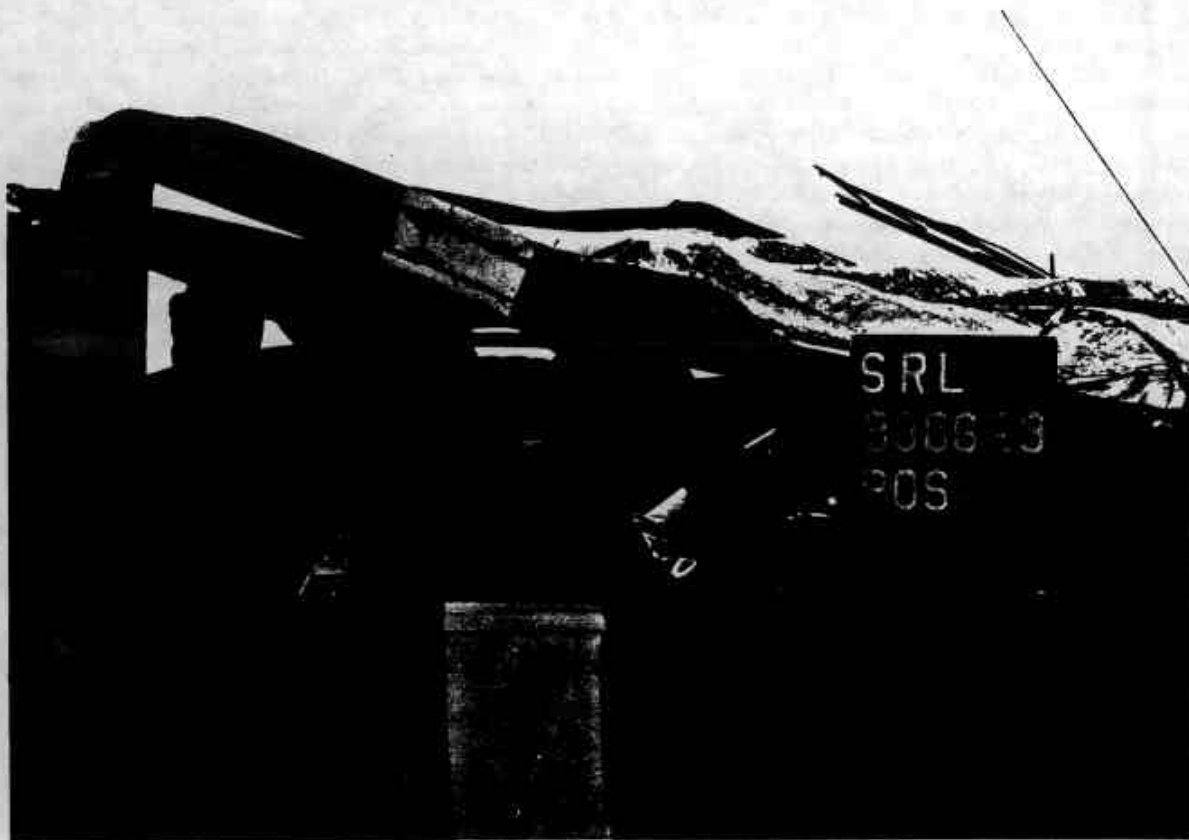


Figure A-28. POST-TEST DUMMY AND VEHICLE - VIEW 1

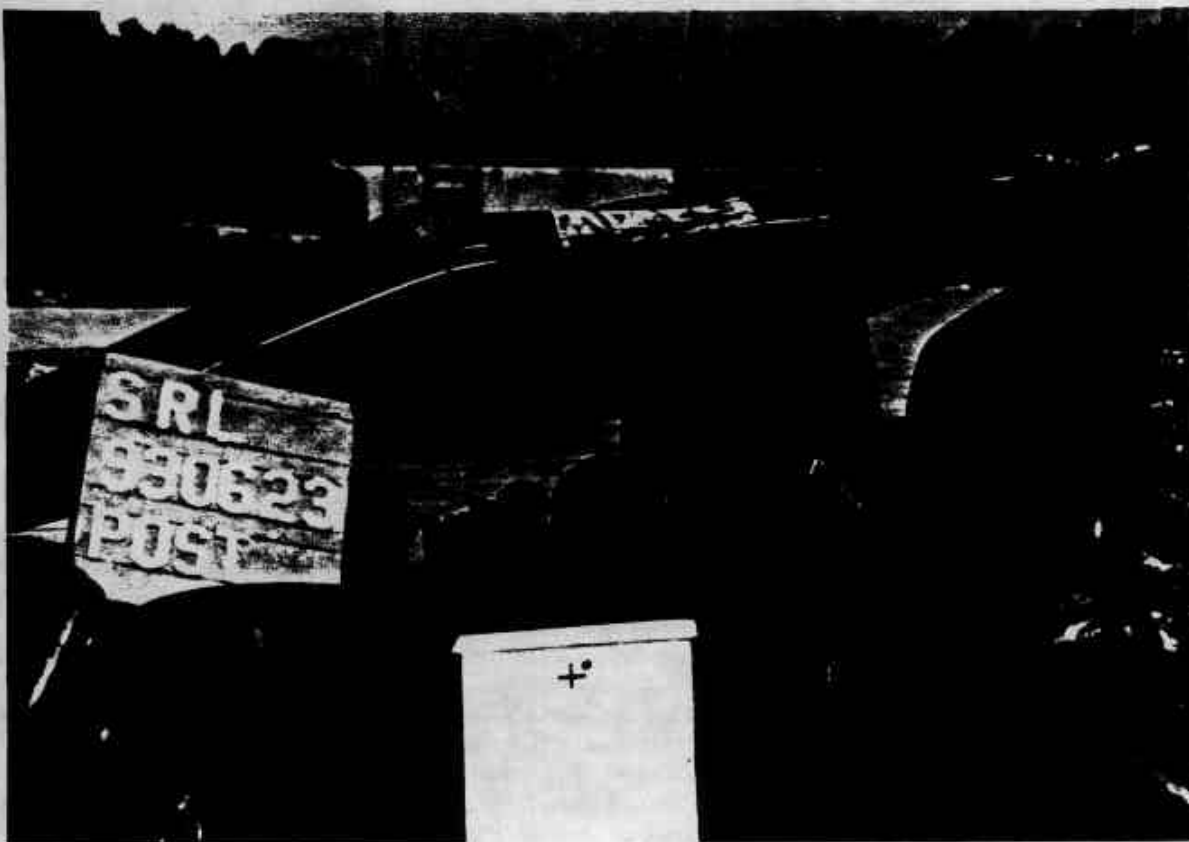


Figure A-29. POST-TEST DUMMY AND VEHICLE - VIEW 2



Figure A-30. POST-TEST DUMMY HEAD CONTACT - VIEW 1

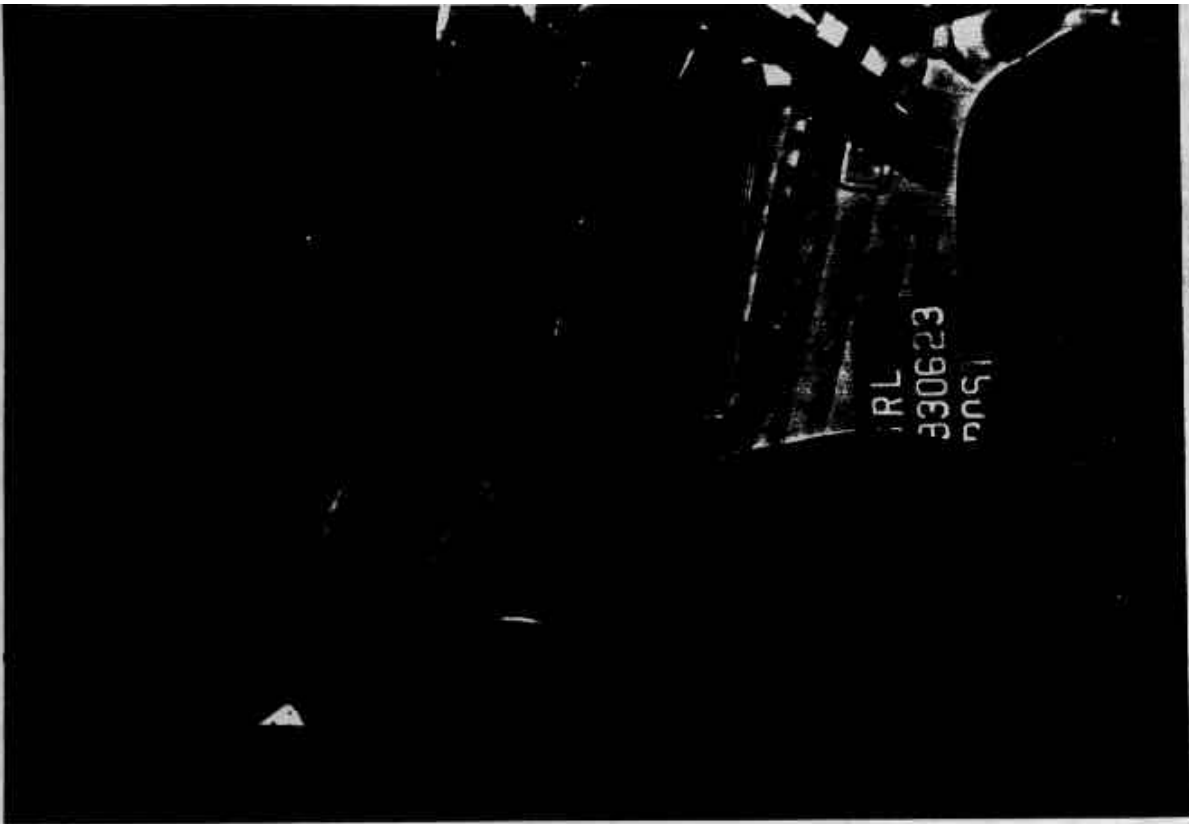


Figure A-31. POST-TEST DUMMY HEAD CONTACT - VIEW 2



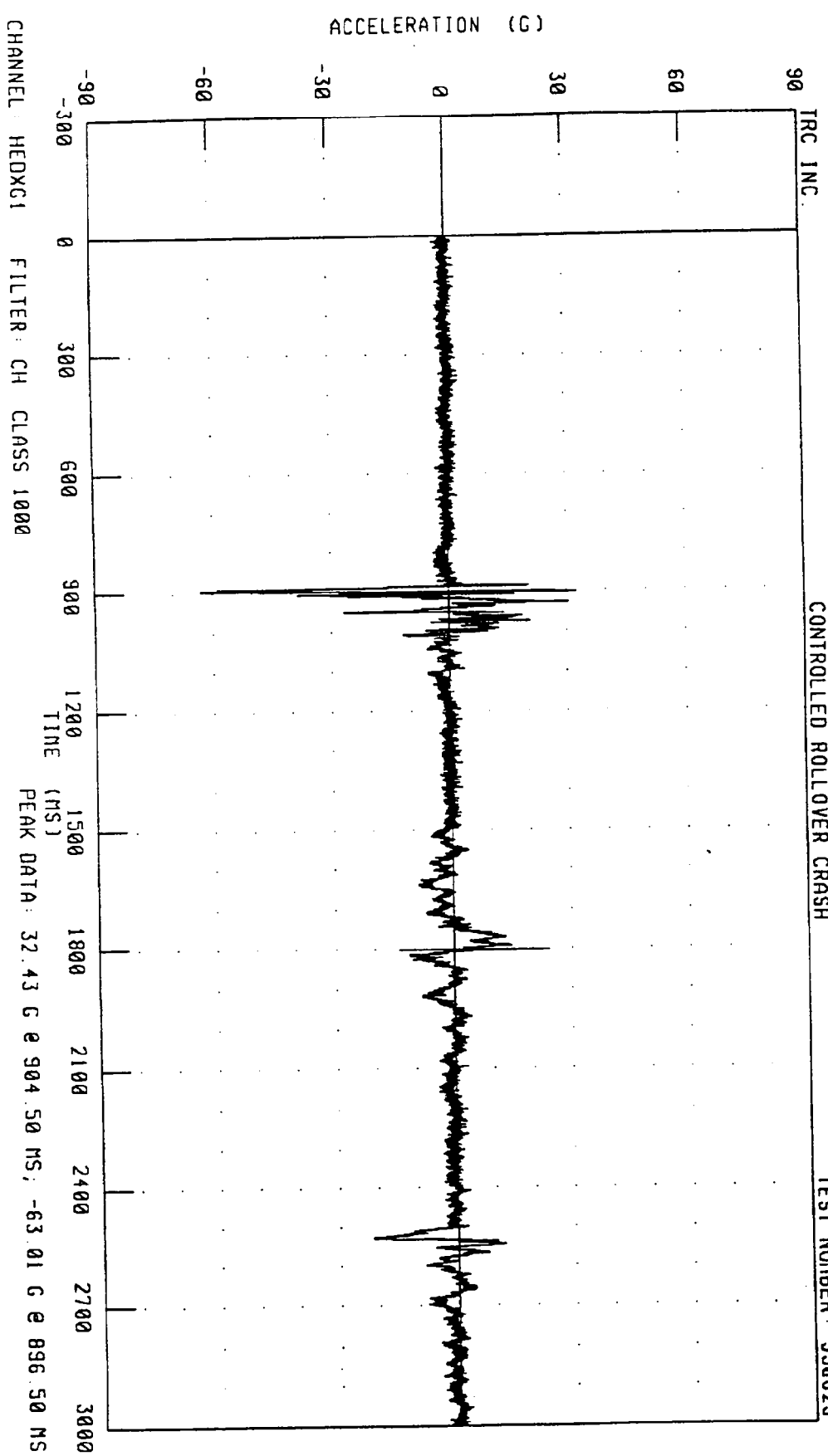
Figure A-32. POST-TEST DUMMY HEAD CONTACT - VIEW 3

APPENDIX B

DATA PLOTS

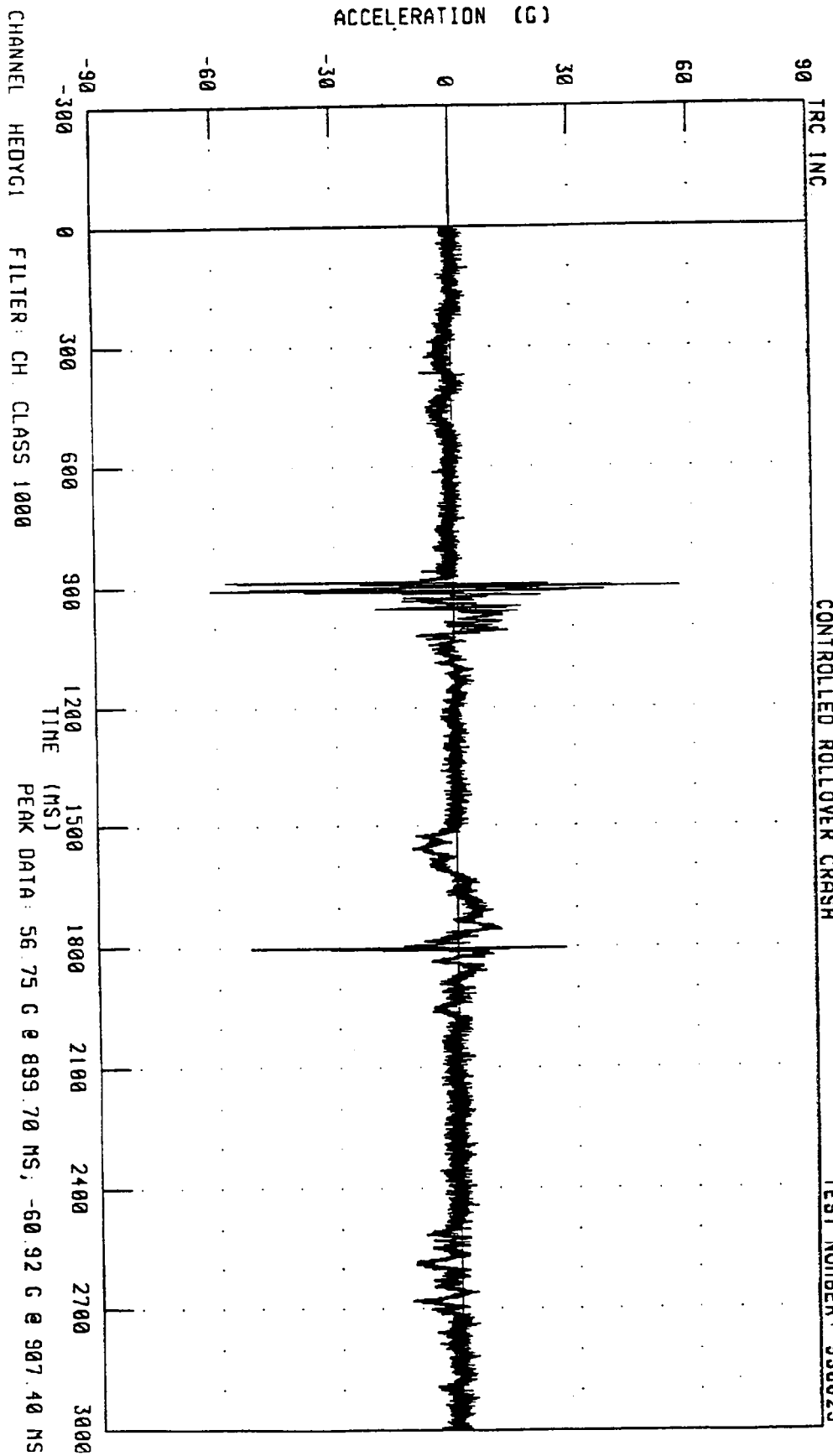
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



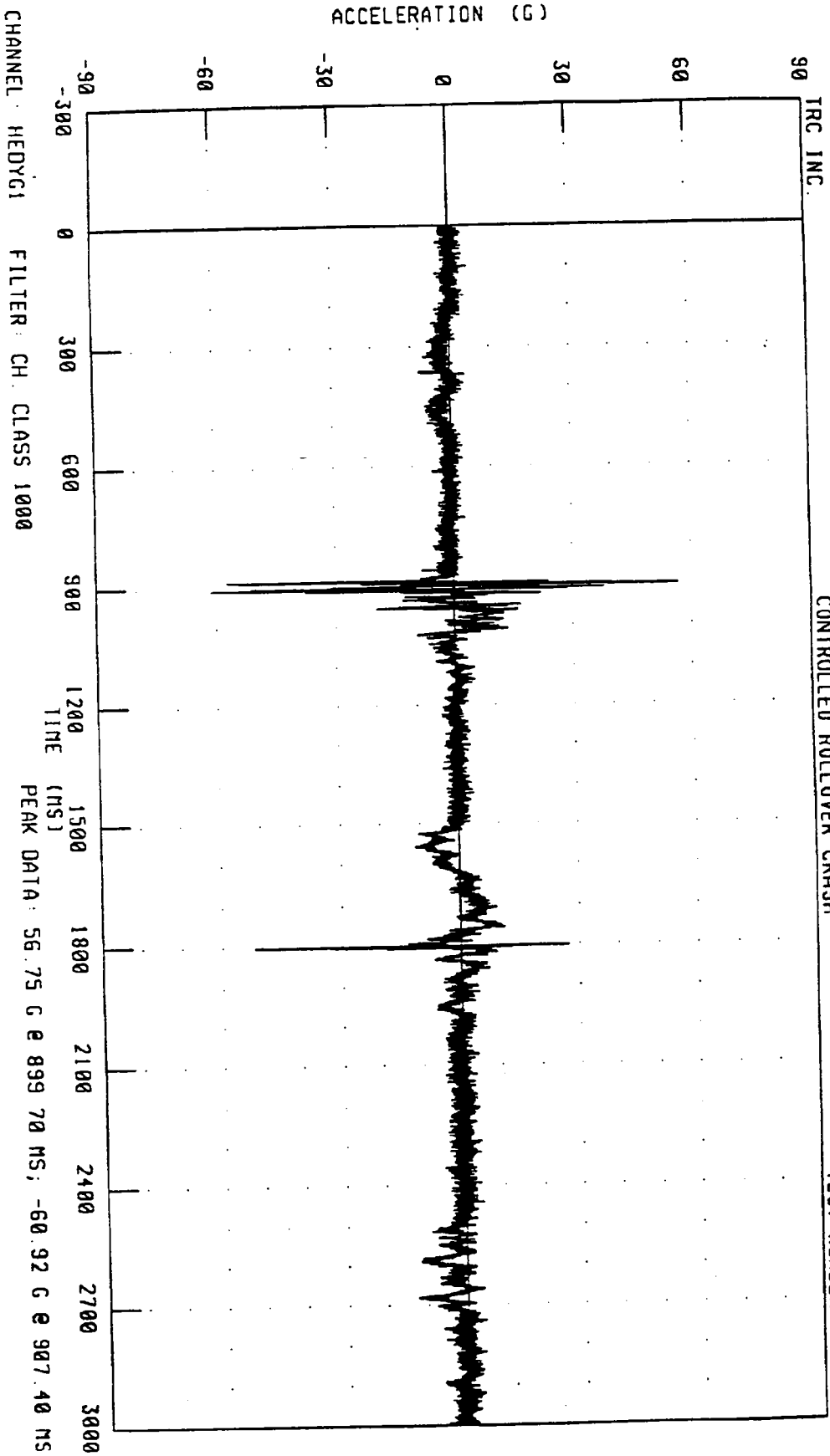
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

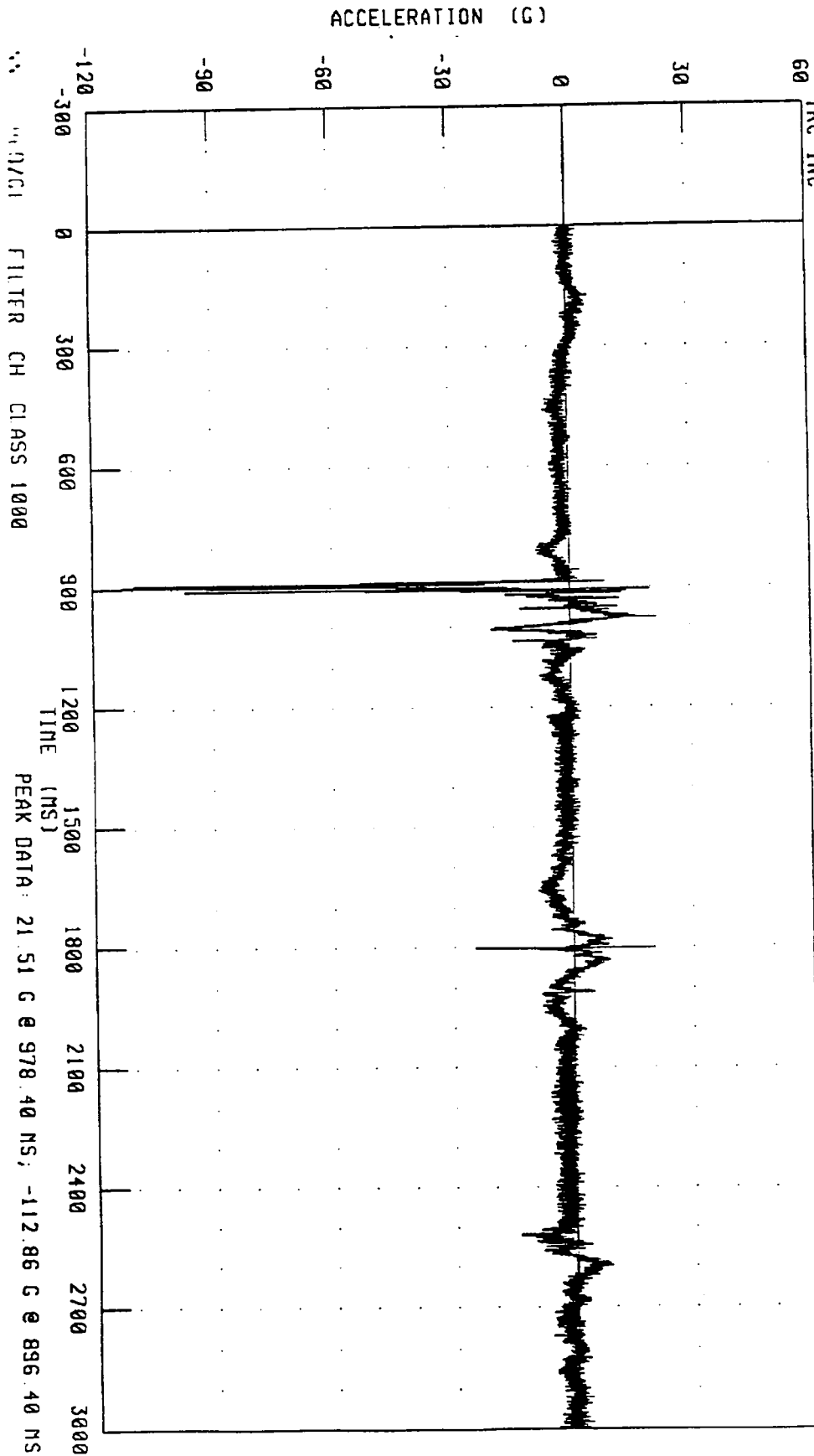


TRC INC

CONTROLLED ROLLOVER CRASH

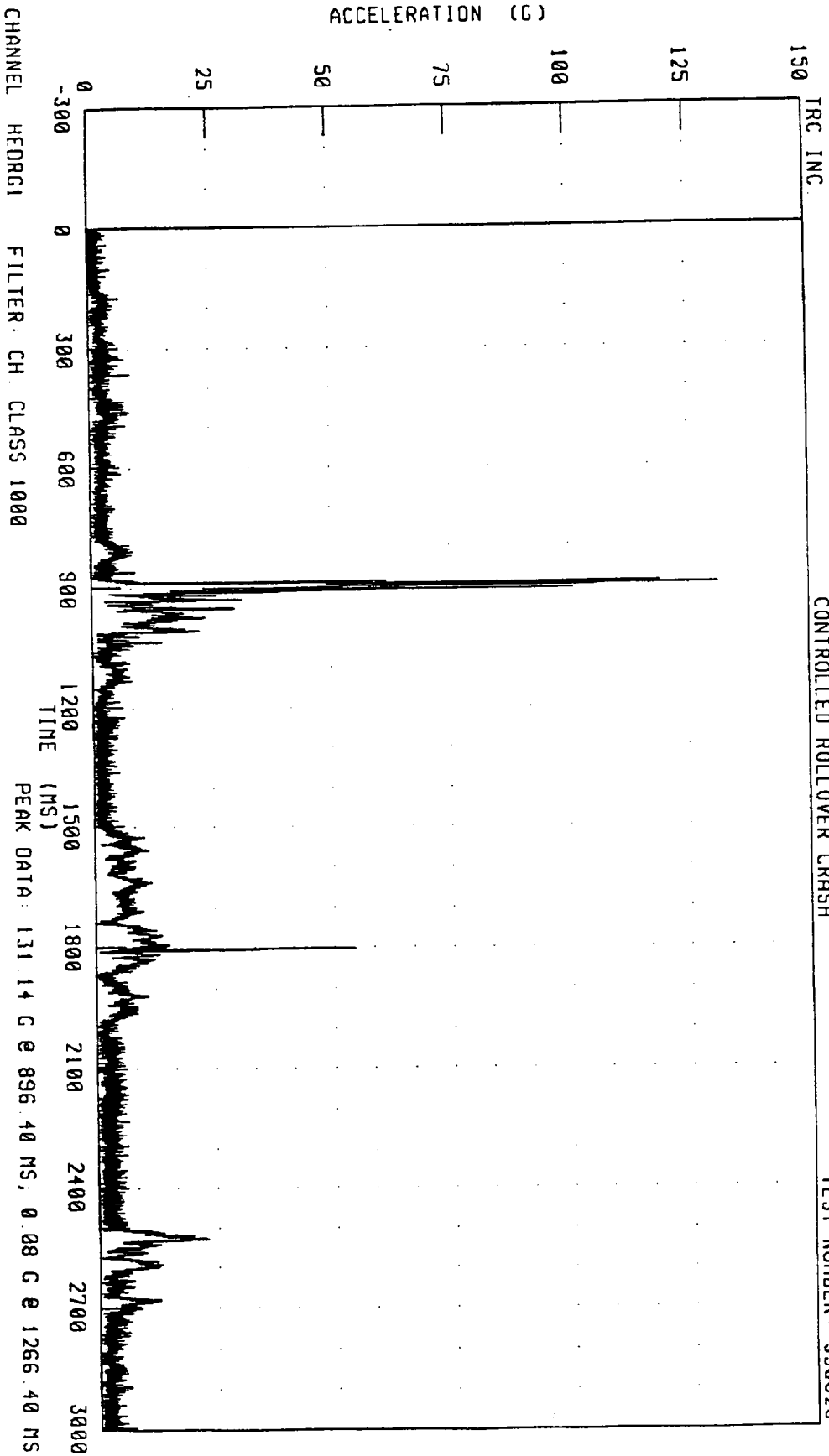
TEST NUMBER: 930623

1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD Z-AXIS ACCELERATION



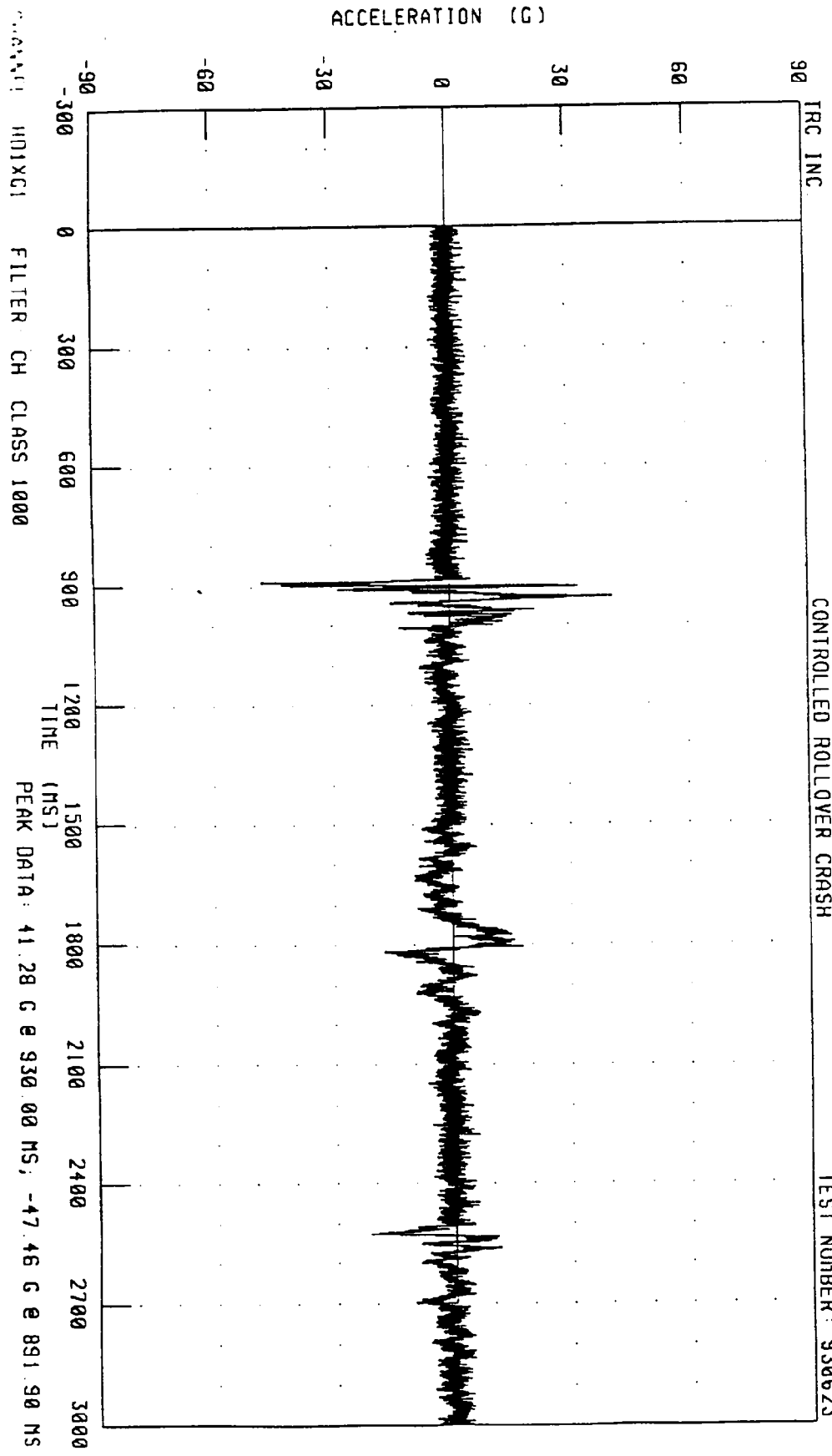
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD RESULTANT ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

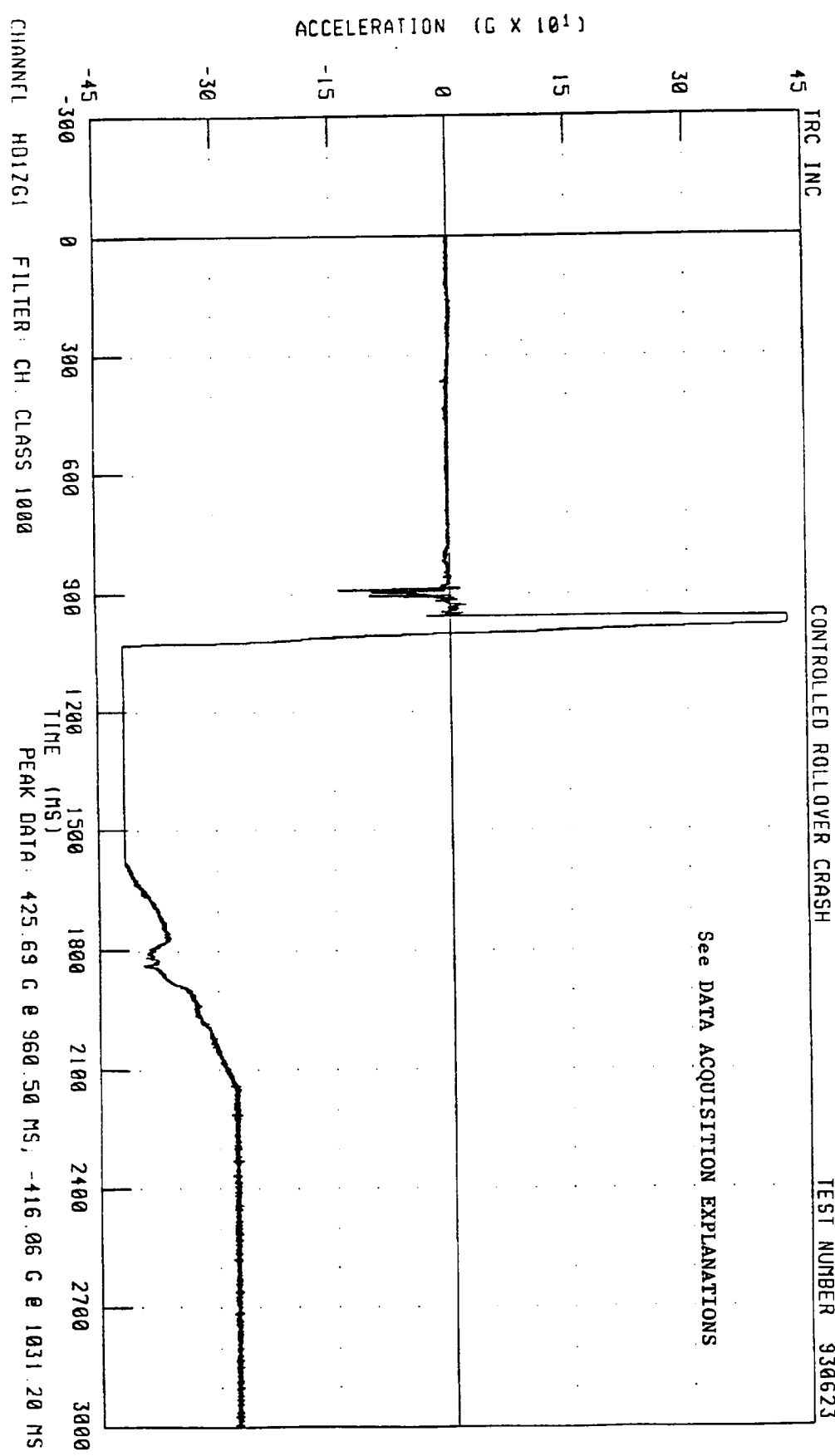


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD ARRAY 1 X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

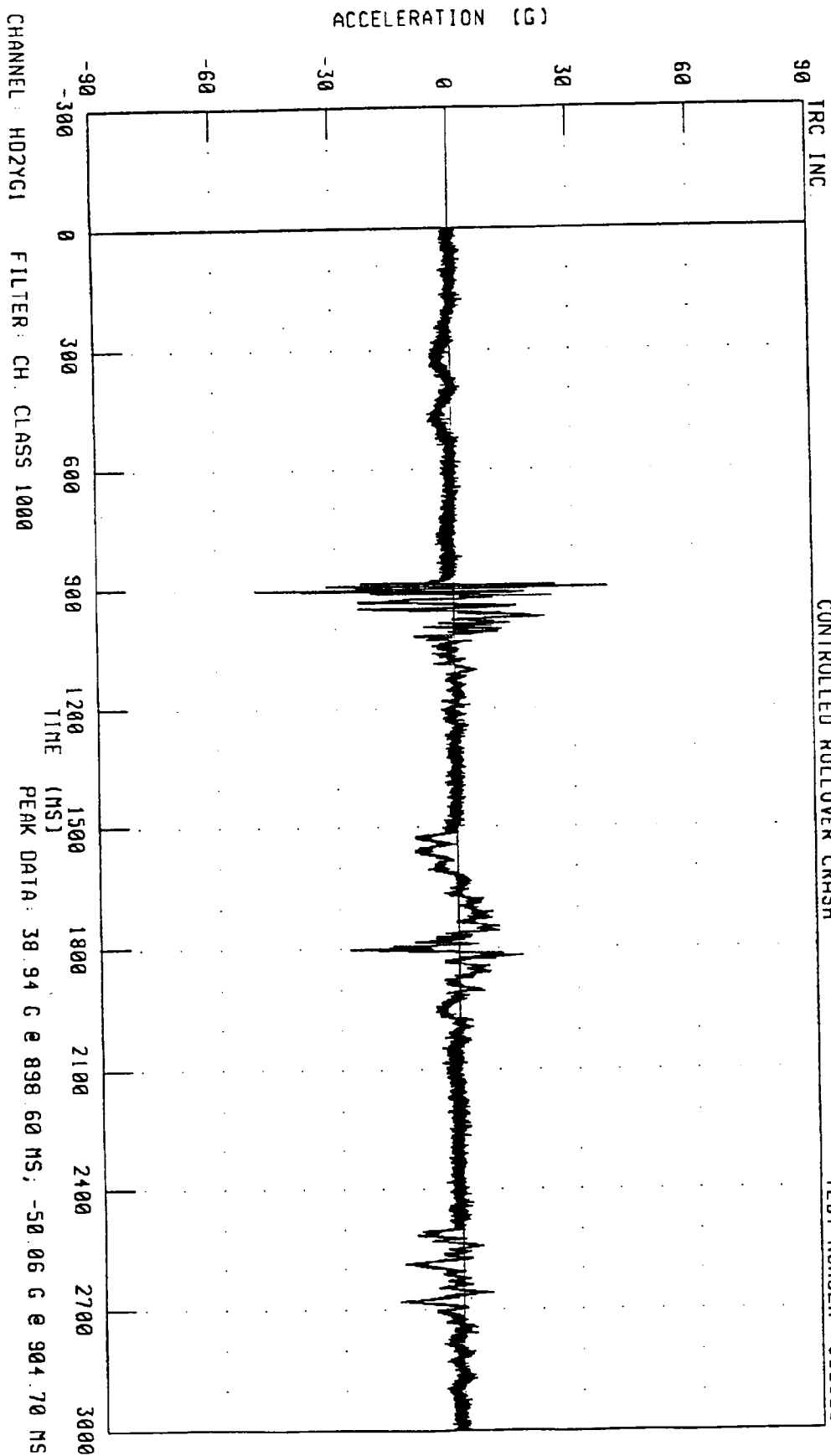


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD ARRAY 1 Z-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH
TEST NUMBER 930623



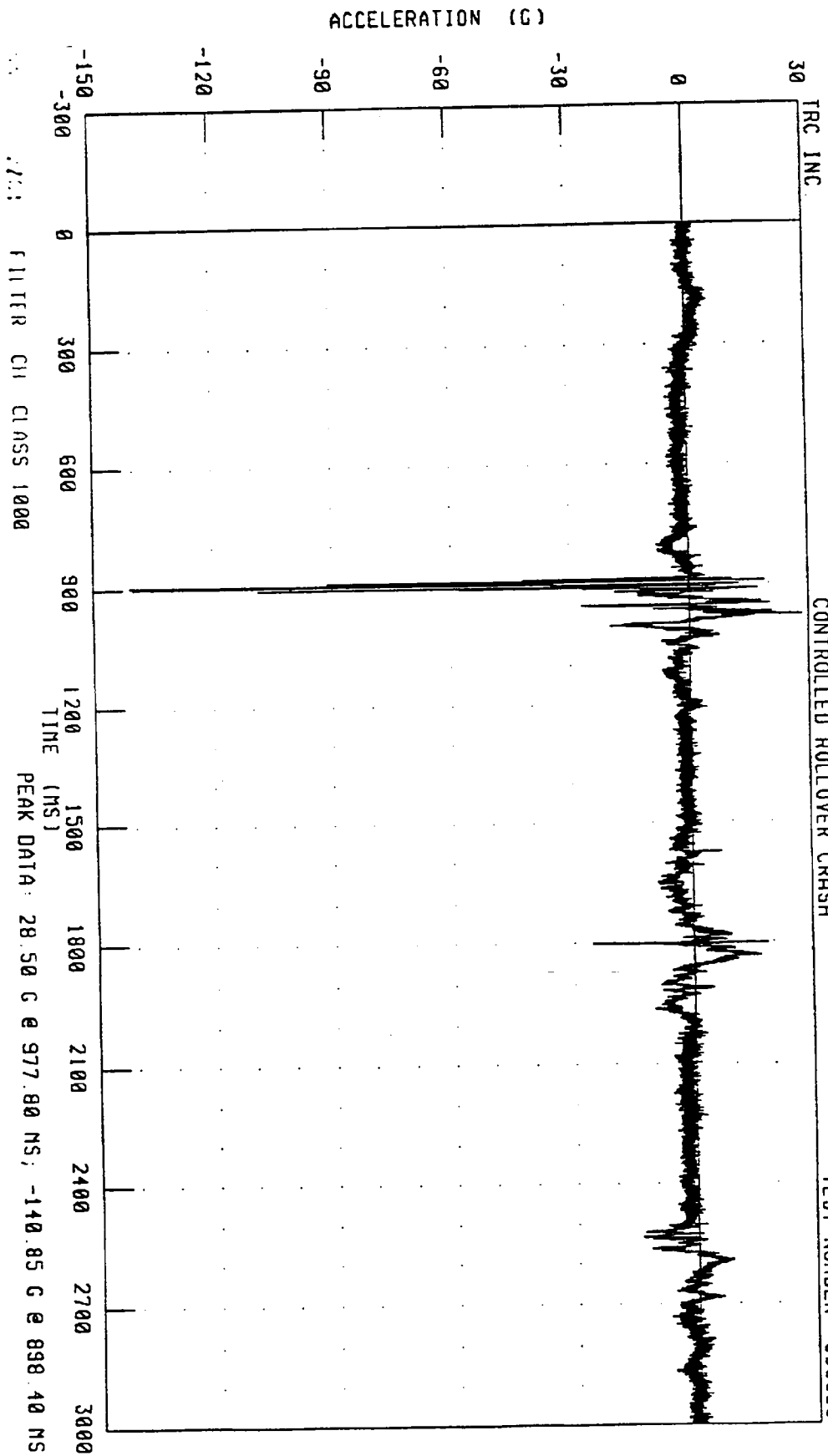
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD ARRAY 2 Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER 930623



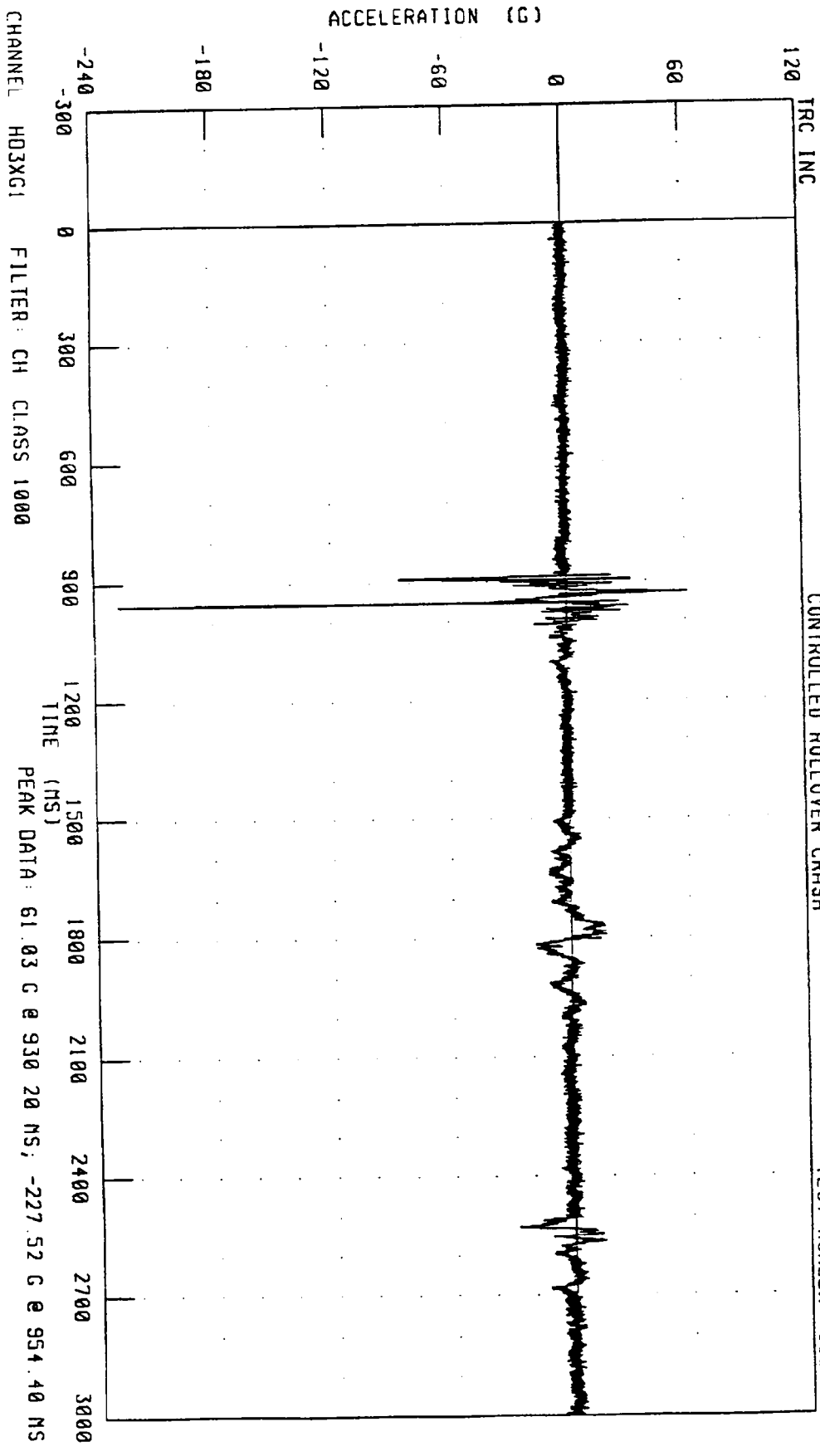
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD ARRAY 2 Z-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER 930623



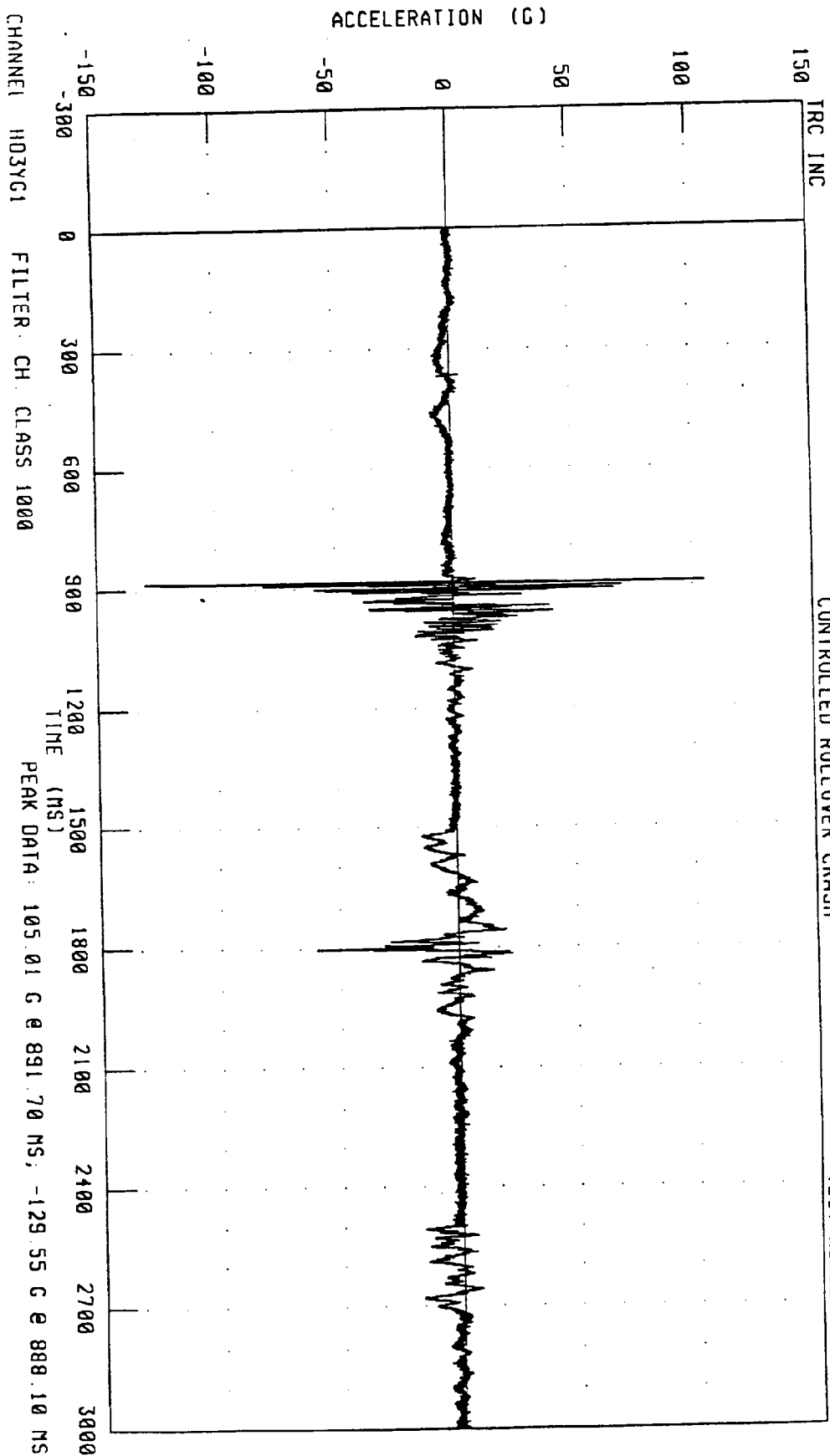
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD ARRAY 3 X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

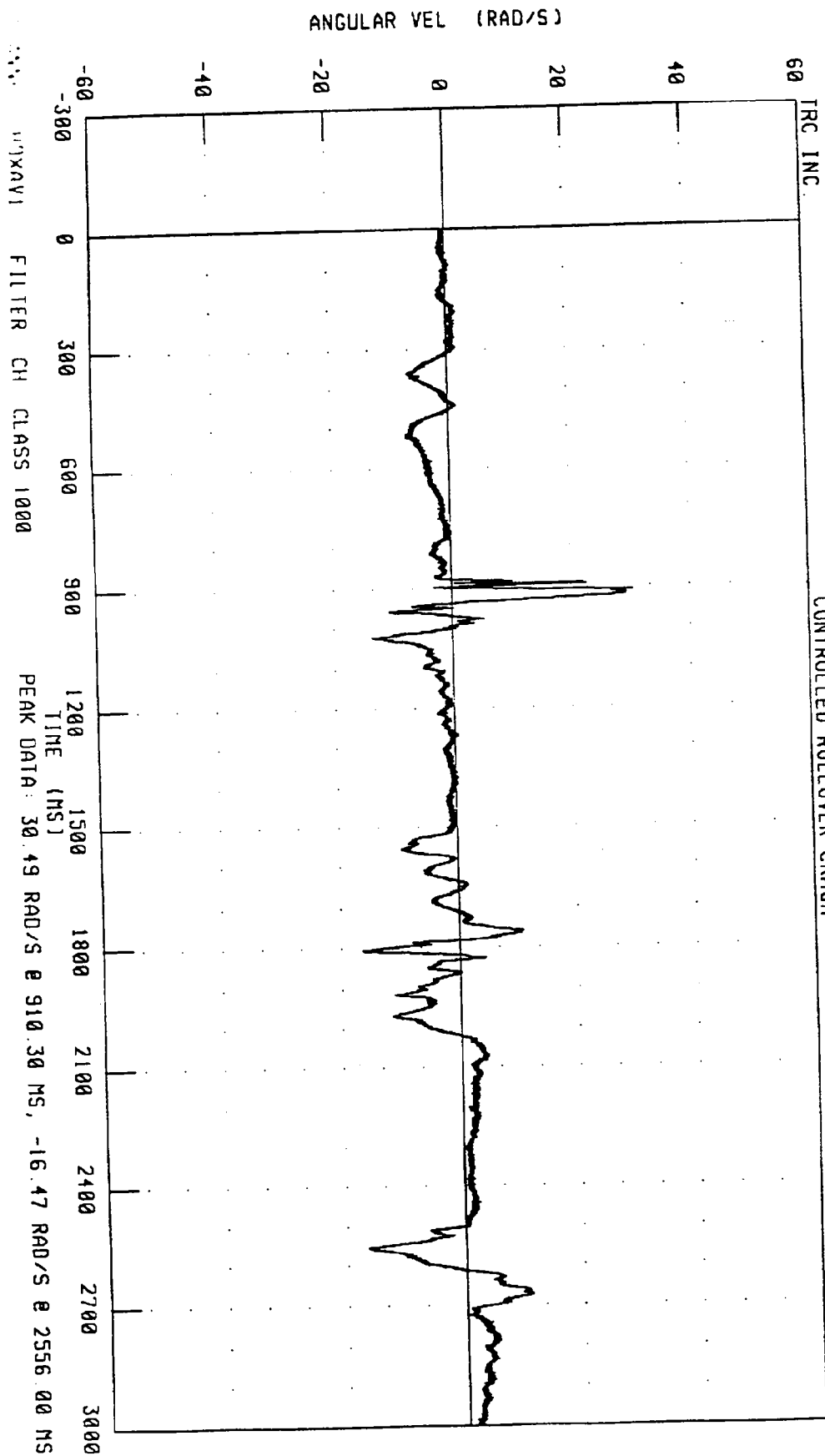


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD ARRAY 3 Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

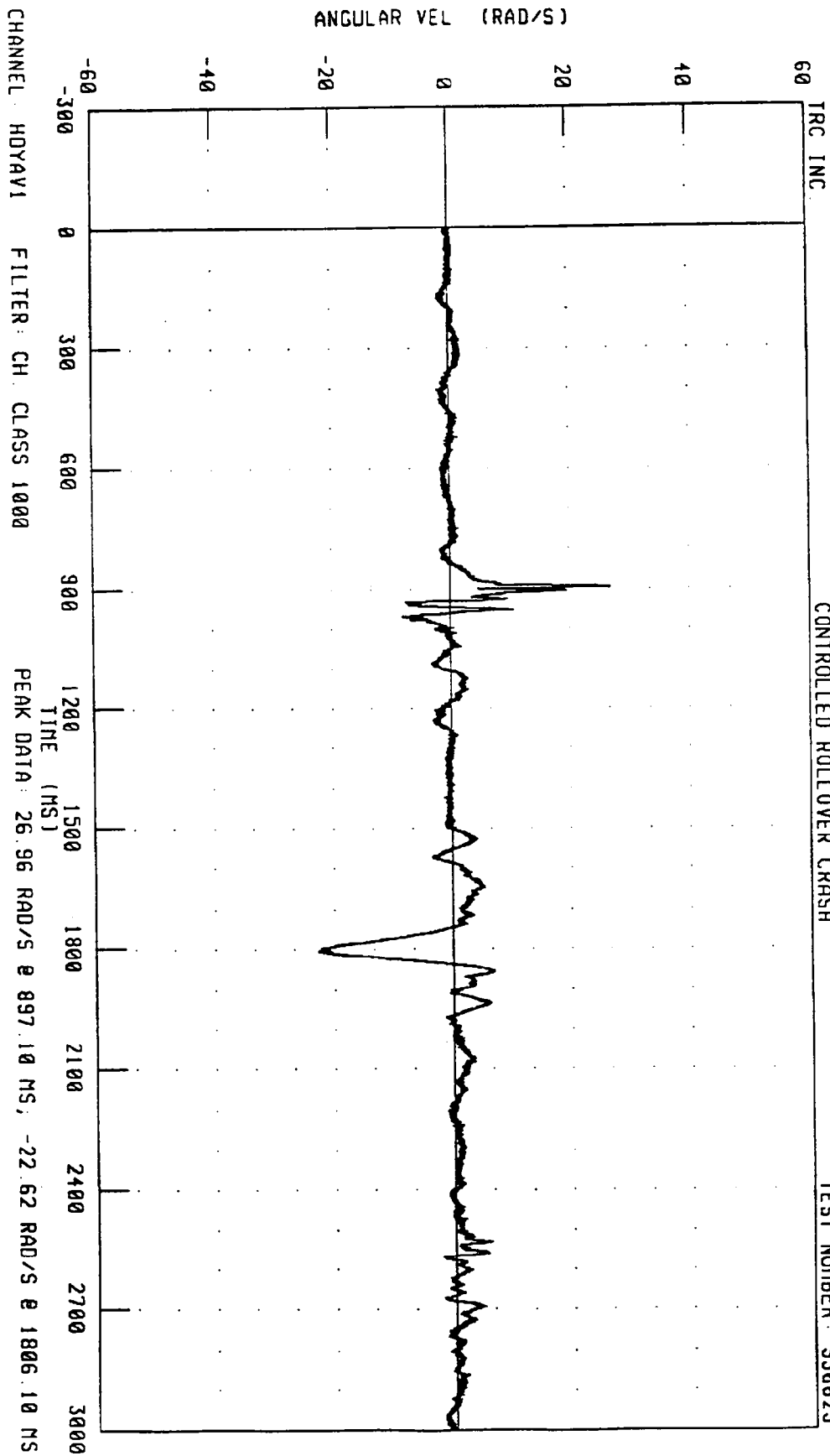


TEST NUMBER: 930623

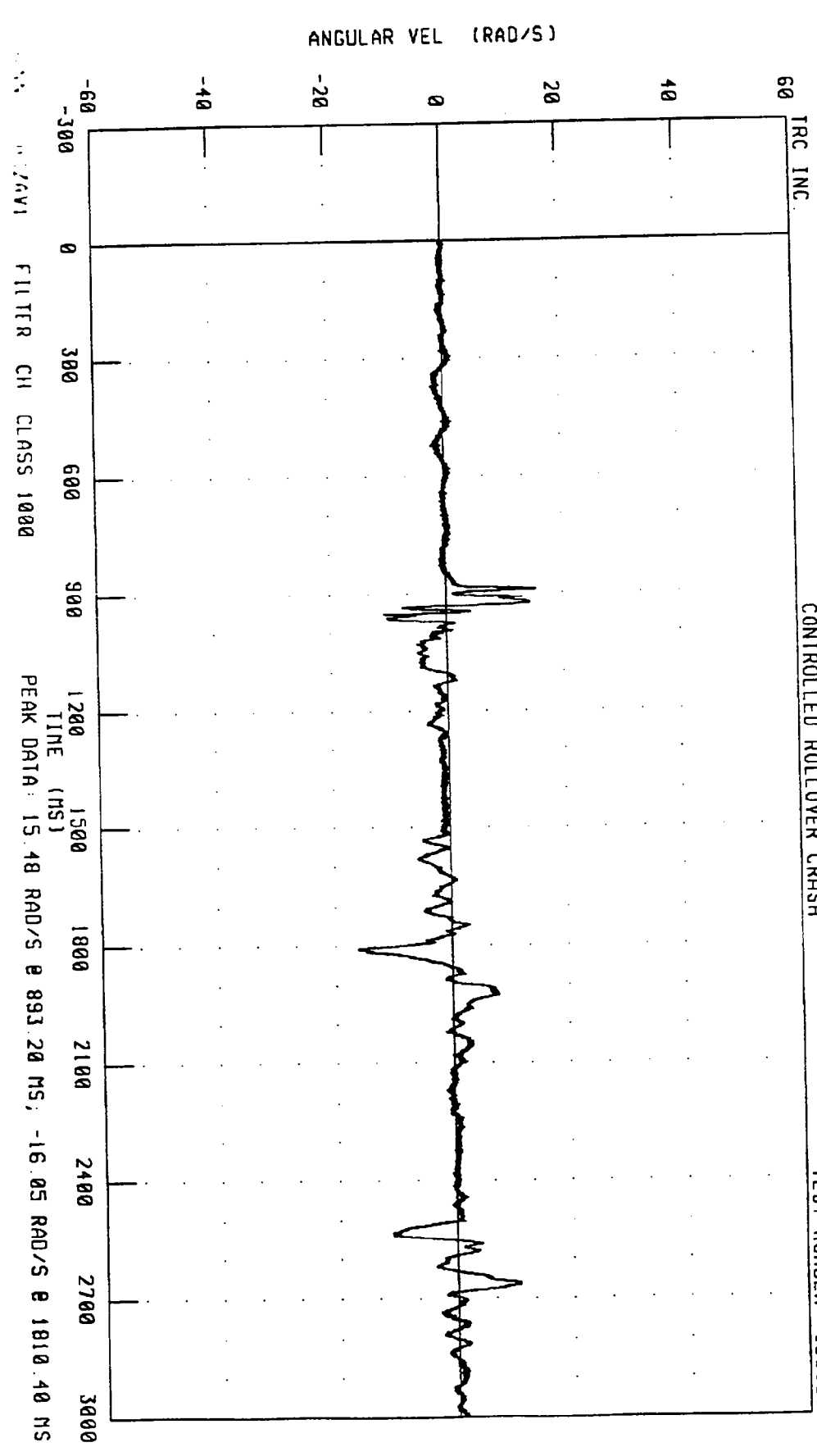


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD Y-AXIS ANGULAR VELOCITY
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

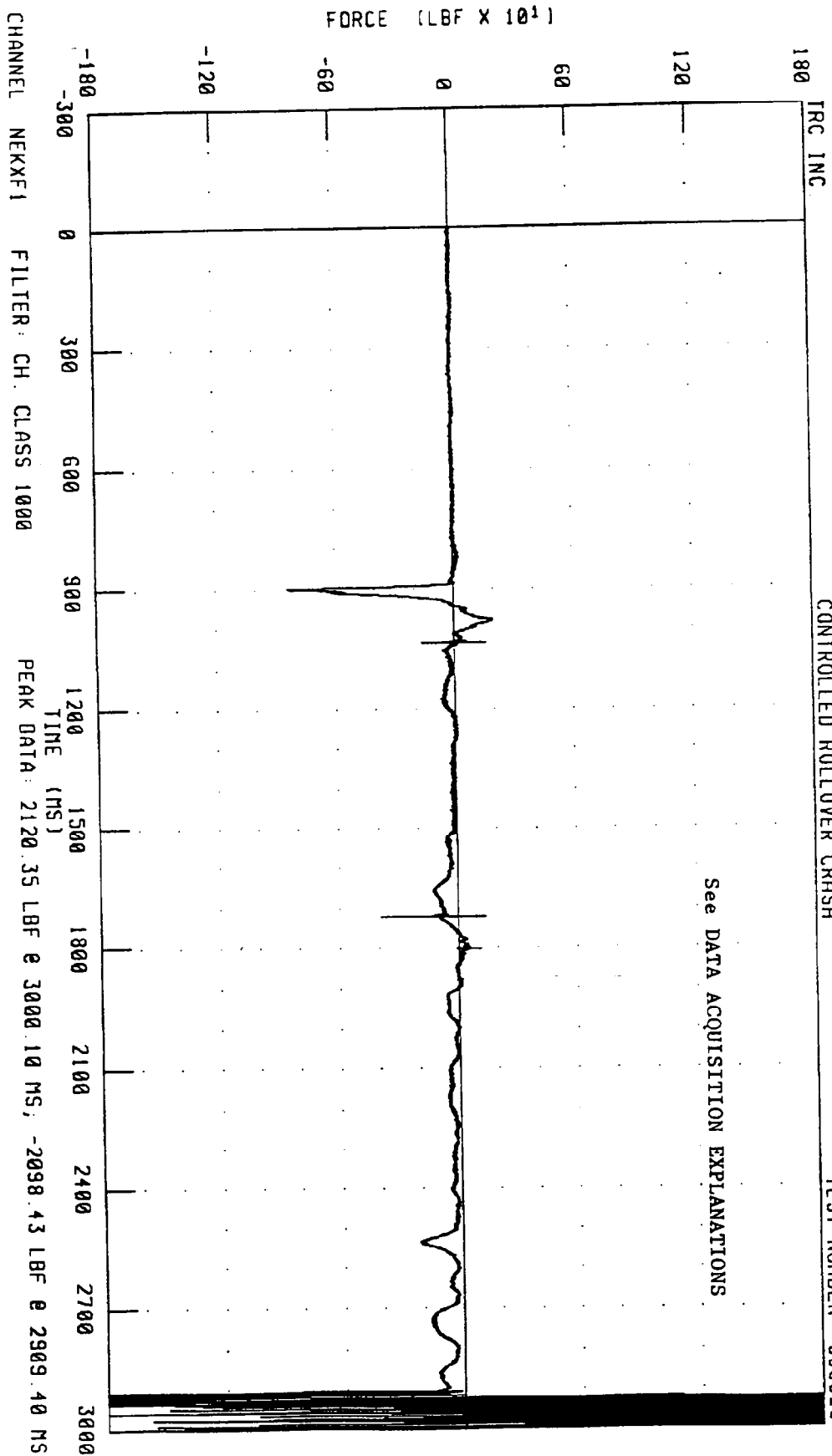


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER HEAD Z-AXIS ANGULAR VELOCITY
CONTROLLED ROLLOVER CRASH
TEST NUMBER: 930623



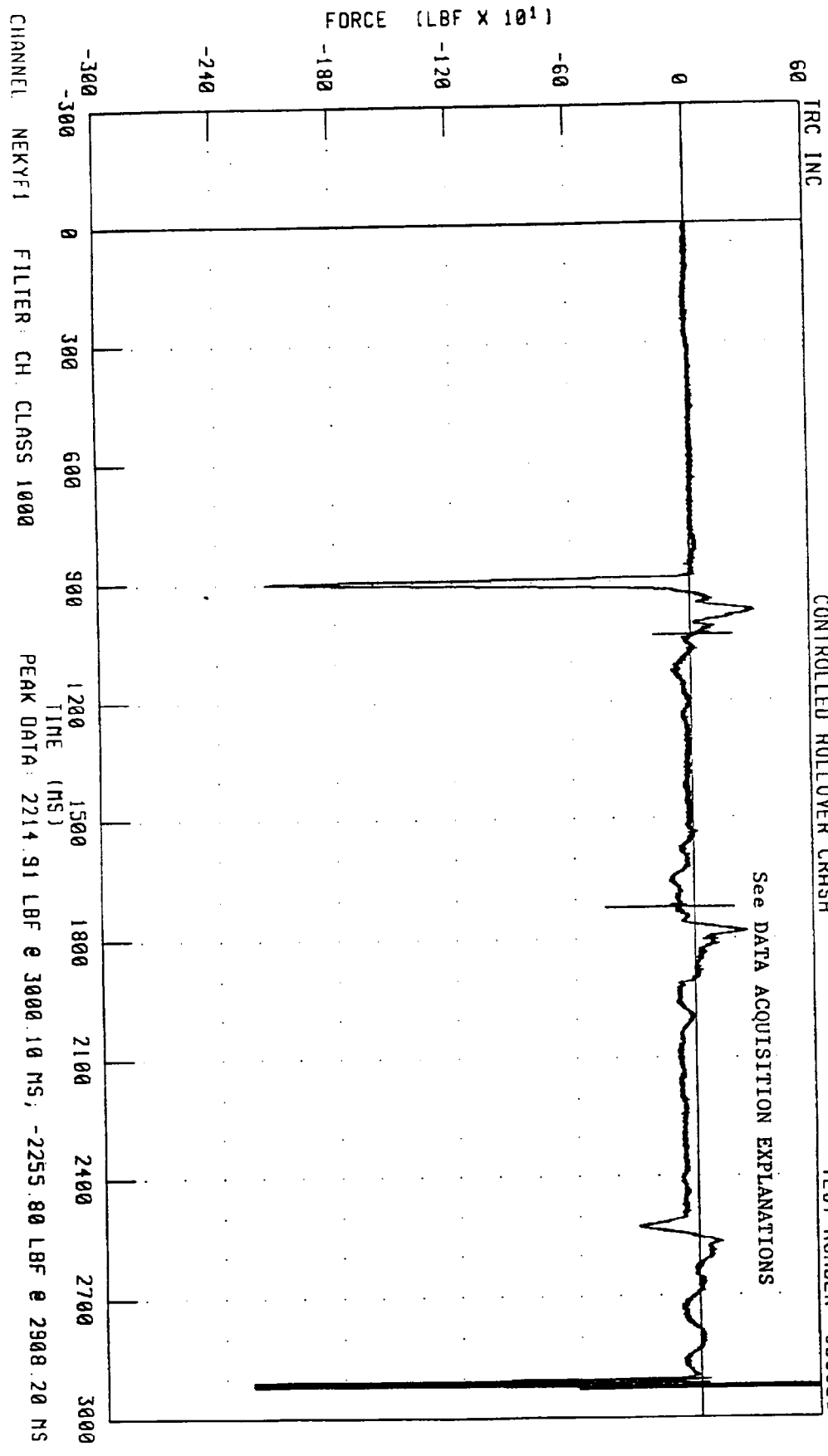
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER NECK X-AXIS SHEAR FORCE
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



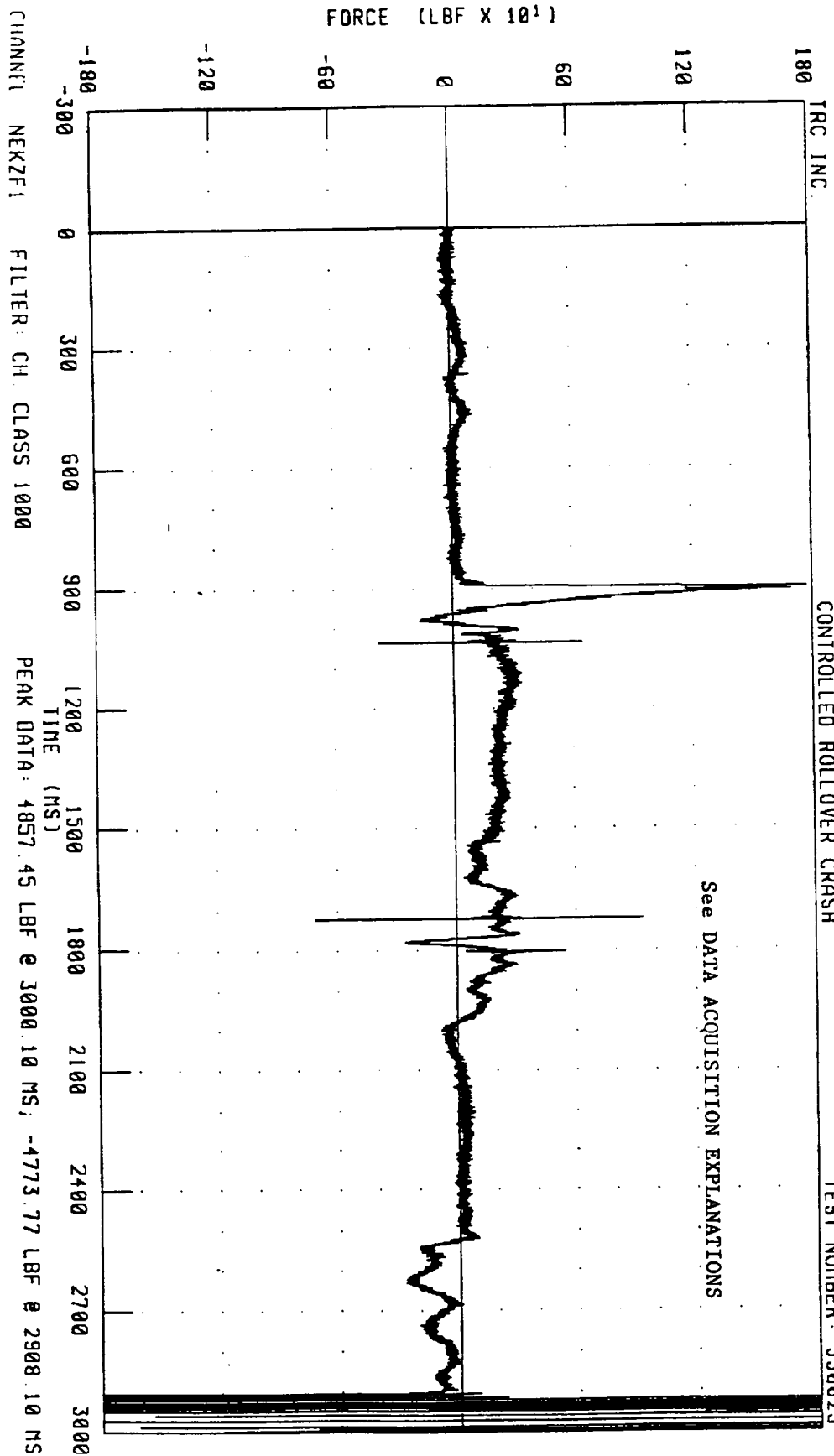
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER NECK Y-AXIS SHEAR FORCE
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



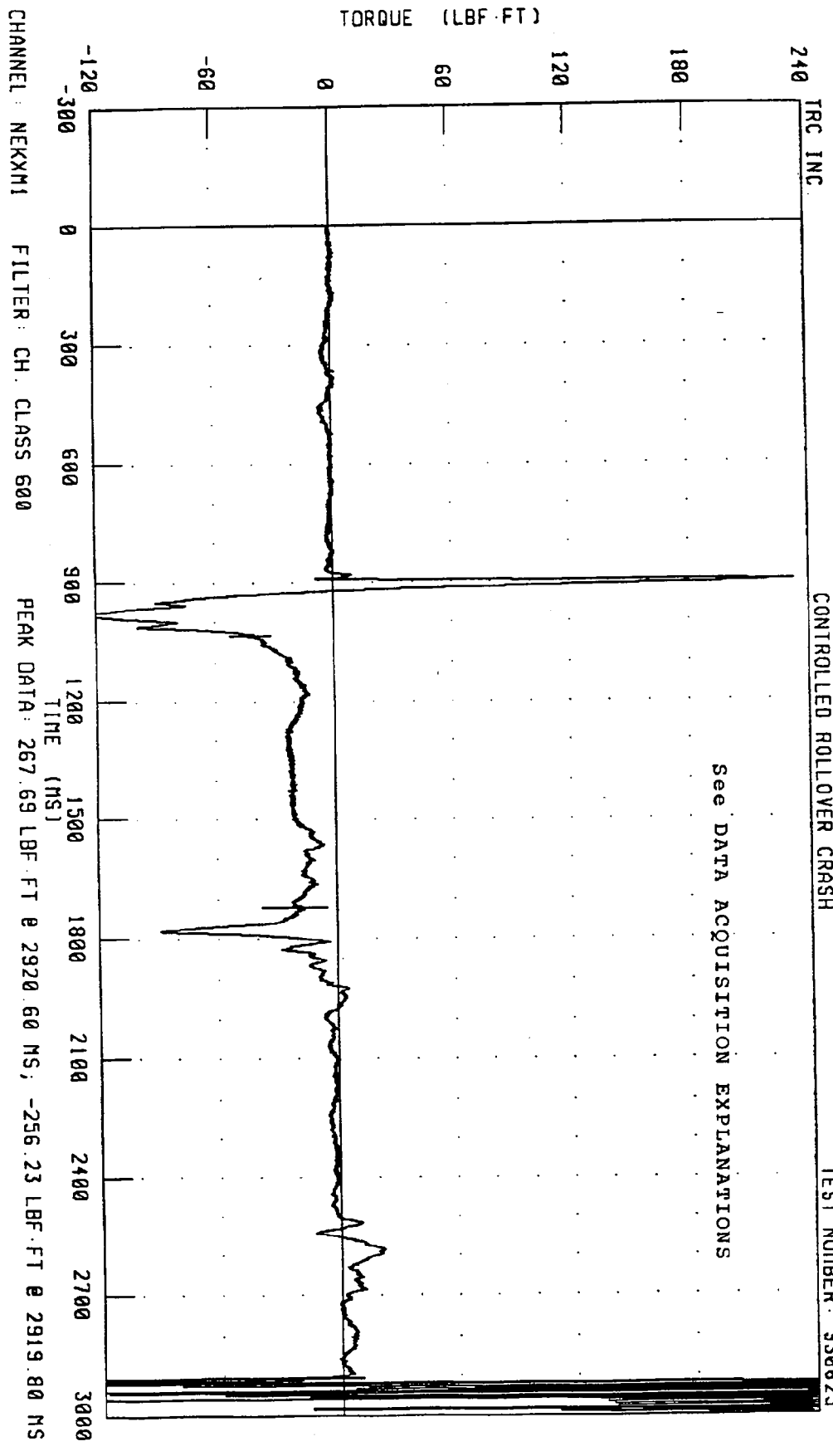
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER NECK Z-AXIS AXIAL FORCE
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER NECK MOMENT ABOUT X-AXIS
CONTROLLED ROLLOVER CRASH

CORRECTED
TEST NUMBER: 930623



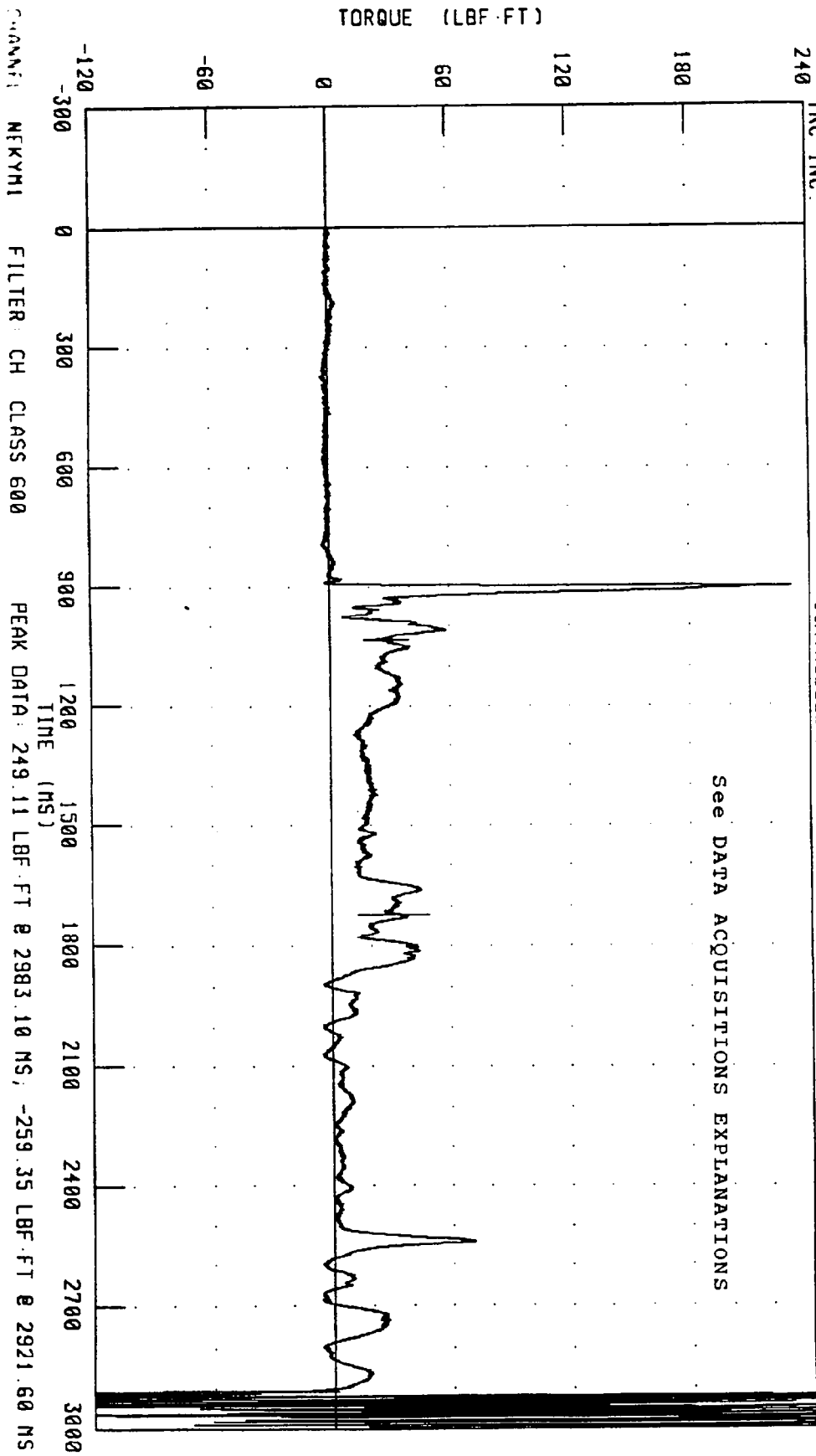
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER NECK MOMENT ABOUT Y-AXIS
CONTROLLED ROLLOVER CRASH

TRC INC.

TEST NUMBER: 930623

CORRECTED

See DATA ACQUISITIONS EXPLANATIONS



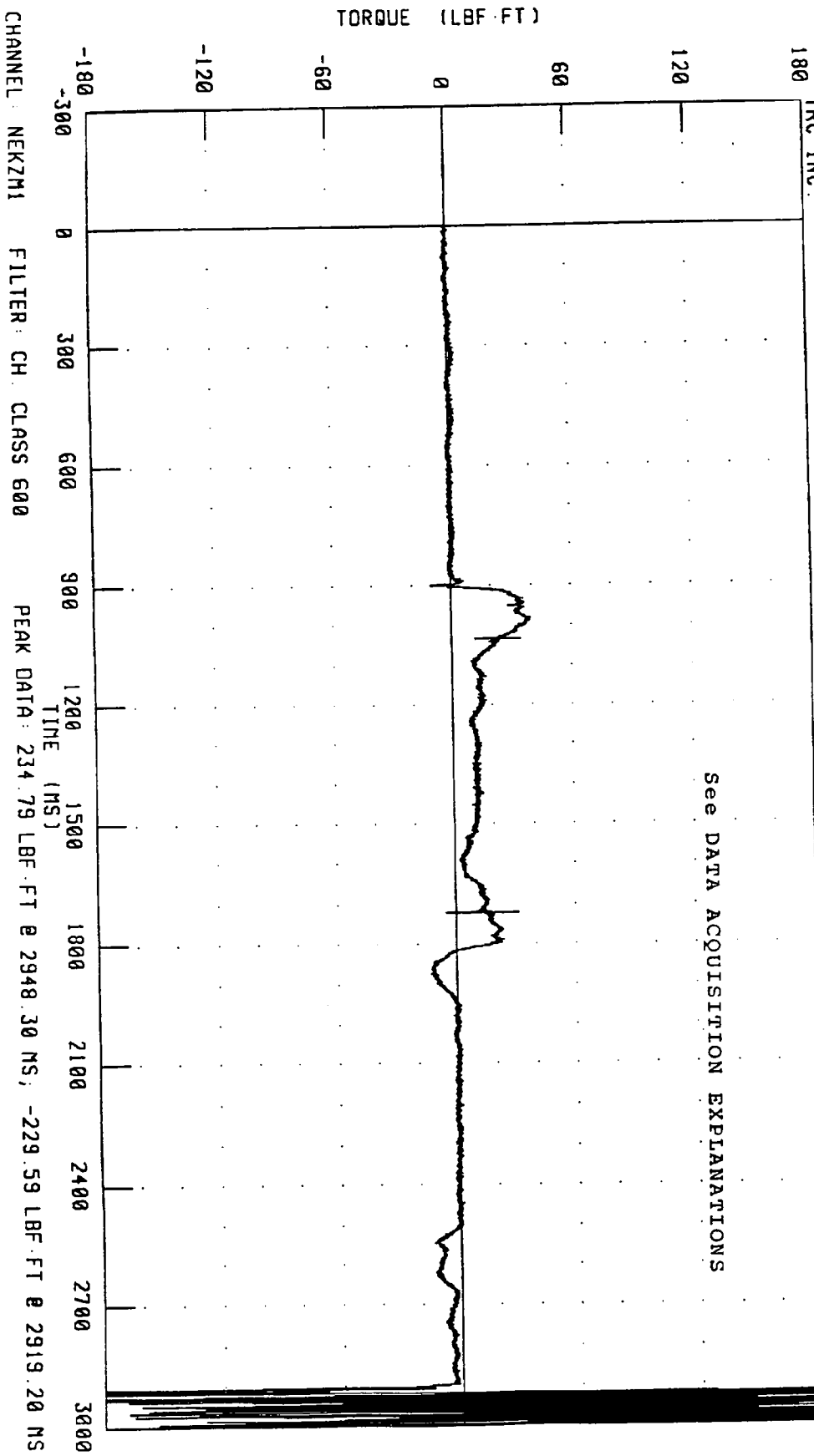
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER NECK MOMENT ABOUT Z-AXIS
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

CORRECTED

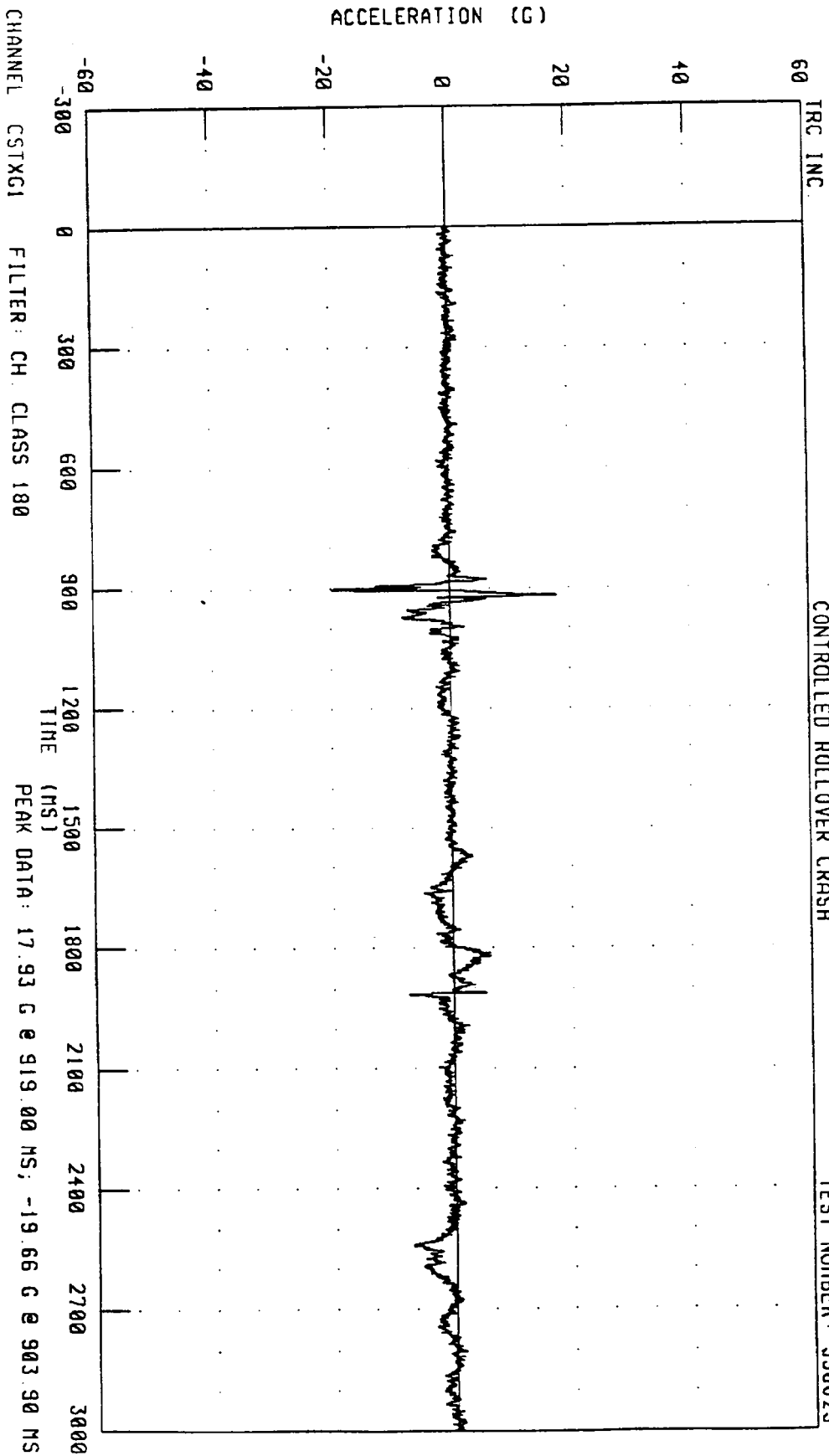
TRC INC.

See DATA ACQUISITION EXPLANATIONS



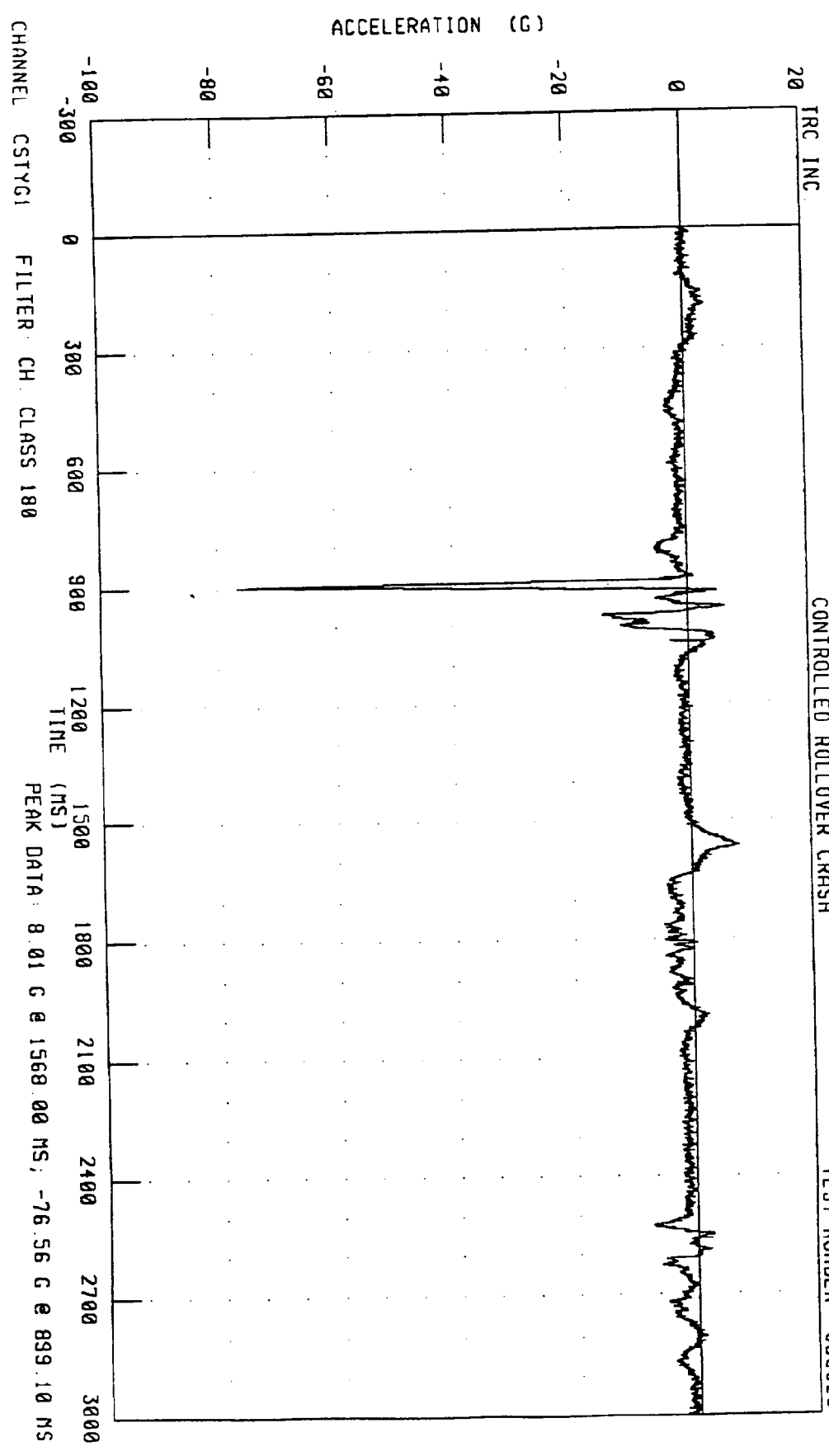
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



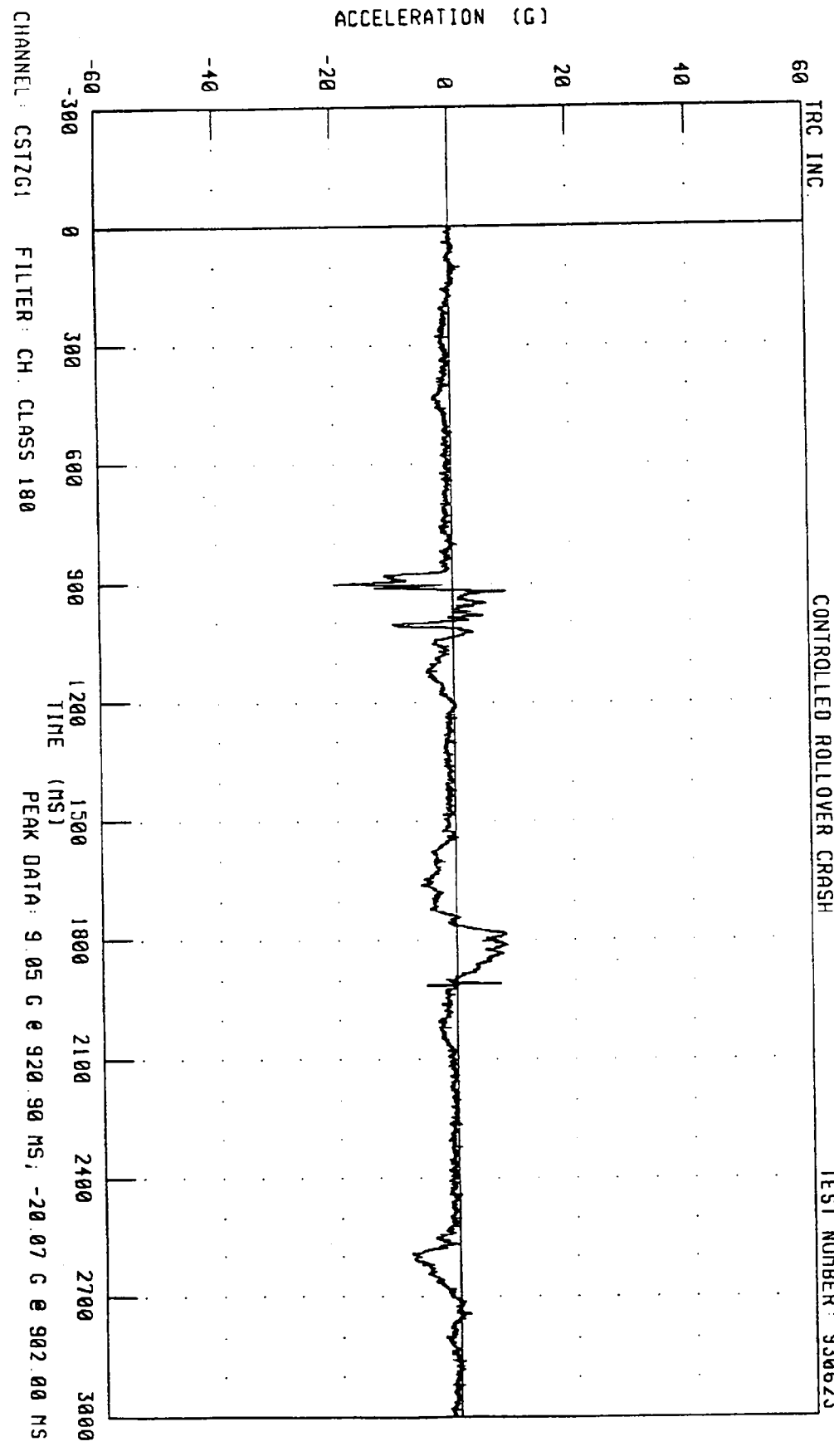
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER 930623



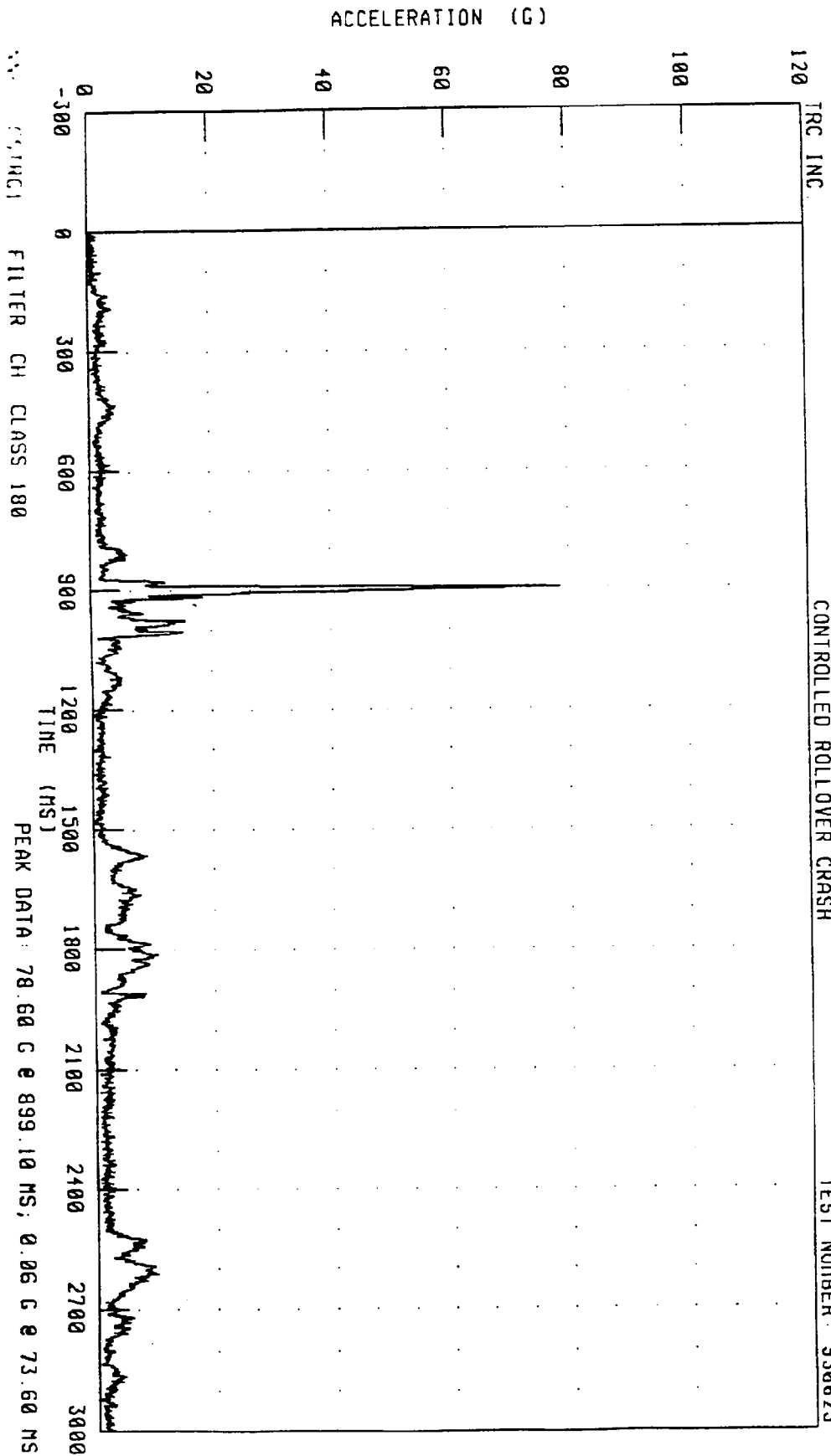
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST Z-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



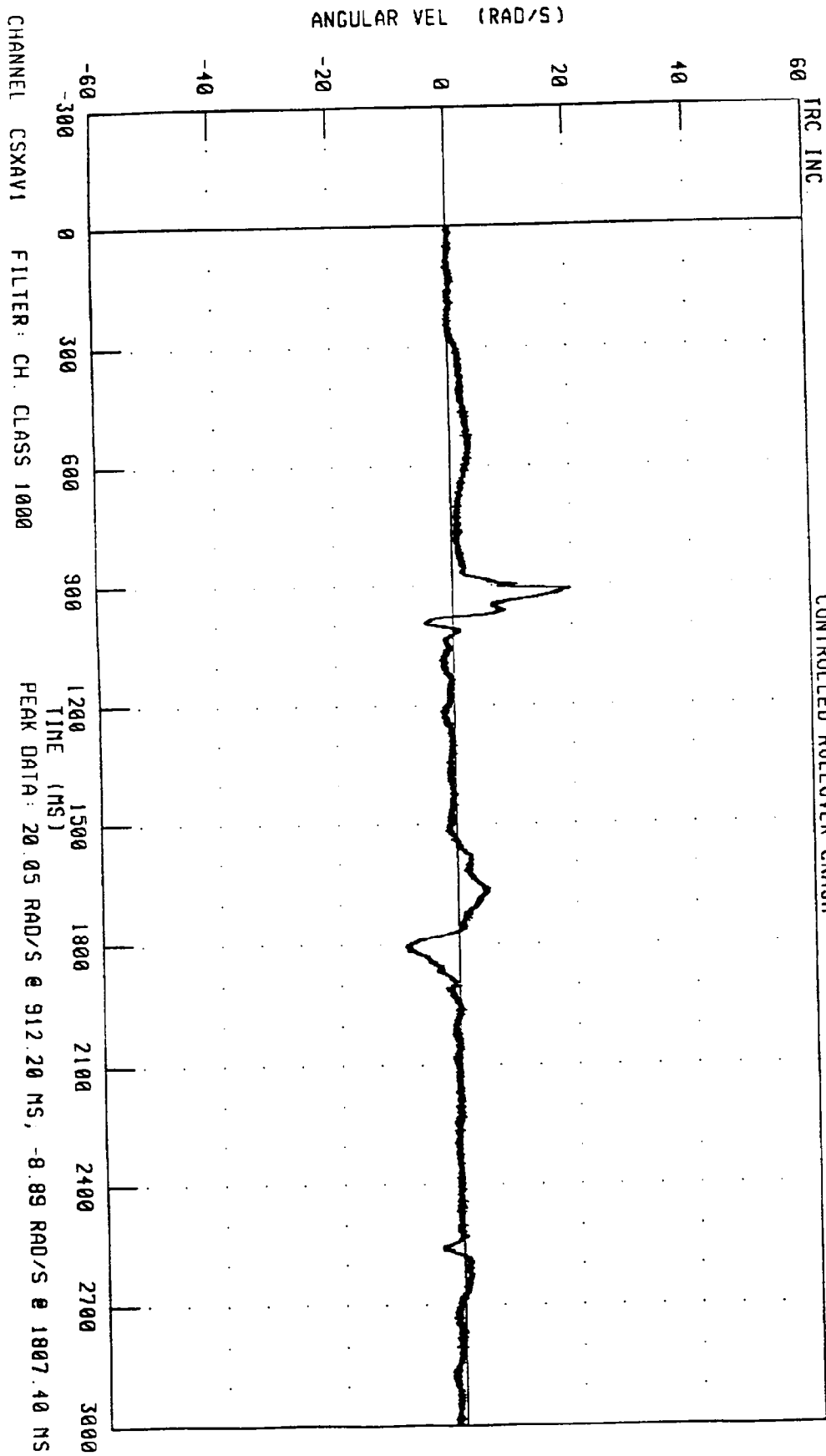
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST RESULTANT ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



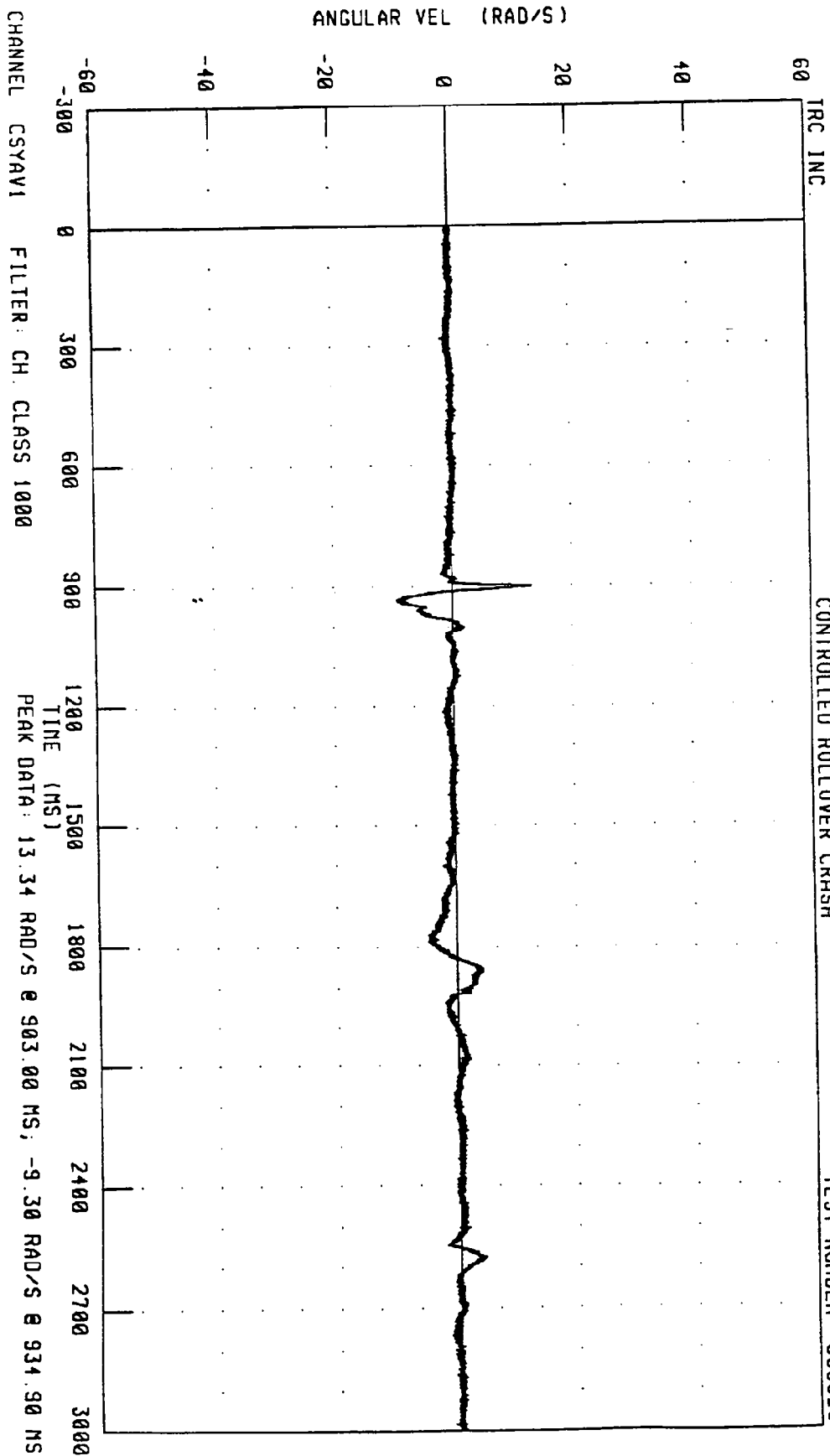
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST X-AXIS ANGULAR VELOCITY
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



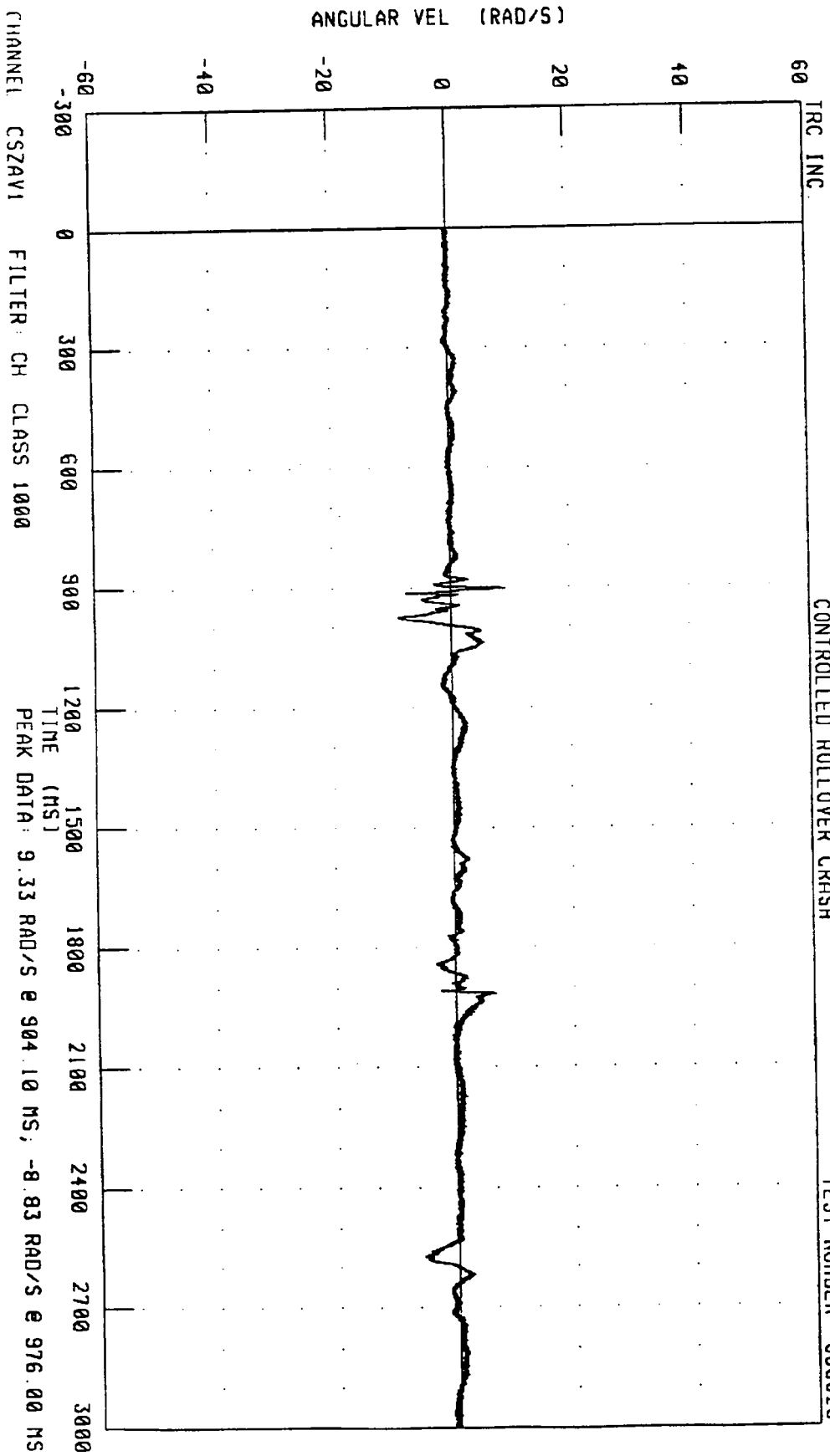
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST Y-AXIS ANGULAR VELOCITY
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



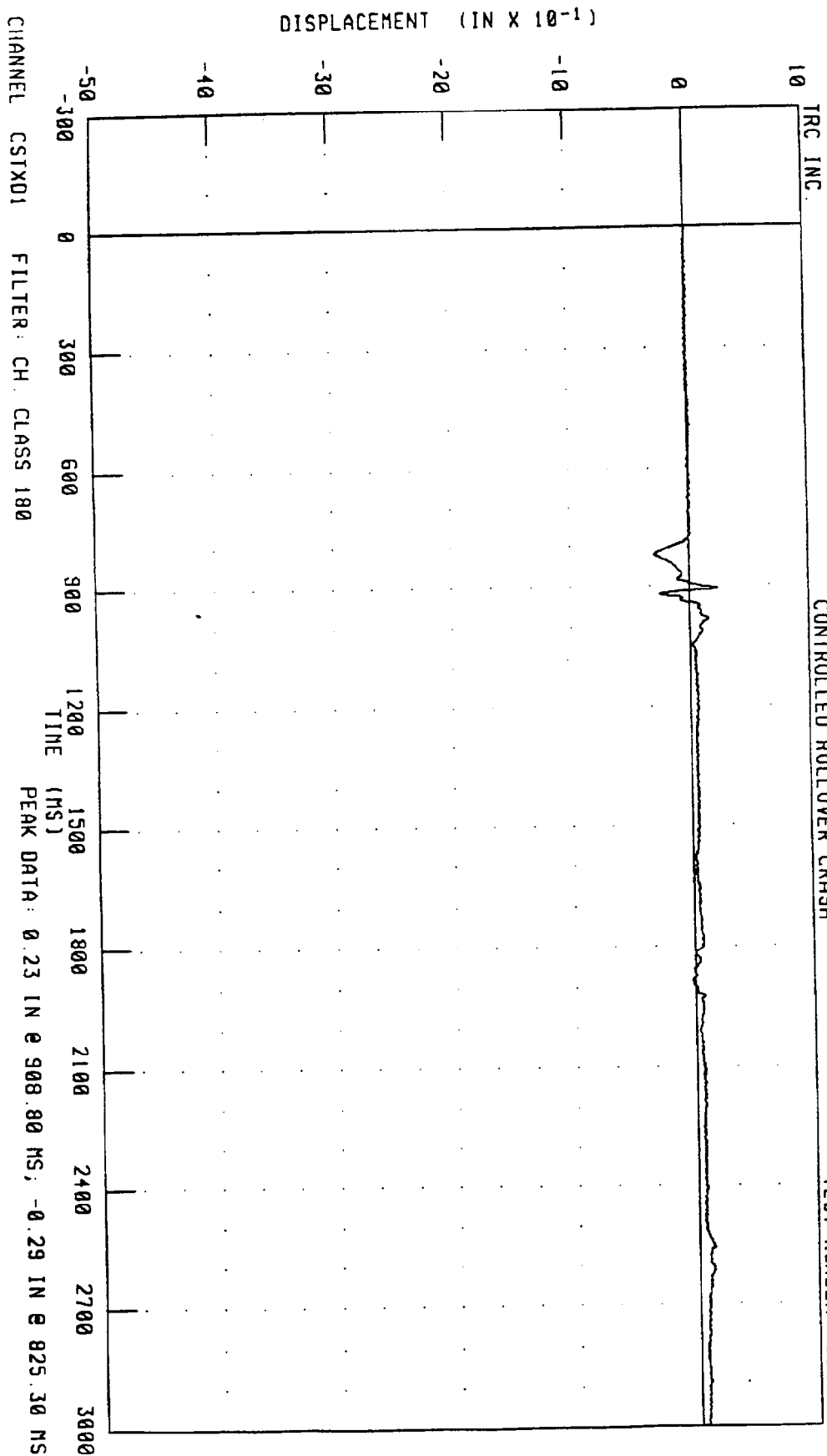
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST Z-AXIS ANGULAR VELOCITY
CONTROLLED ROLLOVER CRASH

TEST NUMBER 930623



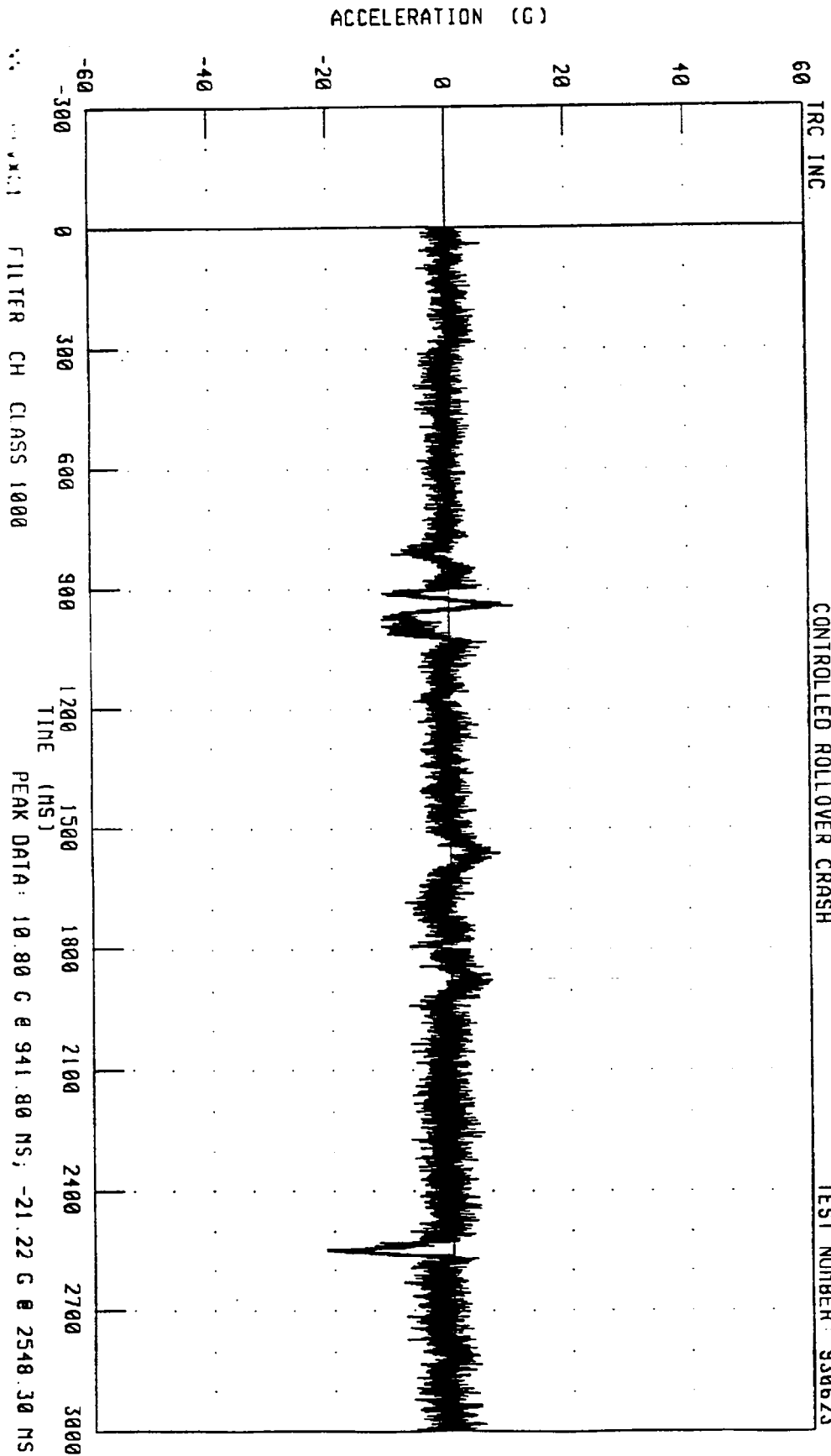
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER CHEST DEFLECTION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



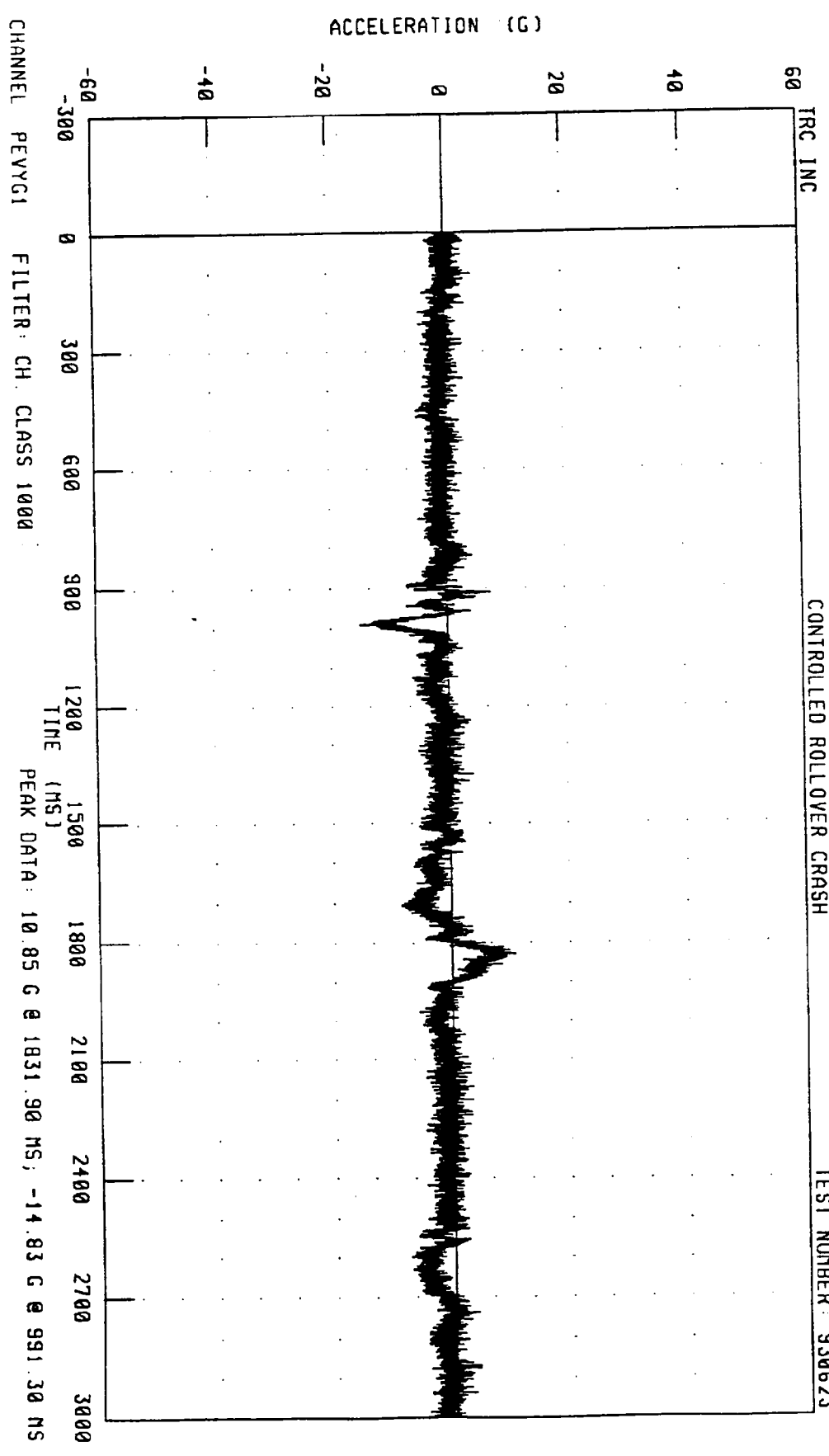
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER PELVIS X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



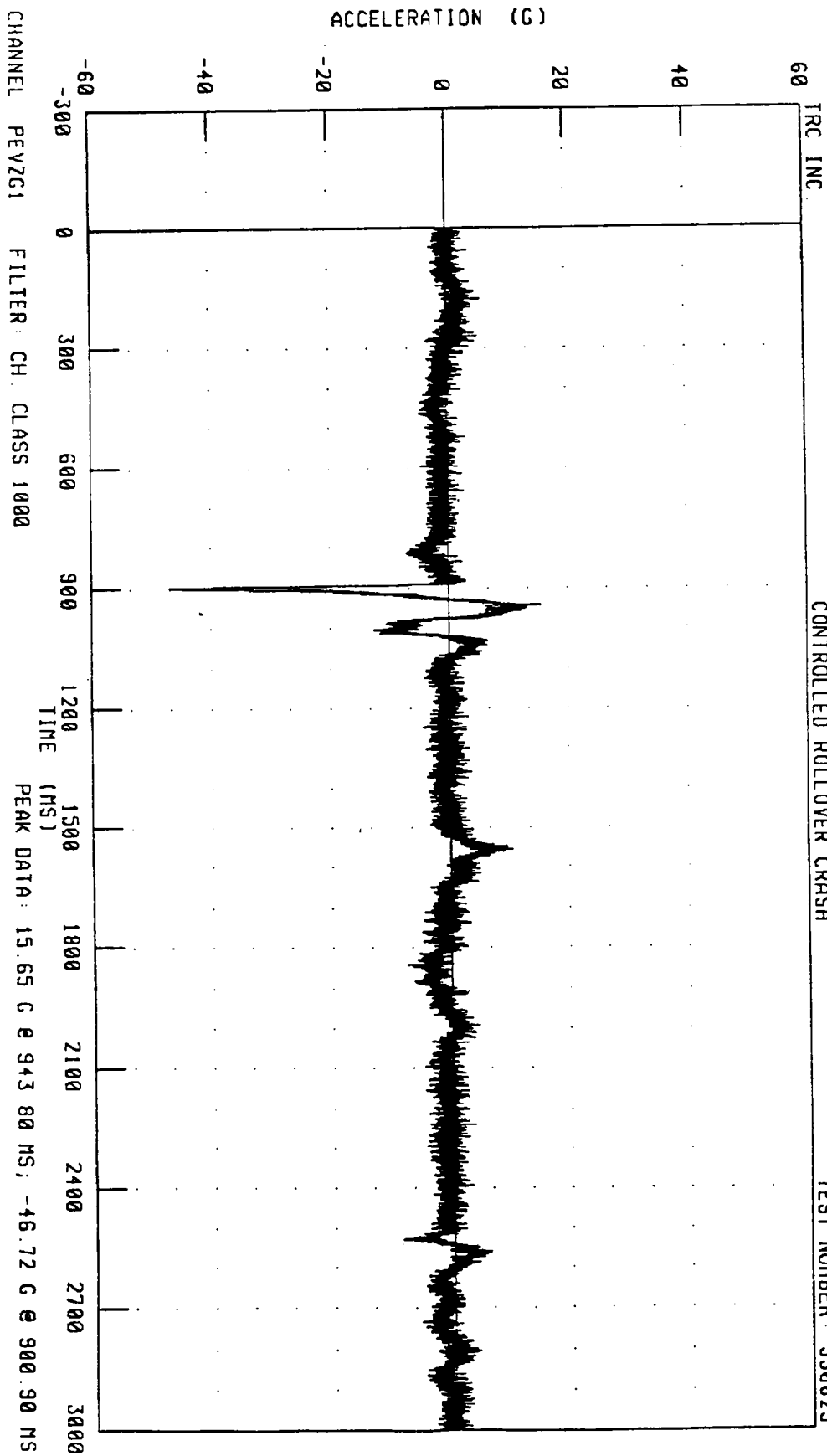
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER PELVIS Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



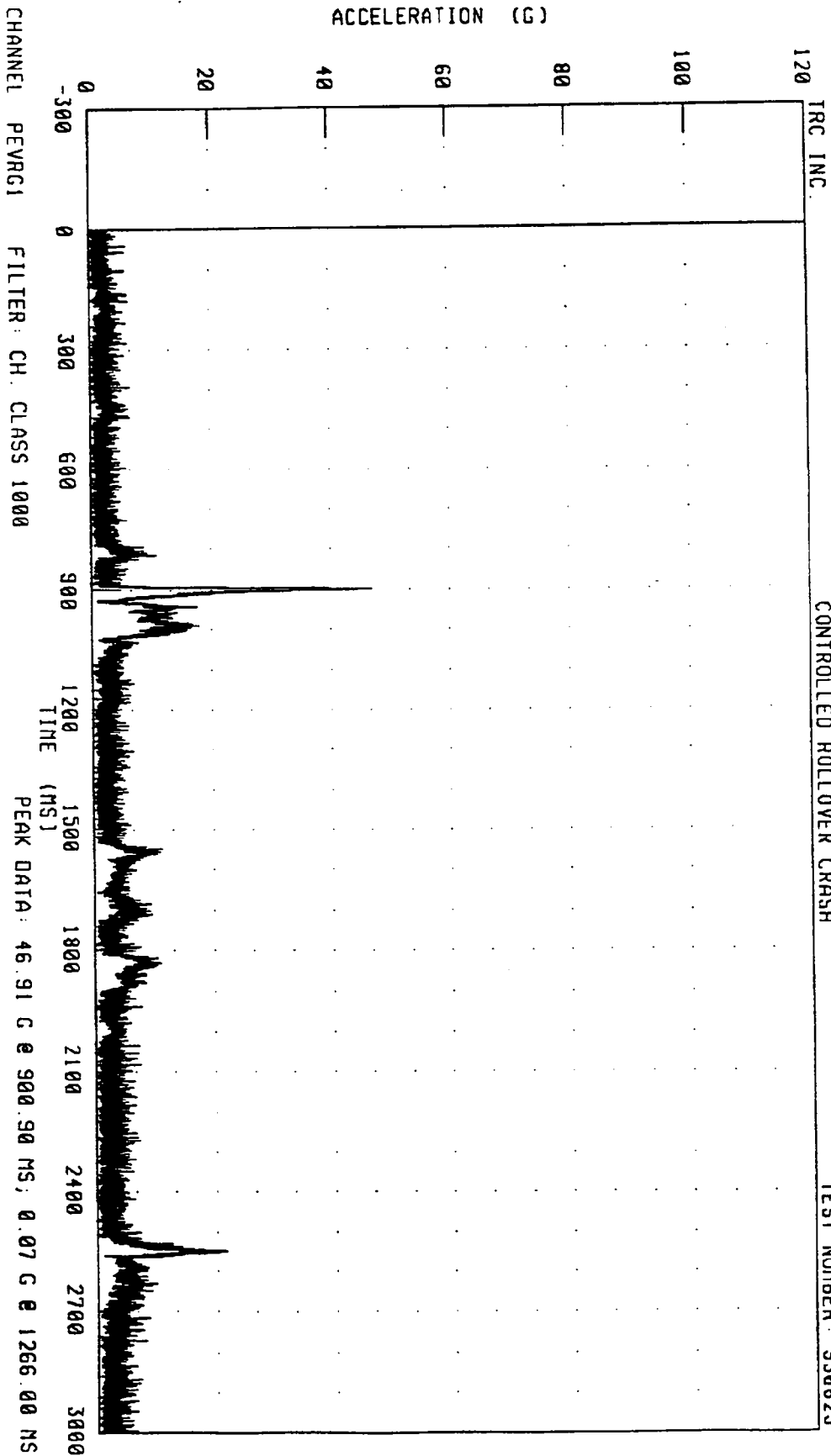
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER PELVIS Z-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER PELVIS RESULTANT ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

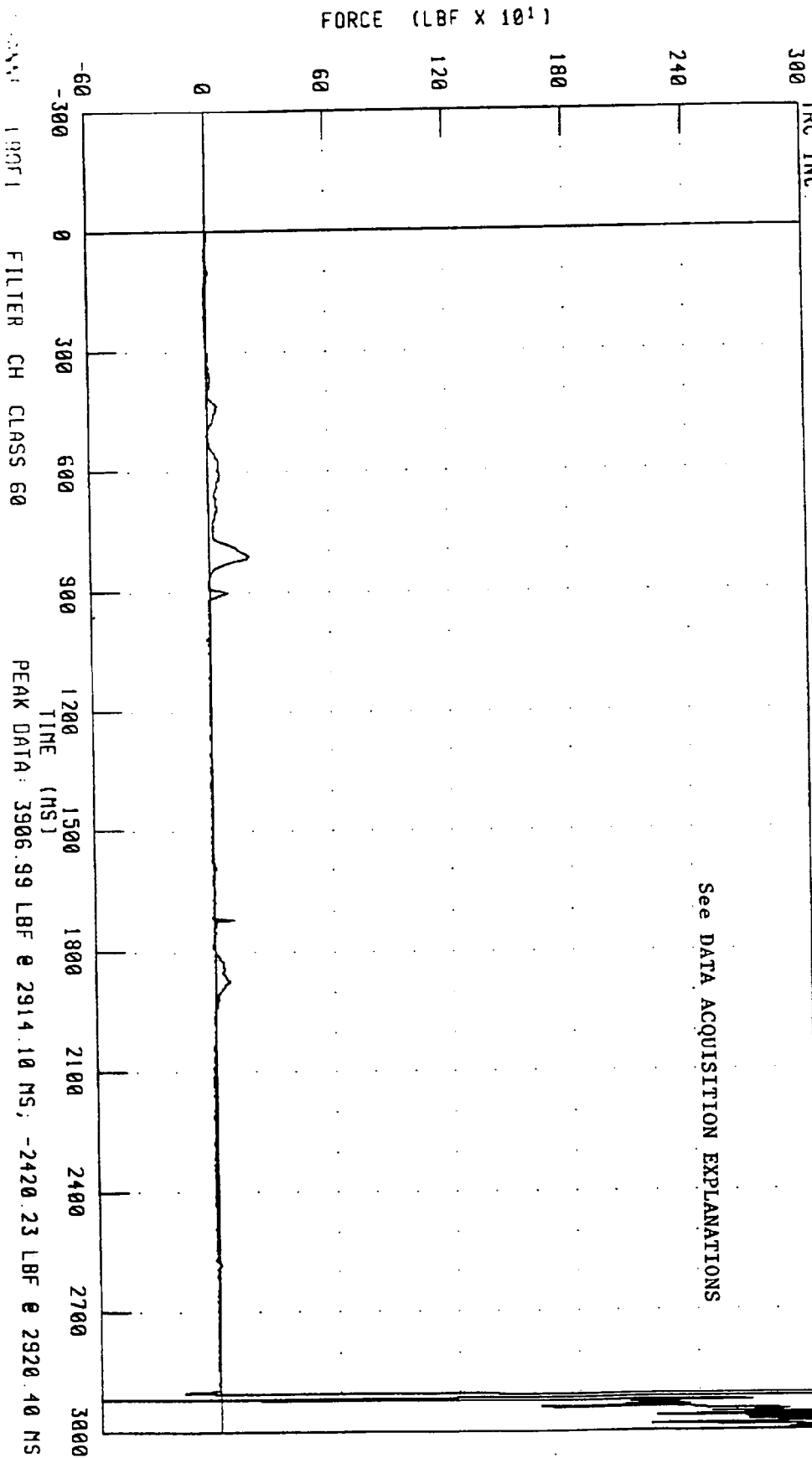


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER LAP BELT FORCE
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

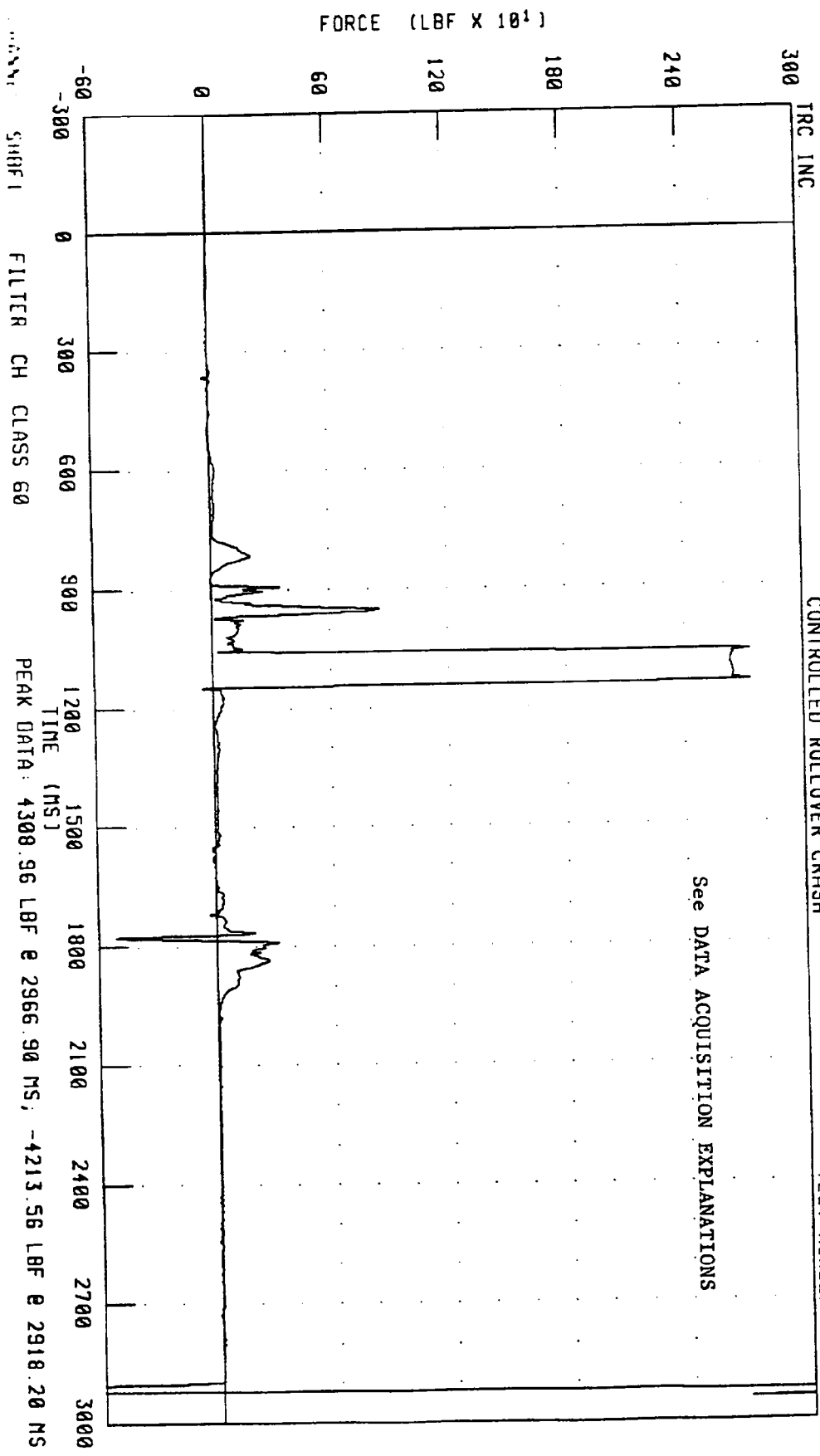
TRC INC.

See DATA ACQUISITION EXPLANATIONS



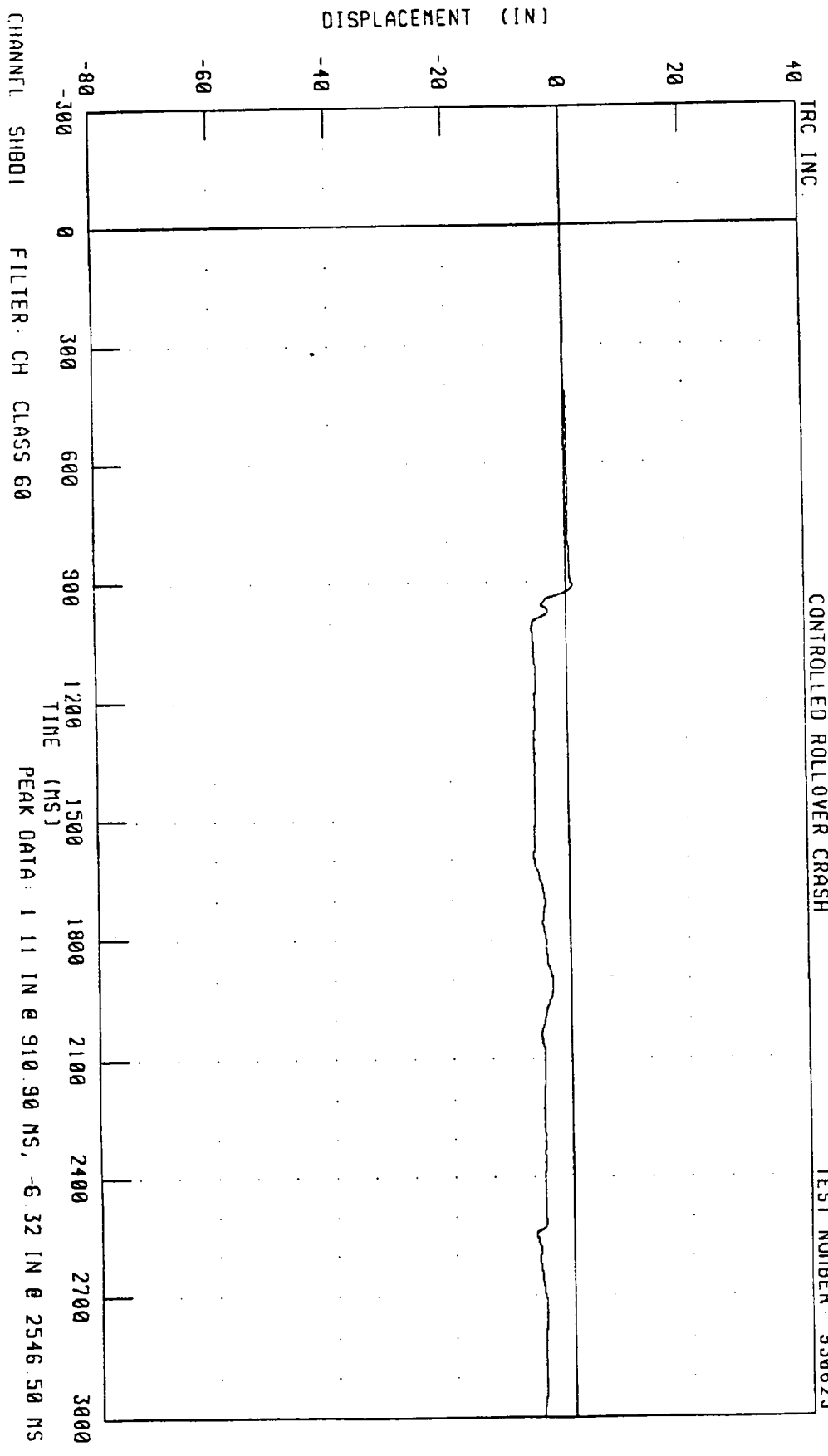
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER SHOULDER BELT FORCE
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
DRIVER SHOULDER BELT DISPLACEMENT
CONTROLLED ROLLOVER CRASH

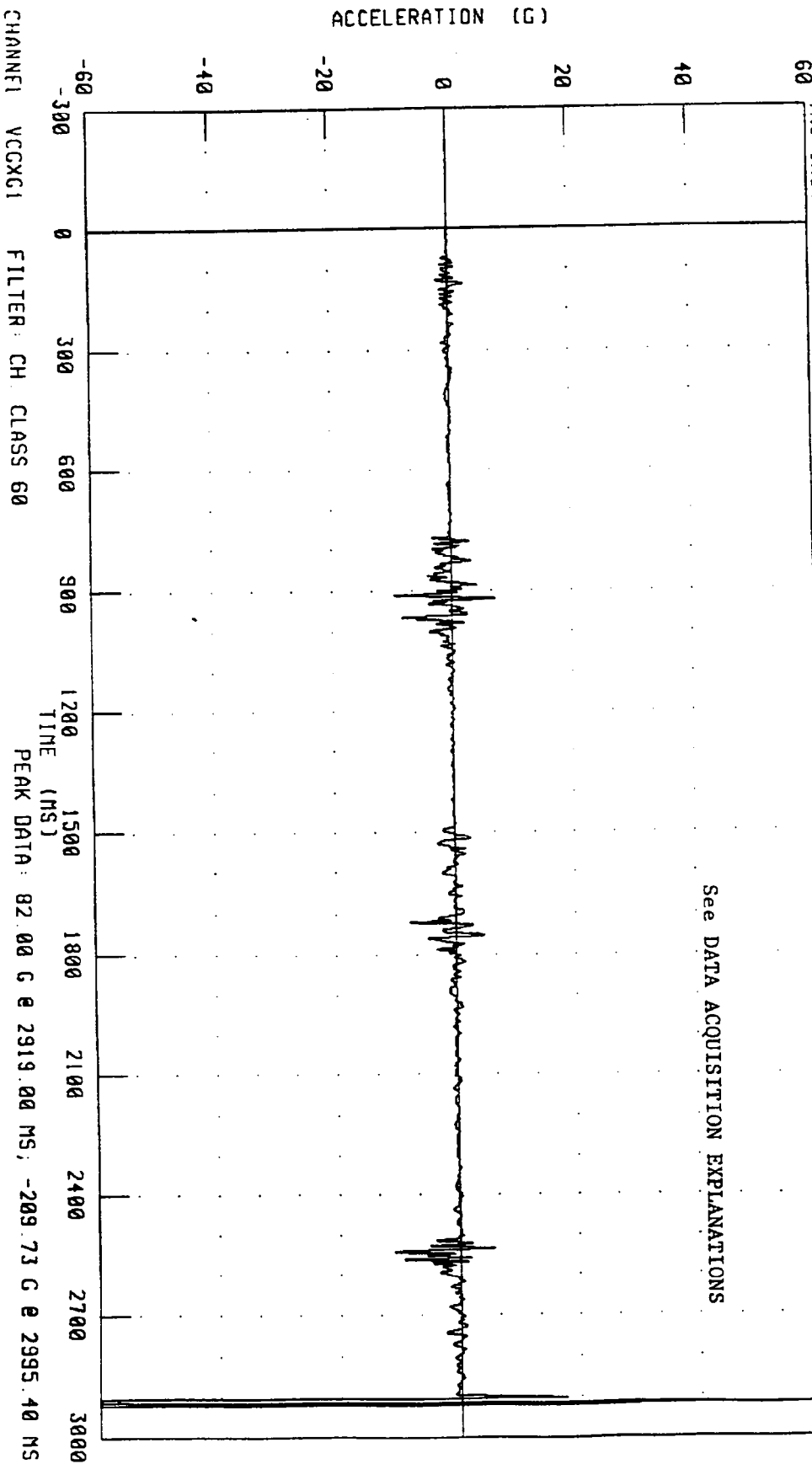
TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

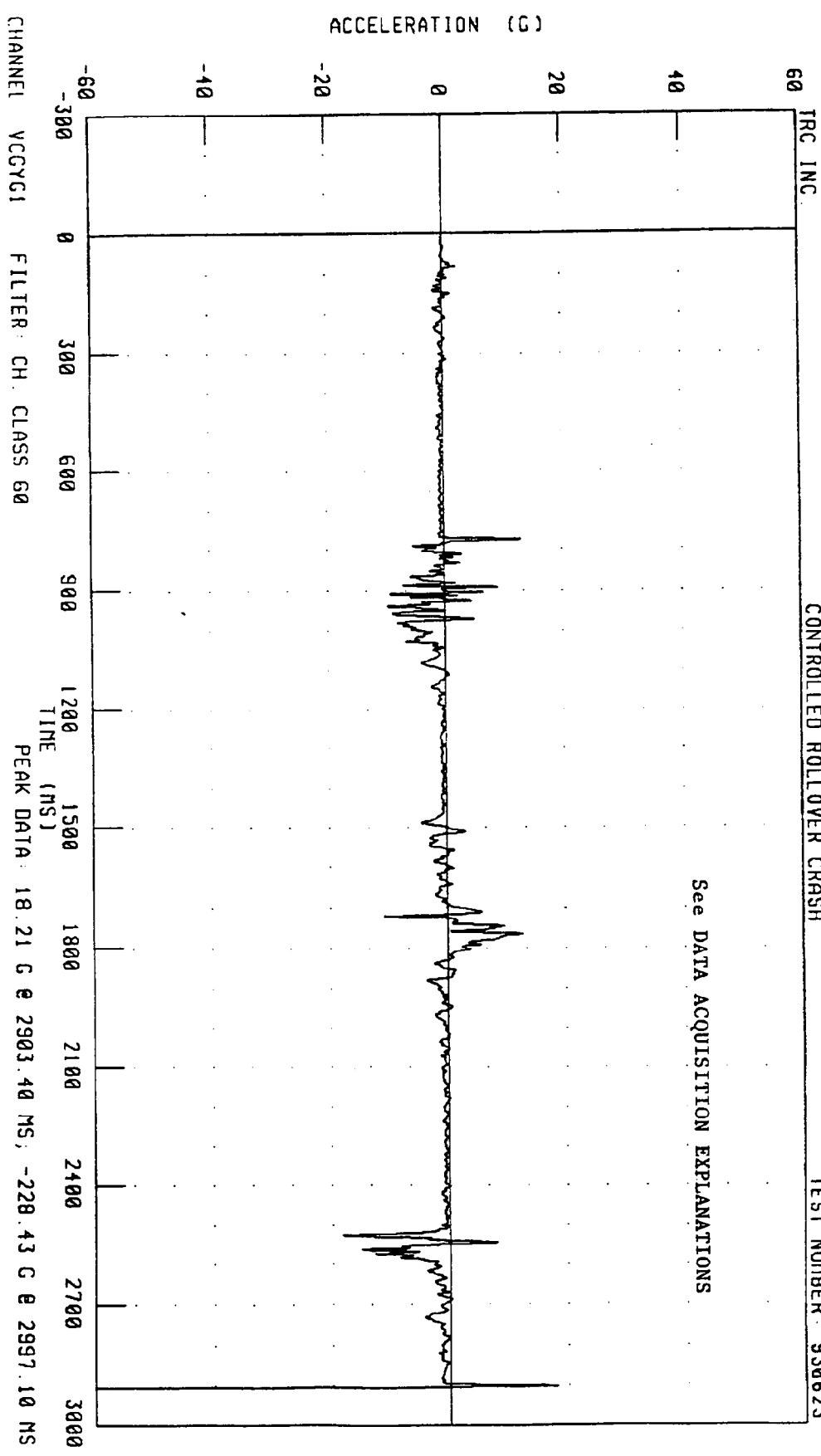
TRC INC.



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

See DATA ACQUISITION EXPLANATIONS

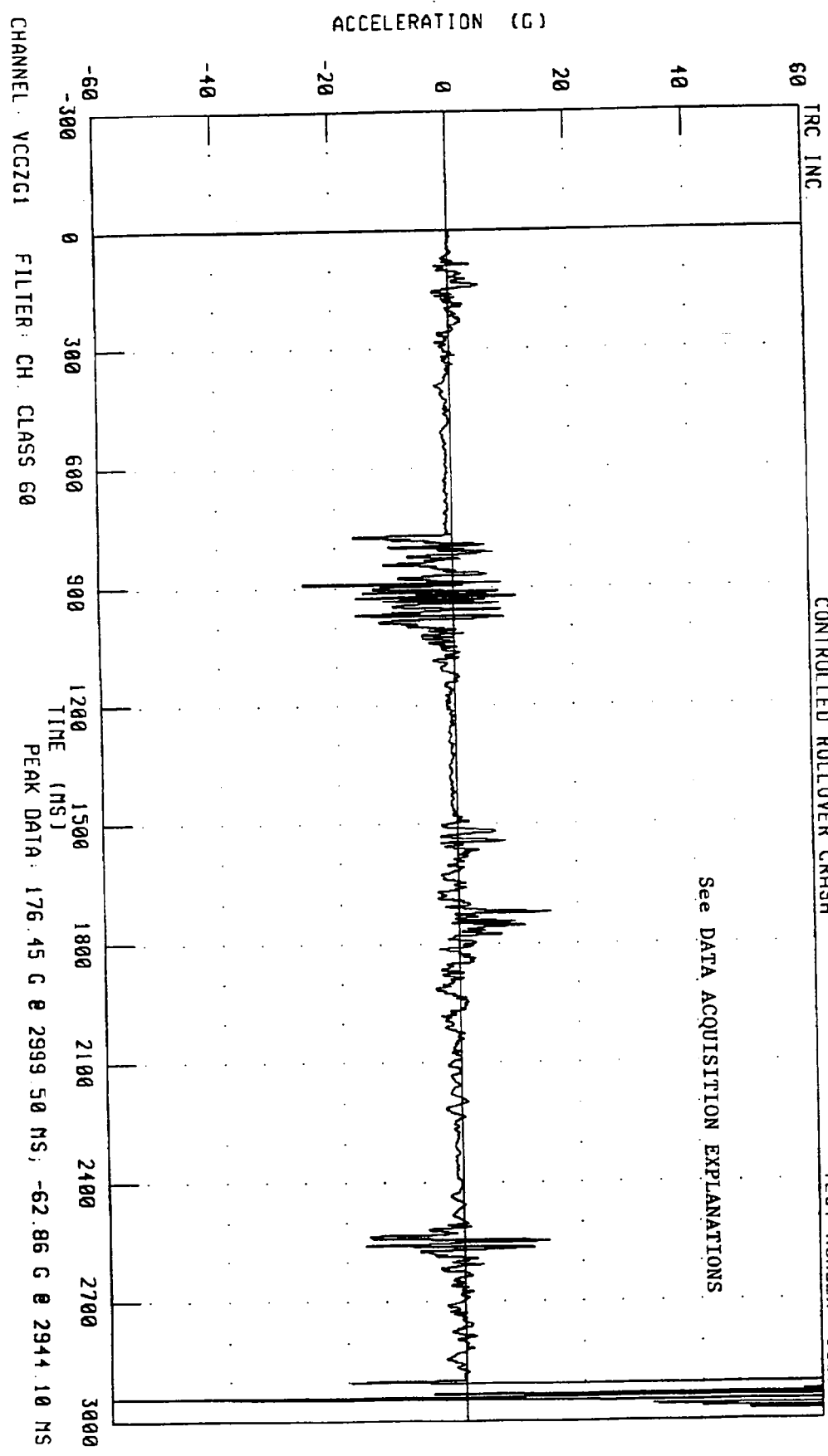


CHANNEL VCCYCI FILTER CH. CLASS 60
PEAK DATA: 18.21 G @ 2903.40 MS, -228.43 G @ 2997.10 MS

1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY Z-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

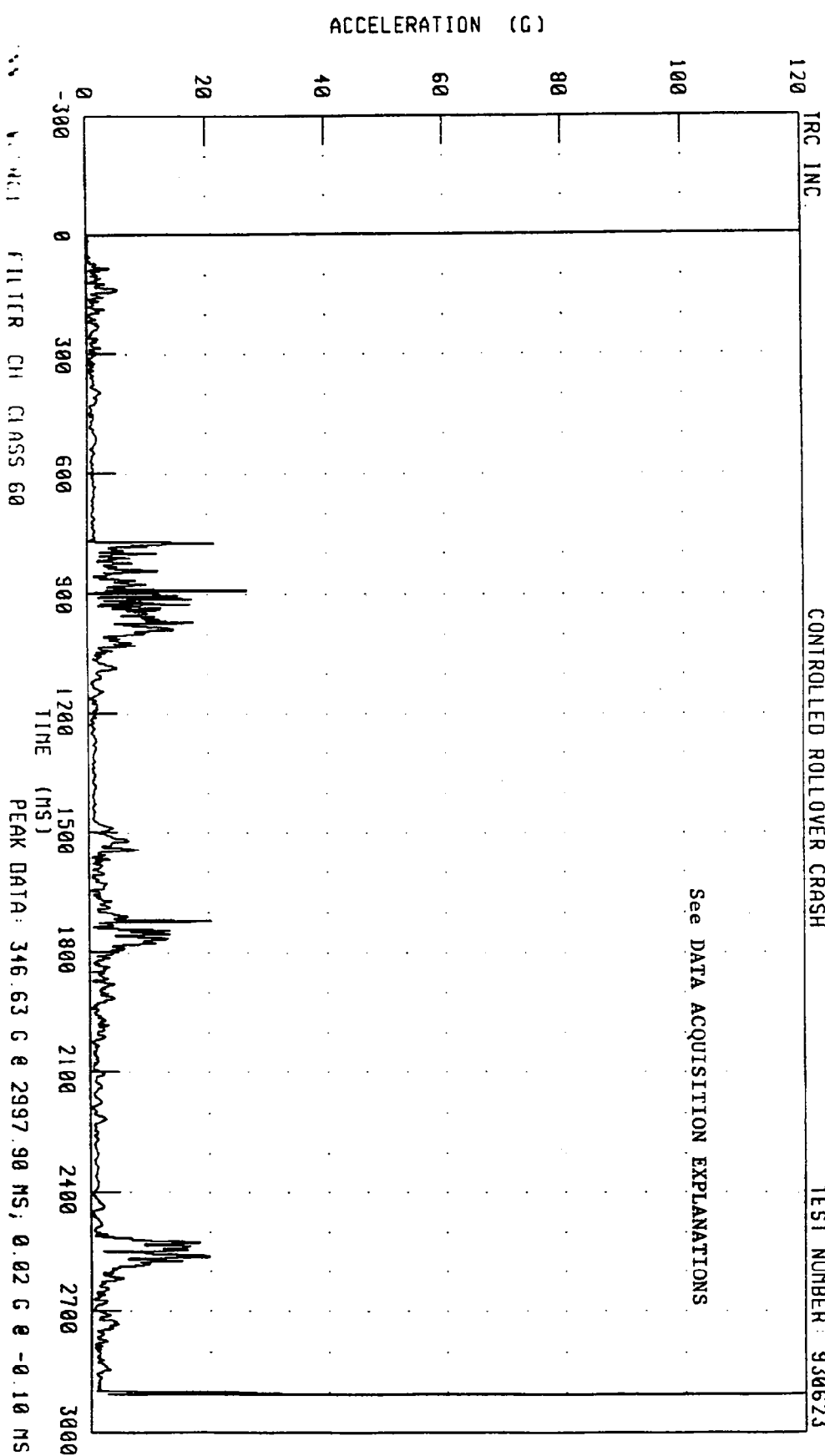
TEST NUMBER: 930623

See DATA ACQUISITION EXPLANATIONS



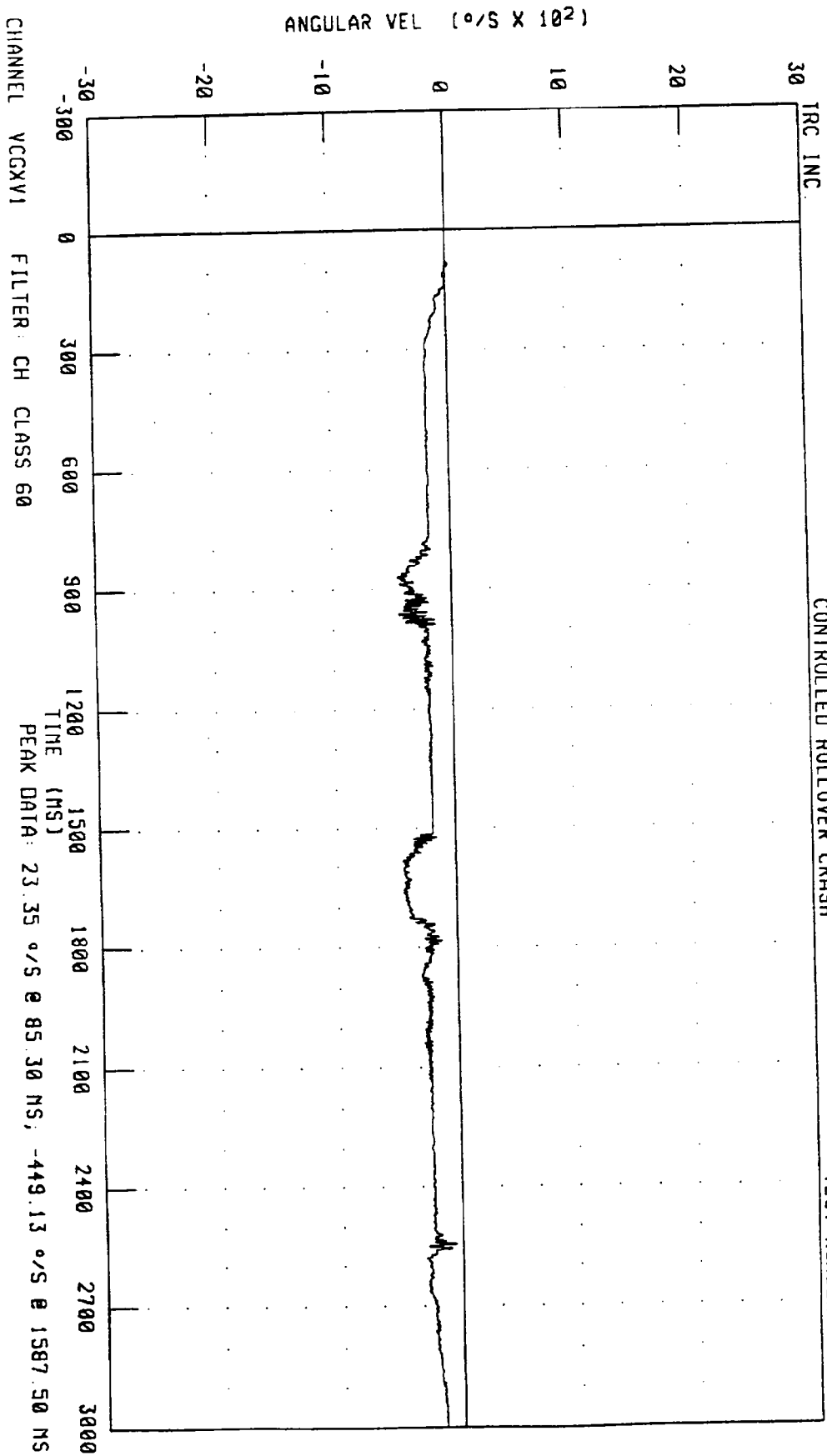
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE CENTER OF GRAVITY RESULTANT ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE ROLL RATE
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

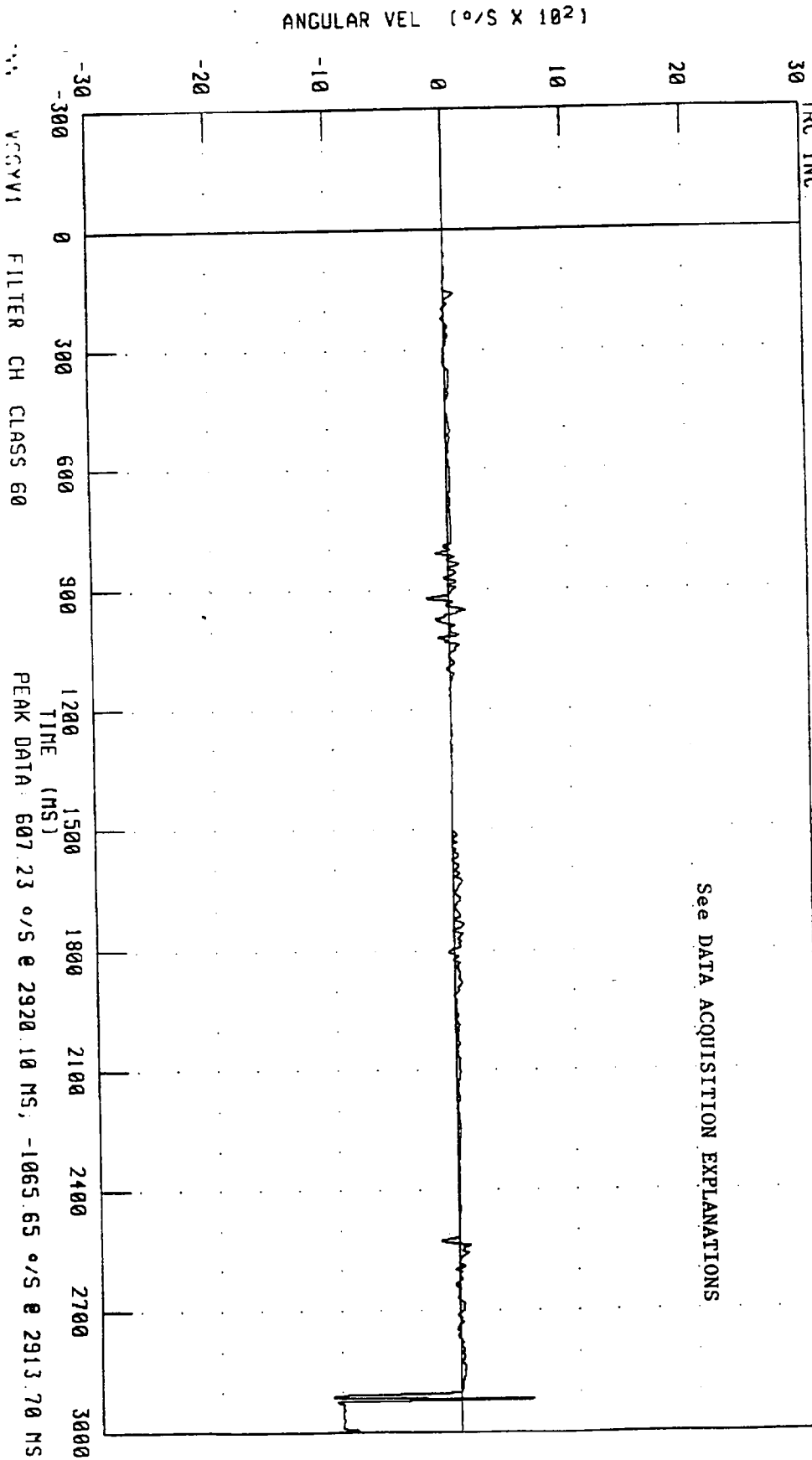


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
 VEHICLE PITCH RATE
 CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

TRC INC.

See DATA ACQUISITION EXPLANATIONS

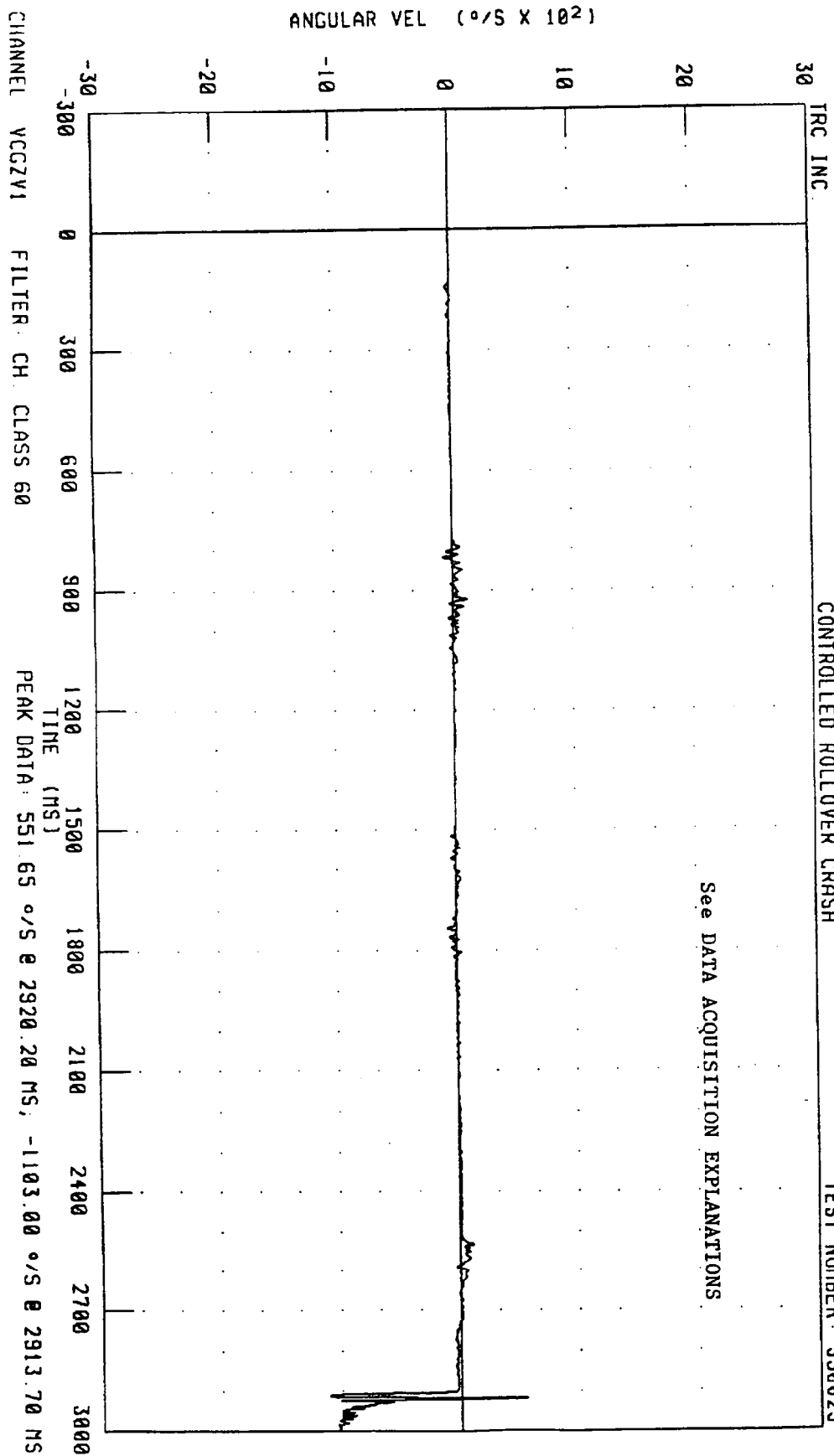


VEGV1 FILTER CH CLASS 60

PEAK DATA: 607.23 °/S @ 2920.10 MS, -1065.65 °/S @ 2913.70 MS

1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE YAW RATE
CONTROLLED ROLLOVER CRASH

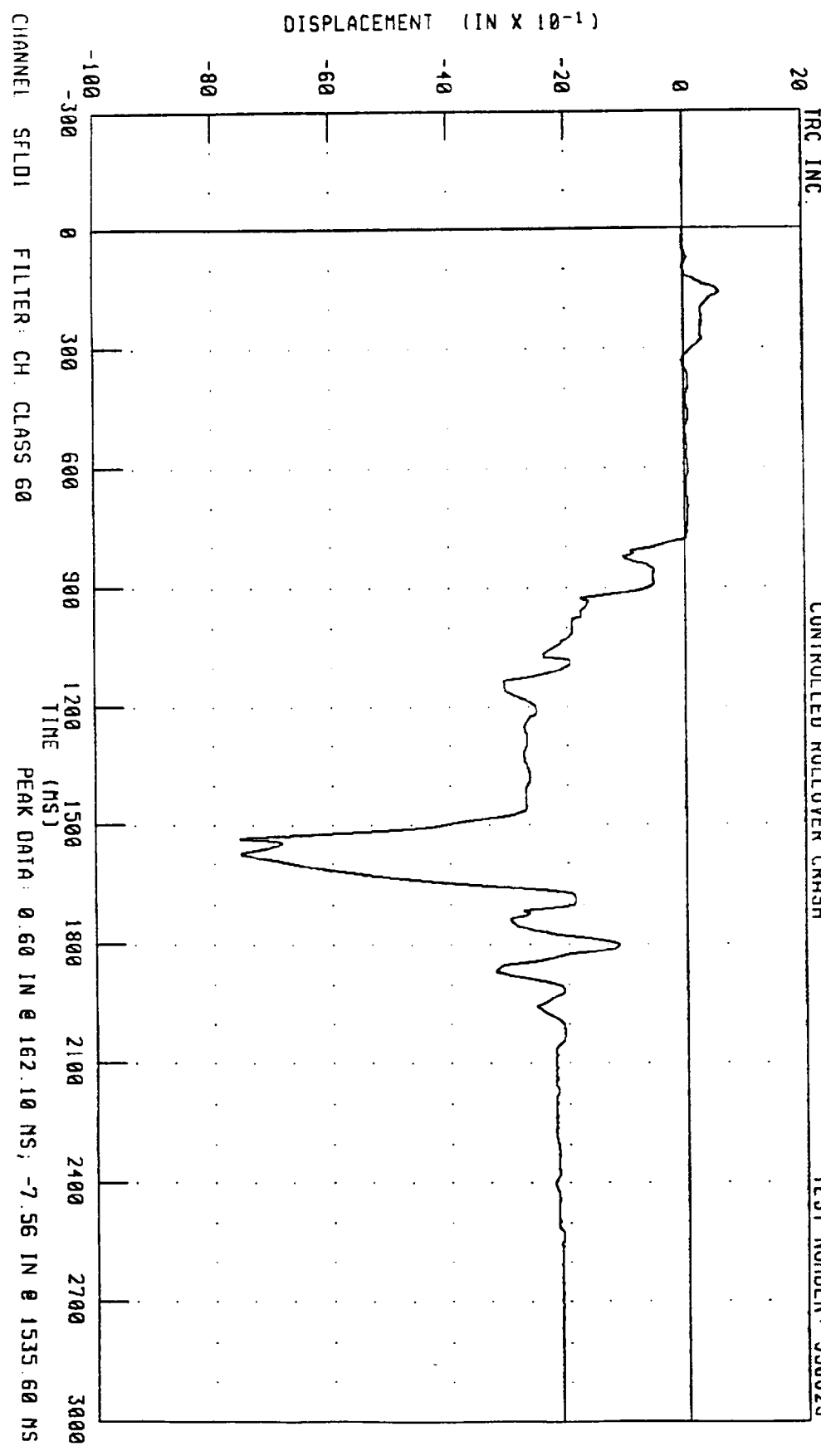
TEST NUMBER: 930623



TRC INC.

TEST NUMBER: 930623

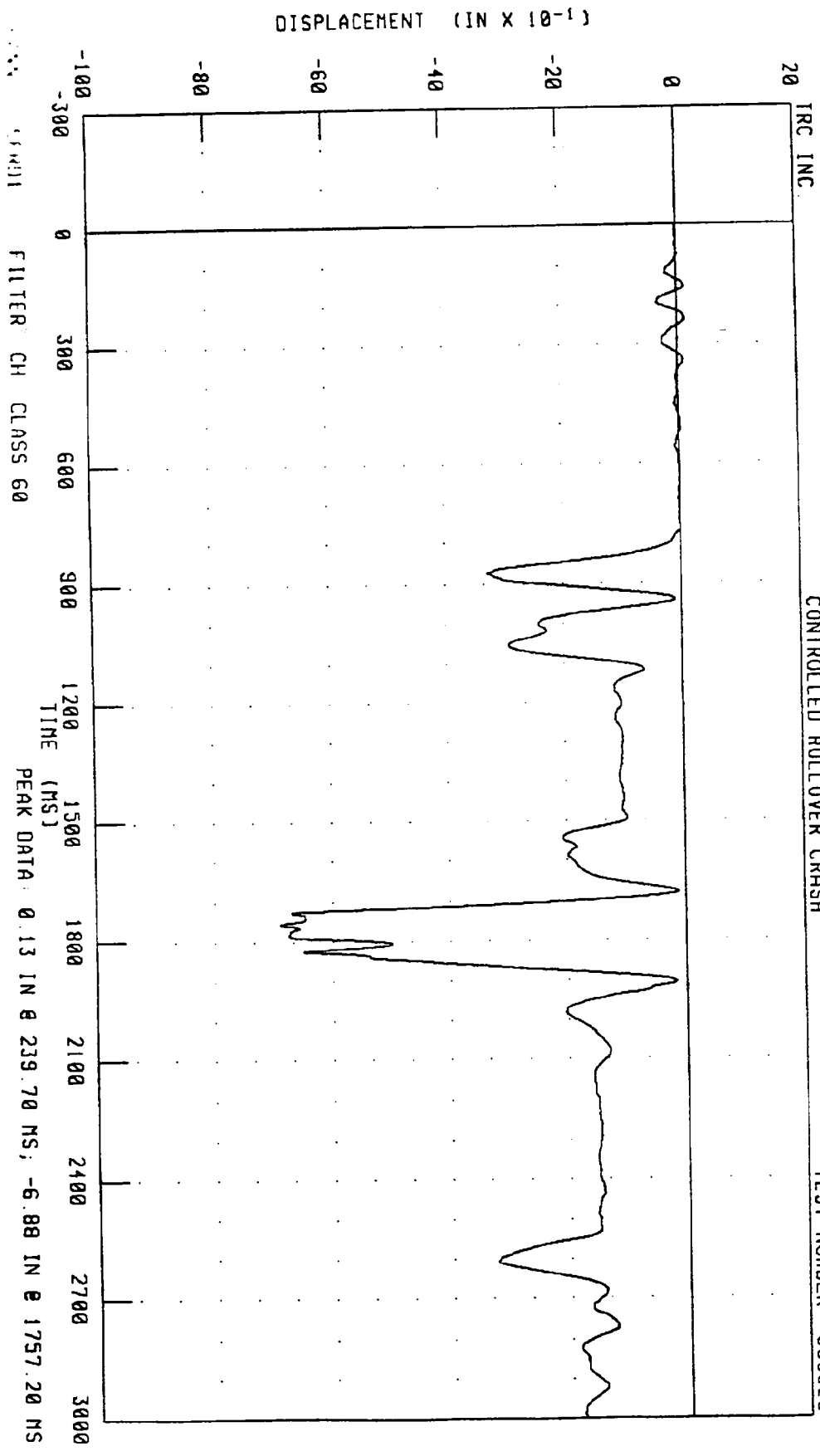
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE LEFT FRONT SUSPENSION DISPLACEMENT
CONTROLLED ROLLOVER CRASH



CHANNEL SFLD1 FILTER CH CLASS 60
PEAK DATA: 0.60 IN @ 162.10 MS, -7.56 IN @ 1535.60 MS

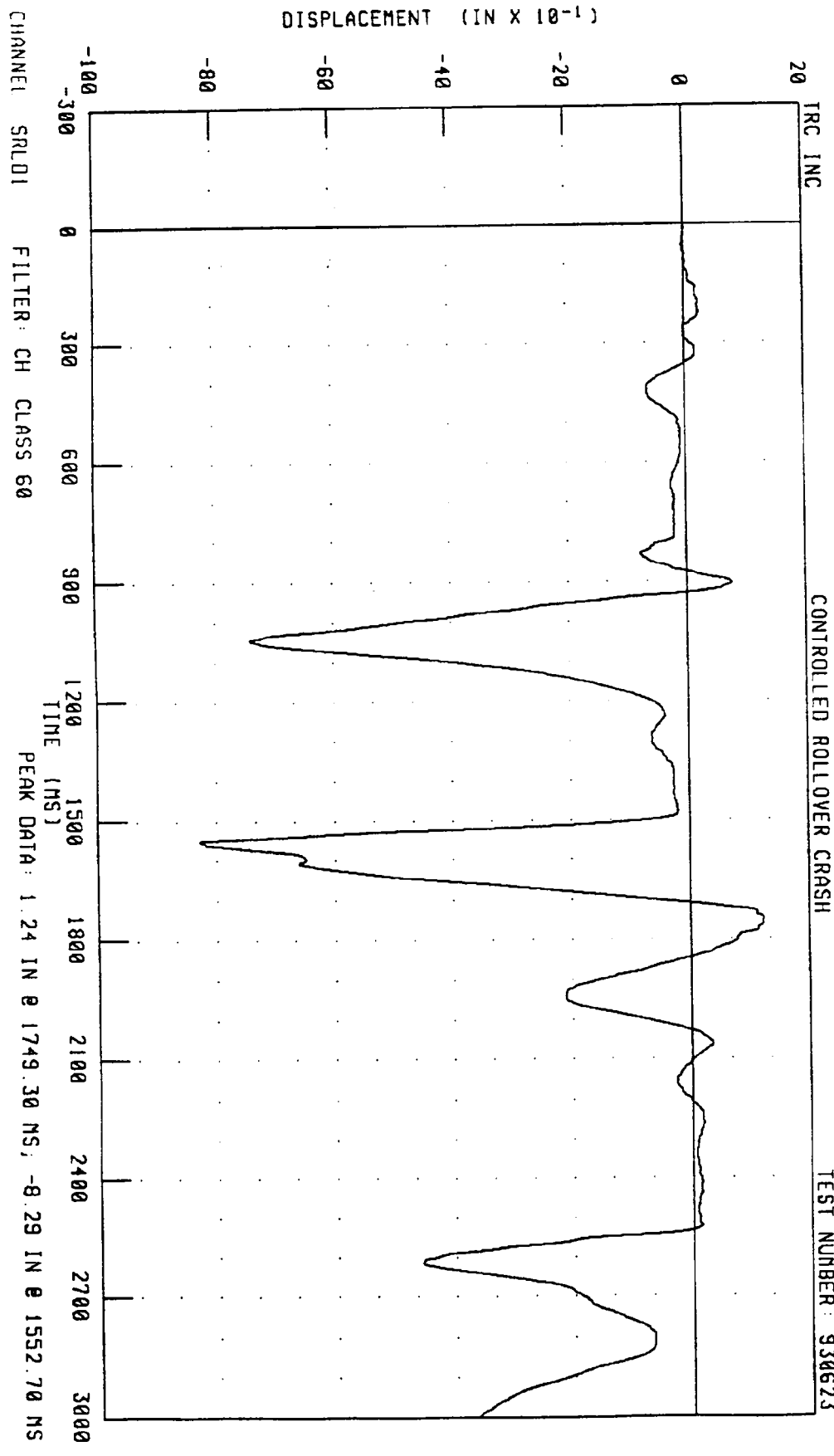
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE RIGHT FRONT SUSPENSION DISPLACEMENT
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



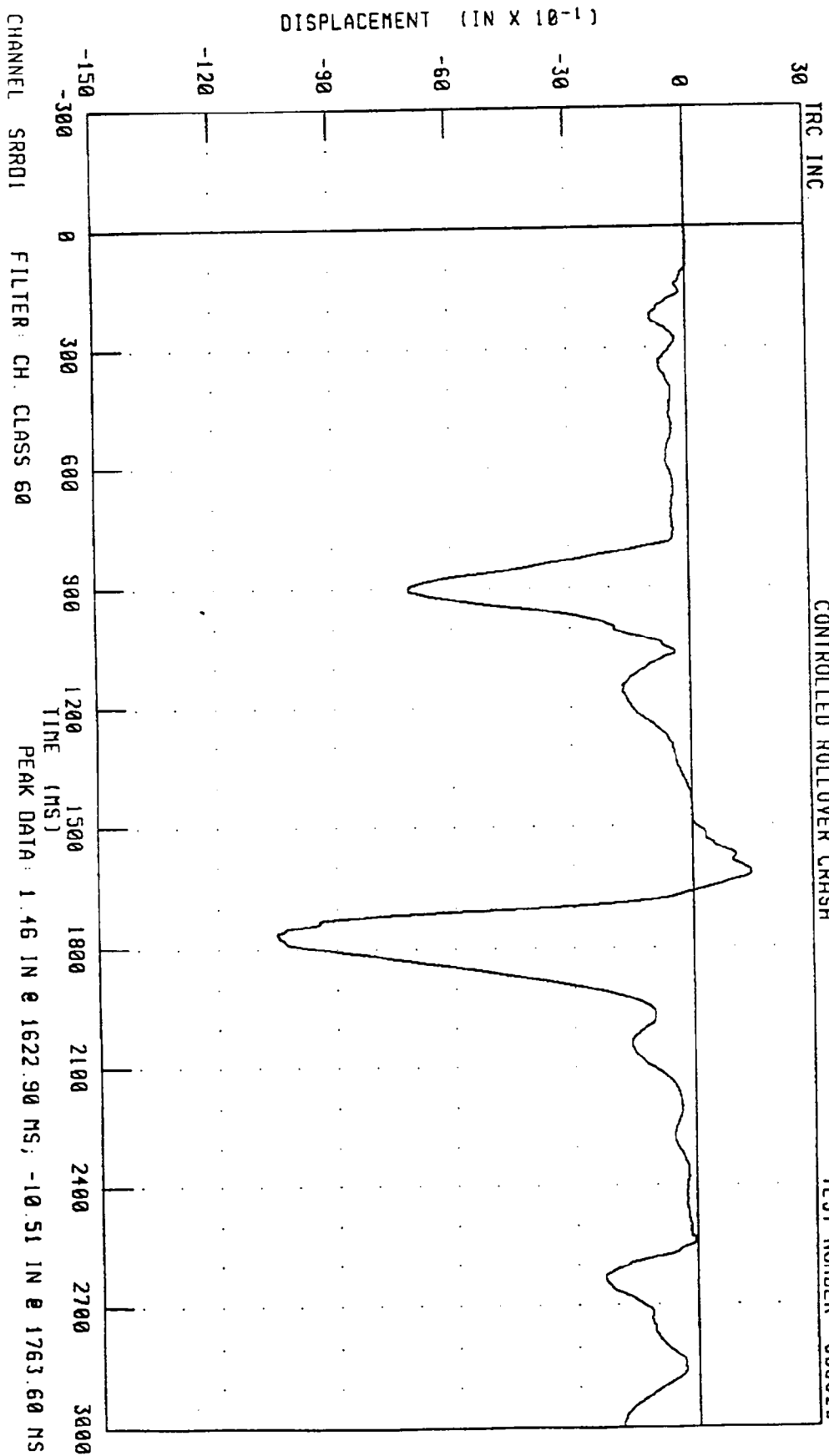
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE LEFT REAR SUSPENSION DISPLACEMENT
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



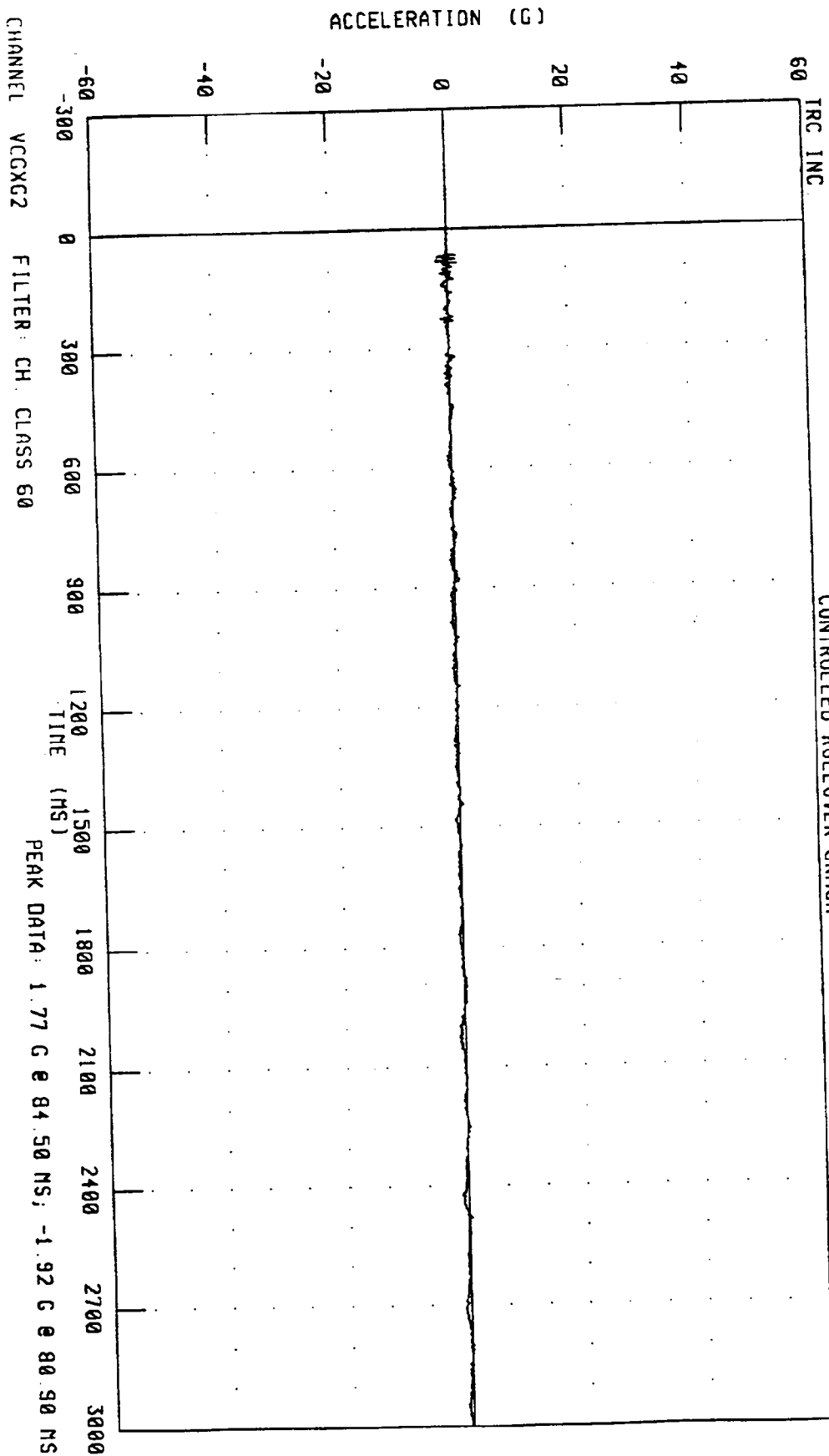
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE RIGHT REAR SUSPENSION DISPLACEMENT
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



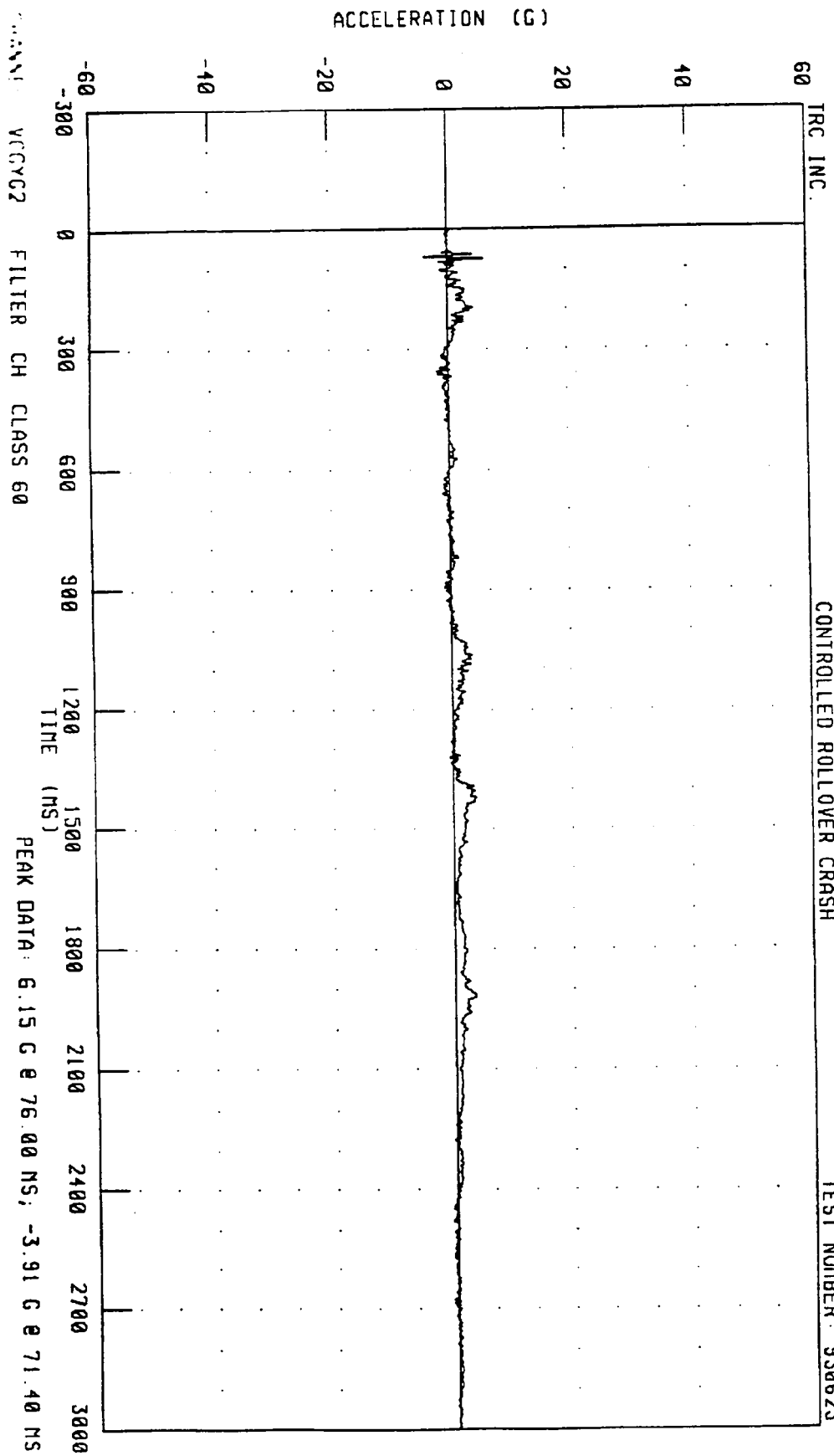
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY X-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY Y-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

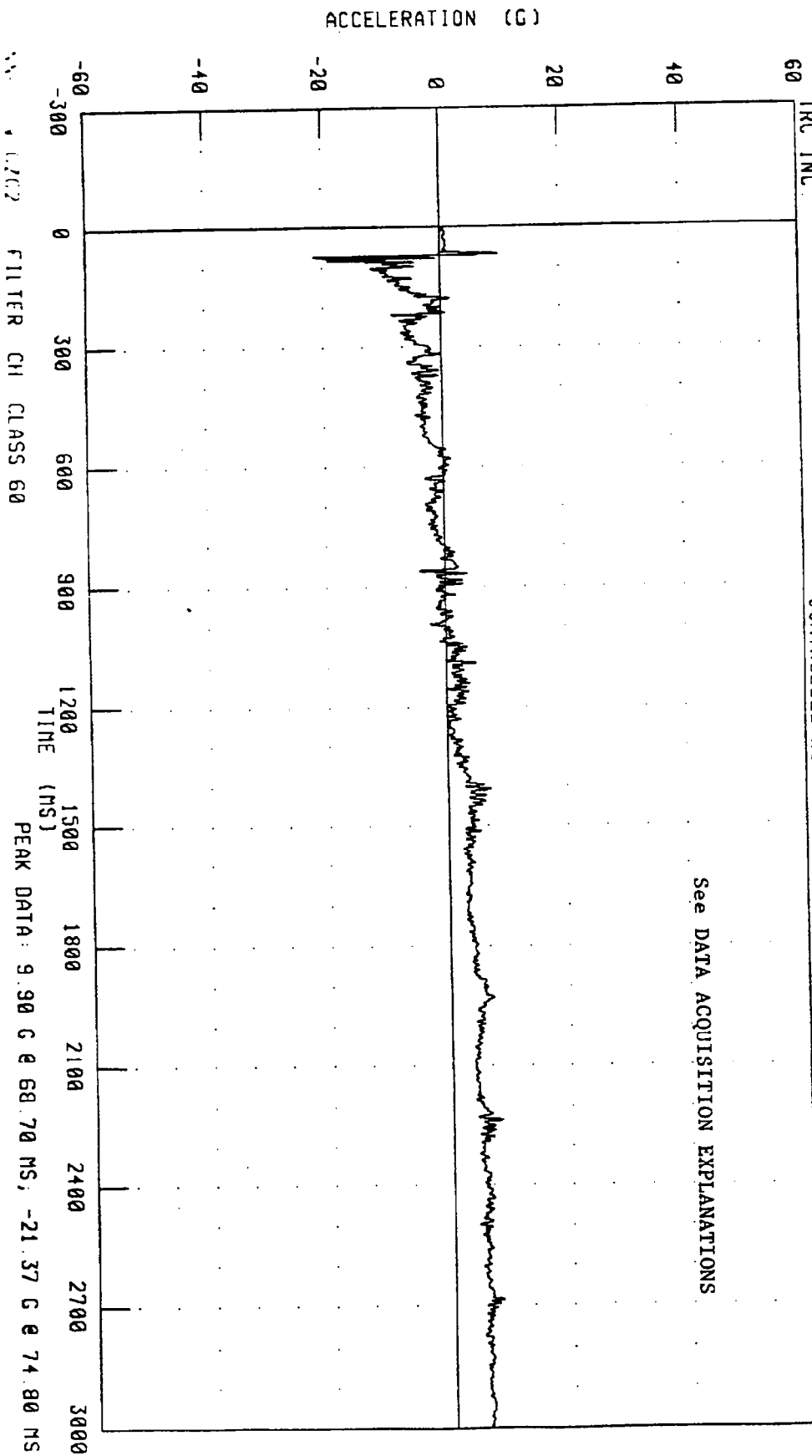


1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY Z-AXIS ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623

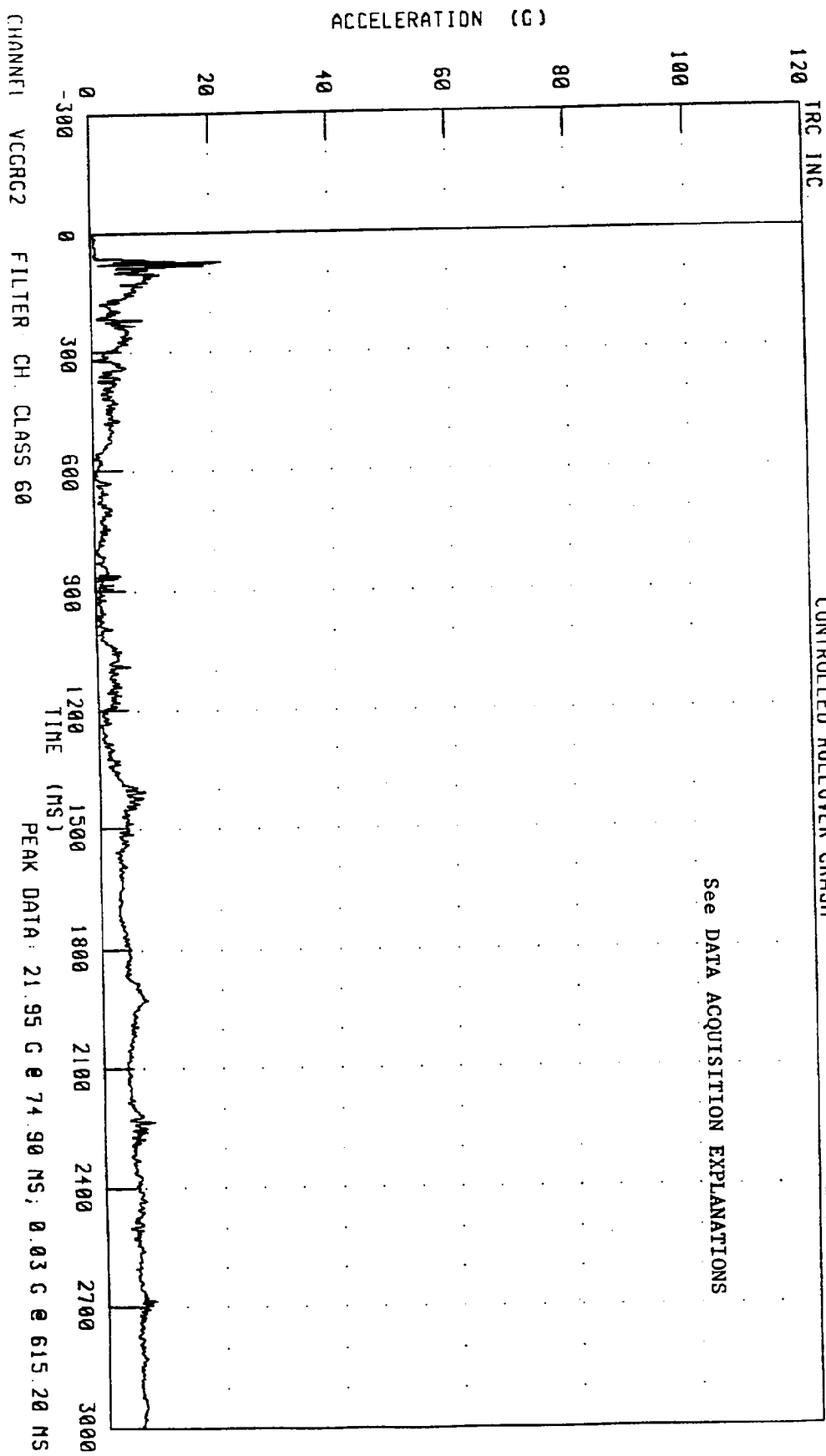
TRC INC.

See DATA ACQUISITION EXPLANATIONS



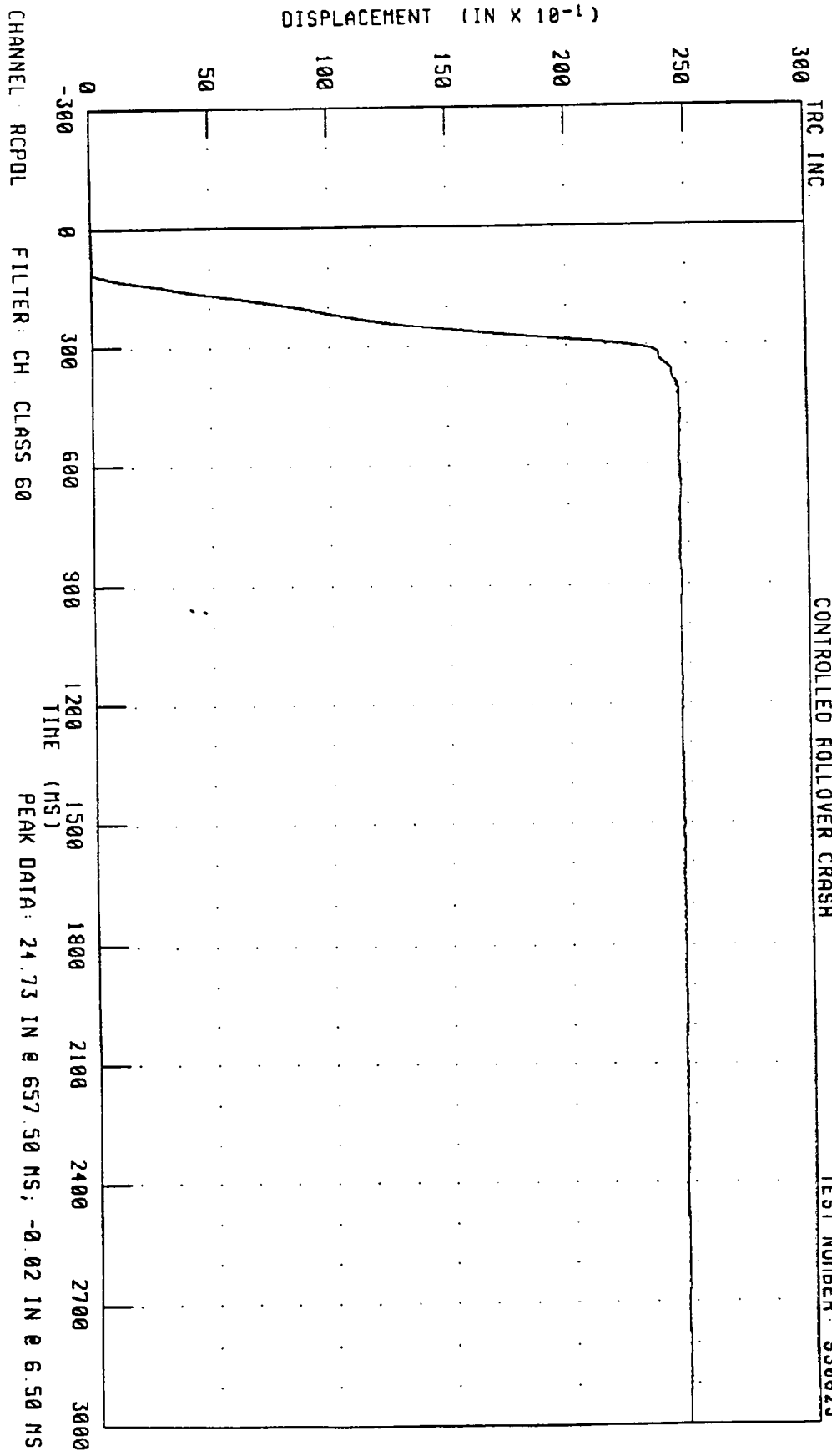
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
ROLL CART CENTER OF GRAVITY RESULTANT ACCELERATION
CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



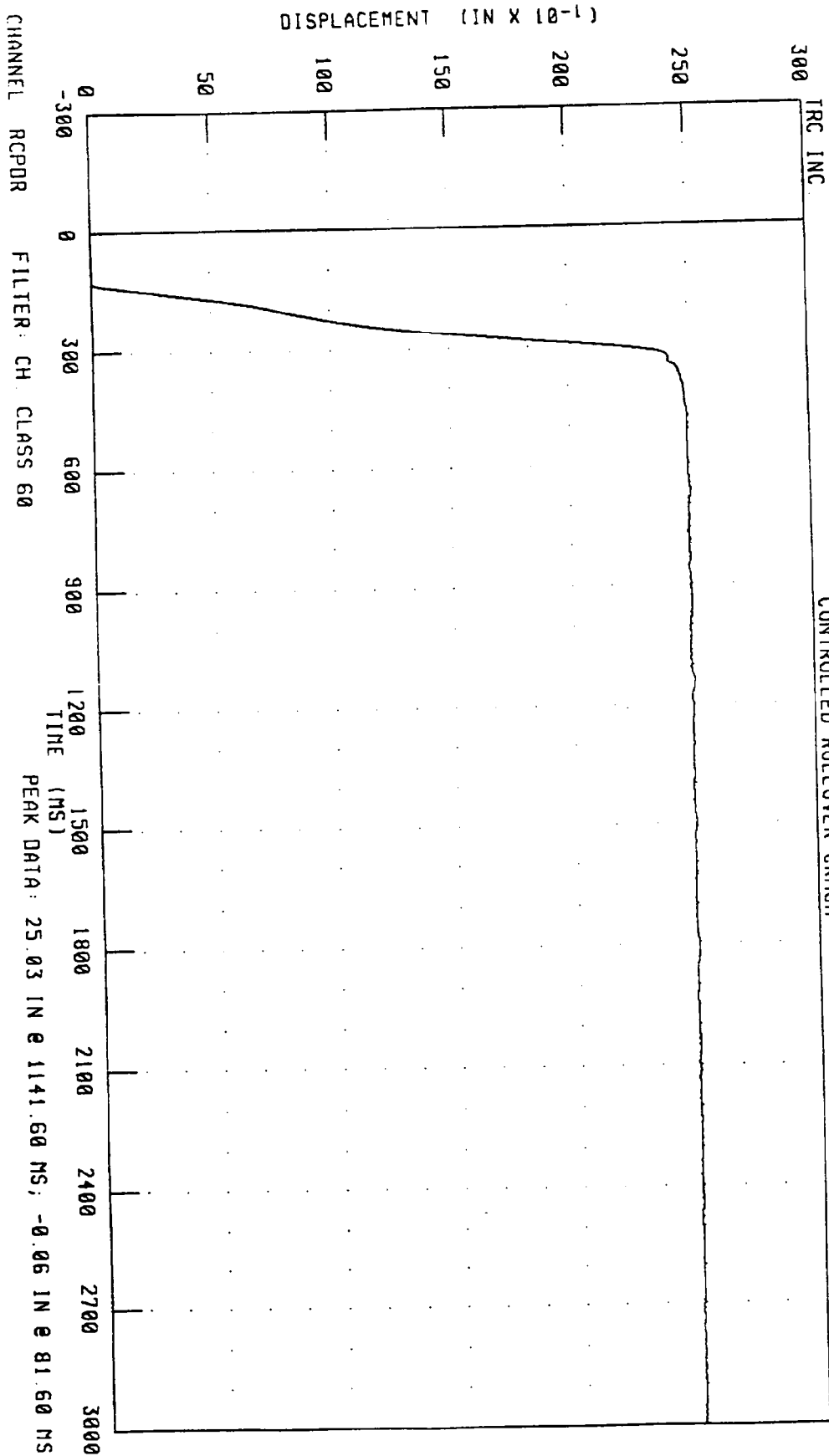
1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
 ROLL CART LEFT CYLINDER DISPLACEMENT
 CONTROLLED ROLLOVER CRASH

TEST NUMBER 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
ROLL CART RIGHT CYLINDER DISPLACEMENT
CONTROLLED ROLLOVER CRASH

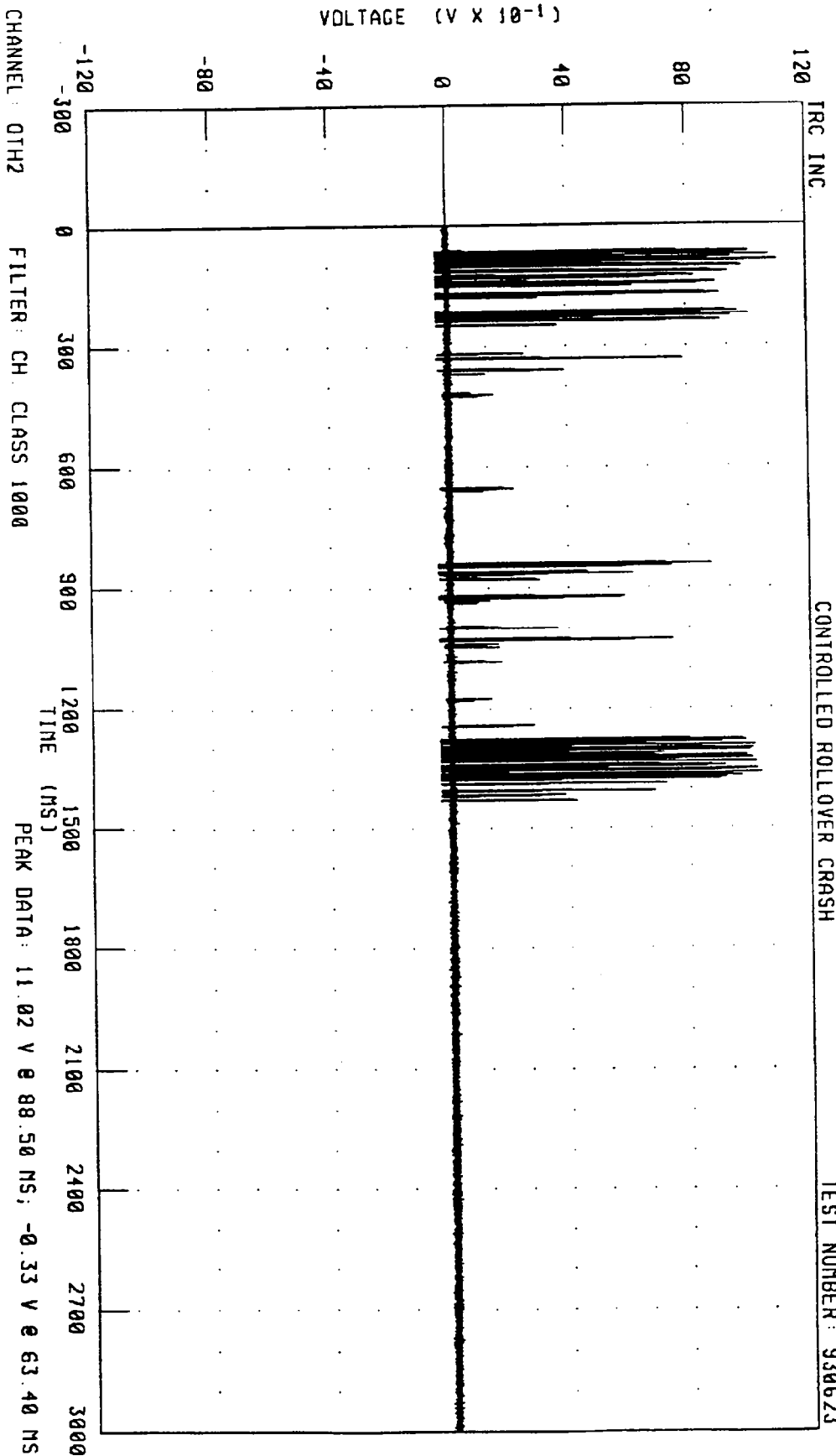
TEST NUMBER: 930623



1990 NISSAN PICKUP FROM ROLLOVER CART AT 30 MPH
VEHICLE/ROLL CART SEPARATION TIME - LOWER SWITCH

CONTROLLED ROLLOVER CRASH

TEST NUMBER: 930623



APPENDIX C

DUMMY CERTIFICATION DATA

POST-TEST CERTIFICATION DATA

DRIVER DUMMY S/N 043

TRANSPORTATION RESEARCH CENTER INC.
HYBRID III EXTERNAL DIMENSIONS
043 HUMANOID

18-JUN-93

TRC	43C5ED1	572E SN043 EXT. DIMENSION CAL05	
TEST PARAMETER	(DIMEN.)	SPECIFICATION	TEST RESULTS
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	(O)	8.4 - 9.0 IN	8.6 IN
H-POINT HEIGHT	(C)	3.3 - 3.5 IN	3.4 IN
H-POINT FROM SEATBACK	(D)	5.3 - 5.5 IN	5.4 IN
SKULL CAP TO BACKLINE	(H)	1.6 - 1.8 IN	1.7 IN
TOTAL SITTING HEIGHT	(A)	34.6 - 35.0 IN	34.8 IN
THIGH CLEARANCE	(F)	5.5 - 6.1 IN	6.1 IN
BUTTOCK KNEE LENGTH	(K)	22.8 - 23.8 IN	23.8 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 Font

TRANSPORTATION RESEARCH CENTER INC.

HEAD DROP TEST

HYBRID III

18-JUN-93

TRC

43C5HD1

572E SN43 HEAD DROP CAL 05

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	57.0 %
PEAK RESULTANT ACCELERATION	225 - 275 G	246.97 G
PEAK LATERAL ACCELERATION	15 G MAX	-4.55 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

TEST MEETS SPECIFICATIONS

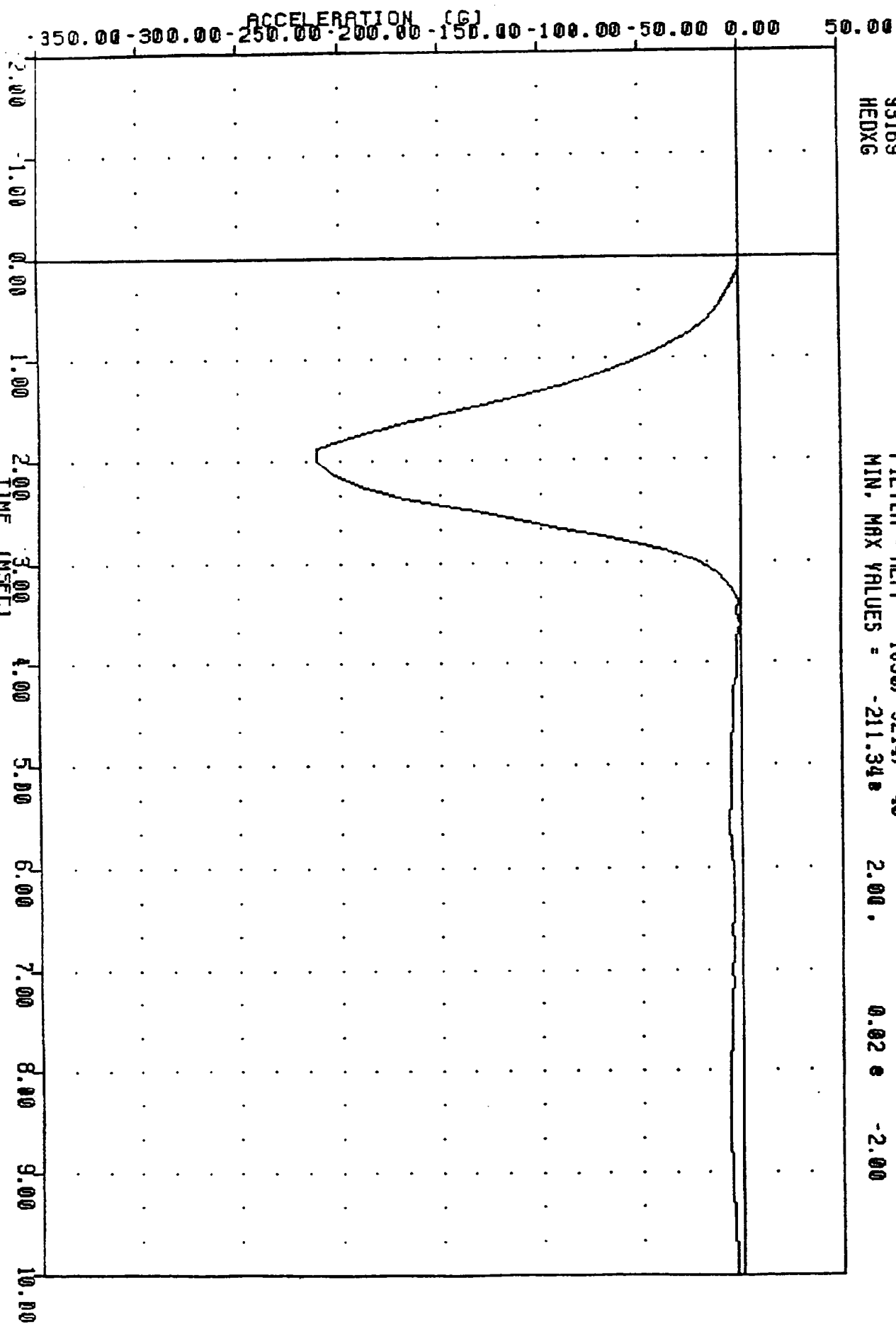
TECHNICIAN

Pete Font

TRC
572E SN43 HEAD DROP CAL 05
93169
HDXG

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -211.34 e

2.00 . 0.02 e -2.00



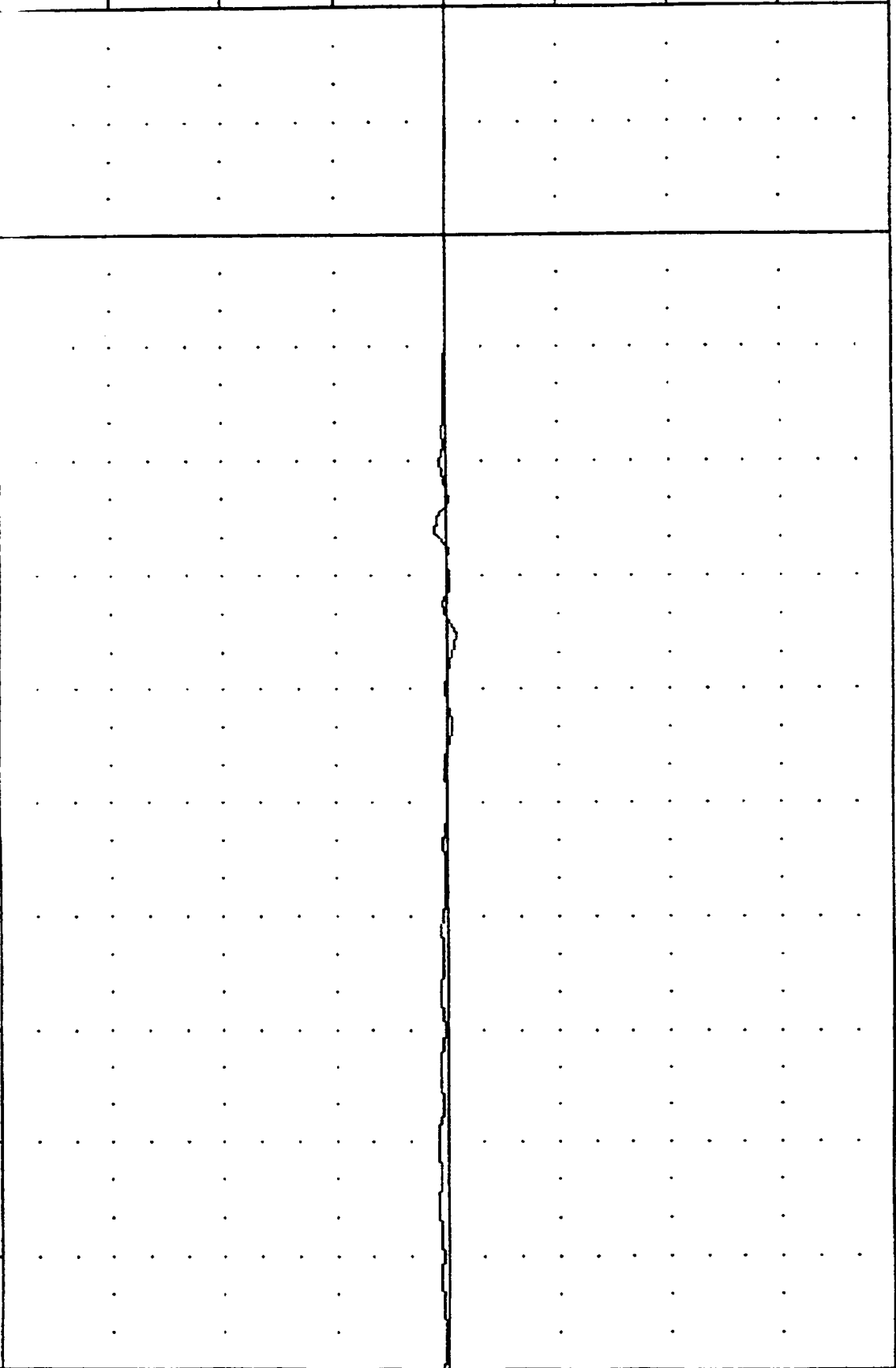
PART 572-E HYBRID III HEAD CALIBRATION

TRC
572E SN43 HEAD DROP CAL 05
93169
HEDYC

FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -4.55 2.63

4.04 3.50

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

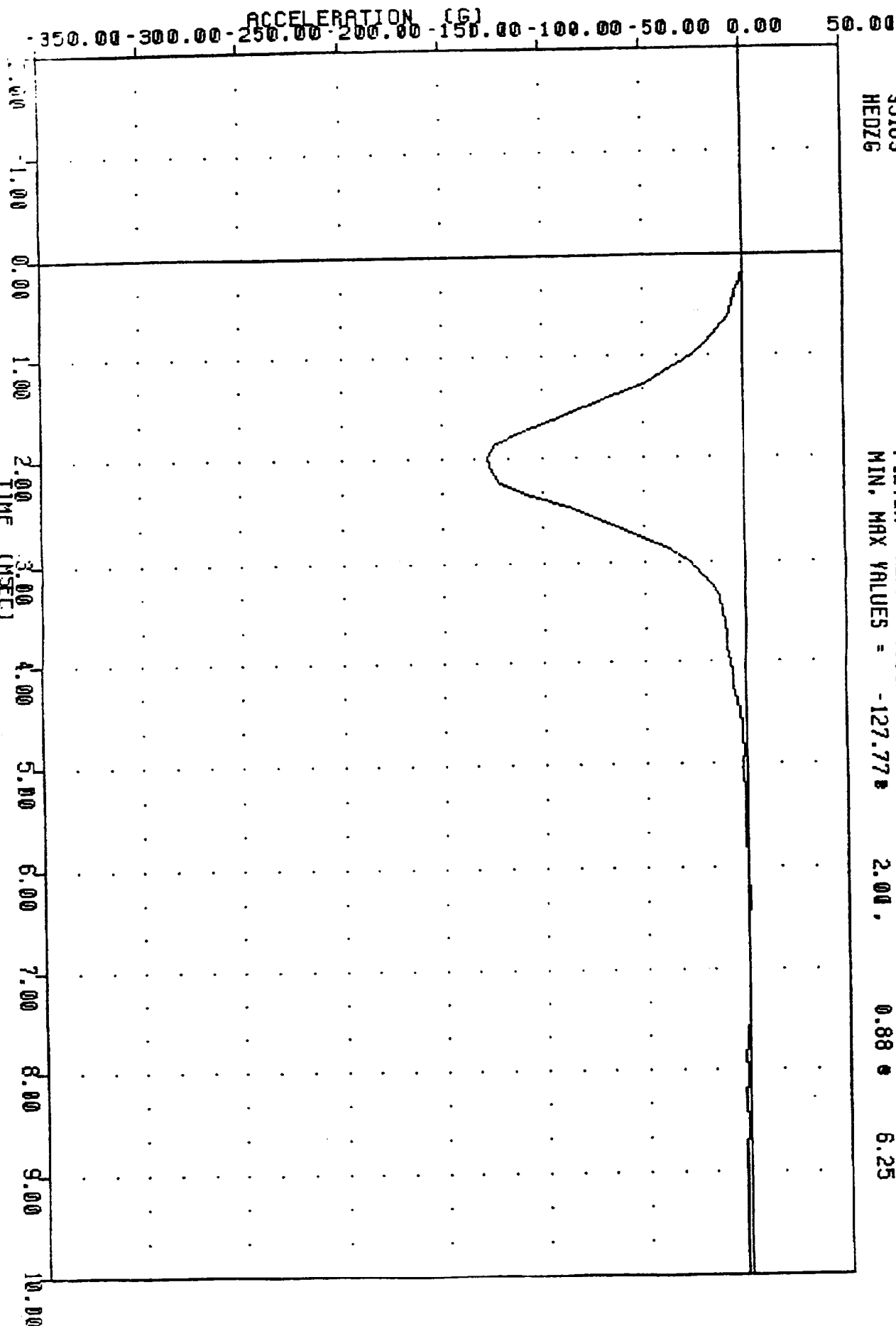


FORM 572-E HYBRID III HEAD CALIBRATION

TRC
572E SN43 HEAD DROP CAL 05
93169
HEDZ6

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -127.77 2.00

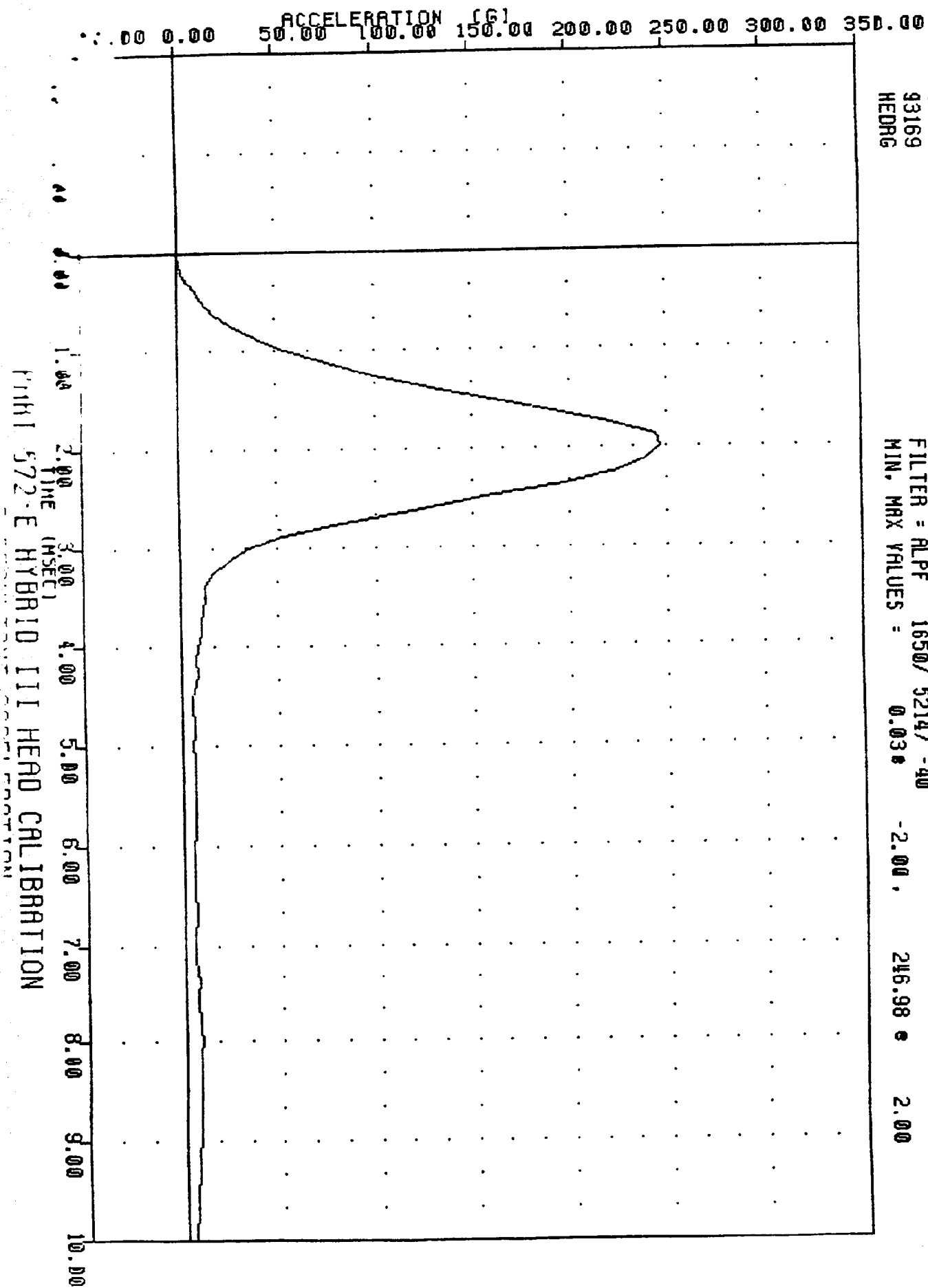
0.88 6.25



PART 572-E HYBRID III HEAD CALIBRATION

TFC
572E SN43 HEAD DROP CAL 05
93169
HEDRG

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = 0.03 246.98 2.00



Hybrid III Head Calibration

TRANSPORTATION RESEARCH CENTER INC.

NECK FLEXION TEST

HYBRID III

18-JUN-93

6 AXIS NECK TRANSDUCER
TRC 43C5NF1

572E SN43 NECK FLEXION CAL05

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY		10% - 70%	55.0 %
IMPACT VELOCITY		22.6 - 23.4 FT/SEC	23.08 FT/SEC
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.17 G
	20 MS	17.60 - 22.60 G	21.19 G
	30 MS	12.50 - 18.50 G	15.82 G
MAX PENDULUM G		29 G MAX	23.94 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	15.76 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	37.75 MS
D PLANE	MAX	64 - 78 DEG.	66.05 DEG.
ROTATION	TIME	57 - 64 MS	58.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	65 - 80 FT. LBS	71.86 FT. LBS
	TIME	47 - 58 MS	51.00 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	116.63 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	100.00 MS

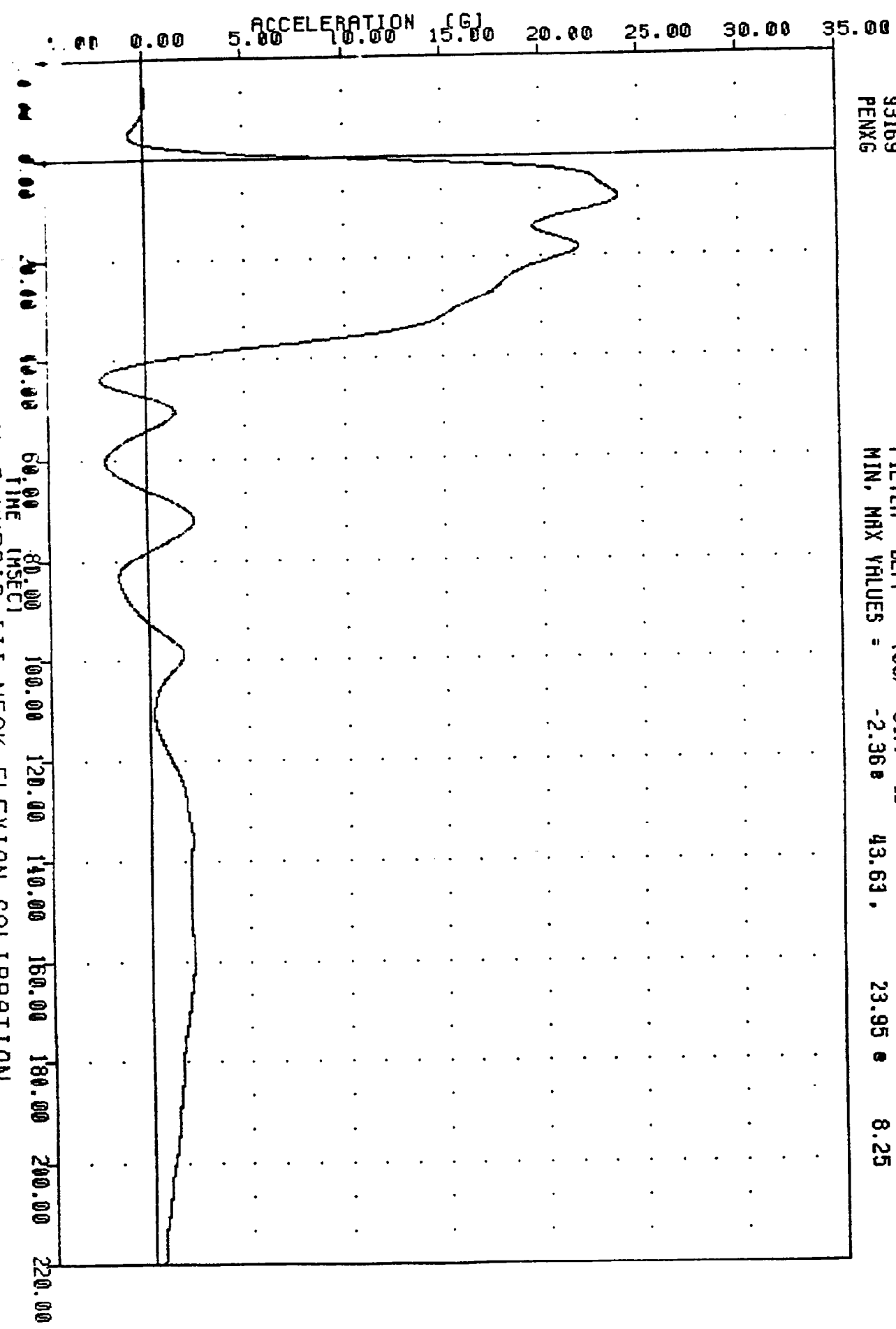
TEST MEETS SPECIFICATIONS

TECHNICIAN

Pete Ford

INU 430CM-1
572E SN49 NECK FLEXION CAL05
93169
PENXG

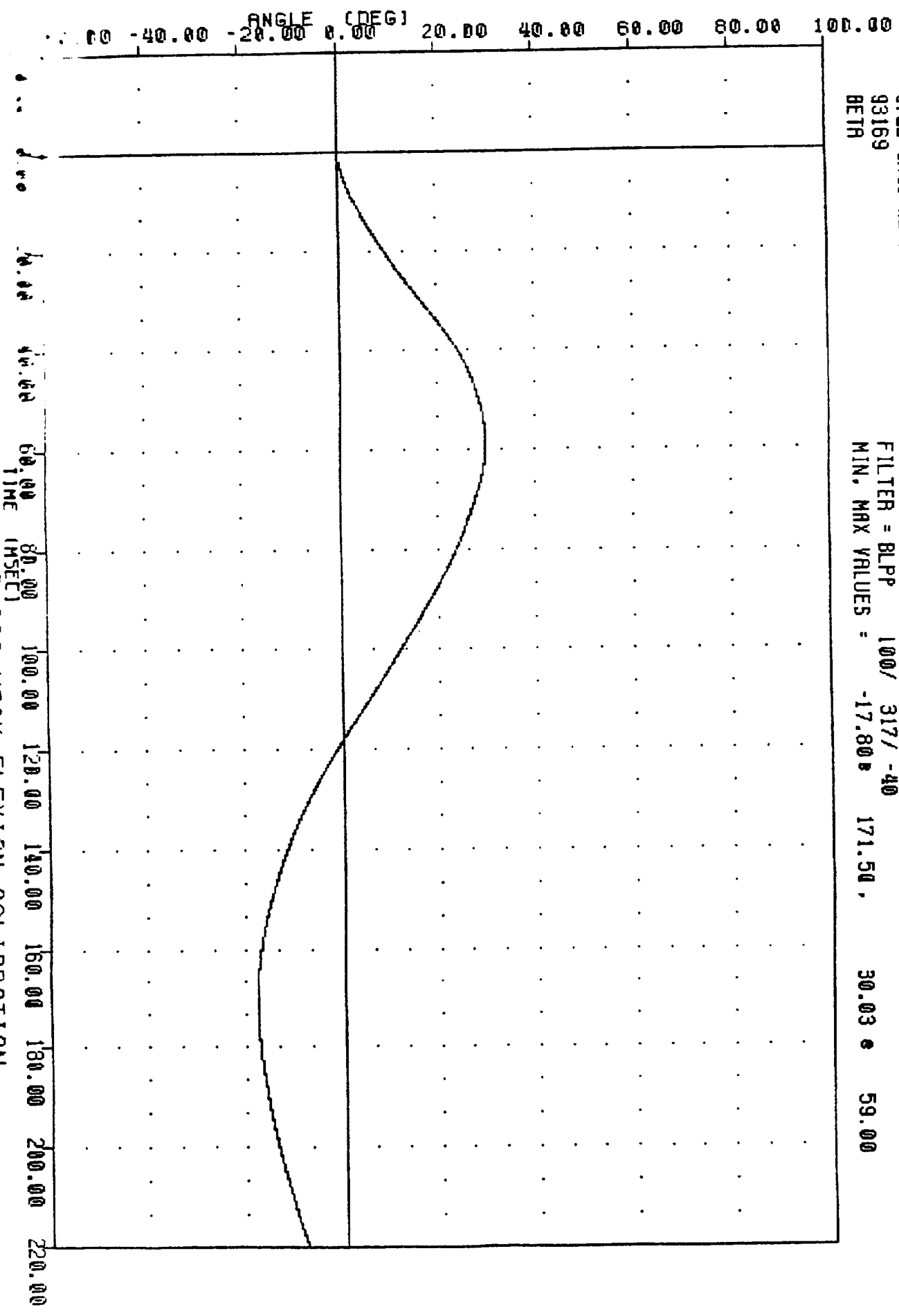
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -2.36e 43.63 , 23.95 e 8.25



PRINT 572-E HYBRID III NECK FLEXION CALIBRATION

INC 4303M-1
 572E SN49 NECK FLEXION CAL05
 93169
 BETA

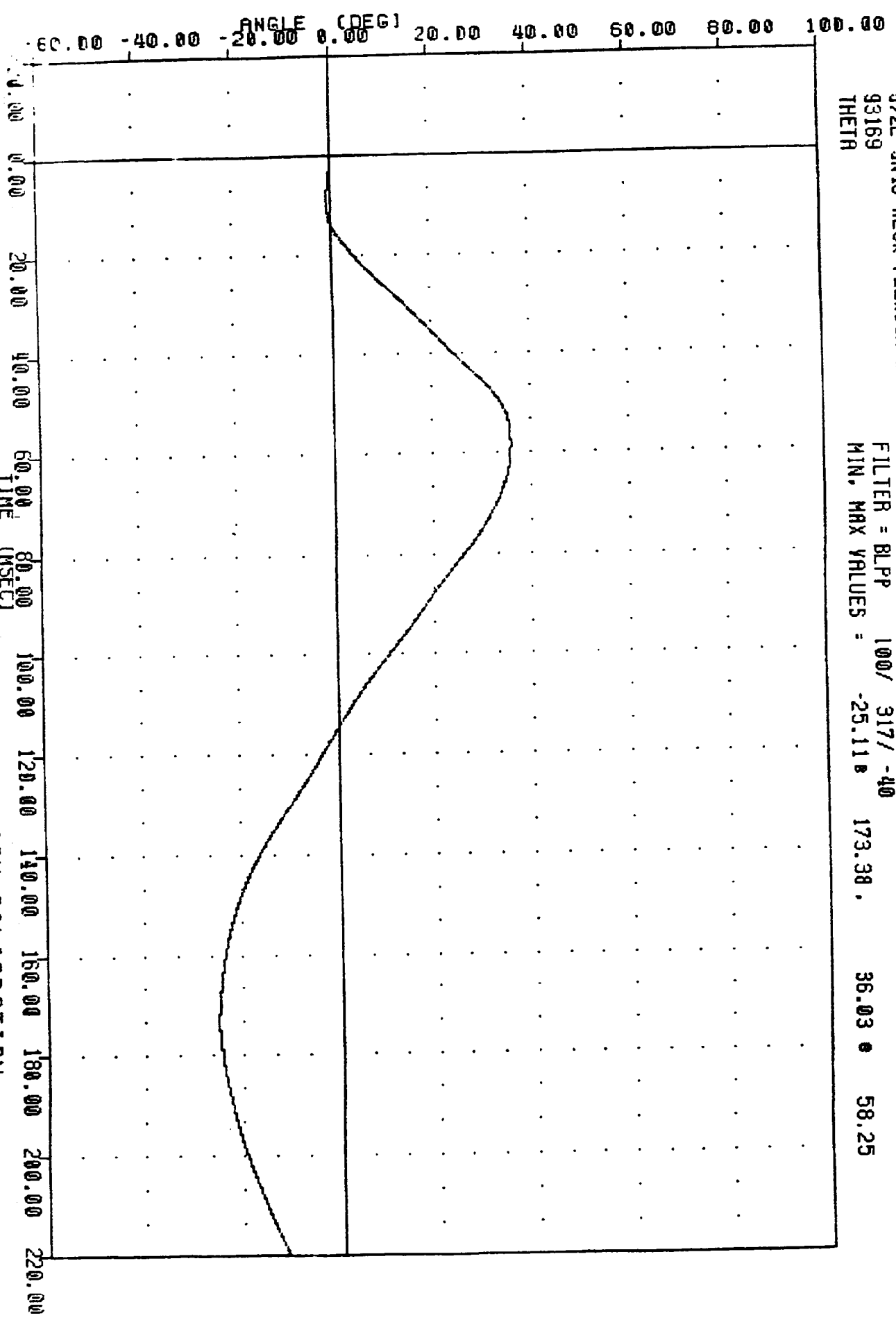
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -17.80 171.50 , 30.03 59.00



Form 572-E HYBRID III NECK FLEXION CALIBRATION

TRC
572E SN43 NECK FLEXION CAL05
93169
THETA

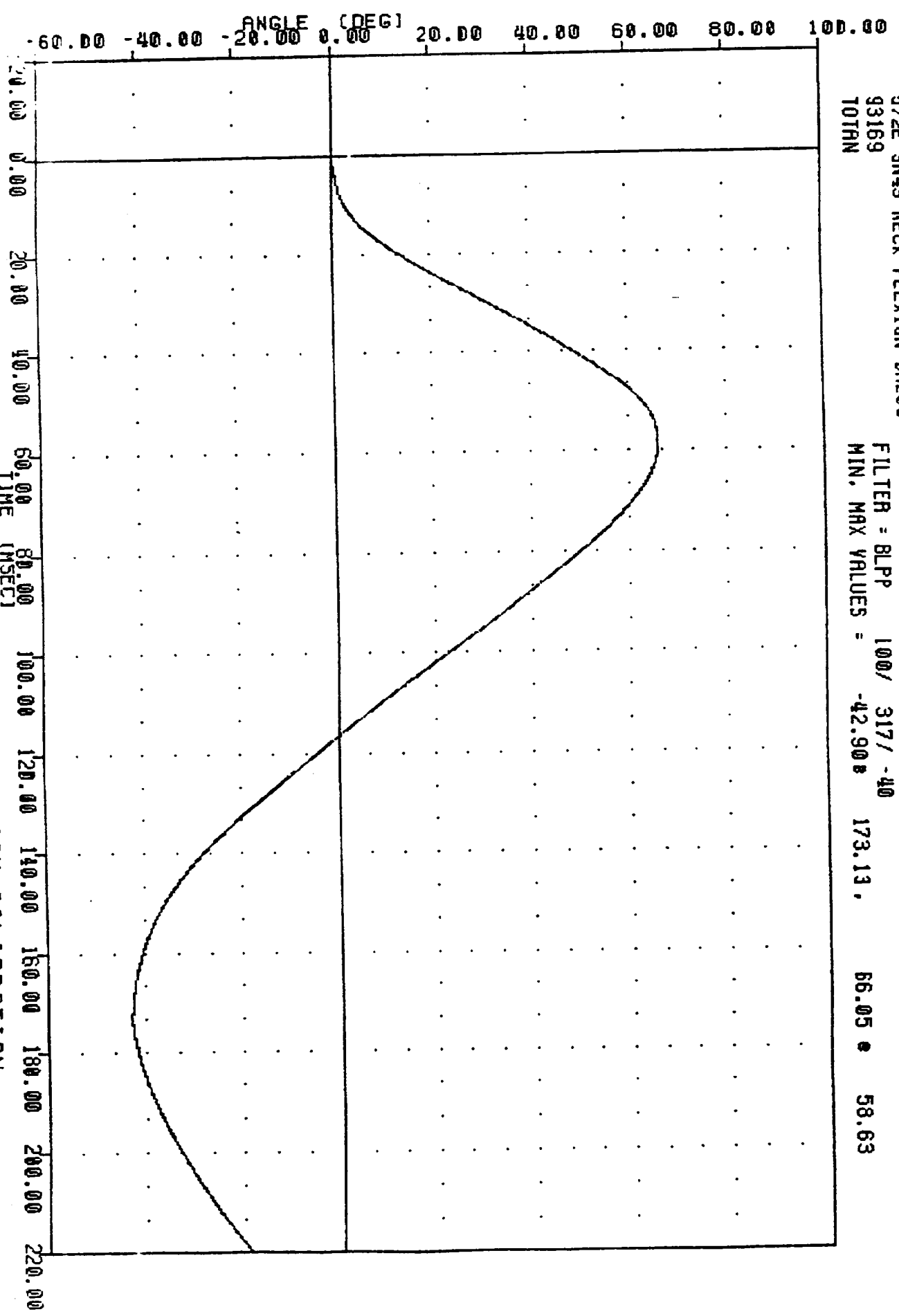
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -25.11 173.38 , 36.03 58.25



PART 572-E HYBRID III NECK FLEXION CALIBRATION

572E SN49 NECK FLEXION CAL05
93169
TOTRN

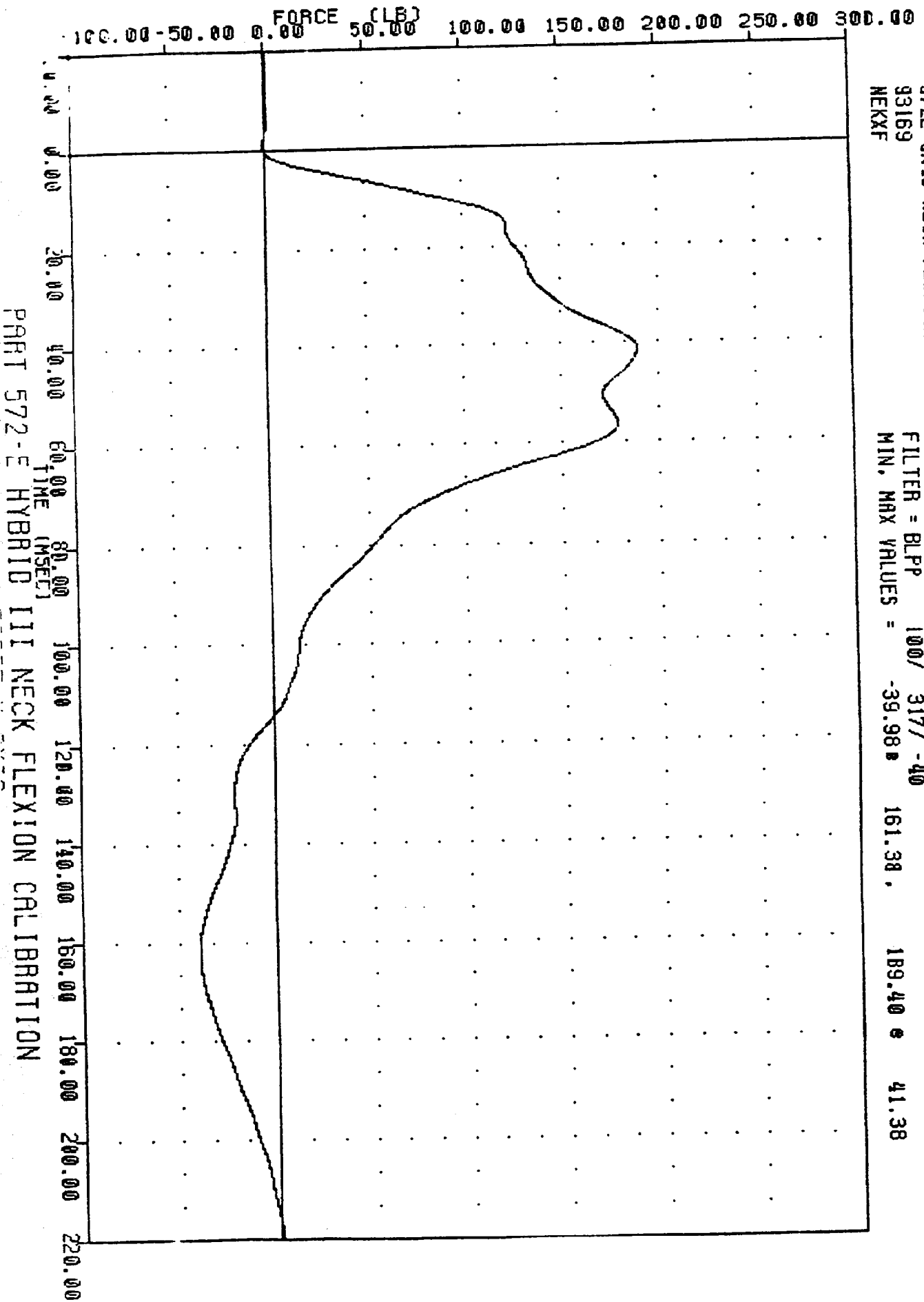
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -42.90 173.13
66.05 58.63



PART 572-E HYBRID III NECK FLEXION CALIBRATION

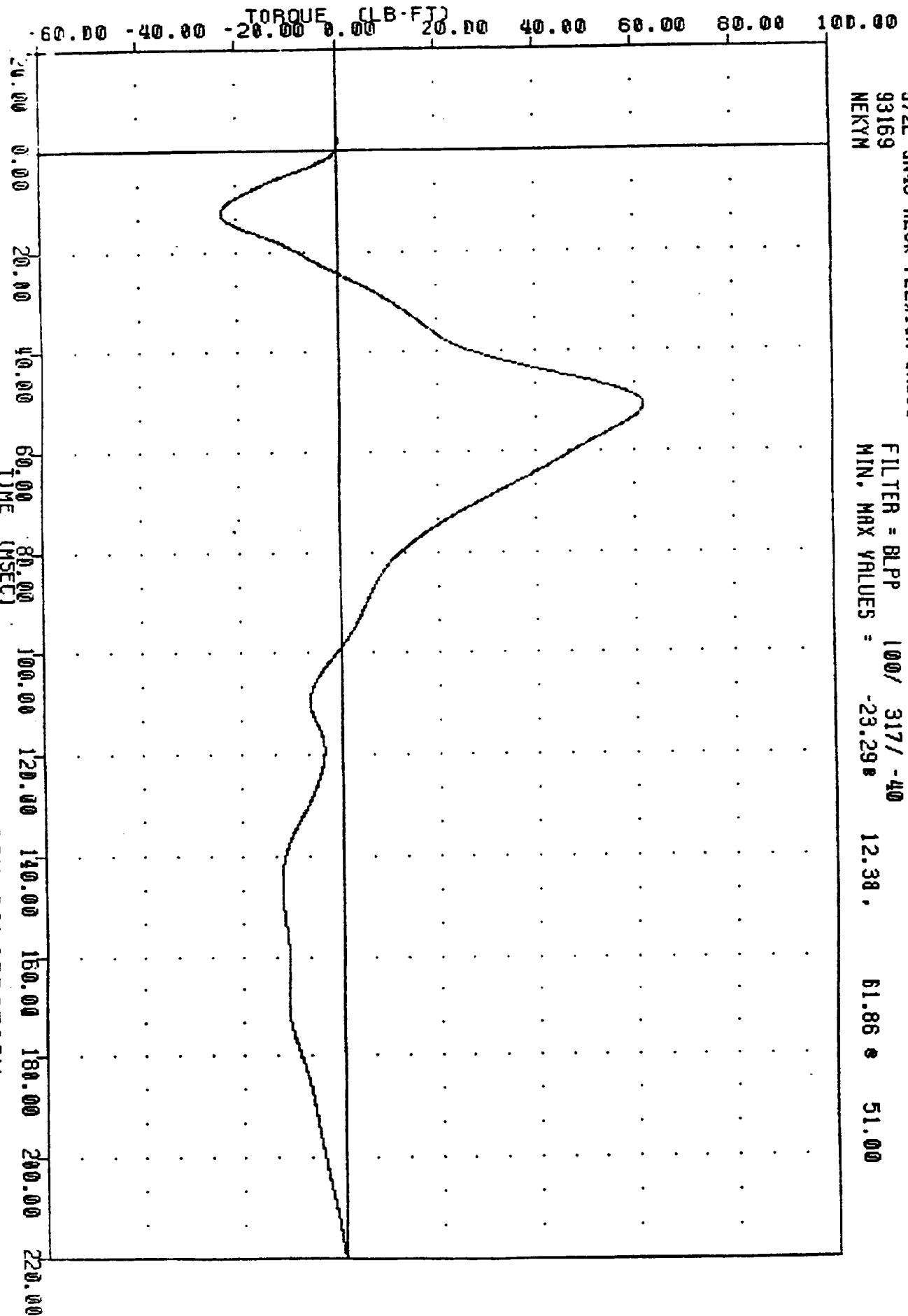
572E SN49 NECK FLEXION CAL05
93169
NEKXF

FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -39.98 161.38 , 189.40 41.38



572E SN43 NECK FLEXION CAL05
93169
NEKYM

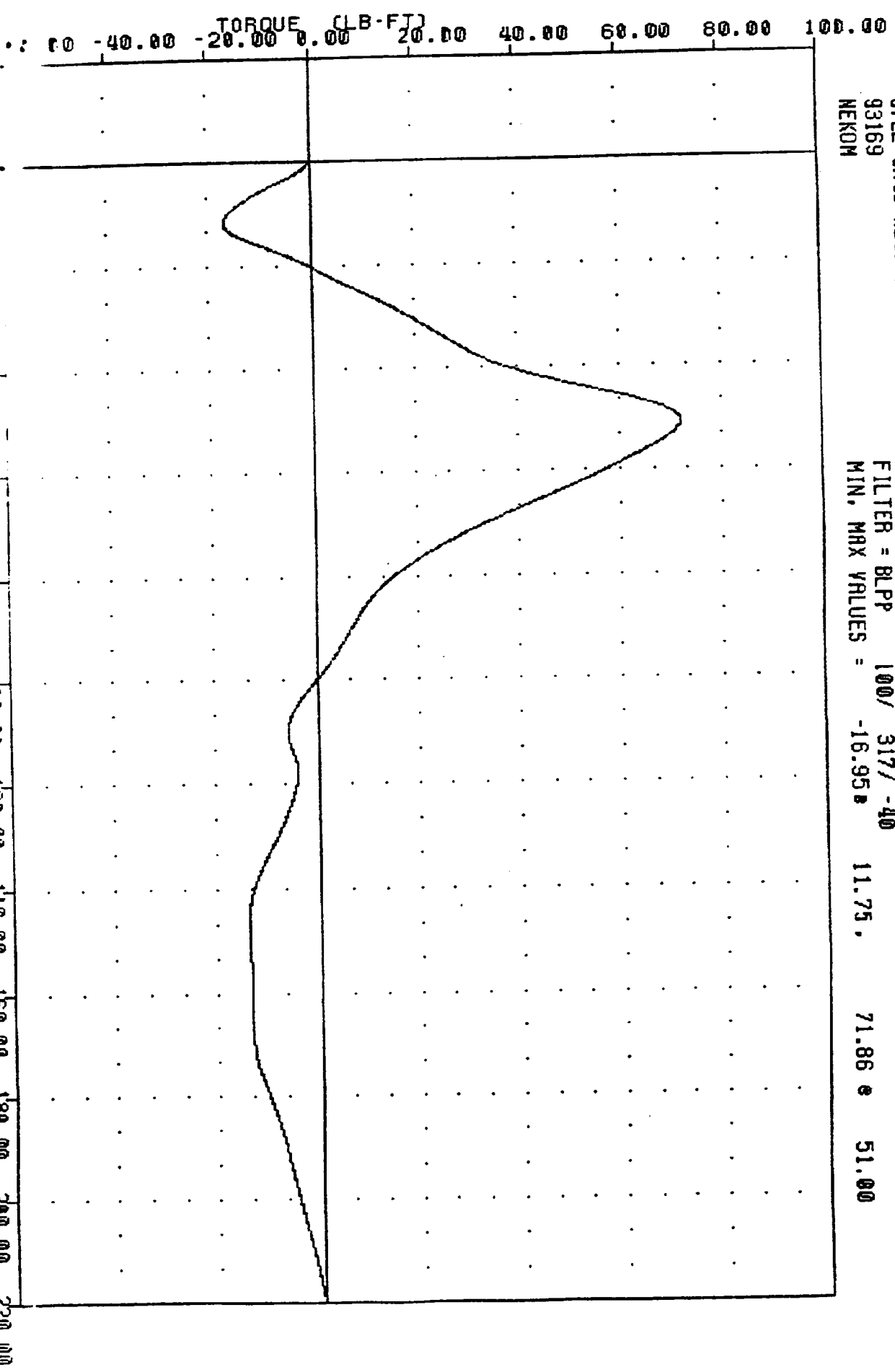
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -23.29 12.38 61.86 51.00



PART 572-E HYBRID III NECK FLEXION CALIBRATION

572E SN43 NECK FLEXION CAL05
93169
NEKOM

FILTER = BLPP 100/ 317/ -40
MIN, MRX VALUES = -16.95 11.75, 71.86 51.00



0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00 180.00 200.00 220.00
Time (msec)
HYBRIC III NECK FLEXION CALIBRATION
ANALOG OUTPUT DIGITAL CONVERSION

TRANSPORTATION RESEARCH CENTER INC.

NECK EXTENSION TEST

HYBRID III

18-JUN-93

6 AXIS NECK TRANSDUCER
TRC 43C5NE1

572E SN43 NECK EXT. CAL05

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		69 - 72 DEG. F	70.0 DEG. F
RELATIVE HUMIDITY		10% - 70%	55.0 %
IMPACT VELOCITY		19.5-20.3 FT/SEC	19.83 FT/SEC
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	18.08 G
	20 MS	14.00 - 19.00 G	17.47 G
	30 MS	11.00 - 16.00 G	14.87 G
MAX PENDULUM G		22 G MAX	18.88 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	14.81 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	39.25 MS
D PLANE	MAX	81 - 106 DEG.	93.50 DEG.
ROTATION	TIME	72 - 82 MS	75.63 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MIN	-59.0/-39.0 FT. LBS	-46.42 FT. LBS
	TIME	65 - 79 MS	70.88 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	159.25 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	136.38 MS

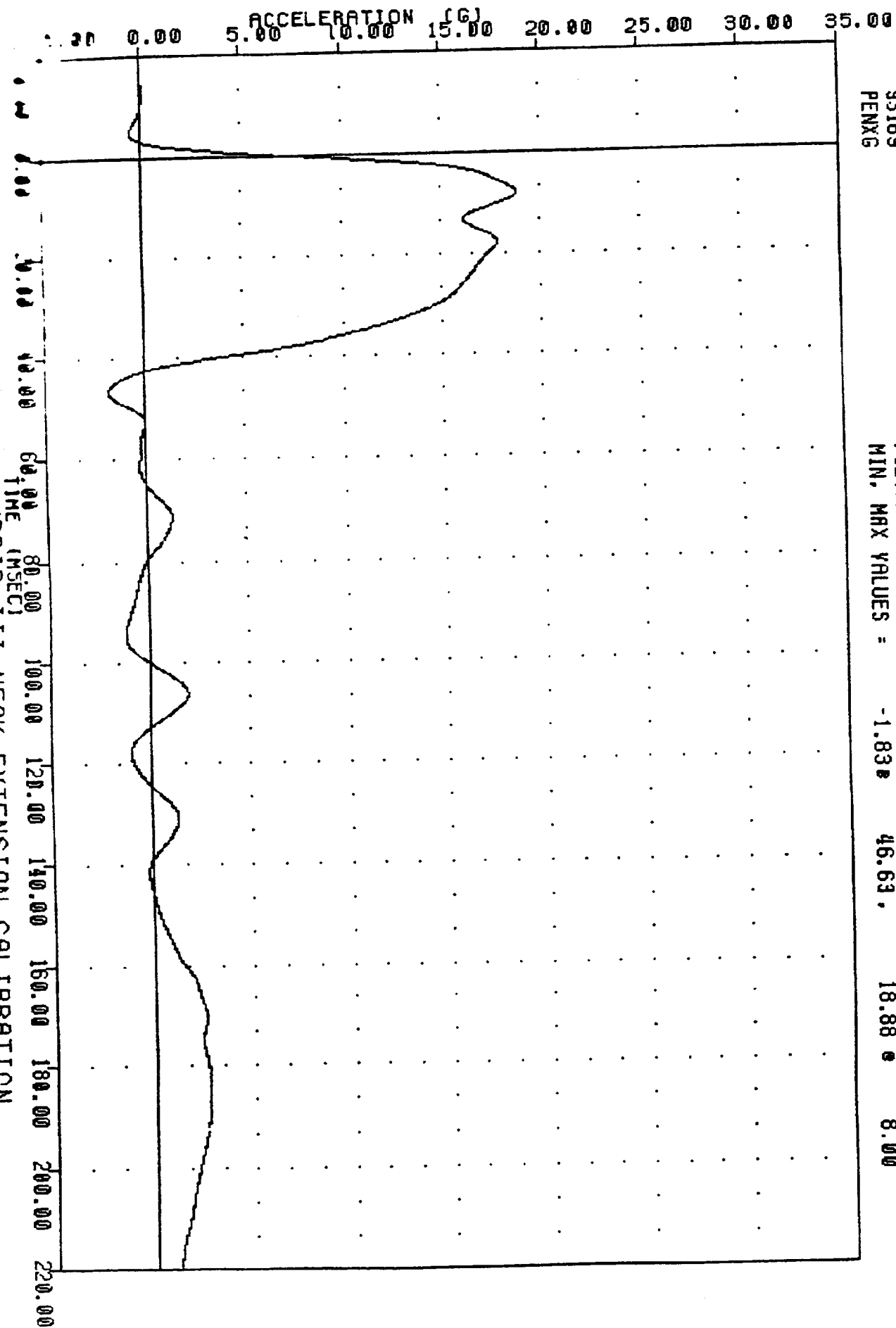
TEST MEETS SPECIFICATIONS

TECHNICIAN

Pete Font

III
572E SN43 NECK EXT. CRL05
93169
PENXG

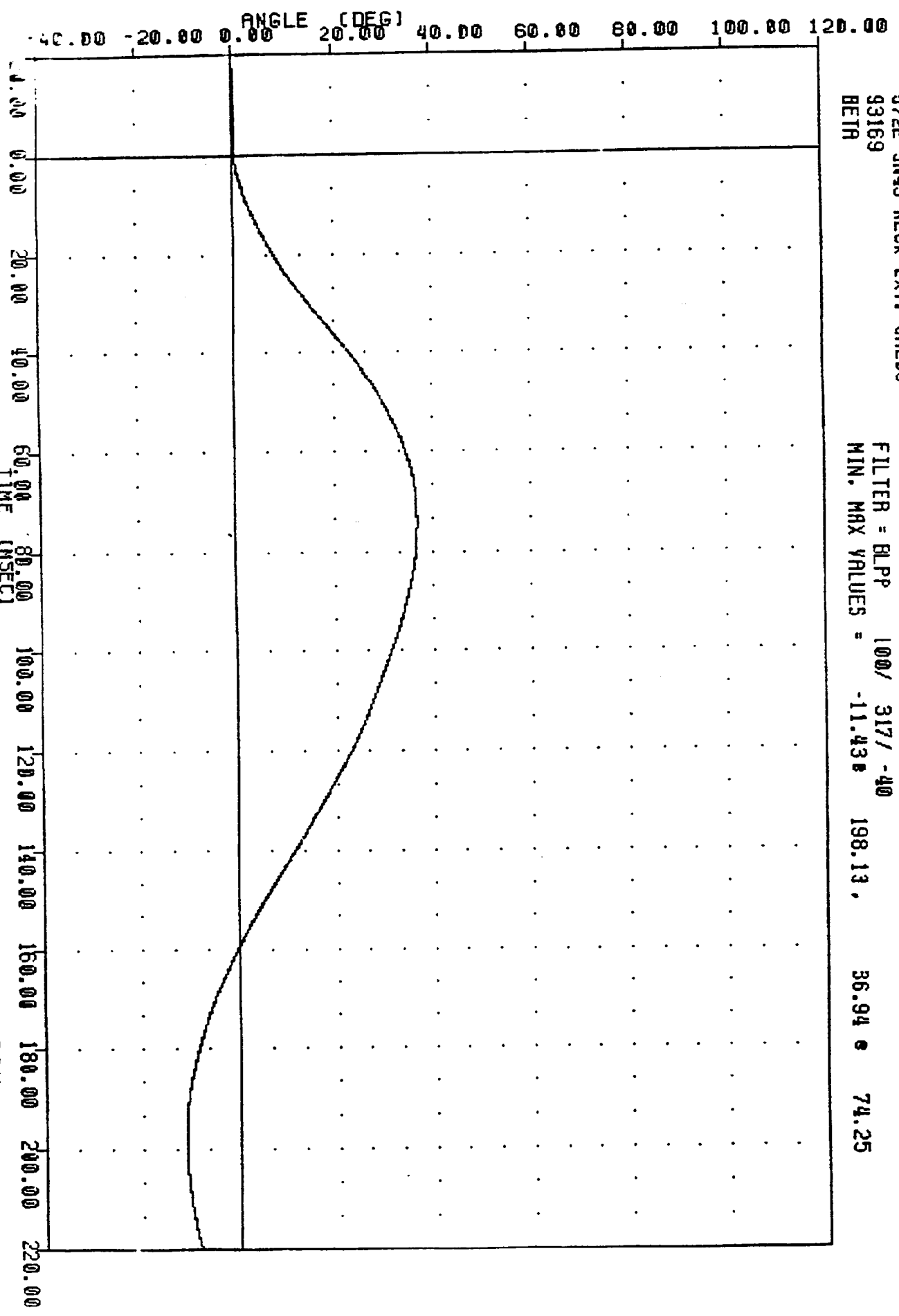
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -1.83 46.63 , 18.88 8.00



PHH1 572-E HYBRID III NECK EXTENSION CALIBRATION

572E SN49 NECK EXT. CAL05
93169
BETA

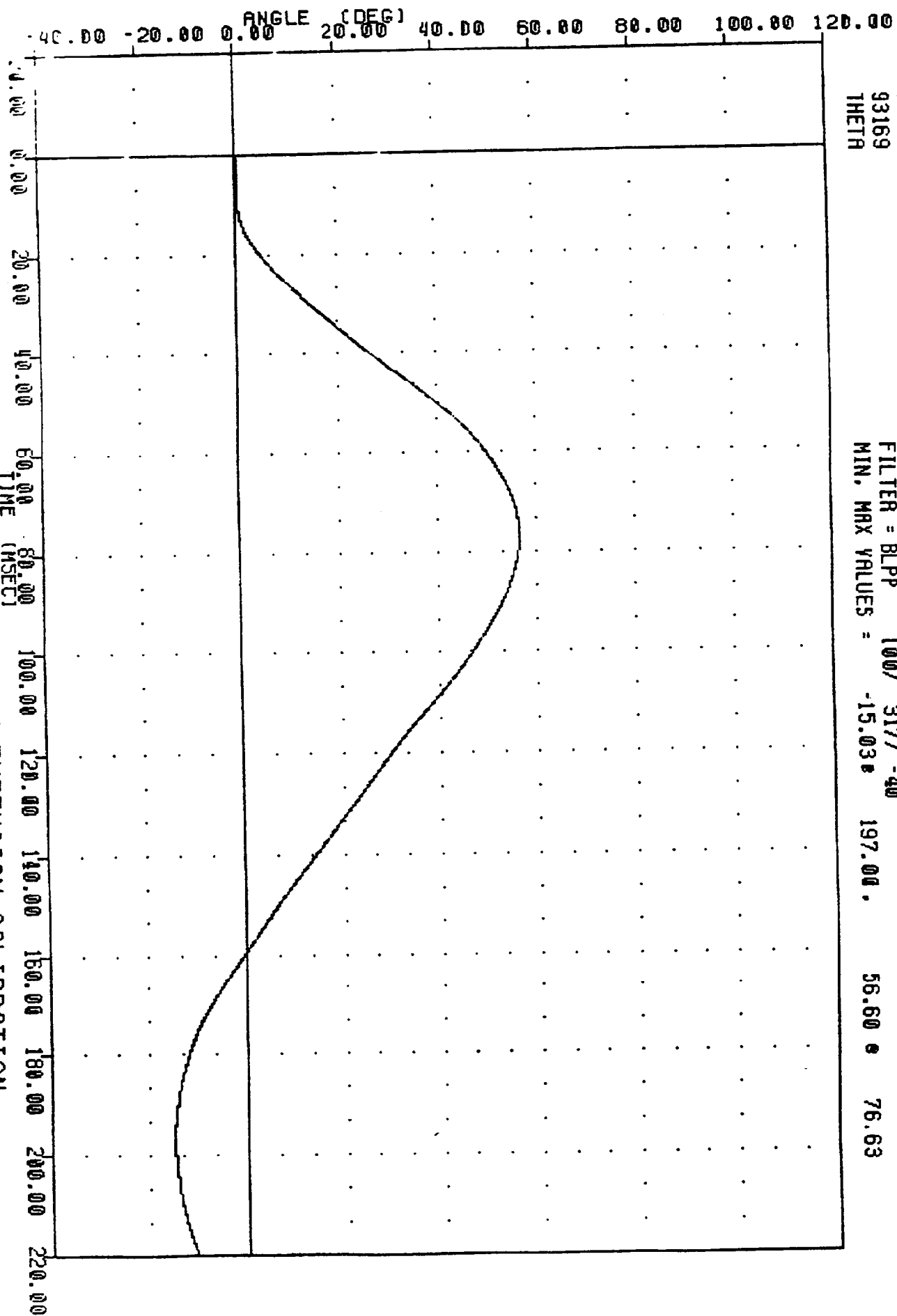
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -11.43 198.13, 36.94 74.25



PART 572-E HYBRID III NECK EXTENSION CALIBRATION

572E SN43 NECK EXT. CAL05
 93169
 THETA

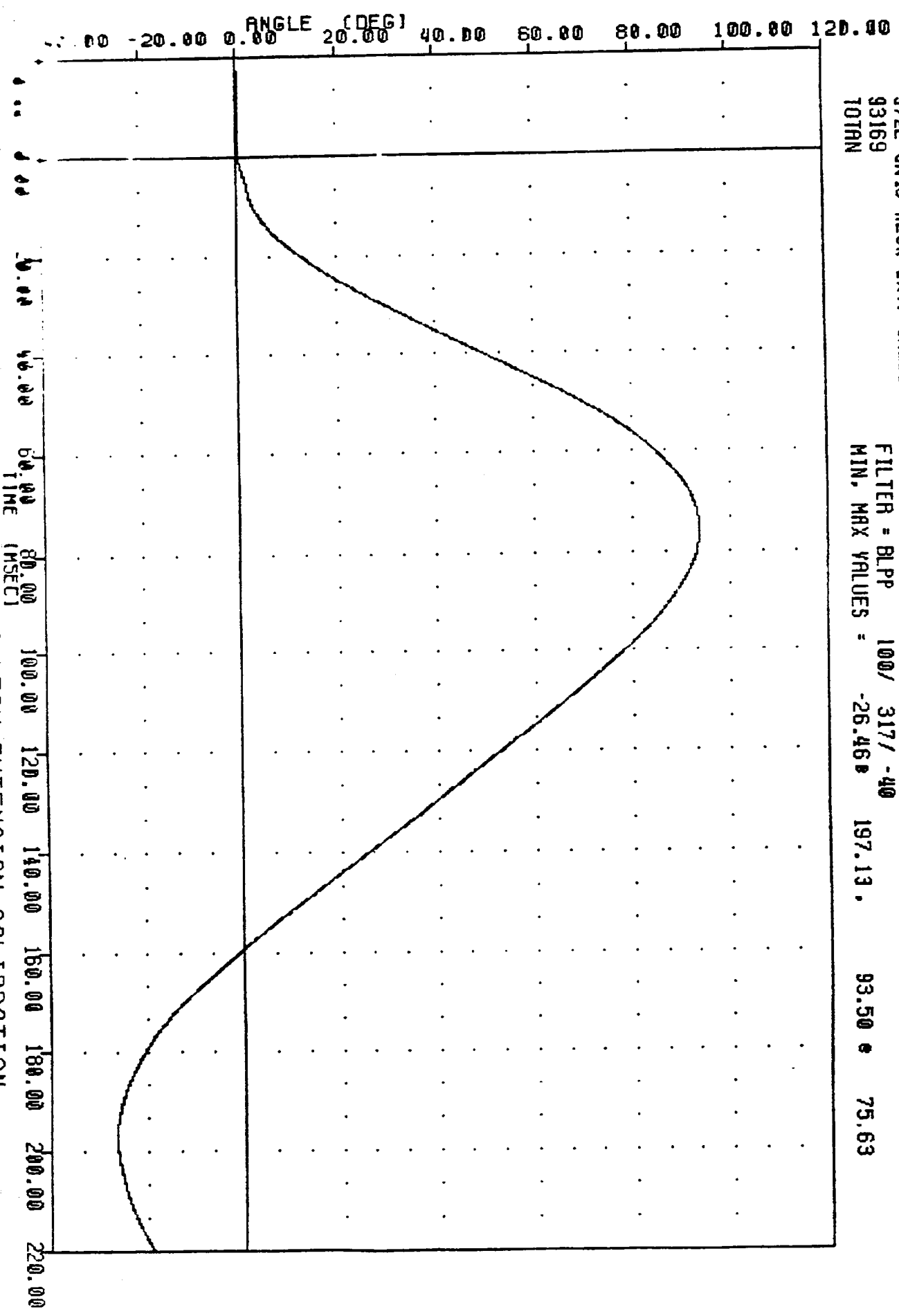
FILTER = BLPP 100/ 317/ -40
 MIN, MAX VALUES = -15.03 197.00 56.60 76.63



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

572E SN43 NECK EXT. CRLO5
93169
TOTALN

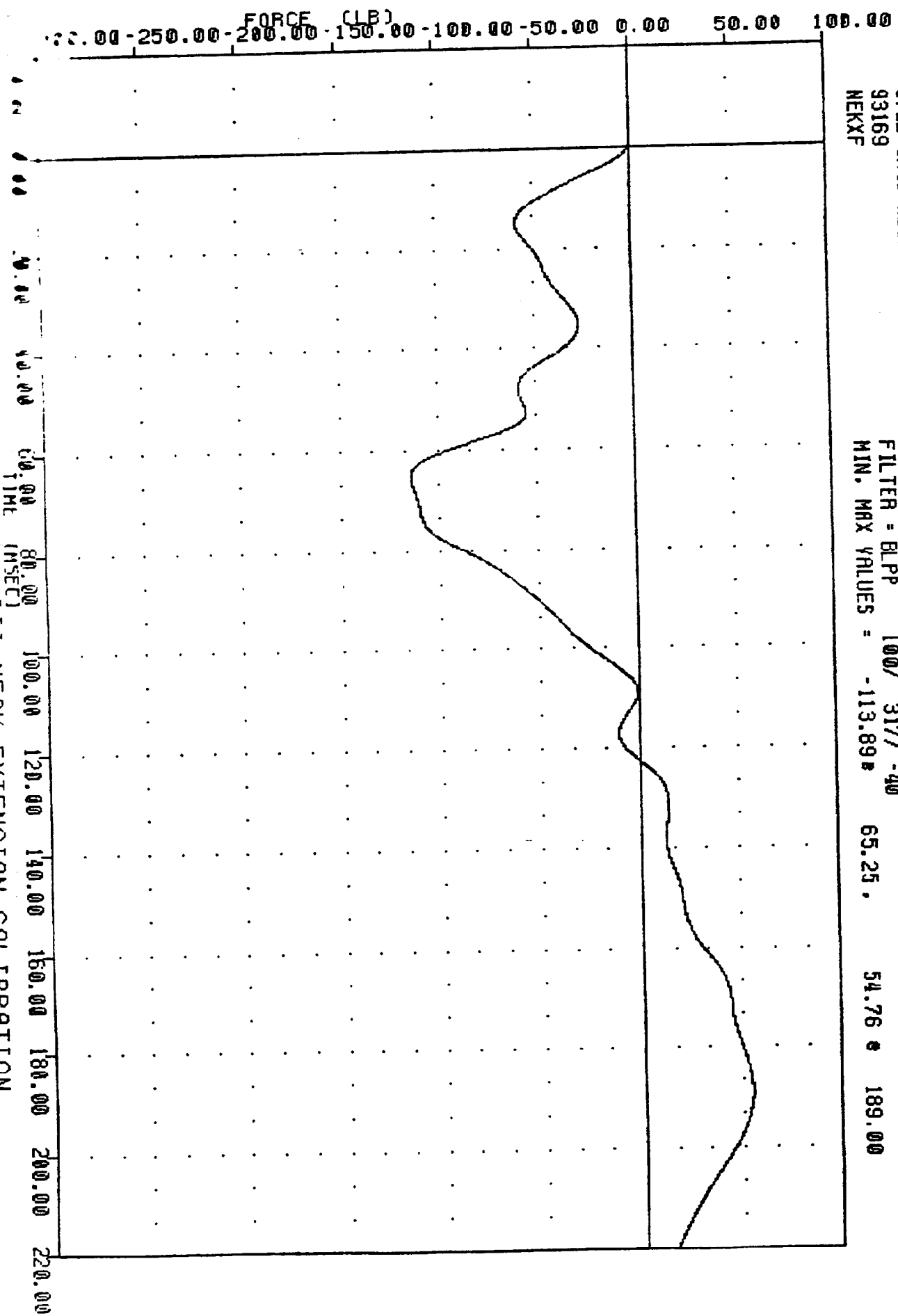
FILTER = BLPP 100/ 317/ -40
MIN, MAX VALUES = -26.46 197.13 . 93.50 75.63



572E HYBRID III NECK EXTENSION CALIBRATION

572E SN43 NECK EXT. CHLB5
93169
NEKXF

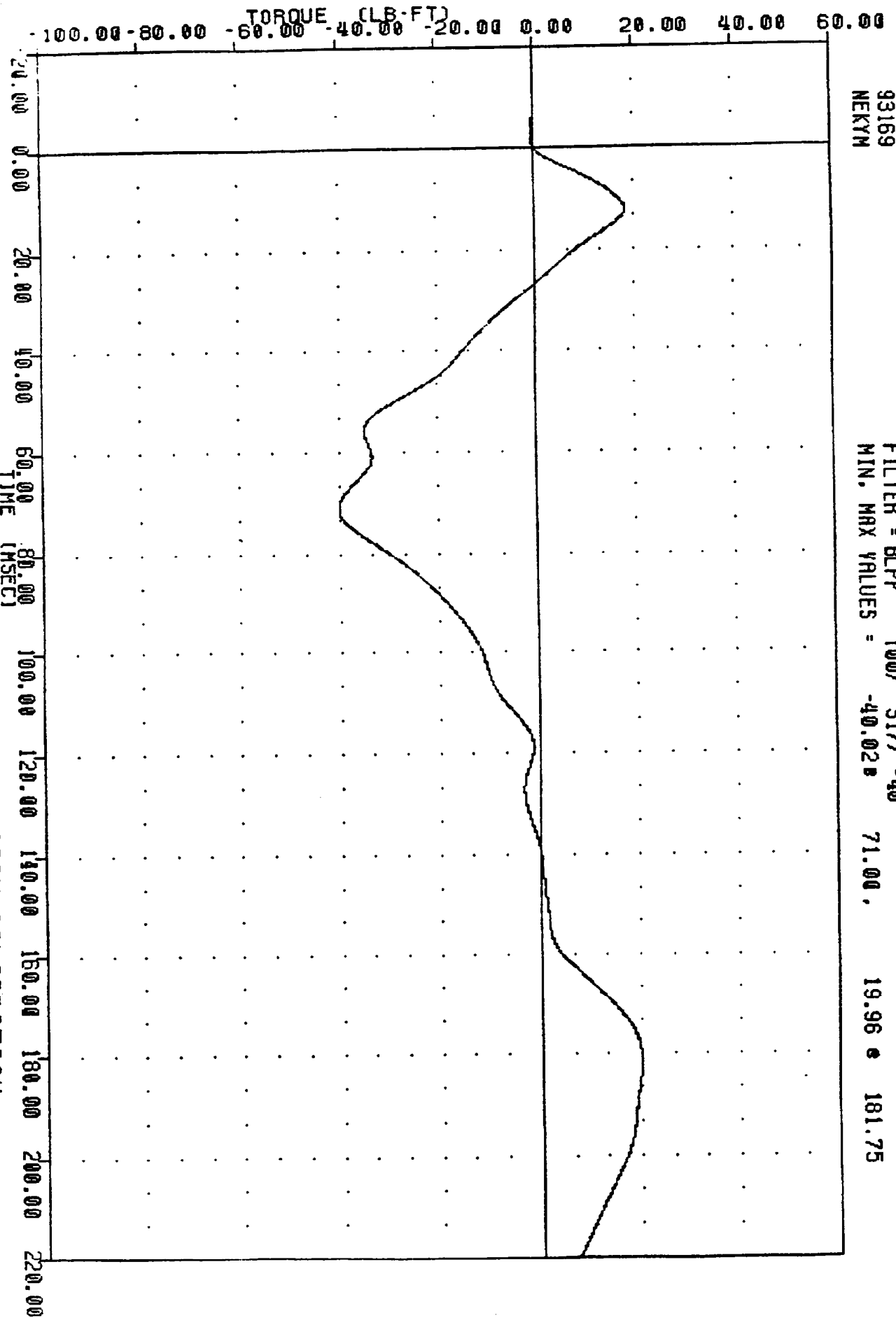
FILTER = BLPP 100/ 317/ -40
MIN. MAX VALUES = -113.89 65.25 54.76 189.00



HYBRID III NECK EXTENSION CALIBRATION

572E SN43 NECK EXT. CAL05
93169
NEKYM

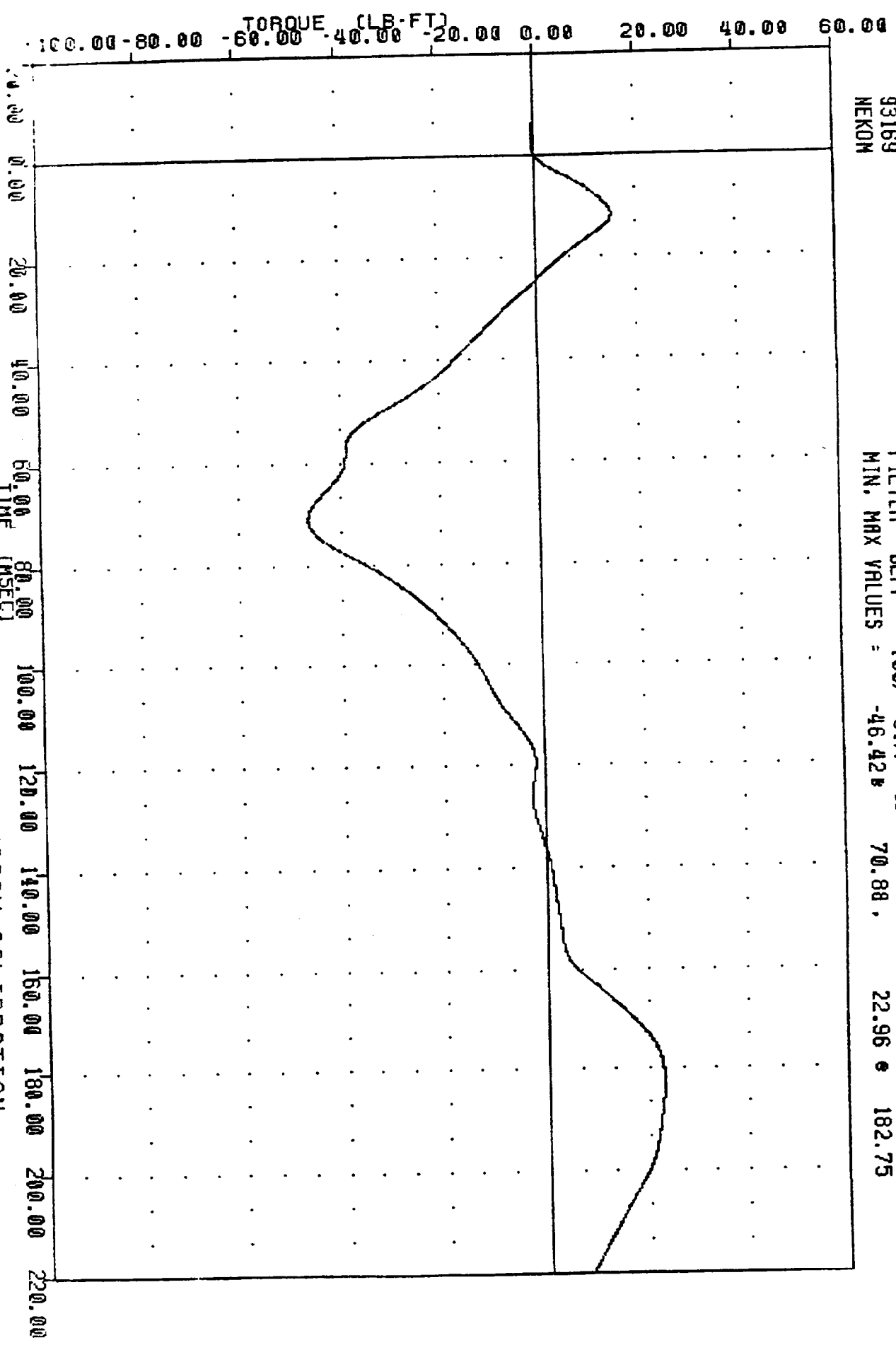
FILTER = BLPP 100/ 317/ -40
MIN. MRX VALUES = -40.02 71.00 19.96 181.75



PART 572-E HYBRID III NECK EXTENSION CALIBRATION

572E SN43 NECK EXT. CAL05
93169
NEKOM

FILTER = BLP 100/ 317/ -40
MIN. MAX VALUES = -46.42 70.88 , 22.96 182.75



PART 572-E HYBRID III NECK EXTENSION CALIBRATION

TRANSPORTATION RESEARCH CENTER INC.

THORAX IMPACT TEST

HYBRID III

21-JUN-93

TRC

43C5TH1

572E SN43 H.S.THORAX CAL05

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	69 - 72 DEG. F	69.0 DEG. F
RELATIVE HUMIDITY	10% - 70%	57.0 %
PENDULUM VELOCITY	21.6-22.4 FT/SEC	21.91 FT/SEC
MAXIMUM DEFLECTION	2.50 - 2.86 IN	2.82 IN
MAXIMUM RESISTIVE FORCE	1160 - 1325 LBS	1201.8 LBS
INTERNAL HYSTERESIS	69% - 85%	73.4%

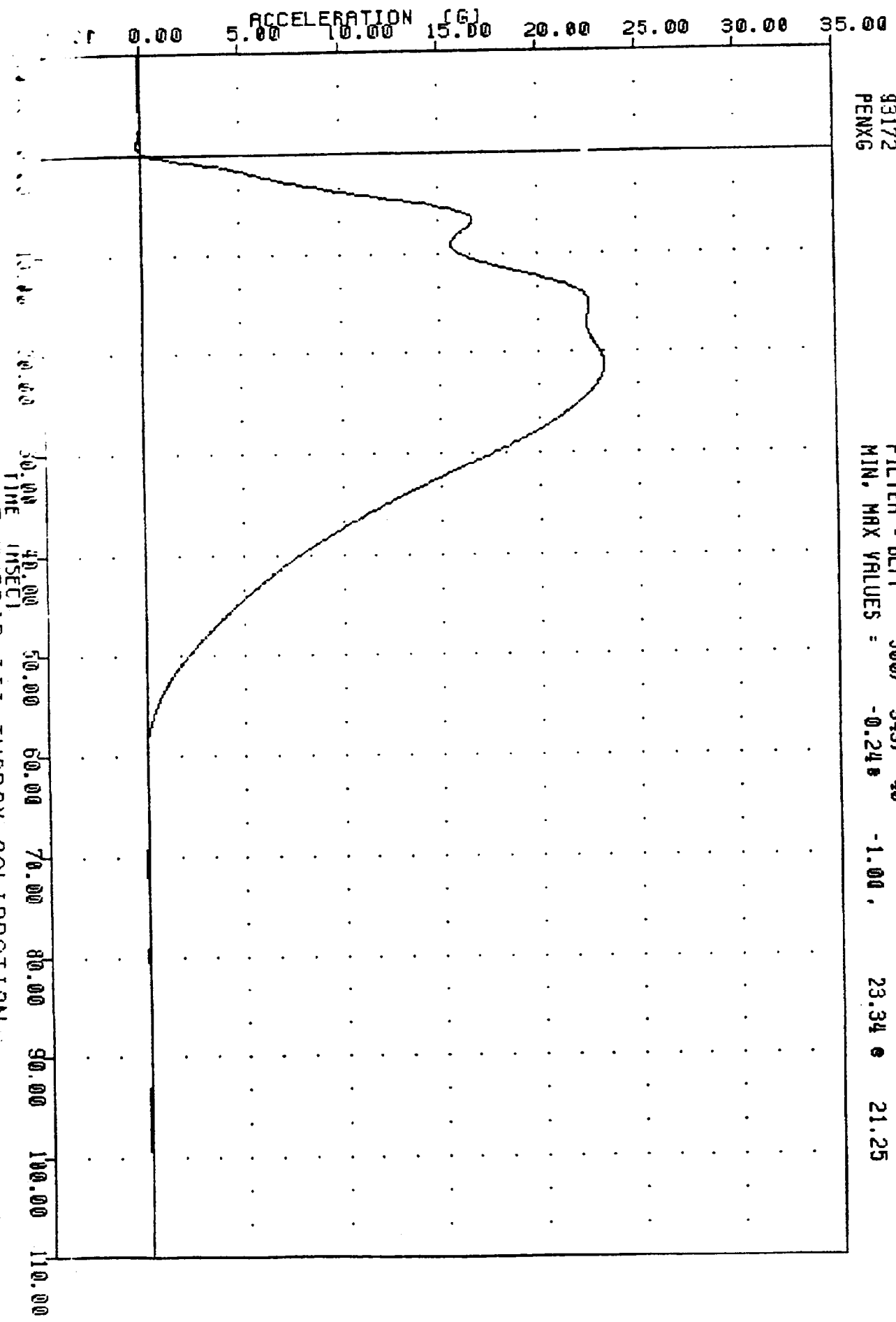
TEST MEETS SPECIFICATIONS

TECHNICIAN

John G. Smith

1HL
572E 5N43 H.S. THORAX CAL05
93172
PENXG

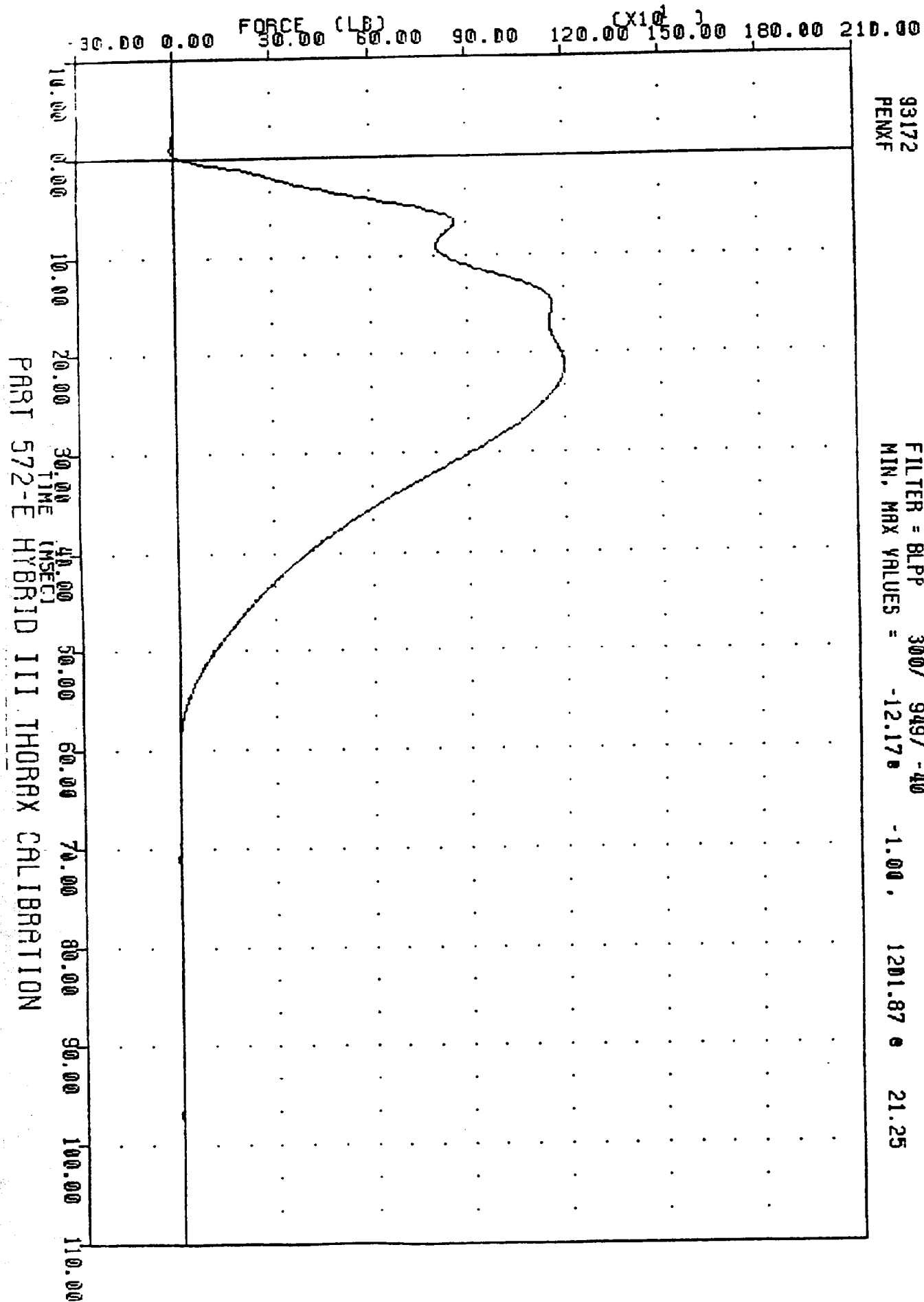
FILTER = BLPP 300/ 949/ -40
MIN, MAX VALUES = -0.24 23.34 21.25
-1.00



572E HYBRID III THORAX CALIBRATION

III
572E SN43 H.S. THORAX CAL05
93172
PENXF

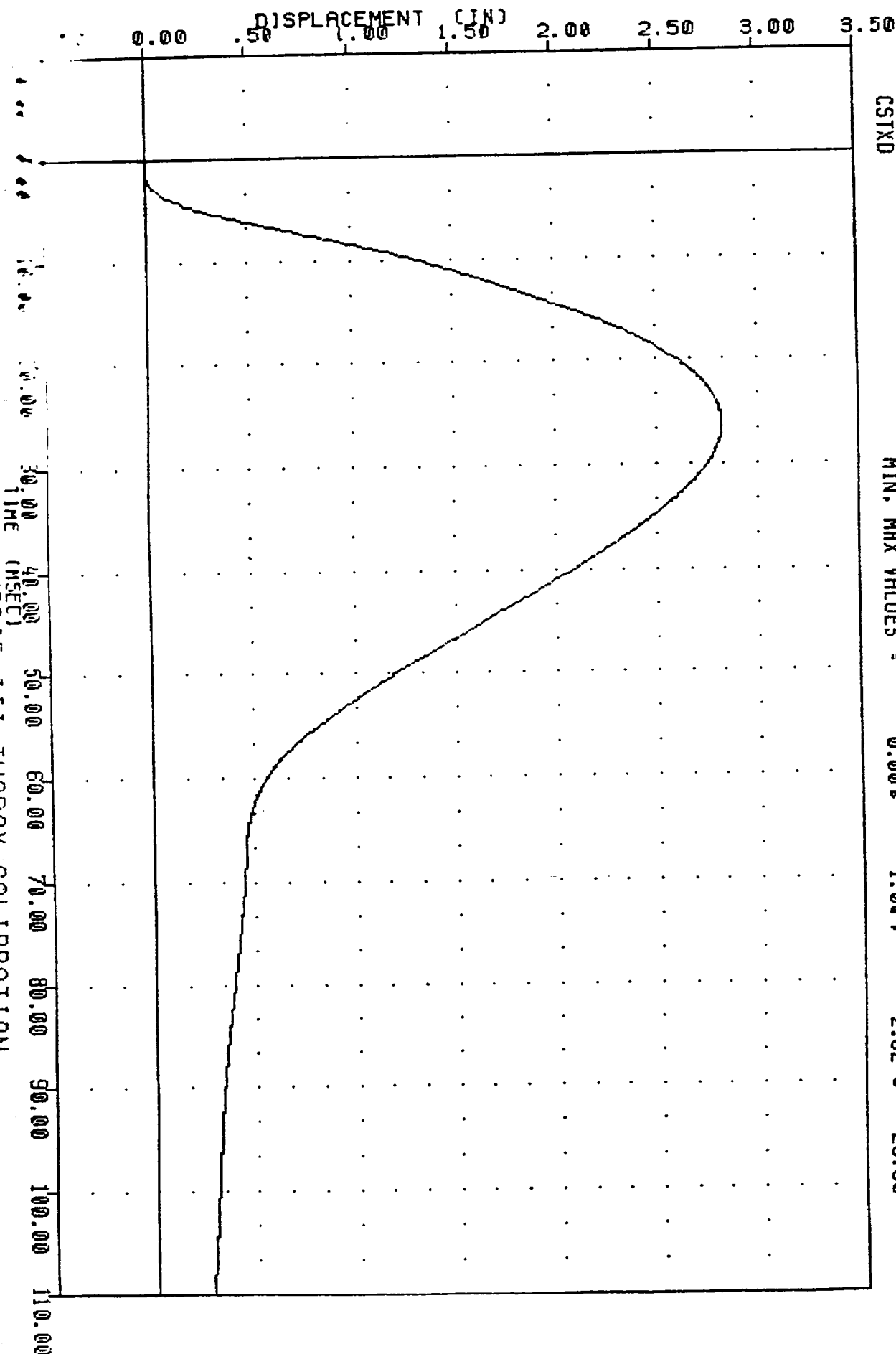
FILTER = BLPP 300/ 949/ -40
MIN, MAX VALUES = -12.17° -1.00 , 1201.87 ° 21.25



PART 572-E HYBRID III THORAX CALIBRATION

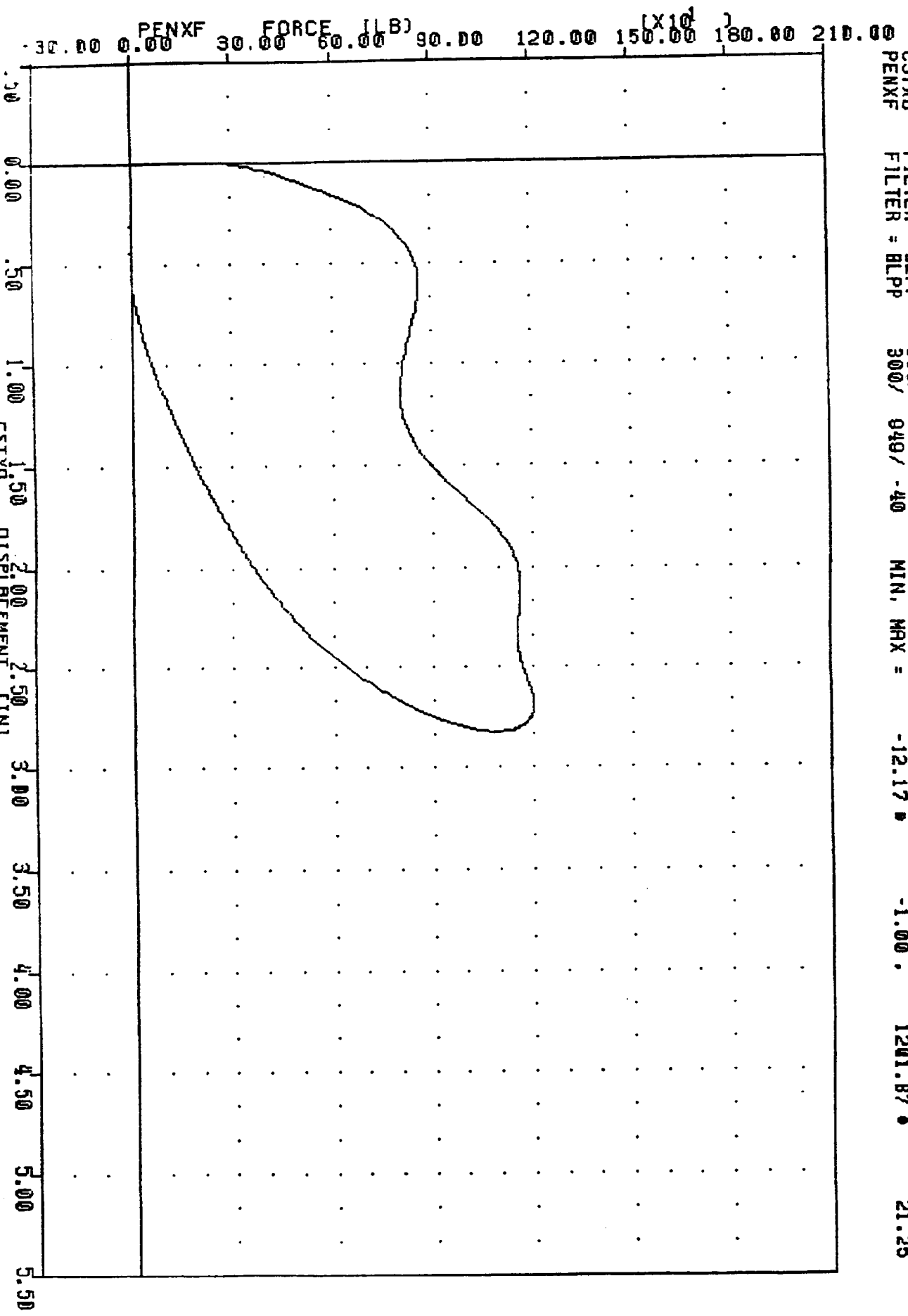
INL
572E SN49 H.S. THORAX CAL05
93172
CSTXD

FILTER = BLP 300/ 949/ -40
MIN. MAX VALUES = 0.00 1.00 2.82 26.50



TIME 572-E HYBRID III THORAX CALIBRATION

LUT
 CSTXD
 PENXF
 FILTER = BLPP
 300/
 300/
 949/
 949/
 -40
 -40
 MIN.
 MIN.
 MAX =
 MAX =
 -0.00
 -12.17
 1.00
 -1.00
 2.82
 1201.87
 26.50
 21.25



PART 572-E HYBRID III THORAX CALIBRATION

APPENDIX D

MISCELLANEOUS TEST INFORMATION

DUMMY INSTRUMENTATION PLACEMENT

DUMMY MFR. & S/N: HUMANOID/043

SEATING POSITION: DRIVER

LOCATION	AXIS	MFR	MODEL	S/N	ORIENTATION (+ SENSING)
HEAD ACCELERATION	X	ENDEVCO	7264	BR19J	FRONT
HEAD ACCELERATION	Y	ENDEVCO	7264	AL08	LEFT
HEAD ACCELERATION	Z	ENDEVCO	7264	BD73J	UP
HEAD 1 ACCELERATION	X	ENDEVCO	7264	BE30J	FRONT
HEAD 1 ACCELERATION	Z	ENDEVCO	7264	AM74	UP
HEAD 2 ACCELERATION	Y	ENDEVCO	7264	BF14J	LEFT
HEAD 2 ACCELERATION	Z	ENDEVCO	7264	BE04J	UP
HEAD 3 ACCELERATION	X	ENDEVCO	7264	BE47J	FRONT
HEAD 3 ACCELERATION	Y	ENDEVCO	7264	BG38J	LEFT
HEAD ANGULAR VELOCITY	X	ATA	ARS-01	177	
HEAD ANGULAR VELOCITY	Y	ATA	ARS-01	176	
HEAD ANGULAR VELOCITY	Z	ATA	ARS-01	179	
NECK FORCE	X	DENTON	1716	0452FX	*
NECK FORCE	Y	DENTON	1716	0452FY	*
NECK FORCE	Z	DENTON	1716	0452FZ	*
NECK MOMENT	X	DENTON	1716	0452MX	*
NECK MOMENT	Y	DENTON	1716	0452MY	*
NECK MOMENT	Z	DENTON	1716	0452MZ	*
CHEST ACCELERATION	X	ENDEVCO	7264	EJ01H	FRONT
CHEST ACCELERATION	Y	ENDEVCO	7264	DH31J	LEFT
CHEST ACCELERATION	Z	ENDEVCO	7264	FF79J	UP
CHEST ANGULAR VELOCITY	X	ATA	ARS-01	184	
CHEST ANGULAR VELOCITY	Y	ATA	ARS-01	167	
CHEST ANGULAR VELOCITY	Z	ATA	ARS-01	161	
CHEST DISPLACEMENT	X	VERNITECH	81422-A	043	OUTWARD
PELVIS ACCELERATION	X	ENDEVCO	7264	DM72J	REAR
PELVIS ACCELERATION	Y	ENDEVCO	7264	BG11J	LEFT
PELVIS ACCELERATION	Z	ENDEVCO	7264	BH87J	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	BY97H	REAR
CENTER OF GRAVITY ACCEL.	Y	ENDEVCO	7264	CG21H	RIGHT
CENTER OF GRAVITY ACCEL.	Z	ENDEVCO	7264	CH86H	UP
CENTER OF GRAVITY ROLL	X	HUMPHREY	RG28-0128-1	H-14	LEFT
CENTER OF GRAVITY PITCH	Y	HUMPHREY	RG28-0128-1	H-19	DOWN
CENTER OF GRAVITY YAW	Z	HUMPHREY	RG28-0128-1	H-21	RIGHT
DRIVER'S SHOULDER BELT DISPLACEMENT		CELESCO	PT-101-0040 111-5110	4839	OUTWARD
DRIVER'S SHOULDER BELT FORCE		LEBOW	3419	590	TENSION
DRIVER'S LAP BELT OUTBOARD FORCE		LEBOW	3419	673	TENSION
LEFT FRONT SUSPENSION DISPLACEMENT		CELESCO	PT-101-50A	A12889	OUTWARD
RIGHT FRONT SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	A02465	OUTWARD
LEFT REAR SUSPENSION DISPLACEMENT		CELESCO	PT-101-40A	A128	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	CH31H	FRONT
CENTER OF GRAVITY	Y	ENDEVCO	7264	CR26H	RIGHT
CENTER OF GRAVITY	Z	ENDEVCO	7264	BH64J	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: June 17, 1993

VEHICLE DATA

Vehicle Make and Model (written out): Nissan pickup truck

NHTSA ID Code (7 characters): 93T539 /Model Year (2 digits): 90

Vehicle Make (2 characters): 64

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): PU

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): 1N6SD11YXLC418900

Odometer Reading: 34762

Thousands of Miles: _____

Overall Length: 178

(in) x 25.4 =: 4521 (mm)

Wheelbase: 104.3

(in) x 25.4 =: 2649 (mm)

Front Track: 55.9

(in) x 25.4 =: 1420 (mm)

Rear Track: 54.8

(in) x 25.4 =: 1392 (mm)

Roof Height: 66.5

(in) x 25.4 =: 1689 (mm)

IPMD VEHICLE DATA SHEET

G.V.W.R.: 5100 (lbs) x 4.45 =: 22686 (N)
FRONT G.A.W.R.: 2500 (lbs) x 4.45 =: 11121 (N)
REAR G.A.W.R.: 2750 (lbs) x 4.45 =: 12233 (N)

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

Weight on RF Tire: 994 (lbs) x 4.45 =: 4422 (N)
Weight on LF Tire: 1046 (lbs) x 4.45 =: 4653 (N)
Weight on LR Tire: 844 (lbs) x 4.45 =: 3754 (N)
Weight on RR Tire: 849 (lbs) x 4.45 =: 3777 (N)
Vehicle Test Weight: 3733 (lbs) x 4.45 =: 16605 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 47.30 (in) x 25.4 =: 1201 (mm)
From Center Line: -0.35 (in) x 25.4 =: 9 (mm)
Engine Displacement: 146 (cu in) x 0.0164 =: 2.4 (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): M

M = Manual A = Automatic

Drive Axle (1 character): 4

F = Front R = Rear 4 = Four Wheel Drive

Vehicle Comments (30 characters): _____

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): A

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): TB

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

FRONT SUSPENSION

Tire Manufacturer (10 characters): Firestone

Tire Size Code (10 characters): 215/75R15

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: 12.5 (in) X 25.4 =: 318 (mm)

Tire Pressure: 26.0 (psi) X 6.897 =: 179 (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): L

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): LL

CO = Coil

TB = Torsion Bar

LL = Longitudinal Leaf

TL = Transverse Leaf

OT = Other: _____

Brake Type (2 characters): DS

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): Firestone

Tire Size Code (10 characters): 215/75R15

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: 12.8

(in) X 25.4 =: 335 (mm)

Tire Pressure: 29.0

(psi) X 6.897 =: 200 (kpa)

I P M D M E A S U R E D D A T A Version 2.05

Vehicle # and Run # 539 Date: 06-17-1993 Time: 15:13:15
 Vehicle Type: pu Fuel: 1/4
 Load: curb + drvr + instr
 Weight (lbs): 3733 Wheelbase (in): 104.3 Roof Height (in): 66.50
 Ramp Distance (in): 45.40 UltraSonic Offset (in): 16.50

[PMD Calibration Check (no Vehicle)]

Applied Weight (lbs.)	Schaevitz Output (Deg.)	System C.G. Pivot
+0	0.03	0.00
+100	-5.27	32.70
+200	-10.43	32.91
+0	0.03	0.00
-100	5.31	32.84
-200	10.52	32.82
+0	0.04	0.00

Average System C.G. Pivot (in): 32.82

C.G. Height:

Applied Weight (lbs.)	Schaevitz Output (Deg.)	Resultant Longitudinal Movement (In.)	Individual C.G. Values
+0	-0.01	0.000	0.00
+100	-3.73	0.087	25.52
+200	-7.37	0.179	25.29
+0	-0.08	0.027	0.00
-100	3.64	-0.075	25.27
-200	7.42	-0.188	25.40
+0	0.04	-0.022	0.00

Average calculated C.G. Height (in): 25.37

Vehicle # and Run # 539 Date: 06-17-1993 Time: 15:13:16

Vehicle Type: pu Fuel: 1/4

Load: curb + drvr + instr

Weight (lbs): 3733 Wheelbase (in): 104.3 Roof Height (in): 66.50

Ramp Distance (in): 45.40 UltraSonic Offset (in): 16.50

Pitch Inertia:

Run #	Period (sec)	Platform Motion Amplitude (Deg.)	Relative Motion Amplitude (In.)	Individual Pitch Calc.
1	4.245	10.15	0.214	2120.5
2	4.245	10.08	0.211	2122.0
3	4.245	10.14	0.213	2120.8

Average Pitch Inertia (ft. lb. sec²): 2121.1

Roll Inertia:

Run #	Period (sec)	Platform Motion Amplitude (Deg.)	Relative Motion Amplitude (In.)	Individual Roll Calc.
1	2.505	7.85	0.147	399.8
2	2.505	8.16	0.157	398.7
3	2.510	8.22	0.157	403.0

Average Roll Inertia (ft. lb. sec²): 400.5

Yaw Inertia:

Run #	Period (sec)	Platform Motion Amplitude (Deg.)	Relative Motion Amplitude (Deg.)	Individual Yaw Calc.
1	2.540	8.97	0.12	2175.2
2	2.545	8.26	0.11	2135.4
3	2.540	8.81	0.12	2176.1

Average Yaw Inertia (ft. lb. sec²): 2178.9

POST-TEST
IPMD VEHICLE DATA SHEET

Filled Out By: B. Queiser

Date: June 25, 1993

VEHICLE DATA

Vehicle Make and Model (written out): Nissan pickup truck

NHTSA ID Code (7 characters): 93T540 /Model Year (2 digits): 90

Vehicle Make (2 characters): 64

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): PU

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): 1N6SD11YXLC418900

Odometer Reading: <u>34,762</u>	Thousands of Miles: _____
Overall Length: <u>179</u>	(in) x 25.4 =: <u>4547</u> (mm)
Wheelbase: <u>104.4</u>	(in) x 25.4 =: <u>2652</u> (mm)
Front Track: <u>54.5</u>	(in) x 25.4 =: <u>1384</u> (mm)
Rear Track: <u>54.8</u>	(in) x 25.4 =: <u>1392</u> (mm)
Roof Height: <u>58.0</u>	(in) x 25.4 =: <u>1473</u> (mm)

IPMD VEHICLE DATA SHEET

G.V.W.R.: 5100 (lbs) x 4.45 =: 22695 (N)
FRONT G.A.W.R.: 2500 (lbs) x 4.45 =: 11125 (N)
REAR G.A.W.R.: 2750 (lbs) x 4.45 =: 12238 (N)

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

Weight on RF Tire: 1048 (lbs) x 4.45 =: 4664 (N)
Weight on LF Tire: 961 (lbs) x 4.45 =: 4276 (N)
Weight on LR Tire: 745 (lbs) x 4.45 =: 3315 (N)
Weight on RR Tire: 743 (lbs) x 4.45 =: 4196 (N)
Vehicle Test Weight: 3697 (lbs) x 4.45 =: 16452 (N)

Lateral and Longitudinal Center of Gravity Location.

From Front Axle: 47.68 (in) x 25.4 =: 1211 (mm)
From Center Line: 2.10 (in) x 25.4 =: 53 (mm)
Engine Displacement: 146 (cu in) x 0.0164 =: 2.4 (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): M

M = Manual A = Automatic

Drive Axle (1 character): 4

F = Front R = Rear 4 = Four Wheel Drive

Vehicle Comments (30 characters): _____

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): A

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): TB

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

FRONT SUSPENSION

Tire Manufacturer (10 characters): Firestone

Tire Size Code (10 characters): 215/75R15

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: 12.5 (in) X 25.4 =: 318 (mm)

Tire Pressure: Left: 26 (psi) X 6.897 =: 179 (kpa)
Right: 0 (flat)

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): L

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): LL

CO = Coil

TB = Torsion Bar

LL = Longitudinal Leaf

TL = Transverse Leaf

OT = Other: _____

Brake Type (2 characters): DS

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): Firestone

Tire Size Code (10 characters): 215/75R15

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: 12.8

(in) X 25.4 =: 325 (mm)

Tire Pressure: Left: 29

(psi) X 6.897 =: 200 (kpa)

Right: 0 (flat)

I P M D M E A S U R E D D A T A Version 2.05

Vehicle # and Run # 540 Date: 06-25-1993 Time: 16:20:15
 Vehicle Type: PU Fuel: 1/4
 Load: curb + drvr + instr
 Weight (lbs): 3697 Wheelbase (in): 104.4 Roof Height (in): 58.00
 Ramp Distance (in): 45.40 UltraSonic Offset (in): 9.25

IPMD Calibration Check (no Vehicle)

Applied Weight (lbs.)	Schaevitz Output (Deg.)	System C.G. Pivot
+0	0.03	0.00
+100	-5.24	32.88
+200	-10.45	32.86
+0	0.03	0.00
-100	5.31	32.81
-200	10.53	32.76
+0	0.03	0.00
Average System C.G. Pivot (in):		32.83

C.G. Height:

Applied Weight (lbs.)	Schaevitz Output (Deg.)	Resultant Longitudinal Movement (In.)	Individual C.G. Values
+0	0.11	0.000	0.00
+100	-3.07	0.052	22.43
+200	-6.34	0.138	22.50
+0	0.04	0.024	0.00
-100	3.28	-0.042	22.54
-200	6.52	-0.118	22.54
+0	0.16	-0.014	0.00
Average calculated C.G. Height (in):		22.50	

Page #2

Vehicle # and Run # 540 Date: 06-25-1993 Time: 16:20:15
Vehicle Type: PU Fuel: 1/4
Load: curb + drvr + instr
Weight (lbs): 3697 Wheelbase (in): 104.4 Roof Height (in): 58.00
Ramp Distance (in): 45.40 UltraSonic Offset (in): 9.25

Pitch Inertia:

Run #	Period (sec)	Platform Motion Amplitude (Deg.)	Relative Motion Amplitude (In.)	Individual Pitch Calc.
1	3.965	10.07	0.153	2104.2
2	3.960	10.14	0.154	2097.4 (1)
3	3.960	10.14	0.154	2096.8

Average Pitch Inertia (ft. lb. sec²): 2099.5

Roll Inertia:

Run #	Period (sec)	Platform Motion Amplitude (Deg.)	Relative Motion Amplitude (In.)	Individual Roll Calc.
1	2.375	9.35	0.162	390.0 (1)
2	2.375	9.00	0.155	390.1 (1)
3	2.370	8.59	0.149	385.6 (1)

Average Roll Inertia (ft. lb. sec²): 388.6

Yaw Inertia:

Run #	Period (sec)	Platform Motion Amplitude (Deg.)	Relative Motion Amplitude (Deg.)	Individual Yaw Calc.
1	2.550	10.00	0.10	2202.5
2	2.545	8.29	0.08	2192.5
3	2.550	8.21	0.08	2202.7

Average Yaw Inertia (ft. lb. sec²): 2199.2

SIGN CONVENTION

ACCELEROMETERS:

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

POTENTIOMETERS:

+CHEST DISPLACEMENT: OUTWARD
+SEAT BELT DISPLACEMENT: OUTWARD
+SEAT BELT EXTENSION: ELONGATION
+VEHICLE DISPLACEMENT: OUTWARD

LOAD CELLS:

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

NECK LOAD CELLS:

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

GYROSCOPES:

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

CORRECTED