

DOT 4903



U.S. Department
of Transportation

National Highway
Traffic Safety
Administration

DOT HS 807 009
Test Report

March 1986

FMVSS 208 RM Crash Simulation Support

A Crash Test of a 1986 Volkswagen Golf
Into a Fixed 30 Degree Oblique Barrier
with a Closing Velocity of 48.3 kph

The United States Government does not endorse products or manufacturers. Trade or manufacturers' names appear only because they are considered essential to the object of this report.

1. Report No. DOT HS 807 009	2. Government Accession No.	3. Recipient's Catalog No.	
4. Title and Subtitle FMVSS 208 RM CRASH SIMULATION SUPPORT: A Crash Test of A 1986 Volkswagen Golf Into A Fixed 30 Degree Oblique Barrier With A Closing Velocity of 48.3 kph		5. Report Date MARCH 1986	
		6. Performing Organization Code	
7. Author(s) B. Wade, J. Sankey; Project Engineers, TRCO		8. Performing Organization Report No. 860225	
9. Performing Organization Name and Address Vehicle Research and Test Center St. Rt. 33, Logan County East Liberty, Ohio 43319		10. Work Unit No. (TRAIS)	
		11. Contract or Grant No. DTNH 22-85-C-08123	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration 400 Seventh Street, S.W. Washington, DC 20590		13. Type of Report and Period Covered TEST REPORT February - March 1986	
		14. Sponsoring Agency Code	
15. Supplementary Notes This test conducted as a part of VRTC Project No. 86-0027 FMVSS 208 RM Crash Simulation Support			
16. Abstract This test report documents one of two crash tests conducted to evaluate Part 572 and Hybrid III dummy responses in a passive belt restrained environment, and to catalog vehicle structural responses. Testing was conducted with a 1986 Volkswagen Golf 3-door hatchback at the TRCO Crash Test Facility, East Liberty, Ohio. The Volkswagen Golf was towed into a fixed 30 degree oblique angle barrier with a closing velocity of 48.3 kph impacting on the driver side of the vehicle. One Part 572 dummy was located in the passenger's right front designated seating position in the vehicle and one Hybrid III dummy was located in the driver's designated seating position. The test date was February 25, 1986 and the ambient temperature was 21° C.			
17. Key Words Occupant Response Crashworthiness Hybrid III Dummy		18. Distribution Statement Available to the U.S. public through the National Technical Information Service, Springfield, Virginia 22161	
19. Security Classif. (of this report) Unclassified	20. Security Classif. (of this page) Unclassified	21. No. of Pages 140	22. Price

TABLE OF CONTENTS

	<u>Page</u>
1.0 PURPOSE AND INTRODUCTION	1-1
2.0 GENERAL TEST AND VEHICLE PARAMETER DATA	2-1
3.0 DATA REQUIRED BY R&D	3-1
APPENDIX A PHOTOGRAPHS	A-1
APPENDIX B DATA PLOT PRESENTATION	B-1
APPENDIX C DUMMY CERTIFICATION	C-1
APPENDIX D MISCELLANEOUS TEST INFORMATION	D-1

<u>Figure</u>	<u>LIST OF PHOTOGRAPHS</u>	<u>Page</u>
A-1.	PRE-TEST RIGHT SIDE OVERALL	A-2
A-2.	POST-TEST RIGHT SIDE OVERALL	A-2
A-3.	PRE-TEST LEFT SIDE OVERALL	A-3
A-4.	POST-TEST LEFT SIDE OVERALL	A-3
A-5.	PRE-TEST VEHICLE FRONT	A-4
A-6.	POST-TEST VEHICLE FRONT	A-4
A-7.	PRE-TEST VEHICLE REAR	A-5
A-8.	POST-TEST VEHICLE REAR	A-5
A-9.	PRE-TEST VEHICLE UNDERBODY VIEW	A-6
A-10.	POST-TEST VEHICLE UNDERBODY VIEW	A-6
A-11.	PRE-TEST DRIVER DUMMY - VIEW 1	A-7
A-12.	POST-TEST DRIVER DUMMY - VIEW 1	A-7
A-13.	PRE-TEST DRIVER DUMMY - VIEW 2	A-8
A-14.	POST-TEST DRIVER DUMMY - VIEW 2	A-8
A-15.	PRE-TEST DRIVER DUMMY - VIEW 3	A-9
A-16.	POST-TEST DRIVER DUMMY - VIEW 3	A-9
A-17.	POST-TEST DRIVER DUMMY - VIEW 4	A-10
A-18.	POST-TEST DRIVER SIDE INTERIOR	A-10
A-19.	PRE-TEST PASSENGER DUMMY - VIEW 1	A-11
A-20.	POST-TEST PASSENGER DUMMY - VIEW 1	A-11
A-21.	PRE-TEST PASSENGER DUMMY - VIEW 2	A-12
A-22.	POST-TEST PASSENGER DUMMY - VIEW 2	A-12
A-23.	PRE-TEST PASSENGER DUMMY - VIEW 3	A-13
A-24.	POST-TEST PASSENGER DUMMY - VIEW 3	A-13
A-25.	POST-TEST PASSENGER DUMMY - VIEW 4	A-14
A-26.	POST-TEST PASSENGER SIDE INTERIOR	A-14

SECTION 1.0
PURPOSE AND INTRODUCTION

PURPOSE

This test was conducted as part of a test program of two crash tests and four sled tests with Part 572 and Hybrid III dummies in the restrained oblique angle crash environment using passive belt restraints. Vehicle structural responses and occupant responses were cataloged.

INTRODUCTION

A 1986 Volkswagen Golf 3-door hatchback was used in an impact with a fixed 30 degree oblique angle barrier with a closing velocity of 48.3 kph on February 25, 1986 impacting on the driver's side. The intended impact speed of the Volkswagen Golf was 48.3 kph. The actual test speed of the Volkswagen Golf was 48.3 kph

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains vehicle crush and dummy response data. Appendix A contains pre-test and post-test vehicle and dummy photographs. Appendix B contains data plots. Appendix C contains dummy certification. Appendix D contains miscellaneous test information.

SECTION 2.0
GENERAL TEST AND VEHICLE PARAMETER DATA

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

VEHICLE INFORMATION

VEHICLE MANUFACTURER: Volkswagen of America, Inc.

MAKE/MODEL: Volkswagen Golf

VIN: IWBA9173GVO39763

BODY STYLE: 3-door hatchback

MODEL YEAR: 1986

NHTSA NO.: R & D

COLOR: white

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT 1800 cc

TRANSMISSION DATA: 5-Speed Manual

DATE VEHICLE RECEIVED: 2/18/86

ODOMETER READING: 61

DEALER'S NAME AND ADDRESS: Volkswagen North, Inc.
Worthington, Ohio 43085

ACCESSORIES:

POWER STEERING	No	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	No	ANTI-SKID BRAKE	No
CLOCK	Yes	REAR WINDOW DEFROSTER	Yes
OTHER	Rear window wiper		

REMARKS:

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

DATA FROM CERTIFICATION LABEL ON LEFT DOOR FACE OR "B" POST:

VEHICLE MANUFACTURED BY: Volkswagen of America, Inc.

DATE OF MANUFACTURE: 1/86

GVWR: 1440 kg. GAWR: FRONT 816 kg. REAR 698 kg.

VEHICLE TIRE DATA

RECOMMENDED COLD TIRE PRESSURE: FRONT 2.0 kg/cm² REAR 2.5 kg/cm²

TIRES ON VEHICLE (MFGR. & LINE, SIZE): Goodyear Corsa GT P175/70R13

BIAS PLY, BELTED, OR RADIAL: radial

PLY RATING: 3

IS SPARE TIRE "SPACE SAVER"? Yes

IS SPARE TIRE STANDARD EQUIPMENT? Yes

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

RIGHT FRONT 298 KG. RIGHT REAR 192 KG.

LEFT FRONT 299 KG. LEFT REAR 188 KG.

TOTAL FRONT WEIGHT 597 KG. (61.1 % OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 380 KG. (38.9 % OF TOTAL VEHICLE WEIGHT)

TOTAL DELIVERED WEIGHT 977 KG.

VEHICLE ATTITUDE (ALL DIMENSIONS IN CENTIMETERS):

DELIVERED ATTITUDE: RF 63.5 ;LF 63.5 ;RR 62.2 ;LR 62.2

PRE-TEST ATTITUDE: RF 61.0 ;LF 61.3 ;RR 58.4 ;LR 59.4

POST-TEST ATTITUDE: RF 55.9 ;LF 60.3 ;RR 62.2 ;LR 53.3

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 88 KG. CARGO:

RIGHT FRONT 329 KG. RIGHT REAR 272 KG.

LEFT FRONT 345 KG. LEFT REAR 269 KG.

TOTAL FRONT WEIGHT 674 KG. (55.5 % OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 541 KG. (44.5 % OF TOTAL VEHICLE WEIGHT)

TOTAL TEST WEIGHT 1215 KG.

WEIGHT OF BALLAST SECURED IN RIGHT FRONT PASSENGER AREA: 0 KG.

VEHICLE TEST WEIGHT CALCULATION

Calculated Test Weight = Unloaded Delivered Weight +
 (Number of Hybrid III Dummies X 76 kg.) +
 (Number of Part 572 Dummies X 74 kg.) +
 Cargo Weight
= 977 + (1 X 76) + (1 X 74) + 77 kg.
= 1204 kg.*

Actual Test Weight = 1215 kg.

Target Test Weight = 1204 kg.

To achieve test weight 55 liters of stoddard solvent and no sand bag ballast were added. The weight of the test vehicle was measured by placing each wheel on a Force Plate manufactured by K.J. Law Engineers, Inc., Detroit, Michigan.

*This weight is a calculated test weight based on the unloaded delivered weight (curb weight) plus two dummies, plus the calculated cargo weight from the label on each vehicle. This weight was used as the target test weight, with instrumentation, camera, etc. in place.

VEHICLE TEST FLUID DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: NA LITERS (FURNISHED BY CTM)

TEST VOLUME: 55 LITERS

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 55 LITERS

DETAIL OF FUEL SYSTEM: NA

ELECTRIC FUEL PUMP: Yes

FUEL INJECTION: Yes

DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING? Yes

DATA FROM "RECOMMENDED TIRE PRESSURE" LABEL ON DOOR, POST, GLOVEBOX, ETC.

VEHICLE LOAD (UP TO CAPACITY): FRONT 2.0 kg/cm² REAR 2.5 kg/cm²

RECOMMENDED TIRE SIZE: P 175/70R13 LOAD RANGE X B, C, A

VEHICLE CAPACITY: 5 TYPES OF SEATS: Front - bucket
Rear - bench

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 2 FRONT
 3 REAR
 5 TOTAL

CARGO LOAD 77 KG.

TOTAL 417 KG.

*WITH ENTIRE FUEL SYSTEM FILLED WITH FUEL THROUGH CARBURETOR BOWL.

VEHICLE TEST CONDITIONS

TEST NUMBER: 860225

DATE OF TEST: February 25, 1986

TIME OF TEST: 14:06

WIND VELOCITY: 0-3 mph @ 333°

HUMIDITY: NA

AMBIENT TEMPERATURE AT IMPACT AREA:

21° C

TEMPERATURE IN OCCUPANT COMPARTMENT:

22° C

DRIVER DUMMY TEMPERATURE

22° C

PASSENGER DUMMY TEMPERATURE

21° C

VEHICLE DATA

	<u>ACTUAL</u>	<u>INTENDED</u>
TEST WEIGHT (KG.)	1215	1204
VEHICLE ORIENTATION (DEGREES)	0	0
VEHICLE VELOCITY (KPH)	48.3	48.3
MAXIMUM CRUSH (CENTIMETERS)	56.6	DNA

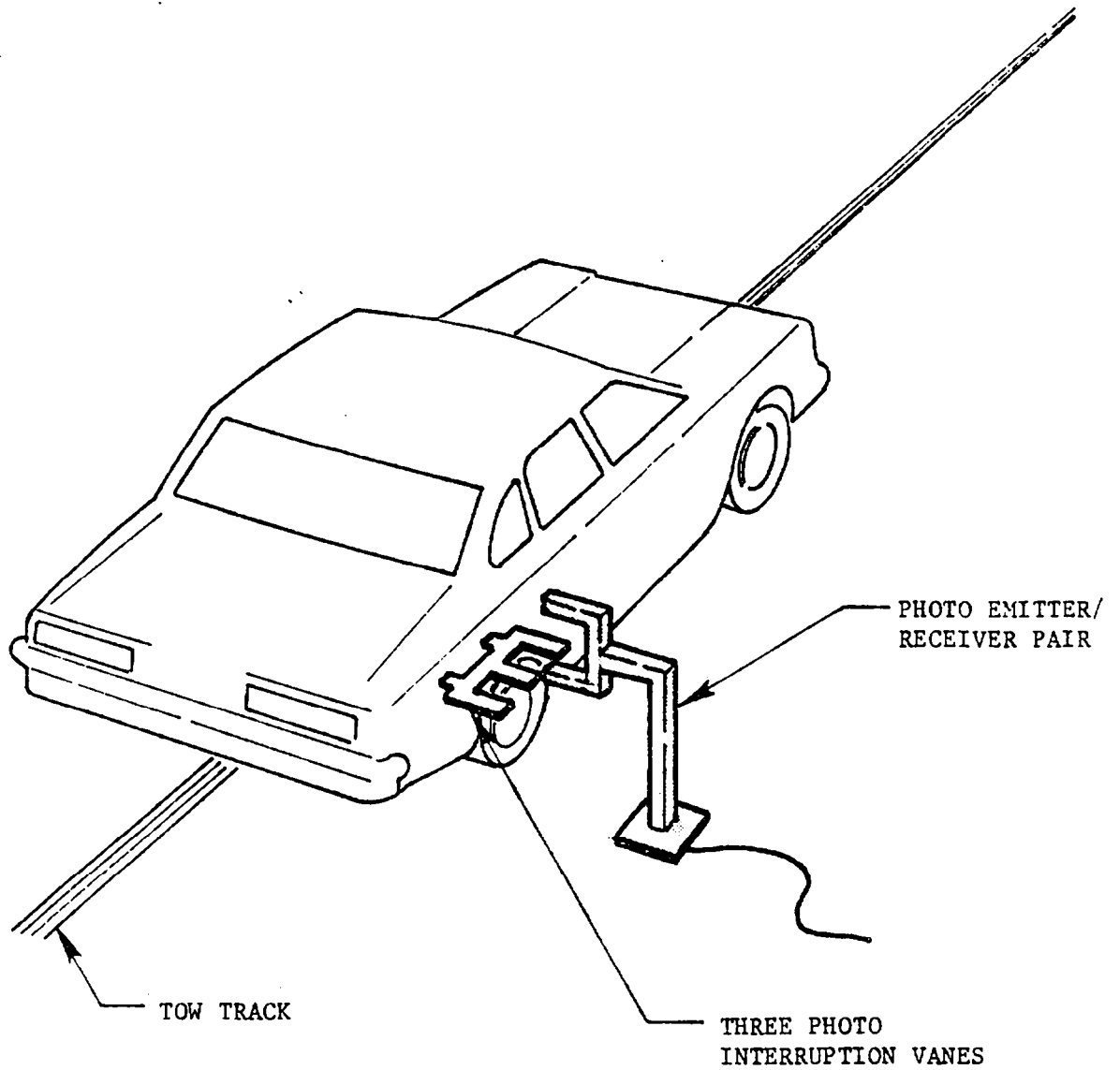
DUMMIES

	<u>DRIVER</u>	<u>MIDDLE PASSENGER</u>	<u>RT. FRONT PASSENGER</u>	<u>LEFT REAR PASSENGER</u>	<u>RT. REAR PASSENGER</u>
TYPE:	H III		P 572		
SERIAL NO.:	61		830		
INSTRUMENTATION:					
HEAD ACCEL.:	3		3		
CHEST ACCEL.:	3		3		
FEMUR L.C.'S:	2		2		
OTHER:	1 Chest Disp.				
	14 Lower Leg Channels				
	2 Knee Shear				
	3 Neck				

RESTRAINT SYSTEM: 2-point passive belt with knee bolster

REMARKS:

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane is located five centimeters before impact.

The vanes have thirty centimeter spacing.

SECTION 3.0
DATA REQUIRED BY R & D

The following pages are included in this section:

1. Dummy temperature control and position data
2. Dummy kinematic summary
3. Vehicle crush data
4. Dummy and vehicle accelerometer location and data summary
5. High speed camera information

DUMMY DATA SUMMARY

DRIVER DUMMY					PASSENGER DUMMY				
SN: 61					SN: 830				
	POSITIVE		NEGATIVE			POSITIVE		NEGATIVE	
	DIRECTION*		DIRECTION**			DIRECTION*		DIRECTION**	
	MAX	TIME	MAX	TIME		MAX	TIME	MAX	TIME
HEAD ACCELERATION (g)									
LONGITUDINAL	11.47	234.38	55.66	108.00		7.34	324.88	17.08	129.00
LATERAL	11.89	201.75	18.52	129.00		8.02	322.50	25.72	123.63
VERTICAL	9.83	131.88	51.17	103.25		4.67	21.88	43.10	94.38
RESULTANT		68.03 @	108.00				46.05 @	94.38	
HIC	590.13 from 84.12 to 134.38 msec					322.38 from 77.00 to 147.00 msec			
NECK LOADS (N)									
SHEAR	1349.33	112.13	170.91	211.25	---	---	α	---	---
AXIAL	1736.00	105.13	240.87	288.00	---	---	α	---	---
NECK MOMENTS (N-m)									
ABOUT LATERAL	80.24	127.25	26.41	264.38	---	---	α	---	---
CHEST ACCELERATION (g)									
LONGITUDINAL	4.78	164.25	39.85	91.63		4.67	118.88	29.60	86.50
LATERAL	3.25	80.38	14.64	103.00		3.27	252.00	14.34	117.13
VERTICAL	---	---	γ	---		9.60	123.00	11.47	96.13
RESULTANT		---	@	---			32.35 @	86.75	
3 MSEC CLIP		---	@	---			31.02 ending at	87.41	
DISPLACEMENT (cm)	1.03	93.63	.02	30.13	---	---	α	---	---
FEMUR LOADS (N)									
LEFT	235.26	321.63	3998.88	84.63		269.34	145.50	3338.55	98.38
RIGHT	343.94	55.50	7247.52	81.00		208.92	143.38	2686.03	78.00

* LONGITUDINAL: FORWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD

**LONGITUDINAL: REARWARD
 LATERAL: RIGHTWARD
 VERTICAL: DOWNWARD

α No instrumentation at this location

γ See TEST ANOMALIES

DUMMY DATA SUMMARY CONTD

DRIVER DUMMY				
SN: 61				
	POSITIVE		NEGATIVE	
	DIRECTION*		DIRECTION**	
	MAX	TIME	MAX	TIME
KNEE LOADS (N)				
LEFT LEG				
LEFT SENSOR	1413.96	94.88	717.36	58.50
RIGHT SENSOR	880.62	91.63	763.01	59.38
RIGHT LEG				
LEFT SENSOR	525.10	220.00	1145.49	66.63
RIGHT SENSOR	375.85	337.88	2154.55	67.25
KNEE DISPLACEMENT (cm)				
LEFT KNEE	1.55	97.38	.03	31.88
RIGHT KNEE	1.00	97.38	.06	69.00
TIBIA MOMENTS (N-m)				
LEFT LEG				
ABOUT LONGITUDINAL	57.62	70.75	43.62	107.75
ABOUT LATERAL	59.36	58.50	219.05	92.25
RIGHT LEG				
ABOUT LONGITUDINAL	59.67	127.63 Y	22.59	219.13 Y
ABOUT LATERAL	89.98	62.63	170.30	73.50
ANKLE LOADS (N)				
LEFT LEG				
LONGITUDINAL	681.72	91.50	651.28	59.50
VERTICAL	1500.61	58.25	777.62	80.63
RIGHT LEG				
LONGITUDINAL	251.45	226.75	855.10	66.13
VERTICAL	2478.01	67.00	195.39	248.75
ANKLE MOMENTS (N-m)				
LEFT LEG				
ABOUT LATERAL	149.13	75.25	29.33	57.63
RIGHT LEG				
ABOUT LATERAL	274.00	83.25	38.47	64.75

* LONGITUDINAL: FORWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD

**LONGITUDINAL: REARWARD
 LATERAL: RIGHTWARD
 VERTICAL: DOWNWARD

Y See TEST ANOMALIES

DUMMY KINEMATIC SUMMARY

DRIVER

Upon impact, the driver dummy slid forward on the seat. The dummy's knees contacted the knee bolster and lower instrument panel. The dummy's head rotated forward until the right side of the forehead contacted the left upper portion of the steering wheel rim. The dummy's left arm contacted the side of the driver's door. The dummy's chest was restrained by the passive belt. The dummy came to rest seated upright in the driver's seat.

PASSENGER

Upon impact the passenger dummy slid forward on the seat. The dummy's knees contacted the knee bolster and the dummy's head rotated forward. The dummy's upper torso rotated toward the center of the car, and the knee rotated toward the outside of the car. The dummy's head rotated rearward during rebound. The dummy came to rest seated leaning toward the center of the car with the right side of the dummy's back on the left side of the passenger's seat back.

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle and dummies were stored in the barrier building for more than 24 hrs. prior to the test. The temperature is controlled between 19° C and 25° C.

The vehicle was taken outside to be hooked up to the tow cable inside the climate control building between 12:00 and 12:15 PM the day of the test. Heaters were turned on in the climate control building to maintain the temperature. The vehicle remained in this position until being launched into the barrier building to impact the load cell barrier at 2:06.

The Hybrid III dummy was seated per the Hybrid III seating procedure using H-point co-ordinates included in Appendix D.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

VEHICLE NHTSA NO. R & D

MFR./MAKE/MODEL: Volkswagen Golf

SEAT TYPE: Bench
X Bucket
Split Bench

ADJUSTER TYPE: X Manual
Power

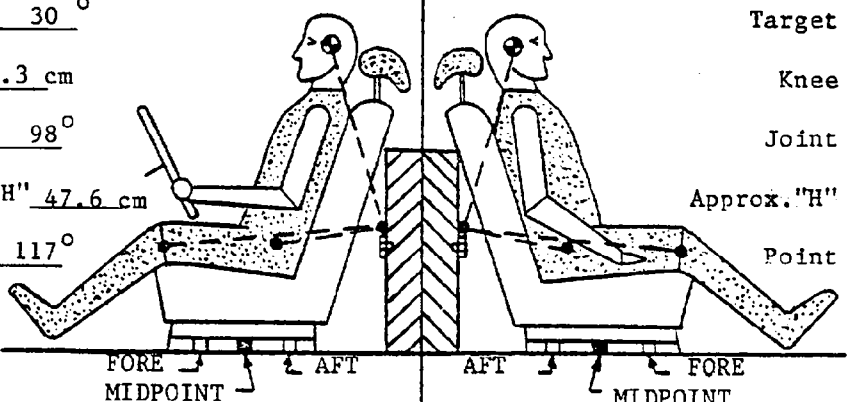
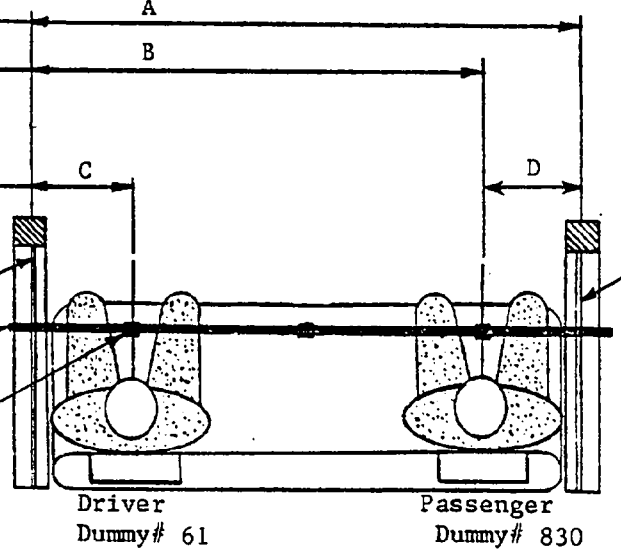
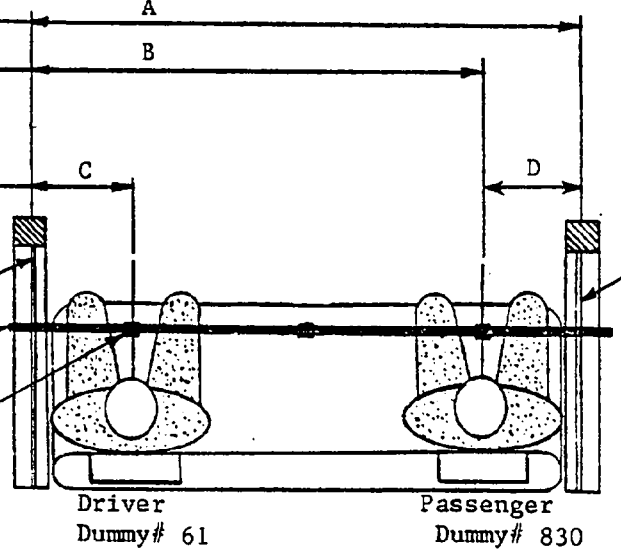
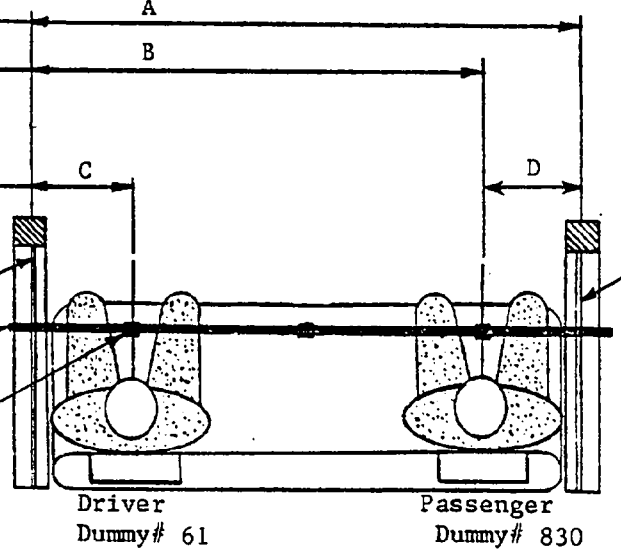
BUCKET SEAT BACK TYPE: Fixed
X Adjustable Reclining

TECHNICIANS:

1. Bob Fishbaugh
2. Robert Benavides
3. _____
4. _____

POSITIONING DATE: 2-25-86

AMBIENT TEMP.: 22° C. TIME: 11:00 AM

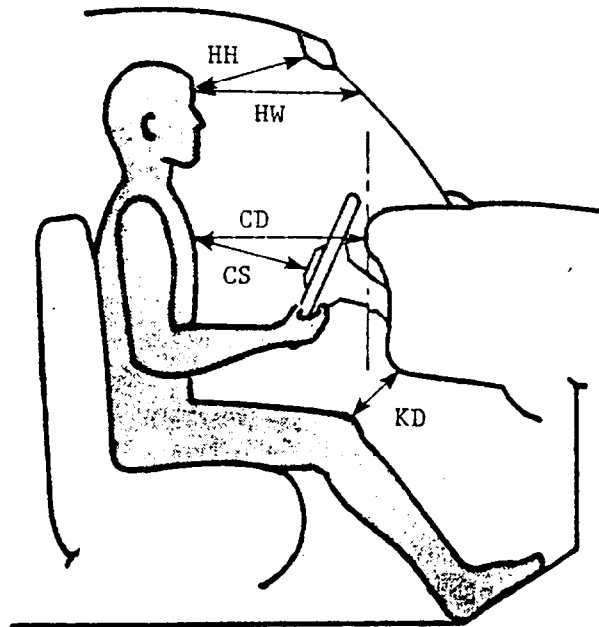
DRIVER DUMMY # <u>61</u> TYPE <u>H III</u> Head <u>52.4</u> cm Pelvis Angle <u>24°</u> Target <u>30°</u> Knee <u>81.3</u> cm Joint <u>98°</u> Approx. "H" <u>47.6</u> cm Point <u>117°</u>	PASSENGER DUMMY # <u>830</u> TYPE <u>P 572</u> Head <u>46.4</u> cm Target <u>32°</u> Knee <u>81.3</u> cm Joint <u>99°</u> Approx. "H" <u>49.0</u> cm Point <u>119°</u>			
				
<table style="width: 100%;"> <tr> <td style="width: 30%;"> A = <u>125.7</u> cm B = <u>95.9</u> cm C = <u>30.5</u> cm D = <u>27.9</u> cm </td> <td style="width: 40%; text-align: center;">  </td> <td style="width: 30%; text-align: right;"> Door Glass Height* <u>28.2</u> cm Door Glass Height* <u>27.3</u> cm </td> </tr> </table>		A = <u>125.7</u> cm B = <u>95.9</u> cm C = <u>30.5</u> cm D = <u>27.9</u> cm		Door Glass Height* <u>28.2</u> cm Door Glass Height* <u>27.3</u> cm
A = <u>125.7</u> cm B = <u>95.9</u> cm C = <u>30.5</u> cm D = <u>27.9</u> cm		Door Glass Height* <u>28.2</u> cm Door Glass Height* <u>27.3</u> cm		

DUMMY IN-VEHICLE POSITION RECORDING SHEET

DRIVER

PASSENGER

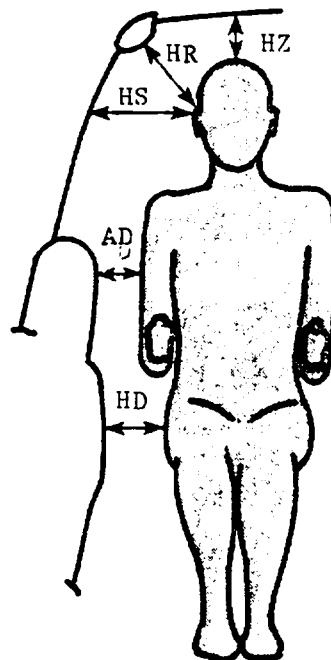
HH	32.4	37.5
HW	49.2	48.3
CD	53.3	53.3
CS	31.4	NA
KDL	10.5	4.4
KDR	11.4	5.1



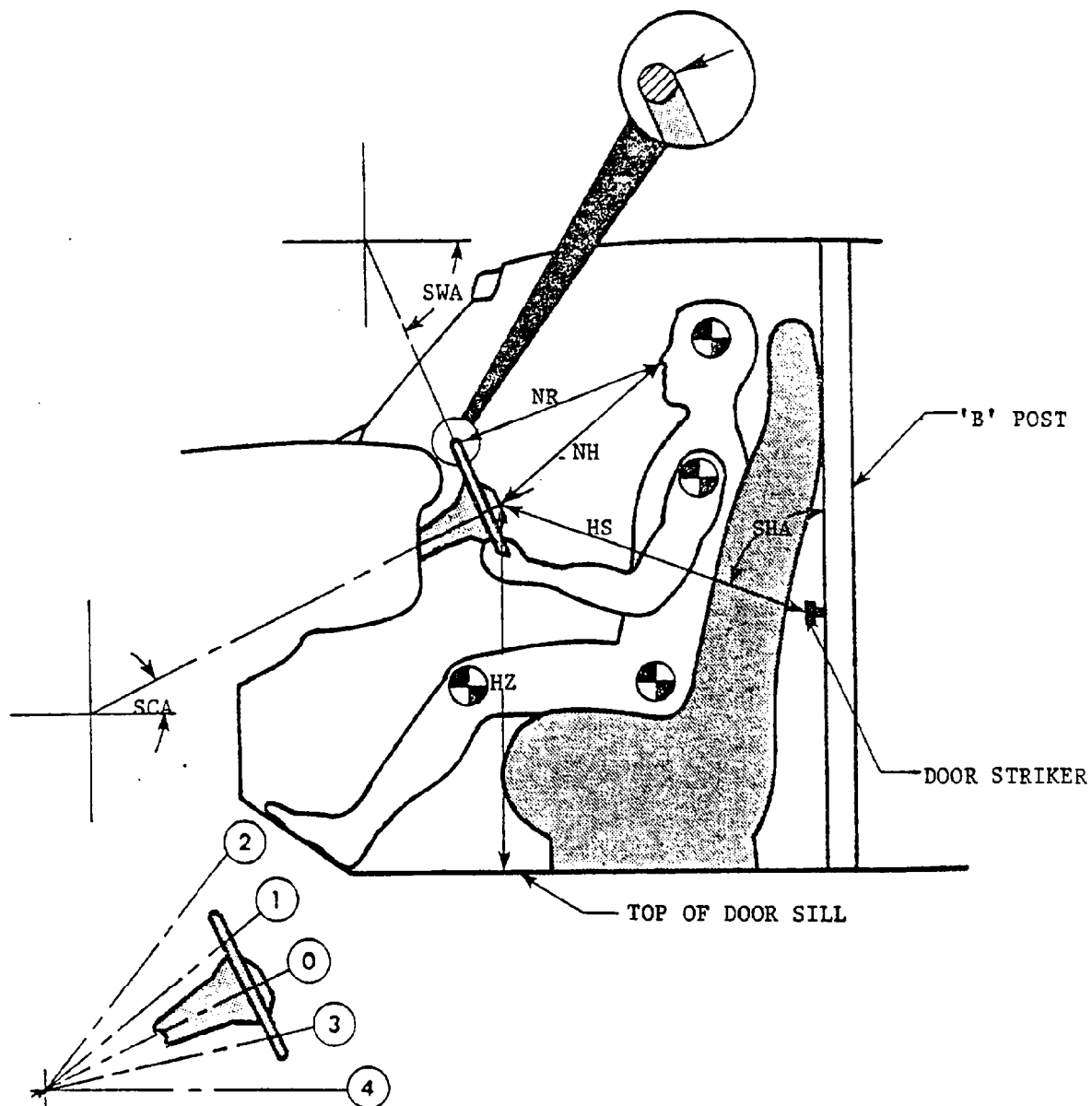
DRIVER

PASSENGER

HR	17.2	14.3
HS	22.9	21.3
AD	8.9	9.9
HD	14.6	14.6
HZ	9.2	7.6

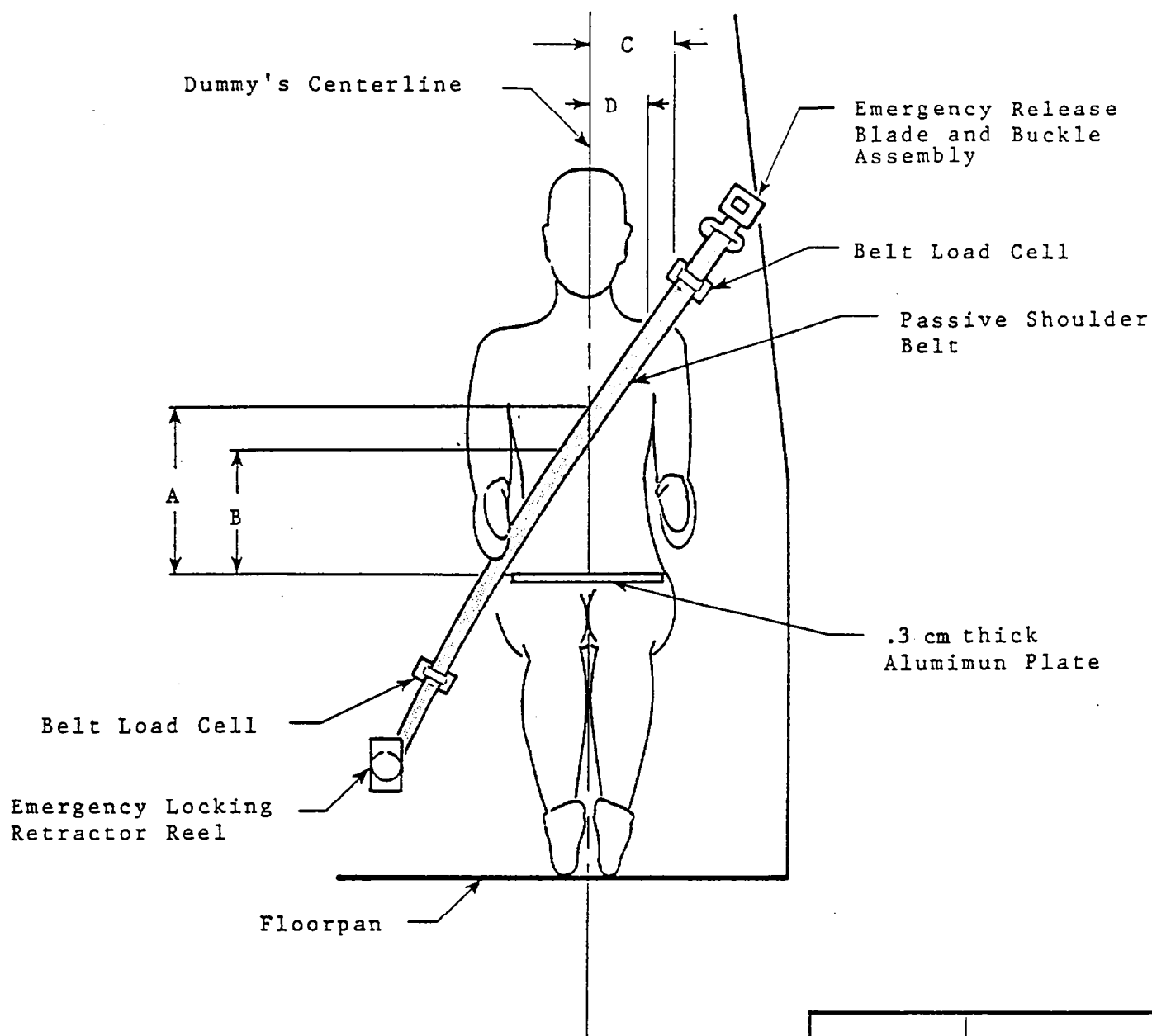


ALL MEASUREMENTS IN CENTIMETERS



	PRE-TEST	POST-TEST
NR	38.2 cm	NA
NH	39.4 cm	NA
HS	70.8 cm	71.8 cm
SCA	26°	29°
SWA	64°	61°
HZ	55.2 cm	59.7 cm
SHA	82°	78°

SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
A - Top surface of alum. plate to belt upper edge (cm)	32.0	37.5
B - Top surface of alum. plate to belt lower edge (cm)	24.1	30.5
C - Dummy centerline to outer edge of belt at chest flesh top (cm)	10.5	10.8
D - Dummy centerline to inner edge of belt at chest flesh top (cm)	5.1	5.1
SHOULDER BELT TENSION (N)	8.9	8.9

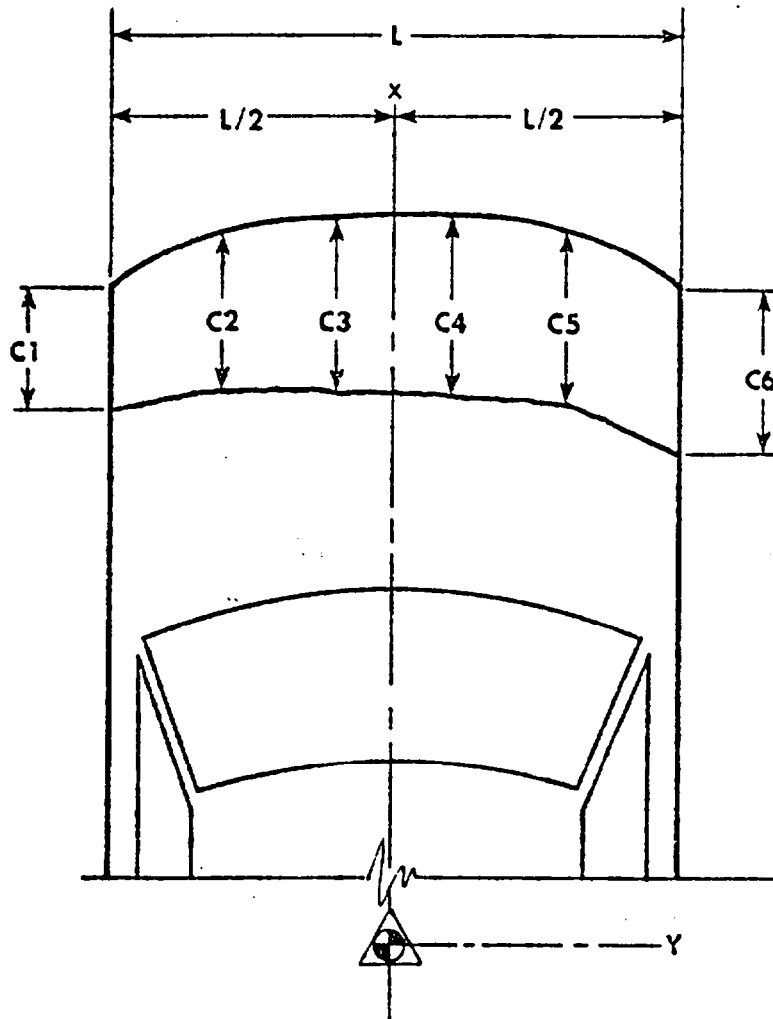
VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X* (cm)	Y* (cm)	Z* (cm)	POSITIVE DIRECTION**		NEGATIVE DIRECTION**	
					MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	LEFT B-PILLAR	161.6	65.1	28.9				
	LONGITUDINAL	$\Delta V = 51.96$ kph at 338.13 msec			1.04	210.88	25.11	70.75
	VERTICAL				12.56	100.63	11.73	53.75
2	RIGHT B-PILLAR	161.6	-65.1	28.6				
	LONGITUDINAL	$\Delta V = 60.04$ kph at 165.13 msec			1.40	269.25	26.35	78.88
	VERTICAL				7.94	91.75	10.55	128.00
3	VEHICLE C.G.	236.5	-2.5	36.8				
	LONGITUDINAL				.51	205.00	32.01	79.00
	LATERAL				13.73	12.88	17.25	64.00
	VERTICAL				23.05	21.00	23.74	51.75

* REFERENCE: X - REAR BUMPER (+ FORWARD),
Y - VEHICLE CENTERLINE (+ TO LEFT),
Z - GROUND LEVEL (+ UP)

** POSITIVE DIRECTION LONGITUDINAL: FORWARD
LATERAL: LEFTWARD
VERTICAL: UPWARD
NEGATIVE DIRECTION LONGITUDINAL: REARWARD
LATERAL: RIGHTWARD
VERTICAL: DOWNWARD

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS IN CENTIMETERS.



NOTE: C1 through C6 are spaced equally apart
All measurements in centimeters

VEHICLE Volkswagen Golf

<u>PRE-TEST</u>		<u>POST-TEST</u>		<u>CRUSH</u>	
L	<u>138.4</u>	L	<u>138.4</u>	L	<u>0.0</u>
C1	<u>396.5</u>	C1	<u>339.6</u>	C1	<u>56.9</u>
C2	<u>399.3</u>	C2	<u>349.9</u>	C2	<u>49.4</u>
C3	<u>401.0</u>	C3	<u>363.9</u>	C3	<u>37.1</u>
C4	<u>401.0</u>	C4	<u>375.6</u>	C4	<u>25.4</u>
C5	<u>399.9</u>	C5	<u>387.6</u>	C5	<u>12.3</u>
C6	<u>397.0</u>	C6	<u>397.2</u>	C6	<u>-.2</u>
D	<u>0</u>	D	<u>0</u>	D	<u>0</u>

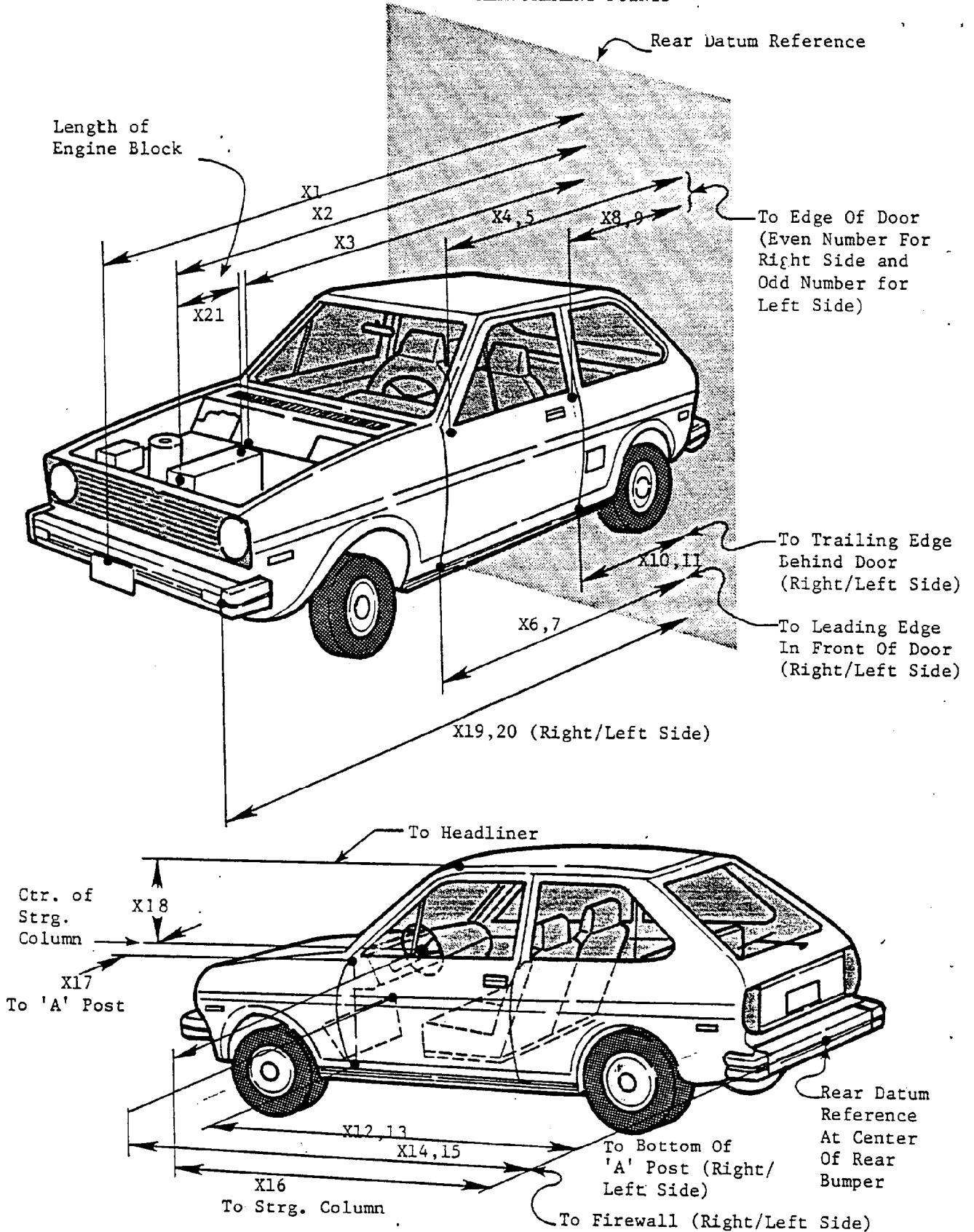
IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL 1986 Volkswagen Golf		TEST NUMBER 860225	DIMENSIONS IN CENTIMETERS	
NO.	TYPE OF MEASUREMENT		PRE-TEST	POST-TEST
X 1	TOTAL LENGTH OF VEHICLE AT CENTERLINE		401.2	368.3
X 2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK		337.8	335.3
X 3	REAR SURFACE OF VEHICLE TO FIREWALL		305.1	297.8
X 4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR		272.6	273.4
X 5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR		272.8	270.7
X 6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR		273.4	272.1
X 7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR		273.2	270.8
X 8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR		157.2	157.5
X 9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR		157.8	155.6
X 10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR		160.3	159.4
X 11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR		161.1	158.4
X 12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST OF RIGHT SIDE		270.2	269.7
X 13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST OF LEFT SIDE		270.2	266.4
X 14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE		308.9	308.6
X 15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE		307.8	292.1
X 16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER		234.8	231.1
X 17	STEERING COLUMN TO "A" POST		38.4	37.5

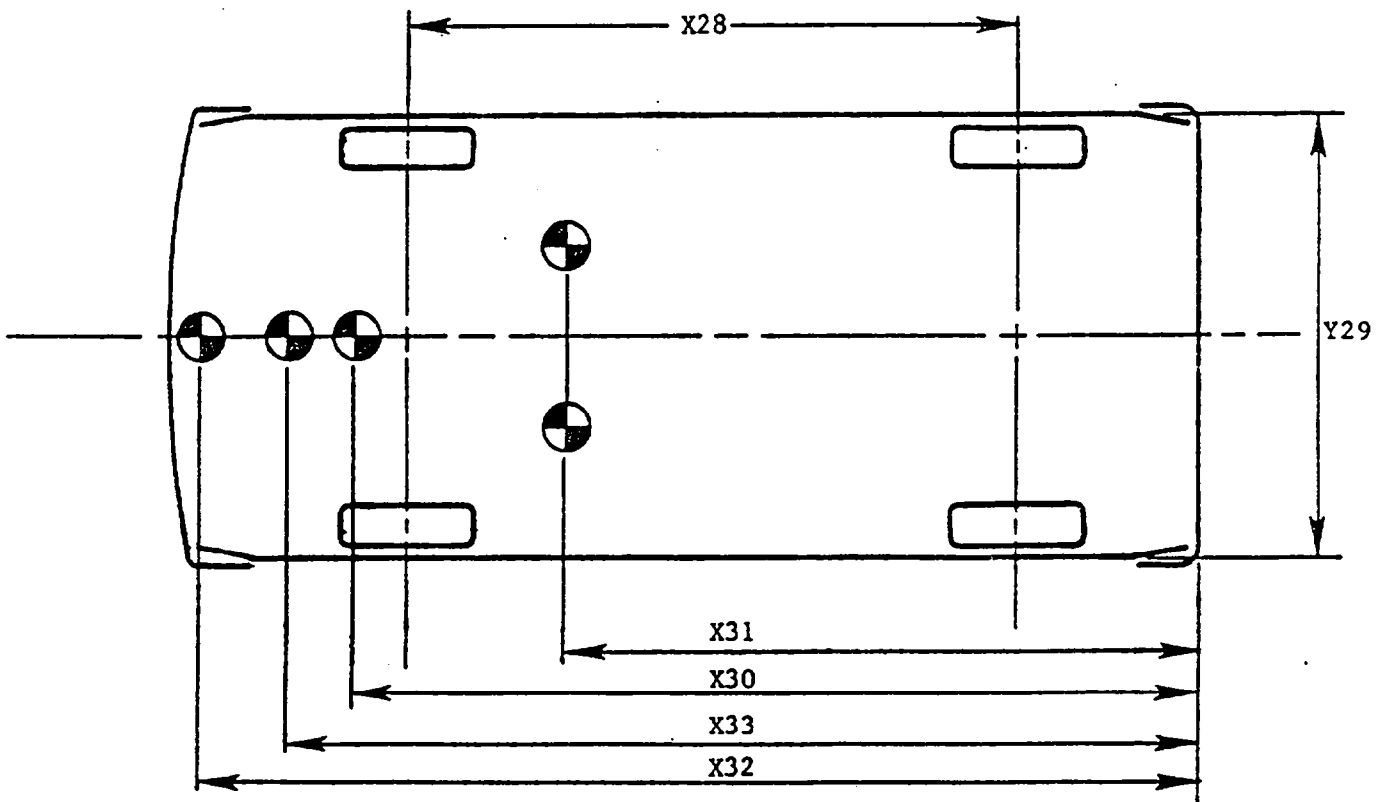
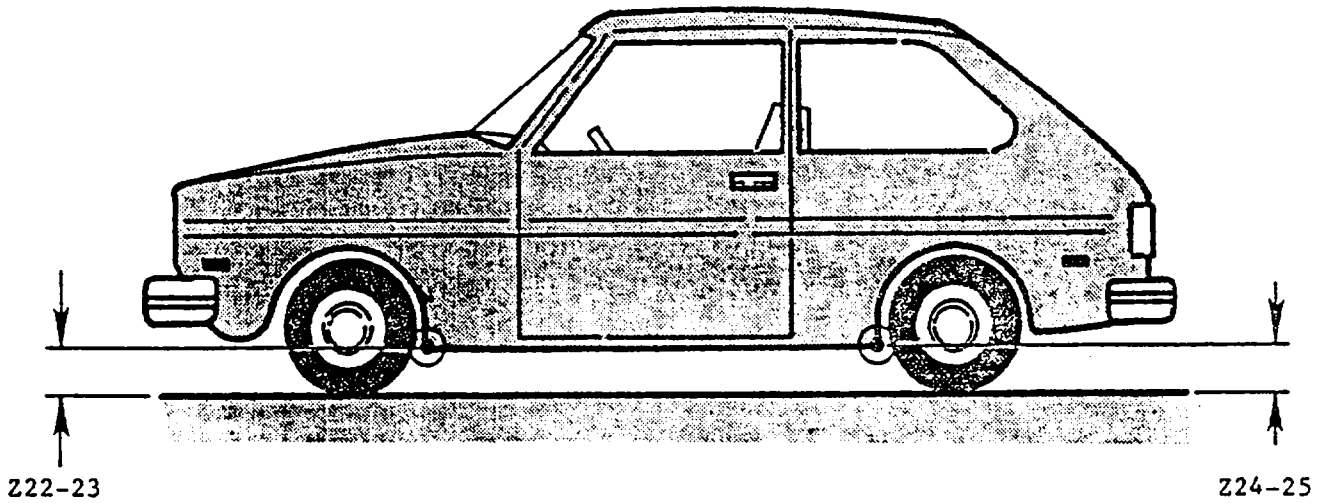
IMPACTED VEHICLE MEASUREMENTS CONTD

VEHICLE MAKE/MODEL 1986 Volkswagen Golf		TEST NUMBER 860225	DIMENSIONS IN CENTIMETERS	
NO	TYPE OF MEASUREMENT		PRE TEST	POST TEST
Z18	REAR OF WINDSHIELD HEADER TO STEERING WHEEL CENTER		43.2	42.6
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER		397.0	397.2
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER		396.5	339.6
X21	WIDTH OF ENGINE BLOCK		12.7	12.7
Z22	RIGHT FRONT SILL TO GROUND PLANE		23.2	18.8
Z23	LEFT FRONT SILL TO GROUND PLANE		23.5	12.4
Z24	RIGHT REAR SILL TO GROUND PLANE		22.6	22.9
Z25	LEFT REAR SILL TO GROUND PLANE		23.2	15.2
X26	FIREWALL TO ENGINE OR TRANSAXLE		26.7	24.8
Z27	VERTICAL DIMENSION FROM DOOR SILL TO CENTERLINE OF STEERING COLUMN		55.2	59.4
X28	WHEELBASE OF VEHICLE		248.0	232.1 Left side
Y29	WIDTH OF VEHICLE AT MAXIMUM WIDTH POINT Rear wheel well		167.0	168.9 Doors
X30	REAR SURFACE OF VEHICLE TO ENGINE TARGET		NA	NA
X31	REAR SURFACE OF VEHICLE TO COMPARTMENT TARGET		NA	NA
X32	REAR SURFACE OF VEHICLE TO BUMPER TARGER		NA	NA
X33	REAR SURFACE OF VEHICLE TO FRAME CROSSMEMBER		NA	NA

PRE-TEST AND POST-TEST MEASUREMENT POINTS



PRE-TEST AND POST-TEST MEASUREMENT POINTS CONTD.



CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Right wide	Photosonic 1B	13	1008	Vehicle Crush
2	Right rear	Photosonic 1B	25	1005	Crush Measurement
3	Right passenger	Photosonic 1B	50	1005	Dummy Kinematics
5	Left wide	Photosonic 1B	17	997	Vehicle Crush
7	Left driver	Photosonic 1B	50	998	Dummy Kinematics
8	Onboard driver	Photosonic 1B	8	998	Dummy Kinematics
9	Barrier top	Photosonic 1B	13	1005	Dummy Kinematics
10	Overhead	Photosonic 1B	17	995	Vehicle Crush
12	Right panning	Kodak	16	24	Real Time Documentation
13	Onboard passenger	Photosonic 1B	8	999	Dummy Kinematics

NOTE: Camera information is included on page D-6

HIGH SPEED CAMERA INFORMATION

CAMERA NO.	X,CM*	Y,CM*	Z,CM*
1	154.9	744.2	94.0
2	302.3	356.9	101.6
3	147.3	972.8	177.8
5	535.9	-726.4	96.5
7	154.9	-848.4	180.3
8		ONBOARD	
9	-61.0	0.0	304.8
10	182.9	0.0	548.6
12	NA	NA	NA
13		ONBOARD	

NOTE: All measurements are in centimeters.

*REFERENCE:

- +X: Rearward with respect to barrier face at point of first contact.
- +Y: Rightward from monorail center.
- +Z: Upward from ground level.

TEST ANOMALIES

The driver's chest Z-axis accelerometer, CSTZG1, lost data after 78 msec due to cabling. The driver's chest resultant, CSTRG1, and 3 msec clip peak calculations were invalid due to the above accelerometer data loss.

The driver's right upper tibia X-axis moment load cell, TBRXM1, lost data from 60 to 130 msec.

APPENDIX A
PHOTOGRAPHS



Figure 1. PRE-TEST RIGHT SIDE OVERALL



Figure 2. POST-TEST RIGHT SIDE OVERALL
A-2



Figure 3. PRE-TEST LEFT SIDE OVERALL

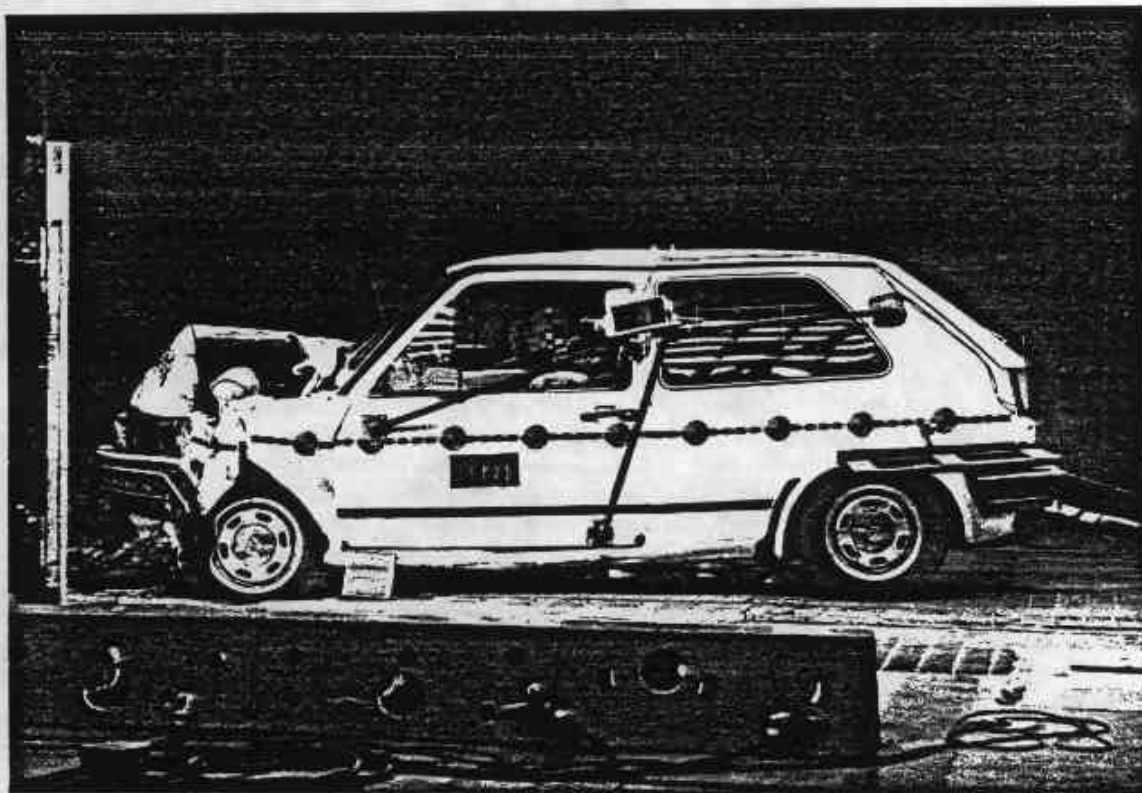


Figure 4. POST-TEST LEFT SIDE OVERALL
A-3



Figure 5. PRE-TEST VEHICLE FRONT



Figure 6. POST-TEST VEHICLE FRONT

A-4



Figure 7. PRE-TEST VEHICLE REAR



Figure 8. POST-TEST VEHICLE REAR
A-5

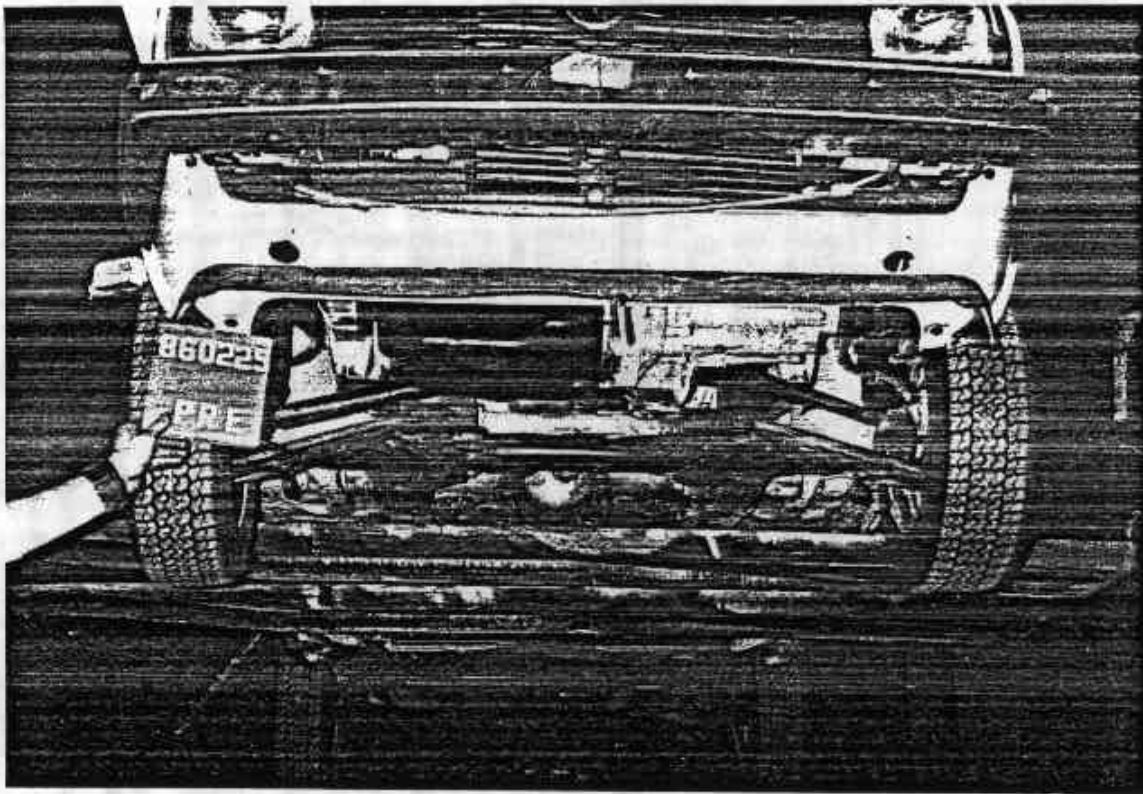


Figure 9. PRE-TEST VEHICLE UNDERBODY VIEW

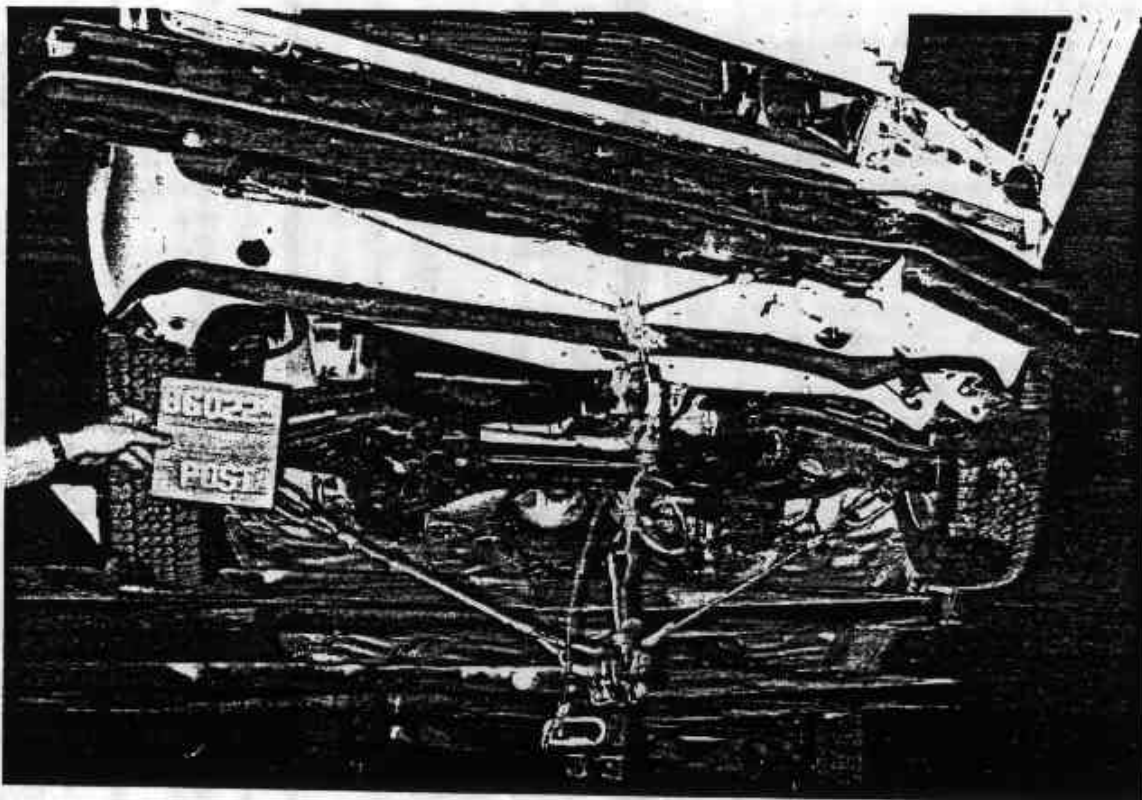


Figure 10. POST-TEST VEHICLE UNDERBODY VIEW



Figure 11. PRE-TEST DRIVER DUMMY - VIEW 1

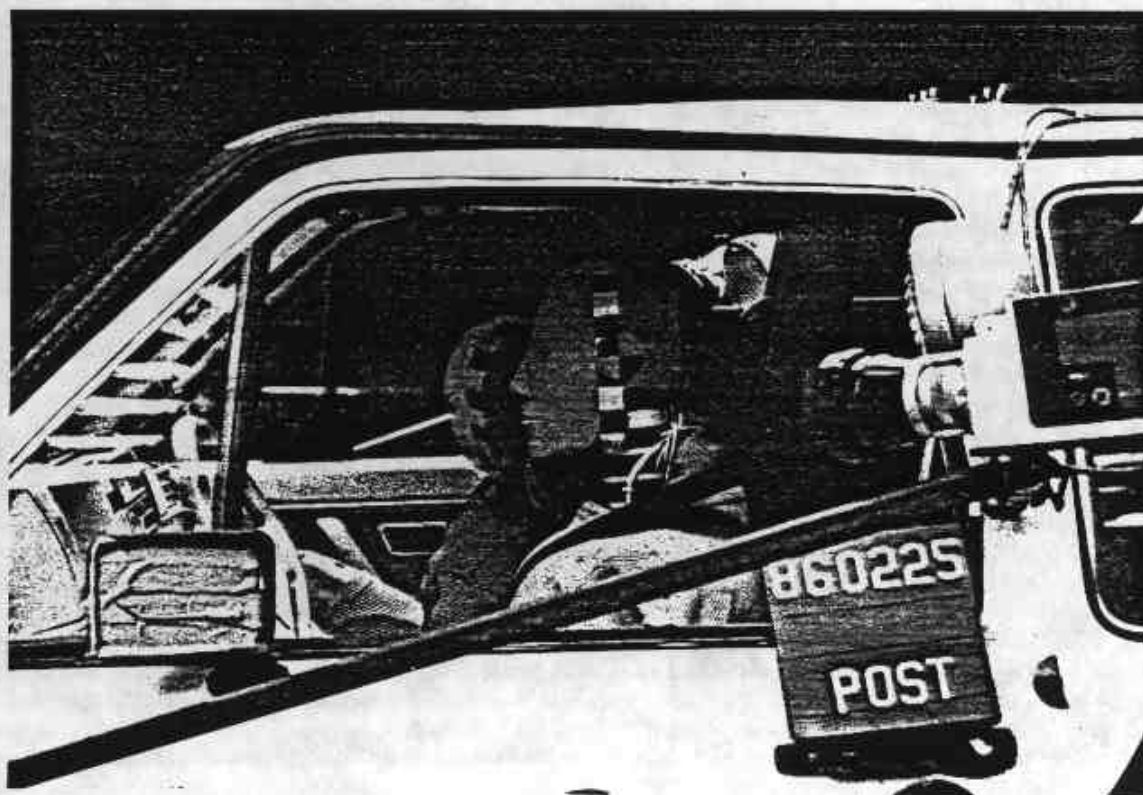


Figure 12. POST-TEST DRIVER DUMMY - VIEW 1
A-7

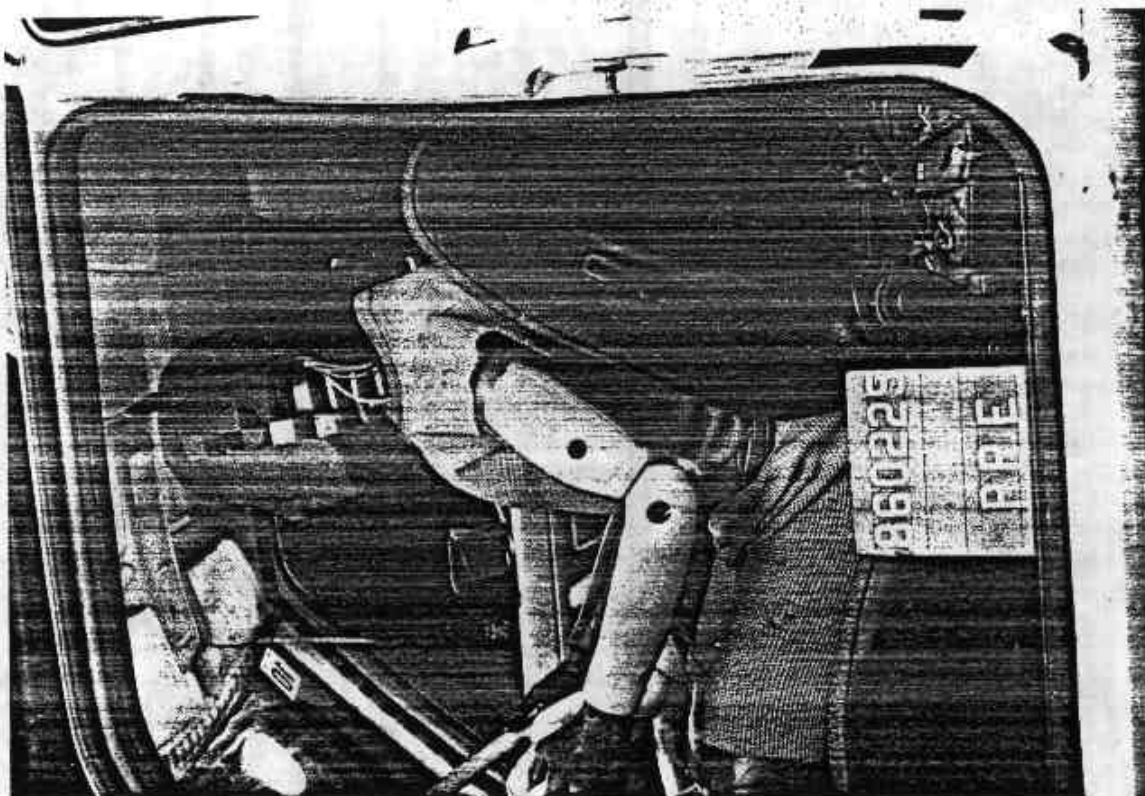


Figure 13. PRE-TEST DRIVER DUMMY - VIEW 2

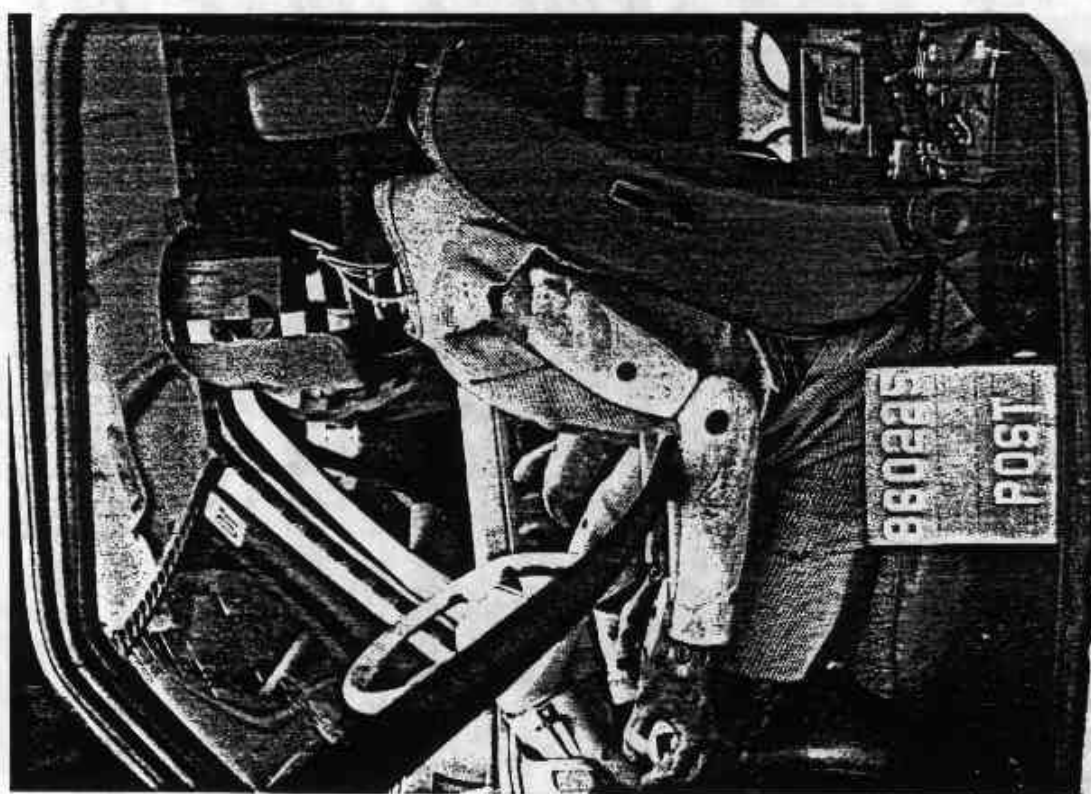


Figure 14. POST-TEST DRIVER DUMMY - VIEW 2

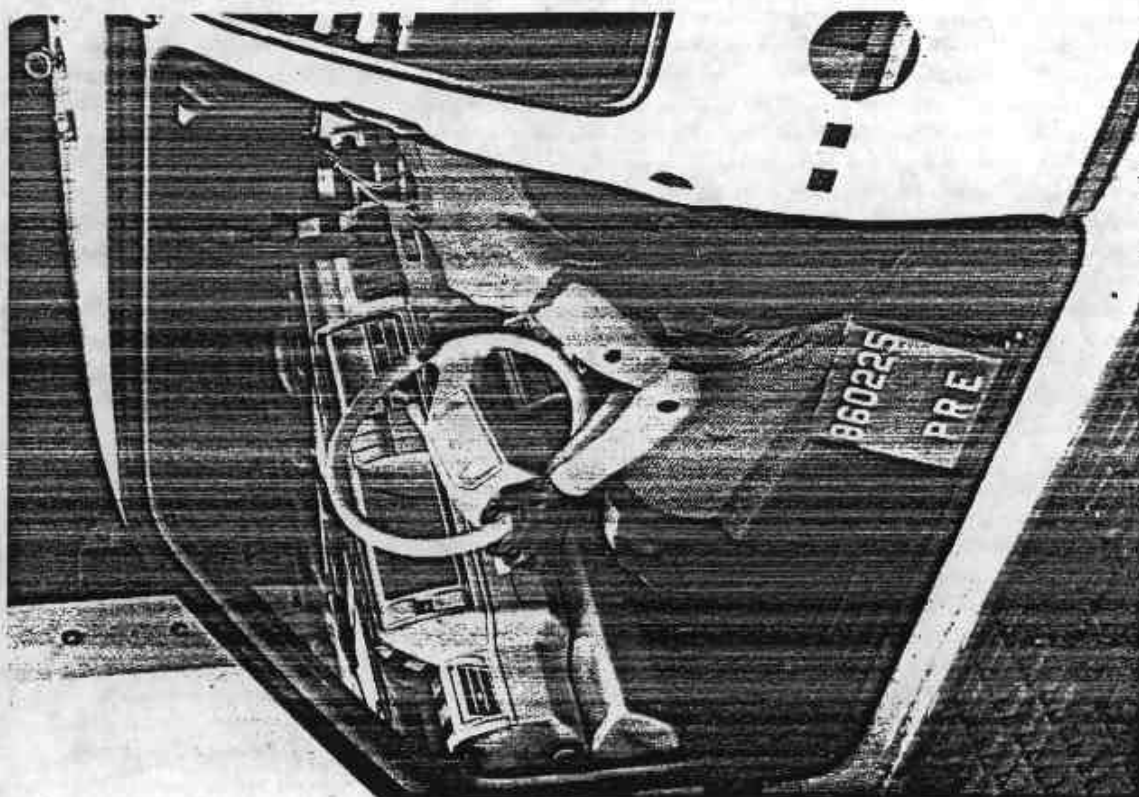


Figure 15. PRE-TEST DRIVER DUMMY - VIEW 3

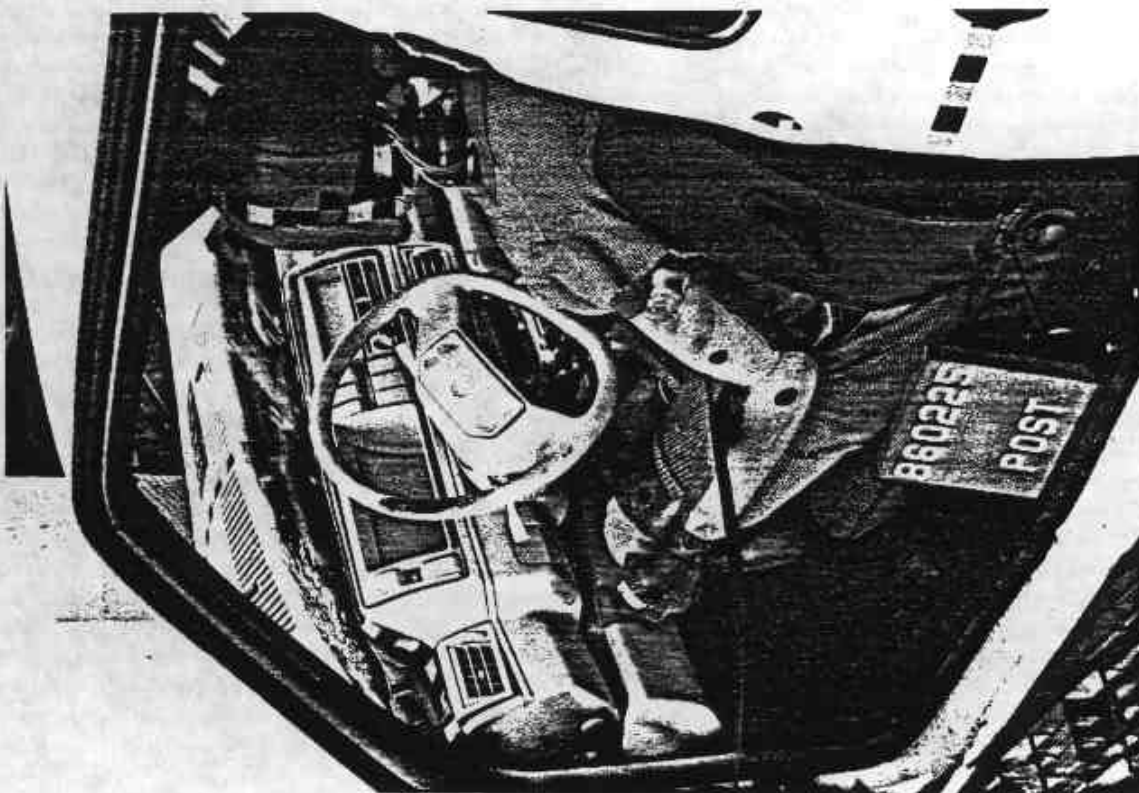


Figure 16. POST-TEST DRIVER DUMMY - VIEW 3

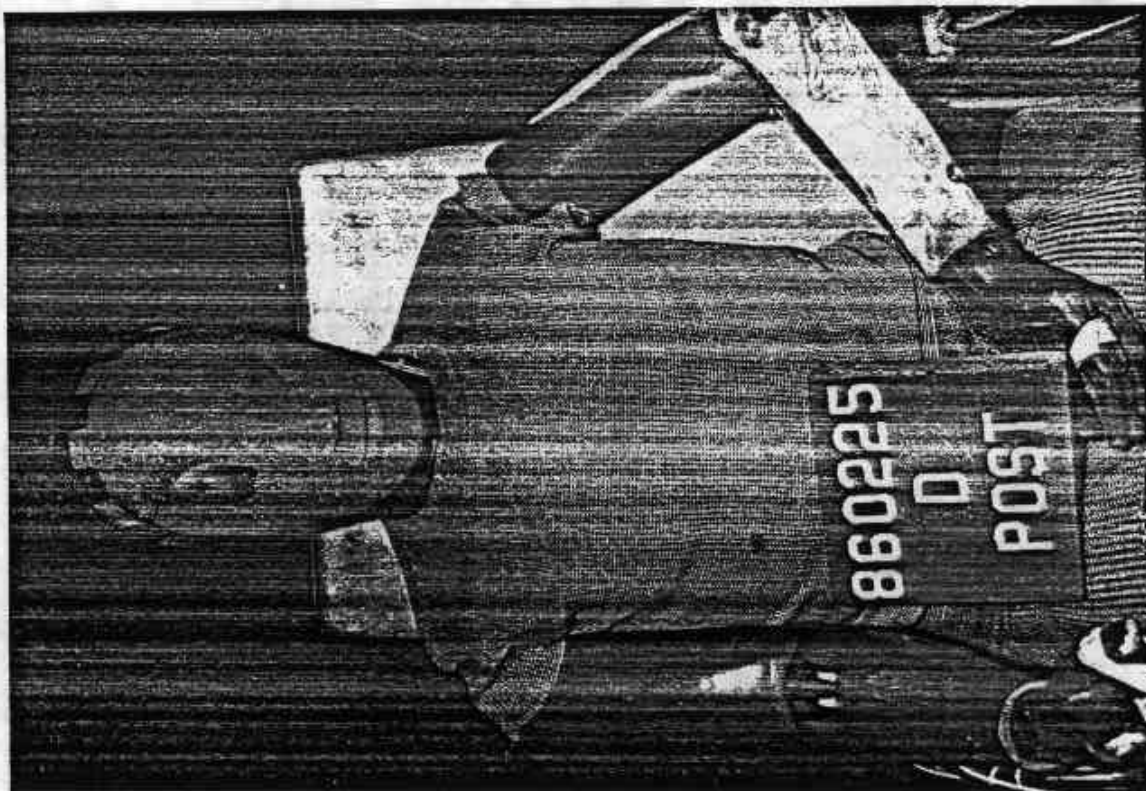


Figure 17. POST-TEST DRIVER DUMMY - VIEW 4

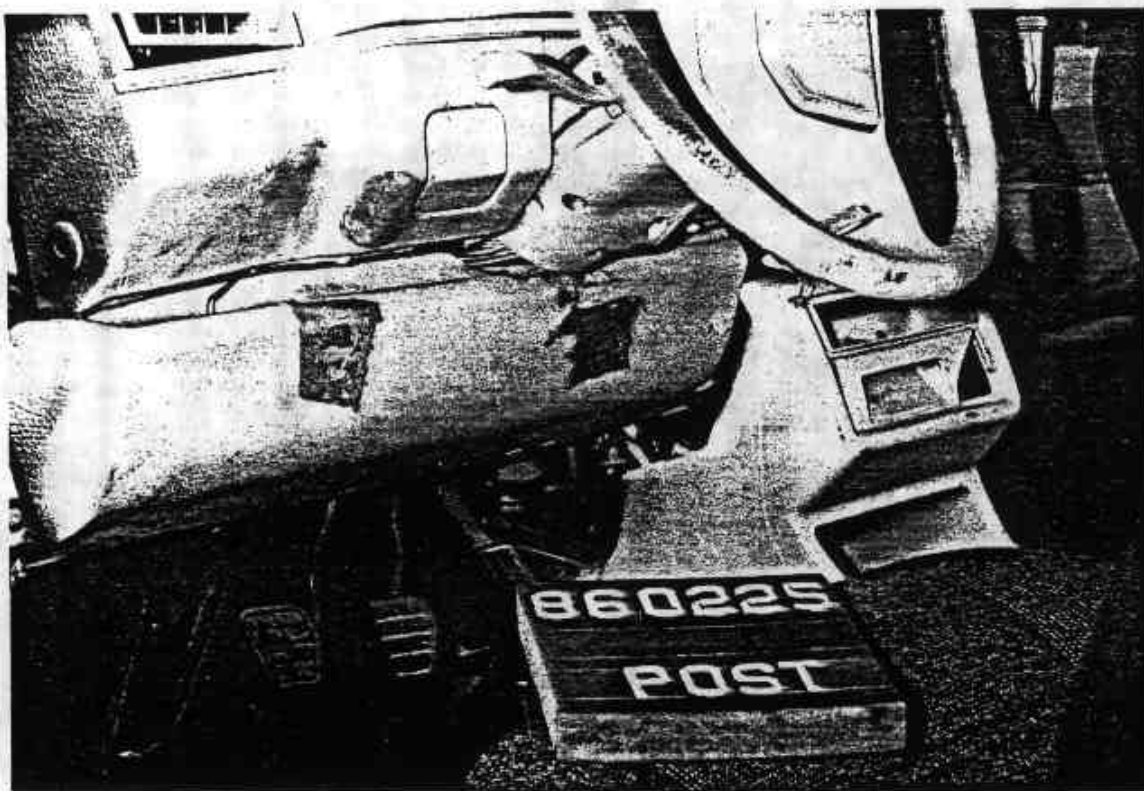


Figure 18. POST-TEST DRIVER SIDE INTERIOR
A-10



Figure 19. PRE-TEST PASSENGER DUMMY - VIEW 1



Figure 20. POST-TEST PASSENGER DUMMY - VIEW 1
A-11

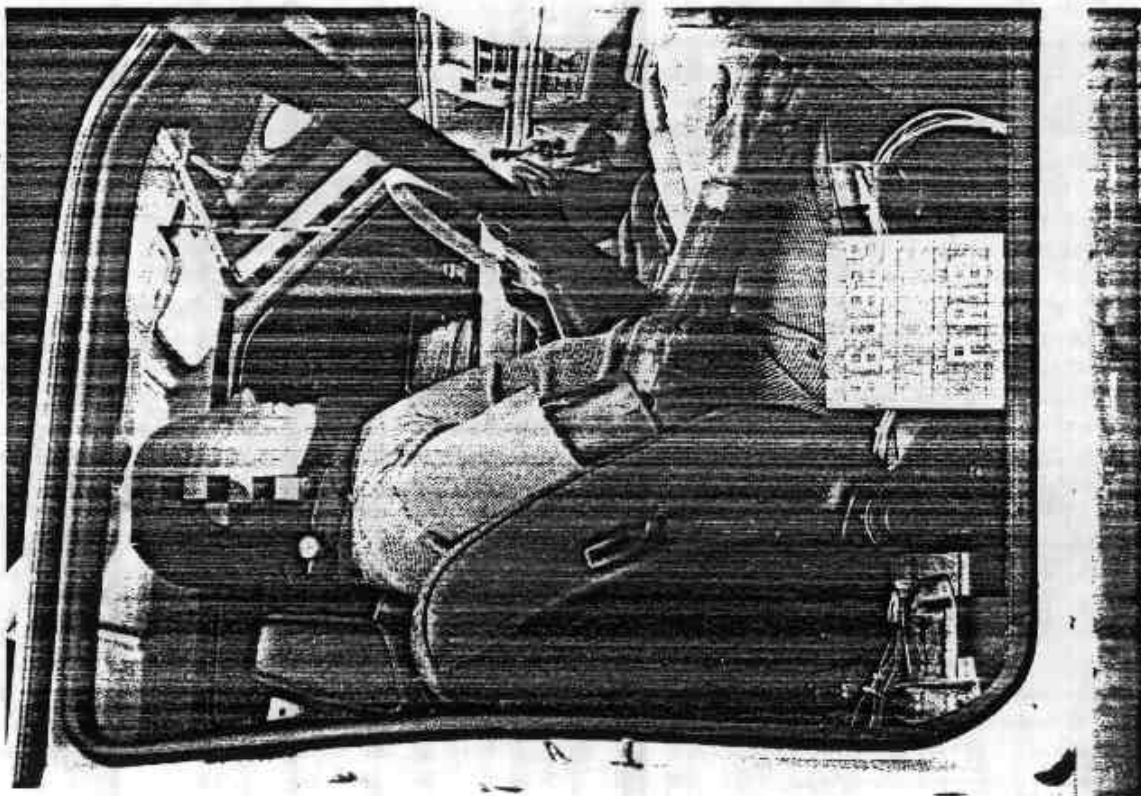


Figure 21. PRE-TEST PASSENGER DUMMY - VIEW 2

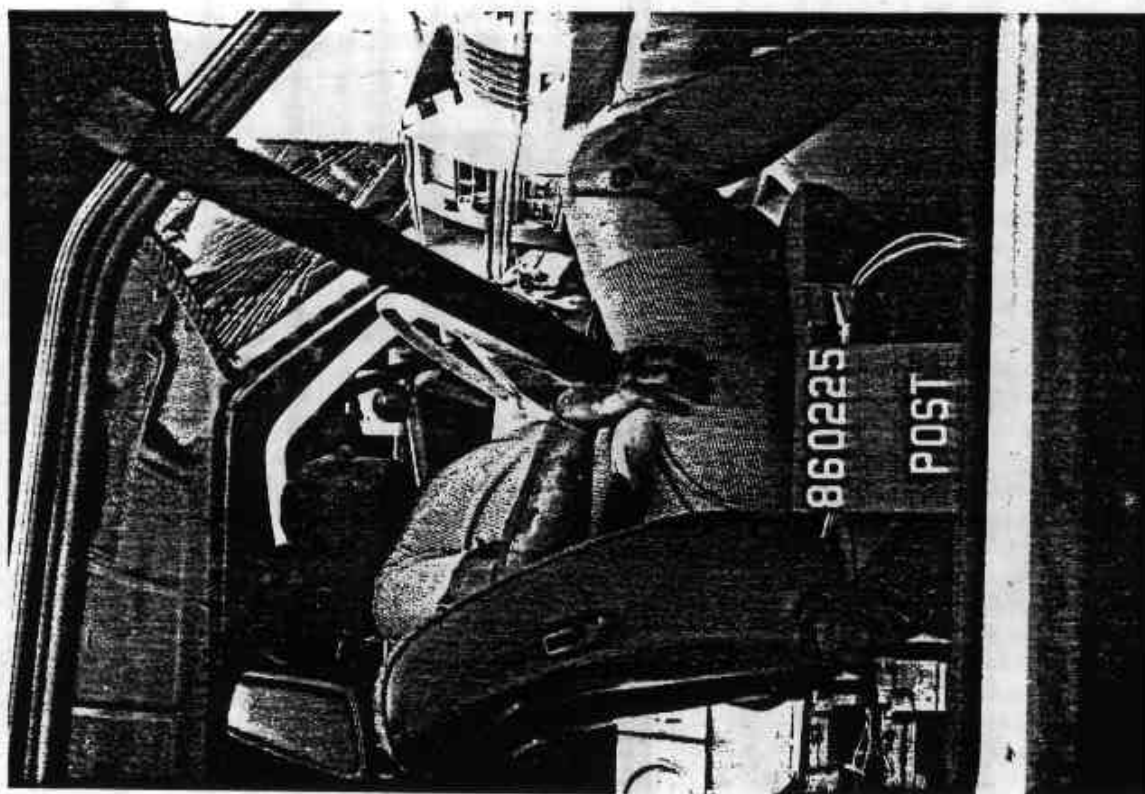


Figure 22. POST-TEST PASSENGER DUMMY - VIEW 2

A-12



Figure 23. PRE-TEST PASSENGER DUMMY - VIEW 3



Figure 24. POST-TEST PASSENGER DUMMY - VIEW 3

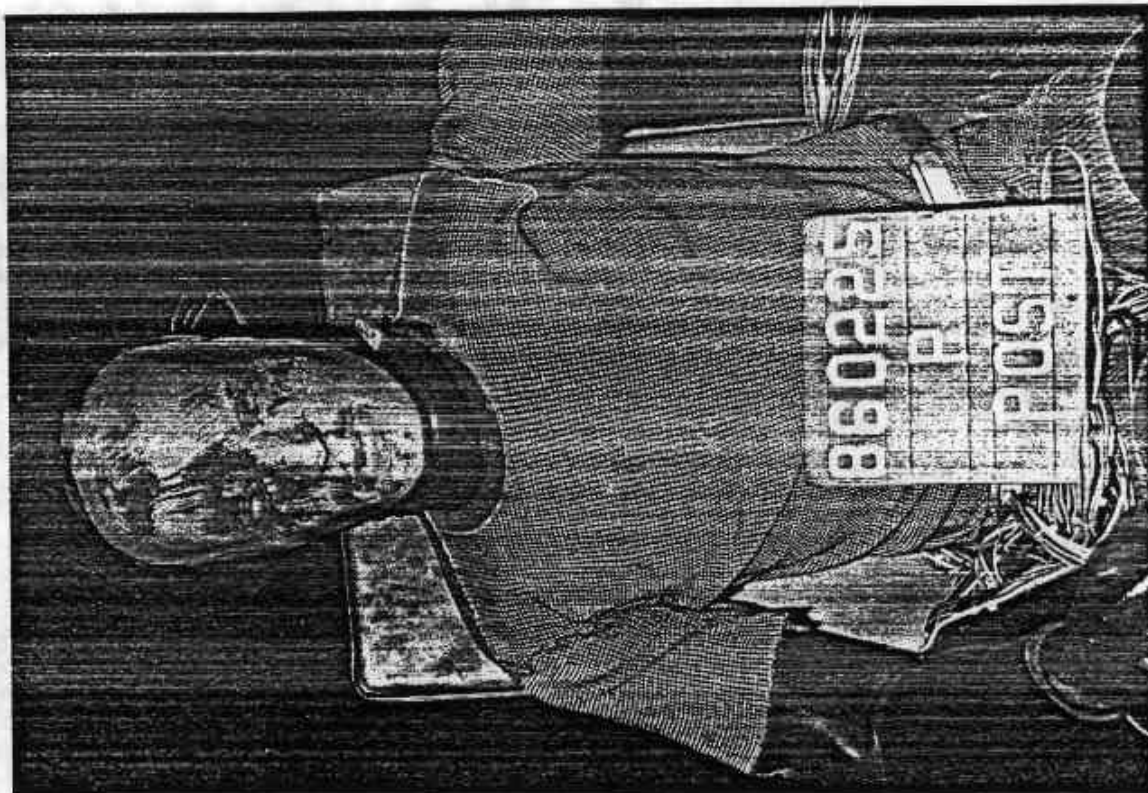


Figure 25. POST-TEST PASSENGER DUMMY - VIEW 4



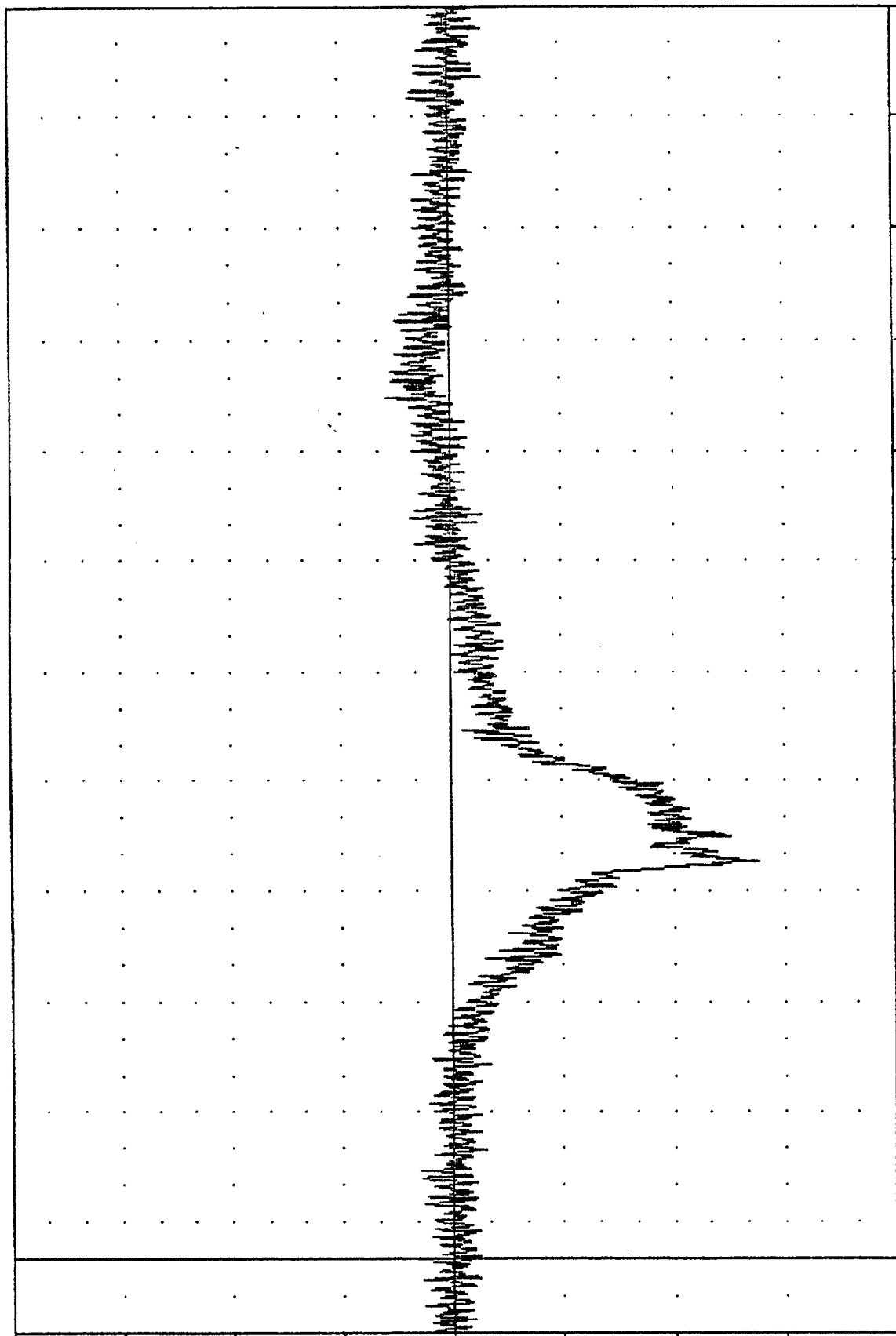
Figure 26. POST-TEST PASSENGER SIDE INTERIOR

APPENDIX B
DATA PLOT PRESENTATION

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HEDXG1

FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = -55.66e 108.00, 11.47 e 234.38

ACCELERATION (G)

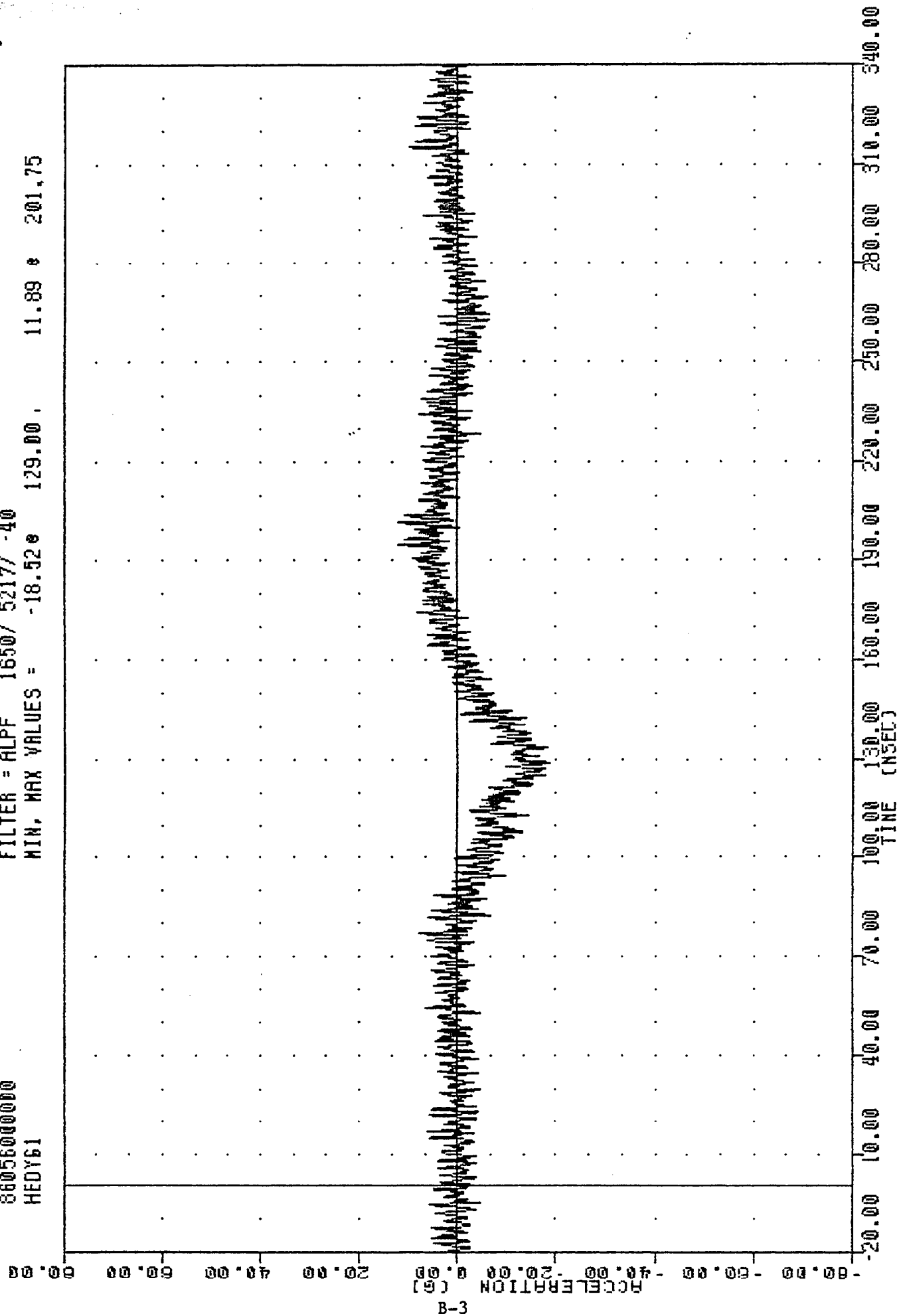


TIME (MSEC)

VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER HEAD ACCELERATION X AXIS

Y001
GOLF INTO 30 DEG L BARRIER
860560000000
HEDY61

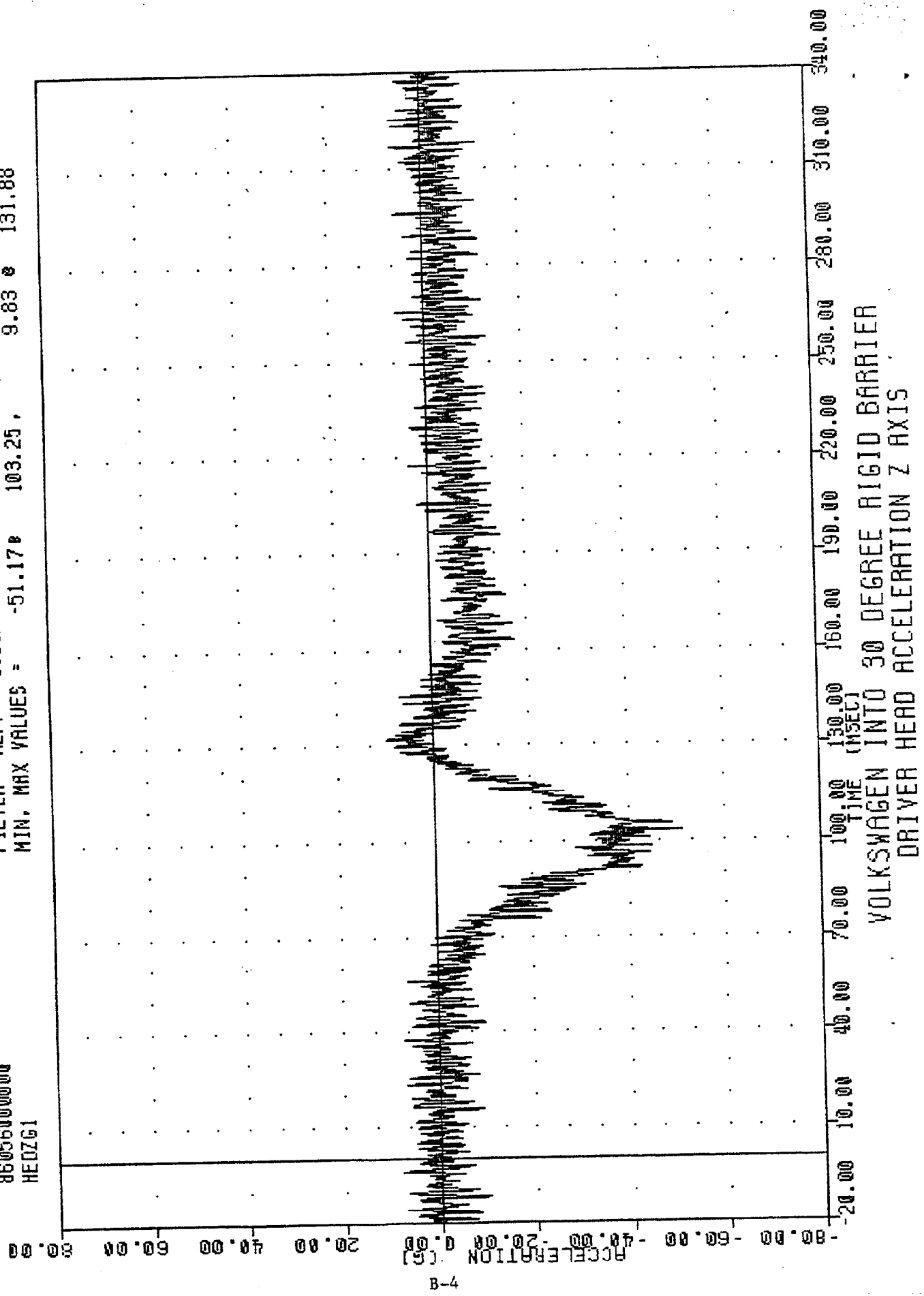
FILTER = ALPF 1650/ 5217/ -40
MIN, MAX VALUES = -18.520 129.00, 11.89 201.75



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
DRIVER HEAD ACCELERATION Y AXIS

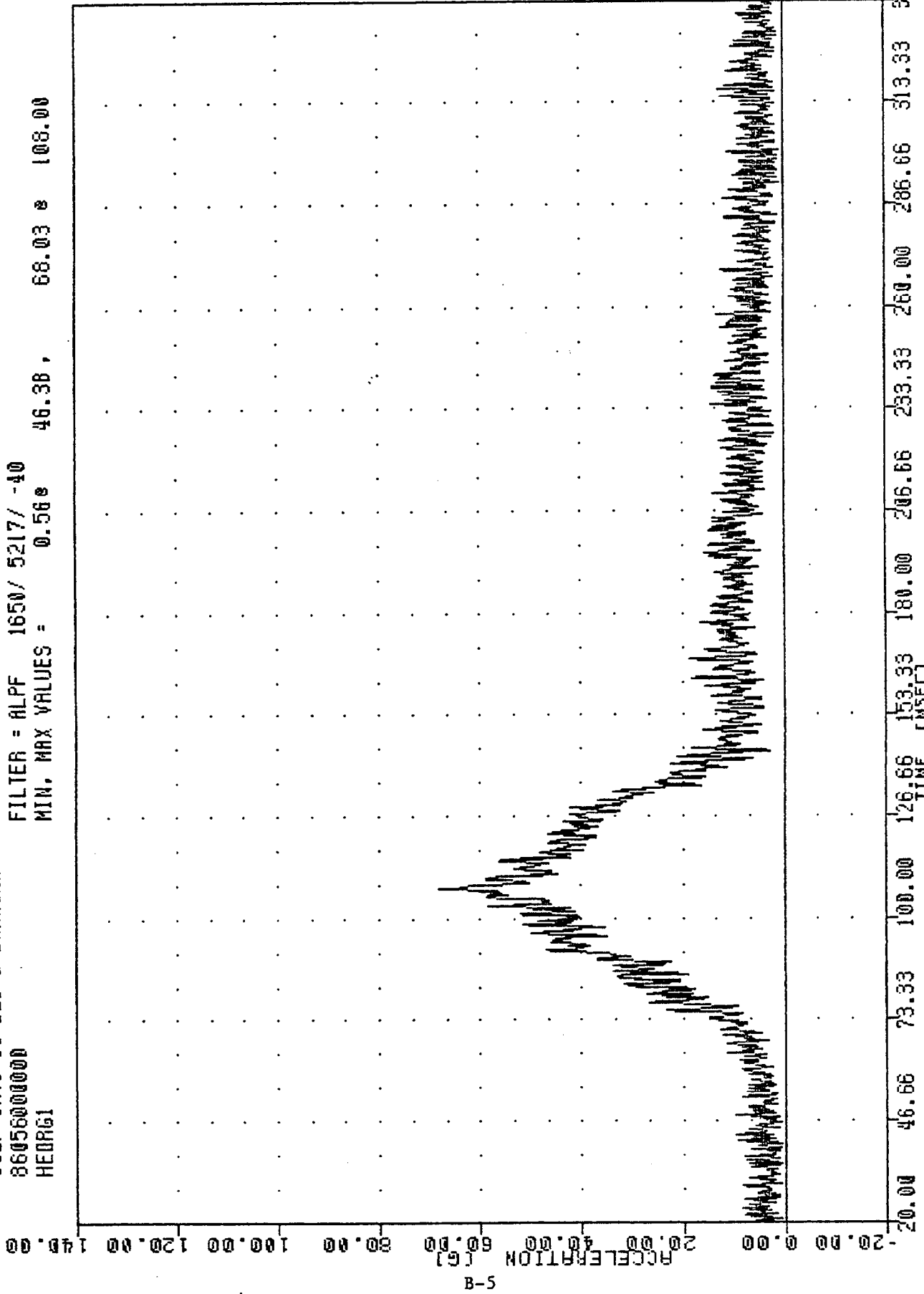
VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HE0ZG1

FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = -51.17 103.25, 9.83 131.88



VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HEDRG1

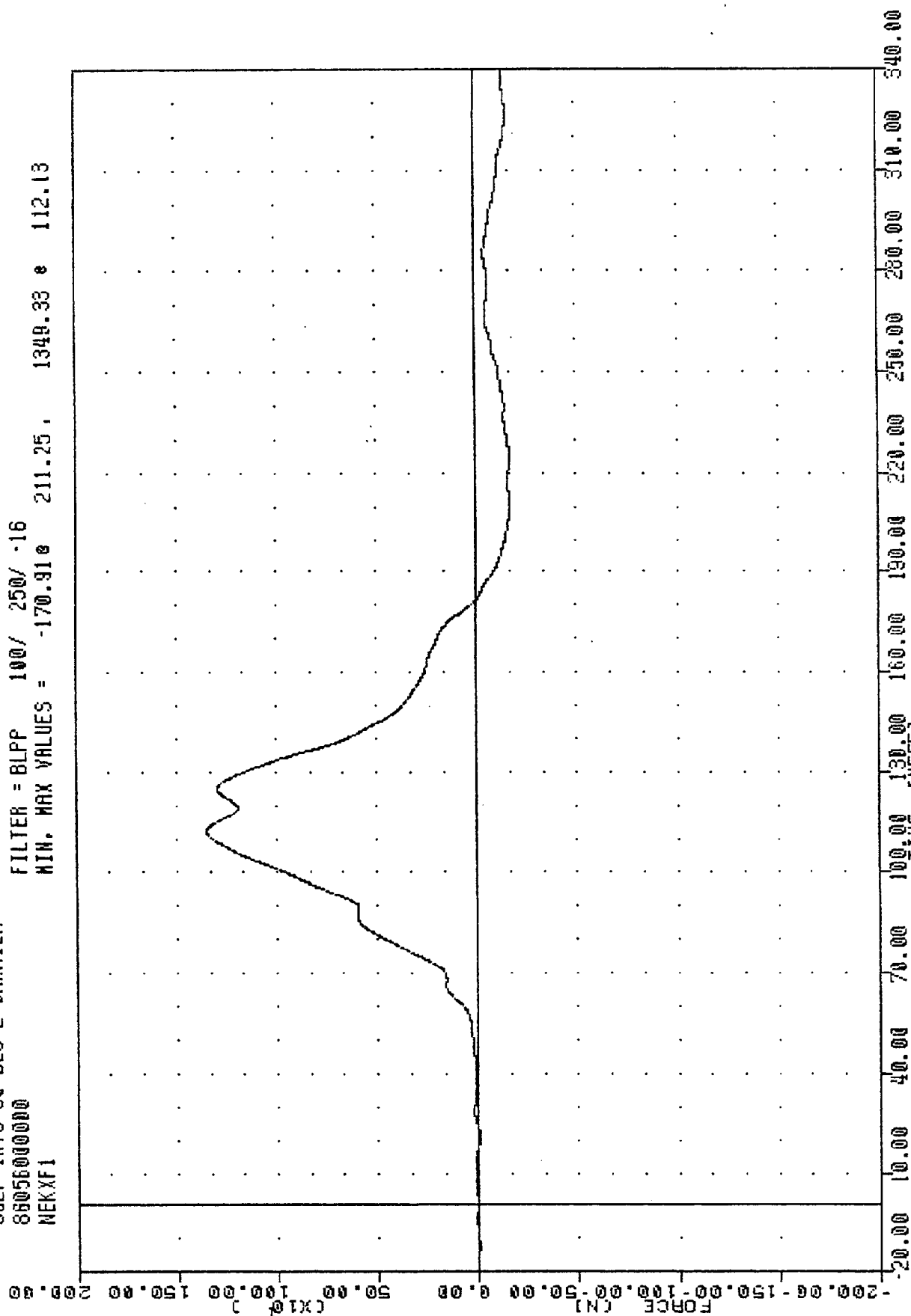
FILTER = ALPF 1650/ 5217/ -40
 MIN. MAX VALUES = 0.56e 46.38 , 68.03 e 108.00



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER HEAD RESULTANT

VAT . 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 NEKXF1

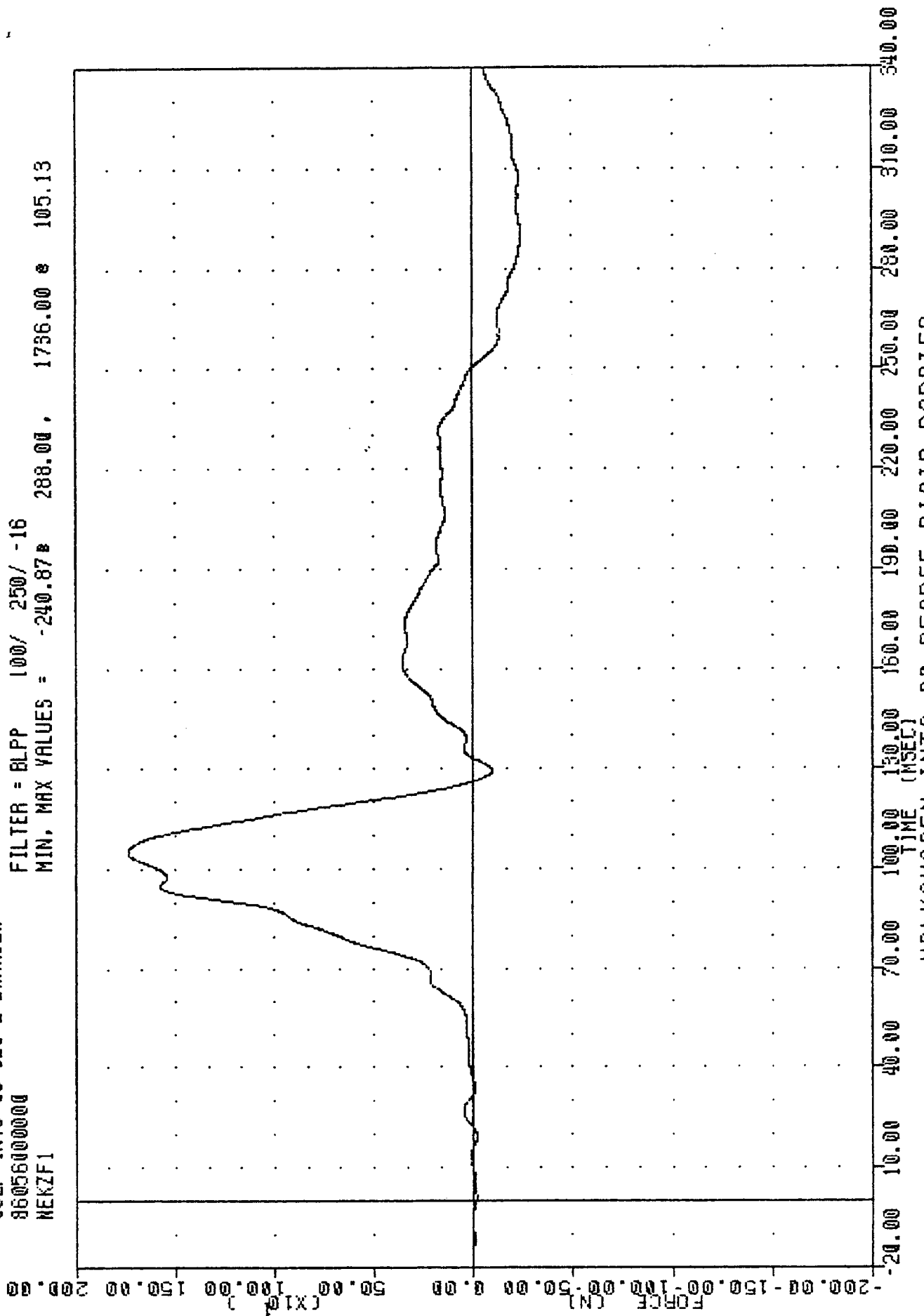
FILTER = BLPP 100/ 250/ .16
 MIN. MAX VALUES = -170.910 211.25 . 1349.33 0 112.13



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER NECK FORCE X AXIS (N)

VRT ,860225
GOLF INTO 30 DEG L BARRIER
86056000000
NEKZF1

FILTER = BLPP 100/ 250/ -16
MIN, MAX VALUES = -240.87 288.00 , 1736.00 105.13

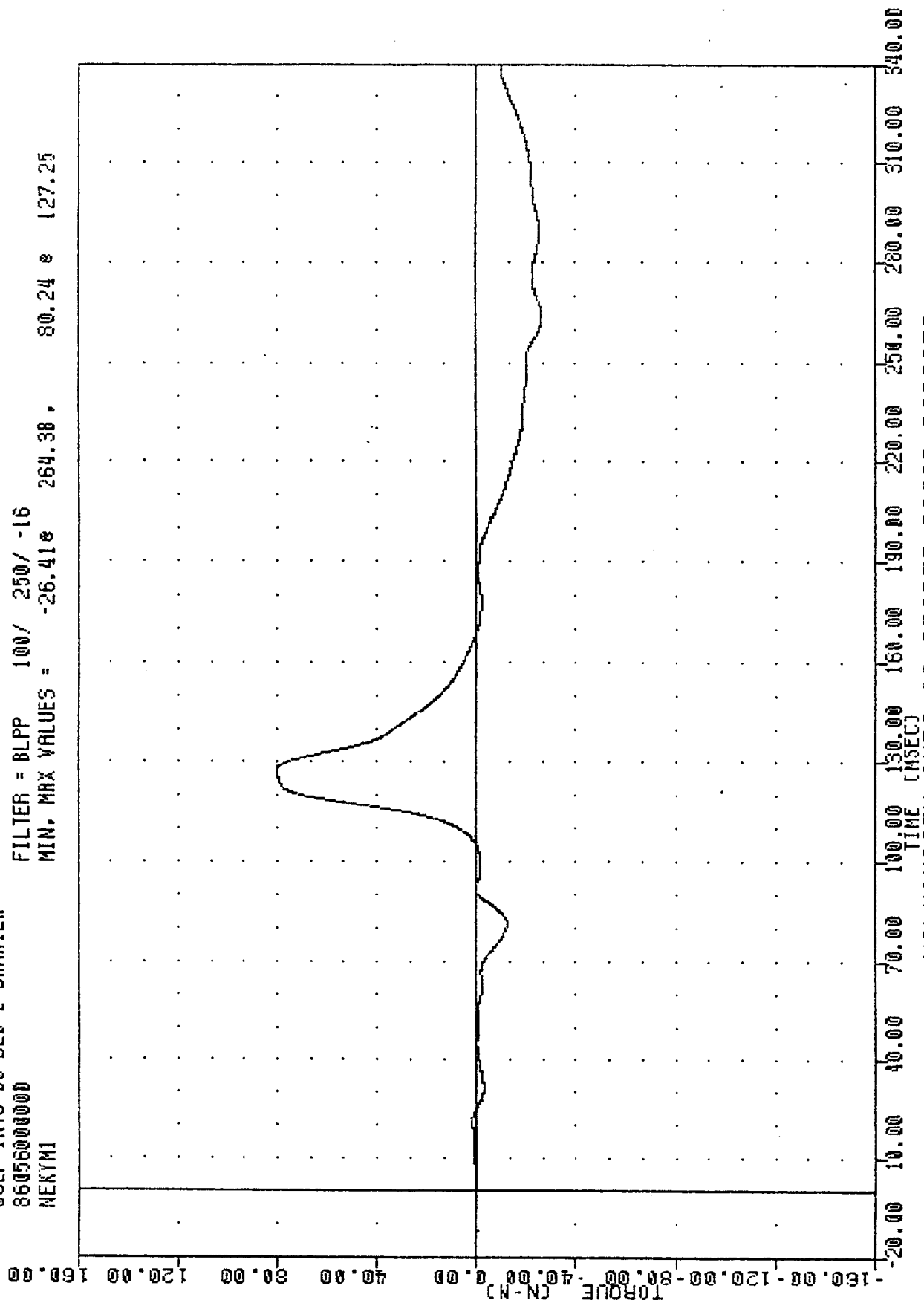


B-7

VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
DRIVER NECK FORCE Z AXIS (N)

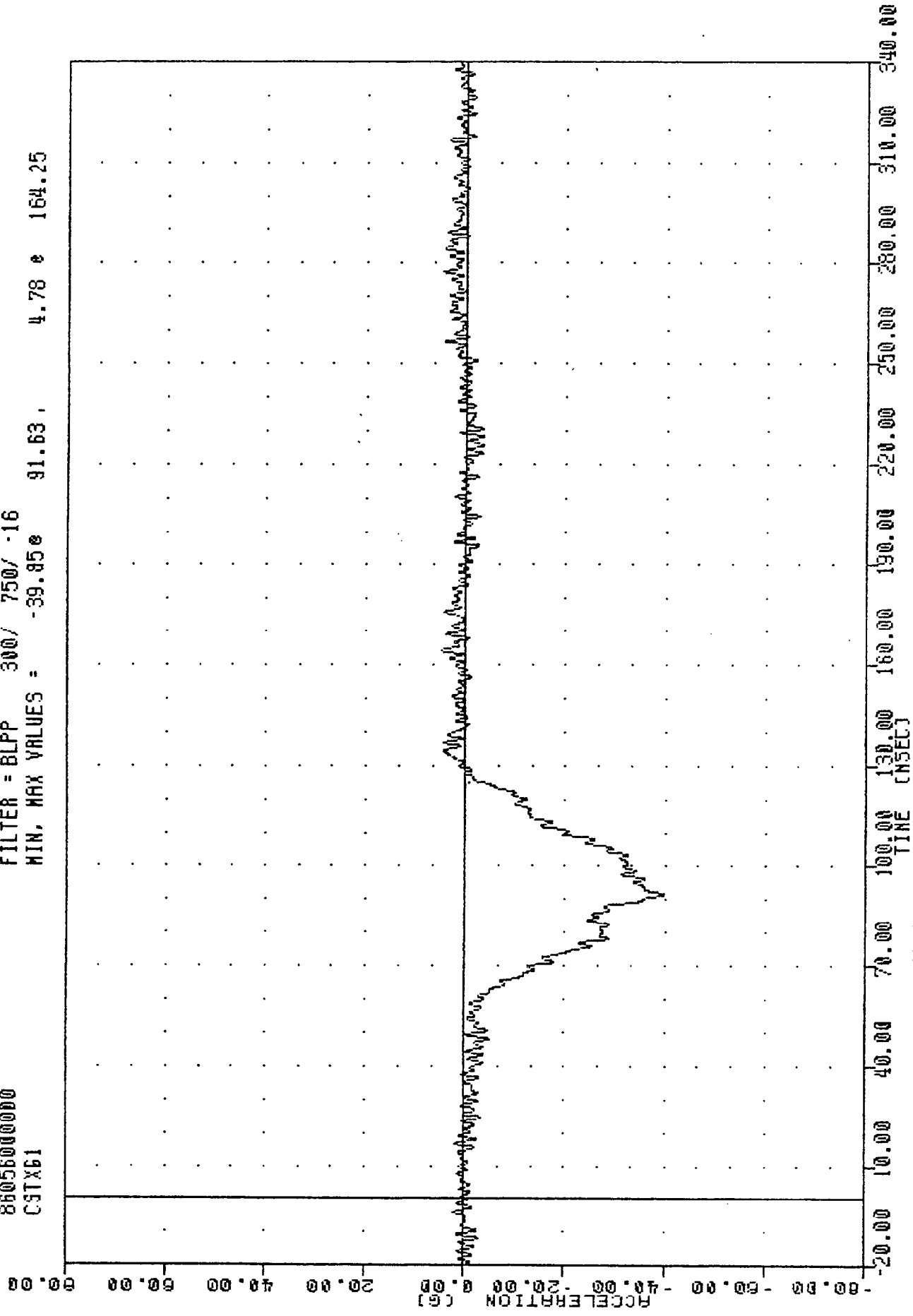
VRT , 860225
GOLF INTO 30 DEG L BARRIER
86056000000
NEKYM1

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -26.41 264.38 80.24 127.25



VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 CSTX61

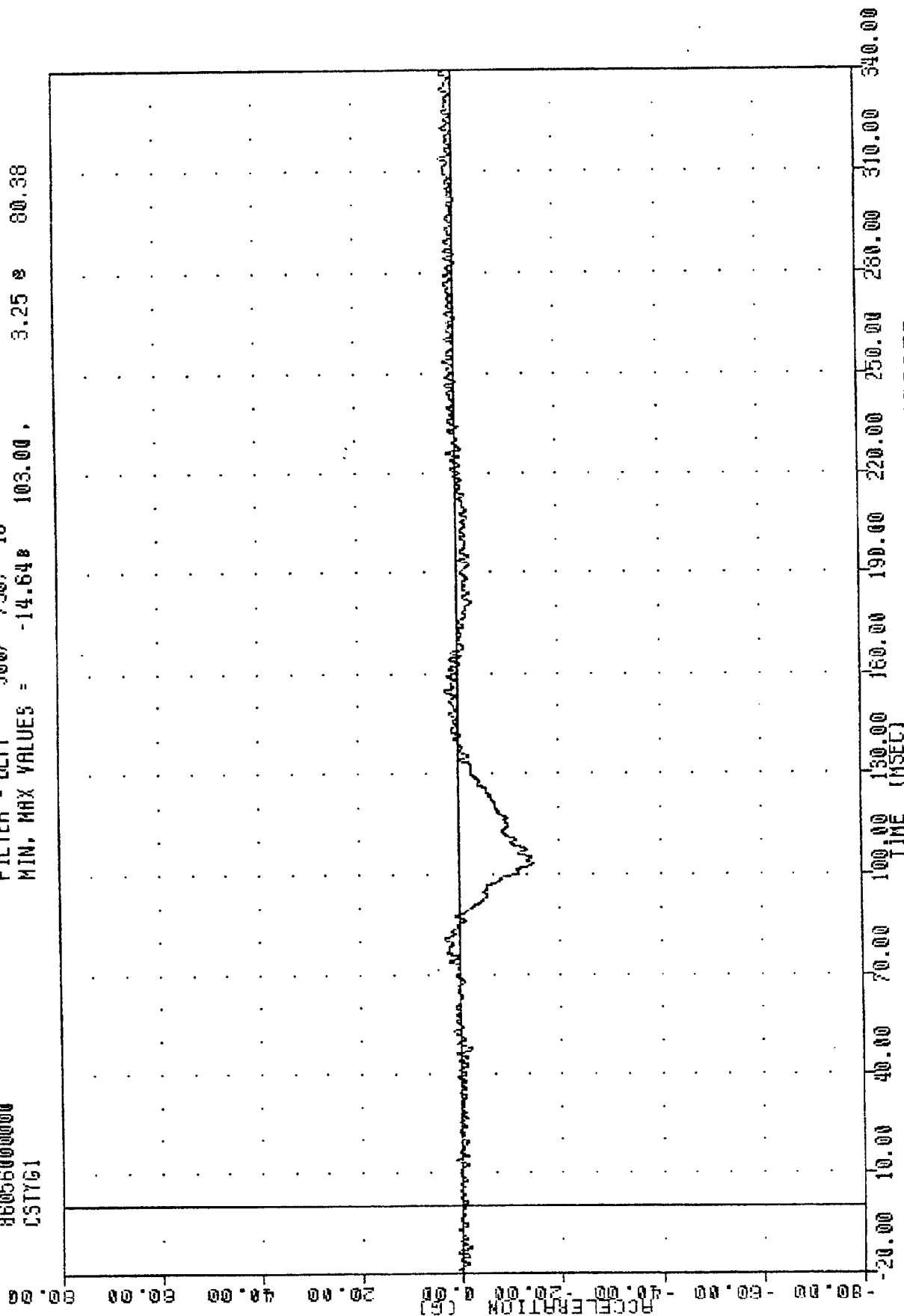
FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -39.850 91.63 , 4.78 0 164.25



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER CHEST ACCELERATION X AXIS

VRT
GOLF INTO 30 DEG L BARRIER
8605600000
CSTYG1

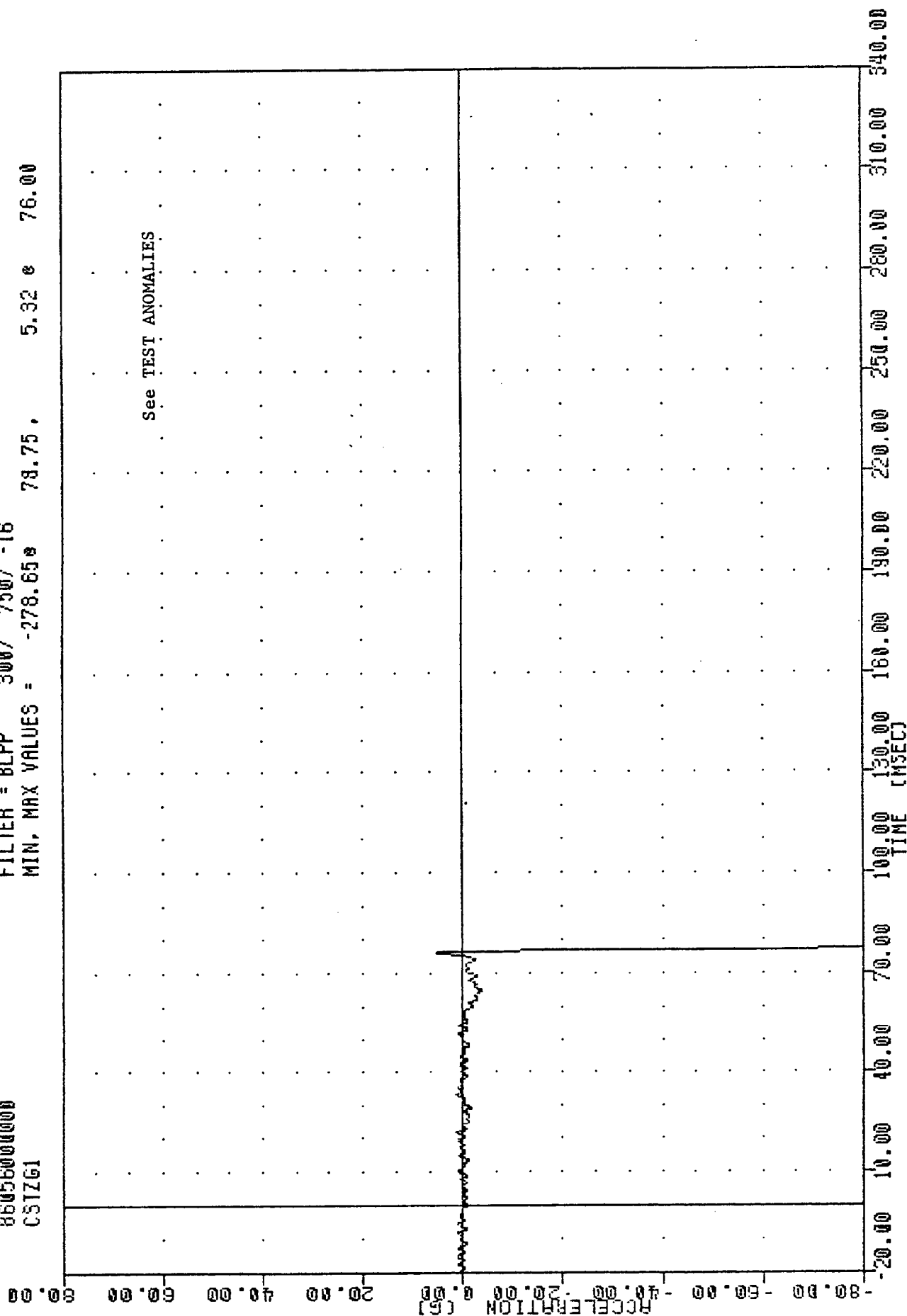
FILTER = BLPP 300/ 750/ -16
MIN, MAX VALUES = -14.648 103.00, 3.25 80.38



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
DRIVER CHEST ACCELERATION Y AXIS

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 CS1ZG1

FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -278.65 78.75, 5.32 76.00

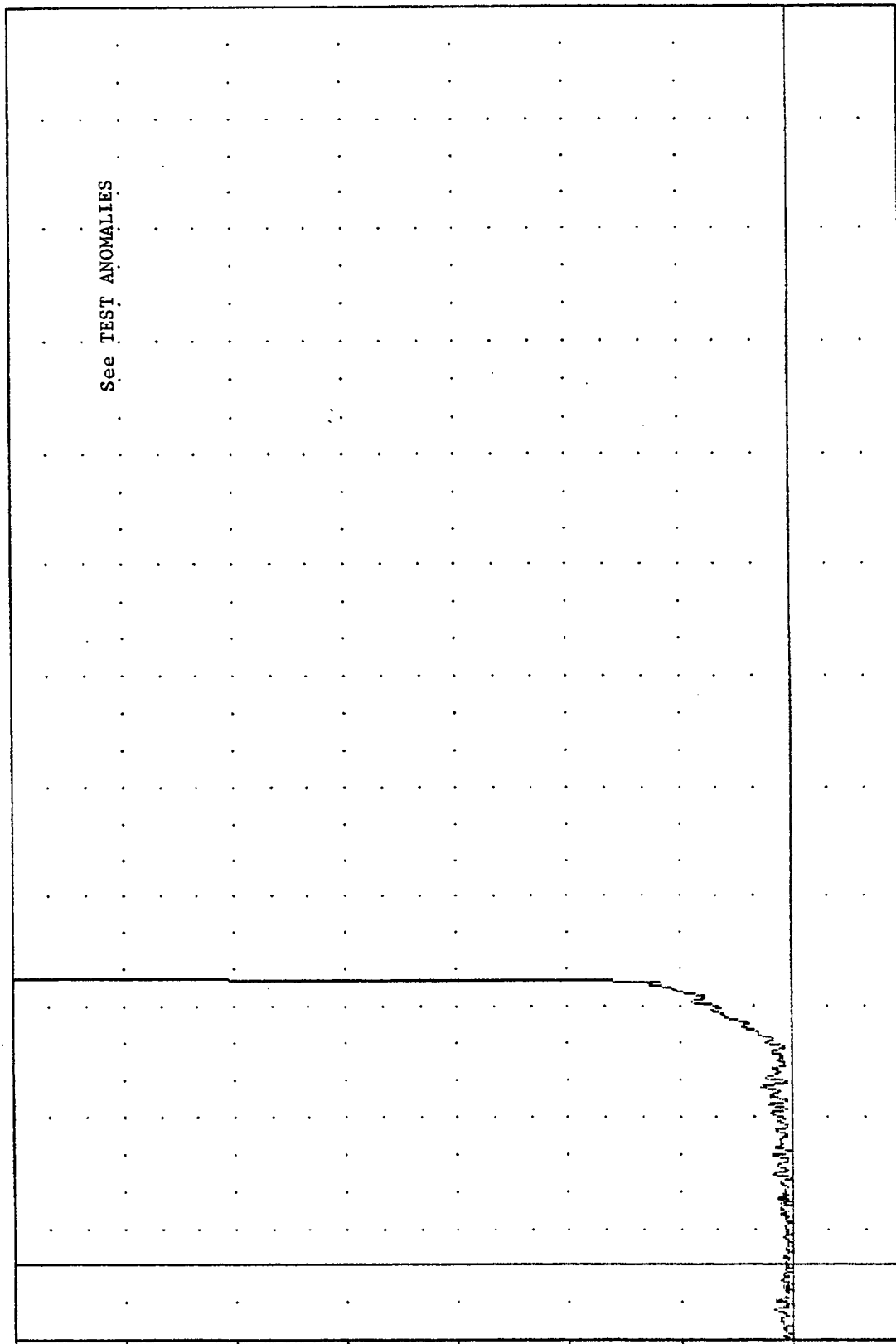


VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER CHEST ACCELERATION Z AXIS

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 CSTR61

FILTER = BLPP 300/ 750/ -16
 MIN. MAX VALUES = 0.150 11.50, 279.97 78.75

ACCELERATION (G)
 -20.00 0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00



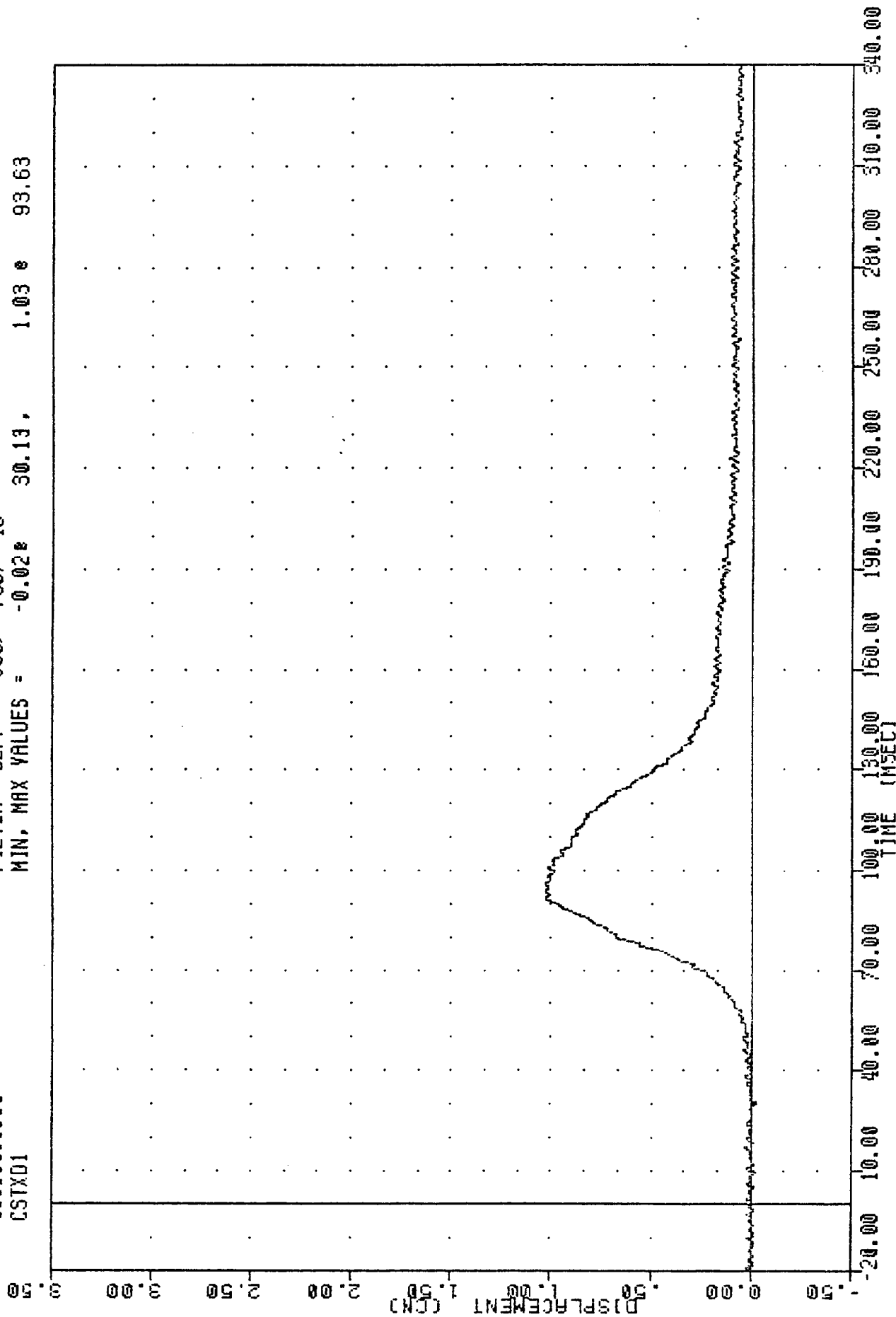
-20.00 0.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00

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

VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER.
 DRIVER CHEST RESULTANT

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 CSTXD1

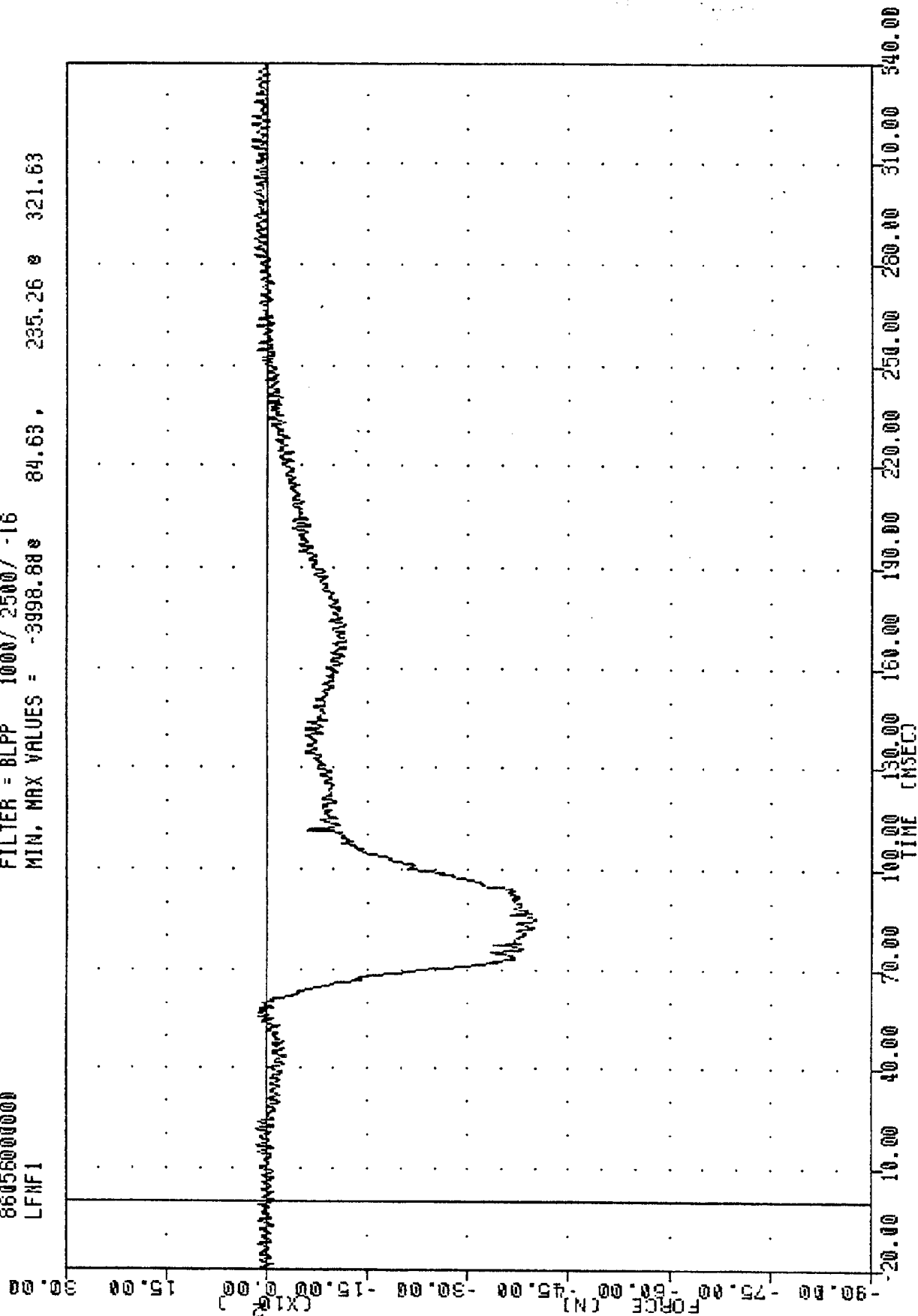
FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -0.028 30.13, 1.03 e 93.63



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER CHEST DISPLACEMENT (CM)

VR1 , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 LFNFI

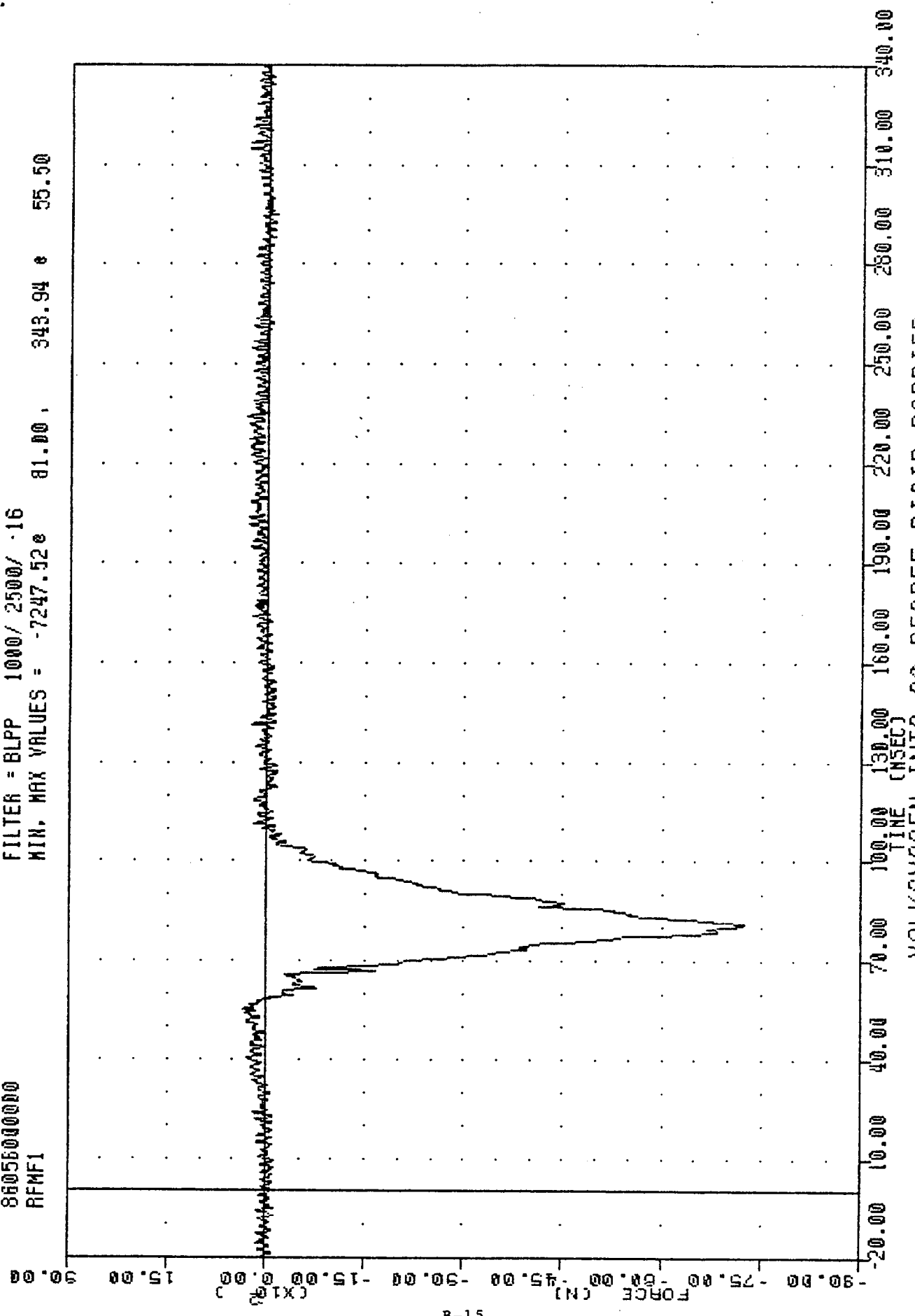
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -3998.88 84.63, 235.26 321.63



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT FEMUR FORCE (N)

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RFMF1

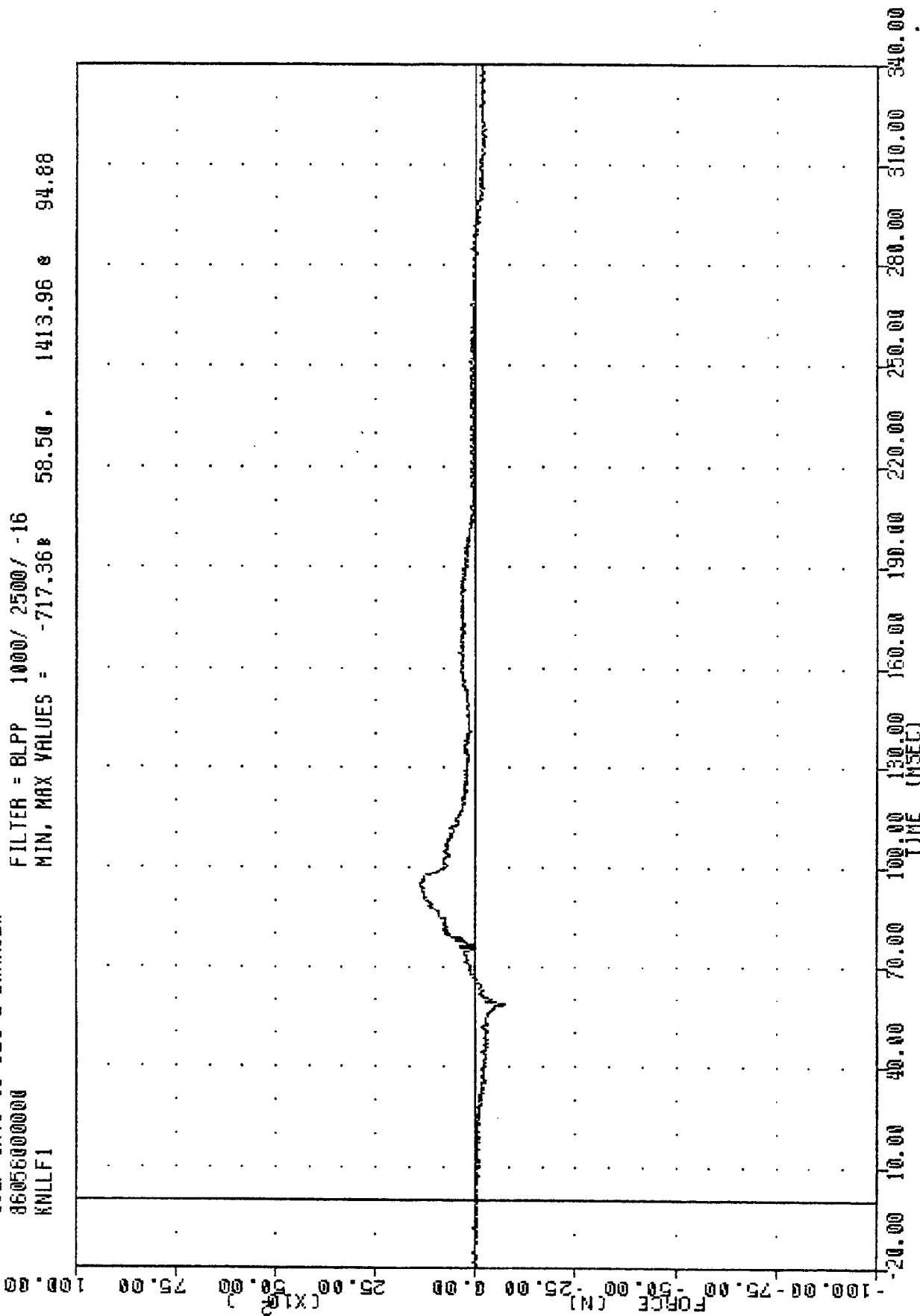
FILTER = BLPP 1000 / 2500 / .16
 MIN, MAX VALUES = -7247.52e 81.00, 343.94 e 55.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT FEMUR FORCE (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86058000000
 KNLLF1

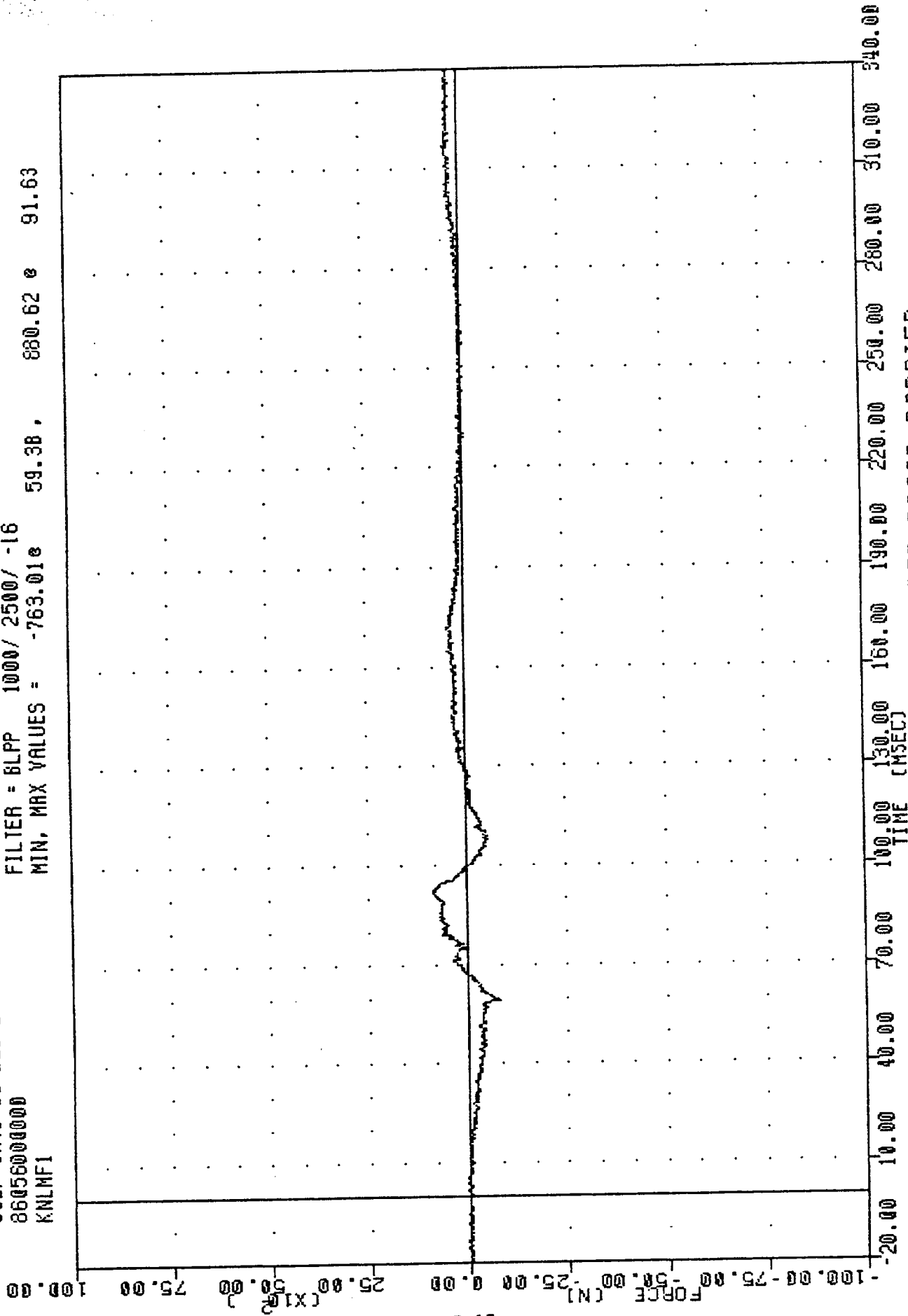
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -717.36 58.50 , 1413.96 94.88



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT KNEE / 1FFT STIFF FORCE (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86058000000
 KNLMF1

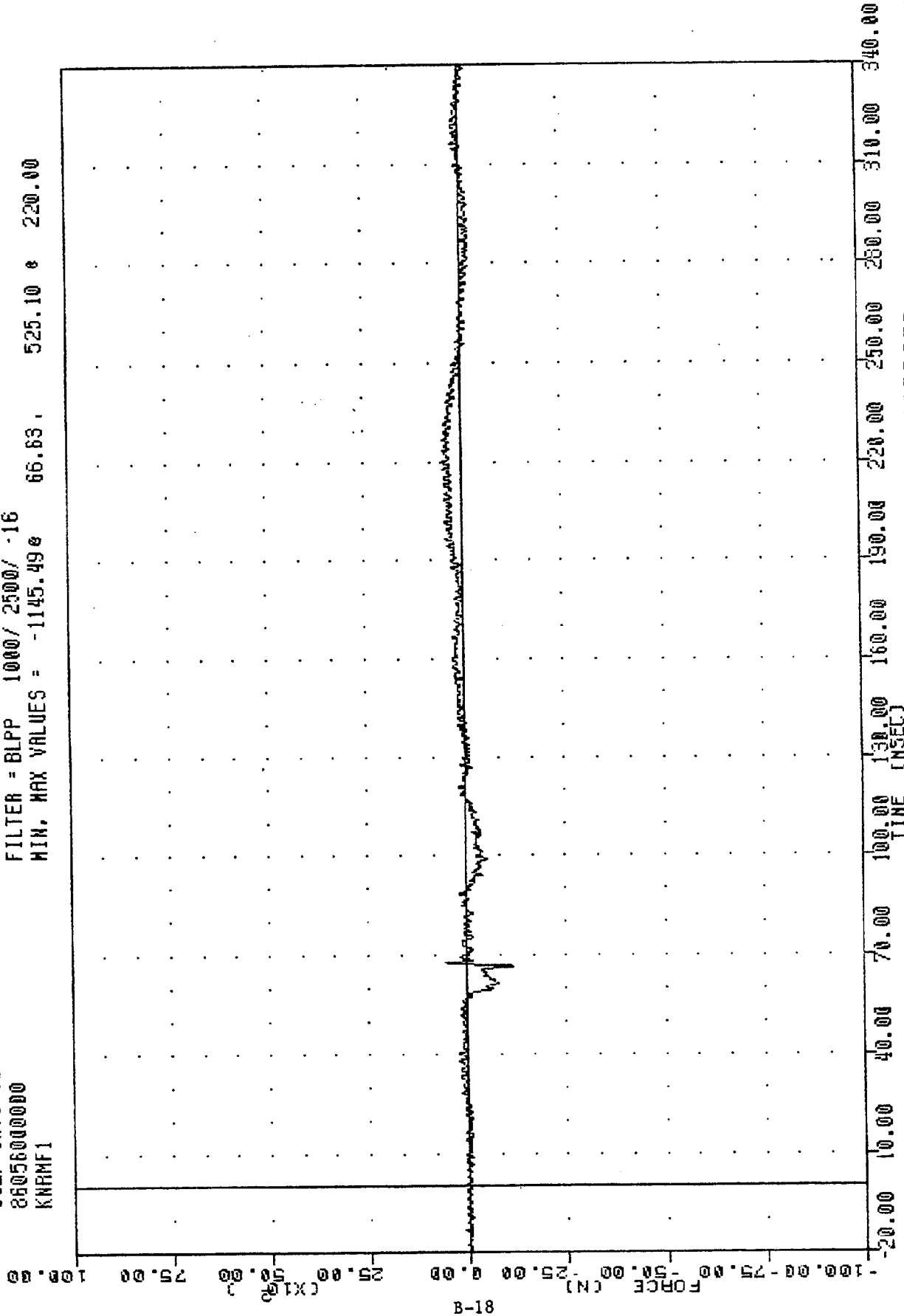
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -763.018 59.38, 880.62 8 91.63



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT KNEE / RIGHT SIDE FORCE (N)

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 26056000000
 KNRMF1

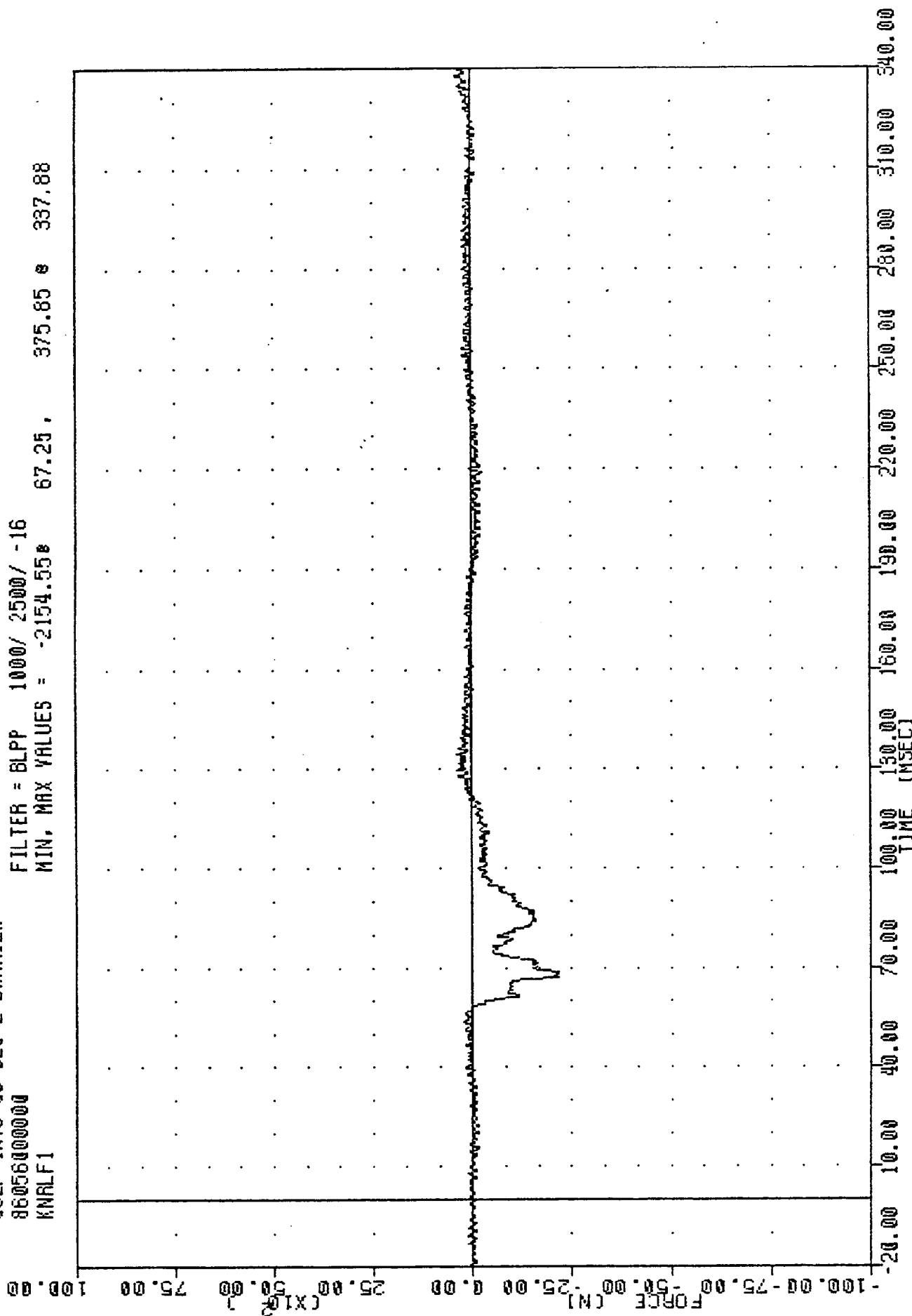
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -1145.49e 66.63, 525.10 e 220.00



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT KNEE / LEFT SIDE FORCE (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 KNALF1

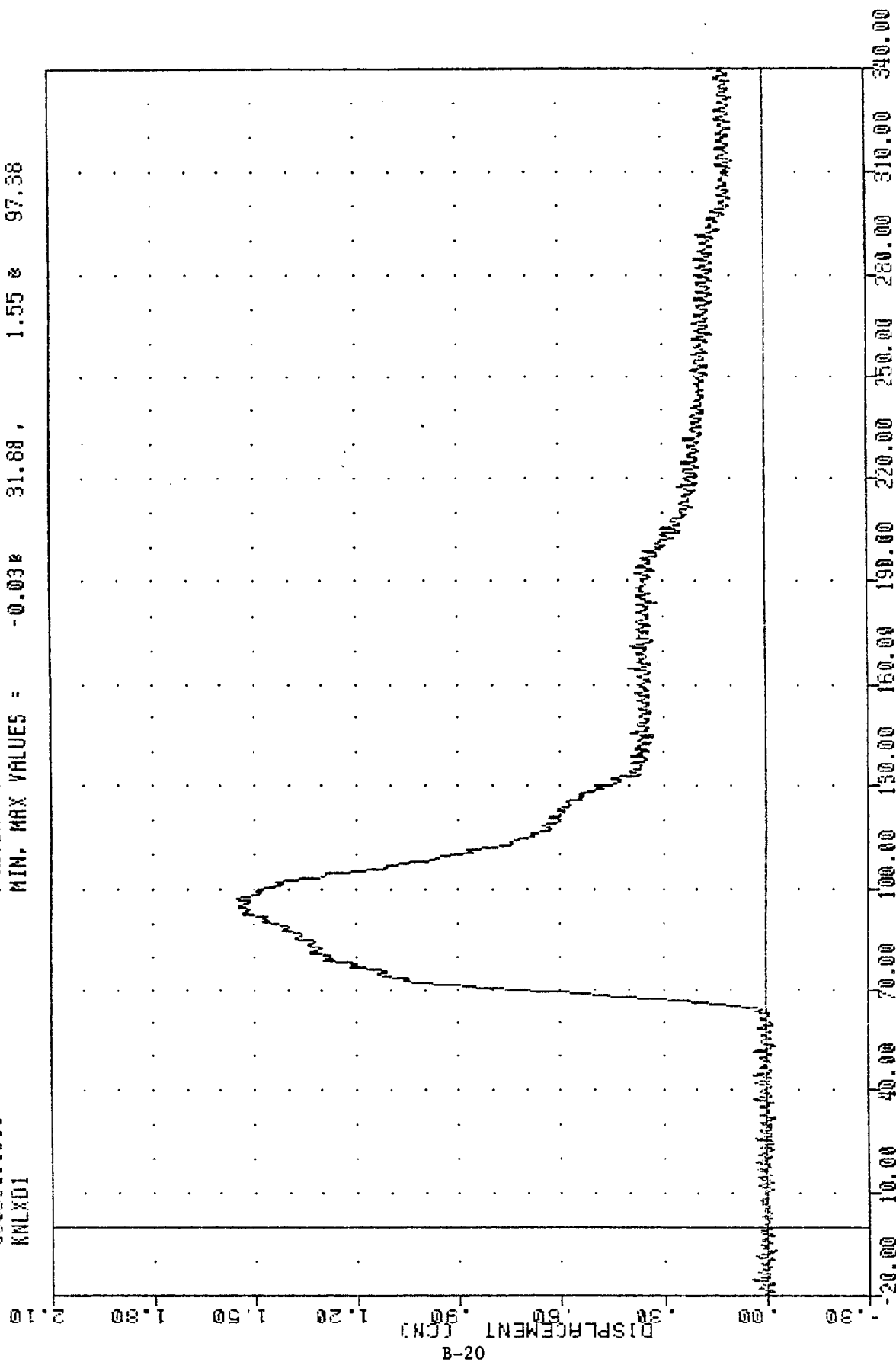
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -2154.55 375.85 337.88



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT KNEE / RIGHT SIDE FORCE (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 KNLXD1

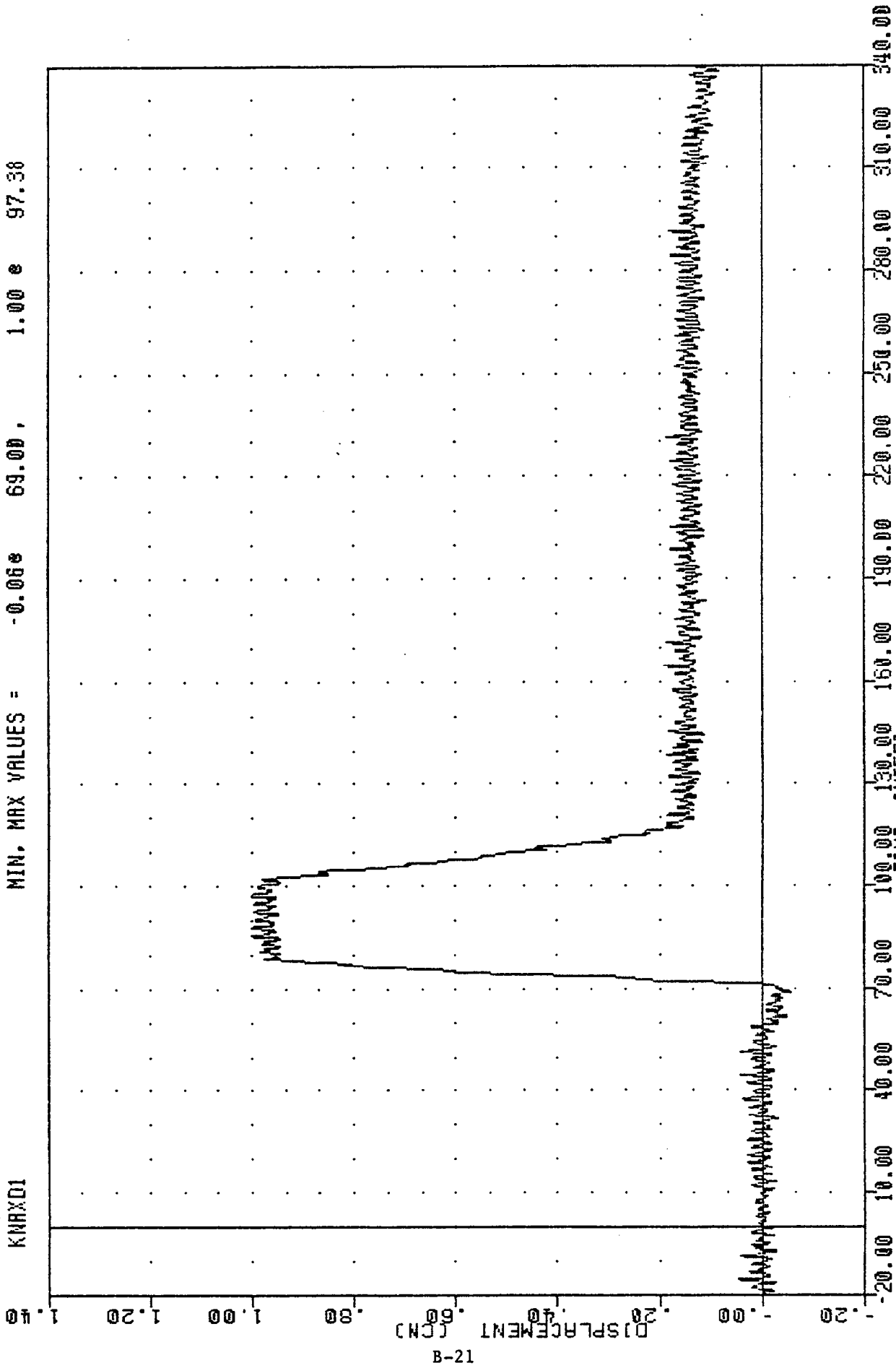
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -0.032 31.88, 1.55 & 97.38



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT KNEE DISPLACEMENT (CM)

VRT . 860225
 GOLF INTO 30 DEG L BARRIER
 8605600000
 KNRX01

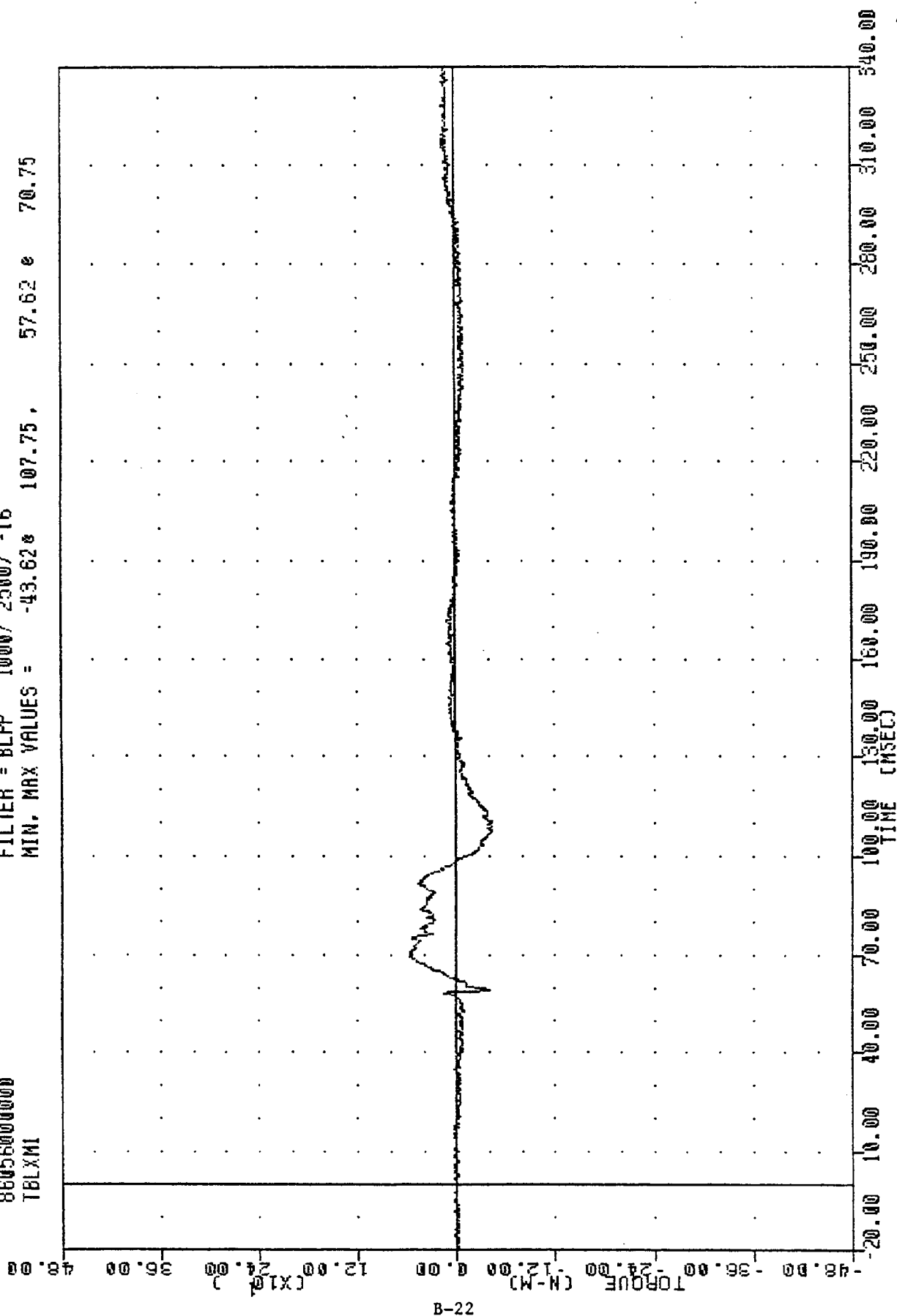
FILTER = BLPP 1000 / 2500 / -16
 MIN. MAX VALUES = -0.06 69.00 , 1.00 97.38



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT KNEE DISPLACEMENT (CM)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 TBLXMI

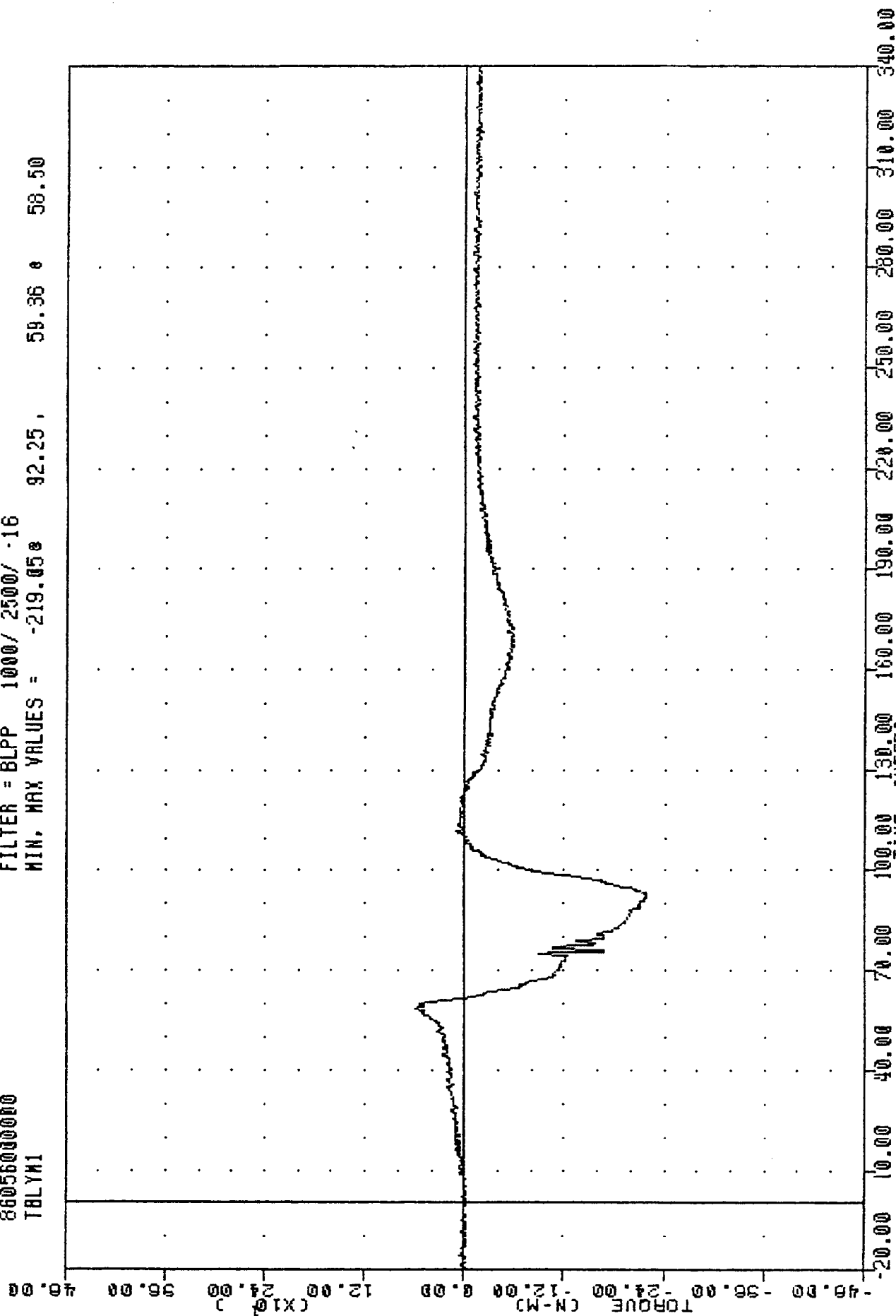
FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -43.62 107.75, 57.62 70.75



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT UPPER TIBIA MOMENT X AXIS (N-M)

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 TBLYN1

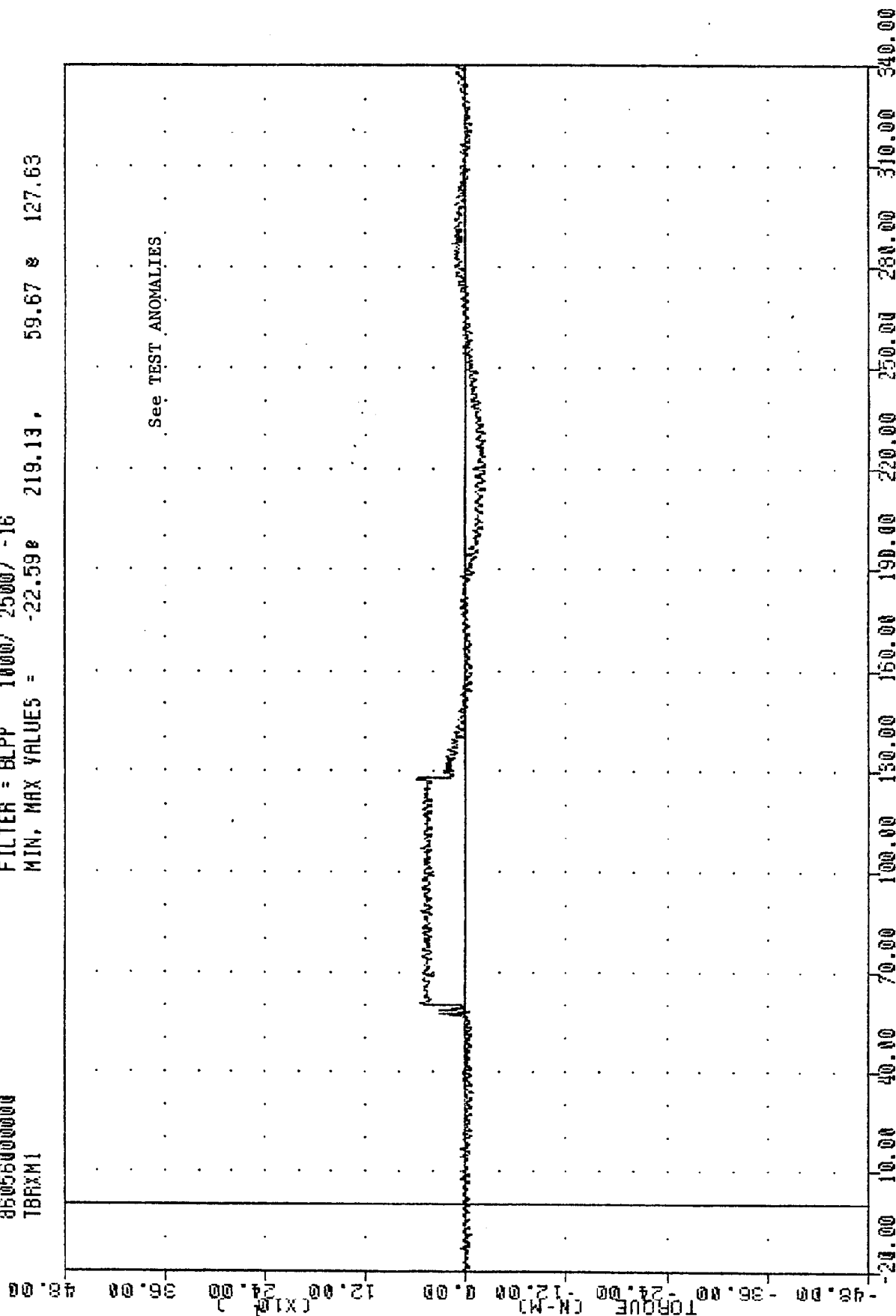
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -219.05 92.25 59.36 58.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT UPPER TIBIA MOMENT Y AXIS (N-M)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 85055000000
 TBRXM1

FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -22.59e 219.13, 59.67 e 127.63



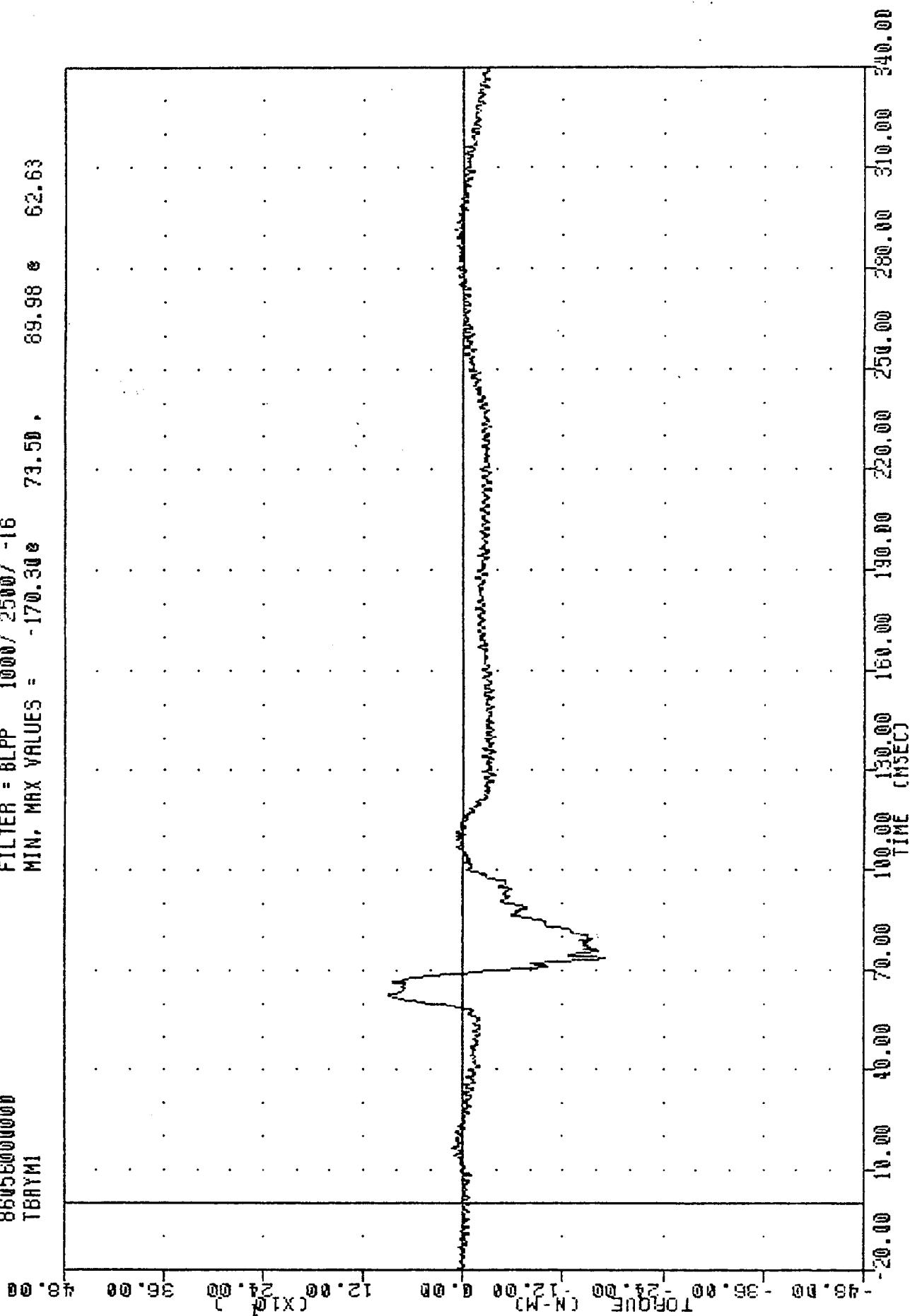
See TEST ANOMALIES

VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT UPPER TIBIA MOMENT X AXIS (N-M)

VRT
GOLF INTO 30 DEG L BARRIER
86058000000
TBRM1

860225

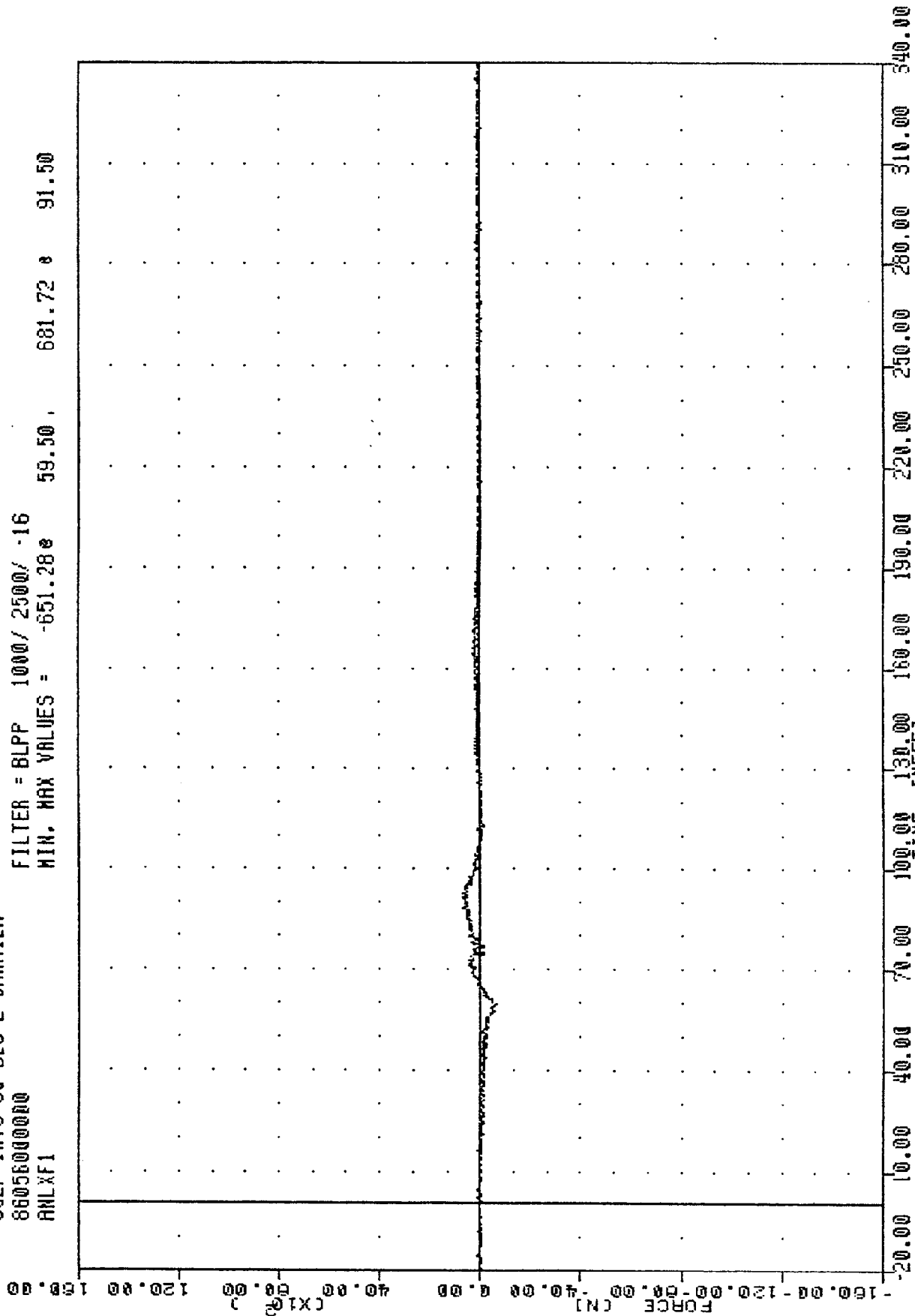
FILTER = BLPP 1000/ 2500/ -16
MIN, MAX VALUES = -170.30e 73.50. 89.98 e 62.63



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
DRIVER RIGHT UPPER TIBIA MOMENT Y AXIS (N-M)

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 ANLXF1

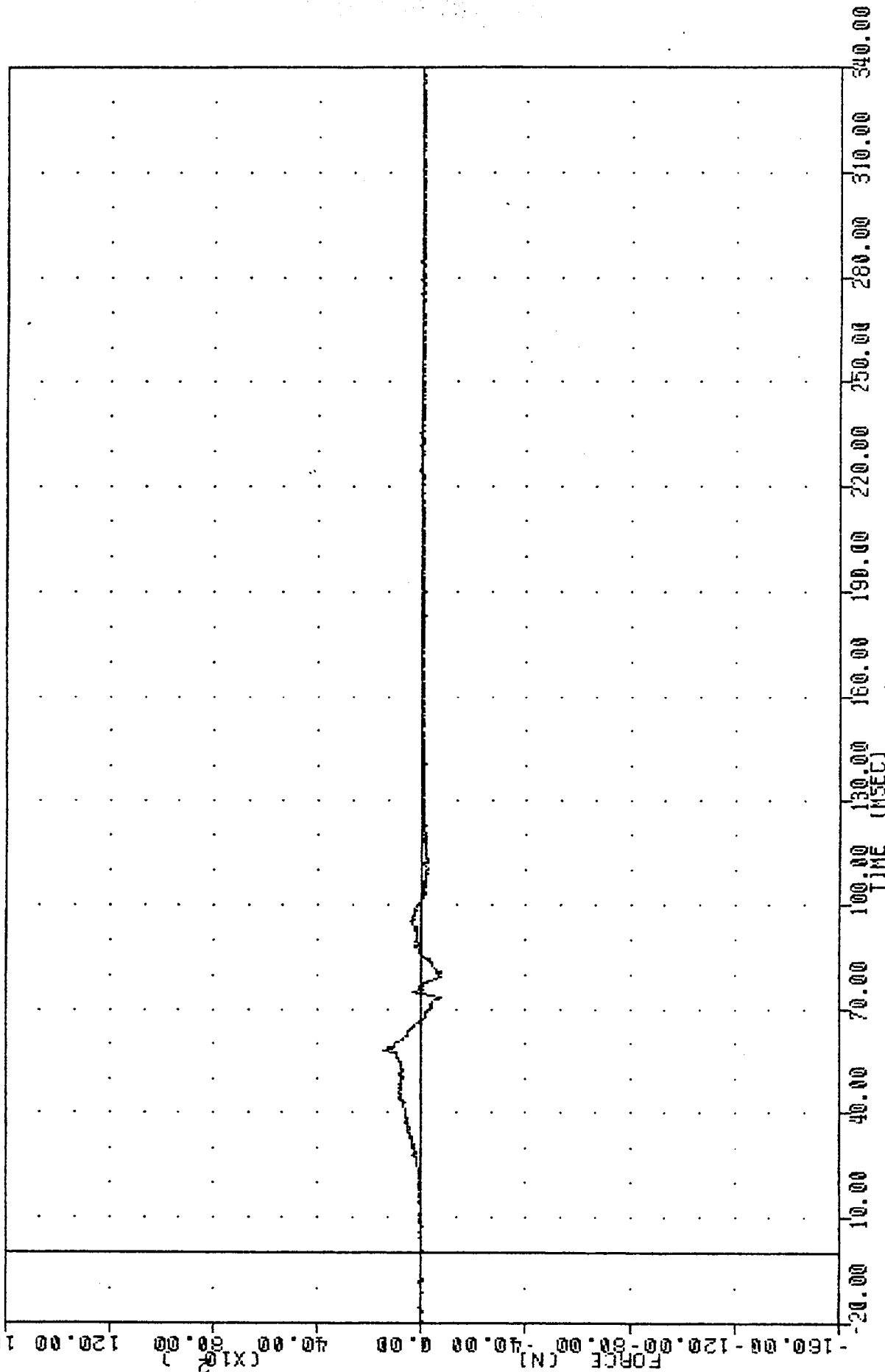
FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -651.28 681.72 59.50 91.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT LOWER TIBIA FORCE X AXIS (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RNLZF1

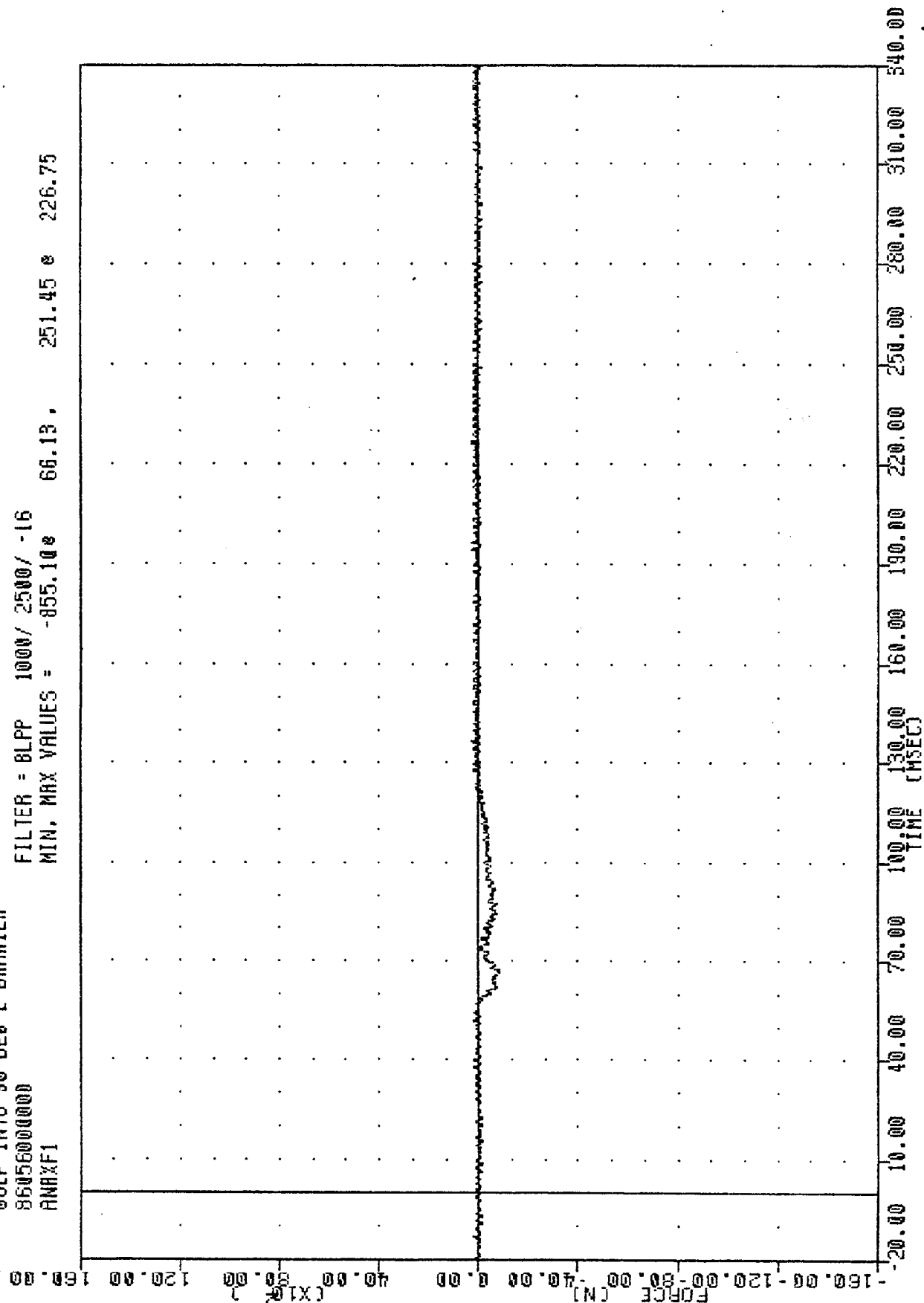
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -777.628 80.63, 1500.61 58.25



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT TIBIA FORCE Z AXIS (N)

VRT
GOLF INTO 30 DEG L BARRIER
85056000000
ANAXF1

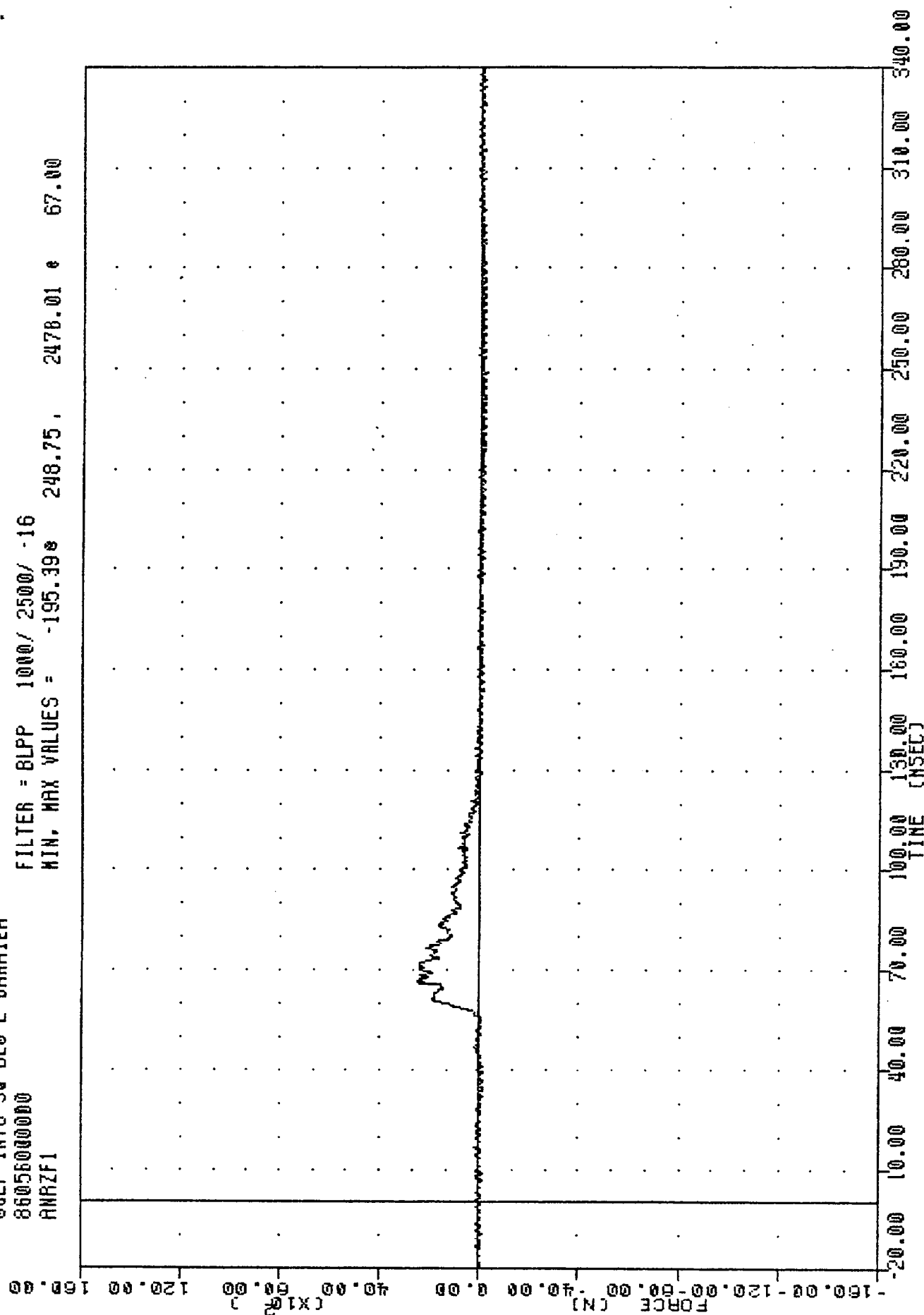
FILTER = BLPP 1000/ 2500/ -16
MIN, MAX VALUES = -855.10* 66.13, 251.45 * 226.75



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
DRIVER RIGHT LOWER TIBIA FORCE X AXIS (N)

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 ANRZF1

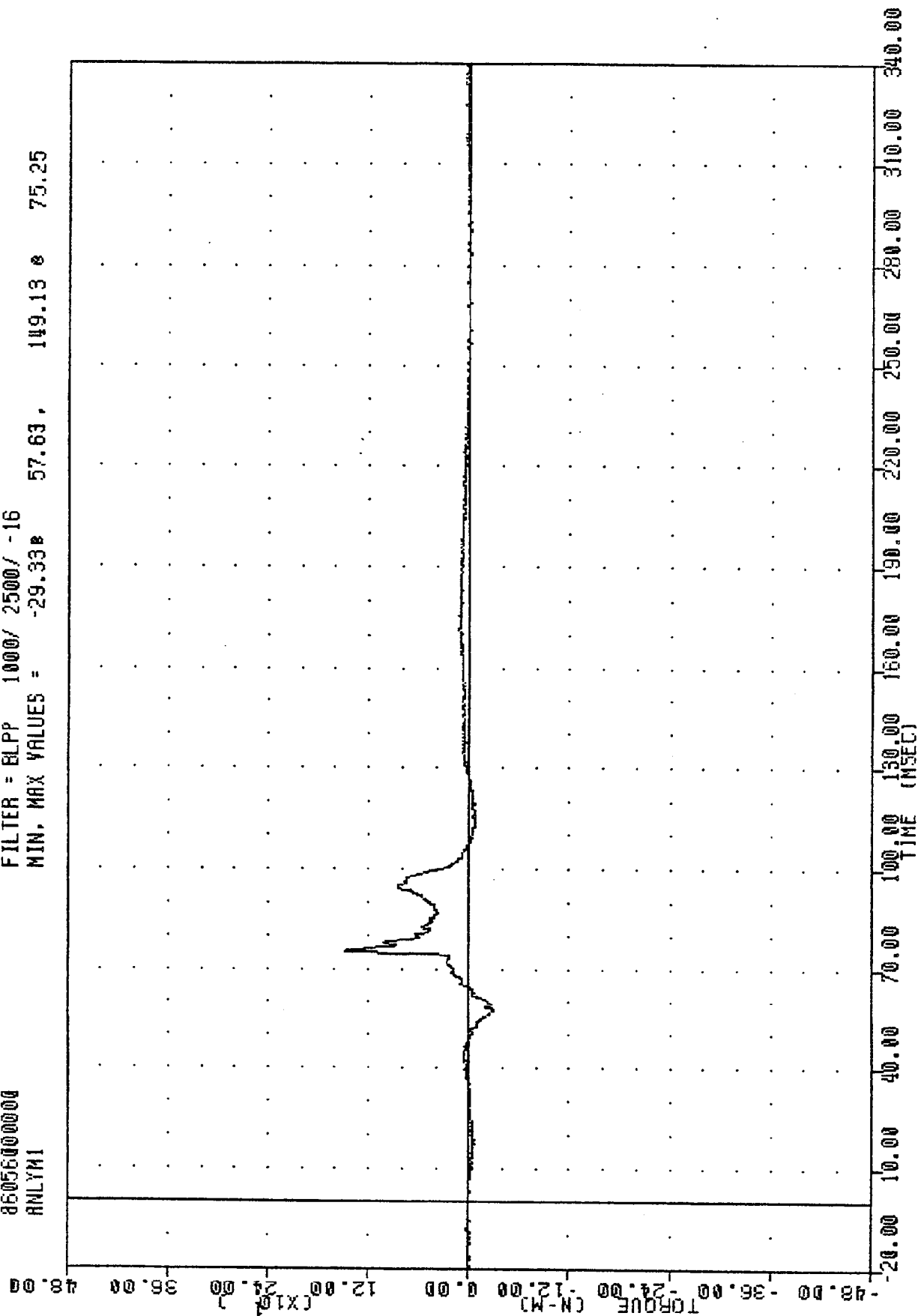
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -195.39 248.75, 2478.01 67.00



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT LOWER TIBIA FORCE Z AXIS (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RNLVMI

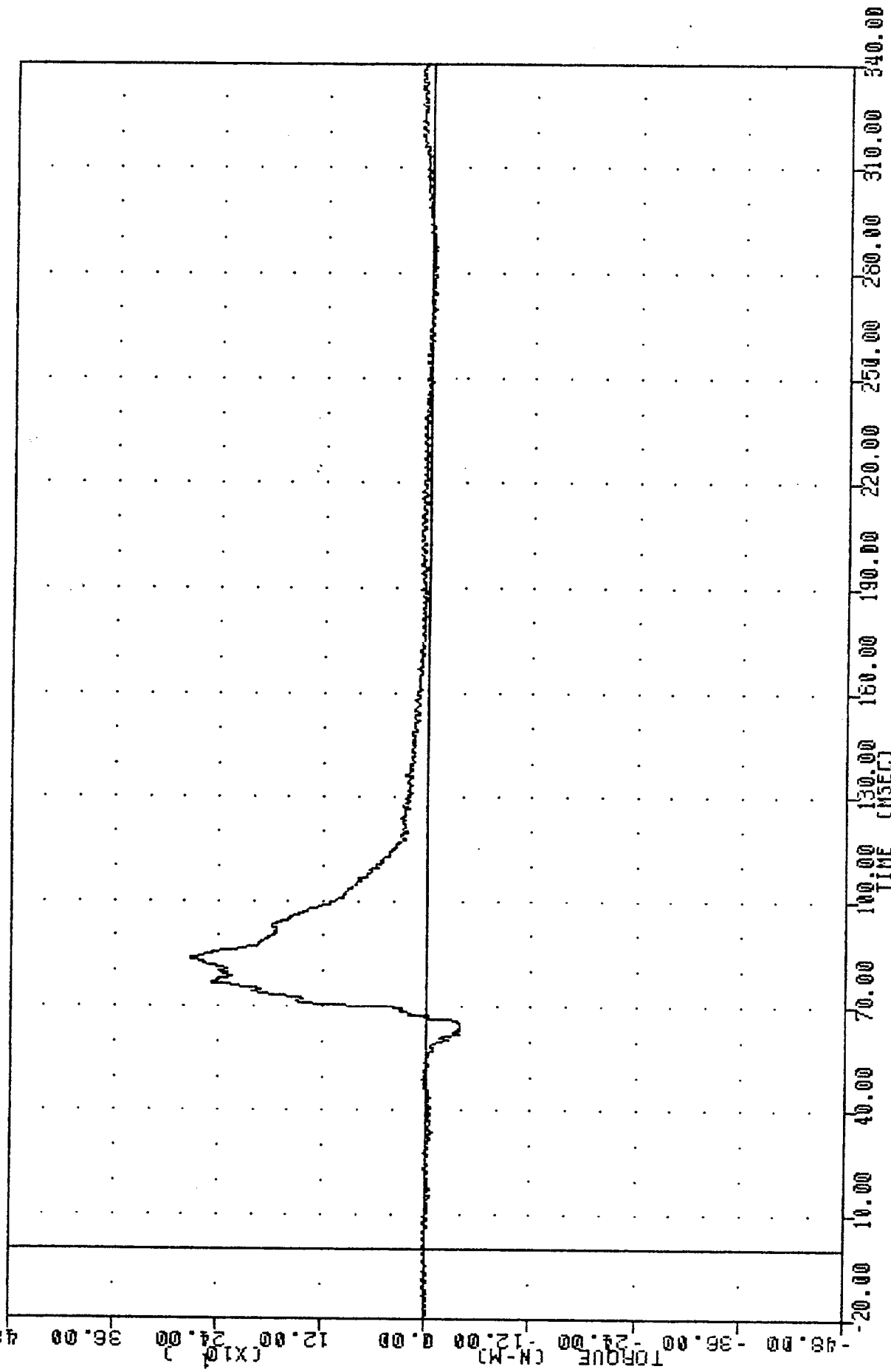
FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -29.33 57.63, 149.13 75.25



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER LEFT LOWER TIBIA MOMENT Y AXIS (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RNRVM1

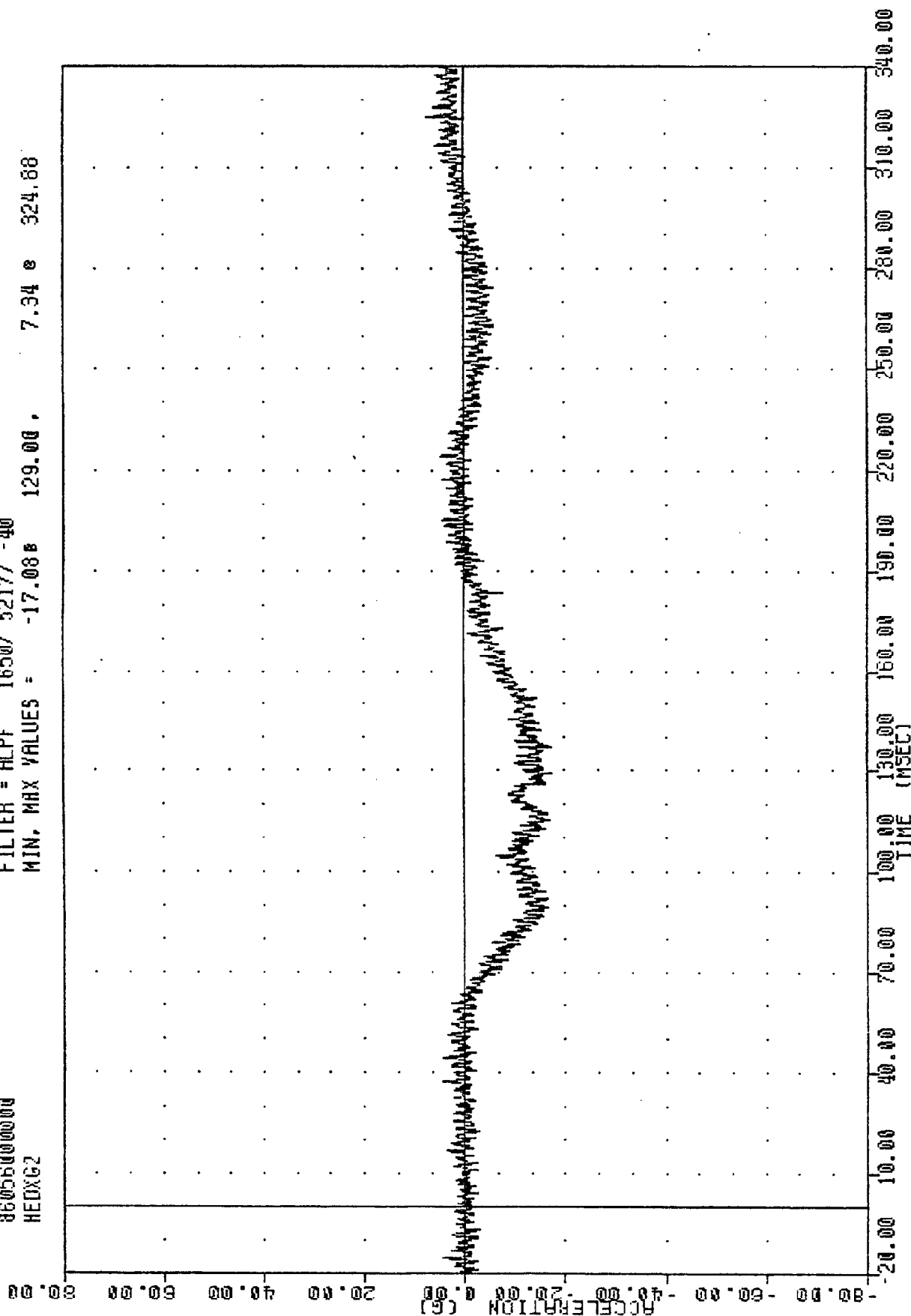
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -38.47e 64.75, 274.00 e 83.25



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DRIVER RIGHT LOWER TIBIA MOMENT Y AXIS (N)

YRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HEDXG2

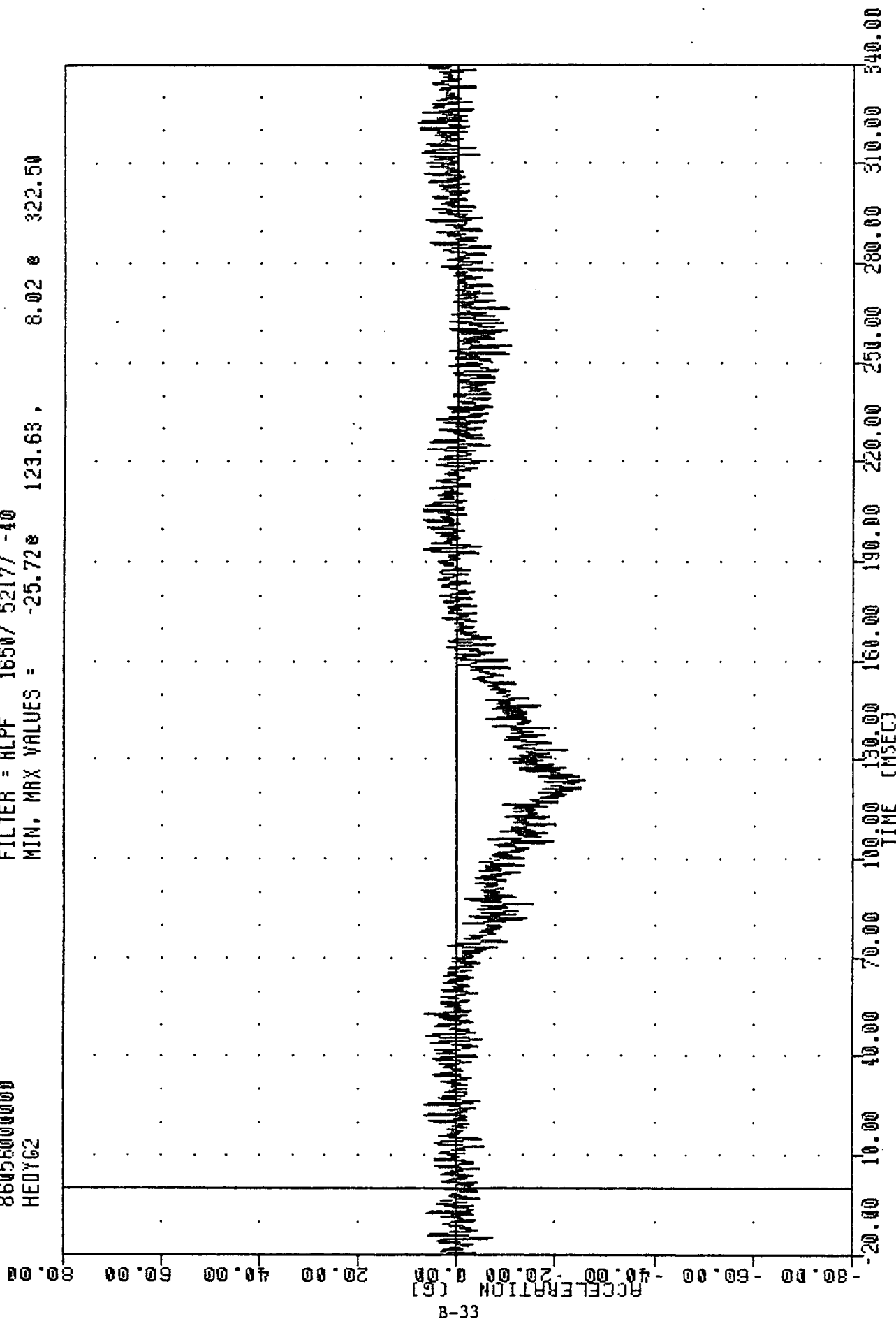
FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = -17.08 129.00, 7.34 324.88



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER HEAD ACCELERATION X AXIS

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HEDY62

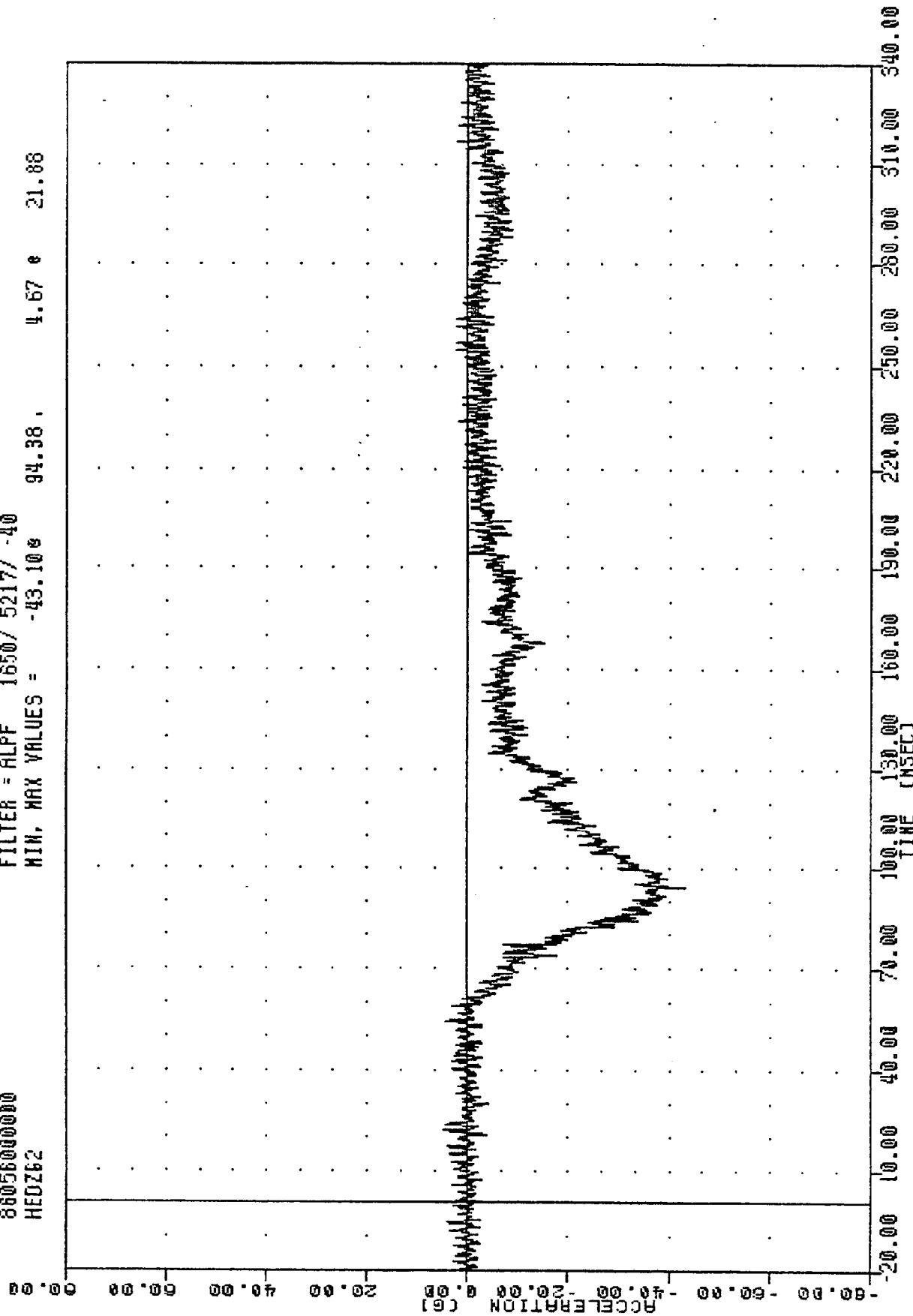
FILTER = ALPF 1650/ 5217/ -40
 MIN. MAX VALUES = -25.72e 123.63, 8.02 e 322.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER HEAD ACCELERATION Y AXIS

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HEDZ62

FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = -43.10 94.38 , 4.67 21.88

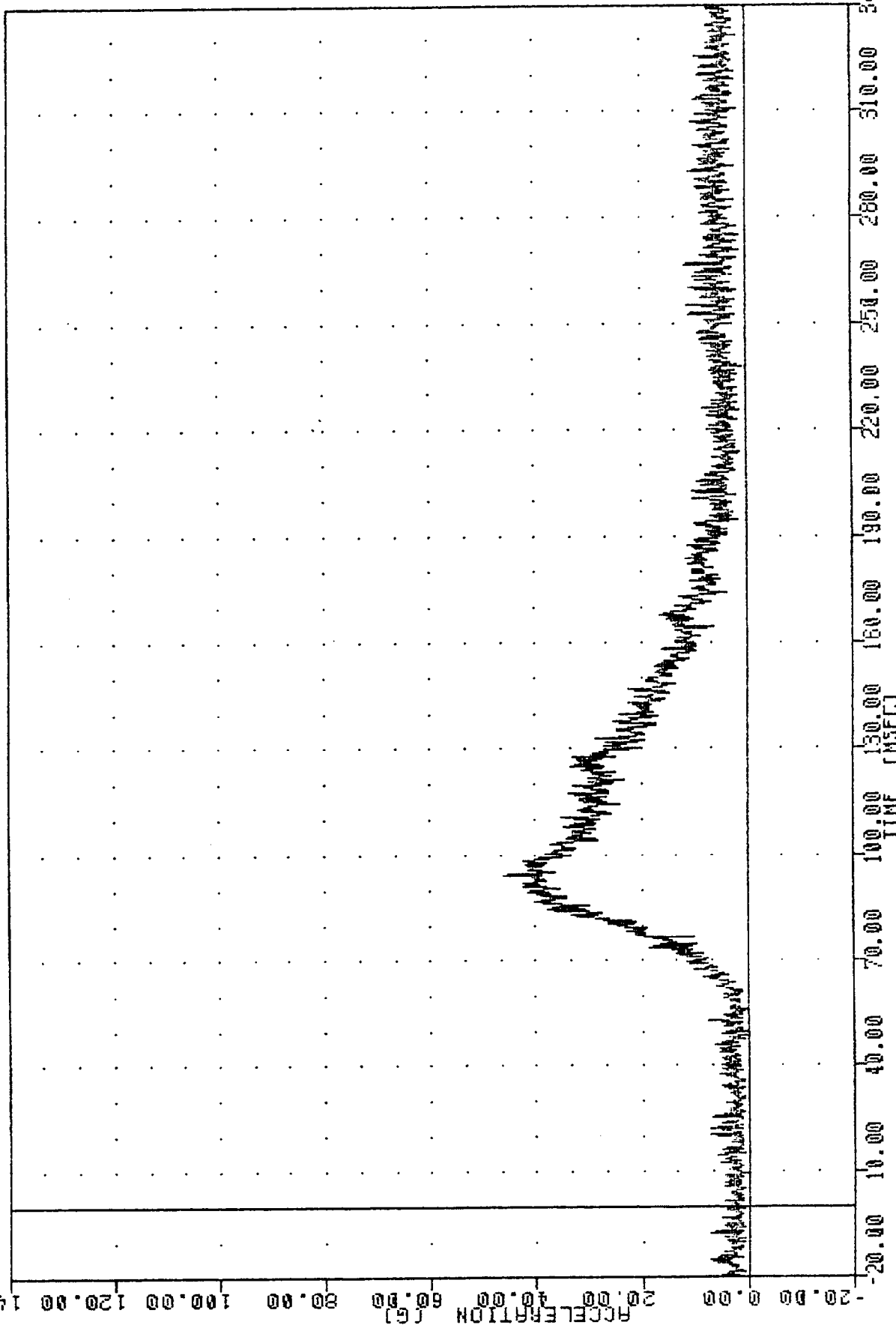


VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER HEAD ACCELERATION Z AXIS

WRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 HEADRC2

FILTER = ALPF 1650/ 5217/ -40
 MIN, MAX VALUES = 0.348

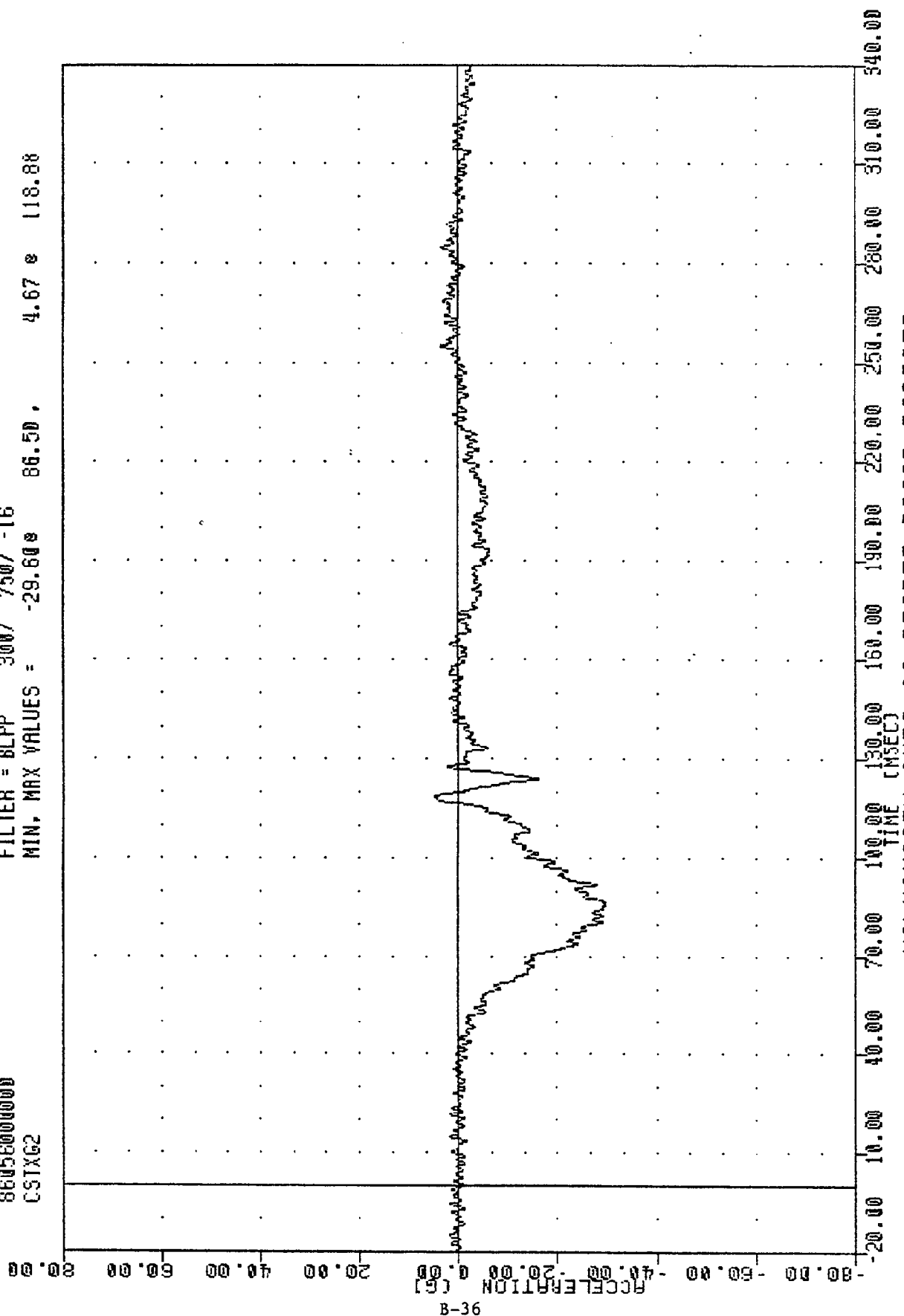
48.75 , 46.05 & 94.38



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER HEAD RESULTANT

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 8605600000
 CSTXG2

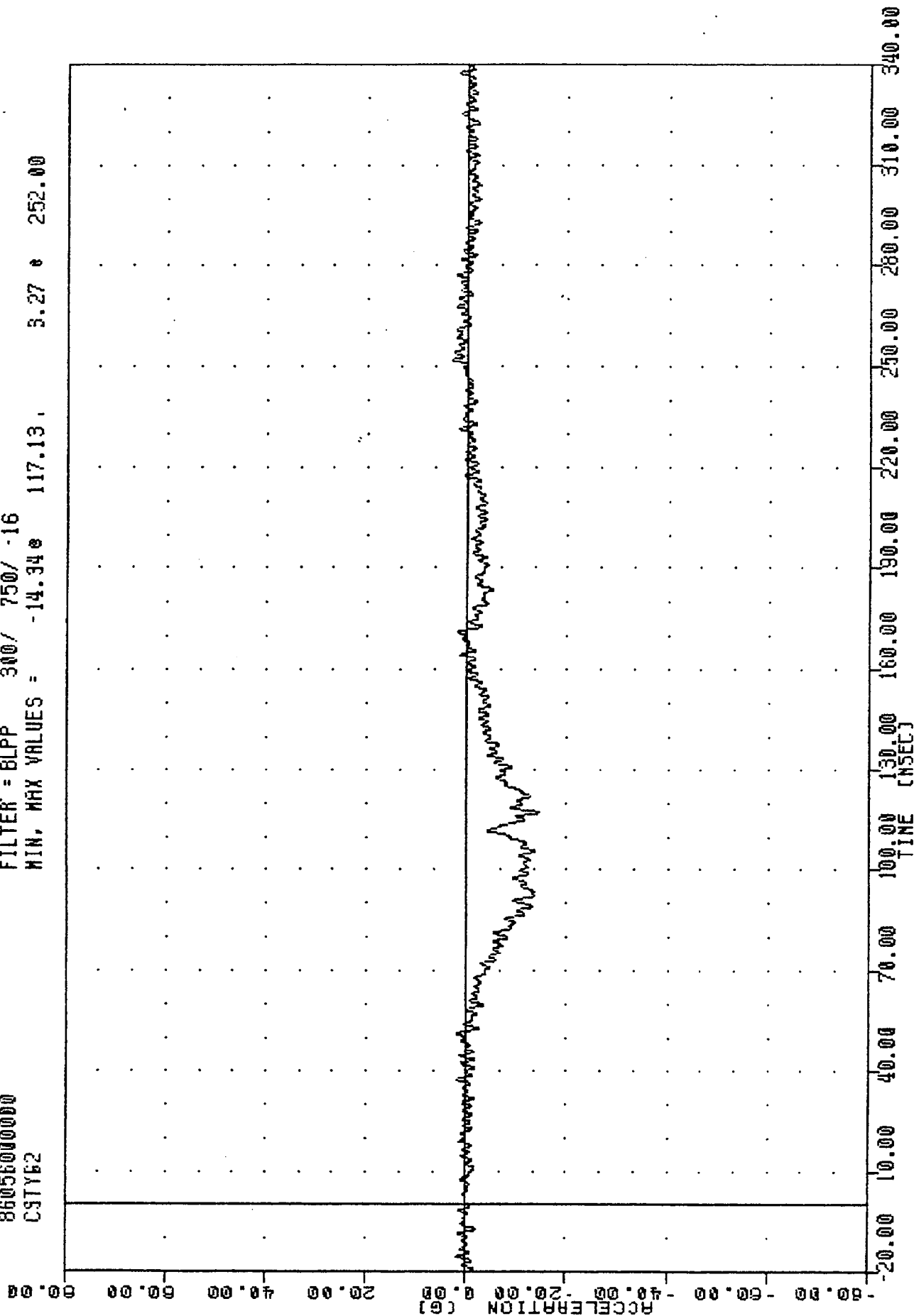
FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -29.600 86.50 , 4.67 & 118.88



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER CHEST ACCELERATION X AXIS

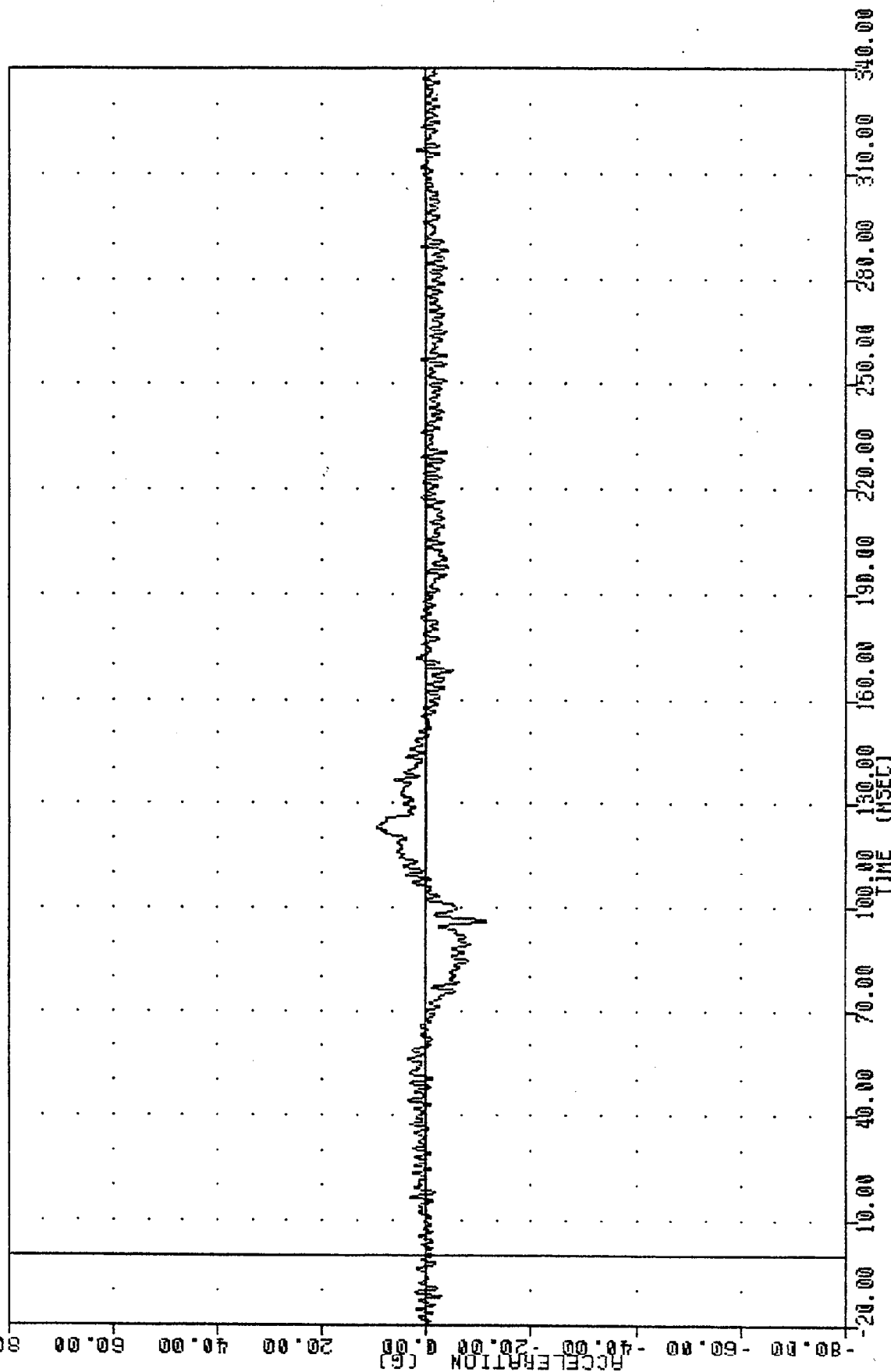
VAT ,860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 CSTY62

FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -14.34 117.13 3.27 252.00



VRT 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 CSTZ62

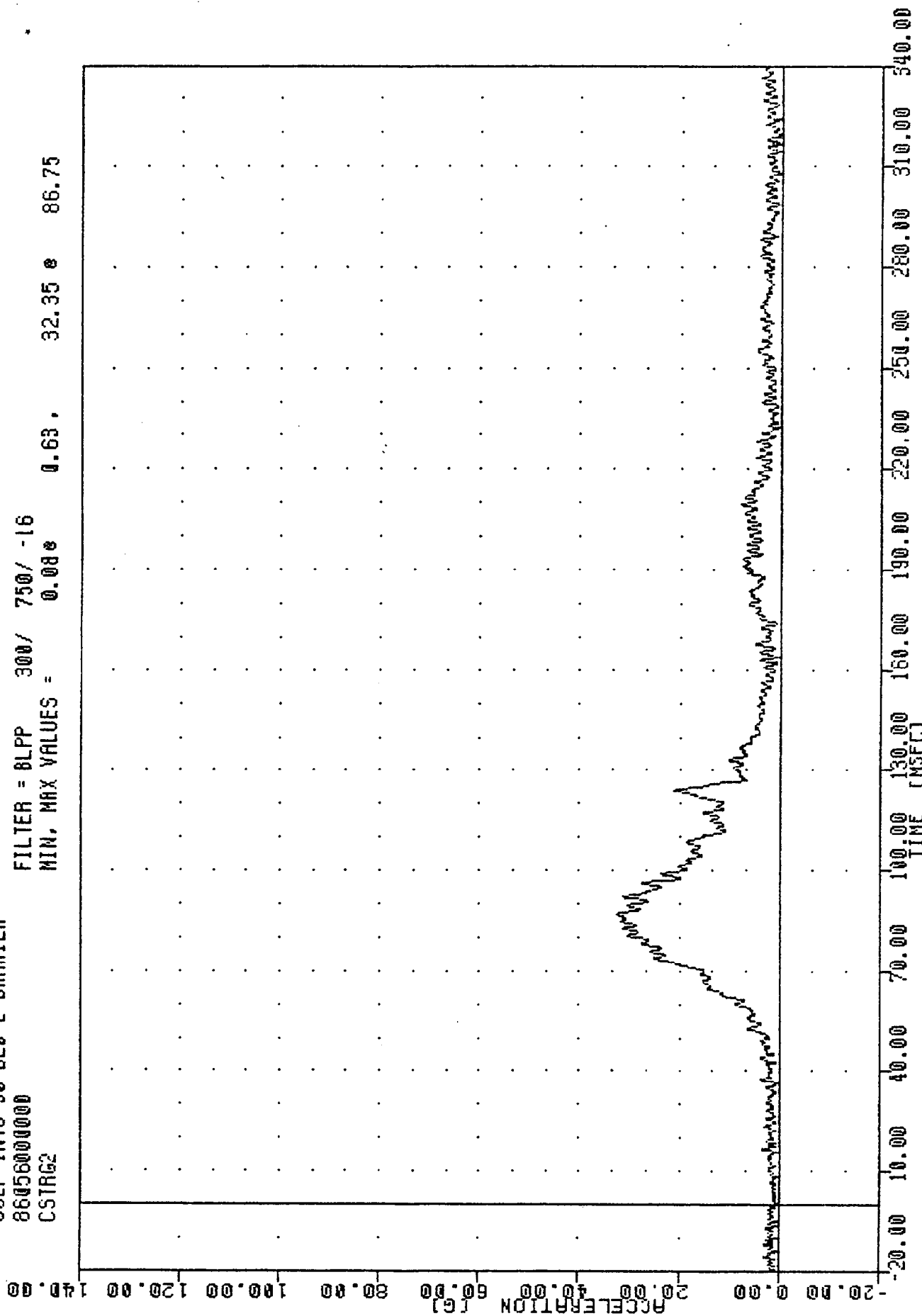
FILTER = BLPP 300/ 750/ -16
 MIN. MAX VALUES = -11.478 96.13, 9.60 123.00



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER CHEST ACCELERATION Z AXIS

VN1
GOLF INTO 30 DEG L BARRIER
86056000000
CSTRG2

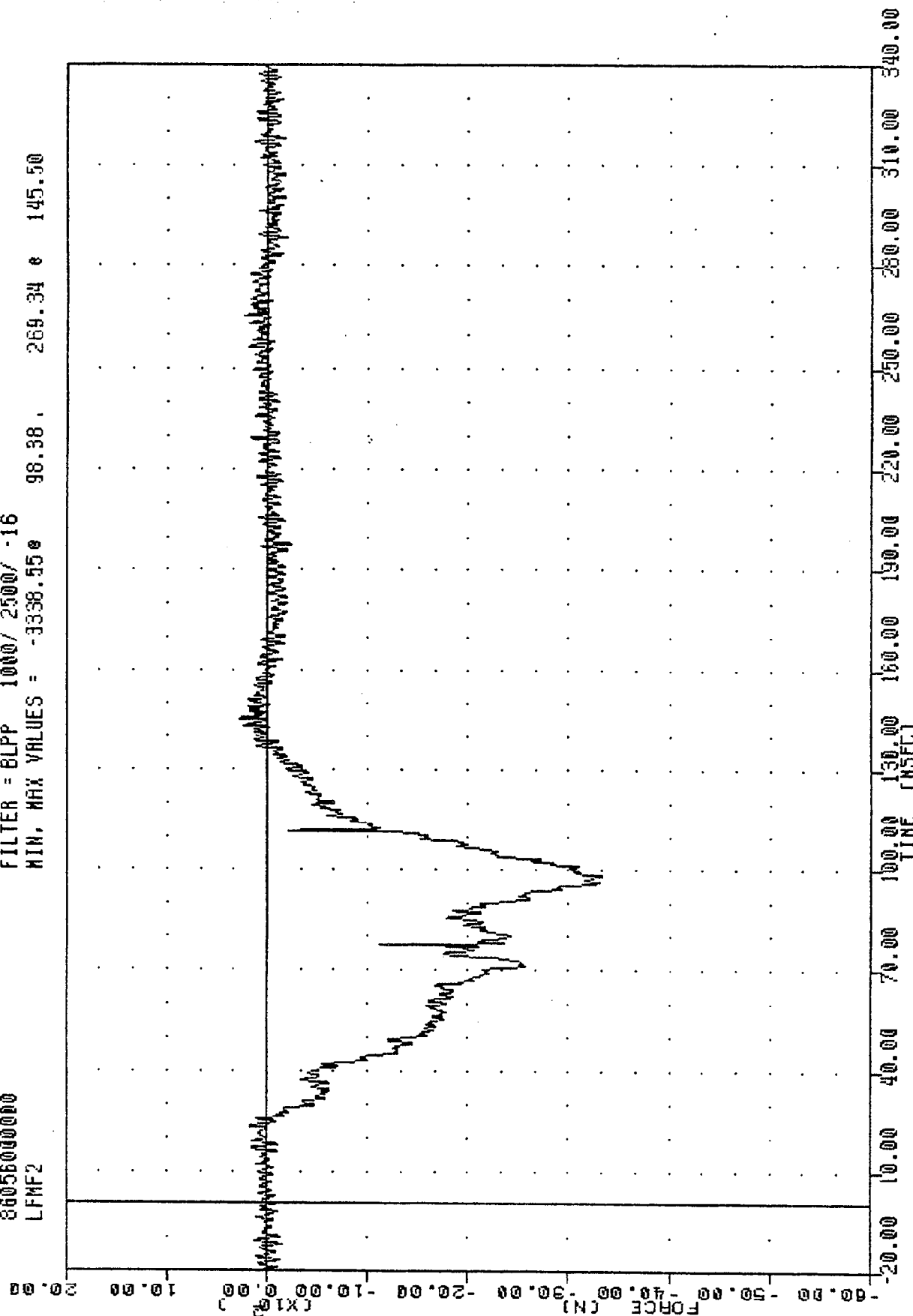
FILTER = BLPP 300/ 750/ -16
MIN, MAX VALUES = 0.08 0.63 32.35 86.75



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
PASSENGER CHEST RESULTANT

VAT
 , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 LFMF2

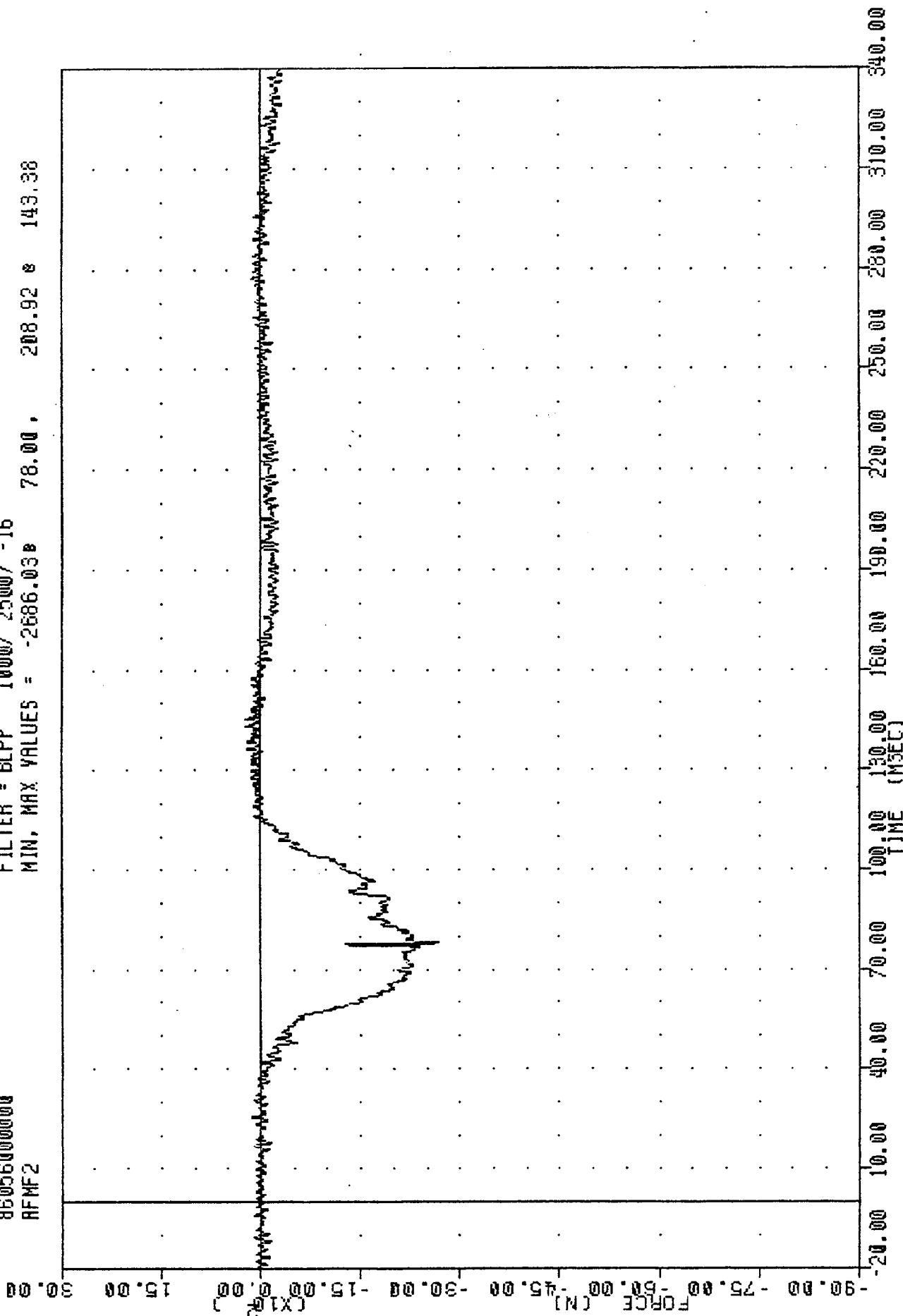
FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -3338.55 98.38 , 269.34 145.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER LEFT FEMUR FORCE (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RFMF2

FILTER = BLPP 1000/ 2500/ -16
 MIN, MAX VALUES = -2686.038 78.00, 208.92 8 143.38

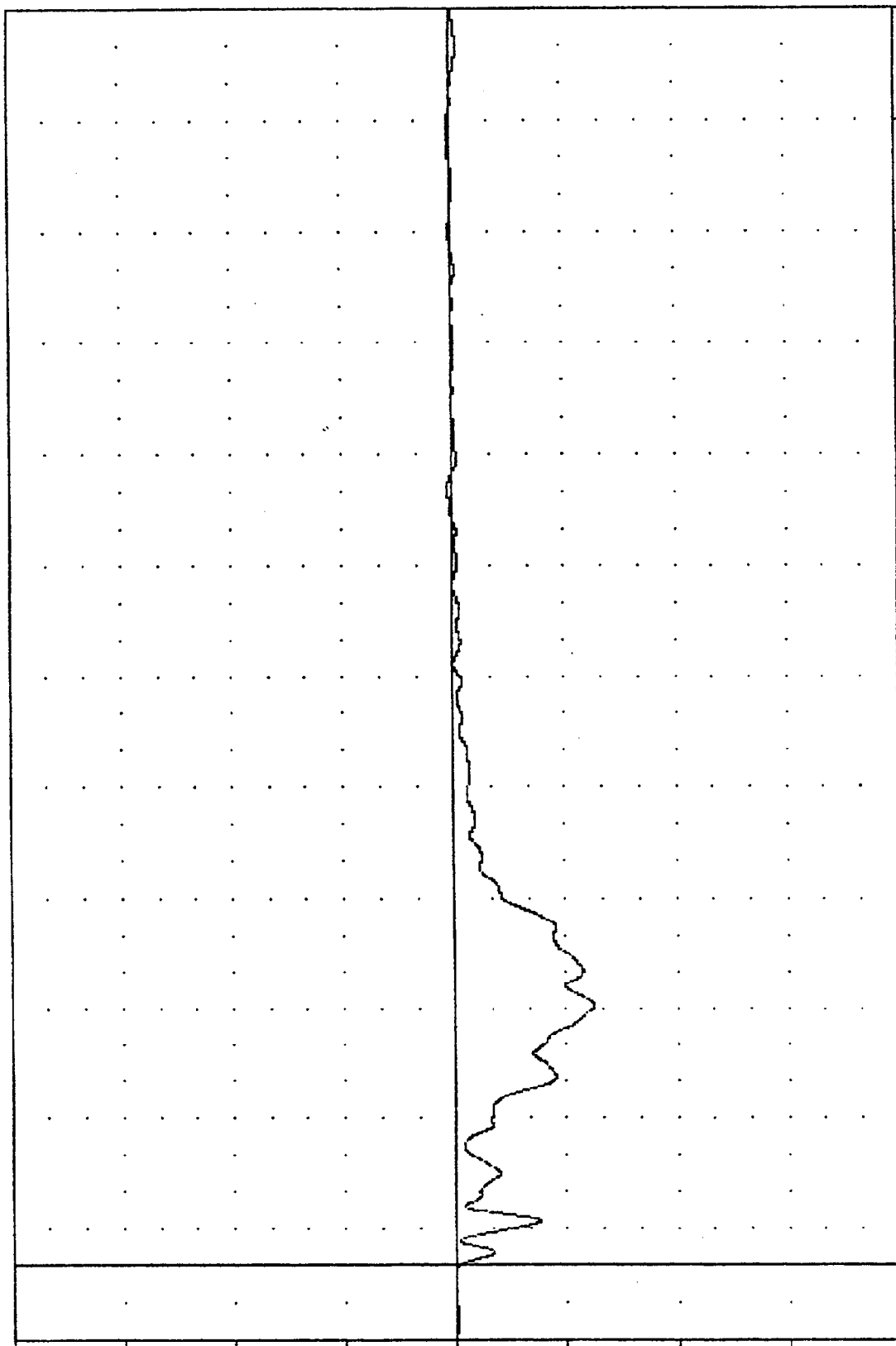


VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 PASSENGER RIGHT FEMUR FORCE (N)

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86058000000
 LPBXG

FILTER = BLPP 100/ 250/ -16
 MIN, MAX VALUES = -25.118 70.75, 1.04 e 210.88

ACCELERATION (G)

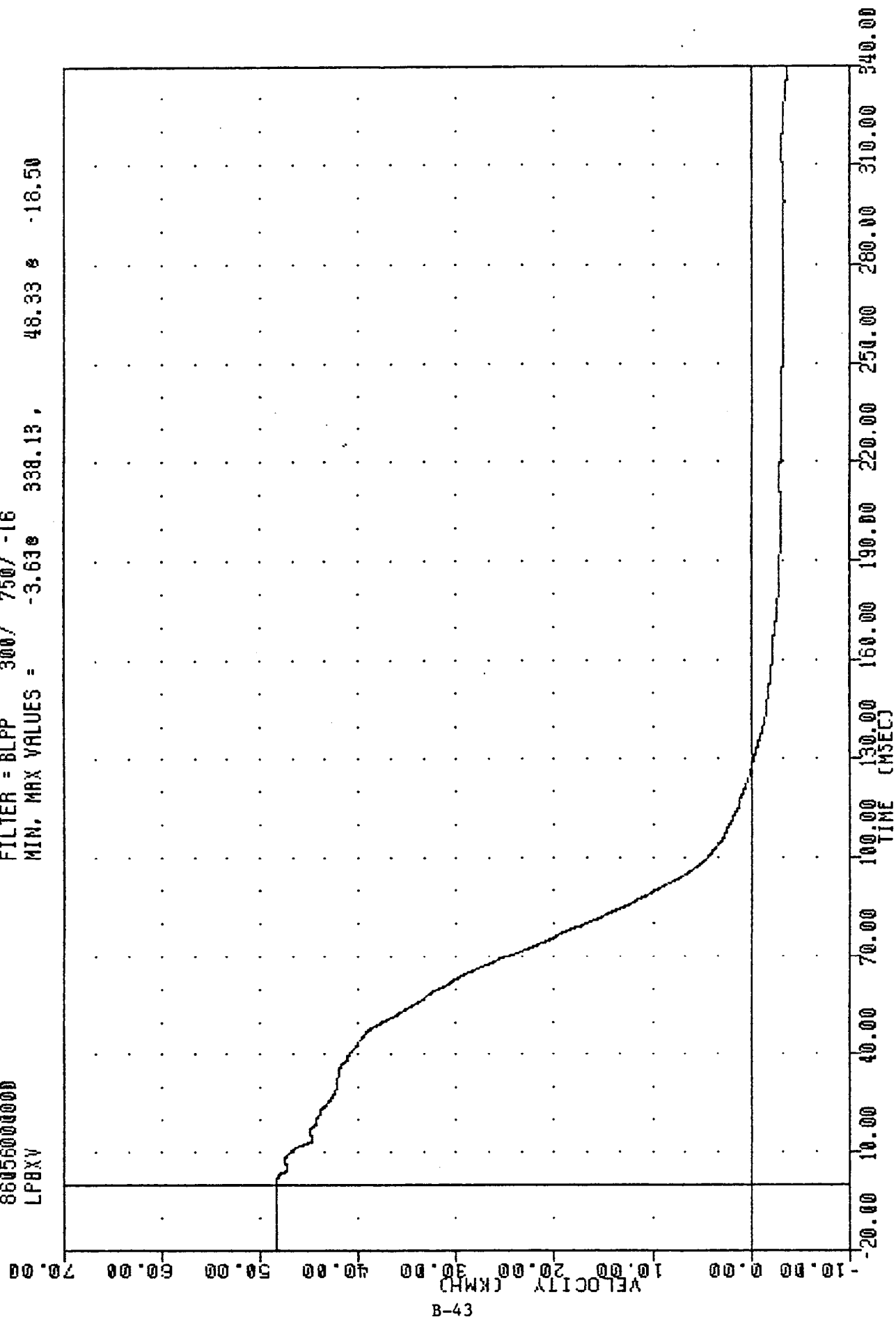


TIME (MSEC)

VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 LEFT B PILLAR ACCELERATION X AXIS

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 LPBXV

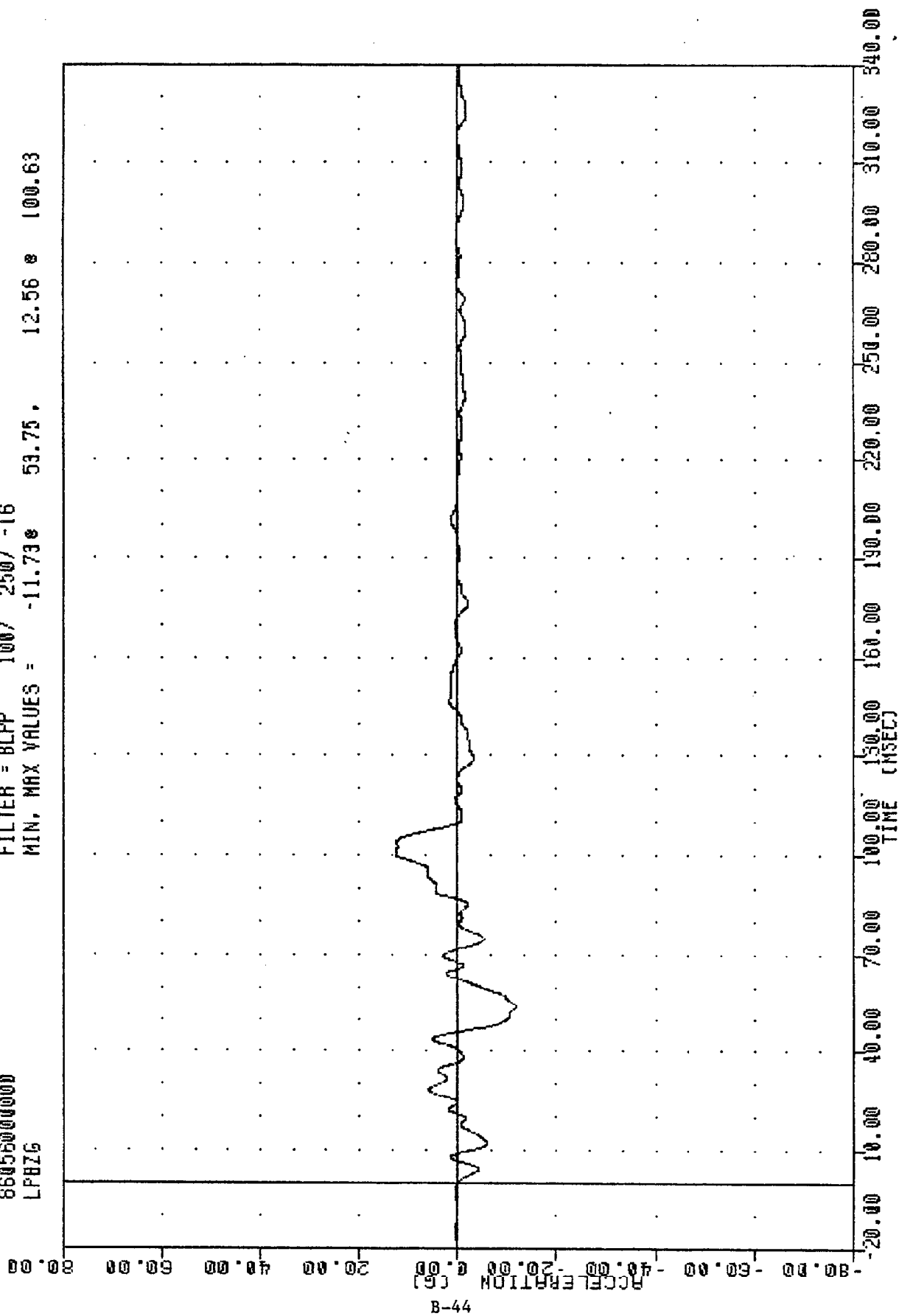
FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -3.63 338.13 , 48.33 8 -18.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DELTA V USING LPBXG

VRT , 860225
GOLF INTO 30 DEG L BARRIER
860550000000
LFBZG

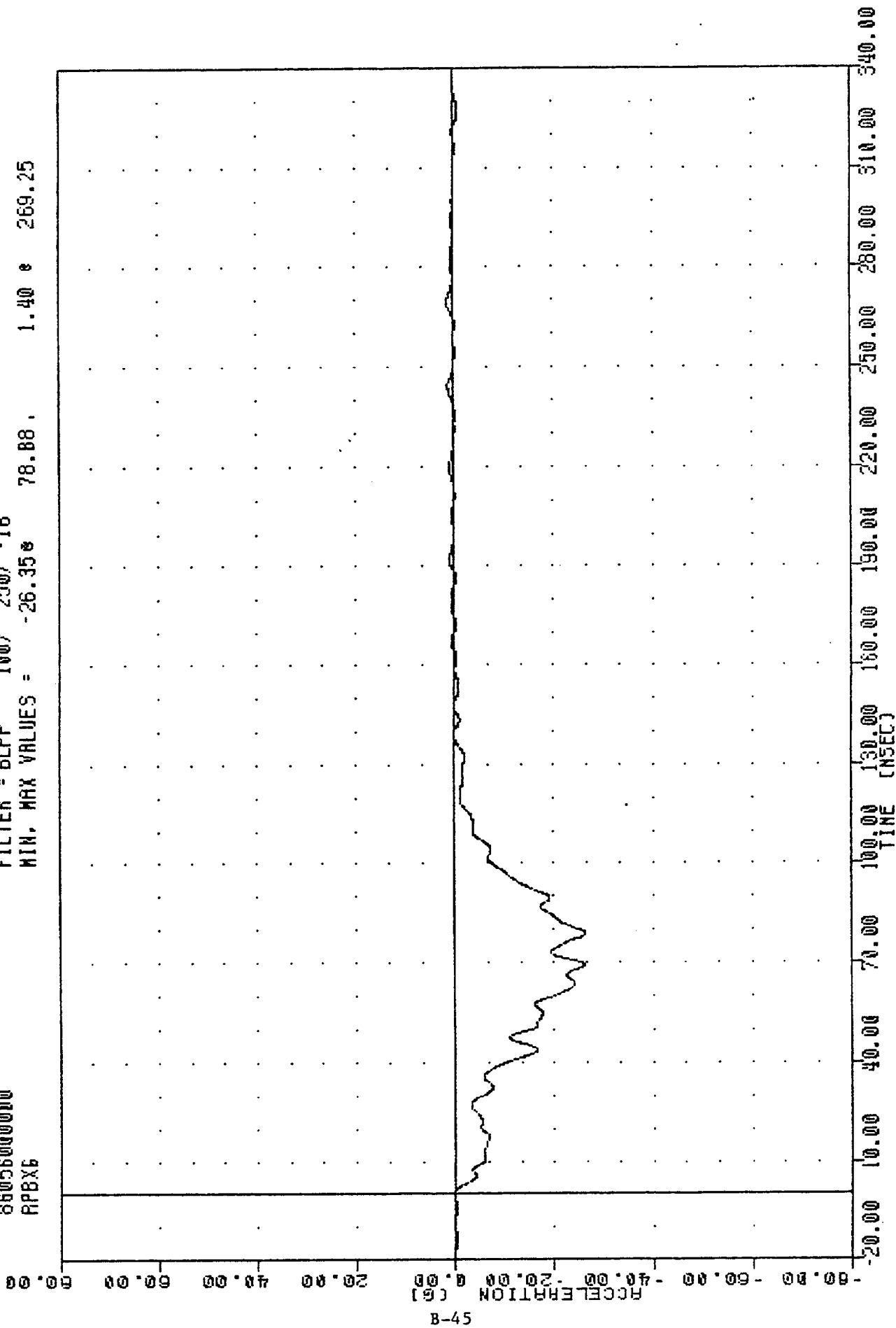
FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -11.73 53.75 12.56 100.63



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
LEFT B PILLAR ACCELERATION Z AXIS

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RPBX6

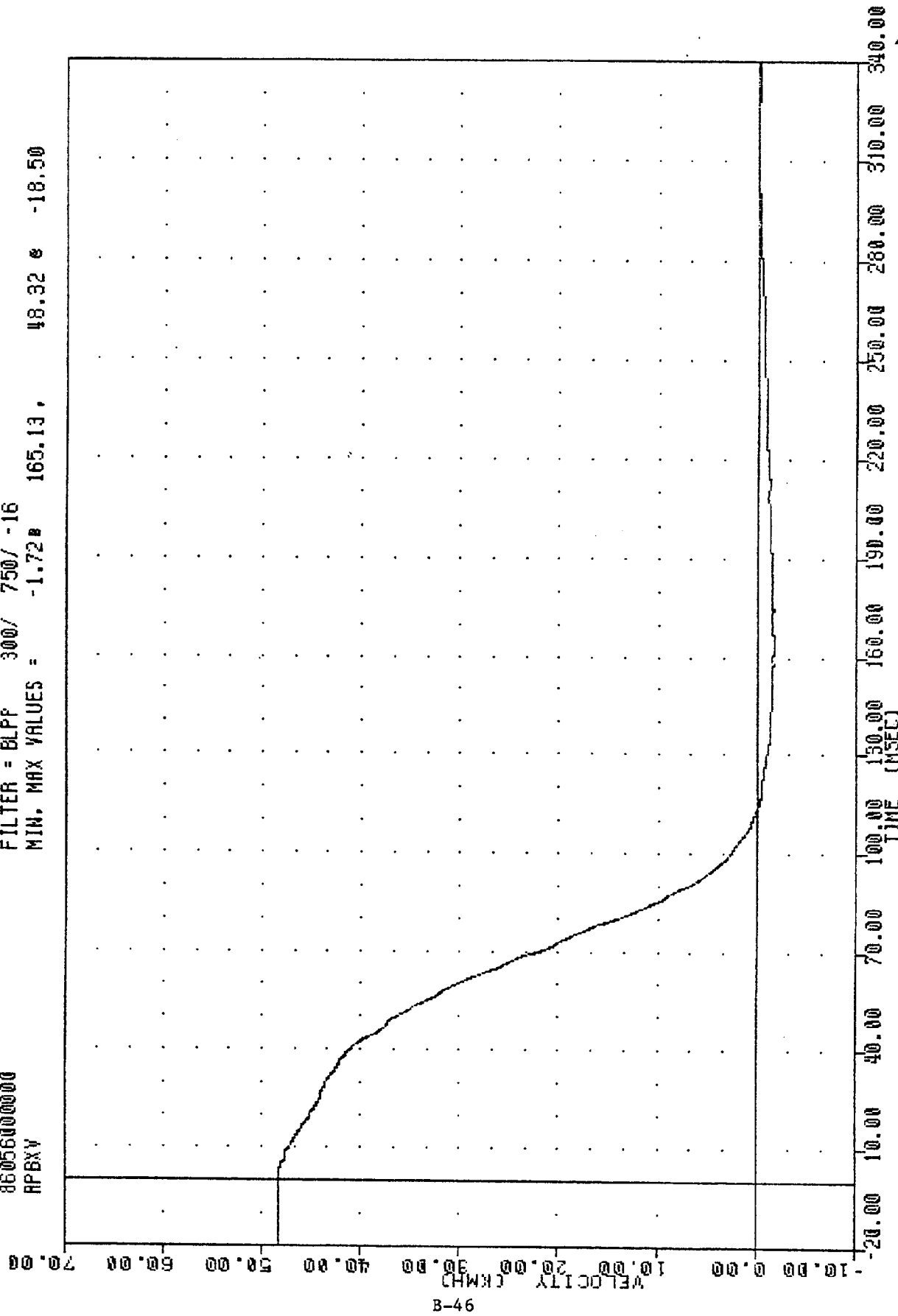
FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -26.35 78.88 1.40 269.25



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 RIGHT B PILLAR ACCELERATION X AXIS

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 8605600000
 APBXV

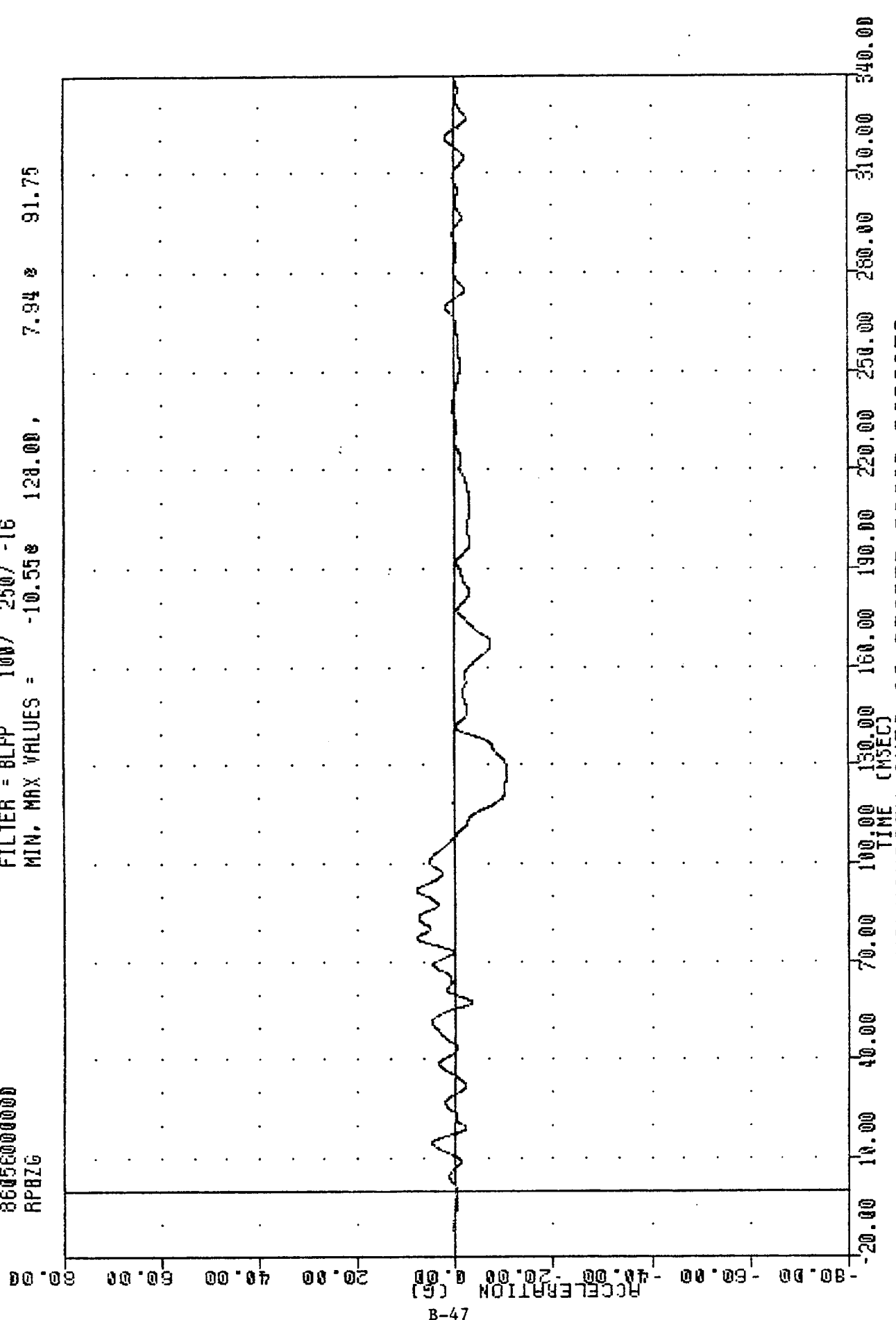
FILTER = BLPF 300/ 750/ -16
 MIN. MAX VALUES = -1.72 165.13 48.32 e -18.50



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 DELTA V USING APBXG

VRT
 , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 RP876

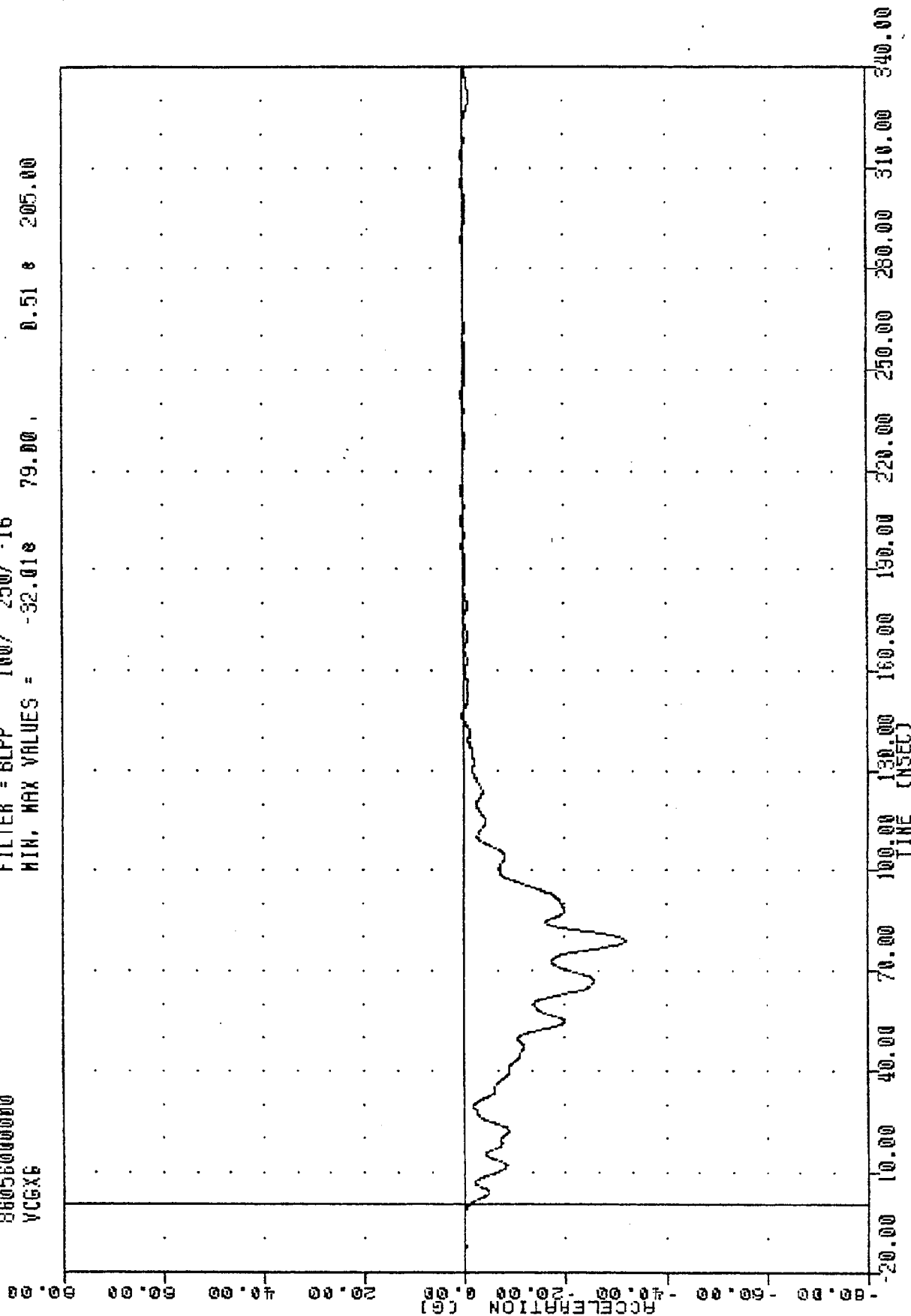
FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -10.55 128.00, 7.94 91.75



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 RIGHT B PILLAR ACCELERATION Z AXIS

VAT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 VCGX6

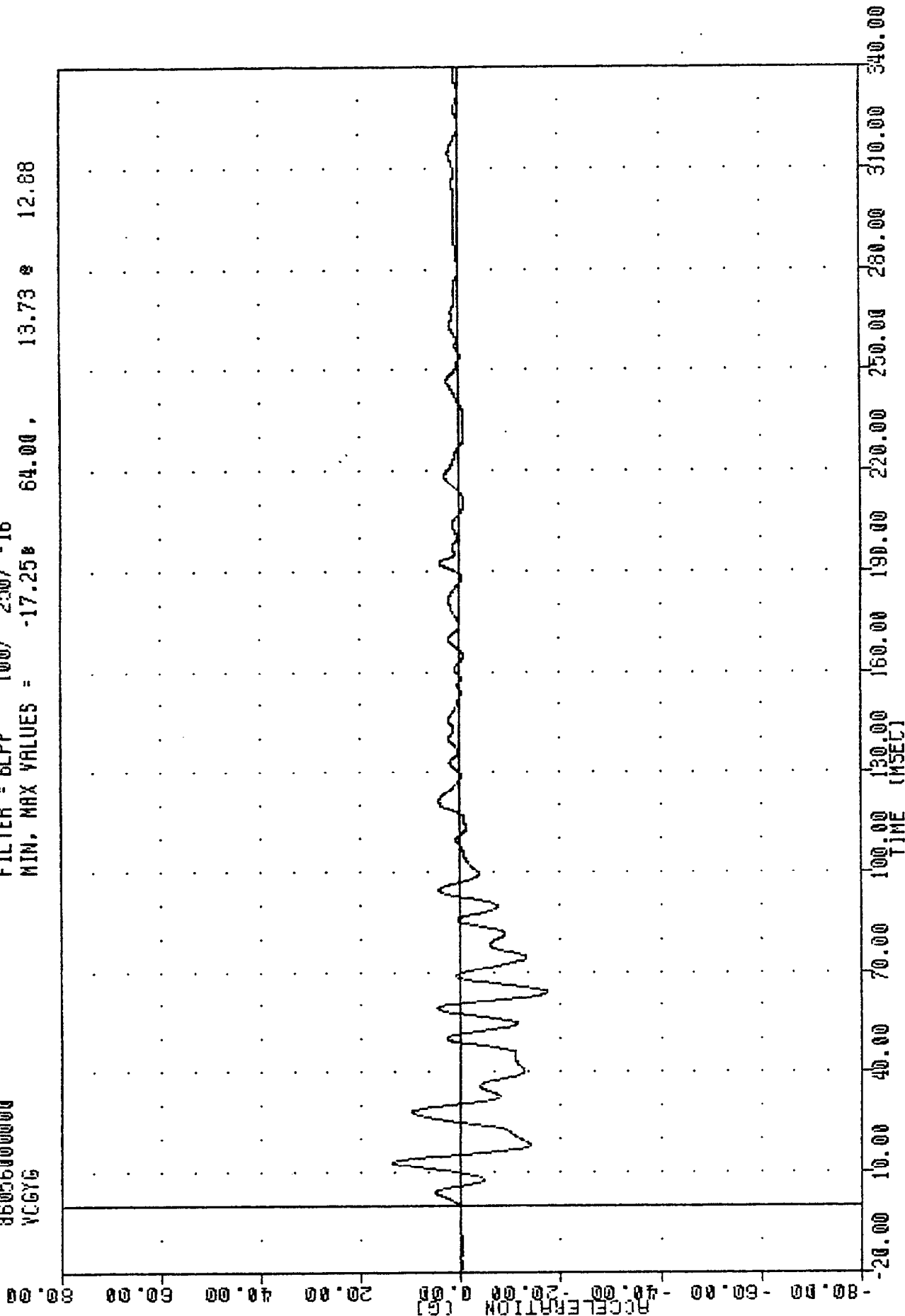
FILTER = BLPP 100/ 250/ -16
 MIN, MAX VALUES = -32.018 79.00 , 0.51 s 205.00



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 VEHICLE CENTER OF GRAVITY ACCELERATION X-AXIS.

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86056000000
 YCGYG

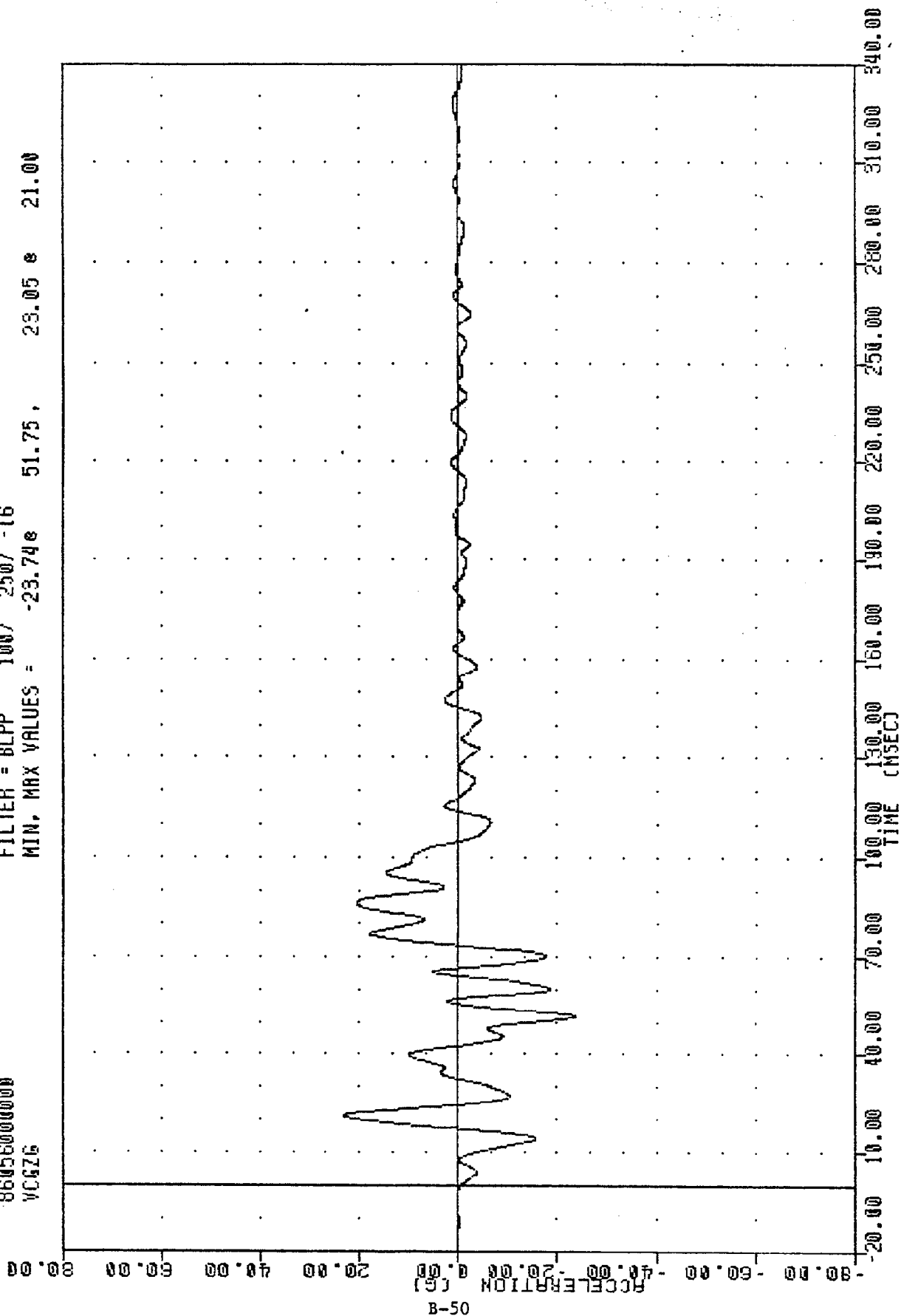
FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -17.25% 64.00 , 13.73 % 12.88



VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 VEHICLE CENTER OF GRAVITY ACCELERATION Y AXIS

VRT , 860225
 GOLF INTO 30 DEG L BARRIER
 86058000000
 VC626

FILTER = BLPP 100/ 250/ -16
 MIN, MAX VALUES = -23.74e 51.75, 23.05 e 21.00



B-50

VOLKSWAGEN INTO 30 DEGREE RIGID BARRIER
 VEHICLE CENTER OF GRAVITY ACCELERATION Z AXIS

APPENDIX C
DUMMY CERTIFICATION

PRE-TEST
CALIBRATION
SN61

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

20-FEB-86

VRTC

61C14HD1

HY3 SN61 HEAD DROP CAL 14

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	73.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	52.00 %
PEAK RESULTANT ACCELERATION	225 - 275 G	264.45 G
PEAK LATERAL ACCELERATION	15 G MAX	7.32 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN

Gay L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

3 AXIS NECK TRANSDUCER

21-FEB-86

VRTC

61C14NE1

HY3 SN61 CAL14 NECK EXTENSION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		66 - 78 DEGREES	70.00 DEGREES
RELATIVE HUMIDITY		10% - 70%	49.00 %
IMPACT VELOCITY		19.50 - 19.90 FPS	19.67 FPS
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	19.74 G
	20 MS	14.00 - 19.00 G	17.41 G
	30 MS	11.00 - 16.00 G	14.54 G
MAXIMUM PENDULUM G		22 G MAX	20.31 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 50 MS	43.88 MS
D PLANE ROTATION	MAX	94 - 106 DEGREES	85.45 DEGREES **
	TIME	72 - 82 MS	76.63 MS
MOMENT ABOUT OCCIPITAL	MAX	11.75 - 17.75 FT.LBS	13.14 FT.LBS
	TIME	12 - 18 MS	15.00 MS
CONDYLES	MIN	-61.2/-50.8 FT.LBS	-45.19 FT.LBS **
	TIME	69 - 77 MS	74.38 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		151 - 167 MS	160.38 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 144 MS	135.88 MS

*** TEST DOES NOT MEET SPECIFICATIONS ***

NOTE: Dummy component meets
VRTC specification

TECHNICIAN

Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

3 AXIS NECK TRANSDUCER

20-FEB-86

VRTC

61C14NF1

HY3 SN61 CAL14 NECK FLEXION

TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		66 - 78 DEGREES	73.00 DEGREES
RELATIVE HUMIDITY		10% - 70%	52.00 %
IMPACT VELOCITY		22.53 - 22.97 FPS	22.97 FPS
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.54 G
	20 MS	17.40 - 22.60 G	19.73 G
	30 MS	12.50 - 18.50 G	15.75 G
MAXIMUM PENDULUM G		29 G MAX	24.59 G
DECELERATION-TIME CURVE			
DECAY TIME TO 5 G		34 - 46 MS	42.63 MS
D PLANE ROTATION	MAX	67 - 79 DEGREES	65.34 DEGREES **
	TIME	54 - 64 MS	61.63 MS
MOMENT ABOUT OCCIPITAL	MAX	70 - 90 FT.LBS	72.71 FT.LBS
	TIME	46 - 56 MS	56.00 MS
CONDYLES	MIN	-22.2/-14.0 FT.LBS	-13.21 FT.LBS **
	TIME	12 - 16 MS	14.88 MS
ROTATION ANGLE-TIME CURVE			
DECAY TIME TO ZERO		109 - 119 MS	119.75 MS **
POSITIVE MOMENT-TIME CURVE			
DECAY TIME TO ZERO		95 - 105 MS	105.88 MS **

*** TEST DOES NOT MEET SPECIFICATIONS ***

NOTE: Dummy component meets
VRTC specification

TECHNICIAN Gary L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

HYBRID III

21-FEB-86

VRTC

61C14TH1

HY3 SN61, CAL 14 H.S.THORAX 01

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	70.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	47.00 %
PENDULUM VELOCITY	21.78-22.22 FT/SEC	22.21 FT/SEC
DEFLECTION AT 25 MSEC	2.51 - 2.75 INCHES	2.738 INCHES
RESISTIVE FORCE AT 19 MSEC	1186 - 1298 POUNDS	1188.0 POUNDS
INTERNAL HYSTERESIS	75% - 85%	73.8% *

*** TEST DOES NOT MEET SPECIFICATIONS ***

NOTE: Dummy component meets
VRTC specification

TECHNICIAN *Larry L. Phelps*

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

21-FEB-86

LEFT
VRTC

KNEE

61C14LK1

HY3 SN61' L.KNEE 11LB CAL 14

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	70.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	49.00 %
PROBE VELOCITY	6.83 - 6.96 FT/SEC	6.96 FT/SEC
PEAK KNEE IMPACT FORCE	1000 - 1560 LBS.	1236.72 LBS.
PROBE WEIGHT	11.0 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN

Larry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

21-FEB-86

RIGHT KNEE
VRTC 61C14RK1

HY3 SN61 R.KNEE 11LB CAL 14

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	70.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	49.00 %
PROBE VELOCITY	6.83 - 6.96 FT/SEC	6.90 FT/SEC
PEAK KNEE IMPACT FORCE	1000 - 1560 LBS.	1304.40 LBS.
PROBE WEIGHT	11.0 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN *Harry L. Phelps*

PRE-TEST
CALIBRATION
SN830

TRANSPORTATION RESEARCH CENTER OF OHIO

EXTERNAL DIMENSIONS

PART 572

20-FEB-86

TEMPERATURE 73.00 F
VRTC ED83010

RELATIVE HUMIDITY 52.00 %
572 SN 830 EXT.DIMENSION CAL10

DESCRIPTION	SPECIFICATION	TEST RESULTS
SN ALDERSON RESEARCH LAB 830		
Sitting Height	35.6 - 35.8IN	35.6 INS
Shoulder Pivot Height	21.8 - 22.4IN	22.2 INS
Hip Pivot Height	3.9 IN (ref.)	3.9 INS
Hip Pivot From Backline	4.8 IN (ref.)	4.8 INS
Knee Pivot From Backline	20.1 - 20.7IN	20.3 INS
Rear of Head From Backline	1.7 IN (ref)	1.7 INS
Chest Depth	9.1 - 9.6IN	9.5 INS
Shoulder Width	17.8 - 18.4IN	17.9 INS
Chest Circumference Over Nipples	36.8 - 40.0IN	37.6 INS
Waist Circumference at Min. Girth	31.4 - 32.6IN	32.4 INS
Hip Width	14.0 - 15.4IN	15.1 INS
Knee Pivot From Floor	19.3 - 19.9IN	19.5 INS

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Larry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

PART 572

20-FEB-86

TEMPERATURE 73 F
VRTC HD83010

RELATIVE HUMIDITY 52 %
572 SN 830 HEAD DROP CAL 10

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PEAK RESULTANT ACCELERATION	210 - 260 G	231.44 G
TIME ABOVE 100 G LEVEL	0.9 - 1.5 MS	1.25 MS
PEAK LATERAL ACCELERATION	10 G MAX	3.81 G
IS ACCELERATION CURVE UNIMODAL?		YES

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572

21-FEB-86

TEMPERATURE 71.00 F
VRTC HN83010

RELATIVE HUMIDITY 47.00 %
572 SN 830 HEAD/NECK CAL 10

Test Parameter	Specification	Test Results
Pendulum velocity	21.5 to 25.5 fps	24.13 fps
Pendulum Deceleration:		
T1 - T2: 5 - 20 G	3 ms. max	1.84 ms.
T2 - T3: 20 - 20 G	25 - 30 ms.	26.37 ms.
T3 - T4: 20 - 5 G	10 ms. max	9.35 ms.
Avg. G level T2 - T3	20 - 24 G	23.56 G
Maximum Rotation Angle	63 - 73 deg.	67.35 deg.
Peak Head Resultant Accel	26 G max	22.39 G

Test Parameter	Specification	Test Results
Rotation Angle	Time Chordal Disp.	Time Chordal Disp.
(degrees)	(ms.) (in.)	(ms.) (in.)
0	-2.0 - +2.0	-0.5 - +0.5
30	25.6 - 34.4	2.1 - 3.1
60	40.3 - 51.7	4.3 - 5.3
max	53.2 - 66.8	5.0 - 6.0
60	67.0 - 83.0	4.3 - 5.3
30	85.4 - 104.6	2.1 - 3.1
0	101.0 - 123.0	-0.5 - +0.5

* DUMMY MEETS SPECIFICATIONS

TECHNICIAN *Gary L. Philips*

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

20-FEB-86

TEMPERATURE 73 F
VRTC TL83010

RELATIVE HUMIDITY 52 %
572 SN 830 L.S.THORAX CAL 10

TEST PARAMETER	LOW SPEED TEST	
	SPECIFICATION	TEST RESULTS
PENDULUM VELOCITY	13.86-14.14 FT/SEC	14.05 FT/SEC
PEAK DEFLECTION	1.1 INCHES MAX.	0.97 INCHES
PEAK RESISTIVE FORCE	1,450. POUNDS MAX.	1346. POUNDS
INTERNAL HYSTERESIS	50% - 70%	60.3%

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

20-FEB-86

TEMPERATURE 73 F
VRTC TH83010

RELATIVE HUMIDITY 52 %
572 SN 830 H.S. THORAX CAL 10

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
PENDULUM VELOCITY	21.78-22.22 FT/SEC	22.22 FT/SEC
PEAK DEFLECTION	1.7 INCHES MAX.	1.47 INCHES
PEAK RESISTIVE FORCE	2,250. POUNDS MAX.	2076. POUNDS
INTERNAL HYSTERESIS	50% - 70%	58.1%

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Ray L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572

20-FEB-86

TEMPERATURE 73.00 F
VRTC LF83010

RELATIVE HUMIDITY 52.00 %
572 SN 830 LUMBAR FLEX CAL10

DEFLECTION	SPECIFICATION	TEST RESULTS
0 Deg.	0 LBS	0.00 LBS
20 Deg	22.00 - 34.00 LBS	30.00 LBS
30 Deg	34.00 - 46.00 LBS	42.00 LBS
40 Deg	46.00 - 58.00 LBS	49.00 LBS
NET RETURN ANGLE	< 12 DEG	10.33 DEG

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

ABDOMINAL COMPRESSION TEST

PART 572

20-FEB-86

TEMPERATURE 73.00 F
VRTC AB83010

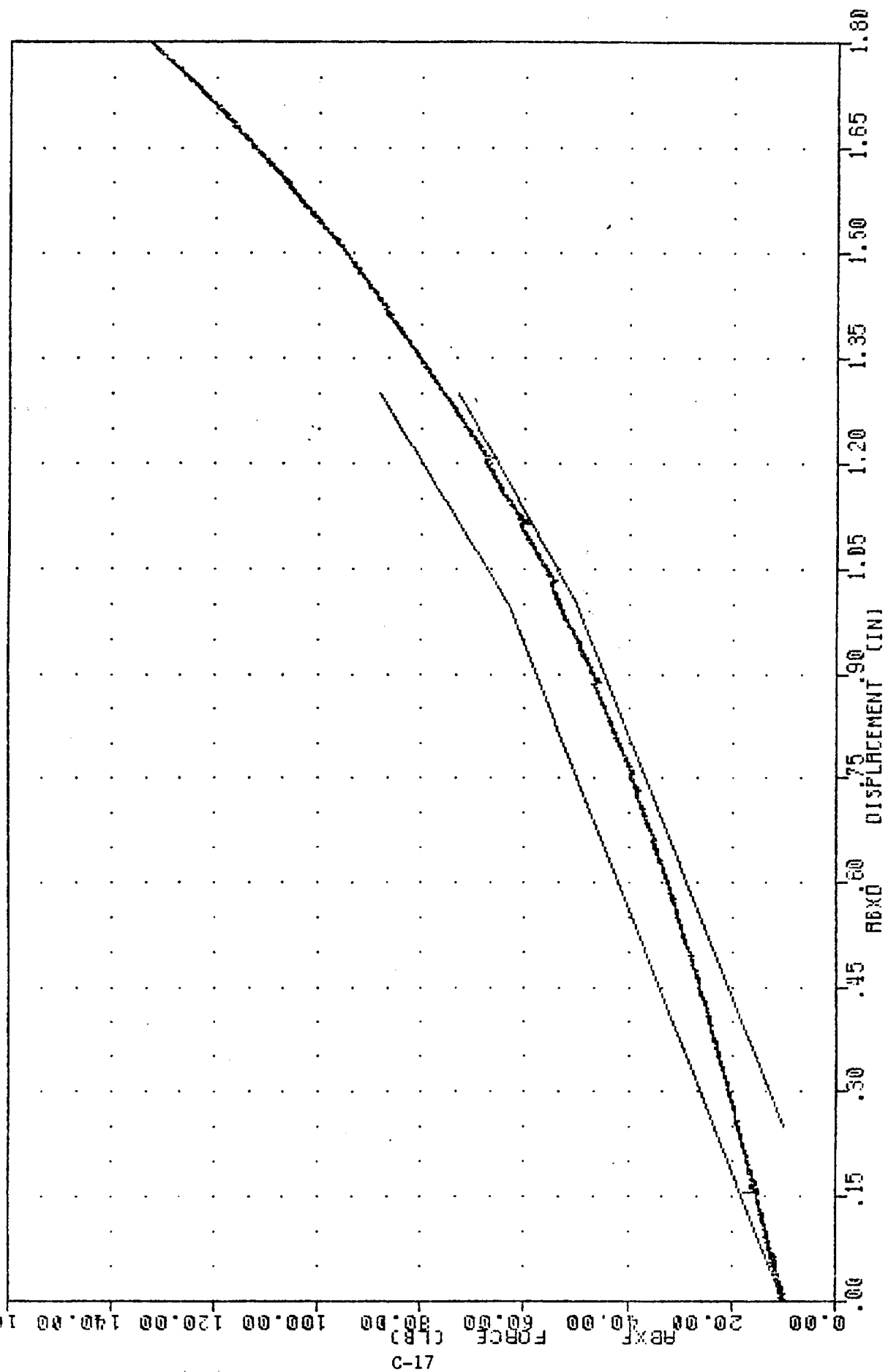
RELATIVE HUMIDITY 52.00 %
572 SN 830 ABDOM COMPR CAL 10

TEST CORRIDORS		
DISPLACEMENT	FORCE	TEST RESULTS
0 IN.	10 LBS	10 LBS
.50 IN.	23.00 - 36.00 LBS	28.31 LBS
.75 IN.	36.00 - 50.00 LBS	39.26 LBS
1.00 IN.	50.00 - 63.00 LBS	53.48 LBS
1.30 IN.	73.00 - 88.00 LBS	75.37 LBS

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

12 55010 522 30 630 48000 COMP. CAL 10 38051 135.14
 FILTER = ALPF 1650/ 5214/ -40 MIN. MAX = 0.00 0.00 1.82
 FILTER = ALPF 1650/ 5214/ -40 MIN. MAX = 9.69 0.00 1.82



ABDOMINAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

21-FEB-86

TEMPERATURE 70 F
RIGHT KNEE
VRTC RK83010

RELATIVE HUMIDITY 49 %
572 SN 830 R.KNEE IMP CAL 10

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PROBE VELOCITY	6.76 - 7.04 FT/SEC	6.89 FT/SEC
PEAK KNEE IMPACT FORCE	1850 - 2500 LBS.	1966.22 LBS.
DURATION ABOVE 1000 LBS.	>=1.7 MS.	1.98 MS.

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

21-FEB-86

TEMPERATURE 70 F
LEFT KNEE
VRTC LK83010

RELATIVE HUMIDITY 49 %
572 SN 830 L.KNEE IMP CAL 10

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PROBE VELOCITY	6.76 - 7.04 FT/SEC	6.91 FT/SEC
PEAK KNEE IMPACT FORCE	1850 - 2500 LBS.	2051.71 LBS.
DURATION ABOVE 1000 LBS.	>=1.7 MS.	1.99 MS.

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

POST-TEST
CALIBRATION
SN61

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

HYBRID III

26-FEB-86

URTC

61C15HD1

HY3 SN61 HEAD DROP CAL 15

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	72.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	44.00 %
PEAK RESULTANT ACCELERATION	225 - 275 G	261.11 G
PEAK LATERAL ACCELERATION	15 G MAX	2.47 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN *Gay L. Phelps*

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK FLEXION TEST

HYBRID III

3 AXIS NECK TRANSDUCER

28-FEB-86

VRTC

61C15NF1

HY3 SN61 CAL15 NECK FLEXION

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	69.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	40.00 %
IMPACT VELOCITY	22.53 - 22.97 FPS	22.97 FPS
PENDULUM	10 MS 22.50 - 27.50 G	23.73 G
DECELERATION	20 MS 17.40 - 22.60 G	20.59 G
	30 MS 12.50 - 18.50 G	16.65 G
MAXIMUM PENDULUM G	29 G MAX	28.25 G
DECELERATION-TIME CURVE		
DECAY TIME TO 5 G	34 - 46 MS	44.38 MS
D PLANE	MAX 67 - 79 DEGREES	66.92 DEGREES **
ROTATION	TIME 54 - 64 MS	62.13 MS
MOMENT ABOUT	MAX 70 - 90 FT.LBS	68.00 FT.LBS **
OCCIPITAL	TIME 46 - 56 MS	56.88 MS **
CONDYLES	MIN -22.2/-14.0 FT.LBS	-14.28 FT.LBS
	TIME 12 - 16 MS	15.00 MS
ROTATION ANGLE-TIME CURVE		
DECAY TIME TO ZERO	109 - 119 MS	121.88 MS **
POSITIVE MOMENT-TIME CURVE		
DECAY TIME TO ZERO	95 - 105 MS	105.38 MS **

*** TEST DOES NOT MEET SPECIFICATIONS ***

NOTE: Dummy component meets
VRTC specification

TECHNICIAN *Harry L. Phelps*

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK EXTENSION TEST

HYBRID III

3 AXIS NECK TRANSDUCER

28-FEB-86

VRTC

61C15NE1

HY3 SN61 CAL15 NECK EXTENSION

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	69.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	41.00 %
IMPACT VELOCITY	19.50 - 19.90 FPS	19.62 FPS
PENDULUM	10 MS 17.20 - 21.20 G	19.75 G
DECELERATION	20 MS 14.00 - 19.00 G	16.84 G
	30 MS 11.00 - 16.00 G	14.33 G
MAXIMUM PENDULUM G	22 G MAX	20.98 G
DECELERATION-TIME CURVE		
DECAY TIME TO 5 G	38 - 50 MS	43.88 MS
D PLANE	MAX 94 - 106 DEGREES	83.60 DEGREES **
ROTATION	TIME 72 - 82 MS	79.38 MS
MOMENT ABOUT	MAX 11.75 - 17.75 FT.LBS	13.42 FT.LBS
OCCIPITAL	TIME 12 - 18 MS	15.25 MS
CONDYLES	MIN -61.2/-50.8 FT.LBS	-44.85 FT.LBS **
	TIME 69 - 77 MS	75.00 MS
ROTATION ANGLE-TIME CURVE		
DECAY TIME TO ZERO	151 - 167 MS	160.88 MS
NEGATIVE MOMENT-TIME CURVE		
DECAY TIME TO ZERO	120 - 144 MS	137.63 MS

*** TEST DOES NOT MEET SPECIFICATIONS ***

NOTE: Dummy component meets
VRTC specification

TECHNICIAN *Gay L Phelps*

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

HYBRID III

28-FEB-B6

VRTC

61C15TH1

HY3 SN61 CAL 15 H.S.THORAX 01

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	69.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	41.00 %
PENDULUM VELOCITY	21.78-22.22 FT/SEC	22.22 FT/SEC
DEFLECTION AT 25 MSEC	2.51 - 2.75 INCHES	2.772 INCHES *
RESISTIVE FORCE AT 19 MSEC	1186 - 1298 POUNDS	1197.8 POUNDS
INTERNAL HYSTERESIS	75% - 85%	73.5% *

*** TEST DOES NOT MEET SPECIFICATIONS ***

NOTE: Dummy component meets
VRTC specification

TECHNICIAN Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

27-FEB-86

LEFT
VRTC

KNEE
61C15LK1

HY3 SN61 L.KNEE 11LB CAL 15

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	70.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	43.00 %
PROBE VELOCITY	6.83 - 6.96 FT/SEC	6.95 FT/SEC
PEAK KNEE IMPACT FORCE	1000 - 1560 LBS.	1354.43 LBS.
PROBE WEIGHT	11.0 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

HYBRID III

27-FEB-86

LEFT KNEE
VRTC 61C15RK1

HY3 SN61 R.KNEE 11LB CAL 15

TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	66 - 78 DEGREES	70.00 DEGREES
RELATIVE HUMIDITY	10% - 70%	43.00 %
PROBE VELOCITY	6.83 - 6.96 FT/SEC	6.94 FT/SEC
PEAK KNEE IMPACT FORCE	1000 - 1560 LBS.	1260.09 LBS.
PROBE WEIGHT	11.0 LBS.	

DUMMY COMPONENT MEETS SPECIFICATIONS

TECHNICIAN *Harry L. Phelps*

POST-TEST
CALIBRATION

SN830

TRANSPORTATION RESEARCH CENTER OF OHIO

EXTERNAL DIMENSIONS

PART 572

26-FEB-86

TEMPERATURE 72.00 F
VRTC ED83011

RELATIVE HUMIDITY 43.00 %
572 SN 830 EXT.DIMENSION CAL11

DESCRIPTION	SPECIFICATION	TEST RESULTS
SN ALDERSON RESEARCH LAB 830		
Sitting Height	35.6 - 35.8IN	35.7 INS
Shoulder Pivot Height	21.8 - 22.4IN	22.4 INS
Hip Pivot Height	3.9 IN (ref.)	3.9 INS
Hip Pivot From Backline	4.8 IN (ref.)	4.8 INS
Knee Pivot From Backline	20.1 - 20.7IN	20.2 INS
Rear of Head From Backline	1.7 IN (ref)	1.7 INS
Chest Depth	9.1 - 9.6IN	9.5 INS
Shoulder Width	17.8 - 18.4IN	17.8 INS
Chest Circumference Over Nipples	36.8 - 40.0IN	37.0 INS
Waist Circumference at Min. Girth	31.4 - 32.6IN	32.5 INS
Hip Width	14.0 - 15.4IN	15.1 INS
Knee Pivot From Floor	19.3 - 19.9IN	19.3 INS

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Gay L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

PART 572

26-FEB-86

TEMPERATURE 73 F
VRTC HD83011

RELATIVE HUMIDITY 43 %
572 SN 830 HEAD DROP CAL 11

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PEAK RESULTANT ACCELERATION	210 - 260 G	224.79 G
TIME ABOVE 100 G LEVEL	0.9 - 1.5 MS	1.26 MS
PEAK LATERAL ACCELERATION	10 G MAX	3.72 G
IS ACCELERATION CURVE UNIMODAL?		YES

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

NECK PENDULUM TEST

PART 572

26-FEB-86

TEMPERATURE 72.00 F
VRTC HN83011

RELATIVE HUMIDITY 44.00 %
572 SN 830 HEAD/NECK CAL 11

Test Parameter	Specification	Test Results
Pendulum velocity	21.5 to 25.5 fps	24.14 fps
Pendulum Deceleration:		
T1 - T2: 5 - 20 G	3 ms. max	1.86 ms.
T2 - T3: 20 - 20 G	25 - 30 ms.	26.70 ms.
T3 - T4: 20 - 5 G	10 ms. max	8.56 ms.
Avg. G level T2 - T3	20 - 24 G	23.88 G
Maximum Rotation Angle	63 - 73 deg.	65.38 deg.
Peak Head Resultant Accel	26 G max	23.63 G

Test Parameter	Specification		Test Results	
Rotation Angle (degrees)	Time (ms.)	Chordal Disp. (in.)	Time (ms.)	Chordal Disp. (in.)
0	-2.0 - +2.0	-0.5 - +0.5	0.13	0.01
30	25.6 - 34.4	2.1 - 3.1	30.87	2.38
60	40.3 - 51.7	4.3 - 5.3	46.80	4.51
max	53.2 - 66.8	5.0 - 6.0	56.50	5.02
60	67.0 - 83.0	4.3 - 5.3	71.77	4.63
30	85.4 - 104.6	2.1 - 3.1	91.03	2.40
0	101.0 - 123.0	-0.5 - +0.5	105.19	0.09

* DUMMY MEETS SPECIFICATIONS

TECHNICIAN *Harry L. Phelps*

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

27-FEB-86

TEMPERATURE 70 F
VRTC TL83011

RELATIVE HUMIDITY 42 %
572 SN 830 L.S.THORAX CAL 11

LOW SPEED TEST		
TEST PARAMETER	SPECIFICATION	TEST RESULTS
PENDULUM VELOCITY	13.86-14.14 FT/SEC	13.99 FT/SEC
PEAK DEFLECTION	1.1 INCHES MAX.	0.93 INCHES
PEAK RESISTIVE FORCE	1,450. POUNDS MAX.	1368. POUNDS
INTERNAL HYSTERESIS	50% - 70%	63.3%

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572

27-FEB-86

TEMPERATURE 70 F
VRTC TH83011

RELATIVE HUMIDITY 42 %
572 SN 830 H.S.THORAX CAL 11

TEST PARAMETER	HIGH SPEED TEST	
	SPECIFICATION	TEST RESULTS
PENDULUM VELOCITY	21.78-22.22 FT/SEC	22.14 FT/SEC
PEAK DEFLECTION	1.7 INCHES MAX.	1.41 INCHES
PEAK RESISTIVE FORCE	2,250. POUNDS MAX.	2127. POUNDS
INTERNAL HYSTERESIS	50% - 70%	60.0%

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

LUMBAR FLEXION TEST

PART 572

26-FEB-86

TEMPERATURE 72.00 F
VRTC LF83011

RELATIVE HUMIDITY 43.00 %
572 SN 830 LUMBAR FLEX CAL11

DEFLECTION	SPECIFICATION	TEST RESULTS
0 Deg.	0 LBS	0.00 LBS
20 Deg	22.00 - 34.00 LBS	34.00 LBS
30 Deg	34.00 - 46.00 LBS	44.00 LBS
40 Deg	46.00 - 58.00 LBS	52.00 LBS
NET RETURN ANGLE	< 12 DEG	7.51 DEG

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

ABDOMINAL COMPRESSION TEST

PART 572

26-FEB-86

TEMPERATURE 72.00 F
VRTC AB83011

RELATIVE HUMIDITY 43.00 %
572 SN 830 ABDOM COMP CAL 11

TEST CORRIDORS		
DISPLACEMENT	FORCE	TEST RESULTS
0 IN.	10 LBS	10 LBS
.50 IN.	23.00 - 36.00 LBS	39.25 LBS
.75 IN.	36.00 - 50.00 LBS	41.20 LBS
1.00 IN.	50.00 - 63.00 LBS	56.17 LBS
1.50 IN.	73.00 - 88.00 LBS	81.59 LBS

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

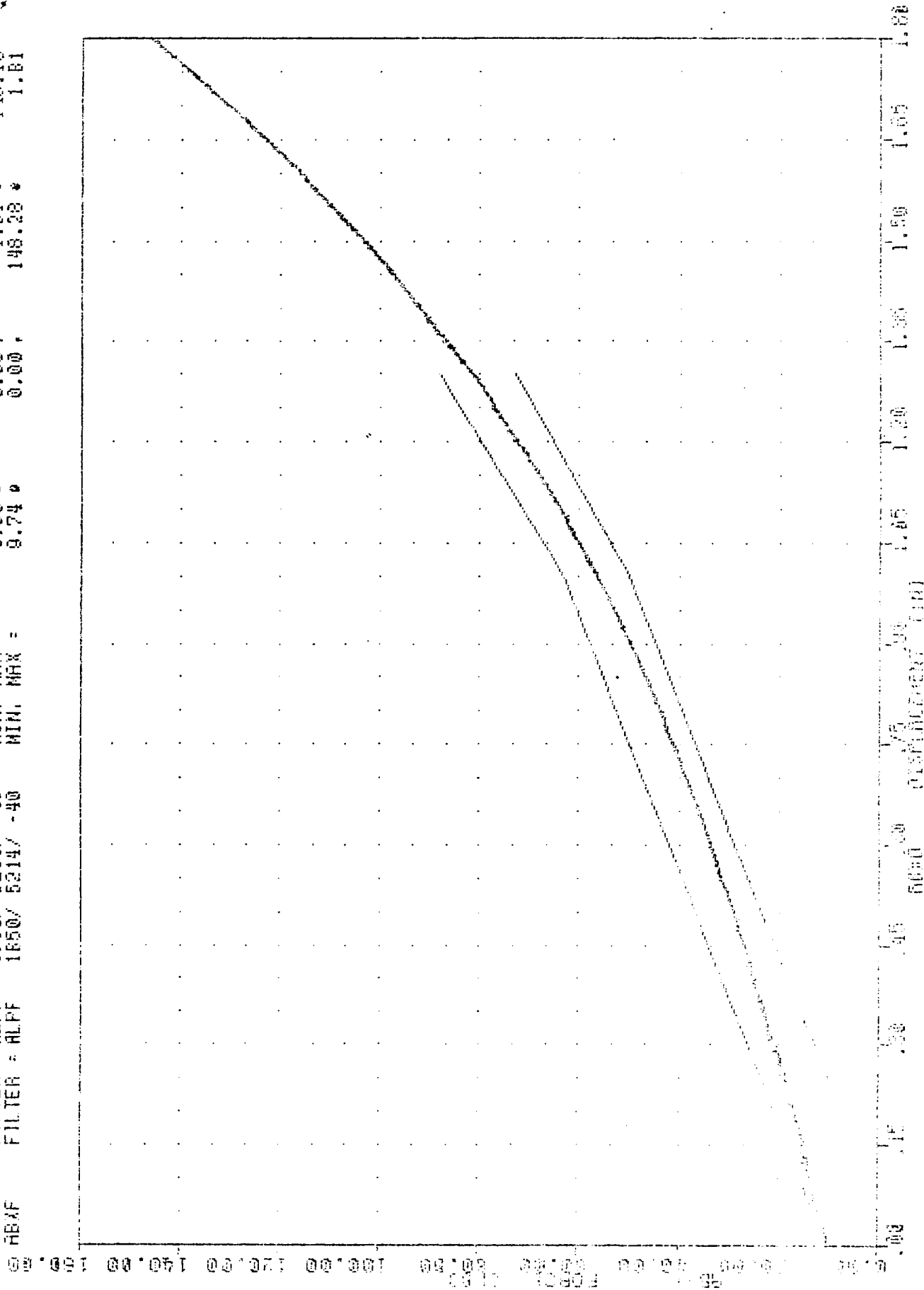
WETC
H840
H84F

RE3011
FILTER = ALPF
FILTER = ALPF

522 501 830 H800M CONFR CAL 11
1650/ 5214/ -40 MIN. MAX =
1650/ 5214/ -40 MIN. MAX =

82057
0.000
9.740

0.00;
0.00;
1.61
148.23
148.16
1.61



C-35

ADDITIONAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

28-FEB-86

TEMPERATURE 69 F
LEFT KNEE
VRTC LK83011

RELATIVE HUMIDITY 40 %
572 SN 830 L.KNEE IMP CAL 11

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PROBE VELOCITY	6.76 - 7.04 FT/SEC	6.83 FT/SEC
PEAK KNEE IMPACT FORCE	1850 - 2500 LBS.	1953.27 LBS.
DURATION ABOVE 1000 LBS.	>=1.7 MS.	2.00 MS.

DUMMY MEETS SPECIFICATIONS

TECHNICIAN

Harry L. Phelps

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572

28-FEB-86

TEMPERATURE 69 F
RIGHT KNEE
VRTC RK83011

RELATIVE HUMIDITY 40 %
572 SN 830 R.KNEE IMP CAL 11

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PROBE VELOCITY	6.76 - 7.04 FT/SEC	6.84 FT/SEC
PEAK KNEE IMPACT FORCE	1850 - 2500 LBS.	2234.61 LBS.
DURATION ABOVE 1000 LBS.	>=1.7 MS.	1.96 MS.

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Harry L. Phelps

APPENDIX D

MISCELLANEOUS TEST INFORMATION

INSTRUMENTATION PLACEMENT

Dummy Chest Humanoid 61, in Body Humanoid 61
(MFR) (S/N) (MFR) (S/N)

Mnemonic	Label No.	Location	Orientation (+Sensing)	Serial No.	Mfr/Model
<u>LFMF1</u>	<u>716</u>	Left Femur	Tension	<u>716</u>	<u>2430</u>
<u>RFMF1</u>	<u>718</u>	Right Femur	Tension	<u>718</u>	<u>2430</u>
<u>CSTXG1</u>	<u>14</u>	Chest (X)	Front	<u>AA05</u>	<u>7264</u>
<u>CSTYG1</u>	<u>Z</u>	Chest (Y)	Left	<u>AP62</u>	<u>7264</u>
<u>CSTZG1</u>	<u>C</u>	Chest (Z)	Up	<u>AH65</u>	<u>7264</u>
<u>HEDXG1</u>	<u>13</u>	Head (X)	Front	<u>AJ34</u>	<u>7264</u>
<u>HEDYG1</u>	<u>63</u>	Head (Y)	Left	<u>AH89</u>	<u>7264</u>
<u>HEDZG1</u>	<u>15</u>	Head (Z)	Up	<u>AK29</u>	<u>7264</u>
<u>NEKXF1</u>	<u>FX</u>	Neck (X)	Front	<u>049</u>	<u>186</u>
<u>NEKYM1</u>	<u>MY</u>	Neck (Y)	Forward	<u>049</u>	<u>186</u>
<u>NEKZF1</u>	<u>FZ</u>	Neck (Z)	Up	<u>049</u>	<u>186</u>
<u>KNLLF1</u>	<u>37L</u>	Left Knee	Tension	<u>037</u>	<u>1587</u>
<u>KNLMF1</u>	<u>37R</u>	Left Knee	Tension	<u>037</u>	<u>1587</u>
<u>KNRMF1</u>	<u>36L</u>	Right Knee	Tension	<u>036</u>	<u>1587</u>
<u>KNRLF1</u>	<u>36R</u>	Right Knee	Tension	<u>036</u>	<u>1587</u>
<u>TBLXM1</u>	<u>40X</u>	Left Tibia	Left	<u>040</u>	<u>1583</u>
<u>TBLYM1</u>	<u>40Y</u>	Left Tibia	Rear	<u>040</u>	<u>1583</u>
<u>TBRXM1</u>	<u>39X</u>	Right Tibia	Left	<u>039</u>	<u>1583</u>
<u>TBYM1</u>	<u>39Y</u>	Right Tibia	Rear	<u>039</u>	<u>1583</u>

*With 10 Vdc input (2000 g range).

INSTRUMENTATION PLACEMENT CONTD

Dummy Chest Humanoid 61, in Body Humanoid 61
(MFR) (S/N) (MFR) (S/N)

Mnemonic	Label No.	Location	Orientation (+Sensing)	Serial No.	Mfr/Model
<u>ANLXF1</u>	<u>34Y</u>	Left Ankle	Forward	<u>034</u>	<u>1584</u>
<u>ANLZF1</u>	<u>34Z</u>	Left Ankle	Compression	<u>034</u>	<u>1584</u>
<u>ANLYM1</u>	<u>34X</u>	Left Ankle	Forward	<u>034</u>	<u>1584</u>
<u>ANRXF1</u>	<u>33Y</u>	Right Ankle	Forward	<u>033</u>	<u>1584</u>
<u>ANRZF1</u>	<u>33Z</u>	Right Ankle	Compression	<u>033</u>	<u>1584</u>
<u>ANRYM1</u>	<u>33X</u>	Right Ankle	Forward	<u>033</u>	<u>1584</u>
<u>CSTXD1</u>	<u>CP</u>	Chest		<u>CP2</u>	<u>Bournes</u>
<u>KNLXD1</u>	<u>LP</u>	Left Knee			<u>Carter</u>
<u>KNRXD1</u>	<u>RP</u>	Right Knee			<u>Carter</u>

*With 10 Vdc input (2000 g range).

INSTRUMENTATION PLACEMENT

Dummy Chest Alderson 830, in Body Alderson 830
(MFR) (S/N) (MFR) (S/N)

Mnemonic	Label No.	Location	Orientation (+Sensing)	Serial No.	Mfr/Model
<u>LFMF2</u>	<u>761</u>	Left Femur	Tension	<u>761</u>	<u>2430</u>
<u>RFMF2</u>	<u>36</u>	Right Femur	Tension	<u>036</u>	<u>2430</u>
<u>CSTXG2</u>	<u>8</u>	Chest (X)	Front	<u>AG34</u>	<u>7264</u>
<u>CSTYG2</u>	<u>21</u>	Chest (Y)	Left	<u>AV28</u>	<u>7264</u>
<u>CSTZG2</u>	<u>78</u>	Chest (Z)	Up	<u>AT75</u>	<u>7264</u>
<u>HEDXG2</u>	<u>4</u>	Head (X)	Front	<u>AR20</u>	<u>7264</u>
<u>HEDYG2</u>	<u>15</u>	Head (Y)	Left	<u>AK96</u>	<u>7264</u>
<u>HEDZG2</u>	<u>80</u>	Head (Z)	Up	<u>AK86</u>	<u>7264</u>

*With 10 Vdc input (2000 g range).

VEHICLE ACCELEROMETER INFORMATION

<u>MNEMONIC</u>	<u>DESCRIPTION</u>	<u>SERIAL NO.</u>	<u>MODEL</u>
LPBXG	LEFT B-PILLAR X-AXIS	AN47	7264
LPBZG	LEFT B-PILLAR Z-AXIS	AS33	7264
RPBXG	RIGHT B-PILLAR X-AXIS	BB60	7264
RPBZG	RIGHT B-PILLAR Z-AXIS	AJ32	7264
VCGXG	VEHICLE C.G. X-AXIS	AY80	7264
VCYG	VEHICLE C.G. Y-AXIS	AL17	7264
VCZG	VEHICLE C.G. Z-AXIS	AS71	7264

CAMERA INFORMATION

CAMERA IDENTIFICATION

TIME ZERO ON HIGH SPEED FILM

Photosonics

Circular timing pulses on one side, vertical event bar on other side.

Back 4 frames from frame where vertical event bar stops.

Hycam

Square shaped timing pulses on one side, vertical event bar on other side.

Back 5 frames from frame where vertical event bar stops.

Stalex

Square shaped timing pulses on one side, vertical event bar on other side.

Back 2 frames from frame where vertical event bar stops.

SIGN CONVENTION

Sign convention for neck load cells and transducers.

Compression (-) on femur load cells.

Neck Transducer Notation

3 channel neck transducer

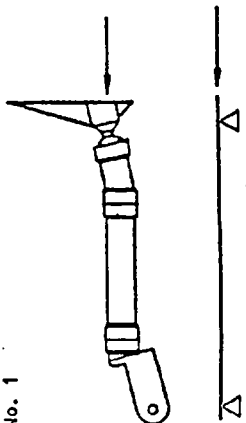
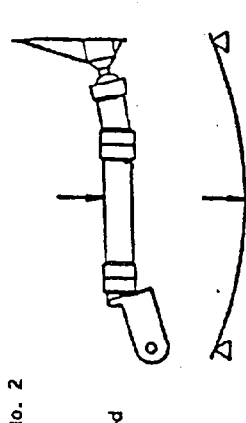
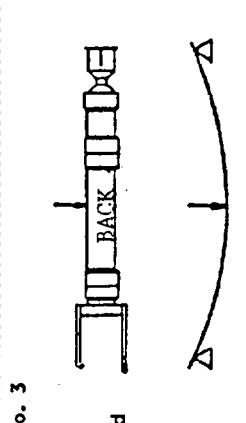
F_x (shear force)	(+) head translating forward
	(-) head translating rearward
F_z (axial force)	(+) tension on neck
	(-) compression on neck
M_y (moment)	(+) forward rotation about neck (chin to thorax, flexion)
	(-) rearward rotation about neck (back of head to spine, extension)

All accelerations in dummies or vehicle are to follow right hand rule.

(+) Forward	X
(+) Left	Y
(+) Up	Z

TABLE

LOWER LEG WIRING SIGNAL POLARITIES

S/N \ AXIS	MNEUMONIC	SIGNAL POLARITY		FORCE APPLIED	LOADING DIAGRAMS	
		L. LEG OUTPUT	ANALOG OUTPUT			
37 / L	KNLLF	Negative	Negative	See Figure No. 1		
37 / R	KNLMF	Negative	Negative	Positive z		
36 / R	KNRLF	Negative	Negative	(compression)		
36 / L	KNRMF	Negative	Negative			
34 / z	ANLZF	Negative	Positive			
33 / z	ANRZF	Negative	Positive			
40 / y	TBLYM	Negative	Negative	See Figure No. 2		
39 / y	TBRYM	Negative	Negative	Negative x		
34 / y	ANLXF	Positive	Positive	(Rearward)		
33 / y	ANRXF	Positive	Positive			
34 / x	ANLYM	Negative	Positive			
33 / x	ANRYM	Negative	Positive			
40 / x	TBLXM	Negative	Negative	See Figure No. 3		
39 / x	TBRXM	Negative	Negative	Right to Left Positive y		

FILTERING DATA
J211 SAE

Vehicle structural accelerations Class 60

Occupant

Head Accelerometer Class 1000

Chest Accelerometer Class 180

Chest Deflection Class 180

Femur Force Class 600

Pelvis Accelerometer Class 180

Lower Leg Class 600

HYBRID III SEATING PROCEDURE

VRTC RECOMMENDED

Each Hybrid III test dummy is clothed in formfitting cotton stretch garments with short sleeves and midcalf pants. Each foot of the dummy is equipped with a six 11EE shoe.

Position the Hybrid III dummy in each front outboard seating position of a vehicle as specified below.

Head:

The transverse instrumentation platform of the head shall be horizontal within 1/2 degree.

Arms:

The driver's upper arms shall be adjacent to the torso with the centerline as close to a vertical plane as possible.

The passenger's upper arms shall be in contact with the seat back and the sides of torso.

Hands:

The palms of the driver test dummy shall be in contact with the outer part of the steering wheel rim at the rim's horizontal centerline. The thumbs shall be over the steering wheel rim and attached with adhesive tape to provide a breakaway force of between 2 to 5 pounds for the driver.

The palms of the passenger test dummy shall be in contact with outside of thigh. The little finger shall be in contact with the seat cushion.

Torso:

In vehicles equipped with bench seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver dummy shall be vertical and parallel to the vehicle's longitudinal centerline, and pass through the center of the steering wheel rim.

In vehicles equipped with bucket seats, the upper torso of the driver and passenger test dummies shall rest against the seat back. The midsagittal plane of the driver and the passenger dummy shall be vertical and shall coincide with the longitudinal centerline of the bucket seat. The midsagittal plane of the passenger dummy shall be the same distance from the vehicle's longitudinal centerline as the midsagittal plane of the driver dummy.

Lower Torso:

H-point:

The H-point of the driver and passenger dummies shall coincide within 1/2 inch in the vertical dimension and 1/2 inch in the horizontal dimension of a point 1/4 inch below the position of the H-point using the equipment and procedures specified in SAE J826 (Apr 80) except that the lower leg and thigh segments of the H-point machine shall be adjusted to 16.3 and 15.8 inches, respectively, instead of the 50th percentile values specified in Table 1 of SAE J826.

Pelvic angle:

As determined using the pelvic angle gage (GM drawing 78051-532 incorporated by reference in Part 572, Subpart E of this chapter) which is inserted into the H-point gaging hole of the dummy, the angle measured from the horizontal on the 3 inch flat surface of the gage shall be 22 1/2 degrees plus or minus 2 1/2 degrees.

Legs:

The upper legs of the driver and passenger test dummies shall rest against the seat cushion to the extent permitted by placement of the feet. The initial distance between the outboard knee clevis flange surfaces shall be 10.6 inches. To the extent practicable, the left leg of the driver dummy and both legs of the passenger dummy shall be in vertical longitudinal planes. Final adjustment to accommodate placement of feet in accordance with S10.6 for various passenger compartment configurations is permitted.

Feet:

The right foot of the driver test dummy shall rest on the undepressed accelerator with the rearmost point of the heel on the floor surface in the plane of the pedal. If the foot cannot be placed on the accelerator pedal, it shall be positioned perpendicular to the tibia and placed as far forward as possible in the direction of the geometric centerline of the pedal with the rearmost point of the heel resting on the floor surface. The heel of the left foot shall be placed as far forward as possible and shall rest on the floor surface. The left foot shall be as flat as

possible on the floor surface. The longitudinal centerline of the left foot shall be placed as parallel as possible to the longitudinal centerline of the vehicle.

The heels of both feet of the passenger test dummy shall be placed as far forward as possible and shall rest on the floor surface. Both feet shall be flat as possible on the floor surface. The longitudinal centerline of the feet shall be placed as parallel as possible from the longitudinal centerline of the vehicle.