

4014675

AIR BAG DEMONSTRATION TEST

1982 FORD LTD INTO A FIXED
BARRIER AT 35.4 MPH

PREPARED BY:
VEHICLE RESEARCH AND TEST CENTER
ST. RT. 33 LOGAN COUNTY
EAST LIBERTY, OHIO 43319



FINAL REPORT
JANUARY 1984

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Prepared By: John C. Stultz
J. C. Stultz
Project Engineer
Transportation Research Center of Ohio

Approved By: Richard W. Runyon
R. W. Runyon
Project Manager
Transportation Research Center of Ohio

Report Accepted By: Andrew G. Detrick
A. G. Detrick
Vehicle Research & Test Center

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16. Abstract This test report documents an air bag demonstration crash test. Testing was conducted on a 1982 Ford LTD 4-door Sedan at the TRCO Crash Test Facility, East Liberty, Ohio. The test vehicle was impacted into a fixed, non-yielding barrier at 35.4 mph. The test vehicle was retrofitted with a Romeo Kojyo air bag and knee restraint. Occupant responses relative to FMVSS 208 were measured along with vehicle accelerations and air bag electronics. The test date was December 8, 1983 and the ambient temperature was 72°F.			
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
in	inches	2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
AREA				
in ²	square inches	6.5	square centimeters	cm ²
ft ²	square feet	0.09	square meters	m ²
yd ²	square yards	0.8	square meters	m ²
mi ²	square miles	2.6	square kilometers	km ²
acres	acres	0.4	hectares	ha
MASS (weight)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons	0.9	metric ton	t
	(2000 lb)			
VOLUME				
tsp	teaspoons	5	milliliters	ml.
Tbsp	tablespoons	15	milliliters	ml.
in ³	cubic inches	16	milliliters	ml.
fl oz	fluid ounces	30	milliliters	ml.
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.8	liters	L
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius	°C

Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
LENGTH				
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
AREA				
cm ²	square centimeters	0.16	square inches	in ²
m ²	square meters	1.2	square yards	yd ²
km ²	square kilometers	0.4	square miles	mi ²
ha	hectares	2.5	acres	
	(10 000 m ²)			
MASS (weight)				
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton	1.1	short tons	
	(1000 kg)			
VOLUME				
ml	milliliters	0.03	fluid ounces	fl oz
ml	milliliters	0.06	cubic inches	in ³
L	liters	2.1	pints	pt
L	liters	1.06	quarts	qt
L	liters	0.26	gallons	gal
m ³	cubic meters	35	cubic feet	ft ³
m ³	cubic meters	1.3	cubic yards	yd ³
TEMPERATURE (exact)				
°C	degrees Celsius	9/5 (then add 32)	degrees Fahrenheit	°F

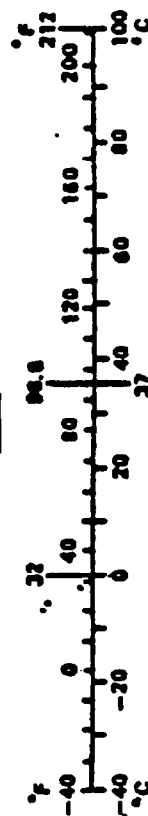


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SECTION 1.0
PURPOSE AND INTRODUCTION

PURPOSE

The purpose of this crash test was to demonstrate the effectiveness of a Romeo Kojyo air bag and knee restraint retrofitted in an otherwise unmodified vehicle. The vehicle was tested using conditions in excess of those currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A 1982 Ford LTD 4-door Sedan which was supplied by the Ohio State Highway Patrol was towed into a fixed rigid barrier on December 8, 1983. The test was conducted to demonstrate the effectiveness of a Romeo Kojyo air bag and knee restraint used in conjunction with the vehicle's production 3-point belt restraint. The intended test speed was 35.7 mph and the actual test speed was 35.4 mph.

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains data required by R & D. Appendix A contain pre-test and post-test vehicle and dummy photographs. Appendix B contains Data Plots. Appendix C contains Dummy Certification Data.

SECTION 2.0
GENERAL TEST AND VEHICLE PARAMETER DATA

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

TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Ford Motor Company of Canada Ltd.

MAKE/MODEL: Ford LTD

VIN: 2FABP31G2CB159225

BODY STYLE: 4-Door Sedan

MODEL YEAR: 1982

NHTSA NO.: R & D

COLOR: Grey

ENGINE DATA: TYPE: V8 CYLINDERS: 8 DISPLACEMENT 5.8 Liters

TRANSMISSION DATA: Automatic Overdrive

DATE VEHICLE RECEIVED: 11/19/83

ODOMETER READING: 84015

DEALER'S NAME AND ADDRESS: NA

ACCESSORIES:

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

REMARKS:

1. IS THE VEHICLE STOCK THROUGHOUT? No; contains Police Package
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: Ford Motor Company of Canada Ltd.

DATE OF MANUFACTURE: 3/82

GVWR: 5346 LBS.,

GAWR: FRONT 2680 LBS., REAR 2716 LBS.

VEHICLE TIRE DATA

RECOMMENDED COLD TIRE PRESSURE: FRONT 32 psi; REAR 32 psi

TIRES ON VEHICLE (MFGR. & LINE, SIZE): LF - Goodyear Blue Streak Radial
P225/70R15
Others - B.F. Goodrich Lifesaver
Pursuit Radial P225/70R15

BIAS PLY, BELTED, OR RADIAL: Radial

PLY RATING: 6

IS SPARE TIRE "SPACE SAVER"? No

IS SPARE TIRE STANDARD EQUIPMENT? Yes

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

RIGHT FRONT	1180	LBS.	RIGHT REAR	850	LBS.
LEFT FRONT	1100	LBS.	LEFT REAR	920	LBS.
TOTAL FRONT WEIGHT	2280	LBS.	(56.3 % OF TOTAL VEHICLE WEIGHT)		
TOTAL REAR WEIGHT	1770	LBS.	(43.7 % OF TOTAL VEHICLE WEIGHT)		
TOTAL DELIVERED WEIGHT	4050	LBS.			

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	RF 28 13/16	;LF 28 3/8	;RR 28 3/8	;LR 27 3/4
PRE-TEST ATTITUDE:	RF 28 3/8	;LF 27 15/16	;RR 27 3/16	;LR 26 15/16
POST-TEST ATTITUDE:	RF 34	;LF 31 5/8	;RR 27 11/16	;LR 26 7/8

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 191 LBS. CARGO:

RIGHT FRONT	1230	LBS.	RIGHT REAR	1005	LBS.
LEFT FRONT	1130	LBS.	LEFT REAR	1040	LBS.
TOTAL FRONT WEIGHT	2360	LBS.	(53.6 % OF TOTAL VEHICLE WEIGHT)		
TOTAL REAR WEIGHT	2045	LBS.	(46.4 % OF TOTAL VEHICLE WEIGHT)		
TOTAL TEST WEIGHT	4405	LBS.			

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 25 LBS.

TEST FLUID DATA

TEST FLUID TYPE: RED STODDARD SOLVENT #2; SPEC. GRAVITY: 0.764
KINEMATIC VISCOSITY: 0.99 CENTISTOKES
"USEABLE" CAPACITY*: 20.95 GALLONS
TEST VOLUME: 19.5 GALLONS (92-94% OF USEABLE)
FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 20.0 GALLONS
DETAILS OF FUEL SYSTEM: DNA

ELECTRIC FUEL PUMP: No FUEL INJECTION: No
DOES ELECTRIC FUEL PUMP OPERATE WITH IGNITION SWITCH "ON" AND THE ENGINE NOT OPERATING?

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES)

OVERALL LENGTH OF TEST VEHICLE: PRE-TEST: R 206 1/16 ;L 205 3/4
POST-TEST: R 182 ;L 182 13/16
TOTAL CRUSH: R 24 1/16 ;L 22 15/16
FOR FRONTAL IMPACTS, DISTANCE FROM FRONT OF TEST VEHICLE TO BARRIER AFTER
IMPACT: CENTER: 16 3/16 ;R 16 1/2 ;L 16 9/16

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

VEHICLE LOAD (UP TO CAPACITY): FRONT 32 psi; REAR 32 psi
RECOMMENDED TIRE SIZE: P225/70R15 LOAD RANGE X B, C,

VEHICLE CAPACITY: TYPES OF SEATS: Bench

NUMBER OF OCCUPANTS (DESIGNATED SEATING CAPACITY): 3 FRONT
 3 REAR
CARGO LOAD 200 LBS. 6 TOTAL
TOTAL 1100 LBS.

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

TEST CONDITIONS

TEST NUMBER: 831208

DATE OF TEST: 12/08/83

TIME OF TEST: 14:00

WIND VELOCITY: DNA

HUMIDITY: DNA

AMBIENT TEMPERATURE AT IMPACT AREA:

72°F

TEMPERATURE IN OCCUPANT COMPARTMENT:

76°F

SUBJECT VEHICLE DATA

	<u>ACTUAL</u>	<u>INTENDED</u>
TEST WEIGHT (LBS.)	4405	4414
VEHICLE ORIENTATION (DEGREES)	0	0
VEHICLE VELOCITY (mph)	35.4	35.7

DUMMIES

	<u>DRIVER</u>	<u>MIDDLE PASSENGER</u>	<u>RT. FRONT PASSENGER</u>	<u>LEFT REAR PASSENGER</u>	<u>RT. REAR PASSENGER</u>
TYPE:	572				
SERIAL NO.:	175				
INSTRUMENTATION:					
HEAD ACCEL.:	Yes				
CHEST ACCEL.:	Yes				
FEMUR L.C.'S:	Yes				
OTHER:					

RESTRAINT SYSTEM: 3-Point Belt

REMARKS: A Romeo Kojyo Airbag and Knee Bar were retrofitted for this test.

VISIBLE DUMMY CONTACT POINTS:

	DRIVER	PASSENGER
Head	<u>Air Bag</u>	<u>DNA</u>
Chest	<u>Air Bag</u>	<u>DNA</u>
Abdomen	<u>N/A</u>	<u>DNA</u>
Left Knee	<u>Knee Bar</u>	<u>DNA</u>
Right Knee	<u>Knee Bar</u>	<u>DNA</u>

DOOR OPENING:

	LEFT	RIGHT
Front	<u>Easy</u>	<u>Easy</u>
Rear	<u>Easy</u>	<u>Easy</u>

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
Front	<u>No</u>	<u>No</u>
Rear	<u>DNA</u>	<u>DNA</u>

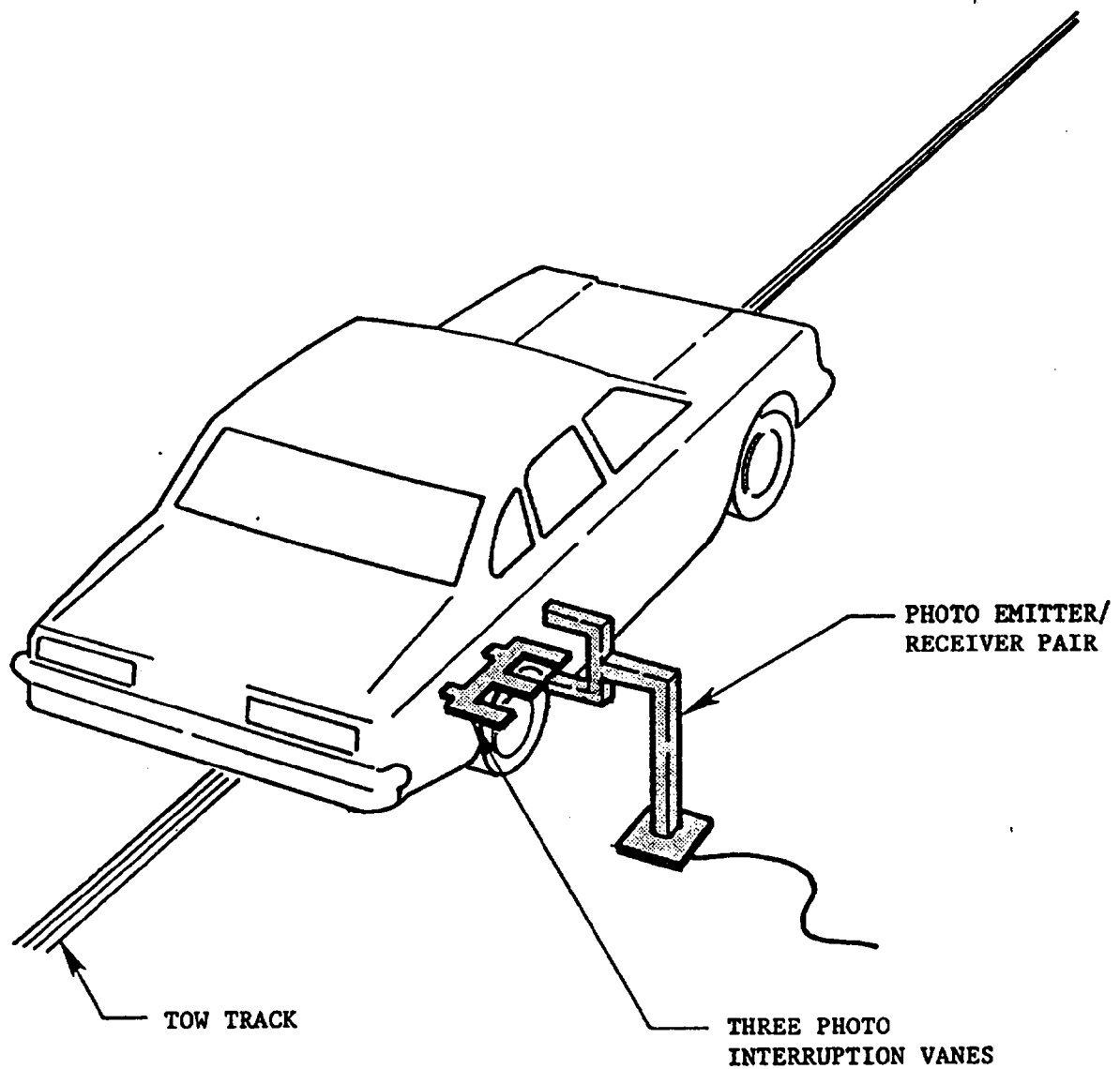
GLAZING DAMAGE:

Windshield cracked; no other damage.

OTHER NOTABLE IMPACT EFFECTS:

Steering column stroked 1 5/8 inches.

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane is located two inches before impact.

The vanes have one foot spacing.

VEHICLE TEST WEIGHT CALCULATION

Test Weight = Unloaded Delivered Weight +
 Number of Dummies X 164 lbs. +
 Cargo Weight
= 4050 + 1 X 164 + 200 lbs.
= 4414 lbs.

To achieve test weight, 25 pounds of sand ballast was added in the trunk.
The weight of the test vehicle was measured by placing each wheel on a
Loadmeter Corporation Hiway Loadometer.

TEST ANOMALIES

Cable separation occurred in the following data channels:

FFCXG1 Front Frame Crossmember Accel. #1 - X Axis

FFCYG2 Front Frame Crossmember Accel. #2 - Y Axis

The separation in data channel FFCXG1 occurred sufficiently late into the crash test that a peak deceleration is reported but no peak acceleration is reported. No peak levels in data channel FFCYG2 are reported.

SECTION 3.0
DATA REQUIRED BY R&D

The following pages are included in this section:

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

DUMMY TEMPERATURE CONTROL AND POSITIONING

The vehicle was kept inside the temperature controlled crash test building until approximately 30 minutes prior to the test. Temperature inside the vehicle and ambient temperature in the crash building were recorded. Dummy temperature while outside the crash test building was maintained portably until approximately 1 minute prior to the test.

The following table summarizes the steps taken to position the instrumented, calibrated dummy in the test vehicle.

DUMMY PLACEMENT AND POSITIONING

PART 572

DUMMY

DRIVER DSP*

HEAD	Surface of transverse instrument mounting platform is horizontal & midsagittal plane falls in longitudinal plane.
UPPER TORSO	Placed against seat back. Midsagittal plane is vertical & is centered behind the steering column.
UPPER ARMS	Initially placed against seat back & tangent to side of upper torso. Push arms rearward into seat back with bending at elbows.
LOWER ARMS	Initially placed against the outside of the thighs. Centerline as close as possible in a vertical plane.
HAND PALMS	Palms contact outer part of steering wheel rim at horizontal centerline.
HAND THUMBS	Placed over steering wheel rim.
HAND LITTLE FINGERS	
LOWER TORSO	Placed against seat back. Midsagittal plane is vertical & is centered behind the steering column.
UPPER LEGS (thighs or femurs)	Placed against seat cushion. Plane defined by femur and tibia centerlines is as close as possible to vertical.
RIGHT KNEE	Knees initially set 14.5" apart between pivot bolt head outer surfaces.

PASSENGER DSP

Surface of transverse instrument mounting platform is horizontal & midsagittal plane falls in longitudinal plane.
Placed against seat back. Midsagittal plane is vertical, & symmetrical with respect to the driver dummy.
Initially placed against seat back & tangent to side of upper torso. Push arms rearward into seat back with bending at elbows. Remains tangent.
Initially placed against the outside of the thighs. Centerline as close as possible in a vertical plane.
Palms contact the outsides of the thighs.
Barely in contact with the seat cushion.
Placed against seat back. Midsagittal plane is vertical & symmetrical with respect to the driver dummy.
Placed against seat cushion. Plane defined by femur and tibia centerlines is as close as possible to vertical.
Located so that plane defined by femur and tibia centerlines is as close as possible to vertical.

*Only a Driver Dummy was utilized in this test.

DUMMY PLACEMENT AND POSITIONING (CONTINUED)

PART 572
DUMMY

DRIVER DSP*

PASSENGER DSP

LEFT KNEE	Outer surface of pivot bolt head is 5.9" from midsagittal plane of dummy.	Located as above.
LOWER LEGS	Plane defined by femur and tibia centerlines is as close as possible to vertical longitudinal plane.	Plane defined by femur and tibia centerlines is as close as possible to vertical longitudinal plane.
RIGHT FOOT	Placed on undepressed accelerometer pedal -- rearmost point of heel on floorpan in plane of pedal.	Centerline falls in vertical longitudinal plane. Placed on toeboard -- rearmost point of heel on floorpan as close as possible to intersection of toeboard and floorpan.
LEFT FOOT	Placed on toeboard -- rearmost point of heel on floorpan as close as possible to intersection of toeboard and floorpan. Centerline falls in vertical longitudinal plane.	Centerline falls in vertical longitudinal plane. Placed on toeboard -- rearmost point of heel on floorpan as close as possible to intersection of toeboard and floorpan.

*Only a Driver Dummy was utilized in this test.

RECORDING SHEET

MFR./MAKE/MODEL: Ford LTD

ADJUSTER TYPE: X Manual
 Power

TECHNICIANS :

2. N. Echeverria

3.

4.



Head 21 7/8"

Target 3°

Knee 23 13/16"

Joint 95°

Approx. 8 7/8"

"H"

Point 129 •

PASSENGER DUMMY # DNA

Head

Target

Knee

Joint

Approx.

"H"

Point

OVERALL

55 3/4"

DNA

DNA

13 7/16"

Door Glass
Height* 12 1/2"

Lateral Bar

Adjustable Pointer—

Left
Front
Door

Driver
Dummy #
175

Center
Dummy #

Passenger
Dummy#

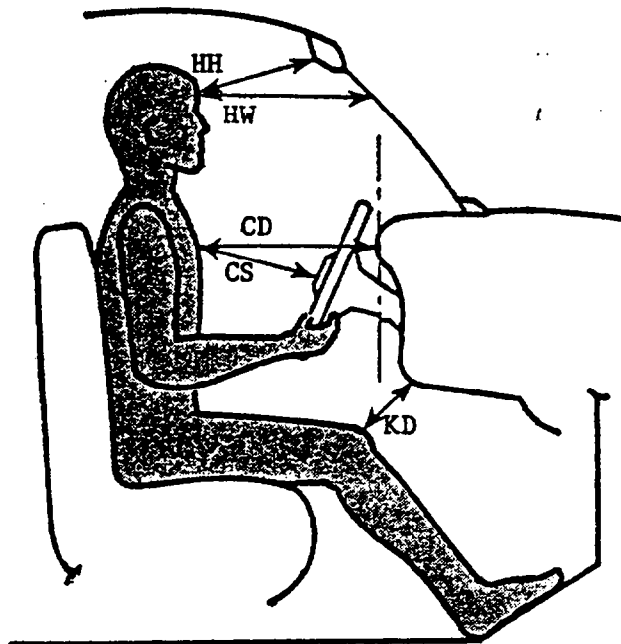
Right
Front
Door

-Door Glass
Height*
12 1/2"

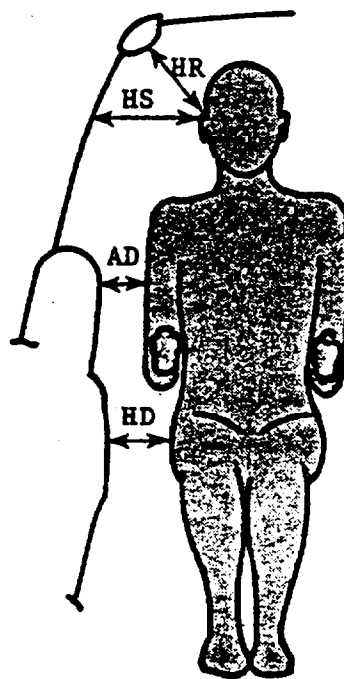
* Door glass height is equal on the right and left side of vehicle.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

	DRIVER	PASSENGER
	175	DNA
HH	14 1/2	
HW	19 7/16	
CD	22 5/16	
CS	11 5/8	
KDL	6 3/4	
KDR	6 9/16	

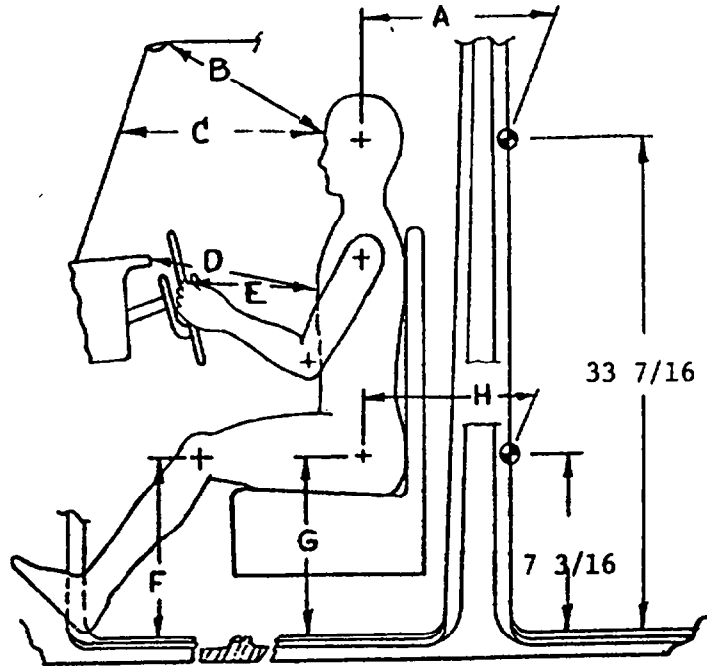
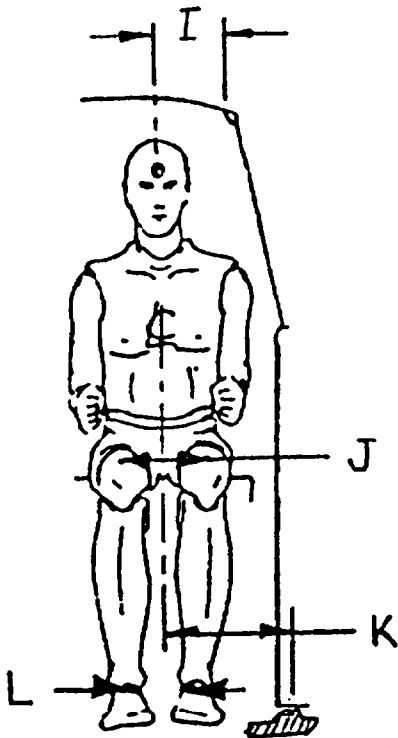


	DRIVER	PASSENGER
	175	DNA
HR	6 3/4	
HS	10 3/4	
AD	6	
HD	8 1/16	



ALL MEASUREMENTS IN INCHES

DUMMY IN-VEHICLE POSITION RECORDING SHEET



$$A = 6 \frac{5}{8}$$

$$B = 14 \frac{1}{2}$$

$$C = 19 \frac{7}{16}$$

$$D = 22 \frac{5}{16}$$

$$E = 11 \frac{5}{8}$$

$$F = 9 \frac{3}{8}$$

$$G = 7 \frac{3}{16}$$

$$H = 10 \frac{3}{4}$$

$$I = 8 \frac{13}{16}$$

$$J = 9 \frac{3}{8}$$

$$K = 14 \frac{3}{4}$$

SEAT POSITION - Mid Position

PRE-TEST TILT POSITION - Second Stop From Lowest Part

HEAD REST POSITION - Fully Extended

ALL MEASUREMENTS IN INCHES .

DUMMY KINEMATIC SUMMARY

DRIVER

During impact, the dummy rotated forward until the face and upper torso contacted the air bag. The knees were forced upward and forward and both struck the knee bar. The dummy rebounded from the air bag and the head struck the head restraint and the top of the seat back. The dummy came to rest setting upright and facing forward.

PART 572 DUMMY DATA SUMMARY

	DRIVER DUMMY			
	POSITIVE DIRECTIONS*		NEGATIVE DIRECTIONS**	
	MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
HEAD ACCELERATION				
LONGITUDINAL	31.19	122.88	58.36	88.38
LATERAL	2.62	27.00	12.31	99.13
VERTICAL	24.16	123.38	51.69	76.00
RESULTANT		74.43 max @	78.25	
HIC		866.32 from	63.13 to	101.00
DELTA V (MPH)		-46.5 @	43.00	
CHEST ACCELERATION				
LONGITUDINAL	11.16	37.00	42.50	75.50
LATERAL	4.57	52.00	13.94	78.13
VERTICAL	19.99	128.13	8.62	67.00
RESULTANT		44.10 max @	75.50	
DELTA V (MPH)		-47.4 @	135.88	
DISPLACEMENT (IN.)	0.89	79.25	0.02	212.25
	MAX (lb)	TIME (msec)	MAX (lb)	TIME (msec)
FEMUR FORCE***				
LEFT	691.85	182.25	672.56	72.75
RIGHT	500.32	182.25	820.02	25.00
SHOULDER BELT FORCE	1187.80	90.13	6.10	201.75

* LONGITUDINAL: FORWARD
 LATERAL: RIGHTWARD
 VERTICAL: DOWNWARD

** LONGITUDINAL: REARWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD

*** COMPRESSION: NEGATIVE

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

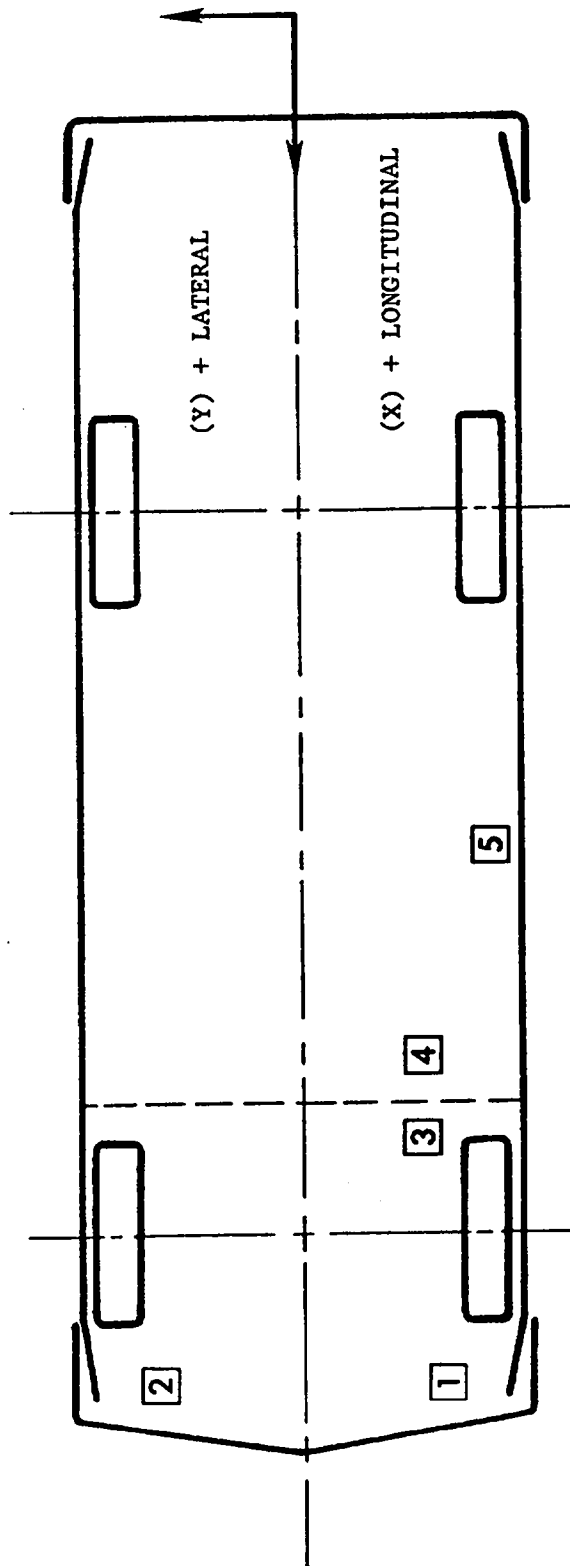
NO.	LOCATION	X*	Y*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
				MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	LEFT FRONT CROSSMEMBER (LONGITUDINAL) (LATERAL)	194.8	-25.4	---	---	164.20	19.38
				14.35	37.88	12.08	23.00
2	RIGHT FRONT CROSSMEMBER (LONGITUDINAL) (LATERAL)	194.1	25.1	27.93	55.50	238.00	20.50
				---	---	---	---
3	LOWER STEERING COLUMN (LONGITUDINAL)	143.3	-6.3	9.74	77.88	78.96	68.63
4	UPPER STEERING COLUMN (LONGITUDINAL)	123.9	-15.0	23.63	76.38	42.06	59.50
5	LEFT B-PILLAR (LONGITUDINAL)	98.4	-26.8	2.62	191.75	31.25	60.63

* REFERENCE: X - REAR BUMPER (+ FORWARD), Y - VEHICLE CENTERLINE (+ TO RIGHT)

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS IN INCHES

Y SEE TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS



IMPACTED VEHICLE MEASUREMENTSVEHICLE NUMBER 225 TEST NUMBER 831208

DIMENSIONS IN INCHES

NO.	TYPE OF MEASUREMENT	PRE-TEST	POST-TEST
X 1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	208 3/4	183 1/2
X 2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	175 5/16	167 1/2
X 3	REAR SURFACE OF VEHICLE TO FIREWALL	149 7/8	146 1/16
X 4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	140	139 5/8
X 5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	139 13/16	140 3/8
X 6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	139 15/16	140
X 7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	139 7/8	139 5/16
X 8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	99 11/16	99 1/2
X 9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	99 9/16	99 5/16
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	98	98 3/16
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	97 15/16	98 9/16
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST OF RIGHT SIDE	139 7/16	139 5/16
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST OF LEFT SIDE	139 3/8	139 7/16
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	151 7/16	149 1/2
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	150 7/8	150 1/8
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	119 3/8	NA*

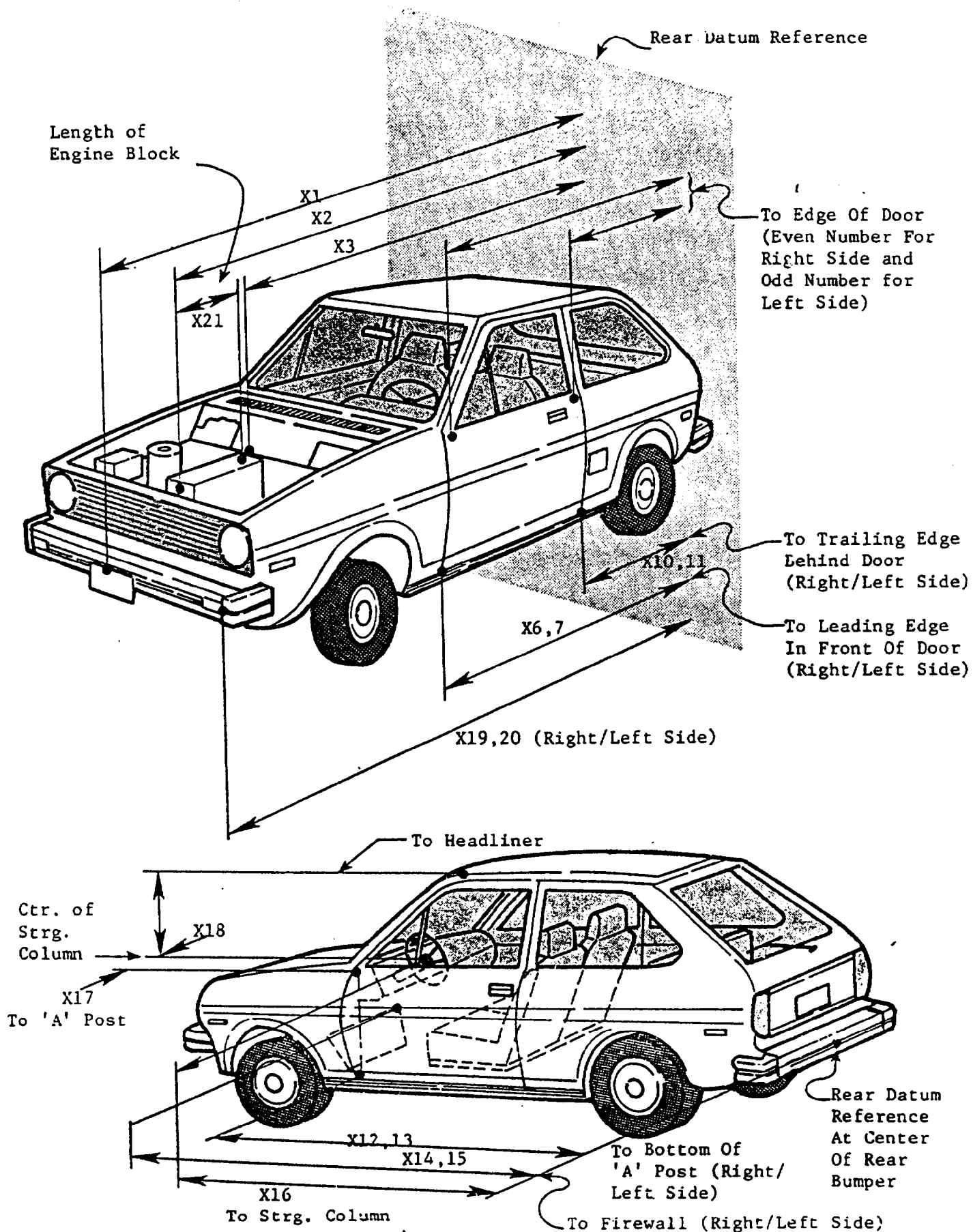
IMPACTED VEHICLE MEASUREMENTSVEHICLE NUMBER 225 TEST NUMBER 831208

DIMENSIONS IN INCHES

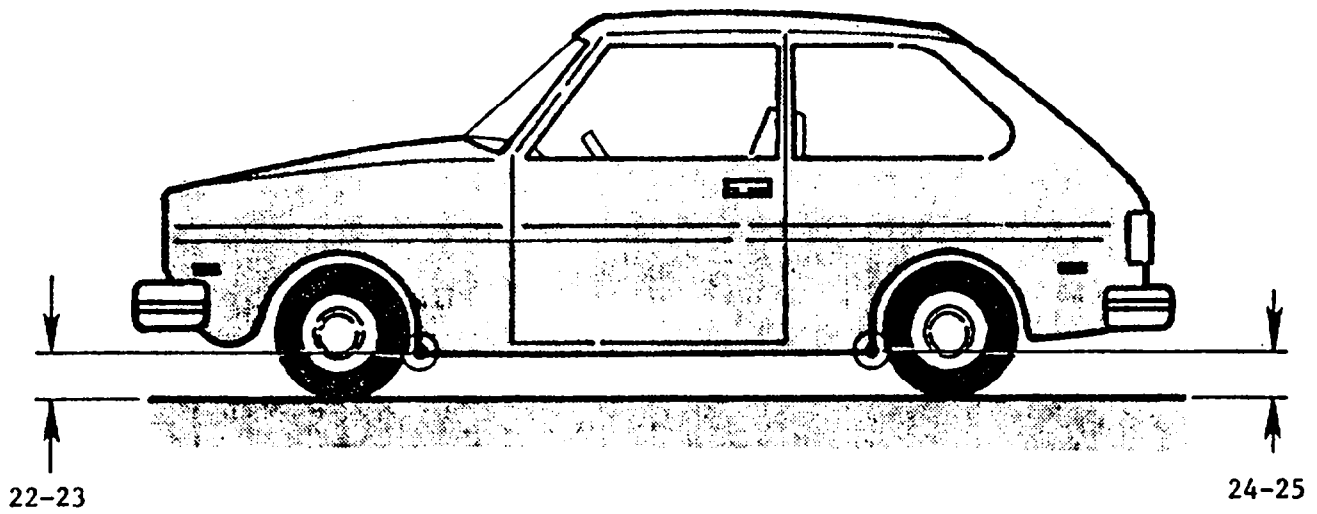
NO.	TYPE OF MEASUREMENT	PRE-TEST	POST-TEST
X17	STEERING COLUMN TO "A" POST	17 13/16	17 3/8
X18	REAR OF WINDSHIELD HEADER TO STEERING WHEEL CENTER	15 3/4	NA*
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	206 1/16	182 1/2
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	205 3/4	183 3/4
X21	LENGTH OF ENGINE BLOCK	20 11/16	20 11/16
X22	RIGHT FRONT SILL TO GROUND PLANE	10 3/8	8 3/4
X23	LEFT FRONT SILL TO GROUND PLANE	10 1/16	7 7/8
X24	RIGHT REAR SILL TO GROUND PLANE	9 3/4	9 1/2
X25	LEFT REAR SILL TO GROUND PLANE	9 11/16	9 1/8

* Measurement not available - air bag deployed

TEST TECHNICIANS J. KokorudaN. EcheverriaTEST ENGINEER J. Stultz



VEHICLE SILL HEIGHT LOCATIONS



HIGH SPEED CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Onboard - overhead	Photosonic 1B	8	812	Occupant Kinematics
2	Onboard - window	Photosonic 1B	8	817	Occupant Kinematics
3	Onboard - floor	Photosonic 1B	8	805	Steering Colum Kinematics
4	Overhead	Photosonic 1B	13	775	Occupant Kinematics
5	Left - 3/4 View	Photosonic 1B	25	850	Occupant Kinematics
6	Left - overall	Photosonic 1B	25	850	Overall View

NOTE: CAMERAS ARE NUMBERED ACCORDING TO SPLICING SEQUENCE OF FILM.
 (24 fps) REAL TIME MOVIE FILM COVERAGE OF PRE-CRASH, POST-CRASH
 AND CRASH EVENT SPLICED AT START AND END OF FILM.



Figure A-1. PRE-TEST FRONT VIEW



Figure A-2. PRE-TEST DRIVER SIDE VIEW

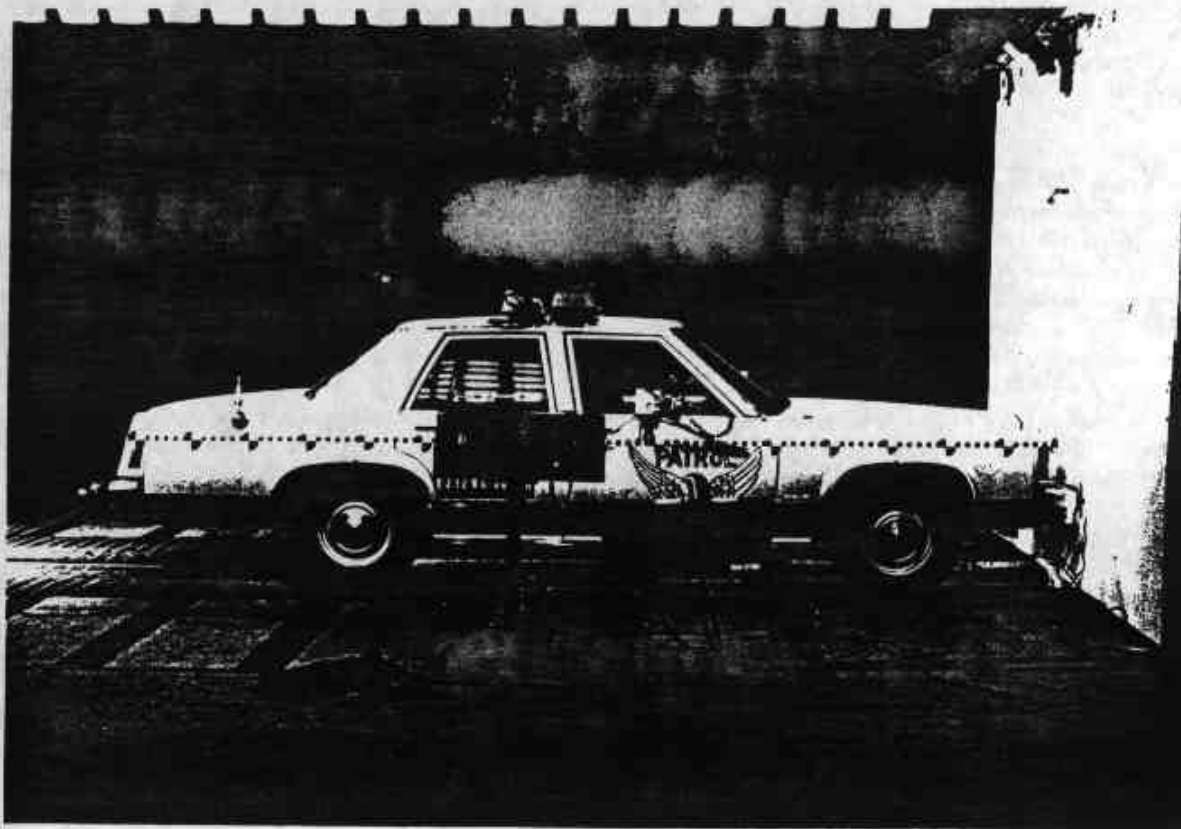


Figure A-3. PRE-TEST PASSENGER SIDE VIEW

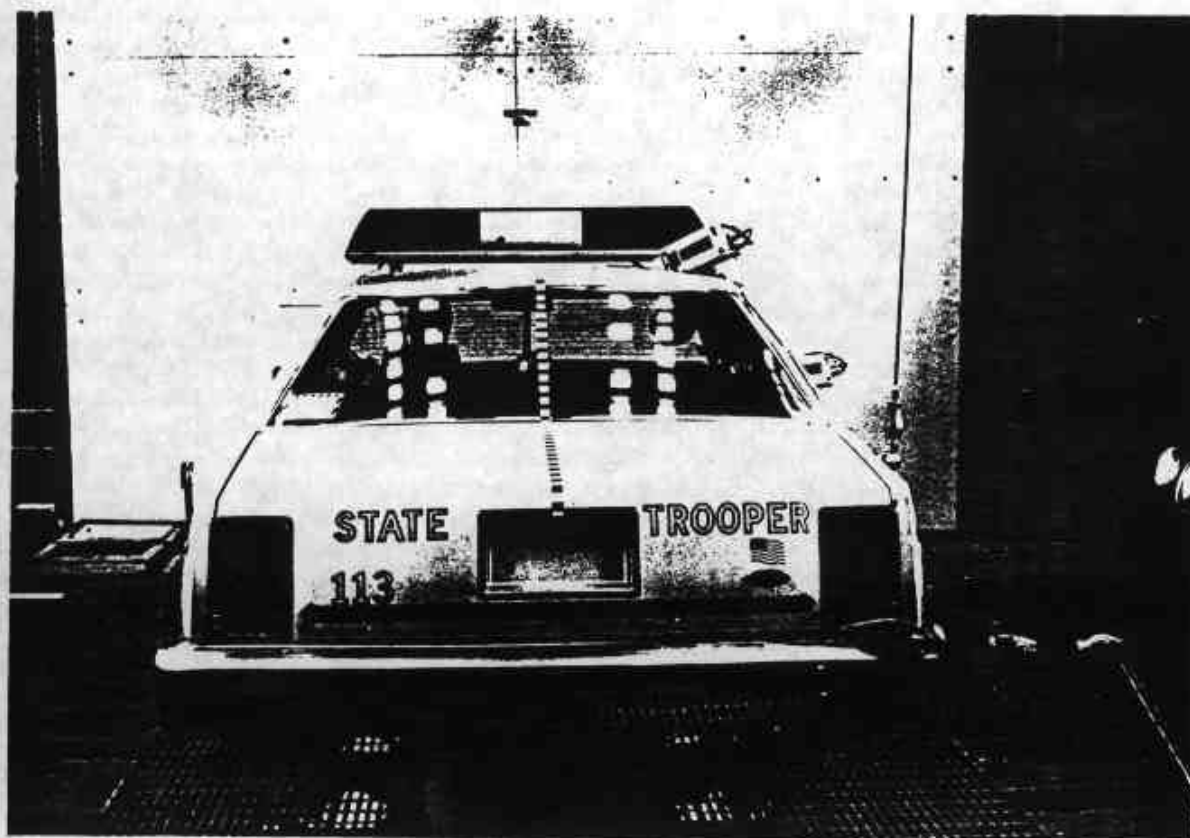


Figure A-4. PRE-TEST REAR VIEW



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

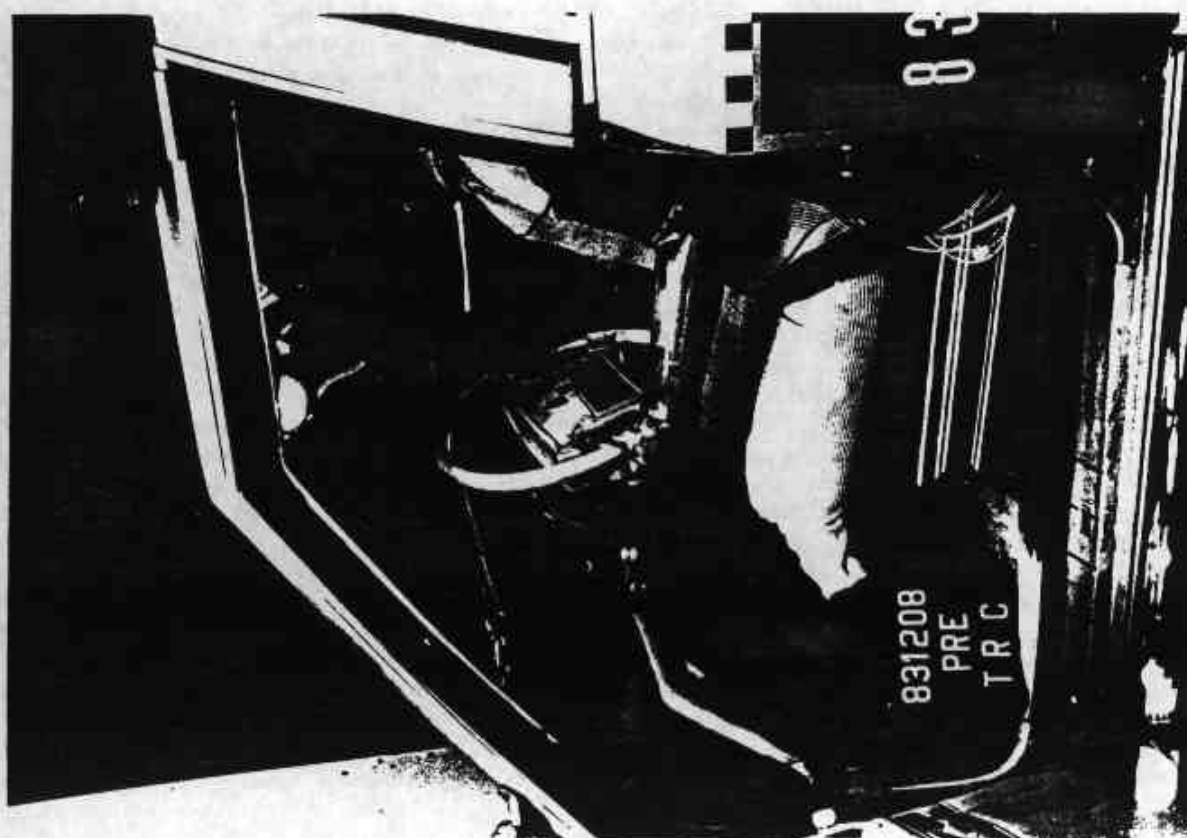


Figure A-6. PRE-TEST DUMMY - VIEW 2

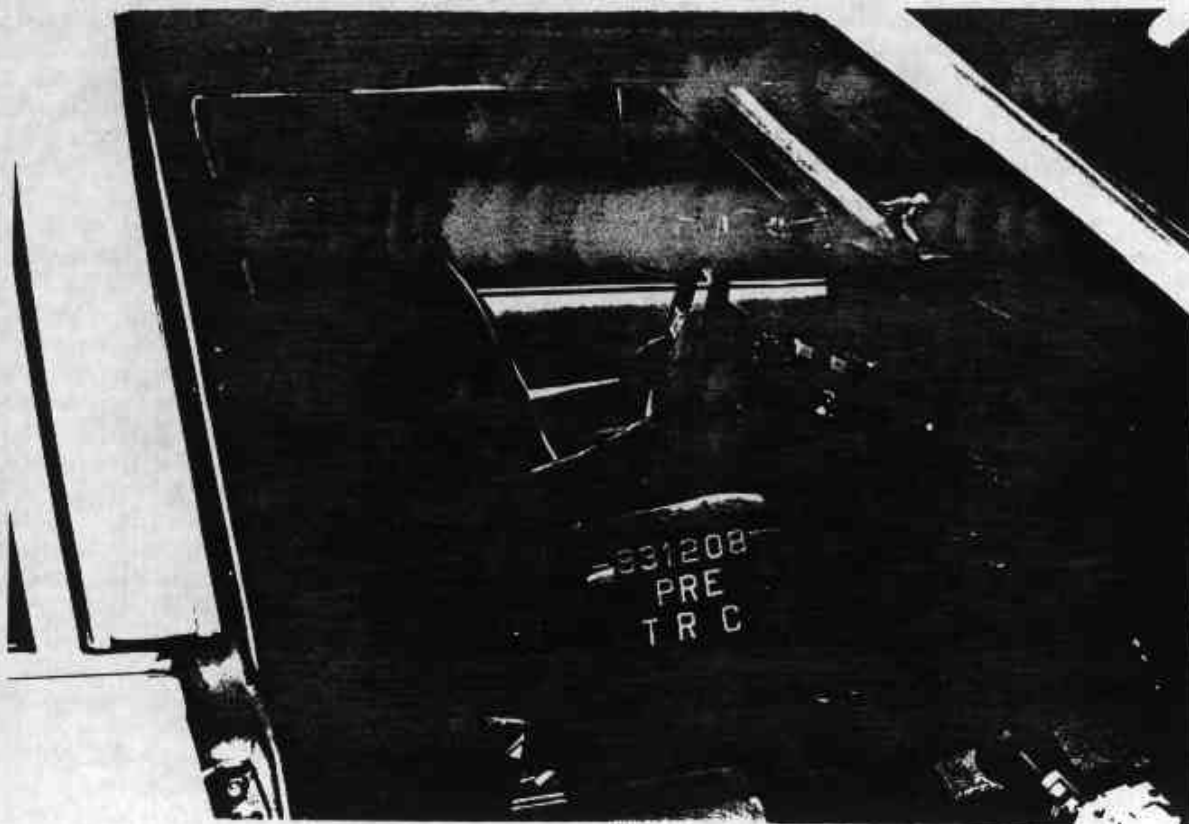


Figure A-7. PRE-TEST DUMMY - VIEW 3

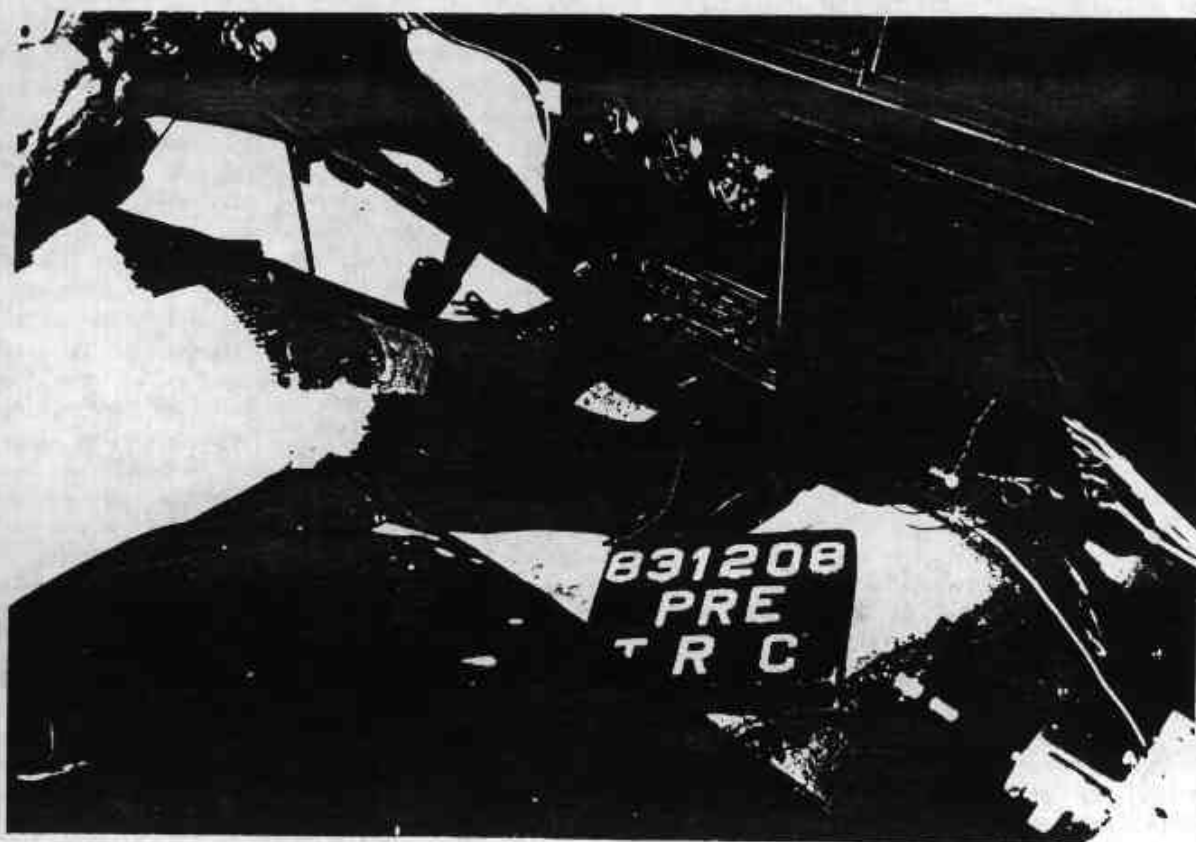


Figure A-8. PRE-TEST DUMMY - VIEW 4

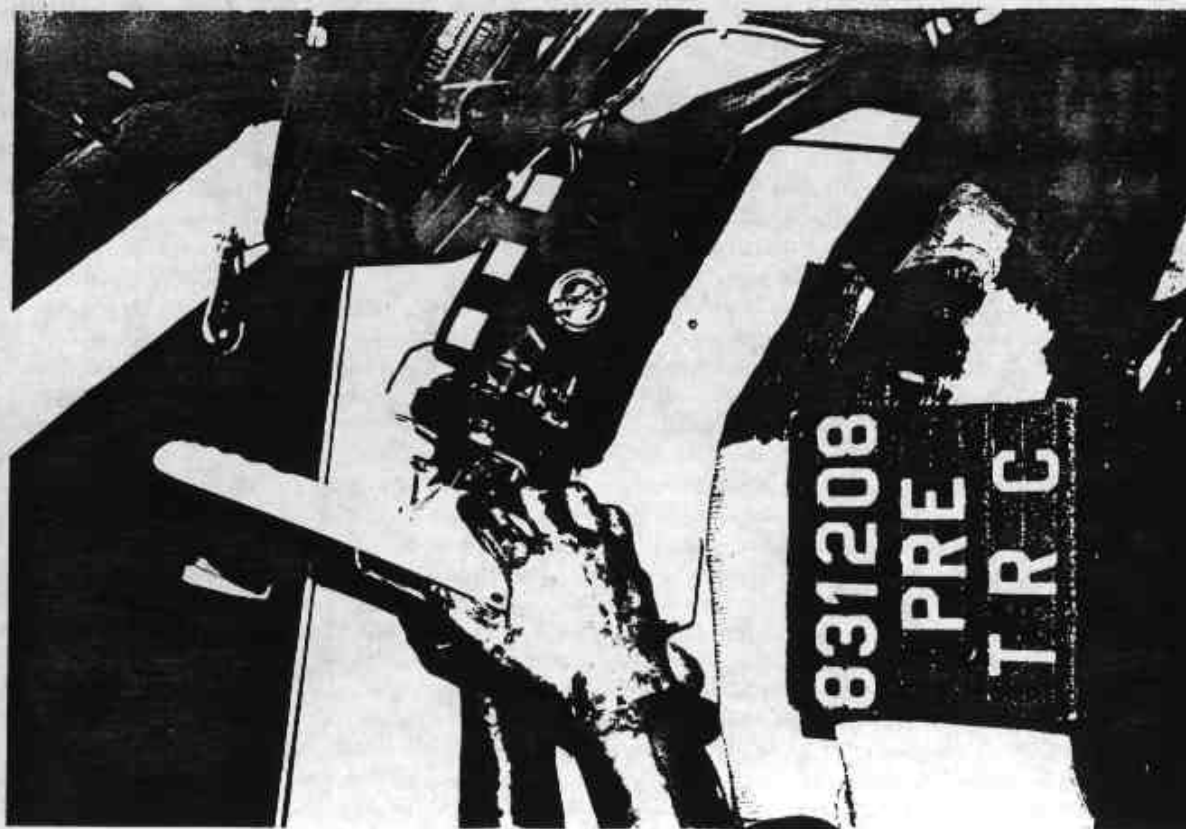


Figure A-9. PRE-TEST STEERING COLUMN

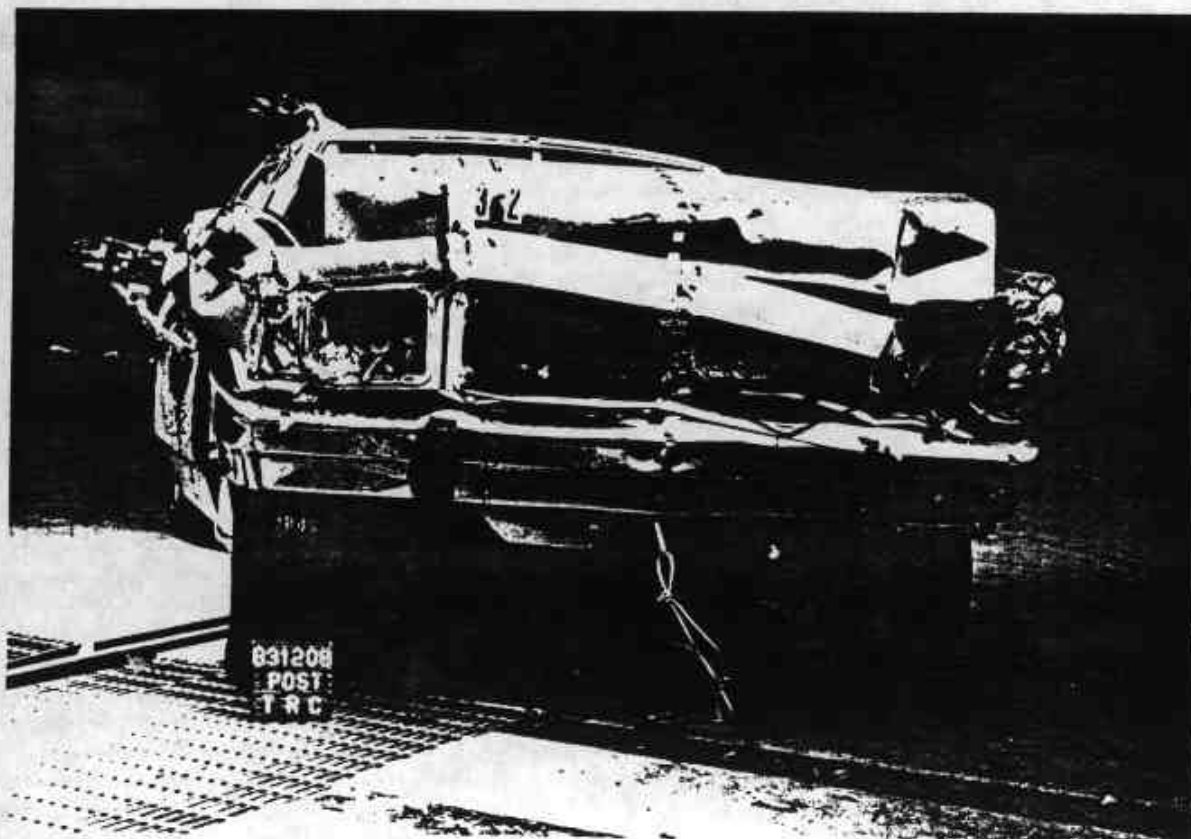


Figure A-10. POST-TEST FRONT VIEW



Figure A-11. POST-TEST DRIVER SIDE VIEW



Figure A-12. POST-TEST PASSENGER SIDE VIEW

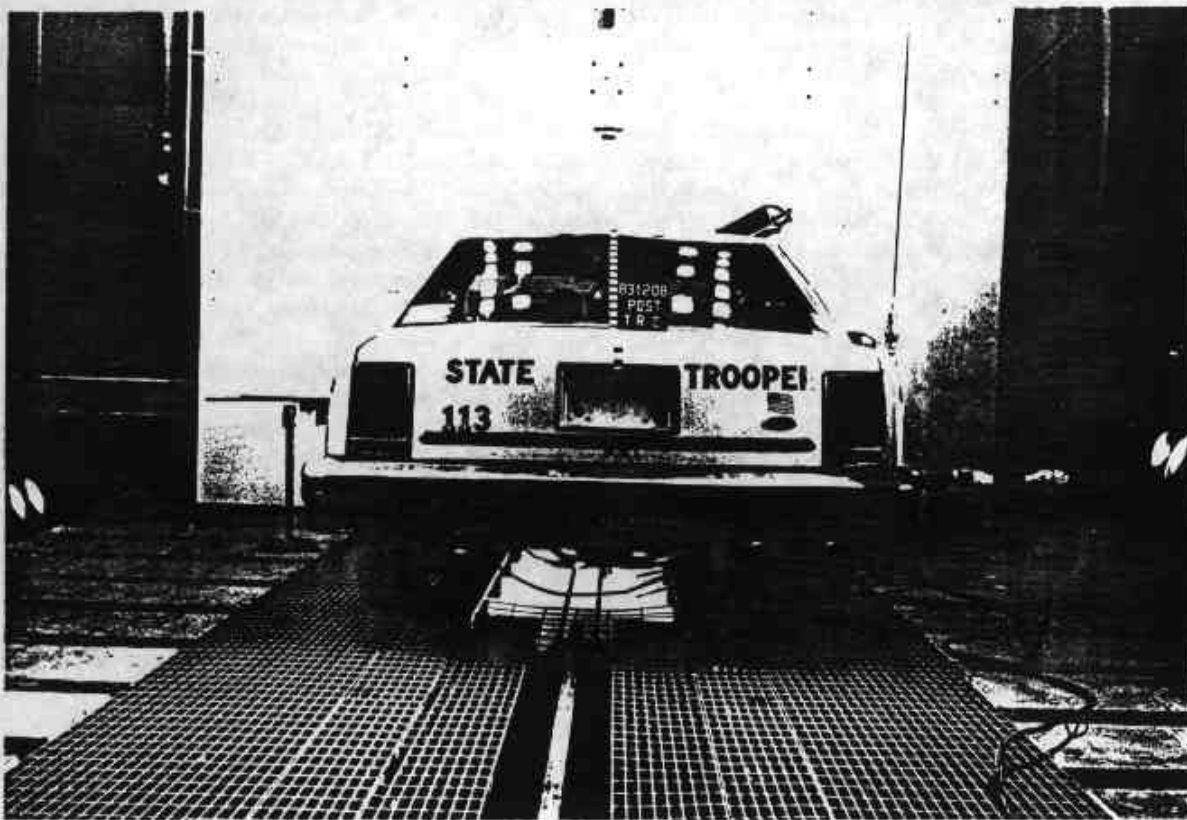


Figure A-13. POST-TEST REAR VIEW



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

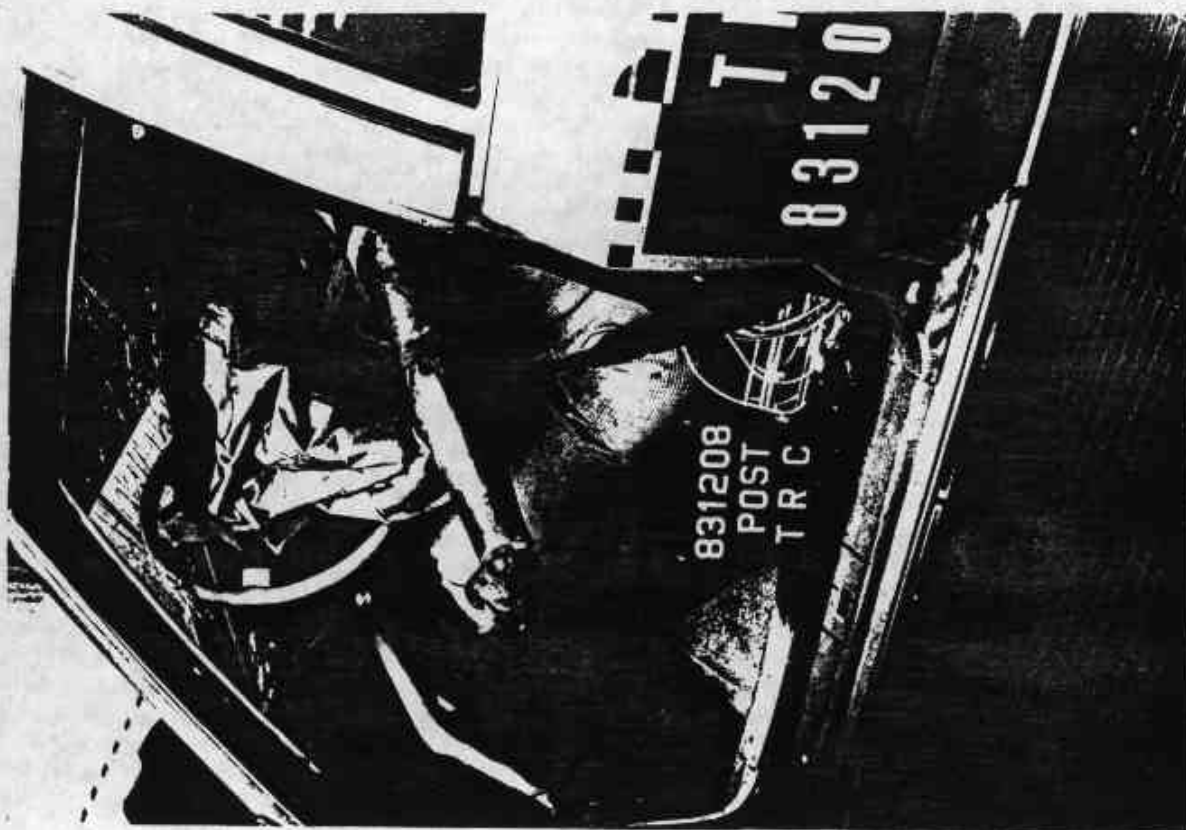


Figure A-15. POST-TEST DUMMY - VIEW 2

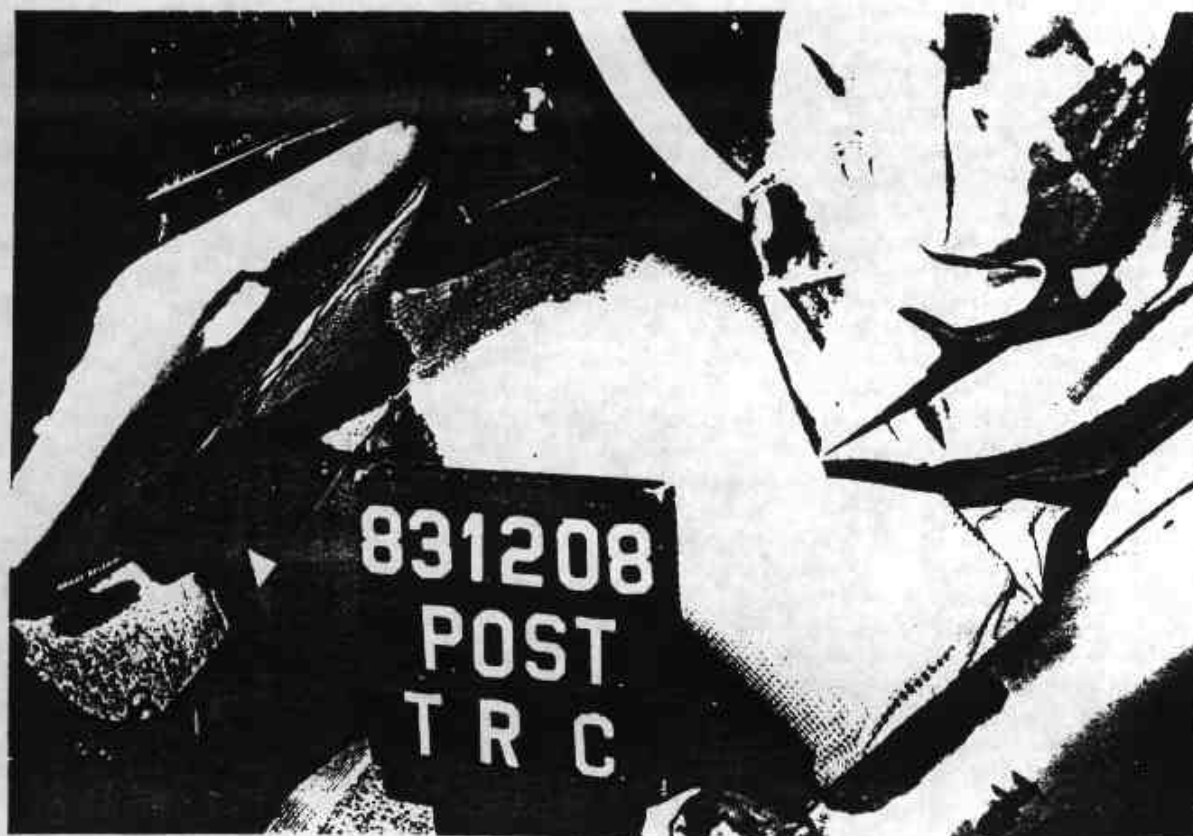


Figure A-16. POST-TEST DUMMY - VIEW 3



Figure A-17. POST-TEST DUMMY - VIEW 4

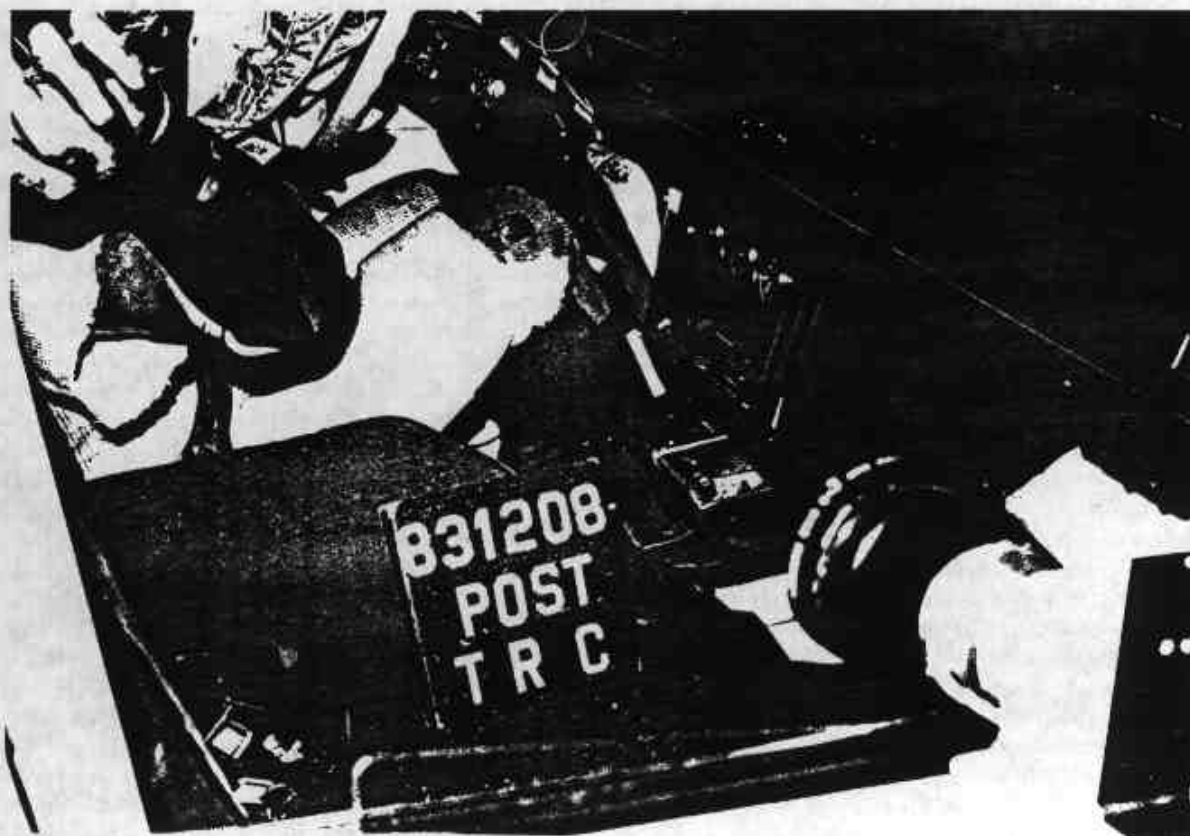


Figure A-18. POST-TEST DUMMY - VIEW 5

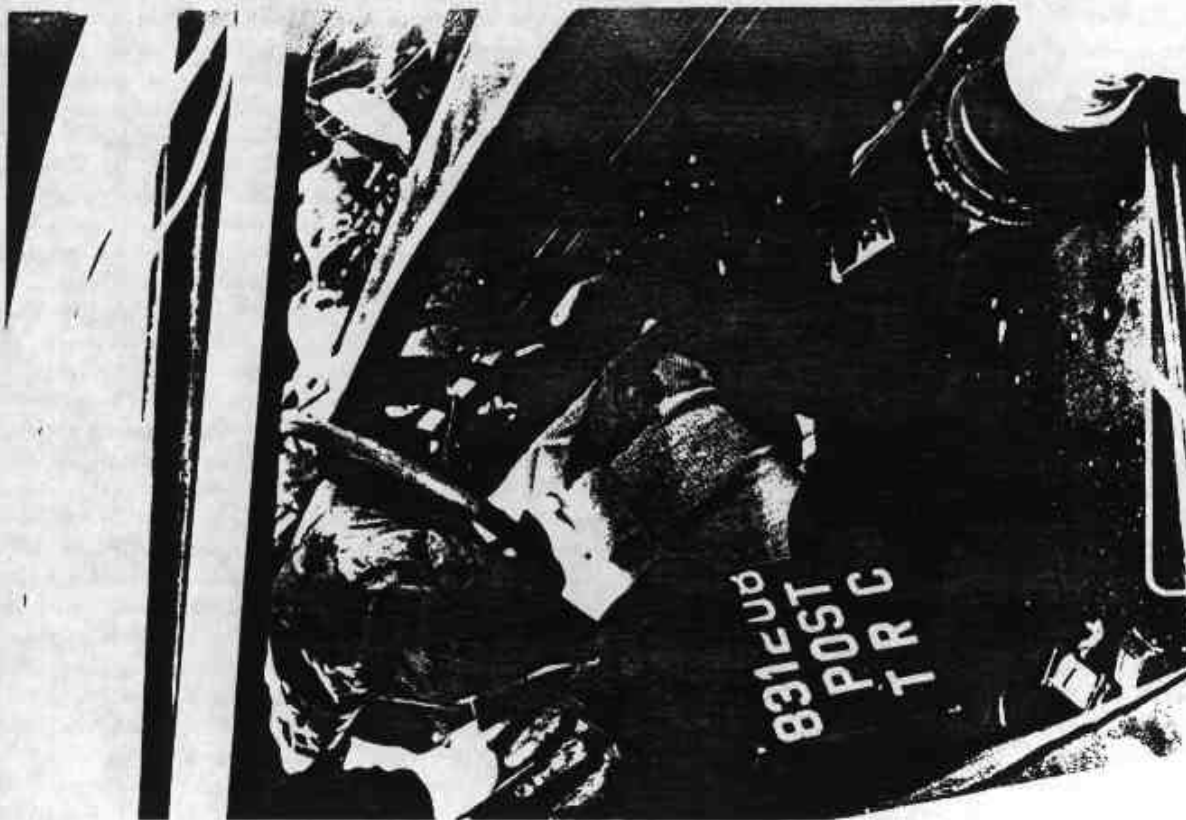


Figure A-19. POST-TEST DUMMY - VIEW 6

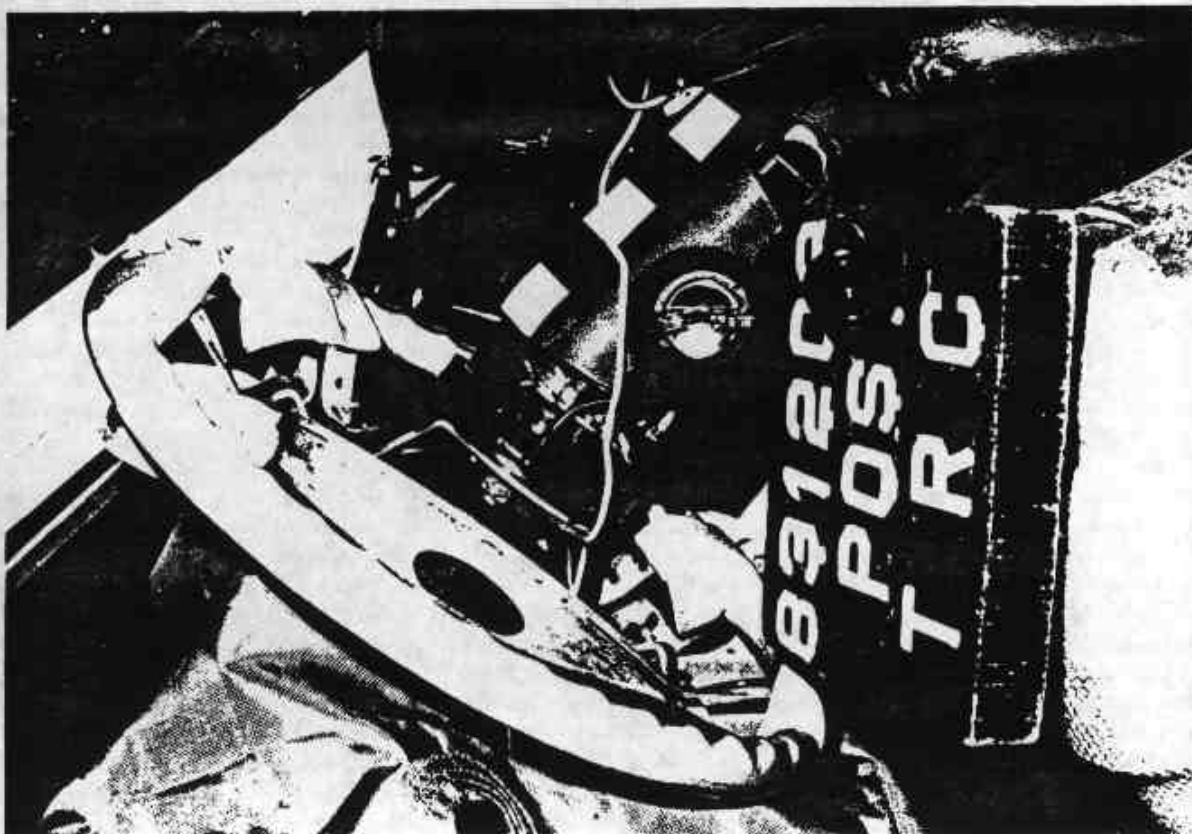


Figure A-20. POST-TEST STEERING COLUMN - VIEW 1



Figure A-21. POST-TEST STEERING COLUMN - VIEW 2

APPENDIX B
DATA PLOT PRESENTATION

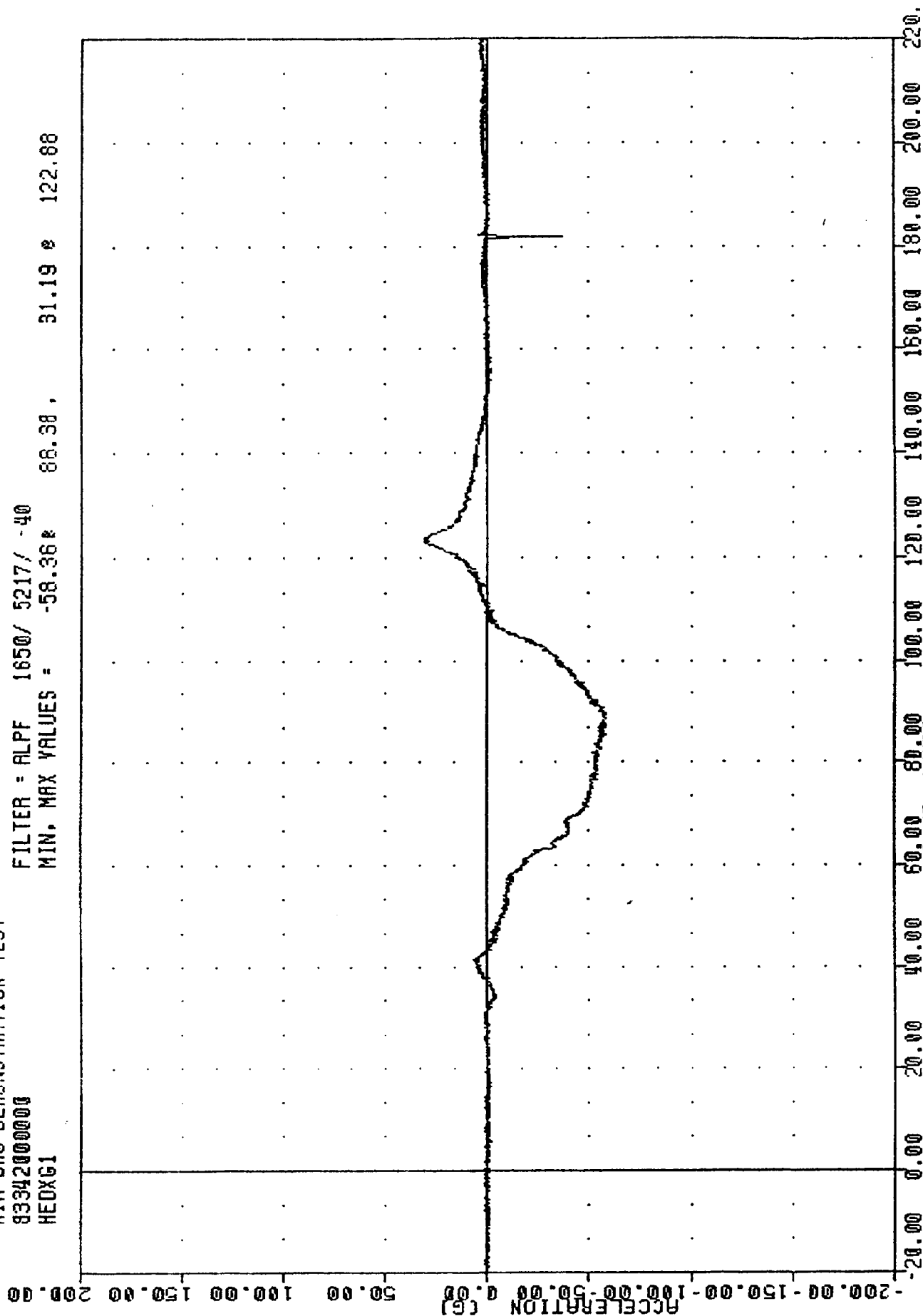
Data plots generated from the crash test data are presented on the following pages. All data are recorded on magnetic tape for inclusion in the NHTSA crash test data base system. All data were filtered according to SAE J211, except that dummy thorax data were filtered using the HSRI filter.

TRC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 HEDXG1

PLOT DATE 12-DEC-83 14:42:37

FILTER = ALPF 1650/ 5217/ -40

MIN, MAX VALUES = -58.36 88.38, 31.19 122.88



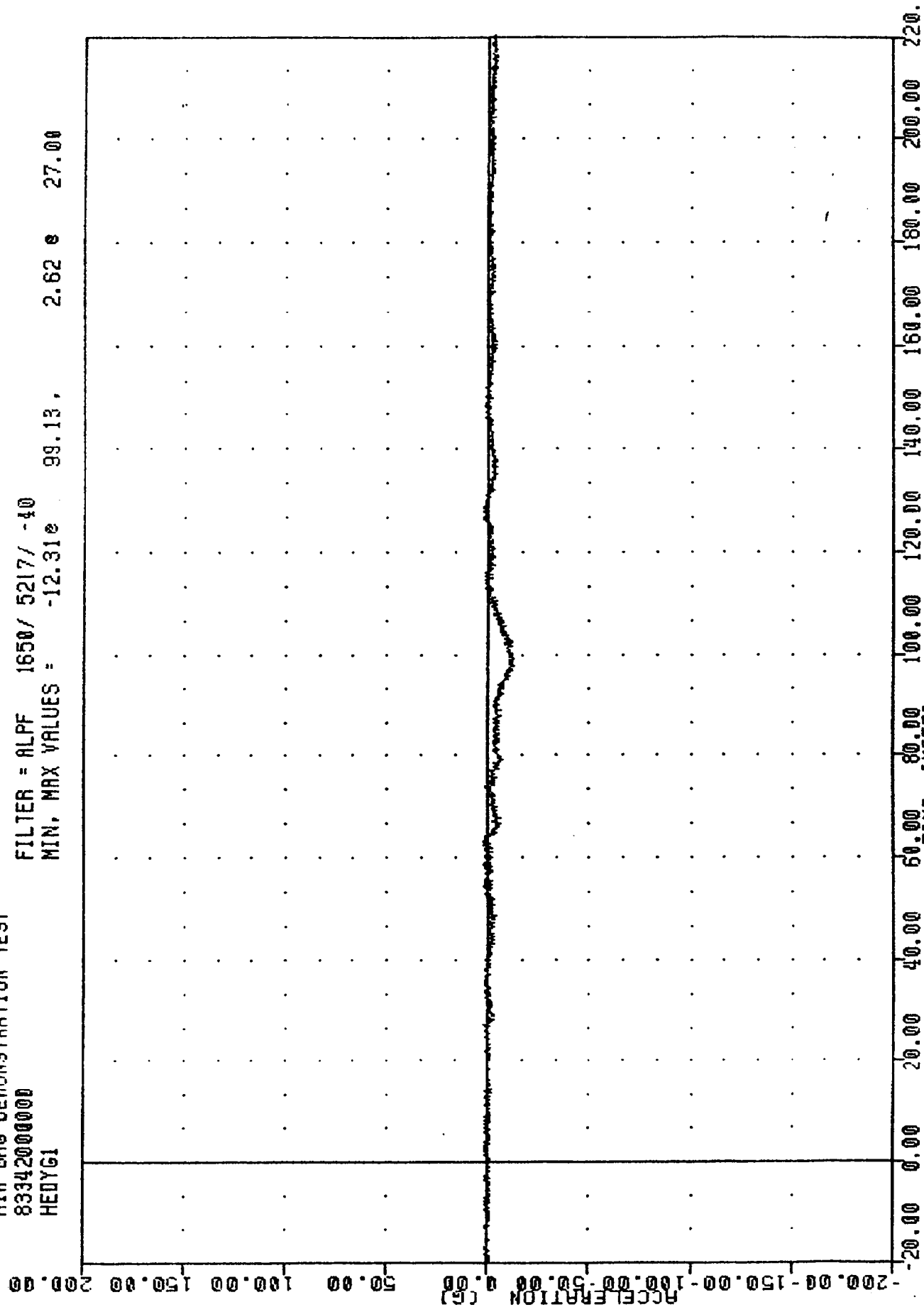
FORD LTD INTO FIXED BARRIER
 DRIVER HEAD ACCELERATION Y AXIS

TRC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 HEDYG1

PLOT DATE 12-DEC-83 14:42:37

FILTER = ALPF 1650/ 5217/ -40

MIN. MAX VALUES = -12.31e 99.13, 2.62 e 27.00



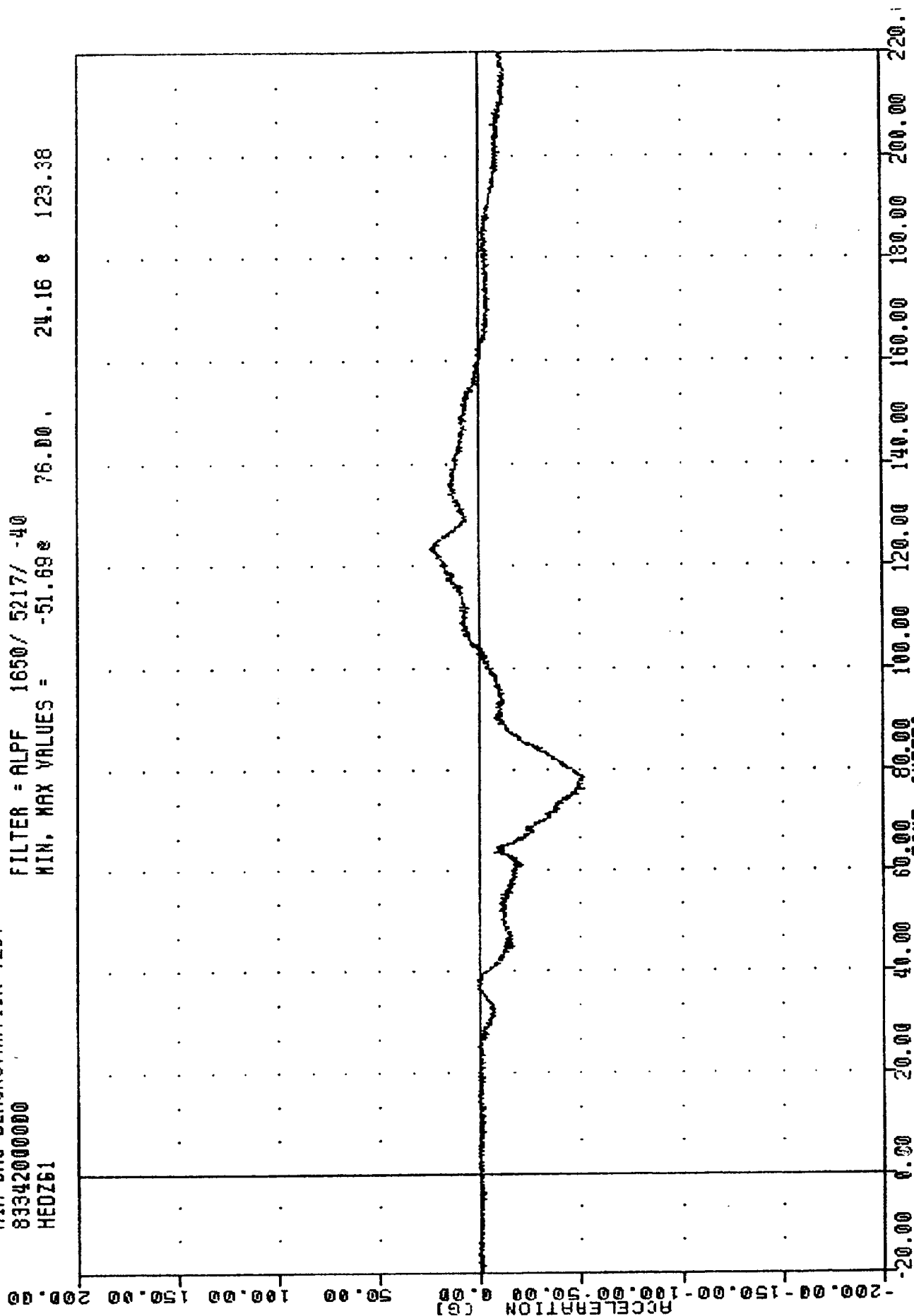
FORD LTD INTO FIXED BARRIER
 DRIVER HEAD ACCELERATION Y AXIS

TAC , 831208
AIR BAG DEMONSTRATION TEST
833420000000
HEDZ61

PLOT DATE 12-DEC-83 14:42:37

FILTER = ALPF 1650/ 5217/ -40

MIN. MAX VALUES = -51.69e 76.00, 24.16 e 123.38



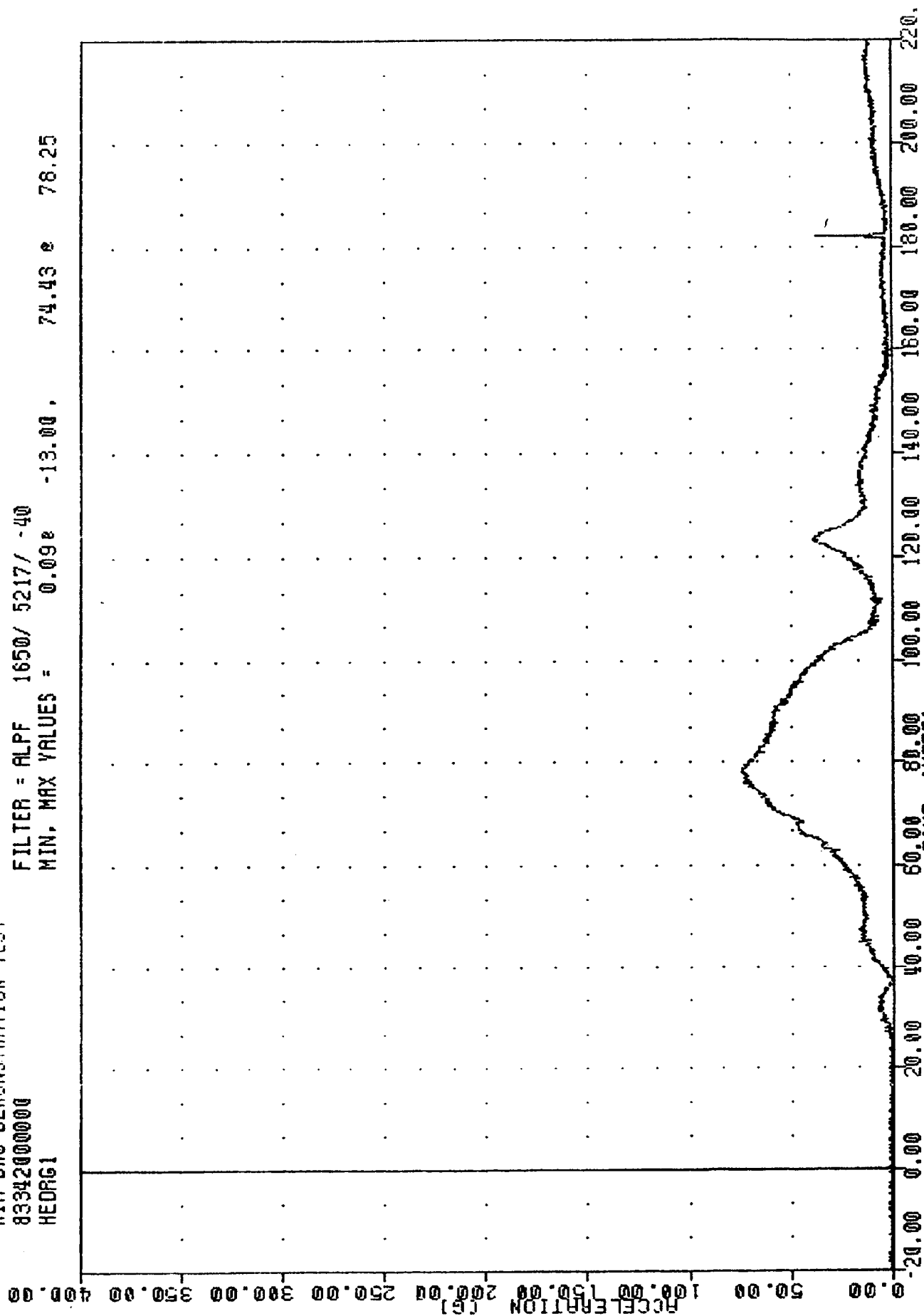
FORD LTD INTO FIXED BARRIER
DRIVER HEAD ACCELERATION Z AXIS

TRC , 831208
AIR BAG DEMONSTRATION TEST
83342000000
HEDRG1

PLOT DATE 12-DEC-83 14:42:10

FILTER = ALPF 1650/ 5217/ -40

MIN. MAX VALUES = 0.09e -13.00, 74.43 e 78.25



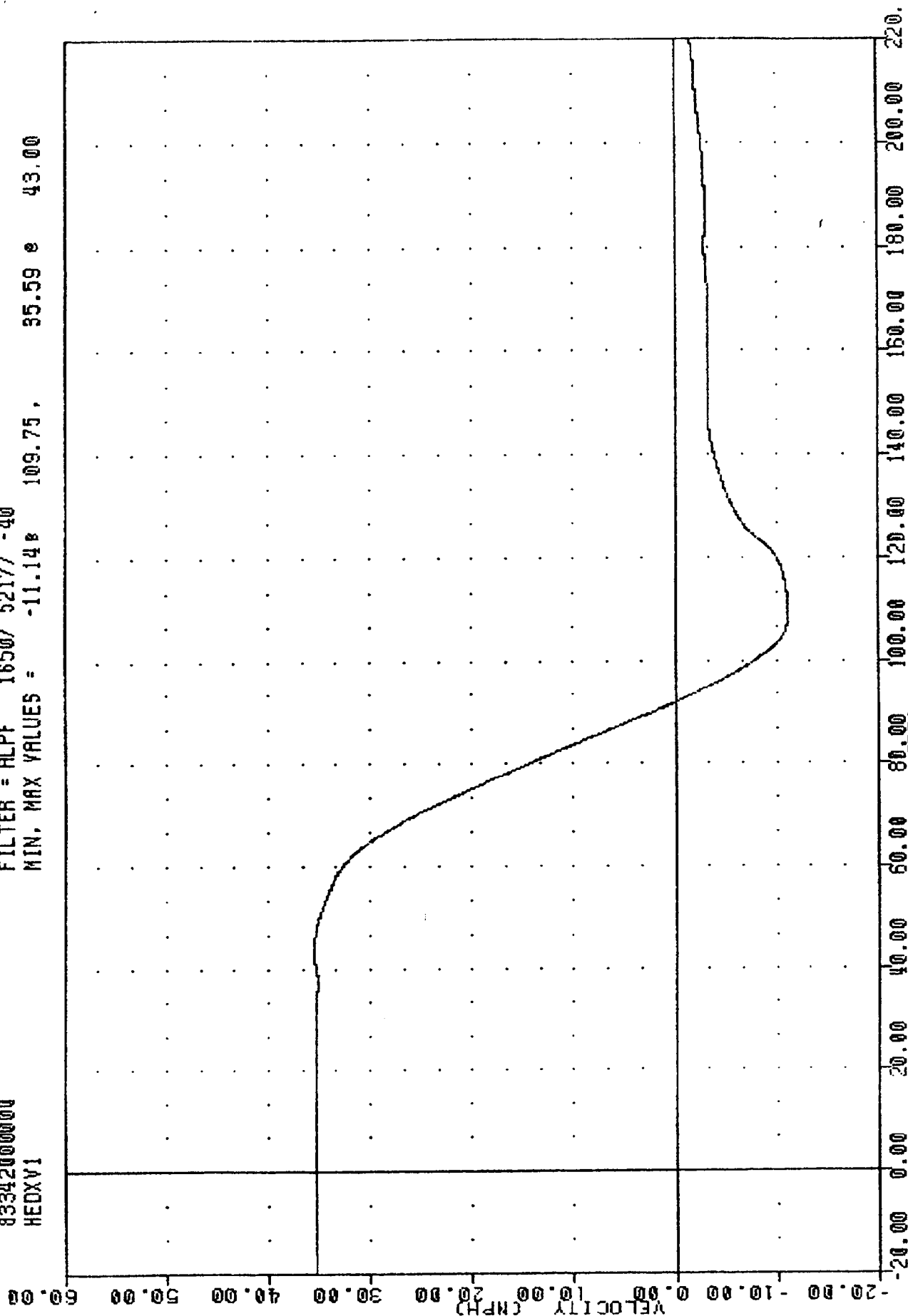
FORD LTD INTO FIXED BARRIER
DRIVER HEAD RESENTANT

IHC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 HEDXV1

PLUT DATE 12-DEC-83 14:41:48

FILTER = ALPF 1650/ 5217/ -40

MIN. MAX VALUES = -11.148 109.75 , 35.59 43.00



FORD LTD INTO FIXED BARRIER

DELTA V USING HEDXG1

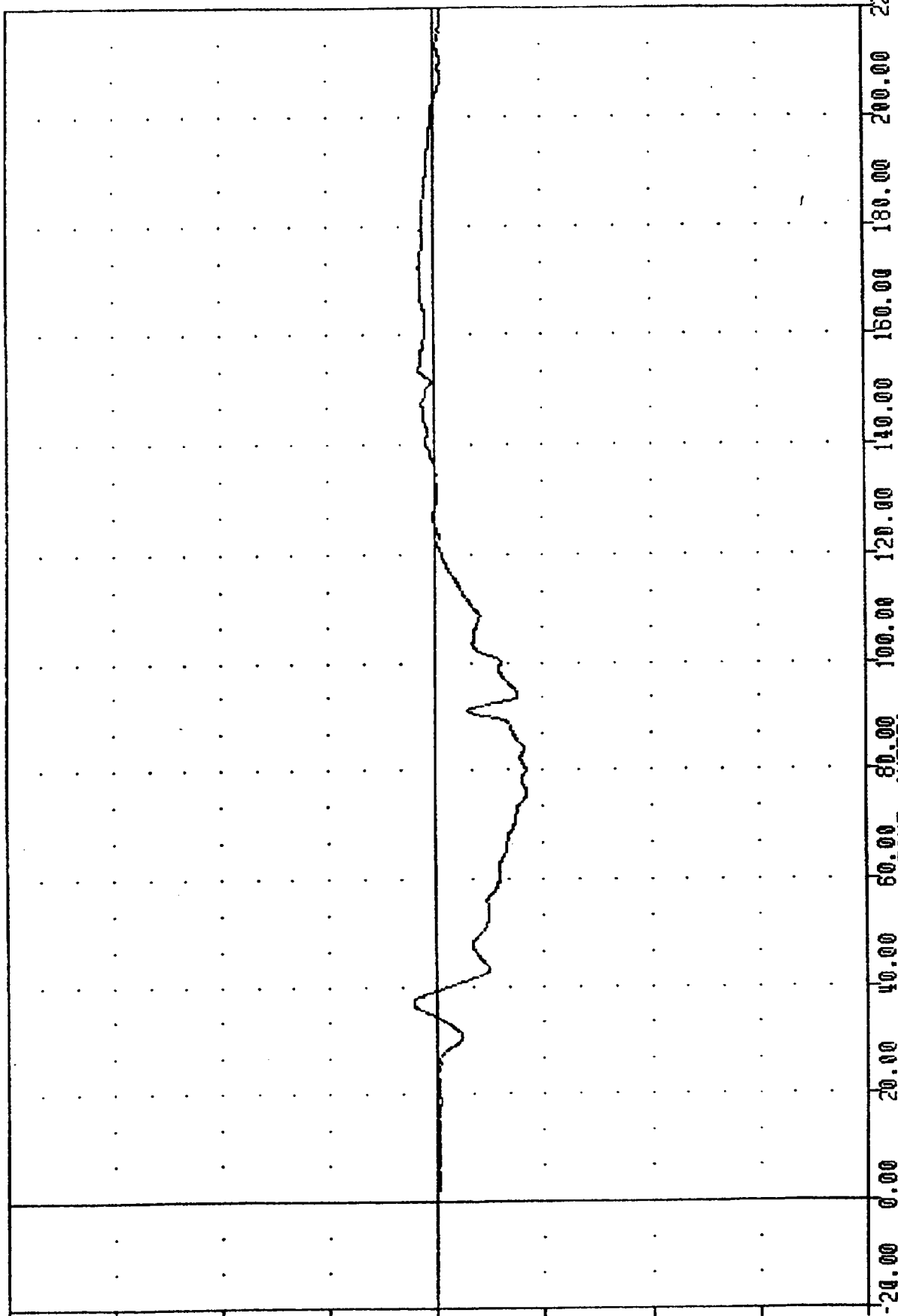
IHC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 CSTXG1

PLUT DATE 12-DEC-83 14:42:37

FILTER = BLPF 300/ 949/ -40

MIN. MAX VALUES = -42.50 75.50 11.16 37.00

ACCELERATION (G)

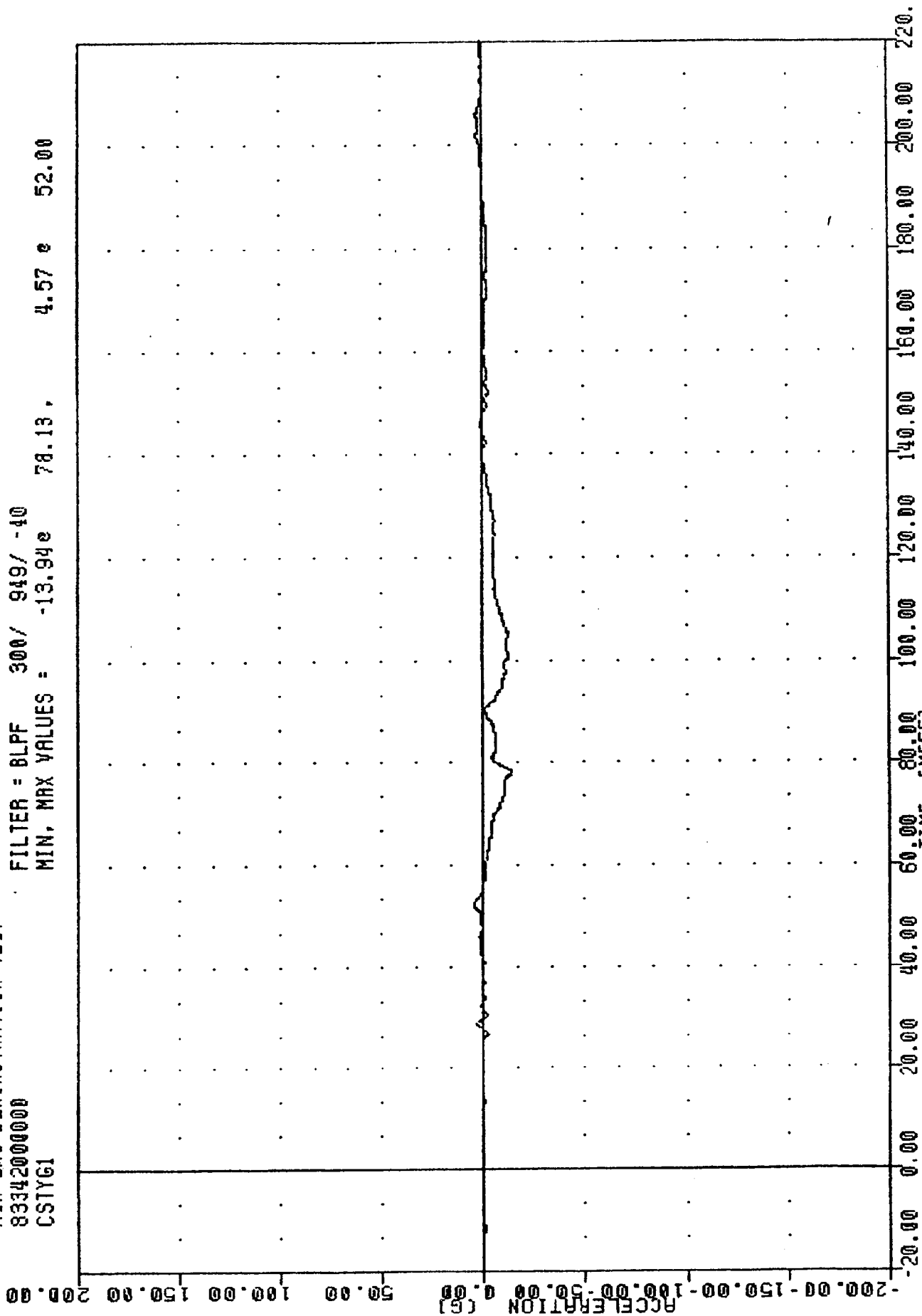


FORD LTD INTO FIXED BARRIER
 DRIVER CHEST ACCELERATION X AXIS

IHC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 CSTYG1

PLOT DATE 12-DEC-83 14:42:37

FILTER = 8LPF 300/ 949/ -40
 MIN, MAX VALUES = -13.94e 78.13, 4.57 e 52.00

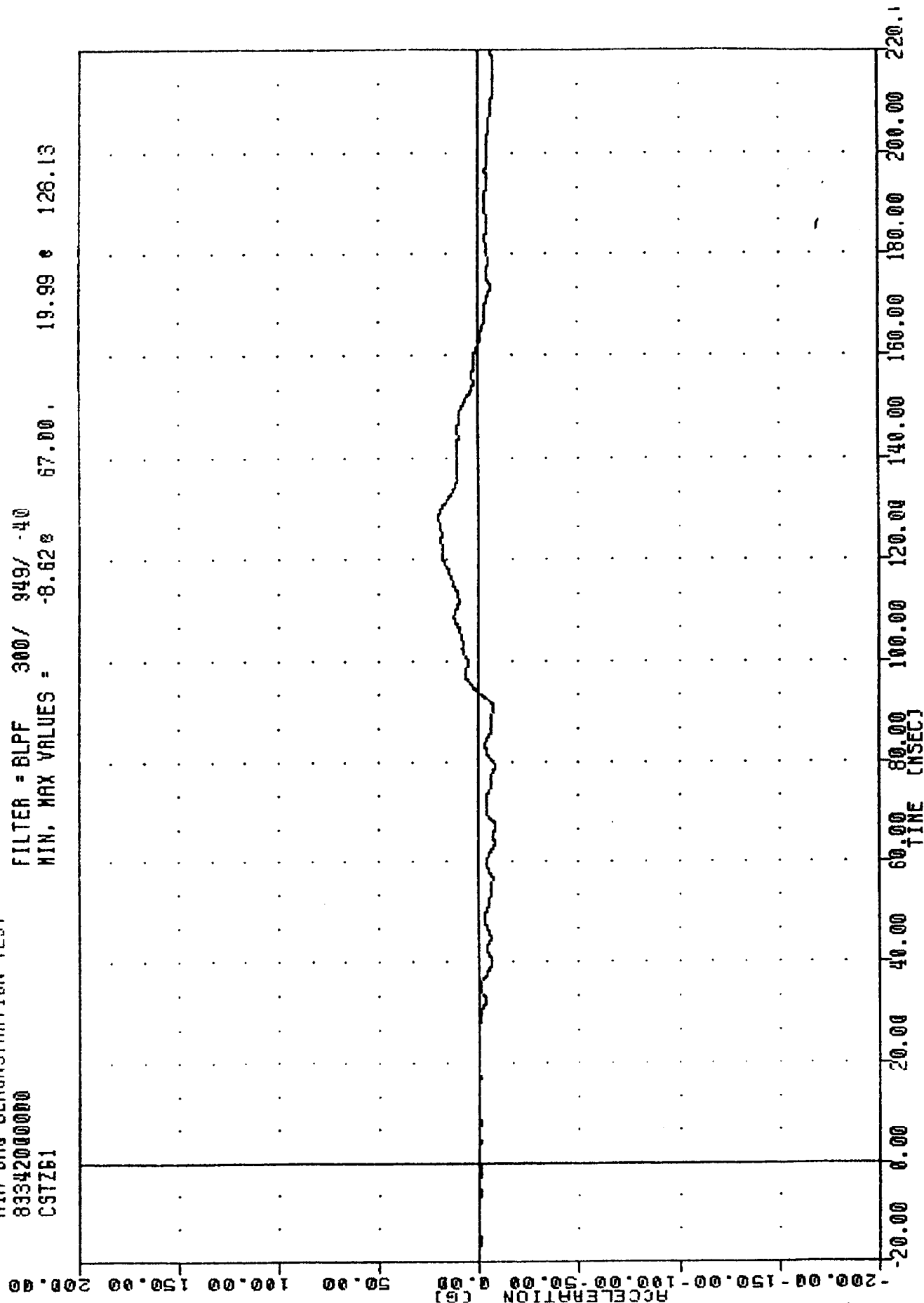


FORD LTD INTO FIXED BARRIER
 DRIVER CHEST ACCELERATION Y AXIS

TAC 831208
AIR BAG DEMONSTRATION TEST
83342000000
CSTZ61

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -8.628 67.00, 19.99 128.13

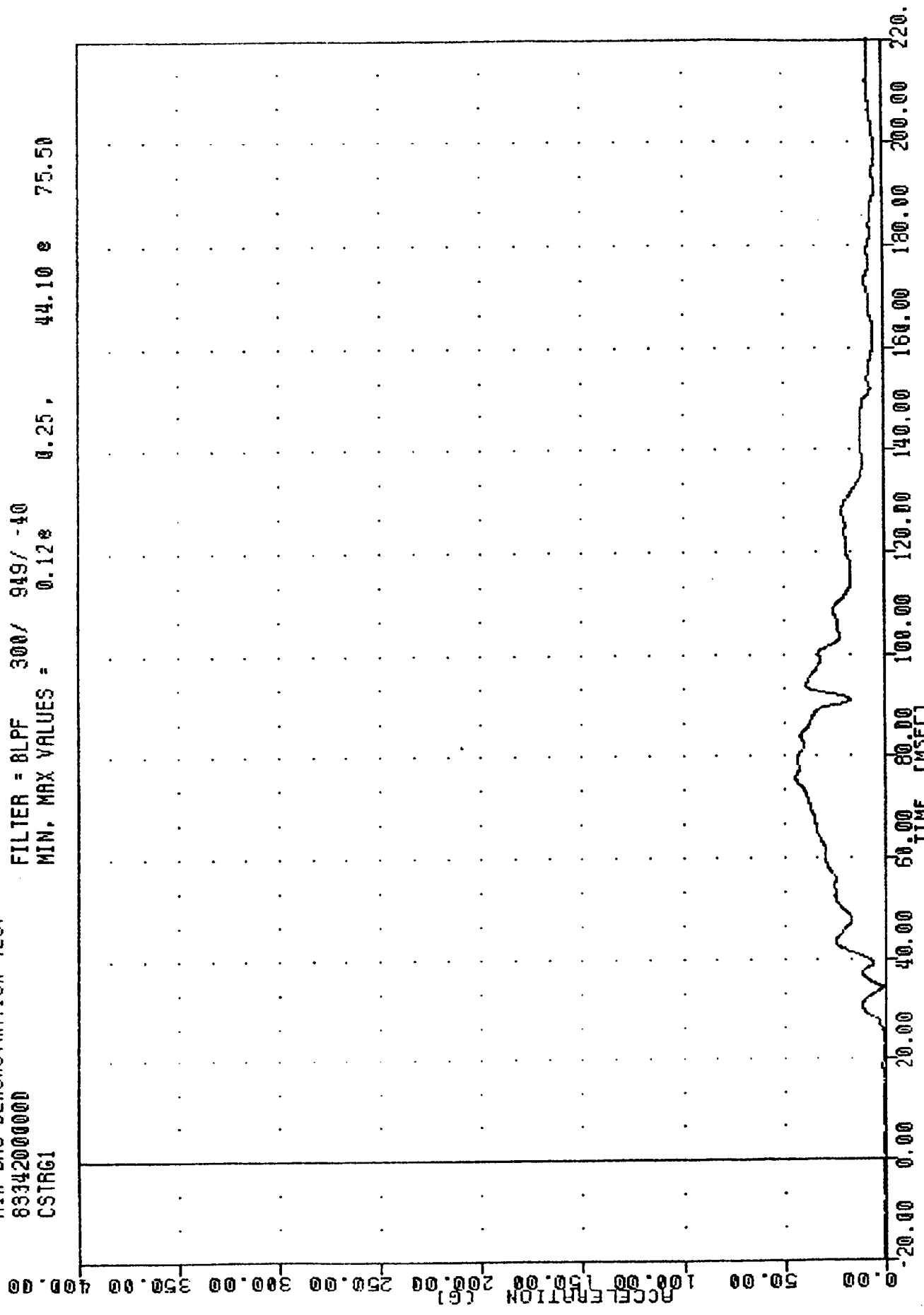


FORD LTD INTO FIXED BARRIER
DRIVER CHEST ACCELERATION Z AXIS

TAC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 CSTRG1

PLOT DATE 12-DEC-83 14:42:10

FILTER = BLPF 300/ 949/ -40
 MIN, MAX VALUES = 0.128 0.25, 44.10 e 75.50



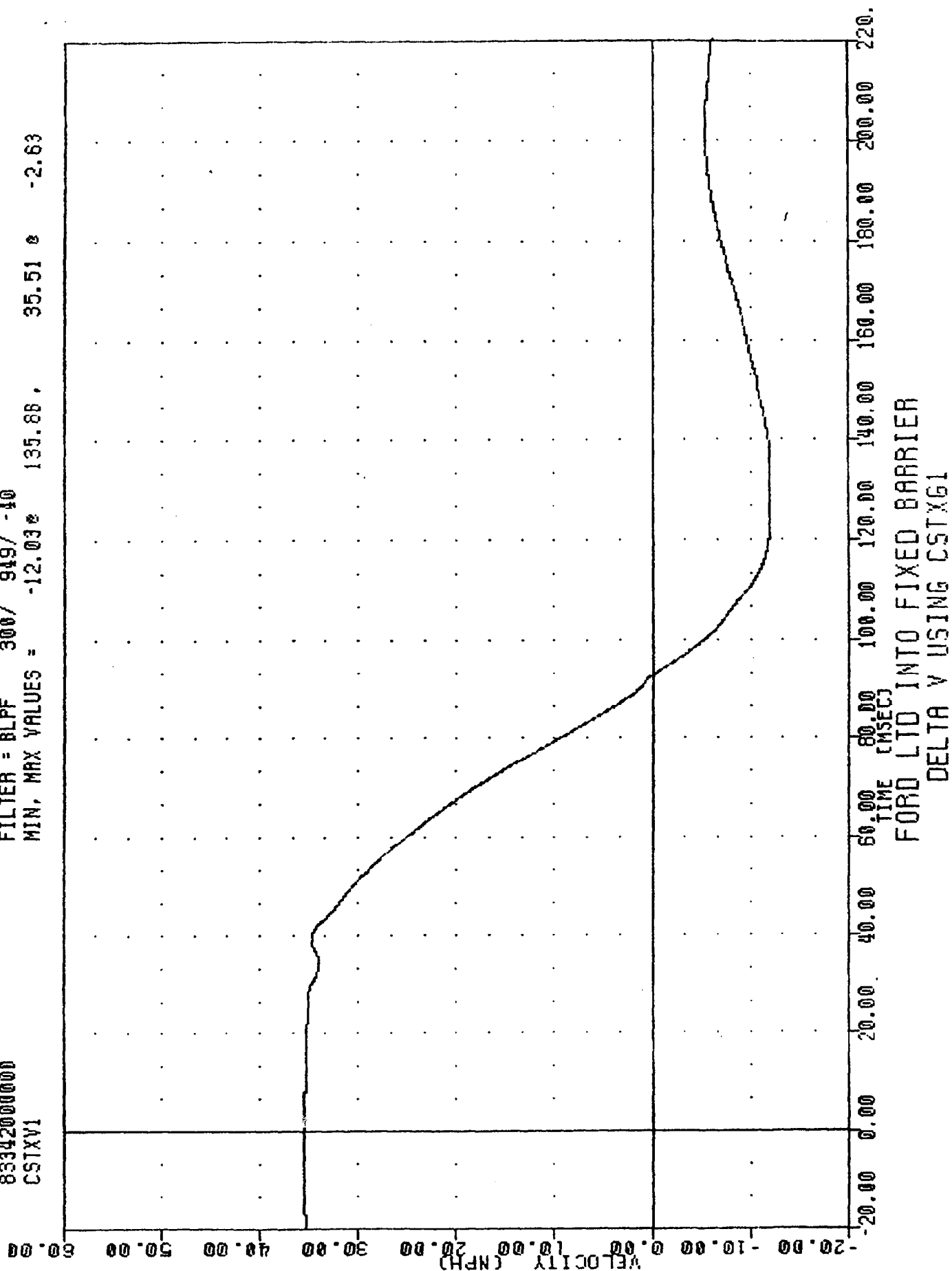
FORD LTD INTO FIXED BARRIER
 DRIVER CHEST RESULTANT

TRC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 CSTXV1

PLOT DATE 12-DEC-83 14:41:46

FILTER = BLPF 300/ 949/ -10

MIN, MAX VALUES = -12.03 135.88, 35.51 8 -2.63

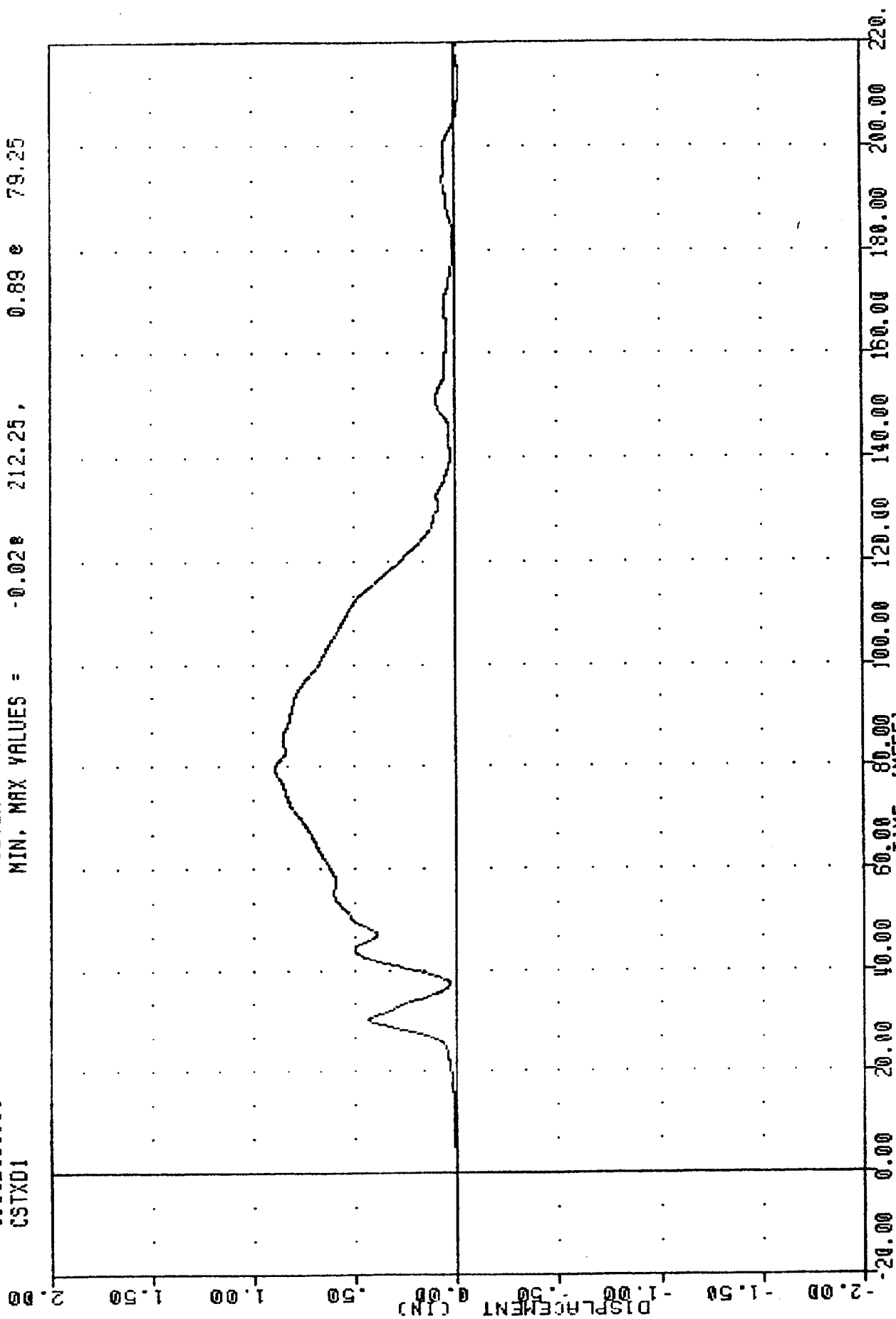


TRC , 831208
AIR BAG DEMONSTRATION TEST
83342000000
CSTXD1

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 300/ 349/ -40

MIN. MAX VALUES = -0.028 212.25, 0.89 e 79.25



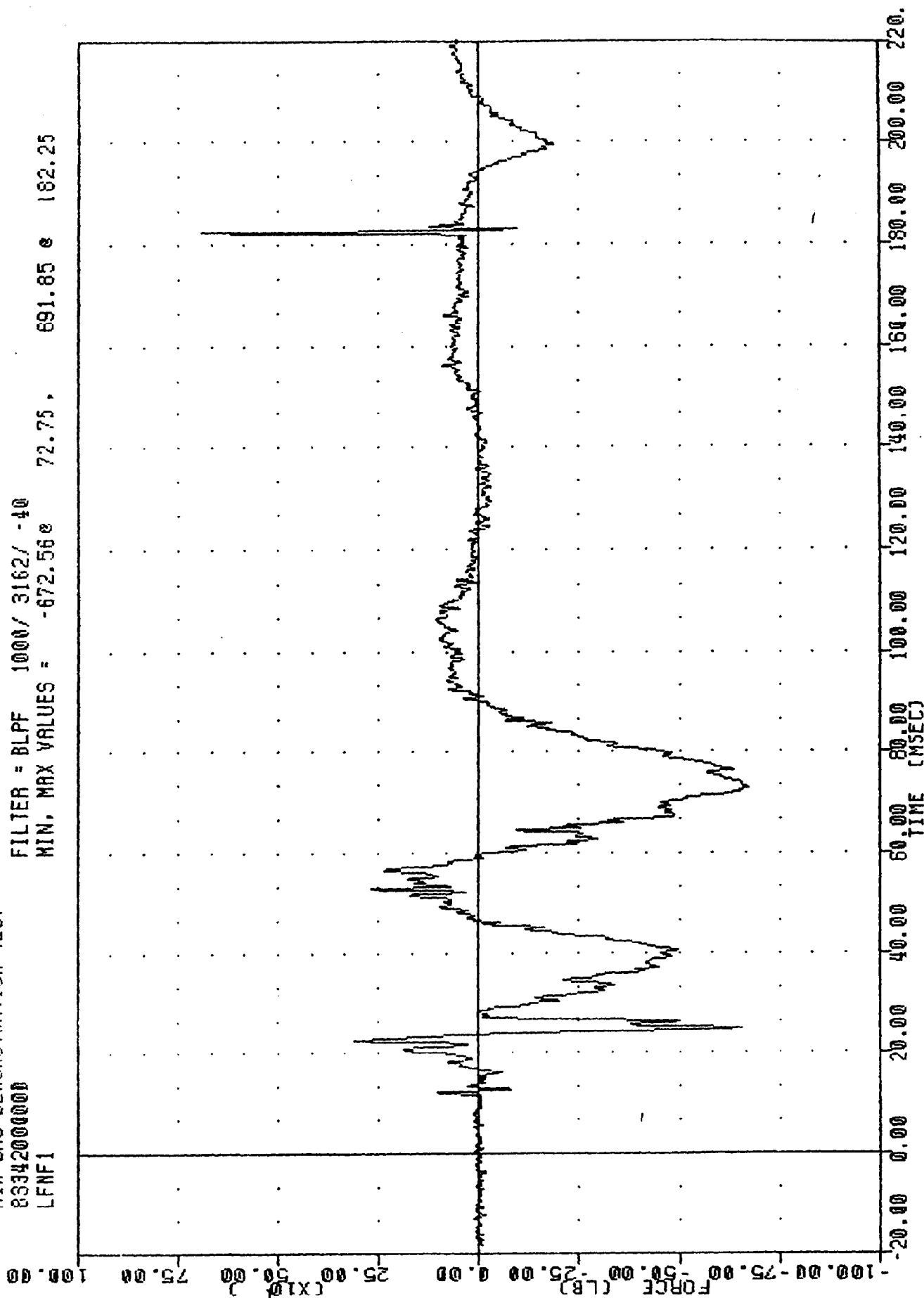
FORD LTD INTO FIXED BARRIER
DRIVER CHEST DISPLACEMENT X

INC 0312400
 AIR BAG DEMONSTRATION TEST
 83342000000
 LFNFI

PLU1 UNIE 12-DEC-83 14:42:37

FILTER = BLPF 1000/ 3162/ -40

MIN. MAX VALUES = -672.56e 72.75, 691.85 e 182.25



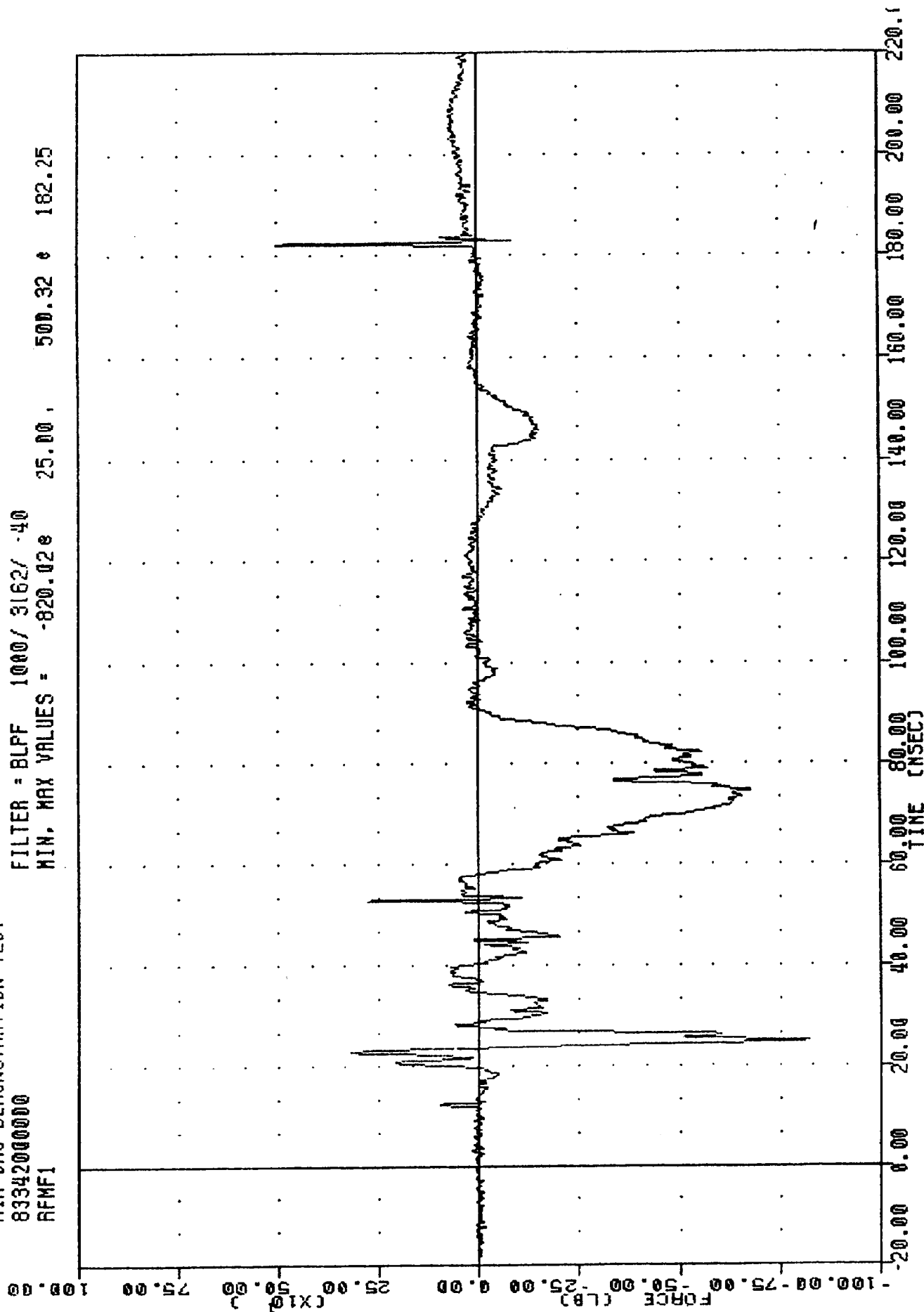
FORD LTD INTO FIXED BARRIER
 DRIVER LEFT FEMUR FORCE

TAC 831208
AIR BAG DEMONSTRATION TEST
83342000000
AFMF1

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 1000/ 3162/ -40

MIN, MAX VALUES = -820.02e 25.00, 500.32 e 182.25

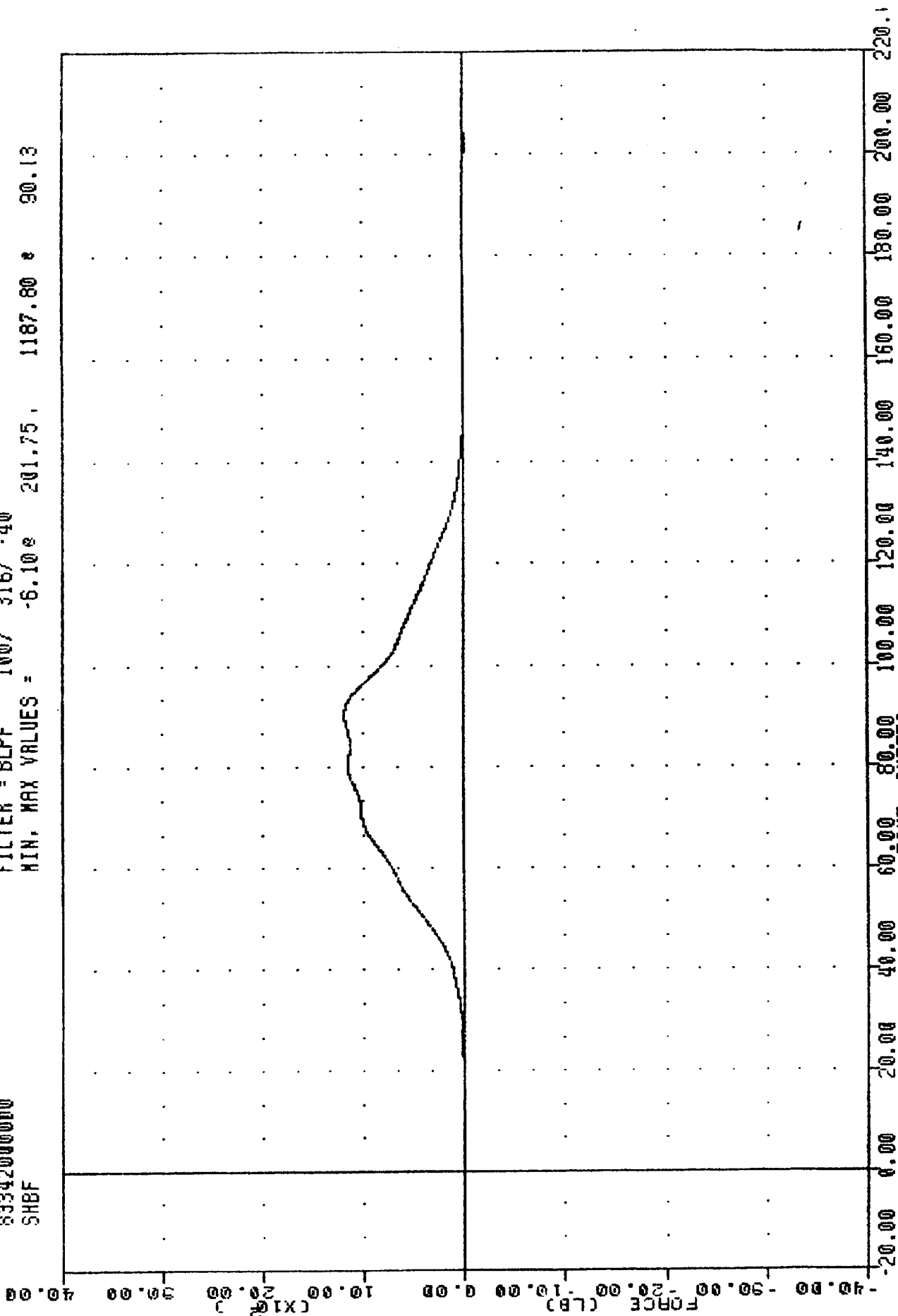


FORD LTD INTO FIXED BARRIER
DRIVER RIGHT FEMUR FORCE

TAC , 831208
 AIR BAG DEMONSTRATION TEST
 833420000000
 SHBF

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 100/ 316/ -40
 MIN, MAX VALUES = -6.10e 201.75, 1187.80 e 90.13



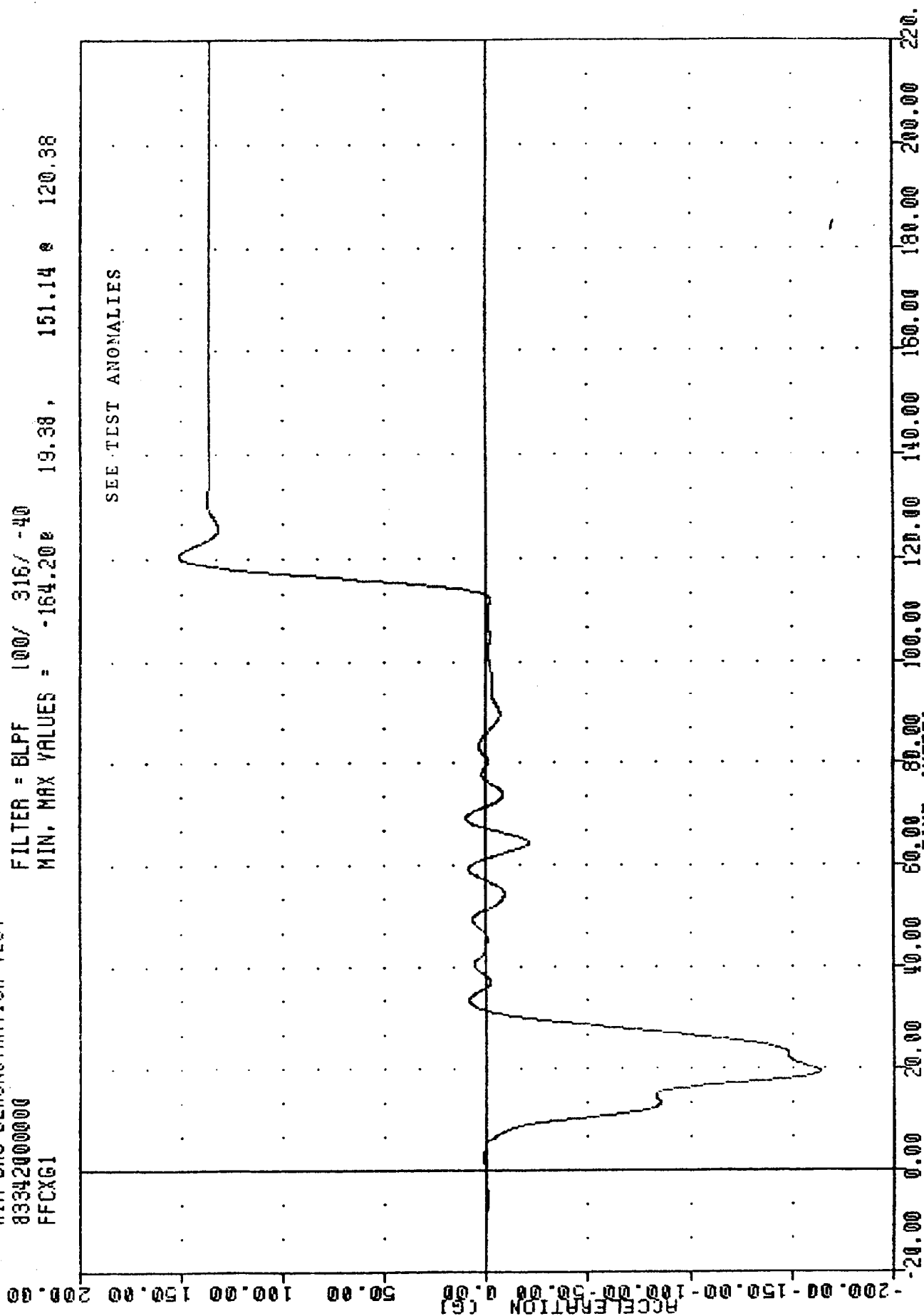
FORD LTD INTO FIXED BARRIER
 SHNIII NFR RFI T FORCE

TRC 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 PFCXG1

PLOT DATE 12-DEC-83 15:27:22

FILTER = BLPF 100/ 316/ -40

MIN, MAX VALUES = -164.200 19.38, 151.14 120.38



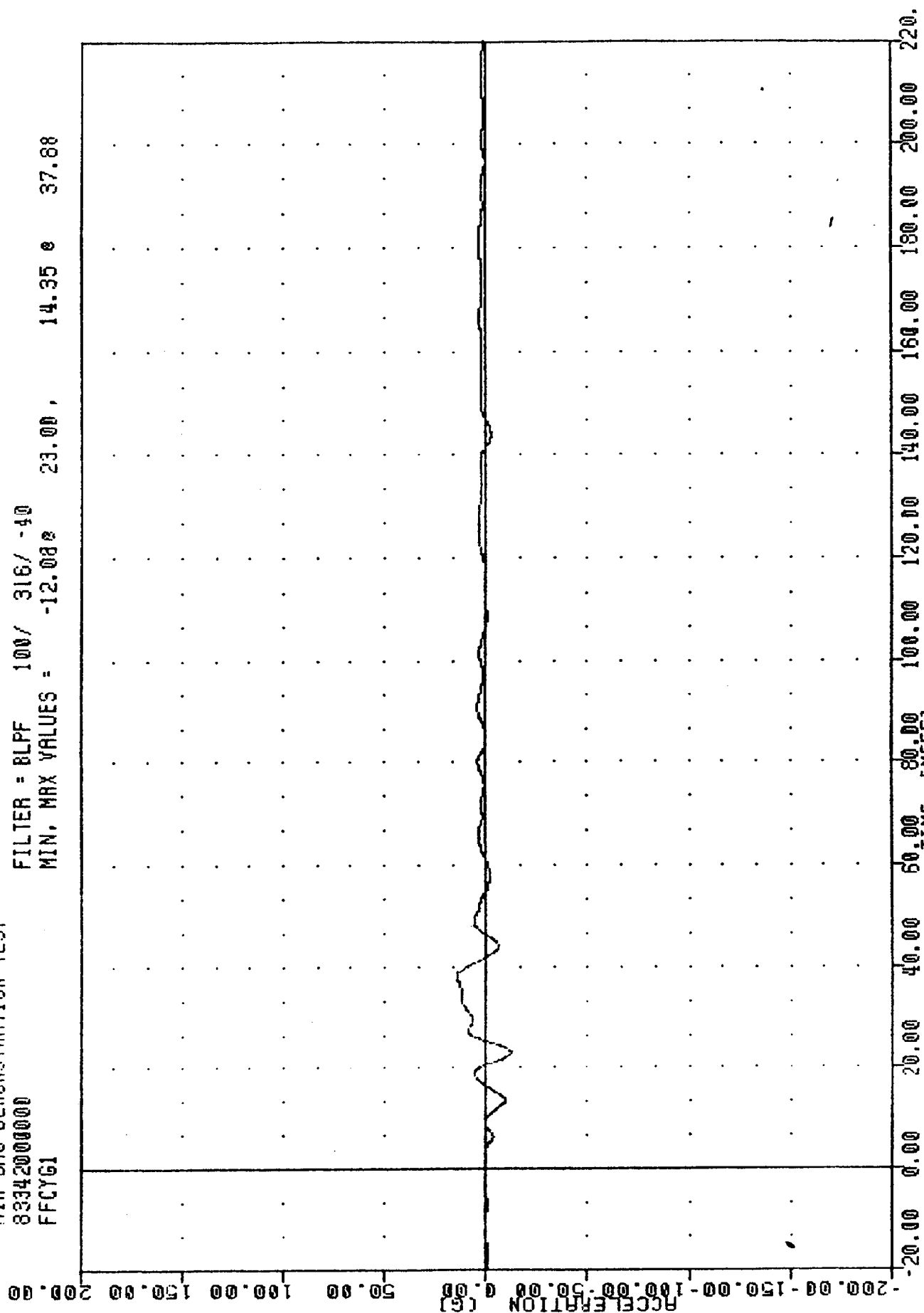
FORD LTD INTO FIXED BARRIER
 FRONT FRAME X-MEMBER ACCEL -1 X AXIS

TAC 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 FFCYG1

PLOT DATE 12-DEC-83 15:27:22

FILTER = BLPF 100/ 316/ -40

MIN, MAX VALUES = -12.088 23.00, 14.35 37.88



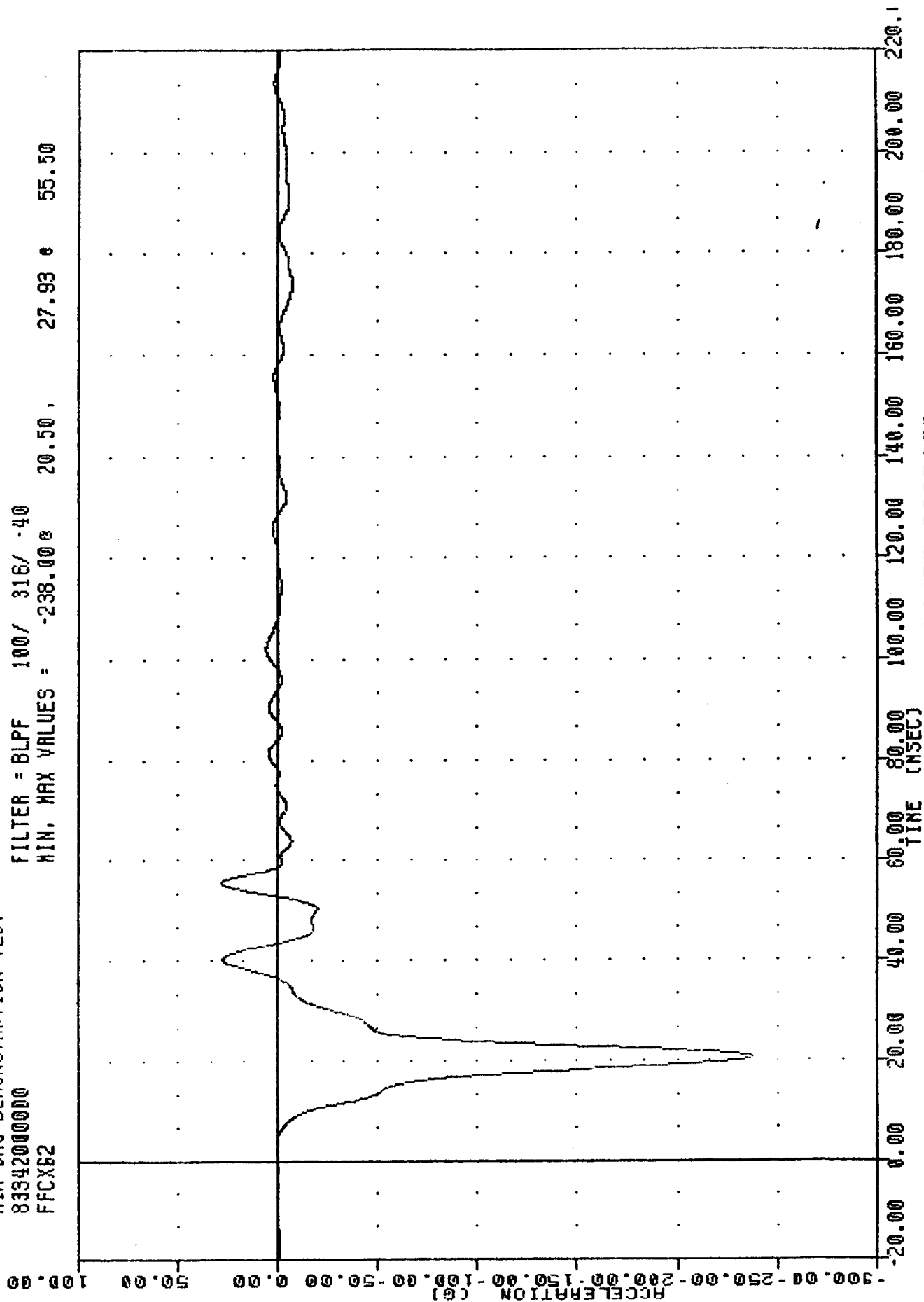
FORD LTD INTO FIXED BARRIER
 FRONT FRAME X-MEMBER ACCEL -1 Y AXIS

IHC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 FFCX62

PLUT DATE 12-DEC-83 15:27:22

FILTER = BLPF 100/ 316/ -40

MIN, MAX VALUES = -238.00 20.50, 27.93 55.50



FORD LTD INTO FIXED BARRIER
 FRONT FRAME X-MEMBER ACCEL -2 X AXIS

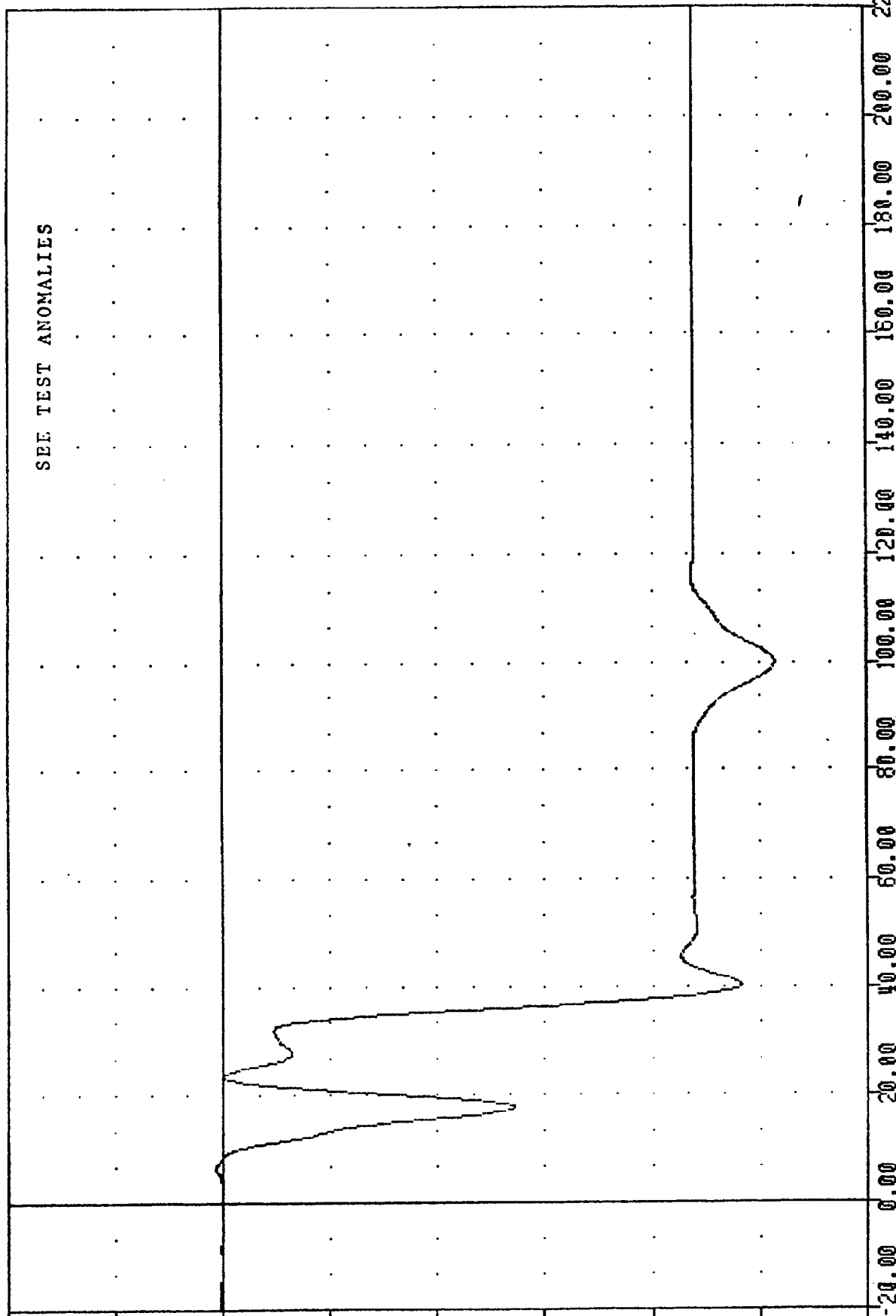
TRC 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 PFCY62

PLOT DATE 12-DEC-83 15:27:22

FILTER = BLPF 100/ 316/ -40

MIN. MAX VALUES = -257.31e 99.88, 3.01 e 6.25

ACCELERATION (G)



TIME (MSEC)

FORD LTD INTO FIXED BARRIER

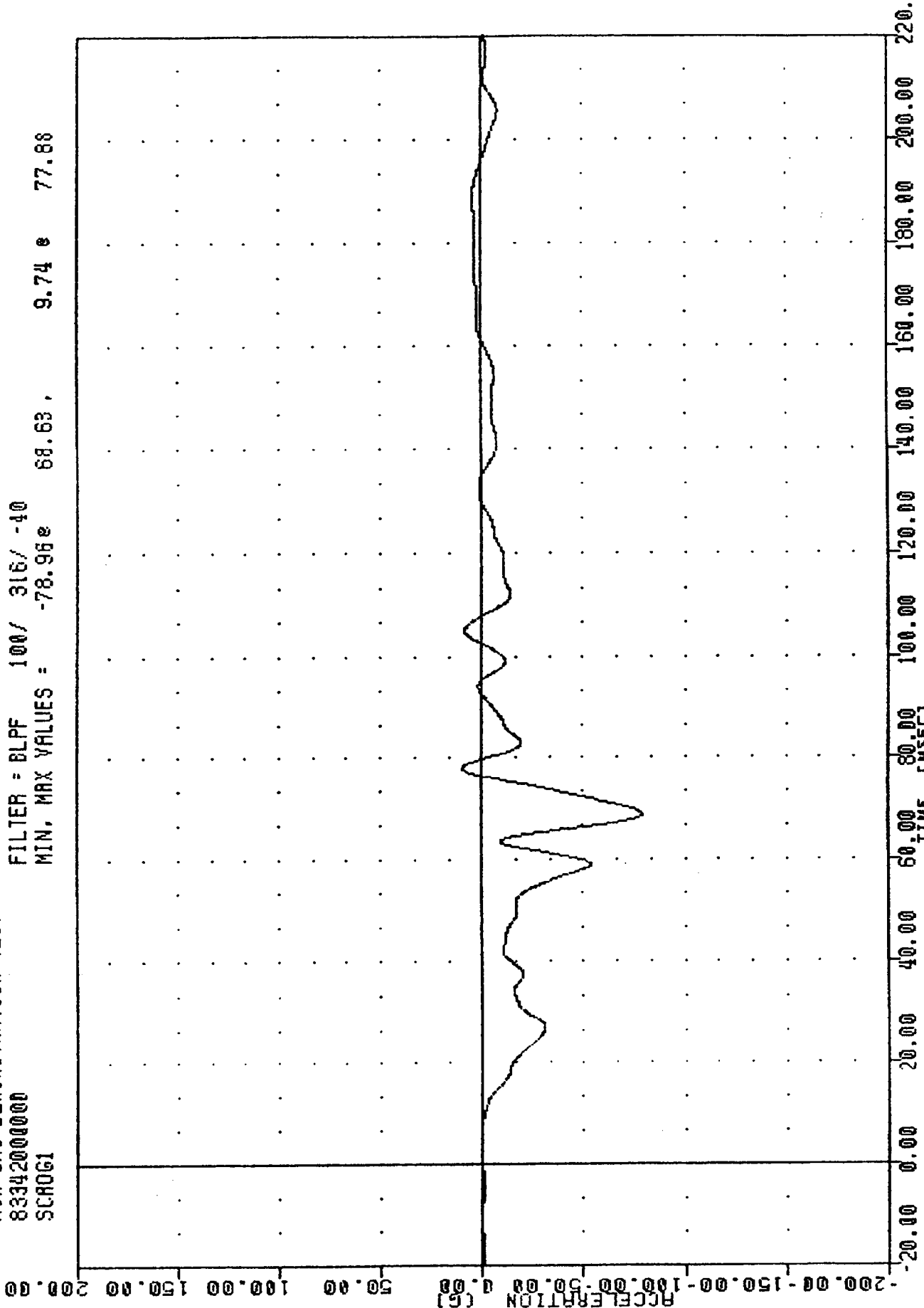
FRONT FRAME X-MEMBER ACCEL -2 Y AXIS

TRC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 SCROG1

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 100/ 316/ -40

MIN. MAX VALUES = -78.96e 68.63 , 9.74 e 77.88



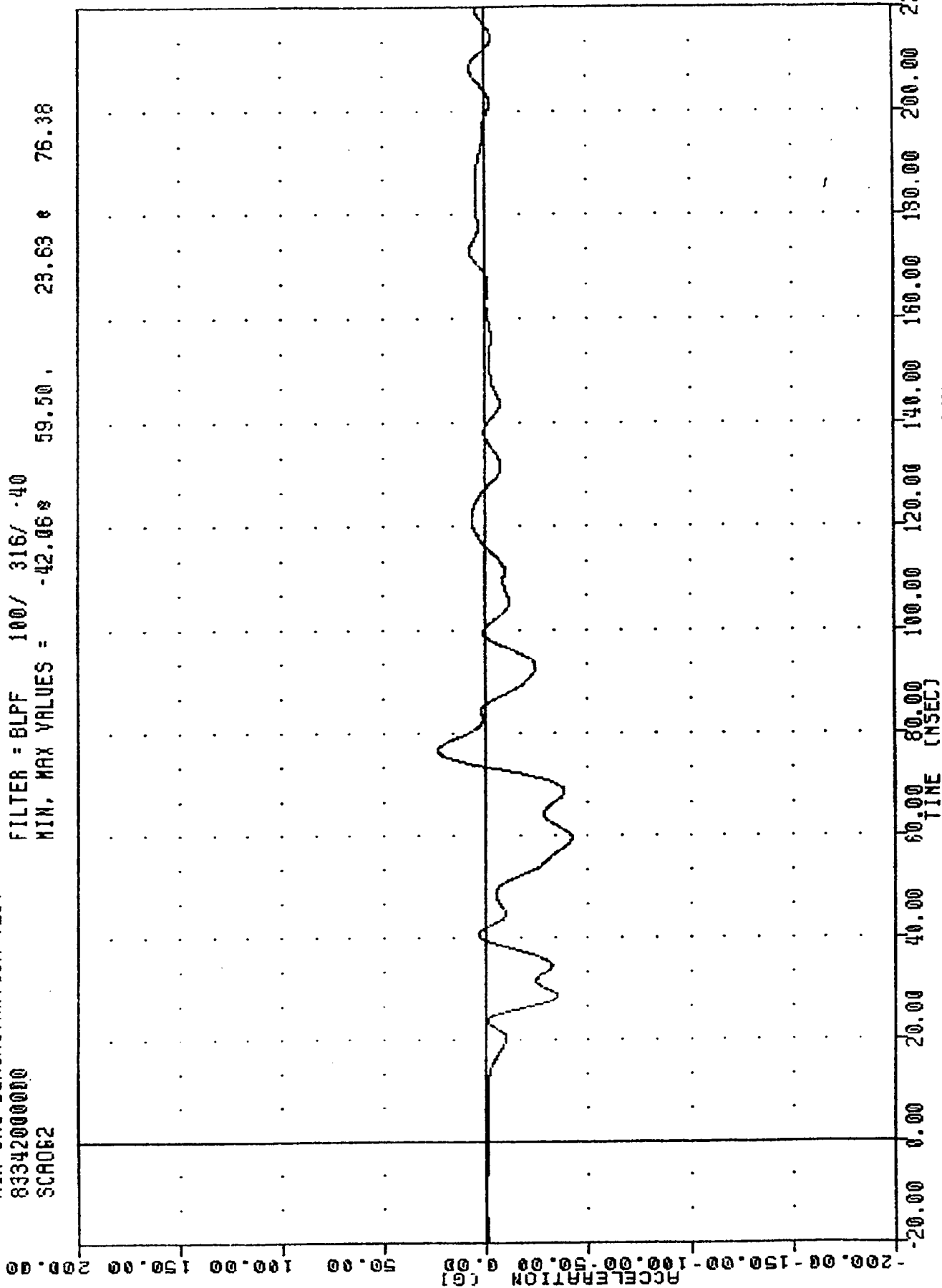
FORD LTD INTO FIXED BARRIER
 STEERING COLUMN ACCIFFRATION INWFR

TAC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 SCAR062

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 100/ 316/ .40

MIN. MAX VALUES = -42.06 59.50 23.63 76.38

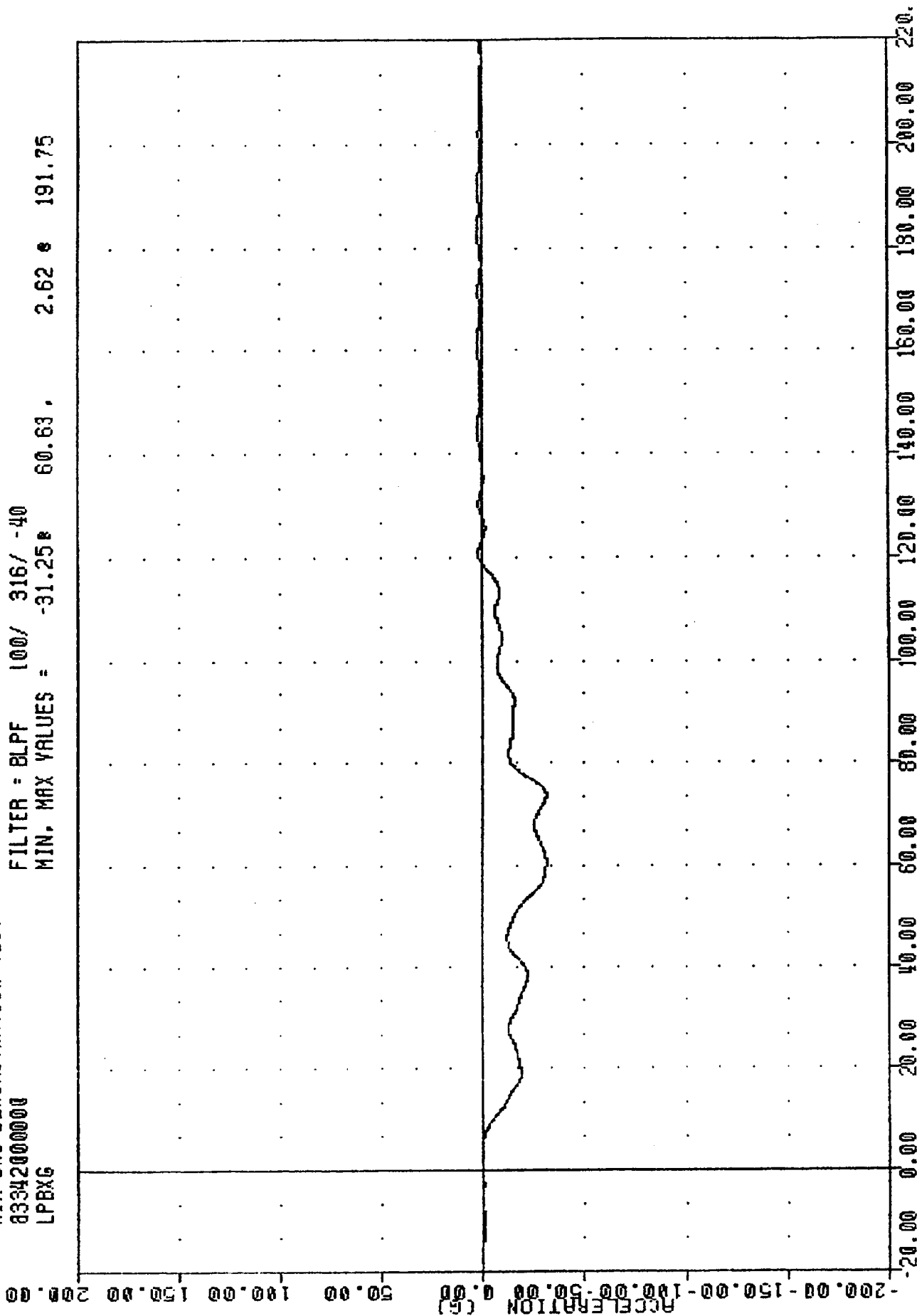


FORD LTD INTO FIXED BARRIER
 STEERING COLUMN OCCUPATION HIPPER

TRC , 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 LPBXG

PLOT DATE 12-DEC-83 14:42:37

FILTER = BLPF 100/ 316/ -40
 MIN, MAX VALUES = -31.25 60.63, 2.62 191.75



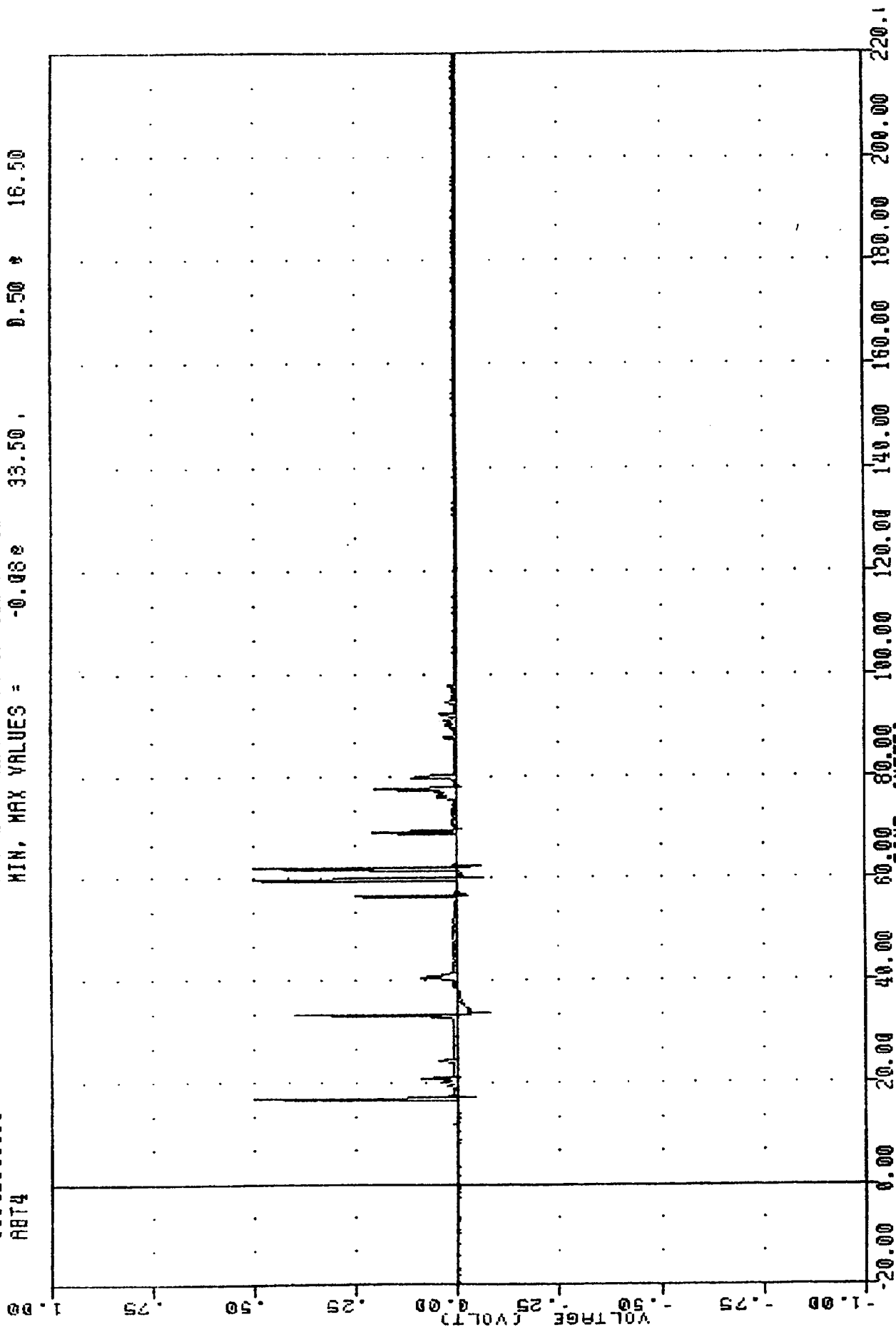
FORD LTD INTO FIXED BARRIER
 PILLAR TEST R ACCELERATION V AYTS

TAC , 831208
AIR BAG DEMONSTRATION TEST
83342000000
ABT4

PLOT DATE 12-DEC-83 14:42:37

FILTER = ALPF 1650/ 5217/ -40

MIN, MAX VALUES = -0.08e 33.50, 0.50 * 16.50



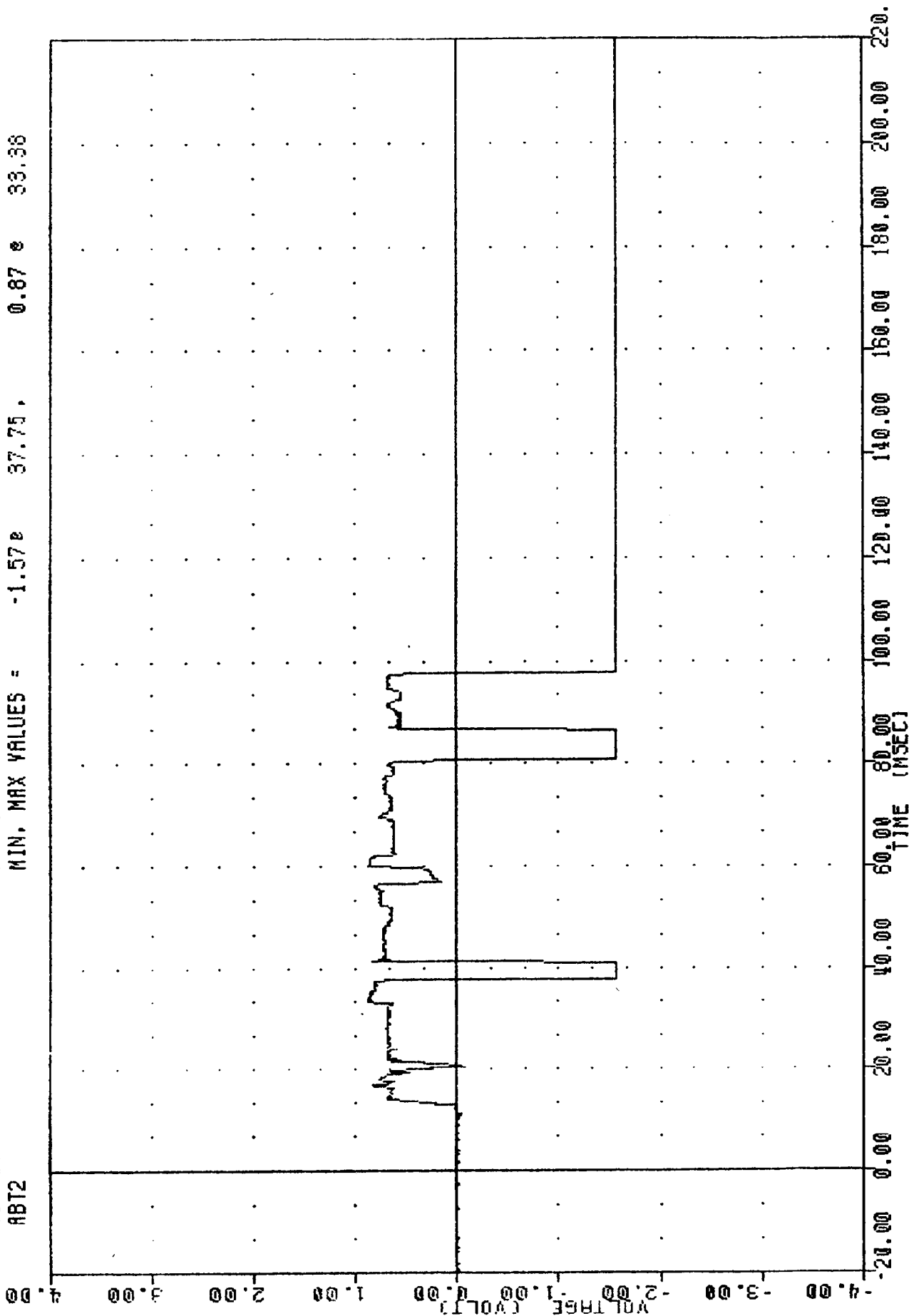
FORD LTD INTO FIXED BARRIER
AIR BAG SQUIBB CURRENT

TRC 831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 ABT2

PLOT DATE 12-DEC-83 14:42:37

FILTER = ALPF 1650/ 5217/ -40

MIN. MAX VALUES = -1.57e 37.75, 0.87 e 33.38



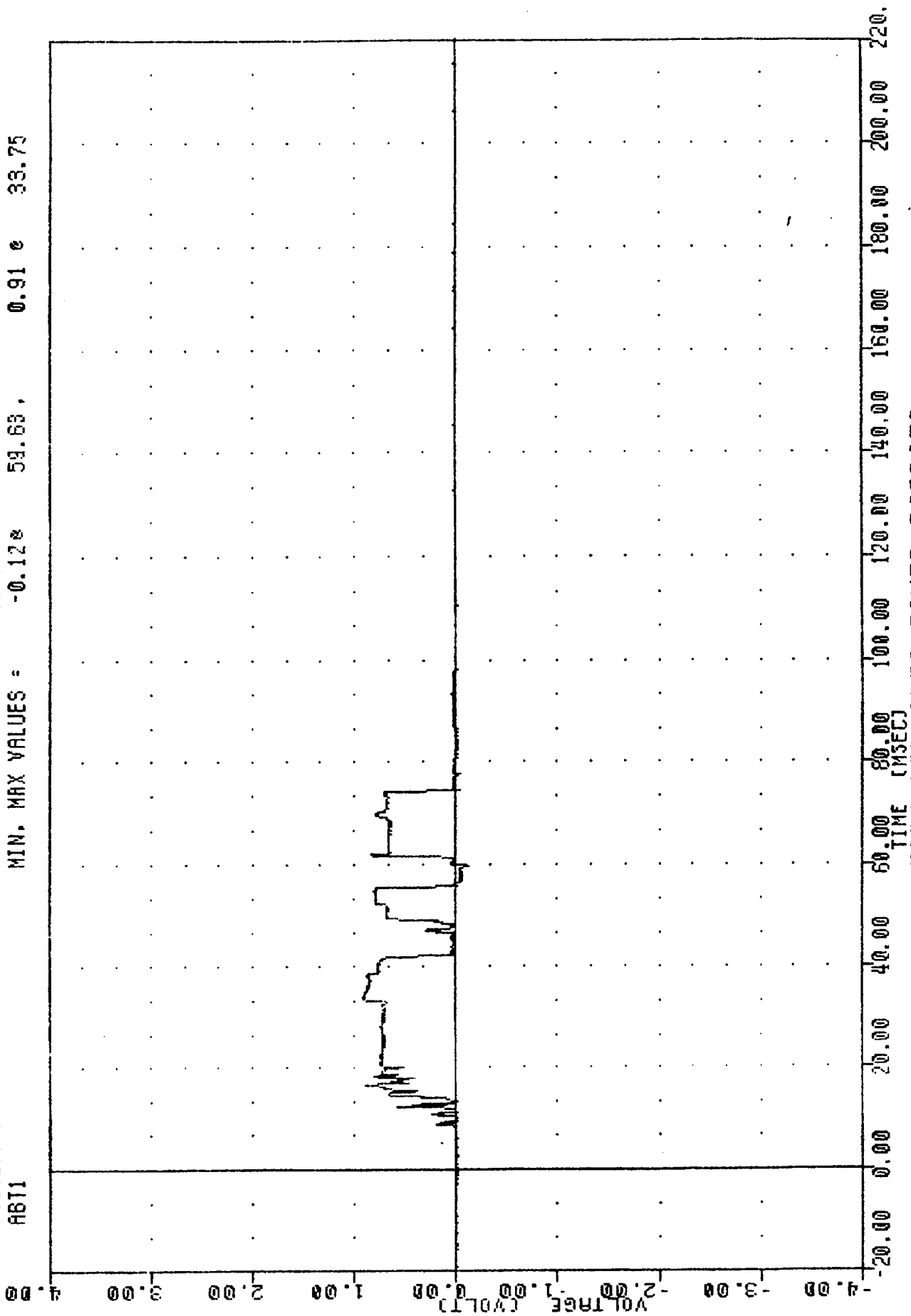
FORD LTD INTO FIXED BARRIER
 010 000 010000 000000

TAC
AIR BAG DEMONSTRATION TEST
83342000000
AB11

PLOT DATE 12-DEC-83 14:42:37

FILTER = ALPF 1650/ 5217/ -40

MIN. MAX VALUES = -0.128 59.63, 0.91 e 33.75



FORD LTD INTO FIXED BARRIER
AIR BAG 1 LEFT SENSOR

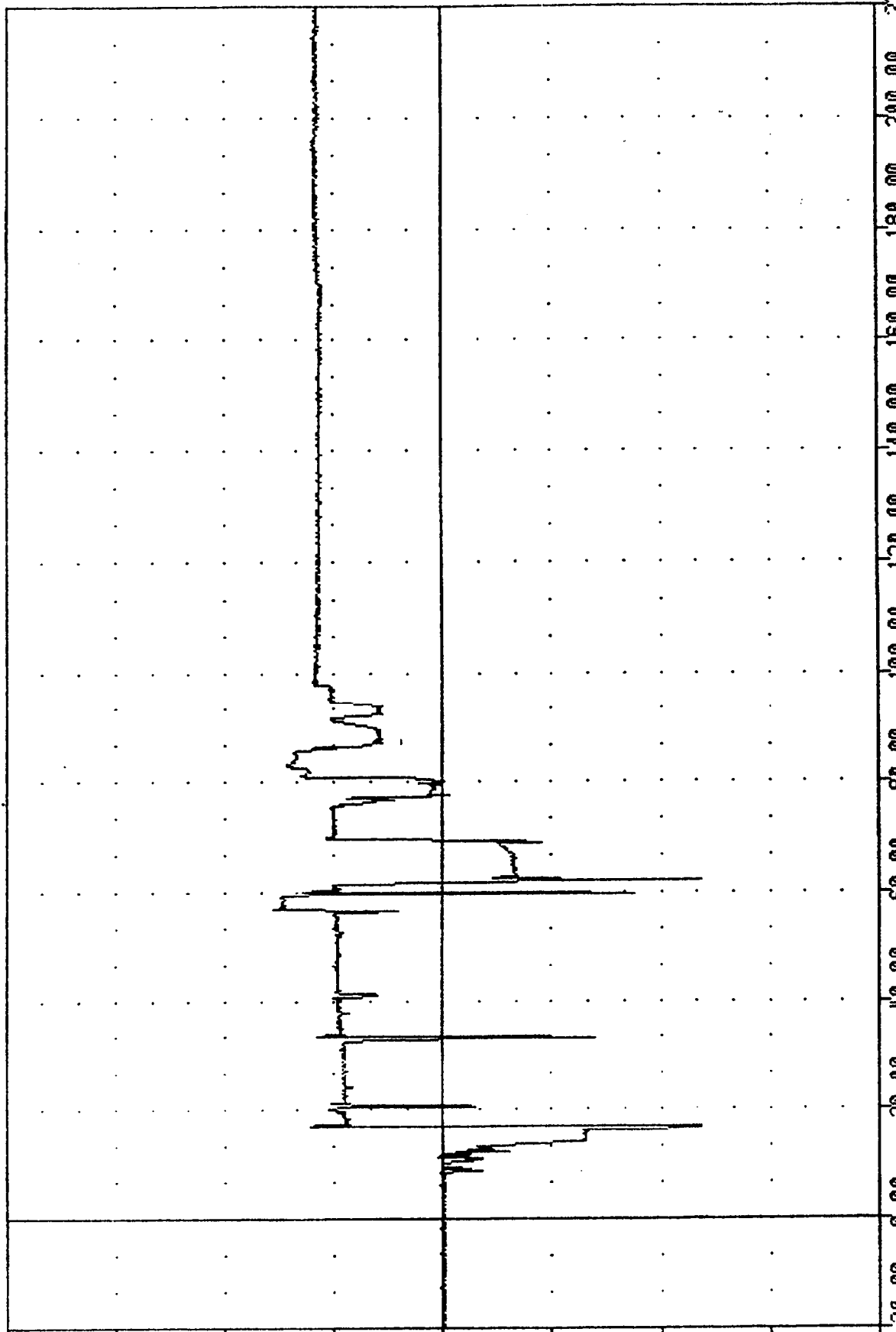
TRC .831208
 AIR BAG DEMONSTRATION TEST
 83342000000
 ABT3

PLOT DATE 12-DEC-83 15:47:38

FILTER - ALPF 1650/ 5217/ -40

MIN, MAX VALUES = -9.48e 16.38, 6.21e 56.63

VOLTAGE (VOLTS)



TIME (MSEC)
 FORD LTD INTO FIXED BARRIER
 AIR BAG SAFETY SENSOR

APPENDIX C
DUMMY CERTIFICATION

TRANSPORTATION RESEARCH CENTER OF OHIO
DUMMY CALIBRATION LABORATORY

MEASUREMENTS, TEST DATA, PARTS IDENTIFICATIONS AND CERTIFICATIONS

PART 572
HYBRID II DUMMY

SERIAL NO.: 175

DATE: 11-21-83

TRANSPORTATION RESEARCH CENTER OF OHIO

EXTERNAL DIMENSIONS

50TH PERCENTILE ADULT MALE (PART 572)

Dummy S/N 175

Manufacturer UNKNOWN

Date 11-21-83

Description	Specification	Actual
Sitting Height	35.7" $\pm$.1"	35.6
Shoulder Pivot Height	22.1" $\pm$.3"	22.2
Hip Pivot Height	3.9" (ref.)	3.9
Hip Pivot From Backline	4.8" (ref.)	4.8
Knee Pivot From Backline	20.4" $\pm$.3"	20.6
Rear of Head From Backline	1.7" (ref.)	1.7
Chest Depth	9.3" $\pm$.2"	9.4
Shoulder Width	18.1" $\pm$.3"	18.0
Chest Circumference Over Nipples	37.4" $\pm$.6"	37.5
Waist Circumference at Min. Girth	32.0" $\pm$.6"	32.1
Hip Width	14.7" $\pm$.7"	14.8
Knee Pivot From Floor	19.6" $\pm$.3"	19.4

Pass/Fail PASS

COMMENTS: _____

Technician TIM MACY, GINNY WATERS Date 11-21-83

Test Engineer MIKE BEEBE Date 11-21-83

PART 572 - HYBRID II DUMMY

Serial No.: 175Date of Calibration: 11-21-83HEAD DROP TESTRESULTS

Parameter	Specification	1st Test	2nd Test	3rd Test	Mean
Peak Resultant Accel	210 - 260g	<u>255.79</u>	_____	_____	_____
Peak Lateral Accel	10g max.	<u>-3.48</u>	_____	_____	_____
Time Above 100g (Resultant)	0.9 - 1.5ms	<u>1.17</u>	_____	_____	_____
Temperature	66 - 78° F	<u>70</u>	_____	_____	_____
Relative Humidity	10 - 70%	<u>39</u>	_____	_____	_____

NECK TESTRESULTS

Parameter	Specification	1st Test	2nd Test	3rd Test	Mean
Pendulum Velocity	21.5-25.5 fps	<u>23.24</u>	_____	_____	_____
Average Decel t_2-t_3	20 - 24g	<u>23.23</u>	_____	_____	_____
Pendulum Decel t_2-t_1	3 ms max.	<u>1.83</u>	_____	_____	_____
Pendulum Decel t_3-t_2	25 - 30 ms	<u>26.64</u>	_____	_____	_____
Pendulum Decel t_4-t_3	10 ms max.	<u>5.33</u>	_____	_____	_____
Pendulum Reversal	123 ms min.	<u>7123</u>	_____	_____	_____
Peak Head Resultant	26g max.	<u>24.32</u>	_____	_____	_____
Peak Head Rotation	63 - 73°	<u>72.76</u>	_____	_____	_____

NECK TEST (continued)RESULTS

Parameter	Specification	1st Test	2nd Test	3rd Test	Mean
Chordal Displacement:					
<u>Head Angle</u>					
0°	Time	2.0 - 2.0ms	0.00		
	Displ	0.5 - 0.5in	0.01		
30°	Time	25.6 - 34.4ms	27.24		
	Displ	2.1 - 3.1in	2.54		
60°	Time	40.3 - 51.7ms	41.71		
	Displ	4.3 - 5.3in	4.53		
Max (73°)	Time	53.2 - 66.8ms	61.38		
	Displ	5.0 - 6.0in	5.57		
60°	Time	67.0 - 83.0ms	80.45		
	Displ	4.3 - 5.3in	4.60		
30°	Time	85.4 - 104.6ms	98.65		
	Displ	2.1 - 3.1in	2.16		
0°	Time	101.0 - 123.0ms	111.39		
	Displ	0.5 - 0.5in	.23		
Temperature	66 - 78° F	71			
Relative Humidity	10 - 70%	43			

ABDOMINAL COMPRESSION TESTRESULTS

Parameter	Specification	1st Test	2nd Test	3rd Test	Mean
Force at 0.0 in	10 lbs.	10			
Force at 1.0 in	50 - 63 lbs.	57.38			
Force at 1.3 in	73 - 88 lbs.	80.99			
Temperature	66 - 78° F	70			
Relative Humidity	10 - 70%	38			

THORAX IMPACT TESTRESULTS

Parameter	Specification	1st Test	2nd Test	3rd Test	Mean
<u>High Speed:</u>					
Probe Velocity	21.78-22.22fps	22.00			
Peak Sternum					
Deflection	1.7 in. max.	1.36			
Peak Resistive Force	2250 lb. max.	2139			
Internal Hysteresis	50 - 70%	56.2			
Temperature	66 - 78° F	71			
Relative Humidity	10 - 70%	42			
<u>Low Speed:</u>					
Probe Velocity	13.86-14.14fps	14.04			
Peak Sternum					
Deflection	1.1 in. max.	.96			
Peak Resistive Force	1450 lb. max.	1378			
Internal Hysteresis	50 - 70%	54.0			
Temperature	66 - 78° F	70			
Relative Humidity	10 - 70%	46			

LUMBAR FLEXION TESTRESULTS

Parameter	Specification	1st Test	2nd Test	3rd Test	Mean
Force at 20°	22 - 34 lbs	34			
Force at 30°	34 - 46 lbs	41			
Force at 40°	46 - 58 lbs	51			
Return Angle	12° max.	3.7			
Temperature	66 - 78° F	70			
Relative Humidity	10 - 70%	38			

RIGHT KNEE IMPACT RESPONSERESULTS

<u>Parameter</u>	<u>Specification</u>	<u>1st Test</u>	<u>2nd Test</u>	<u>3rd Test</u>	<u>Mean</u>
Probe Velocity	<u>6.76-7.04fps</u>	<u>6.84</u>	<u> </u>	<u> </u>	<u> </u>
Peak Force	<u>1850-2500lbs</u>	<u>2346.7</u>	<u> </u>	<u> </u>	<u> </u>
Time Above 1000 Lbs.	<u>1.7 ms min.</u>	<u>1.74</u>	<u> </u>	<u> </u>	<u> </u>
Temperature	<u>66 - 78° F</u>	<u>70</u>	<u> </u>	<u> </u>	<u> </u>
Relative Humidity	<u>10 - 70%</u>	<u>47</u>	<u> </u>	<u> </u>	<u> </u>

LEFT KNEE IMPACT RESPONSERESULTS

<u>Parameter</u>	<u>Specification</u>	<u>1st Test</u>	<u>2nd Test</u>	<u>3rd Test</u>	<u>Mean</u>
Probe Velocity	<u>6.76-7.04fps</u>	<u>6.87</u>	<u> </u>	<u> </u>	<u> </u>
Peak Force	<u>1850-2500lbs</u>	<u>2445.4</u>	<u> </u>	<u> </u>	<u> </u>
Time Above 1000 Lbs.	<u>1.7 ms min.</u>	<u>1.72</u>	<u> </u>	<u> </u>	<u> </u>
Temperature	<u>66 - 78° F</u>	<u>70</u>	<u> </u>	<u> </u>	<u> </u>
Relative Humidity	<u>10 - 70%</u>	<u>47</u>	<u> </u>	<u> </u>	<u> </u>