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BREED AIR BAG PROGRAM

A 1983 DODGE DIPLOMAT INTO A FIXED RIGID BARRIER AT 29.9 MPH

PREPARED BY:
VEHICLE RESEARCH AND TEST CENTER
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EAST LIBERTY, OHIO 43319

TEST REPORT
MARCH 1985

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
400 SEVENTH STREET, S.W.
WASHINGTON, D.C. 20590

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15 Supplementary Notes

16 Abstract

This test report documents a crash test conducted under NHTSA Contract DTNH22-82-A-08401 involving a 1983 Dodge Diplomat 4-door sedan retrofitted with a Breed air bag and a knee bolster. The test vehicle was impacted into a fixed, rigid barrier at 29.9 mph. Vehicle accelerations, air bag sensors and occupant responses were measured. All testing was conducted at the TRCO Crash Test Facility in East Liberty, Ohio.

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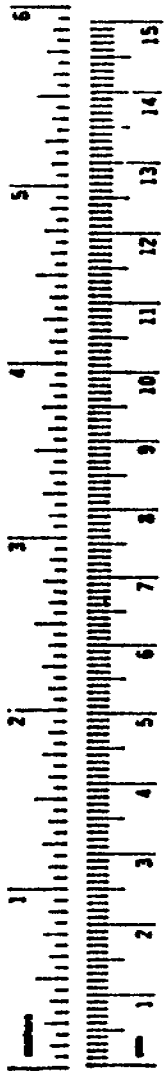
METRIC CONVERSION FACTORS

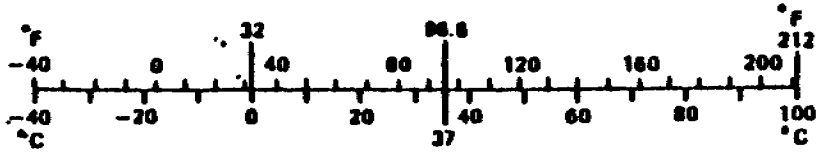
Approximate Conversions to Metric Measures

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	0.4	hectares	ha
	MASS (weight)			
z	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	metric ton	t
	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 (10 000 m^2)	2.5	acres	
	MASS (weight)			
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	metric ton (1000 kg)	1.1	short tons	
	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 the Breed All Mechanical Air Bag System and Knee Restraint when retrofitted in a vehicle. The vehicle was tested using conditions in excess of those currently contained in a Federal Motor Vehicle Safety Standard.

INTRODUCTION

A 1983 Dodge Diplomat 4-door Sedan which was supplied by NHTSA was towed into a fixed rigid barrier at 29.9 mph. This test was conducted to determine the firing velocity of the air bag and to demonstrate the effectiveness of the Breed air bag and knee restraint system when used without the vehicle's production belt restraint. The intended test speed was 30 mph.

Section 2 contains General Test and Vehicle Parameter Data. Section 3 contains data required by R & D. Appendix A contains pre-test and post-test vehicle photographs. Appendix B contains data plots and 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: Chrysler Canada Ltd.

MAKE/MODEL: Dodge Diplomat VIN: 2B3BG2648DR250447

BODY STYLE: 4-Door Sedan MODEL YEAR: 1983

NHTSA NO.: R & D COLOR: White

ENGINE DATA: TYPE: V8 CYLINDERS: 8 DISPLACEMENT 318 CID

TRANSMISSION DATA: 3-speed Automatic

DATE VEHICLE RECEIVED: 12/3/84 ODOMETER READING: 46459

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	No
POWER WINDOWS	No	TELESCOPING STEERING WHEEL	No
TINTED GLASS	Yes	AIR CONDITIONING	Yes
RADIO	Yes	ANTI-SKID BRAKE	No
CLOCK	Yes	REAR WINDOW DEFROSTER	Yes
OTHER			

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: Chrysler Canada Ltd.

DATE OF MANUFACTURE: 6/83

GVWR: 5000 LBS.,

GAWR: FRONT 2515 LBS., REAR 2535 LBS.

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 200 LBS. CARGO:

RIGHT FRONT	1080	LBS.	RIGHT REAR	990	LBS.
LEFT FRONT	1160	LBS.	LEFT REAR	890	LBS.
TOTAL FRONT WEIGHT	2240	LBS. (54.4 % OF TOTAL VEHICLE WEIGHT)			
TOTAL REAR WEIGHT	1880	LBS. (45.6 % OF TOTAL VEHICLE WEIGHT)			
TOTAL TEST WEIGHT	4120	LBS.			

WEIGHT OF BALLAST SECURED IN VEHICLE TRUNK AREA: 90 LBS.

VEHICLE REBOUND AND CRUSH

OVERALL LENGTH OF TEST VEHICLE:	PRE-TEST:	R 201 1/4	;L 200 3/4
	POST-TEST:	R 180 1/4	;L 180 7/16
TOTAL CRUSH:		R 20 7/8	;L 20

FOR FRONTAL IMPACTS, DISTANCE FROM FRONT OF TEST VEHICLE TO BARRIER AFTER IMPACT: CENTER: 13 9/16 ;R 14 3/8 ;L 13 7/16

TEST CONDITIONS

TEST NUMBER: 841220

DATE OF TEST: 12/20/84 TIME OF TEST: 1547

WIND VELOCITY: 0 - 2 MPH HUMIDITY: NA

AMBIENT TEMPERATURE AT IMPACT AREA: 70°F

TEMPERATURE IN OCCUPANT COMPARTMENT: 68°F

SUBJECT VEHICLE DATA

	ACTUAL	INTENDED
TEST WEIGHT (LBS.)	4120	4144
VEHICLE ORIENTATION (DEGREES)	0	0
VEHICLE VELOCITY (mph)	29.9	30

DUMMIES

	DRIVER	MIDDLE PASSENGER	RT. FRONT PASSENGER	LEFT REAR PASSENGER	RT. REAR PASSENGER
TYPE:	572				
SERIAL NO.:	187				
INSTRUMENTATION:					
HEAD ACCEL.:	Yes				
CHEST ACCEL.:	Yes				
FEMUR L.C.'S:	Yes				
OTHER:	Pelvis				

RESTRAINT SYSTEM: Breed airbag and knee bolster

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #187	PASSENGER
Head	Air Bag	NA
Chest	Air Bag	NA
Abdomen	Air Bag	NA
Left Knee	Bolster	NA
Right Knee	Bolster	NA

DOOR OPENING:

	LEFT	RIGHT
Front	With Difficulty	NA
Rear	With Difficulty	NA

SEAT MOVEMENT:

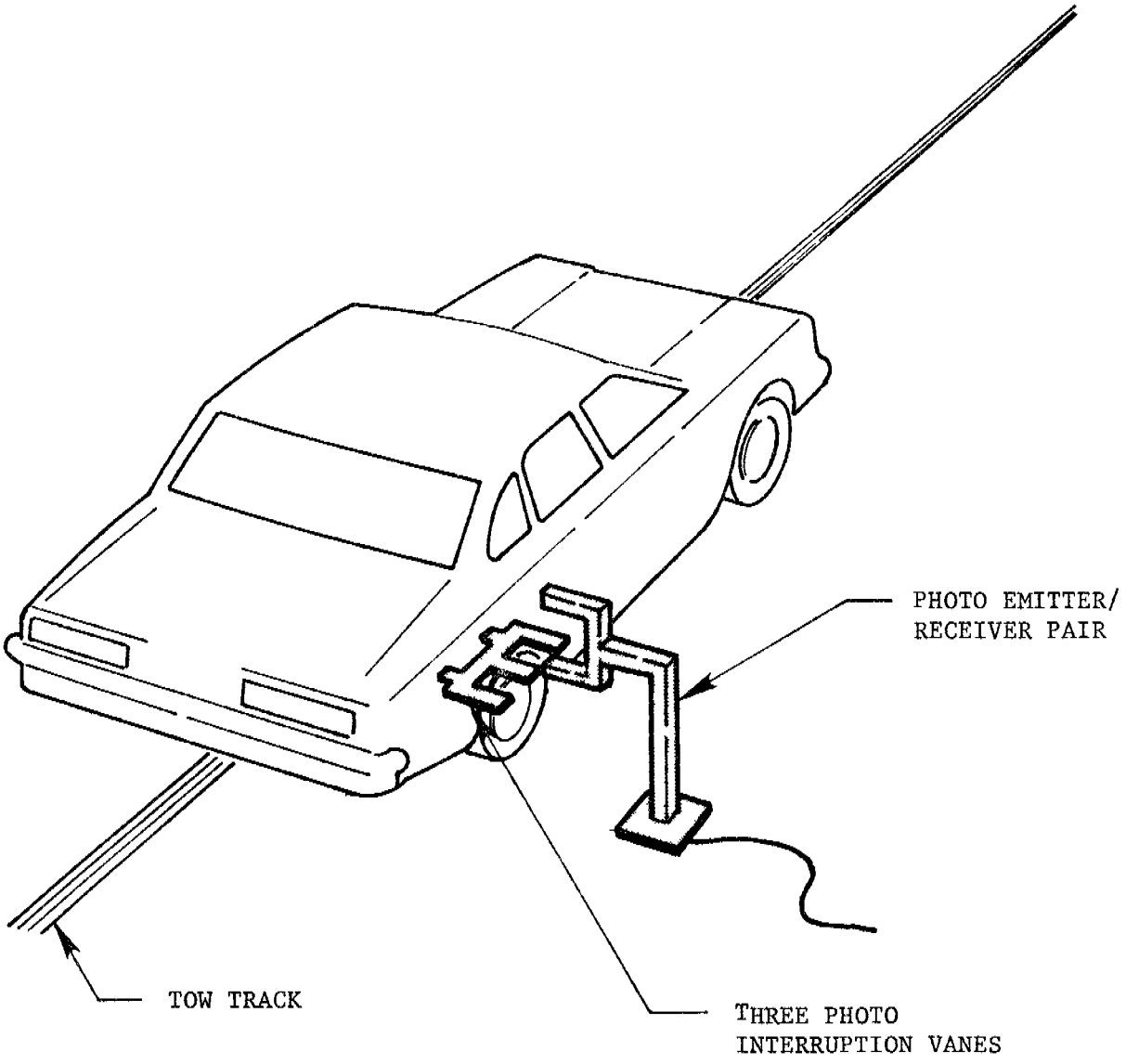
	SEAT BACK FAILURE	SEAT SHIFT
Front	No	NA
Rear	NA	NA

GLAZING DAMAGE: None

OTHER NOTABLE IMPACT EFFECTS:

None

IMPACT VELOCITY MEASUREMENT SYSTEM



The final vane clears emitter/receiver 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
= 3780 + 1 X 164 + 200 lbs.
= 4144 lbs.

To achieve test weight, 90 pounds of sand ballast was added. The weight of the test vehicle was measured by placing each wheel on a Loadmeter Corporation Hiway Loadometer.

TEST ANOMALIES

The accelerometer in the pelvis "X" axis, PEVXG, did not return to zero. Therefore, data from this channel and the pelvis resultant data should be carefully considered.

The steering column hub accelerometers in the posterior and lateral positions, STHPG and STHLG, both broke at approximately 80 msec. Data from these two channels should be disregarded, along with the calculated velocity, distance, and the resultant.

The accelerometer in the inferior position on the steering column hub, STHIG, did not return to zero.

The left and right front frame rail accelerometers, FFRXGL and FFRXGR, did not return to zero. The right accelerometer also had a pinched wire from approximately 85 to 100 msec. The calculated velocities and distances from these channels should be disregarded.

The airbag pressure transducer, ABTP, was damaged at approximately 53 msec.

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 dummy was positioned according to New Car Assessment Program Test Procedure, but with one exception. Instead of using the 50 pound lower torso force during dummy placement, a 10 pound force on the lower torso was substituted. 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 & longitudinal & passes through center point of steering wheel rim.
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	Centered on bucket seat cushion. Midsagittal plane is vertical & longitudinal. For bench seat, midsagittal plane is vertical & longitudinal & passes through center point of plane described by steering wheel rim.
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.

PART 572 DUMMY	DRIVER DSP
LEFT KNEE	Outer surface of pivot bolt head is 5.9" from midsagittal plane of dummy.
LOWER LEGS	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.
LEFT FOOT	Placed on towboard -- rearmost point of heel on floorpan as close as possible to intersection of toeboard and floorpan. Centerline falls in vertical longitudinal plane.

PART 572 DUMMY IN-VEHICLE POSITION RECORDING SHEET

VEHICLE NHTSA NO. R & D MFR./MAKE/MODEL: Dodge Diplomat

SEAT TYPE: x Bench ___ Bucket ___ Split Back

ADJUSTER TYPE: x Manual ___ Power

BUCKET SEAT BACK TYPE: x Fixed ___ Adjustable Reclining

TECHNICIANS:
1. B. Miller
2. B. Fishbaugh
3. D. Carpenter
4. P. Clay

POSITIONING DATE: 12/20/84

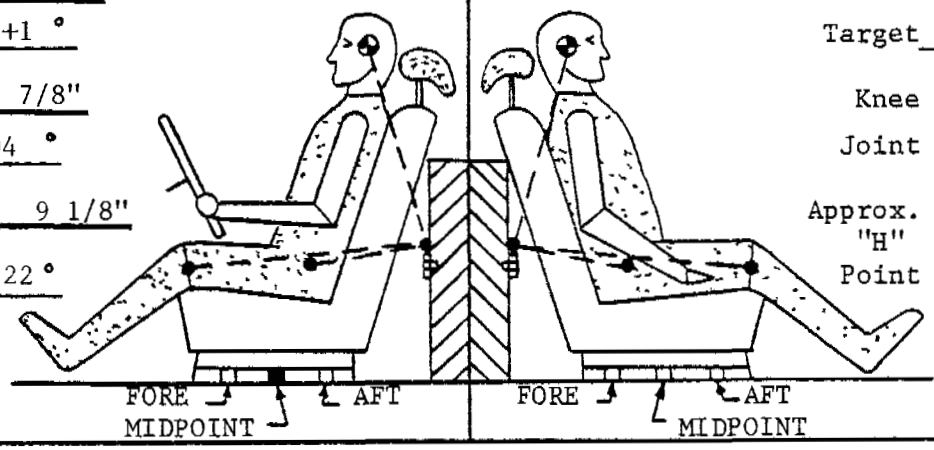
AMBIENT TEMP.: 72° F. TIME: 11:50

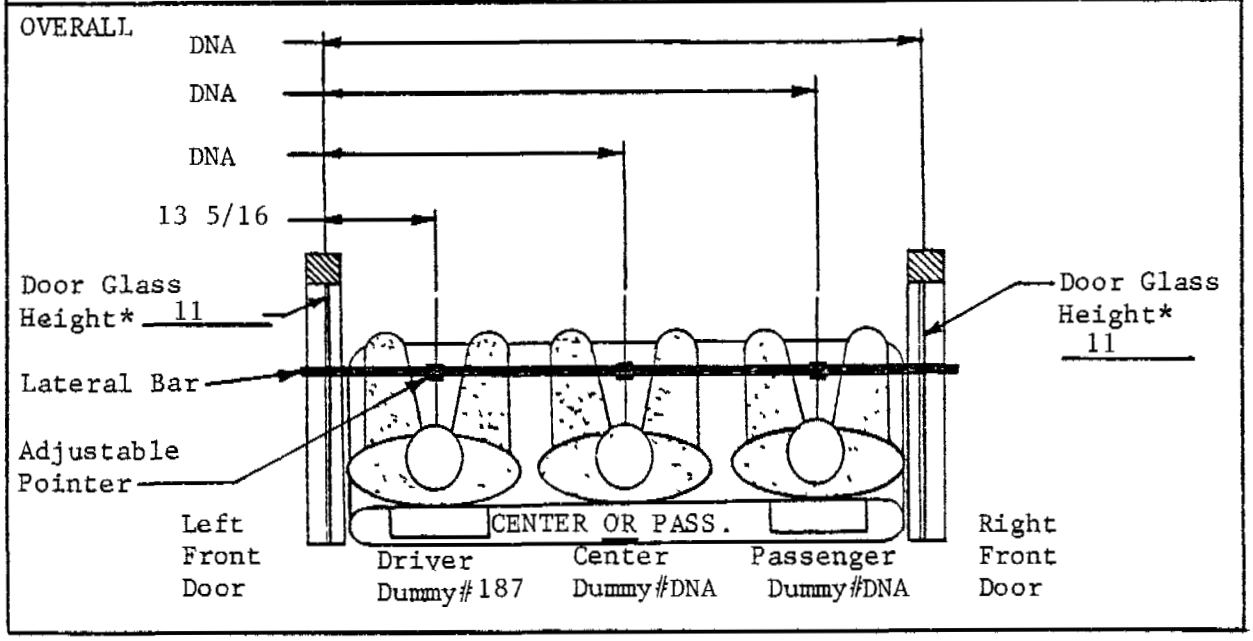
DRIVER DUMMY # 187

Head 22 1/2"
Target +1 °
Knee 22 7/8"
Joint -94 °
Approx. 9 1/8" "H" Point -122 °

PASSENGER DUMMY # DNA

Head ____
Target ____ °
Knee ____
Joint ____ °
Approx. ____ "H" Point ____ °

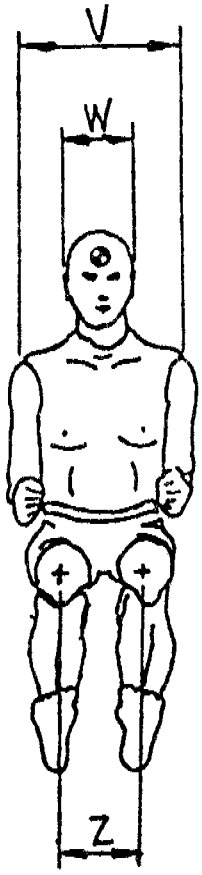


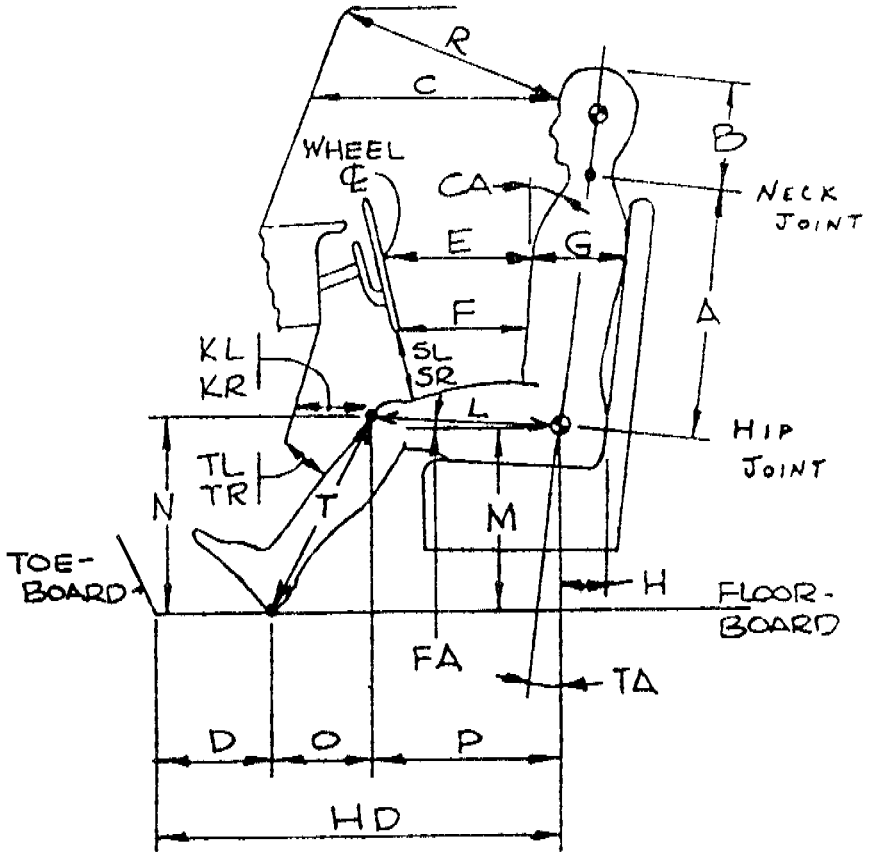


* Door glass height is equal on the right and left side of vehicle.

DUMMY IN-VEHICLE POSITION RECORDING SHEET

BREED VERSION (Not Standard)





Seat @ Mid-Postion

ALL MEASUREMENTS TO THE NEAREST 1/4 INCH, AND WHOLE DEGREE.

Measurements A,B,L are parallel to the dummy inclination; SL,SR,TL,TR,R are "shortest distance" measurements; all the rest are horizontal and vertical.

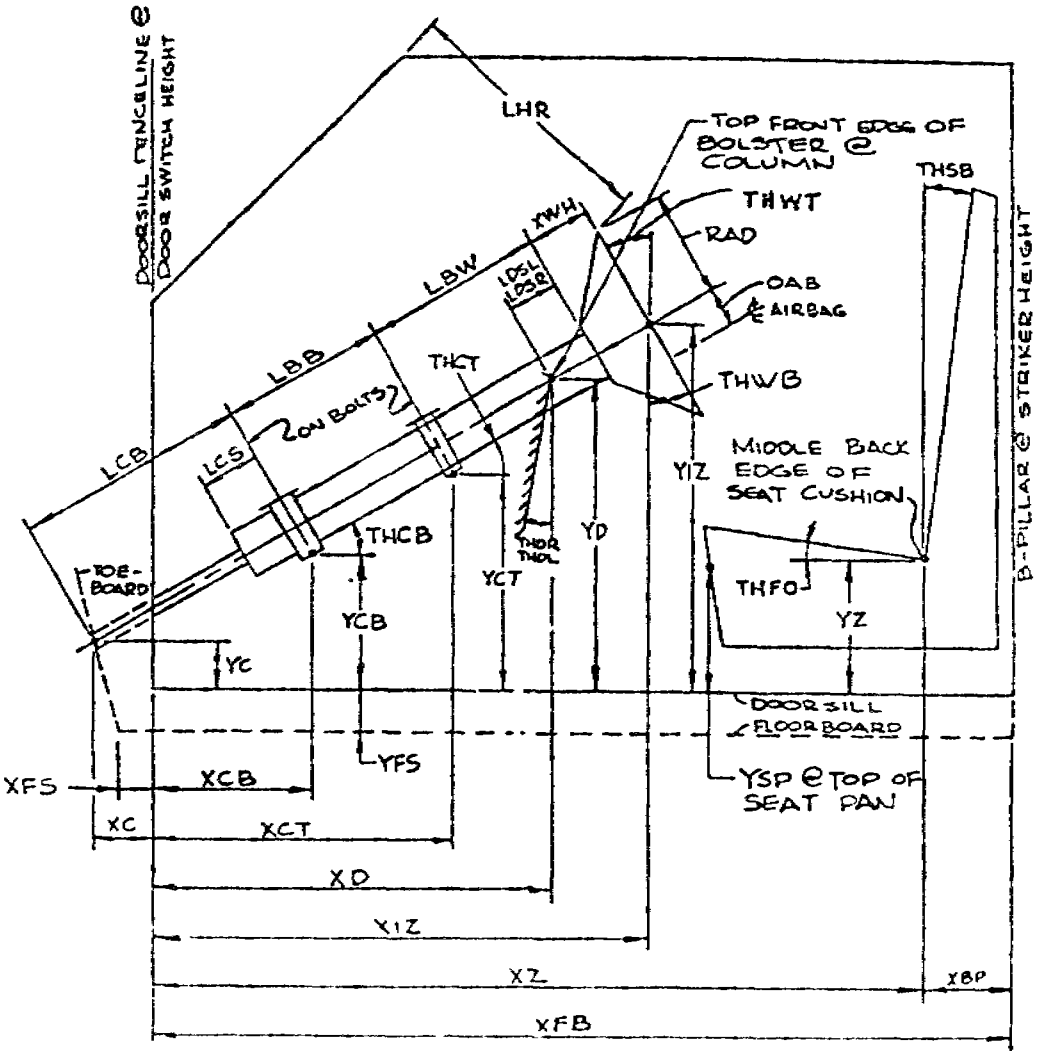
A = 22	B = 9 1/2	KL = 5 1/4	L = 18	T = 20
C = 20 1/4	E = 11 1/2	KR = 4 3/4	G = 9 1/2	Q = 4 1/2
M = 9 3/4	N = 13 1/4	F = 7	P = 18	I = 17 3/4
R = 16 3/4	V = 17 1/2	O = 15	Z = 10 1/2	
HD = 36 1/2	CA = 23 °	W = 6 1/4	FA = 13 °	
D = 2	TR = 3	TA = 18 °	SR = 3 3/4	
H = 4 3/4	TL = 3 1/2	LA = NA	SL = 4	

CAR PARAMETERS, PRE & POST TEST

	PRE	POST
LBW=	11 1/2	10 1/2
LBB=	NA	NA
LCB=	15 1/2	13
XC=	13 3/4	
YC=	7 1/4	6 3/4
YIZ=	20	20 1/2
XIZ=	15 1/2	14 1/2
XZ=	32	31 1/4
YZ=	4	4
THCT=	22°	28°
THCB=		
THWT=	22°	19
THWB=		
THFO=	14°	13°
THSB=	25°	25°
THDL=	45°	46°
THDR=		

	PRE	POST
YD=	7	6 1/2
YD=	15 1/2	14 1/2
LDSL=	6 1/2	5 1/2
LDSR=		
XBP=	4	3 1/2
XFB=	36	35 3/4
XFS=	6	7 1/4
LHR=	12 3/4	13
YSP=	NA	NA
YFS=	4	3 1/2
LCS=	NA	NA
OAB=	3/4	NA
XCB=	NA	NA
YCB=		
XCT=	1	1 3/4
YCT=	13 1/4	14

	PRE	POST N	POST S	POST E	POST W
RAD=	7 1/8	6 3/4	7 1/4	7 1/2	7 1/4
XWH=	4 1/2	3 1/2	3 5/8	4	4 3/4



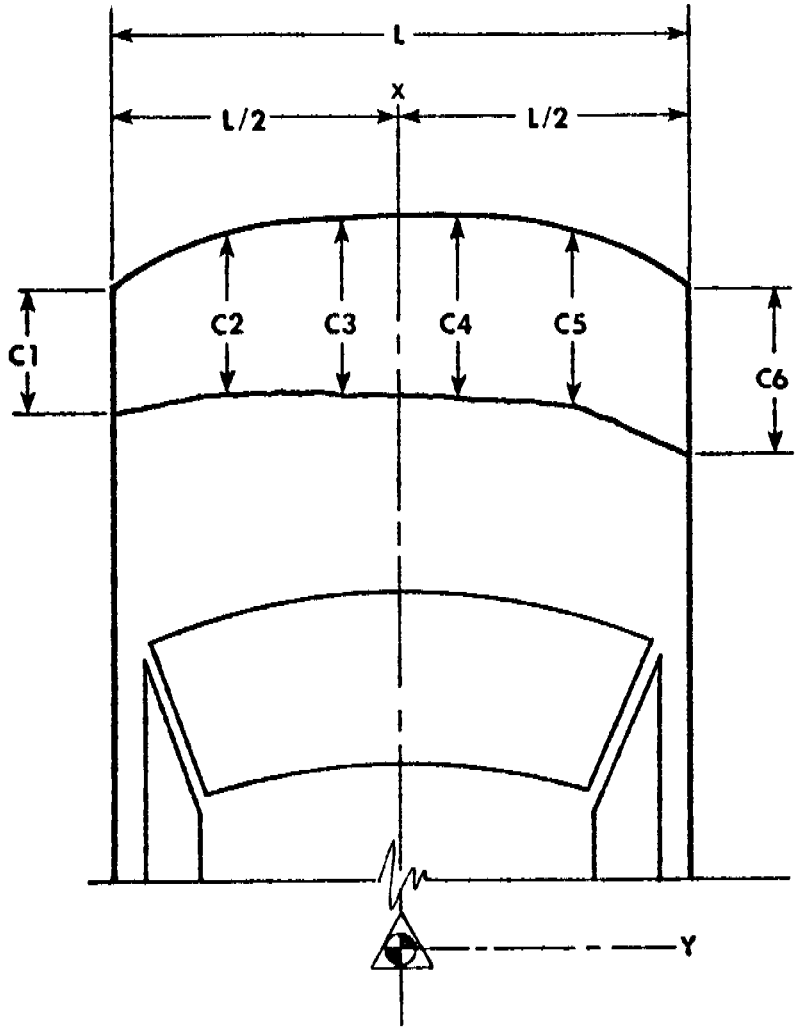
ALL DIMENSIONS TO NEAREST 1/4 INCH & WHOLE DEGREE

ALL MEASUREMENTS IN INCHES UNLESS OTHERWISE SPECIFIED

DUMMY KINEMATIC SUMMARY

During impact the airbag expanded, contacting the dummy's chest. As the dummy moved forward, the face and upper torso were enfolded by the airbag. At the same time the dummy's knees contacted the knee bolster. Forward movement continued as the steering column was forced upwards and the dash panel cracked.

The dummy rebounded from the airbag, the head hitting the head rest. Final resting position showed the driver seated upright with his knees still contacting the knee bolster.



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

VEHICLE Dodge Diplomat

	PRE-TEST	POST-TEST	CRUSH
L	66 5/8	66 1/2	1/8
C1	15 1/16	35 3/8	20 5/16
C2	13 1/2	35 1/8	21 5/8
C3	12	35	23
C4	11 3/4	35 1/8	23 3/8
C5	13 1/2	35 1/2	22
C6	14 5/8	35 5/8	21
D	0	0	0

Reference point is 18' forward from rear bumper

PART 572 DUMMY DATA SUMMARY

TEST NO. 841220

DRIVER DUMMY

	POSITIVE DIRECTIONS* MAX (g)	TIME (msec)	NEGATIVE DIRECTIONS** MAX (g)	TIME (msec)
HEAD ACCELERATION				
LONGITUDINAL	4.32	52.63	61.86	82.25
LATERAL	2.47	171.50	6.37	103.50
VERTICAL	8.09	66.50	28.29	88.00
RESULTANT		64.96	max @ 84.13	
HIC		460.84	from 74.88 to 109.88	
DELTA V (MPH)		-41.3	@ 180.00	
DELTA X (INCHES)		-41.9	@ 180.00	
CHEST ACCELERATION				
LONGITUDINAL	7.01	47.25	49.61	77.88
LATERAL	1.90	126.50	6.43	75.50
VERTICAL	8.20	56.25	9.23	78.00
RESULTANT		50.58	max @ 77.88	
DELTA V (MPH)		-41.8	@ 164.00	
DELTA X (INCHES)		-45.8	@ 180.00	
PELVIS ACCELERATION				
LONGITUDINAL	4.73	134.88 Y	54.86	82.00 Y
LATERAL	8.93	80.88	10.05	57.75
VERTICAL	11.93	54.75	16.30	77.00
RESULTANT		56.20	@ 82.00	
DELTA V (MPH)		-37.4	@ 115.88	
DELTA X (INCHES)		-44.8	@ 180.00	

	MAX (lb)	TIME (msec)	MAX (lb)	TIME (msec)
FEMUR FORCE***				
LEFT	47.18	31.75	2122.97	84.25
RIGHT	68.00	151.00	1530.33	85.50

* LONGITUDINAL: FORWARD
LATERAL: RIGHTWARD
VERTICAL: DOWNWARD

** LONGITUDINAL: REARWARD
LATERAL: LEFTWARD
VERTICAL: UPWARD

*** COMPRESSION: NEGATIVE

Y SEE TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY
TEST NO. 841220

NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION MAX (g)	POSITIVE DIRECTION TIME (msec)	NEGATIVE DIRECTION MAX (g)	NEGATIVE DIRECTION TIME (msec)
1	LEFT FENDER WELL	183.3	-17.3	17.5				
	LONGITUDINAL	ΔV = --- mph @ --- msecγ			41.28	13.38 γ	90.79	34.45 γ
		ΔX = --- in @ --- msec γ						
2	RIGHT FENDER WELL	183.9	20.9	25.0				
	LONGITUDINAL	ΔV = --- mph @ --- msec γ			---	--- γ	---	--- γ
		ΔX = --- in @ --- msec γ						
3	STEERING COLUMN HUB	122.0	-14.0	33.0				
	POSTERIOR	ΔV = --- mph @ --- msec γ			---	--- γ	---	--- γ
		ΔX = --- in @ --- msec γ						
	LATERAL				---	--- γ	---	--- γ
	VERTICAL				108.32	100.88	26.80	43.38
	RESULTANT					138.51 @	76.63	
4	LEFT B PILLAR	98.0	-28.5	17.0				
	LONGITUDINAL	ΔV =-33.7 mph @ 112.63 msec			21.92	14.50	24.99	62.38
		ΔX =-48.9 in @ 180.00 msec						
	LATERAL				16.06	62.50	10.68	24.00
	VERTICAL				12.40	56.25	13.38	16.00
	RESULTANT					31.24 @	62.38	

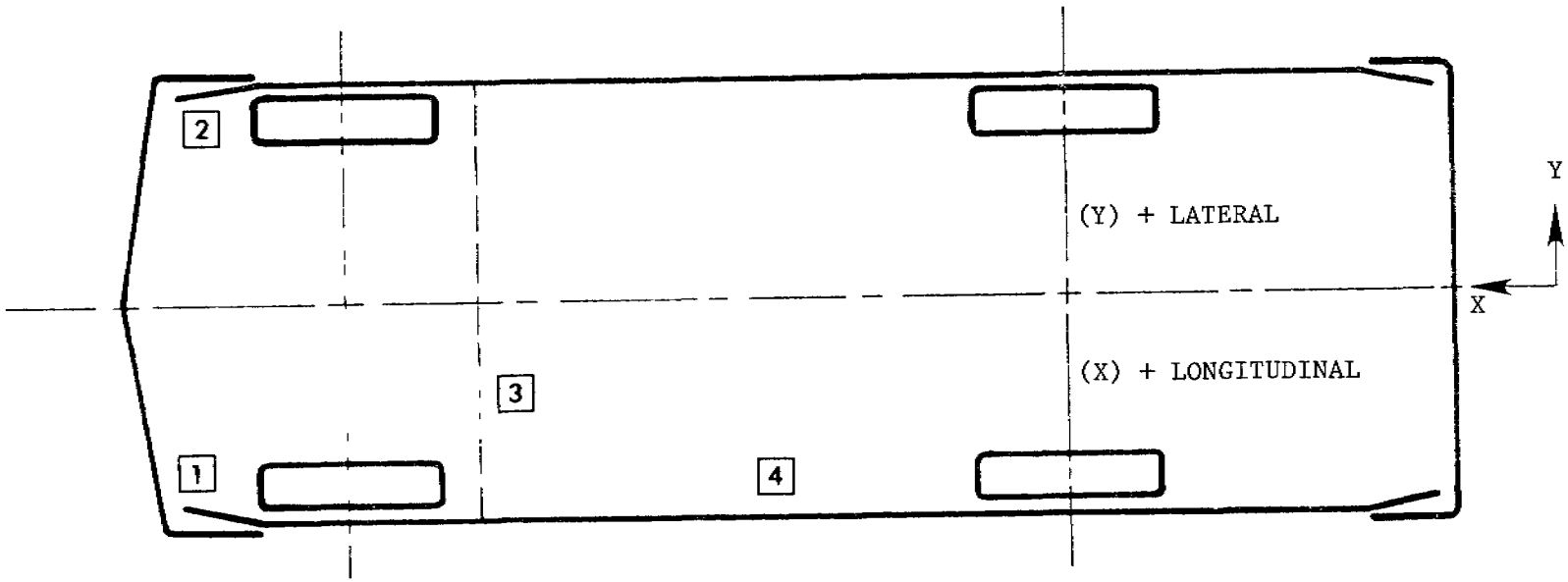
* REFERENCE: X - REAR BUMPER (+ FORWARD), Y - VEHICLE CENTERLINE (+ TO RIGHT)
Z - GROUND (+ UP)

AIRBAG FIRING TIME = 38.0 MSEC
AIRBAG PRESSURE (PSI) = 46.23 @ 31.63 γ

ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS IN INCHES

γ SEE TEST ANOMALIES

VEHICLE ACCELEROMETER LOCATIONS



HIGH SPEED CAMERA INFORMATION

CAMERA NO.	LOCATION	TYPE	LENS (mm)	SPEED (fps)	PURPOSE OF CAMERA DATA
1	Onboard-Window	Photosonic 1B	8	1000	Dummy Kinematics
2	Onboard-Roof	Photosonic 1B	8	1000	Dummy Kinematics
3	Onboard-Floor	Photosonic 1B	8	1000	Dummy Kinematics
4	Left Closeup	Photosonic 1B	25	1000	Vehicle Dynamics
5	Right Wide	Photosonic 1B	25	1000	Overall Impact
6	Right Closeup	Photosonic 1B	25	1000	Vehicle Crush
7	Right	Kodak	16	24	Vehicle Dynamics
8	Right	Beaulieu	N/A	24	Real Time
9	Overhead	Photosonic 1B	17	1000	Vehicle Dynamics

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.

APPENDIX A

PHOTOGRAPHS

Figure A-1. PRE-TEST OVERALL - VIEW 1

Figure A-2. PRE-TEST OVERALL - VIEW 2

Figure A-3. PRE-TEST OVERALL - VIEW 3

Figure A-4. PRE-TEST OVERALL - VIEW 4

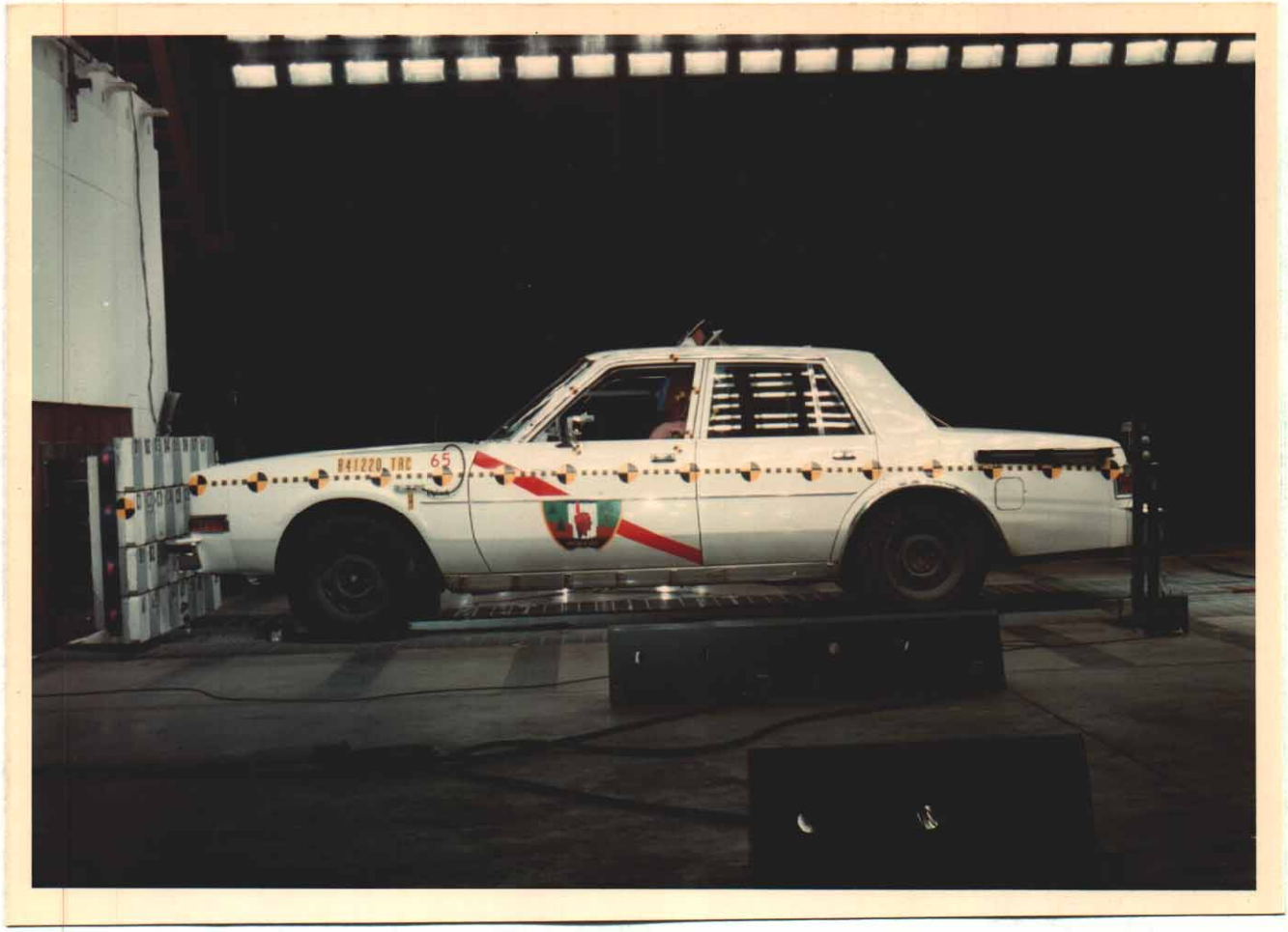


Figure A-5. PRE-TEST OVERALL - VIEW 5

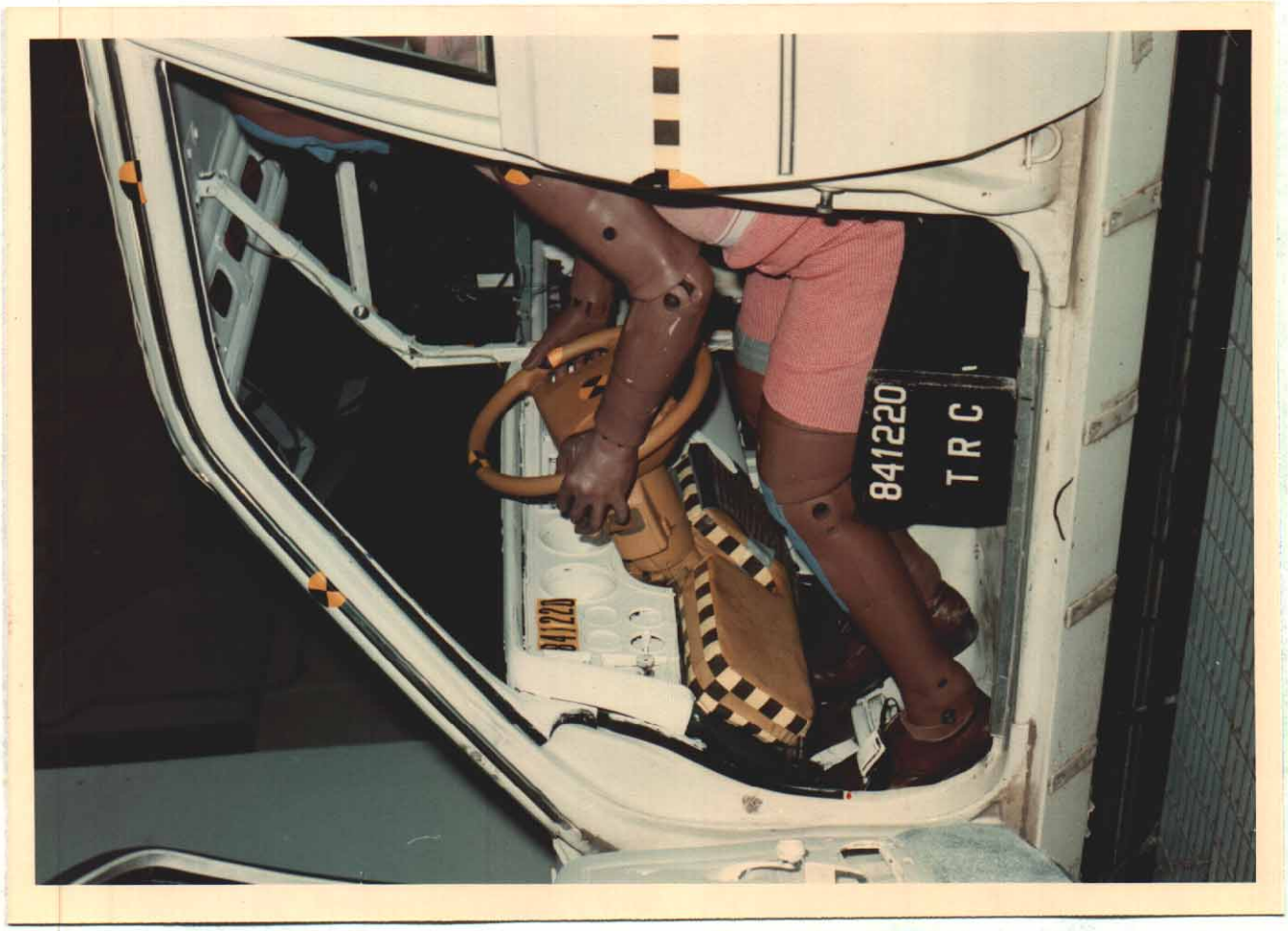


Figure A-6. PRE-TEST DRIVER DUMMY - VIEW 1

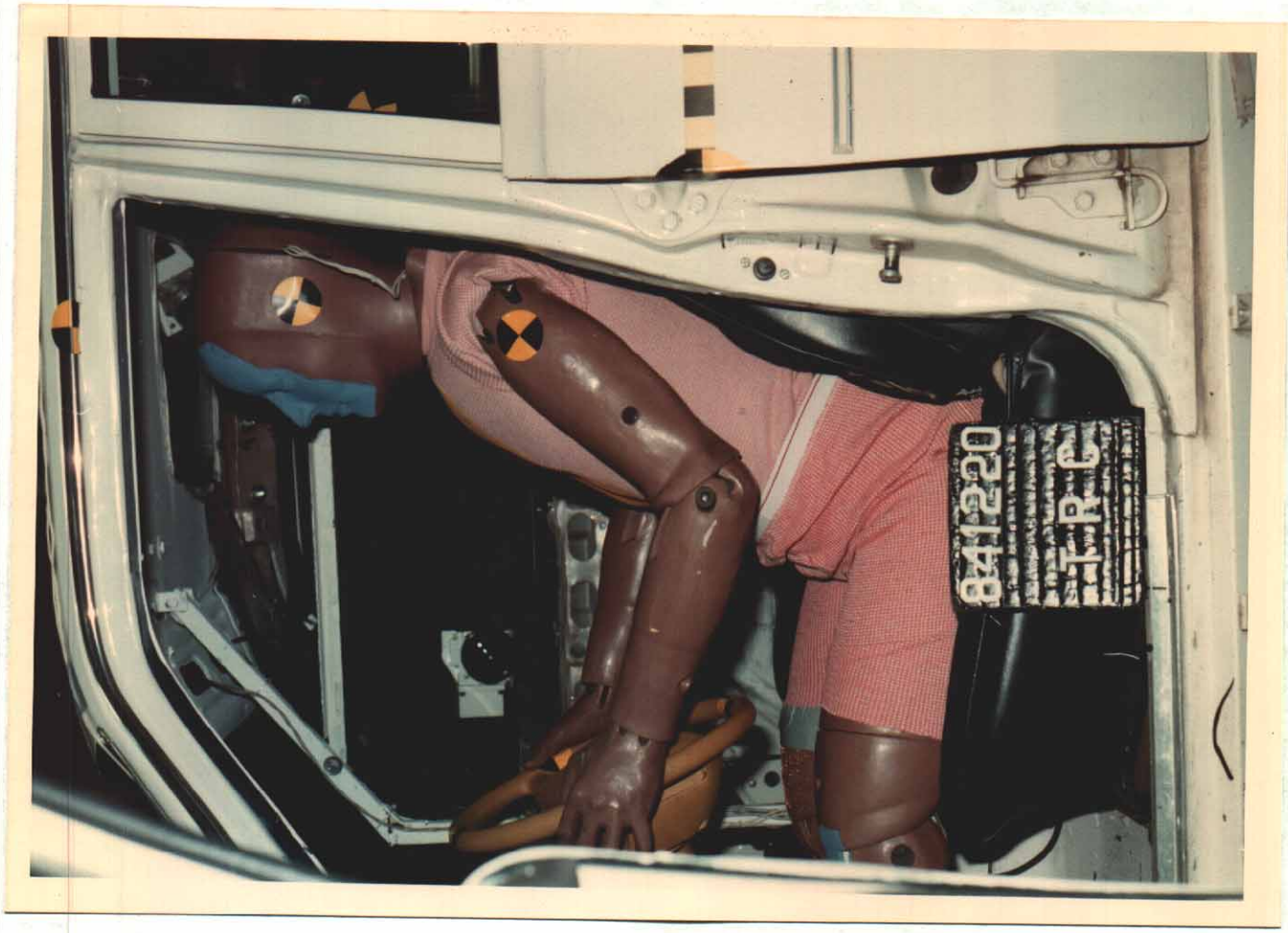


Figure A-7. PRE-TEST DRIVER DUMMY - VIEW 2

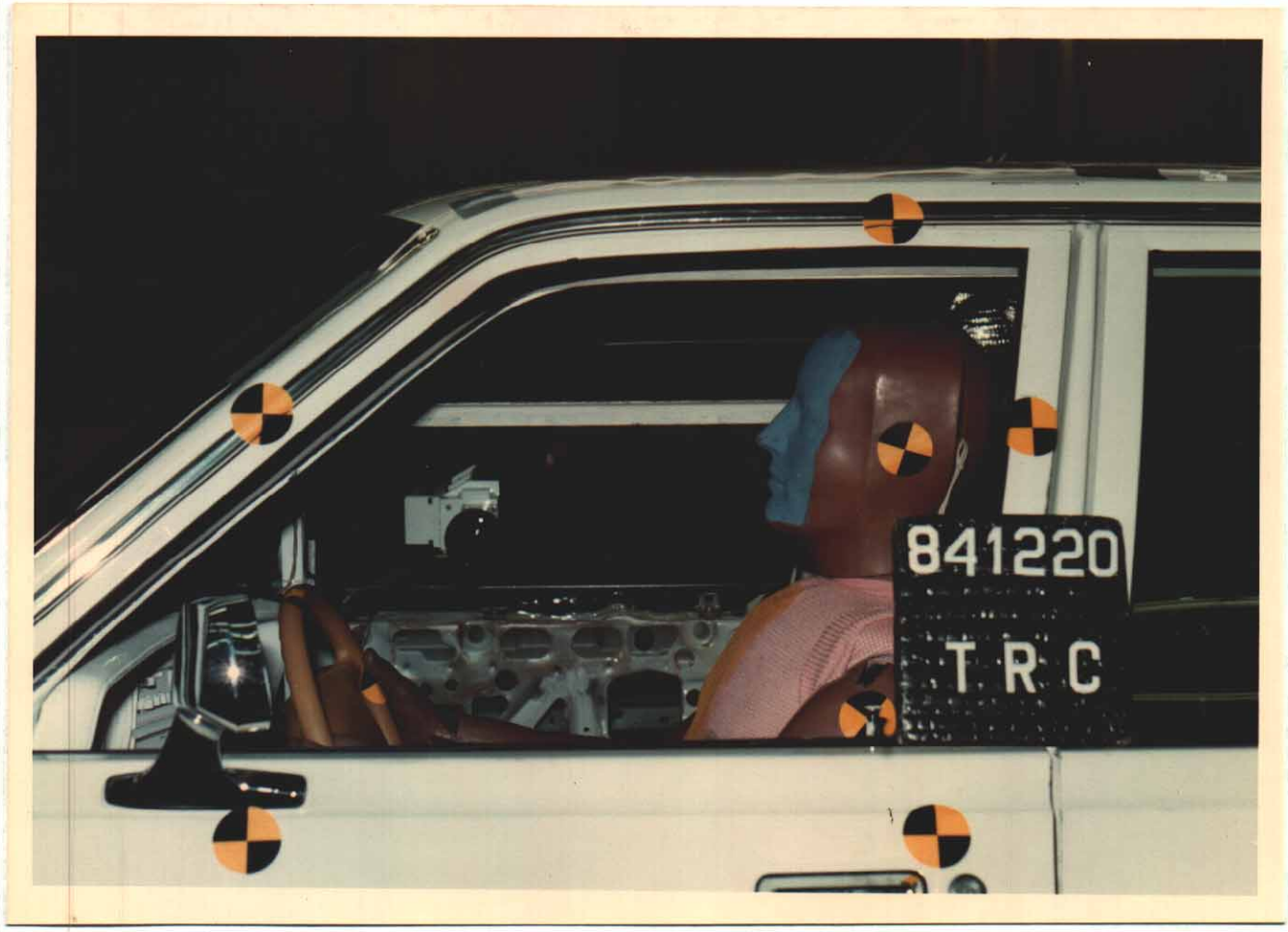


Figure A-8. PRE-TEST DRIVER DUMMY - VIEW 3

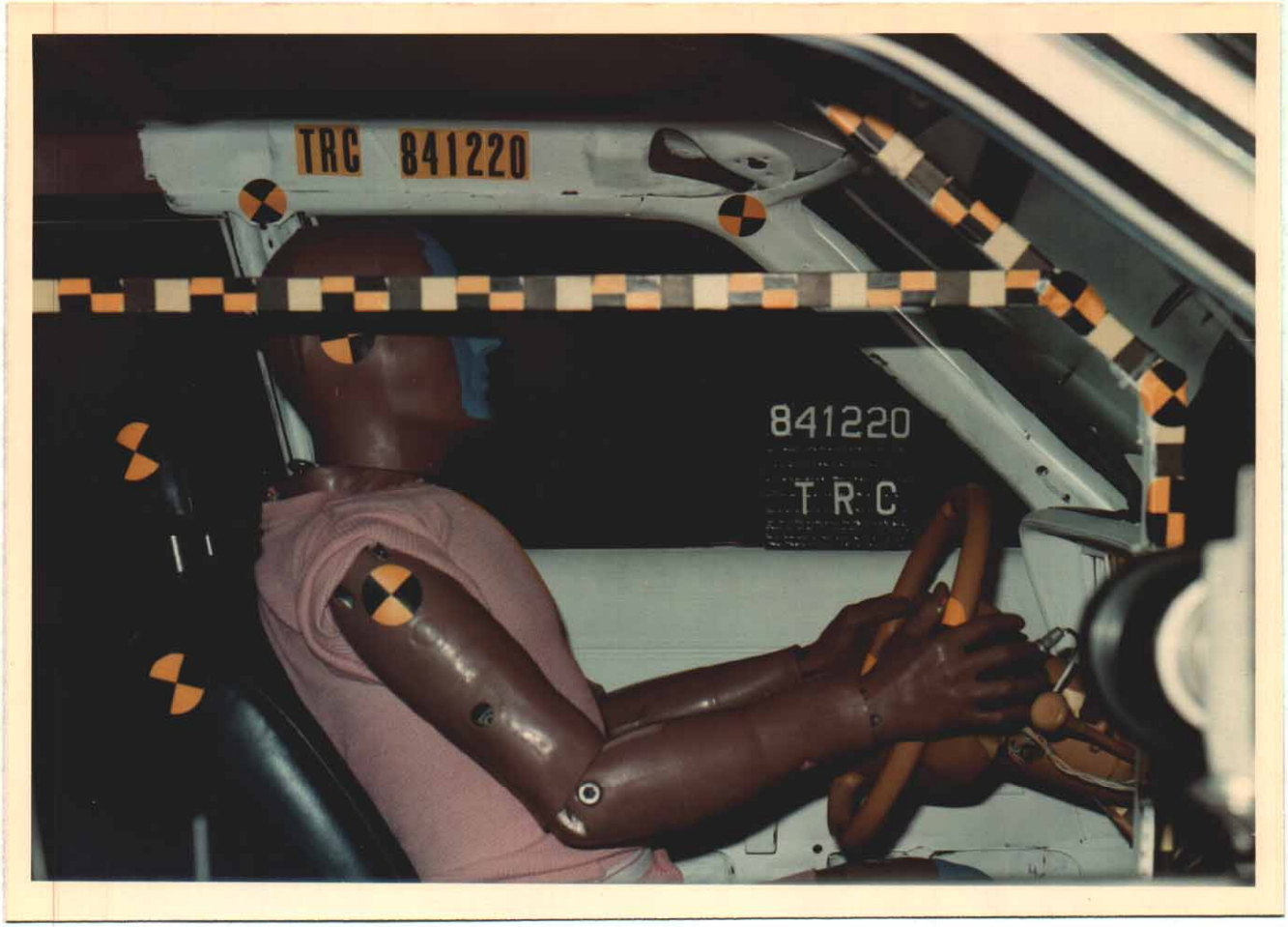


Figure A-9. PRE-TEST DRIVER DUMMY - VIEW 4

Figure A-10. POST-TEST OVERALL - VIEW 1

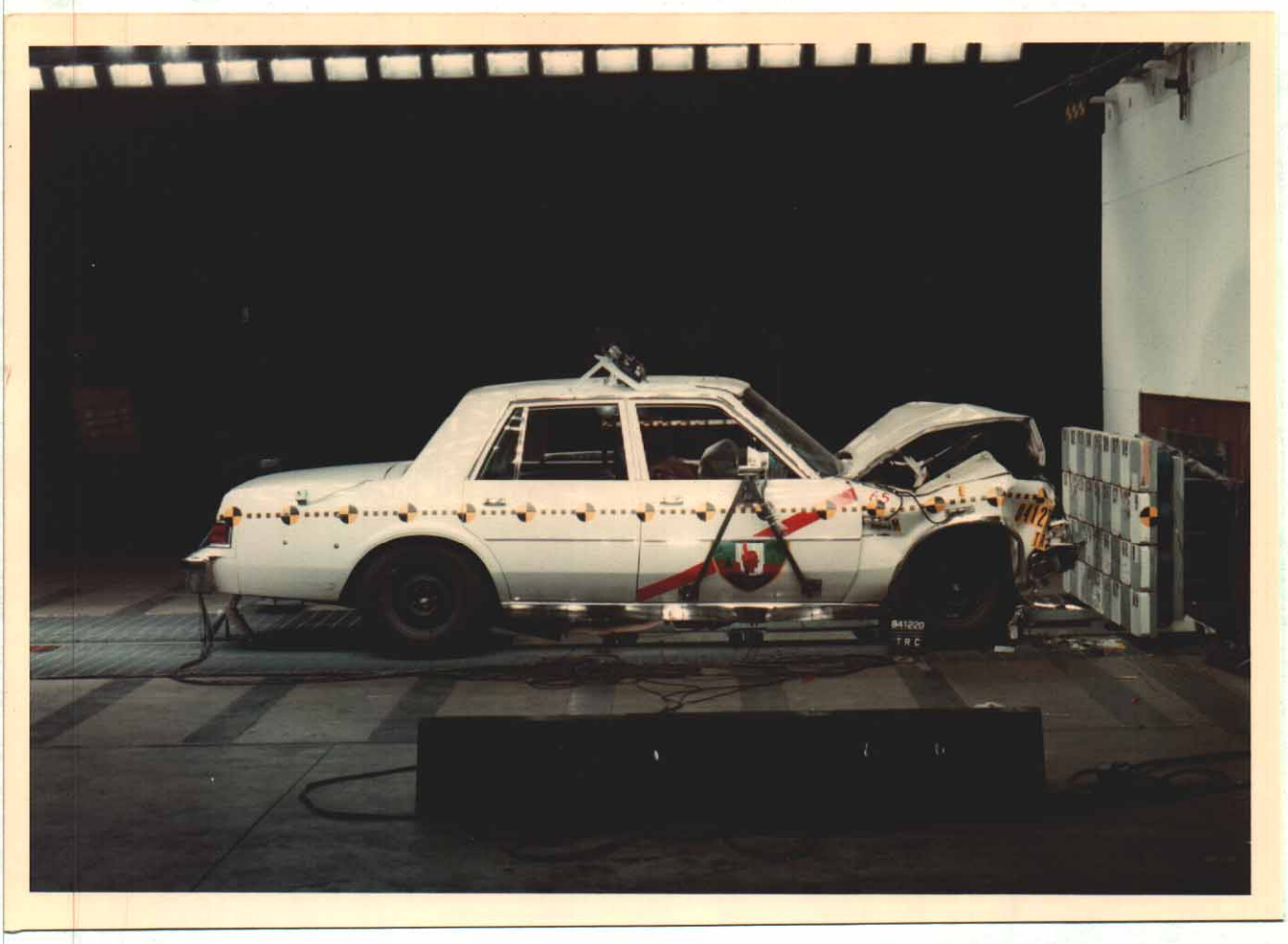


Figure A-11. POST-TEST OVERALL - VIEW 2

Figure A-12. POST-TEST OVERALL - VIEW 3

Figure A-13. POST-TEST OVERALL - VIEW 4

Figure A-14. POST-TEST OVERALL - VIEW 5

Figure A-15. POST-TEST DRIVER DUMMY - VIEW 1

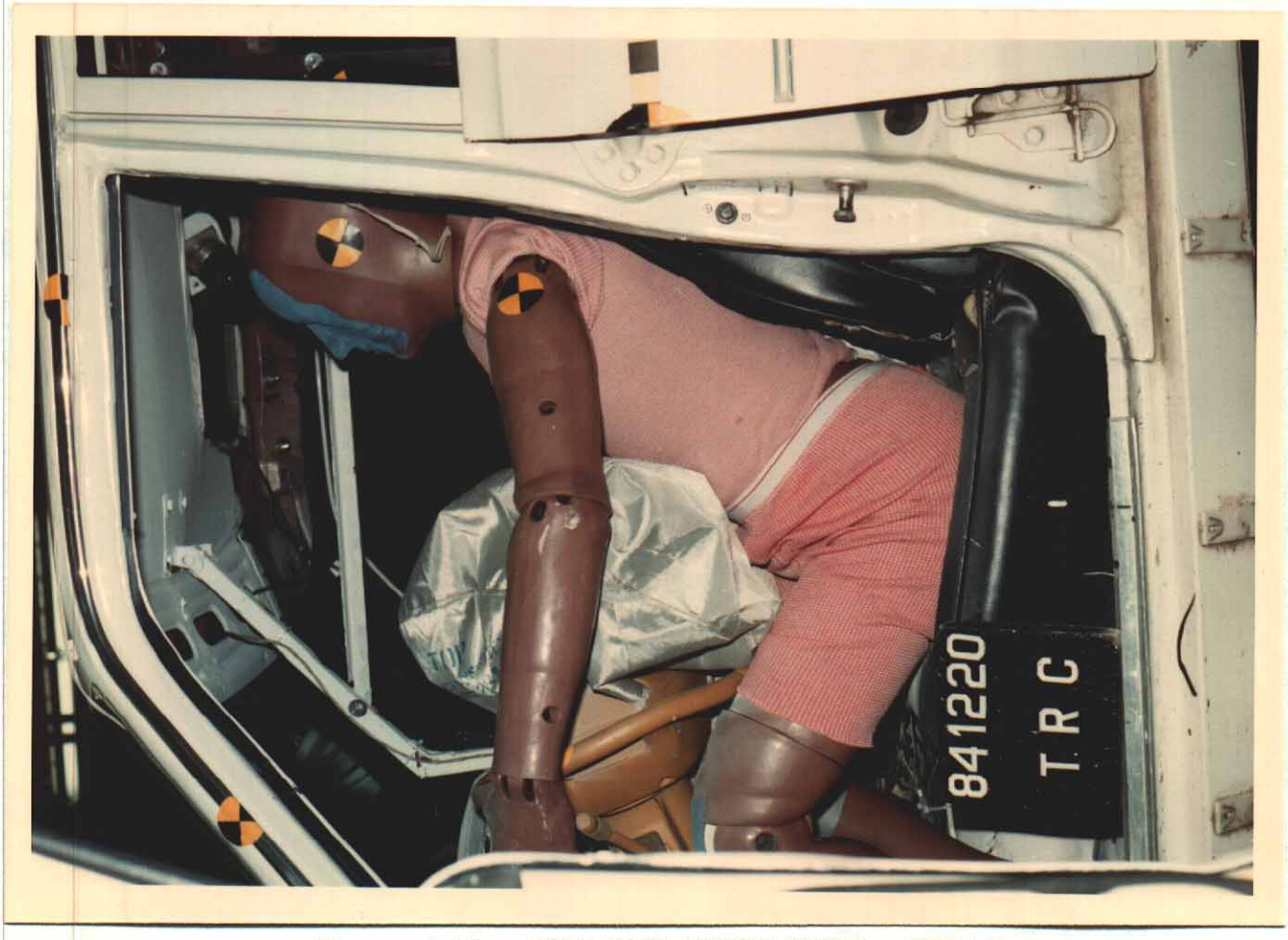


Figure A-16. POST-TEST DRIVER DUMMY - VIEW 2

Figure A-17. POST-TEST DRIVER DUMMY - VIEW 3

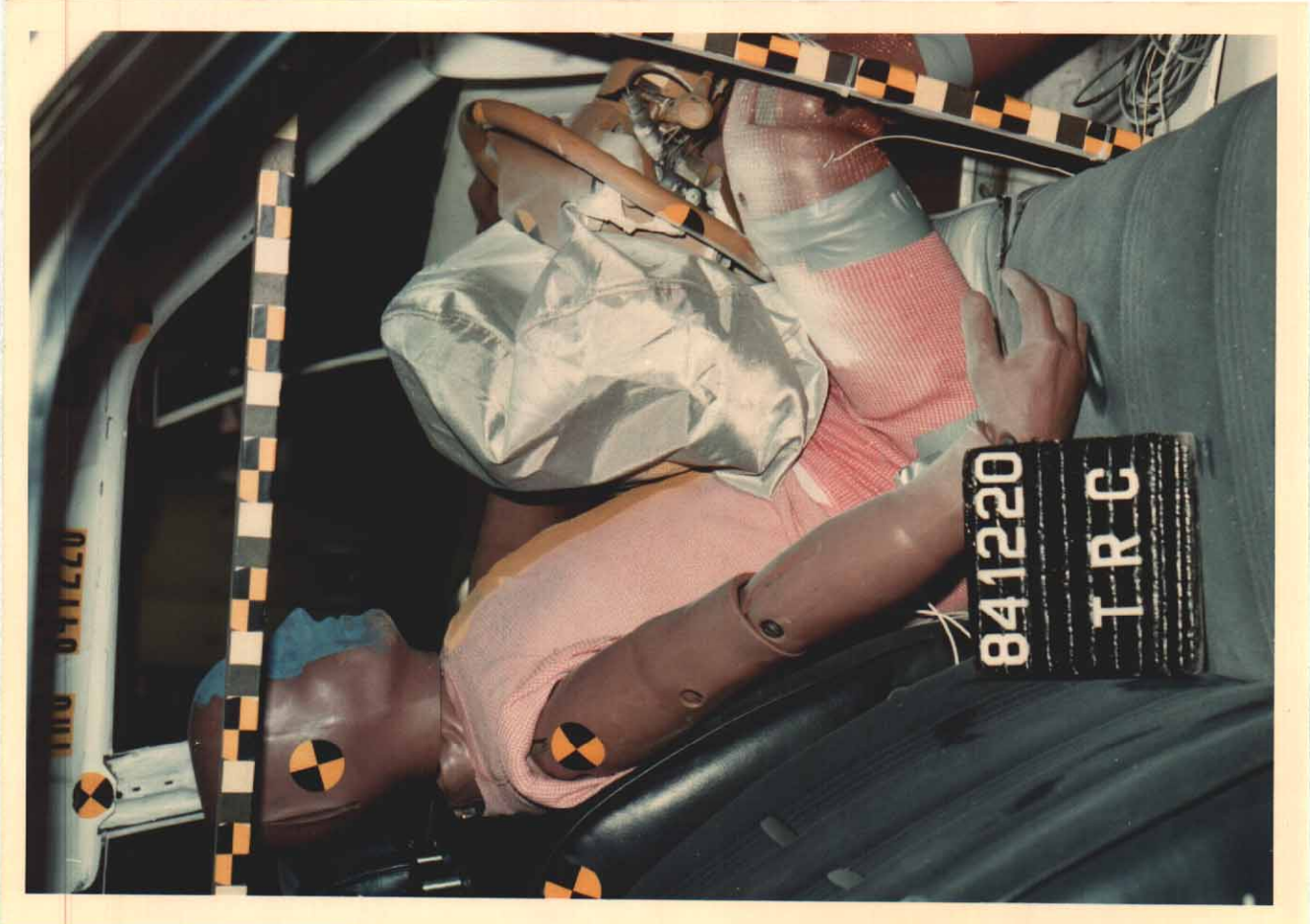


Figure A-18. POST-TEST DRIVER DUMMY - VIEW 4

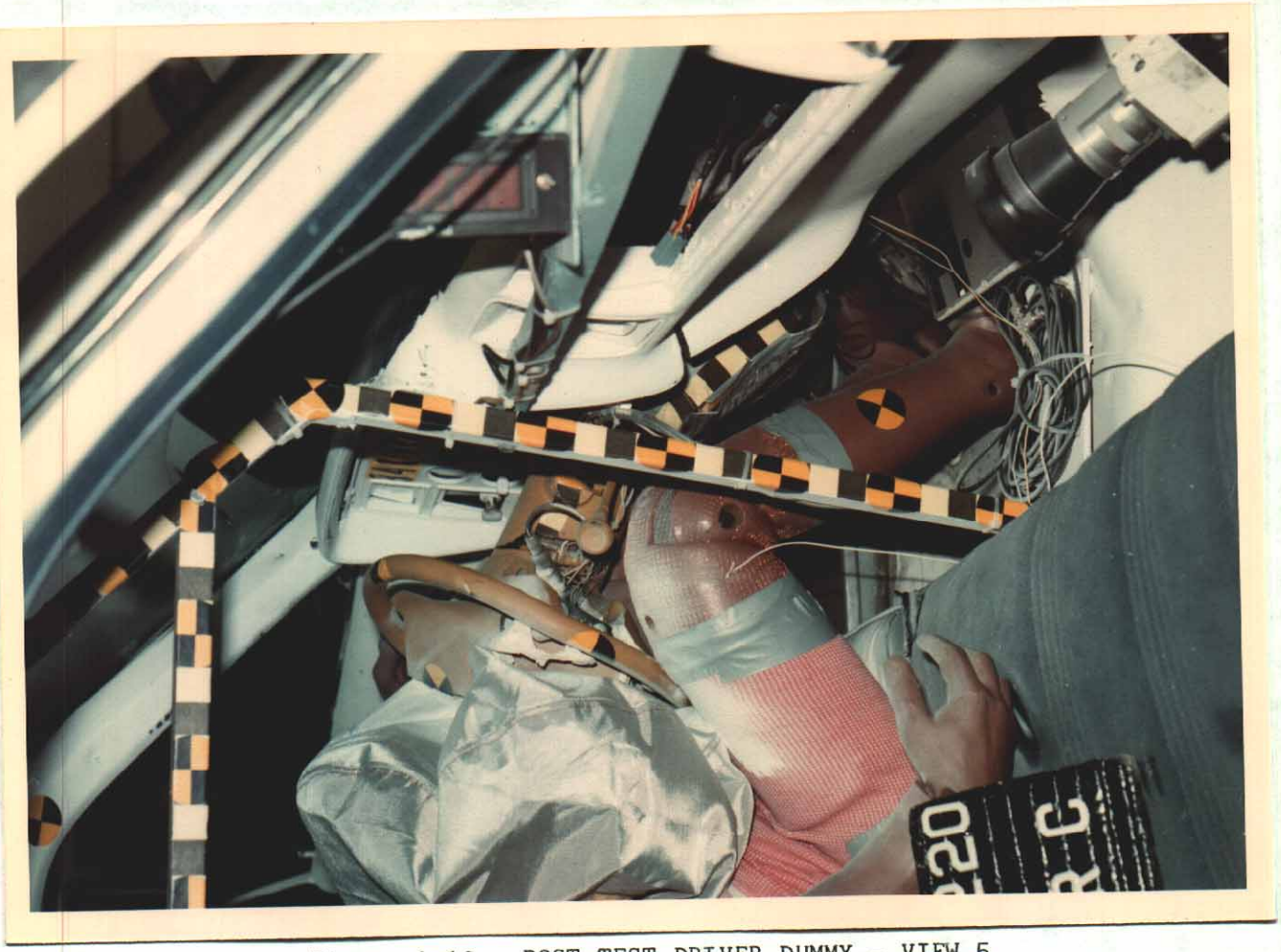


Figure A-19. POST-TEST DRIVER DUMMY - VIEW 5

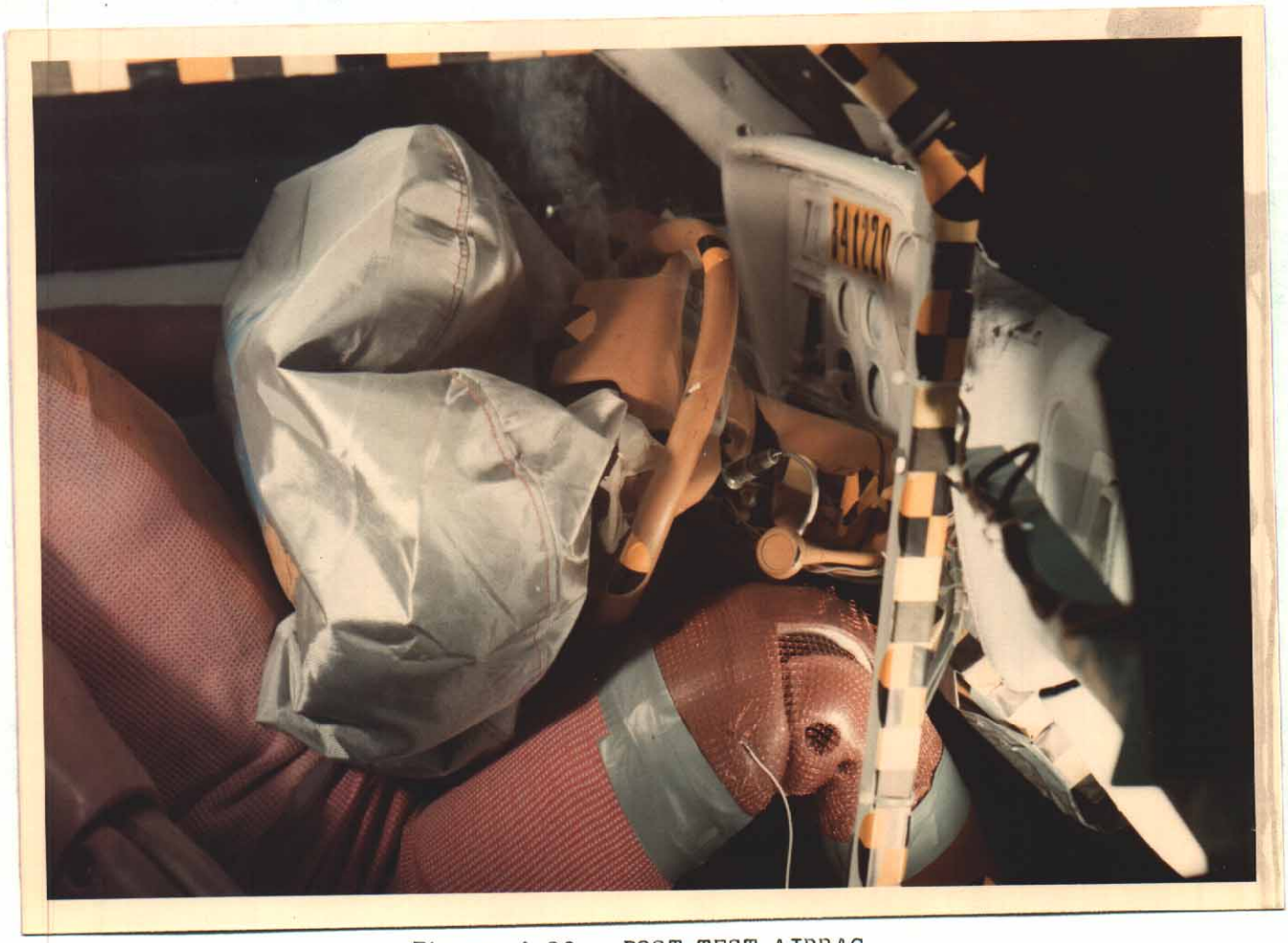
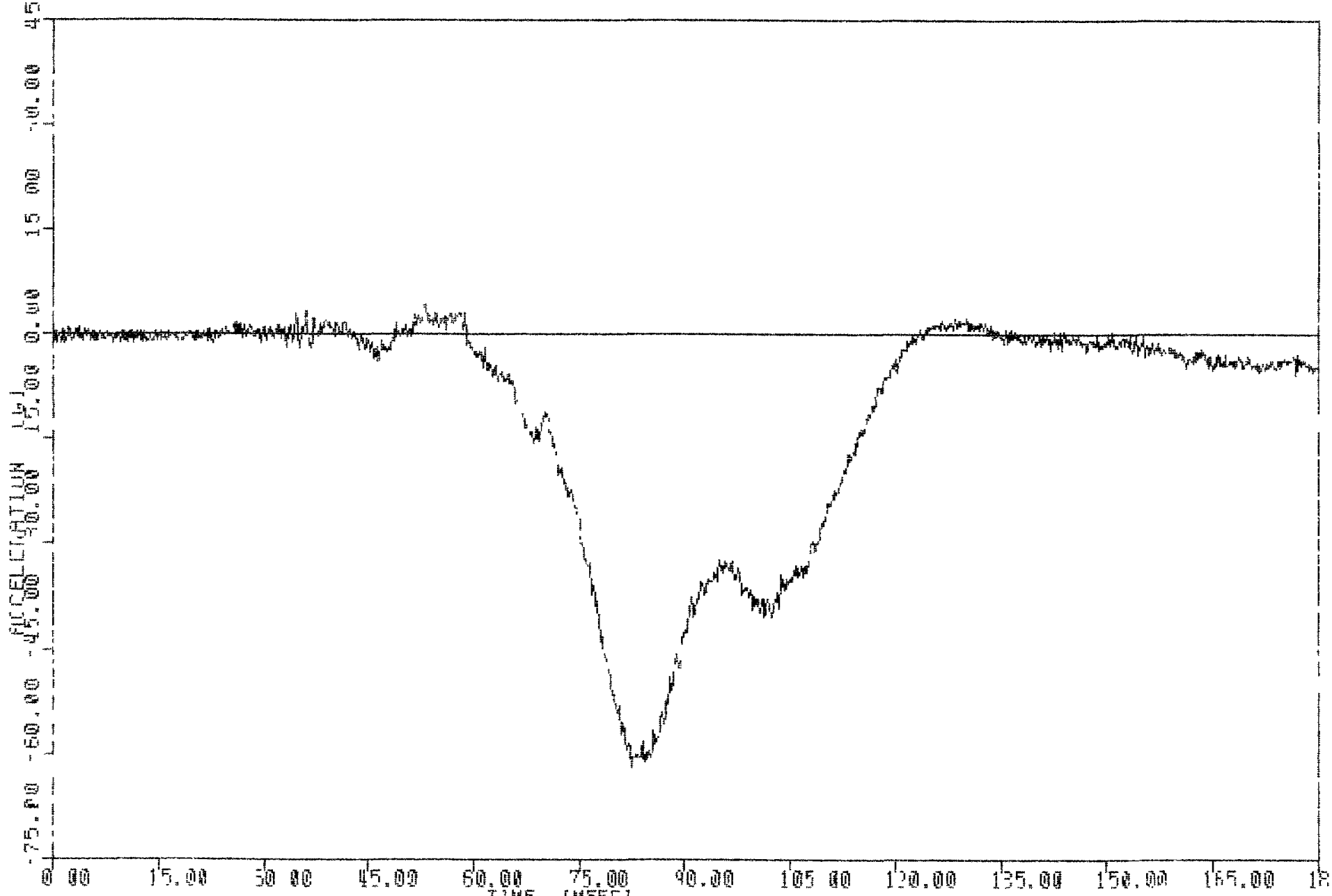


Figure A-20. POST-TEST AIRBAG

APPENDIX B

DATA PLOT PRESENTATION

341220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
94355 FILTER = ALPF 1650, 5214, -40
HEDYG MIN. MAX VALUES = -61.86 @ 82.25, 4.32 @ 52.63



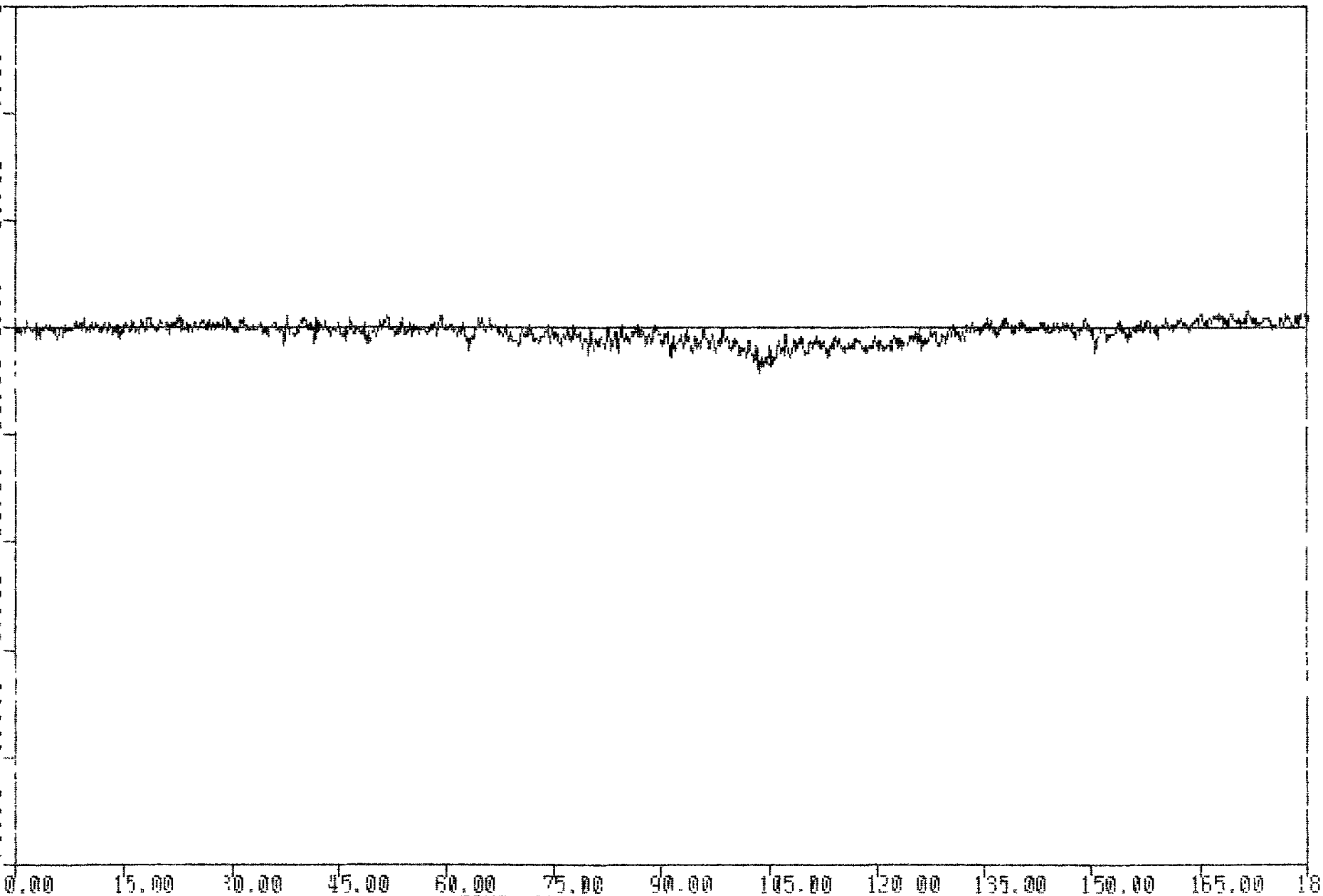
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER HEAD ACCELERATION, X AXIS

841220 , 30 MPH
BREED AIRBAG FRDGARM
84355
HEDYG

PLOT DATE = 21-DEC-84 10:39:09

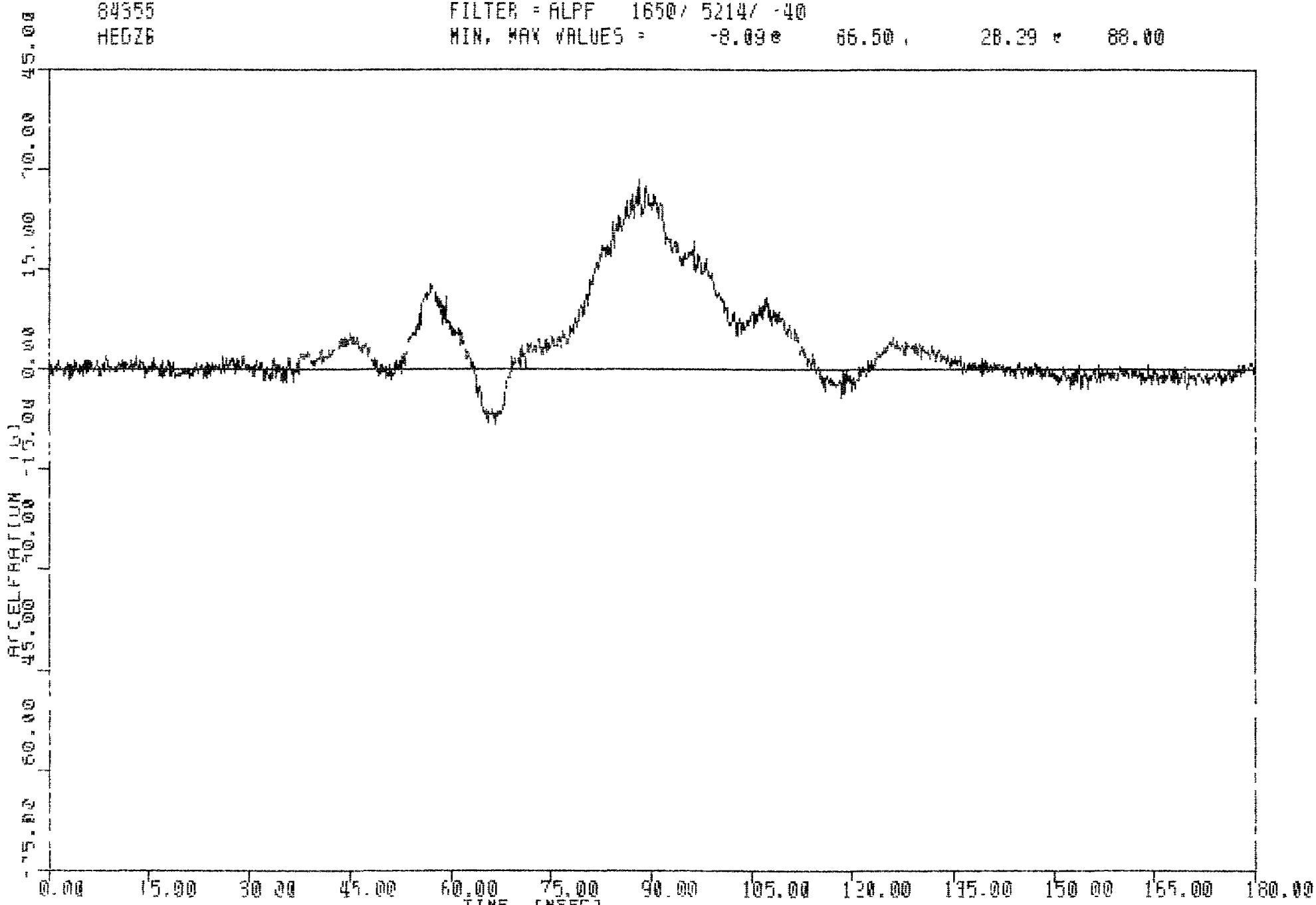
FILTER = RLPF 1650/ 5214/ -40

MIN, MAX VALUES = -6.97 @ 103.50 , 2.47 @ 171.50



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER HEAD ACCELERATION , AXIS

841220 , 30 MPH PLOT DATE 21-DEC-84 10:39.09
BREED AIRBAG PROGRAM
84355 FILTER = ALPF 1650/ 5214/ -40
HEDZB MIN, MAX VALUES = -8.09@ 66.50 , 28.29 @ 88.00



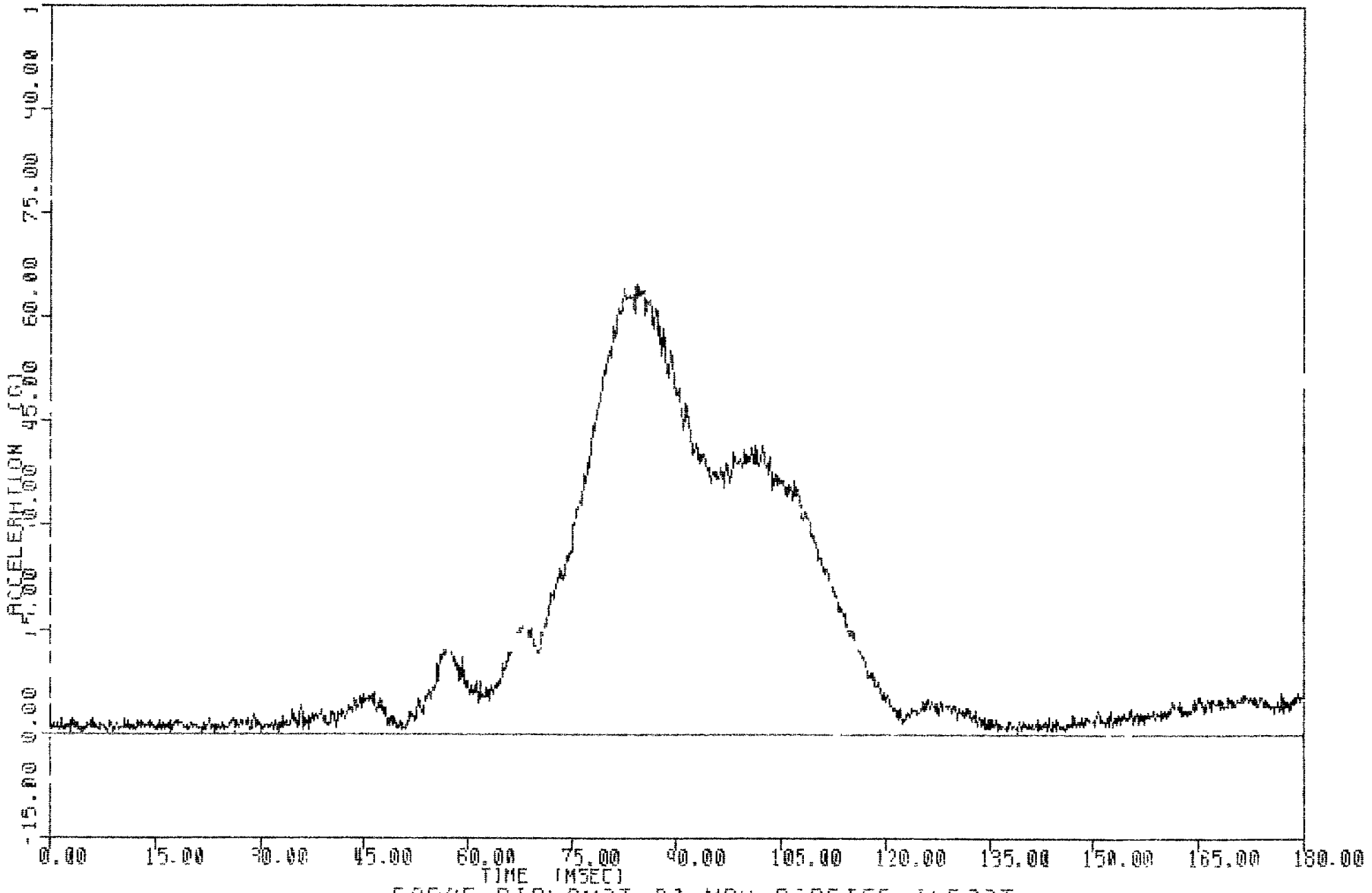
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER HEAD ACCELERATION Z AXIS

841220 , 30 MPH
BREED AIRBAG PROGRAM
84355
HEDRG

PLOT DATE = 21-DEC-84 10:59:09

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = 0.11 @ 28.25 , 84.96 @ 94.13

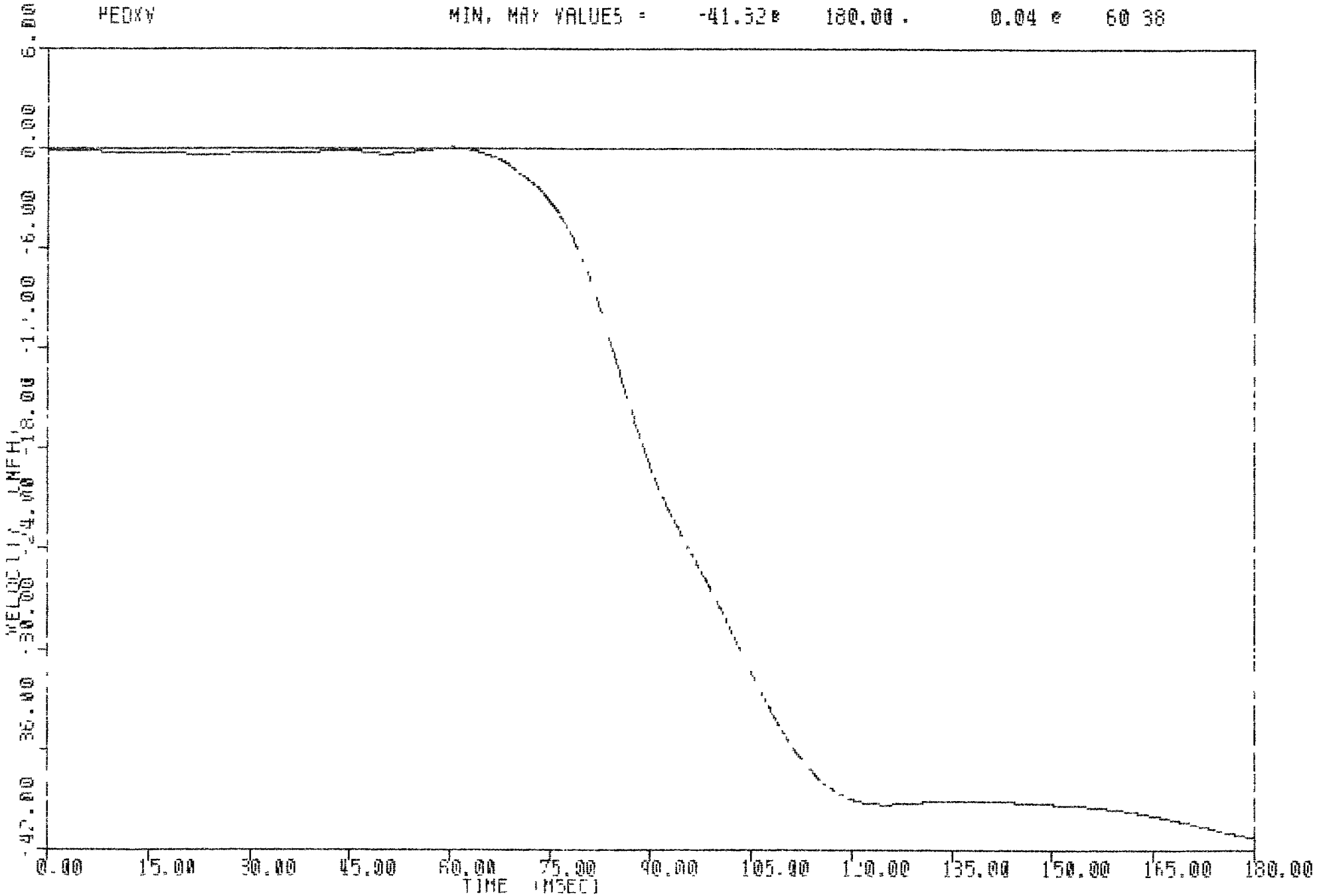


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER HEAD RESULTANT

841220 , 30 MPH
BREED AIRBAG PROGRAM
34355
HEDXV

PLOT DATE 21-DEC-84 10:40:19

FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -41.32@ 180.00 . 0.04 @ 60 38



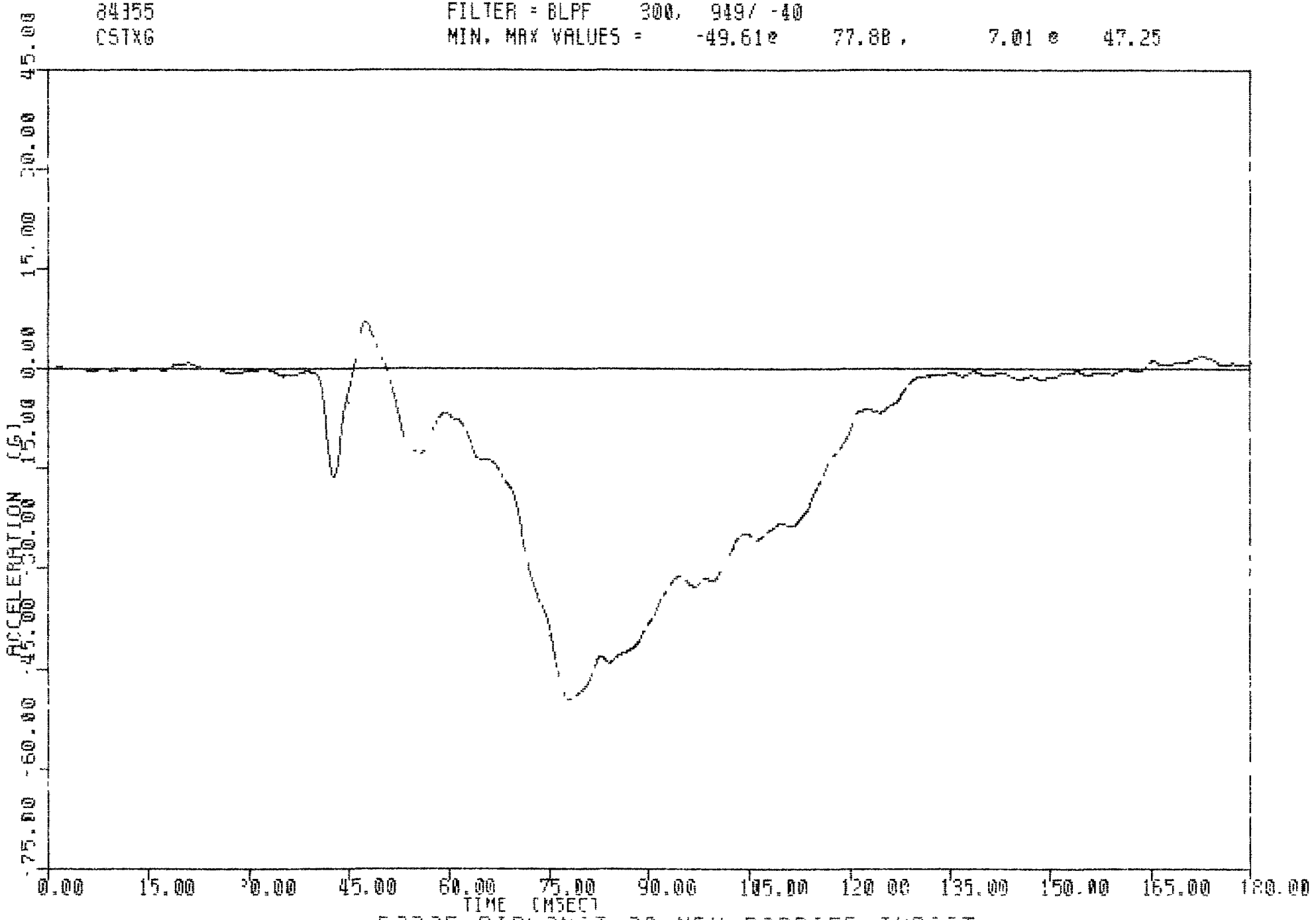
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING HED-6

DISPLACEMENT (IN)
-21.00
-18.00
-15.00
-12.00
-9.00
-6.00
-3.00
0.00
3.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
120.00
135.00
150.00
165.00
180.00
TIME (MSEC)
841220 . 30 NPA
BREED AIRBAG PROGRAM
84J55
HEORD
PLOT DATE: 27-DEC-84 17:40:19
FILTER = BLPF 300/ 2437 -40
MIN, MAX VALUES = -41.89@ 180.00, -0.02@ 0.00
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V US INC HEORD

841220 , 30 MPH
BREED AIRBAG PROGRAM
84355
CSTXG

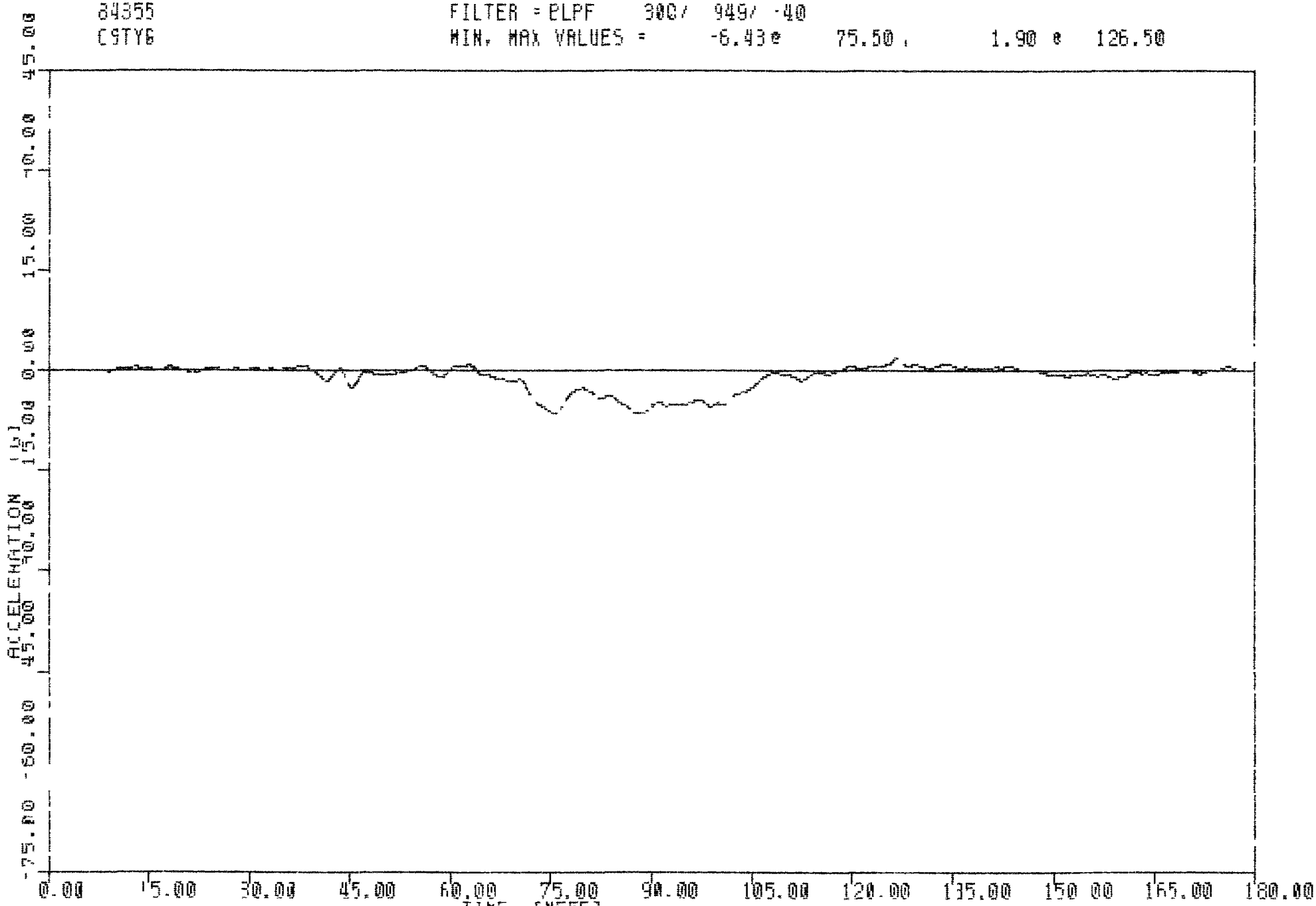
PLOT DATE 21-DEC-84 10:59:09

FILTER = BLPF 300. 949/ -40
MIN. MAX VALUES = -49.61@ 77.88 , 7.01 @ 47.25



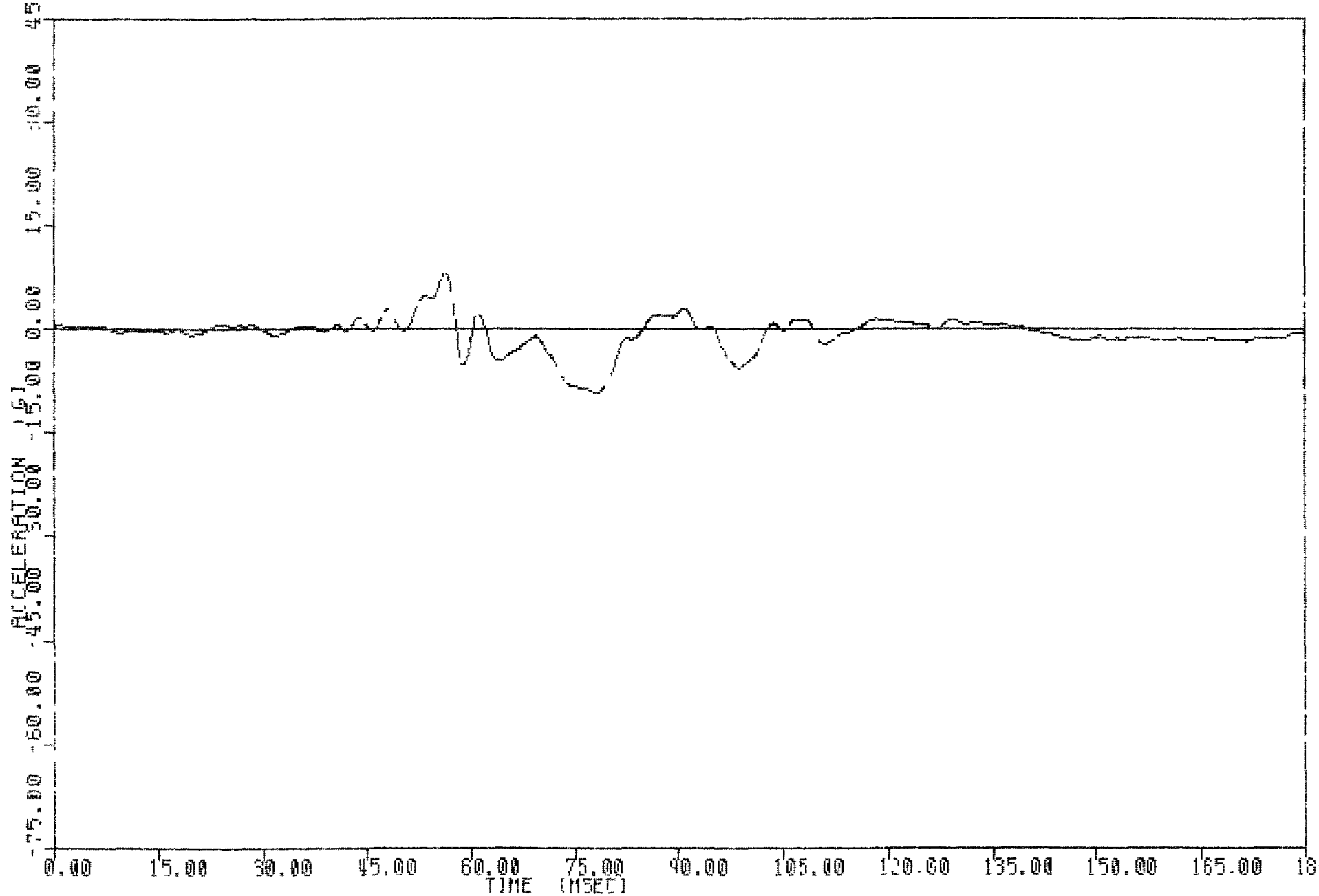
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER CHEST ACCELERATION X AXIS

841220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
84355 FILTER = ELPF 300/ 949/ -40
CSTY6 MIN, MAX VALUES = -6.43@ 75.50 , 1.90 @ 126.50



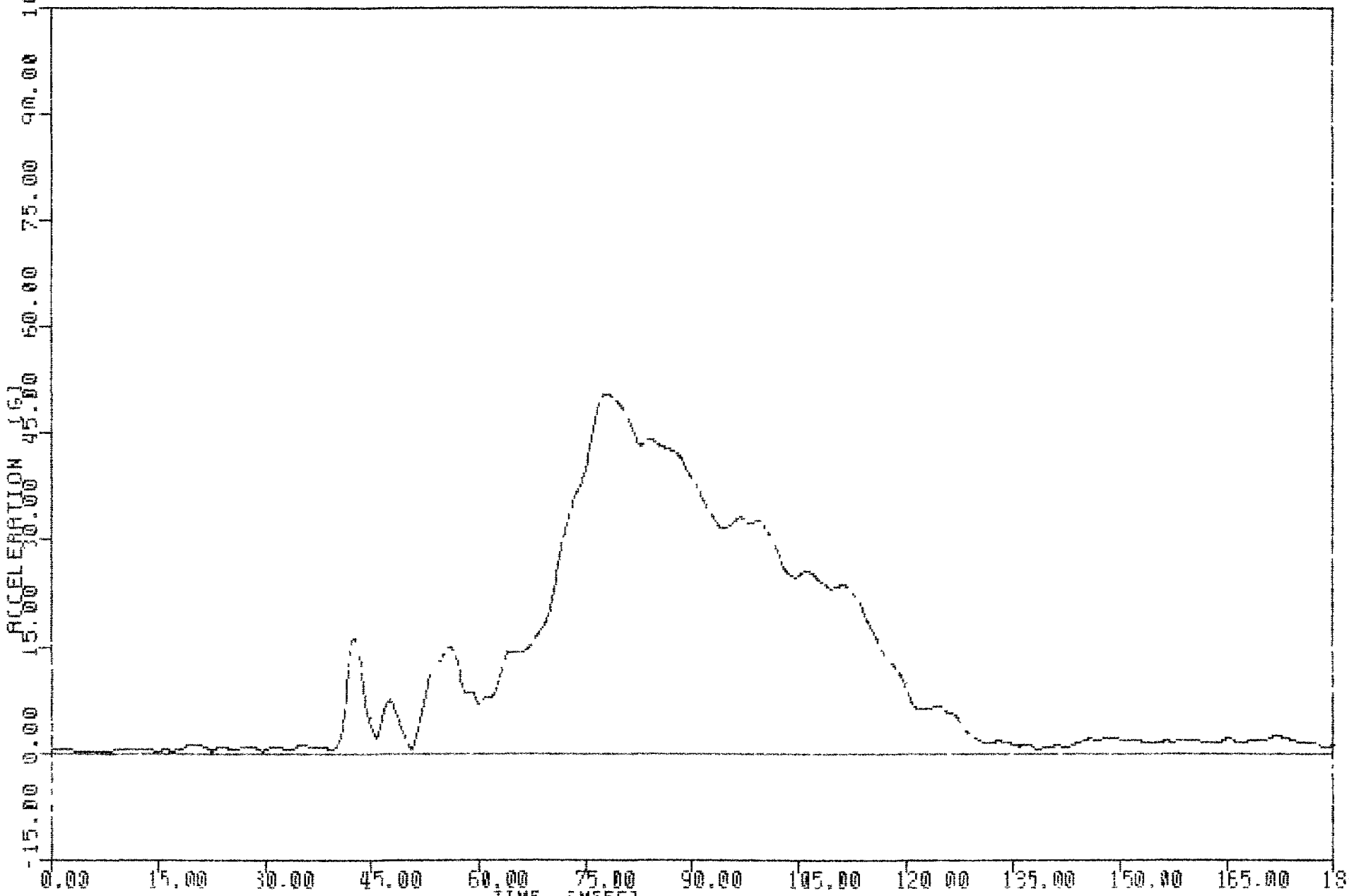
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER CHEST ACCELERATION Y AXIS

841220 , 30 MPH PLOT DATE 21-DEC-84 10:59:09
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 949/ -40
CSTZG MIN, MAX VALUES = -9.29 @ 78.00 , 8.20 @ 56.25



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER CHEST ACCELERATION Z AXIS

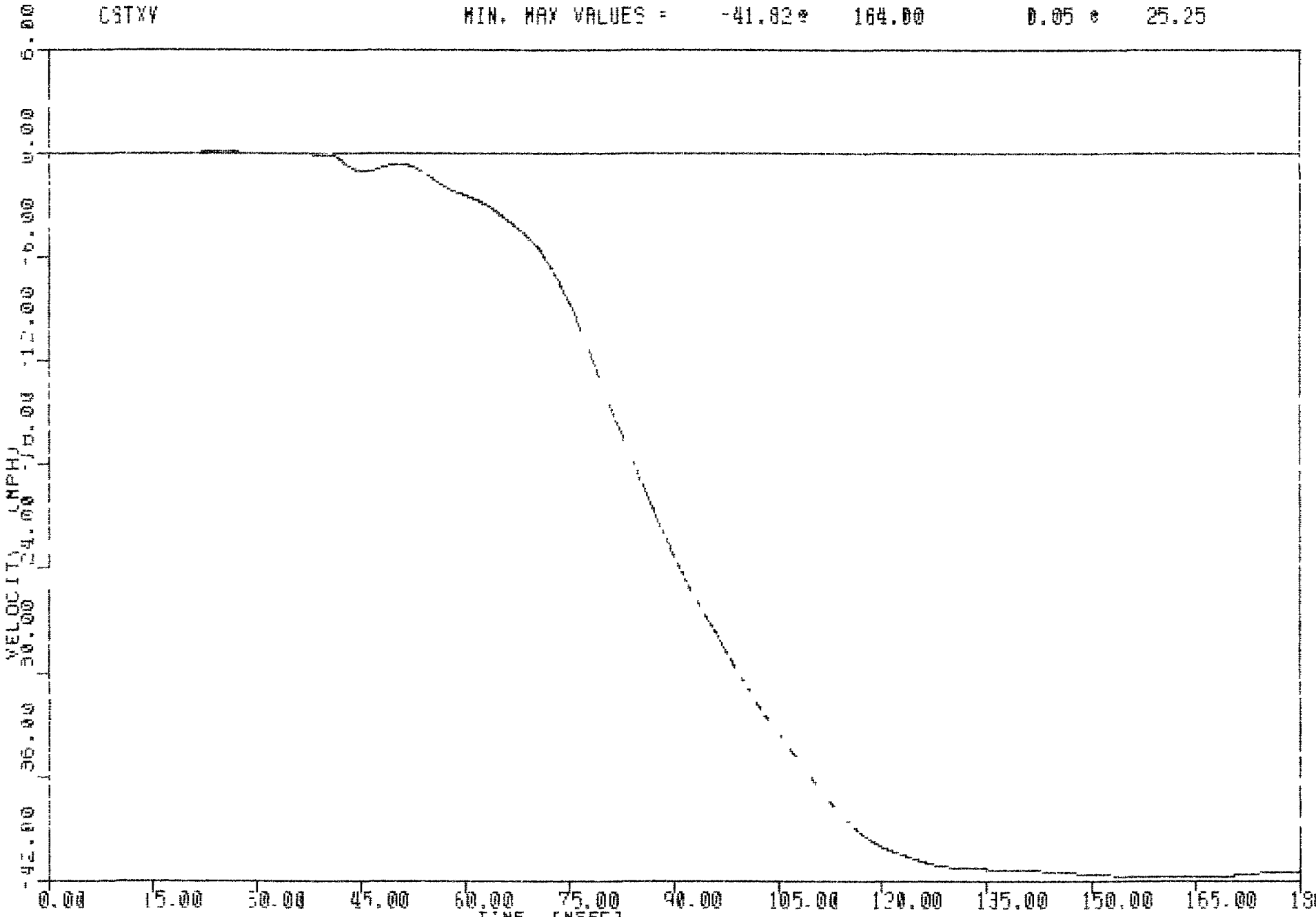
841220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
64355 FILTER = BLPF 300/ 949/ -40
CSTRG MIN, MAX VALUES = 0.13@ 7.88 , 50.58 @ 77.88



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER CHEST RESULTANT

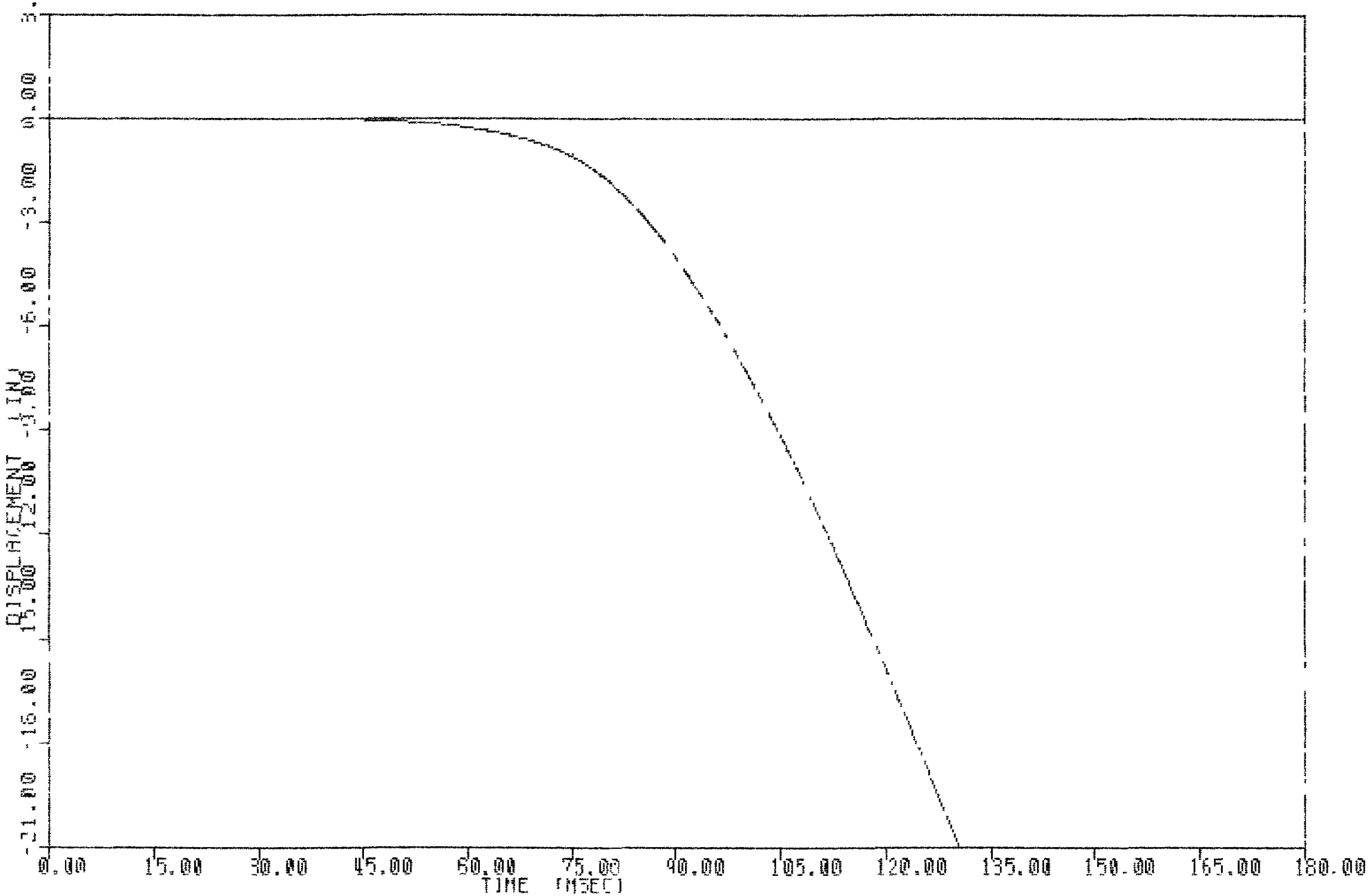
841220 , 30 MPH
BREED AIRBAG PROGRAM
64355
CSTXY

PLOT DATE 21-DEC-84 10:40:19
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -41.82 @ 164.00 0.05 @ 25.25



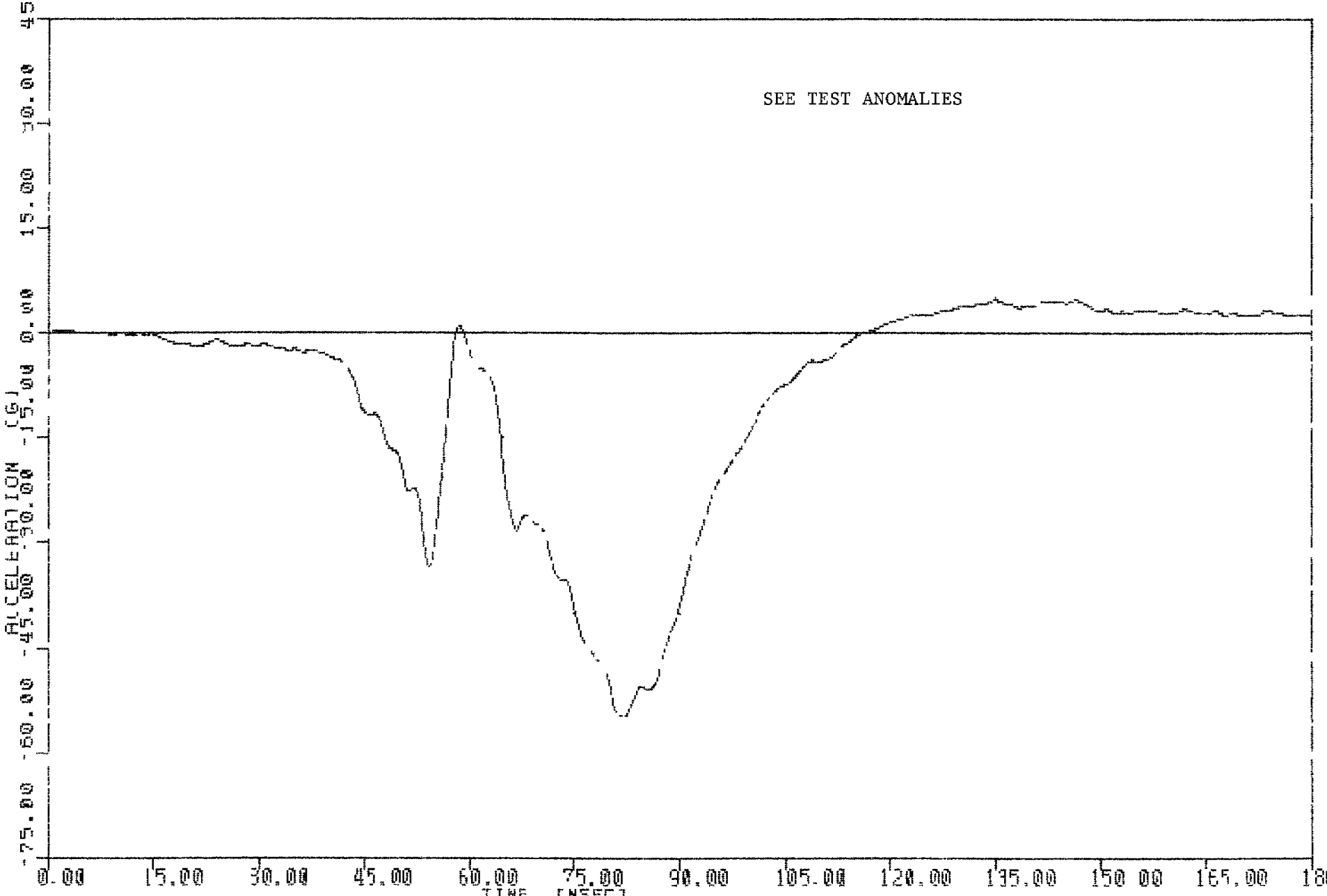
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING CST'G

841220 , 30 MPH PLOT DATE 21-DEC-84 10:40:19
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 949/ -40
CSTXD MIN, MAX VALUES = -45.77@ 180.00 , -0.01 @ 30.63

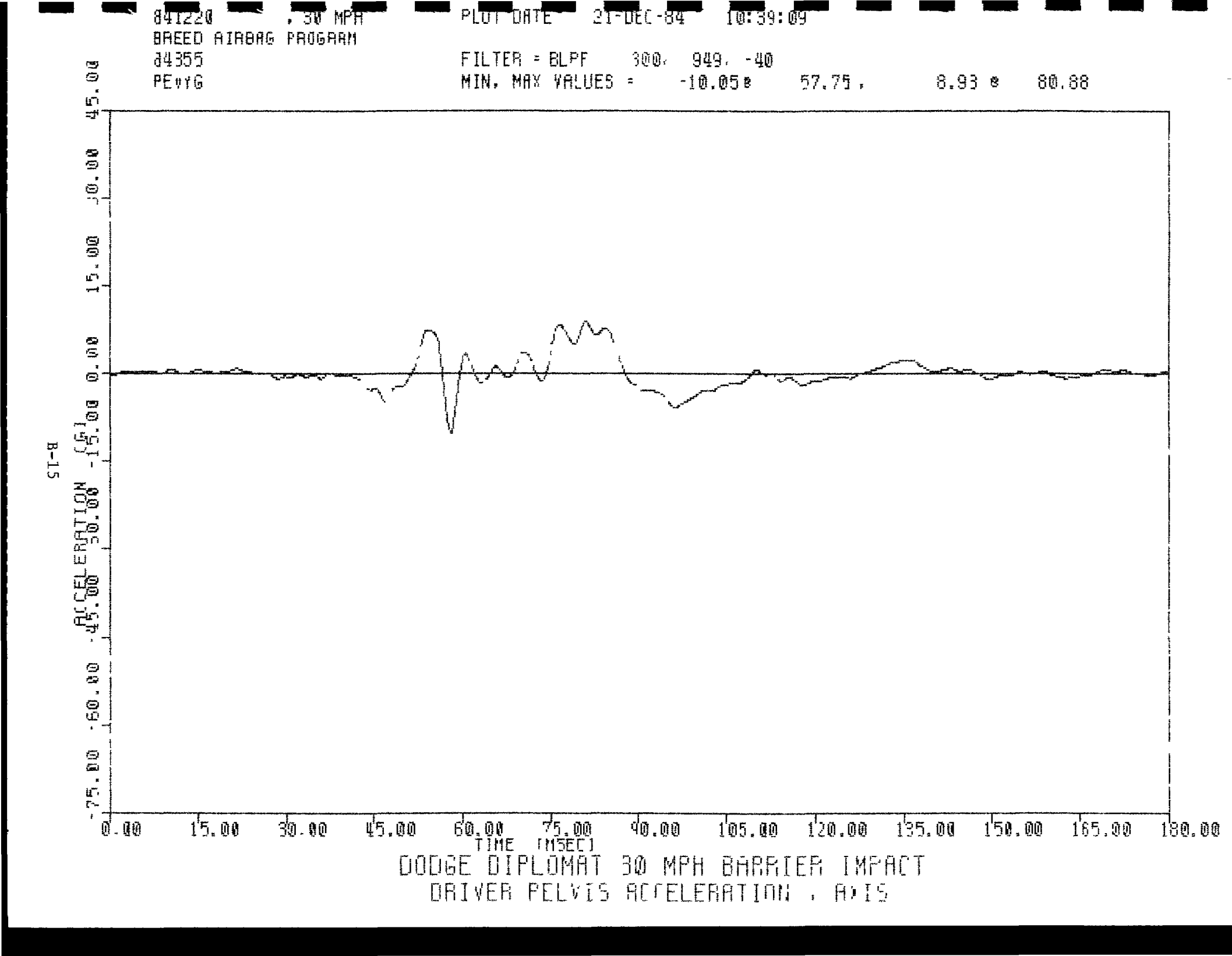


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA X USING LSTXV

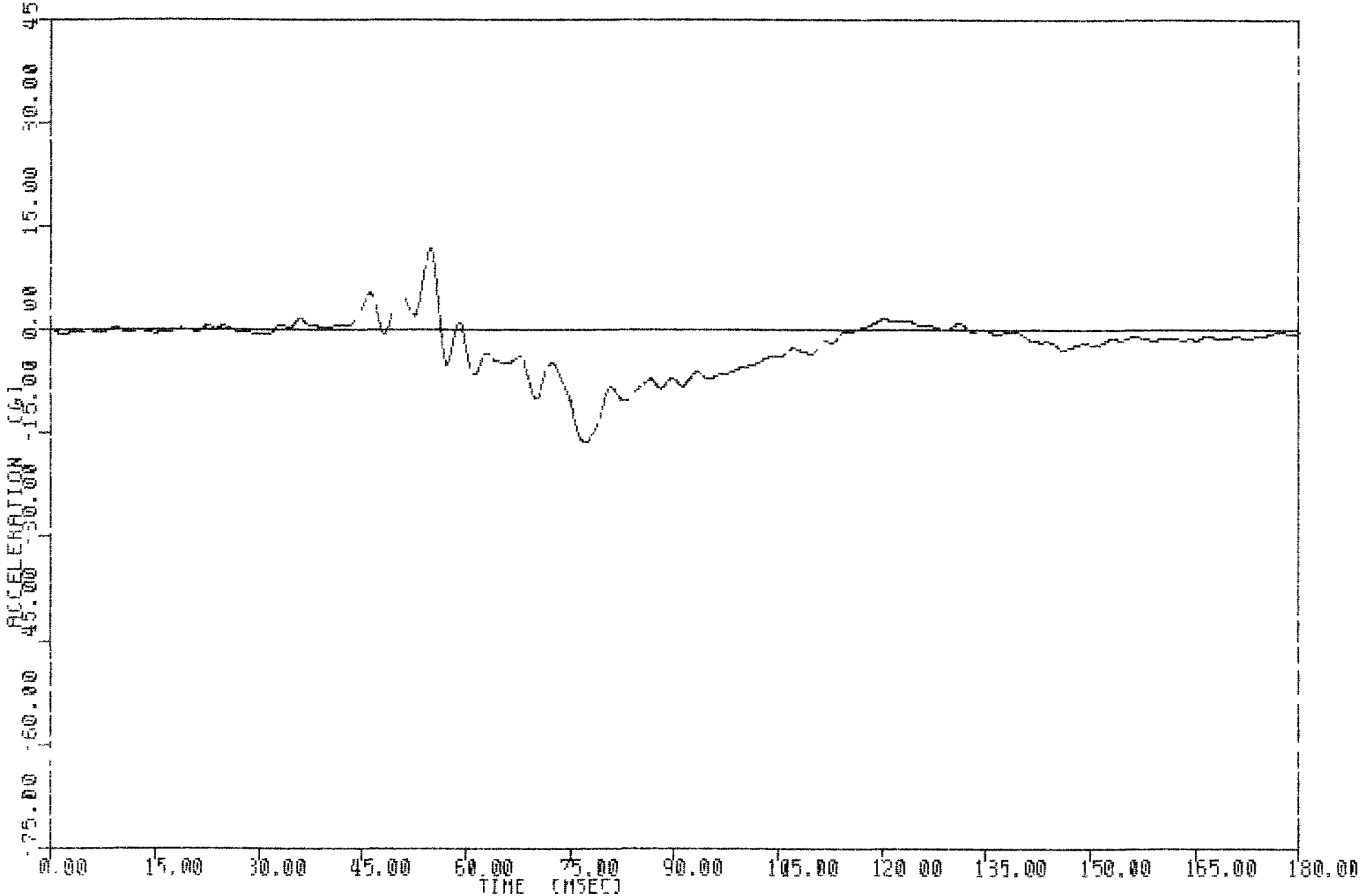
841220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300. 949. -40
PEVX6 MIN. MAX VALUES = -54.86 @ 82.00 , 4.73 @ 134.88



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER PELVIS ACCELERATION : AXIS


841220 , 30 MPH
PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
d4355
FILTER = BLPF 300. 949. -40
PEAKG
MIN, MAX VALUES = -10.05 @ 57.75 , 8.93 @ 80.88
ACCELERATION (G)
45.00
30.00
15.00
0.00
-15.00
-30.00
-45.00
-60.00
-75.00
0.00
15.00
30.00
45.00
60.00
75.00
90.00
105.00
120.00
135.00
150.00
165.00
180.00
TIME (MSEC)
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER PELVIS ACCELERATION , AXIS

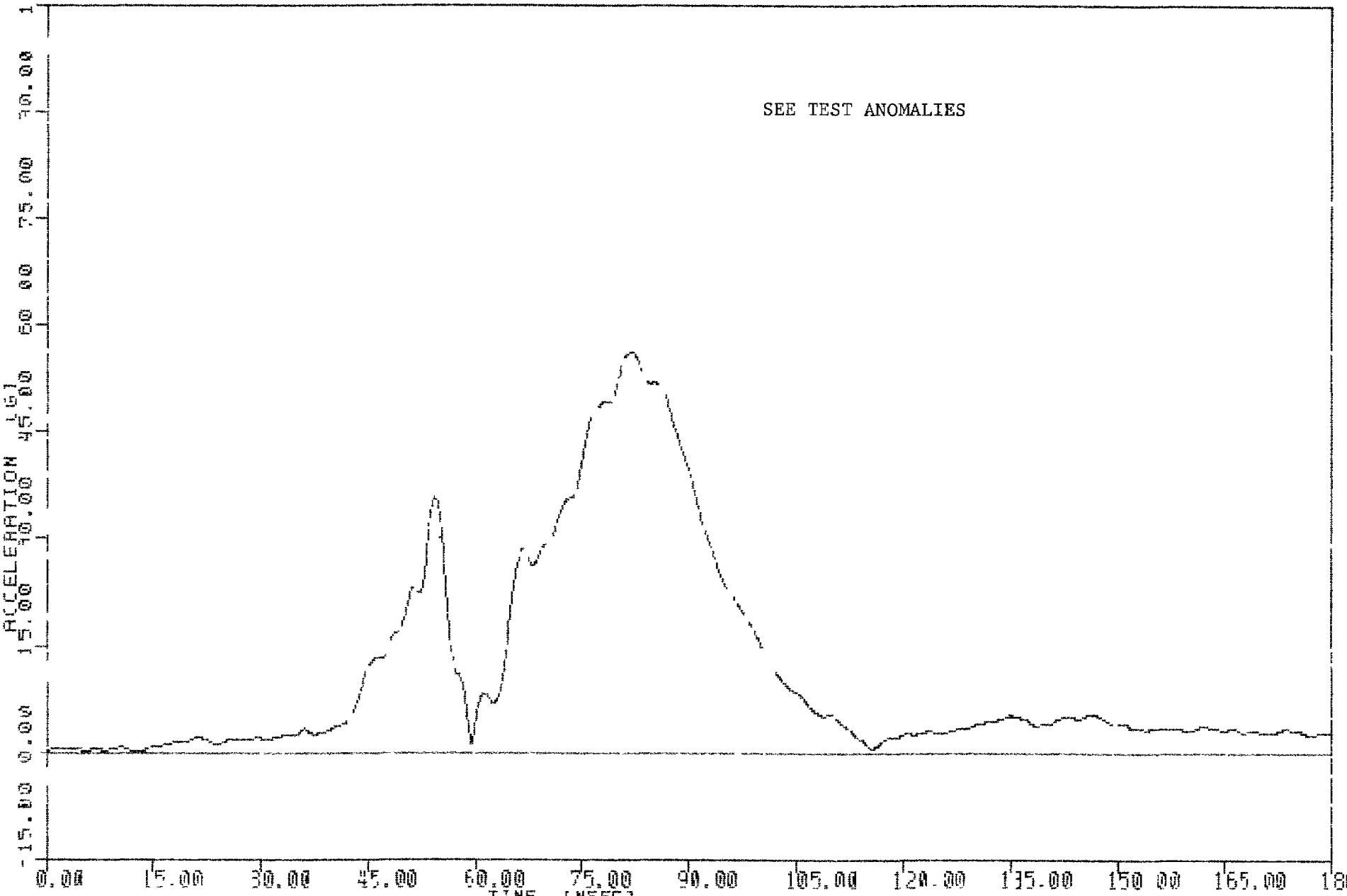
841220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 949/ -40
PEVZG MIN, MAX VALUES = -16.30 @ 77.00 , 11.93 @ 54.75



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER PELVIS ACCELERATION Z AXIS

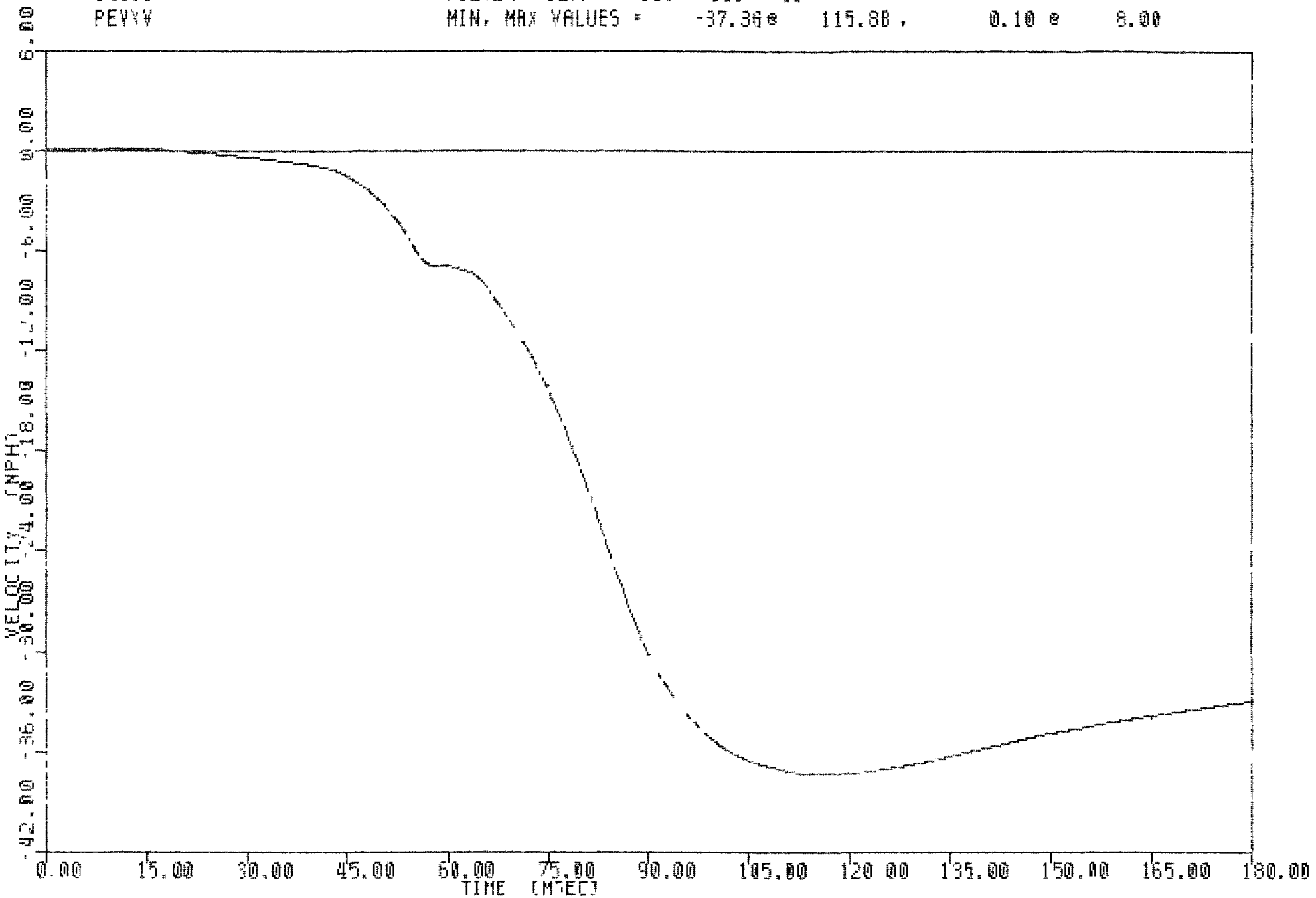
841220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
64555 FILTER = BLPF 300/ 949/ -40
PEVR6 MIN. MAX VALUES = 0.07@ 8.13 . 56.20 @ 82.00

SEE TEST ANOMALIES



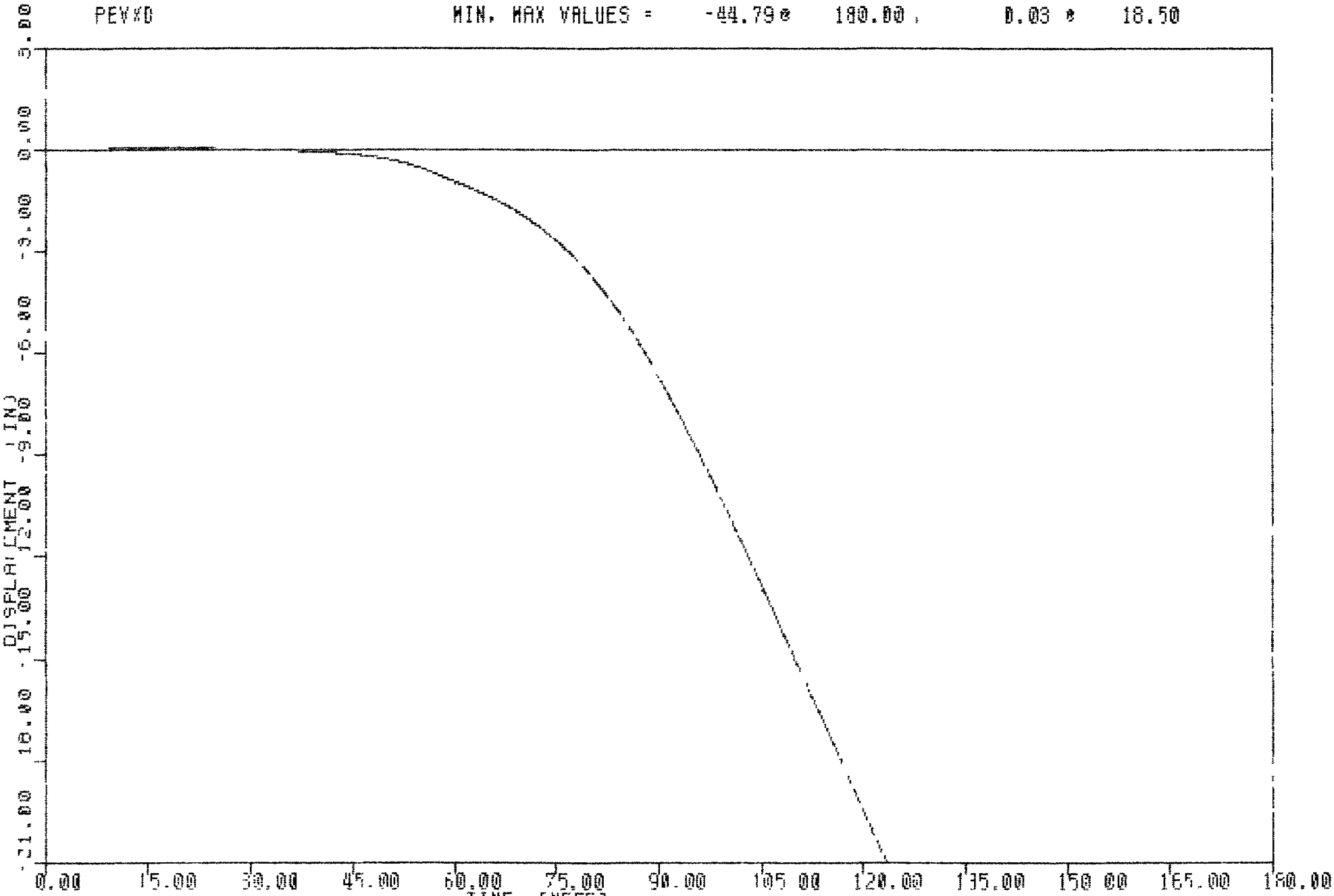
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER PELVIS RESULTANT

841220 , 30 MPH PLOT DATE 21-DEC-84 10:40:19
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 943/ -40
PEVXV MIN, MAX VALUES = -37.36@ 115.88 , 0.10 @ 8.00



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING PEVXG

841220 , 30 MPH PLOT DATE 21-DEC-84 10:40:19
BREED AIRBAG PROGRAM
34355 FILTER = BLPF 300/ 949/ -40
PEVXD MIN, MAX VALUES = -44.79 @ 180.00 , 0.03 @ 18.50



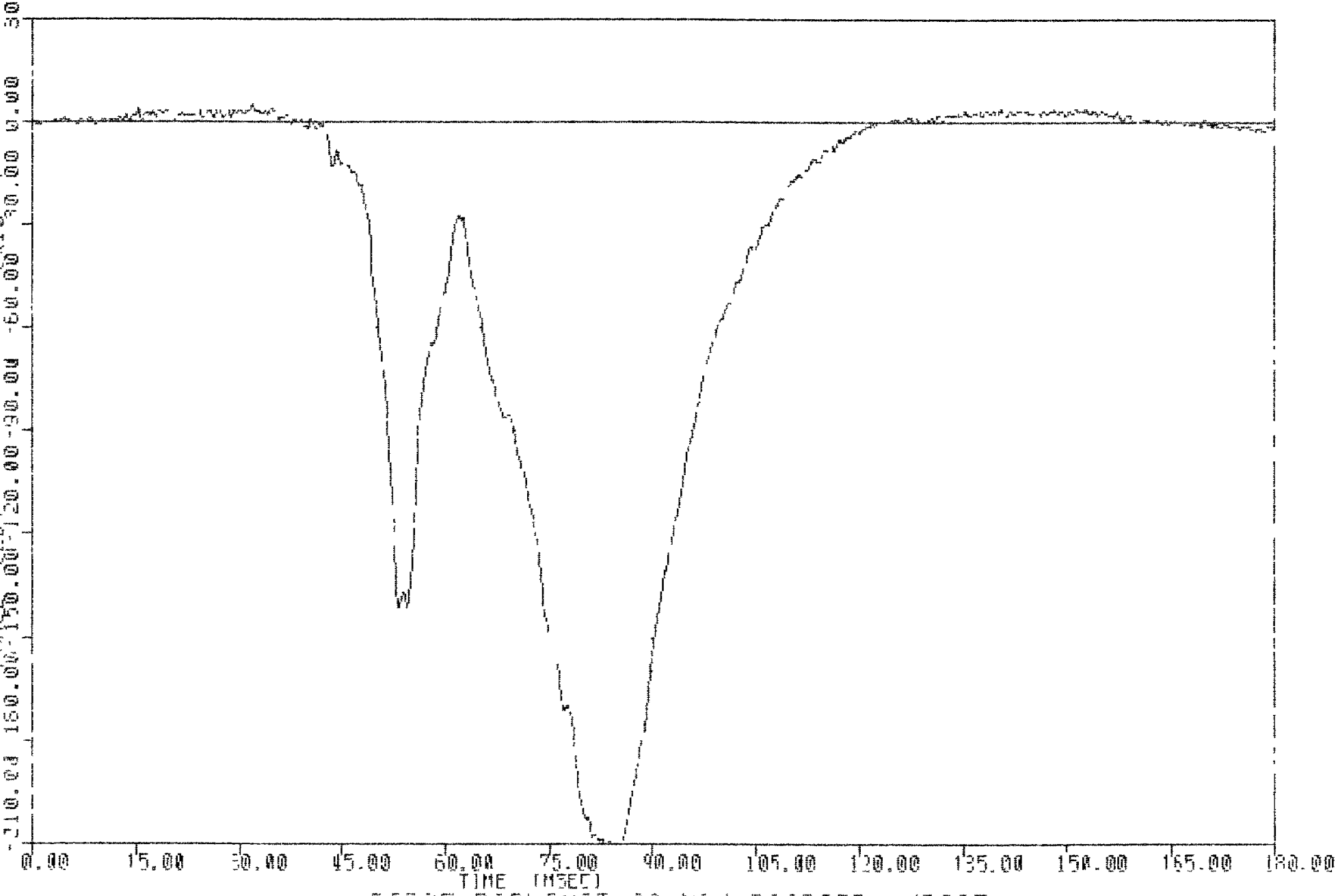
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA > USING PEVXD

841220 , 30 MPH
BREED AIRBAG PROGRAM
84355
LFMF

PLOT DATE = 21-DEC-84 10:39:09

FILTER = BLPF 1000/ 3162. -40

MIN. MAX VALUES = -2122.97@ 84.25 , 47.18 @ 31.75

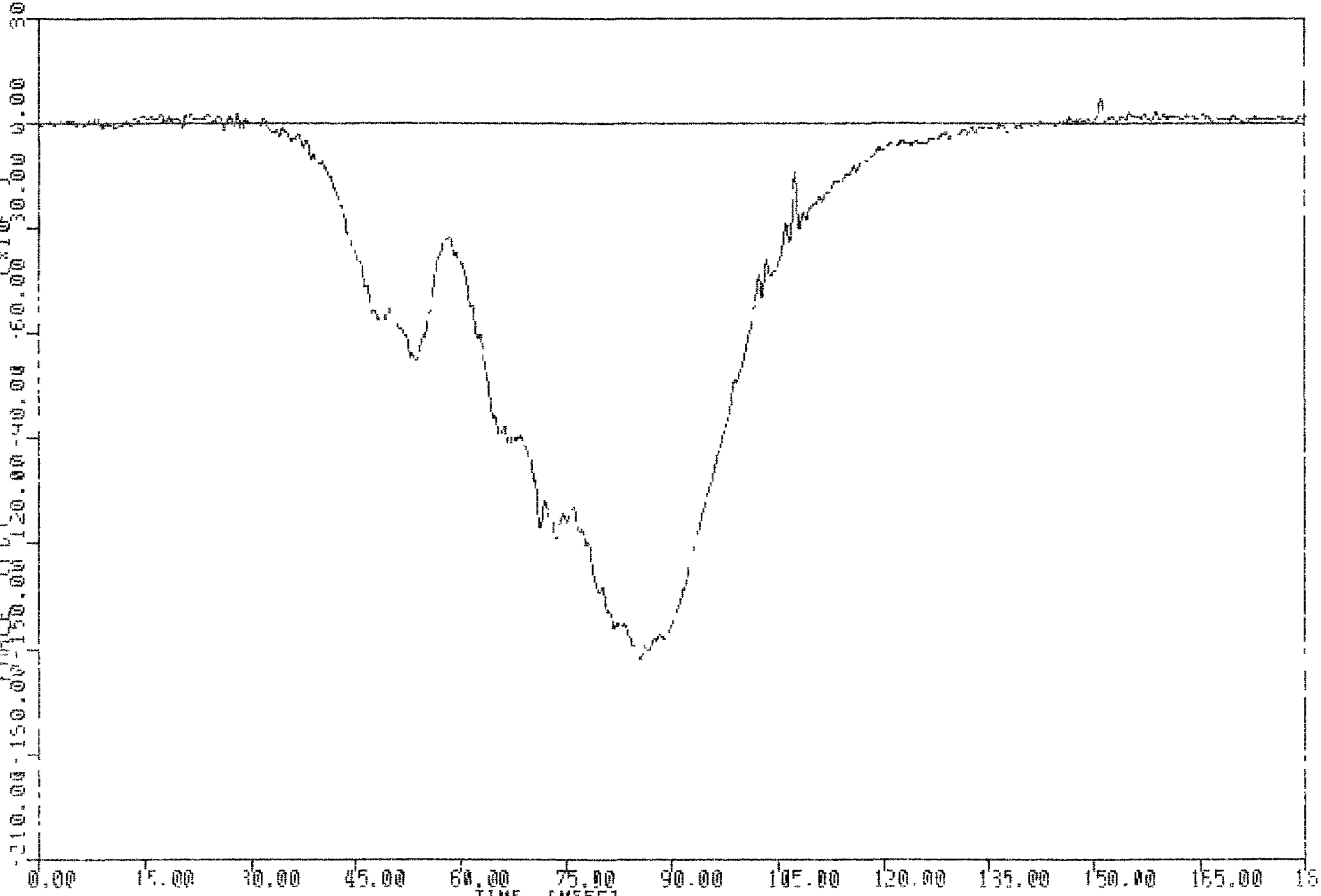


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER LEFT FEMUR FORCE

841220 , 30 MPH
BREED AIRBAG PROGRAM
34355
RFNF

PLOT DATE 21-DEC-84 10:39:09

FILTER = BLPF 1000/ 3162/ -40
MIN, MAX VALUES = -1530.33@ 85.50 , 68.00 @ 151.00

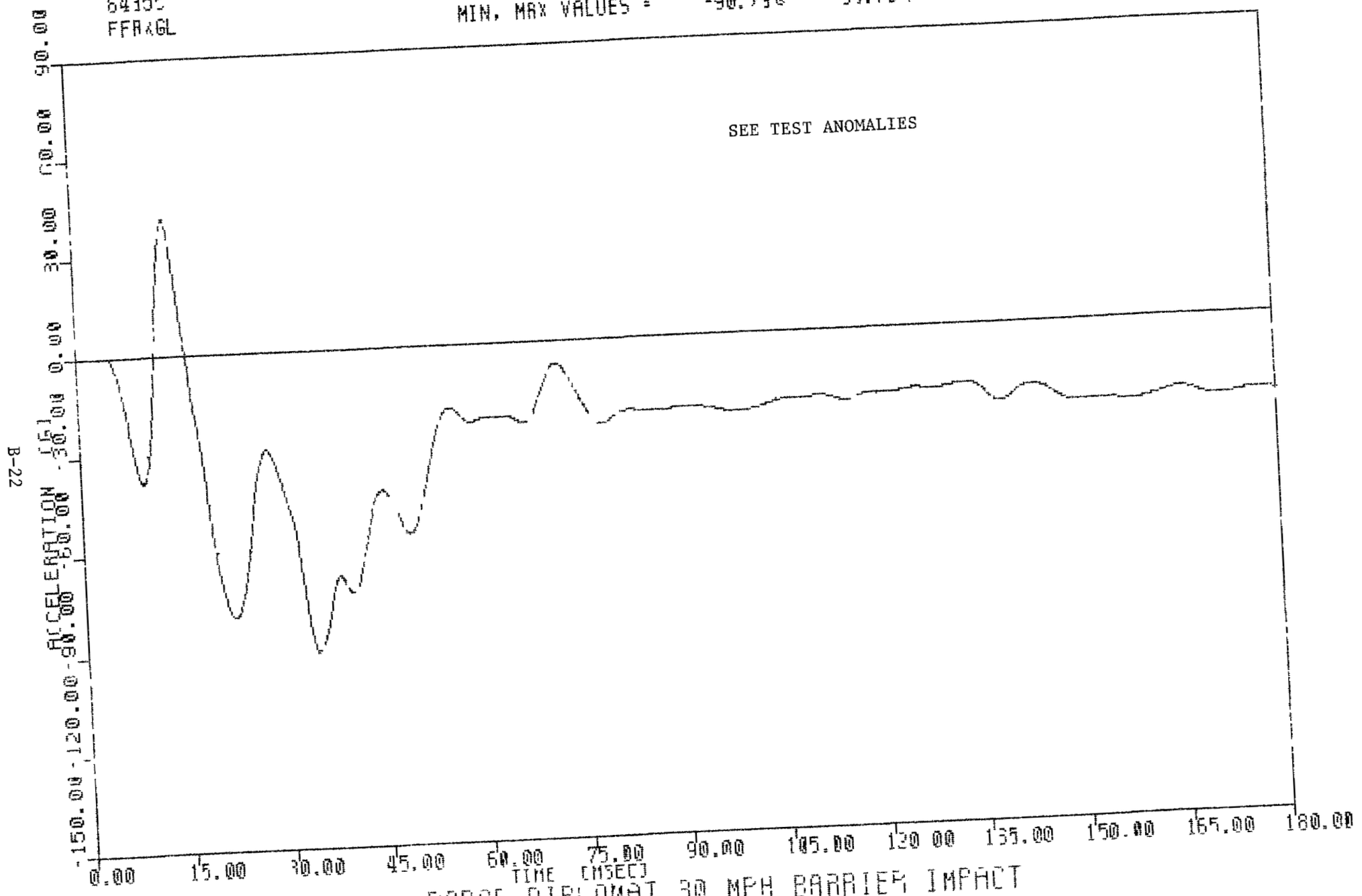


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DRIVER RIGHT FEMUR FORCE

841220 , 30 MPH
BREED AIRBAG PROGRAM
64355
FFR&GL

PLOT DATE 21-DEC-84 10:39:09

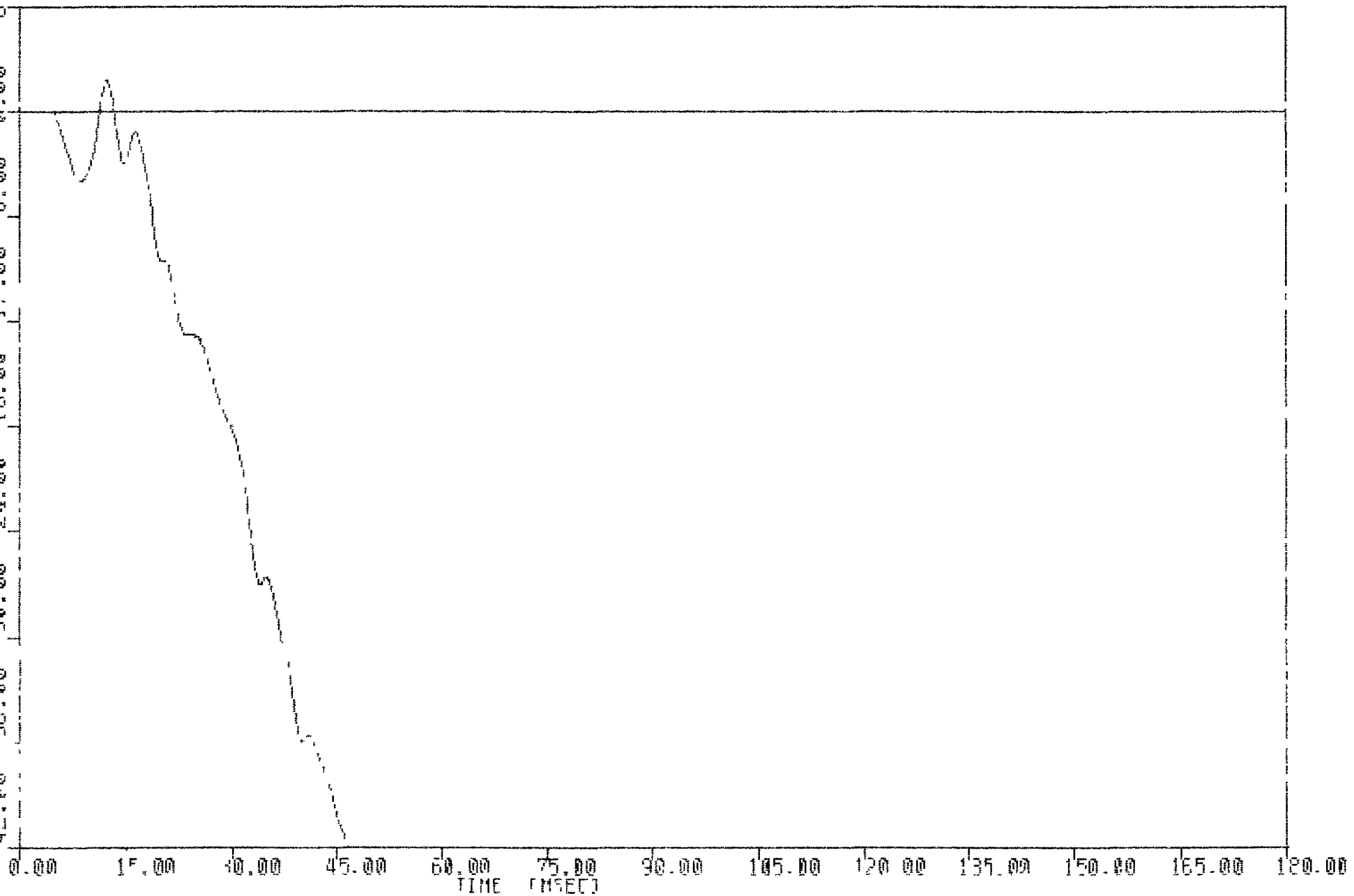
FILTER = BLPF 100/ 315/ -40
MIN, MAX VALUES = -90.79@ 34.75 , 41.28 @ 13.38



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
FRONT FRAME X-MEMBER ACCEL & HIC

841220 , 30 MPH
BREED AIRBAG PROGRAM
64355
FFRXVL

PLOT DATE 21-DEC-84 10:40:19
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -106.61@ 180.00 , 1.78 @ 12.13

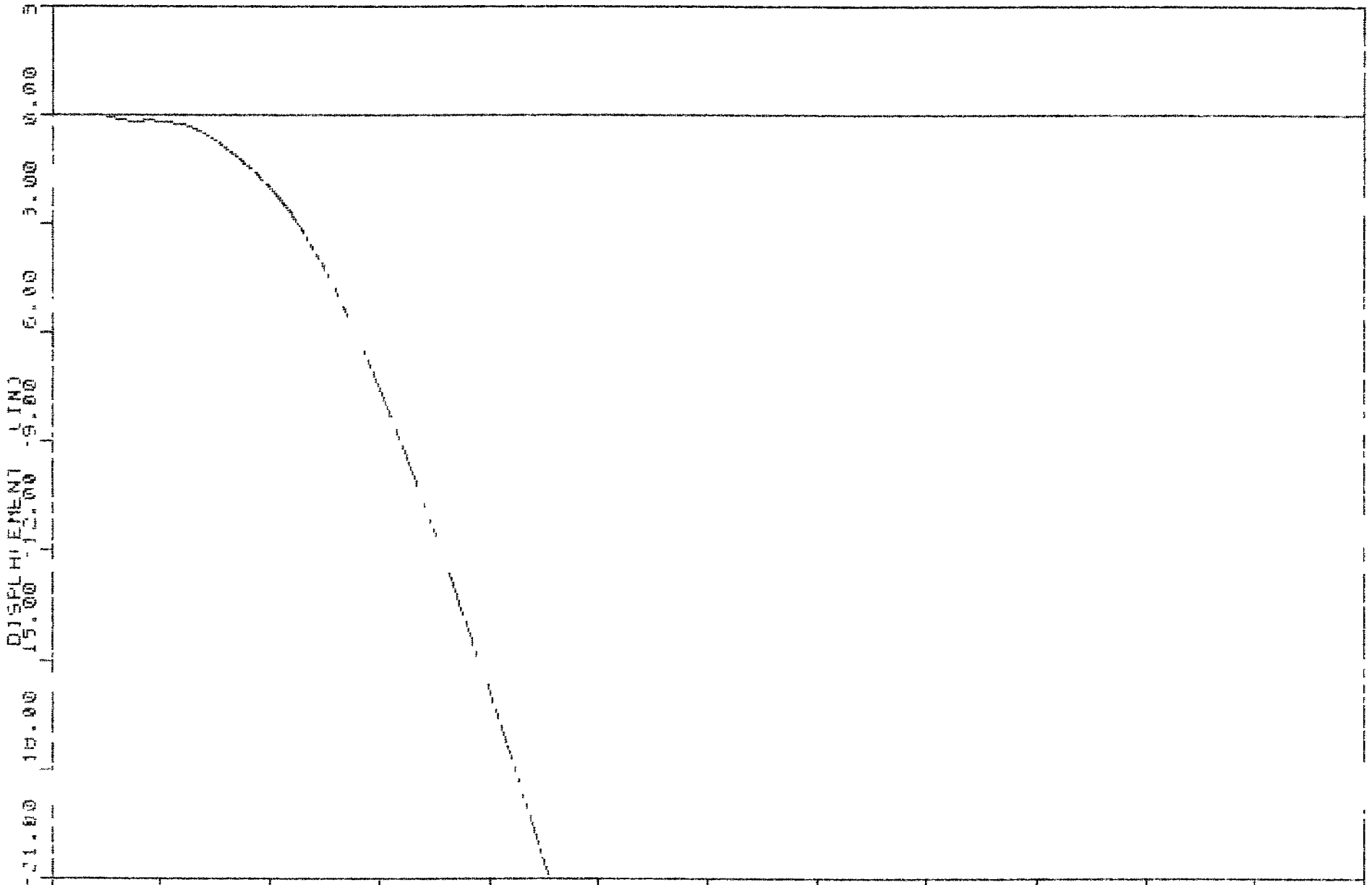


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING FFR'EL

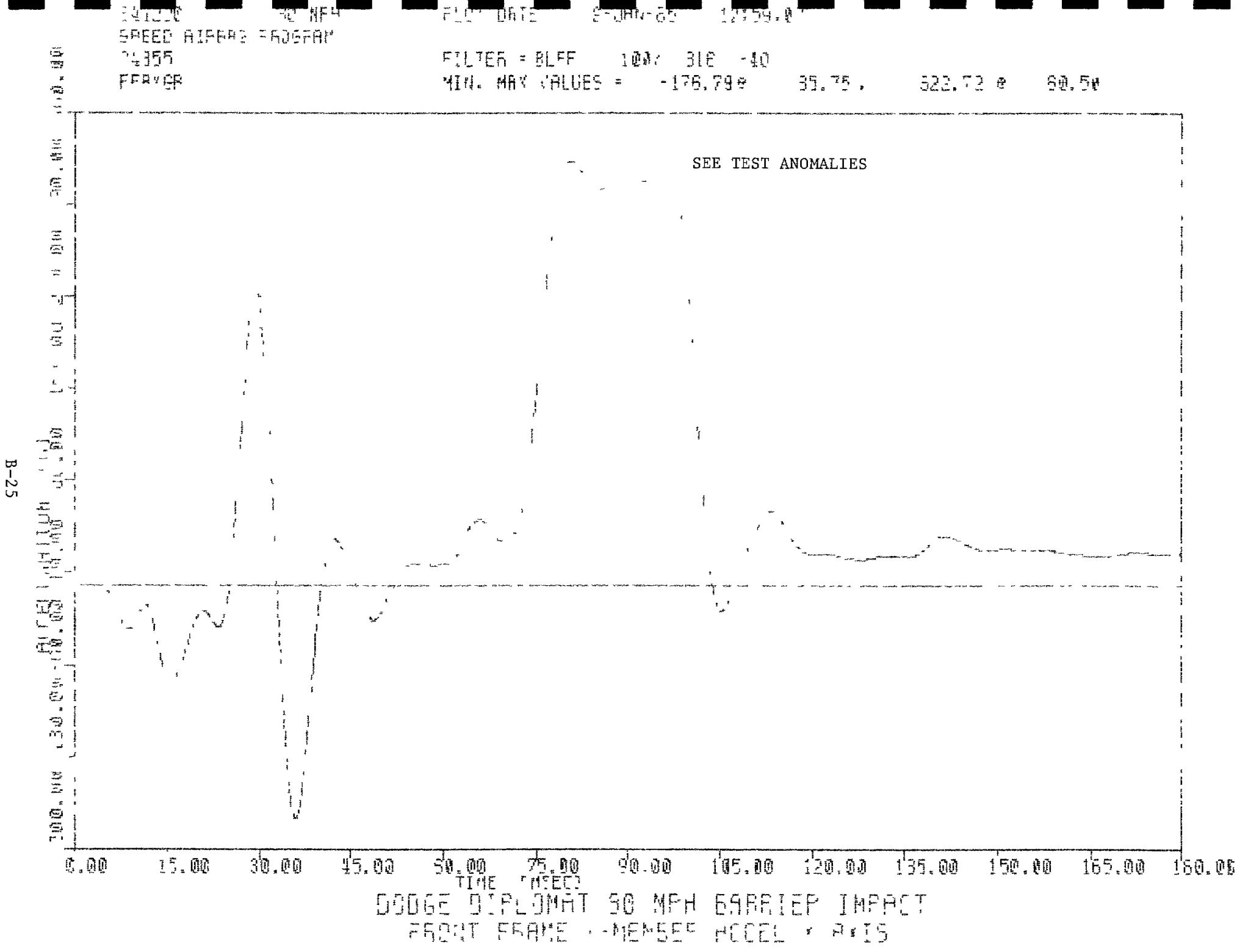
841220 , 30 MPH
BREED AIRBAG PROGRAM
84355
FFRxDL

PLOT DATE 21-DEC-84 10:40:19

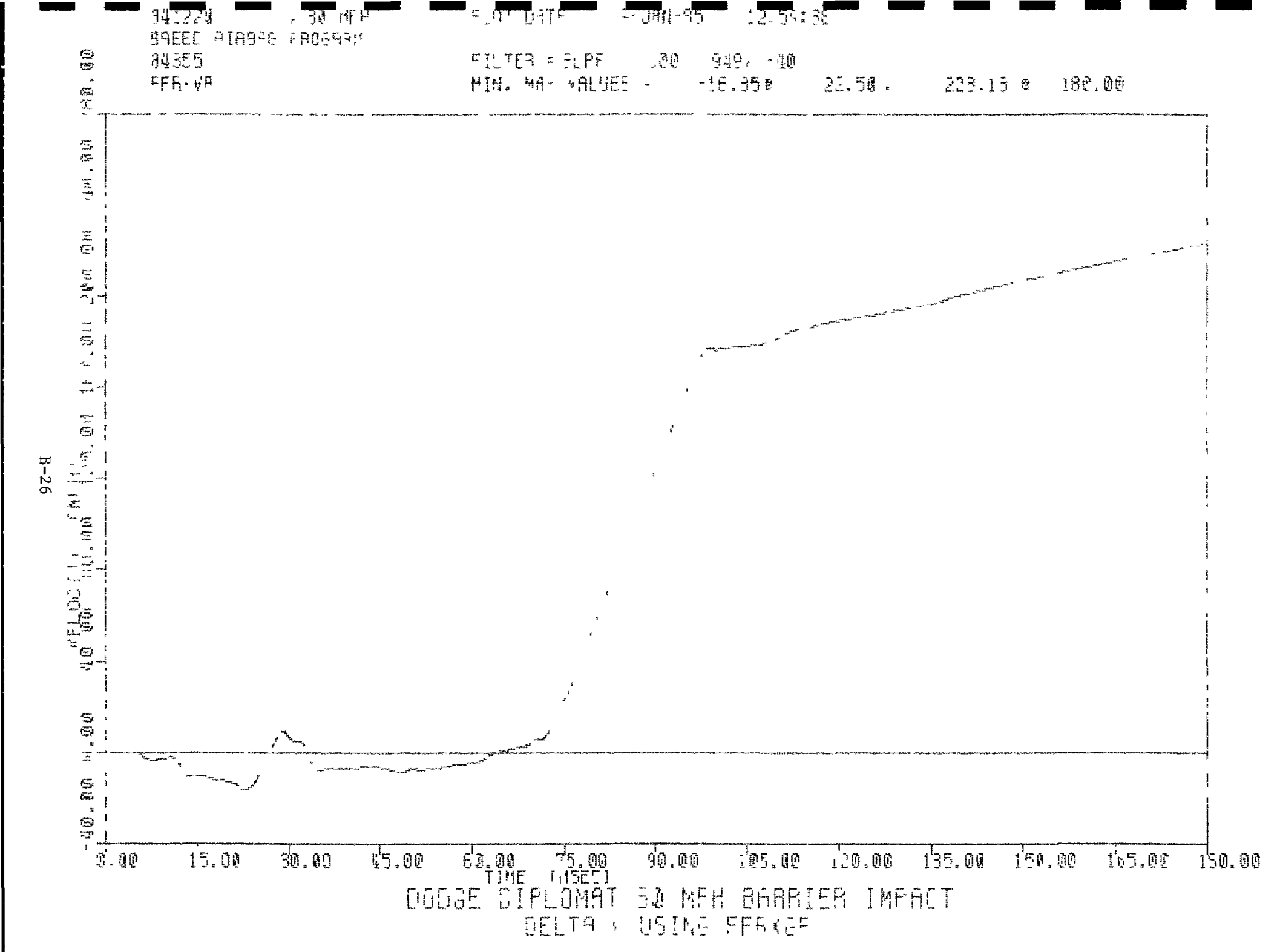
FILTER = BLPF 300/ 949/ -40
MIN, MAX VALUES = -127.67 @ 180.00 , 0.00 @ 4.63

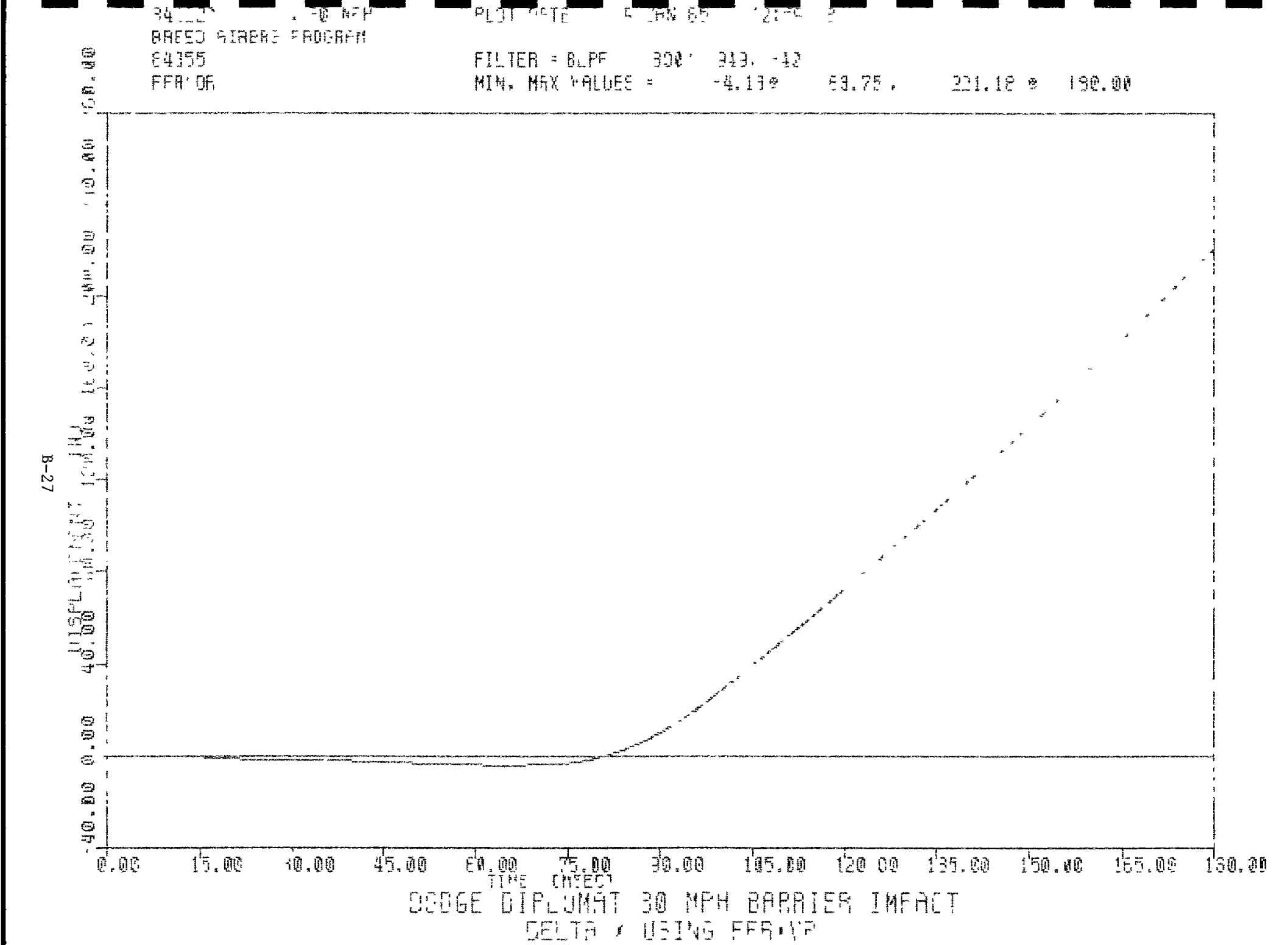


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA-V USING FFR'VL



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
FRONT FRAME - MEMBER ACCEL - X-IS


TIME (MSEC)
DODGE DIPLOMAT 30 MPH BARRIER IMPACT


BREED SIABRS PROGRAM
64355
FFR'OR
FILTER = BLPF 300' 313. -42
MIN. MAX VALUES = -4.13@ 53.75, 221.12 @ 190.00
-40.00 0.000 40.00 80.00 120.00 160.00 200.00
0.00 15.00 30.00 45.00 60.00 75.00 90.00 105.00 120.00 135.00 150.00 165.00 180.00
TIME (MSEC)
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING FFR-12

[redacted] 30 MPH [redacted] 4-JAN-89 [illegible]

BREED AIRBAG "SOSAB"

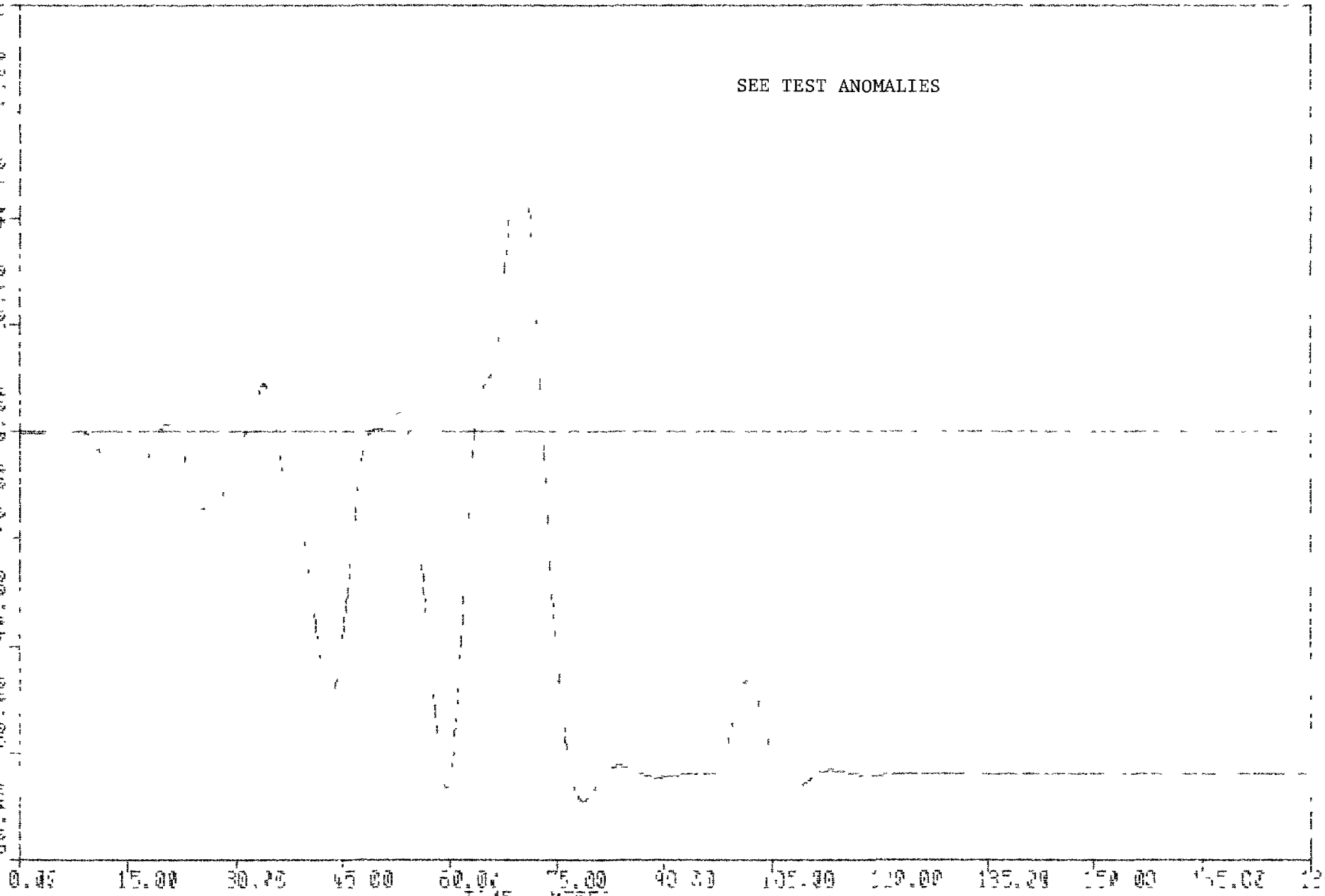
94355

5THPG

FILTER = BLPF 100. 316 -40

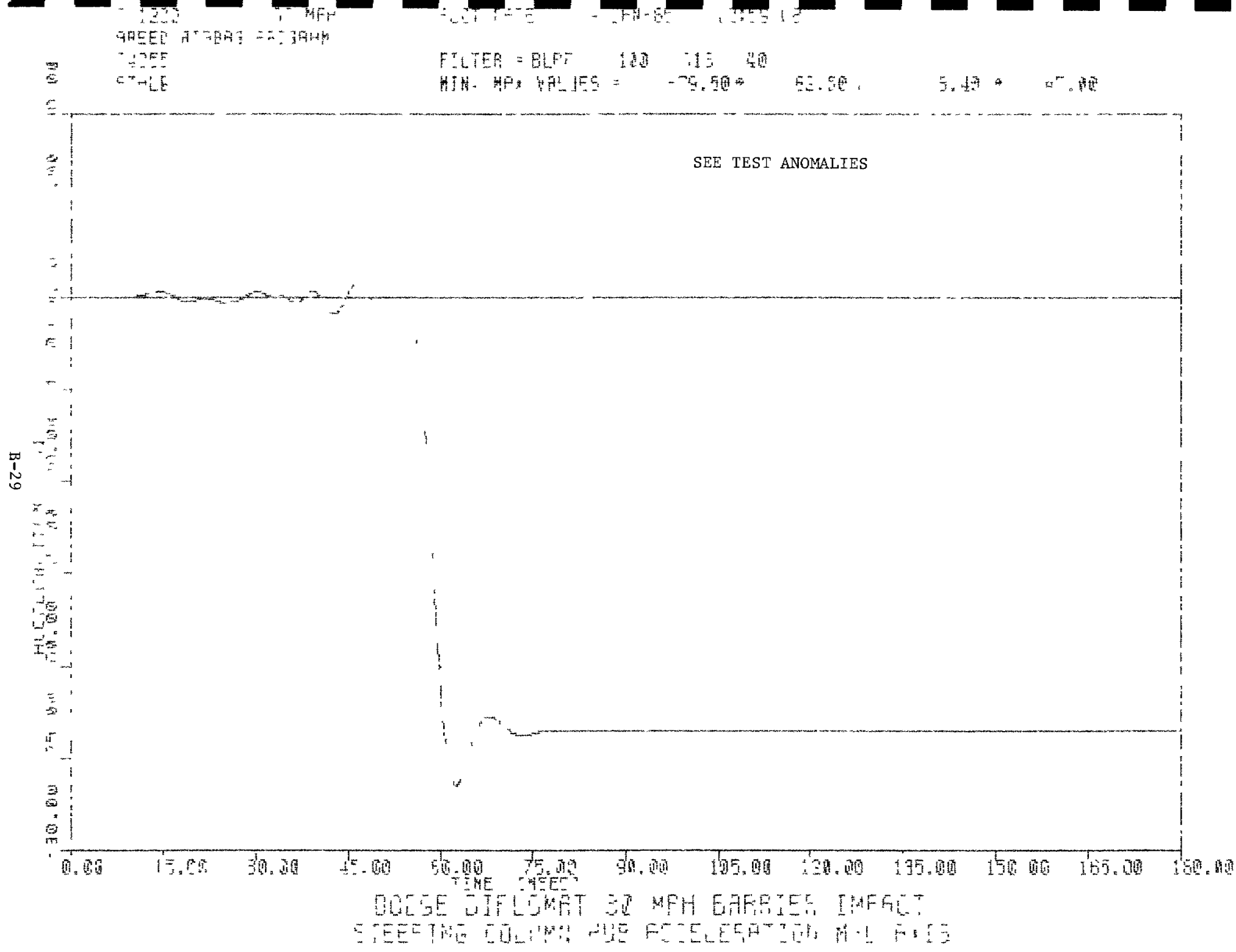
MIN. MAX VALUES - -59.04g 78.58, 55.6F g 25.63

SEE TEST ANOMALIES

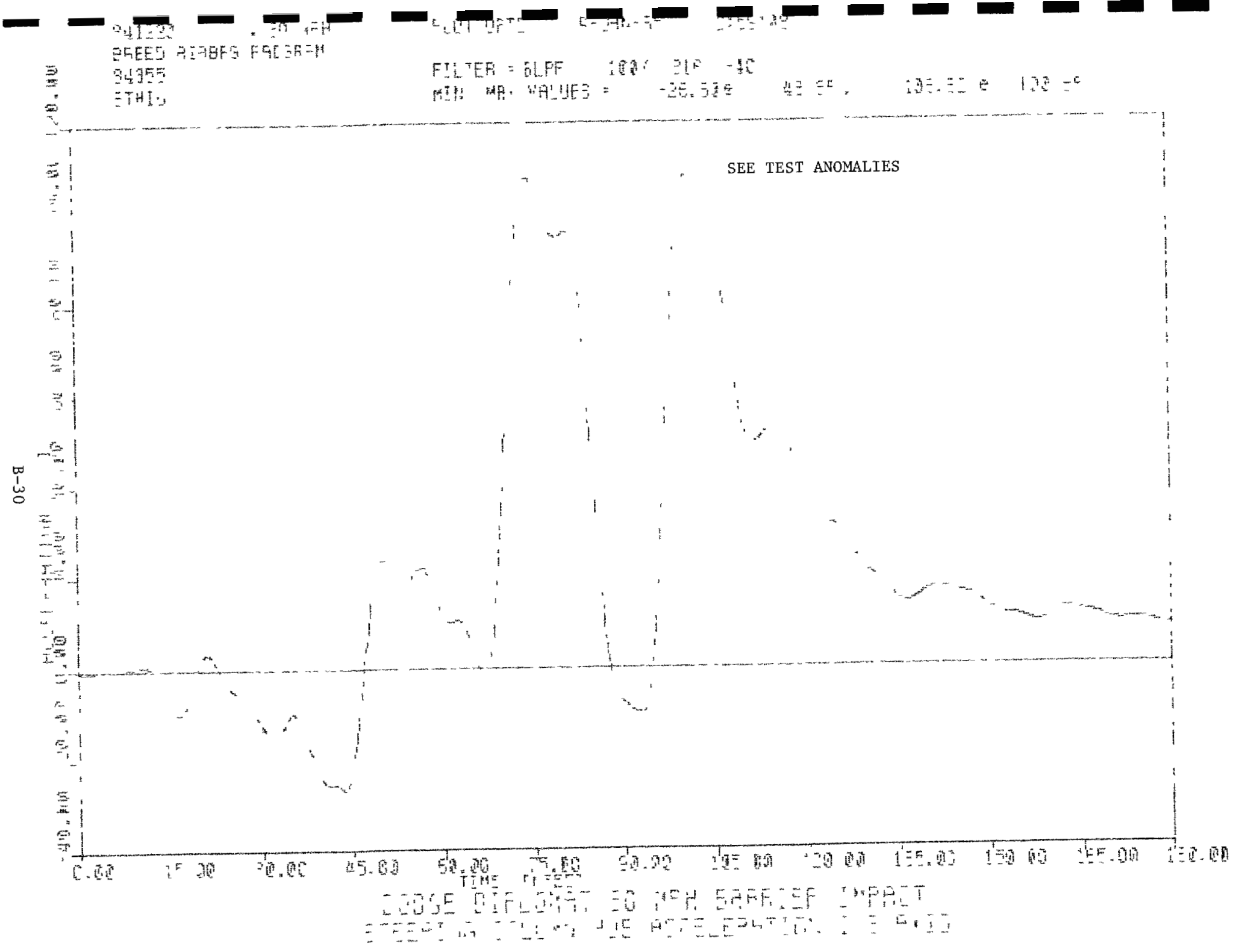


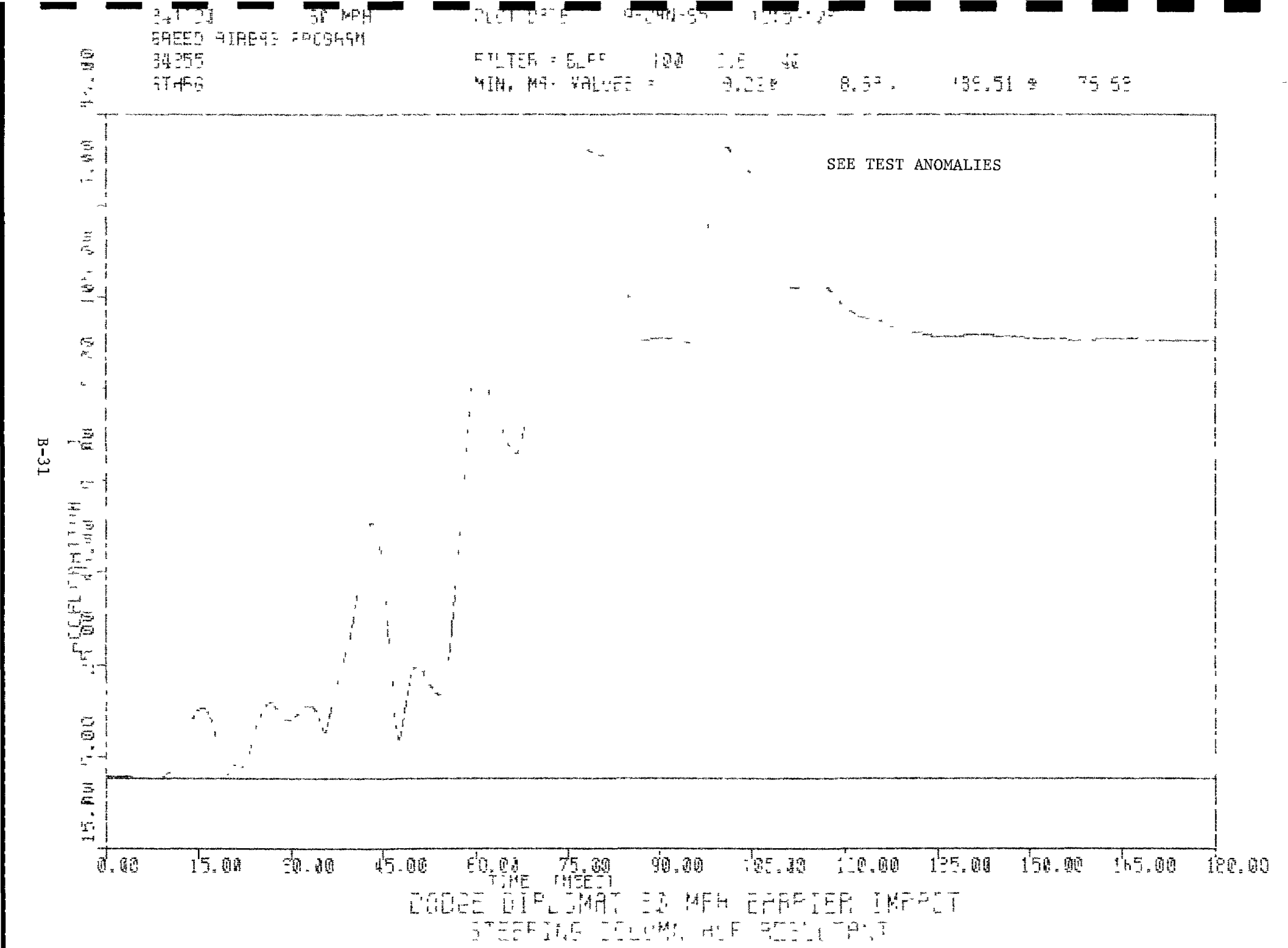
DODGE DIPLOMAT 10 MPH SEVERE IMPACT

STEERING COLUMN KNEE ACCELERATION X-D AXIS



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
STEERING COLUMN: DOR ACCELERATION, M/L AXIS


SEE TEST ANOMALIES
TIME



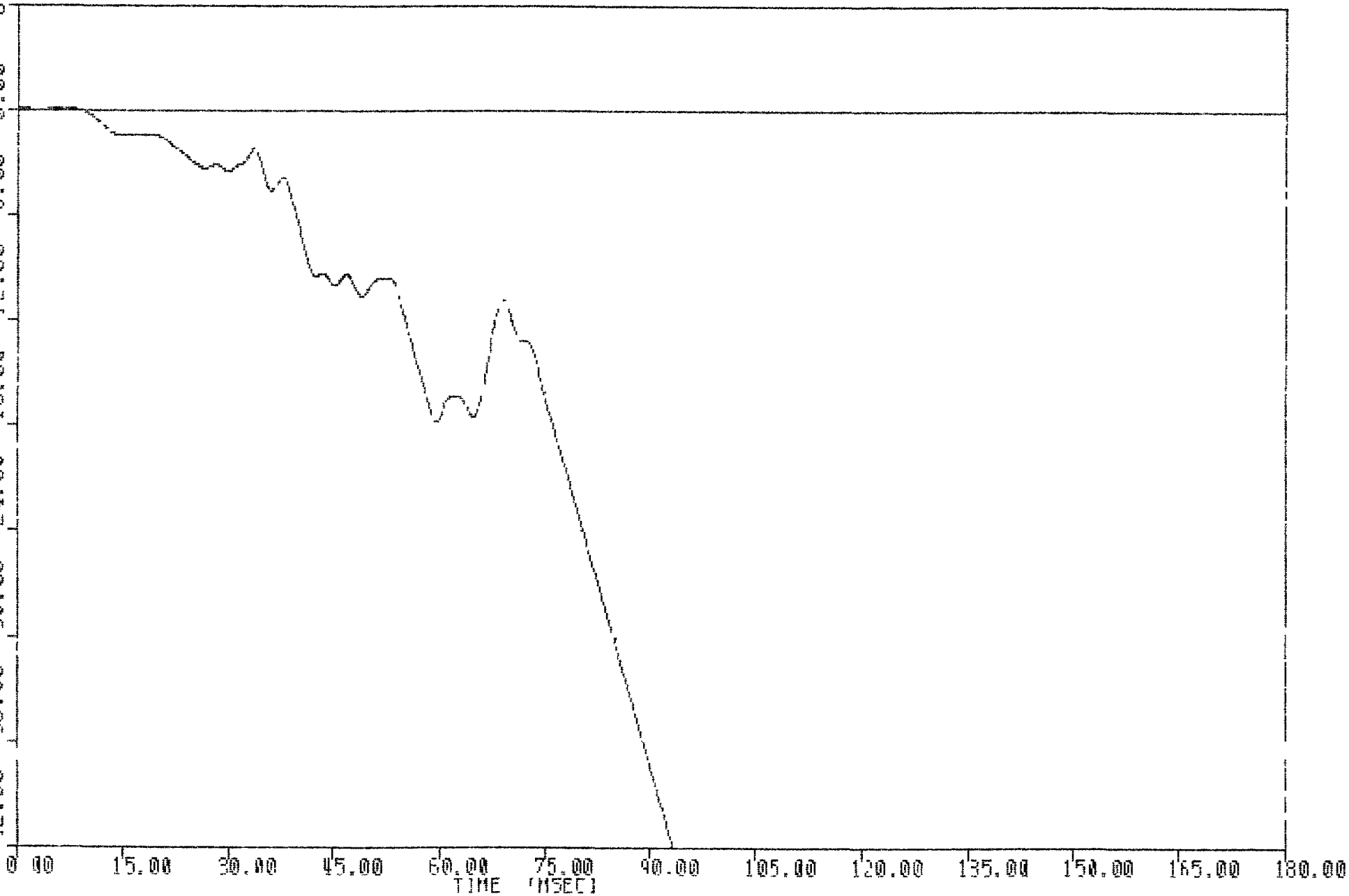
DODGE DIPLOMAT 35 MPH BARRIER IMPACT
STEERING COLUMN, LOWER

841220 , 30 MPH
BREED AIRBAG PROGRAM
84355
STHPV

PLOT DATE 21-DEC-84 10:40:19

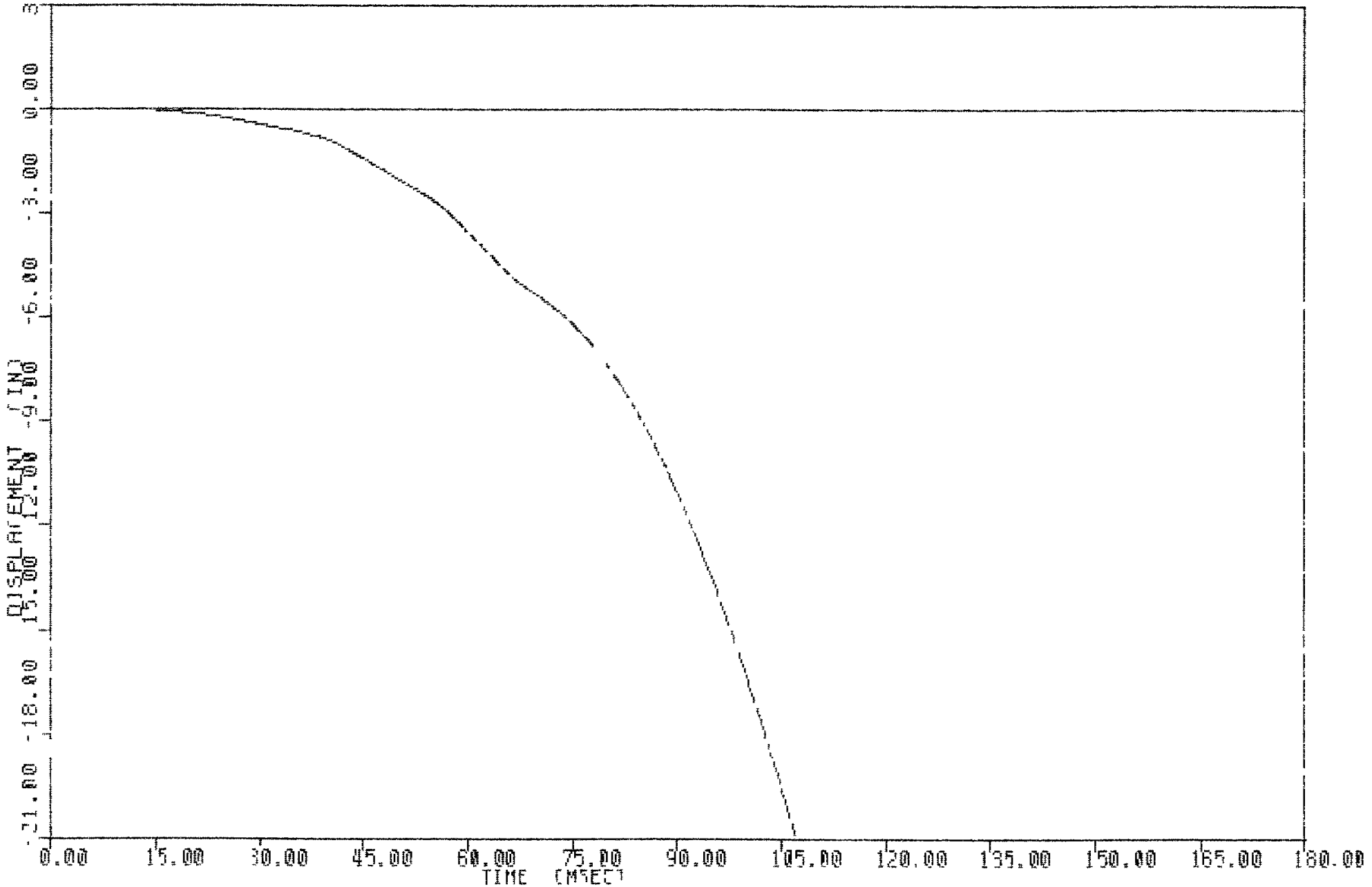
FILTER = BLPF 300/ 949/ -40

MIN, MAX VALUES = -162.51 @ 180.00 , 0.07 @ 6.63



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING STHPG

841220 , 30 MPH PLOT DATE 21-DEC-84 10:40:19
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 949/ -40
STHPD MIN, MAX VALUES = -118.54@ 180.00 , 0.02 @ 8.50

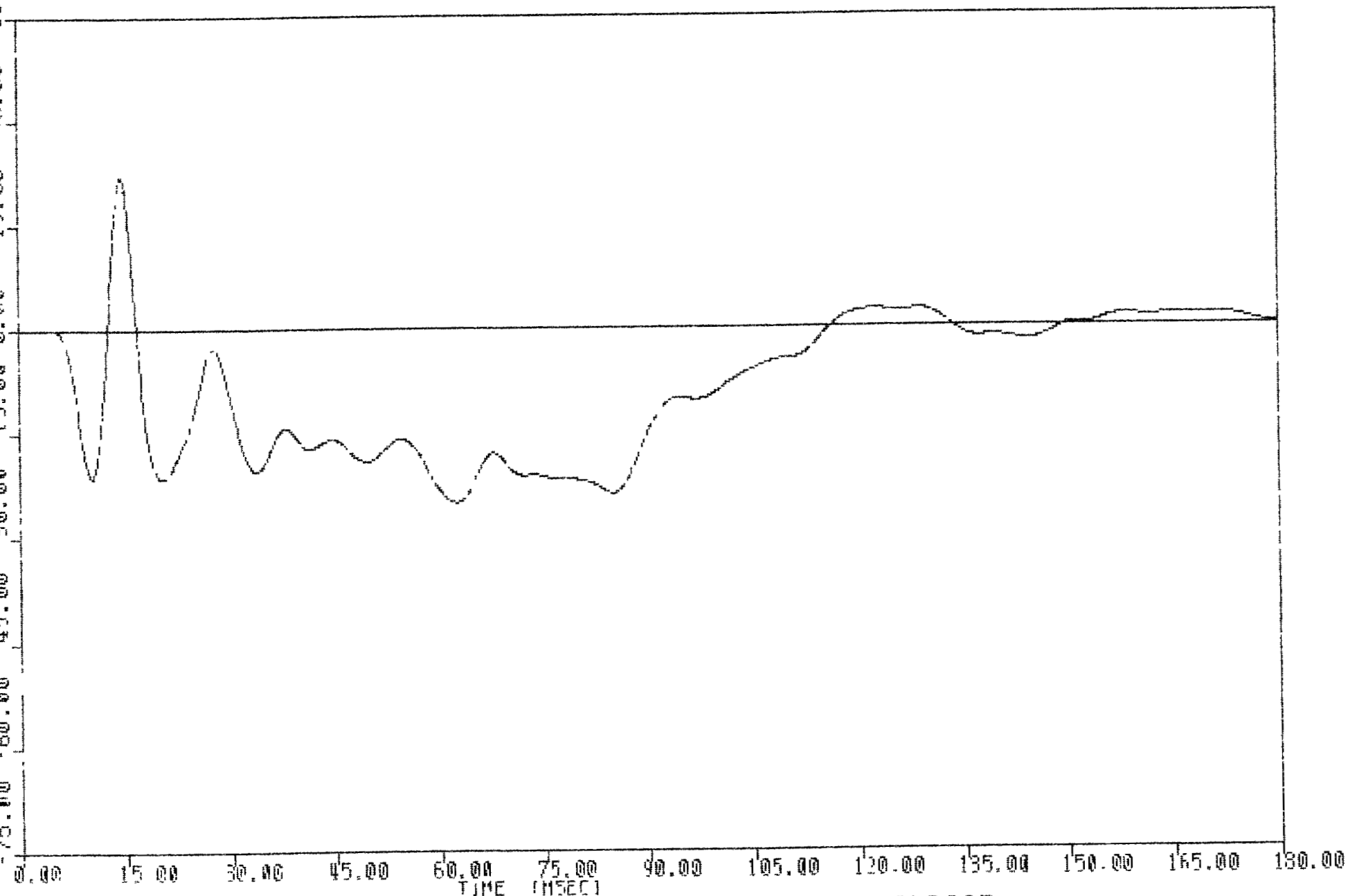


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTH : USING STHPV

841220 , 30 MPH
BREED AIRBAG PROGRAM
84355
LPBX0

PLOT DATE = 21-DEC-84 10:39:09

FILTER = BLPF 100. 316/ -40
MIN. MAX VALUES = -24.99@ 62.38 , 21.92 @ 14.50

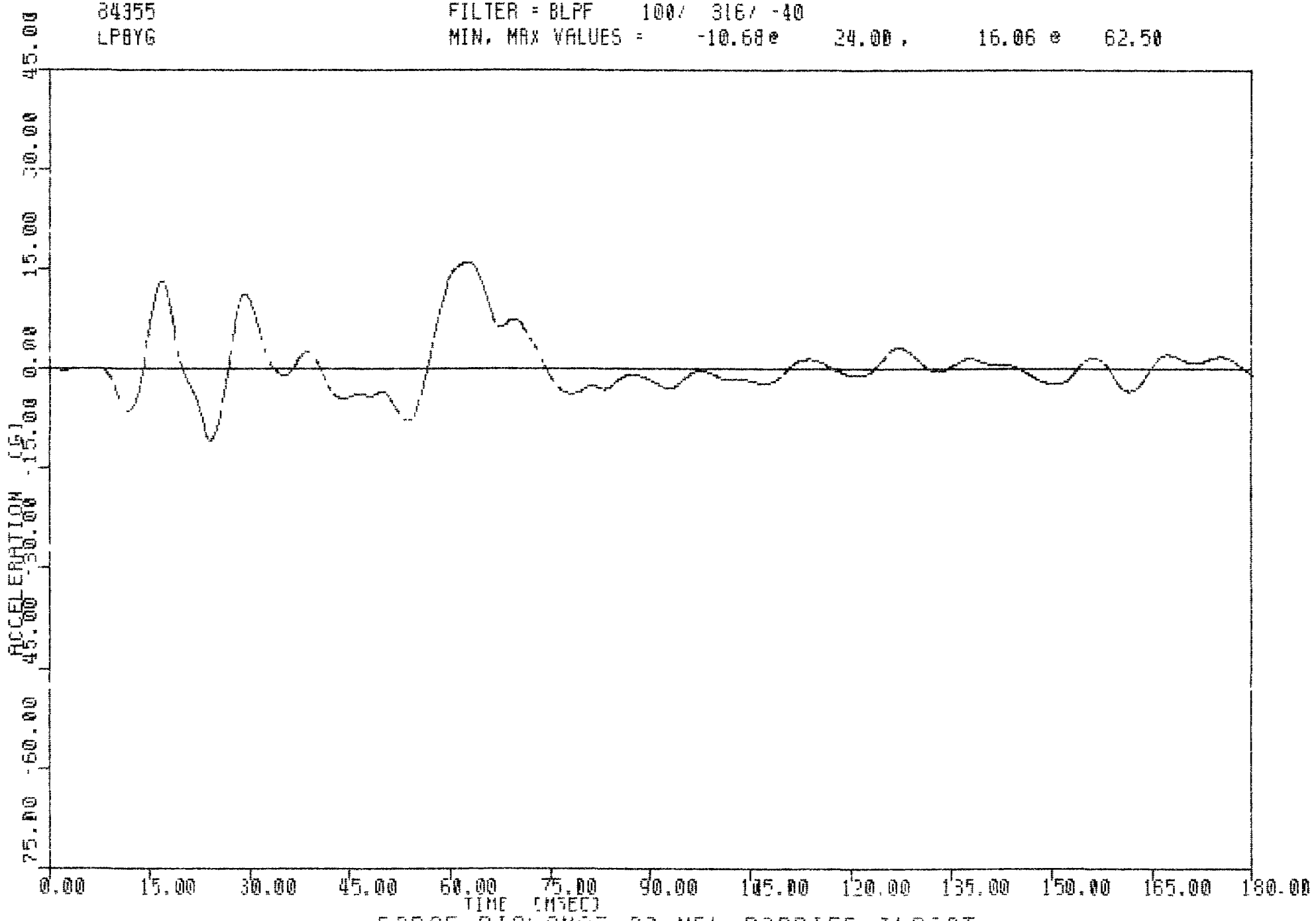


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
PILLAR LEFT B ACCELERATION - A.I5

641230 , 30 MPH
BREED AIRBAG PROGRAM
84355
LP8YG

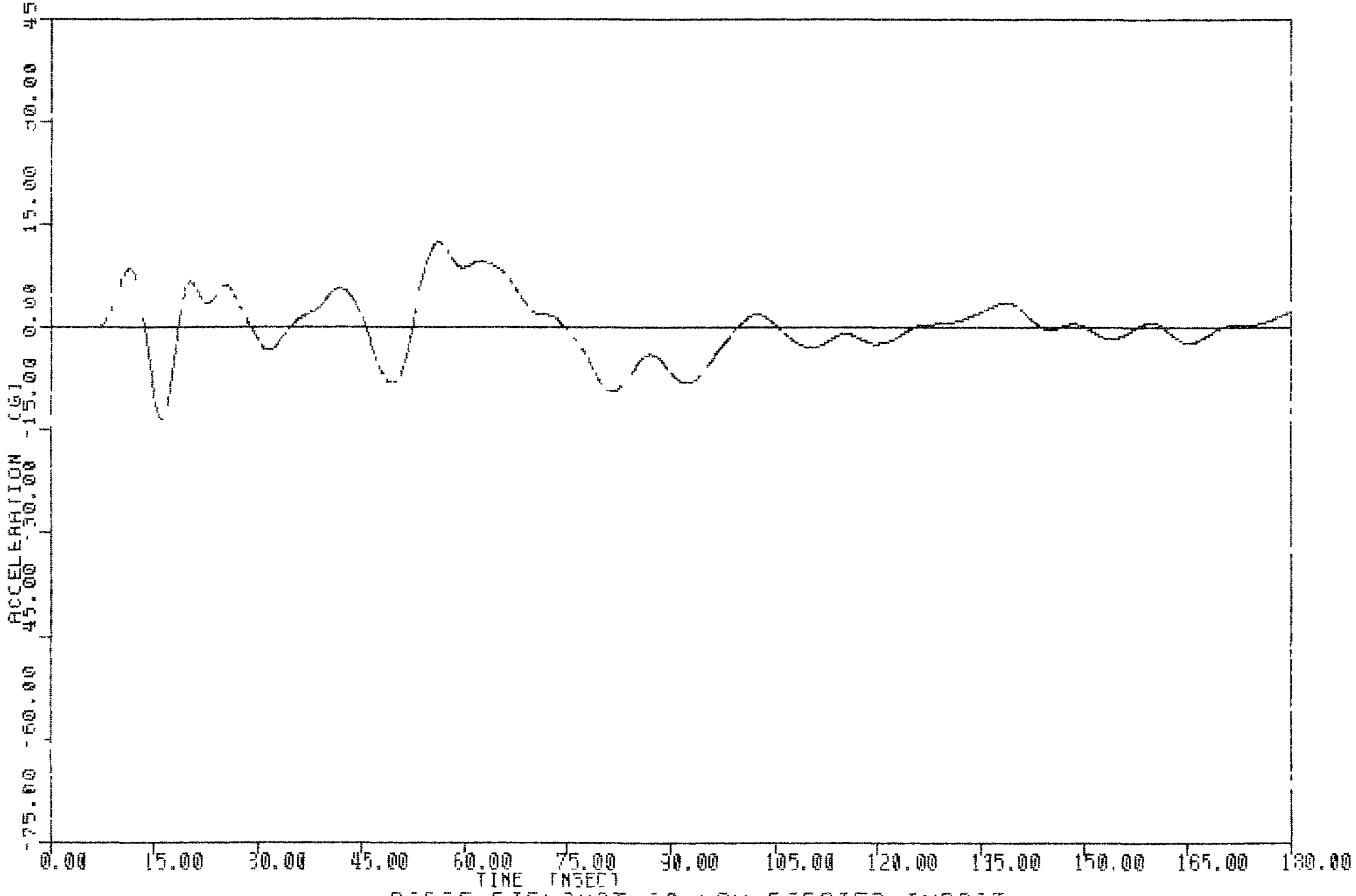
PLOT DATE 21-DEC-84 10:39:09

FILTER = BLPF 100/ 316/ -40
MIN, MAX VALUES = -10.68@ 24.00 , 16.06 @ 62.50



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
FILTER LEFT B ACCELERATION Y AXIS

841220 , 30 MPH PLOT DATE 21-DEC-84 10:39:09
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 100/ 316/ -40
LPBZ6 MIN. MAX VALUES = -13.38 @ 16.00 , 12.40 @ 56.25



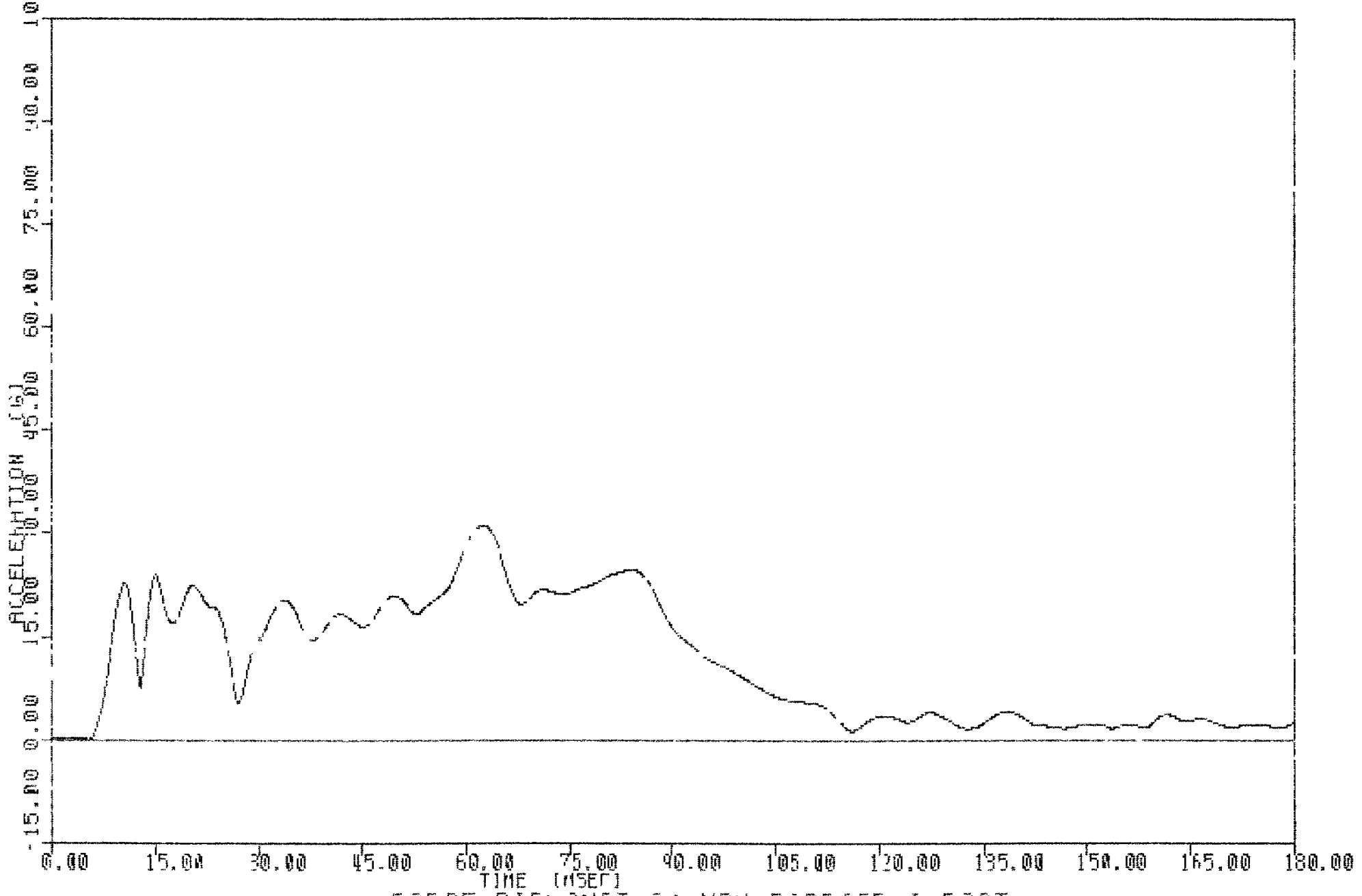
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
PILLAR LEFT B ACCELERATION Z AXIS

841220 . 30 MPH
BREED AIRBAG PROGRAM
84355
LPBRG

PLOT DATE = 21-DEC-84 10:39:09

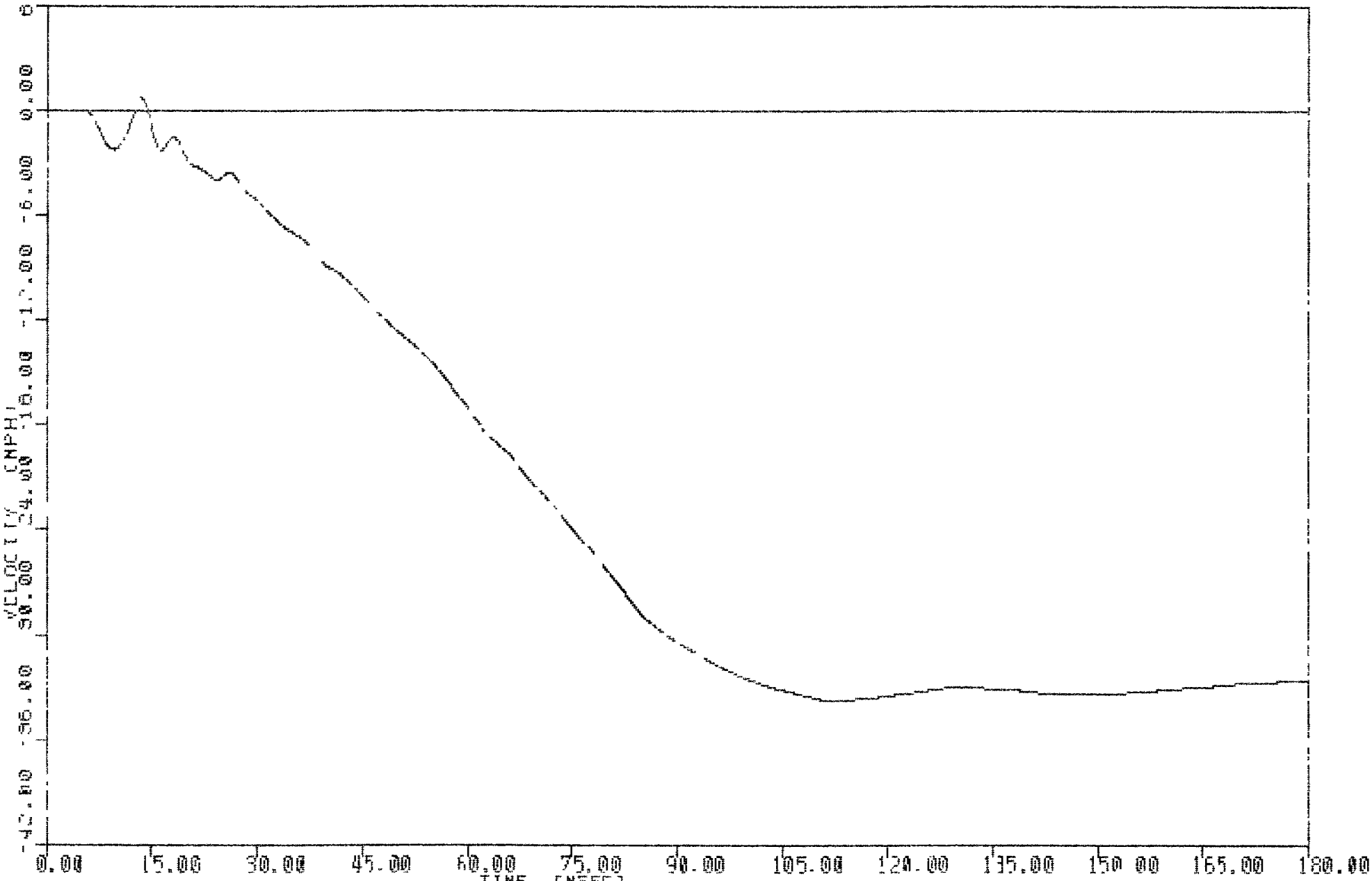
FILTER = BLPF [00/ 316/ -40

MIN. MAX VALUES = 0.04 @ 5.00 , 31.24 @ 62.36



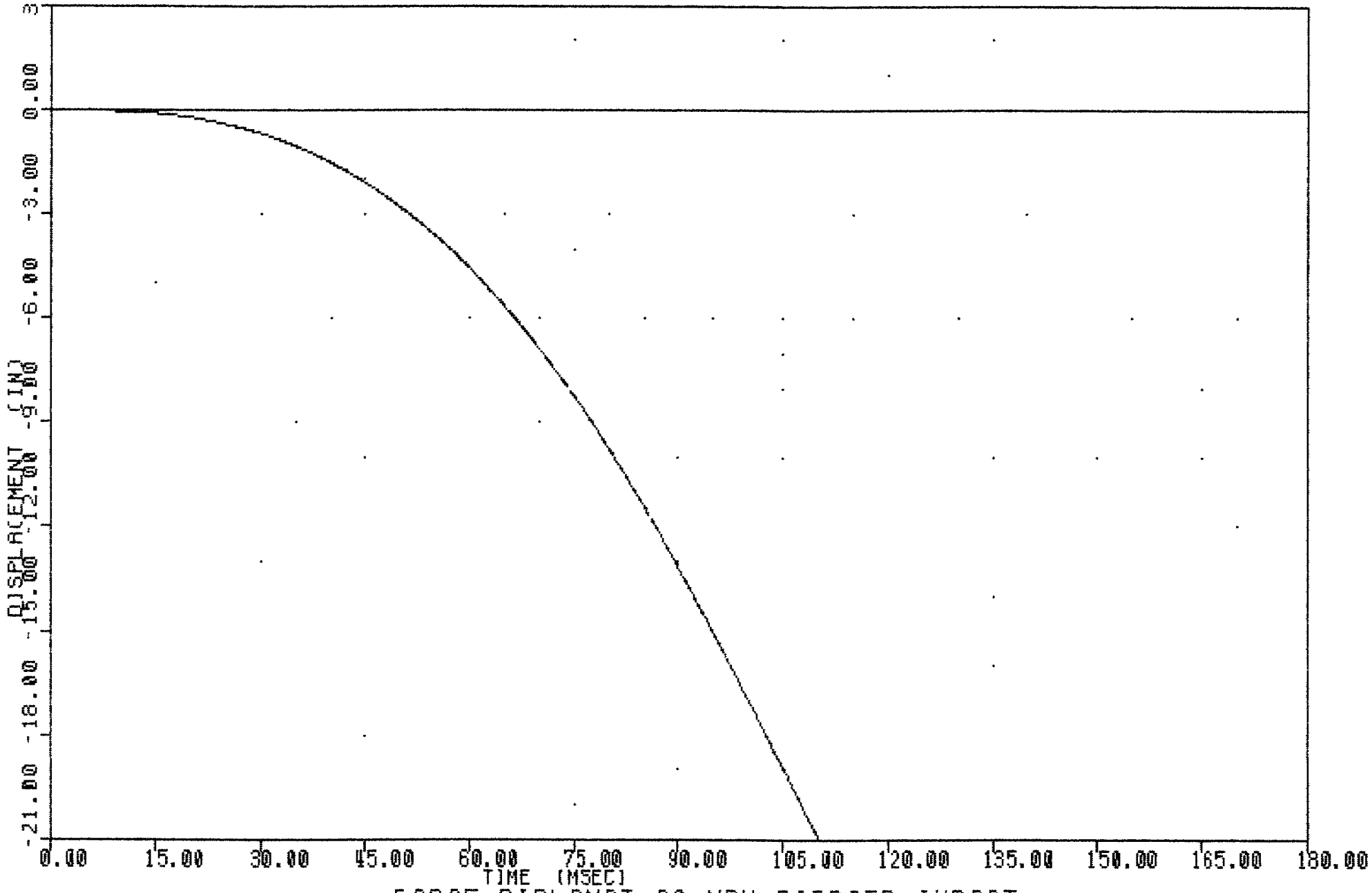
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
PILLAR LEFT B RESULTANT

841220 . 30 MPH PLOT DATE 21-DEC-84 10:40:19
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 949/ -40
LPBXV MIN. MAX VALUES = -35.74 @ 112.63 , 0.70 @ 13.25



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA V USING LPBXG

841220 . 30 MPH PLOT DATE 14-JAN-85 15:59:49
BREED AIRBAG PROGRAM
84355 FILTER = BLPF 300/ 949/ -40
LPBXD MIN, MAX VALUES = -48.86 @ 180.00 , 0.00 @ 4.75

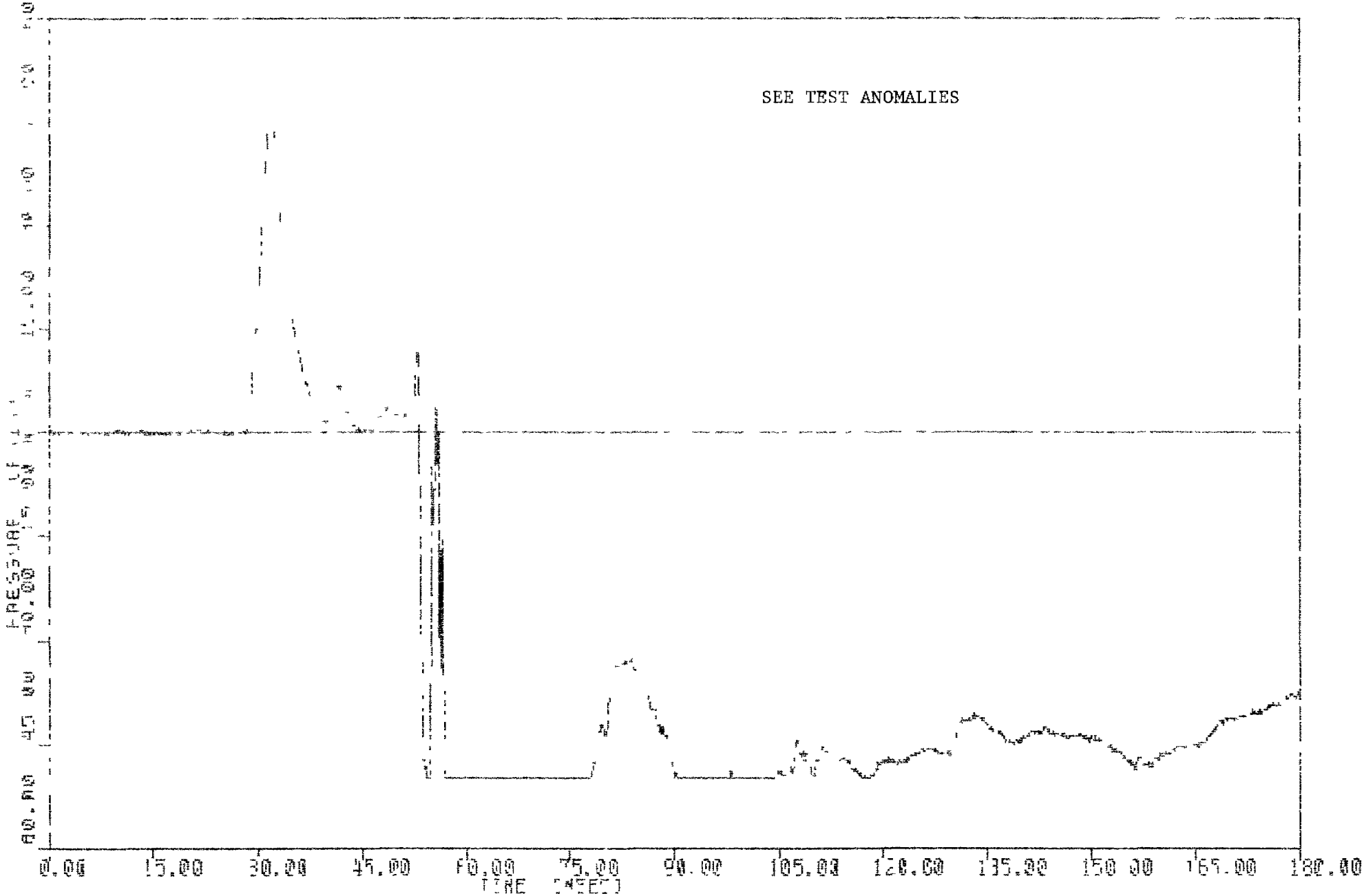


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
DELTA X USING LPBXV

SPEED AIRBAG PROGRAM
54355
ABTF

FILTER = CLFF 1000 CFC

MIN. MAX VALUES = -42.32 56.13 46.25 31.55

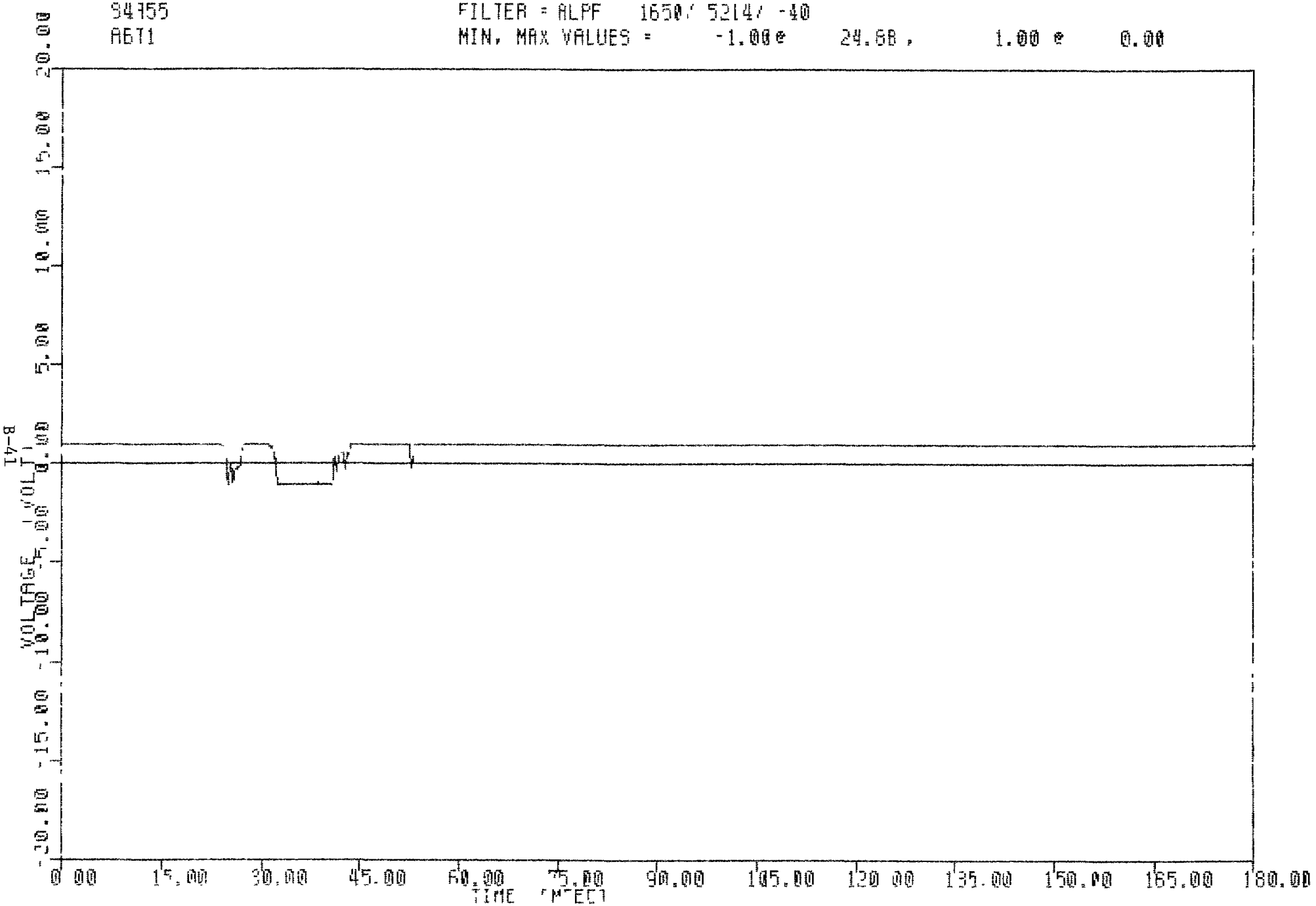


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
PIPBAG PRESSURE

841220 , 30 MPH
BREED RIABAG PADGRAM
94755
AGT1

PLOT DATE 21-DEC-84 10:38:09

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -1.00@ 24.68 , 1.00 @ 0.00

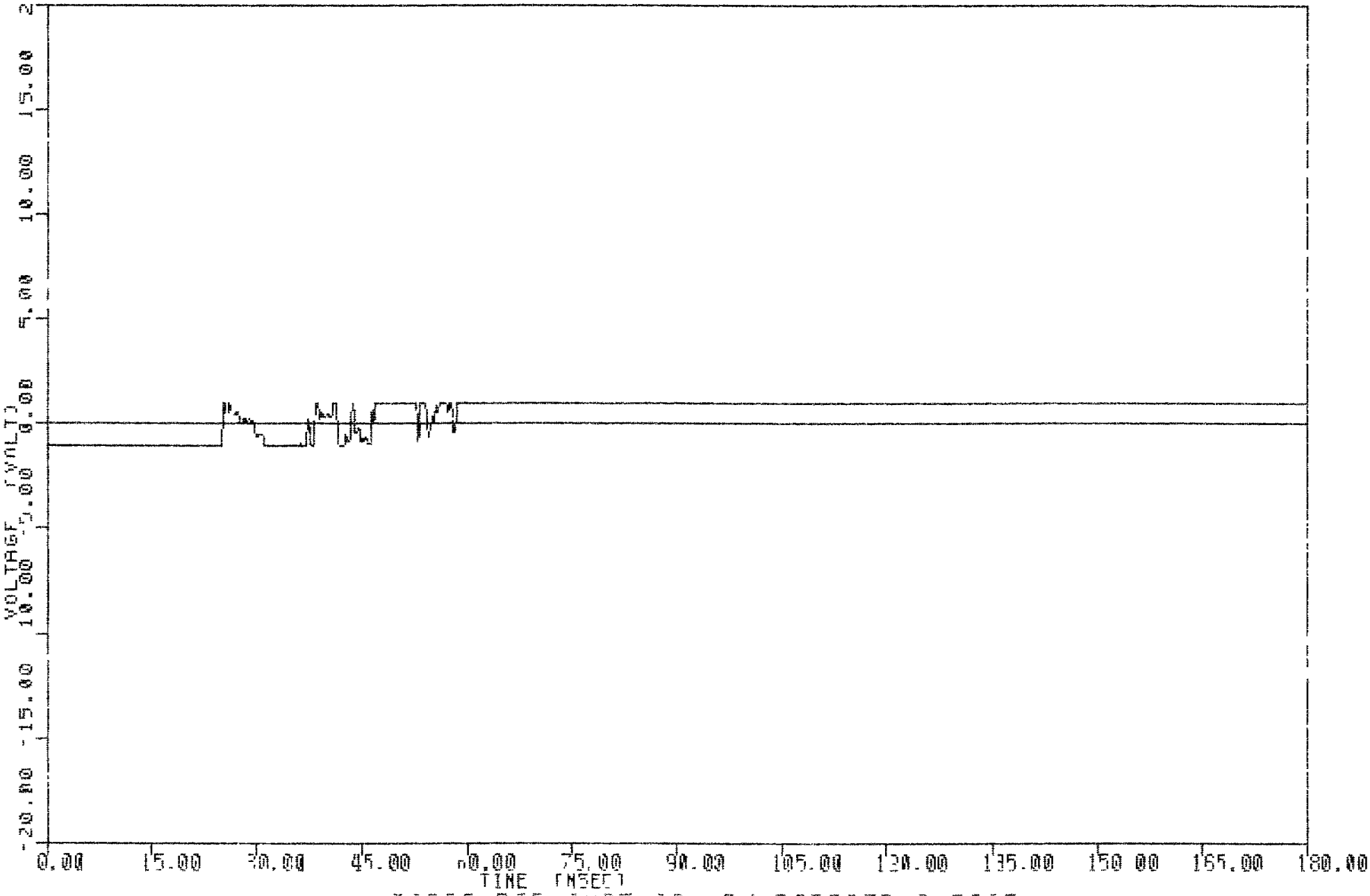


DODGE DIPLOMAT 30 MPH BARRIER IMPACT
SENSOR BURNWIRE 1

841220 . 30 MPH
BREED AIRBAG PROGRAM
84355
ABT2

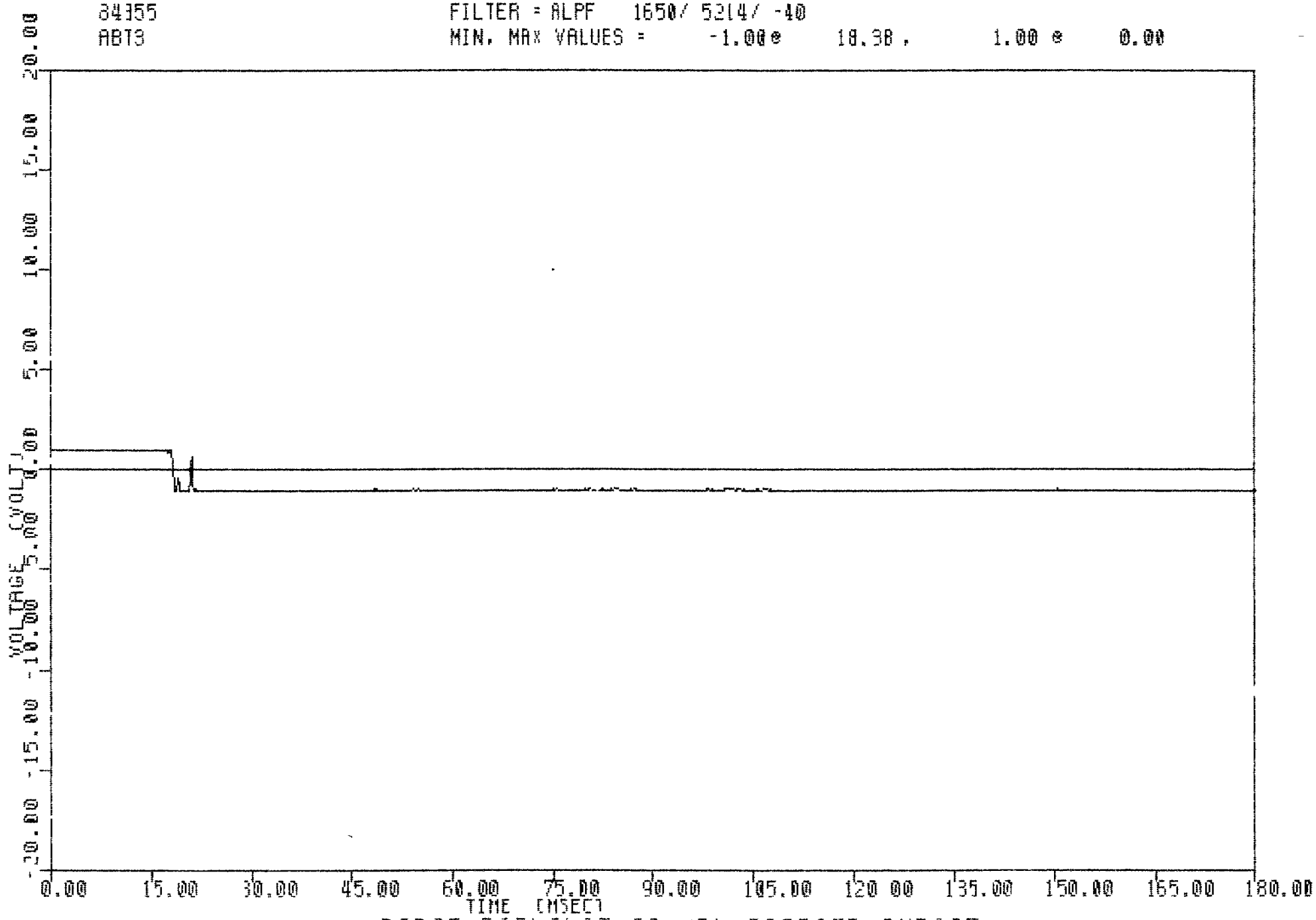
PLOT DATE 21-DEC-84 10:39:09

FILTER = ALPF 1650/ 5214/ -40
MIN. MAX VALUES = -1.00 @ 0.00 , 1.00 @ 25.13



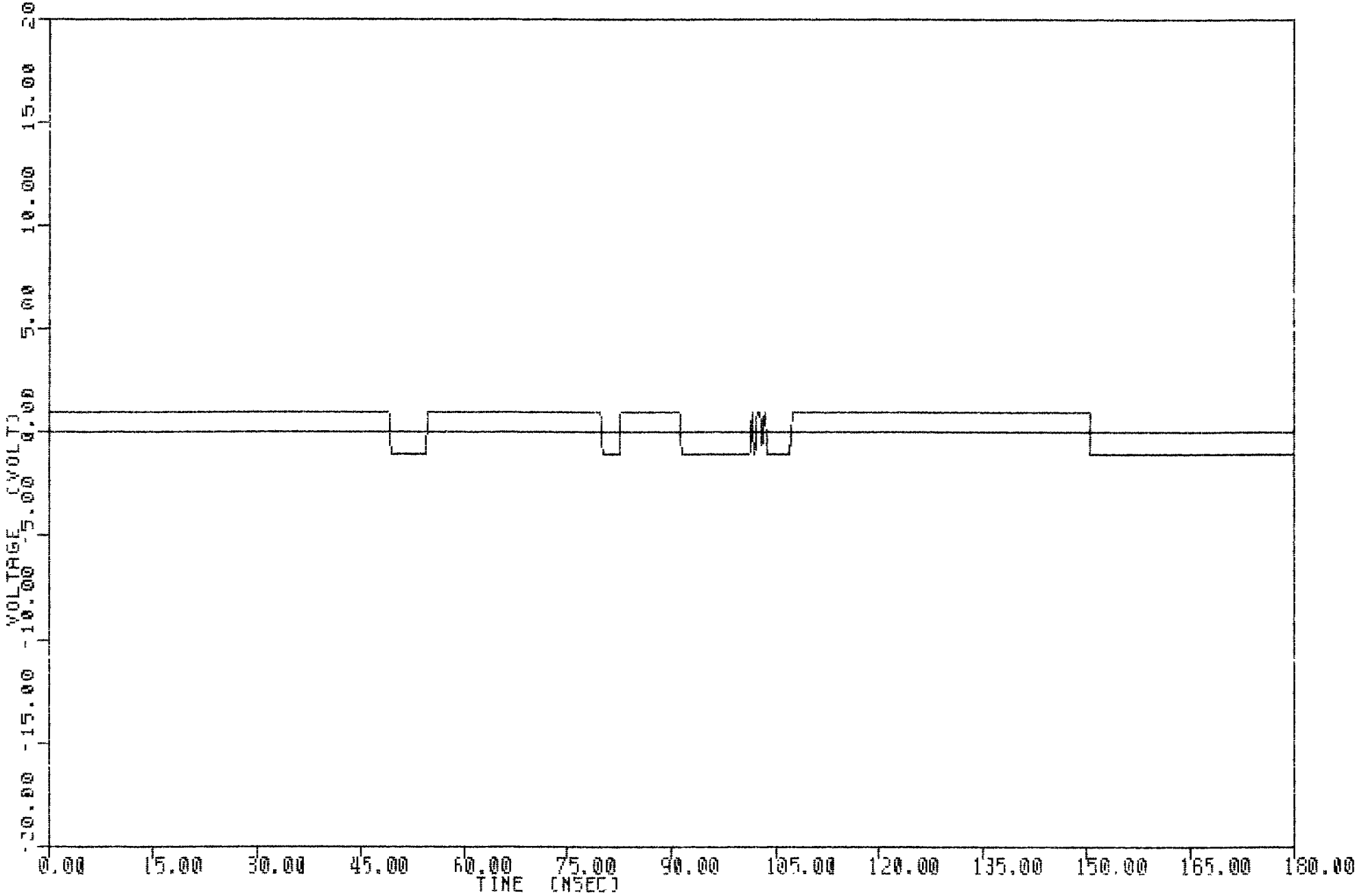
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
SENSOR BURNWIRE 2

841220 , 30 MPH PLOT DATE 21-DEC-84 12:27:18
BREED RIABAG PROGRAM
84155 FILTER = ALPF 1650/ 5214/ -40
ABT3 MIN. MAX VALUES = -1.00 @ 18.38 , 1.00 @ 0.00



DODGE DIPLOMAT 30 MPH BARRIER IMPACT
BREED B-PILLAR SENSOR

841220 , 30 MPH PLOT DATE 21-DEC-84 13:27:18
BREED AIRBAG PROGRAM
84355 FILTER = ALPF 1650/ 5214/ .40
ABT4 MIN, MAX VALUES = -1.00 @ 49.38 , 1.00 @ 0.00



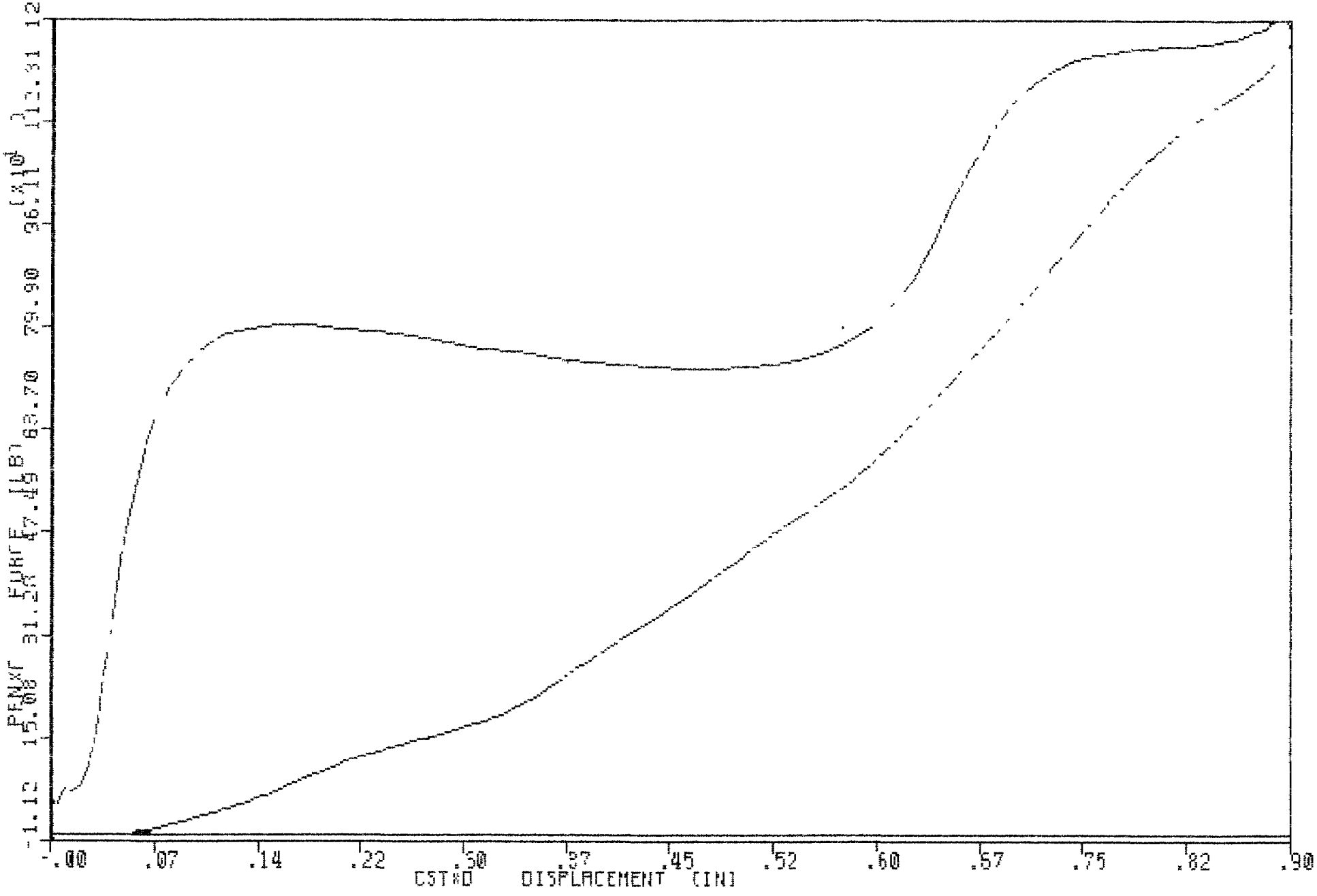
DODGE DIPLOMAT 30 MPH BARRIER IMPACT
KNEE CONTACT

APPENDIX C

DUMMY CERTIFICATION

[redacted] RL[redacted] [redacted] SN [redacted] [redacted] CAL [redacted] [redacted] PLOT [redacted] [redacted]-DEC-[redacted] [redacted]:24:27

CSTxD	FILTER = ALPF	300/	948/ -40	MIN, MAX =	0.00 @	-1.40 ,	0.90 @	1266.94
PENxF	FILTER = ALPF	500/	948/ -40	MIN, MAX =	-11.22 @	0.00 ,	1285.32 @	0.00



HYSTERESIS

[illegible] RESEARCH CENTER OF OHIO

EXTERNAL DIMENSION

PAGE [illegible]   [illegible]-DEC-94 09:[illegible]

TEMPERATURE [illegible]   RELATIVE HUMIDITY [illegible]
[illegible] 046   [illegible] EXT DIMENSIONS (4)

DESCRIPTION	SPECIFICATION	TEST RESULTS
SN HUMANOID [illegible]		
Sitting Height	[illegible] - 3[illegible].9 IN	[illegible].6 INS
Shoulder Pivot Height	[illegible] - [illegible] IN	[illegible] INS
Hip Pivot Height	3.[illegible] IN (ref.)	[illegible] INS
Hip Pivot From Backline	4.[illegible] IN (ref.)	4.[illegible] INS
Knee Pivot From Backline	[illegible].1 - [illegible] IN	[illegible] INS
Rear of Head From Backline	1.[illegible] IN (ref.)	1.[illegible] INS
Chest Depth	[illegible] - [illegible] IN	[illegible] INS
Shoulder Width	[illegible] - [illegible].4 IN	1[illegible] INS
Chest Circumference Over Nipples	[illegible]6.8 - 40.[illegible] IN	3[illegible].[illegible] INS
Waist Circumference at Min. Girth	[illegible] - [illegible] IN	[illegible] INS
Hip Width	14.[illegible] - 1[illegible] IN	14.9 INS
Knee Pivot From Floor	19.[illegible] - 19.9 IN	19.[illegible] INS

[illegible] MEETS SPECIFICATIONS

TECHNICIAN V. L. Watters

TEST SUPERVISOR R. E. [illegible]

TRANSPORTATION RESEARCH CENTER OF OHIO
LUMBAR FLEXION TEST

Customer VRTC

Dummy S/N 187 Manufacturer Humanoid

Test Date 11/9/84 Time of Test

Ambient Temperature 71°F Relative Humidity 40%

Test No. LF18704

Deflection Angle	Specification	Test Results
0°	0 lbs.	0
20°	22 - 34 lbs.	34
30°	34 - 46 lbs.	44
40°	46 - 58 lbs.	49

Pass/Fail Pass

Starting Reference Angle

Return Angle

Net Return Angle 4.7

COMMENTS:

Technician V. L. Watters Date 11-9-84

Test Engineer R. E. LeVan Date 11-9-84

TRANSPORTATION RESEARCH CENTER OF OHIO
ABDOMINAL COMPRESSION TEST

Customer R & D

Dummy S/N 187 Manufacturer Humanoid

Test Date 11/9/84 Time of Test 15:50

Ambient Temperature 72°F Relative Humidity 42%

Test No. AB18704

TEST CORRIDORS

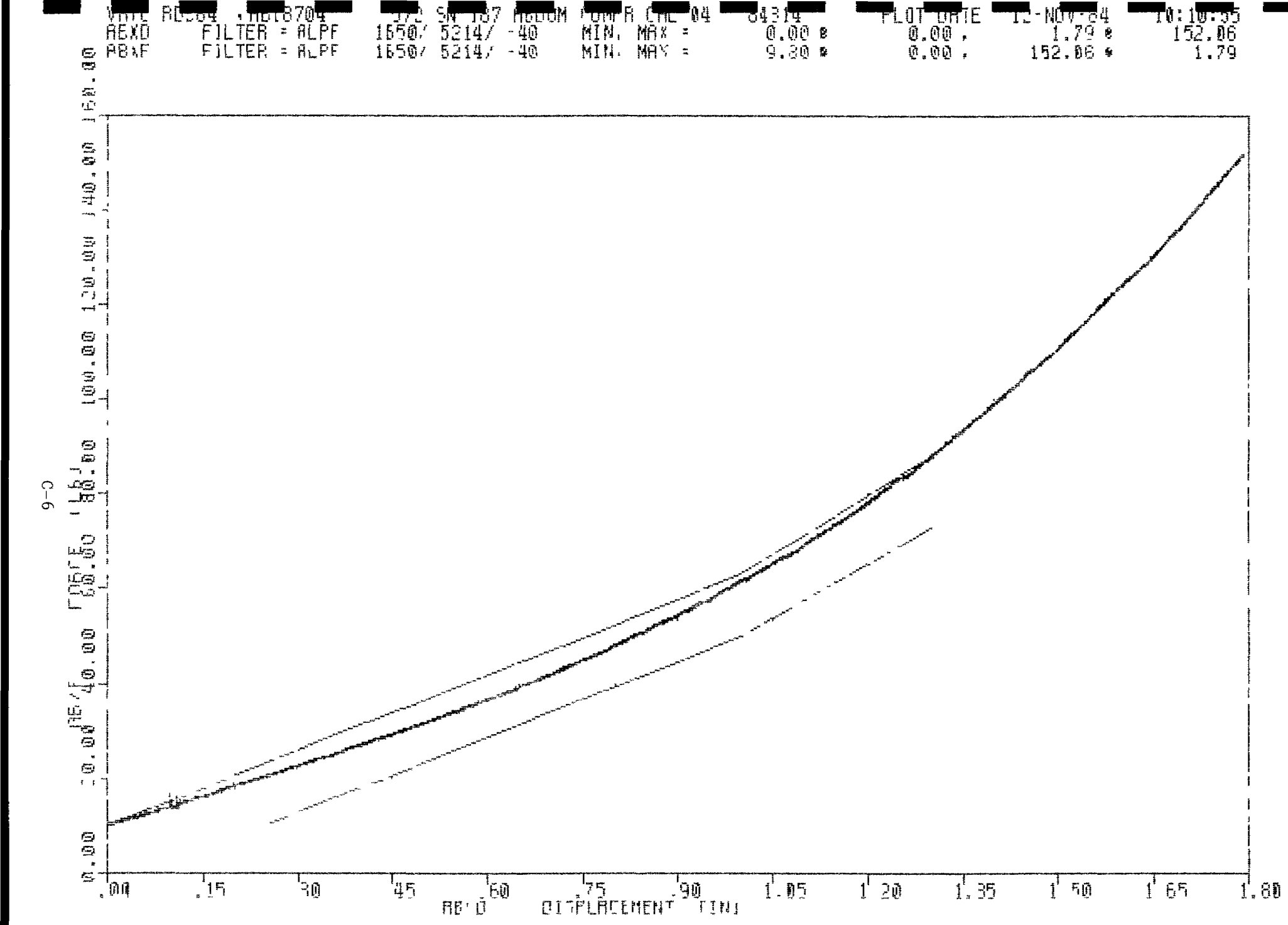
Displacement (inches)	Force (lbs.)	Test Results
0	10	10
.25	10 - 23.25	20.18
1.00	50 - 63	61.85
1.30	73 - 88	87.73

Pass/Fail Pass

COMMENTS:

Technician V.J. Watkins Date 11-9-84

Test Engineer R.E. LeVan Date 11-9-84



ABDOMINAL COMPRESSION VS DISPLACEMENT

TRANSPORTATION RESEARCH CENTER OF OHIO

HEAD DROP TEST

PART 572 20-NOV-84 11:23:12

TEMPERATURE 71 F
VRTC RD384 HD18/04

RELATIVE HUMIDITY 24 %
572 SN 127 HEAD DROP CAL 04

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PEAK RESULTANT ACCELERATION	210 - 260 G	214.87 G
TIME ABOVE 100 G LEVEL	0.9 - 1.5 MS	1.29 MS
PEAK LATERAL ACCELERATION	10 G MAX	3.01 G
IS ACCELERATION CURVE UNIMODAL?		YES

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V. L. Watters
TEST SUPERVISOR D. E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

Neck Pendulum Test

Part 572 20-NOV-84 11:26:59

VRTC RD384 HN18/04 572 SN 187 HEAD/NECK CAL 04

Test Parameter	Specification	Test Results
Pendulum velocity	21.5 to 25.5 fps	22.86 fps
Pendulum Deceleration:		
T1 - T2: 5 - 20 G	3 ms. max	2.33 ms.
T2 - T3: 20 - 20 G	25 - 30 ms.	27.71 ms.
T3 - T4: 20 - 5 G	10 ms. max	4.49 ms.
Avg. G level T2 - T3	20 - 24 G	22.35 G
Maximum Rotation Angle	63 - 73 deg.	67.41 deg.
Peak Head Resultant Accel	26 G max	25.53 G

Test Parameter	Specification			Test Results		
Rotation Angle (degrees)	Time (ms.)		Chordal Disp. (in.)	Time (ms.)	Chordal Disp. (in.)	
0	0		-0.5 - +0.5	0.13	0.00	
30	25.6	34.4	2.1 - 3.1	29.84	2.38	
60	40.3 -	51.7	4.3 - 5.3	44.74	4.53	
max	53.2 -	66.8	5.0 - 6.0	58.50	5.39	
60	67.0 -	83.0	4.3 - 5.3	71.53	4.74	
30	85.4 -	104.6	2.1 - 3.1	90.42	2.30	
0	101.0 -	123.0	-0.5 - +0.5	104.55	0.12	

Dummy meets specifications

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

PART 572 5 DEC-84 10:22:11

TEMPERATURE 71 F
UNIT F0294 T: 12:04B

RELATIVE HUMIDITY 21 %
572 SN 137 F.R.THORAX CAL 04B

TEST PARAMETER	LOW SPEED TEST SPECIFICATION	TEST RESULTS
PENDULUM VELOCITY	13.86-14 14 FT/SEC	14.04 FT/SEC
PEAK DEFLECTION	1.1 INCHES MAX.	0.90 INCHES
PEAK RESISTIVE FORCE	1.450 POUNDS MAX	1285. POUNDS
INTERNAL HYSTERESIS	50% - 70%	46.7% *

* DUMMY NOT A PART SPECIFICATION

TECHNICIAN V.J. Watters
TEST SUPERVISOR R.E. Ferguson

TRANSPORTATION RESEARCH CENTER OF OHIO

THORAX IMPACT TEST

TAPE [illegible] [illegible] DEC-94 14:13.12

TEMPERATURE 70 F RELATIVE HUMIDITY [illegible] %
[illegible] 1D 54 [illegible] 048 572 SN 192 H.S. THORAX CAL 048

TEST PARAMETER	HIGH SPEED TEST SPECIFICATION	TEST RESULTS
PENDULUM VELOCITY	[illegible] FT/SEC	22.[illegible] FT/SEC
PEAK DEFLECTION	1.[illegible] INCHES MAX.	1.5[illegible] INCHES
PEAK RESISTIVE FORCE	[illegible],250. POUNDS MAX.	1,019. POUNDS
INTERNAL HYSTERESIS	[illegible]0% - [illegible]0%	[illegible]

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V. L. Watters
TEST SUPERVISOR R. E. LeVan

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572 15-NOV 84 16:14:07

TEMPERATURE 71 F RELATIVE HUMIDITY 44 %
RIGHT KNEE
VRTC RD384 RK18704 572 SN 187 R.KNEE IMP CAL 04

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PROBE VELOCITY	6.83 - 6.96 FT/SEC	6.84 FT/SEC
PEAK KNEE IMPACT FORCE	1850 - 2500 LBS.	1883.70 LBS.
DURATION ABOVE 1000 LBS.	-1.7 MS.	1.74 MS.

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V. L. Walters
TEST SUPERVISOR R. E. Lofton

TRANSPORTATION RESEARCH CENTER OF OHIO

KNEE IMPACT TEST

PART 572 15-NOV-84 13:05:45

TEMPERATURE 69 F RELATIVE HUMIDITY 26 %
LEFT KNEE
VRTC RD384 LK18704 572 SN 187 L.KNEE IMP CAL 04

TEST PARAMETER	SPECIFICATION	TEST RESULTS
PROBE VELOCITY	6.83 - 6.96 FT/SEC	6.90 FT/SEC
PEAK KNEE IMPACT FORCE	1850 - 2500 LBS.	2204.07 LBS.
DURATION ABOVE 1000 LBS.	`=1.7 MS.	1.88 MS.

DUMMY MEETS SPECIFICATIONS

TECHNICIAN V.L. Wattley
TEST SUPERVISOR R.E. Layton