

REPORT NOS. 208-CAL-89-06
212-CAL-89-06
301-CAL-89-06

**VEHICLE SAFETY COMPLIANCE TESTING FOR OCCUPANT CRASH PROTECTION,
WINDSHIELD MOUNTING, WINDSHIELD ZONE INTRUSION (PARTIAL)
AND FUEL SYSTEM INTEGRITY**

HYUNDAI MOTOR CORPORATION
1989 HYUNDAI SONATA GLS
4-DOOR SEDAN

NHTSA NO. CK0507
CALSPAN TEST NO. 7715-6

MAY 23, 1989

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FINAL REPORT

Prepared for:

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16. Abstract A 30 mph vehicle safety compliance test was conducted on a 1989 Hyundai Sonata GLS 4-Door Sedan. This test was performed at the Calspan Advanced Technology Center in Buffalo, New York on May 23, 1989. The purpose of this test was to determine compliance with the performance requirements of the following Federal Motor Vehicle Safety Standards (FMVSS 213): 1. FMVSS No. 208, "Occupant Crash Protection" 2. FMVSS No. 212, "Windshield Mounting" 3. FMVSS No. 219 (partial), "Windshield Zone Intrusion" 4. FMVSS No. 301, "Fuel System Integrity" The test mode was perpendicular (0°) and the impact velocity was 29.3 mph. The ambient temperature at the impact face was 64°F. The subject test vehicle appears to comply with the requirements of FMVSS Nos. 208, 212, 219 (partial) and 301. <u>Type of Restraint System:</u> The test vehicle was equipped with automatic shoulder belt restraint on driver and passenger locations. Manual lap belts were not used for the test.					
17. Key Words 30 mph Vehicle Safety Compliance Testing FMVSS 208, "Occupant Crash Protection" FMVSS 212, "Windshield Mounting" FMVSS 219, "Windshield Zone Intrusion" FMVSS 301, "Fuel System Integrity" Frontal Impact			18. Distribution Statement <u>Copies of this report are available from:</u> Technical Reference Division National Highway Traffic Safety Admin. Nassif Building, Room 5108 400 Seventh St., S.W., Washington, DC 20590		
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Section 1
PURPOSE AND TEST PROCEDURE

This 30 mph frontal barrier impact test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 208, 212, 219 (partial) and 301 compliance test program conducted for the National Highway Traffic Safety Administration (NHTSA) by Calspan Advanced Technology Center under Contract No. DTNH22-88-C-01038. The purpose of this test was to determine if the subject vehicle, a 1989 Hyundai Sonata GLS 4-Door Sedan, meets the performance requirements of FMVSS 208, "Occupant Crash Protection"; FMVSS No. 212, "Windshield Mounting"; FMVSS No. 219 (partial), "Windshield Zone Intrusion"; and FMVSS No. 301, "Fuel System Integrity". This compliance test was conducted using the requirements found in the OVSC Laboratory Test Procedure No. TP-208-07.

Section 2
SUMMARY OF TEST NUMBER CK0507

A frontal barrier was impacted by a 1989 Hyundai Sonata GLS 4-Door Sedan at a velocity of 29.3 mph. The test was performed at the Calspan Corporation Advanced Technology Center on May 23, 1989. Pre- and post-test photographs of the vehicle and dummies can be found in Appendix A.

The frontal barrier impact event was documented by one real-time camera and 14 high-speed cameras. Camera locations and other pertinent camera information can be found in this report.

Two Part 572, 50th percentile male anthropomorphic test devices (ATDs) were placed in the driver and right-front passenger seating positions, according to dummy placement instructions specified in the OVSC Laboratory Test Procedure.

Both ATDs were fully instrumented with head and chest triaxial accelerometers and left/right femur load cells. These ATDs had been certified prior to the test.

The 27 channels of data were recorded on three 14-channel FM tape recorders. Appendix B contains the vehicle and dummy response data traces.

The driver's head struck the steering wheel hub and his HIC was 420. The maximum chest deceleration over 3 milliseconds was 43.0 g's.

The maximum force on the driver's left femur was 1764 lbs and 1570 lbs on the right femur.

The right front passenger's HIC was 298. The maximum chest deceleration over 3 milliseconds was 34.3 g's and femur loads were 1264 and 1054 pounds on the left and right femurs respectively.

TABLE 1

CRASH TEST SUMMARYVEHICLE NHTSA NO.: CK0507 TEST MODE: 30 mph Frontal BarrierTEST DATE: 5/23/89 TIME: 12:10 TEMP: 64° FVEHICLE MAKE/MODEL/BODY STYLE: 1989 Hyundai Sonata GLS 4-Door SedanVEHICLE TEST WEIGHT: 3380 lbsVEHICLE/BARRIER IMPACT ANGLE: 0°IMPACT VELOCITY: 29.3 mphMAXIMUM STATIC CRUSH: 16.5"VEHICLE REBOUND: 18.4"DUMMIES:DRIVERPASSENGER

TYPE

Part 572Part 572

RESTRAINT SYSTEM

Automatic
shoulder belt
restraintAutomatic
shoulder belt
restraintNUMBER OF DATA CHANNELS: 27NUMBER OF CAMERAS: 1 Real Time14 High SpeedDOOR OPENING DATA: closed-operable - Left Frontclosed-operable - Right FrontFRONT SEAT(S) DATA:DRIVERPASSENGER

Seat Track Failure -

0.00.0

inches of shift

Seat Back Failure -

nonenoneVISIBLE DUMMY CONTACT POINTS:DRIVERPASSENGER

Head

steering wheel hubchin with upper chest

Chest

lower steering wheel rim-

Knees

lower instrument panelglove box

TABLE 2

GENERAL TEST AND VEHICLE PARAMETER DATATEST VEHICLE INFORMATION:

Year/Make/Model/Body Style: 1989 Hyundai Sonata GLS 4-Door Sedan
 NHTSA No. CK0507; VIN KMHBFB32S4KU036529; Color: Gold
 Engine Data: 4 cylinders; 143.4 CID; 2.4 Litres; - cc
 Placement - Longitudinal or In-Line; X Transverse or lateral
 Transmission Data: 5 speeds; X Manual; - Automatic; X Overdrive
 Final Drive: - Rear Wheel Drive; X Front Wheel Drive; - Four Wheel Drive
 Major Options: X A/C; X Pwr Strg. X Pwr. Brakes X Pwr Windows
X Power Door Locks
 Date Received: February 17, 1989; Odometer Reading - 21 miles
 Selling Dealer: Northtown Hyundai
 & address Amherst, New York

DATA FROM VEHICLE'S CERTIFICATION LABEL:

Vehicle Manufactured by: Hyundai Motor Corp.
 Data of Manufacture: 12/13/88;
 GVWR: 3900 lbs; GAWR: 2095 lbs FRONT
2095 lbs REAR

DATA FROM TIRE PLACARD:

Tire Pressure with Maximum Capacity Vehicle Load 30 psi Front
30 psi Rear
 Recommended Tire Size P185/70R14 - P195/70R14 Load Range Standard
 Recommended Cold Tire Pressure 30 psi Front 30 psi Rear
 Size of Tires on Test Vehicle P185/70R14 Manufacturer Michelin
 Vehicle Capacity Data:
 Type of Front Seats - Bench X Bucket - Split Bench
 Number of Occupants 2 Front 3 Rear 5 Total
 Vehicle Capacity Weight (VCW) = 899 lbs.
 No. of Occupants x 150 lbs = 750 lbs.
 Rated Cargo/Luggage Weight (RCLW) = 149 lbs. (Difference)

WEIGHT OF TEST VEHICLE AS RECEIVED AT LABORATORY (with maximum fluids):

Right Front = 880 lbs Right Rear = 560 lbs
 Left Front = 890 lbs Left Rear = 570 lbs
 TOTAL FRONT = 1770 lbs TOTAL REAR = 1130 lbs
 % of Total Weight = 60.8 % % of Total Weight = 39.2 %
 TOTAL DELIVERED WEIGHT = 2900 lbs.

TABLE 2 (continued)
GENERAL TEST & VEHICLE PARAMETER DATA

CALCULATION OF VEHICLE'S TARGET TEST WEIGHT:

Total Delivered Weight	=	<u>2900</u>	lbs.
Rated Cargo/Luggage Weight (RCLW)	=	<u>149</u>	lbs.
Weight of 2 P.572 Dummies @ 164 ea.	=	<u>328</u>	lbs.
TARGET TEST WEIGHT	=	<u><u>3377</u></u>	lbs. (sum)

WEIGHT OF TEST VEHICLE WITH TWO DUMMIES AND 0 LBS OF CARGO WEIGHT:

Right Front =	<u>970</u>	lbs.	Right Rear =	<u>720</u>	lbs.
Left Front =	<u>950</u>	lbs.	Left Rear =	<u>740</u>	lbs.
TOTAL FRONT =	<u>1920</u>	lbs.	TOTAL REAR =	<u>1460</u>	lbs.
% of Total Weight =	<u>56.8</u>	%	% of Total Weight =	<u>43.2</u>	%
TOTAL TEST WEIGHT =	<u>3380</u>	lbs.			
Weight of Ballast secured in vehicle's cargo area =	<u>0</u>	lbs.			
Vehicle Components Removed for Weight Reduction	<u>None</u>				

TEST VEHICLE ATTITUDE: (all dimensions in inches)

AS DELIVERED	RF	<u>27.4</u> ;	LF	<u>27.5</u> ;	RR	<u>25.1</u> ;	LR	<u>24.9</u>
FULLY LOADED	RF	<u>26.5</u> ;	LF	<u>26.2</u> ;	RR	<u>22.8</u> ;	LR	<u>22.4</u>
AS TESTED	RF	<u>27.3</u> ;	LF	<u>27.5</u> ;	RR	<u>23.6</u> ;	LR	<u>23.6</u>
Vehicle's Wheelbase =	<u>93.8</u>	inches						
Location of Vehicle's C.G. =	<u>45 inches rearward of front wheel center</u>							

FUEL SYSTEM DATA:

Fuel System Capacity From Owner's Manual =	<u>15.9</u>	gallons
Usable Capacity Figure Furnished by COTR =	<u>15.9</u>	gallons
Test Volume Range (92 to 94% of Usable Capacity) =	<u>14.6</u> to <u>14.9</u>	gallons
ACTUAL TEST VOLUME =	<u>14.7</u>	gallons (with entire fuel system filled)

TABLE 3
POST-IMPACT DATA

TYPE OF TEST: X Frontal IMPACT ANGLE: 0⁰

TEST DATE: May 23, 1989 TIME: 12:15 TEMP: 64 °F

VEHICLE NHTSA NO.: CK0507

REQUIRED IMPACT VELOCITY RANGE: 28.9 to 29.9 mph

BARRIER IMPACT VELOCITY: (speed traps within 5 feet of impact plane)

Trap No. 1 = 29.3 mph; Trap No. 2 = 29.3 mph

Distance from vehicle to barrier (1) entering trap = 52 inches

(2) exiting trap = 12 inches

VEHICLE STATIC CRUSH: (for Frontal and Rear Impacts Only)

Vehicle Length: Pre-Test Right = 181.2 "; C/L = 184.1 "; Left = 181.3 "

Post-Test Right = 166.2 "; C/L = 167.6 "; Left = 166.7 "

CRUSH Right = 15.0 "; C/L = 16.5 "; Left = 14.6 "

AVERAGE = 15.4 inches

VEHICLE REBOUND: (from rigid barrier only)

Distance from front of test vehicle to impact point:

Right = 18.6 "; C/L = 17.7 "; Left = 18.9 "

AVERAGE = 18.4 inches

<u>DOOR OPENING:</u>	Left	Right
Front	<u> closed-operable </u>	<u> closed-operable </u>
Rear	<u> closed-operable </u>	<u> closed-operable </u>
<u>SEAT MOVEMENT:</u>	Seat Back Failure	Seat Shift
Front	<u> None </u>	<u> None </u>
Rear	<u> None </u>	<u> None </u>

TABLE 3 (continued)

POST-IMPACT DATA

GLAZING DAMAGE: whindshield cracked

OTHER NOTABLE IMPACT FEATURES: None

Section 3
OCCUPANT AND VEHICLE DATA

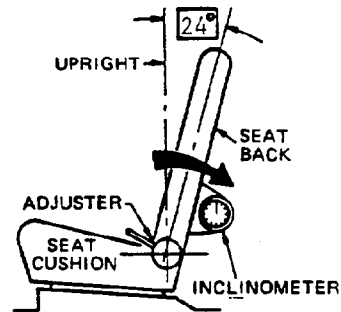
Figure 1

TEST VEHICLE INFORMATION

VEHICLE IDENTIFICATION:

Model year: 1989 Vehicle Model: Hyundai Sonata GLS Body Style: 4-Door Sedan

1. Nominal Design Riding Position for adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent, if applicable.



LEFT SIDE VIEW

Seat back angle for driver's seat 24°
Measurement instructions: Seat back adjusted to the 11th latch position
from the first locking position (seat in full down position)

Seat back angle for passenger's seat 24°
Measurement instructions: Same as driver seat back.

2. Seat Fore and Aft Positioning

Provide instructions for positioning the driver and front outboard passenger seat(s) in the center of fore and aft travel. For example, provide information to locate the detent in which the seat track is to be locked.

Positioning of the driver's seat: Midpoint of seat track (11th position of
21 total positions)

Positioning of the passenger's seat (if applicable): Midpoint of seat
track (9th position of 17 total positions)

3. Fuel Tank Capacity Data

A. "Usable Capacity" of the standard equipment fuel tank is 15.9
gallons.

B. "Usable Capacity" of the optional equipment fuel tank is N/A
gallons.

Additional Instructions: None

Figure 2

PART 572 DUMMY IN-VEHICLE POSITION

TEST NO.: CK0507

1989 Hyundai Sonata GLS
VEHICLE: 4-Door Sedan

SEAT TYPE:

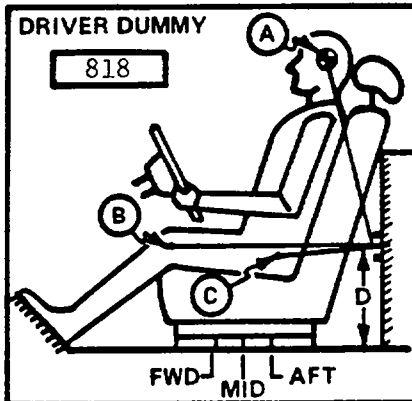
- Bench
X Bucket
- Split Bench

ADJUSTER TYPE:

X Manual
- Power

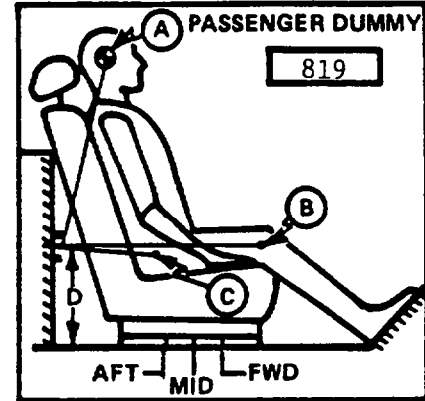
BUCKET SEAT BACK TYPE:

- Fixed
X Adjustable Reclining



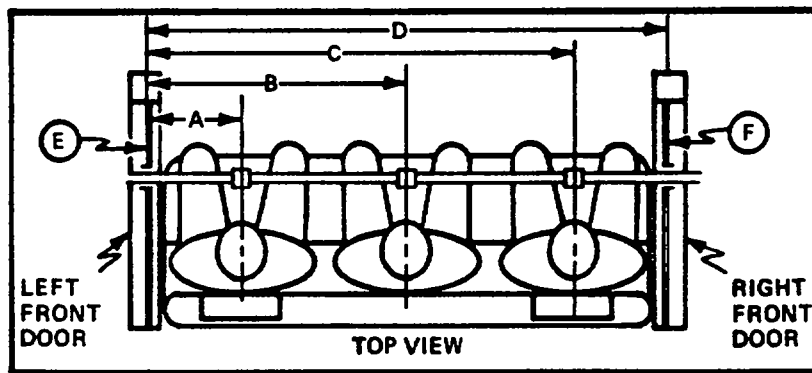
MEASUREMENT
LOCATION

A - Head Target
B - Knee Joint
C - Approximate
'H' Point
D - Sill to
Reference
Point



A = 21.0 in. 4 Degrees
B = 24.1 in. 98 Degrees
C = 10.1 in. 128 Degrees
D = 14.5 in.

A = 21.5 in. 4 Degrees
B = 24.7 in. 99 Degrees
C = 9.4 in. 127 Degrees
D = 14.5 in.



818

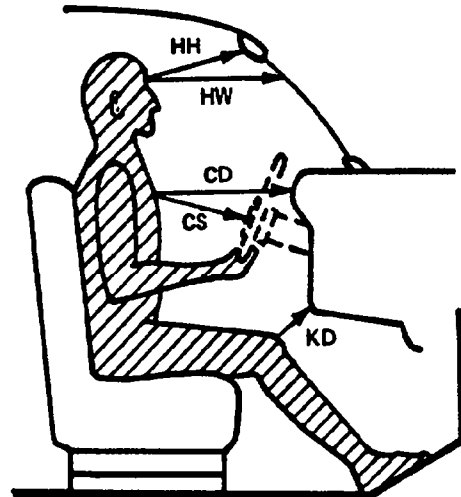
819

A = Left Door to Driver Centerline 11.5 in.
B = Left Door to Center Passenger Centerline - in.
C = Left Door to Right Passenger Centerline 40.2 in.
D = Left Door to Right Door 51.5 in.
E, F = Window Glass Height (Right and Left Must Be Equal) 11.6 in.

Figure 3

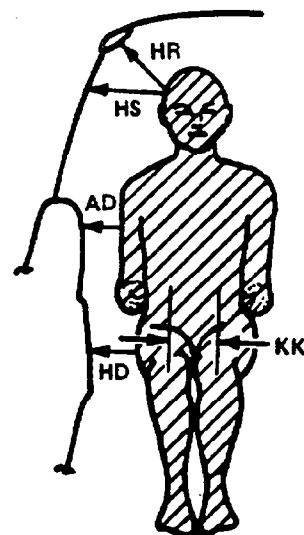
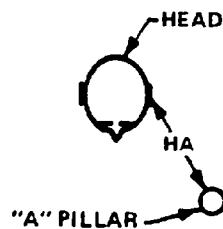
OCCUPANT CLEARANCE DIMENSIONS

	DRIVER	PASSENGER
HH	15.8	15.6
HW	20.5	20.7
CD	22.7	24.4
CS	14.6	-
KDL	6.4	7.2
KDR	4.3	7.3
SA	24°	24°
TA	24°	23°



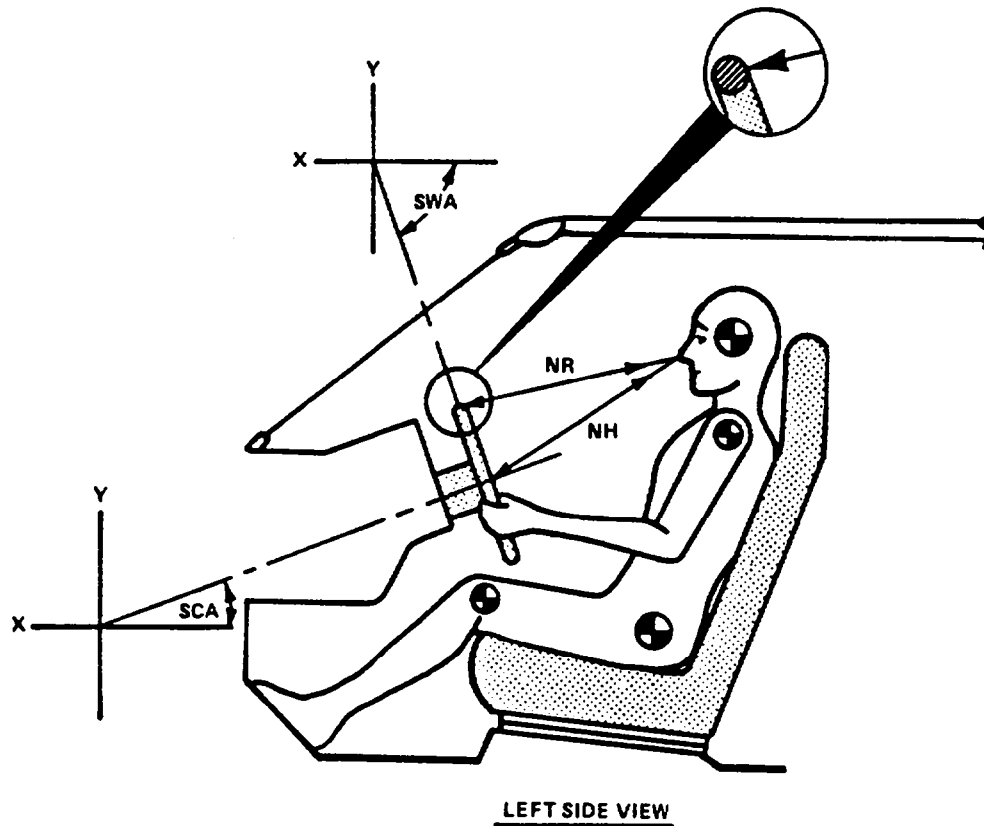
HH = Head to Windshield Header
 HW = Head to Windshield
 CD = Chest to Dash
 CS = Chest to Steering Wheel
 KD(L/R) = Knee to Dash (Left/Right)
 SA = Seat Back Angle
 TA = Torso Angle

HA = Head Target to "A" Pillar
 HR = Head to Side Roof
 HS = Head to Side Window
 AD = Arm to Door
 HD = Hip to Door
 KK = Knee to Knee



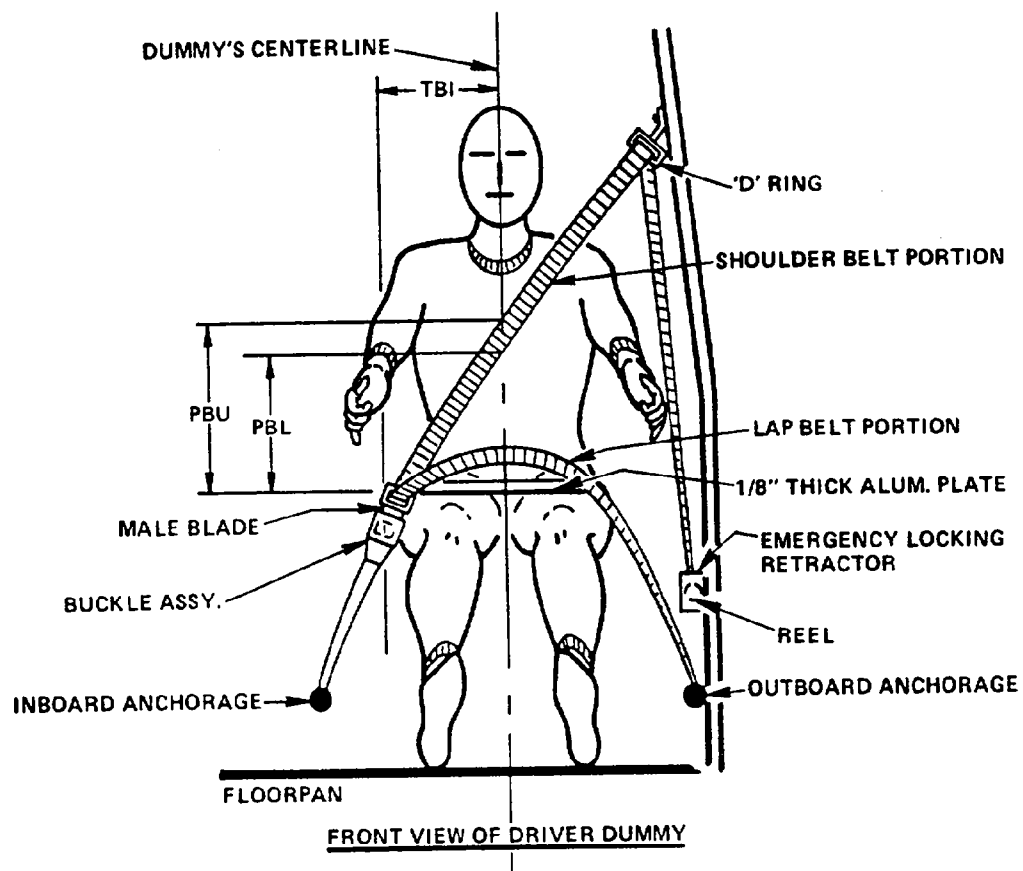
	DRIVER	PASSENGER
HR	4.7	4.6
HS	8.5	8.8
AD	4.8	4.7
HD	7.5	7.3
KK	9.4	7.7
HA	18.8	18.4

Figure 4
DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



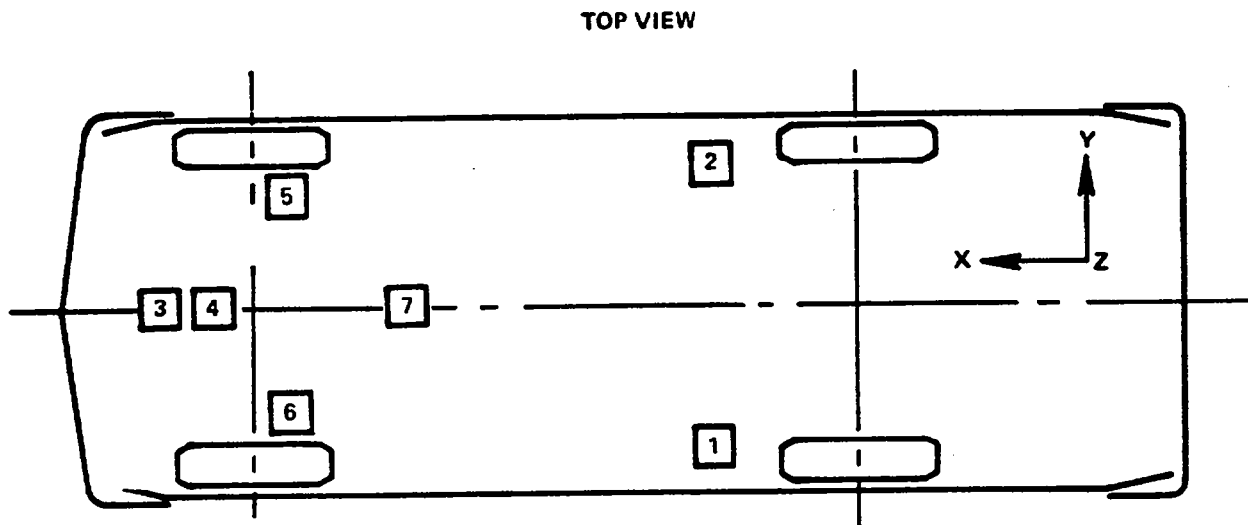
MEASUREMENTS		
<u>NR</u> -- Distance from tip of dummy's nose to Top Rear surface of steering wheel rim	19.8	Inches
<u>NH</u> -- Distance from tip of dummy's nose to center of steering column hub	20.3	Inches
<u>SCA</u> -- Angle of steering column relative to the horizontal X axis	25	Degrees
<u>SWA</u> -- Angle of steering wheel relative to the horizontal X axis	-65	Degrees

Figure 5
SEAT BELT POSITIONING DATA



	DRIVER DUMMY (inches)	PASSENGER DUMMY (inches)
<u>PBU</u> -- Top surface of alum. plate to upper edge	14.7	14.8
<u>PBL</u> -- Top surface of alum. plate to belt lower edge	11.8	12.0
<u>TBI</u> -- distance from Torso centerline to buckle	N/A	N/A

Figure 6
VEHICLE ACCELEROMETER LOCATIONS



ACCELEROMETER NUMBER*	ACCELEROMETER LOCATION	DIRECTION		
		X	Y	Z
1	Left Rear Seat Crossmember	x		
2	Right Rear Seat Crossmember	x		
3	Top of Engine	x		
4	Bottom of Engine	x		
5	Right Disc Brake Caliper	x		
6	Left Disc Brake Caliper	x		
7	Instrument Panel	x		
8	Front Shock Tower	x		
9	Firewall	x		
10	Cradle Frame	x		
11	Radiator Support	x		

*The accelerometer pack number can be correlated with the vehicle response data traces found in Appendix B.

TABLE 4

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION**		NEGATIVE DIRECTION**	
					MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
1	REAR SEAT X-MEMBER AT LEFT SIDE	71.3	22.2	14.9				
	PRE:							
	POST:	71.0	22.0	15.6				
	LONGITUDINAL ACCELERATION				1	141	-31	49
2	REAR SEAT X-MEMBER AT RIGHT SIDE	71.3	-22.2	14.9				
	PRE:							
	POST:	71.4	-23.5	15.7				
	LONGITUDINAL ACCELERATION				1	190	-34	39
3	TOP OF ENGINE BLOCK	161.2	9.0	29.1				
	PRE:							
	POST:	155.5	8.6	27.7				
	LONGITUDINAL ACCELERATION				33	44	-92	35
4	BOTTOM OF ENGINE BLOCK	159.2	13.5	10.1				
	PRE:							
	POST:	151.5	14.3	10.1				
	LONGITUDINAL ACCELERATION				28	42	-98	32
5	BRAKE CALIPER AT RIGHT SIDE	145.4	-22.6	21.8				
	PRE:							
	POST:	143.3	-20.3	23.0				
	LONGITUDINAL ACCELERATION				23	63	-65	44
6	BRAKE CALIPER AT LEFT SIDE	145.4	22.6	21.9				
	PRE:							
	POST:	143.3	23.4	22.7				
	LONGITUDINAL ACCELERATION				25	68	-61	50
7	DASH PANEL	117.3	1.0	37.3				
	PRE:							
	POST:	116.8	1.3	37.0				
	LONGITUDINAL ACCELERATION				23	84	-32	66

**

POSITIVENEGATIVE

*X + Forward from rear bumper
 Y + Left from vehicle centerline
 Z + Up from ground

LONGITUDINAL: FORWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD

REARWARD
 RIGHTWARD
 DOWNWARD

DISTANCE MEASUREMENTS IN INCHES

TABLE 4 (continued)

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

NO.	LOCATION	X*	Y*	Z*	POSITIVE DIRECTION**		NEGATIVE DIRECTION**	
					MAX (g)	TIME (msec)	MAX (g)	TIME (msec)
8	FRONT SHOCK TOWER***	151.3	20.0	33.1				
	PRE:							
	POST:	145.9	18.0	32.4				
	LONGITUDINAL ACCELERATION				----	-	-42	25
9	FIREWALL	139.4	17.6	34.8				
	PRE:							
	POST:	144.5	17.7	34.0				
	LONGITUDINAL ACCELERATION				10	43	-50	50
10	CRADLE FRAME	140.2	-5.1	9.3				
	PRE:							
	POST:	136.0	-6.6	11.1				
	LONGITUDINAL ACCELERATION				34	25	-126	38
11	RADIATOR SUPPORT	171.4	16.5	28.4				
	PRE:							
	POST:	159.6	16.3	28.8				
	LONGITUDINAL ACCELERATION				59	42	-132	28

*X + Forward from rear bumper
 Y + Left from vehicle centerline
 Z + Up from ground

**

POSITIVE
 LONGITUDINAL: FORWARD
 LATERAL: LEFTWARD
 VERTICAL: UPWARD

NEGATIVE
 REARWARD
 RIGHTWARD
 DOWNWARD

DISTANCE MEASUREMENTS IN INCHES

***Data cable cut - data questionable after 42 milliseconds.

Figure 7

CAMERA POSITIONS FOR FRONTAL IMPACTS

NOTE: Camera Information Shown on Table 5

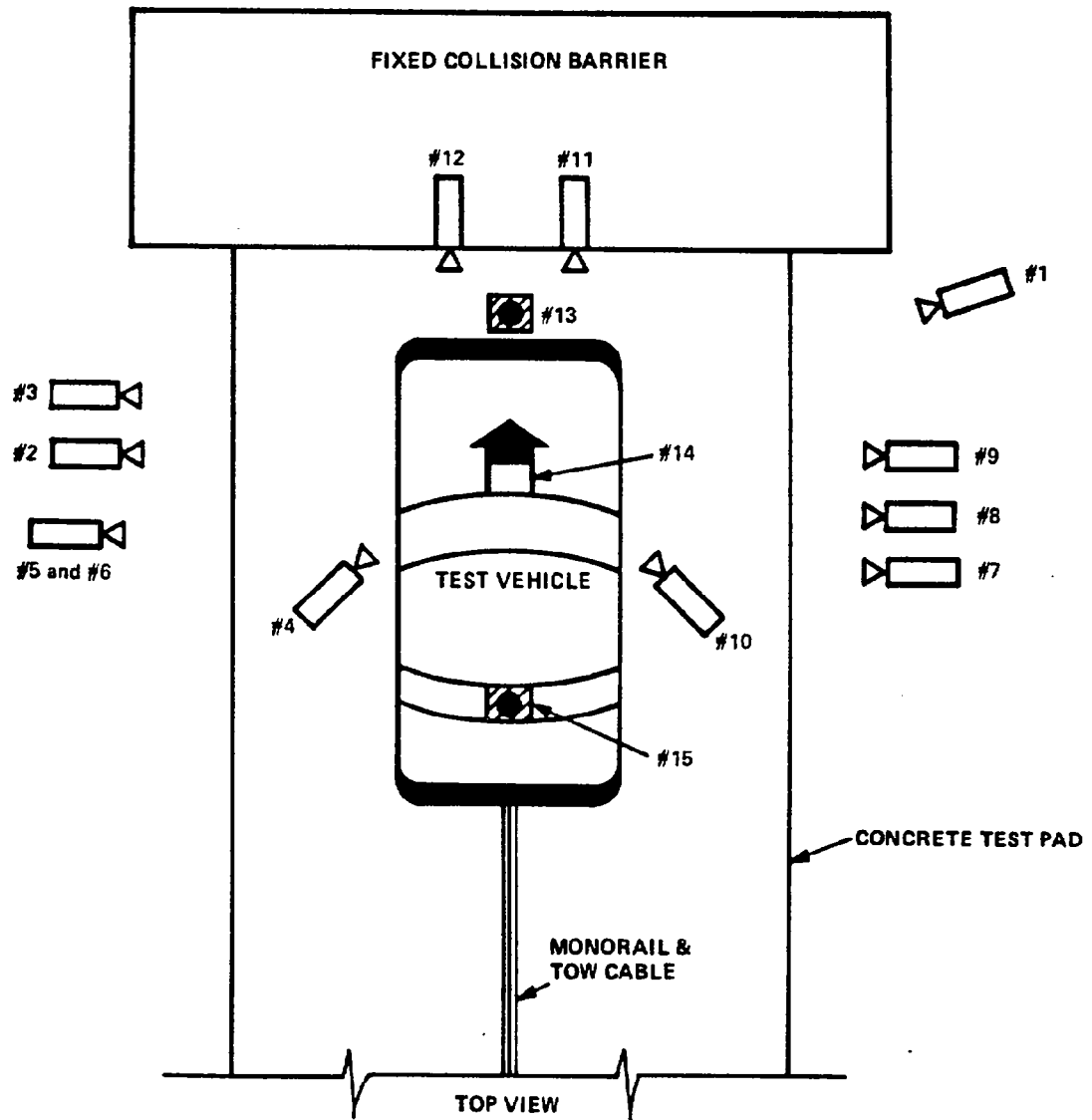


TABLE 5
HIGH-SPEED CAMERA LOCATIONS

Test No. CK0507			Vehicle 1989 Hyundai Sonata GLS 4-Door Sedan					
CAMERA NO.	VIEW	CAMERA POSITIONS (in)*			ANGLE** (deg)	FILM PLANE TO HEAD TARGET	LENS (mm)	SPEED (fps)
		X	Y	Z				
1	Real-Time Camera	-	-	-	-	-	-	24
2	Overall Left Side	224	58	41.0	-5	207	13	540
3	Left Side View	303	29	41.0	-3	286	25	535
4	Driver and Interior View	103	110	67.5	-15	-	13	910
5	Steering Column (bottom)	302	77	46.0	-4	285	25	550
6	Steering Column (top)	302	77	69.5	-10	285	25	555
7	Overall Right Side	225	83	41.5	-3	208	13	1110
8	Right Side View	294	67	41.0	-2	277	25	765
9	Right Passenger View	304	82	57.0	-4	287	35	725
10	Passenger and Interior View	95	112	68.0	-18	-	13	600
11	Passenger Front View	46	17.5	73.0	-45	-	13	600
12	Driver Front View	56	18.5	66.0	-41	-	13	560
13	Windshield View	0	0	126.0	-52	-	13	585
14	Pit View of Engine	0	36	-120.0	90	-	13	850
15	Pit View of Fuel Tank	0	130	-120.0	90	-	13	800

* X = Film plane to monorail centerline
 Y = Film plane to impact location
 Z = Film Plane to ground
 ** = Referenced to horizontal plane

VEHICLE TARGET LOCATIONS



Figure 9

TEST VEHICLE MEASUREMENTS

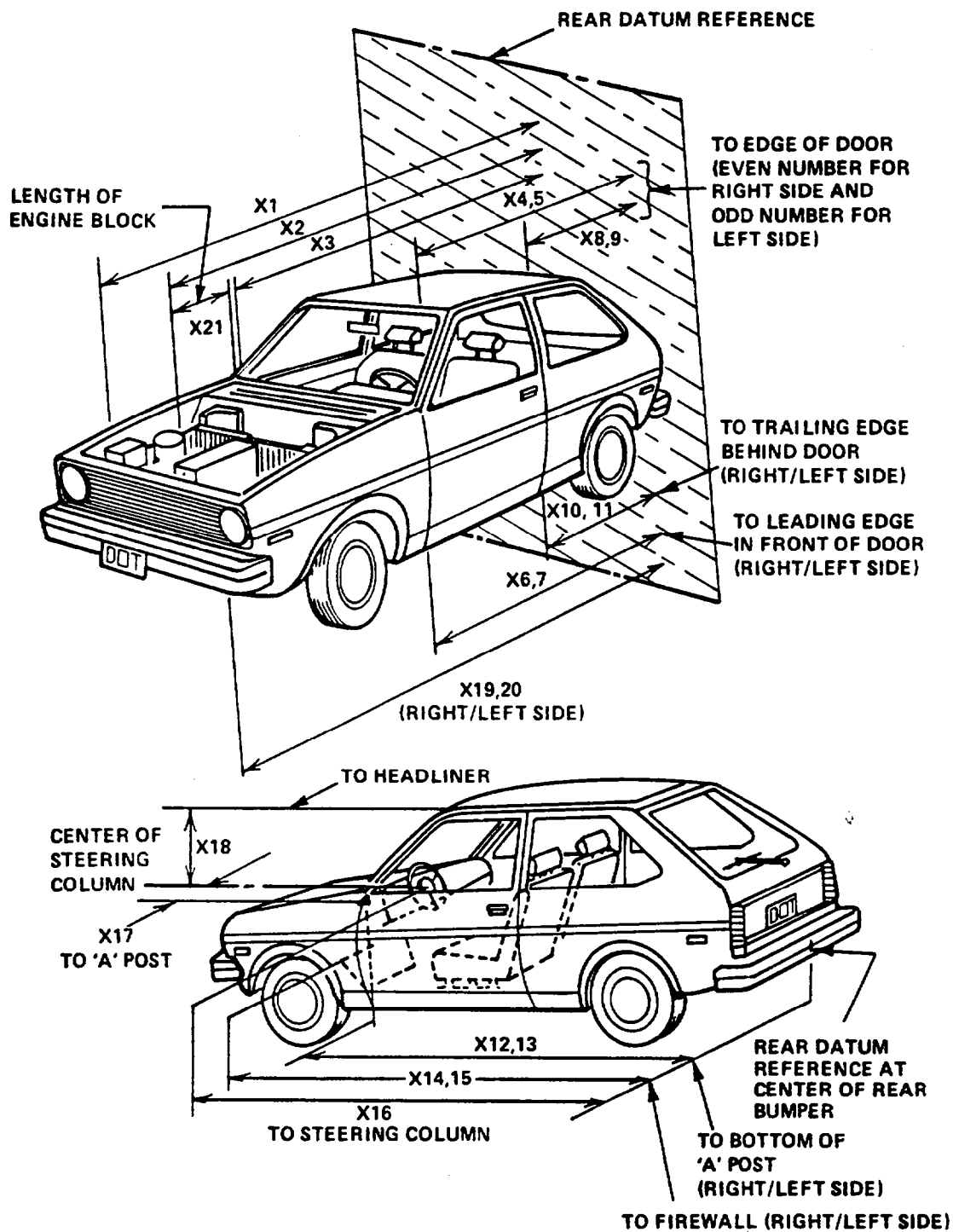


TABLE 6
VEHICLE MEASUREMENTS

No.		All Dimensions in Inches		
		Pre-Test	Post-Test	Differences
X1	Total Length of Vehicle at Centerline	184.1	167.6	16.5
X2	Rear Surface of Vehicle to Front of Engine	159.1	153.8	5.3
X3	Rear Surface of Vehicle to Firewall	139.6	136.1	3.5
X4	Rear Surface of Vehicle to Upper Leading Edge of Right Door	125.4	125.0	0.4
X5	Rear Surface of Vehicle to Upper Leading Edge of Left Door	125.2	123.5	1.7
X6	Rear Surface of Vehicle to Lower Leading Edge of Right Door	125.9	125.9	0.0
X7	Rear Surface of Vehicle to Lower Leading Edge of Left Door	125.5	125.5	0.0
X8	Rear Surface of Vehicle to Upper Trailing Edge of Right Door	85.1	84.3	0.8
X9	Rear Surface of Vehicle to Upper Trailing Edge of Left Door	85.1	84.3	0.8
X10	Rear Surface of Vehicle to Lower Trailing Edge of Right Door	86.2	85.8	0.4
X11	Rear Surface of Vehicle to Lower Trailing Edge of Left Door	85.4	85.1	0.3
X12	Rear Surface of Vehicle to Bottom of "A" Post of Right Side	127.4	127.3	0.1
X13	Rear Surface of Vehicle to Bottom of "A" Post of Left Side	125.8	126.1	-0.3
X14	Rear Surface of Vehicle to Firewall, Right Side	138.8	136.6	2.2
X15	Rear Surface of Vehicle to Firewall, Left Side	138.7	136.2	2.5
X16	Rear Surface of Vehicle to Steering Column	110.2	108.7	1.5
X17	Center of Steering Column to "A" Post	17.7	17.3	0.4
X18	Center of Steering Column to Headliner	18.3	16.6	1.7
X19	Rear Surface of Vehicle to Right Side of Front Bumper	181.2	166.2	15.0
X20	Rear Surface of Vehicle to Left Side of Front Bumper	181.3	166.7	14.6
X21	Length of Engine Block	10.0	10.0	0.0

Section 4

SUMMARY OF RESULTS OF FMVSS NOS. 208, 212, 219(P) AND 301-75

- o "Occupant Crash Protection," FMVSS No. 208 Data
- o "Windshield Mounting," FMVSS No. 212 Data
- o "Windshield Zone Intrusion," FMVSS No. 219 (Partial) Data
- o "Fuel System Integrity," FMVSS No. 301-75

TABLE 7
DUMMY INJURY CRITERIA VALUES

	MAXIMUM ACCELERATION ("G")							
	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DUMMY (1)	-72	-34	44	84	-44	-12	-9	43.0
DUMMY (2)	-23	15	41	44	-33	14	14	34.3

	MAXIMUM FORCE - FEMUR LOAD (LBS)	
	Left Femur	Right Femur
DUMMY (1)	1764	1570
DUMMY (2)	1264	1054

	HEAD INJURY CRITERIA **			
	HIC	36 millisecond Maximum		AVE. ACC. (g) t ₁ TO t ₂
		t ₁ (SEC)	t ₂ (SEC)	
DUMMY (1)	420	.07147	.10747	42.3
DUMMY (2)	298	.06735	.10335	36.9

*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

TABLE 8
FMVSS NO. 208 - SEAT BELT WARNING SYSTEM CHECK

With occupant in driver's position, the lap belt in stowed position, and ignition switch placed in "Start/On" position:

Log time duration of audible warning signal = 7.0 sec.

Log time duration of reminder light operation = 7.0 sec.

With occupant in driver's position, lap belt in use, and the ignition switch placed in "Start/On" position:

Log time duration of audible warning signal = 0.0 sec.
(audible warning should not operate)

Log time duration of reminder light operation = 6.5 sec.

Note wording of visual warning:

Fasten seat belt	<u>-</u>
Fasten Belt	<u>-</u>
Symbol 101-80	<u>X</u>

TABLE 9

FMVSS NO. 208 - READINESS INDICATOR

An occupant restraint system that deploys in the event of a crash shall have a monitoring system with a readiness indicator. A totally mechanical system is exempt from this requirement.

Is the system totally mechanical? YES X NO

TABLE 10

FMVSS NO. 208 - COMFORT AND CONVENIENCE TEST SUMMARY

Test Vehicle NHTSA No.:	CK0507
Make/Model:	1989 Hyundai Sonata GLS
	4-Door Sedan
Date of Comfort/Convenience Check:	5/22/89
Technician Performing Check:	D.J.T
GVWR:	3900 lbs.

Seat belt comfort and convenience requirements cover vehicles manufactured on or after September 1, 1986, which have a gross vehicle weight rating of 10,000 pounds or less. Exemptions to this rule are belts installed in a walk-in, van-type vehicle and manual Type 2 belt systems installed in the front outboard seating positions of passenger automobiles. On or after September 1, 1989, the exemption of the Type 2 manual seat belts installed in the front outboard seating positions of passenger automobiles will change depending on the states' enactment of mandatory usage laws.

Was vehicle built after or on September 1, 1986, and is it equipped with:

1. Automatic seat belts YES X NO

If yes, go to requirements D1, D2 and D3

D1**CONVENIENCE HOOKS**

A convenience hook or other device is provided to stow seat belt webbing to facilitate entering or exiting the vehicle.

YES NO X

D2**WEBBING TENSION - RELIEVING DEVICE**

The seat belt assembly installed in the outboard designated seating position has either manual or automatic tension relieving devices permitting the introduction of slack in the webbing of the shoulder belt ("comfort clips" or "window shade" devices).

YES NO X

TABLE 10 (continued)

FMVSS NO. 208 - COMFORT AND CONVENIENCE TEST SUMMARY

D3
BELT CONTACT FORCE

1. Do not measure the belt contact force if the manual or automatic seat belt assemblies in this vehicle incorporate a webbing tension relieving device.

YES NO X
2. Seats are adjusted according to instructions in Appendix B.

YES X NO
3. The test dummies are positioned according to dummy position placement instructions in Appendix B and Appendix C.

YES X NO
4. Close the vehicle's adjacent door, pull either 12 inches of belt webbing or the maximum available amount of belt webbing, whichever is less, from the retractor and then release it, allowing the belt webbing to return to the dummy's chest. Then fasten the latch. Locate the point where the centerline of the upper torso belt webbing crosses the midsagittal line on the dummy's chest. At that point, pull the belt webbing out 3 inches from the dummy's chest and release until it is within one inch from the dummy's chest. Measure the contact force exerted by the belt webbing on the dummy's chest. The contact force is 0.4 pounds. Contact the COTR if the contact force exceeds 0.7 pounds.

Figure 10

FMVSS NO. 212 - "WINDSHIELD MOUNTING" DATA SHEET

DETAILS OF WINDSHIELD MOUNTING SUCH AS RETENTION METHOD, TRIM TYPE, ETC.:

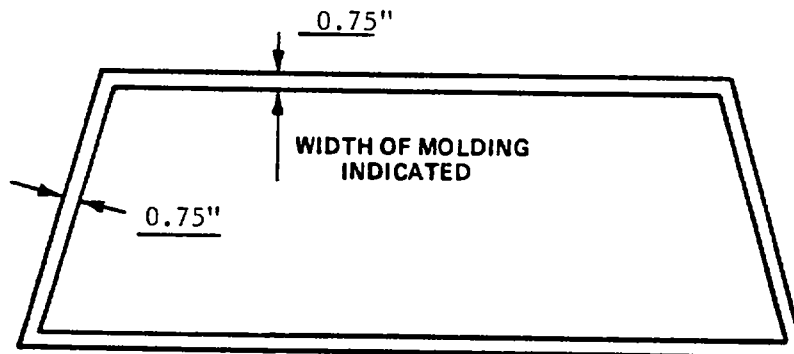
Windshield bonded in place. Top and side of windshield is covered by a combination metal and rubber trim 0.75 inches wide. Bottom of windshield covered by a plastic shroud.

FMVSS 212 REQUIREMENTS: The Post-Test periphery retention amount must be at least 75% of the Pre-Test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

	WINDSHIELD PERIPHERY		PERCENT RETENTION
	PRE-TEST (in.)	POST-TEST (in.)	
RIGHT SIDE	79.85	79.85	100%
LEFT SIDE	79.85	79.85	100%
TOTAL	159.70	159.70	100%

AREA OF RETENTION FAILURE:



FRONT VIEW

FAILURE DETAILS:

None.

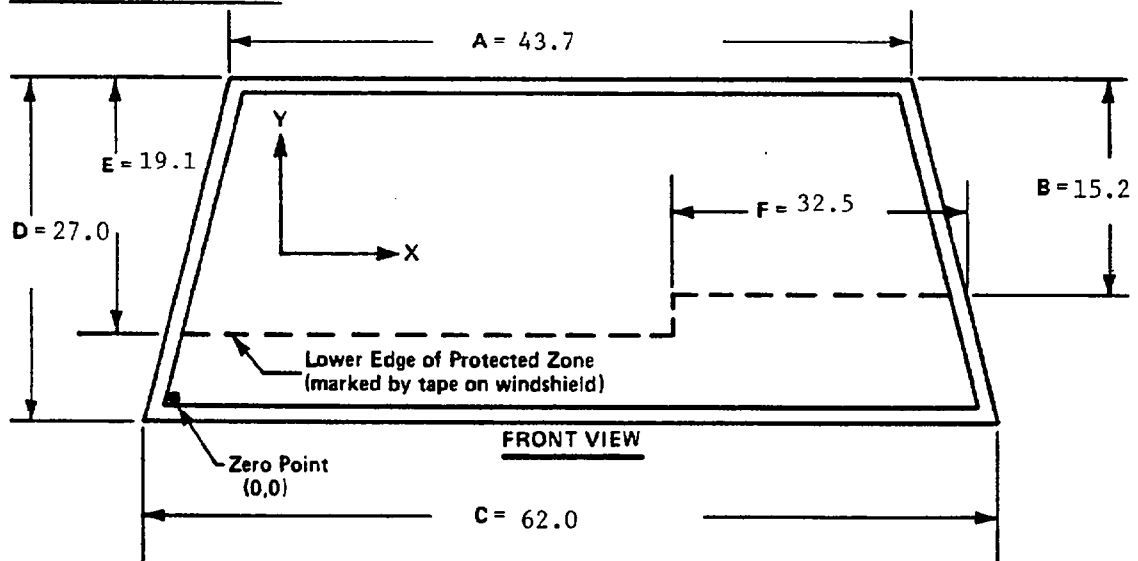
Figure 11

FMVSS NO. 219 (PARTIAL) - "WINDSHIELD ZONE INTRUSION" DATA SHEET

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5" dia. rigid sphere weighing 15 pounds in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. The locus of points is drawn on the inner surface of the windshield contacted by the sphere across the width of the instrument panel. From the outermost contactable points, extend the locus line horizontally to the edges of the windshield, and then draw a line on the inner surface of the windshield below and 1/2" distant from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection of this line onto the outer surface of the windshield.

FMVSS 219 TEST DATA:



DETAILS OF WINDSHIELD GLASS PENETRATION GREATER THAN 1/4":
 (Show location of penetration on above sketch)

None.

	COORDINATES	
	X	Y
1.		
2.		
3.		
4.		

TABLE 11

FUEL SYSTEM INTEGRITY POST IMPACT TEST DATAFHVSS NO. 301

TEST VEHICLE NHTSA NO.:

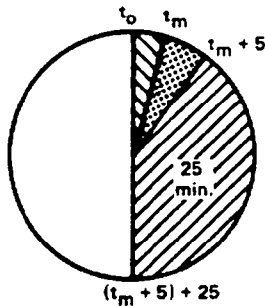
C	K	0	5	0	7
---	---	---	---	---	---

 TEST DATE: May 23, 1989
 Vehicle Mfr/Make/Model: 1989 Hyundai Sonata GLS 4-Door Sedan

Test vehicle fuel tank filled to 92% to 94% of manufacturer's "useable" capacity and with electric fuel pump operating (if it will operate without engine operation) Part 572 test dummies located at each front designated seating position.

TEST VEHICLE IMPACT TYPE

- X Frontal (30 mph)
 - Oblique (30 mph) with ° barrier face
 first contacting
 (driver/passenger) side
 - Rear Moving Barrier (30 mph)
 - Lateral Moving Barrier (20 mph)

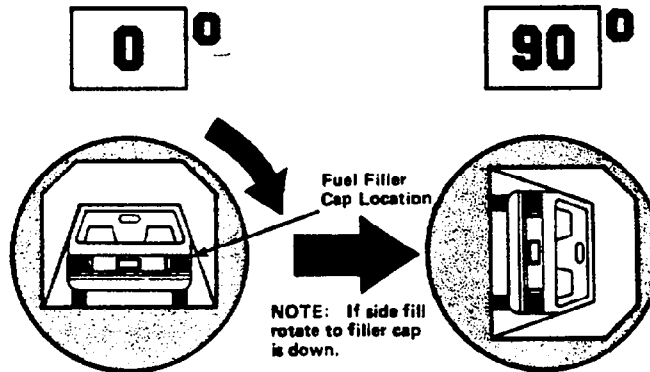
FUEL SPILLAGE MEASUREMENTSOLVENT SPILLAGE DETAILS

1. From impact until vehicle motion ceases
2. For 5 minute period after vehicle motion ceases
3. For next 25 minutes

ACTUAL	MAX ALLOWED
0	1 oz
0	5 oz
0	1 oz/1 min

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

TEST PHASE:



Rollover Fixture 90° Rotation Time
(Spec. Range = 1 to 3 minutes)

3 minutes 0 seconds

FMVSS 301 Position Hold Time +

05 minutes 00 seconds

TOTAL

8 minutes 0 seconds

Next whole minute interval

8 minutes

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	----------------------

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

0	0	0	0
---	---	---	---

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

4-10

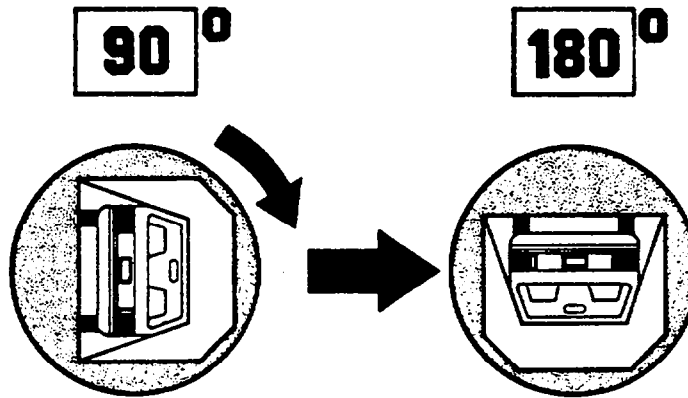
7715-6

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

Veh. NHTSA ID No.:

CK0507

TEST PHASE:



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 56 seconds
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 05 minutes 00 seconds

TOTAL 7 minutes 56 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	----------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

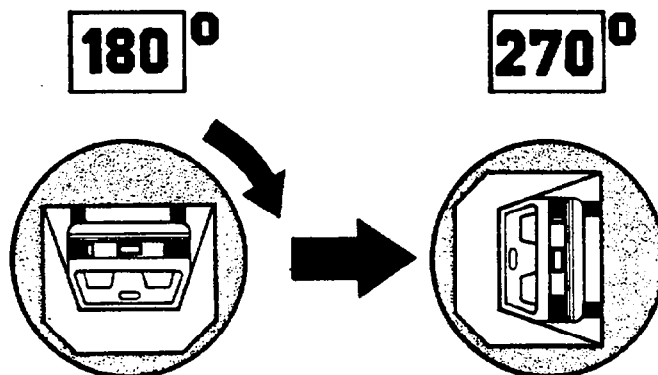
0	0	0	0
---	---	---	---

Note: Record spillage for whole minute intervals only as determined above.

IV. SOLVENT SPILLAGE LOCATION(S):

None.

TABLE 12 (continued)

FMVSS NO. 301 STATIC ROLLOVER DATA SHEETVeh. NHTSA ID No.:
CK0507TEST PHASE:I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:Rollover Fixture 90° Rotation Time 2 minutes 59 seconds
(Spec. Range = 1 to 3 minutes)FMVSS 301 Position Hold Time + 05 minutes 00 secondsTOTAL 7 minutes 59 secondsNext whole minute interval 8 minutesII. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	----------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0
---	---	---	---

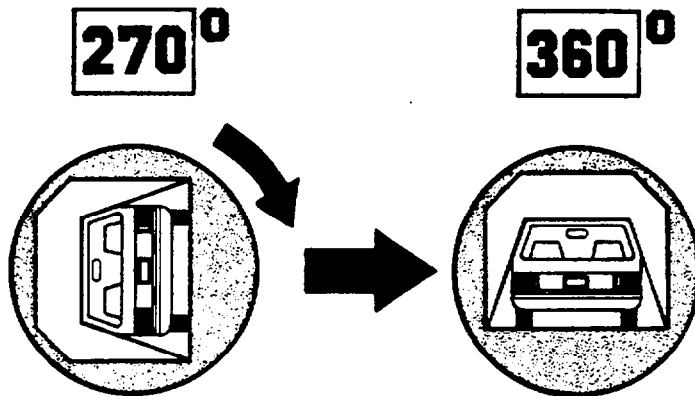
Note: Record spillage for
whole minute intervals
only as determined
above.IV. SOLVENT SPILLAGE LOCATION(S):

None.

FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

Veh. NHTSA ID No.:
CK0507

TEST PHASE:



I. DETERMINATION OF SOLVENT COLLECTION TIME PERIOD:

Rollover Fixture 90° Rotation Time 2 minutes 59 seconds
(Spec. Range = 1 to 3 minutes)

FMVSS 301 Position Hold Time + 05 minutes 00 seconds

TOTAL 7 minutes 59 seconds

Next whole minute interval 8 minutes

II. FMVSS 301 REQUIREMENTS:

(1) Time Period

First 5 min FROM onset of rotation	6th min.	7th min.	8th min. if reqd.
------------------------------------	----------	----------	----------------------

(2) Maximum Allowable Solvent Spillage

5 ounces	1 ounce	1 ounce	1 ounce
----------	---------	---------	---------

III. ACTUAL TEST VEHICLE SOLVENT SPILLAGE:

0	0	0	0
---	---	---	---

Note: Record spillage for
whole minute intervals
only as determined
above.

IV. SOLVENT SPILLAGE LOCATION(S):

None.

TABLE 13

TEST VEHICLE NONCOMPLIANCE NOTICE

NHTSA CONTRACT LAB: Calspan Advanced Technology Center

LAB. PROJECT MANAGER & TELEPHONE NO.: Walter E. Levan (716) 632-7500

DATE OF TEST: May 23, 1989 VEH. NHTSA No. CK0507

VEHICLE MANUFACTURER: Hyundai Motor Company

Model Year 1989 VIN: KMHBF32S4KU036529

Body Style: 4-Door Sedan Build Date: December 13, 1988

DUMMY STABILIZED TEMPERATURE AT TIME OF TEST: 69 °F (Spec. = 66-78°F)

IMPACT VELOCITY: 29.3 mph TIME OF TEST: 12:10

TYPE OF AUTOMATIC RESTRAINT SYSTEM: Automatic shoulder belts for driver
and passenger

FAILURE DETAILS: Vehicle appears to to comply with the requirements
of FMVSS Nos. 208, 212, 219 (partial) and 301.

Appendix A

PHOTOGRAPHS

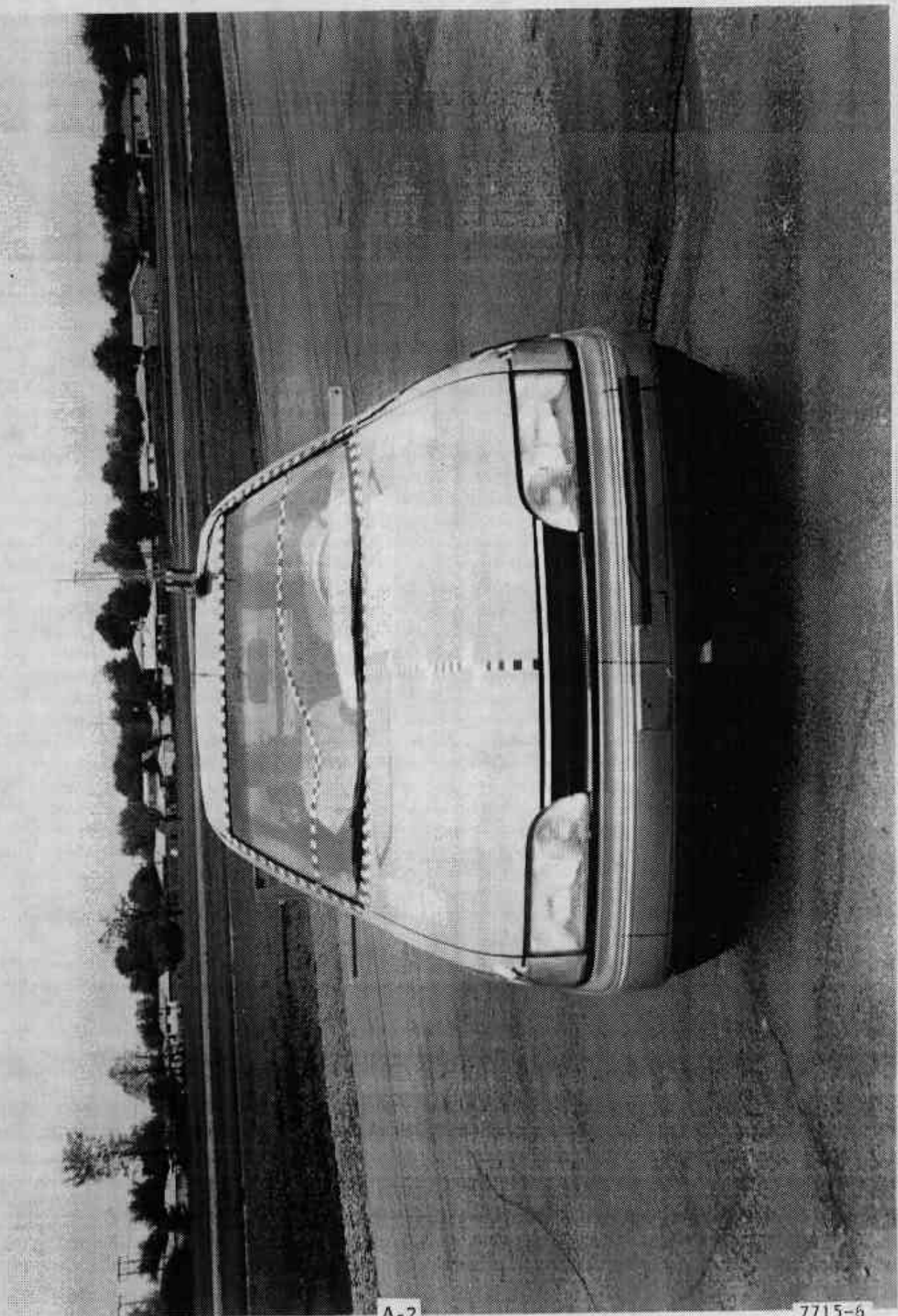


Figure A-1 PRE-TEST FRONT VIEW

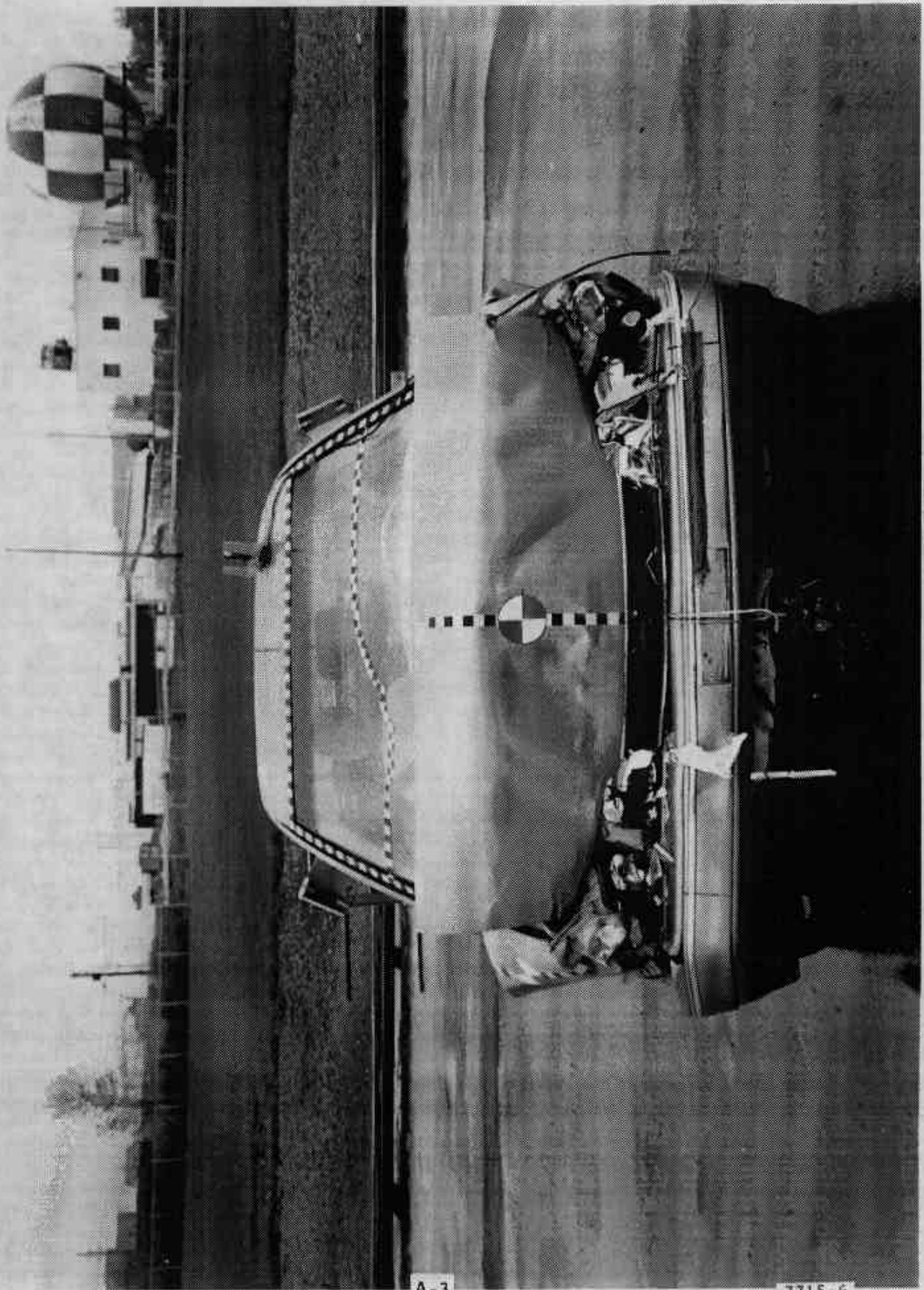


Figure A-2 POST-TEST FRONT VIEW

A-3

7715-6

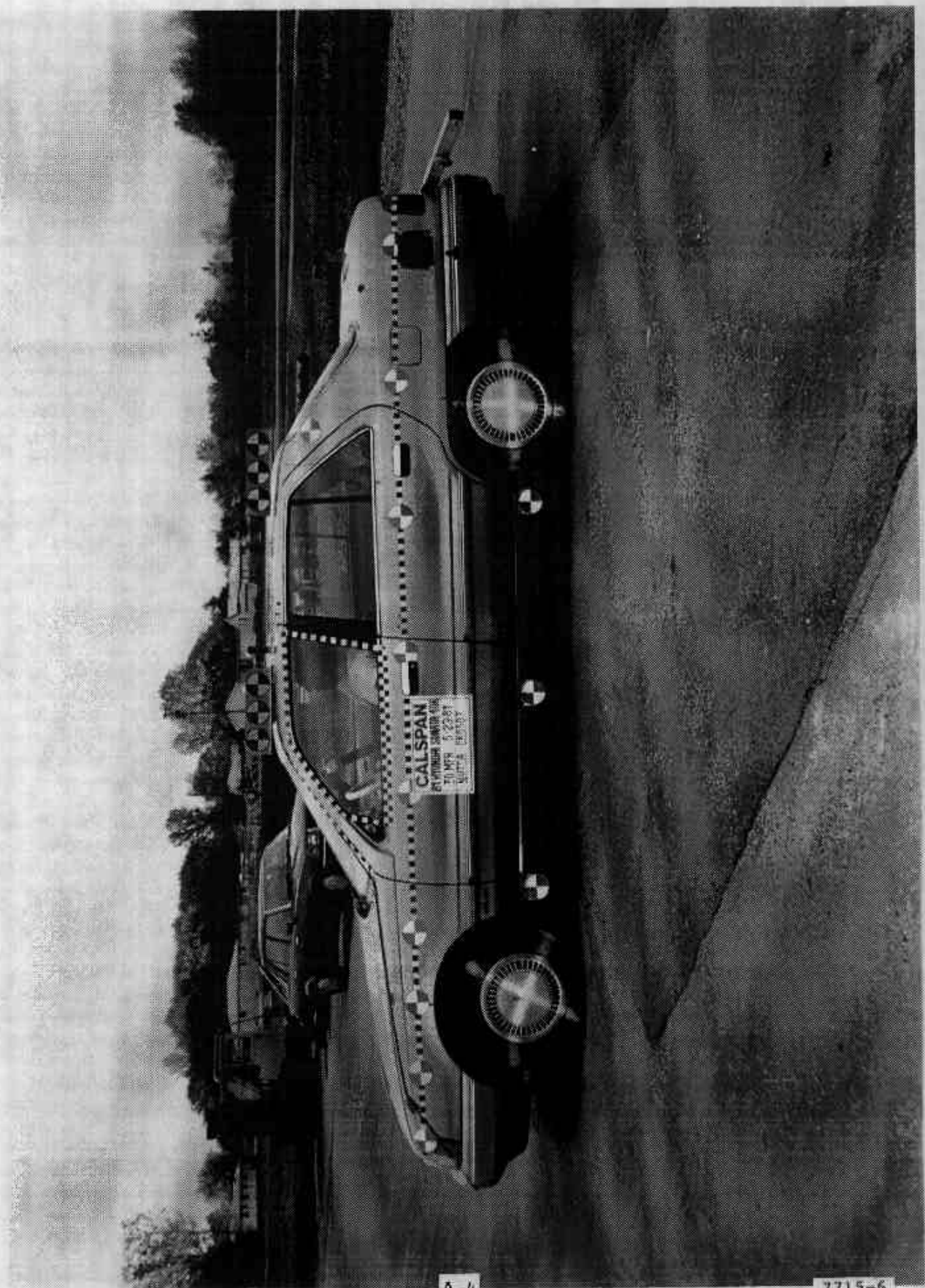


Figure A-3 PRE-TEST LEFT SIDE VIEW

A-4

7715-6

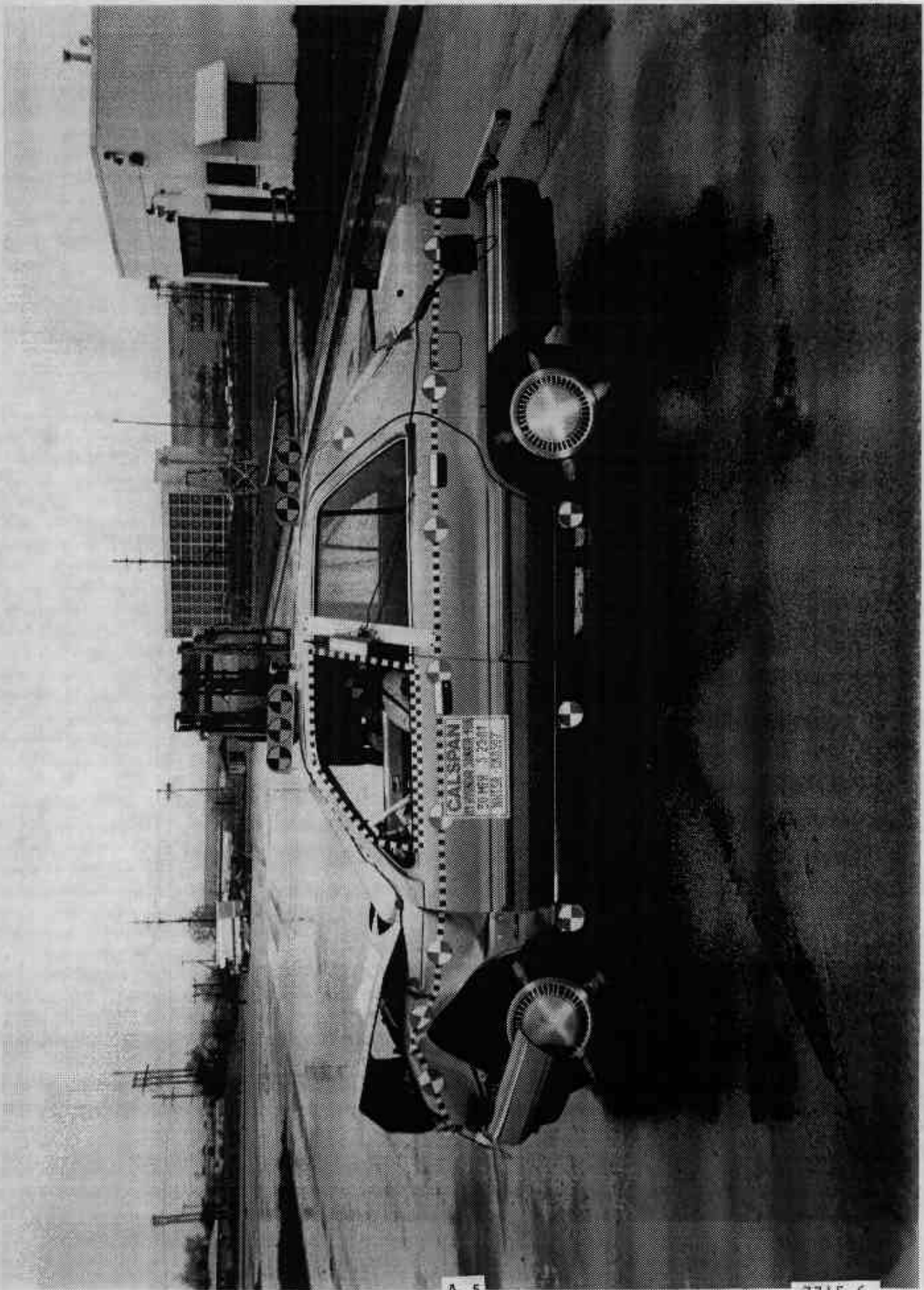


Figure A-4 POST-TEST LEFT SIDE VIEW

A-5

7715-6

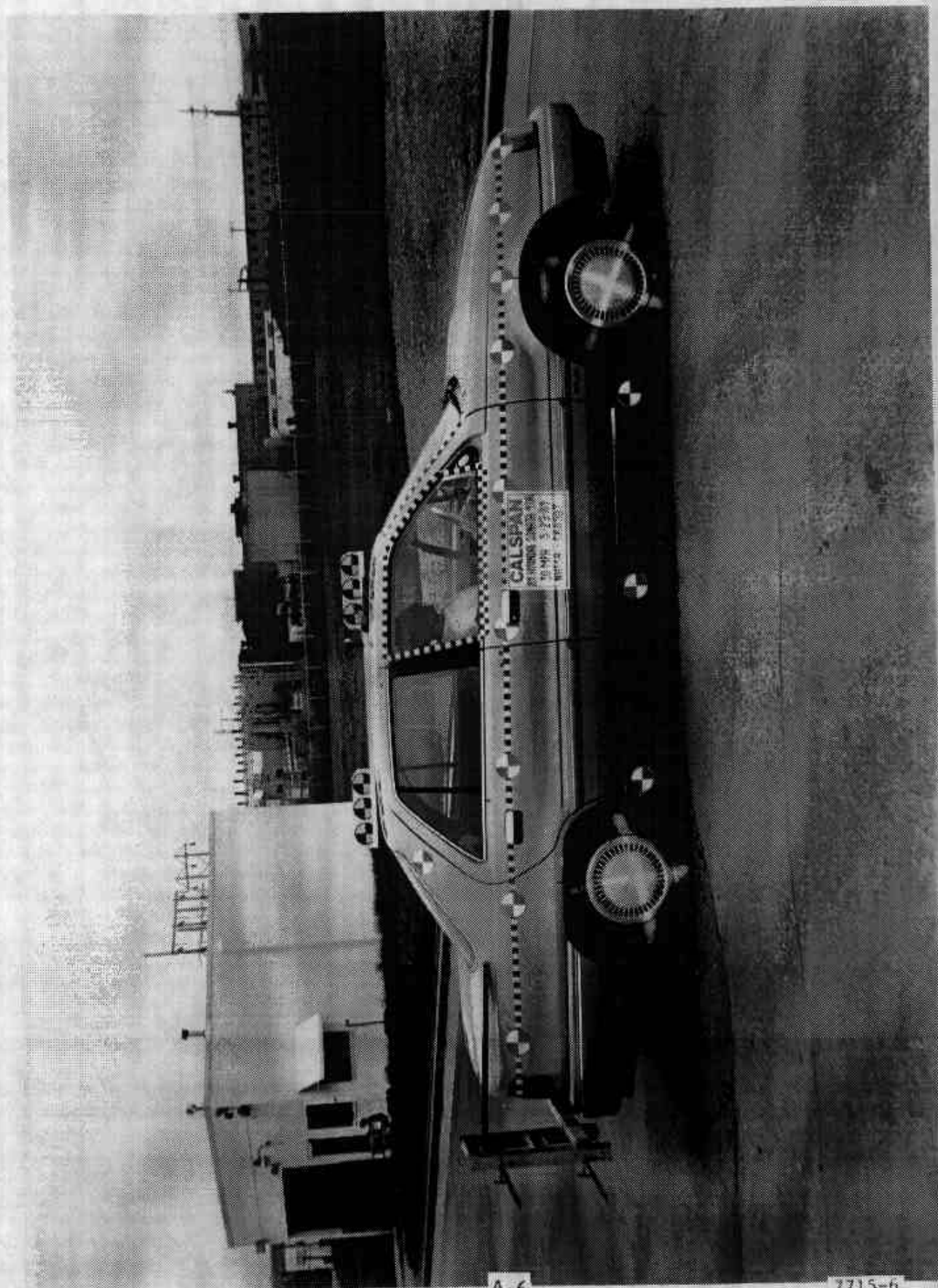


Figure A-5 PRE-TEST RIGHT SIDE VIEW

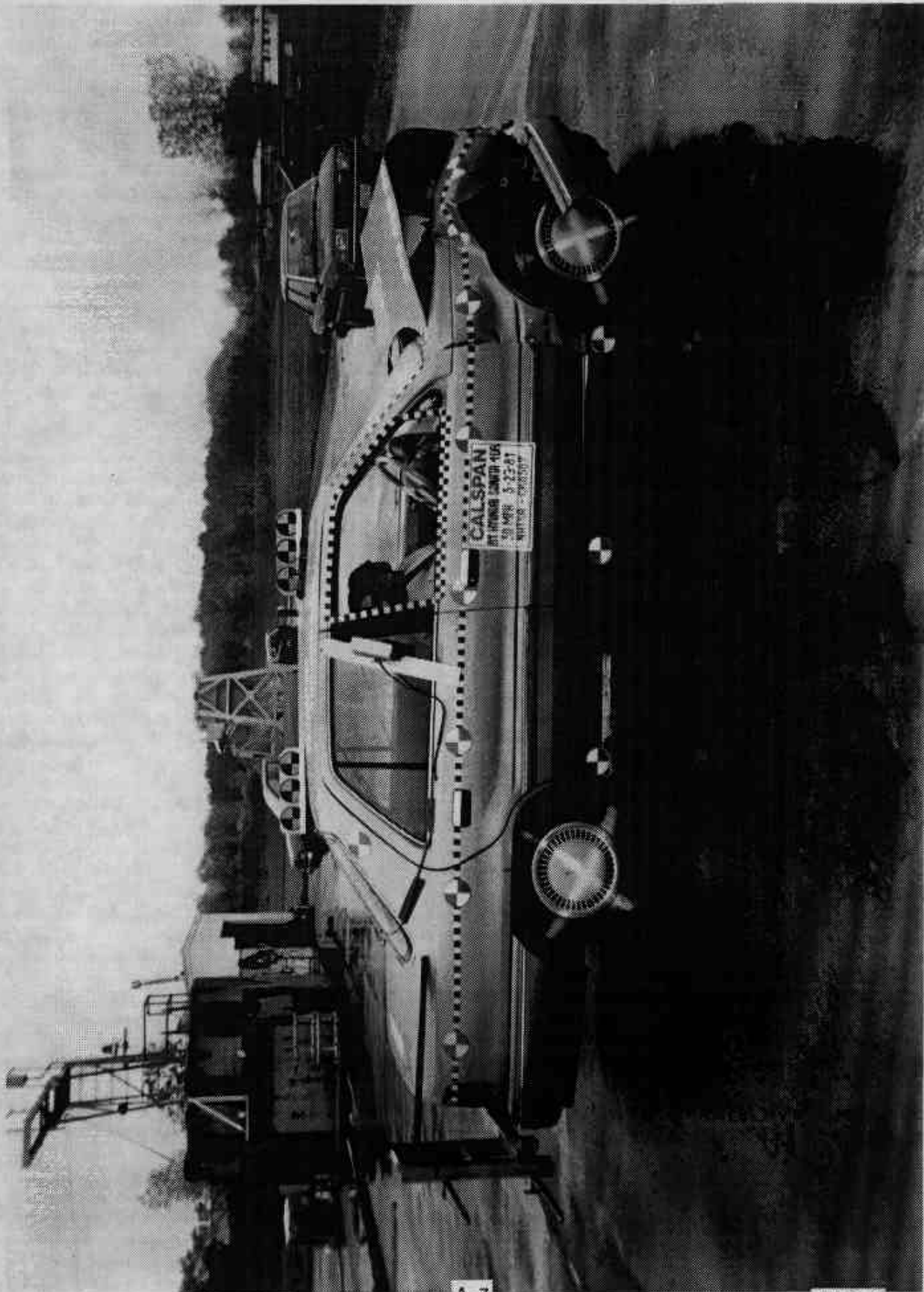


Figure A-6 POST-TEST RIGHT SIDE VIEW

A-7

7715-6

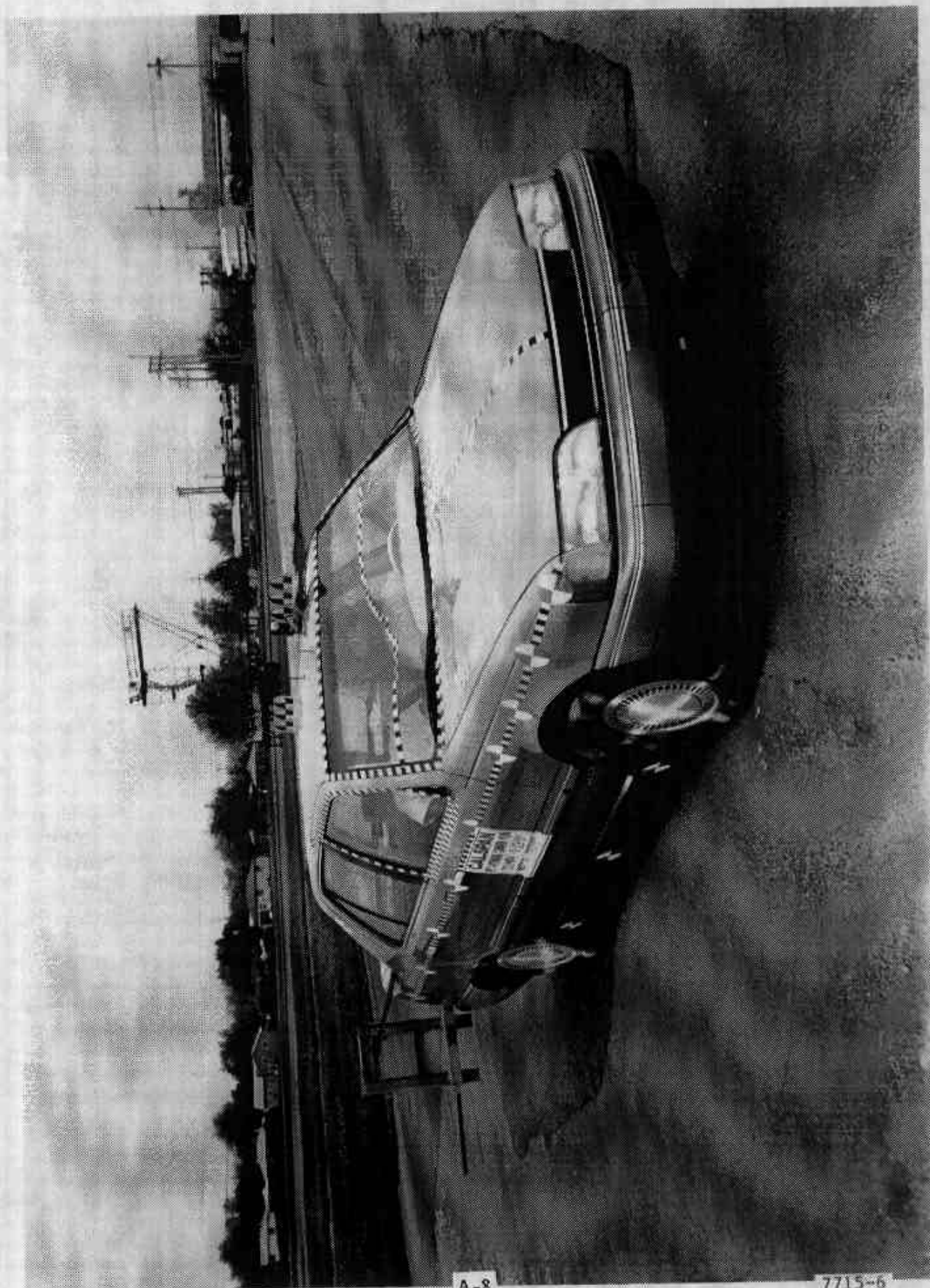


Figure A-7 PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

A-8

7715-6

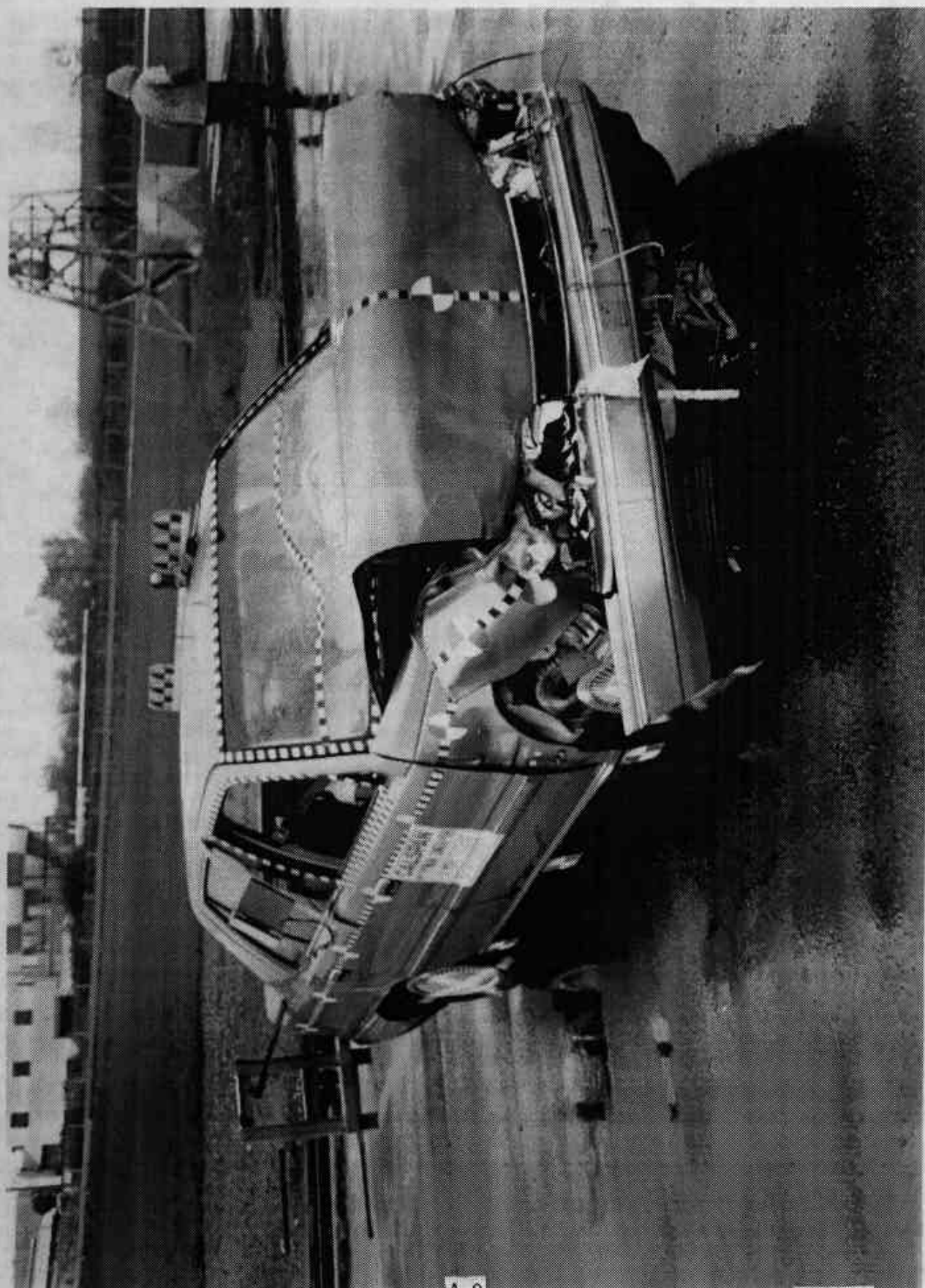


Figure A-8 POST-TEST RIGHT FRONT THREE-QUARTER VIEW

A-9

7715-6



A-10

7715-6

Figure A-9 PRE-TEST LEFT REAR THREE-QUARTER VIEW



Figure A-10 POST-TEST LEFT REAR THREE-QUARTER VIEW



Figure A-11 POST-TEST TOP VIEW

A-12

7715-6

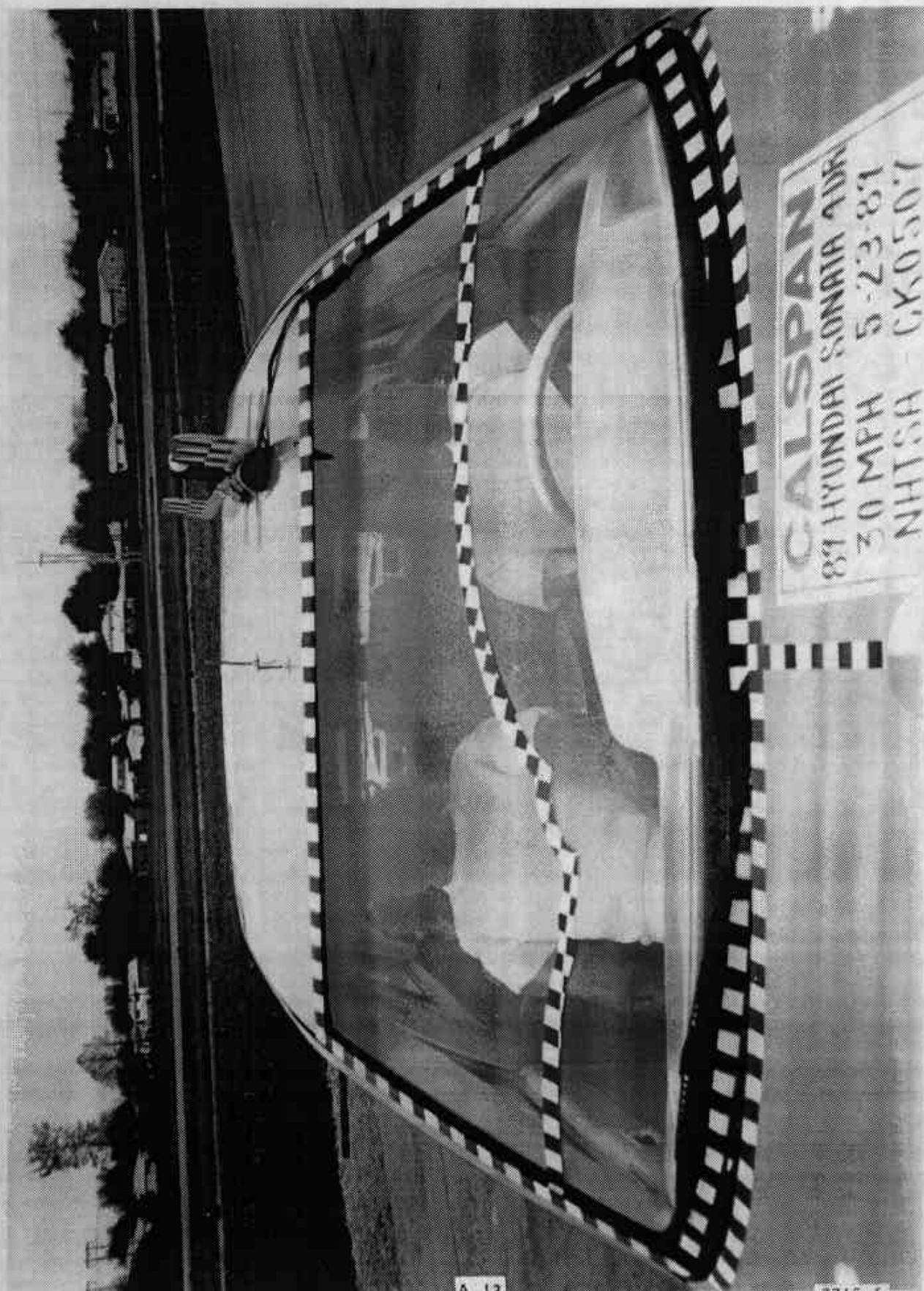


Figure A-12 PRE-TEST WINDSHIELD VIEW

A-13

7715-6

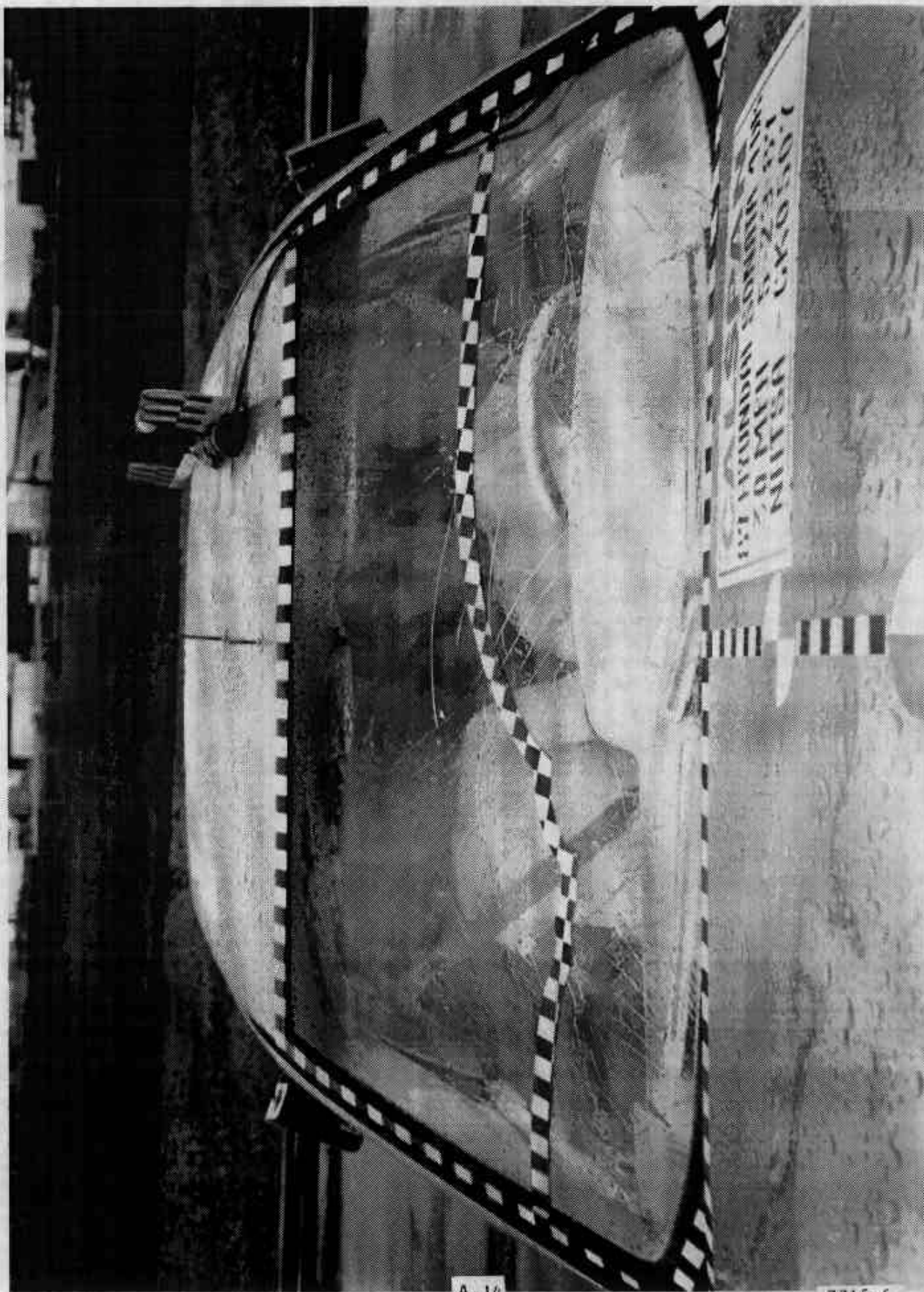


Figure A-13 POST-TEST WINDSHIELD VIEW

A-14

7715-6

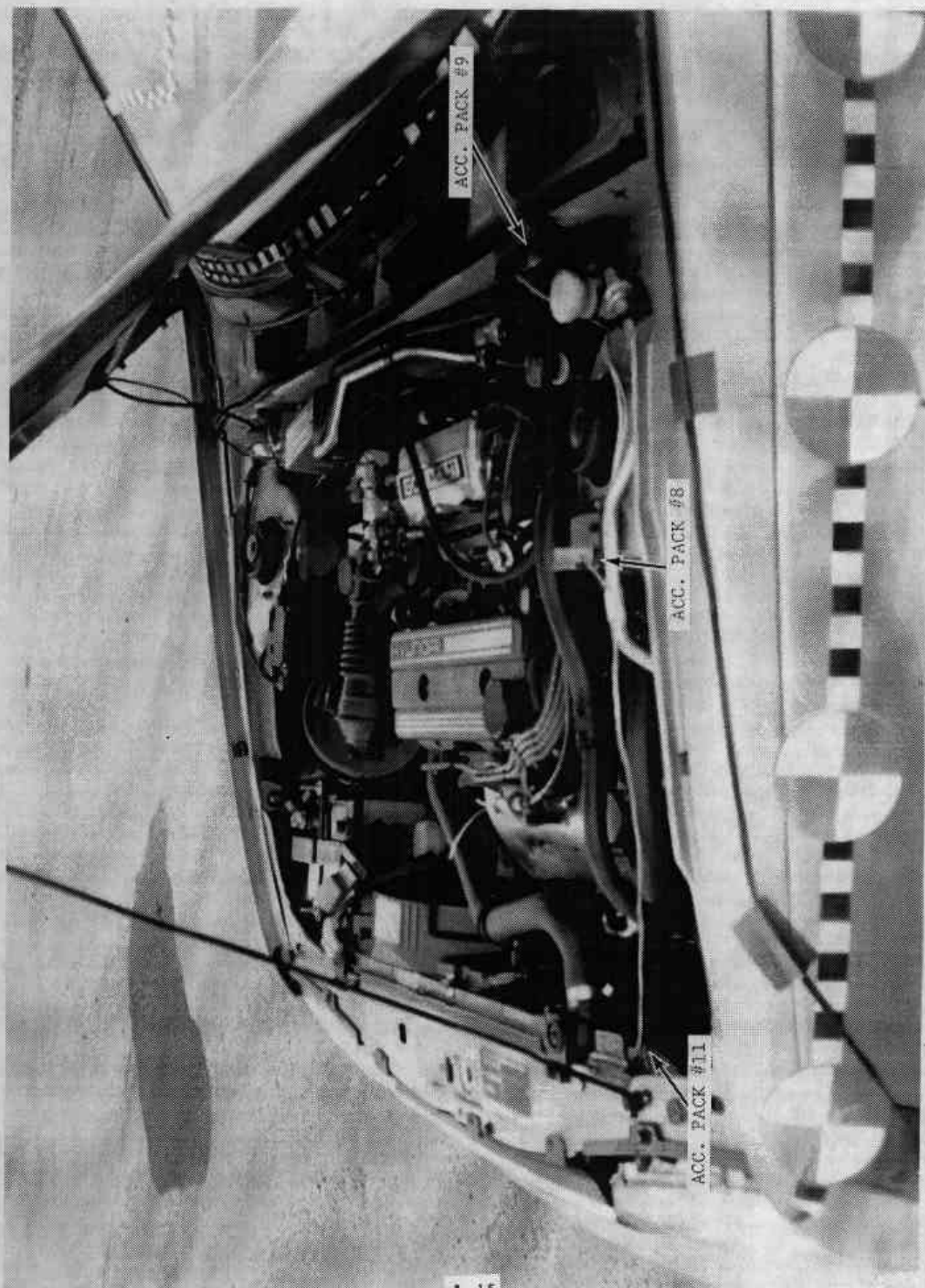


Figure A-14 PRE-TEST ENGINE COMPARTMENT VIEW

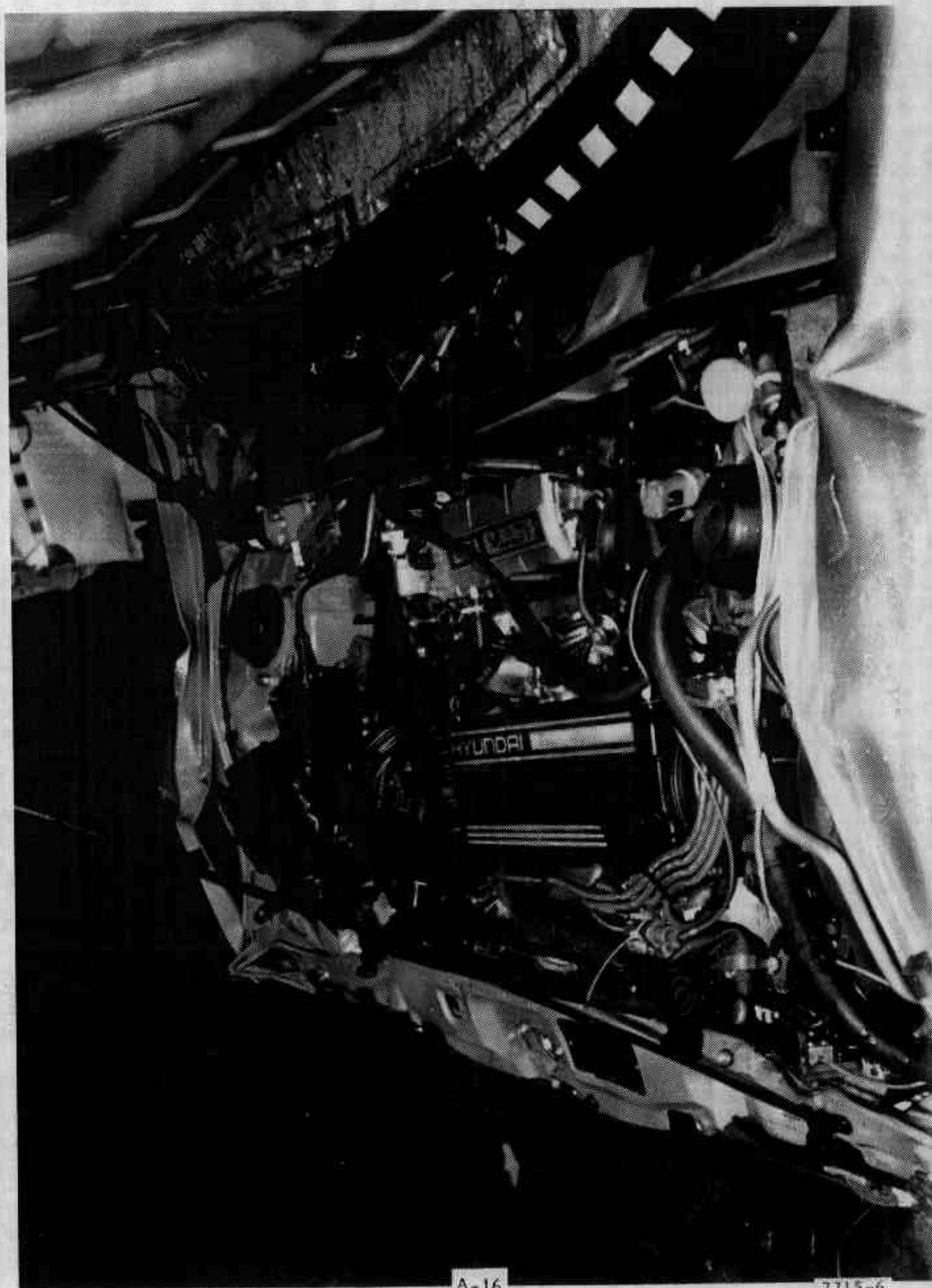


Figure A-15 POST-TEST ENGINE COMPARTMENT VIEW

A-16

7715-6



Figure A-16 PRE-TEST FUEL FILLER CAP VIEW

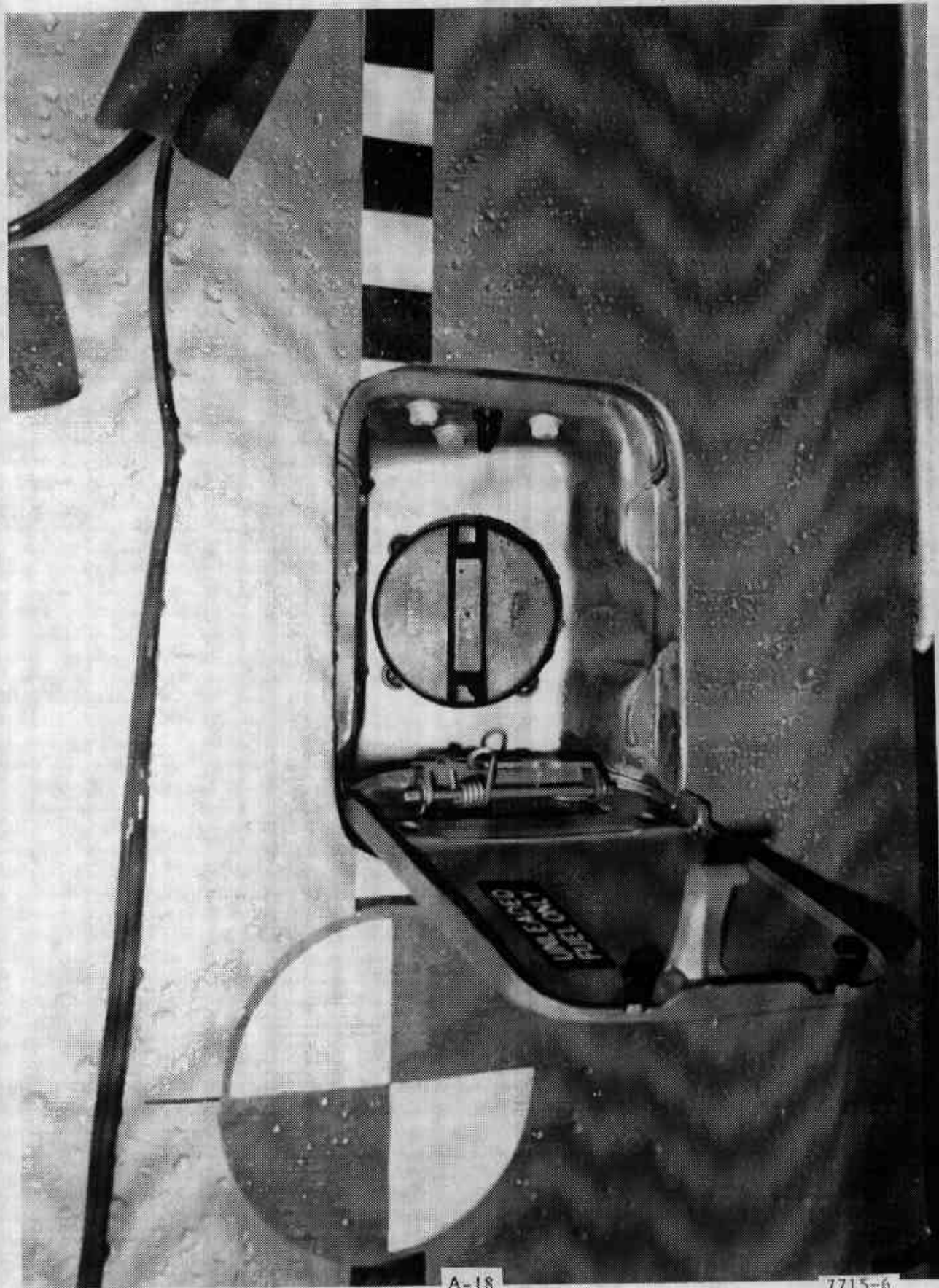


Figure A-17 POST-TEST FUEL FILLER CAP VIEW

A-18

7715-6

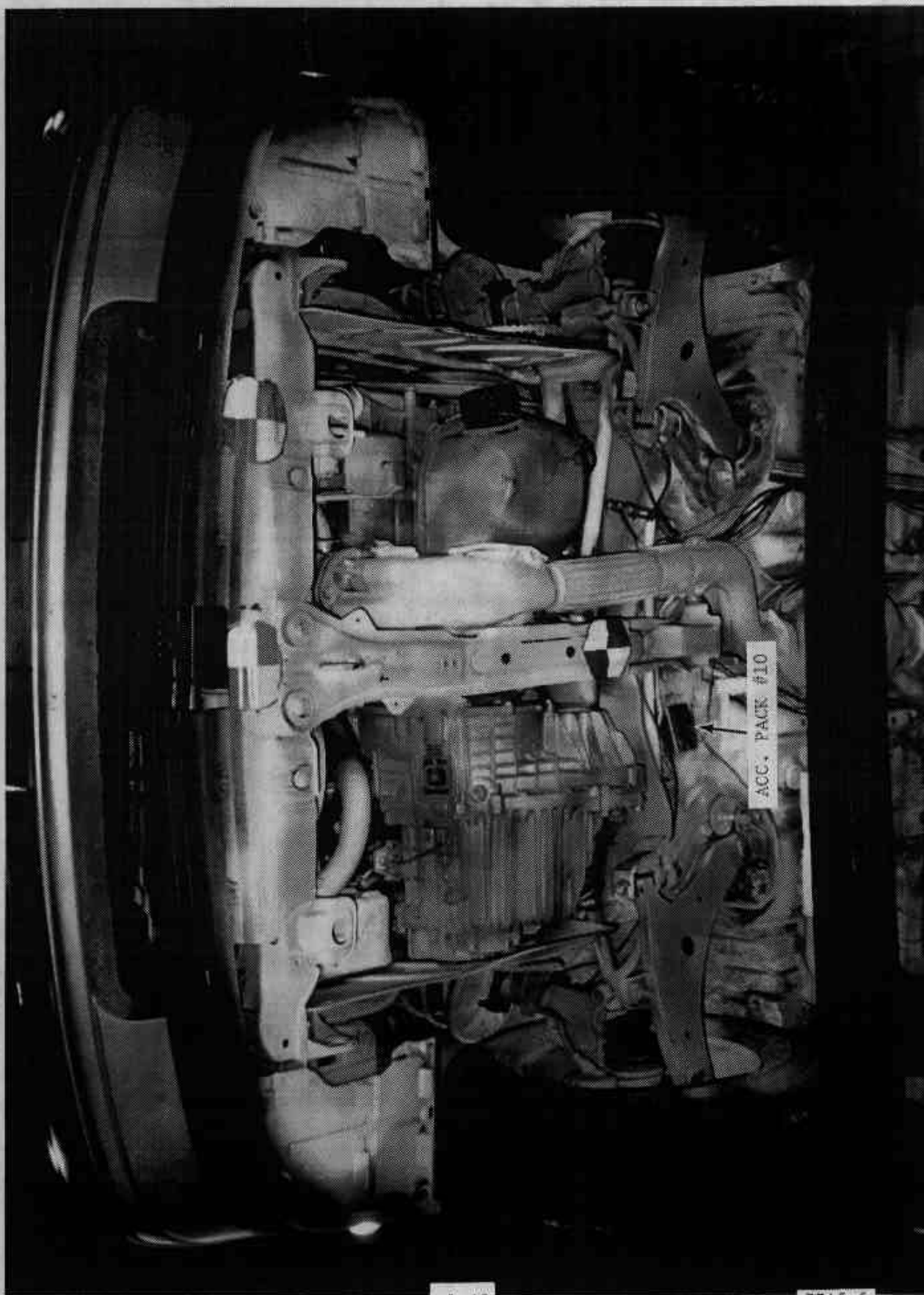


Figure A-18 PRE-TEST FRONT UNDERBODY VIEW

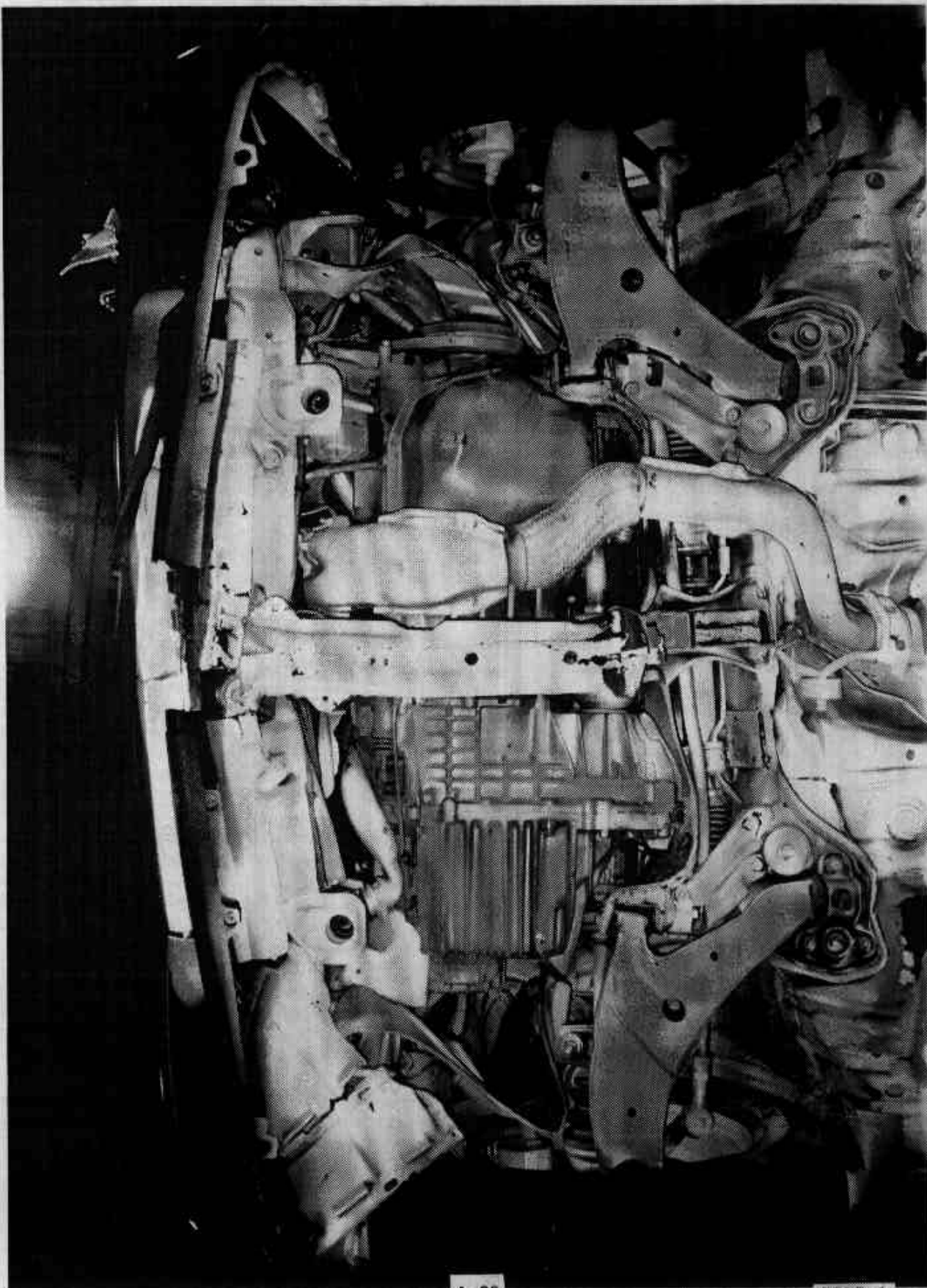


Figure A-19 POST-TEST FRONT UNDERBODY VIEW

A-20

7715-6

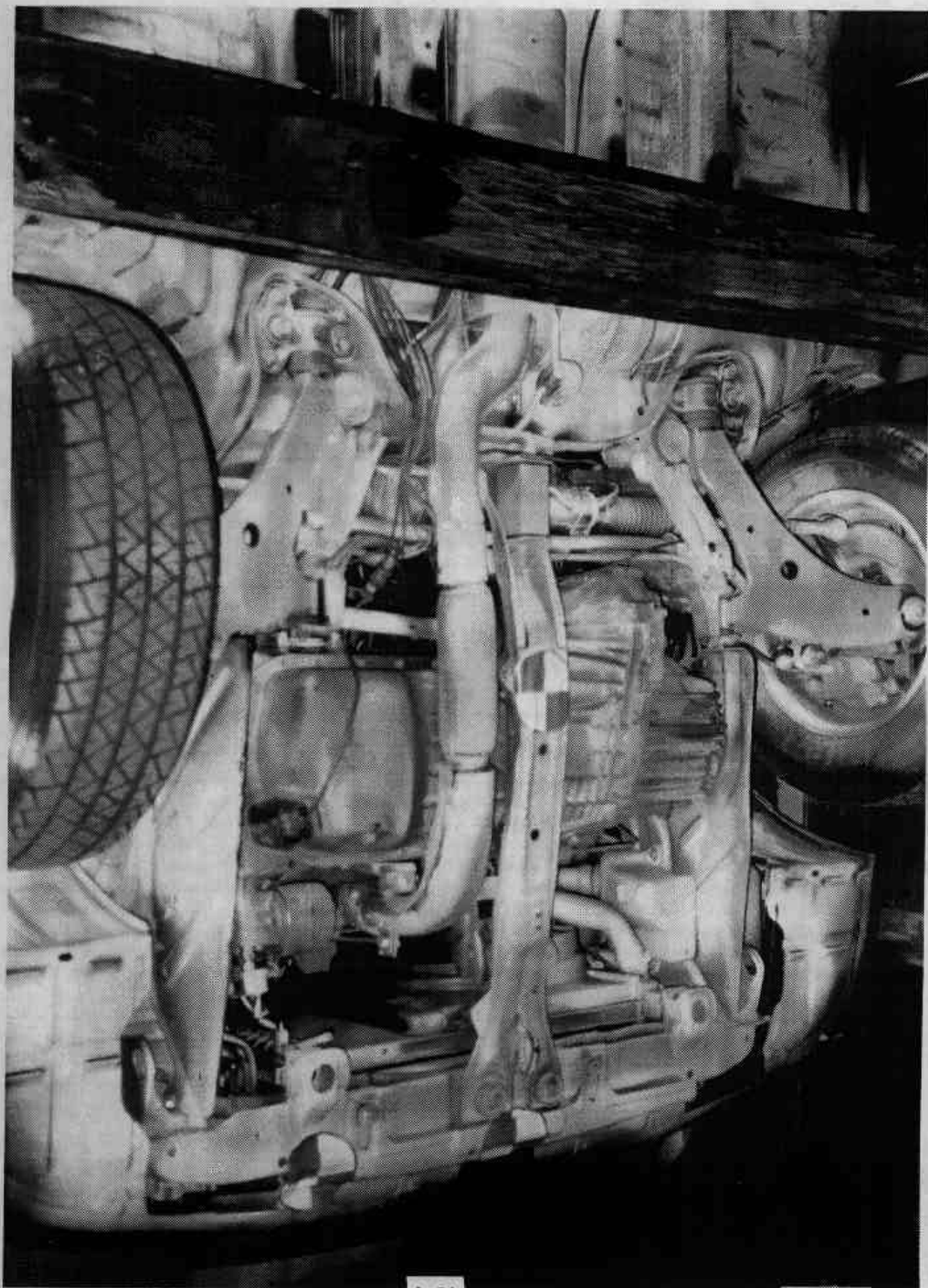
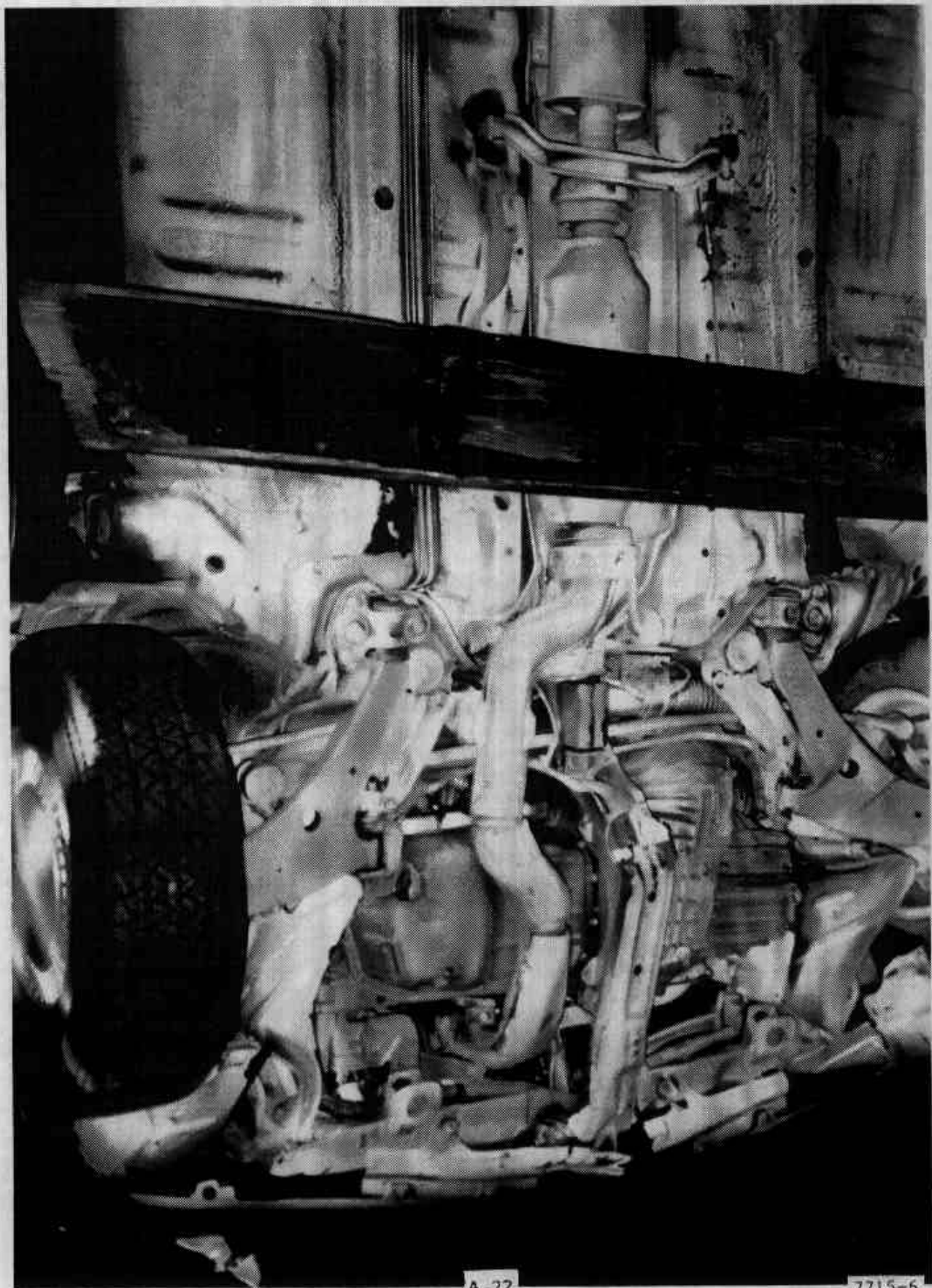


Figure A-20 PRE-TEST FRONT SIDE UNDERBODY VIEW

A-21

7715-6



A-22

7715-6

Figure A-21 POST-TEST FRONT SIDE UNDERBODY VIEW



Figure A-22 PRE-TEST REAR UNDERBODY VIEW

A-23

7713-6

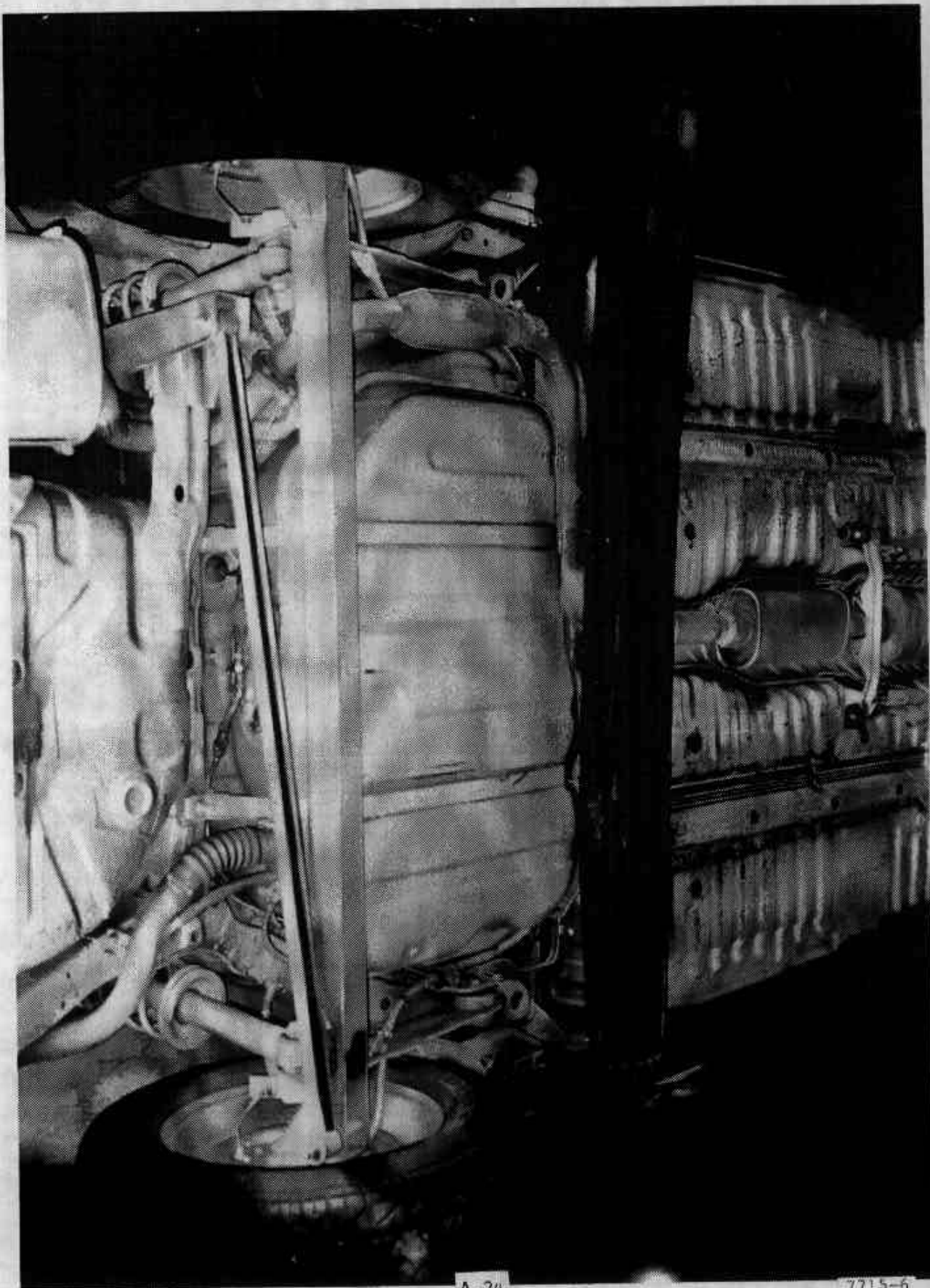


Figure A-23 POST-TEST REAR UNDERBODY VIEW

A-24

7715-6

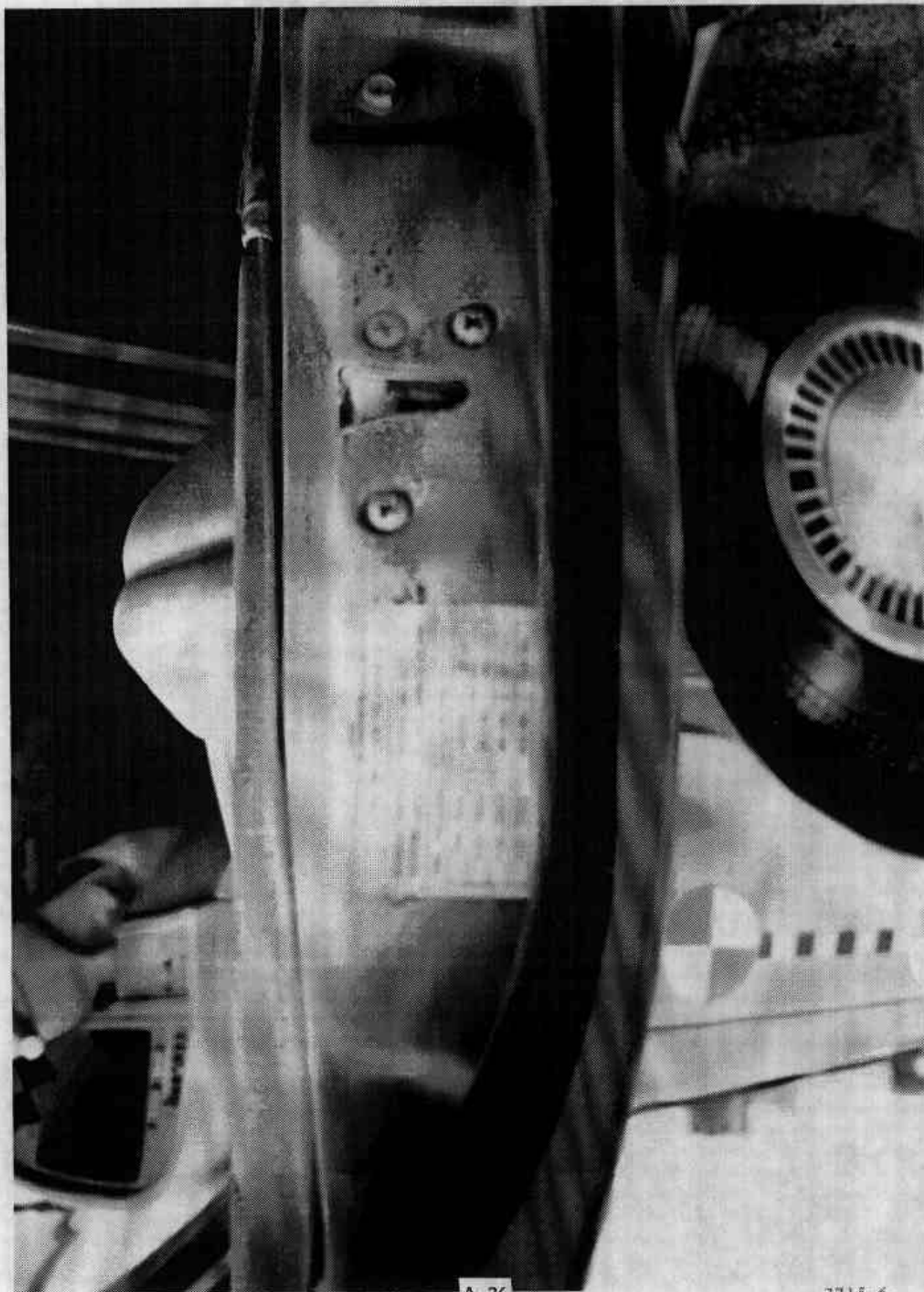


Figure A-25 TIRE PLACARD

A-26

7715-6



Figure A-26 PRE-TEST DRIVER DUMMY POSITION

A-27

7715-6

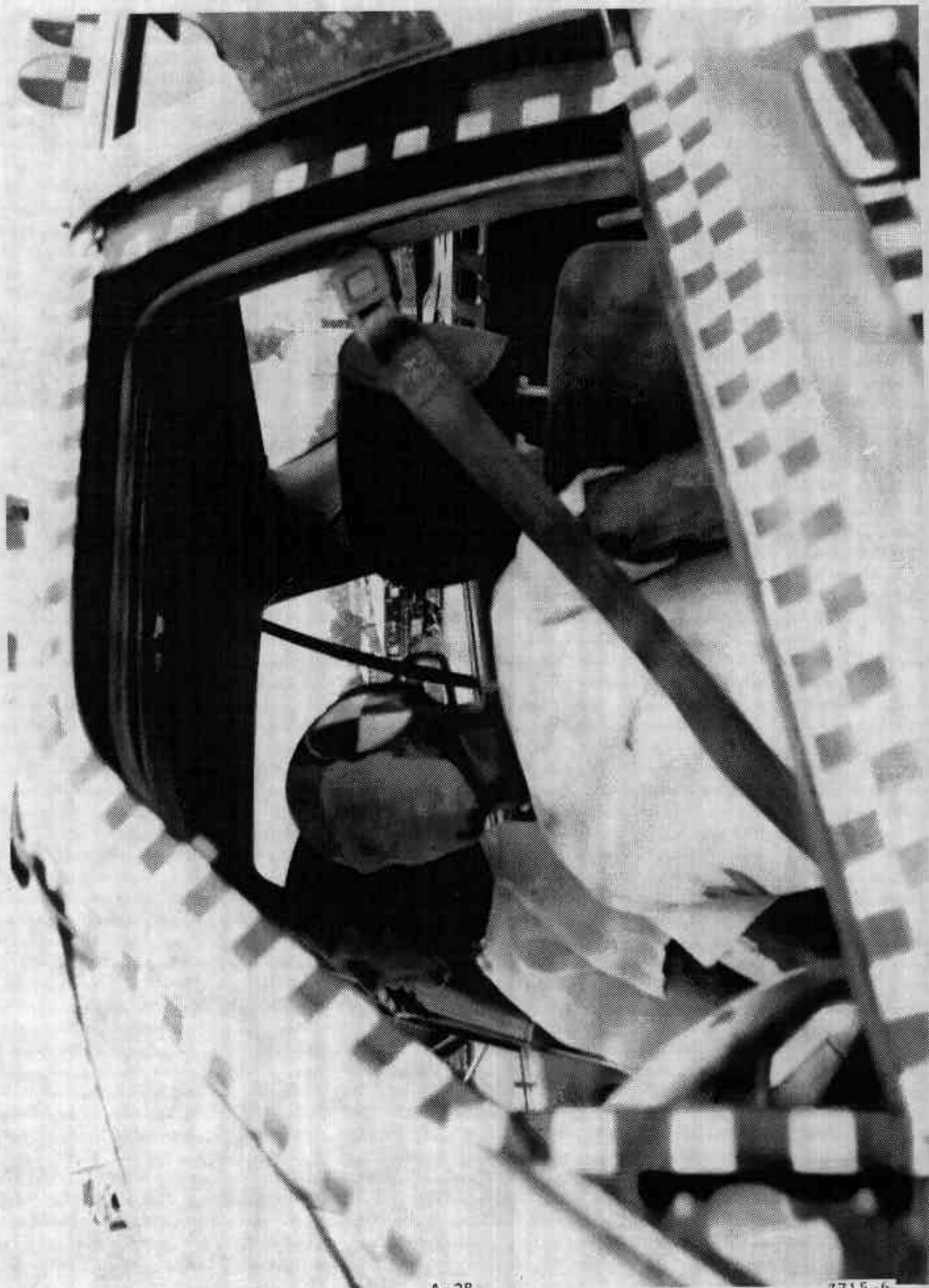


Figure A-27 POST-TEST DRIVER DUMMY POSITION

A-28

7715-6



Figure A-28 PRE-TEST PASSENGER DUMMY POSITION

A-29

7715-6



Figure A-29 POST-TEST PASSENGER DUMMY POSITION

A-30

7715-6



Figure A-30 PRE-TEST DRIVER DUMMY AND INTERIOR VIEW

A-31

7715-6



Figure A-31 POST-TEST DRIVER DUMMY AND INTERIOR VIEW



Figure A-32 PRE-TEST PASSENGER DUMMY AND INTERIOR VIEW



Figure A-33 POST-TEST PASSENGER DUMMY AND INTERIOR VIEW

A-34

7715-6

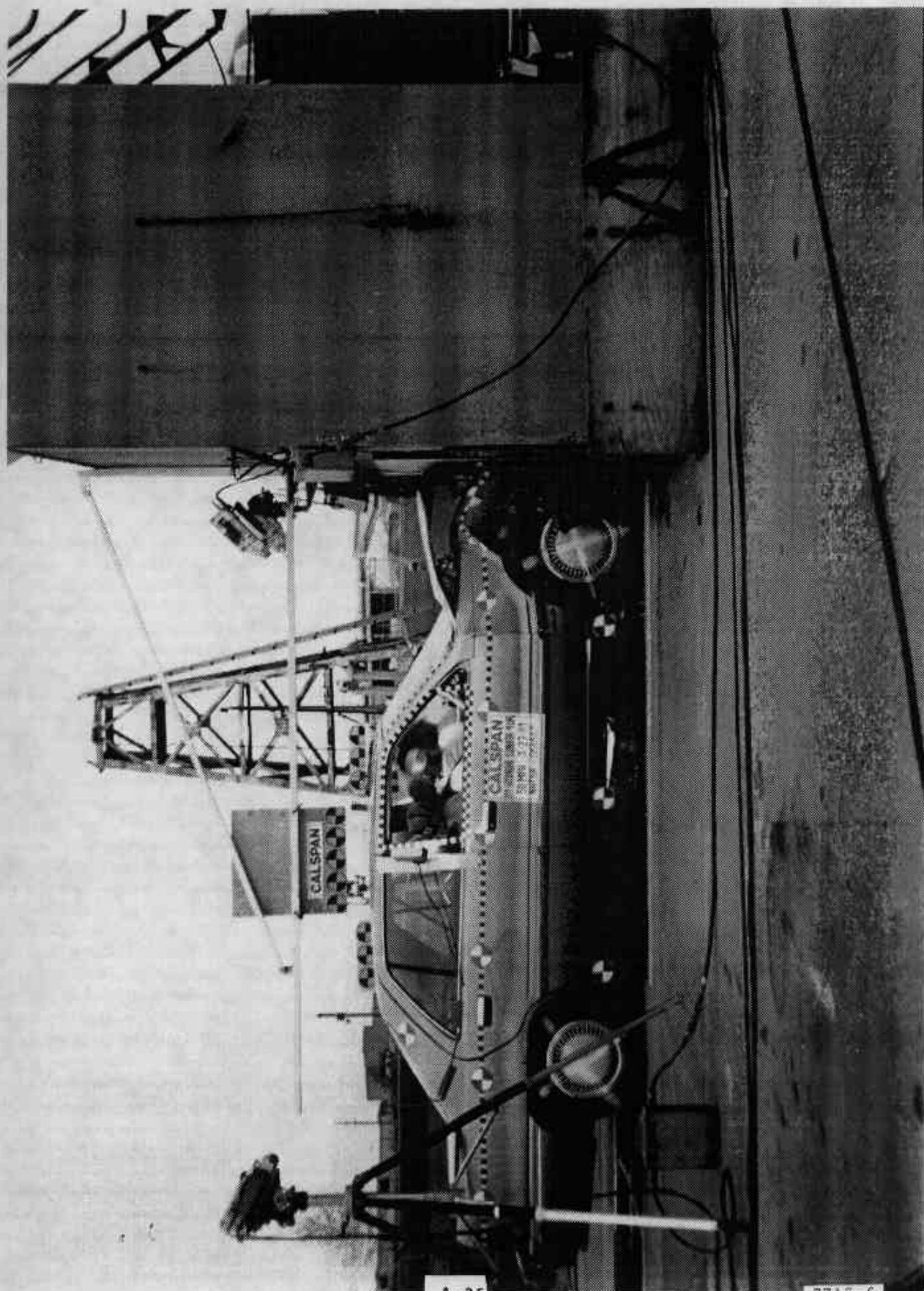


Figure A-34 VEHICLE IMPACT

Appendix B

VEHICLE AND DUMMY RESPONSE DATA

TEST NO. CK0507

VEHICLE DATA

FILTER CHANNEL CLASS

60

B-2

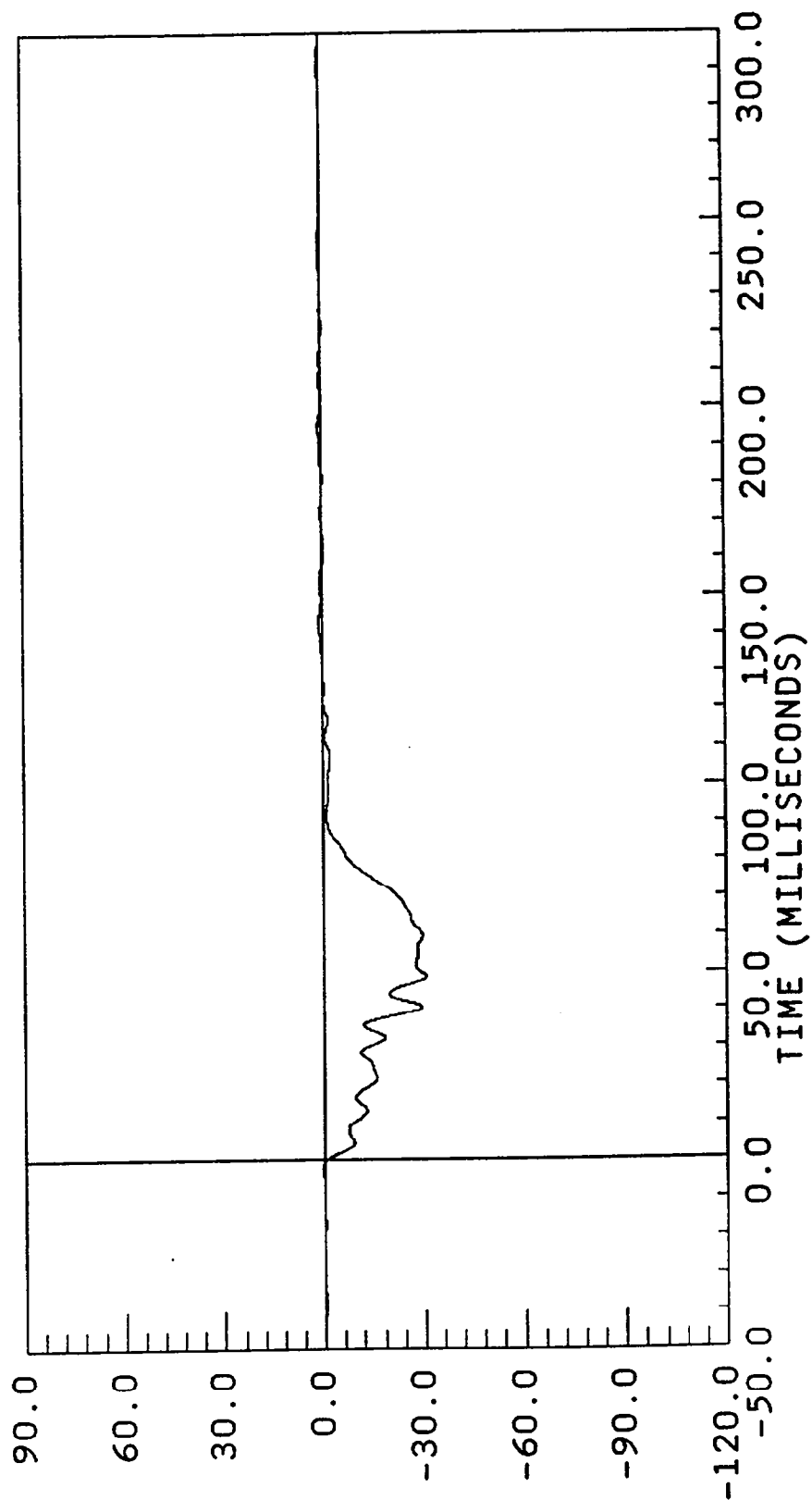
7715-6

BW898-17.DAT

29.30 mph

ACC PACK #1(X)
FILTERED
FILTER CUTOFF: 100Hz

XL AXIS
YMIN = -30.52525 at 48.90000
YMAX = 1.179464 at 141.4500



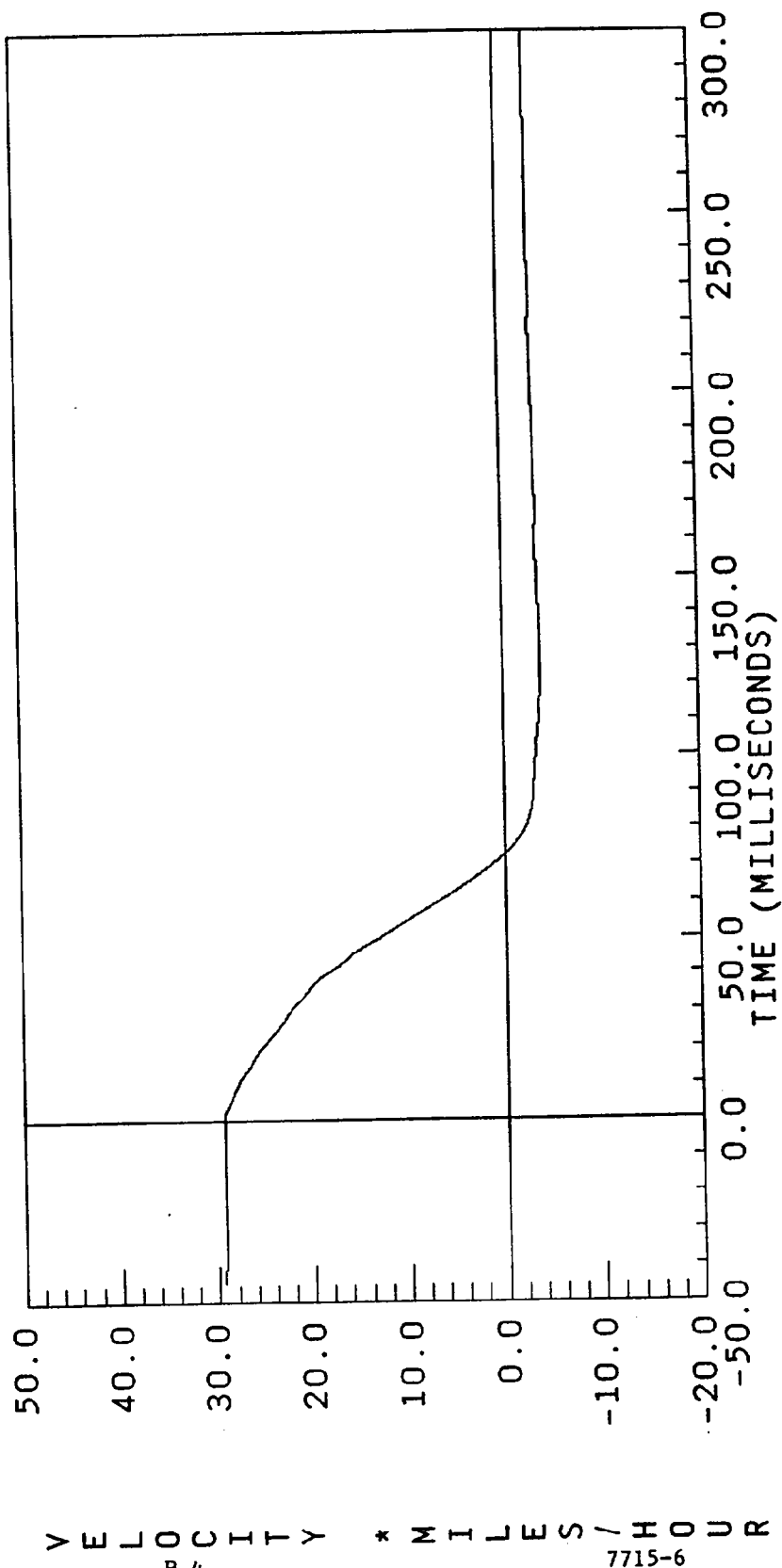
ACCELERATION * G * S *
B-3 7715-6

V898-17.DAT

29.30 mph

ACC PACK #1(X)
COMPUTED
FILTER CUTOFF: 100Hz

XL AXIS
YMIN = -3.928705 at 128.0250
YMAX = 29.33009 at -42.15000

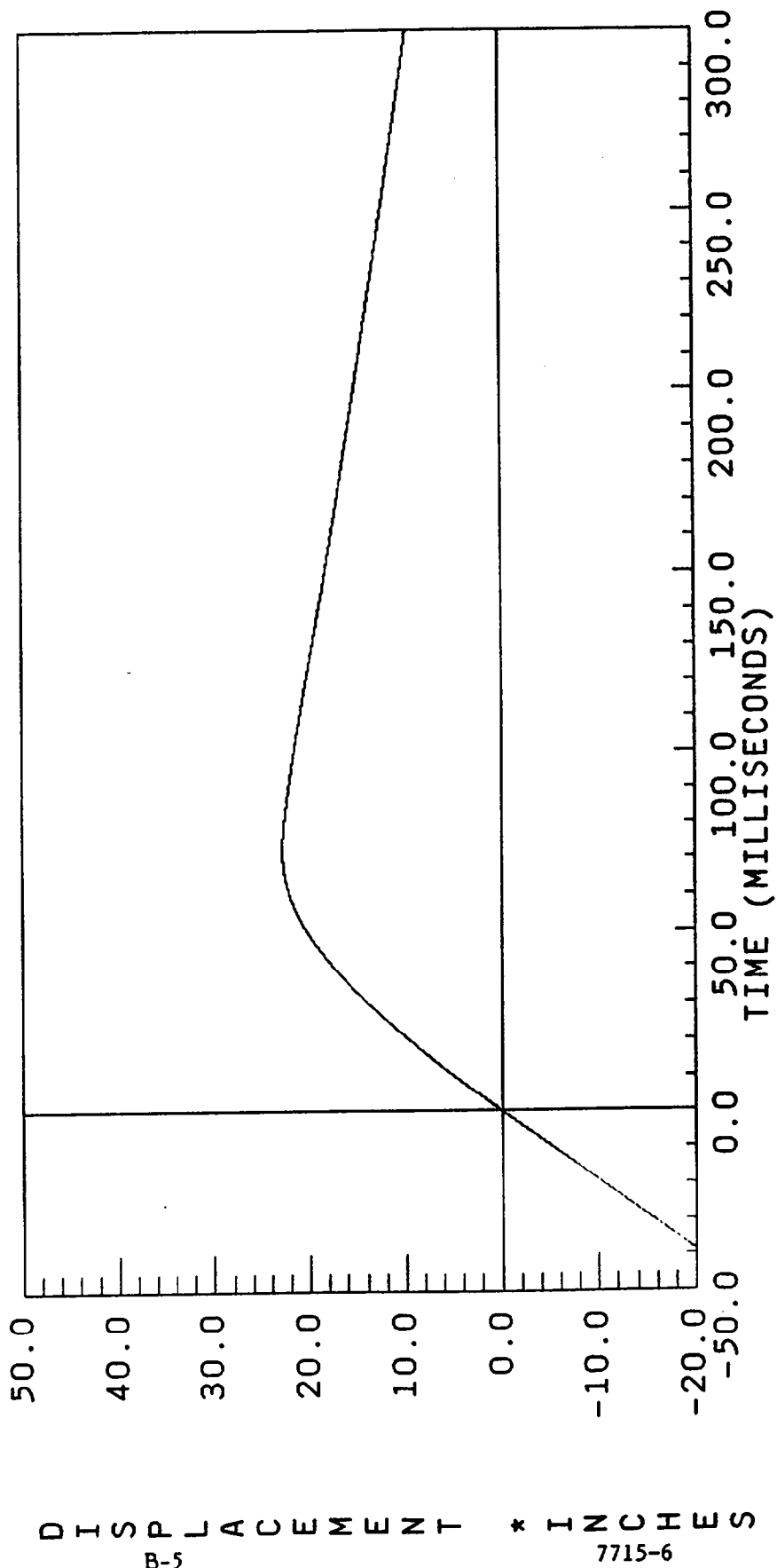


D898-17.DAT

29.30 mph

ACC PACK #1(X)
COMPUTED
FILTER CUTOFF: 100HZ

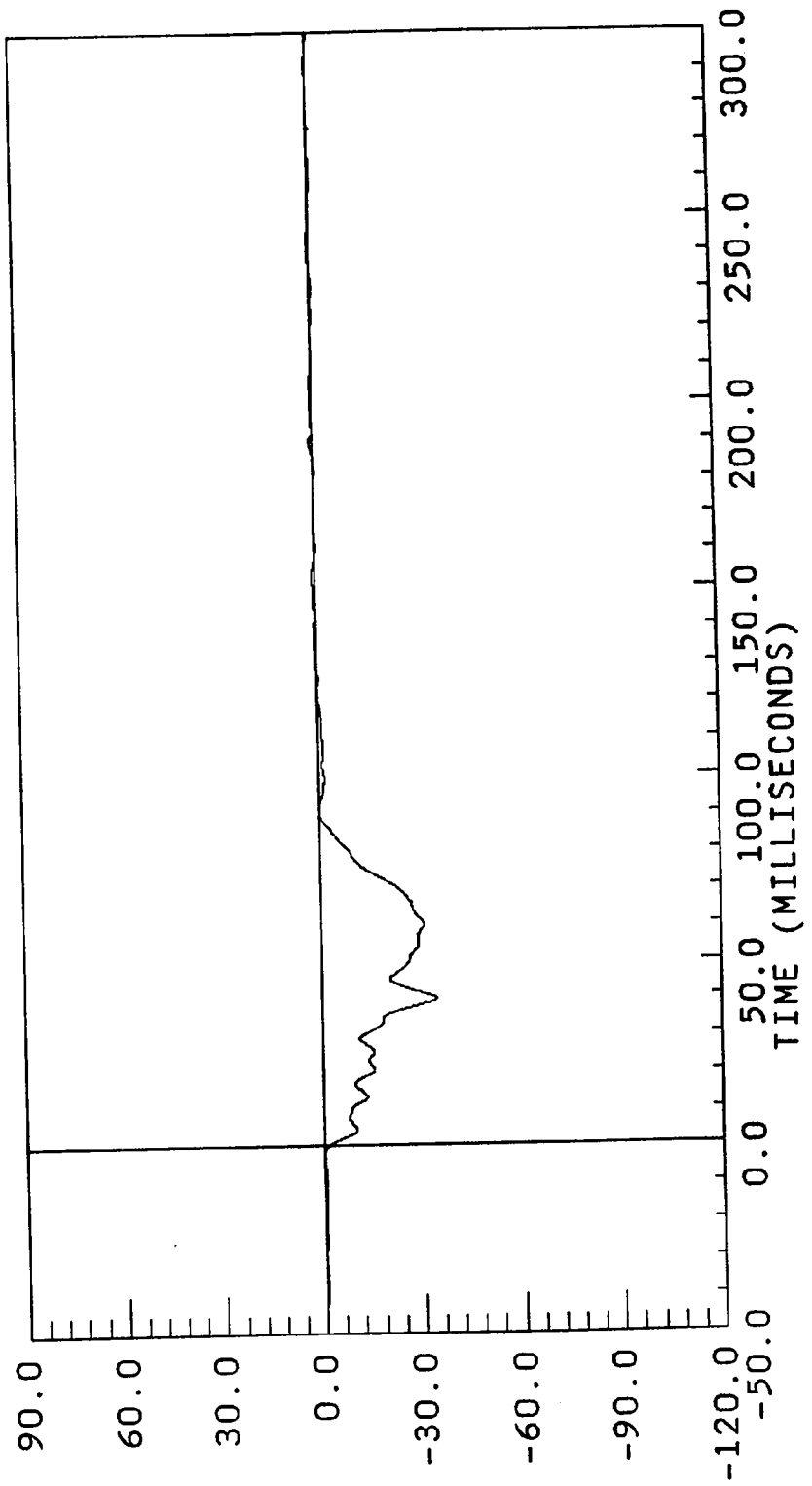
XL AXIS
YMIN = -23.16208 at 128.0250
YMAX = 22.78107 at 72.45000



BW898-18.DAT

29.30 mph

ACC PACK #2(X) XL AXIS
FILTERED YMIN = -34.45605 at 39.45000
FILTER CUTOFF: 100Hz YMAX = 0.991847 at 189.5250



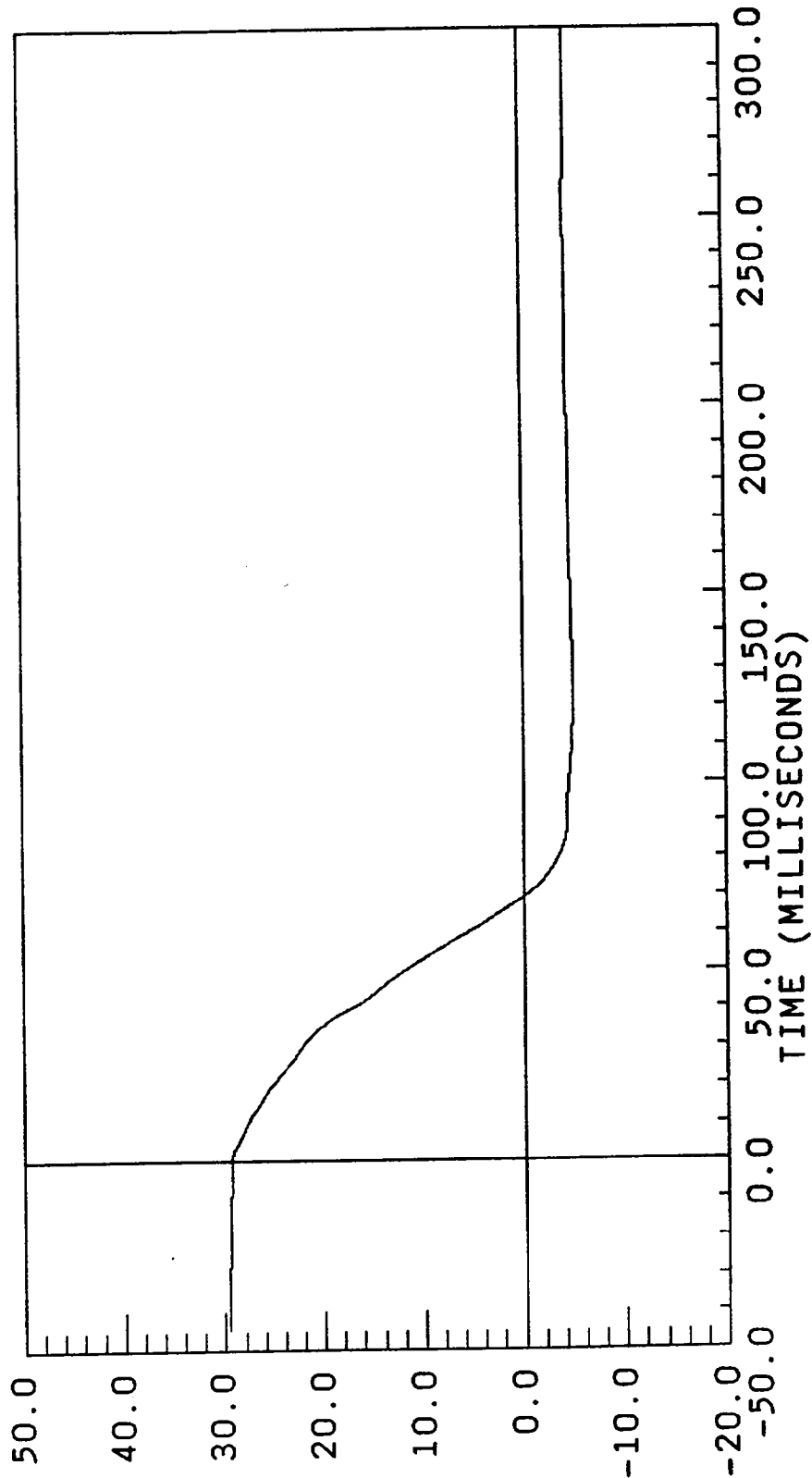
ACCELERATION * G * S
B-6 7715-6

V898-18.DAT

29.30 mph

ACC PACK #2(X)
COMPUTED
FILTER CUTOFF: 100Hz

XL AXIS
YMIN = -5.016896 at 127.4250
YMAX = 29.60561 at -43.57500



VELOCITY * MILES / HOUR

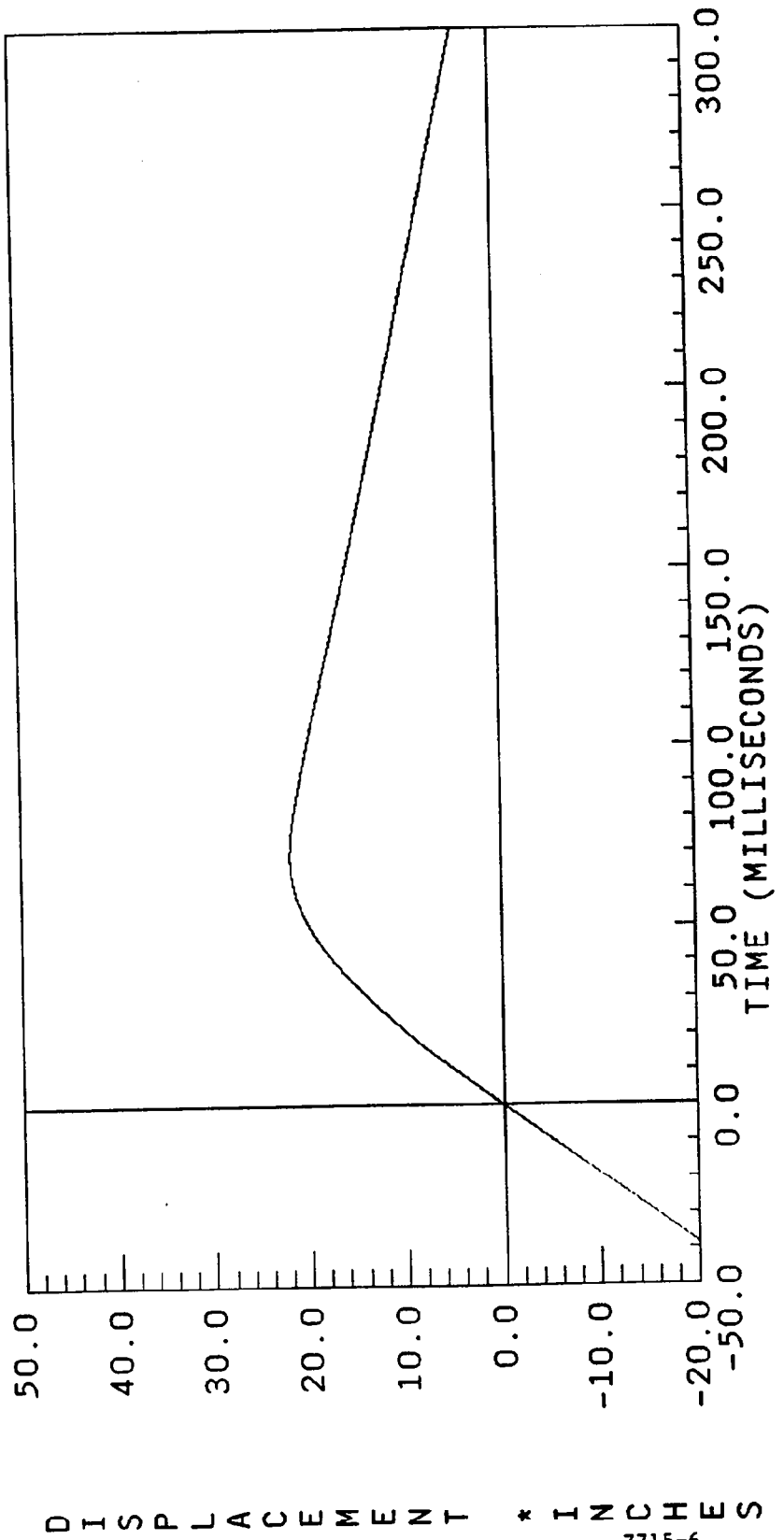
B-7

7715-6

D898-18.DAT

29.30 mph

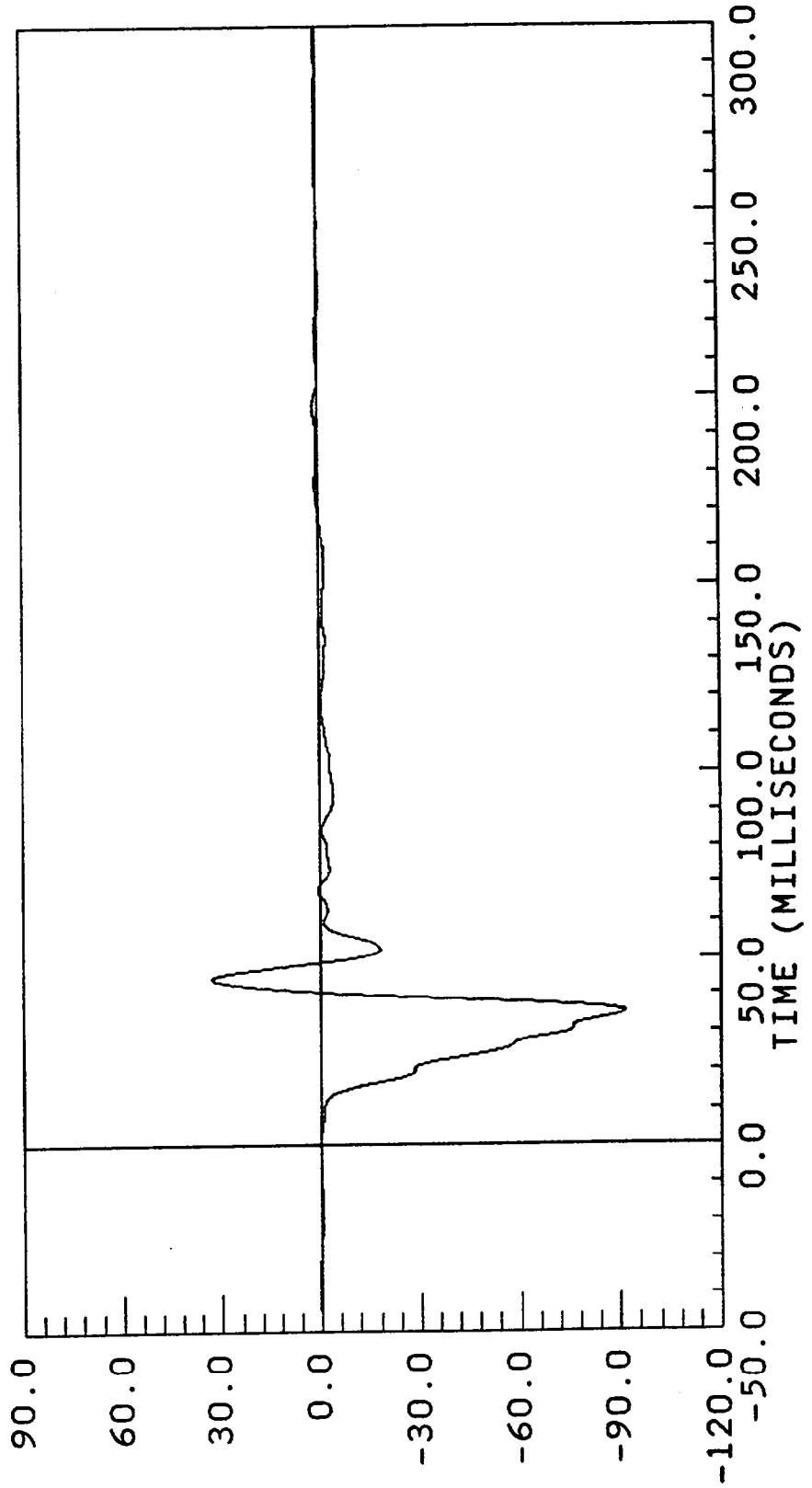
ACC PACK #2(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -23.28378 at 127.4250
YMAX = 21.92677 at 69.22501



BW898-19.DAT

29.30 mph

ACC PACK #3(X)
FILTERED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -91.61293 at 35.17500
YMAX = 33.08620 at 44.47500



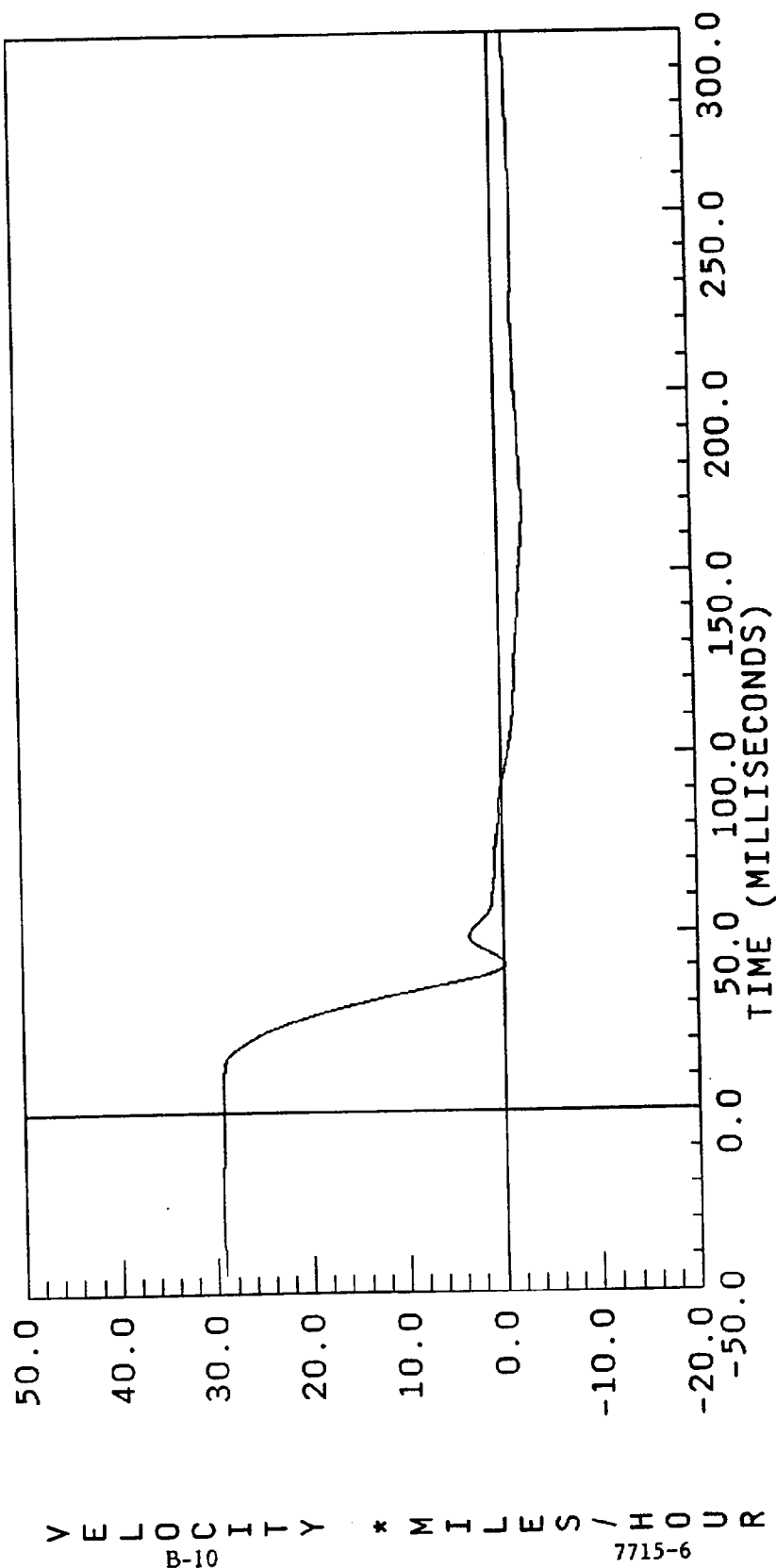
ACCELERATION * G, S *
B-9 7715-6

V898-19.DAT

29.30 mph

ACC PACK #3(X)
COMPUTED
FILTER CUTOFF: 100Hz

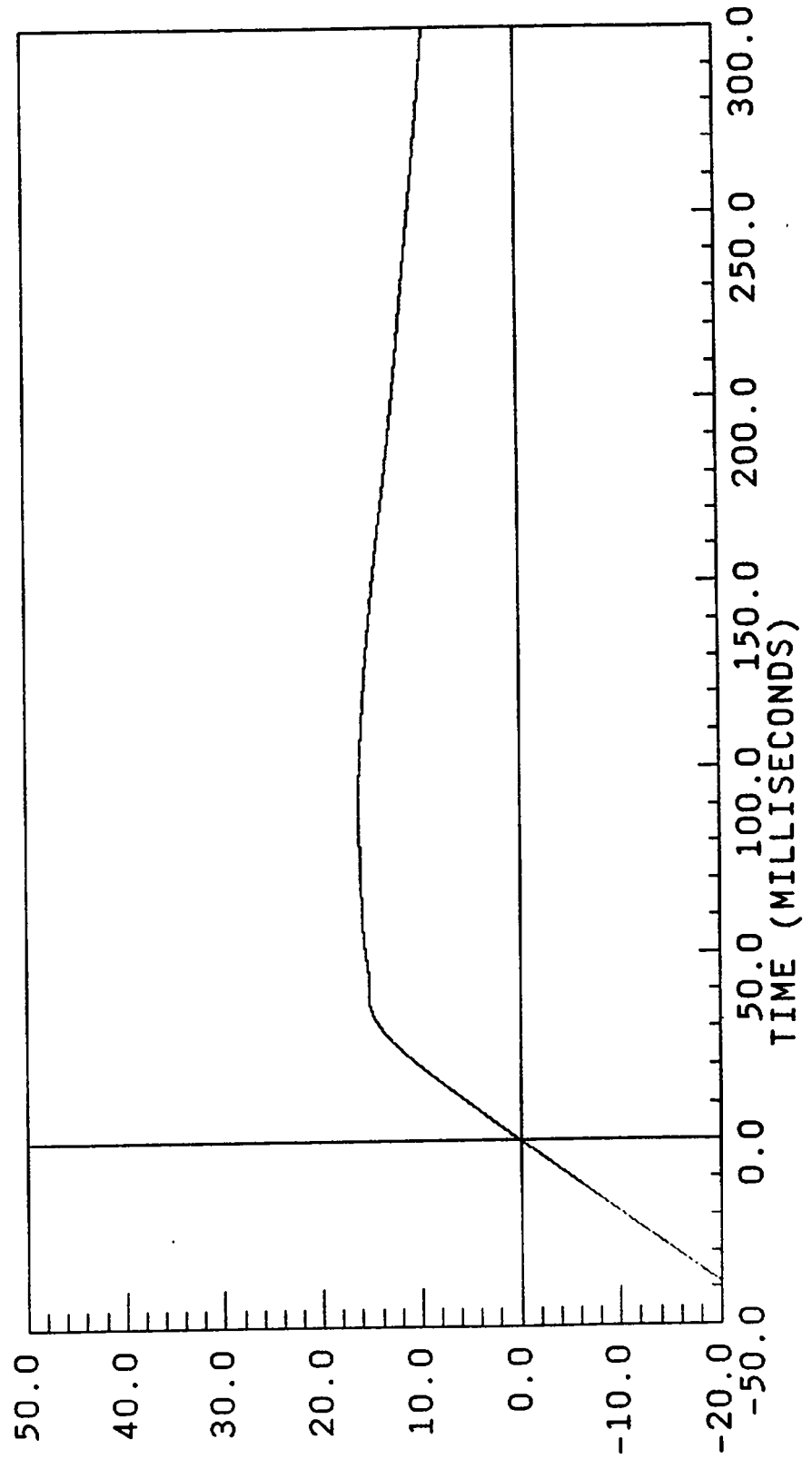
XL AXIS
YMIN = -2.652939 at 168.2250
YMAX = 29.25875 at -26.32500



D898-19.DAT

29.30 mph

ACC PACK #3(X)
COMPUTED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -23.19899 at 168.2250
YMAX = 16.19530 at 90.60001



DISPLACEMENT * INCHES

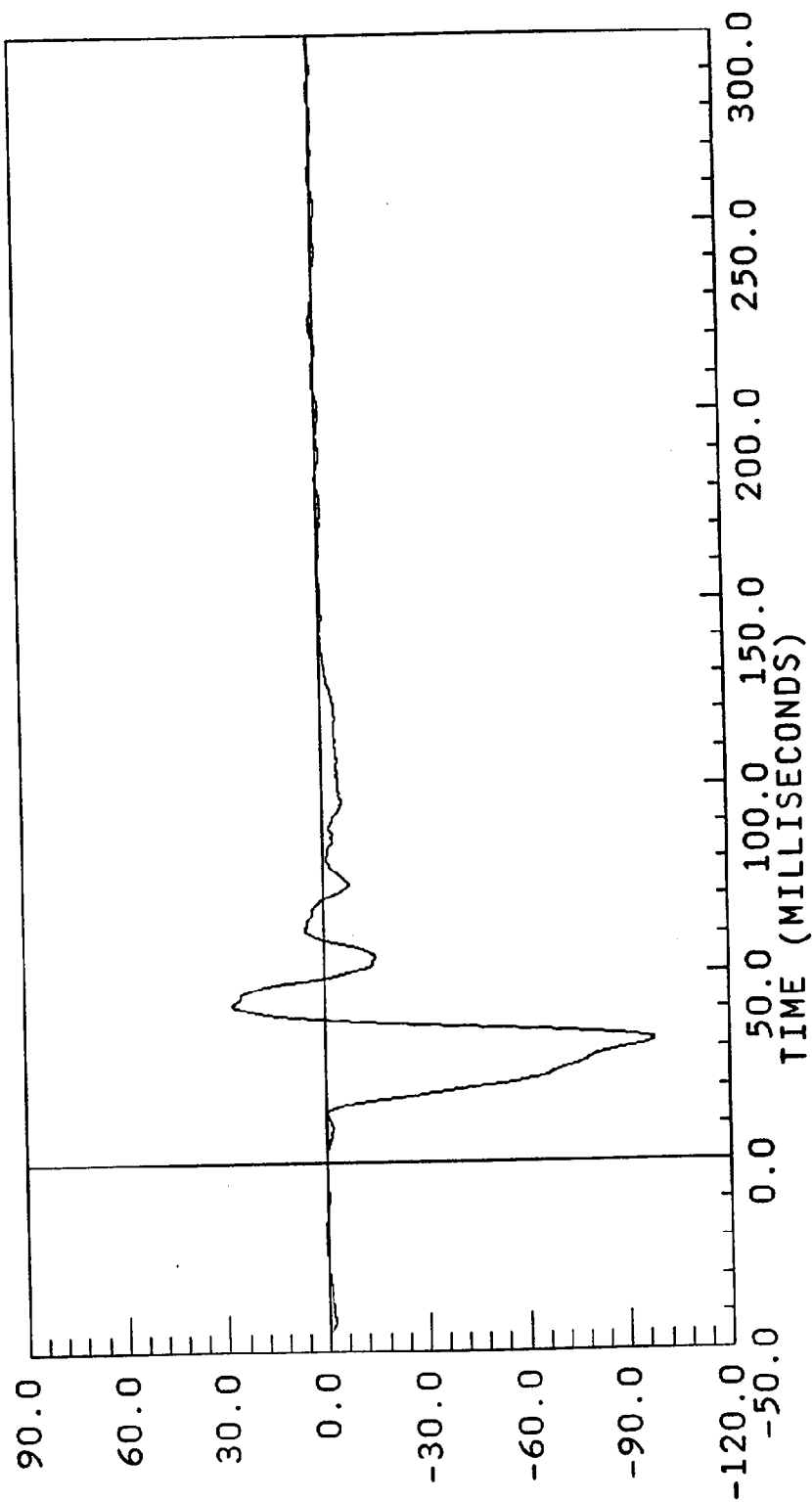
B-11

7715-6

BW898-20.DAT

29.30 mph

ACC PACK #4(X) XL AXIS
FILTERED YMIN = -97.85103 at 31.80000
FILTER CUTOFF: 100Hz YMAX = 27.69268 at 41.70000

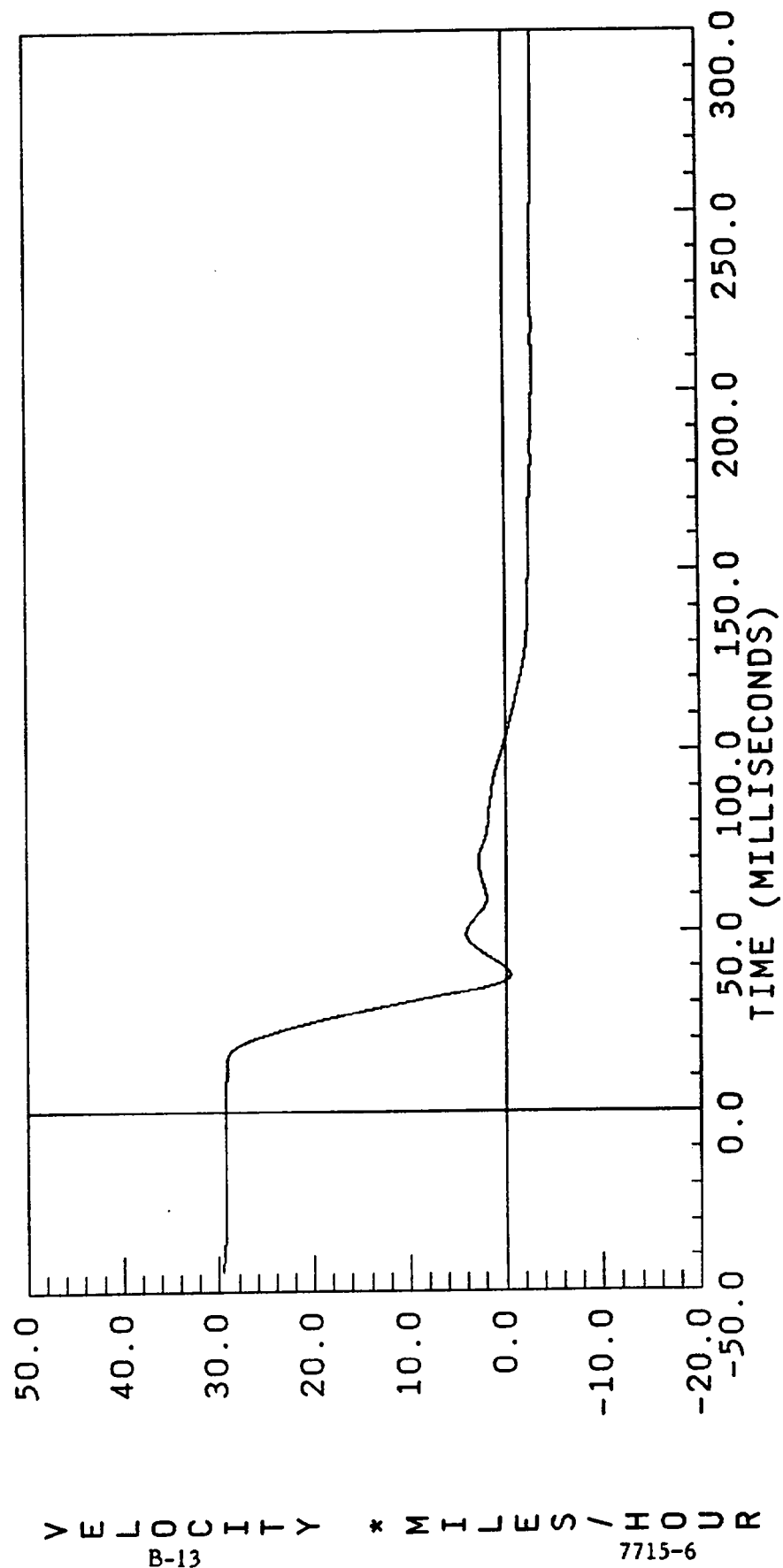


ACCELERATION * G, S *
B-12 7715-6

V898-20.DAT

29.30 mph

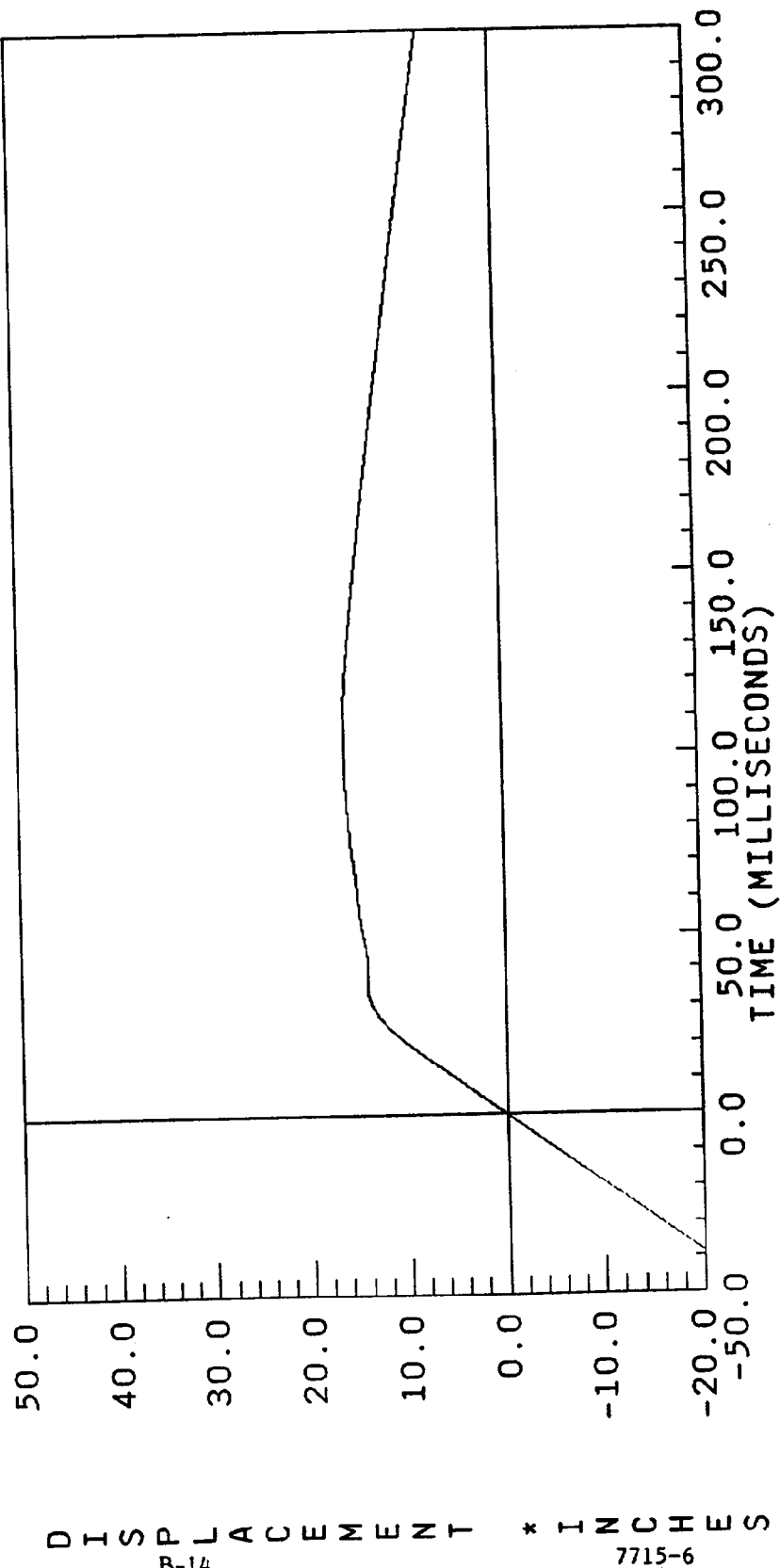
ACC PACK #4(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -3.077163 at 281.2500
YMAX = 29.58230 at 41.70000



D898-20.DAT

29.30 mph

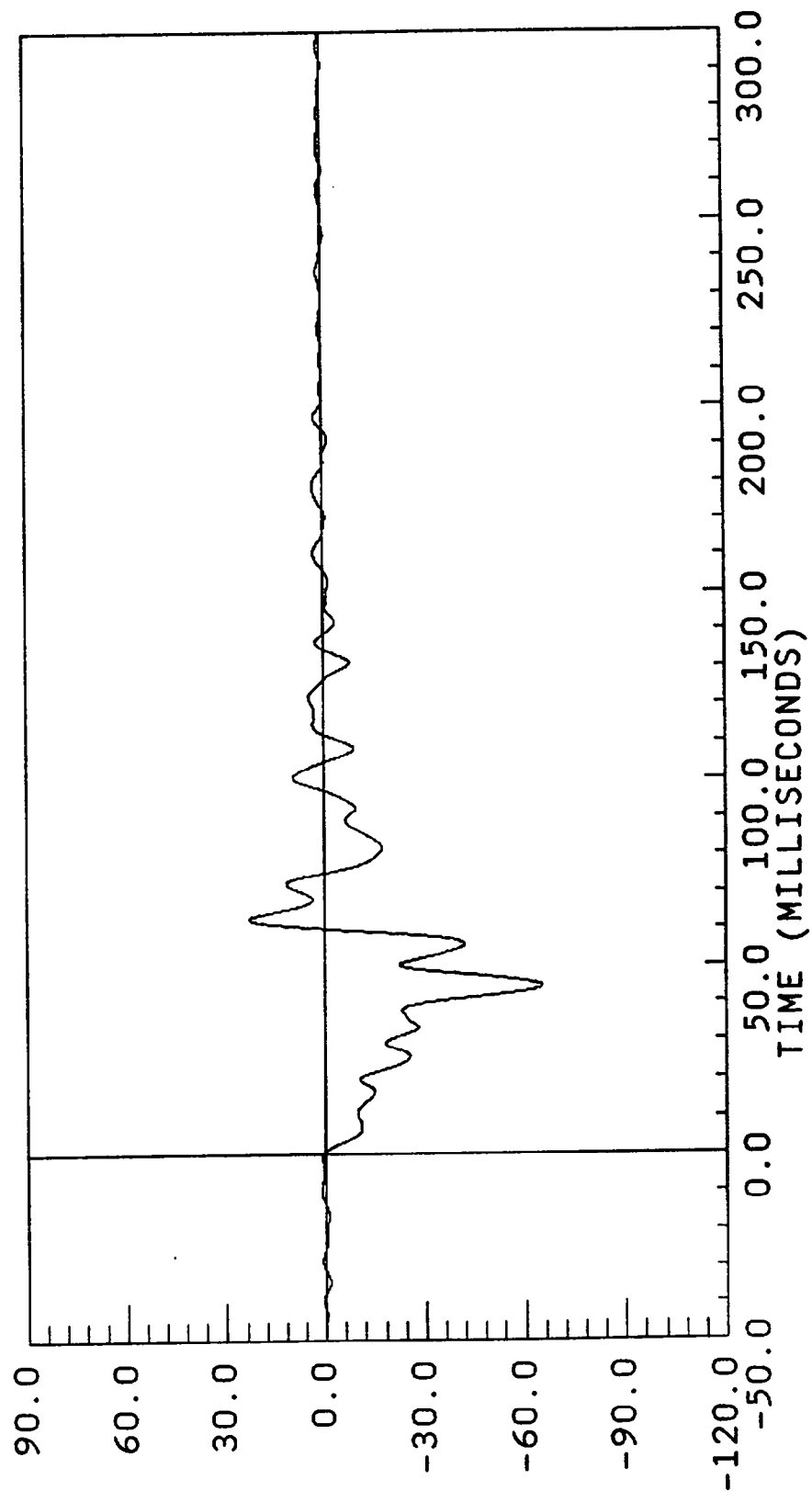
ACC PACK #4(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -23.17384 at 281.2500
YMAX = 16.30653 at 102.9750



BW898-21.DAT

29.30 mph

ACC PACK #5(X)
FILTERED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -65.39252 at 44.40000
YMAX = 22.93591 at 62.70000

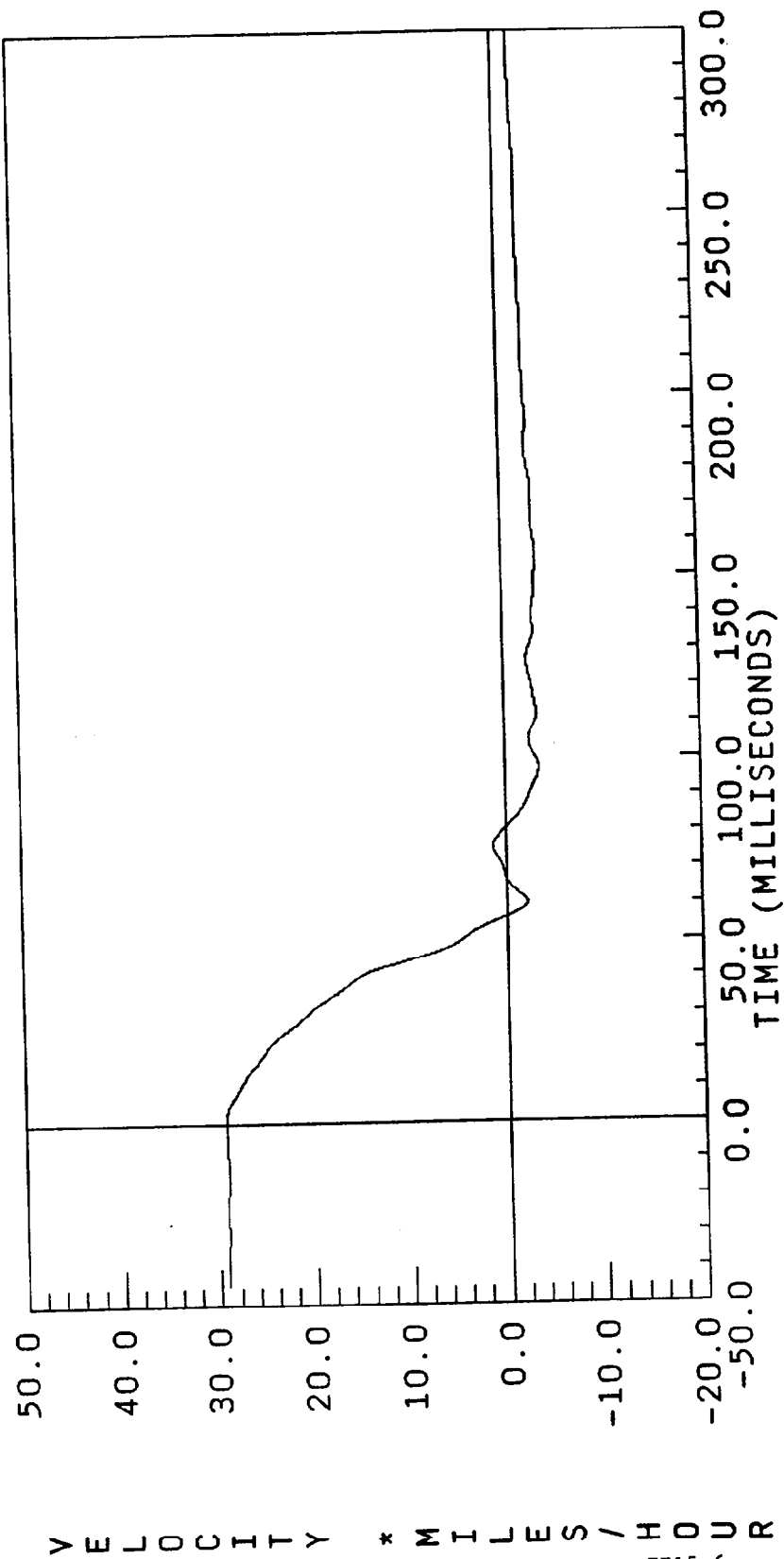


ACCELERATION * G * S *
B-15 7715-6

V898-21.DAT

29.30 mph

ACC PACK #5(X)
COMPUTED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -3.577344 at 156.0750
YMAX = 29.30593 at 0.750000

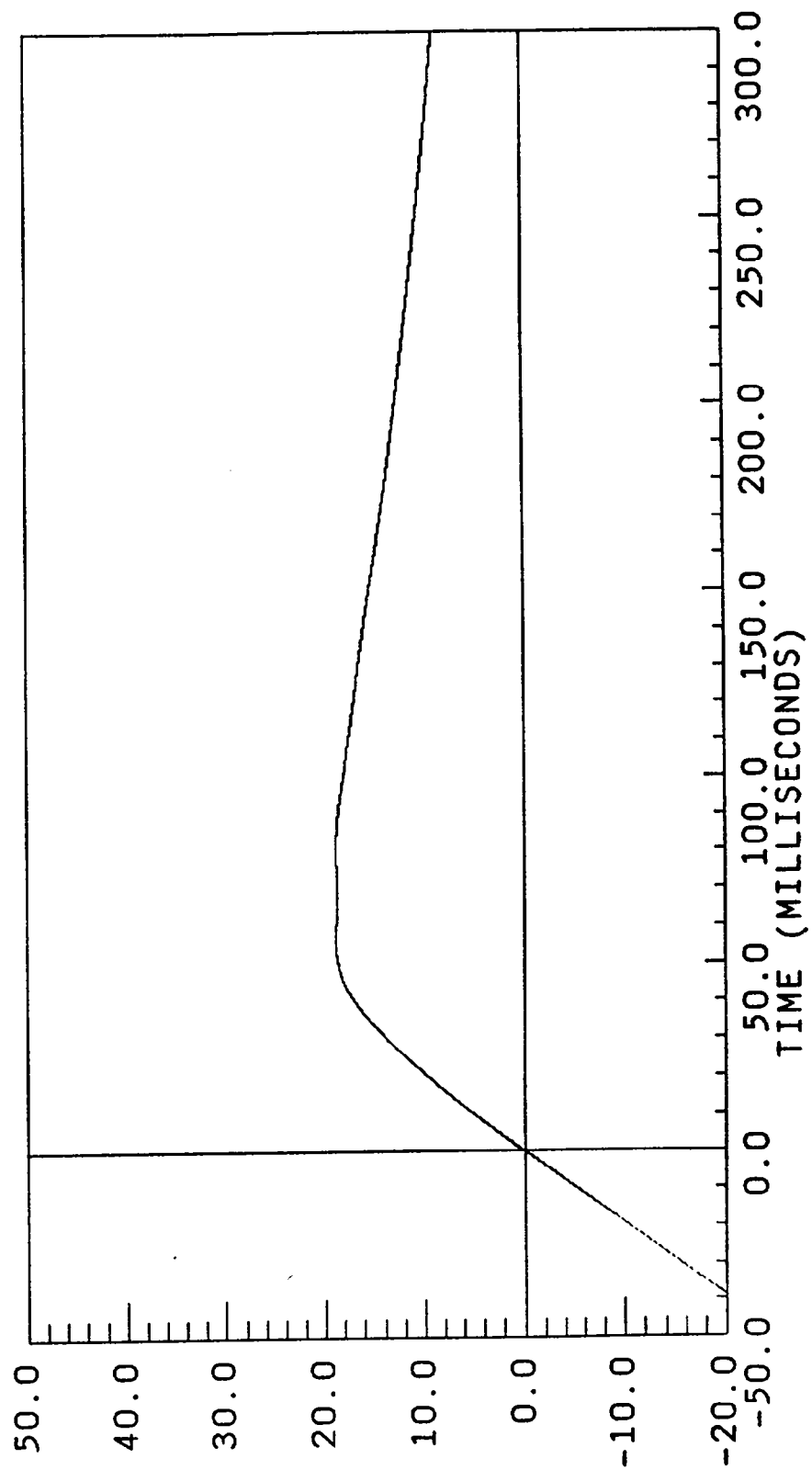


D898-21.DAT

29.30 mph

ACC PACK #5(X)
COMPUTED
FILTER CUTOFF: 100Hz

XL AXIS
YMIN = -23.07344 at 156.0750
YMAX = 18.89378 at 56.25000



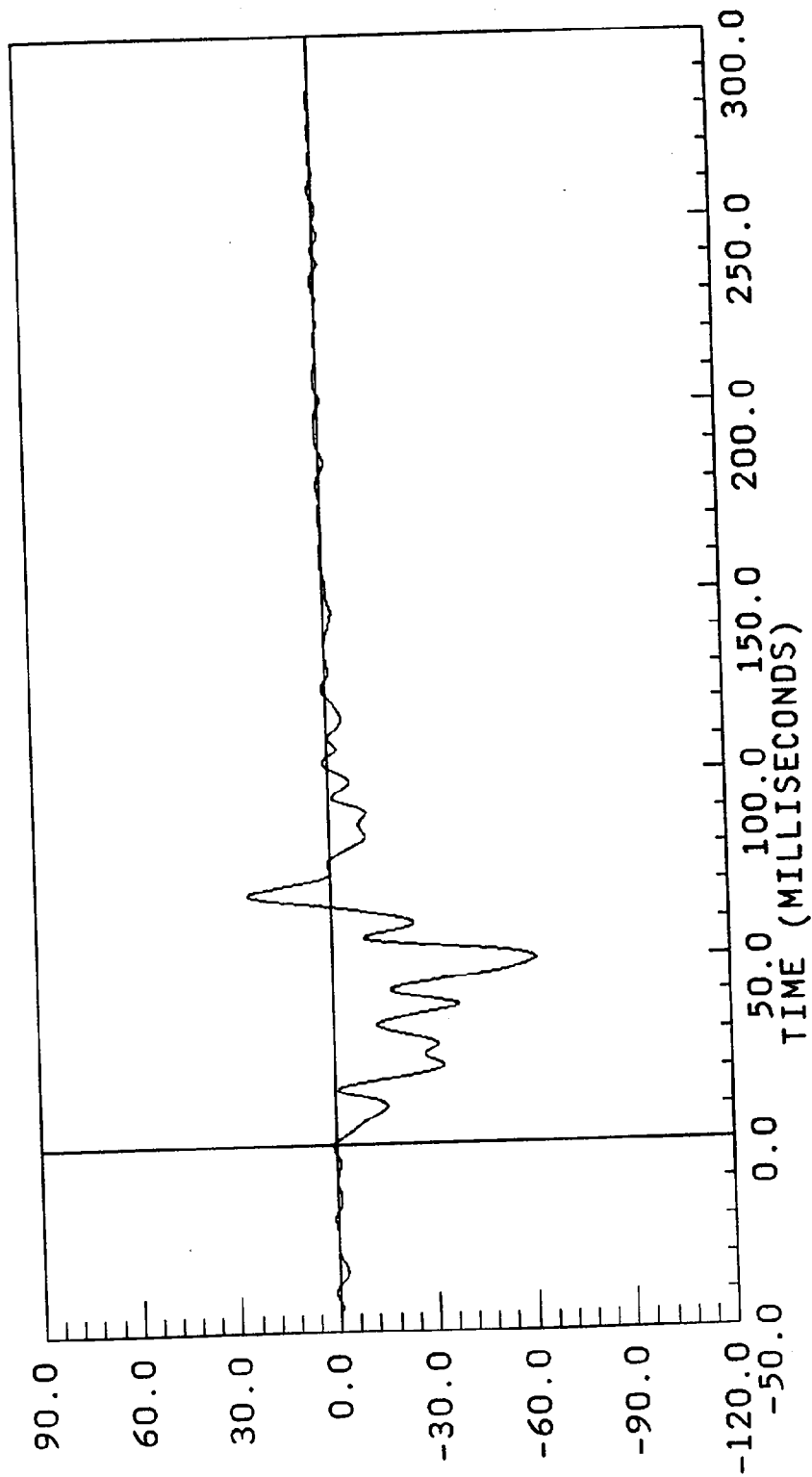
DISPLACEMENT * INCHES

BW898-22.DAT

29.30 mph

ACC PACK #6(X)
FILTERED
FILTER CUTOFF: 100Hz

XL AXIS
YMIN = -61.53598 at 49.80000
YMAX = 25.38860 at 67.65000



ACCELERATION * G, S *

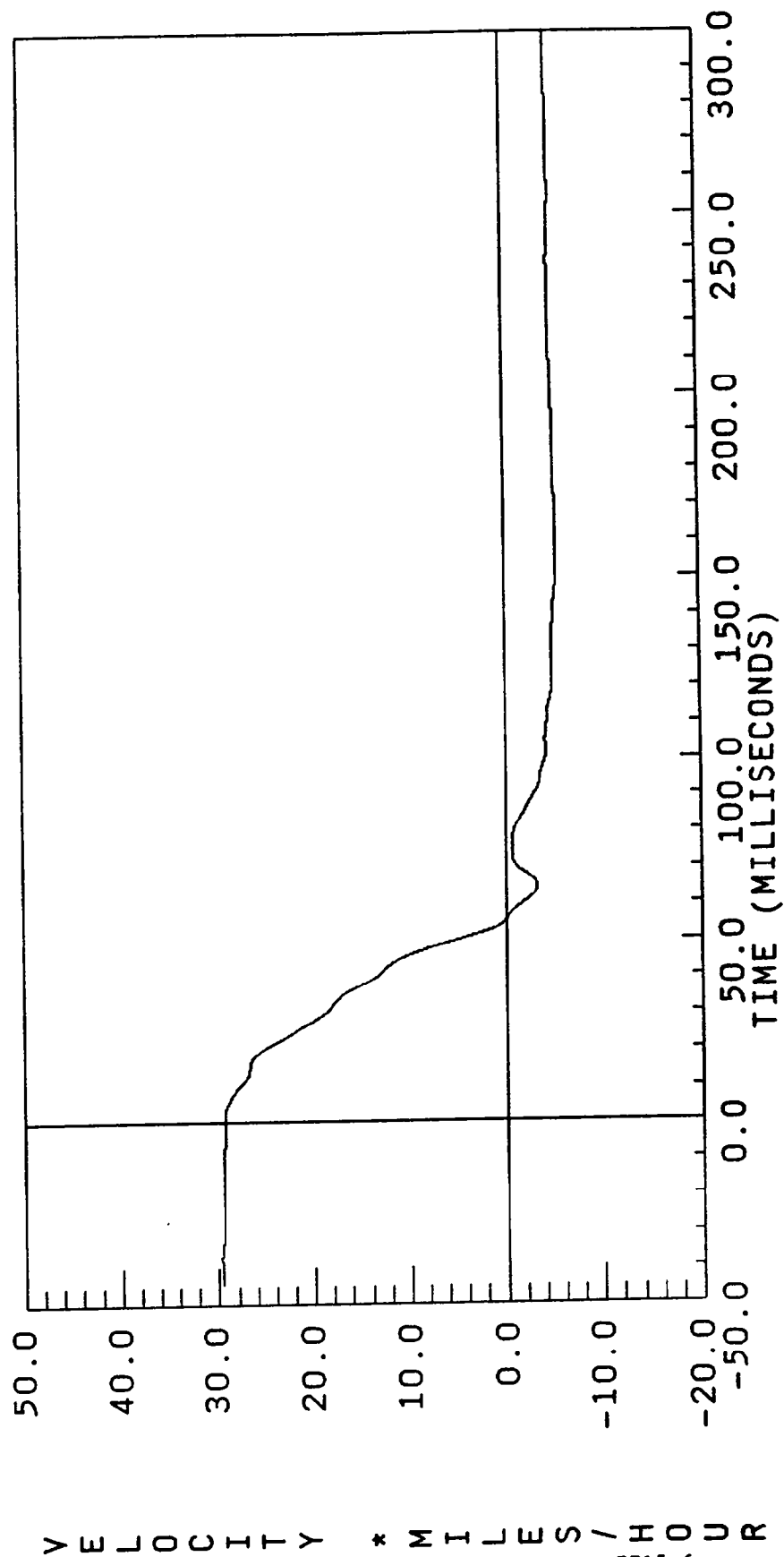
B-18

7715-6

V898-22.DAT

29.30 mph

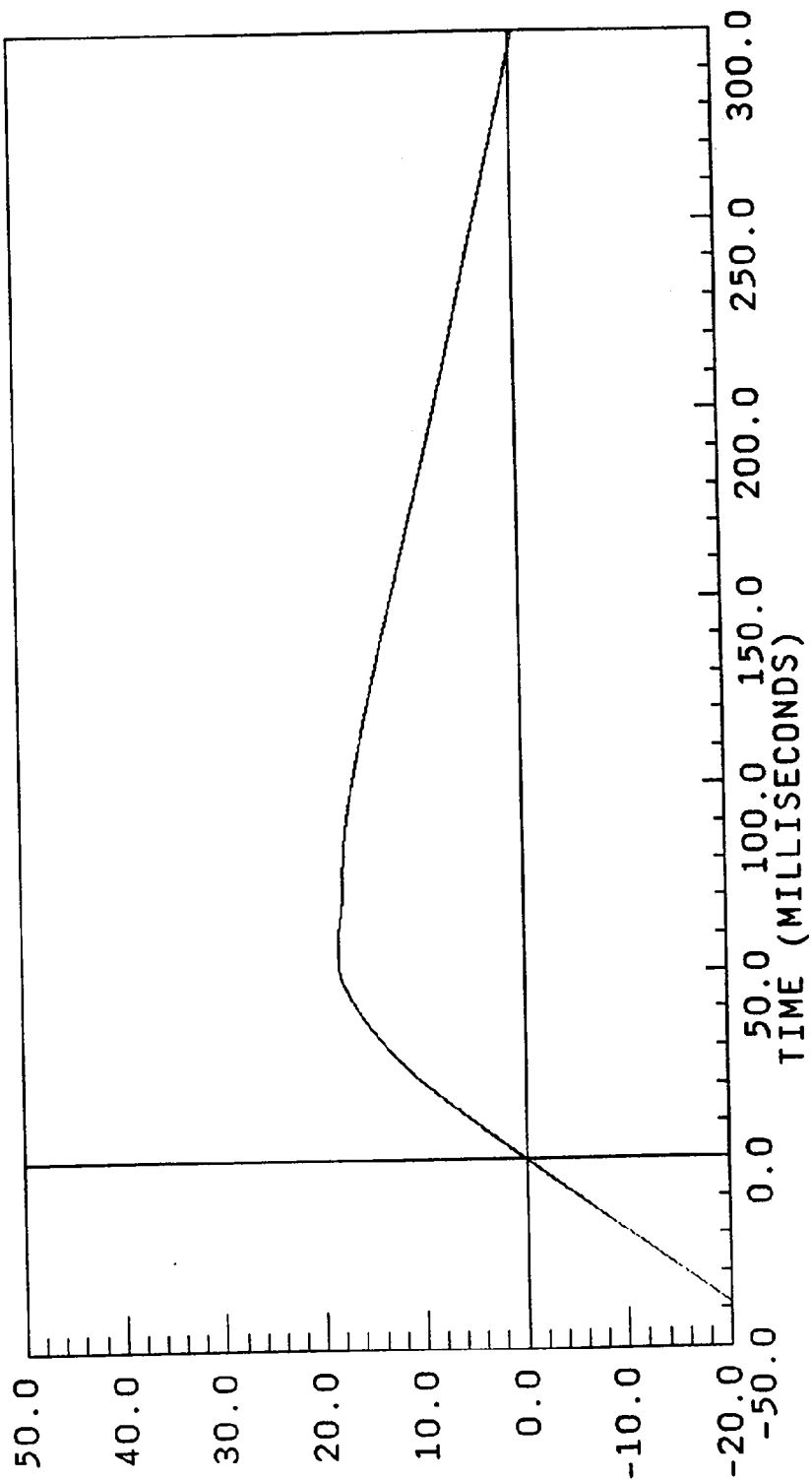
ACC PACK #6(X)
COMPUTED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -5.401714 at 155.6250
YMAX = 29.63748 at -37.42500



D898-22.DAT

29.30 mph

ACC PACK #6(X) XL AXIS
COMPUTED YMIN = -23.27134 at 155.6250
FILTER CUTOFF: 100HZ YMAX = 18.42694 at 54.97500



DISPLACEMENT * INCHES

B-20

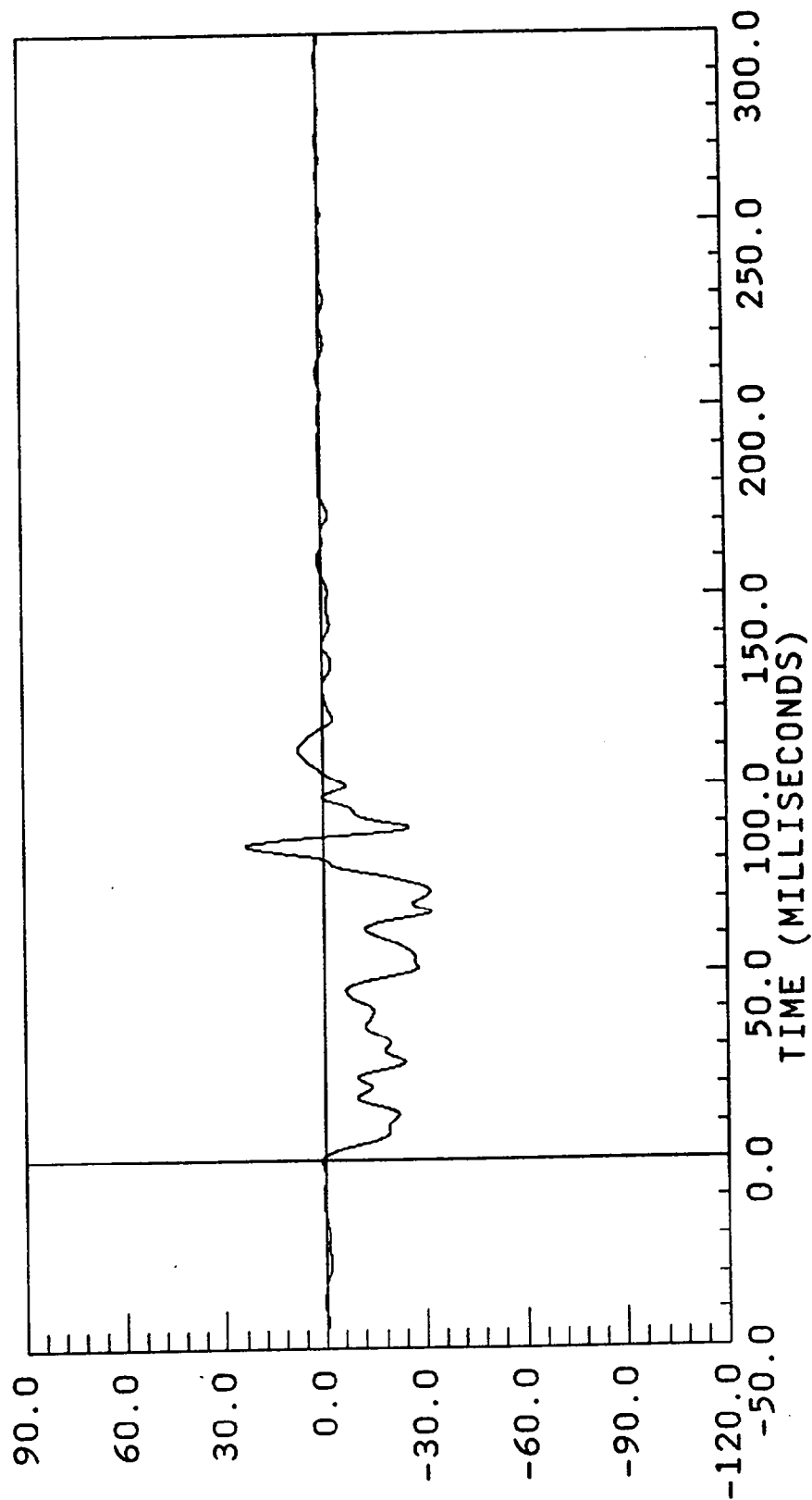
7715-6

BW898-23.DAT

29.30 mph

ACC PACK #7(X)
FILTERED
FILTER CUTOFF: 100HZ

XL AXIS
YMIN = -32.13472 at 66.22501
YMAX = 23.29389 at 84.15000

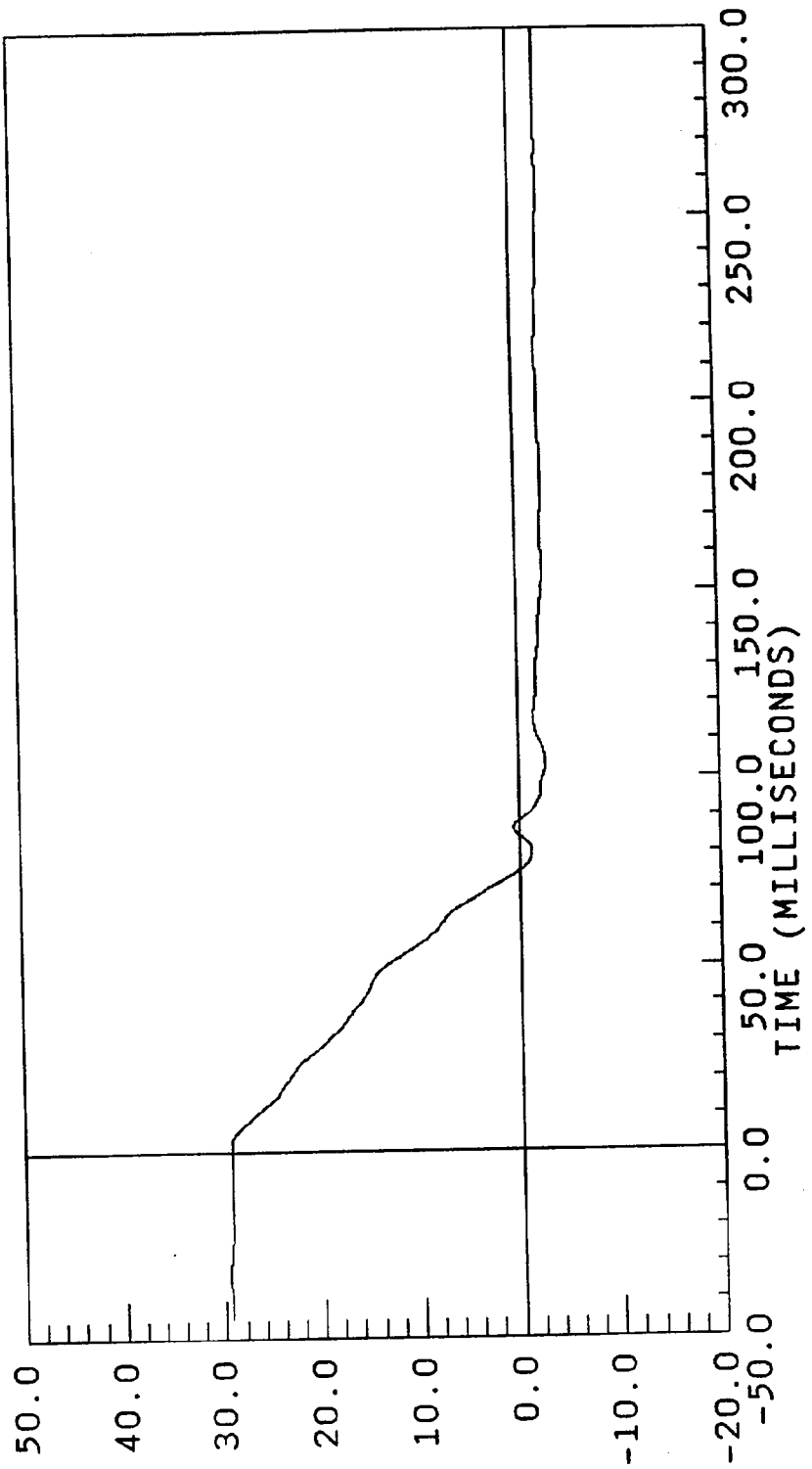


ACCELERATION * G, S *

V898-23.DAT

29.30 mph

ACC PACK #7(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -2.827754 at 254.5500
YMAX = 29.48670 at -32.55000

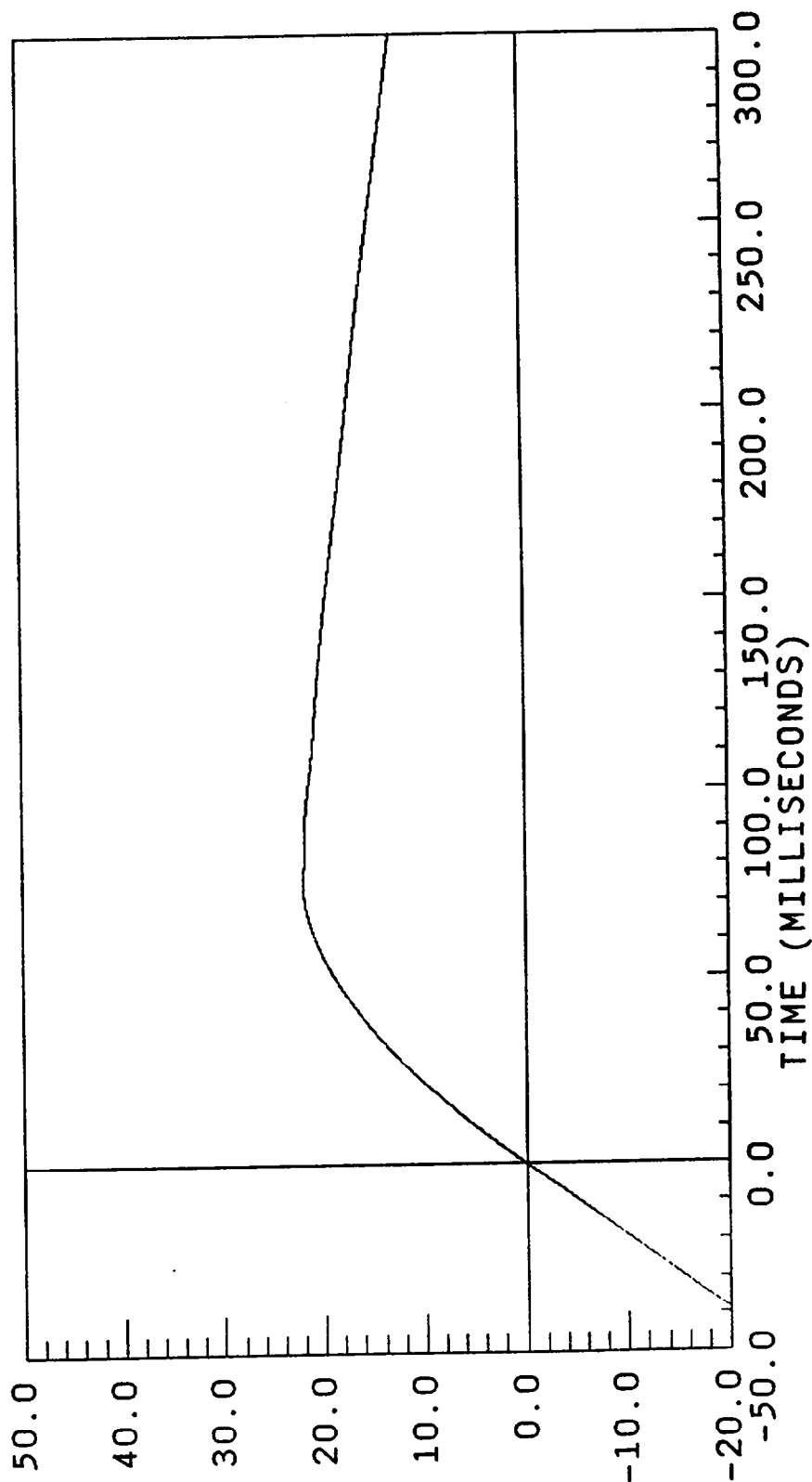


VELOCITY * MILES / HOUR

29.30 mph

ACC PACK #7(X)
COMPUTED
FILTER CUTOFF: 100HZ

XL AXIS
YMIN = -23.19470 at 254.5500
YMAX = 21.97918 at 74.85001

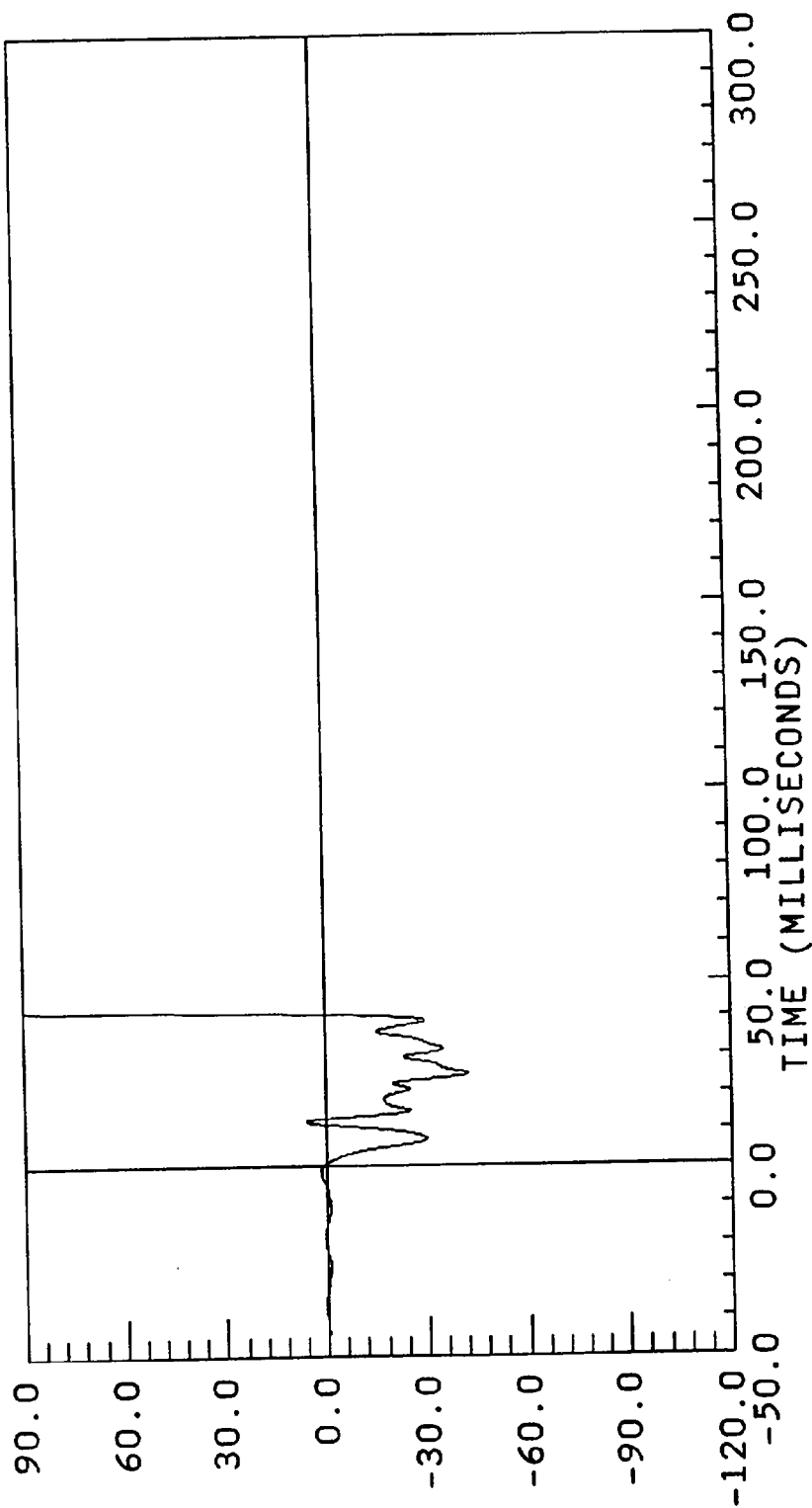


DISPLACEMENT * INCHES

BW898-24.DAT

29.30 mph

ACC PACK #8(X)
FILTERED
FILTER CUTOFF: 100HZ
DATA CABLE CUT - DATA QUESTIONABLE AFTER 42 MILLISECONDS.
XL AXIS
YMIN = -42.48846 at 24.90000
YMAX = 469.9805 at 47.10000



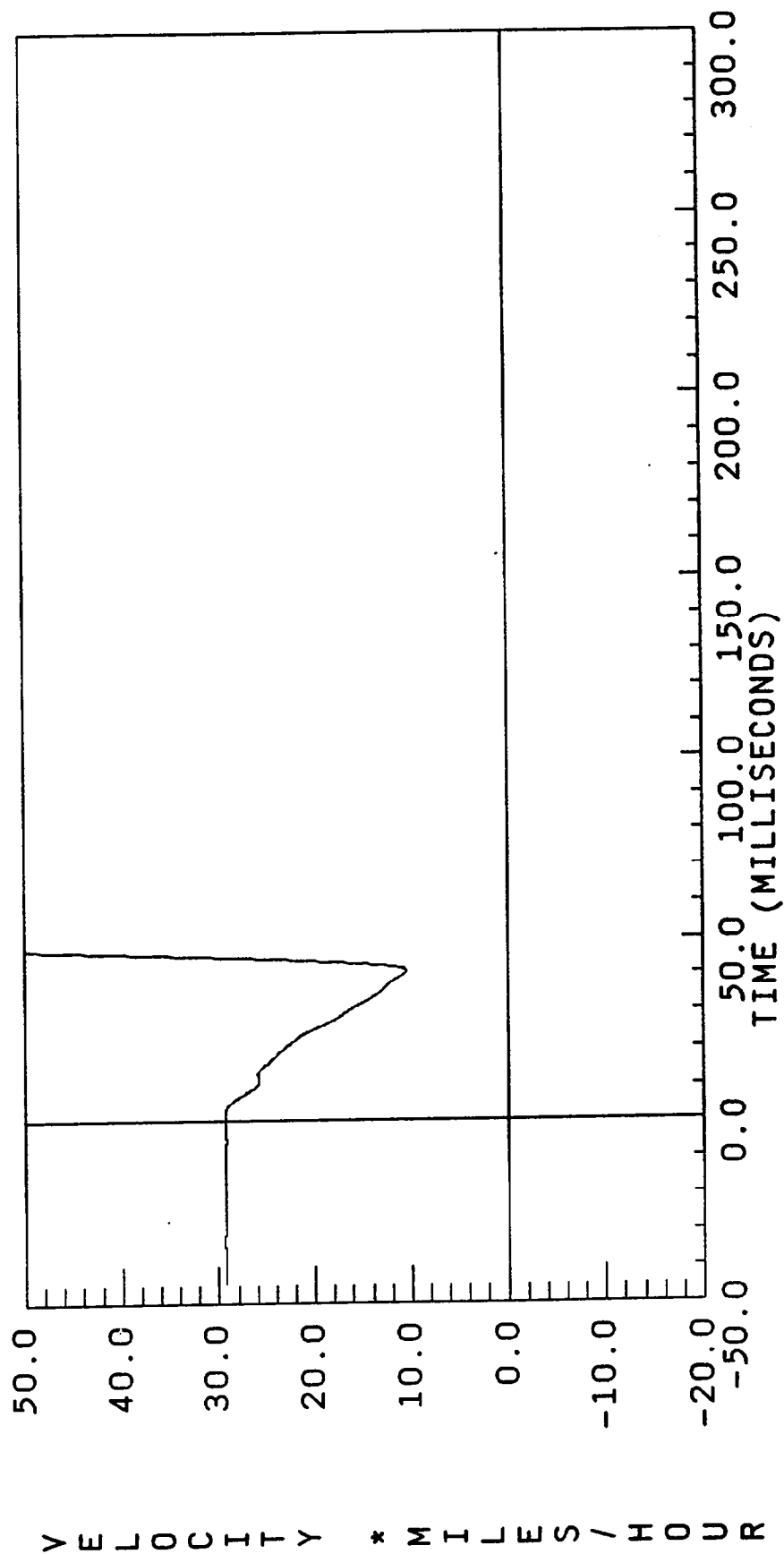
ACCELERATION * G, S *
B-24 7715-6

V898-24.DAT

29.30 mph

ACC PACK #8(X)
COMPUTED
FILTER CUTOFF: 100Hz
DATA CABLE CUT

XL AXIS
YMIN = 10.39658 at 41.02500
YMAX = 2560.580 at 300.0000

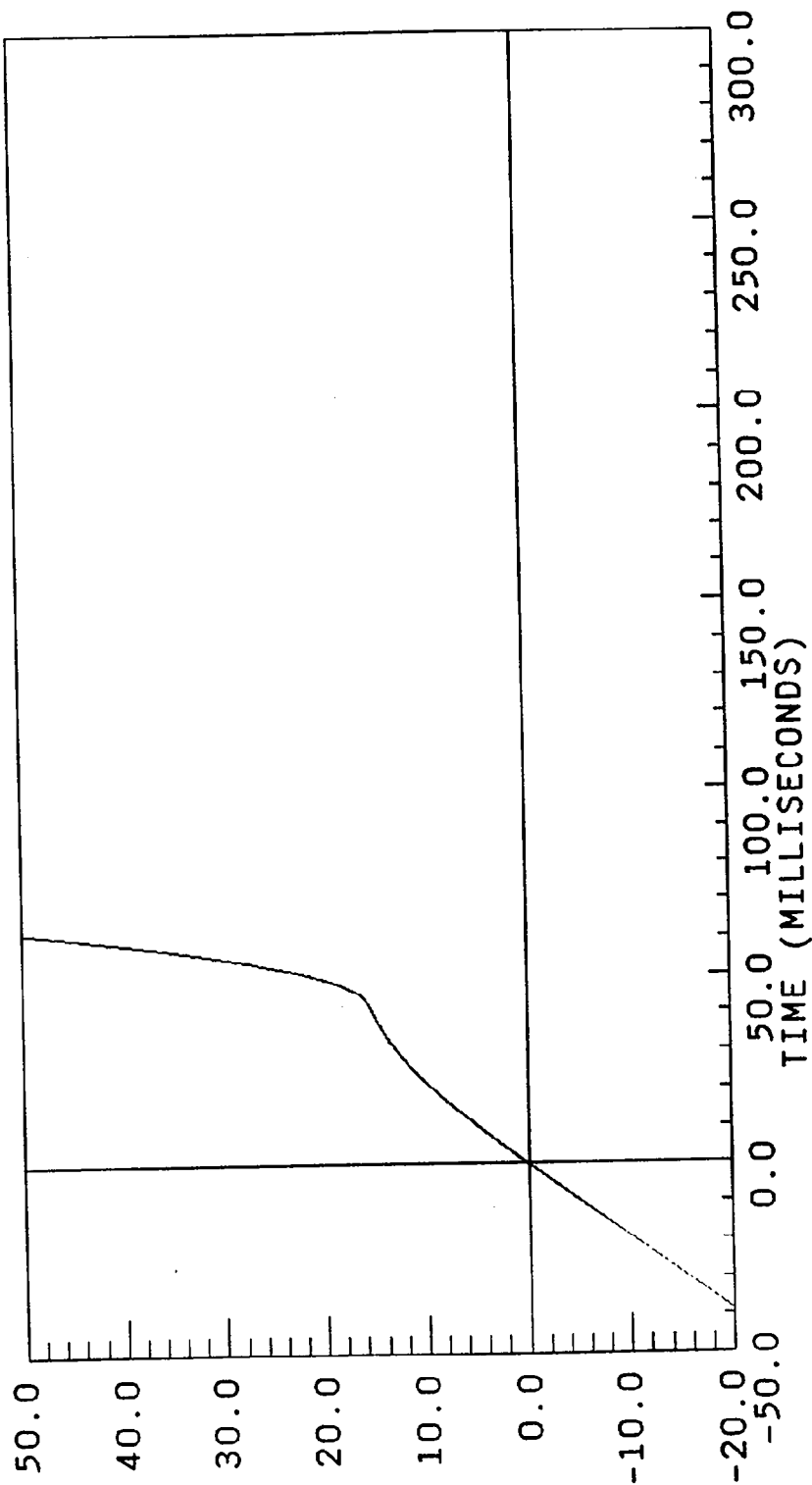


D898-24.DAT

29.30 mph

ACC PACK #8(X)
COMPUTED
FILTER CUTOFF: 100Hz
DATA CABLE CUT

XL AXIS
YMIN = -23.13641 at 41.02500
YMAX = 5828.675 at 300.0000

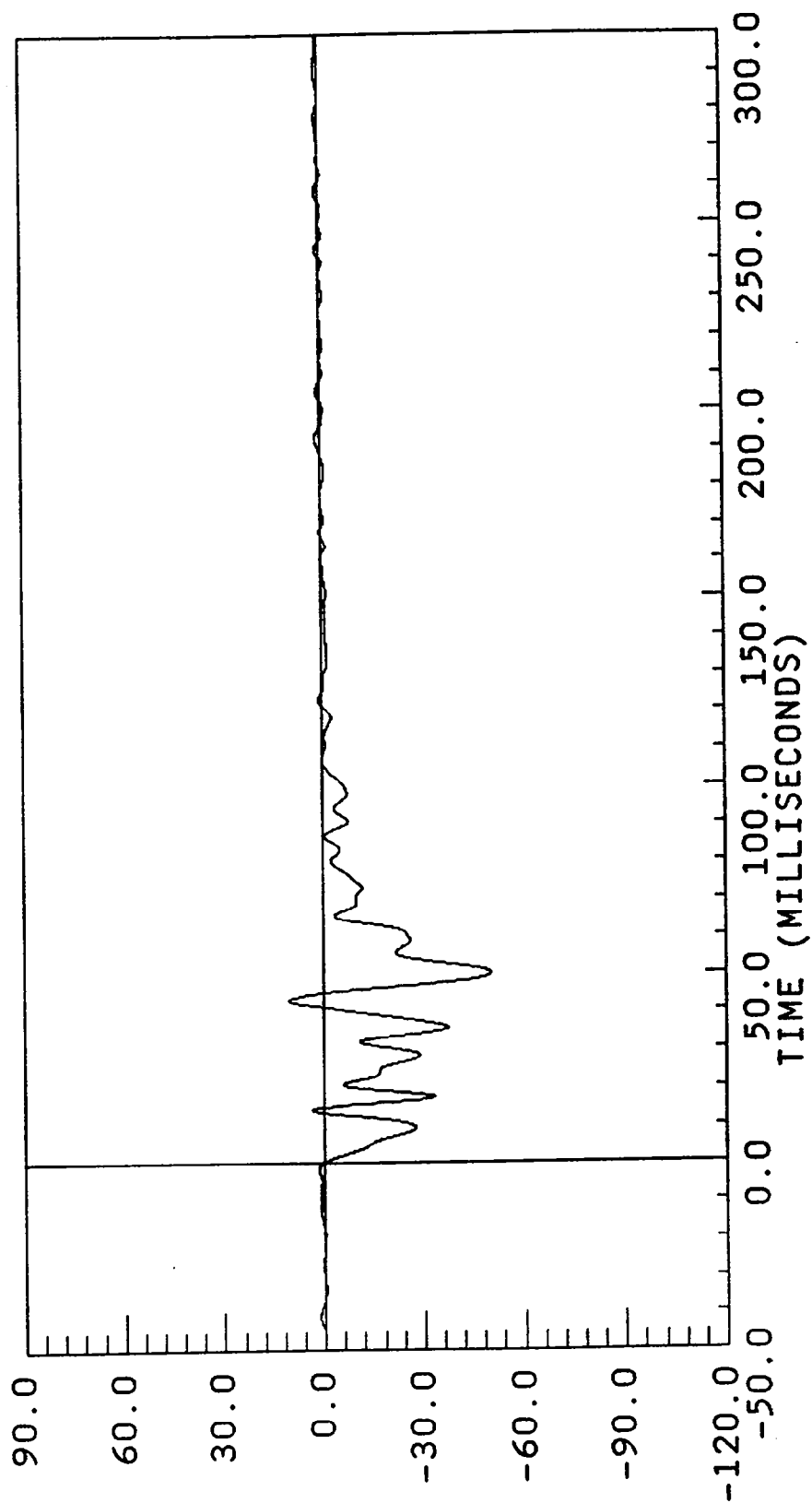


BW898-25.DAT

29.30 mph

ACC PACK #9(X)
FILTERED
FILTER CUTOFF: 100Hz

XL AXIS
YMIN = -50.19764 at 50.10000
YMAX = 10.33828 at 42.97500

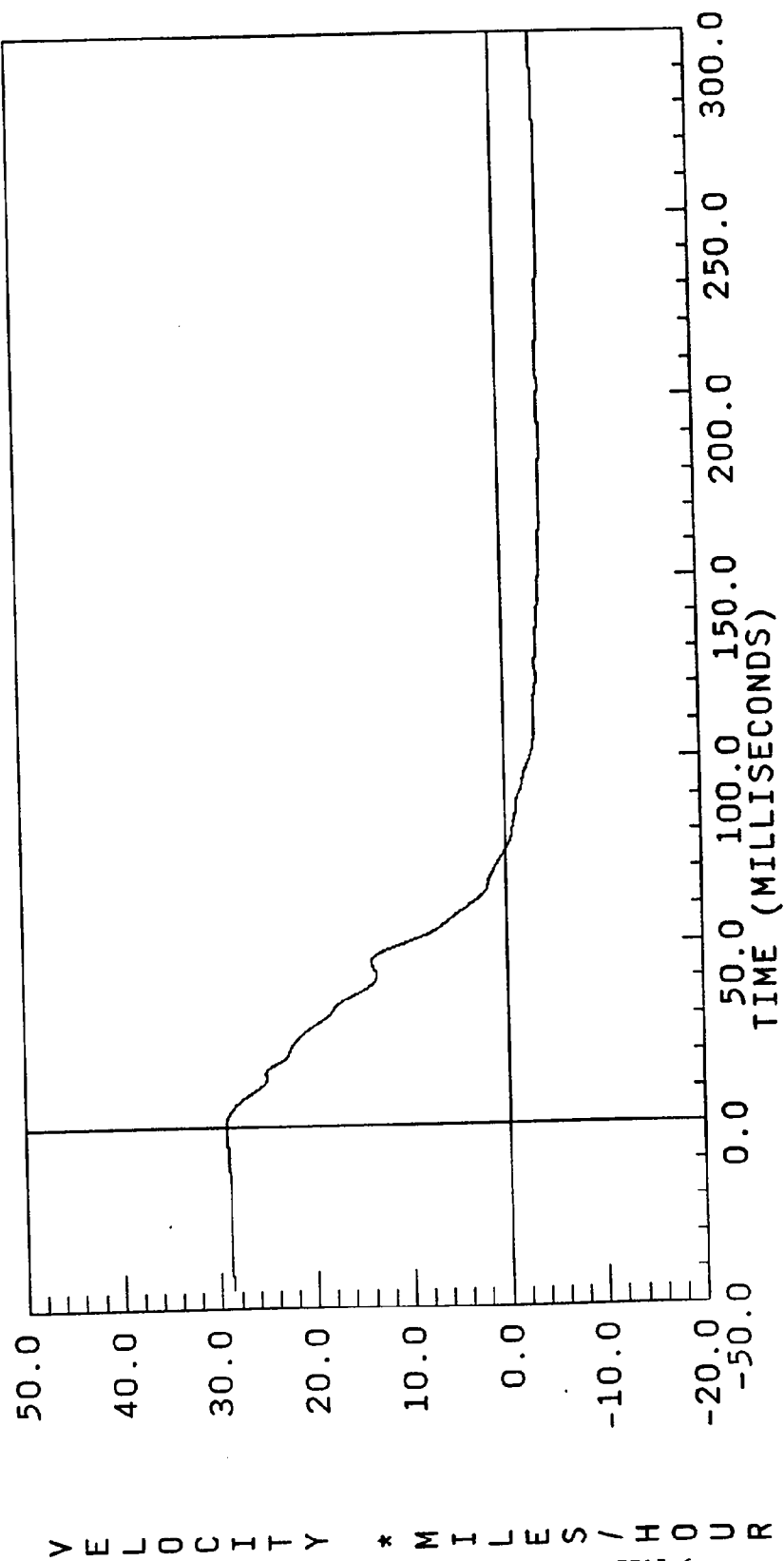


ACCELERATION * G * S *
B-27 7715-6

V898-25.DAT

29.30 mph

ACC PACK #9(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -4.546505 at 255.3750
YMAX = 29.30085 at 0.225000



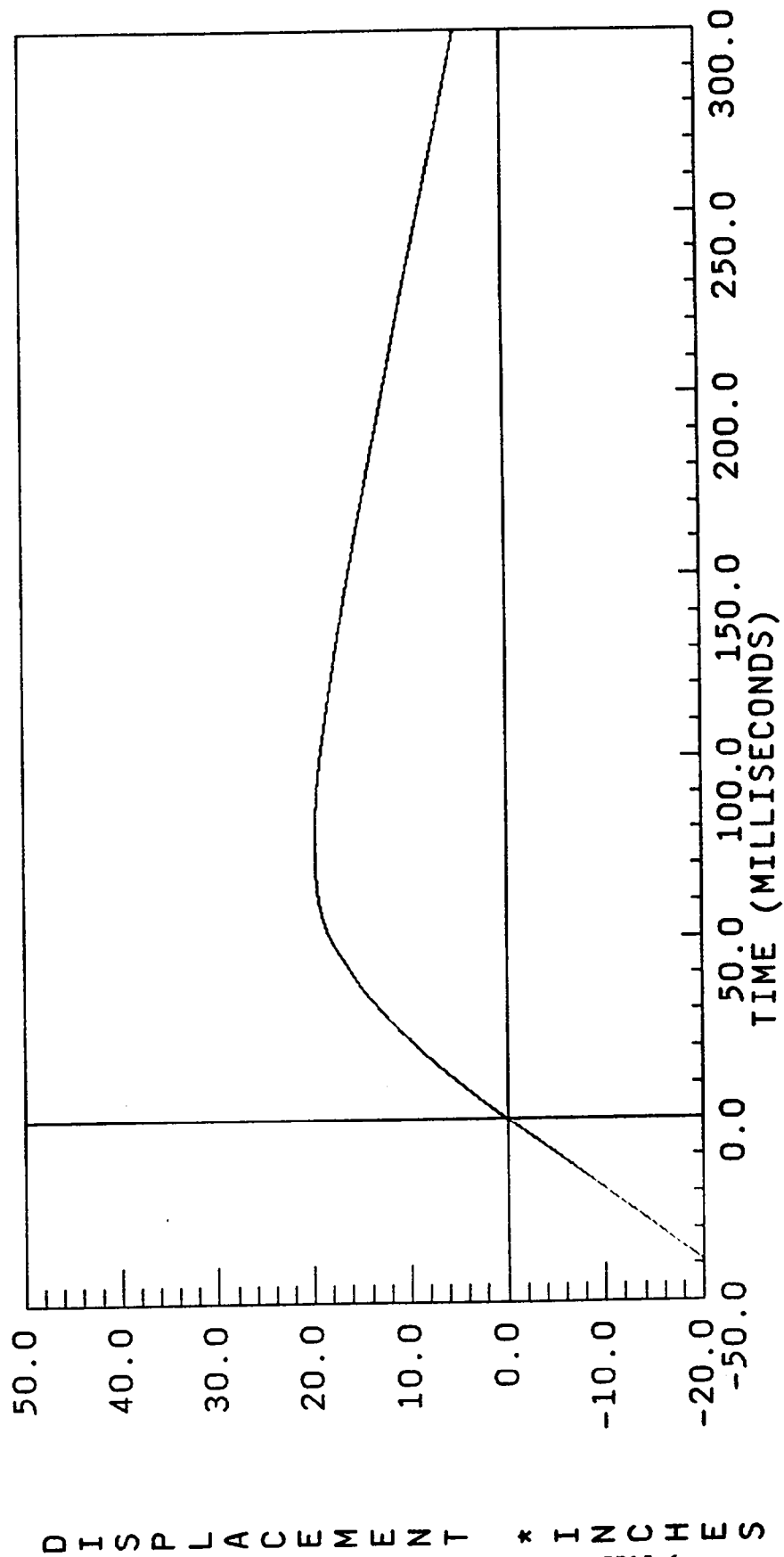
D898-25.DAT

29.30 mph

ACC PACK #9(X)
COMPUTED
FILTER CUTOFF: 100Hz

XL AXIS

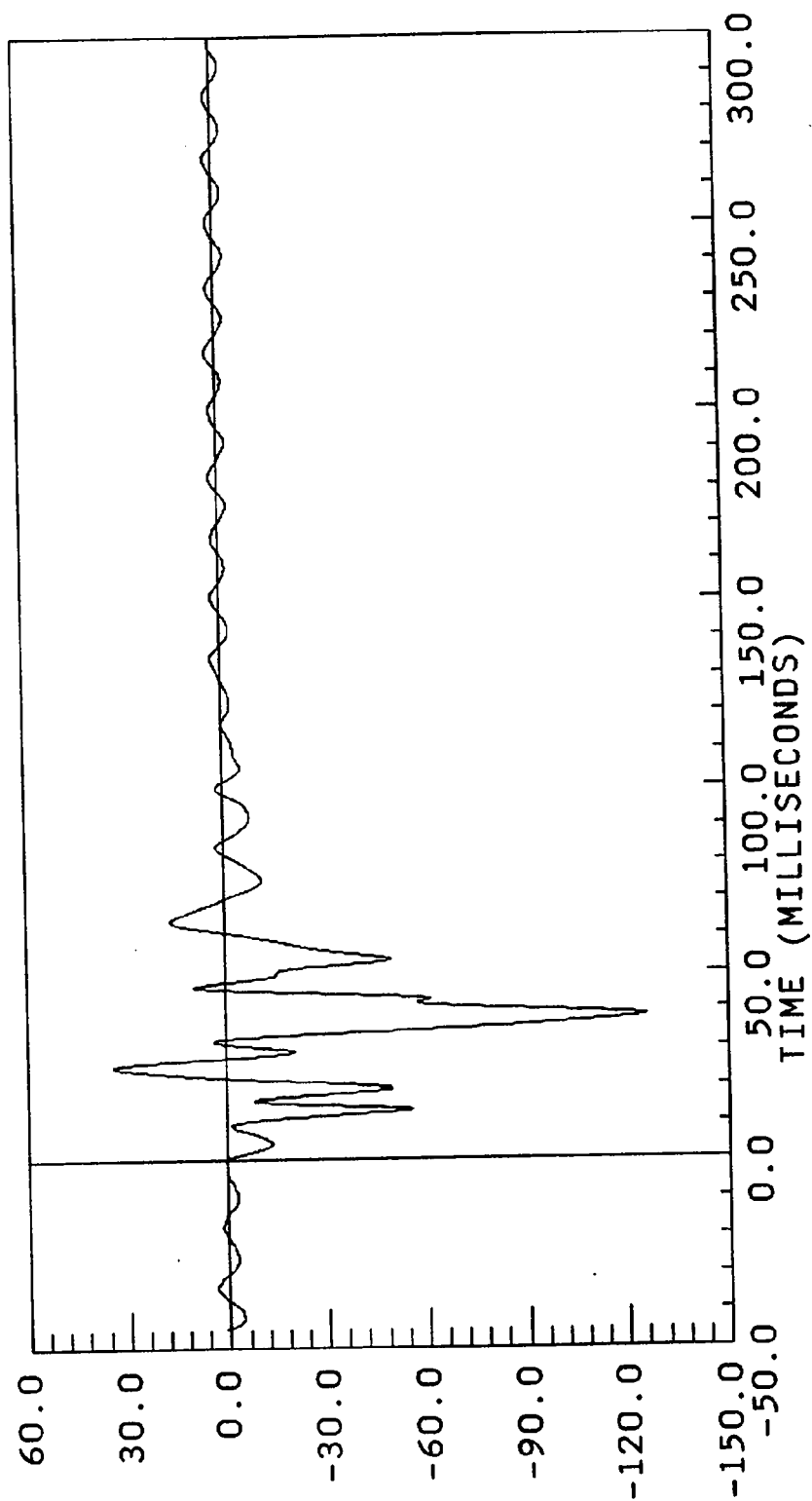
YMIN = -22.90188 at 255.3750
YMAX = 19.75575 at 74.55000



BW898-26.DAT

29.30 mph

ACC PACK #10(X)
FILTERED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -125.9649 at 38.10000
YMAX = 34.14205 at 25.05000

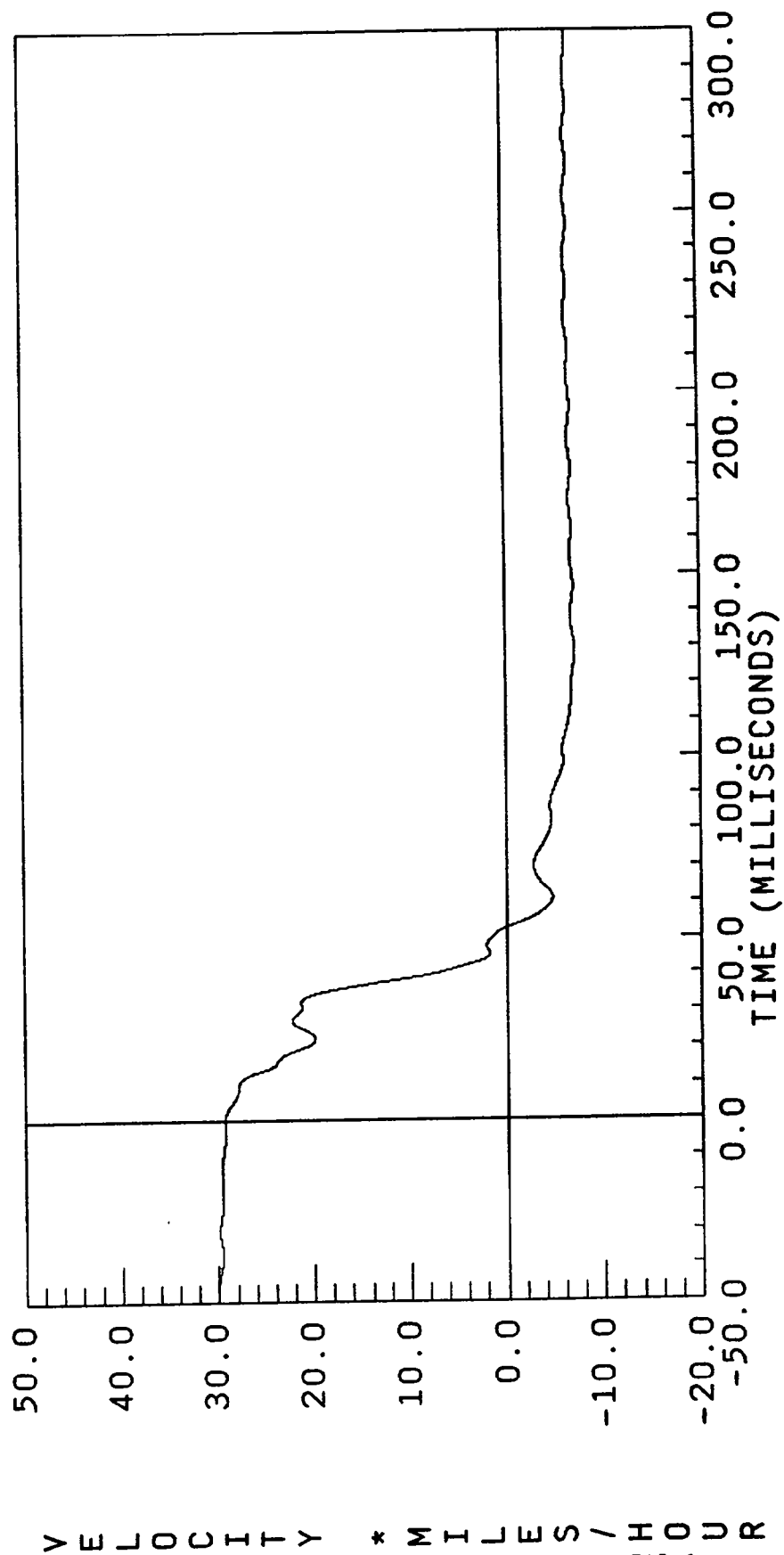


ACCELERATION * G * S
B-30 7715-6

V898-26.DAT

29.30 mph

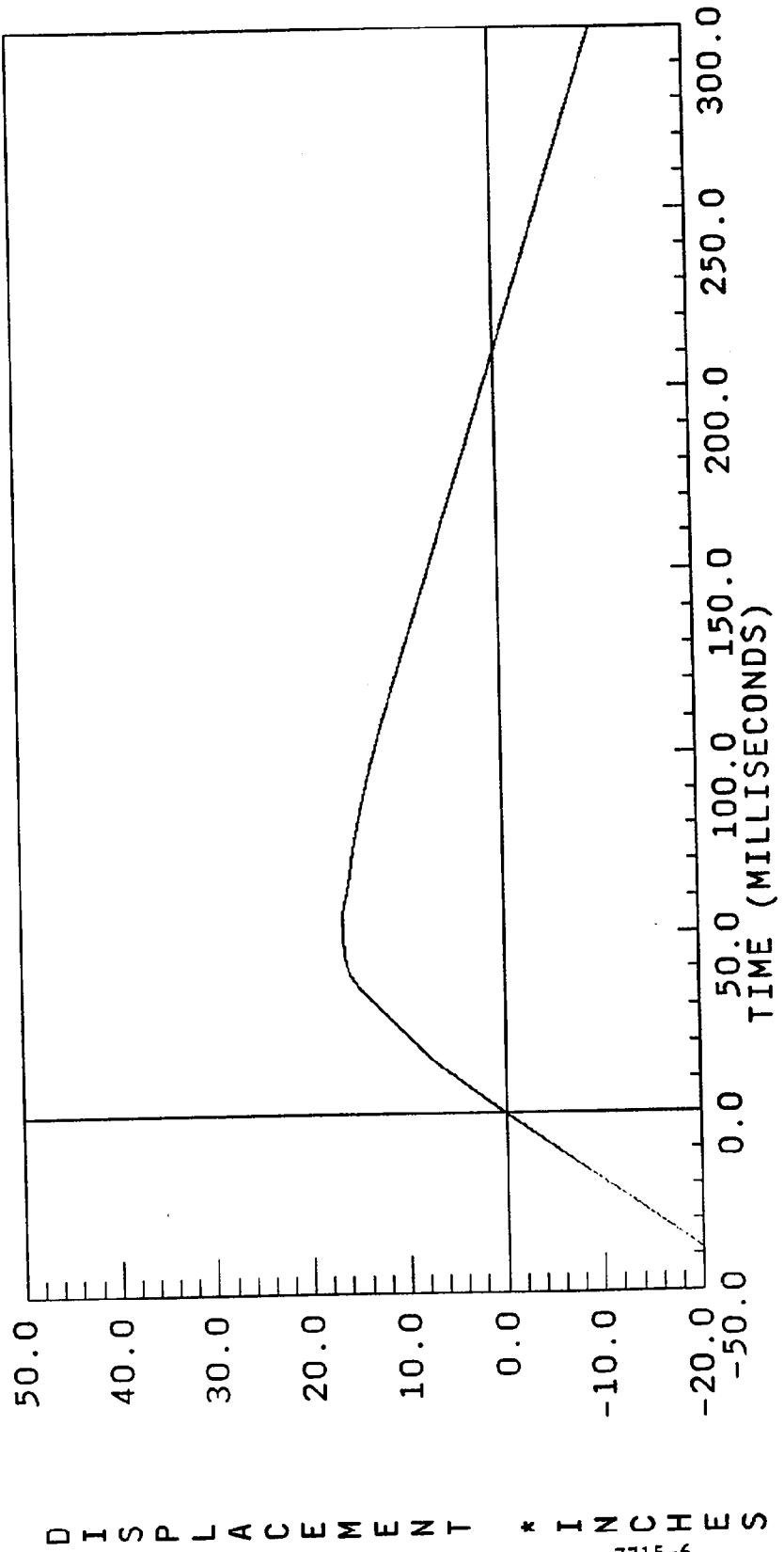
ACC PACK #10(X)
COMPUTED
FILTER CUTOFF: 100Hz
XL AXIS
YMIN = -7.159214 at 128.4750
YMAX = 29.95321 at -44.62500



D898-26.DAT

29.30 mph

ACC PACK #10(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -23.39425 at 128.4750
YMAX = 16.62274 at 52.57500



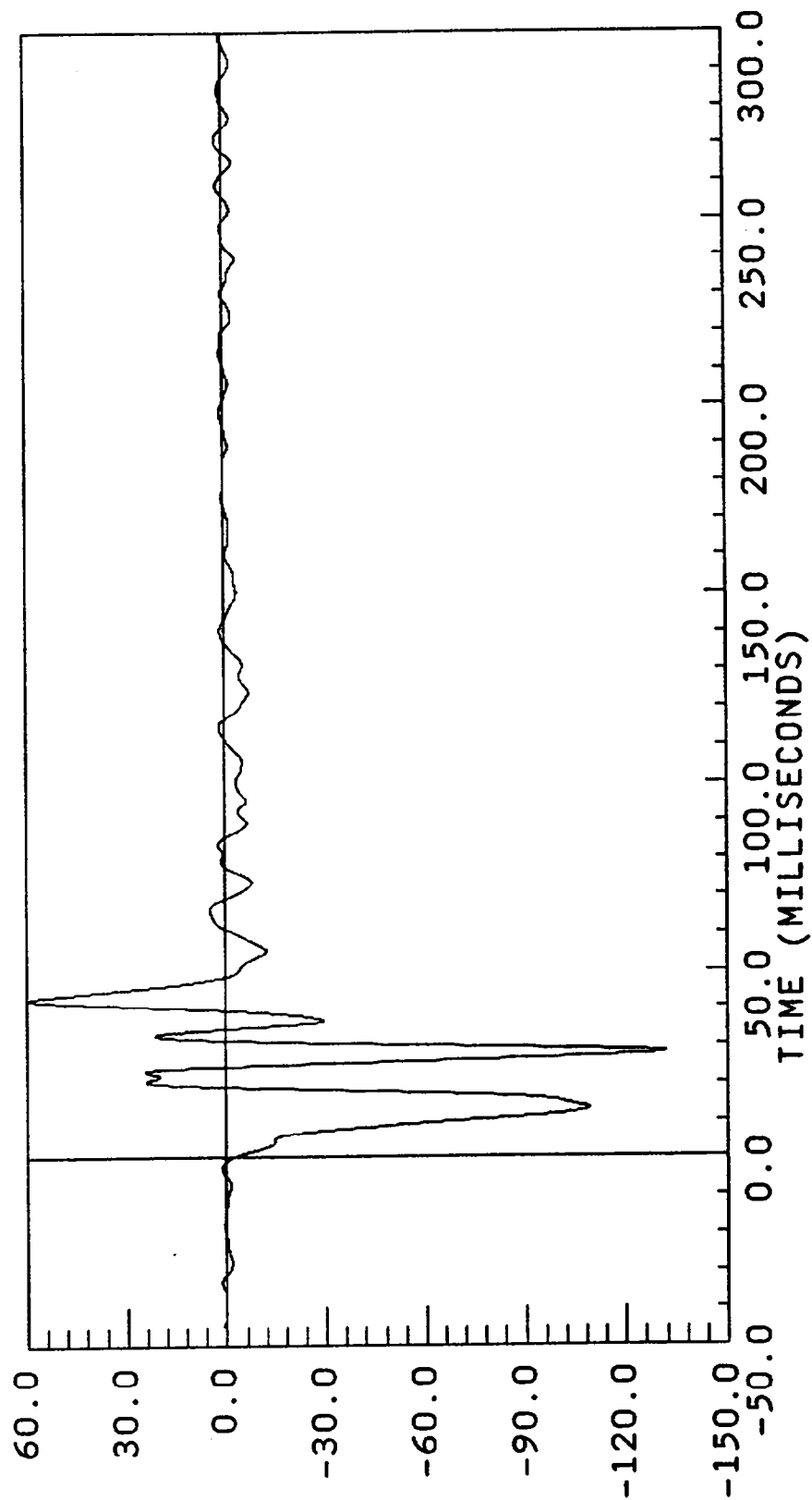
BW898-27.DAT

29.30 mph

ACC PACK #11(X)
FILTERED
FILTER CUTOFF: 100Hz

XL AXIS

YMIN = -131.7708 at 27.97500
YMAX = 59.37344 at 42.45000

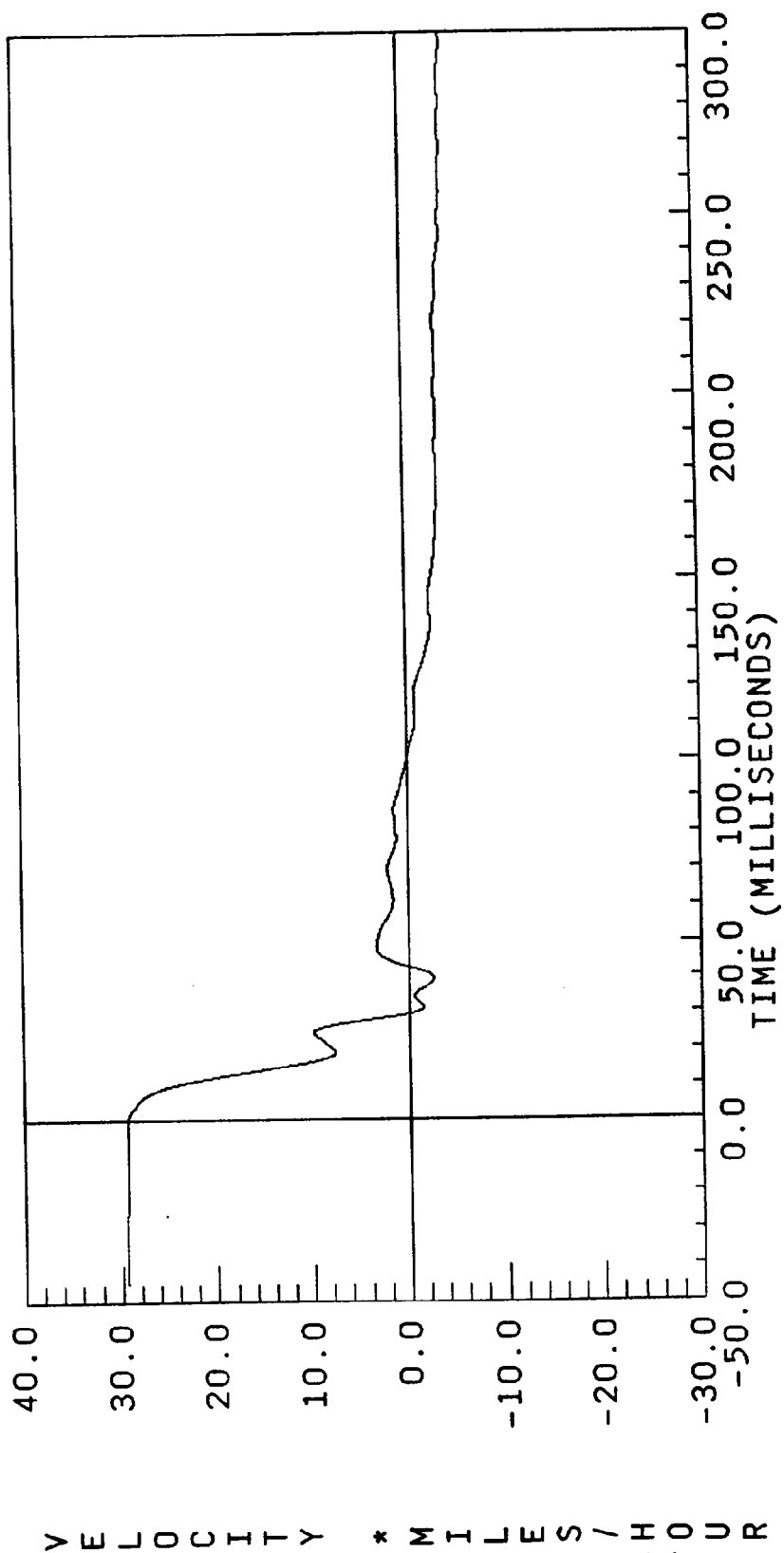


ACCELERATION * G * S *
B-33 7715-6

V898-27.DAT

29.30 mph

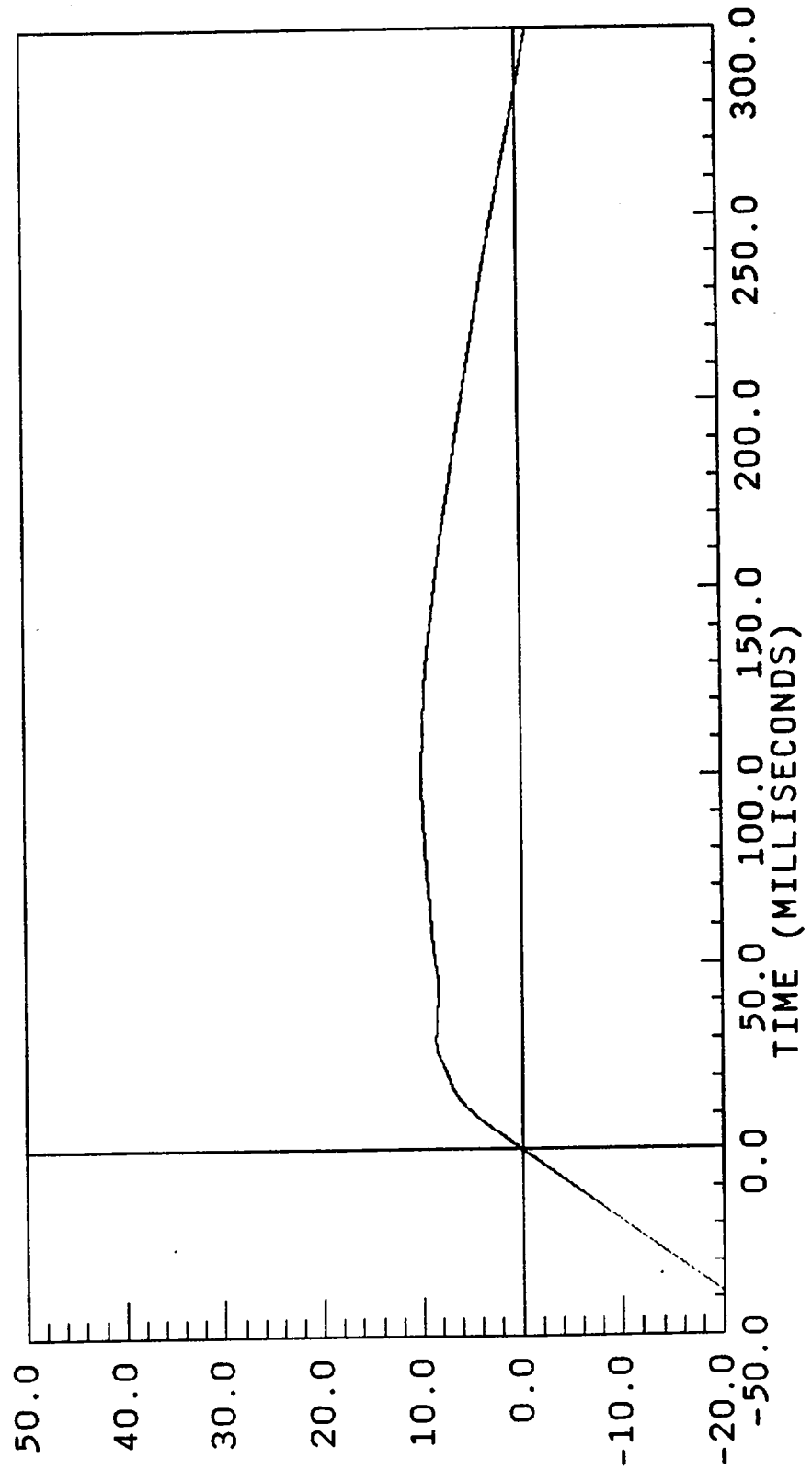
ACC PACK #11(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -4.402824 at 296.8500
YMAX = 29.36970 at -31.05000



D898-27.DAT

29.30 mph

ACC PACK #11(X)
COMPUTED
FILTER CUTOFF: 100HZ
XL AXIS
YMIN = -23.22029 at 296.8500
YMAX = 9.929110 at 99.82500



DISPLACEMENT * INCHES

TEST NO. CK0507

DUMMY DATA

	FILTER CHANNEL CLASS
HEAD ACCELERATIONS	1000
CHEST ACCELERATIONS	180
FEMUR FORCES	600
BELT LOADS	60

HEAD INJURY CRITERION
HEAD SEVERITY INDEX
36MS. MAXIMUM DURATION

NHTSA CRASH TEST - PROC 208

RUN= 998

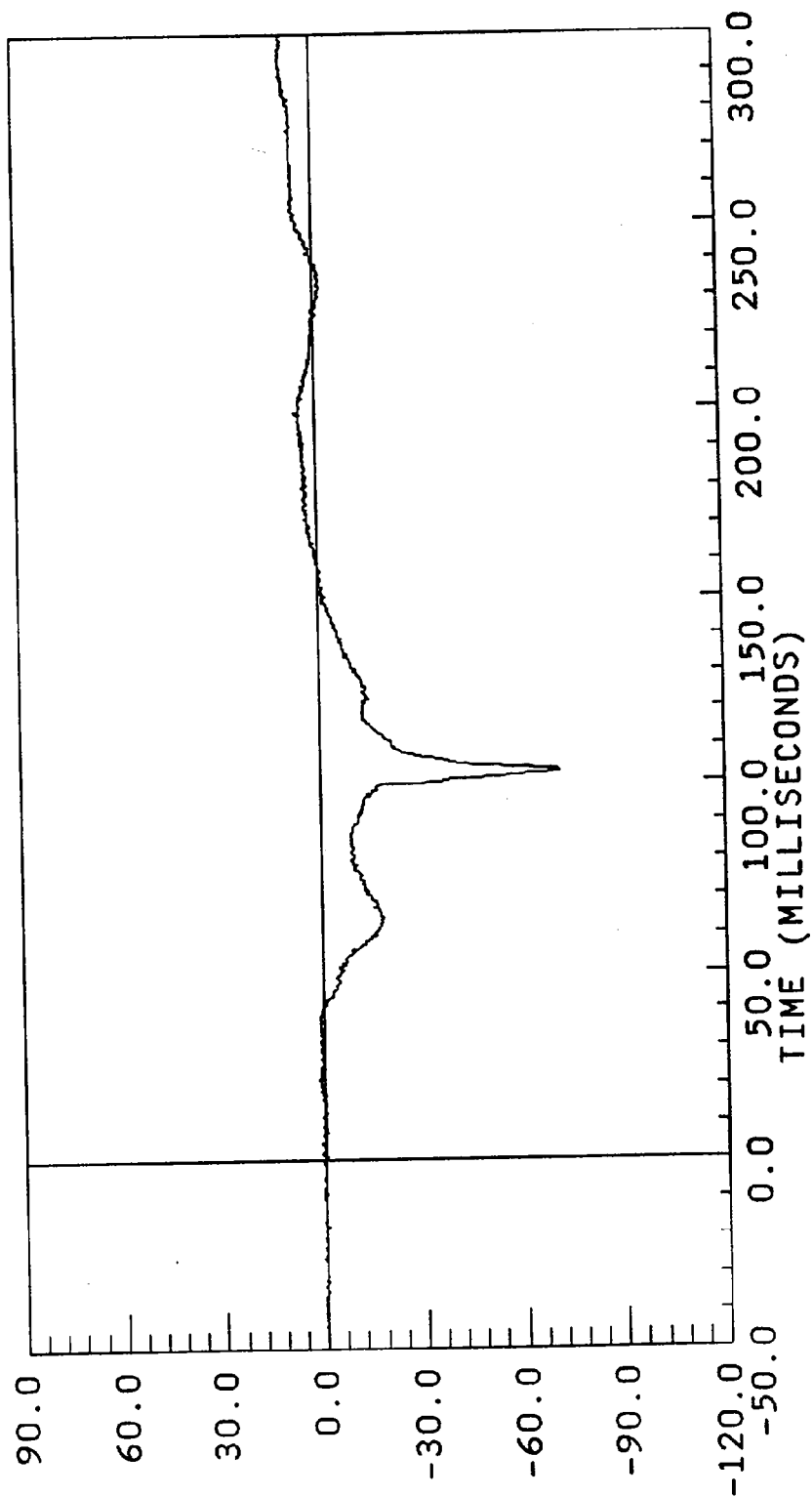
POS#1 HEAD R

HIC= 420.0 FROM T1= .07147 TO T2= .10747
AVERAGE ACCELERATION BETWEEN T1 AND T2= 42.3G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX= 635.6

UDS\$898-1.DAT

0.00 mph

POS#1 HEAD X
XL AXIS
YMIN = -71.81800 at 102.7500
YMAX = 10.13500 at 293.4000
FILTER CUTOFF: OHZ

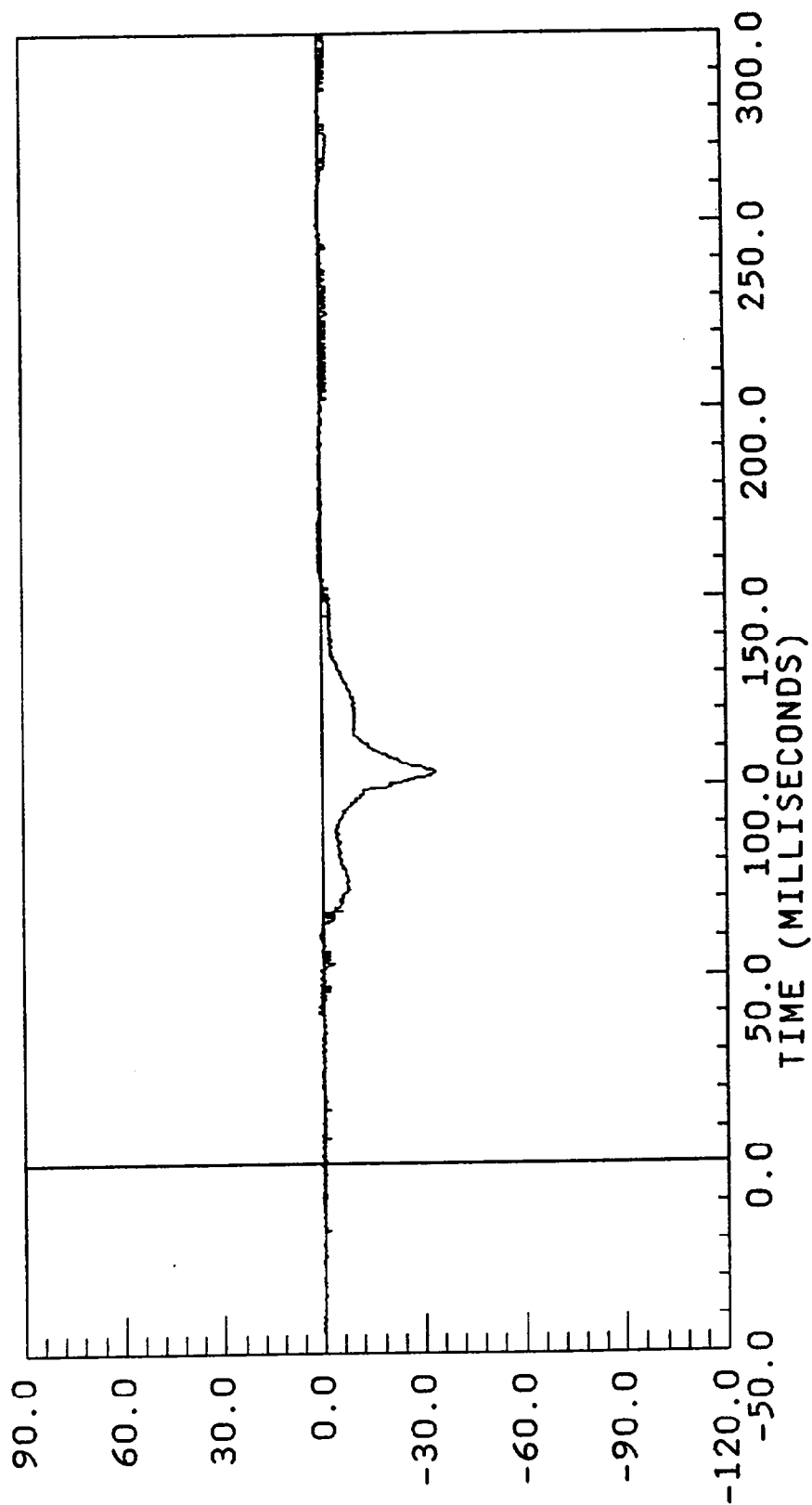


ACCELERATION * G, S *
B-38 7715-6

UDS\$898-2.DAT

0.00 mph

POS#1 HEAD Y
YL AXIS
YMIN = -34.13700 at 103.3500
YMAX = 1.427300 at 40.35000
FILTER CUTOFF: 0Hz



ACCELERATION * G * S *

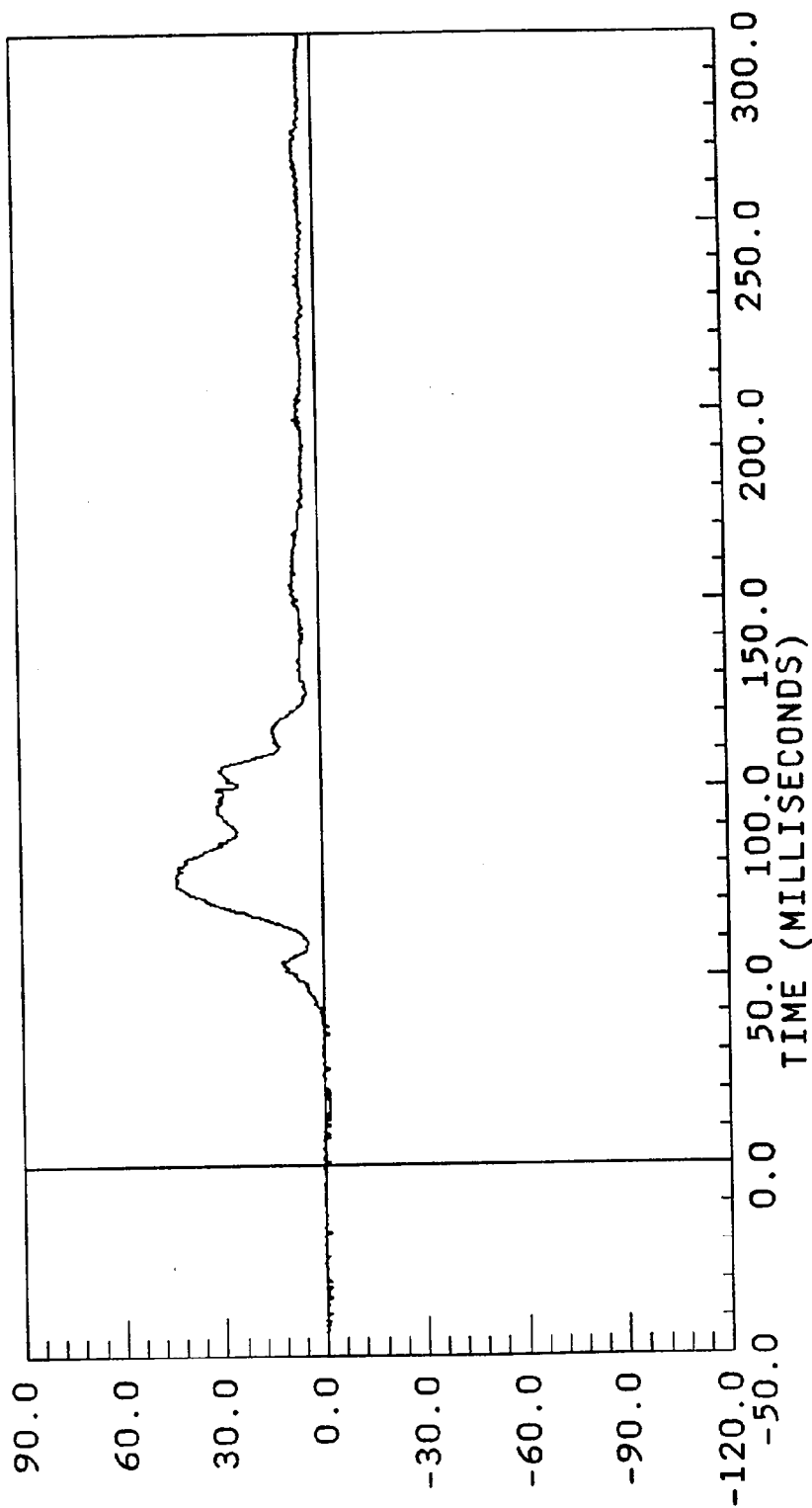
B-39

7715-6

UDS\$898-3.DAT

0.00 mph

POS#1 HEAD Z ZL AXIS
YMIN = 0.0428910 at -39.22500
YMAX = 43.84400 at 76.65000
FILTER CUTOFF: 0HZ

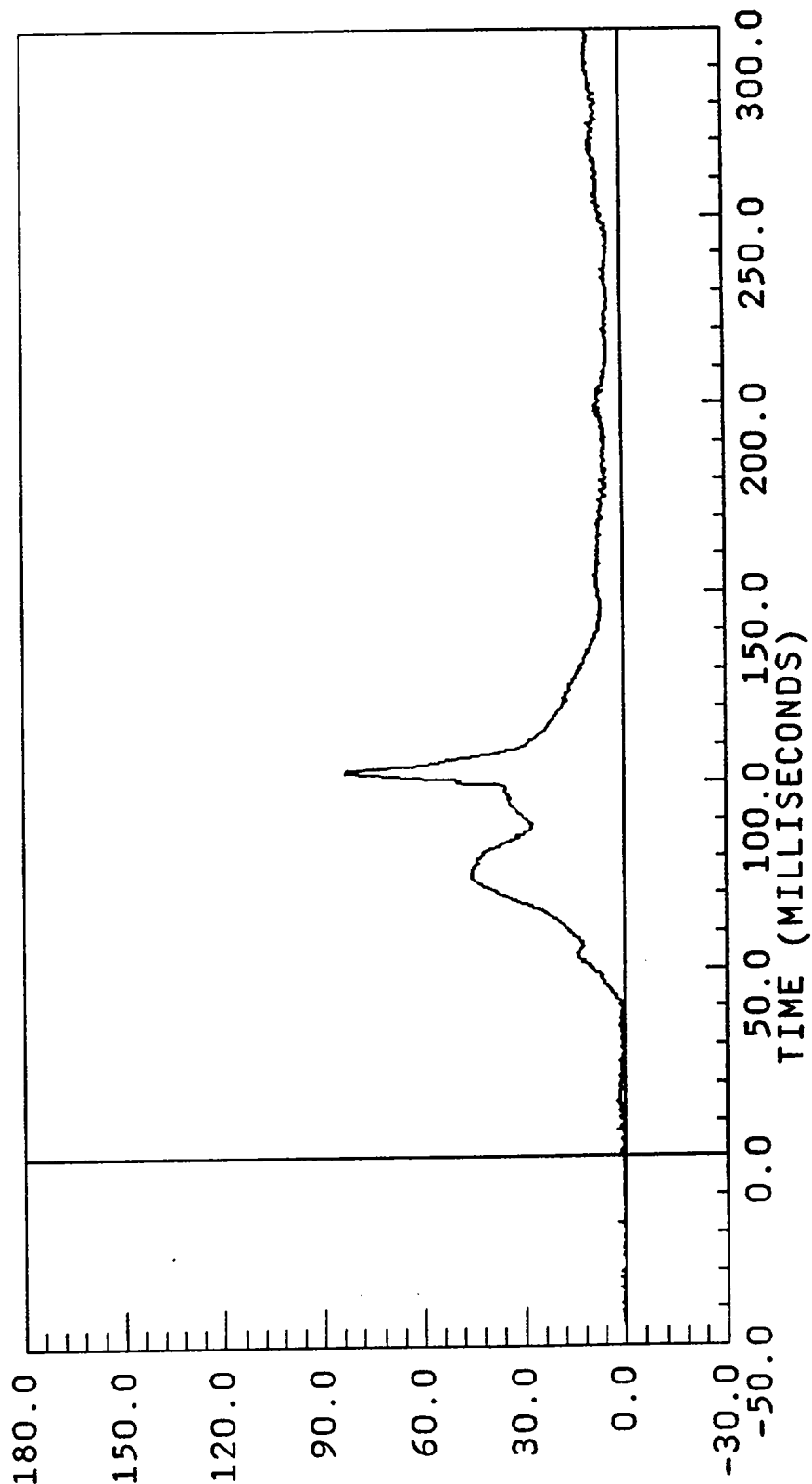


ACCELERATION * G, S *
B-40 7715-6

HRES898-1.DAT

0.00 mph

POS#1 HEAD RS AXIS
NONSTANDARD YMIN = 0.649426 at -44.55000
FILTER CUTOFF: 0Hz YMAX = 83.78244 at 102.7500



ACCELERATION * G * S *

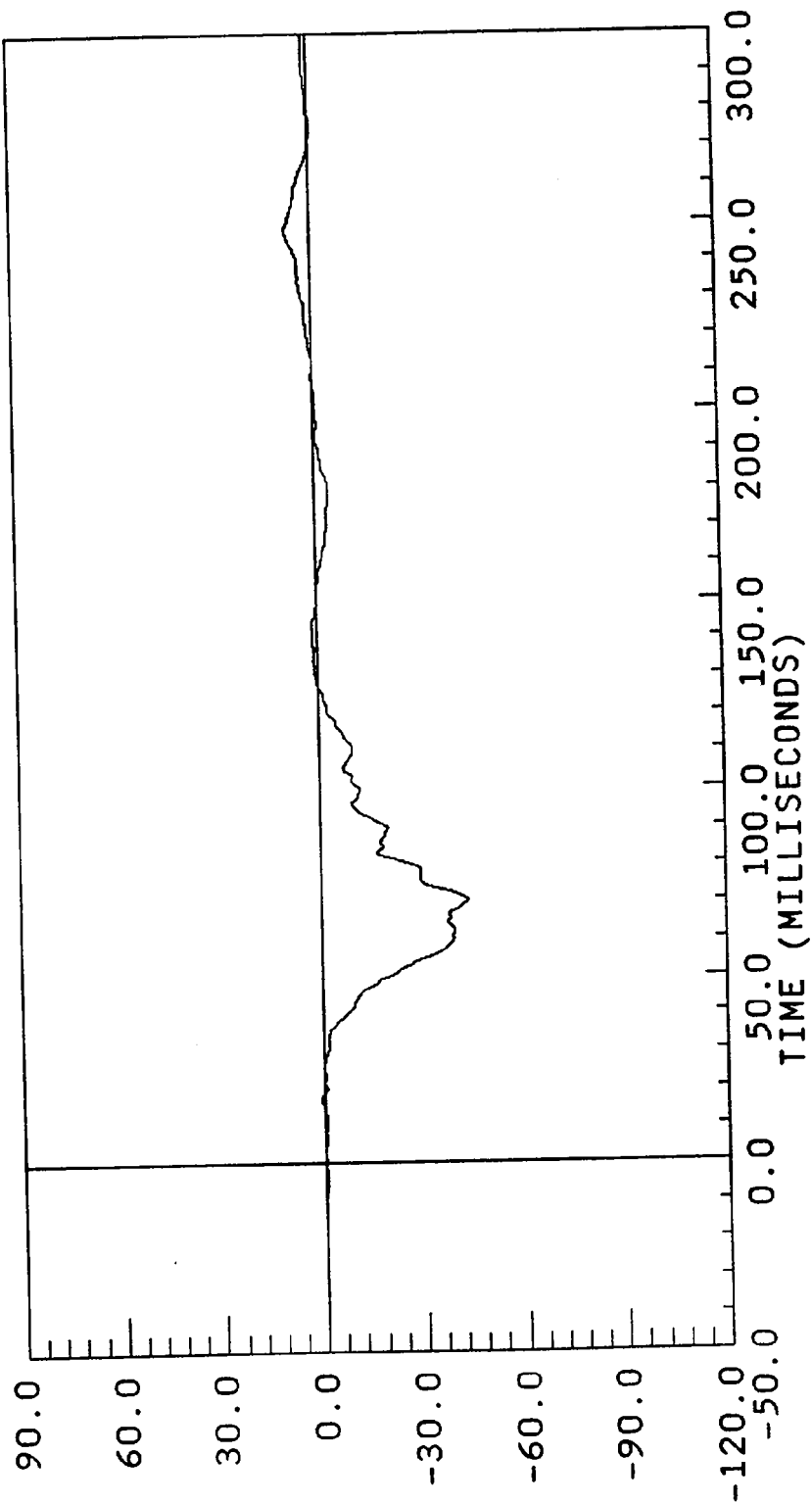
B-41

7715-6

BW898-4.DAT

0.00 mph

POS#1 CHEST X
FILTERED
FILTER CUTOFF: 300HZ
XL AXIS
YMIN = -43.71077 at 70.27500
YMAX = 7.414222 at 248.4000



ACCELERATION * G * S *

B-42

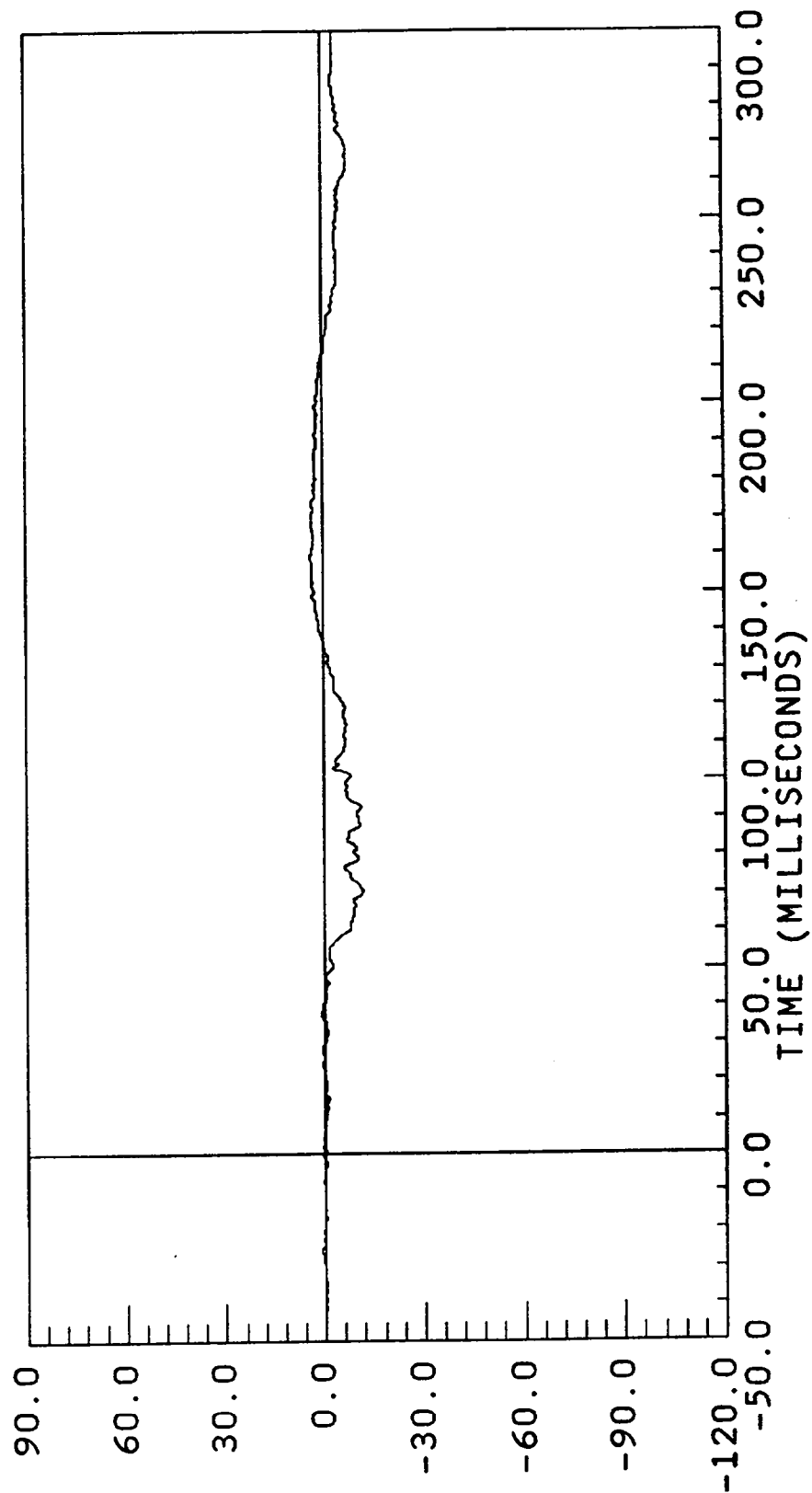
7715-6

BW898-5.DAT

0.00 mph

POS#1 CHEST Y
FILTERED
FILTER CUTOFF: 300HZ

YL AXIS
YMIN = -11.56971 at 70.57500
YMAX = 3.911373 at 159.4500



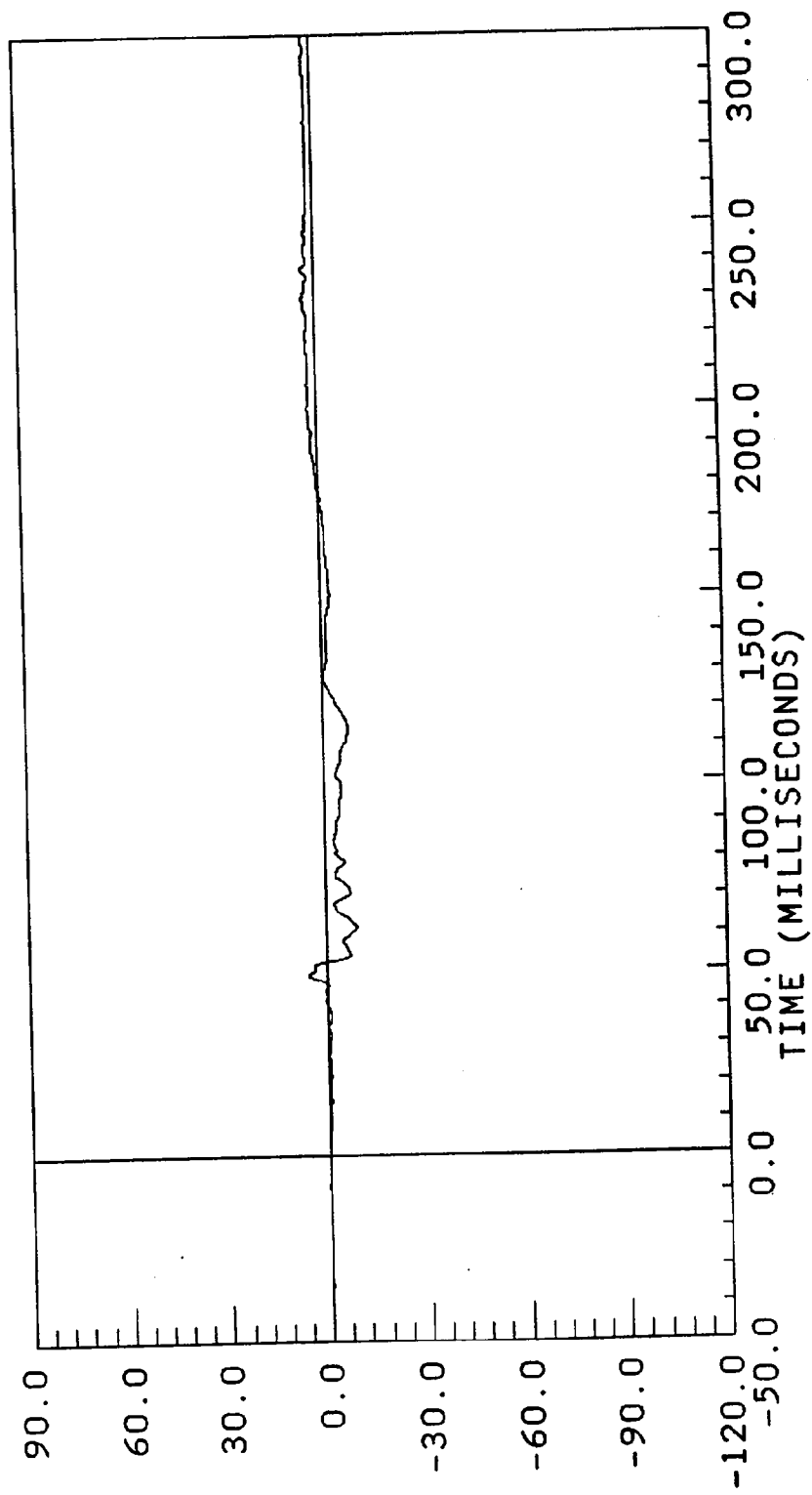
ACCELERATION * G * S *
B-43 7715-6

BW898-6.DAT

0.00 mph

POS#1 CHEST Z
FILTERED
FILTER CUTOFF: 300Hz

ZL AXIS
YMIN = -9.117633 at 61.95000
YMAX = 5.712547 at 48.97500



ACCELERATION * G * S *

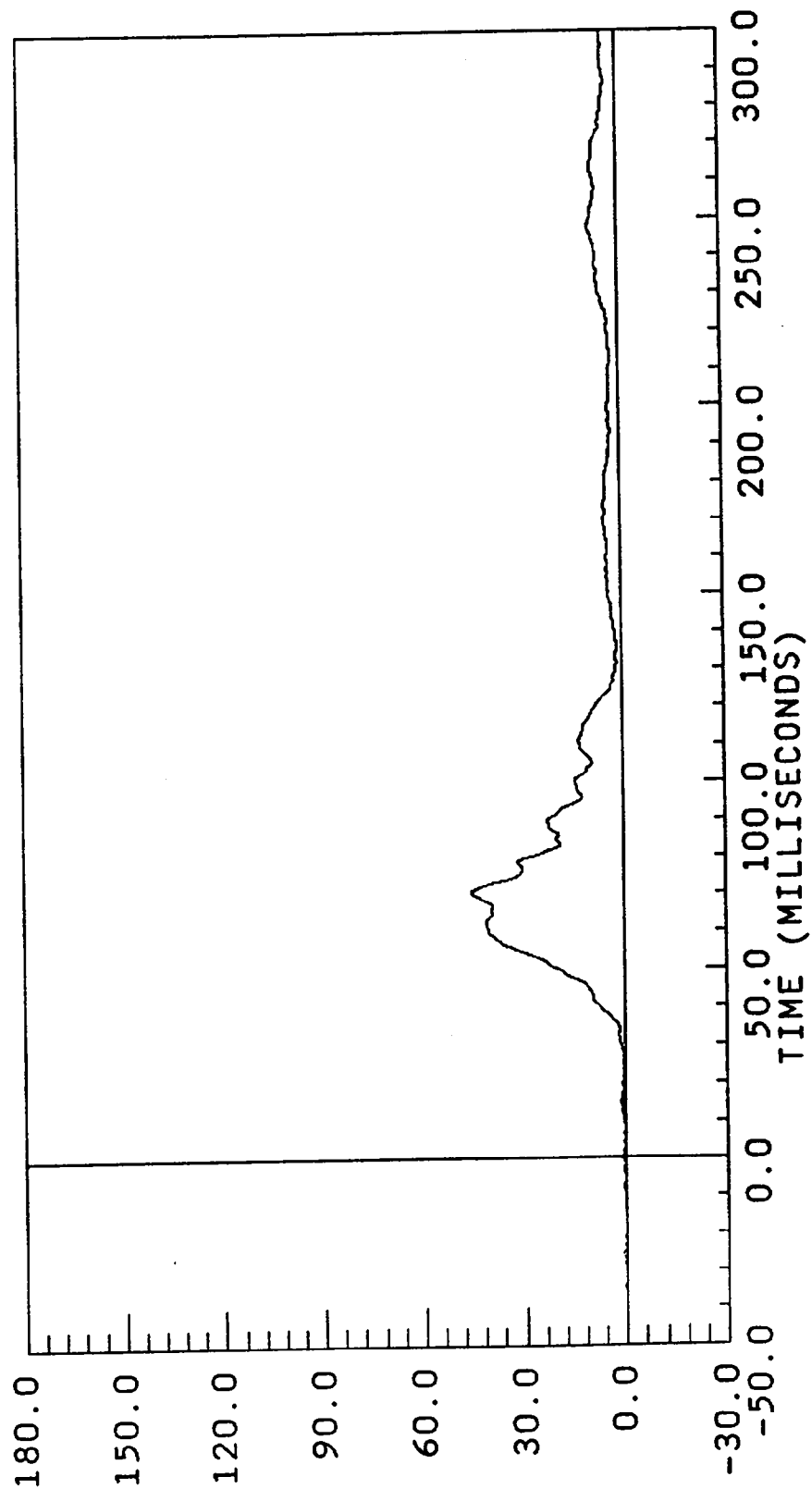
B-44

7715-6

CHST898-1.DAT

0.00 mph

POS#1 CHEST
COMPUTED
FILTER CUTOFF: 300HZ
RS AXIS
YMIN = 0.0528826 at -16.87500
YMAX = 45.73825 at 70.35001

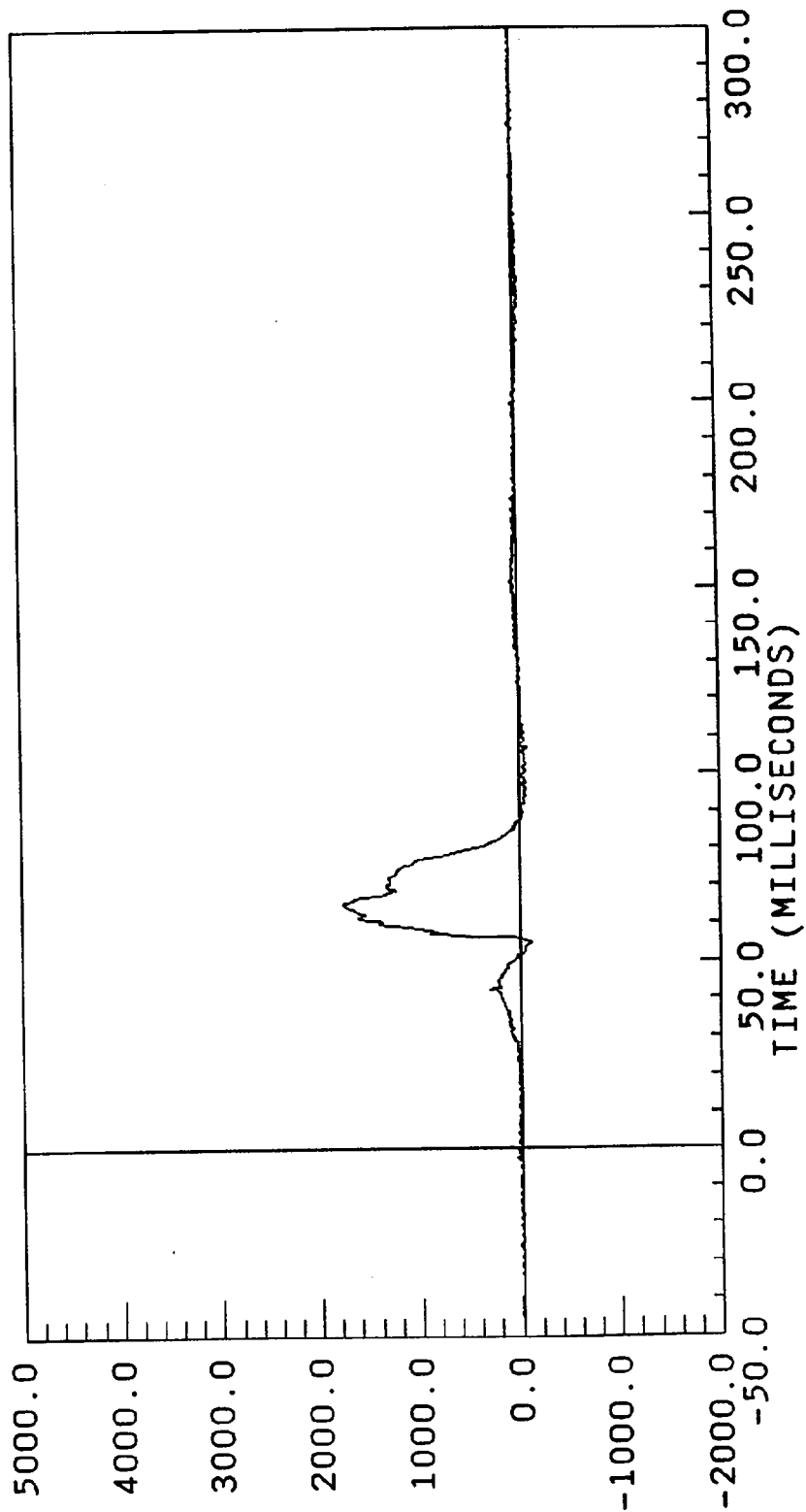


ACCELERATION * G * S *
B-45 7715-6

BW898-7.DAT

0.00 mph

POS#1 LEFT FEMUR
FILTERED
FILTER CUTOFF: 1000HZ
NA AXIS
YMIN = -127.4867 at 54.90000
YMAX = 1763.856 at 65.25000



F O R C E * L B S *
B-46

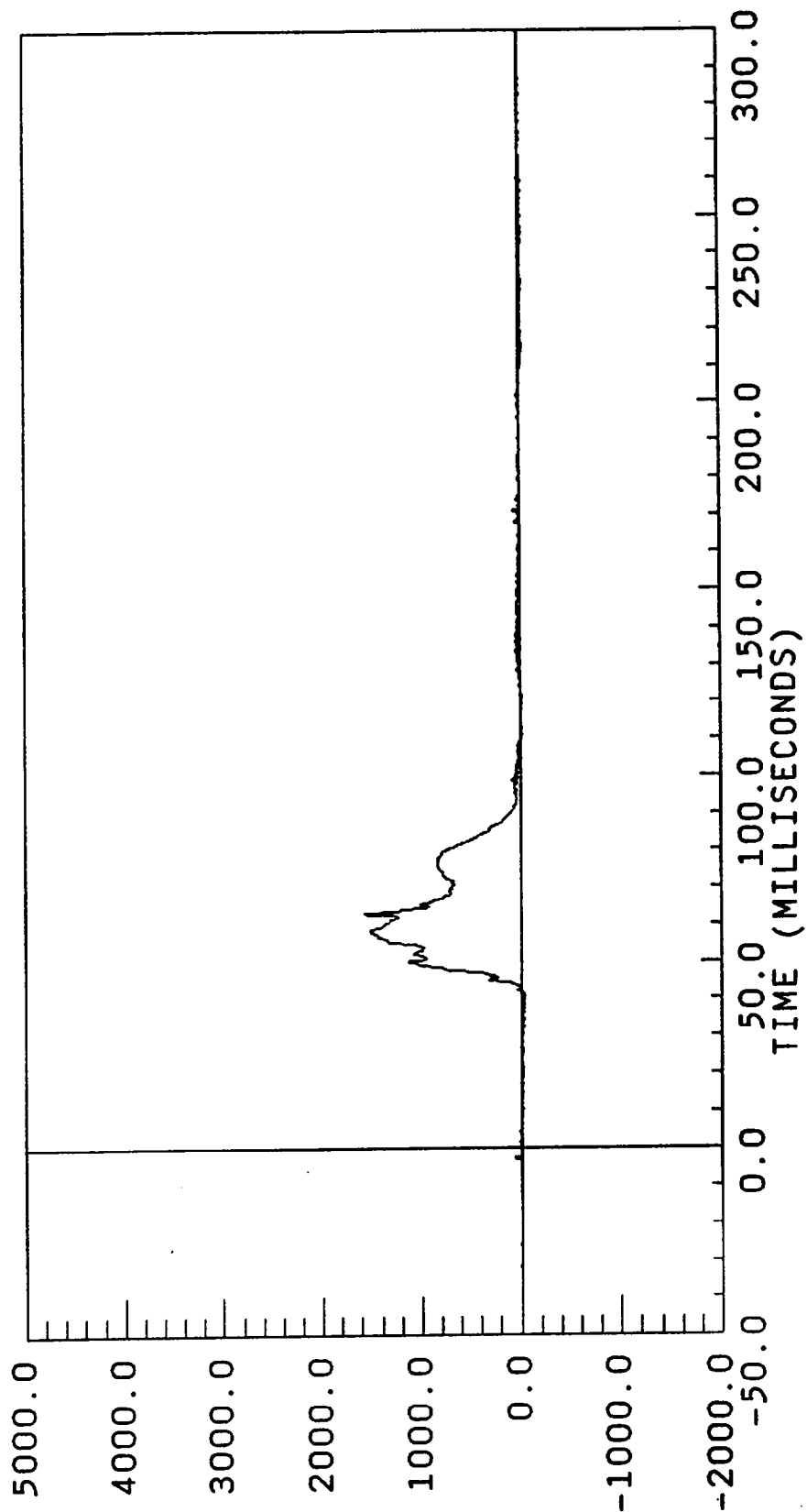
7715-6

BW898-8.DAT

0.00 mph

POS#1 RIGHT FEMUR
FILTERED
FILTER CUTOFF: 1000Hz

NA AXIS
YMIN = -46.70808 at 232.6500
YMAX = 1570.386 at 62.85000



FORCE * LBS *

HEAD INJURY CRITERION
HEAD SEVERITY INDEX
36MS. MAXIMUM DURATION

NHTSA CRASH TEST - PROC. 208

RUN= 998

POS#2 HEAD R

HIC= 298.0 FROM T1= .08735 TO T2= .10335
AVERAGE ACCELERATION BETWEEN T1 AND T2= 36.9G'S
EVENT TIME= 300.0 MSEC
SEVERITY INDEX= 582.0

UDS\$898-11.DA

0.00 mph

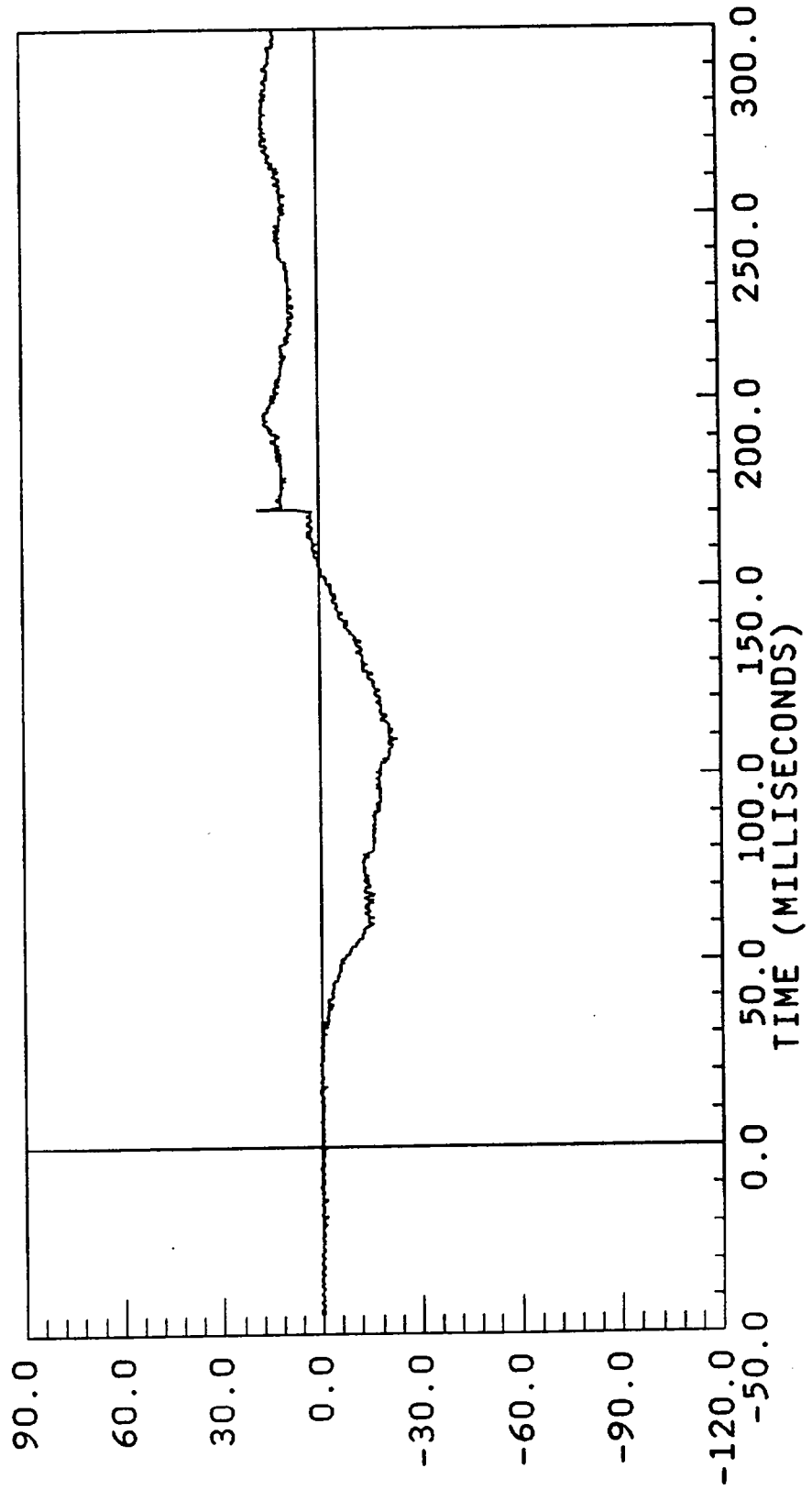
POS#2 HEAD X

XL AXIS

YMIN = -22.92600 at 109.4250

YMAX = 18.89200 at 171.2250

FILTER CUTOFF: OHZ



ACCELERATION * G * S *

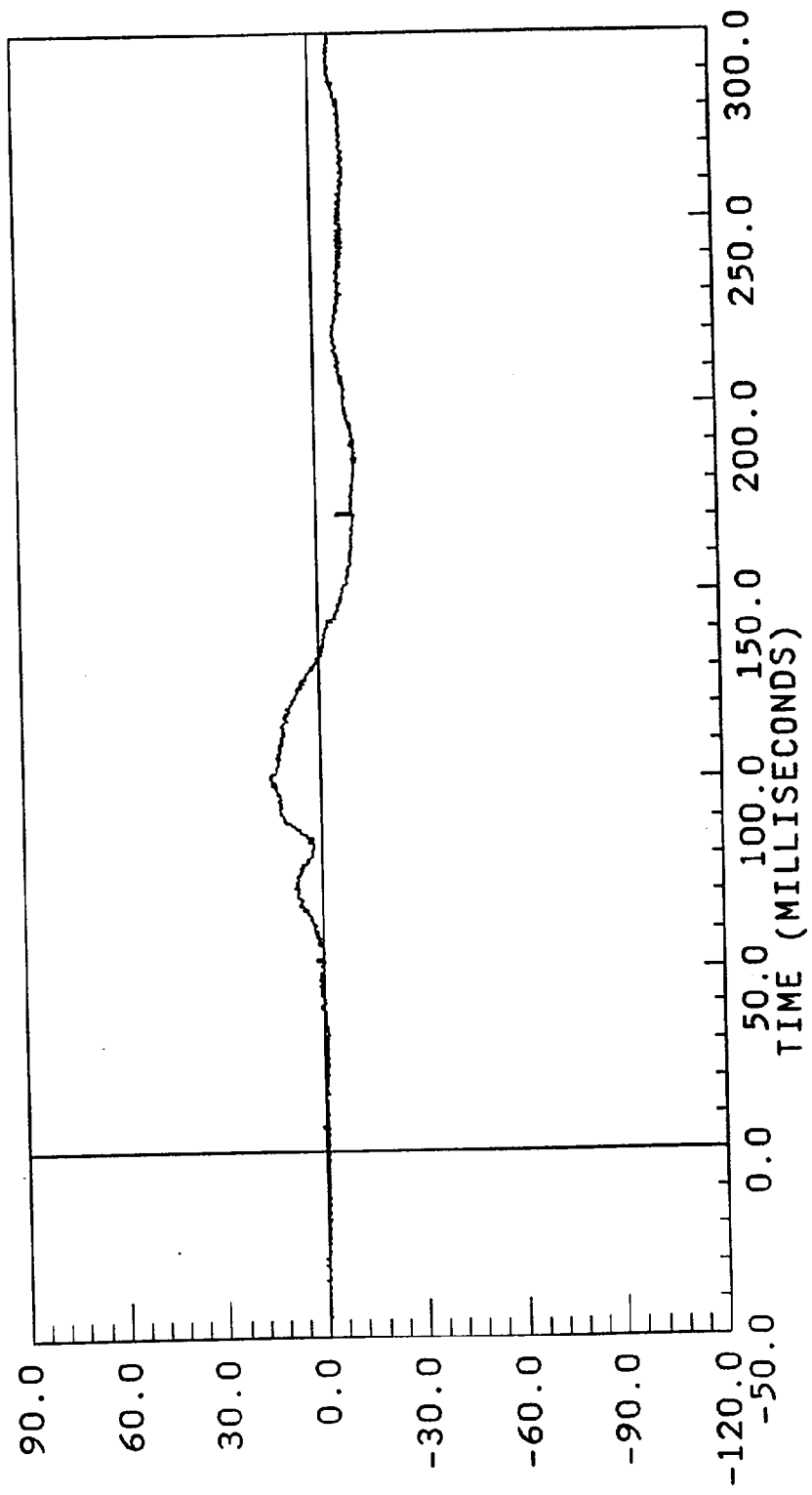
B-49

7715-6

UDS\$898-12.DA

0.00 mph

POS#2 HEAD Y
YL AXIS
YMIN = -12.47000 at 184.9500
YMAX = 15.24100 at 100.3500
FILTER CUTOFF: 0Hz

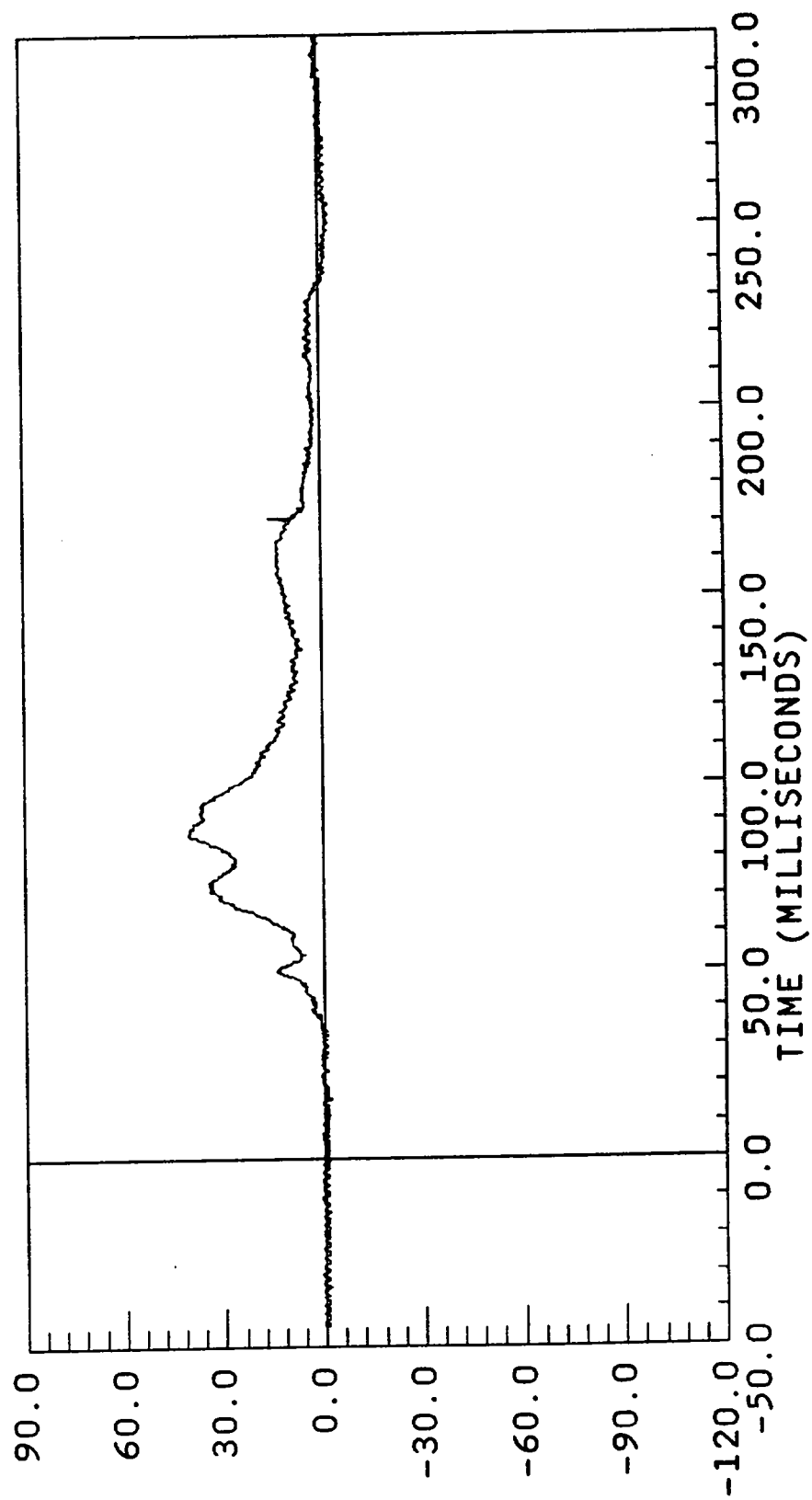


ACCELERATION * G * S
B-50 7715-6

UDS\$898-13.DA

0.00 mph

POS#2 HEAD Z
ZL AXIS
YMIN = -2.748400 at 248.5500
YMAX = 40.72700 at 86.40000
FILTER CUTOFF: 0HZ

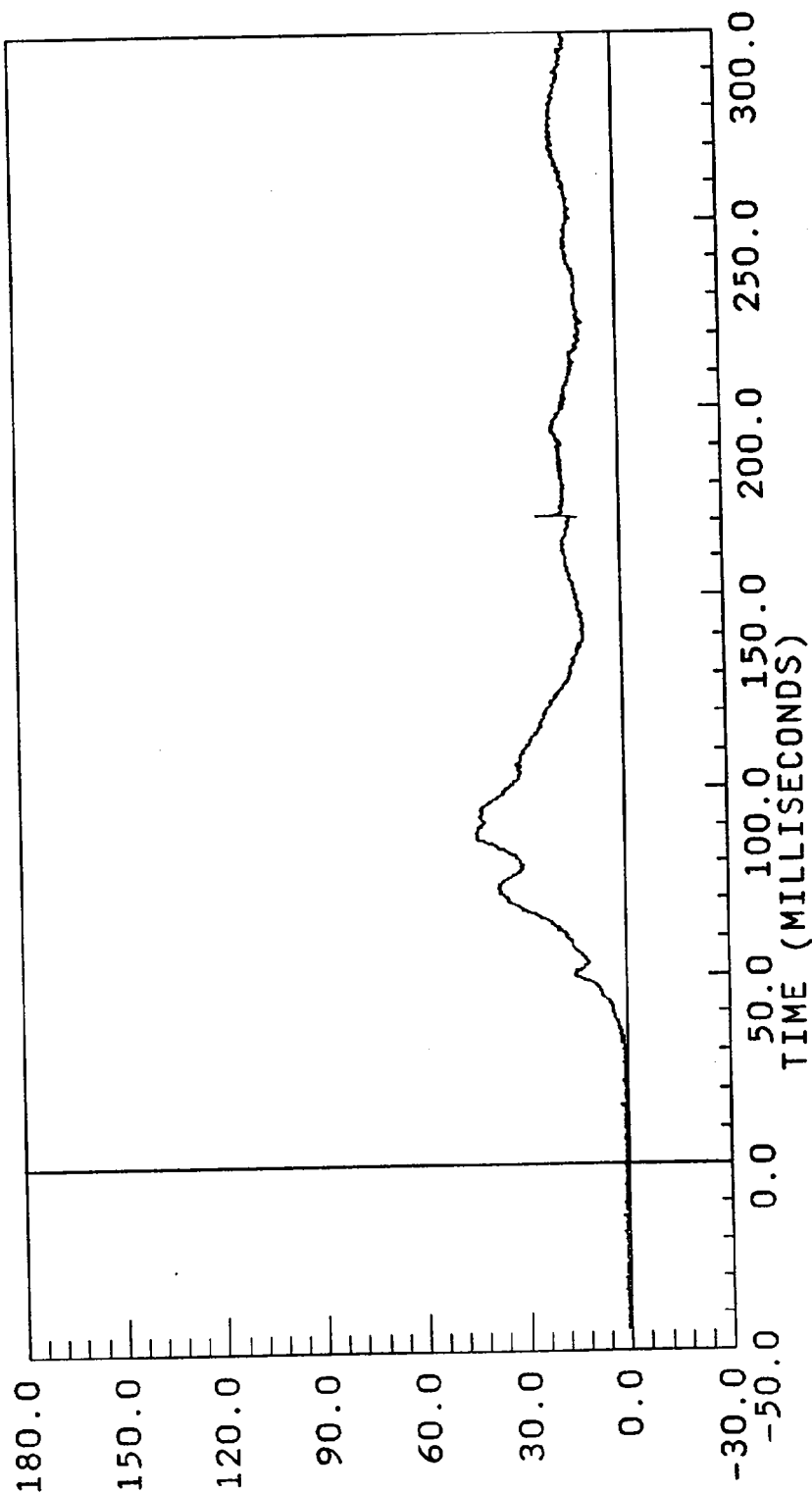


ACCELERATION * G, S *
B-51 7715-6

HRES898-2.DAT

0.00 mph

POS#2 HEAD
NONSTANDARD
FILTER CUTOFF: 0HZ
RS AXIS
YMIN = 1.041352 at -43.12500
YMAX = 44.20213 at 87.97501

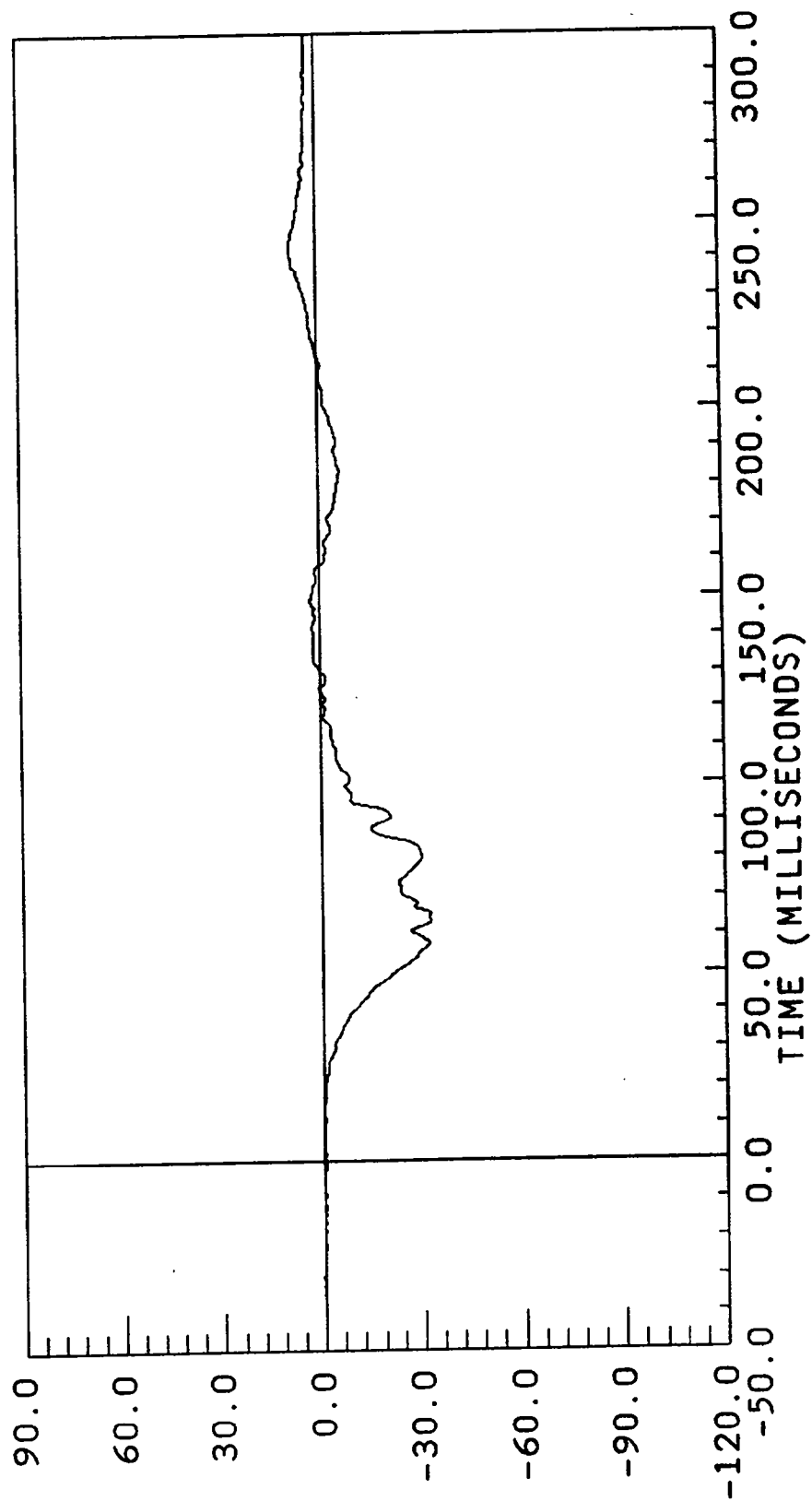


ACCELERATION * G, S *
B-52 7715-6

BW898-14.DAT

0.00 mph

POS#2 CHEST X
FILTERED
FILTER CUTOFF: 300Hz
XL AXIS
YMIN = -32.67978 at 65.85001
YMAX = 7.962877 at 243.3750

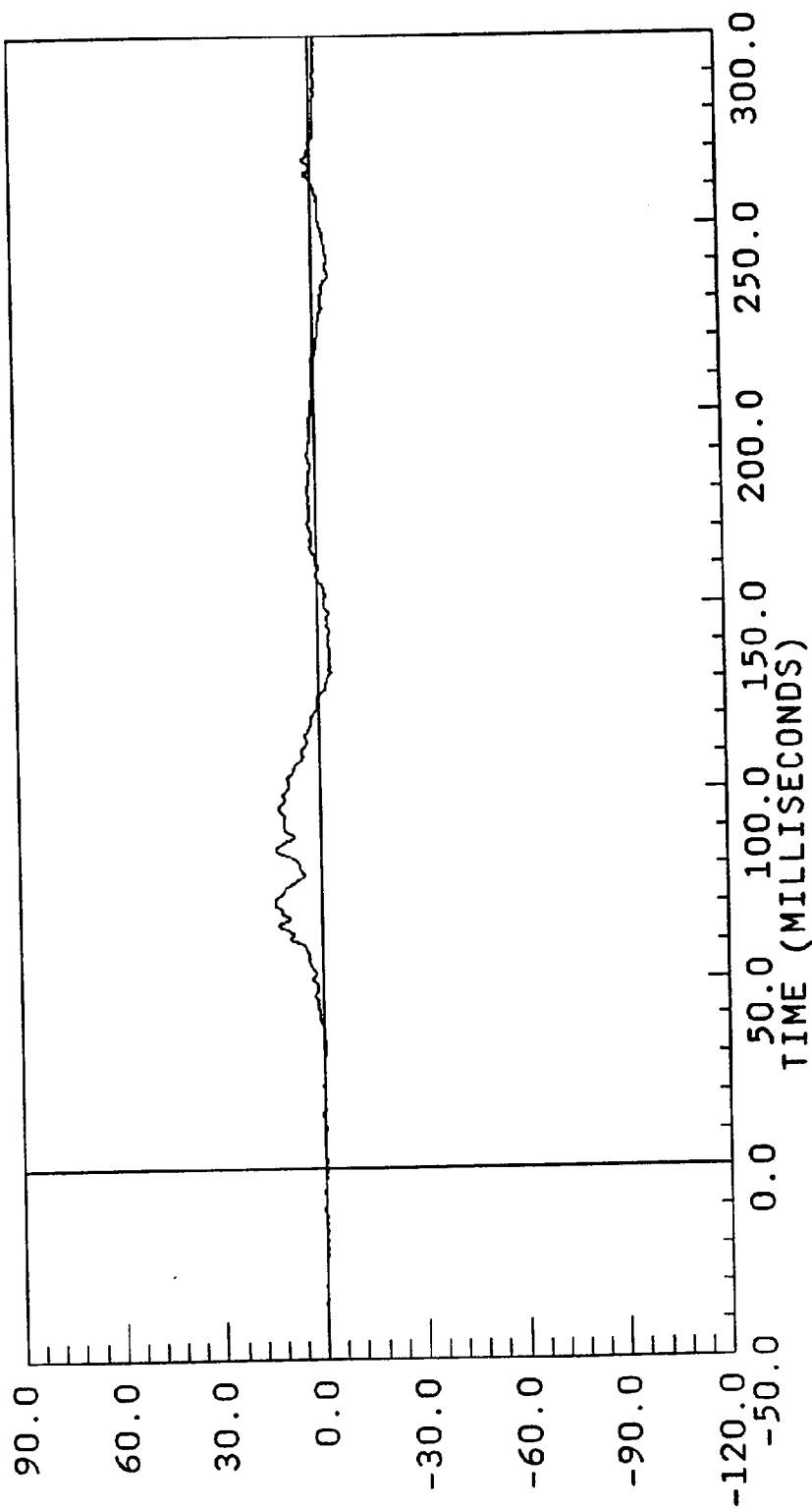


ACCELERATION * G, S *
B-53 7715-6

BW898-15.DAT

0.00 mph

POS#2 CHEST Y
FILTERED
FILTER CUTOFF: 300Hz
YL AXIS
YMIN = -4.884798 at 236.7750
YMAX = 14.10430 at 69.97501

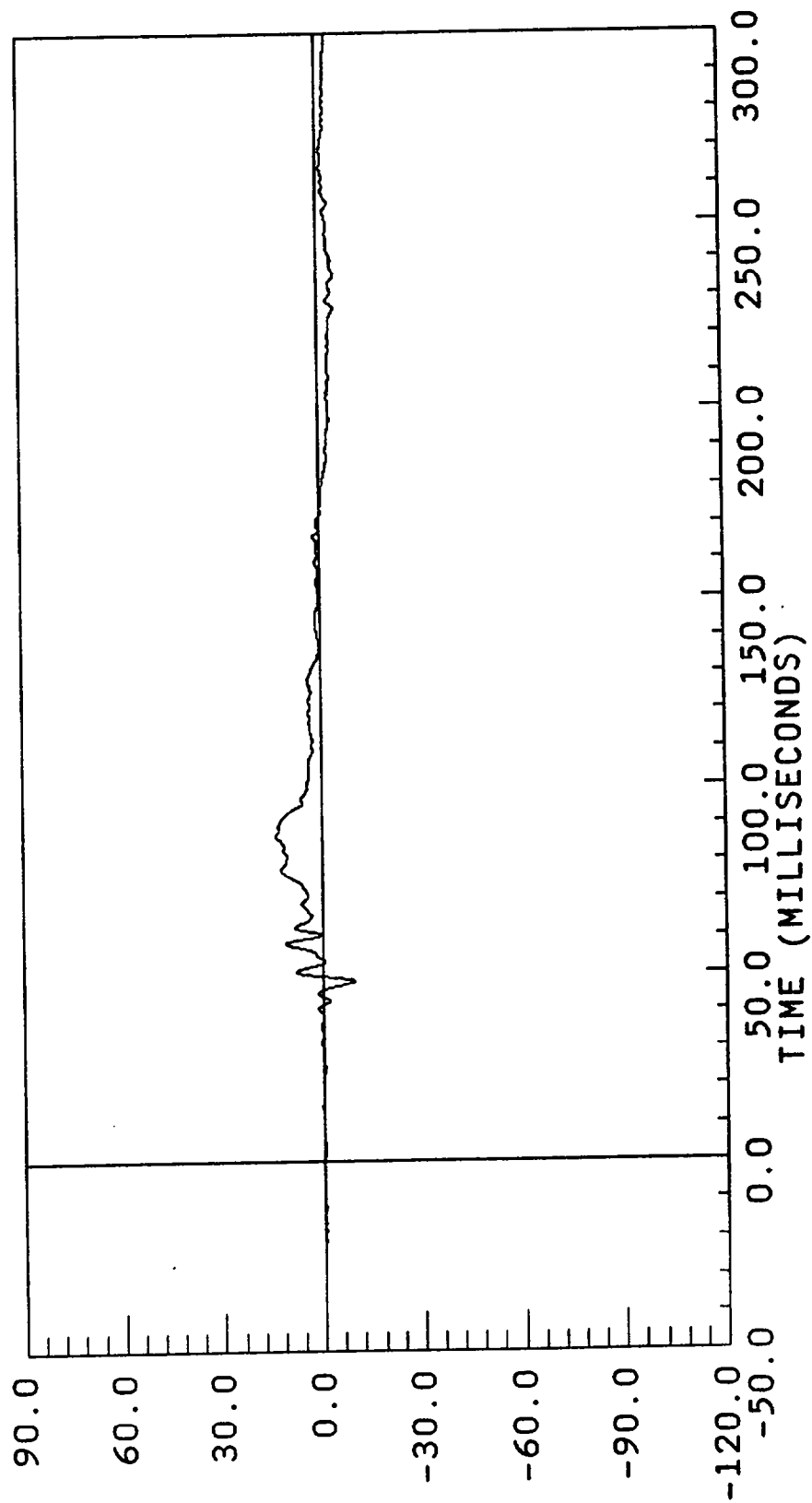


ACCELERATION * G * S *
B-54 7715-6

BW898-16.DAT

0.00 mph

POS#2 CHEST Z
FILTERED
FILTER CUTOFF: 300Hz
ZL AXIS
YMIN = -9.313355 at 48.00000
YMAX = 14.07712 at 86.92500

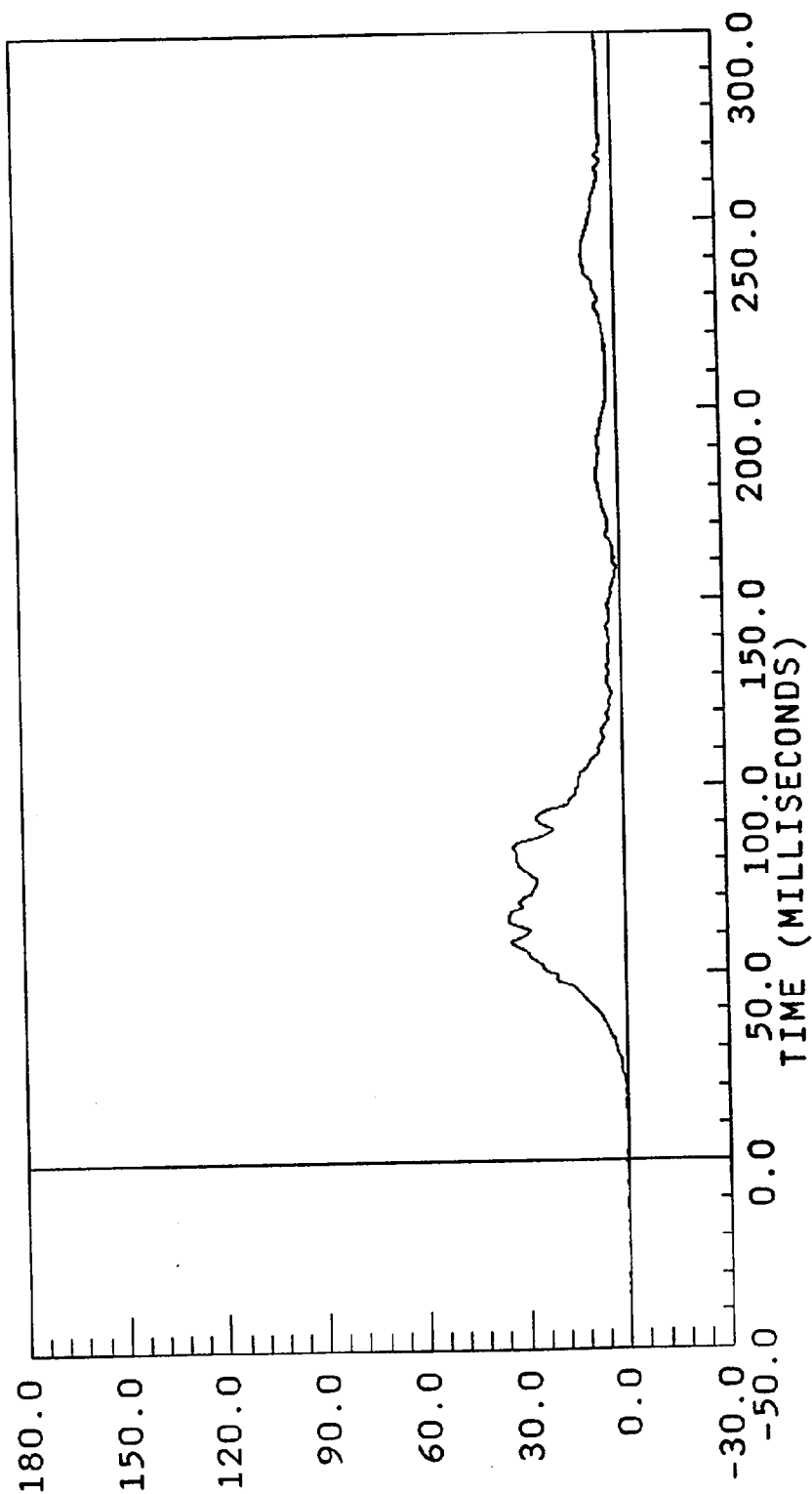


ACCELERATION * G * S
B-55 7715-6

CHST898-2.DAT

0.00 mph

POS#2 CHEST
COMPUTED
FILTER CUTOFF: 300Hz
RS AXIS
YMIN = 0.0276323 at -44.32500
YMAX = 34.91659 at 63.82500



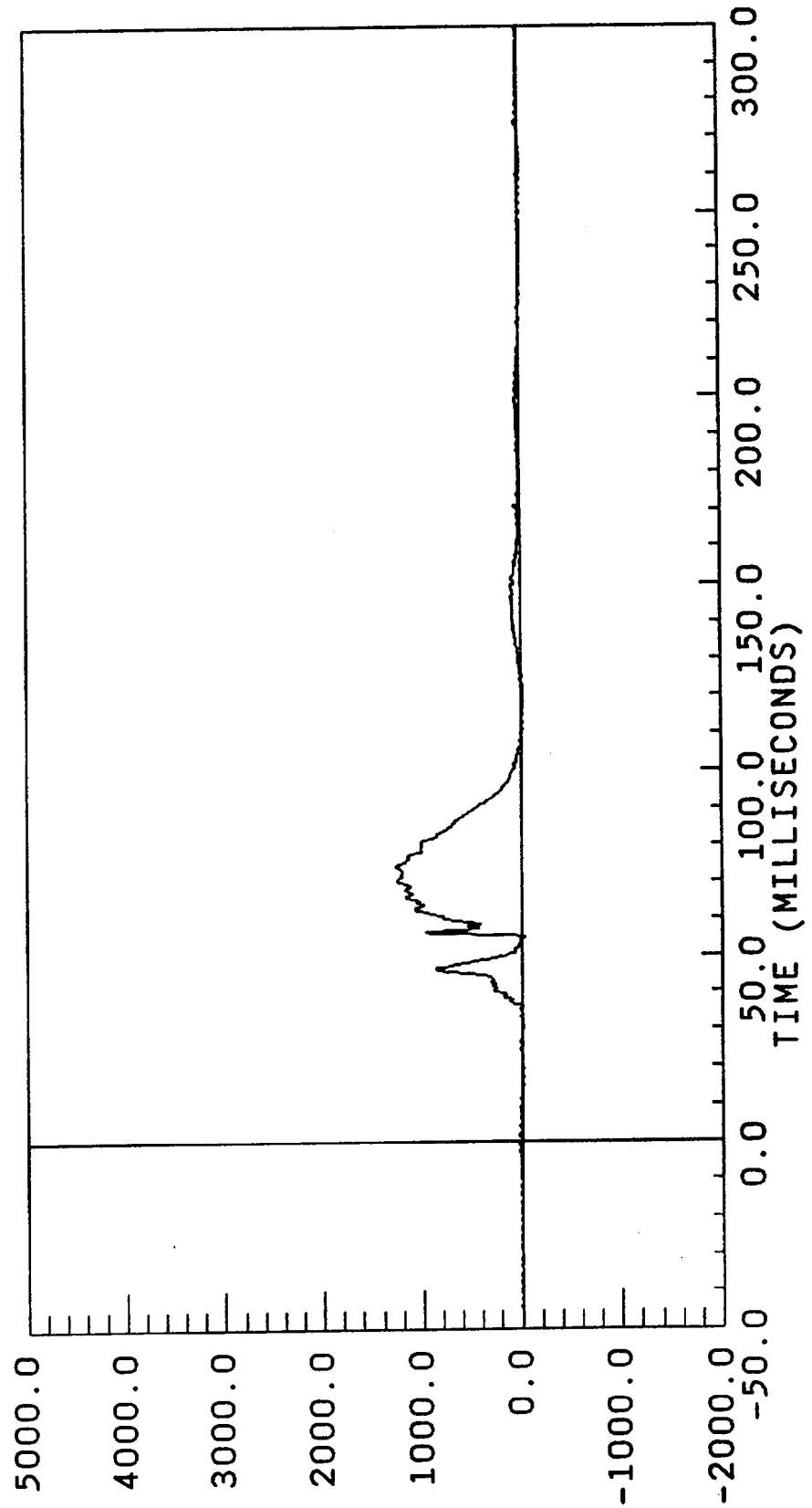
ACCELERATION * G, S *
B-56 7715-6

BW898-9.DAT

0.00 mph

POS#2 LEFT FEMUR
FILTERED
FILTER CUTOFF: 1000HZ

NA AXIS
YMIN = -35.32734 at 54.97500
YMAX = 1264.096 at 74.25000



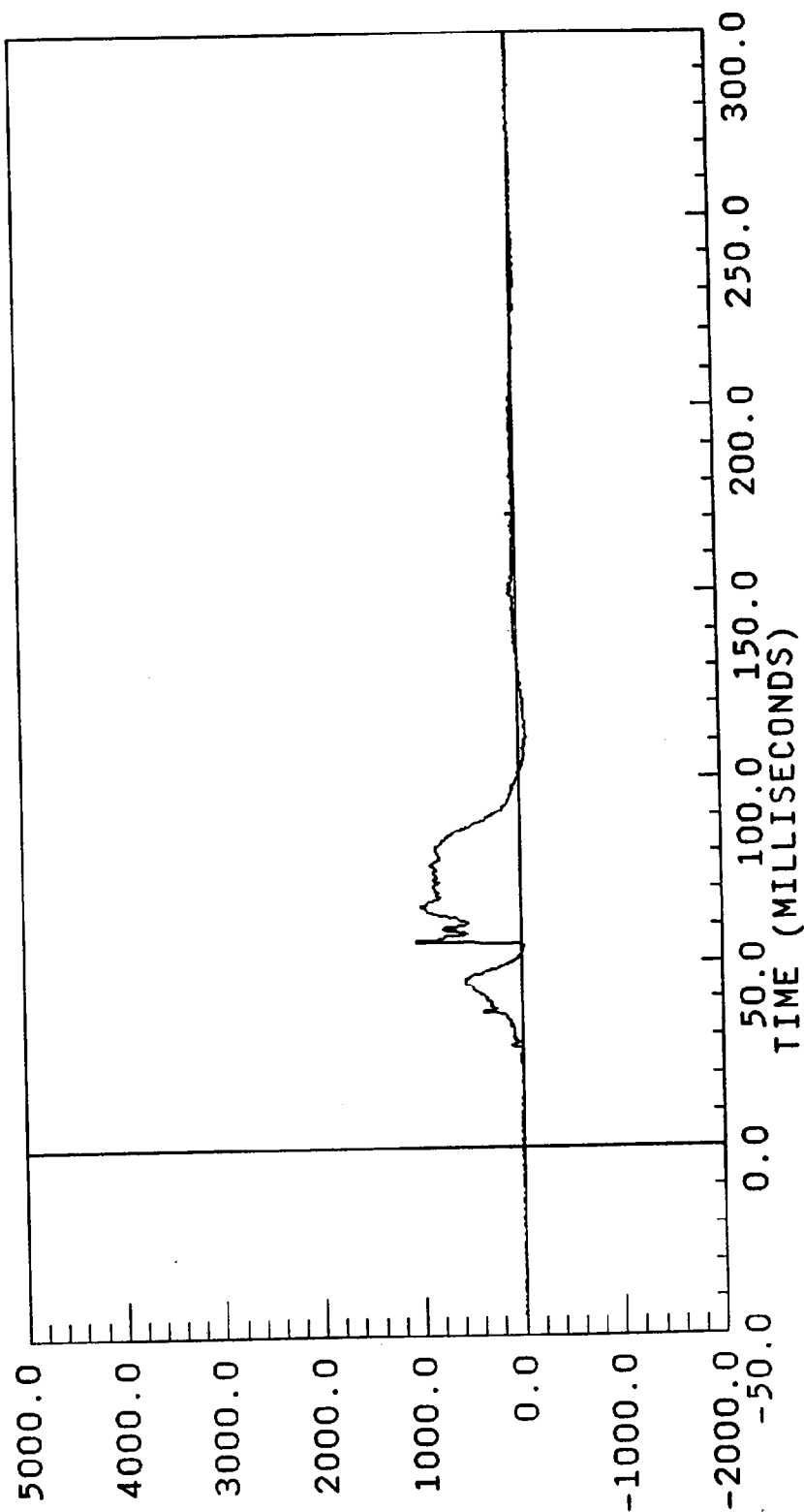
B-57
F O R C E * L B S *

7715-6

BW898-10.DAT

0.00 mph

POS#2 RIGHT FEMUR NA AXIS
FILTERED YMIN = -85.47911 at 111.0750
FILTER CUTOFF: 1000HZ YMAX = 1053.639 at 55.80000



Appendix C

VEHICLE OWNERS MANUAL OCCUPANT RESTRAINT SYSTEM INSTRUCTIONS

FEATURES OF YOUR HYUNDAI SONATA

AUTOMATIC SEAT BELT SYSTEM

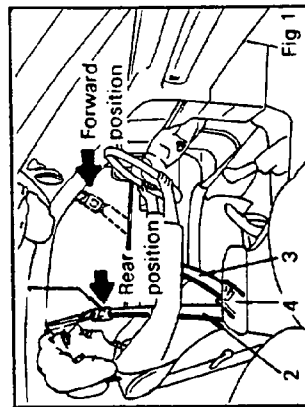
The Automatic Seat Belt system consists of automatic shoulder belts and manual lap belts for the driver and the front passenger. The shoulder belts will automatically adjust to the body and seating positions whenever the door is closed and the ignition key is inserted.

SEAT BELT SYSTEM OPERATION

Shoulder Belt Operation

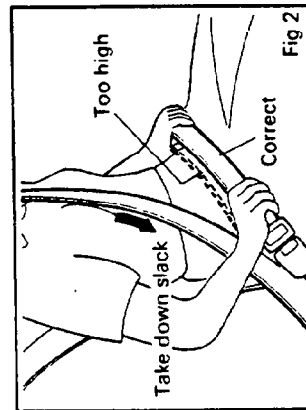
The shoulder belt will move to the rear position after the door has been closed and the ignition key is inserted. (Fig. 1) Pull the shoulder belt toward the retractor to take up extra slack. (Fig. 2)

1. Shoulder buckle
2. Shoulder belt
3. Lap belt
4. Lap buckle



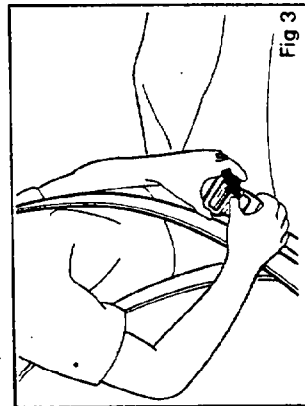
Lap Belt Operation

Slowly pull the lap belt out of the retractor and insert the tongue into the lap belt buckle until it clicks. Position the lap belt as low on the hips as possible then pull the belt toward the retractor to take up the extra slack. (Fig. 2)



Releasing the Belts

The lap belt is released by pressing the button on the lap buckle. (Fig. 3) The shoulder belt will move to the forward position when the door is opened or the ignition key is pulled out. (Fig. 1)



FEATURES OF YOUR HYUNDAI SONATA

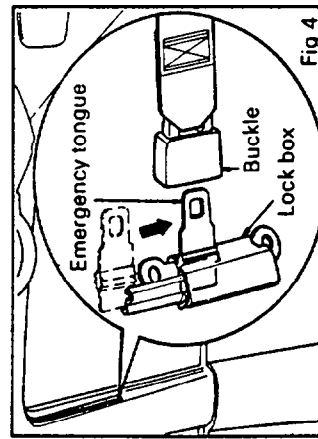
SEAT BELT WARNING LIGHT AND CHIME

With the key in the "ON" position and the lap belt unfastened, the seat belt warning light will stay on and the chime will sound for six seconds. (driver's only)

If the shoulder belt is disconnected while the key is in the "ON" position, the buzzer will sound for 6 seconds and the warning light will flash until the shoulder belt is re-connected.

SYSTEM MALFUNCTIONS

If the warning light flickers and the buzzer sounds for 60 seconds while the key is on, it may indicate a system malfunction. Have the system checked immediately by your HYUNDAI dealer.



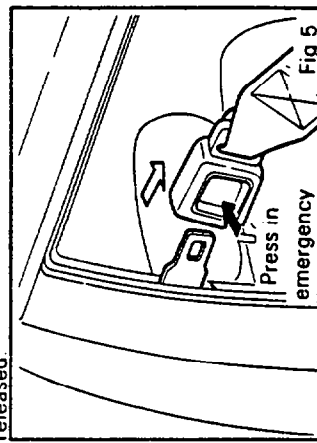
Inoperative Shoulder Belts

If for any reason the tongue does not move to the rear position and latch into the lock box, use the emergency tongue provided in the glove box.

To use the emergency tongue, unlatch the shoulder belt buckle and latch it onto the emergency tongue as shown in figure 4. Have the seat belt system checked and repaired immediately by your HYUNDAI dealer.

EMERGENCY OPERATION

To release the shoulder belt from the shoulder belt tongue in the event of an emergency, push the "Press in Emergency" button on the buckle. (Fig. 5) This feature should be used only when the shoulder belts keep you from leaving the vehicle in an accident. The shoulder belts should automatically draw back into the retractor when released.



CAUTIONS:

- o For maximum restraint system protection, the lap belt must always be used in conjunction with the shoulder belt whenever the car is moving.
- o The shoulder belt buckle must remain connected to the shoulder belt tongue to assure proper operation of the automatic seat belt systems.
- o Seat belts are most effective when seat backs are in the upright position.
- o Hyundai recommends that children be seated in the rear seats.
- o The shoulder belt should be positioned midway over the shoulder nearest the door for the most effective protection. (Fig. 2) Never wear the seat belt under the arm nearest the door.
- o Avoid wearing twisted seat belts.
- o Be careful not to damage the belt webbing or hardware.
- o Keep fingers clear of the door rails when the seat belt is moving.
- o Release the shoulder belt buckle from the tongue only in an emergency.
- o Never wear the lap belt on top of or across the shoulder belt.
- o The retractors lock only on sudden impact or stops. The belt will allow some freedom of movement if done slowly.