

DOT 1465

REPORT NOS. 208-TRC-90-017

212-TRC-90-017

301-TRC-90-017

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

HYUNDAI MOTOR CO.

1990 HYUNDAI EXCEL

3-DOOR HATCHBACK

NHTSA NO. CL0502

TRC TEST NO. 900426

THE TRANSPORTATION RESEARCH CENTER OF OHIO

10820 STATE ROUTE 347

EAST LIBERTY, OHIO 43319



MAY 14, 1990

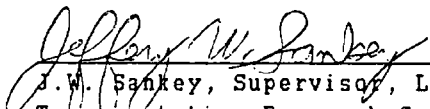
FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF VEHICLE SAFETY COMPLIANCE
400 SEVENTH STREET, S.W.
ROOM NO. 6115 (NEF-31)
WASHINGTON, DC 20590

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-88-C-11038. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

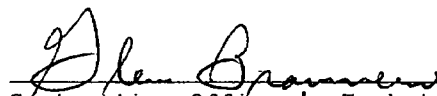
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1. Report No. 208-TRC-90-017 212-TRC-90-017 301-TRC-90-017		2. Government Accession No.		3. Recipient's Catalog No.	
4. Title and Subtitle FINAL REPORT OF FMVSS NOS. 208, 212, 219 (PARTIAL), AND 301 COMPLIANCE TESTING OF A 1990 HYUNDAI EXCEL 3-DOOR HATCHBACK, NHTSA NO. CL0502				5. Report Date MAY 1990	
				6. Performing Organization Code	
7. Author(s) J.W. Sankey, Supervisor, Laboratory Engineering, TRC				8. Performing Organization Report No. 208-TRC-90-017, 212-TRC-90-017 301-TRC-90-017	
9. Performing Organization Name and Address Transportation Research Center of Ohio 10820 State Route 347 East Liberty, Ohio 43319				10. Work Unit No. (TRAIS)	
				11. Contract or Grant No. DTNH22-88-C-11038	
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Office of Vehicle Safety Compliance (NEF-31) 400 Seventh St., S.W., Washington, DC 20590				13. Type of Report and Period Covered FINAL REPORT APRIL - MAY 1990	
				14. Sponsoring Agency Code DOT/NHTSA/NEF/OVSC	
15. Supplementary Notes					
16. Abstract A 30 mph flat frontal barrier impact compliance test was conducted on a 1990 Hyundai Excel 3-door hatchback, VIN KMHVD12J8LU029969, NHTSA No. CL0502 at the Transportation Research Center of Ohio on April 26, 1990. This test was conducted to determine compliance with Federal Motor Vehicle Safety Standards: FMVSS No. 208, "Occupant Crash Protection" FMVSS No. 212, "Windshield Mounting" FMVSS No. 219, (Partial), "Windshield Zone Intrusion" FMVSS No. 301, "Fuel System Integrity" The barrier impact velocity was 29.5 mph. The ambient temperature was 84° F The vehicle appears to comply with the applicable requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.					
17. Key Words Frontal Impact 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"			18. Distribution Statement Available from: Technical Reference Division National Highway Traffic Safety Admin Nassif Building, Room 5108 400 Seventh Street, SW Washington, DC 20590		
19. Security Classif. (of this report) Unclassified		20. Security Classif. (of this page) Unclassified		21. No. of Pages 92	
				22. Price	

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)				
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons	0.9	metric ton	t
	(2000 lb)			
VOLUME				
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
in ³	cubic inches	16	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	L
pt	pints	0.47	liters	L
qt	quarts	0.95	liters	L
gal	gallons	3.8	liters	L
ft ³	cubic feet	0.03	cubic meters	m ³
yd ³	cubic yards	0.76	cubic meters	m ³
TEMPERATURE (exact)				
°F	degrees Fahrenheit	5/9 (after subtracting 32)	degrees Celsius	°C

Approximate Conversions from Metric Measures

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

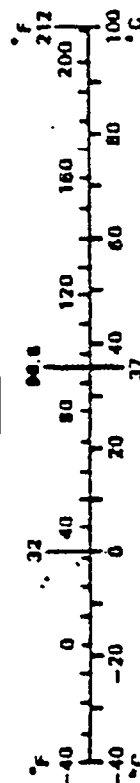


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SECTION 1.0

PURPOSE AND TEST SUMMARY

PURPOSE

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 the Transportation Research Center of Ohio (TRC) under Contract No. DTNH22-88-C-11038. The purpose of this test was to determine if the subject vehicle, a 1990 Hyundai Excel 3-door hatchback, NHTSA No. CL0502, meets the performance requirements of FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Mounting"; FMVSS 219 (partial), "Windshield Zone Intrusion"; and FMVSS 301, "Fuel System Integrity." The test was conducted in accordance with the Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure No. TP-208-07.

TEST SUMMARY

The 1990 Hyundai Excel 3-door hatchback, NHTSA No. CL0502, was equipped with a 1.5 liter, transverse engine, manual transmission, and power brakes. The test weight of the vehicle was 2621 pounds. The test vehicle appeared to comply with the performance requirements of FMVSS test Nos. 208, 212, 219 (partial), and 301. The Head Injury Criteria (HIC) calculations were less than 1000, the resultant accelerations of the thorax did not exceed 60 g's and the compressive forces transmitted through the upper legs did not exceed 2,250 pounds as measured by Part 572 B dummies seated in the driver's and right front passenger's seats. There was 100 percent windshield retention. There was no intrusion into the windshield. There was no fluid spillage from the fuel system following the impact or during the static rollover test.

Two (2) Part 572 B, adult male anthropomorphic test devices (ATDs) were seated in the front outboard designated seating positions. The dummies were positioned according to the dummy placement procedures specified in Appendices B and C of Laboratory Procedure TP-208-07.

Both ATDs were instrumented with head and chest accelerometers oriented to measure accelerations in the longitudinal, lateral, and vertical directions, and with right and left femur load cells.

The vehicle was instrumented with seven (7) accelerometers oriented to measure longitudinal axis acceleration.

The crash event was recorded by one (1) real-time panning camera and fourteen (14) high-speed motion picture cameras operating at approximately 500 frames per second. The pre-test and post-test events were recorded with one (1) real-time camera.

The twenty-three (23) channels of data were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 8000 samples per second and digitally processed per sections 12.8 and 12.9 of the Laboratory Procedure.

The vehicle was impacted into the rigid, flat frontal barrier at the Transportation Research Center of Ohio on April 26, 1990. The test vehicle's impact speed was 29.5 mph. The vehicle sustained 18.9 inches of static crush.

The FMVSS 208, 212, 219 (partial), and 301 compliance data are presented in Section 2.0. The camera information is presented in Section 3.0. Appendix A contains the still photographic prints. Appendix B contains the vehicle and dummy data plots.

TABLE 1 CRASH TEST SUMMARY

NHTSA NO.:	CL0502	PROJECT:	208 Compliance
DATE:	04/26/90	TIME:	1324 TEMP: 84° F
VEHICLE:	1990 Hyundai Excel 3-door hatchback		
TEST WEIGHT (LBS):	2621		
IMPACT ANGLE (DEG)*:	0		
IMPACT VELOCITY (MPH)**:	PRIMARY = 29.5	SECONDARY =	29.6
MAXIMUM STATIC CRUSH (IN):	18.9		
VEHICLE REBOUND (IN):	31.5		
DUMMIES:	Driver #354	Passenger	#690
TYPE:	Part 572 B	Part 572 B	
LOCATION:	Left front	Right front	
RESTRAINT:	2-point passive belt	2-point passive belt	
NUMBER OF DATA CHANNELS:	23		
NUMBER OF HIGH SPEED CAMERAS:	HIGH-SPEED: 14	REAL-TIME:	2

*With respect to tow track centerline.

**Speed trap measurement ($\pm$.05 mph accuracy)

TABLE 2 TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Hyundai Motor Co.

MAKE/MODEL: Hyundai Excel

VIN: KMHVD12J8LU029969

BODY STYLE: 3-door hatchback

MODEL YEAR: 1990

NHTSA NO.: CL0502

COLOR: Red

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 1.5 liter

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

DATE VEHICLE RECEIVED: 03/19/90

ODOMETER READING: 51.0

DEALER'S NAME AND ADDRESS: Germain Hyundai
5880 Scarborough Blvd.
Columbus, OH 43232

ACCESSORIES:

POWER STEERING No
POWER BRAKES Yes
POWER SEATS No
POWER WINDOWS No
TINTED GLASS No
RADIO Yes
CLOCK No
OTHER None

AUTOMATIC TRANSMISSION No
AUTOMATIC SPEED CONTROL No
TILTING STEERING WHEEL No
TELESCOPING STEERING WHEEL No
AIR CONDITIONING Yes
ANTI-SKID BRAKE No
REAR WINDOW DEFROSTER Yes

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: Hyundai Motor Co.

DATE OF MANUFACTURE: 12/89

GVWR: 3298 LBS

GAWR: FRONT 1730 LBS., REAR 1630 LBS.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

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

VEHICLE LOAD (UP TO CAPACITY): FRONT 28 psi; REAR 28 psi

RECOMMENDED TIRE SIZE: P155/80R13 LOAD RANGE X B, C, D

TIRES ON VEHICLE (MFR., LINE, SIZE): Goodyear Invicta GL P155/80R13

IS SPARE TIRE A "SPACE SAVER": Yes

IS SPARE TIRE STANDARD EQUIPMENT: Yes

VEHICLE CAPACITY: TYPES OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manually adjustable

NUMBER OF OCCUPANTS 2 FRONT 3 REAR 5 TOTAL

CARGO LOAD 100 LBS. TOTAL 850 LBS.

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

RIGHT FRONT 699 lbs. RIGHT REAR 390 lbs.

LEFT FRONT 684 lbs. LEFT REAR 434 lbs.

TOTAL FRONT WEIGHT 1383 lbs. (62.7% OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 824 lbs. (37.3% OF TOTAL VEHICLE WEIGHT)

TOTAL DELIVERED WEIGHT 2207 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (2207 LBS)

VCW = VEHICLE CAPACITY WEIGHT (850 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

RCLW = VCW - 150 (DCS) = 850 - 150(5) = 100 LBS

TARGET TEST WEIGHT = UDW + RCLW + (2 DUMMIES X 164 LBS/DUMMY)

= 2207 + 100 + 328 LBS

TARGET TEST WEIGHT = 2635 LBS

TABLE 2 TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 86 LBS. CARGO:

RIGHT FRONT	768 lbs.	RIGHT REAR	531 lbs.
LEFT FRONT	753 lbs.	LEFT REAR	569 lbs.
TOTAL FRONT WEIGHT	1521 lbs.	(58.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1100 lbs.	(42.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2621 lbs.	(0.5% UNDER TARGET WEIGHT)	

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

COMPONENTS REMOVED TO MEET TARGET WEIGHT: None

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	LF 25.5;	RF 25.4;	LR 24.6;	RR 24.4
PRE-TEST ATTITUDE:	LF 24.6;	RF 24.8;	LR 22.8;	RR 23.0
POST-TEST ATTITUDE:	LF 25.2;	RF 27.3;	LR 22.8;	RR 22.1

MAXIMUM WIDTH: 63.2 INCHES

WHEELBASE: 93.9 INCHES

CG = 39.4 INCHES REARWARD OF FRONT WHEEL CENTERLINE

TABLE 3 TEST CONDITIONS

TEST NUMBER: 900426

DATE OF TEST: 04/26/90

TIME OF TEST: 1324

TYPE OF TEST: Frontal barrier impact

IMPACT ANGLE: 0°

AMBIENT TEMPERATURE AT IMPACT AREA:

84° F

TEMPERATURE IN OCCUPANT COMPARTMENT:

70° F

IMPACT VELOCITY: PRIMARY = 29.5 MPH

SECONDARY = 29.6 MPH

(SPECIFIED RANGE = 28.9 TO 29.9 MPH)

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES):

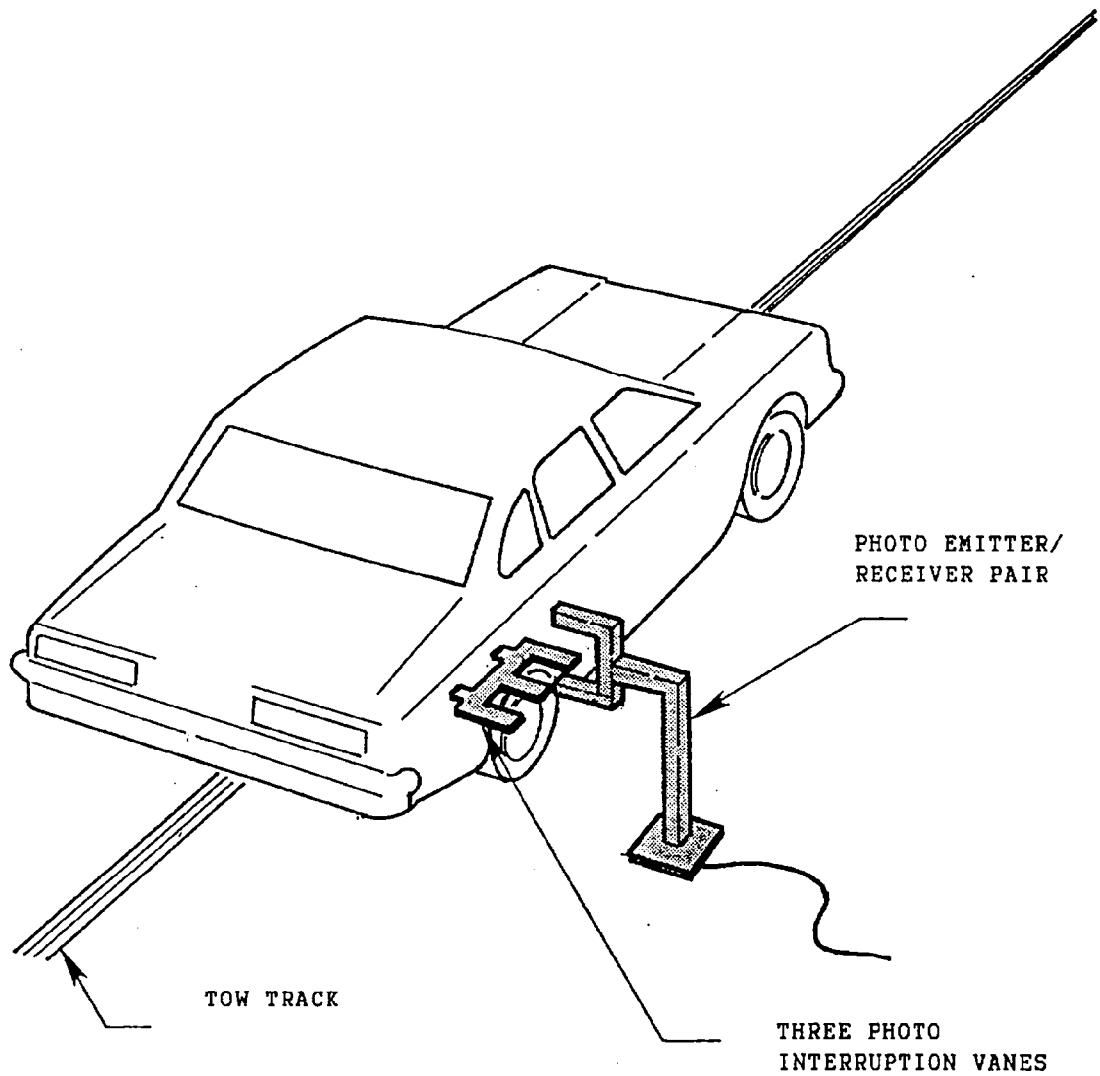
OVERALL LENGTH OF TEST VEHICLE: PRE-TEST: L 157.5; C 161.5; R 157.4

POST-TEST: L 140.6; C 143.8; R 142.6

TOTAL CRUSH: L 16.9; C 17.7; R 14.8

FOR FRONTAL IMPACTS, DISTANCE FROM FRONT OF TEST VEHICLE TO BARRIER AFTER
IMPACT: L: 32.8; C: 31.5; R: 30.2; AVG: 31.5

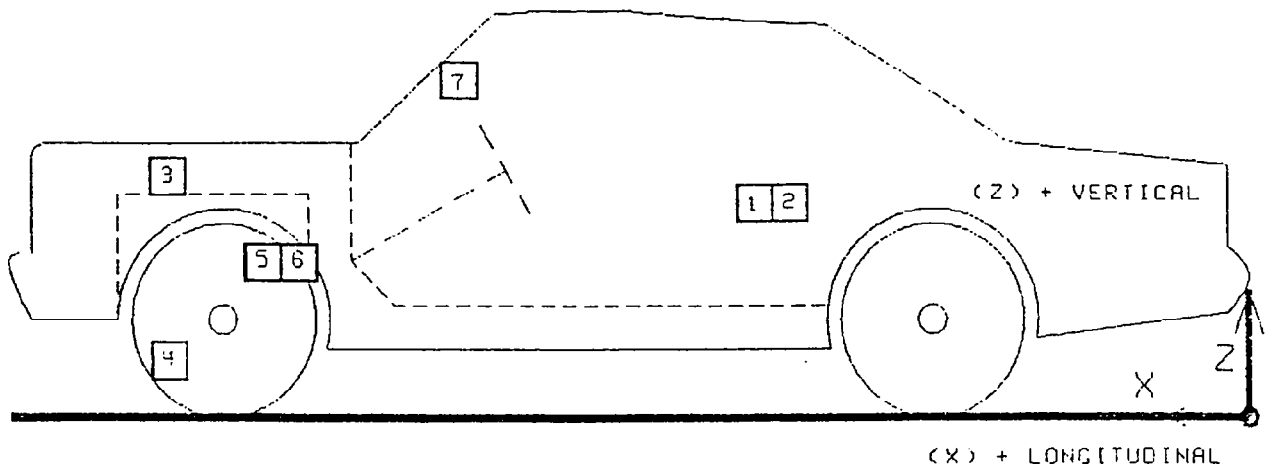
FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



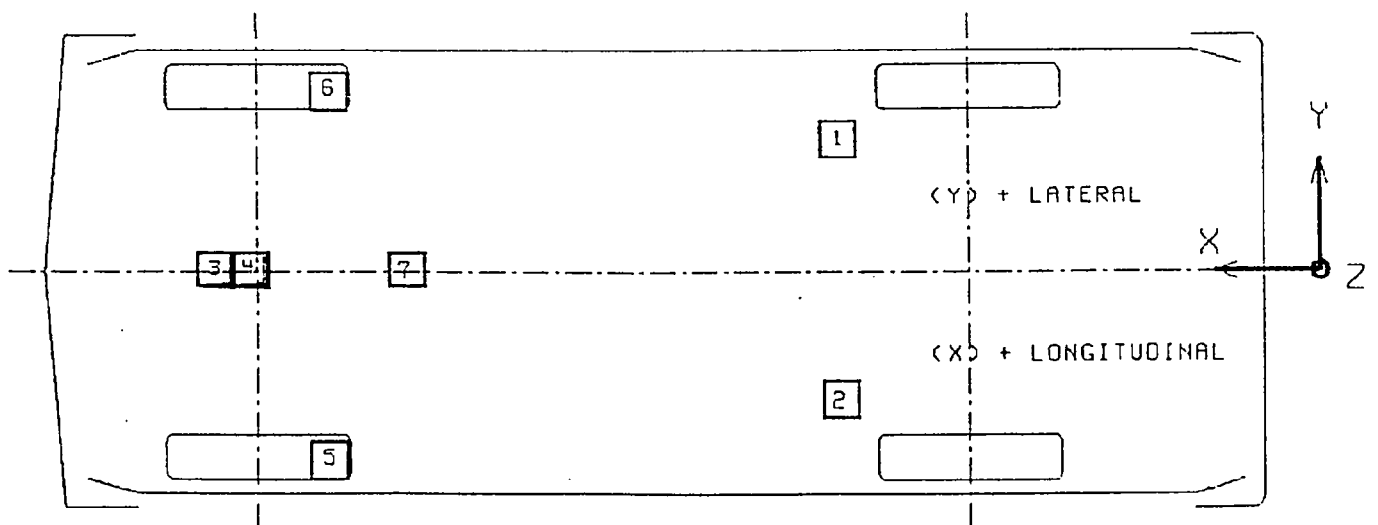
The final vane clears emitter/receiver two inches before impact.

The vanes have one foot spacing.

FIGURE 2
VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 900426

No.	LOCATION		X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
						MAX G MSEC		MAX G MSEC	
1	REAR SEAT CROSSMEMBER AT LEFT SIDE LONGITUDINAL	PRE	55.2	11.4	13.2				
		POST	54.8	11.5	13.5				
						1.9	129.6	39.2	42.4
2	REAR SEAT CROSSMEMBER AT RIGHT SIDE LONGITUDINAL	PRE	55.0	-16.1	13.2				
		POST	55.5	-15.8	13.0				
						1.5	138.0	38.9	41.3
3	TOP OF ENGINE BLOCK LONGITUDINAL	PRE	137.0	5.2	27.8				
		POST	129.4	5.5	27.6				
						30.6	44.5	87.2	28.1
4	BOTTOM OF ENGINE BLOCK LONGITUDINAL	PRE	133.4	11.0	5.9				
		POST	127.6	10.0	4.7				
						44.6	43.1	81.4	22.3
5	BRAKE CALIPER AT RIGHT SIDE LONGITUDINAL	PRE	129.5	-23.9	10.1				
		POST	130.1	-24.8	9.9				
						17.1	71.8	77.1	49.1
6	BRAKE CALIPER AT LEFT SIDE LONGITUDINAL	PRE	129.2	23.9	10.0				
		POST	128.9	24.2	10.1				
						33.2	69.5	69.5	47.6
7	DASH PANEL LONGITUDINAL	PRE	105.0	0.6	33.8				
		POST	104.8	1.2	36.0				
						27.3	70.8	49.7	53.9

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

REFERENCE: X: + FORWARD FROM REAR BUMPER
 Y: + LEFTWARD FROM VEHICLE CENTERLINE
 Z: + UPWARD FROM GROUND LEVEL

FIGURE 3 ACCIDENT INVESTIGATION DIVISION DATA
FOR 30 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: Hyundai/Excel/3-door hatchback
 VEH. NHTSA NO.: CLO502; VIN: KMHVD12J8LU029969
 MODEL YEAR: 1990; BUILD DATE: 12/89; TEST DATE: 04/26/90
 VEH. SIZE CATEGORY: Subcompact; TEST WEIGHT: 2621 lbs.
 VEH. WHEELBASE: 93.9
 MAX. WIDTH: 63.2
 FRONT OVERHANG: 34.5

COLLISION DEFORMATION
 CLASSIFICATION (CDC) CODE: 12FDEW2

F (Frontal)

CRUSH DEPTH
 DIMENSIONS:

C1 = 16.9 inches
 C2 = 17.1 inches
 C3 = 18.9 inches
 C4 = 17.4 inches
 C5 = 16.0 inches
 C6 = 14.8 inches

MIDPOINT OF DAMAGE: D = Vehicle Centerline
(Longitudinal)

LENGTH OF DAMAGED
 REGION: L = 52.0 inches

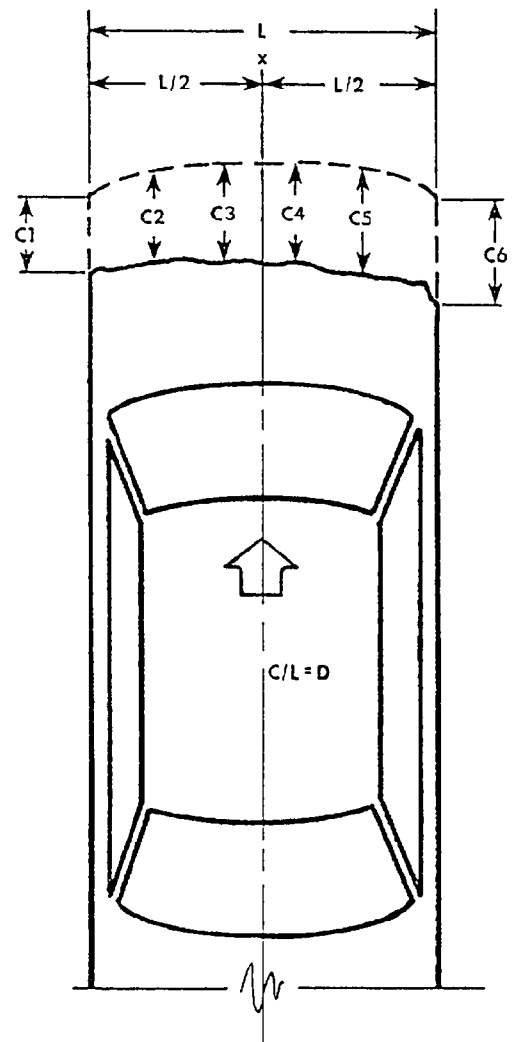


FIGURE 4

PRE-TEST AND POST-TEST MEASUREMENT POINTS

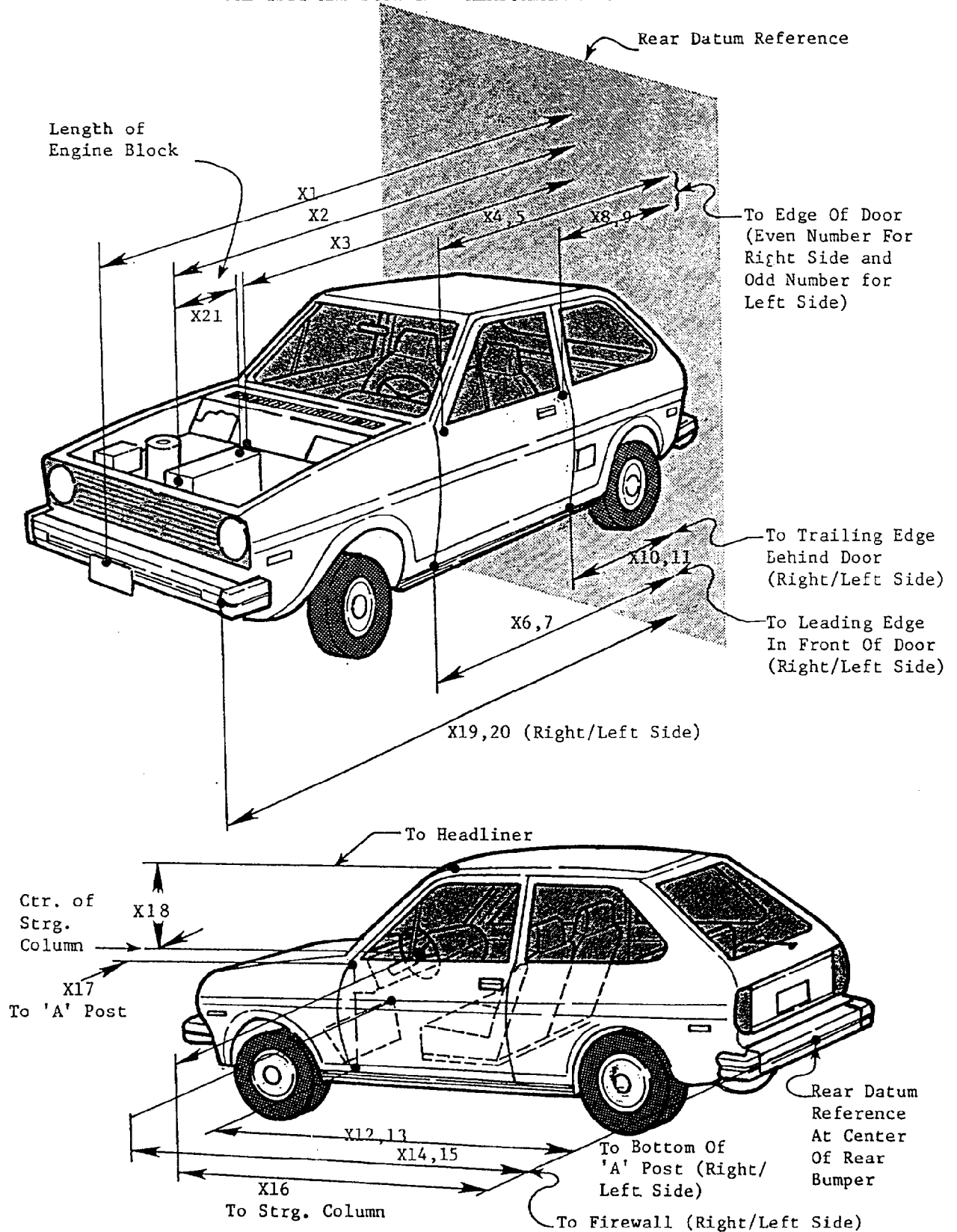
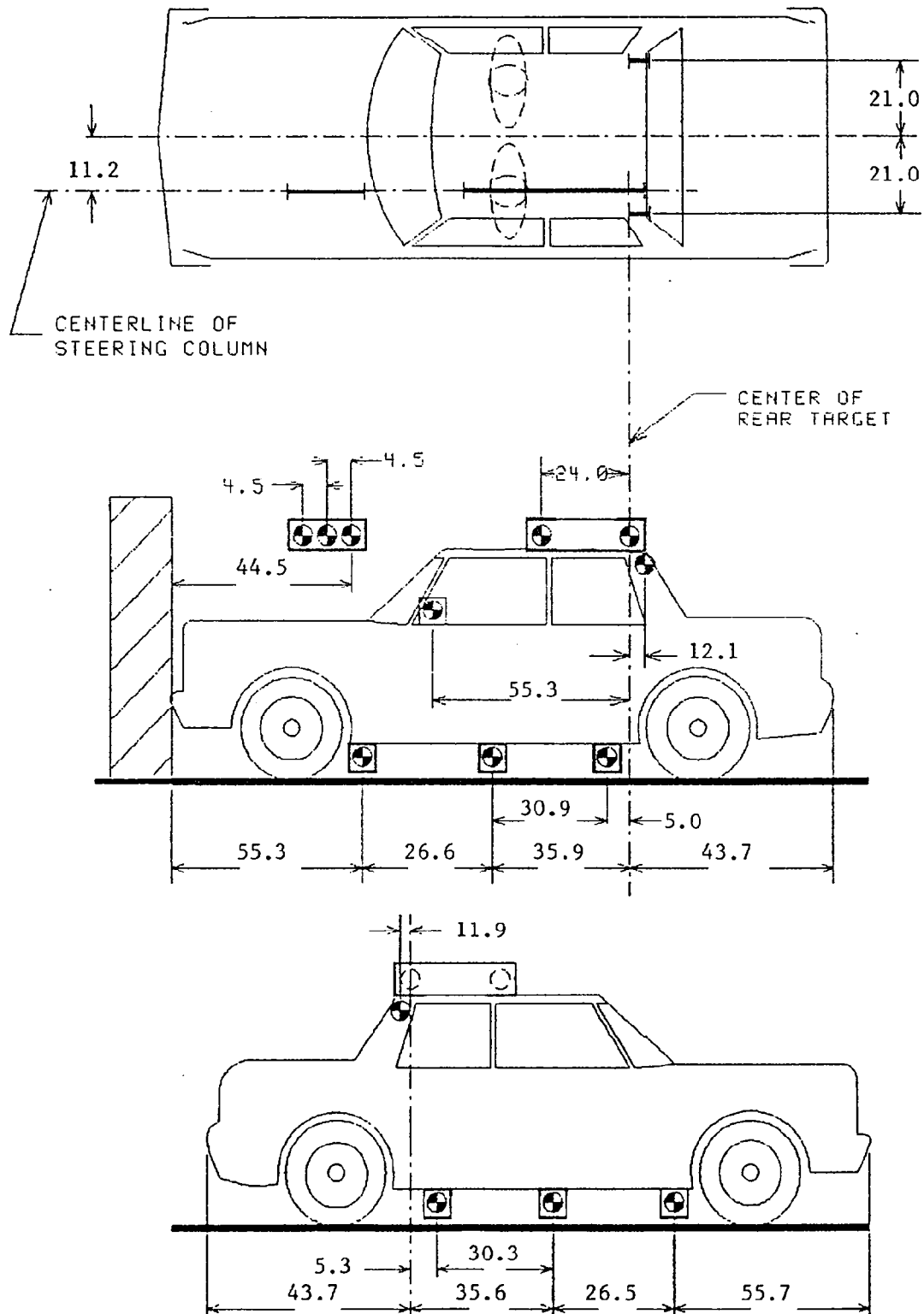


TABLE 5 IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Hyundai/Excel TEST NUMBER: 900426

NO.	TYPE OF MEASUREMENT	DIMENSIONS IN INCHES		
		PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	161.5	143.8	17.7
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	139.5	132.5	7.0
X3	REAR SURFACE OF VEHICLE TO FIREWALL	120.8	116.5	4.3
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	108.5	108.5	0.0
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	108.5	108.5	0.0
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	107.5	108.0	-0.5
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	107.9	108.5	-0.6
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	60.4	60.5	-0.1
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	60.4	60.5	-0.1
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	62.2	62.5	-0.3
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	62.4	62.8	-0.4
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	107.4	106.8	0.6
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	107.8	106.6	1.2
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	118.2	115.4	2.8
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	118.6	115.9	2.7
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	91.8	89.2	2.6
X17	CENTER OF STEERING COLUMN TO "A" POST	15.1	14.5	0.6
X18	CENTER OF STEERING COLUMN TO HEADLINER	16.9	16.1	0.8
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	157.4	142.6	14.8
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	157.5	140.6	16.9
X21	LENGTH OF ENGINE BLOCK	14.4	14.4	0.0

FIGURE 5
VEHICLE TARGET LOCATIONS



ALL DISTANCE MEASUREMENTS ARE IN INCHES.

REPORT OF VEHICLE CONDITION AT THE
COMPLETION OF TESTING

Contract No.: DTNH22-88-C-11038
From: The Transportation Research Center of Ohio
10820 State Route 347
East Liberty, OH 43319

To: Karen Nuschler
COTR
Office of Vehicle Safety Compliance

The following vehicle has been subjected to testing for FMVSS 208. The vehicle was inspected upon arrival at the laboratory for the test and found to contain all of the equipment listed below. All variances have been reported within 2 working days of vehicle arrival, by letter, to the NHTSA Industrial Property Manager/NAD-30, with a carbon copy to the responsible testing office. The vehicle is again inspected, after the above test has been conducted, and all changes are noted below. The final condition of the vehicle is also noted in detail.

NHTSA NO.: CL0502
MAKE/MODEL/BODY STYLE: Hyundai/Excel/3-door hatchback
MODEL YEAR: 1990 BODY COLOR: Red
VIN: KMHVD12J8LU029969
ODOMETER (ARRIVAL): 51.0 DATE: 03/19/90
ODOMETER (COMPLETION): 57.0 DATE: 04/26/90
COST: \$ 7,483.00

☒ Air Conditioner	☐ Console	Brakes: ☒ Power
☐ Tinted Glass	☐ Tachometer	Front: Disc
☐ Power Steering	☐ Speed Control	Rear: Drum
☐ Power Windows	☒ Rear Window Def.	
☐ Power Door Locks	☐ Sun/Moon Roof	Front Seats: ☐ Power
☒ Radio	☐ T-Top	Seat Type: Bucket
☐ Clock	☐ Tilt Steering Wheel	No. of Seats: 5
☐ Roof Rack	☐ Other Options: <u>None</u>	

Engine: 4 Cylinders; 1.5 LITRES
Transmission: Manual; Drive Type: Front
Tire Size: P155/80R13
Gasoline Type: Unleaded

Equipment that is no longer on the vehicle as noted above: None

Explanation: NA

Vehicle Condition: Vehicle has been subjected to a 30 mph frontal
barrier crash test.

SECTION 2.0

SUMMARY OF RESULTS FOR:

FMVSS 208, "Occupant Crash Protection"

FMVSS 212, "Windshield Mounting"

FMVSS 219, (Partial), "Windshield Zone Intrusion"

FMVSS 301, "Fuel System Integrity"

COMPLIANCE DATA SUMMARY

The test vehicle, a 1990 Hyundai Excel 3-door hatchback, NHTSA No. CL0502, appeared to comply with the requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.

The driver's Head Injury Criteria (HIC) was 310. The driver's maximum chest deceleration over three milliseconds was 39.5 g. The driver's right and left compressive femur loads were 1201 pounds and 1447 pounds, respectively.

The right front passenger's Head Injury Criteria (HIC) was 504. The right front passenger's maximum chest deceleration over three milliseconds was 44.0 g. The right front passenger's right and left compressive femur loads were 1207 pounds and 1323 pounds, respectively.

The vehicle's restraint system met the comfort and convenience requirements of FMVSS 208.

The windshield retention was 100 percent.

There was no intrusion into the inner surface of the windshield below the protected zone.

There was no Stoddard fluid spillage following the crash test event or during any phase of the post-test static rollover.

TABLE 6 DUMMY INJURY CRITERIA

MAXIMUM ACCELERATION ('G')

	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DRIVER	-29.2	14.8	-36.6	43.2	-39.3	8.5	14.7	39.5
PASSENGER	42.3	11.5	-46.8	54.4	-44.7	-5.7	20.8	44.0

MAXIMUM FORCE-FEMUR LOAD (LBS)

	LEFT FEMUR	RIGHT FEMUR
DRIVER	1447	1201
PASSENGER	1323	1207

HEAD INJURY CRITERIA**

	HIC	TIME t_1 (MSEC) ¹	TIME t_2 (MSEC) ²
DRIVER	310	64.2	100.2
PASSENGER	504	65.5	101.5

*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

DUMMY KINEMATIC SUMMARY

DRIVER DUMMY

Upon impact, the driver dummy translated forward on the seat impacting both knees into the instrument panel. The dummy's head rotated forward, impacting the dummy's chest. The dummy's chest impacted the lower steering wheel rim as the dummy was restrained by the two-point passive belt. The dummy's head rotated rearward as the dummy rebounded rearward and rightward into the right portion of the seat back. The dummy came to rest seated in the driver's seat, leaning to the right, restrained by the two-point passive belt.

RIGHT FRONT PASSENGER DUMMY

Upon impact, the right front passenger dummy translated forward on the seat impacting both knees into the instrument panel. The dummy's head rotated forward impacting the dummy's chest as the dummy was restrained by the two-point passive belt. The dummy's head rotated rearward into the head restraint as the dummy rebounded rearward into the seat back. The dummy came to rest seated in the right front passenger's seat, restrained by the two-point passive belt.

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #354	PASSENGER #690
Head	<u>Chest</u>	<u>Chest</u>
	<u>Lower</u>	
Chest	<u>steering wheel rim</u>	<u>None</u>
Abdomen	<u>None</u>	<u>None</u>
Left knee	<u>Instrument panel</u>	<u>Instrument panel</u>
Right knee	<u>Instrument panel</u>	<u>Instrument panel</u>

DOOR OPENING:

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

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
Front	<u>None</u>	<u>None</u>
Rear	<u>NA</u>	<u>NA</u>

GLAZING DAMAGE:

The windshield was cracked upon impact.

OTHER NOTABLE IMPACT EFFECTS:

None

FIGURE 6 DUMMY POSITIONING DATA FOR 30 MPH FRONTAL BARRIER IMPACT TEST

PRE-IMPACT DATA:

Make/Model: Hyundai/Excel
 Body Style: 3-door hatchback Model Year: 1990
 NHTSA No.: CL0502 Color: Red

DATA FROM CERTIFICATION LABEL:

Vehicle Manufacturer: Hyundai Motor Co.
 Date of Manufacture: 12/89 VIN: KMHVD12J8LU029969
 GVWR: 3298 lb; GAWR: Front = 1730 lb; Rear = 1630 lb

POST-IMPACT DATA:

Date of Test: 04/26/90 Time: 1324 Temperature: 84° F
 Required Impact Velocity Range: 28.9 to 29.9 mph
 Impact Velocity: Primary = 29.5 mph Secondary = 29.6 mph
 Seat Type: Bucket Adjuster Type: Manual
 Bucket Seat Back Type: Manual
 Technicians: D. Carpenter, P. Cummins, & R. Benavides

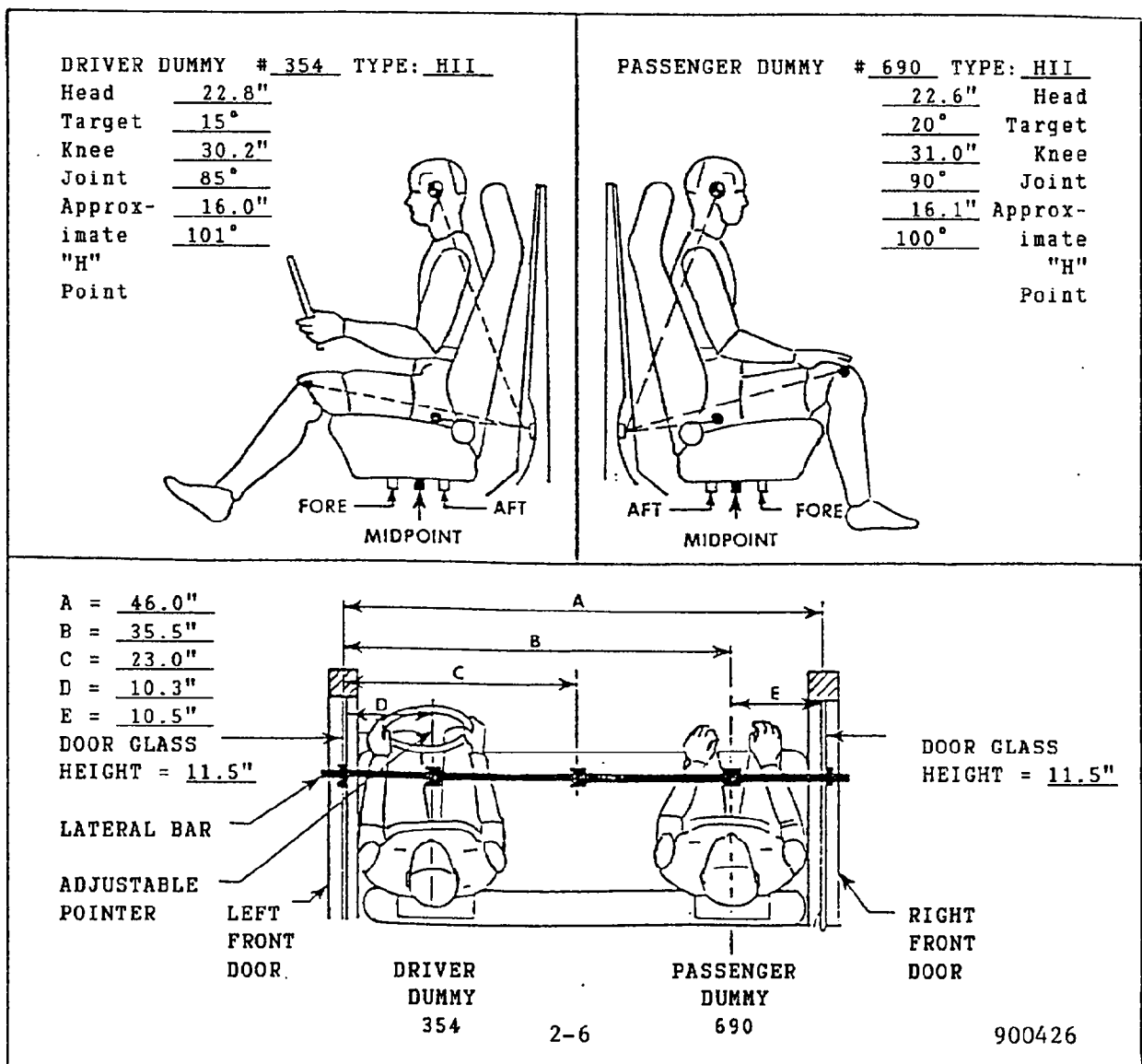
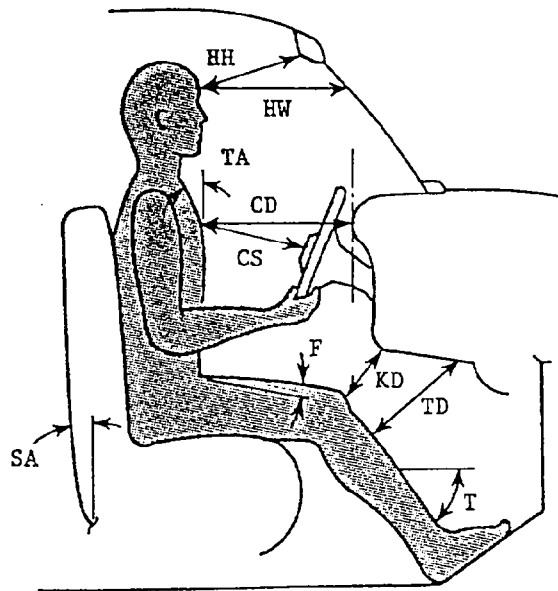


FIGURE 7 DUMMY IN-VEHICLE POSITION RECORDING SHEET

	DRIVER	PASSENGER
HH	15.2	16.0
HW	20.1	20.0
CD	21.8	24.0
CS	14.0	NA
KDL	5.4	6.6
KDR	6.0	5.9
TA	23°	25°
SA	19°	19°
HA	20.8	21.9

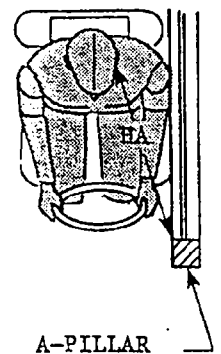
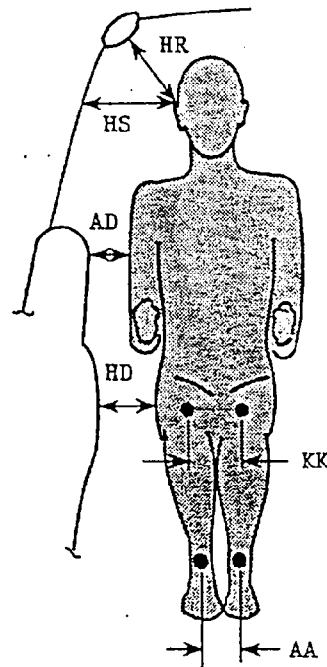


	DRIVER	PASSENGER
HR	5.0	5.0
HS	7.2	7.2
AD	3.8	4.0
HD	6.2	6.2
KK	10.0	7.8
AA	13.0	8.0

Knee outer bolt head to outer bolt head spacing:

Driver = 14.5

Passenger = 11.8



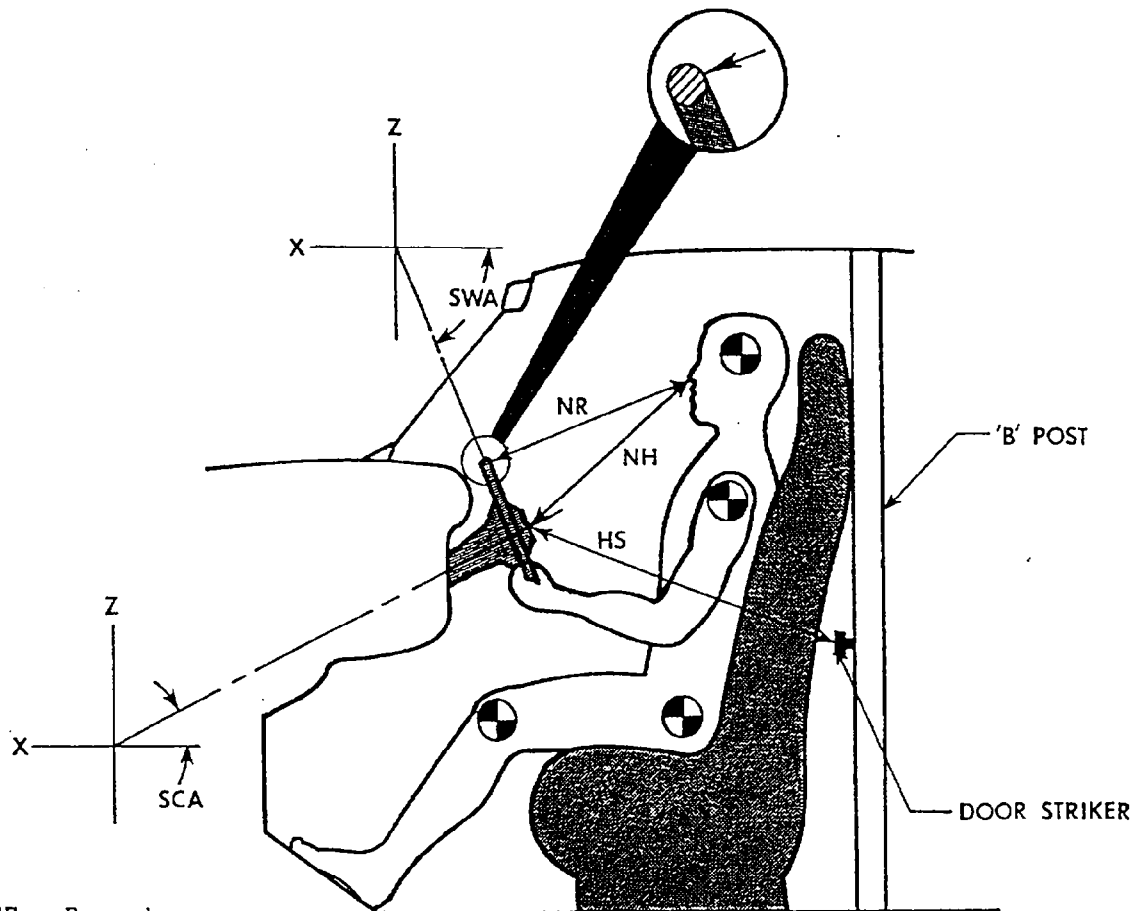
HH = Head to Windshield Header
 HW = Head to Windshield
 CD = Chest to Dash
 CS = Chest to Steering Wheel
 KD = Knee to Dash
 TA = Torso Angle
 SA = Seat Back Angle

HR = Head to Side Roof
 HS = Head to Side Window
 AD = Arm to Door
 HD = Hip to Door
 KK = Knee to Knee
 AA = Ankle to Ankle
 HA = Head to A-Pillar

Torso and seat back angles are relative to vertical.

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

FIGURE 8 DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSY. REFERENCE DIMENSIONS



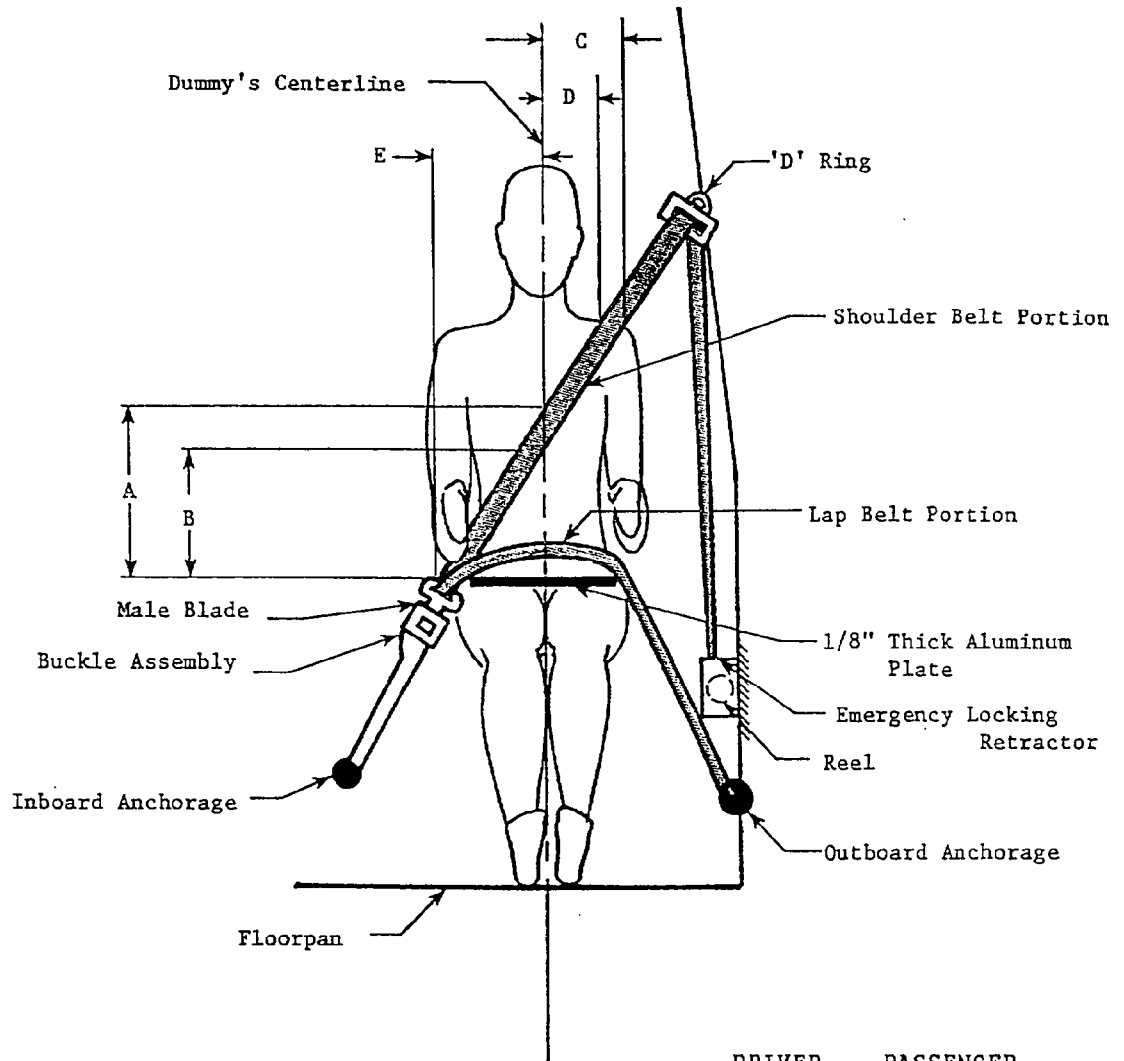
NOTE: Record position of tilt strg. column in REMARKS section

REMARKS: The steering column was a non-tilt column.

MEASUREMENTS

NR	- Distance from tip of dummy's nose to top rear surface of steering wheel rim. (in.)	19.5
NH	- Distance from tip of dummy's nose to center of steering column hub. (in.)	20.1
HS	- Distance from center of steering column hub to the forward surface of the door lock striker pin. (in.)	30.0
SCA	- Angle of steering column relative to the horizontal X axis	25°
SWA	- Angle of steering wheel relative to the horizontal X axis	65°

FIGURE 9 SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
A - Top surface of alum. plate to belt upper edge (in)	13.8	13.8
B - Top surface of alum. plate to belt lower edge (in)	10.8	10.6
C - Dummy centerline to outer edge of belt at chest flesh top (in)	5.0	6.2
D - Dummy centerline to inner edge of belt at chest flesh top (in)	2.8	3.8

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA

VEHICLE VIN: KMHVD12J8LU029969 NHTSA NO: CL0502
MAKE: Hyundai MODEL: Excel
VEHICLE BUILD DATE: 12/89 VEHICLE TYPE: 3-door hatchback
FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:
(check one): X Automatic belts
 Type 2 lap/shoulder belts
 Other

CONVENIENCE HOOKS:

DEVICE AUTOMATICALLY RELEASES WHEN IGNITION IS TURNED TO "ON" OR "START"

AND (check one):

 Vehicle's drivetrain is engaged
 Vehicle's parking brake is in the released mode
 X Not applicable, vehicle's restraint system does not
include convenience hooks

WEBBING TENSION - RELIEVING DEVICE:

DO OUTBOARD SEATING POSITION BELTS HAVE TENSION - RELIEVING DEVICES?

 No

BELT CONTACT FORCE:

FOR BELTS WITHOUT TENSION-RELIEVING DEVICES: BELT CONTACT FORCE:

 0.2 POUNDS

LATCHPLATE ACCESS: NA

RETRACTION: NA

ACCESSIBILITY: NA

LATCH MECHANISM: NA

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

WITH OCCUPANT IN DRIVER'S POSITION AND LAP BELT STOWED POSITION AND IGNITION SWITCH PLACED IN "START/ON" POSITION:

Duration of audible warning signal = 6 sec.

Duration of reminder light operation = 6 sec.

WITH OCCUPANT IN DRIVER'S POSITION AND PASSIVE BELT IN USE AND THE IGNITION SWITCH PLACED IN "START/ON" POSITION:

Duration of audible warning signal = 0 sec.

(NOTE: audible warning should not operate)

Duration of reminder light operation = 6 sec.

Wording of visual warning:

Fasten Seat Belt

Fasten Belt

Symbol 101-80 X

TABLE 9 FMVSS NO. 208 - LABELING AND DRIVER'S MANUAL DATA

DESCRIBE LOCATION OF LABEL WHICH DESCRIBES MANUFACTURER'S MAINTENANCE OR
REPLACEMENT SCHEDULE FOR CRASH-DEPLOYED OCCUPANT PROTECTION SYSTEM: NA,
vehicle did not contain a crash-deployed occupant protection system.

TABLE 10 FMVSS NO. 208 - READINESS INDICATOR DATA

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. NA, vehicle did not contain a crash-deployed occupant protection system.

TABLE 11 SUMMARY OF FMVSS 301 DATA

PRE-IMPACT DATA

MAKE/MODEL: Hyundai Excel

BODY STYLE: 3-door hatchback

MODEL YEAR: 1990

NHTSA NO.: CL0502

COLOR: Red

DATA FROM CERTIFICATION LABEL

VEHICLE MANUFACTURER: Hyundai Motor Co.

DATE OF MANUFACTURE: 12/89

VIN: KMHVD12J8LU029969

GVWR: 3298 LBS., GAWR: FRONT 1730 LBS., REAR 1630 LBS.

POST-IMPACT DATA

TYPE OF TEST: Frontal Barrier Impact

DATE OF TEST: 04/26/90

TIME: 1324

TEMP: 84° F

REQUIRED IMPACT VELOCITY RANGE: 28.9 MPH TO 29.9 MPH

IMPACT VELOCITY: PRIMARY = 29.5 MPH, SECONDARY = 29.6 MPH

TEST WEIGHT = 2621 LBS., STATIC CRUSH MAX. = 18.9 IN., REBOUND = 31.5 IN.

FUEL SYSTEM DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: 11.9 GALLONS (FURNISHED BY COTR)

TEST VOLUME: 11.1 GALLONS (92-94% OF USEABLE)

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 11.9 GALLONS

DETAILS OF FUEL SYSTEM: The fuel tank is located behind the rear axle.

The fuel filler neck is on the left side. The fuel lines run along the

left frame rail to the front.

ELECTRIC FUEL PUMP: Yes

FUEL INJECTON: Yes

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

*WITH ENTIRE FUEL SYSTEM FILLED.

FIGURE 10 FMVSS NO. 212. "WINDSHIELD MOUNTING", DATA SHEET

Details of windshield mounting such as retention method, trim type, etc.:

Adhesive trim around inner perimeter, plastic trim around outer perimeter.

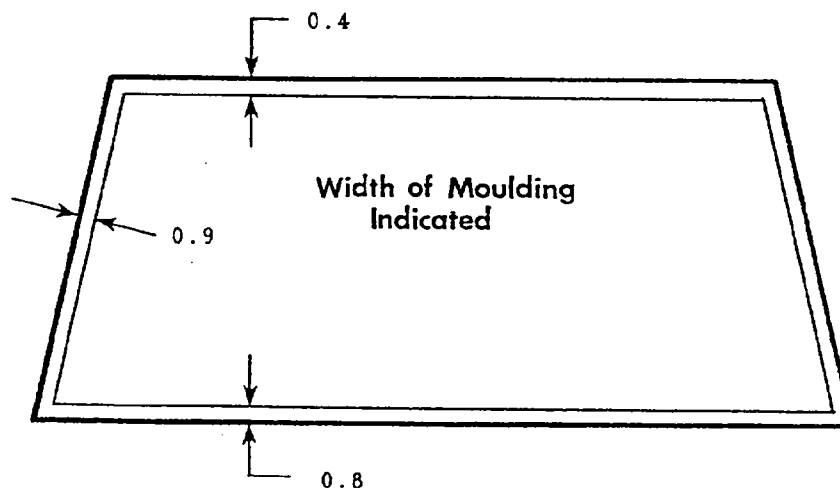
FMVSS 212 REQUIREMENTS: The post-test periphery retention amount must be at least 75% of the pre-test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

WINDSHIELD PERIPHERY

	PRE-TEST (in)	POST-TEST (in)	PERCENT RETENTION
RIGHT SIDE	72.2	72.2	100%
LEFT SIDE	72.2	72.2	100%
TOTAL	144.4	144.4	100%

AREA OF RETENTION FAILURE:



WINDSHIELD TEMPERATURE: 70° F

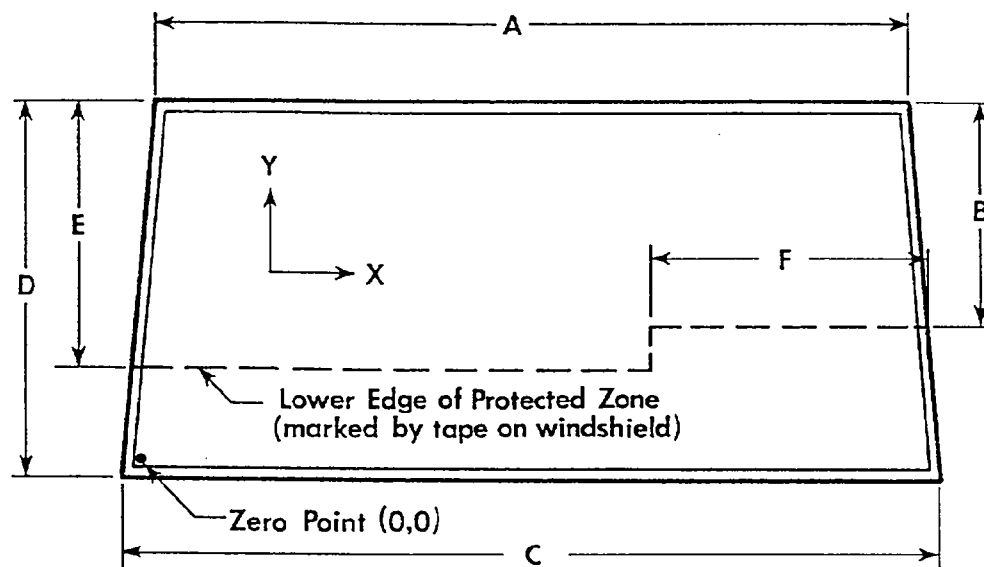
FAILURE DETAILS: None

FIGURE 11 FMVSS NO. 219. "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. Draw the locus of points on the inner surface of the windshield contactable 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" from the locus line. The LOWER EDGE OF THE PROTECTED ZONE is the longitudinal projection onto the outer surface of the windshield of this line.

FMVSS 219 TEST DATA:



FRONT VIEW

A = 39.2	C = 56.0	E = 20.1
B = 18.3	D = 27.0	F = 23.4

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

COORDINATES
X Y

None

1.
2.
3.
4.

ALL MEASUREMENTS ARE IN INCHES.

TABLE 12 "FUEL SYSTEM INTEGRITY" POST-IMPACT

TEST DATA, FMVSS NO. 301

TEST VEHICLE NHTSA NO.: CLO502; TEST DATE: 04/26/90

VEH. MFR./MAKE/MODEL: Hyundai Motor Company/Hyundai/Excel

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:

- ☒ Frontal (30 mph)
- ☐ Oblique (30 mph) with ☐ barrier face
first contacting ☐ (driver/pass.) side.
- ☐ Rear Moving Barrier (30 mph)
- ☐ Lateral Moving Barrier (20 mph)

FUEL SPILLAGE MEASUREMENT:

	<u>ACTUAL</u>	<u>MAX. ALLOW.</u>
1. From impact until vehicle motion ceases - - -	0	1 oz.
2. For 5 min. period after veh. motion ceases- -	0	5 oz.
3. For next 25 minutes - - - - -	0	1 oz./1 min.

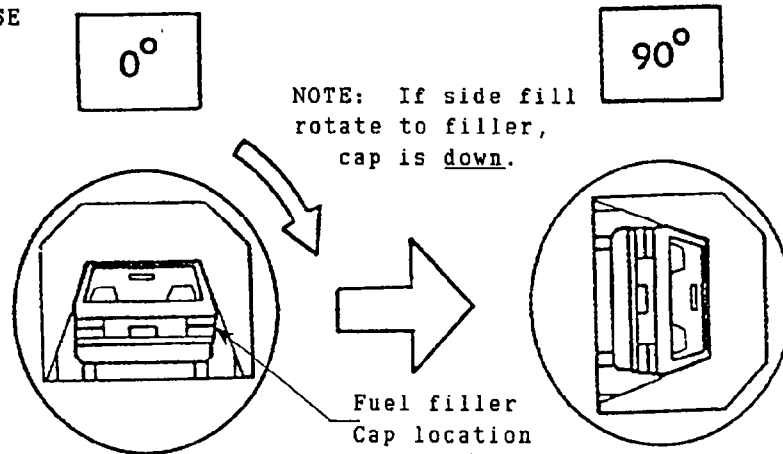
SOLVENT SPILLAGE DETAILS:

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

NHTSA NO.: CL0502

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301 position hold time = 5 minutes, 00 seconds

TOTAL - - - - - = 7 minutes, 00 seconds

Next whole minute interval - - - - - = 7 minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes FROM ONSET OF ROTATION	6th Minute	7th Minute
Maximum allowable solvent spillage - -	<u>5 oz.</u>	<u>1 oz.</u>	<u>1 oz.</u>
0 to 90° (filler cap down) - - - - -	<u>0 oz.</u>	<u>0 oz.</u>	<u>0 oz.</u>

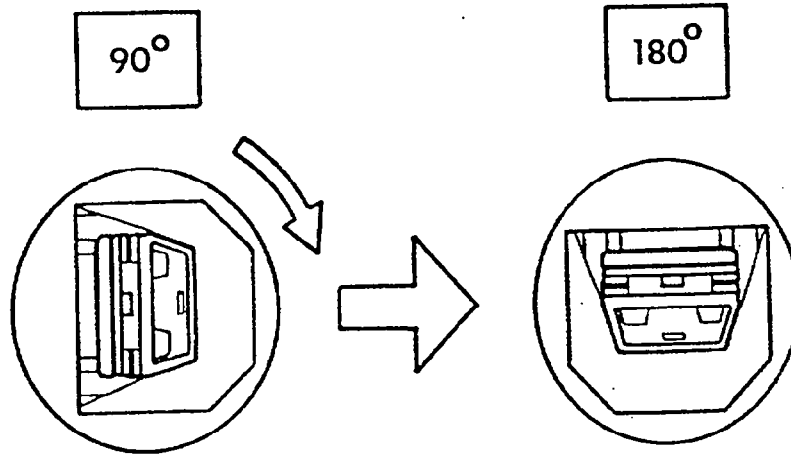
SOLVENT SPILLAGE LOCATION(S)

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET CONT'D

NHTSA NO.: CL0502

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301 position hold time = 5 minutes, 00 seconds

TOTAL - - - - - = 7 minutes, 00 seconds

Next whole minute interval - - - - = 14 minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes	6th	7th
	FROM ONSET OF ROTATION	Minute	Minute
Maximum allowable solvent spillage - -	<u>5 oz.</u>	<u>1 oz.</u>	<u>1 oz.</u>
90° to 180° - - - - -	<u>0 oz.</u>	<u>0 oz.</u>	<u>0 oz.</u>

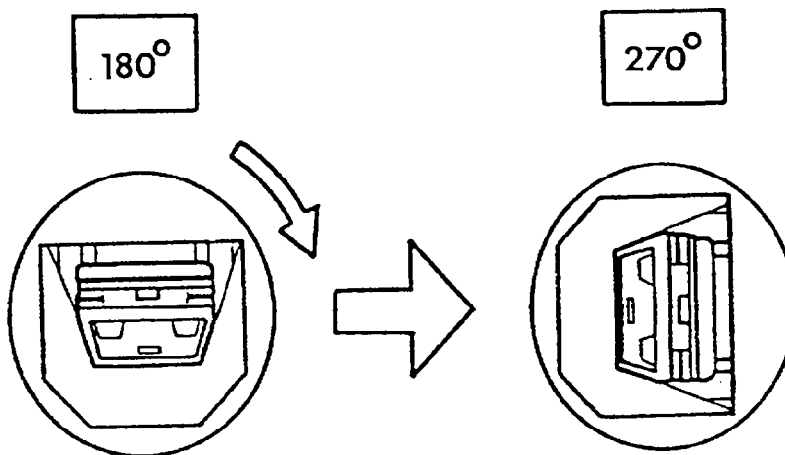
SOLVENT SPILLAGE LOCATION(S)

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET CONT'D

NHTSA NO.: CL0502

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301 position hold time = 5 minutes, 00 seconds

TOTAL - - - - - = 7 minutes, 00 seconds

Next whole minute interval - - - - = 21 minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes	6th	7th
	FROM ONSET OF ROTATION	Minute	Minute
Maximum allowable solvent spillage - -	<u>5 oz.</u>	<u>1 oz.</u>	<u>1 oz.</u>
180° to 270° - - - - -	<u>0 oz.</u>	<u>0 oz.</u>	<u>0 oz.</u>

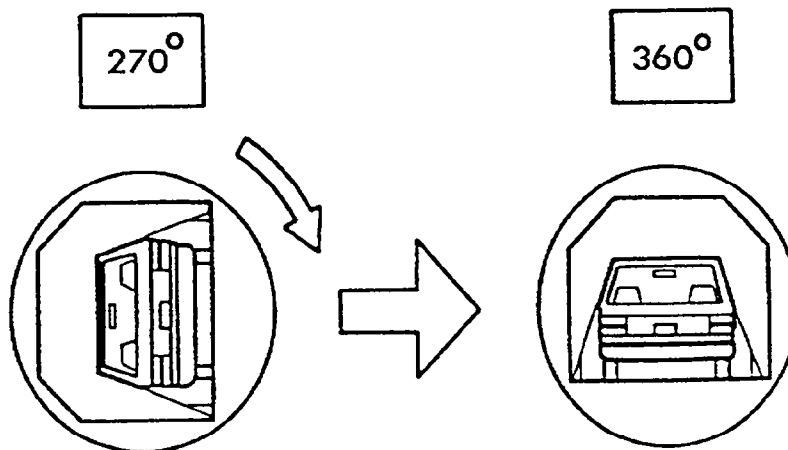
SOLVENT SPILLAGE LOCATION(S)

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET CONT'D

NHTSA NO.: CLO502

TEST PHASE



STATIC ROLLOVER MACHINE ROTATION TIME INFORMATION: (Spec. Range = 1-3 min.)

Time req. for machine to rotate 90° = 2 minutes, 00 seconds

FMVSS 301 position hold time = 5 minutes, 00 seconds

TOTAL - - - - - = 7 minutes, 00 seconds

Next whole minute interval - - - - = 28 minutes

FMVSS 301 REQUIREMENTS

	First 5 minutes FROM ONSET OF ROTATION	6th Minute	7th Minute
Maximum allowable solvent spillage - -	<u>5 oz.</u>	<u>1 oz.</u>	<u>1 oz.</u>
270° to 360° - - - - -	<u>0 oz.</u>	<u>0 oz.</u>	<u>0 oz.</u>

SOLVENT SPILLAGE LOCATION(S)

None

SECTION 3.0

CAMERA INFORMATION

FIGURE 13

CAMERA POSITIONS

4, 7, 8

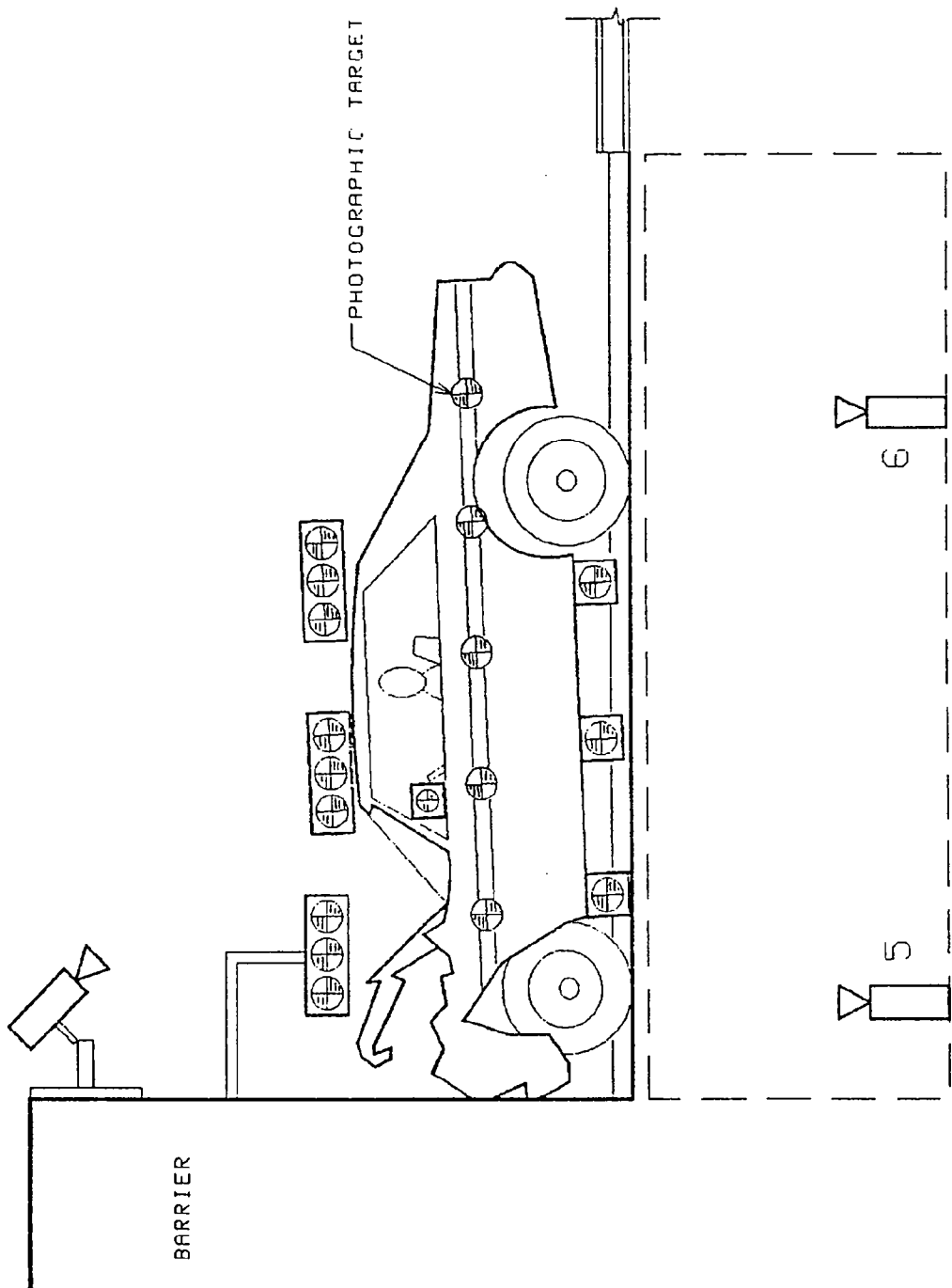


FIGURE 13

CAMERA POSITIONS, CONTINUED

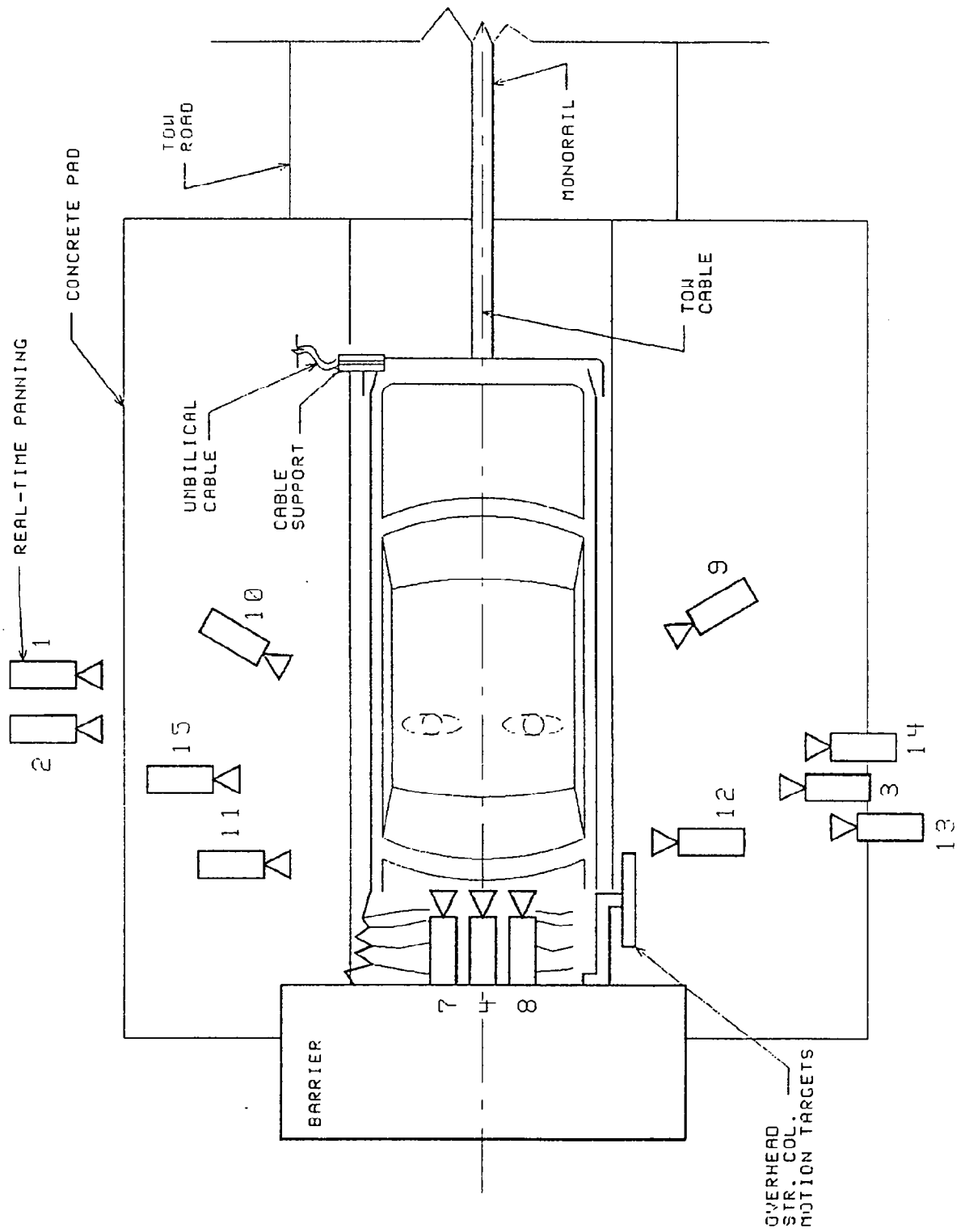


TABLE 13 HIGH SPEED CAMERA LOCATIONS

CAMERA NO.	VIEW	CAMERA POSITIONS (IN)*			ANGLE** (DEG)	FILM PLANE		LENS (MM)	SPEED (FPS)
		X	Y	Z		TO HEAD TARGET			
1	Real time panning	-142.0	-504.0	61.0	NA	NA		16	24
2	Vehicle crush	-81.3	-266.4	37.1	-2	NA		13	502
3	Dummy kinematics	-41.5	295.0	44.0	-4	218.0		25	500
4	Windshield damage	-6.0	0.0	96.0	-40	NA		8.5	500
5	Crush & fluid spillage	-50.5	0.0	-92.4	90	NA		13	1000
6	Fluid spillage	-99.3	0.0	-99.0	90	NA		13	1002
7	Passenger kinematics	-4.5	-13.8	93.0	-50	NA		13	500
8	Driver kinematics	-6.8	14.5	93.0	-50	NA		13	498
9	Driver kinematics	-157.3	116.0	87.0	-27	91.0		25	500
10	Passenger kinematics	-152.1	-116.0	87.0	-26	93.0		25	505
11	Windshield intrusion	-38.1	-306.1	44.0	0	NA		50	500
12	Windshield intrusion	-53.0	309.4	42.3	0	NA		50	500
13	Column movement	-90.0	290.0	103.0	-14	NA		25	500
14	Column movement	-90.0	290.0	75.1	-9	NA		25	498
15	Passenger kinematics	-38.6	-293.0	45.3	-4	226.0		25	542

* +X = Film plane forward of barrier face

+Y = Film plane to left of monorail centerline

+Z = Film plane above ground level

** +Angle = Film plane angled upward from horizontal plane

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST FRONT VIEW

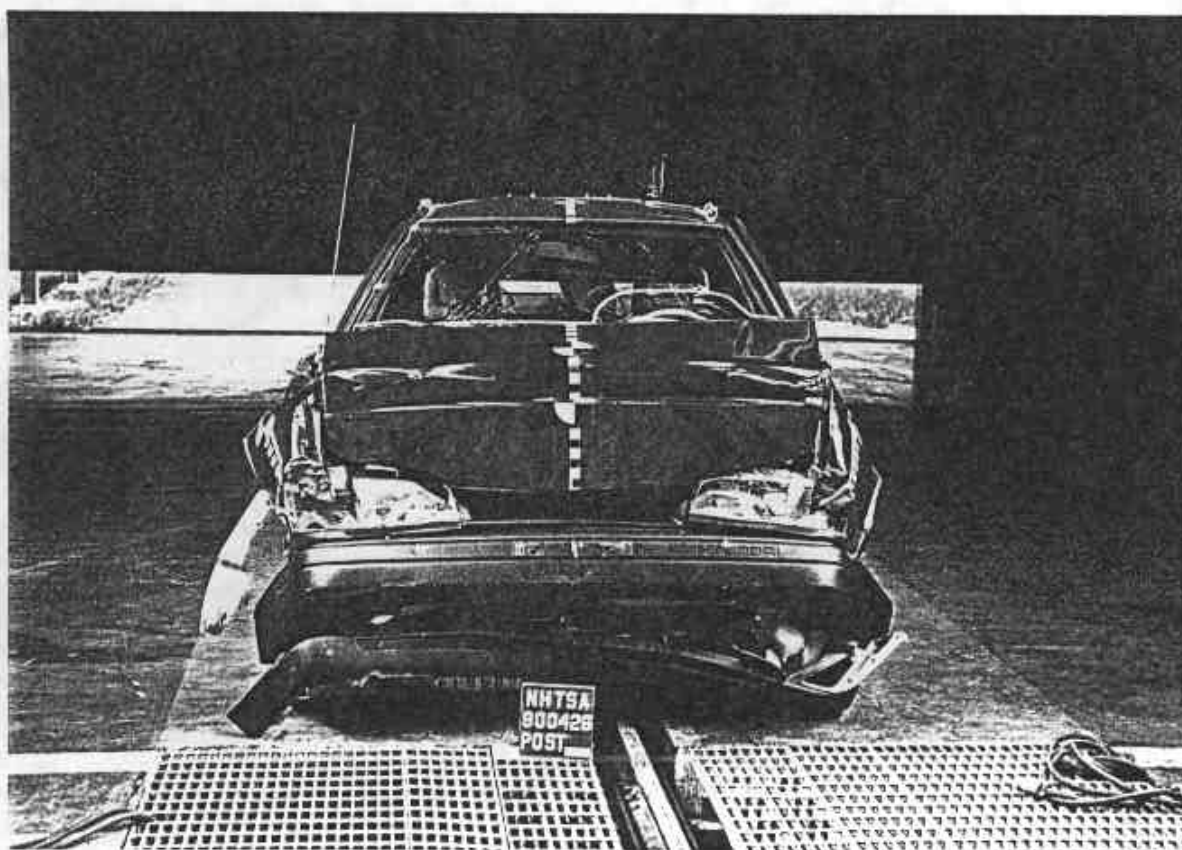


Figure A-2. POST-TEST FRONT VIEW



Figure A-3. PRE-TEST LEFT SIDE VIEW



Figure A-4. POST-TEST LEFT SIDE VIEW

A-3

900426



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



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



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



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

A-6

900426



Figure A-11. PRE-TEST REAR VIEW

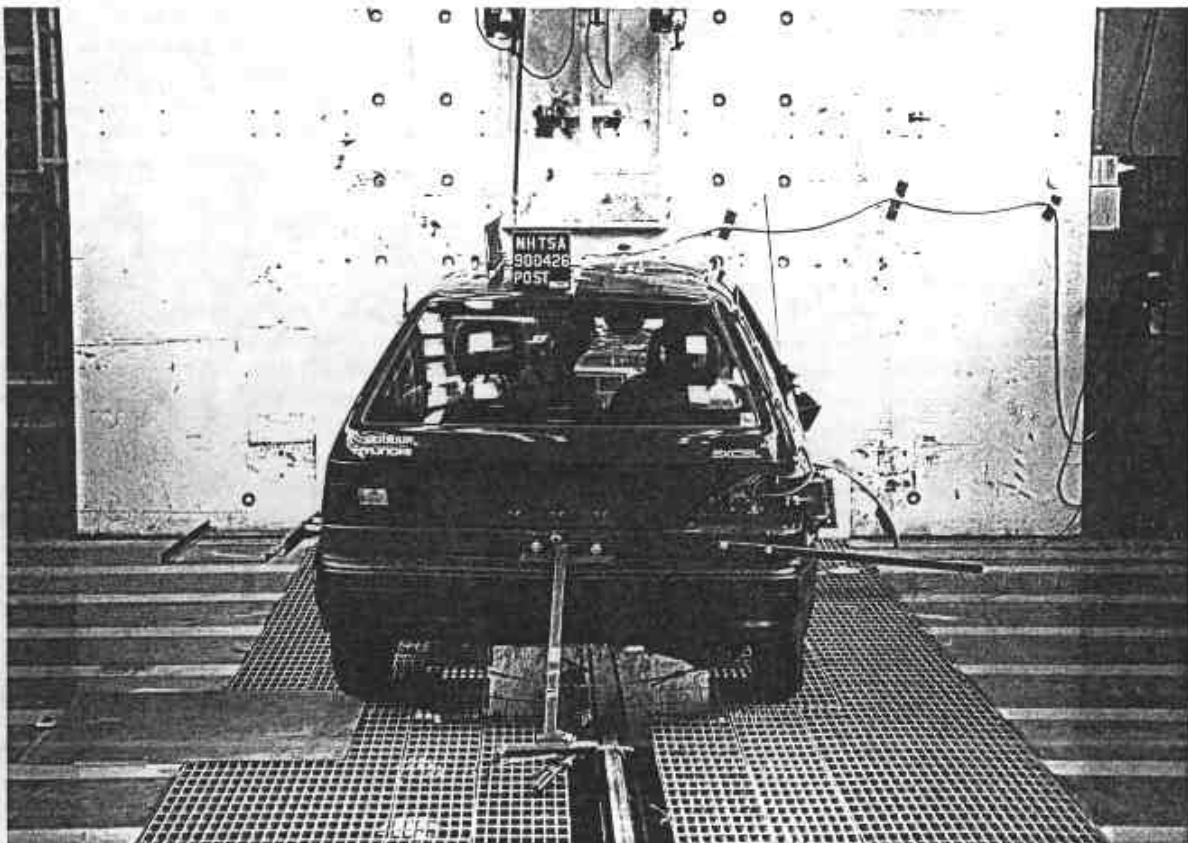


Figure A-12. POST-TEST REAR VIEW

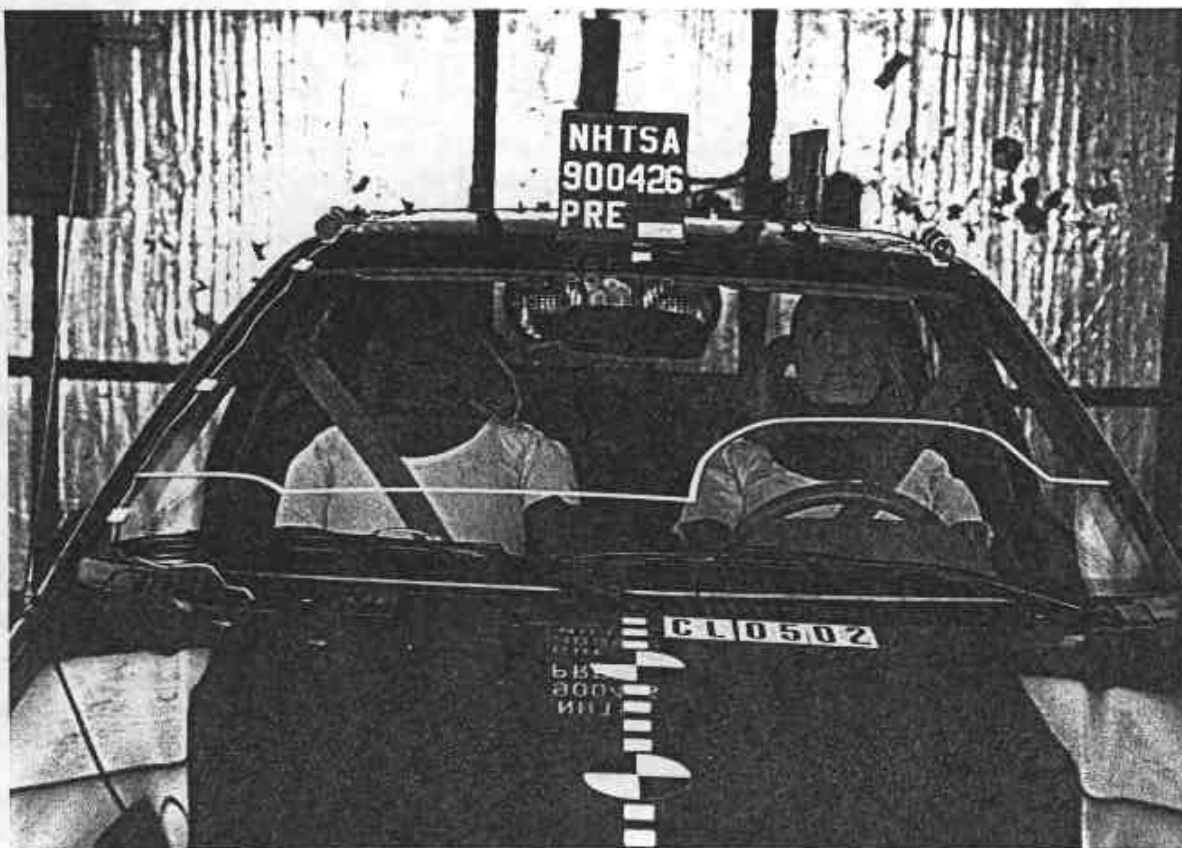


Figure A-13. PRE-TEST WINDSHIELD VIEW



Figure A-14. POST-TEST WINDSHIELD VIEW

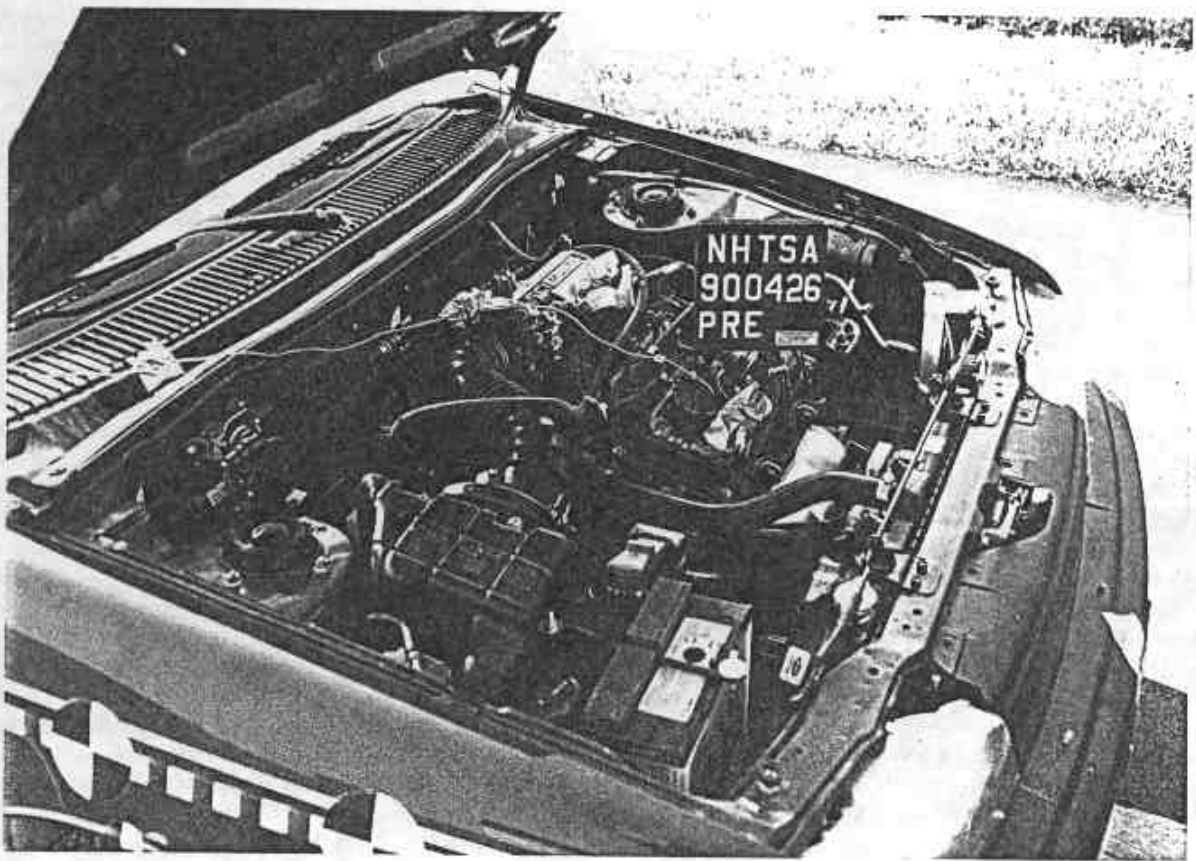


Figure A-15. PRE-TEST ENGINE COMPARTMENT VIEW

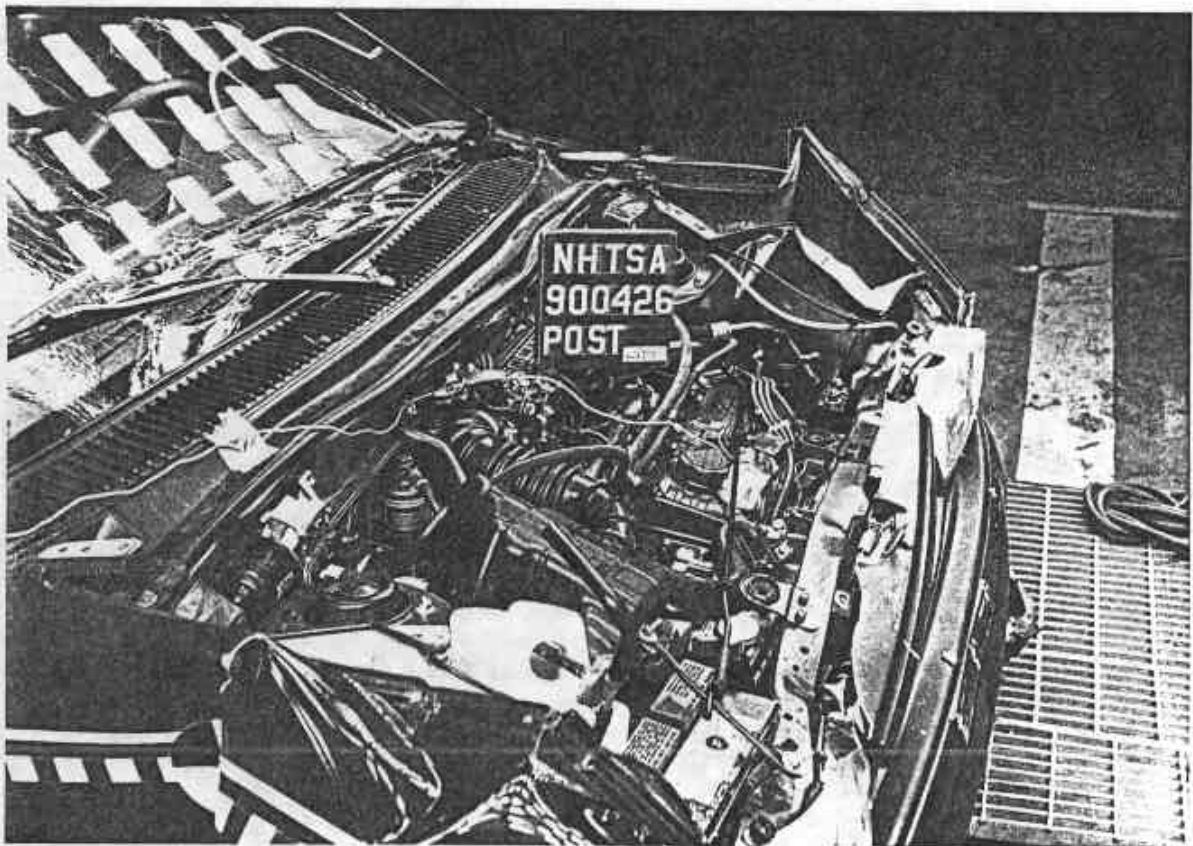


Figure A-16. POST-TEST ENGINE COMPARTMENT VIEW

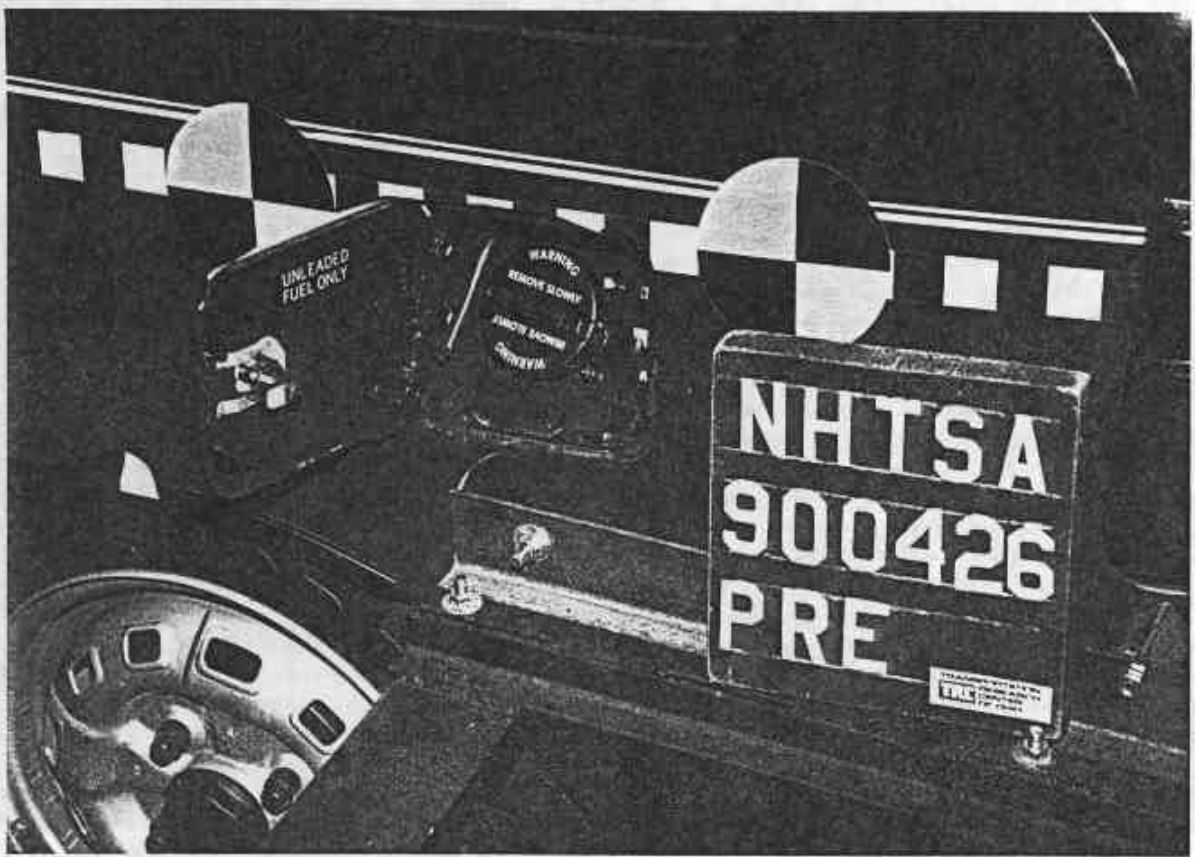


Figure A-17. PRE-TEST FUEL FILLER CAP VIEW

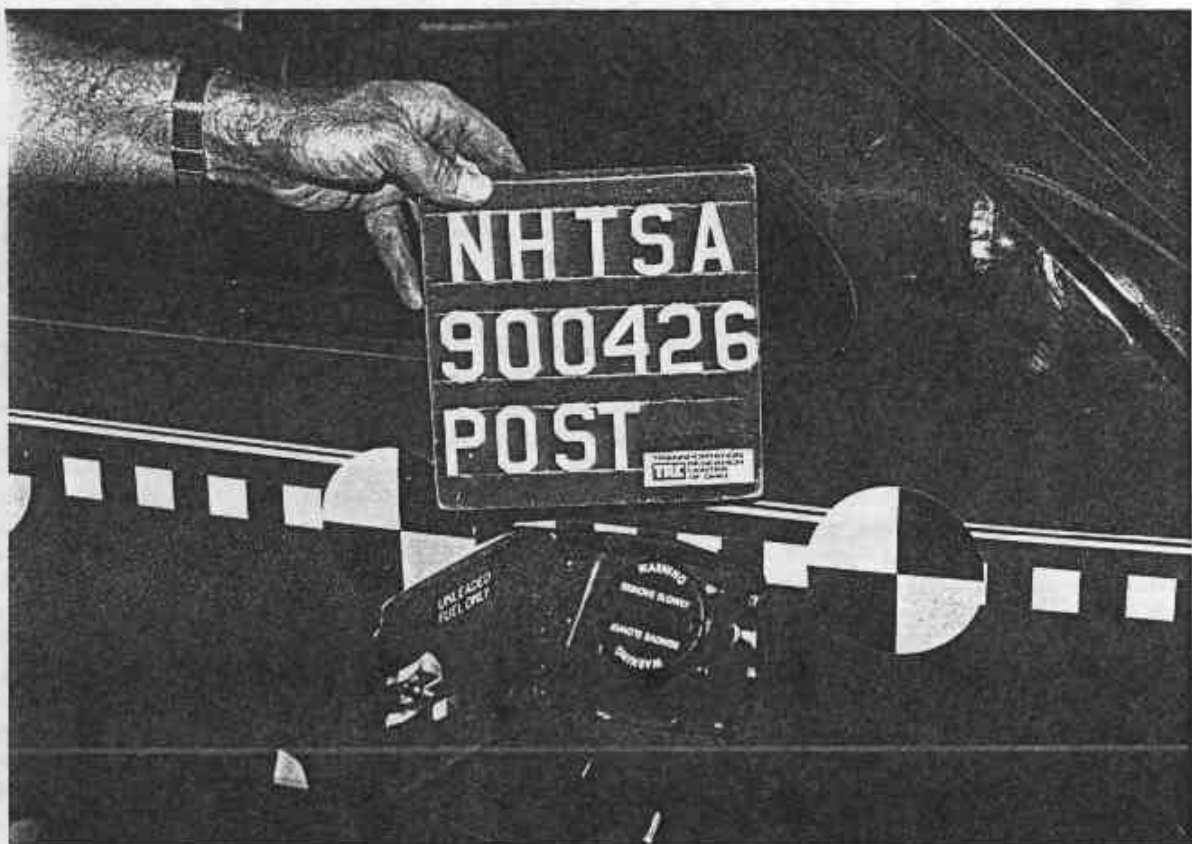


Figure A-18. POST-TEST FUEL FILLER CAP VIEW



Figure A-19. PRE-TEST FRONT UNDERBODY VIEW

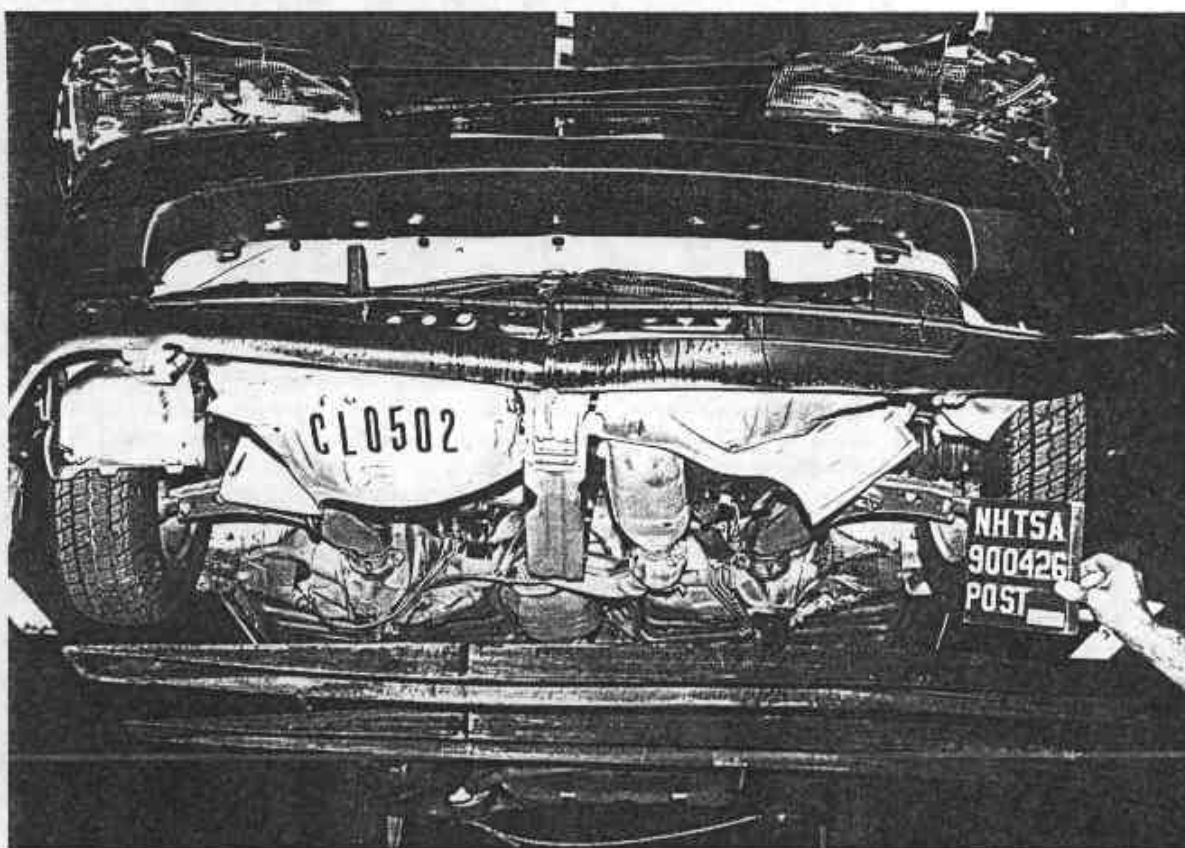


Figure A-20. POST-TEST FRONT UNDERBODY VIEW

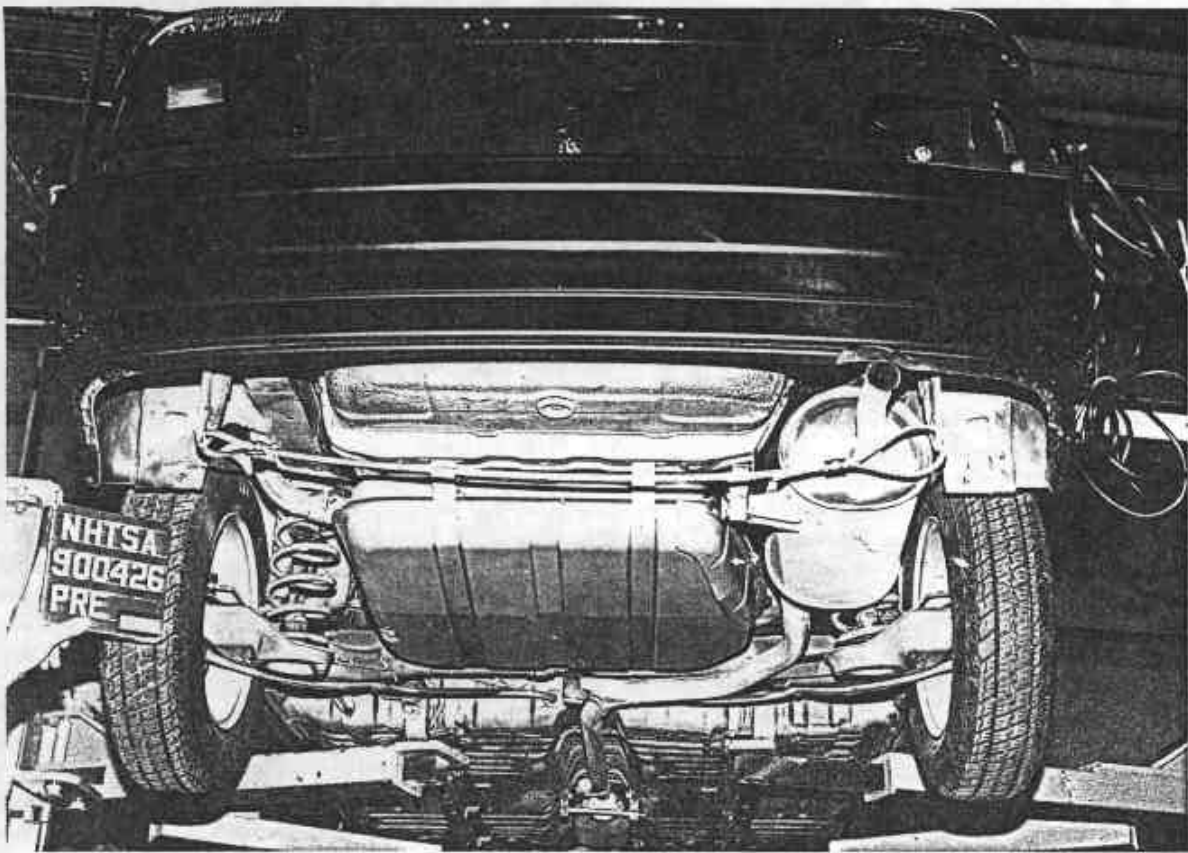


Figure A-21. PRE-TEST REAR UNDERBODY VIEW

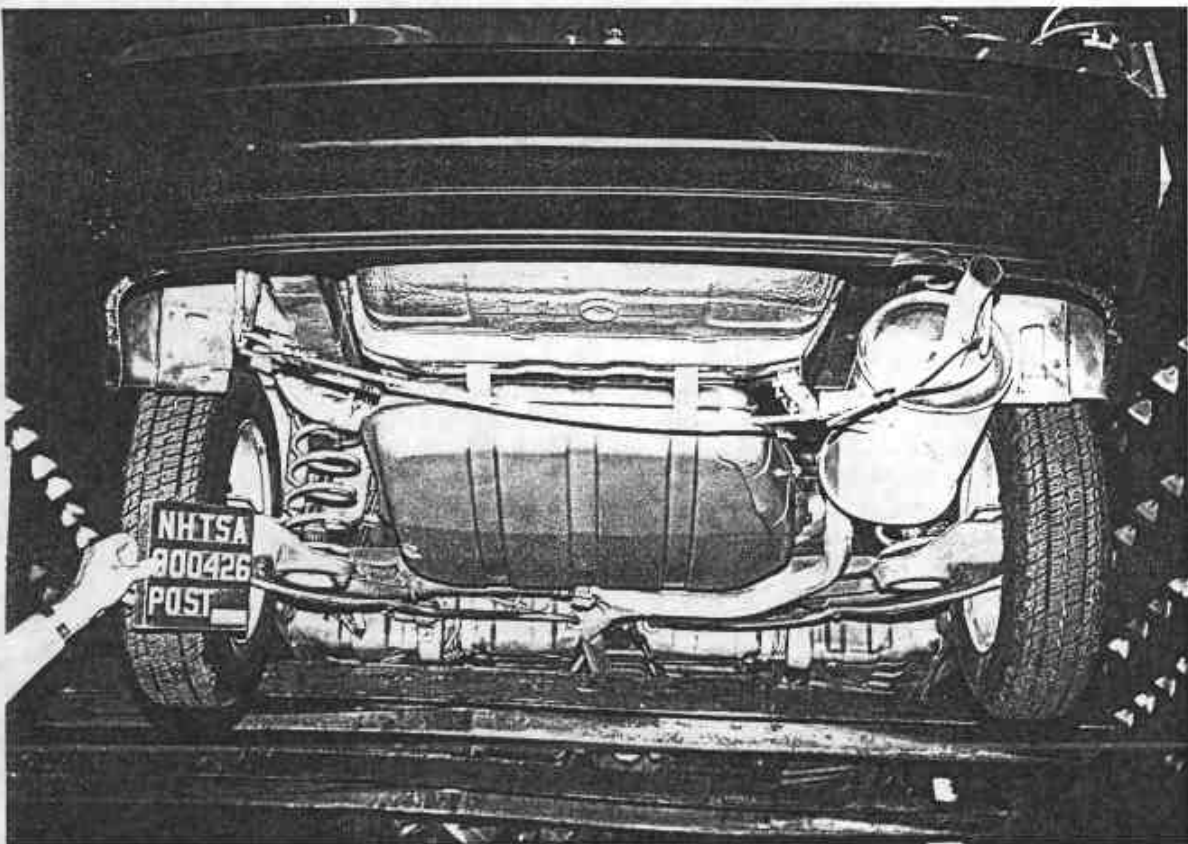


Figure A-22. POST-TEST REAR UNDERBODY VIEW



Figure A-23. PRE-TEST FUEL FILLER NECK VIEW



Figure A-24. PRE-TEST DRIVER DUMMY POSITION VIEW



Figure A-25. POST-TEST DRIVER DUMMY POSITION VIEW

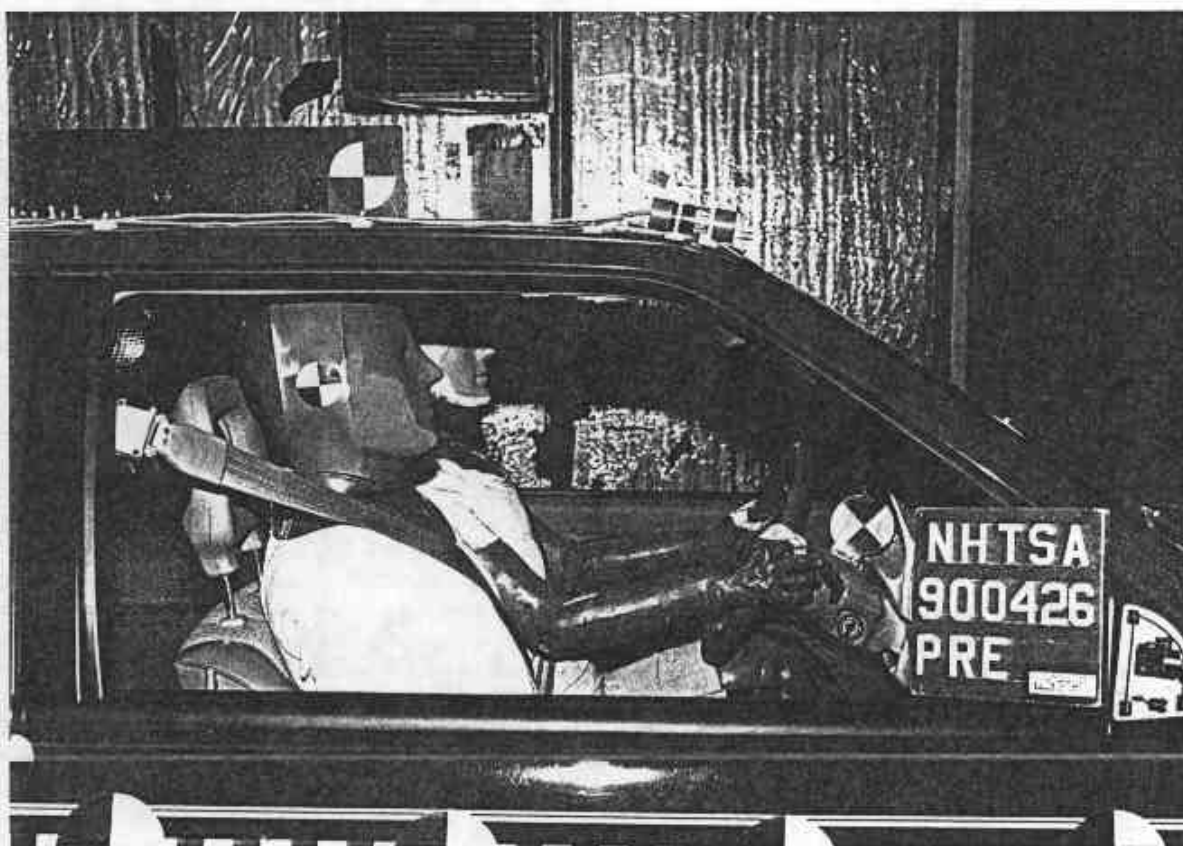


Figure A-26. PRE-TEST PASSENGER DUMMY POSITION VIEW

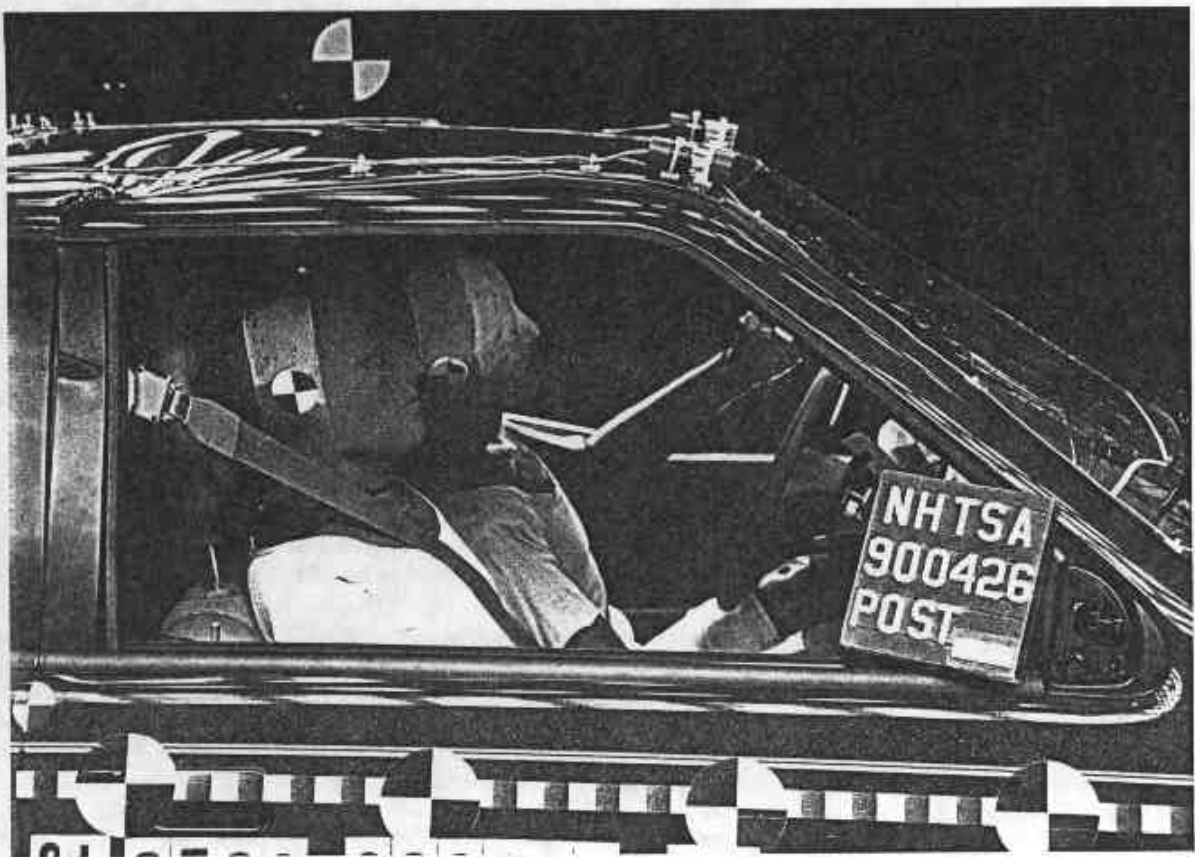


Figure A-27. POST-TEST PASSENGER DUMMY POSITION VIEW



Figure A-28. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR

A-15

900426

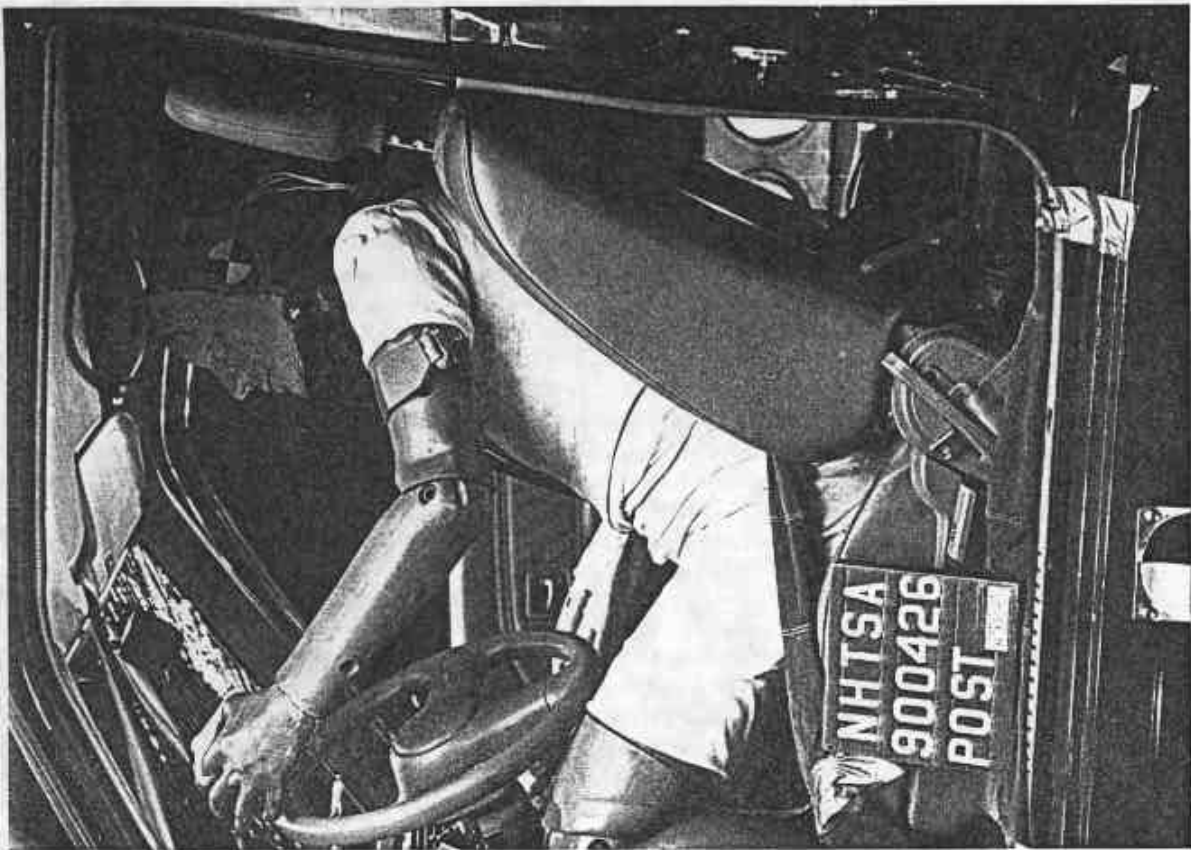


Figure A-29. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

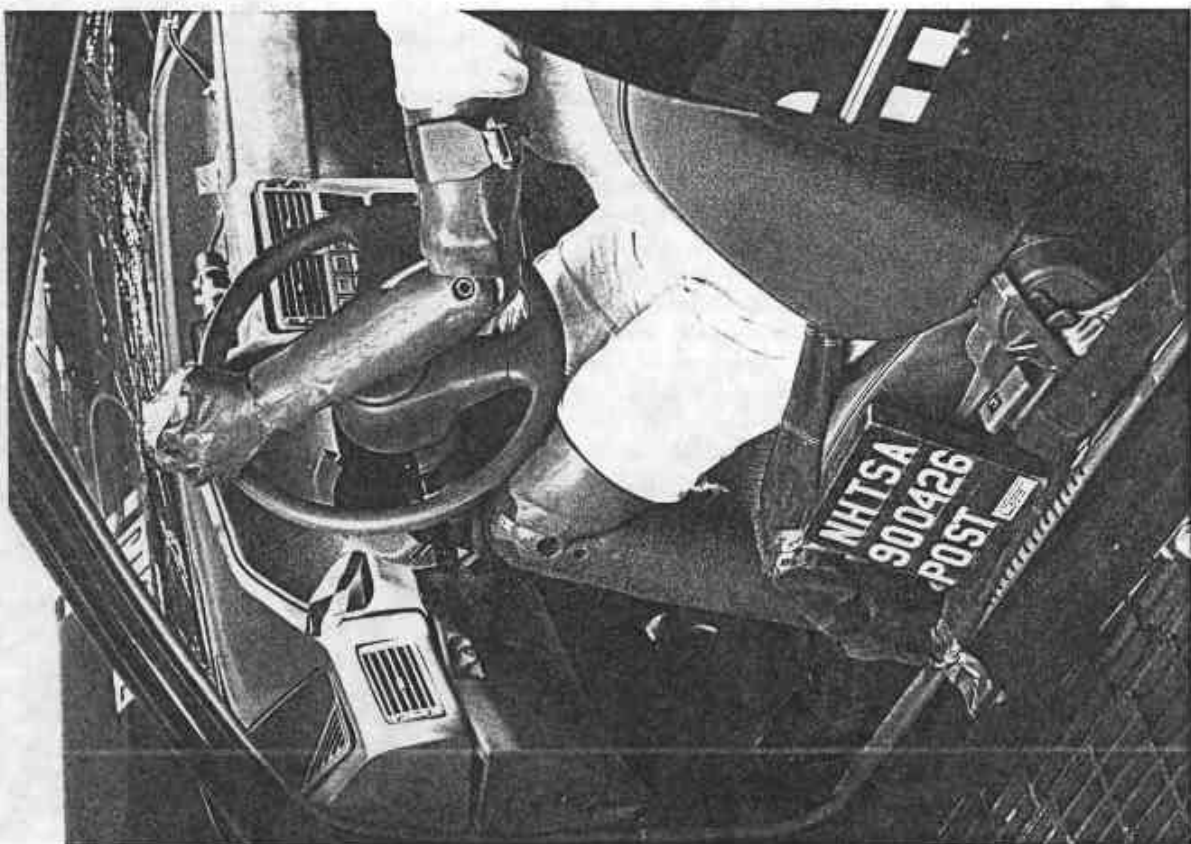


Figure A-30. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

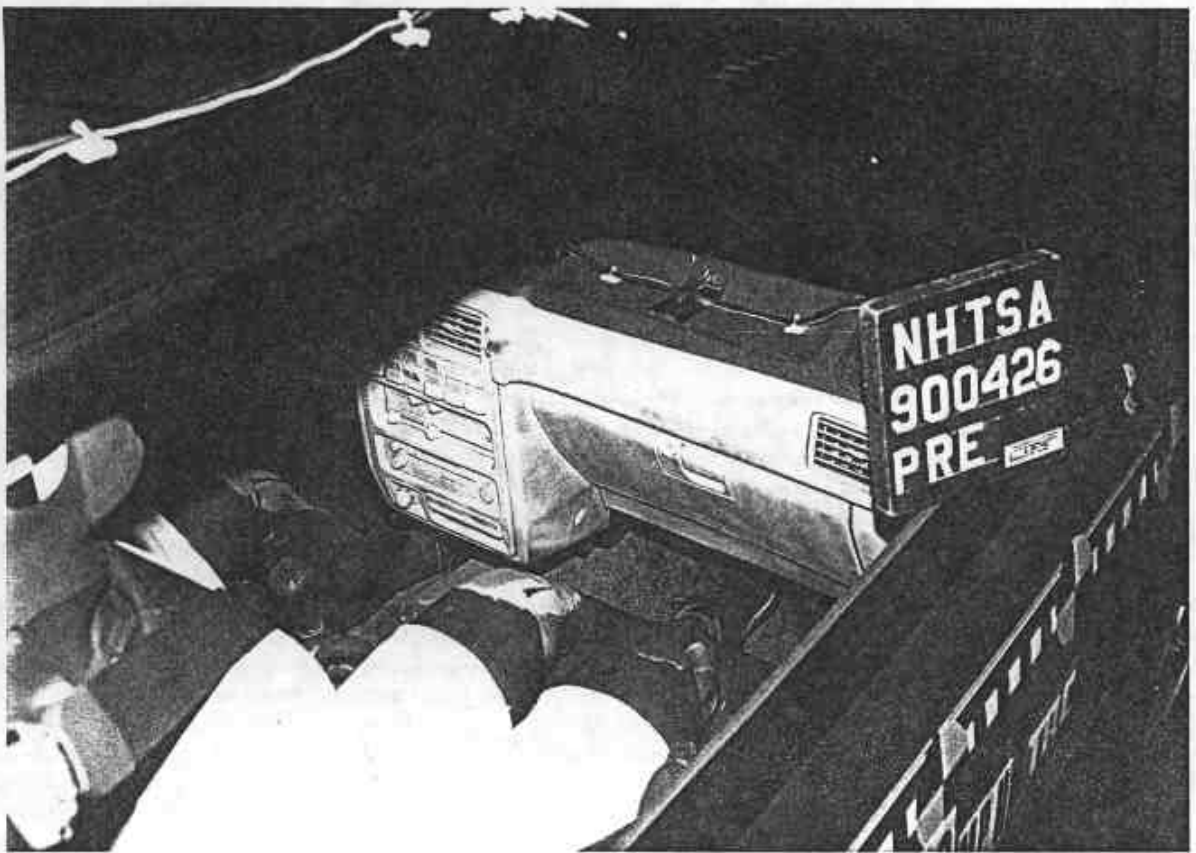


Figure A-31. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR

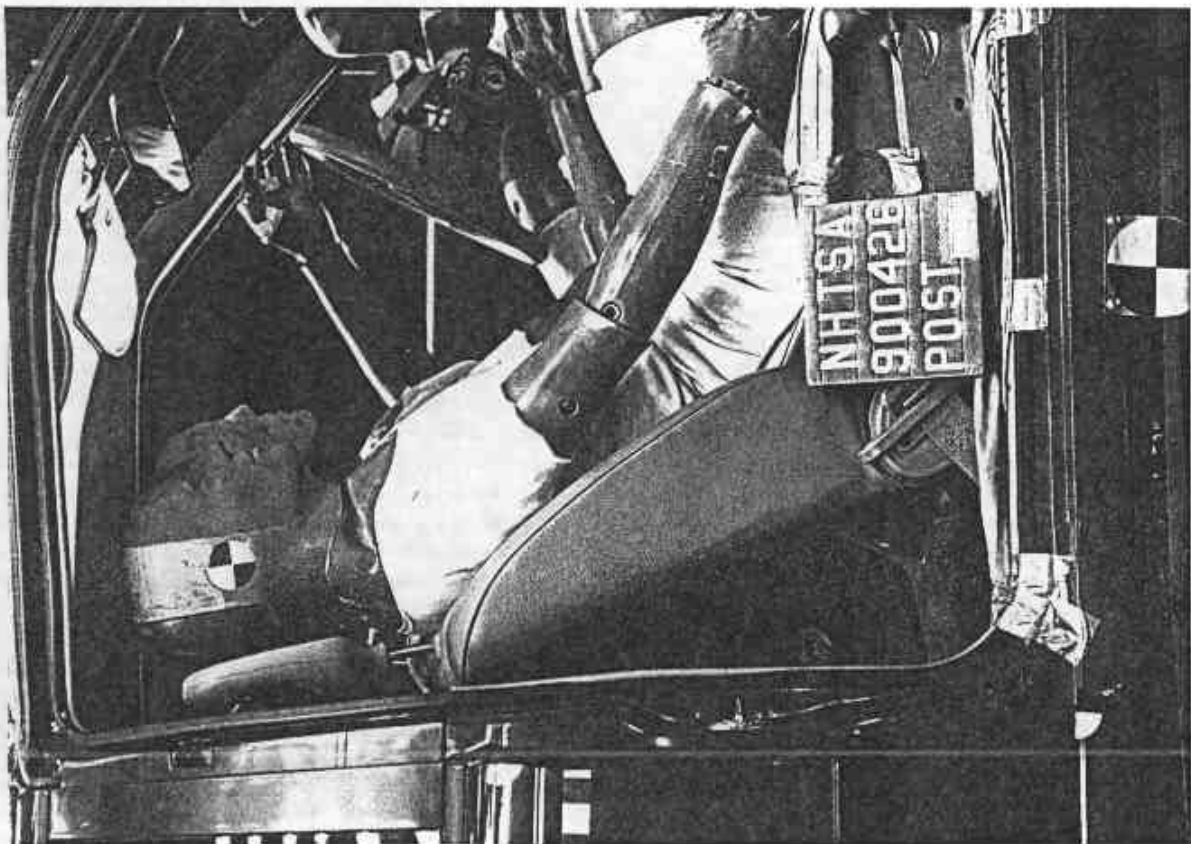


Figure A-32. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

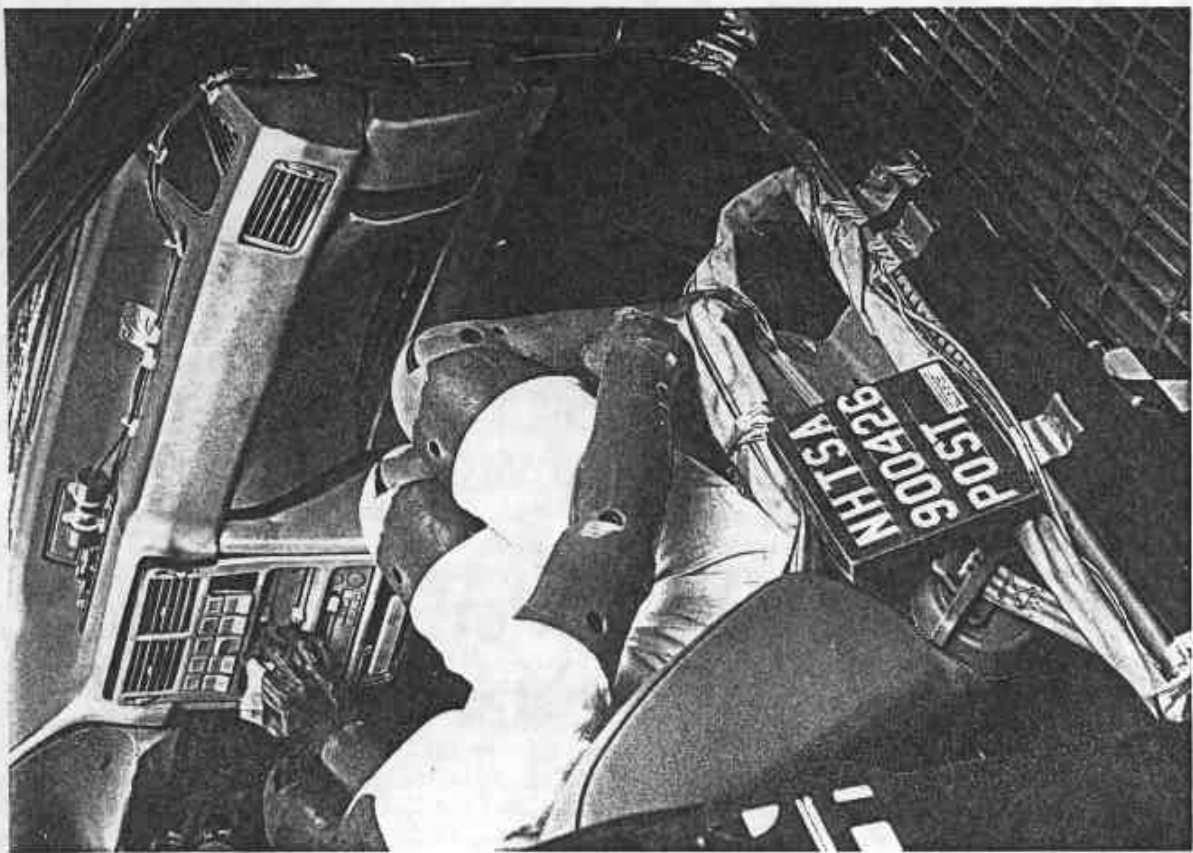


Figure A-33. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-34. POST-TEST DRIVER DUMMY HEAD CONTACT VIEW

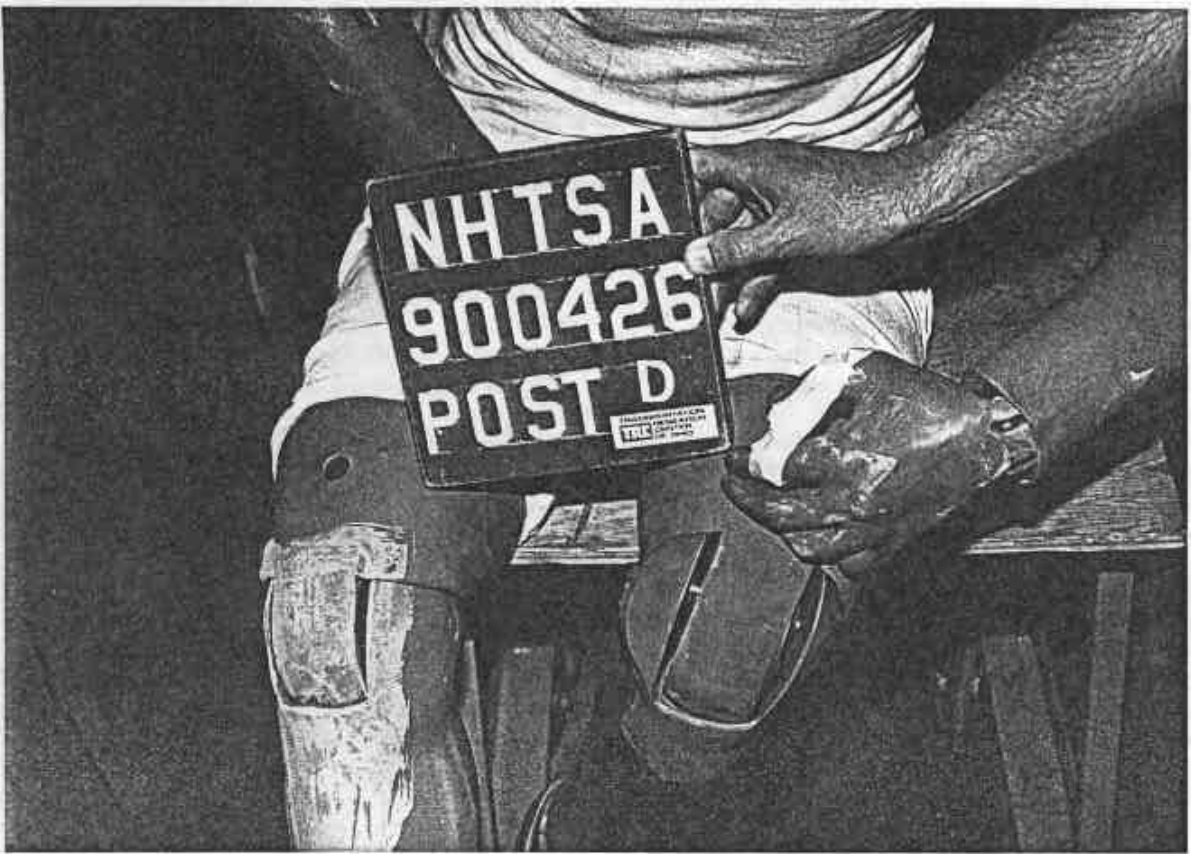


Figure A-35. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

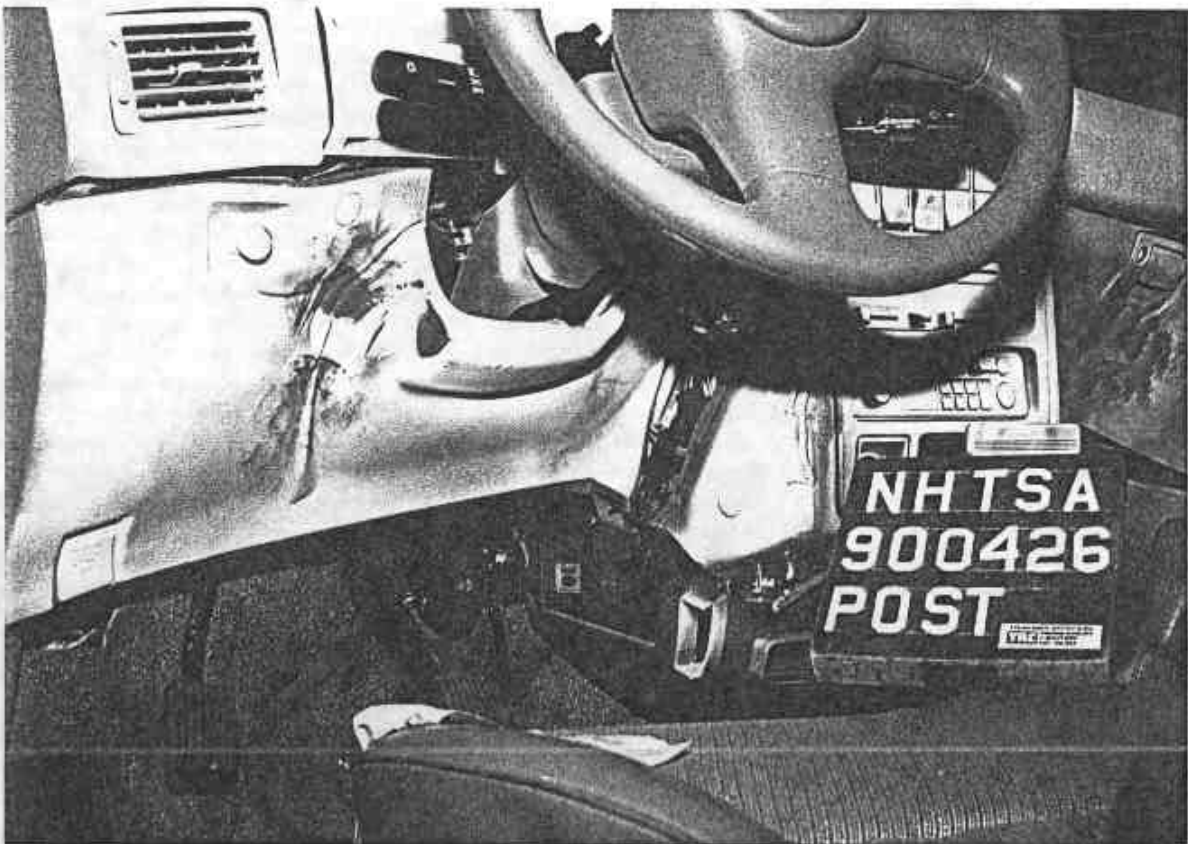


Figure A-36. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2



Figure A-37. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW

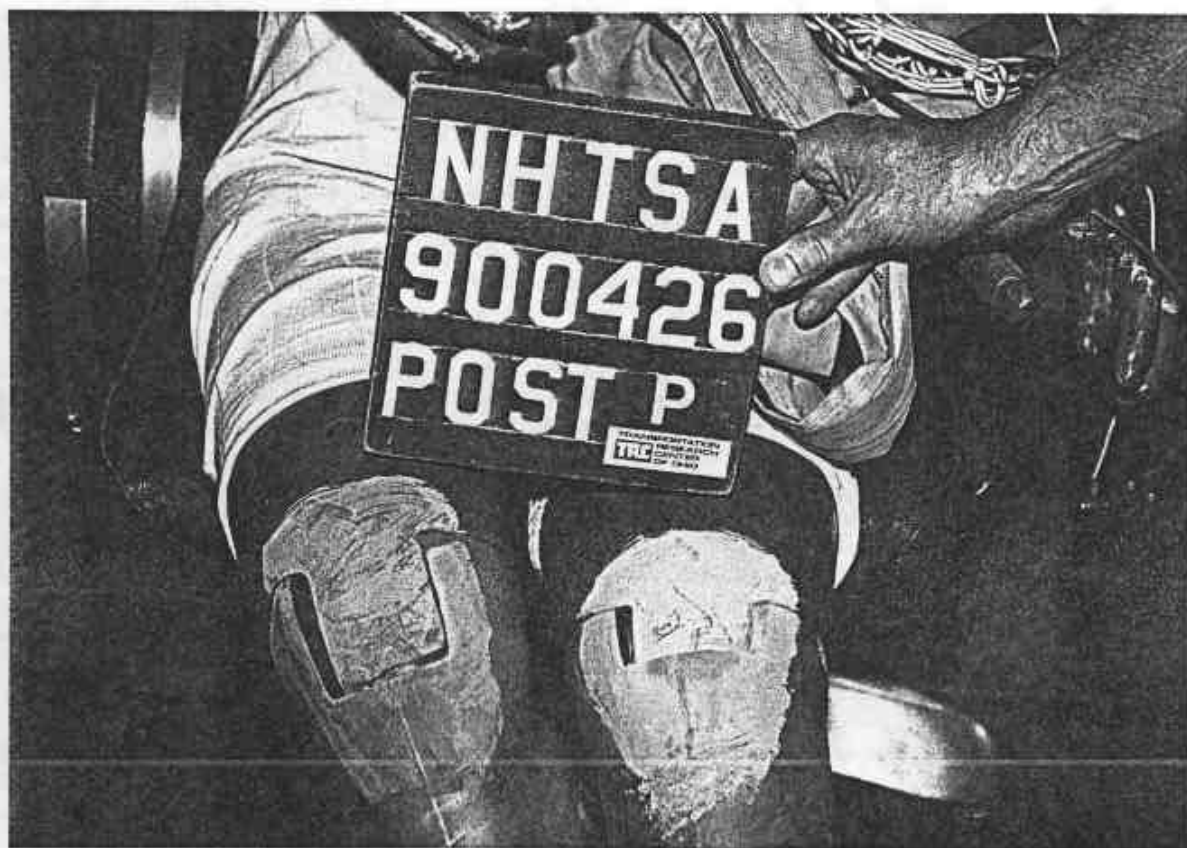


Figure A-38. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 1



Figure A-39. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 2



Figure A-40. PRE-TEST VEHICLE CERTIFICATION LABEL VIEW

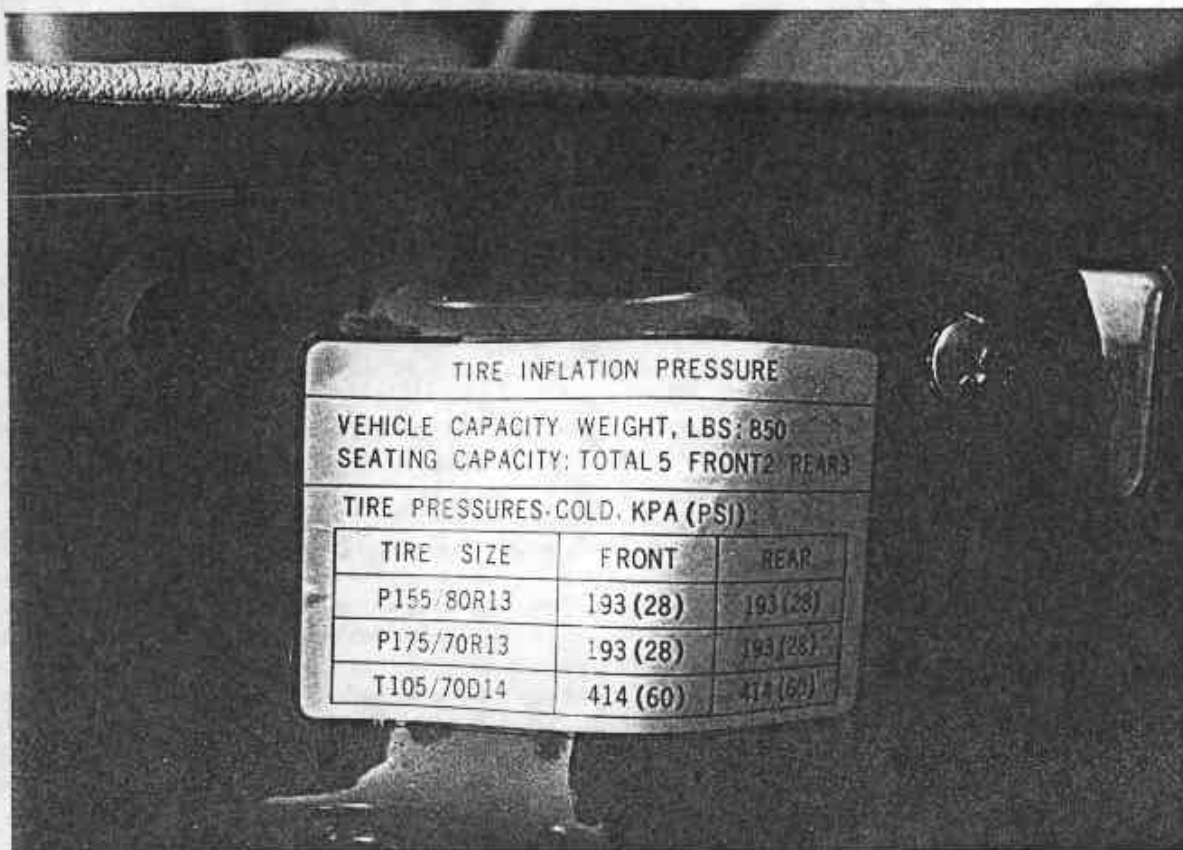


Figure A-41. PRE-TEST VEHICLE TIRE LOAD LABEL VIEW

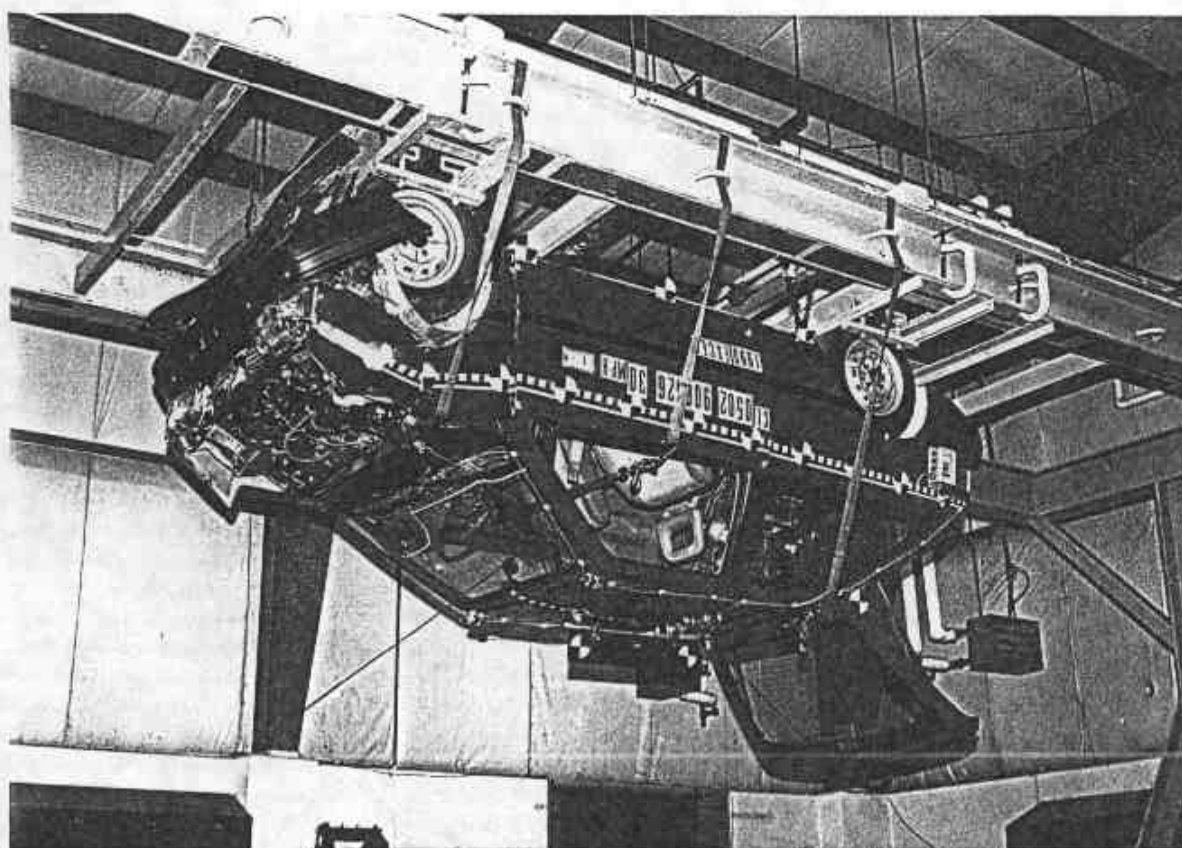


Figure A-42. POST-TEST VEHICLE ON ROLLOVER MACHINE VIEW

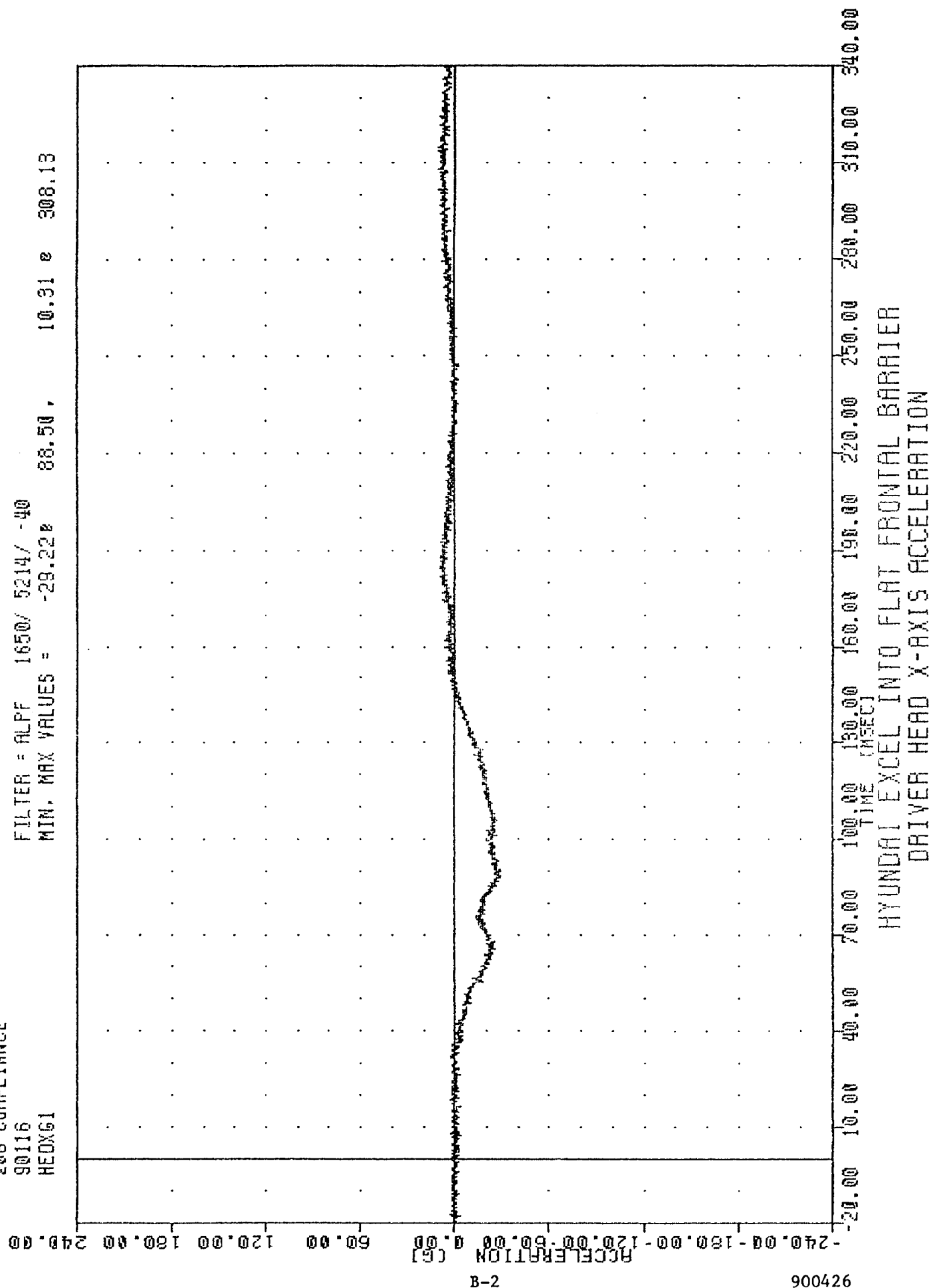
APPENDIX B

DATA PLOTS

DUMMY AND VEHICLE AXES: X: FRONT/REAR
Y: LEFT/RIGHT
Z: UP/DOWN

TRC , 900426
200 COMPLIANCE
90116
HEDXG1

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -29.220 88.50 , 10.31 e 308.13



TRC . 900426

200 COMPLIANCE

90116

HEDYG1

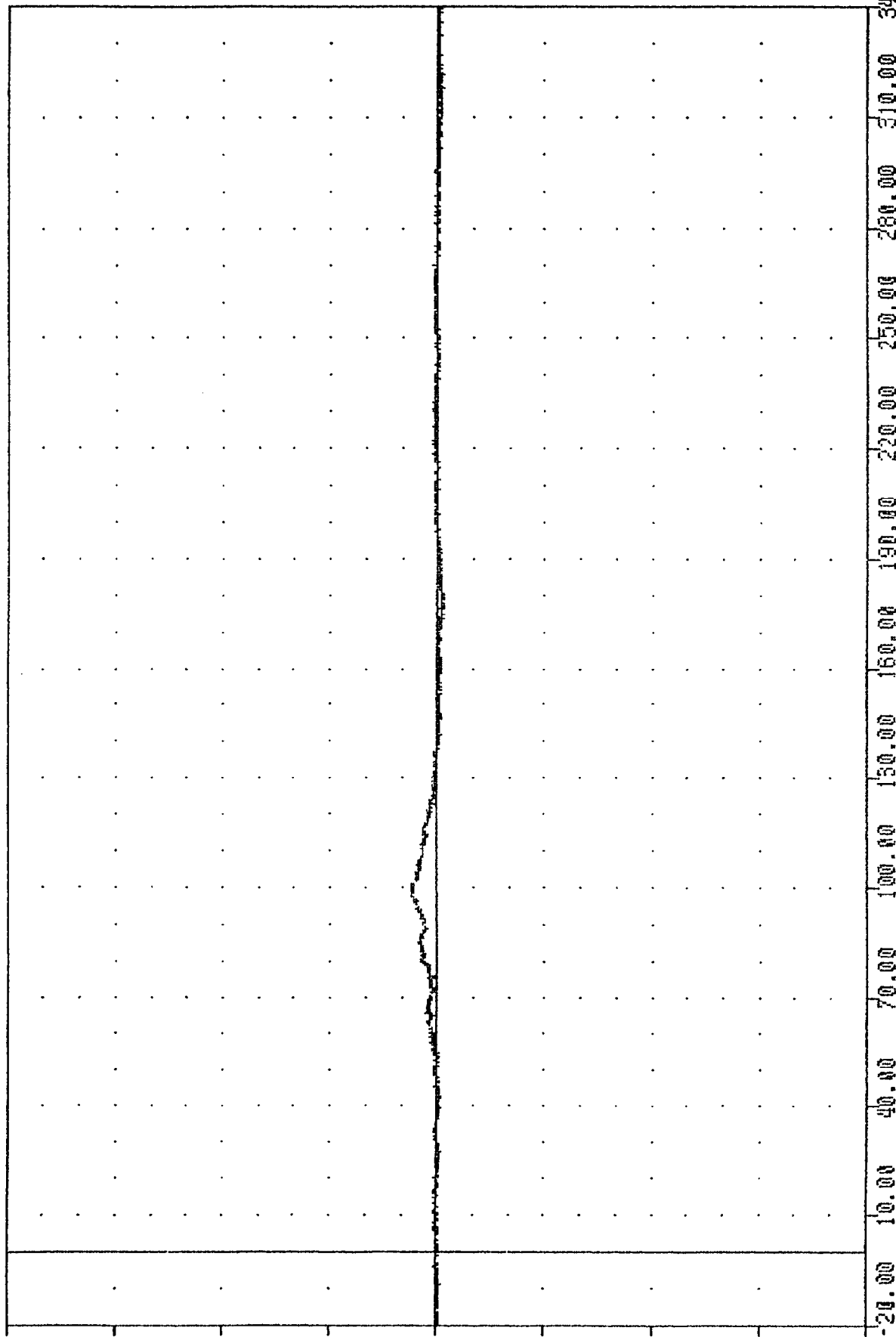
FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -3.86e 174.38, 14.76 e 97.75

ACCELERATION (G)

B-3

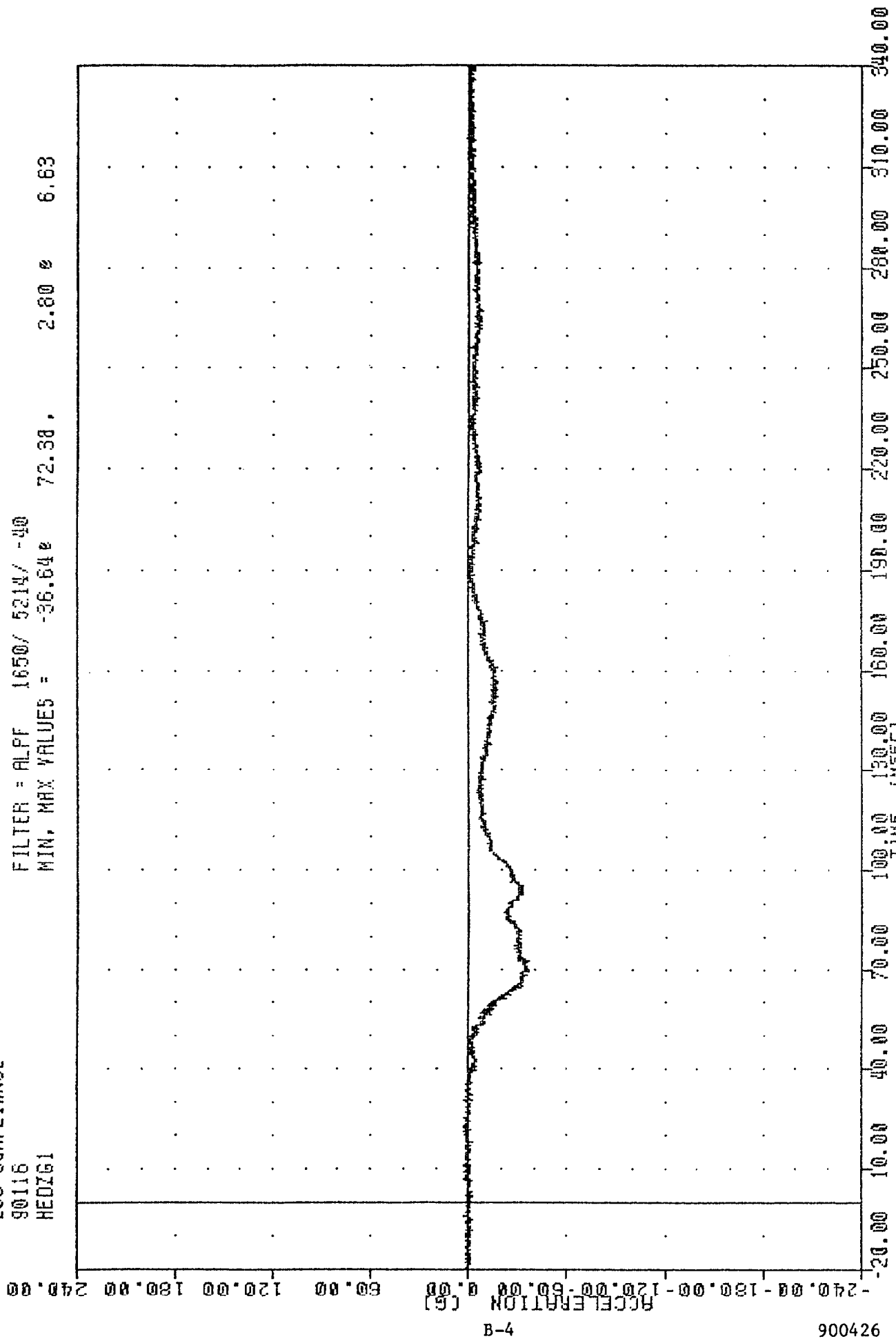
900426



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER HEAD Y-AXIS ACCELERATION

TRC , 980428
 200 COMPLIANCE
 90116
 HEDZ61

FILTER = ALPF 1650/ 5214/ -40
 MIN, MAX VALUES = -36.64e 72.38, 2.80 e 6.63



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 DRIVER HEAD Z-AXIS ACCELERATION

TRC , 900426

200 COMPLIANCE

90116

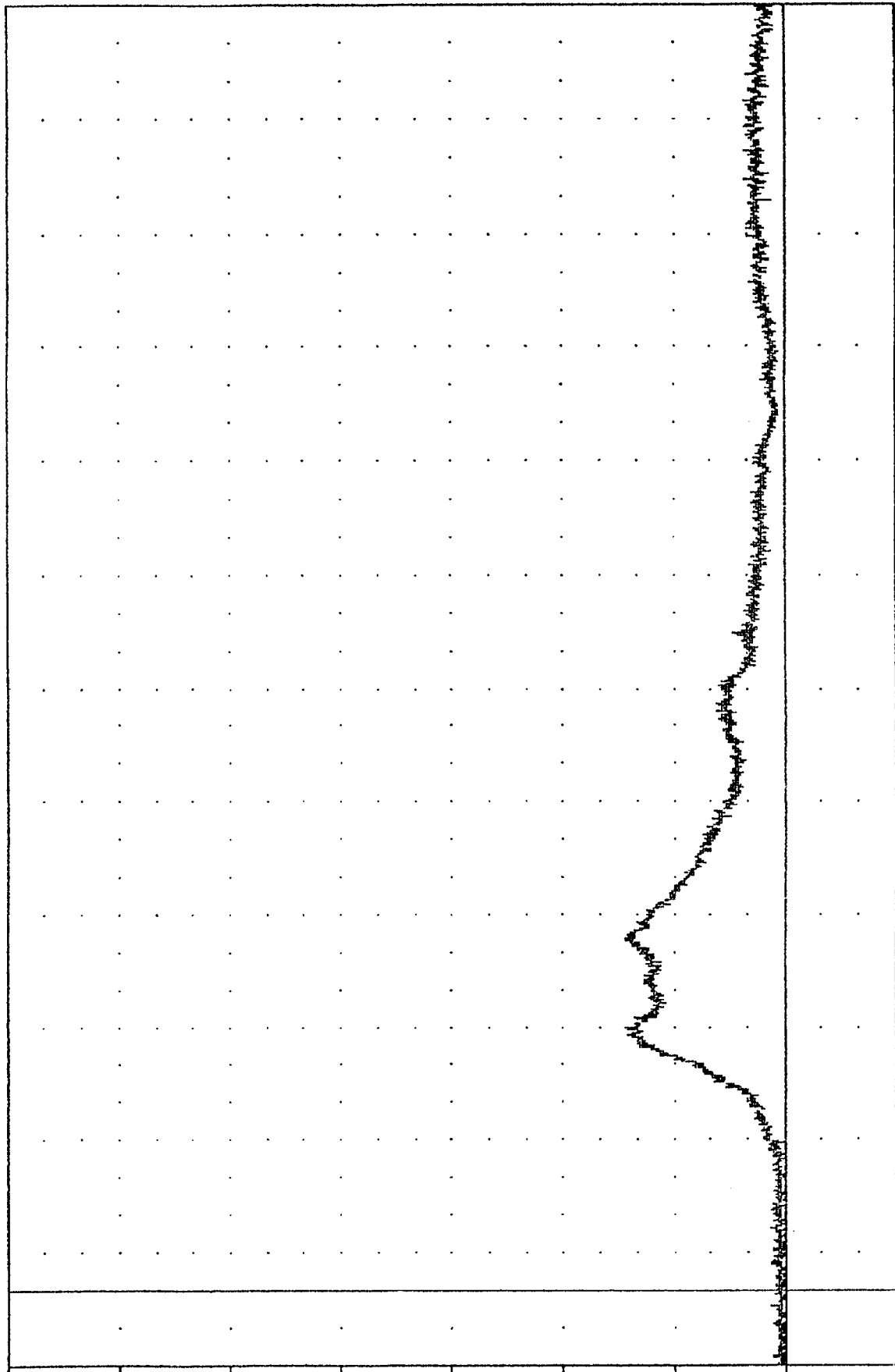
HEDRG1

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = 0.210 -19.25 ,

13.22 0 93.13

ACCELERATION (G)



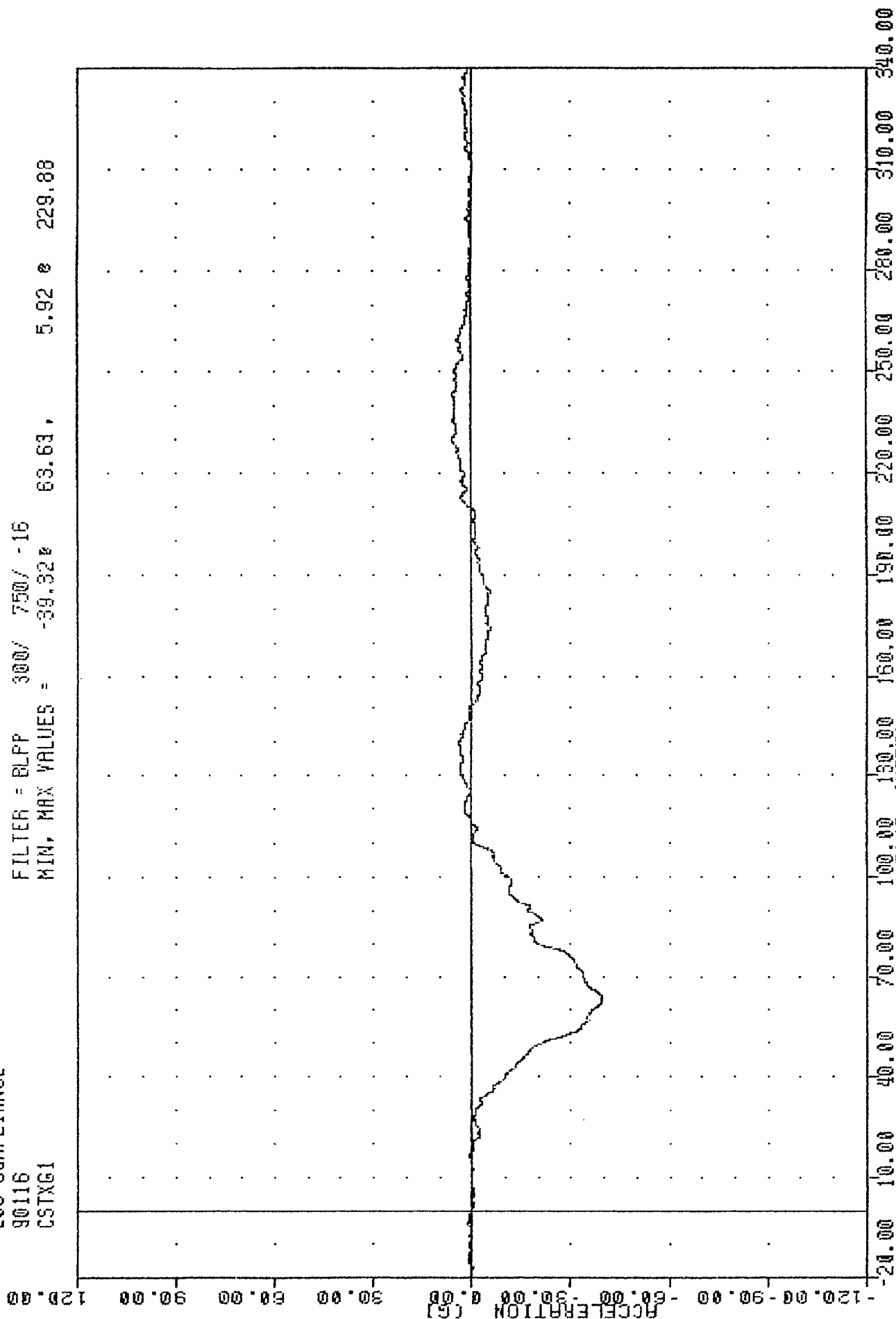
900426

B-5

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER HEAD RESIDUANT ACCELERATION

TRC , 900426
200 COMPLIANCE
90116
CSTXG1

FILTER = BLPP 300/ 750/ -16
MIN, MAX VALUES = -39.32 63.63, 5.92 229.88



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER CHEST X-AXIS ACCELERATION

TRC , 900426

208 COMPLIANCE

90116

CSTY61

FILTER = BLPP 300/ 750/ -16

MIN, MAX VALUES = -1.338 211.75, 8.53 e 90.75

120.00

90.00

60.00

30.00

0.00

-30.00

-60.00

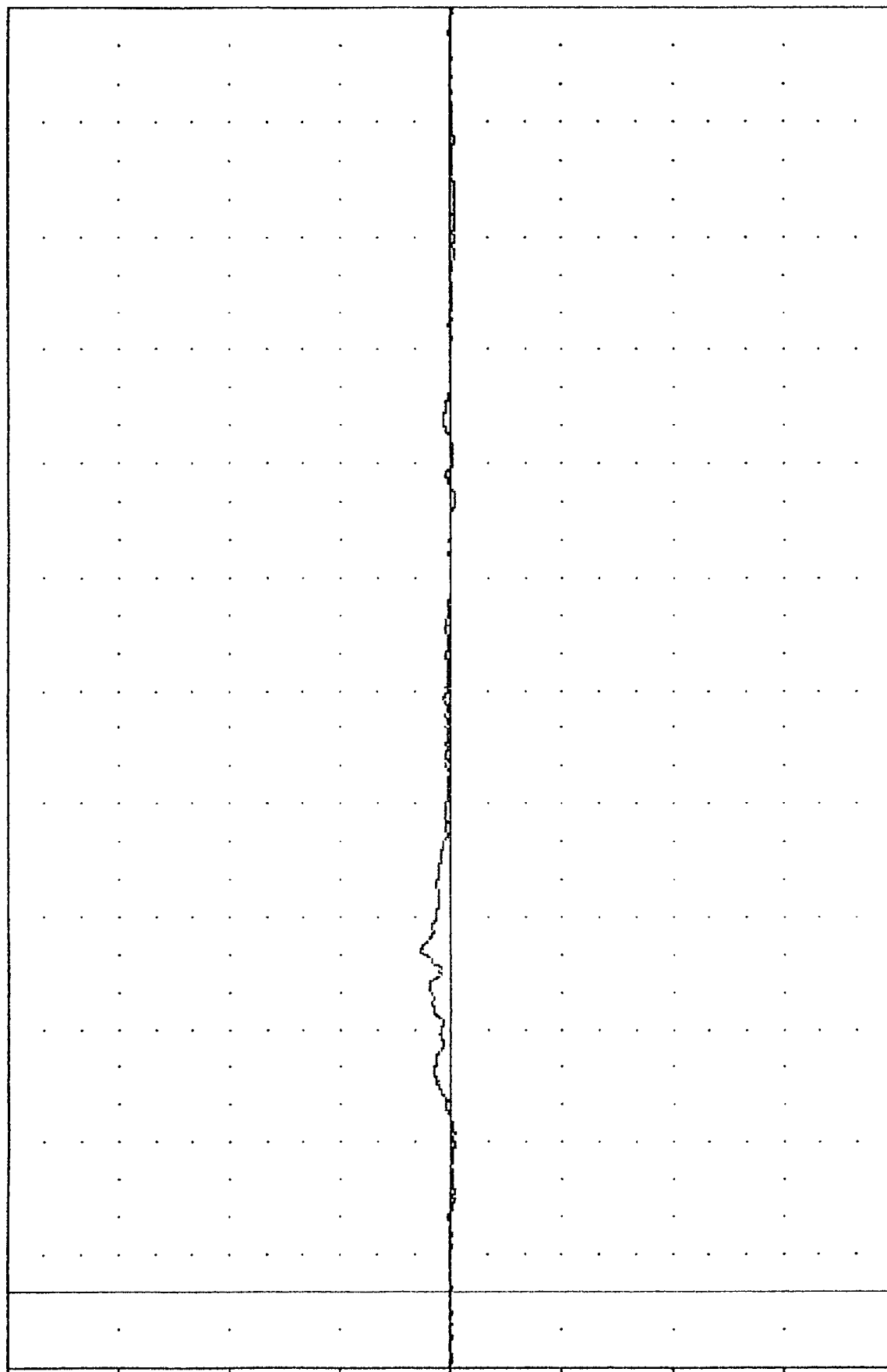
-90.00

-120.00

ACCELERATION (G)

900426

B-7

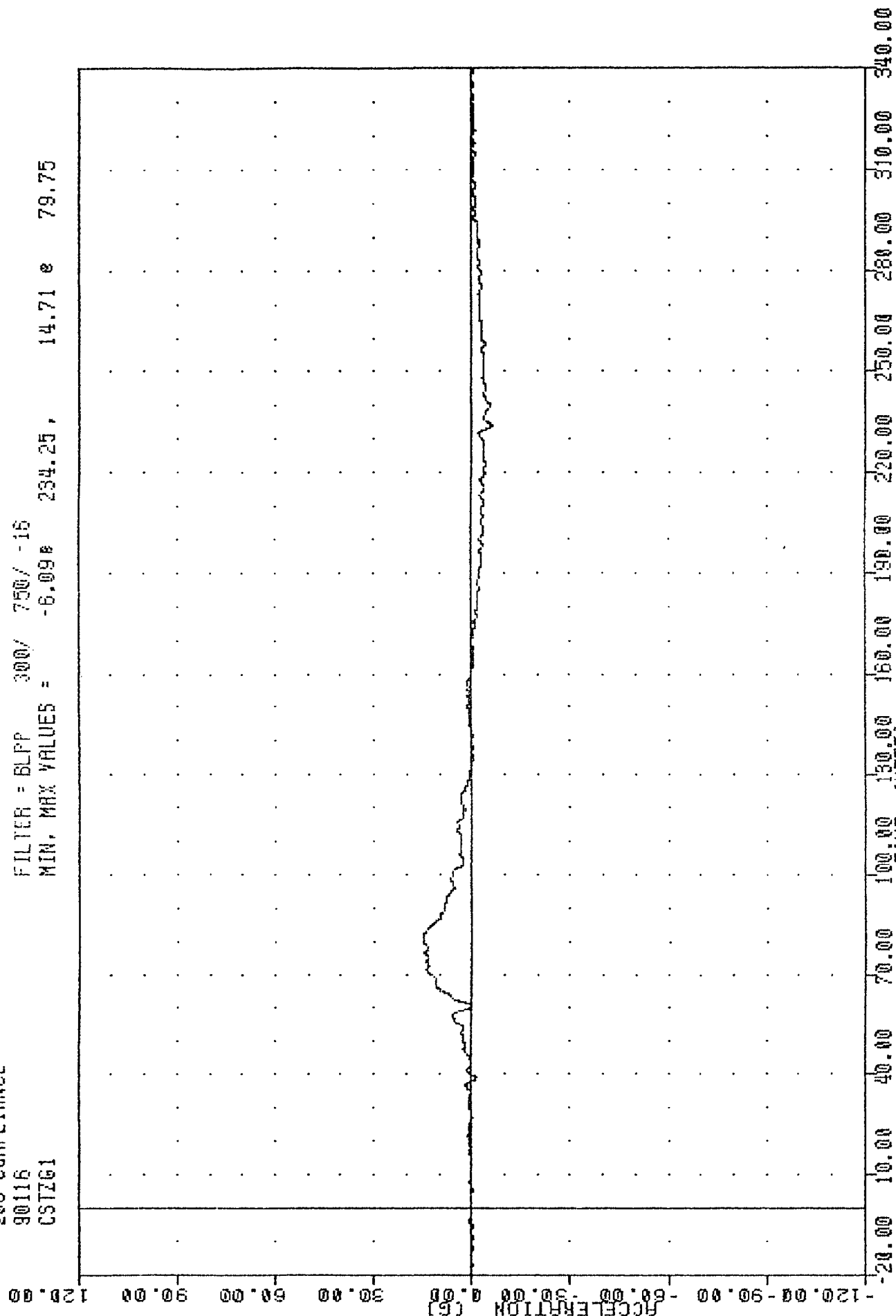


-20.00 20.00 40.00 60.00 80.00 100.00 120.00 140.00 160.00 180.00 200.00 220.00 240.00 260.00 280.00 300.00 320.00 340.00

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER CHEST Y-AXIS ACCELERATION

TRC , 900426
 208 COMPLIANCE
 90116
 CSTZ61

FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = -6.098 234.25, 14.71 e 79.75



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 NATVR CHEST 7-AXIS ACCELERATION

TRC 900426

208 COMPLIANCE

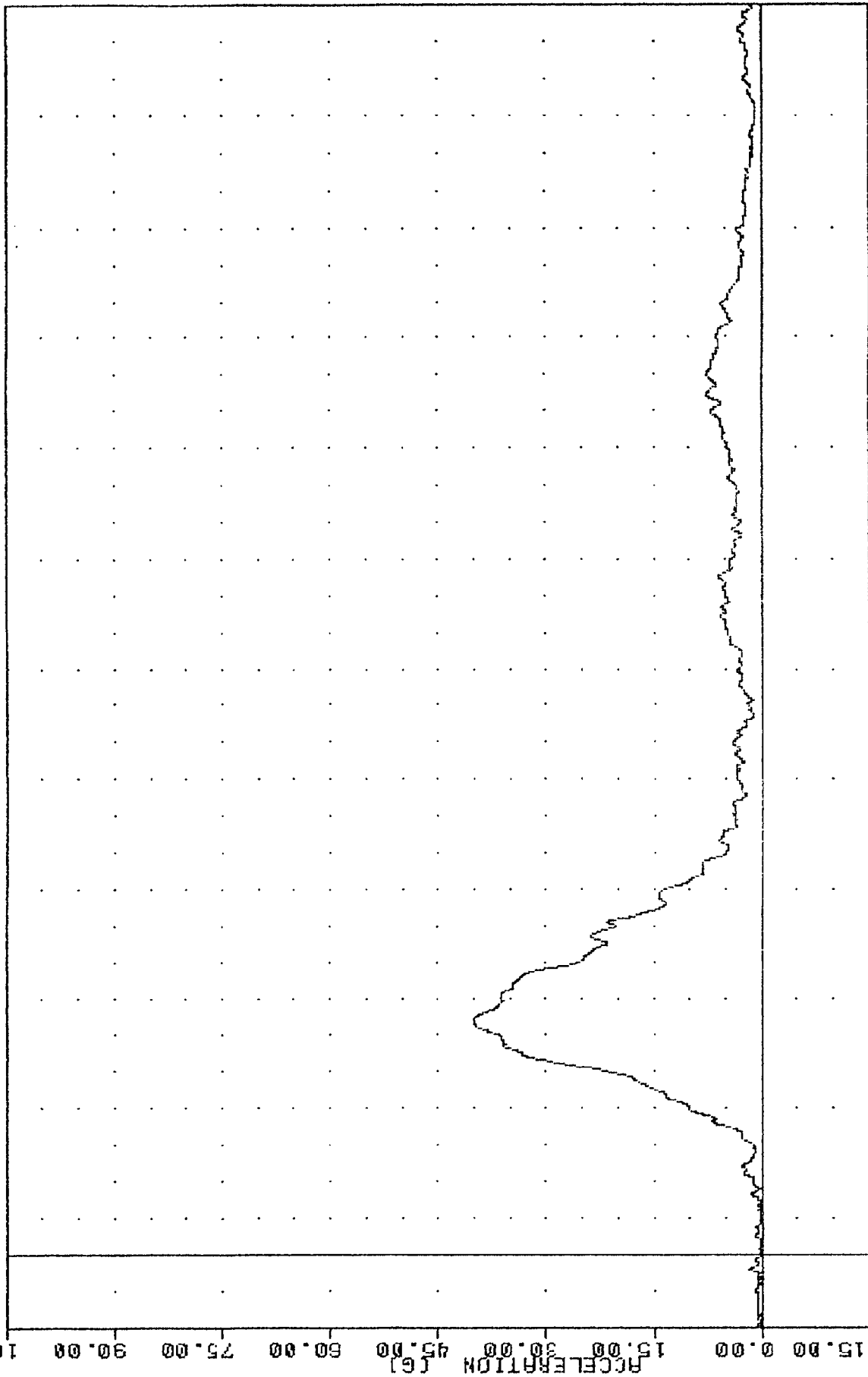
90116

CSTRG1

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = 0.038 9.13, 40.018 64.25

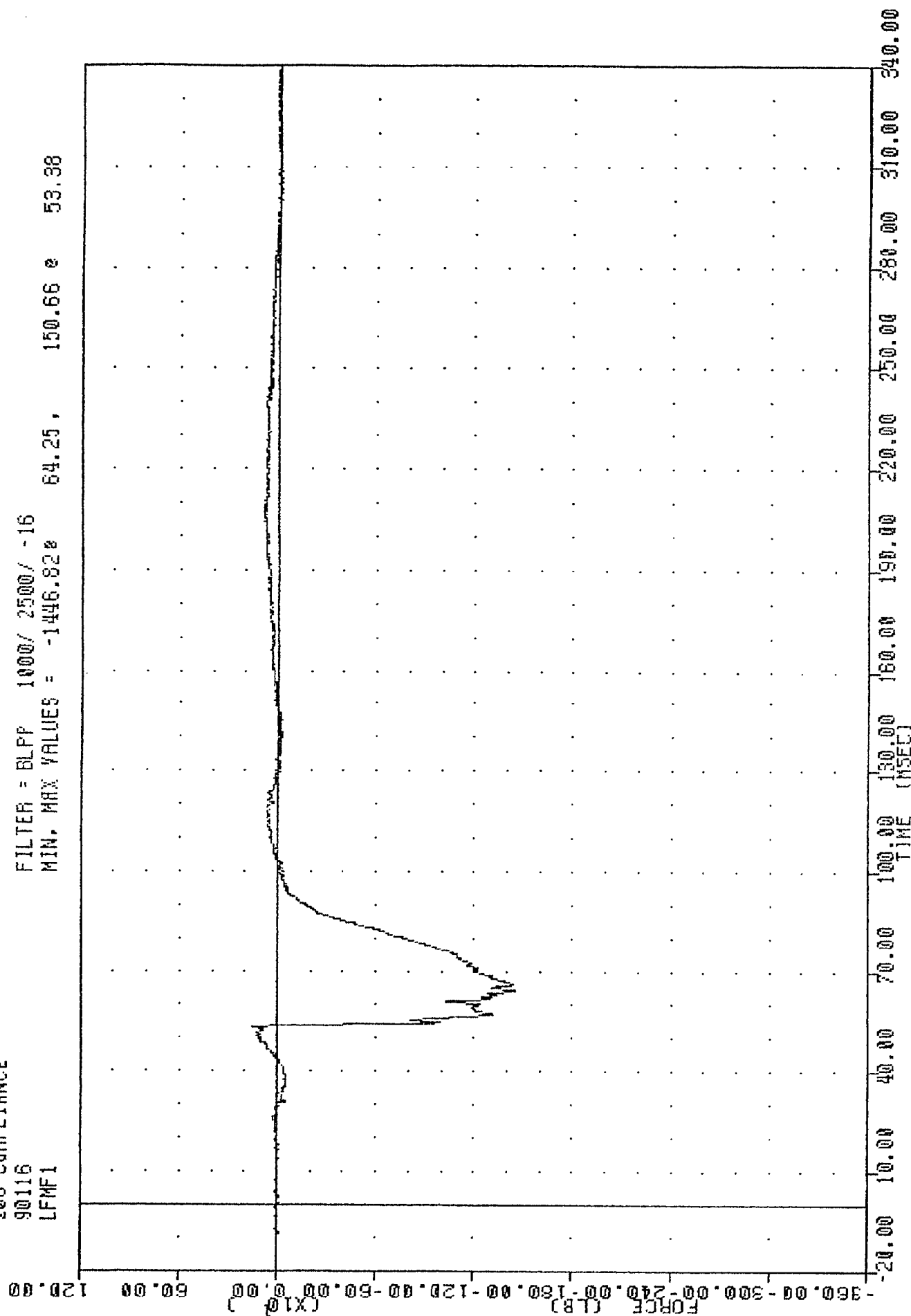
105.00



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER CHEST RESISTANT ACCELERATION

TRC , 900426
208 COMPLIANCE
90116
LFMF1

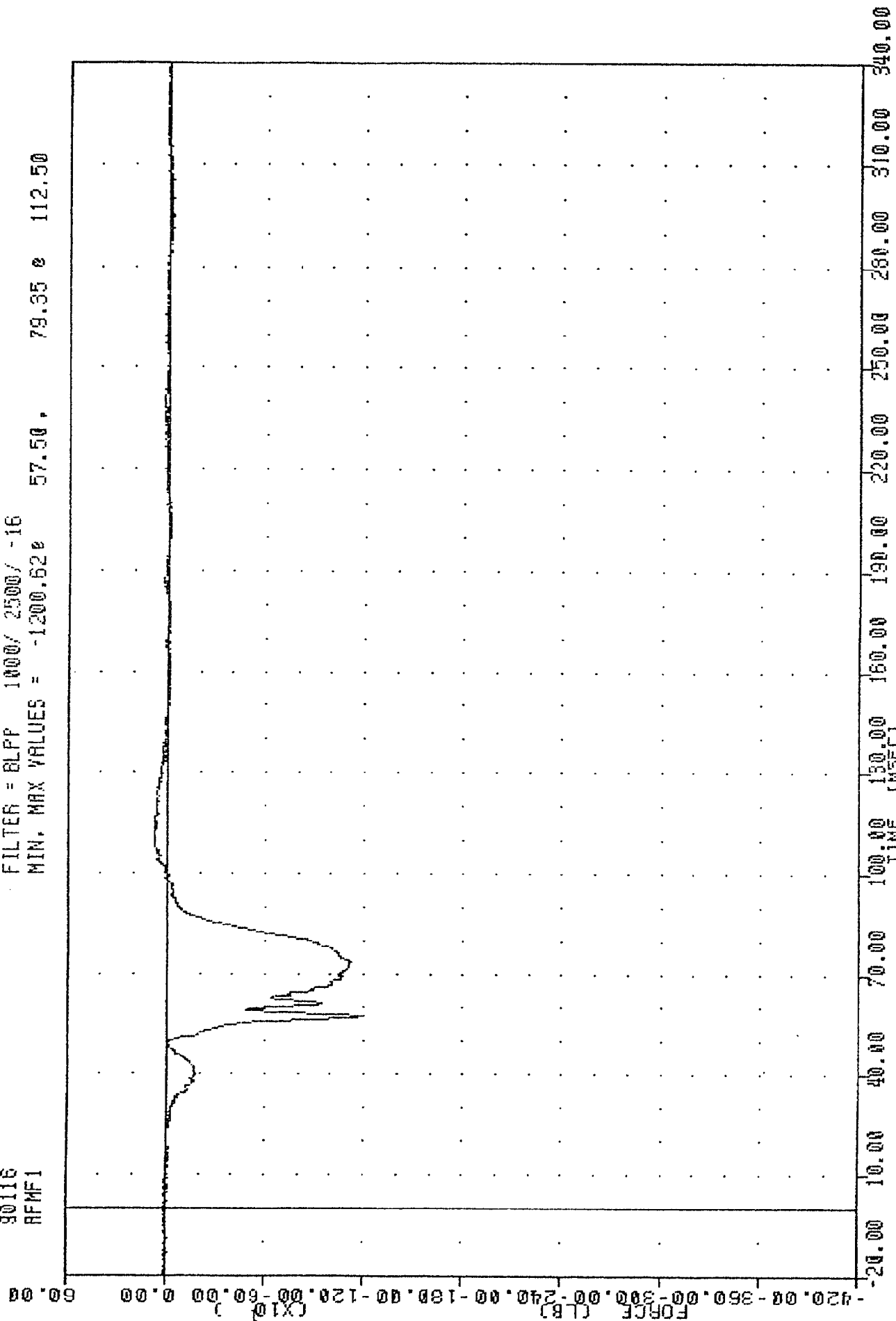
FILTER = BLFF 1000/ 2500/ -16
MIN. MAX VALUES = -1446.820 64.25 , 150.66 53.38



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER LEFT FFMIR FORCE

TRC
208 COMPLIANCE
90116
RFMF1

FILTER = BLPP 1000/ 2500/ -16
MIN. MAX VALUES = -1200.620 57.50, 79.35 0 112.50

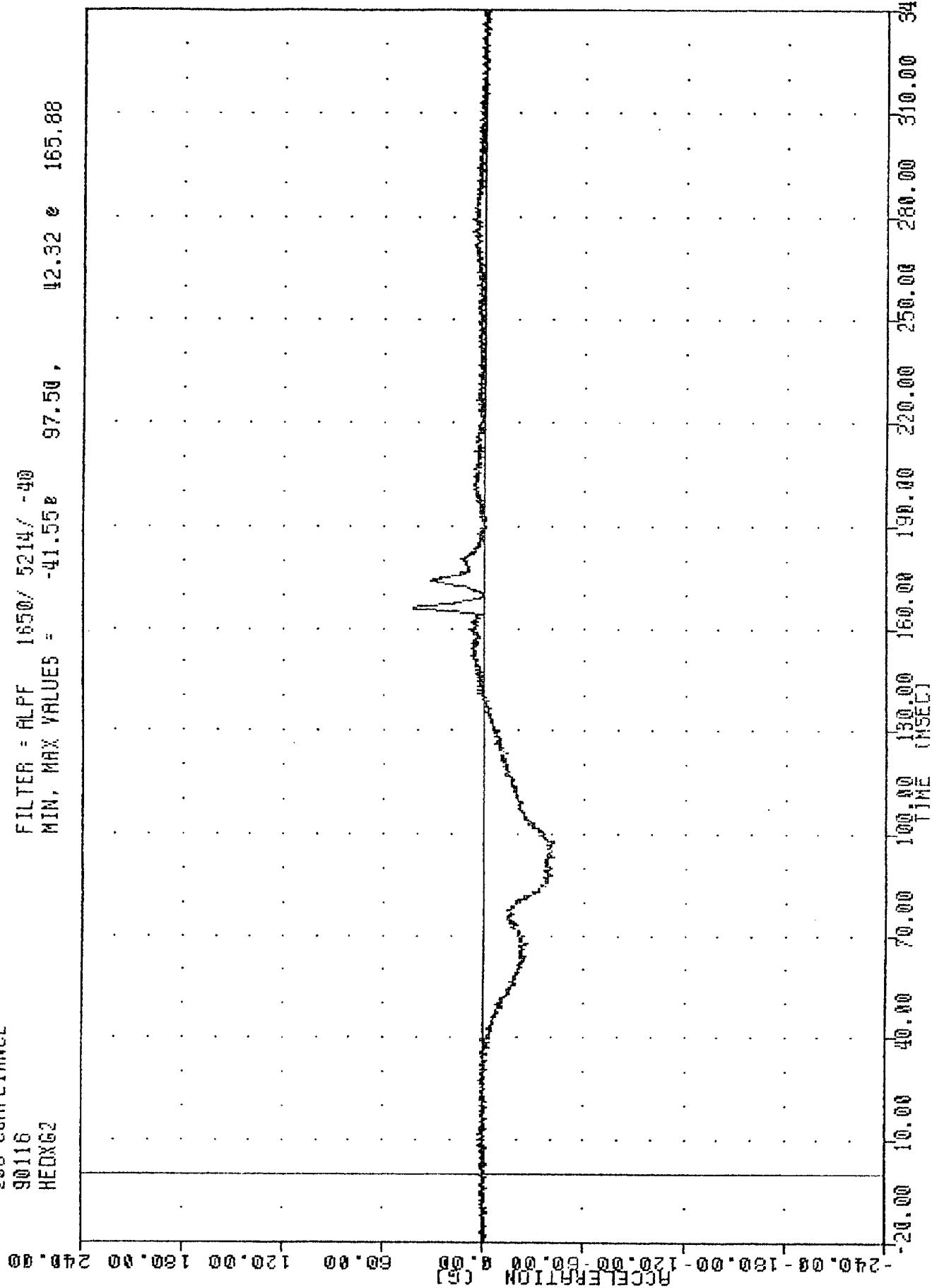


HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DRIVER RIGHT FEMUR FORCE

TRC
208 COMPLIANCE
90116
HEDXG2

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = -41.55g

97.50, 42.32 g 165.88



B-12

900426

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION

TRC , 900426

208 COMPLIANCE

90116

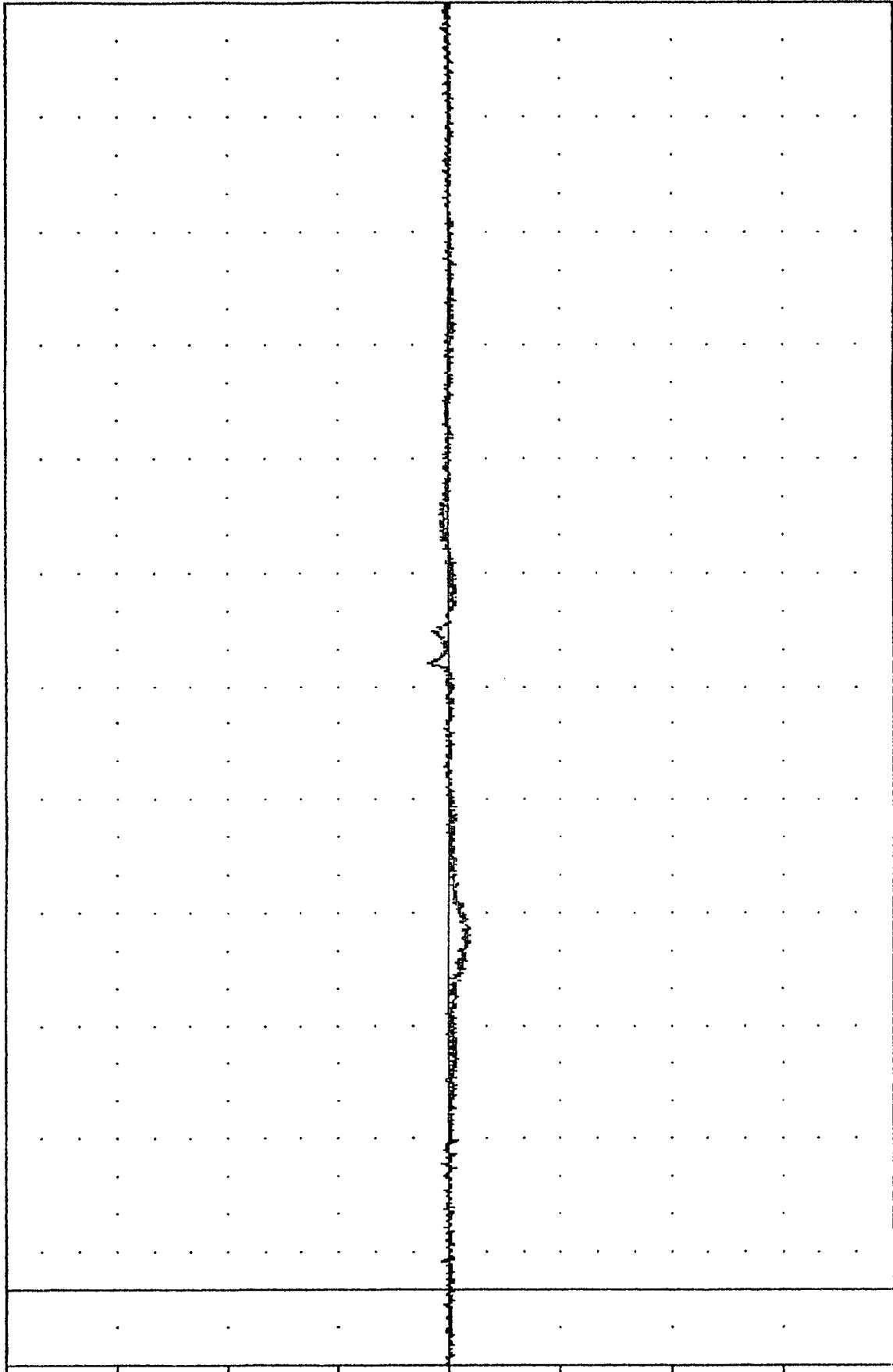
HEDYG2

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -11.36%

94.25, 11.51 @ 166.00

ACCELERATION (G)



900426

B-13

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION

TRC , 900426

200 COMPLIANCE

90116

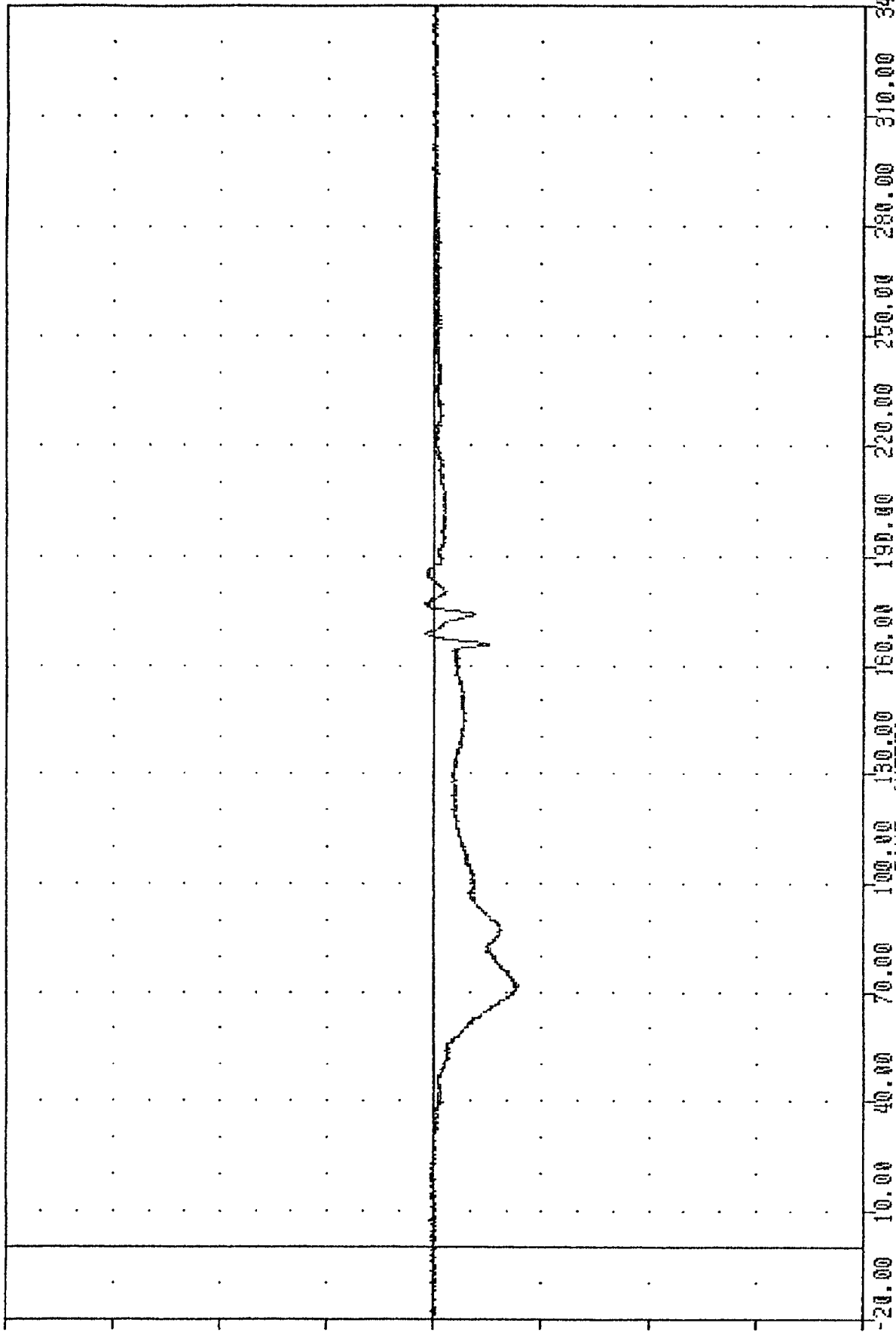
HEAD262

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -46.76e

71.38, 5.77 @ 176.75

ACCELERATION (G)



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD 7-AXIS ACCELERATION

TAC , 900426
 209 COMPLIANCE
 90116
 HEDRG2

FILTER = ALPF 1650/ 5214/ -40
 MIN. MAX VALUES = 0.00e 10.50, 54.41 e 87.75

ACCELERATION (g)

210.00

180.00

150.00

120.00

90.00

60.00

30.00

0.00

-30.00

-60.00

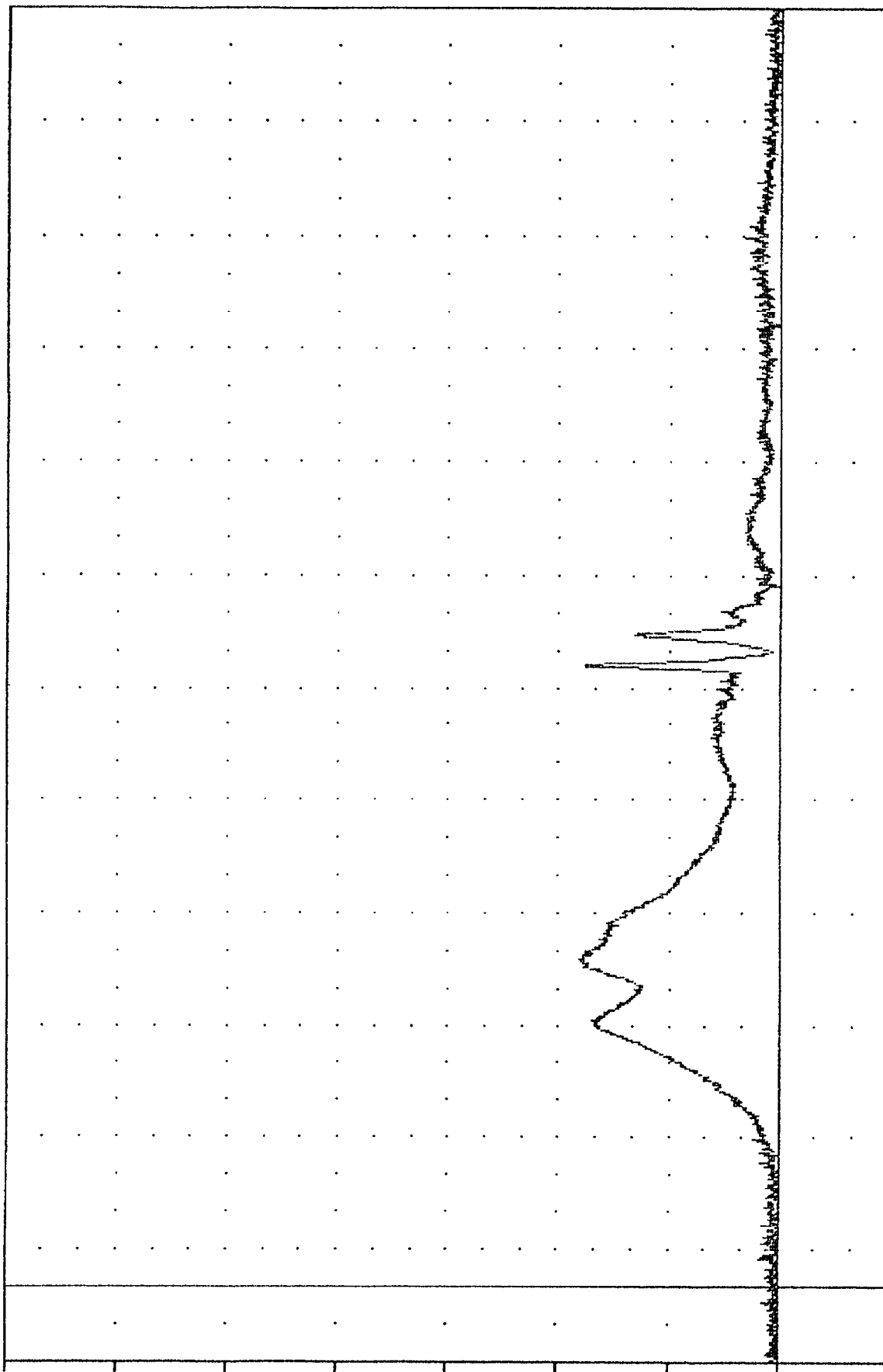
-90.00

-120.00

-150.00

-180.00

-210.00



900426

B-15

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

TRC , 900426

208 COMPLIANCE

90116

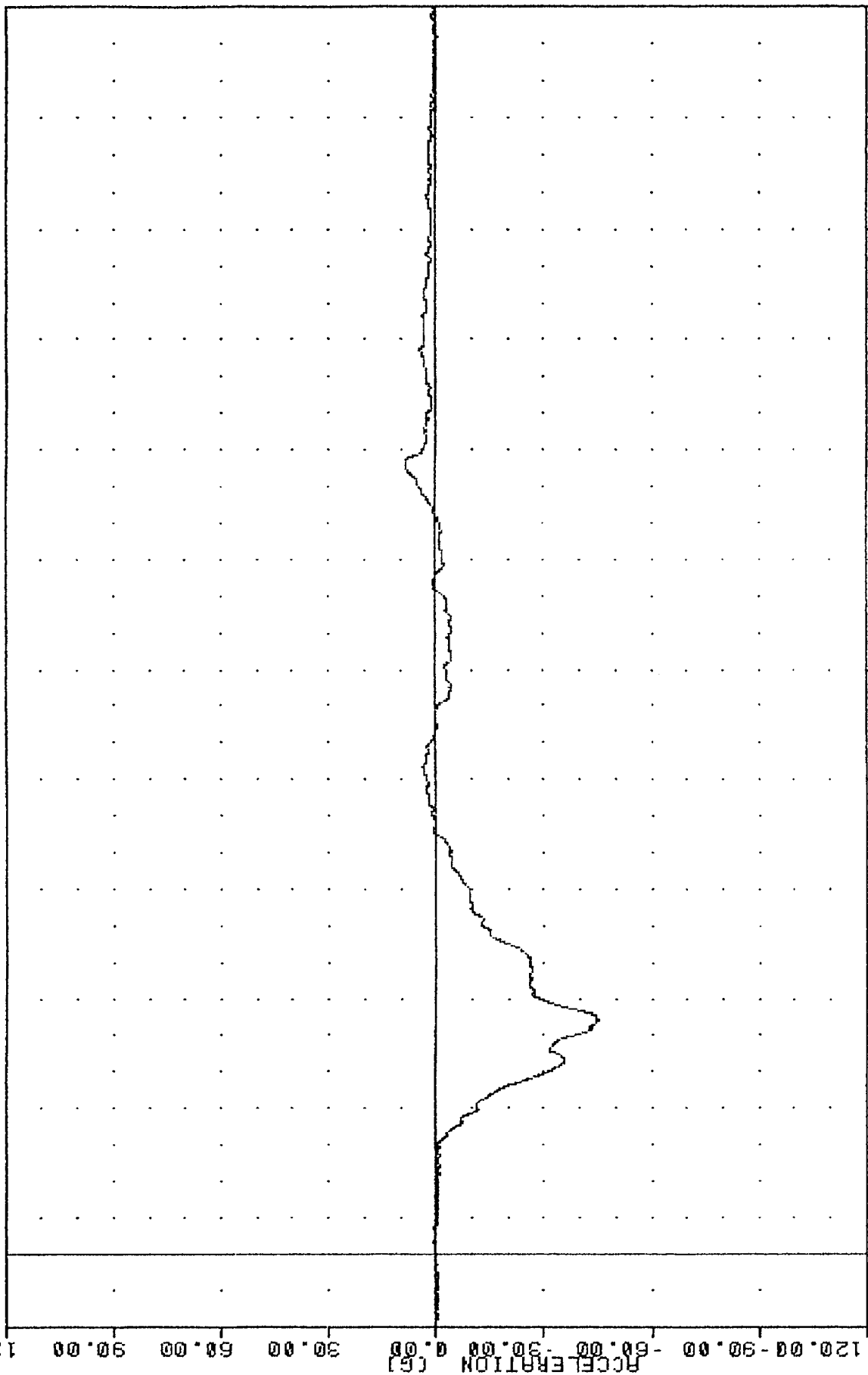
CSTXG2

FILTER = BLPP 300/ 750/ -16

MIN, MAX VALUES = -44.72e

64.13, 8.64 e 215.50

120.00



B-16

900426

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER

DIGIT COUNT BECAME NEGATIVE V-DOTIS ACCELERATION

TRC 900426

308 COMPLIANCE

90116

CSTYG2

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = -5.698 72.13, 2.80 183.13

120.00

90.00

60.00

30.00

0.00

-30.00

-60.00

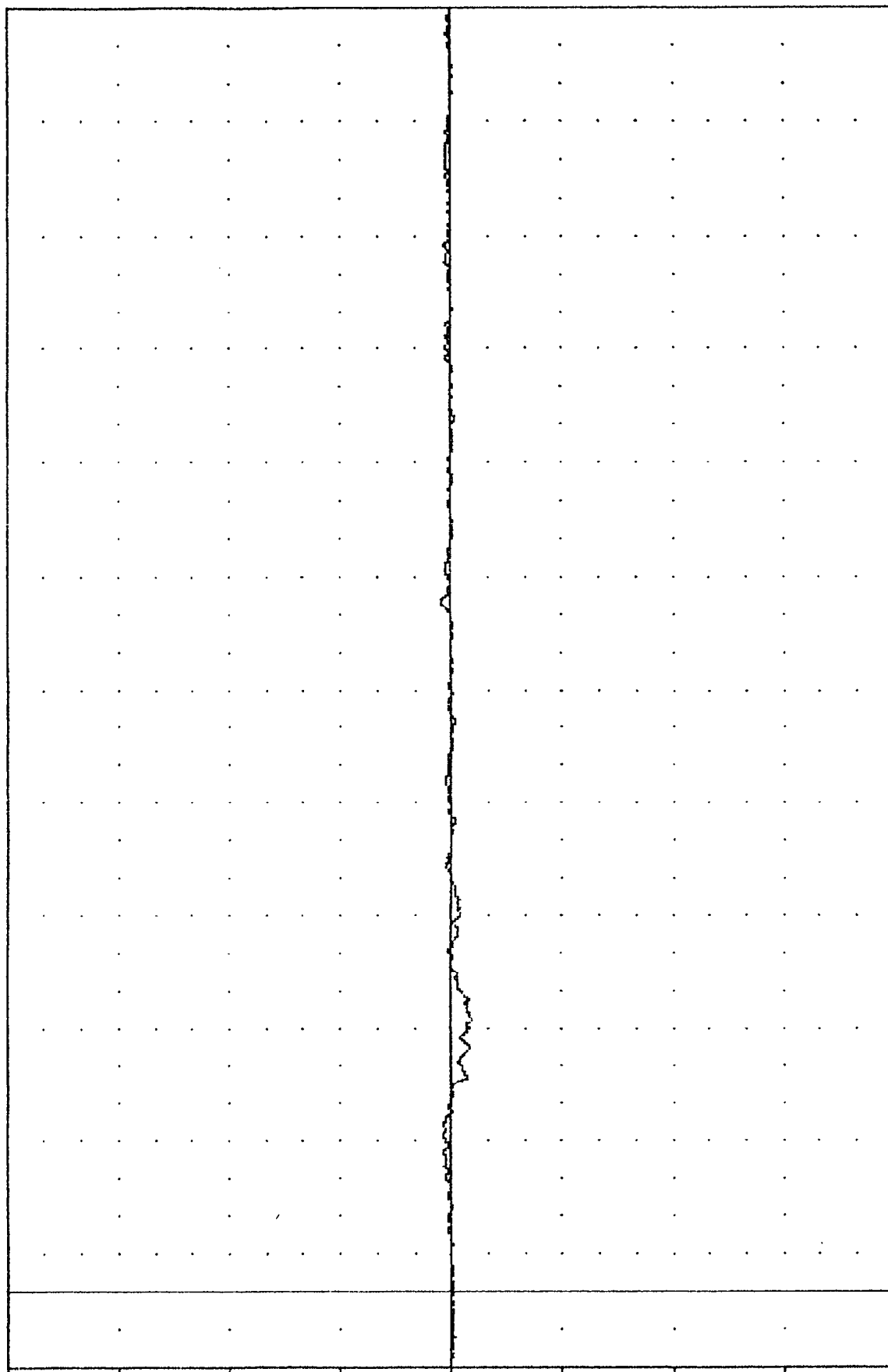
-90.00

-120.00

ACCELERATION (G)

B-17

900426

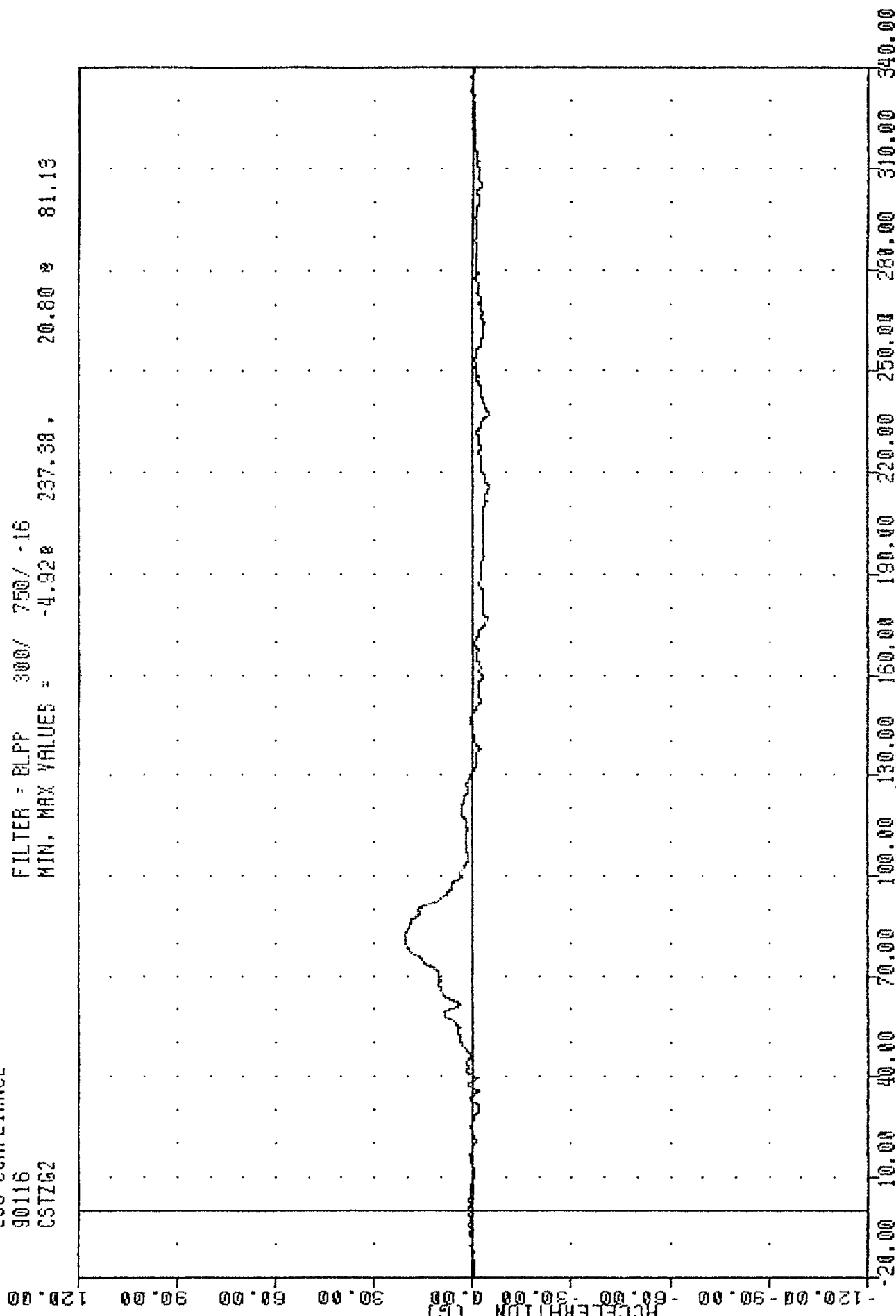


-20.00 10.00 20.00 30.00 40.00 50.00 60.00 70.00 80.00 90.00 100.00 110.00 120.00 130.00 140.00 150.00 160.00 170.00 180.00 190.00 200.00 210.00 220.00 230.00 240.00 250.00 260.00 270.00 280.00 290.00 300.00 310.00 320.00 330.00 340.00

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION

TRC , 900426
 200 COMPLIANCE
 90116
 CSTZG2

FILTER = BLPP 300/ 750/ -16
 MIN. MAX VALUES = -4.920 237.38 20.80 81.13



B-18

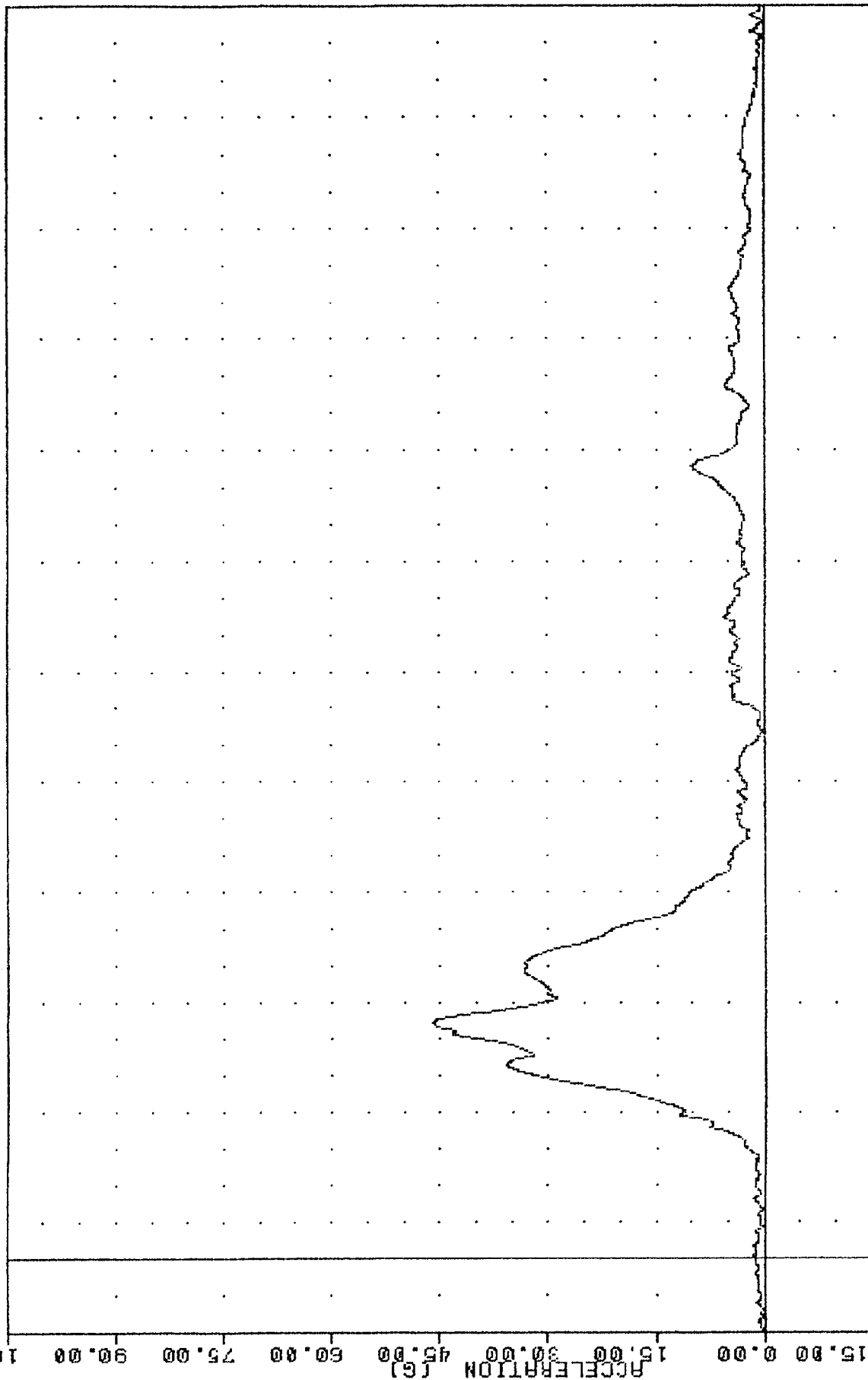
900426

HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 RIGHT FRONT PASSENGER CHEST 7-AXIS ACCELERATION

TRC 900426
 200 COMPLIANCE
 90116
 CSTRG2

FILTER = BLPP 300/ 750/ -16
 MIN, MAX VALUES = 0.05% -20.00, 45.88 % 64.50

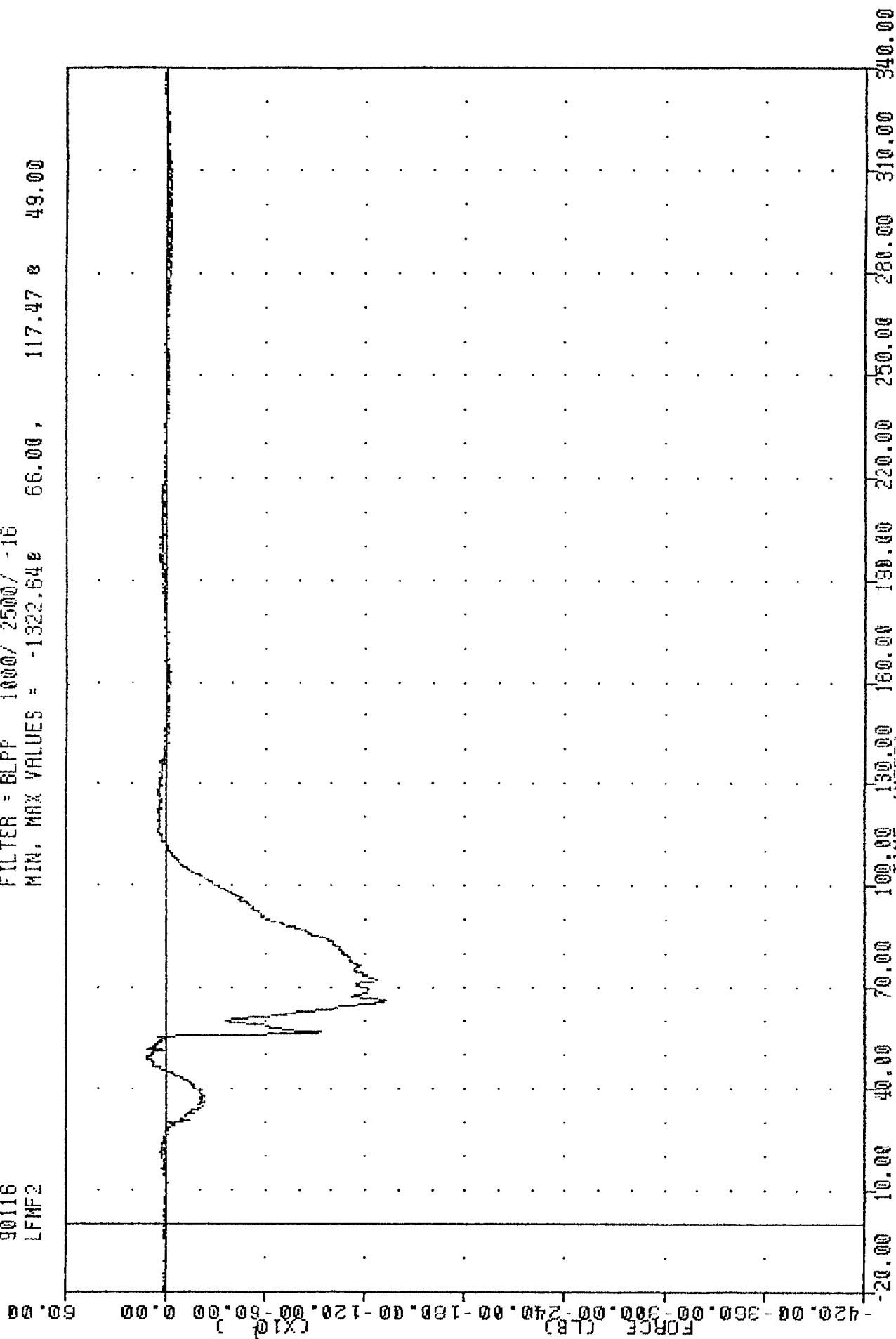
105.00



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 RIGHT FRONT PASSENGER CHEST RESISTANT ACCELERATION

TRC , 900426
 200 COMPLIANCE
 90116
 LFMF2

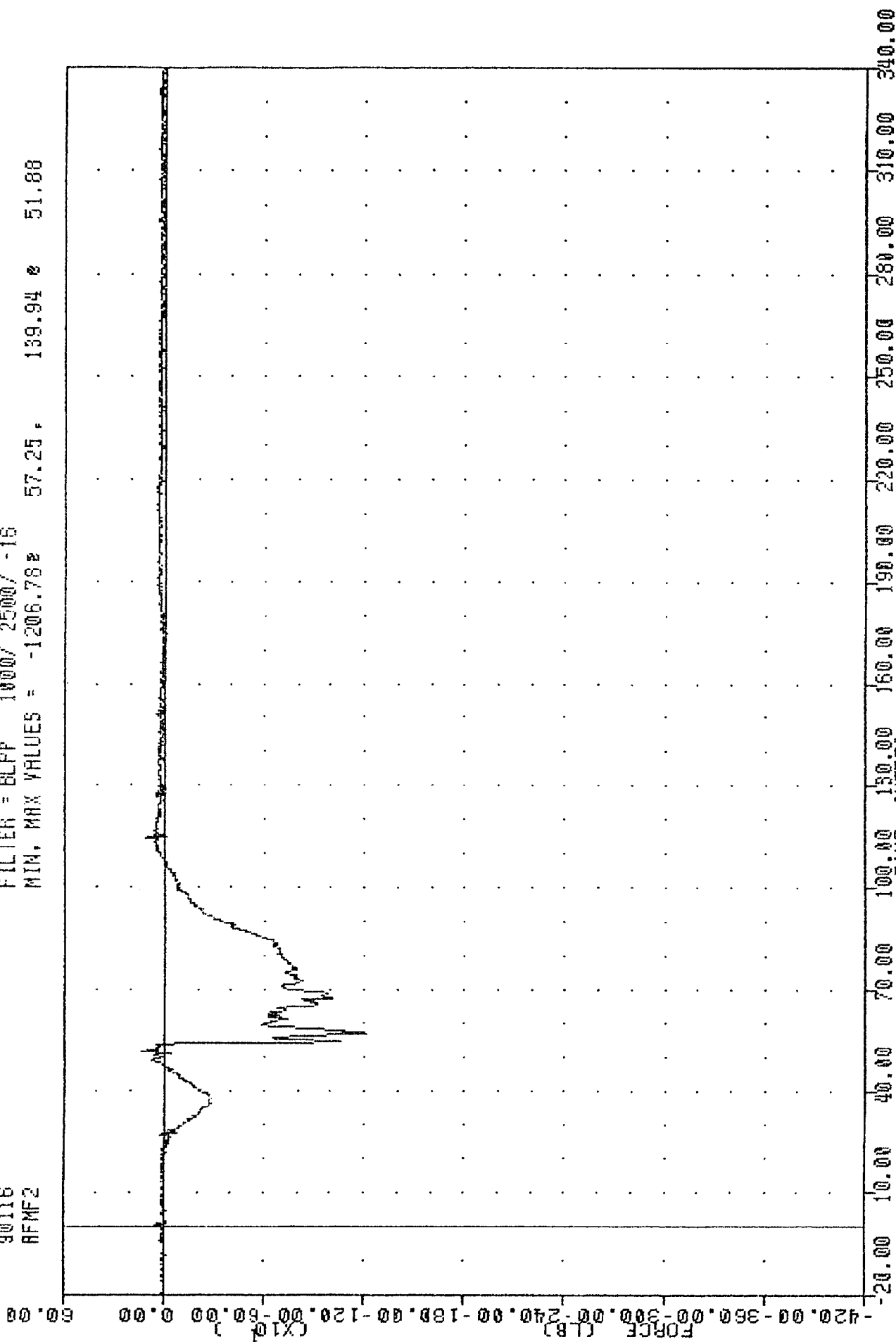
FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -1322.642 66.00, 117.47 8 49.00



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 RIGHT FRONT PASSENGER LEFT FFMIR FORCE

TRC , 800426
 200 COMPLIANCE
 90116
 AFMF2

FILTER = BLPP 1000/ 2500/ -16
 MIN. MAX VALUES = -1206.78 57.25 139.94 51.88



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

TRC , 900426

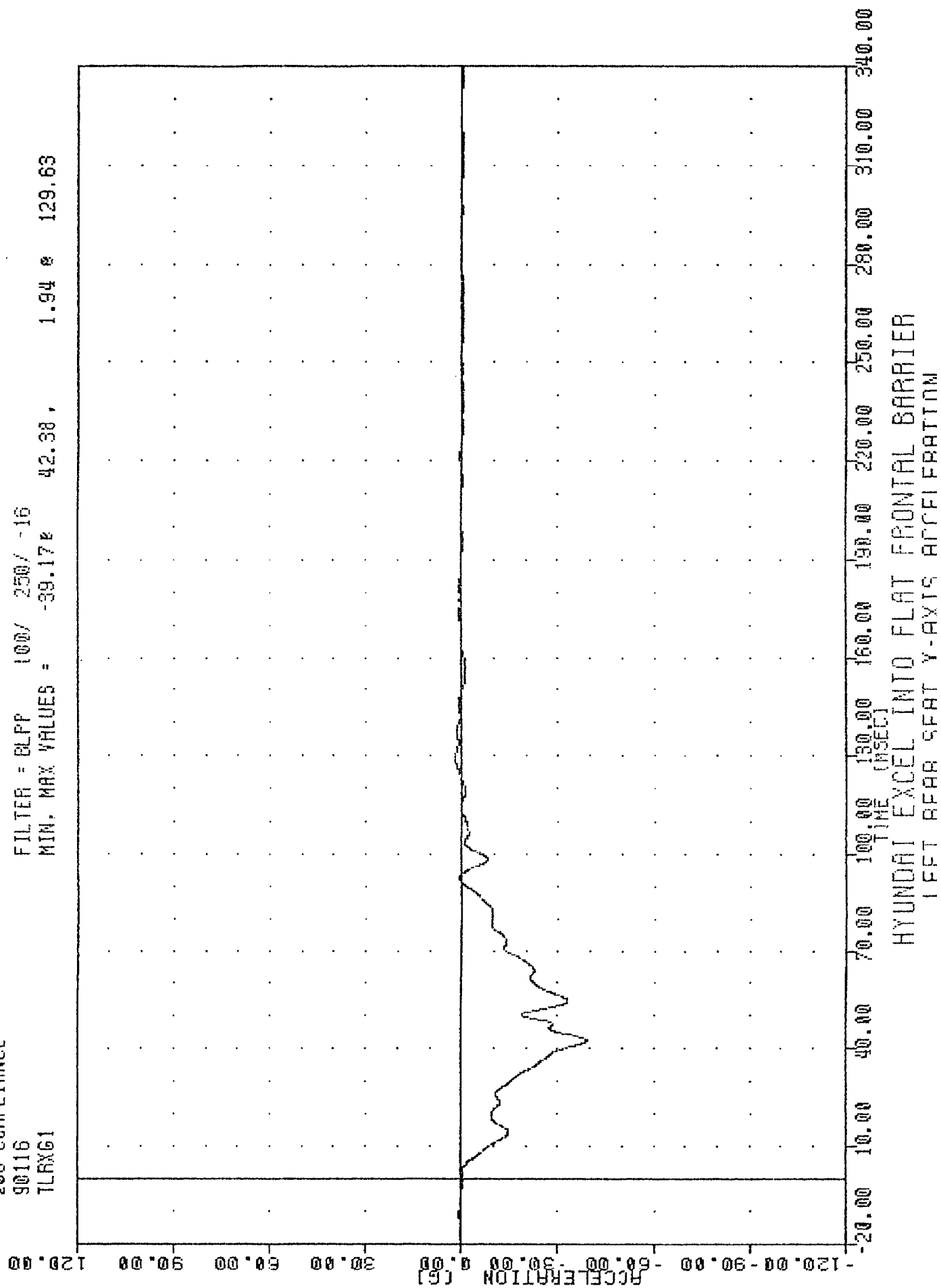
200 COMPLIANCE

90116

TLRX61

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -39.17 42.38 , 1.94 129.63



TRC 900426

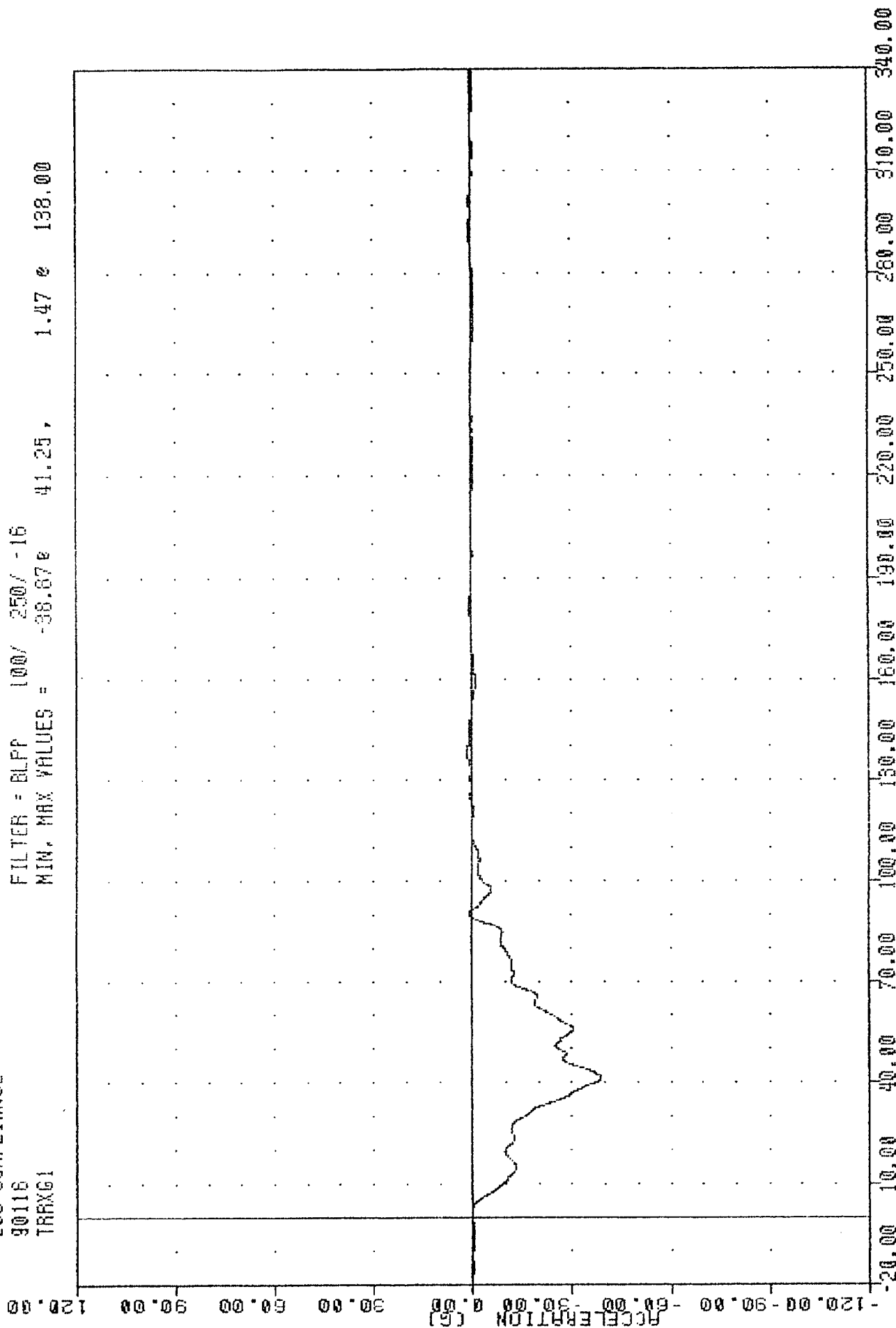
208 COMPLIANCE

90118

TRRXG1

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -38.67 41.25, 1.47 138.00



TRC 900426

208 COMPLIANCE

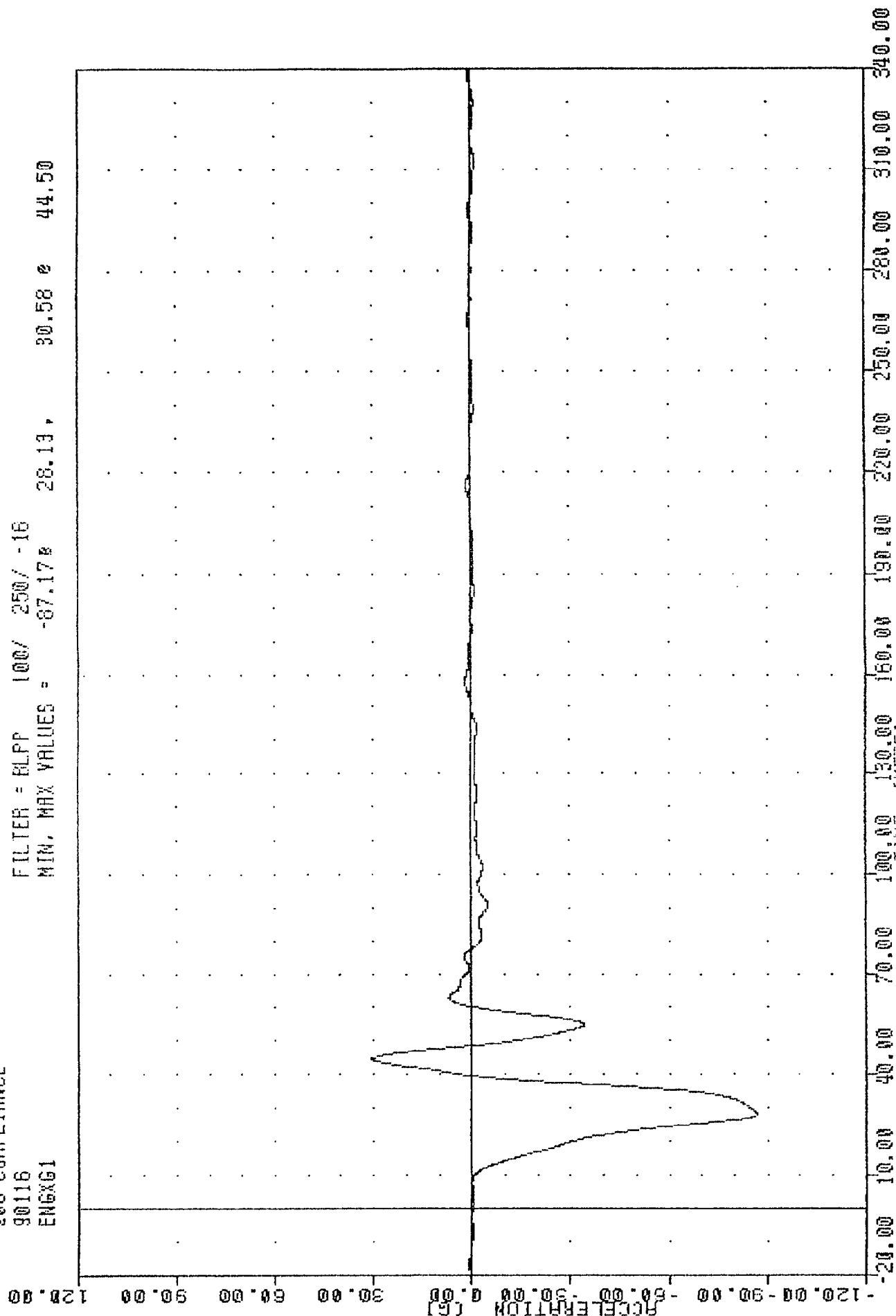
90116

ENGXG1

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -87.17 28.13

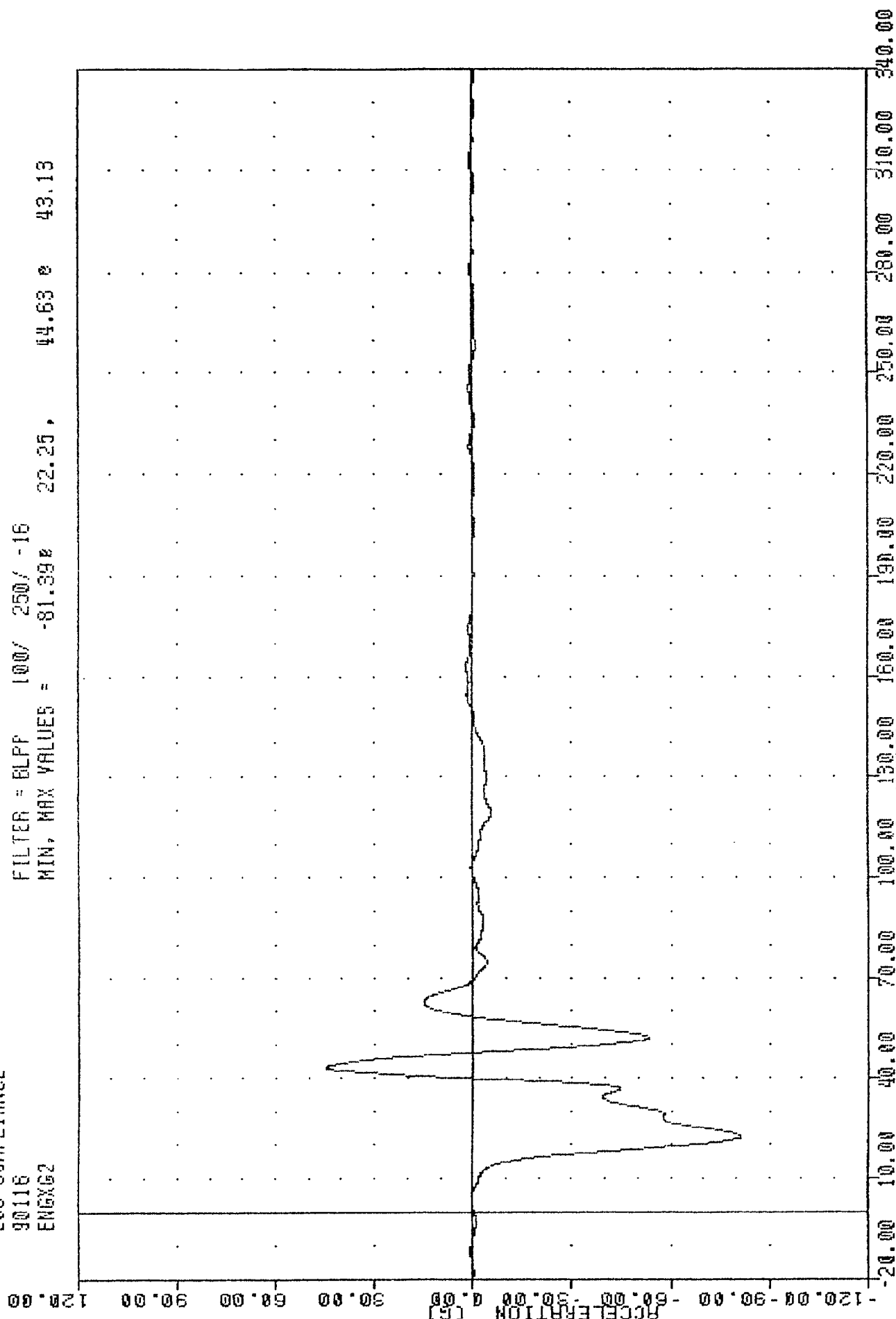
30.58 44.50



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
ENGINE UPPER RIRK X-AXIS ACCELERATION

TRC , 900426
200 COMPLIANCE
90116
ENGXG2

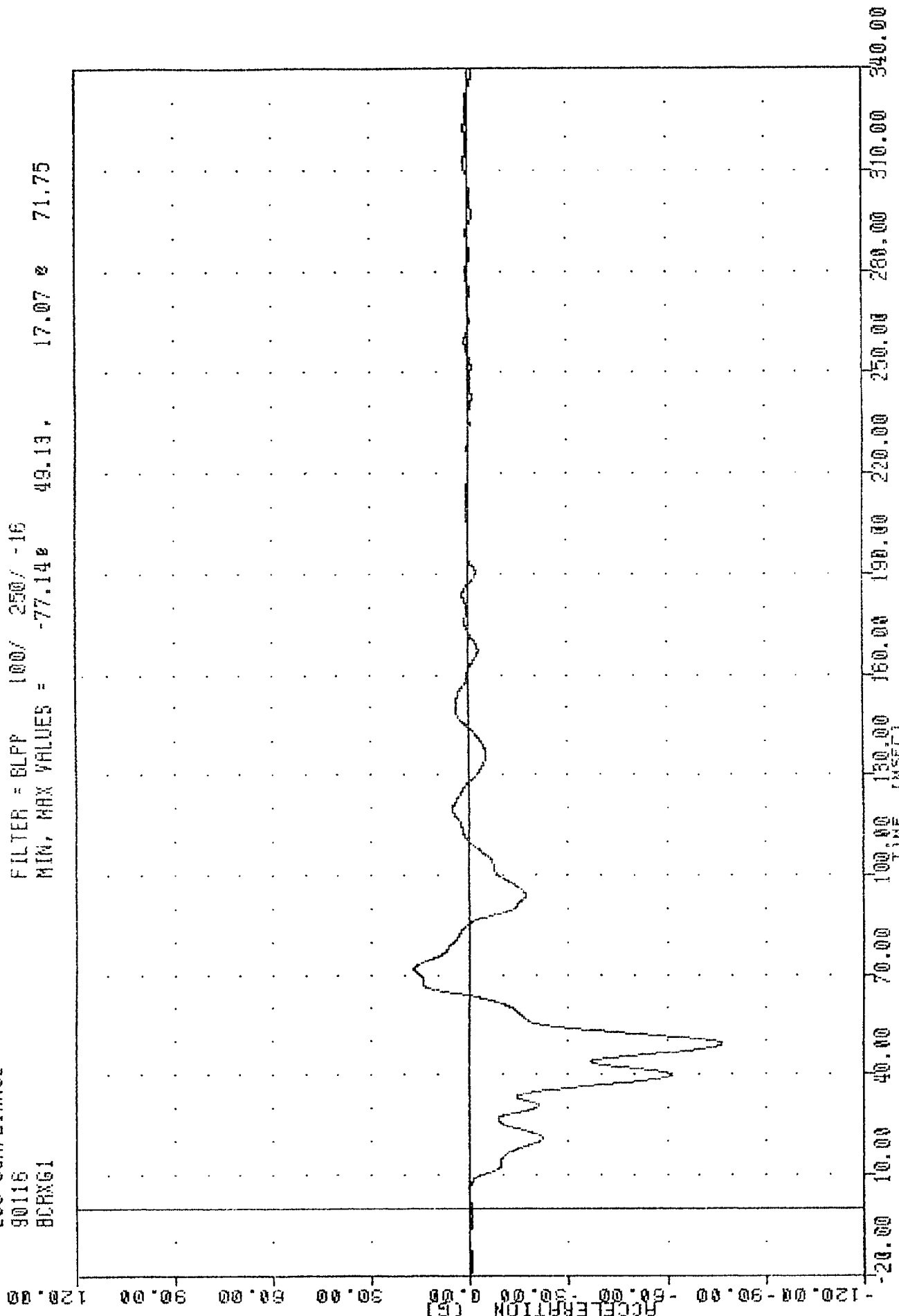
FILTER = BLPP 100/ 250/ -16
MIN, MAX VALUES = -81.39 22.25, 44.63 43.13



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
ENGINE BOTTOM BUCK X-AXIS ACCELERATION

TRC , 900426
 208 COMPLIANCE
 90116
 BCRXG1

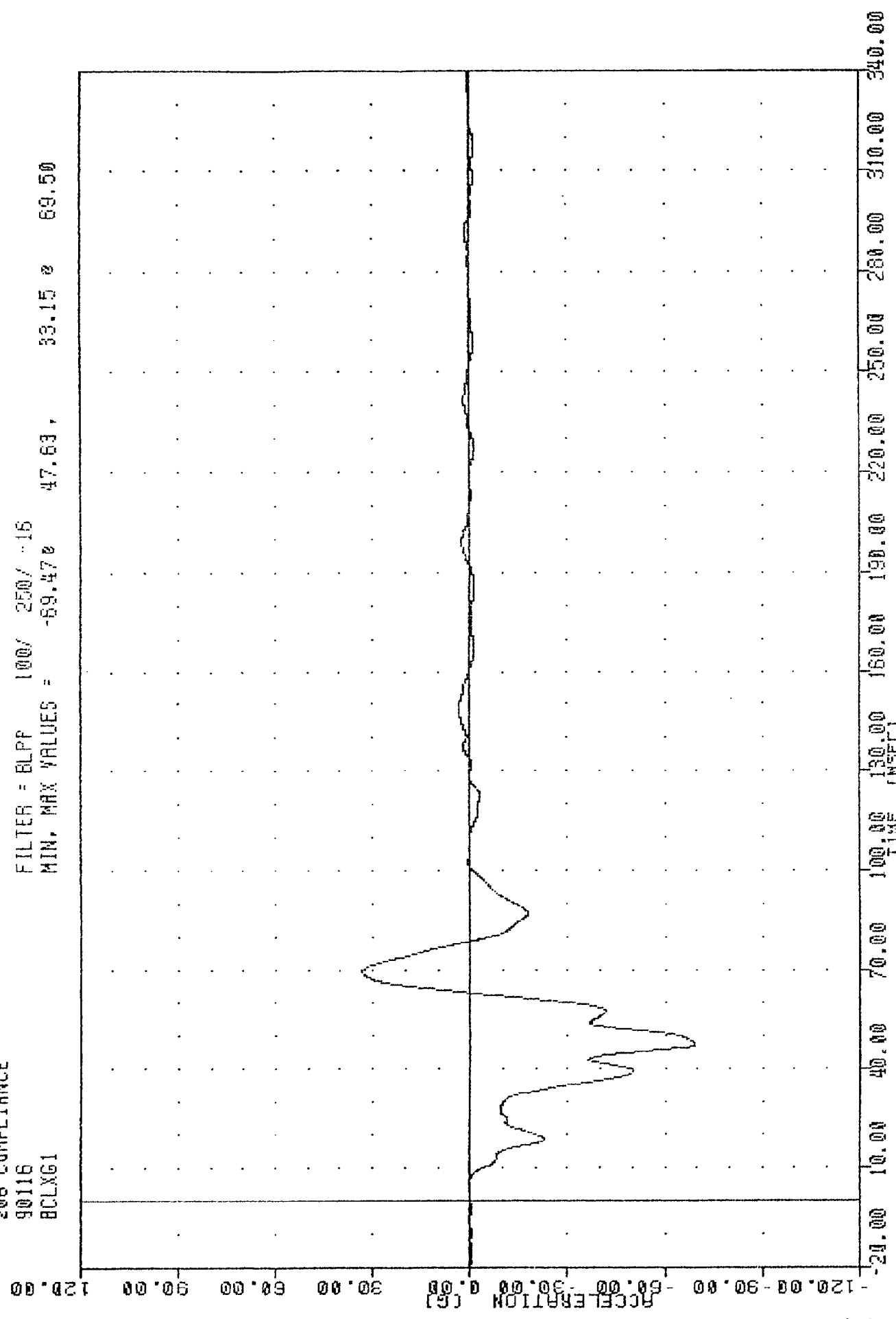
FILTER = BLPP 100/ 250/ -16
 MIN, MAX VALUES = -77.14e 49.13, 17.07 e 71.75



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 RIGHT BRAKE CALIPER X-AXIS ACCELERATION

TRC , 900426
 200 COMPLIANCE
 90116
 BCLXG1

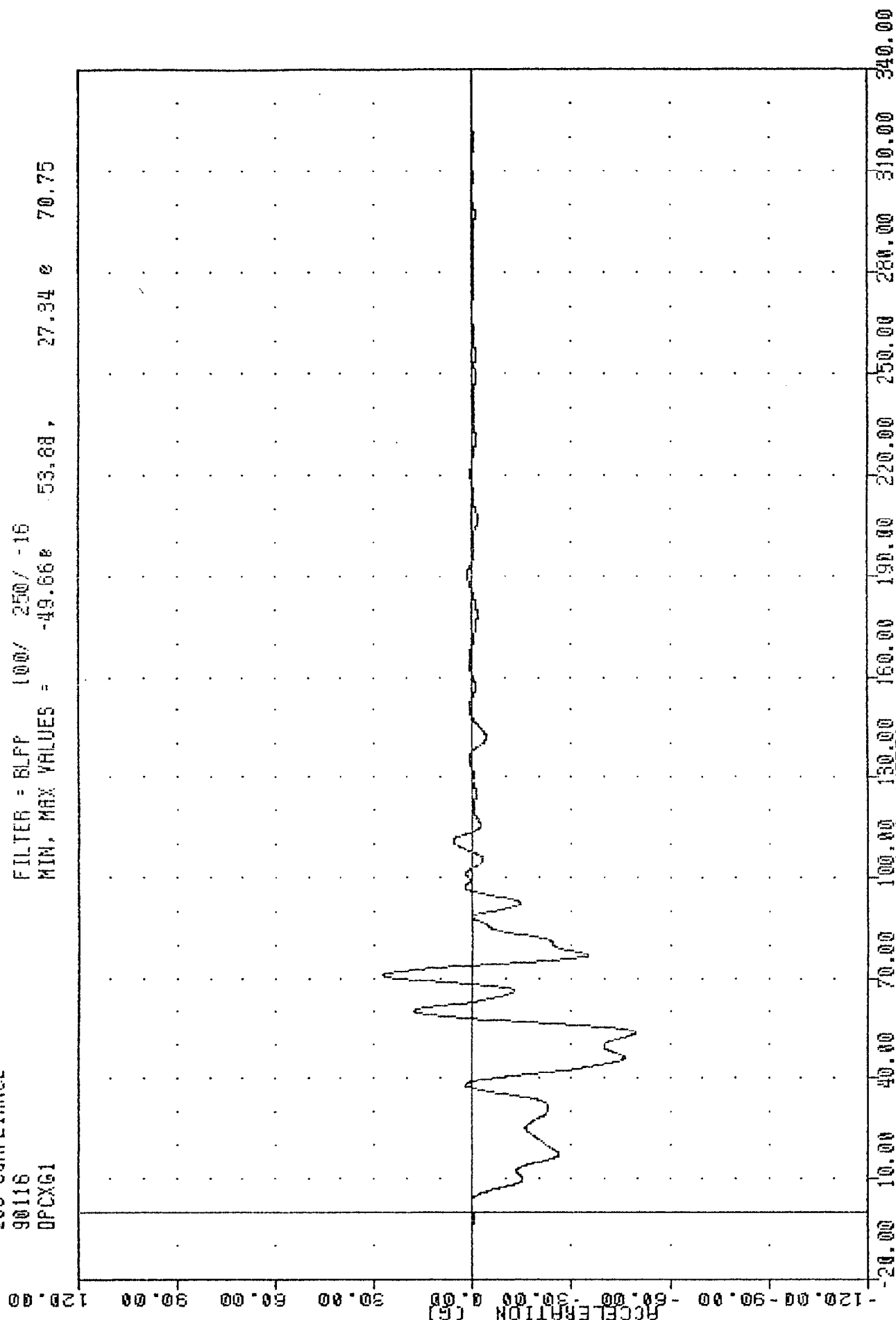
FILTER = BLPP 100/ 250/ -16
 MIN. MAX VALUES = -69.470 47.63 , 33.15 0 69.50



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
 LEFT BRAKE CHAIR X-AXIS ACCELERATION

TRC , 900426
208 COMPLIANCE
90116
DPCXG1

FILTER = BLPP 100/ 250/ -16
MIN. MAX VALUES = -49.66e 53.88, 27.34 e 70.75



HYUNDAI EXCEL INTO FLAT FRONTAL BARRIER
DASH PANEL CENTER X-AXIS ACCELERATION