

1446

REPORT NOS. 208-TRC-90-010

212-TRC-90-010

301-TRC-90-010

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

FUJI HEAVY INDUSTRIES, LTD.

1990 SUBARU LEGACY

4-DOOR SEDAN

NHTSA NO. CL5501

TRC TEST NO. 900222

THE TRANSPORTATION RESEARCH CENTER OF OHIO

U.S. RT. 33, LOGAN COUNTY

EAST LIBERTY, OHIO 43319



MARCH 12, 1990

FINAL REPORT

PREPARED FOR:

U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF VEHICLE SAFETY COMPLIANCE
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ROOM NO. 6115 (NEF-31)
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16. Abstract A 30 mph flat frontal barrier impact compliance test was conducted on a 1990 Subaru Legacy 4-door sedan, VIN JF1BC6229LB612567, NHTSA No. CL5501 at the Transportation Research Center of Ohio on February 22, 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 72° 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		
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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

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

Approximate Conversions from Metric Measures

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

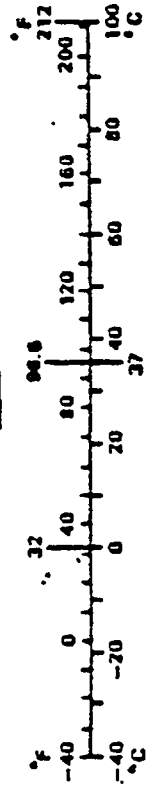


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SECTION 1.0

PURPOSE AND 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 Subaru Legacy 4-door sedan, NHTSA No. CL5501, 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 Subaru Legacy 4-door sedan, NHTSA No. CL5501, was equipped with a 2.2 liter, inline engine, manual transmission, and power brakes. The test weight of the vehicle was 3067 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 February 23, 1990. The test vehicle's impact speed was 29.5 mph. The vehicle sustained 17.3 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.:	CL5501	PROJECT:	208 Compliance
DATE:	02/22/90	TIME:	1337 TEMP: 72° F
VEHICLE:	1990 Subaru Legacy 4-door sedan		
TEST WEIGHT (LBS):	3067		
IMPACT ANGLE (DEG)*:	0		
IMPACT VELOCITY (MPH)**:	PRIMARY = 29.5	SECONDARY =	29.5
MAXIMUM STATIC CRUSH (IN):	17.3		
VEHICLE REBOUND (IN):	32.0		
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: Fuji Heavy Industries, Ltd; Japan

MAKE/MODEL: Subaru Legacy

VIN: JF1BC6229LB612567

BODY STYLE: 4-door sedan

MODEL YEAR: 1990

NHTSA NO.: CL5501

COLOR: White

ENGINE DATA: TYPE: inline CYLINDERS: 4 DISPLACEMENT: 2.2 liter

TRANSMISSION DATA: 5 SPEED, X MANUAL, AUTOMATIC, X FWD, RWD, 4WD

DATE VEHICLE RECEIVED: 10/10/89

ODOMETER READING: 76.0

DEALER'S NAME AND ADDRESS: Byer's Imports
401 N. Hamilton Road
Box 16513
Columbus, OH 43216

ACCESSORIES:

POWER STEERING Yes

POWER BRAKES Yes

POWER SEATS No

POWER WINDOWS No

TINTED GLASS Yes

RADIO No

CLOCK No

OTHER None

AUTOMATIC TRANSMISSION No

AUTOMATIC SPEED CONTROL No

TILTING STEERING WHEEL No

TELESCOPING STEERING WHEEL No

AIR CONDITIONING No

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: Fuji Heavy Industries, Ltd.; Japan

DATE OF MANUFACTURE: 05/89

GVWR: 3930 LBS

GAWR: FRONT 2065 LBS., REAR 1865 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 30 psi; REAR 29 psi

RECOMMENDED TIRE SIZE: P175/70R14 84H LOAD RANGE X B, C, D

TIRES ON VEHICLE (MFR., LINE, SIZE): Yokohama 372 A/S P175/70R14 84H

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: Manual adjustable

NUMBER OF OCCUPANTS 2 FRONT 3 REAR 5 TOTAL

CARGO LOAD 60 LBS. TOTAL 810 LBS.

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

RIGHT FRONT 757 lbs. RIGHT REAR 565 lbs.

LEFT FRONT 784 lbs. LEFT REAR 593 lbs.

TOTAL FRONT WEIGHT 1541 lbs. (57.1% OF TOTAL VEHICLE WEIGHT)

TOTAL REAR WEIGHT 1158 lbs. (42.9% OF TOTAL VEHICLE WEIGHT)

TOTAL DELIVERED WEIGHT 2699 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (2699 LBS)

VCW = VEHICLE CAPACITY WEIGHT (810 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

$RCLW = VCW - 150 (DCS) = 810 - 150(5) = 60 \text{ LBS}$

$TARGET \text{ TEST WEIGHT} = UDW + RCLW + (2 \text{ DUMMIES} \times 164 \text{ LBS/DUMMY})$

$= 2699 + 60 + 328 \text{ LBS}$

TARGET TEST WEIGHT = 3087 LBS

TABLE 2 TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 40 LBS. CARGO:

RIGHT FRONT	825 lbs.	RIGHT REAR	683 lbs.
LEFT FRONT	869 lbs.	LEFT REAR	690 lbs.
TOTAL FRONT WEIGHT	1694 lbs.	(55.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1373 lbs.	(44.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	3067 lbs.	(0.6% UNDER TARGET WEIGHT)	

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

COMPONENTS REMOVED TO MEET TARGET WEIGHT: Rear bumper; rear seat belt retractors

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE: LF 26.1; RF 26.0; LR 24.4; RR 24.5

PRE-TEST ATTITUDE: LF 26.0; RF 26.1; LR 24.2; RR 24.3

POST-TEST ATTITUDE: LF 28.4; RF 27.2; LR 23.5; RR 22.9

MAXIMUM WIDTH: 66.3 INCHES

WHEELBASE: 102.0 INCHES

CG = 45.7 INCHES REARWARD OF FRONT WHEEL CENTERLINE

TABLE 3 TEST CONDITIONS

TEST NUMBER: 900222

DATE OF TEST: 02/22/90

TIME OF TEST: 1337

TYPE OF TEST: Frontal barrier impact

IMPACT ANGLE: 0°

AMBIENT TEMPERATURE AT IMPACT AREA:

72° F

TEMPERATURE IN OCCUPANT COMPARTMENT:

69° F

IMPACT VELOCITY: PRIMARY = 29.5 MPH

SECONDARY = 29.5 MPH

(SPECIFIED RANGE = 28.9 TO 29.9 MPH)

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES):

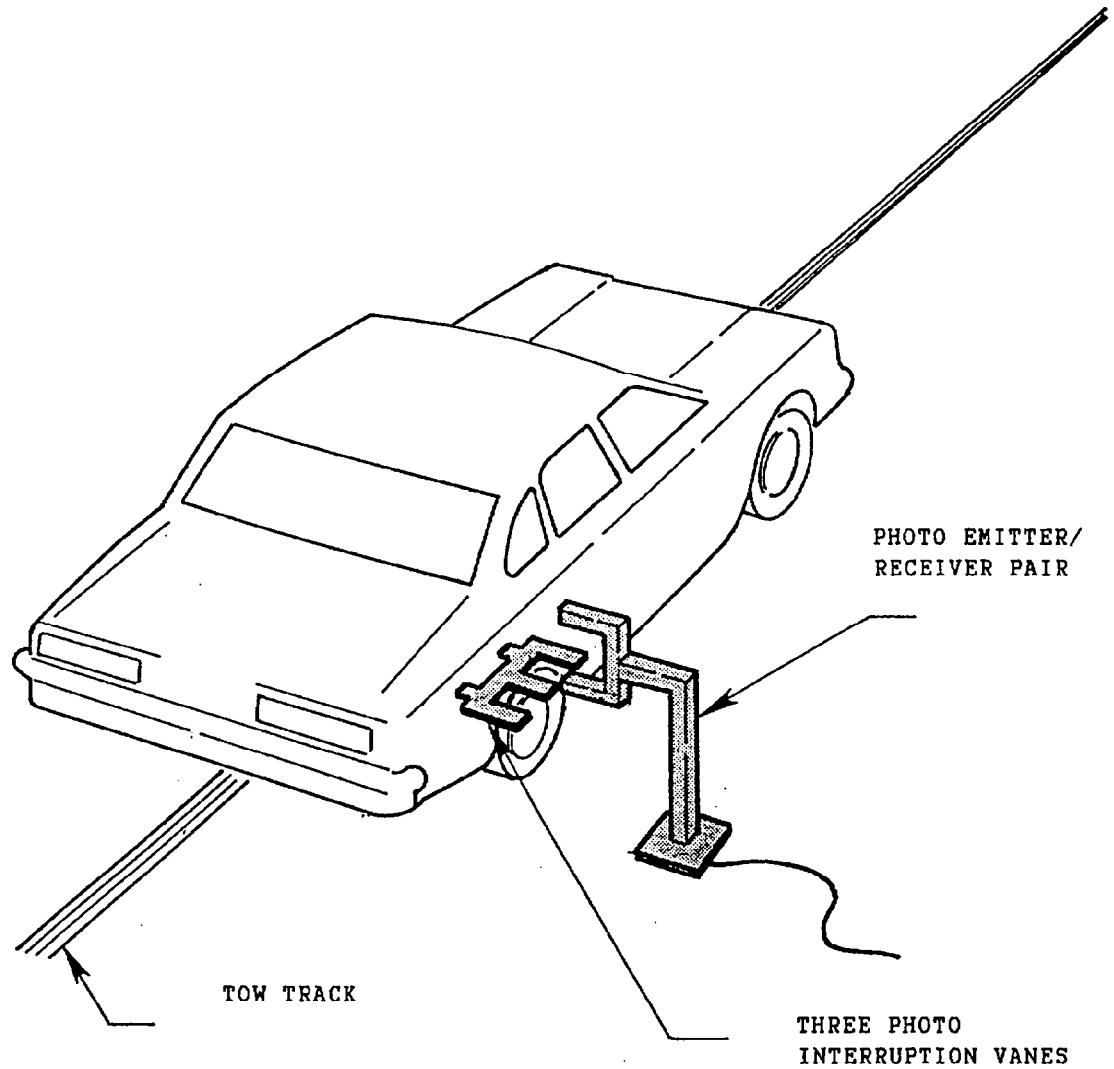
OVERALL LENGTH OF TEST VEHICLE: PRE-TEST: L 173.4; C 177.2; R 173.4

POST-TEST: L 158.8; C 160.2; R 159.0

TOTAL CRUSH: L 14.6; C 17.0; R 14.4

FOR FRONTAL IMPACTS, DISTANCE FROM FRONT OF TEST VEHICLE TO BARRIER AFTER
IMPACT: L: 33.1; C: 31.0; R: 31.8; AVG: 32.0

FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM

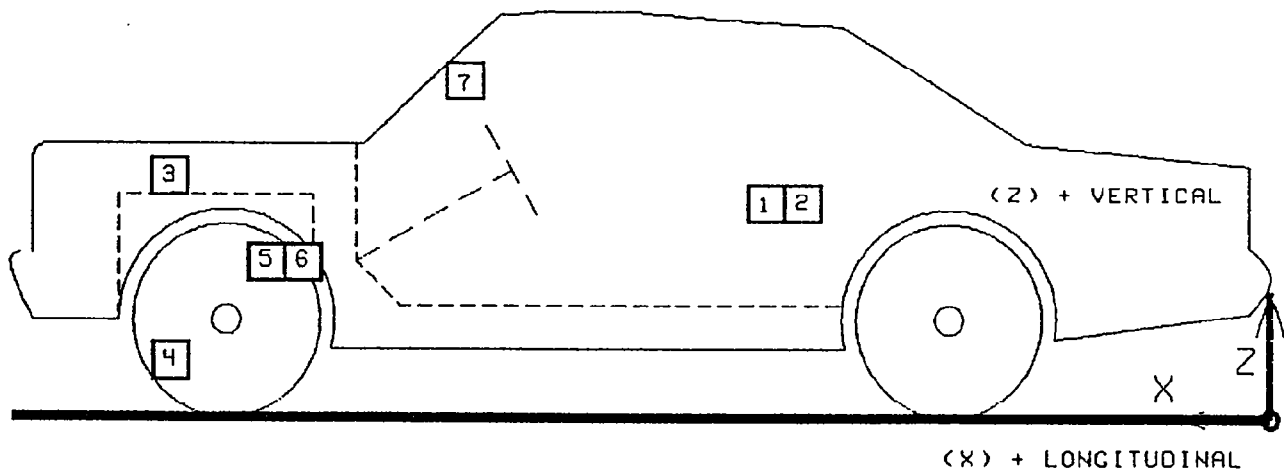


The final vane clears emitter/receiver two inches before impact.

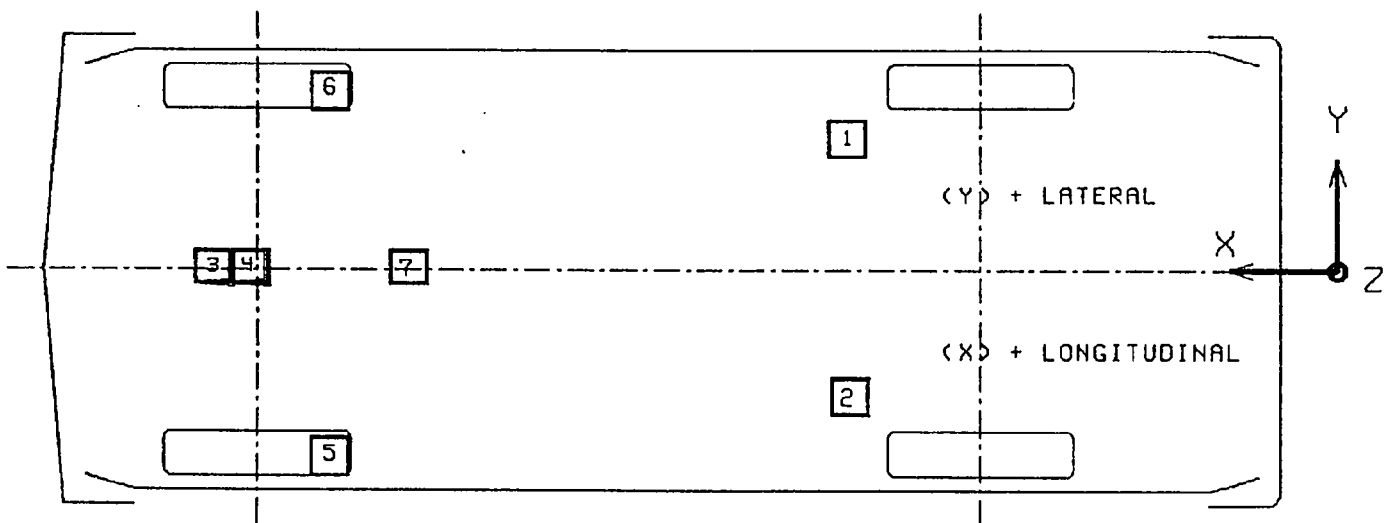
The vanes have one foot spacing.

FIGURE 2

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4
VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 900222

No.	LOCATION		X*	Y*	Z*	POSITIVE DIRECTION		NEGATIVE DIRECTION	
						MAX G MSEC		MAX G MSEC	
1	REAR SEAT CROSSMEMBER AT LEFT SIDE LONGITUDINAL	PRE	65.1	26.8	11.8				
		POST	65.1	26.8	13.2				
						1.7	140.6	37.1	42.6
2	REAR SEAT CROSSMEMBER AT RIGHT SIDE LONGITUDINAL	PRE	66.1	-20.8	13.1				
		POST	66.1	-20.8	14.4				
						1.7	136.9	33.9	45.4
3	TOP OF ENGINE BLOCK LONGITUDINAL	PRE	156.3	5.5	26.2				
		POST	148.6	6.2	29.4				
						44.8	44.0	110.2	34.0
4	BOTTOM OF ENGINE BLOCK LONGITUDINAL	PRE	157.0	0.2	7.1				
		POST	151.5	1.0	10.8				
						57.1	43.3	104.6	33.5
5	BRAKE CALIPER AT RIGHT SIDE LONGITUDINAL	PRE	136.8	-25.0	12.2				
		POST	136.8	-24.6	11.4				
						6.0	70.1	54.6	49.0
6	BRAKE CALIPER AT LEFT SIDE LONGITUDINAL	PRE	136.9	25.0	12.2				
		POST	136.0	24.6	11.1				
						5.9	85.1	64.1	47.8
7	DASH PANEL LONGITUDINAL	PRE	119.6	1.6	36.4				
		POST	119.9	2.4	38.5				
						9.9	64.4	50.9	47.1

* 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: Subaru/Leqacy/4-door sedan
VEH. NHTSA NO.: CL5501; VIN: JF1BC6229LB612567
MODEL YEAR: 1990; BUILD DATE: 05/89; TEST DATE: 02/22/90
VEH. SIZE CATEGORY: Compact; TEST WEIGHT: 3067 lbs.
VEH. WHEELBASE: 102.0
MAX. WIDTH: 66.3
FRONT OVERHANG: 35.2

COLLISION DEFORMATION
CLASSIFICATION (CDC) CODE: 12FDEW2

F (Frontal)
CRUSH DEPTH
DIMENSIONS:

C1 = 14.6 inches
C2 = 17.3 inches
C3 = 17.3 inches
C4 = 17.2 inches
C5 = 17.1 inches
C6 = 14.4 inches

MIDPOINT OF DAMAGE: D = Vehicle Centerline
(Longitudinal)

LENGTH OF DAMAGED
REGION: L = 59.5 inches

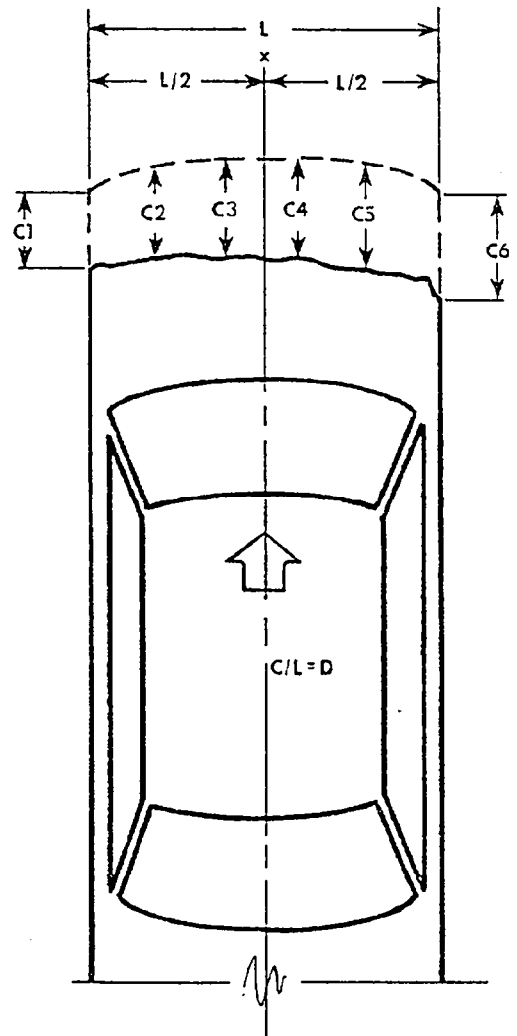


FIGURE 4

PRE-TEST AND POST-TEST MEASUREMENT POINTS

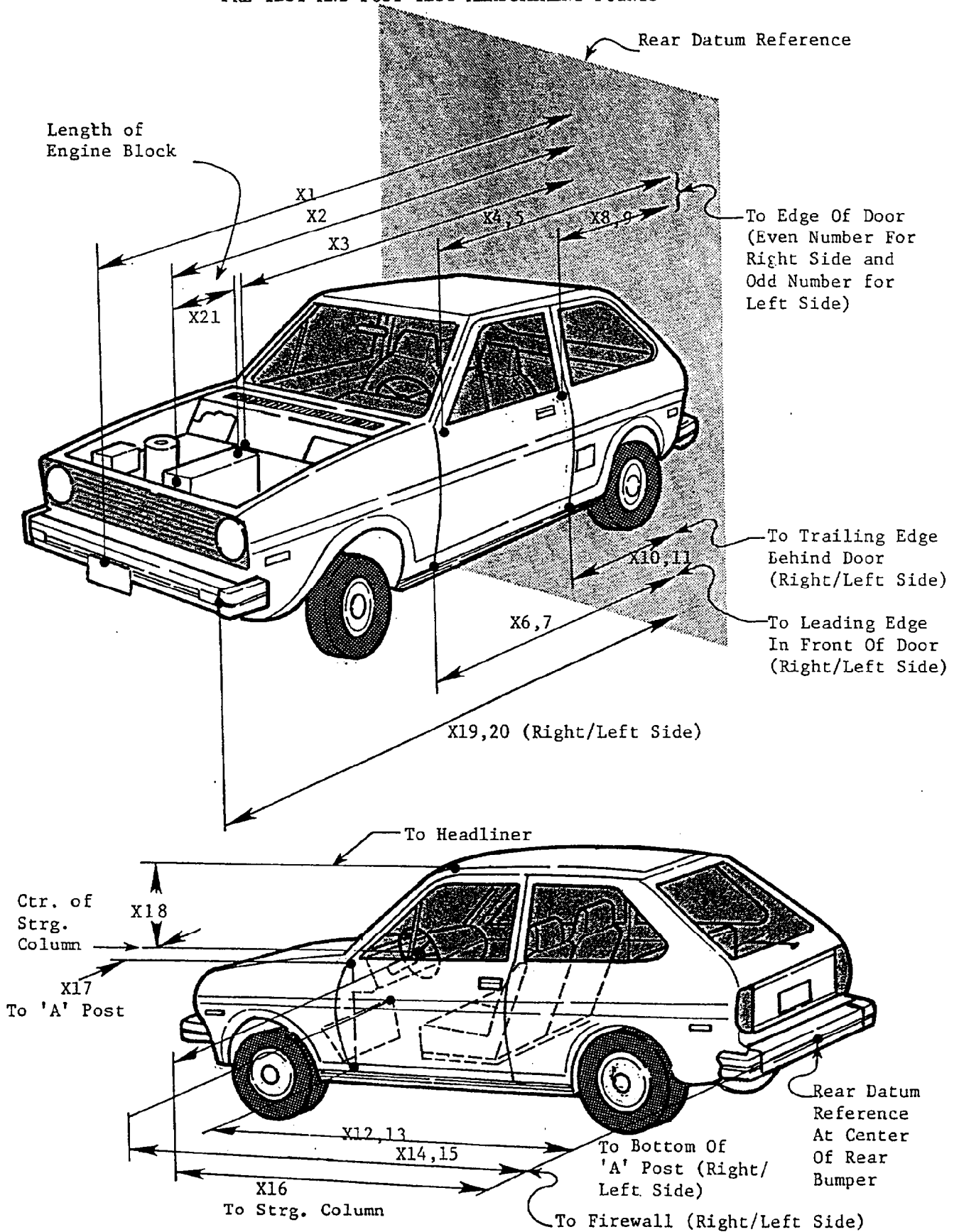
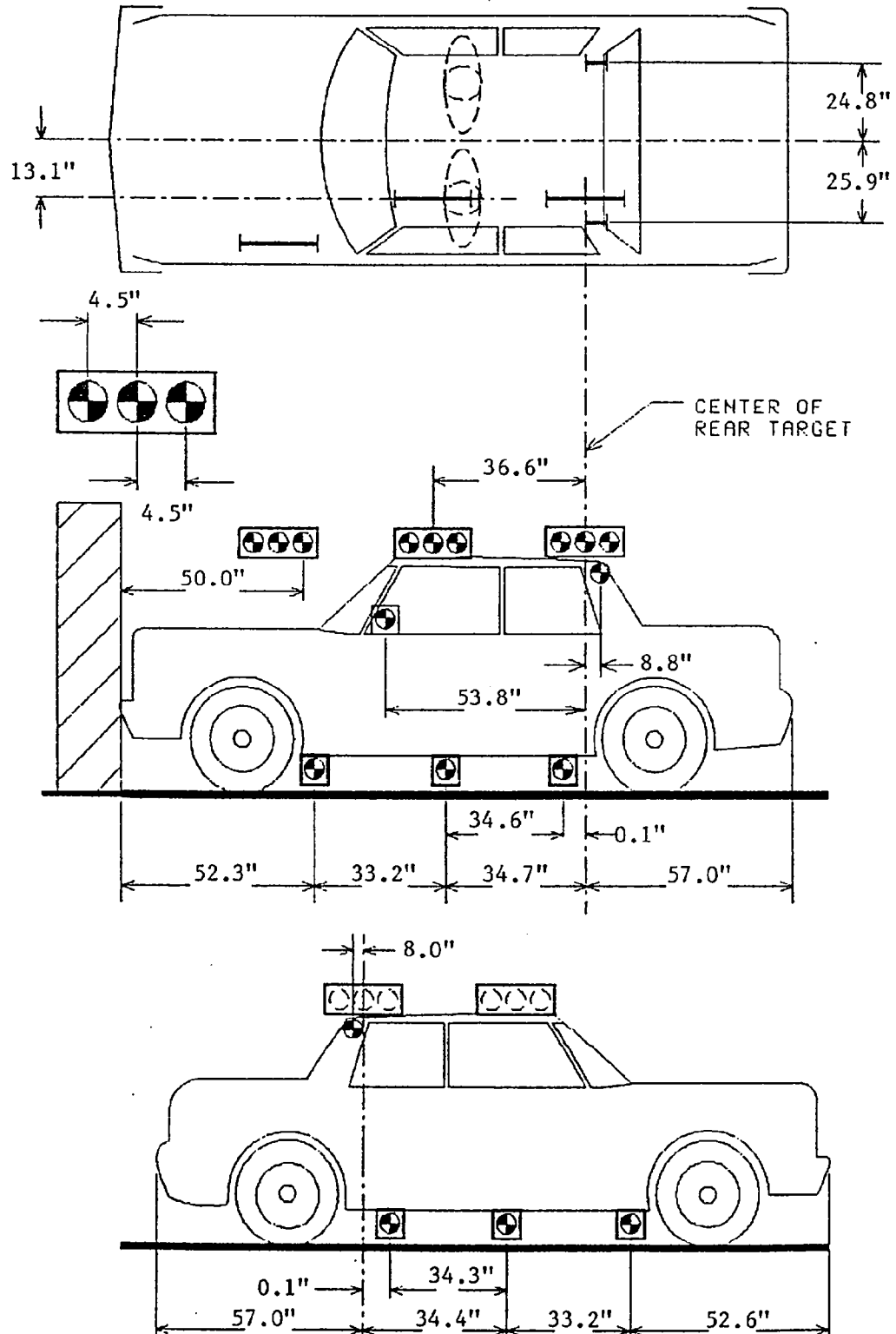


TABLE 5 IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Subaru Legacy		TEST NUMBER: 900222		DIMENSIONS IN INCHES		
NO.	TYPE OF MEASUREMENT	PRE-TEST		POST-TEST	DIFF.	
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	177.2	160.2	17.0		
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	161.5	154.2	7.3		
X3	REAR SURFACE OF VEHICLE TO FIREWALL	133.8	133.0	0.8		
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	120.1	119.8	0.3		
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	119.9	119.6	0.3		
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	122.2	122.0	0.2		
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	122.1	122.0	0.1		
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	82.4	82.2	0.2		
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	82.3	81.9	0.4		
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	82.5	82.2	0.3		
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	82.8	82.0	0.8		
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	121.5	121.6	-0.1		
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	121.2	121.9	-0.7		
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	133.5	132.0	1.5		
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	133.5	132.1	1.4		
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	103.9	103.6	0.3		
X17	CENTER OF STEERING COLUMN TO "A" POST	13.2	13.0	0.2		
X18	CENTER OF STEERING COLUMN TO HEADLINER	18.1	19.0	-0.9		
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	173.4	159.0	14.4		
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	173.4	158.8	14.6		
X21	LENGTH OF ENGINE BLOCK	16.8	16.8	0.0		

FIGURE 5

VEHICLE TARGET LOCATIONS



REPORT OF VEHICLE CONDITION AT THE
COMPLETION OF TESTING

Contract No.: DTNH22-88-C-11038
From: The Transportation Research Center of Ohio
U.S. Route 33
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.: CL5501
MAKE/MODEL/BODY STYLE: Subaru/Legacy/4-door sedan
MODEL YEAR: 1990 BODY COLOR: White
VIN: JF1BC6229LB612567
ODOMETER (ARRIVAL): 76.0 DATE: 10/10/89
ODOMETER (COMPLETION): 80.0 DATE: 02/22/90
COST: \$11,913

☐ Air Conditioner	☐ Console	Brakes: ☒ Power
☒ Tinted Glass	☐ Tachometer	Front: Disc
☒ Power Steering	☐ Speed Control	Rear: Disc
☐ 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; 2.2 LITRES
Transmission: 5-speed; Drive Type: Front
Tire Size: P175/70R14
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 Subaru Legacy 4-door sedan, NHTSA No. CL5501, appeared to comply with the requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.

The driver's Head Injury Criteria (HIC) was 711. The driver's maximum chest deceleration over three milliseconds was 39.8 g. The driver's right and left compressive femur loads were 1799 pounds and 1570 pounds, respectively.

The right front passenger's Head Injury Criteria (HIC) was 452. The right front passenger's maximum chest deceleration over three milliseconds was 45.8 g. The right front passenger's right and left compressive femur loads were 1376 pounds and 1014 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	-60.4	30.6	-56.8	68.4	-40.9	18.7	-16.3	39.8
PASSENGER	-29.3	-17.8	-56.9	57.6	-47.1	-9.0	8.0	45.8

MAXIMUM FORCE-FEMUR LOAD (LBS)

	LEFT FEMUR	RIGHT FEMUR
DRIVER	1570	1799
PASSENGER	1014	1376

HEAD INJURY CRITERIA**

	HIC	TIME t ₁ (MSEC) ¹	TIME t ₂ (MSEC) ²
DRIVER	711	70.6	106.6
PASSENGER	452	66.5	102.5

*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, impacted the upper steering wheel rim, and rotated to the left. The dummy's chest impacted the steering wheel as the chest was restrained by the two-point passive belt. The dummy's head rotated rearward as the dummy's upper torso rotated toward the right and rebounded into the seat back. The dummy came to rest seated in the driver's seat, 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, the top of the head contacted the sun visor and the dummy's chin contacted the dummy's chest. The dummy's chest was restrained by the two-point passive belt. The dummy's head rotated rearward as the dummy rebounded 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>Steering wheel upper rim</u>	<u>Chest and sun visor</u>
Chest	<u>Steering wheel</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>Easy</u>	<u>Easy</u>

SEAT MOVEMENT:

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

GLAZING DAMAGE:

Both lower corners of the windshield were 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: Subaru/Legacy
 Body Style: 4-door sedan Model Year: 1990
 NHTSA No.: CL5501 Color: White

DATA FROM CERTIFICATION LABEL:

Vehicle Manufacturer: Fuji Heavy Industries, Ltd.
 Date of Manufacture: 05/89 VIN: JF1BC6229LB612567
 GVWR: 3930 lb; GAWR: Front = 2065 lb; Rear = 1865 lb

POST-IMPACT DATA:

Date of Test: 02/22/90 Time: 1337 Temperature: 72° F
 Required Impact Velocity Range: 28.9 to 29.9 mph
 Impact Velocity: Primary = 29.5 mph Secondary = 29.5 mph
 Seat Type: Bucket Adjuster Type: Manual
 Bucket Seat Back Type: Manual-adjustable
 Technicians: P. Cummins, R. Cribley, & D. Carpenter

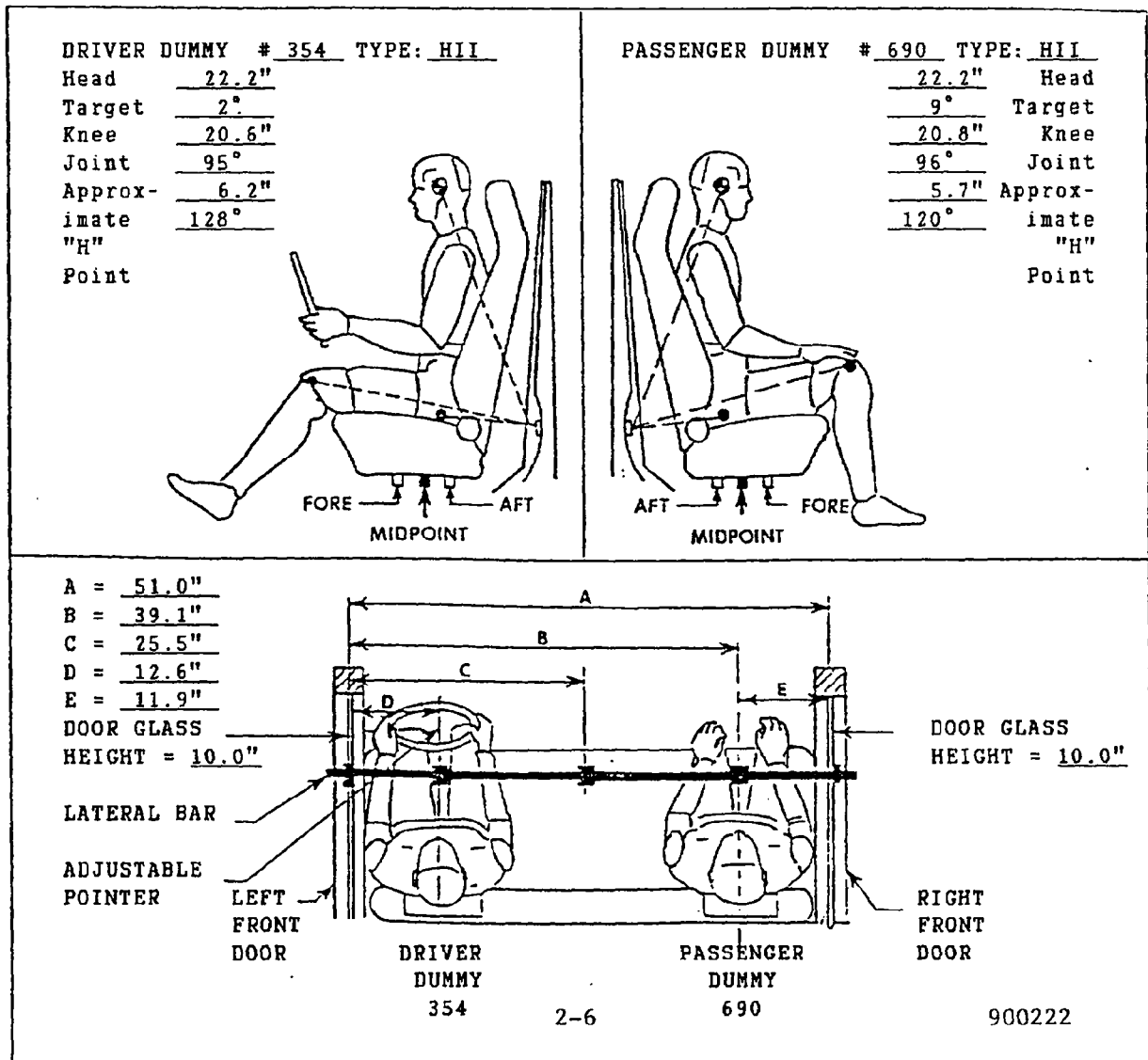
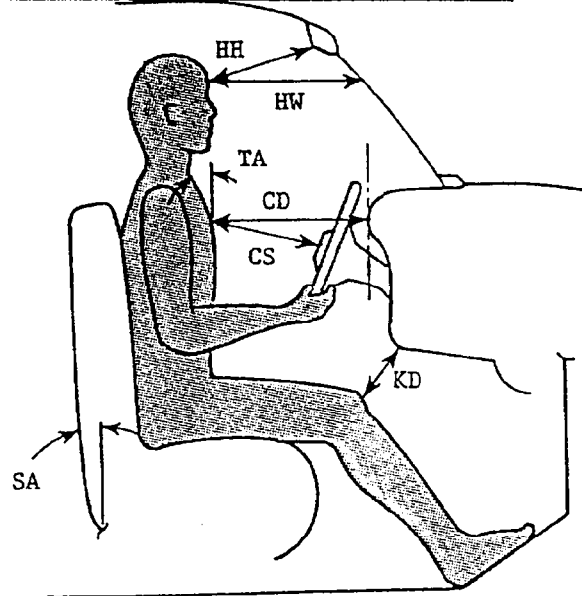


FIGURE 7 DUMMY IN-VEHICLE POSITION RECORDING SHEET

	DRIVER	PASSENGER
HH	13.6	13.8
HW	18.9	18.7
CD	21.4	25.2
CS	15.8	NA
KDL	4.3	5.2
KDR	4.0	5.3
TA	23°	21°
SA	25°	25°
HA	14.5	13.5

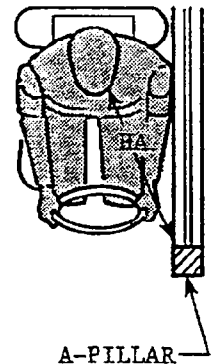
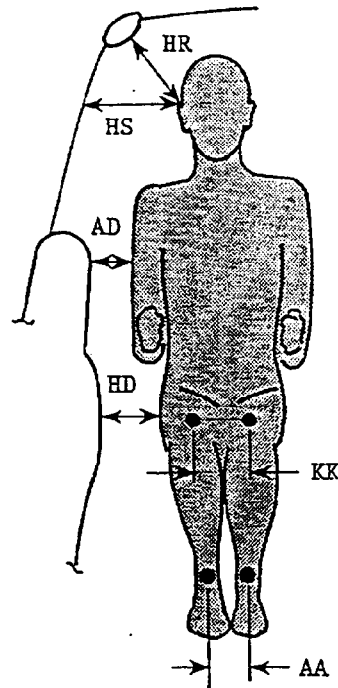


	DRIVER	PASSENGER
HR	5.8	4.6
HS	9.5	8.8
AD	4.7	3.8
HD	7.2	6.6
KK	10.6	7.6
AA	11.0	6.8

Knee outer bolt head to outer bolt head spacing:

Driver = 14.5

Passenger = 11.8



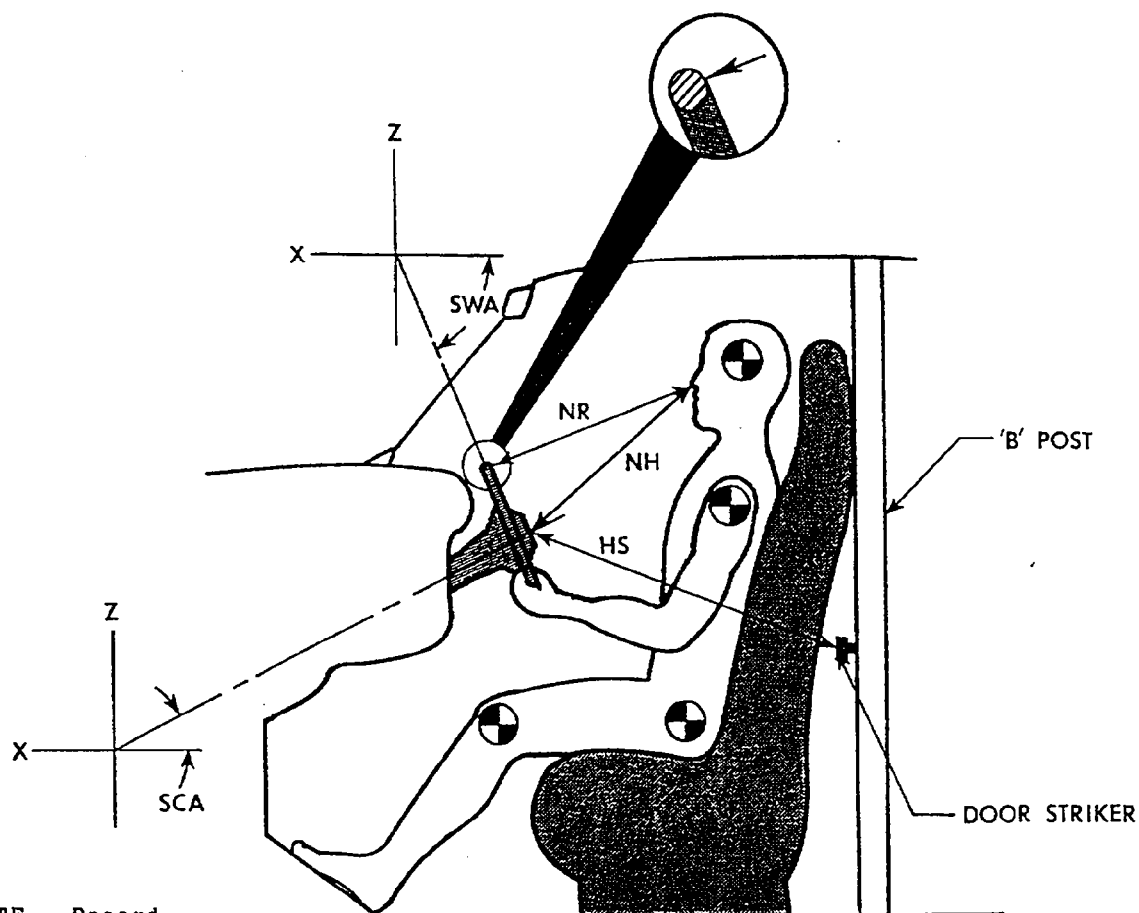
HH = Head to Windshield Header
 HW = Head to Windshield
 CD = Chest to Dash
 CS = Chest to Steering Wheel
 KD = Knee to Dash
 TA = Torso Angle
 SA = Seat Back Angle

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



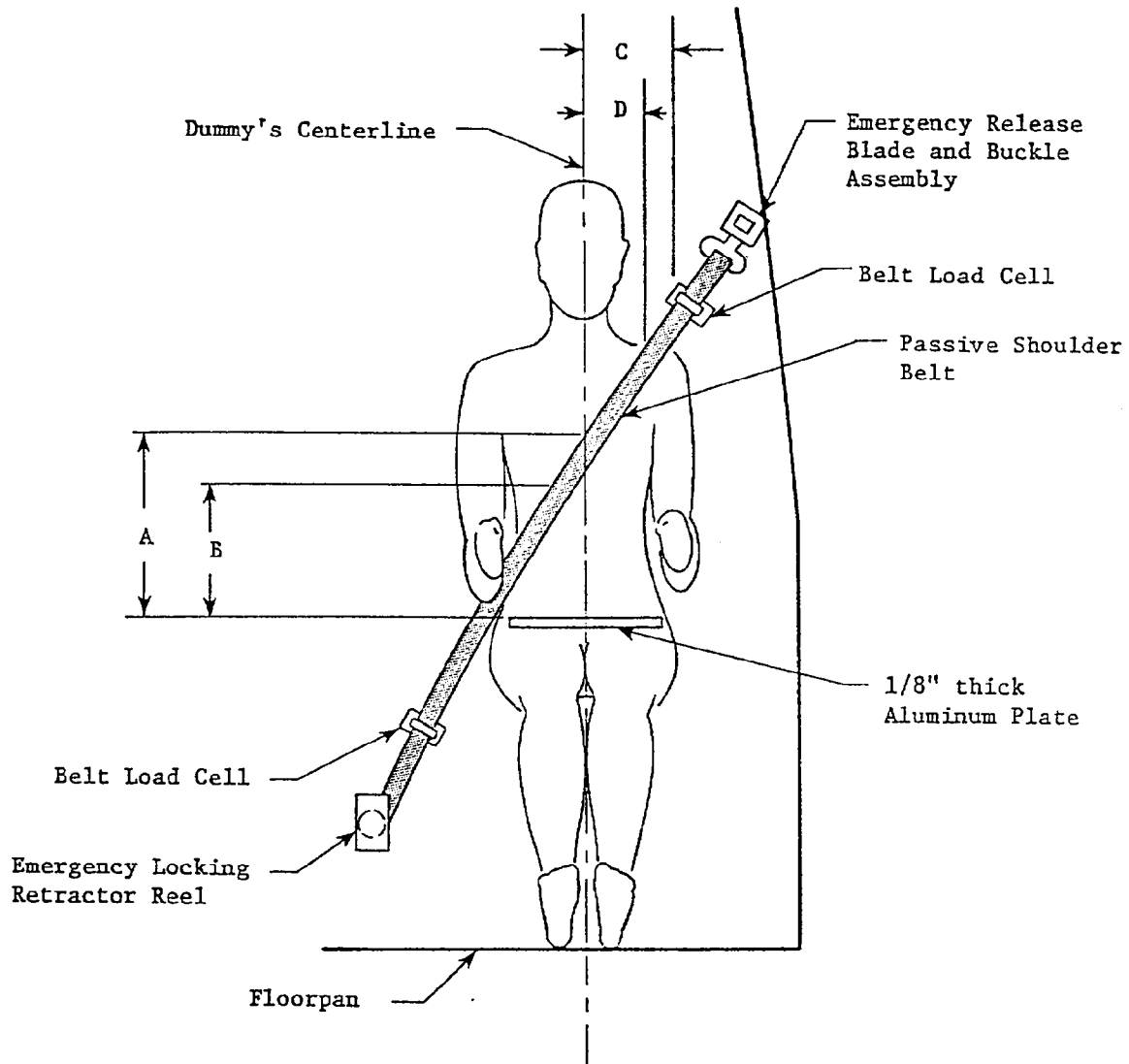
NOTE: Record position of tilt strg. column in REMARKS section

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.)	18.6
NH	- Distance from tip of dummy's nose to center of steering column hub. (in.)	19.9
HS	- Distance from center of steering column hub to the forward surface of the door lock striker pin. (in.)	22.2
SCA	- Angle of steering column relative to the horizontal X axis	22°
SWA	- Angle of steering wheel relative to the horizontal X axis	68°

FIGURE 9 SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
A - Top surface of alum. plate to belt upper edge (in)	11.8	12.9
B - Top surface of alum. plate to belt lower edge (in)	8.5	9.4
C - Dummy centerline to outer edge of belt at chest flesh top (in)	8.2	7.1
D - Dummy centerline to inner edge of belt at chest flesh top (in)	5.6	4.6

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA

VEHICLE VIN: JF1BC6229LB612567 NHTSA NO: CL5501
MAKE: Subaru MODEL: Legacy
VEHICLE BUILD DATE: 05/89 VEHICLE TYPE: 4-door sedan
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:
 0.1 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 IN 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 LAP 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: Subaru/Legacy

BODY STYLE: 4-door sedan

MODEL YEAR: 1990

NHTSA NO.: CL5501

COLOR: White

DATA FROM CERTIFICATION LABEL

VEHICLE MANUFACTURER: Fuji Heavy Industries, Ltd.; Japan

DATE OF MANUFACTURE: 05/89

VIN: JF1BC6229LB612567

GVWR: 3930 LBS., GAWR: FRONT 2065 LBS., REAR 1865 LBS.

POST-IMPACT DATA

TYPE OF TEST: Frontal Barrier Impact

DATE OF TEST: 02/22/90

TIME: 1337

TEMP: 72° F

REQUIRED IMPACT VELOCITY RANGE: 28.9 MPH TO 29.9 MPH

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

TEST WEIGHT = 3067 LBS., STATIC CRUSH MAX. = 17.3 IN., REBOUND = 32.0 IN.

FUEL SYSTEM DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: 15.9 GALLONS (FURNISHED BY COTR)

TEST VOLUME: 14.8 GALLONS (92-94% OF USEABLE)

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 15.9 GALLONS

DETAILS OF FUEL SYSTEM: The fuel tank is located in front of the rear
axle. The fuel filler is on the right side of the vehicle and enters
the rear of the fuel tank.

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 around perimeter, plastic trim around outer perimeter.

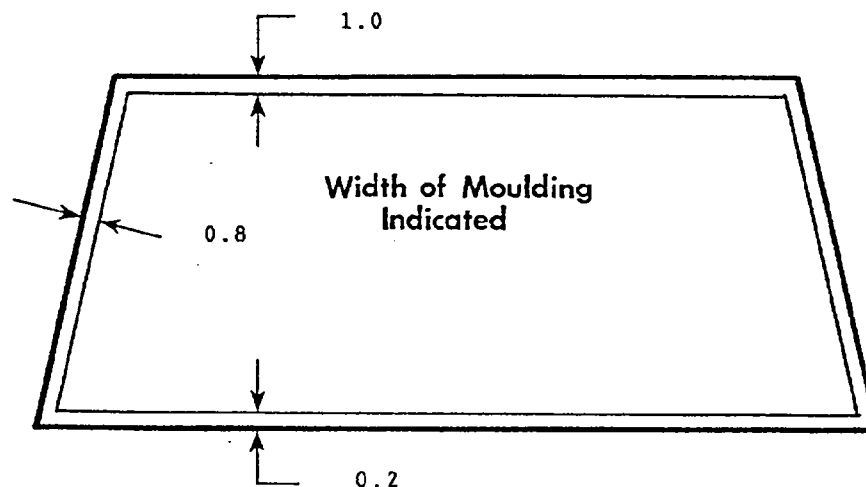
FMVSS 212 REQUIREMENTS: The post-test periphery retention amount must be at least 75% of the pre-test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

FMVSS 212 TEST DATA:

WINDSHIELD PERIPHERY

	PRE-TEST (in)	POST-TEST (in)	PERCENT RETENTION
RIGHT SIDE	83.0	83.0	100%
LEFT SIDE	83.0	83.0	100%
TOTAL	166.0	166.0	100%

AREA OF RETENTION FAILURE:



WINDSHIELD TEMPERATURE: 69° F

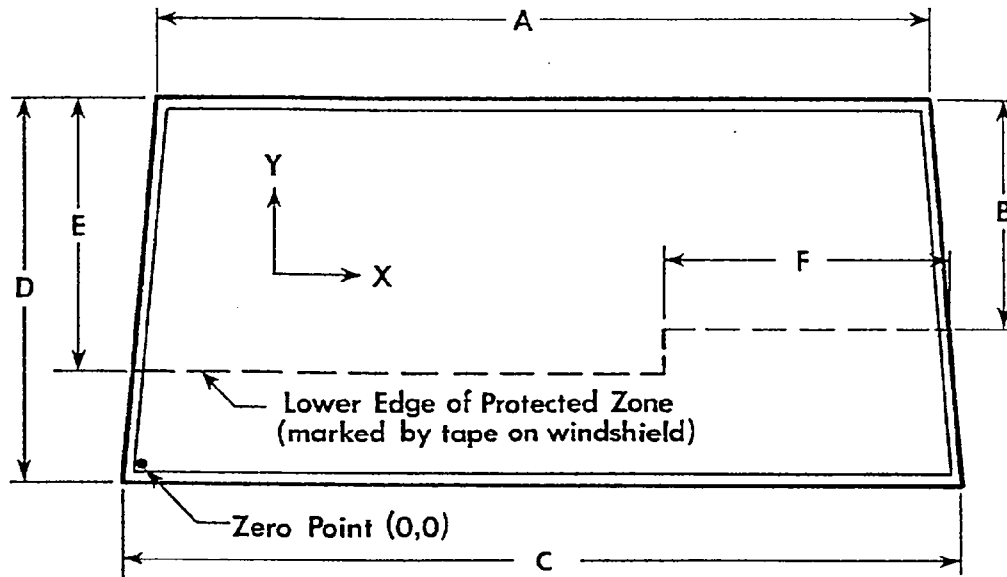
FAILURE DETAILS: None

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 = 45.0	C = 61.6	E = 23.2
B = 20.2	D = 33.5	F = 23.2

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

COORDINATES
X Y

None

1.

2.

3.

ALL MEASUREMENTS ARE IN INCHES.

4.

TABLE 12 "FUEL SYSTEM INTEGRITY" POST-IMPACT

TEST DATA, FMVSS NO. 301

TEST VEHICLE NHTSA NO.: CL5501; TEST DATE: 02/22/90

VEH. MFR./MAKE/MODEL: Fuji Heavy Industries, Ltd./Subaru/Legacy

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/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.

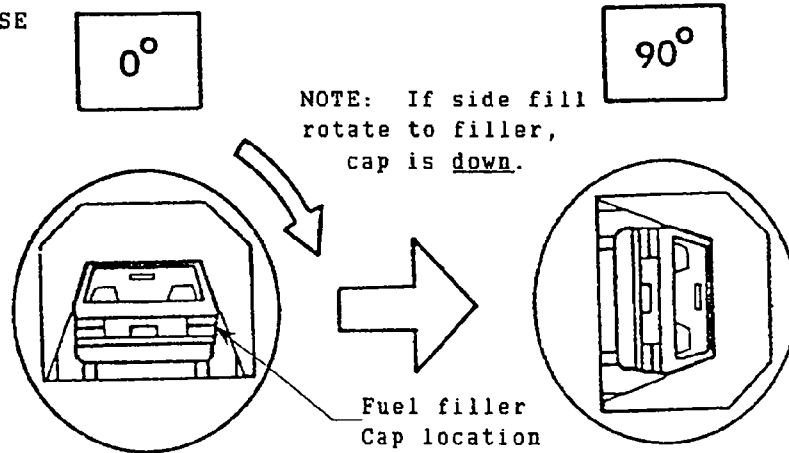
SOLVENT SPILLAGE DETAILS:

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

NHTSA NO.: CL5501

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>

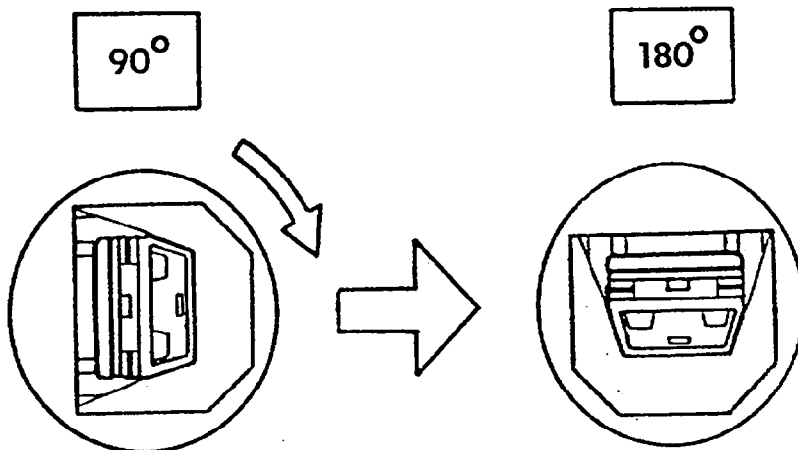
SOLVENT SPILLAGE LOCATION(S)

None

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

NHTSA NO.: CL5501

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 FROM ONSET OF ROTATION	6th Minute	7th 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>

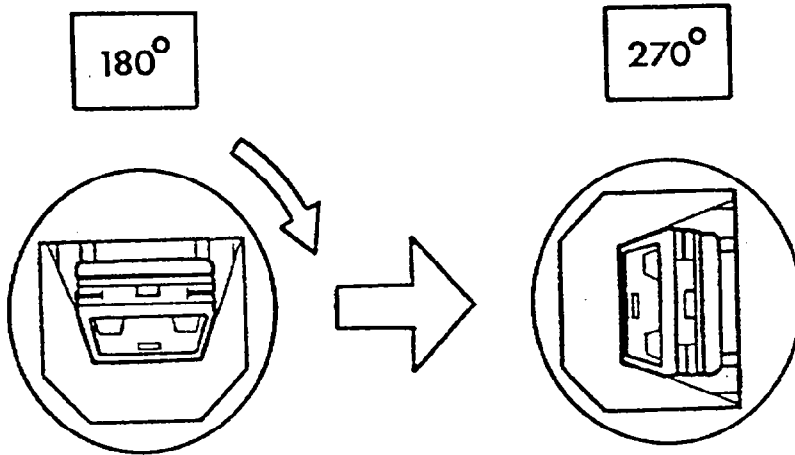
SOLVENT SPILLAGE LOCATION(S)

None

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

NHTSA NO.: CL5501

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

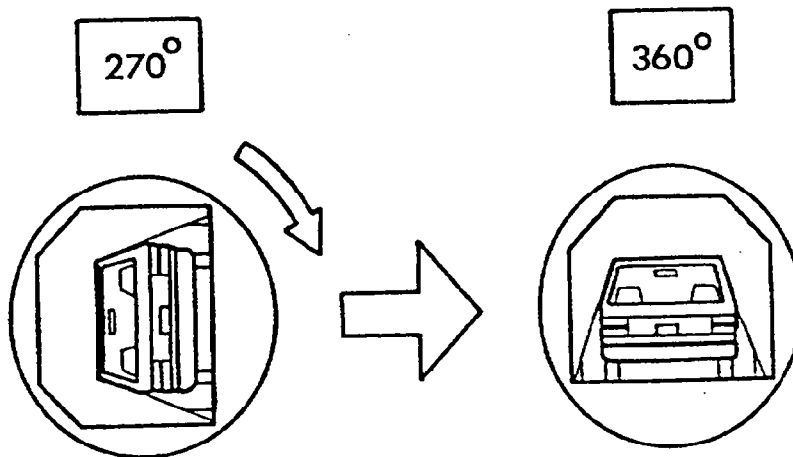
FMVSS 301 REQUIREMENTS

	First 5 minutes FROM ONSET OF ROTATION	6th Minute	7th 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.: CL5501
 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>

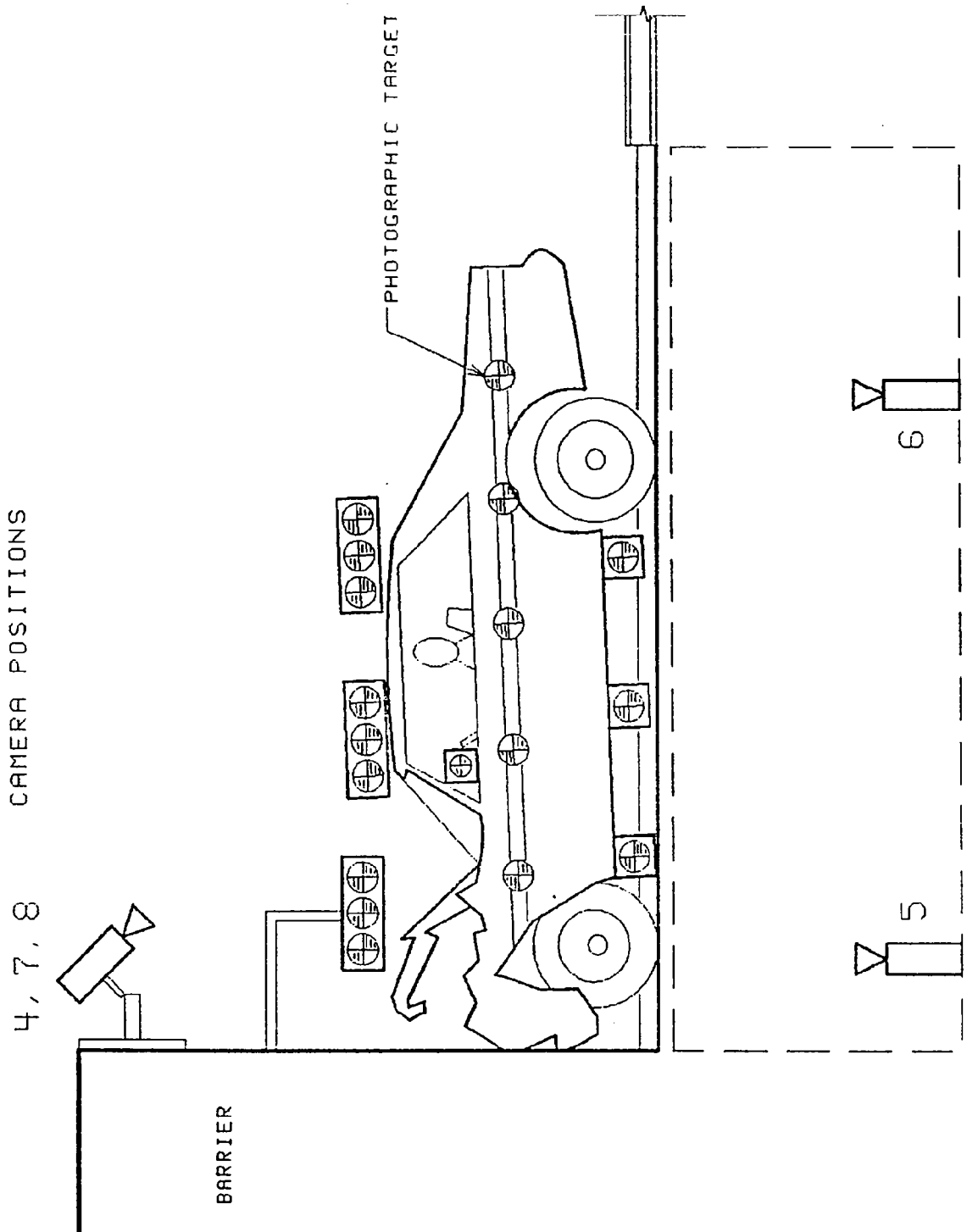
SOLVENT SPILLAGE LOCATION(S)

None

SECTION 3.0

CAMERA INFORMATION

FIGURE 13
CAMERA POSITIONS



REAL-TIME PANNING

CONCRETE PAD

TOW ROAD

MONORAIL

TOW CABLE

UNBILICAL CABLE

CABLE SUPPORT

BARRIER

OVERHEAD STR. COL. MOTION TARGETS

1

2

3

4

5

6

7

8

9

10

11

12

13

14

15

TABLE 13 HIGH SPEED CAMERA LOCATIONS

TEST NO.: 900222		VEHICLE: 1990 Subaru Legacy 4-door sedan		CAMERA POSITIONS (IN)*			ANGLE** (DEG)		FILM PLANE		SPEED (FPS)
CAMERA NO.	VIEW	X	Y	Z					TO HEAD TARGET	LENS (MM)	
1	Real time panning	-142.0	-504.0	61.0			NA		NA	16	NA***
2	Vehicle crush	-81.3	-266.4	37.1			-2		NA	13	500
3	Dummy kinematics	-41.5	295.0	44.0			-4		228.5	25	500
4	Windshield damage	-6.0	0.0	99.0			-40		NA	13	500
5	Crush & fluid spillage	-50.5	0.0	-92.4			90		NA	13	992
6	Fluid spillage	-99.3	0.0	-99.0			90		NA	13	498
7	Passenger kinematics	-4.5	-13.8	93.0			-50		NA	17	500
8	Driver kinematics	-6.8	14.5	93.0			-50		NA	17	507
9	Driver kinematics	-157.3	116.0	87.0			-27		90.0	25	500
10	Passenger kinematics	-152.1	-116.0	87.0			-26		94.0	25	502
11	Windshield intrusion	-38.1	-306.1	44.0			0		NA	50	498
12	Windshield intrusion	-53.0	309.4	42.3			0		NA	50	500
13	Column movement	-146.0	256.0	103.0			-14		NA	25	502
14	Column movement	-146.0	256.0	75.1			-9		NA	25	500
15	Passenger kinematics	-38.8	-293.0	45.3			-4		246.0	25	498

* +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

*** The film did not run properly through the real-time motion picture camera, thus there is no real-time motion picture film documentation of this test vehicle.

APPENDIX A

PHOTOGRAPHS



Figure A-1. PRE-TEST FRONT VIEW

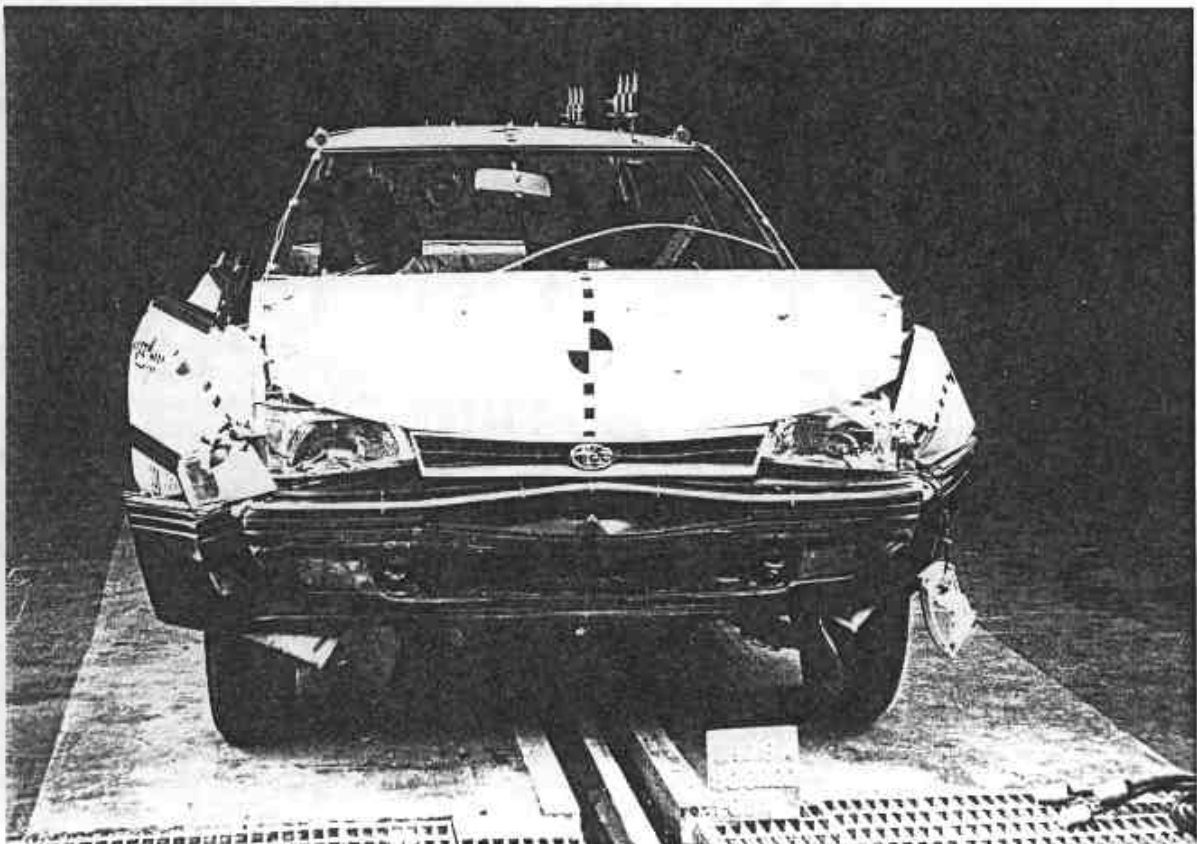


Figure A-2. POST-TEST FRONT VIEW
A-2

900222

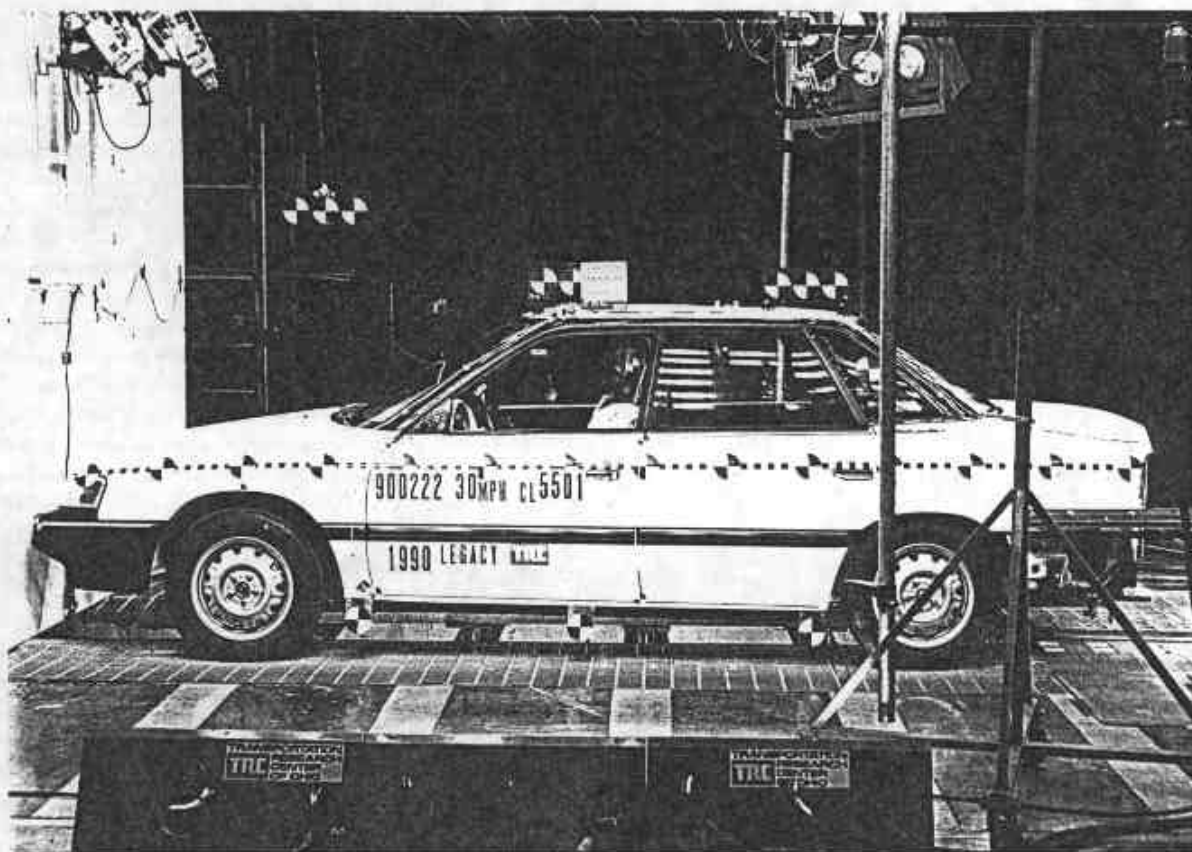


Figure A-3. PRE-TEST LEFT SIDE VIEW



Figure A-4. POST-TEST LEFT SIDE VIEW

A-3

900222



Figure A-5. PRE-TEST RIGHT SIDE VIEW



Figure A-6. POST-TEST RIGHT SIDE VIEW

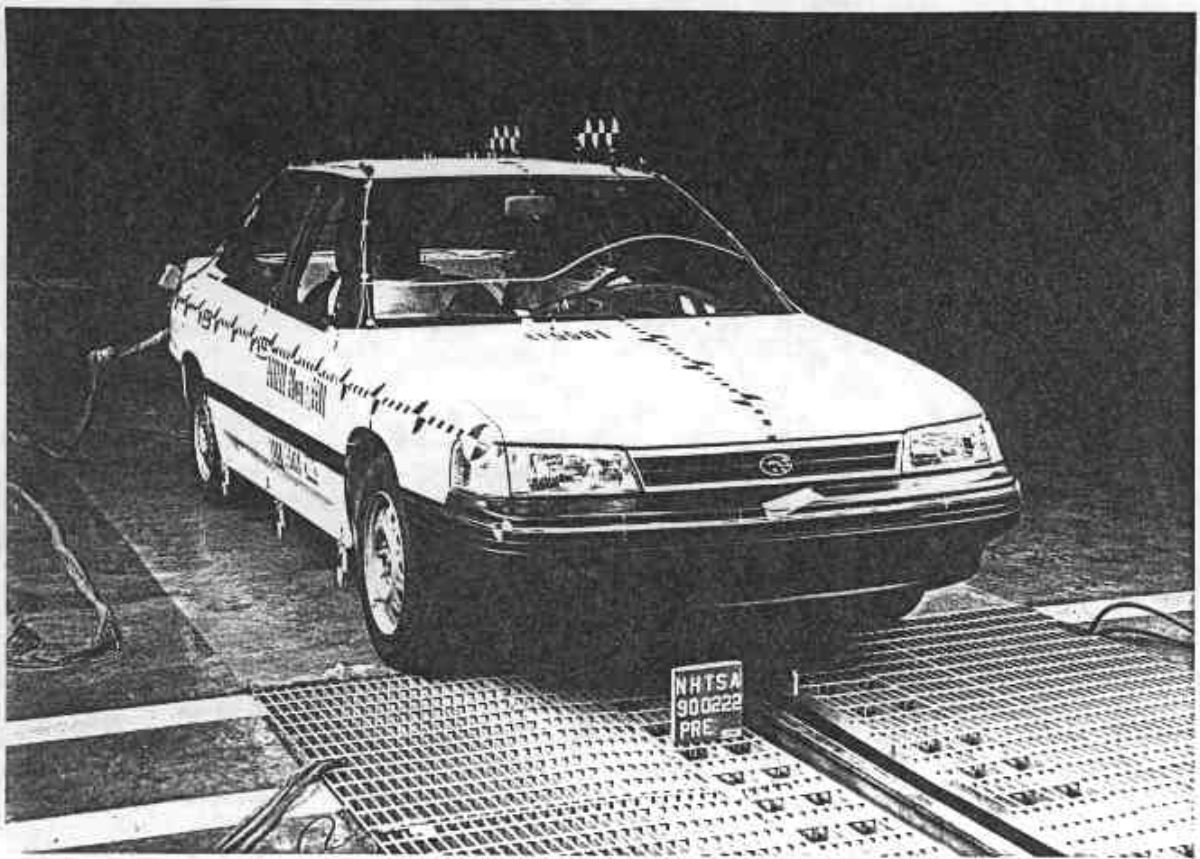


Figure A-7. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW



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

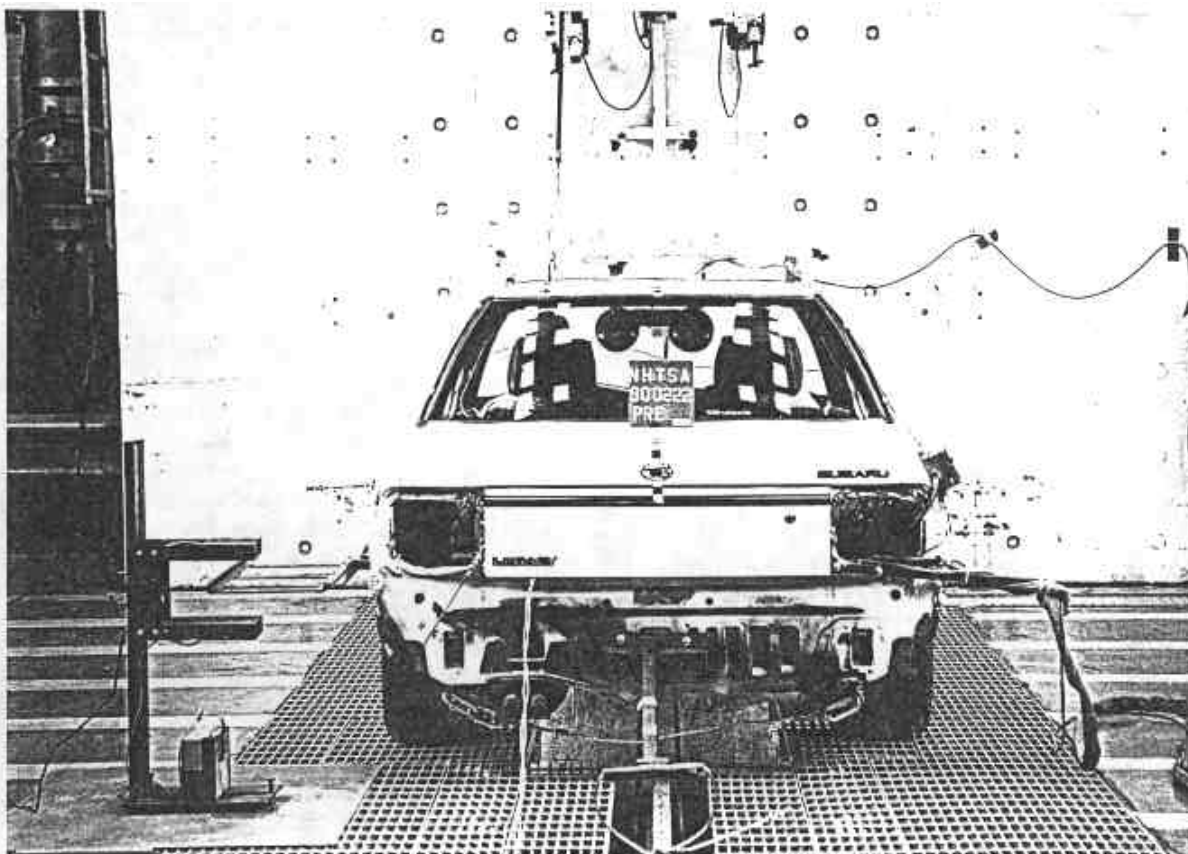


Figure A-11. PRE-TEST REAR VIEW

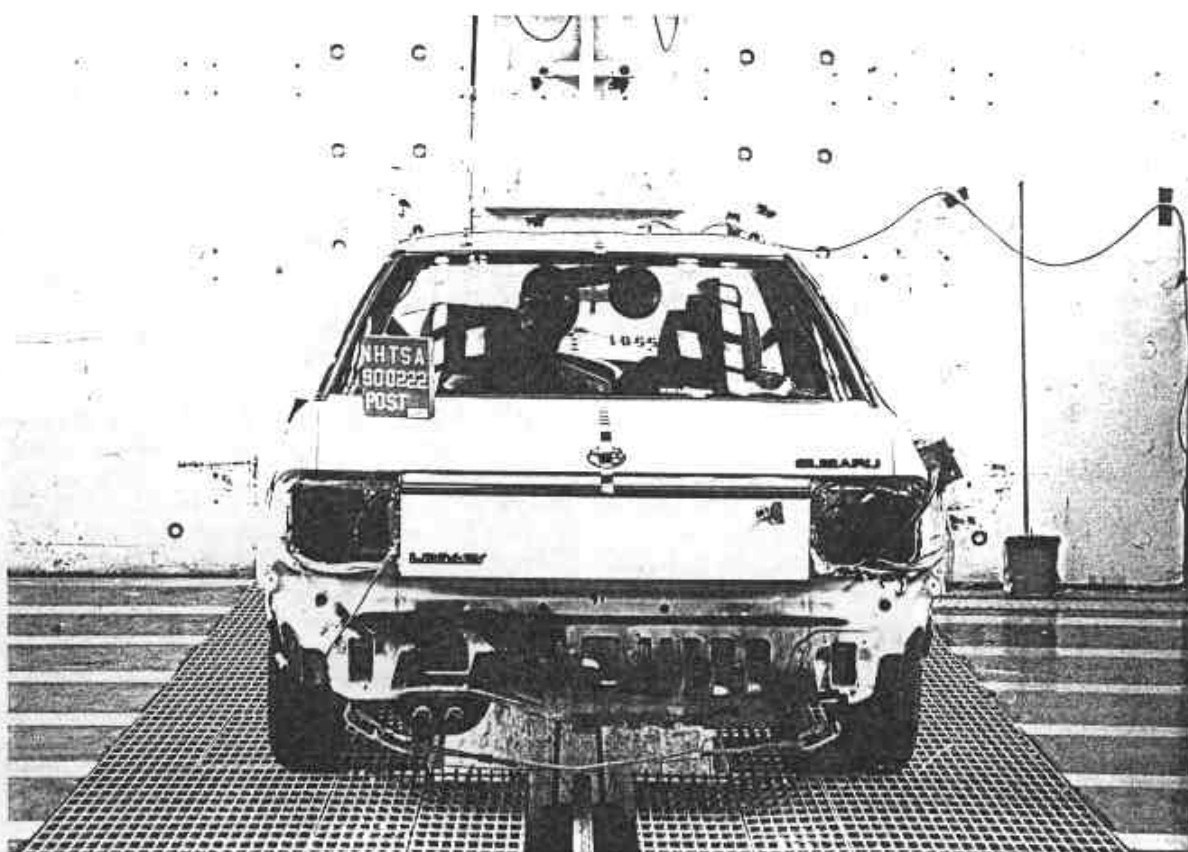


Figure A-12. POST-TEST REAR VIEW
A-7

900222

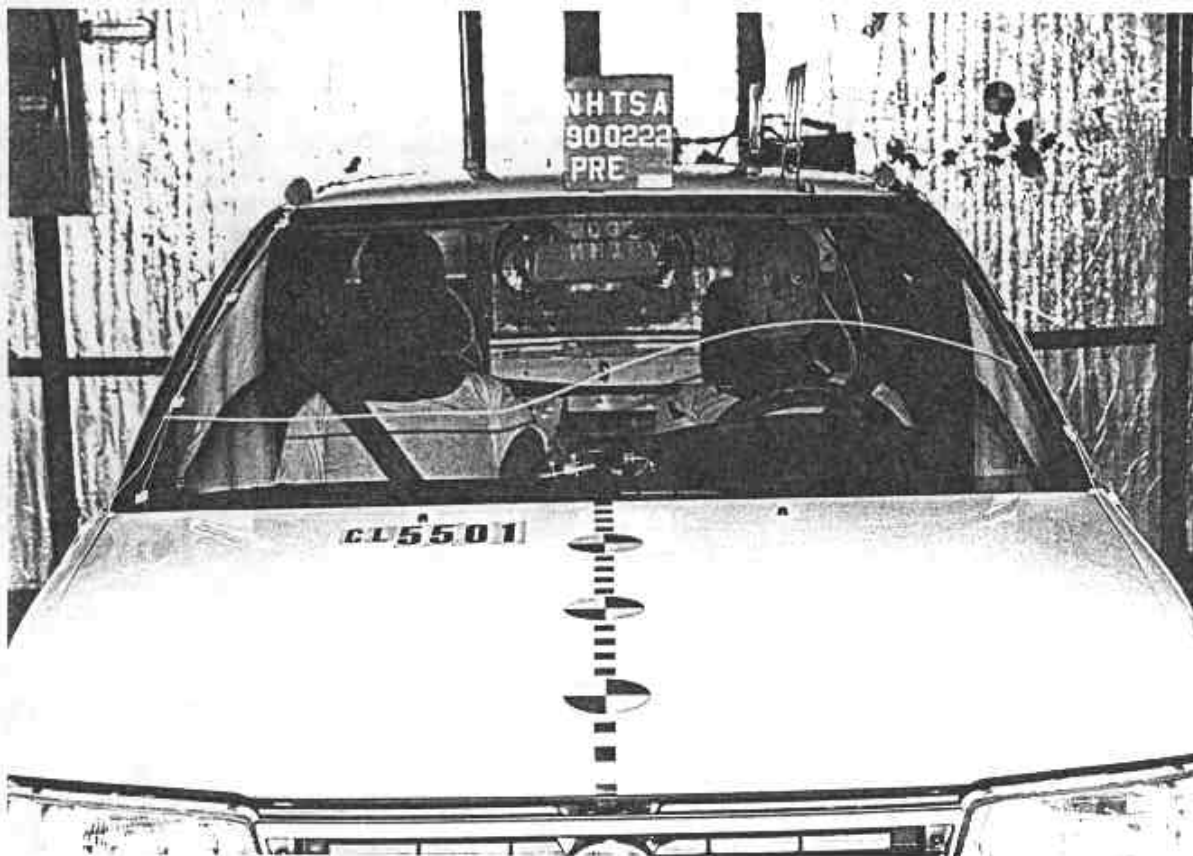


Figure A-13. PRE-TEST WINDSHIELD VIEW

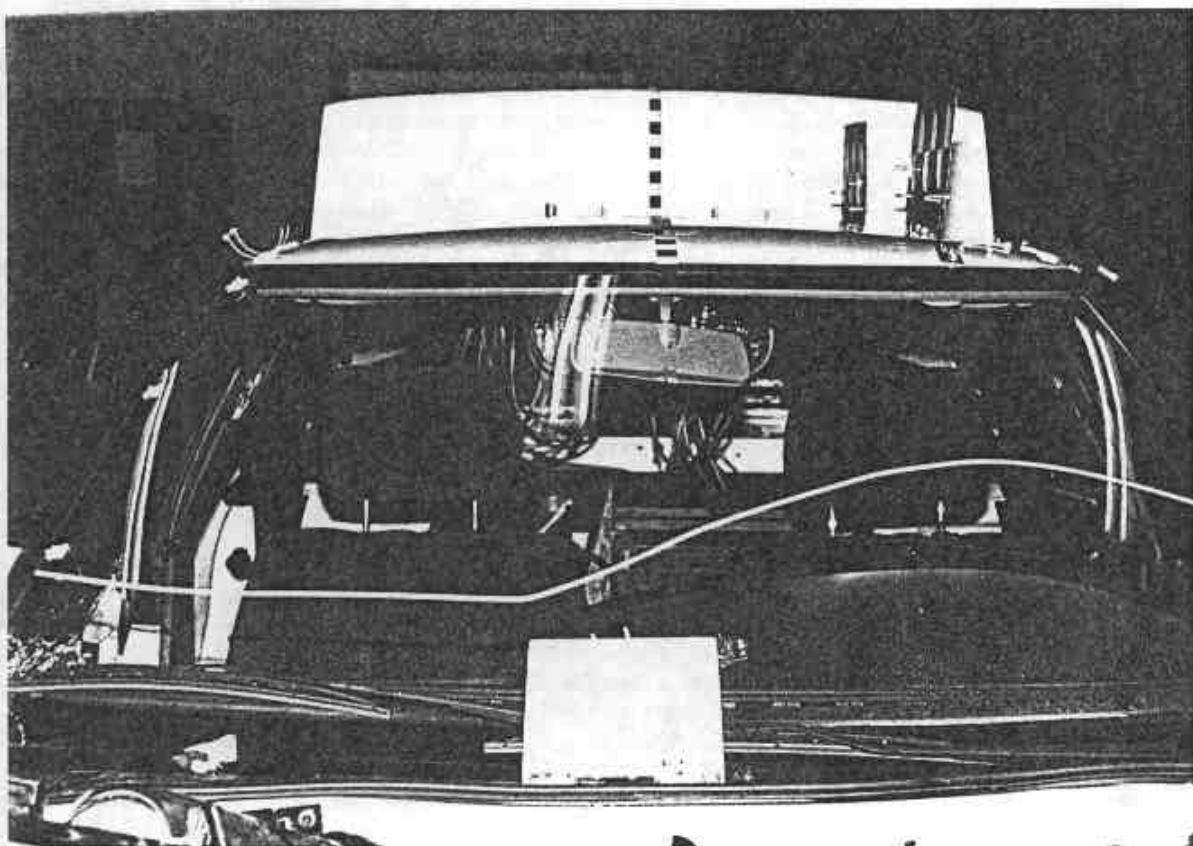


Figure A-14. POST-TEST WINDSHIELD VIEW

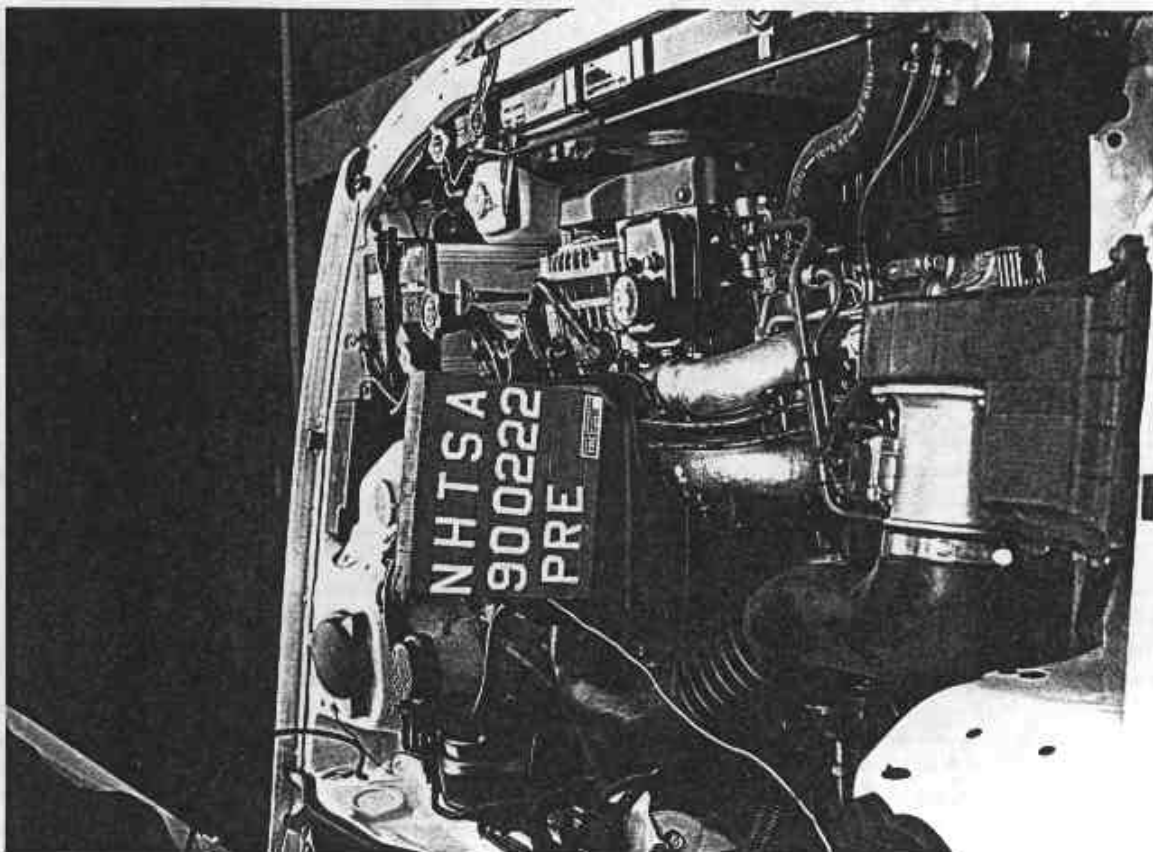


Figure A-15. PRE-TEST ENGINE COMPARTMENT VIEW

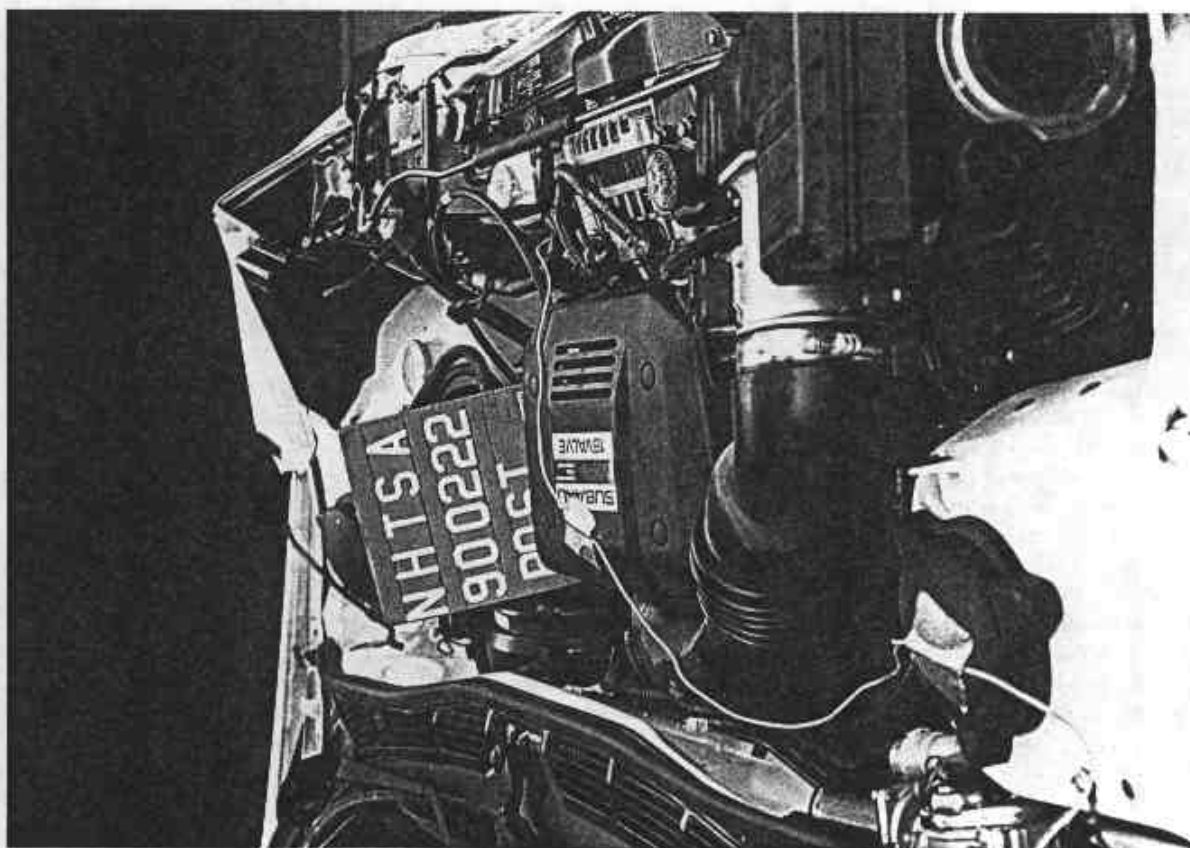


Figure A-16. POST-TEST ENGINE COMPARTMENT VIEW



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

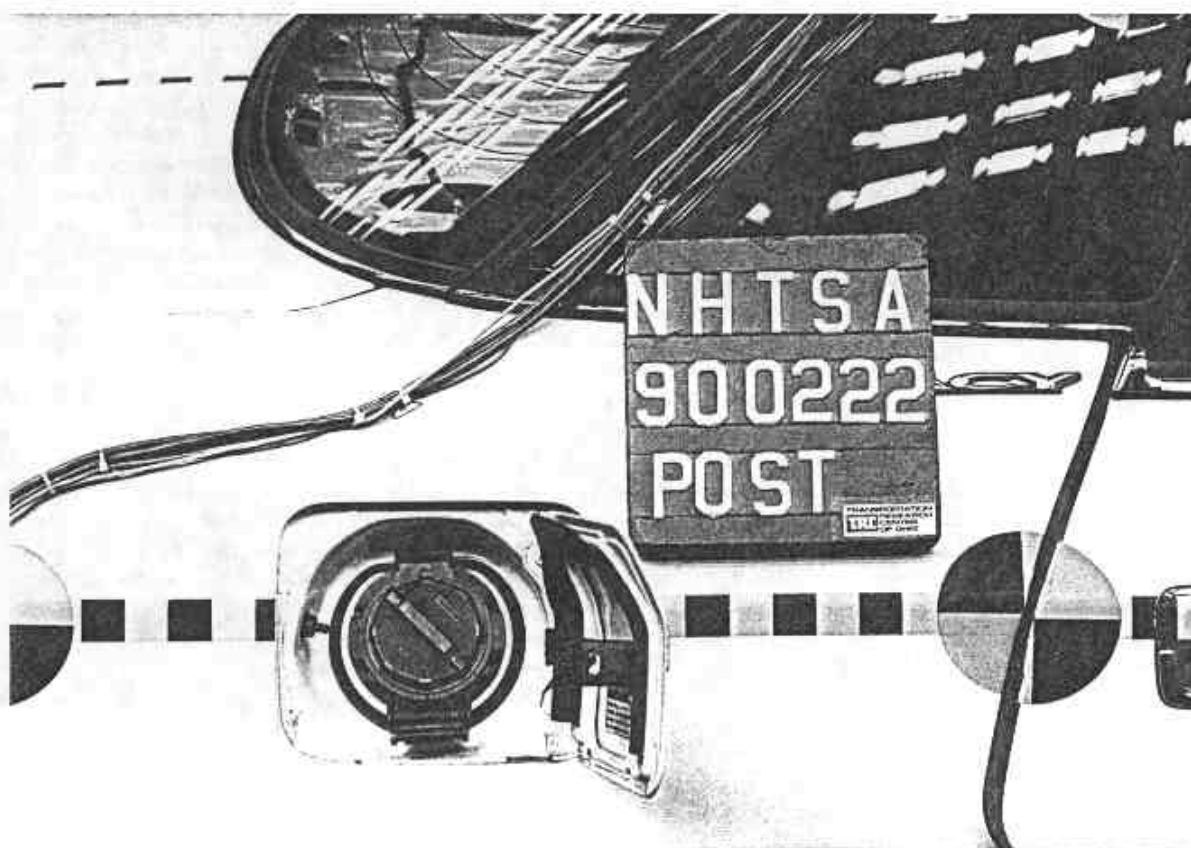


Figure A-18. POST-TEST FUEL FILLER CAP VIEW



Figure A-19. PRE-TEST FRONT UNDERBODY VIEW

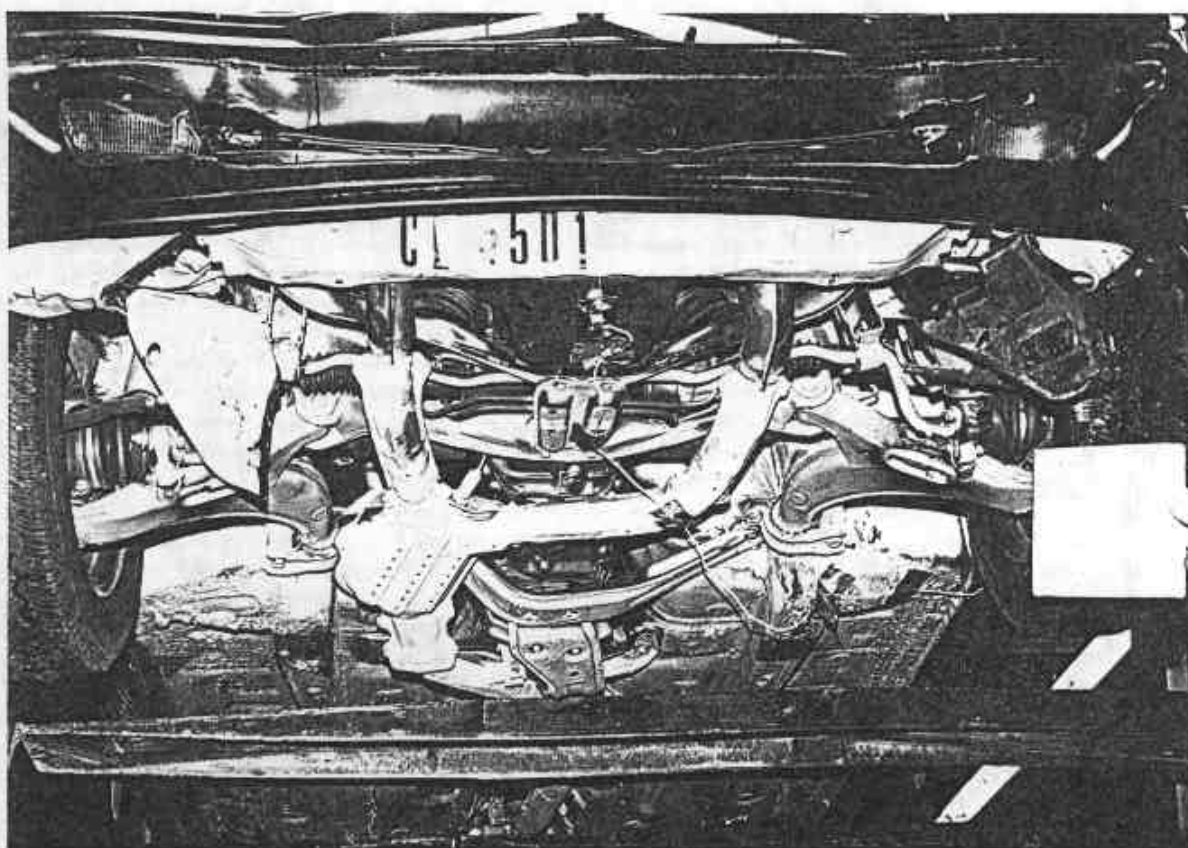


Figure A-20. POST-TEST FRONT UNDERBODY VIEW

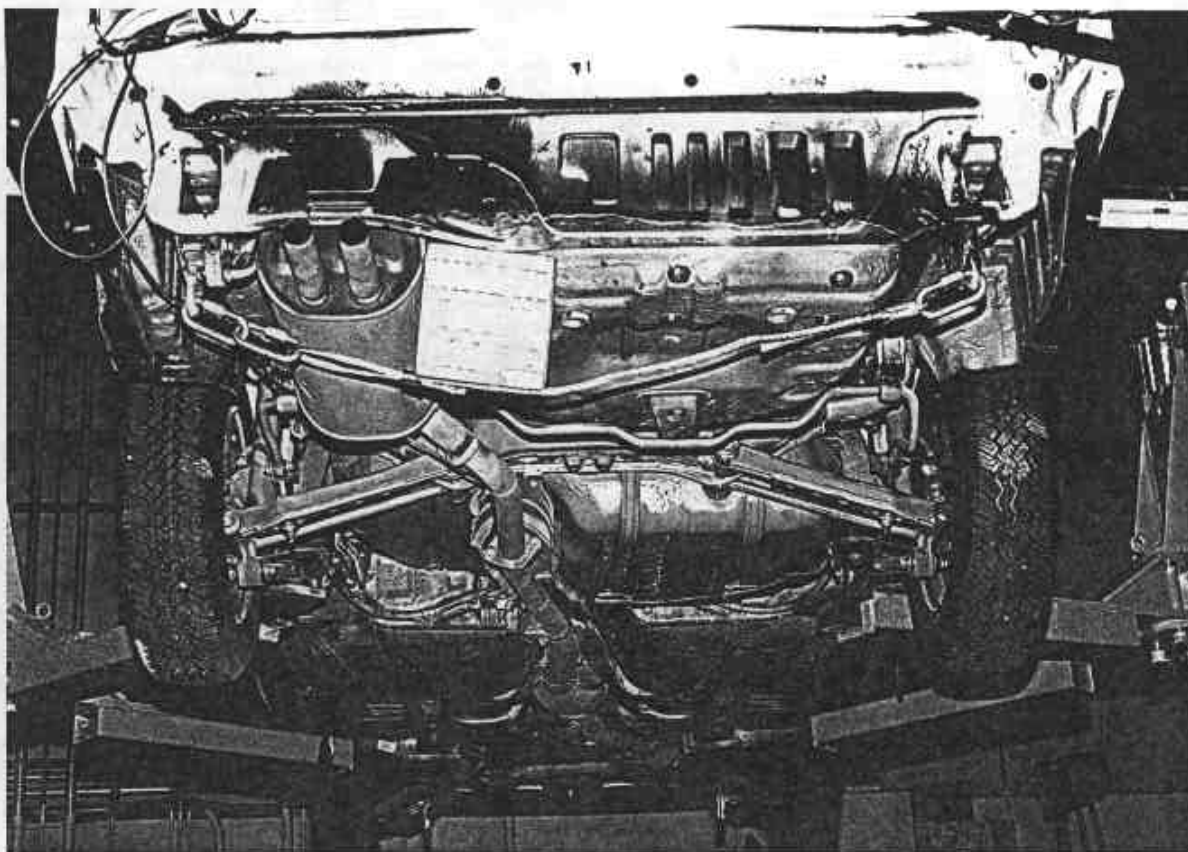


Figure A-21. PRE-TEST REAR UNDERBODY VIEW

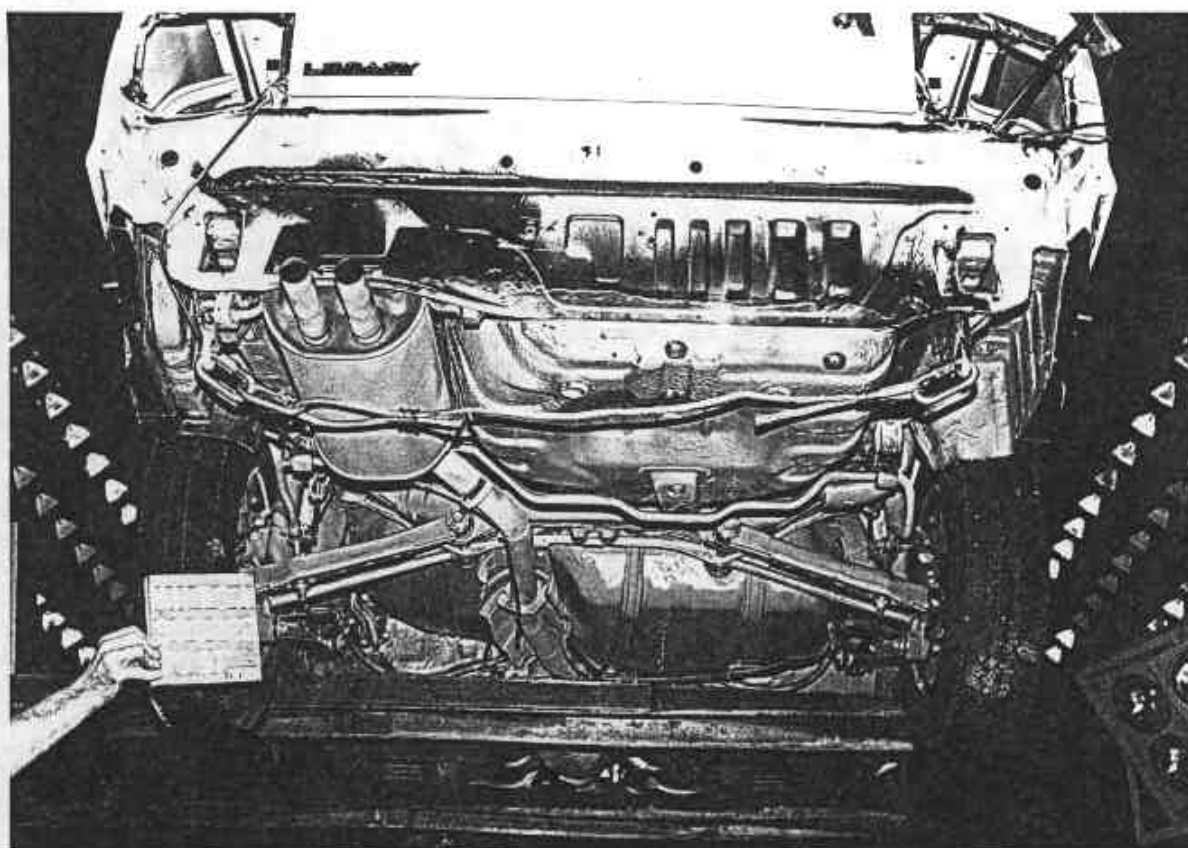


Figure A-22. POST-TEST REAR UNDERBODY VIEW

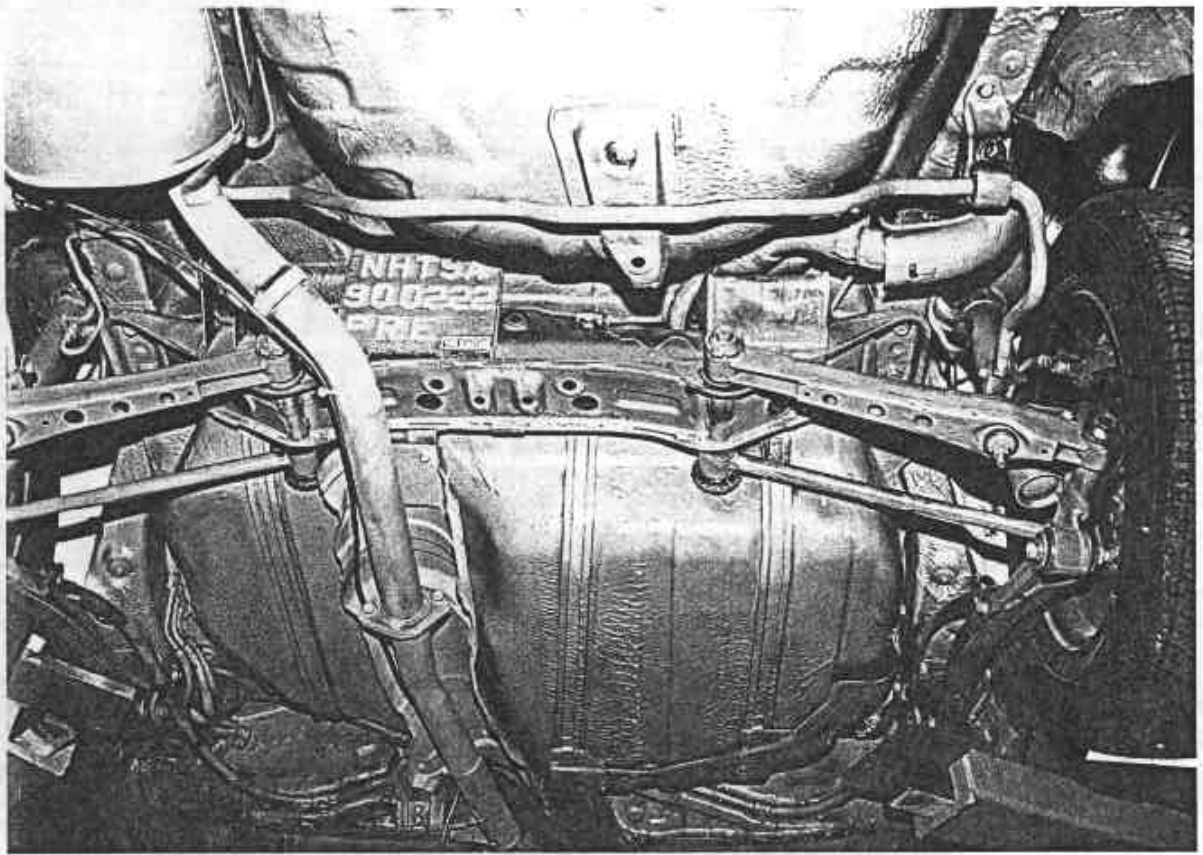


Figure A-23. PRE-TEST FUEL FILLER NECK AND FUEL TANK VIEW



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

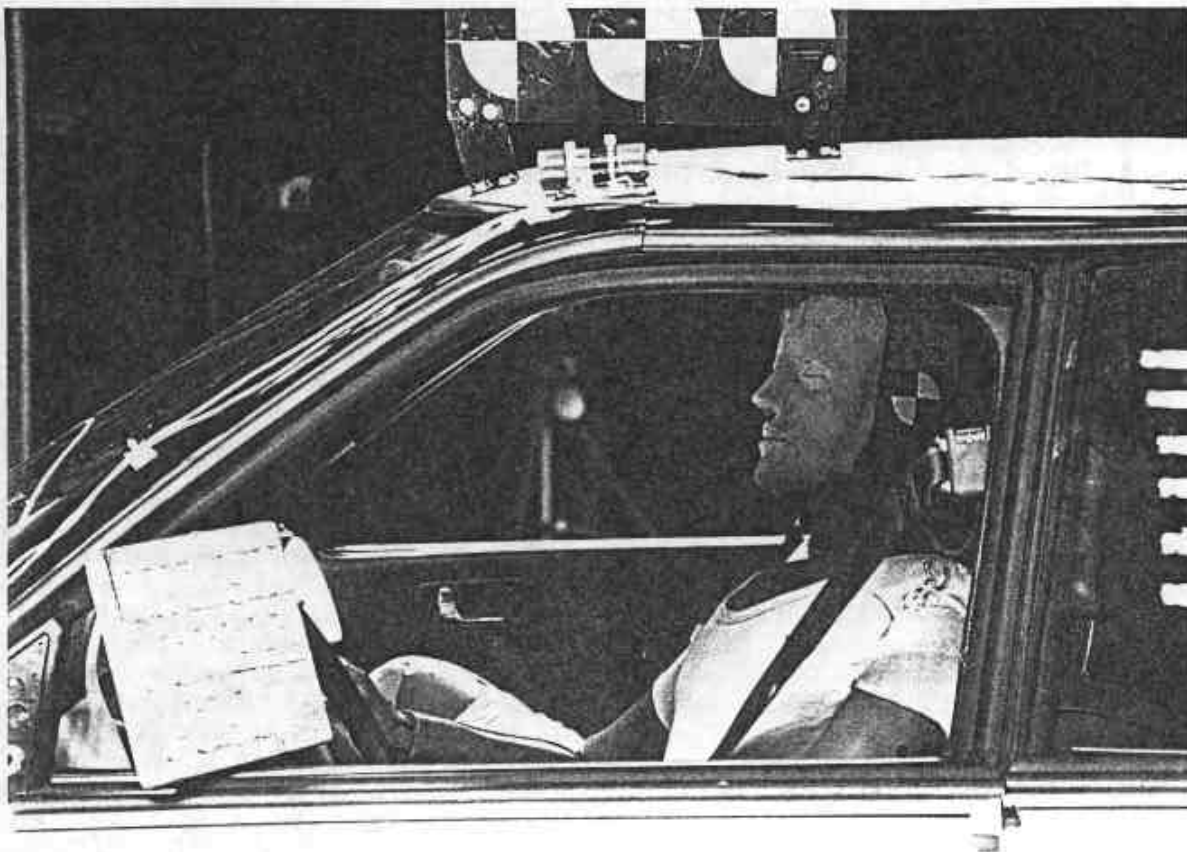


Figure A-25. POST-TEST DRIVER DUMMY POSITION VIEW



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



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

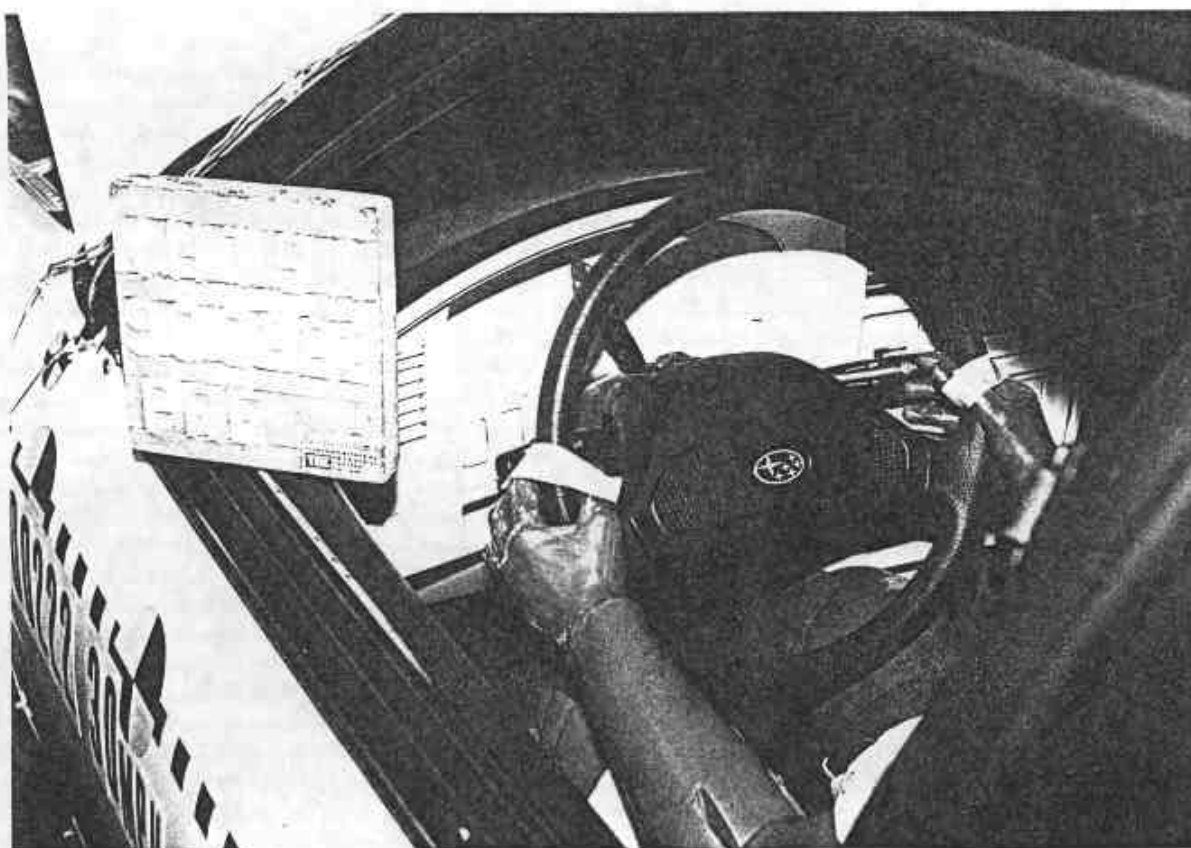


Figure A-28. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR

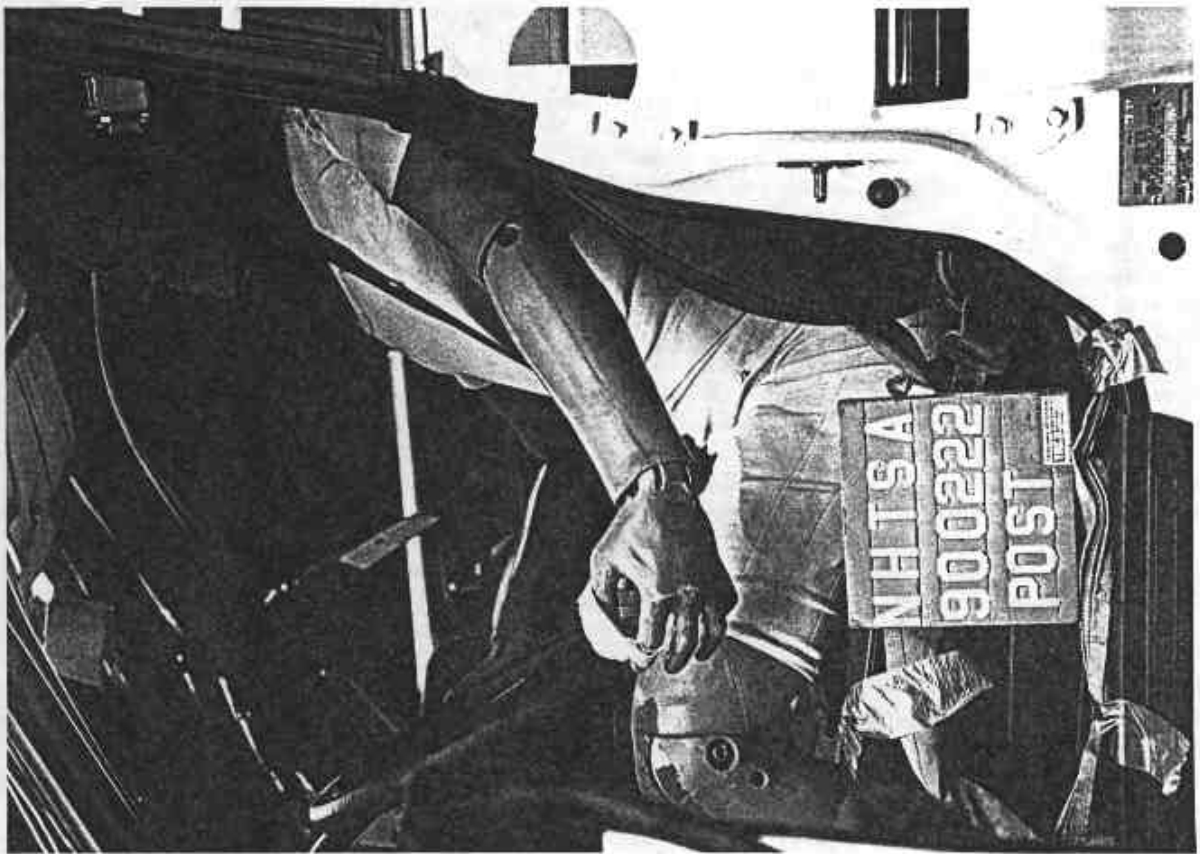


Figure A-29. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

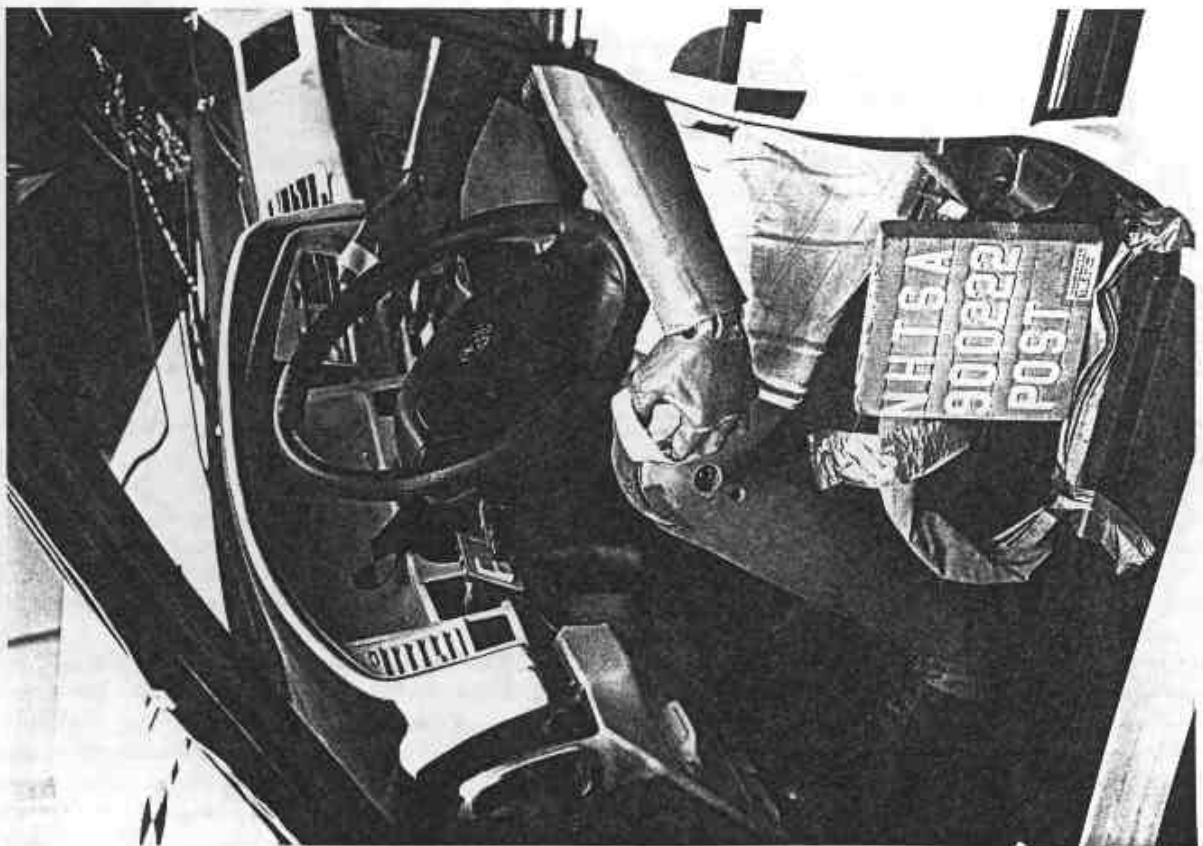


Figure A-30. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

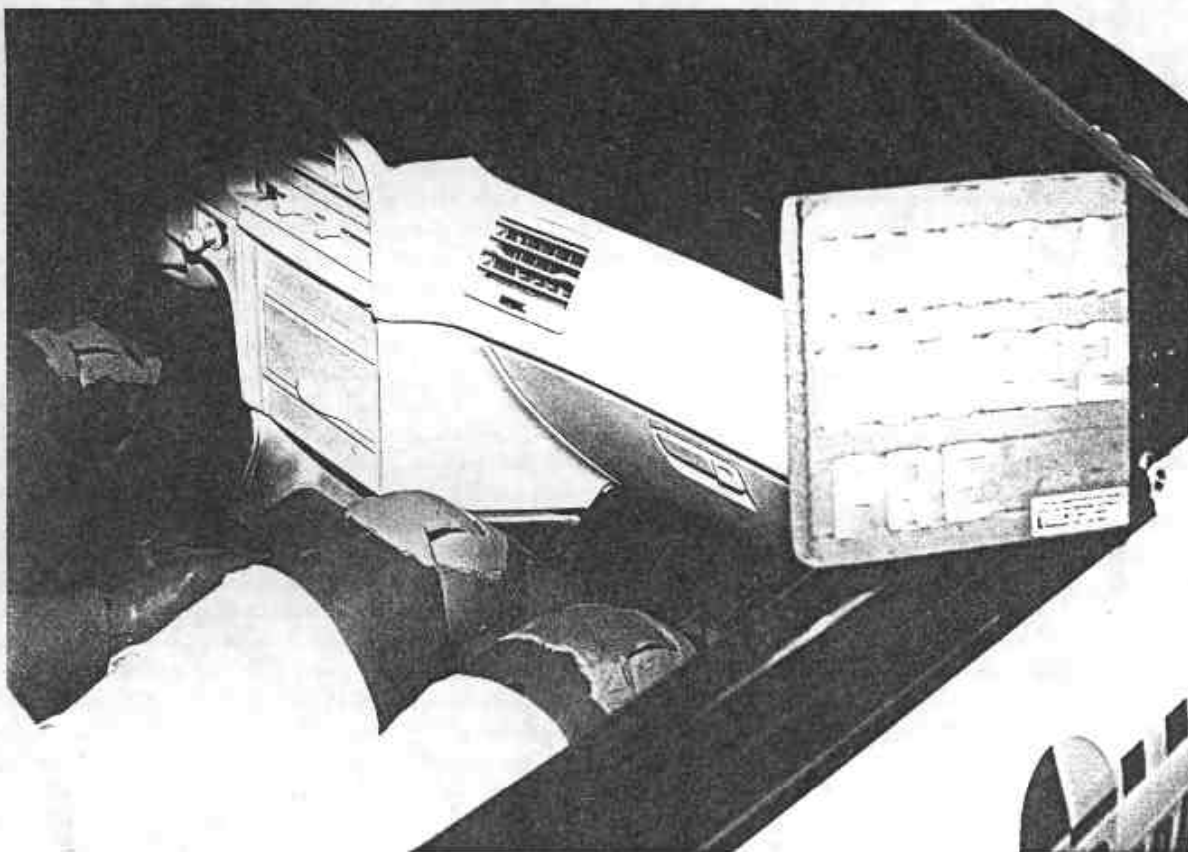


Figure A-31. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR

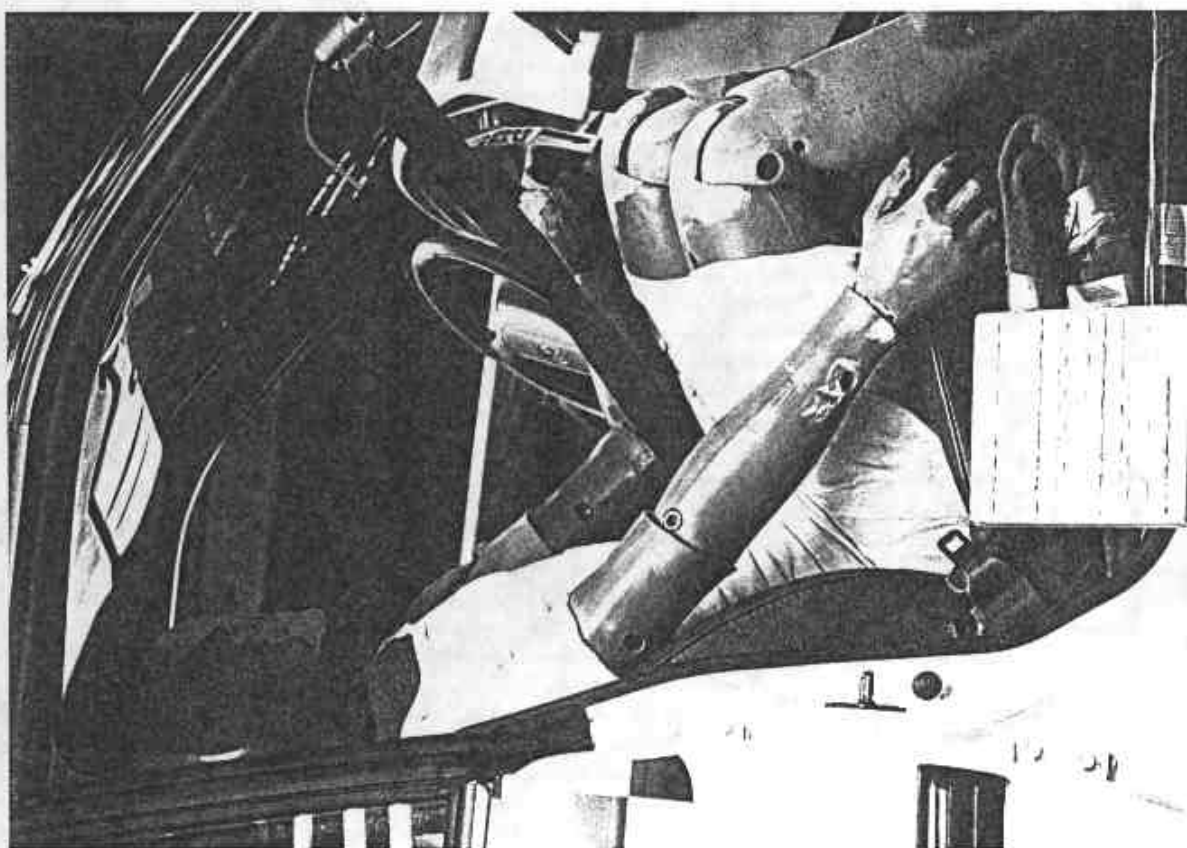


Figure A-32. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

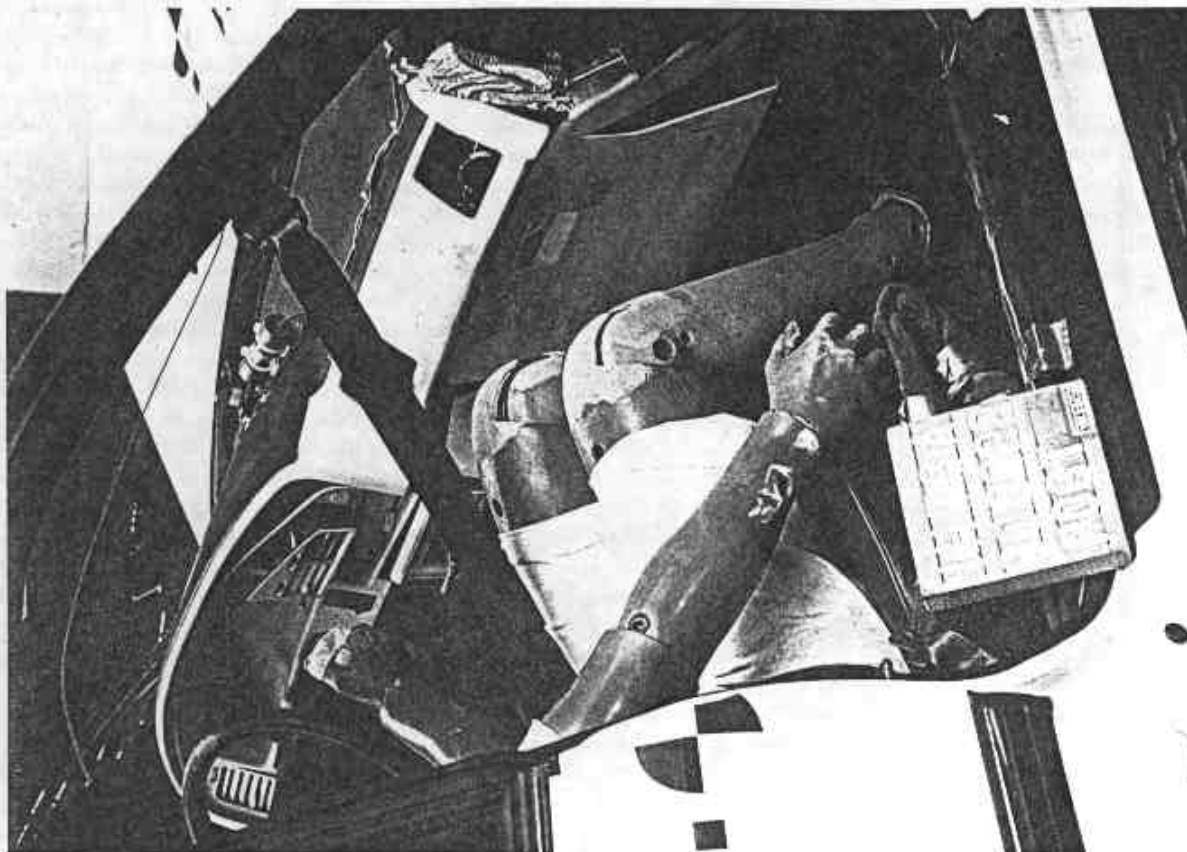


Figure A-33. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2



Figure A-34. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 1

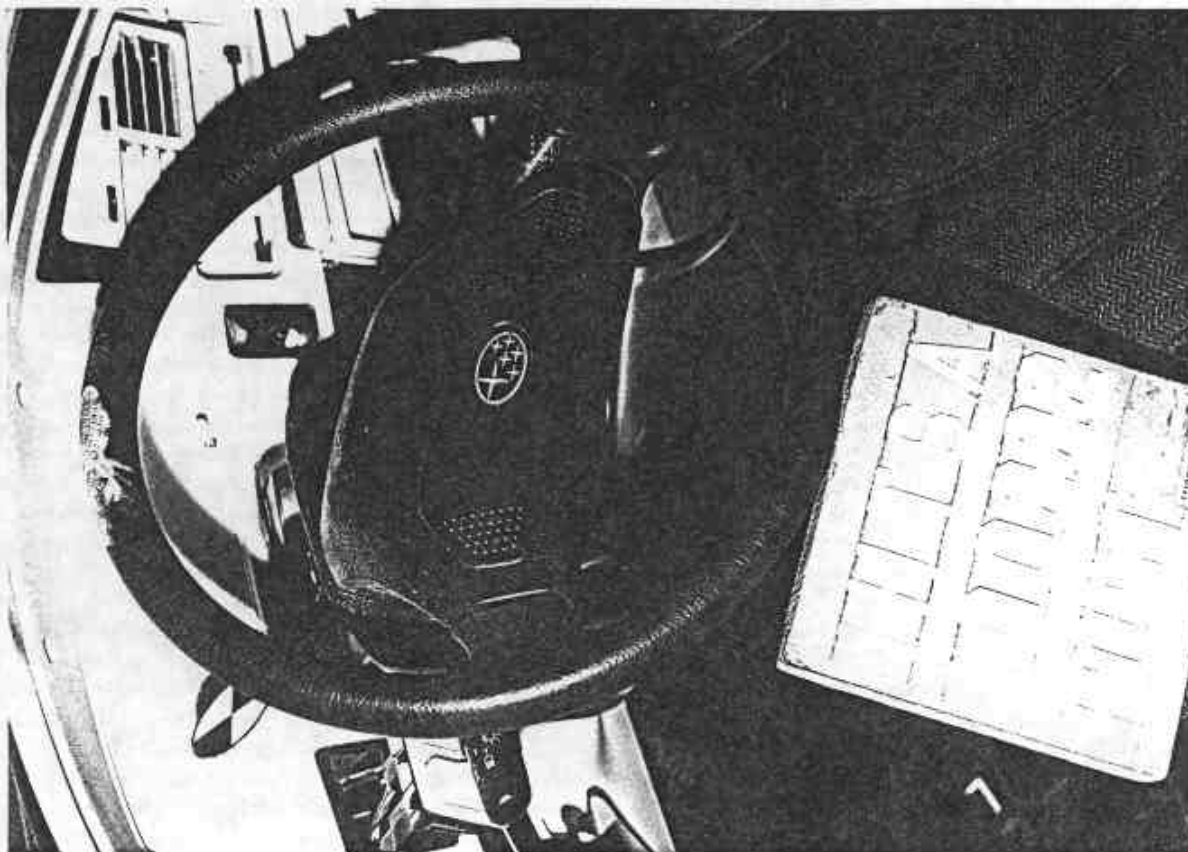


Figure A-35. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 2

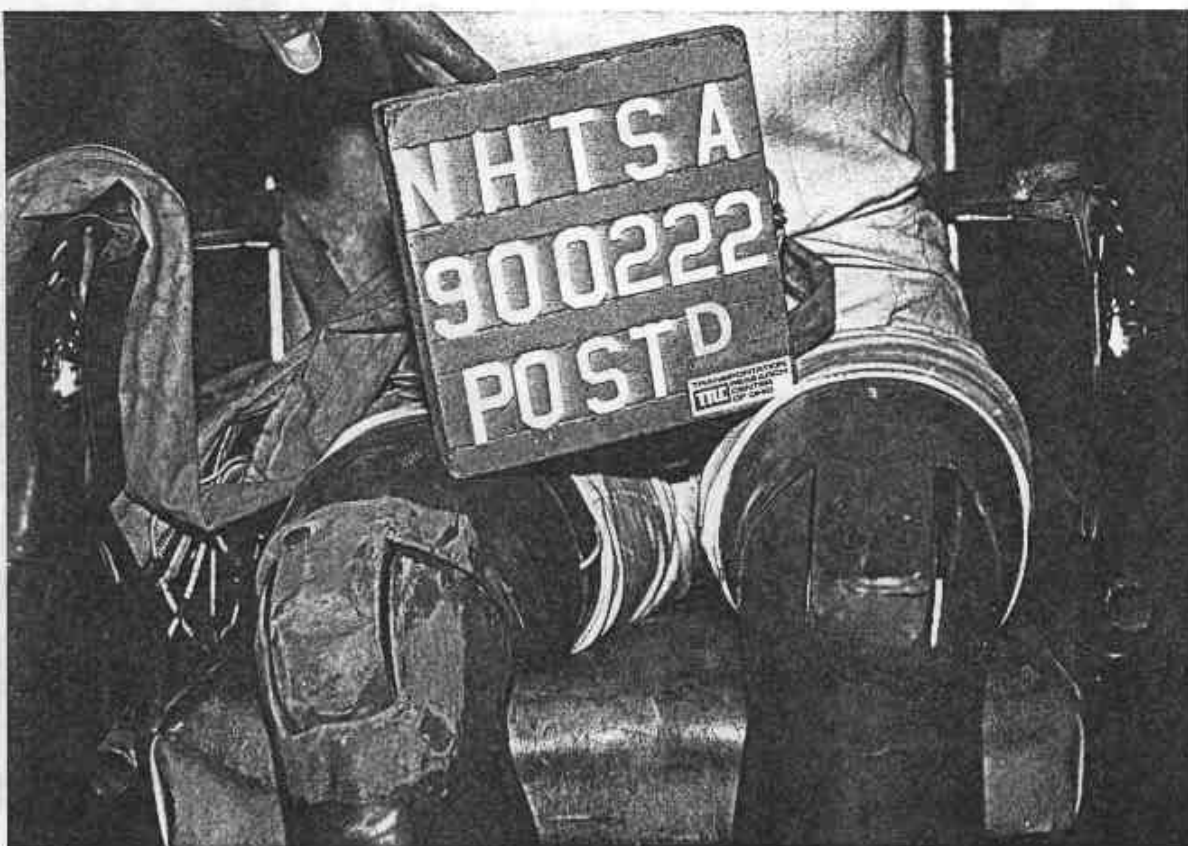


Figure A-36. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

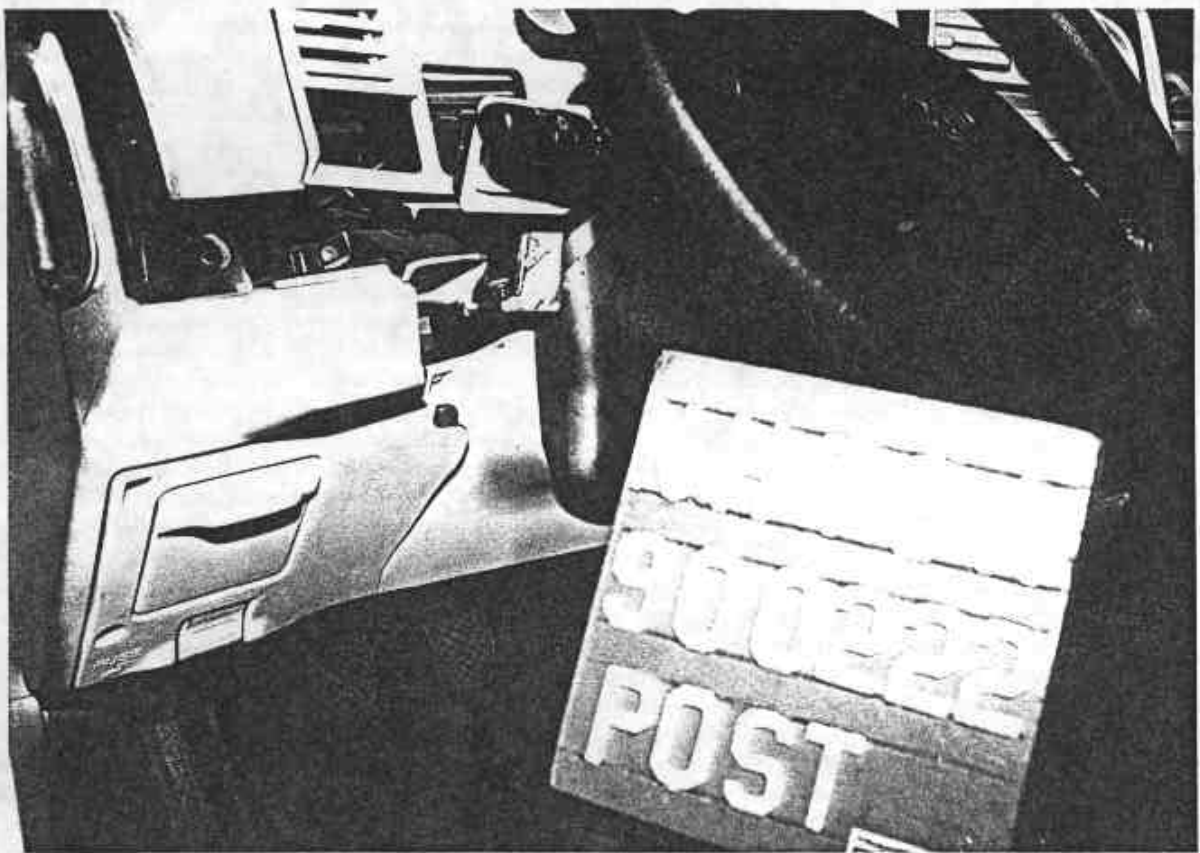


Figure A-37. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2



Figure A-38. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW

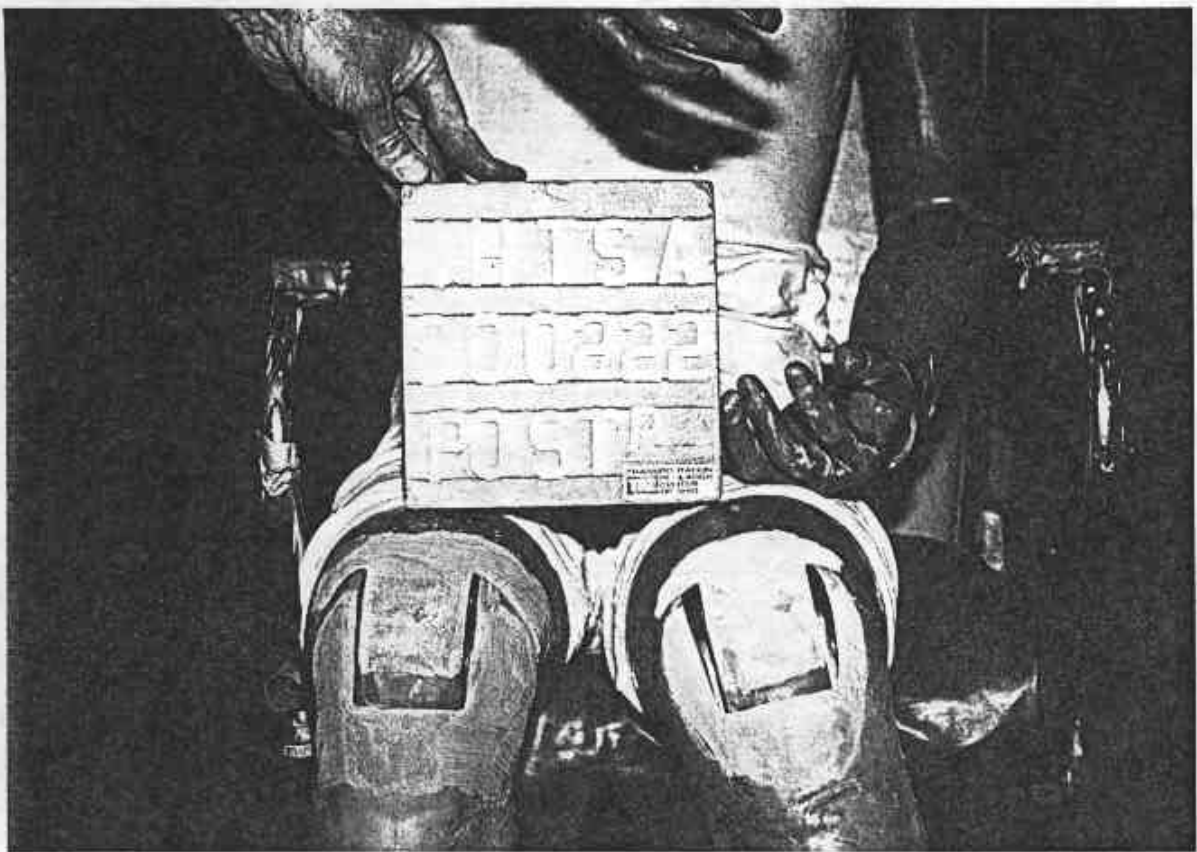


Figure A-39. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 1



Figure A-40. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 2



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

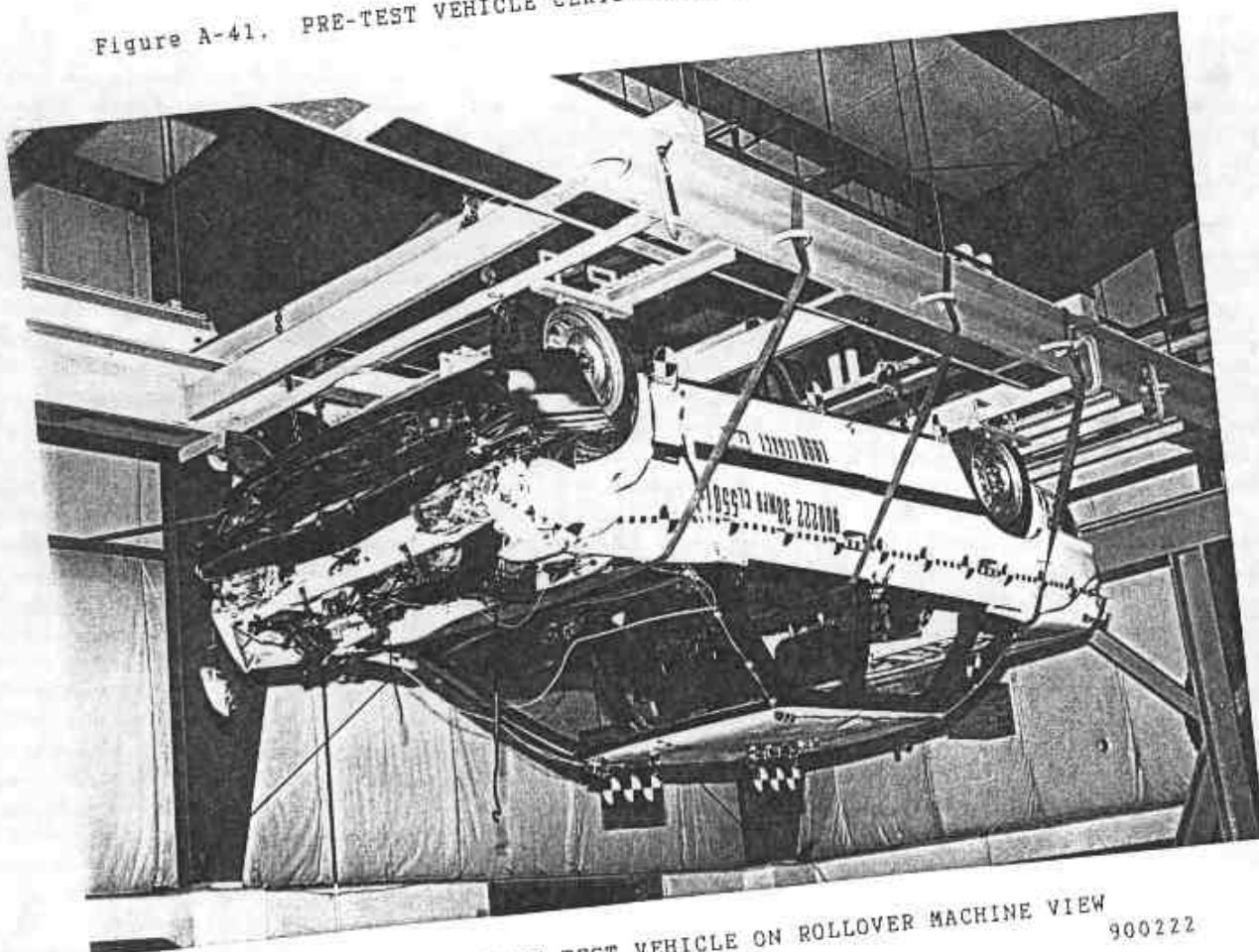


Figure A-42. POST-TEST VEHICLE ON ROLLOVER MACHINE VIEW

APPENDIX B

DATA PLOTS

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

TRC 900222

308 COMPLIANCE

90053

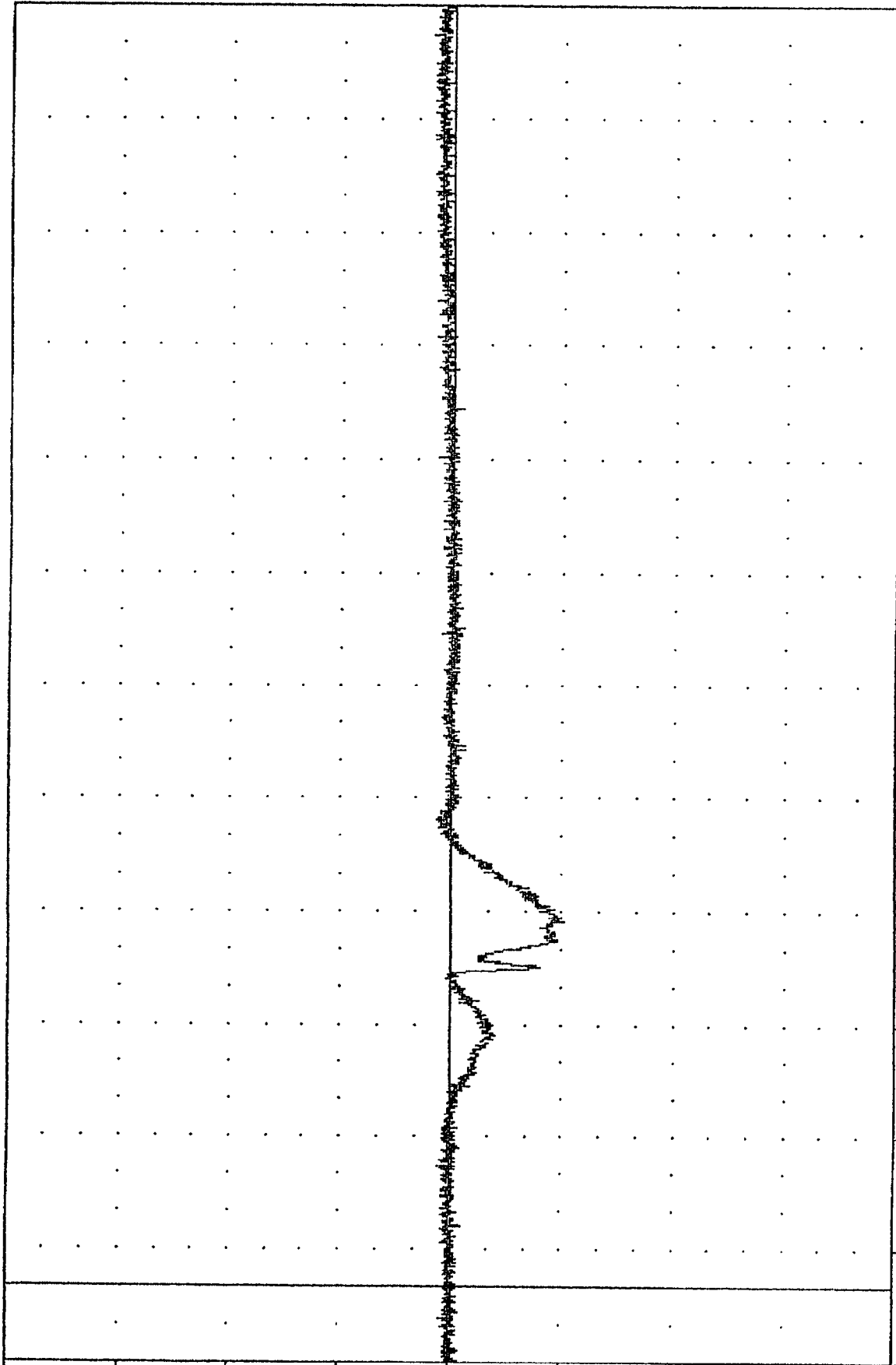
HEDXG1

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -60.43e

97.50 . 11.93 e 332.25

900222
B-2
ACCELERATION (G)
-240.00 -180.00 -120.00 -60.00 0.00 60.00 120.00 180.00 240.00
TIME (MSEC)
-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER HEAD X AXIS ACCELERATION

TRC 300222

208 COMPLIANCE

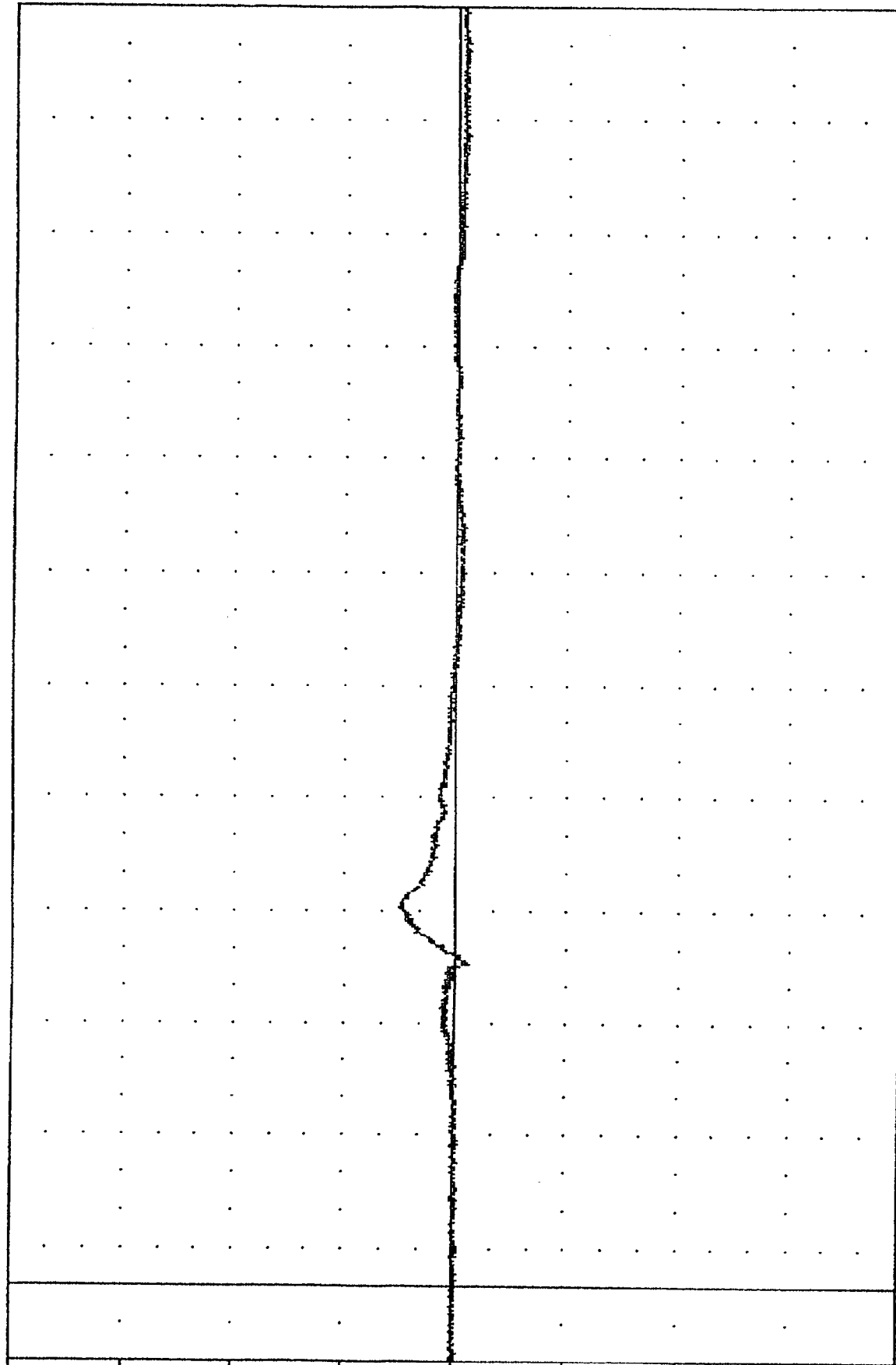
90053

HEDY61

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -6.87 85.88, 30.62 100.75

ACCELERATION (G) 240.00 180.00 120.00 60.00 0.00 -60.00 -120.00 -180.00 -240.00



0.00 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

900222

B-3

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER HEAD Y AXIS ACCELERATION

TRC 900222

208 COMPLIANCE

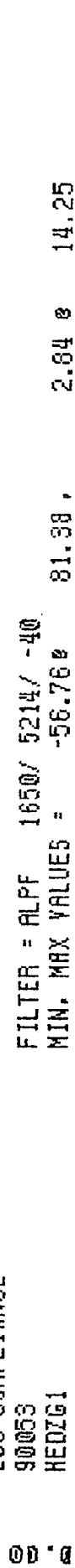
90053

HEDZG1

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -56.76 81.38

2.84 14.25



TRC 900222

208 COMPLIANCE

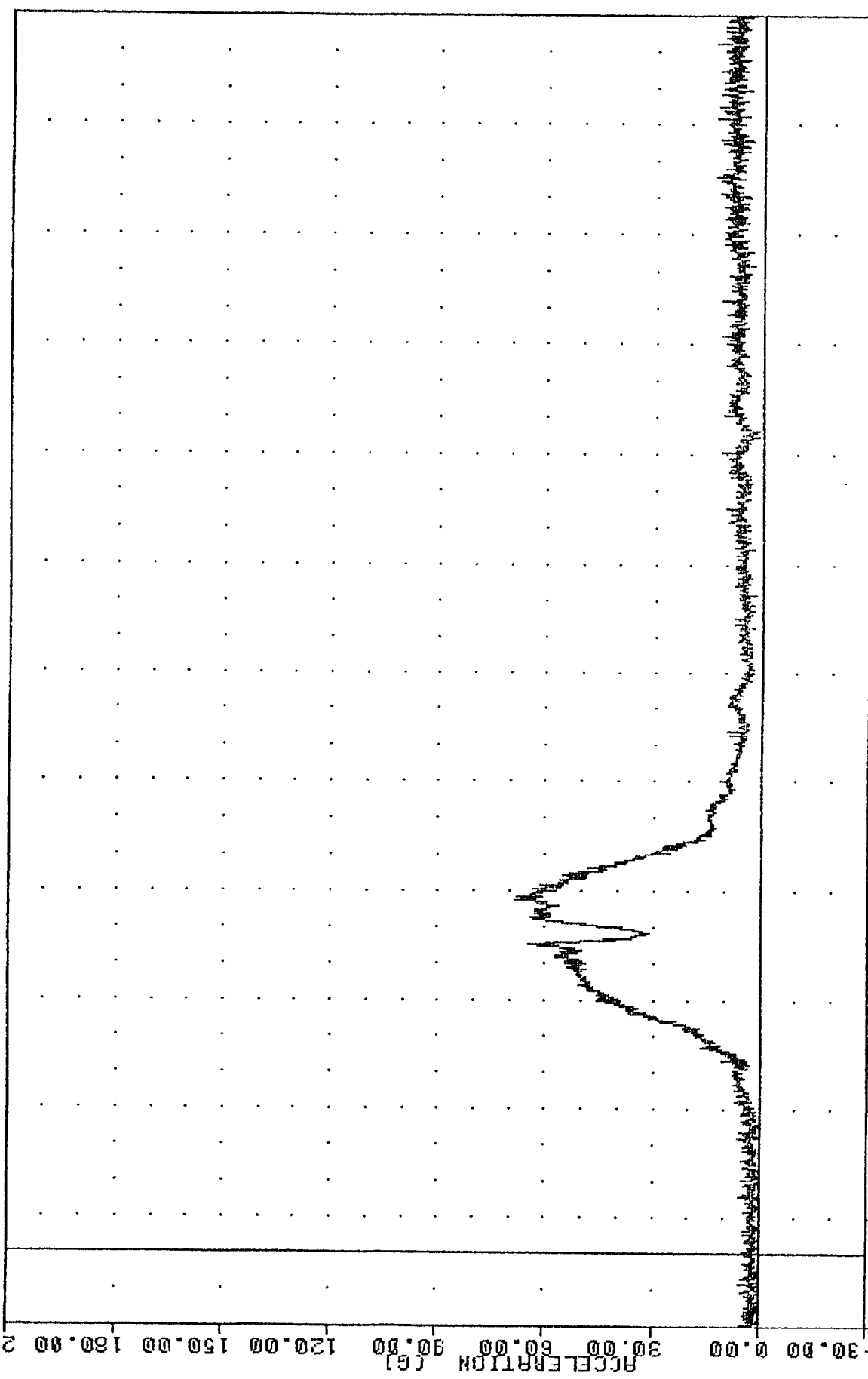
90053

HEDRG1

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = 0.18 21.25 68.35 97.50

210.00



B-5

900222

-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER HEAD RESULTANT ACCELERATION

TRC 900222

200 COMPLIANCE

90053

CSTX61

FILTER = BLPP 300/ 750/ -16

MIN, MAX VALUES = -40.920

61.88,

5.06 293.25

120.00

90.00

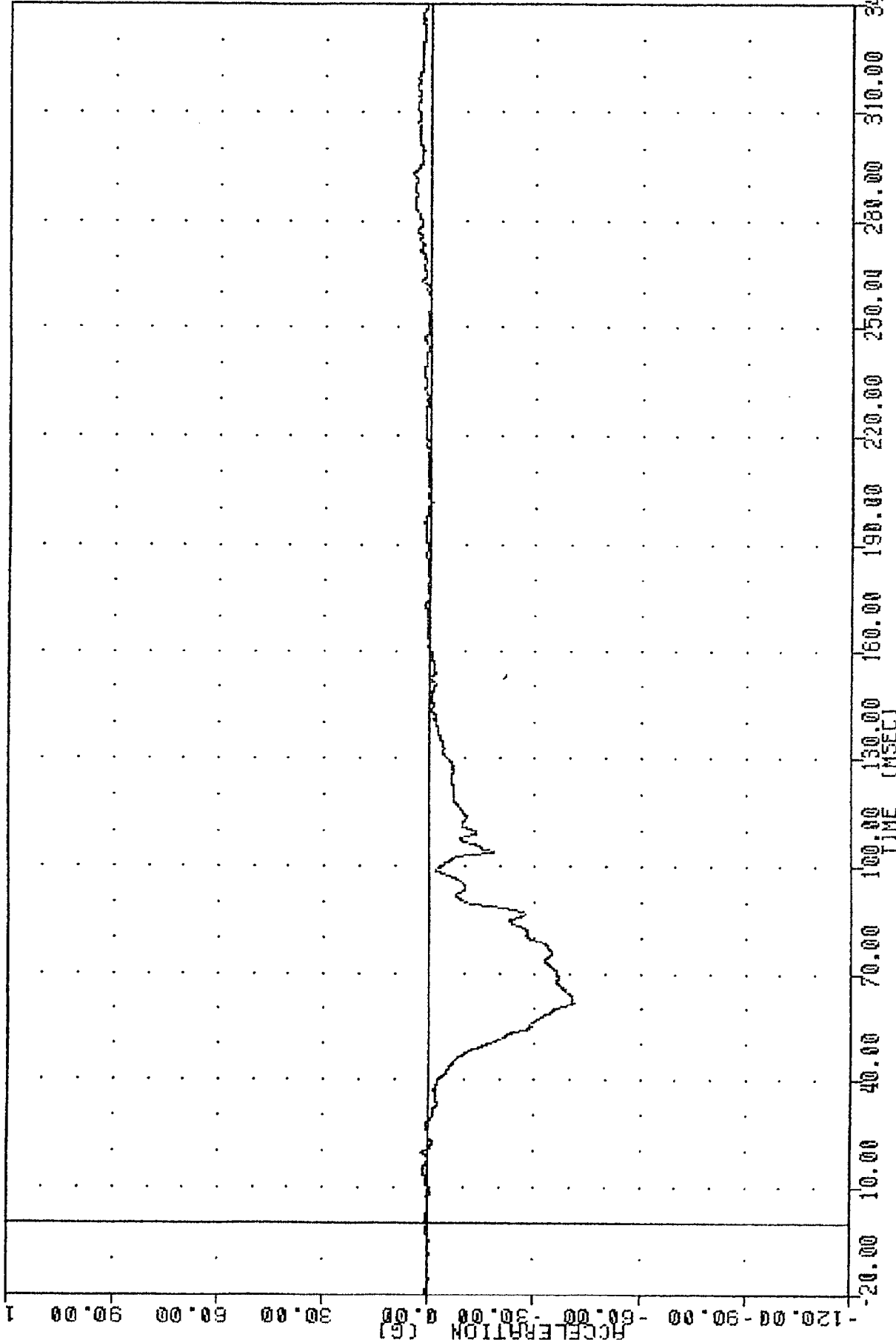
60.00

30.00

0.00

B-6

900222



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER CHEST X AXIS ACCELERATION

TRC 900222

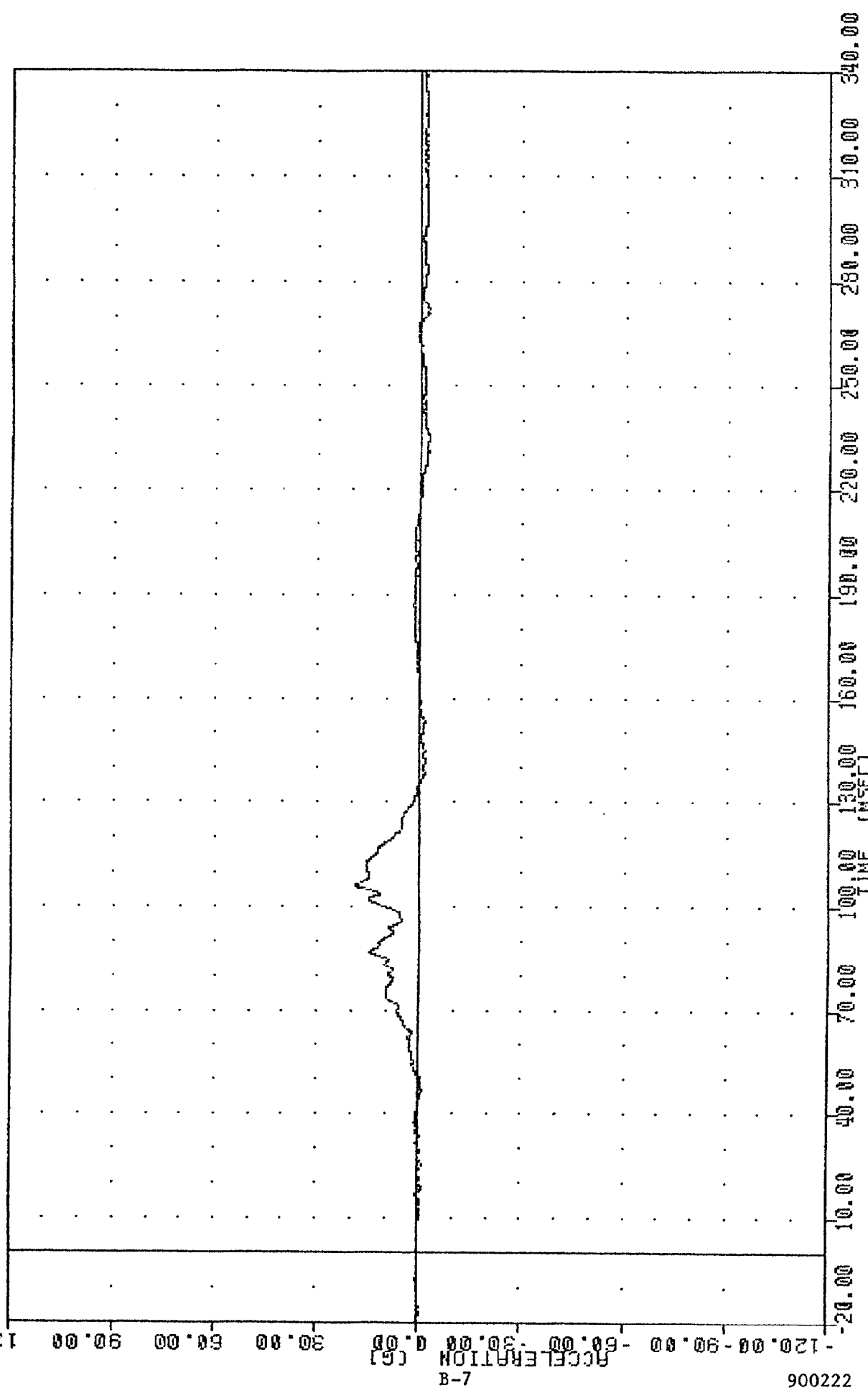
200 COMPLIANCE

90053

CSTYG1

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = -2.42 234.50 18.67 106.00



900222

B-7

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER CHEST Y AXIS ACCELERATION

TRC 900222

200 COMPLIANCE

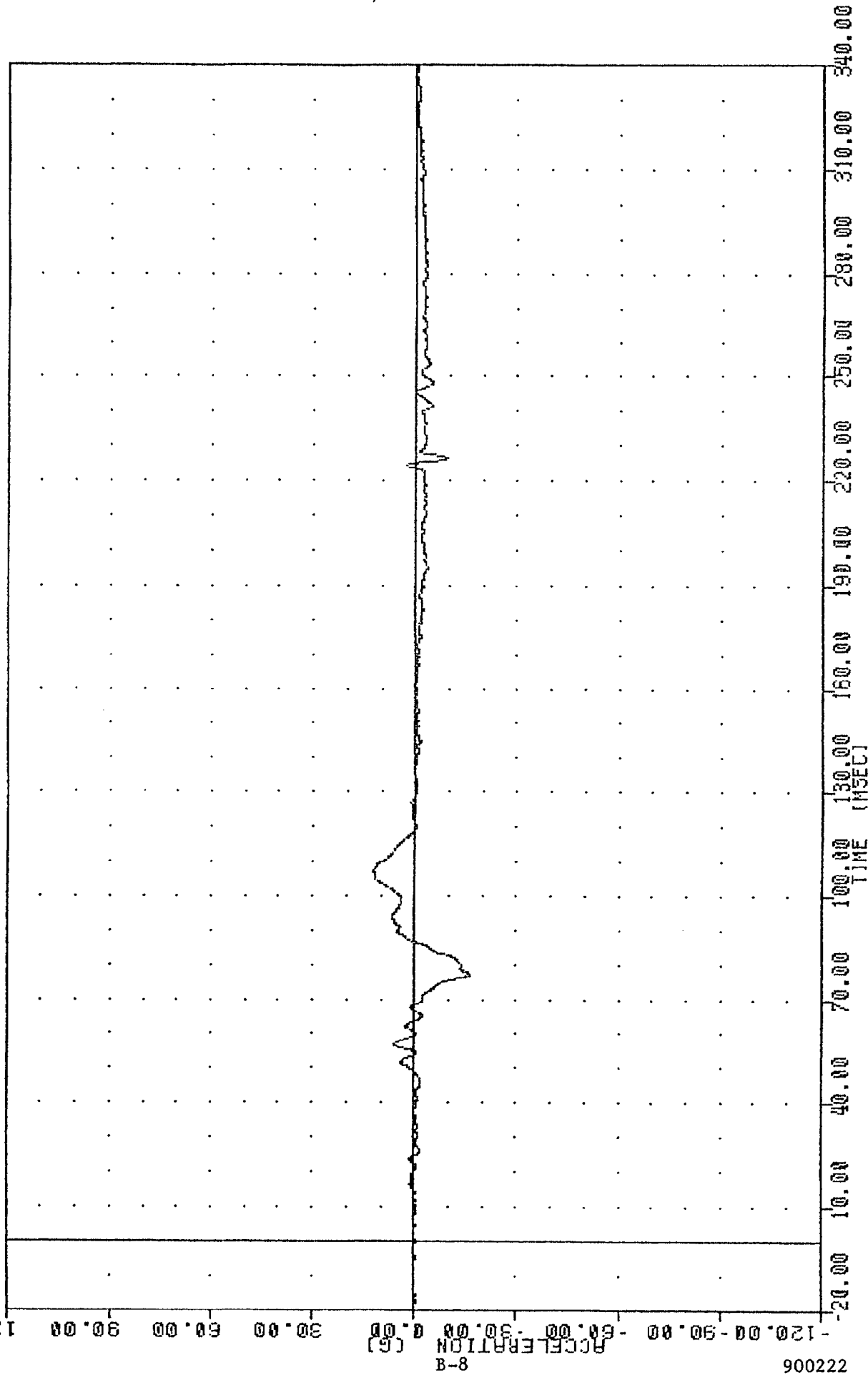
90053

CSTZG1

FILTER = BLPP 300/ 750/ -16

MIN, MAX VALUES = -16.31e

77.13, 12.07 e 107.25



900222

B-8

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER CHEST Z AXIS ACCELERATION

TRC 900222

208 COMPLIANCE

90053

CSTRG1

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = 0.028 -15.13, 41.10 e 62.00

105.00

90.00

75.00

60.00

45.00

30.00

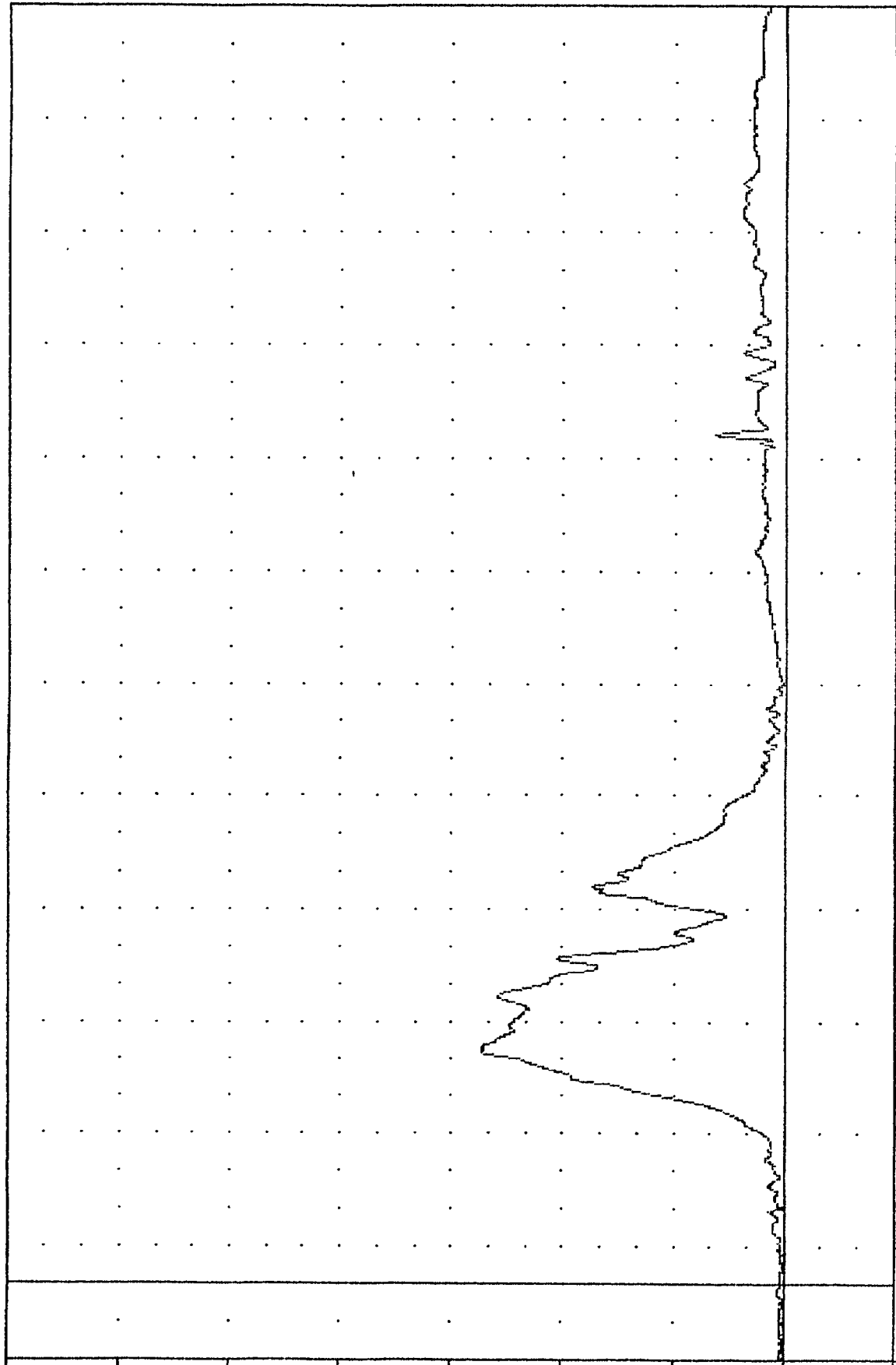
15.00

0.00

-15.00

B-6

900222



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER CHEST RESULTANT ACCELERATION

16C 900222

209 COMPLIANCE

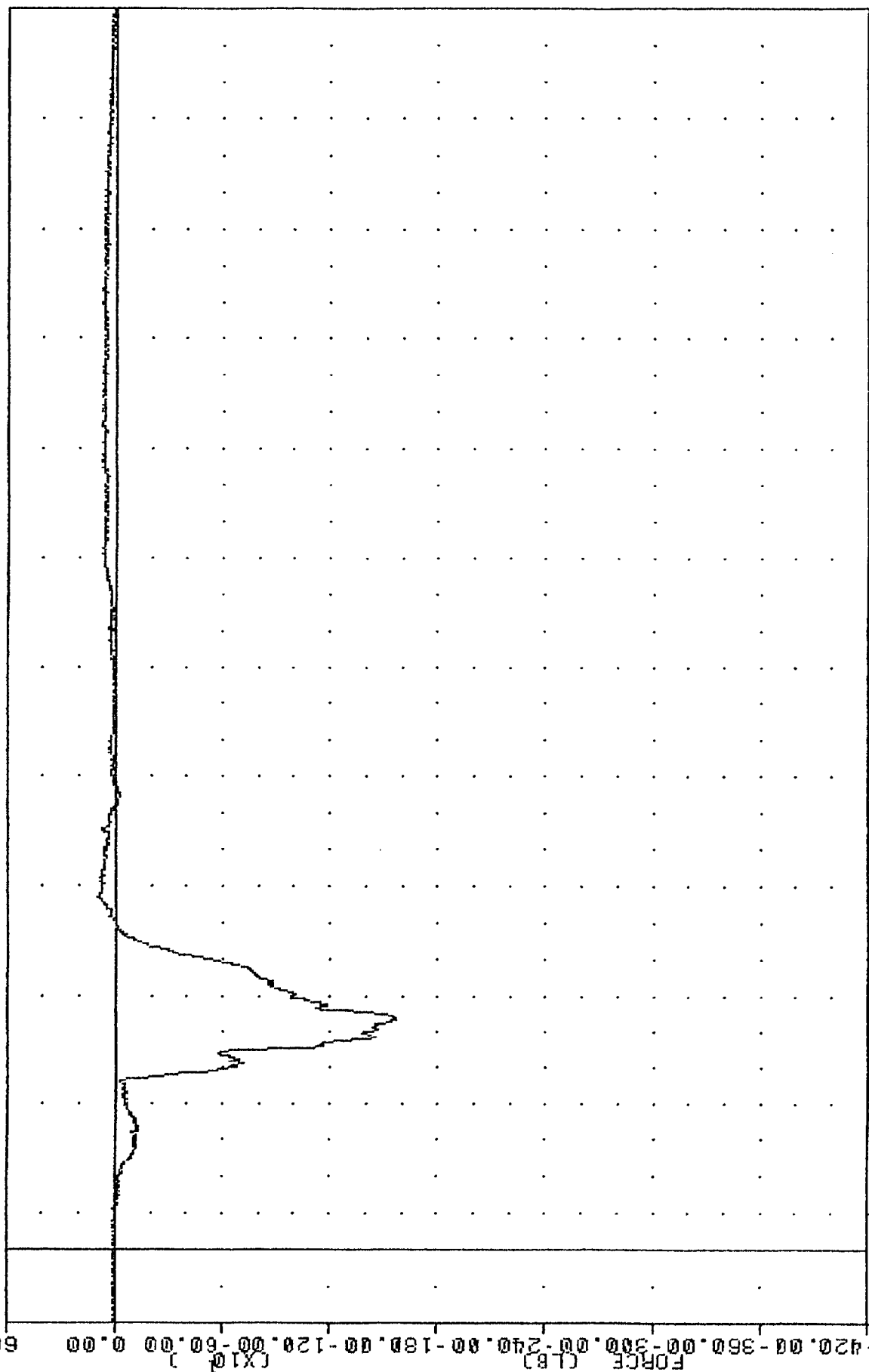
90053

LFMF1

FILTER = BLPP 1000/ 2500/ -16

MIN. MAX VALUES = -1569.89 63.75, 93.03 97.00

60.00
0.00
-60.00
-120.00
-180.00
-240.00
-300.00
-360.00
-420.00



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER LEFT FEMUR FORCE

TRC 900222

208 COMPLIANCE

90053

RFMF1

FILTER = BLPP 1000/ 2500/ -16

MIN, MAX VALUES = -1799.208 73.63, 80.27 & 110.13

60.00

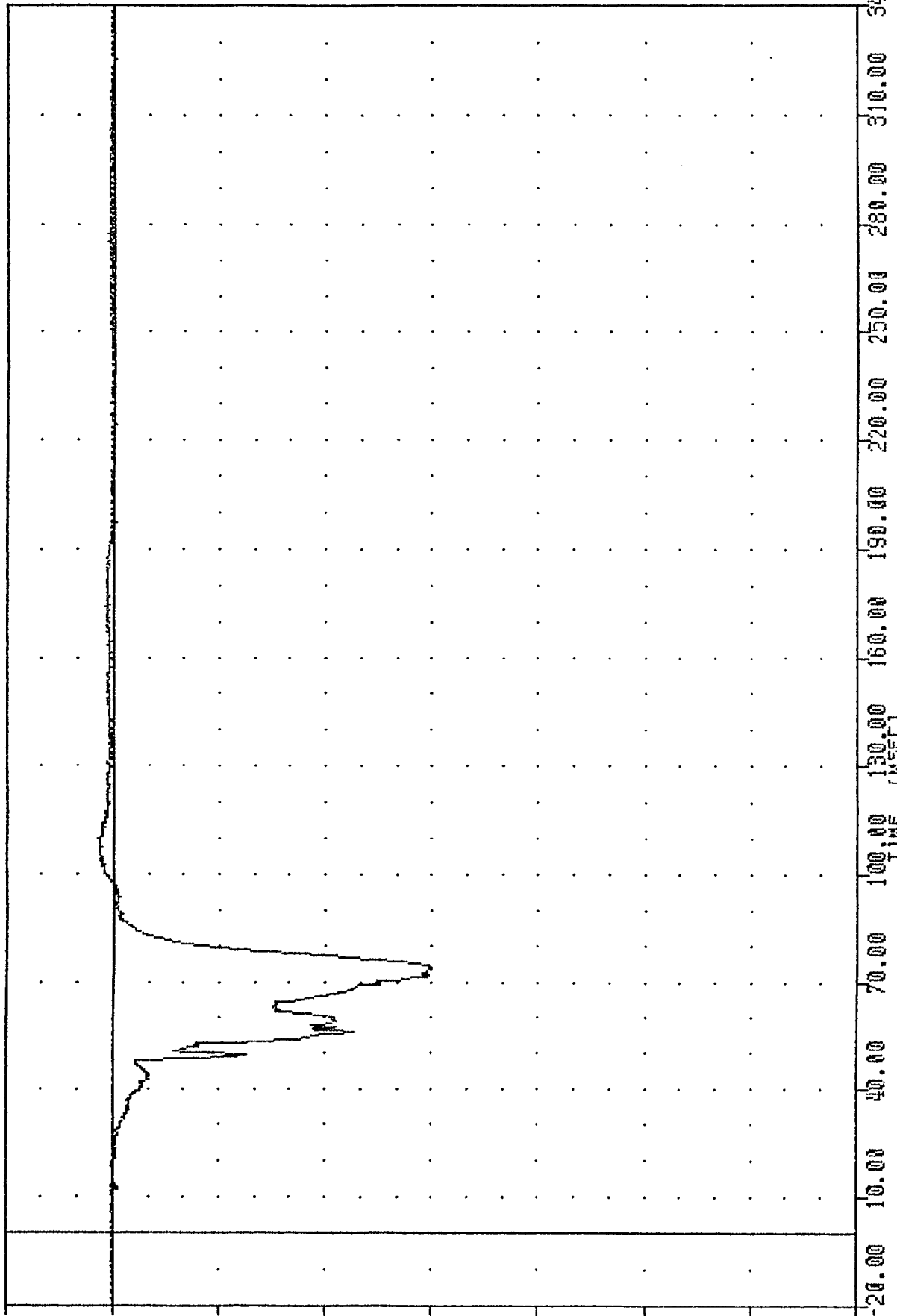
0.00

(X10³)

B-11

FORCE (LB)

900222



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DRIVER RIGHT FEMUR FORCE

TRC 900222

200 COMPLIANCE

90053

HEDXG2

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -29.290 97.30 , 13.06 e 284.38

240.00

180.00

120.00

60.00

0.00

-60.00

-120.00

-180.00

-240.00

ACCELERATION [G]

TIME (MSEC)

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

360.00

380.00

400.00

420.00

440.00

460.00

480.00

500.00

520.00

540.00

560.00

580.00

600.00

620.00

640.00

660.00

680.00

700.00

720.00

740.00

760.00

780.00

800.00

820.00

840.00

860.00

880.00

900.00

920.00

940.00

960.00

980.00

1000.00

1020.00

1040.00

1060.00

1080.00

1100.00

1120.00

1140.00

1160.00

1180.00

1200.00

1220.00

1240.00

1260.00

1280.00

1300.00

1320.00

1340.00

1360.00

1380.00

1400.00

1420.00

1440.00

1460.00

1480.00

1500.00

1520.00

1540.00

1560.00

1580.00

1600.00

1620.00

1640.00

1660.00

1680.00

1700.00

1720.00

1740.00

1760.00

1780.00

1800.00

1820.00

1840.00

1860.00

1880.00

1900.00

1920.00

1940.00

1960.00

1980.00

2000.00

2020.00

2040.00

2060.00

2080.00

2100.00

2120.00

2140.00

2160.00

2180.00

2200.00

2220.00

2240.00

2260.00

2280.00

2300.00

2320.00

2340.00

2360.00

2380.00

2400.00

2420.00

2440.00

2460.00

2480.00

2500.00

2520.00

2540.00

2560.00

2580.00

2600.00

2620.00

2640.00

2660.00

2680.00

2700.00

2720.00

2740.00

2760.00

2780.00

2800.00

2820.00

2840.00

2860.00

2880.00

2900.00

2920.00

2940.00

2960.00

2980.00

3000.00

3020.00

3040.00

3060.00

3080.00

3100.00

3120.00

3140.00

3160.00

3180.00

3200.00

3220.00

3240.00

3260.00

3280.00

3300.00

3320.00

3340.00

3360.00

3380.00

3400.00

3420.00

3440.00

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3680.00

3700.00

3720.00

3740.00

3760.00

3780.00

3800.00

3820.00

3840.00

3860.00

3880.00

3900.00

3920.00

3940.00

3960.00

3980.00

4000.00

4020.00

4040.00

4060.00

4080.00

4100.00

4120.00

4140.00

4160.00

4180.00

4200.00

4220.00

4240.00

4260.00

4280.00

4300.00

4320.00

4340.00

4360.00

4380.00

4400.00

4420.00

4440.00

4460.00

4480.00

4500.00

4520.00

4540.00

4560.00

4580.00

4600.00

4620.00

4640.00

4660.00

4680.00

4700.00

4720.00

4740.00

4760.00

4780.00

4800.00

4820.00

4840.00

4860.00

4880.00

4900.00

4920.00

4940.00

4960.00

4980.00

5000.00

5020.00

5040.00

5060.00

5080.00

5100.00

5120.00

5140.00

5160.00

5180.00

5200.00

5220.00

5240.00

5260.00

5280.00

5300.00

5320.00

5340.00

5360.00

5380.00

5400.00

5420.00

5440.00

5460.00

5480.00

5500.00

5520.00

5540.00

5560.00

5580.00

5600.00

5620.00

5640.00

5660.00

5680.00

5700.00

5720.00

5740.00

TRC 900222

208 COMPLIANCE

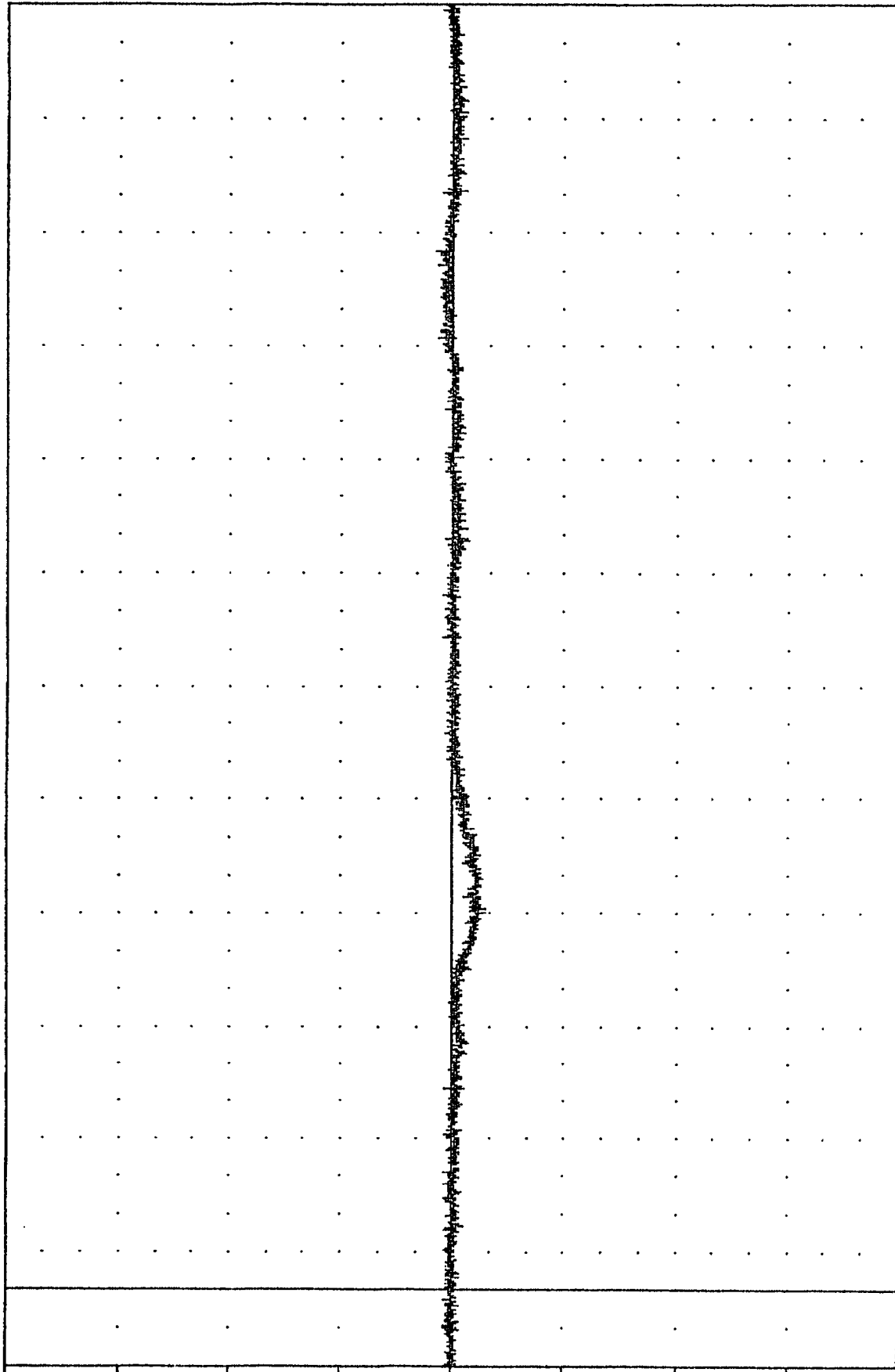
90053

HEDY62

FILTER = ALPF 1650/ 5214/ -40

MIN. MAX VALUES = -17.80e 101.00, 9.01 e 274.88

240.00



B-13
ACCELERATION (G)

222006

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Y AXIS ACCELERATION

900222

208 COMPLIANCE

90053

HEADG2

FILTER = ALPF 1650/ 5214/ -40

MIN, MAX VALUES = -56.91 82.25,

3.53 e 16.00

240.00

180.00

120.00

60.00

0.00

-60.00

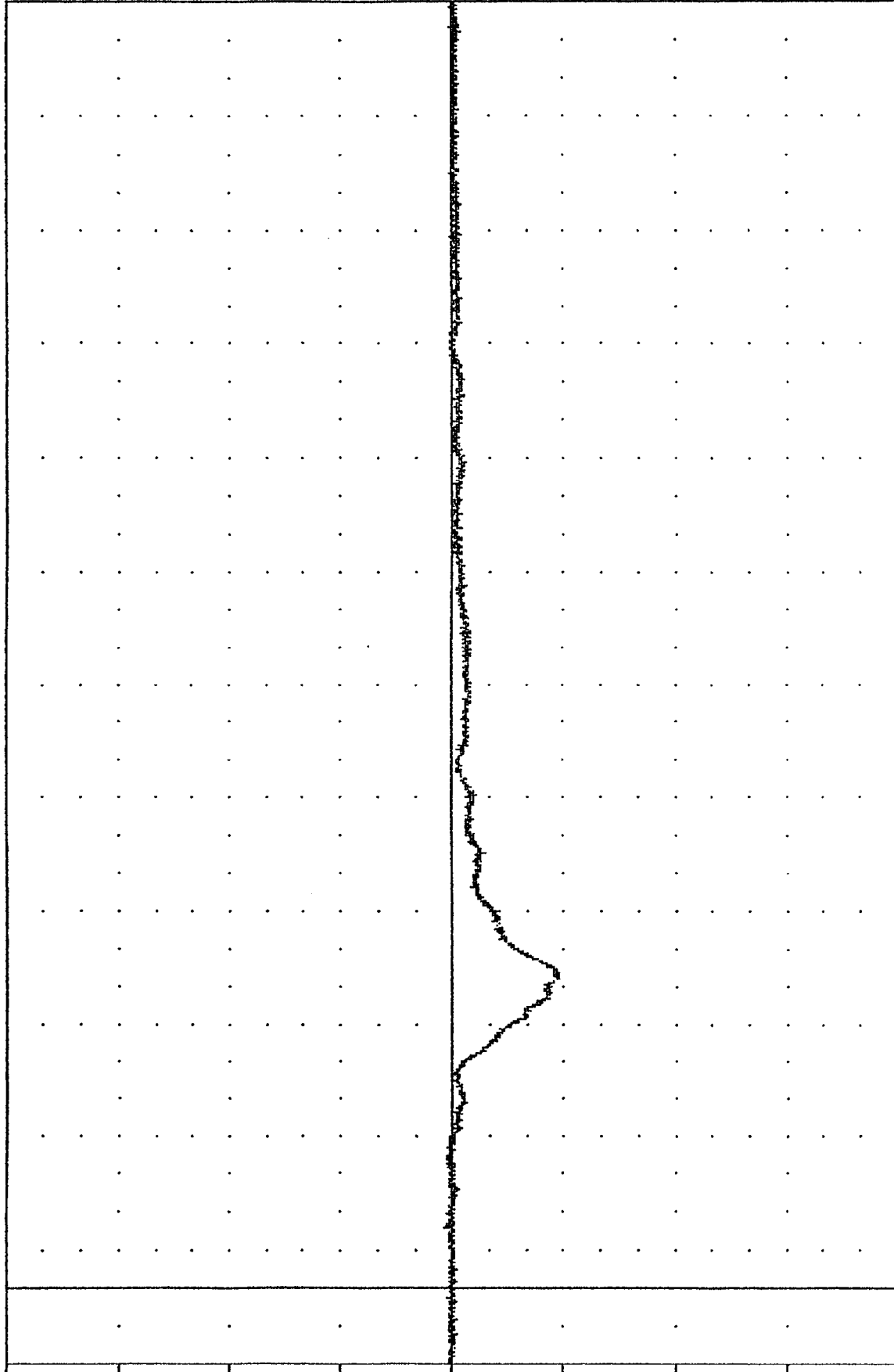
-120.00

-180.00

-240.00

41-B

900222



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Z AXIS ACCELERATION

TRC 900222

200 COMPLIANCE

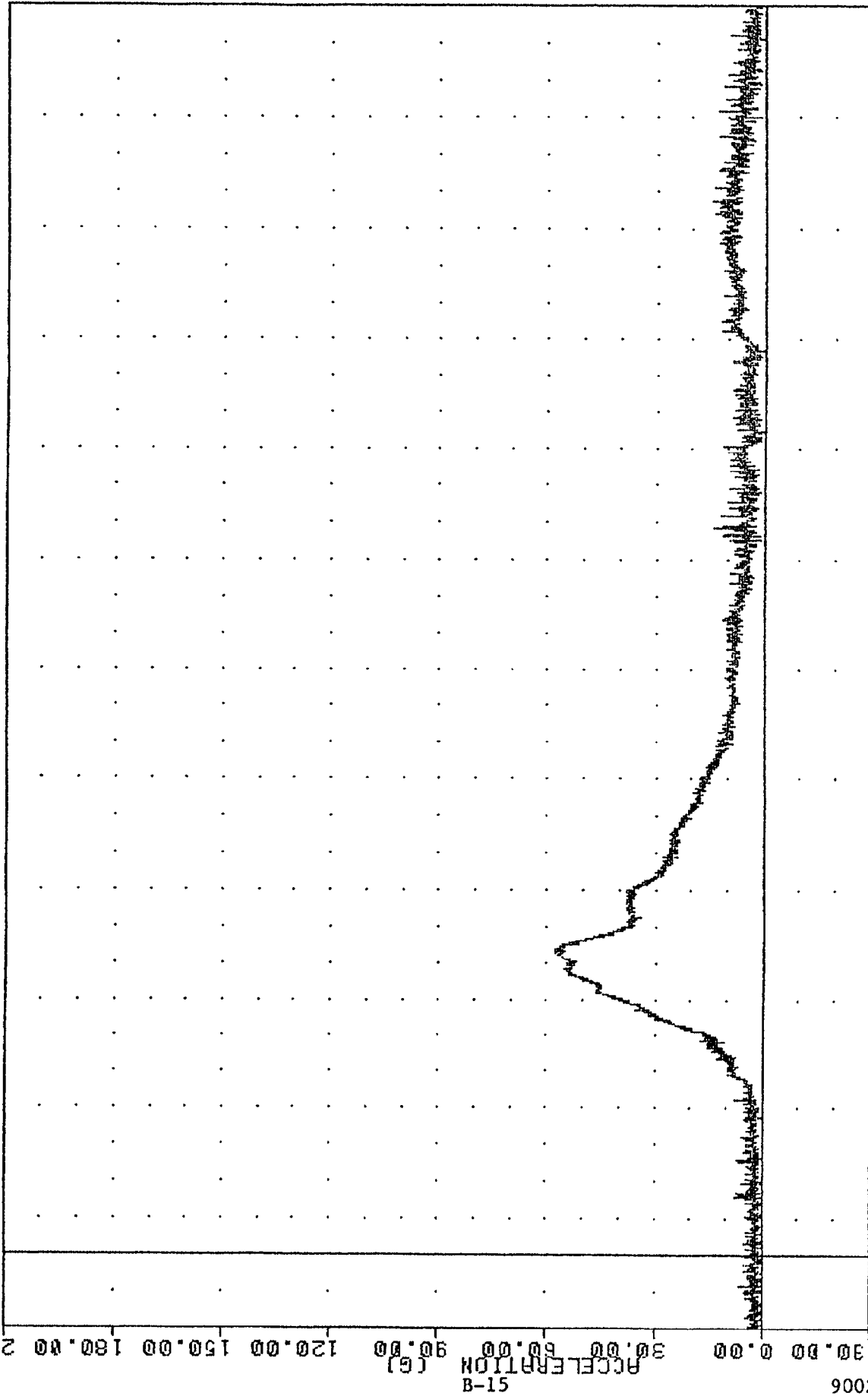
90053

HEAD62

FILTER = ALFF 1650/ 5214/ -40

MIN, MAX VALUES = 0.16 10.38, 57.64 82.25

210.00



900222

-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

TRC 900222

208 COMPLIANCE

90053

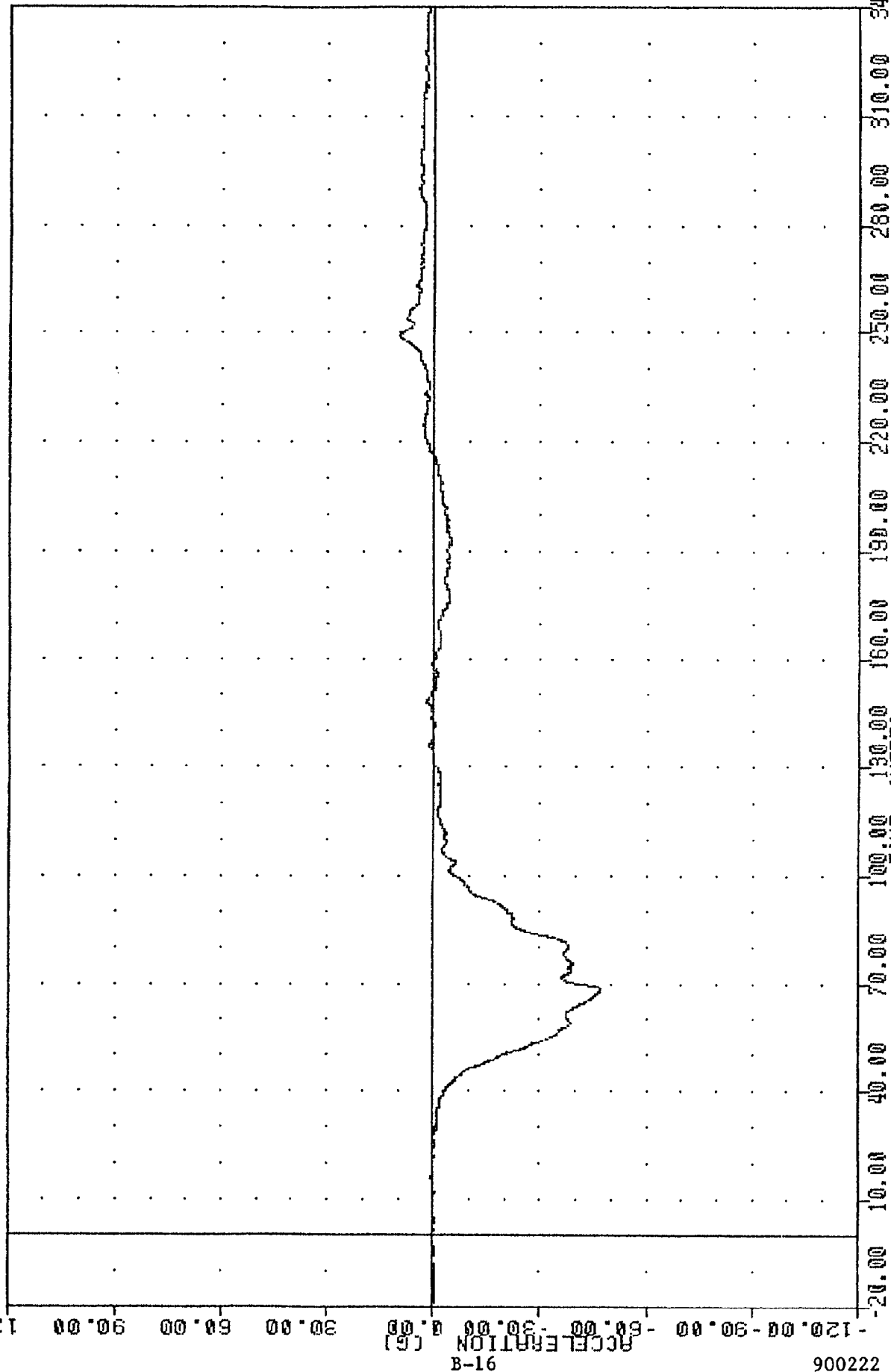
CSTXG2

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = -47.14e

68.38,

9.64 e 249.13



900222

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST X AXIS ACCELERATION

TRC 900222

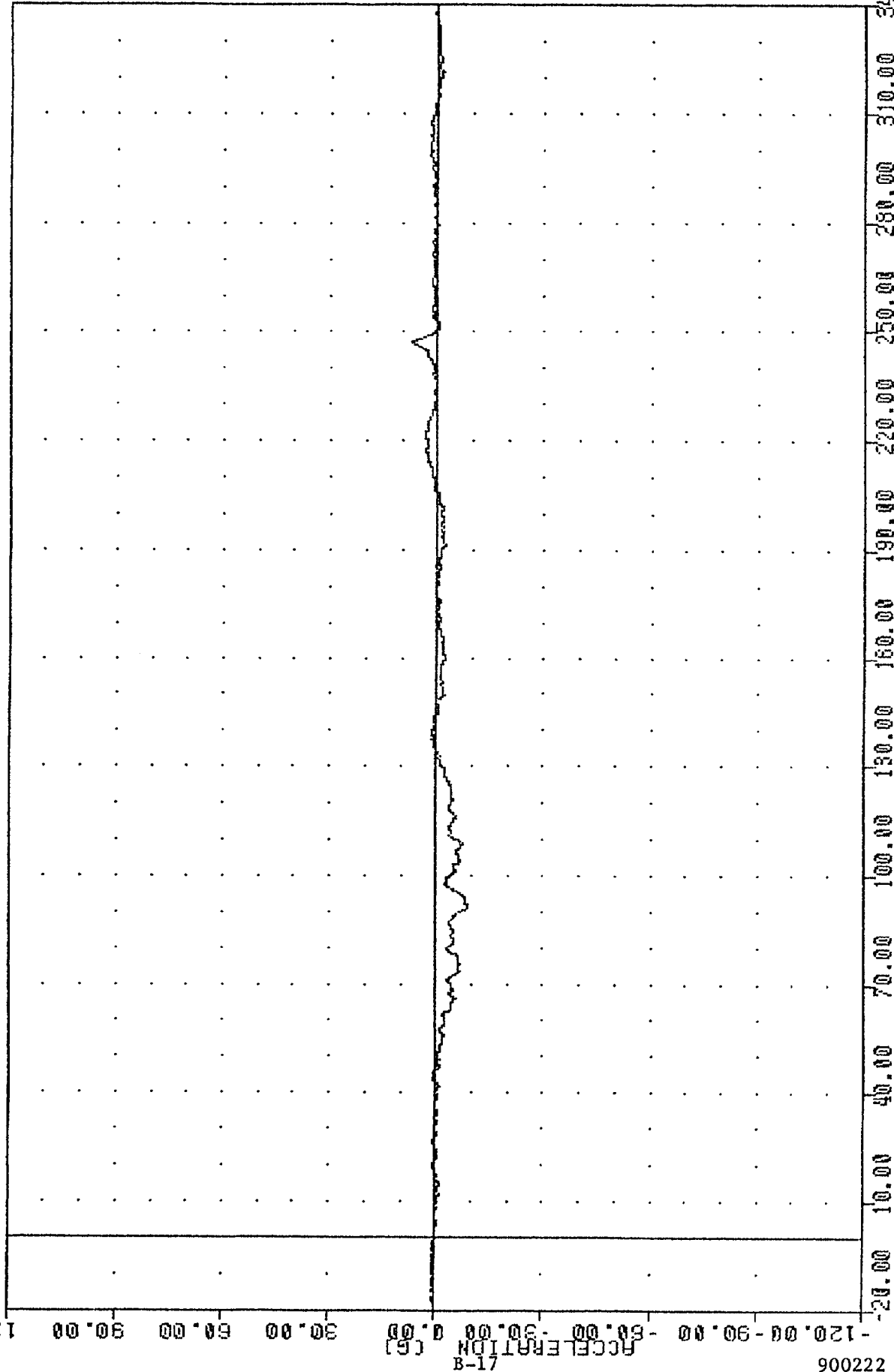
208 COMPLIANCE

90053

CSTY62

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = -9.02e 91.25, 7.03 e 247.13



9002226

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Y AXIS ACCELERATION

TRC 900222

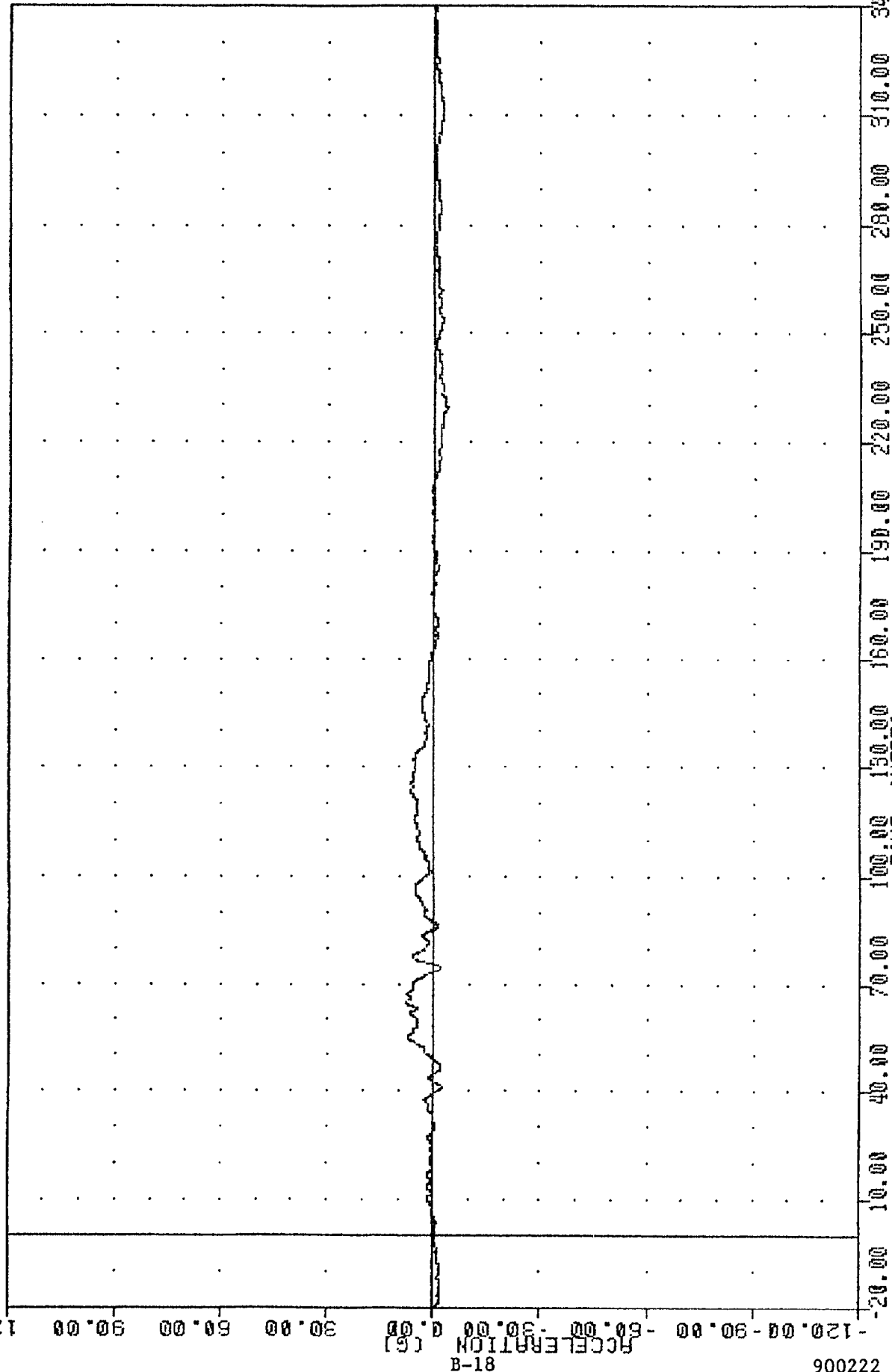
208 COMPLIANCE

90053

CSTZG2

FILTER = BLPP 300/ 750/ -16

MIN. MAX VALUES = -3.438 229.13 8.00 64.88



B-18

900222

TAC 900222

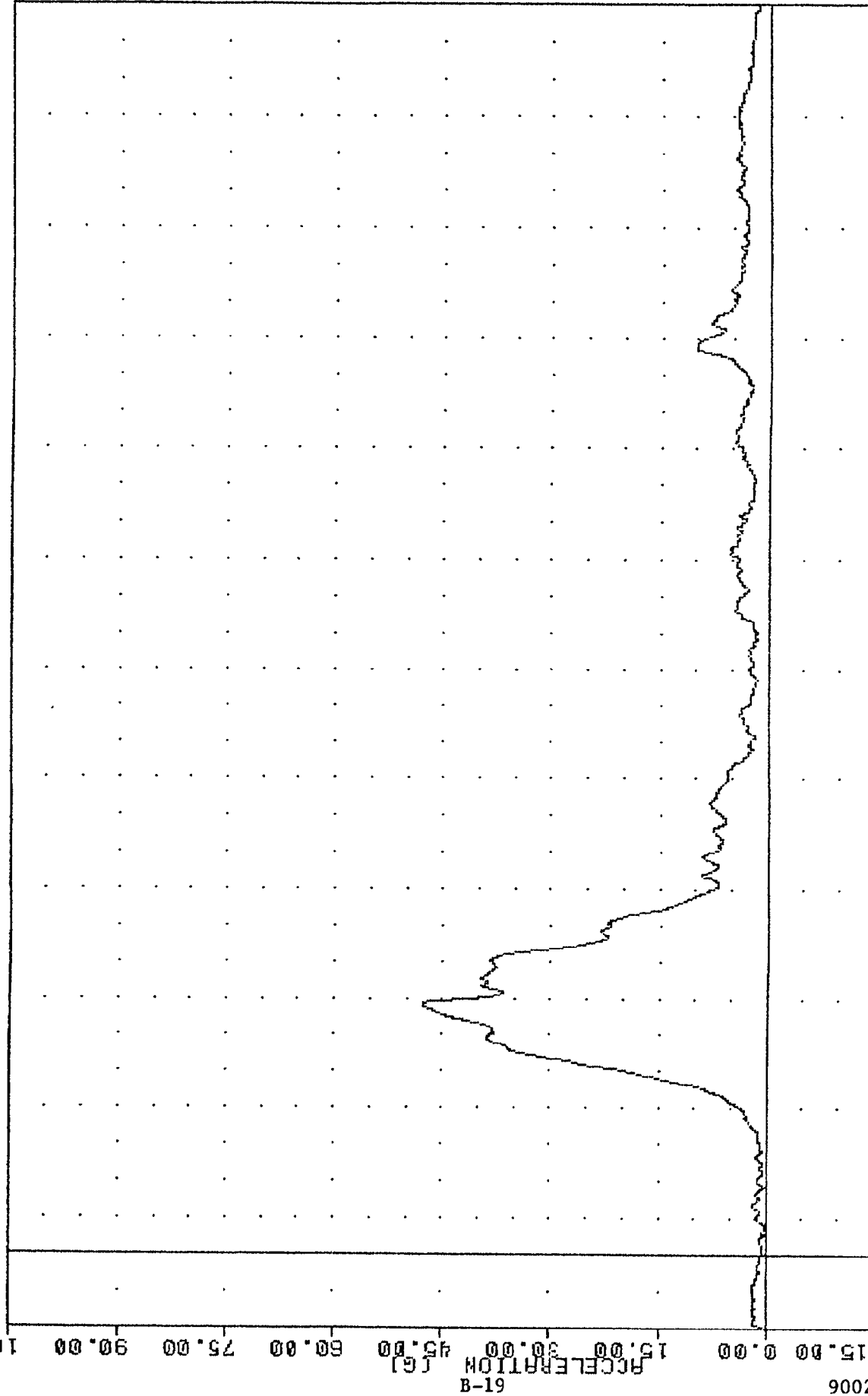
208 COMPLIANCE

90053

CSTRG2

FILTER = BLPP 300/ 750/ -16

MIN, MAX VALUES = 0.130 -20.00, 47.75 & 68.25



900222

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION

TRC 900222

208 COMPLIANCE

90053

LFMF2

FILTER = BLPP 1000/ 2500/ -16

MIN, MAX VALUES = -1014.53 83.63, 47.55 @ 132.25

60.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

0.00

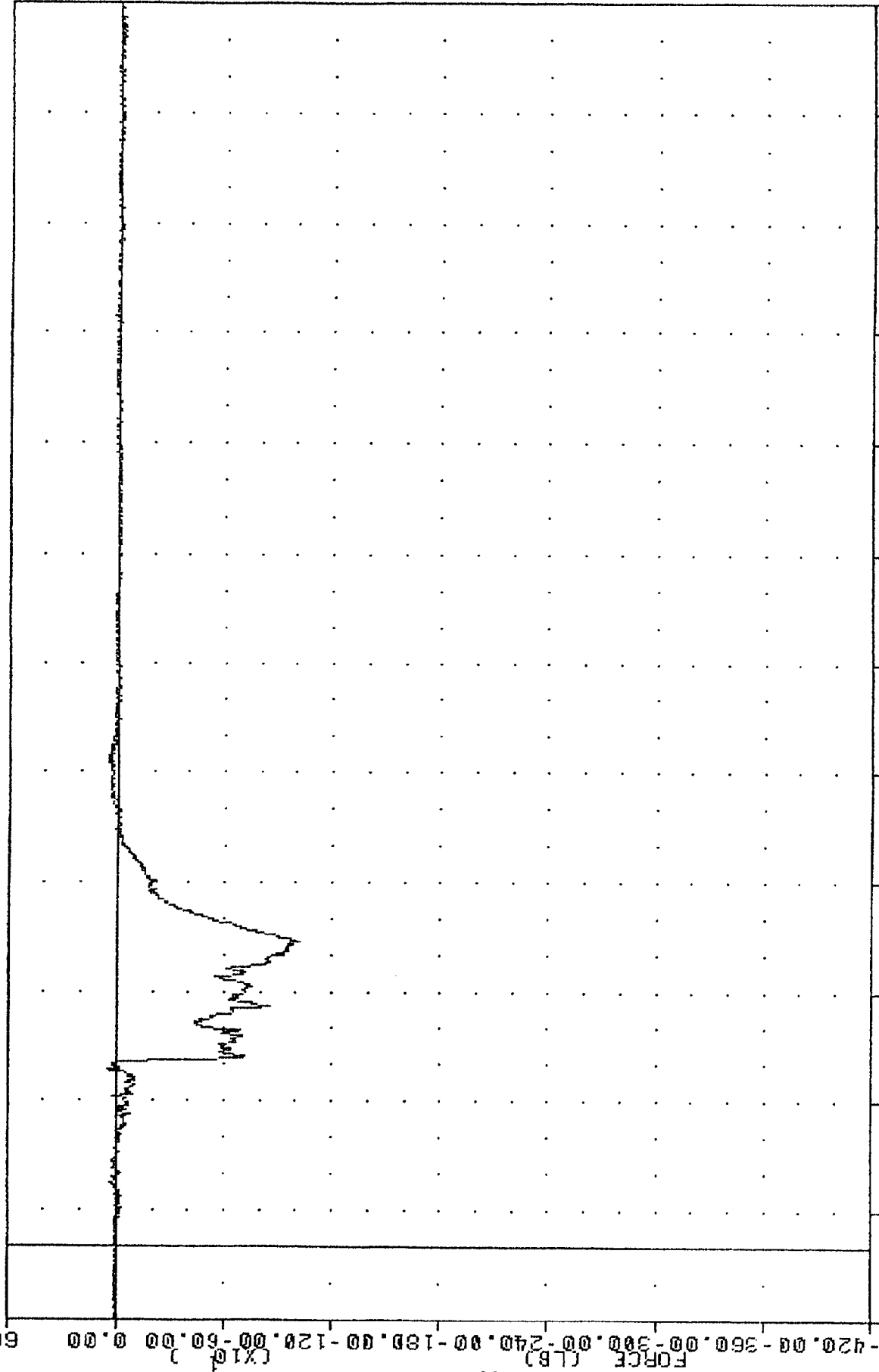
0.00

0.00

0.00

B-20

900222



-420.00 -360.00 -300.00 -240.00 -180.00 -120.00 -60.00 0.00 60.00

TIME (MSEC)

0.00 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

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER LEFT FEMUR FORCE

TRC 900222

200 COMPLIANCE

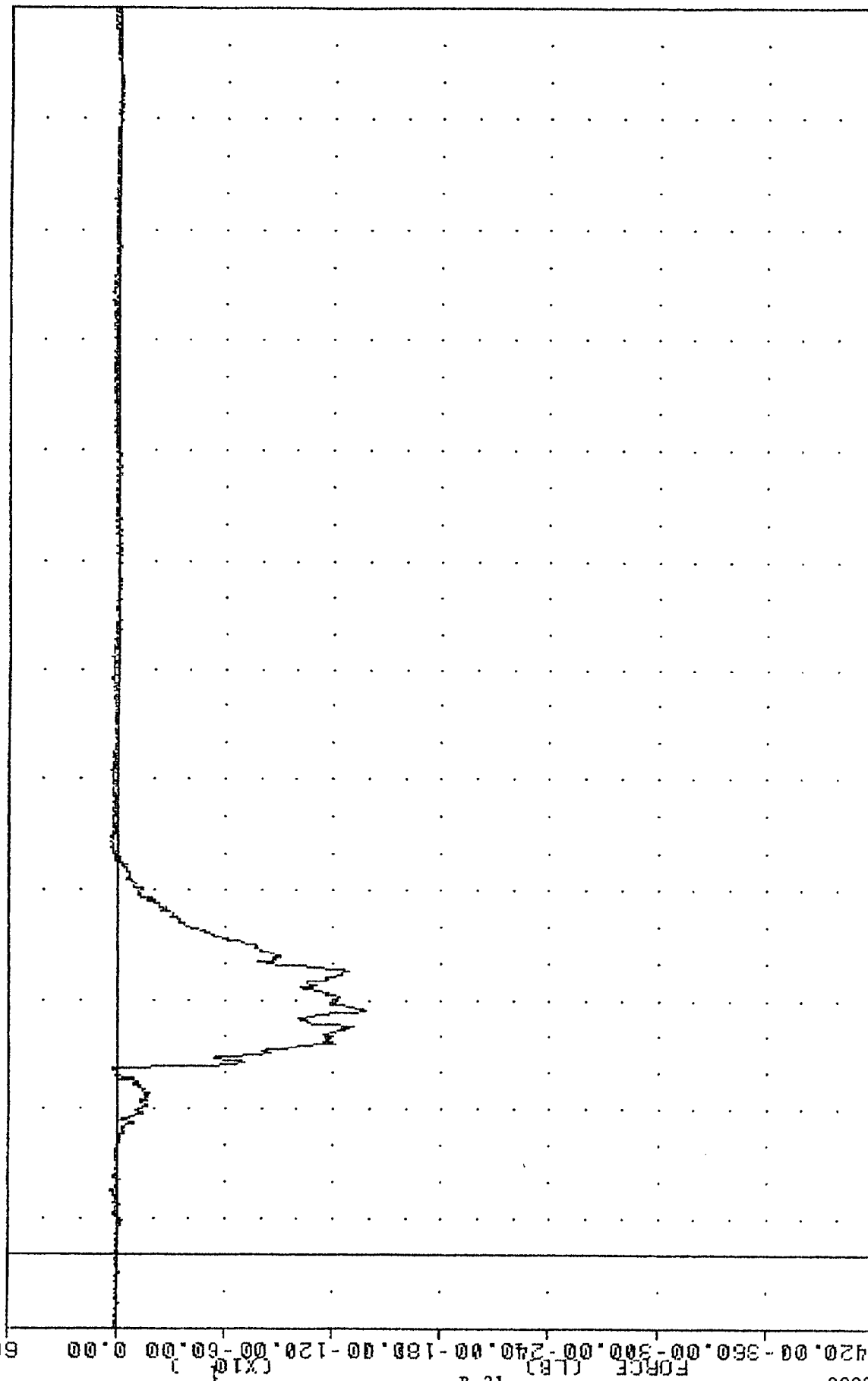
90053

AFMF2

FILTER = BLPP 1000/ 2500/ -16

MIN, MAX VALUES = -1376.200 67.00, 40.43 114.38

50.00



B-21

900222

-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

TRC 900222

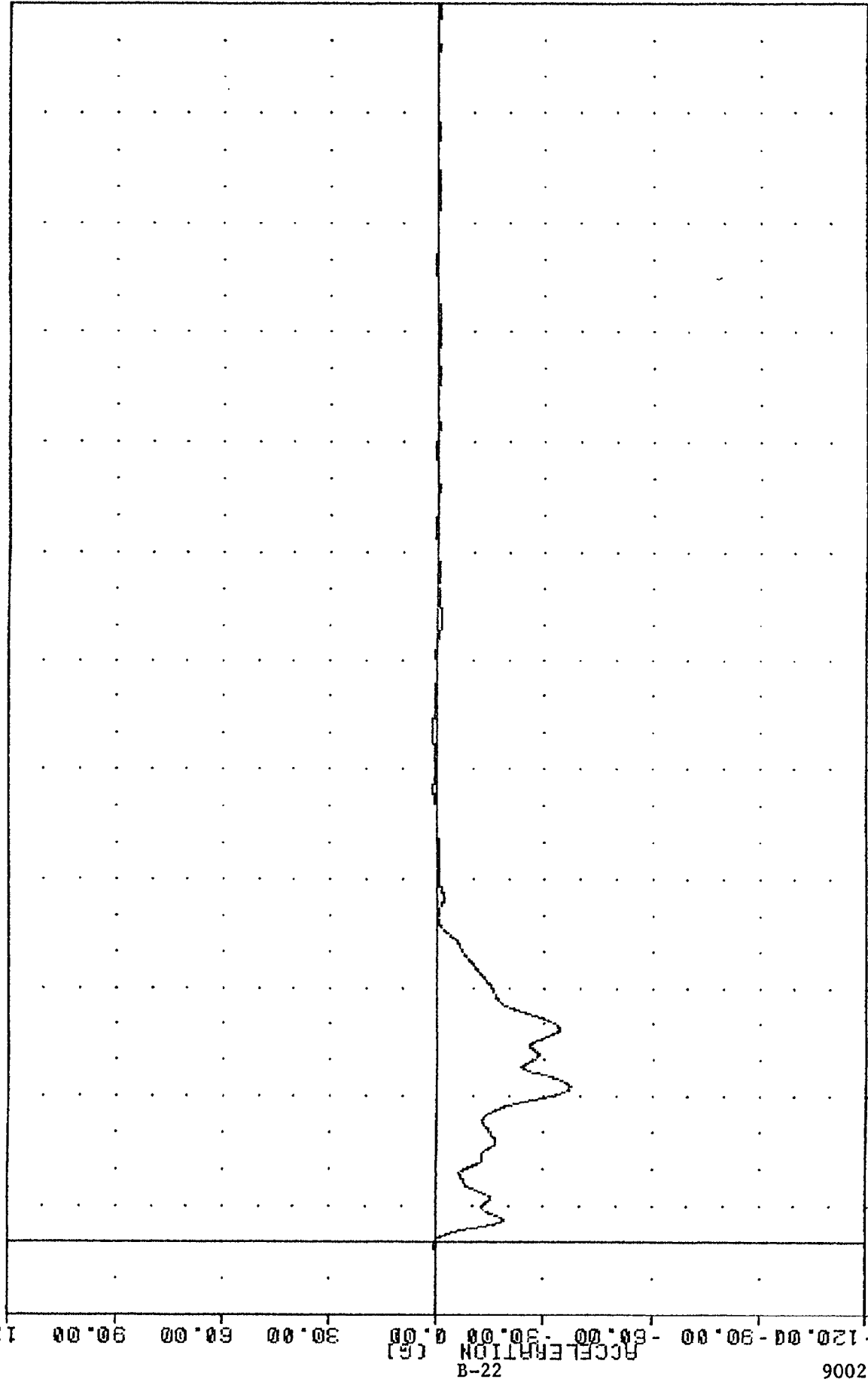
208 COMPLIANCE

90053

TLRXG1

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -37.068 42.63, 1.65 @ 140.63



900222

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
LEFT REAR SEAT X AXIS ACCELERATION

TRC 900222

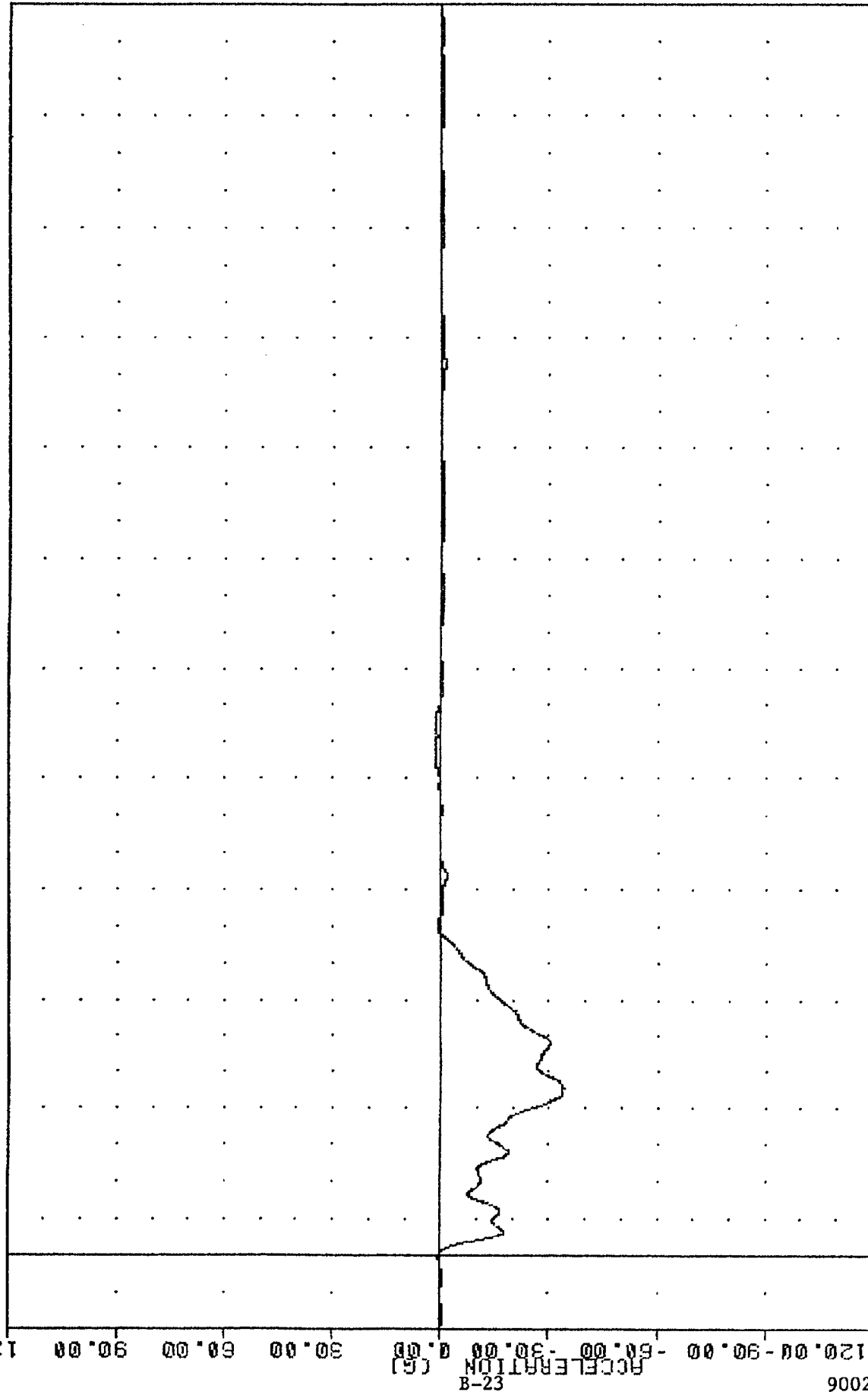
208 COMPLIANCE

90053

TRRXG1

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -33.88 45.38 1.68 136.88



900222

-20.00 10.00 40.00 70.00 100.00 130.00 160.00 190.00 220.00 250.00 280.00 310.00 340.00

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT REAR SEAT X AXIS ACCELERATION

TAC 900222

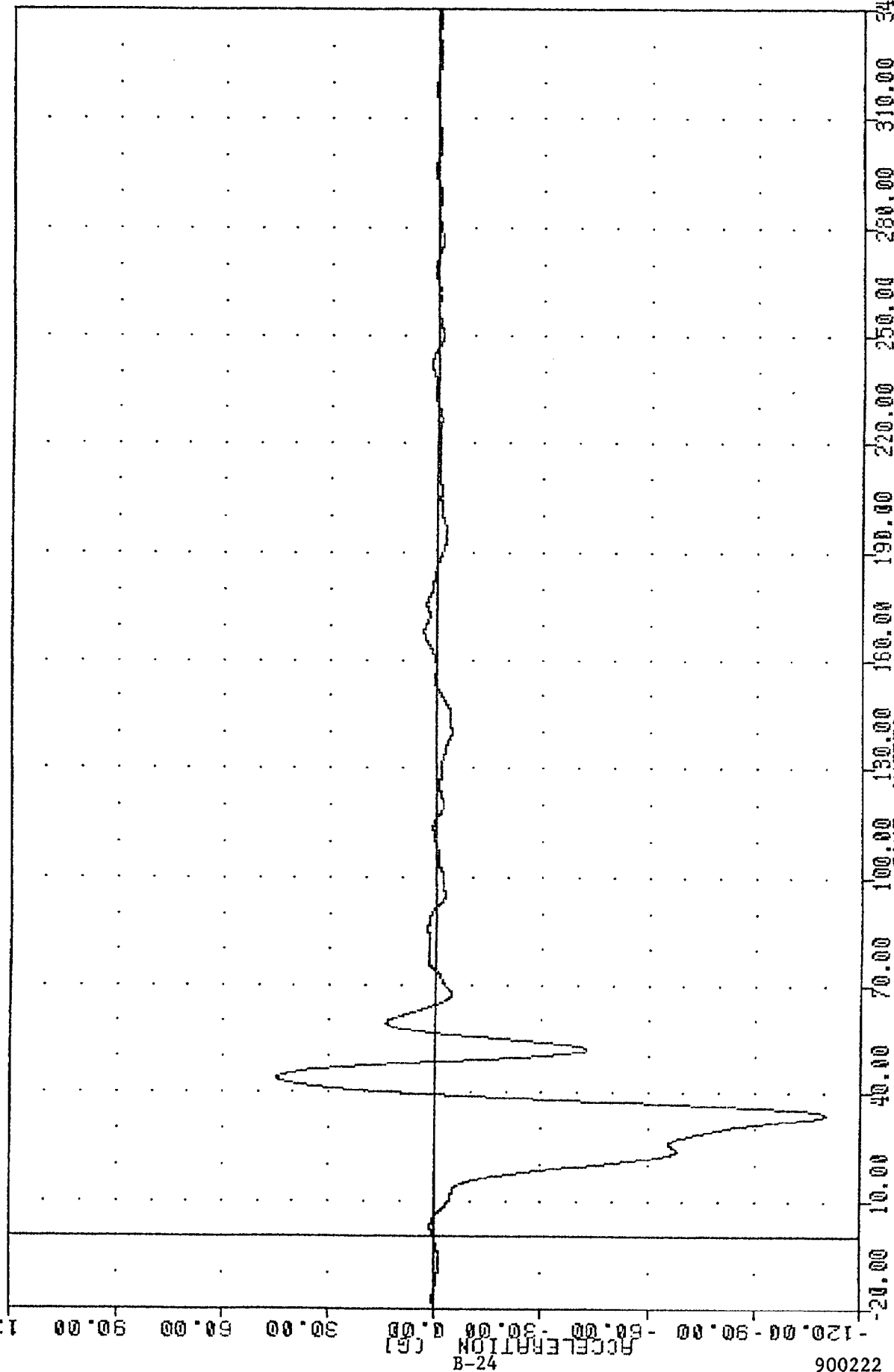
208 COMPLIANCE

90053

ENGXG1

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -110.240 34.00, 44.78 0 44.00



900222

B-24

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
ENGINE UPPER BLOCK X AXIS ACCELERATION

TRC 900222

208 COMPLIANCE

90053

ENGX62

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -104.650 33.50, 57.00 0 43.25

120.00

90.00

60.00

30.00

0.00

-30.00

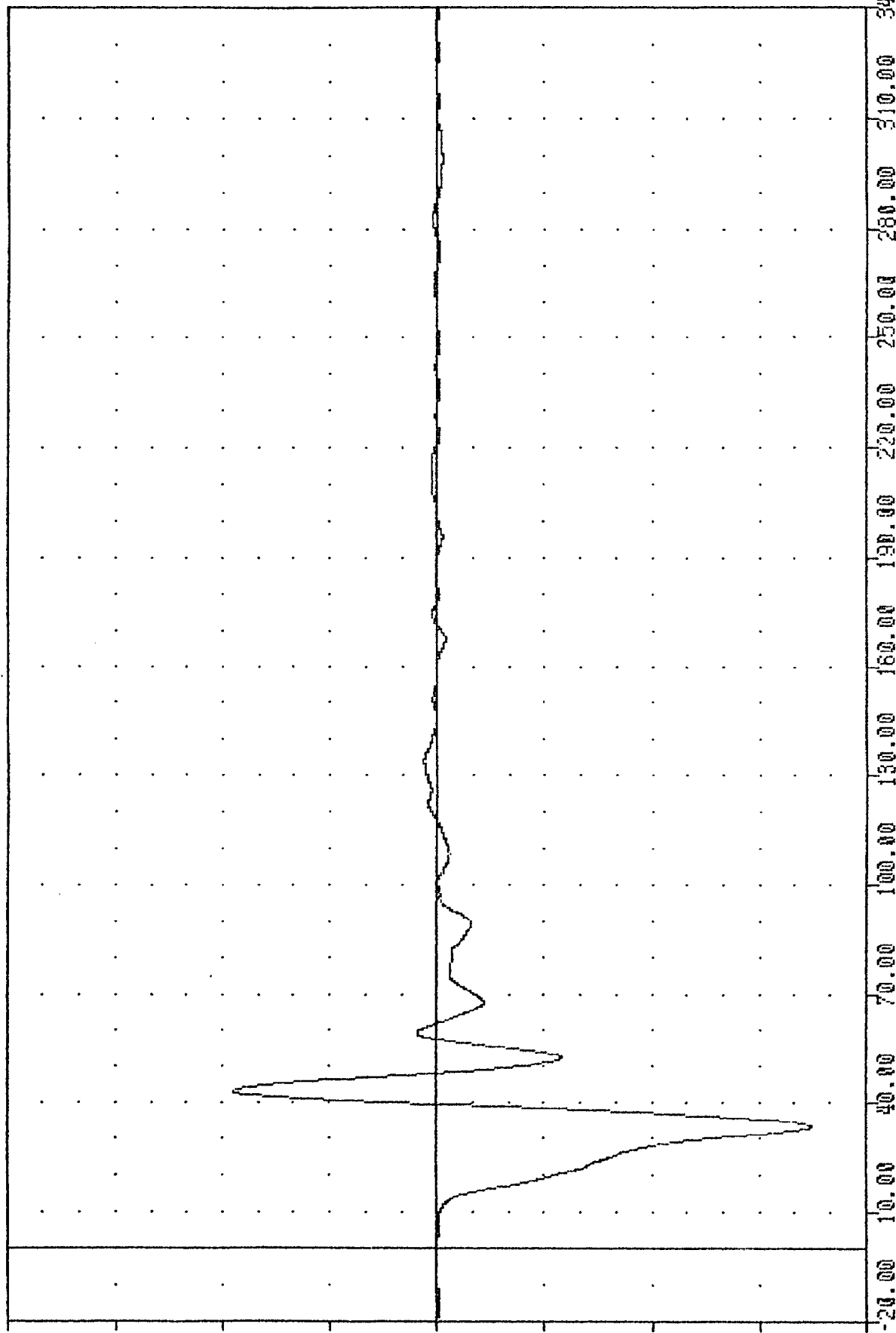
-60.00

-90.00

-120.00

B-25
ACCELERATION (G)

900222



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
ENGINE BOTTOM BLOCK X AXIS ACCELERATION

TRC 900222

208 COMPLIANCE

90053

BCRXG1

FILTER = BLPF 100/ 250/ -18

MIN. MAX VALUES = -54.57 49.00 5.96 70.13

120.00

90.00

60.00

30.00

0.00

-30.00

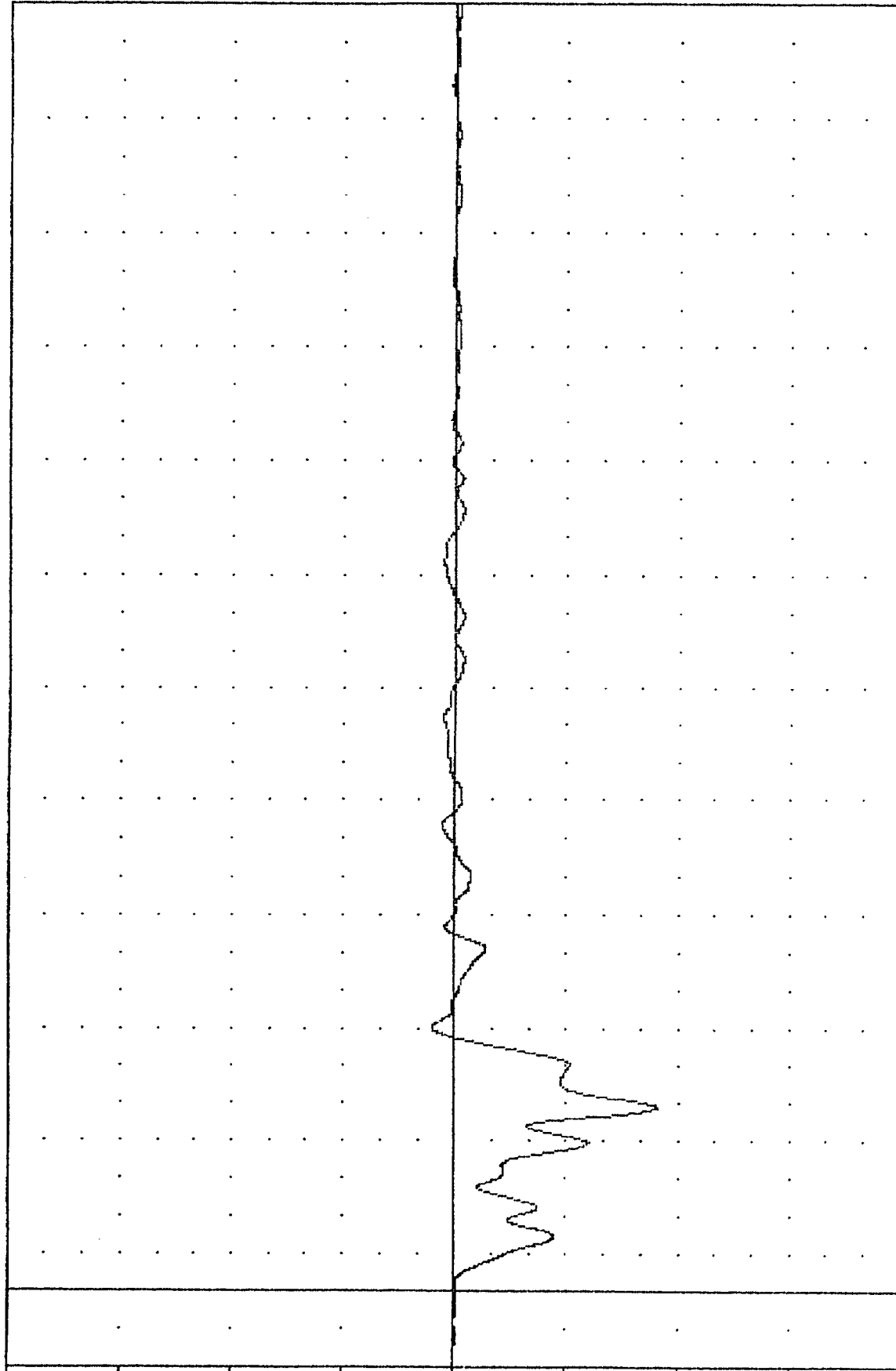
-60.00

-90.00

-120.00

B-26

ACCELERATION (G)



900222

-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

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
RIGHT BRAKE CALIPER X AXIS ACCELERATION

TRC 900222

208 COMPLIANCE

90053

BCLX61

FILTER = BLPP 100/ 250/ -16

MIN, MAX VALUES = -64.128

47.75, 5.92 85.13

120.00

90.00

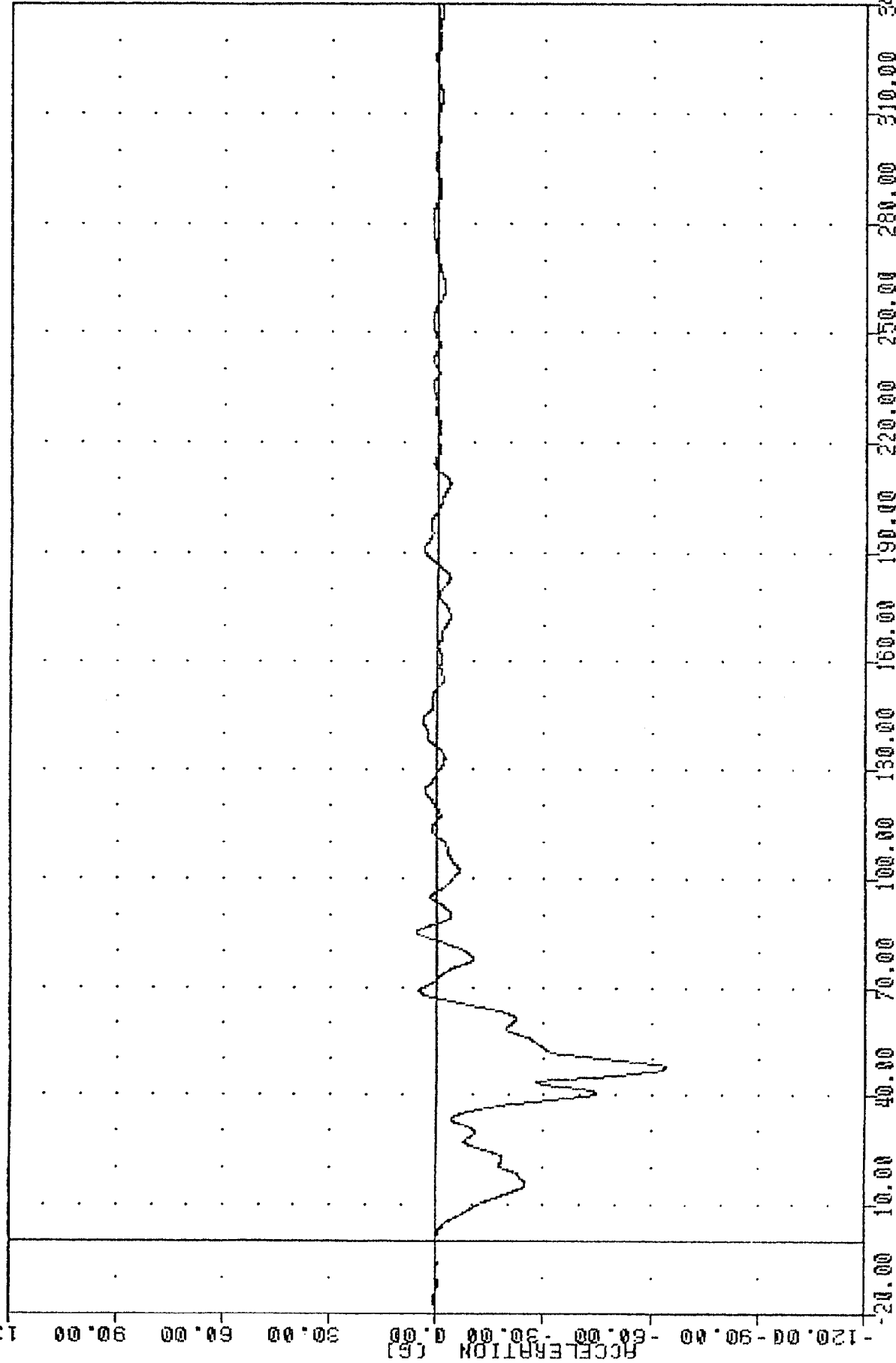
60.00

30.00

0.00

B-27

900222



SUBARU LEGACY INTO FLAT FRONTAL BARRIER
LEFT BRAKE CALIPER X AXIS ACCELERATION

TRC 900222

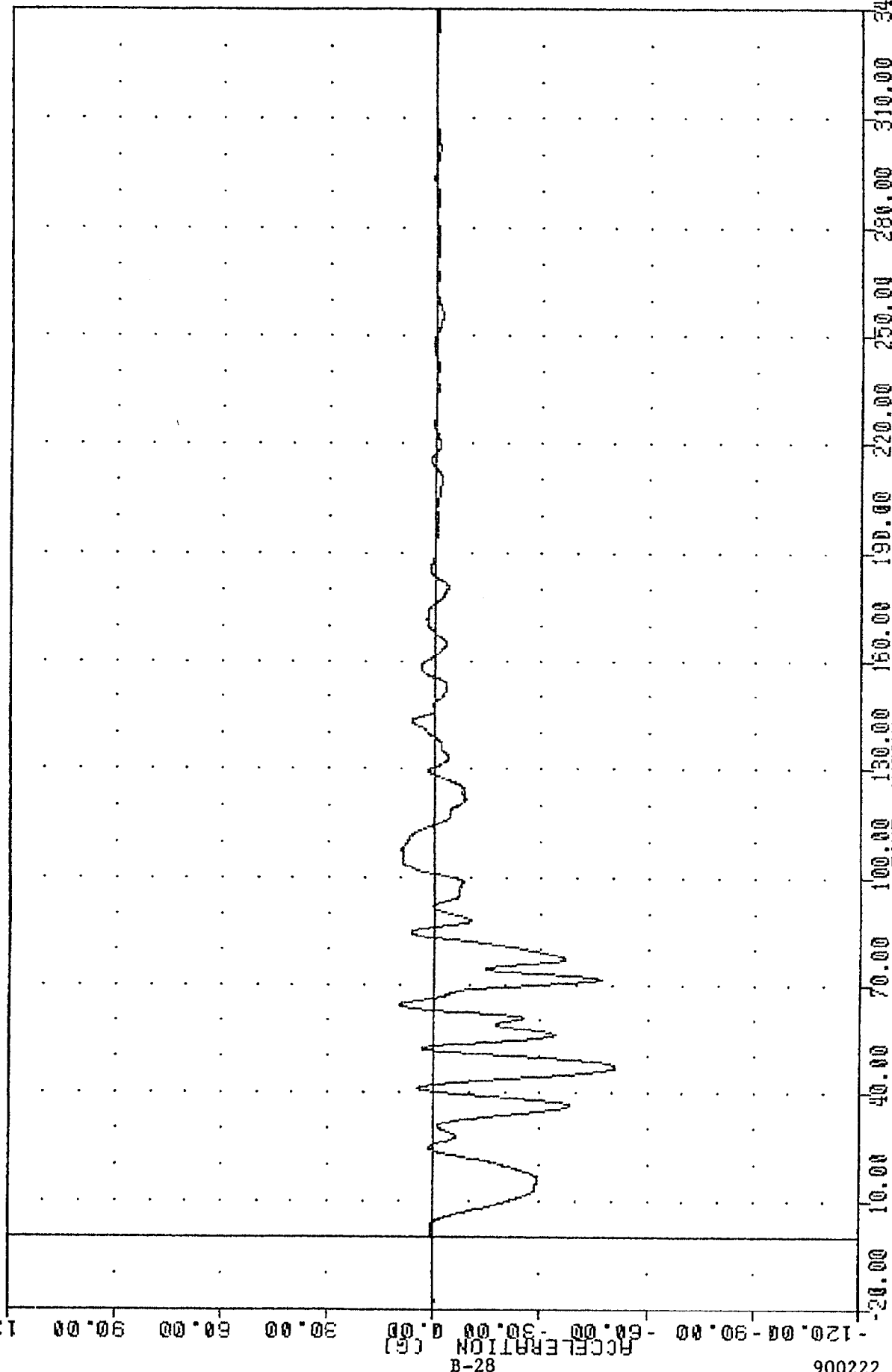
208 COMPLIANCE

90053

OPCXG1

FILTER = BLPP 100/ 250/ -16

MIN. MAX VALUES = -50.94e 47.13, 9.86 e 64.38



B-28

900222

SUBARU LEGACY INTO FLAT FRONTAL BARRIER
DASH PANEL CENTER X AXIS ACCELERATION