V1549

REPORT NOS. 208-TRC-91-006
212-TRC-91-006
301-TRC-91-006

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

DAEWOO MOTOR COMPANY, LTD.
1991 PONTIAC LEMANS
3-DOOR HATCHBACK
NHTSA NO. CM0108
TRC TEST NO. 910121

THE TRANSPORTATION RESEARCH CENTER OF OHIO
10820 STATE ROUTE 347
EAST LIBERTY, OHIO 43319

FEBRUARY 6, 1991
FINAL REPORT

PREPARED FOR:
U.S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
OFFICE OF VEHICLE SAFETY COMPLIANCE (NEF-31)
400 SEVENTH STREET, S.W., ROOM NO. 6111
WASHINGTON, DC 20590

This Final Test Report was prepared for the U.S. Department of Transportation, National Highway Traffic Safety Administration, under Contract No. DTNH22-90-C-21003. 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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15. Supplementary Notes

16. Abstract

A 30 mph flat frontal barrier impact test was conducted on a 1991 Pontiac LeMans 3-door hatchback, NHTSA No. CM0108, at the Transportation Research Center of Ohio on January 21, 1991. 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 301, "Fuel System Integrity." The barrier impact velocity was 29.3 mph. The vehicle's maximum crush was 21.3 inches. The ambient temperature was 72° F.

The driver's head injury criteria (HIC) was 647. The driver's maximum chest deceleration over three (3) milliseconds was 50.3 g. The driver's chest displacement was 0.8 inches. The driver's maximum left and right femur forces were 2115 pounds and 1762 pounds, respectively.

The passenger's head injury criteria (HIC) was 588. The passenger's maximum chest deceleration over three (3) milliseconds was 48.2 g. The passenger's chest displacement was 1.2 inches. The passenger's maximum left and right femur forces were 1288 pounds and 1821 pounds, respectively.

The vehicle appears to comply with the applicable requirements of FMVSS 208, 212, 219 (partial), and 301.

17. Key Words	18. Distribution Statement
Frontal Impact 30 mph Vehicle Safety Compliance Testing FMVSS 208, "Occupant Crash Protection" FMVSS 212, "Windshield Mounting" FMVSS 219P, "Windshield Zone Intrusion" FMVSS 301, "Fuel System Integrity"	Available from: NHTSA Technical Reference Division Room 5108, (NAD-52) 400 Seventh Street, SW Washington, DC 20590 Attn: Mr. Robert Hornickle

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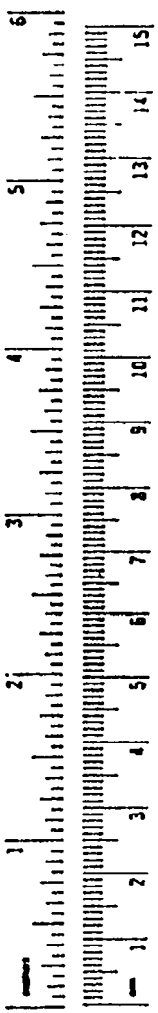
910121

METRIC CONVERSION FACTORS

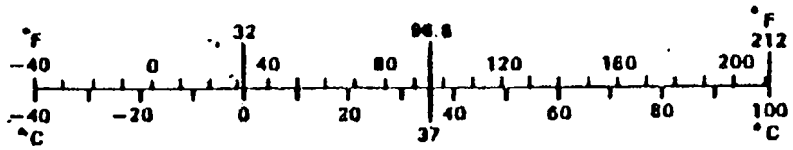
Approximate Conversions to Metric Measures

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



Approximate Conversions from Metric Measures

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



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SECTION 1.0

PURPOSE & TEST PROCEDURE

PURPOSE

This 30 mph flat 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. DTNH22-90-C-21003. The purpose of this test was to determine if the subject vehicle, a 1991 Pontiac LeMans 3-door hatchback, NHTSA No. CM0108, 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," in the flat frontal barrier impact mode.

TEST PROCEDURE

This test was conducted in accordance with NHTSA's Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure No. TP-208-08. Data was obtained relative to FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Mounting"; FMVSS 219 (partial), "Windshield Zone Intrusion"; and FMVSS 301, "Fuel System Integrity," performance.

The test vehicle was instrumented with seven (7) accelerometers to measure longitudinal axis accelerations. The vehicle's specified impact velocity range was 28.9 to 29.9 mph. The vehicle impacted a flat frontal barrier.

The test vehicle contained two (2) Part 572 E 50th percentile adult male anthropomorphic test devices (dummies). The dummies were positioned in the front outboard designated seating positions according to the dummy placement procedure specified in Appendix B and Optional Appendix C of the Laboratory Test Procedure.

Both dummies were instrumented with head and chest accelerometers to measure longitudinal, lateral, and vertical accelerations, and with left and right femur load cells to measure axial forces. The Part 572 E dummy's instrumentation also included a chest potentiometer to measure longitudinal displacement.

The twenty-five (25) data channels were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 8000 samples per second and processed per sections 12.8 and 12.9 of the Laboratory Test Procedure.

The crash event was recorded by one (1) real-time panning motion picture camera and fourteen (14) high-speed motion picture cameras. The pre-test and post-test conditions were recorded by one (1) real-time motion picture camera.

The vehicle and occupant data are summarized in Section 2.0. The FMVSS 208, 212, 219 (partial) and 301 data are presented in Section 3.0. The vehicle, occupant, and camera measurements are presented in Section 4.0. Appendix A contains the still photographic prints. Appendix B contains the dummy and vehicle data plots.

SECTION 2.0

FRONTAL BARRIER IMPACT TEST SUMMARY

TEST RESULTS SUMMARY

This flat frontal barrier test was conducted at TRC on January 21, 1991.

The test vehicle, a 1991 Pontiac LeMans 3-door hatchback, NHTSA No. CM0108, appeared to comply with the performance requirements of FMVSS test Nos. 208, 212, 219 (partial), and 301 in the flat frontal barrier impact mode. The Head Injury Criteria (HIC) calculations were less than 1000, the chest resultant accelerations 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 E dummies seated in the front outboard designated seating positions. For the Part 572 E dummies, the chest displacement did not exceed 3.0 inches. The vehicle's restraint system met the applicable comfort and convenience requirements. The windshield periphery retention was 100 percent. There was no penetration into any portion of the windshield. No fluid spilled from the vehicle's fuel system following the impact or during the static rollover test.

The test vehicle was equipped with a 1.6 liter, transverse engine, manual transmission, and power brakes. The vehicle's test weight was 2628 pounds. The vehicle's impact speed was 29.3 mph. The vehicle's maximum crush was 21.3 inches.

The driver's head injury criteria (HIC) was 647. The driver's maximum chest resultant acceleration over three (3) milliseconds was 50.3 g. The driver's chest displacement was 0.8 inches. The driver's maximum left and right femur forces were 2115 pounds and 1762 pounds, respectively.

The right front passenger's HIC was 588. The right front passenger's maximum chest resultant acceleration over three (3) milliseconds was 48.2 g. The right front passenger's chest displacement was 1.2 inches. The right front passenger's maximum left and right femur forces were 1288 pounds and 1821 pounds, respectively.

There was no loss of windshield periphery retention.

There was no intrusion through the windshield.

There was no fluid spillage from the vehicle's fuel system following the crash test event or during the static rollover test.

TABLE 1 CRASH TEST SUMMARY

NHTSA NO.: CM0108 TEST TYPE: Frontal Barrier Impact

TEST DATE: 01/21/91 TEST TIME: 1333 AMBIENT TEMP. (°F): 72

VEHICLE YEAR/MAKE/MODEL/BODY STYLE: 1991 Pontiac LeMans 3-door hatchback

VEHICLE TEST WEIGHT (LBS): 2628

IMPACT ANGLE (DEG)*: 0

IMPACT VELOCITY (MPH)**: PRIMARY = 29.3 SECONDARY = 29.4

MAXIMUM STATIC CRUSH (IN): 21.3

AVERAGE REBOUND (IN): 25.6

DUMMIES:	Driver #314	Passenger #230
TYPE:	Part 572 E	Part 572 E
LOCATION:	Left front	Right front
RESTRAINT:	2-point passive belt	2-point passive belt

NUMBER OF DATA CHANNELS: 25

NUMBER OF CAMERAS: HIGH-SPEED 14 REAL-TIME 2

*With respect to tow track centerline.
**Speed trap measurement (± .05 mph accuracy)

TABLE 2 TEST VEHICLE INFORMATION

VEHICLE MANUFACTURER: Daewoo Motor Company, Ltd.

MAKE/MODEL: Pontiac/LeMans VIN: KL2TX2462MB301238

BODY STYLE: 3-door hatchback MODEL YEAR: 1991

NHTSA NO.: CM0108 COLOR: Red

ENGINE DATA: TYPE: transverse CYLINDERS: 4 DISPLACEMENT: 1.6 liter

TRANSMISSION DATA: 4 SPEED, X MANUAL, ___AUTOMATIC, X FWD, ___RWD, ___4WD

DATE VEHICLE RECEIVED: 11/06/90 ODOMETER READING: 60.5

DEALER'S NAME AND ADDRESS: Dennis Pontiac Inc.
2900 Morse Road
Columbus, OH 43229

ACCESSORIES:

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

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

CERTIFICATION DATA FROM VEHICLE'S LABEL:

VEHICLE ALTERED BY: Daewoo Motor Company, Ltd.

DATE OF MANUFACTURE: 07-90 VIN: KL2TX2462MB301238

GVWR: 3141 LBS

GAWR: FRONT: 1565 LBS., REAR: 1576 LBS.

TABLE 2 TEST VEHICLE INFORMATION CONT'D

TIRES ON VEHICLE (MFR., LINE, SIZE): Uniroyal Tiger Paw P175/70R13

TIRE PRESSURE WITH MAXIMUM CAPACITY VEHICLE LOAD: FRONT: 35 PSI
REAR: 35 PSI

SPARE TIRE (MFR., LINE, SIZE): Uniroyal Tiger Paw P175/70R13

TYPE OF SEATS: FRONT: Bucket
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manual adjustable

MAXIMUM WIDTH: 65.2 INCHES

WHEELBASE: 99.5 INCHES

LOCATION OF LABEL STATING TIRE & CAPACITY DATA: THE LABEL WAS LOCATED ON THE DRIVER'S DOOR.

TIRE & CAPACITY DATA FROM VEHICLE'S LABEL:

RECOMMENDED TIRE SIZE: FRONT: P175/70R13

RECOMMENDED COLD TIRE PRESSURE: FRONT: 29 PSI; REAR: 26 PSI

DESIGNATED SEATING CAPACITY: 2 FRONT 3 REAR 5 TOTAL

VEHICLE CAPACITY WEIGHT: 880 LBS.

TEST VEHICLE ATTITUDE (ALL MEASUREMENTS ARE IN INCHES):

DELIVERED ATTITUDE:	LF	24.7;	RF	24.5;	LR	23.1;	RR	22.9
FULLY LOADED ATTITUDE:	LF	23.9;	RF	23.9;	LR	21.4;	RR	21.4
PRE-TEST ATTITUDE:	LF	24.1;	RF	24.1;	LR	21.4;	RR	21.5
POST-TEST ATTITUDE:	LF	27.2;	RF	25.1;	LR	22.4;	RR	20.0

TABLE 2 TEST VEHICLE INFORMATION CONT'D

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

RIGHT FRONT	643 LBS.	RIGHT REAR	422 LBS.
LEFT FRONT	688 LBS.	LEFT REAR	423 LBS.
TOTAL FRONT WEIGHT	1331 LBS.	(61.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	845 LBS.	(38.8% OF TOTAL VEHICLE WEIGHT)	
TOTAL DELIVERED WEIGHT	2176 LBS.		

CALCULATION OF TEST VEHICLE'S TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT*

UDW = UNLOADED DELIVERED WEIGHT (2176 LBS)

VCW = VEHICLE CAPACITY WEIGHT (880 LBS)

DSC = DESIGNATED SEATING CAPACITY (5)

RCLW*= VCW - 150 (DSC) = 880 - 150 (5) = 130

TARGET TEST WEIGHT = UDW + RCLW*+ (NO. OF HYBRID III DUMMIES X 167 LBS/DUMMY)

TARGET TEST WEIGHT = 2176 + 130 + 334

TARGET TEST WEIGHT = 2640 LBS

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 118 LBS. OF CARGO WEIGHT:

RIGHT FRONT	716 LBS.	RIGHT REAR	594 LBS.
LEFT FRONT	742 LBS.	LEFT REAR	576 LBS.
TOTAL FRONT WEIGHT	1458 LBS.	(55.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1170 LBS.	(44.5% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	2628 LBS.	(0.4% UNDER TARGET TEST WEIGHT)	

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

COMPONENTS REMOVED TO MEET TARGET TEST WEIGHT: None

CG = 44.3 INCHES REARWARD OF FRONT WHEEL CENTERLINE

*Cargo weight for multi-purpose passenger vehicles, trucks, and buses is the vehicle's rated cargo and luggage weight from the vehicle's label or 300 pounds, whichever is less.

TABLE 3 POST-IMPACT DATA

TEST NUMBER: 910121 NHTSA NO.: CM0108

TEST DATE: 01/21/91 TEST TIME: 1333

TEST TYPE: Frontal Barrier Impact IMPACT ANGLE: 0

AMBIENT TEMPERATURE AT IMPACT AREA: 72° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 70° F

IMPACT VELOCITY: PRIMARY = 29.3 MPH SECONDARY = 29.4 MPH

(SPECIFIED RANGE = 28.9 TO 29.9 MPH)

DISTANCE FROM VEHICLE TO BARRIER: ENTERING VELOCITY TRAP = 26.0 IN.

EXITING VELOCITY TRAP = 2.0 IN.

TEST VEHICLE STATIC CRUSH (ALL MEASUREMENTS ARE IN INCHES):

OVERALL LENGTH OF TEST VEHICLE: PRE-TEST: L 159.4; C 163.8; R 159.8

POST-TEST: L 143.4; C 142.5; R 142.5

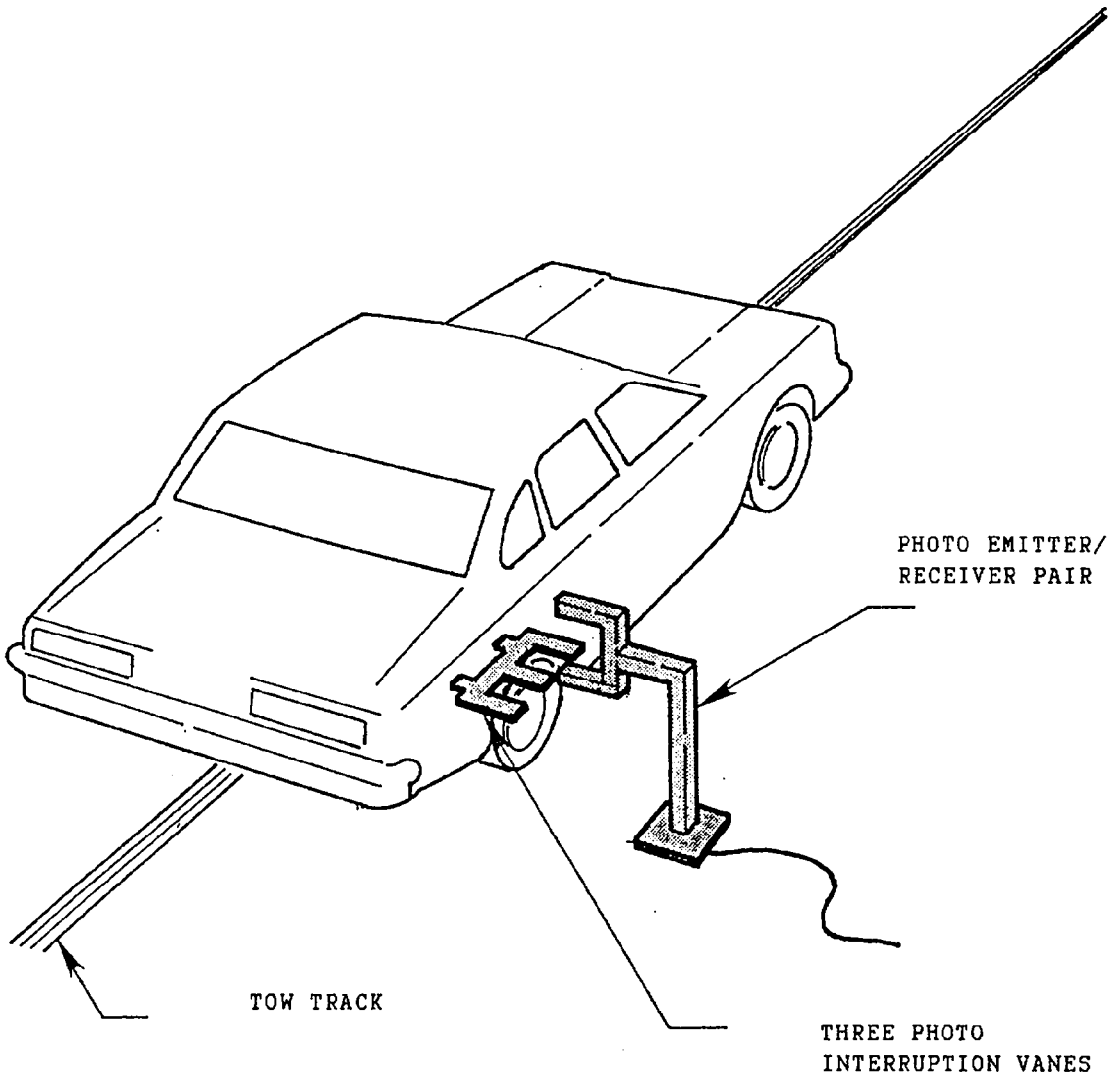
TOTAL CRUSH: L 16.0; C 21.3; R 17.3

AVERAGE CRUSH: 18.2

TEST VEHICLE REBOUND FROM FLAT BARRIER (ALL MEASUREMENTS ARE IN INCHES):

DISTANCE FROM TEST VEHICLE TO BARRIER: L 25.8; C 26.1; R 25.0; AVG. 25.6

FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM



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

The vanes have one foot spacing.

FIGURE 2 ACCIDENT INVESTIGATION DIVISION DATA
FOR 30 MPH FRONTAL BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: Pontiac LeMans 3-door hatchback

VEHICLE NHTSA NO.: CM0108 ; VIN: KL2TX2462MB301238

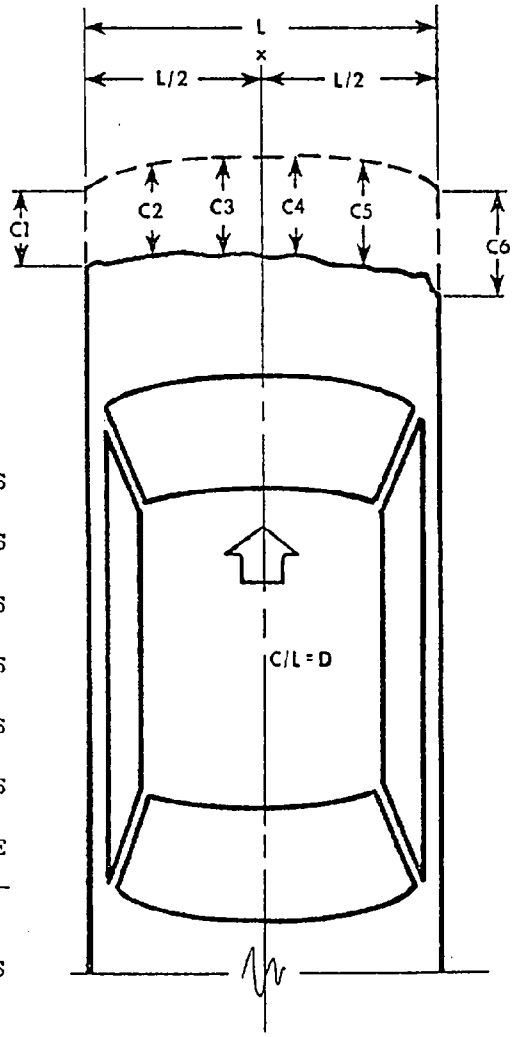
MODEL YEAR: 1991 ; BUILD DATE: 07/90 ; TEST DATE: 01/21/91

VEHICLE SIZE CATEGORY: Compact ; TEST WEIGHT: 2628 LBS.

VEHICLE WHEELBASE: 99.5 INCHES

MAXIMUM WIDTH: 65.2 INCHES

FRONT OVERHANG: 31.5 INCHES



COLLISION DEFORMATION
CLASSIFICATION (CDC) CODE: 12FDEW3

CRUSH DEPTH MEASUREMENTS:

C1 = 16.0 INCHES

C2 = 19.2 INCHES

C3 = 21.3 INCHES

C4 = 21.2 INCHES

C5 = 20.0 INCHES

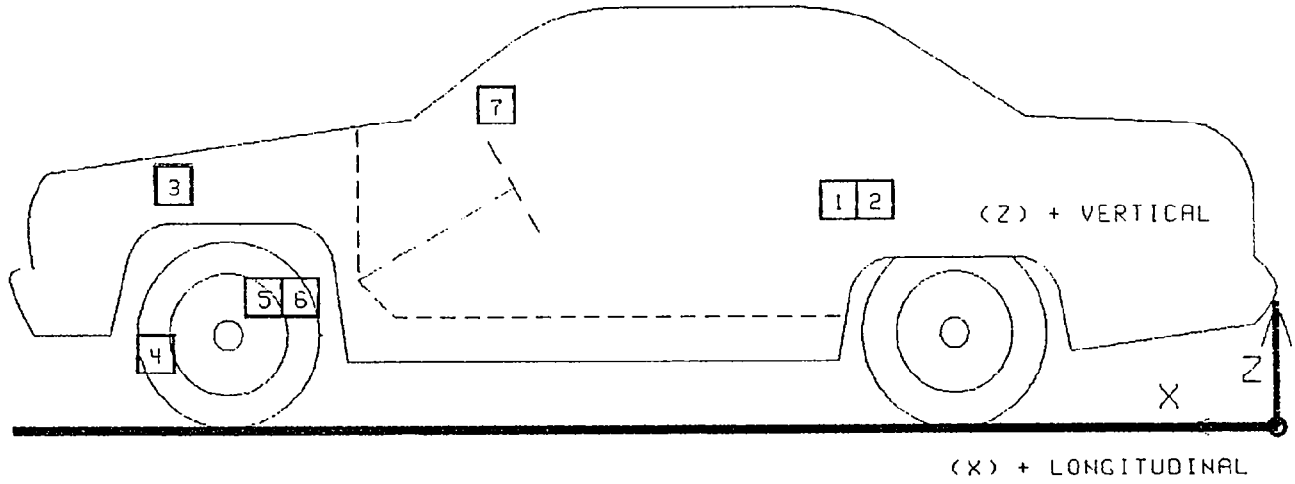
C6 = 17.3 INCHES

MIDPOINT OF DAMAGE: D = VEHICLE CENTERLINE (LONGITUDINAL)

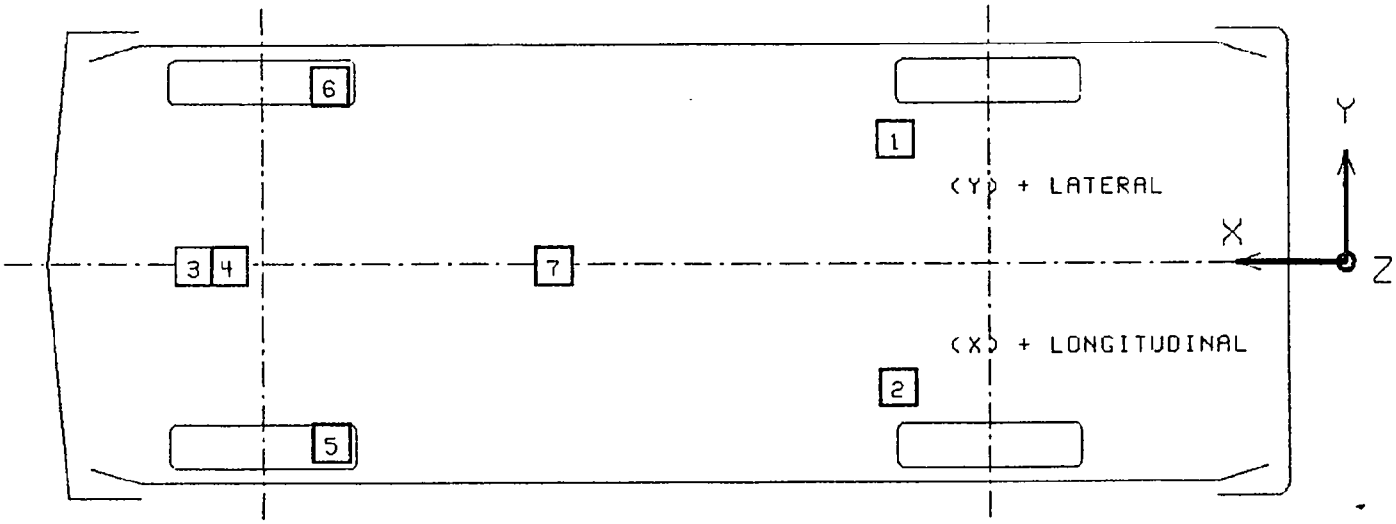
LENGTH OF DAMAGED REGION: L = 54.2 INCHES

FIGURE 3

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

TEST NUMBER 910121

No.	LOCATION		X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	LEFT REAR SEAT CROSSMEMBER	PRE	62.1	23.9	12.2				
		POST	61.5	23.9	13.0				
	LONGITUDINAL					0.7	294.1	30.0	61.6
2	RIGHT REAR SEAT CROSSMEMBER	PRE	61.9	-23.8	12.1				
		POST	61.4	-23.8	11.6				
	LONGITUDINAL					1.6	240.1	30.4	59.1
3	ENGINE TOP	PRE	140.0	-1.5	29.8				
		POST	133.5	-2.0	28.0				
	LONGITUDINAL					56.7	51.0	113.6	36.9
4	ENGINE BOTTOM	PRE	135.5	-0.2	6.1				
		POST	134.0	-1.0	4.8				
	LONGITUDINAL					4.5	71.3	73.7	33.0
5	RIGHT BRAKE CALIPER	PRE	132.6	-25.1	8.4				
		POST	132.8	-24.6	9.8				
	LONGITUDINAL					7.2	74.0	47.3	54.5
6	LEFT BRAKE CALIPER	PRE	132.5	25.1	7.9				
		POST	130.9	24.6	9.6				
	LONGITUDINAL					10.6	64.6	87.8	40.5
7	INSTRUMENT PANEL CENTER	PRE	105.2	-0.8	34.1				
		POST	105.2	-0.8	34.5				
	LONGITUDINAL					35.7	63.1	72.9	75.4

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

REPORT OF VEHICLE CONDITION AT THE
COMPLETION OF TESTING

CONTRACT NO.: DTNH22-90-C-21003
FROM: The Transporation Research Center of Ohio
10820 State Route 347
East Liberty, OH 43319

TO: Mr. Glen Brammeier
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.: CM0108
MAKE/MODEL/BODY STYLE: Pontiac/LeMans/3-door hatchback
MODEL YEAR: 1991 BODY COLOR: Red
VIN: KL2TX2462MB301238
ODOMETER (ARRIVAL): 60.5 DATE: 11/06/90
ODOMETER (COMPLETION): 63.2 DATE: 01/21/91
COST: $7,611.00

___ AIR CONDITIONER	___ CONSOLE	BRAKES: X POWER
___ TINTED GLASS	___ TACHOMETER	FRONT: Disc
___ POWER STEERING	___ SPEED CONTROL	REAR: Disc
___ POWER WINDOWS	X REAR WINDOW DEF.	
___ POWER DOOR LOCKS	___ SUN/MOON ROOF	FRONT SEATS: ___ POWER
X RADIO AM/FM TAPE	___ T-TOP	SEAT TYPE: Bucket
X CLOCK	___ TILT STEERING WHEEL	NO. OF SEATS: 5
___ ROOF RACK	X OTHER OPTIONS: Cassette, front and rear floor mats	

ENGINE: 4 CYLINDERS; 1.6 LITERS
TRANSMISSION: 4-speed manual; DRIVE TYPE: Front wheel
TIRE SIZE: P175/70R13
GASOLINE TYPE: Unleaded

EQUIPMENT THAT IS NO LONGER ON THE VEHICLE AS NOTED ABOVE: None

EXPLANATION: NA

VEHICLE CONDITION: Vehicle was subjected to a 30 mph frontal impact test.

SECTION 3.0

FMVSS 208, 212, 219 (partial), & 301 DATA

TABLE 5 DUMMY INJURY CRITERIA

MAXIMUM ACCELERATION (G)

	HEAD				CHEST			
	X	Y	Z	R	X	Y	Z	R*
DRIVER	-40.8	7.8	-60.9	72.3	-51.8	-7.5	12.2	50.3
PASSENGER	58.0	-13.6	-54.6	66.5	-48.5	8.7	10.4	48.2

MAXIMUM FEMUR COMPRESSIVE FORCE (LBS)

	LEFT FEMUR	RIGHT FEMUR
DRIVER	2115	1762
PASSENGER	1288	1821

HEAD INJURY CRITERIA**

	HIC	TIME t_1 (MSEC)	TIME t_2 (MSEC)
DRIVER	647	72.0	108.0
PASSENGER	588	72.1	108.1

MAXIMUM CHEST DISPLACEMENT (IN)	
DRIVER	0.8
PASSENGER	1.2

*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

TABLE 6 POST-IMPACT DUMMY/VEHICLE DATA

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #314	PASSENGER #230
HEAD	Chest	Chest
CHEST	None	None
ABDOMEN	None	None
LEFT KNEE	Instrument panel	Instrument panel
RIGHT KNEE	Instrument panel	Instrument panel

DOOR OPENING:

	LEFT	RIGHT
FRONT	Easy	Easy
REAR	NA	NA

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
FRONT	None	None
REAR	NA	NA

GLAZING DAMAGE:

None

OTHER NOTABLE IMPACT EFFECTS:

None

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, contacting the dummy's chest, as the dummy's chest was restrained by the two-point passive belt. The dummy's head rotated rearward into the head restraint as the dummy 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, contacting the dummy's chest, as the dummy's chest was restrained by the two-point passive belt. The dummy's head rotated rearward into the head restraint 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.

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA FOR AUTOMATIC SEAT BELTS

MAKE/MODEL: Pontiac/LeMans VIN: KL2TX2462MB301238

BODY STYLE: 3-door hatchback NHTSA NO.: CM0108

DATE OF MANUFACTURE: 07/90

CONVENIENCE HOOKS:

DEVICE TO STOW SEAT BELT WEBBING TO FACILITATE ENTERING OR EXITING THE VEHICLE AUTOMATICALLY RELEASES THE WEBBING WHEN THE IGNITION IS TURNED TO THE "ON" OR "START" POSITION AND (check one):

_____ The vehicle's drivetrain is engaged

_____ The vehicle's parking brake is in the released mode

_____ Not applicable, the vehicle's restraint system does not include convenience hooks or devices to stow seat belt webbing.

__X__ The webbing is placed in position whenever the ignition is "ON".

WEBBING TENSION - RELIEVING DEVICE:

DO OUTBOARD SEATING POSITION SEAT BELTS HAVE WEBBING TENSION - RELIEVING DEVICES? __No___

BELT CONTACT FORCE:

BELT CONTACT FORCE ON CHEST OF TEST DUMMY: __.1__ POUNDS

TABLE 8 FMVSS 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 = 8 sec.

Duration of reminder light operation = 10 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 = 2 sec.

WORDING OF VISUAL WARNING:

Fasten Seat Belt	_____
Fasten Belt	_____
Symbol 101-80	_____
Lap belts	X

TABLE 9 FMVSS 208 LABELING AND DRIVER'S MANUAL DATA

DESCRIBE LOCATION OF LABEL WHICH DESCRIBES MANUFACTURER'S MAINTENANCE OR REPLACEMENT SCHEDULE FOR CRASH-DEPLOYED OCCUPANT PROTECTON SYSTEM:

__X__ NOT APPLICABLE, VEHICLE DID NOT CONTAIN A CRASH-DEPLOYED OCCUPANT PROTECTION SYSTEM.

TABLE 10 FMVSS 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.

__X__ NOT APPLICABLE, VEHICLE DID NOT CONTAIN A CRASH-DEPLOYED OCCUPANT PROTECTION SYSTEM.

FIGURE 4 FMVSS 212 TEST DATA

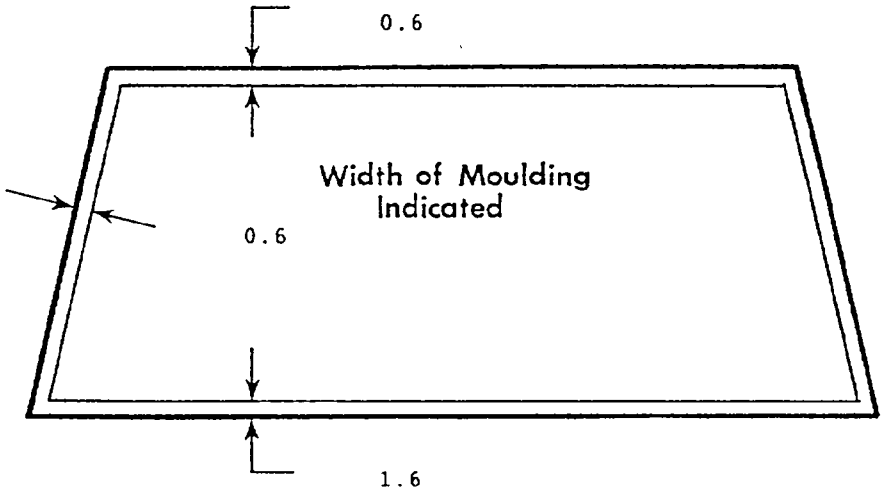
DETAILS OF WINDSHIELD MOUNTING SUCH AS RETENTION METHOD, TRIM TYPE, ETC.:
Adhesive around inner perimeter, plastic trim around outer perimeter.

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.

WINDSHIELD PERIPHERY MEASUREMENTS:

	PRE-TEST	POST-TEST	PERCENT RETENTION
RIGHT SIDE	74.2	74.2	100%
LEFT SIDE	74.2	74.2	100%
TOTAL	148.4	148.4	100%

PRE-TEST WINDSHIELD MOUNTING MATERIAL TEMPERATURE: 70° F



FRONT VIEW OF WINDSHIELD*

LOSS OF WINDSHIELD RETENTION LENGTHS: None

ALL DISTANCE MEASUREMENTS ARE IN INCHES.
*INDICATE AREAS OF LOSS OF RETENTION, IF ANY, ON WINDSHIELD DIAGRAM.

FIGURE 5 FMVSS 219 TEST DATA

PROTECTED ZONE LOWER EDGE REQUIREMENT:

The lower edge of the protected zone is determined by placing a 6.5 inch diameter 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 0.5 inch 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.

WINDSHIELD MEASUREMENTS:

A = 43.5

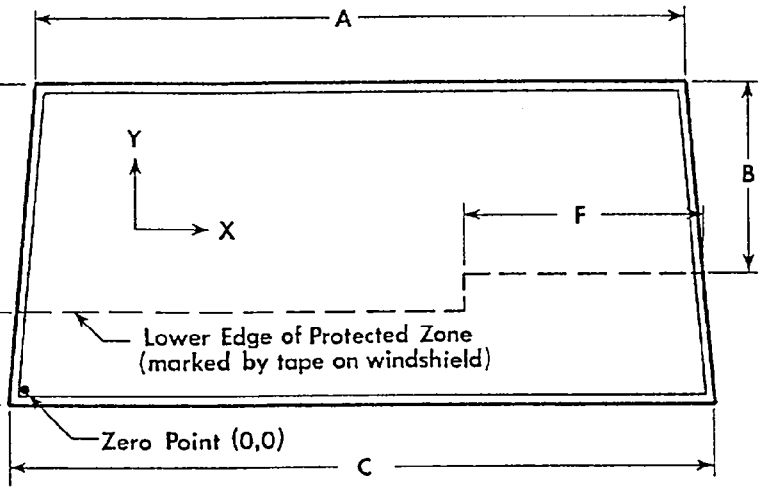
B = 17.5

C = 55.9

D = 27.2

E = 19.1

F = 21.8



FRONT VIEW

METHOD OF ADHERING PROTECTED ZONE TEMPLATE TO WINDSHIELD: NA

AREAS OF WINDSHIELD TEMPLATE PENETRATION GREATER THAN 0.25 IN.: NA

	COORDINATES X	Y
1.		
2.		
3.		

AREAS OF WINDSHIELD PENETRATION, BELOW THE PROTECTED ZONE, THROUGH THE INNER SURFACE OF THE WINDSHIELD: None

1.
2.
3.

ALL MEASUREMENTS ARE IN INCHES.

TABLE 11 FUEL SYSTEM DATA

MAKE/MODEL: Pontiac LeMans NHTSA NO.: CM0108

FUEL SYSTEM CAPACITY: 13.0 GALLONS (FROM OWNER'S MANUAL)

USABLE CAPACITY: 12.8 GALLONS (FURNISHED BY COTR)

TEST VOLUME RANGE: 11.8 GALLONS TO 12.0 GALLONS (92-94% OF USABLE)

ACTUAL TEST VOLUME: 11.9 GALLONS (WITH ENTIRE FUEL SYSTEM FILLED)

TEST FLUID TYPE: STODDARD SOLVENT

SPECIFIC GRAVITY: 0.764

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

TEST FLUID COLOR: PURPLE

DETAILS OF FUEL SYSTEM: The fuel tank is located in front of the rear axle. The fuel filler neck is located on the right side and enters the rear of the tank. The fuel lines run along the right sill to the front.

ELECTRIC FUEL PUMP: Yes FUEL INJECTION: Yes

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

TABLE 12 FMVSS 301 POST-IMPACT TEST DATA

TEST VEHICLE NHTSA NO.: CM0108 ; TEST DATE: 01/21/91

VEHICLE MAKE/MODEL/BODY STYLE: Pontiac LeMans 3-door hatchback

TEST REQUIREMENTS:

Test vehicle fuel tank filled to 92 to 94% of manufacturer's usable 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 SYSTEM FLUID SPILLAGE MEASUREMENTS:

	TEST RESULTS	MAXIMUM ALLOWABLE
1. FROM IMPACT UNTIL VEHICLE MOTION CEASES - - -	0 OZ.	1 OZ.
2. 5 MINUTE PERIOD AFTER VEHICLE MOTION CEASES -	0 OZ.	5 OZ.
3. NEXT 25 MINUTES AFTER 5 MINUTE PERIOD - - - -	0 OZ.	1 OZ./1 MIN.

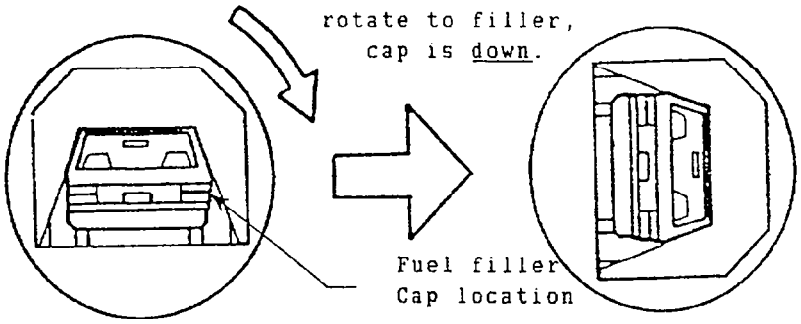
FUEL SYSTEM FLUID SPILLAGE LOCATION(S):

None

FIGURE 6 FMVSS 301 STATIC ROLLOVER TEST DATA

NHTSA NO.: CM0108

TEST PHASE 0° 90°



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

FUEL SYSTEM FLUID SPILLAGE MEASUREMENTS:

0° TO 90° ROTATION (FUEL FILLER CAP DOWN)	TEST RESULTS	MAXIMUM ALLOWABLE
1. FIRST 5 MINUTES FROM ONSET OF ROTATION - - - - - - - - -	0 oz.	5 oz.
2. 6TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - - -	0 oz.	1 oz.
3. 7TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - - -	0 oz.	1 oz.

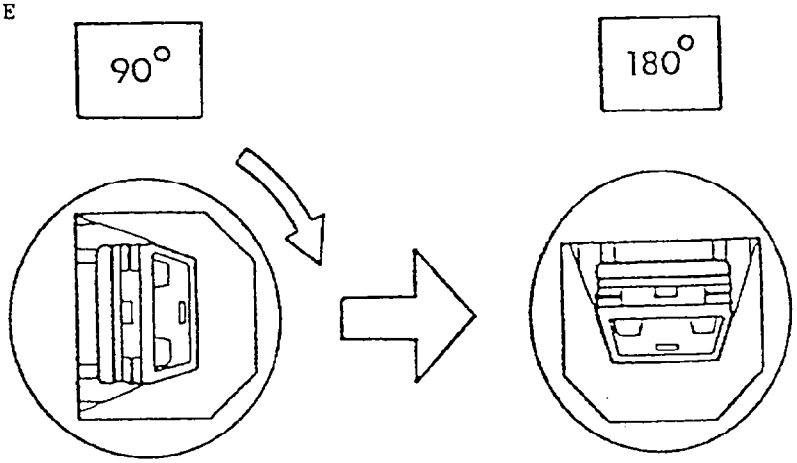
FUEL SYSTEM FLUID SPILLAGE LOCATION(S):

None

FIGURE 6 FMVSS 301 STATIC ROLLOVER TEST DATA, CONT'D.

NHTSA NO.: CM0108

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

FUEL SYSTEM FLUID SPILLAGE MEASUREMENTS:

90° TO 180° ROTATION	TEST RESULTS	MAXIMUM ALLOWABLE
1. FIRST 5 MINUTES FROM ONSET OF ROTATION - - - - - - - -	0 oz.	5 oz.
2. 6TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - -	0 oz.	1 oz.
3. 7TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - -	0 oz.	1 oz.

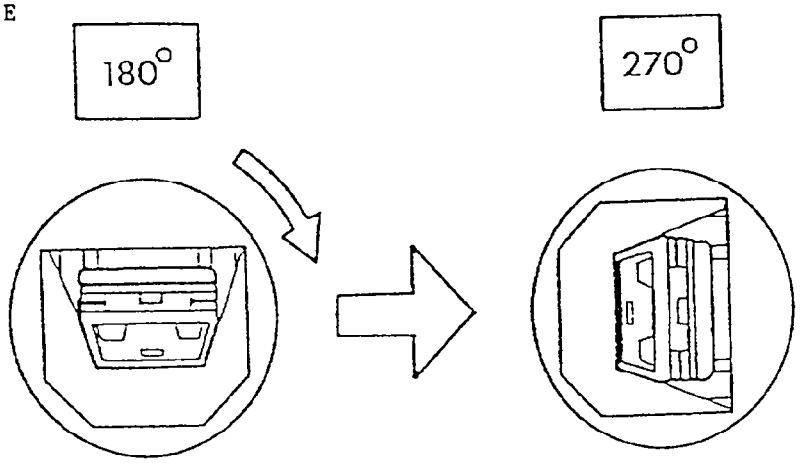
FUEL SYSTEM FLUID SPILLAGE LOCATION(S):

None

FIGURE 6 FMVSS 301 STATIC ROLLOVER TEST DATA, CONT'D.

NHTSA NO.: CM0108

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

FUEL SYSTEM FLUID SPILLAGE MEASUREMENTS:

180° TO 270° ROTATION	TEST RESULTS	MAXIMUM ALLOWABLE
1. FIRST 5 MINUTES FROM ONSET OF ROTATION - - - - - - - - -	0 oz.	5 oz.
2. 6TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - - -	0 oz.	1 oz.
3. 7TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - - -	0 oz.	1 oz.

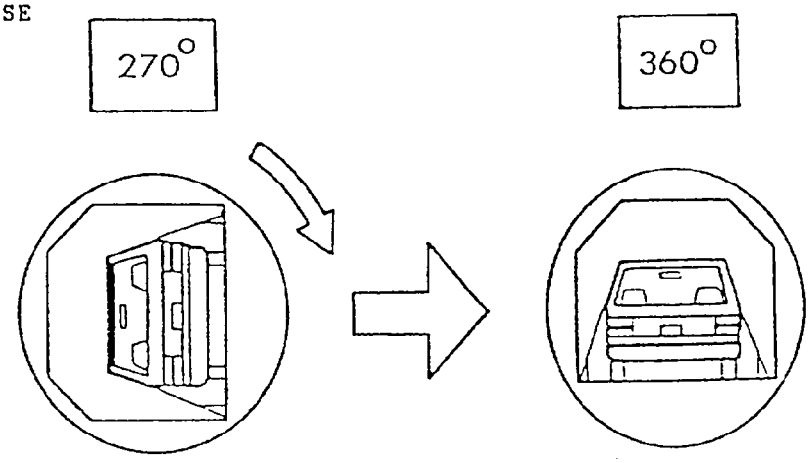
FUEL SYSTEM FLUID SPILLAGE LOCATION(S):

None

FIGURE 6 FMVSS 301 STATIC ROLLOVER TEST DATA, CONT'D.

NHTSA NO.: CM0108

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

FUEL SYSTEM FLUID SPILLAGE MEASUREMENTS:

270° TO 360° ROTATION	TEST RESULTS	MAXIMUM ALLOWABLE
1. FIRST 5 MINUTES FROM ONSET OF ROTATION - - - - - - - -	0 oz.	5 oz.
2. 6TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - -	0 oz.	1 oz.
3. 7TH MINUTE FROM ONSET OF ROTATION - - - - - - - - - -	0 oz.	1 oz.

FUEL SYSTEM FLUID SPILLAGE LOCATION(S):

None

SECTION 4.0

VEHICLE, OCCUPANT, AND CAMERA MEASUREMENTS

FIGURE 7

PRE-TEST AND POST-TEST MEASUREMENT POINTS

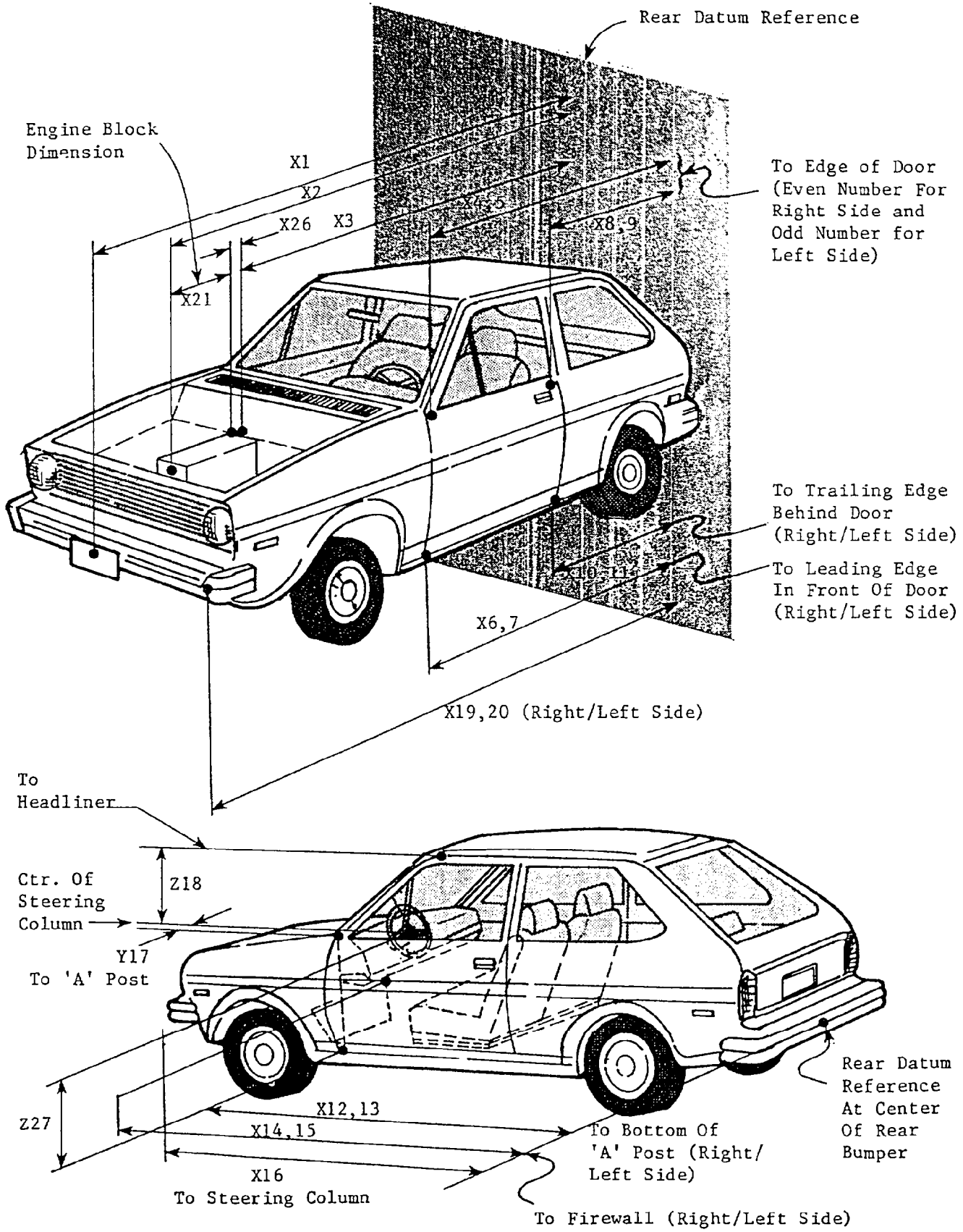


TABLE 13 IMPACTED VEHICLE MEASUREMENTS

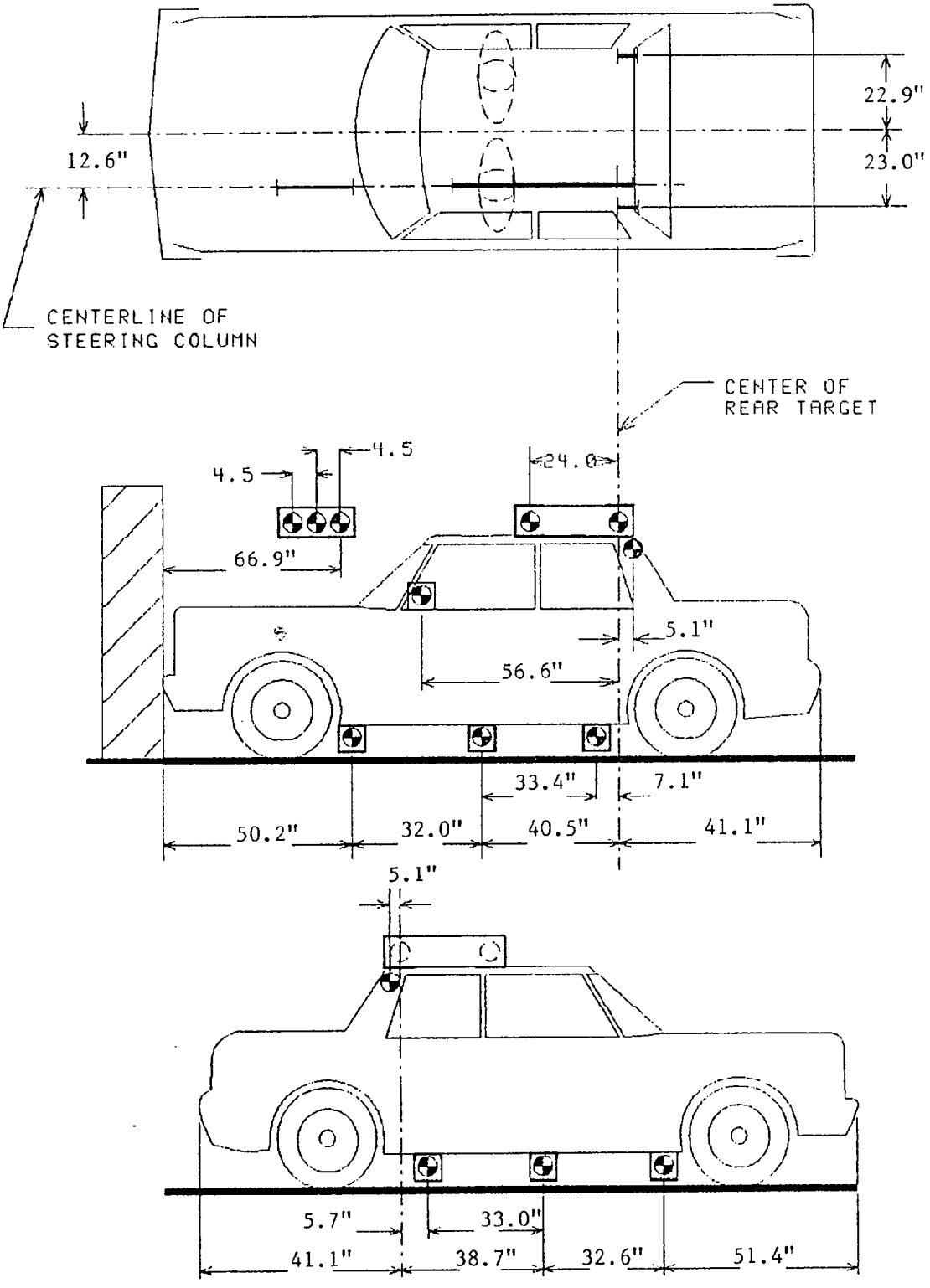
VEHICLE MAKE/MODEL: Pontiac/LeMans TEST NUMBER: 910121

ALL MEASUREMENTS ARE IN INCHES

NO.	TYPE OF MEASUREMENT	PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	163.8	142.5	21.3
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	142.1	135.0	7.1
X3	REAR SURFACE OF VEHICLE TO FIREWALL	123.5	122.5	1.0
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	108.5	109.0	-0.5
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	108.6	109.0	-0.4
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	108.3	108.0	0.3
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	108.6	108.0	0.6
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	62.6	63.1	-0.5
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	62.8	63.1	-0.3
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	62.1	61.5	0.6
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	62.3	61.8	0.5
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	107.7	107.0	0.7
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	107.8	107.4	0.4
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	119.2	118.6	0.6
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	119.5	118.8	0.7
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	93.1	92.9	0.2
X17	CENTER OF STEERING COLUMN TO "A" POST	11.5	10.2	1.3
X18	CENTER OF STEERING COLUMN TO HEADLINER	17.4	15.2	2.2
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	159.8	142.5	17.3
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	159.4	143.4	16.0
X21	LENGTH OF ENGINE BLOCK	19.0	19.0	0.0

FIGURE 8

VEHICLE TARGET LOCATIONS



ALL DISTANCE MEASUREMENTS ARE IN INCHES.

FIGURE 9 DUMMY AND SEAT POSITIONING DATA

PRE-IMPACT DATA:

MAKE/MODEL: Pontiac/LeMans

BODY STYLE: 3-door hatchback MODEL YEAR: 1991

NHTSA NO.: CM0108 COLOR: Red

DATA FROM CERTIFICATION LABEL:

VEHICLE MANUFACTURER: Daewoo Motor Company

DATE OF MANUFACTURE: 07/90 VIN: KL2TX2462MB301238

GVWR: 3141 LBS.; GAWR: FRONT = 1565 LBS.; REAR = 1576 LBS.

POST-IMPACT DATA:

DATE OF TEST: 01/21/91 TIME: 1333 TEMPERATURE: 72° F

IMPACT VELOCITY: PRIMARY = 29.3 MPH SECONDARY = 29.4 MPH

REQUIRED IMPACT VELOCITY RANGE: 28.9 TO 29.9 MPH

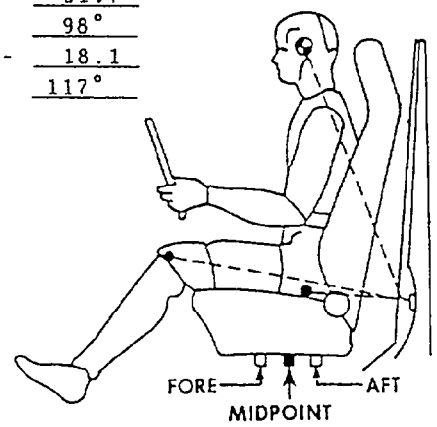
SEAT TYPE: Bucket ADJUSTER TYPE: Manual

FRONT SEAT BACK TYPE: Manual adjustable

TECHNICIANS: S. Ericksen, B. Fishbaugh, & P. Cummins

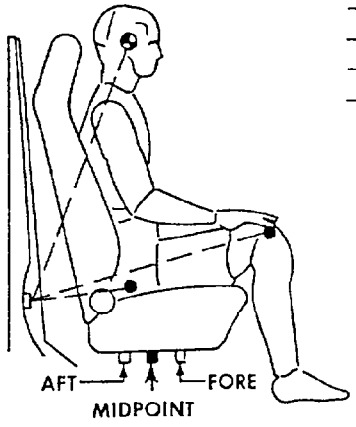
DRIVER DUMMY # 314 TYPE: HIII

HEAD	20.9
TARGET	58°
KNEE	31.7
JOINT	98°
APPROX-IMATE "H" POINT	18.1 / 117°

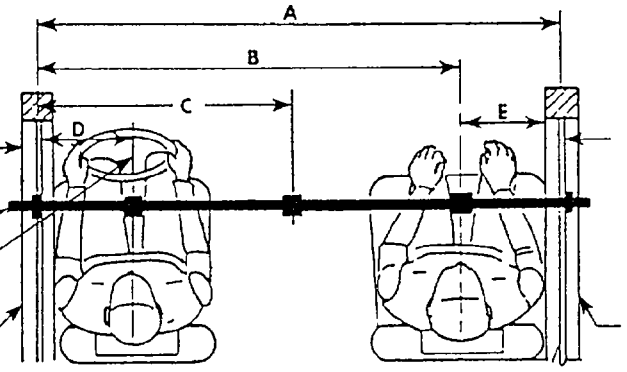


PASSENGER DUMMY # 230 TYPE: HIII

20.9	HEAD
57°	TARGET
32.3	KNEE
98°	JOINT
15.1 / 118°	APPROX-IMATE "H" POINT



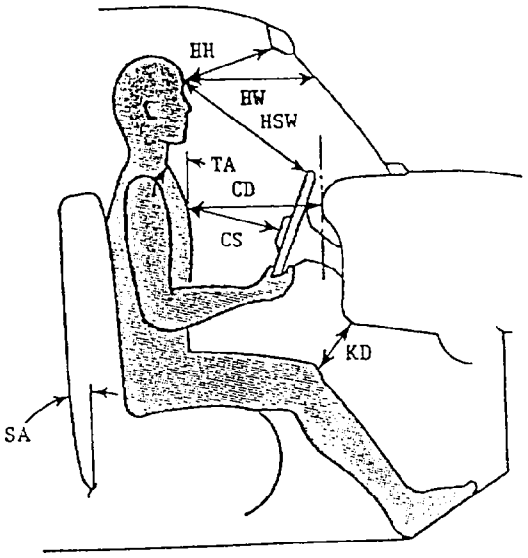
A = 51.2
B = 38.4
C = 25.6
D = 12.6
E = 12.8
DOOR GLASS HEIGHT = 8.9



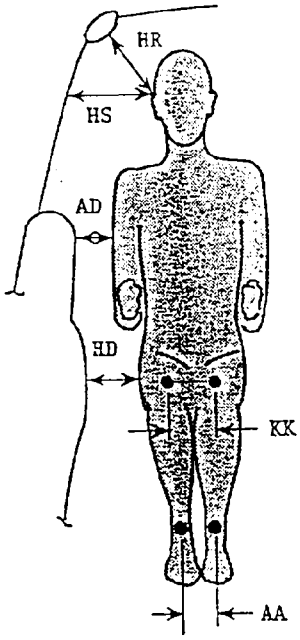
ALL ANGLES ARE RELATIVE TO VERTICAL PLANE THROUGH DOOR STRIKER.
ALL DISTANCE MEASUREMENTS ARE IN INCHES.

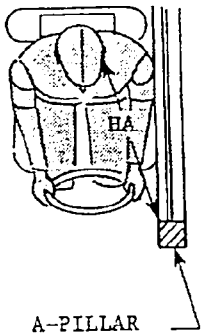
FIGURE 10 DUMMY IN VEHICLE POSITIONING DATA

	DRIVER	PASSENGER
HH	14.0	13.1
HW	21.2	20.9
CD	21.7	21.9
CS	15.1	NA
KDL	6.0	5.4
KDR	6.2	5.2
TA	17°	21°
SA	22°	22°
HSW	20.8	NA



	DRIVER	PASSENGER
HR	6.5	6.8
HS	9.8	9.7
AD	4.4	4.2
HD	6.7	6.8
KK	8.5	8.0
AA	9.5	8.0
HA	21.1	20.2





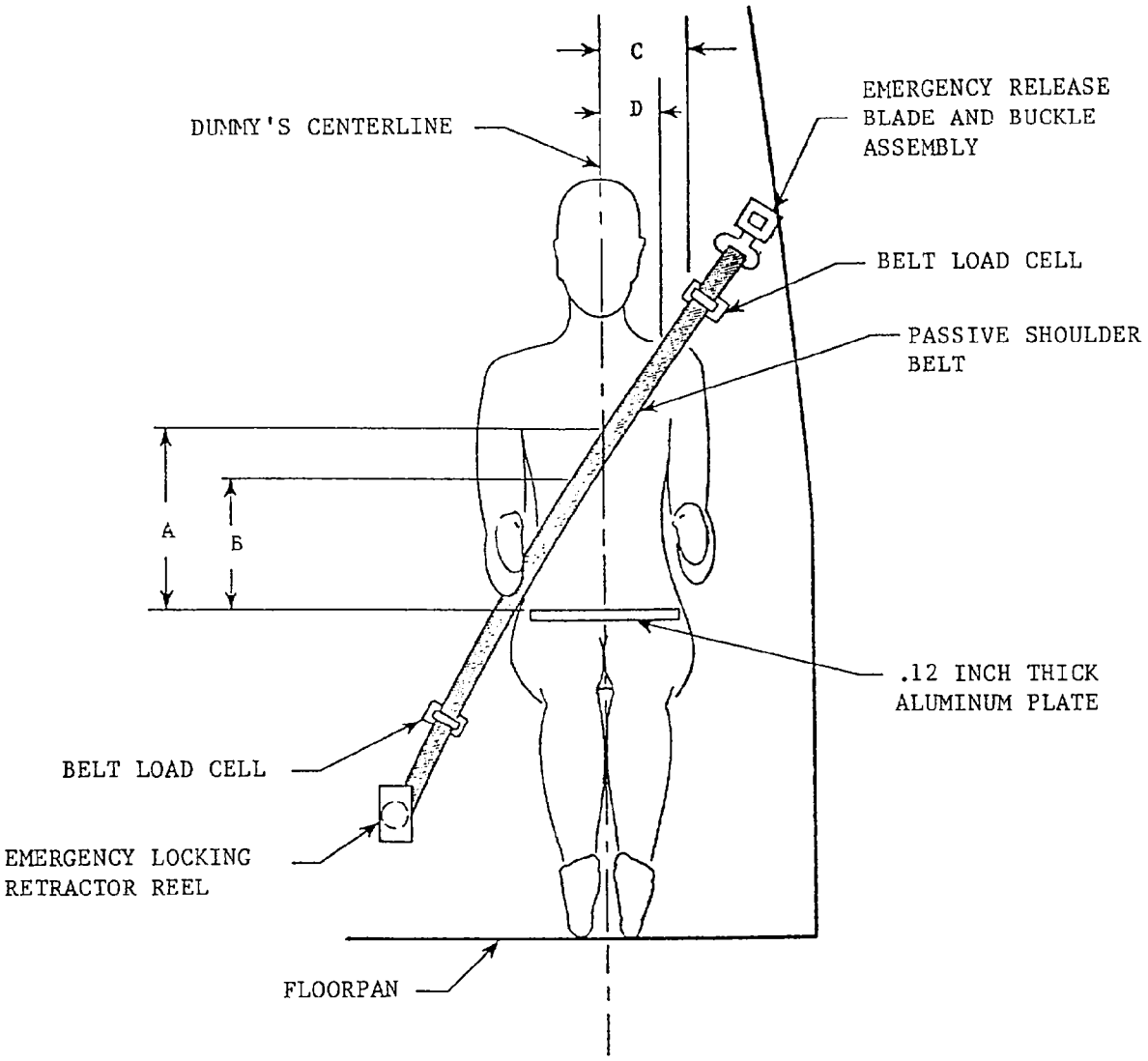
KNEE OUTER CLEVIS TO OUTER CLEVIS SPACING:
DRIVER = 10.6
PASSENGER = 10.6
PELVIS ANGLE:
DRIVER = 25°
PASSENGER = 25°

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
HSW= HEAD TO STEERING WHEEL

HR = HEAD C.G. TARGET TO SIDE ROOF HEADER
HS = HEAD C.G. TARGET TO SIDE WINDOW
AD = ARM TO DOOR
HD = HIP TO DOOR
KK = KNEE TO KNEE
AA = ANKLE TO ANKLE
HA = HEAD C.G. TARGET TO A-PILLAR

TORSO AND SEAT BACK ANGLES ARE RELATIVE TO VERTICAL.
ALL DISTANCE MEASUREMENTS ARE IN INCHES.

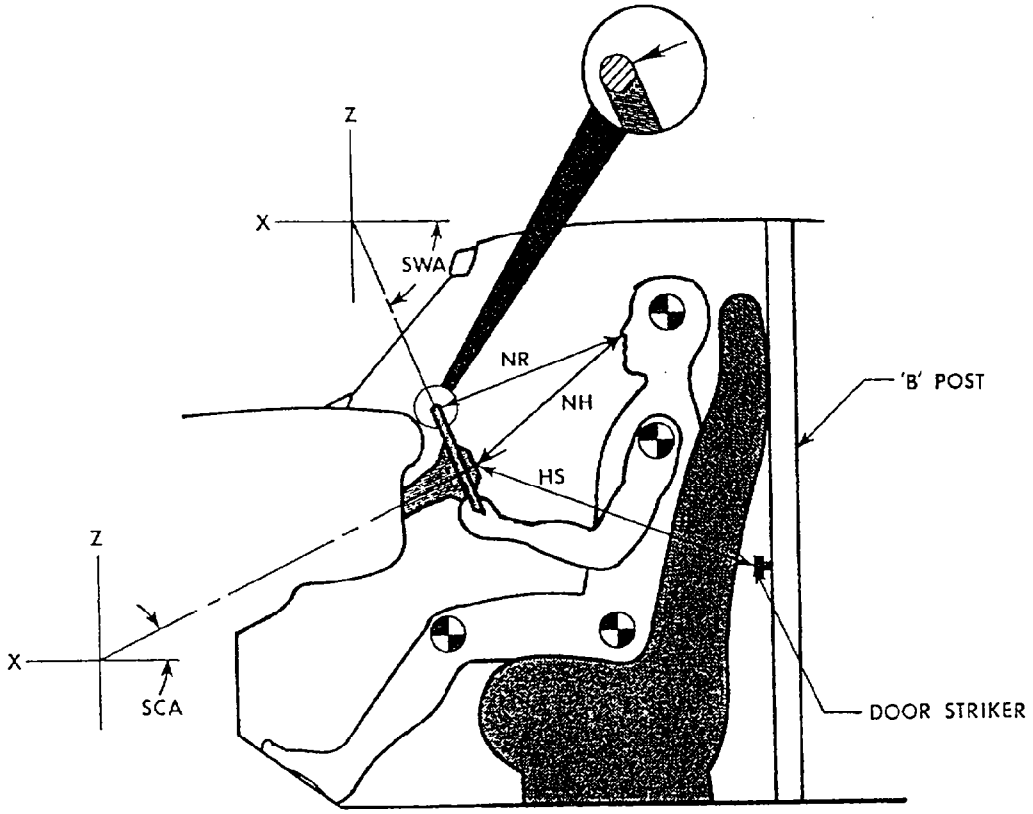
FIGURE 11 SEAT BELT POSITIONING DATA



	DRIVER DUMMY	PASSENGER DUMMY
A - Top surface of alum. plate to belt upper edge (in)	14.9	14.0
B - Top surface of alum. plate to belt lower edge (in)	12.5	11.1
C - Dummy centerline to outer edge of belt at chest flesh top (in)	3.7	3.8
D - Dummy centerline to inner edge of belt at chest flesh top (in)	1.2	1.6

ALL MEASUREMENTS ARE IN INCHES.

FIGURE 12 DRIVER DUMMY TO STEERING COLUMN/WHEEL ASSEMBLY DATA

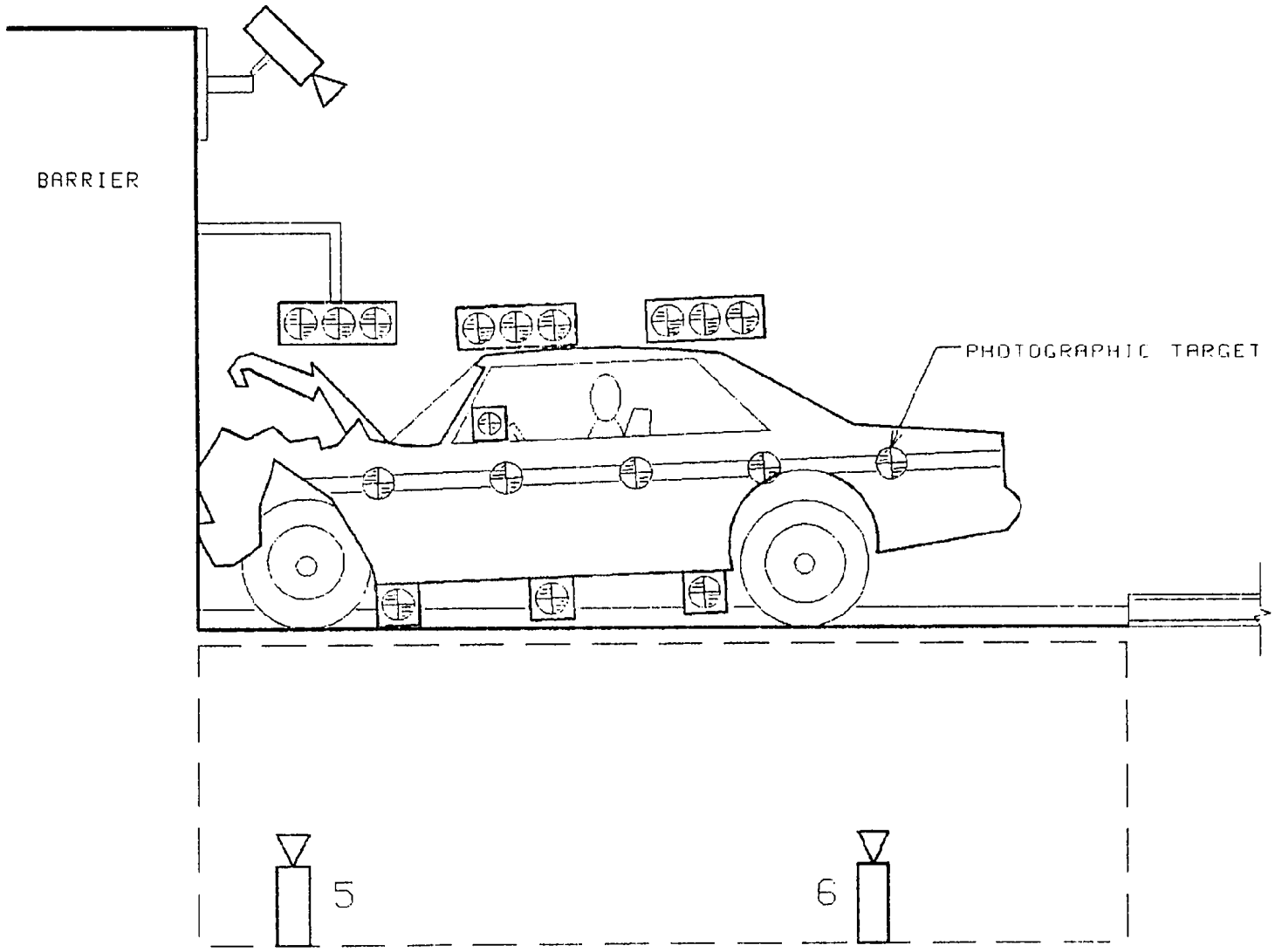


POSITION OF STEERING COLUMN TILTING AND TELESCOPING ADJUSTMENTS, IF ANY:
The steering column was not adjustable.

	MEASUREMENTS
NR - DISTANCE FROM TIP OF DUMMY'S NOSE TO TOP REAR SURFACE OF STEERING WHEEL RIM.	19.0
NH - DISTANCE FROM TIP OF DUMMY'S NOSE TO CENTER OF STEERING COLUMN HUB.	18.9
HS - DISTANCE FROM CENTER OF STEERING COLUMN HUB TO THE FORWARD SURFACE OF THE DOOR LOCK STRIKER PIN.	33.1
SCA - ANGLE OF STEERING COLUMN RELATIVE TO THE HORIZONTAL X AXIS	24°
SWA - ANGLE OF STEERING WHEEL RELATIVE TO THE HORIZONTAL X AXIS	66°

ALL DISTANCE MEASUREMENTS ARE IN INCHES.

4, 7, 8 CAMERA POSITIONS FIGURE 13



CAMERA POSITIONS, CONTINUED FIGURE 13

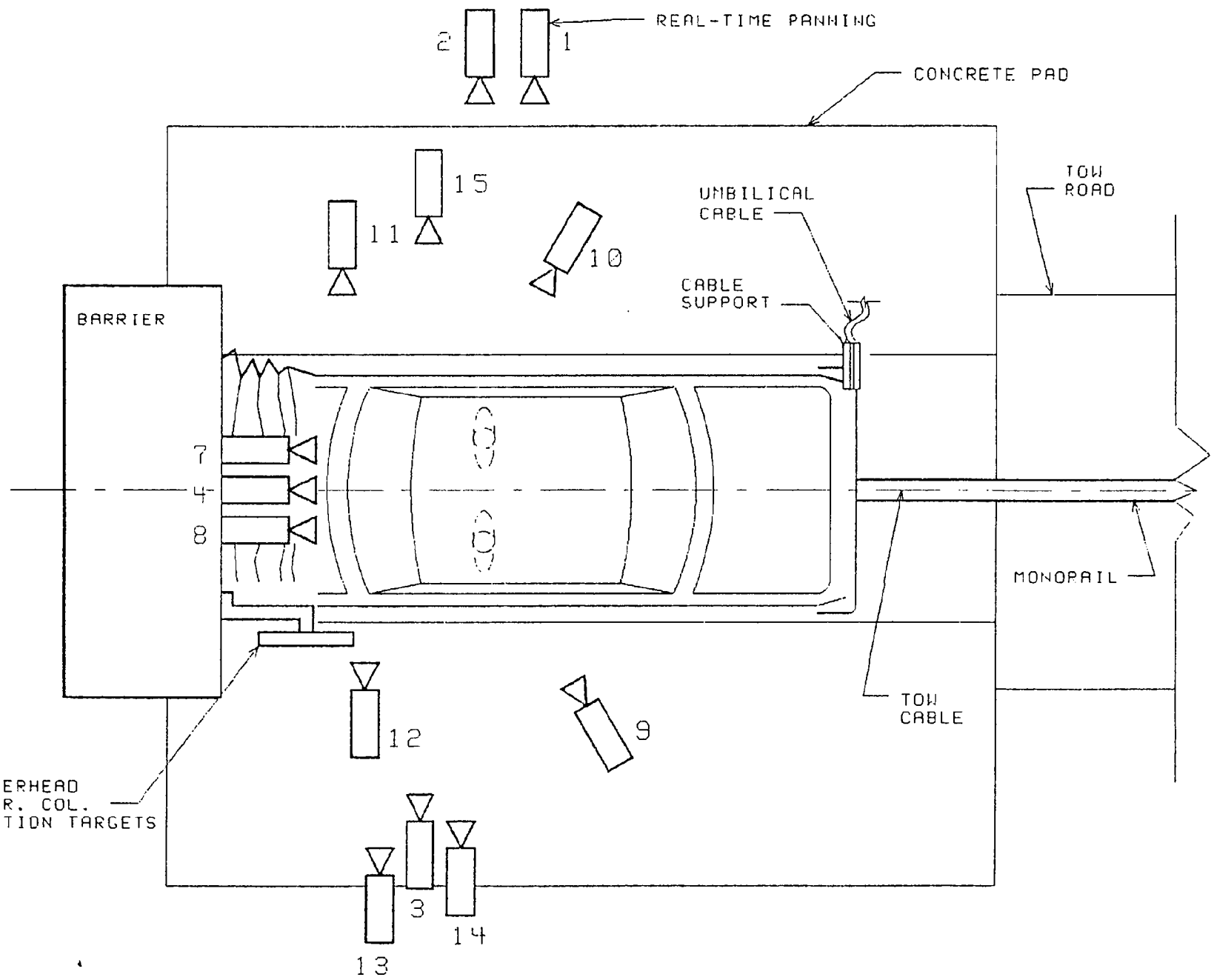


TABLE 14 MOTION PICTURE CAMERA LOCATIONS

TEST NO.: 910121 VEHICLE: Pontiac/LeMans 3-door hatchback

CAMERA NO.	VIEW	CAMERA POSITIONS (IN)* X	Y	Z	ANGLE** (DEG)	FILM PLANE TO HEAD TARGET(IN)	LENS (MM)	FILM SPEED (FPS)
1	Real-time panning	-142.0	-504.0	61.0	NA	NA	16	24
2	Right overall	-81.3	-266.4	37.1	-2	NA	13	485
3	Left vehicle crush	-41.5	295.0	44.0	-4	205.0	25	490
4	Windshield front view	-6.0	0.0	102.0	-40	NA	8.5	498
5	Pit front position	-50.5	0.0	-92.4	90	NA	13	999
6	Pit rear position	-99.3	0.0	-99.0	90	NA	13	1002
7	Passenger front view	-4.5	-13.8	93.0	-50	NA	17	505
8	Driver front view	-6.8	14.5	93.0	-50	NA	17	500
9	Driver kinematics	-157.3	116.0	87.0	-27	84.0	25	498
10	Passenger kinematics	-152.1	-116.0	87.0	-26	80.0	25	498
11	Right windshield intrusion	-38.1	-306.1	44.0	0	NA	50	500
12	Left windshield instrusion	-53.0	309.4	42.3	0	NA	50	500
13	Steering column motion	-106.0	280.0	103.0	-14	NA	25	520
14	Steering column motion	-106.0	280.0	75.1	-9	NA	25	500
15	Passenger kinematics	-38.8	-293.0	45.3	-4	225.0	25	498
16	Real-time documentation	NA	NA	NA	NA	NA	12-120	24

* +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

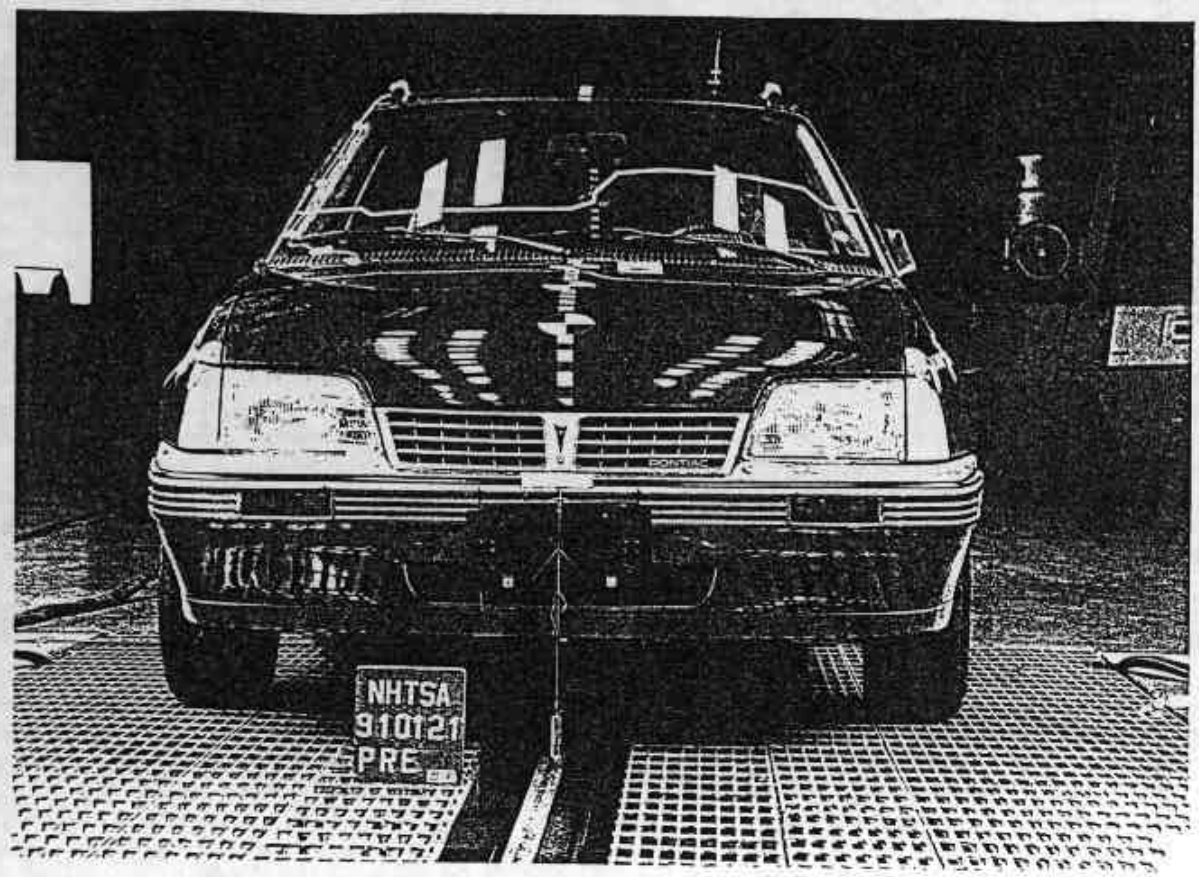


Figure A-1. PRE-TEST FRONT VIEW

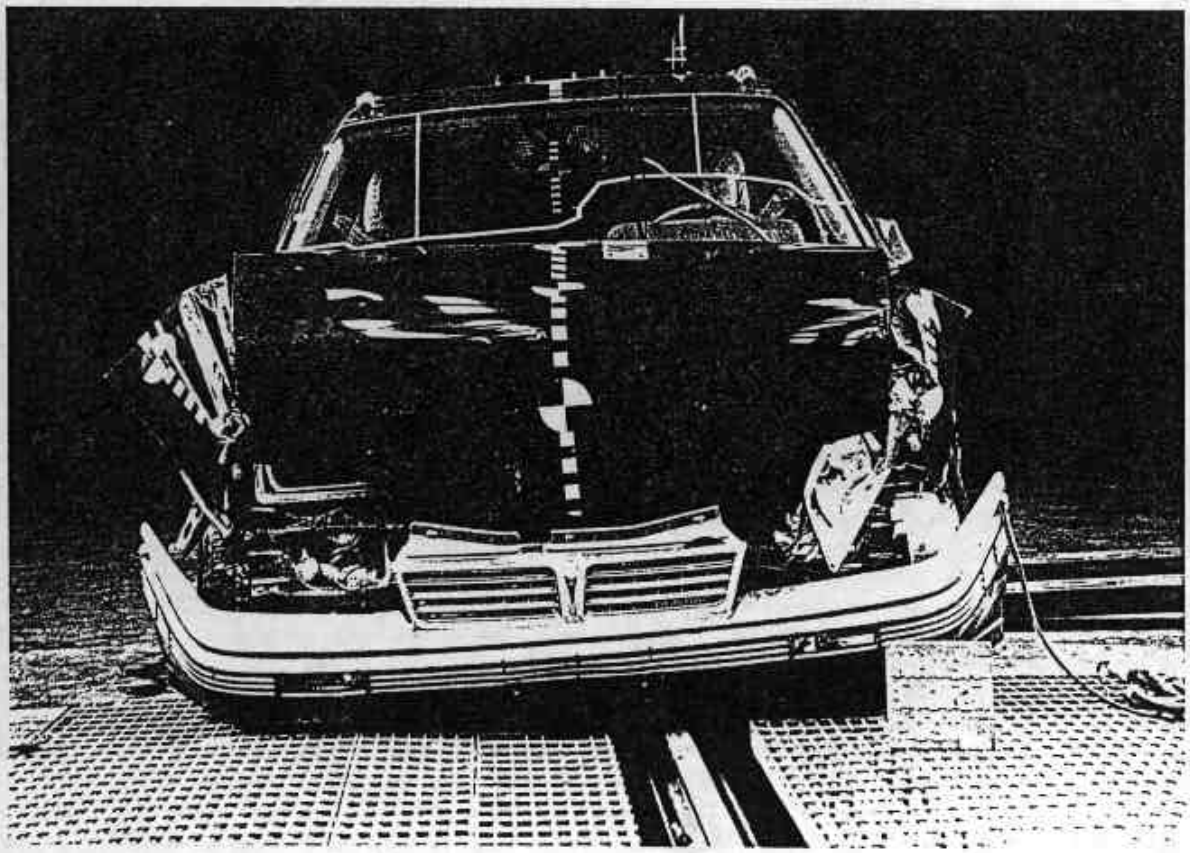


Figure A-2. POST-TEST FRONT VIEW

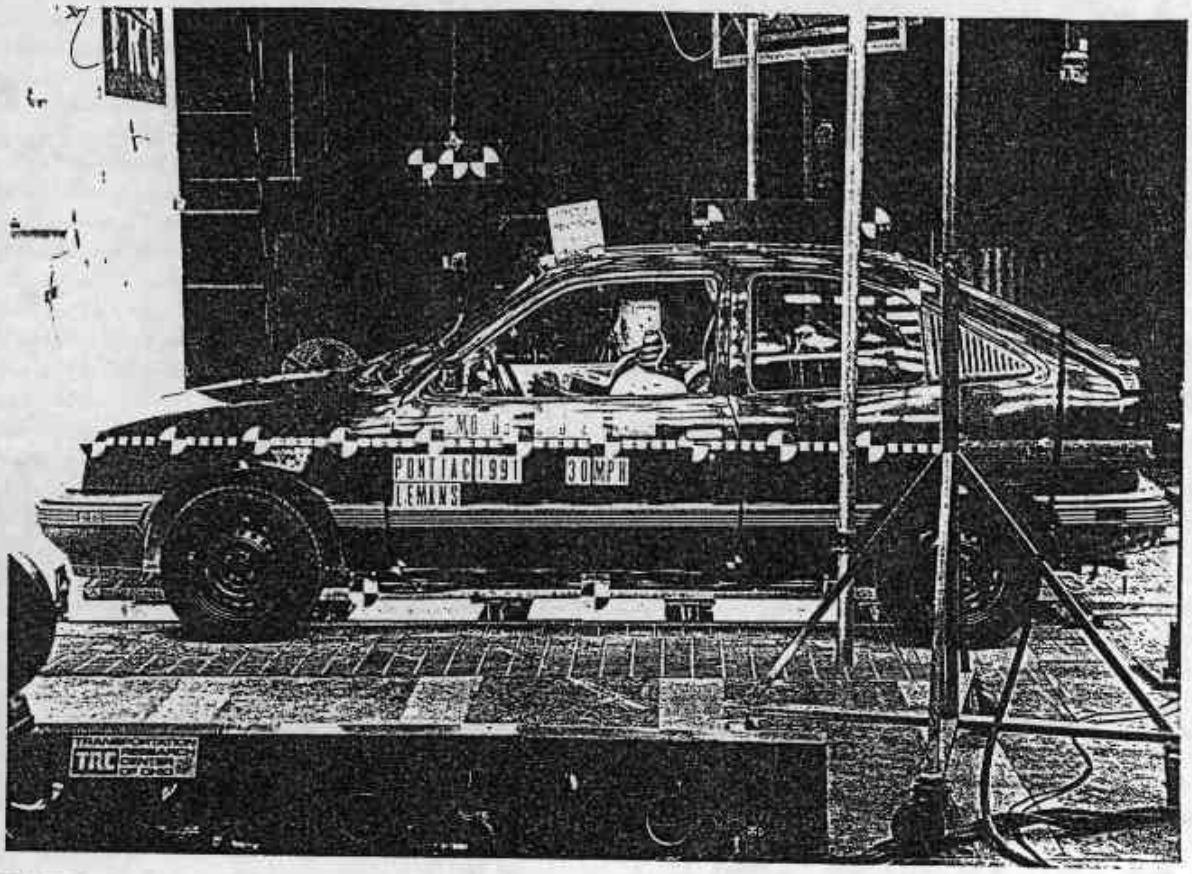


Figure A-3. PRE-TEST LEFT SIDE VIEW

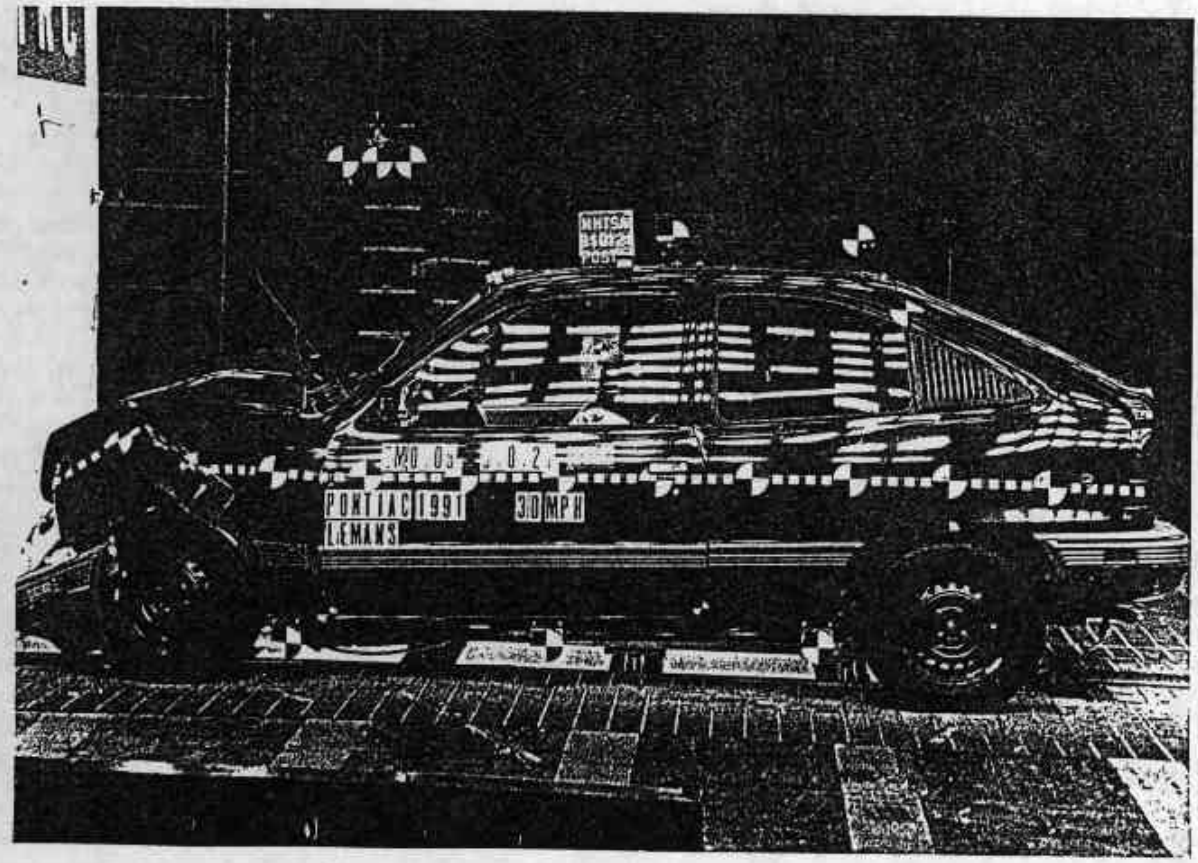


Figure A-4. POST-TEST LEFT SIDE VIEW

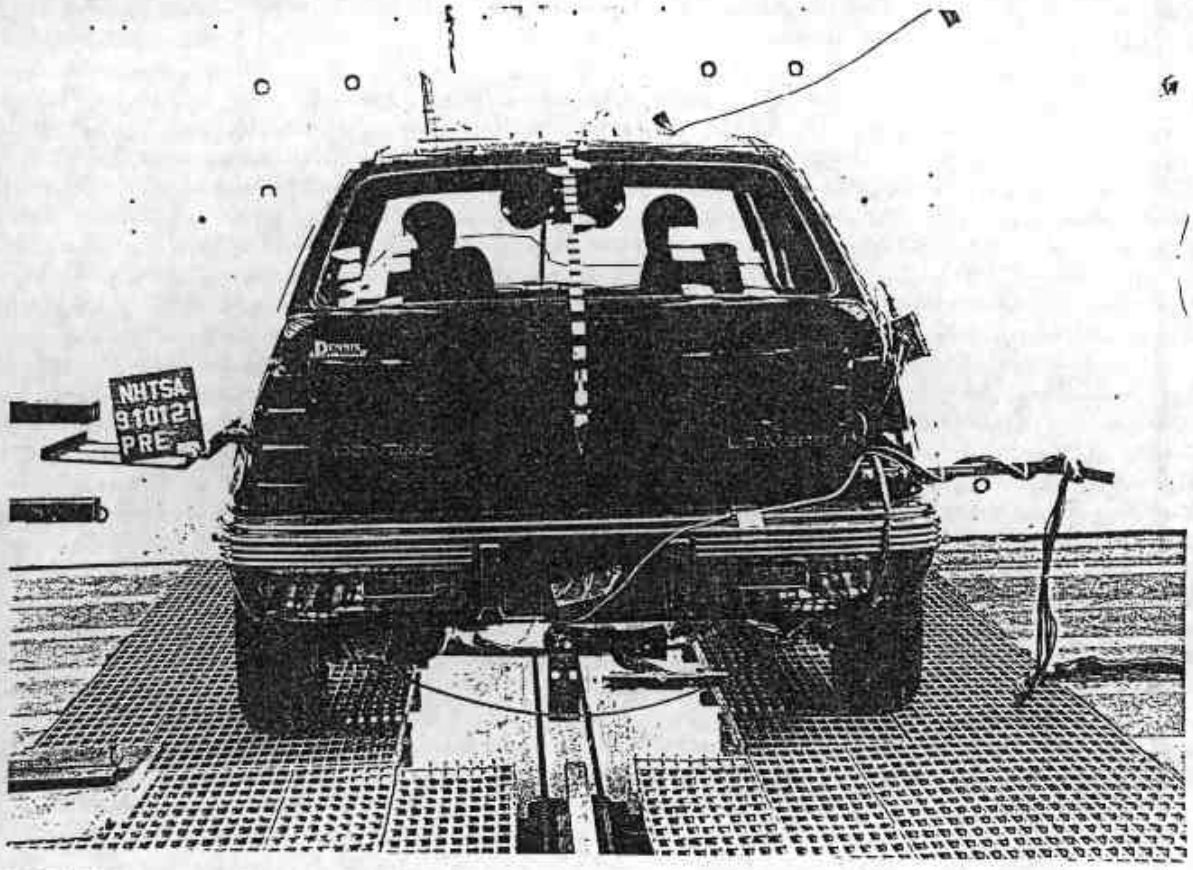


Figure A-5. PRE-TEST REAR VIEW

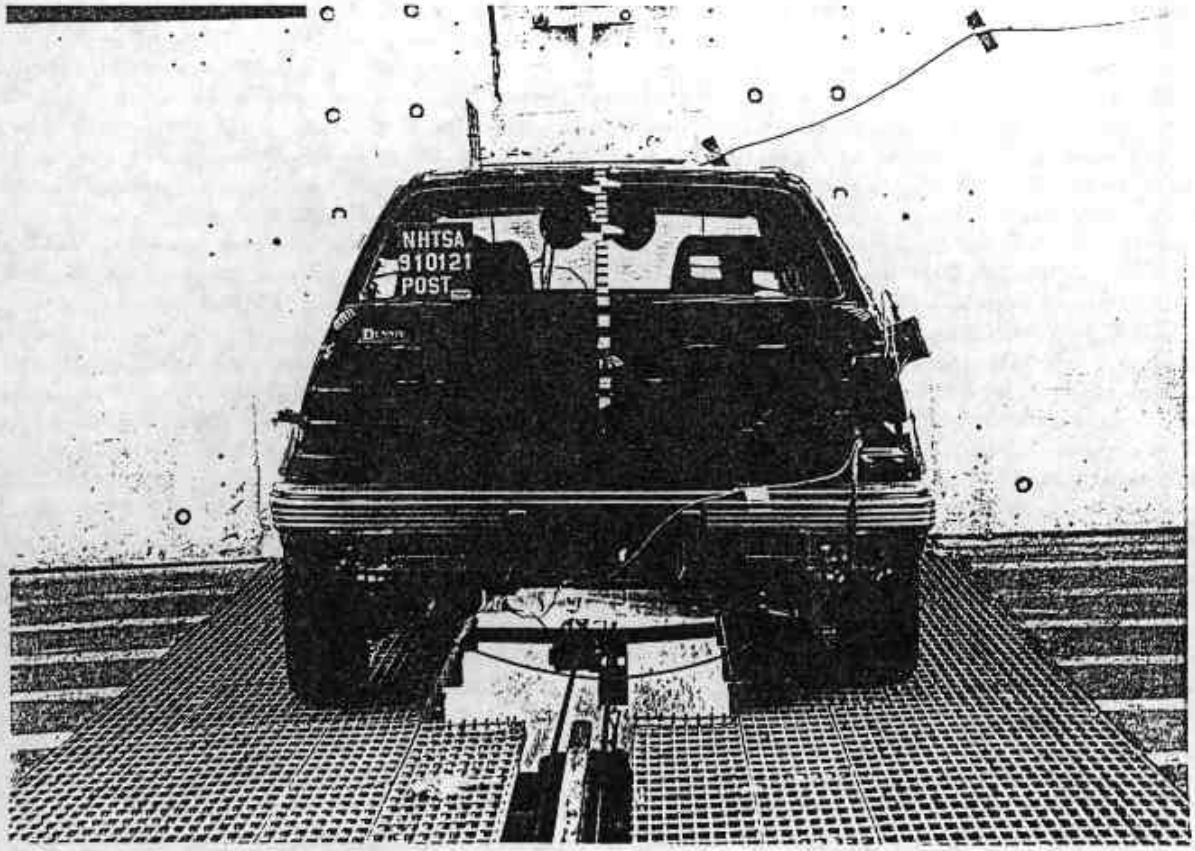


Figure A-6. POST-TEST REAR VIEW

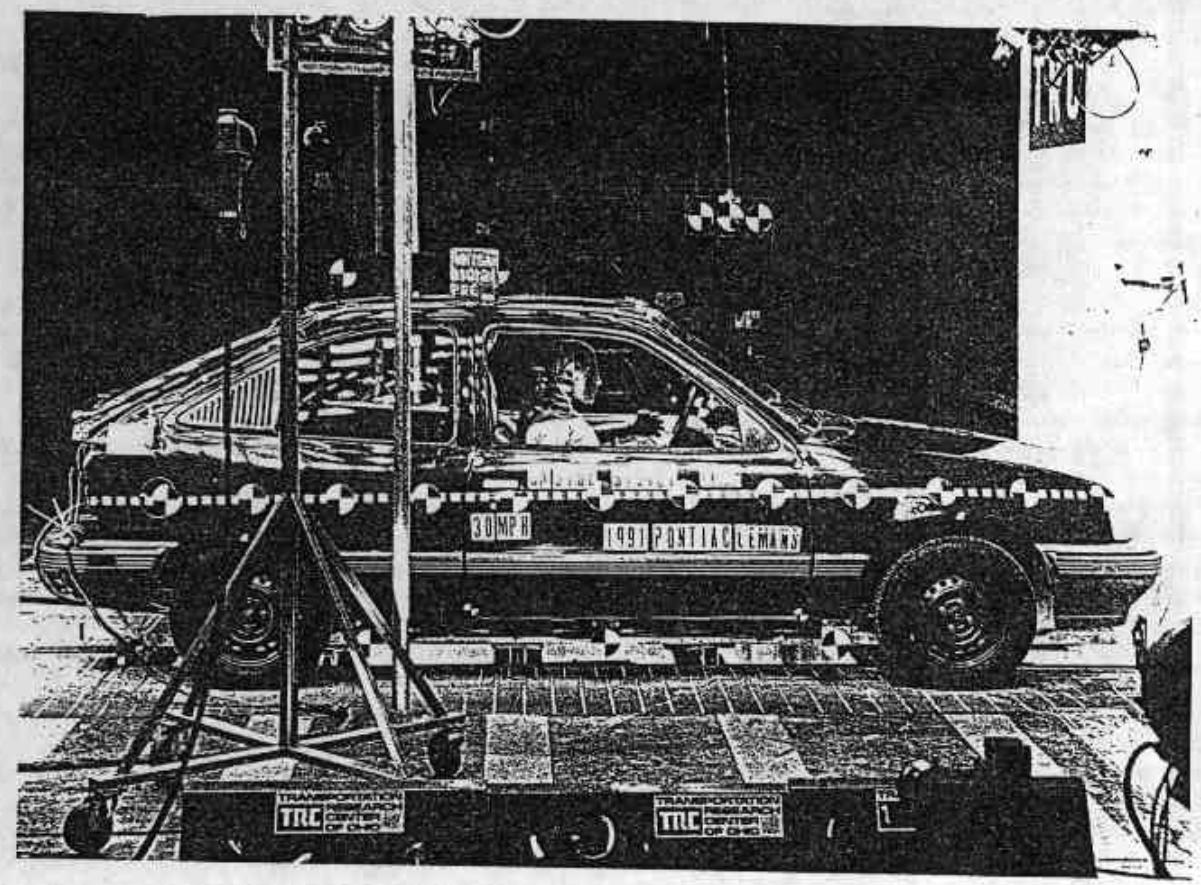


Figure A-7. PRE-TEST RIGHT SIDE VIEW

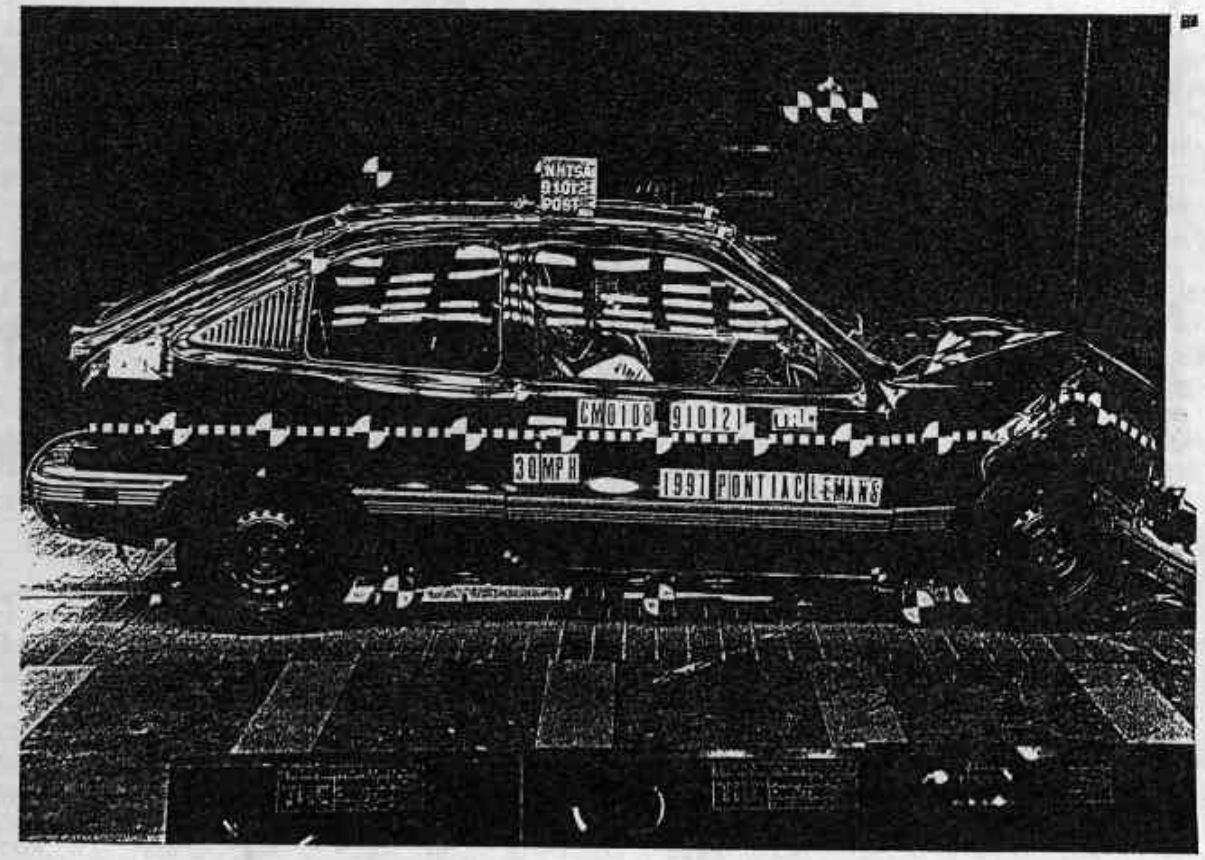


Figure A-8. POST-TEST RIGHT SIDE VIEW

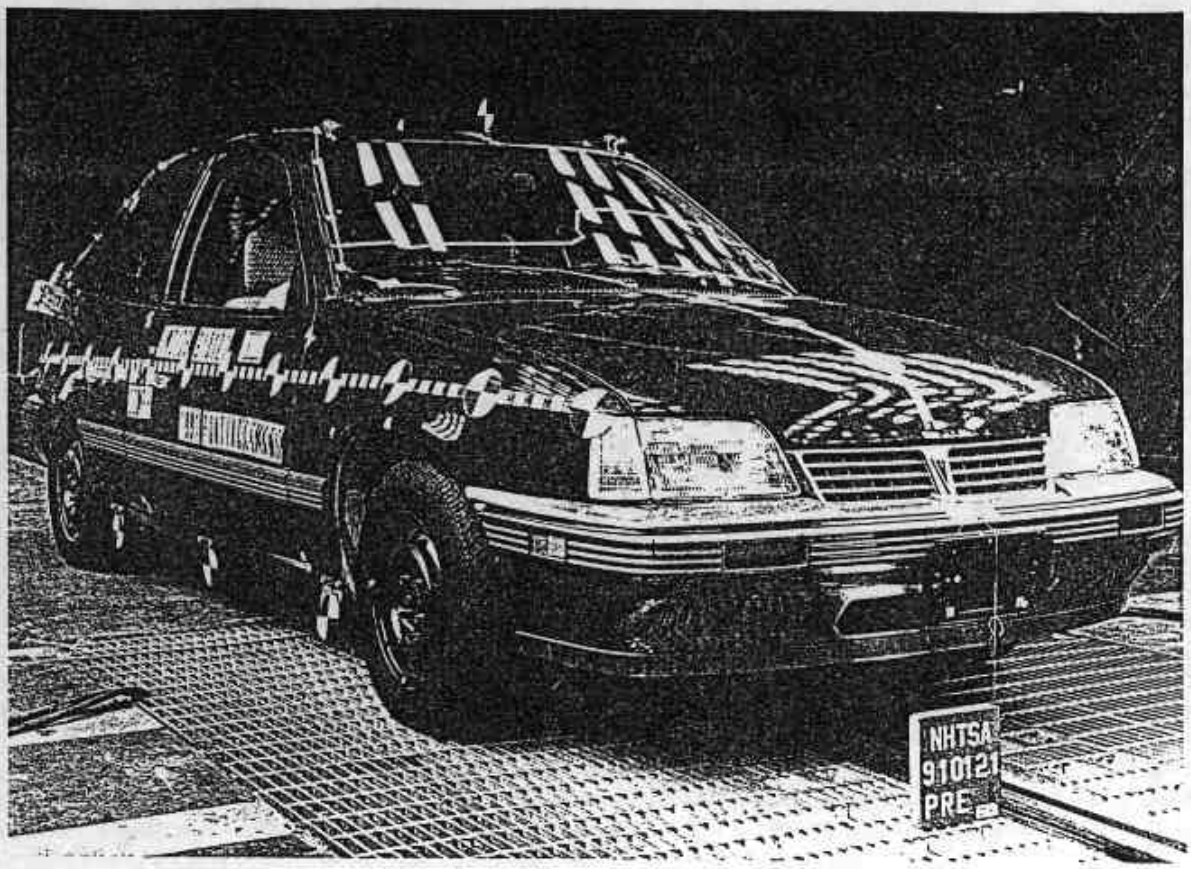


Figure A-9. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

Figure A-10. POST-TEST RIGHT FRONT THREE-QUARTER VIEW

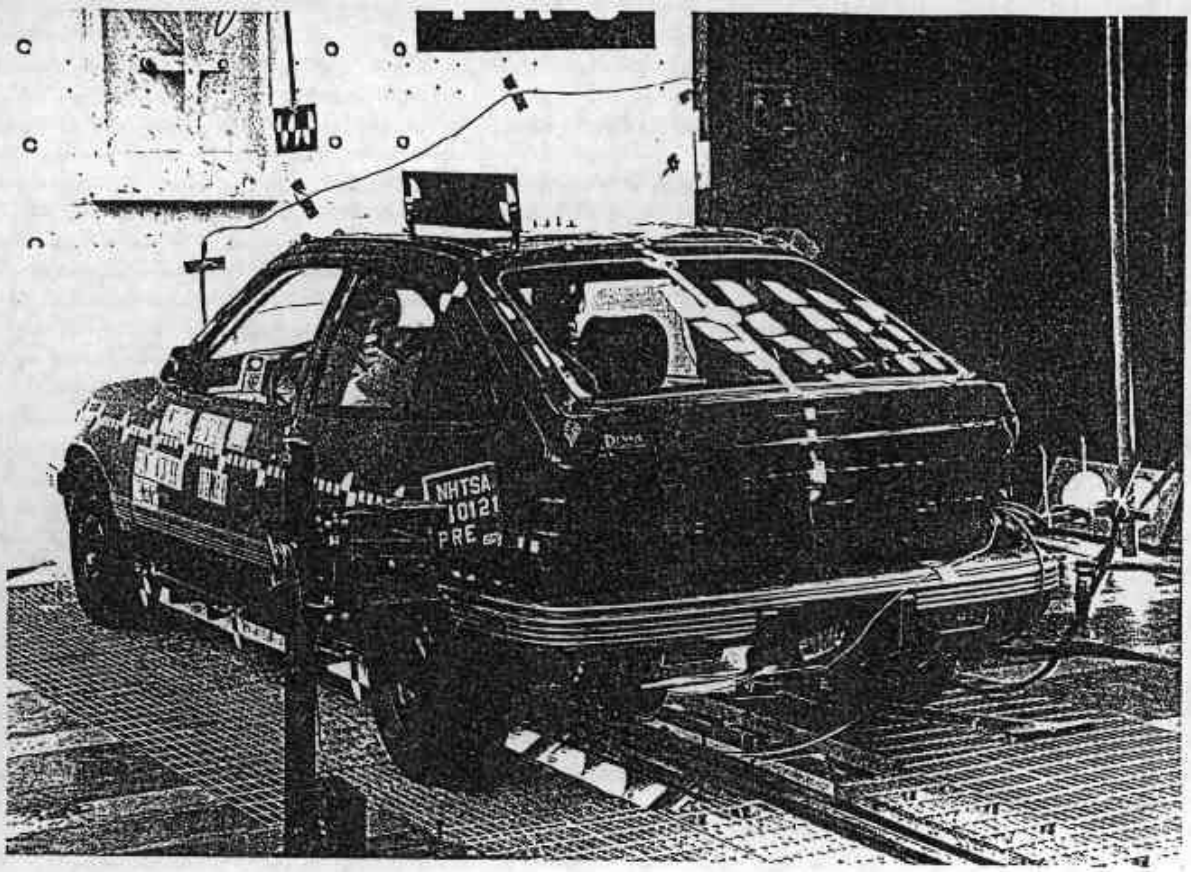


Figure A-11. PRE-TEST LEFT REAR THREE-QUARTER VIEW

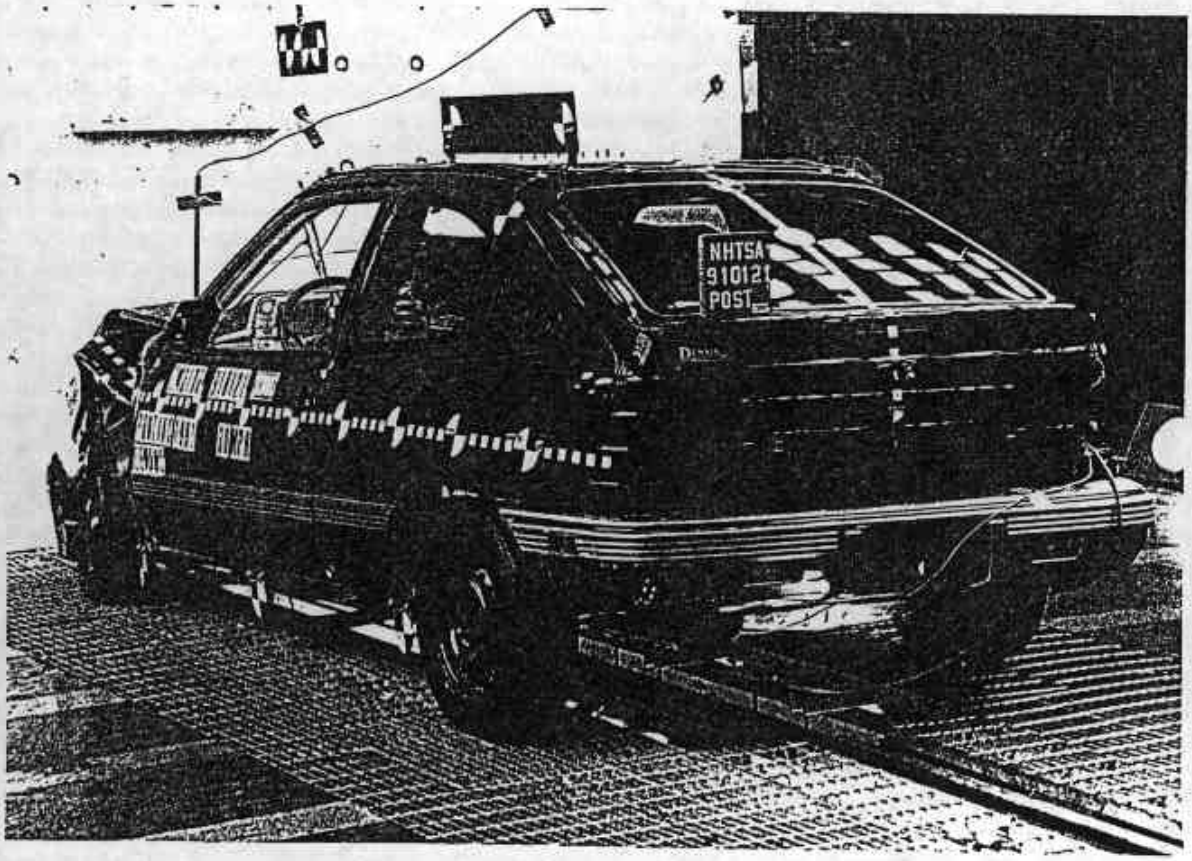


Figure A-12. POST-TEST LEFT REAR THREE-QUARTER VIEW

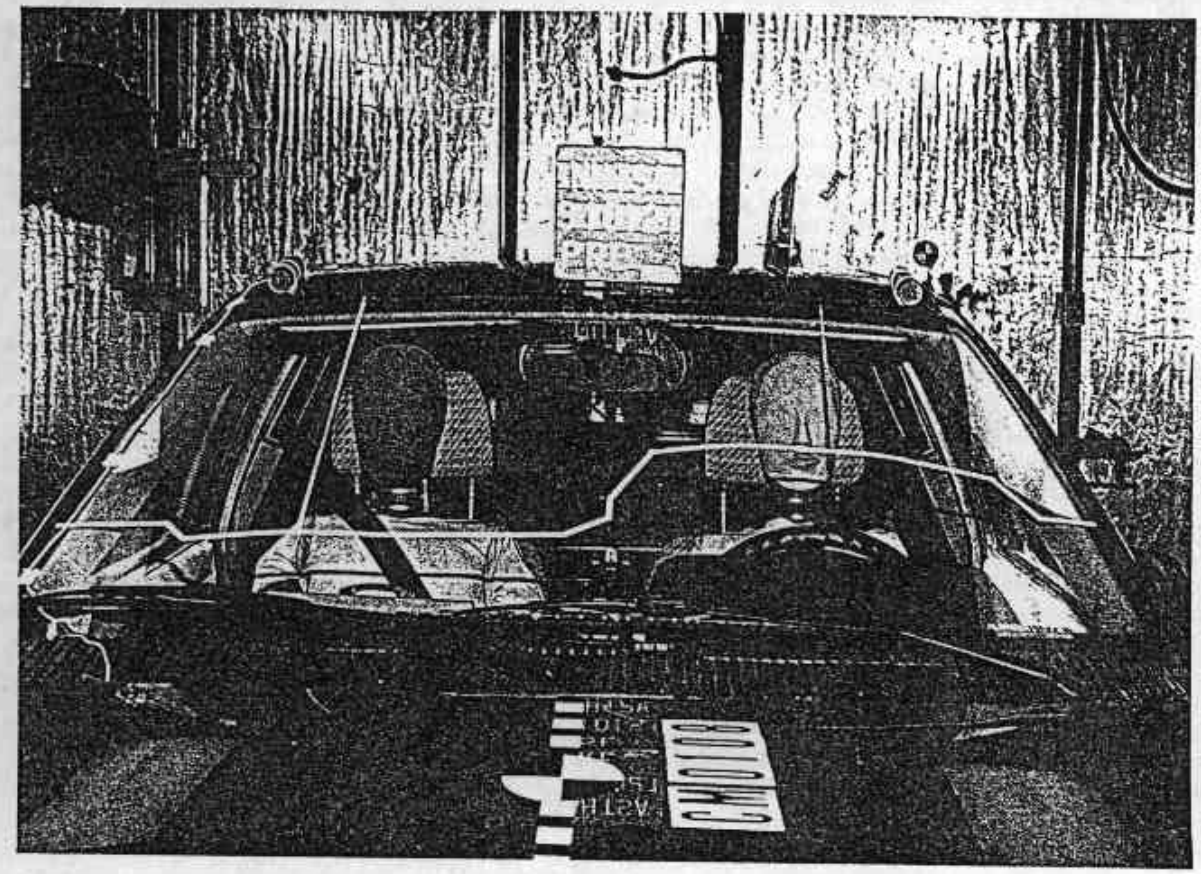


Figure A-13. PRE-TEST WINDSHIELD VIEW

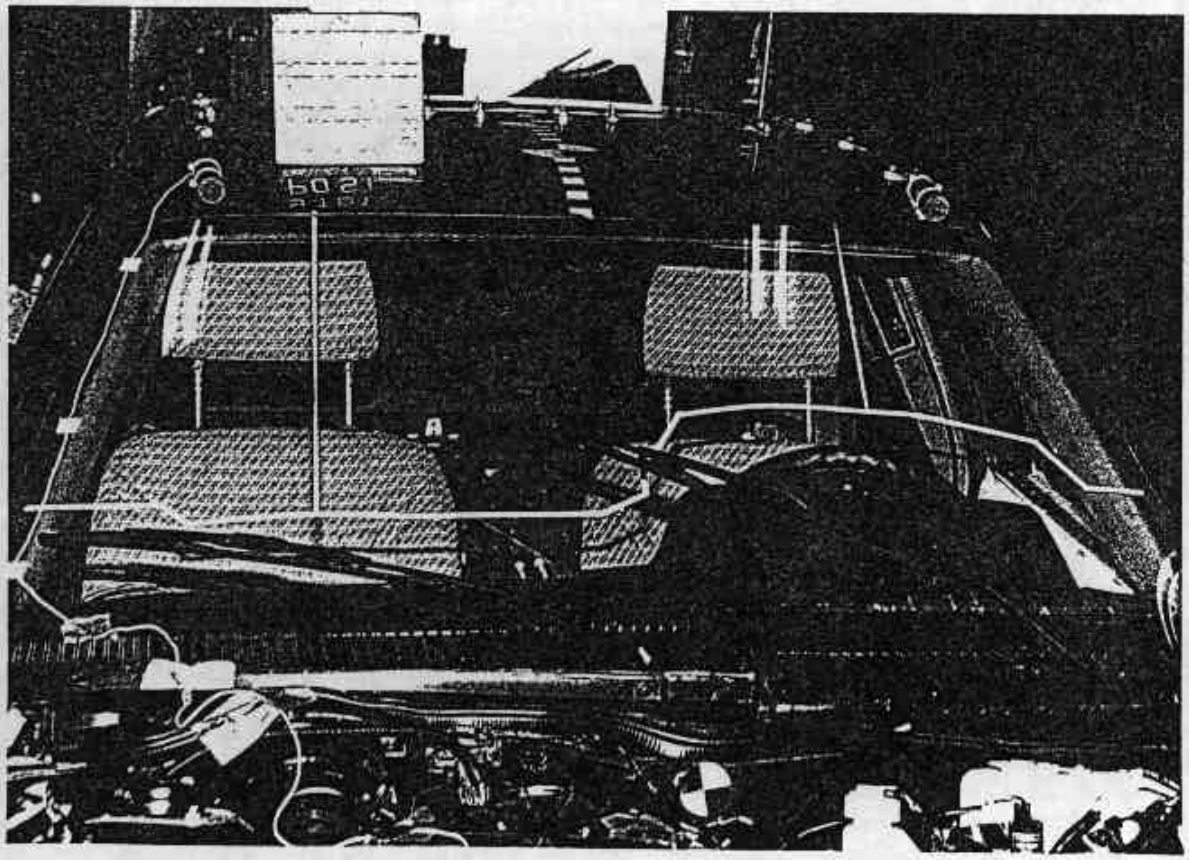


Figure A-14. POST-TEST WINDSHIELD VIEW

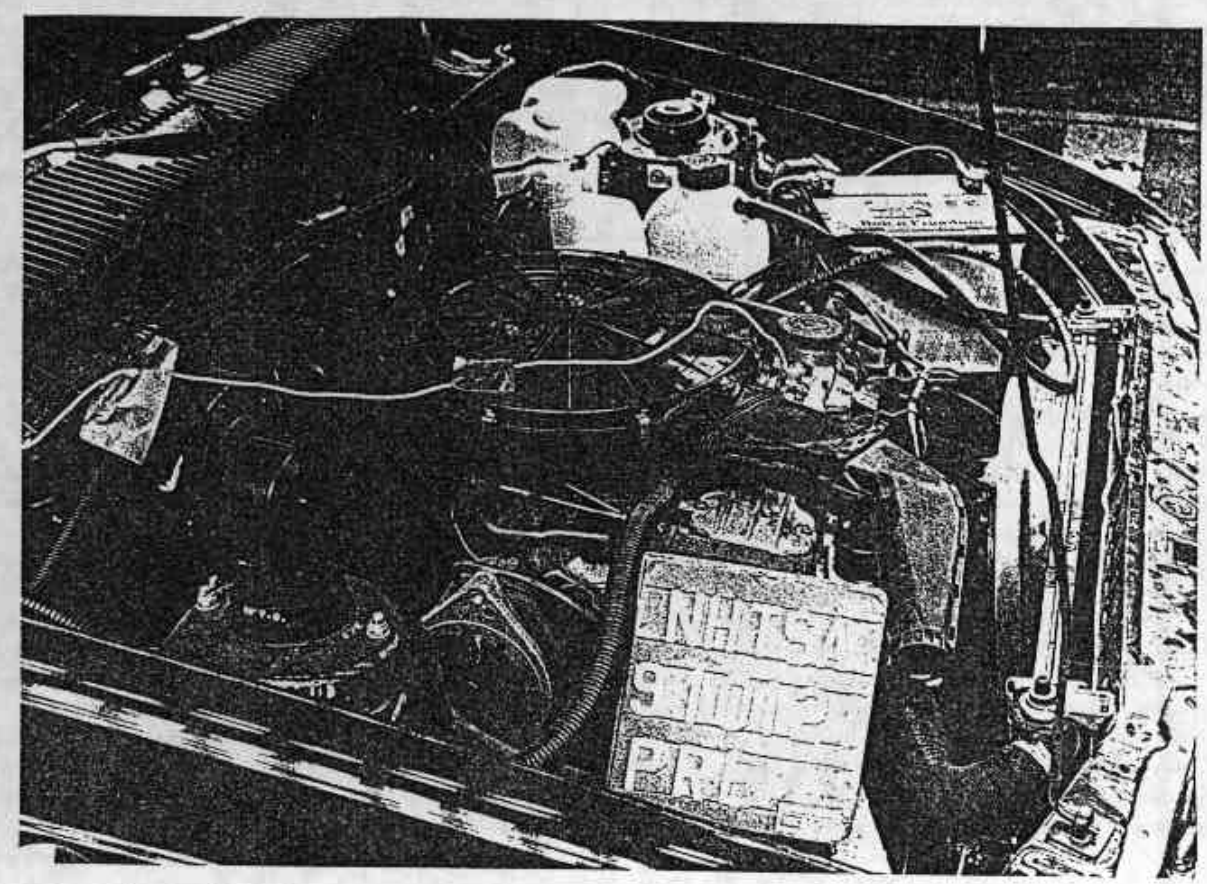


Figure A-15. PRE-TEST ENGINE COMPARTMENT VIEW

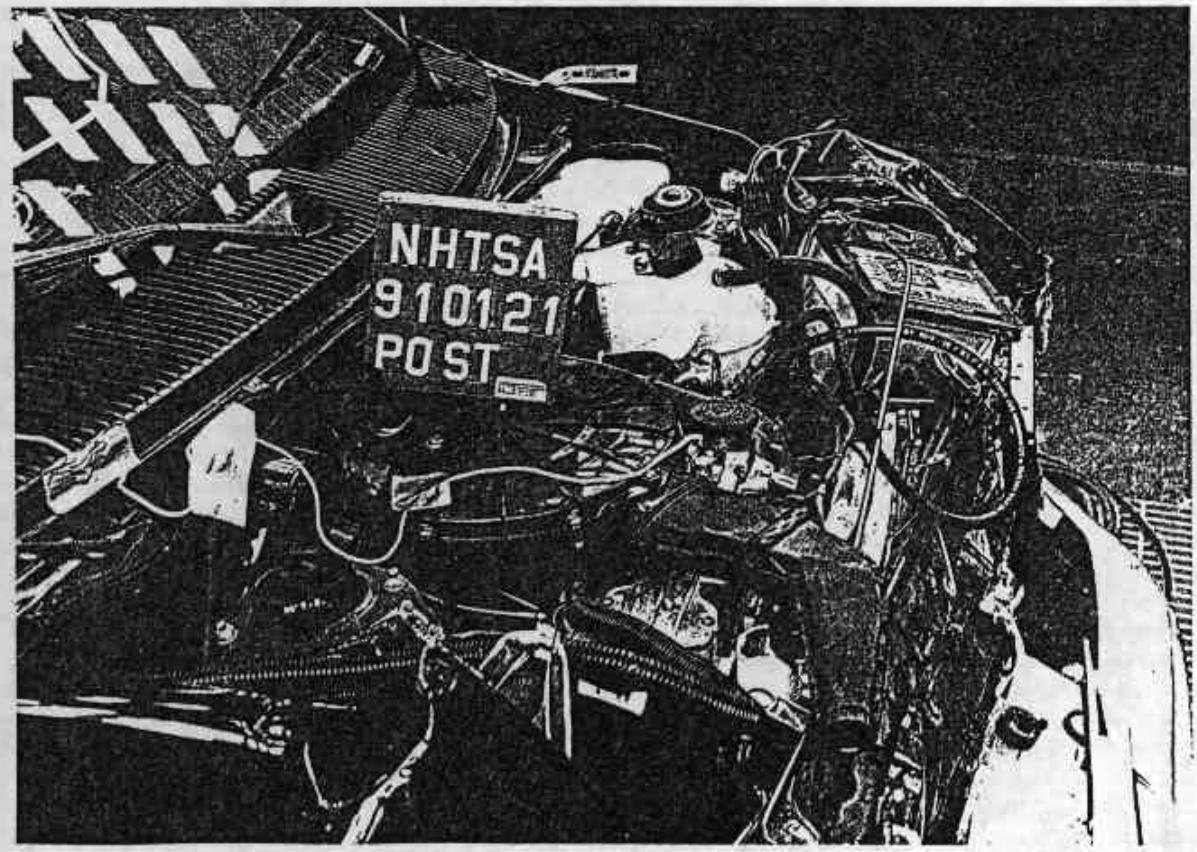


Figure A-16. POST-TEST ENGINE COMPARTMENT VIEW

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

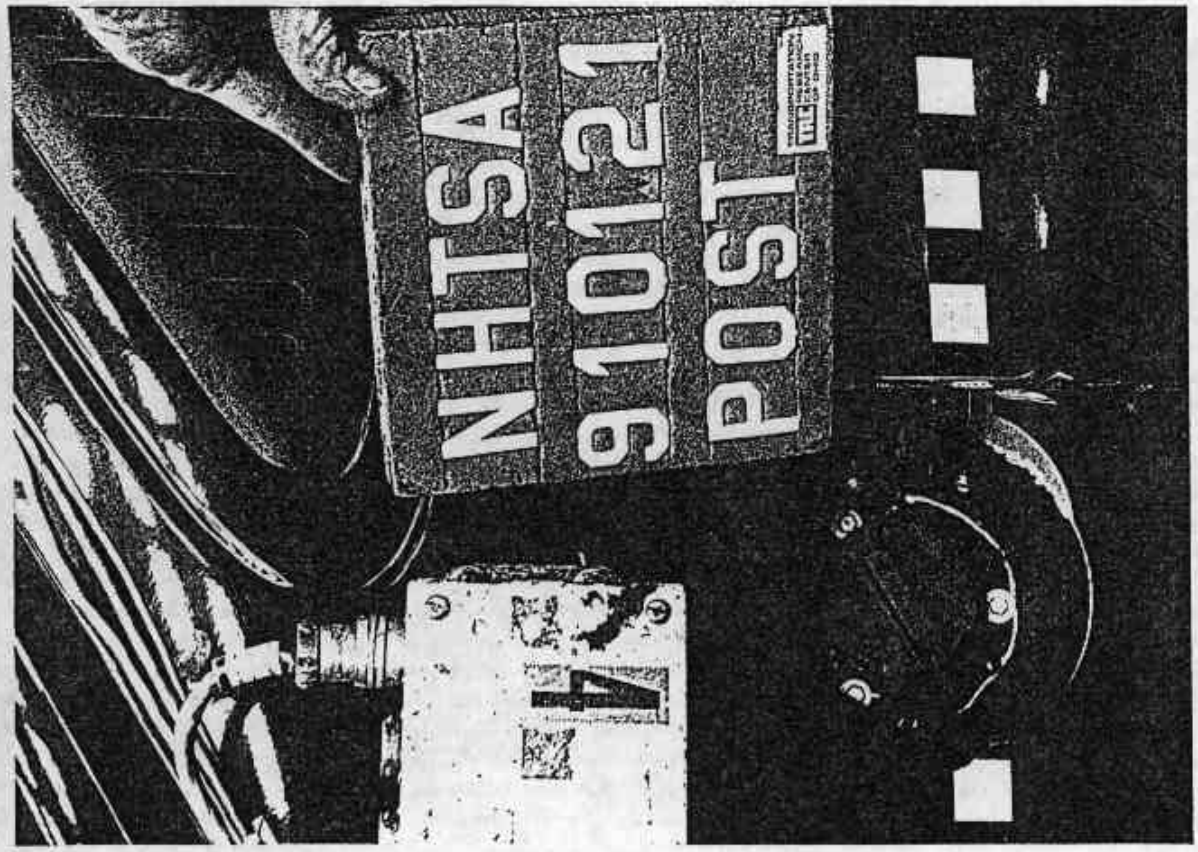


Figure A-18. POST-TEST FUEL FILLER CAP VIEW

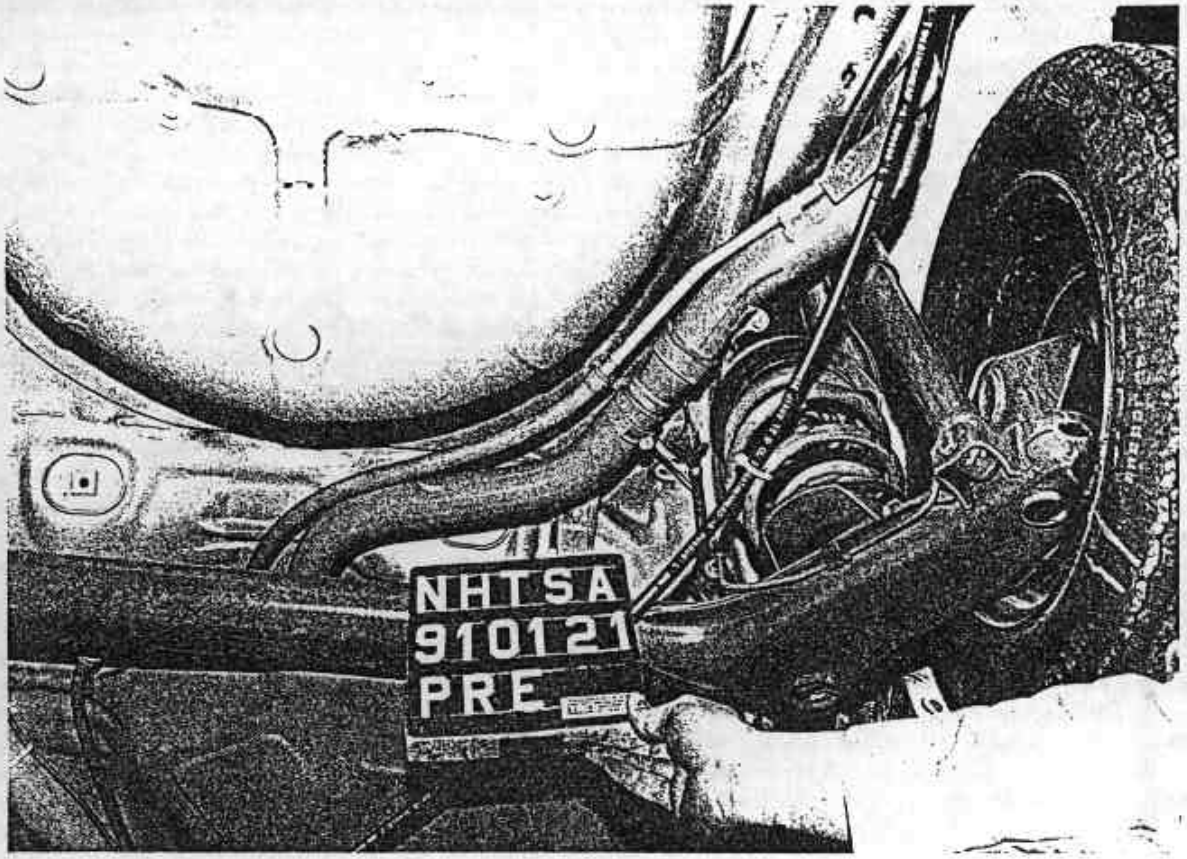


Figure A-19. PRE-TEST FUEL FILLER NECK VIEW

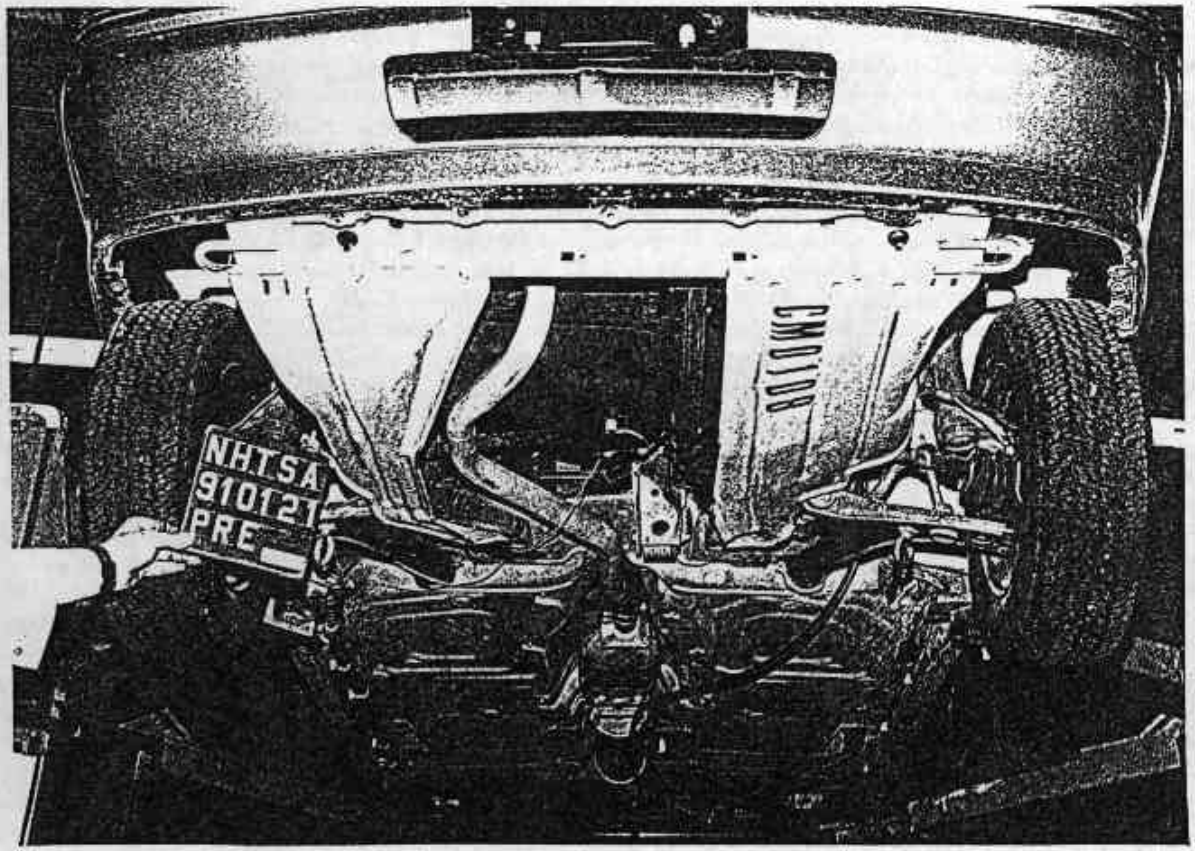


Figure A-20. PRE-TEST FRONT UNDERBODY VIEW

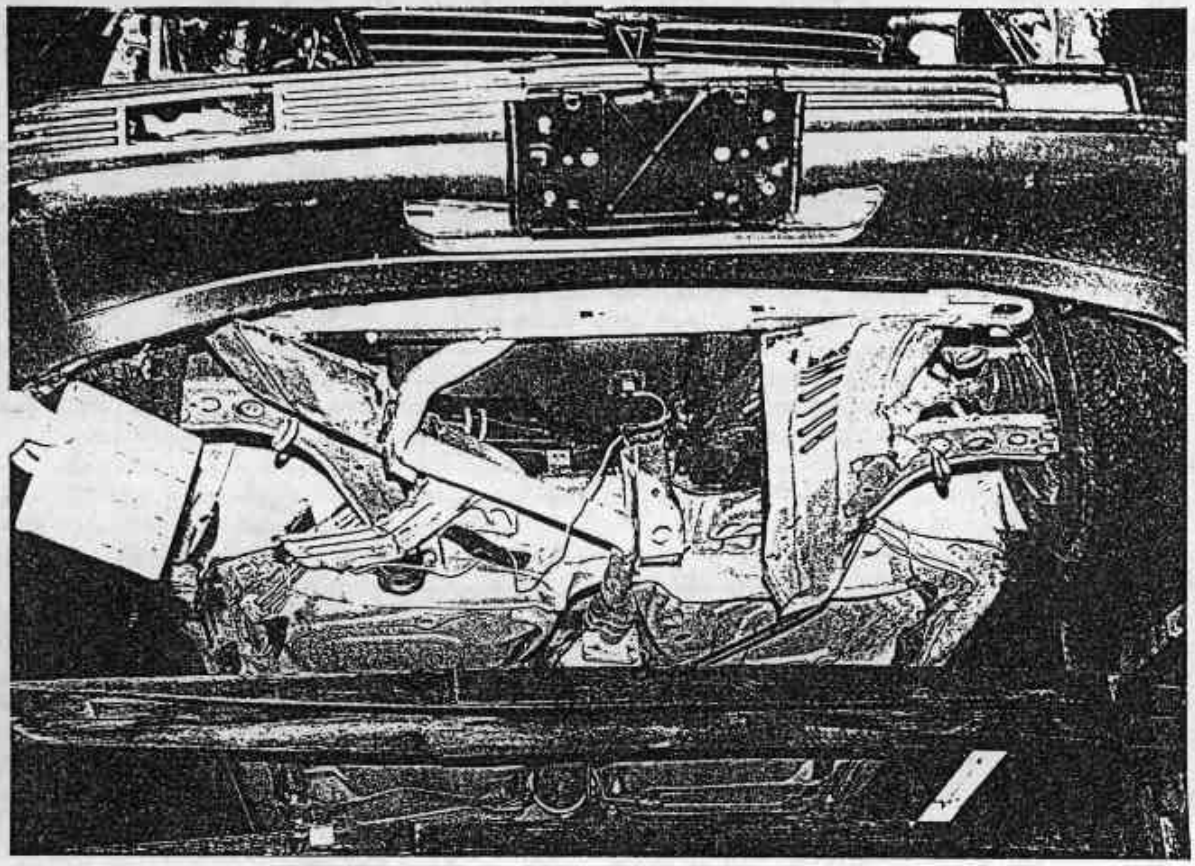


Figure A-21. POST-TEST FRONT UNDERBODY VIEW

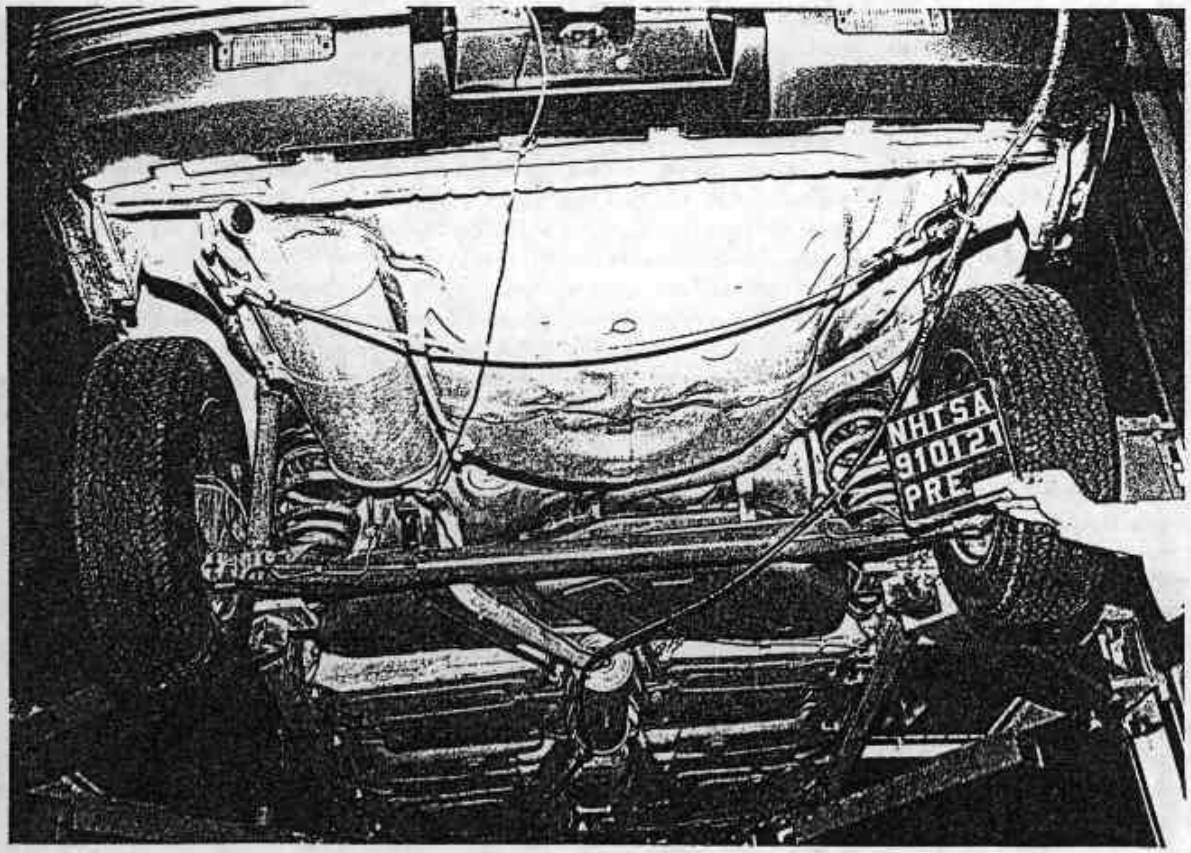


Figure A-22. PRE-TEST REAR UNDERBODY VIEW

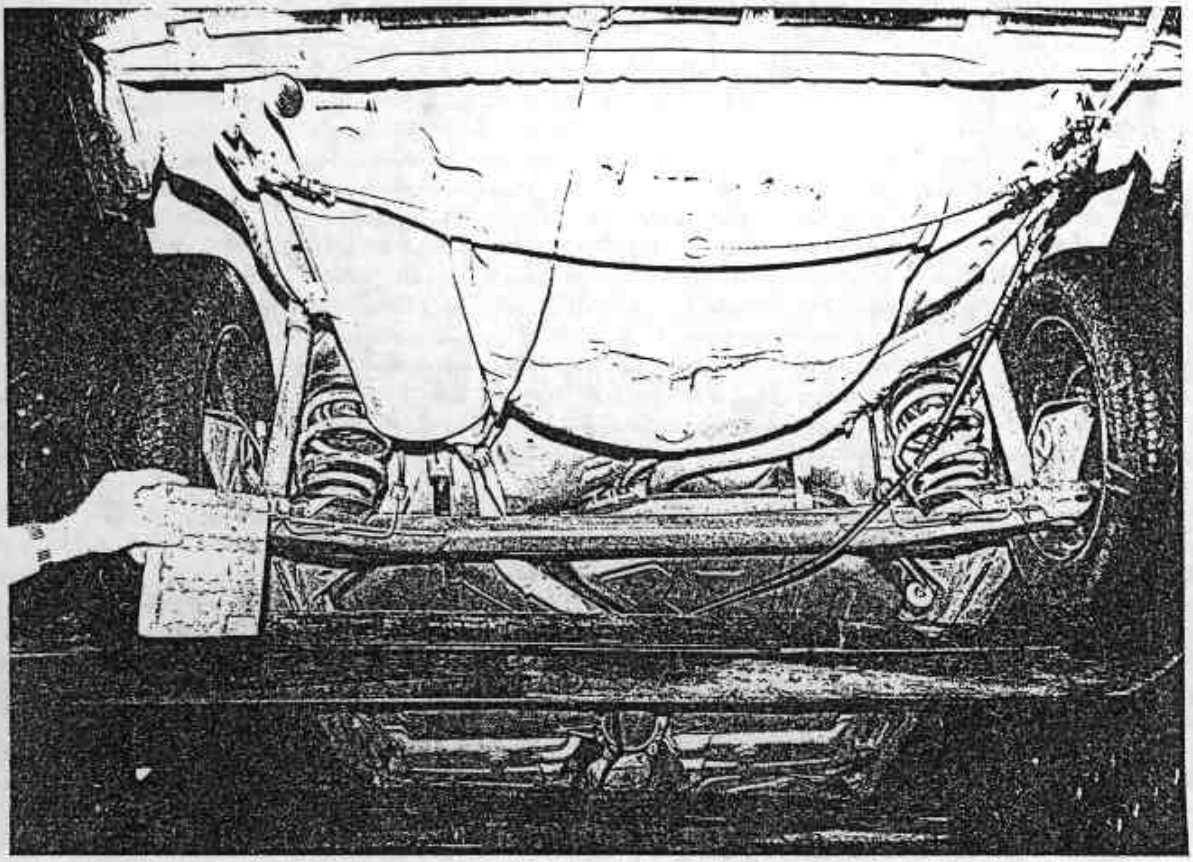


Figure A-23. POST-TEST REAR UNDERBODY VIEW

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

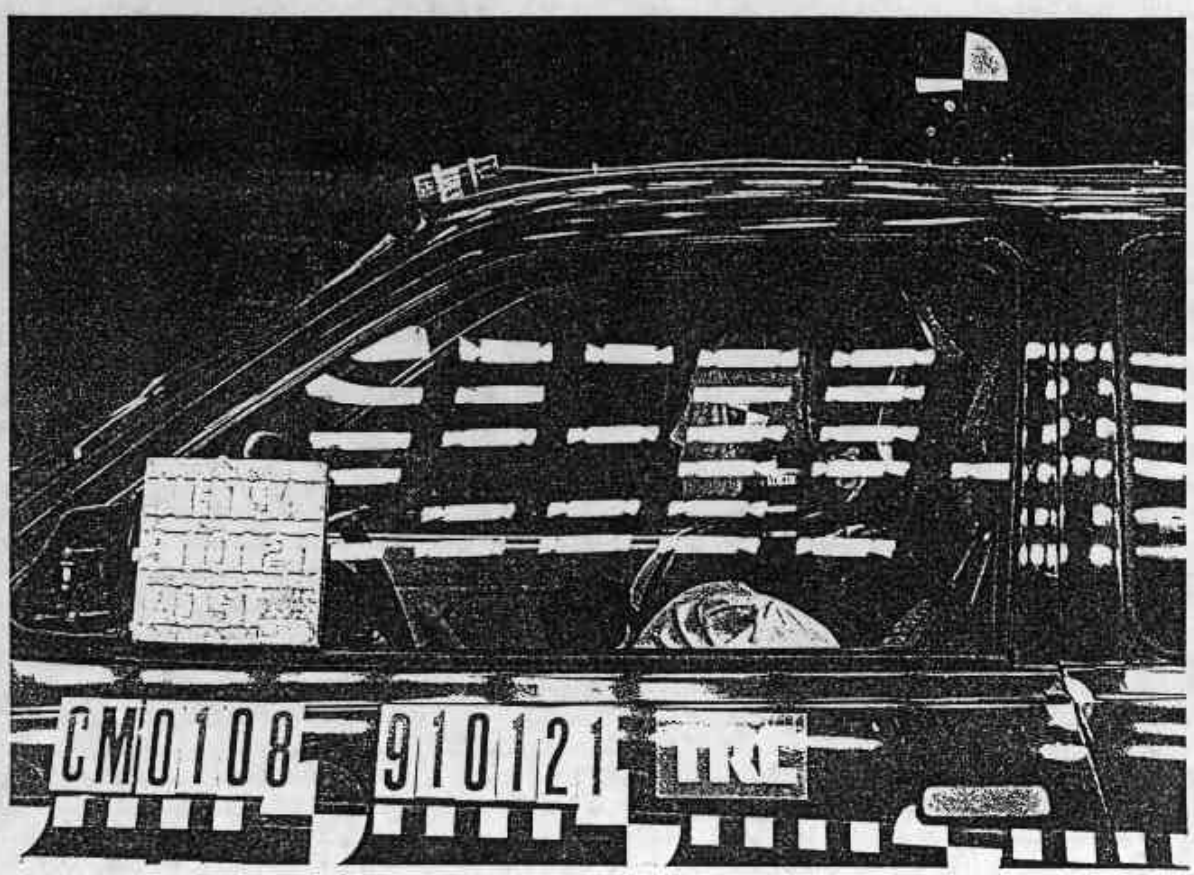


Figure A-25. POST-TEST DRIVER DUMMY POSITION VIEW

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

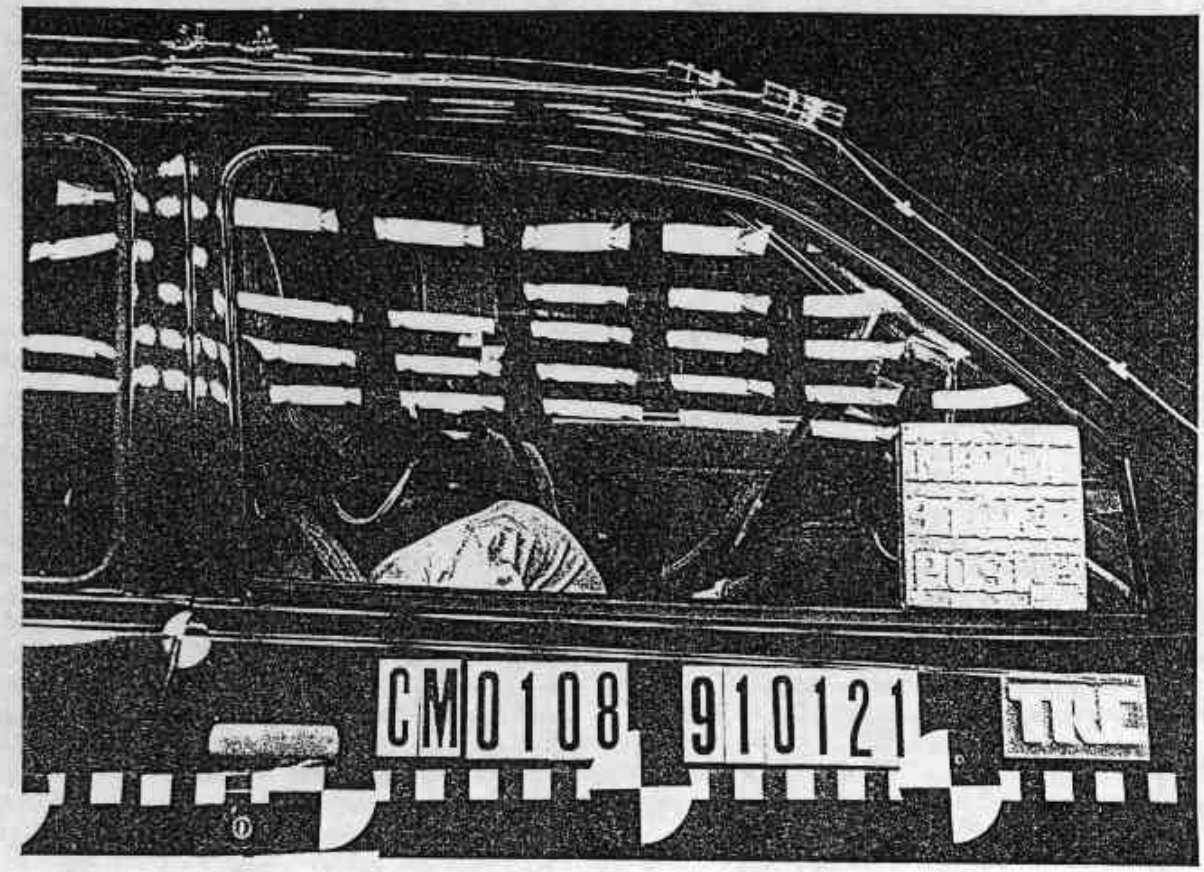


Figure A-27. POST-TEST PASSENGER DUMMY POSITION VIEW

Figure A-28. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

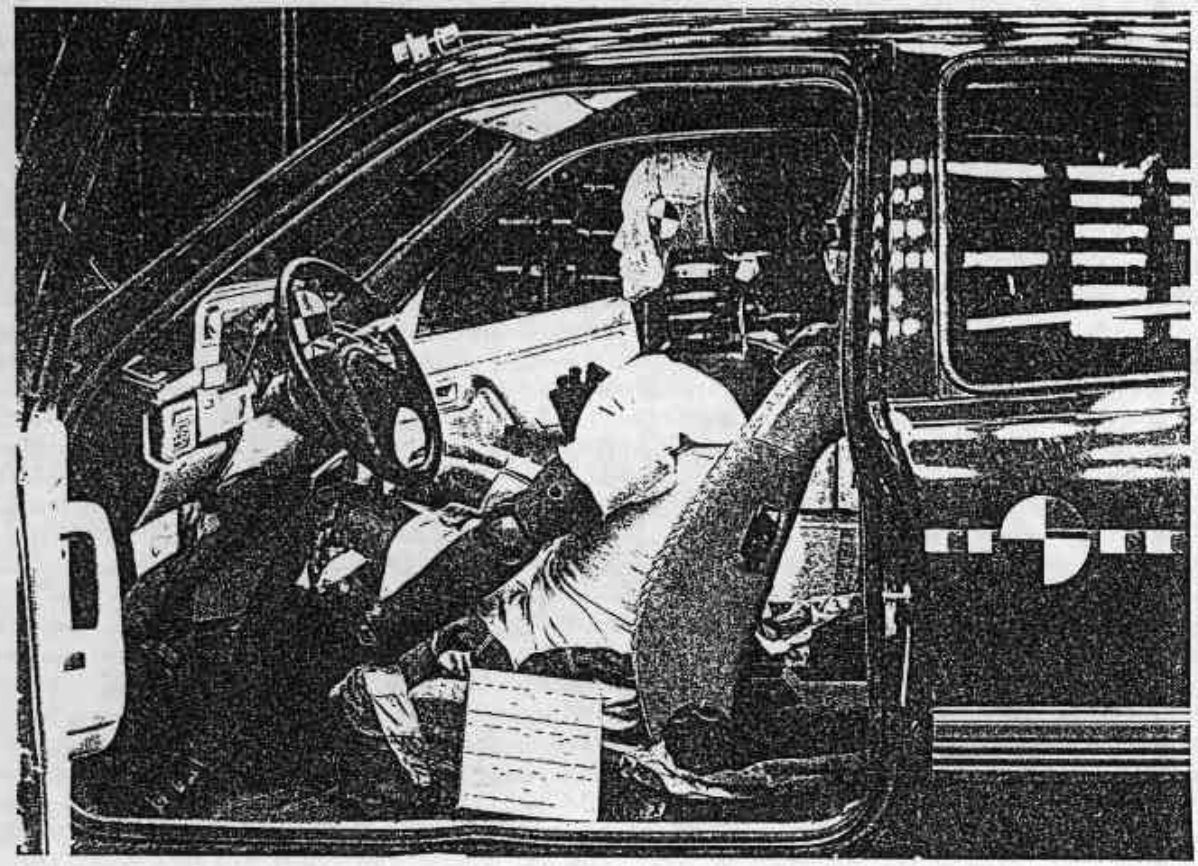


Figure A-29. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

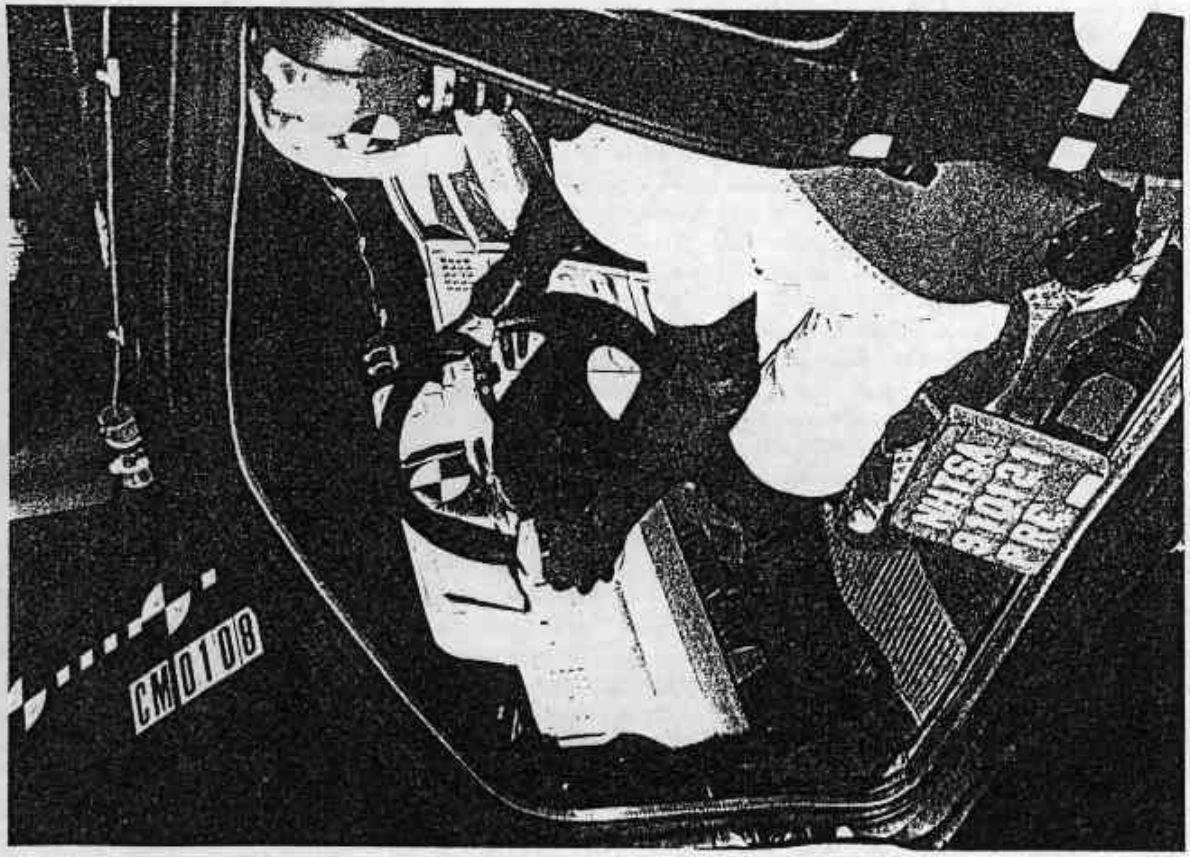


Figure A-30. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

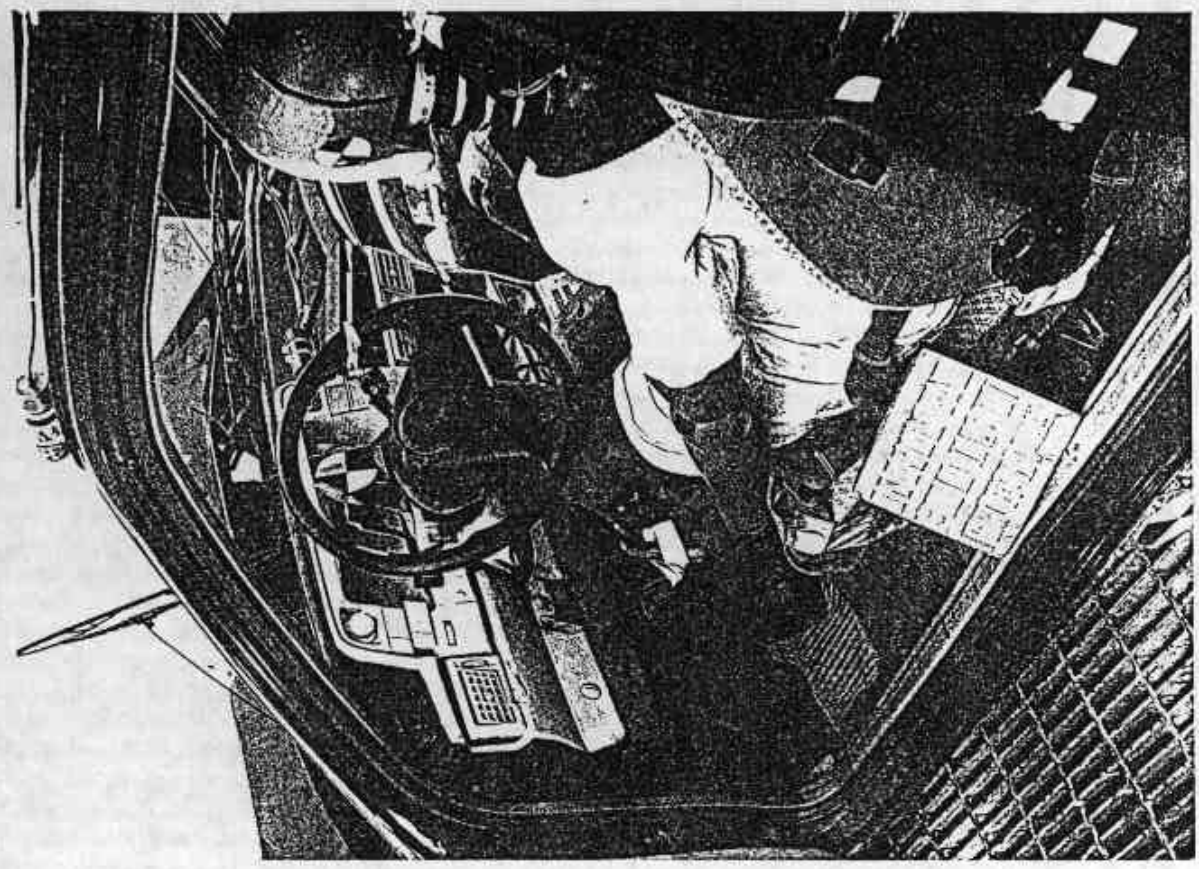


Figure A-31. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

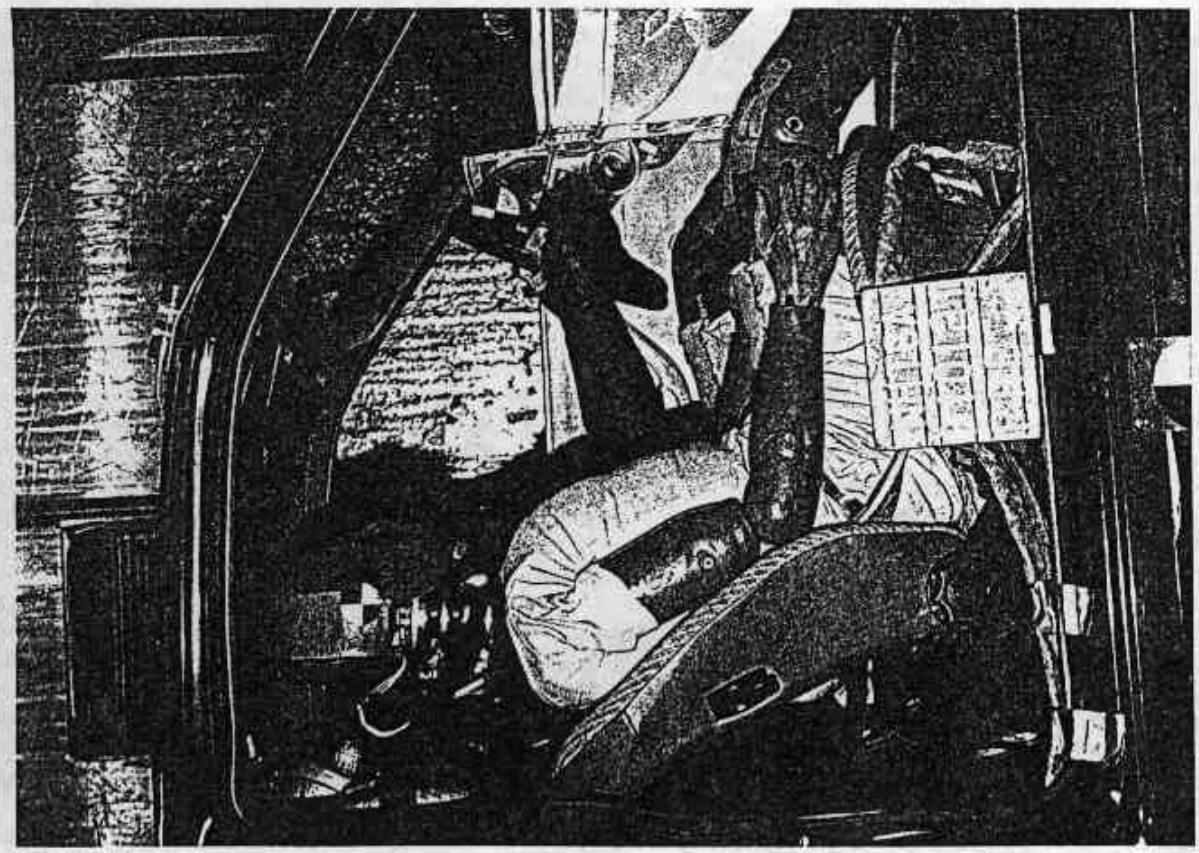


Figure A-32. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

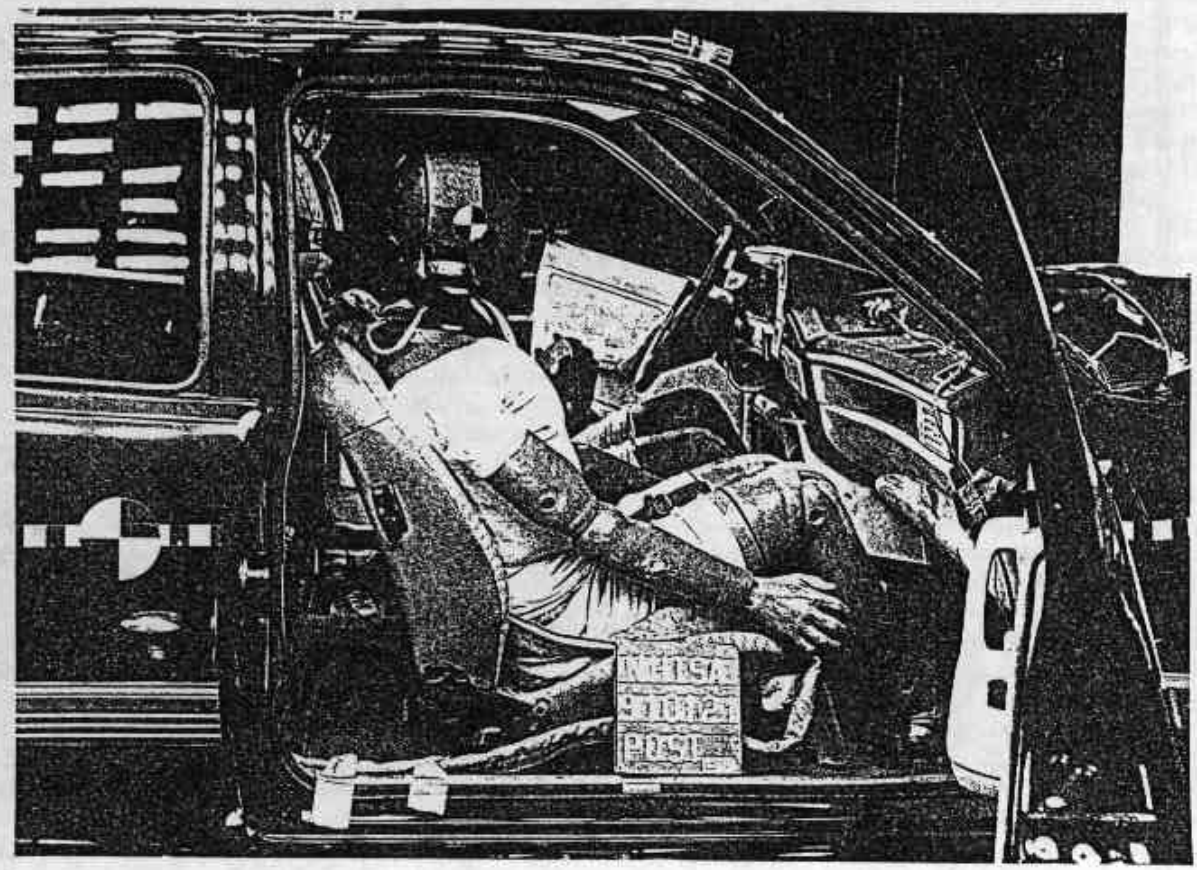


Figure A-33. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

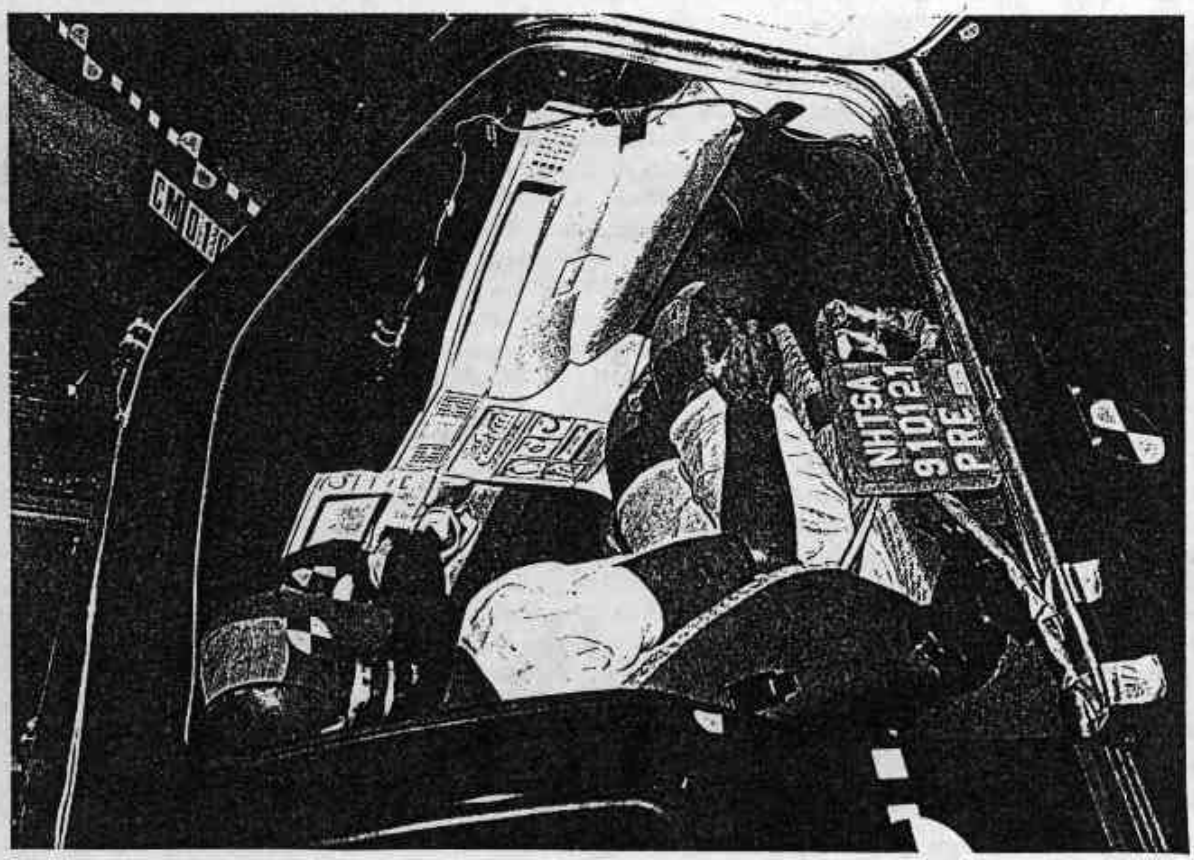


Figure A-34. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2

Figure A-35. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2

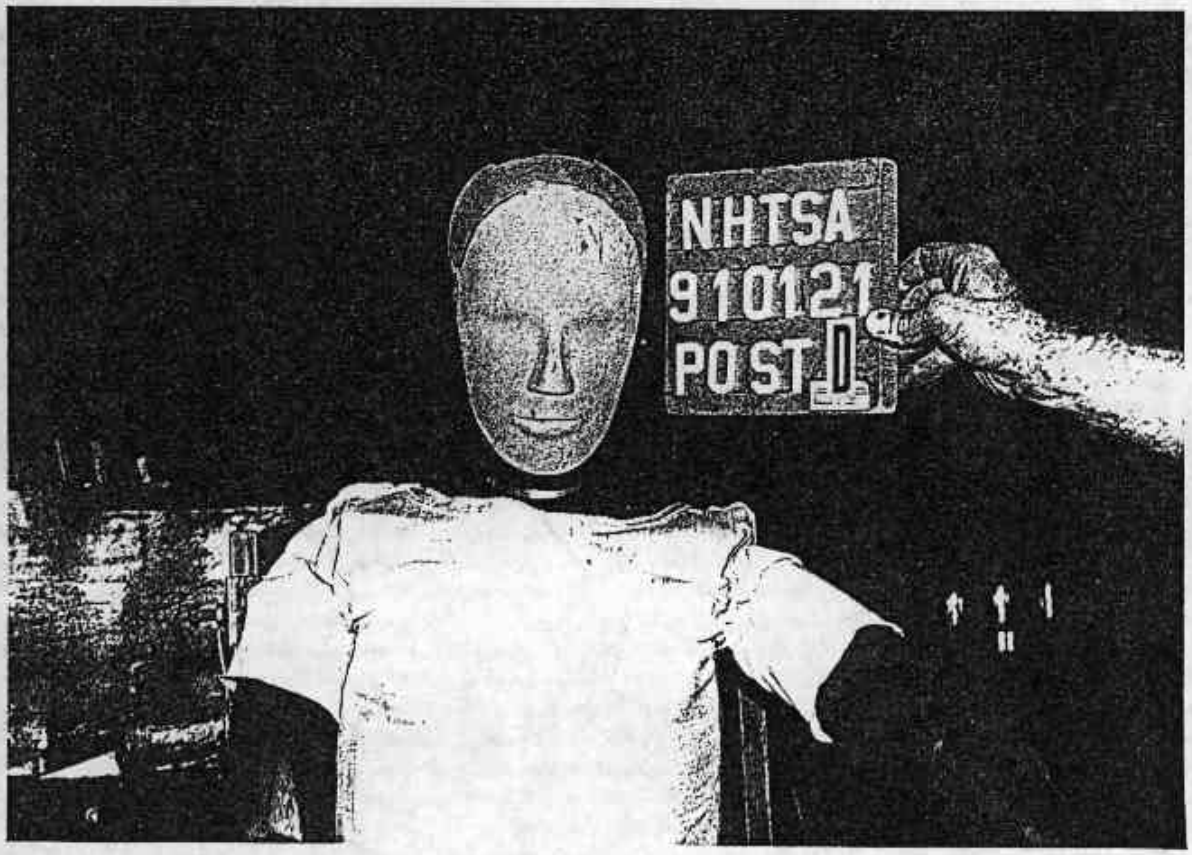


Figure A-36. POST-TEST DRIVER DUMMY HEAD CONTACT VIEW

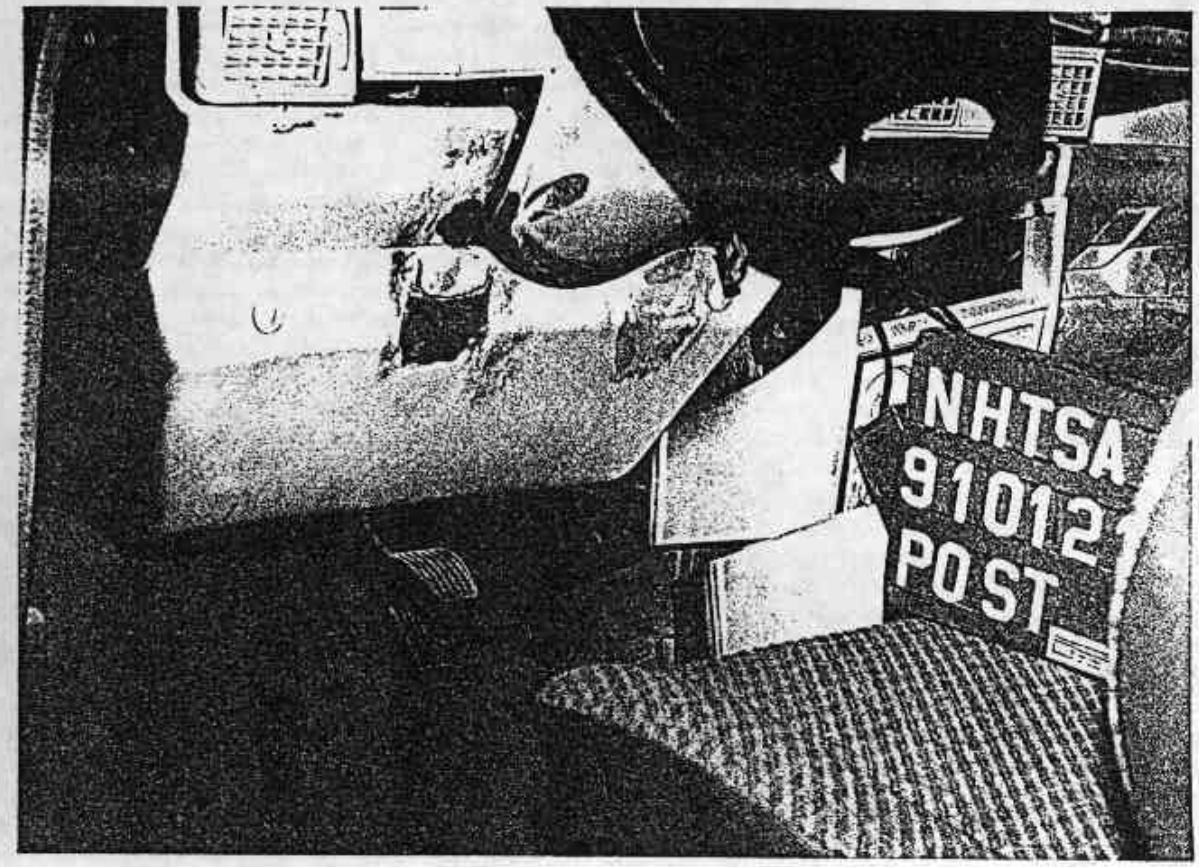


Figure A-37. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

Figure A-38. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2

Figure A-39. POST-TEST PASSENGER DUMMY HEAD CONTACT VIEW

Figure A-40. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 1

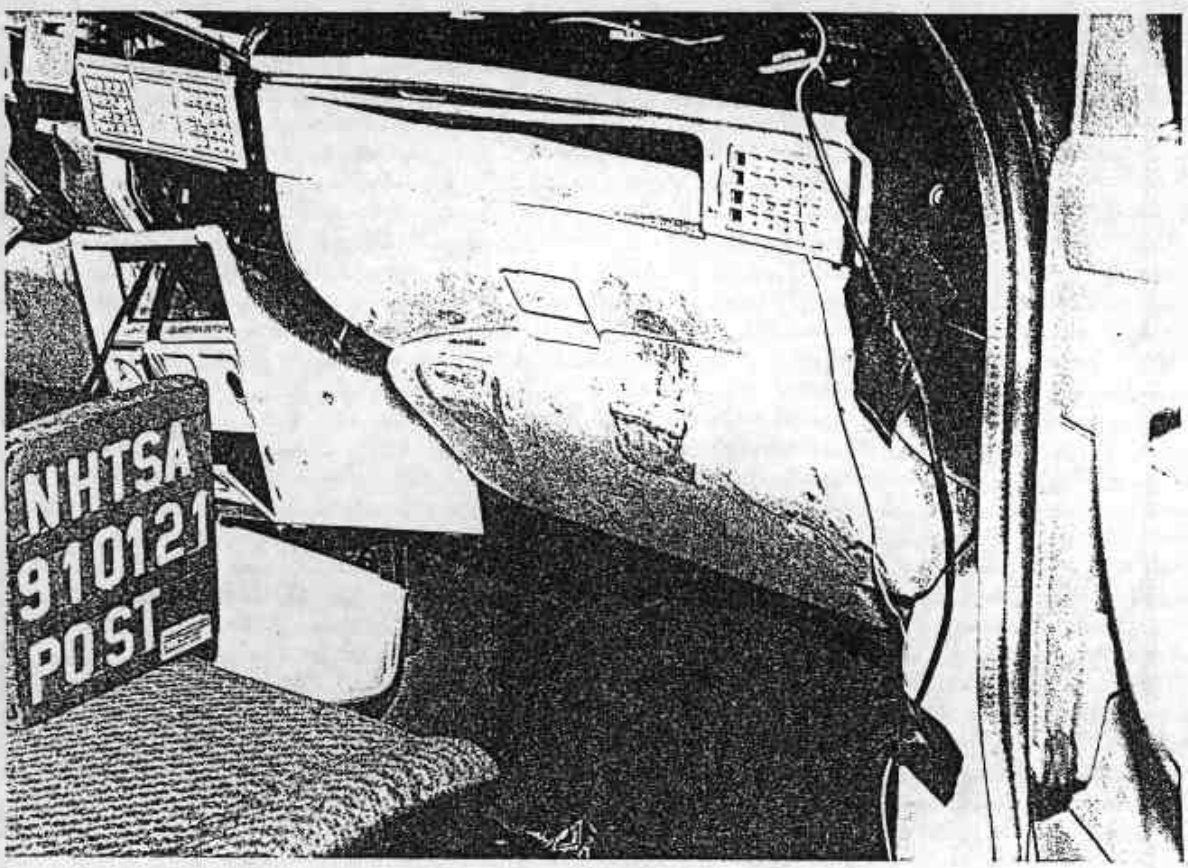


Figure A-41. POST-TEST PASSENGER DUMMY KNEE CONTACT - VIEW 2

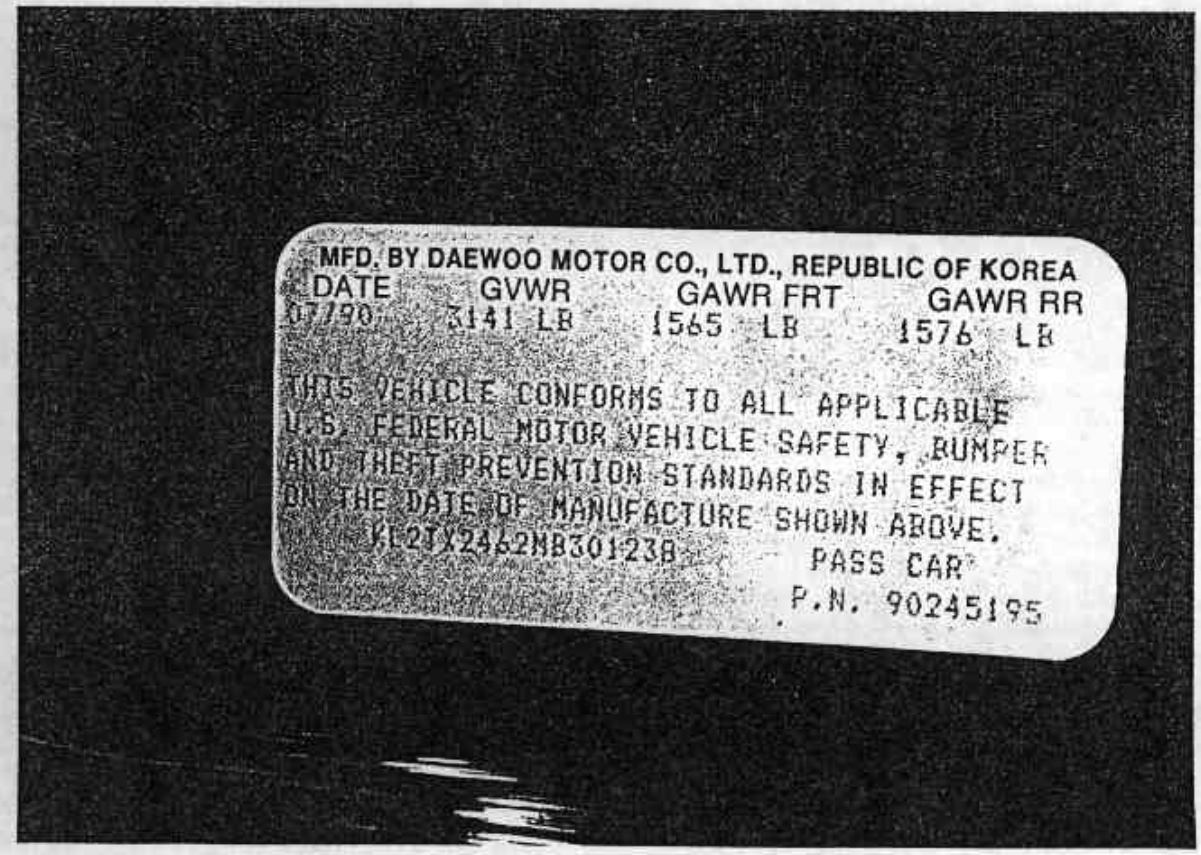


Figure A-42. PRE-TEST VEHICLE CERTIFICATION LABEL VIEW

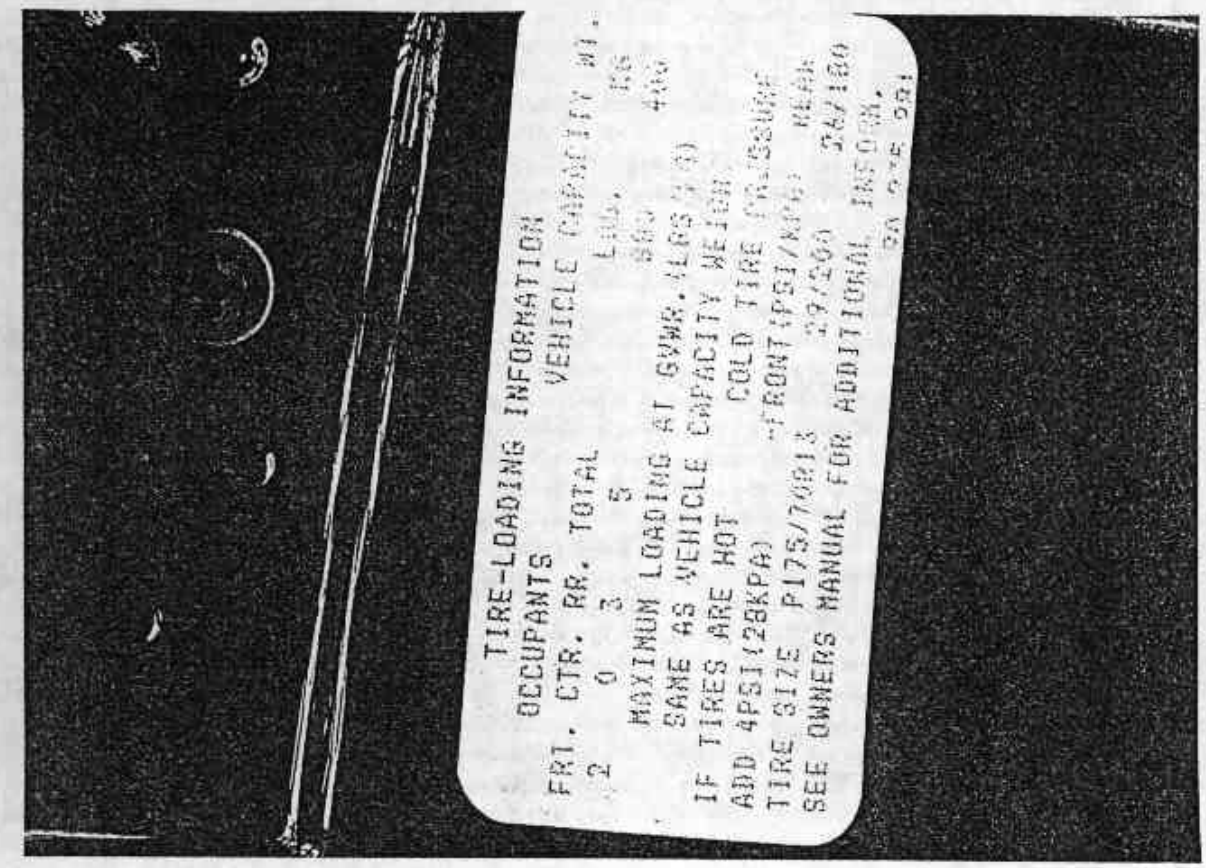


Figure A-43. PRE-TEST RECOMMENDED TIRE PRESSURE LABEL VIEW

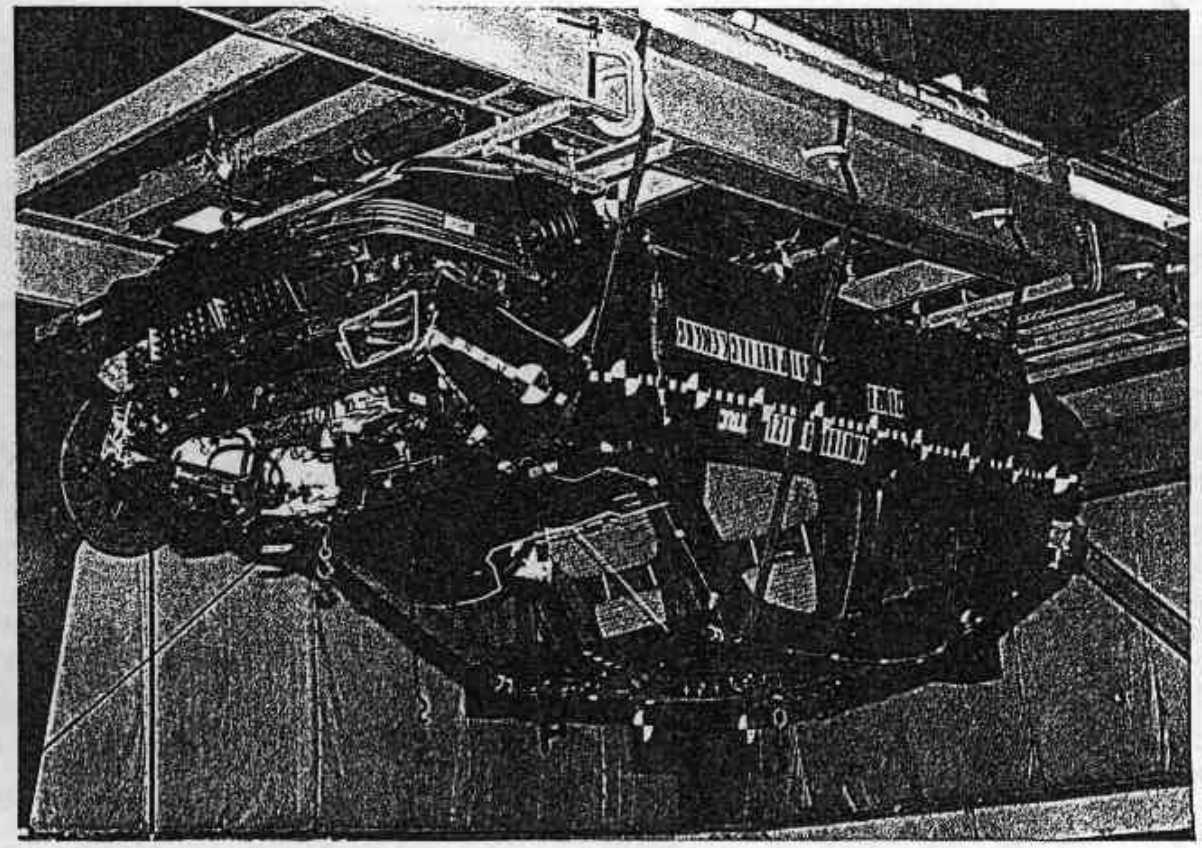
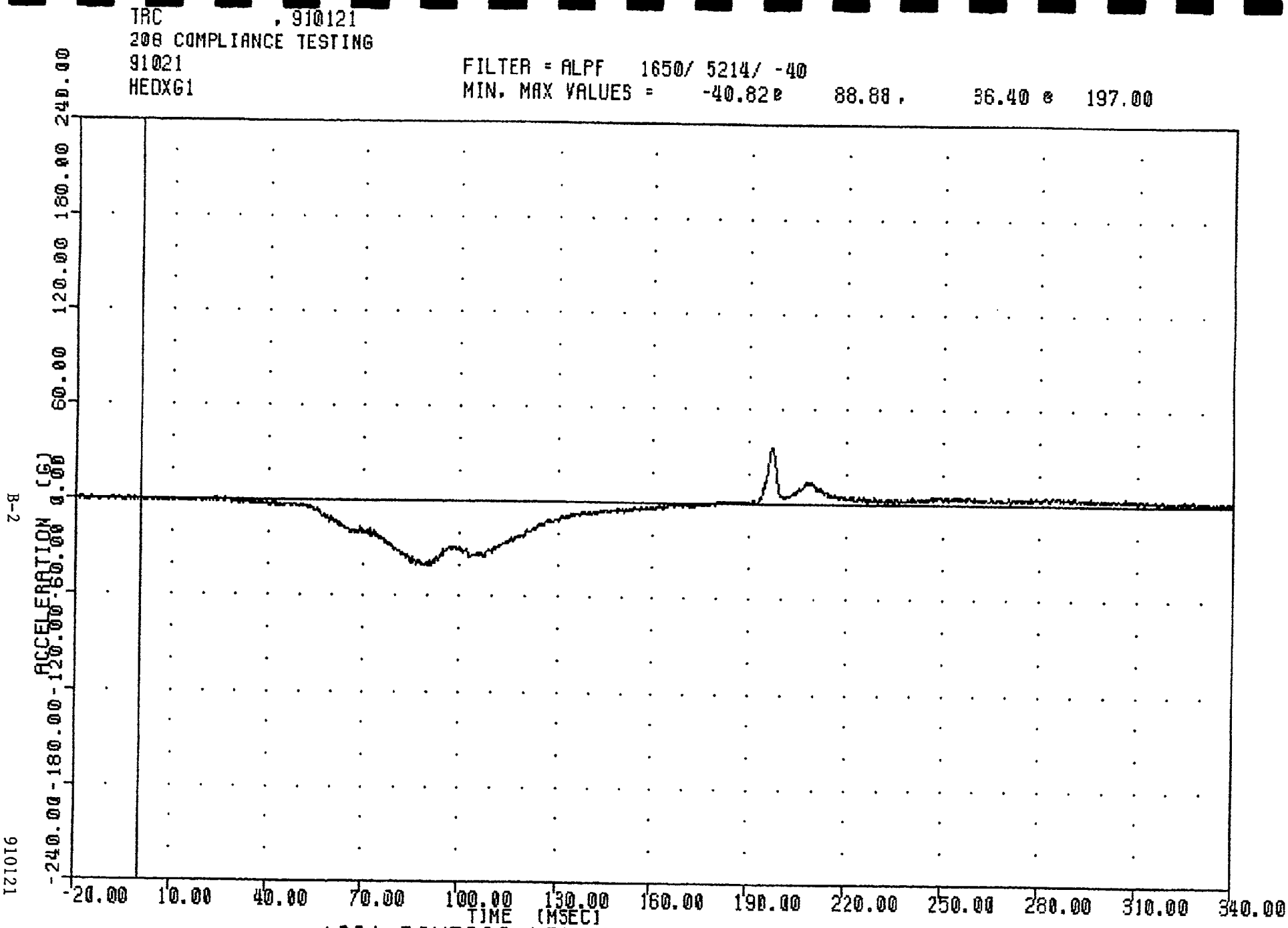


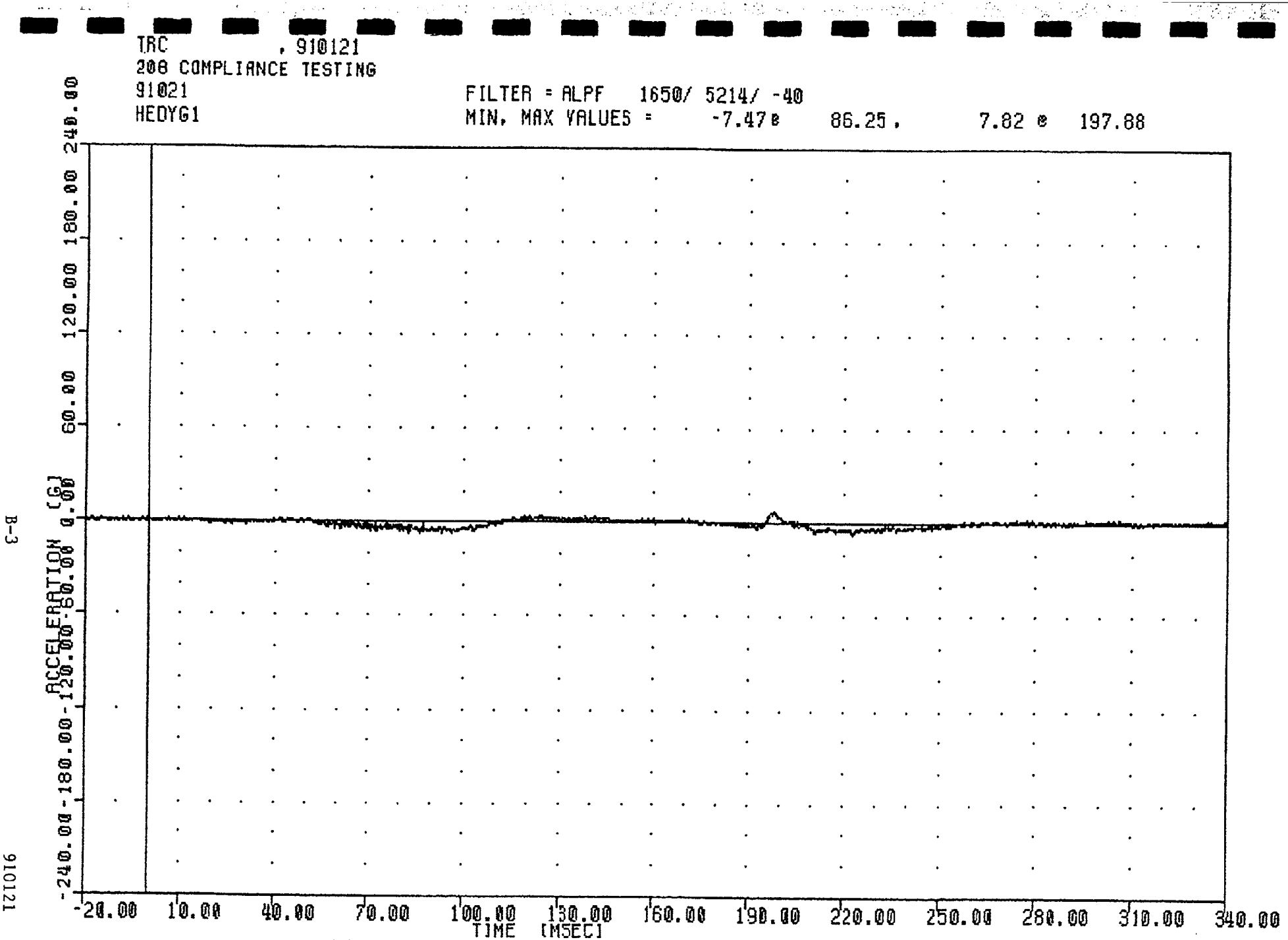
Figure A-44. POST-TEST VEHICLE ON STATIC ROLLOVER MACHINE VIEW

APPENDIX B

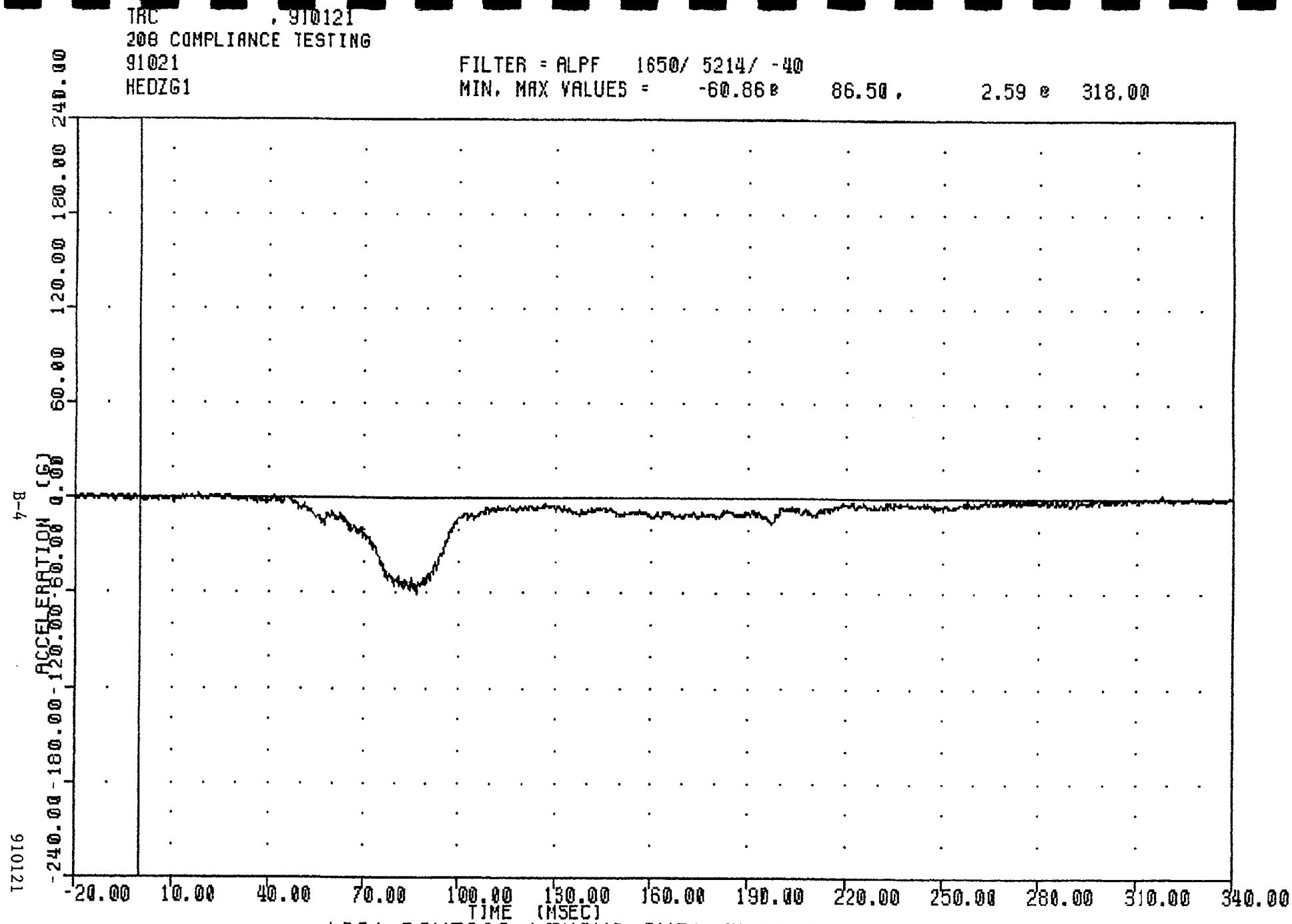
DATA PLOTS



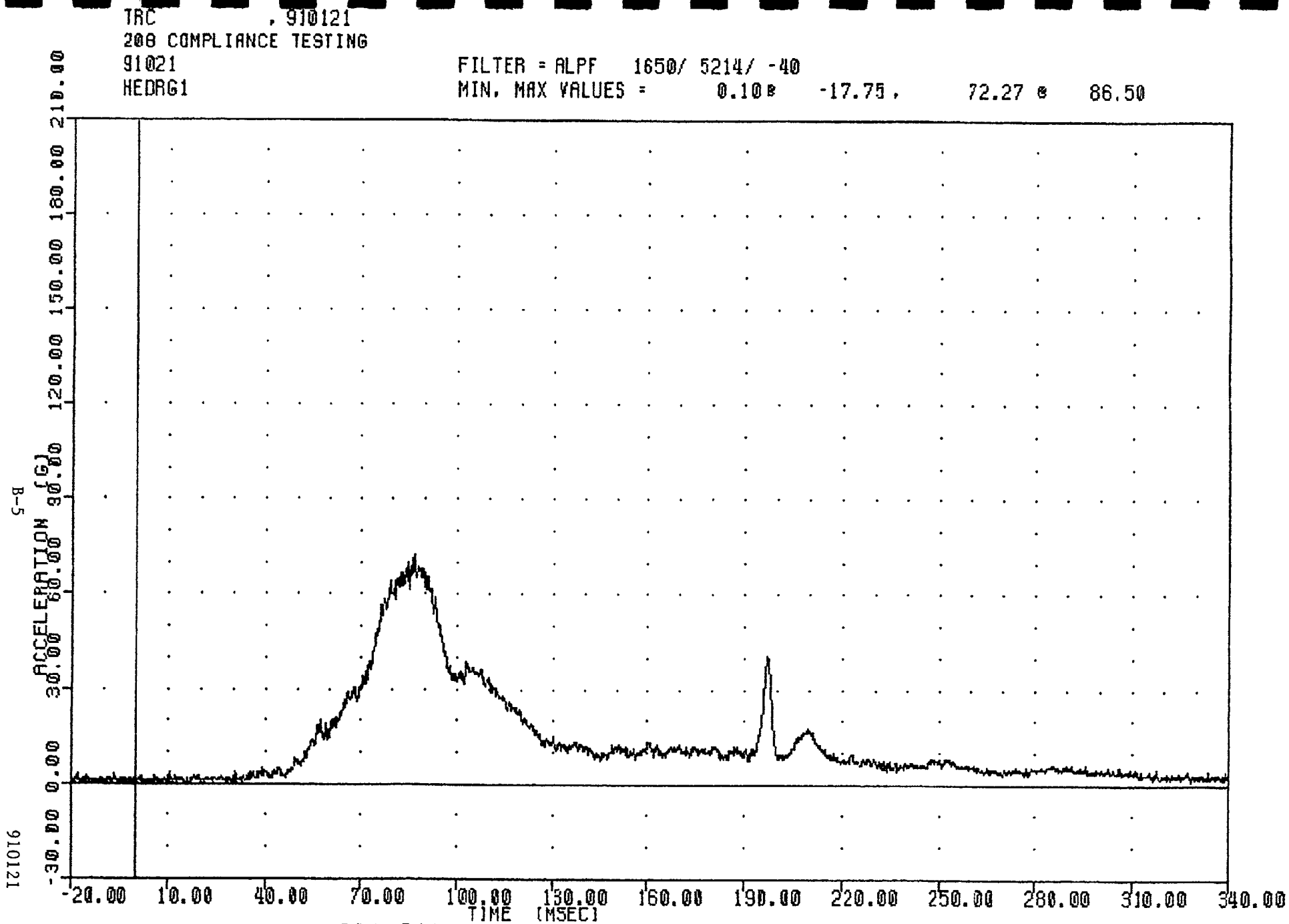
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER HEAD X-AXIS ACCELERATION



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER HEAD Y-AXIS ACCELERATION

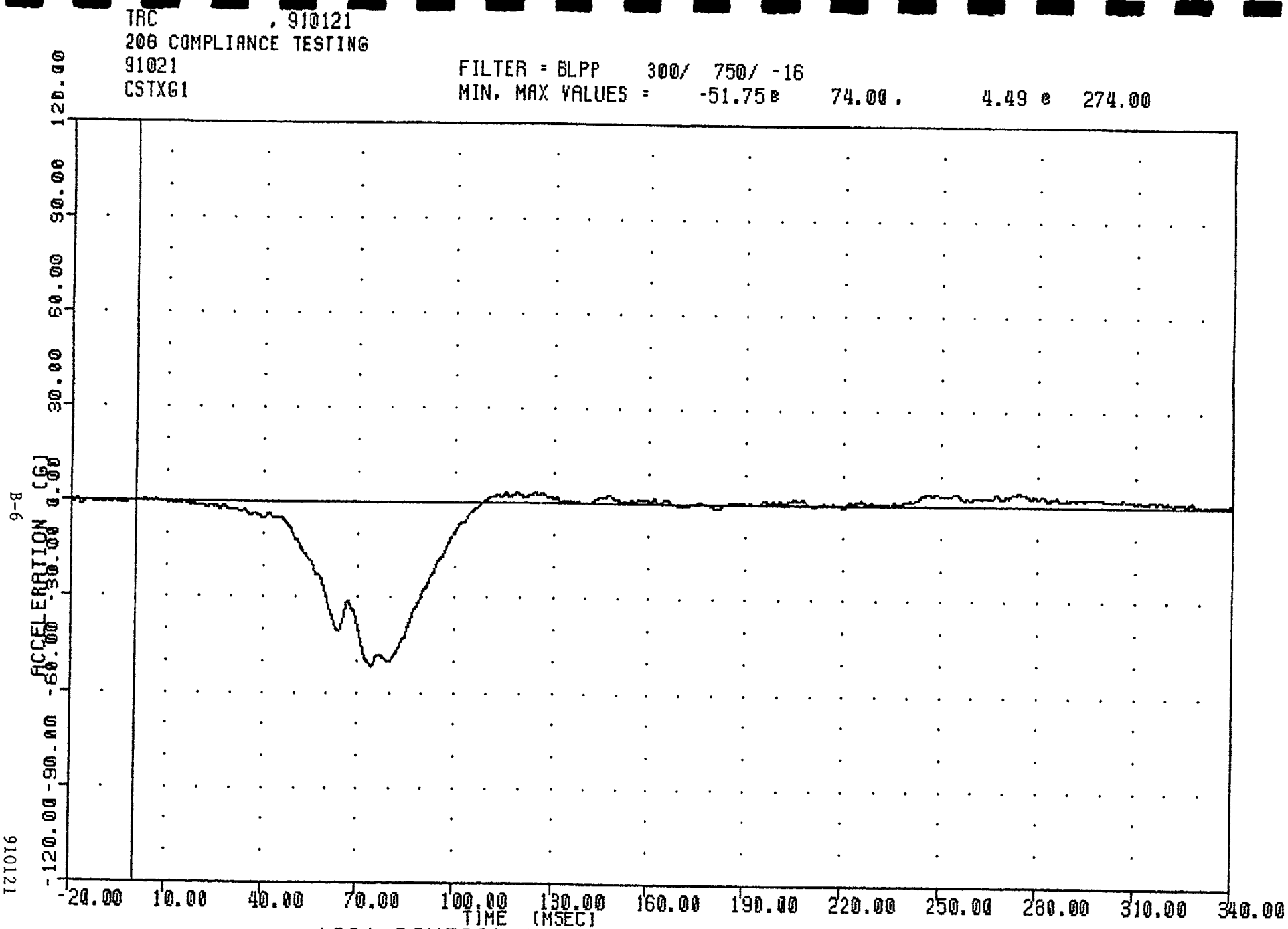


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER HEAD Z-AXIS ACCELERATION

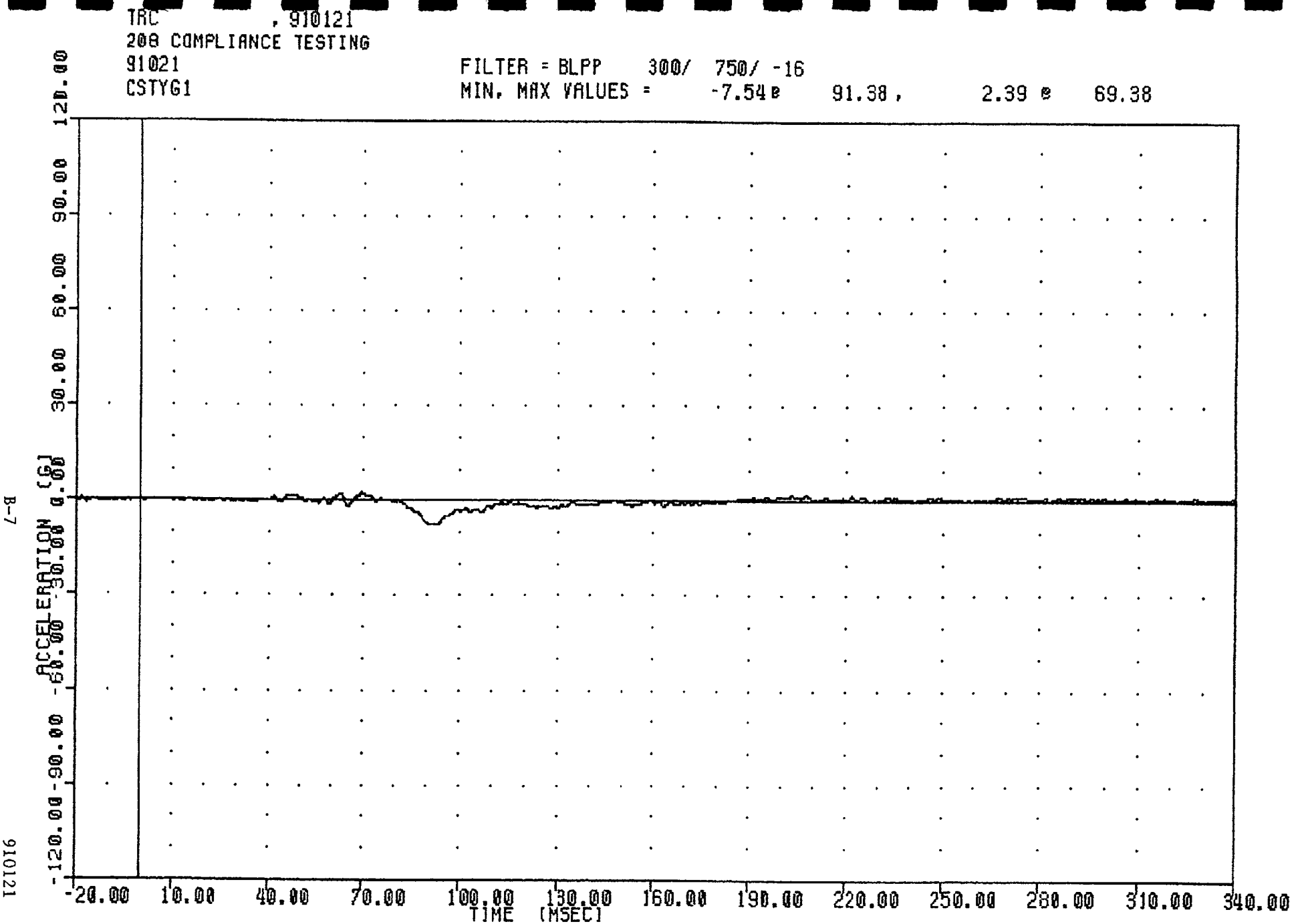


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER HEAD RESULTANT ACCELERATION

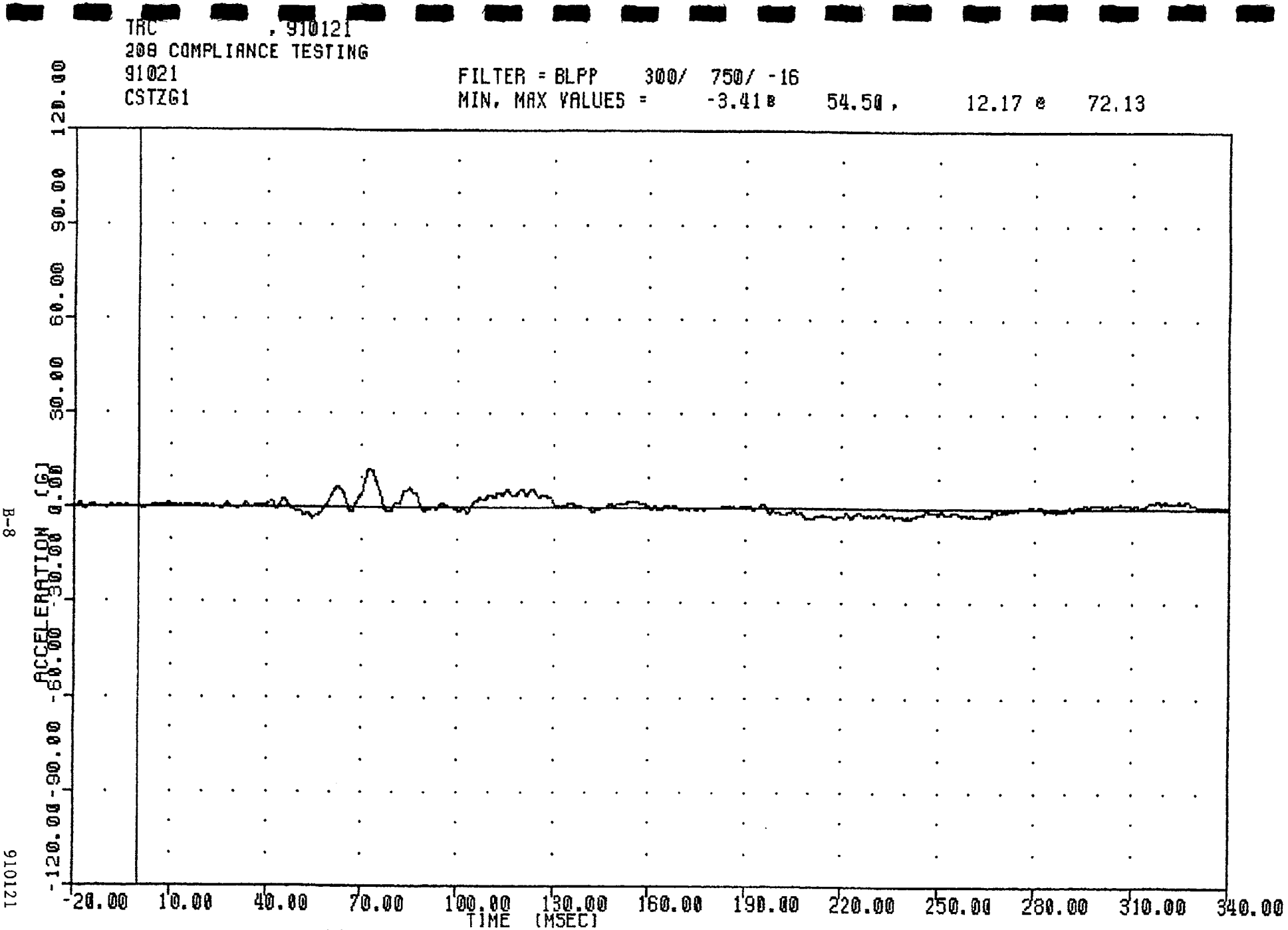
910121



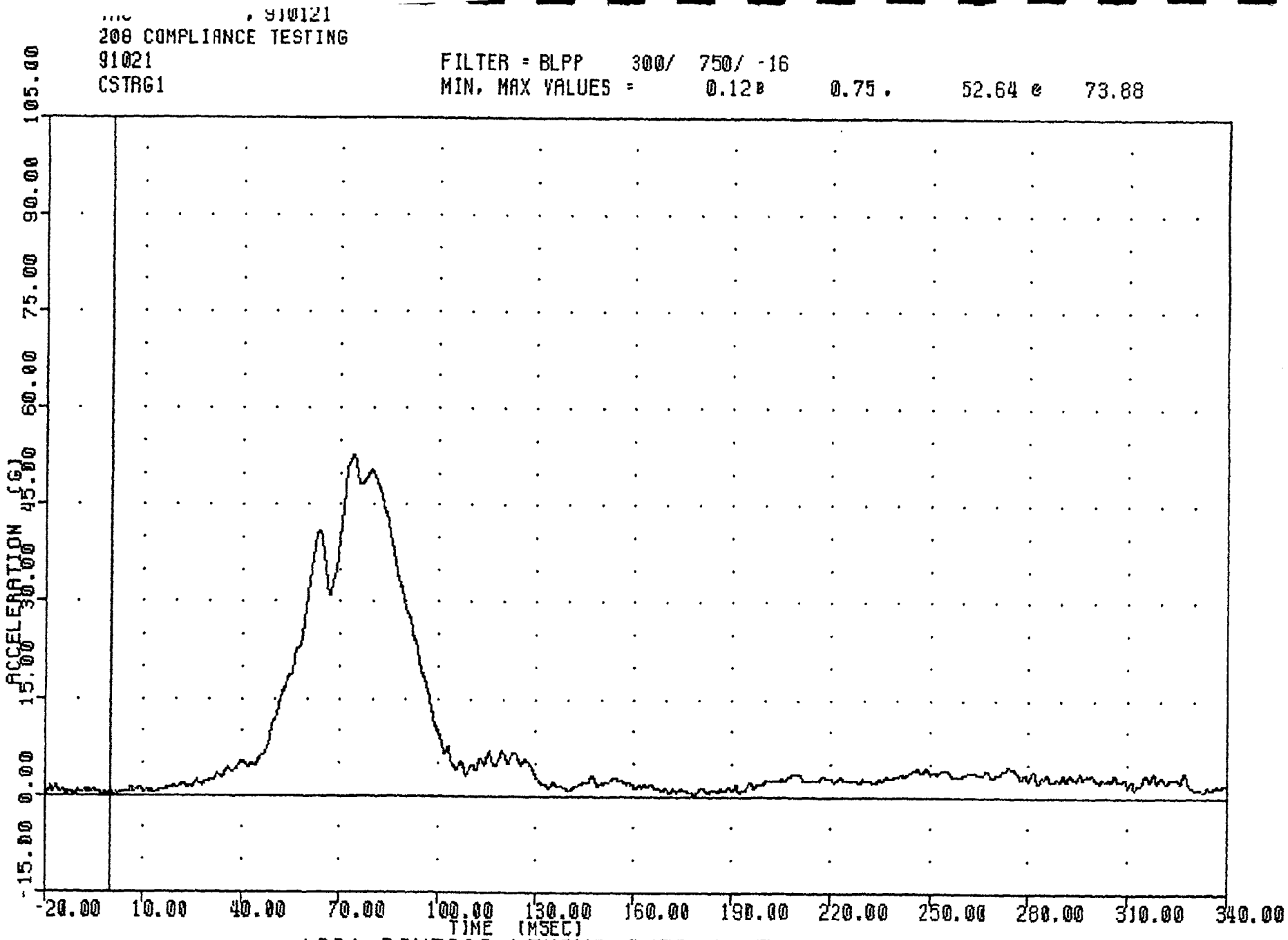
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER CHEST X-AXIS ACCELERATION



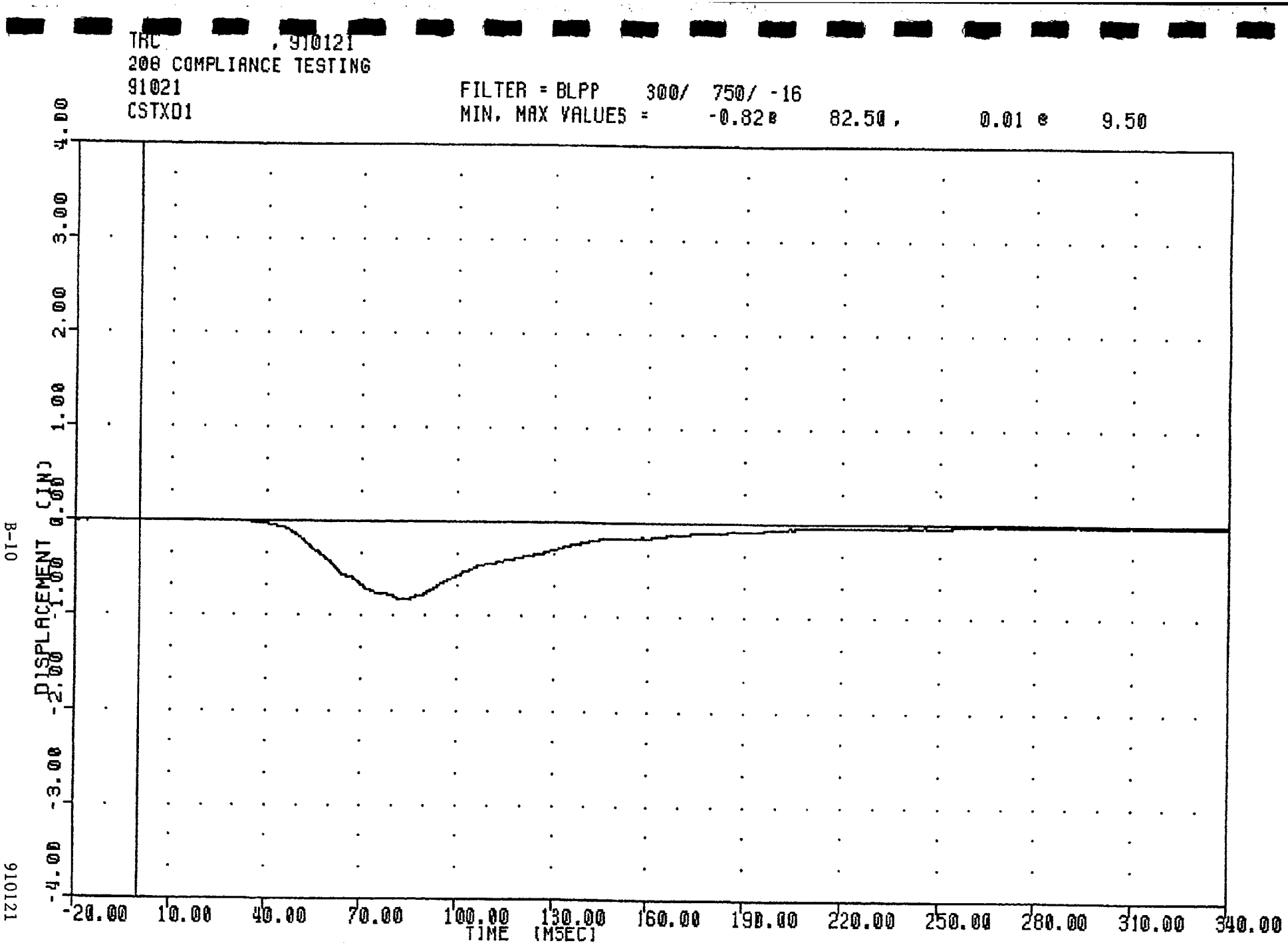
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER CHEST Y-AXIS ACCELERATION



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER CHEST Z-AXIS ACCELERATION

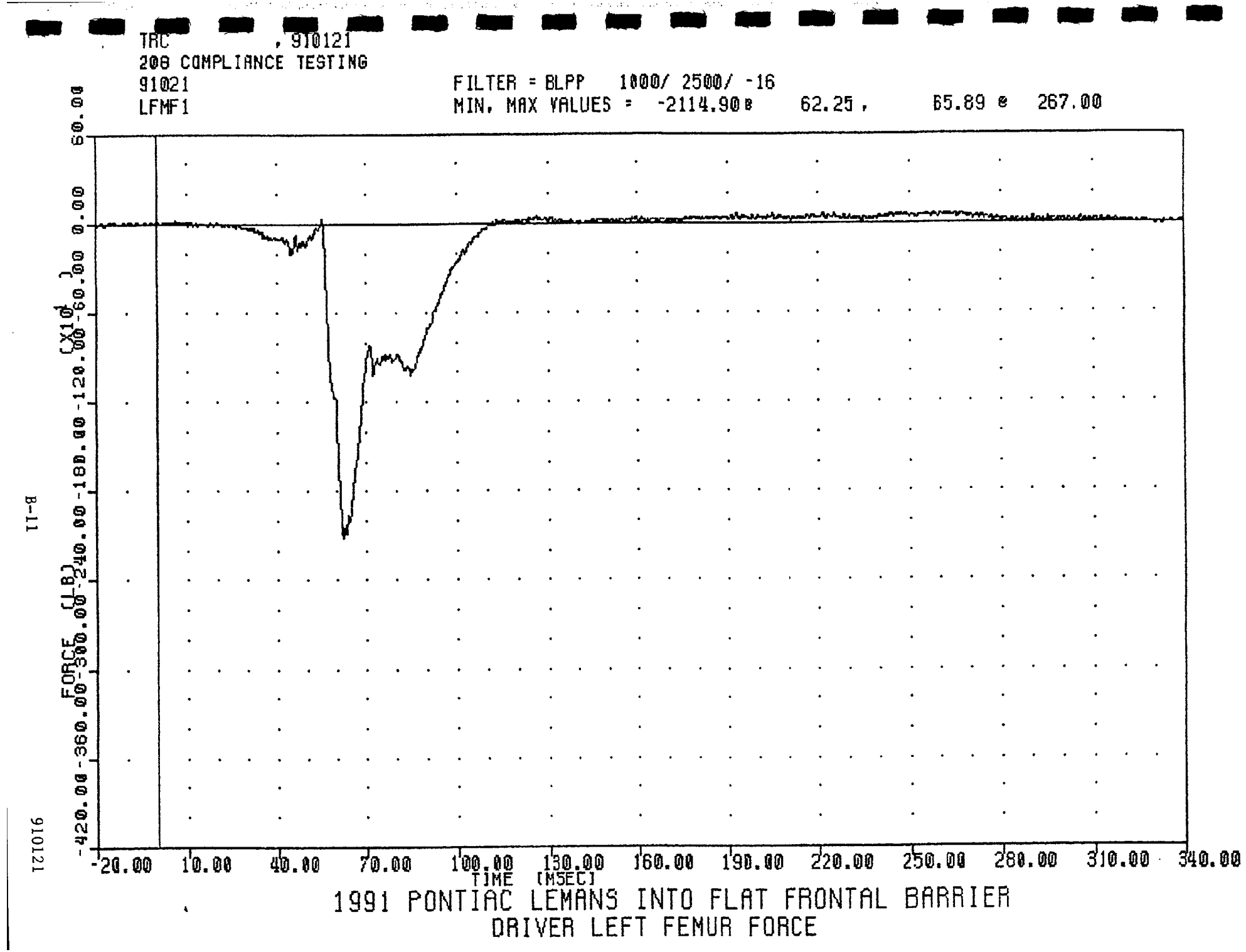


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER CHEST RESULTANT ACCELERATION

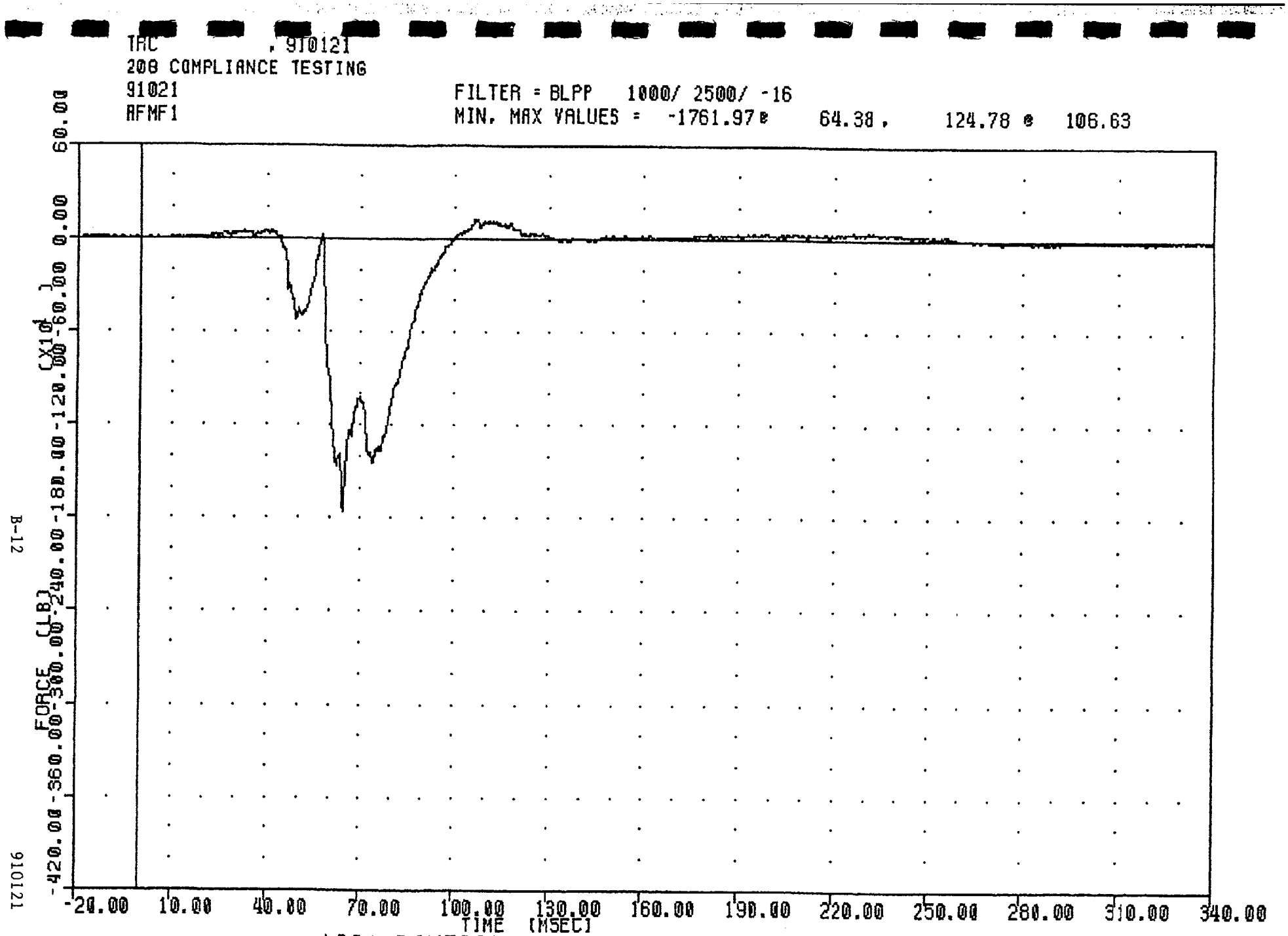


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER CHEST DISPLACEMENT

910121

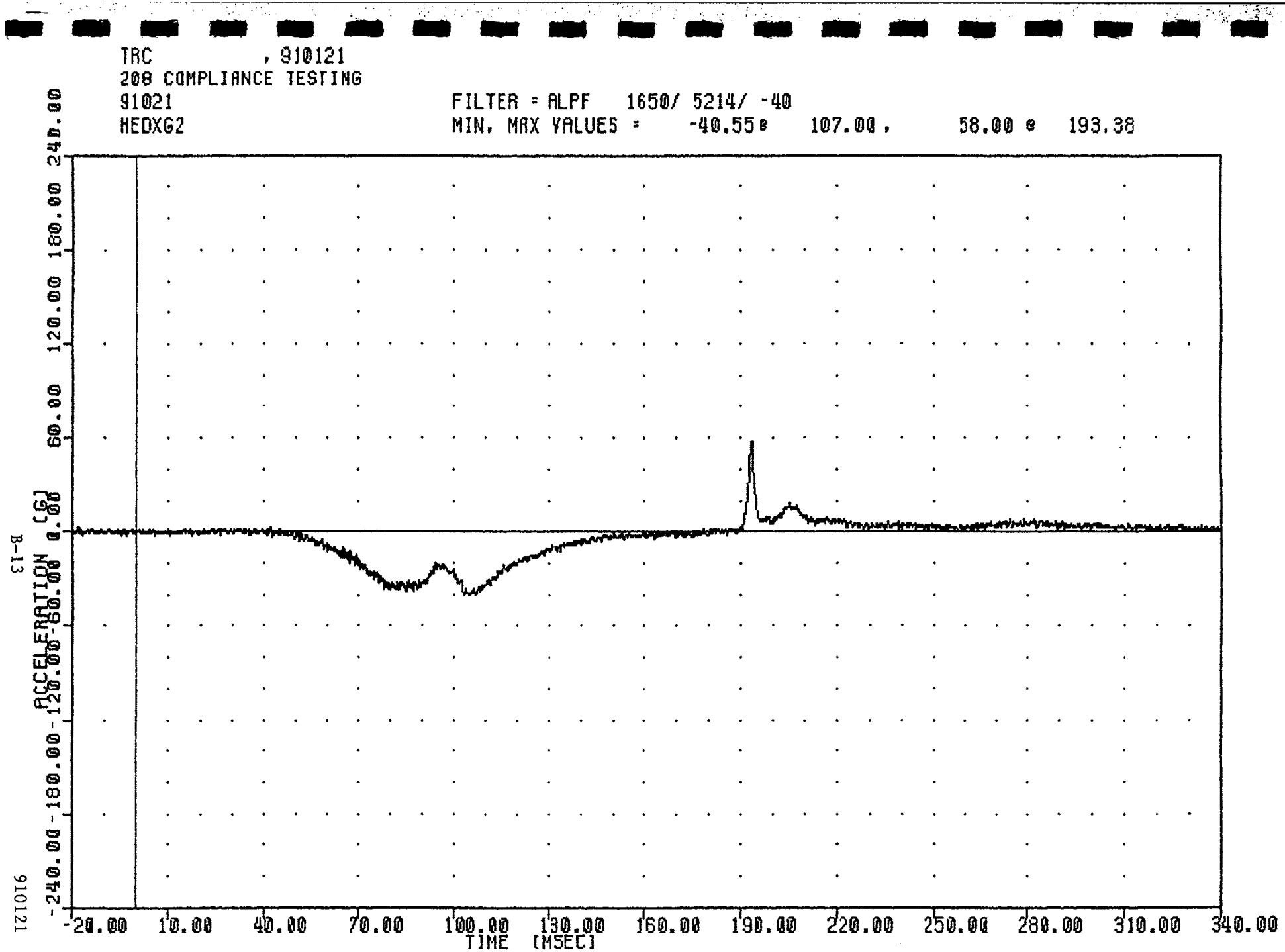


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER LEFT FEMUR FORCE

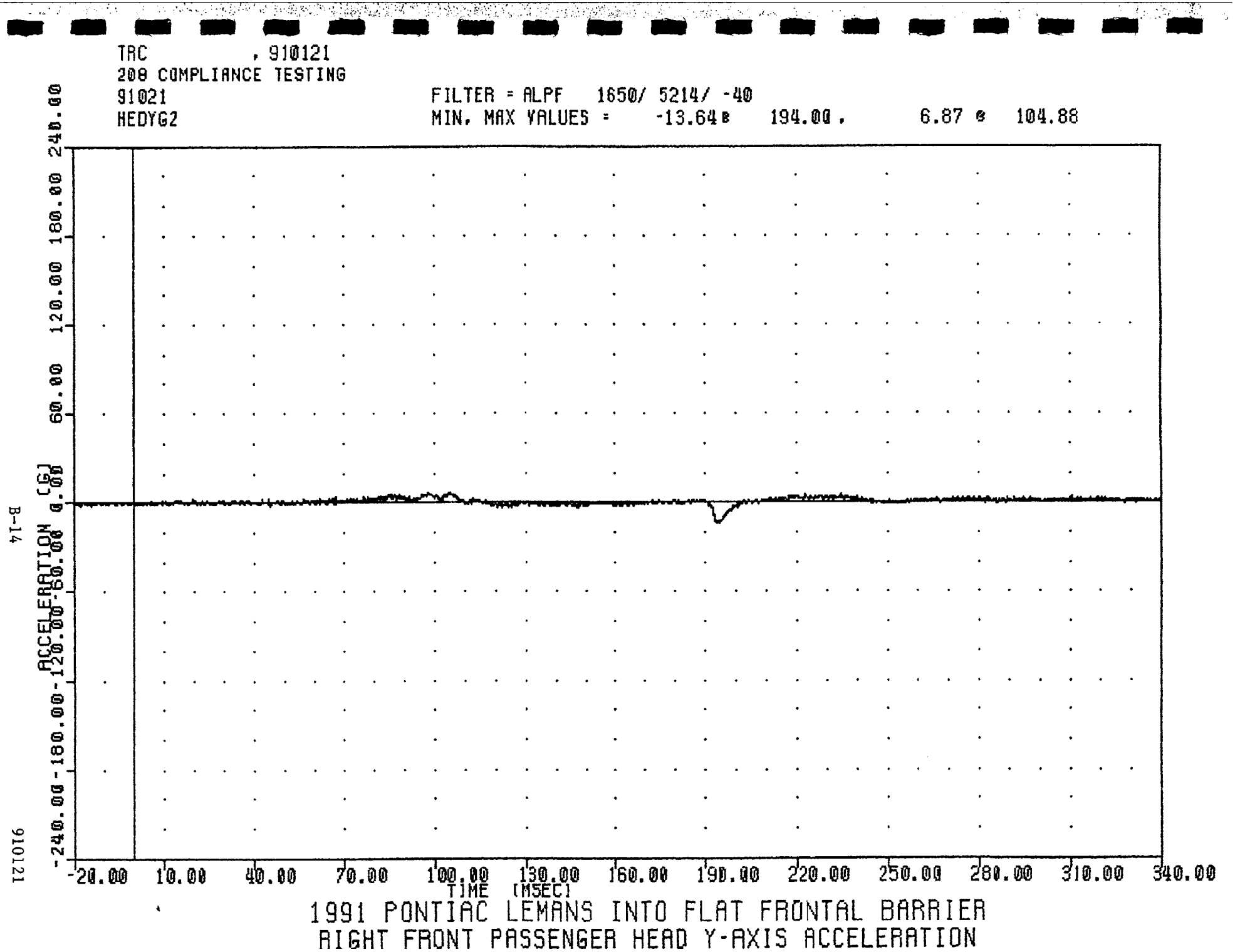


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
DRIVER RIGHT FEMUR FORCE

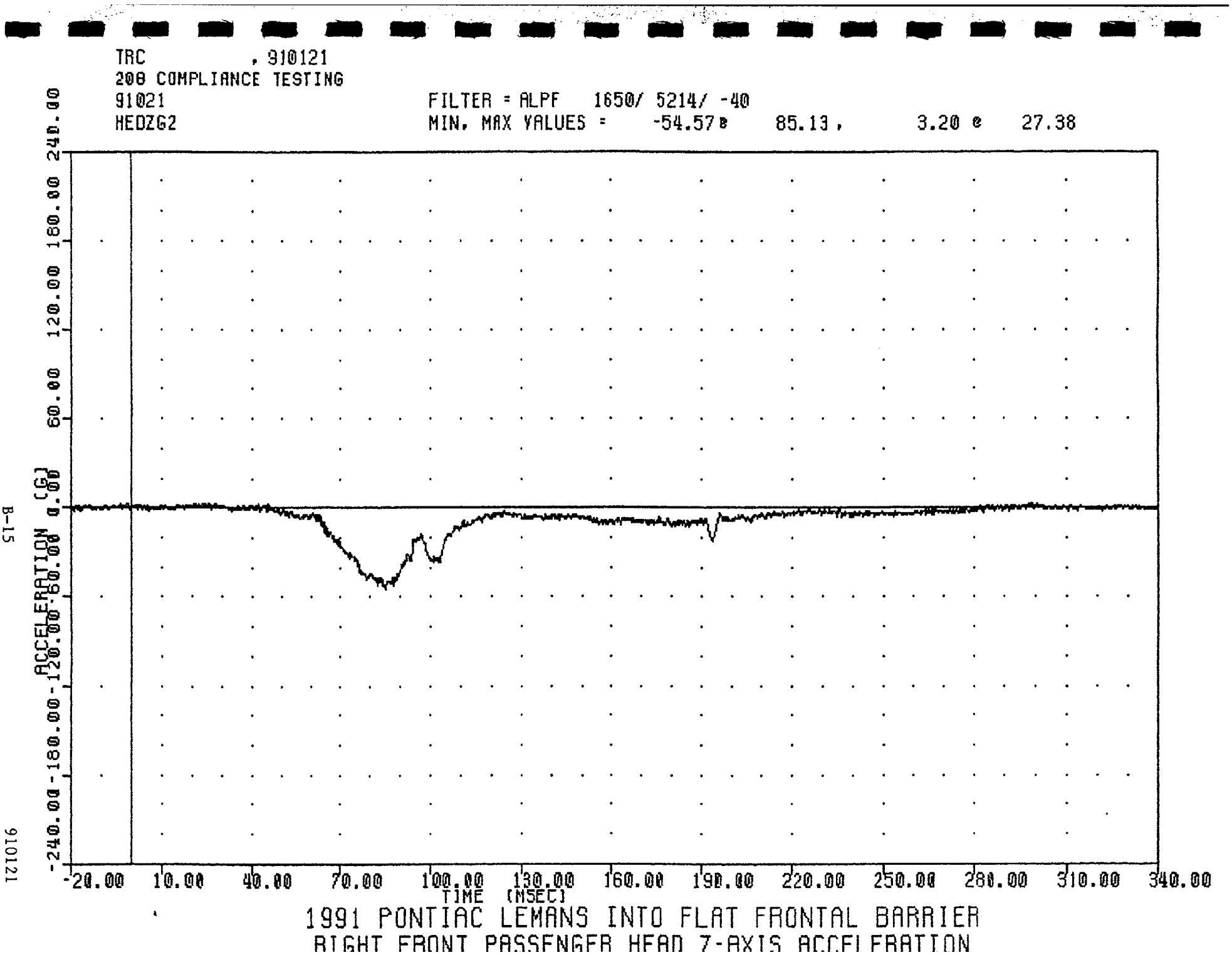
910121



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION



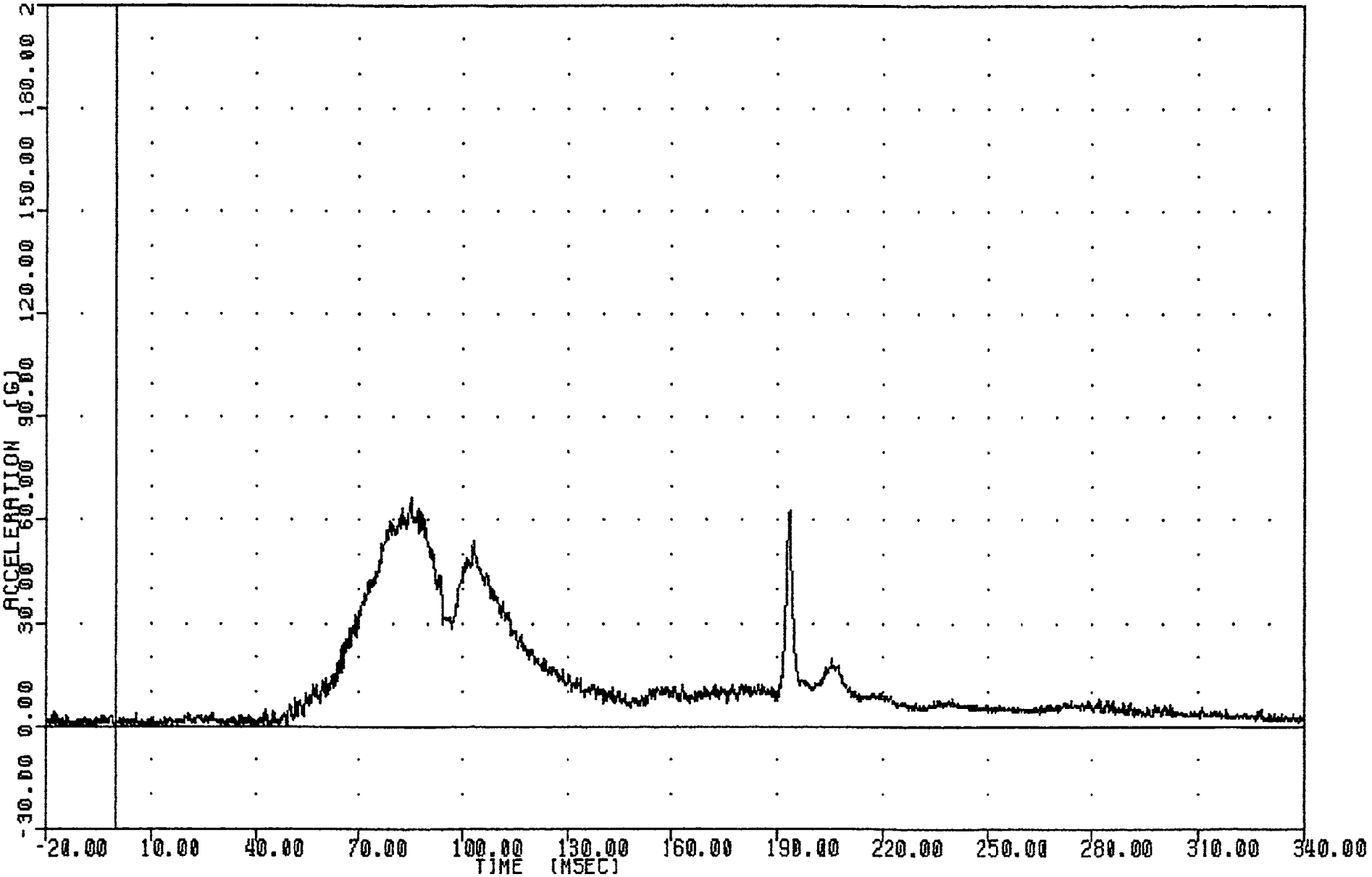
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION



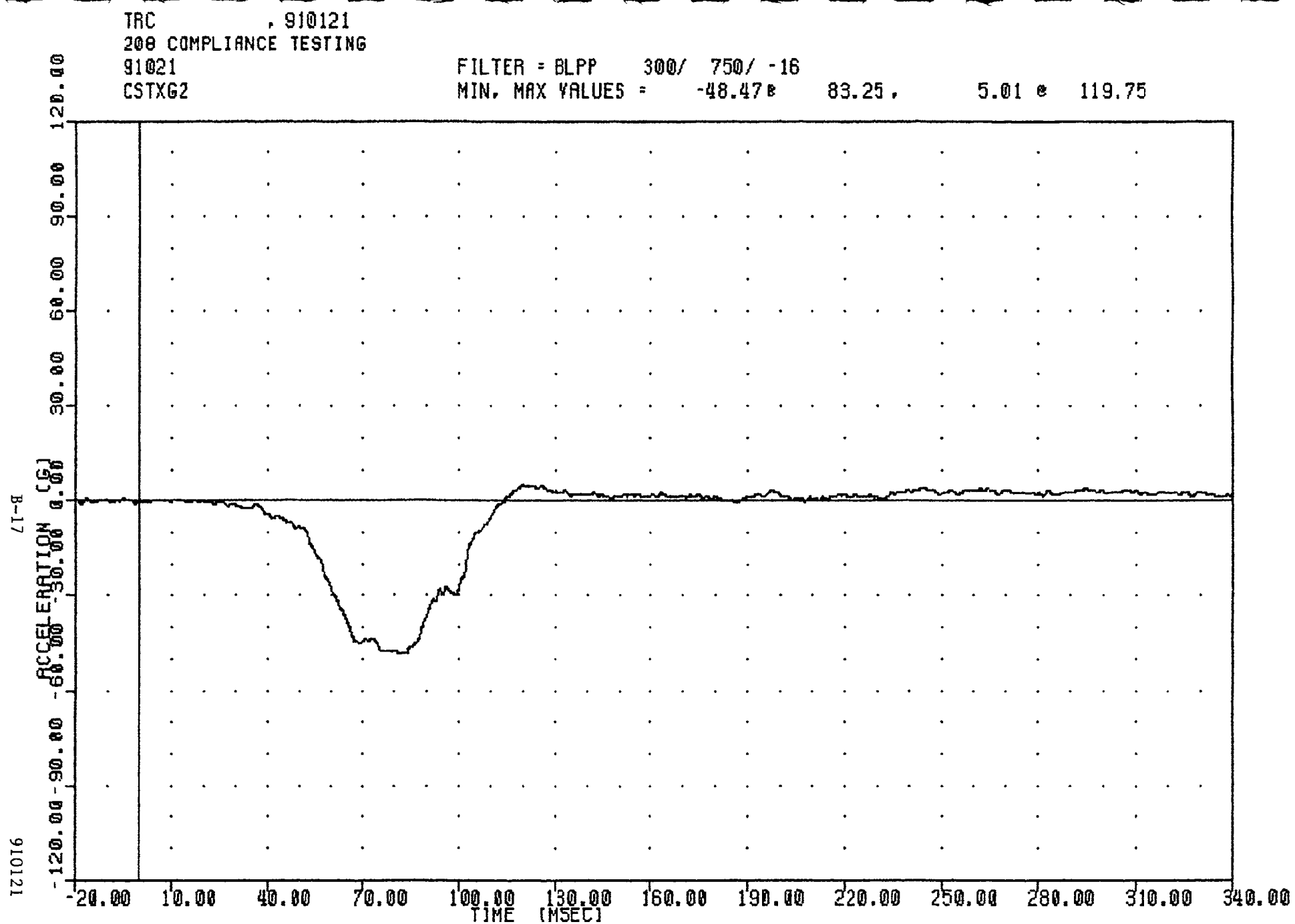
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION

TRC , 910121
208 COMPLIANCE TESTING
91021
HEDRG2

FILTER = ALPF 1650/ 5214/ -40
MIN, MAX VALUES = 0.12 @ -7.75 , 66.46 @ 85.00

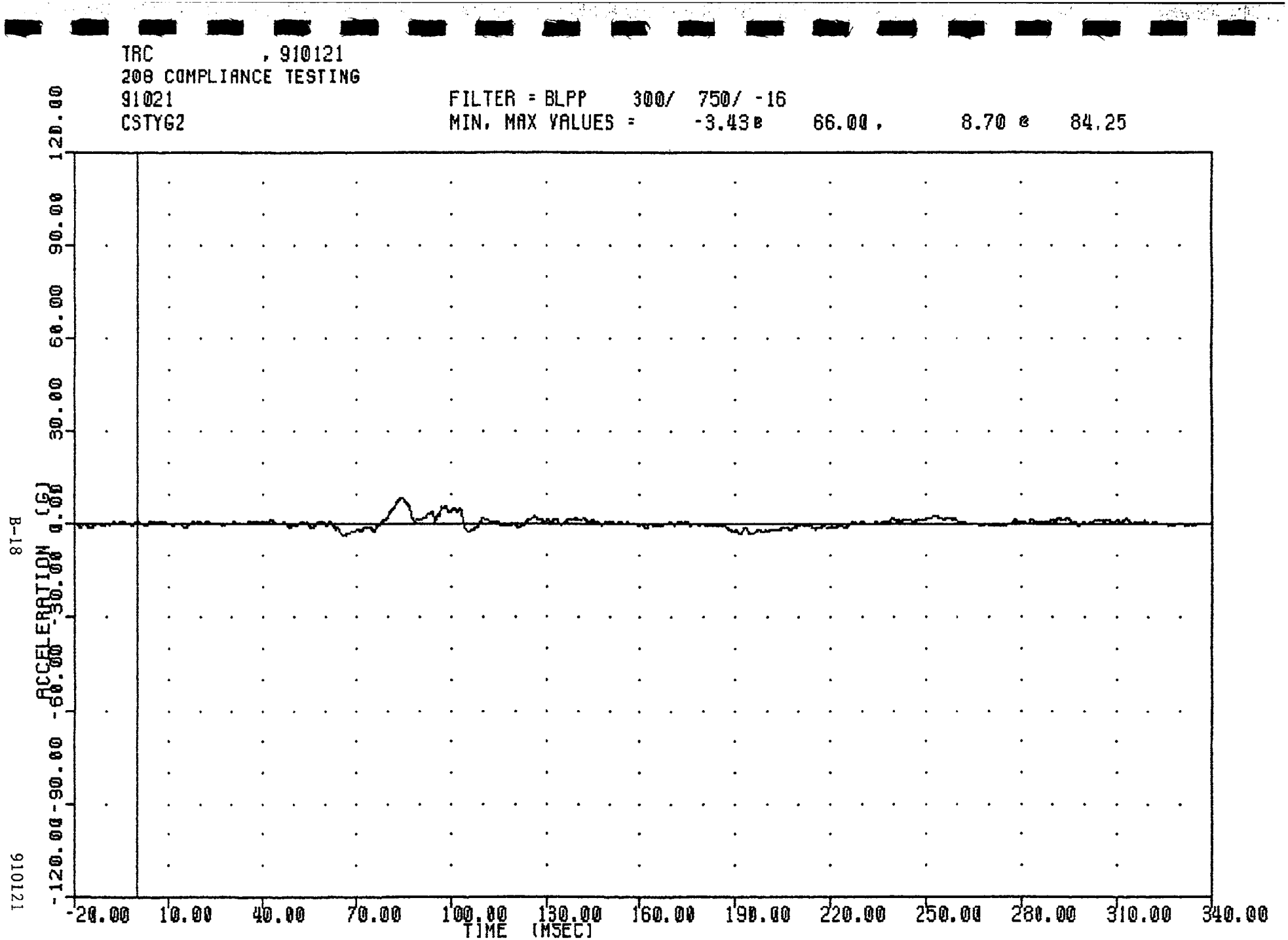


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

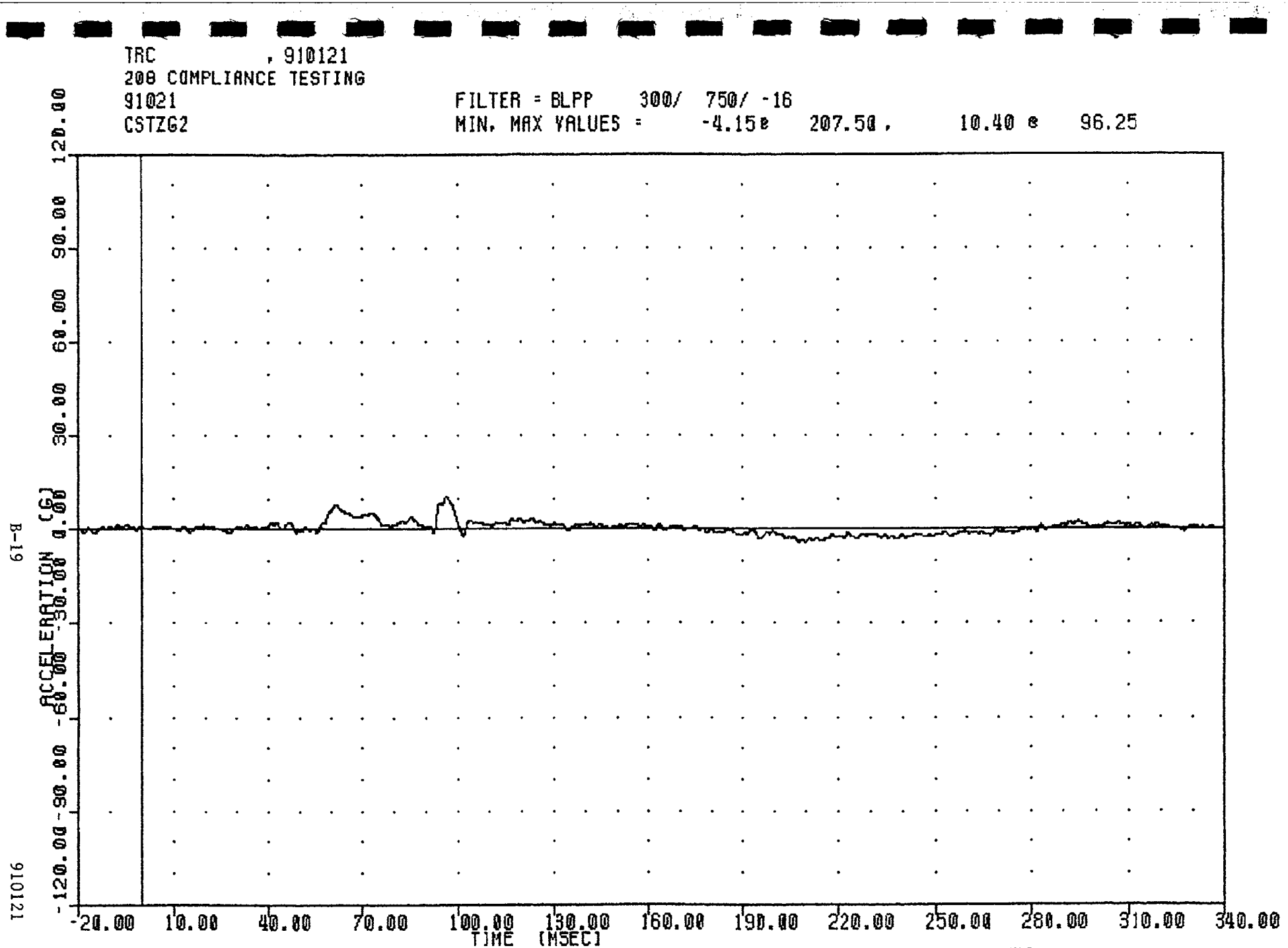


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION

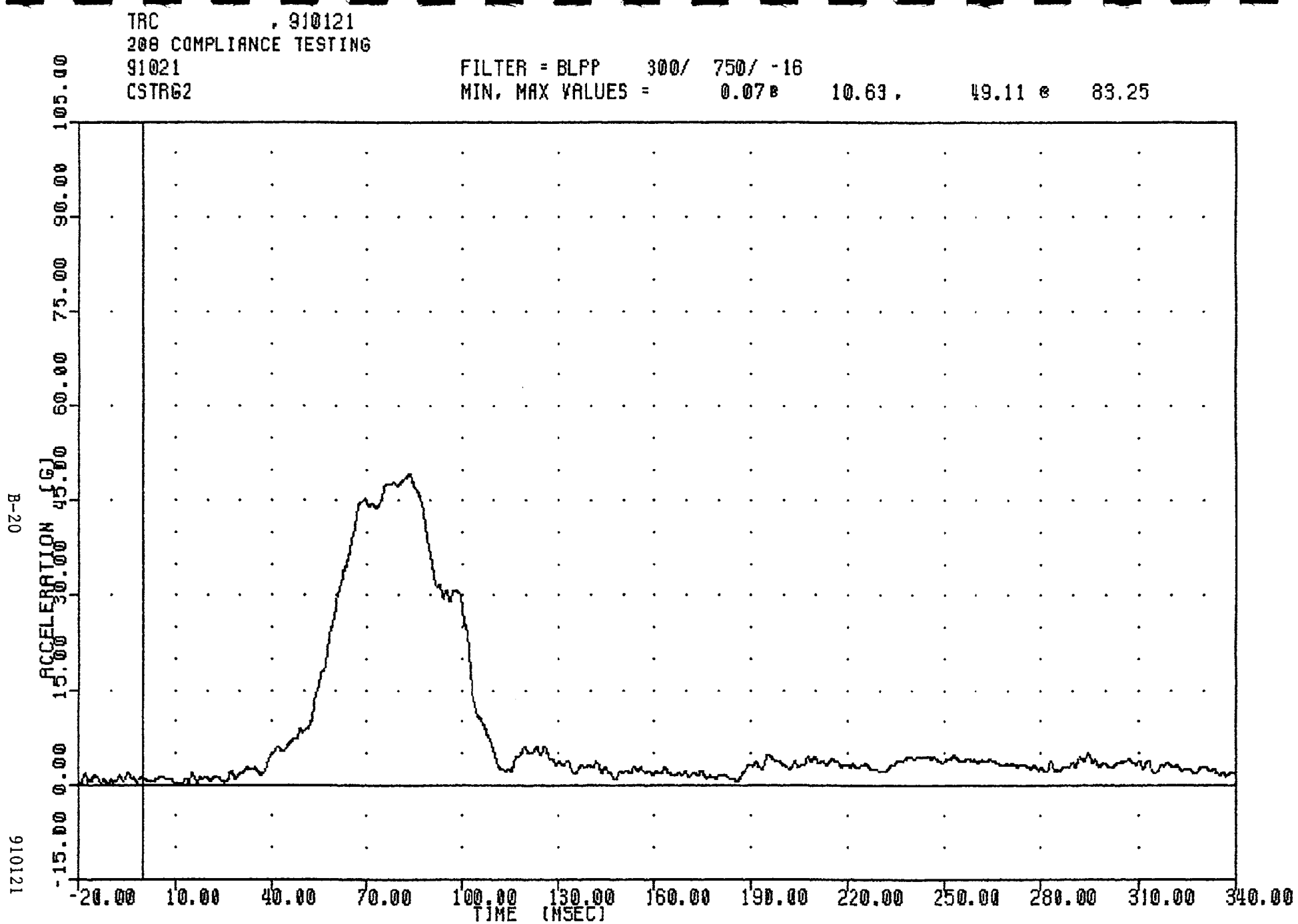
910121



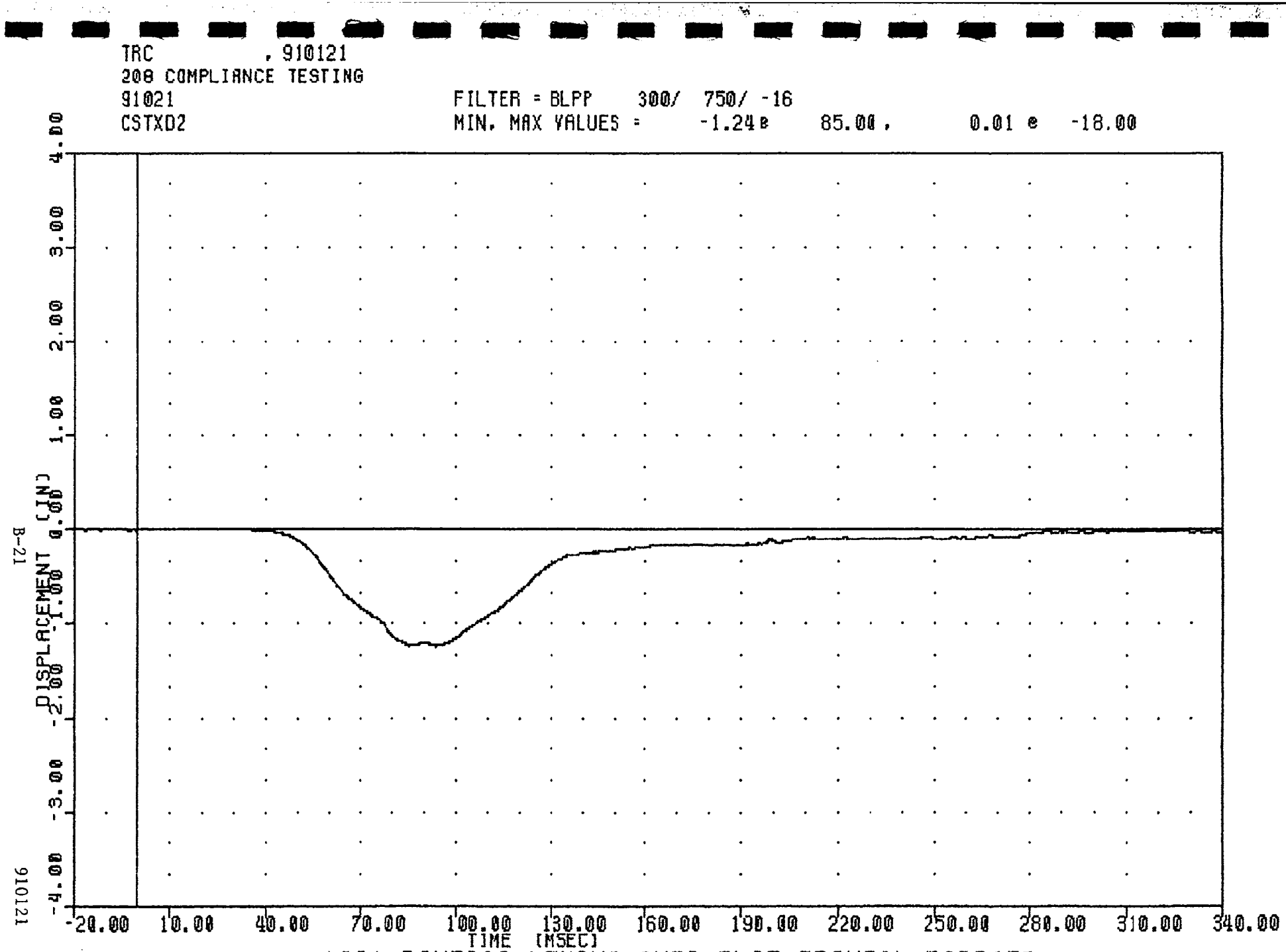
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION

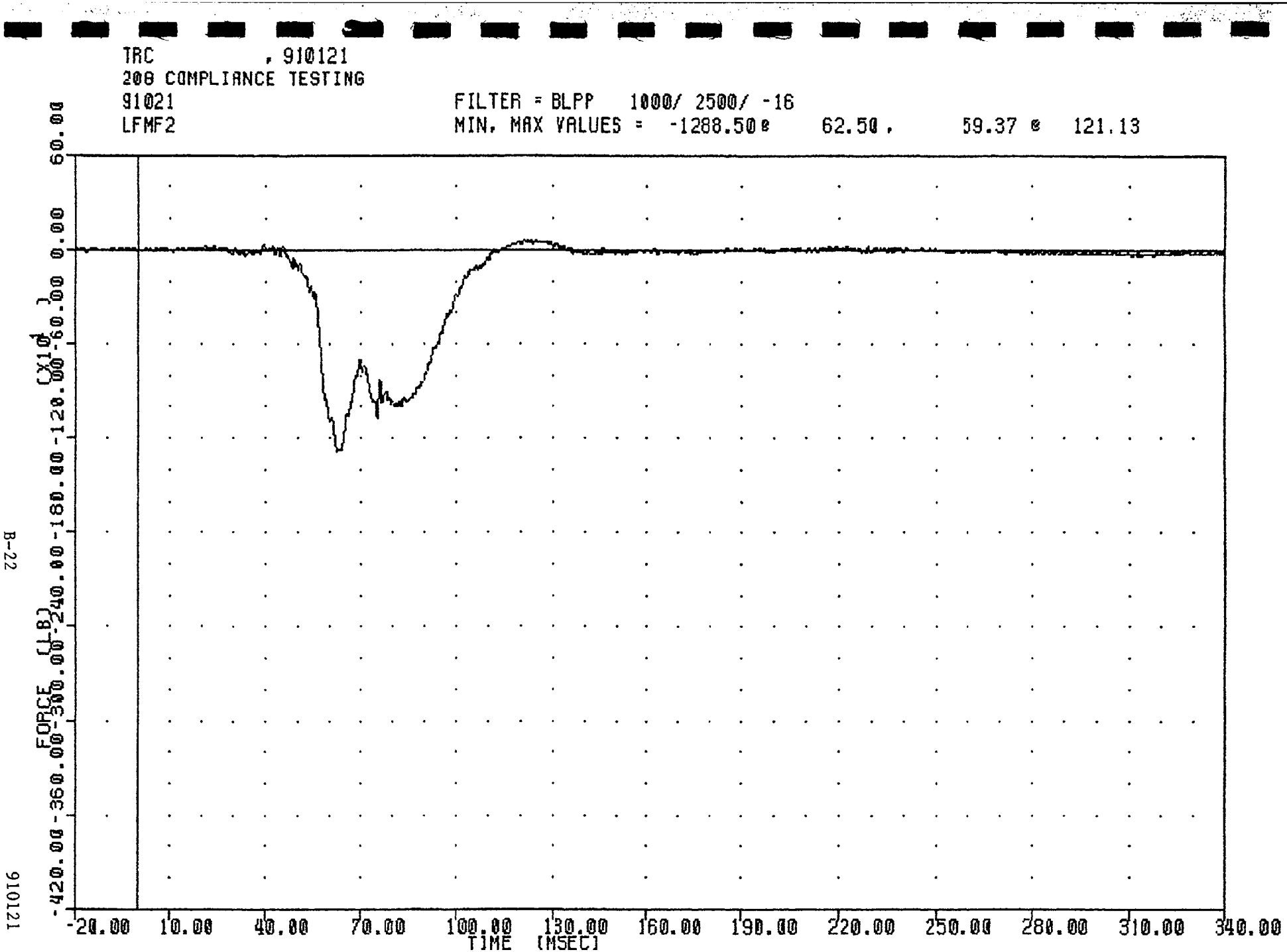


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST DISPLACEMENT

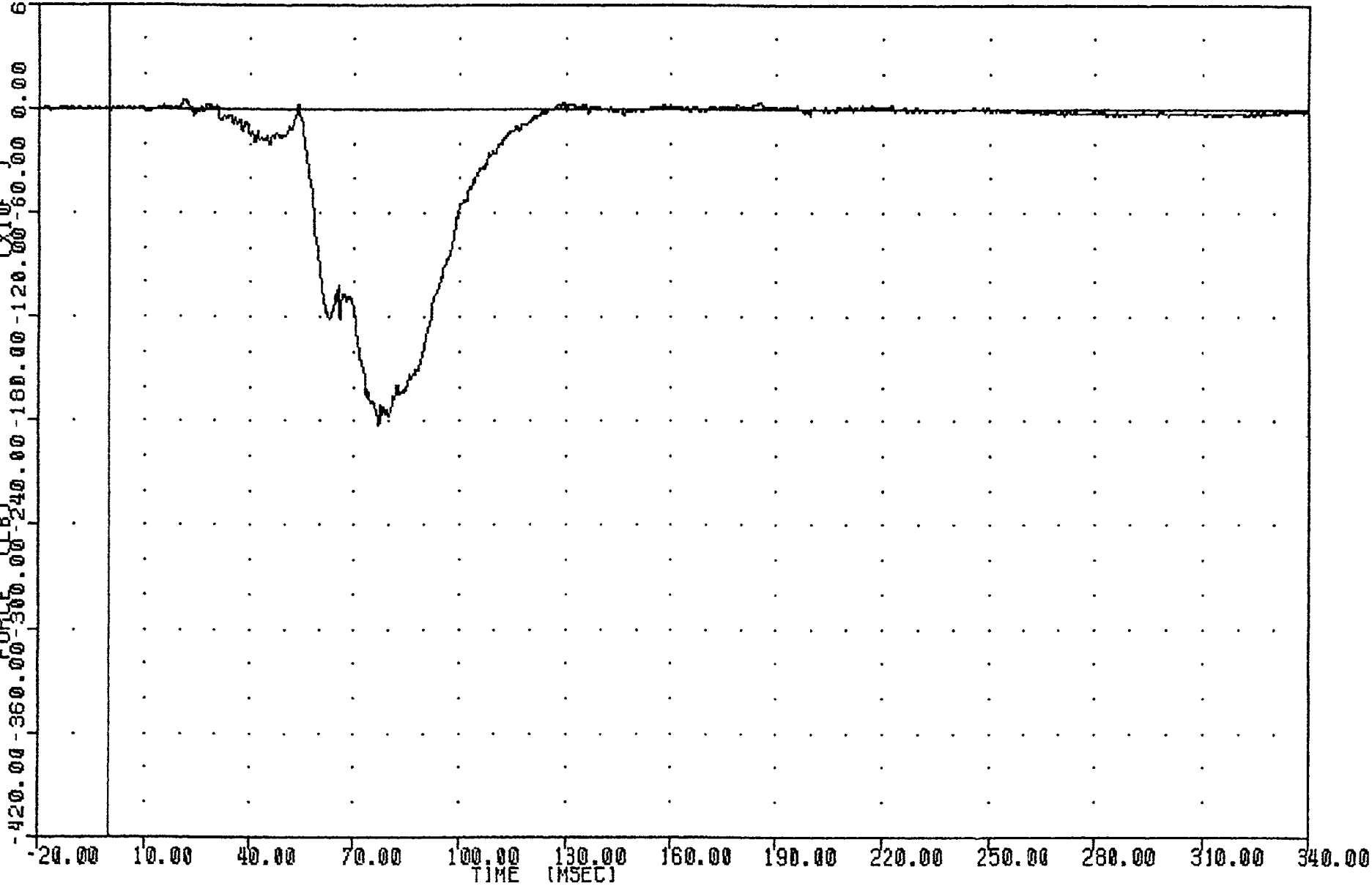
910121



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER LEFT FEMUR FORCE

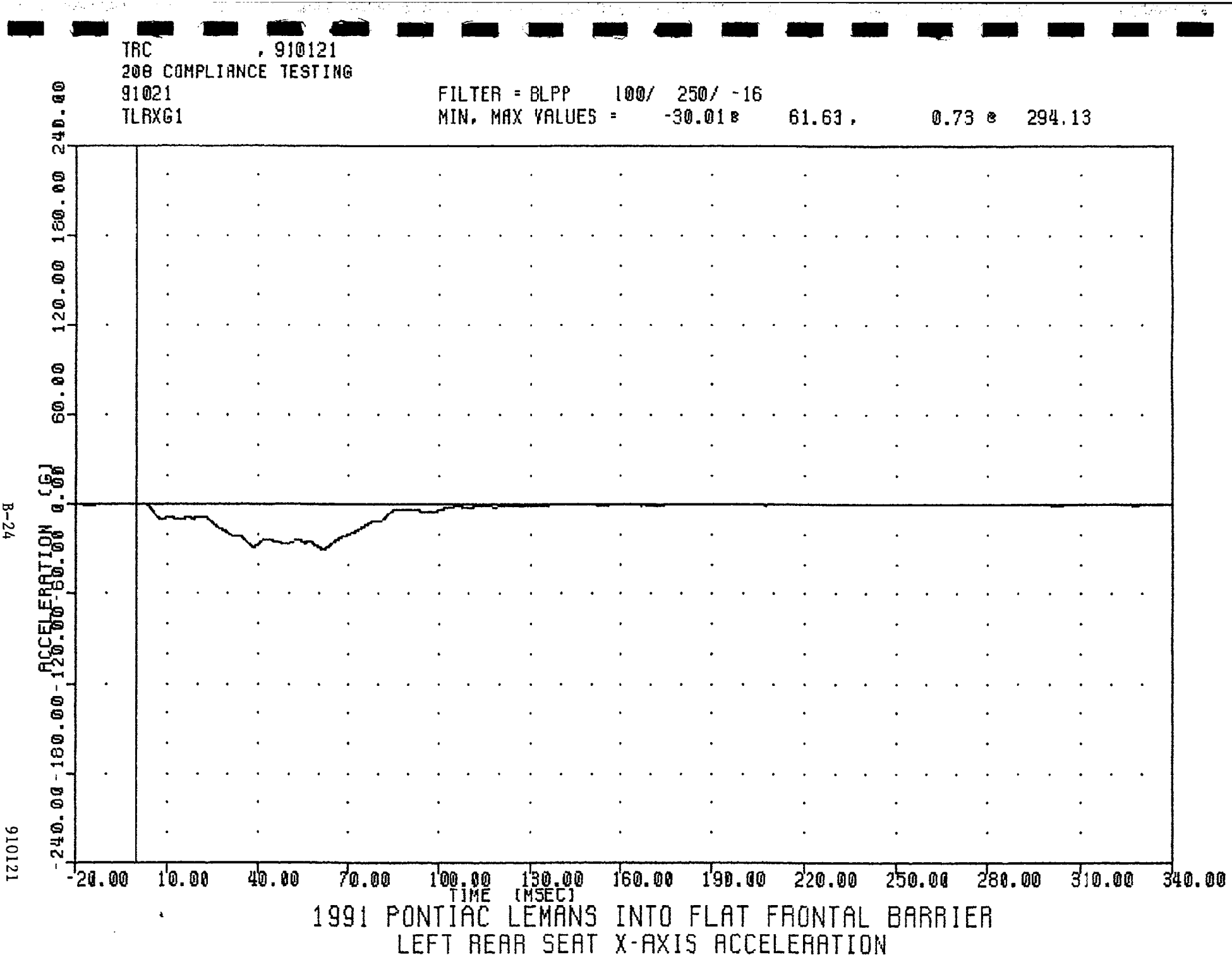
TRC , 910121
208 COMPLIANCE TESTING
91021
RFMF2

FILTER = BLPP 1000/ 2500/ -16
MIN, MAX VALUES = -1820.92 @ 76.88 , 52.68 @ 21.00

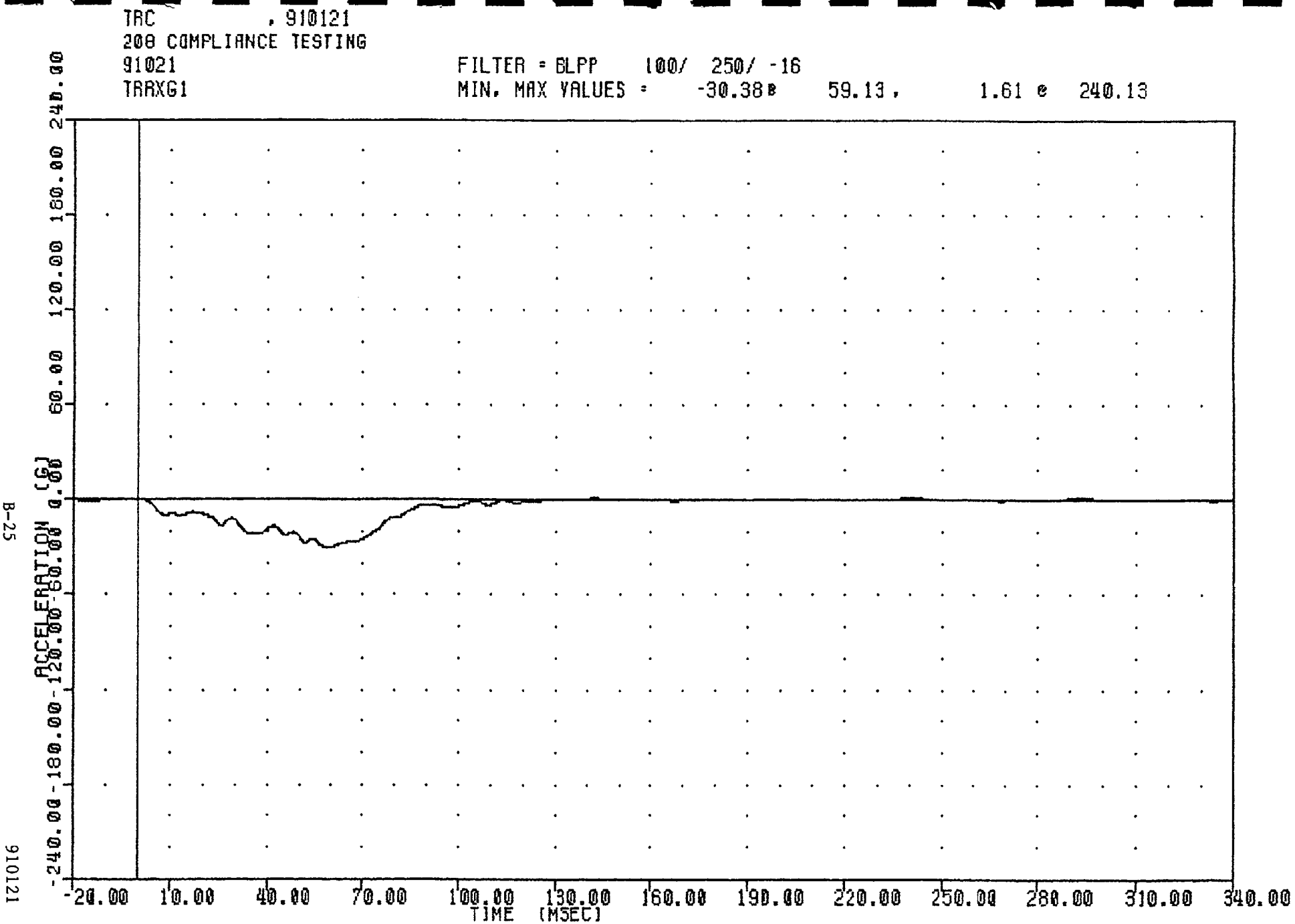


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

910121

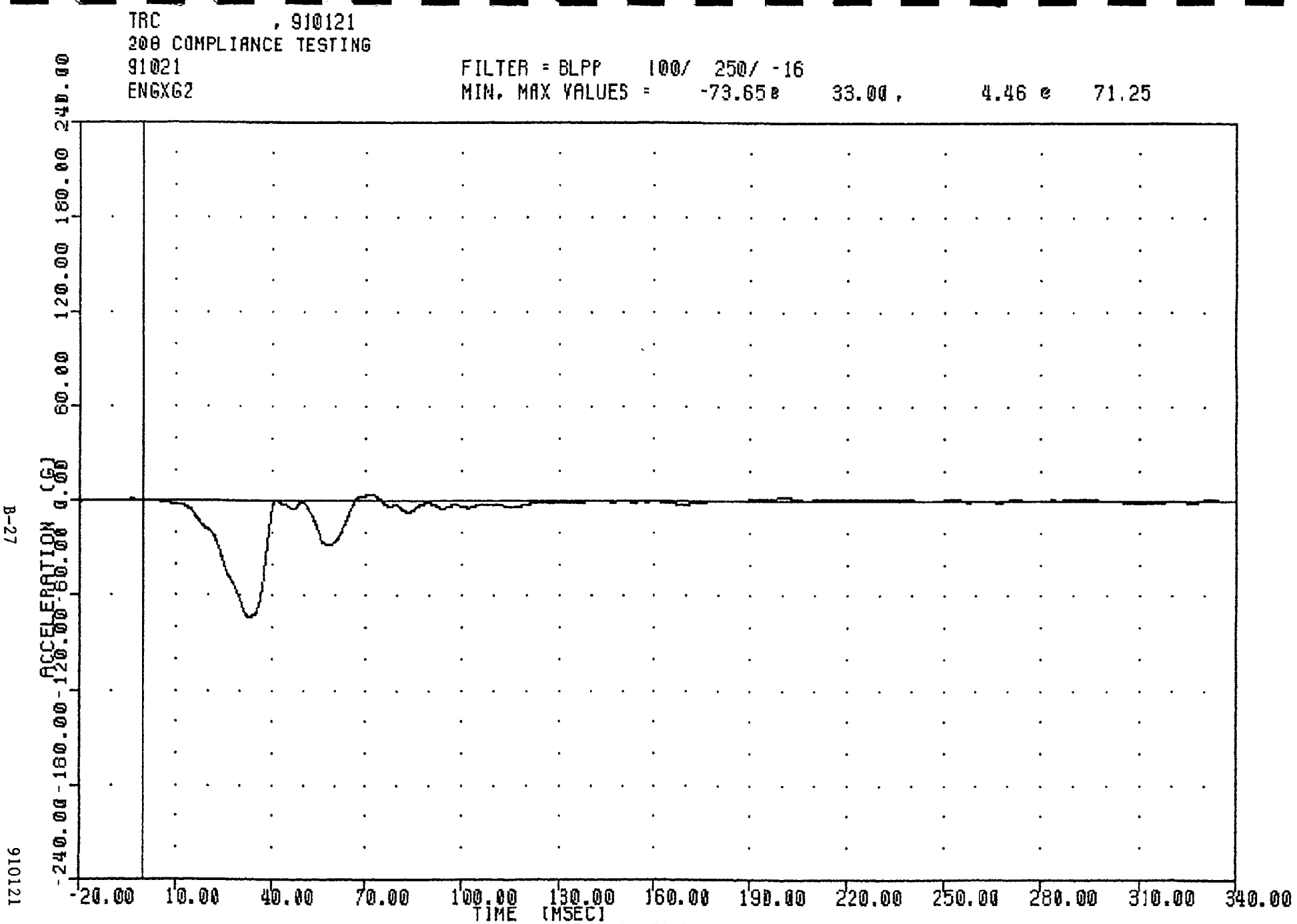


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
LEFT REAR SEAT X-AXIS ACCELERATION

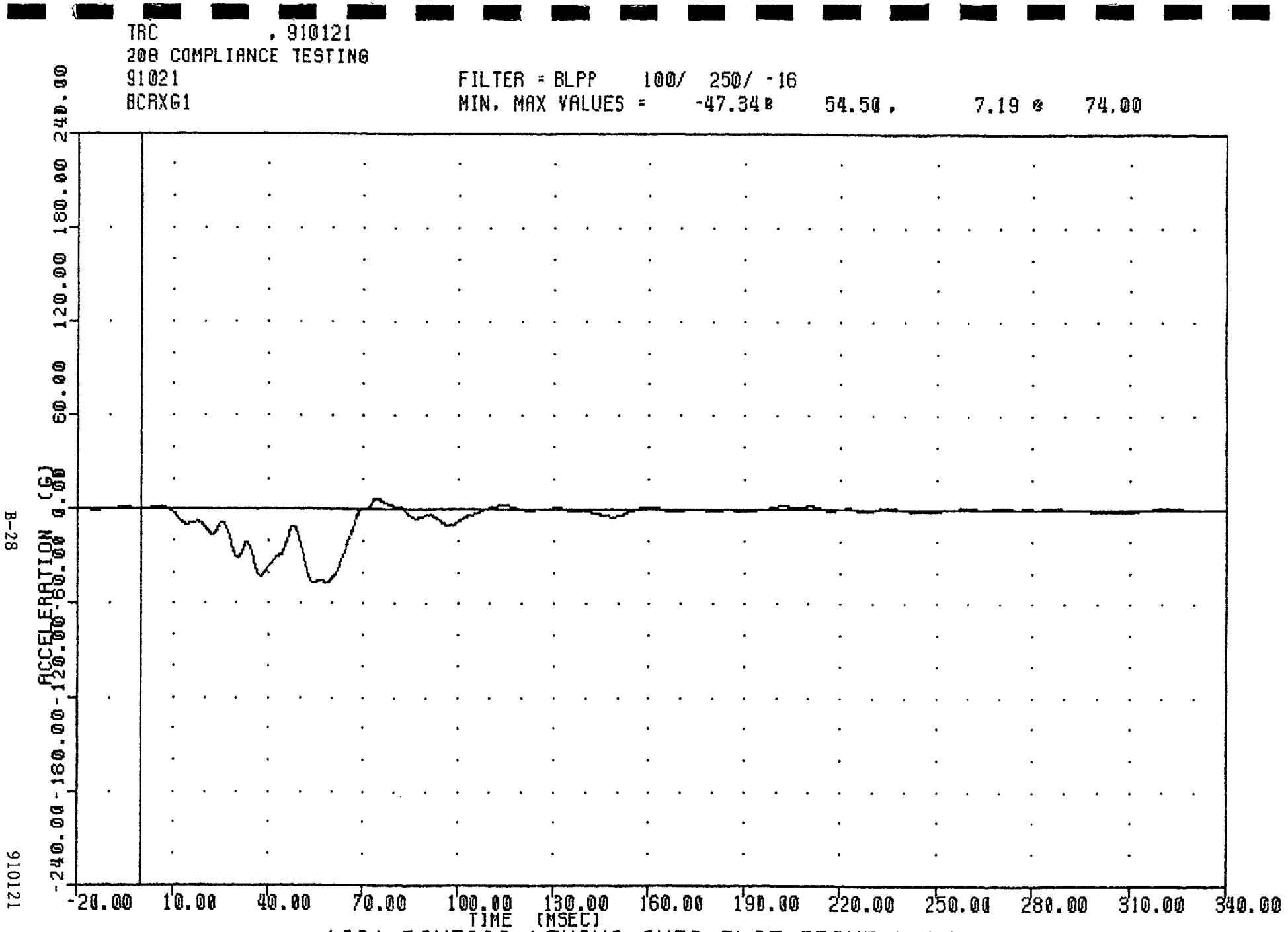


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT REAR SEAT X-AXIS ACCELERATION

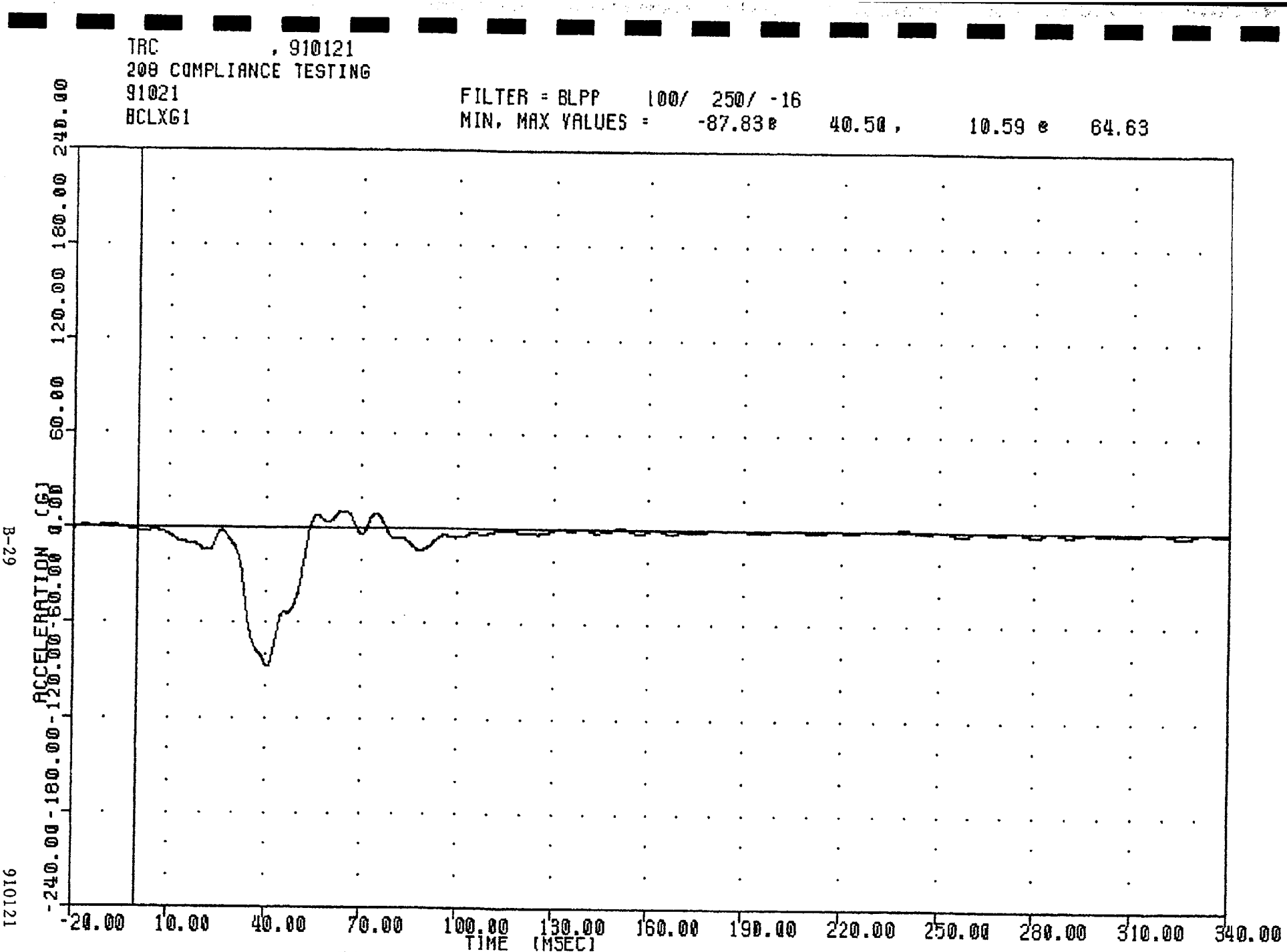
910121



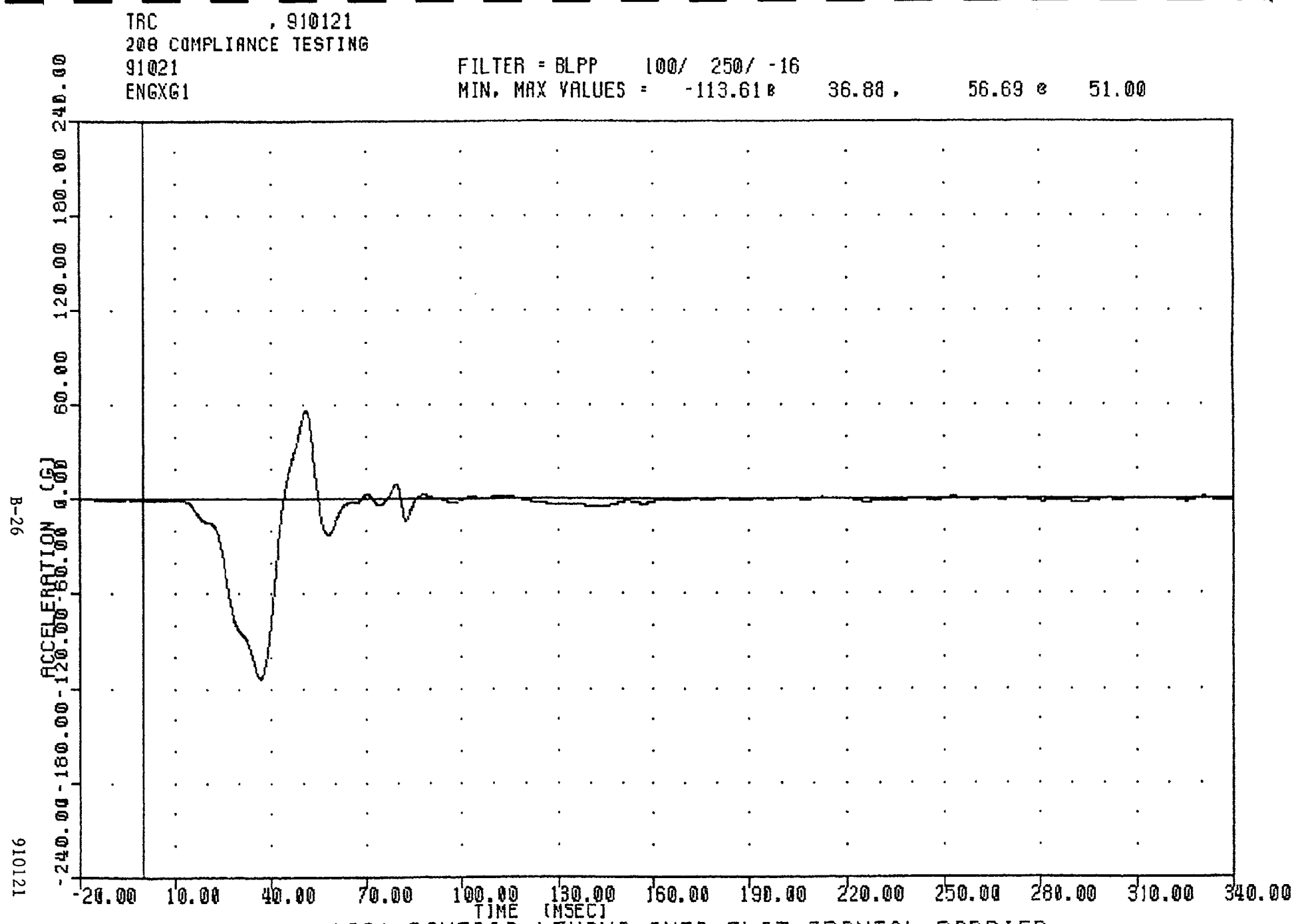
1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
ENGINE BOTTOM X-AXIS ACCELERATION



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
RIGHT BRAKE CALIPER X-AXIS ACCELERATION

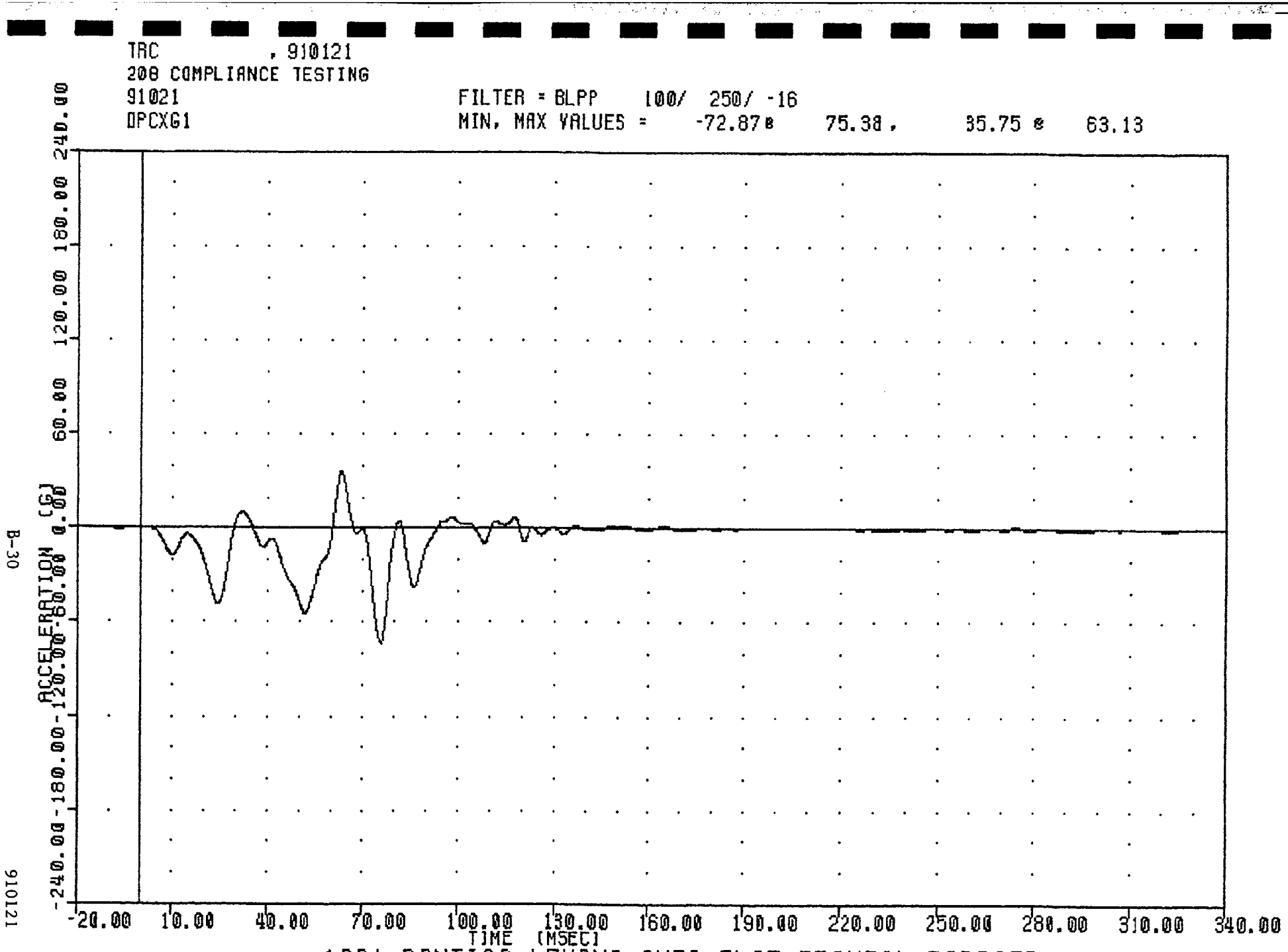


1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
LEFT BRAKE CALIPER X-AXIS ACCELERATION



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
ENGINE TOP X-AXIS ACCELERATION

910121



1991 PONTIAC LEMANS INTO FLAT FRONTAL BARRIER
INSTRUMENT PANEL CENTER X-AXIS ACCELERATION

910121