1387

REPORT NOS. 208-TRC-90-003
212-TRC-90-003
301-TRC-90-003

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

GENERAL MOTORS CORPORATION
1990 OLDSMOBILE EIGHTY-EIGHT ROYALE
4-DOOR SEDAN
NHTSA NO. CL0103
TRC TEST NO. 891215

THE TRANSPORTATION RESEARCH CENTER OF OHIO
U.S. RT. 33, LOGAN COUNTY
EAST LIBERTY, OHIO 43319

JANUARY 3, 1990
FINAL REPORT

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

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FINAL REPORT OF FMVSS NOS. 208, 212, 219 (PARTIAL), AND 301 EXPERIMENTAL COMPLIANCE TESTING OF A 1990 OLDSMOBILE EIGHTY-EIGHT 4-DOOR SEDAN, NHTSA NO. CL0103	DECEMBER 1989 - JANUARY 1990
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15. Supplementary Notes

16. Abstract

A 30 mph 30° left front barrier impact experimental compliance test was conducted on a 1990 Oldsmobile Eighty-Eight 4-door sedan, VIN 1G3HN53C9L1803718, NHTSA No. CL0103 at the Transportation Research Center of Ohio on December 15, 1989. 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 29.6 mph.
The ambient temperature was 71° F
The vehicle appears to comply with the applicable requirements of FMVSS Nos. 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 219, "Windshield Zone Intrusion" FMVSS 301, "Fuel System Integrity"	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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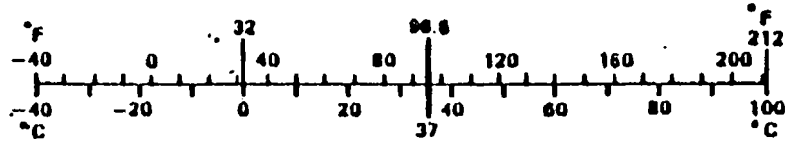
METRIC CONVERSION FACTORS

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	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 AND TEST SUMMARY

PURPOSE

This 30 mph 30° left front 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 Oldsmobile Eighty-Eight Royale 4-door sedan, NHTSA No. CL0103, 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 Oldsmobile Eighty-Eight Royale 4-door sedan, NHTSA No. CL0103, was equipped with a 3.8 liter, transverse engine, automatic transmission, and power brakes. The test weight of the vehicle was 3810 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 E 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 E, 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 Notice 45 of Federal Motor Vehicle Safety Standard TP-208-07.

Both ATDs were instrumented with head and chest accelerometers oriented to measure accelerations in the longitudinal, lateral, and vertical directions, with a chest displacement potentiometer, 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-five (25) 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, 30° left front barrier at the Transportation Research Center of Ohio on December 15, 1989. The test vehicle's impact speed was 29.6 mph. The vehicle sustained 32.5 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.: CL0103 PROJECT: 208 Compliance

DATE: 12/15/89 TIME: 1400 TEMP: 71° F

VEHICLE: 1990 Oldsmobile Eighty-Eight Royale 4-door sedan

TEST WEIGHT (LBS): 3810

IMPACT ANGLE (DEG)*: 330

IMPACT VELOCITY (MPH)**: PRIMARY = 29.6 SECONDARY = 29.5

MAXIMUM STATIC CRUSH (IN): 32.5

DUMMIES:	Driver #229	Passenger #230
TYPE:	Part 572 E	Part 572 E
LOCATION:	Left front	Right front
RESTRAINT:	Airbag	3-point unibelt

NUMBER OF DATA CHANNELS: 25

NUMBER OF HIGH SPEED 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: General Motors Corporation

MAKE/MODEL: Oldsmobile/Eighty-Eight Royale VIN: 1G3HN53C9L1803718

BODY STYLE: 4-door sedan MODEL YEAR: 1990

NHTSA NO.: CL0103 COLOR: White

ENGINE DATA: TYPE: transverse CYLINDERS: 6 DISPLACEMENT: 3.8 liter

TRANSMISSION DATA: _4_SPEED, ___MANUAL, _X_AUTOMATIC, _X_FWD, ___RWD, ___4WD

DATE VEHICLE RECEIVED: 11/05/89 ODOMETER READING: 21.5

DEALER'S NAME AND ADDRESS: Roy's Motor Sales, Inc.
P.O. Box 332
Three Rivers, MI 49093

ACCESSORIES:

POWER STEERING Yes	AUTOMATIC TRANSMISSION Yes
POWER BRAKES Yes	AUTOMATIC SPEED CONTROL Yes
POWER SEATS Yes	TILTING STEERING WHEEL Yes
POWER WINDOWS Yes	TELESCOPING STEERING WHEEL No
TINTED GLASS Yes	AIR CONDITIONING Yes
RADIO Yes	ANTI-SKID BRAKE Yes
CLOCK Yes	REAR WINDOW DEFROSTER Yes
OTHER Driver's airbag	

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: General Motors Corporation

DATE OF MANUFACTURE: 9/89

GVWR: 4479 LBS

GAWR: FRONT 2456 LBS., REAR 2023 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 30 psi

RECOMMENDED TIRE SIZE: P205/75R15 LOAD RANGE X B, _____C, _____D

TIRES ON VEHICLE (MFR., LINE, SIZE): Goodyear Invicta GS P205/70R15

IS SPARE TIRE A "SPACE SAVER": Yes

IS SPARE TIRE STANDARD EQUIPMENT: Yes

VEHICLE CAPACITY: TYPES OF SEATS: FRONT: Split bench
REAR: Bench

TYPE OF FRONT SEAT BACKS: Manual adjustable

NUMBER OF OCCUPANTS 3 FRONT 3 REAR 6 TOTAL

CARGO LOAD 167 LBS. TOTAL 1067 LBS.

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

RIGHT FRONT	1070 lbs.	RIGHT REAR	600 lbs.
LEFT FRONT	1060 lbs.	LEFT REAR	590 lbs.
TOTAL FRONT WEIGHT	2130 lbs.	(64.2% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1190 lbs.	(35.8% OF TOTAL VEHICLE WEIGHT)	

TOTAL DELIVERED WEIGHT 3320 lbs.

CALCULATION FOR TARGET TEST WEIGHT:

RCLW = RATED CARGO AND LUGGAGE WEIGHT

UDW = UNLOADED DELIVERED WEIGHT (3320 LBS)

VCW = VEHICLE CAPACITY WEIGHT (1067 LBS)

DSC = DESIGNATED SEATING CAPACITY (6)

RCLW = VCW - 150 (DCS) = 1067 - 150(6) = 167 LBS

TARGET TEST WEIGHT = UDW + RCLW + (2 DUMMIES X 167 LBS/DUMMY)

= 3320 + 167 + 334 LBS

TARGET TEST WEIGHT = 3821 LBS

TABLE 2 TEST VEHICLE INFORMATION CONT'D

WEIGHT OF TEST VEHICLE WITH REQUIRED DUMMIES AND 156 LBS. CARGO:

RIGHT FRONT	1108 lbs.	RIGHT REAR	776 lbs.
LEFT FRONT	1139 lbs.	LEFT REAR	787 lbs.
TOTAL FRONT WEIGHT	2247 lbs.	(59.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL REAR WEIGHT	1563 lbs.	(41.0% OF TOTAL VEHICLE WEIGHT)	
TOTAL TEST WEIGHT	3810 lbs.	(0.3% UNDER TARGET WEIGHT)	

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

COMPONENTS REMOVED TO MEET TARGET WEIGHT: None

VEHICLE ATTITUDE (ALL DIMENSIONS IN INCHES):

DELIVERED ATTITUDE:	LF	28.6;	RF	28.5;	LR	29.2;	RR 29.2
PRE-TEST ATTITUDE:	LF	28.2;	RF	28.2;	LR	27.4;	RR 27.5
POST-TEST ATTITUDE:	LF	26.6;	RF	28.8;	LR	33.9;	RR 27.2

MAXIMUM WIDTH: 72.9 INCHES

WHEELBASE: 110.8 INCHES

CG = 45.4 INCHES REARWARD OF FRONT WHEEL CENTERLINE

TABLE 3 TEST CONDITIONS

TEST NUMBER: 891215

DATE OF TEST: 12/15/89 TIME OF TEST: 1400

TYPE OF TEST: 30° left front barrier impact IMPACT ANGLE: 330°

AMBIENT TEMPERATURE AT IMPACT AREA: 71° F

TEMPERATURE IN OCCUPANT COMPARTMENT: 69° F

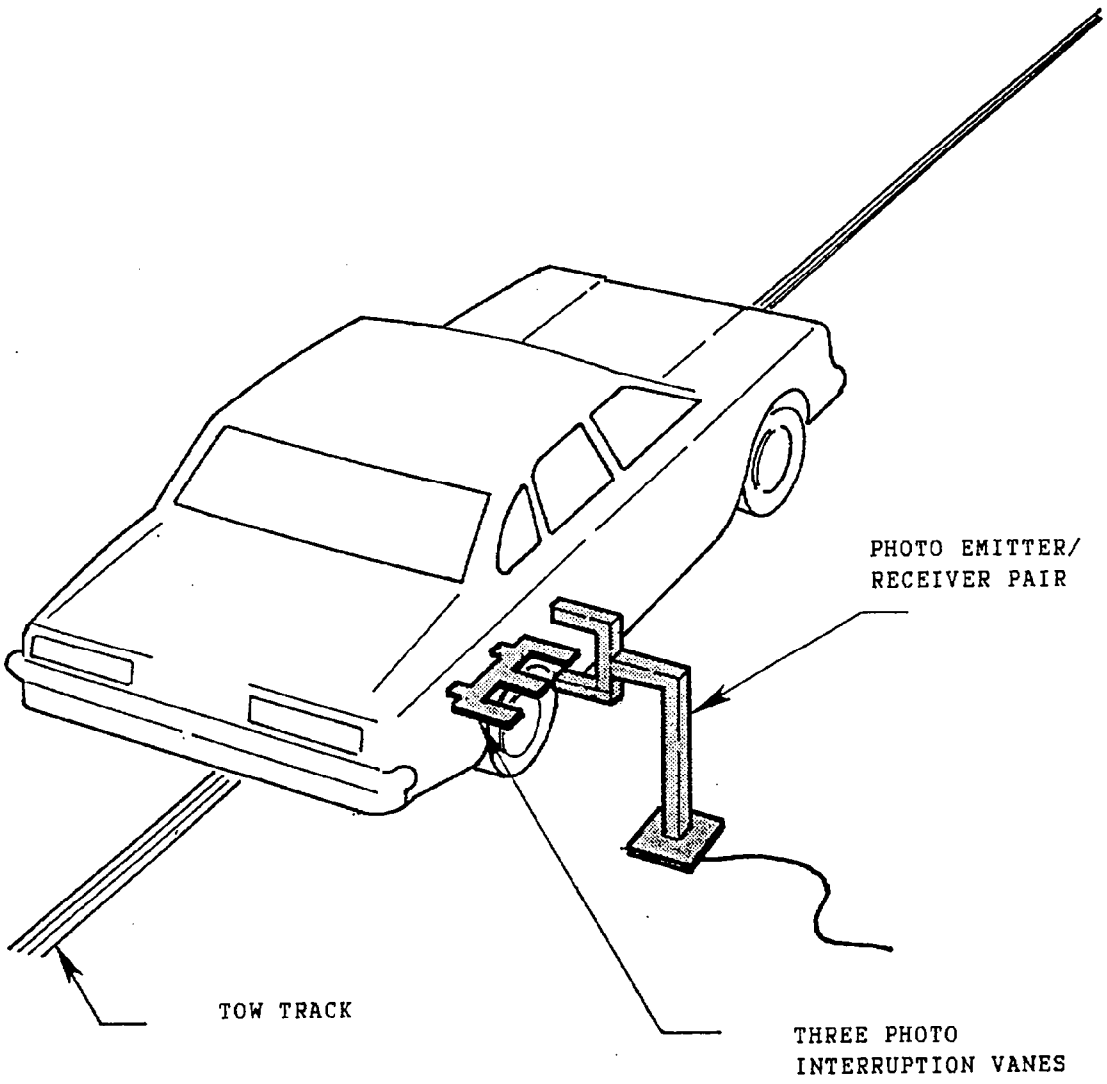
IMPACT VELOCITY: PRIMARY = 29.6 MPH SECONDARY = 29.5 MPH

(SPECIFIED RANGE = 28.9 TO 29.9 MPH)

VEHICLE REBOUND AND CRUSH (ALL DIMENSIONS IN INCHES):

OVERALL LENGTH OF TEST VEHICLE:	PRE-TEST:	L	193.1;	C	197.0;	R 193.2
	POST-TEST:	L	160.6;	C	179.0;	R 193.7
	TOTAL CRUSH:	L	32.5;	C	18.0;	R -0.5

FIGURE 1 IMPACT VELOCITY MEASUREMENT SYSTEM

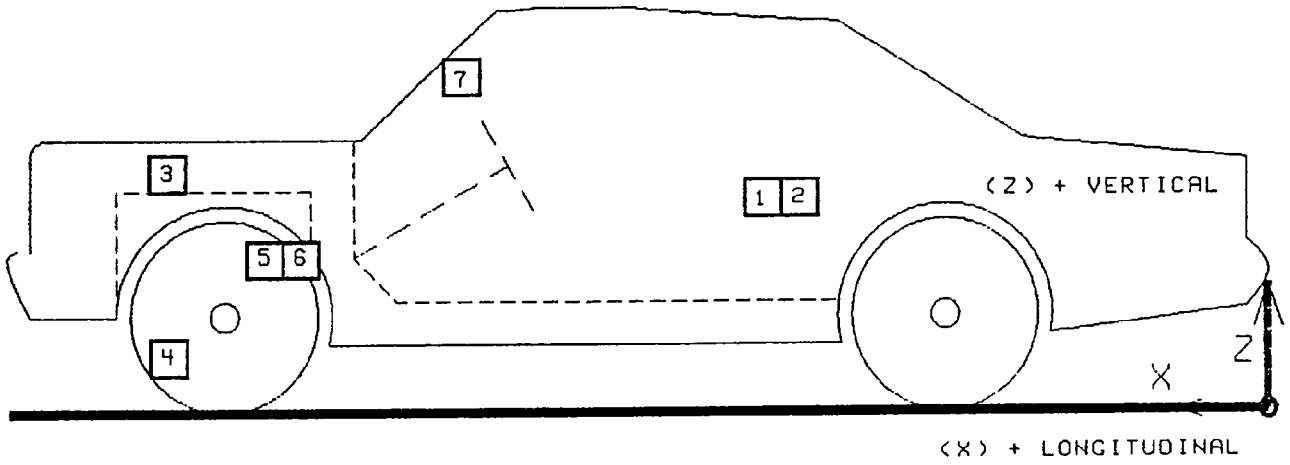


The final vane clears emitter/receiver two inches before impact.

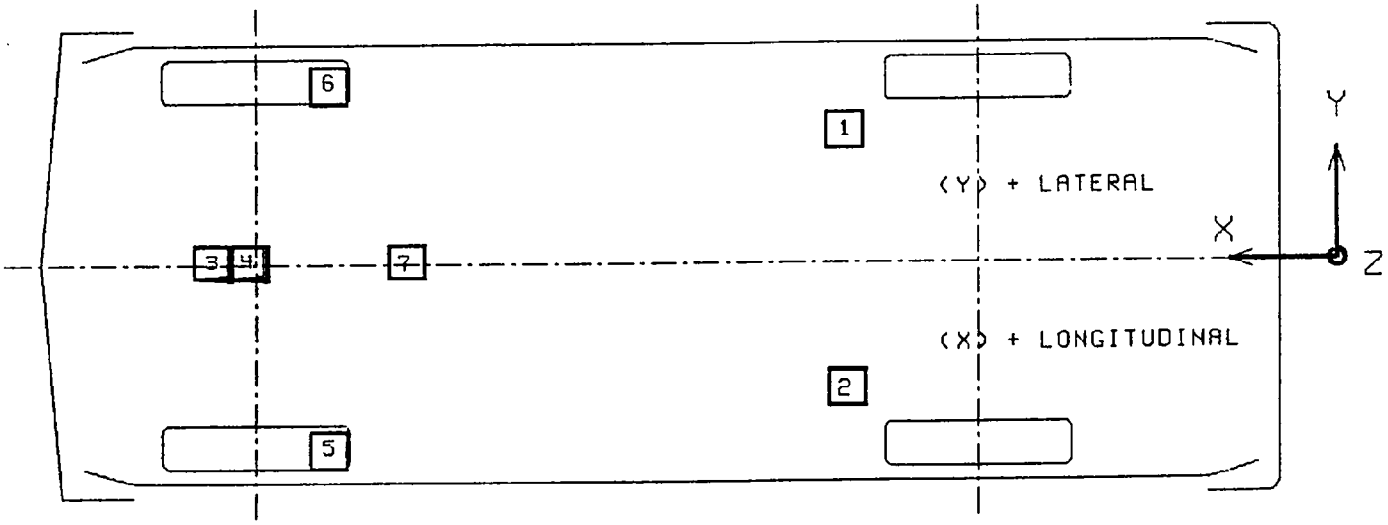
The vanes have one foot spacing.

FIGURE 2

VEHICLE ACCELEROMETER PLACEMENT



SIDE VIEW



BOTTOM VIEW

TABLE 4

TEST NUMBER 891215

VEHICLE ACCELEROMETER LOCATIONS AND DATA SUMMARY

No.	LOCATION		X*	Y*	Z*	POSITIVE DIRECTION MAX G	POSITIVE DIRECTION MSEC	NEGATIVE DIRECTION MAX G	NEGATIVE DIRECTION MSEC
1	REAR SEAT CROSSMEMBER AT LEFT SIDE	PRE	73.8	18.6	15.2				
		POST	73.8	18.6	16.6				
	LONGITUDINAL					1.3	258.8	21.1	103.6
2	REAR SEAT CROSSMEMBER AT RIGHT SIDE	PRE	73.8	18.4	15.1				
		POST	73.8	18.4	17.3				
	LONGITUDINAL					2.0	186.8	23.8	81.5
3	TOP OF ENGINE BLOCK	PRE	168.3	5.0	28.0				
		POST	166.3	0.0	37.2				
	LONGITUDINAL					15.3	95.9	78.6	69.6
4	BOTTOM OF ENGINE BLOCK	PRE	163.1	-1.0	7.2				
		POST	161.1	-6.0	7.3				
	LONGITUDINAL					7.8	92.5	34.8	74.4
5	BRAKE CALIPER AT RIGHT SIDE	PRE	159.6	26.5	13.2				
		POST	157.2	32.5	13.2				
	LONGITUDINAL					10.7	152.8	46.3	94.0
6	BRAKE CALIPER AT LEFT SIDE	PRE	158.6	26.5	12.7				
		POST	155.1	23.5	12.7				
	LONGITUDINAL					46.8	79.9	117.9	71.5
7	DASH PANEL	PRE	130.6	-0.5	38.8				
		POST	130.7	-0.5	41.5				
	LONGITUDINAL					8.2	33.1	30.8	91.4

* ALL MEASUREMENTS OF ACCELEROMETER LOCATIONS ARE IN INCHES.

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

FIGURE 3 ACCIDENT INVESTIGATION DIVISION DATA
FOR 30 MPH 30° LEFT FRONT BARRIER IMPACT

VEHICLE MAKE/MODEL/BODY STYLE: Oldsmobile/Eighty-Eight Royale/4-door sedan

VEH. NHTSA NO.: CL0103 ; VIN: 1G3HN53C9L1803718

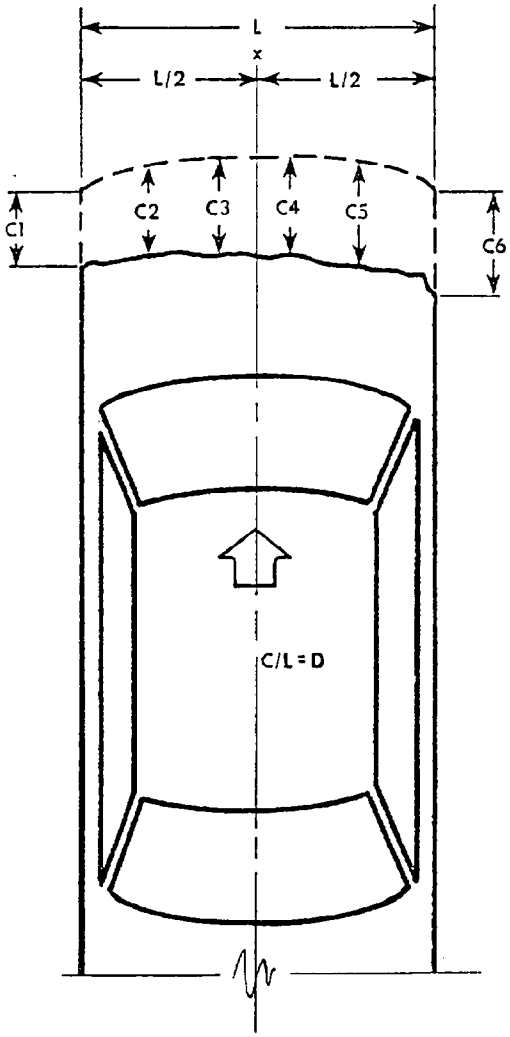
MODEL YEAR: 1990 ; BUILD DATE: 9/89 ; TEST DATE: 12/15/89

VEH. SIZE CATEGORY: Large ; TEST WEIGHT: 3810

VEH. WHEELBASE: 110.8

MAX. WIDTH: 72.9

FRONT OVERHANG: 44.5



COLLISION DEFORMATION
CLASSIFICATION (CDC) CODE: 11FDEW2

F (Frontal)

CRUSH DEPTH DIMENSIONS:

C1 = 32.5 inches

C2 = 25.4 inches

C3 = 19.6 inches

C4 = 13.6 inches

C5 = 4.9 inches

C6 = -0.5 inches

MIDPOINT OF DAMAGE: D = Vehicle Centerline (Longitudinal)

LENGTH OF DAMAGED REGION: L = 64.5 inches

FIGURE 4

PRE-TEST AND POST-TEST MEASUREMENT POINTS

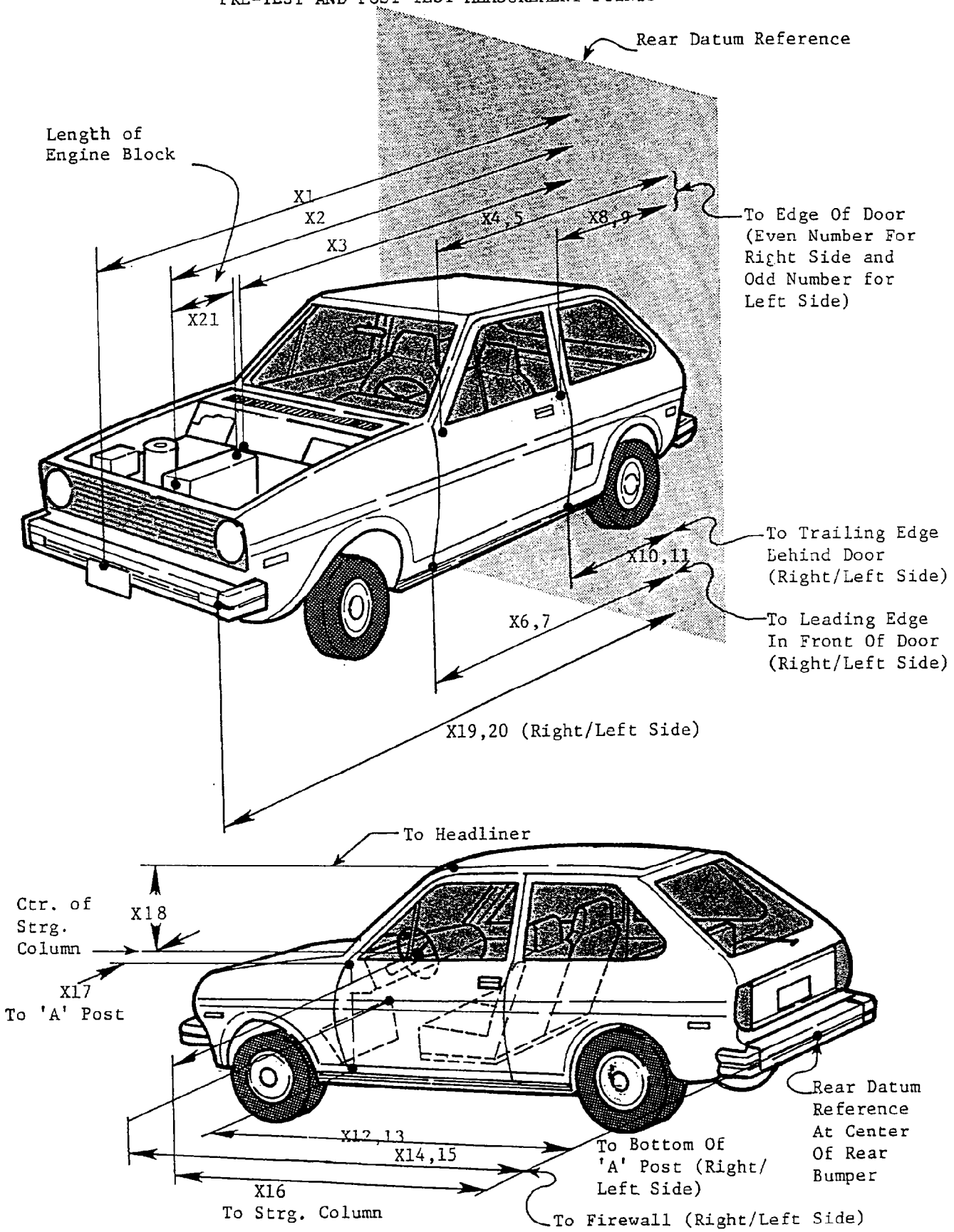


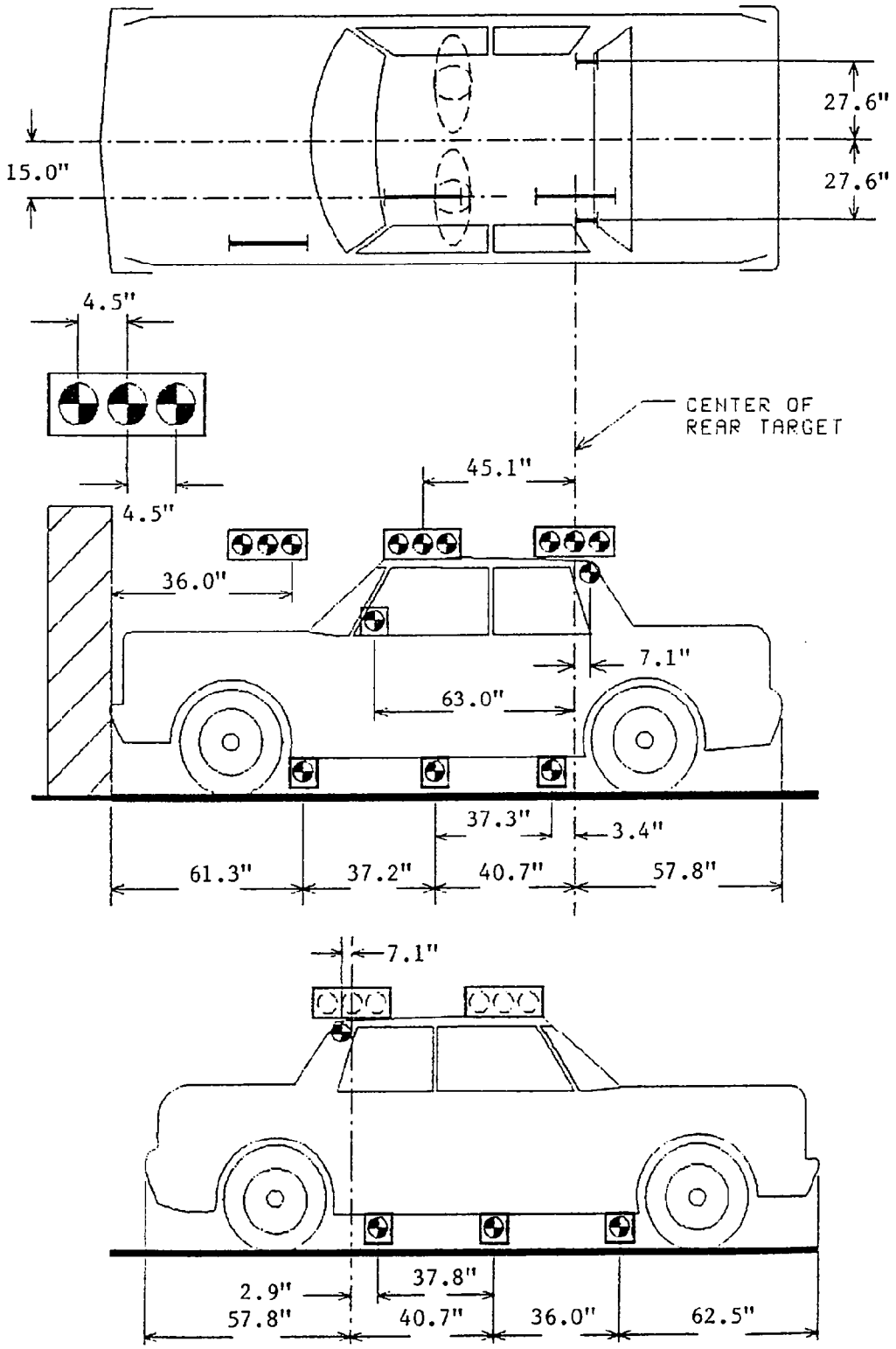
TABLE 5 IMPACTED VEHICLE MEASUREMENTS

VEHICLE MAKE/MODEL: Olsmobile Eighty-Eight Royale TEST NUMBER: 891215

NO.	TYPE OF MEASUREMENT	DIMENSIONS IN INCHES PRE-TEST	POST-TEST	DIFF.
X1	TOTAL LENGTH OF VEHICLE AT CENTERLINE	197.0	179.0	18.0
X2	REAR SURFACE OF VEHICLE TO FRONT OF ENGINE BLOCK	173.2	171.0	2.2
X3	REAR SURFACE OF VEHICLE TO FIREWALL	144.0	144.0	0.0
X4	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF RIGHT DOOR	131.4	131.6	-0.2
X5	REAR SURFACE OF VEHICLE TO UPPER LEADING EDGE OF LEFT DOOR	131.5	131.0	0.5
X6	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF RIGHT DOOR	130.9	131.0	-0.1
X7	REAR SURFACE OF VEHICLE TO LOWER LEADING EDGE OF LEFT DOOR	131.4	130.9	0.5
X8	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF RIGHT DOOR	88.4	88.6	-0.2
X9	REAR SURFACE OF VEHICLE TO UPPER TRAILING EDGE OF LEFT DOOR	88.5	88.0	0.5
X10	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF RIGHT DOOR	90.4	90.4	0.0
X11	REAR SURFACE OF VEHICLE TO LOWER TRAILING EDGE OF LEFT DOOR	90.7	90.2	0.5
X12	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON RIGHT SIDE	129.9	130.3	-0.4
X13	REAR SURFACE OF VEHICLE TO BOTTOM OF "A" POST ON LEFT SIDE	130.6	130.0	0.6
X14	REAR SURFACE OF VEHICLE TO FIREWALL - RIGHT SIDE	141.9	141.6	0.3
X15	REAR SURFACE OF VEHICLE TO FIREWALL - LEFT SIDE	143.5	141.5	2.0
X16	REAR SURFACE OF VEHICLE TO STEERING WHEEL CENTER	112.8	115.0	-2.2
X17	CENTER OF STEERING COLUMN TO "A" POST	13.5	15.0	-1.5
X18	CENTER OF STEERING COLUMN TO HEADLINER	17.0	14.8	2.2
X19	REAR SURFACE OF VEHICLE TO RIGHT SIDE OF FRONT BUMPER	193.2	193.7	-0.5
X20	REAR SURFACE OF VEHICLE TO LEFT SIDE OF FRONT BUMPER	193.1	160.6	32.5
X21	LENGTH OF ENGINE BLOCK	21.8	21.8	0.0

FIGURE 5

VEHICLE TARGET LOCATIONS



891215

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 Knuschler
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.: CL0103
MAKE/MODEL/BODY STYLE: Oldsmobile/Eighty-Eight Royale/4-door sedan
MODEL YEAR: 1990 BODY COLOR: White
VIN: 1G3HN53C9L1803718
ODOMETER (ARRIVAL): 18.0 DATE: 11/05/89
ODOMETER (COMPLETION): 22.0 DATE: 12/15/89
COST: $18,463.00

X Air Conditioner	___ Console	Brakes: X Power
X Tinted Glass	___ Tachometer	Front: Disc
X Power Steering	X Speed Control	Rear: Disc
X Power Windows	X Rear Window Def.	
___ Power Door Locks	___ Sun/Moon Roof	Front Seats: X Power
X Radio AM/FM cass.	___ T-Top	Seat Type: Bench
X Clock	X Tilt Steering Wheel	No. of Seats: 6
___ Roof Rack	___ Other Options: Driver's airbag	

Engine: 6 Cylinders; 3.8 LITRES
Transmission: Automatic; Drive Type: Front wheel
Tire Size: P205/70R15
Gasoline Type: Unleaded gasoline

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

Explanation: NA

Vehicle Condition: Vehicle has been subjected to a 30 mph 30° left front angled barrier crash test.

DATA ACQUISITION EXPLANATIONS

The right front passenger's left and right femur force load cells, LFMF2 and RFMF2, recorded a spike at 310 milliseconds.

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 Oldsmobile Eighty-Eight Royale 4-door sedan, NHTSA No. CL0103, appeared to comply with the requirements of FMVSS Nos. 208, 212, 219 (partial), and 301.

The driver's Head Injury Criteria (HIC) was 88. The driver's maximum chest deceleration over three milliseconds was 26.4 g. The driver's chest displacement was 0.6 inches. The driver's right and left compressive femur loads were 1208 pounds and 1006 pounds, respectively.

The right front passenger's Head Injury Criteria (HIC) was 183. The right front passenger's maximum chest deceleration over three milliseconds was 34.5 g. The right front passenger's chest displacement was 1.7 inches. The right front passenger's right and left compressive femur loads were 160 pounds and 337 pounds, respectively. (See DATA ACQUISITION EXPLANATIONS.)

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	-24.9	-24.1	-14.5	28.3	-25.5	-20.1	7.1	26.4
PASSENGER	-32.1	23.7	-29.4	37.4	-32.0	-16.4	16.7	34.5

MAXIMUM FORCE-FEMUR LOAD (LBS)

	LEFT FEMUR	RIGHT FEMUR
DRIVER	1006	1208
PASSENGER	337 $^{\gamma}$	160 $^{\gamma}$

HEAD INJURY CRITERIA**

	HIC	TIME t_1 (MSEC)	TIME t_2 (MSEC)
DRIVER	88	94.4	130.4
PASSENGER	183	129.8	165.8

*Defined as exceeding 0.003 sec. duration

**As defined in FMVSS No. 208

$^{\gamma}$See DATA ACQUISITION EXPLANATIONS

DUMMY KINEMATIC SUMMARY

DRIVER DUMMY

Upon impact, the driver dummy translated forward on the seat impacting both knees into the instrument panel. As the driver's head and chest were restrained by the driver's airbag, the driver's torso rotated to the left. The left side of the dummy's head contacted the driver's door frame as the dummy's head rotated to the right. The dummy's head then rotated to the left and the dummy's torso rotated to the right as the dummy rebounded into the seat. The dummy came to rest, leaning to the left, in the driver's seat.

RIGHT FRONT PASSENGER DUMMY

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

VISIBLE DUMMY CONTACT POINTS:

	DRIVER #229	PASSENGER #230
Head	Airbag and upper door frame	Chest
Chest	Airbag	None
Abdomen	None	None
Left knee	Instrument panel	Instrument panel
Right knee	Instrument panel	Instrument panel

DOOR OPENING:

	LEFT	RIGHT
Front	Difficult, no tools required	Easy
Rear	Easy	Easy

SEAT MOVEMENT:

	SEAT BACK FAILURE	SEAT SHIFT
Front	None	None
Rear	NA	NA

GLAZING DAMAGE:

The left side of the windshield was cracked upon impact.

OTHER NOTABLE IMPACT EFFECTS:

None

FIGURE 6 DUMMY POSITIONING DATA FOR 30 MPH 30° LEFT FRONT BARRIER IMPACT TEST

PRE-IMPACT DATA:

Make/Model: Oldsmobile/Eighty-Eight Royale
Body Style: 4-door sedan Model Year: 1990
NHTSA No.: CL0103 Color: White

DATA FROM CERTIFICATION LABEL:

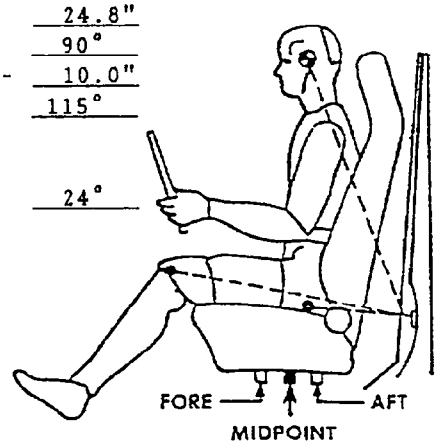
Vehicle Manufacturer: General Motors Corporation
Date of Manufacture: 9/89 VIN: 1G3HN53C9L1803718
GVWR: 4479 lb; GAWR: Front = 2456 lb; Rear = 2023 lb

POST-IMPACT DATA:

Date of Test: 12/15/89 Time: 1400 Temperature: 71° F
Required Impact Velocity Range: 28.9 to 29.9 mph
Impact Velocity: Primary = 29.6 mph Secondary = 29.5 mph
Seat Type: Split bench Adjuster Type: Power
Bucket Seat Back Type: Manual-adjustable
Technicians: R. Benavides & D. Carpenter

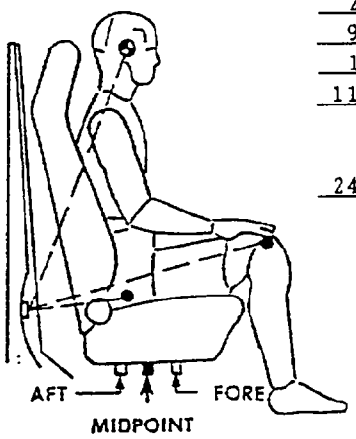
DRIVER DUMMY # 229 TYPE: HIII

Head	21.8"
Target	10°
Knee	24.8"
Joint	90°
Approx-imate "H" Point	10.0"
Pelvis	115°
	24°

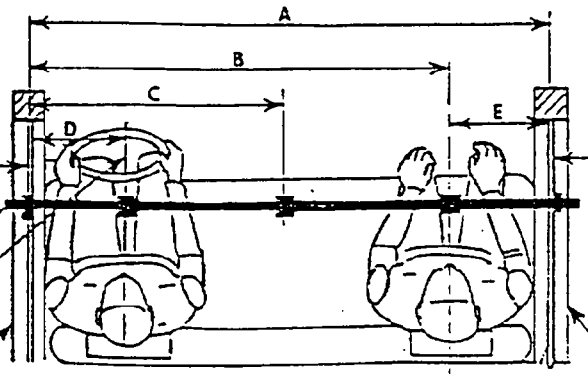


PASSENGER DUMMY # 230 TYPE: HIII

22.1"	Head
9°	Target
25.8"	Knee
90°	Joint
10.6"	Approx-imate "H" Point
110°	
24.5°	Pelvis



A = 58.5"
B = 43.2"
C = 29.2"
D = 15.0"
E = 15.3"
DOOR GLASS HEIGHT = 10.0"



DOOR GLASS HEIGHT = 10.0"

LATERAL BAR

ADJUSTABLE POINTER

LEFT FRONT DOOR

RIGHT FRONT DOOR

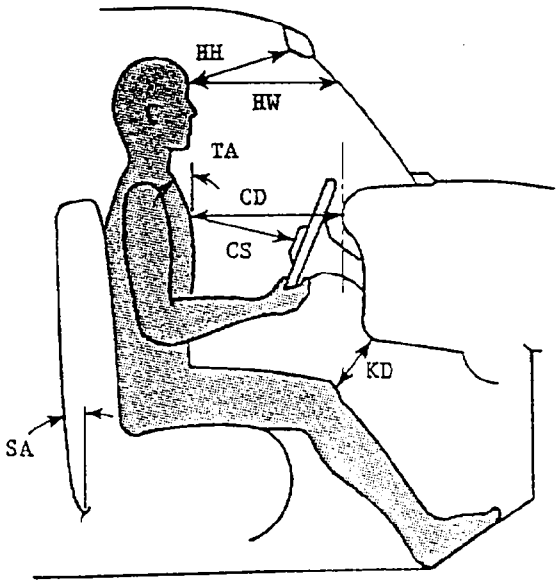
DRIVER DUMMY 229

PASSENGER DUMMY 230

891215

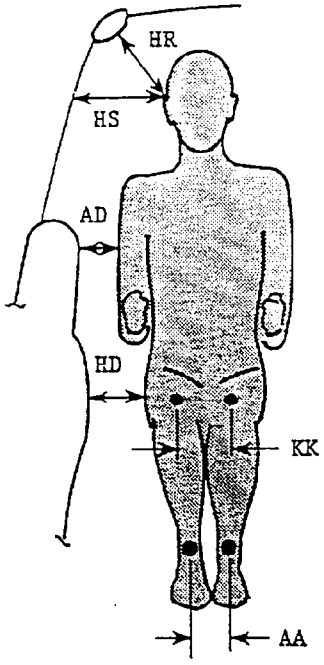
FIGURE 7 DUMMY IN-VEHICLE POSITION RECORDING SHEET

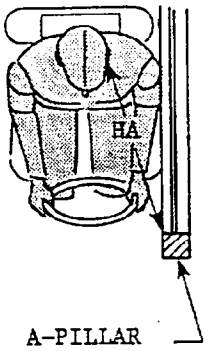
	DRIVER	PASSENGER
HH	15.9	15.4
HW	23.6	23.4
CD	25.6	22.2
CS	12.6	NA
KDL	5.2	6.1
KDR	5.5	6.2
TA	20°	20°
SA	24°	24°
HA	17.8	17.8



	DRIVER	PASSENGER
HR	8.0	8.1
HS	11.9	12.5
AD	5.8	6.3
HD	7.6	8.0
KK	8.2	8.2
AA	10.5	9.0

Knee outer clevis to outer clevis spacing:
Driver = 10.6
Passenger = 10.6





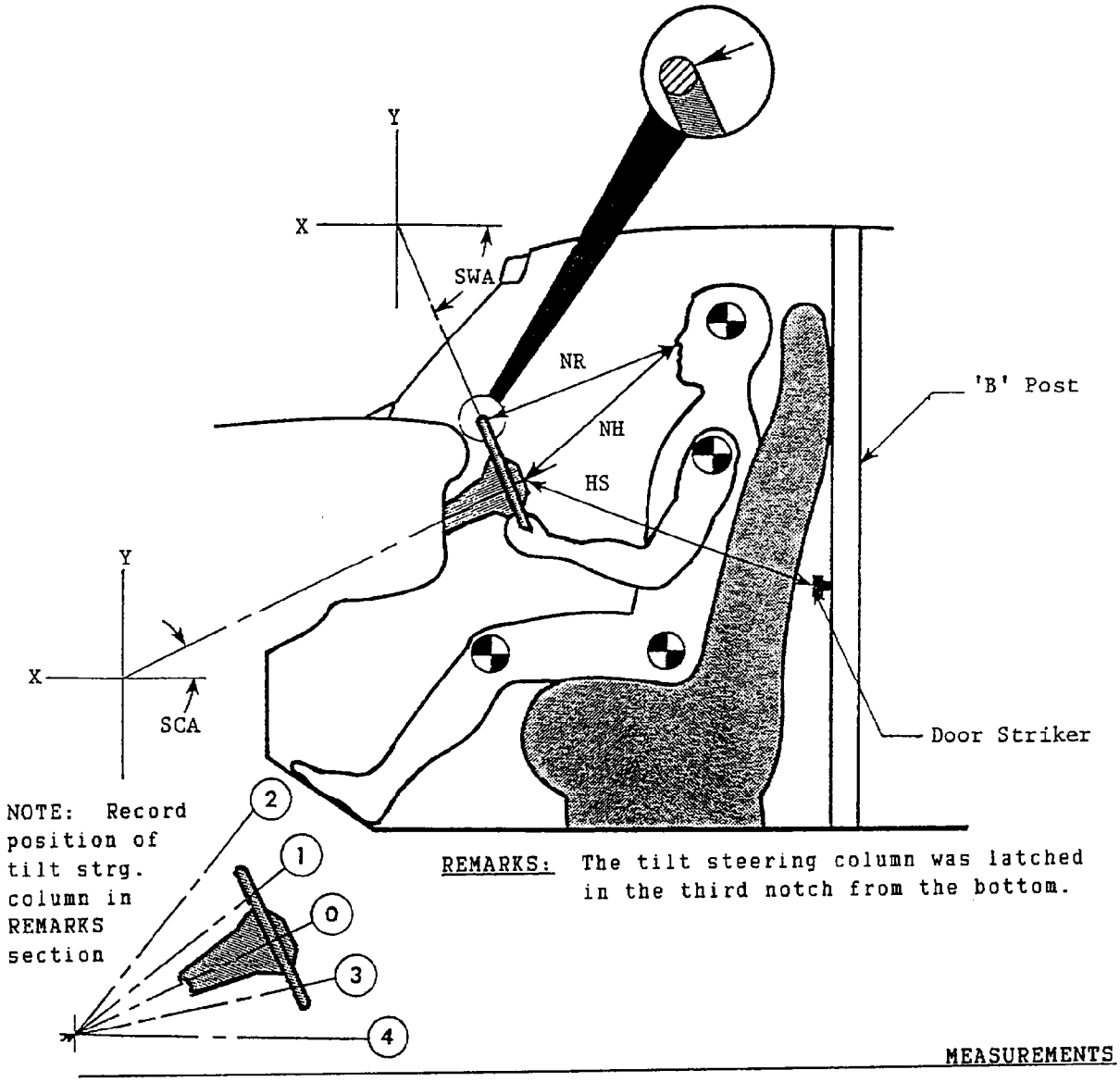
HH = Head to Windshield Header
HW = Head to Windshield
CD = Chest to Dash
CS = Chest to Steering Wheel
KD = Knee to Dash
TA = Torso Angle
SA = Seat Back Angle

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

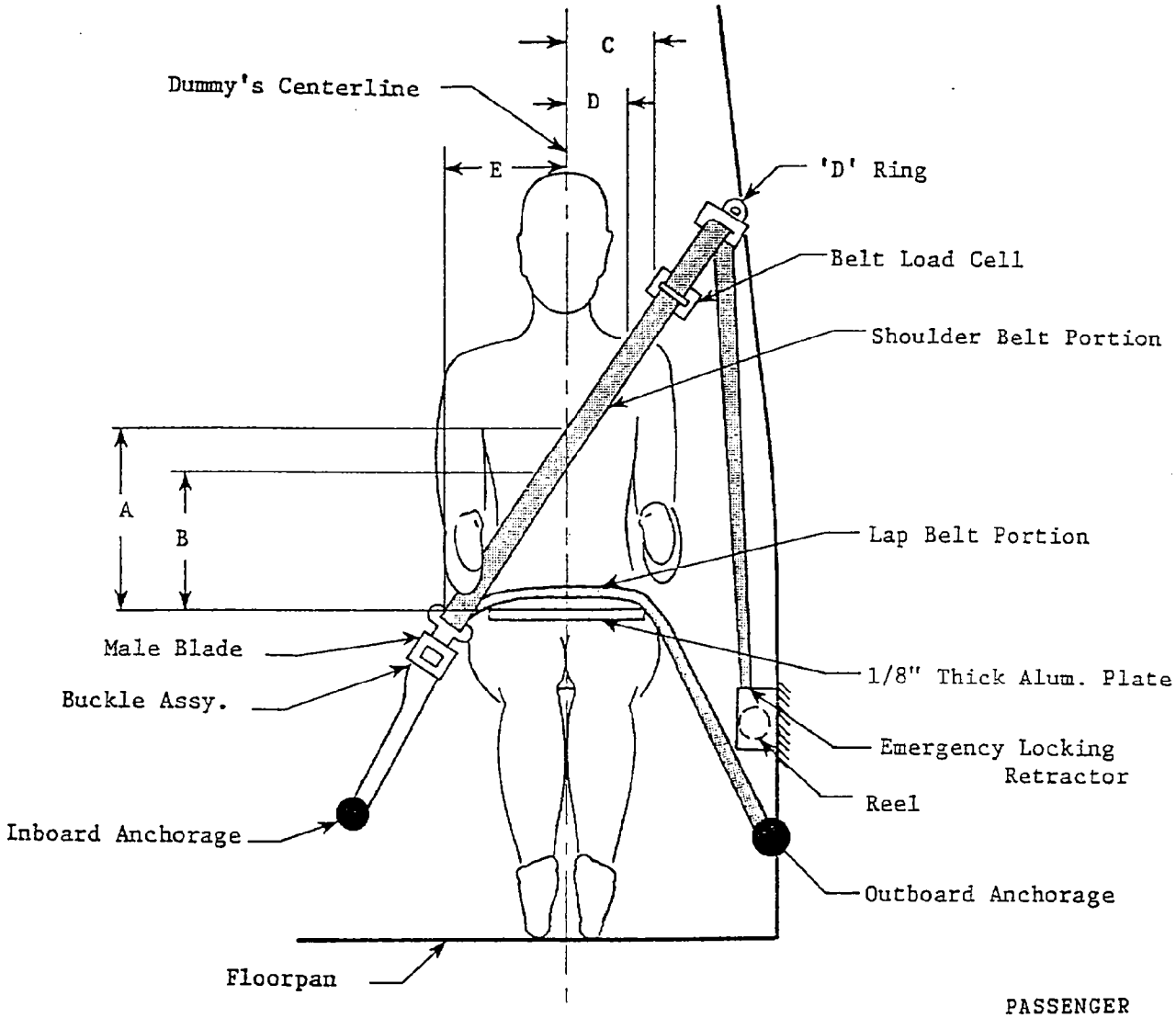


REMARKS: The tilt steering column was latched in the third notch from the bottom.

MEASUREMENTS

NR - Distance from tip of dummy's nose to top rear surface of steering wheel rim. (in.)	16.4
NH - Distance from tip of dummy's nose to center of steering column hub. (in.)	16.1
HS - Distance from center of steering column hub to the forward surface of the door lock striker pin. (in.)	24.4
SCA - Angle of steering column relative to the horizontal X axis	25°
SWA - Angle of steering wheel relative to the horizontal X axis	65°

FIGURE 9 SEAT BELT POSITIONING DATA



	PASSENGER DUMMY
A - Top surface of alum. plate to belt upper edge (in)	13.2
B - Top surface of alum. plate to belt lower edge (in)	10.0
C - Dummy centerline to outer edge of belt at chest flesh top (in)	4.5
D - Dummy centerline to inner edge of belt at chest flesh top (in)	2.0
E - Dummy centerline to intersection of upper torso belt and lap belt (in)	11.5

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA

VEHICLE VIN: 1G3HN53C9L1803718 NHTSA NO: CL0103

MAKE: Oldsmobile MODEL: Eighty-Eight Royale

VEHICLE BUILD DATE: 9/89 VEHICLE TYPE: 4-door sedan

FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:

(check one): ____ Automatic belts

X 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:

ARE SEATBELT LATCHPLATES WITHIN REACH ENVELOPE? YES

DOES CLEARANCE TEST BLOCK MOVE UNHINDERED TO LATCHPLATE OR BUCKLE:

YES

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA CONT'D

VEHICLE VIN: 1G3HN53C9L1803718 NHTSA NO: CL0103

MAKE: Oldsmobile MODEL: Eighty-Eight Royale

VEHICLE BUILD DATE: 9/89 VEHICLE TYPE: 4-door sedan

FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:

(check one): _____ Automatic belts

X Type 2 lap/shoulder belts

_____ Other

RETRACTION:

SEATBELT AUTOMATICALLY RETRACTS WHEN

(check one): _____ Adjacent vehicle door is open and seatbelt latchplate is released

X Seatbelt latchplate is released

ARE THE STOWED WEBBING AND HARDWARE PINCHED WHEN THE DOOR IS CLOSED?

NO

ACCESSIBILITY:

IS SEAT CUSHION REMOVABLE SO THE SEATBACK SERVES A FUNCTION OTHER THAN SEATING? No

IS SEAT REMOVABLE? No

IS SEAT MOVABLE SO THE SPACE CAN BE USED FOR A SECONDARY FUNCTION?

No

IF WEBBING IS DESIGNED TO PASS THROUGH THE SEAT CUSHION OR BETWEEN THE CUSHION AND SEAT BACK ARE ONE OF THE FOLLOWING PARTS NORMALLY ON TOP OF OR ABOVE THE SEAT CUSHION: LATCHPLATE, BUCKLE, WEBBING? NA

ARE THE REMAINING TWO PARTS ACCESSIBLE UNDER NORMAL CONDITIONS?

NA

TABLE 7 FMVSS 208 COMFORT AND CONVENIENCE DATA CONT'D

VEHICLE VIN: 1G3HN53C9L1803718 NHTSA NO: CL0103

MAKE: Oldsmobile MODEL: Eighty-Eight Royale

VEHICLE BUILD DATE: 9/89 VEHICLE TYPE: 4-door sedan

FRONT OUTBOARD SEATING POSITIONS SEAT BELT TYPE:

(check one): _____ Automatic belts

X Type 2 lap/shoulder belts

_____ Other

ACCESSIBILITY CONT'D:

DO THE LATCHPLATE AND BUCKLE PASS THROUGH THE GUIDES PROVIDED AND FALL BEHIND THE SEAT WHEN THE BELT IS COMPLETELY RETRACTED (OR UNATTACHED IF NONRETRACTABLE); THE SEAT IS MOVED TO ANY POSITION; AND THE SEAT BACK, IF FOLDABLE, IS FOLDED FORWARD AS FAR AS POSSIBLE AND THEN MOVED BACKWARD INTO POSITION? No

IS THE INBOARD RECEPTACLE END ACCESSIBLE WITH THE CENTER ARM REST IN ANY POSITION TO WHICH IT CAN BE ADJUSTED WITHOUT MOVING THE ARMREST FOR ACCESS? Yes

LATCH MECHANISM:

ARE LATCH MECHANISM COMPONENTS ACCESSIBLE TO A SEATED OCCUPANT IN THE STOWED AND OPERATIONAL POSITIONS? Yes

DOES LATCH MECHANISM RELEASE BOTH TORSO AND LAP BELTS SIMULTANEOUSLY?

YES

DOES LATCH MECHANISM RELEASE AT A SINGLE POINT BY A PUSH BUTTON ACTION?

YES

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

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

Duration of audible warning signal = 7 sec.

Duration of reminder light operation = 7 sec.

WITH OCCUPANT IN DRIVER'S POSITION AND SEAT 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 = 7 sec.

Wording of visual warning:

Fasten Seat Belt _____

Fasten Belt X

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 PROTECTON SYSTEM:

The label is located on the headliner above the driver's sunvisor.

THE MANUFACTURER'S RECOMMENDED SCHEDULE IS TO: (check one)*

replace _____ or repair _____ this system

a. by _____ month, _____ year

b. by _____ miles

c. or after a time interval of _____months or _____ years.

*The label states that regular maintenance is not required.

WERE APPROPRIATE INSTRUCTIONS CONCERNING MAINTENANCE AND/OR REPLACEMENT OF THIS SYSTEM PROVIDED? Yes

WAS A DESCRIPTION OF THE FUNCTIONAL OPERATION OF THE SYSTEM PROVIDED?
Yes, owner's manual, page 69

IS THERE A REFERENCE TO THE INSTRUCTIONS AND DESCRIPTION OF THE SYSTEM ON THE LABEL? Yes

WAS AN OWNER'S MANUAL PROVIDED? Yes

DID THE OWNER'S MANUAL CONTAIN APPROPRIATE INFORMATION CONCERNING MAINTENANCE AND/OR REPLACEMENT AND A DESCRIPTION OF THE FUNCTIONAL OPERATION OF THE SYSTEMS? Yes

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.

Is the system totally mechanical? No

IF NO:

Describe the location of the readiness indicator: The readiness indicator is a light stating "Inflatable Restraint" on the instrument panel immediately above the volt meter.

Is the readiness indicator clearly visible to the driver? Yes

Is a list of the elements in the occupant restraint system, being monitored by the readiness indicator, provided? No

TABLE 11 SUMMARY OF FMVSS 301 DATA

PRE-IMPACT DATA

MAKE/MODEL: Oldsmobile/Eighty-Eight Royale

BODY STYLE: 4-door sedan MODEL YEAR: 1990

NHTSA NO.: CL0103 COLOR: White

DATA FROM CERTIFICATION LABEL

VEHICLE MANUFACTURER: General Motors Corporation

DATE OF MANUFACTURE: 9/89 VIN: 1G3HN53C9L1803718

GVWR: 4479 LBS., GAWR: FRONT 2456 LBS., REAR 2023 LBS.

POST-IMPACT DATA

TYPE OF TEST: 30° left front barrier

DATE OF TEST: 12/15/89 TIME: 1400 TEMP: 71° F

REQUIRED IMPACT VELOCITY RANGE: 28.9 MPH TO 29.9 MPH

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

TEST WEIGHT = 3810 LBS., STATIC CRUSH MAX. = 32.5 IN.

FUEL SYSTEM DATA

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

KINEMATIC VISCOSITY: 0.99 CENTISTOKES

"USEABLE" CAPACITY*: 18.0 GALLONS (FURNISHED BY COTR)

TEST VOLUME: 16.9 GALLONS (92-94% OF USEABLE)

FUEL SYSTEM CAPACITY (DATA FROM OWNERS MANUAL): 18.0 GALLONS

DETAILS OF FUEL SYSTEM: The fuel tank is located in front of the rear axle. The fuel filler neck is located on the left side. The fuel lines run along the left frame rail to the front.

ELECTRIC FUEL PUMP: Yes FUEL INJECTON: Yes

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

*WITH ENTIRE FUEL SYSTEM FILLED.

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

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

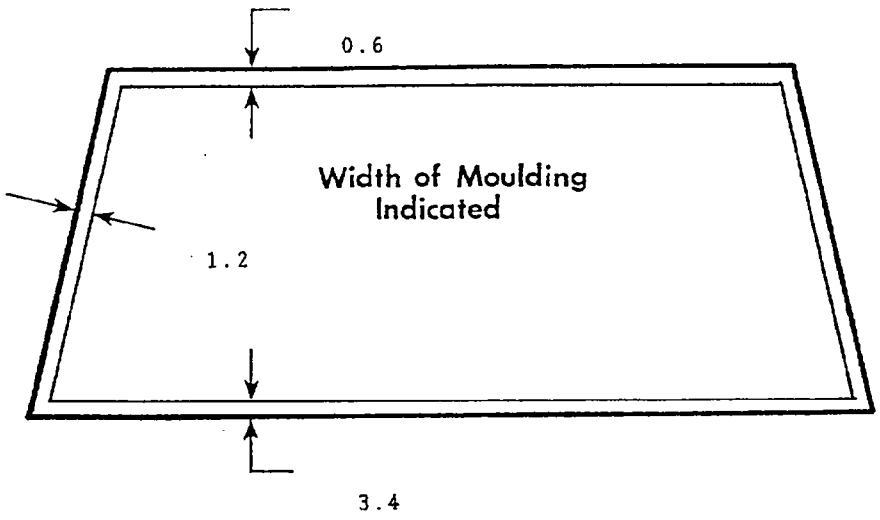
Adhesive around perimeter, plastic molding over outer perimeter.

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	84.6	84.6	100%
LEFT SIDE	84.6	84.6	100%
TOTAL	169.2	169.2	100%

AREA OF RETENTION FAILURE:



WINDSHIELD TEMPERATURE: 69° F

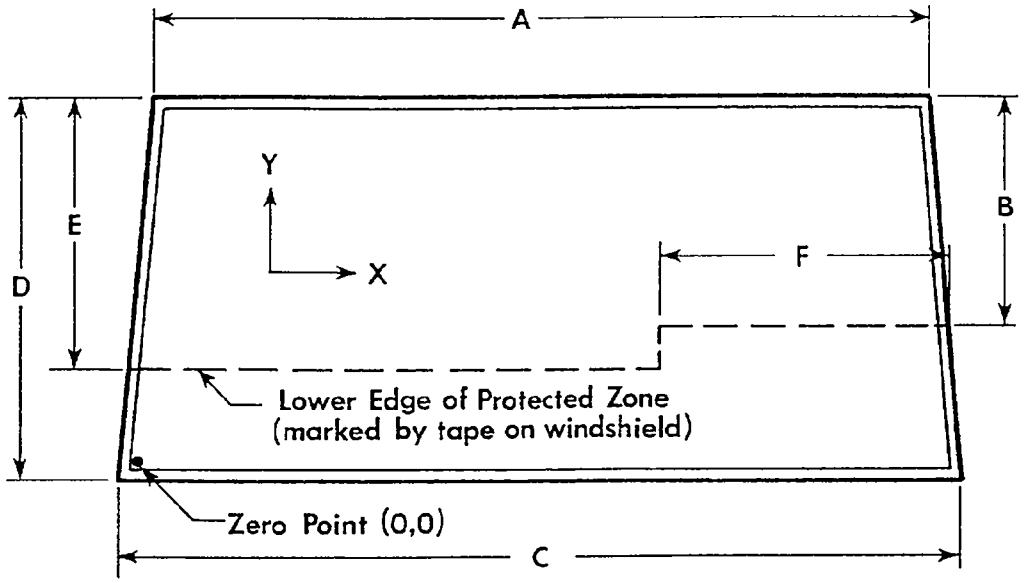
FAILURE DETAILS: None

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 = 53.8 C = 66.5 E = 22.0

B = 20.1 D = 28.5 F = 37.9

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

None

COORDINATES

	X	Y
1.		
2.		
3.		
4.		

ALL MEASUREMENTS ARE IN INCHES.

TABLE 12 "FUEL SYSTEM INTEGRITY" POST-IMPACT

TEST DATA, FMVSS NO. 301

TEST VEHICLE NHTSA NO.: CL0103 ; TEST DATE: 12/15/89

VEH. MFR./MAKE/MODEL: General Motors Corporation/Oldsmobile/Eighty-Eight Royale

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

. . . . . .

TEST VEHICLE IMPACT TYPE:

_____Frontal (30 mph)

_X_ Oblique (30 mph) with _30°_ barrier face first contacting the driver's side.

_____Rear Moving Barrier (30 mph)

_____Lateral Moving Barrier (20 mph)

FUEL SPILLAGE MEASUREMENT:

	ACTUAL	MAX. ALLOW.
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.

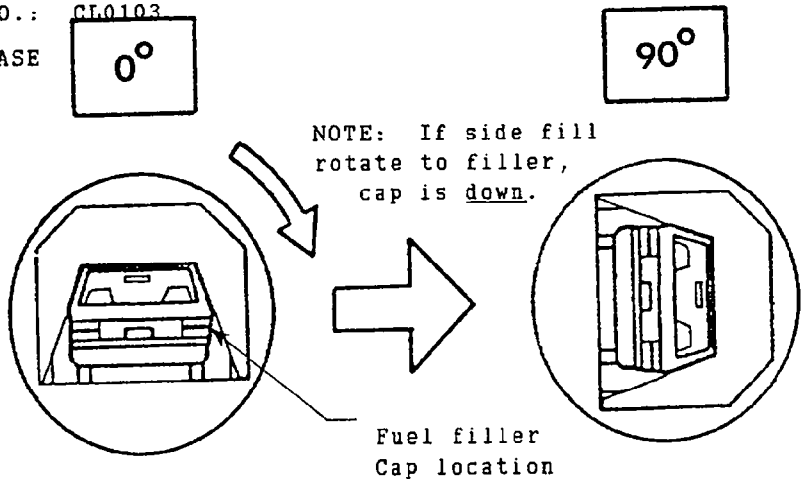
SOLVENT SPILLAGE DETAILS:

None

FIGURE 12 FMVSS NO. 301 STATIC ROLLOVER DATA SHEET

NHTSA NO.: CL0103

TEST PHASE 0°



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 - -	5 oz.	1 oz.	1 oz.
0 to 90° (filler cap down) - - - - - -	0 oz.	0 oz.	0 oz.

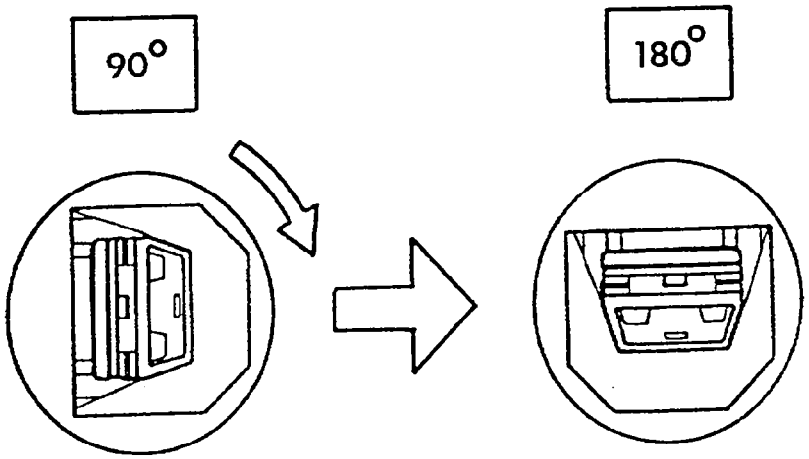
SOLVENT SPILLAGE LOCATION(S)

None

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

NHTSA NO.: CL0103

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 - -	5 oz.	1 oz.	1 oz.
90° to 180°- - - - - - - - - - - - - - - -	0 oz.	0 oz.	0 oz.

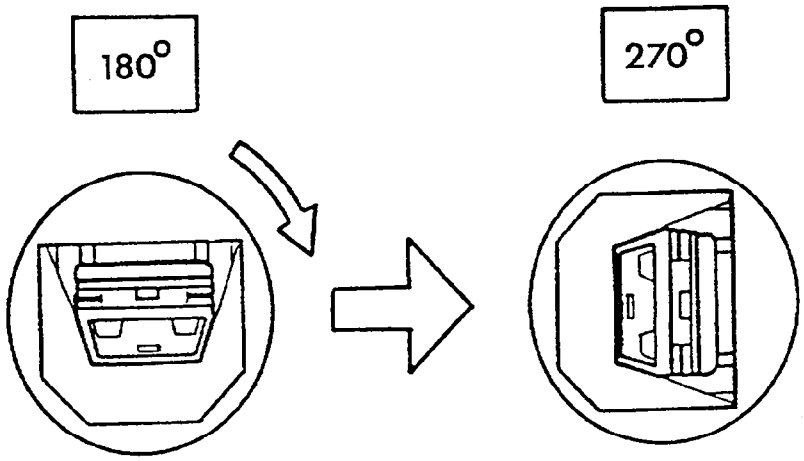
SOLVENT SPILLAGE LOCATION(S)

None

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

NHTSA NO.: CL0103

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

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

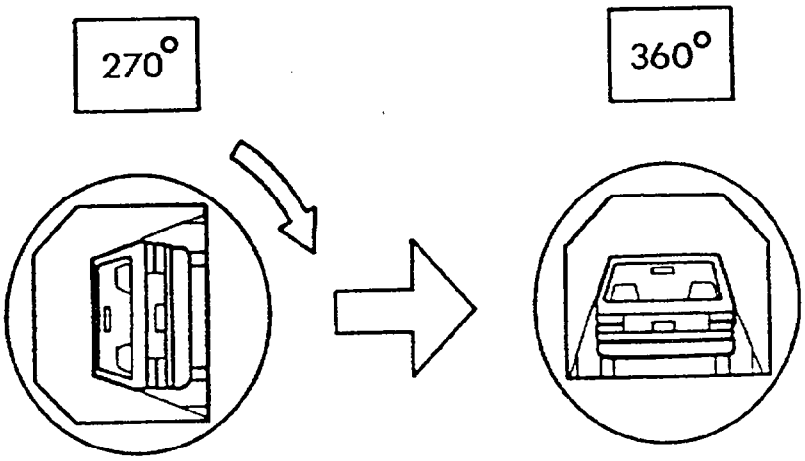
SOLVENT SPILLAGE LOCATION(S)

None

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

NHTSA NO.: CL0103

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 - -	5 oz.	1 oz.	1 oz.
270° to 360° - - - - - - - - - - - - - - -	0 oz.	0 oz.	0 oz.

SOLVENT SPILLAGE LOCATION(S)

None

SECTION 3.0

CAMERA INFORMATION

FIGURE 13

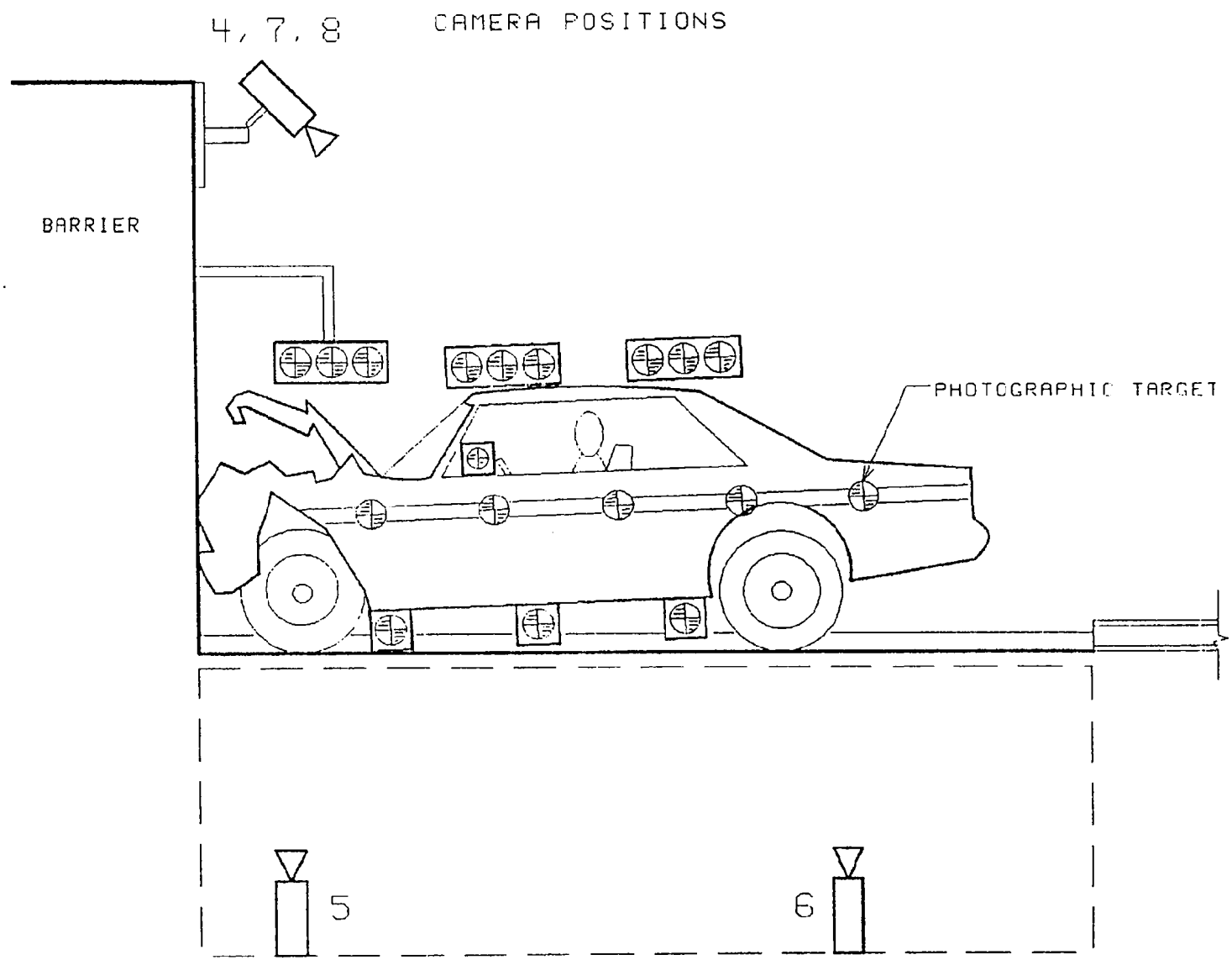


FIGURE 13

CAMERA POSITIONS, CONTINUED

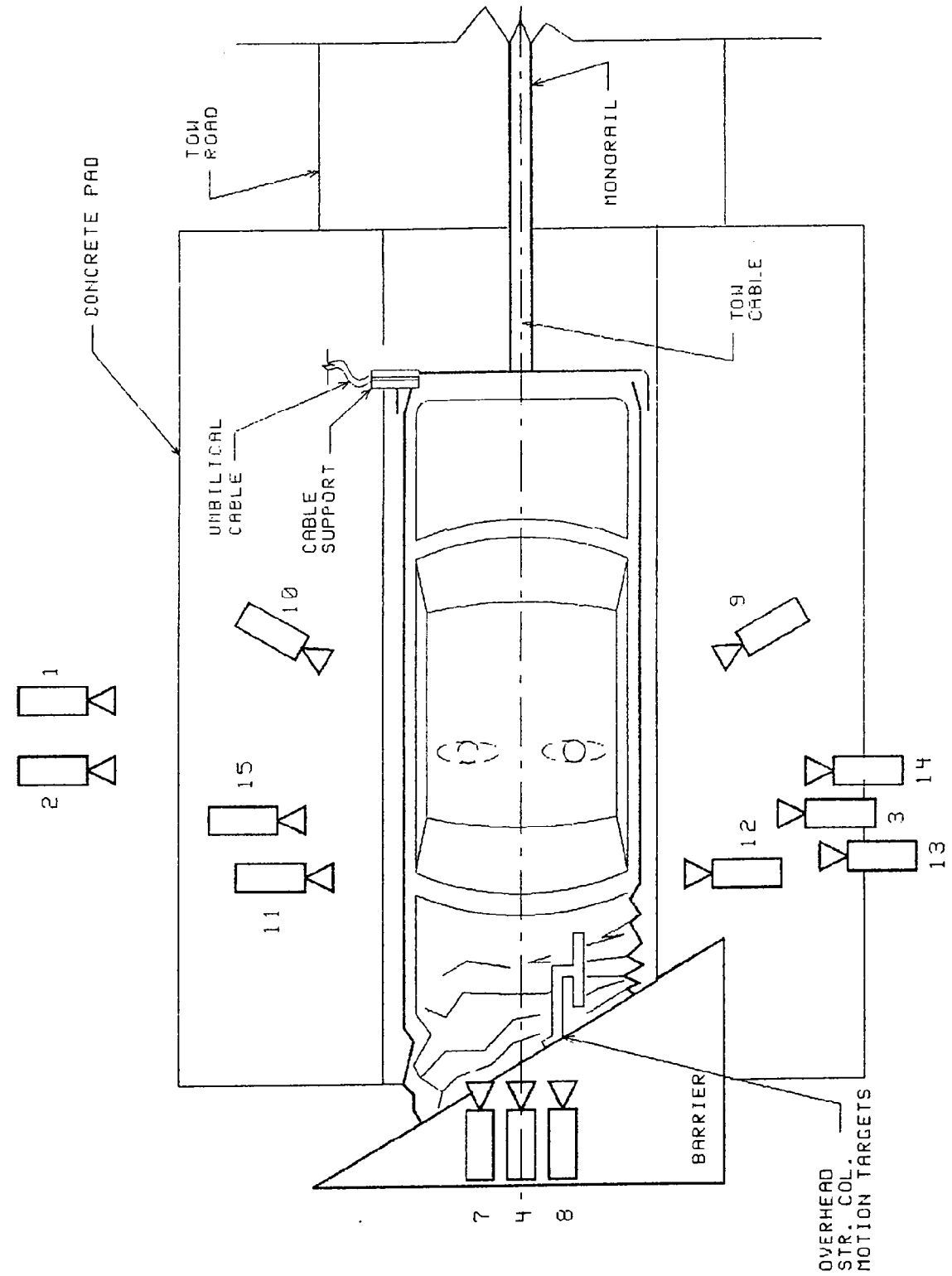


TABLE 13 HIGH SPEED CAMERA LOCATIONS

TEST NO.: 891215 VEHICLE: 1990 Oldsmobile Eighty-Eight Royale

CAMERA NO.	VIEW	CAMERA POSITIONS (IN)* X	Y	Z	ANGLE** (DEG)	FILM PLANE TO HEAD TARGET	LENS (MM)	SPEED (FPS)
1	Real time panning	-142.0	-504.0	61.0	NA	NA	16	24
2	Vehicle crush	-81.3	-266.4	37.1	-2	NA	13	500
3	Dummy kinematics	-41.5	295.0	44.0	-4	262.0	25	500
4	Windshield damage	-6.0	0.0	90.0	-40	NA	13	999
5	Crush & fluid spillage	-50.5	0.0	-92.4	90	NA	13	1006
6	Fluid spillage	-99.3	0.0	-99.0	90	NA	13	500
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	498
9	Driver kinematics	-157.3	116.0	87.0	-27	109.0	25	498
10	Passenger kinematics	-152.1	-116.0	87.0	-26	110.0	25	498
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	-128.0	256.0	103.0	-14	NA	25	510
14	Column movement	-128.0	256.0	75.1	-9	NA	25	495
15	Passenger kinematics	-38.8	-293.0	45.3	-4	270.0	25	498

* +X = Film plane forward of barrier face at monorail centerline
+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

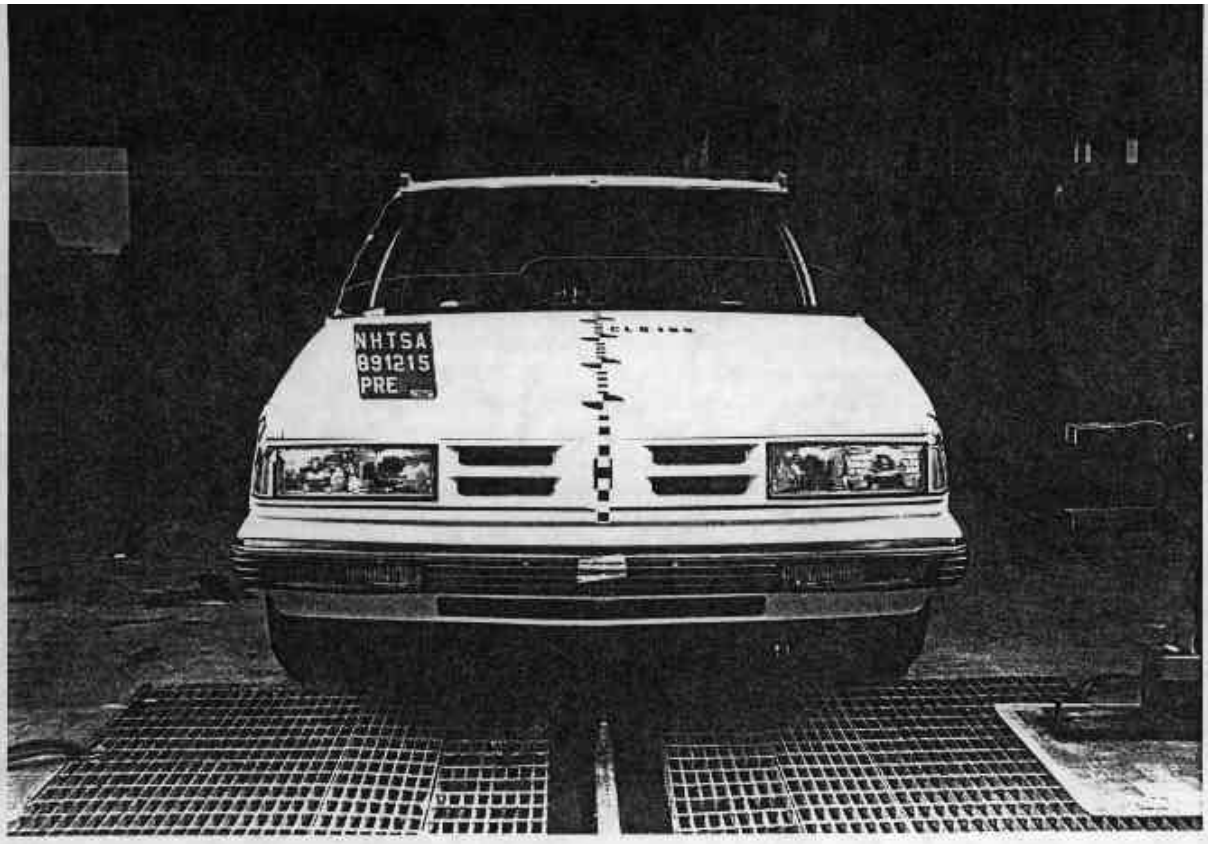


Figure A-1. PRE-TEST FRONT VIEW

Figure A-2. POST-TEST FRONT VIEW

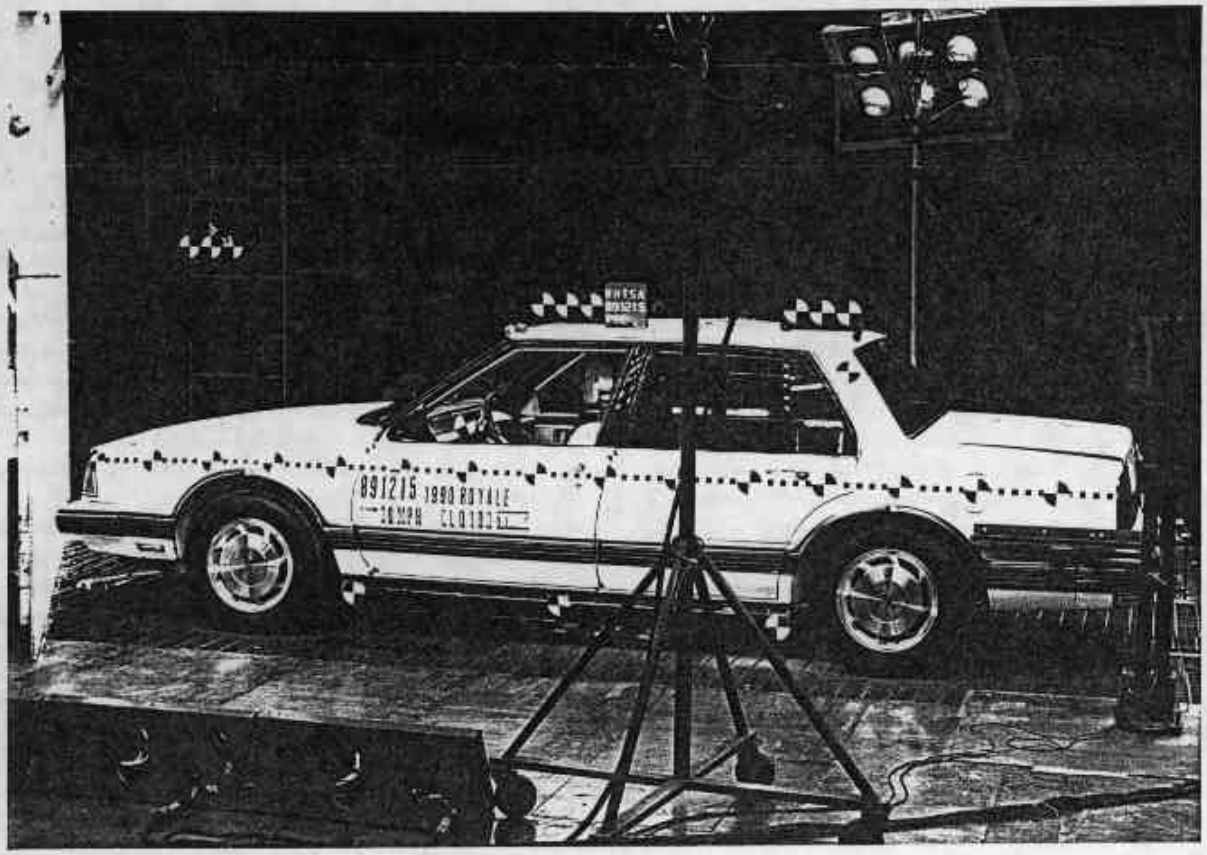


Figure A-3. PRE-TEST LEFT SIDE VIEW

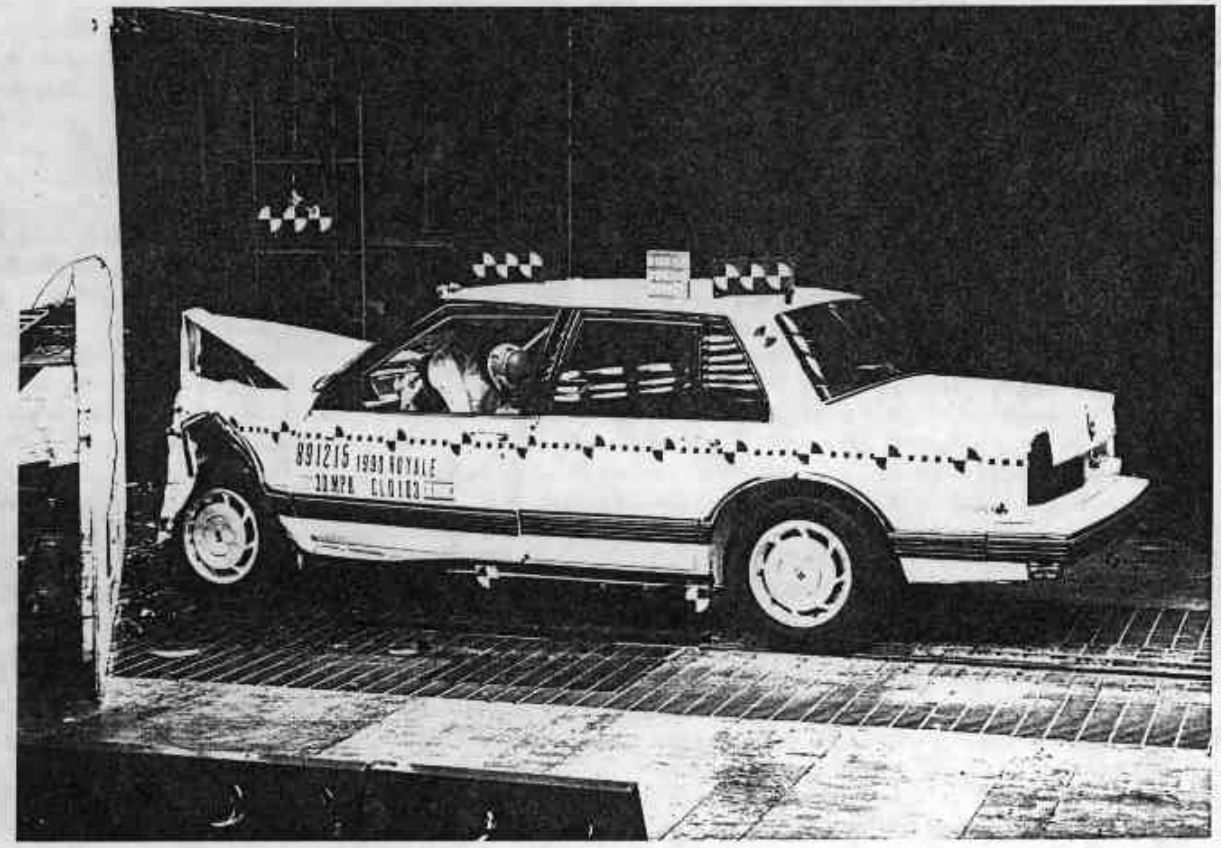


Figure A-4. POST-TEST LEFT SIDE VIEW

Figure A-5. PRE-TEST RIGHT SIDE VIEW

Figure A-6. POST-TEST RIGHT SIDE VIEW

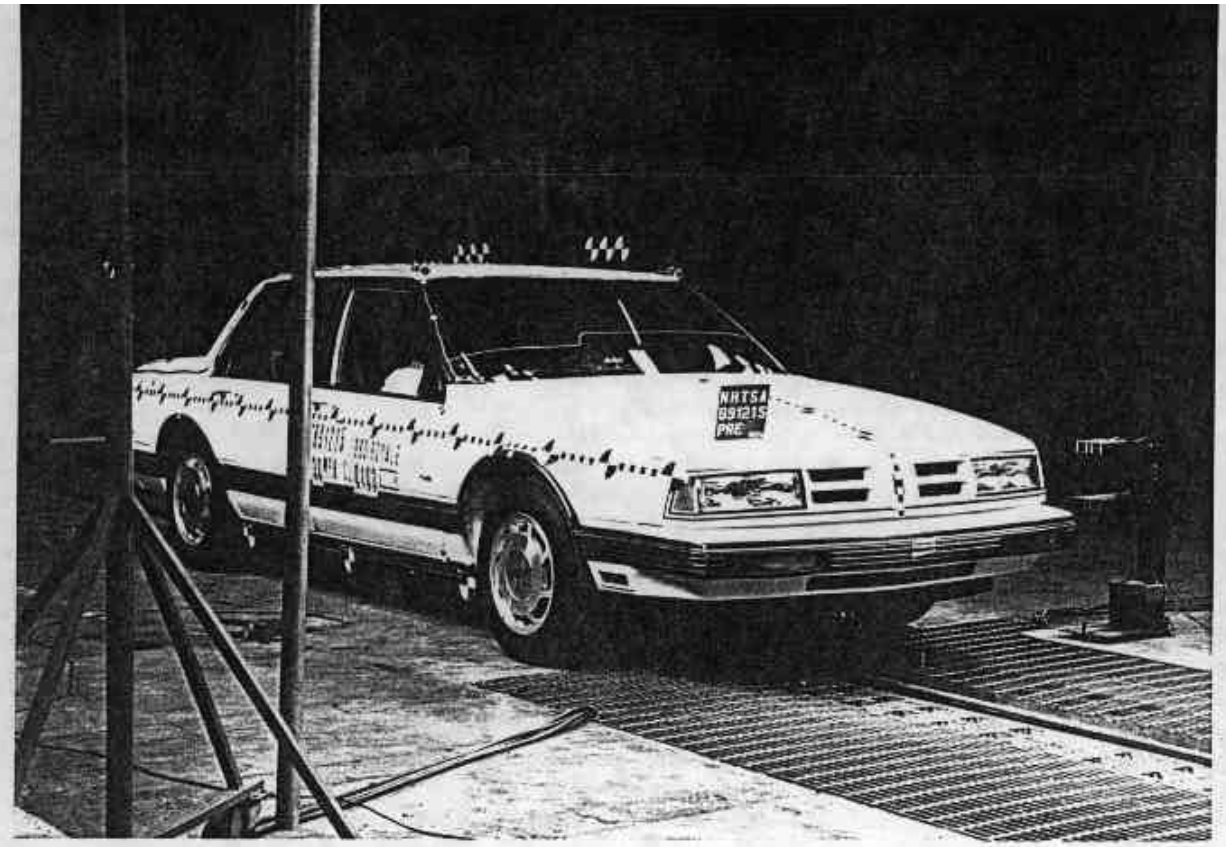


Figure A-7. PRE-TEST RIGHT FRONT THREE-QUARTER VIEW

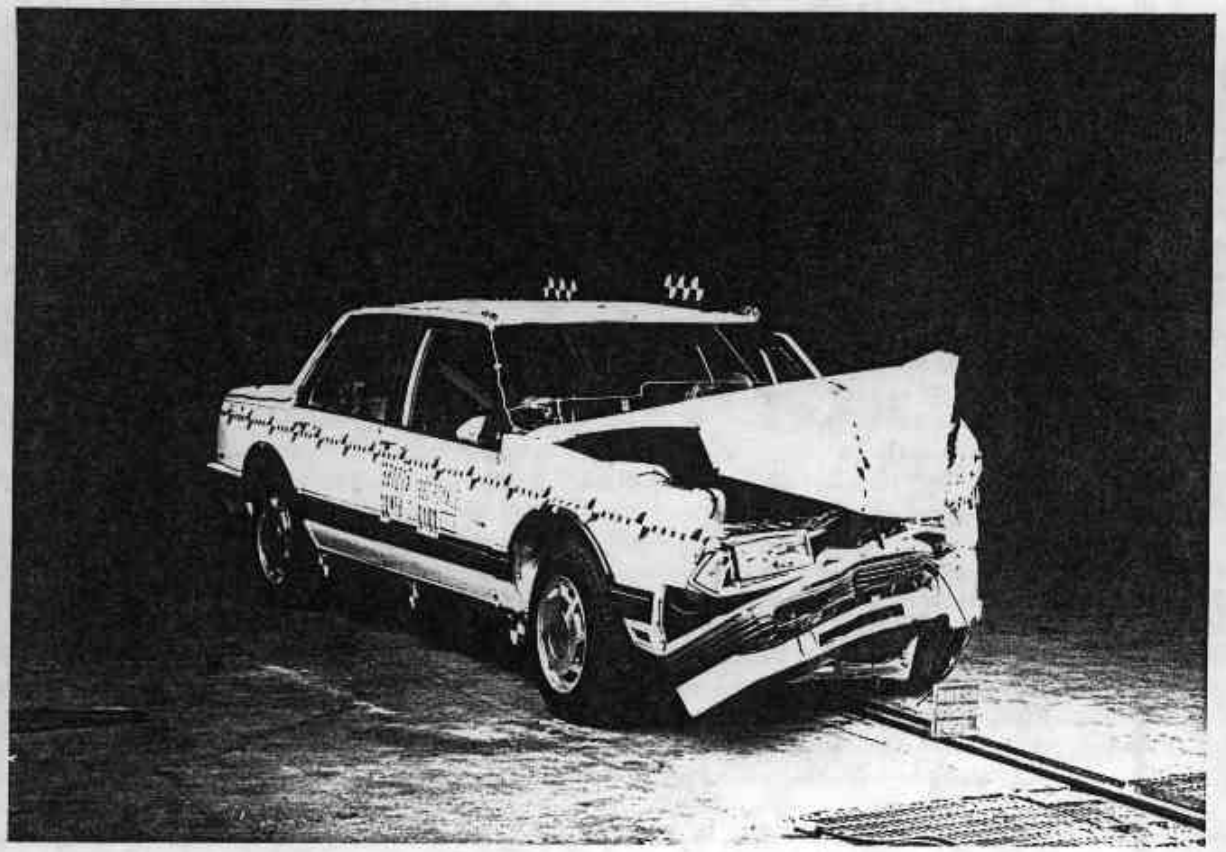


Figure A-8. POST-TEST RIGHT FRONT THREE-QUARTER VIEW

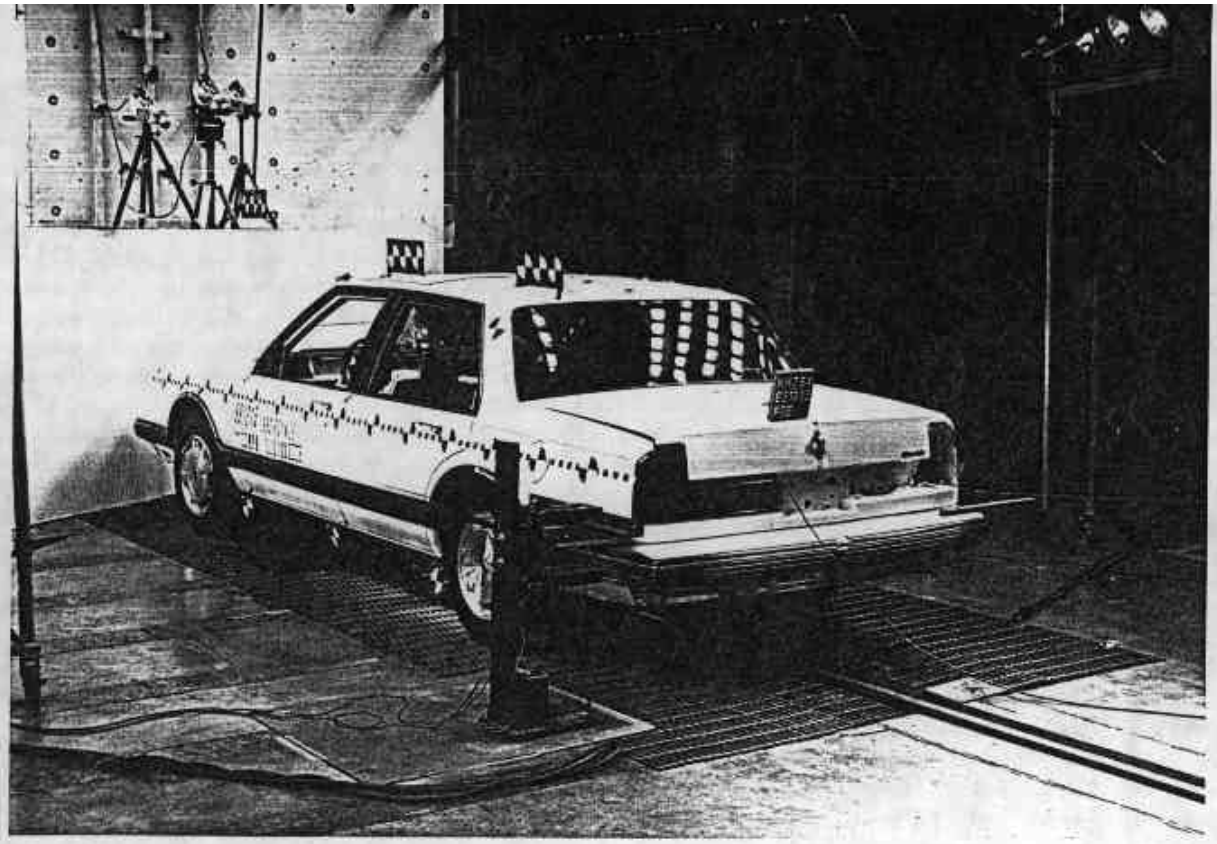


Figure A-9. PRE-TEST LEFT REAR THREE-QUARTER VIEW

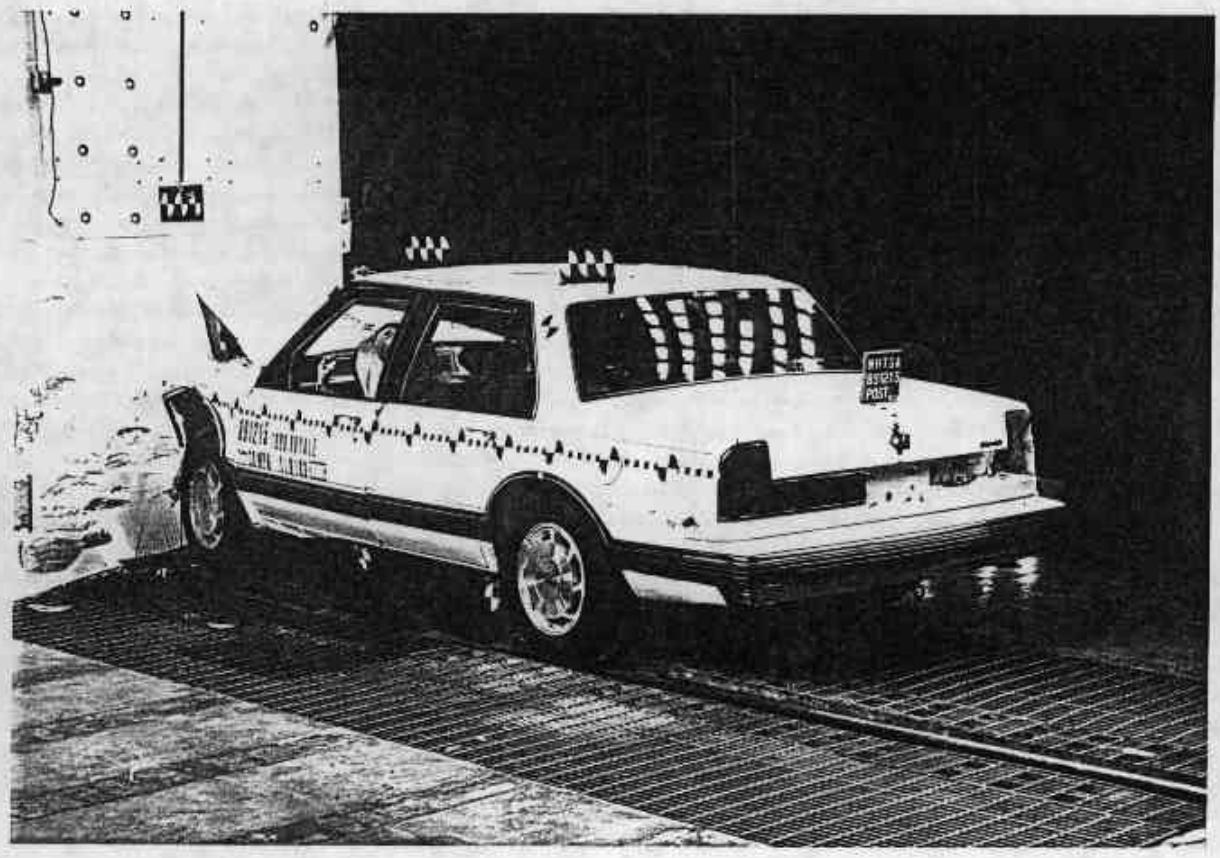


Figure A-10. POST-TEST LEFT REAR THREE-QUARTER VIEW

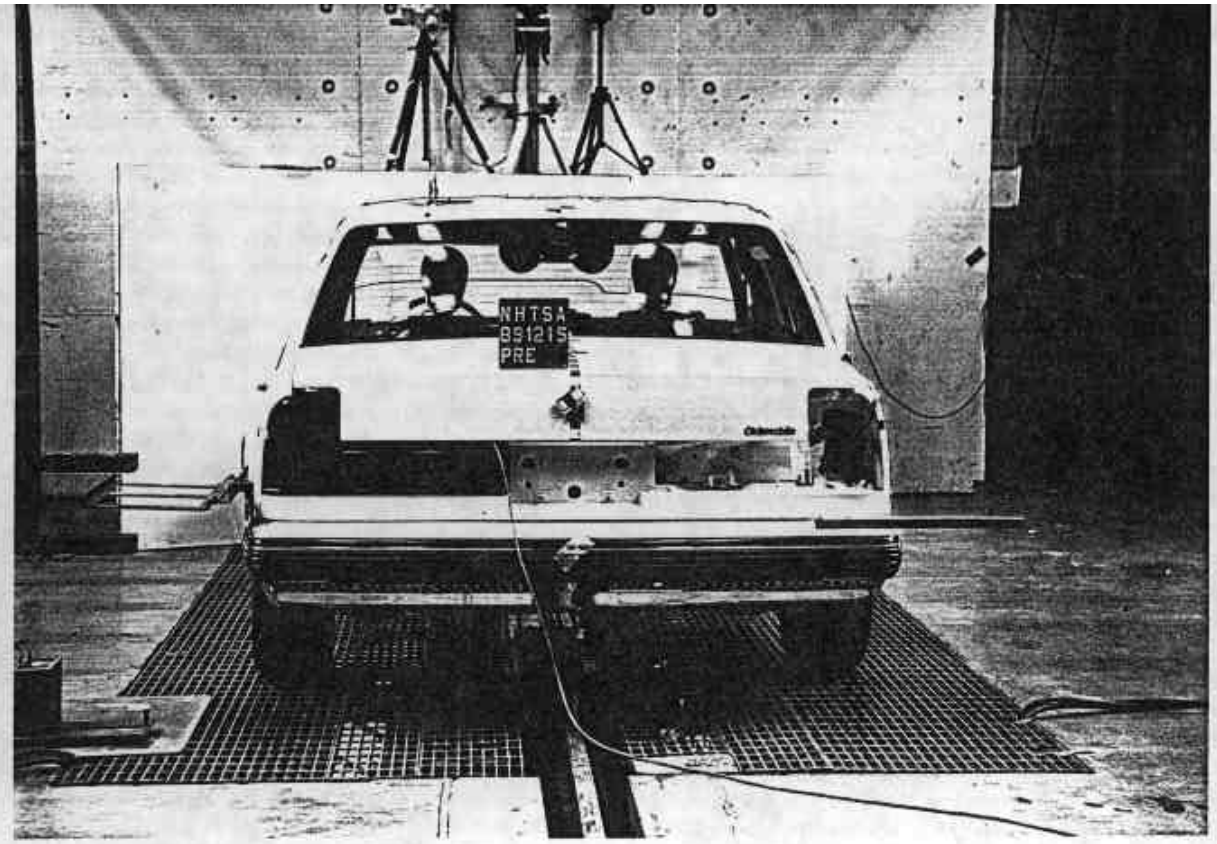


Figure A-11. PRE-TEST REAR VIEW

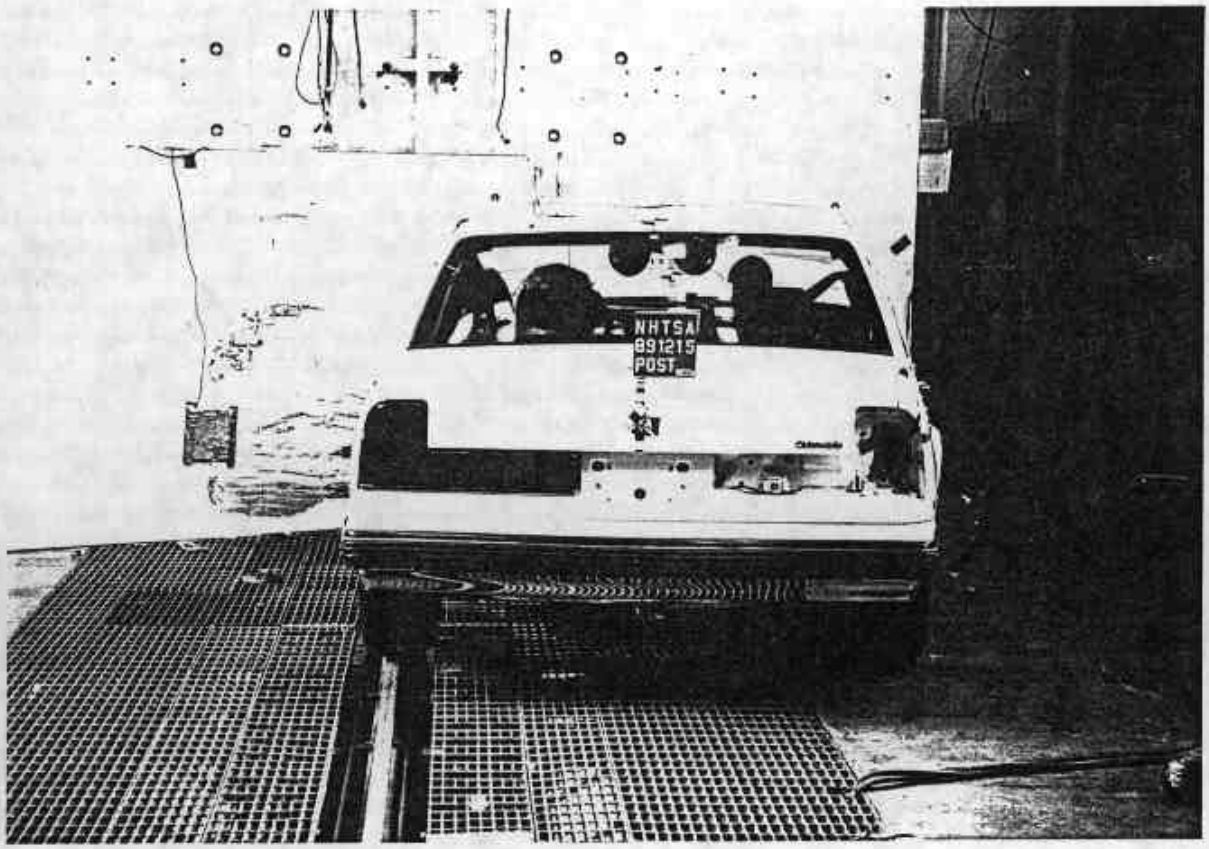


Figure A-12. POST-TEST REAR VIEW

Figure A-13. PRE-TEST WINDSHIELD VIEW

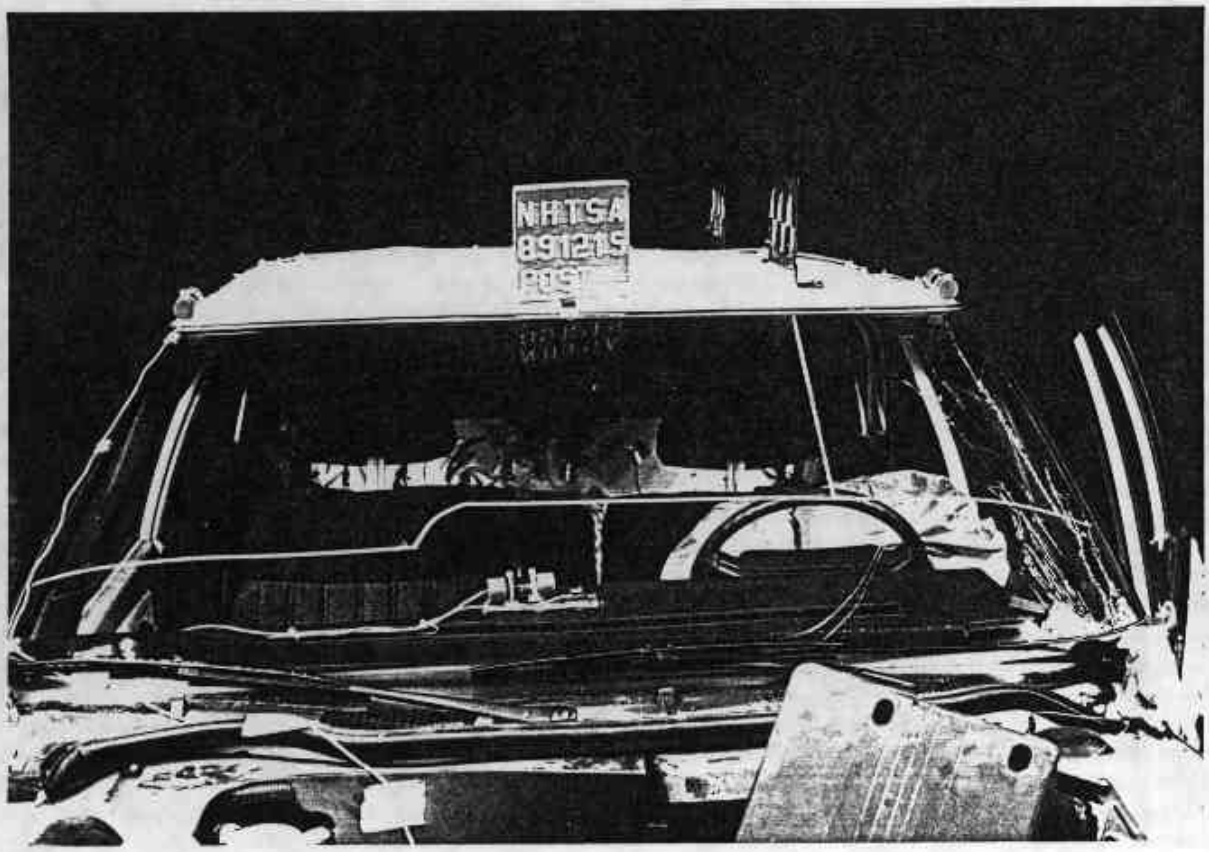


Figure A-14. POST-TEST WINDSHIELD VIEW

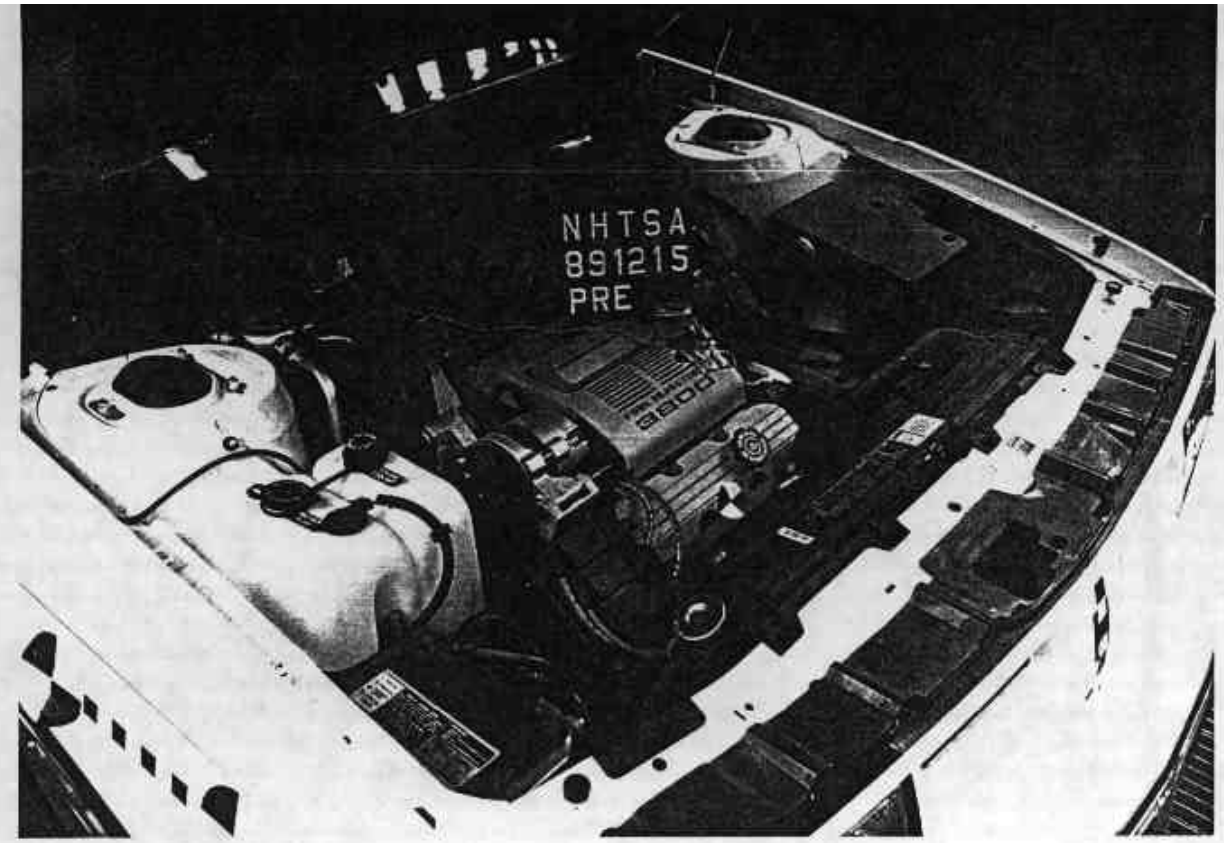


Figure A-15. PRE-TEST ENGINE COMPARTMENT VIEW

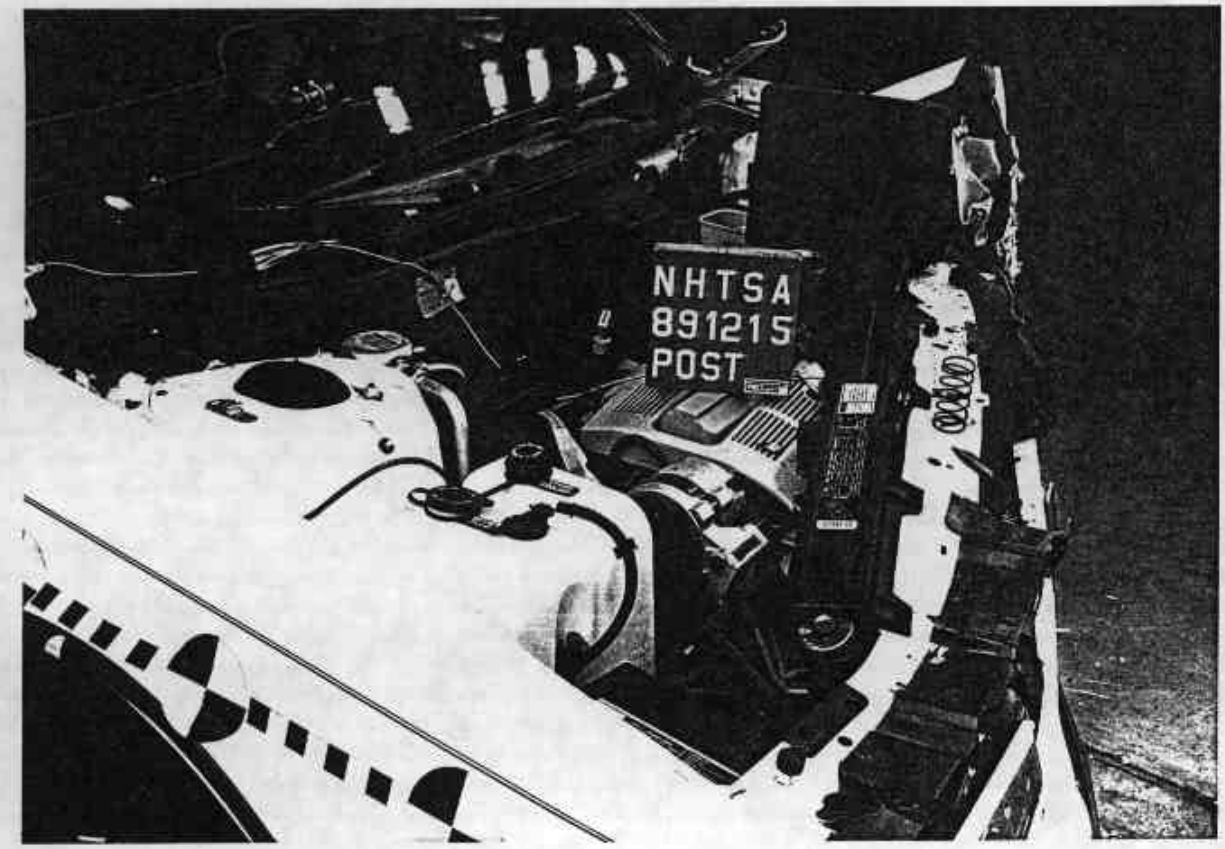


Figure A-16. POST-TEST ENGINE COMPARTMENT VIEW

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

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

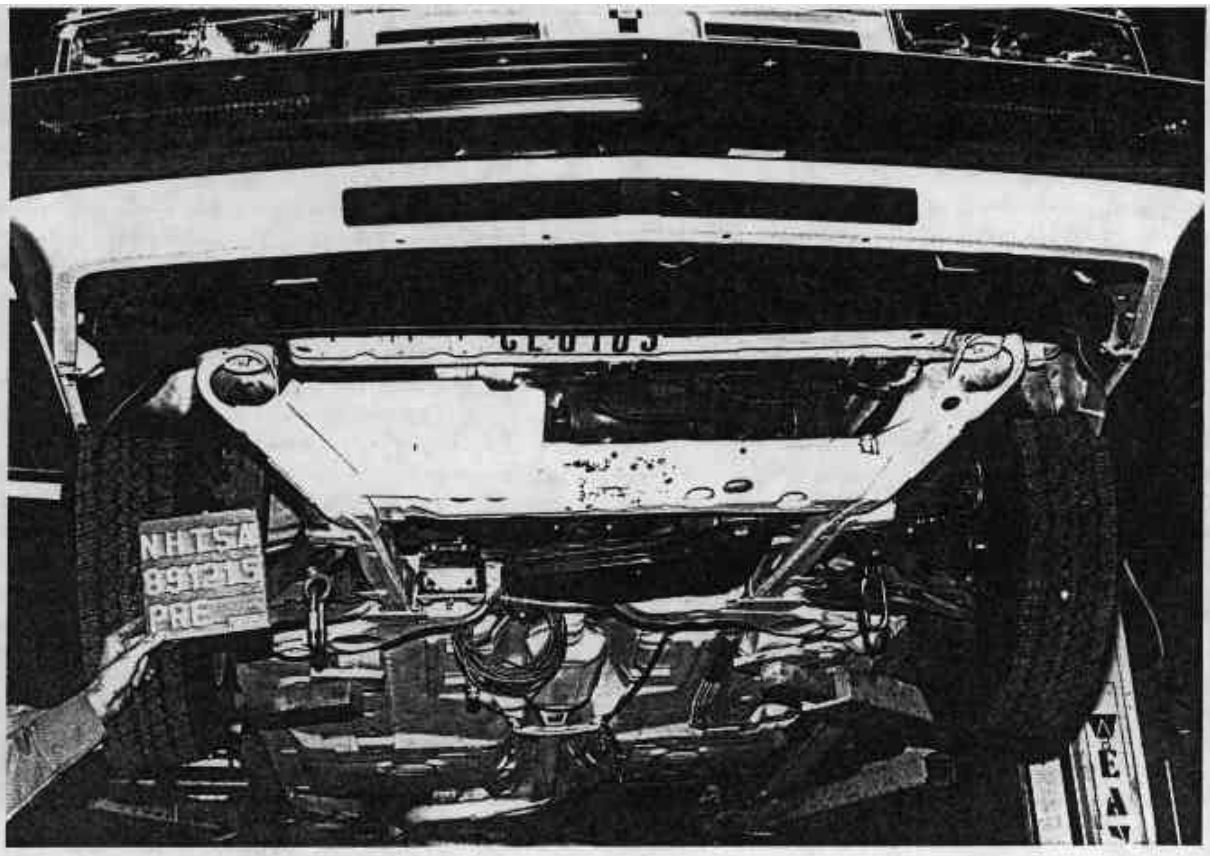


Figure A-19. PRE-TEST FRONT UNDERBODY VIEW

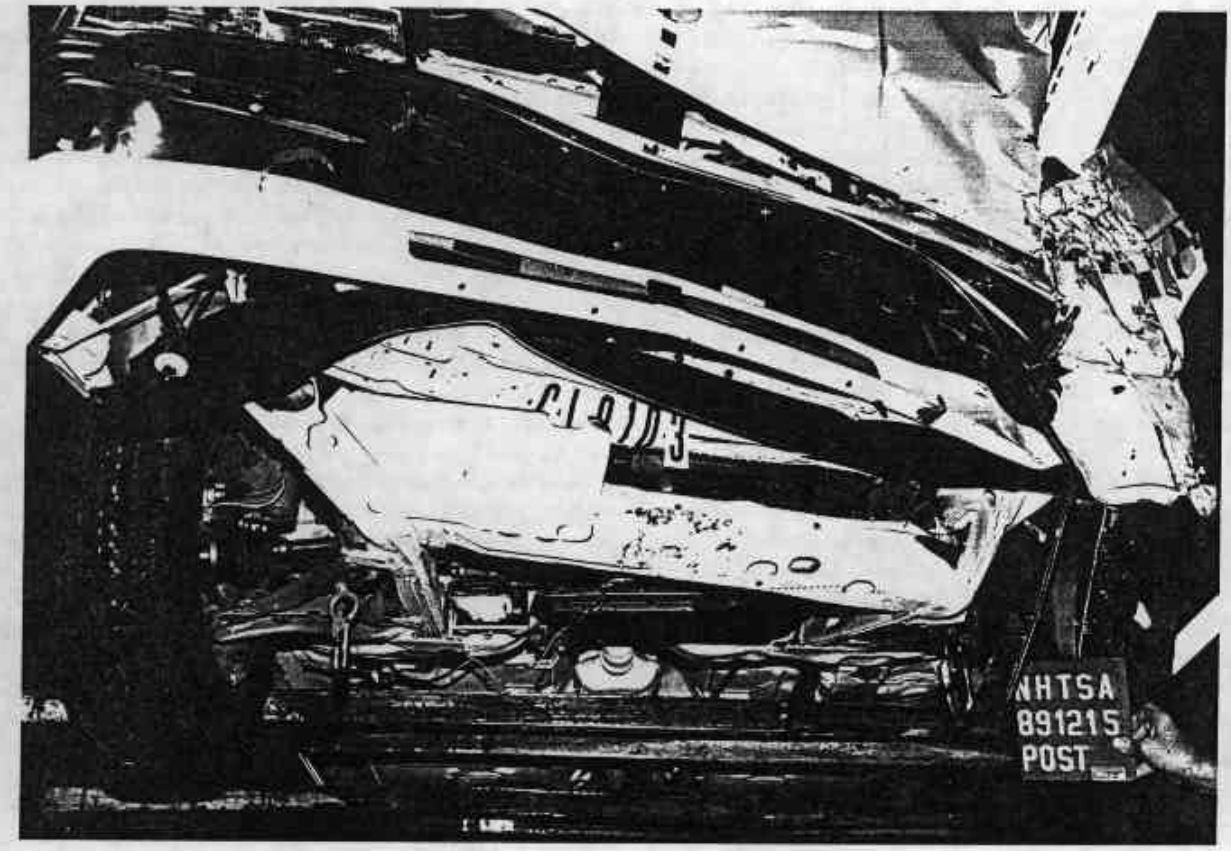


Figure A-20. POST-TEST FRONT UNDERBODY VIEW

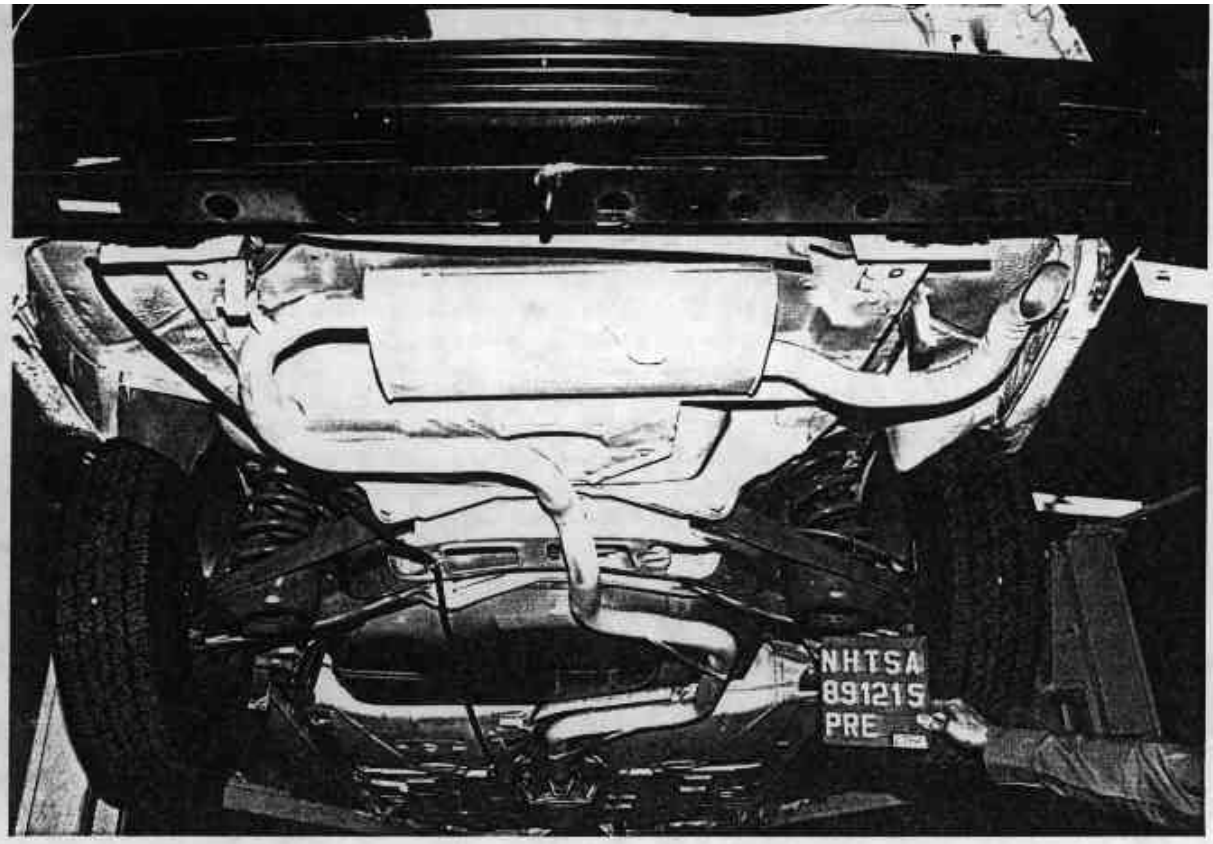


Figure A-21. PRE-TEST REAR UNDERBODY VIEW

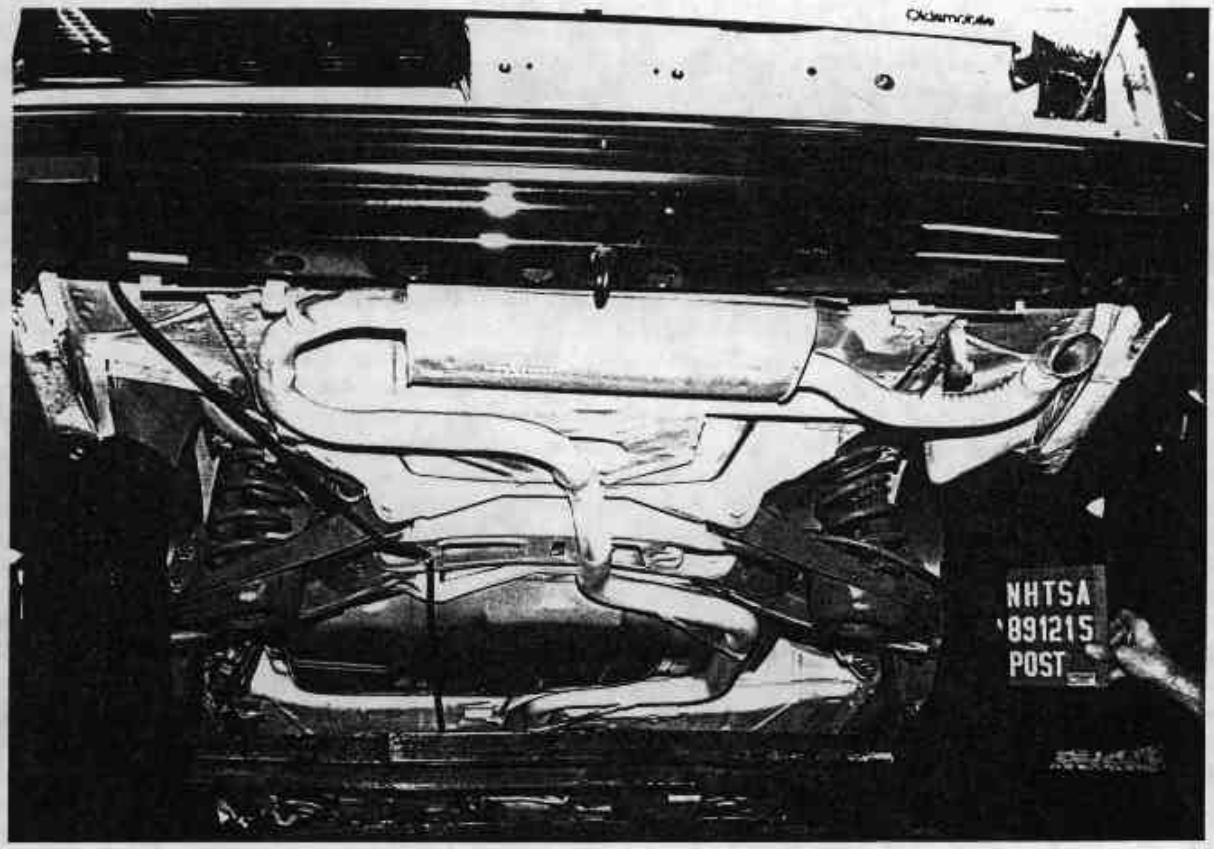


Figure A-22. POST-TEST REAR UNDERBODY VIEW

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

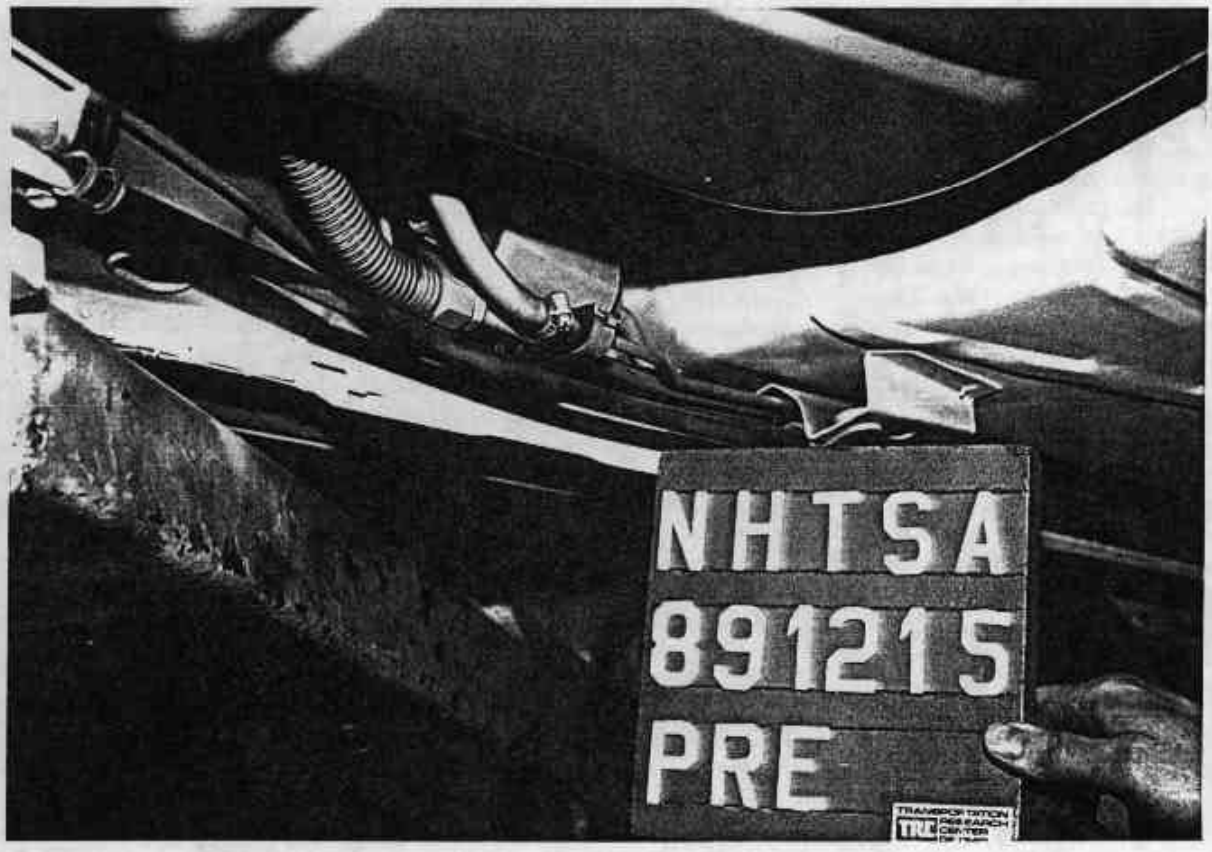


Figure A-24. PRE-TEST FUEL LINES VIEW

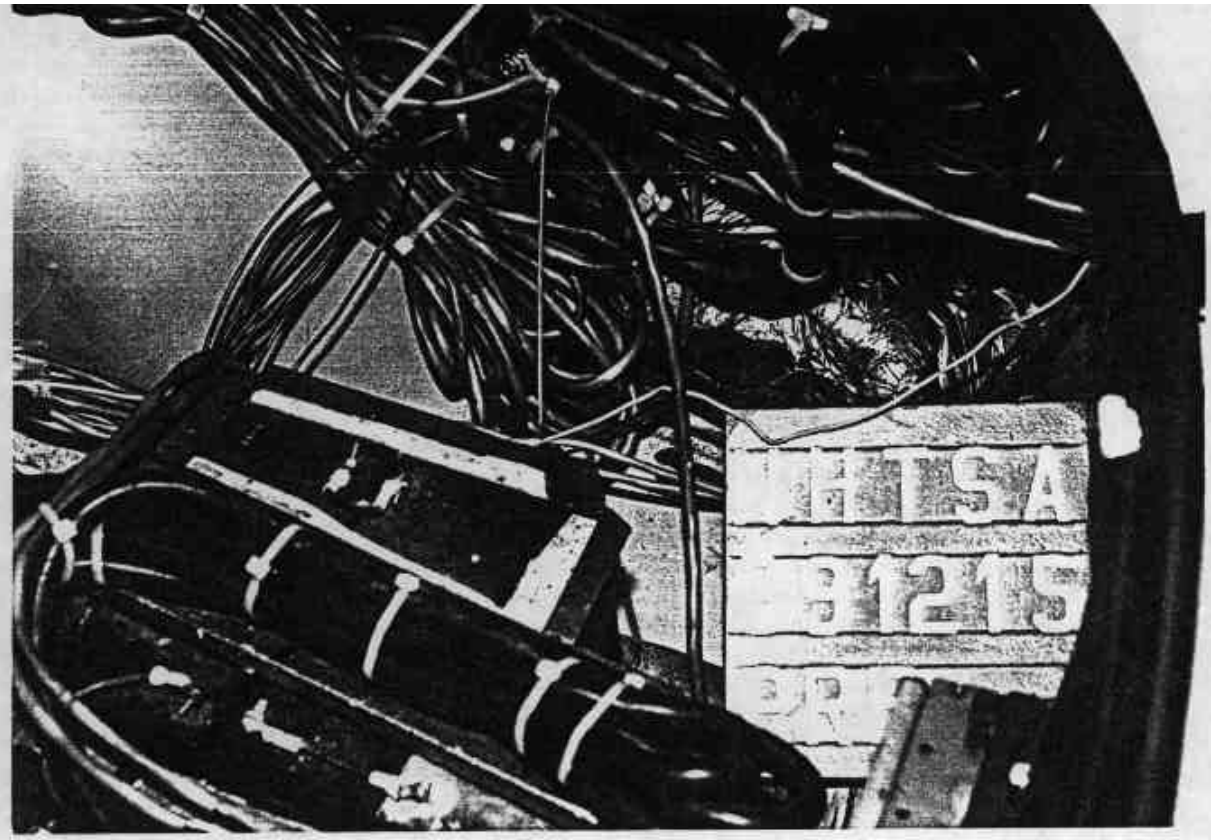


Figure A-25. PRE-TEST BALLAST - VIEW 1

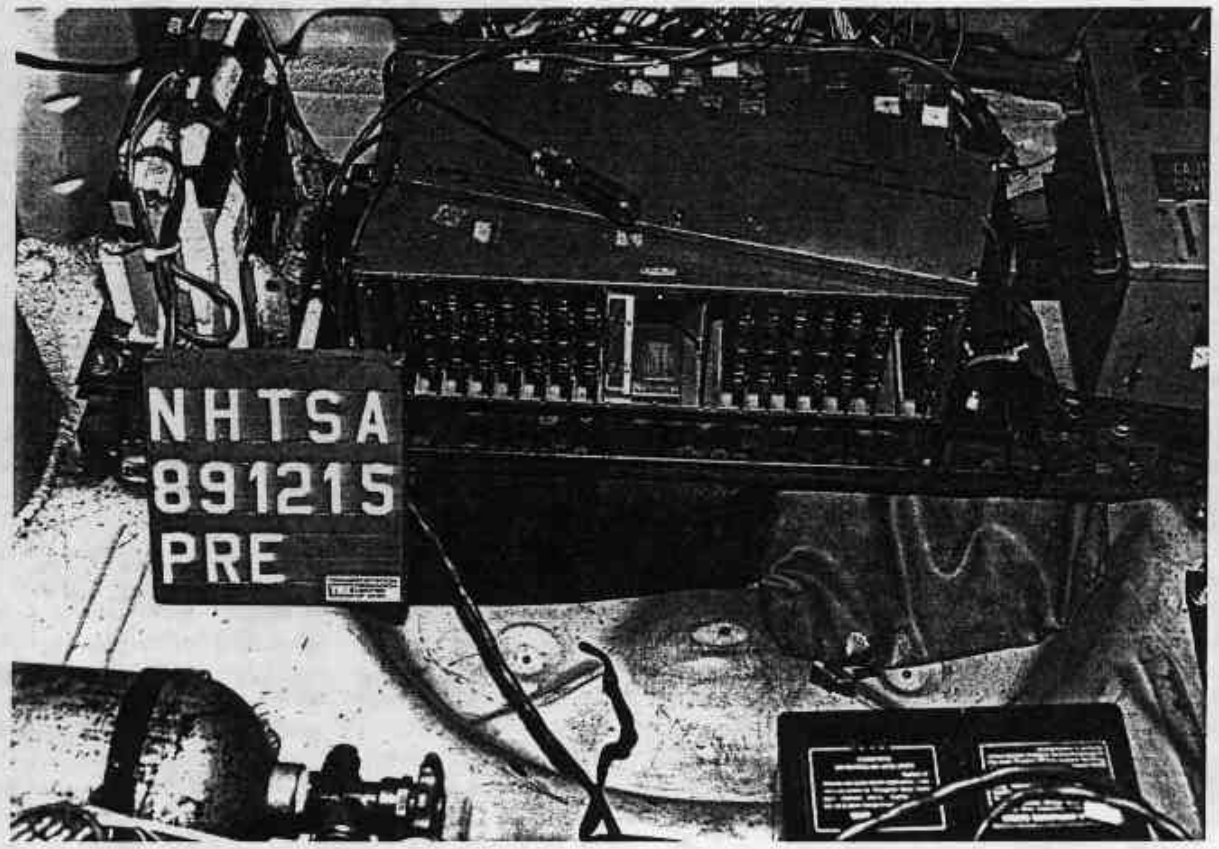


Figure A-26. PRE-TEST BALLAST - VIEW 2

Figure A-27. PRE-TEST DRIVER DUMMY POSITION VIEW

Figure A-28. POST-TEST DRIVER DUMMY POSITION VIEW

Figure A-29. PRE-TEST PASSENGER DUMMY POSITION VIEW

Figure A-30. POST-TEST PASSENGER DUMMY POSITION VIEW

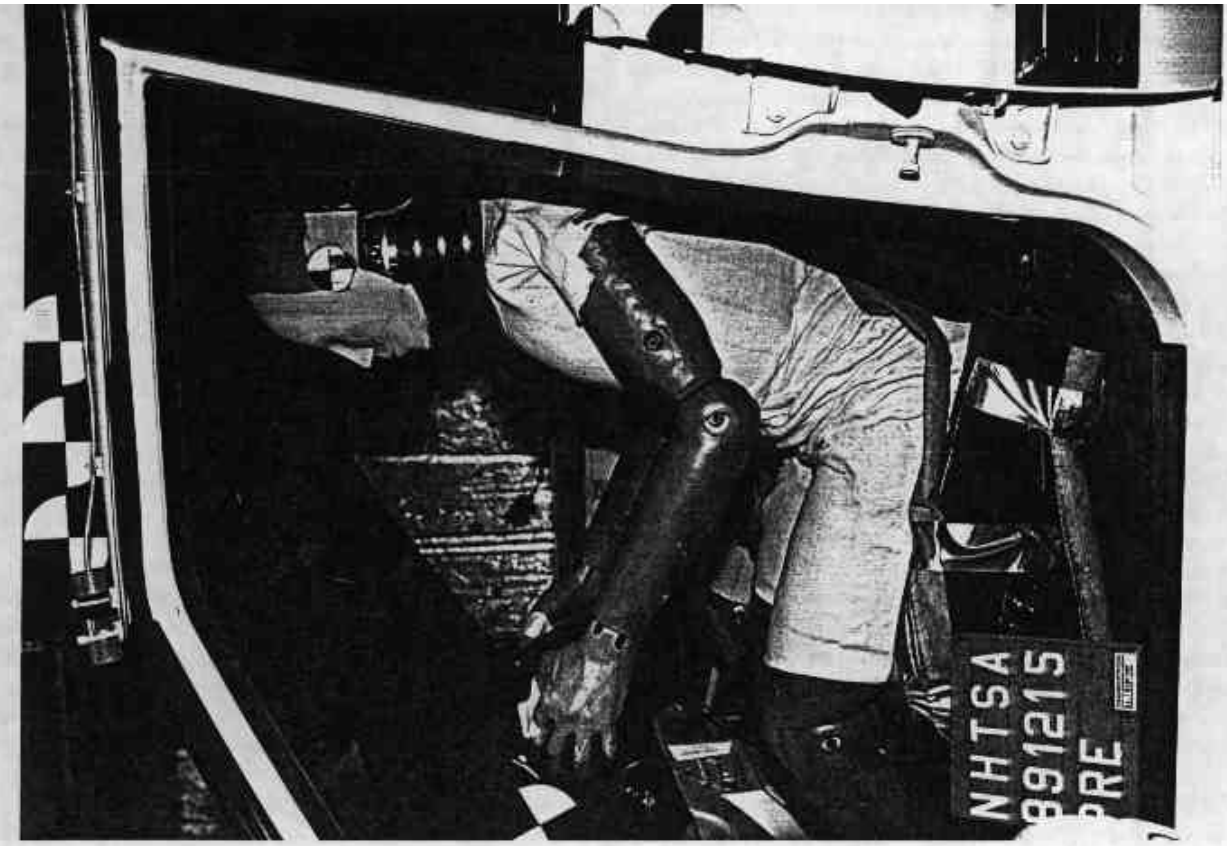


Figure A-31. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

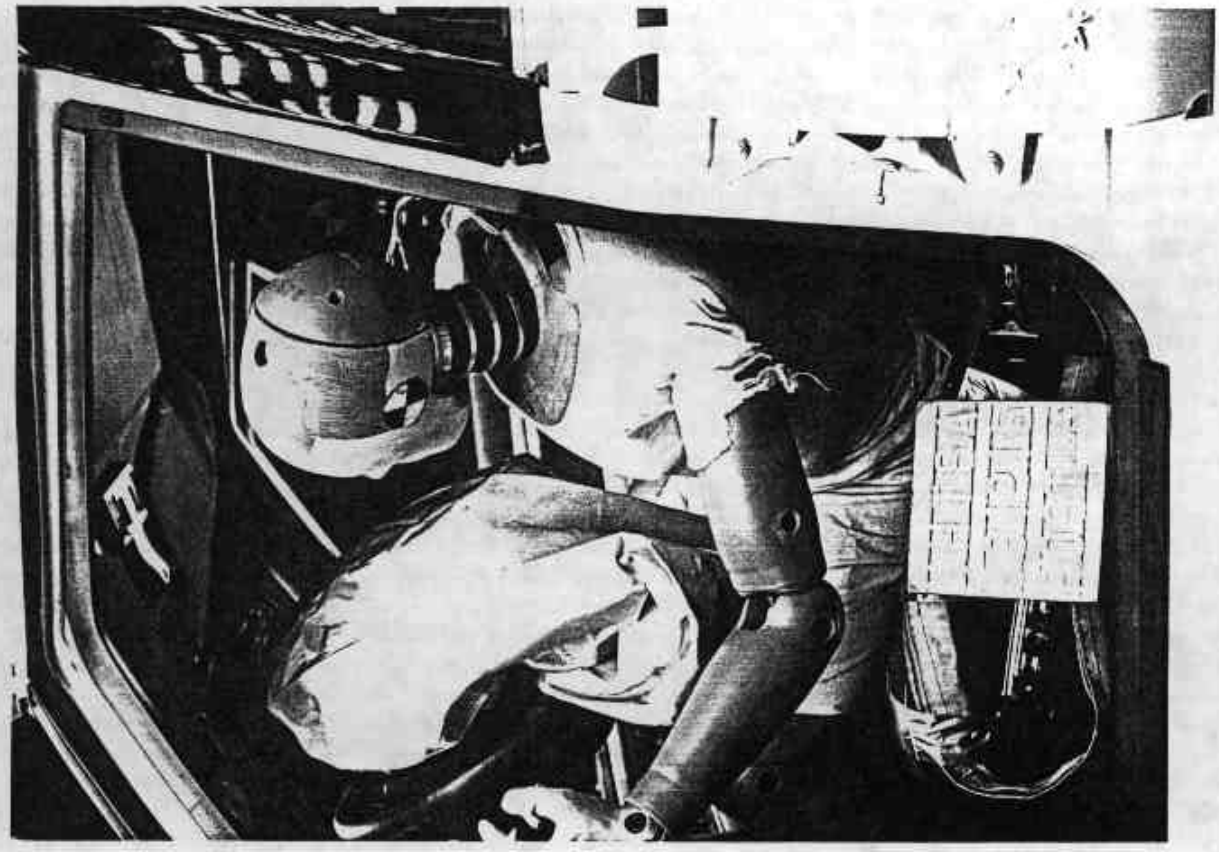


Figure A-32. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 1

Figure A-33. PRE-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

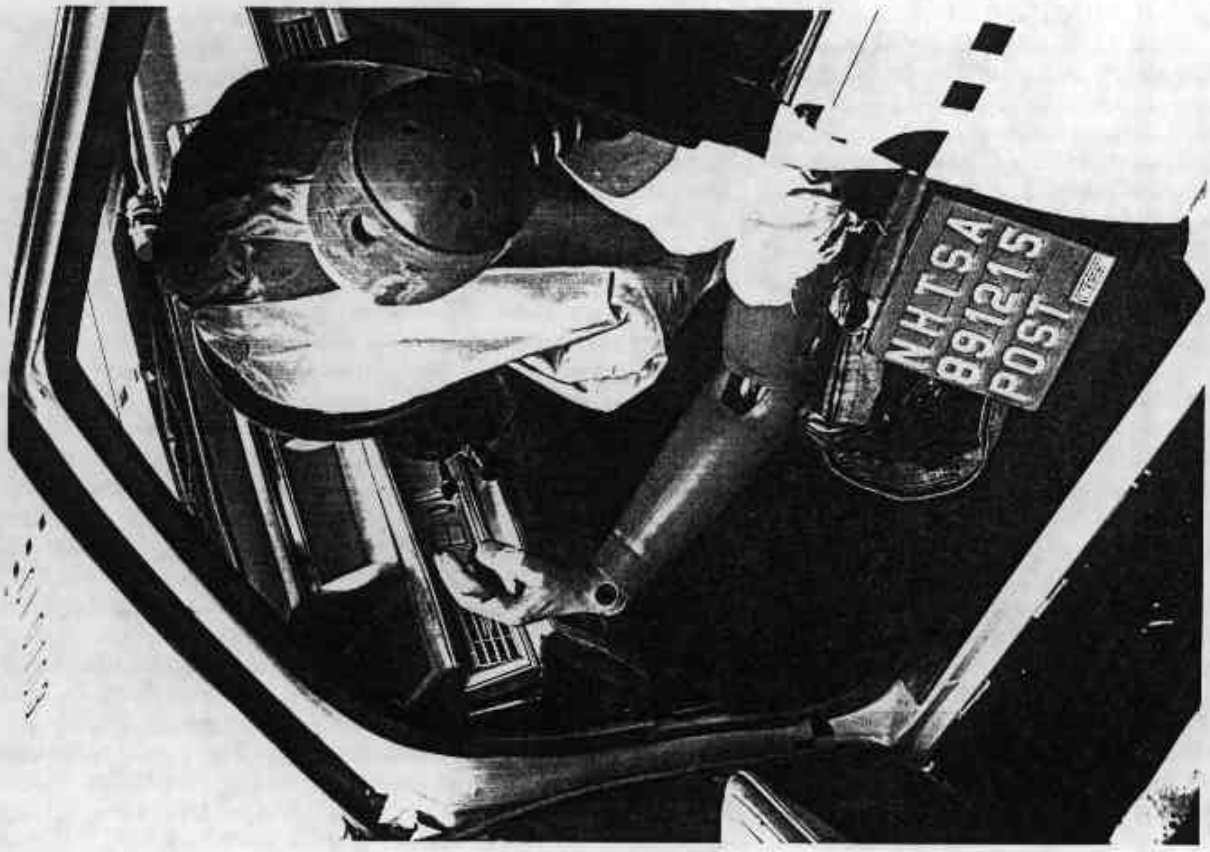


Figure A-34. POST-TEST DRIVER DUMMY & VEHICLE INTERIOR - VIEW 2

Figure A-35. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

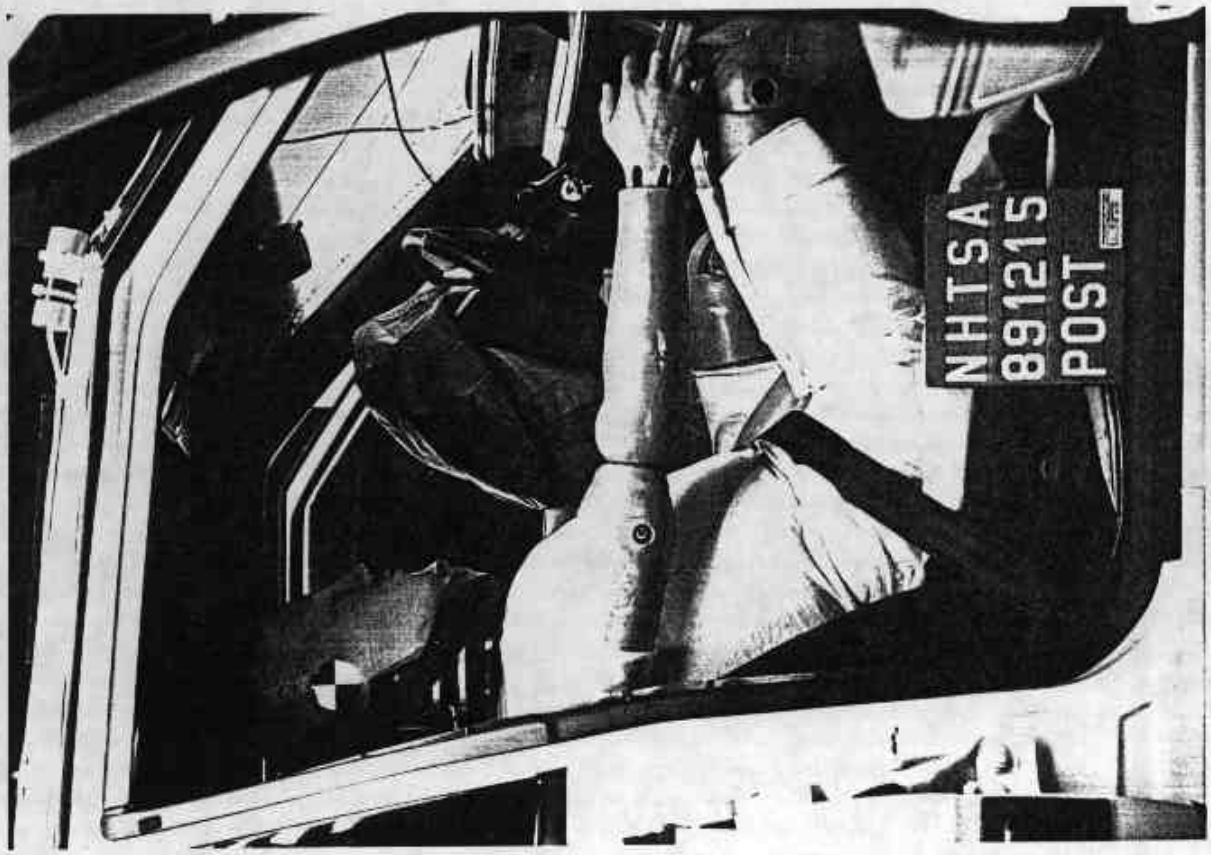


Figure A-36. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 1

Figure A-37. PRE-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2

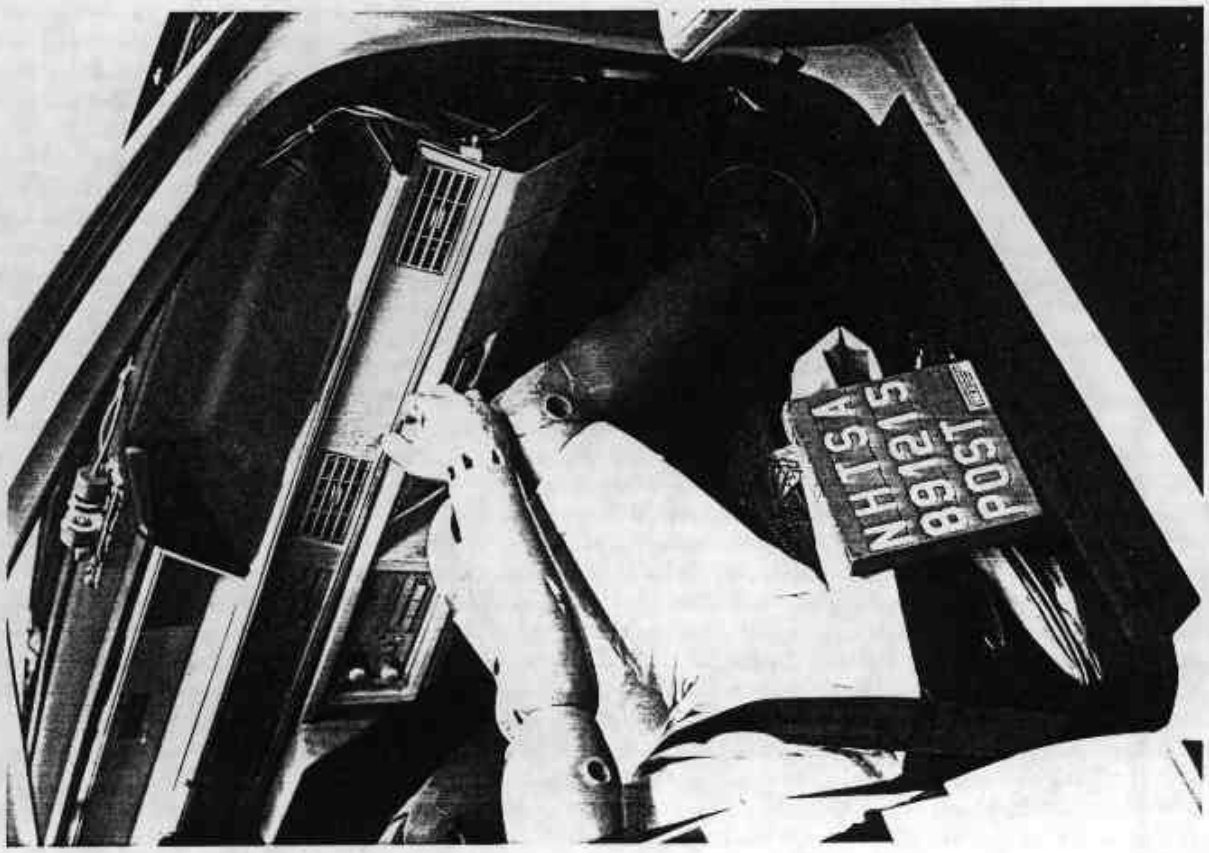


Figure A-38. POST-TEST PASSENGER DUMMY & VEHICLE INTERIOR - VIEW 2

Figure A-39. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 1

Figure A-40. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 2

Figure A-41. POST-TEST DRIVER DUMMY HEAD CONTACT - VIEW 3

Figure A-42. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 1

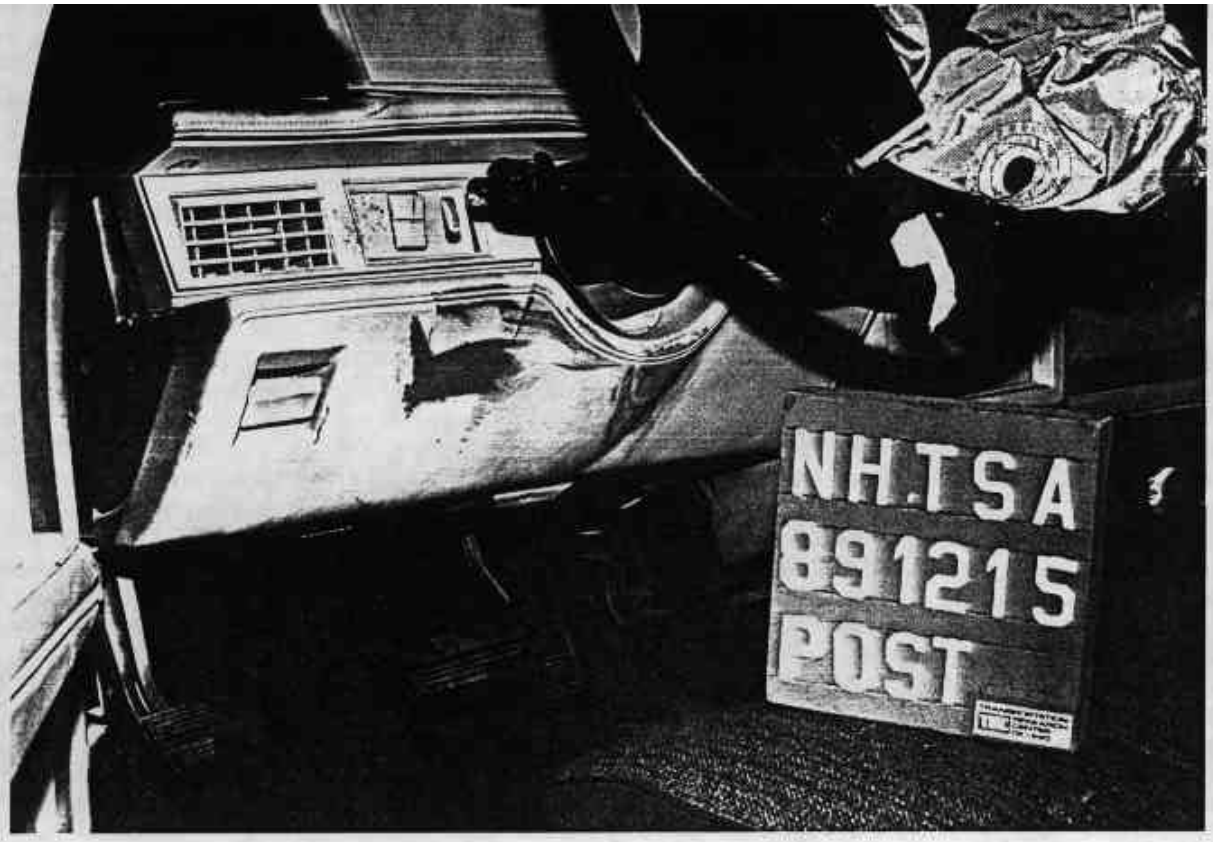


Figure A-43. POST-TEST DRIVER DUMMY KNEE CONTACT - VIEW 2

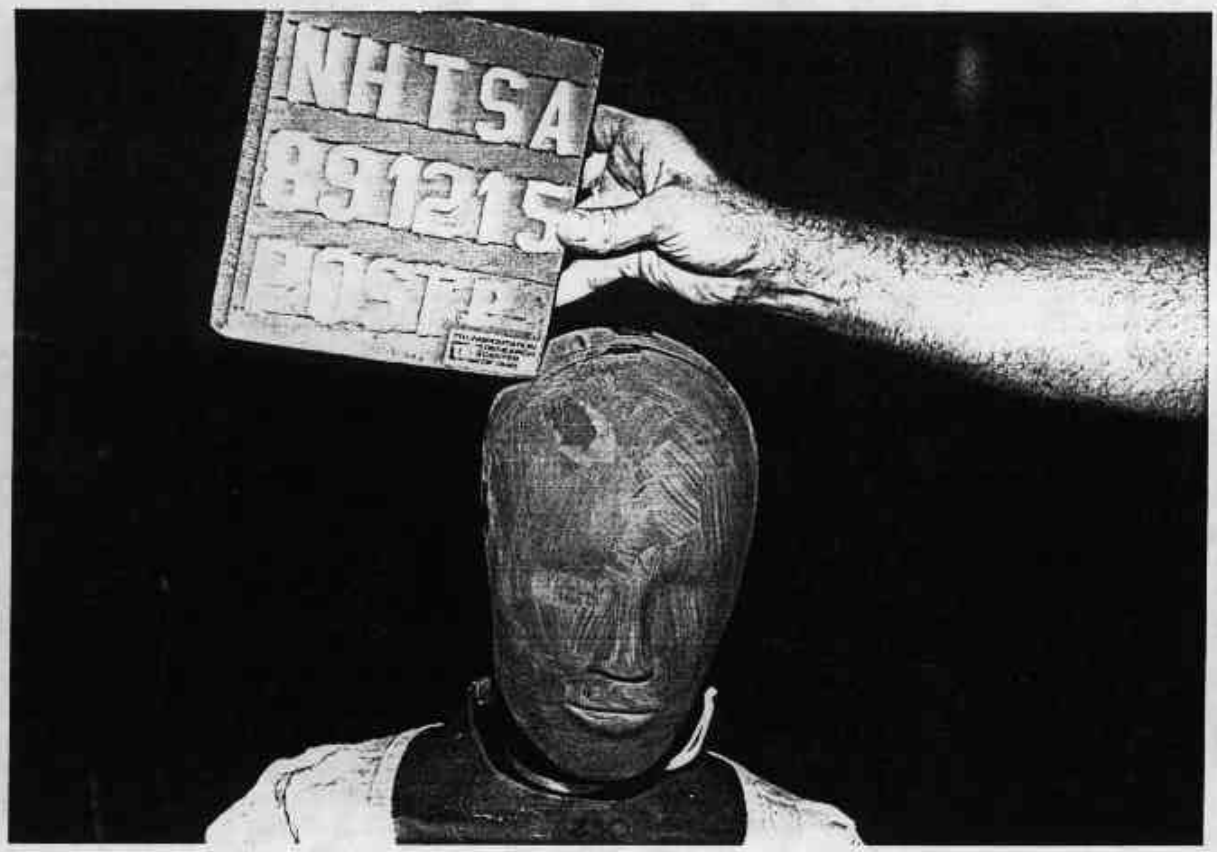


Figure A-44. POST-TEST RIGHT FRONT PASSENGER HEAD CONTACT VIEW

Figure A-45. POST-TEST RIGHT FRONT PASSENGER KNEE CONTACT - VIEW 1

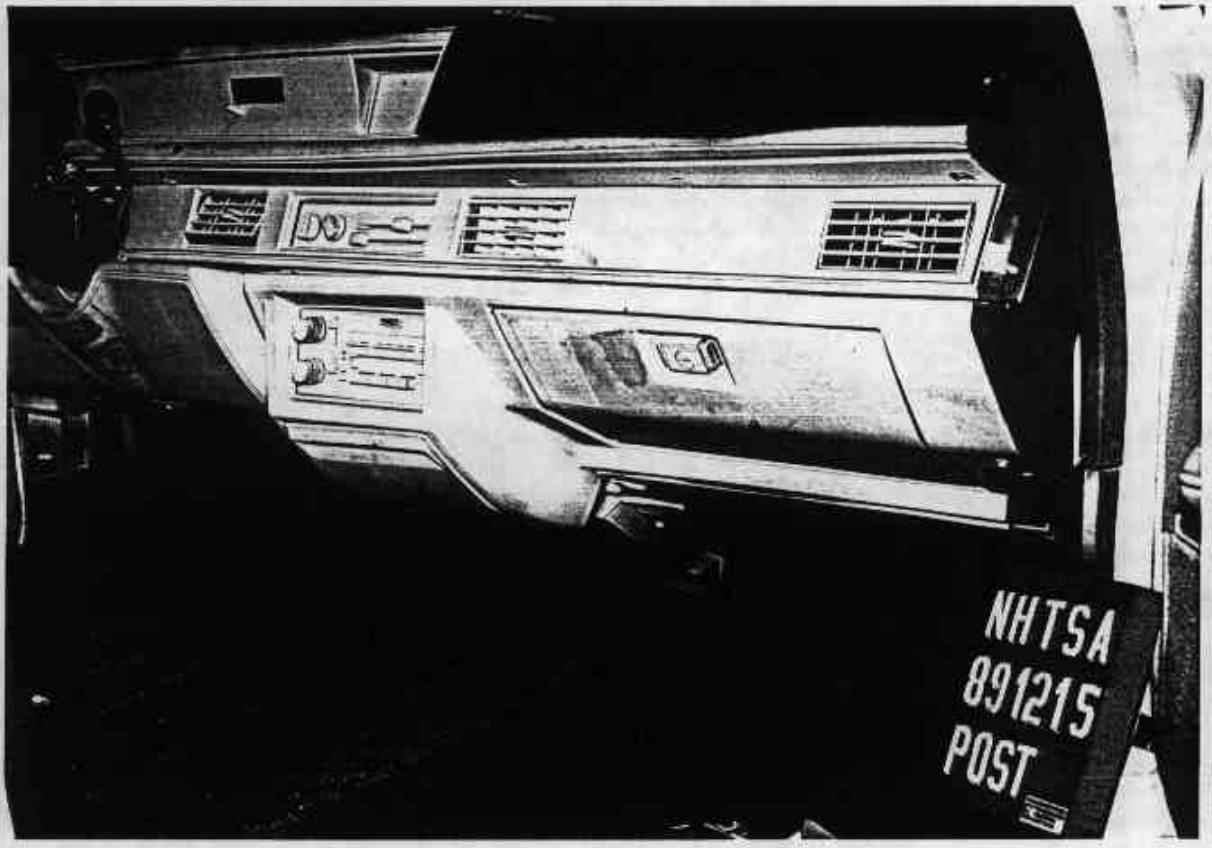


Figure A-46. POST-TEST RIGHT FRONT PASSENGER KNEE CONTACT - VIEW 2

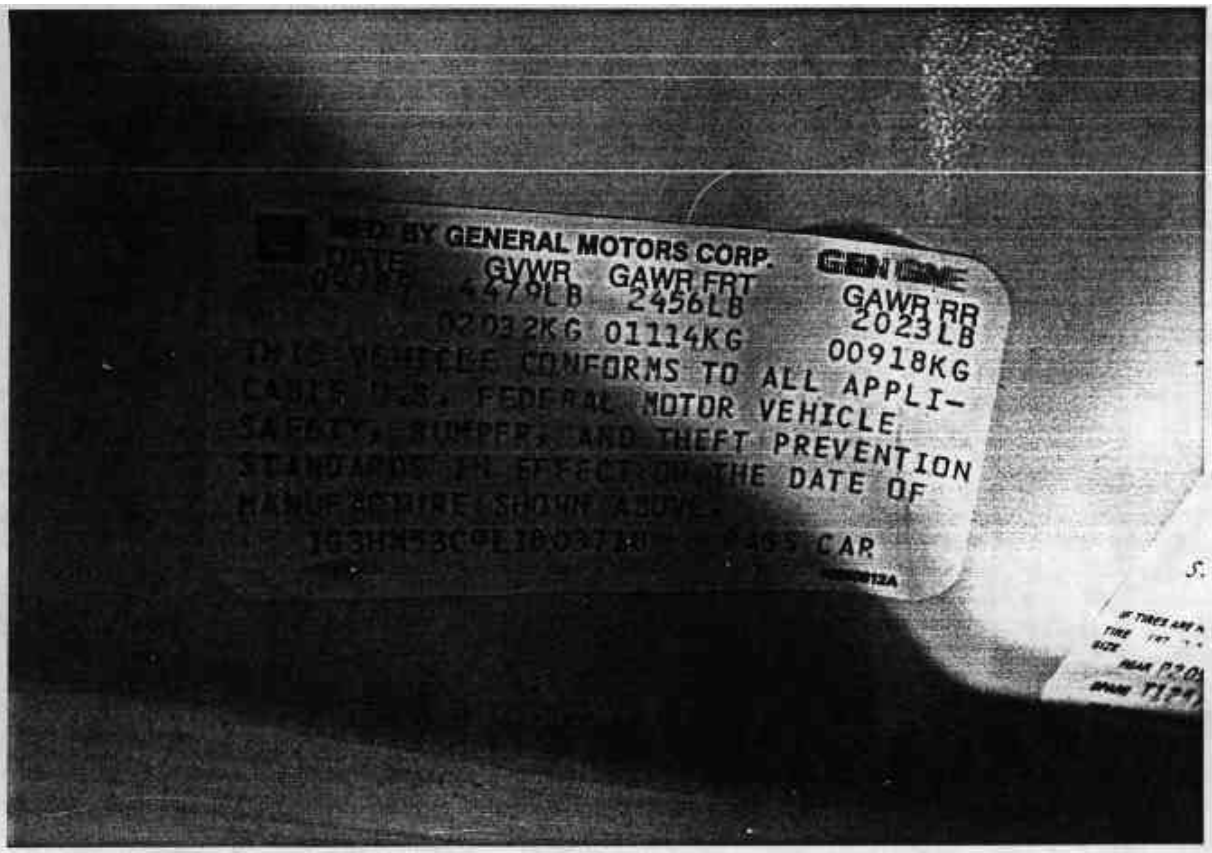


Figure A-47. PRE-TEST VEHICLE CERTIFICATION LABEL

Figure A-48. PRE-TEST VEHICLE TIRE LOAD LABEL

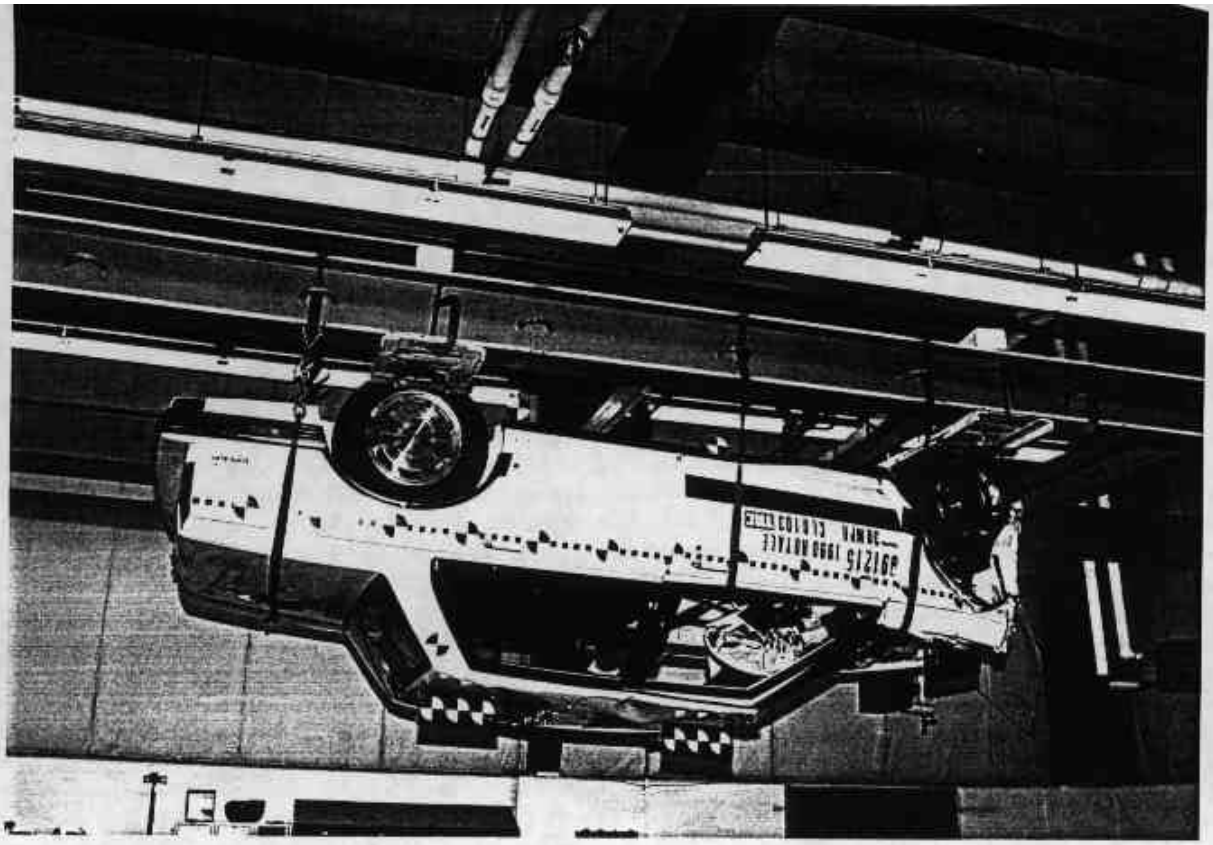


Figure A-49. POST-TEST VEHICLE ON ROLLOVER MACHINE VIEW

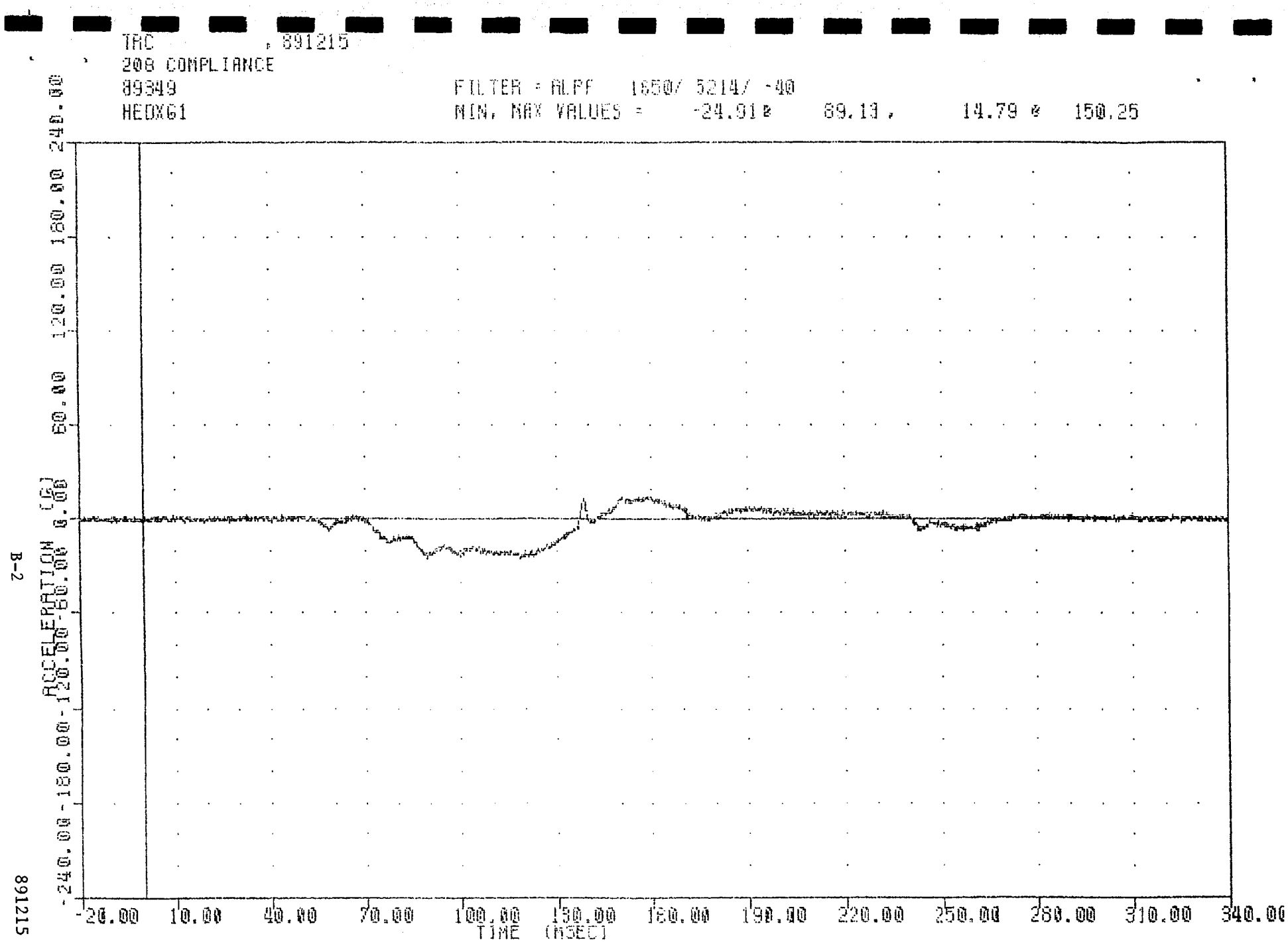
APPENDIX B

DATA PLOTS

DUMMY AND VEHICLE AXES: X: FRONT/REAR

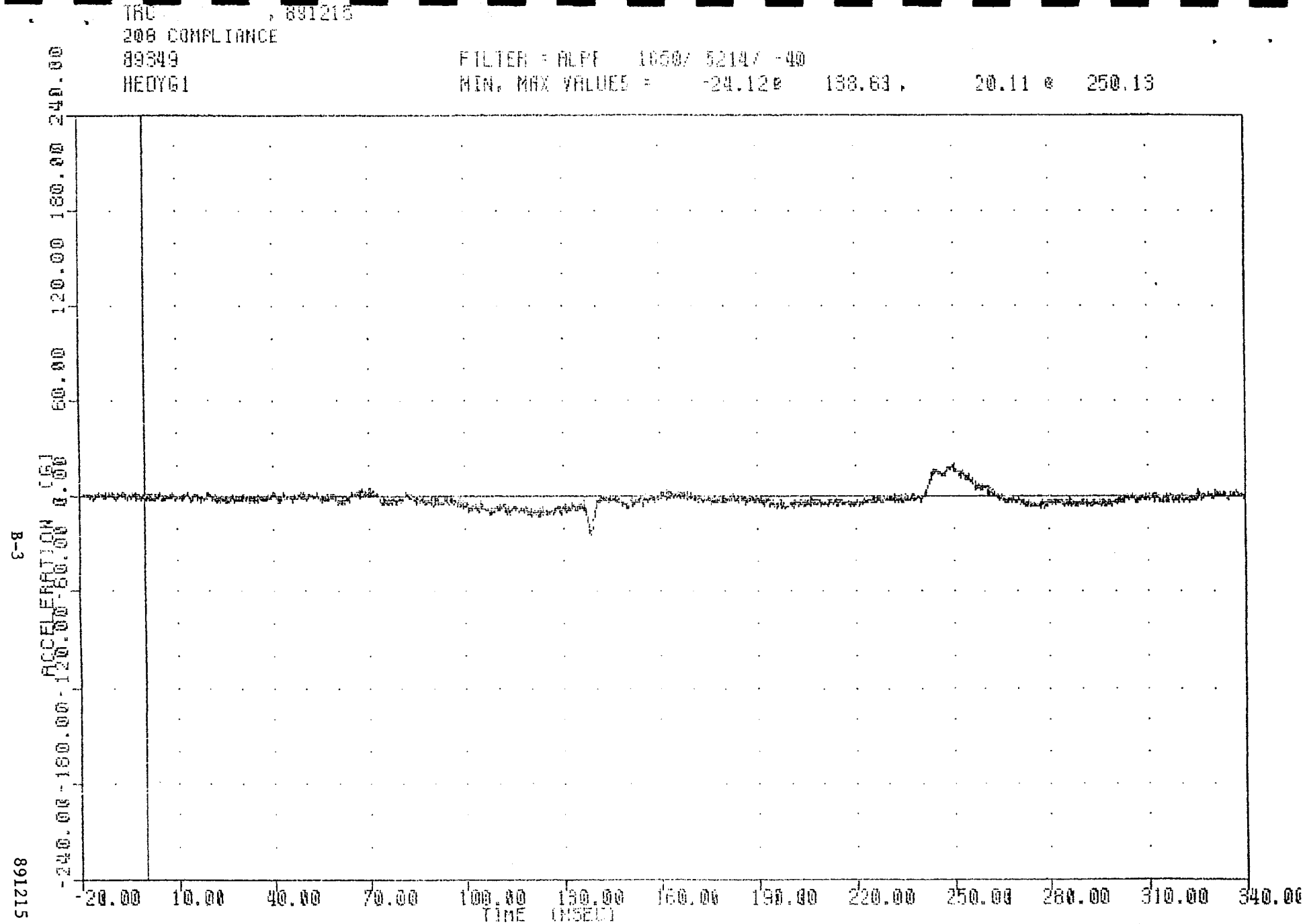
Y: LEFT/RIGHT

Z: UP/DOWN



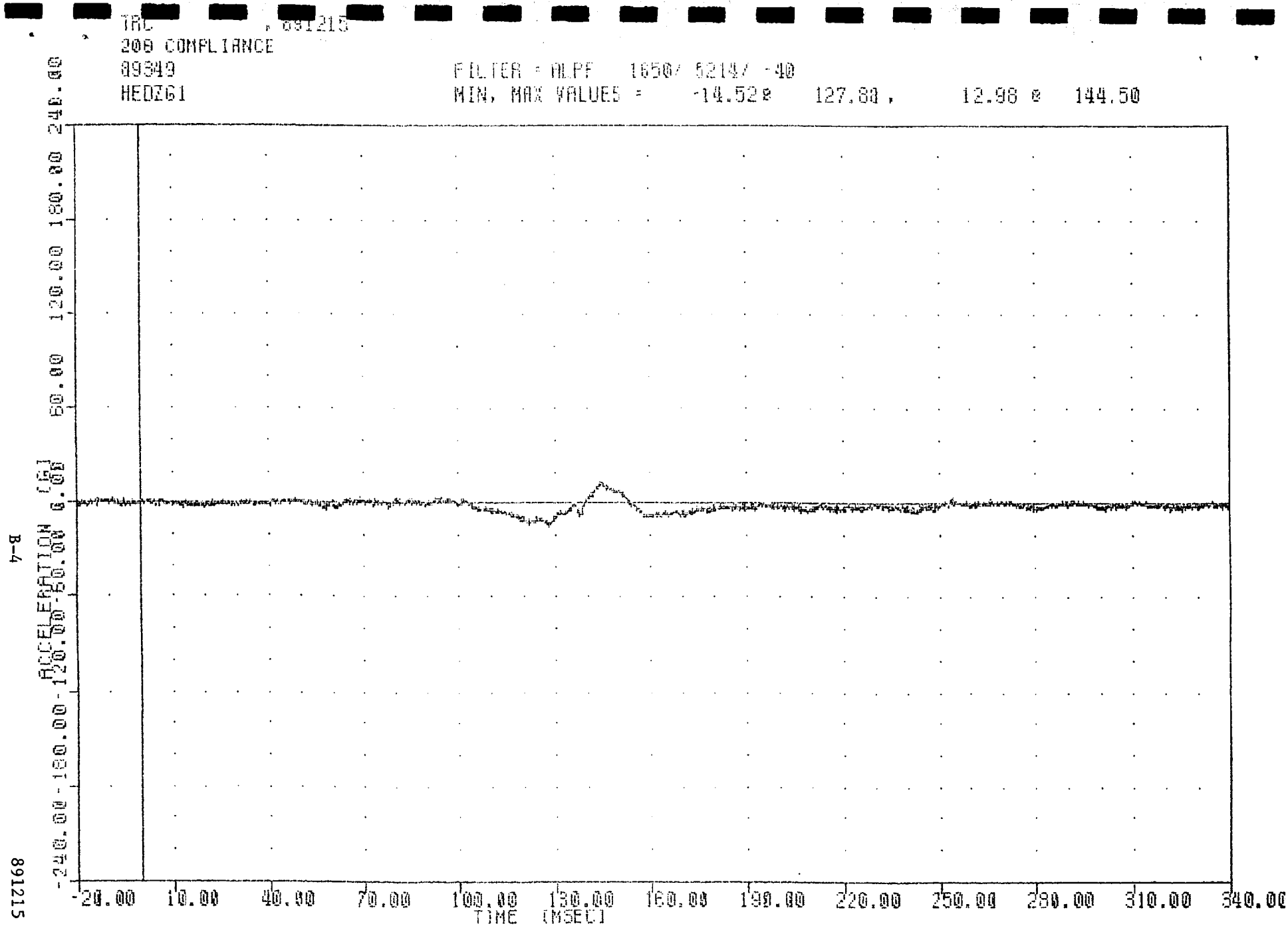
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER HEAD X AXIS ACCELERATION

891215



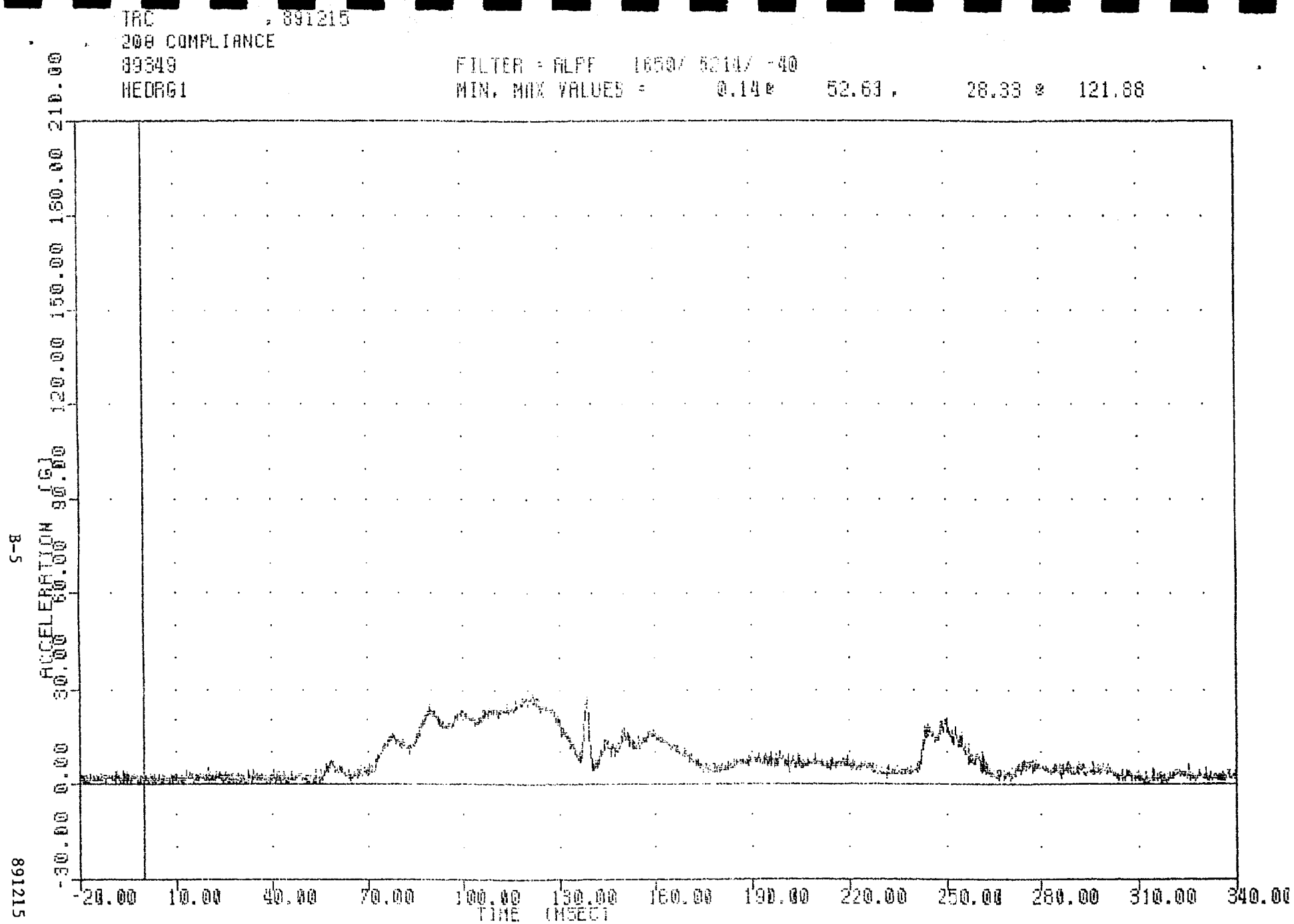
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER HEAD Y AXIS ACCELERATION

891215

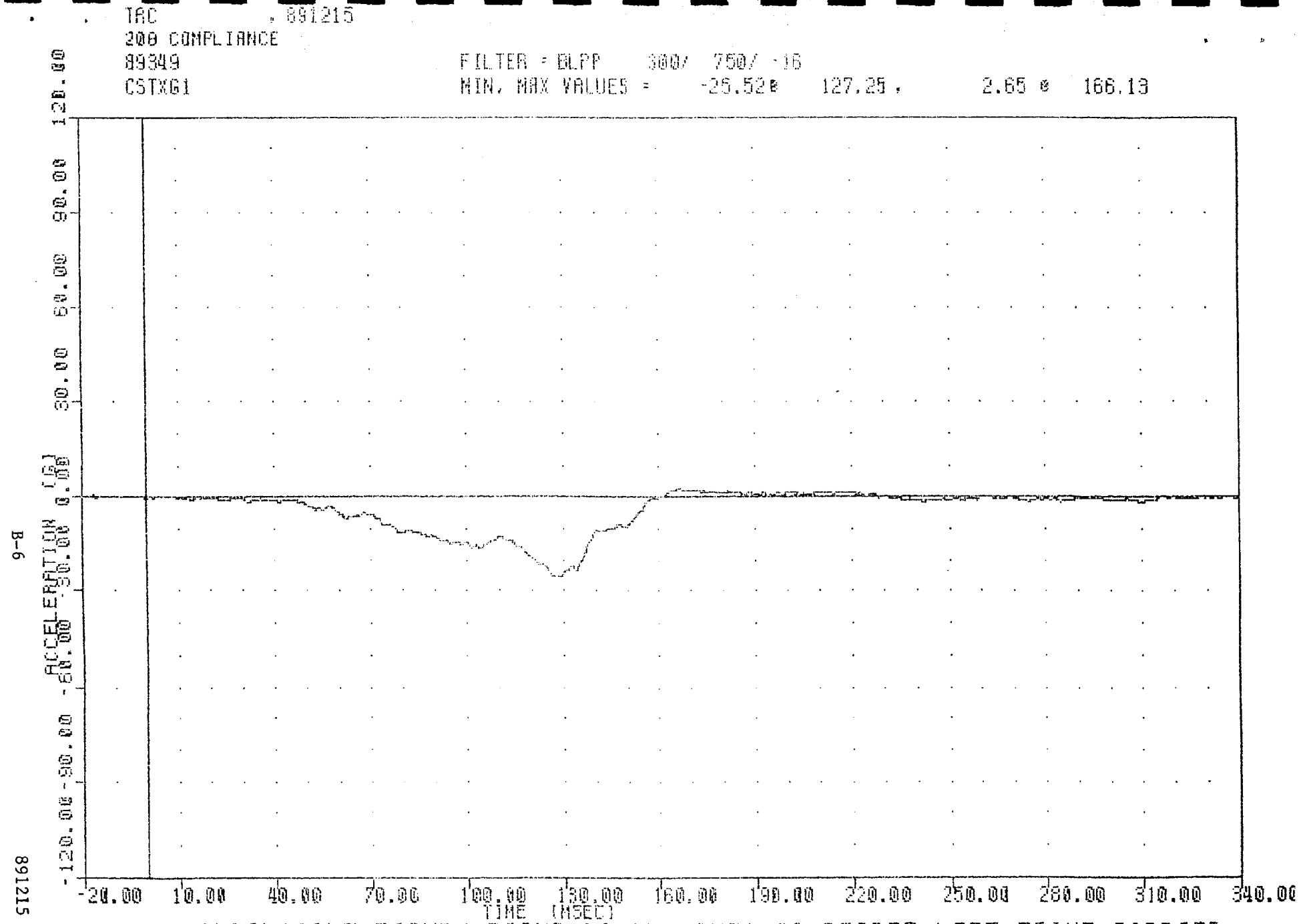


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER HEAD Z AXIS ACCELERATION

891215

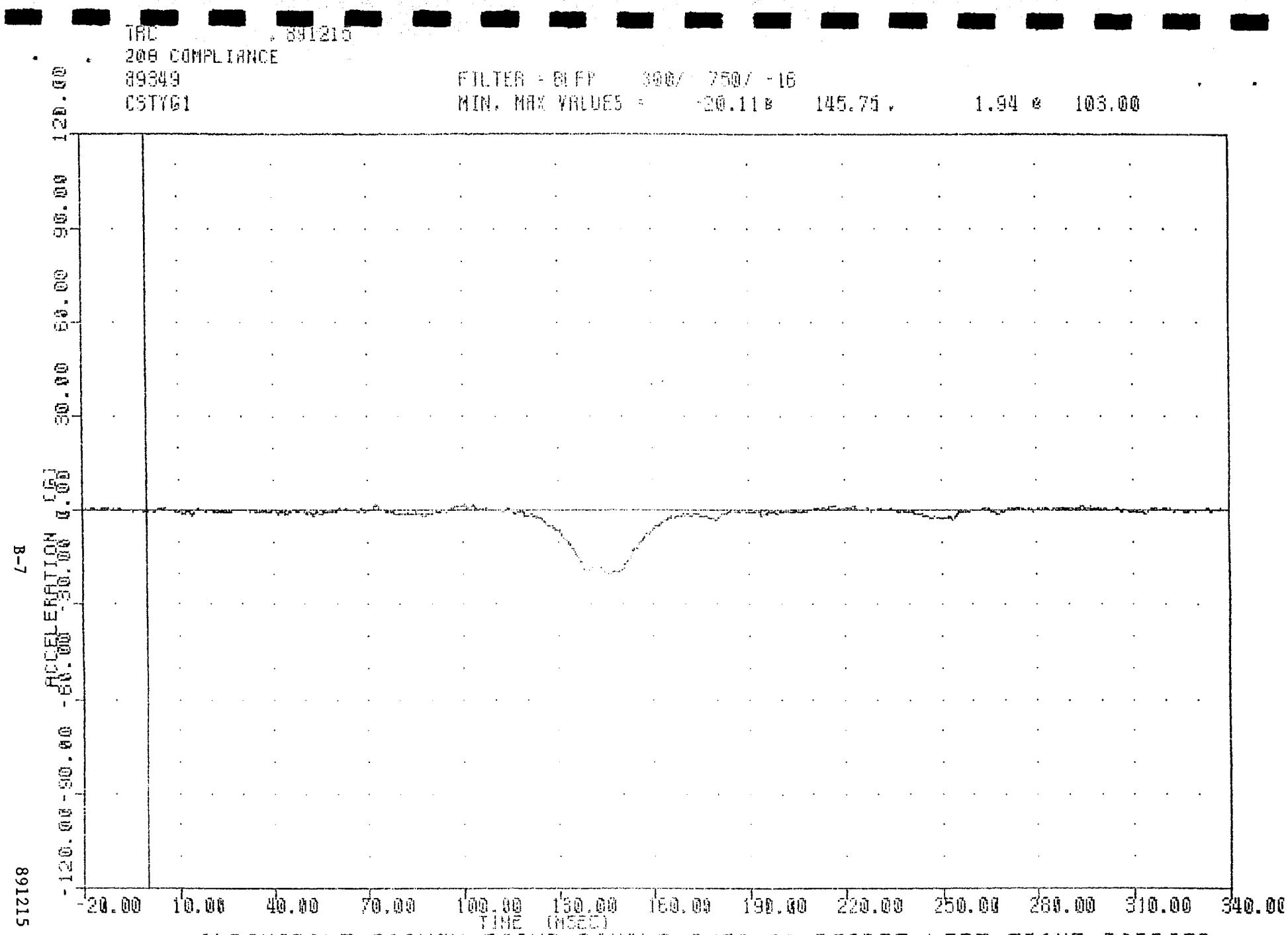


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER HEAD RESULTANT ACCELERATION



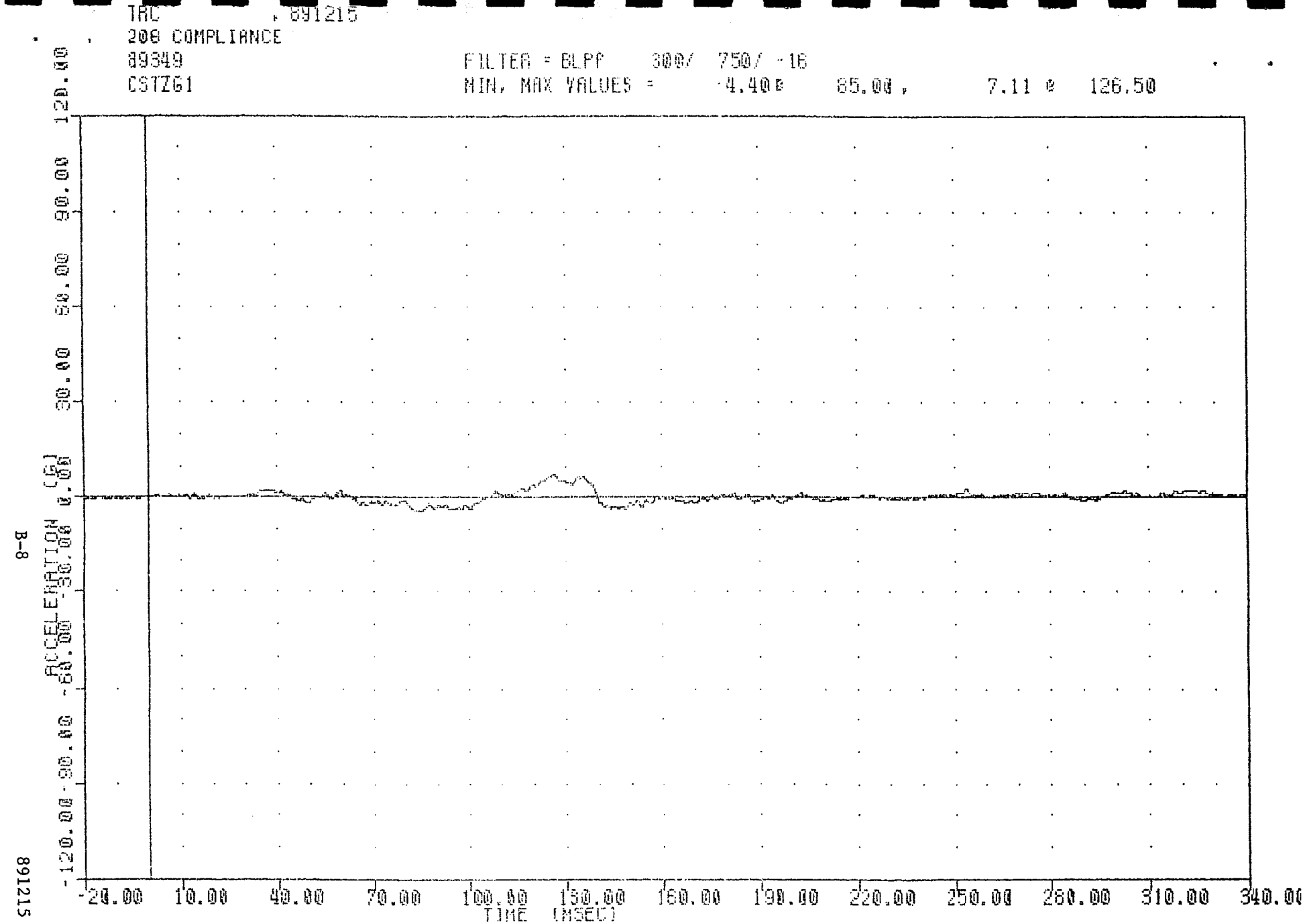
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER CHEST X AXIS ACCELERATION

891215



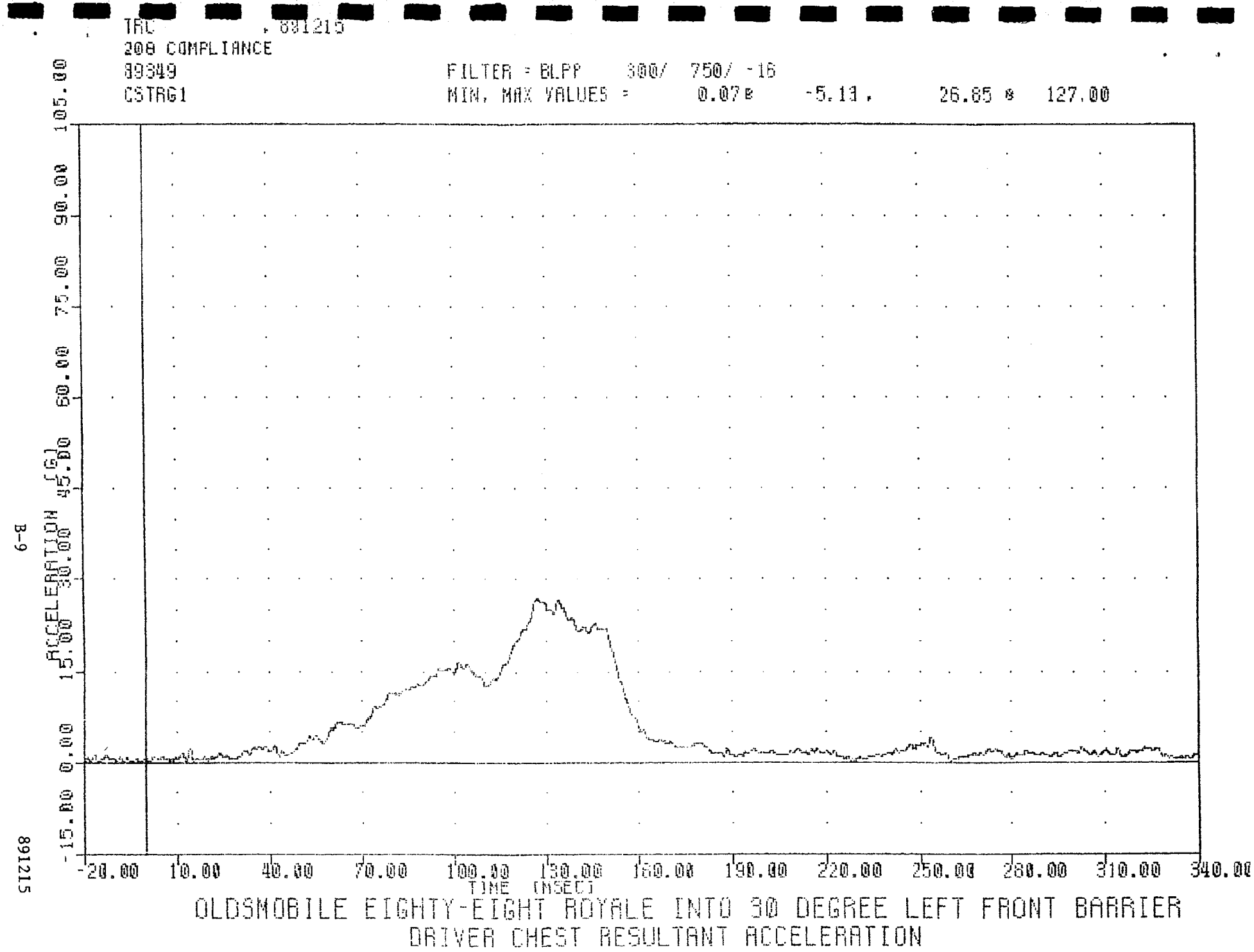
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER CHEST Y AXIS ACCELERATION

891215



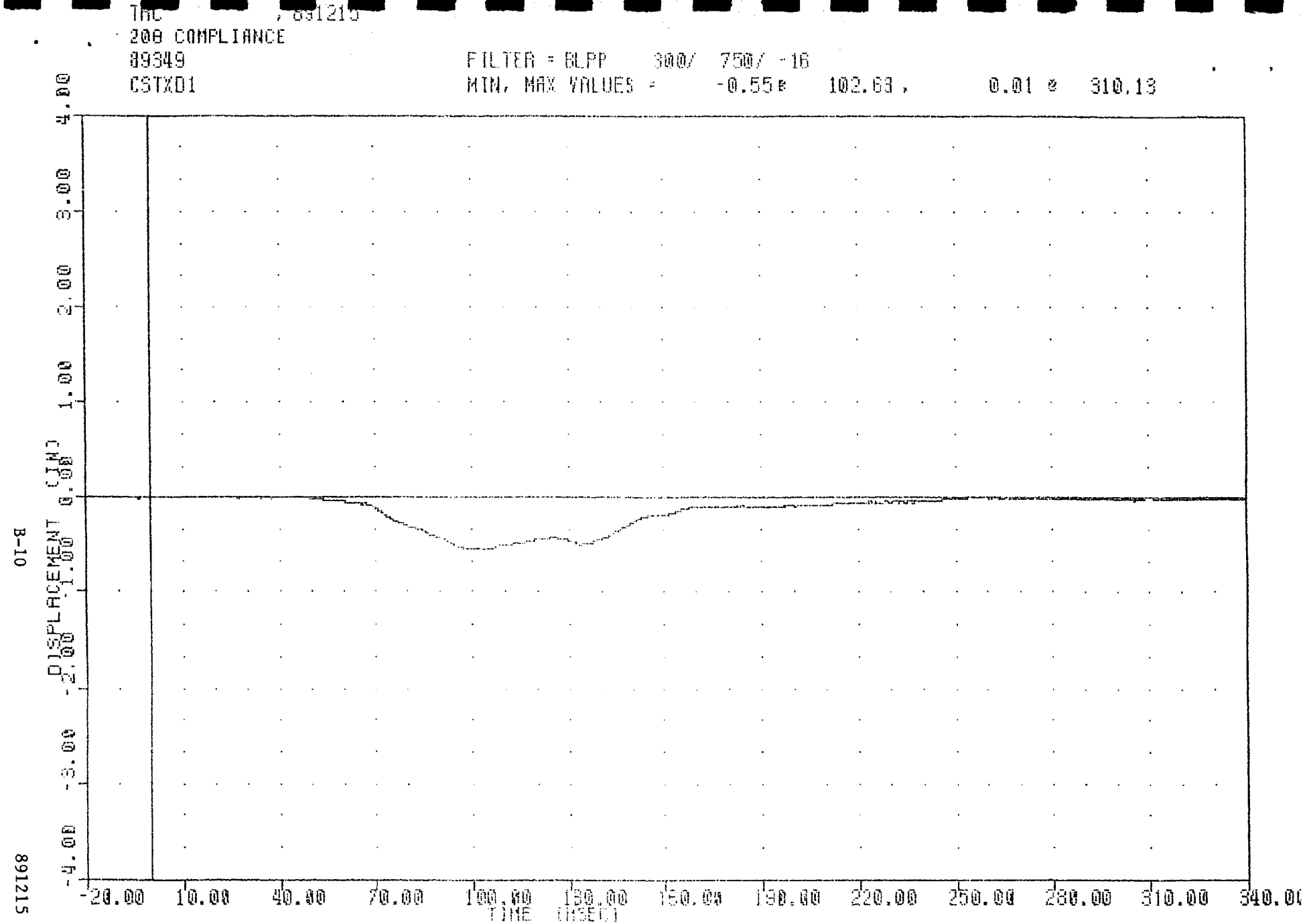
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER CHEST Z AXIS ACCELERATION

891215



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER CHEST RESULTANT ACCELERATION

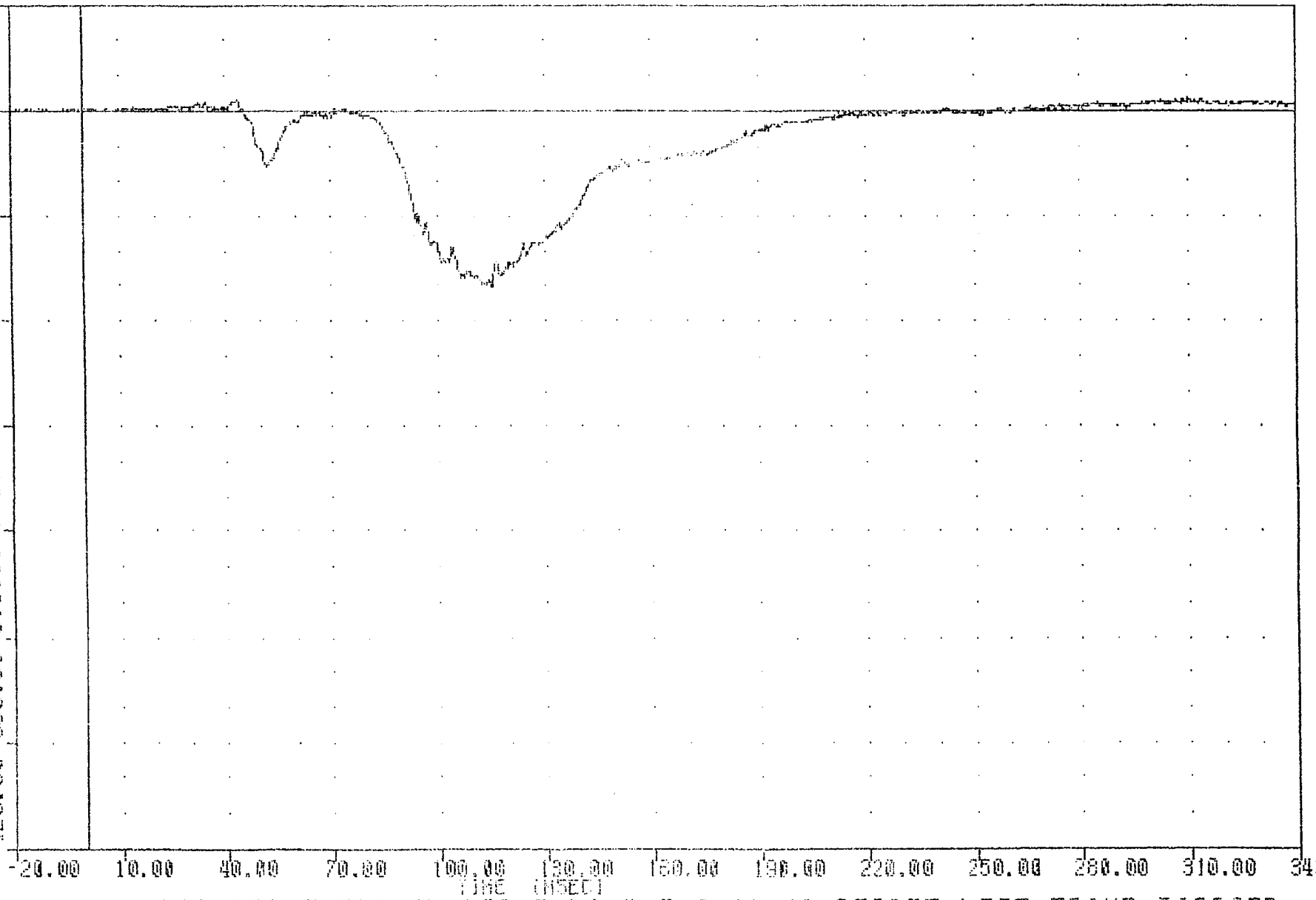
891215



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER CHEST DISPLACEMENT

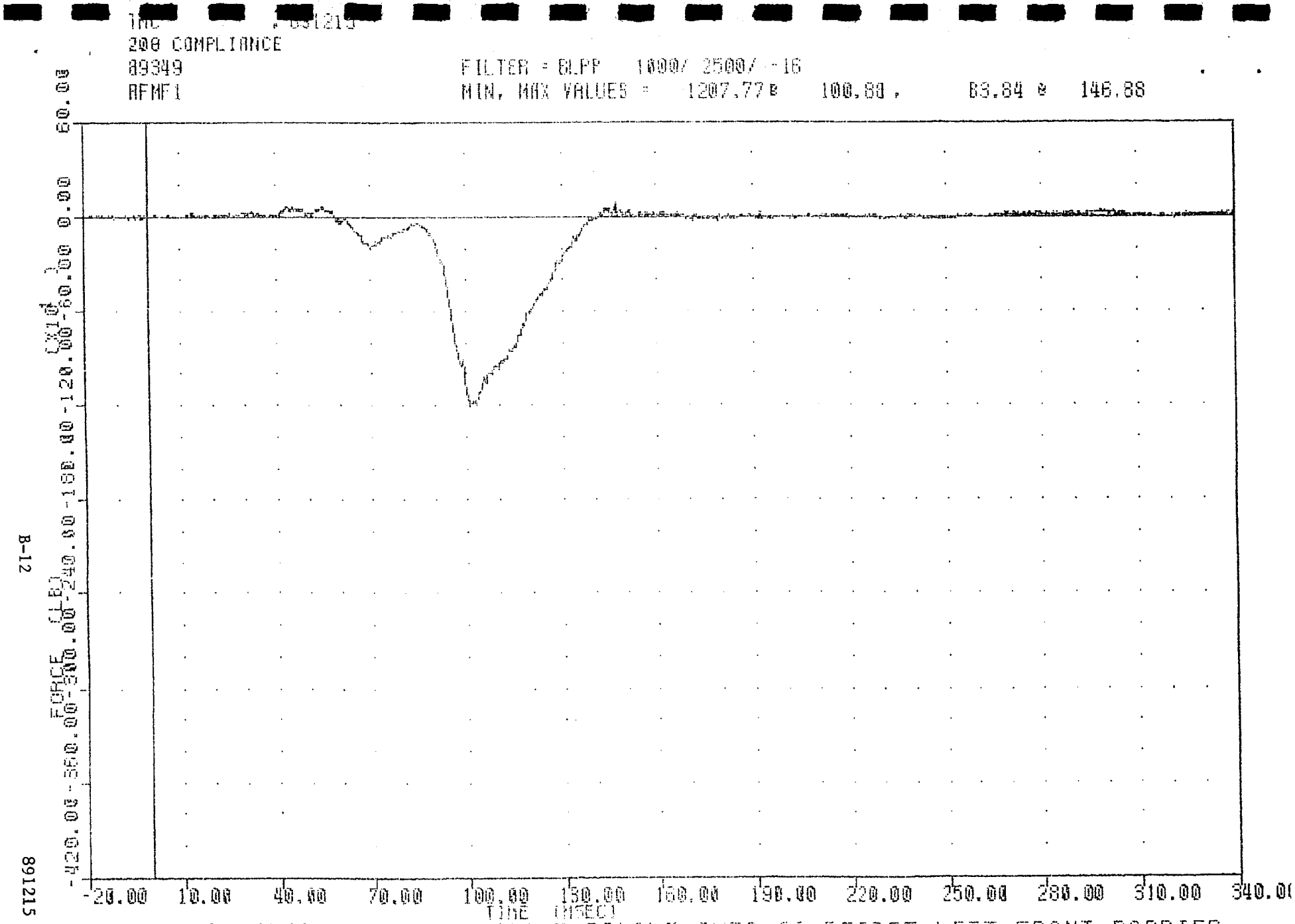
891215

TRC .891215
208 COMPLIANCE
89349 FILTER = BLPP 1000/ 2500/ -16
LFMF1 MIN, MAX VALUES = -1006.16@ 115.13, 70.11 @ 310.25

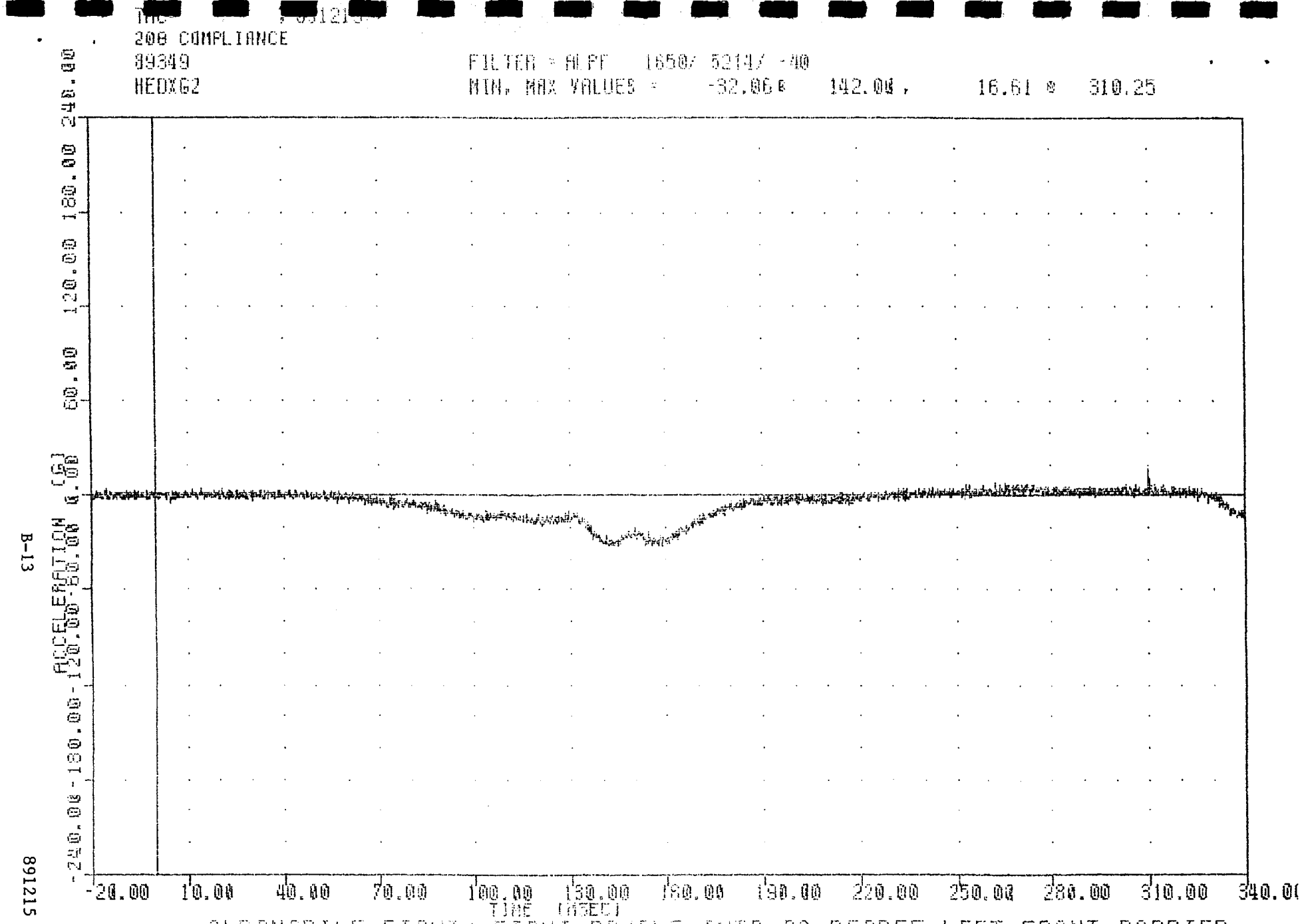


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER LEFT FEMUR FORCE

891215

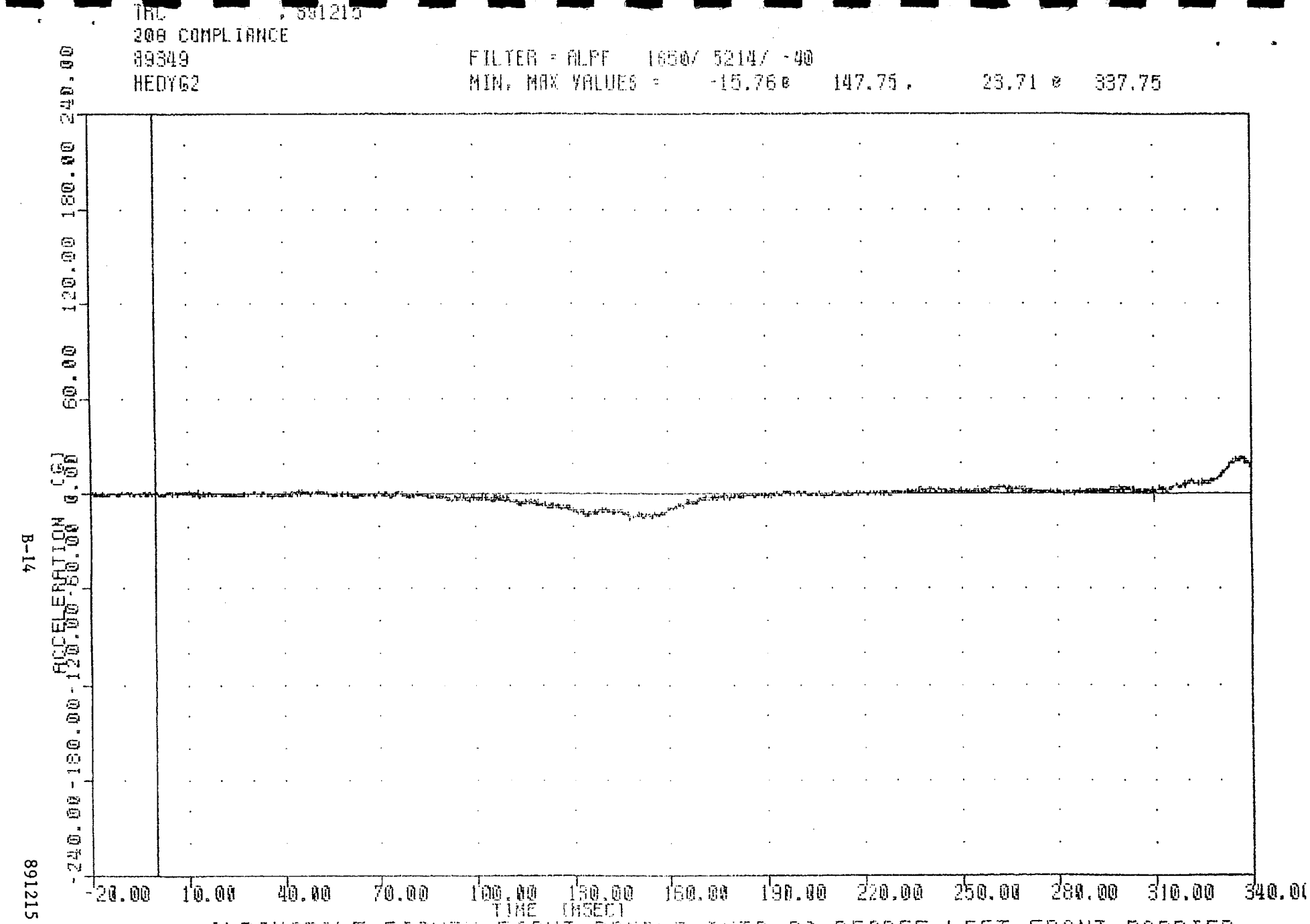


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DRIVER RIGHT FEMUR FORCE

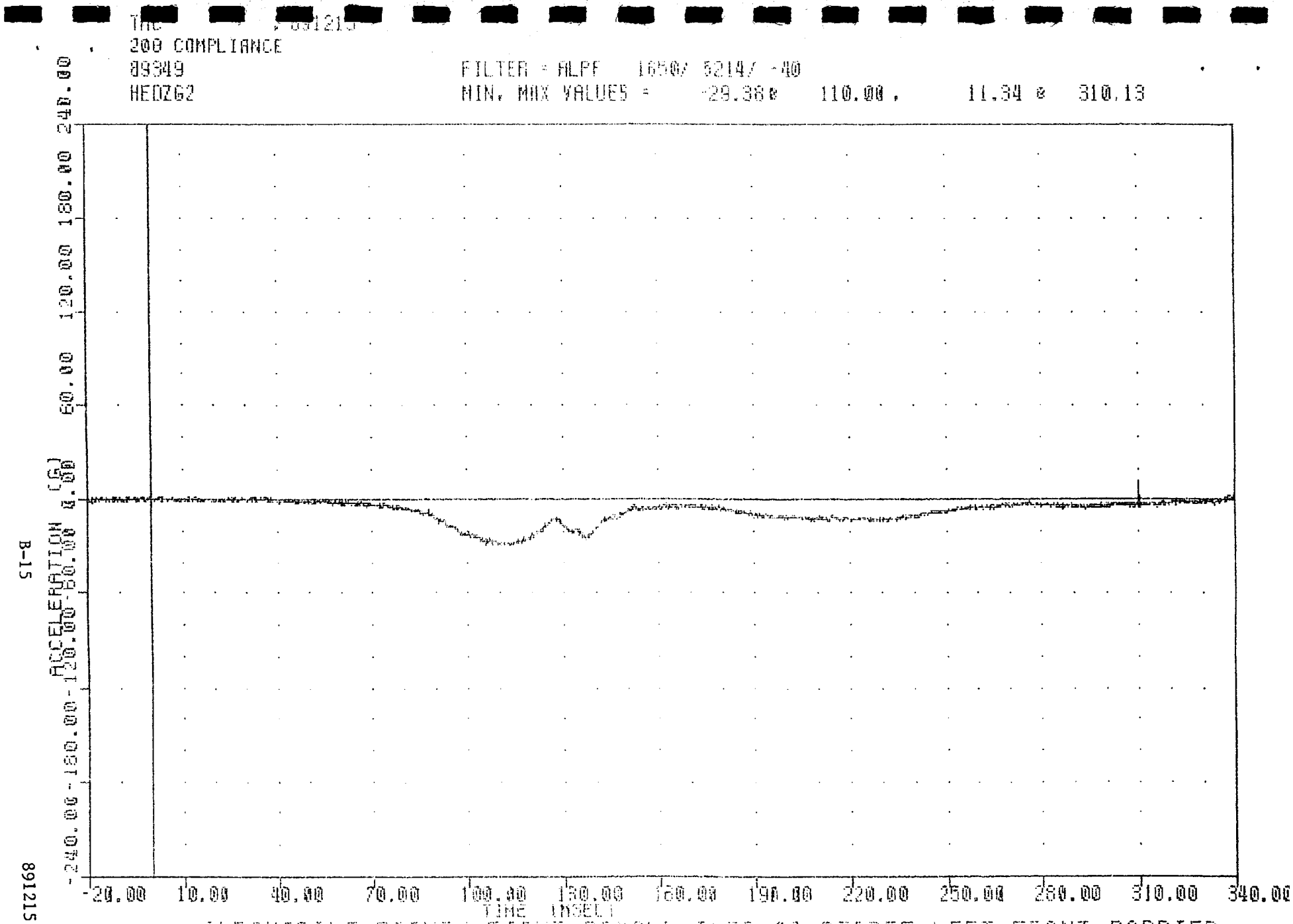


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER HEAD X AXIS ACCELERATION

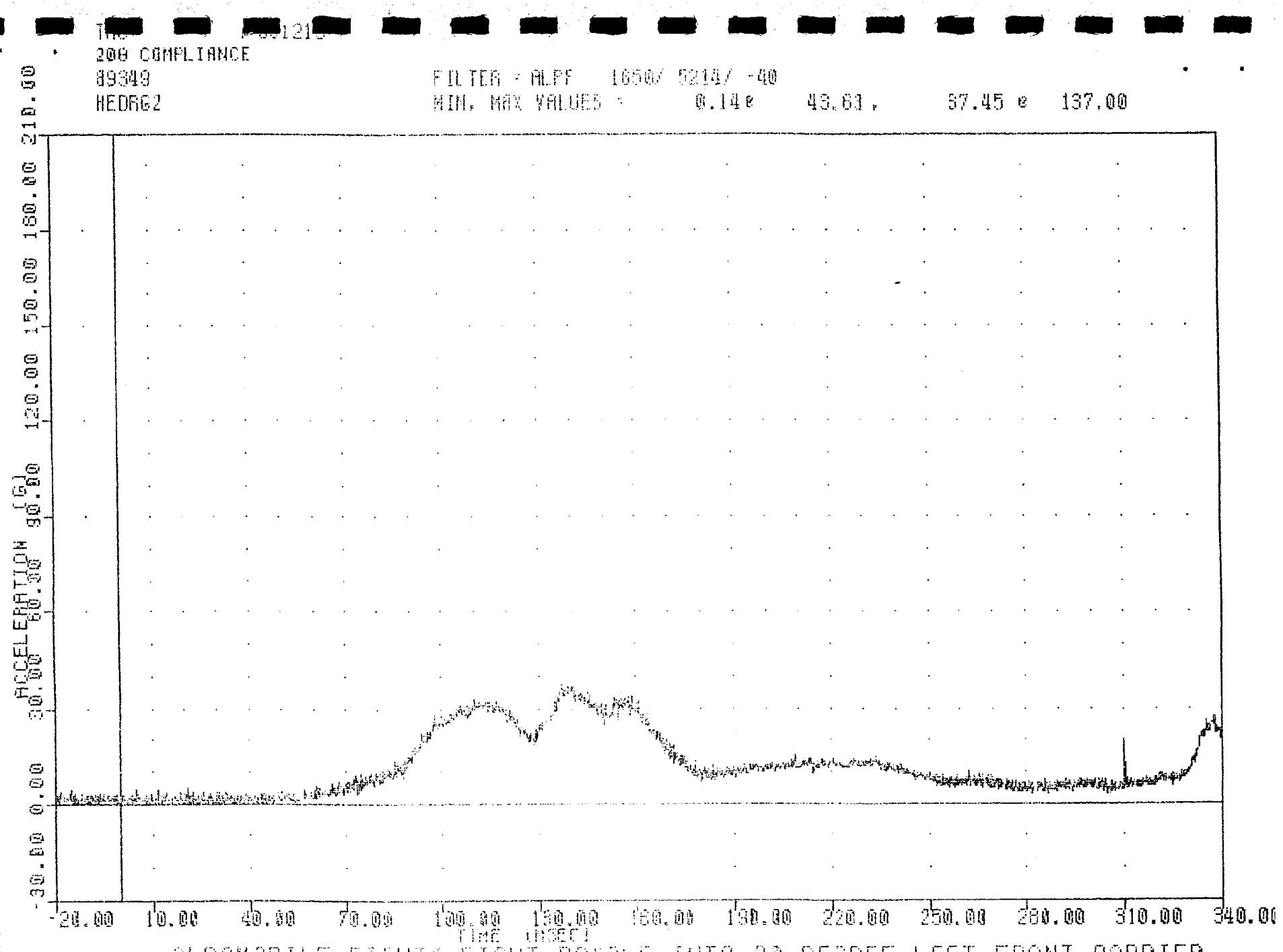
891215



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER HEAD Y AXIS ACCELERATION



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER HEAD Z AXIS ACCELERATION

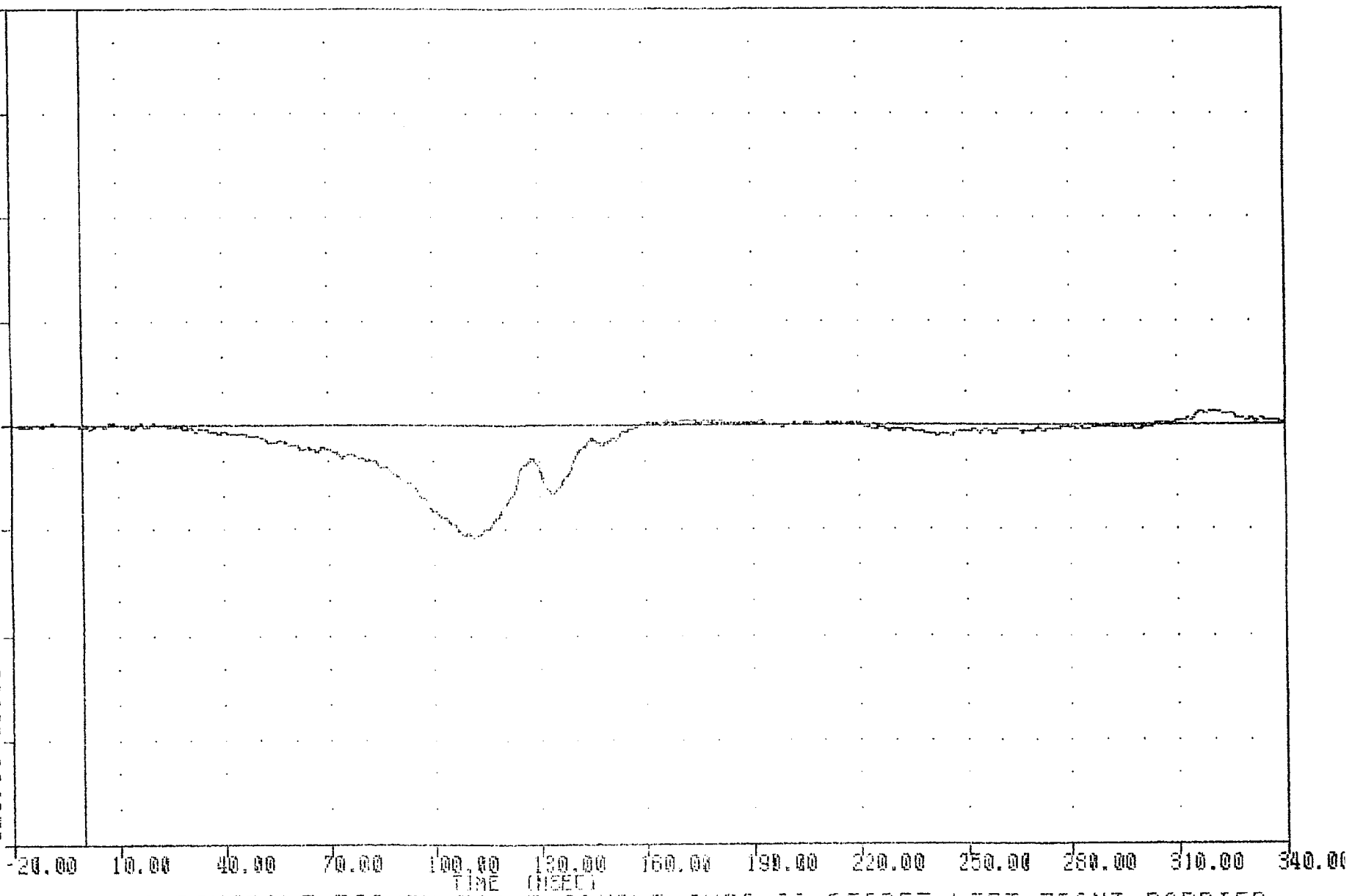


OLDSMOBILE EIGHTY-EIGHT ROTATE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

89215

TRC . 891215
208 COMPLIANCE
89349
CSTXG2

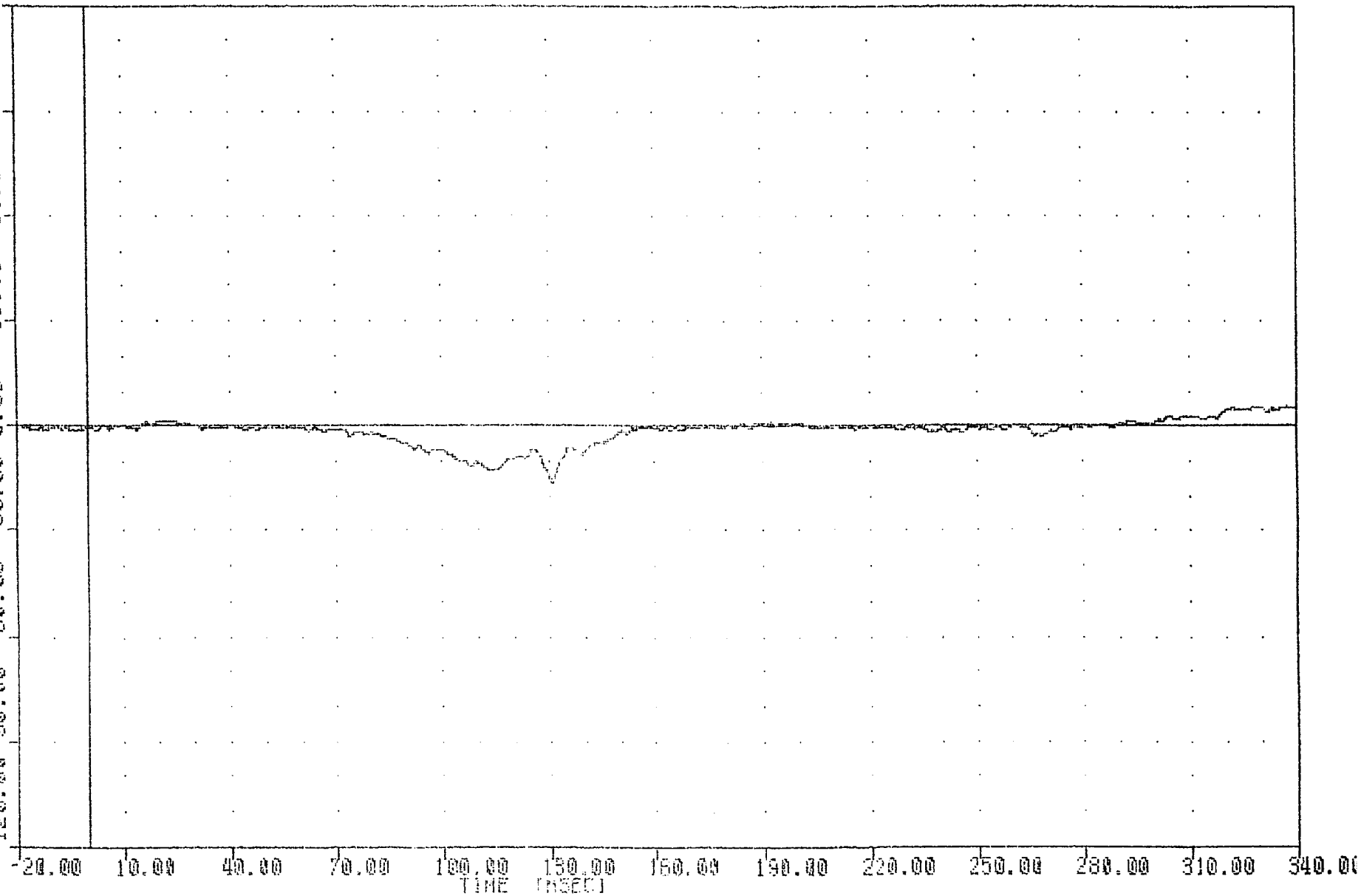
FILTER = CLFP 300/ 750/ -16
MIN, MAX VALUES = -32.00@ 111.00 , 4.11 @ 320.13



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER CHEST X AXIS ACCELERATION

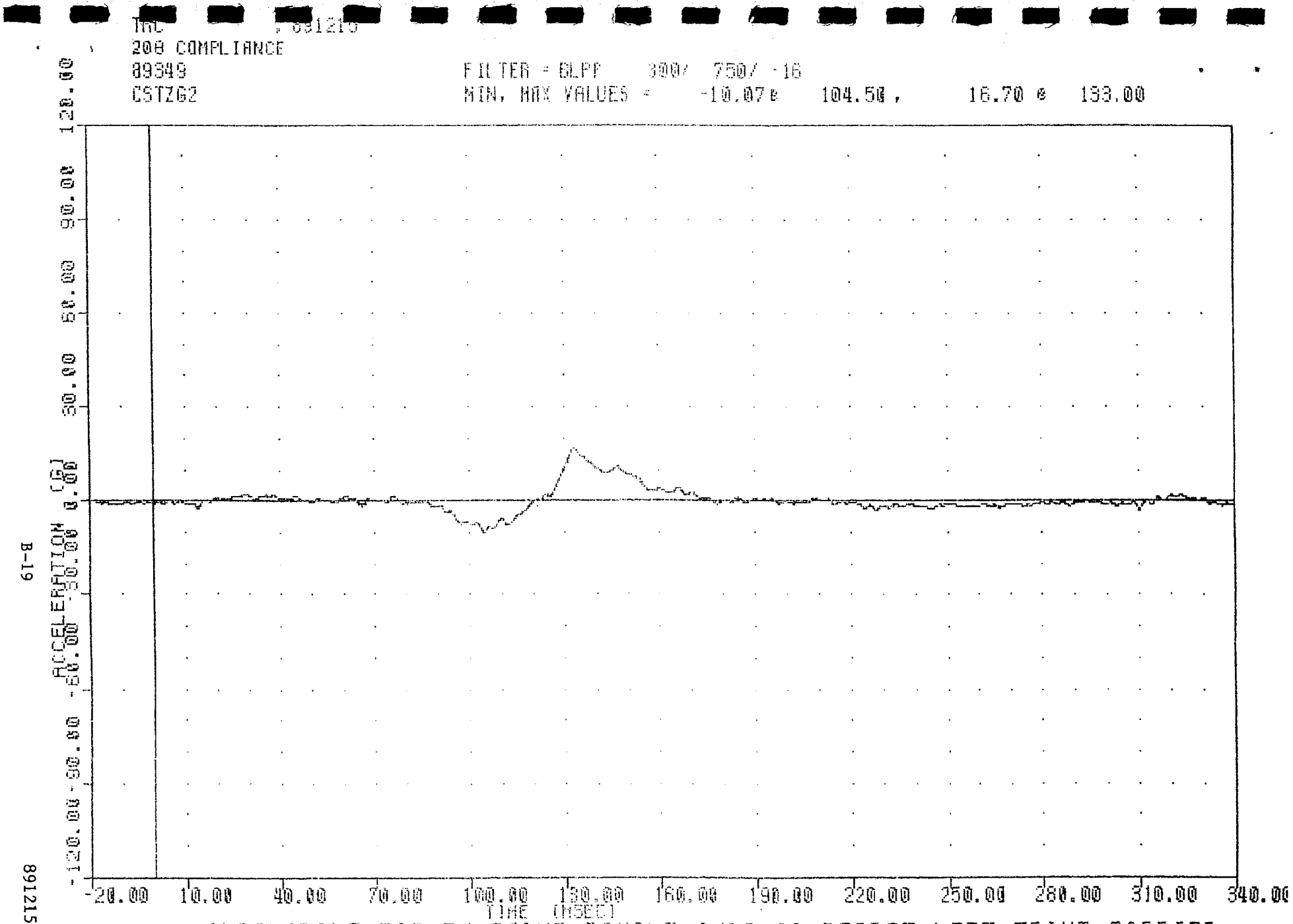
891215

TRC , 891215
200 COMPLIANCE
69349 FILTER = BLPP 300/ 750/ -16
CSTY62 MIN, MAX VALUES = -16.43 @ 131.00 , 5.59 @ 337.63



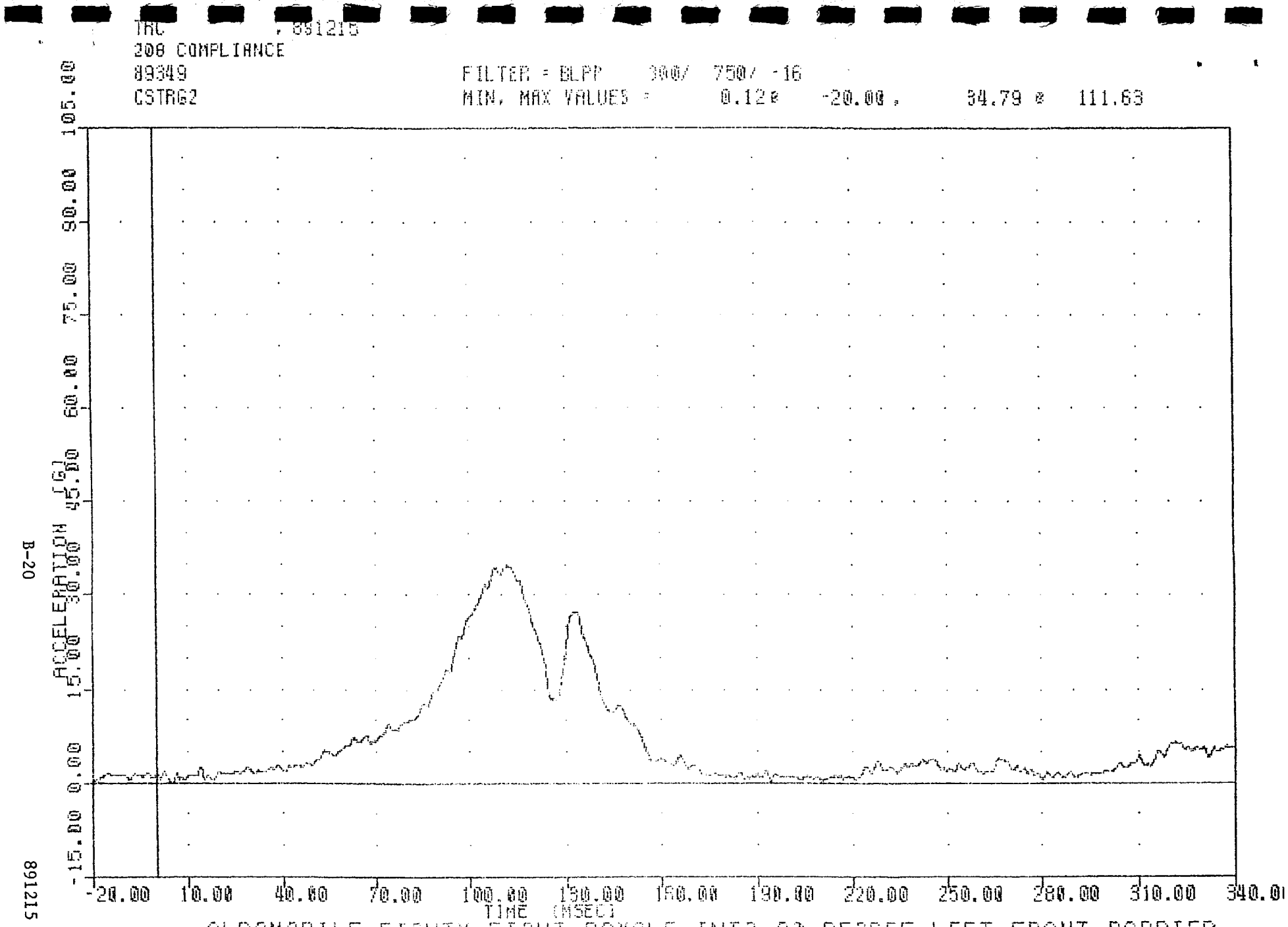
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER CHEST Y AXIS ACCELERATION

891215



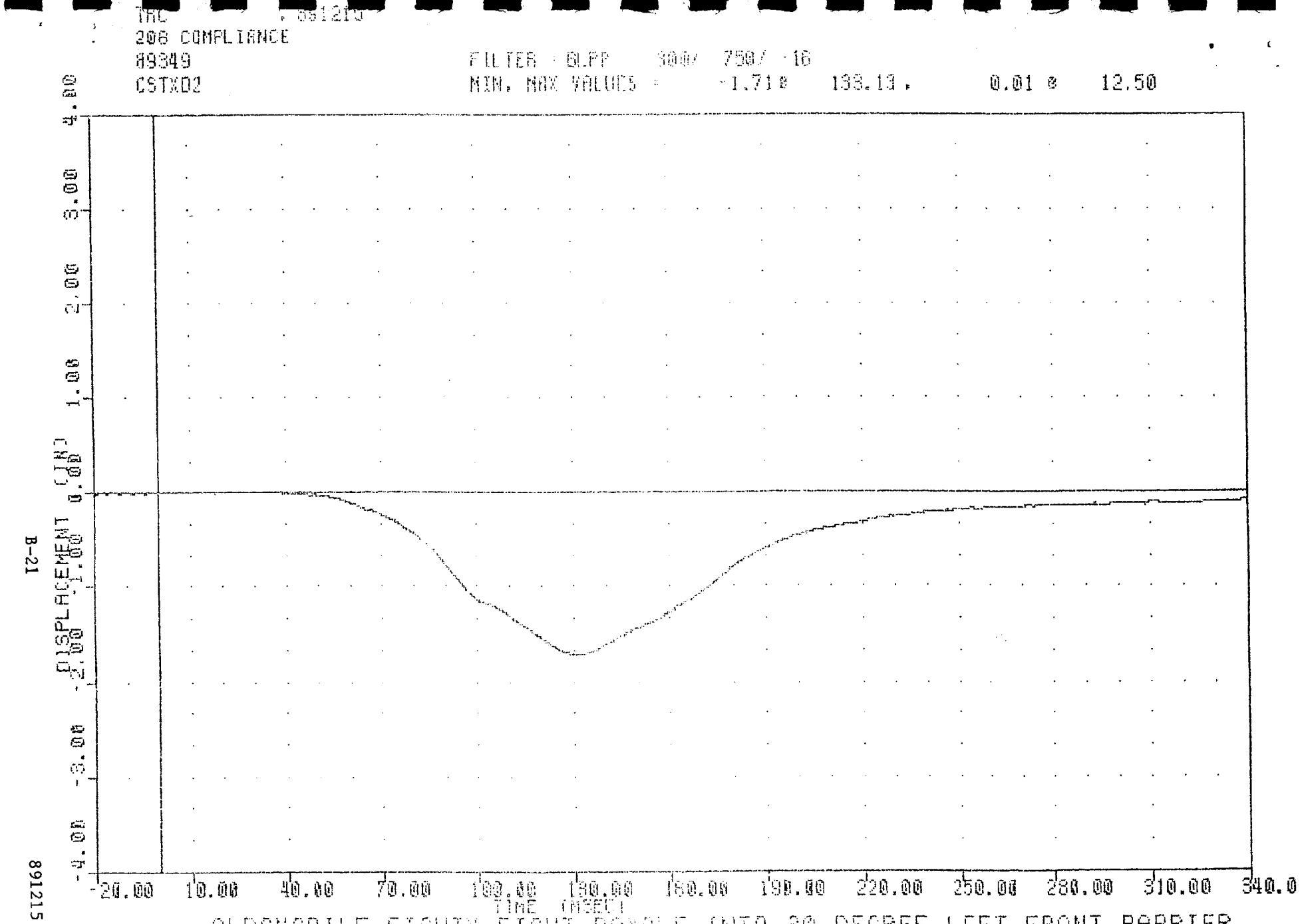
OLDSMOBILE EIGHTY-EIGHT ROYALE INIO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER CHEST Z AXIS ACCELERATION

891215



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION

891215

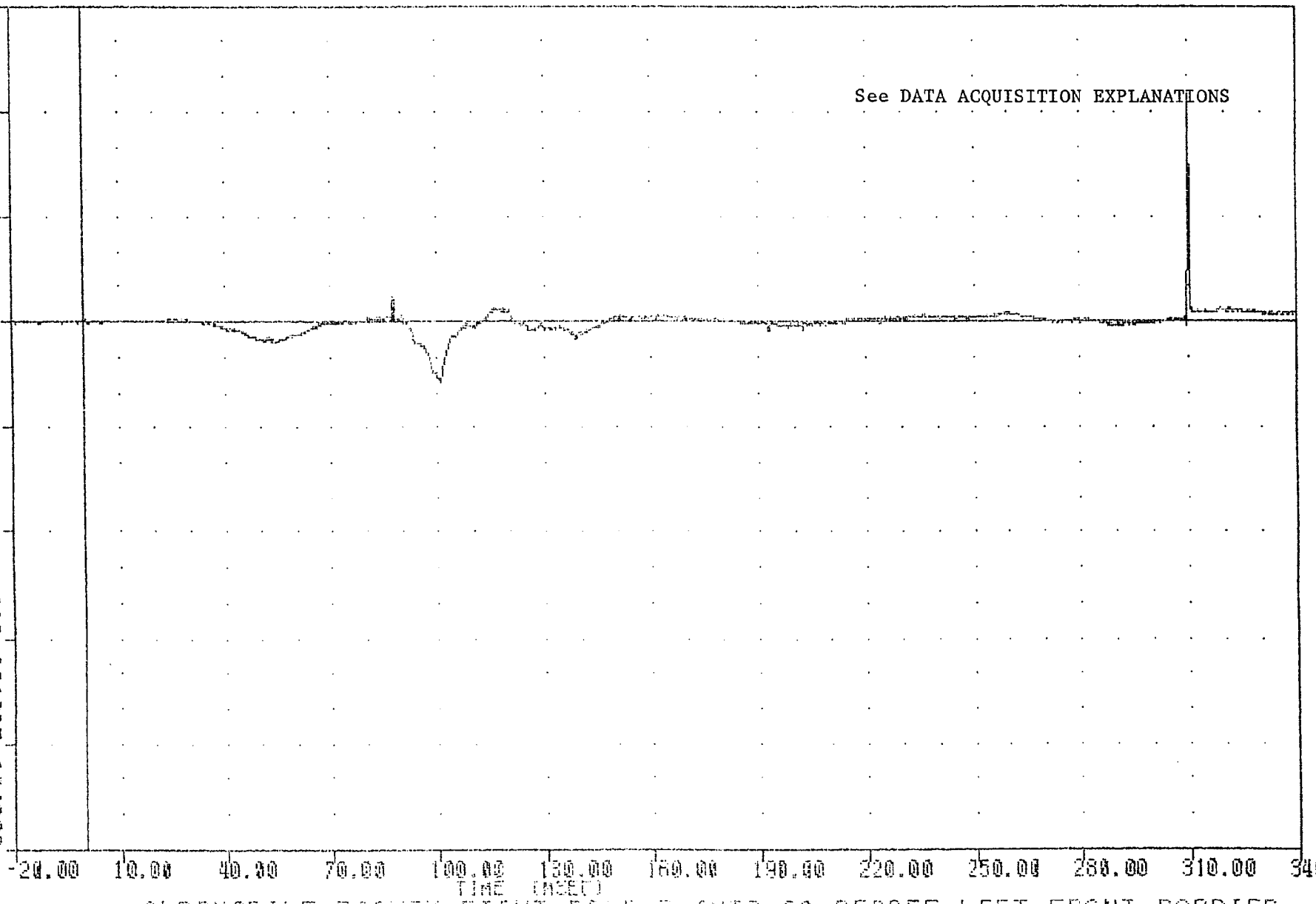


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER CHEST DISPLACEMENT

891215

TMC
200 COMPLIANCE
89349
LFMF2

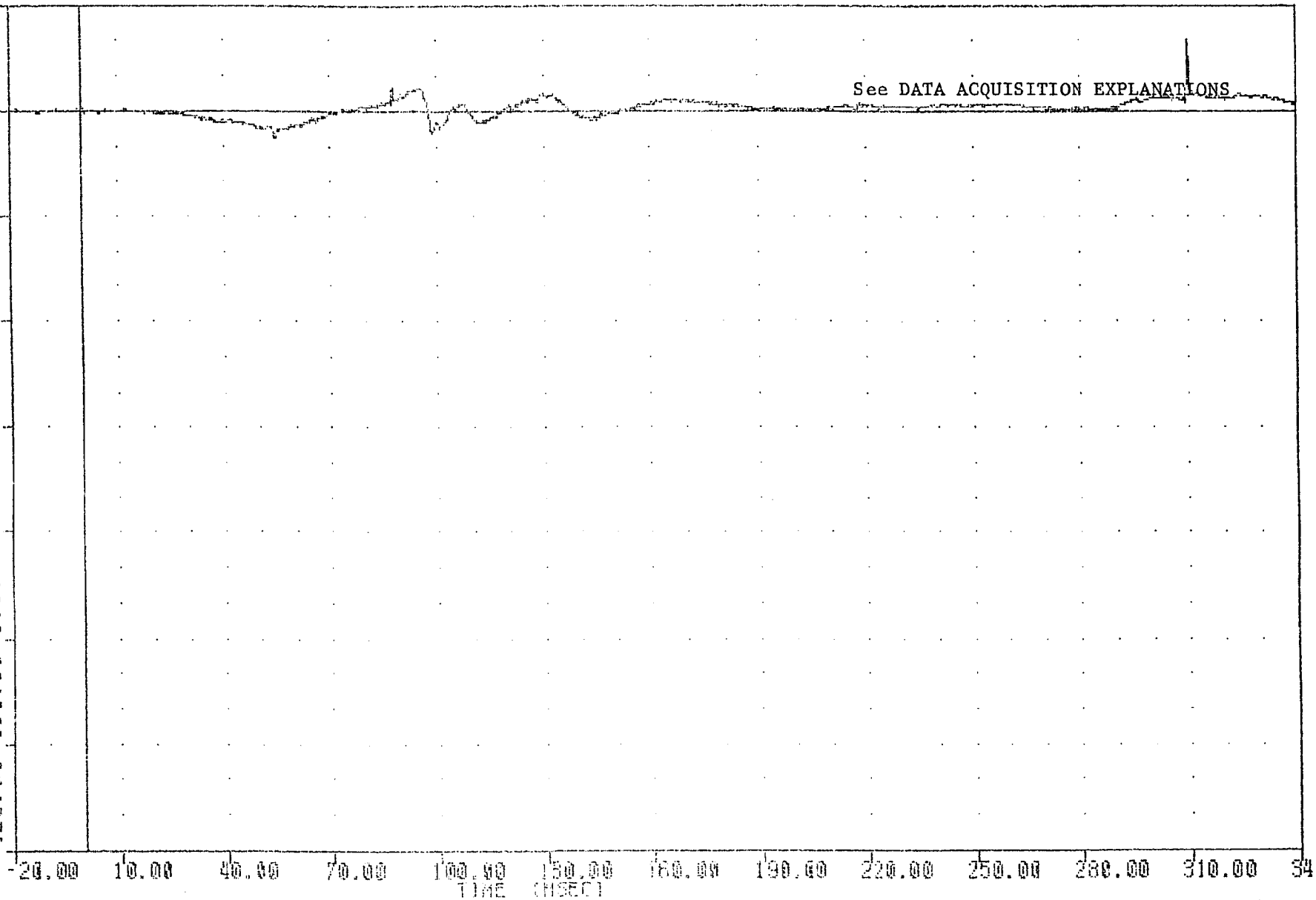
FILTER = BLPF 1000/ 2500/ -16
MIN, MAX VALUES = -336.79 @ 100.80 , 1296.17 @ 310.13



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 90 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER LEFT FEMUR FORCE

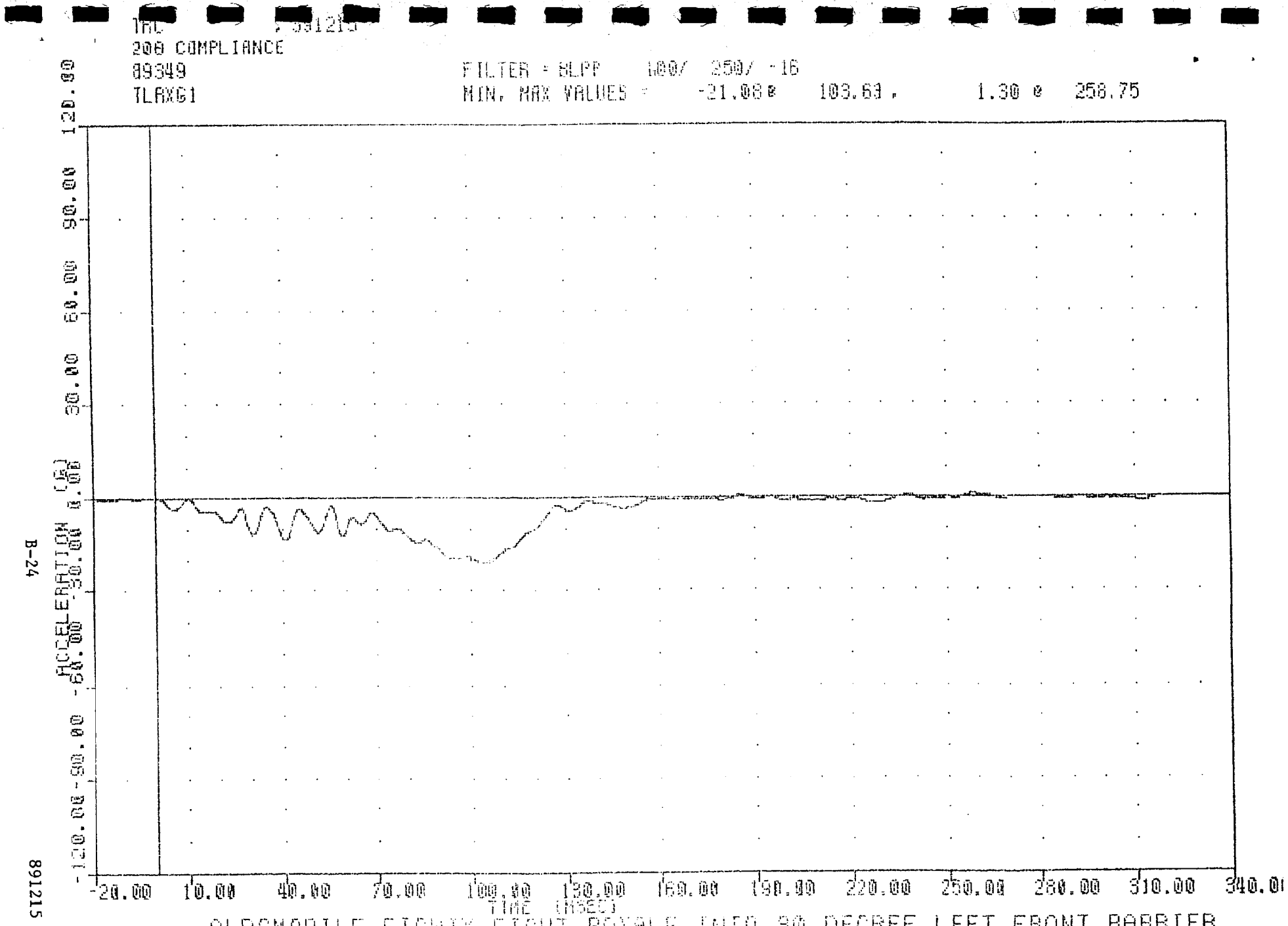
TRC 891215
208 COMPLIANCE
89549
RFMF2

FILTER = CLFP 1000/ 2500/ -16
MIN, MAX VALUES = -160.27@ 54.75, 410.32@ 310.13



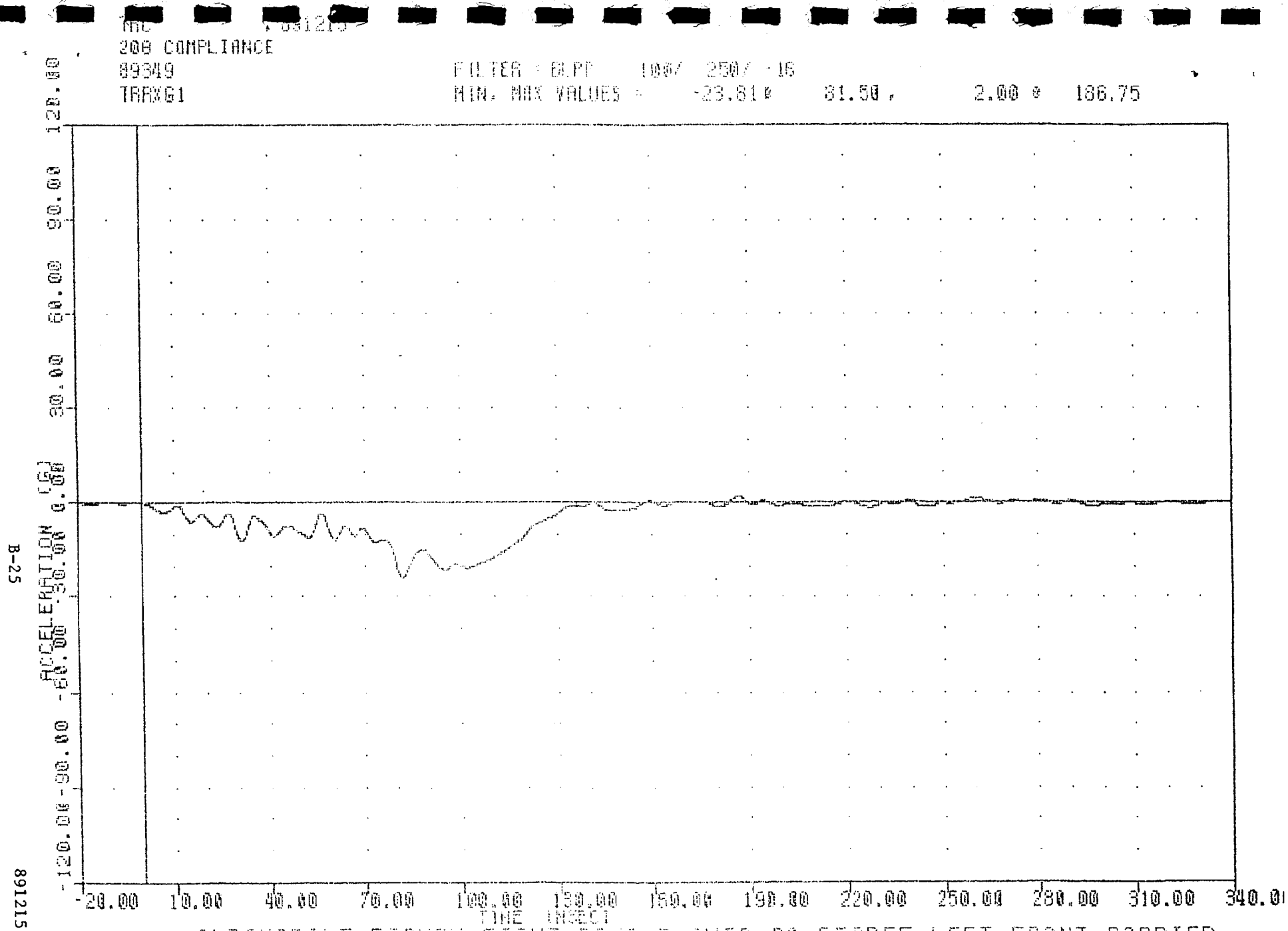
OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

891215

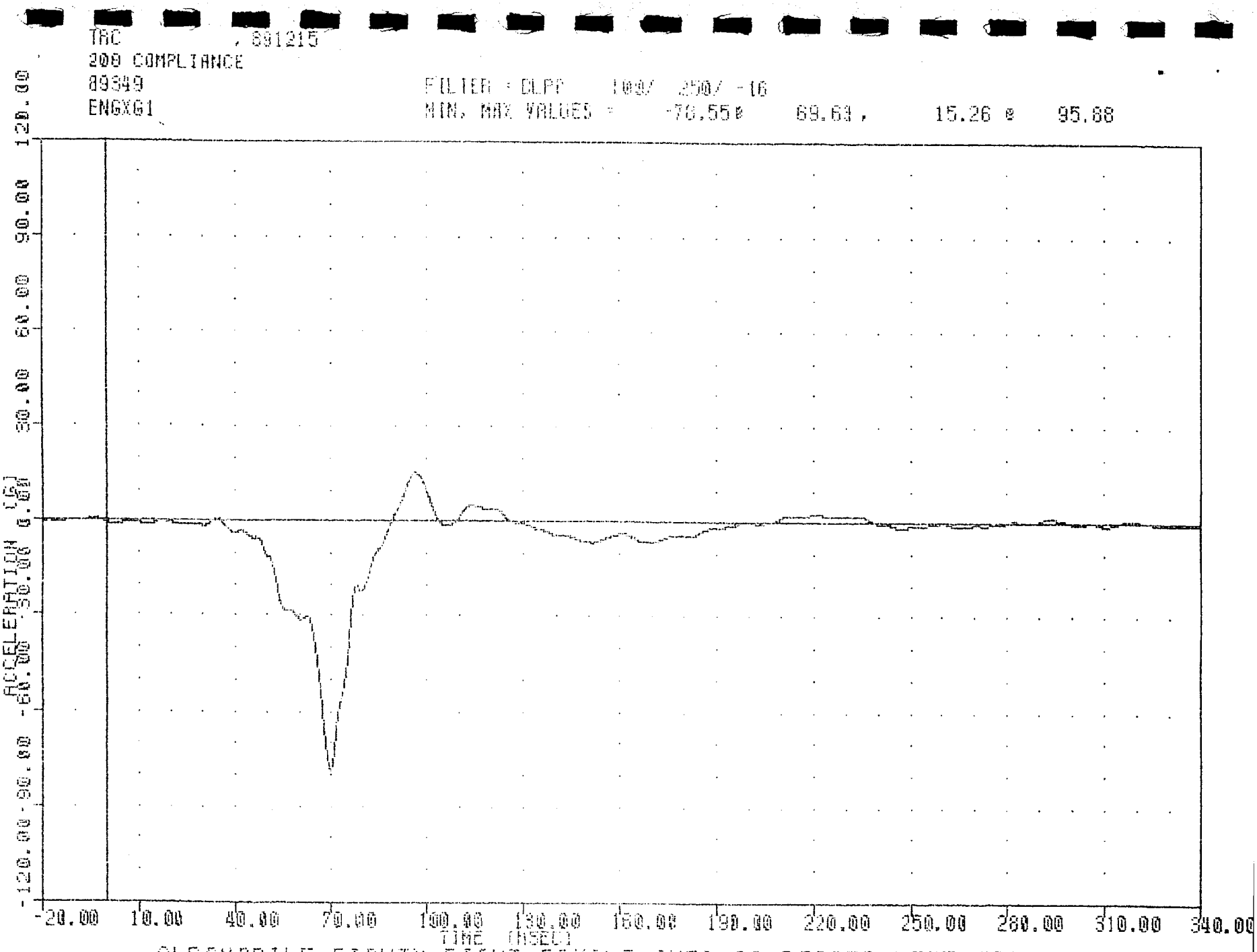


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
LEFT REAR SEAT X AXIS ACCELERATION

891215



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT REAR SEAT X AXIS ACCELERATION

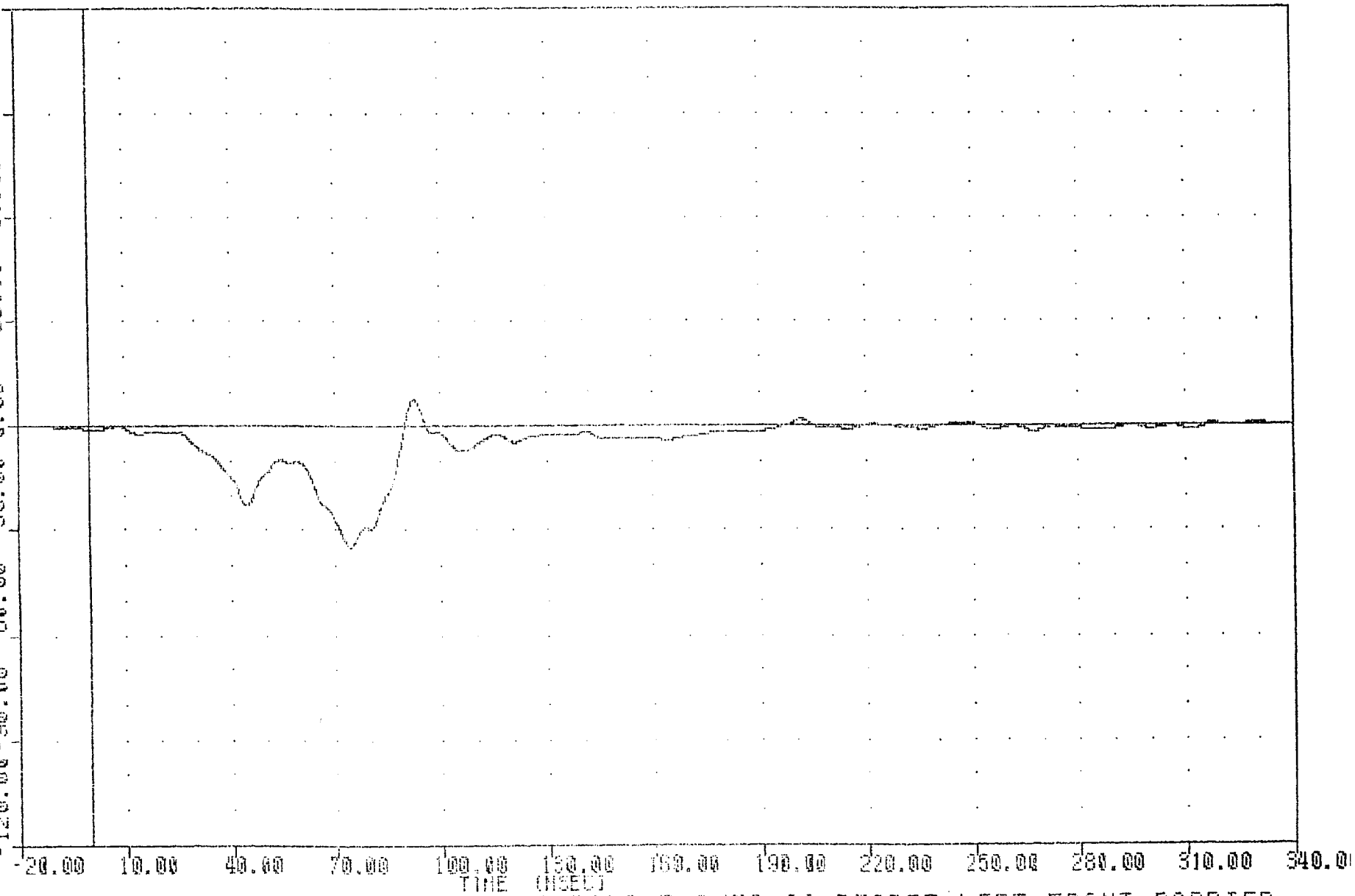


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
ENGINE UPPER BLOCK X AXIS ACCELERATION

891215

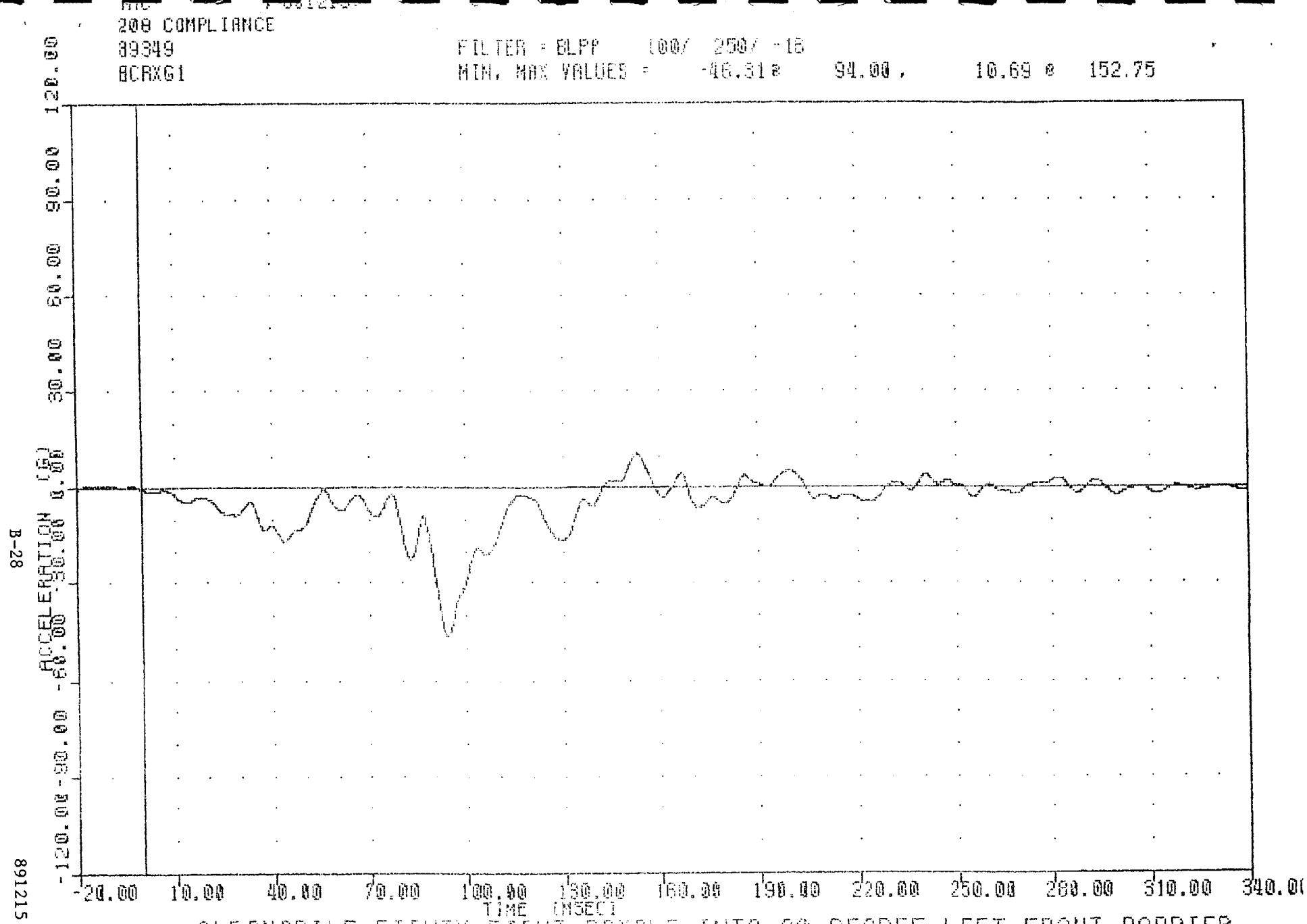
INC , 891215
200 COMPLIANCE
89349
ENGXG2

FILTER = CLFP 100/ 250/ -16
MIN, MAX VALUES = -84.77@ 74.38, 7.80 @ 92.50

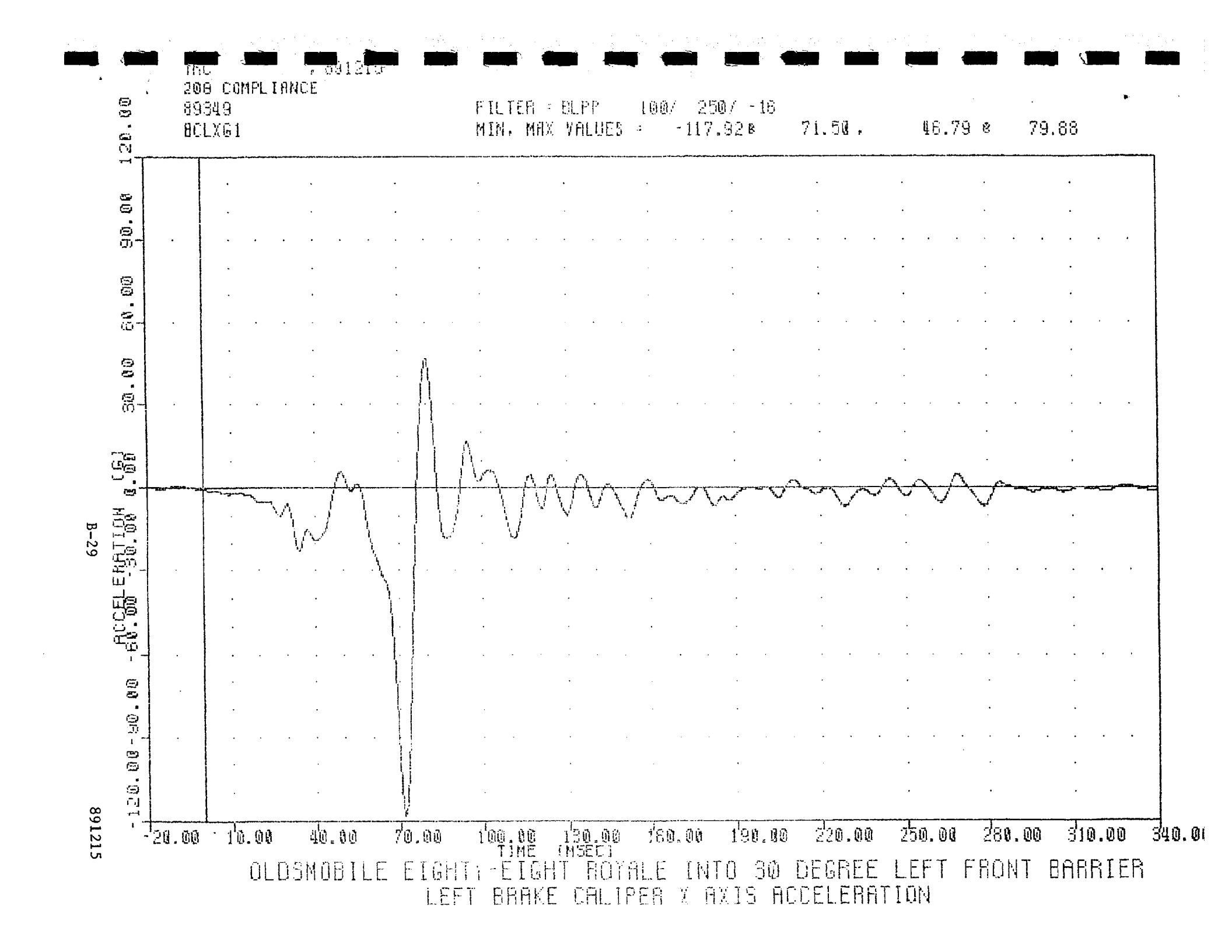


OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 90 DEGREE LEFT FRONT BARRIER
ENGINE BOTTOM BLOCK X AXIS ACCELERATION

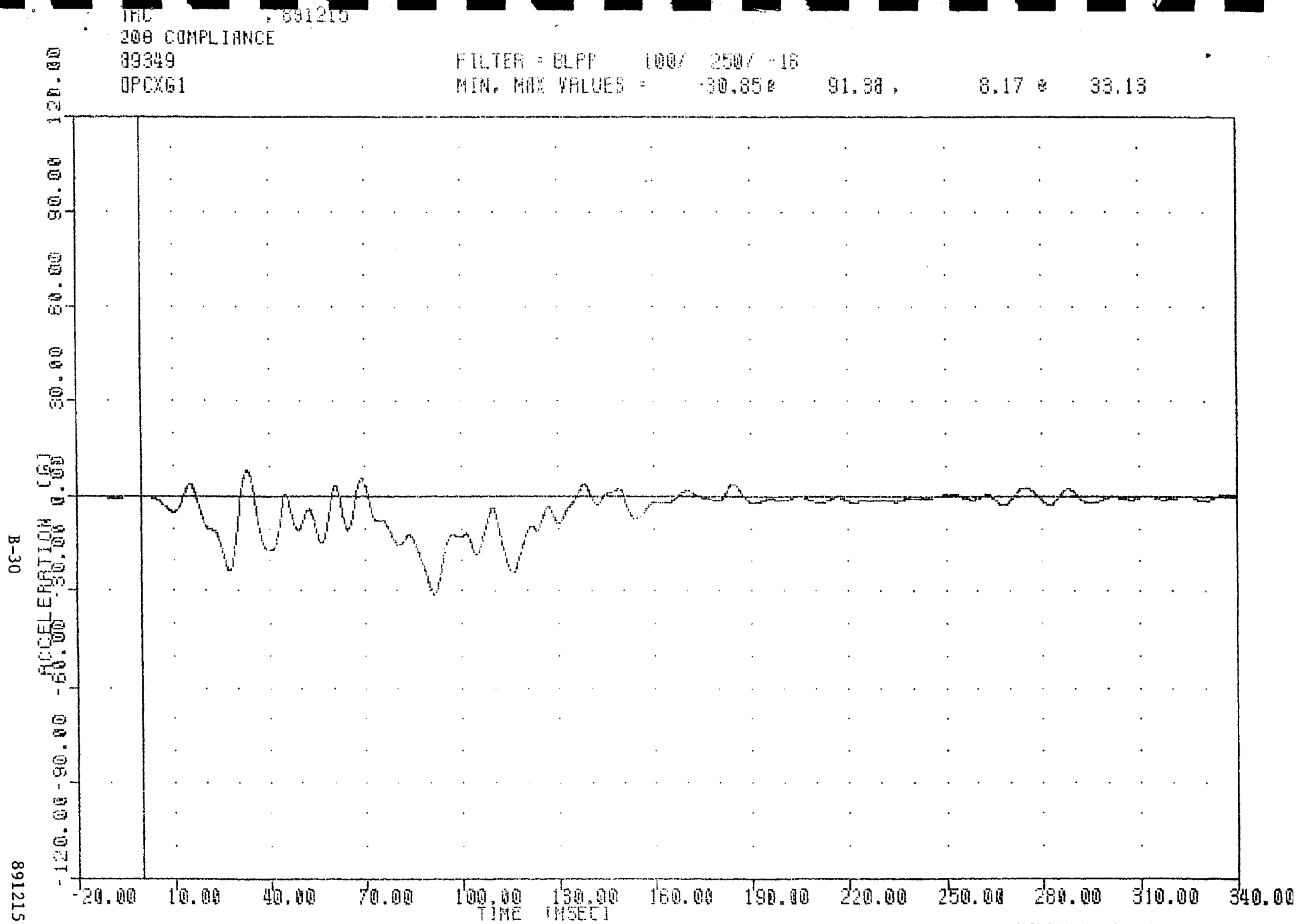
891215



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
RIGHT BRAKE CALIPER X AXIS ACCELERATION



OLDSMOBILE EIGHT; EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
LEFT BRAKE CALIPER X AXIS ACCELERATION



OLDSMOBILE EIGHTY-EIGHT ROYALE INTO 30 DEGREE LEFT FRONT BARRIER
DASH PANEL CENTER X AXIS ACCELERATION

891215