V2327

Report Numbers: 208-TRC-96-002
212-TRC-96-002
301-TRC-96-002

Vehicle Safety Compliance Testing for Occupant Crash Protection, Windshield Mounting, Windshield Zone Intrusion, and Fuel System Integrity

Volvo Gothenburg Sweden

1996 Volvo 850

4-door sedan

NHTSA Number: CT5900

TRC Test Number: 951116

Transportation Research Center Inc.

10820 State Route 347

East Liberty, Ohio 43319

December 7, 1995

Final Report

Prepared For:

U.S. Department of Transportation

National Highway Traffic Safety Administration

Office of Vehicle Safety Compliance (NEF-30)

400 Seventh Street, S.W., Room No. 6115

Washington, DC 20590

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16. Abstract

A 30 mph flat frontal barrier impact test was conducted on a 1996 Volvo 850 4-door sedan, NHTSA No. CT5900, at Transportation Research Center Inc. on November 16, 1995. This test was conducted to determine compliance with Federal Motor Vehicle Safety Standards: FMVSS 208, "Occupant Crash Protection"; 212, "Windshield Mounting"; 219 (partial), "Windshield Zone Intrusion"; and 301 "Fuel System Integrity." The barrier impact velocity was 29.6 mph. The vehicle's maximum static crush was 14.1 inches. The ambient temperature was 72° F.

The driver's Head Injury Criteria (HIC) was 298. The driver's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 53.8 g. The driver's left and right femur maximum axial forces were 1776 pounds and 1942 pounds, respectively.

The passenger's HIC was 122. The passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 36.0 g. The passenger's left and right femur maximum axial forces were 1362 pounds and 1229 pounds, respectively.

17. Key Words Frontal Impact 30 mph Vehicle Safety Compliance Testing: FMVSS 208, "Occupant Crash Protection" FMVSS 212, "Windshield Retention" FMVSS 219, "Windshield Zone Intrusion" FMVSS 301, "Fuel System Integrity"	18. Distribution Statement Copies of this report are available from: NHTSA Technical Reference Division Nassif Building, Room 5108 400 Seventh Street, S.W. Washington, DC 20590

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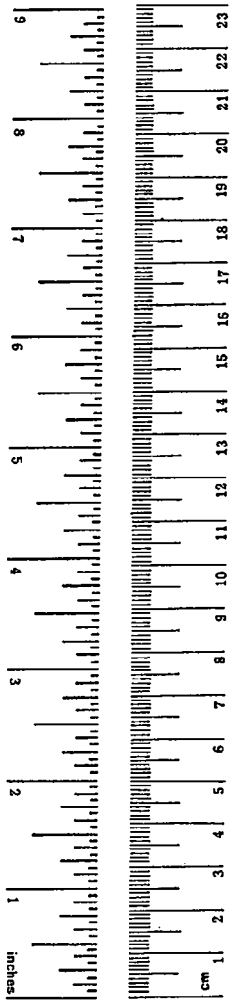
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

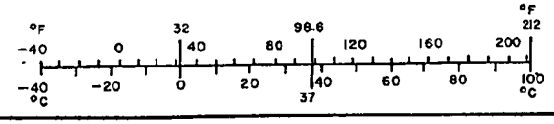
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	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	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	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	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.



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	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
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	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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Section 1.0

Purpose and Test Procedure

Purpose

This 30 mph flat frontal barrier impact test is part of the Federal Motor Vehicle Safety Standards (FMVSS) 208, 212, 219 (partial), and 301 compliance test program conducted for the National Highway Traffic Safety Administration (NHTSA) by the Transportation Research Center Inc. (TRC) under Contract No. DTNH22-93-D-01089. The purpose of this test was to determine if the subject vehicle, a 1996 Volvo 850 4-door sedan, NHTSA No. CT5900, 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-208-09. 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 and one (1) accelerometer to measure vertical axis acceleration. 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 B 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 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 twenty-four (24) data channels were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 12,500 samples per second and processed per Sections 11.13 through 11.15 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. Appendix C contains the manufacturer's vehicle information.

Section 2.0

Frontal Barrier Impact Test Summary

Test Results Summary

This flat frontal barrier test was conducted at TRC on November 16, 1995.

The test vehicle, a 1996 Volvo 850 4-door sedan, NHTSA No. CT5900, appeared to comply with the performance requirements of FMVSS 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 B dummies seated in the front outboard designated seating positions. 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 airbags at the driver's and right front passenger's seating position. The vehicle's test weight was 3630 pounds. The vehicle's impact speed was 29.6 mph. The vehicle's maximum static crush was 14.1 inches.

The driver's HIC was 298. The driver's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 53.8 g. The driver's left and right femur maximum compressive forces were 1776 pounds and 1942 pounds, respectively.

The right front passenger's HIC was 122. The right front passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 36.0 g. The right front passenger's left and right femur maximum compressive forces were 1362 pounds and 1229 pounds, respectively.

There was no loss of windshield periphery retention and no penetration through the windshield. Following the impact, no fluid spilled from the vehicle's fuel system prior to the static rollover test or during any portion of the static rollover test.

Table 1 Crash Test Summary

NHTSA number:	CT5900
Test type:	Frontal barrier impact
Test date:	11/16/95
Test time:	1418
Ambient temperature at impact area:	72° F
Vehicle year/make/ model/body style:	1996/Volvo/850/4-door sedan
Vehicle test weight:	3630 lb
Impact angle[1]:	0°
Impact velocity[2]:	
Primary:	29.6 mph
Secondary:	29.6 mph
Maximum static crush:	14.1 in
Average rebound:	75.8 in
Number of cameras:	
Real-time:	2
High-speed:	14
Door opening data:	
Left-front:	Easy
Right-front:	Easy

[1] With respect to tow track centerline.
[2] Speed trap measurement (± .05 mph accuracy)

Table 1. Crash Test Summary, Cont'd.

Dummies:	Driver #353	Passenger #354
Type:	Part 572 B	Part 572 B
Location:	Left front	Right front
Restraint:	Airbag	Airbag
Number of data channels:	8	8
Front seat data:		
Seat track failure:	None	None
Seat back failure:	None	None
Visible dummy contact points:		
Head:	Airbag, head restraint, and sun visor	Airbag and sun visor
Chest:	Airbag	Airbag
Abdomen:	None	None
Left knee:	Instrument panel	Instrument panel
Right knee:	Instrument panel	Instrument panel

Table 2 Test Vehicle Information

Vehicle year/make/ model/body style:	1996/Volvo/850/4-door sedan			
Color:	Silver			
VIN:	YV1LS5516T2268222			
NHTSA number:	CT5900			
Engine data:				
Placement:	Transverse/Lateral			
Cylinders:	5			
Displacement:	2.4 liters			
Transmission data:	4 speed,	__manual,	X automatic,	__overdrive
Final drive:	X fwd,	__rwd,	__4wd	
Date vehicle received:	10/10/95			
Odometer reading:	86			
Dealer's name and address:	George Byers Sone, Inc. 401 N. Hamilton Rd. Columbus, OH 43216			

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	Yes
Tinted glass	Yes	Air conditioning	Yes
Radio	Yes	Anti-skid brake	Yes
Clock	Yes	Rear window defroster	Yes
Power door locks	Yes	Other:	None

Certification data from vehicle's label:

Vehicle manufactured by:		Volvo Gothenburg Sweden
Date of manufacture:		06/95
VIN:		YV1LS5516T2268222
GVWR:		4180 lb
GAWR:	Front:	2240 lb
	Rear:	1980 lb

Table 2 Test Vehicle Information, Cont'd.

Size of tires on vehicle:	P195/60R15
Spare tire:	Space saver
Type of front seats:	Bucket

Tire & capacity data from vehicle's label:

Recommended tire size:	P195/60R15
Recommended cold tire pressure:	
Front:	36 psi
Rear:	36 psi
Designated Seating Capacity:	
Front	2
Rear	3
Total	5
Vehicle Capacity Weight:	920 lbs.

Test vehicle attitudes:

Delivered attitude:	LF: 25.8 in.	RF: 26.1 in	LR: 25.1 in	RR: 25.4 in
Fully loaded attitude:	LF: 24.8 in	RF: 24.9 in	LR: 23.7 in	RR: 23.8 in
Pre-test attitude:	LF: 24.9 in	RF: 25.2 in	LR: 23.7 in	RR: 23.9 in

Table 2 Test Vehicle Information, Cont'd.

Weight of test vehicle as received (with maximum fluids):

Right front	956	lb	Right rear	593	lb
Left front	982	lb	Left rear	616	lb
Total front weight	1938	lb	(61.6% of total vehicle weight)		
Total rear weight	1209	lb	(38.4% of total vehicle weight)		
Total delivered weight	3147	lb			

Calculation of test vehicle's target test weight:

RCLW = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight (3147 lb)

VCW[1] = Vehicle Capacity Weight = 920

DSC = Designated Seating Capacity (5)

RCLW = VCW - 150 (DSC) = 170

Target test weight = UDW + RCLW[1] + (Number of Hybrid II dummies x 164 lb per dummy)

Target test weight = 3147 + 170 + 328 = 3645 lb

Weight of test vehicle with required dummies and 155 lb of cargo weight:

Right front	1024	lb	Right rear	758	lb
Left front	1044	lb	Left rear	804	lb
Total front weight	2068	lb	(57.0% of total vehicle weight)		
Total rear weight	1562	lb	(43.0% of total vehicle weight)		
Total test weight	3630	lb	(0.4% under target test weight)		

Weight of ballast secured in vehicle cargo area: 50 lb

Components removed to meet target test weight: None

CG rearward of front wheel centerline: 45.3 in

Vehicle Wheelbase: 105.3 in

[1] From vehicle's tire load label.

Table 3 Post-Impact Data

Test number:	951116
NHTSA number:	CT5900
Test date:	11/16/95
Test time:	1418
Test type:	Frontal barrier impact
Impact angle:	0°
Ambient temperature at impact area:	72° F
Temperature in occupant compartment:	72° F

Impact velocity:

Primary:	29.6 mph
Secondary	29.6 mph
Specified range:	28.9 to 29.9 mph

Distance from vehicle to barrier:

Entering velocity trap:	14.0 in
Exiting velocity trap:	2.0 in

Test vehicle static crush:

Overall length of test vehicle:

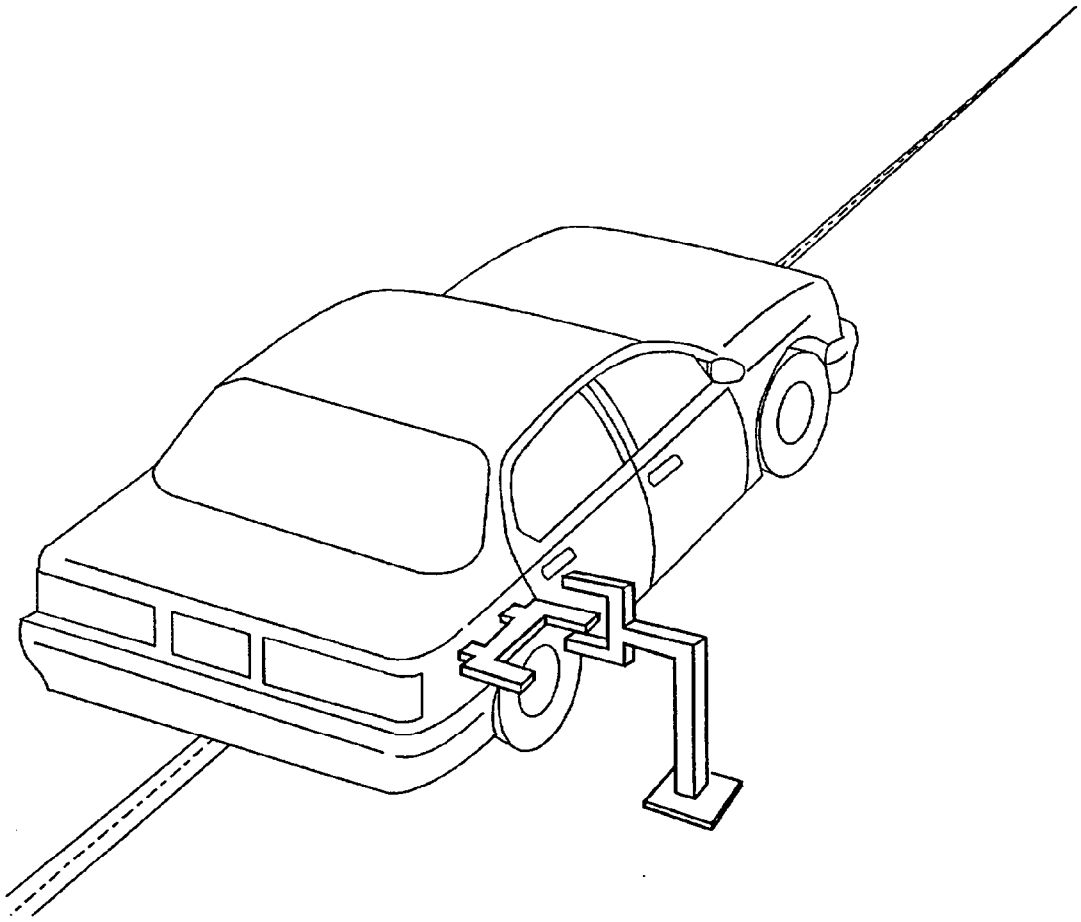
Pre-test:	L:	179.5 in	C:	183.3 in	R:	180.5 in
Post-test:	L:	167.8 in	C:	169.2 in	R:	167.5 in
Total crush:	L:	11.7 in	C	14.1 in	R:	13.0 in
Average crush:	12.9 in					

Test vehicle rebound from flat barrier:

Distance from test vehicle to barrier:

Post-test:	L:	76.2 in	C:	75.3 in	R:	75.9 in
Average rebound:	75.8 in					

Figure 1 Impact Velocity Measurement System

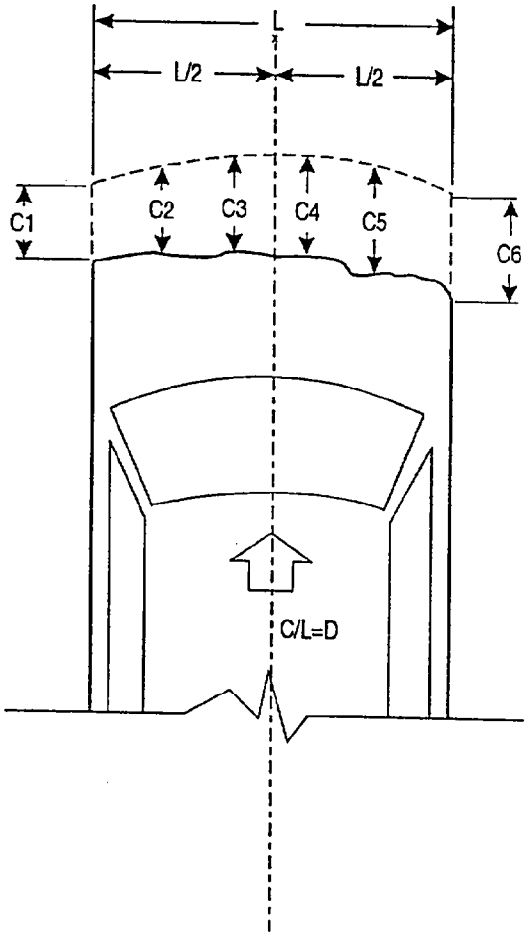


The final vane clears emitter/receiver two inches before impact.

The vanes have a one-foot spacing.

Figure 2 Accident Investigation Division Data for 30 mph Frontal Barrier Impact

NHTSA number:	CT5900
Test date:	11/16/95
Vehicle year/make/ model/body style:	1996/Volvo/850/4-door sedan
Vehicle size category:	Large
VIN:	YV1LS5516T2268222
Build date:	06/95
Test weight:	3630 lb
Vehicle wheelbase:	105.3 in
Maximum width:	69.3 in
Front overhang:	39.0 in



Collision Deformation Classification (CDC) Code: 12FDEW2

Crush depth measurements:	C1:	11.7 in
	C2:	13.6 in
	C3:	14.1 in
	C4:	13.9 in
	C5:	13.3 in
	C6:	13.0 in

Midpoint of damage: D: Vehicle Longitudinal Centerline

Length of damaged region: L: 60.0 in

Table 4 Post-test Airbag Data

NHTSA number:	CT5900
Test date:	11/16/95
Technician:	Markusic
Vehicle year/make/ model/body style:	1996/Volvo/850/4-door sedan

A. Number of airbag vent holes:

Driver:	NA
Passenger:	1

B. Size of airbag vent holes:

Driver:	NA
Passenger:	2.5 in dia.

C. Total airbag vent area:

Driver:	NA
Passenger:	4.9 in^2

D. Deflated airbag length and width dimensions or, if round, diameter

Driver:	Length	NA
	Width	NA
	Diameter	26.5 in
Passenger:	Length:	28.0 in
	Width:	30.0 in
	Diameter:	NA

Table 4 Post-test Airbag Data, Cont'd.

E. Is the airbag tethered?

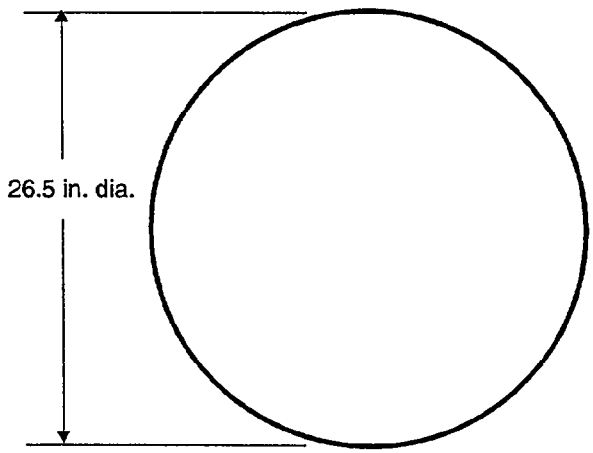
Driver: Yes

If yes, record length of tether: 4 tethers, 9 inches each

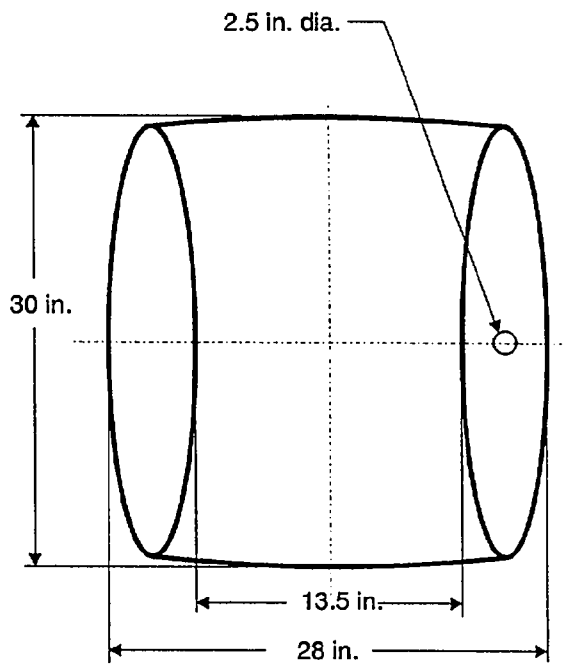
Passenger: No

If yes, record length of tether: NA

Driver's airbag:



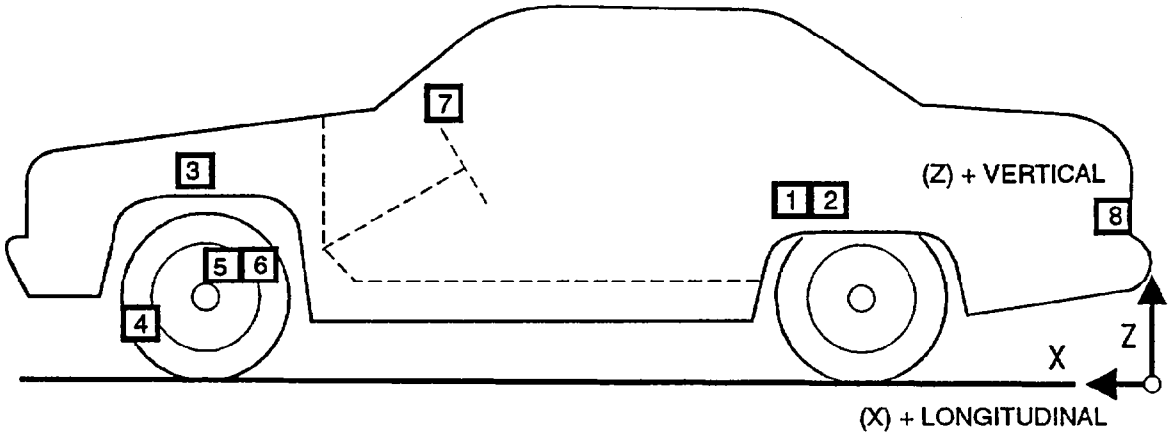
Passenger's airbag:



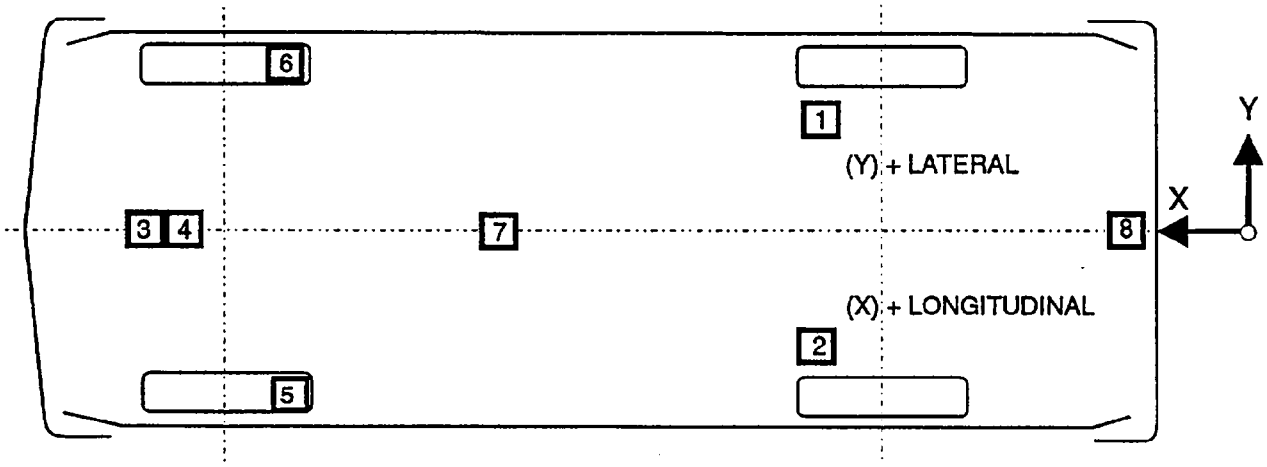
F. Airbag and gas generator part numbers and manufacturer's names.

Driver:	Mfr.: Svensk, 10917951660037	Inflator mfr.: Autoliv, 9138277
Passenger:	Mfr.: Svensk, 2182951651650230	Inflator mfr.: Autoliv, 9156244

Figure 3 Vehicle Accelerometer Placement



SIDE VIEW



BOTTOM VIEW

Table 5 Vehicle Accelerometer Locations and Data Summary

TEST NUMBER: 951116

No.	LOCATION		X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
1	LEFT REAR SEAT CROSSMEMBER	PRE	68.7 in	24.3 in	12.7 in				
		POST	68.9 in	24.3 in	13.9 in				
	LONGITUDINAL					1.9 g	@ 132.8 ms	31.3 g	@ 43.9 ms
2	RIGHT REAR SEAT CROSSMEMBER	PRE	68.7 in	-24.3 in	12.8 in				
		POST	68.9 in	-24.3 in	14.1 in				
	LONGITUDINAL					1.5 g	@ 151.1 ms	33.7 g	@ 54.2 ms
3	ENGINE TOP	PRE	153.6 in	-1.2 in	30.4 in				
		POST	149.2 in	-1.0 in	33.4 in				
	LONGITUDINAL					29.7 g	@ 55.2 ms	75.5 g	@ 28.1 ms
4	ENGINE BOTTOM	PRE	149.5 in	-4.6 in	7.9 in				
		POST	147.0 in	-4.0 in	4.9 in				
	LONGITUDINAL					24.9 g	@ 49.0 ms	77.8 g	@ 33.9 ms
5	RIGHT BRAKE CALIPER	PRE	150.5 in	-26.0 in	13.1 in				
		POST	150.0 in	-25.1 in	13.1 in				
	LONGITUDINAL					33.2 g	@ 54.2 ms	75.0 g	@ 39.7 ms
6	LEFT BRAKE CALIPER	PRE	150.5 in	26.0 in	12.5 in				
		POST	151.0 in	26.2 in	11.1 in				
	LONGITUDINAL					6.5 g	@ 87.8 ms	59.2 g	@ 41.6 ms
7	INSTRUMENT PANEL CENTER	PRE	123.6 in	0.2 in	38.1 in				
		POST	124.8 in	0.0 in	36.2 in				
	LONGITUDINAL					51.9 g	@ 39.4 ms	124.4 g	@ 28.6 ms
8	VEHICLE REAR CENTER	PRE	9.2 in	0.0 in	16.1 in				
		POST	9.0 in	0.0 in	13.0 in				
	VERTICAL					9.7 g	@ 50.3 ms	10.2 g	@ 27.2 ms

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

Section 3.0

FMVSS 208, 212, 219 (partial), and 301 Data

Table 6 Dummy Injury Criteria

Maximum Acceleration

	Head				Chest		
	X	Y	Z	R	X	Y	Z
Driver	-47.1 g	-7.7 g	-45.2 g	65.3 g	-53.8 g	-4.5 g	-33.3 g
Passenger	-42.8 g	15.5 g	24.6 g	44.4 g	-36.1 g	16.7 g	-21.1 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Driver	1776 lbf	1942 lbf
Passenger	1362 lbf	1229 lbf

Head Injury Criteria[1]

	HIC	Time t_1	Time t_2
Driver	298	62.400 ms	98.400 ms
Passenger	122	71.840 ms	107.840 ms

Chest Maximum Resultant Acceleration[2]

	Acceleration	Time t_1	Time t_2
Driver	53.8 g	79.4 ms	82.4 ms
Passenger	36.0 g	81.8 ms	84.8 ms

[1] As defined in FMVSS No. 208

[2] Defined as equal to or exceeding 0.003 sec. duration

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 impacted the airbag and sun visor. The dummy's chest impacted the airbag. The dummy's head and chest were restrained by the airbag. The dummy's head rotated forward and then rearward into the head restraint as the dummy rebounded rearward into the seat back. The driver dummy came to rest seated 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 contacted the airbag and sun visor as the dummy's chest contacted the airbag. The dummy's upper torso rotated to the left. The dummy's head and chest were restrained by the passenger's airbag. The dummy's head rotated rearward as the dummy rebounded to the right into the seat back.. The dummy came to rest seated in the right front passenger's seat rotated slightly to the left and leaning to the right.

Table 7 FMVSS 208 Seat Belt Comfort and Convenience Test Summary

Front Outboard Designated Seating Positions

NHTSA number: CT5900

Vehicle model year/make/model/body style: 1996/Volvo/850/4-door sedan

Date of comfort/convenience check: 11/16/95

Technician performing check: Markusic

GVWR: 4180 lb

Automatic seat belts installed in any vehicle, other than a walk-in van-type vehicle which has a gross vehicle weight rating of 10,000 pounds or less, and is manufactured on or after September 1, 1986, shall meet the requirements for convenience hooks, webbing tension-relieving devices, and belt contact force.

Manual seat belts installed for compliance with this standard in front outboard designated seating positions of any vehicle, other than a walk-in van-type vehicle which has a gross vehicle rating of 10,000 pounds or less, and is manufactured after September 1, 1989, shall meet the requirements for belt contact force, plate access, retraction and seat belt guides, and hardware.

Vehicle Equipment:

The vehicle's front outboard seating positions were equipped with manual Type 2 seat belts which must comply with the dynamic test requirements of S5.1; requirements for webbing tension-relieving devices (S7.4.2), belt contact force (S7.4.3), latchplate access (S7.4.4), retraction (S7.4.5), and seat belt guides and hardware (S7.4.6) apply.

Convenience Hooks (S7.4.1):

Not applicable, the vehicle was not equipped with automatic seat belts.

Table 7 FMVSS 208 Seat Belt Comfort and Convenience Test Summary

Front Outboard Designated Seating Positions, Cont'd.

NHTSA number: CT5900

Vehicle model year/make/model/body style: 1996/Volvo/850/4-door sedan

Date of comfort/convenience check: 11/16/95

Technician performing check: Markusic

GVWR: 4180 lb

Webbing Tension-Relieving Device (S7.4.2):

The front outboard seating position assemblies do not have webbing tension-relieving devices.

Belt Contact Force (S7.4.3):

The belt contact force on the chest of the test dummy is 0.2 pound.

Latchplate Access (S7.4.4):

The seat belt latchplates, in their normal stowed position, are within the reach envelope.

The clearance test block moves unhindered to the latchplate or buckle.

Retraction (S7.4.5):

The seat belt automatically retracts when the seat belt latchplate is released.

The stowed seat belt webbing and hardware are not pinched when the door is closed.

Table 7 FMVSS 208 Seat Belt Comfort and Convenience Test Summary

Front Outboard Designated Seating Positions, Cont'd.

NHTSA number: CT5900

Vehicle model year/make/model/body style: 1996/Volvo/850/4-door sedan

Date of comfort/convenience check: 11/16/95

Technician performing check: Markusic

GVWR: 4180 lb

Seat Belt Guides and Hardware (S7.4.6):

The seat cushion is not removable.

The seat back does not serve a function other than seating.

The seat is not removable.

The seat is movable but the space formerly occupied by the seat cannot be used for a secondary function.

Note: If the seat or seat cushion is removable or if the seat is movable so the space formerly occupied by the seat can be used for a secondary function, the seat belt guides and hardware requirements do not apply.

The webbing is not designed to pass through the seat cushion or between the cushion and seat back.

The restraint system does not include webbing guides.

The seat belt receptacles were accessible without moving the center arm rest for access.

Table 8 FMVSS 208 Equipment Data

FMVSS 208 Seat Belt Warning System Data

With an occupant in the driver's position and the unibelt in stowed position and ignition switch placed in the "start/on" position, the duration of audible warning signal and the reminder light is 6 s.

With an occupant in the driver's position and the unibelt in use and the ignition switch placed in the "start/on" position the duration of audible warning signal is 0 s and the duration of the reminder light operation is 6 s.

NOTE: the audible warning should not operate.

The visual seat belt warning is the symbol from Table 2 of FMVSS 101.

Table 8 FMVSS 208 Equipment Data, Cont'd.

FMVSS 208 Labeling and Driver's Manual Data

The labels which describe the manufacturer's maintenance or replacement schedule for the crash-deployed occupant protection system were located on the driver's and passenger's sunvisors.

The manufacturer's recommended regular airbag maintenance is to replace airbag module every ten years.

Appropriate instructions concerning maintenance and/or replacement of this system were provided in the owner's manual on page 3:5.

A description of the functional operation of the system was provided in the owner's manual on pages 3:4 through 3:7.

A reference to the instructions and description of the system was included on the label.

An owner's manual was provided.

The owner's manual contained appropriate information concerning maintenance and/or replacement and a description of the functional operation of the systems on pages 3:4 and 3:7.

Table 8 FMVSS 208 Equipment Data, Cont'd.

FMVSS 208 Readiness Indicator Data

The vehicle contained a crash-deployed occupant protection system which was not totally mechanical. The readiness indicator was a light stating "SRS" located on the lower left portion of the instrument cluster.

The readiness indicator was clearly visible to the driver.

A list of the elements in the occupant restraint system, being monitored by the readiness indicator was provided in the owner's manual on pages 3:5.

FMVSS 208 Rear Outboard Seating Position Seat Belts

All rear outboard seating positions had Type 2 seat belts.

Figure 4 FMVSS 212 Test Data

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

Plastic trim around outer perimeter and adhesive around inner perimeter.

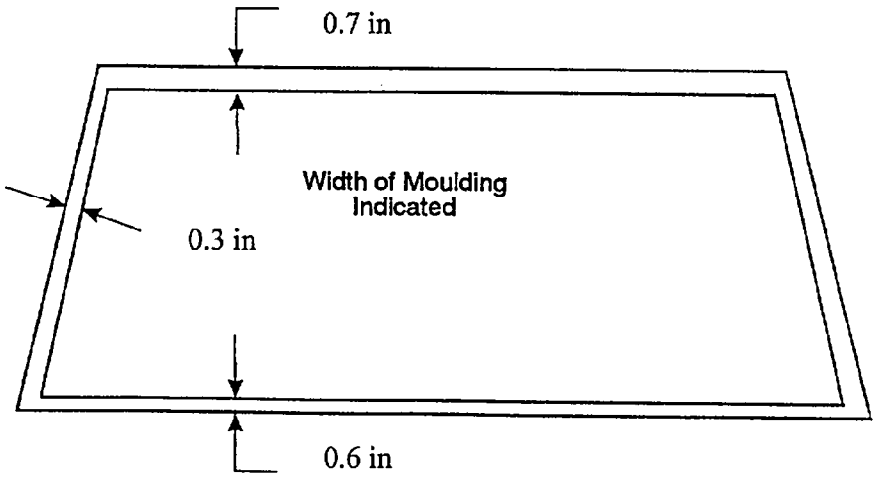
Clips or brackets used to retain windshield: None

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	84.2 in	84.2 in	100.0
Left side	84.2 in	84.2 in	100.0
Total	168.4 in	168.4 in	100.0

Pre-test windshield mounting material temperature: 72° F



Front view of windshield[1]

Loss of windshield retention lengths: None

[1] 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: 50.0 in

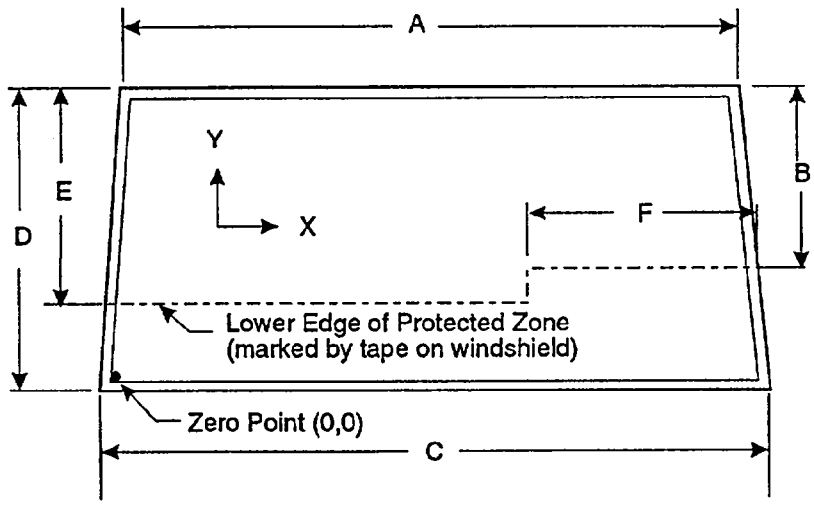
B: 18.3 in

C: 56.4 in

D: 30.5 in

E: 20.0 in

F: 26.3 in



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.

Table 9 Fuel System Data

Vehicle year/make/ model/body style:	1996/Volvo/850/4-door sedan
NHTSA number:	CT5900
Fuel system capacity:	19.3 gal (from owner's manual)
Usable capacity:	19.3 gal (furnished by COTR)
Test volume range:	17.8 gal to 18.1 gal (92-94% of usable)
Actual test volume:	17.9 gal (with entire fuel system filled)
Test fluid type:	Stoddard solvent
Specific gravity:	0.764
Kinematic viscosity:	0.99 centistoke
Test fluid color:	purple
Type of fuel pump:	electric

The electric fuel pump did not operate with ignition switch "on" and the engine not operating.

Details of fuel system:

The fuel tank was located behind the rear axle. The fuel filler neck was located on the right side. The fuel lines run along the right side to the front.

Table 10 FMVSS 301 Post-Impact Test Data

NHTSA number:	CT5900
Test date:	11/16/95
Vehicle year/make/ model/body style:	1996/Volvo/850/4-door sedan

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's/passenger's) side

____ Rear moving barrier (30 mph)

____ Lateral moving barrier (20 mph)

Fuel system fluid spillage measurements:

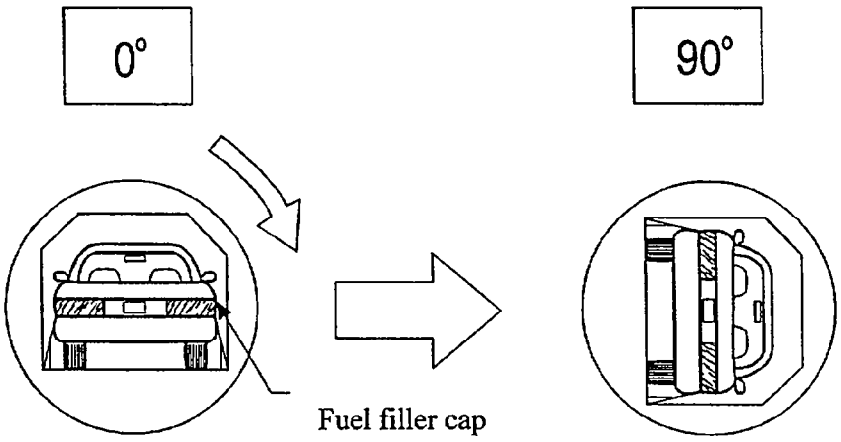
		Test Results	Maximum Allowable
1.	From impact until vehicle motion ceases	0 oz	1 oz
2.	5-Minute period after vehicle motion ceases	0 oz	5 oz
3.	Next 25 minutes after 5-minute period	0 oz	1 oz/1 min

Fuel system fluid spillage location(s): None

Figure 6 FMVSS 301 Static Rollover Test Data

NHTSA number: CT5900

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	7	minutes		

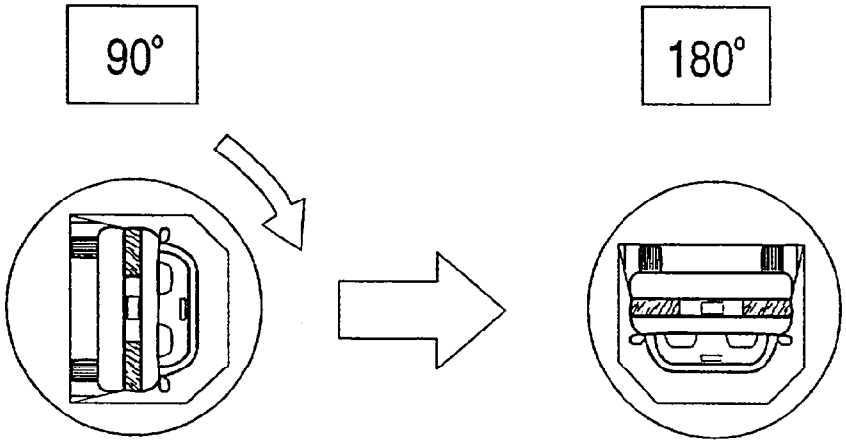
Fuel system fluid spillage measurements:

0° to 90° rotation (fuel filler cap down)	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0 oz	5 oz
2. Sixth minute from onset of rotation	0 oz	1 oz
3. Seventh 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.

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	14	minutes		

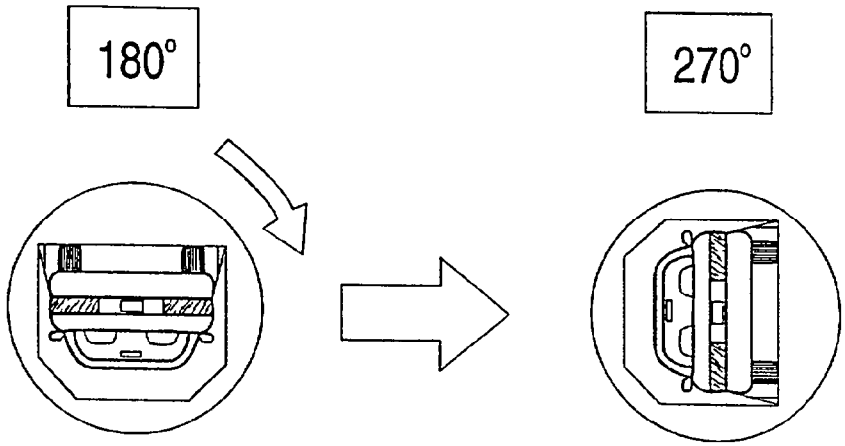
Fuel system fluid spillage measurements:

90° to 180° rotation	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0 oz	5 oz
2. Sixth minute from onset of rotation	0 oz	1 oz
3. Seventh 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.

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	21	minutes		

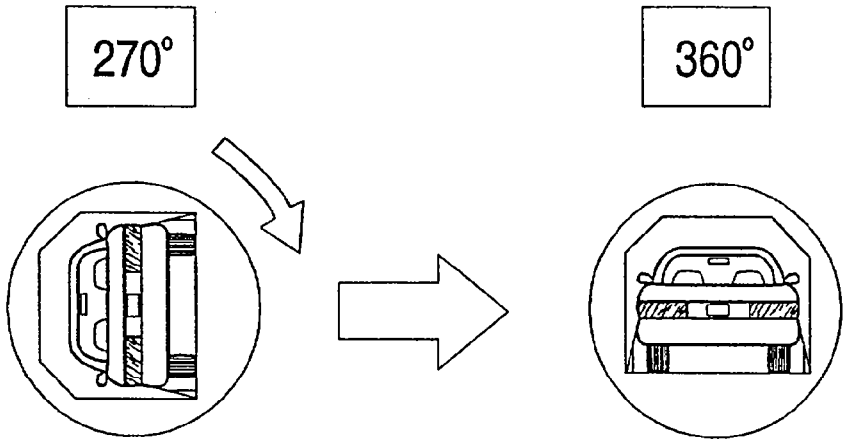
Fuel system fluid spillage measurements:

180 to 270° rotation	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0 oz	5 oz
2. Sixth minute from onset of rotation	0 oz	1 oz
3. Seventh 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.

Test phase



Static rollover machine rotation time information: (specified range is 1-3 minutes)

Time required for machine to rotate 90°	=	2	minutes,	0	seconds
FMVSS 301 position hold time	=	5	minutes,	0	seconds
Total	=	7	minutes,	0	seconds
Next whole minute interval	=	28	minutes		

Fuel system fluid spillage measurements:

270° to 360° rotation	Test Results	Maximum Allowable
1. First five minutes from onset of rotation	0 oz	5 oz
2. Sixth minute from onset of rotation	0 oz	1 oz
3. Seventh 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

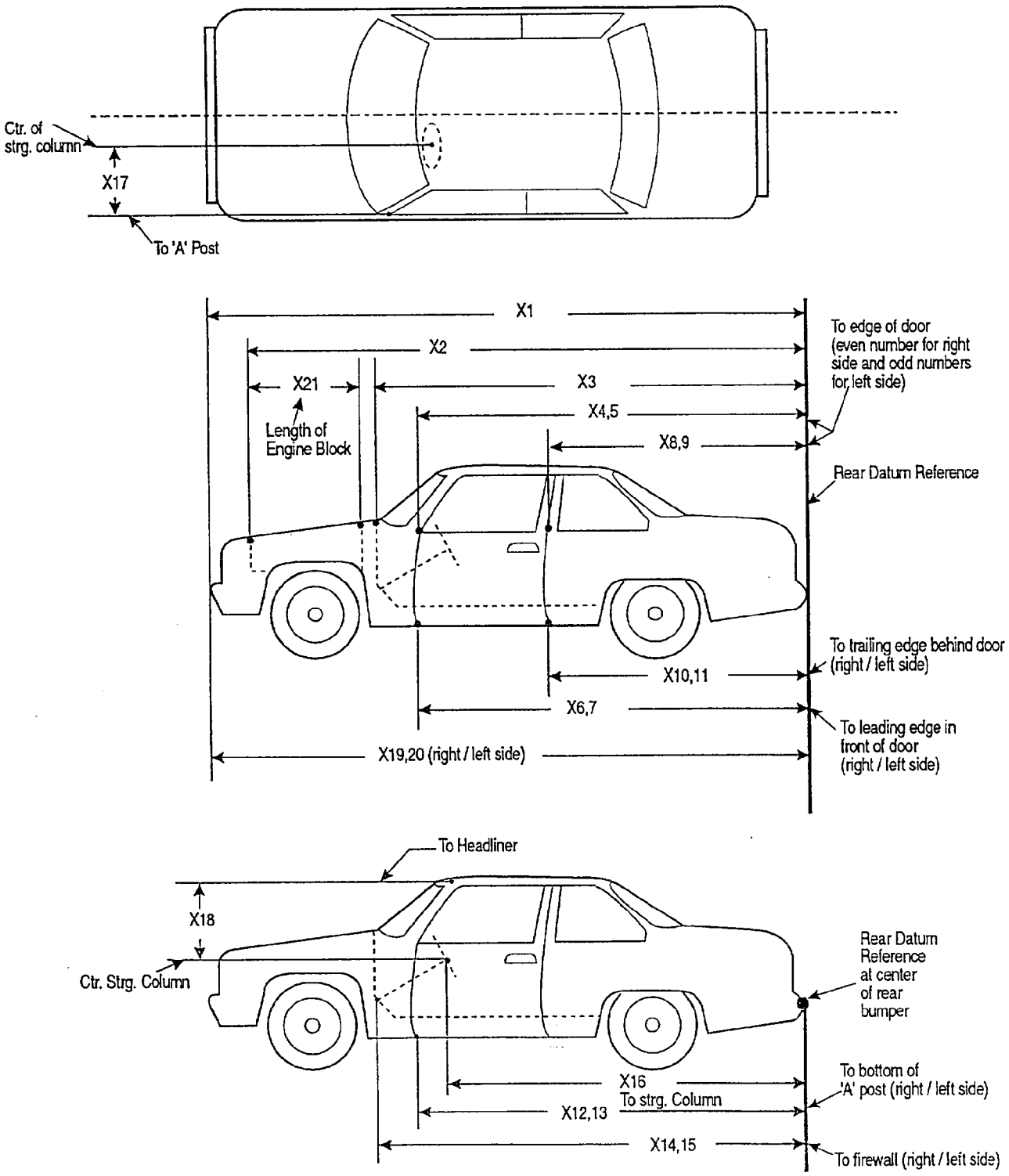


Table 11 Impacted Vehicle Measurements

Vehicle year/make/model/body style: 1996/Volvo/850/4-door sedan Test Number: 951116

No.	Type of measurement	Pre-test	Post-test	Diff.
X1	Total length of vehicle at centerline	183.3 in	169.2 in	14.1 in
X2	Rear surface of vehicle to front of engine block	157.6 in	153.2 in	4.4 in
X3	Rear surface of vehicle to firewall	137.8 in	138.5 in	-0.7 in
X4	Rear surface of vehicle to upper leading edge of right door	121.4 in	122.5 in	-1.1 in
X5	Rear surface of vehicle to upper leading edge of left door	121.2 in	122.8 in	-1.6 in
X6	Rear surface of vehicle to lower leading edge of right door	122.0 in	121.9 in	0.1 in
X7	Rear surface of vehicle to lower leading edge of left door	121.9 in	122.2 in	-0.3 in
X8	Rear surface of vehicle to upper trailing edge of right door	82.7 in	83.8 in	-1.1 in
X9	Rear surface of vehicle to upper trailing edge of left door	82.6 in	84.1 in	-1.5 in
X10	Rear surface of vehicle to lower trailing edge of right door	83.8 in	83.6 in	0.2 in
X11	Rear surface of vehicle to lower trailing edge of left door	83.8 in	84.0 in	-0.2 in
X12	Rear surface of vehicle to bottom of "A" post on right side	122.3 in	123.0 in	-0.7 in
X13	Rear surface of vehicle to bottom of "A" post on left side	122.0 in	123.0 in	-1.0 in
X14	Rear surface of vehicle to firewall - right side	138.7 in	138.0 in	0.7 in
X15	Rear surface of vehicle to firewall - left side	139.9 in	138.5 in	1.4 in
X16	Rear surface of vehicle to steering wheel center	106.8 in	105.0 in	1.8 in
X17	Center of steering column to "A" post	14.1 in	14.8 in	-0.7 in
X18	Center of steering column to headliner	18.0 in	16.2 in	1.8 in
X19	Rear surface of vehicle to right side of front bumper	180.5 in	167.5 in	13.0 in
X20	Rear surface of vehicle to left side of front bumper	179.5 in	167.8 in	11.7 in
X21	Length of engine block	19.3 in	19.3 in	0.0 in

Figure 8 Vehicle Target Locations

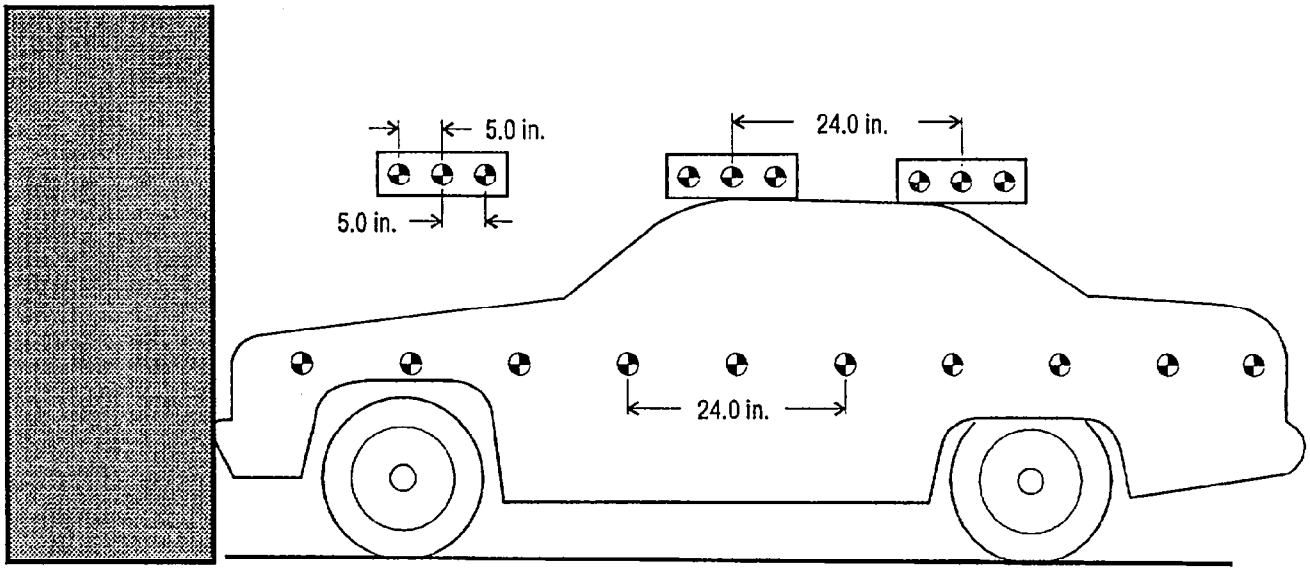


Figure 9 Dummy Measurement Locations for Front Seat Occupants

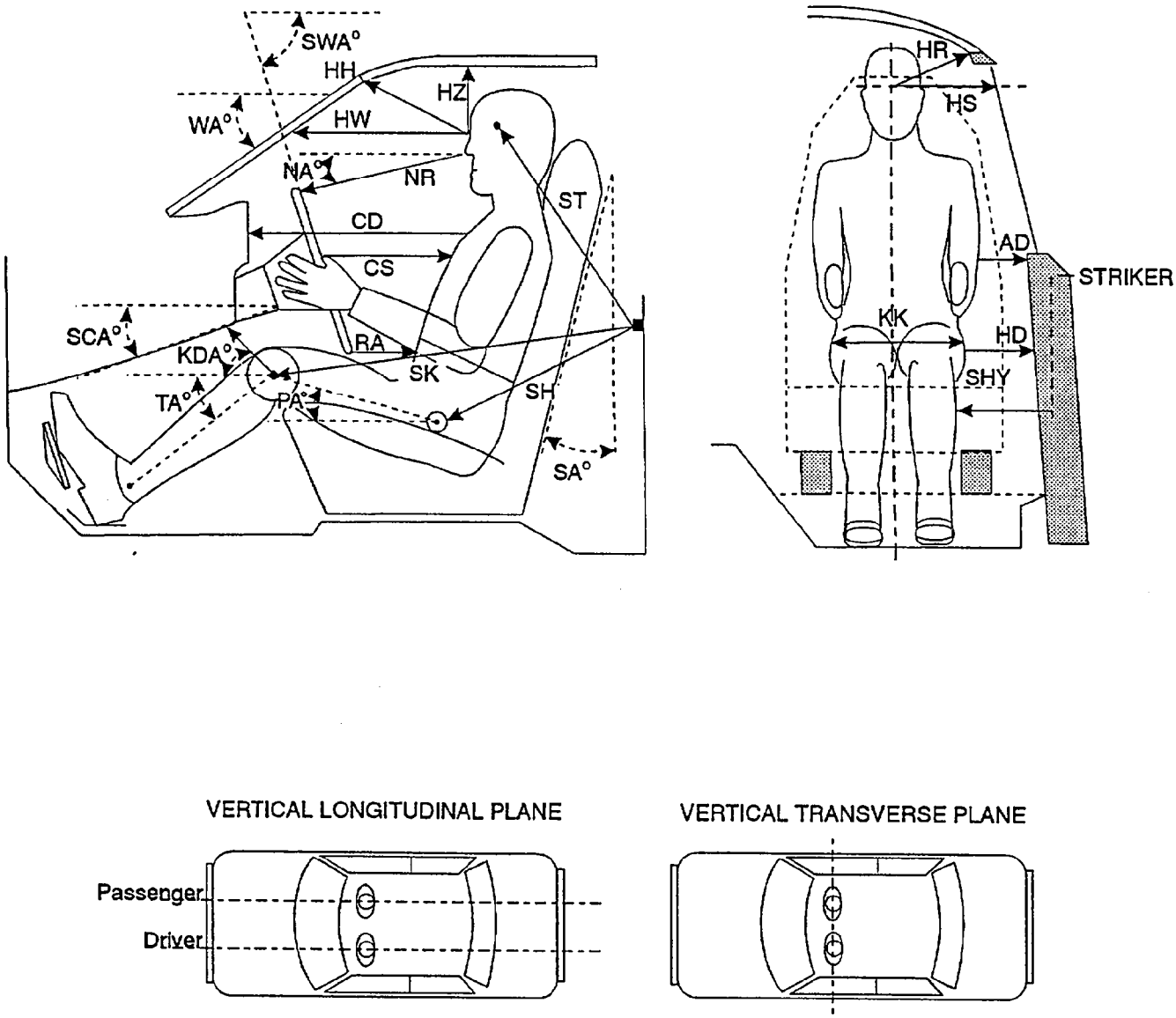


Table 12 Dummy Measurement Data for Front Seat Occupants

Designation	Type of Measurement	Driver (Serial #353)	Passenger (Serial #354)
WA	Windshield angle	30.5°	NA
SWA	Steering wheel angle	68°	NA
SCA	Steering column angle	22°	NA
SA	Seat back angle	18°	18°
HZ	Head to roof	6.1 in	6.0 in
HH	Head to header	14.3 in	14.3 in
HW	Head to windshield	20.6 in	22.5 in
HR	Head to side header	8.9 in	8.5 in
NR	Nose to rim	16.1 in	NA
NA	Nose to rim angle	15°	NA
CD	Chest to dash	21.8 in	23.6 in
CS	Steering wheel to chest	12.8 in	NA
RA	Rim to abdomen	6.5 in	NA
KDL	Left knee to dash	7.2 in	6.3 in
KDR	Right knee to dash	8.1 in	6.1 in
KDA	Outboard knee to dash angle	19°	21°
PA	Pelvic angle	16°	20°
TA	Tibial angle	40°	42°
KK	Knee to knee	12.3 in	10.8 in
ST[1]	Striker to head	16.4 in	15.8 in
	Striker to head angle	-76°	-83°
SK[1]	Striker to knee	25.6 in	26.2 in
	Striker to knee angle	14°	10°
SH[1]	Striker to H-point	13.3 in	13.9 in
	Striker to H-point angle	48°	41°
SHY	Striker to H-point (Y dir.)	9.8 in	9.8 in
HS	Head to side window	13.3 in	12.6 in
HD	H-point to door	5.8 in	6.4 in
AD	Arm to door	5.2 in	2.8 in

The seat back angle (SA°) is measured relative to vertical, all other angles are measured relative to horizontal.

[1] A negative angle indicates the measurement point was located above the striker.

Figure 10 Camera Positions

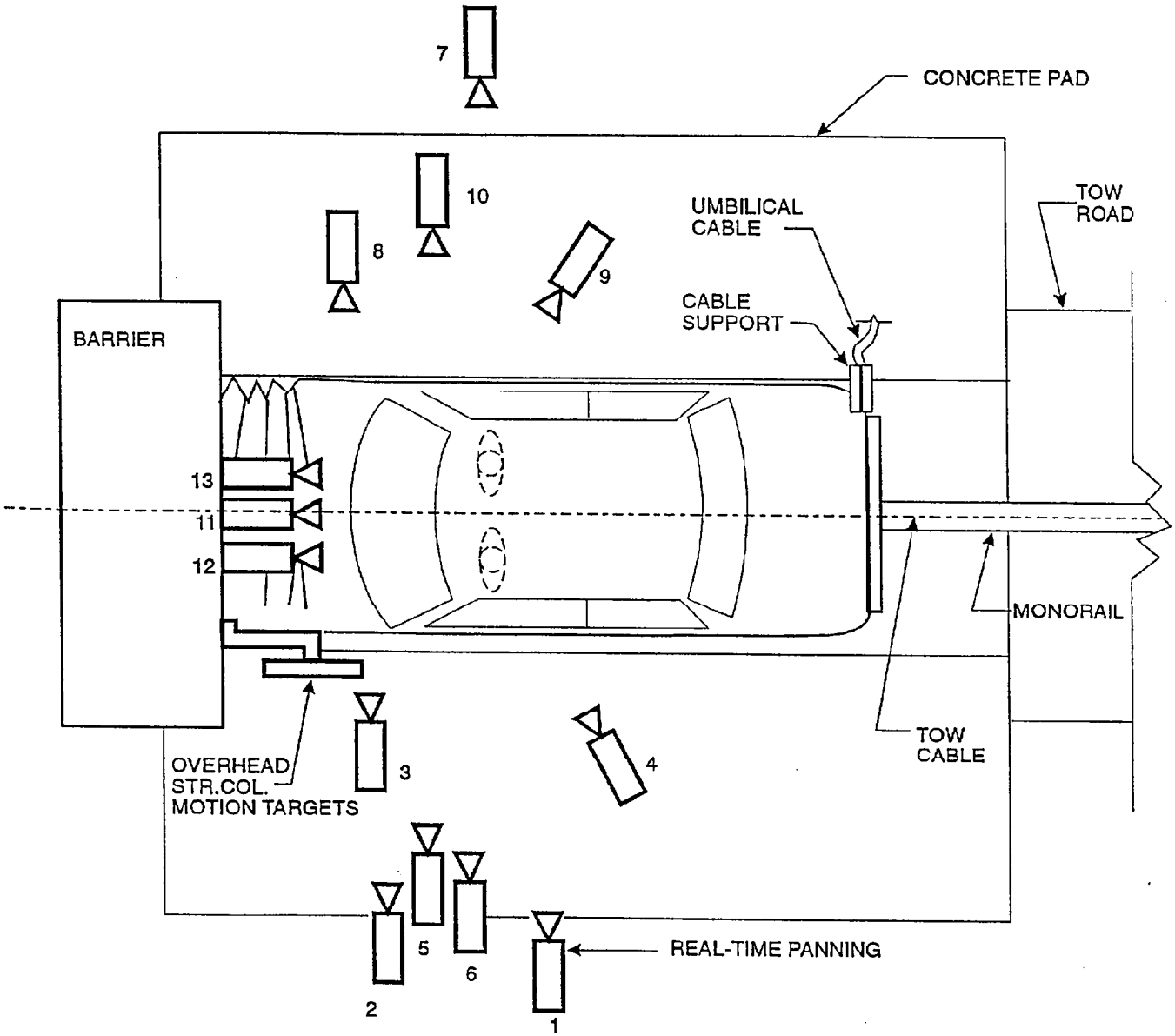


Figure 10 Camera Positions, Cont'd.

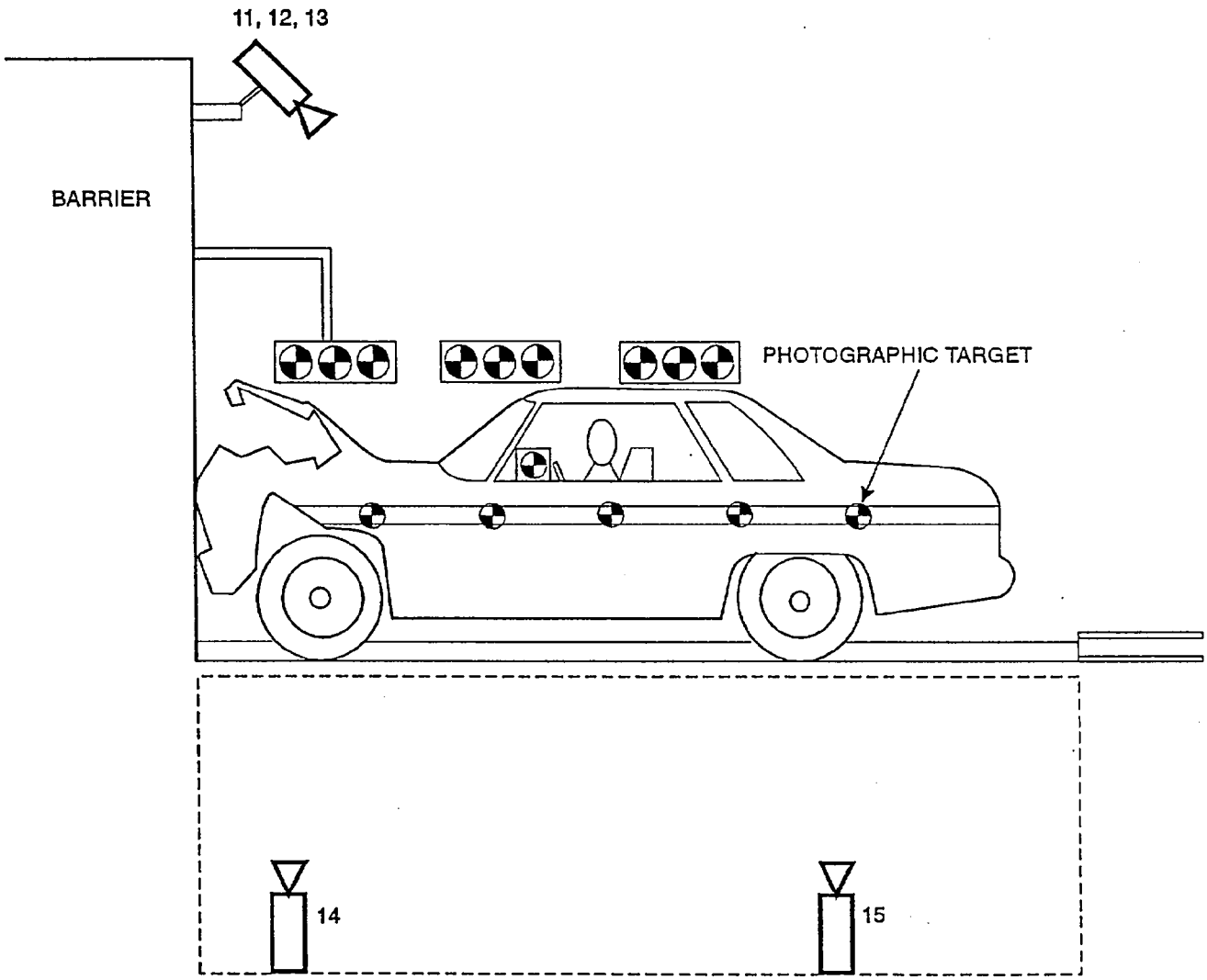


Table 13 Motion Picture Camera Locations

Vehicle year/make/model/body style: 1996/Volvo/850/4-door sedan

Test number: 951116

Camera Number	View	Camera Positions[1] X	Y	Z	Camera Angle[2]	Film Plane to Head Target	Camera Lens	Film Speed
1	Real-time panning	-142.0 in	504.0 in	61.0 in	NA	NA	16 mm	24 frames/s
2	Left vehicle crush	-41.5 in	295.0 in	44.0 in	-4°	284.0 in	25 mm	1002 frames/s
3	Left windshield intrusion	-53.0 in	309.4 in	42.3 in	0°	NA	50 mm	1008 frames/s
4	Driver kinematics	-157.3 in	116.0 in	87.0 in	-27°	90.0 in	25 mm	973 frames/s
5	Steering column motion	-108.0 in	286.0 in	103.0 in	-14°	NA	25 mm	1005 frames/s
6	Steering column motion	-108.0 in	286.0 in	75.1 in	-9°	NA	25 mm	995 frames/s
7	Right overall	-81.3 in	-266.4 in	37.1 in	-2°	NA	13 mm	1002 frames/s
8	Right windshield intrusion	-38.1 in	-306.1 in	44.0 in	0°	NA	50 mm	1012 frames/s
9	Passenger kinematics	-152.1 in	-116.0 in	87.0 in	-26°	91.0 in	25 mm	1000 frames/s
10	Passenger kinematics	-38.8 in	-293.0 in	45.3 in	-4°	286.0 in	25 mm	1000 frames/s
11	Windshield front view	-6.0 in	0.0 in	89.0 in	-40°	NA	13 mm	1005 frames/s
12	Driver - front view	-6.8 in	14.5 in	93.0 in	-50°	NA	17 mm	1002 frames/s
13	Passenger - front view	-4.5 in	-13.8 in	93.0 in	-50°	NA	17 mm	998 frames/s
14	Pit - front position	-50.5 in	0.0 in	-92.4 in	90°	NA	13 mm	NA[3] frames/s
15	Pit - rear position	-99.3 in	0.0 in	-99.0 in	90°	NA	13 mm	998 frames/s
16	Real-time documentation	NA	NA	NA	NA	NA	12-120 mm	24 frames/s

1 +X: Film plane forward of barrier face
+Y: Film plane to left of monorail centerline
+Z: Film plane above ground level

2 +Angle: Film plane angled upward from horizontal plane

3 The camera did not run as a result of shredding its film on start-up.

Appendix A

Photographs

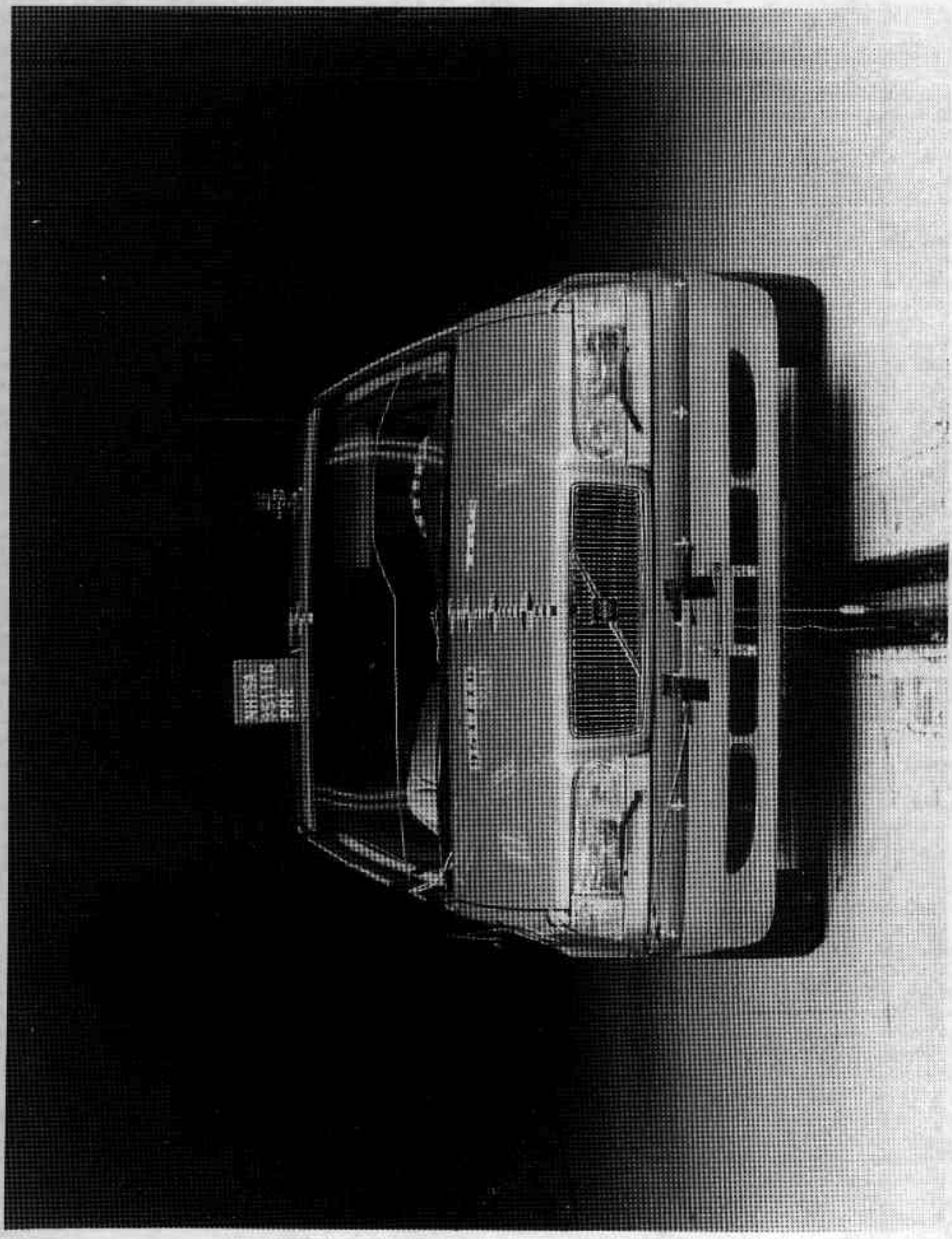


Figure A-1. Pre-Test Front View

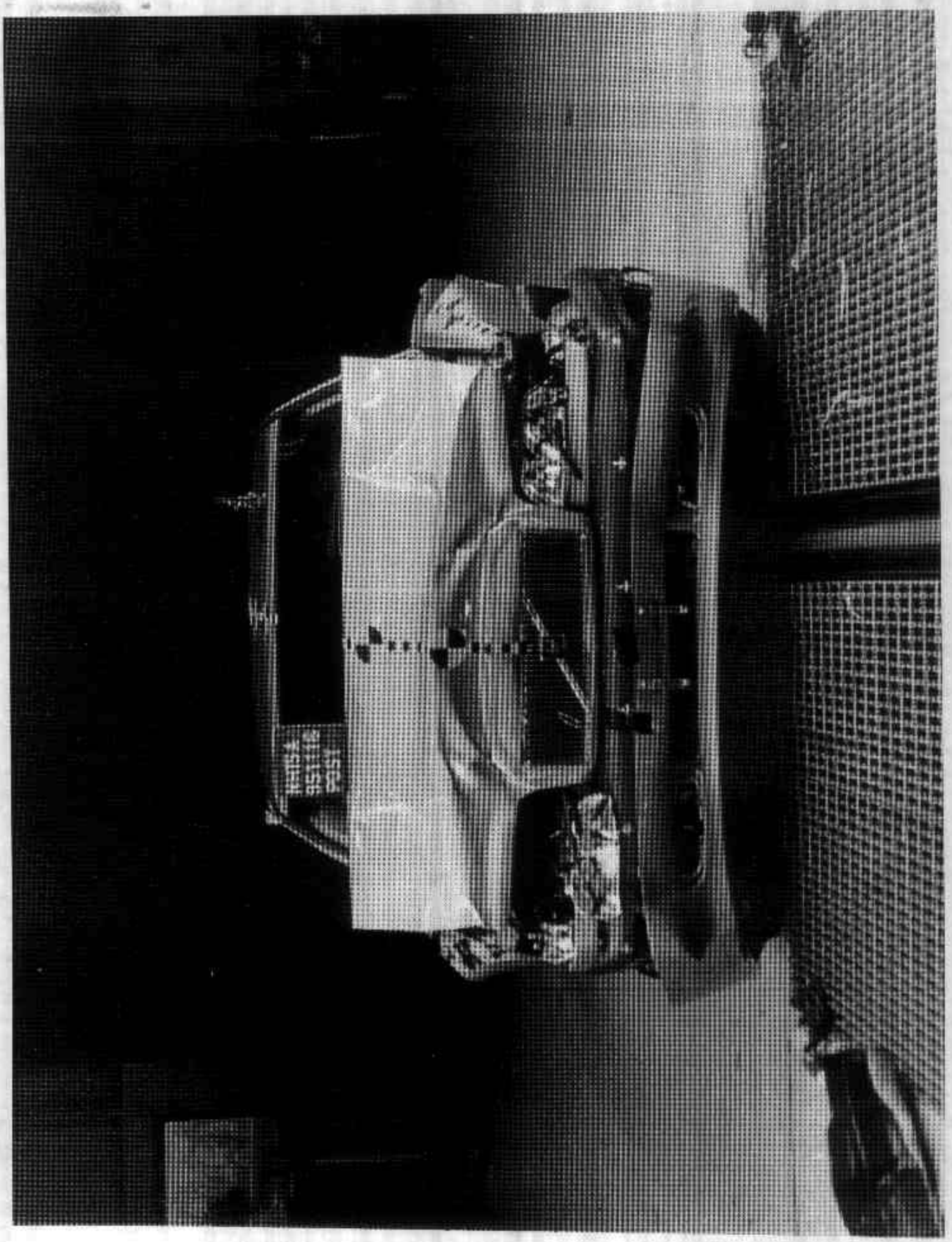


Figure A-2. Post-Test Front View

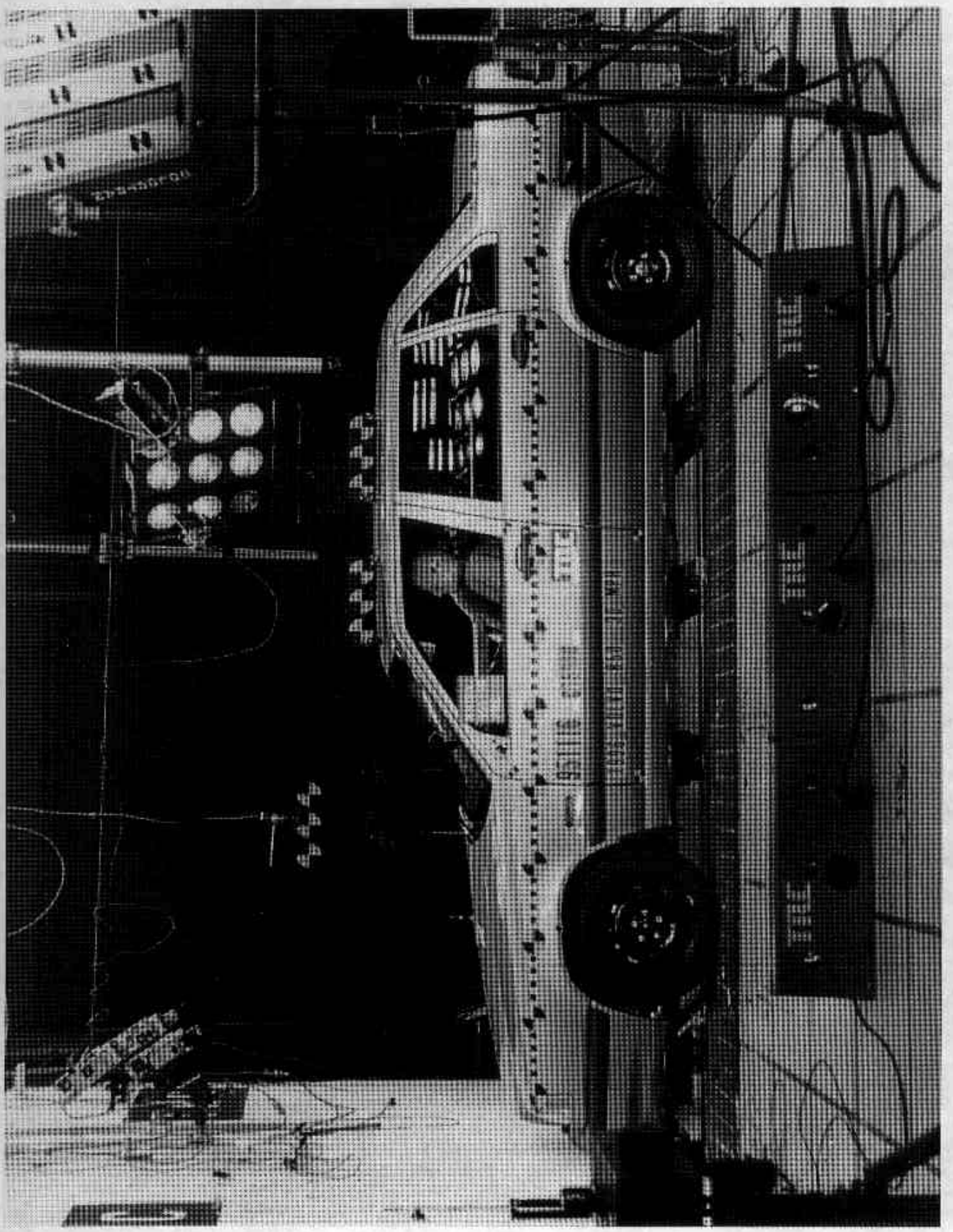


Figure A-3. Pre-Test Left Side View

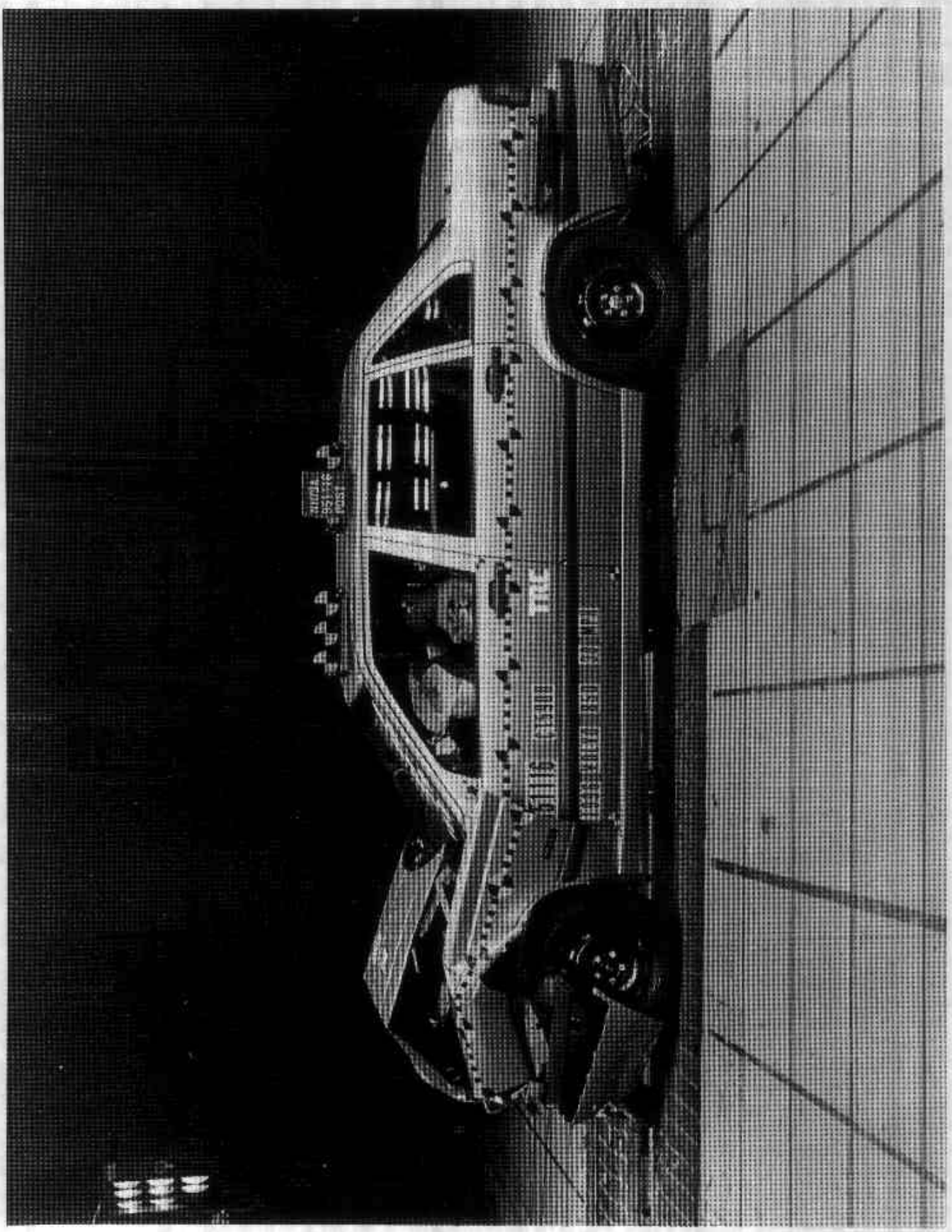


Figure A-4. Post-Test Left Side View

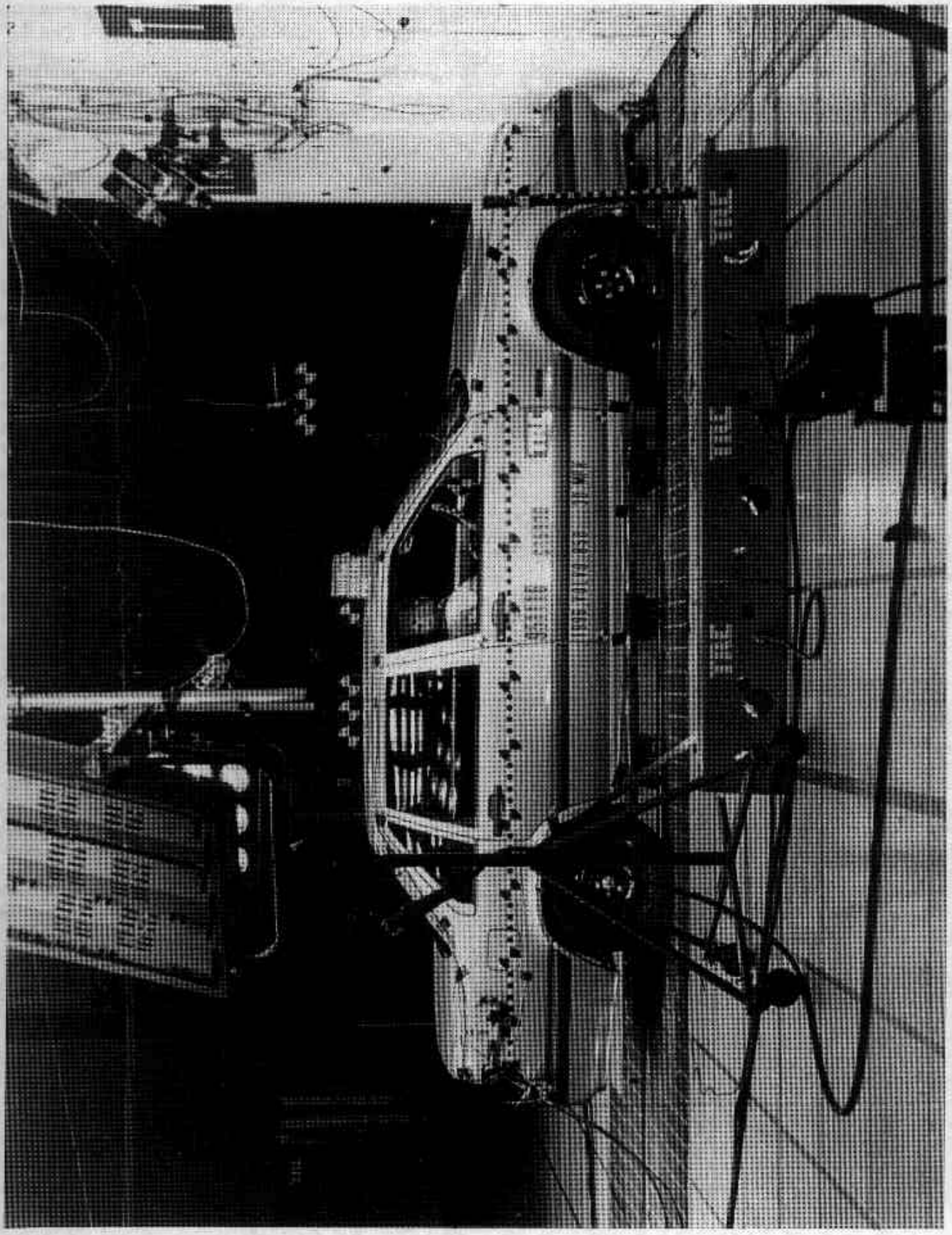


Figure A-5. Pre-Test Right Side View

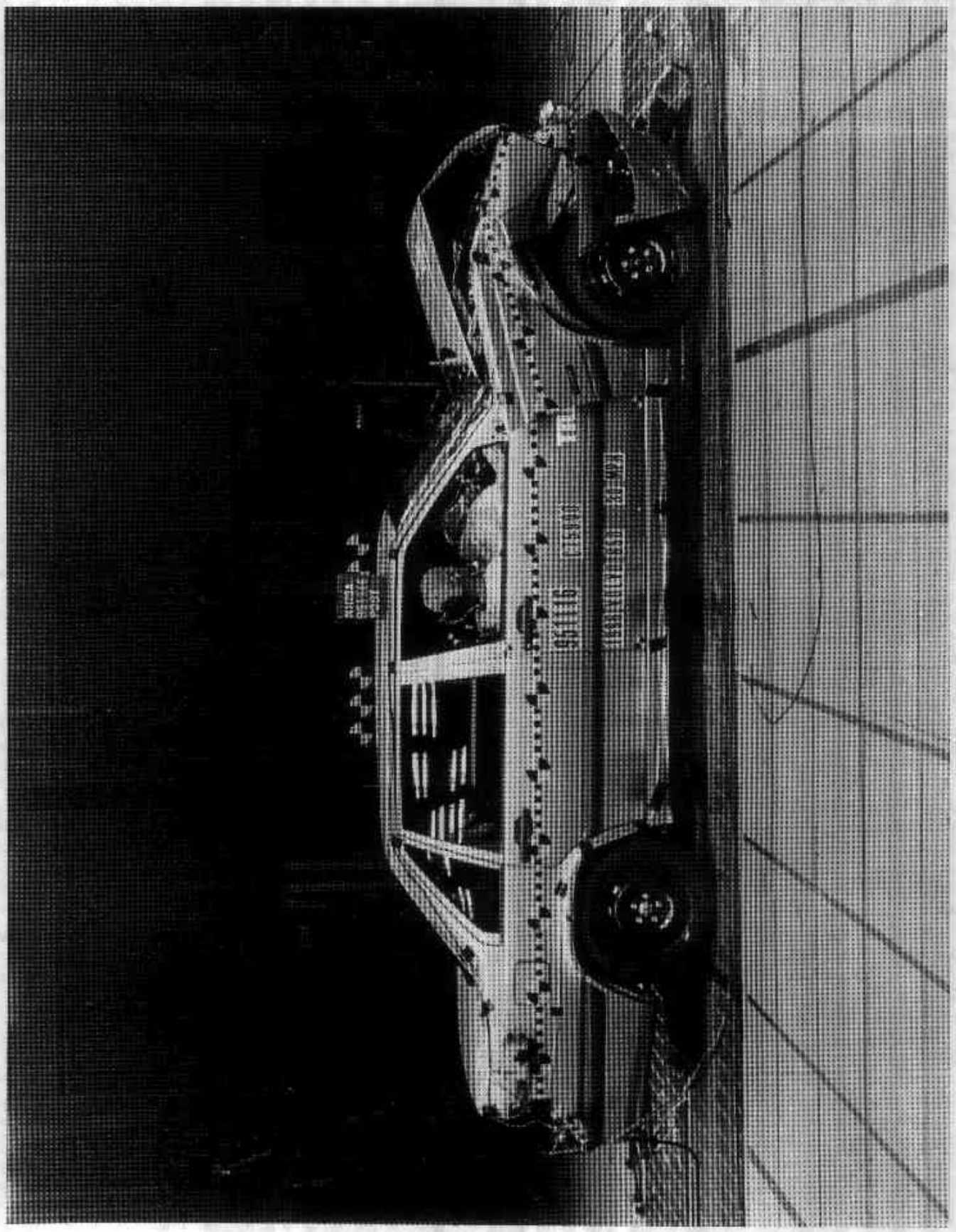


Figure A-6. Post-Test Right Side View

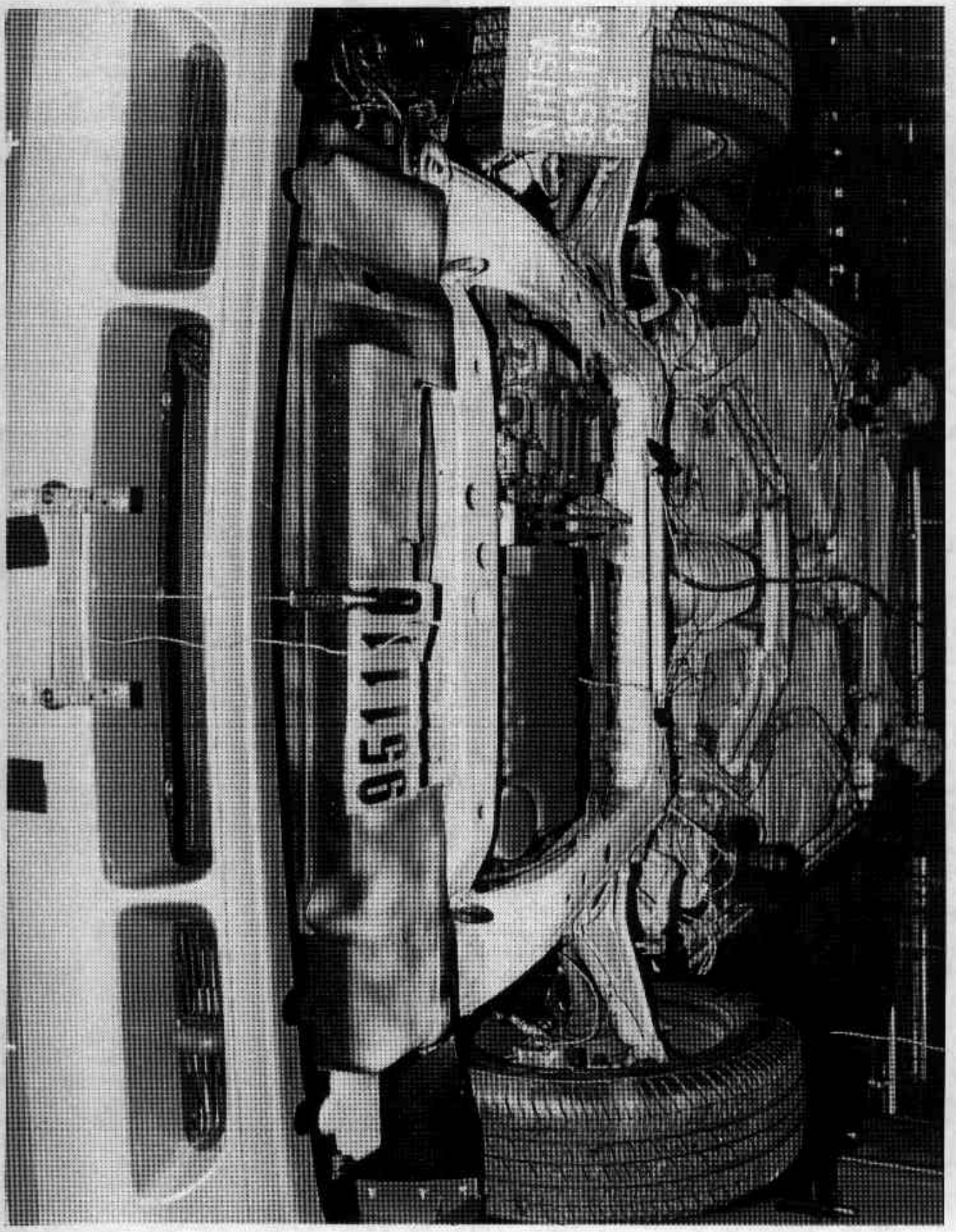


Figure A-7. Pre-Test Front Underbody View

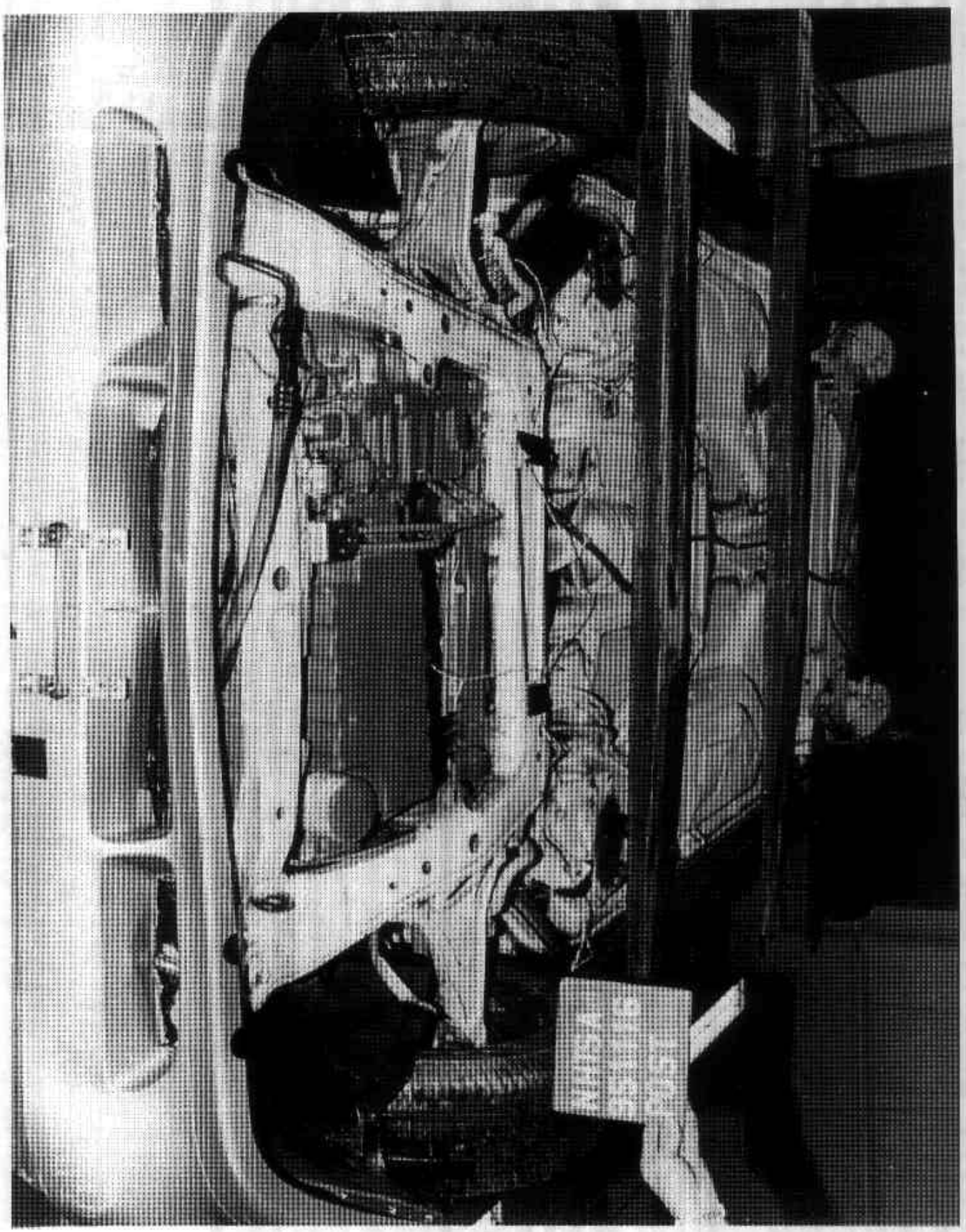


Figure A-8. Post-Test Front Underbody View

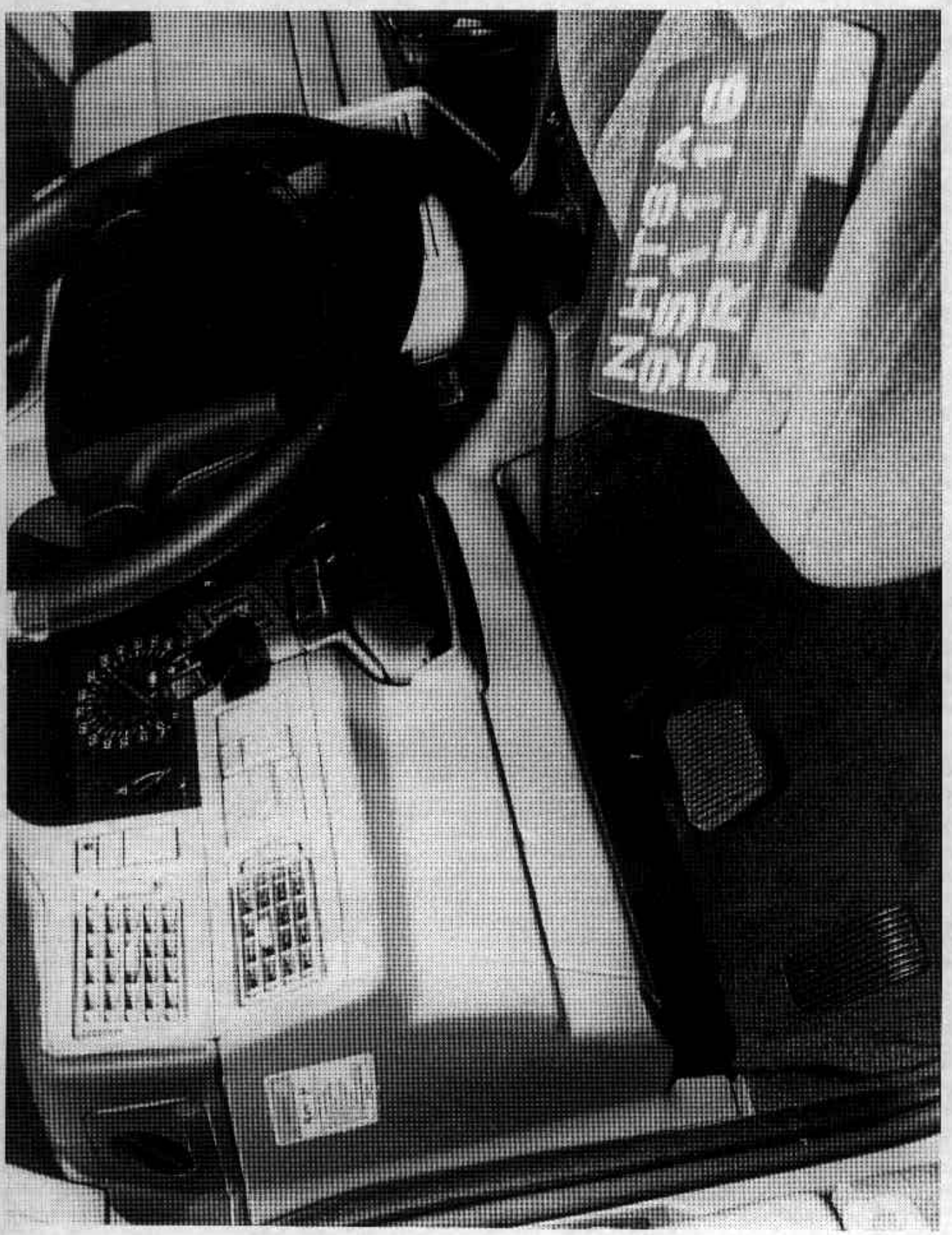


Figure A-9. Pre-Test Driver's Knee Bolster View

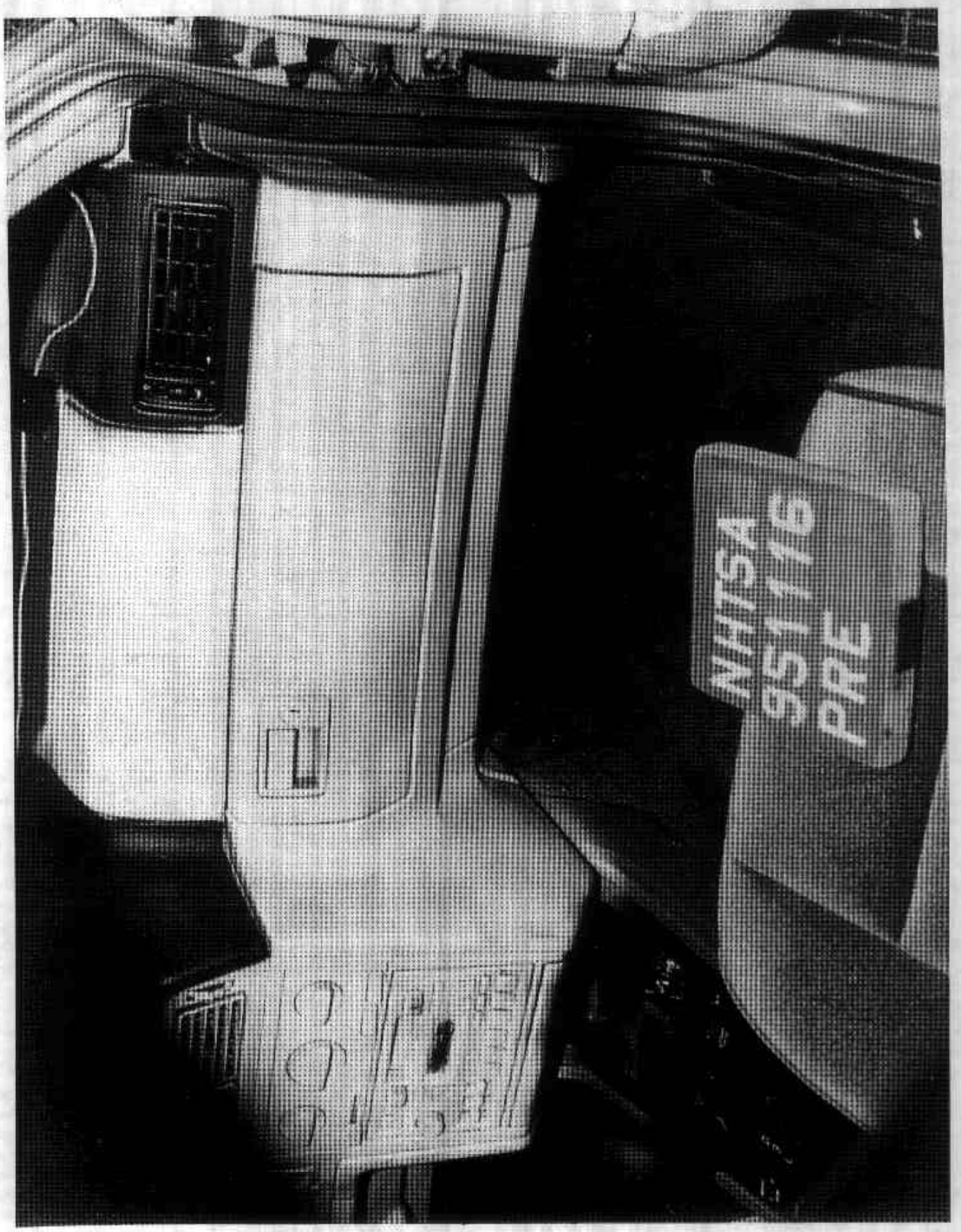


Figure A-10. Pre-Test Passenger's Knee Bolster View

Figure A-11. Pre-Test Driver's Seat Location View

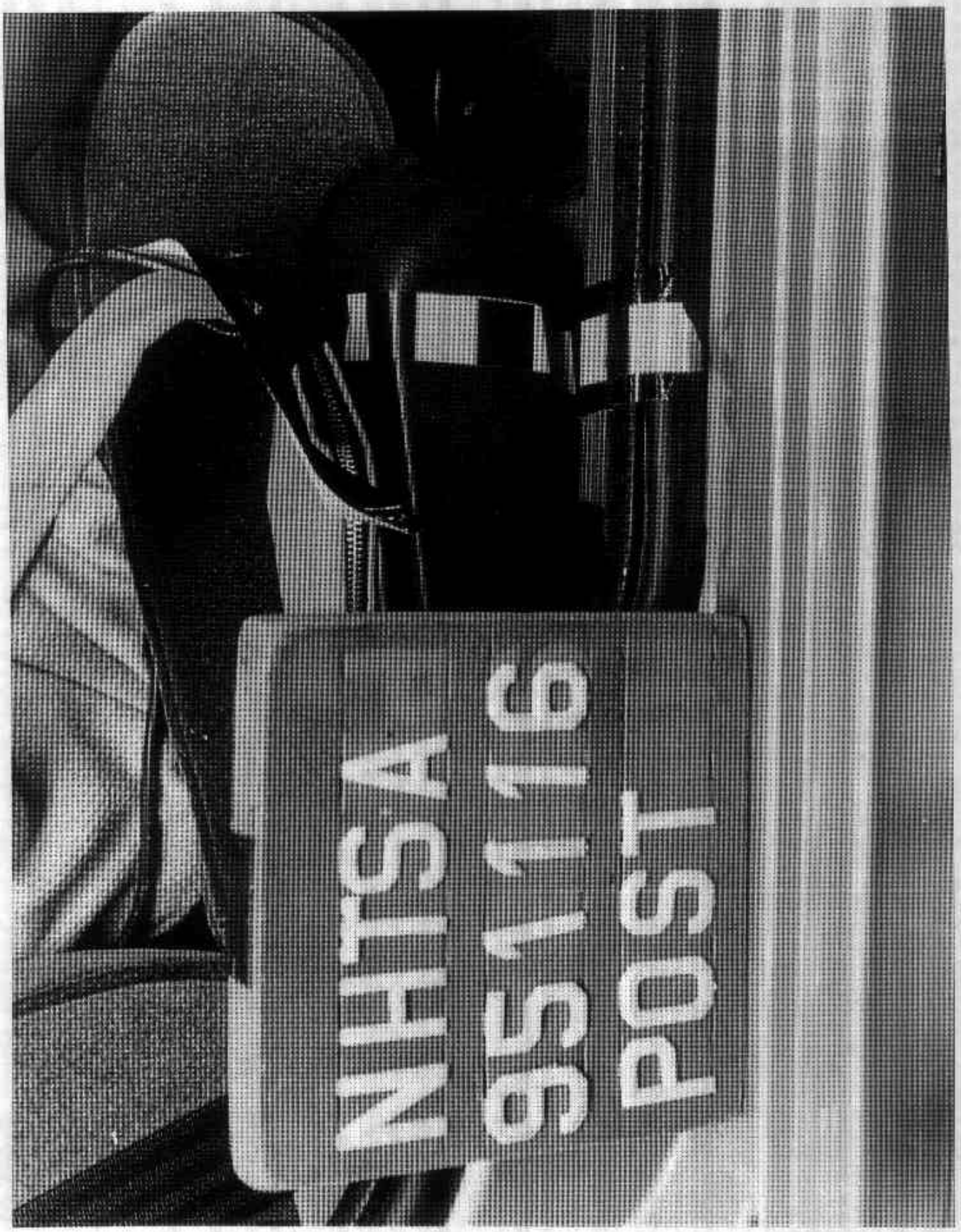


Figure A-12. Pre-Test Passenger's Seat Location View

Figure A-13. Pre-Test Steering Column at Firewall View - Interior

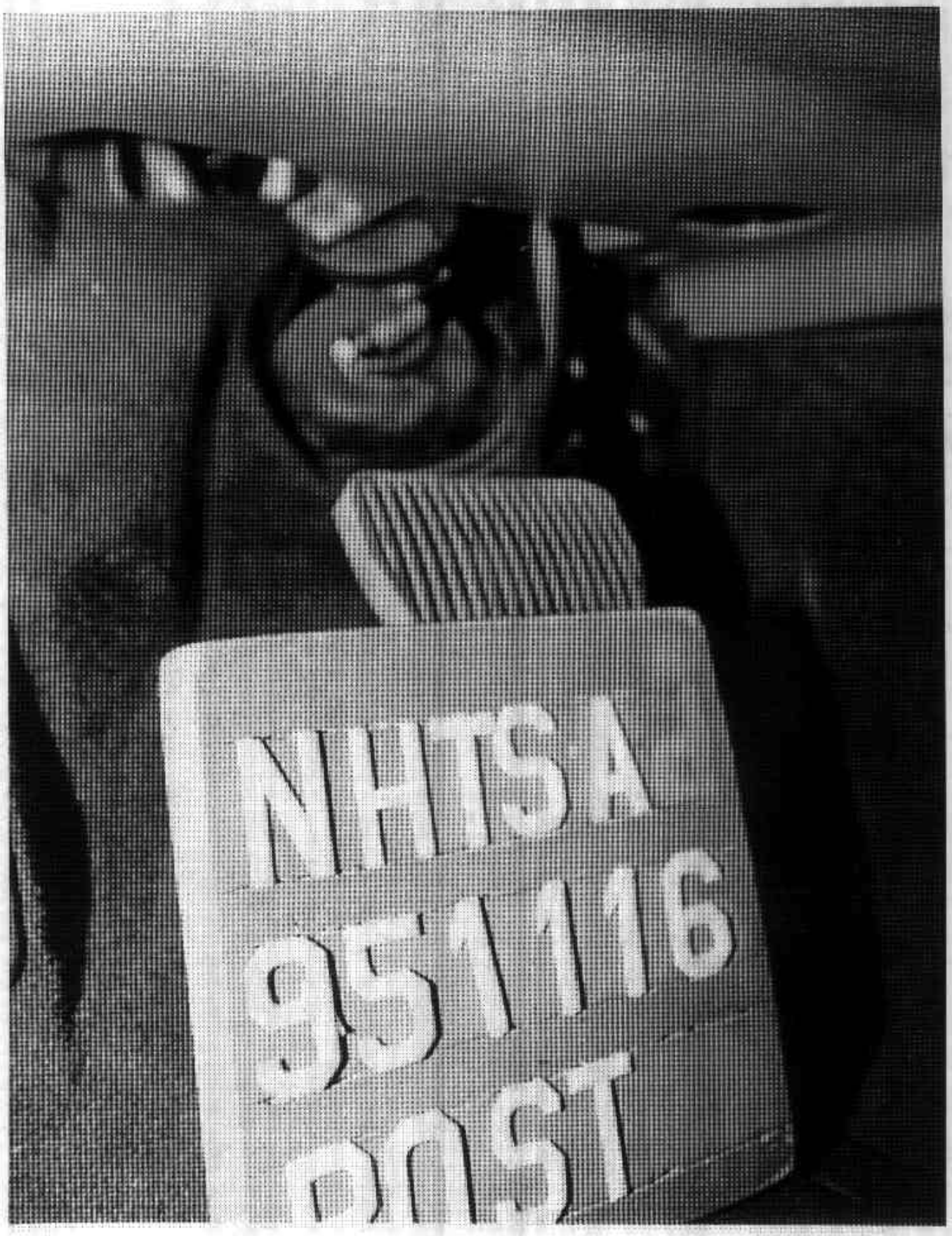


Figure A-14. Post-Test Steering Column at Firewall View - Interior

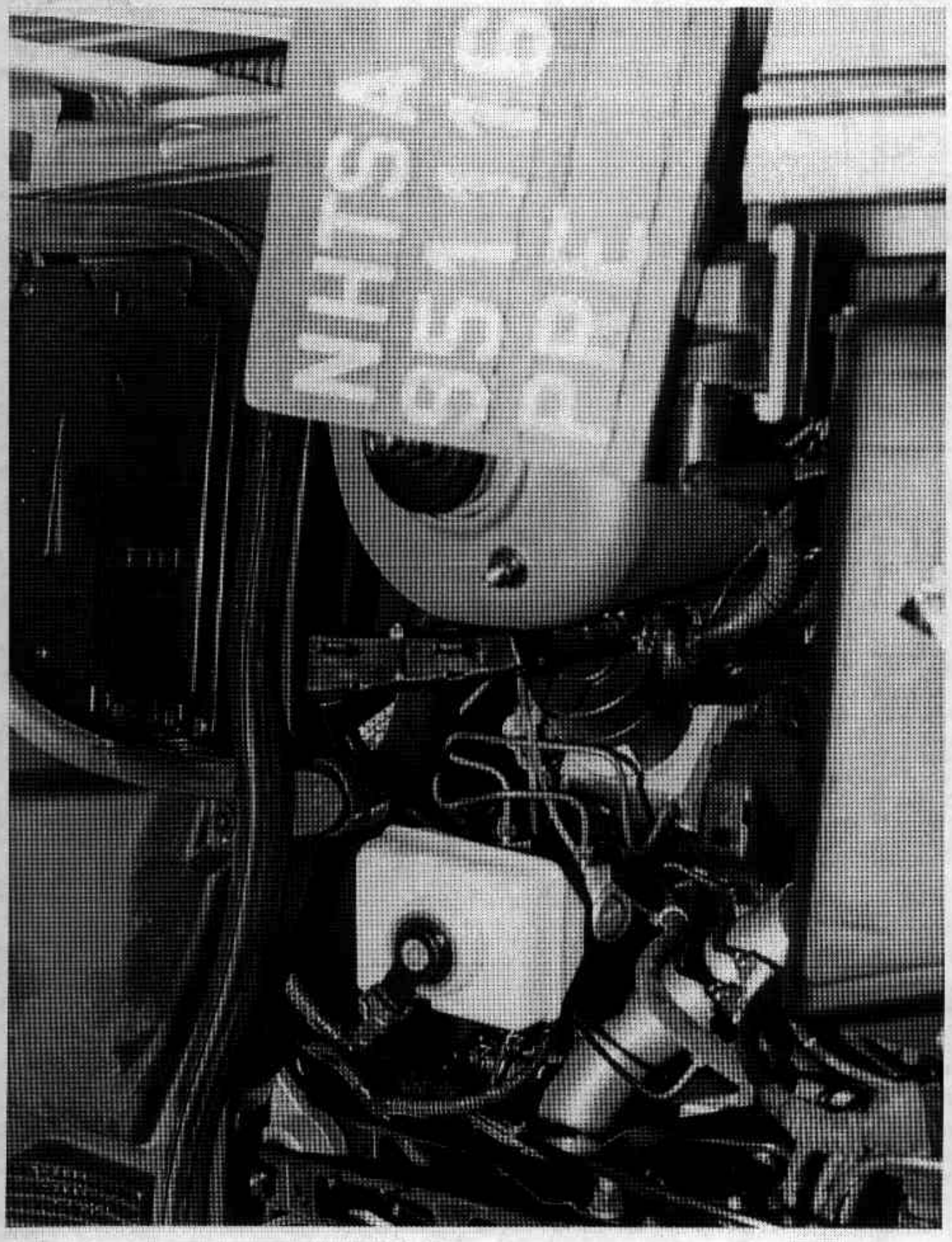


Figure A-15. Pre-Test Steering Column at Firewall View - Exterior

Figure A-16. Post-Test Steering Column at Firewall View - Exterior

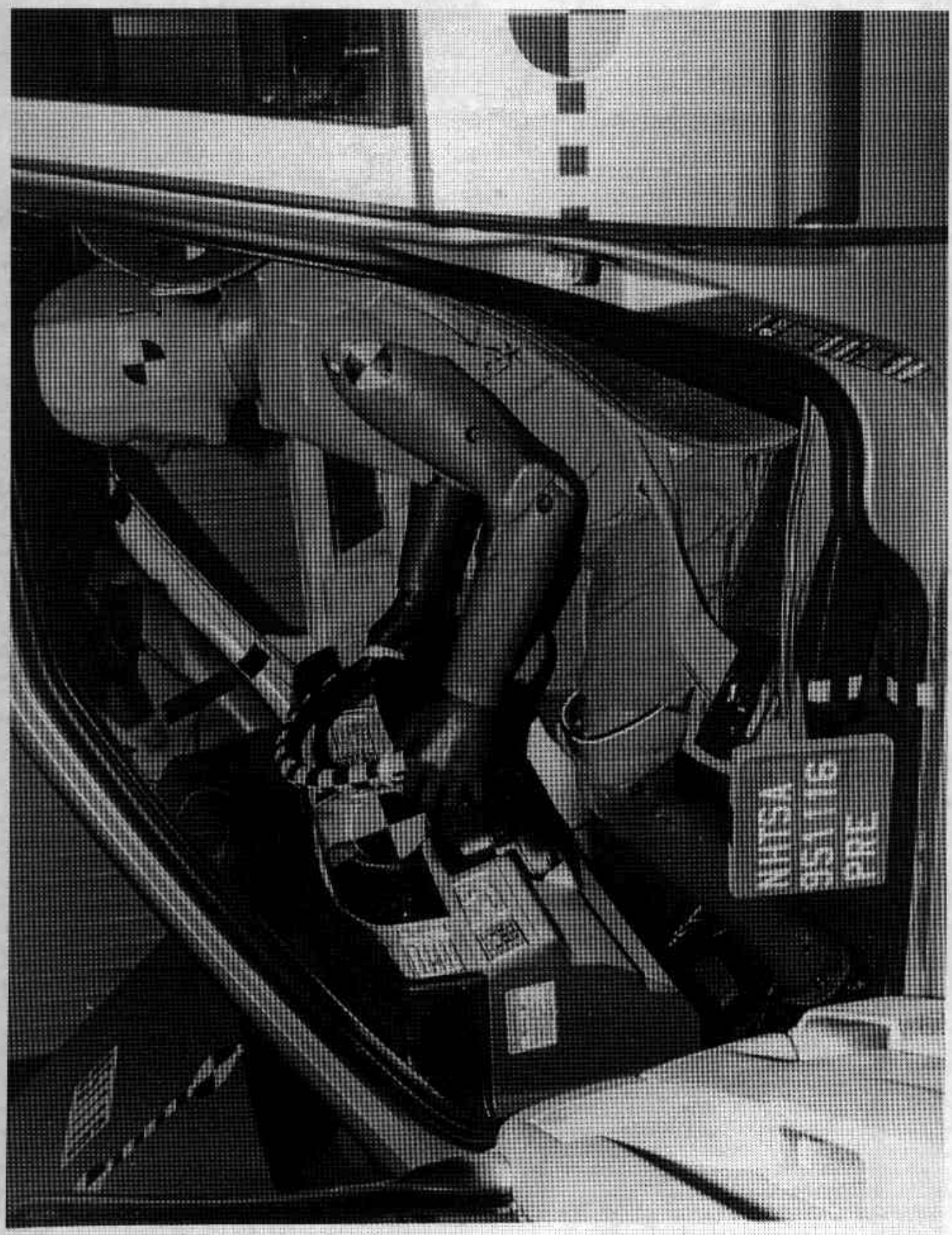


Figure A-17. Pre-Test Driver Dummy & Vehicle Interior View

Figure A-18. Post-Test Driver Dummy & Vehicle Interior View

Figure A-20. Post-Test Passenger Dummy & Vehicle Interior View

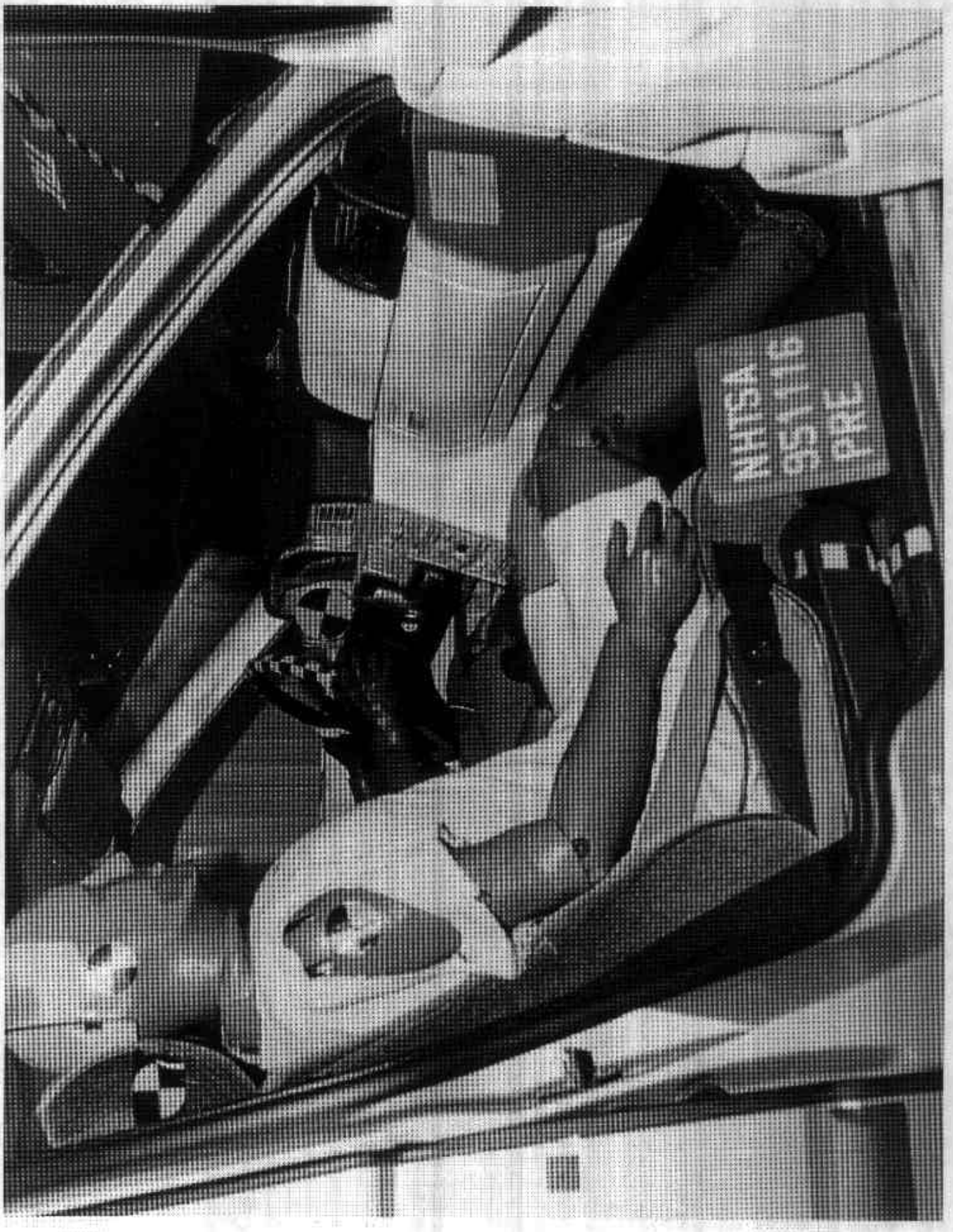


Figure A-19. Pre-Test Passenger Dummy & Vehicle Interior View

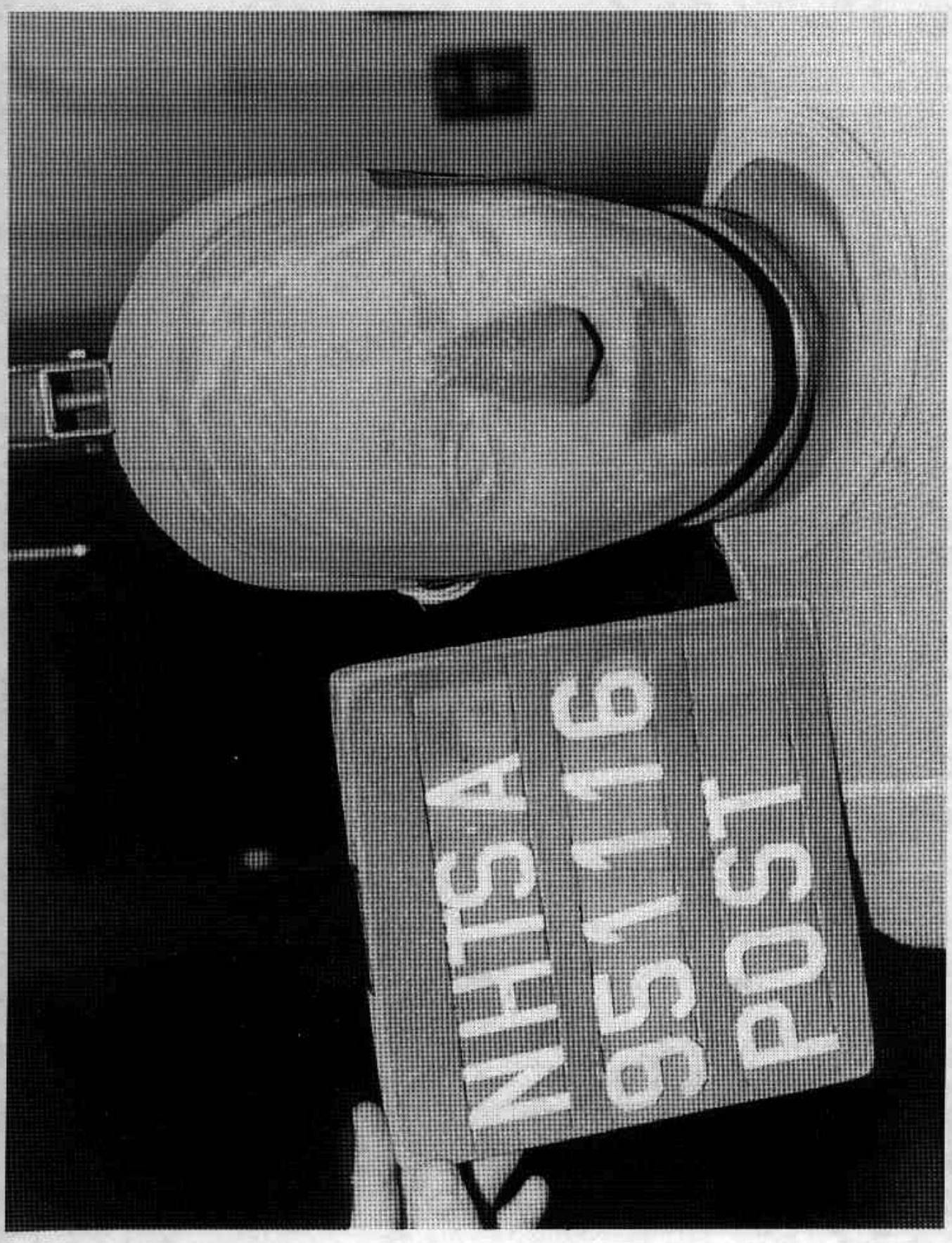


Figure A-21. Post-Test Driver Dummy Head Contact - View 1

Figure A-22. Post-Test Driver Dummy Head Contact - View 2

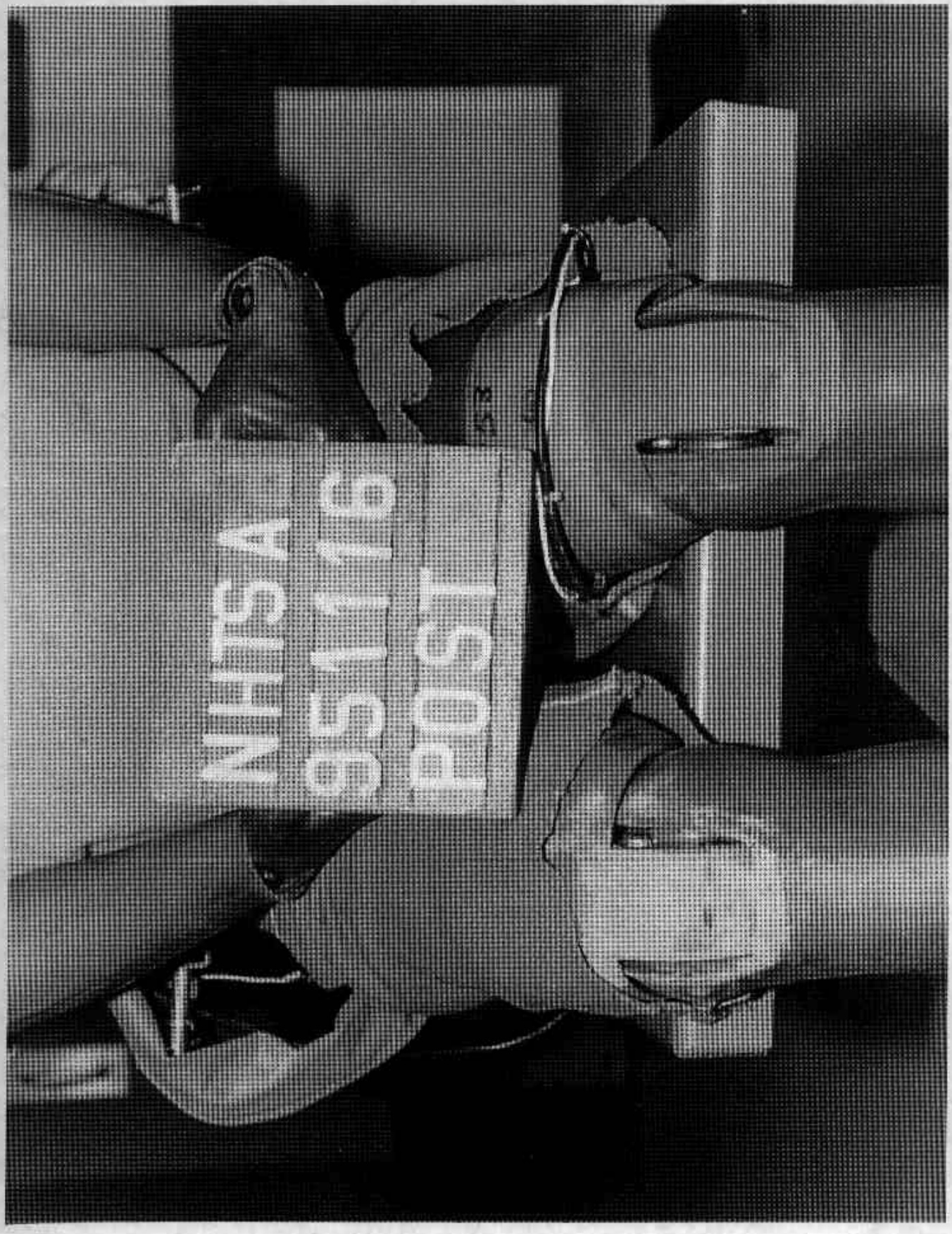


Figure A-23. Post-Test Driver Dummy Knee Contact - View 1

Figure A-24. Post-Test Driver Dummy Knee Contact - View 2

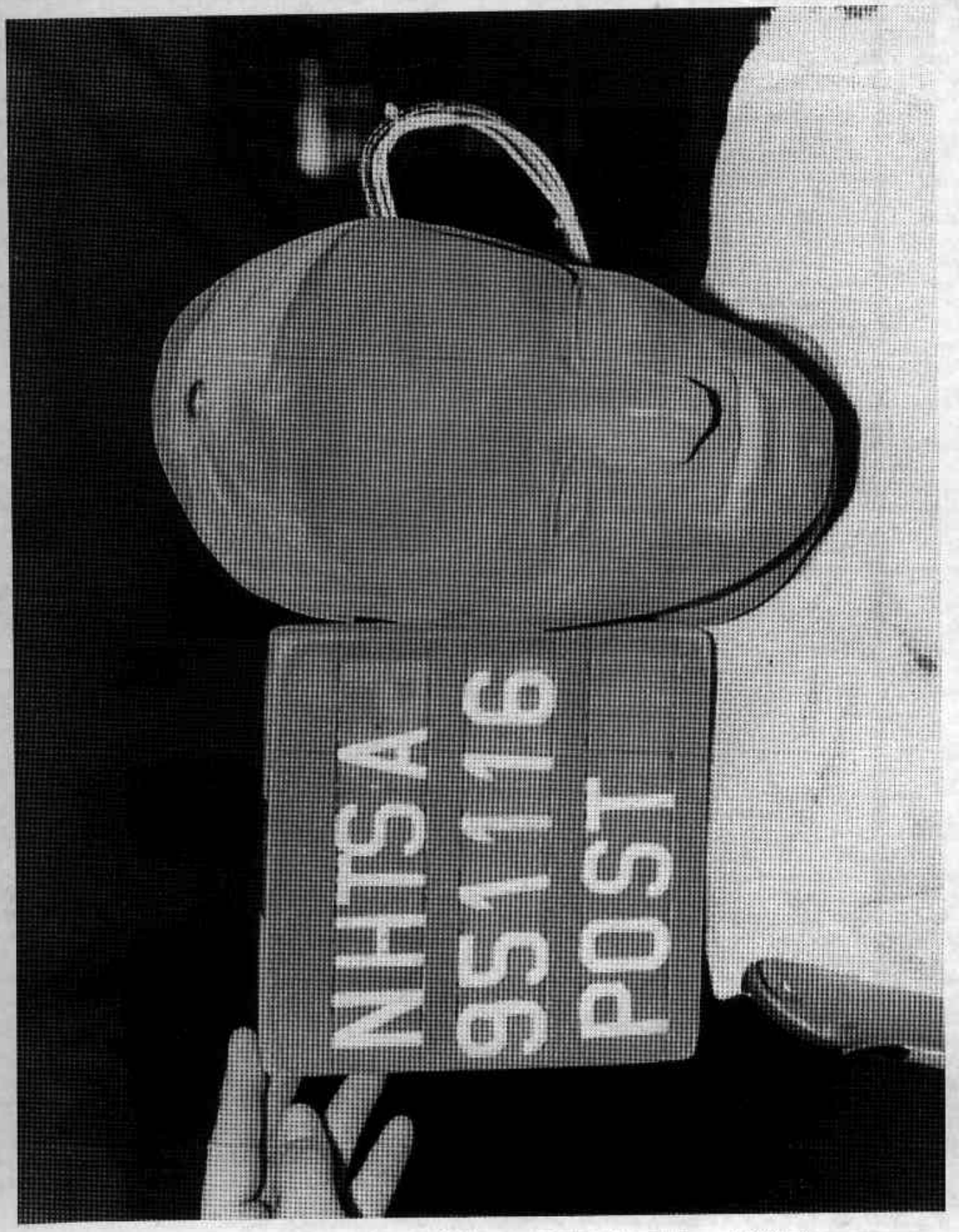


Figure A-25. Post-Test Passenger Dummy Head Contact - View 1

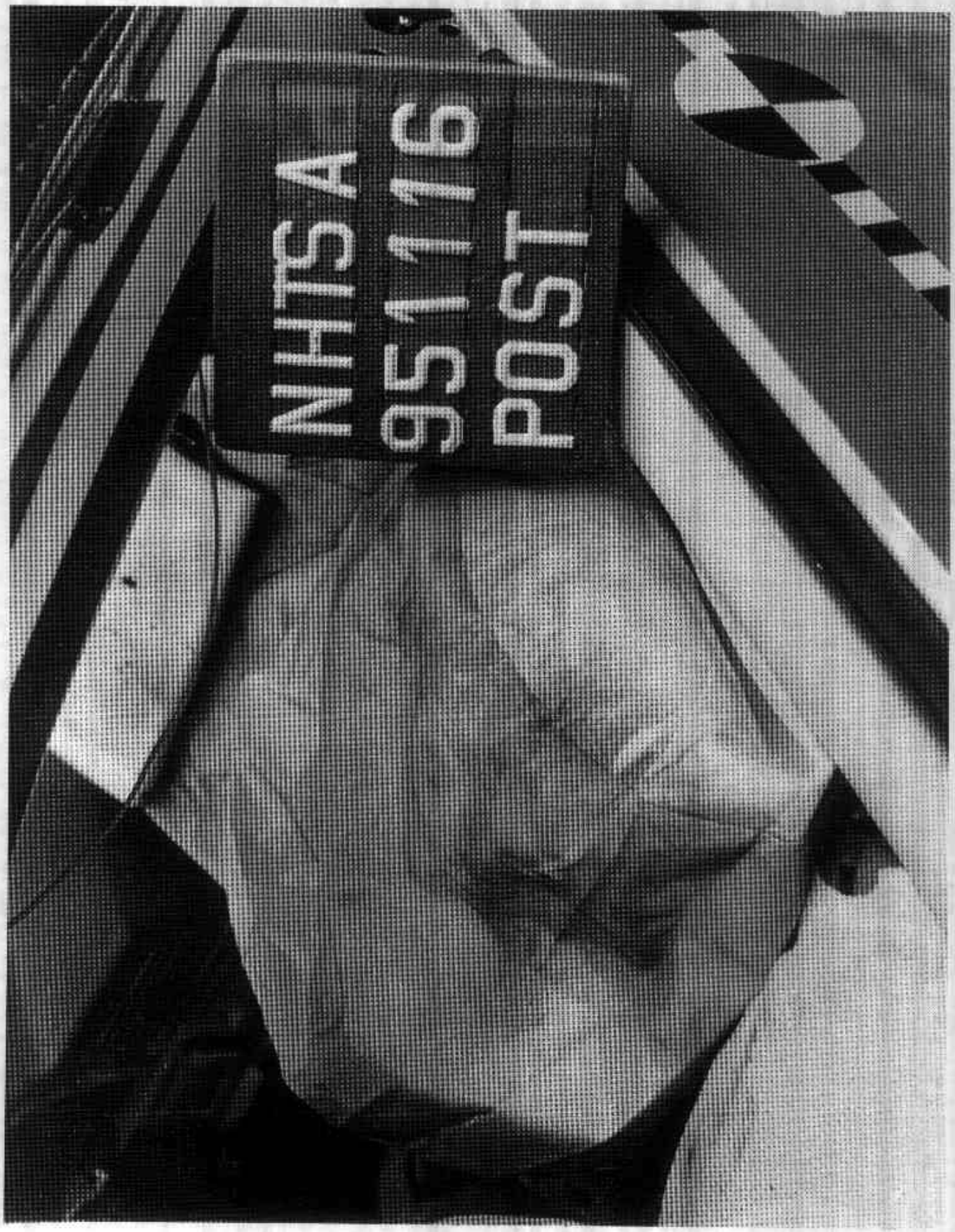


Figure A-26. Post-Test Passenger Dummy Head Contact - View 2

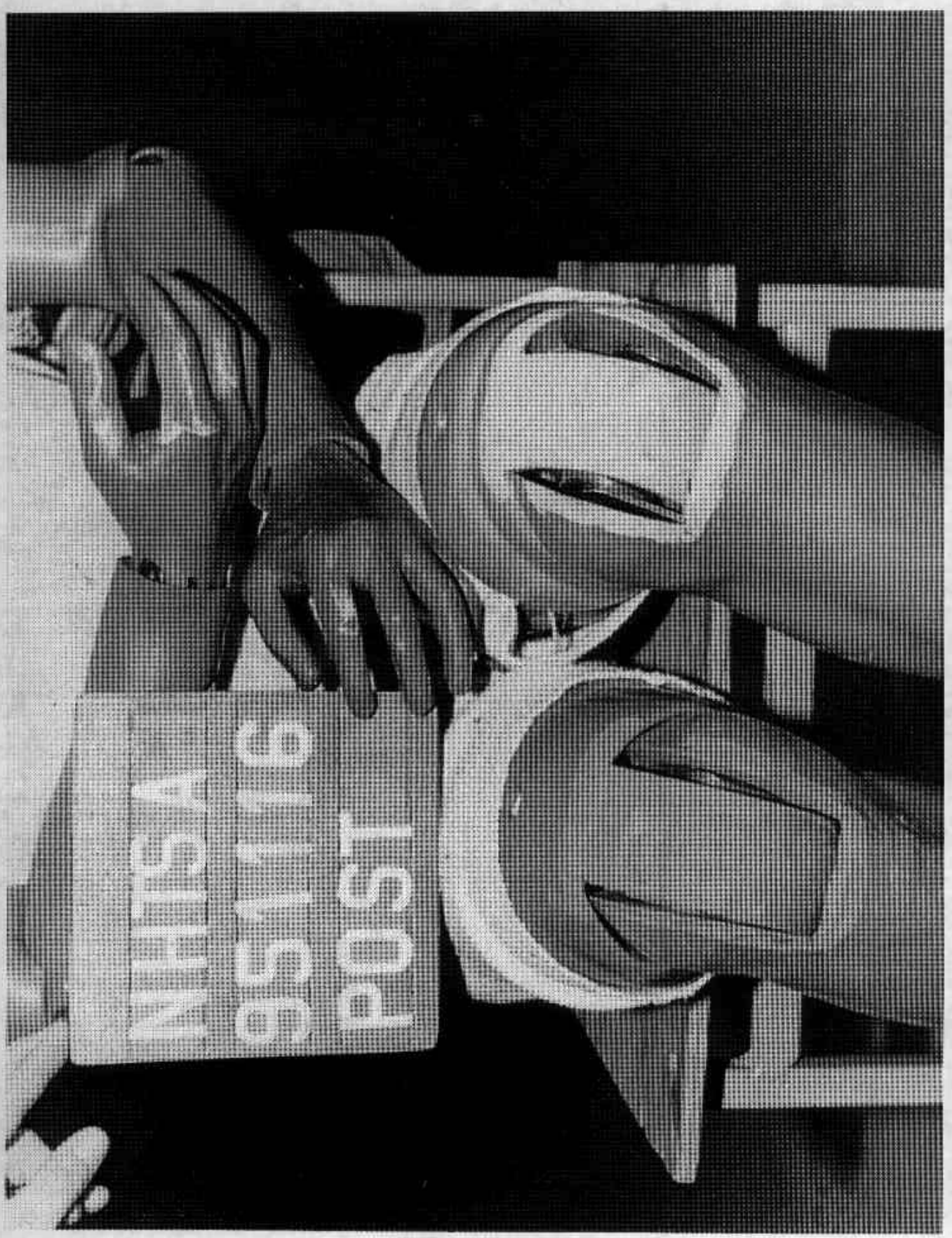


Figure A-27. Post-Test Passenger Dummy Knee Contact - View 1

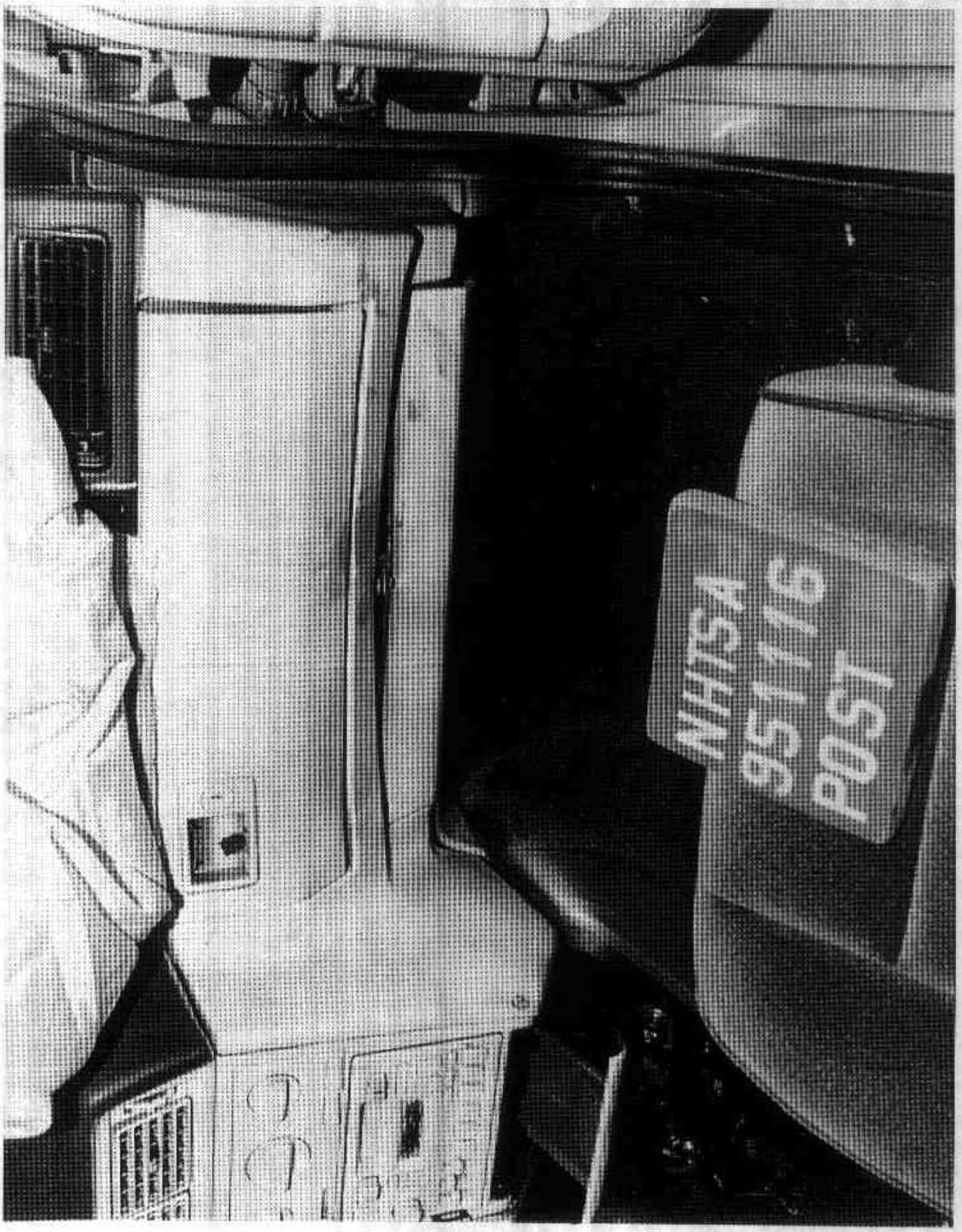


Figure A-28. Post-Test Passenger Dummy Knee Contact - View 2

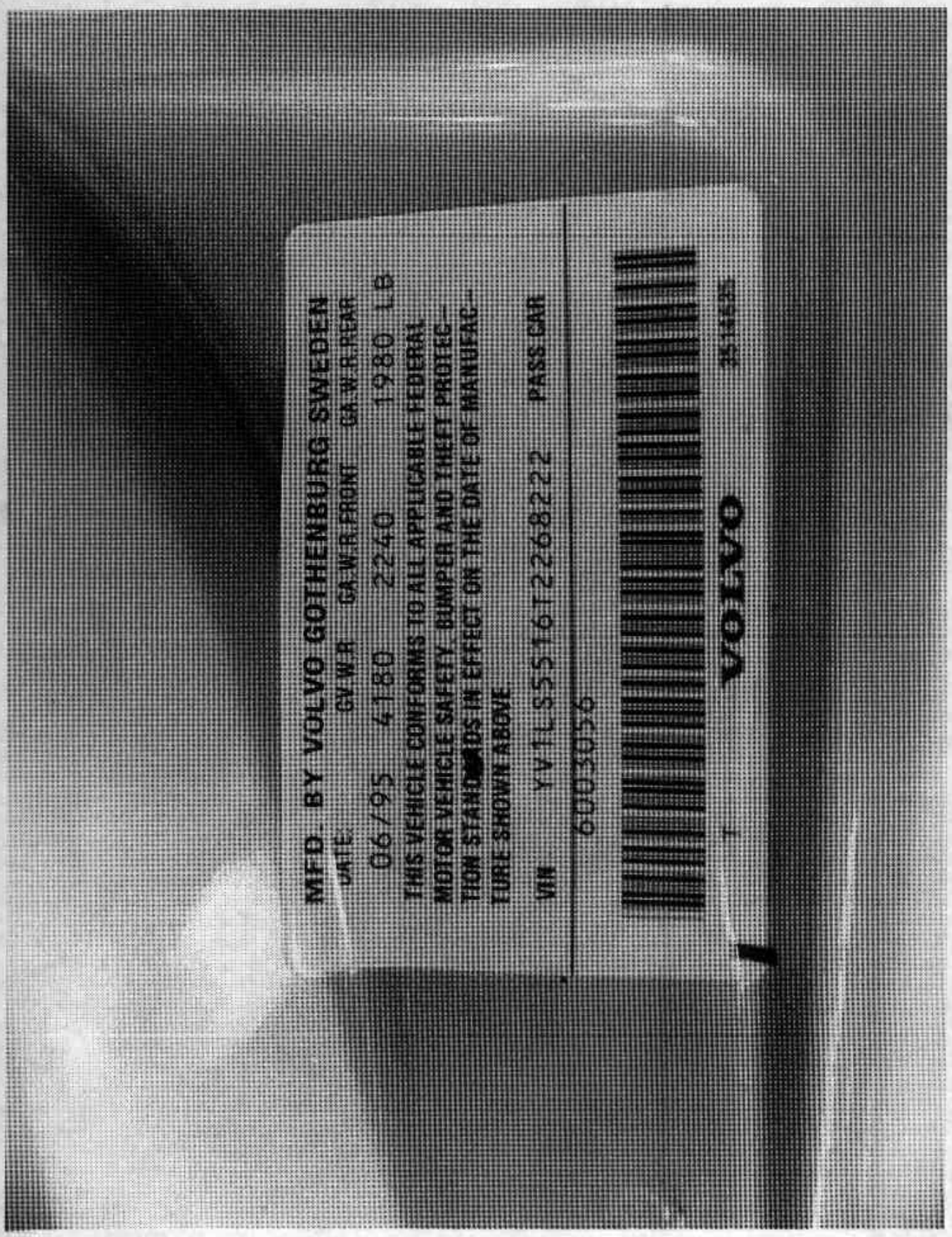


Figure A-29. Pre-Test Vehicle Certification Label View

Figure A-30. Pre-Test Recommended Tire Pressure View

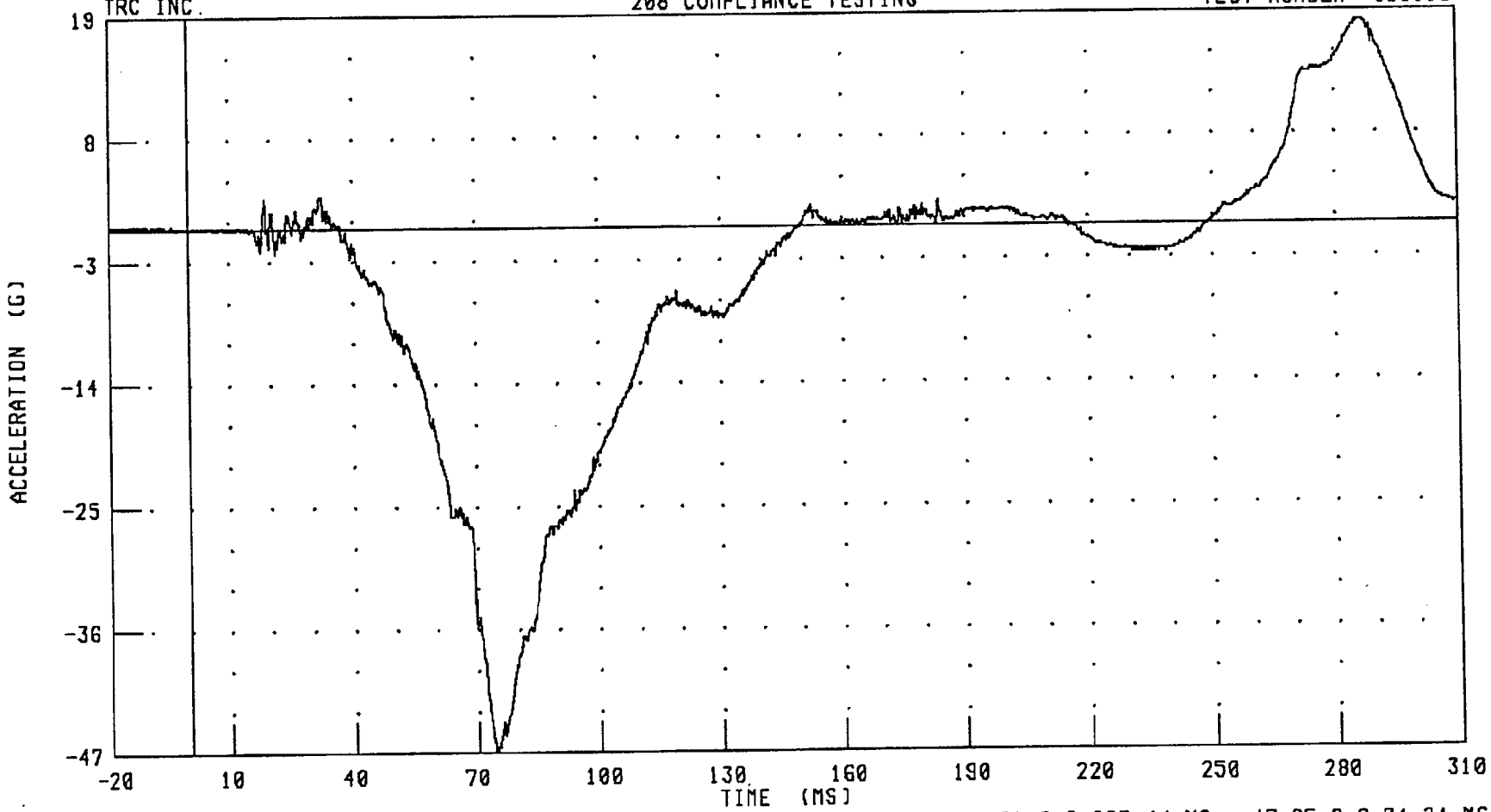
Appendix B

Data Plots

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER HEAD X-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

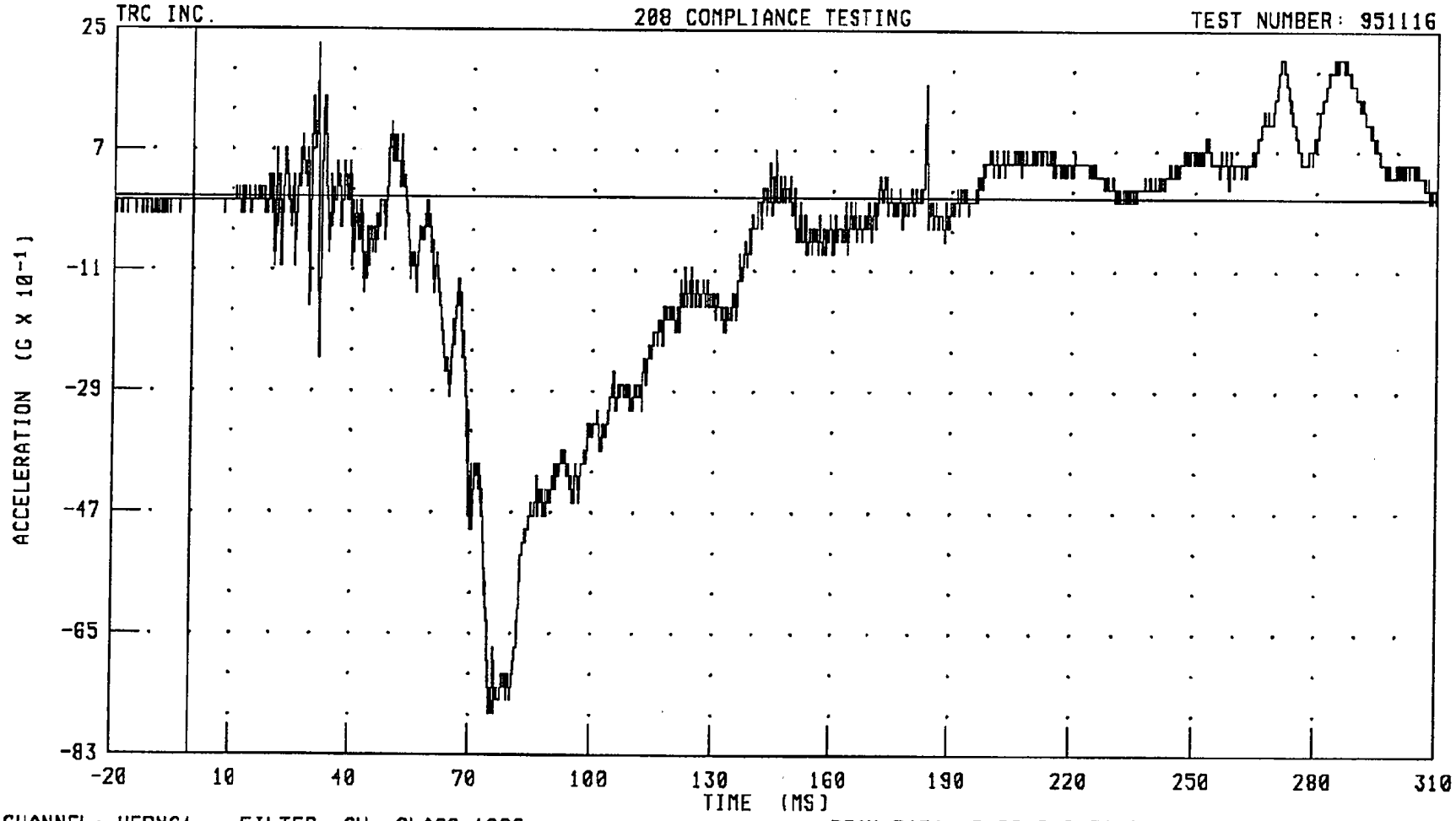
TEST NUMBER: 951116



CHANNEL: HEDXG1 FILTER: CH. CLASS 1000

PEAK DATA: 18.01 G @ 285.44 MS; -47.05 G @ 74.24 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER HEAD Y-AXIS ACCELERATION
208 COMPLIANCE TESTING



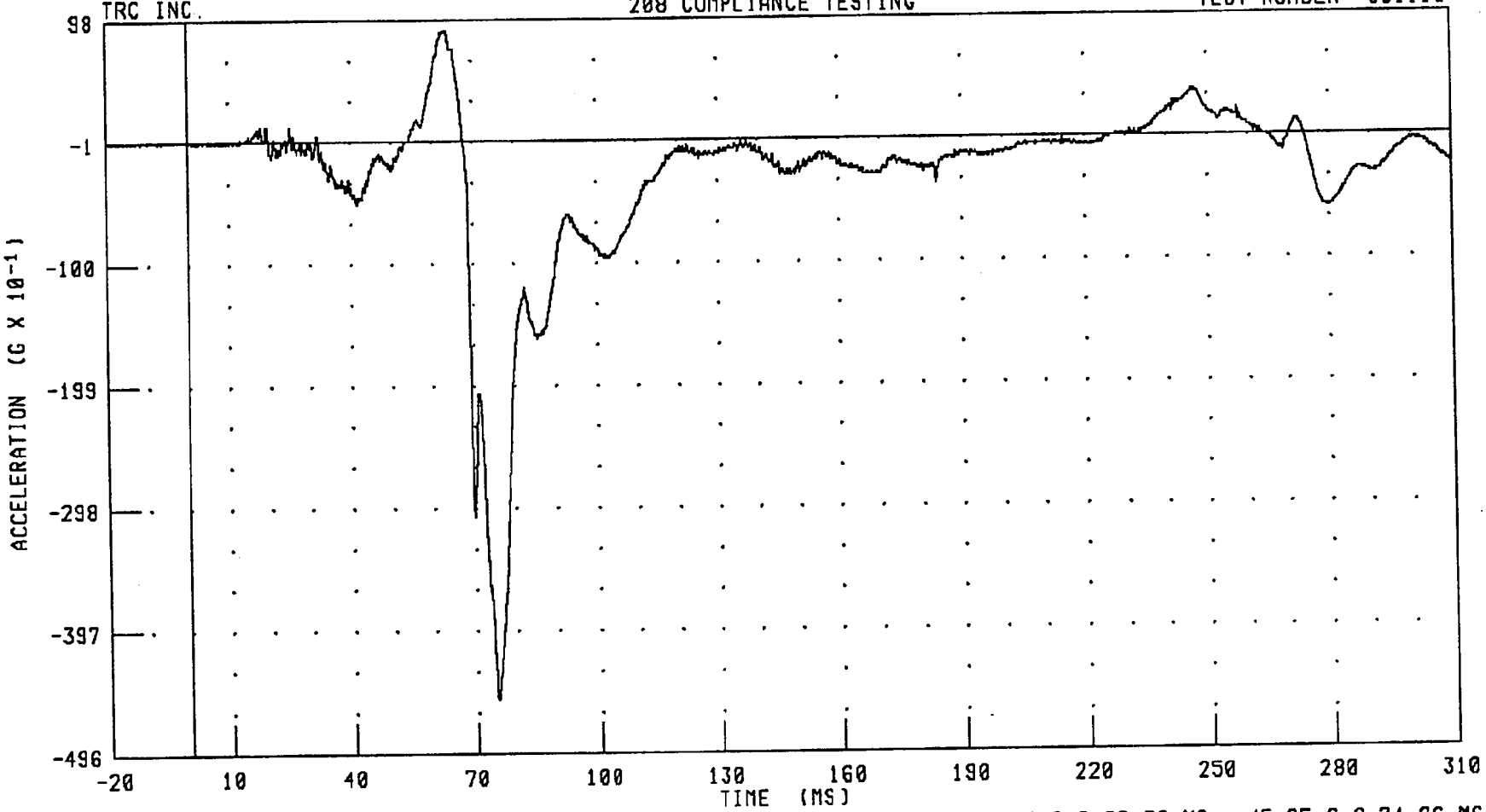
CHANNEL: HEDYG1 FILTER: CH. CLASS 1000

PEAK DATA: 2.28 G @ 31.36 MS; -7.69 G @ 75.20 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER HEAD Z-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

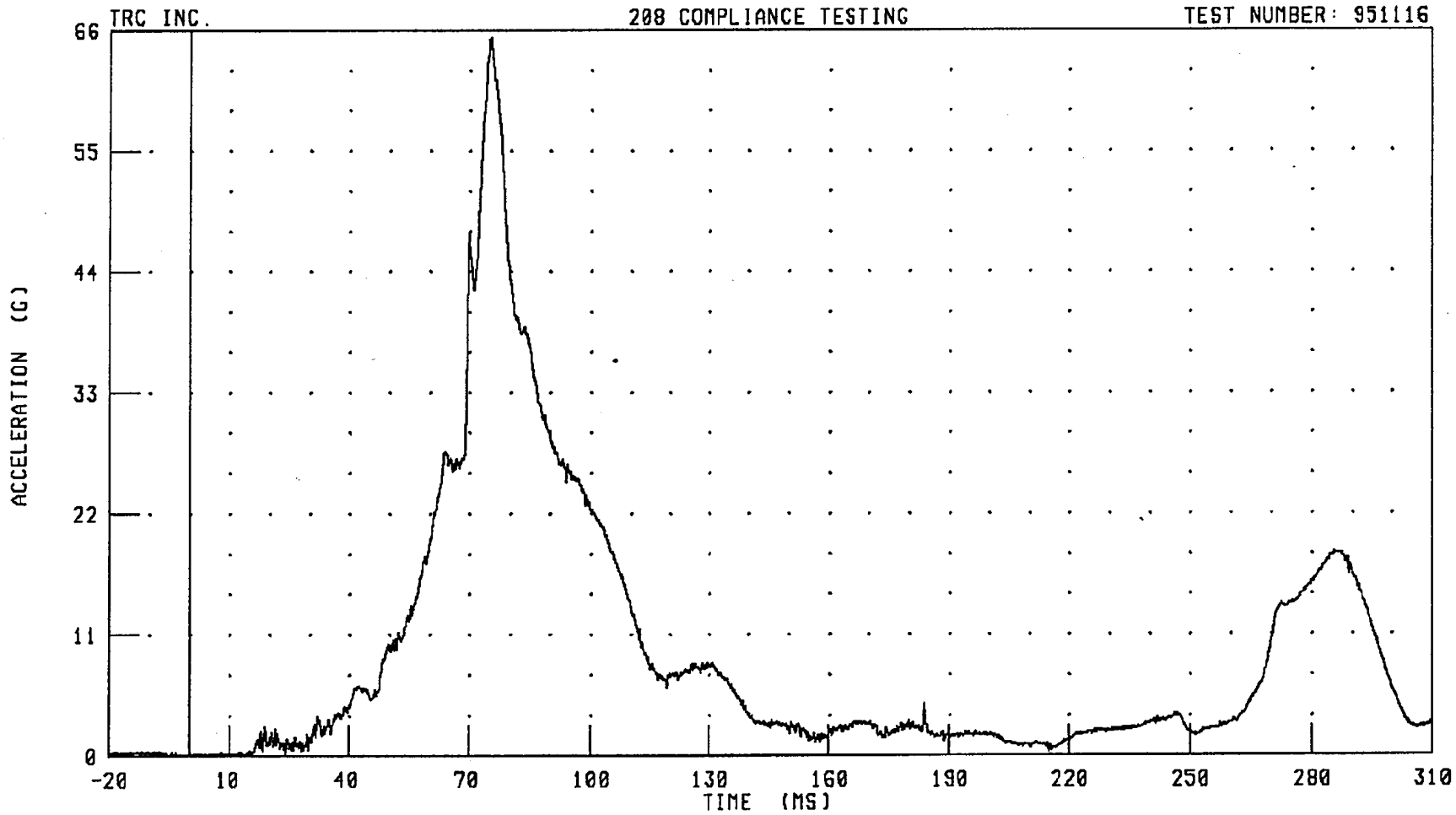
TEST NUMBER: 951116



CHANNEL: HEDZG1 FILTER: CH. CLASS 1000

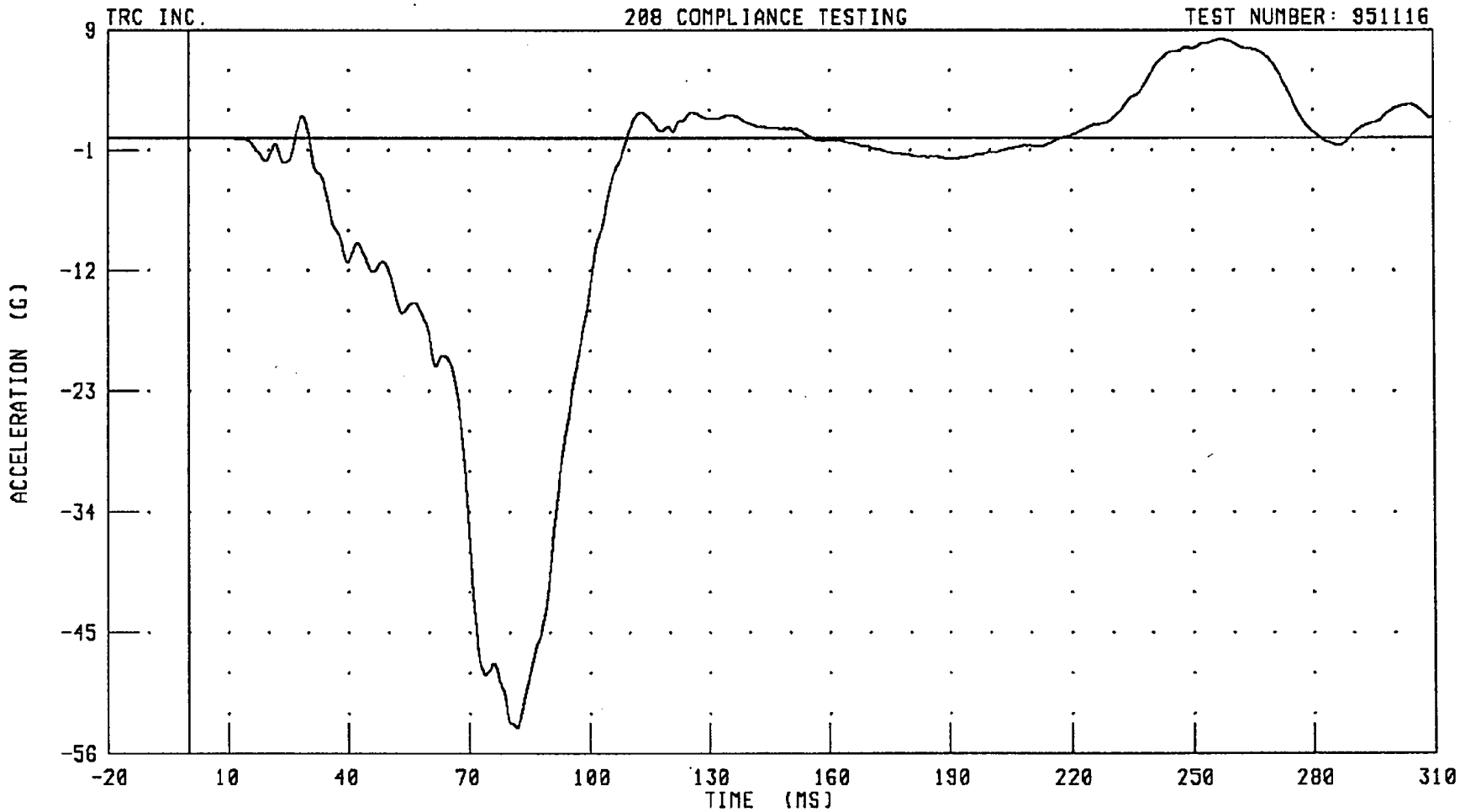
PEAK DATA: 8.98 G @ 63.36 MS; -45.25 G @ 74.96 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER HEAD RESULTANT ACCELERATION



CHANNEL: HEDRG1 FILTER: CH. CLASS 1000 PEAK DATA: 65.31 G @ 75.28 MS; 0.10 G @ -19.36 MS

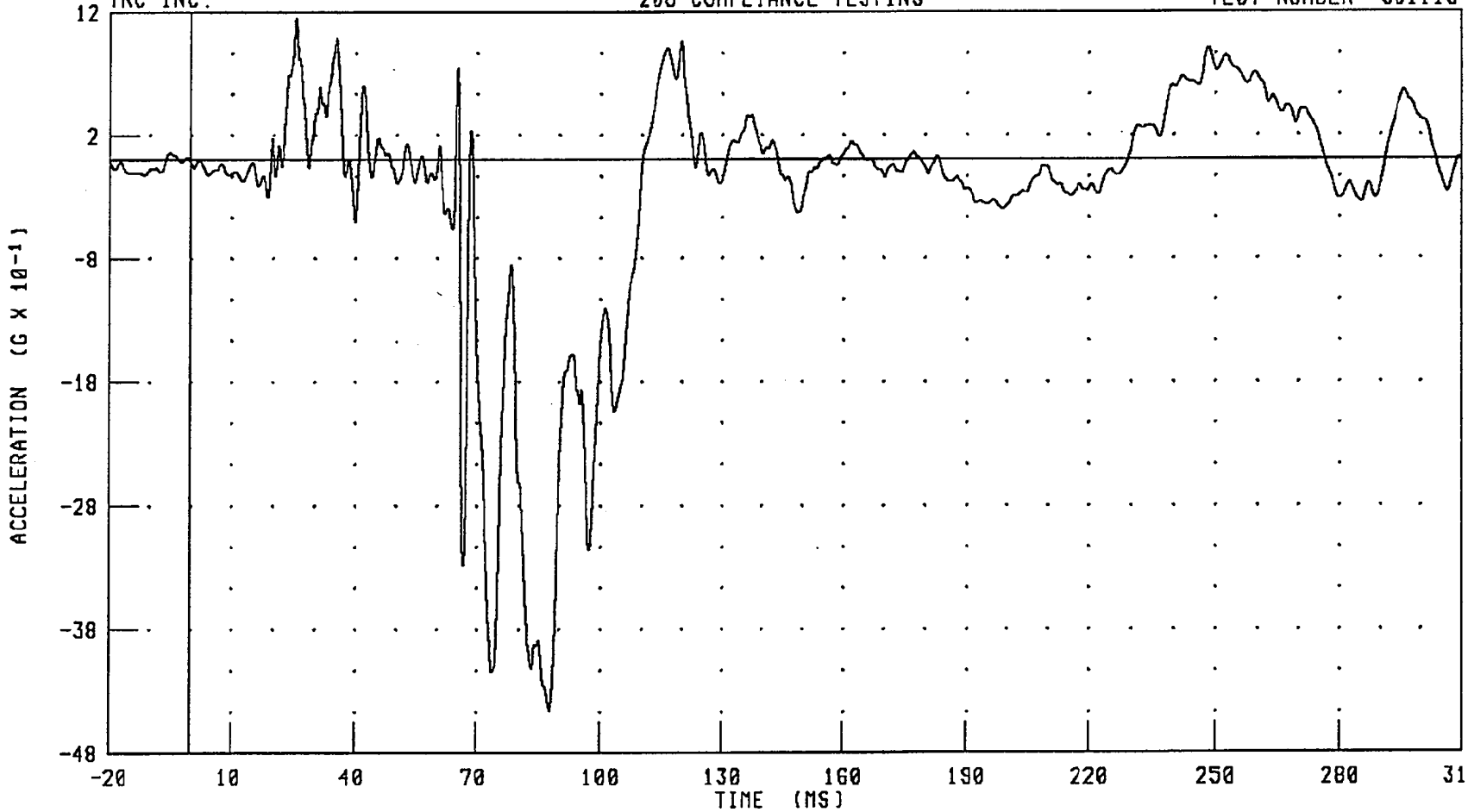
1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER CHEST X-AXIS ACCELERATION



CHANNEL: CSTXG1 FILTER: CH. CLASS 180 PEAK DATA: 9.07 G @ 257.36 MS; -53.76 G @ 81.84 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER CHEST Y-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC. TEST NUMBER: 951116

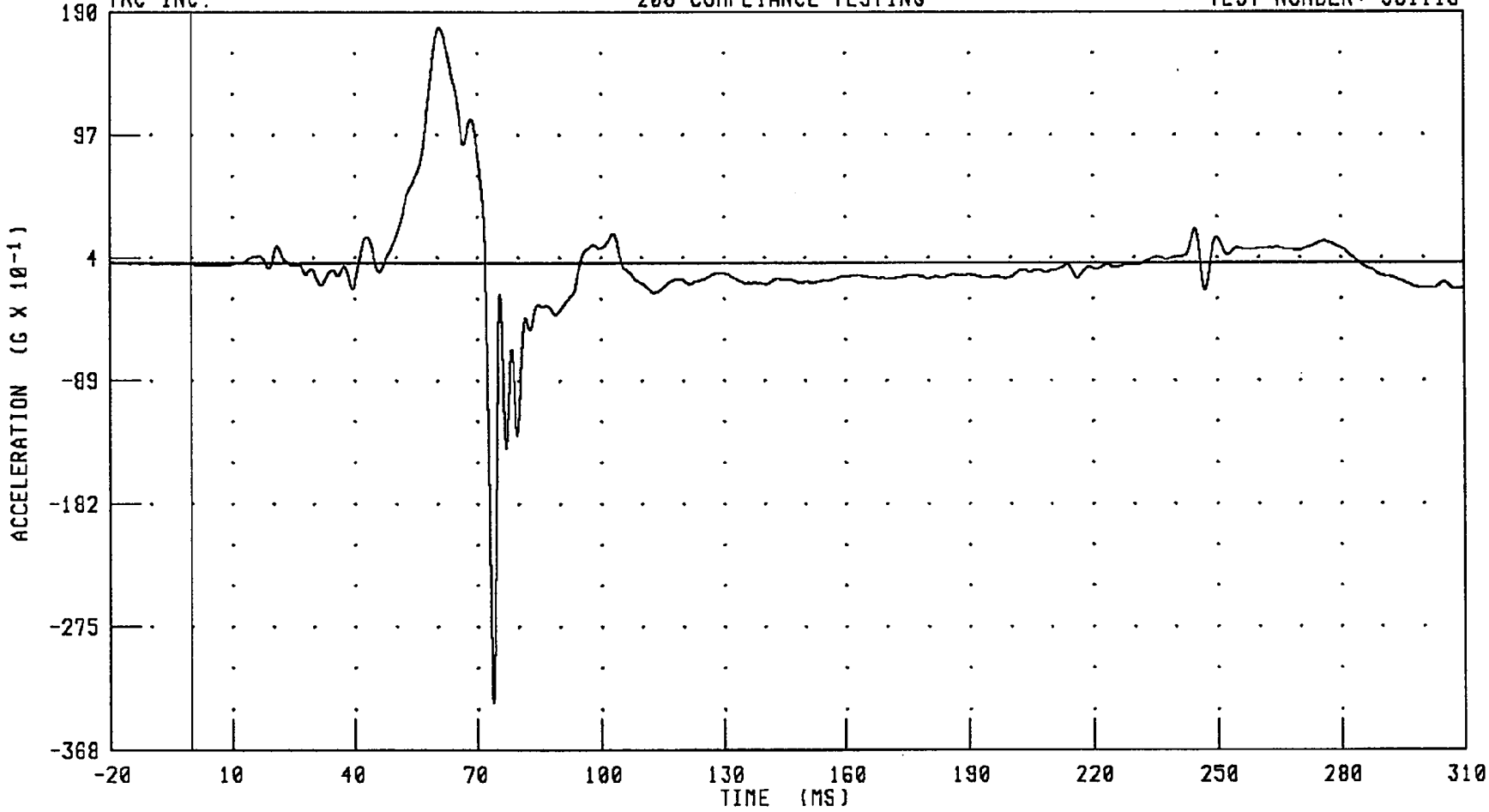


CHANNEL: CSTYG1 FILTER: CH. CLASS 180 PEAK DATA: 1.15 G @ 25.44 MS; -4.46 G @ 87.68 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER CHEST Z-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

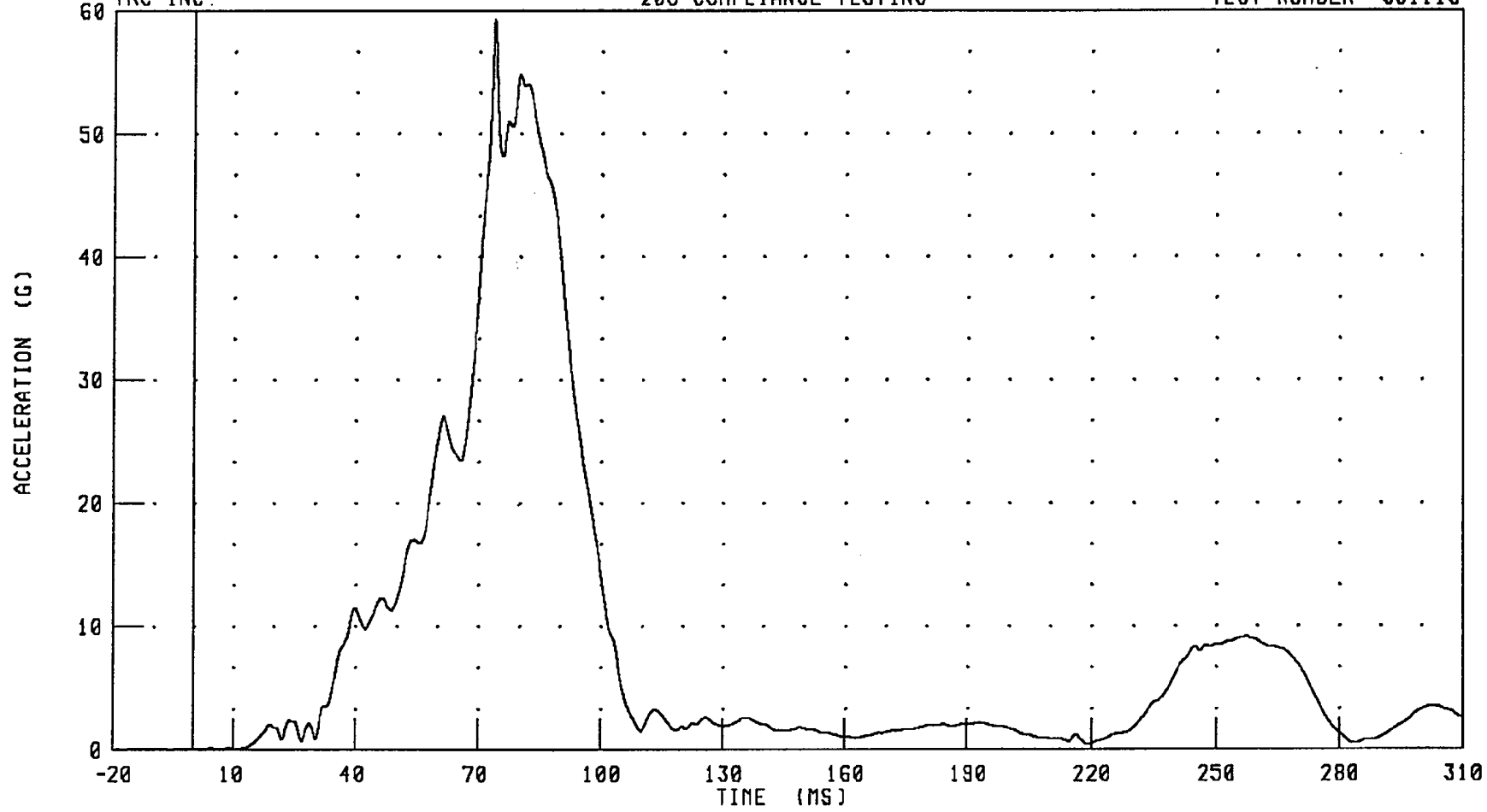
TEST NUMBER: 951116



CHANNEL: CSTZG1 FILTER: CH. CLASS 180

PEAK DATA: 17.80 G @ 60.64 MS; -33.26 G @ 73.84 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER CHEST RESULTANT ACCELERATION
TRC INC. 208 COMPLIANCE TESTING TEST NUMBER: 951116

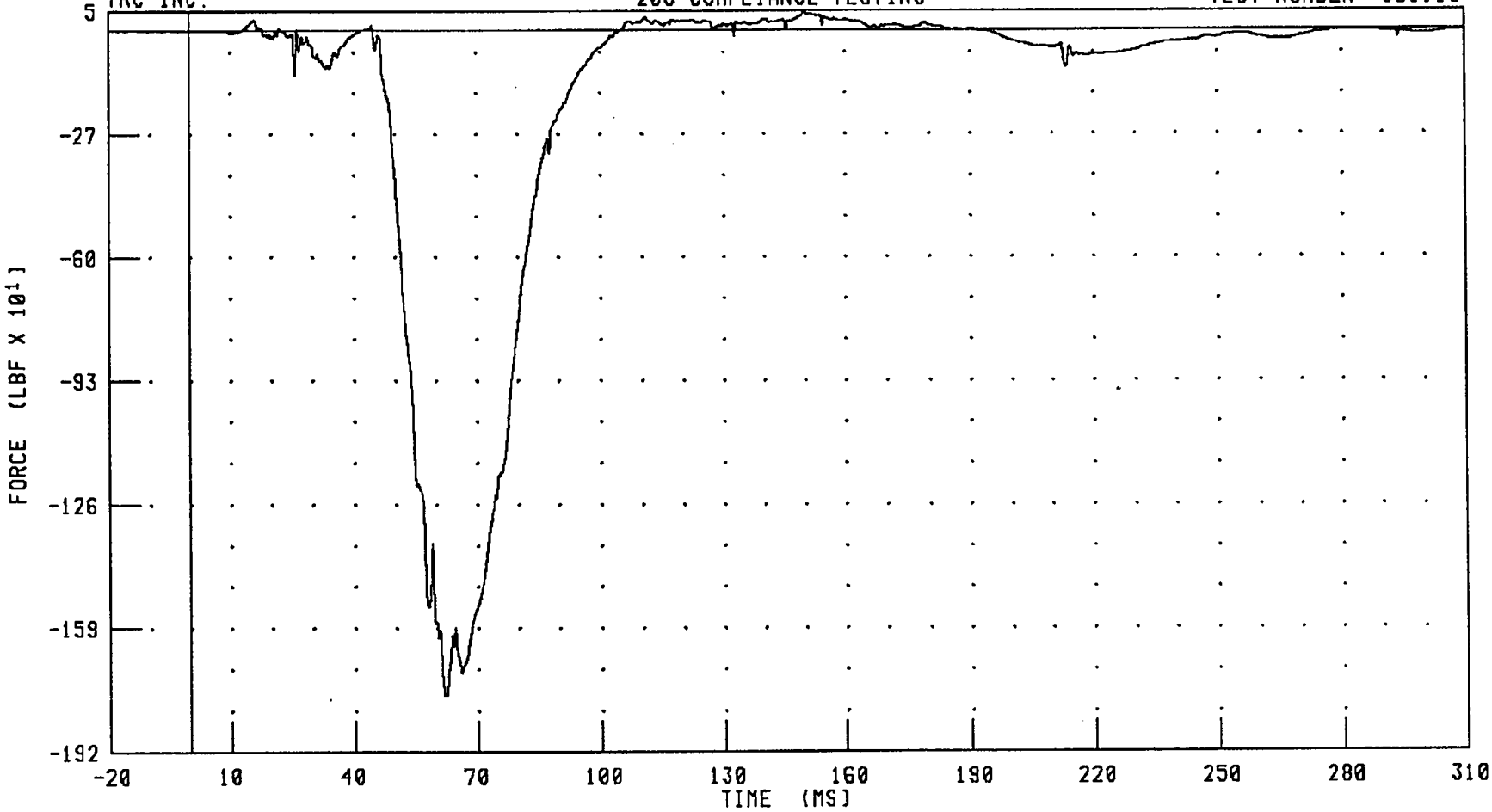


CHANNEL: CSTRG1 FILTER: CH. CLASS 180 PEAK DATA: 59.32 G @ 73.84 MS; 0.01 G @ -20.00 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER LEFT FEMUR FORCE
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



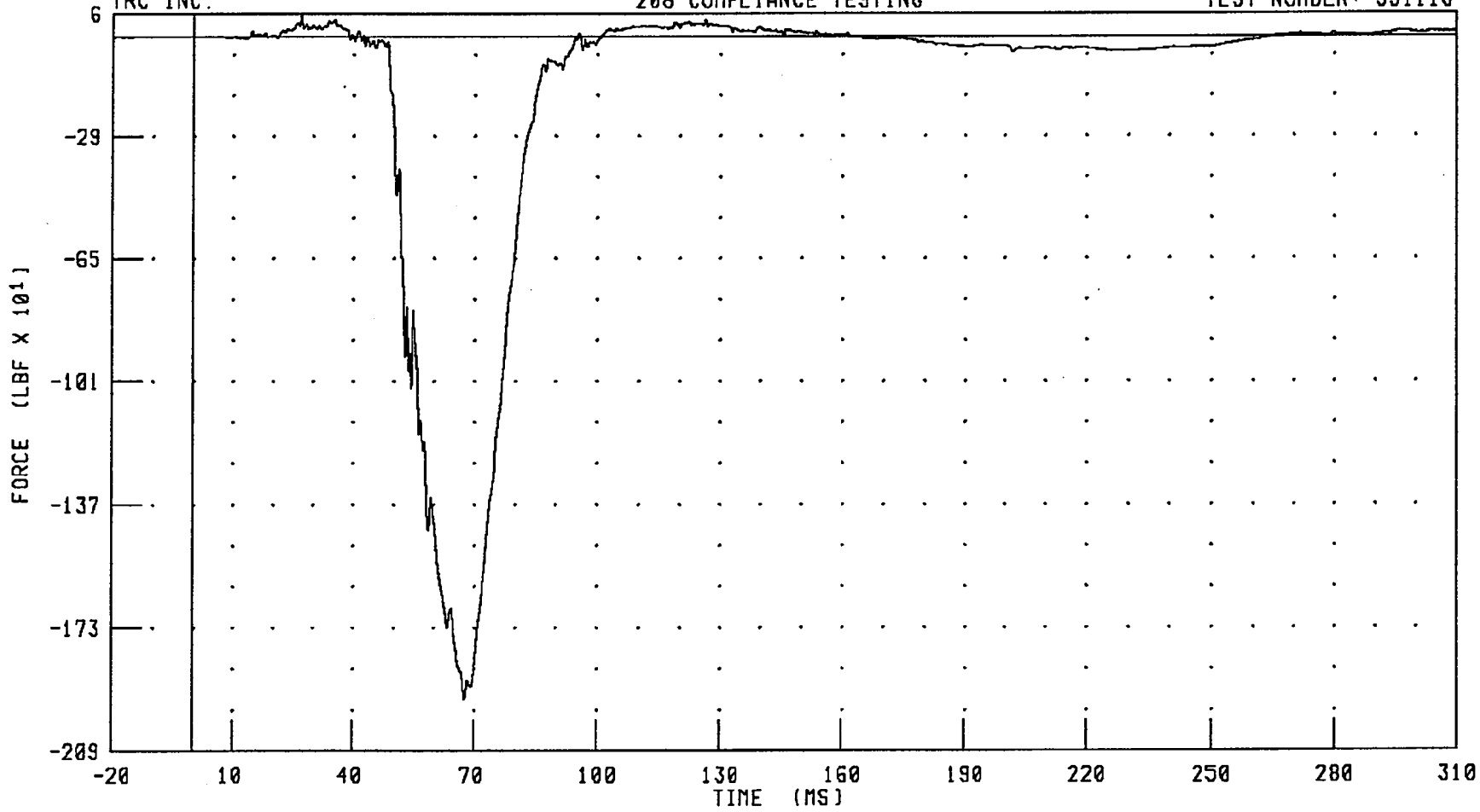
CHANNEL: LFMF1 FILTER: CH. CLASS 600

PEAK DATA: 47.62 LBF @ 150.08 MS; -1775.90 LBF @ 62.48 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DRIVER RIGHT FEMUR FORCE
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



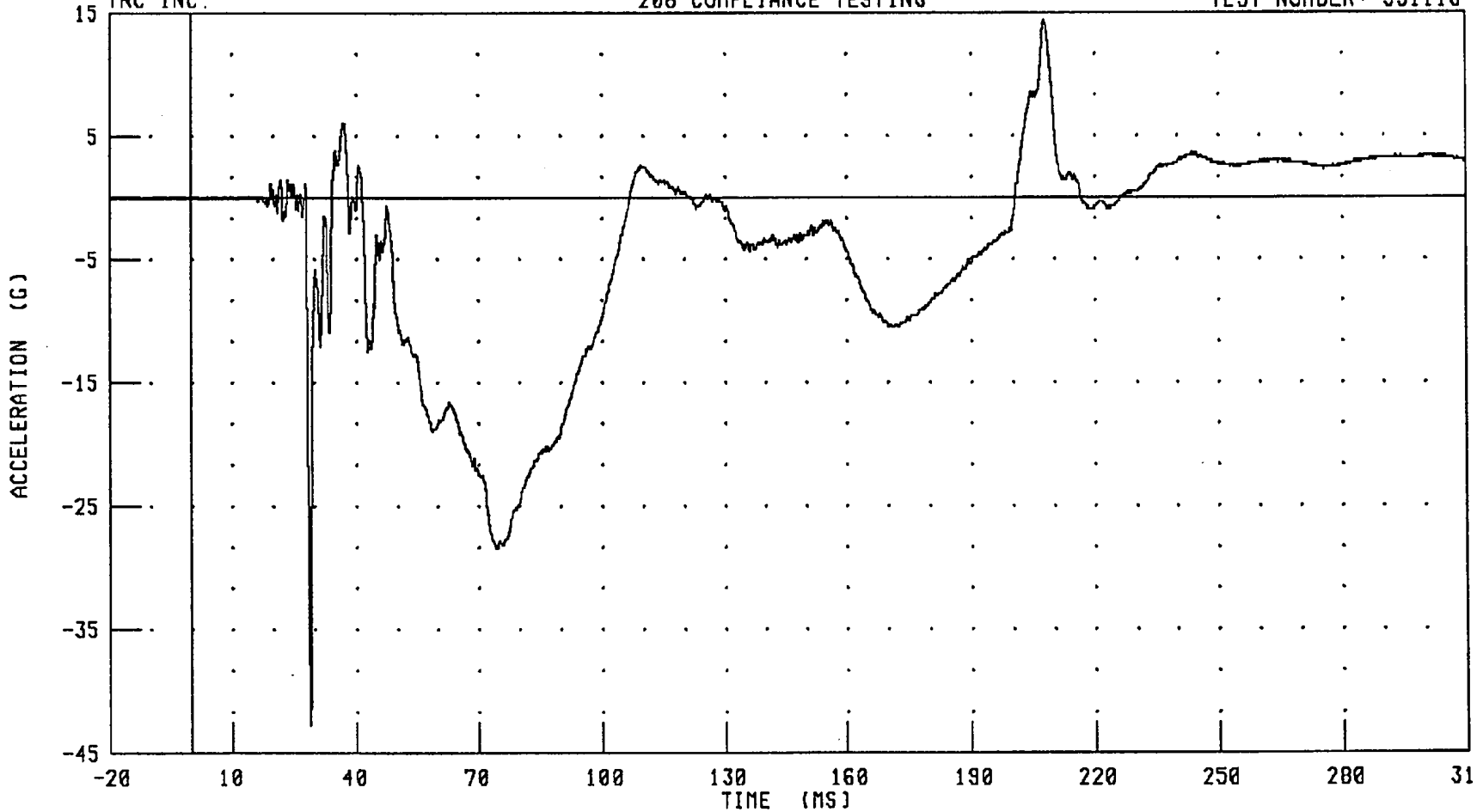
CHANNEL: RFMF1 FILTER: CH. CLASS 600

PEAK DATA: 61.97 LBF @ 26.88 MS; -1942.40 LBF @ 67.60 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



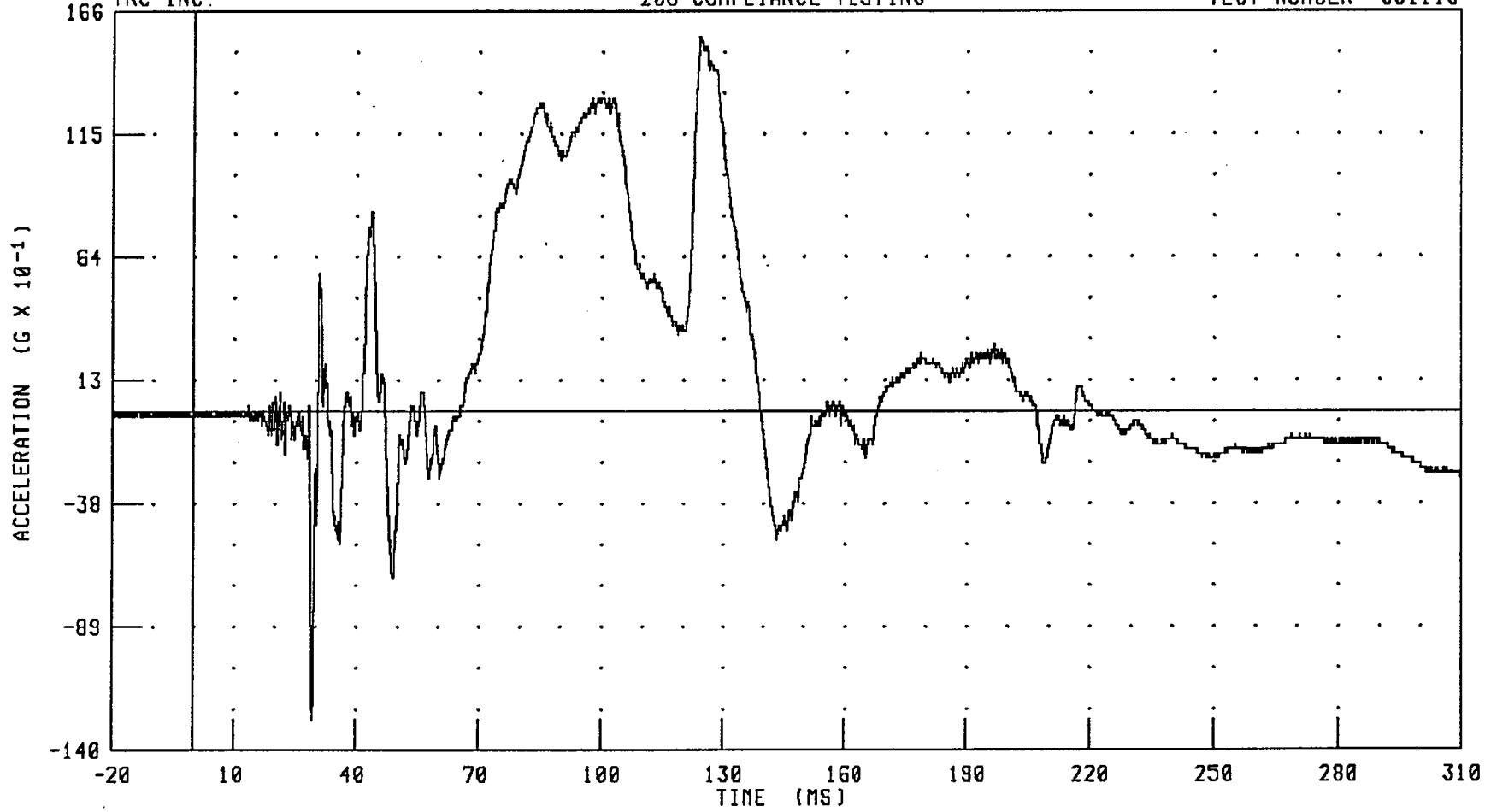
CHANNEL: HEDXG2 FILTER: CH. CLASS 1000

PEAK DATA: 14.42 G @ 207.60 MS; -42.79 G @ 29.12 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



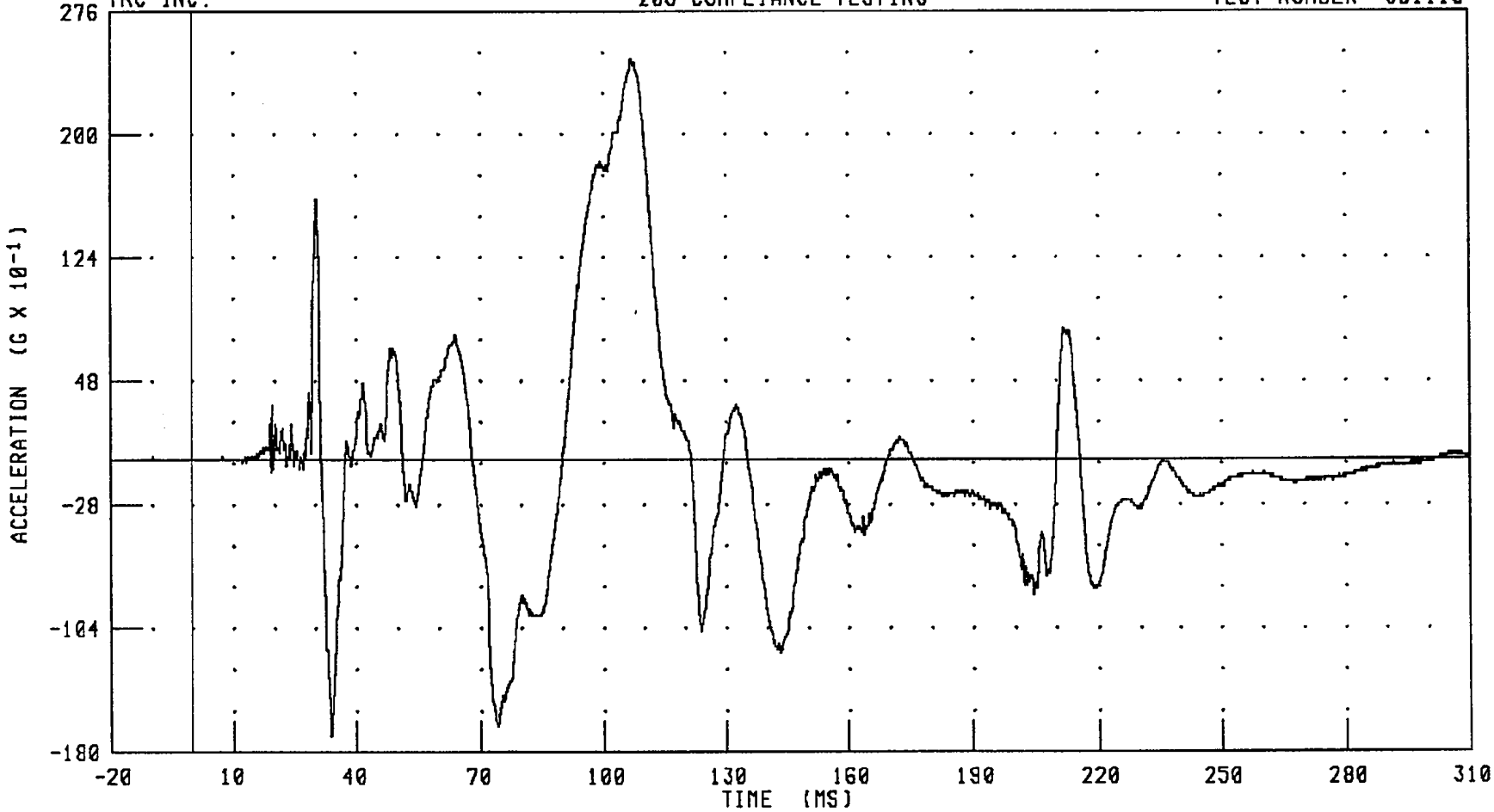
CHANNEL: HEDYG2 FILTER: CH. CLASS 1000

PEAK DATA: 15.52 G @ 124.16 MS; -12.75 G @ 29.28 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



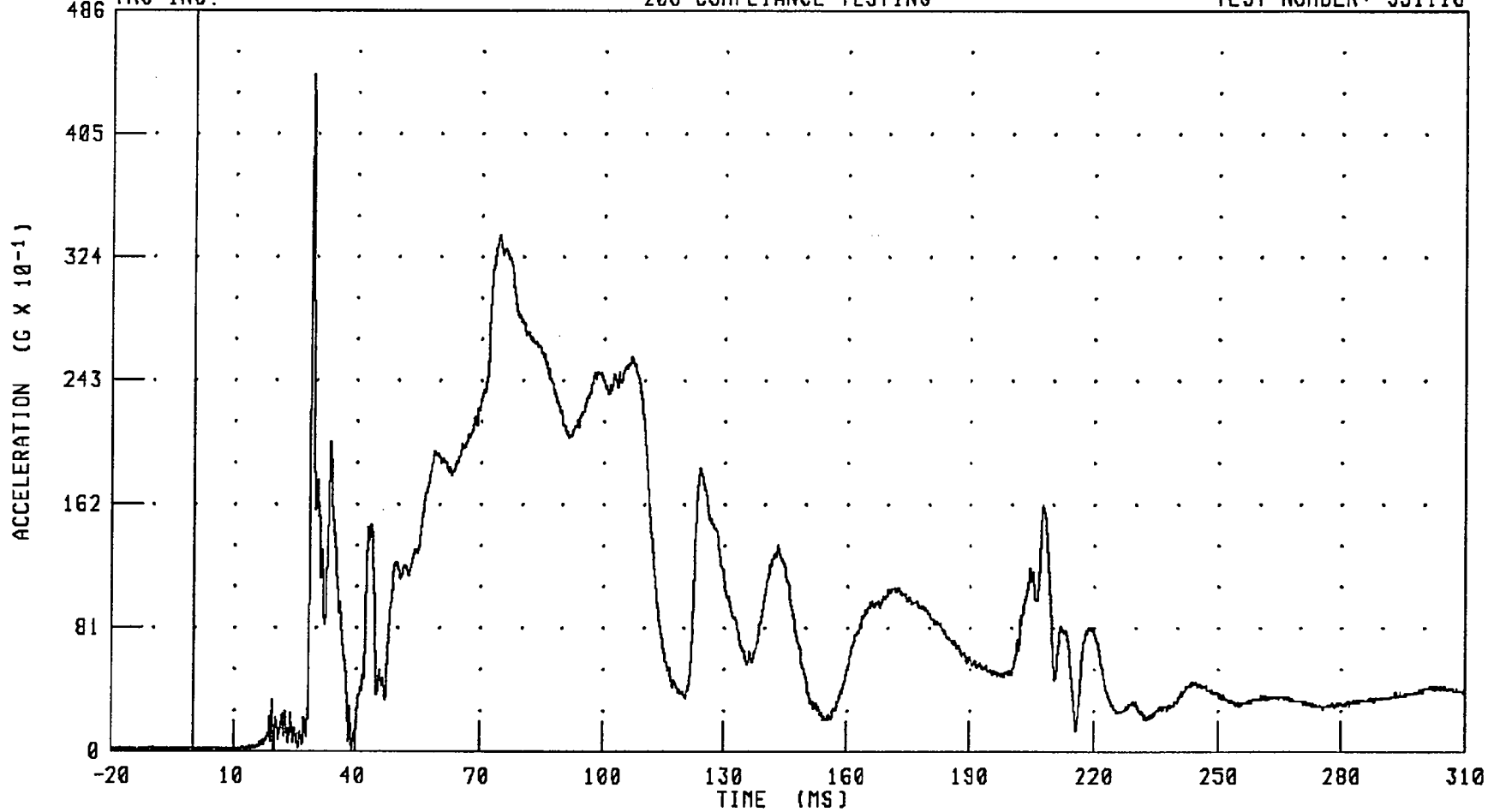
CHANNEL: HEDZG2 FILTER: CH. CLASS 1000

PEAK DATA: 24.60 G @ 106.96 MS; -17.01 G @ 33.76 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



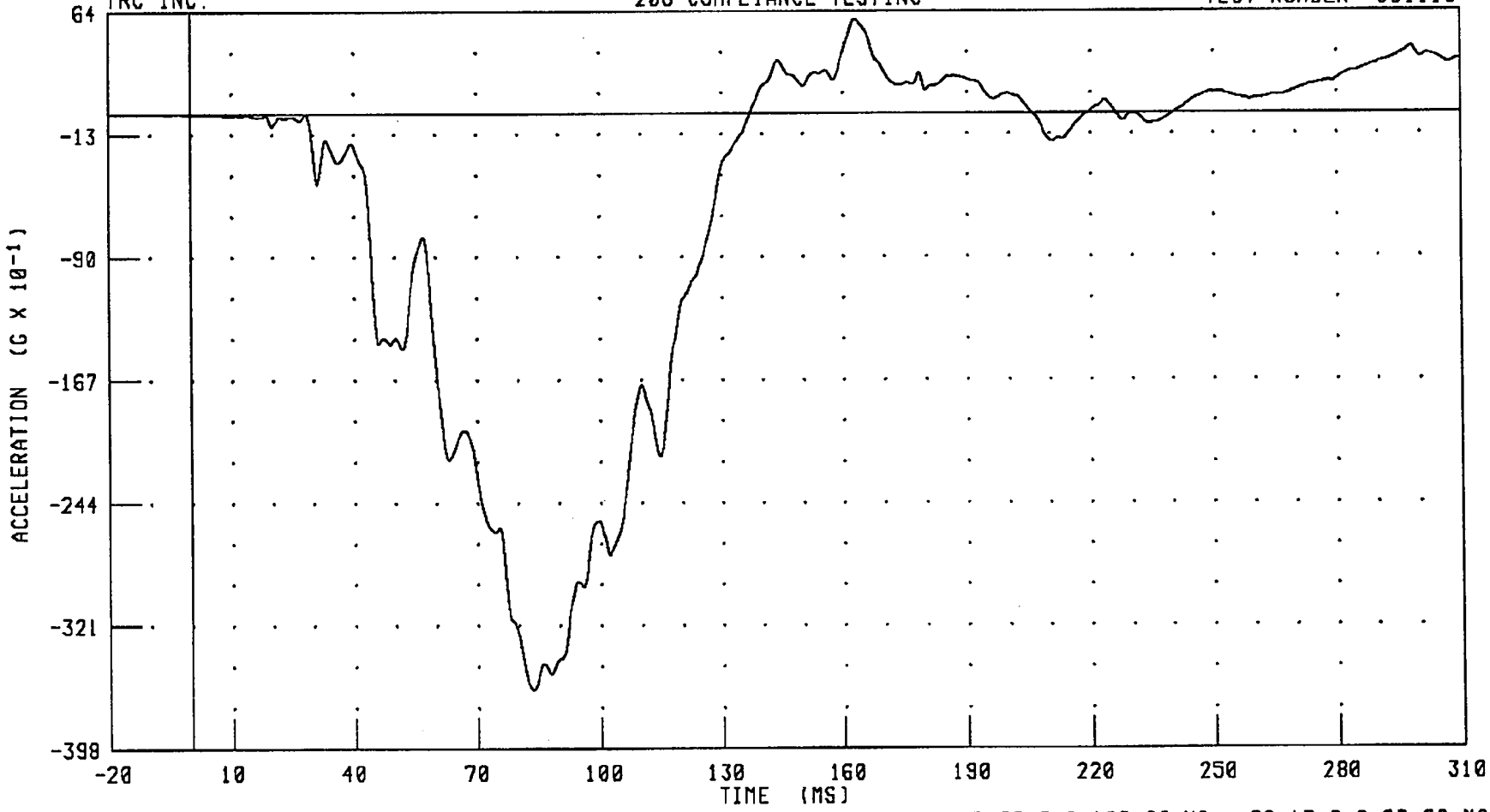
CHANNEL: HEDRG2 FILTER: CH. CLASS 1000

PEAK DATA: 44.38 G @ 29.12 MS; 0.07 G @ -18.16 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

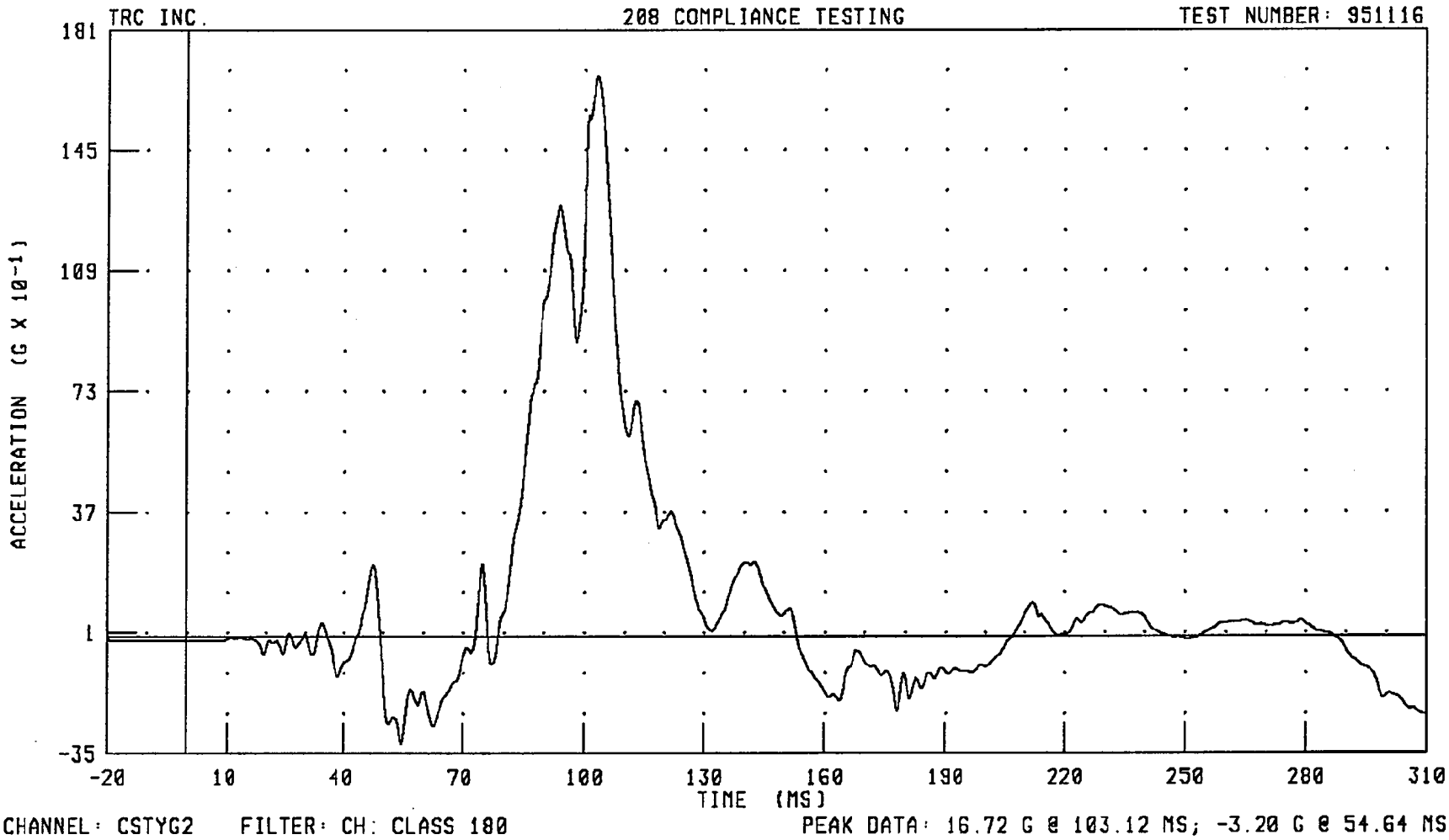
TEST NUMBER: 951116



CHANNEL: CSTXG2 FILTER: CH. CLASS 180

PEAK DATA: 5.87 G @ 163.28 MS; -36.13 G @ 83.68 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION

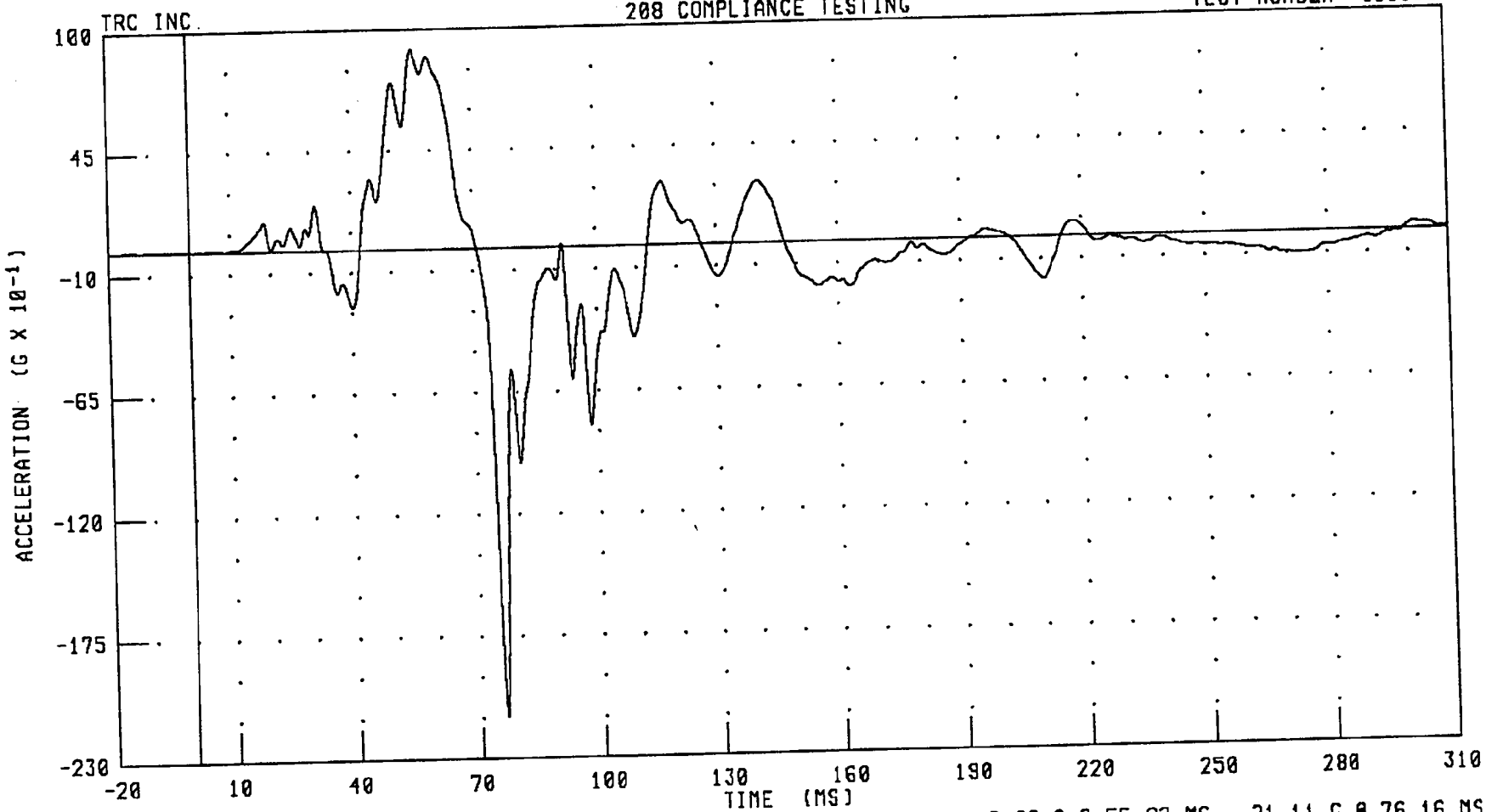


CHANNEL: CSTYG2 FILTER: CH: CLASS 180 PEAK DATA: 16.72 G @ 103.12 MS; -3.20 G @ 54.64 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116

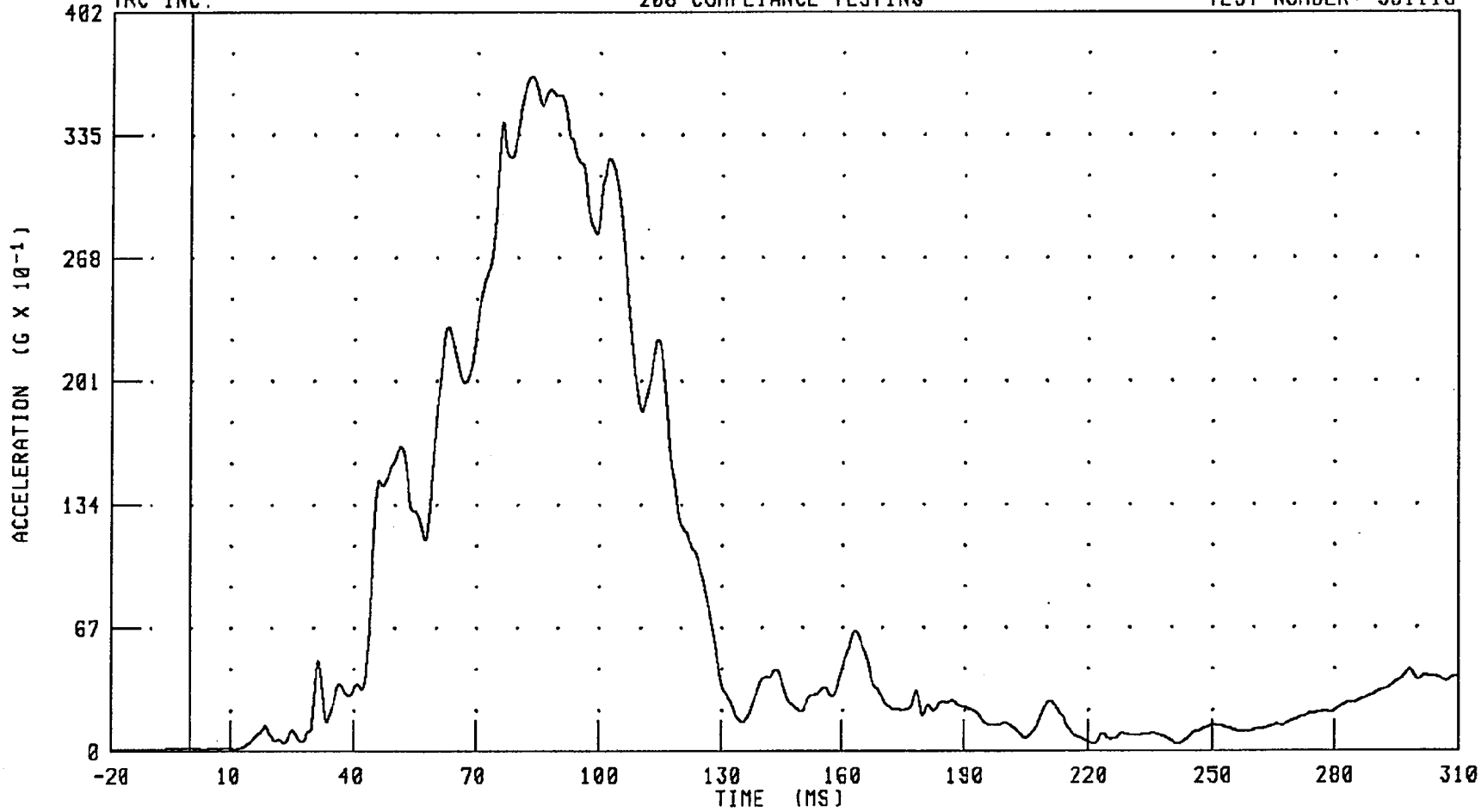


CHANNEL: CSTZG2 FILTER: CH. CLASS 180

PEAK DATA: 9.09 G @ 55.92 MS; -21.11 G @ 76.16 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION
208 COMPLIANCE TESTING

TRC INC. TEST NUMBER: 951116

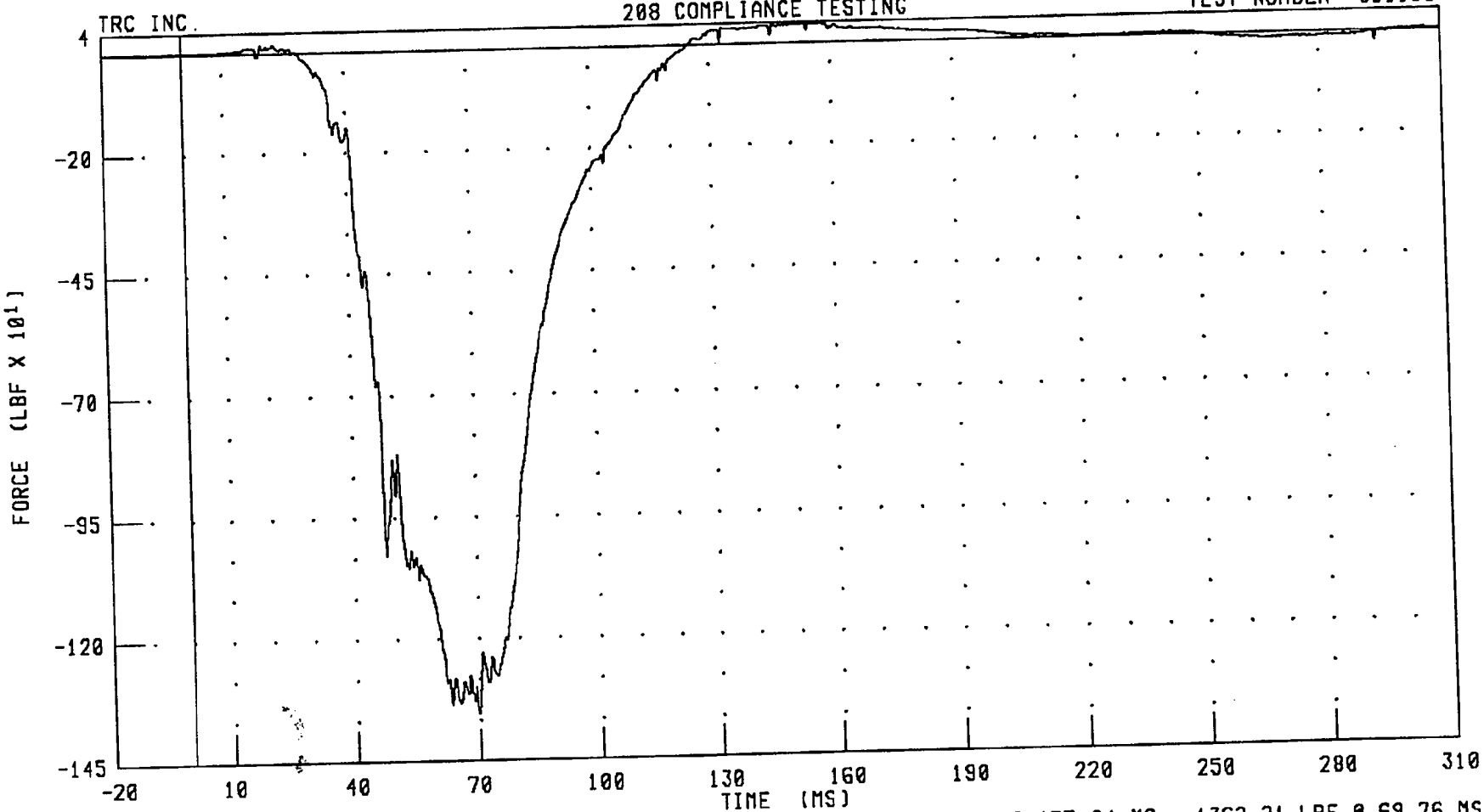


CHANNEL: CSTRG2 FILTER: CH. CLASS 180 PEAK DATA: 36.68 G @ 83.36 MS; 0.01 G @ -20.00 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER LEFT FEMUR FORCE
208 COMPLIANCE TESTING

TRC INC.

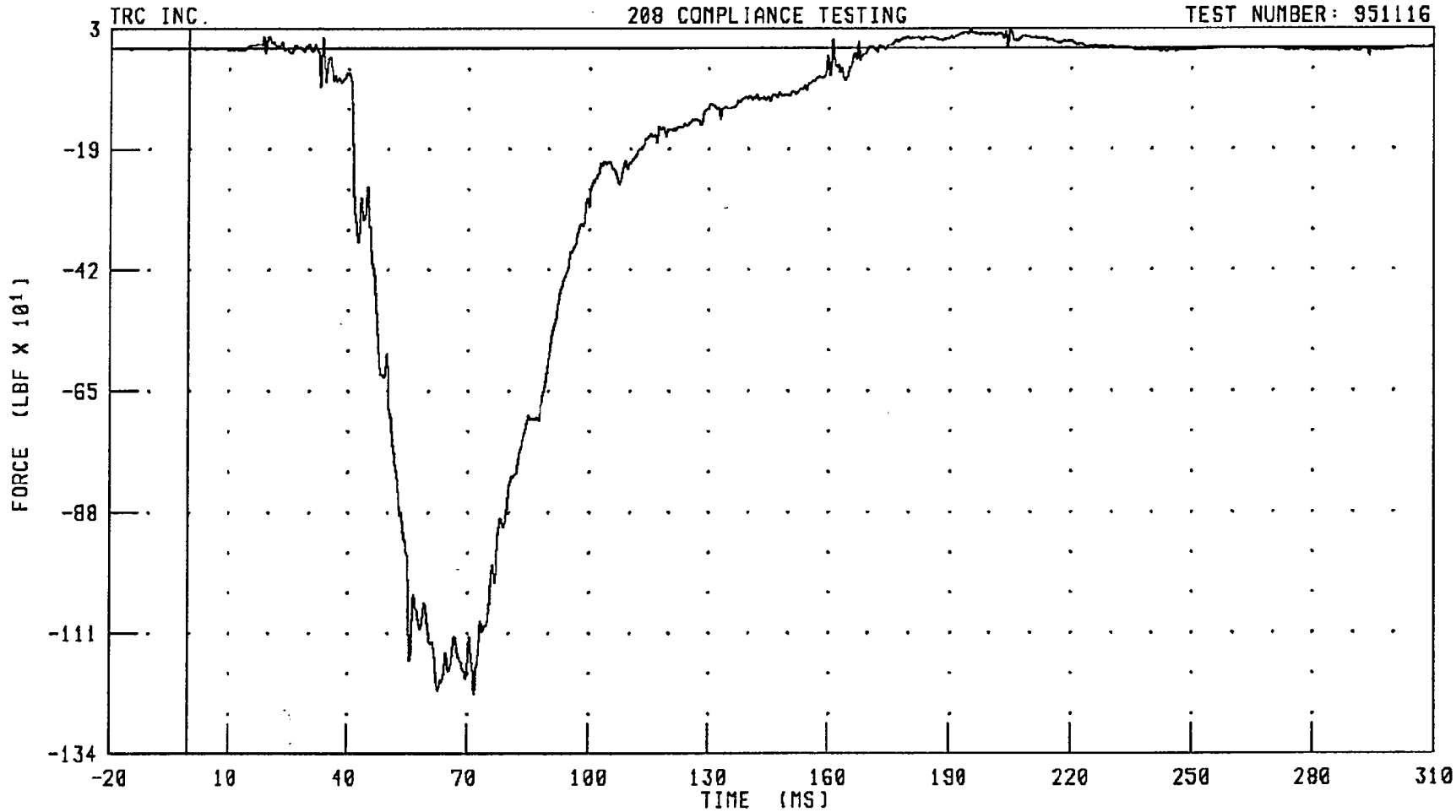
TEST NUMBER: 951116



CHANNEL: LFMF2 FILTER: CH. CLASS 600

PEAK DATA: 38.99 LBF @ 155.04 MS; -1362.21 LBF @ 69.76 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

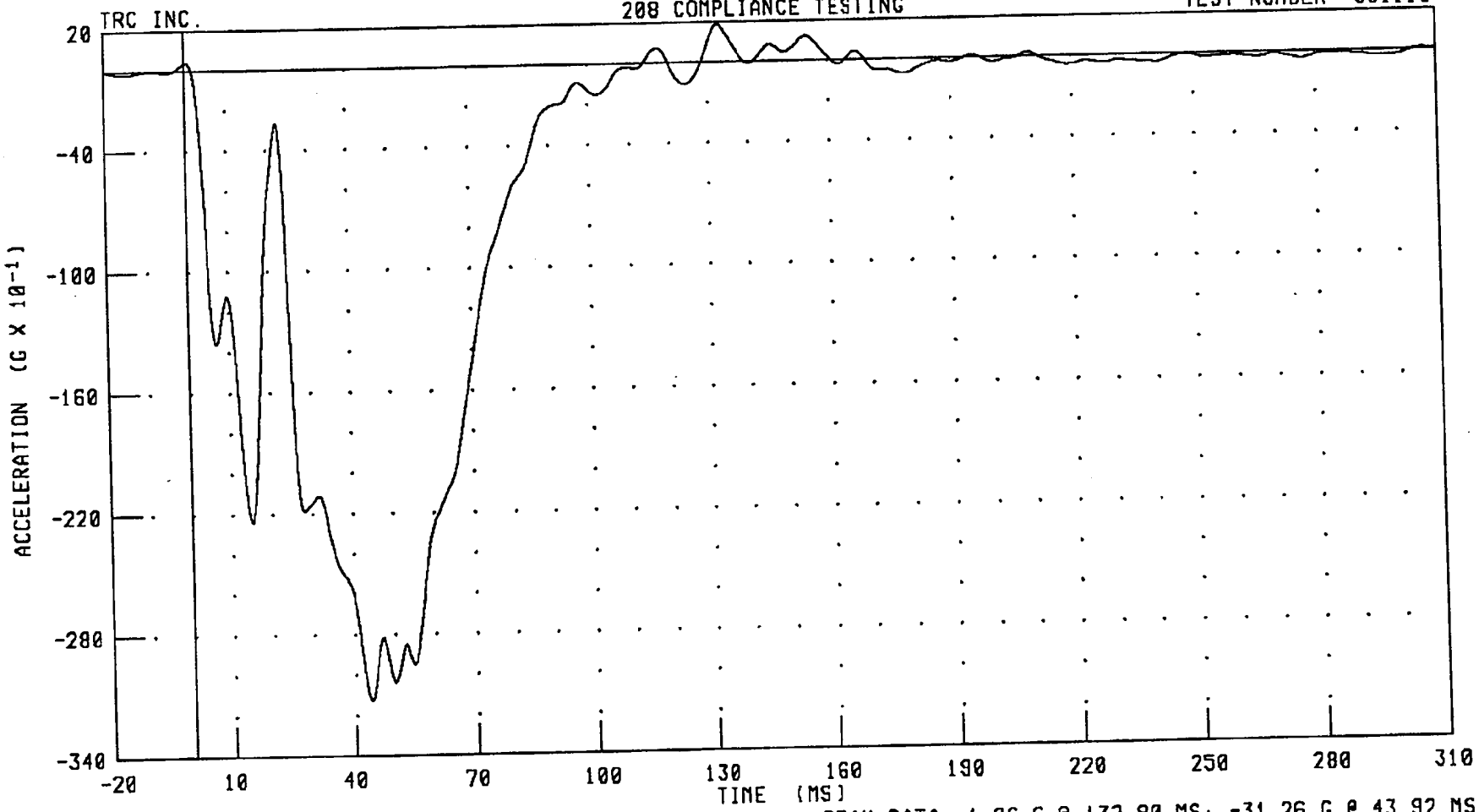


CHANNEL: RFMF2 FILTER: CH. CLASS 600 PEAK DATA: 34.60 LBF @ 195.44 MS; -1228.86 LBF @ 71.76 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
LEFT REAR SEAT X-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116

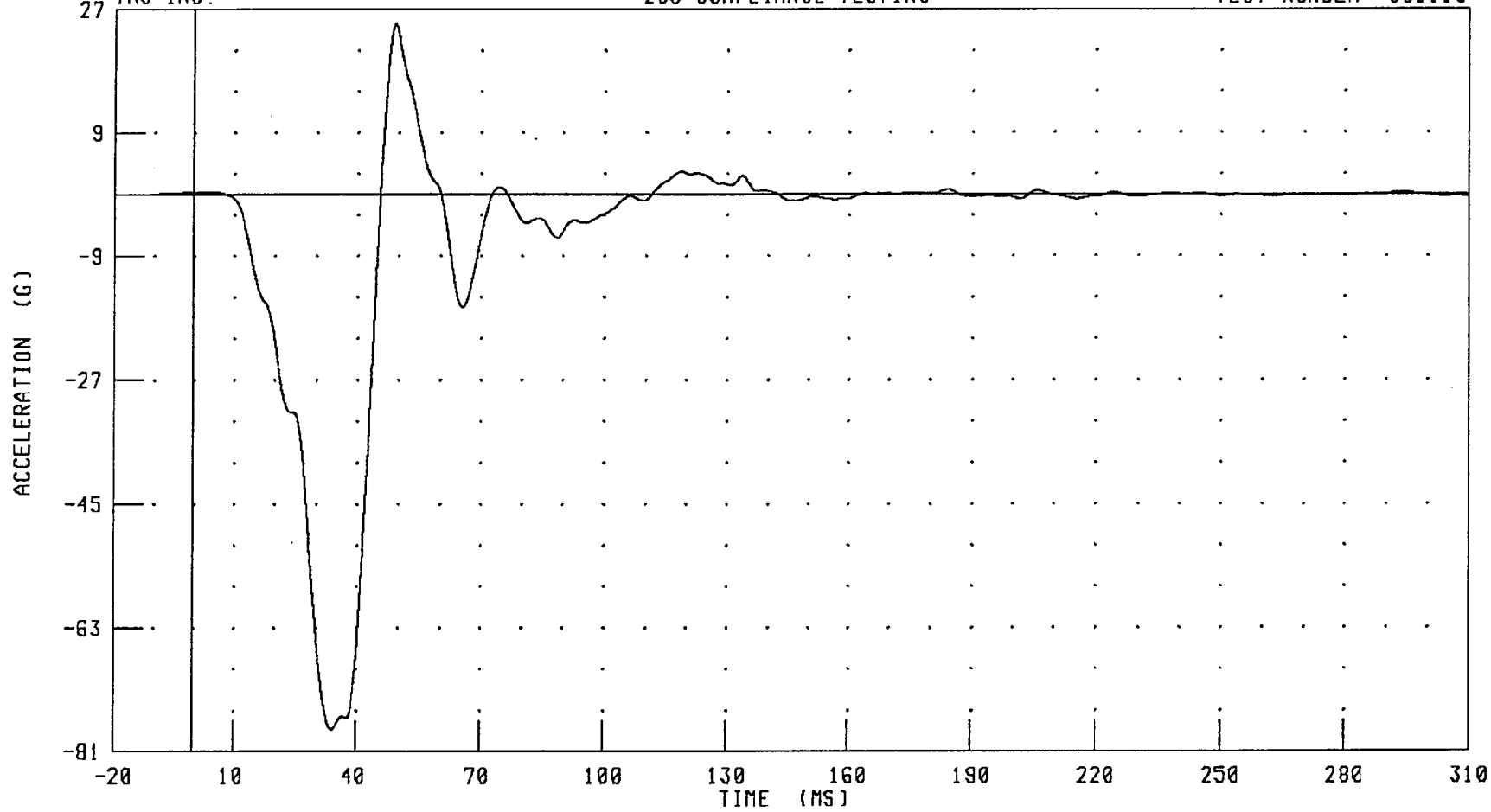


CHANNEL: TLRXG1 FILTER: CH. CLASS 60

PEAK DATA: 1.86 G @ 132.80 MS; -31.26 G @ 43.92 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
ENGINE BOTTOM BLOCK X-AXIS ACCELERATION

TRC INC. 208 COMPLIANCE TESTING TEST NUMBER: 951116

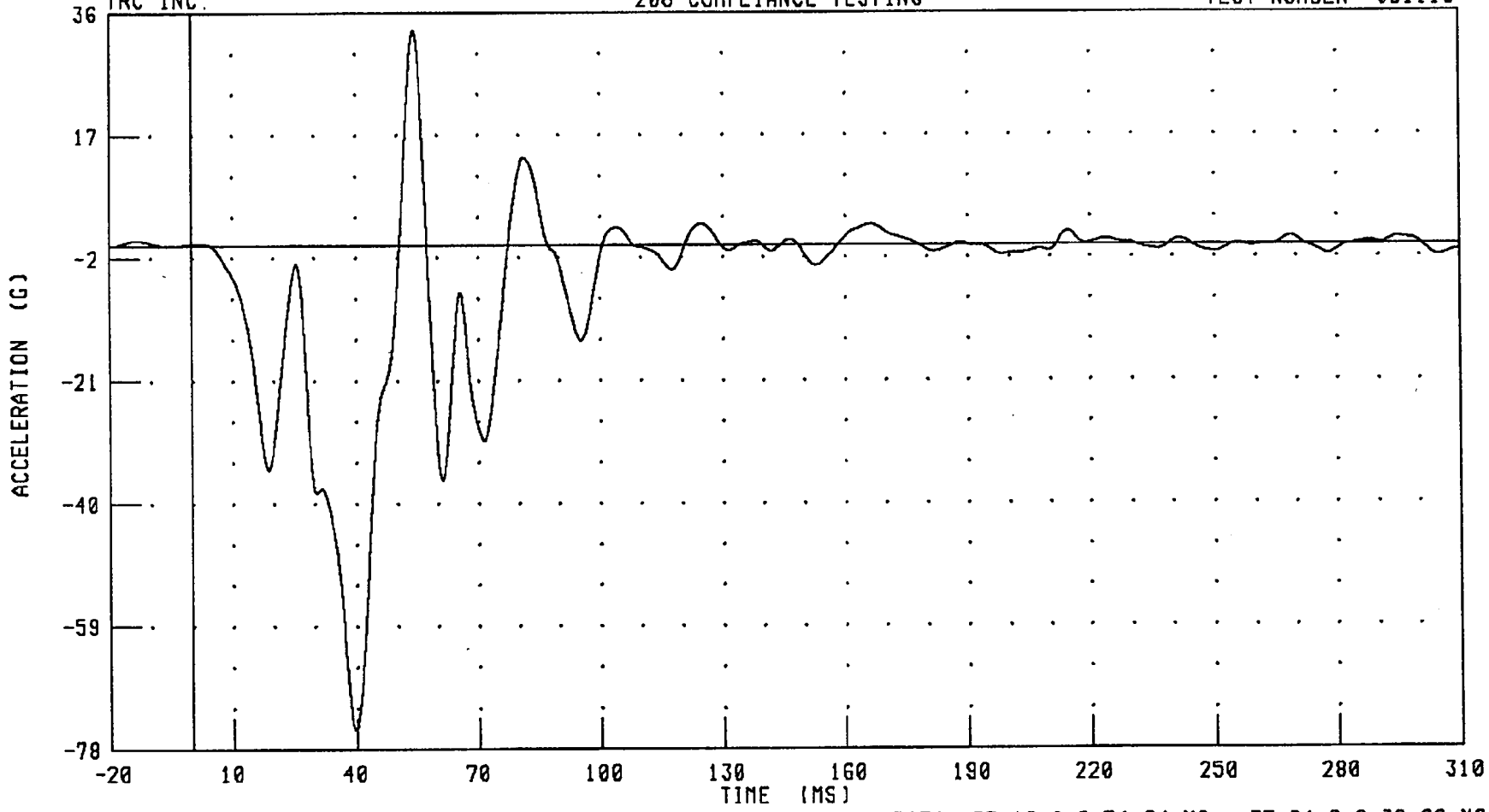


CHANNEL: ENGXG2 FILTER: CH. CLASS 60 PEAK DATA: 24.85 G @ 49.04 MS; -77.77 G @ 33.92 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
RIGHT BRAKE CALIPER X-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116

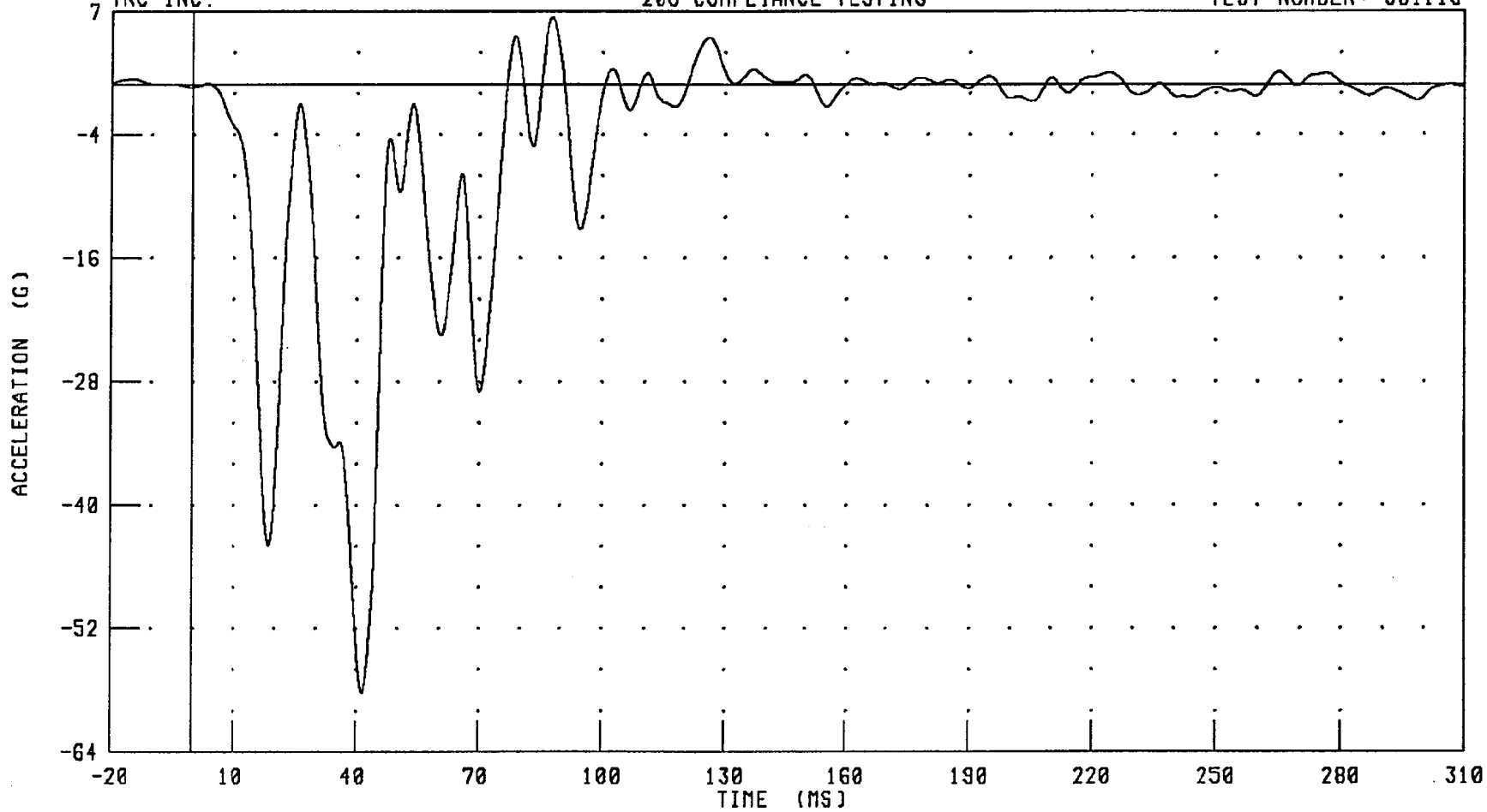


CHANNEL: BCRXG1 FILTER: CH. CLASS 60

PEAK DATA: 33.18 G @ 54.24 MS; -75.04 G @ 39.68 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
LEFT BRAKE CALIPER X-AXIS ACCELERATION

TRC INC. 208 COMPLIANCE TESTING TEST NUMBER: 951116

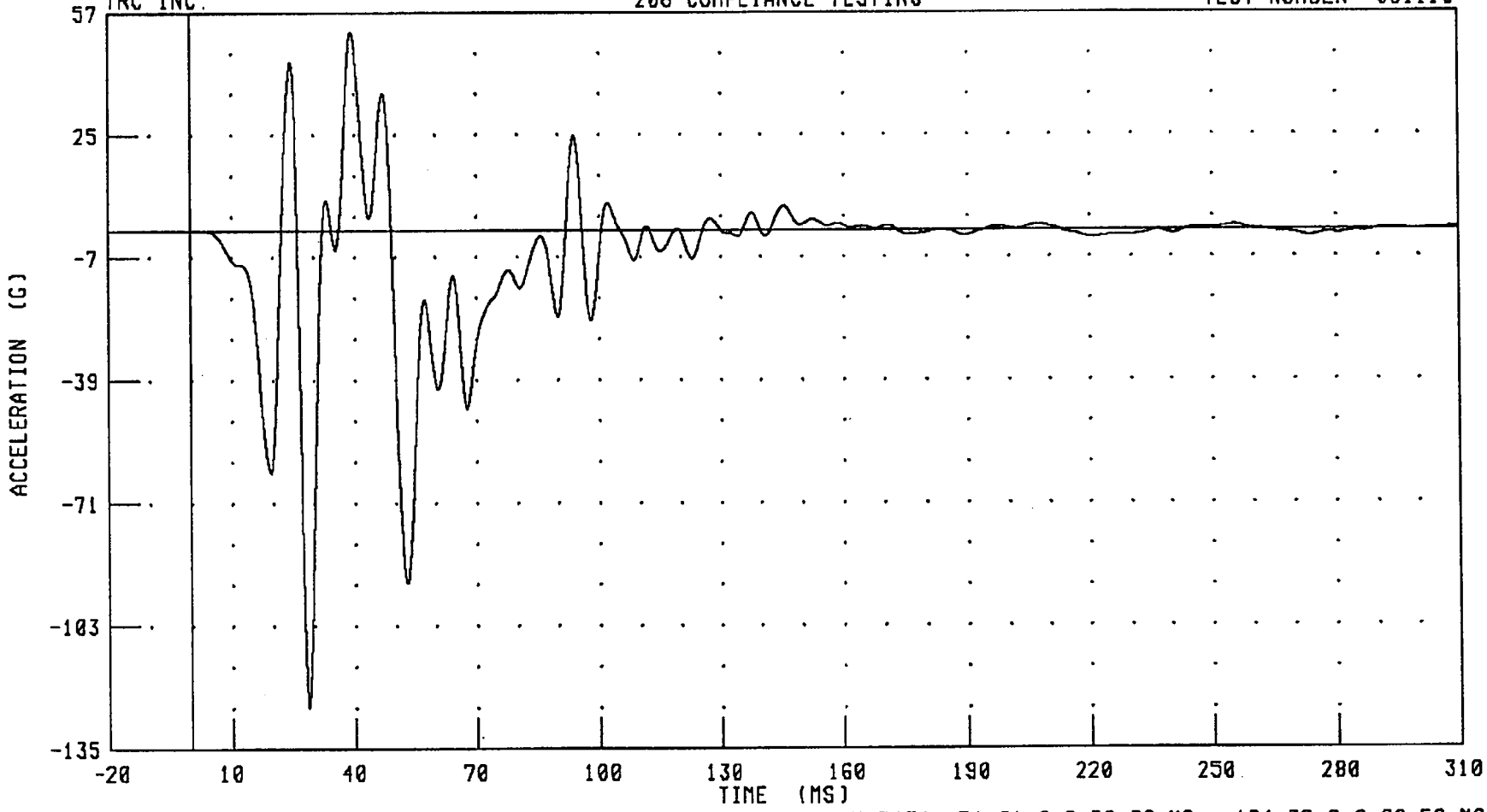


CHANNEL: BCLXG1 FILTER: CH. CLASS 60 PEAK DATA: 6.49 G @ 87.84 MS; -59.20 G @ 41.60 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
DASH PANEL CENTER X-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



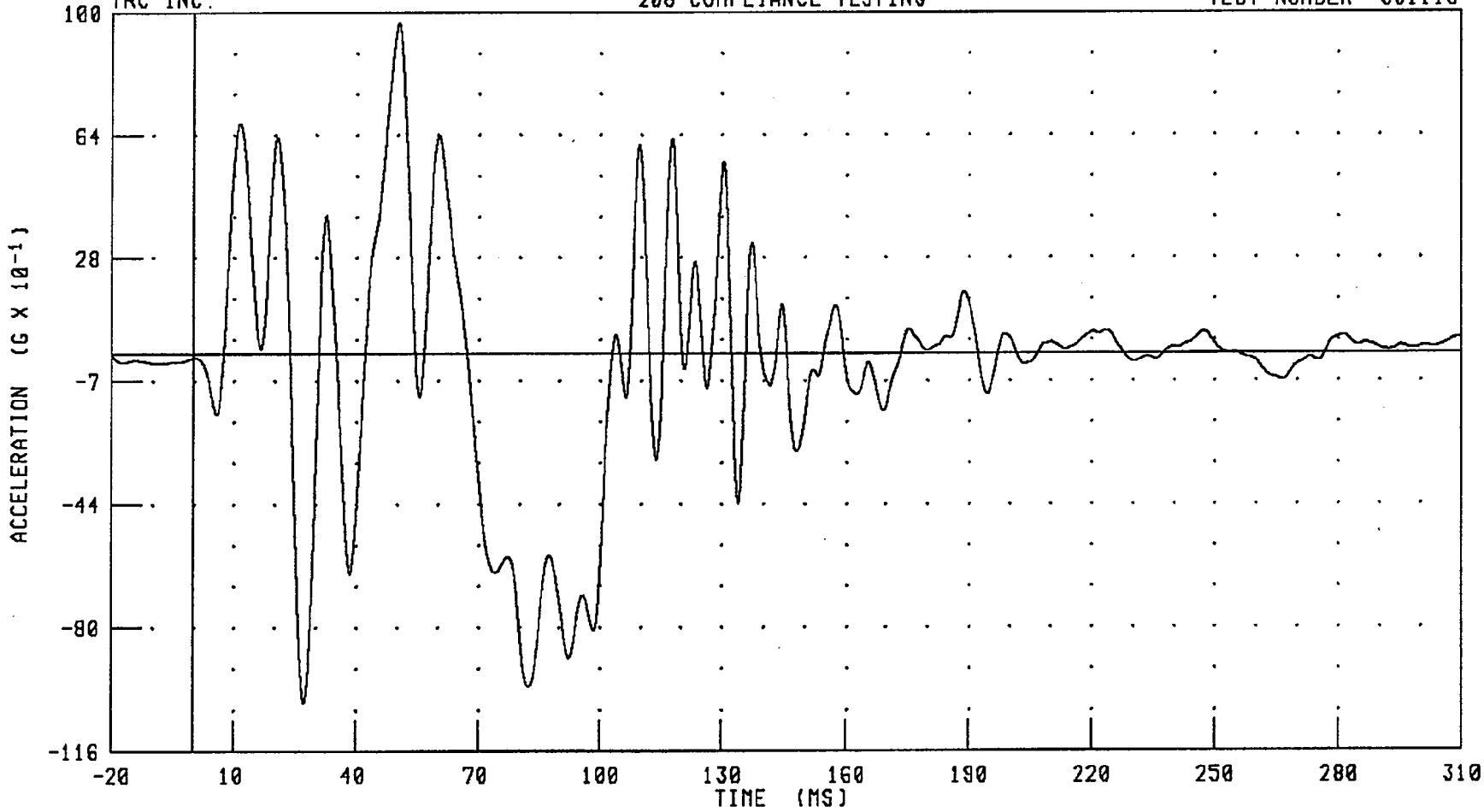
CHANNEL: DPCXG1 FILTER: CH. CLASS 60

PEAK DATA: 51.91 G @ 39.36 MS; -124.38 G @ 28.56 MS

1996 VOLVO 850 INTO FLAT FRONTAL BARRIER
VEHICLE REAR CENTER Z-AXIS ACCELERATION
208 COMPLIANCE TESTING

TRC INC.

TEST NUMBER: 951116



CHANNEL: TFCZG1 FILTER: CH. CLASS 60

PEAK DATA: 9.70 G @ 50.32 MS; -10.19 G @ 27.20 MS

Appendix C

Manufacturer's Vehicle Information

VOLVO

Volvo Cars of North America, Inc.
Rockleigh, New Jersey

September 1, 1995

Mr. Harry Thompson
Chief, Vehicle Division
Office of Vehicle Safety Compliance
National Highway Traffic Safety Administration
400 Seventh St., S.W.
Washington, D.C. 20590

RE: NSA-31CCa
IR 1664

Dear Mr. Thompson,

This is in response to your letter as referenced above. A copy of your letter is enclosed. We are providing our responses below, numbered in accordance with your questions:

1. The automatic restraint system provided at the driver's and passenger's seating positions in the Volvo 850 series are certified to meet the requirements of S4.1.2.1(c)(2) for FMVSS 208.

2. Not applicable.

3. Copies of the following test reports are enclosed:

TEST	SPEED	DEGREES	POS.	BELT USE	TEST#
3.1	30 MPH	0	DR	UNBELTED	LM128487
3.2	30 MPH	0	DR+PS	UNBELTED	LM128208
3.3	30 MPH	0	DR+PS	UNBELTED	LM128082
3.4	30 MPH	0	PS	UNBELTED	LM128032
3.5	30 MPH	0	DR+PS	BELTED	LM131132
3.6	35 MPH	0	DR+PS	BELTED	LM128385
3.7	35 MPH	0	DR+PS	BELTED	LM128386
3.8	30 MPH	30 LEFT	DR+PS	UNBELTED	LM128388
3.9	30 MPH	30 LEFT	DR+PS	BELTED	LM131134
3.10	30 MPH	30 RIGHT	DR+PS	UNBELTED	LM128387
3.11	30 MPH	30 RIGHT	DR+PS	BELTED	LM131133

All tests show that the FMVSS 208 criteria are fulfilled.

Mailing Address
Volvo Drive
Rockleigh, NJ 07647-0913

Telephone
201-768-7300

4. Not applicable.

5. Not applicable.

6. Copies of the BAM test reports showing compliance with S9.2 are enclosed.

7. Not applicable.

8. For all 0 degree tests, the two front door windows are fully open, and the rear door windows are fully closed. For all 30 degree tests, all four door windows are fully closed. The vehicles do not have movable vent windows.

9. For each certification test, a Part 572(B) (Hybrid II) test dummy was used in both the driver's and passenger's seats. Enclosed is a chart, "Dummy measurement for front seat passenger, Volvo 850 series", showing dummy placement measurements.

All of the subject vehicles have a foot rest for the driver.

None of the subject vehicles can be equipped with a split front bench seat.

10. The requested information is on the enclosed forms.

11. The requested information is on the enclosed chart, "Adjustable upper anchorage position, Volvo 850 series", showing the design position.

12. Impact speed, vehicle test weight, and injury criteria are all included within the data of the test reports enclosed in response to Question 3. The requested time plots are enclosed.

13. In order to obtain the proper test weight, the following components are removed in this order of priority:

- spare tire and jack.
- complete rear bumper.
- trunk lid.
- tail lamps.
- trunk area trim.
- all carpet with the exception of the front seat passenger's.

14. Enclosed is the test report LM123205 showing compliance with FMVSS 204.

15. Not applicable.

In addition to the above, we are pleased to also provide the following information regarding the 1996 model year 850 series vehicles. The planned suggested retail pricing and projected sales of these models is as follows:

(2)

	PRICE	VOLUME
850 sedan non-Turbo:	$26,125	30,265
850 wagon non-Turbo:	$27,425	11,754
850 Turbo sedan:	$32,650	11,935
850 Turbo wagon:	$33,950	8,724

We trust that the above information answers your request. Should you need additional information, please contact me directly at 201 767-4815.

DRIVE SAFELY,

VOLVO CARS OF NORTH AMERICA, INC.
Customer and Product Support

Richard A. Reina

Richard A. Reina
Compliance Programs Manager
Regulatory Compliance & Environmental Affairs

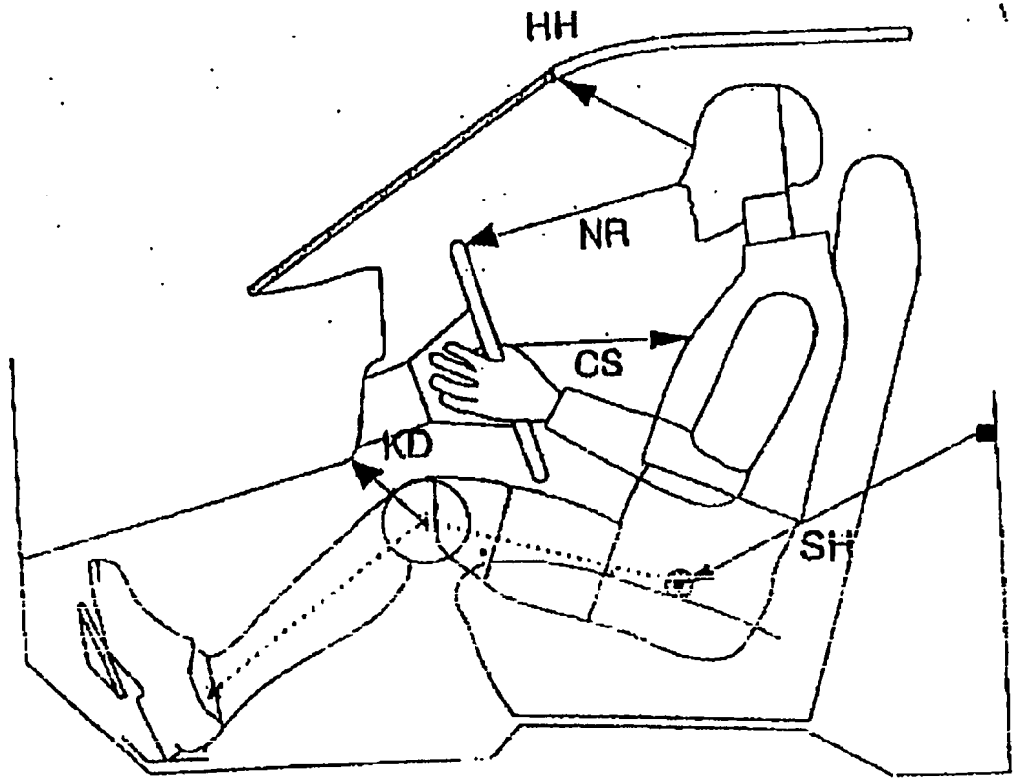
/rar

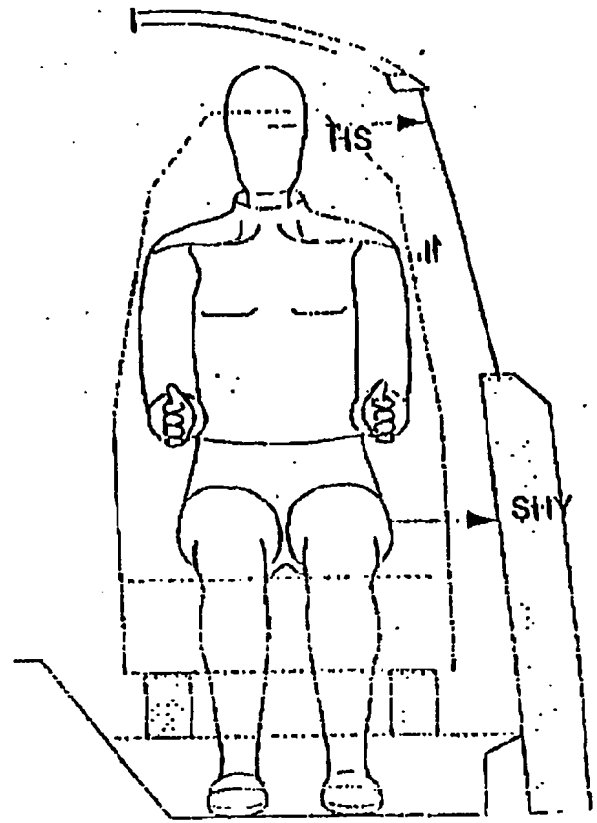
enclosures

cc: (w/o enclosures)
A. Eugensson
W. Shapiro
RCE

(3)

DUMMY MEASUREMENTS FOR FRONT SEAT PASSENGERS





HH - Head to Header
NR - Nose to Rim
CS - Steering Wheel to Chest
KDL/KDR - Knee to Dash
SH - Striker to H-Point

SHY - Striker to H-Point (Y Dir.)
HS - Head to Side Window

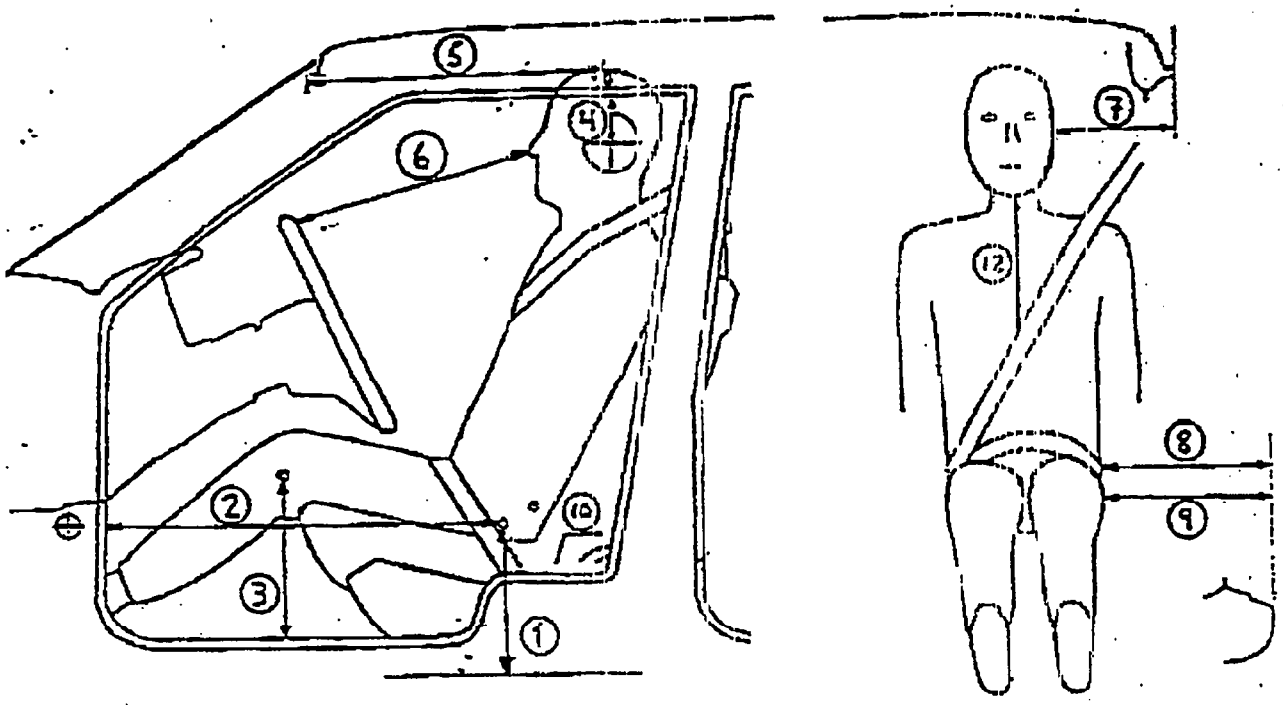
951116

July 10, 1992

Dummy measurement for front seat passenger, Volvo 850 series.

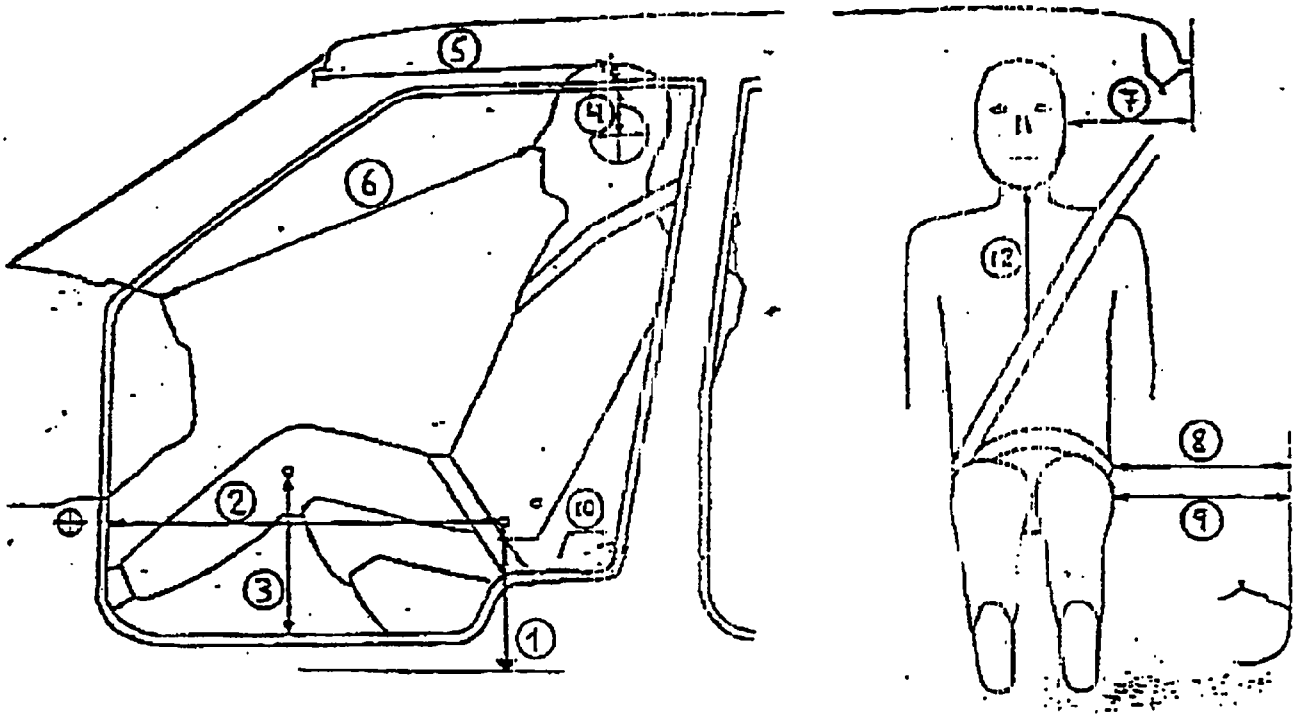
Test position:

Driver side:



No 1.	Pelvis vertical	to outer dorr sill.	180mm
No 2.	Pelvis hor.	to the plate flange.	710mm
No 3.	Knee vertical	to the plate flange.	250mm
No 4.	Head vertical	to the plate flange.	155mm
No 5.	Head horisontal	to the plate flange/ window	460mm
No 6.	Nose to the steering wheel.		395mm
No 7.	Head lateral	to edge roof	200mm
No 8.	Pelvis lateral	to edge door sill	255mm
No 9.	Knee lateral	to edge door sill	280mm
No 12.	Chin vertical	to upper edge seat belt.	120mm

Passenger side:

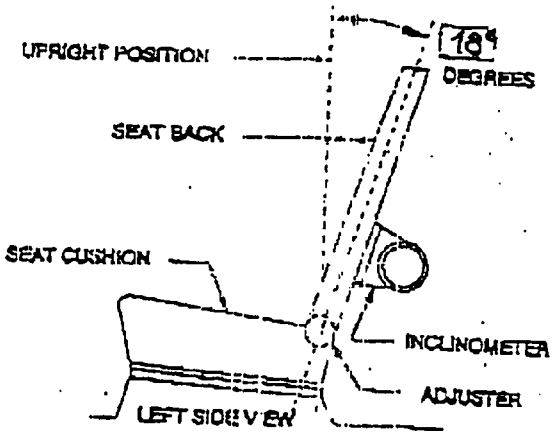


No 1.	Pelvis vertical	to outer door sill.	180mm
No 2.	Pelvis hor.	to the plate flange.	710mm
No 3.	Knee vertical	to the plate flange.	250mm
No 4.	Head vertical	to the plate flange.	155mm
No 5.	Head horisontal	to the plate flange/ window	470mm
No 6.	Nose to the dashboard.		680mm
No 7.	Head lateral to edge roof		195mm
No 8.	Pelvis lateral	to edge door sill	255mm
No 9.	Knee lateral	to edge door sill	280mm
No 12.	Chin vertical	to upper edge seat belt.	120mm

TEST VEHICLE INFORMATION

Vehicle Model Year & Make: MY 95 Volvo
Vehicle Model & Body Style: 850 - SERIES

1. NOMINAL DESIGN RIDING POSITION - -
For adjustable driver and passenger seat backs. Please describe how to position the inclinometer to measure the seat back angle. Include description of the location of the adjustment latch detent if applicable. Indicate, if applicable, how the detents are numbered (Is the first detent "0" or "1"?). Indicate if the seat back angle is measured with the dummy in the seat.



Seat back angle for driver's seat = 18 degrees.
Measurement Instructions:

See appendix 10.1

Seat back angle for passenger's seat = 18 degrees.
Measurement Instructions:

See appendix 10.1

2. SEAT FORE & AFT POSITIONS - -
Provide instructions for positioning the driver and front outboard passenger seat(s) in the center of fore and aft travel. For example, indicate how the detents are numbered (Is the first detent "0" or "1"?). Provide information to locate the detent in which the seat track is to be locked.

Positioning of the driver's seat:

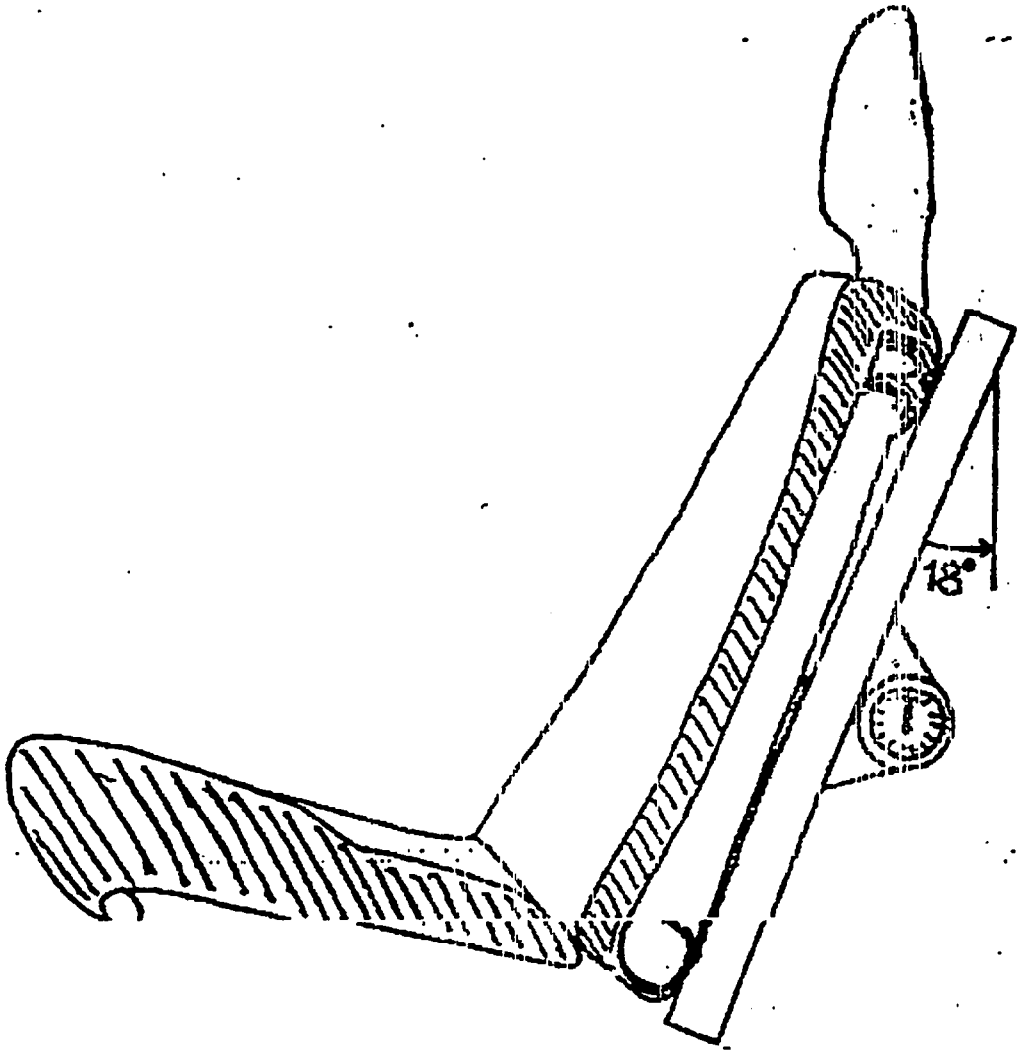
See appendix 10.2

Positioning of the passenger's seat (if applicable):

See appendix 10.2

Rev. 7/11/94

Adjustment of seat-back angle, Volvo 850 series.



Press a bar against the centerline of the seat-back. When car attitude angle i 0 degrees, the angle of the seat-back should be 18 degrees from vertical.

Seat height and fore & aft position, Volvo 850 series.

Height position:

Power seats:

Place the seat in the full-down position, with the electrical manaeuver knobs. Positioned on the side of the seat against the door.

Mechanical seats:

Place the seat in the full-down position, with the manuel shift handle. Positioned on the side of the seat against the middle of the car.
Press in foreward to lower the front of the seat and backwards to lower the back of the seat.

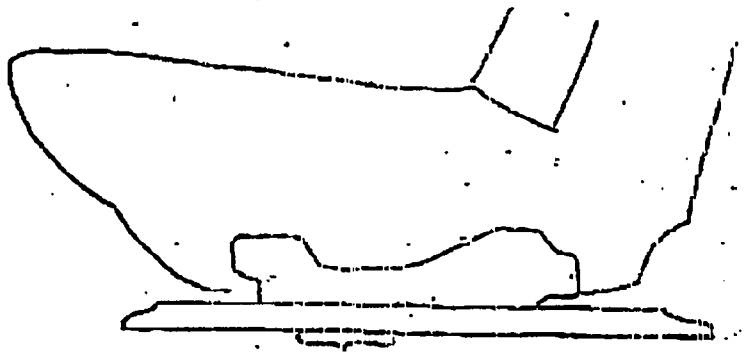
Fore & Aft position:

Power seats:

Mark the extremes of travel and position the seat in the mid position.

Mechanical seats:

The seat should be positioned in the center of the fore and aft travel. In this position there are eight empty holes in the front of the locking mechanism as indicated in figure 1 below.



8 empty holes in front of the locking mechanism.

Figure 1. Mid position of the mechanical seat.

(Q11)

Adjustable upper anchorage position, Volvo 850 series.

The seat belt are self adjustable at the upper anchorage on the b-pillar. The upper anchorage is on the Volvo 850 series integrated in the reel.

Test position:

The test position for the seat belt at the upper anchorage, is in the "mid position". This is obtained, by pulling the seat belt out (approx 200mm) and guide it backwards manually on to the reel. So that it is in the position as shown in the figure 2 below.

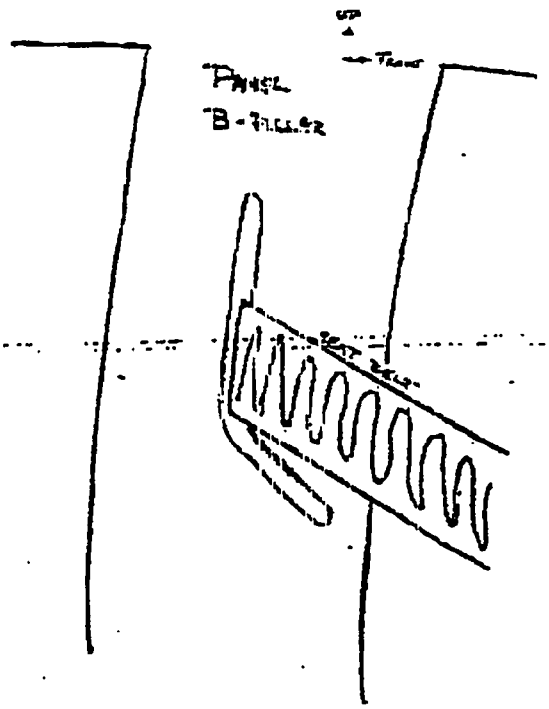


Figure 2. Seat belt position at the upper anchorage.

Tilt & length adjustable steering column positioning data.

The steering column on the Volvo 850 series, are adjustable both in length and in height.

Test position:

Tilt:

The test position is in the middle of the tilt range. Press a bar against the steering wheel rim. When car attitude angle i 0 degrees, the angle of the steering wheel should be 22.5 degrees from vertical.
See figure 3 below:

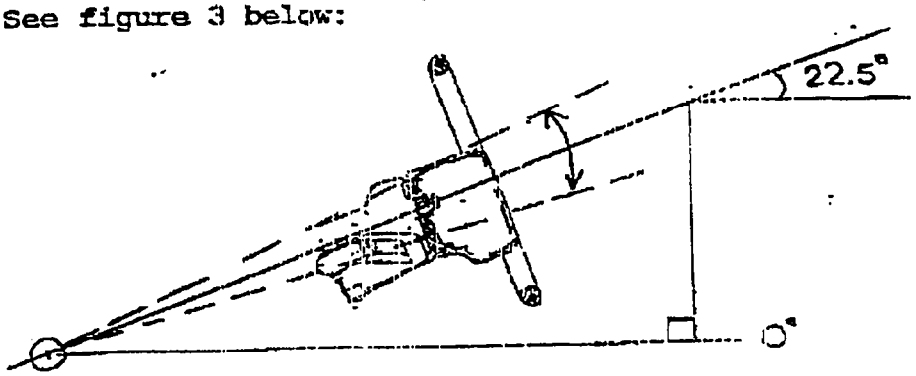


Figure 3. Tilt position.

Length:

The test position is in the middle of the adjustable lenght range. The total adjustable lenght are 40mm.
See figure 4 below.

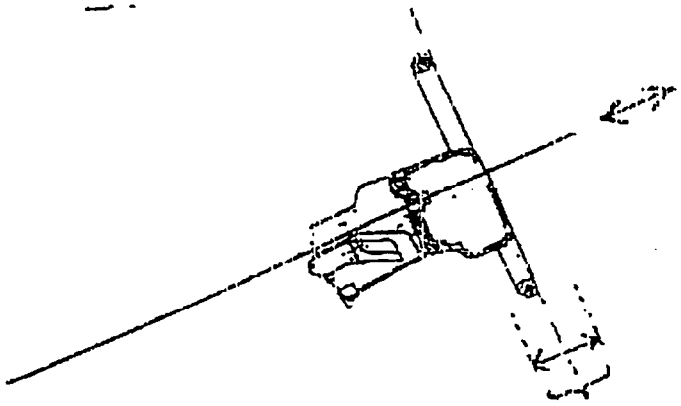


Figure 4. Length position.