

V2736

Report Numbers: 208S-TRC-97-001

Vehicle Safety Compliance Testing
for Occupant Crash Protection

General Motors Corporation

1998 Chevrolet Lumina

4-Door Sedan

NHTSA Number: CW0109

TRC Test Number: 971028S

Transportation Research Center Inc.

10820 State Route 347

East Liberty, OH 43319



November 18, 1997

Final Report

Prepared For:

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Safety Assurance

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

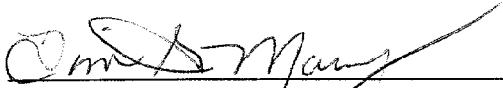
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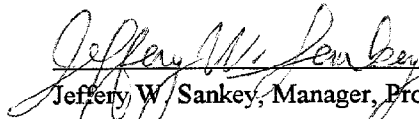
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16. Abstract An FMVSS 208 compliance sled test was conducted on a 1998 Chevrolet Lumina 4-door sedan, NHTSA No. CW0109, at Transportation Research Center Inc. on October 28, 1997. This test was conducted to determine compliance with Federal Motor Vehicle Safety Standards (FMVSS): 208, "Occupant Crash Protection." The Hybrid III dummies were not restrained by seat belts. The ambient temperature was 70 F. The sled carriage was accelerated to 17.4 g with an integrated velocity change of 29.0 mph. The driver's Head Injury Criteria (HIC) was 89. The driver's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 42.3 g. The driver's chest deflection was 1.4 inches. The driver's left and right femur maximum axial forces were 1247 pounds and 1114 pounds, respectively. The driver's maximum neck flexion about the occipital condyle was 39.9 Newton-meters. The driver's maximum neck extension about the occipital condyle was 12.4 Newton-meters. The driver's maximum axial neck tension was 1071 Newtons. The driver's maximum axial neck compression was 85 Newtons. The driver's maximum fore and aft neck shear was 553 Newtons. The passenger's HIC was 109. The passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 31.4 g. The passenger's chest deflection was 0.5 inch. The passenger's left and right femur maximum axial forces were 1109 pounds and 922 pounds, respectively. The passenger's maximum neck flexion about the occipital condyle was 57.6 Newton-meters. The passenger's maximum neck extension about the occipital condyle was 11.7 Newton-meters. The passenger's maximum axial neck tension was 371 Newtons. The passenger's maximum axial neck compression was 769 Newtons. The passenger's maximum fore and aft neck shear was 1024 Newtons.			
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Section 1.0

Purpose and Test Procedure

Purpose

This FMVSS 208 compliance sled test is part of the Federal Motor Vehicle Safety Standard (FMVSS) 208 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 1998 Chevrolet Lumina 4-door sedan, NHTSA No. CW0109, meets the performance requirements of FMVSS 208, "Occupant Crash Protection," in the impact simulation sled test mode.

Test Procedure

This test was conducted in accordance with NHTSA's Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure No. TP-208S-00, dated June 17, 1997. Data was obtained relative to FMVSS 208, "Occupant Crash Protection," performance.

The test vehicle was instrumented with six (6) accelerometers to measure longitudinal axis accelerations.

The test vehicle contained two (2) Part 572 E 50th percentile adult male anthropomorphic test devices (dummies). The dummies were positioned in the front outboard designated seating positions according to the dummy placement procedure specified in Appendix B of the Laboratory Test Procedure. The dummies were not restrained by seat belts.

Both dummies were instrumented with head and chest accelerometers to measure longitudinal, lateral, and vertical accelerations; chest deflection potentiometers; left and right femur load cells to measure axial forces; and upper neck load cells to measure longitudinal, lateral, and vertical forces and moments.

The forty (40) data channels were digitally sampled at 12,500 samples per second and processed per Sections 11.7 through 11.9 of the Laboratory Test Procedure.

The crash event was recorded by one (1) real-time motion picture camera and six (6) 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 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

FMVSS 208 Compliance Sled Test Summary

Test Results Summary

This FMVSS 208 compliance sled test was conducted at TRC on October 28, 1997.

The test vehicle, a 1998 Chevrolet Lumina 4-door sedan, NHTSA No. CW0109, appeared to comply with the performance requirements of FMVSS 208 in the impact simulation sled test mode. The Head Injury Criteria (HIC) calculations were less than 1000, the chest resultant accelerations did not exceed 60 g's, the chest deflections did not exceed 3.0 inches, and the compressive forces transmitted through the upper legs did not exceed 2,250 pounds as measured by Part 572 E dummies seated in the front outboard designated seating positions. The neck flexion moment about the occipital condyle did not exceed 190 N·m, the neck extension moment about the occipital condyle did not exceed 57 N·m, the neck tension did not exceed 3300 N, the neck compression did not exceed 4000 N, and the neck fore and aft shear force did not exceed 3100 N as measured by the Part 572 E dummies. The vehicle's seat belts met the applicable lap belt lockability requirements.

The test vehicle was equipped with airbags at the driver and passenger seating positions. The Hybrid III dummies were not restrained by seat belts. The sled carriage was accelerated to 17.4 g with an integrated velocity change of 29.0 mph. The airbags were triggered at 20.2 milliseconds after 0.5 g acceleration was measured by the firing circuit. Following subsequent digital data processing and filtering the acceleration signal to Channel Class 60, the airbag event trigger signal was 17.3 ms after the 0.5 g acceleration level was indicated.

The driver's HIC was 89. The driver's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 42.3 g. The driver's chest deflection was 1.4 inches. The driver's left and right femur maximum compressive forces were 1247 pounds and 1114 pounds, respectively. The driver's maximum neck moments about the occipital condyle were 12.4 N·m extension and 39.9 N·m flexion. The driver's maximum neck forces were 1071 N axial tension, 85 N axial compression and 553 N fore and aft shear.

Test Results Summary, Cont'd

The right front passenger's HIC was 109. The right front passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 31.4 g. The passenger's chest deflection was 0.5 inch. The right front passenger's left and right femur maximum compressive forces were 1109 pounds and 922 pounds, respectively. The passenger's maximum neck moments were 11.7 N·m extension and 57.6 N·m flexion. The passenger's maximum neck forces were 371 N tension, 469 N compression and 1024 N fore and aft shear.

Data Acquisition Explanations

The test dummies were stationed in the Dummy Calibration Laboratory until 3:30 p.m., 10/28/97. The dummies were transported to the sled room test area. It was discovered that the thermo-graph was inoperable and had not recorded the temperature prior to that time. Temperature recording sensors were attached to the head, spine box, neck, and knee of each dummy at the test site. All channels were within the 69° ~72° specification with the exception of the passenger knee. Pre-test photographs were taken underneath the overhead lights. At 5:45 p.m. the spine box of the driver dummy exceeded 72.5°. At 6:30 p.m. a number of temperature sensors exceeded 72.5° F for a short time. Fans were placed at each front occupant window opening of the test vehicle to cool the dummies. At 7:30 p.m. the passenger spine box temperature lowered to 72.5° F. At 8:14 p.m. the driver spine box temperature lowered to 72.5° F and the COTR gave permission to conduct the sled test.

Table 1 Sled Test Summary

NHTSA number:	CW0109	
Test type:	FMVSS 208 Compliance Sled Test	
Test date:	10/28/97	
Test time:	8:33 pm	
Ambient temperature at impact area:	72° F	
Vehicle year/make/ model/body style:	1998/Chevrolet/Lumina/4-door sedan	
Vehicle test weight:	3750 lb	
Sled carriage:		
Integrated velocity from the integration of the entire sled acceleration:	29.0 mph	
Measured velocity from the light trap device attached to the sled:	29.7 mph	
Acceleration:	17.4 g	
Time from T-0 (-0.5 g) to 0.0 g::	124.1 msec	
Acceleration corridor achieved:	Yes	
Number of cameras:		
Real-time:	1	
High-speed:	6	
Dummies:	<u>Driver #229</u>	<u>Passenger #230</u>
Type:	Part 572 E	Part 572 E
Location:	Left front	Right front
Restraint:	Airbag	Airbag
Number of data channels:	15	15
Front seat data:		
Seat track failure:	No apparent failure	
Seat back failure:	No apparent failure	
Visible dummy contact points:		
Head:	Airbag, sun visor	Airbag, sun visor
Chest:	Airbag	Airbag
Abdomen:	Steering wheel rim	Airbag
Left knee:	Instrument panel	Instrument panel
Right knee:	Instrument panel	Instrument panel

Table 2 Test Vehicle Information

Vehicle year/make/
model/body style: 1998/Chevrolet/Lumina/4-door sedan

Color: Dark Jade Green Metallic

VIN: 2G1WL52M6W9105406

NHTSA number: CW0109

Engine data:

Placement: Transverse/Lateral

Cylinders: 6

Displacement: 3.1 liters

Transmission data: 4 speed, manual, X automatic, X overdrive

Final drive: X fwd, rwd, 4wd

Date vehicle received: 09/12/97

Odometer reading: 36

Dealer's name
and address: Dave Kehl Chevrolet, Inc.
45 East Sandusky St.
Mechanicsburg, OH 43044

Accessories:

Power steering	Yes	Automatic transmission	Yes
Power brakes	Yes	Automatic speed control	Yes
Power seats	No	Tilting steering wheel	Yes
Power windows	No	Telescoping steering wheel	No
Tinted glass	Yes	Air conditioning	Yes
Radio	Yes	Anti-skid brake	No
Clock	Yes	Rear window defroster	Yes
Power door locks	Yes	Other:	None

Certification data from vehicle's label:

Vehicle manufactured by: General Motors of Canada, Ltd.

Date of manufacture: 07/97

VIN: 2G1WL52M6W9105406

GVWR: 4427 lb

GAWR: Front: 2443 lb

Rear: 1984 lb

Table 2 Test Vehicle Information, Cont'd.

Size of tires on vehicle: P205/70R15
Spare tire: Space Saver
Type of front seats: Cloth Split Bench 60/40

Tire & capacity data from vehicle's label:

Recommended tire size: P205/70R15

Recommended cold tire pressure:

Front: 30 psi

Rear: 30 psi

Designated Seating Capacity:

Front 3

Rear 3

Total 6

Vehicle Capacity Weight: 1058 lb

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

Right front	1058	lb	Right rear	584	lb
Left front	1069	lb	Left rear	612	lb
Total front weight	2127	lb	(64% of total vehicle weight)		
Total rear weight	1196	lb	(36% of total vehicle weight)		
Total delivered weight	3323	lb			

Table 2 Test Vehicle Information, Cont'd.

Calculation of test vehicle's target test weight:

RCLW¹ = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight (3323 lb)

VCW¹ = Vehicle Capacity Weight (1058)

DSC² = Designated Seating Capacity (6)

RCLW¹ = VCW - 150 (DSC) = 1058 - 150 (6) = 158 lb

Target test weight = UDW + RCLW¹ + (Number of Hybrid III dummies x 167 lb
per dummy)

Target test weight = 3323 + 158 + 334 = 3815 lb

Weight of test vehicle with required dummies and 150 lb of cargo weight:

Right front	1127	lb	Right rear	746	lb
Left front	1133	lb	Left rear	744	lb
Total front weight	2260	lb	(60.3% of total vehicle weight)		
Total rear weight	1490	lb	(39.7% of total vehicle weight)		
Total test weight	3750	lb	(65 lbs. under target test weight)		

Weight of ballast secured in vehicle: None

Components removed to meet target test weight: none

¹ From vehicle's tire load label.

Table 2 Test Vehicle Information, Cont'd.

Test Vehicle Attitude:

As delivered door sill angle: 0.7°
As tested door sill angle: 0.6°
Fully loaded door sill angle: 0.5°
Vehicle Wheelbase: 107.0 in

Seat Data:

Front seats: Manual 60/40 cloth bench seats.
Seat track settings: 12 open notches in front of locking mechanism (mid for both seats).
Seat back settings: Locate 3 inches up from seat back pivot and cut fabric adjacent to seat back frame. The seat back frames were set to 26°.

Fuel System Data:

Fuel system capacity from owner's manual: 16.6 gallons
Useable capacity figure furnished by COTR: 16.6 gallons

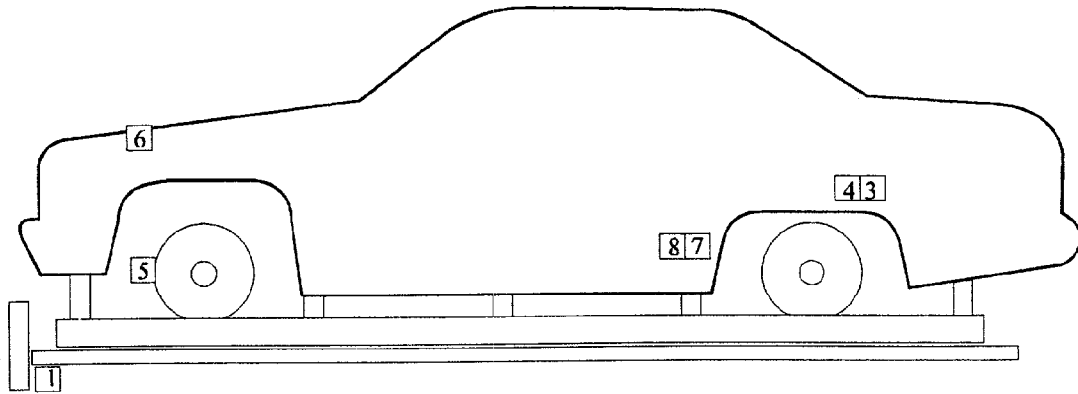
Steering Column Adjustments

The steering wheel hub was set to the geometric center of its full range of driving positions. There were 5 positions available. With the top position as no. 1, the steering wheel hub was set 2 notches down to position no. 3.

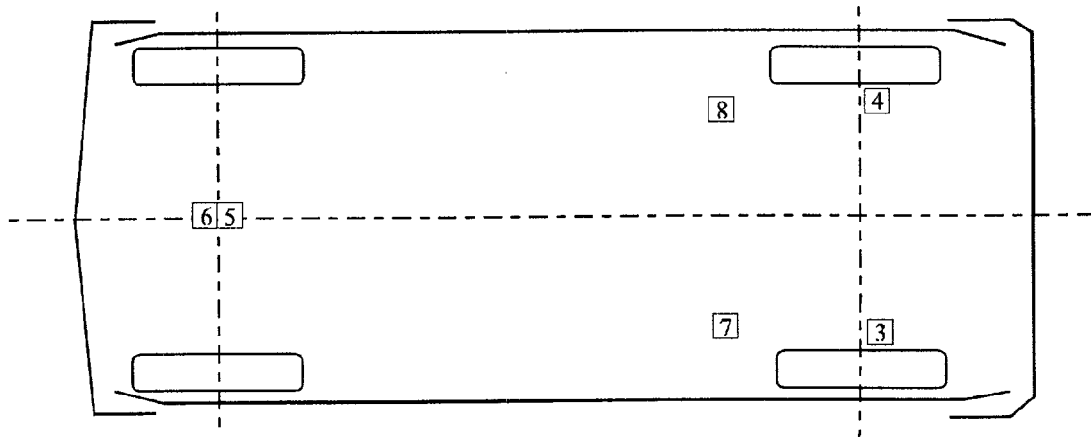
Table 3 Post-Impact Data

Test number:	971028S
NHTSA number:	CW0109
Test date:	10/28/97
Test time:	8:33 pm
Test type:	FMVSS 208 Compliance Sled Test
Impact angle:	0°
Ambient temperature at impact area:	70° F
Temperature in occupant compartment:	72° F
Impact velocity:	
Integrated velocity from the integration of the entire sled acceleration:	29.0 mph
Measured velocity from the light trap device attached to the sled:	29.7 mph
Specified integrated velocity range:	28 to 30 mph
Sled carriage acceleration:	
Acceleration:	17.4 g
Specified acceleration range:	16.0 g - 18.2 g
Sled carriage acceleration duration:	
Time from T-0 (-0.5 g) to 0.0 g:	124.1 msec
Specified acceleration duration:	120.0 - 130.0 msec.
The sled acceleration corridor was achieved.	

Figure 1 Vehicle Accelerometer Placement



Side View



Bottom View

Table 4 Vehicle Accelerometer Locations and Data Summary

TEST NUMBER: S971028S No. LOCATION	X	Y	POSITIVE DIRECTION	NEGATIVE DIRECTION
1 SLED ACCELERATION PRIMARY REDUNDANT	176.2 in	-1.0 in	0.8 g @ 155.0 ms 0.8 g @ 164.7 ms	17.4 g @ 56.3 ms 17.8 g @ 59.0 ms
2 SLED VELOCITY MEASURED INTEGRATED			-0.1 km/h @ 7.1 ms -0.2 km/h @ 7.1 ms	47.8 km/h @ 146.1 ms 46.7 km/h @ 143.2 ms
3 RIGHT REAR AXLE LONGITUDINAL	47.2 in	31.2 in	1.5 g @ 132.2 ms	19.5 g @ 57.3 ms
4 LEFT REAR AXLE LONGITUDINAL	48.2 in	-31.2 in	1.4 g @ 127.2 ms	19.4 g @ 47.8 ms
5 BOTTOM ENGINE LONGITUDINAL	164.0 in	0.0 in	2.4 g @ 129.0 ms	19.9 g @ 53.4 ms
6 TOP ENGINE LONGITUDINAL	161.0 in	0.0 in	5.4 g @ 137.3 ms	19.5 g @ 60.1 ms
7 RIGHT REAR SEAT MEMBER LONGITUDINAL	125.0 in	13.5 in	2.2 g @ 131.3 ms	21.3 g @ 48.5 ms
8 LEFT REAR SEAT MEMBER LONGITUDINAL	125.0 in	-13.5 in	2.1 g @ 131.4 ms	19.3 g @ 48.4 ms

Table 4 Vehicle Accelerometer Locations and Data Summary, Cont'd.

TEST NUMBER: S971028S No. LOCATION	X	Y	POSITIVE DIRECTION	NEGATIVE DIRECTION
9 AIRBAG EVENT			7.0 volt @ 17.3 ms	---

REFERENCE: X: + FORWARD FROM VEHICLE REAR SURFACE
Y: + RIGHTWARD FROM SLED CARRIAGE CENTERLINE

Section 3.0

FMVSS 208 Data

Table 5 Dummy Injury Criteria
Maximum Acceleration

	Head				Chest		
	X	Y	Z	R	X	Y	Z
Driver	68.0 g	-7.3 g	16.9 g	69.9 g	-43.4 g	6.2 g	7.3 g
Passenger	-25.3 g	-8.4 g	18.3 g	28.6 g	-31.9 g	-4.1 g	10.4 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Driver	1247 lbf	1114 lbf
Passenger	1109 lbf	922 lbf

Head Injury Criteria¹

	HIC	Time t ₁	Time t ₂
Driver	89	79.3 ms	115.3 ms
Passenger	109	86.8 ms	122.8 ms

Chest Maximum Resultant Acceleration²

	Acceleration	Time t ₁	Time t ₂
Driver	42.3 g	87.3 ms	90.3 ms
Passenger	31.4 g	97.5 ms	100.6 ms

Maximum Chest Deflection

Driver	1.4 in
Passenger	0.5 in

Neck Injury Criteria

	Flexion Moment	Extension Moment	Axial Tension Force	Axial Compression Force	Maximum Fore and Aft Shear Force
Driver	39.9 N.m	12.4 N.m	1071 N	85 N	553 N
Passenger	57.6 N.m	11.7 N.m	371 N	469 N	1024 N

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 and chest impacted the airbag. The dummy's head and chest were restrained by the airbag. The dummy's head and upper torso rotated forward. The dummy's lower torso rebounded into the seat back. The dummy's head contacted the sun visor upon rebound. The driver dummy came to rest seated in the driver's seat with its upper torso leaning forward into the airbag.

Right Front Passenger Dummy

Upon impact, the passenger dummy translated forward on the seat impacting both knees into the instrument panel. The dummy's head and chest impacted the airbag. The dummy's head and chest were restrained by the airbag. The dummy's head and upper torso rotated forward. The dummy's lower torso rebounded into the seat back. The dummy's head contacted the sun visor upon rebound. The passenger dummy came to rest seated in the driver's seat. The upper torso was leaning forward.

Table 6 FMVSS 208 Lap Belt Lockability
Outboard Designated Seating Positions (S7.1.1.5)

NHTSA number: CW0109

Vehicle model year/make/model/body style: 1998/Chevrolet/Lumina/4-door sedan

Date of lap belt lockability check: 11/24/97

Technician performing check: Macy

GVWR: 4427 lb

Lap Belt Lockability (S7.1.1.5):

Right Front Seating Position:

Test seat position: Full rear

The lap belt portion of the seat belt consists of a locking device that does not have to be attached by the vehicle user to the seat belt webbing, retractor, or any other part of the vehicle.

The lap belt portion of the seat belt consists of a locking device that does not require inverting, twisting or deforming of the belt webbing.

Seat belt locking feature: As instructed on pages 1-60 and 1-61 of the Owner's manual.
"Pull the shoulder belt all the way out of the retractor to set the lock."

Seat belt lock deactivation: As instructed on pages 1-61 of the owner's manual.
"Unbuckle the vehicle's safety belt and let it go back all the way."

Maximum lap belt length: 51.5 inches between point A and point B

Lap belt length at 10 lb preload: 28.2 inches between point A and point B

Force application angle: 10°

Lap belt length at 50 lb load: 28.6 inches between point A and point B

Force application angle / rate: 10° / 20 lb/sec

Difference 2 inches or less?: Yes

The difference in length of the lap belt webbing from points A and B from the fully extended position to the 50 lb. load position exceeded 3 inches.

Table 6 FMVSS 208 Lap Belt Lockability, Cont'd.
Outboard Designated Seating Positions (S7.1.1.5)

NHTSA number: CW0109

Vehicle model year/make/model/body style: 1998/Chevrolet/Lumina/4-door sedan

Date of lap belt lockability check: 11/24/97

Technician performing check: Macy

GVWR: 4427 lb

Lap Belt Lockability

Right Rear Seating Position:

Test seat position: Fixed

The lap belt portion of the seat belt consists of a locking device that does not have to be attached by the vehicle user to the seat belt webbing, retractor, or any other part of the vehicle.

The lap belt portion of the seat belt consists of a locking device that does not require inverting, twisting or deforming of the belt webbing.

Seat belt locking feature: As instructed on pages 1-60 and 1-61 of the Owner's manual.
"Pull the shoulder belt all the way out of the retractor to set the lock."

Seat belt lock deactivation: As instructed on pages 1-61 of the owner's manual.
"Unbuckle the vehicle's safety belt and let it go back all the way."

Maximum lap belt length: 56.8 inches between point A and point B

Lap belt length at 10 lb preload: 36.9 inches between point A and point B

Force application angle: 10°

Lap belt length at 50 lb load: 37.3 inches between point A and point B

Force application angle / rate: 10° / 20 lb/sec

Difference 2 inches or less?: Yes

The difference in length of the lap belt webbing from points A and B from the fully extended position to the 50 lb. load position exceeded 3 inches.

Table 6 FMVSS 208 Lap Belt Lockability, Cont'd
Outboard Designated Seating Positions (S7.1.1.5)

NHTSA number: CW0109

Vehicle model year/make/model/body style: 1998/Chevrolet/Lumina/4-door sedan

Date of lap belt lockability check: 11/24/97

Technician performing check: Macy

GVWR: 4427 lb

Lap Belt Lockability (S7.1.1.5):

Left Rear Seating Position:

Test seat position: Fixed

The lap belt portion of the seat belt consists of a locking device that does not have to be attached by the vehicle user to the seat belt webbing, retractor, or any other part of the vehicle.

The lap belt portion of the seat belt consists of a locking device that does not require inverting, twisting or deforming of the belt webbing.

Seat belt locking feature: As instructed on pages 1-60 and 1-61 of the Owner's manual.
"Pull the shoulder belt all the way out of the retractor to set the lock."

Seat belt lock deactivation: As instructed on pages 1-61 of the owner's manual.
"Unbuckle the vehicle's safety belt and let it go back all the way."

Maximum lap belt length: 57.5 inches between point A and point B

Lap belt length at 10 lb preload: 26.6 inches between point A and point B

Force application angle: 10°

Lap belt length at 50 lb load: 27.6 inches between point A and point B

Force application angle / rate: 10° / 20 lb/sec

Difference 2 inches or less?: Yes

The difference in length of the lap belt webbing from points A and B from the fully extended position to the 50 lb. load position exceeded 3 inches.

Table 7 FMVSS 208 Equipment Data

FMVSS 208 Seat Belt Warning System Data

With an occupant in the driver's position and the seat belt in stowed position and ignition switch placed in the "start/on" position, the duration of the reminder light is continuous. The audible warning signal operates for 5 s.

With an occupant in the driver's position and the seat belt in use and the ignition switch placed in the "start/on" position the duration of audible warning signal is 0 s and reminder light operation is 7 s.

NOTE: the audible warning should not operate.

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

FMVSS 208 Labeling and Drivers Manual Information

The vehicle did not have a label describing manufacturer's maintenance or replacement schedule for crash-deployed occupant protection system.

Appropriate instructions concerning maintenance and/or replacement of the air bag system was located in the vehicle owner's manual on page 1-25.

A description of the functional operation of the system is provided in the owner's manual on pages 1-24 and 1-25.

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 1-21, 1-22, and 1-23.

Table 7 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 located on the lower left corner 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 page 2-52.

FMVSS 208 Rear Outboard Seating Position Seat Belts

All rear outboard seating positions have type 2 seat belts.

Table 7 FMVSS 208 Equipment Data, Cont'd.
Air Bag Labels

1. FMVSS 208 Air Bag Maintenance Label and Owner's Manual Instructions:

- 1.1 The manufacturer's recommended regular airbag maintenance is that the system does not require regular maintenance.

2. The Vehicle:

- 2.1 Does not provide an automatic means to ensure that the air bag does not deploy when a child seat or child with a total mass of 30 kg or less is present on the front outboard passenger seat.
- 2.2 Does not incorporate sensors which automatically prevent the passenger air bag from deploying in situations in which it might have an adverse effect on infants in rear-facing child seats, and unbelted or improperly belted children.
- 2.3 Does not have a passenger air bag designed to deploy in a manner that does not create a risk of serious injury to infants in rear-facing child seats, and unbelted or improperly belted children.

3. Sun Visor Warning Label

- 3.1 A warning label is affixed to each sun visor by adhesive backing.
- 3.2 Each front outboard occupant sun visor warning label conforms in content to (S4.5.1(b)(2).
- 3.3 Each front outboard occupant sun visor warning label area is yellow with the "WARNING" alert symbol in black and is located on the left side of the label.
- 3.4 Each front outboard occupant sun visor warning label message is white with black text.
- 3.5 Each front outboard occupant sun visor warning label message area is 49.3 cm².
- 3.6 Each front outboard occupant sun visor warning label has a black pictogram with a red circle and slash on a white background.
- 3.7 Each front outboard occupant sun visor warning label pictogram is 32 mm in diameter.

Table 7 FMVSS 208 Equipment Data, Cont'd.
Air Bag Labels

3. Sun Visor Warning Label Cont'd

- 3.8 Each front outboard occupant sun visor warning label is affixed free of other information.
- 3.9 Each front outboard occupant sun visor warning label is free of other information about air bags or the need to wear seat belts.

4. Air Bag Alert Label

- 4.1 Each front outboard occupant sun visor warning label is visible when the sun visor is in the stowed position.

5. Label On Dash

- 5.1 The vehicle is equipped with a passenger air bag.
- 5.2 The vehicle is equipped with a warning label affixed to the dash.
- 5.3 The warning label affixed to the dash conforms in content with S4.5.1(e).
- 5.4 The heading area is yellow with the word "WARNING" in black letters.
- 5.5 The message area is white with black text.
- 5.6 The message area is 52 cm².

Table 7 FMVSS 208 Equipment Data, Cont'd.
FMVSS 208 Seat Belt Comfort and Convenience Test Summary
Front Outboard Designated Seating Positions

Seat Belt Contact Force

The seat belts do not incorporate webbing tension-relieving devices

The contact force exerted by the webbing on the dummy's chest was 0.5 pound for both the driver and right front passenger seating positions.

Latch Plate Access

Both front outboard occupants latchplates are within the reach envelope.

There is sufficient clearance between the vehicle seats and the sides of the vehicle interior to allow the test block to move unhindered to the latchplates.

Retraction

The torso and lap belt webbing of the seat belt systems automatically retracts when the seat belt latch plates are released.

With the webbing and hardware systems in the stowed positions and the front doors closed, the webbing and hardware are not pinched.

Seat Belt Guides and Hardware

Each manual seat belt has the buckle above the seat cushion.

The remaining two seat belt parts are accessible under normal conditions.

The buckles and latchplates do not pass through the guides or conduits provided and fall behind the seat when the following events occur:

When the belts are completely retracted.

When the seats are moved to any position which they are designed to be adjusted.

When the seat backs are folded forward as far as possible and then moved backward into position.

The inboard seat belt receptacle ends are accessible with the center arm rest in any position to which it can be adjusted (without moving the armrest).

Section 4.0

Vehicle, Occupant, and Camera Measurements

Figure 2 Vehicle Target Locations

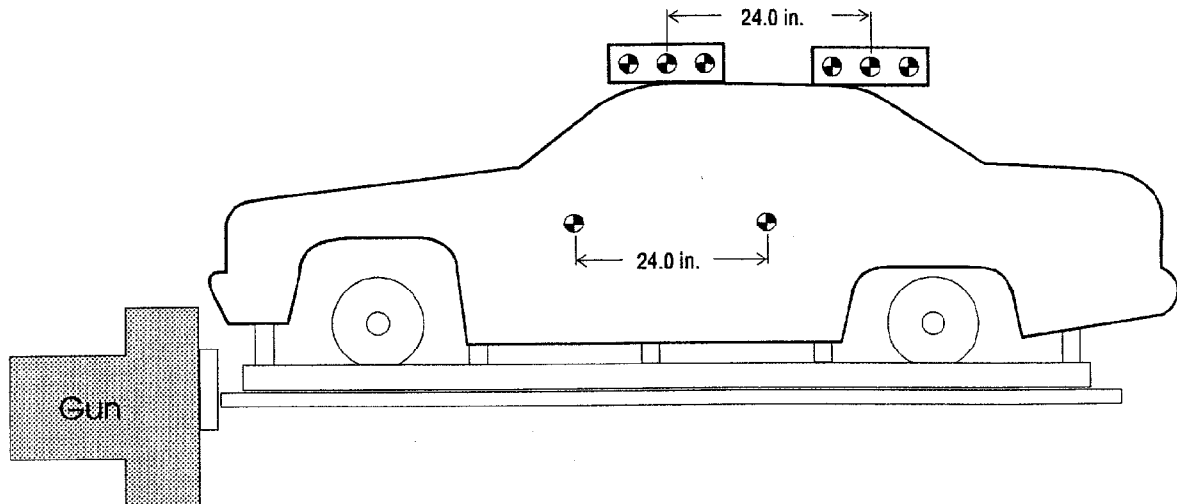


Figure 3 Dummy Measurement Locations for Front Seat Occupants

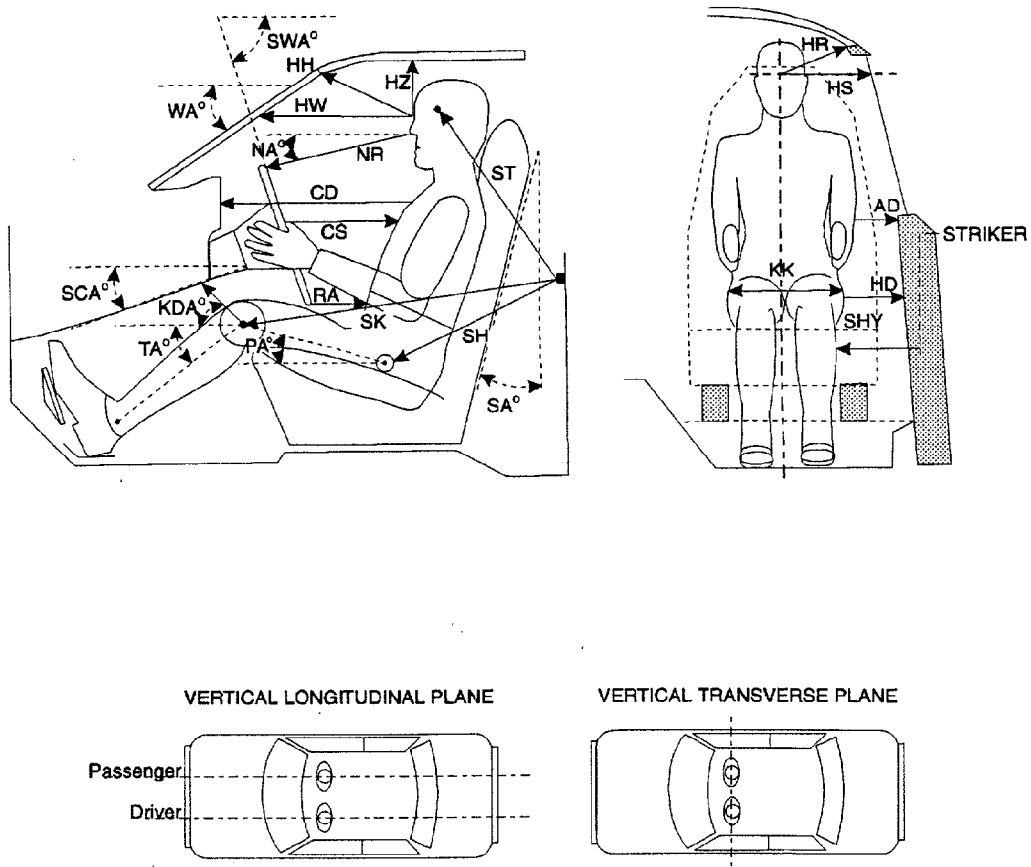


Table 8 Dummy Measurement Data for Front Seat Occupants

Designation	Type of Measurement	Driver (Serial #229)	Passenger (Serial #230)
WA	Windshield angle	28.5°	NA
SWA	Steering wheel angle	67.8°	NA
SCA	Steering column angle	22.0°	NA
SA	Seat back angle	26.0°	26.0°
HZ	Head to roof	6.1 in	5.8 in
HH	Head to header	12.2 in	13.7 in
HW	Head to windshield	20.9 in	21.4 in
HR	Head to side header	8.3 in	7.6 in
NR	Nose to rim	13.3 in	NA
NA	Nose to rim angle	14.0°	NA
CD	Chest to dash	18.8 in	19.5 in
CS	Steering wheel to chest	9.4 in	NA
RA	Rim to abdomen	5.1 in	NA
KDL	Left knee to dash	5.0 in	5.4 in
KDR	Right knee to dash	4.8 in	5.1 in
KDA	Outboard knee to dash angle	35.0°	50.0°
PA	Pelvic angle	22.2°	23.3°
TA	Tibial angle	43.2°	38.5°
KK	Knee to knee	11.4 in	10.6 in
ST ¹	Striker to head	19.4 in	20.0 in
	Striker to head angle	-82.0°	-80.4°
SK ¹	Striker to knee	23.6 in	23.7 in
	Striker to knee angle	0.5°	5.5°
SH ¹	Striker to H-point	10.2 in	10.0 in
	Striker to H-point angle	30.2°	27.9°
SHY	Striker to H-point (Y dir.)	11.0 in	9.8 in
HS	Head to side window	14.0 in	13.8 in
HD	H-point to door	6.5 in	5.8 in
AD	Arm to door	6.1 in	5.7 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 4 Camera Positions

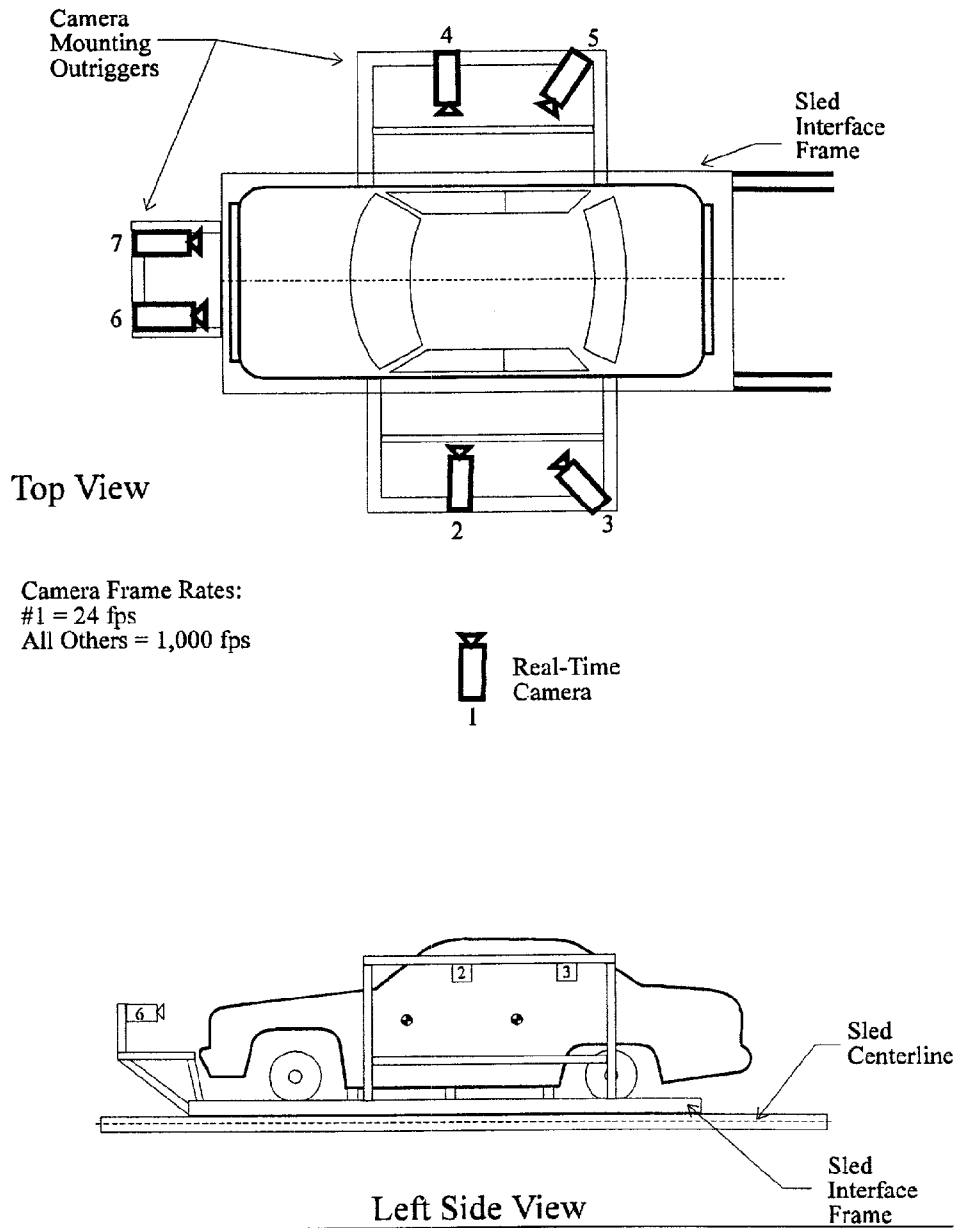


Table 9 Motion Picture Camera Locations

Vehicle year/make/model/body style: 1998/Chevrolet/Lumina/4-door sedan

Test number: 971028S

Camera Number	View	Camera Positions ¹			Camera Angle ²	Film Plane to Head Target	Camera Lens	Film Speed
		X	Y	Z				
1	Left side view offboard	123.0 in	298.0 in	50.4 in	3.1°	278.0 in	NA	24 frames/s
2	Left side view wide	83.0 in	72.5 in	48.7 in	6.0°	53.0 in	8 mm	998 frames/s
3	Left side view over shoulder	98.0 in	47.3 in	51.6 in	10.8°	30.8 in	8 mm	1002 frames/s
4	Right side view	81.8 in	92.0 in	48.2 in	3.1°	70.0 in	13 mm	1002 frames/s
5	Right side view over shoulder	98.5 in	47.9 in	52.3 in	12.7°	30.3 in	8 mm	998 frames/s
6	Front view - driver	41.7 in	12.7 in	50.8 in	8.0°	49.0 in	8 mm	1002 frames/s
7	Front view - passenger	42.3 in	16.1 in	50.2 in	8.8°	49.0 in	8 mm	995 frames/s

¹ +X: Film plane to front of sled

+Y: Film plane to sled centerline

+Z: Film plane to top of sled

+Angle: Film plane angled upward from horizontal plane

Appendix A

Photographs

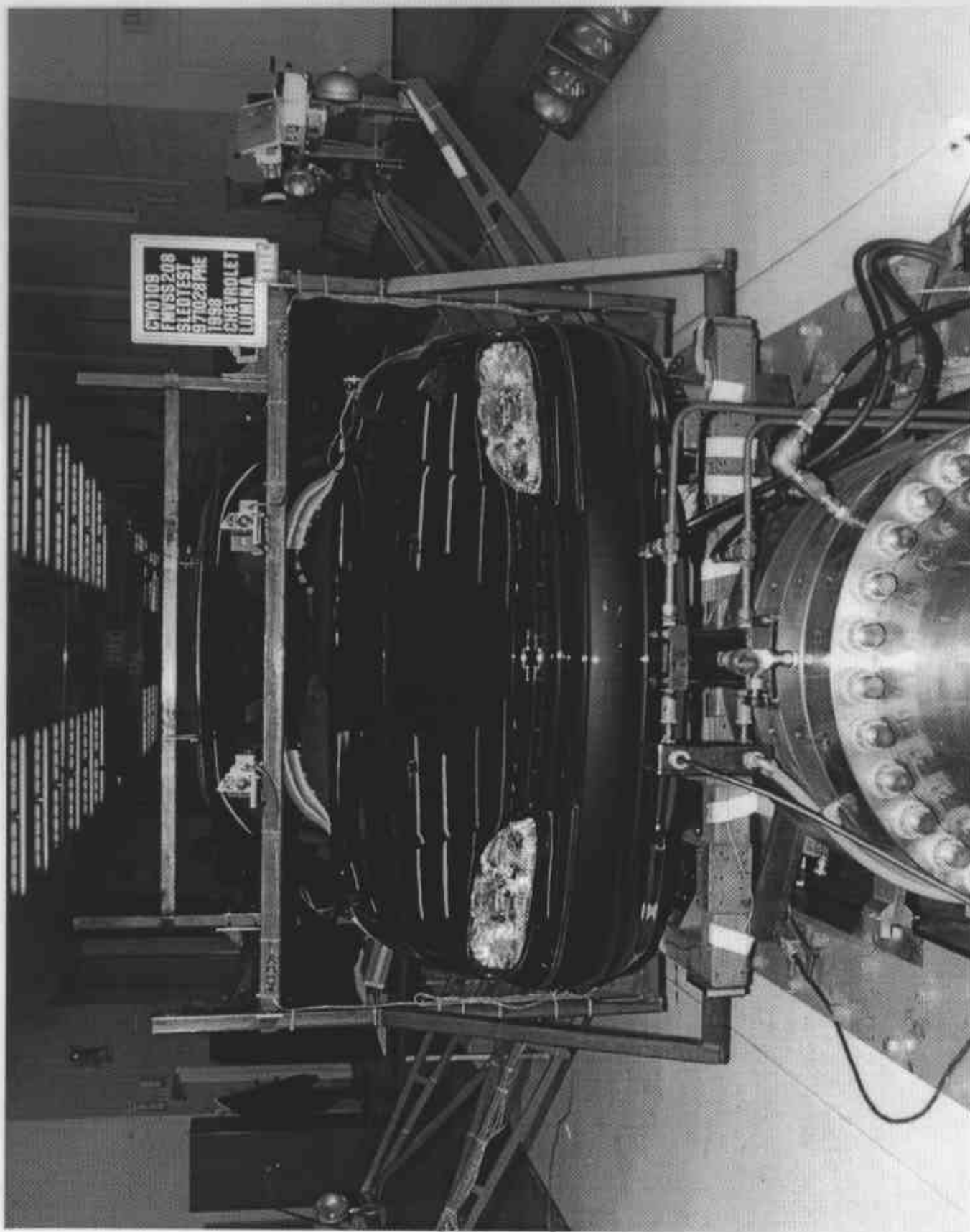


Figure A-1 Pre-Test Front View Of Test Vehicle Mounted To Sled

A-2

971028S

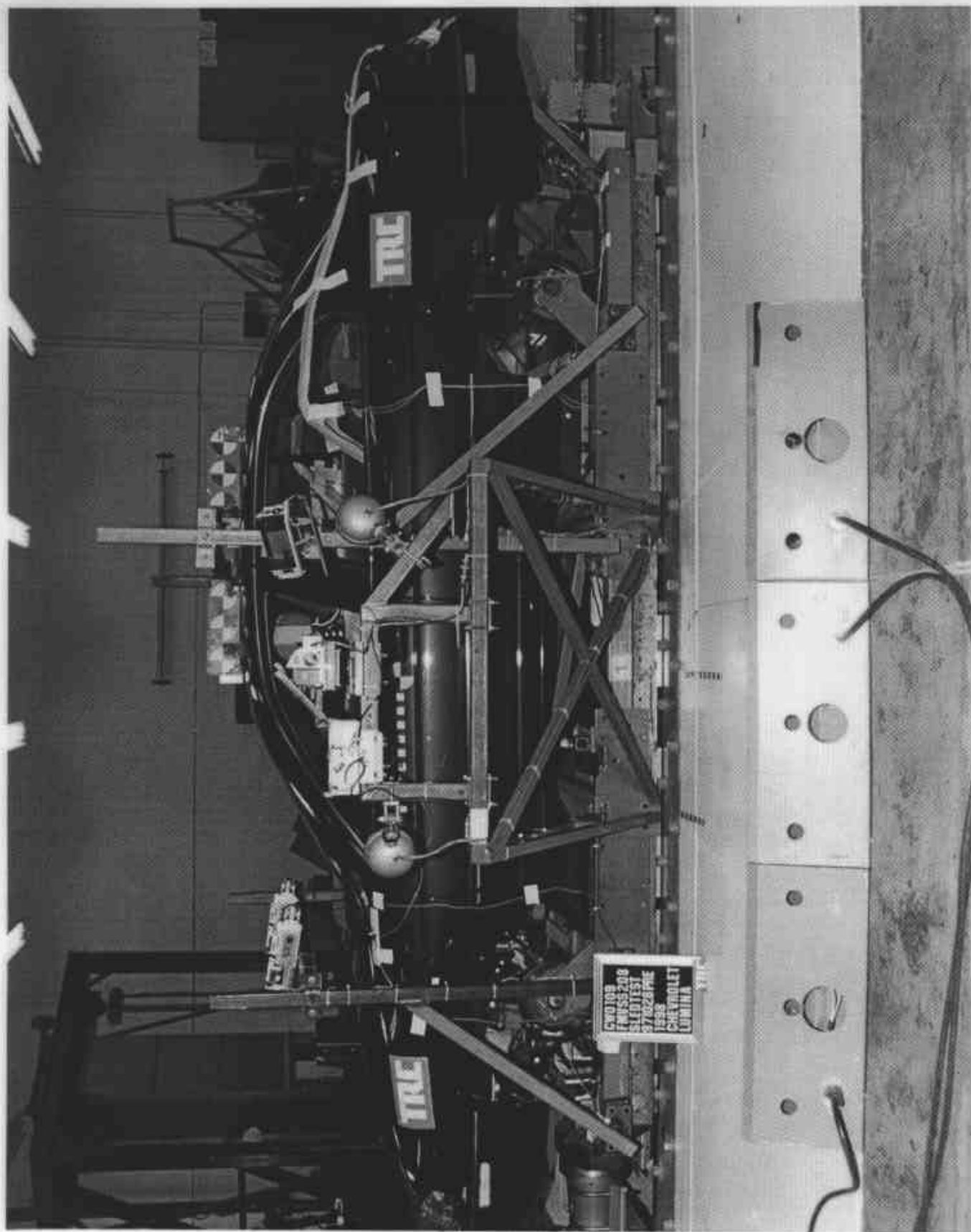


Figure A-2 Pre-Test Left Side View Of Test Vehicle Mounted To Sled
A-3 971028S

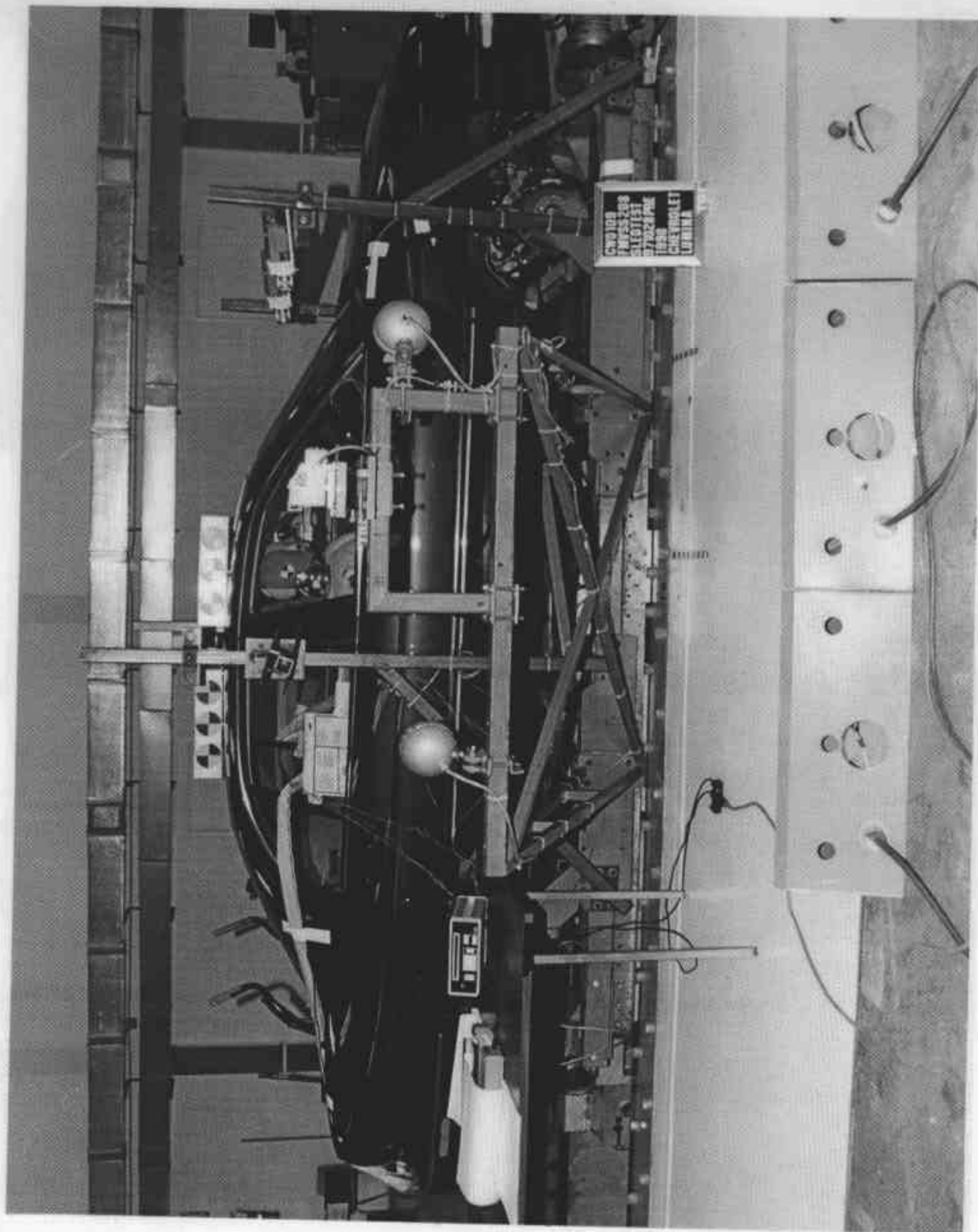


Figure A-3 Pre-Test Right Side View Of Test Vehicle Mounted To Sled

A-4

971028S

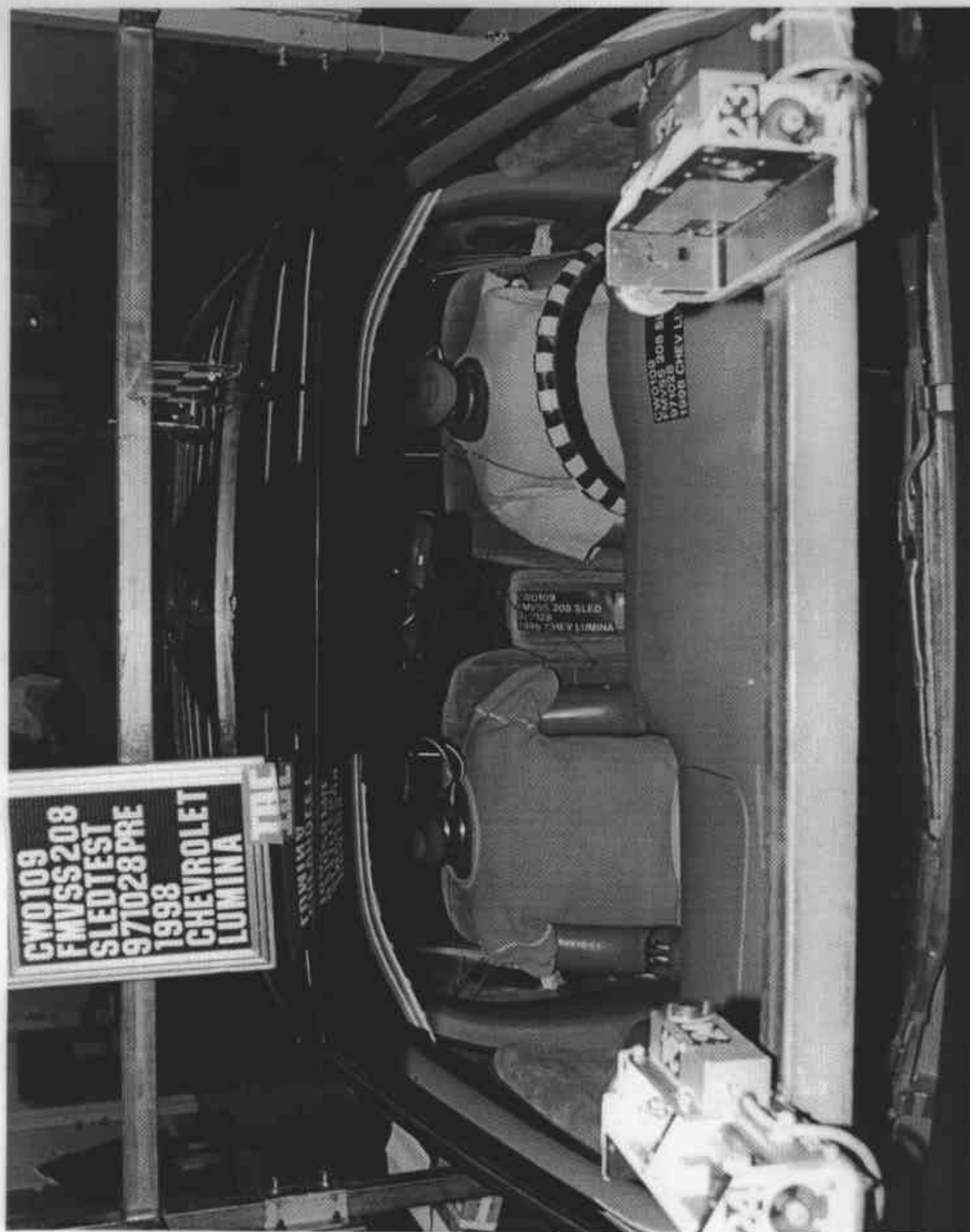


Figure A-4 Pre-Test Windshield View
A-5

971028S



Figure A-5 Post-Test Windshield View
A-6

971028S



Figure A-6 Pre-Test Driver Dummy Position View With Door Open

A-7

971028S



Figure A-7 Pre-Test Driver Seat Position View
A-8

971028S



Figure A-8 Post-Test Driver Dummy Position View With Door Open

A-9

971028S



Figure A-8.1 Post-Test Driver Seat Position View
A-9.1

971028S



Figure A-9 Pre-Test Driver Knee Bolster View
A-10

971028S



Figure A-10 Post-Test Driver Knee Bolster View
A-11

971028S

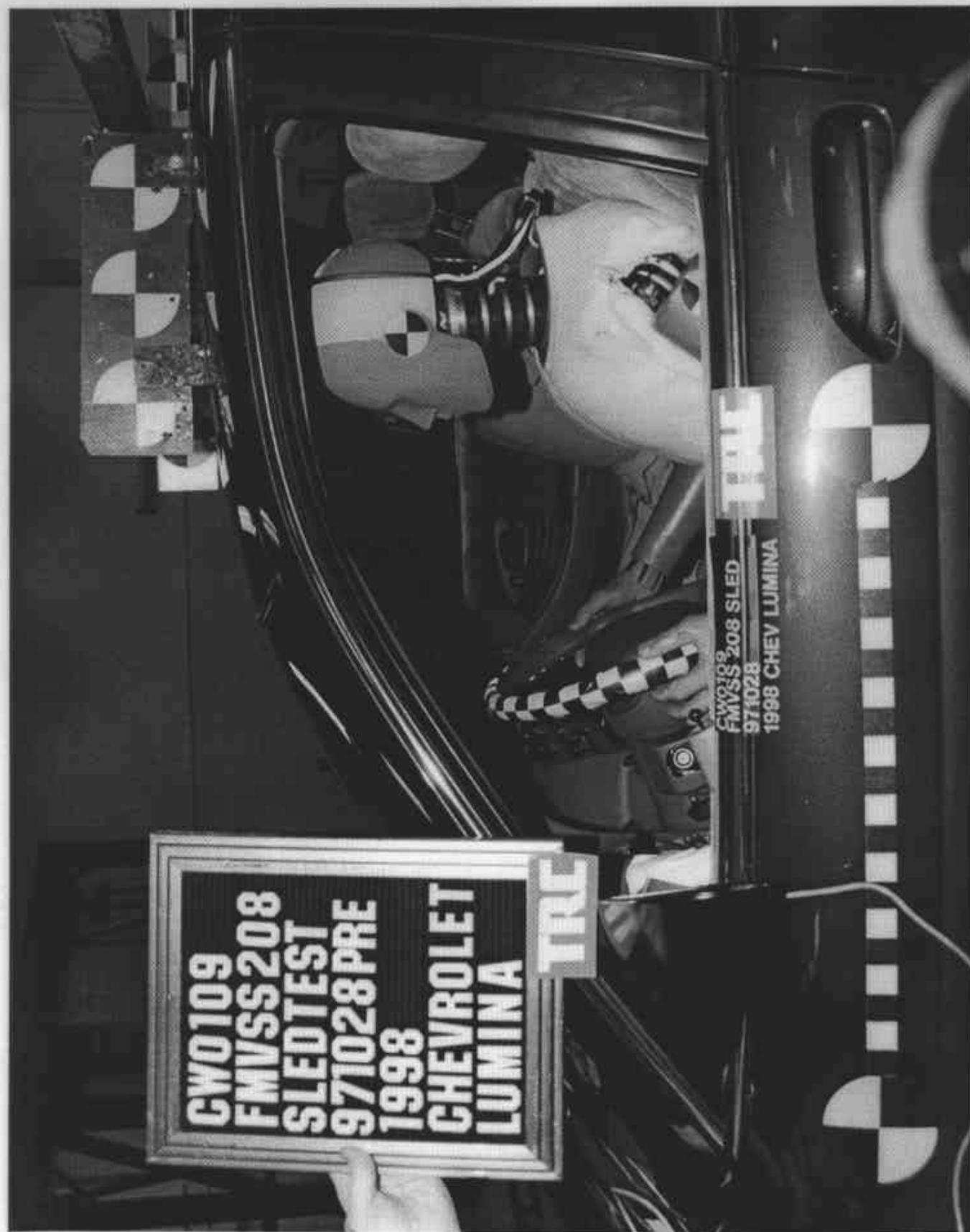


Figure A-11 Pre-Test Driver Dummy Position View With Door Closed

A-12

971028S

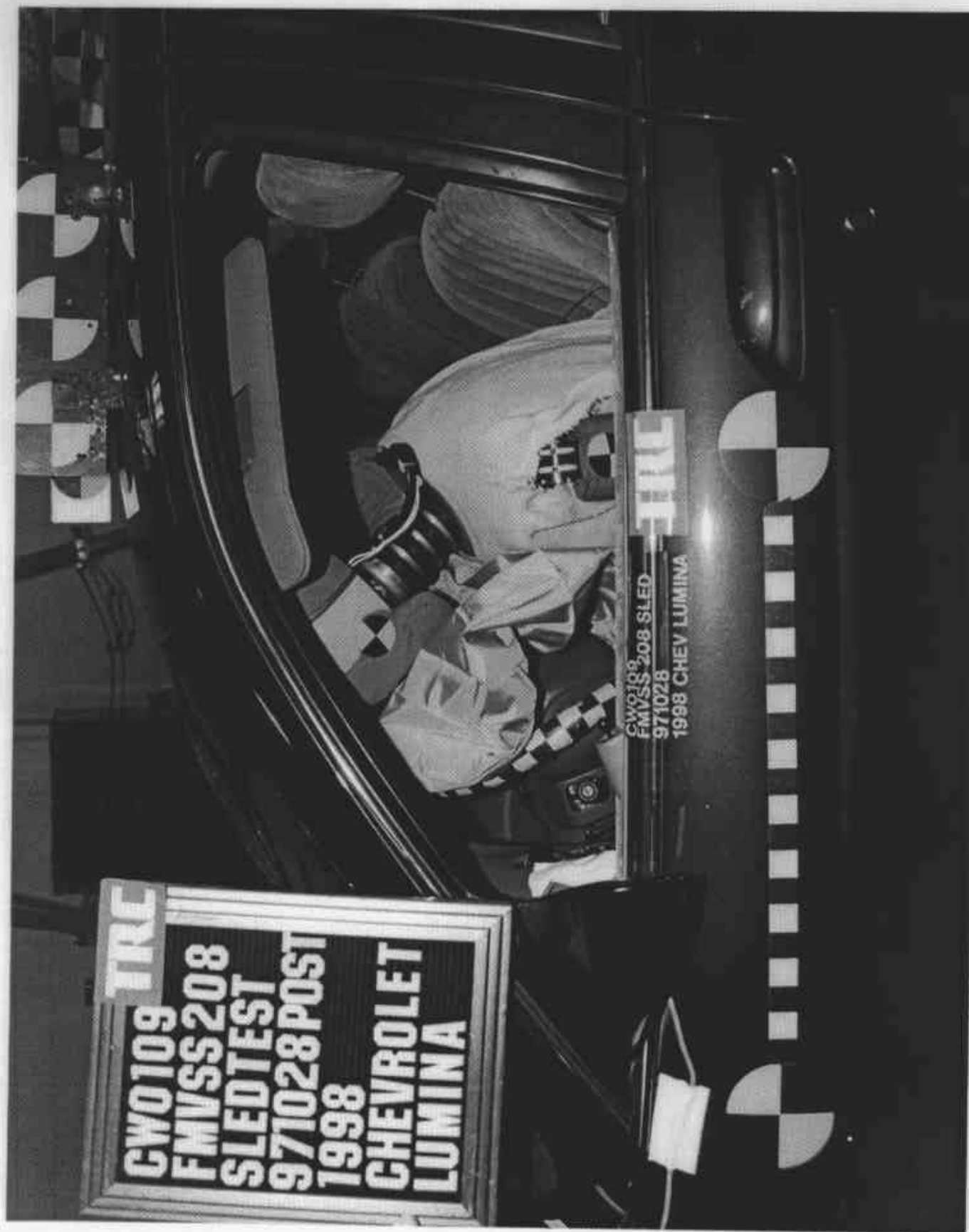


Figure A-12 Post-Test Driver Dummy Position View With Door Closed

A-13

971028S

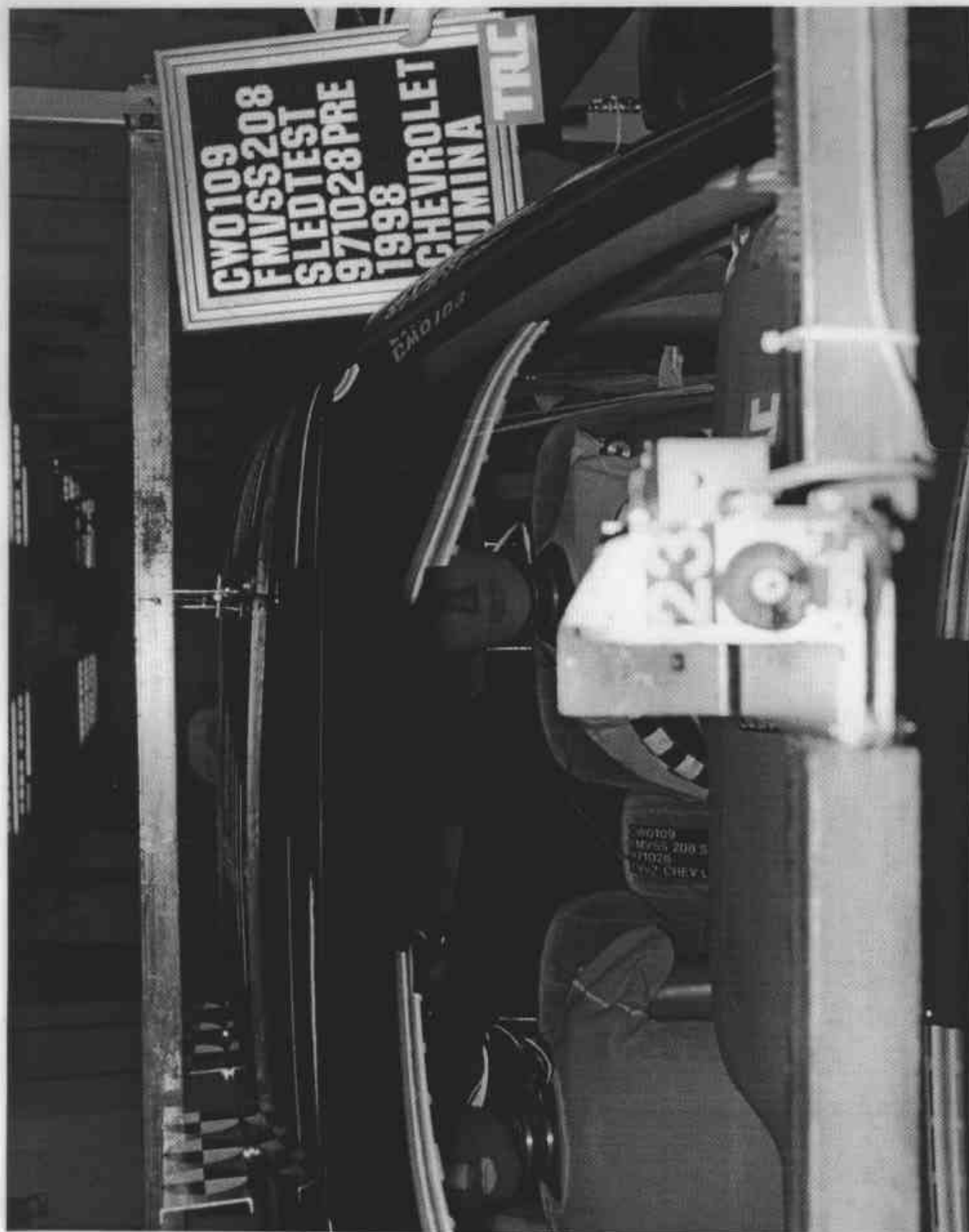


Figure A-13 Pre-Test Driver Dummy Position Front View

A-14

971028S

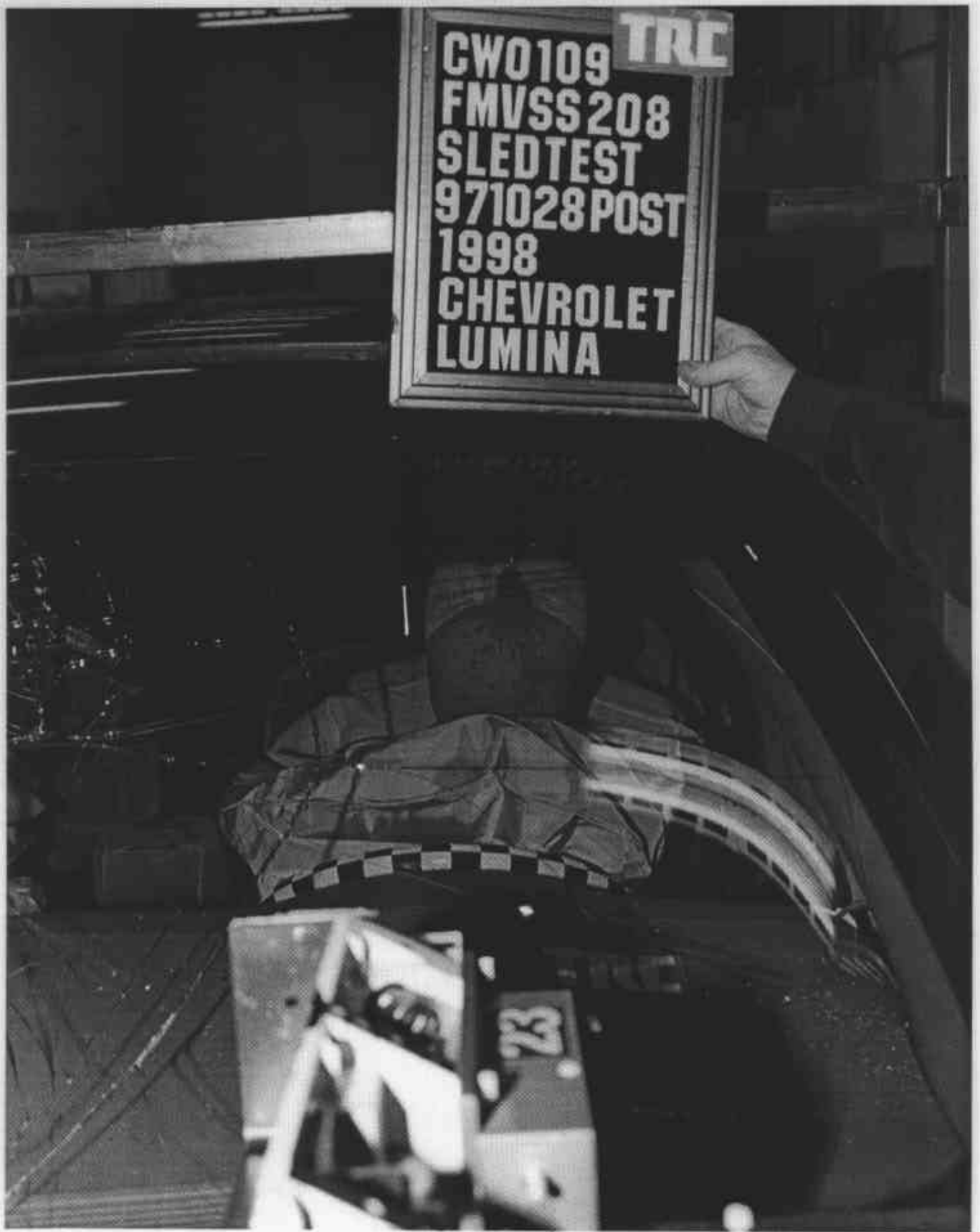


Figure A-14 Post-Test Driver Dummy Position Front View

A-15

971028S



Figure A-15 Post-Test Driver Airbag View
A-16

971028S



Figure A-16 Post-Test Driver Dummy Overall View
A-17

971028S

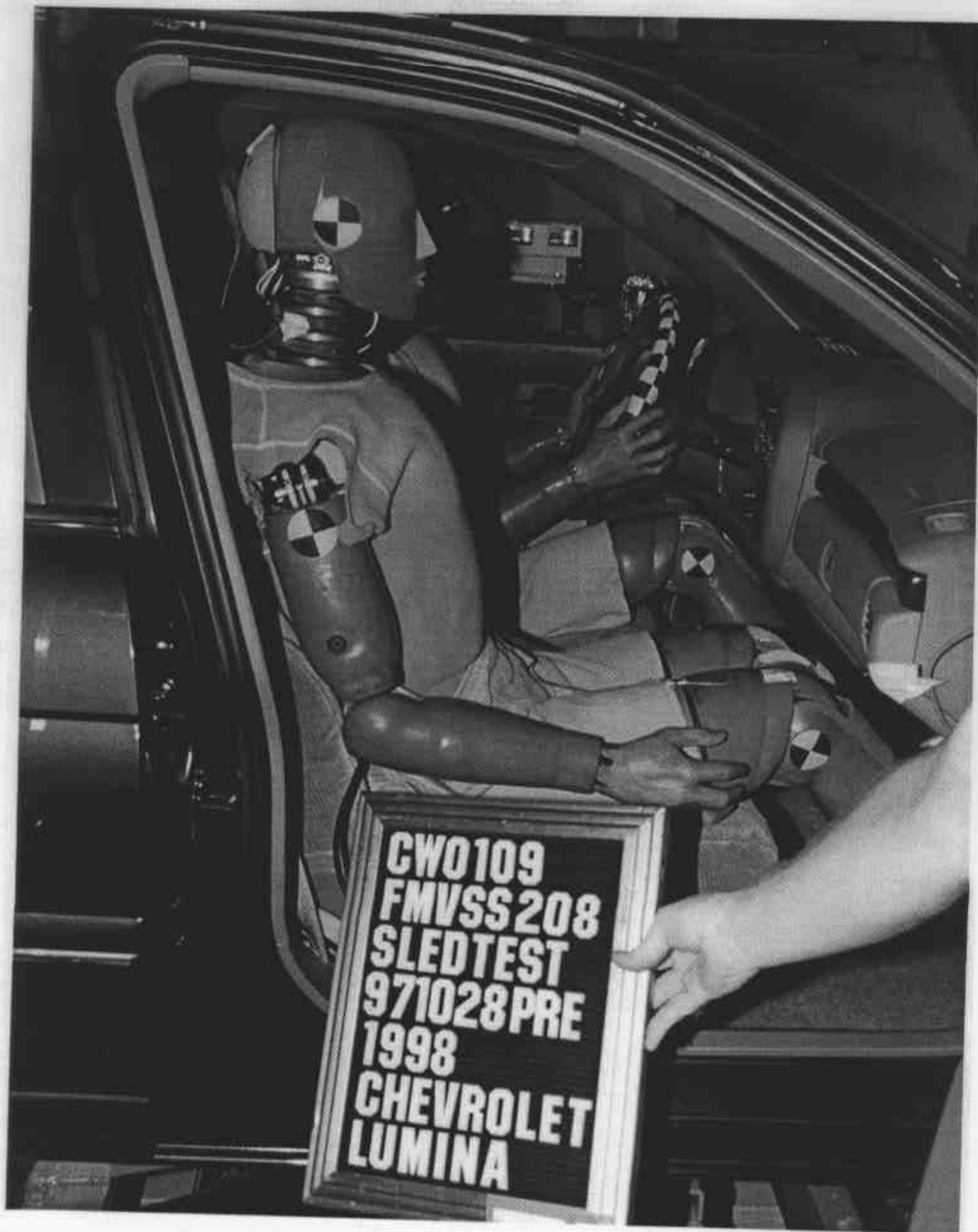


Figure A-17 Pre-Test Passenger Dummy Position View With Door Open
A-18 971028S

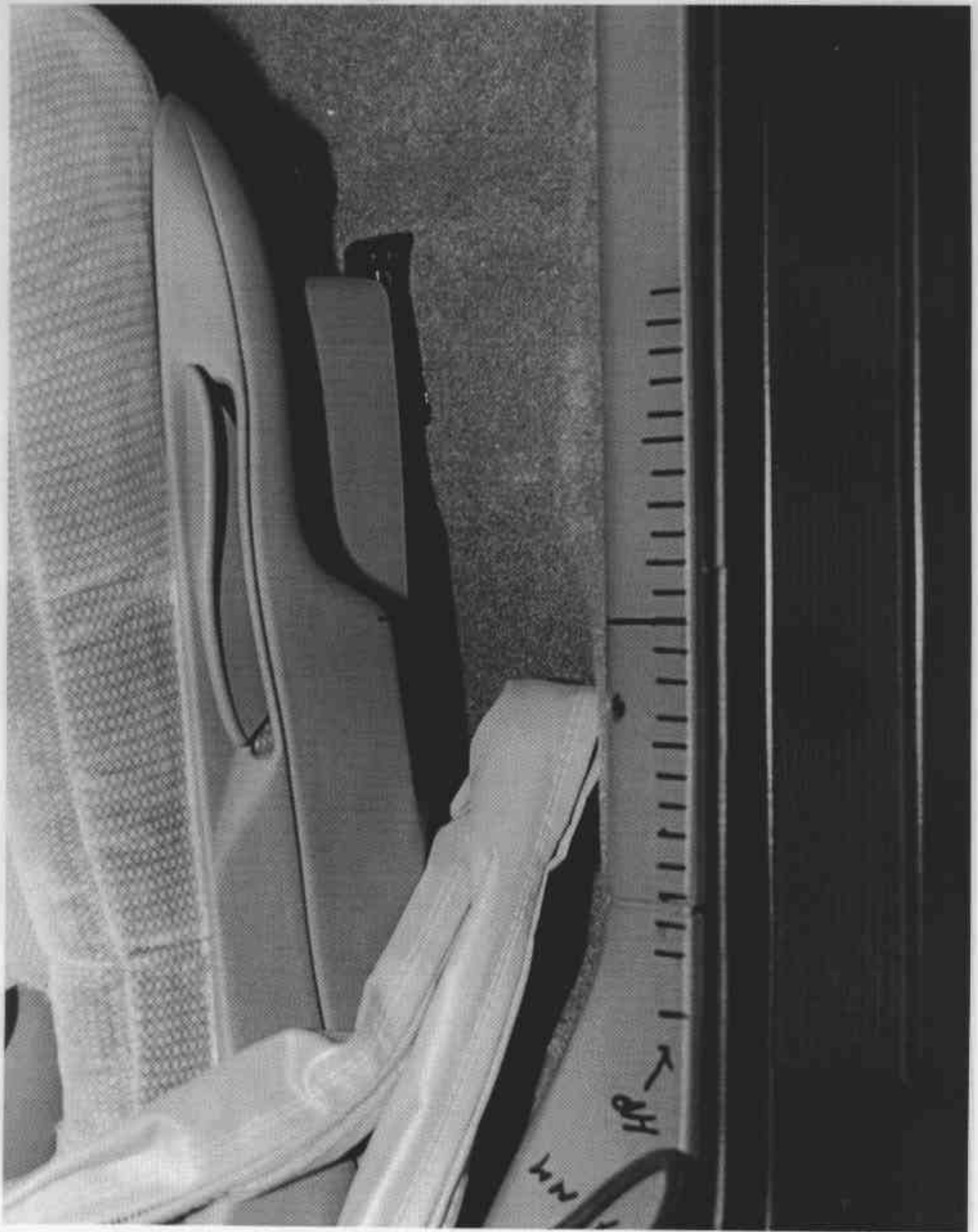


Figure A-18 Pre-Test Passenger Seat Position View
A-19

971028S



Figure A-19 Post-Test Passenger Dummy Position View With Door Open

A-20

971028S



Figure A-20 Pre-Test Passenger Glove Box View
A-21

971028S

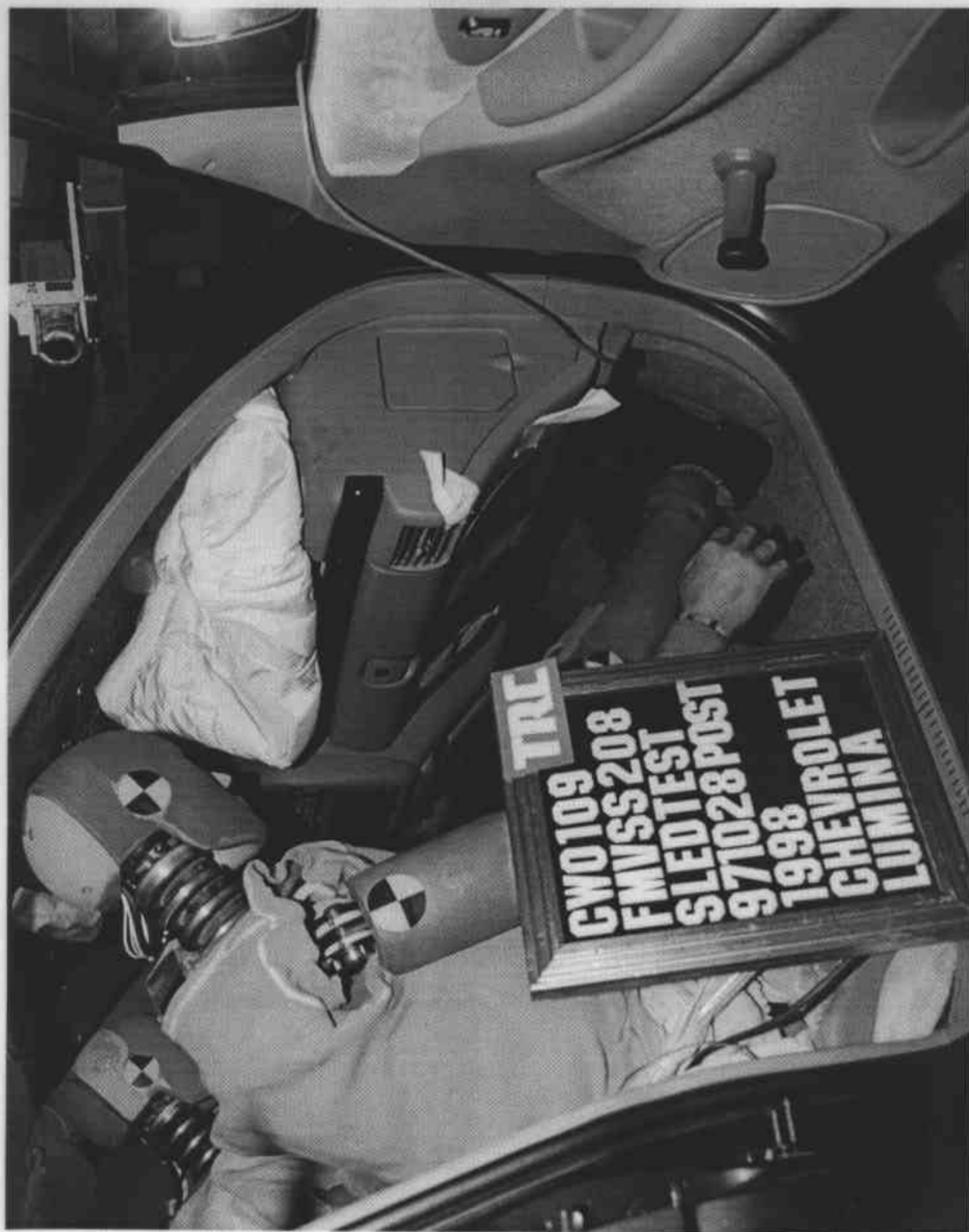


Figure A-21 Post-Test Passenger Glove Box View
A-22

971028S



Figure A-22 Pre-Test Passenger Dummy Position View With Door Closed



Figure A-23 Post-Test Passenger Dummy Position View With Door Closed

A-24

971028S

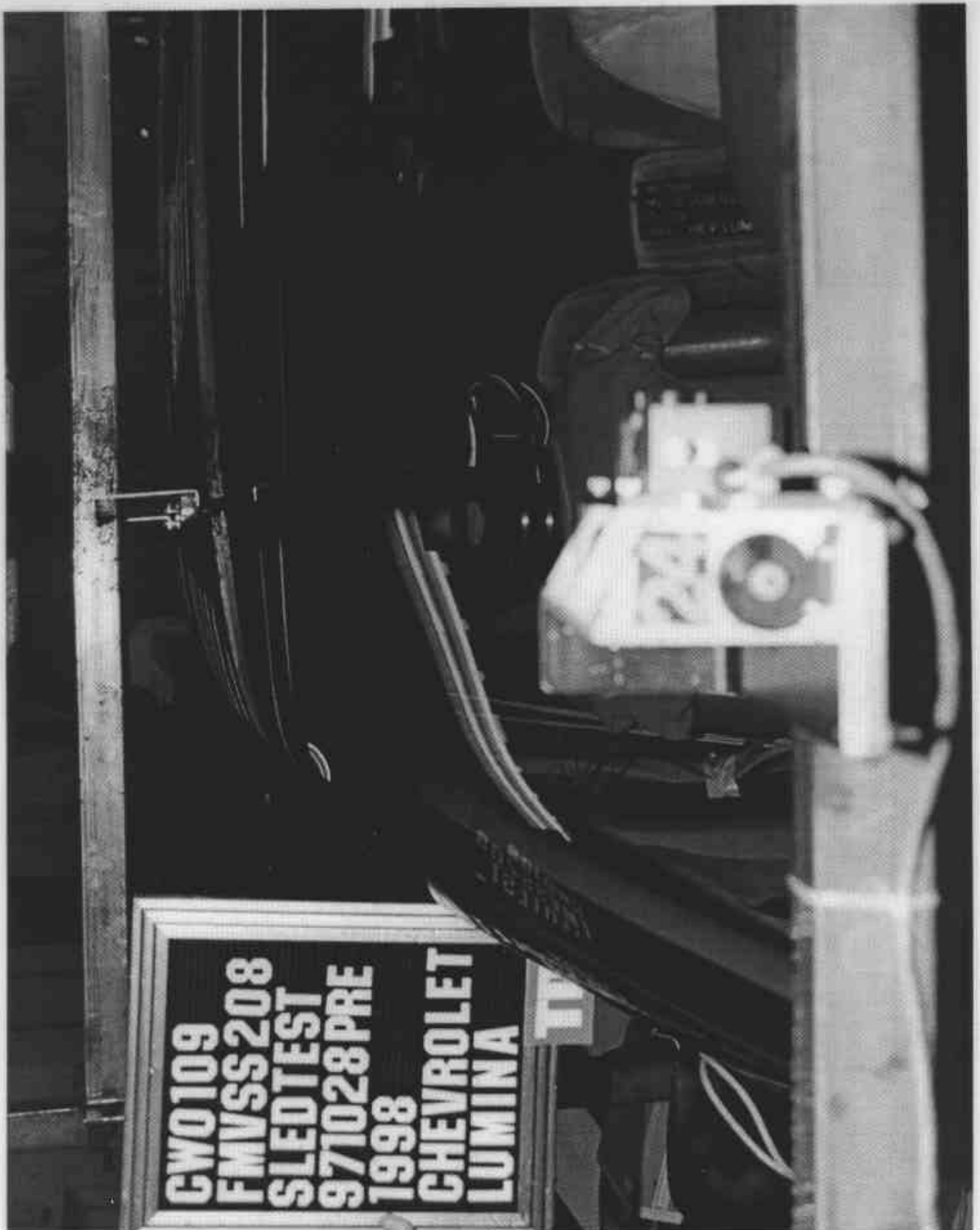


Figure A-24 Pre-Test Passenger Dummy Position Front View

A-25

971028S

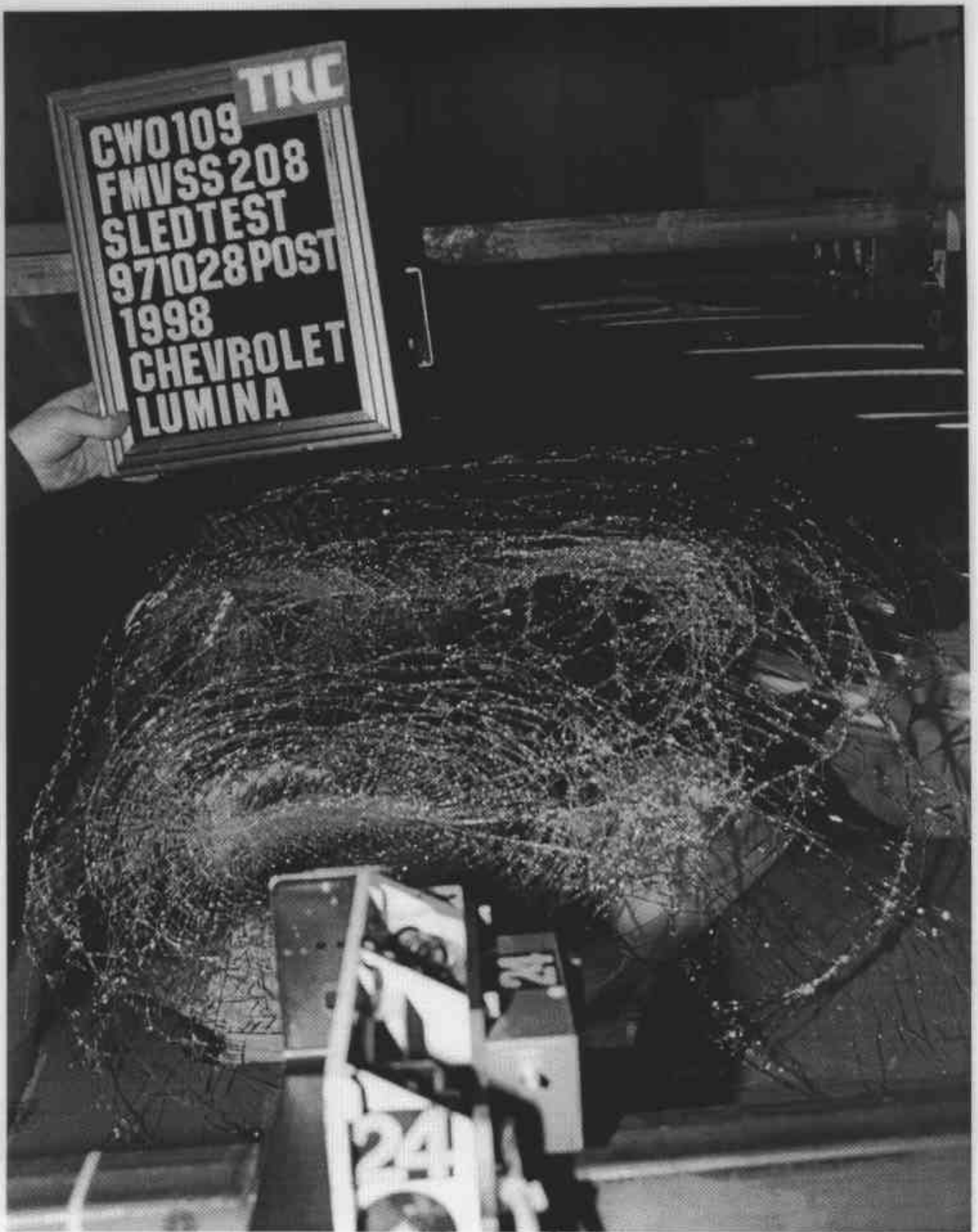


Figure A-25 Post-Test Passenger Dummy Position Front View
A-26

971028S

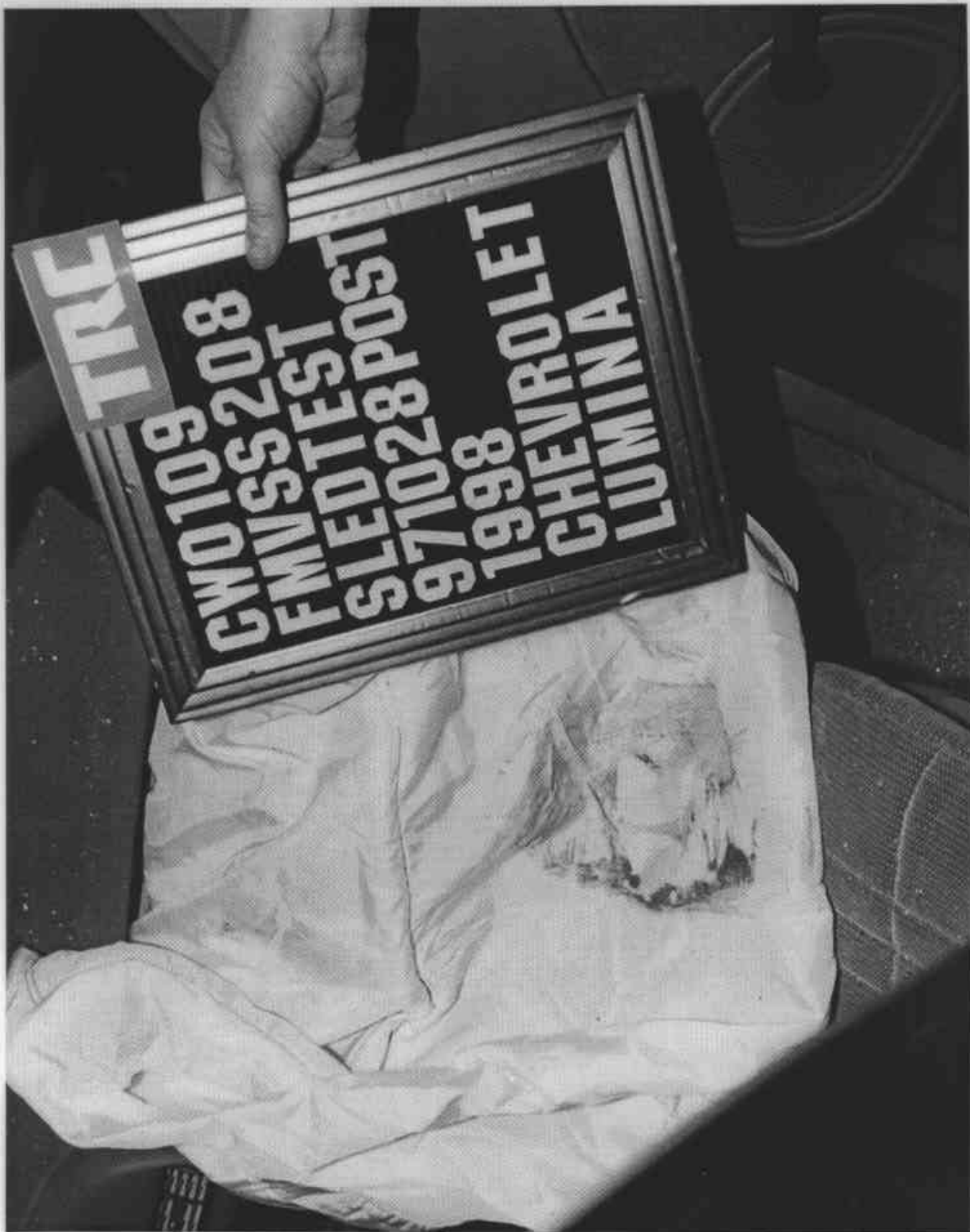


Figure A-26 Post-Test Passenger Airbag View
A-27

971028S

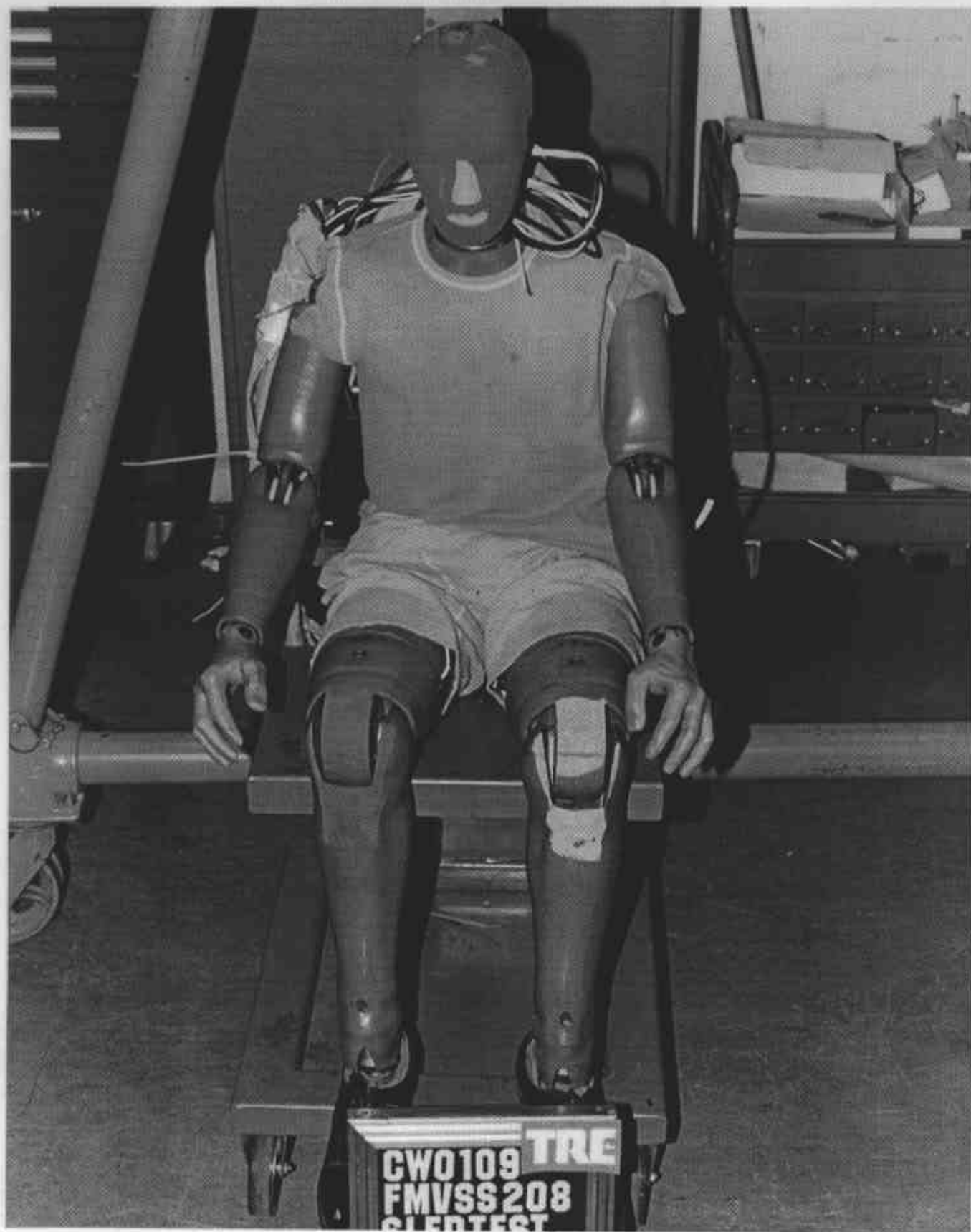


Figure A-27 Post-Test Passenger Dummy Overall View
A-28

971028S



Figure A-28 Post-Test Driver And Passenger Head Contact With Sun Visor View
A-29 971028S

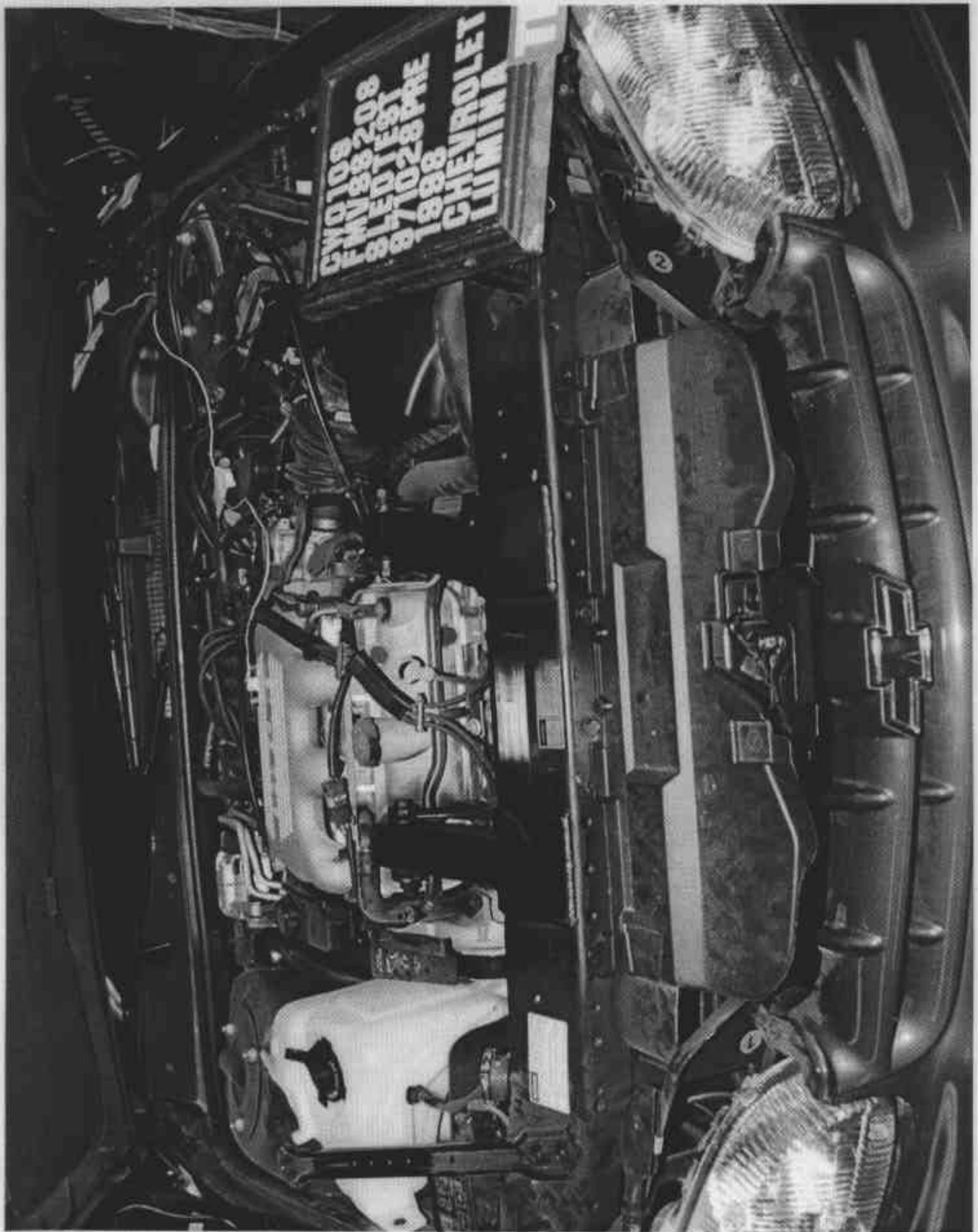


Figure A-29 Pre-Test Engine Compartment View
A-30

971028S



Figure A-30 Pre-Test Vehicle Certification Label View
A-31

971028S

TIRE - LOADING INFORMATION				
OCCUPANTS			VEHICLE CAP. WT.	
FRT.	CTR.	RR.	TOTAL	
				KG LBS
3	0	3	6	480 1058
MAX. LOADING @ GVWR SAME AS VEHICLE CAPACITY WEIGHT.				
2G1WL52M6W9105406				
MODEL: WL69 WAA				
TIRE SIZE		SPEED RTG	COLD TIRE PRESSURE	
FRT	P205/70R15	S	210KPA(30PSI)	
RR	P205/70R15	S	210KPA(30PSI)	
SPA	T125/70D16	M	420KPA(60PSI)	
IF TIRES ARE HOT, ADD 28KPA(4LBS)				
SEE OWNER'S MANUAL FOR MORE INFORMATION				

Figure A-31 Pre-Test Vehicle FMVSS 110 Label View

Appendix B

Data Plots

CW0109 / 1998 CHEVROLET LUMINA

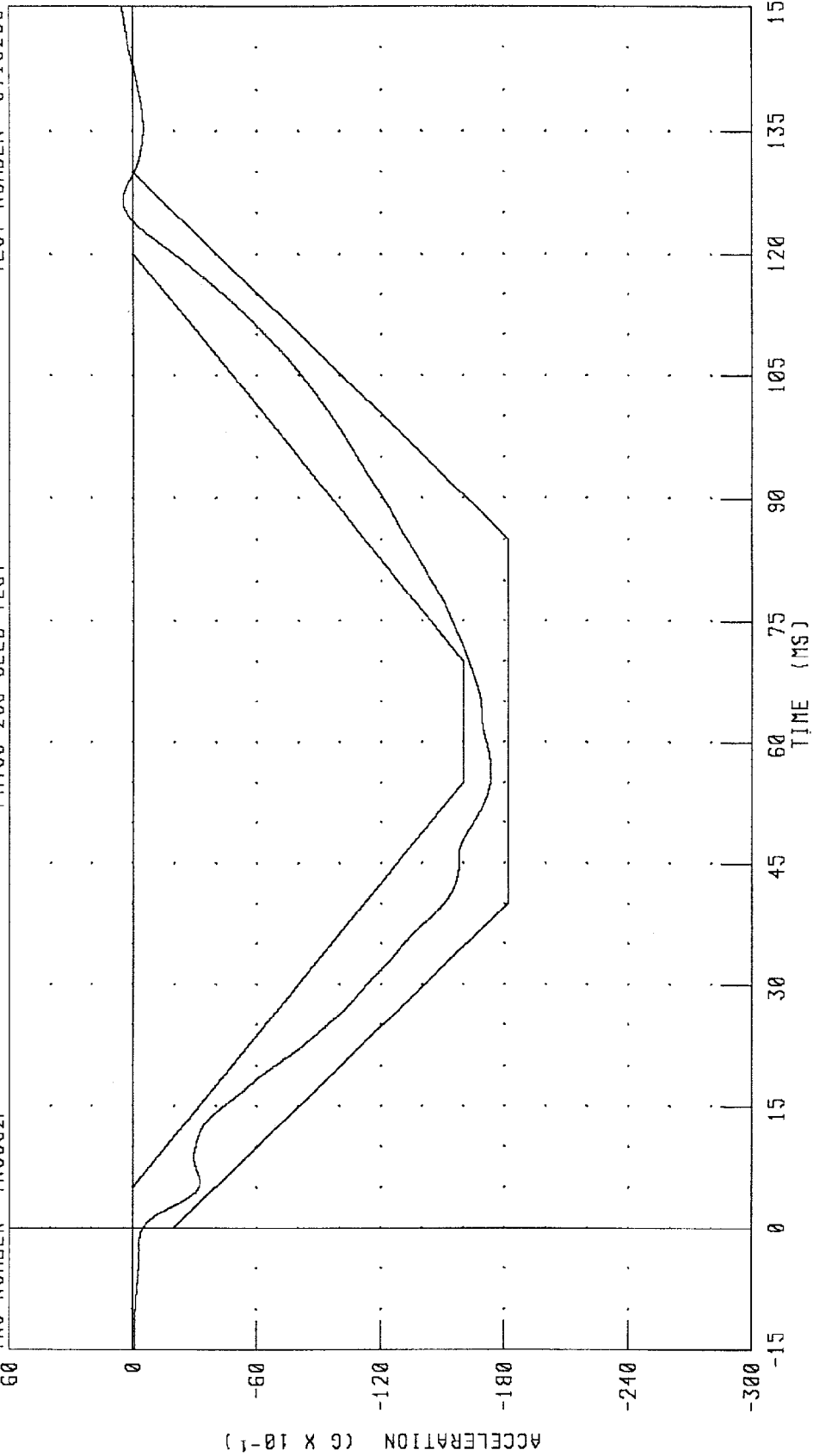
SLED ACCELERATION

FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

60



CHANNEL: SLDXG FILTER: CH. CLASS 60

PEAK DATA: 0.52 G @ 150.00 MS, -17.35 G @ 56.32 MS

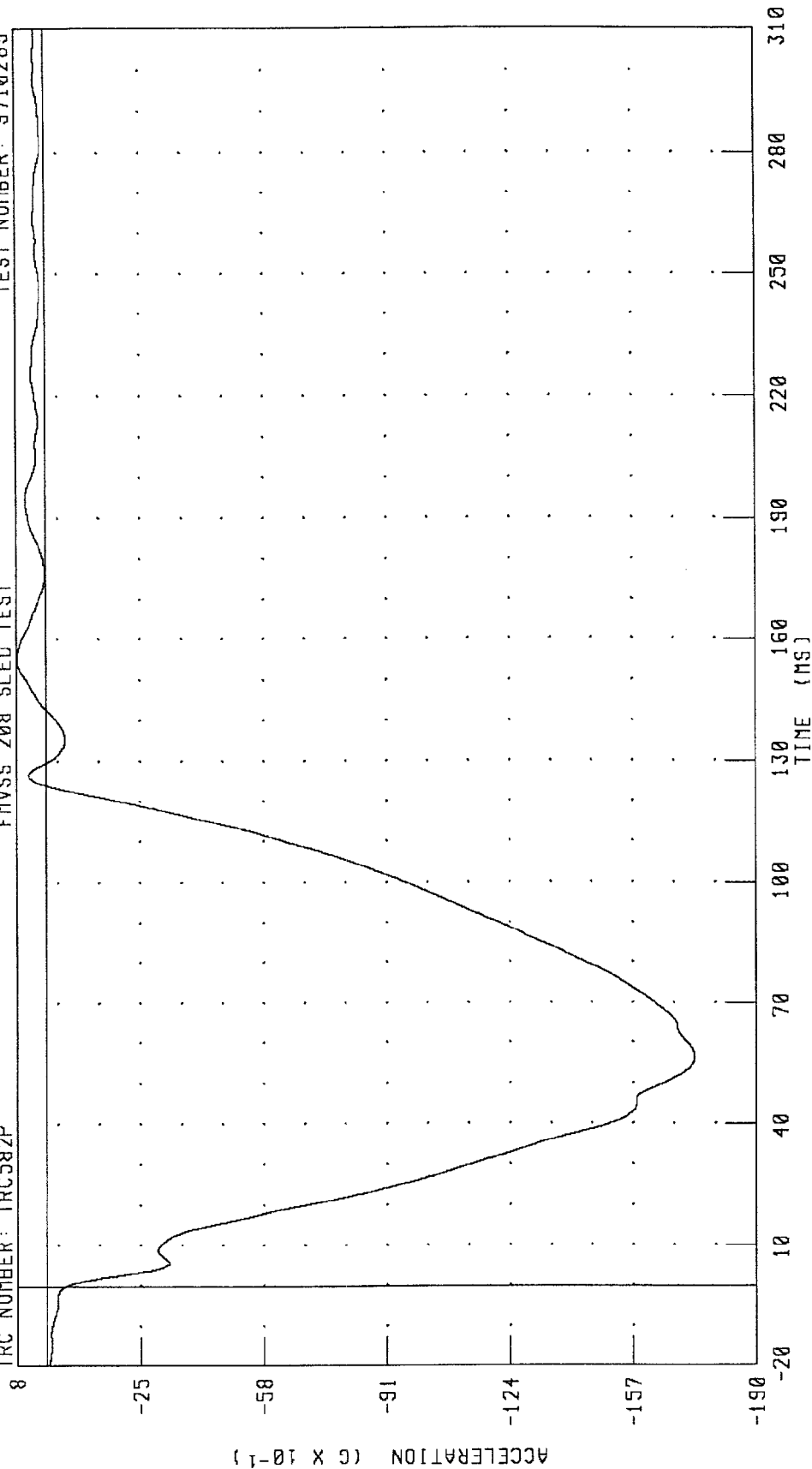
CW0109 / 1998 CHEVROLET LUMINA

SLED ACCELERATION

FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



CHANNEL: SLDXG FILTER: CH. CLASS 60

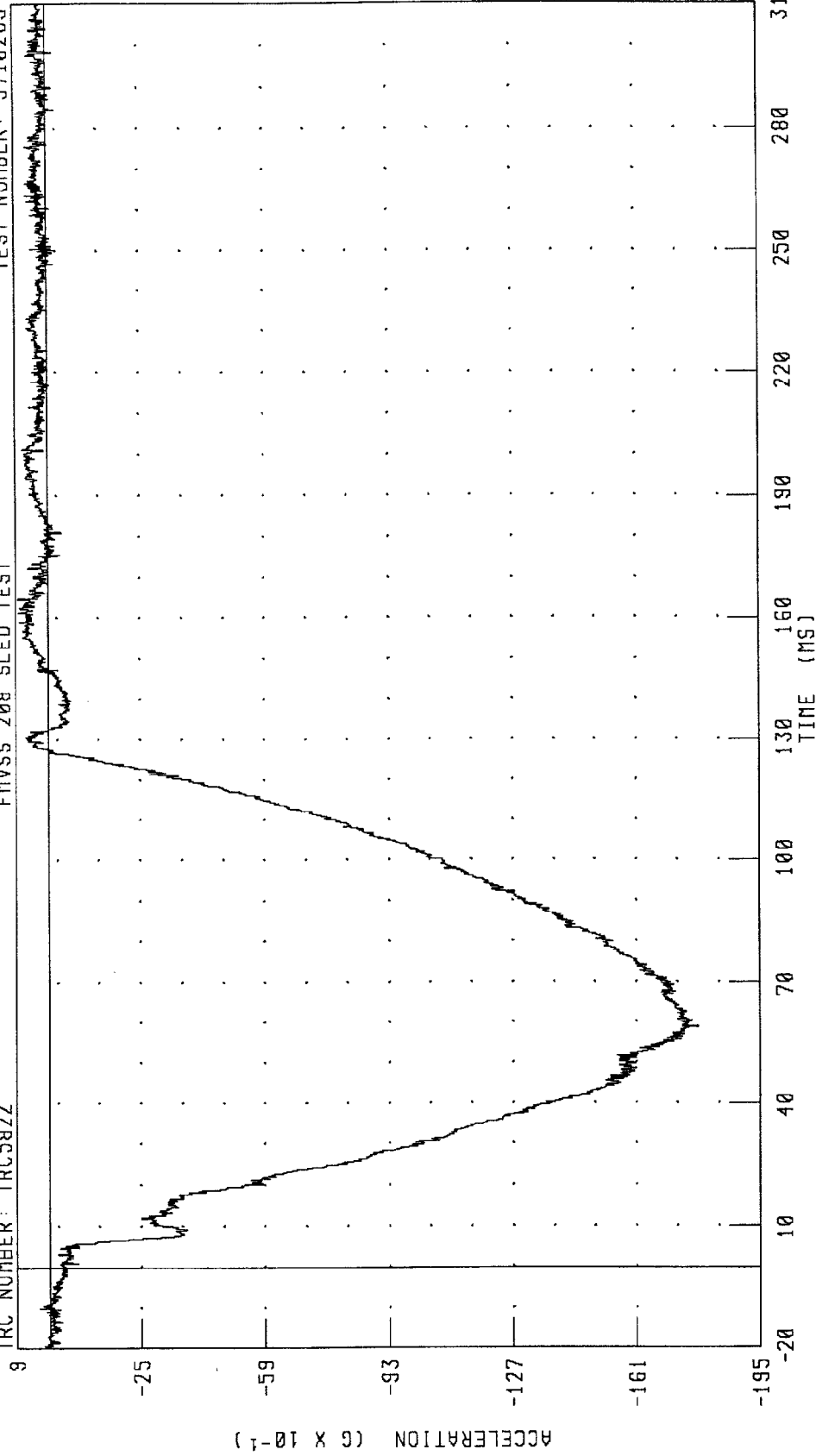
PEAK DATA: 0.77 G @ 154.96 MS, -17.35 G @ 56.32 MS

CW0109 / 1998 CHEVROLET LUMINA
SLED ACCELERATION REDUNDANT

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582Z



CHANNEL: SLDXGA FILTER: CH. CLASS 1000

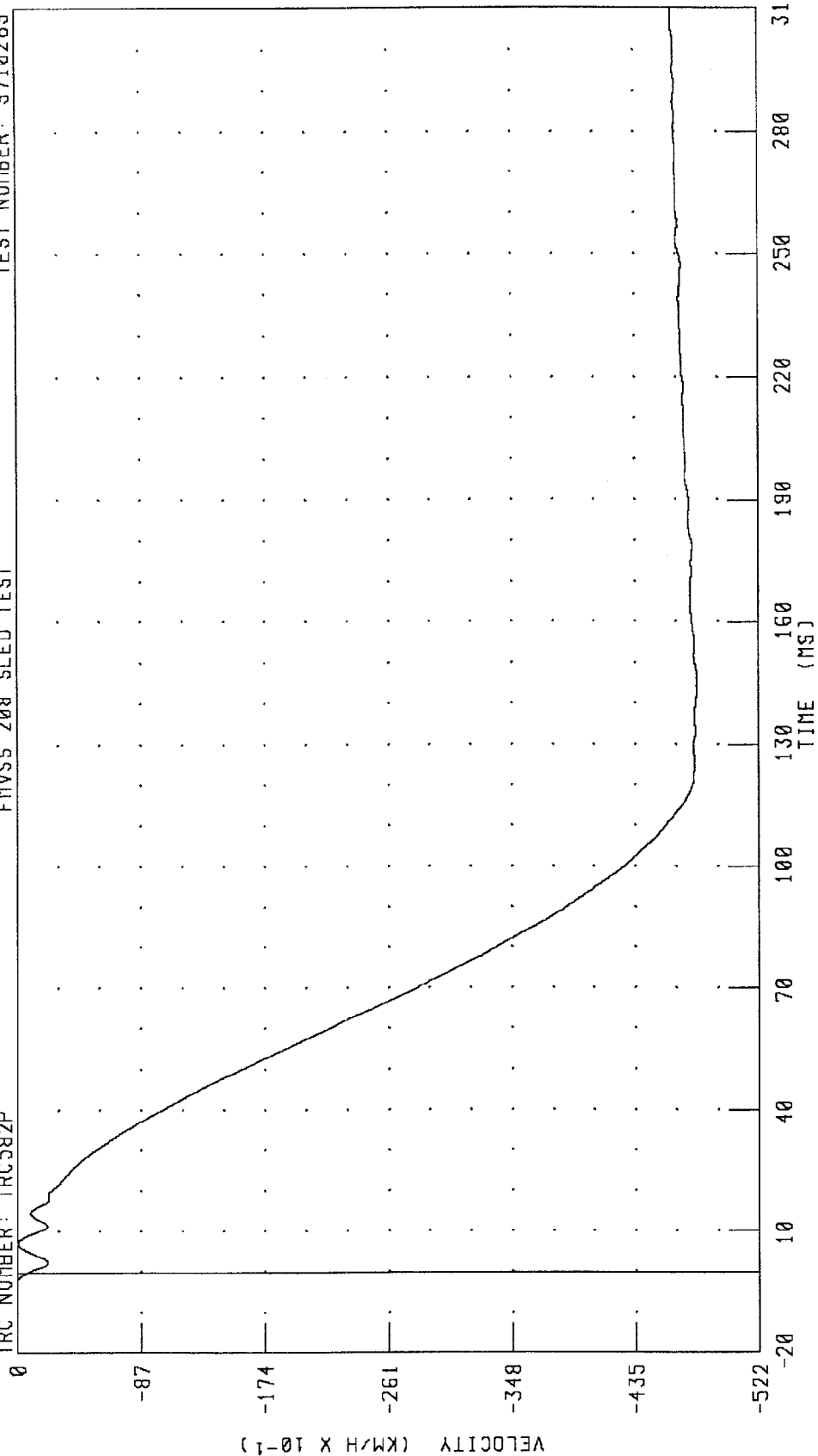
PEAK DATA: 0.83 G @ 164.72 MS; -17.79 G @ 58.96 MS

CW0109 / 1998 CHEVROLET LUMINA
MEASURED VELOCITY TRAP

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P



PEAK DATA: 0.09 KM/H @ -7.60 MS; -47.85 KM/H @ 146.00 MS

CHANNEL: SLDXV FILTER: CH. CLASS 60

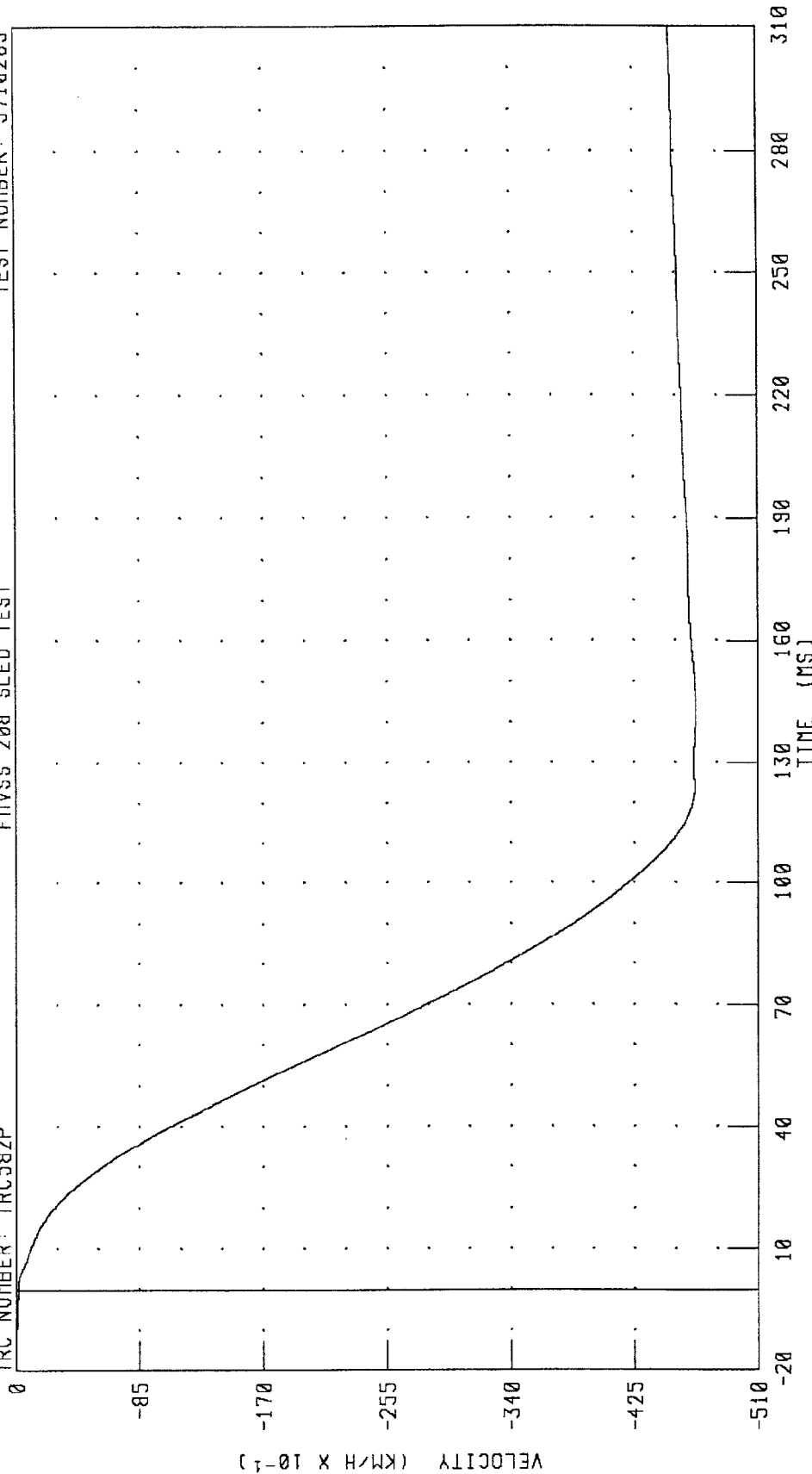
CV0109 / 1998 CHEVROLET LUMINA

SLED VELOCITY (INTEGRATED)

FMVSS 208 SLED TEST

TEST NUMBER: 9710285

TRC NUMBER: TRC582P



CHANNEL: SLDXVI FILTER: CH. CLASS 180

PEAK DATA: -0.01 KM/H @ -20.00 MS; -46.73 KM/H @ 143.20 MS

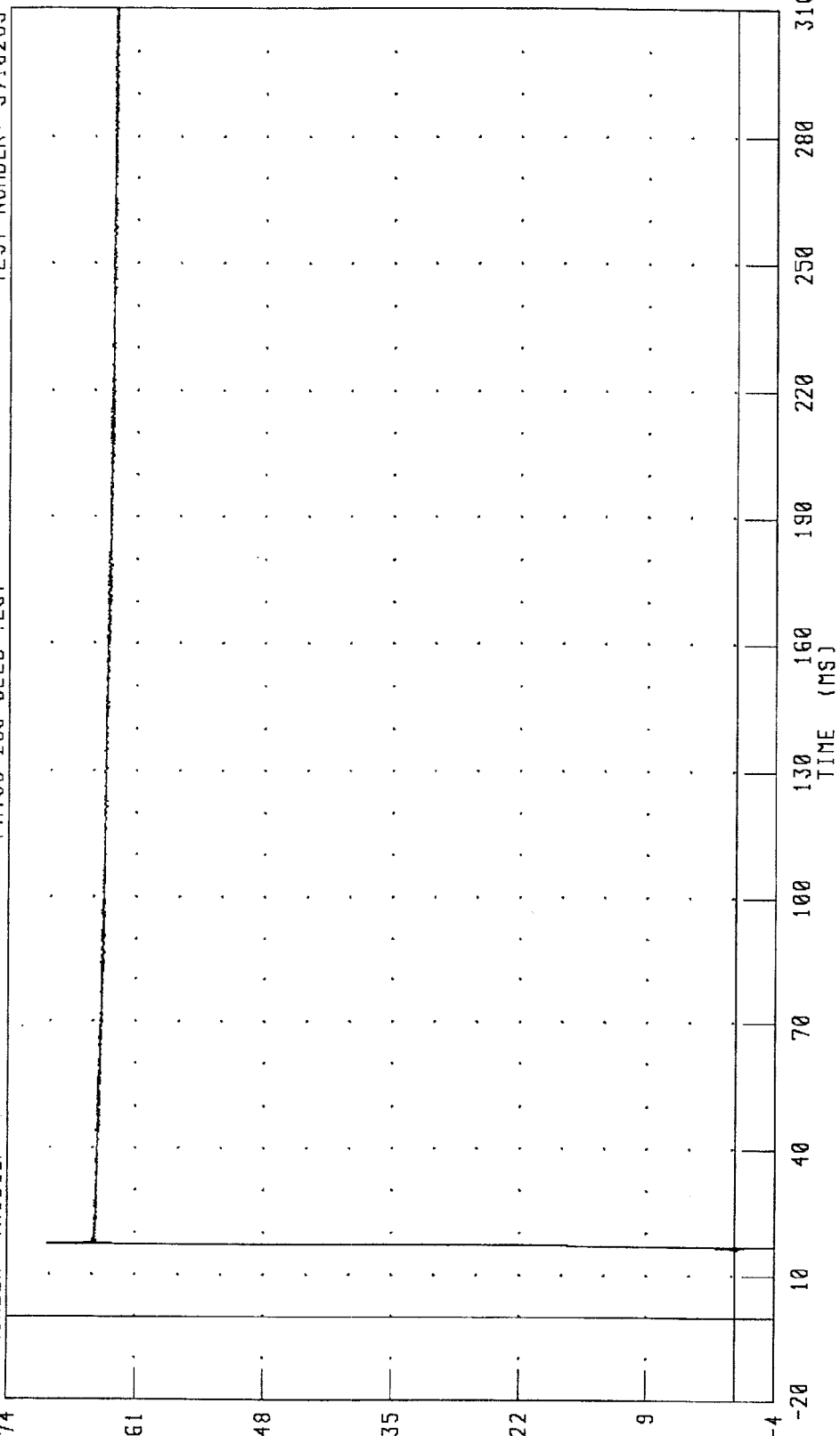
CW0109 / 1998 CHEVROLET LUMINA
AIRBAG EVENT

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST

TEST NUMBER: 971028S

74



PEAK DATA: 6.99 V @ 17.28 MS; -0.45 V @ 16.88 MS

CHANNEL: ABEVT

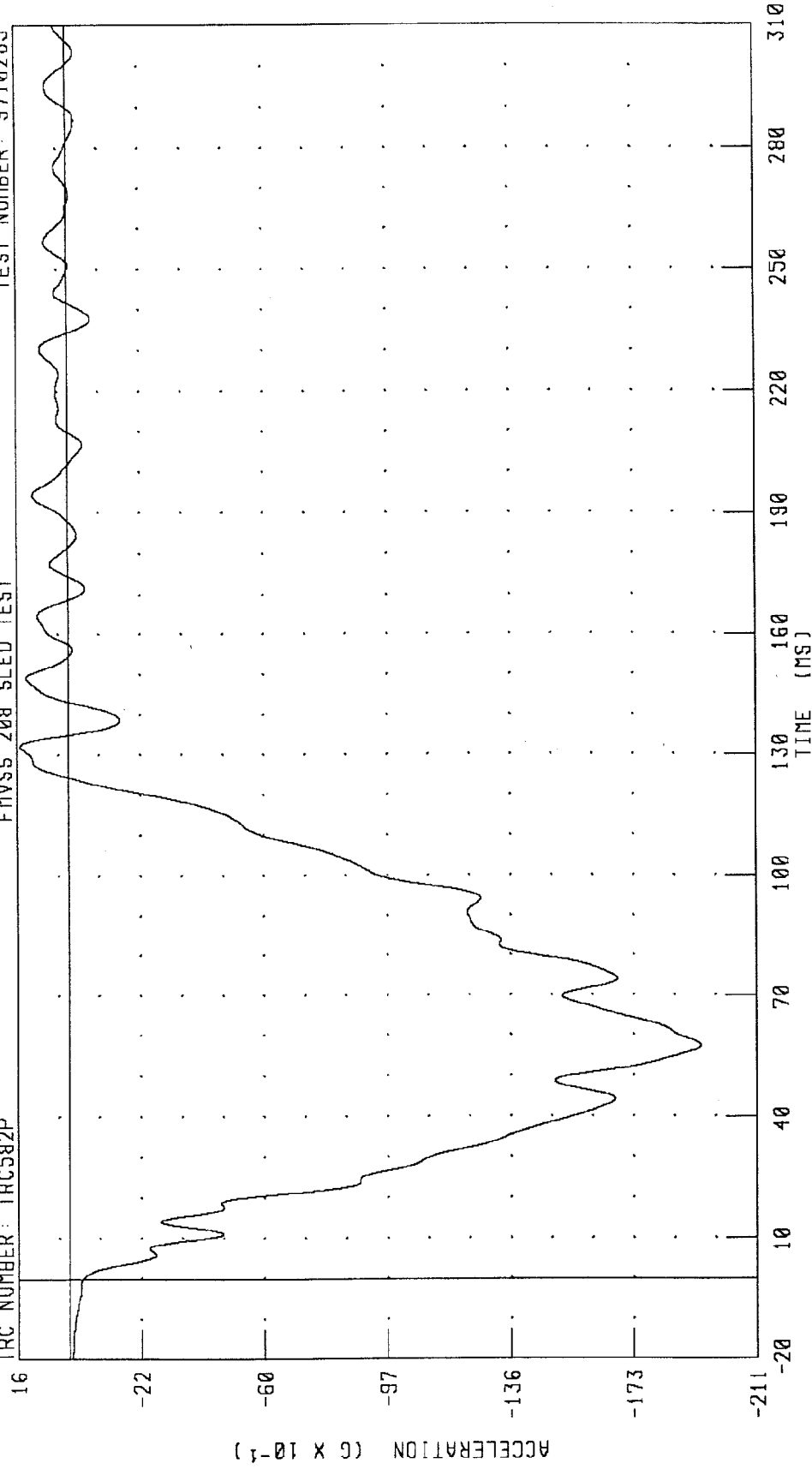
FILTER: CH. CLASS 1000

CW0109 / 1998 CHEVROLET LUMINA
RIGHT REAR BRAKE X-AXIS ACCELERATION

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST

TEST NUMBER: 971028S



CHANNEL: RRAXG FILTER: CH. CLASS 60

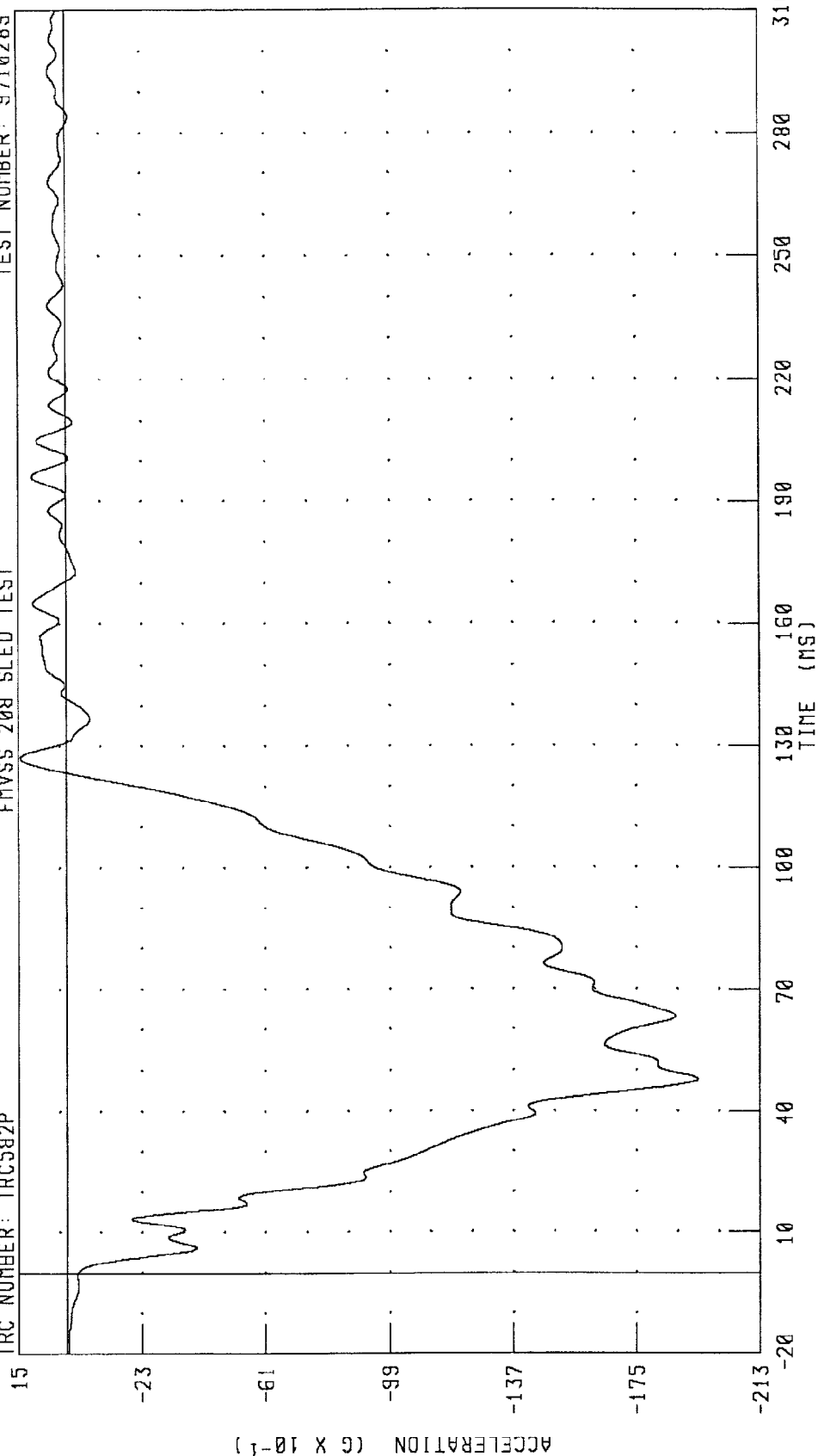
PEAK DATA: 1.50 G @ 132.16 MS, -19.49 G @ 57.28 MS

CW0109 / 1998 CHEVROLET LUMINA
LEFT REAR BRAKE X-AXIS ACCELERATION

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST



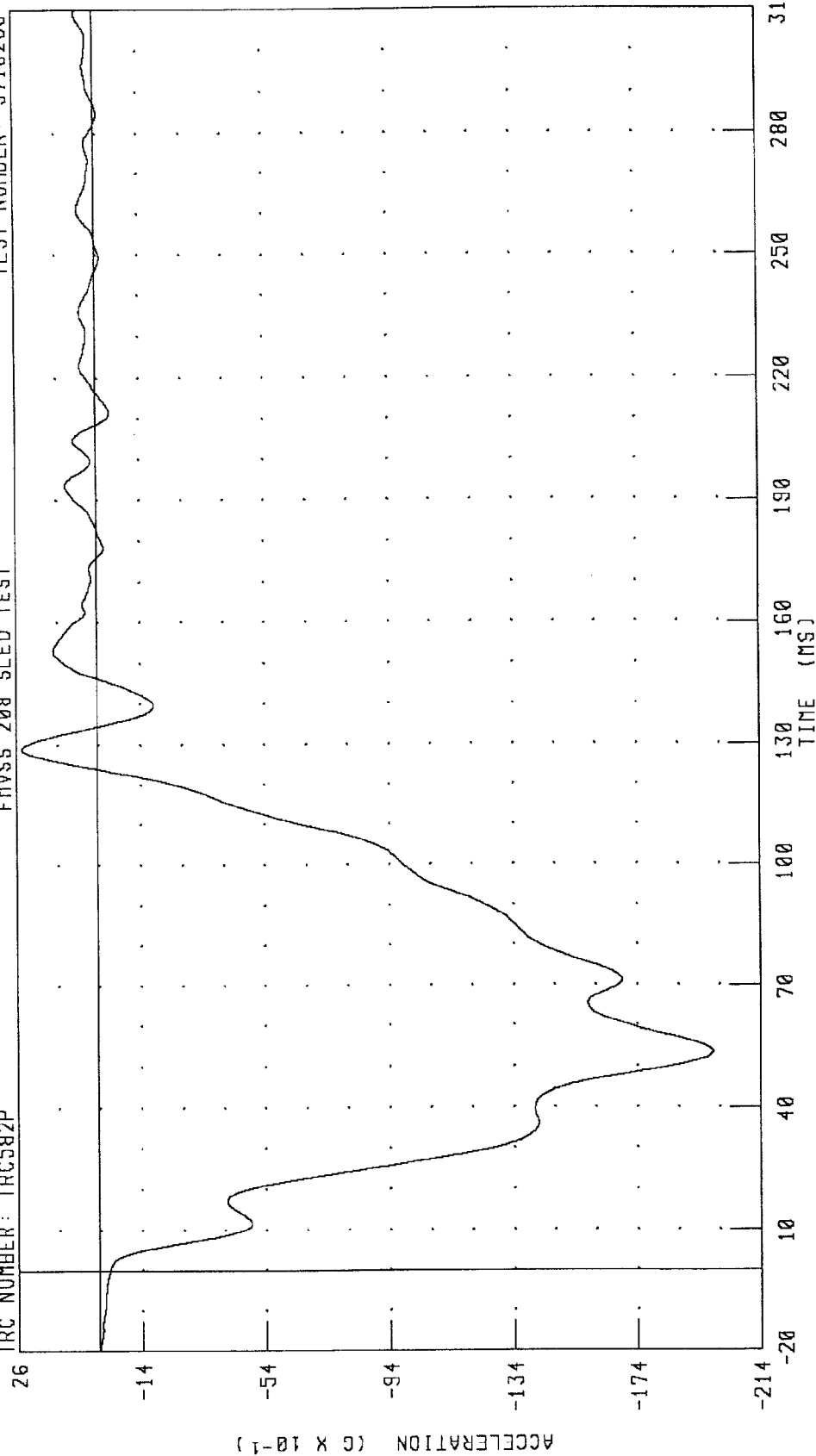
CHANNEL: LRAXG FILTER: CH. CLASS 60

PEAK DATA: 1.43 G @ 127.20 MS; -19.38 G @ 47.76 MS

CW0109 / 1998 CHEVROLET LUMINA
 BOTTOM ENGINE X-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



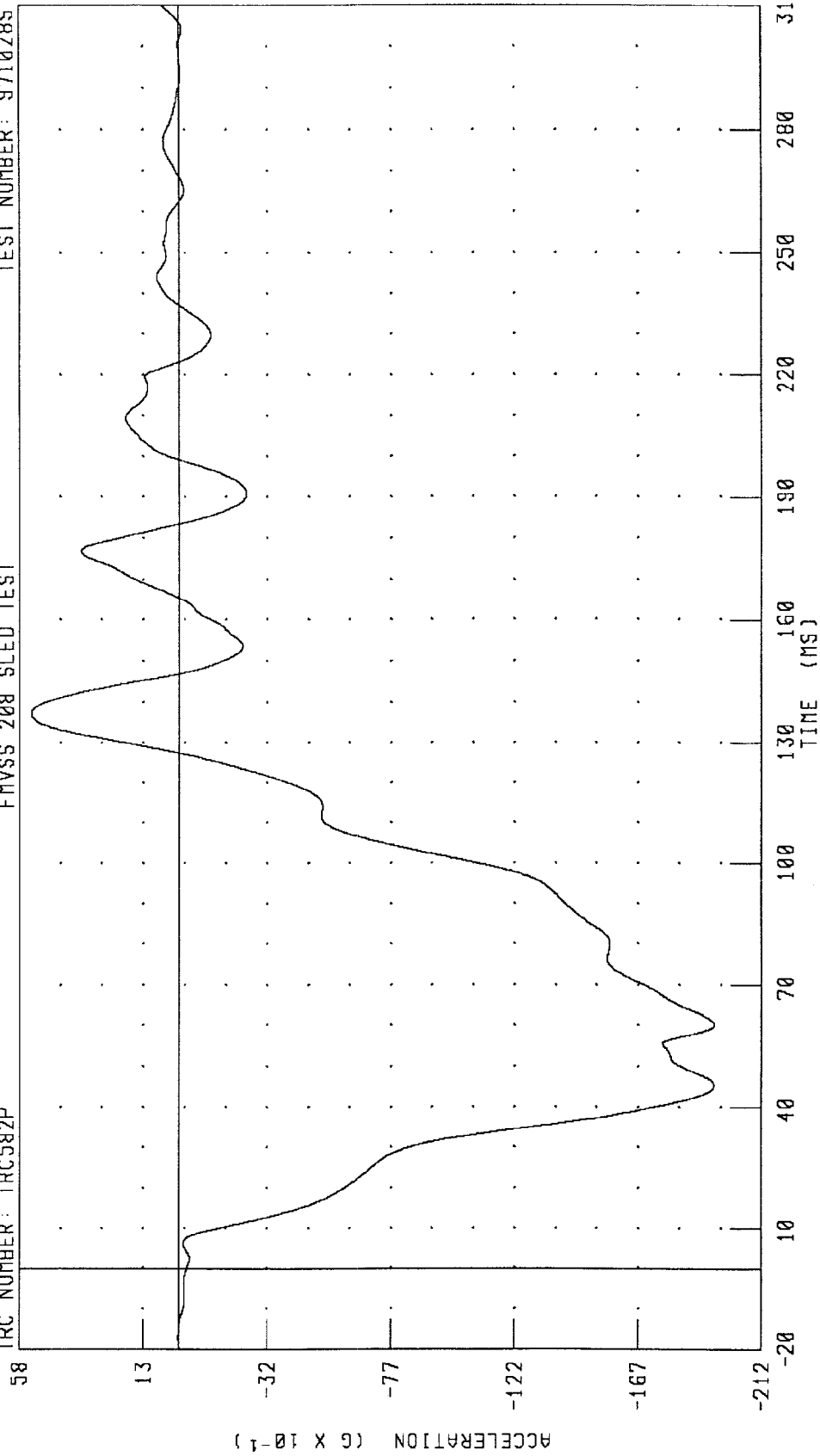
CHANNEL: BEXG FILTER: CH. CLASS 60

PEAK DATA: 2.42 G @ 129.04 MS; -19.85 G @ 53.44 MS

CW0109 / 1998 CHEVROLET LUMINA
 TOP ENGINE X-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S

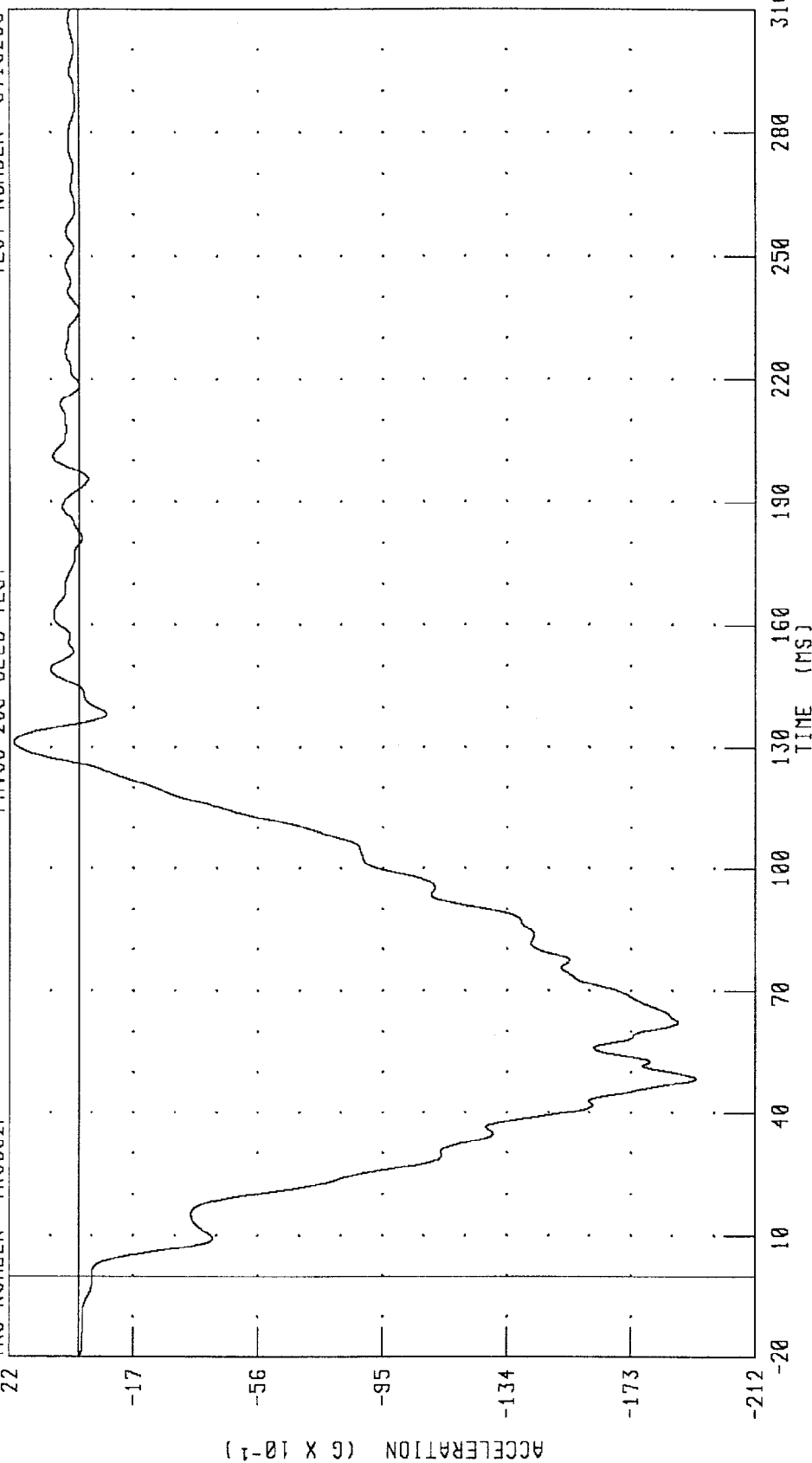


CHANNEL: TEXTG FILTER: CH. CLASS 60

CW0108 / 1998 CHEVROLET LUMINA
 LEFT REAR SEAT MEMBER X-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S



CHANNEL: LRSMXG FILTER: CH. CLASS 60

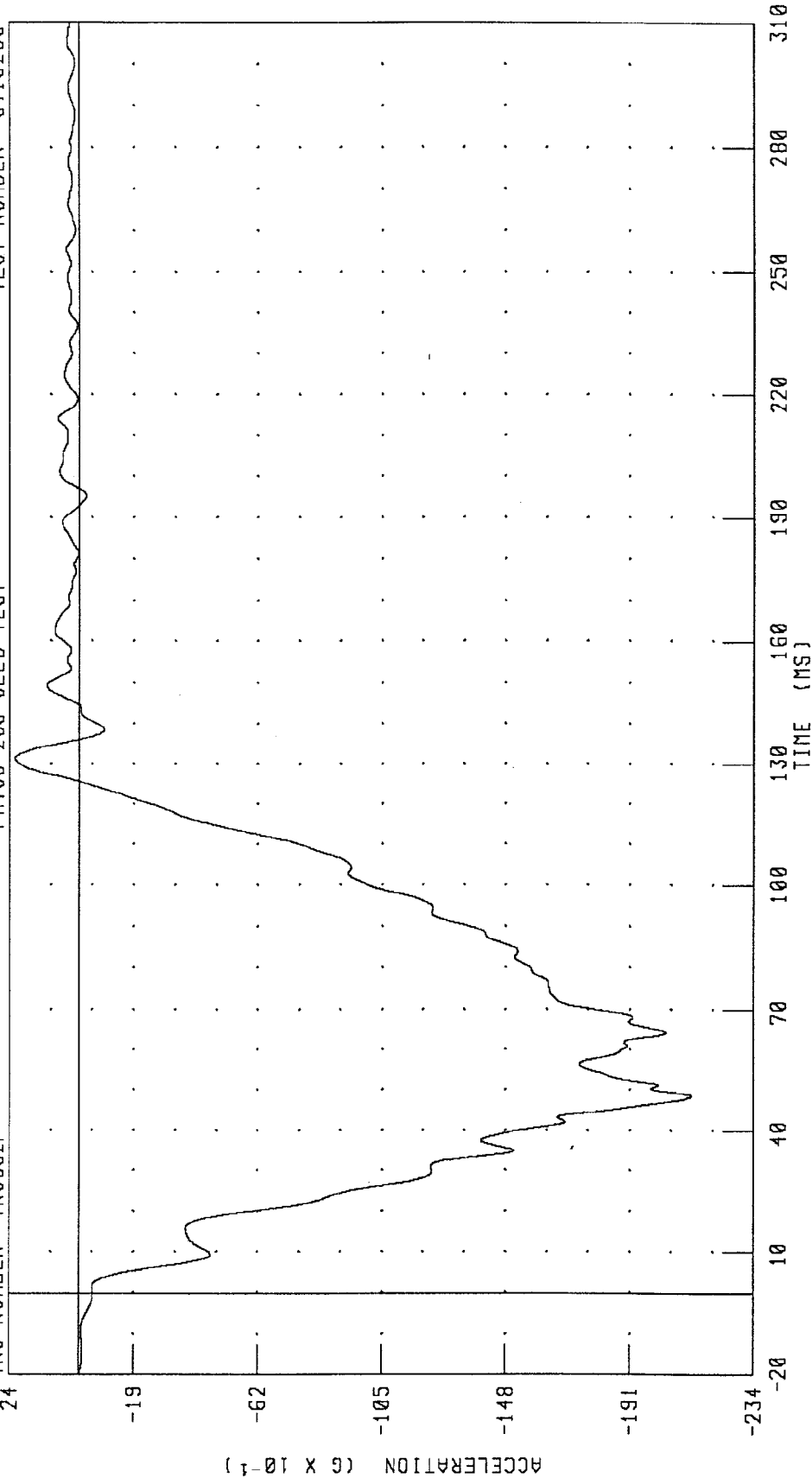
PEAK DATA: 2.07 G @ 131.44 MS; -19.33 G @ 48.40 MS

CW0109 / 1998 CHEVROLET LUMINA
RIGHT REAR SEAT MEMBER X-AXIS ACCELERATION

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P



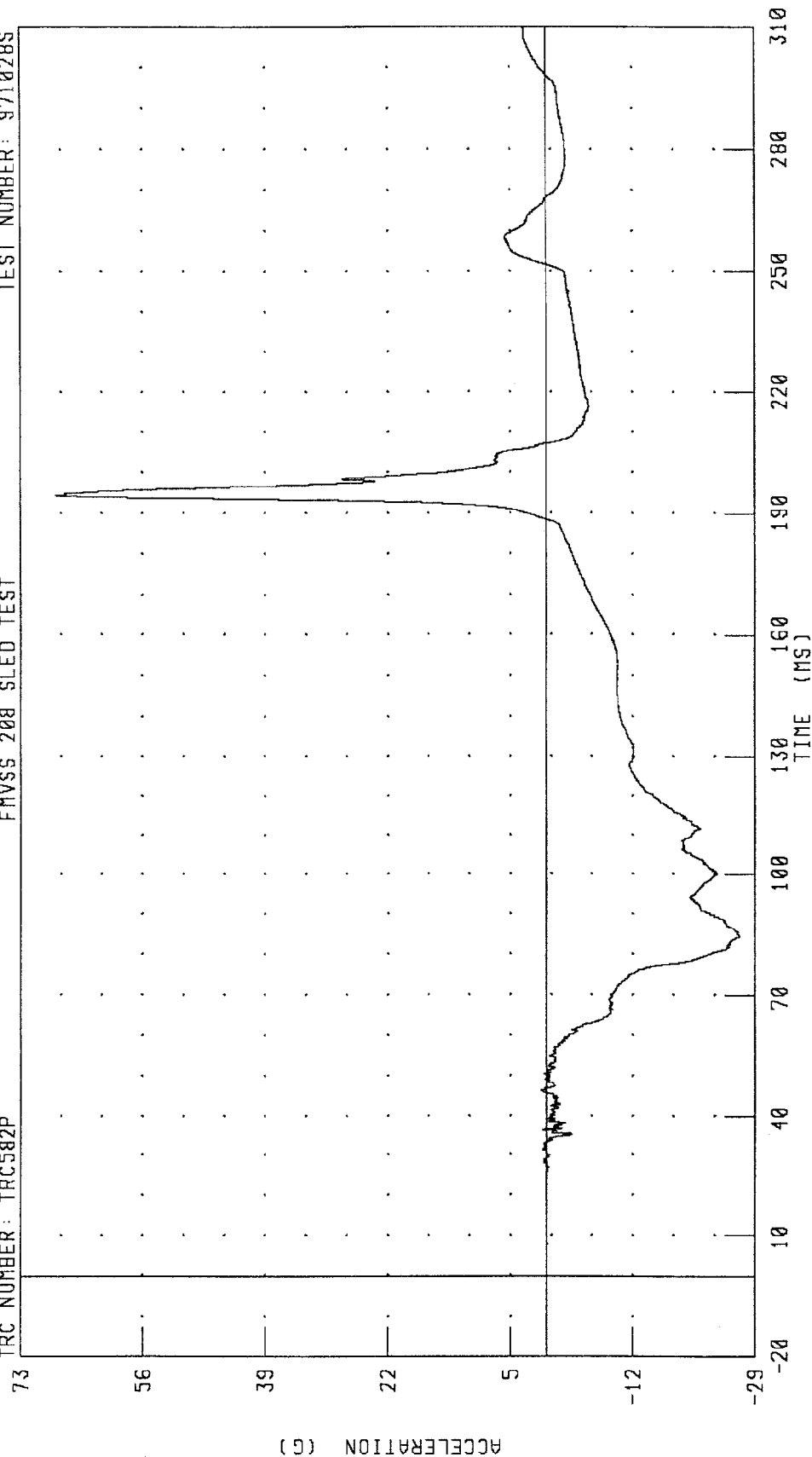
CHANNEL: RRSXG FILTER: CH. CLASS 60

PEAK DATA: 2.20 G @ 131.28 MS; -21.25 G @ 48.48 MS

CW0109 / 1998 CHEVROLET LUMINA
 DRIVER HEAD X-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



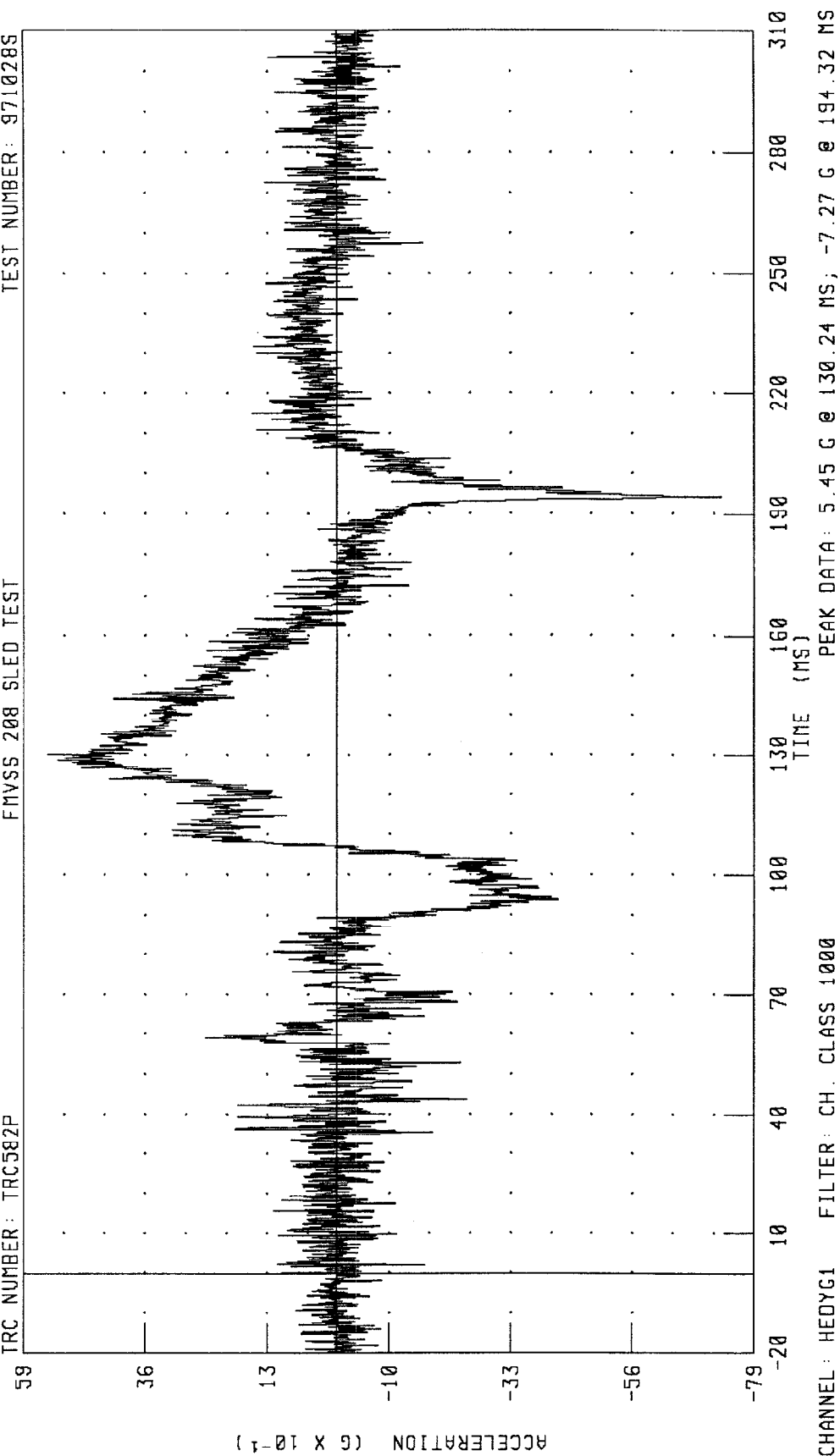
CHANNEL: HEDXG1 FILTER: CH. CLASS 1000

PEAK DATA: 68.00 G @ 194.64 MS; -26.78 G @ 84.40 MS

CW0109 / 1998 CHEVROLET LUMINA
DRIVER HEAD Y-AXIS ACCELERATION
FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S

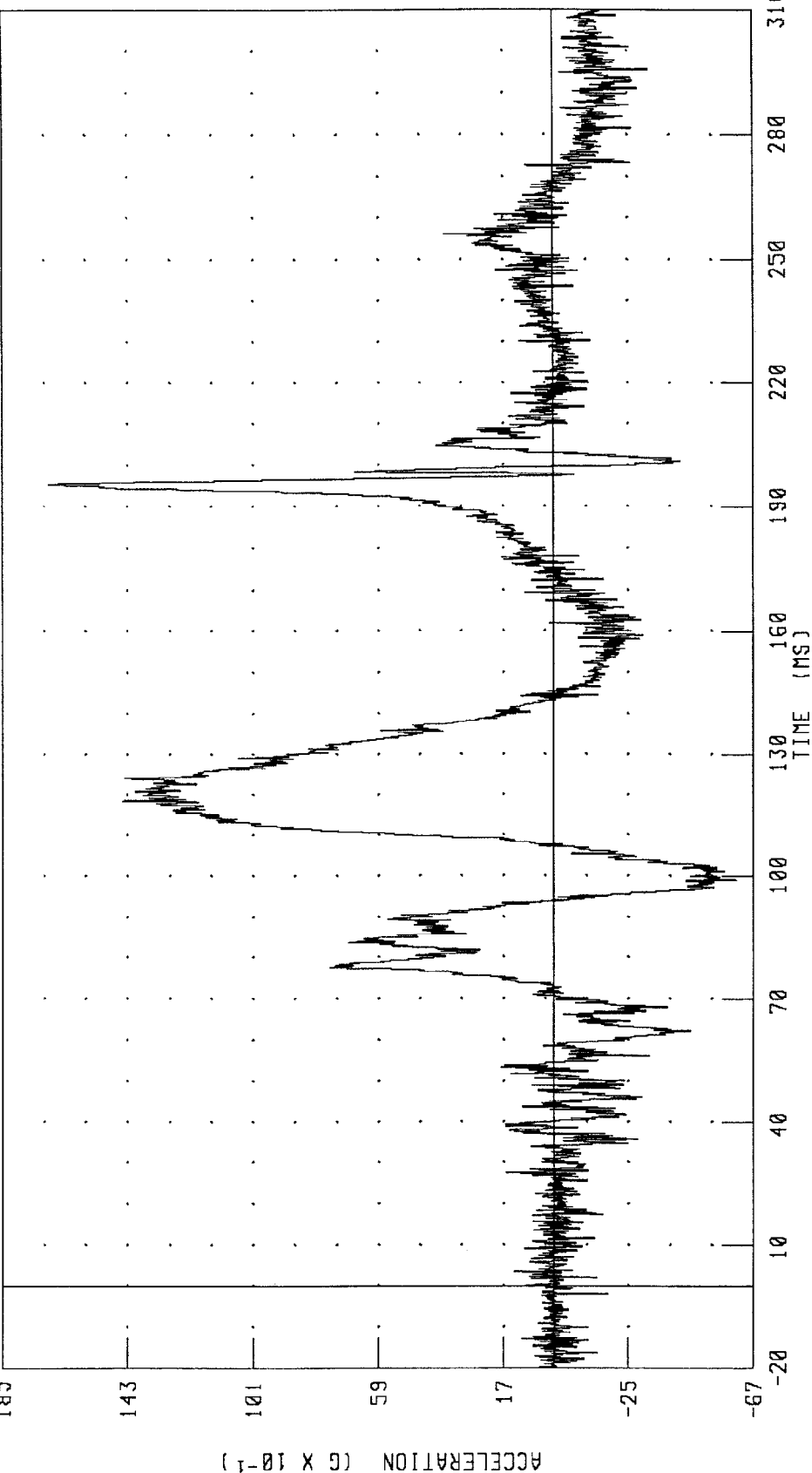


CW0109 / 1998 CHEVROLET LUMINA
DRIVER HEAD Z-AXIS ACCELERATION

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S



CHANNEL: HEDZG1 FILTER: CH. CLASS 1000

PEAK DATA: 16.91 G @ 195.52 MS; -6.10 G @ 98.96 MS

CW0109 / 1998 CHEVROLET LUMINA
 DRIVER HEAD RESULTANT ACCELERATION

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

72

60

48

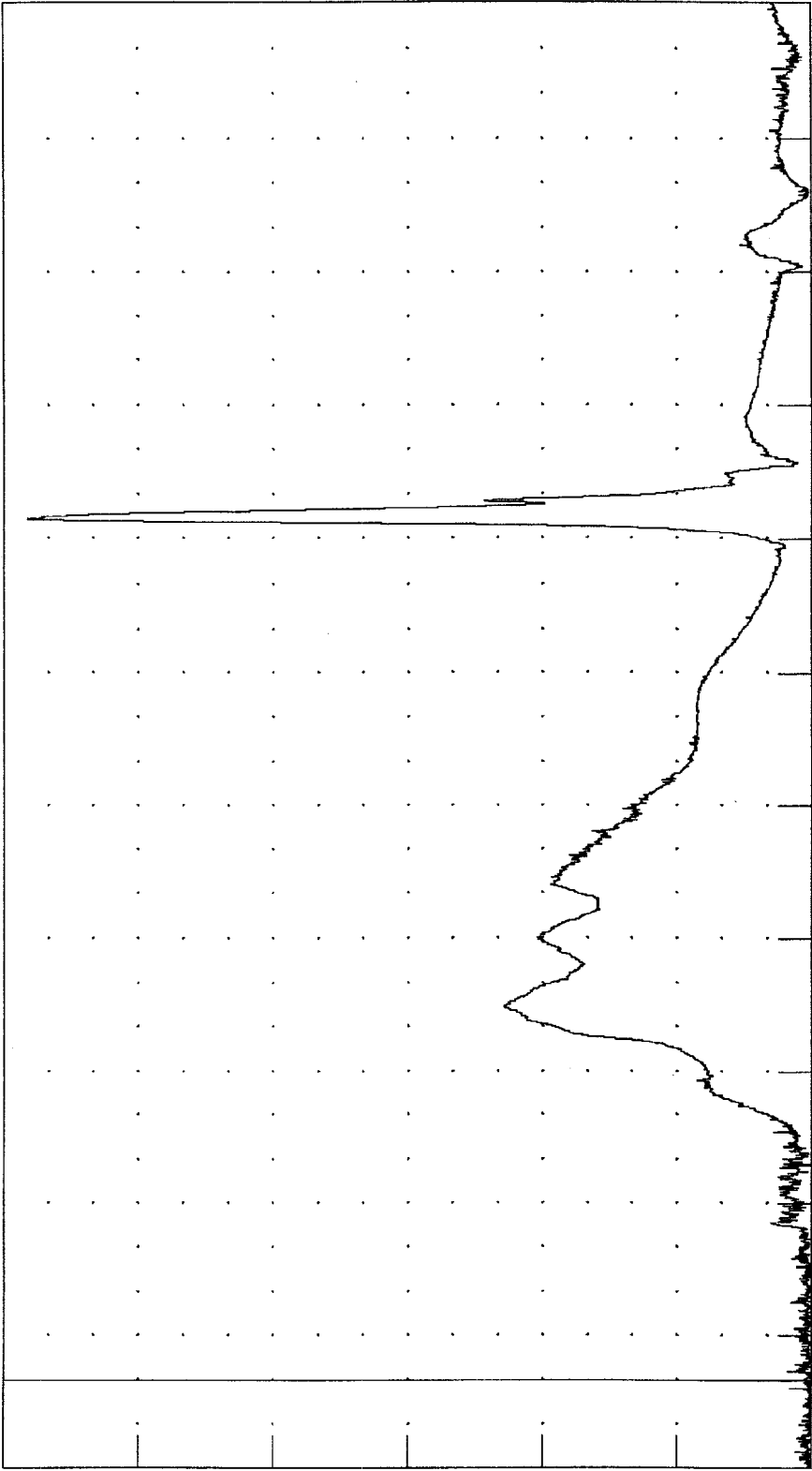
36

24

12

0

ACCELERATION (G)



TIME (MS)

CHANNEL: HEDRG1 FILTER: CH. CLASS 1000

PEAK DATA: 69.88 G @ 194.64 MS; 0.02 G @ -17.36 MS

CW0109 / 1998 CHEVROLET LUMINA
DRIVER NECK X-AXIS SHEAR FORCE

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

58

42

26

10

-6

-22

-38

TIME (MS)

130

160

190

220

250

280

310

TEST NUMBER: 971028S

PEAK DATA: 553.43 N @ 102.40 MS; -350.86 N @ 157.76 MS

CHANNEL: NEKXF1

FILTER: CH. CLASS 1000

8201428

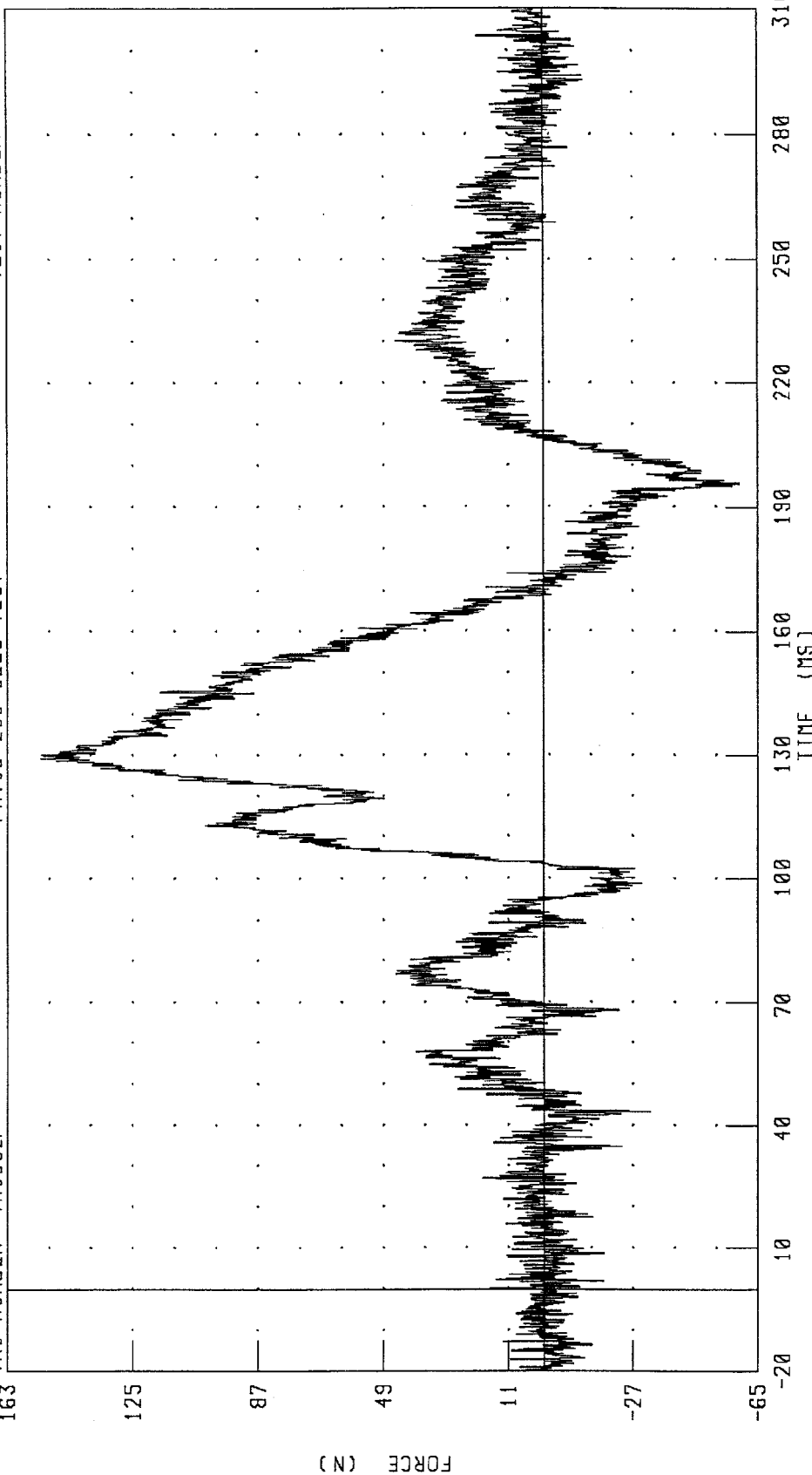
CW0109 / 1998 CHEVROLET LUMINA
DRIVER NECK Y-AXIS SHEAR FORCE

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

163



PEAK DATA: 152.86 N @ 129.20 MS; -59.53 N @ 195.84 MS

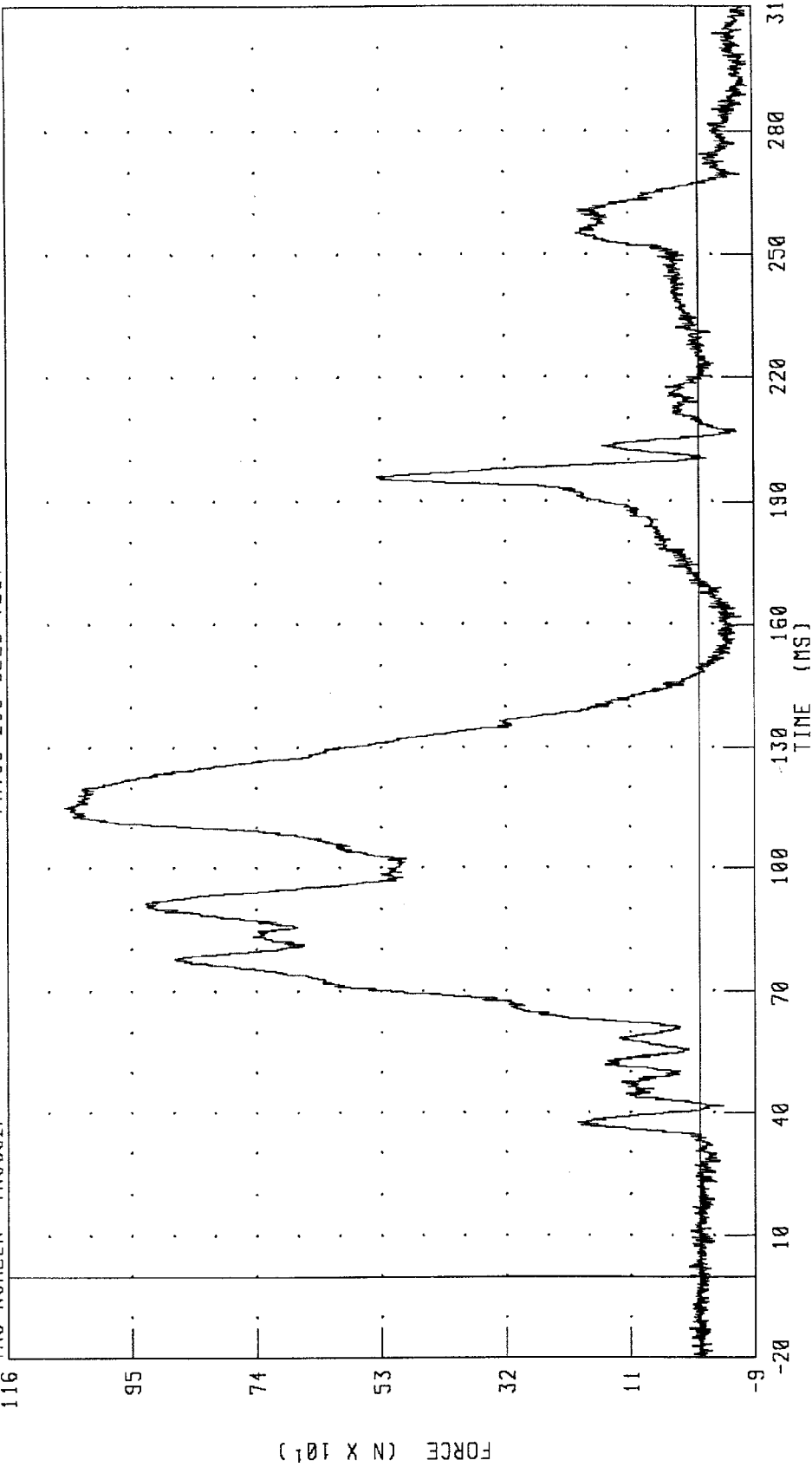
CHANNEL: NEKYF1 FILTER: CH. CLASS 1000

CW0109 / 1988 CHEVROLET LUMINA
DRIVER NECK Z-AXIS AXIAL FORCE

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S



PEAK DATA: 1070.80 N @ 115.20 MS; -84.77 N @ 310.00 MS

CHANNEL: NEKZF1 FILTER: CH. CLASS 1000

CW0109 / 1998 CHEVROLET LUMINA
DRIVER NECK MOMENT ABOUT X AXIS

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

112

82

52

22

-8

-38

-68

TORQUE (N·M X 10⁻¹)

TIME (MS)

130

160

190

220

250

280

310

TEST NUMBER: 971028S

PEAK DATA: 10.37 N·M @ 121.04 MS; -6.26 N·M @ 108.48 MS

CHANNEL: NEKXM1

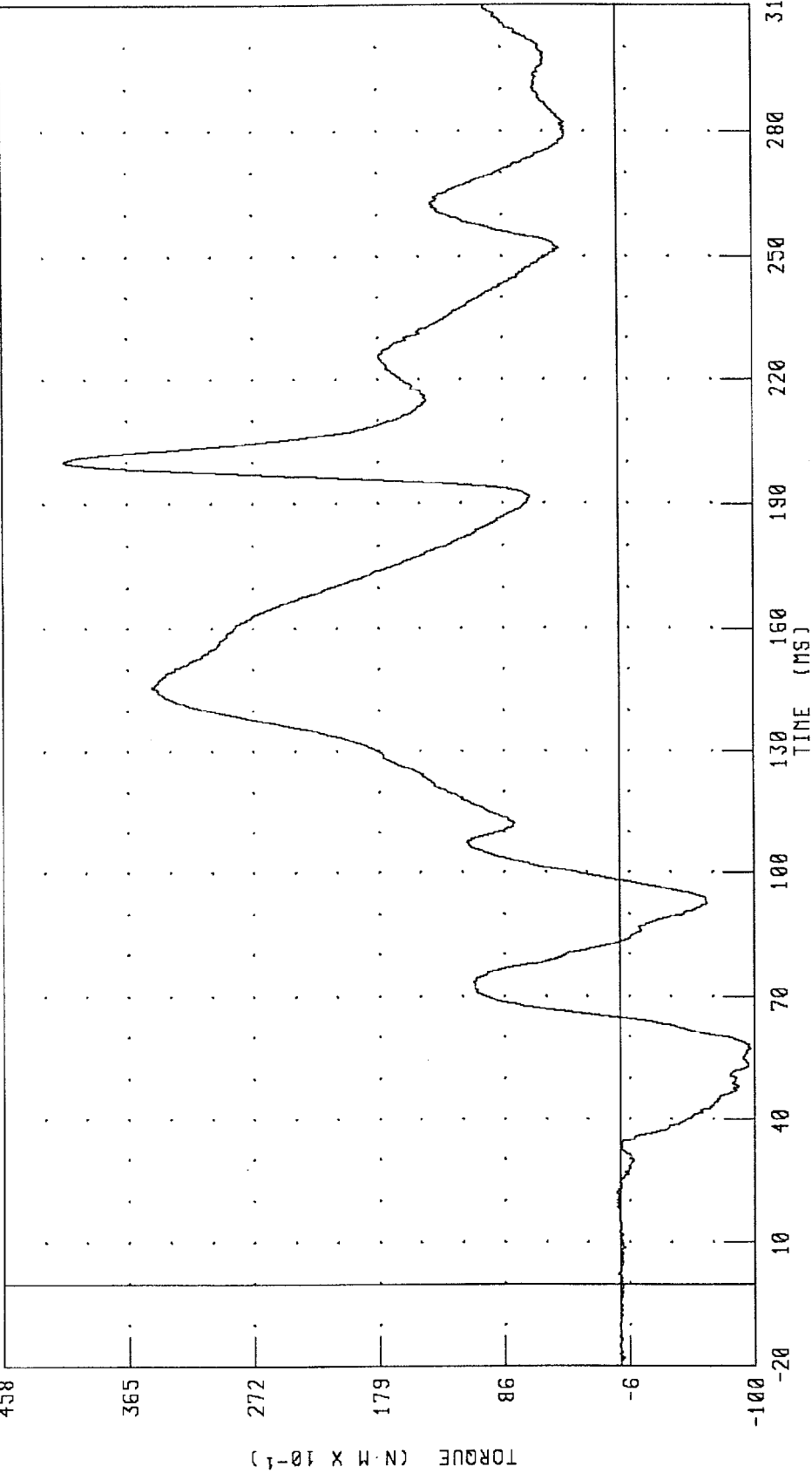
FILTER: CH. CLASS 600

CW0109 / 1998 CHEVROLET LUMINA
DRIVER NECK MOMENT ABOUT Y AXIS

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S



CHANNEL: NEKYM1 FILTER: CH. CLASS 600

PEAK DATA: 41.24 N·M @ 200.24 MS; -9.63 N·M @ 57.20 MS

CW0109 / 1998 CHEVROLET LUMINA
DRIVER NECK MOMENT ABOUT Z AXIS

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

62

42

TORQUE (N·M X 10⁻¹)

22

2

-18

-38

-58

310

280

250

220

190

160

130

100

70

40

10

-20

TIME (MS)

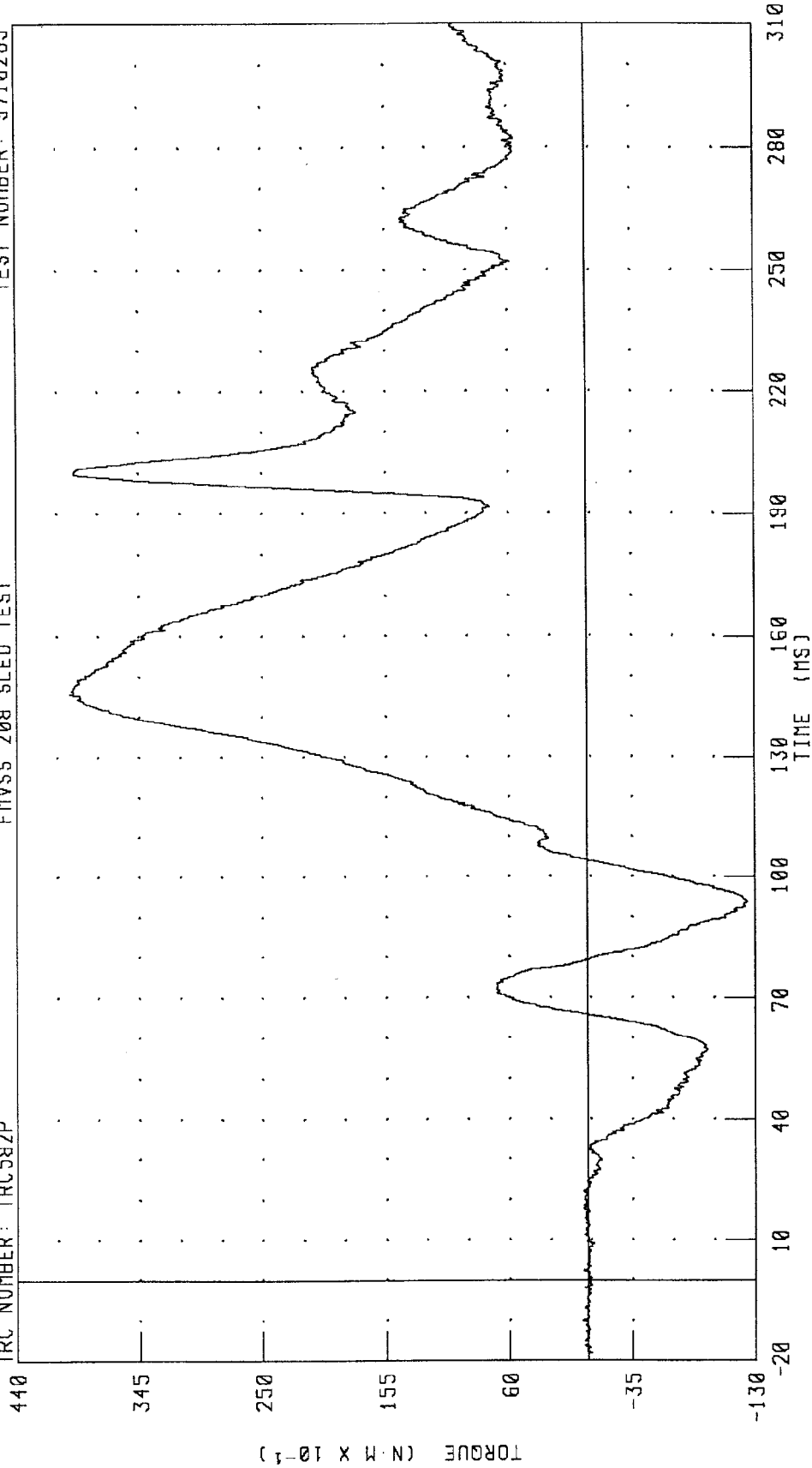
CHANNEL: NEKZM1 FILTER: CH. CLASS 600

PEAK DATA: 5.72 N·M @ 83.28 MS; -5.34 N·M @ 144.72 MS

CW0109 / 1998 CHEVROLET LUMINA
 DRIVER NECK OCCIPITAL CONDYLE ABOUT Y AXIS
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



PEAK DATA: 39.89 N·m @ 145.76 MS; -12.38 N·m @ 93.84 MS

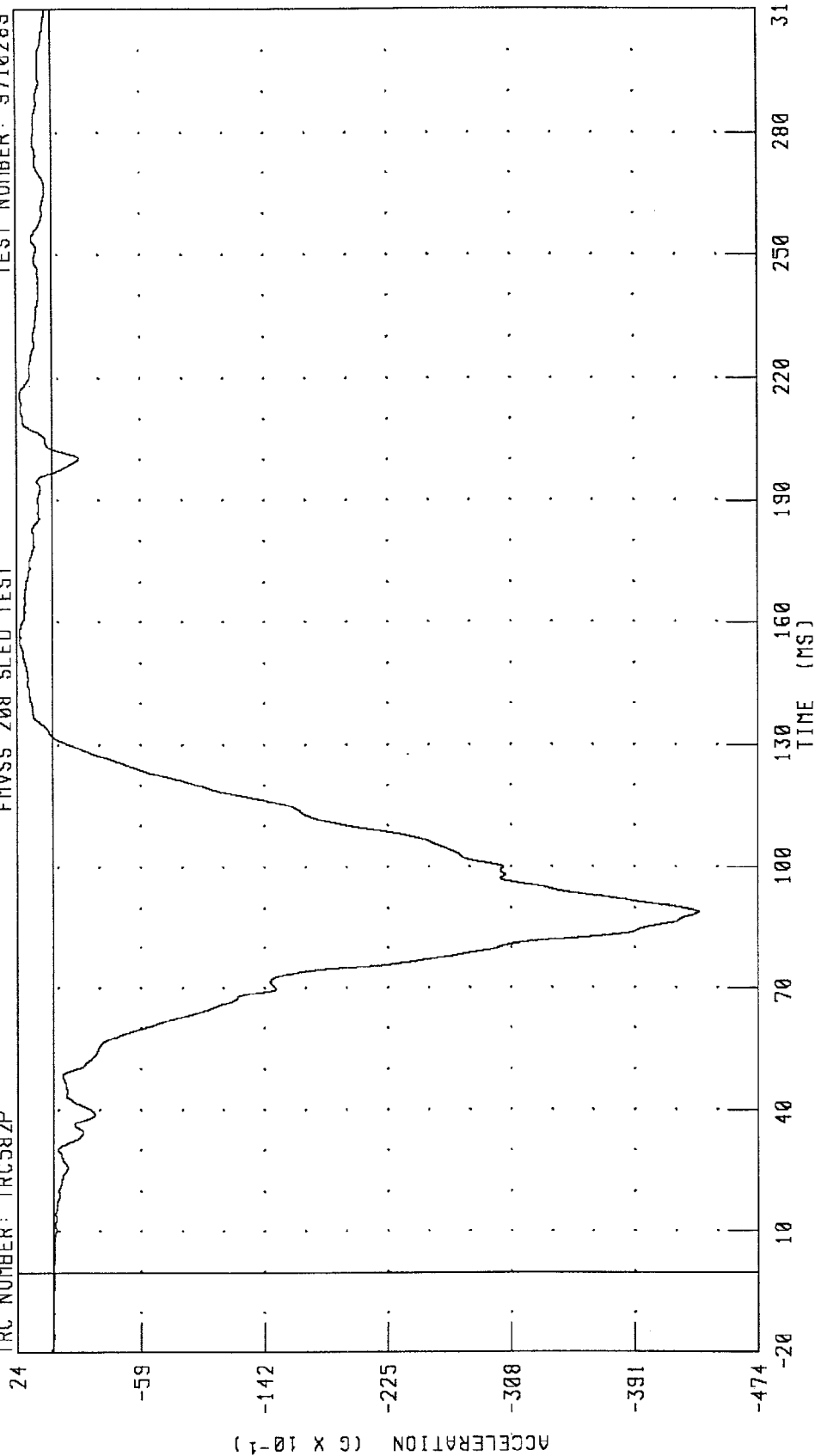
CHANNEL: NEK0M1 FILTER: CH. CLASS 600

CW0109 / 1998 CHEVROLET LUMINA
DRIVER CHEST X-AXIS ACCELERATION

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P



PEAK DATA: 2.19 G @ 157.84 MS, -43.43 G @ 89.04 MS

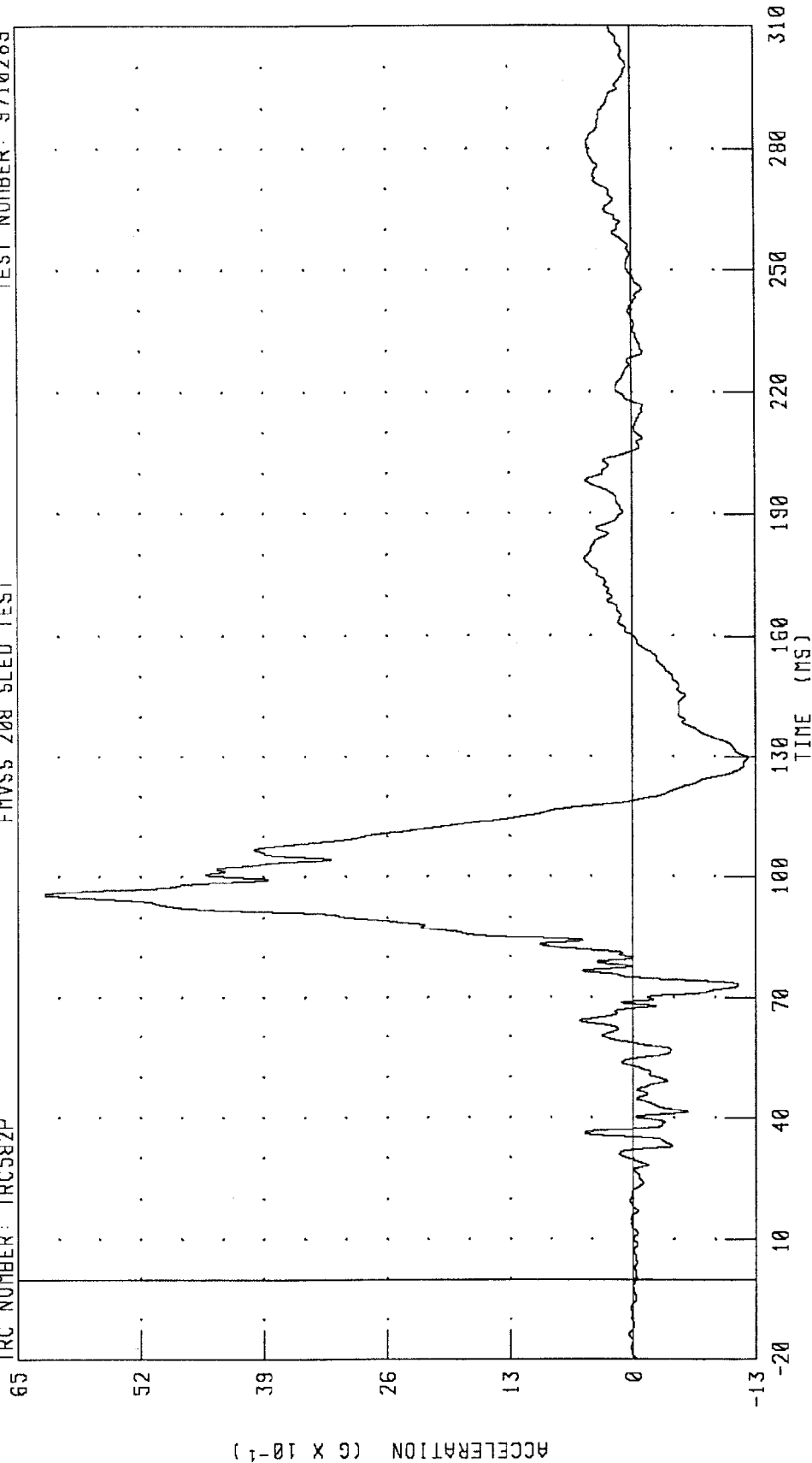
CHANNEL: CSTXG1 FILTER: CH. CLASS 180

CW0109 / 1998 CHEVROLET LUMINA
 DRIVER CHEST Y-AXIS ACCELERATION

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S



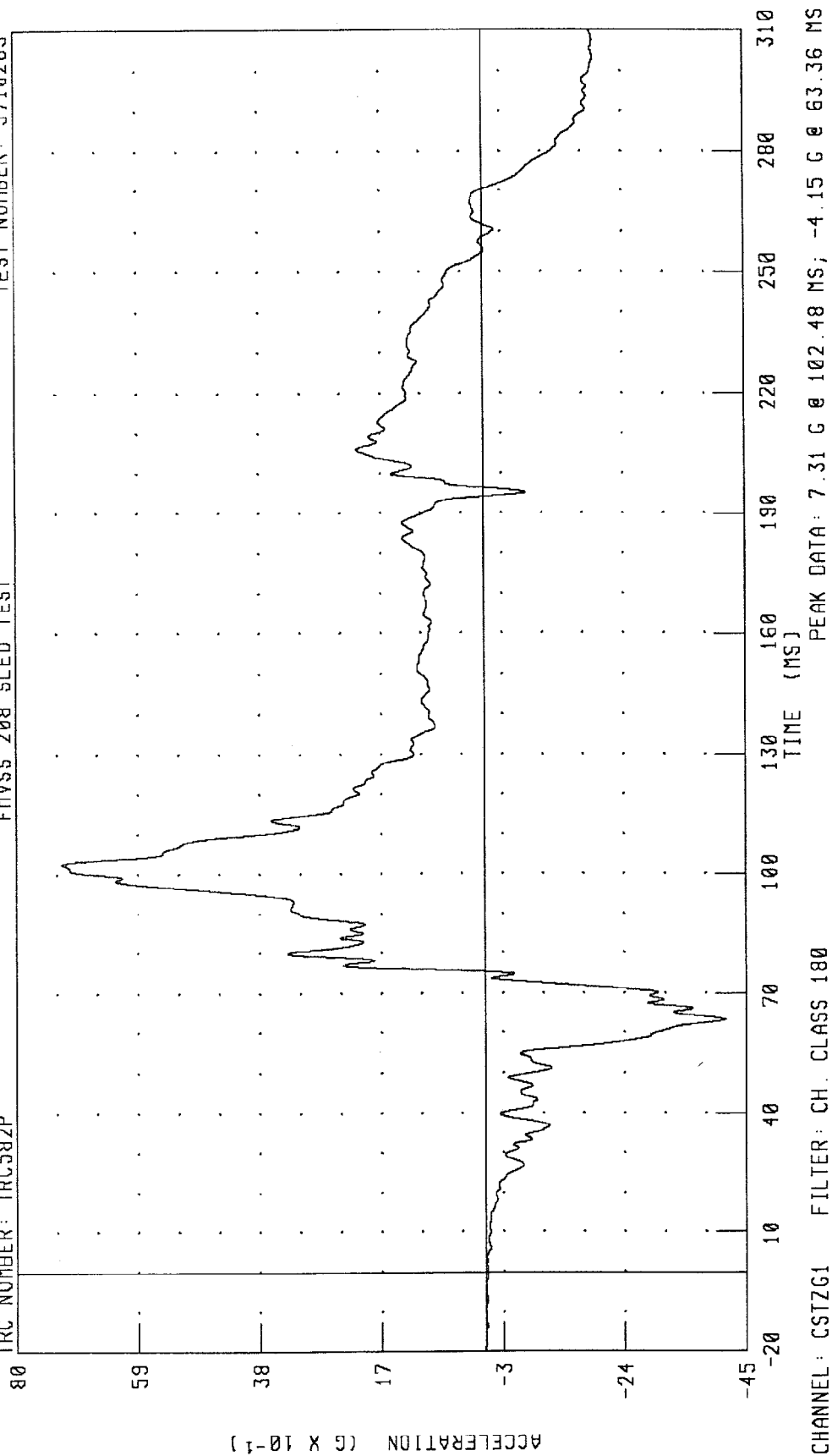
CHANNEL: CSTY01 FILTER: CH. CLASS 180

PEAK DATA: 6.22 G @ 95.68 MS; -1.21 G @ 129.68 MS

CW0109 / 1998 CHEVROLET LUMINA
 DRIVER CHEST Z-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



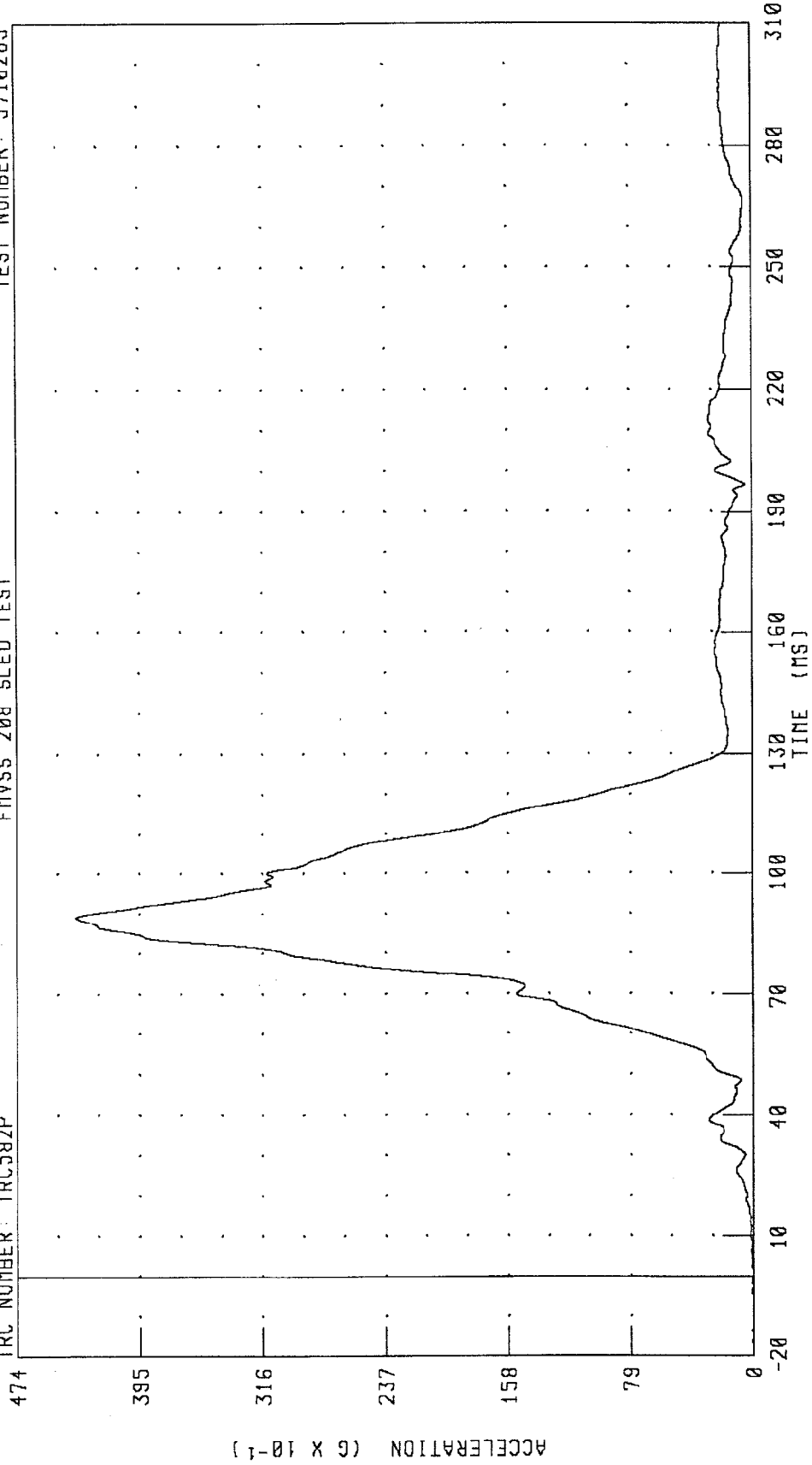
CHANNEL: CSTZG1 FILTER: CH. CLASS 180

PEAK DATA: 7.31 G @ 102.48 MS; -4.15 G @ 63.36 MS

CW0109 / 1998 CHEVROLET LUMINA
 DRIVER CHEST RESULTANT ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



PEAK DATA: 43.60 G @ 89.04 MS; 0.01 G @ -18.80 MS

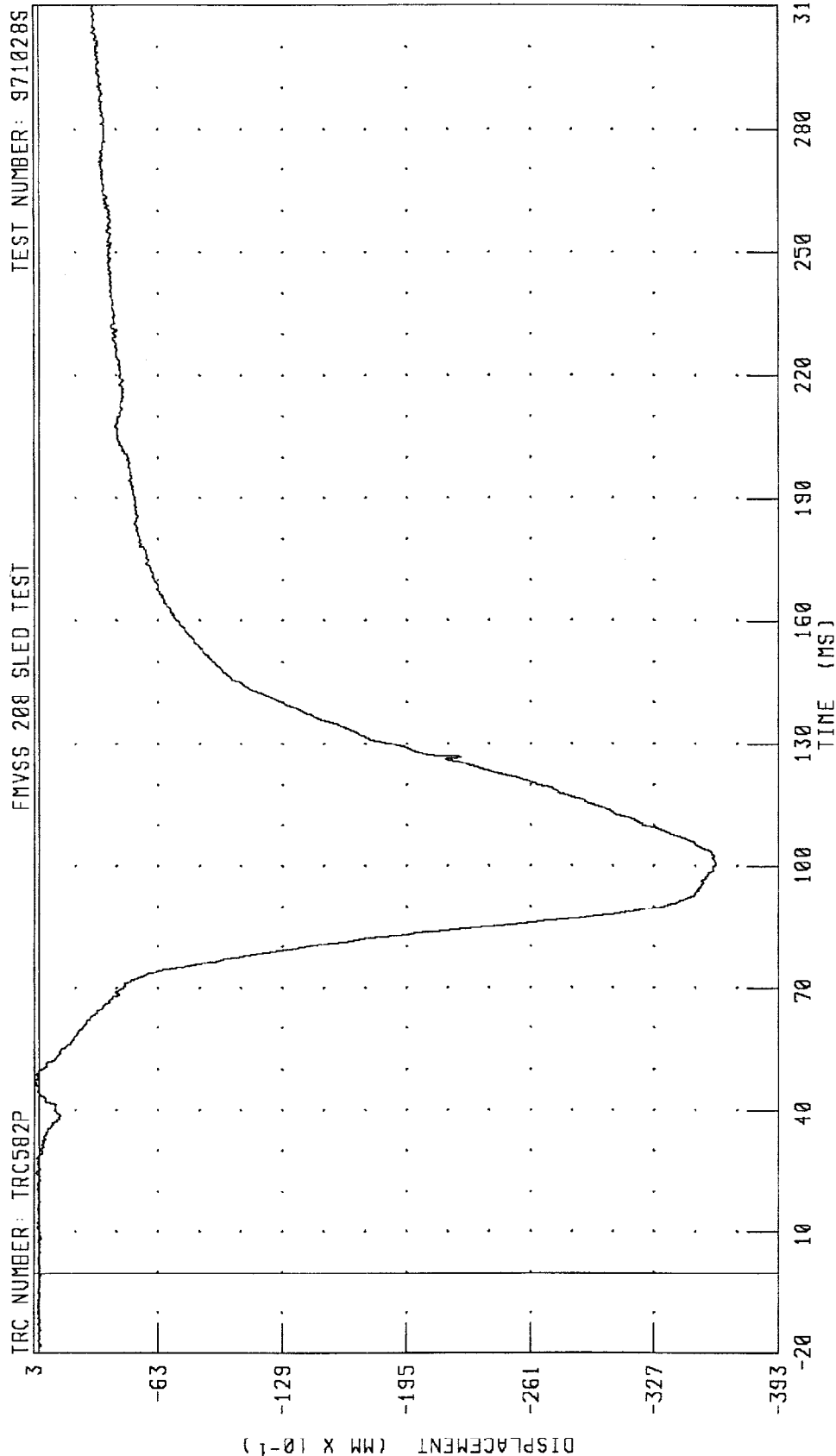
CHANNEL: CSTRG1 FILTER: CH. CLASS 180

CW0109 / 1998 CHEVROLET LUMINA
DRIVER CHEST DEFLECTION

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P



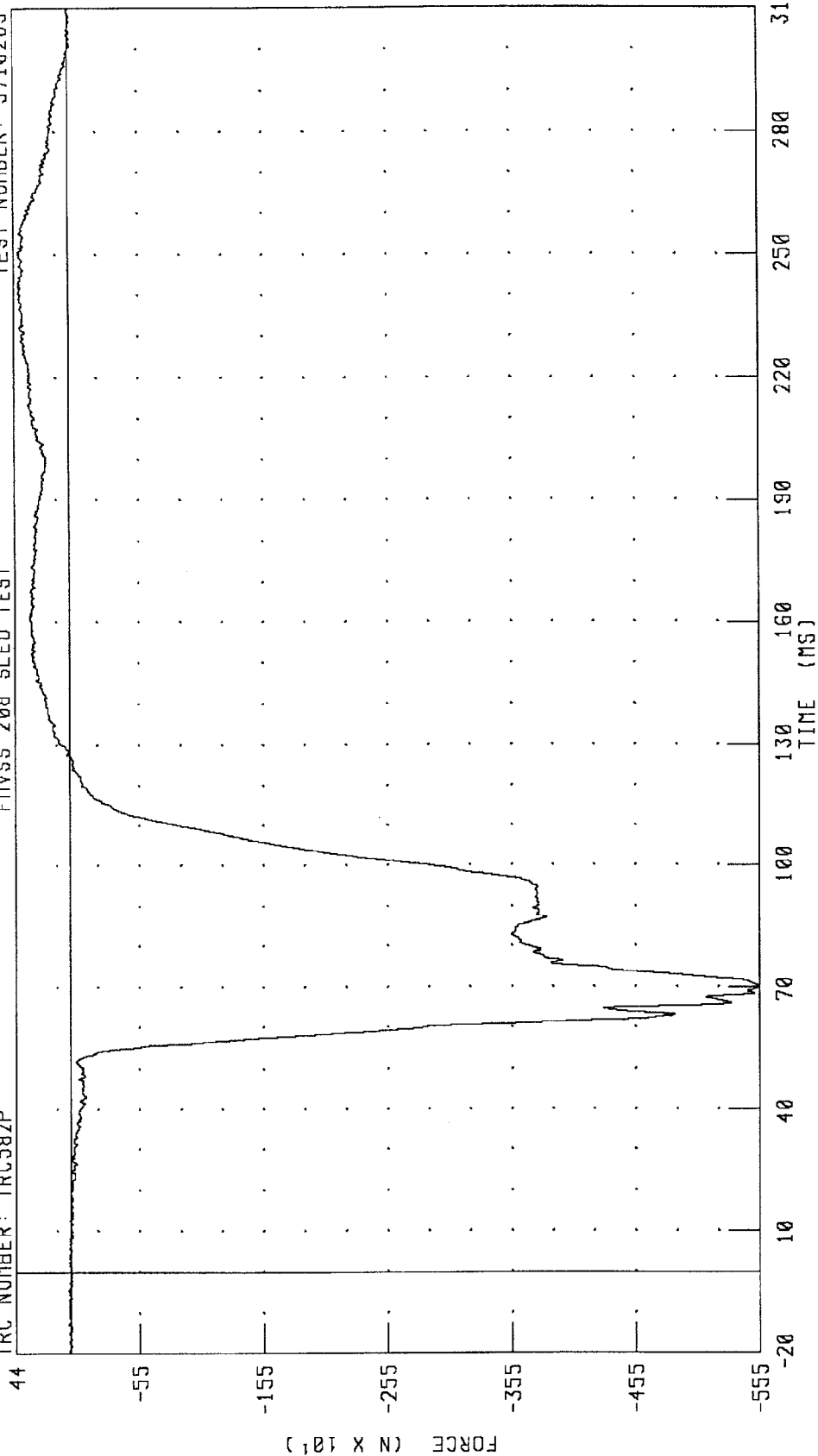
PEAK DATA: 0.34 MM @ 47.36 MS, -35.99 MM @ 100.72 MS

CHANNEL: CSTXD1 FILTER: CH. CLASS 600

CW0109 / 1998 CHEVROLET LUMINA
DRIVER LEFT FEMUR FORCE
FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



CHANNEL: LFMF1 FILTER: CH. CLASS 600

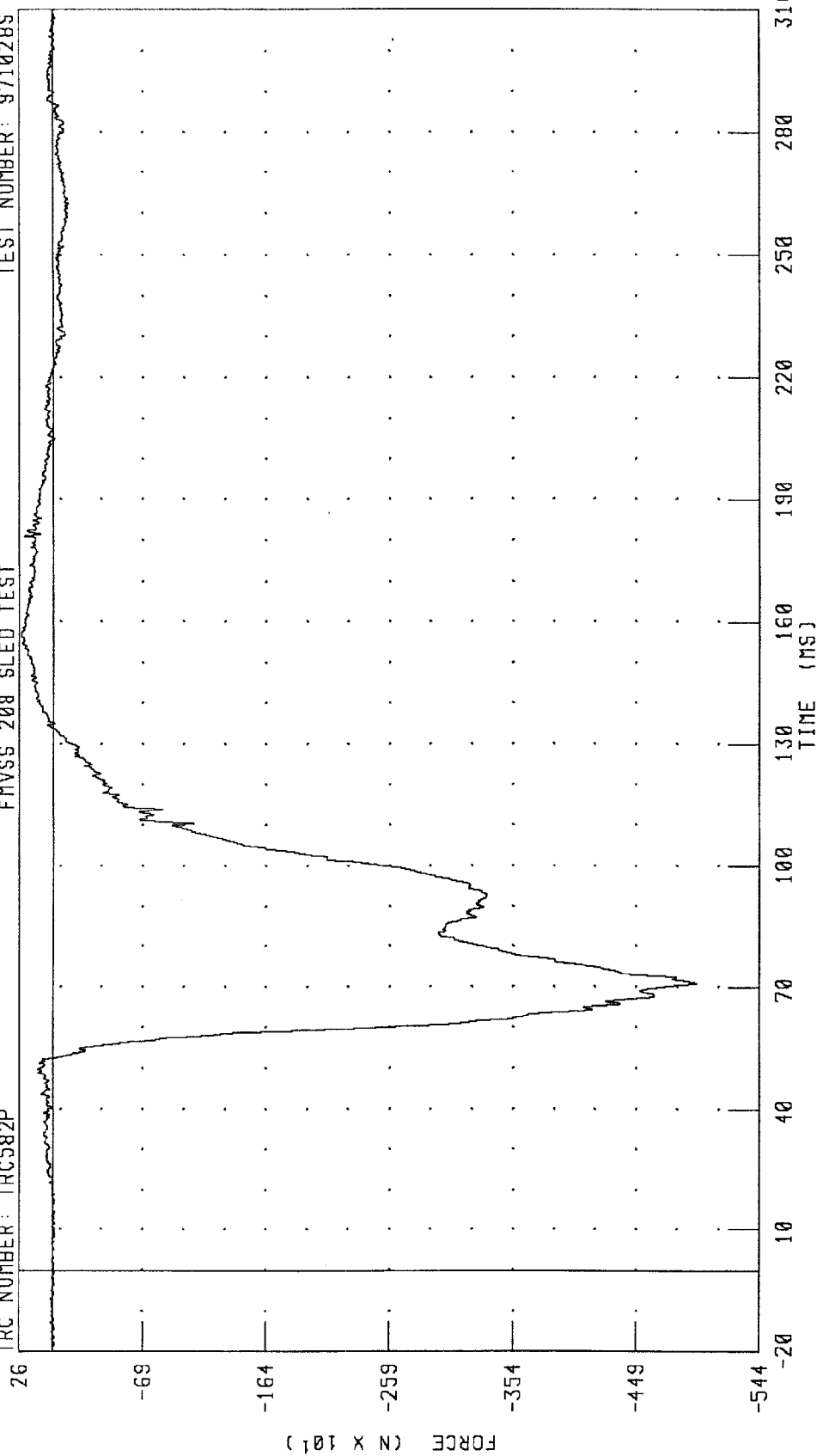
PEAK DATA: 405.06 N @ 243.12 MS; -5545.11 N @ 70.00 MS

CW0109 / 1998 CHEVROLET LUMINA
DRIVER RIGHT FEMUR FORCE

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST

TEST NUMBER: 971028S



PEAK DATA: 239.51 N @ 156.64 MS, -4956.02 N @ 70.96 MS

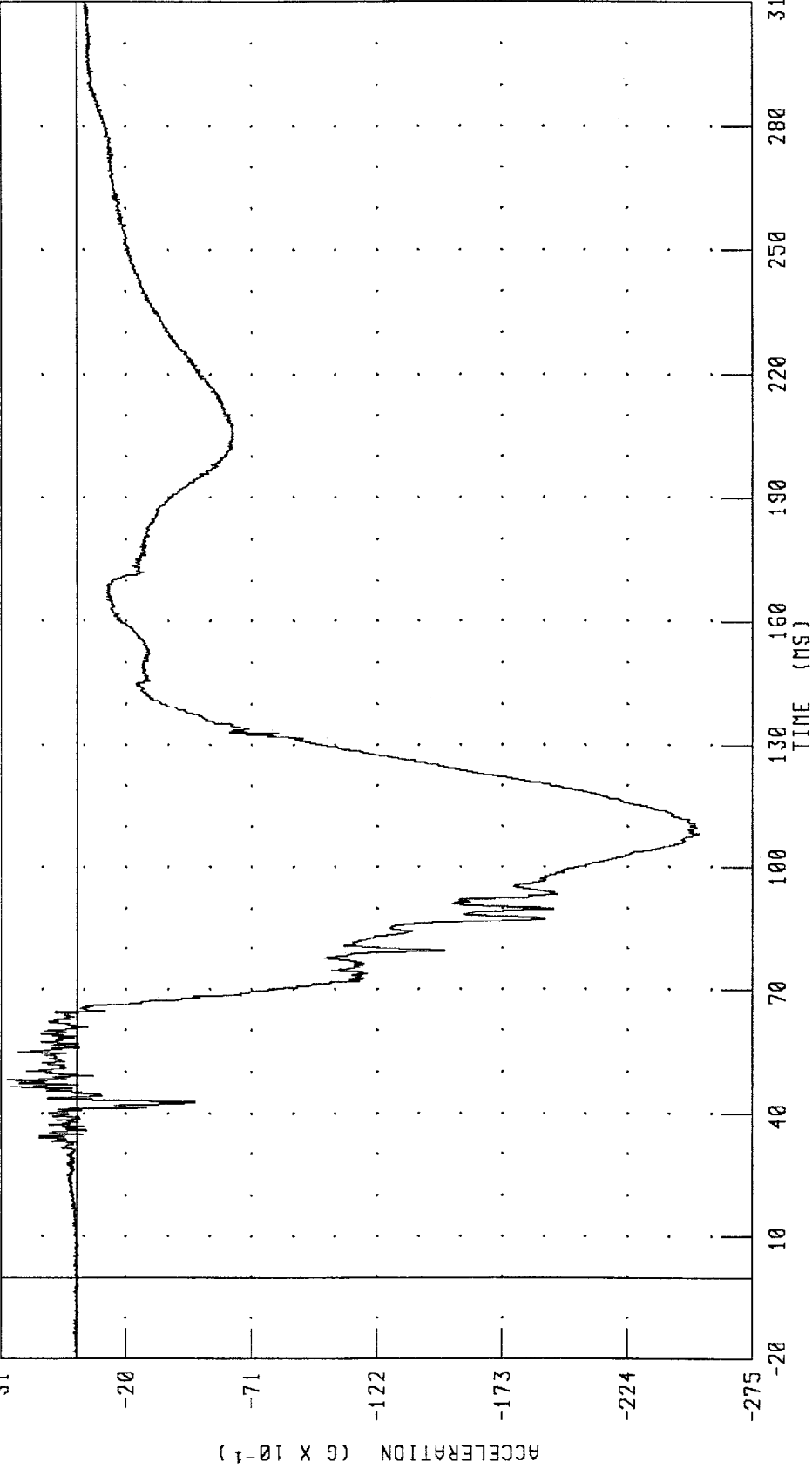
CHANNEL: RFMF1 FILTER: CH. CLASS 600

CW0109 / 1998 CHEVROLET LUMINA
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION
FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

31



CHANNEL: HEDXG2 FILTER: CH. CLASS 1000

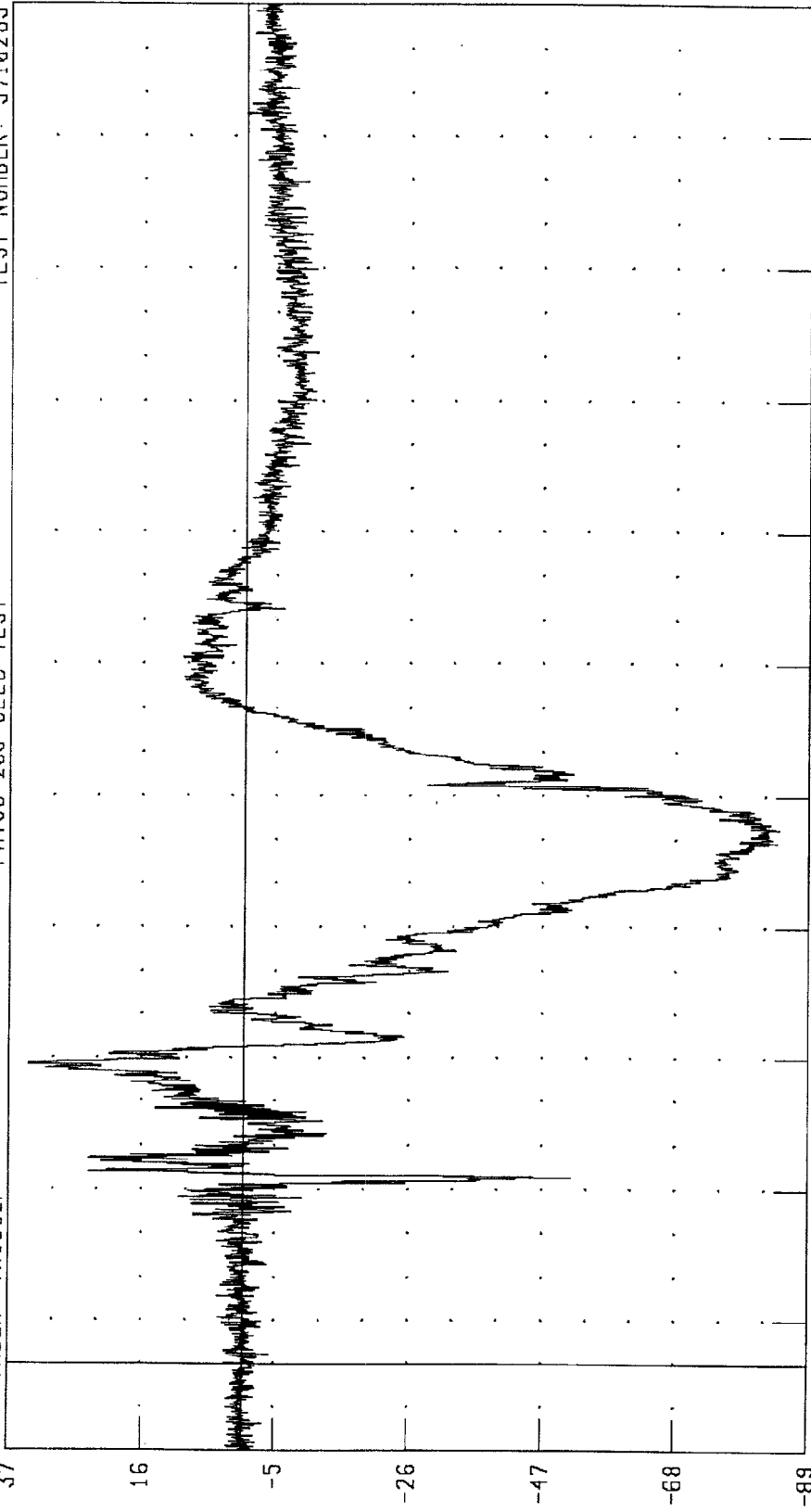
PEAK DATA: 2.85 G @ 48.08 MS; -25.31 G @ 108.24 MS

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

37



ACCELERATION (G X 10⁻¹)

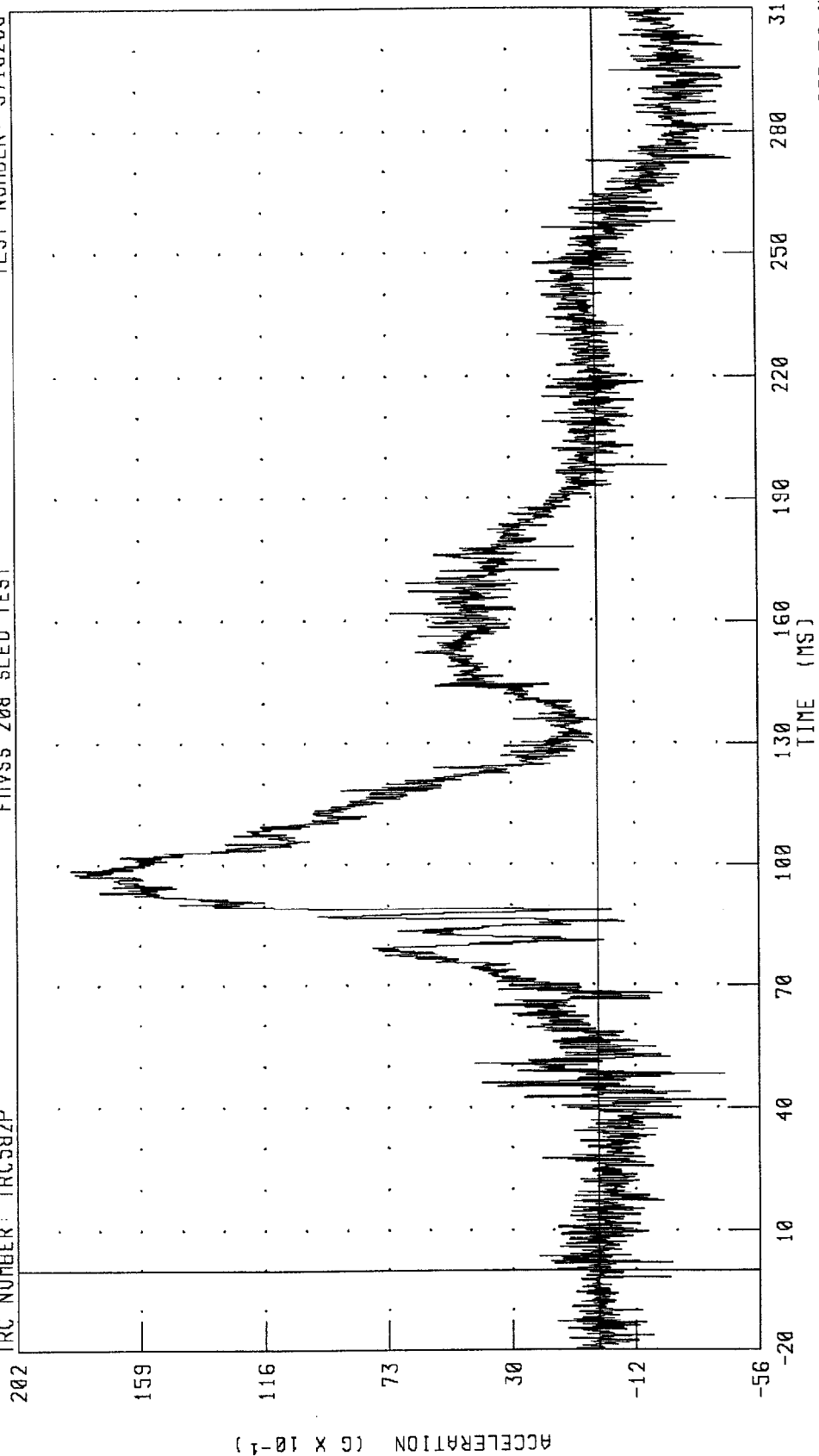
PEAK DATA: 3.39 G @ 68.56 MS; -8.43 G @ 122.56 MS

CHANNEL: HEDYG2 FILTER: CH. CLASS 1000

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

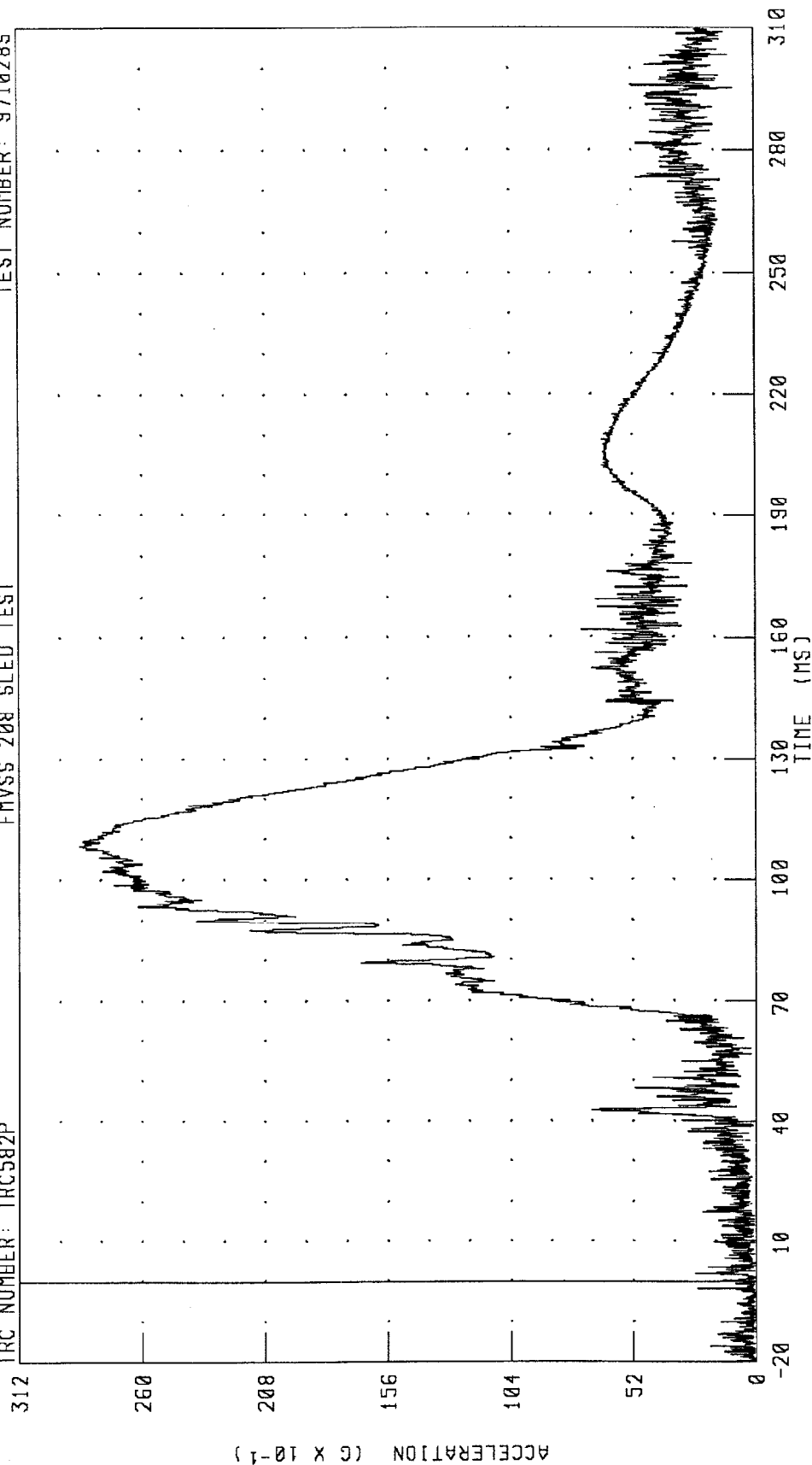


CHANNEL: HEDZG2 FILTER: CH. CLASS 1000

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



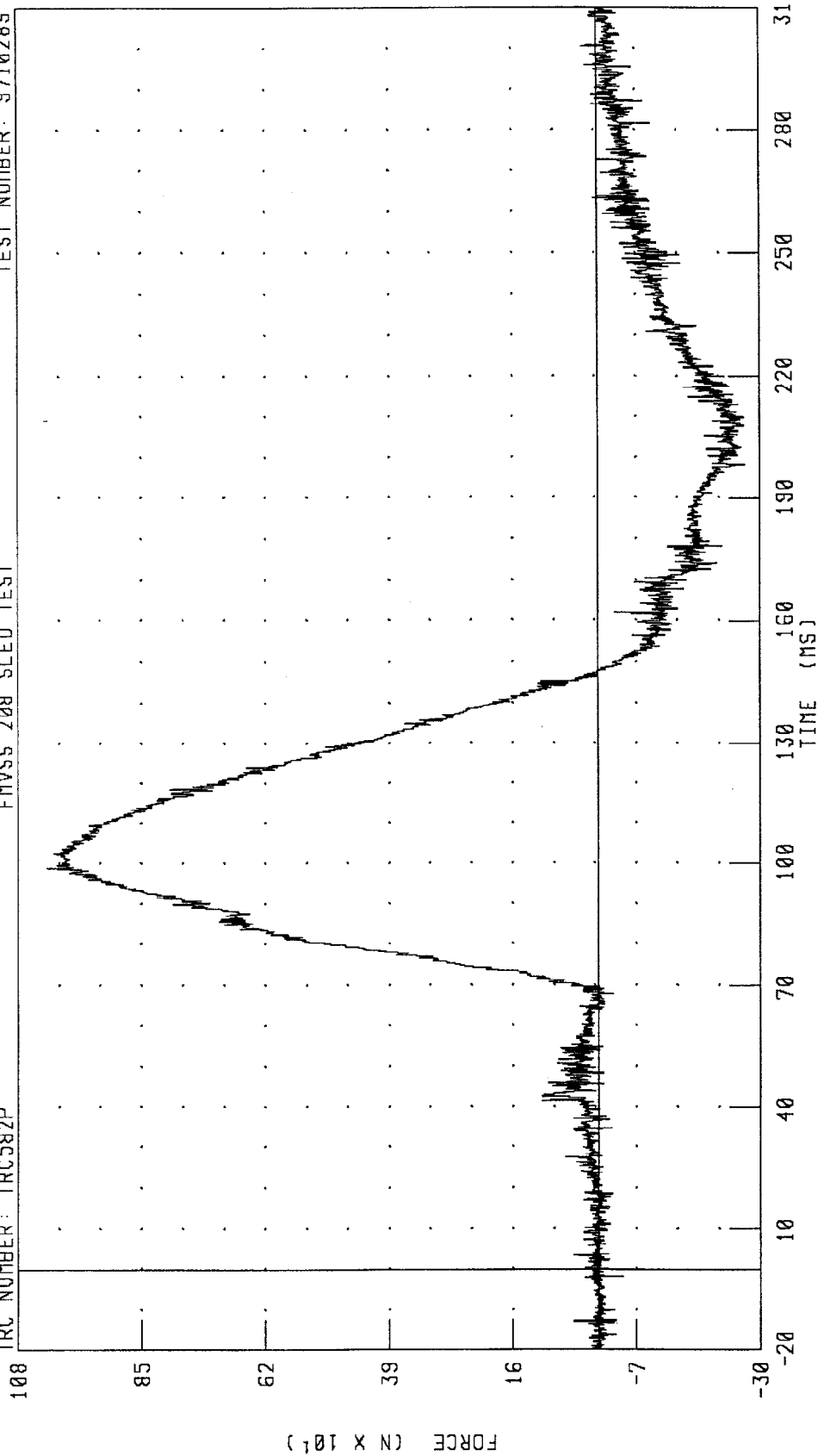
PEAK DATA: 28.63 G @ 108.24 MS; 0.03 G @ -11.76 MS

CHANNEL: HEDRG2 FILTER: CH. CLASS 1000

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER NECK X-AXIS SHEAR FORCE
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



PEAK DATA: 1024.05 N @ 98.88 MS, -272.82 N @ 198.24 MS

CHANNEL: NEKXF2 FILTER: CH. CLASS 1000

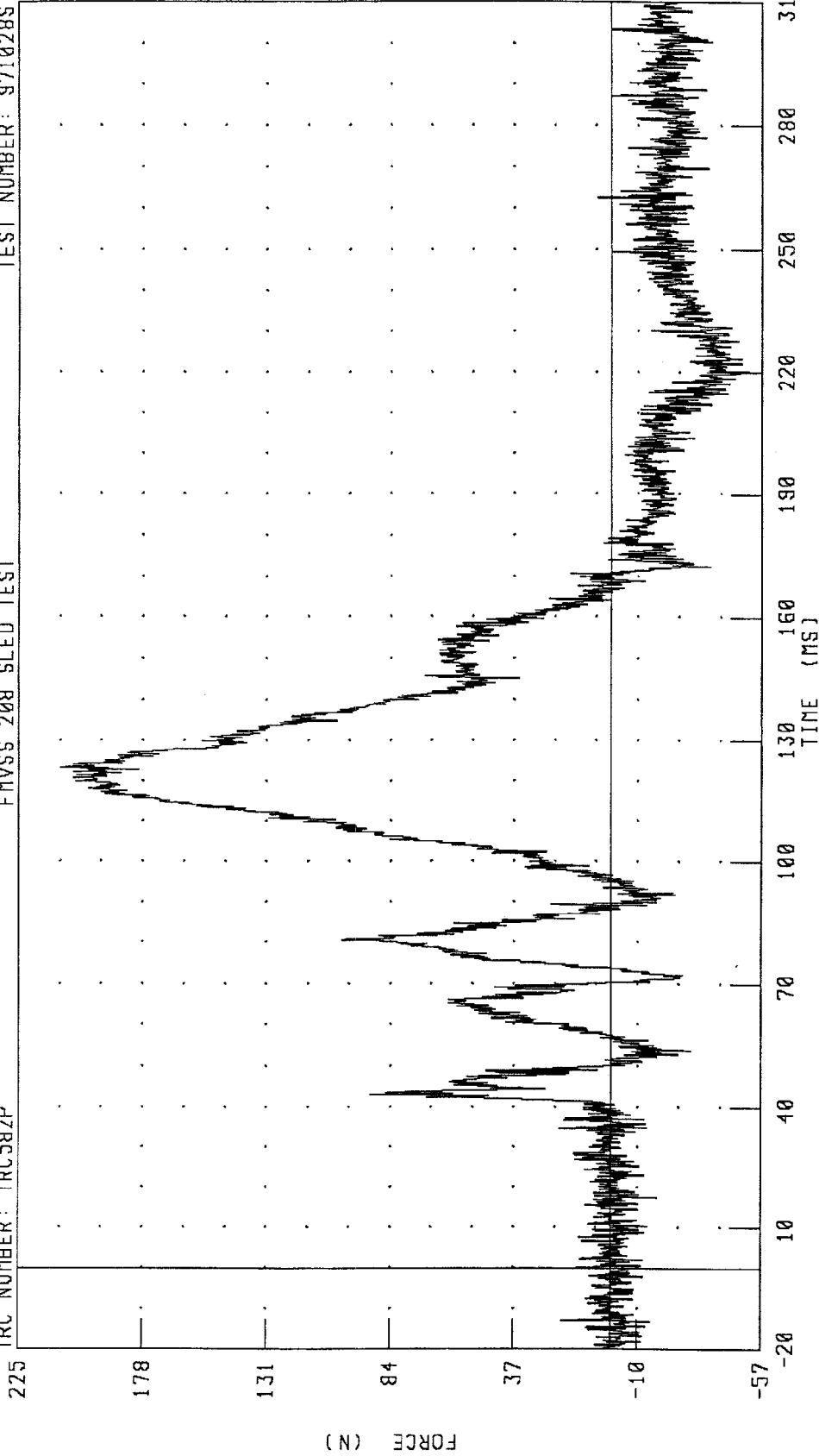
CW0109 / 1998 CHEVROLET LUMINA

RIGHT FRONT PASSENGER NECK Y-AXIS SHEAR FORCE

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST



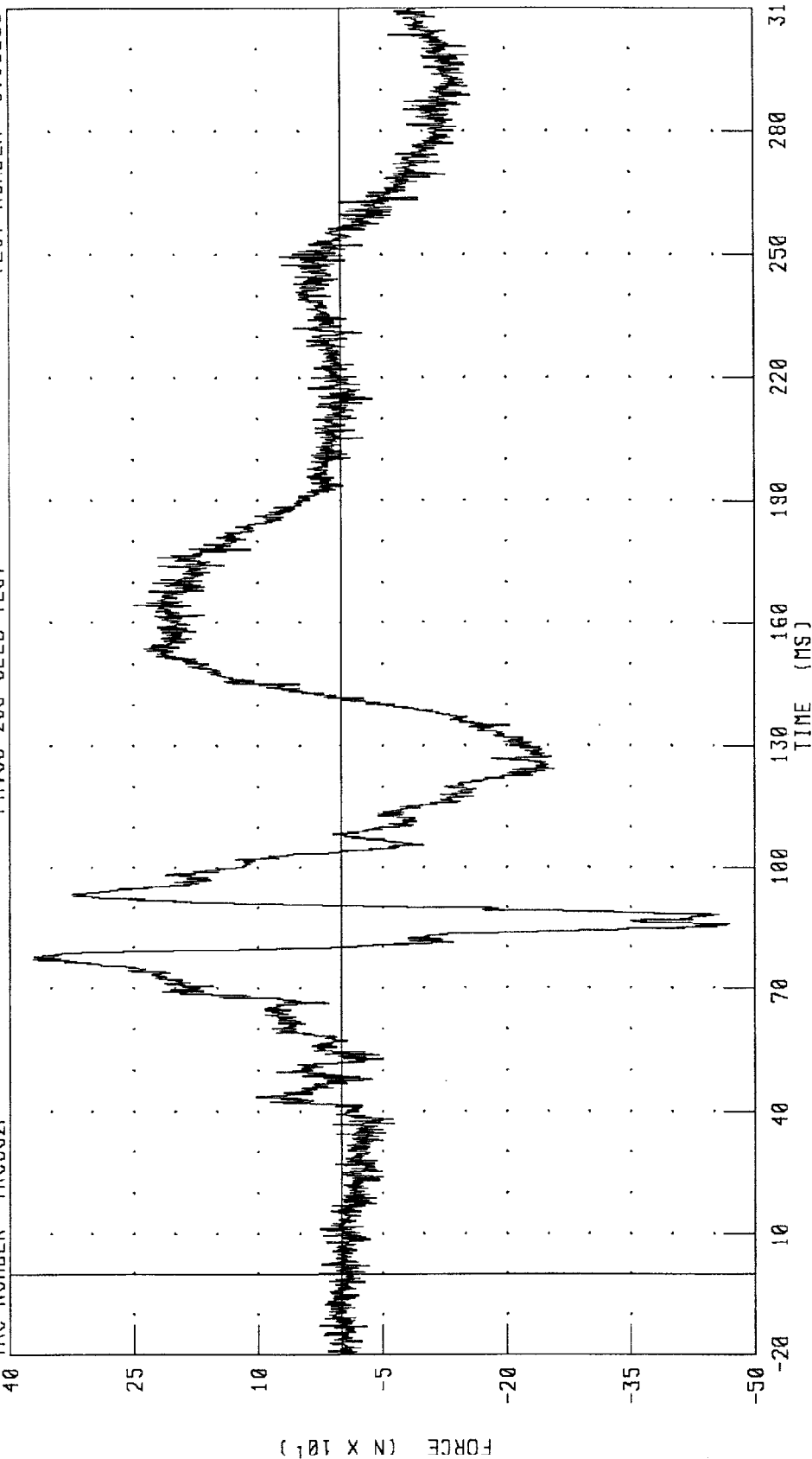
PEAK DATA: 209.43 N @ 123.36 MS; -52.10 N @ 220.32 MS

CHANNEL: NEKYF2 FILTER: CH. CLASS 1000

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER NECK Z-AXIS AXIAL FORCE
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



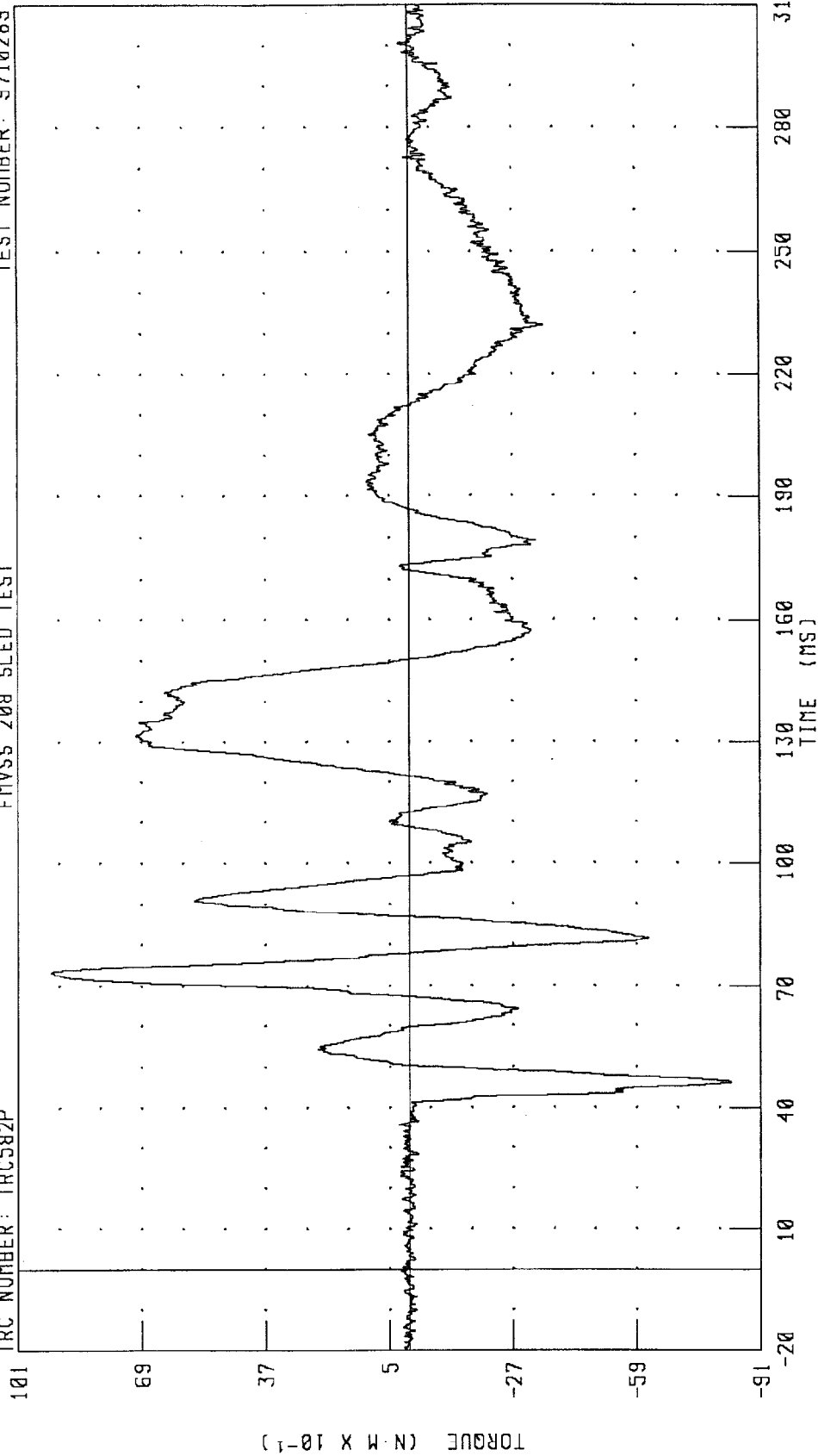
CHANNEL: NEKZF2 FILTER: CH. CLASS 1000

PEAK DATA: 371.43 N @ 77.12 MS; -469.05 N @ 85.68 MS

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER NECK MOMENT ABOUT X AXIS
 FMVSS 208 SLED TEST

TEST NUMBER: S71028S

TRC NUMBER: TRC582P



CHANNEL: NEKXN2 FILTER: CH. CLASS 600

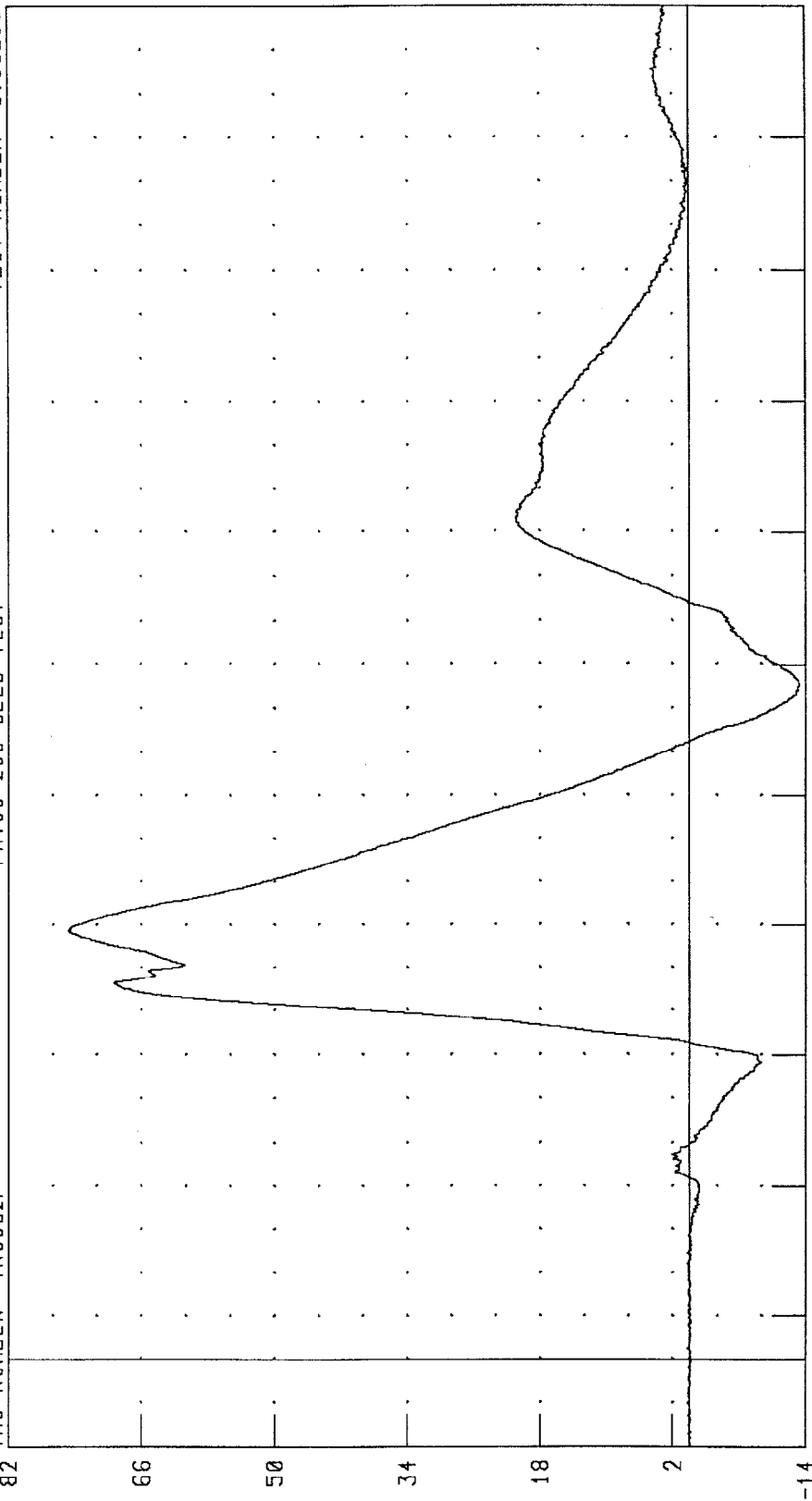
PEAK DATA: 9.24 N·m @ 73.52 MS; -8.33 N·m @ 46.32 MS

CW0109 / 1998 CHEVROLET LUMINA
RIGHT FRONT PASSENGER NECK MOMENT ABOUT Y AXIS
FMVSS 208 SLED TEST

TRC NUMBER: TRC582P

TEST NUMBER: 971028S

82



TORQUE (N·M)

TIME (MS)

CHANNEL: NEKYM2 FILTER: CH. CLASS 600

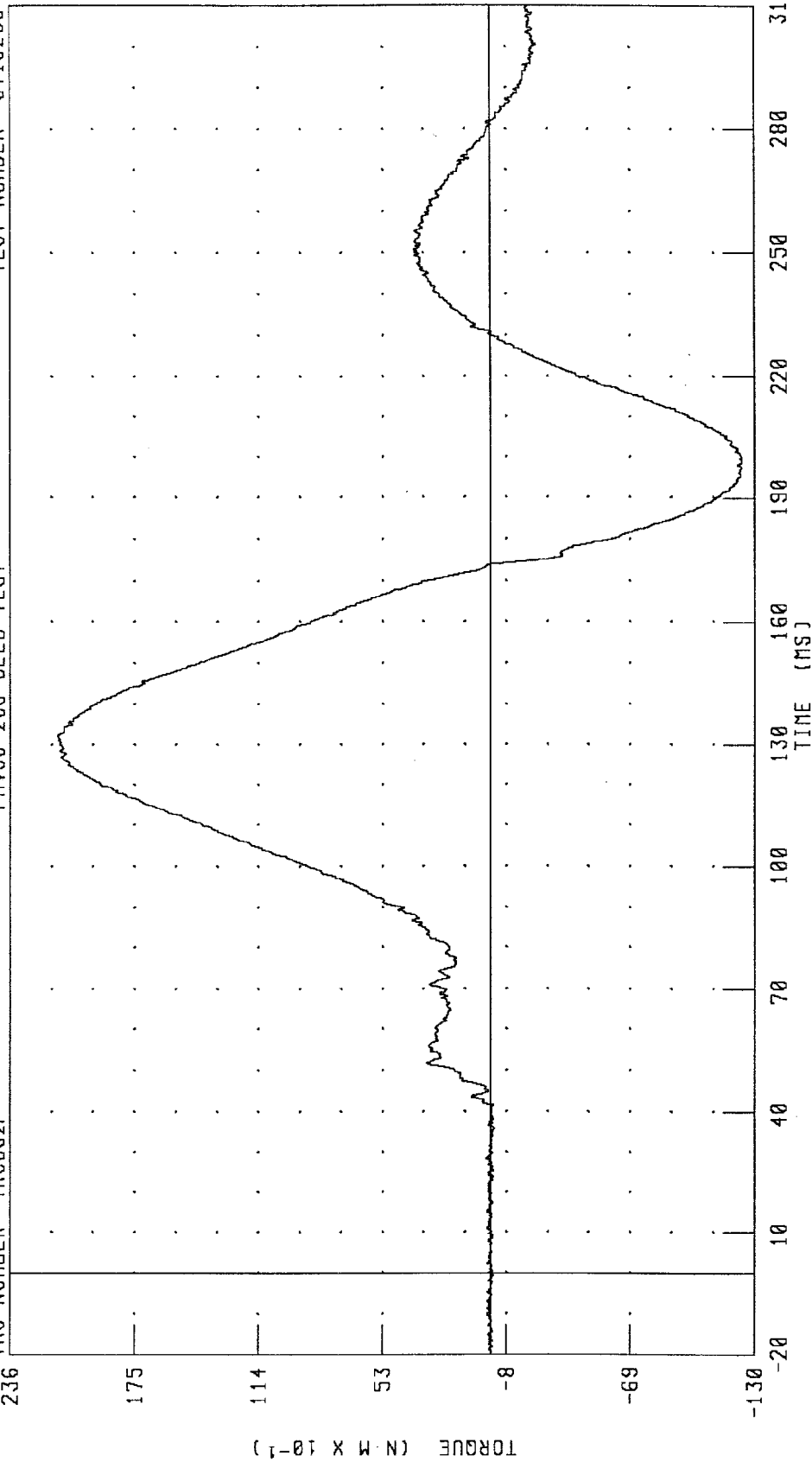
PEAK DATA: 74.74 N·M @ 98.56 MS; -13.26 N·M @ 155.36 MS

CW0109 / 1998 CHEVROLET LUMINA
RIGHT FRONT PASSENGER NECK MOMENT ABOUT Z AXIS

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST

TEST NUMBER: 9710285



CHANNEL: NEKZM2 FILTER: CH. CLASS 600

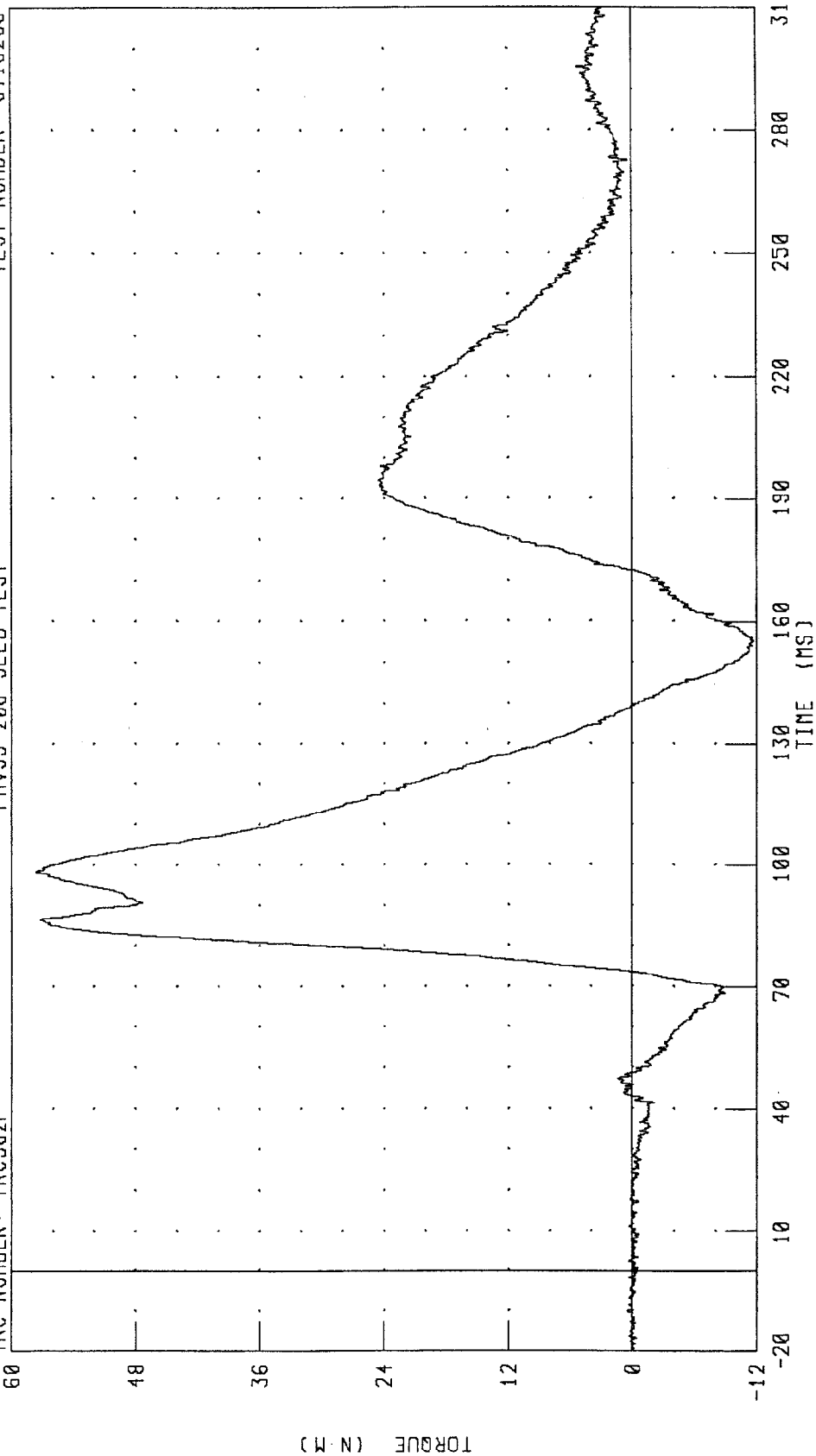
PEAK DATA: 21.26 N·m @ 132.16 ms; -12.38 N·m @ 199.20 ms

CW0109 / 1998 CHEVROLET LUMINA
RIGHT FRONT PASSENGER NECK OCCIPITAL CONDYLE ABOUT Y AXIS

TRC NUMBER: TRC582P

FMVSS 208 SLED TEST

TEST NUMBER: 971028S



CHANNEL: NEKOM2 FILTER: CH. CLASS 600

PEAK DATA: 57.61 N·M @ 98.32 MS; -11.69 N·M @ 155.36 MS

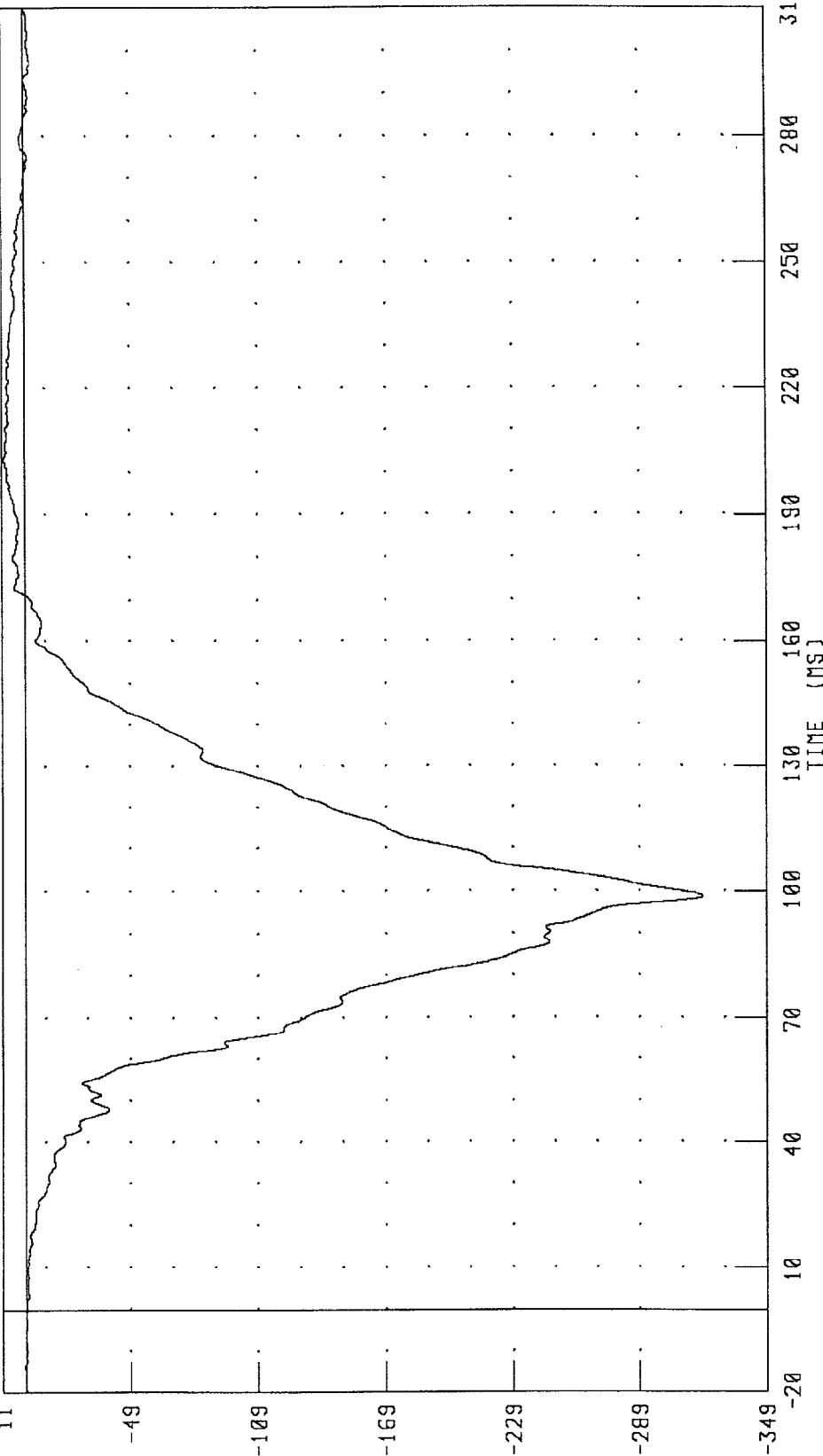
CW0109 / 1988 CHEVROLET LUMINA
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION
FMVSS 208 SLED TEST

TEST NUMBER: 9710285

TRC NUMBER: TRC582P

11

ACCELERATION (G X 10⁻¹)



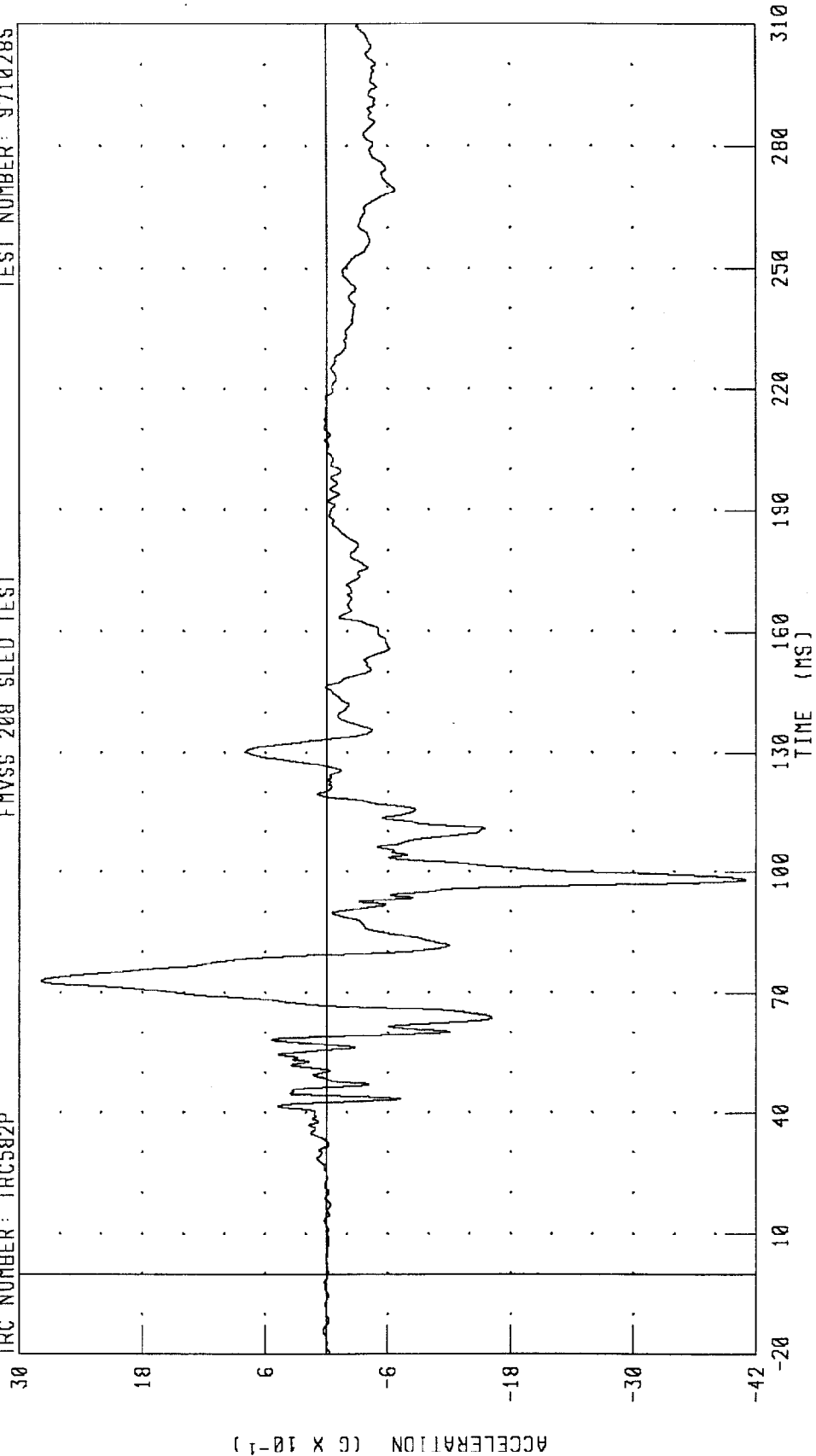
CHANNEL: CSTXC2 FILTER: CH. CLASS 180

PEAK DATA: 1.03 G @ 202.96 MS; -31.88 G @ 98.72 MS

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



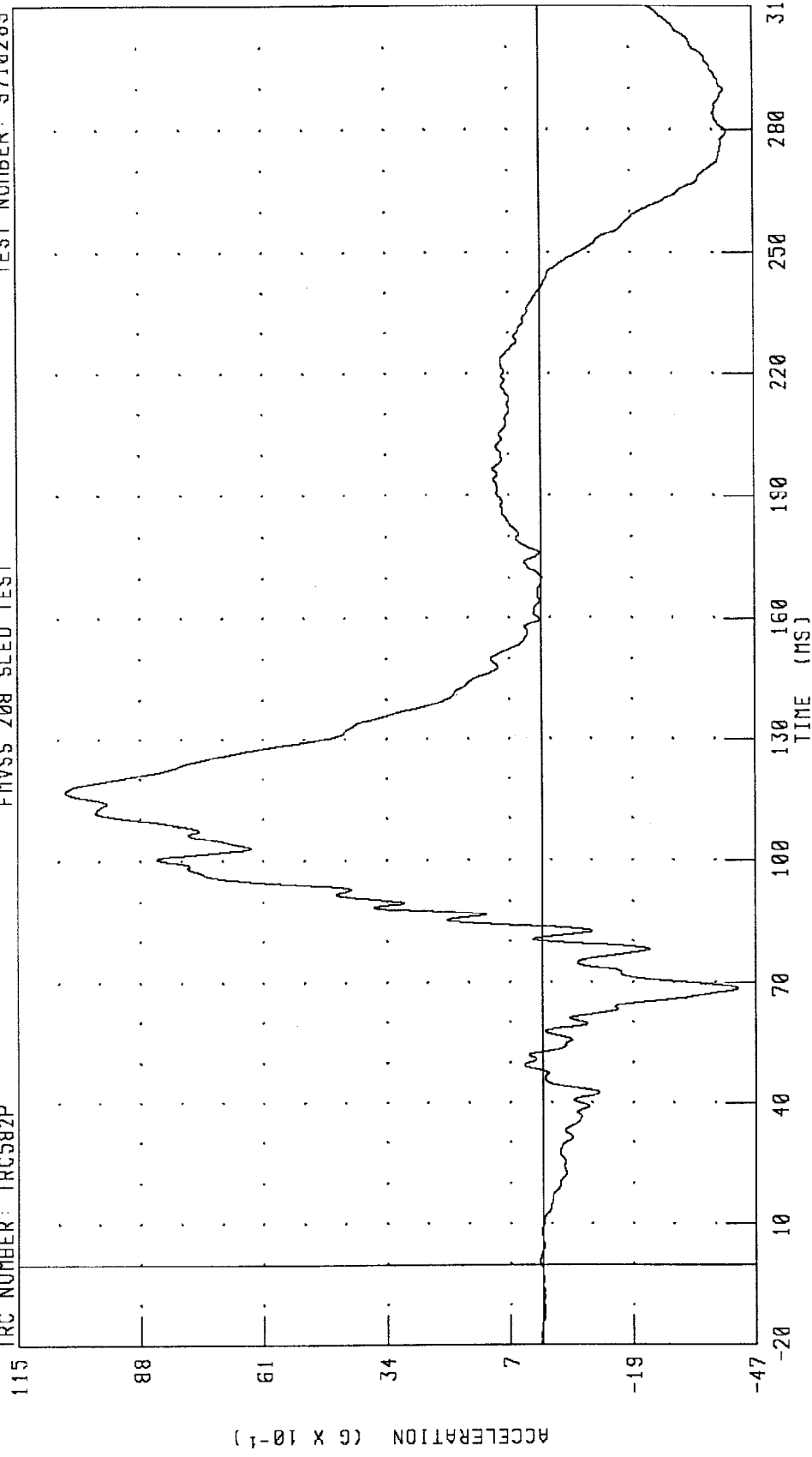
CHANNEL: CSTYG2 FILTER: CH. CLASS 180

PEAK DATA: 2.79 G @ 73.04 MS; -4.10 G @ 98.08 MS

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



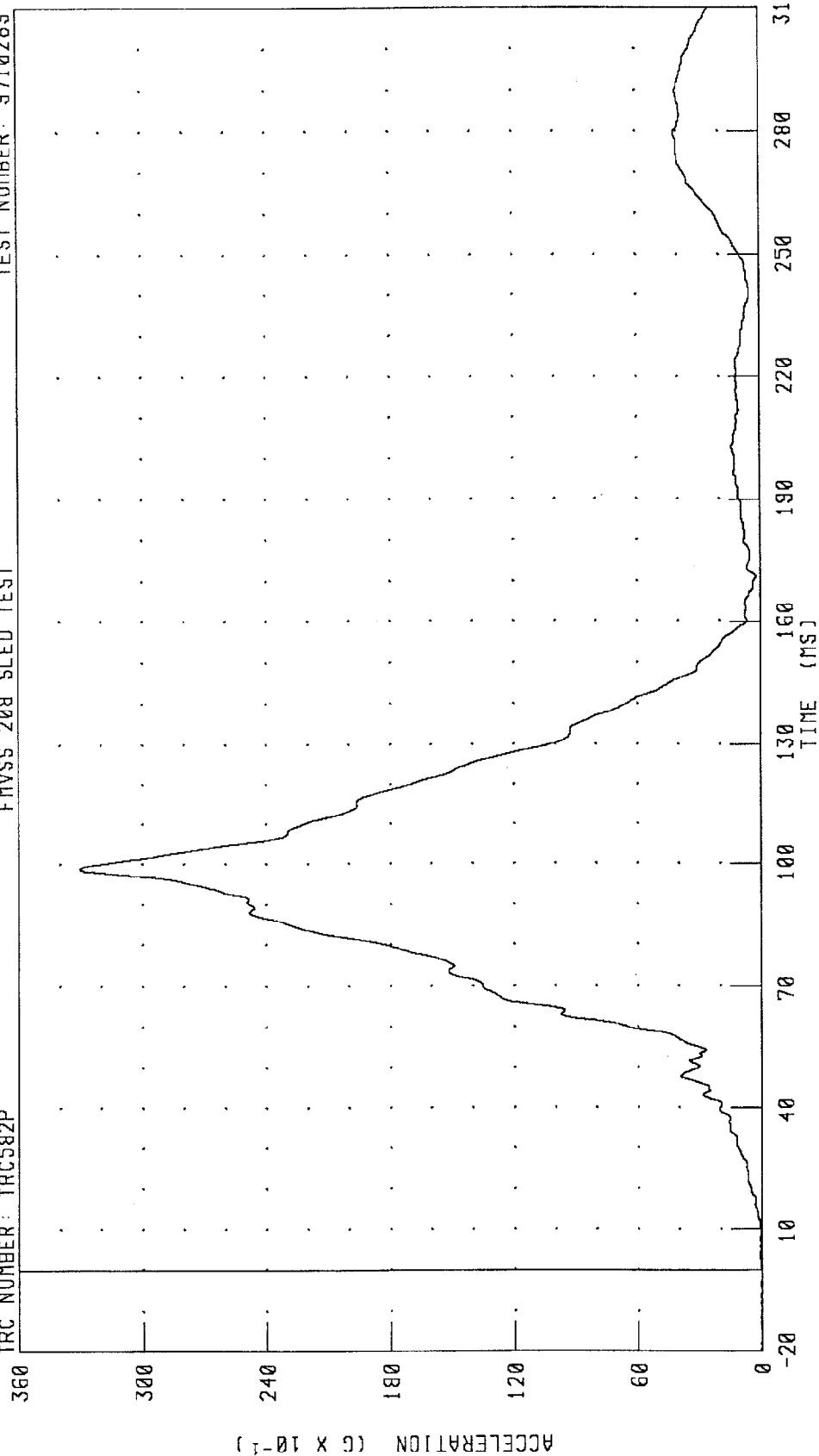
PEAK DATA: 10.44 G @ 116.96 MS, -4.30 G @ 68.56 MS

CHANNEL: CSTZG2 FILTER: CH. CLASS 180

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P



PEAK DATA: 33.02 G @ 98.72 MS; 0.01 G @ -4.88 MS

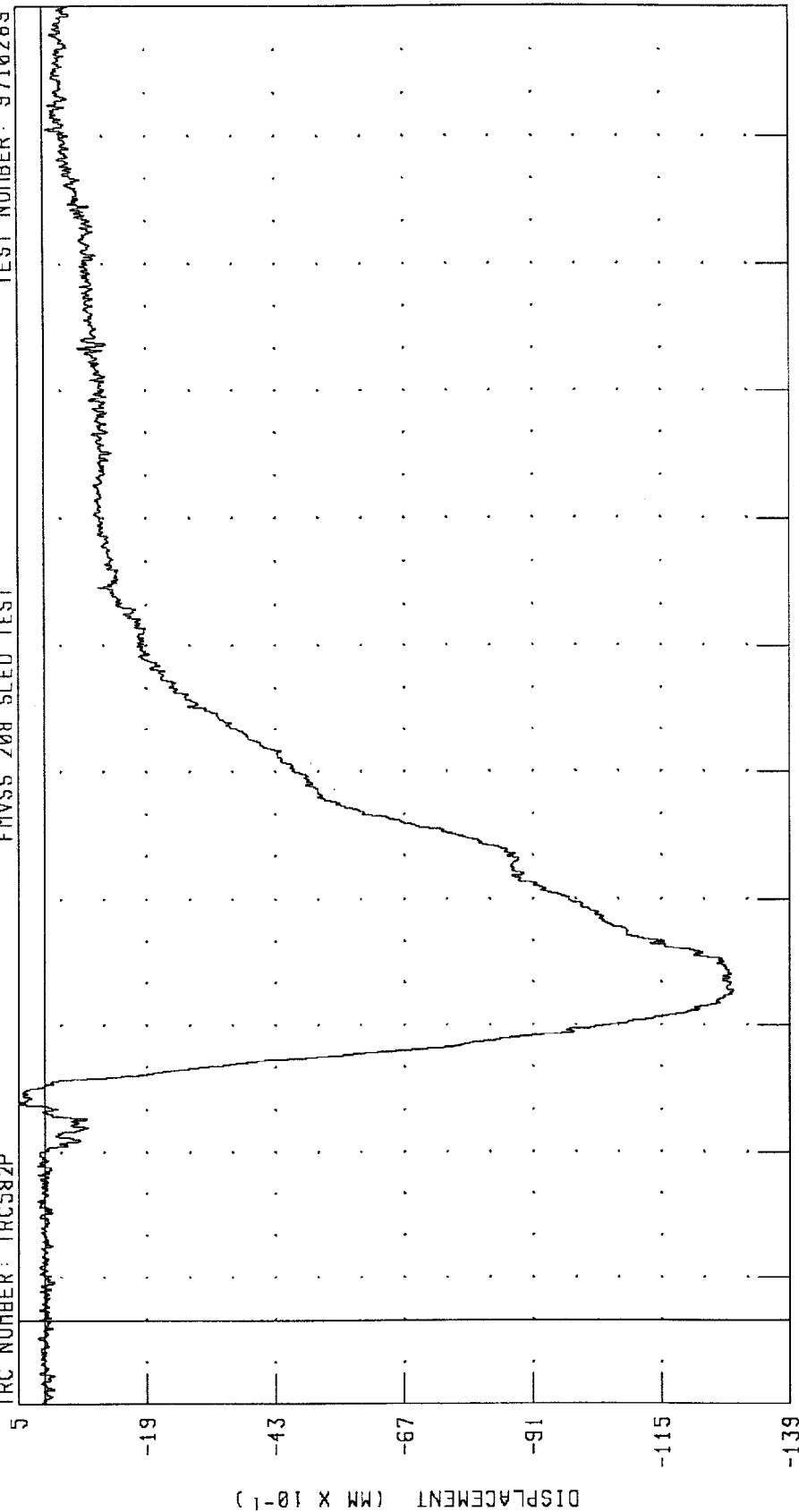
CHANNEL: CSTRG2 FILTER: CH. CLASS 180

CW0109 / 1998 CHEVROLET LUMINA
RIGHT FRONT PASSENGER CHEST DEFLECTION

TEST NUMBER: 971028S

FMVSS 208 SLED TEST

TRC NUMBER: TRC582P



PEAK DATA: 0.48 MM @ 51.76 MS, -12.86 MM @ 78.08 MS

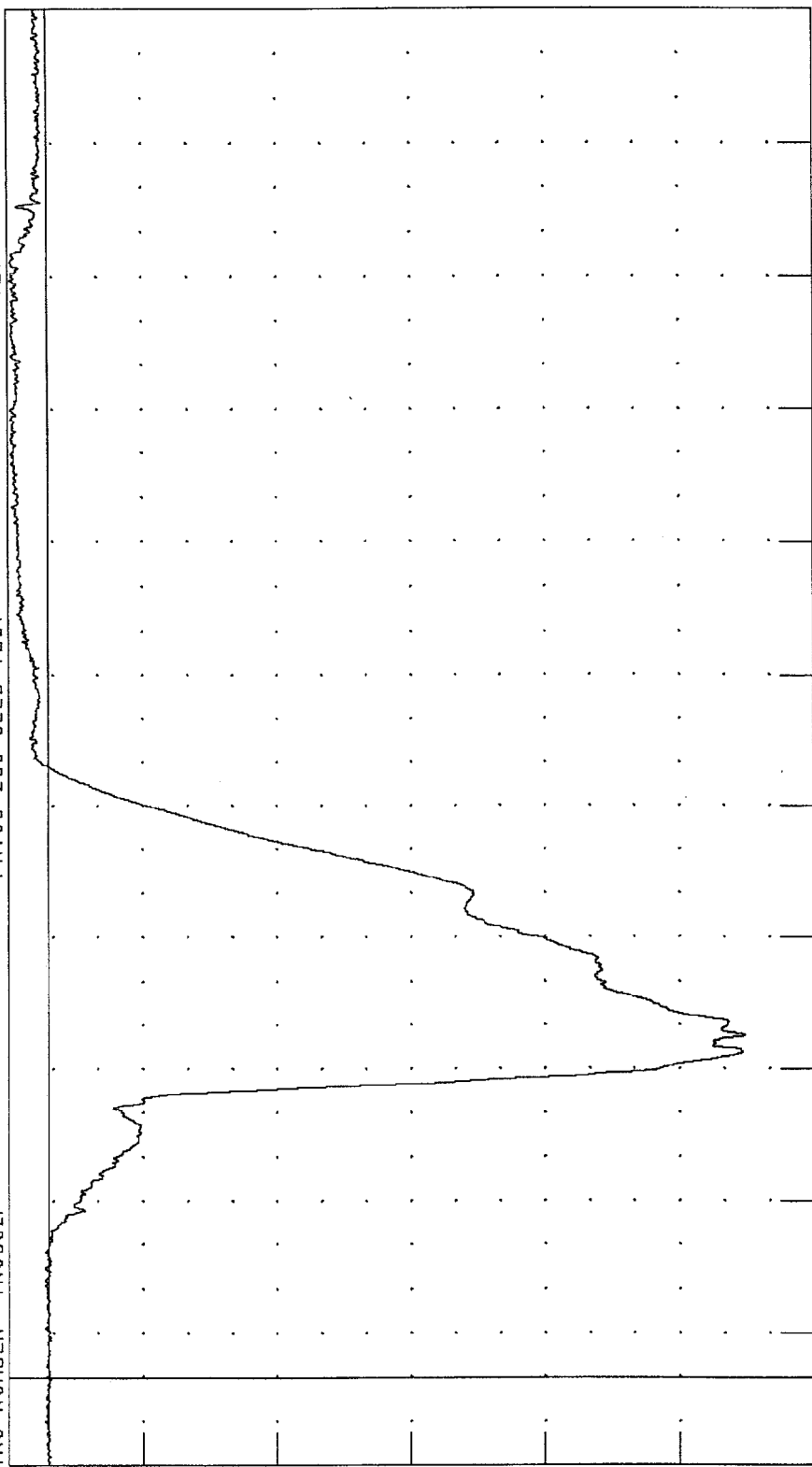
CHANNEL: CSTXD2 FILTER: CH. CLASS 600

CW0109 / 1998 CHEVROLET LUMINA
 RIGHT FRONT PASSENGER LEFT FEMUR FORCE
 FMVSS 208 SLED TEST

TEST NUMBER: 971028S

TRC NUMBER: TRC582P

28

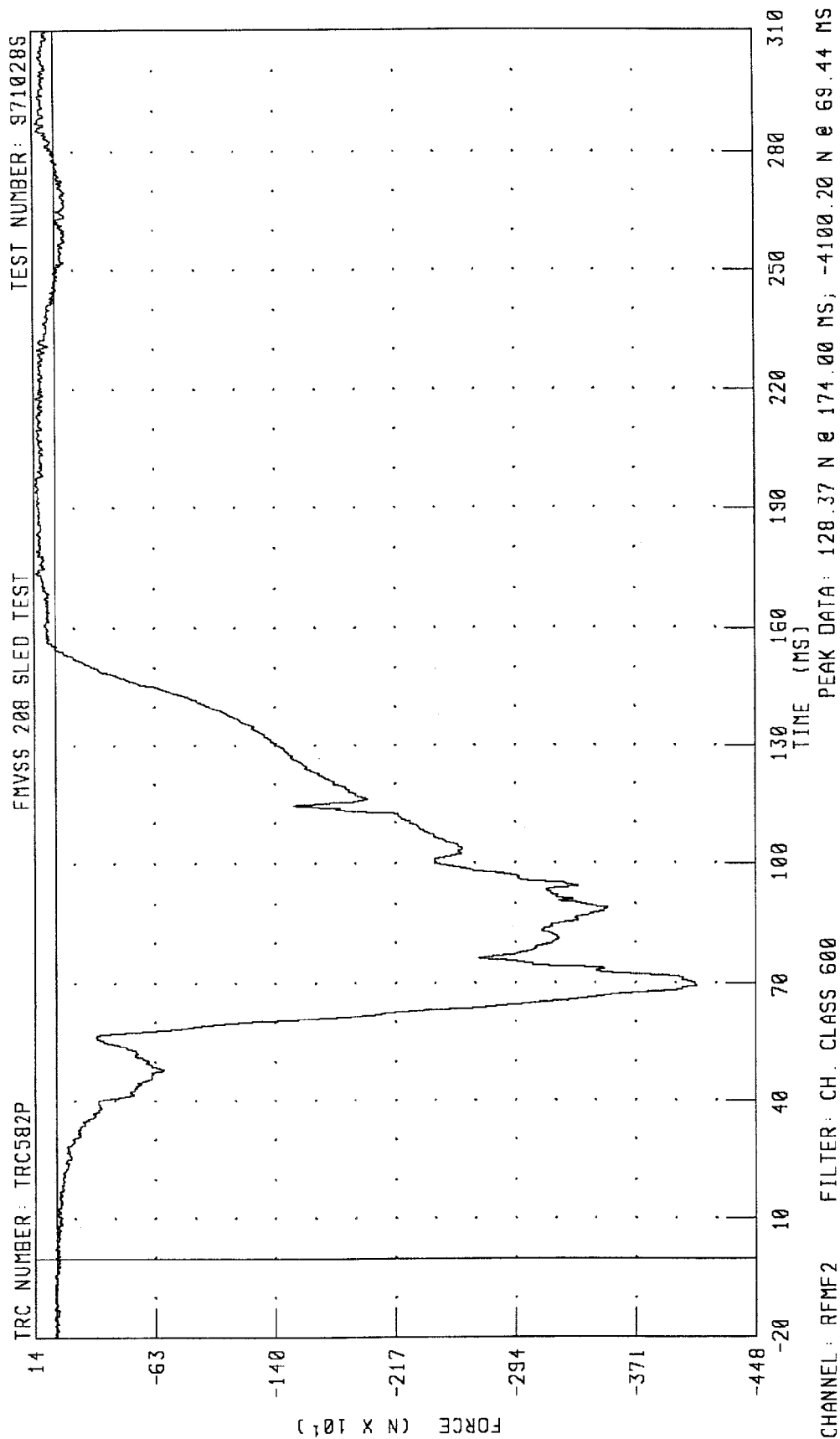


310
 280
 250
 220
 190
 160
 130
 TIME (MS)

CHANNEL: LFMF2 FILTER: CH. CLASS 600

PEAK DATA: 262.92 N @ 220.08 MS; -4933.17 N @ 77.68 MS

CW0109 / 1998 CHEVROLET LUMINA
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE



Appendix C

Manufacturer's Vehicle Information



North American Operations
Engineering Center

TRC
CW0109

September 18, 1997
USG 3359

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

Subject: Information Request NSA-31CCa/OA:208970811X

Dear Mr. Thompson:

This is in response to your letter received August 20, 1997, requesting information for proposed FMVSS 208 enforcement testing of the 1998 Chevrolet Lumina. Specifically, the letter requested certain information on the alternative requirements that the automatic restraint in this vehicle meets, if tension-relief devices were incorporated into the restraint system and certain test set-up information.

The specific OVSC questions and the General Motors Corporation responses are included in Enclosure 1.

We trust this information is responsive to your request. We welcome the opportunity to discuss any aspects of our response with you or members of your staff. If there are any questions, please do not hesitate to contact Mr. John E. Kromrei (810/947-1735) of my staff, or Mr. Richard F. Humphrey (202/775-5071) of GM's Washington Office.

Sincerely,

for C. Thomas Terry, Director
Safety Affairs & Regulations
Safety Center

cc: C. Case, NHTSA

OVSC QUESTIONS & GM RESPONSES
REGARDING FMVSS 208 INFORMATION REQUEST
1998 Chevrolet Lumina
NSA-31CCa / OA:208970811X

Item 1

Please inform OVSC if the air bag restraint system is certified to meet the requirements of S4.1.5.1(a)(1) or S13.

If the air bags were installed to meet the requirements of S4.1.5.1(a)(1), please provide a copy of the certification test reports for the frontal/angular barrier impact tests of the automatic restraint system with the manual safety belts unfastened and fastened.

If the air bags were installed to meet the requirements of S13, please provide a copy of the certification test reports for the frontal/angular barrier impact tests of the automatic restraint system with the manual safety belts fastened and the certification test reports for the sled test with only the automatic restraint system.

GM Response

The air bag restraint system provided at the driver's and passenger's seating positions in the subject vehicle is installed to meet S13. In addition, the air bag restraint system provided at the driver's and passenger's seating positions, along with the manual 3-point safety belt, were installed to meet the requirements of paragraphs S4.1.5.1(a)(3) of FMVSS 208.

Since the subject vehicle's driver and passenger air bag restraint system are installed to meet the requirements of S13, no response is required.

Attachment A includes those portions of the frontal barrier test reports and sled tests pertinent to the requirements of FMVSS 208.

Item 2

If the air bags are or will be depowered or changed from the previous model year, explain the changes.

GM Response

The air bags for both the driver and right front passenger in the subject vehicle were reduced in force by reducing the inflator output in the 1998 model. The following describes the changes:

<u>1997 Driver Inflator</u>	<u>1998 Driver Inflator</u>	<u>1997 Pass. Inflator</u>	<u>1998 Pass. Inflator</u>
370 Kpa x 12 Kpa/ms *	300 Kpa x 10 Kpa/ms *	370 Kpa **	320 Kpa **

* Peak Pressure x Slope

** Peak Pressure

Item 3

If the air bag has been depowered or changed, explain how it can be determined, prior to purchase, that a particular vehicle has a depowered air bag.

GM Response

All 1998 models of the subject vehicle have depowered air bags. A 1998 model year vehicle can be verified by confirming that the 10th digit of the vehicle identification number (VIN) is the letter W.

Item 4

If the vehicle was certified with unrestrained dummies to meet the requirements of S13, describe how to disconnect the air bags from the vehicle sensors and connect them to the triggering mechanism used in the sled test. Describe the method used in certification to determine when to trigger the air bag and the system used to trigger the air bag.

GM Response

Sled tests used to meet the requirements of S13 were performed on a sled buck in which the air bags were never connected to vehicle sensors. Air bags for full scale tests can be electrically disconnected from the vehicle harness and a separate electrical harness can be attached directly to the air bags, specifically for test deployment. Attachment B includes a section from the subject vehicle's service manual, showing location, attachment, and proper disabling of the SIR system. [NOTE: This is only a section of the service manual and is not meant to include all steps and precautions used in providing full service of the SIR system.]

For GM's sled testing, the air bags are powered and activated by a remote system whether a full vehicle or a sled buck is used. This remote air bag control system is electronically wired to the air bag through a junction box. To deploy the air bags, the air bag control system provides the power through the interconnect of electronic wiring. The air bag control system is programmed to activate the air bag as follows:

The FMVSS 208 requirement states that the air bag "is to be activated at 20 ms $\pm$ 2 ms from the time that 0.5 g is measured on the dynamic test platform." GM's sled facility generates a time reference signal when the sled reaches 1.0 g. After reviewing the reference signal's time difference between 0.5 and 1.0 g in several sled tests, the average difference was determined to be 0.61 ms. Using this information, the remote air bag control system at GM's sled facility is programmed to trigger at 19 ms after the 1.0 g reference level to activate the air bag within the required timing stated above.

Item 5

State, for any safety belt system in this vehicle, whether or not it is equipped with a tension-relieving device. Provide a copy of the information furnished in accordance with S7.4.2, if the tension-relieving device is used.

GM Response

The safety belt systems used in the subject vehicles are not equipped with a tension-relieving device.

Item 6

FMVSS No. 208, S8.1.5 allows the manufacturer the option of having movable vehicle windows and vents placed in the closed position. State whether the vehicle's movable windows and vents were opened or closed for the certification tests.

GM Response

The windows and vents were open during zero degree frontal testing.

Item 7

Submit dummy placement measurements, including diagrams or photographs which show exactly where measurements were taken. Enclosed is a diagram of some of OVSC's dummy measurements. Where possible, use the dimension shown in the diagram to provide the individual dummy placement measurements.

State whether the vehicle has a foot rest for the driver.

GM Response

The available dummy placement information is included in Attachment C.

The subject vehicle does not incorporate a driver foot rest.

Item 8

Provide the seat positioning, steering column positioning, and fuel tank data on the enclosed form. If more than one front seating configuration, steering column, or fuel tank are available on this vehicle, provide separate information for each.

GM Response

Attachment D includes the requested information.

Item 9

If the vehicle is equipped with adjustable seat (belt) anchorages, provide the manufacturer's nominal design position for a 50th percentile adult male occupant.

GM Response

The subject vehicle is equipped with height-adjustable shoulder belt guides for the driver and right front passenger. The nominal design position for a 50th percentile male occupant is one (1) position down from full up.

Item 10

For barrier tests provide the speed at impact, vehicle test weight, and resulting injury criteria (i.e., HIC, chest acceleration, chest compression and femur loads) recorded for all certification tests conducted to meet the requirements of S4.1.5.1(a)(1). For sled tests, provide the resulting injury criteria (i.e., HIC, chest acceleration, chest compression, femur loads and neck moments and forces) recorded for all certification tests conducted to meet the requirements of S13.

GM Response

Attachment E includes a summary of the requested injury criteria information.

Item 11

When vehicle components must be removed to obtain the proper test weight for the barrier test, what components do you recommend for removal and in what priority order do you recommend removal?

GM Response

GM does not typically prioritize which components are to be removed from a test vehicle to accommodate test weight. However, components that have been removed during our testing include trunk interior trim, spare tire and jack, rear seats and rear carpeting. Additional components that may have been removed during specific tests include rear door trim, rear bumper fascia, rear bumper and the deck lid.

Item 12

If the vehicle uses a pressure vessel to inflate the air bag, provide a copy of the test reports or engineering analysis to demonstrate that it meets all the requirements of S9.1.

GM Response

The air bags installed in the subject vehicles do not incorporate a pressure vessel to inflate the system. No response is required.

Item 13

If the vehicle uses an explosive device to inflate the air bag, provide a copy of the test reports or engineering analysis to demonstrate that it meets all the requirements of S9.1.

GM Response

The air bags installed in the subject vehicles do not incorporate an explosive device to inflate the system. No response is required.

Attachment B

USG 3359

6 pages
(including this cover)

Repair Instructions

SIR Service Precautions

Caution: When you are performing service on or near the SIR components or the SIR wiring, you must disable the SIR system. Use the following procedure to temporarily disable the SIR system. Failure to follow the correct procedure could cause air bag deployment, personal injury, or unnecessary SIR system repairs.

The inflatable restraint Sensing and Diagnostic Module (SDM) maintains a reserve energy supply. The reserve energy supply provides deployment power for the air bags. Deployment power is available for as much as 10 minutes after disconnecting the vehicle power by any of the following methods:

- You turn OFF the ignition switch.
- You remove the fuse that provides power to the SDM.
- You disconnect the vehicle battery from the vehicle electrical system.

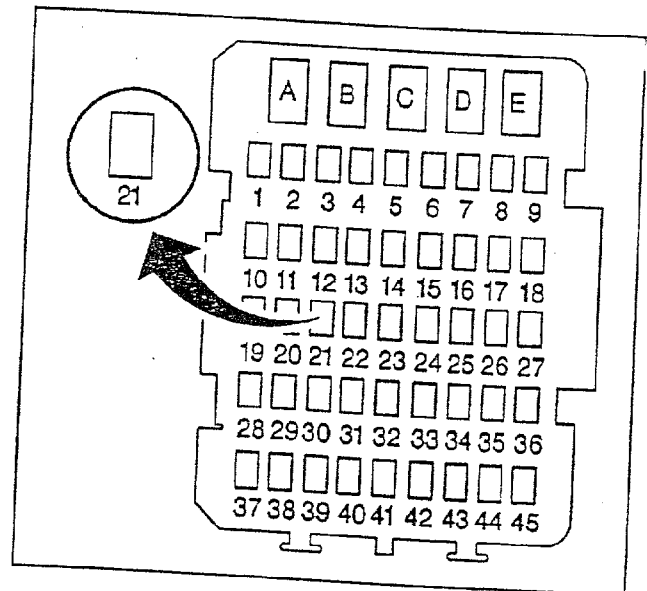
Performing the following procedure prevents deploying of the air bags from the reserve energy supply power.

Disabling the SIR System

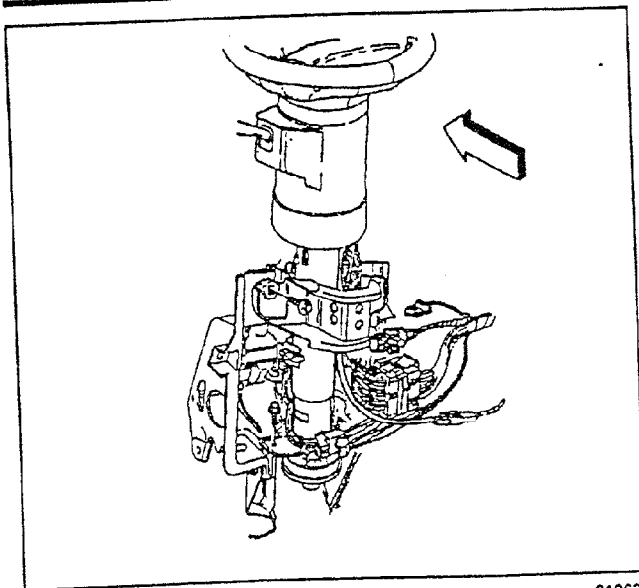
1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to the OFF position.
3. Remove the key from the ignition switch.
4. Remove the IP fuse block door. Refer to Fuse Block in Instrument Panel, Gages and Console.

Important: With Fuse 21 removed and the ignition switch in the RUN position, The AIR BAG warning lamp illuminates. This is normal operation, and does not indicate an SIR system malfunction.

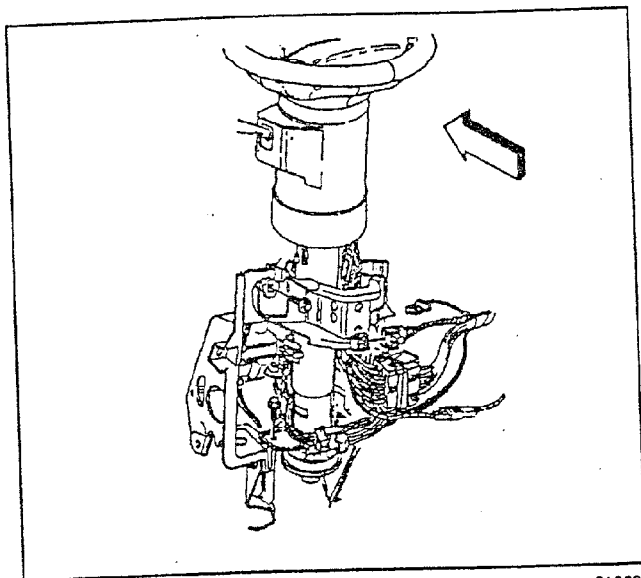
5. Remove Fuse 21 from the IP fuse block.



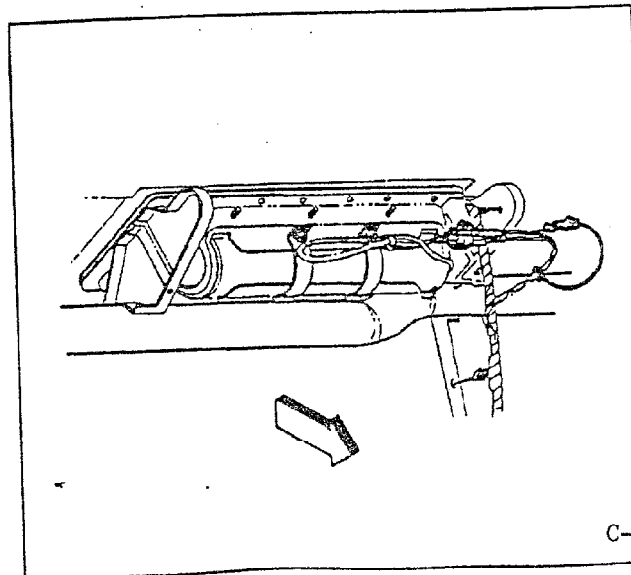
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C-10

6. Remove the sound insulator-LH. Refer to Instrument Panel Sound Insulators in Instrument Panel, Gages and Console.

7. Remove the Connector Position Assurance (CPA) from the driver yellow 2-way connector located at the base of the steering column.

8. Disconnect the driver yellow 2-way connector located at the base of the steering column.

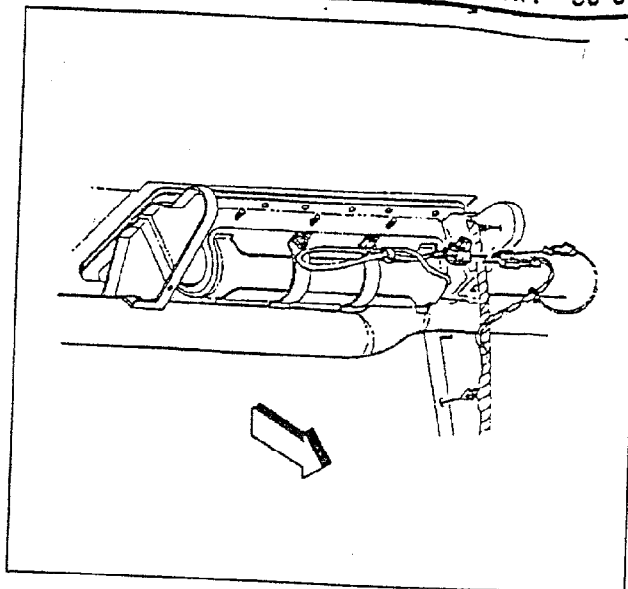
9. Remove the sound insulator-RH. Refer to Instrument Panel Sound Insulators in Instrument Panel, Gages and Console.

10. Remove the Connector Position Assurance (CPA) from the passenger yellow 2-way connector located behind the IP compartment door.

Restraints

SIR 9J-87

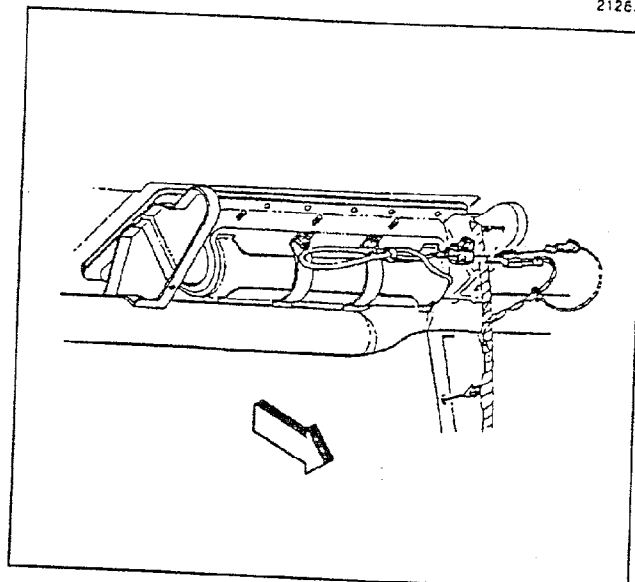
11. Disconnect the passenger yellow 2-way connector located behind the IP compartment door.



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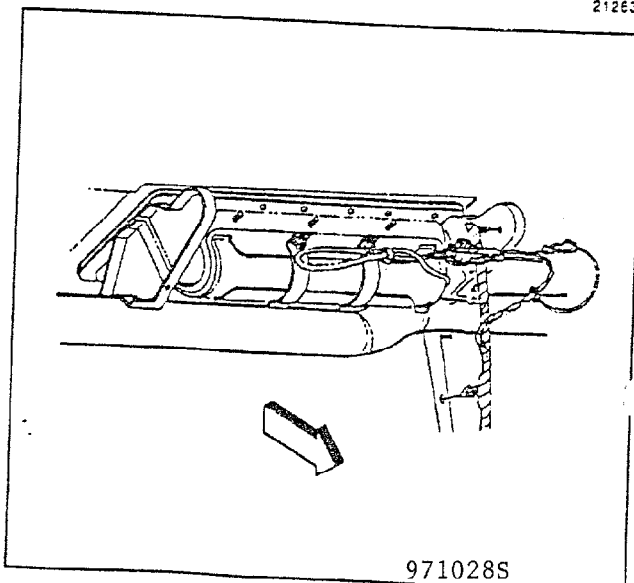
Enabling the SIR System

1. Remove the key from the ignition switch.
2. Connect the passenger yellow 2-way connector located behind the IP compartment door.



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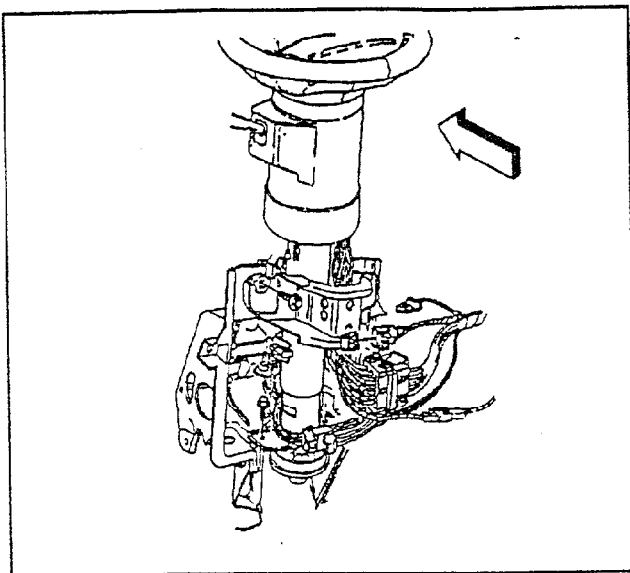
3. Install the Connector Position Assurance (CPA) to the passenger yellow 2-way connector located behind the IP compartment door.



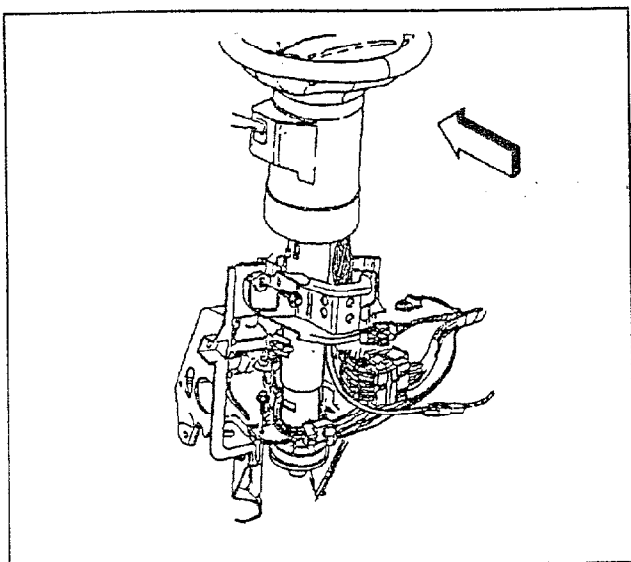
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C-11

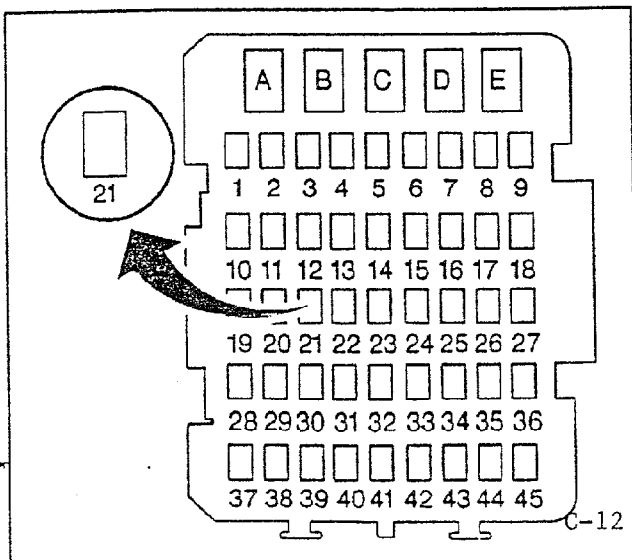
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C-12

4. Connect the driver yellow 2-way connector located at the base of the steering column.

5. Install the Connector Position Assurance (CPA) to the driver yellow 2-way connector located at the base of the steering column.

6. Install the sound insulator-RH. Refer to Instrument Panel Sound Insulators in Instrument Panel, Gages and Console.

7. Install the sound insulator-LH. Refer to Instrument Panel Sound Insulators in Instrument Panel, Gages and Console.

8. Install Fuse 21 to the IP fuse block.

9. Install the IP fuse block door. Refer to Fuse Block in Instrument Panel, Gages and Console.

10. Staying well away from both air bags, turn the ignition switch to the RUN position.

10.1. The AIR BAG warning lamp will flash seven times.

10.2. The AIR BAG warning lamp will then turn OFF.

11. Perform the SIR Diagnostic System Check if the AIR BAG warning lamp does not operate as described.

General Service Instructions

- Do not expose the inflator modules to temperatures above 65°C (150°F).
- Verify the correct replacement part number. Do not substitute a component from a different vehicle.
- Do not repair any of the following components. Service these components by replacement only.
 - The inflatable restraint Sensing and Diagnostic Module (SDM).
 - The inflatable restraint IP (inflator) module.
 - The inflatable restraint steering wheel (inflator) module.
 - The inflatable restraint steering wheel module coil.
- Use only new or remanufactured parts from an authorized original equipment manufacturer dealer. Do not use salvaged parts for repairs to the SIR system.
- Discard any of the following components if it has been dropped from a height of 91 centimeters (3 feet) or greater. Do not install the component in a vehicle.
 - The inflatable restraint Sensing and Diagnostic Module (SDM).
 - The inflatable restraint IP (inflator) module.
 - The inflatable restraint steering wheel (inflator) module.
 - The inflatable restraint steering wheel module coil.
- When you replace the SDM, verify that the following conditions are met:
 - The mounting surface is clean.
 - The arrow on the module points toward the front of the vehicle.
 - The module is flat on the mounting surface, parallel to the vehicle datum line.
 - The module fasteners are installed and tightened as specified.
- In order to avoid setting false diagnostic trouble codes, only apply power to the SIR system when one of the following two conditions is met:
 - All SIR system components are properly mounted and electrically connected.
 - A diagnostic procedure directs you to apply power.
- Begin diagnosis of malfunctions with the SIR Diagnostic System Check. Perform the SIR Diagnostic System Check in order to verify the following:
 - The proper operation of the AIR BAG warning lamp.
 - Communication with the SDM through the serial data line.
 - The presence or absence of diagnostic trouble codes.
 - Whether additional diagnosis is required and where the information resides.
- Not beginning with the SIR Diagnostic System Check could cause the following:
 - Extended diagnostic time.
 - Incorrect diagnosis.
 - Unneeded parts replacement.

SEAT POSITIONING

Set seat at mid-point. The rearmost adjusted position is the same for both manual and power seat adjusters.

Manual Adjuster: Set at notch # 12 from the forwardmost position of the seat adjuster (forwardmost notch counted as # 1). The total available fore-aft travel of the seats on models equipped with manual adjusters is 220 mm. There are a total of 23 positions at 10 mm intervals.

Power Adjuster: Measure total available seat travel and mark mid-point. The total available fore-aft travel on models equipped with power adjusters is 200 mm.

SEAT BACK ANGLE MEASUREMENT

An inclinometer should be placed on the rearward surface of the outboard seat-back frame.

Starting approximately 2-3 inches above the seat back pivot point near the outboard edge, press against the seat back rear surface to feel for the hard structure (i.e.: steel frame). Move fingers upward to locate the frame member. Make certain that there is enough flat surface to place the base of the inclinometer which is being utilized.

Cut the trim fabric vertically along a line slightly inward of the steel member. Pull open and remove material over the frame member. Make certain that the frame surface is flat and clear of any foam material. Place the inclinometer firmly on the frame through the fabric opening and adjust the seat back until an angle of 26 degrees is indicated.

FUEL TANK CAPACITY:

Usable fuel capacity of the 1998 Chevy W cars is 16.6 gals (62.8 L). The unusable capacity is 0.3 gals (1.1L). There are no optional equipment fuel tanks. For FMVSS 301 testing, the unusable capacity of stoddard solvent fuel is first established inside the tank. Then 95% of the usable capacity is added. The fuel system in C-11360 was filled in this manner.

Attachment E

USG 3359

2 pages
(including this cover)

TEST VEHICLE INFORMATION

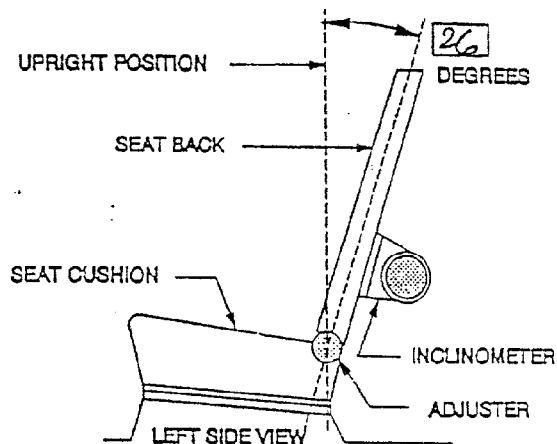
Vehicle Model Year & Make: 1998 CHEVROLET
 Vehicle Model & Body Style: LUMINA (4DR) MONTE CARLO (2DR)

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 = 26 degrees.
 Measurement Instructions:

SEE ATTACHED SHEET



Seat back angle for passenger's seat = 26 degrees.
 Measurement Instructions:

SAME AS DRIVER

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 ATTACHED SHEET

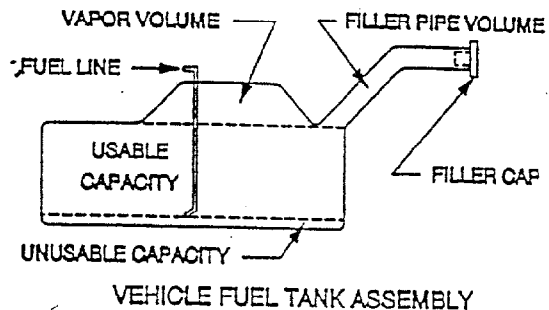
Positioning of the passenger's seat (if applicable):

SAME AS DRIVER

Rev. 7/11/94

3. FUEL TANK CAPACITY DATA - -

- 3.1 A. "Usable Capacity" of standard equipment fuel tank = 16.6 gallons.
- B. "Usable Capacity" of optional equipment fuel tank = N/A gallons.
- C. "Usable Capacity" of vehicle(s) used for certification testing to requirements of FMVSS 301 = 16.6 gallons.



Operational Instructions:

- 3.2 Amount of Stoddard solvent added to vehicle(s) used for certification test(s) = 15.8 gallons
- 3.3 Is vehicle equipped with electric fuel pump? ☒ YES ☐ NO
If YES, explain the vehicle operating conditions under which the fuel pump will pump fuel.

See attached sheet

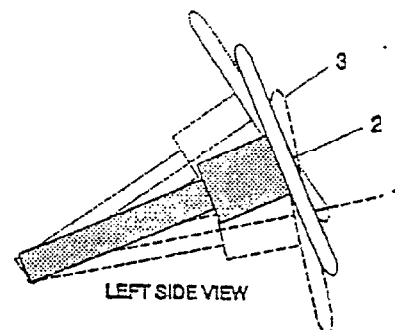
4. STEERING COLUMN ADJUSTMENTS - -

Steering wheel and column adjustments are made so that the steering wheel hub is at the geometric center of the locus it describes when it is moved through its full range of driving positions. If the tested vehicle has any of these adjustments, does your company use any specific procedures to determine the geometric center.

Operational Instructions:

FMVSS TESTING

SEE ATTACHED SHEET



STEERING COLUMN ASSEMBLY