

V3113

**1999 Saturn SL1
into a Flat Frontal Barrier
TRC Test Number: 990614-1**

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Section 1.0

Purpose and Test Procedure

Purpose and Test Summary

This 30 mph flat frontal barrier impact test has as the main objective to investigate both vehicle and occupant dynamics during a flat frontal barrier test. A secondary objective is to gather information on depowered airbags.

This test was conducted with a 1999 Saturn SL1 that impacted a flat frontal barrier. The test vehicle contained two instrumented Hybrid III 5th percentile adult female dummies.

Section 2.0

Flat Frontal Barrier Impact Test Summary

Test Procedure

This test was conducted per VRTC personnel's instructions. Data was obtained relative to FMVSS 208, "Occupant Crash Protection," performance.

The test vehicle was instrumented with eight (8) accelerometers to measure longitudinal, lateral, and vertical axis accelerations and two (2) inductive pickup switches to measure the driver and passenger airbag fire times. The vehicle's specified impact velocity range was 47.5 to 49.1 kph. The vehicle impacted a flat frontal barrier.

The test vehicle contained two (2) Hybrid III 5th percentile adult female anthropomorphic test devices (dummies). The dummies were positioned in the front outboard designated seating positions according to the FMVSS 208 laboratory seating procedure.

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 forces and moments.

The forty (40) data channels were digitally sampled at 12,500 samples per second and processed per Sections 11.13 through 11.15 of the Laboratory Test Procedure.

One (1) real-time panning motion picture camera and fourteen (14) high-speed motion picture cameras recorded the crash event. 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 miscellaneous test information.

Test Results Summary

This flat frontal barrier test was conducted at TRC on June 14, 1999.

The test vehicle, a 1999 Saturn SL1, was equipped with airbags at the driver's and right front passenger's seating positions. The vehicle's test weight was 1181.2 kilograms. The vehicle's impact speed was 48.3 kph. The vehicle's maximum static crush was 443 millimeters.

The driver's 15-millisecond HIC was 106 and its 36-millisecond HIC was 212. The driver's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 37.1 g. The driver's chest deflection was 31.1 millimeters. The driver's left and right femur maximum compressive forces were 3566 N and 2445 N, respectively.

The right front passenger's 15-millisecond HIC was 277 and its 36-millisecond HIC was 396. The right front passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 44.7 g. The passenger's chest deflection was 15.2 millimeters. The right front passenger's left and right femur maximum compressive forces were 3072 N and 3259 N, respectively.

Data Acquisition Explanations

The driver neck moment about the X-axis, channel NEKXM1, recorded data spikes between approximately 25 and 100 milliseconds.

Table 1 Crash Test Summary

Test type:	Flat frontal barrier impact
Test date:	June 14, 1999
Test time:	1339
Ambient temperature at impact area:	22° C
Vehicle year/make/ model/body style:	1999/Saturn/SLI/Sedan
Vehicle test weight:	1181.2 kg
Impact angle ¹ :	0°
Impact velocity ² :	
Primary:	48.3 kph
Secondary:	48.3 kph
Maximum static crush:	443 mm
Average rebound:	1561 mm
Number of cameras:	
Real-time:	1
High-speed:	14
Door opening data:	
Left-front:	Easy
Right-front:	Easy

¹ With respect to tow track centerline.

² Speed trap measurement ($\pm .08$ km/h accuracy)

Table 1 Crash Test Summary, Cont'd.

Dummies:	<u>Driver #289</u>	<u>Passenger #369</u>
Type:	Hybrid III 5 th percentile adult female	Hybrid III 5 th percentile adult female
Location:	Left front	Right front
Restraint:	Airbag	Airbag
Number of data channels:	15	15
Front seat data:		
Seat track failure:	None	None
Seat back failure:	None	None
Visible dummy contact points:		
Head:	Airbag, Headrest	Airbag, Headrest
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: 1999/Saturn/SL1/Sedan

Color: Silver

VIN: 1G8ZG5283XZ308492

Engine data:

Placement: Transverse

Cylinders: 4

Displacement: 1.9 liters

Transmission data: 5 speed, X manual, ___ automatic, ___ overdrive

Final drive: X fwd, ___ rwd, ___ 4wd

Date vehicle received: N/A

Odometer reading: N/A

Dealer's name and address: Saturn North
8645 North High Street
Worthington, OH 43085

Accessories:

Power steering	Yes	Automatic transmission	No
Power brakes	Yes	Automatic speed control	No
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: Saturn Corp.

Date of manufacture: 03/99

VIN: 1G8ZG5283XZ308492

GVWR: 3251 lb.

GAWR: Front: 1647 lb.

Rear: 1604 lb.

Table 2 Test Vehicle Information, Cont'd.

Size of tires on vehicle:	P175/70R14
Spare tire:	Space saver
Type of front seats:	Bucket

Tire & capacity data from vehicle's label:

Recommended tire size:	P175/70R14
------------------------	------------

Recommended cold tire pressure:

Front:	30 psi
--------	--------

Rear:	26 psi
-------	--------

Designated Seating Capacity:

Front	2
-------	---

Rear	3
------	---

Total	5
-------	---

Vehicle Cargo Weight:	849 lb.
-----------------------	---------

Test vehicle attitudes:

Delivered attitude:	LF: 668 mm	RF: 668 mm	LR: 678 mm	RR: 679 mm
Fully loaded attitude:	LF: 660 mm	RF: 657 mm	LR: 656 mm	RR: 653 mm
Pre-test attitude:	LF: 657 mm	RF: 650 mm	LR: 644 mm	RR: 644 mm
Post-test attitude:	LF: 655 mm	RF: 730 mm	LR: 644 mm	RR: 646 mm

Table 2 Test Vehicle Information, Cont'd.

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

Right front	318.0 kg	Right rear	209.6 kg
Left front	320.2 kg	Left rear	200.5 kg
Total front weight	638.2 kg	(60.9% of total vehicle weight)	
Total rear weight	410.1 kg	(39.1% of total vehicle weight)	
Total delivered weight	1048.3 kg		

Calculation of test vehicle's target test weight:

RCLW = Rated Cargo and Luggage Weight

UDW = Unloaded Delivered Weight (1048.3 kg)

DSC¹ = Designated Seating Capacity (5)

RCLW² = 44.9 kg

Target test weight = UDW + RCLW + (number of Hybrid III Dummies x 47.6 kg per dummy)

Target test weight = 1048.3 + 44.9 + 95.2 = 1188.4 kg

Weight of test vehicle with required dummies:

Right front	331.1 kg	Right rear	255.4 kg
Left front	346.6 kg	Left rear	248.1 kg
Total front weight	677.7 kg	(57.4% of total vehicle weight)	
Total rear weight	503.5 kg	(42.6% of total vehicle weight)	
Total test weight	1181.2 kg	(0.61% under target test weight)	

Weight of ballast secured in vehicle: N/A

Components removed to meet target test weight: Rear fascia, Bumper, Exhaust muffler,

Taillights, Rear seat, Rear door panels, Rear shelf liner, Rear speakers, Rear seat belt assembly, C-pillar trim, Spare tire, Jack, Third brake light, Rear door glass, Rear window crank assembly, Rear door seals

CG rearward of front wheel centerline: 1108 mm

Vehicle Wheelbase: 2600 mm

¹ The designated seating capacity is determined by counting the number of seat belts installed in the vehicle.

² From vehicle's tire label.

Table 3 Post-Impact Data

Test number:	990614-1
Test date:	June 14, 1999
Test time:	1339
Test type:	Flat frontal barrier impact
Impact angle:	0°
Ambient temperature at impact area:	22° C
Temperature in occupant compartment:	21° C
Impact velocity:	
Primary:	48.3 kph
Secondary	48.3 kph
Specified range:	47.5 to 49.1 kph

Distance from vehicle to barrier:

Entering velocity trap:	356 mm
Exiting velocity trap:	51 mm

Test vehicle static crush:

Overall length of test vehicle:

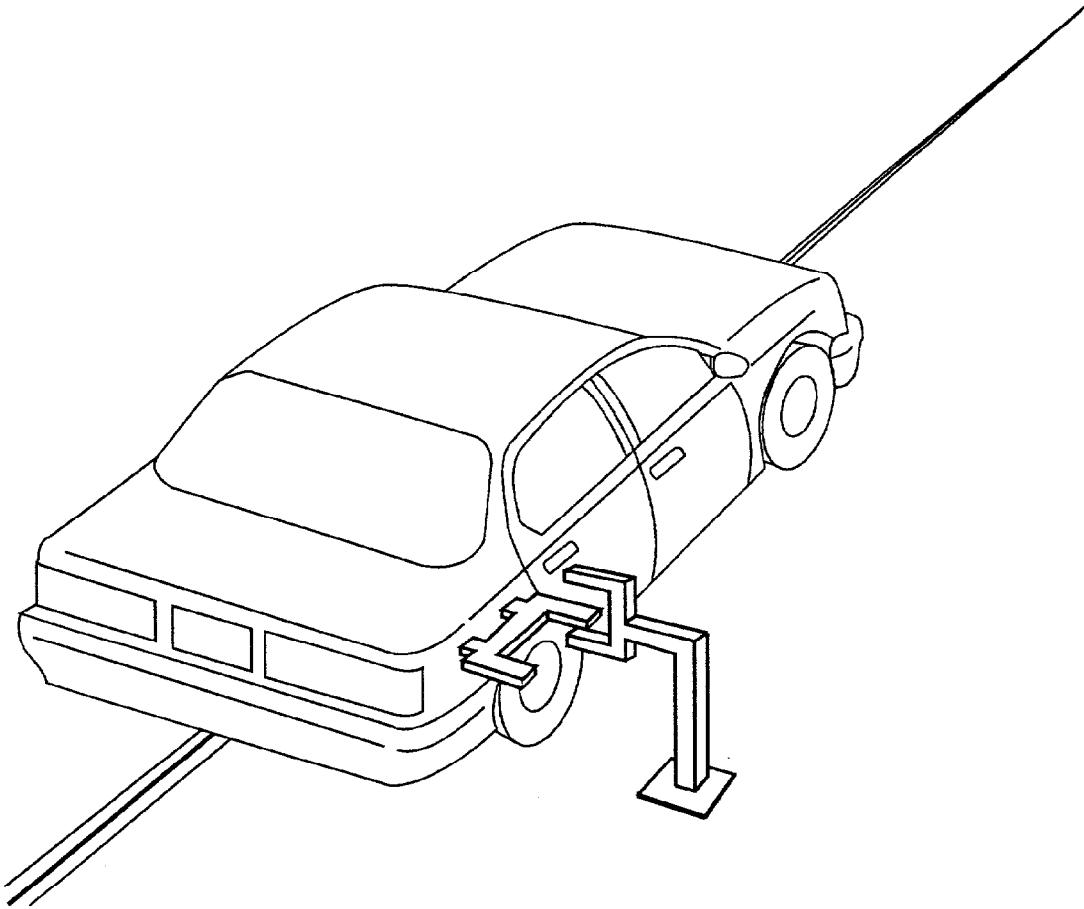
Pre-test:	L: 4400 mm	C: 4615 mm	R: 4405 mm
Post-test:	L: 4202 mm	C: 4197 mm	R: 4051 mm
Total crush:	L: 198 mm	C: 418 mm	R: 354 mm
Average crush:	323 mm		

Test vehicle rebound from flat frontal barrier:

Distance from test vehicle to barrier:

Post-test:	L: 1494 mm	C: 1523 mm	R: 1666 mm
Average rebound:	1561 mm		

Figure 1 Impact Velocity Measurement System



The final vane clears the final emitter/receiver pair 51 millimeters before impact.

The vanes have 305-millimeter spacing.

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

Test date: June 14, 1999
 Vehicle year/make/
 model/body style: 1999/Saturn/SL1/Sedan
 VIN: 1G8ZG5283XZ308492
 Build date: 03/99
 Test weight: 1181.2 kg
 Vehicle wheelbase: 2600 mm
 Maximum width: 1682 mm
 Front overhang: 980 mm

Collision Deformation
 Classification (CDC) Code: 12FDEW3

Crush depth
 measurements:

C1:	198 mm
C2:	302 mm
C3:	401 mm
C4:	443 mm
C5:	400 mm
C6:	354 mm

Midpoint of damage: D: Vehicle Longitudinal Centerline

Length of damaged
 region: L: 1525 mm

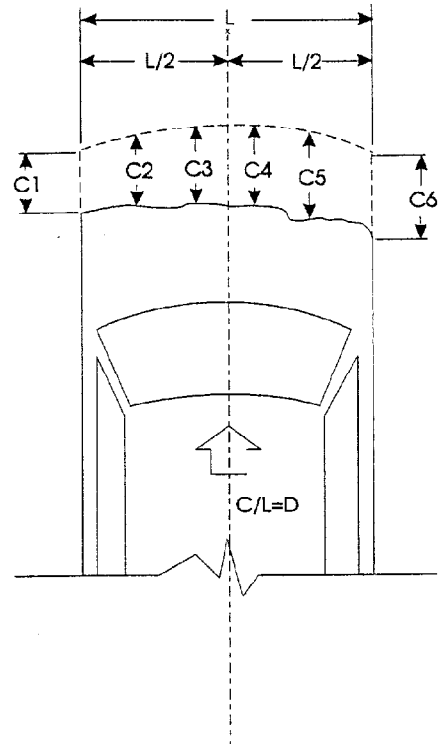


Figure 3 Vehicle Accelerometer Placement

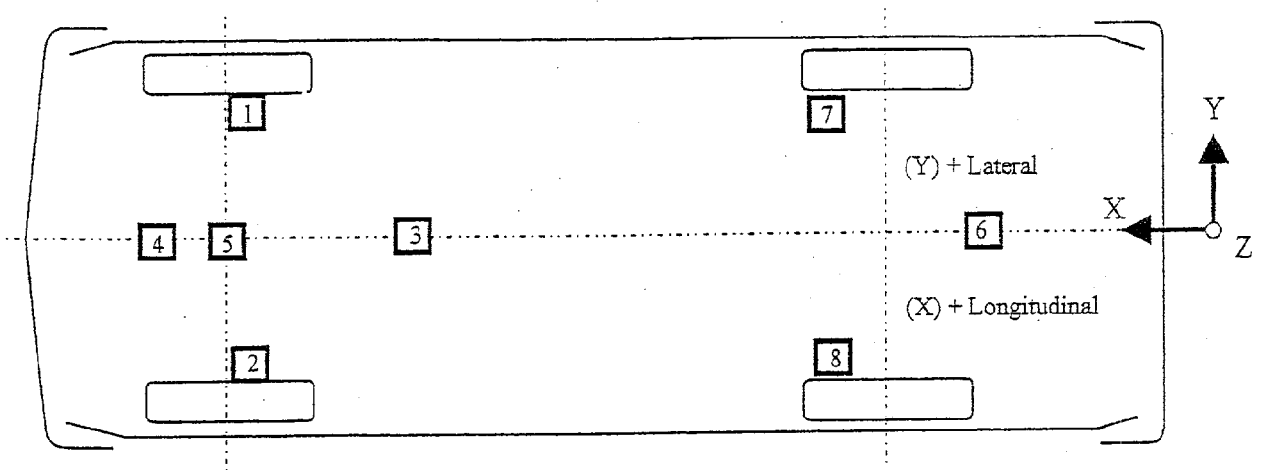
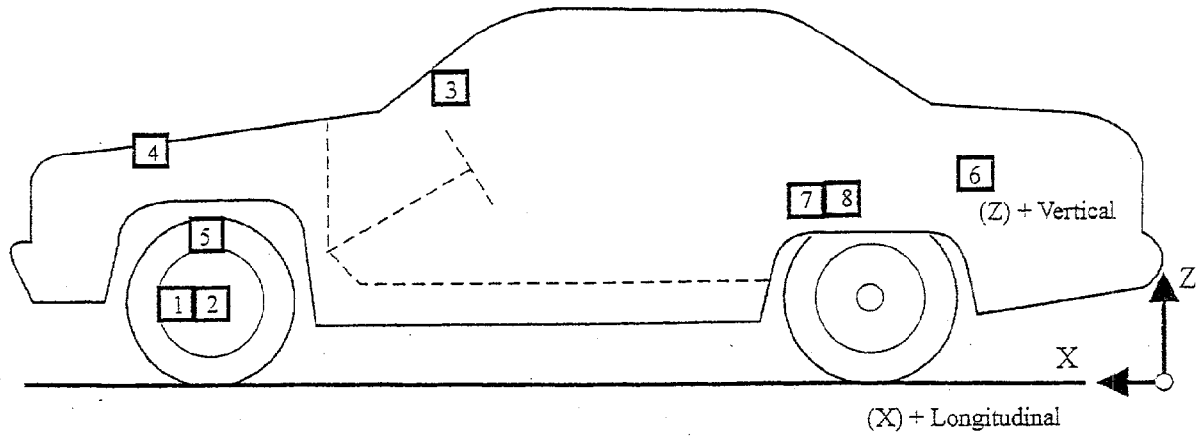


Table 4 Vehicle Accelerometer Locations and Data Summary

TEST NUMBER: 990614-1 No. LOCATION	X	Y	Z	POSITIVE DIRECTION	NEGATIVE DIRECTION
1 LEFT BRAKE CALIPER	PRE 3650 mm POST 3570 mm	640 mm 645 mm	306 mm 292 mm		
LONGITUDINAL				31.9 g @ 80.5 ms	40.5 g @ 63.4 ms
2 RIGHT BRAKE CALIPER	PRE 3650 mm POST 3593 mm	-640 mm -650 mm	306 mm 292 mm		
LONGITUDINAL				14.4 g @ 89.0 ms	65.5 g @ 57.7 ms
3 INSTRUMENT PANEL CENTER	PRE 3083 mm POST 3045 mm	0 mm 0 mm	846 mm 831 mm		
LONGITUDINAL				20.0 g @ 40.3 ms	75.4 g @ 51.4 ms
4 ENGINE TOP	PRE 3792 mm POST 3610 mm	-100 mm -35 mm	801 mm 794 mm		
LONGITUDINAL				10.0 g @ 66.0 ms	58.8 g @ 29.5 ms
5 ENGINE BOTTOM	PRE 3690 mm POST 3618 mm	195 mm 175 mm	176 mm 192 mm		
LONGITUDINAL				12.8 g @ 60.7 ms	70.8 g @ 41.9 ms

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

TEST NUMBER: 990614-1		X		Y	Z	POSITIVE DIRECTION	NEGATIVE DIRECTION
No. LOCATION							
6	REAR VEHICLE	PRE	340 mm	0 mm	487 mm		
	CENTERLINE	POST	340 mm	0 mm	483 mm		
	VERTICAL					11.2 g @ 38.6 ms	9.5 g @ 32.4 ms
7	LEFT REAR SEAT	PRE	1705 mm	497 mm	295 mm		
		POST	1700 mm	497 mm	275 mm		
	LONGITUDINAL					1.2 g @ 144.0 ms	24.5 g @ 29.0 ms
8	RIGHT REAR SEAT	PRE	1710 mm	530 mm	295 mm		
		POST	1708 mm	530 mm	275 mm		
	LONGITUDINAL					1.5 g @ 143.0 ms	24.2 g @ 61.2 ms

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

Section 3.0

FMVSS 208 Data

Table 5 Dummy Injury Criteria

<u>Maximum Acceleration</u>							
	Head				Chest		
	X	Y	Z	R	X	Y	Z
Driver	-35.8 g	-14.7 g	-9.1 g	38.4 g	-37.8 g	-3.0 g	-10.1 g
Passenger	-61.4 g	7.5 g	12.2 g	61.8 g	-43.5 g	-3.7 g	14.7 g

Maximum Femur Compressive Force

	Left Femur	Right Femur
Driver	3566 N	2445 N
Passenger	3072 N	3259 N

15-millisecond Head Injury Criteria¹

	HIC	Time t ₁	Time t ₂
Driver	106	56.2 ms	71.2 ms
Passenger	277	81.3 ms	96.3 ms

36-millisecond Head Injury Criteria¹

	HIC	Time t ₁	Time t ₂
Driver	212	45.4 ms	81.4 ms
Passenger	396	66.1 ms	102.1 ms

Chest Maximum Resultant Acceleration²

	Acceleration	Time t ₁	Time t ₂
Driver	37.1 g	67.7 ms	70.7 ms
Passenger	44.7 g	78.1 ms	81.1 ms

Maximum Chest Deflection

Driver	31.1 mm
Passenger	15.2 mm

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. As the dummy rebounded rearward into the seat, the back of the dummy's head contacted the headrest. The dummy came to rest seated upright in the driver's seat, leaning slightly to the right.

Right Front Passenger Dummy

Upon impact, the passenger dummy translated forward on the seat impacting both knees into the instrument panel. The dummy impacted its chest and then its head into the airbag. The dummy's head continued to translate forward into the airbag until the top of the dummy's head reached the instrument panel. The dummy's head rebounded off of the instrument panel. As the dummy rebounded rearward into the seat, the back of the dummy's head contacted the headrest. The dummy came to rest seated upright in the passenger's seat, leaning slightly forward.

Section 4.0

Vehicle, Occupant, and Camera Measurements

Figure 4 Pre-test and Post-test Measurement Points

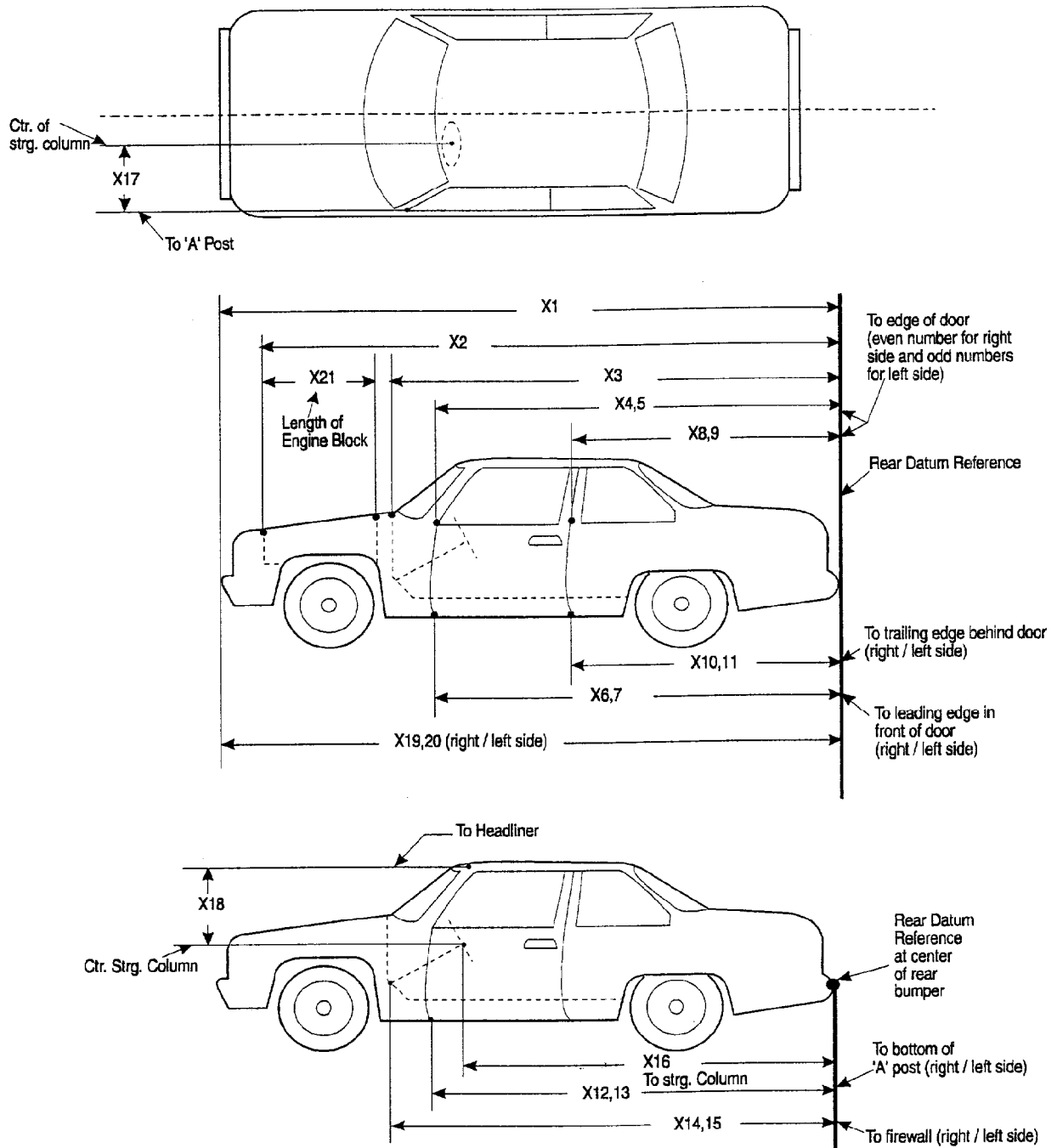


Table 6 Impacted Vehicle Measurements

Vehicle year/make/model/body style: 1999/Saturn/SL1/Sedan

Test Number: 990614-1

No.	Type of measurement	Pre-Test	Post-Test	Difference
X1	Total Length of Veh. at Centerline	4615	4197	418
X2	Rear Surface of Veh. to Front of Engine Block	3881	3720	161
X3	Rear Surface of Veh. to Firewall	3538	3465	73
X4	Rear Surface of Veh. to Upper Leading Edge of Right Door	3079	3068	11
X5	Rear Surface of Veh. to Upper Leading Edge of Left Door	3090	3087	3
X6	Rear Surface of Veh. to Lower Leading Edge of Right Door	3068	3068	0
X7	Rear Surface of Veh. to Lower Leading Edge of Left Door	3069	3065	4
X8	Rear Surface of Veh. to Upper Trailing Edge of Right Door	2122	2120	2
X9	Rear Surface of Veh. to Upper Trailing Edge of Left Door	2124	2121	3
X10	Rear Surface of Veh. to Lower Trailing Edge of Right Door	2139	2136	3
X11	Rear Surface of Veh. to Lower Trailing Edge of Left Door	2150	2147	3
X12	Rear Surface of Veh. to Bottom of " A " Post on Right Side	3050	3057	-7
X13	Rear Surface of Veh. to Bottom of " A " Post on Left Side	3065	3064	1
X14	Rear Surface of Veh. to Firewall--Right Side	3536	3471	65
X15	Rear Surface of Vehicle to Firewall --Left Side	3524	3477	47
X16	Rear Surface of Veh. to Steering Wheel Center	2681	2713	-32
X17	Center of Steering Column to " A " Post	304	319	-15
X18	Center of Steering Column to Headliner	435	435	0
X19	Rear Surface of Veh. to Right Side of Front Bumper	4405	4051	354
X20	Rear Surface of Veh. to Left Side of Front Bumper	4400	4202	198
X21	Length of Engine Block	400	400	0

Figure 5 Vehicle Target Locations

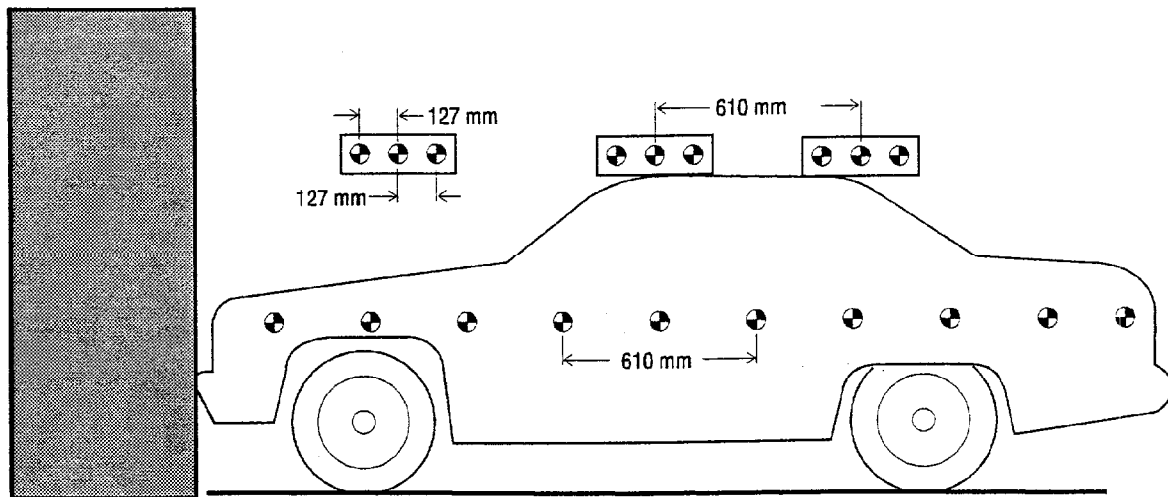


Figure 6 Dummy Measurement Locations for Front Seat Occupants

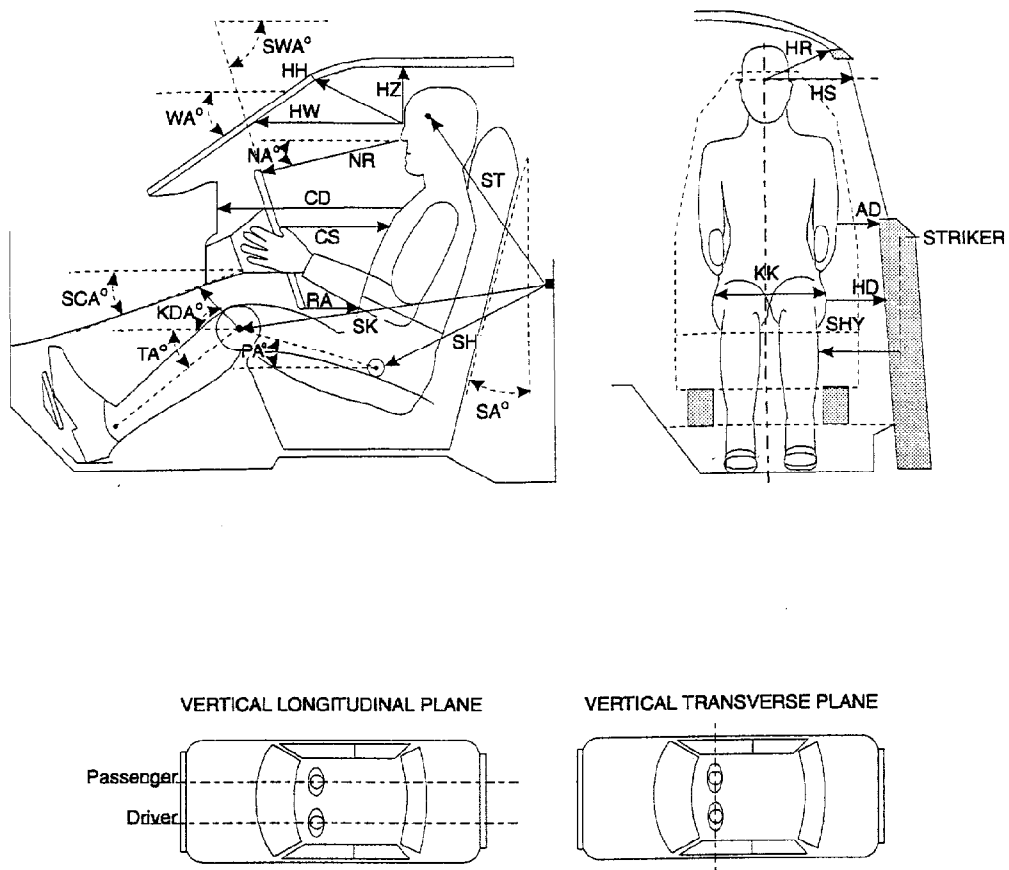


Table 7 Dummy Measurement Data For Front Seat Occupants

Designation	Type of Measurement	Driver (Serial #289)	Passenger (Serial #369)
WA	Windshield angle	25.4°	25.4°
SWA	Steering wheel angle	71°	N/A
SCA	Steering column angle	19°	N/A
SA	Seat back angle	68.4°	70.6°
HZ	Head to roof	202 mm	203 mm
HH	Head to header	276 mm	275 mm
HW	Head to windshield	573 mm	601 mm
HR	Head to side header	250 mm	240 mm
NR	Nose to rim	151 mm	N/A
NA	Nose to rim angle	4°	N/A
CD	Chest to dash	404 mm	367 mm
CS	Steering wheel to chest	202 mm	N/A
RA	Rim to abdomen	81 mm	N/A
KDL	Left knee to dash	125 mm	106 mm
KDR	Right knee to dash	107 mm	101 mm
KDA	Outboard knee to dash angle	46°	43°
PA	Pelvic angle	22.3°	21.5°
TA	Tibial angle	47°	60°
KK	Knee to knee	290 mm	263 mm
ST ¹	Striker to head	441 mm	438 mm
	Striker to head angle	-76°	-71°
SK ¹	Striker to knee	620 mm	602 mm
	Striker to knee angle	6°	0°
SH ¹	Striker to H-point	321 mm	341 mm
	Striker to H-point angle	20°	24°
SHY	Striker to H-point (Y dir.)	211 mm	229 mm
HS	Head to side window	335 mm	327 mm
HD	H-point to door	146 mm	147 mm
AD	Arm to door	158 mm	143 mm

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 above the striker.

Figure 7 Camera Positions

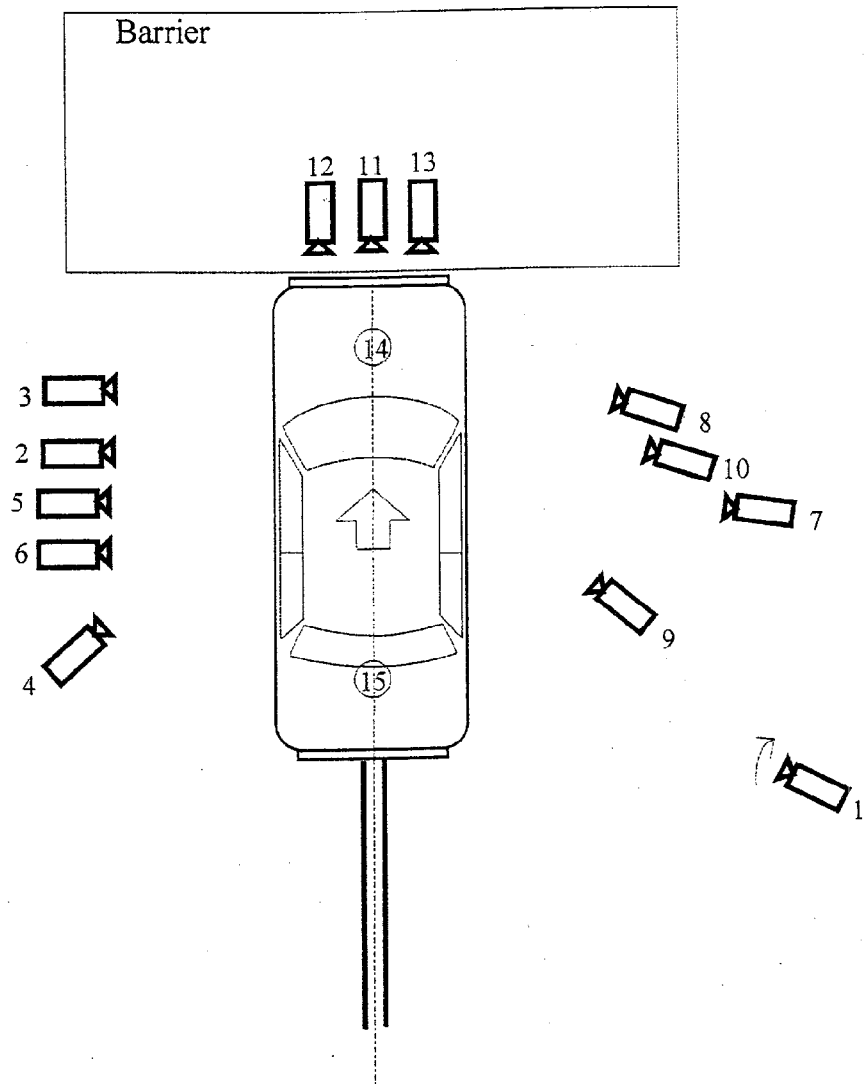


Figure 7 Camera Positions, Cont'd.

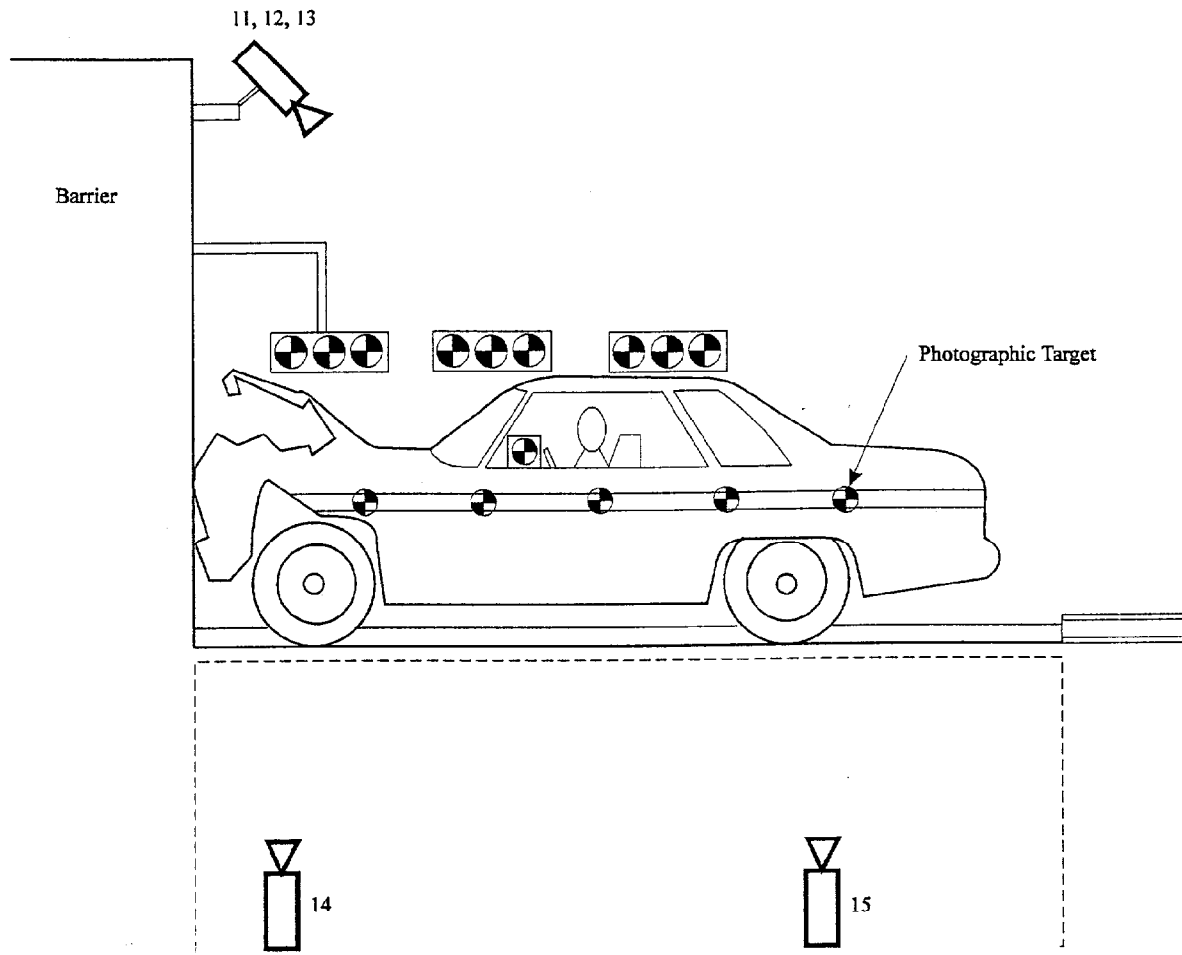


Table 8 Motion Picture Camera Locations

Vehicle year/make/model/body style: 1999/Saturn/SL1/Sedan

Test number: 990614-1

Camera Number	View	Camera Positions ¹			Camera Angle ²	Film Plane to Head Target	Camera Lens	Film Speed
		X	Y	Z				
1	Real-time panning	6706 mm	-8534 mm	1499 mm	-3°	NA	Zoom	24 frames/s
2	Left vehicle crush	1397 mm	7239 mm	1130 mm	1°	8103 mm	13 mm	1007 frames/s
3	Left windshield intrusion	1067 mm	6248 mm	940 mm	3°	NA	50 mm	1000 frames/s
4	Left angle	3912 mm	1829 mm	1994 mm	-16°	2972 mm	25 mm	997 frames/s
5	Steering column motion - upper	2667 mm	6629 mm	2565 mm	-13°	NA	25 mm	1000 frames/s
6	Steering column motion - lower	2667 mm	6629 mm	1600 mm	-6°	NA	25 mm	1002 frames/s
7	Right wide	2921 mm	-6909 mm	787 mm	-1°	NA	25 mm	997 frames/s
8	Right windshield intrusion	1118 mm	-5613 mm	1080 mm	0°	NA	13 mm	997 frames/s
9	Right angle	3962 mm	-1676 mm	1930 mm	-16°	2769 mm	50 mm	992 frames/s
10	Passenger A-pillar to B-pillar	5563 mm	-2362 mm	1461 mm	-3°	6477 mm	25 mm	1025 frames/s
11	Windshield front view	457 mm	0 mm	2337 mm	-55°	NA	25 mm	N/A ³
12	Driver - front view	457 mm	381 mm	2337 mm	-56°	NA	13 mm	1000 frames/s
13	Passenger - front view	457 mm	-381 mm	2337 mm	-55°	NA	25 mm	997 frames/s
14	Pit - front position	1295 mm	0 mm	2972 mm	92°	NA	13 mm	1000 frames/s
15	Pit - rear position	2946 mm	0 mm	2972 mm	90°	NA	13 mm	1002 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 cameras' film speed could not be measured.

Appendix A

Photographs



Figure A-1 Pre-Test Front View

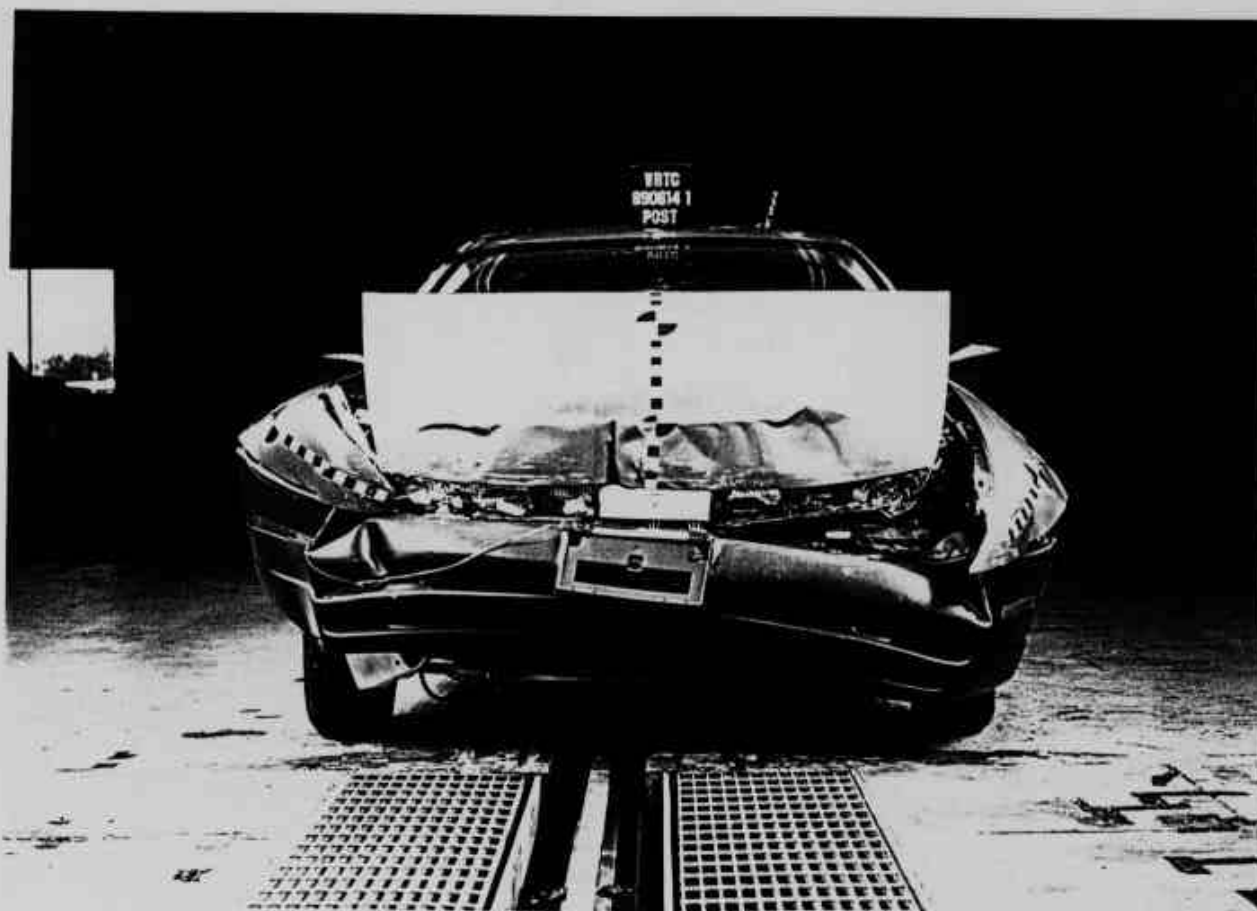


Figure A-2 Post-Test Front View



Figure A-3 Pre-Test Left Side View



Figure A-4 Post-Test Left Side View



Figure A-5 Pre-Test Left Rear Three-Quarter View



Figure A-6 Post-Test Left Rear Three-Quarter View

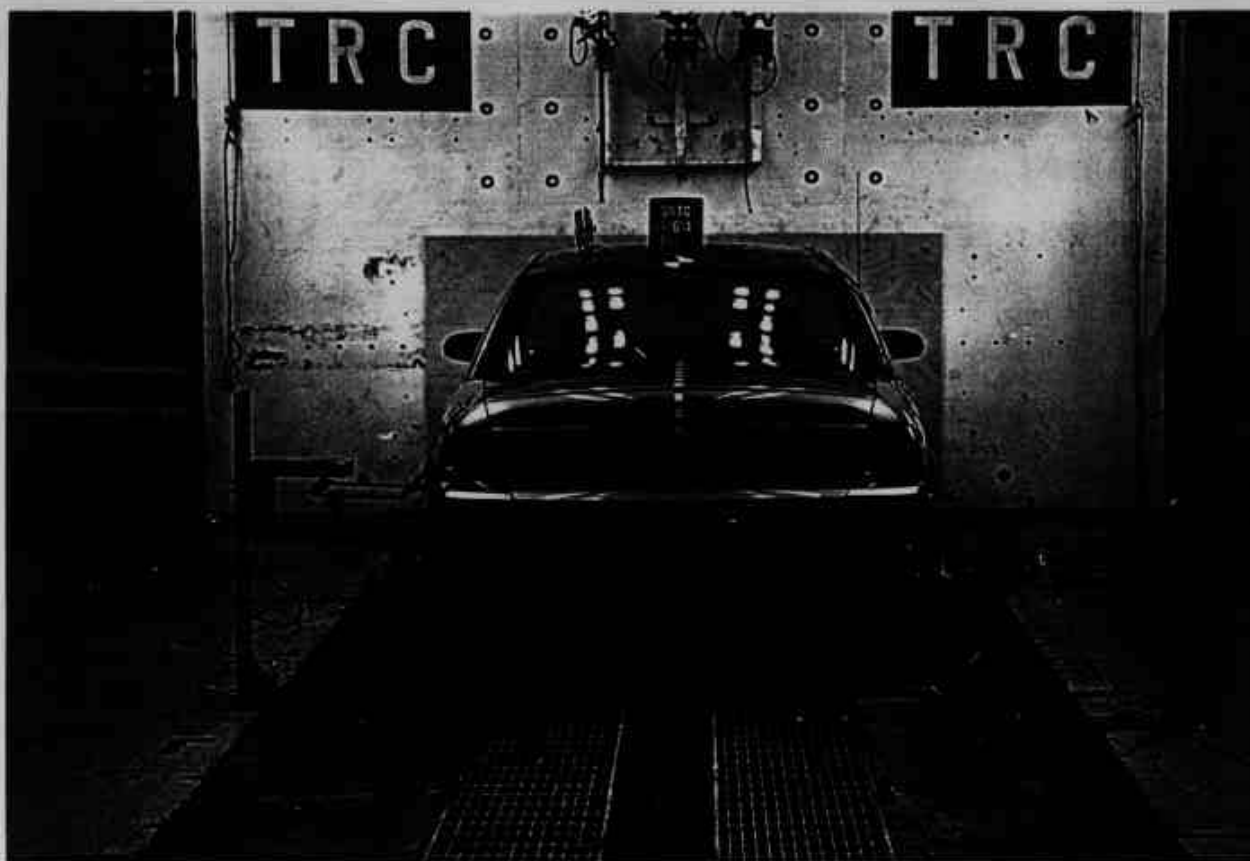


Figure A-7 Pre-Test Rear View



Figure A-8 Post-Test Rear View



Figure A-9 Pre-Test Right Side View



Figure A-10 Post-Test Right Side View



Figure A-11 Pre-Test Right Front Three-Quarter View



Figure A-12 Post-Test Right Front Three-Quarter View

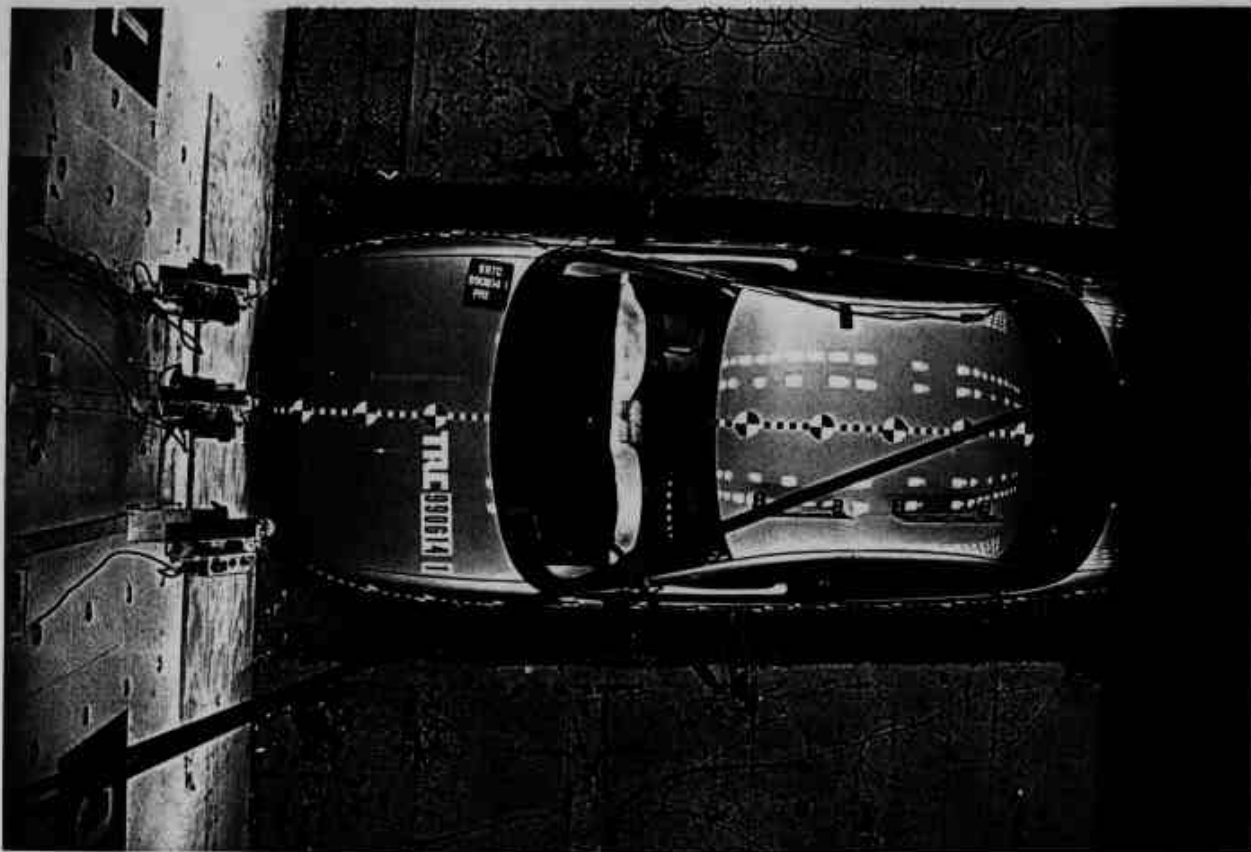


Figure A-13 Pre-Test Overhead View

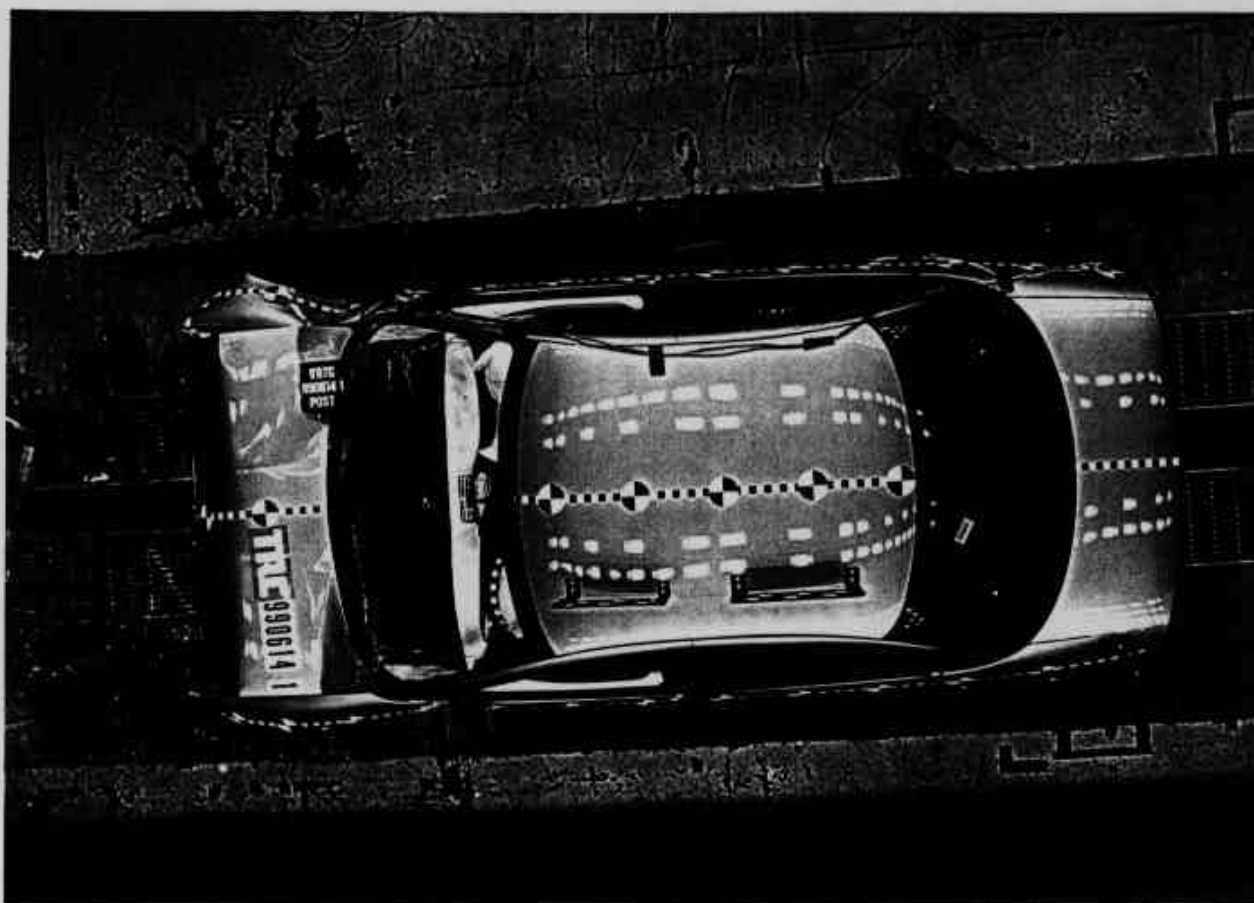


Figure A-14 Post-Test Overhead View

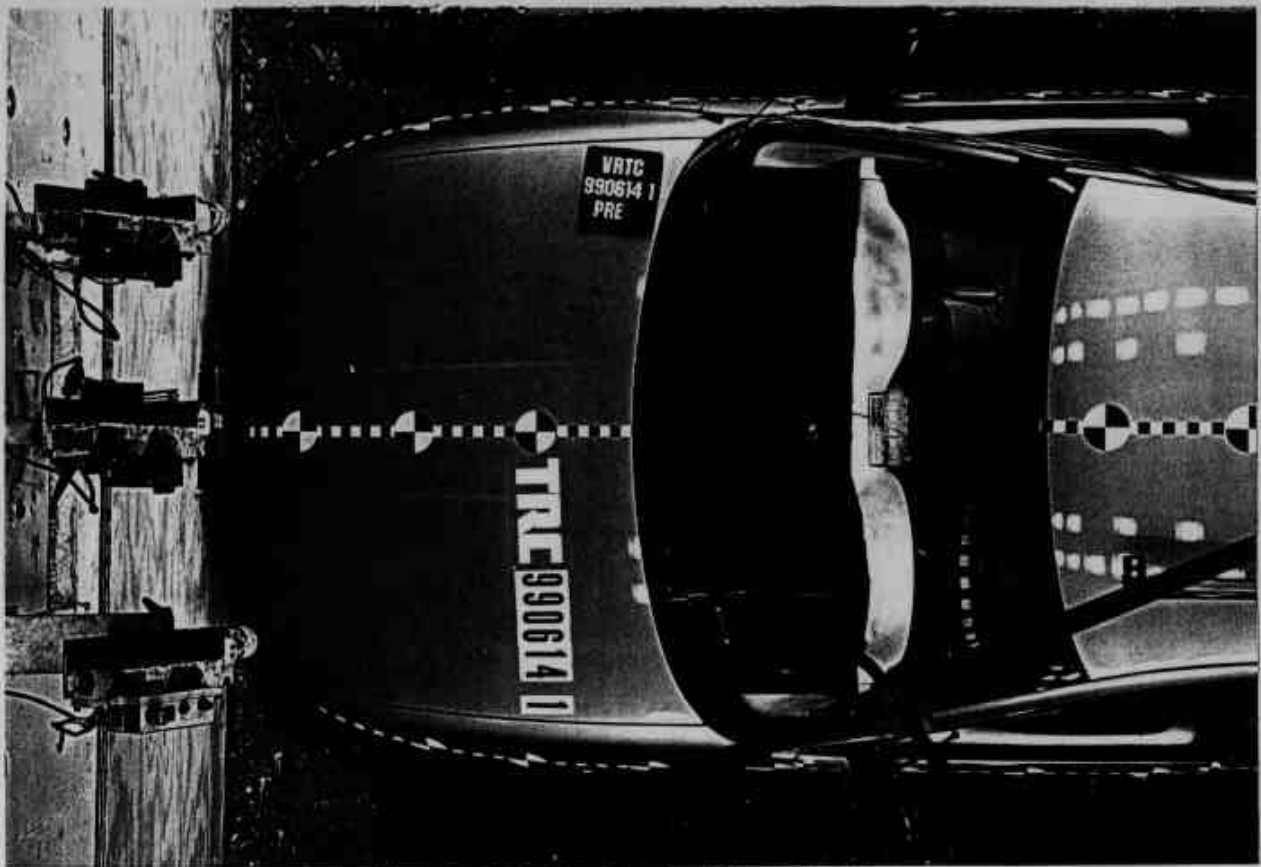


Figure A-15 Pre-Test Overhead Close-Up View



Figure A-16 Post-Test Overhead Close-Up View

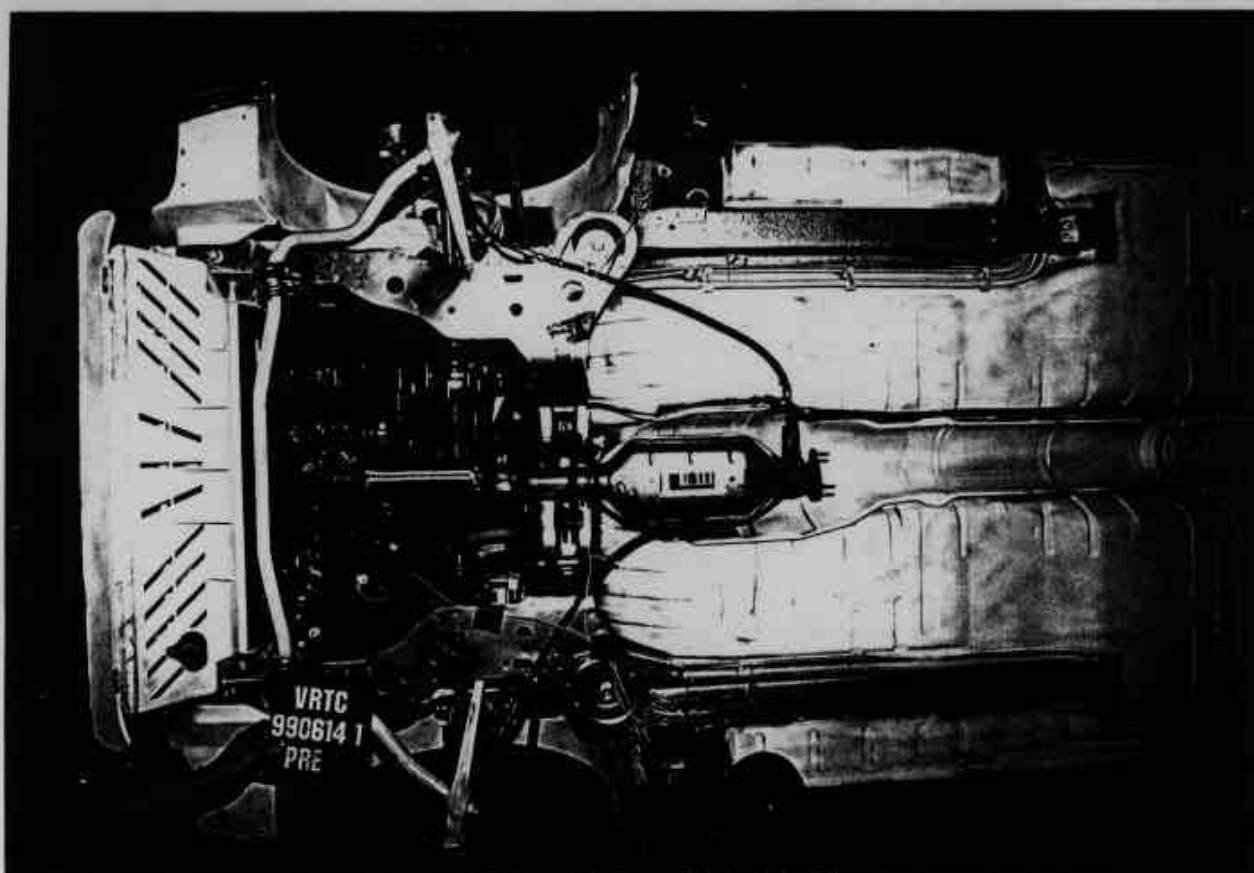


Figure A-17 Pre-Test Front Underbody View

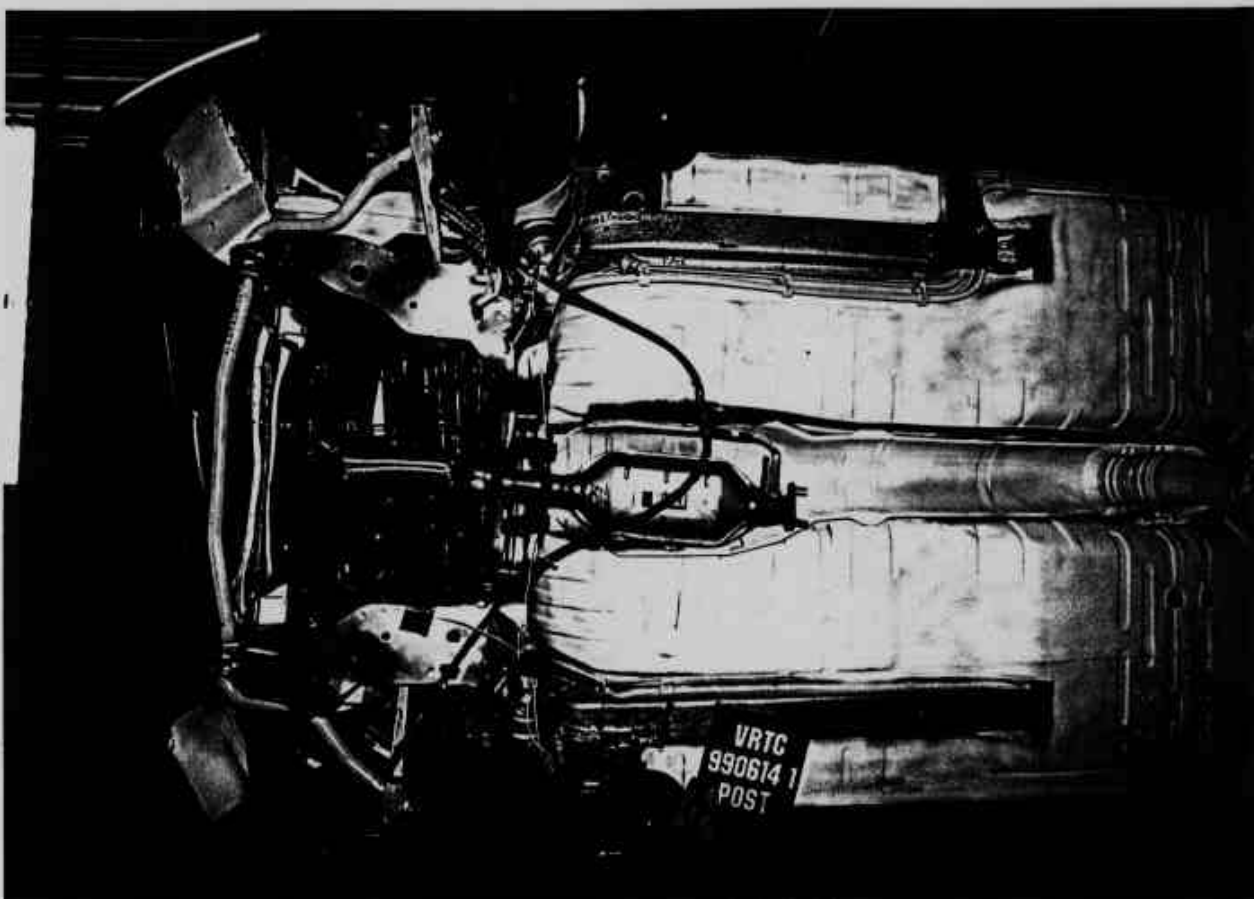


Figure A-18 Post-Test Front Underbody View

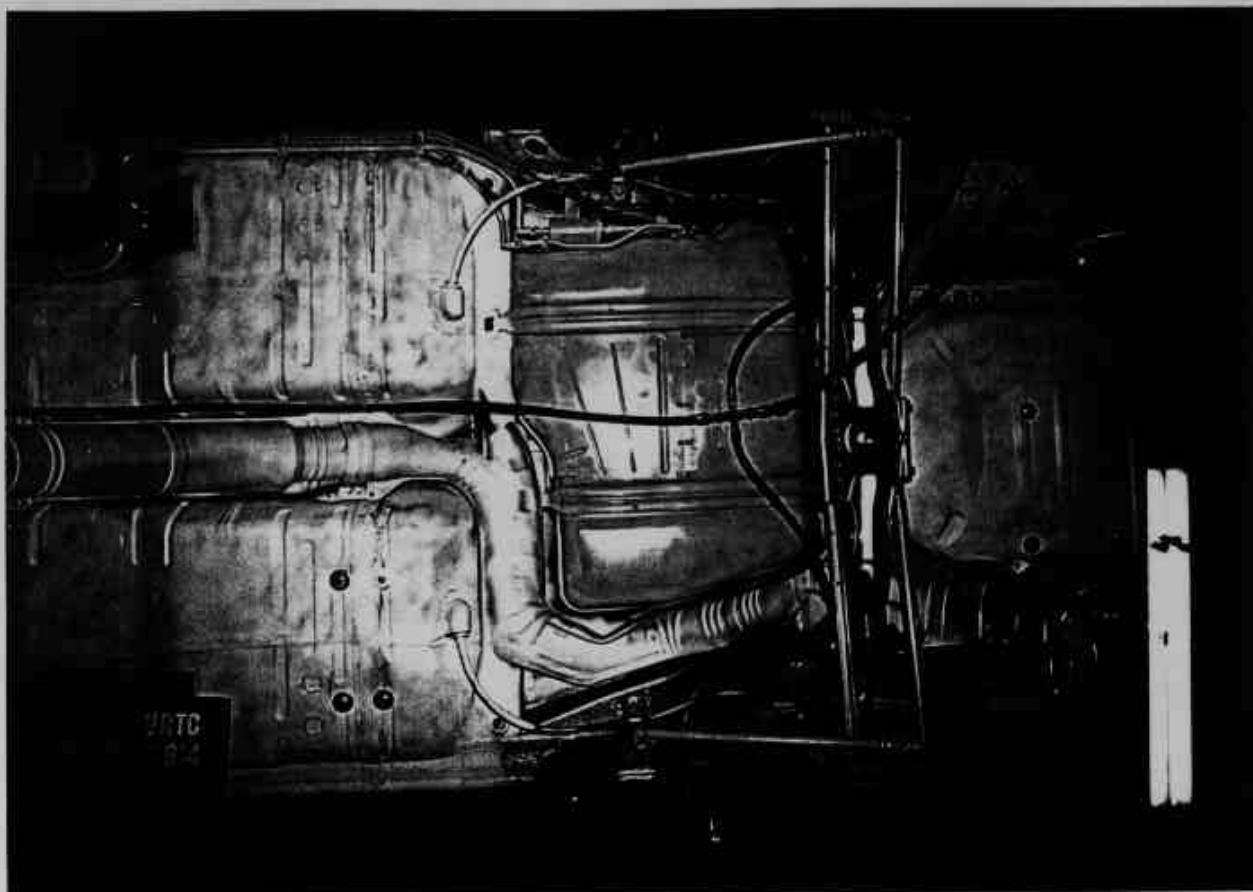


Figure A-19 Pre-Test Rear Underbody View



Figure A-20 Post-Test Rear Underbody View

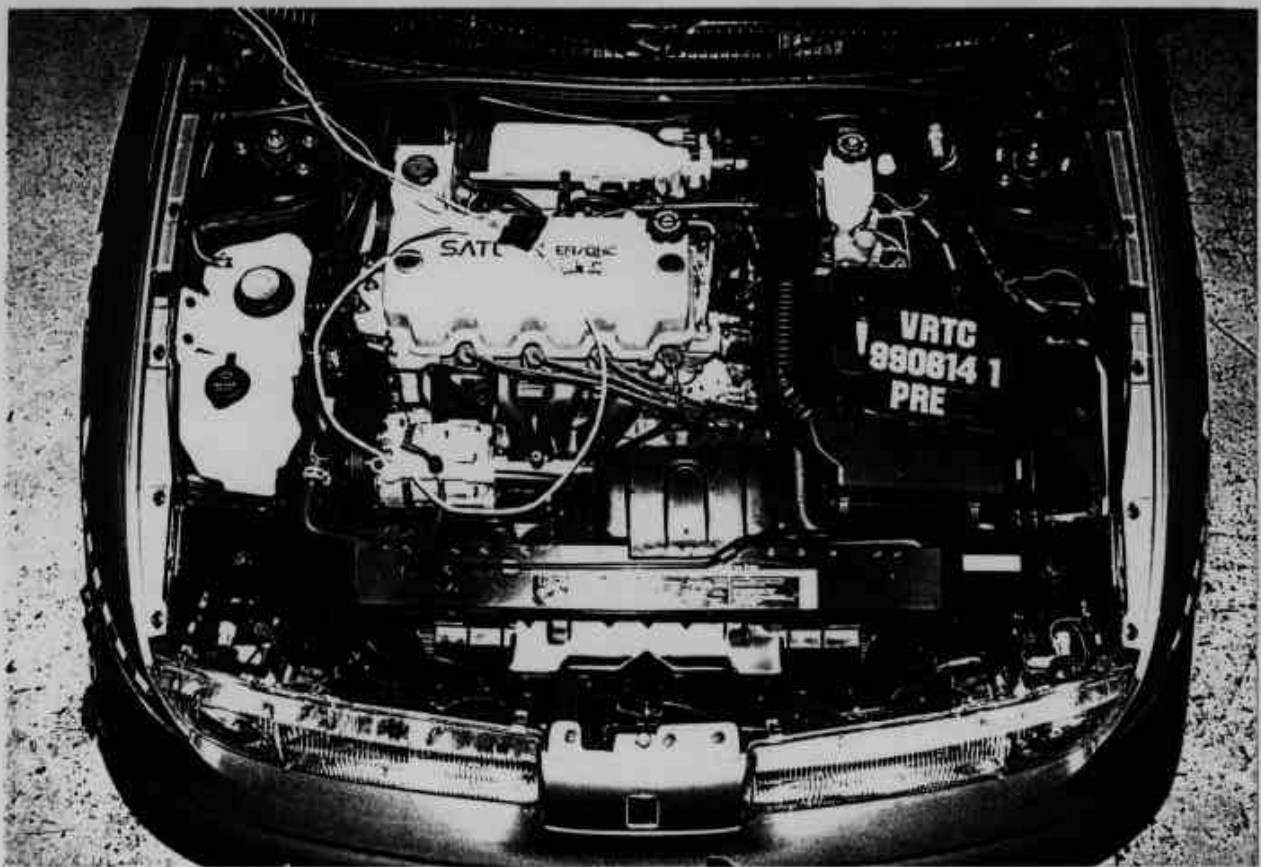


Figure A-21 Pre-Test Engine Compartment View

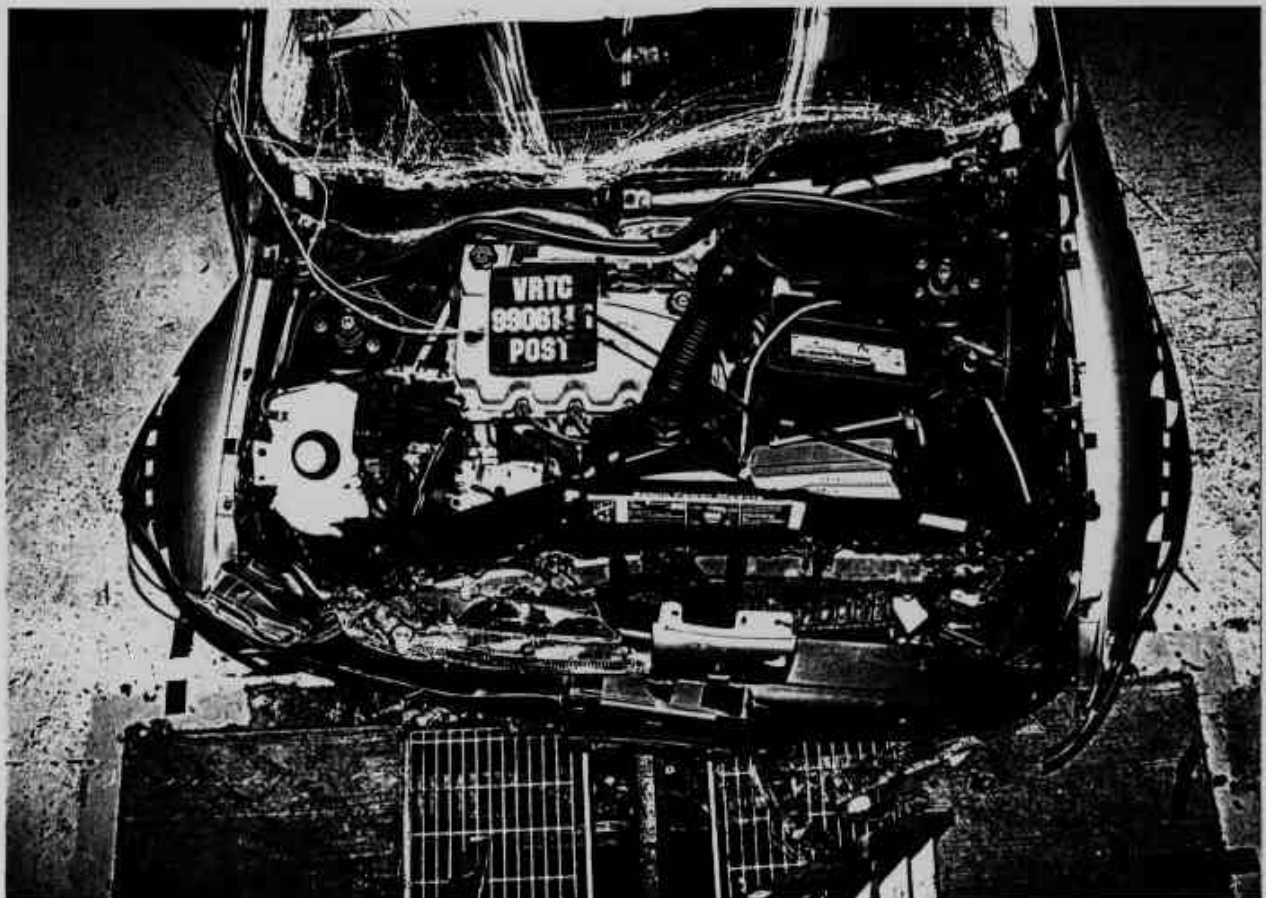


Figure A-22 Post-Test Engine Compartment View

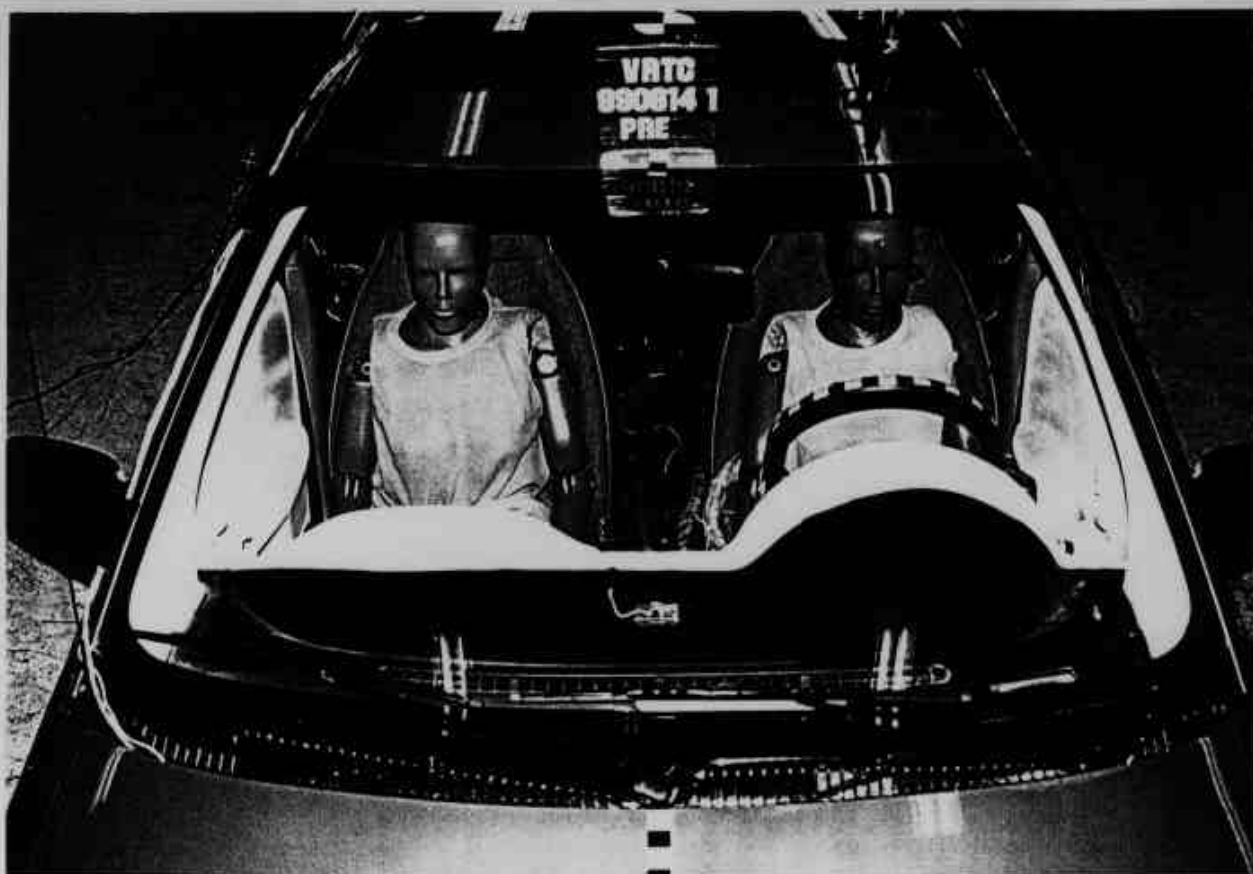


Figure A-23 Pre-Test Windshield - View 1



Figure A-24 Post-Test Windshield - View 1

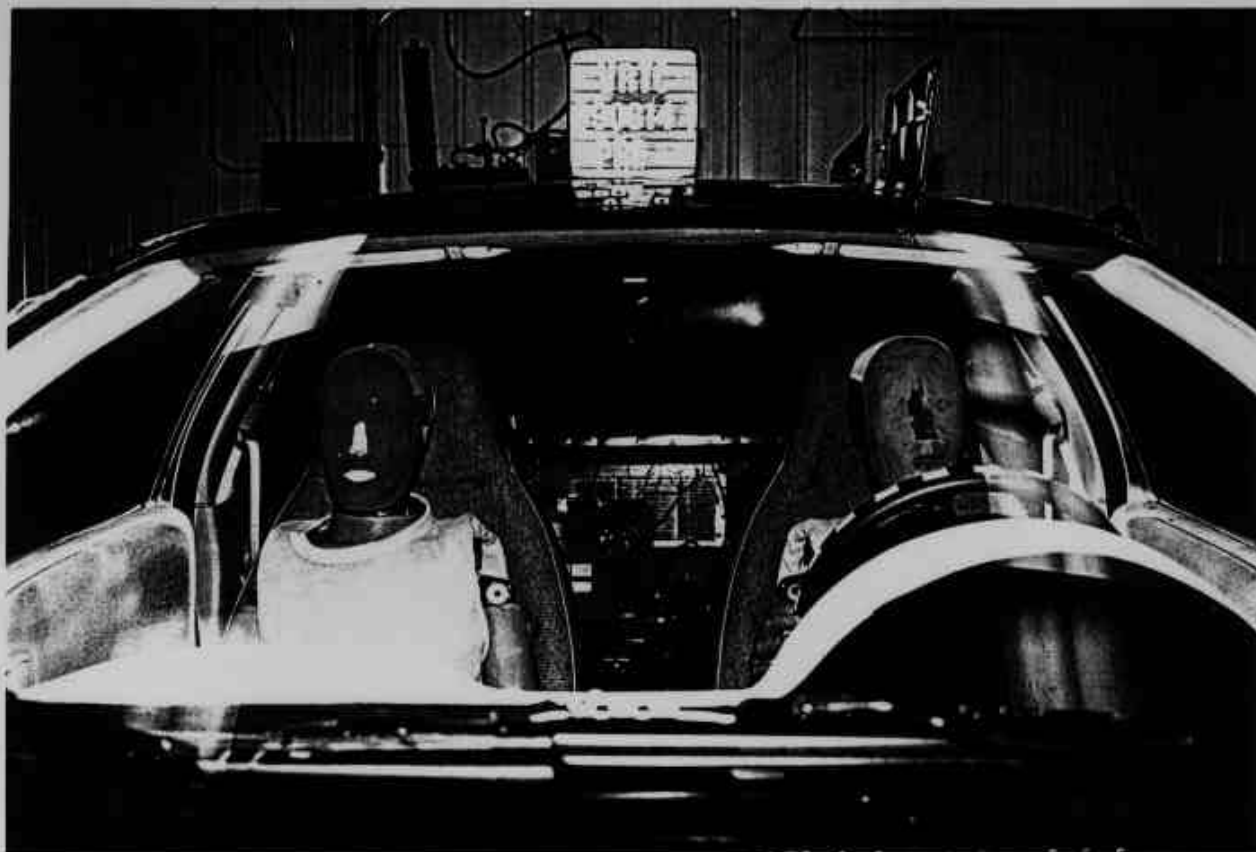


Figure A-25 Pre-Test Windshield - View 2

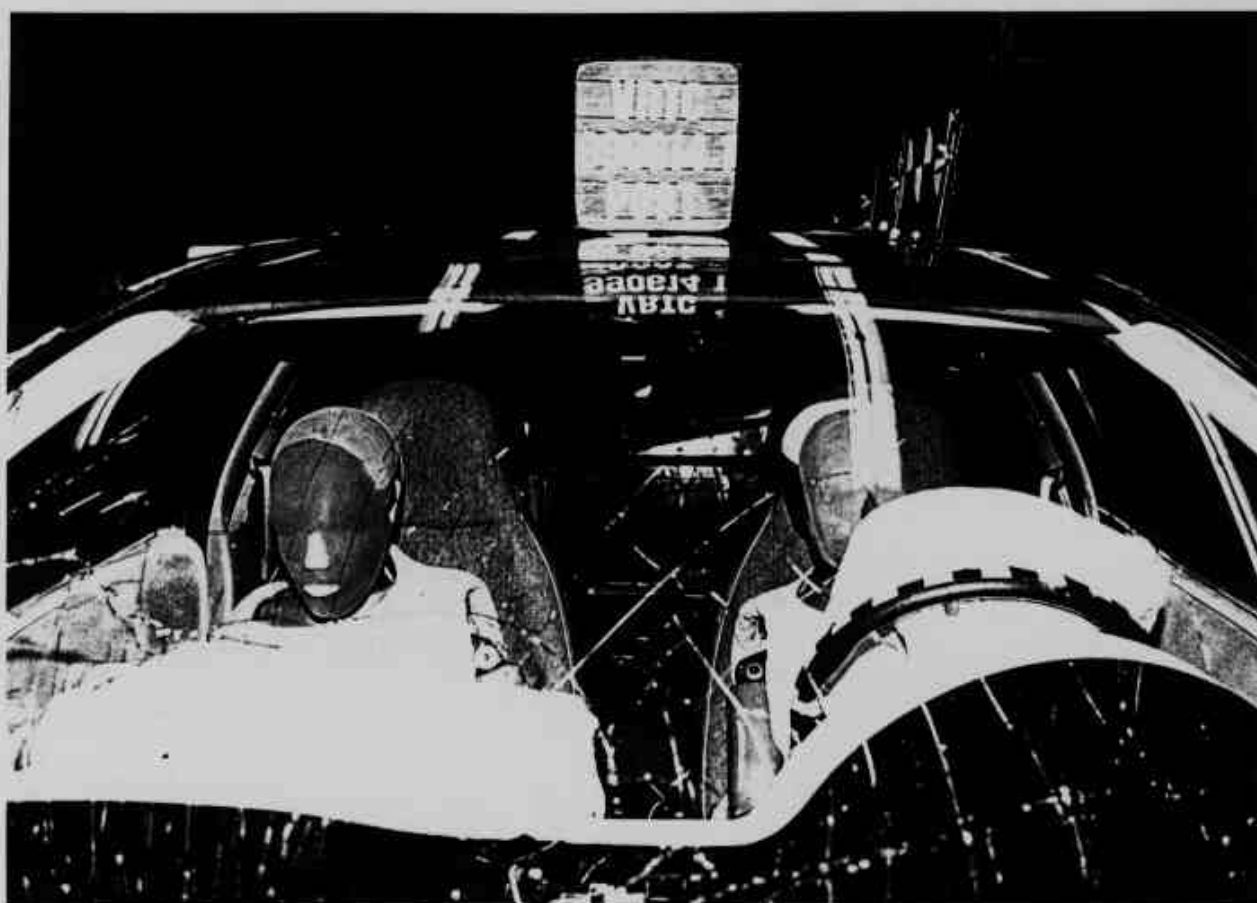


Figure A-26 Post-Test Windshield - View 2

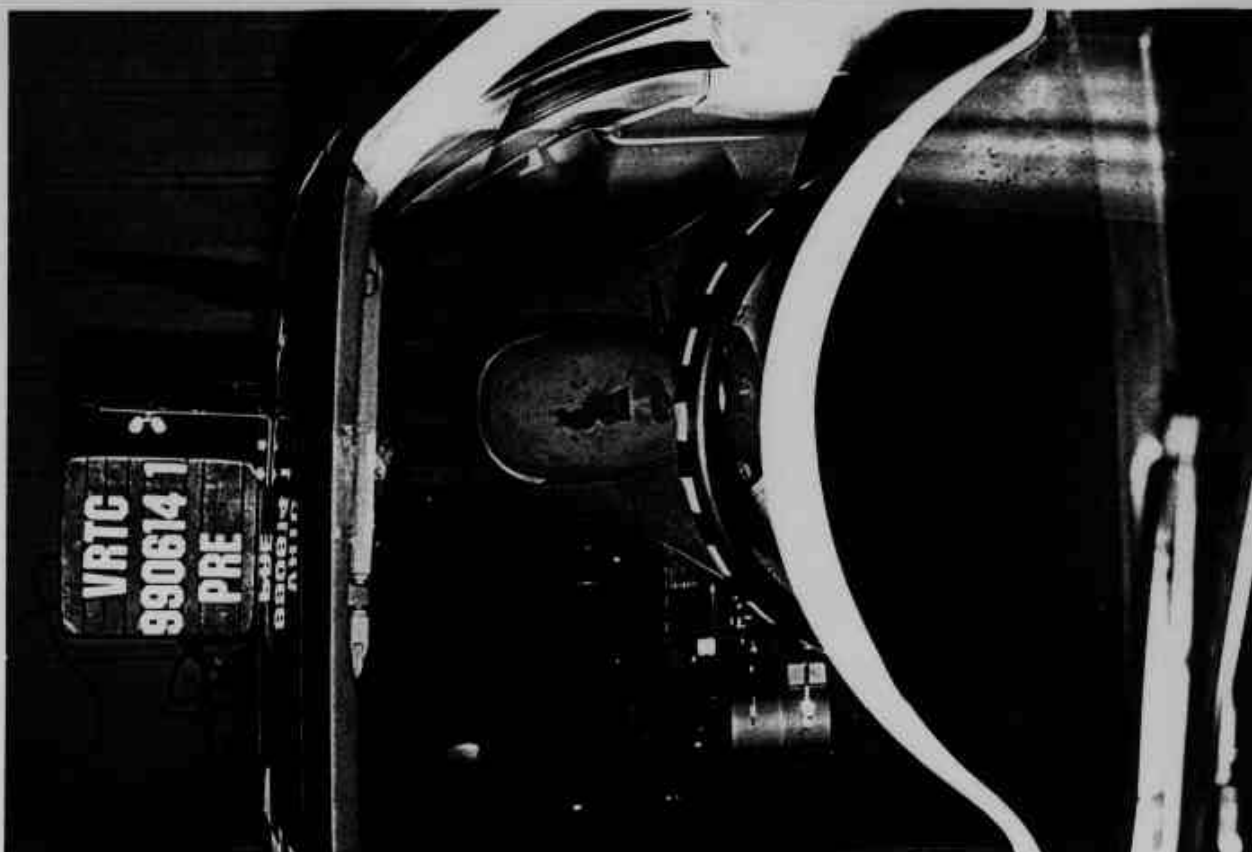


Figure A-27 Pre-Test Driver Dummy Windshield View

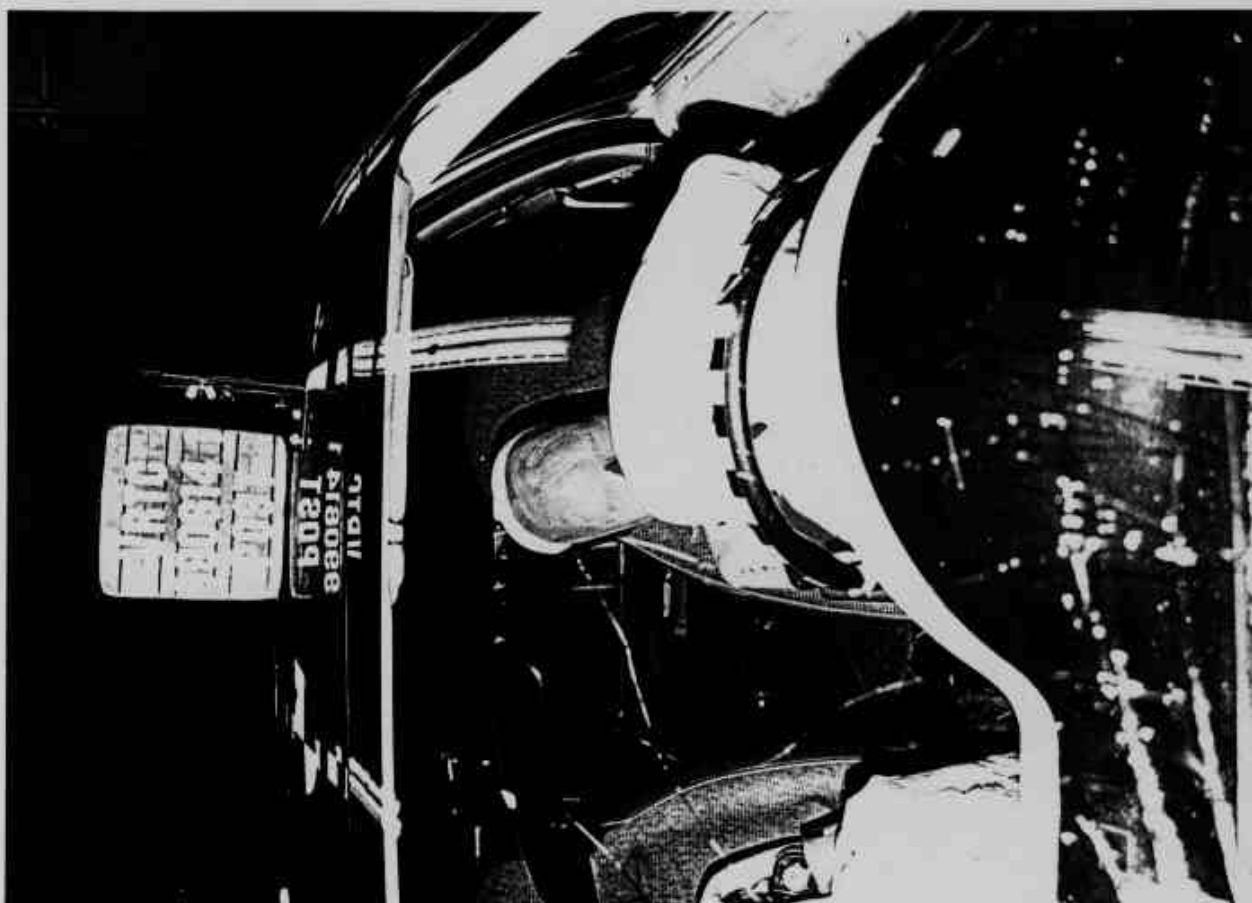


Figure A-28 Post-Test Driver Dummy Windshield View

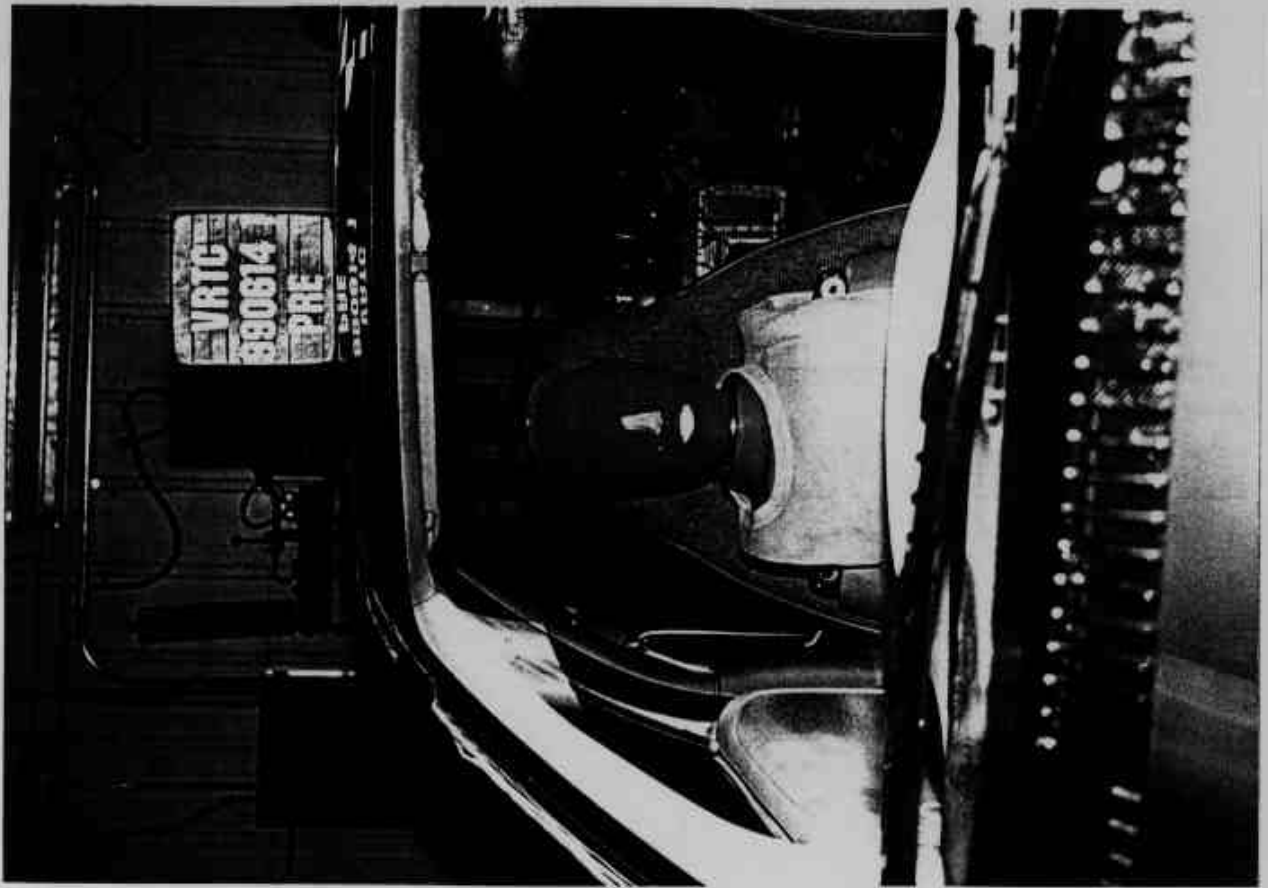


Figure A-29 Pre-Test Passenger Dummy Windshield View

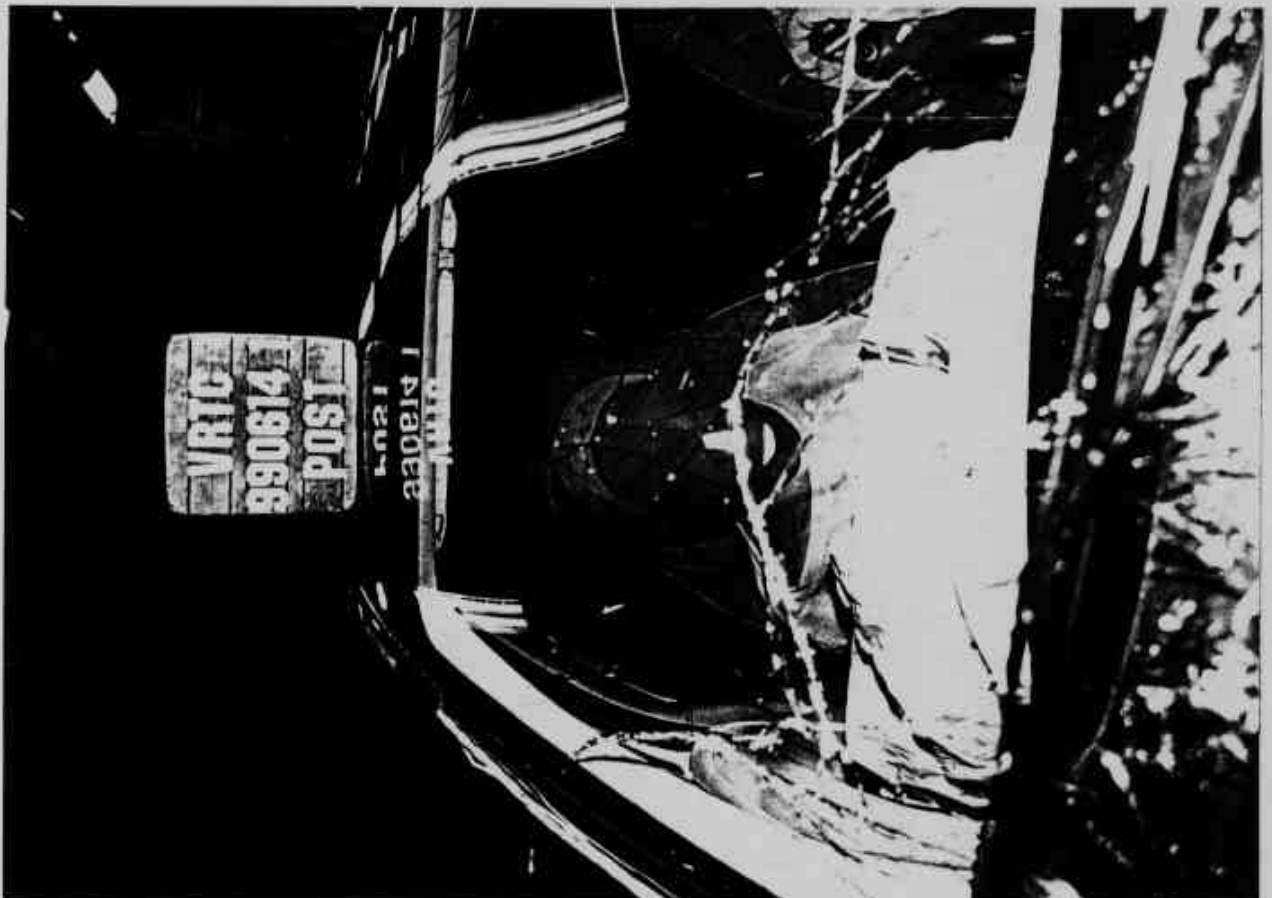


Figure A-30 Post-Test Passenger Dummy Windshield View



Figure A-31 Pre-Test Driver Dummy Position - View 1



Figure A-32 Post-Test Driver Dummy Position - View 1



Figure A-33 Pre-Test Driver Dummy Position -View 2



Figure A-34 Post-Test Driver Dummy Position - View 2



Figure A-35 Pre-Test Driver Dummy Position -View 3



Figure A-36 Post-Test Driver Dummy Position - View 3



Figure A-37 Pre-Test Passenger Dummy Position - View 1



Figure A-38 Post-Test Passenger Dummy Position - View 1



Figure A-39 Pre-Test Passenger Dummy Position - View 2



Figure A-40 Post-Test Passenger Dummy Position - View 2



Figure A-41 Pre-Test Passenger Dummy Position - View 3



Figure A-42 Post-Test Passenger Dummy Position - View 3

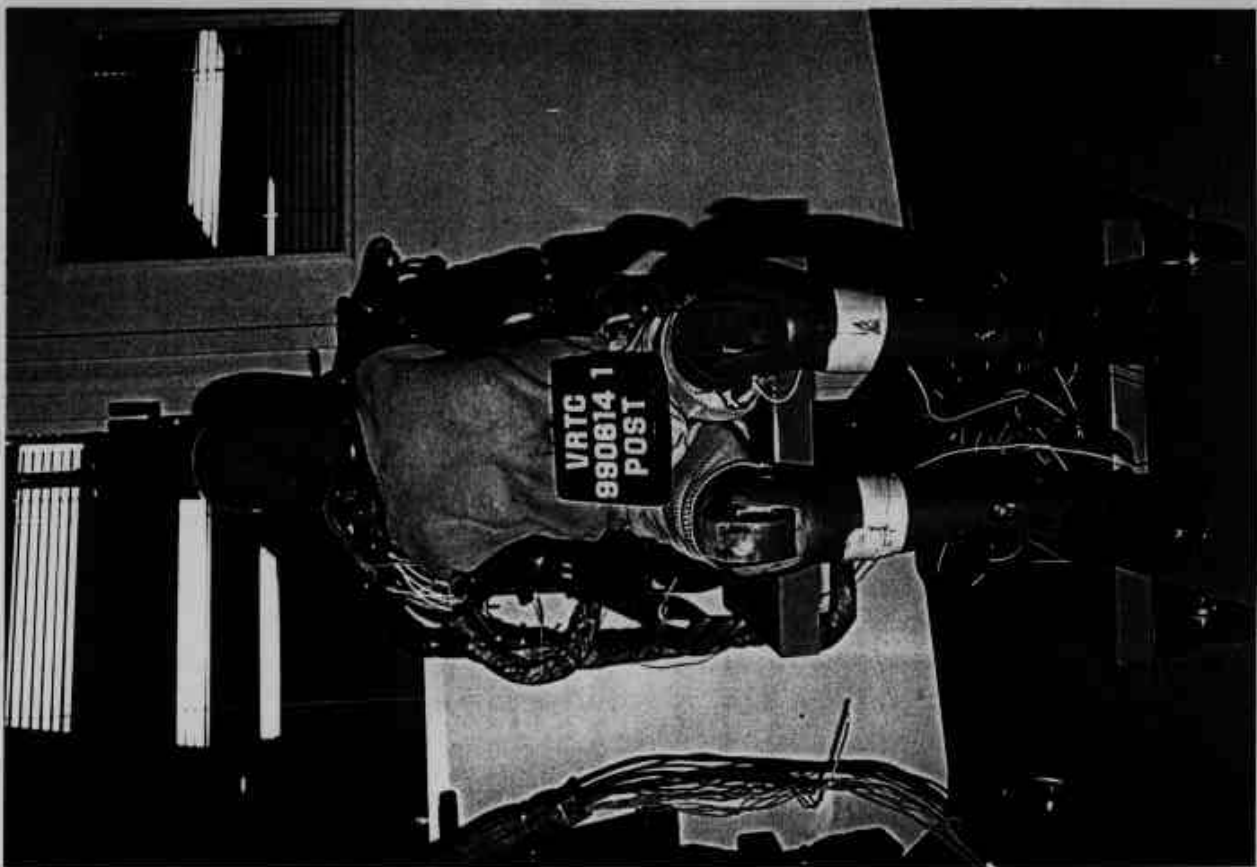


Figure A-43 Post-Test Driver Dummy View



Figure A-44 Post-Test Driver Dummy Head Contact - View 1



Figure A-45 Post-Test Driver Dummy Head Contact - View 2



Figure A-46 Post-Test Driver Dummy Head Contact - View 3



Figure A-47 Post-Test Driver Dummy Knee Contact - View 1



Figure A-48 Post-Test Driver Dummy Knee Contact - View 2



Figure A-49 Post-Test Driver Footwell Deformation View

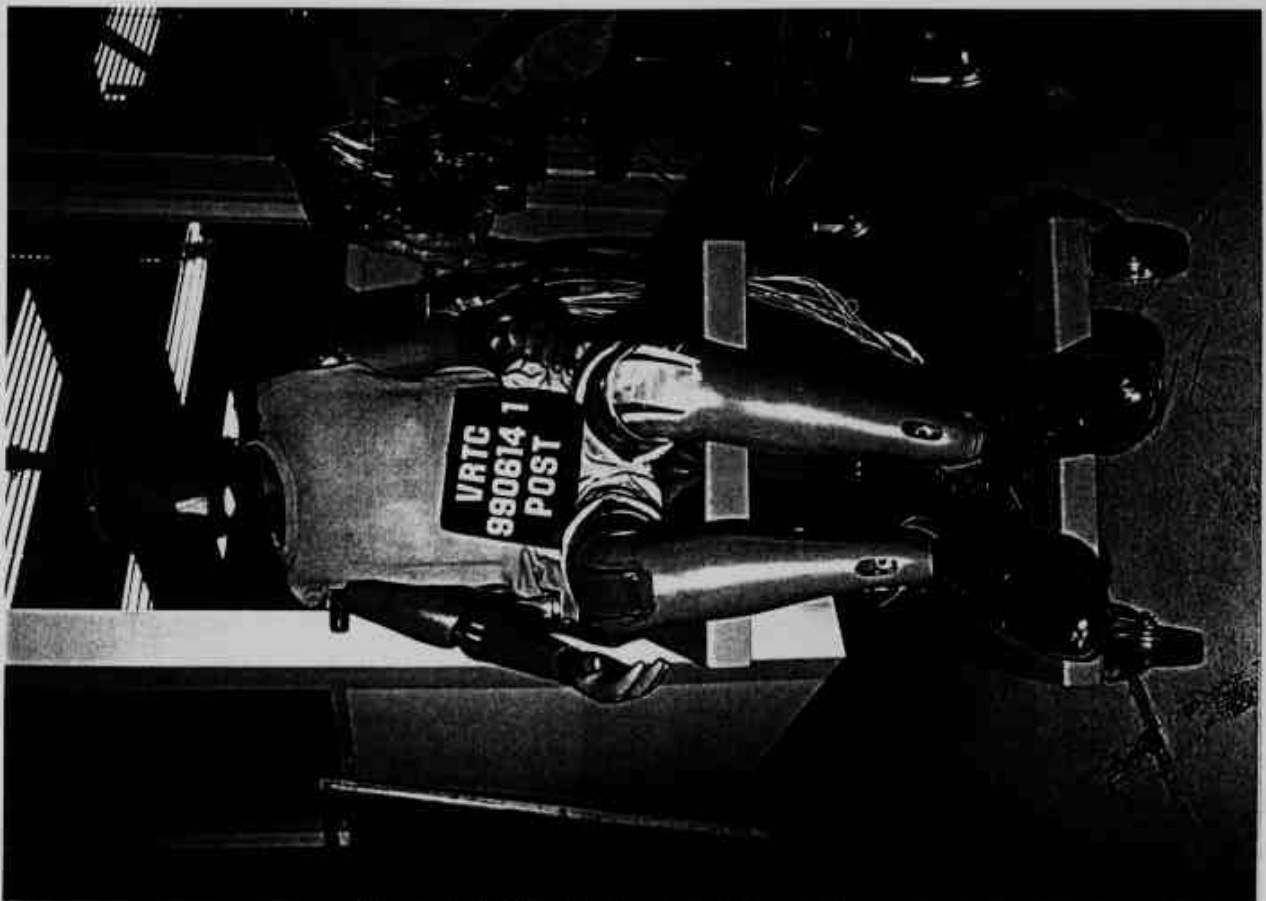


Figure A-50 Post-Test Passenger Dummy View



Figure A-51 Post-Test Passenger Dummy Head Contact - View 1



Figure A-52 Post-Test Passenger Dummy Head Contact - View 2



Figure A-53 Post-Test Passenger Dummy Head Contact - View 3



Figure A-54 Post-Test Passenger Dummy Knee Contact - View 1



Figure A-55 Post-Test Passenger Dummy Knee Contact - View 2



Figure A-56 Post-Test Passenger Footwell Deformation View



Figure A-57 Pre-Test Fuel Cap View



Figure A-58 Post-Test Fuel Cap


MFD BY SATURN CORPORATION
 DATE GVWR GAWR FRT GAWR RR
 03/99 3251LB 1647LB 1604LB
 1475KG 0747KG 0728KG

THIS VEHICLE CONFORMS TO ALL APPLI-
 CABLE U.S. FEDERAL MOTOR VEHICLE
 SAFETY, BUMPER, AND THEFT PREVENTION
 STANDARDS IN EFFECT ON THE DATE OF
 MANUFACTURE SHOWN ABOVE.

1G8ZG5283XZ308492 PASS CAR



Figure A-59 Pre-Test Vehicle Certification Label View

TIRE-LOADING INFORMATION

OCCUPANTS VEHICLE CAPACITY WT.
 FRT. CTR. RR. TOTAL LBS KG
 2 0 3 5 849 385

MAXIMUM LOADING AT GVWR:
 SAME AS VEHICLE CAPACITY WEIGHT

ZZ46

COLD TIRE
PRESSURE

	TIRE SIZE	SPEED RATING	PSI/KPA
FRONT	P175/70R14	S	30/210
REAR	P175/70R14	S	30/210
SPARE	T115/70R14	M	60/420

IF TIRES ARE HOT, ADD 4 PSI (28 KPA)
 SEE OWNER'S MANUAL FOR ADDITIONAL
 INFORMATION

Figure A-60 Pre-Test Vehicle Tire Information Label View

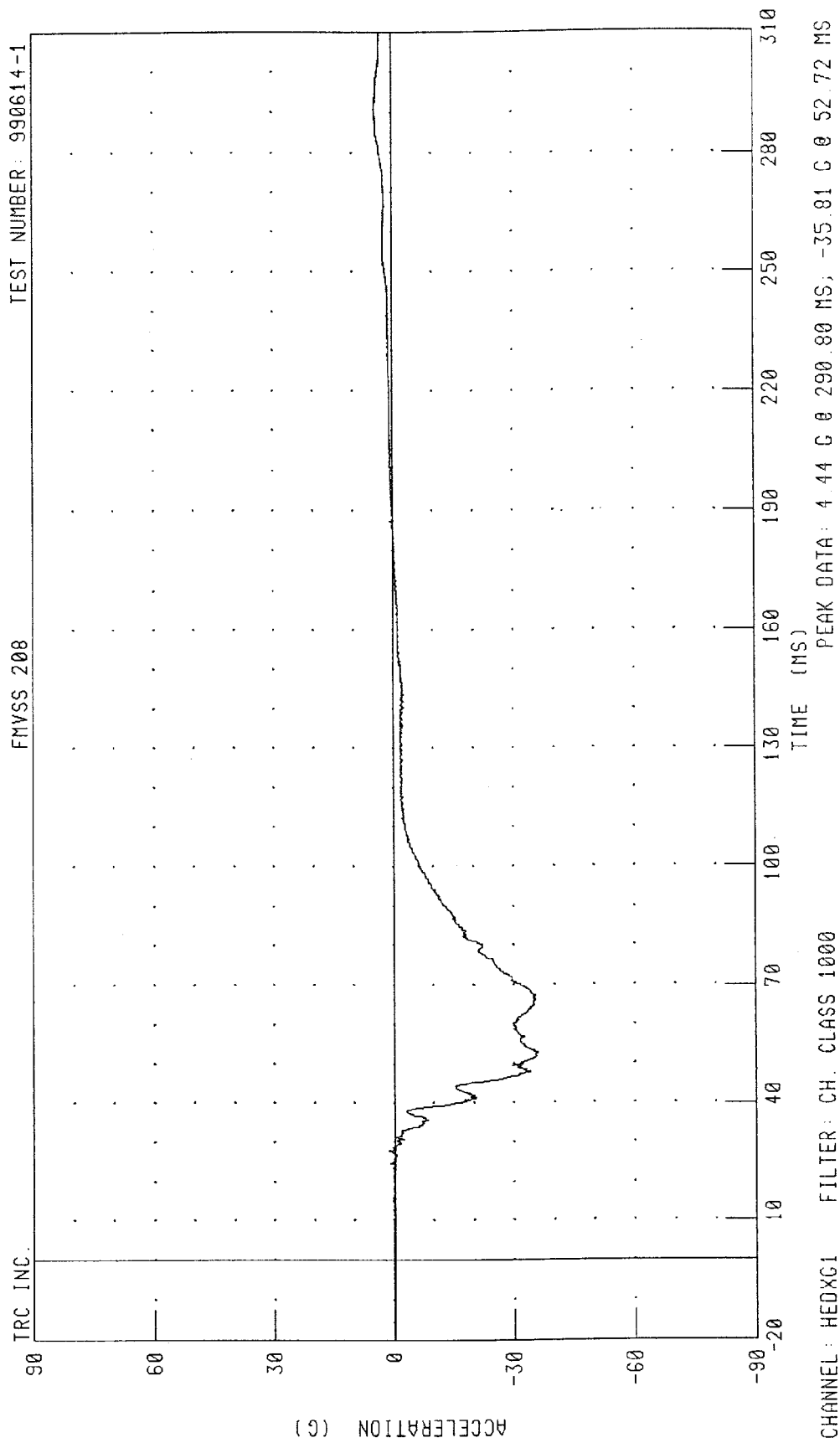


Figure A-61 Impact Event

Appendix B

Data Plots

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER HEAD X-AXIS ACCELERATION

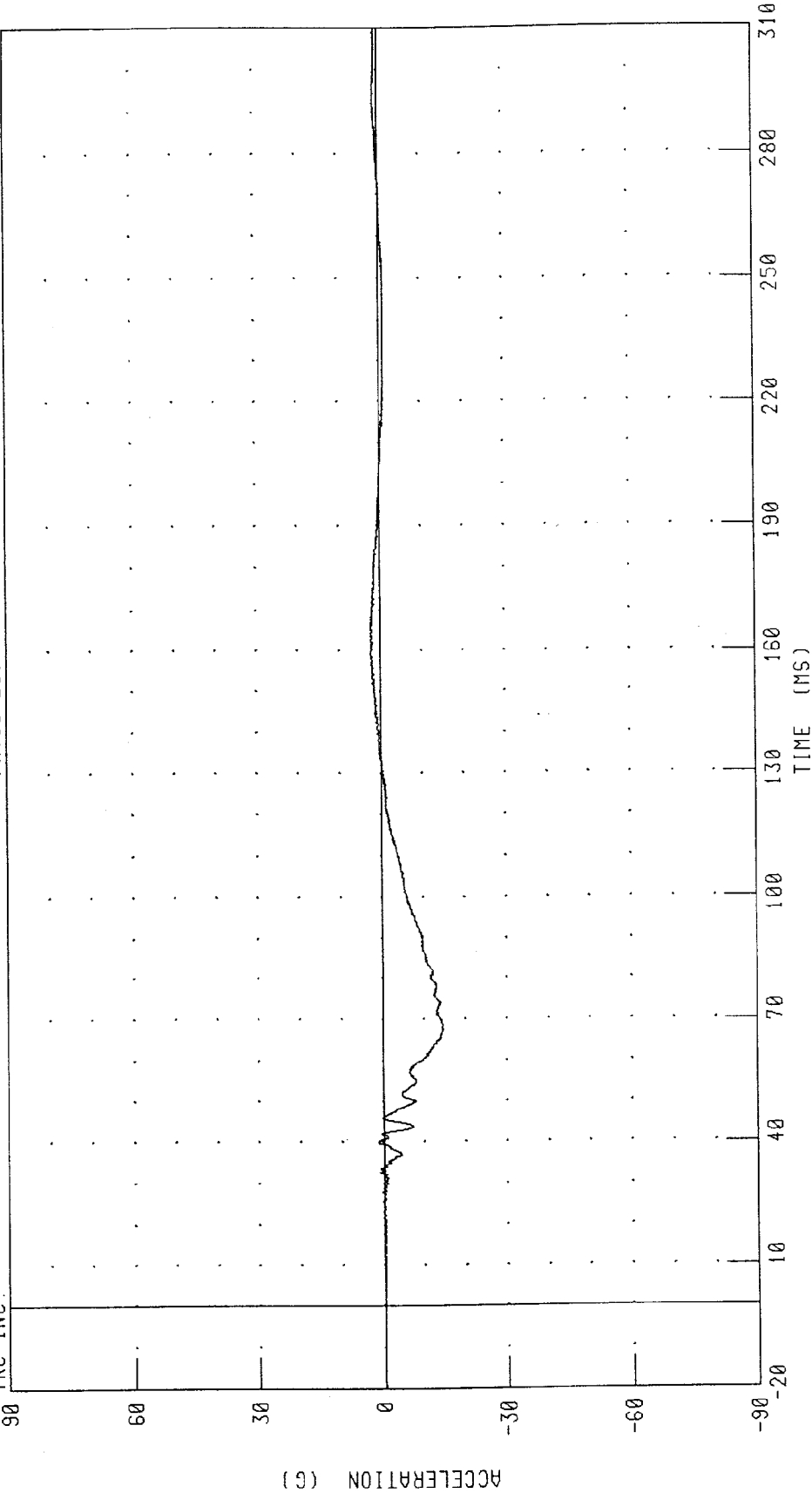


1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER HEAD Y-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 2.28 G @ 162.72 MS; -14.74 G @ 67.52 MS

CHANNEL: HEDYG1 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER HEAD Z-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.

90

60

30

ACCELERATION (G)

-30

-60

-90

-20

10

40

70

100

130

160

190

220

250

280

310

TIME (MS)

PEAK DATA: 6.98 G @ 80.00 MS; -9.09 G @ 78.16 MS

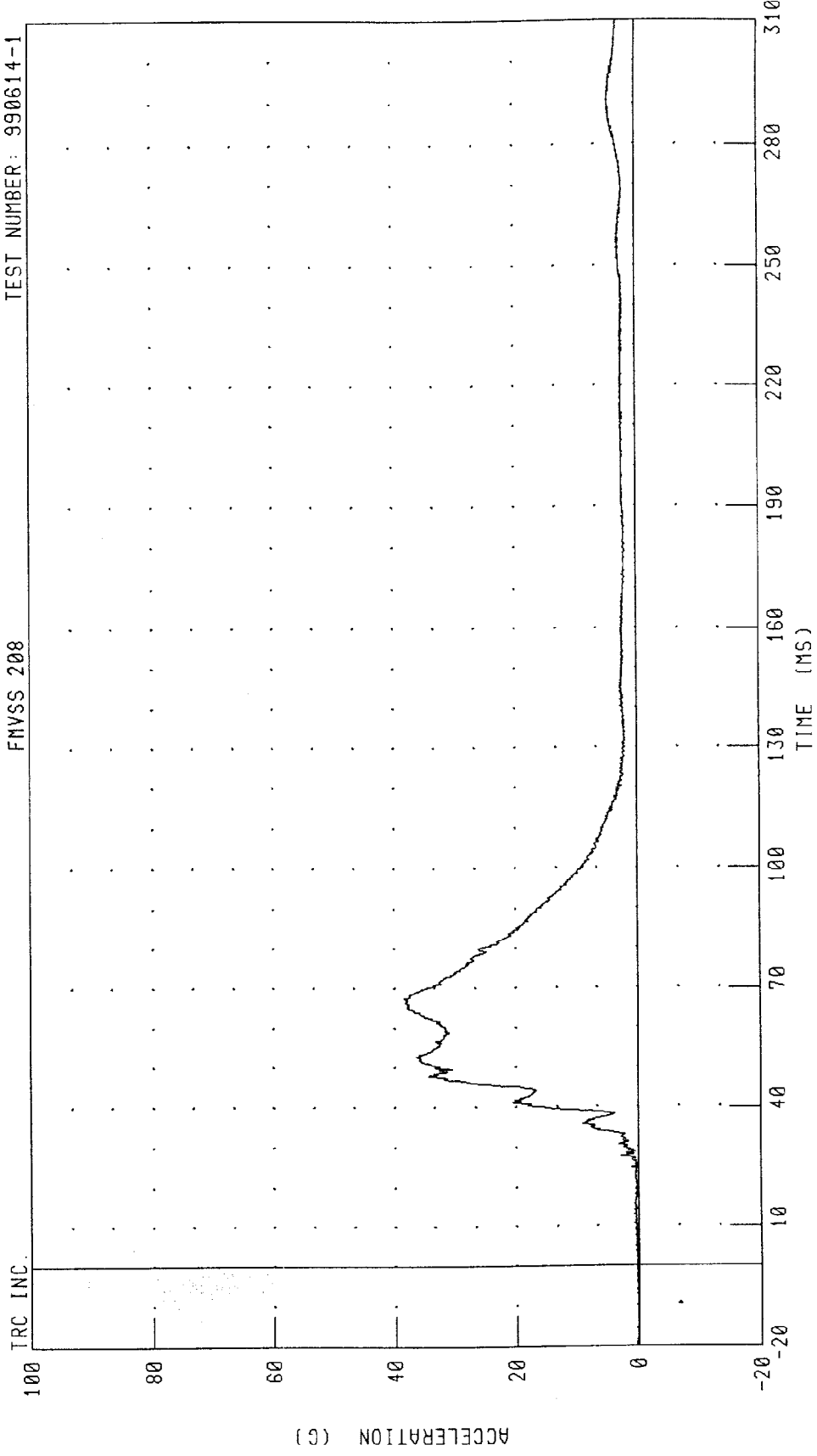
CHANNEL: HEDZG1 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER HEAD RESULTANT ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



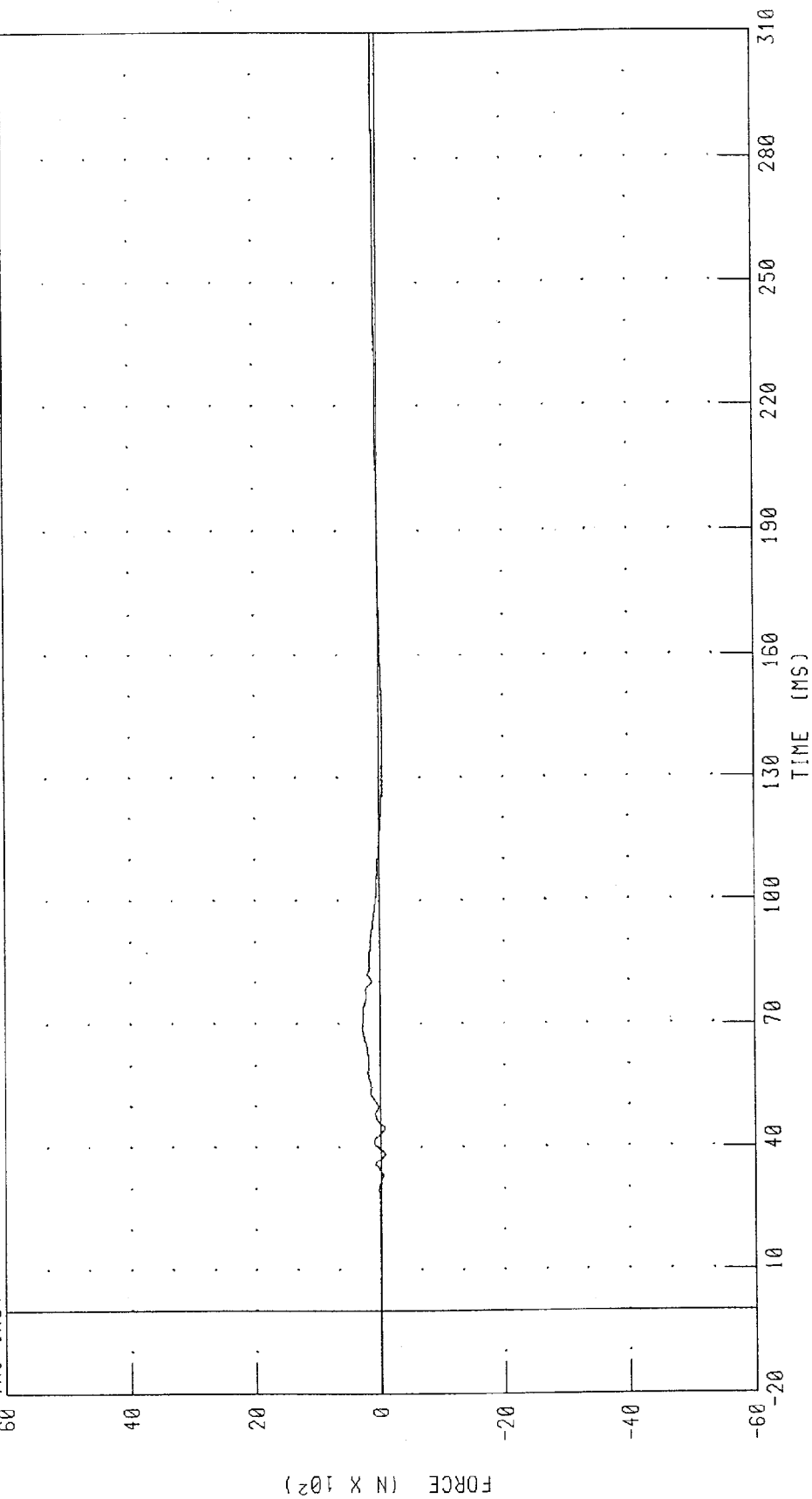
CHANNEL: HEDRC1 FILTER: CH. CLASS 1000 PEAK DATA: 38.40 G @ 67.52 MS; 0.11 G @ -10.32 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK X-AXIS SHEAR FORCE

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: NEKXF1 FILTER: CH. CLASS 1000

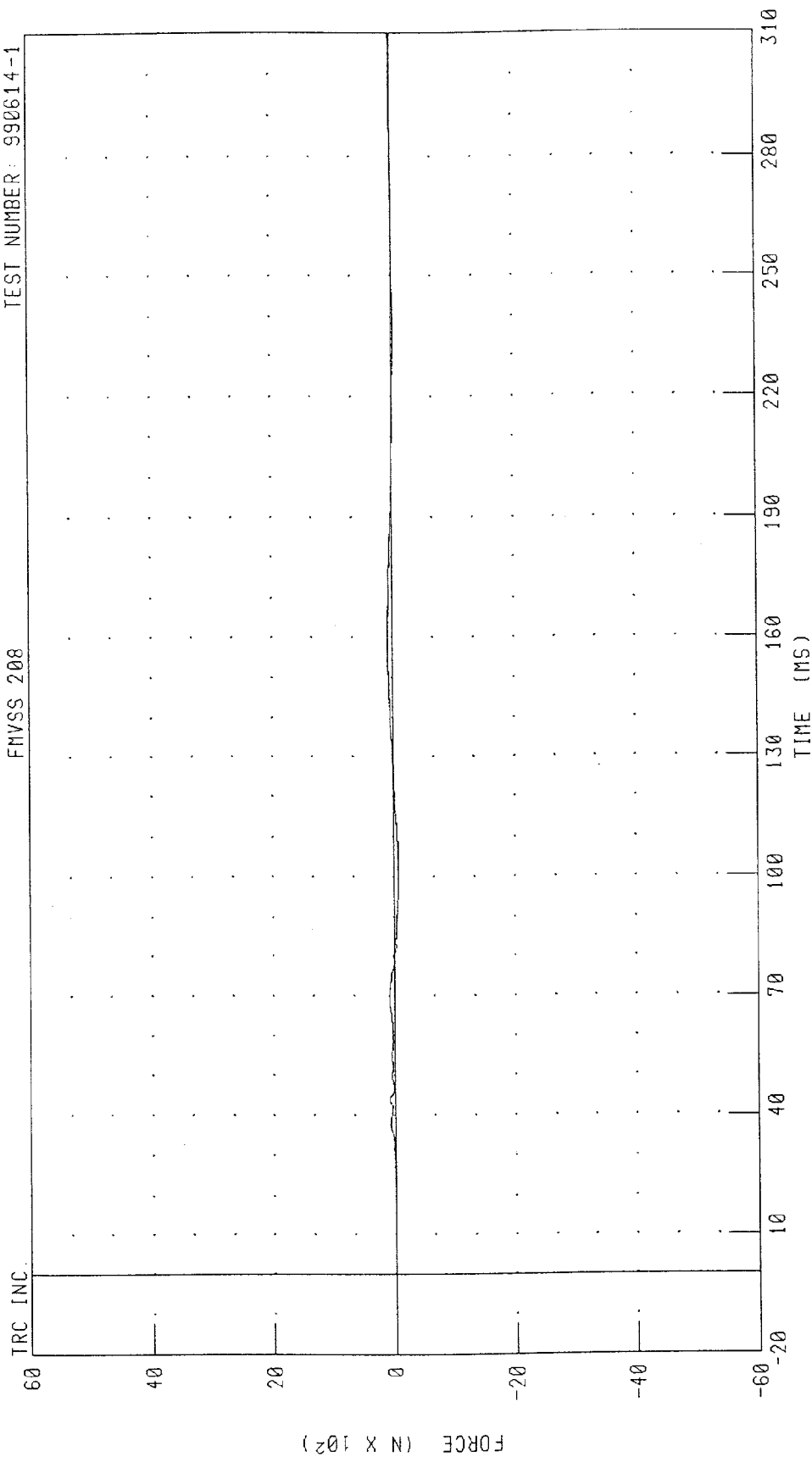
TIME (MS)

PEAK DATA: 277.73 N @ 68.56 MS; -87.37 N @ 38.48 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK Y-AXIS SHEAR FORCE

TEST NUMBER: 990614-1

FHVSS 208



CHANNEL: NEKYF1 FILTER: CH. CLASS 1000

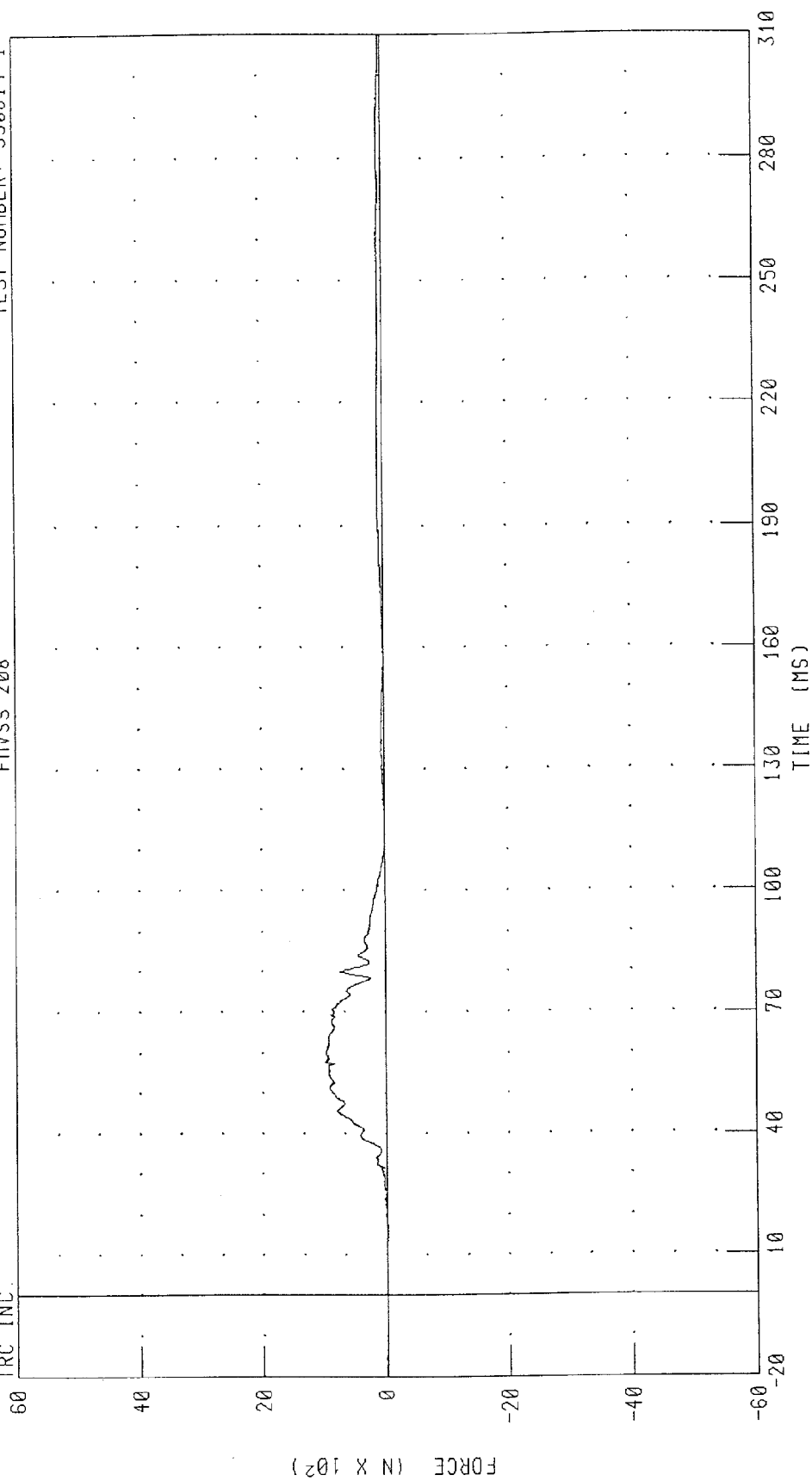
PEAK DATA: 88.86 N @ 70.16 MS; -76.10 N @ 95.76 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK Z-AXIS AXIAL FORCE

TEST NUMBER: 990614-1

FMVSS 208

IRC INC.



PEAK DATA: 990.50 N @ 57.60 MS, -19.79 N @ 13.44 MS

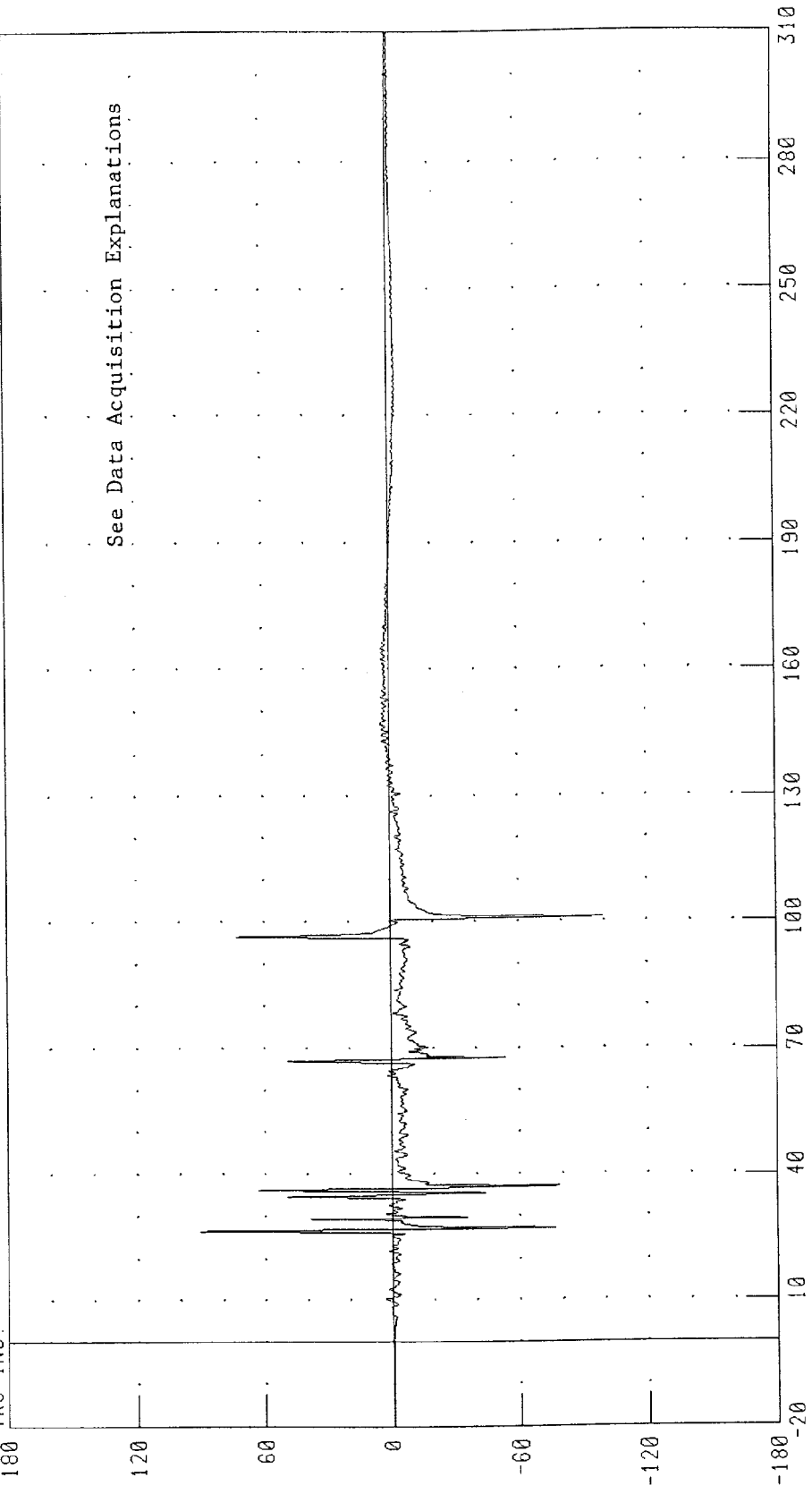
CHANNEL: NEKZF1 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK MOMENT ABOUT X AXIS

TEST NUMBER: 990614-1

FMYSS 208

TRC INC.



PEAK DATA: 90.83 N-M @ 26.56 MS; -99.37 N-M @ 101.04 MS

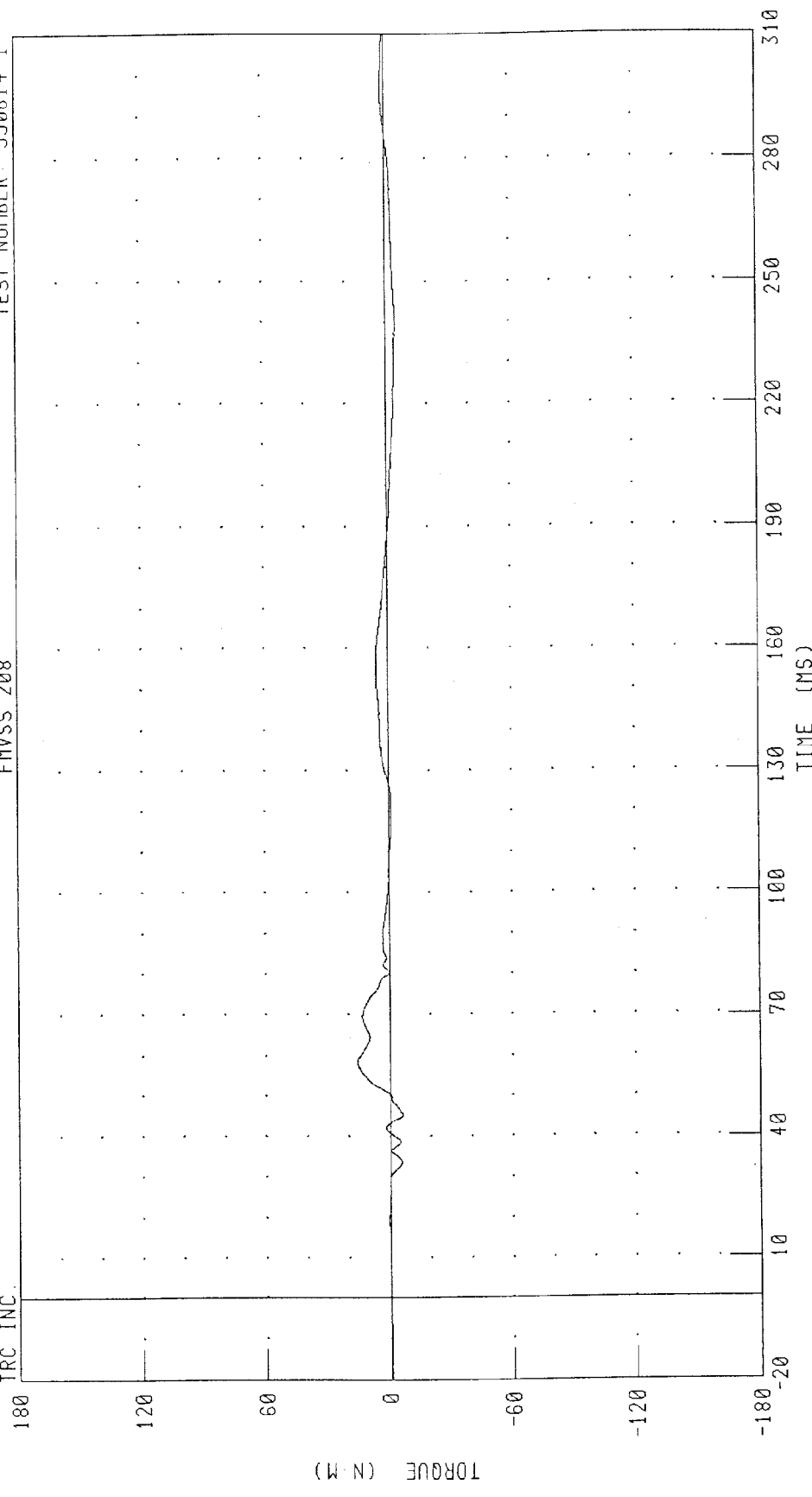
CHANNEL: NEKX11 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK MOMENT ABOUT Y AXIS

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 15.68 N-M @ 58.72 MS, -6.51 N-M @ 45.28 MS

FILTER: CH. CLASS 600

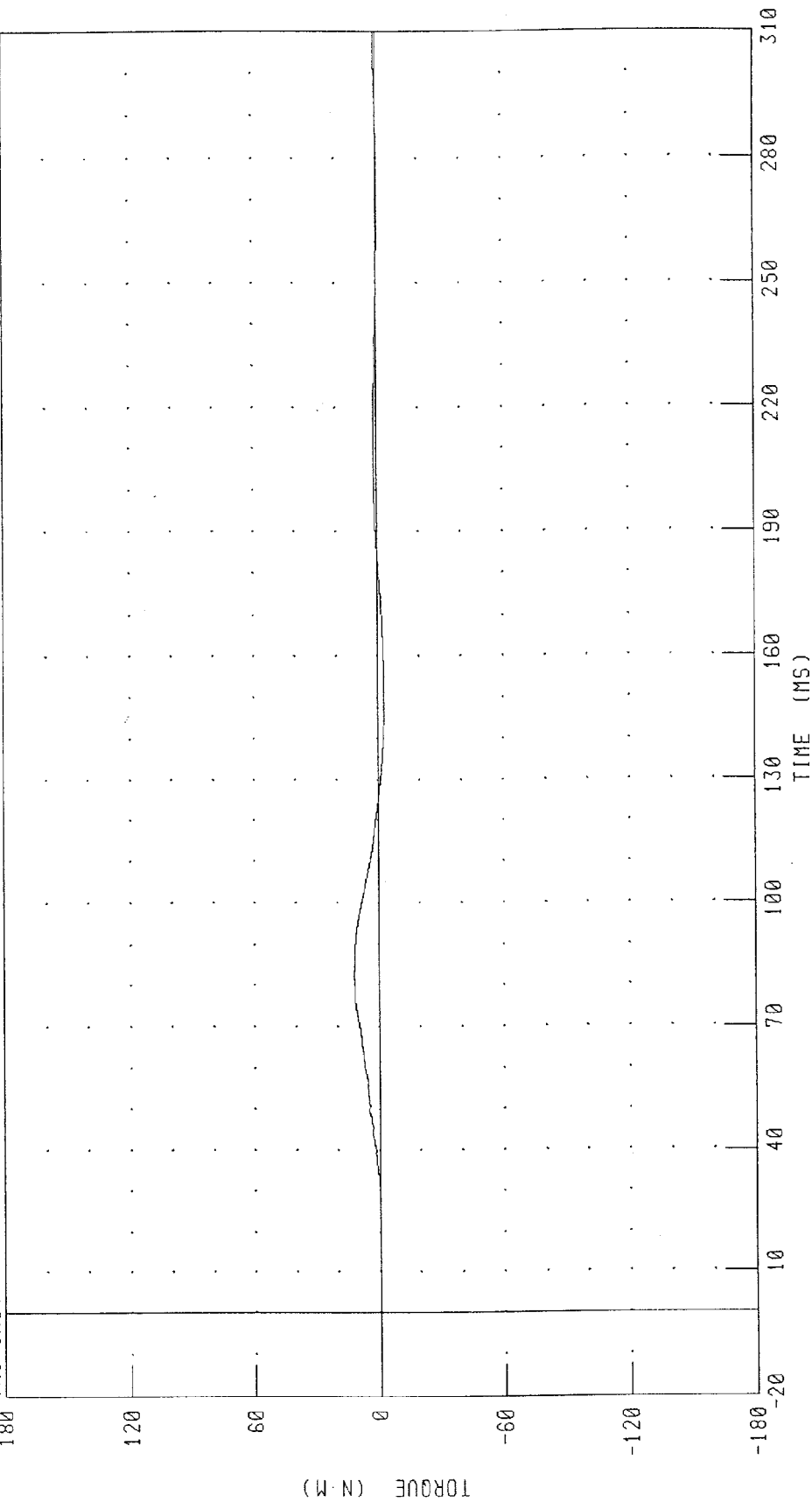
CHANNEL: NEKYH1

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK MOMENT ABOUT Z AXIS

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 11.86 N-M @ 82.24 MS, -3.30 N-M @ 152.08 MS

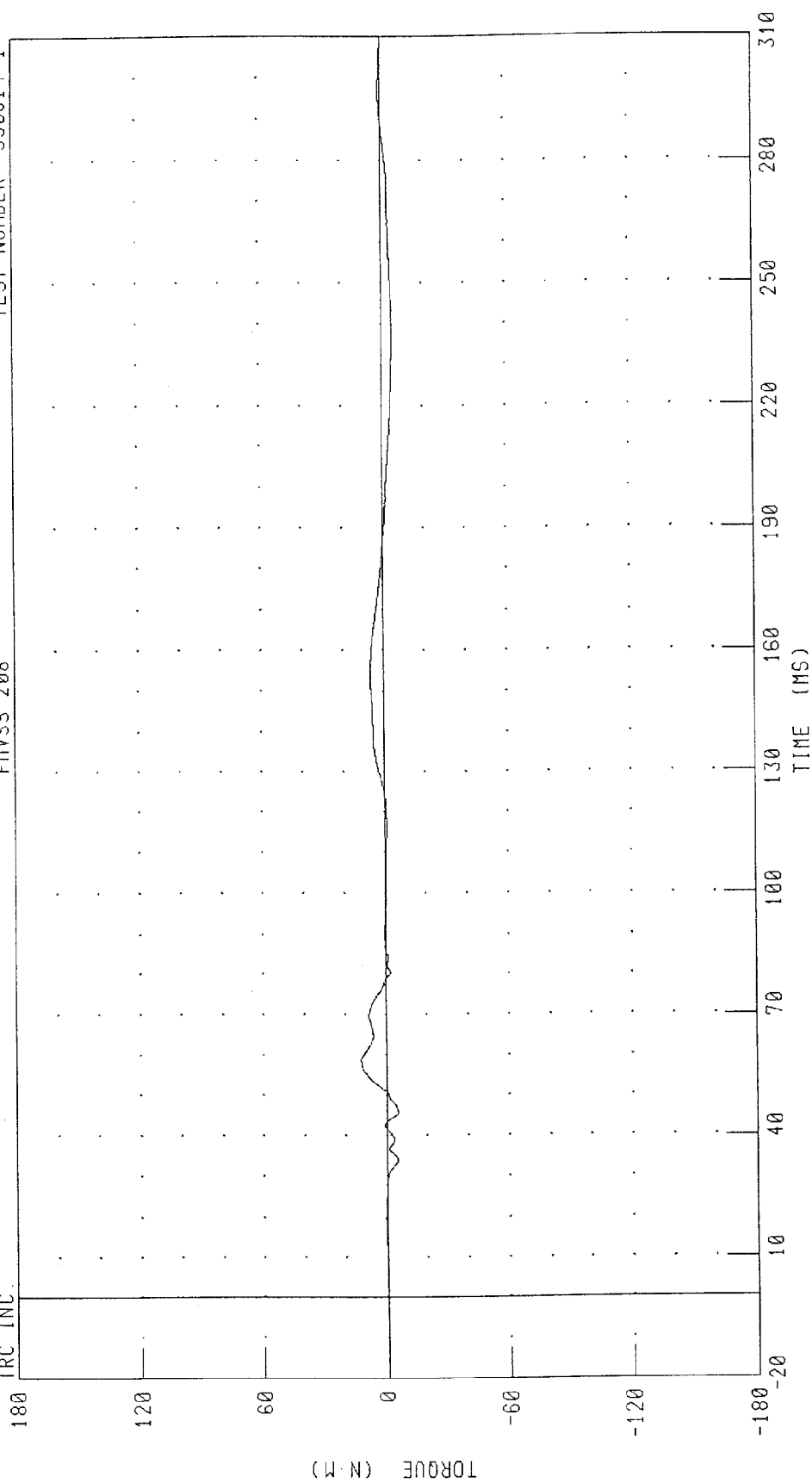
CHANNEL: NEKZM1 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER NECK OCCIPITAL CONDYLE

TEST NUMBER: 990614-1

FHVSS 208

TRC INC.



PEAK DATA: 12.31 N-M @ 58.80 MS; -5.75 N-M @ 45.68 MS

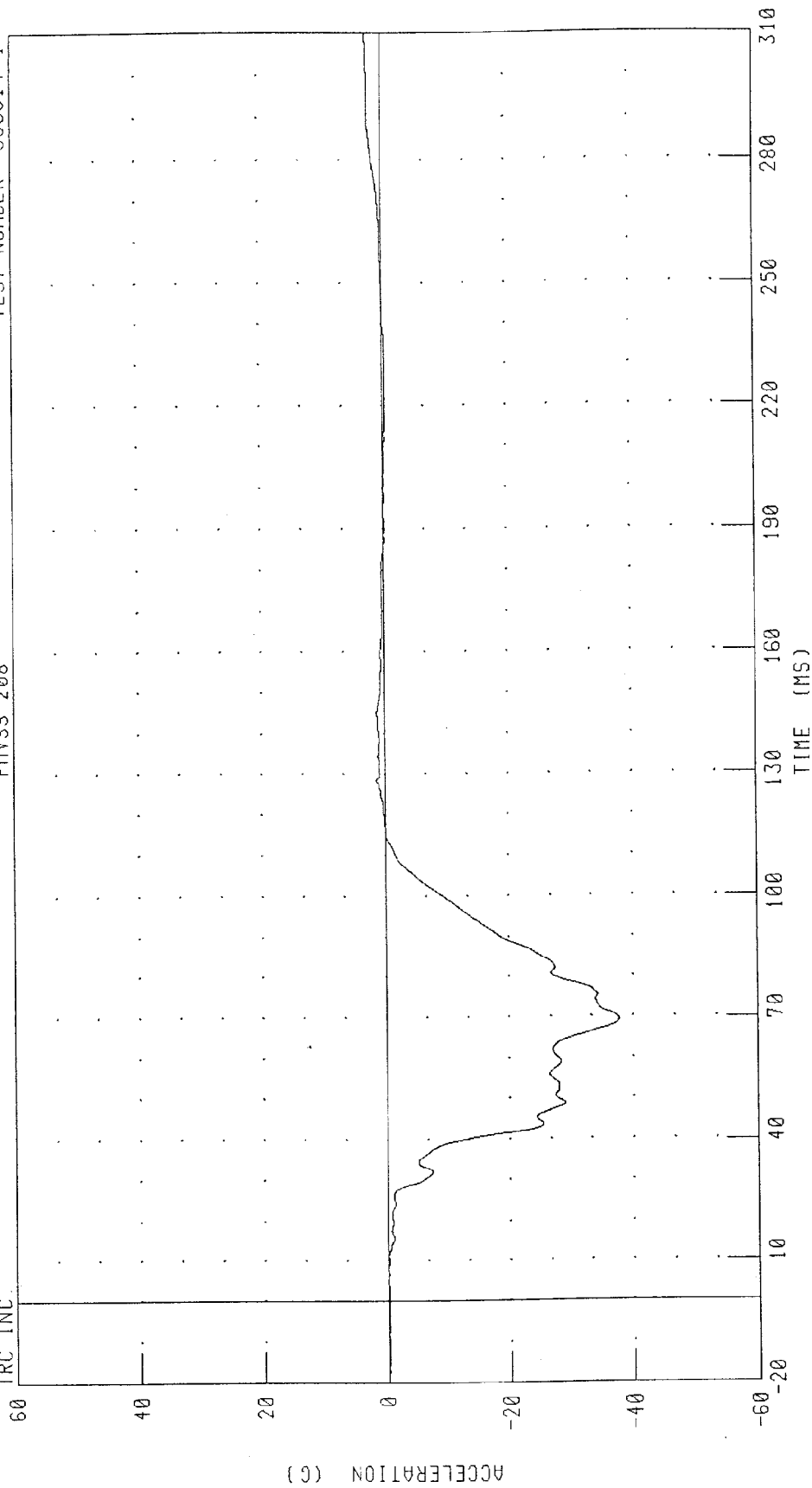
CHANNEL: NEKOM1 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER CHEST X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTXC1 FILTER: CH. CLASS 180

PEAK DATA: 2.48 G @ 309.44 MS, -37.78 G @ 69.36 MS

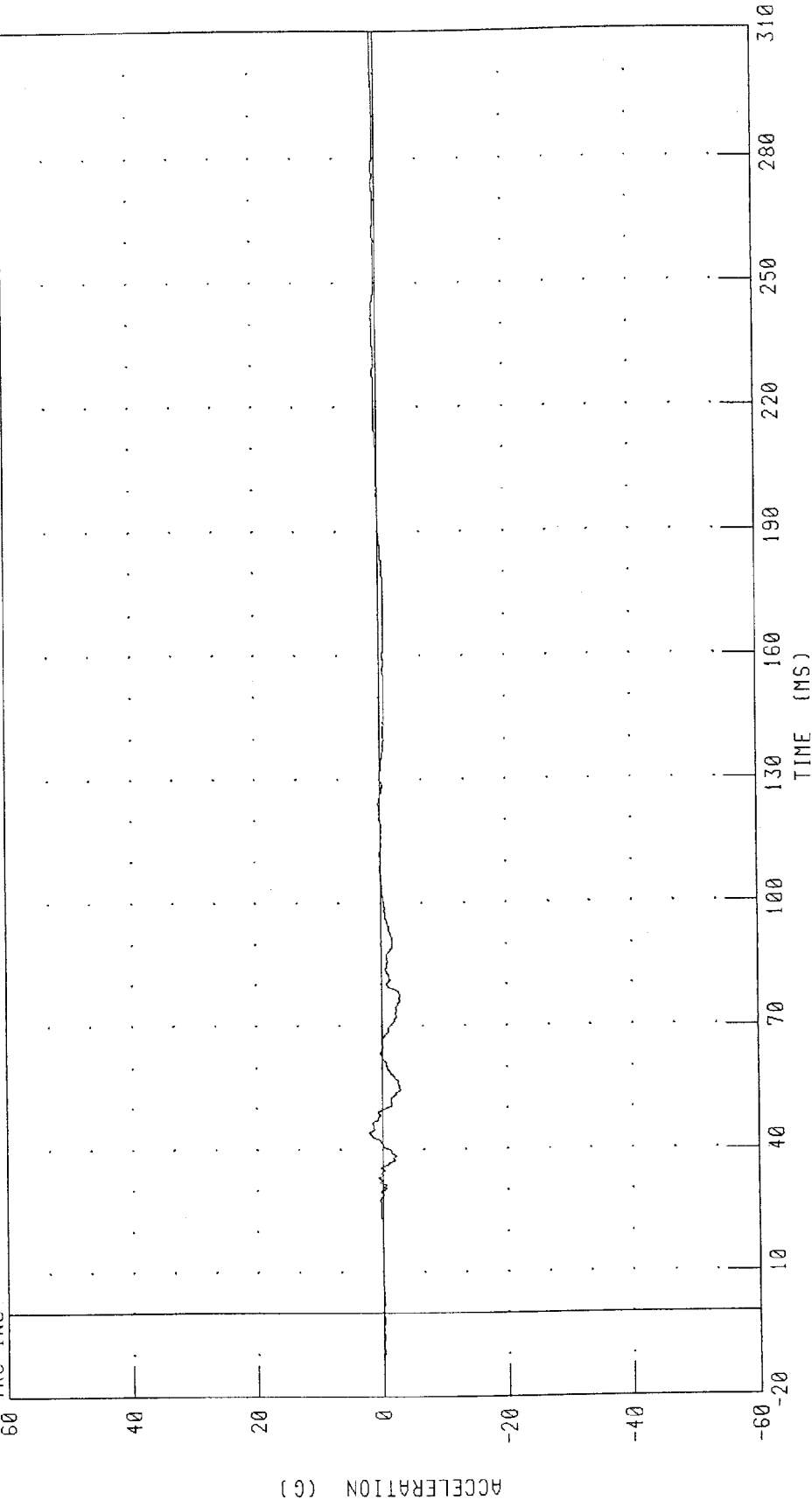
1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH

DRIVER CHEST Y-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC



CHANNEL: CSTYG1 FILTER: CH. CLASS 180

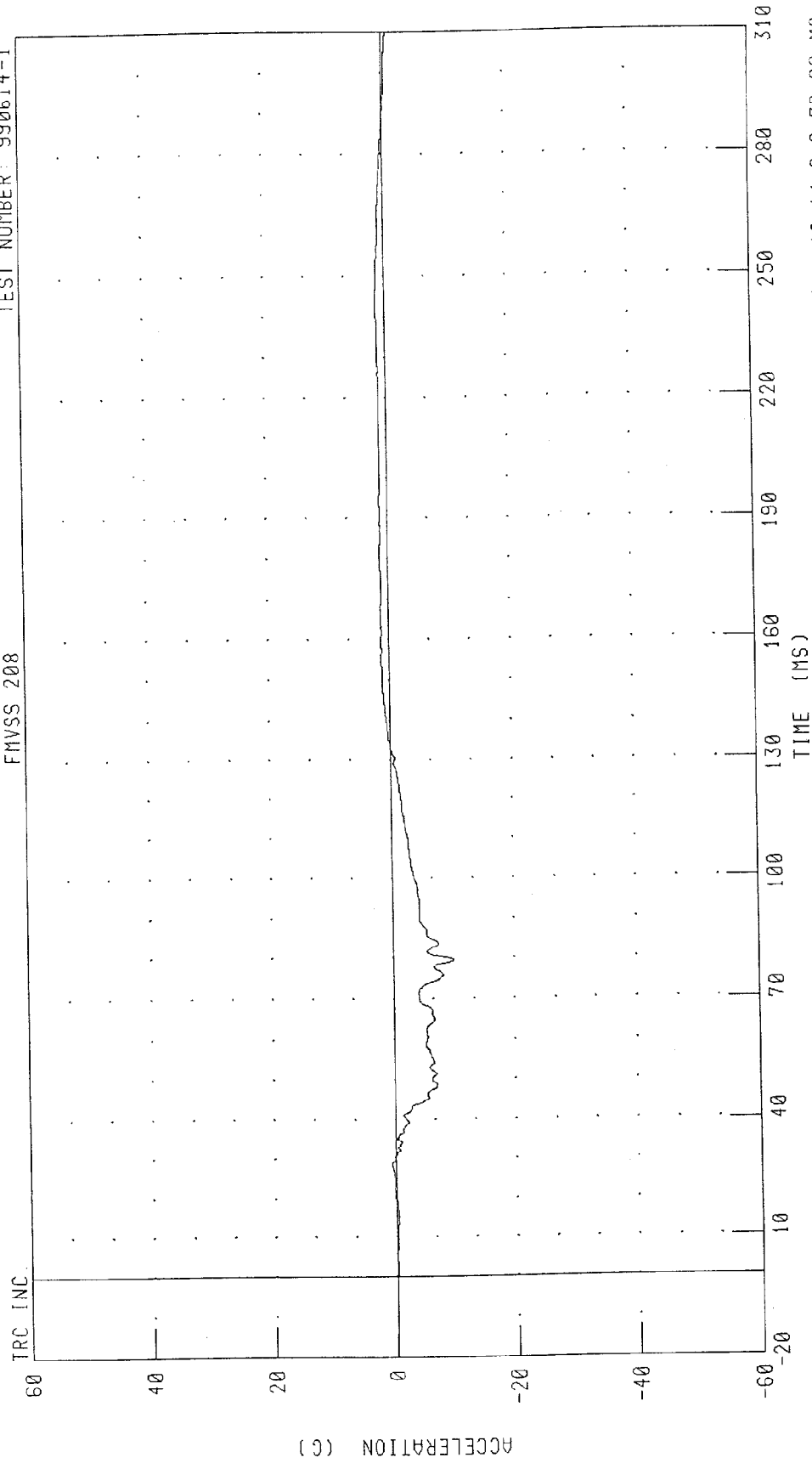
PEAK DATA: 2.06 G @ 44.24 MS, -3.01 G @ 77.52 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER CHEST Z-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 1.40 G @ 241.92 MS, -10.14 G @ 79.60 MS

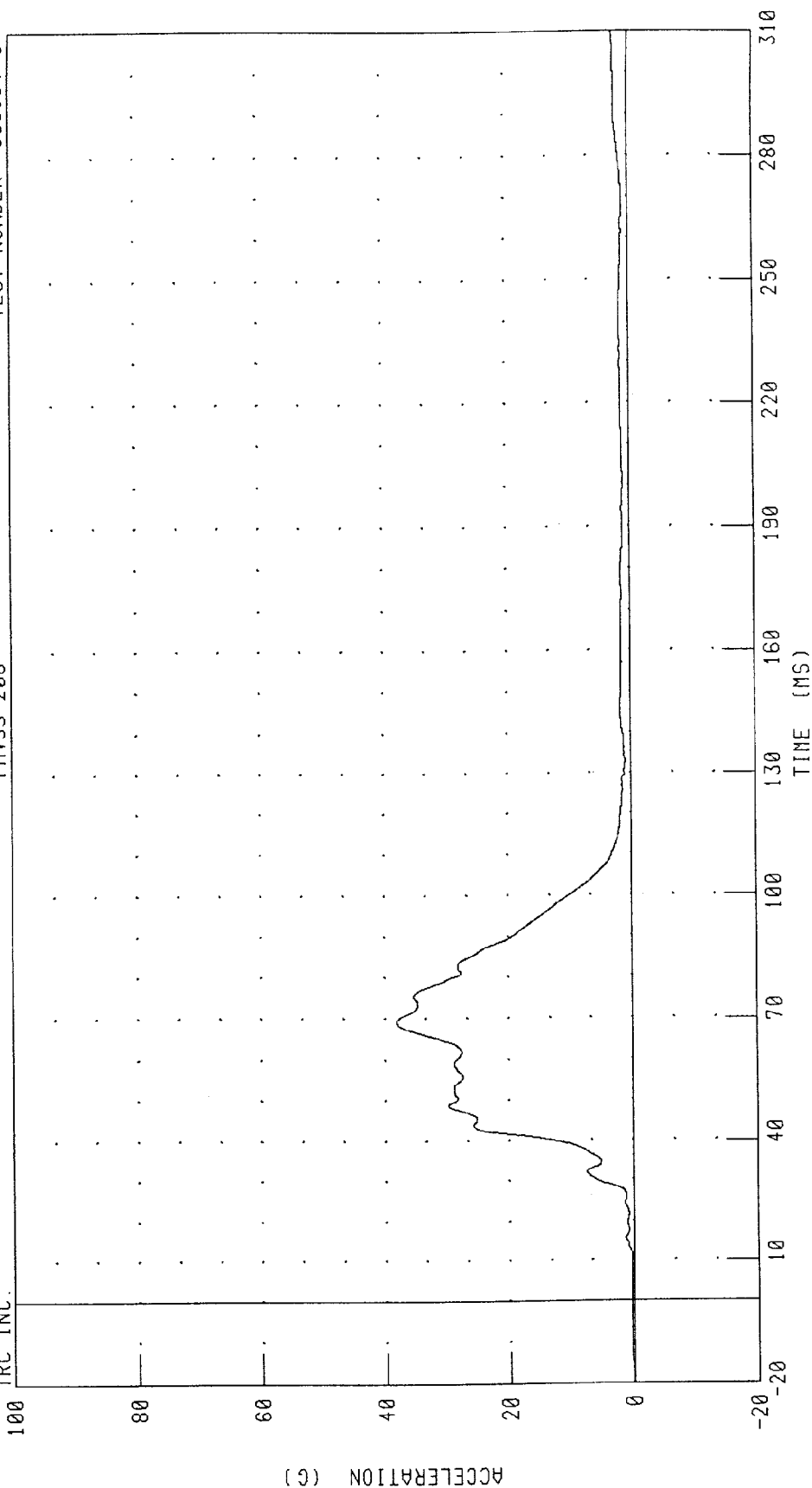
CHANNEL: CSTZC1 FILTER: CH. CLASS 180

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER CHEST RESULTANT ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTRG1 FILTER: CH. CLASS 180

PEAK DATA: 38.05 G @ 69.36 MS; 0.01 G @ -20.00 MS

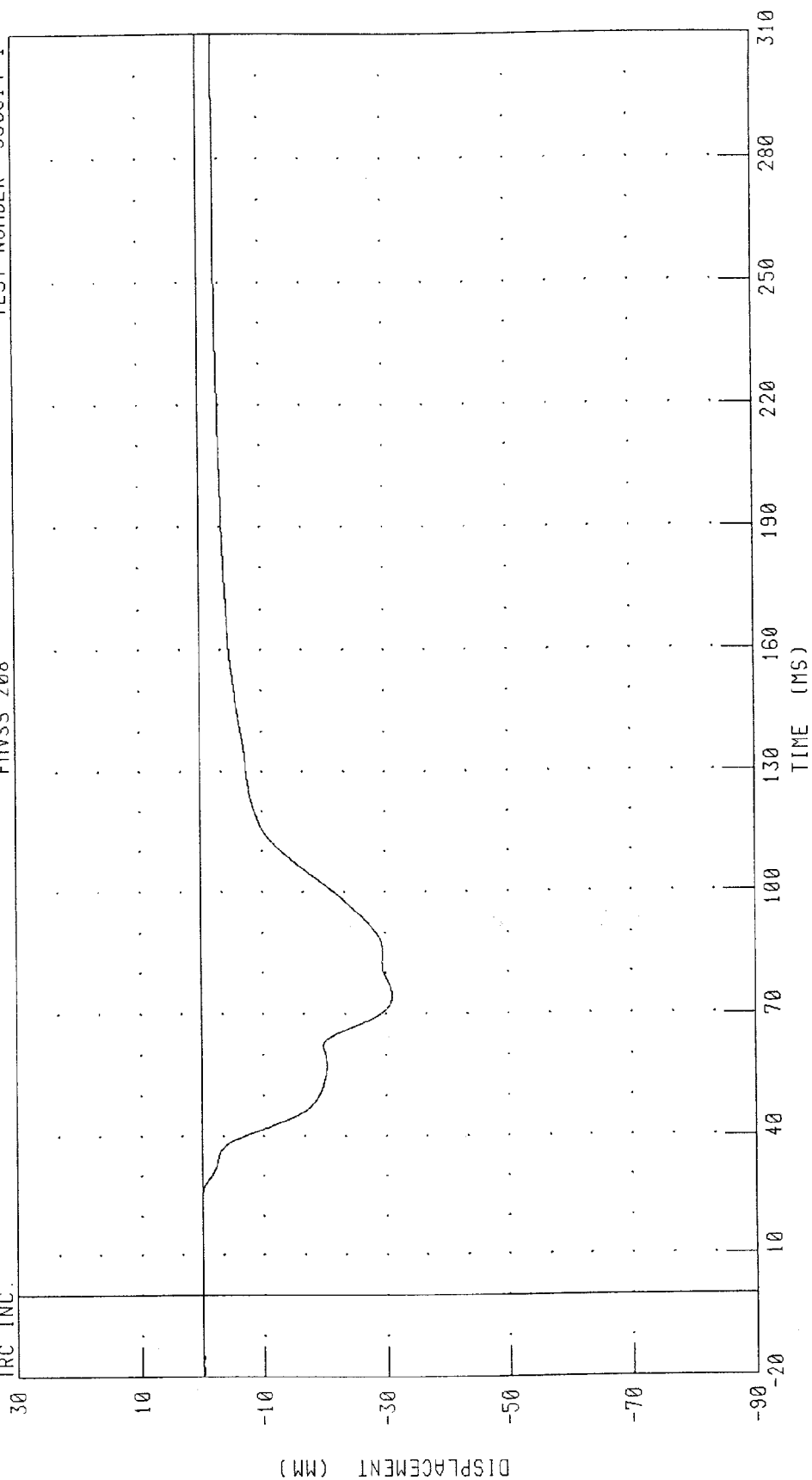
1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH

DRIVER CHEST DEFLECTION

FMVSS 208

TEST NUMBER: 990614-1

TRC INC.



CHANNEL: CSTXD1 FILTER: CH. CLASS 180

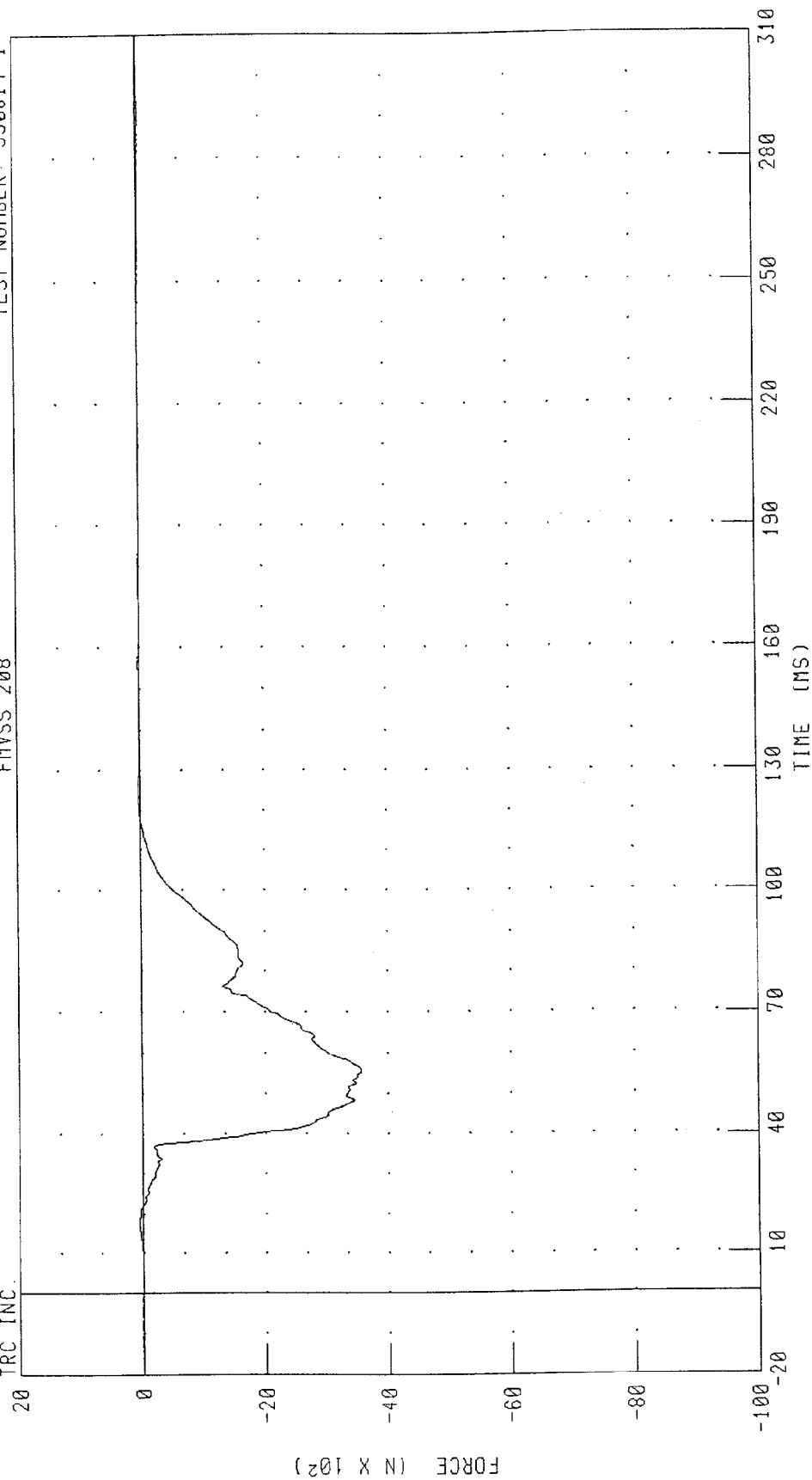
PEAK DATA: 0.06 MM @ 18.56 MS; -31.10 MM @ 74.56 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER LEFT FEMUR FORCE

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: LFMF1 FILTER: CH. CLASS 600

PEAK DATA: 58.32 N @ 16.48 MS; -3565.58 N @ 55.36 MS

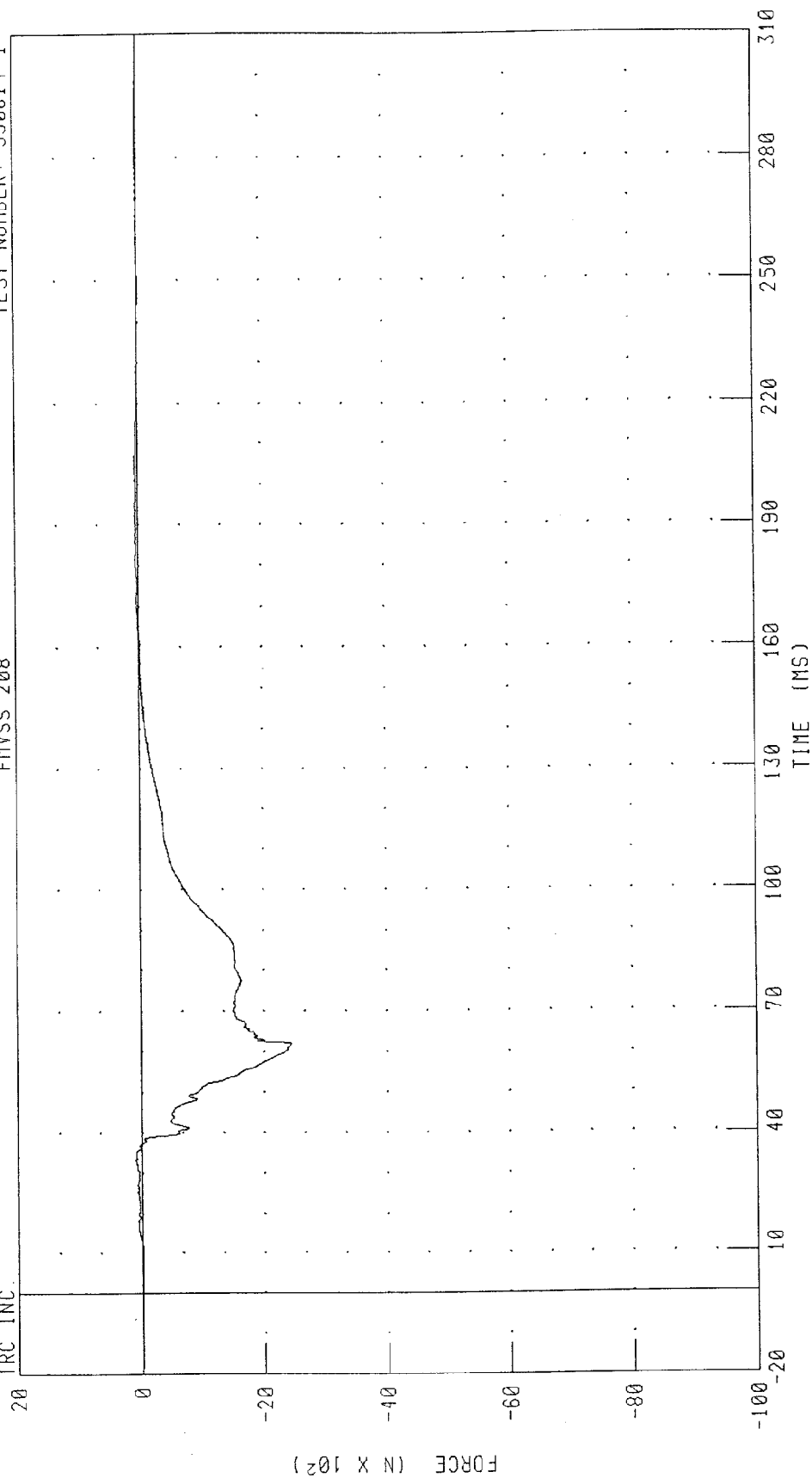
1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH

DRIVER RIGHT FEMUR FORCE

FMVSS 208

TEST NUMBER: 990614-1

TRC INC.



PEAK DATA: 101.70 N @ 33.36 MS; -2445.11 N @ 62.00 MS

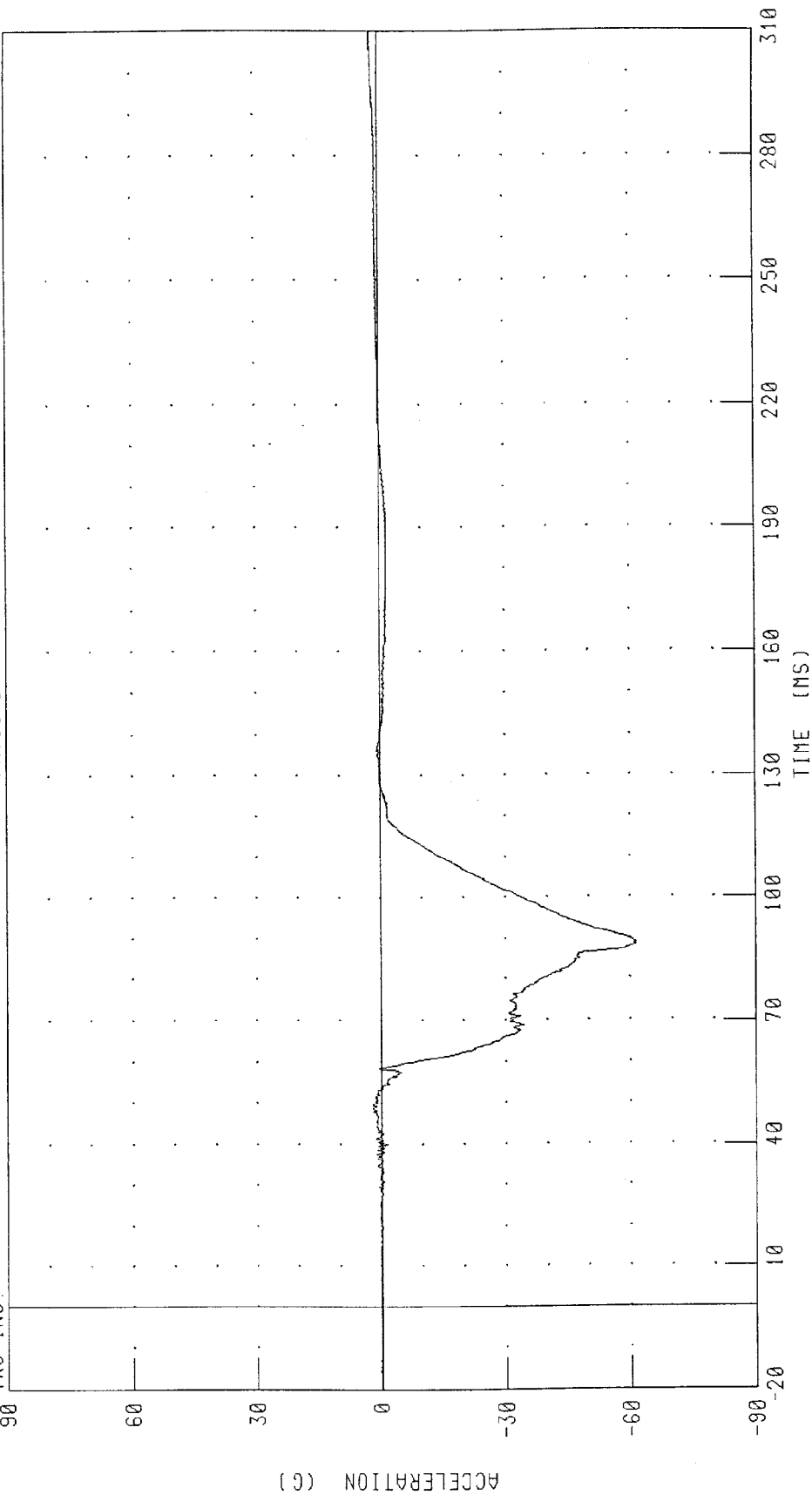
CHANNEL: RFMF1 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 2.19 G @ 48.72 MS; -61.41 G @ 88.56 MS

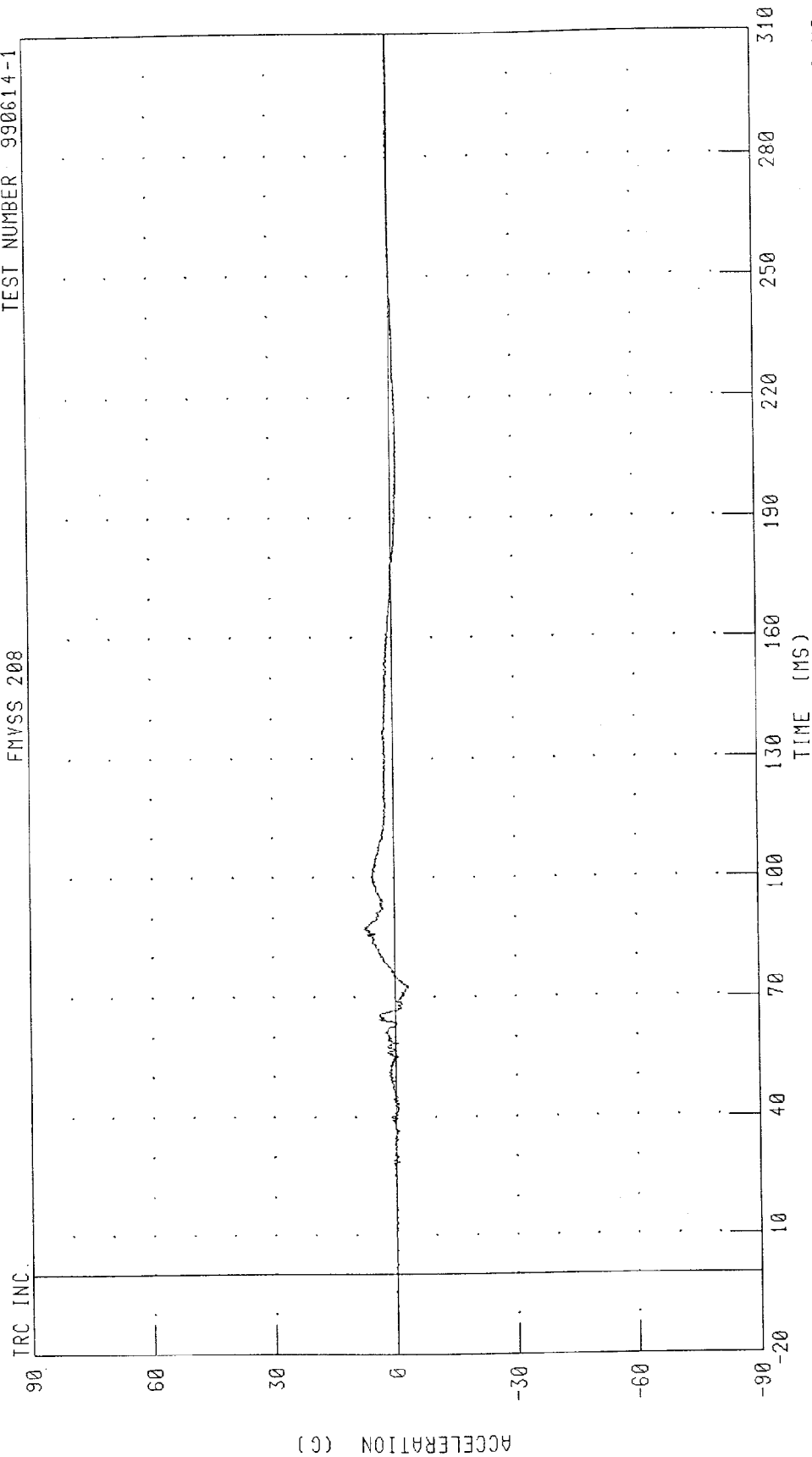
CHANNEL: HEDXC2 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 7.48 G @ 87.12 MS, -3.50 G @ 72.40 MS

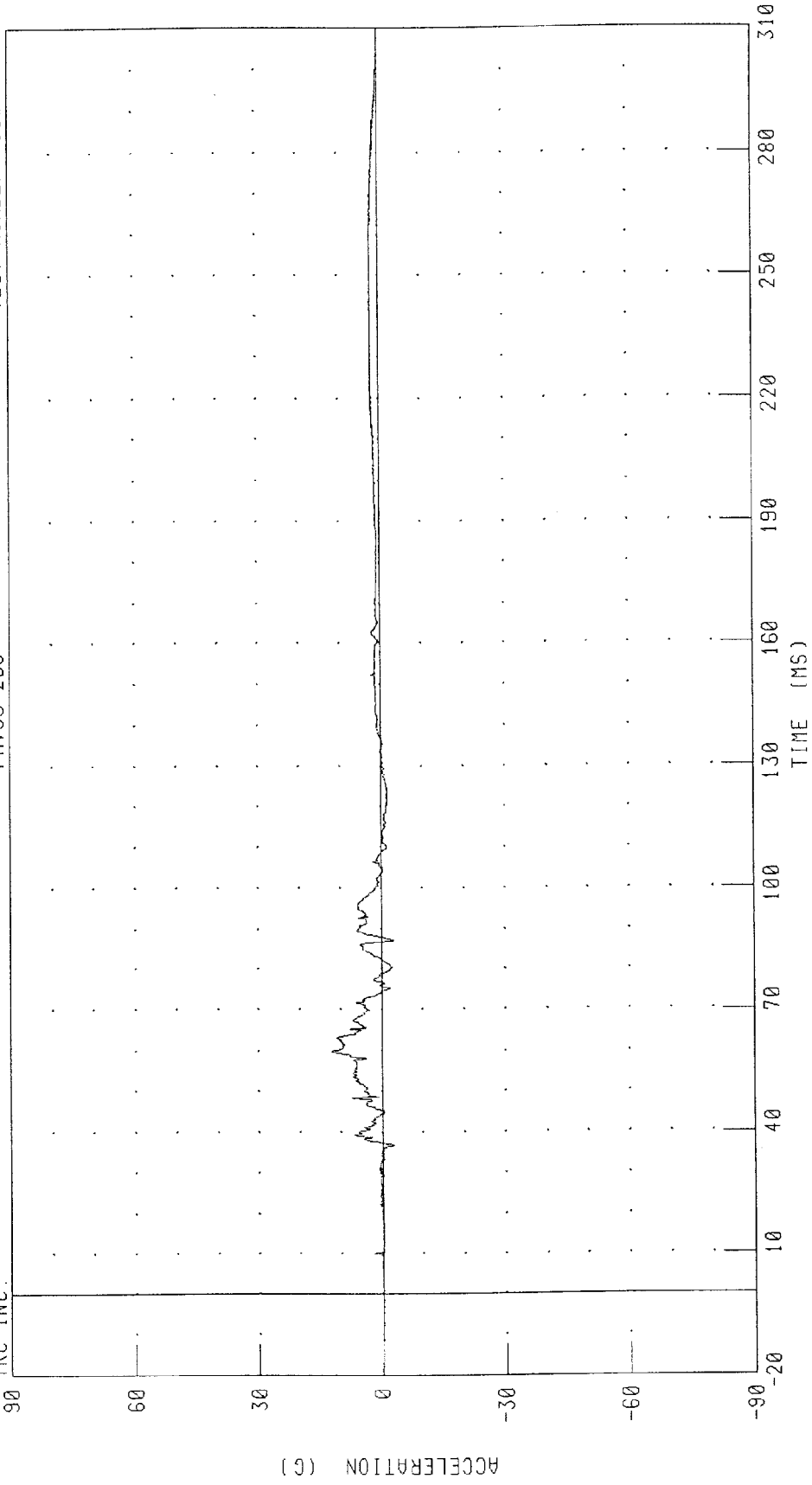
CHANNEL: HEDYG2 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: HEDZG2 FILTER: CH. CLASS 1000

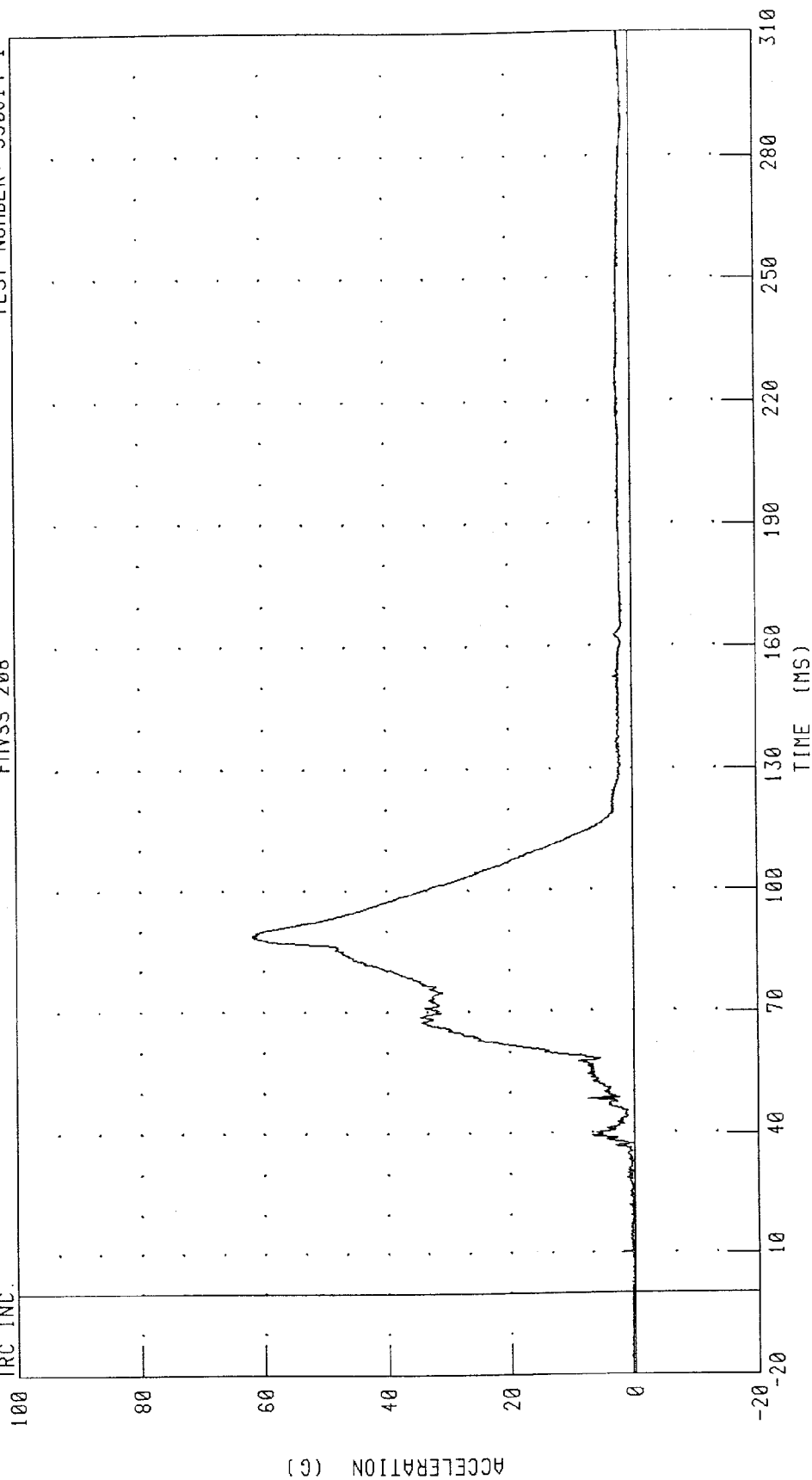
PEAK DATA: 12.16 G @ 59.92 MS, -3.02 G @ 87.20 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 61.80 G @ 89.04 MS, 0.11 G @ 18.80 MS

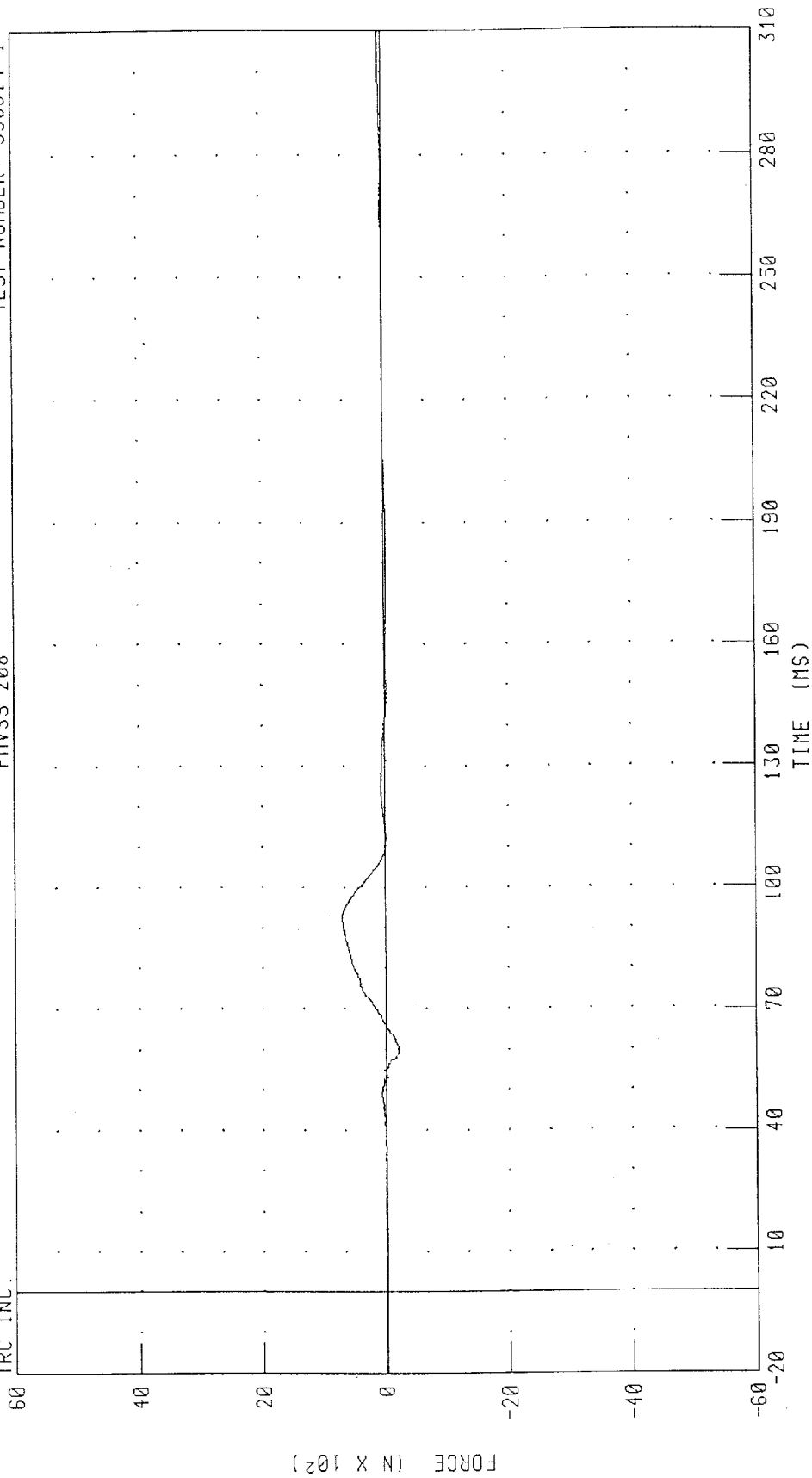
CHANNEL: HEDRG2 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK X-AXIS SHEAR FORCE

TEST NUMBER: 990814-1

FMVSS 208

TRC INC.



PEAK DATA: 707.12 N @ 91.92 MS, -213.37 N @ 59.44 MS

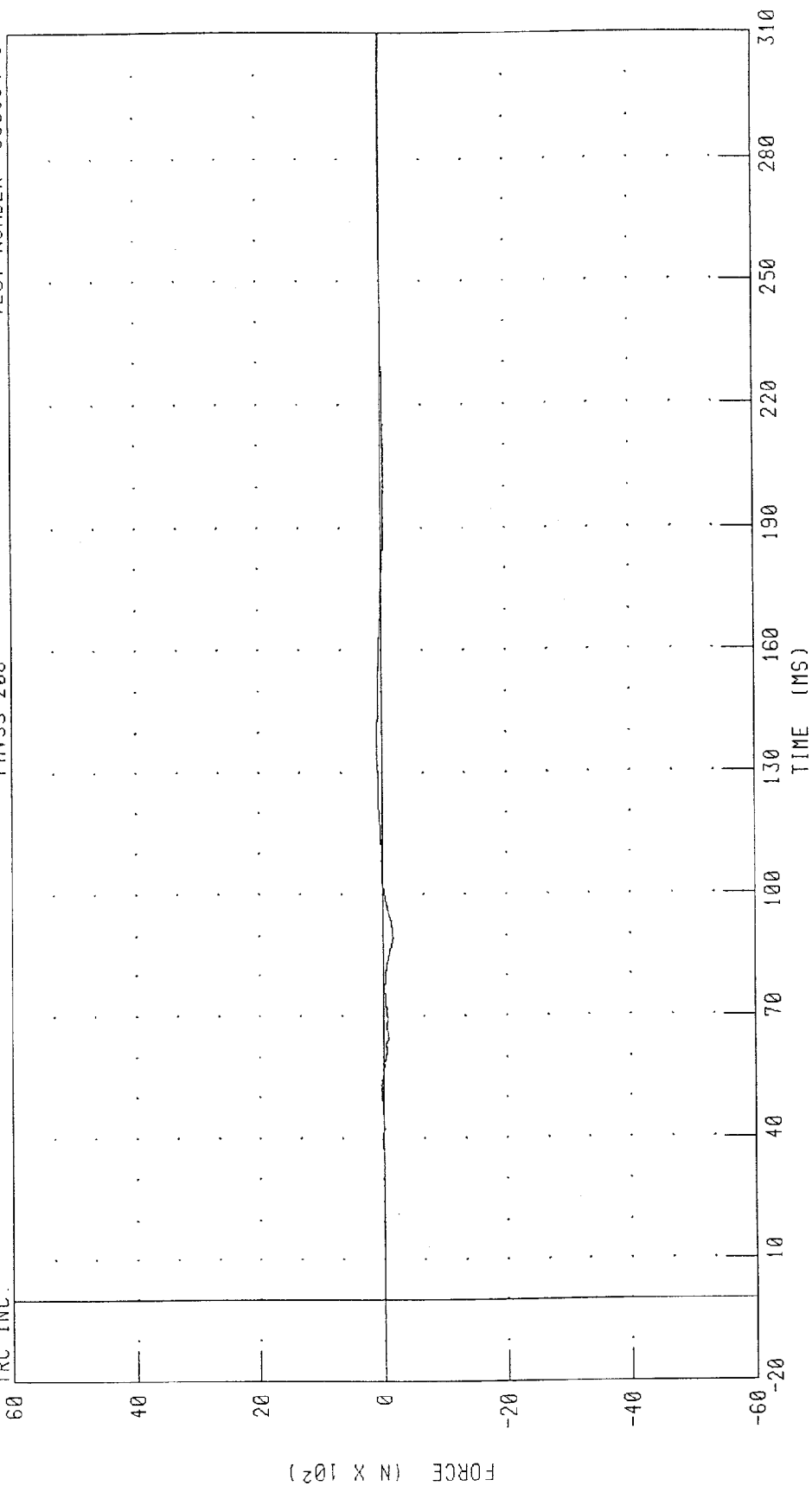
CHANNEL: NEKXF2 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK Y-AXIS SHEAR FORCE

TEST NUMBER: 990614-1

FMVSS 208

IRC INC.



PEAK DATA: 75.40 N @ 134.40 MS, -172.32 N @ 89.52 MS

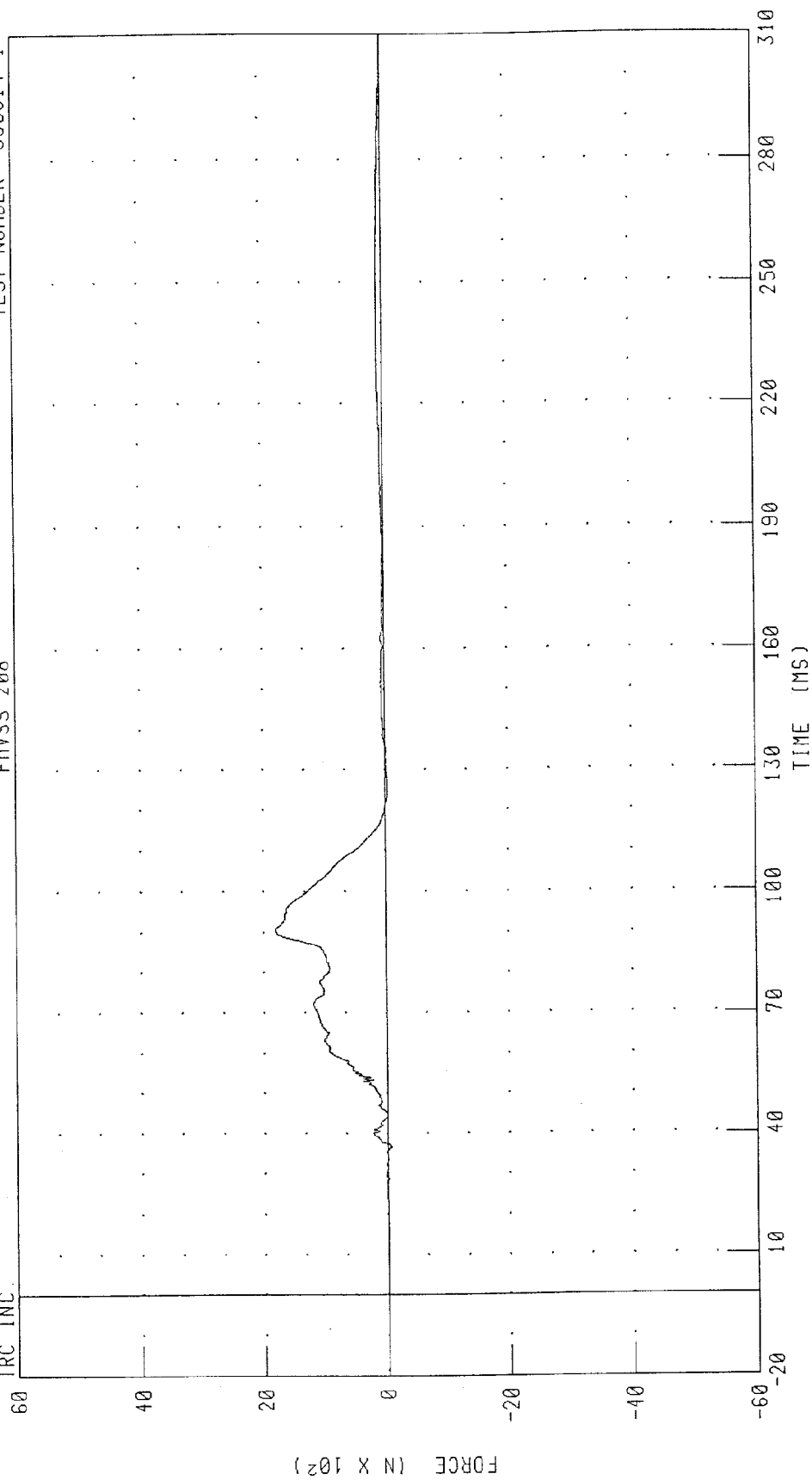
CHANNEL: NEKYF2 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK Z-AXIS AXIAL FORCE

TEST NUMBER: 990614-1

FMVSS 208

IRC INC.



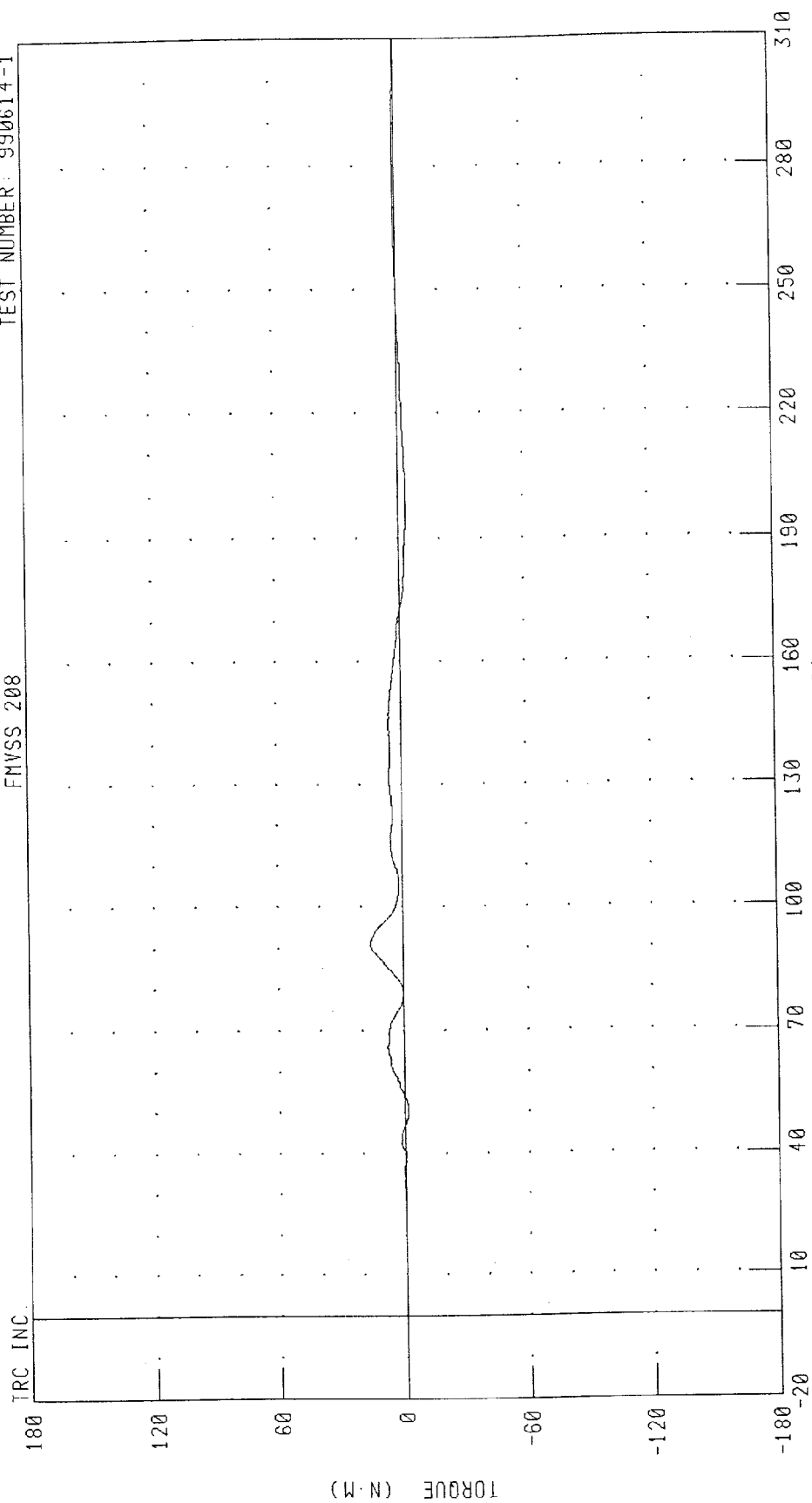
PEAK DATA: 1802.44 N @ 90.24 MS; -67.08 N @ 36.72 MS

CHANNEL: NEKZF2 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK MOMENT ABOUT X AXIS

TEST NUMBER: 990614-1

FMVSS 208



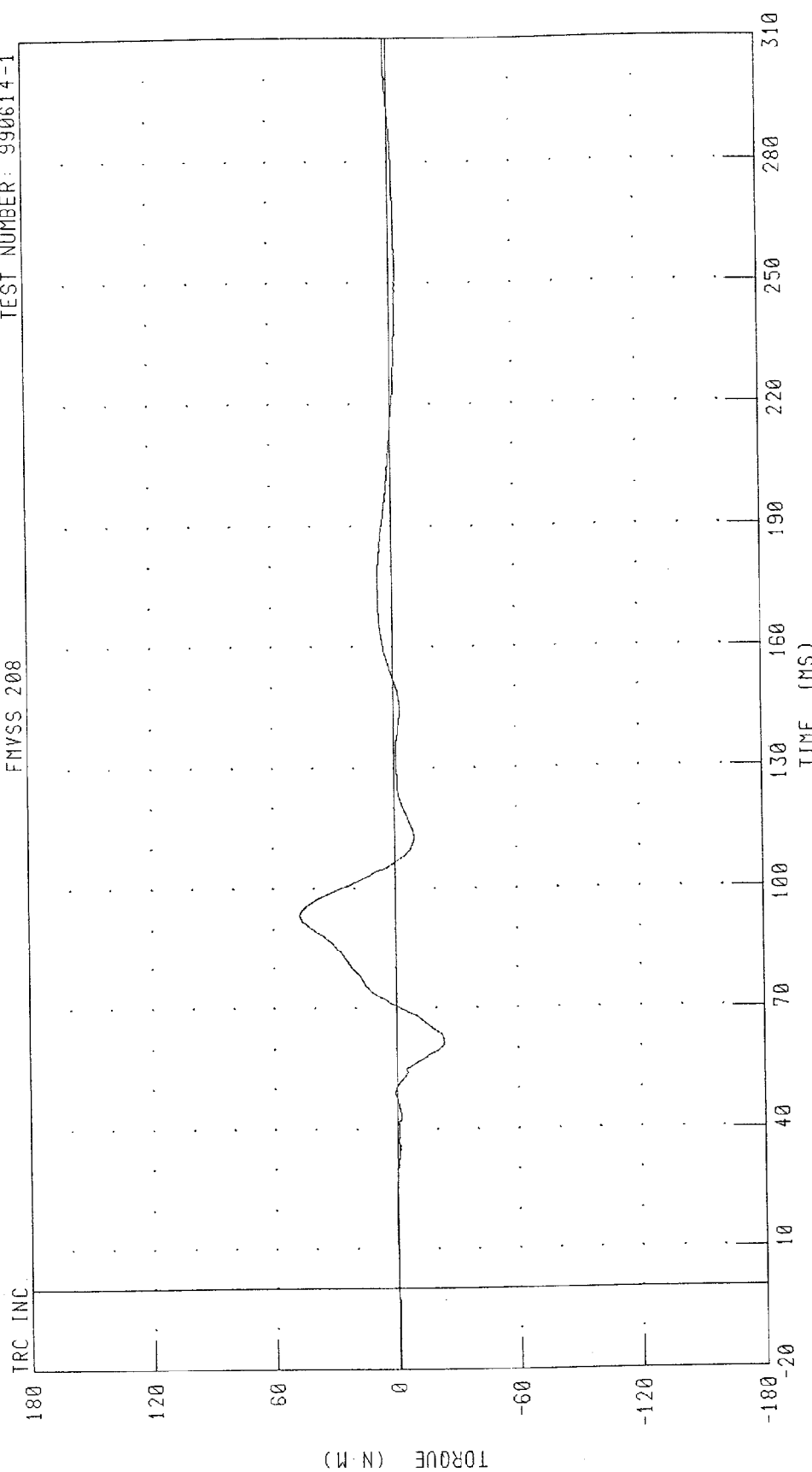
PEAK DATA: 15.57 N·M @ 91.28 MS, -3.88 N·M @ 196.80 MS

CHANNEL: NEKXN2 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK MOMENT ABOUT Y AXIS

TEST NUMBER: 990614-1

FMVSS 208



PEAK DATA: 46.93 N-M @ 93.44 MS, -23.86 N-M @ 61.76 MS

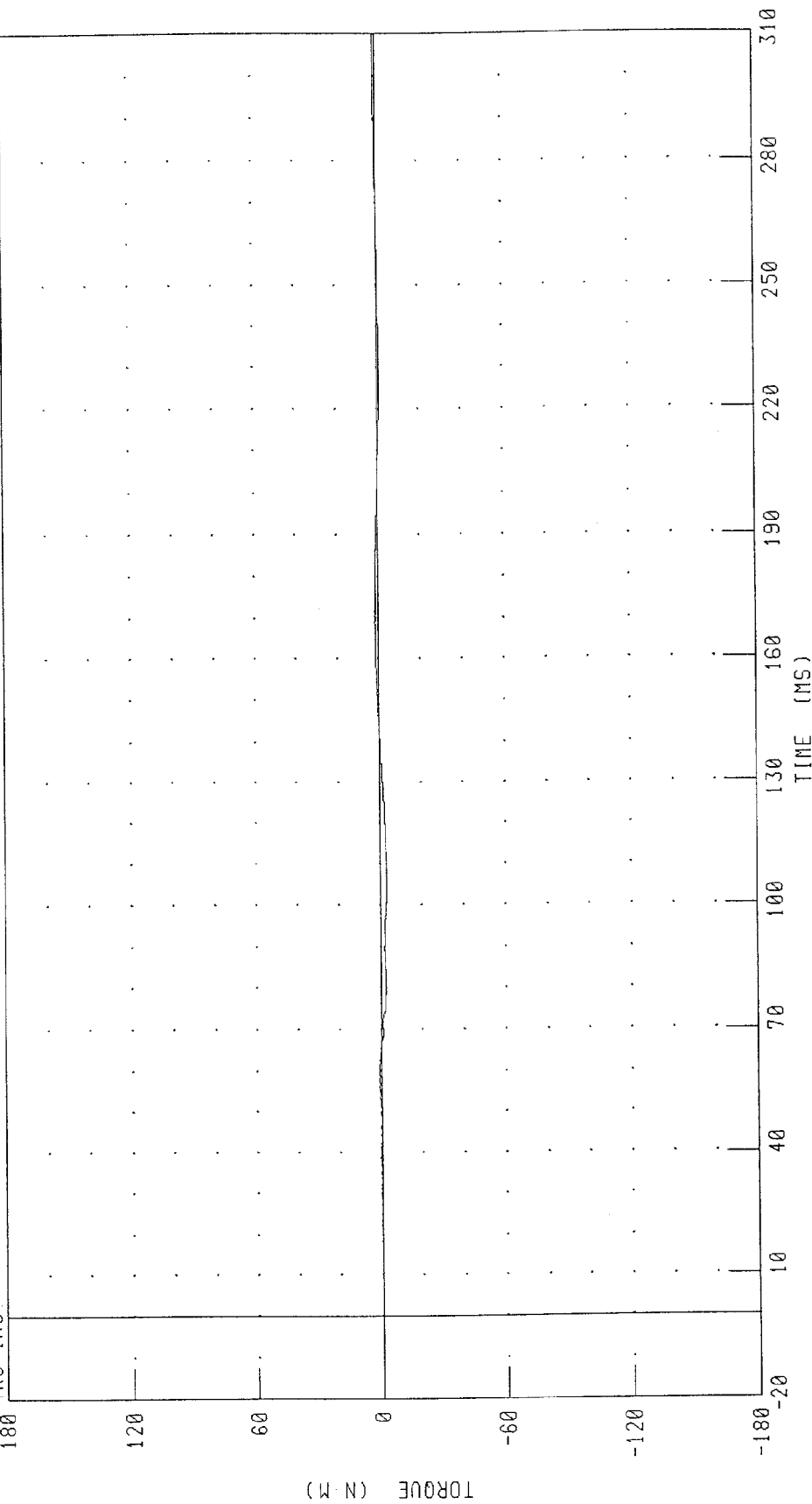
CHANNEL: NEKYN2 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK MOMENT ABOUT Z AXIS

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: NEKZM2 FILTER: CH. CLASS 600

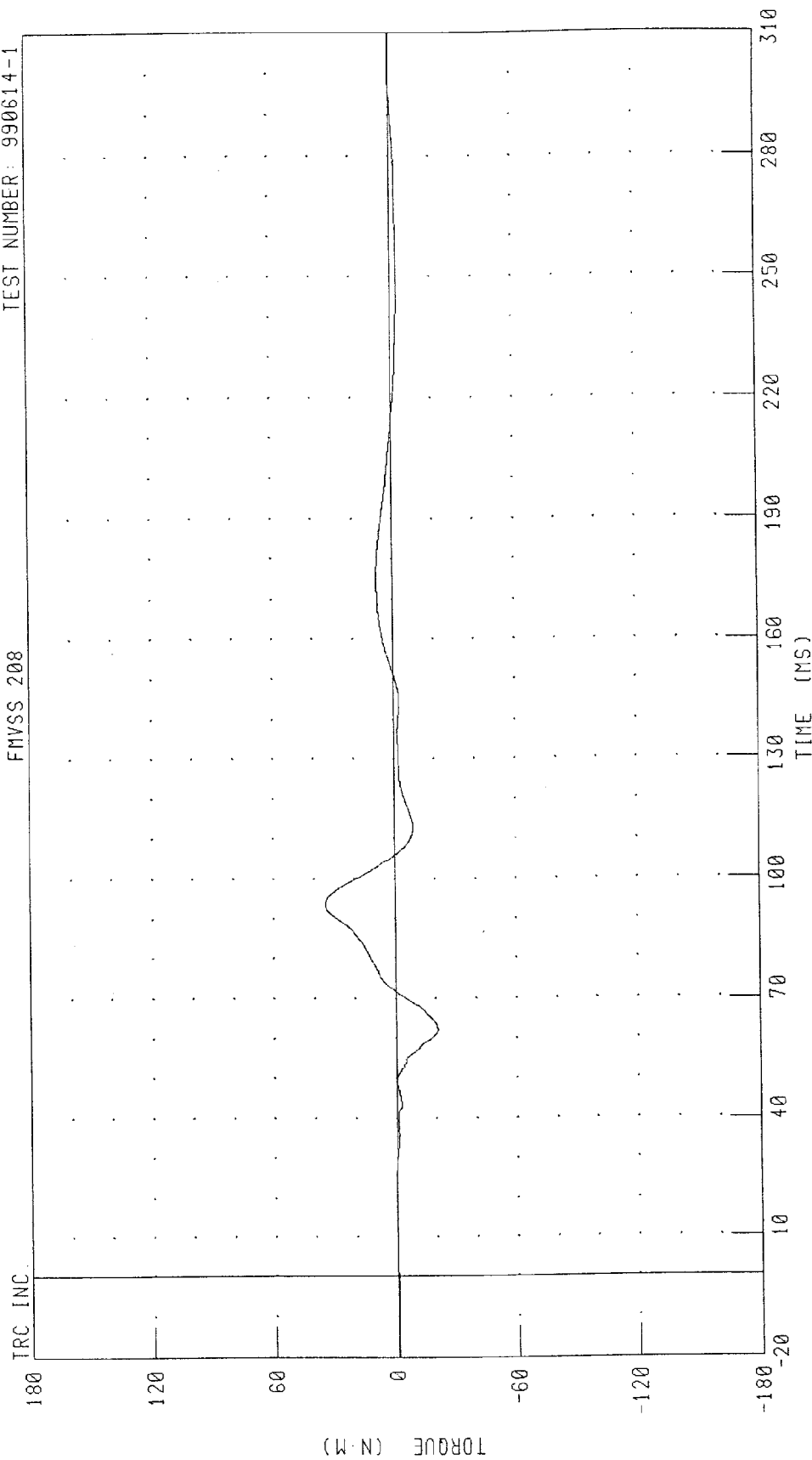
PEAK DATA: 1.63 N-M @ 169.20 MS; -3.45 N-M @ 108.80 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER NECK OCCIPITAL CONDYLE

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



PEAK DATA: 34.55 N-M @ 93.60 MS; -20.87 N-M @ 62.16 MS

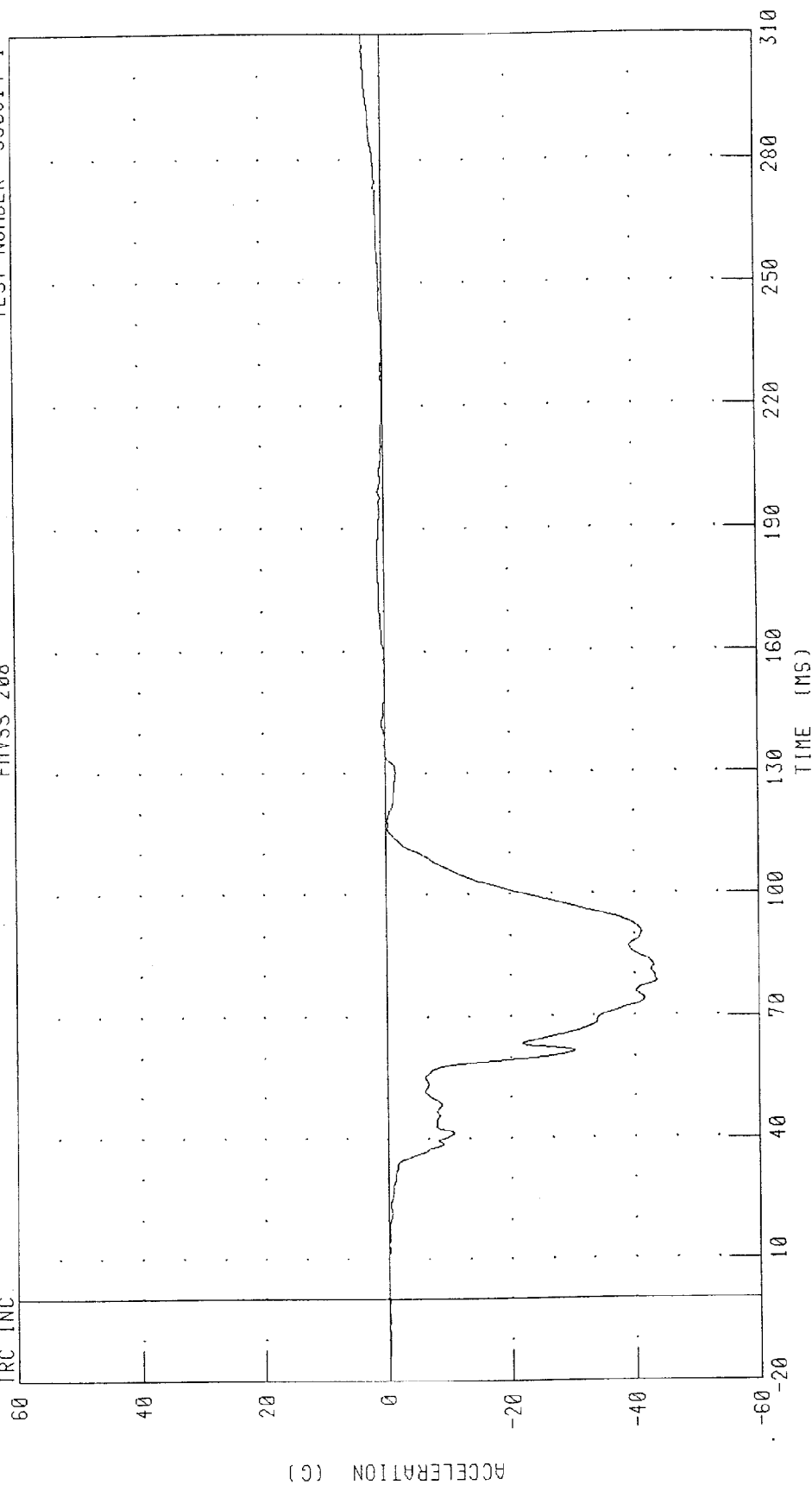
CHANNEL: NEK012 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTXG2 FILTER: CH. CLASS 180

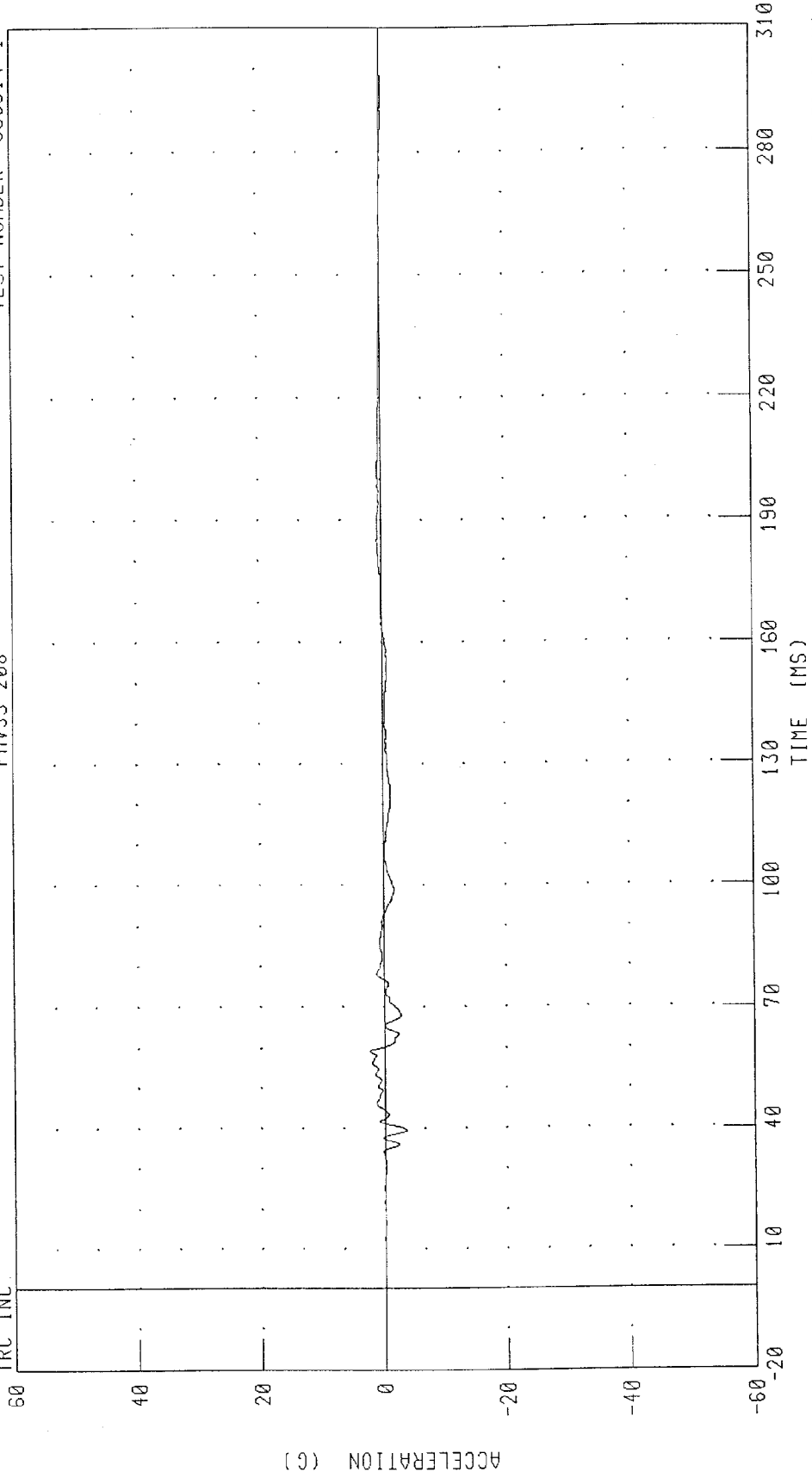
PEAK DATA: 2.92 G @ 308.48 MS; -43.54 G @ 78.48 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTVC2 FILTER: CH. CLASS 180

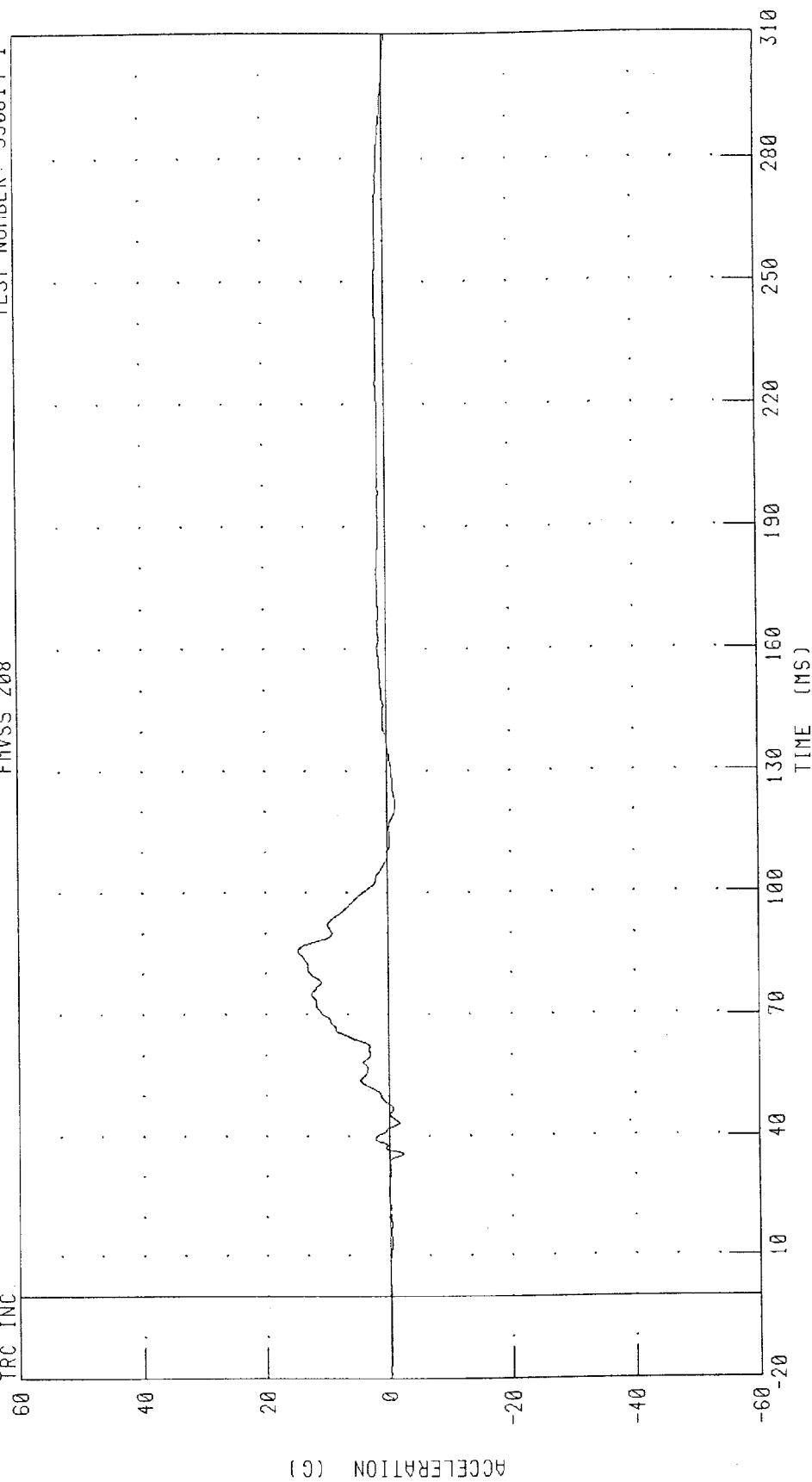
PEAK DATA: 2.32 G @ 59.28 MS, -3.69 G @ 39.68 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTZC2 FILTER: CH. CLASS 180

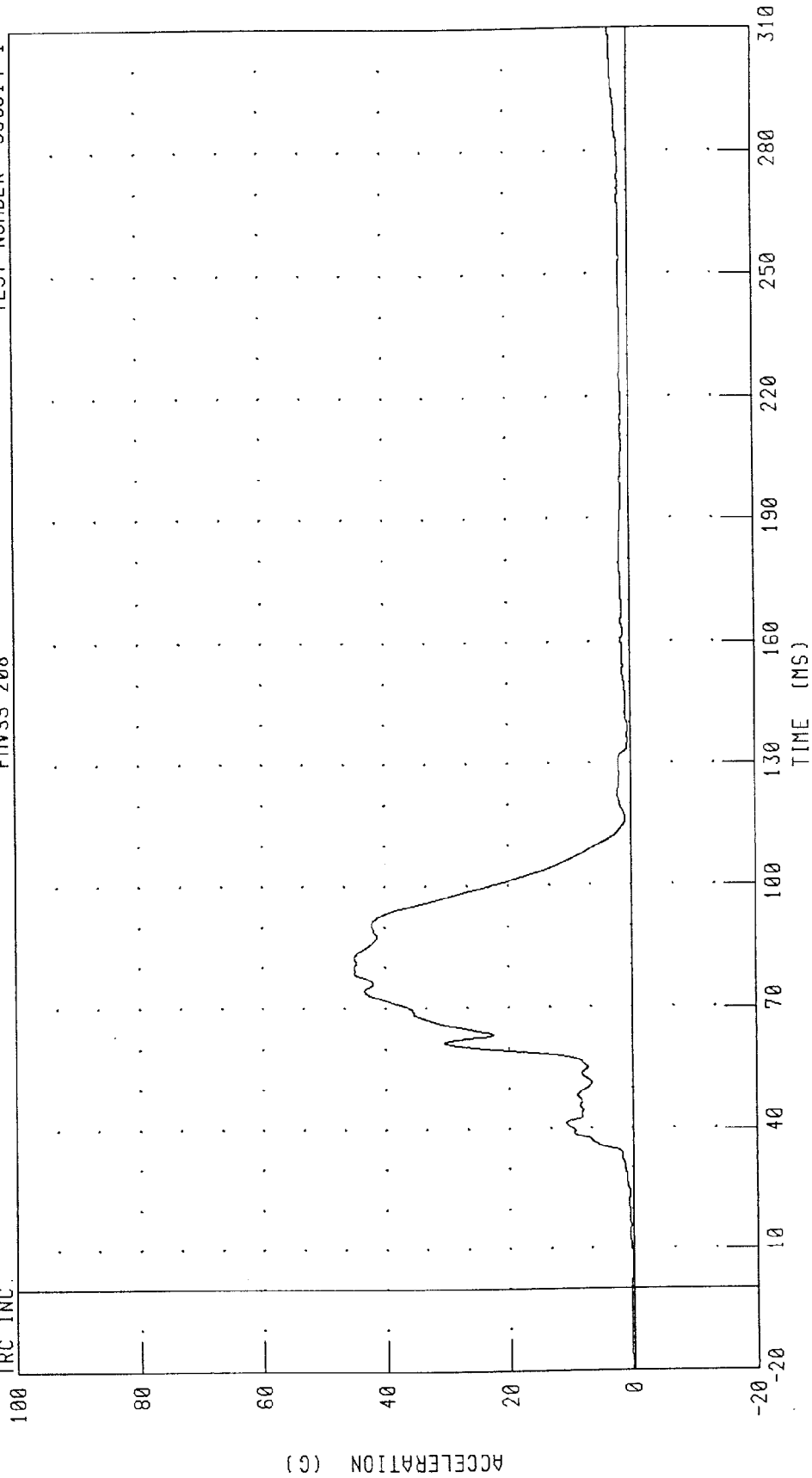
PEAK DATA: 14.74 G @ 85.84 MS; -2.39 G @ 35.84 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTRG2 FILTER: CH. CLASS 180

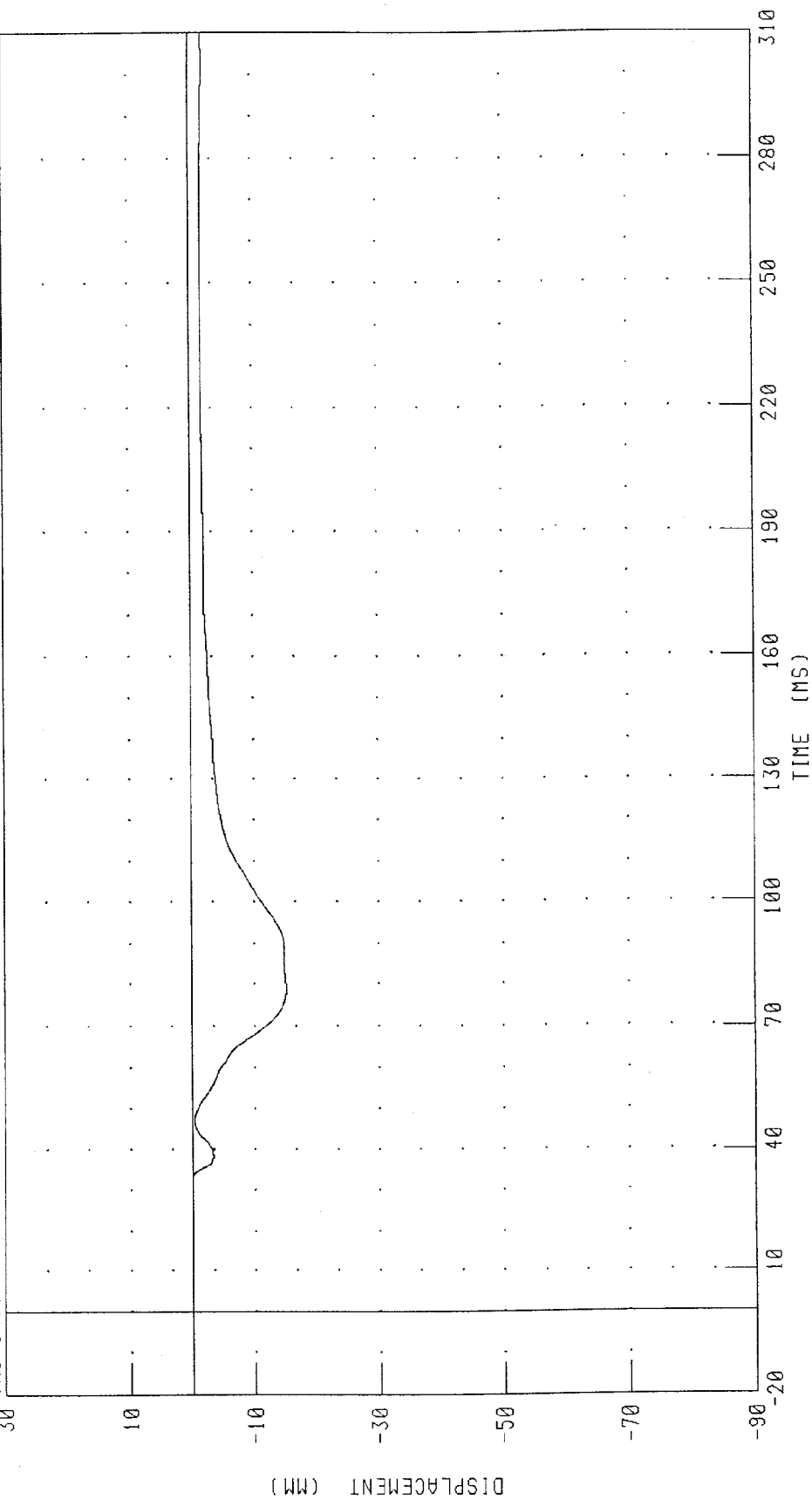
PEAK DATA: 45.03 G @ 80.00 MS; 0.02 G @ -20.00 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER CHEST DEFLECTION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: CSTXD2 FILTER: CH. CLASS 180

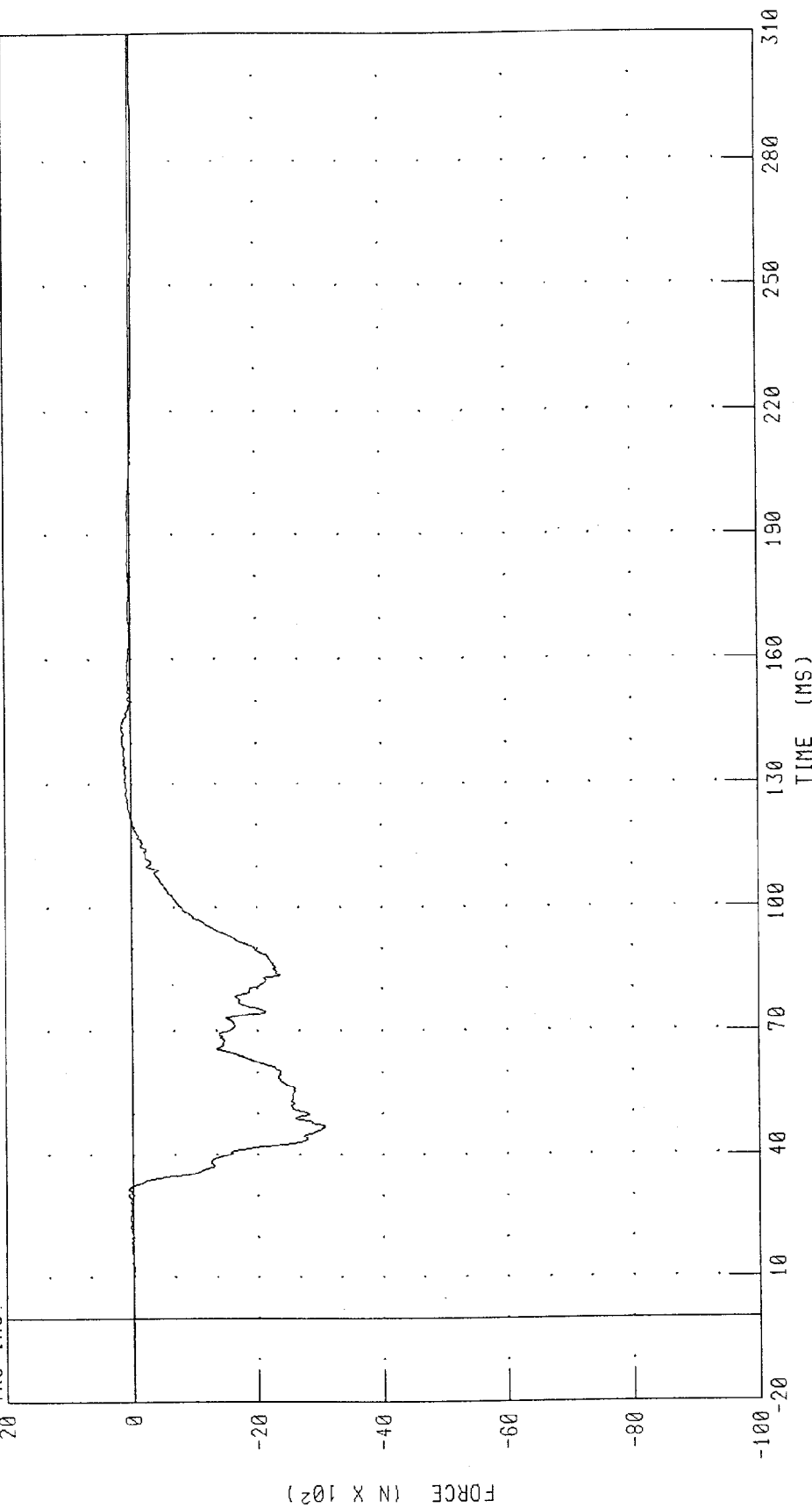
PEAK DATA: 0.06 MM @ 29.52 MS; -15.16 MM @ 78.72 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER LEFT FEMUR FORCE

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



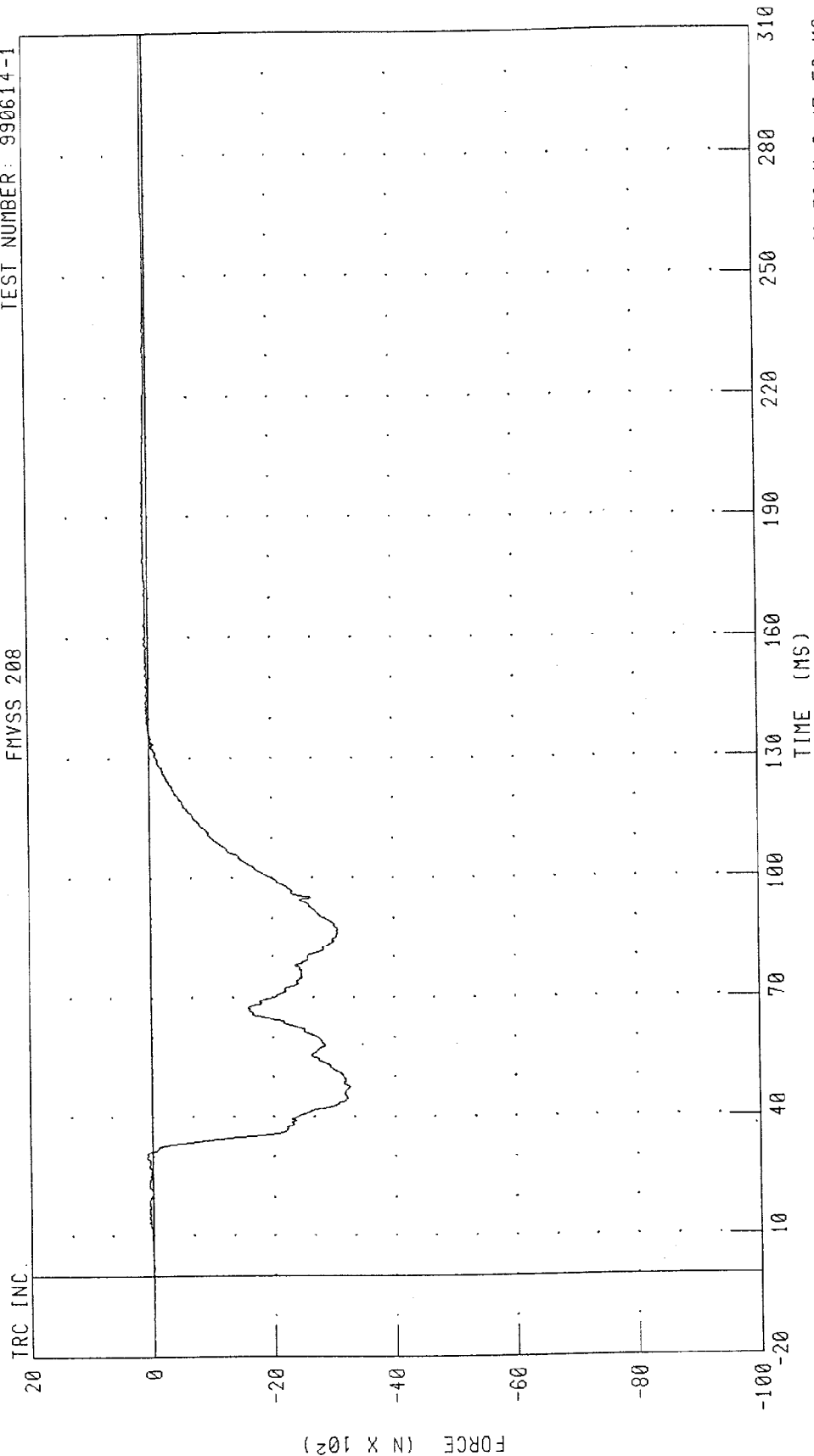
CHANNEL: LFMF2 FILTER: CH CLASS 600

PEAK DATA: 154.35 N @ 144.40 MS; -3071.94 N @ 46.88 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE

TEST NUMBER: 990614-1

FMVSS 208



PEAK DATA: 94.35 N @ 29.84 MS; -3258.58 N @ 47.52 MS

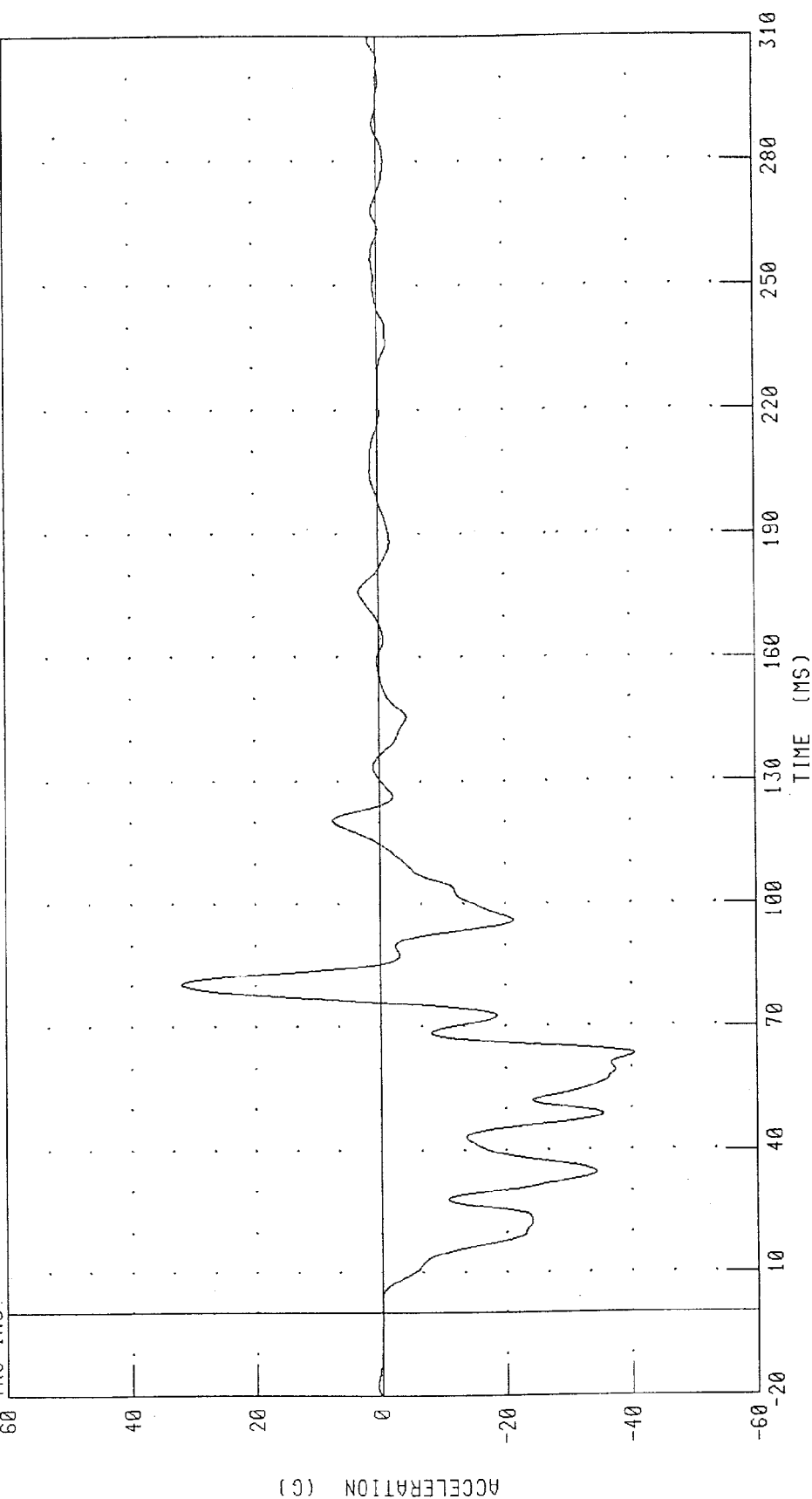
CHANNEL: RFMF2 FILTER: CH. CLASS 600

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
LEFT BRAKE CALIPER X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



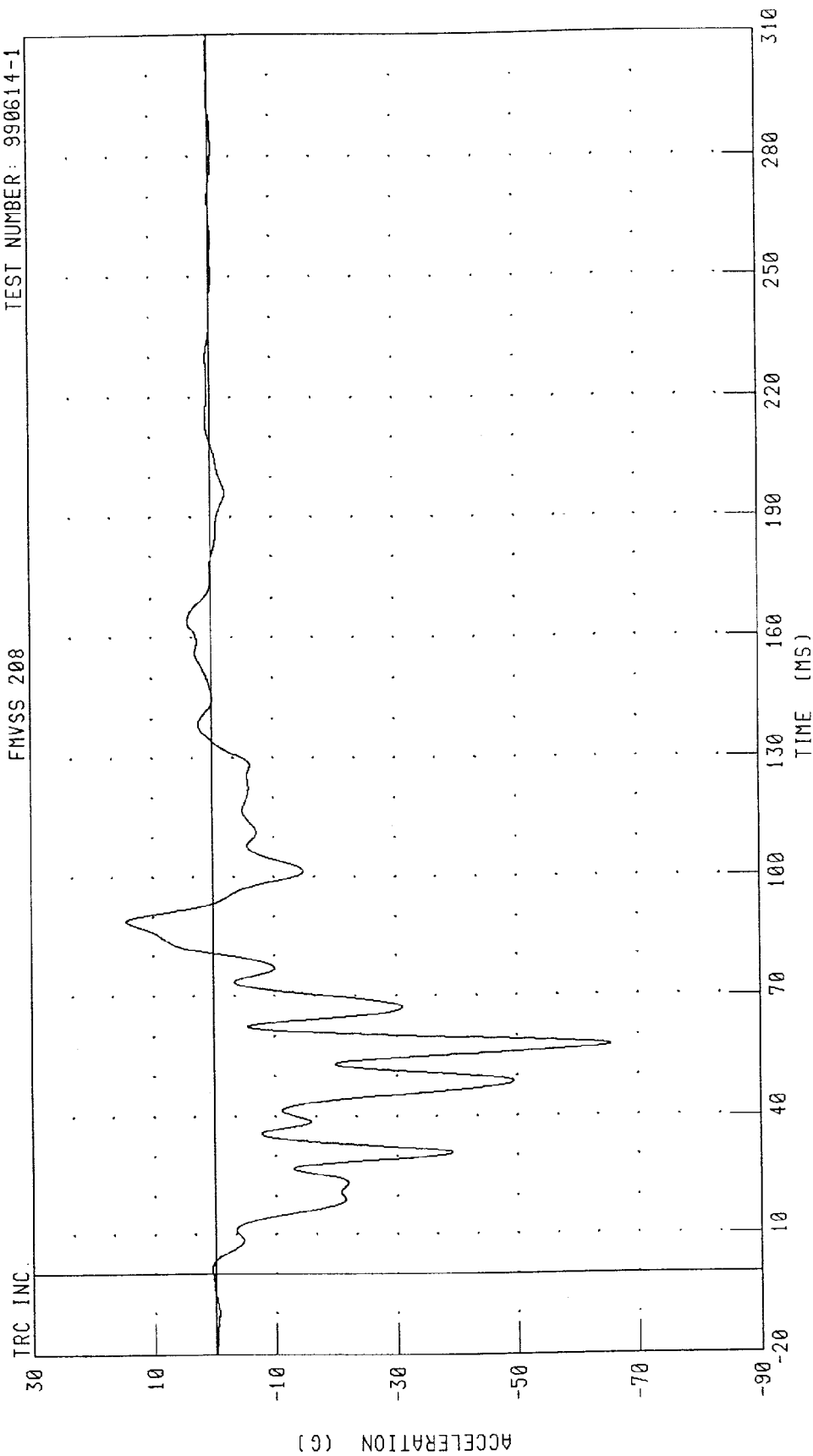
CHANNEL: BCLXG1 FILTER: CH. CLASS 60

PEAK DATA: 31.89 G @ 80.48 MS; -40.52 G @ 63.36 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT BRAKE CALIPER X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FHVSS 208



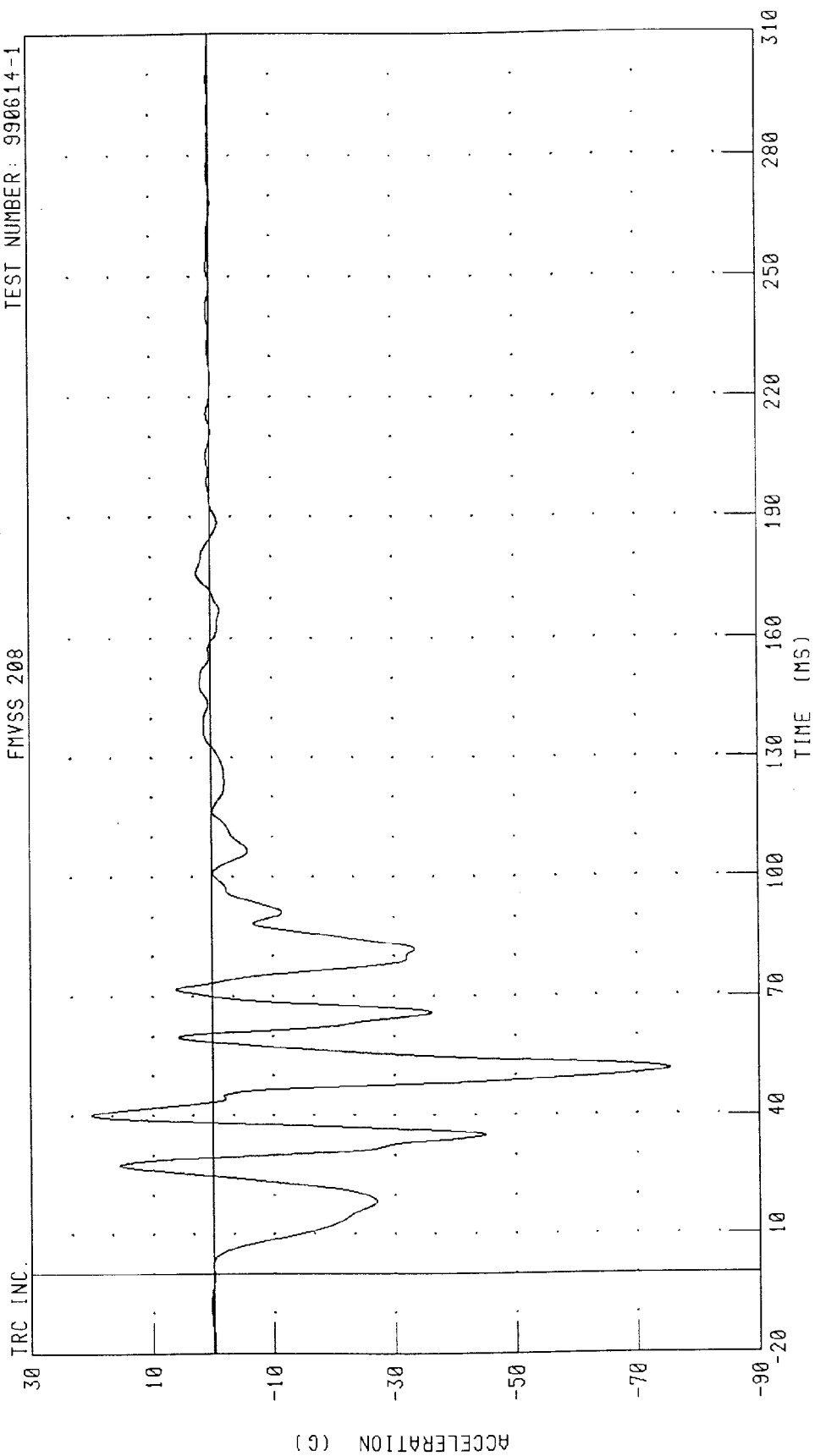
PEAK DATA: 14.42 G @ 88.96 MS; -65.52 G @ 57.68 MS

CHANNEL: BCRXC1 FILTER: CH. CLASS 60

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DASH PANEL CENTER X-AXIS ACCELERATION

FMVSS 208

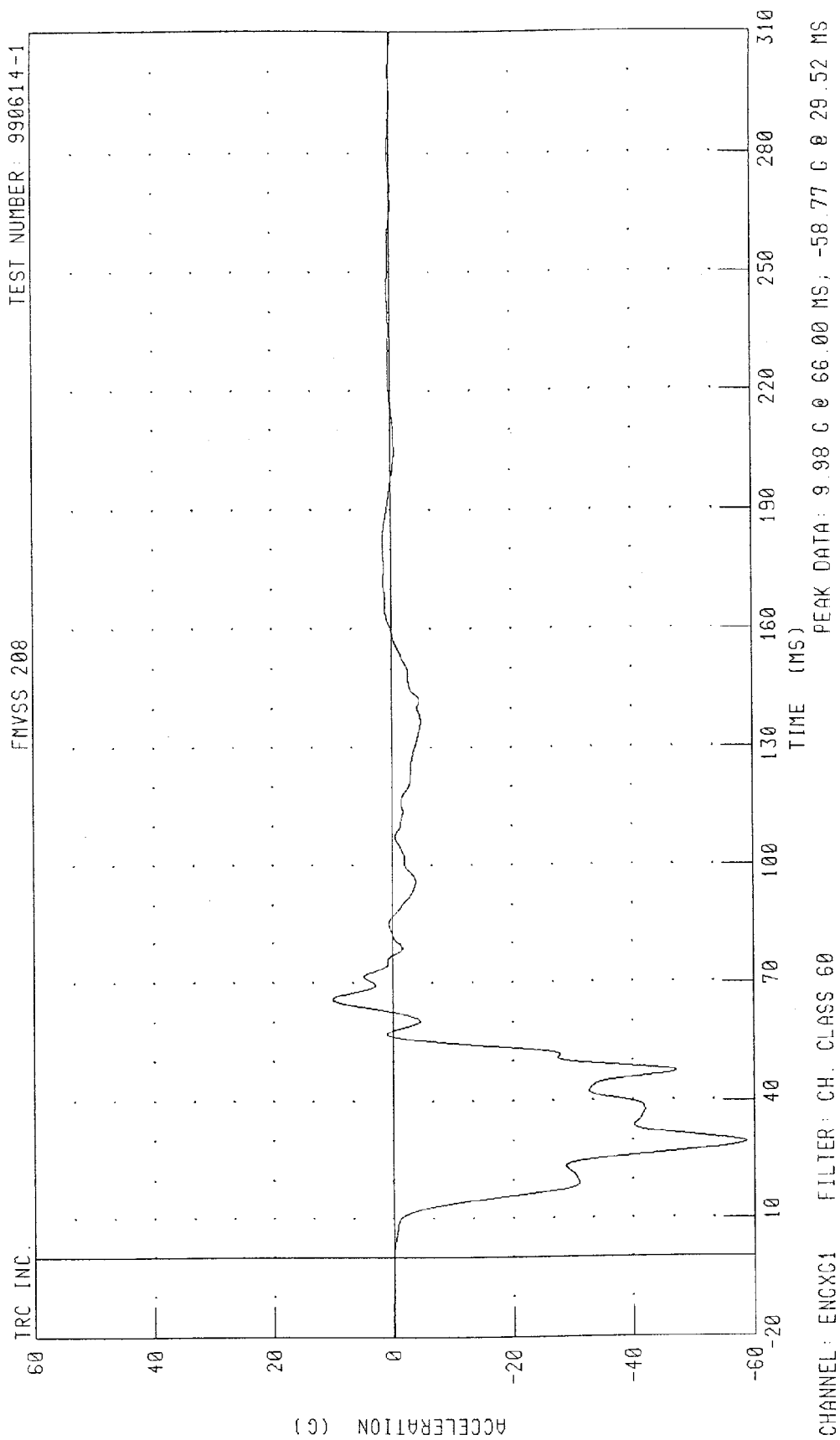
TEST NUMBER: 990614-1



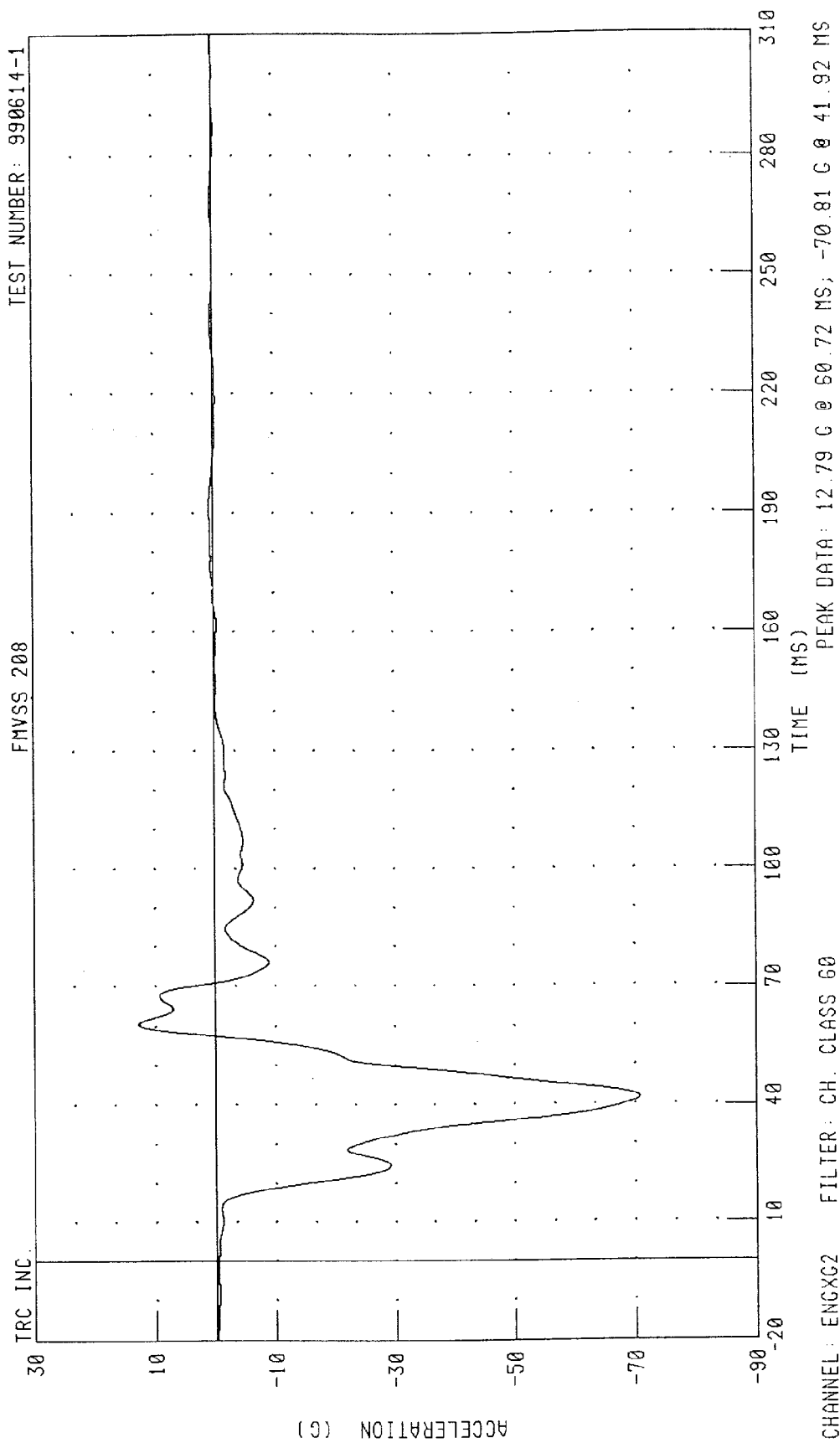
CHANNEL: DPCXG1 FILTER: CH. CLASS 60

PEAK DATA: 19.99 C @ 40.32 MS; -75.44 G @ 51.44 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
ENGINE TOP X-AXIS ACCELERATION



1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
ENGINE BOTTOM X-AXIS ACCELERATION

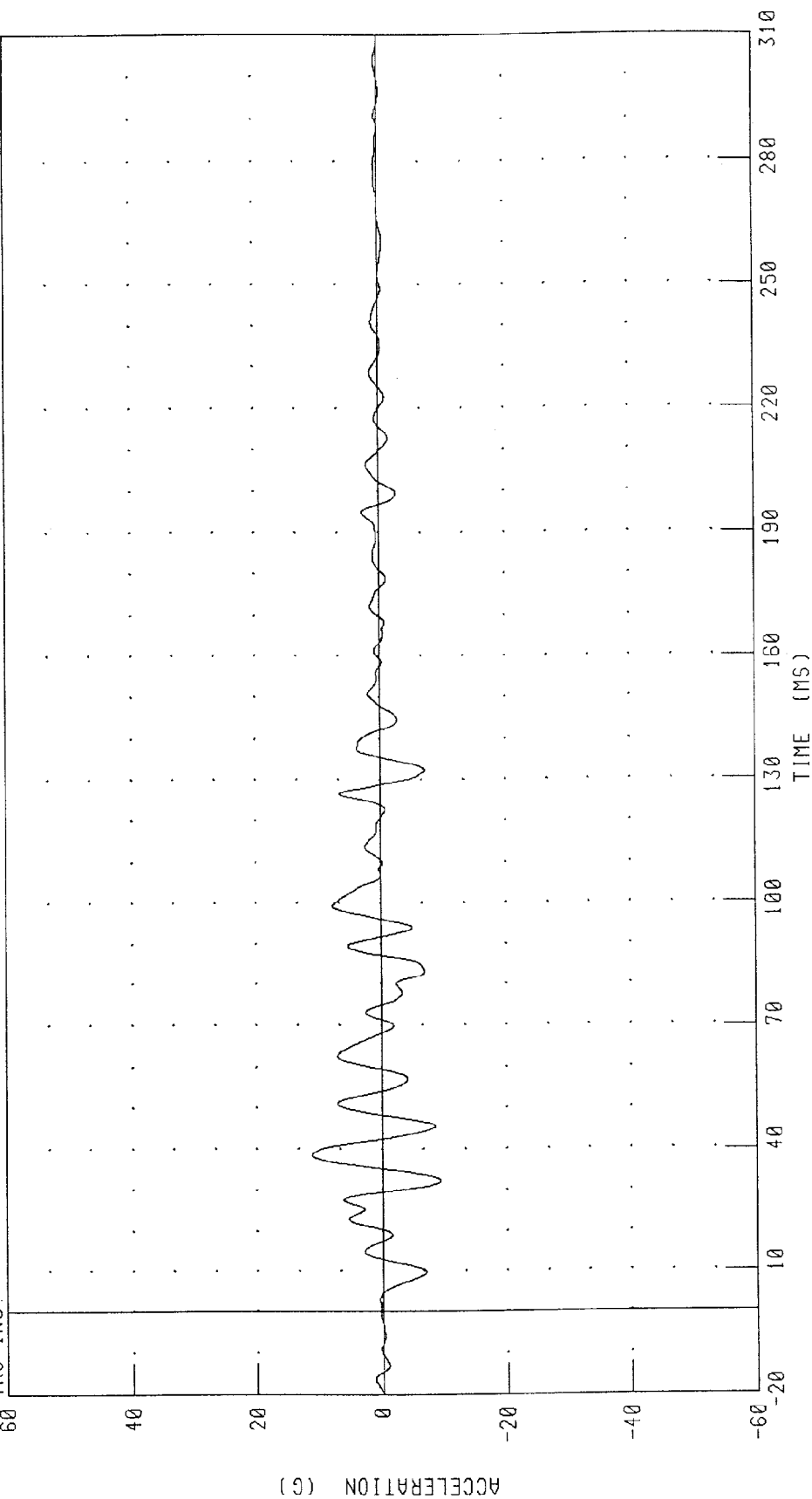


1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
VEHICLE REAR CENTER Z-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

IRC INC.



CHANNEL: RDKZG1 FILTER: CH. CLASS 60

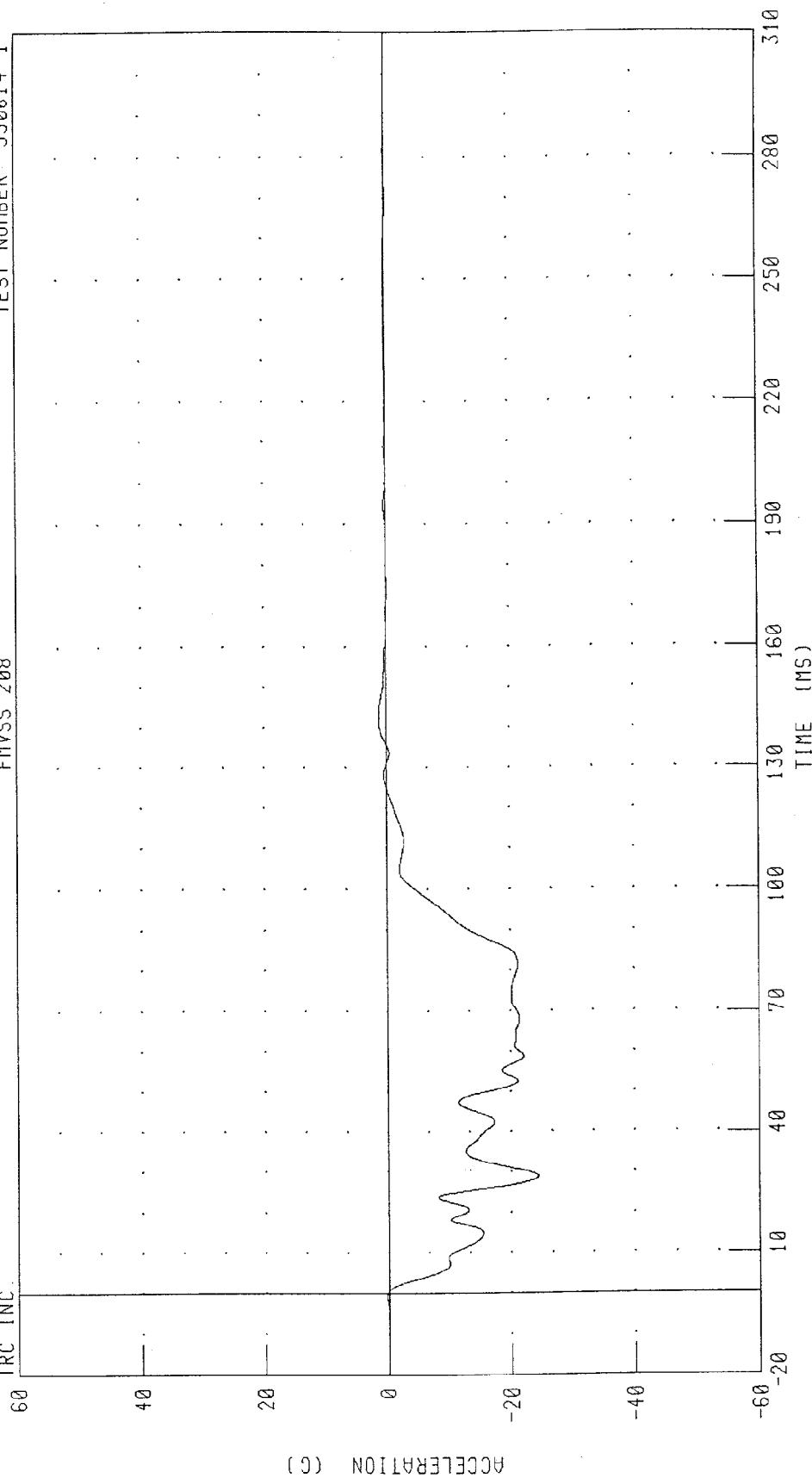
PEAK DATA: 11.18 G @ 38.64 MS; -9.46 G @ 32.40 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
LEFT REAR SEAT X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: TLRXG1 FILTER: CH. CLASS 60

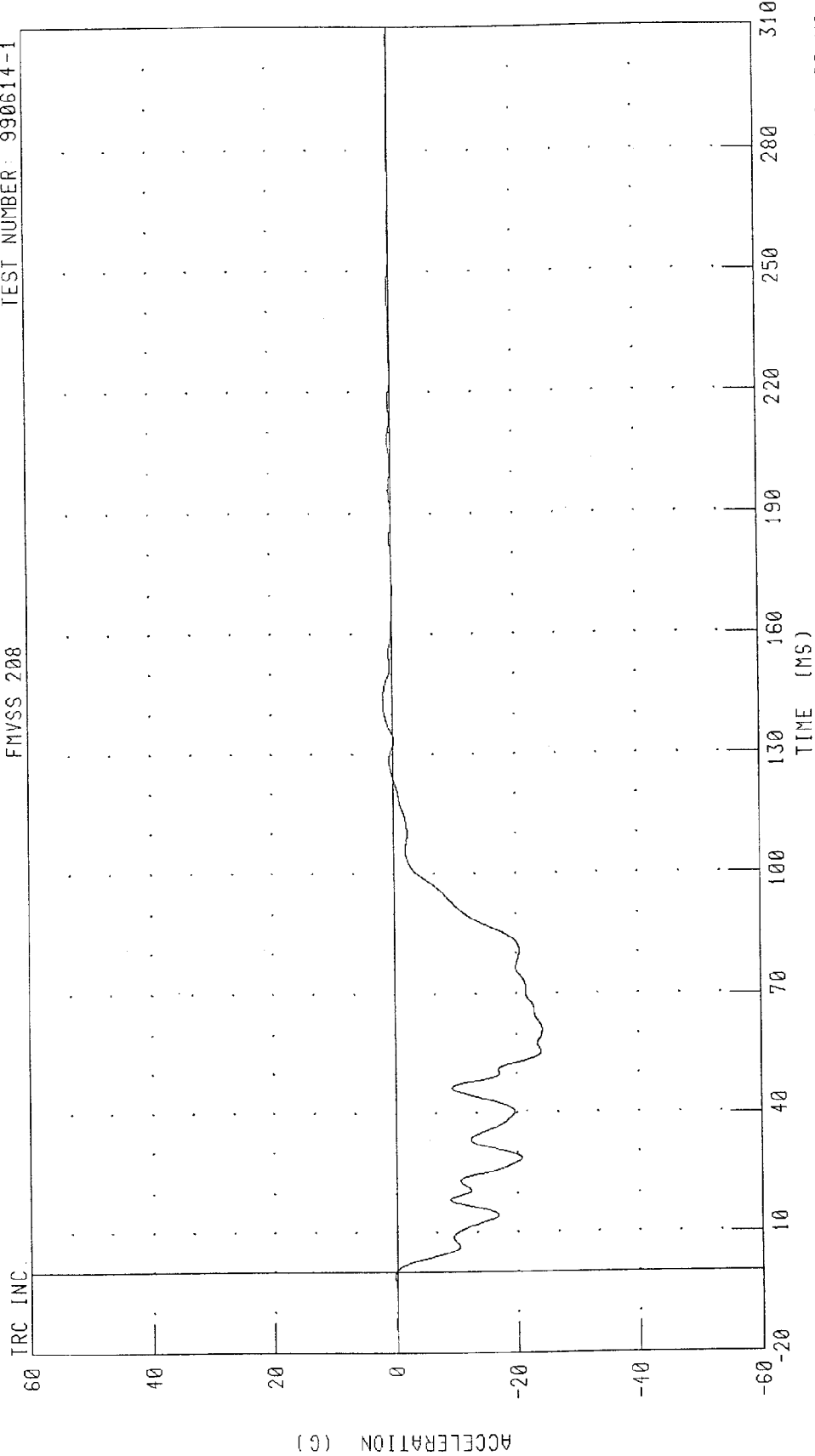
PEAK DATA: 1.16 G @ 144.00 MS; -24.46 G @ 28.96 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
RIGHT REAR SEAT X-AXIS ACCELERATION

TEST NUMBER: 990614-1

FMVSS 208

TRC INC.



CHANNEL: TRRX01 FILTER: CH. CLASS 60

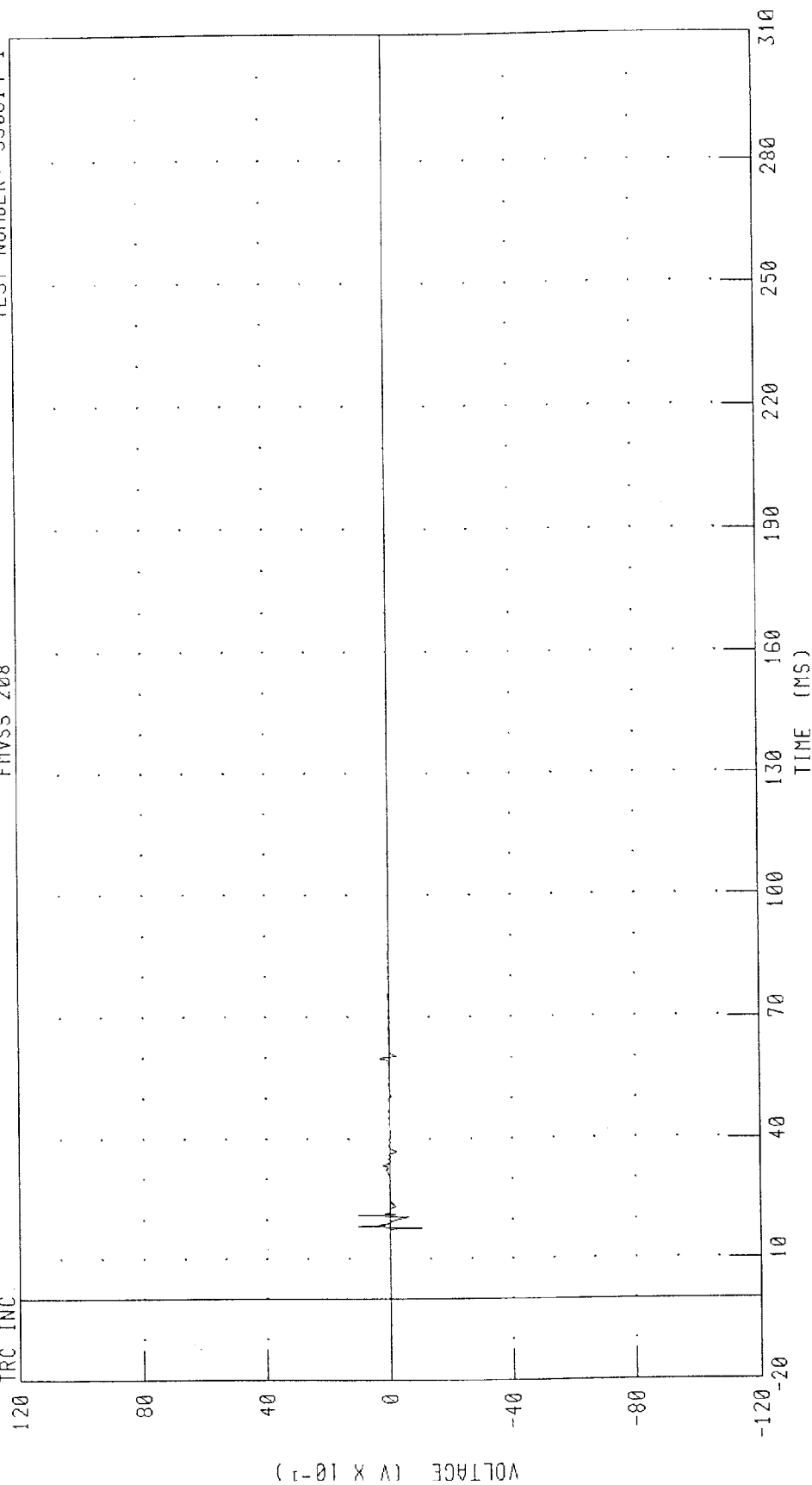
PEAK DATA: 1.48 G @ 143.04 MS; -24.23 G @ 61.20 MS

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
DRIVER SIDE INDUCTIVE AIRBAG FIRE PICKUP

TEST NUMBER: 990614-1

FMVSS 208

TRC INC



PEAK DATA: 1.02 V @ 18.32 MS; -1.02 V @ 17.92 MS

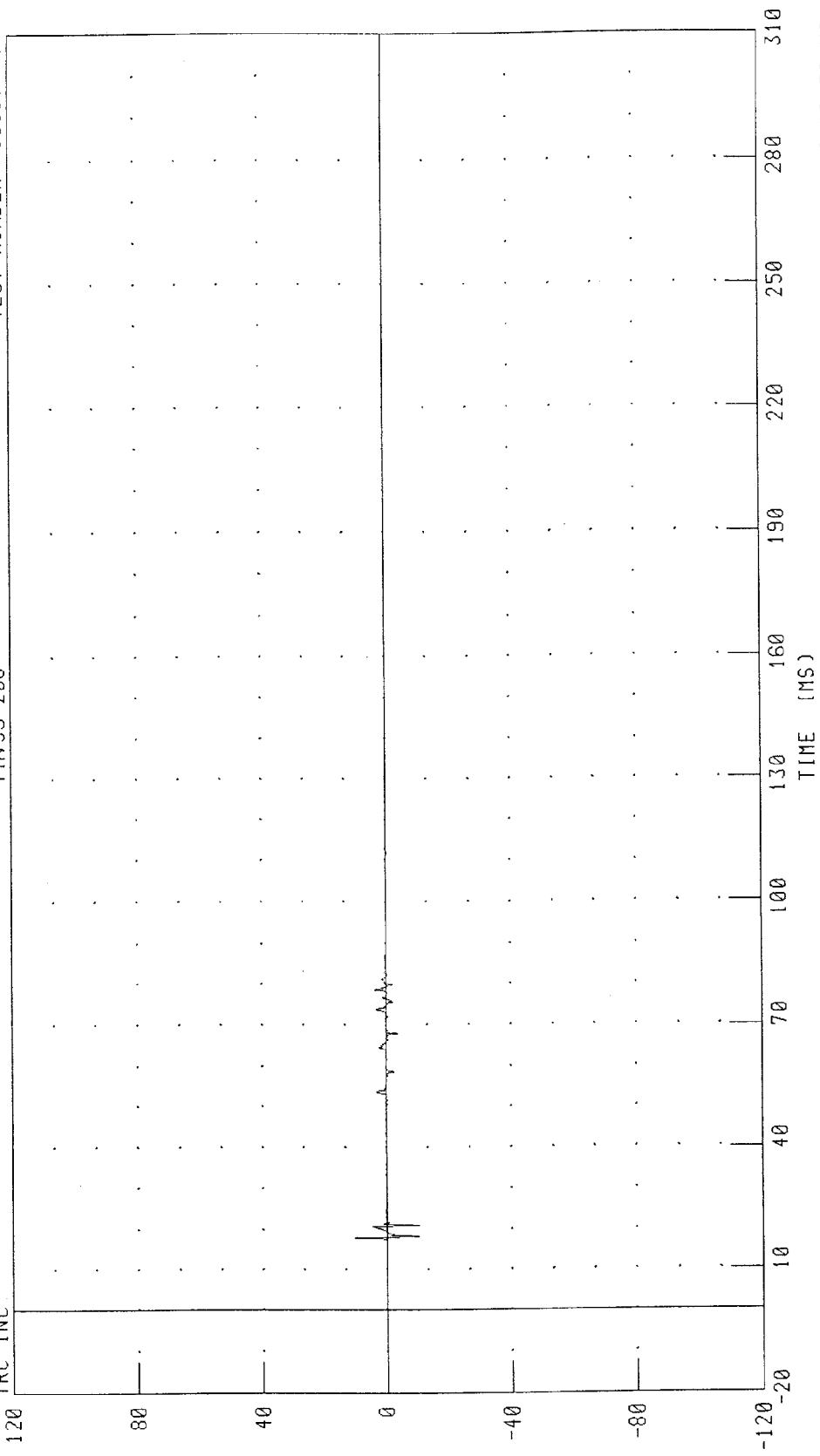
CHANNEL: ABSQ1 FILTER: CH. CLASS 1000

1999 SATURN SL1 INTO A FLAT FRONTAL BARRIER AT 30 MPH
PASSENGER SIDE INDUCTIVE AIRBAG FIRE PICKUP

TEST NUMBER: 990614-1

FMVSS 208

TRC INC



PEAK DATA: 1.02 V @ 17.92 MS, -1.02 V @ 18.32 MS

CHANNEL: ABS02 FILTER: CH. CLASS 1000

Appendix C

Miscellaneous Test Information

Dummy Sign Convention

Accelerometers: +X: Forward
 +Y: Rightward
 +Z: Downward

Potentiometers: +Chest longitudinal deflection: Outward

Load cells: +Femur force: Tension

Neck load cells: +X force: Head rearward
 +Y force: Head leftward
 +Z force: Head upward (tension on neck)
 +X moment: Left ear rotating toward left shoulder
 +Y moment: Chin rotating toward chest
 +Z moment: Chin rotating toward left shoulder

Filtering Data

J211 MAR95

Load Cell Barrier Forces Class 60

Vehicle Structural Accelerations Class 60

Occupant

Head Accelerometer Class 1000

Neck Class 60

Chest Accelerometer Class 180

Chest Deflection Class 180

Femur Force Class 600

Sternum Accelerometer Class 180

Lower Leg Class 600

Vehicle Instrumentation Placement

Vehicle year/make/model/body style: 1999/Saturn/SL1/Sedan

Test number: 990614-1

Number	Location	Axis	Manufacturer	Model	S/N	Orientation (+ Sensing)
1	Left Brake Caliper	X	Endevco	7264-2000T	J27949	Rearward
2	Right Brake Caliper	X	Endevco	7264-2000T	J25410	Forward
3	Instrument Panel Center	X	Endevco	7264-2000T	J21532	Forward
4	Engine Top	X	Endevco	7264-2000T	J27678	Forward
5	Engine Bottom	X	Endevco	7264-2000T	J26493	Forward
6	Vehicle Rear Center	Z	Endevco	7264-2000T	J27651	Up
7	Left Rear Seat Crossmember	X	Endevco	7264-2000T	J27867	Forward
8	Right Rear Seat Crossmember	X	Endevco	7264-2000T	J21764	Forward
9	Driver Airbag	N/A	Fluke	Y8101A	IP1	N/A
10	Passenger Airbag	N/A	Fluke	Y8101A	IP2	N/A

Description Of Timing Marks On TRC High-Speed Film

All TRC high-speed cameras are equipped with red leds which put timing marks on the right edge of the film. TRC uses a single timing generator to generate the timing for all cameras. This allows the timing marks to be common to all cameras. The timing marks can be used to measure camera speed (frames per second) or to locate a point in time before or after the time-zero event.

The timing marks appear on the film as small red marks on the right edge of the film. Round marks are left by the Photo-Sonics and Stalex cameras while horizontal bars are left by the Hycam, Locam, and Fastax II cameras.

The timing generator puts out a pulse for every millisecond plus it generates additional pulses for hundredths and tenths of seconds. To explain this further, we can use an example of a camera running at 1000 frames per second.

1. Every frame will have **one** led appear in it. This indicates a *millisecond* pulse.
2. Every ten frames will have **two** leds appear in it. These indicate a *millisecond* pulse plus a *hundredth of a second* pulse.
3. Every one hundred frames will have **three** leds appear in it. These indicate a *millisecond* pulse, a *hundredth of a second* pulse, and a *tenth of a second* pulse.

ENGINEER:	Rhule
TEST DATE:	Feb-98
DUNNIFY S/N:	289
TYPE:	5th fence

MEMORIC PARAMETER BEING MEASURED	DESCRIPTION	MODEL NO	SERIAL NO	MFR.	SENSITIVITY mv/g @ 100 Hz	ALL CAL.DUE DATE	FULL SCALE DESIGNED G	DIRECTION OF POSITIVE POLARITY
CSTXG*	chest x	7264	J20599	Endevco	0.0000 3059	8/17/98	200	FWD
CSTYG*	chest y	7264	J20580	Endevco	0.2263 2237	8/17/98	200	LEFT
CSTZG*	chest z	7264	EH88J	Endevco	0.2877 2833	8/17/98	200	UP
STTXG*	sternum top x	7264	J20569	Endevco	0.2199 2199	8/17/98	2000	FWD
STMXG*	sternum middle x	7264	J20064	Endevco	0.2302 2277	8/17/98	2000	FWD
STBXG*	sternum bottom x	7264	J20570	Endevco	0.2254 2230	8/17/98	2000	FWD
SPTXG*	spine top x	7264	J19872	Endevco	0.2430 2418	8/17/98	200	REAR
SPMXG*	spine middle x	7264	J19877	Endevco	0.2400 2412	8/17/98	200	REAR
SPBXG*	spine bottom x	7264	J19890	Endevco	0.2296 2267	8/17/98	200	REAR
HEDXG*	head x	7264	J20165	Endevco	0.2245 2225	8/17/98	200	FWD
HEDYG*	head y	7264	J19865	Endevco	0.2155 2119	8/17/98	200	RIGHT
HBDZG*	head z	7264	J19934	Endevco	0.2184 2152	8/17/98	200	UP
PEVXG*	pelvis x	7264	CY06H	Endevco	0.2061 2010	8/17/98	200	REAR
PEVYG*	pelvis y	7264	AGAC4	Endevco	0.2410 2385	8/17/98	200	LEFT
PEVZG*	pelvis z	7264	BF63J	Endevco	0.2389 2357	8/17/98	200	UP
PEV16A	11 Y	11	J20218	11	0.2473	10-27-97		RET

TRANSDUCER INFORMATION

ENGINEER:	Rhule
TEST DATE:	Feb-98
DUNNAMY S/N:	289
TYPE:	Hybrid III Side

MNEMONIC PARAMETER BEING MEASURED	DESCRIPTION	MODEL NO	SERIAL NO	SENSITIVITY (mV/V)	POSITIVE POLARITY DESCRIPTION	CAL DUE DATE	FULL SCALE DESIRED
	NECK LOAD CELL					10-7-99	
NEKXP*	neck x-force	1716	425	1-6850 @ 2,000 lbs	head forward/chest rearward	6/6/98	2010
NEKYF*	neck y-force	1716	425	1-6849 @ 2,000 lbs	head left/chest right	6/6/98	2000
NEKZF*	neck z-force	1716	425	1-1561 @ 3,000 lbs	head up/chest down	6/6/98	3000
NEKXM*	neck x-moment	1716	425	1-6814 @ 2500 in-lbs	right ear to right shoulder	6/6/98	2500
NEKYM*	neck y-moment	1716	425	1-6238 @ 2500 in-lbs	chin forward to sternum	6/6/98	2500
NEKZM*	neck z-moment	1716	425	1-2651 @ 2500 in-lbs	chin to left shoulder	6/6/98	2500
	FEMUR LOAD CELLS					10-7-99	
	left femur						
LFMXF	left femur x-force	1914	0259	1-9981 @ 3000 lbs	knee upward/upper femur down	6/30/98	3000
LFMYF	left femur y-force	1914	0259	1-9941 @ 3000 lbs	knee left/upper femur right	6/30/98	3000
LFMZF*	left femur z-force	1914	0259	1-1874 @ 5000 lbs	knee forward/pelvis rearward	6/30/98	5000
LFMXM	left femur x-moment	1914	0259	1-5037 @ 3000 in-lbs	knee left, hold upper femur in place	6/30/98	3000
LFMYM	left femur y-moment	1914	0259	1-4884 @ 3000 in-lbs	knee up, hold upper femur in place	6/30/98	3000
LFMZM	left femur z-moment	1914	0259	1-6620 @ 3000 in-lbs	twist knee to right, hold up femur	6/30/98	3000
	right femur					10-7-99	
RFMXF	right femur x-force	1914	0257	1-9180 @ 3000 lbs	knee upward/upper femur down	6/30/98	3000
RFMYF	right femur y-force	1914	0257	1-9240 @ 3000 lbs	knee left/upper femur right	6/30/98	3000
RFMZ*	right femur z-force	1914	0257	1-1927 @ 5000 lbs	knee forward/pelvis rearward	6/30/98	5000
RFMXM	right femur x-moment	1914	0257				
RFMYM	right femur y-moment	1914	0257				
RFMZM	right femur z-moment	1914	0257				

ENGINEER:	Rhule
TEST DATE:	Feb-98
DUMMY S/N:	289
TYPE:	Hybrid III 5th %ile

[illegible]

TRANSDUCER INFORMATION

5th Female HYBRID III DUMMY SERIAL NO.: 369t ; MFR.: ; SEATING POSITION: PASS

PROJECT-SEGMENT NO.: 097360 4103 ; ENGINEER: PG ; TEST DATE: 6-14-99

MNEMONIC PARAMETER BEING MEASURED	TYPE OF TRANSDUCER	MODEL NO.	SERIAL NO.	MFR.	SENSITIVITY	CAL DUE DATE	FULL SCALE (ENGR. UNITS) DESIRED ACTUAL	DIRECTION OF POSITIVE POLARITY	CABLE NO.
HEDXG HAP	HEAD X-AXIS ACCEL.	7264	A20FJ	End	.2563 mv/g at 10 volts	12-2- 1999	400 g	Rear	A20FJ
HEDYG HLR	HEAD Y-AXIS ACCEL.	"	A31FJ	"	.2683 mv/g at 10 volts	"	400 g	Left	A31FJ
HEDZG HIS	HEAD Z-AXIS ACCEL.	"	CL95H	"	.2822 mv/g at 10 volts	"	400 g	Up	CL95H
NEKXF NFX	NECK X-AXIS SHEAR FORCE	1716A	0534	DEN	1.7247 mv/v at 2000 lbs.	12-2- 1999	2,000 lbs. 9,000 N		FX
NEKYF NFY	NECK Y-AXIS SHEAR FORCE	"	"	"	1.6643 mv/v at 2000 lbs.	"	2,000 lbs. 9,000 N		FY
NEKZF NFZ	NECK Z-AXIS AXIAL FORCE	"	"	"	1.1561 mv/v at 3000 lbs.	"	3,000 lbs. 13,500 N		FZ
NEKXM NMX	NECK MOMENT ABOUT X AXIS	"	"	"	1.6355 mv/v at 2500 in. lbs.	"	200 ft-lbs 275 N-m		MX
NEKYM NMY	NECK MOMENT ABOUT Y AXIS	"	"	"	1.6430 mv/v at 2500 in. lbs.	"	200 ft-lbs 275 N-m		MY
NEKZM NMZ	NECK MOMENT ABOUT Z AXIS	"	"	"	2.3186 mv/v at 2500 in. lbs.	"	200 ft-lbs 275 N-m		MZ

TRANSDUCER INFORMATION

5th Female HYBRID III DUMMY SERIAL NO.: 3691; MFR.: ; SEATING POSITION: PASS

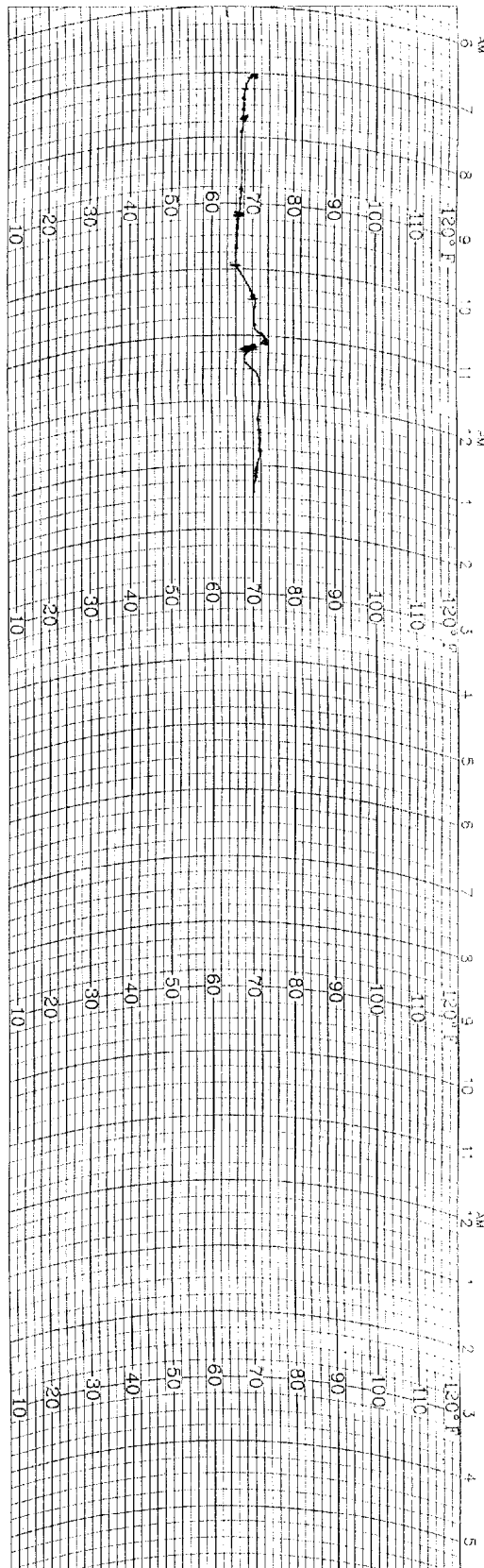
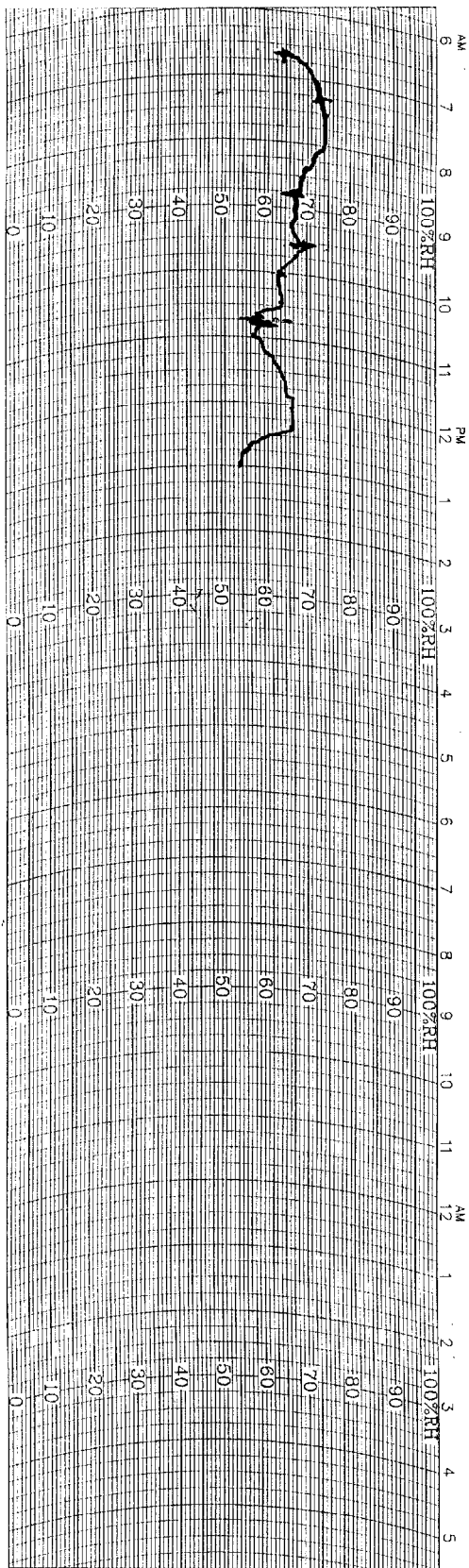
PROJECT-SEGMENT NO.: 097360 4103; ENGINEER: PG; TEST DATE: 6-14-99

MNEMONIC PARAMETER BEING MEASURED	TYPE OF TRANSDUCER	MODEL NO.	SERIAL NO.	MFR.	SENSITIVITY	CAL DUE DATE	FULL SCALE (ENGR. UNITS) DESIRED ACTUAL	DIRECTION OF POSITIVE POLARITY	CABLE NO.
CSTXG CAP	CHEST X-AXIS ACCEL.	7264	A72JJ	End.	.2773 mv/g at 10 volts	12-2- 1999	400 g	Forward	A72JJ
CSTYG CLR	CHEST Y-AXIS ACCEL.	"	A69JJ	"	.2702 mv/g at 10 volts	"	400 g	Left	A69JJ
CSTZG CIS	CHEST Z-AXIS ACCEL.	"	A34FJ	"	.2565 mv/g at 10 volts	"	400 g	Down up	A34FJ
CSTXD CAPD	CHEST DEFLECTION	14CB1- 2897	289	Bourn	43.6 mv/v/in	"	6 inch 150 mm		S39
PEVXG PAP	PELVIS X-AXIS ACCEL.	7264	CY31H	End.	.2031 mv/g at 10 volts	"	400 g	Rear	C14981
PEVYG PLR	PELVIS Y-AXIS ACCEL.	"	A51JJ	"	.2917 mv/g at 10 volts	"	400 g	Left	C15183
PEVZG PIS	PELVIS Z-AXIS ACCEL.	"	A75JJ	"	.2695 mv/g at 10 volts	"	400 g	Up	C15184
LFMF LF	LEFT FEMUR FORCE	2430	1006	DEN	0.9459 mv/v at 3000 lbs.	12-2- 1999	1300 Kg 3,000 lbs. 13,500 N		1518
RFMF RF	RIGHT FEMUR FORCE	"	1007	"	0.9114 mv/v at 3000 lbs.	"	1300 Kg 3,000 lbs. 13,500 N		71

5th Female HYBRID III DUMMY SERIAL NO.: 369t; MFR.: ; SEATING POSITION: PASS

PROJECT-SEGMENT NO.: 097360 4103; ENGINEER: PG; TEST DATE: 6-14-99

[illegible]



WeatherMeasure
WEATHERtronics
Division of QUALIMETRICS, Inc.

P.O. BOX 41039
SACRAMENTO, CA 95841
PHONE: (916) 923-0055

HYGROTHERMOGRAPH
1 DAY

CHART NO. M699123
C311-D-HF
ECN 2717
6-9-87

STATION _____ DATE ON 6/14/99 DATE OFF _____