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DOT HS 808 313

February 1995

Final Report

Final Report of a 1995 Solectria E–10 Pickup into Flat Frontal Barrier

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16. Abstract

A 48 kph flat frontal barrier impact test was conducted on a 1995 Solectria E-10 pickup at Transportation Research Center Inc. on December 19, 1994. This test was conducted to gather data concerning the application of the following Federal Motor Vehicle Safety Standards to electric vehicles: FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Mounting"; and FMVSS 219 (partial), "Windshield Zone Instrusion."

The impact velocity was 47.2 kph. The vehicle's maximum static crush was 746 millimeters. The ambient temperature was 22° C.

The driver's Head Injury Criteria (HIC) was 286. The driver's chest maixmum resultant acceleration with three milliseconds minimum duration was 36.5 g. The driver's chest maximum deflection was 32 mm. The driver's left and right femur maximum axial forces were 3459 N and 5320 N, respectively.

The passenger's HIC was 370. The passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 29.1 g. The passenger's chest maximum deflection was 34 millimeters. The passenger's left and right femur maximum axial forces were 1530 N and 1522 N, respectively.

17. Key Words: 1995 Solectria E-10 Pickup; Electric Vehicle; 48 kph Flat Frontal Barrier Impact Test; FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Retention"; FMVSS 219 (partial), "Windshield Zone Intrusion"	18. Distribution Statement: Document is available to the public from the National Technical Service Springfield, VA 22161

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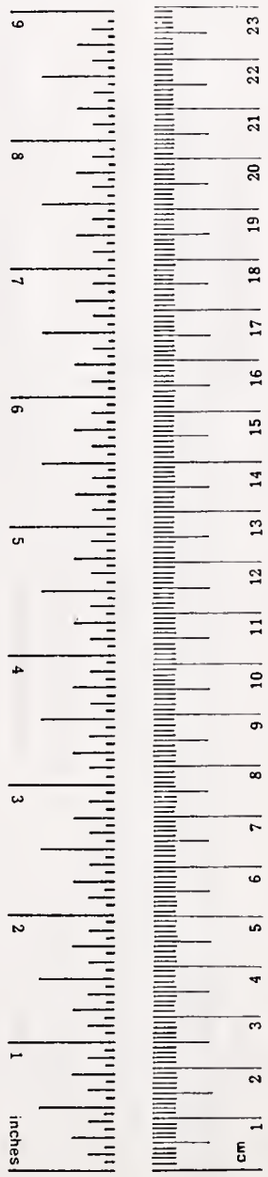
METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

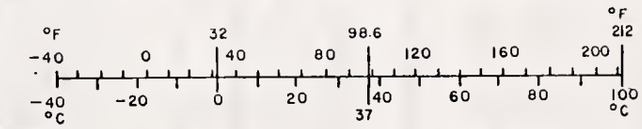
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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



Approximate Conversions from Metric Measures

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



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Section 1.0

Purpose and Test Procedure

Purpose

This 48 kph flat frontal barrier impact test was conducted for Vehicle Research and Test Center by Transportation Research Center Inc. (TRC). The purpose of this test was to gather data concerning the application of the following Federal Motor Vehicle Safety Standards to electric vehicles: FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Mounting"; FMVSS 219 (partial), "Windshield Zone Intrusion."

Test Procedure

This test was conducted using NHTSA's Office of Vehicle Safety Compliance (OVSC) Laboratory Test Procedure No. TP-208-09 as a guideline with the addition of a post-impact static rollover test to determine if electrolyte leakage occurred into the passenger's compartment or outside the vehicle. Data was obtained relative to FMVSS 208, "Occupant Crash Protection"; FMVSS 212, "Windshield Retention"; and FMVSS 219 (partial), "Windshield Zone Intrusion."

The test vehicle was instrumented with thirteen (13) accelerometers to measure longitudinal and vertical axis accelerations. The vehicle's specified impact velocity range was 46.5 to 48.1 kph. The vehicle impacted a flat frontal barrier.

The test vehicle contained two (2) Part 572 E 50th percentile adult male anthropomorphic test devices (dummies). The dummies were positioned in the front outboard designated seating positions according to the dummy placement procedures specified in Appendix C of the Laboratory Test Procedure. The seat was not positioned at the design midtrack location as a result of the console blocking forward travel by two notches and the charger in the rear blocking travel by one notch.

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

The thirty-one (31) data channels were multiplexed and recorded on a 14-track tape drive. The data was digitally sampled at 12,500 samples per second and processed per Sections 11.13 through 11.15 of the Laboratory Test Procedure.

The crash event was recorded by one (1) real-time panning motion picture camera and fourteen (14) high-speed motion picture cameras operating at approximately 1000 frames per

second. The pre- and post-test conditions were recorded by one (1) real-time motion picture camera.

The vehicle and occupant data are presented in Section 2.0. The FMVSS 208, 212, and 219 (partial) 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 dummy certification data. Appendix D contains miscellaneous test information.

Section 2.0

Frontal Barrier Impact Test Summary

Test Results Summary

This flat frontal barrier test was conducted at TRC on December 19, 1994.

The test vehicle, a 1995 Solectria E-10 pickup, appeared to comply with the performance requirements of FMVSS 208, 212, and 219 (partial) in the flat frontal barrier impact mode. The Head Injury Criteria (HIC) calculations were less than 1000, the chest resultant accelerations did not exceed 60 g's, and the axial forces transmitted through the upper legs did not exceed 10,008 N as measured by Part 572 E dummies seated in the front outboard designated seating positions. For each Part 572 E dummy, the chest deflection did not exceed 76.2 millimeters. There was no penetration into any portion of the windshield.

The vehicle's test weight was 2028 kg. The vehicle's impact speed was 47.2 kph. The vehicle sustained 746 millimeters of static crush during the impact.

The driver's HIC was 286. The driver's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 36.5 g. The driver's chest maximum deflection was 32 mm. The driver's left and right femur maximum axial forces were 3459 N and 5320 N, respectively.

The passenger's HIC was 370. The passenger's chest maximum resultant acceleration with three (3) milliseconds minimum duration was 29.1 g. The passenger's chest maximum deflection was 34 mm. The passenger's left and right femur maximum axial forces were 1530 N and 1522 N, respectively.

Windshield retention loss occurred along the lower edge of the windshield from 70 to 350 mm and from 1176 to 1546 mm measured from the lower left corner. There was no penetration through the windshield. No electrolyte was found in the passenger's compartment after completion of the static rollover test.

Data Acquisition Explanations

The left brake caliper X-axis accelerometer, BCLXG1, lost data at 46 milliseconds as a result of the accelerometer's cable being cut by the vehicle's crush on impact.

The front battery box X-axis accelerometer, OTHXG1, lost data at 38 milliseconds as a result of the accelerometer's cable being cut by the vehicle's crush on impact.

The trunk floor center X-axis accelerometer, TFCZG1, did not return to zero following the impact event.

Table 1 Crash Test Summary

Test type:	Flat Frontal Barrier Impact	
Test date:	12/19/94	
Test time:	1512	
Ambient temperature:	22° C	
Vehicle year/make/ model/body style:	1995/Solectria/E-10/pickup	
Vehicle test weight:	2028 kg	
Impact angle[1]:	0°	
Impact velocity[2]:	Primary = 47.2 kph Secondary = 47.2 kph	
Maximum static crush:	746 mm	
Average rebound:	656 mm	
Dummies:	Driver #551	Passenger #591
Type:	Part 572 E	Part 572 E
Location:	Left front	Right front
Restraint:	3-point unibelt and airbag	3-point unibelt
Number of data channels:	31	
Number of cameras:	High-speed 14 Real-time 2	

[1] With respect to tow track centerline.
[2] Speed trap measurement (± .08 kph accuracy)

Table 2 Test Vehicle Information

Vehicle manufactured by:	General Motors Corporation
Vehicle altered by:	Solectria Corporation
Vehicle year/make/ model/body style:	1995/Solectria/E-10/pickup
Color:	Red
VIN:	1GCCS1446SK100668
Electric motor data:	Two AC motors
Transmission data:	__speed, __manual, X automatic, __overdrive __FWD, X RWD, __4WD
Date vehicle received:	12/12/94
Odometer reading:	396
Dealer's name and address:	NA

Accessories:

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

Certification data from vehicle's label:

Vehicle manufactured by:	General Motors Corporation
Date of manufacture:	06/94
VIN:	1GCCS1446SK100668
GVWR:	2087 kg
GAWR: Front:	1124 kg
Rear:	1225 kg

Table 2 Test Vehicle Information, Cont'd.

Size of tires:	P205/75R15
Spare tire:	None
Type of front seats:	Bench

Tire & capacity data from vehicle's label:

Recommended tire size:	P205/75R15
Recommended cold tire pressure:	
Front:	240 kPa
Rear:	240 kPa
Designated seating capacity:	
Front	NA
Rear	NA
Total	NA
Vehicle capacity weight:	NA

Test vehicle attitude:

Delivered attitude:	LF 784 mm;	RF 793 mm;	LR 761 mm;	RR 771 mm
Pre-test attitude:	LF 774 mm;	RF 785 mm;	LR 724 mm;	RR 733 mm
Post-test attitude:	LF 773 mm;	RF 777 mm;	LR 740 mm;	RR 740 mm

Table 2 Test Vehicle Information, Cont'd

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

Right front	367	kg	Right rear	497	kg
Left front	416	kg	Left rear	482	kg
Total front weight	783	kg	(44.4% of total vehicle weight)		
Total rear weight	979	kg	(55.6% of total vehicle weight)		
Total delivered weight	1762	kg			

Calculation of test vehicle's target test weight:

RCLW[1] = Rated cargo and luggage weight

GVWR = Gross vehicle weight rating (2087 kg)

UDW = Unloaded delivered weight (1762 kg)

VCW = Vehicle capacity weight = GVWR - UDW = 2087 - 1762 = 325 kg

DSC[2] = Designated seating capacity (3)

RCLW[1] = GVWR - UDW - 68 (DSC) = 2087 - 1762 - 68 (3) = 121 kg

Target test weight = UDW + RCLW[1] + (Number of Hybrid III dummies x 76 kg/dummy)

Target test weight = 1762 + 121 + 152 = 2035 kg

Weight of test vehicle with required dummies and 114 kg of cargo weight:

Right front	410	kg	Right rear	593	kg
Left front	452	kg	Left rear	573	kg
Total front weight	862	kg	(42.5% of total vehicle weight)		
Total rear weight	1166	kg	(57.5% of total vehicle weight)		
Total test weight	2028	kg	(0.3 % under target test weight)		

Weight of ballast secured in vehicle: 11 kg

Components removed to meet target test weight: None

CG rearward of front wheel centerline: 1584 mm

Vehicle wheelbase: 2755 mm

Front overhang: 603 mm

Maximum width: 1689 mm

[1] Cargo weight for multi-purpose passenger vehicles, trucks, and buses is the vehicle's calculated cargo and luggage weight or 300 pounds, whichever is less.

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

Table 3 Post-Impact Data

Test number:	941219
Test date:	12/19/94
Test time:	1512
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	47.2 kph
Secondary	47.2 kph
Specified range	46.5 to 48.1 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:

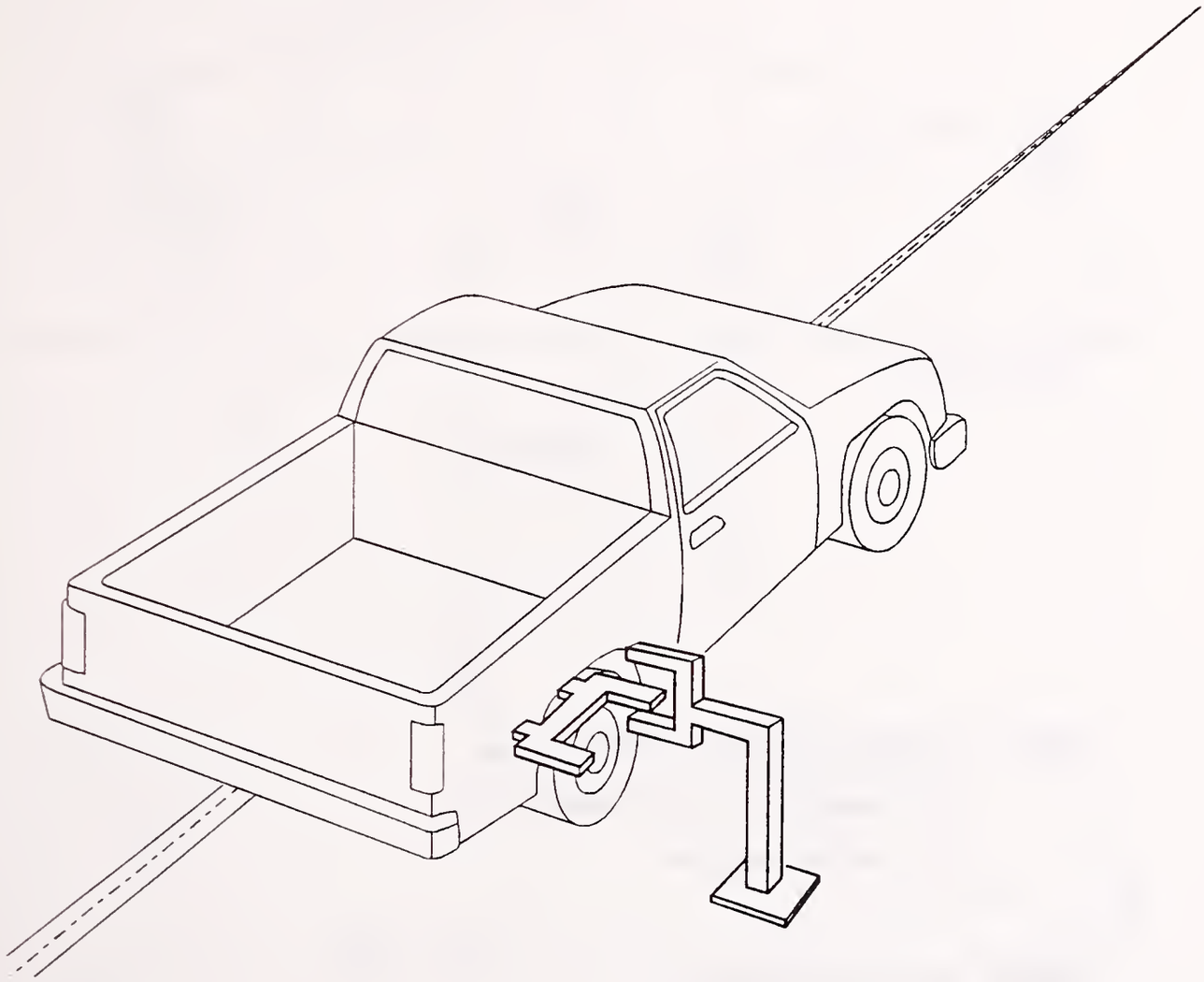
Pre-test:	L	4627 mm;	C	4782 mm;	R	4654 mm
Post-test:	L	4024 mm;	C	4036 mm;	R	4019 mm
Total crush:	L	603 mm;	C	746 mm;	R	635 mm
Average crush:	661 mm					

Test vehicle rebound from flat barrier:

Distance from test vehicle to barrier:

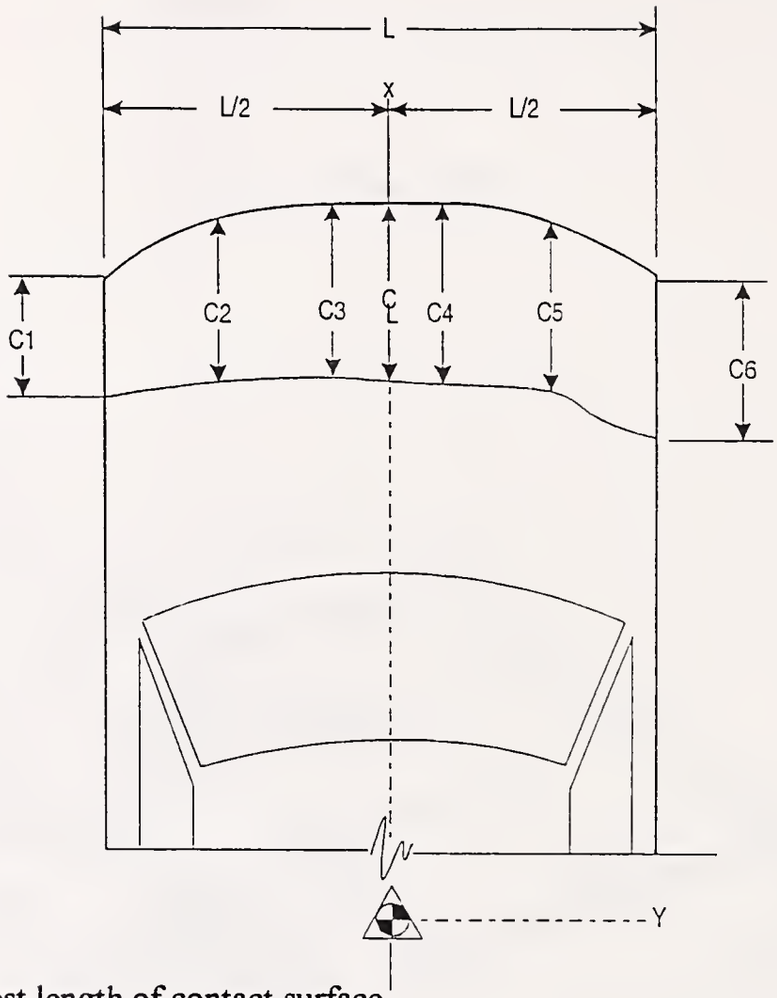
Post-test:	L	600 mm;	C	573 mm;	R	795 mm
Average rebound	656 mm					

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 Vehicle Crush



Notes: L is pre-test length of contact surface.

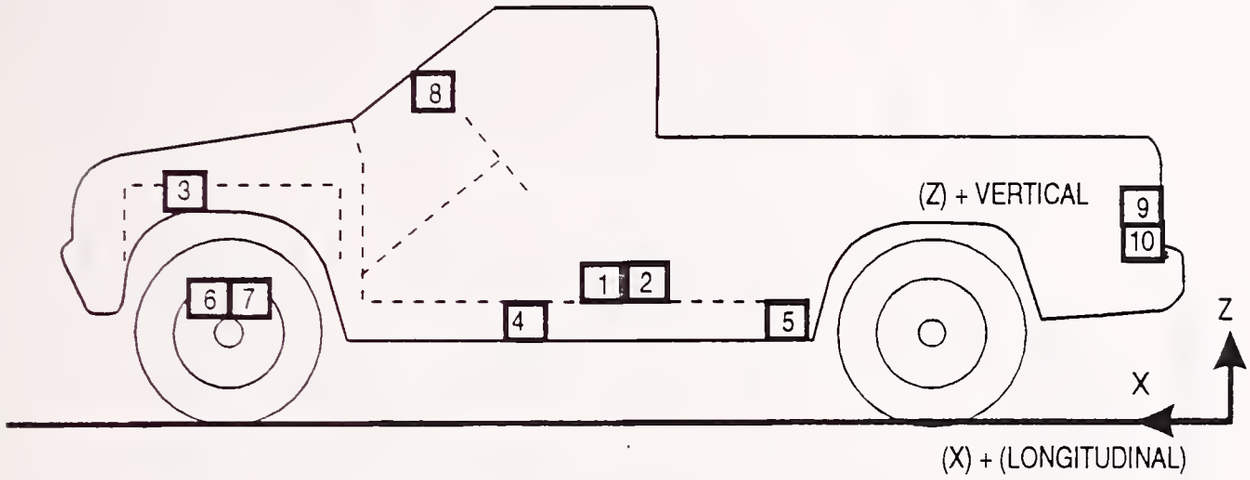
C1 through C6 are spaced equally apart.

CL is vehicle centerline.

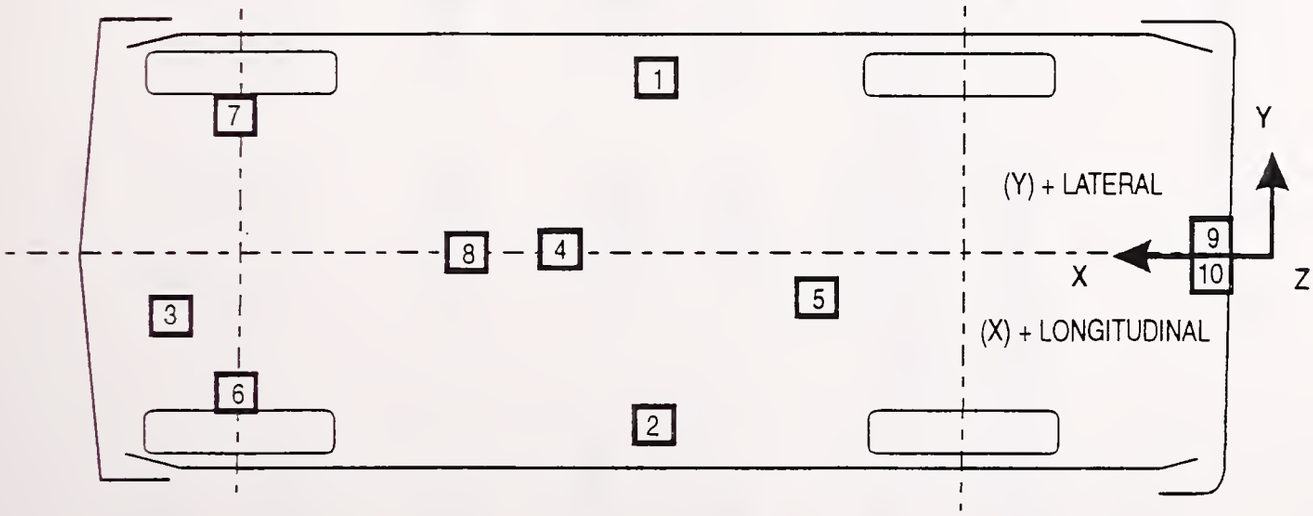
Vehicle: Solectria E-10 pickup

	Pre-test	Post-test	Crush
L	1415 mm		
C1	4627 mm	4024 mm	603 mm
C2	4686 mm	4051 mm	635 mm
C3	4767 mm	4038 mm	729 mm
C4	4769 mm	4036 mm	733 mm
C5	4725 mm	4054 mm	671 mm
C6	4654 mm	4019 mm	635 mm
CL	4782 mm	4036 mm	746 mm

Figure 3 Vehicle Accelerometer Placement



SIDE VIEW



BOTTOM VIEW

Table 4 Vehicle Accelerometer Locations and Data Summary

TEST NUMBER: 941219 No. LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
1 LEFT REAR SEAT CROSSMEMBER	2280 mm	560 mm	507 mm				
LONGITUDINAL				9.5 g	@ 63.9 ms	27.7 g	@ 46.6 ms
2 RIGHT REAR SEAT CROSSMEMBER	2278 mm	-615 mm	503 mm				
LONGITUDINAL				12.3 g	@ 63.2 ms	27.5 g	@ 50.9 ms
3 FRONT BATTERY BOX	4449 mm	-131 mm	704 mm				
LONGITUDINAL[1]				-0.6 g	@ 63.2 ms	1100.4 g	@ 42.8 ms
4 REAR BATTERY BOX - FRONT	2275 mm	0 mm	364 mm				
LONGITUDINAL				17.9 g	@ 217.8 ms	53.0 g	@ 58.7 ms
VERTICAL				8.6 g	@ 31.5 ms	17.6 g	@ 26.8 ms
5 REAR BATTERY BOX - REAR	1295 mm	-194 mm	371 mm				
LONGITUDINAL				11.6 g	@ 29.2 ms	24.8 g	@ 62.5 ms
VERTICAL				8.6 g	@ 70.2 ms	14.1 g	@ 30.4 ms
6 RIGHT BRAKE CALIPER	3822 mm	-543 mm	352 mm				
LONGITUDINAL				86.7 g	@ 89.6 ms	67.1 g	@ 44.6 ms
7 LEFT BRAKE CALIPER	3815 mm	543 mm	333 mm				
LONGITUDINAL[1]				2.1 g	@ 32.1 ms	898.7 g	@ 50.6 ms

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

TEST NUMBER: 941219 No. LOCATION	X	Y	Z	POSITIVE DIRECTION		NEGATIVE DIRECTION	
8 INSTRUMENT PANEL CENTER	3382 mm	0 mm	1111 mm				
LONGITUDINAL				4.0 g	@ 192.2 ms	40.7 g	@ 41.1 ms
9 VEHICLE REAR CENTER	251 mm	0 mm	628 mm				
VERTICAL[1]				17.2 g	@ 239.0 ms	11.2 g	@ 126.1 ms
10 GEAR BOX	261 mm	0 mm	524 mm				
LONGITUDINAL				5.5 g	@ 31.5 ms	29.0 g	@ 24.8 ms
VERTICAL				11.0 g	@ 143.4 ms	23.7 g	@ 32.5 ms

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

[1] See DATA ACQUISITION EXPLANATIONS

Section 3.0

FMVSS 208, 212, and 219 (partial) Data

Table 5 Dummy Data Summary

TEST NUMBER: 941219

DRIVER DUMMY SERIAL NUMBER: 551

	POSITIVE DIRECTION		NEGATIVE DIRECTION	
HEAD ACCELERATION				
LONGITUDINAL	6.0 g	@ 152.8 ms	40.2 g	@ 67.4 ms
LATERAL	26.9 g	@ 86.3 ms	9.6 g	@ 134.8 ms
VERTICAL	11.8 g	@ 133.4 ms	23.5 g	@ 56.2 ms
RESULTANT	42.3 g	@ 67.4 ms		
HIC	286 from 55.2 to 91.2 ms			
CHEST ACCELERATION				
LONGITUDINAL	2.4 g	@ 231.6 ms	37.5 g	@ 61.8 ms
LATERAL	7.4 g	@ 69.0 ms	6.8 g	@ 143.2 ms
VERTICAL	11.8 g	@ 134.1 ms	14.9 g	@ 55.0 ms
RESULTANT	37.6 g	@ 61.8 ms		
3 MSEC	36.5 g			
CHEST DEFLECTION				
LONGITUDINAL	0.3 mm	@ 20.2 ms	32.0 mm	@ 74.1 ms
FEMUR LOAD				
LEFT	343.7 N	@ 39.9 ms	3458.5 N	@ 63.4 ms
RIGHT	906.5 N	@ 44.6 ms	5320.1 N	@ 65.4 ms

POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	LEFTWARD	LATERAL:	RIGHTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
FORCE:	TENSION	FORCE:	COMPRESSION

Table 5 Dummy Data Summary, Cont'd.

TEST NUMBER: 941219

PASSENGER DUMMY SERIAL NUMBER: 591

	POSITIVE DIRECTION		NEGATIVE DIRECTION	
HEAD ACCELERATION				
LONGITUDINAL	6.8 g	@ 260.7 ms	39.2 g	@ 122.6 ms
LATERAL	5.4 g	@ 165.0 ms	7.3 g	@ 115.7 ms
VERTICAL	2.8 g	@ 15.6 ms	43.5 g	@ 100.8 ms
RESULTANT	51.2 g	@ 102.9 ms		
HIC	370 from 91.1 to 127.1 ms			
CHEST ACCELERATION				
LONGITUDINAL	1.8 g	@ 308.1 ms	28.9 g	@ 71.9 ms
LATERAL	5.3 g	@ 117.5 ms	4.7 g	@ 53.6 ms
VERTICAL	10.8 g	@ 140.6 ms	12.7 g	@ 51.5 ms
RESULTANT	29.8 g	@ 72.0 ms		
3 MSEC	29.1 g			
CHEST DEFLECTION				
LONGITUDINAL	0.2 mm	@ 19.0 ms	34.4 mm	@ 103.5 ms
FEMUR LOAD				
LEFT	858.0 N	@ 107.3 ms	1529.9 N	@ 69.1 ms
RIGHT	812.1 N	@ 62.6 ms	1521.6 N	@ 105.2 ms

POSITIVE DIRECTION		NEGATIVE DIRECTION	
LONGITUDINAL:	FORWARD	LONGITUDINAL:	REARWARD
LATERAL:	LEFTWARD	LATERAL:	RIGHTWARD
VERTICAL:	UPWARD	VERTICAL:	DOWNWARD
FORCE:	TENSION	FORCE:	COMPRESSION

Table 6 Post-Impact Dummy/Vehicle Data

Visible Dummy Contact Points:

	Driver #551	Passenger #591
Head	Airbag & head restraint	Chest, instrument panel, and head restraint
Chest	Airbag	None
Abdomen	None	None
Left knee	Instrument panel	Instrument panel
Right knee	Instrument panel	Instrument panel

Door Opening:

	Left	Right
Front	Difficult - required tools	Difficult - required tools
Rear	NA	NA

Seat Movement:

	Seat Back Failure	Seat Shift
Front	None	None
Rear	NA	NA

Glazing Damage: The entire windshield cracked upon impact. The rear window shattered on impact.

Other Notable Impact Effects: The front battery box intruded into the passenger's compartment. Please see Figures A-48 and A-53.

Figure 4 FMVSS 212 Test Data

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

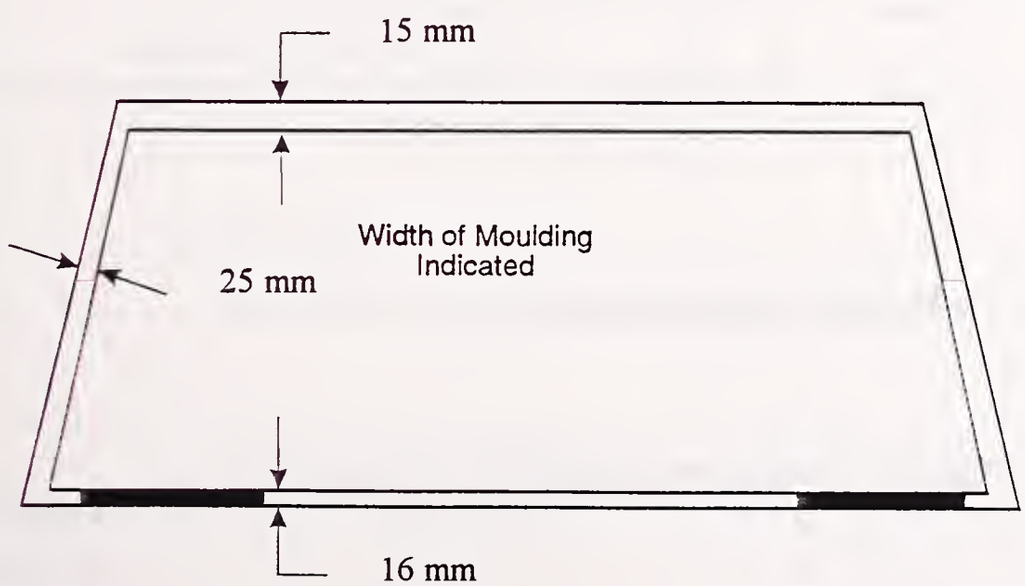
Plastic trim around outer perimeter, adhesive around inner perimeter.

FMVSS 212 requirements: The post-test periphery retention amount must be at least 75% of the pre-test periphery measurement for vehicles NOT equipped with automatic restraints, and 50% for each side of windshield for vehicles equipped with automatic restraint systems for front occupants.

Windshield periphery measurements:

	Pre-test	Post-test	Percent retention
Right side	2131 mm	1761 mm	82.6
Left side	2131 mm	1851 mm	86.9
Total	4262 mm	3612 mm	84.7

Pre-test windshield mounting material temperature: 21° C



Front view of windshield[1]

Loss of windshield retention lengths: Windshield retention loss occurred along the lower edge of the windshield from 70 to 350 mm and from 1176 to 1546 mm measured from the lower left corner.

[1] Indicate areas of loss of retention, if any, on windshield diagram.

Figure 5 FMVSS 219 Test Data

Protected zone lower edge requirement:

The lower edge of the protected zone is determined by placing a 165-millimeter diameter rigid sphere weighing 6.8 kg in a position such that it simultaneously contacts the inner surface of the windshield and the top surface of the instrument panel including padding. Draw the locus of points on the inner surface of the windshield contactable by the sphere across the width of the instrument panel. From the outermost contactable points, extend the locus line horizontally to the edges of the windshield, and then draw a line on the inner surface of the windshield below and 13 millimeters from the locus line. The **lower edge of the protected zone** is the longitudinal projection onto the outer surface of the windshield of this line.

Windshield measurements:

A = 1292 mm

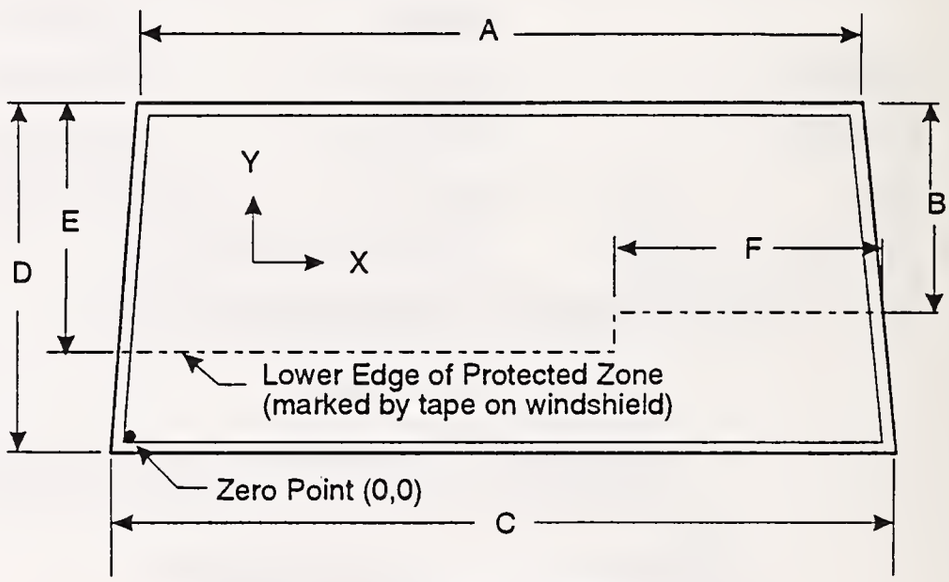
B = 405 mm

C = 1686 mm

D = 718 mm

E = 457 mm

F = 441 mm



FRONT VIEW

Method of adhering protected zone template to windshield: NA

Areas of windshield template penetration greater than 6 mm: NA

	Coordinates X	Coordinates Y
1.		
2.		
3.		

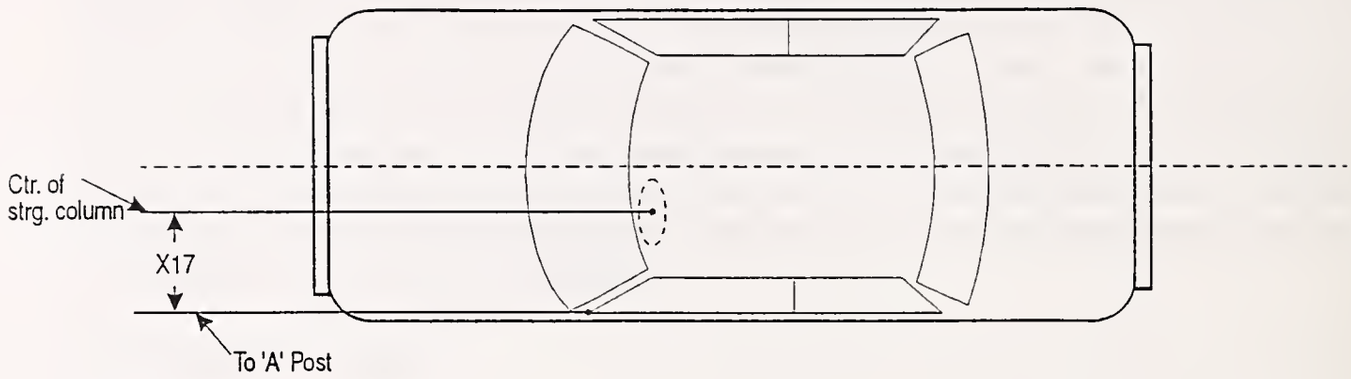
Areas of windshield penetration, below the protected zone, through the inner surface of the windshield: None

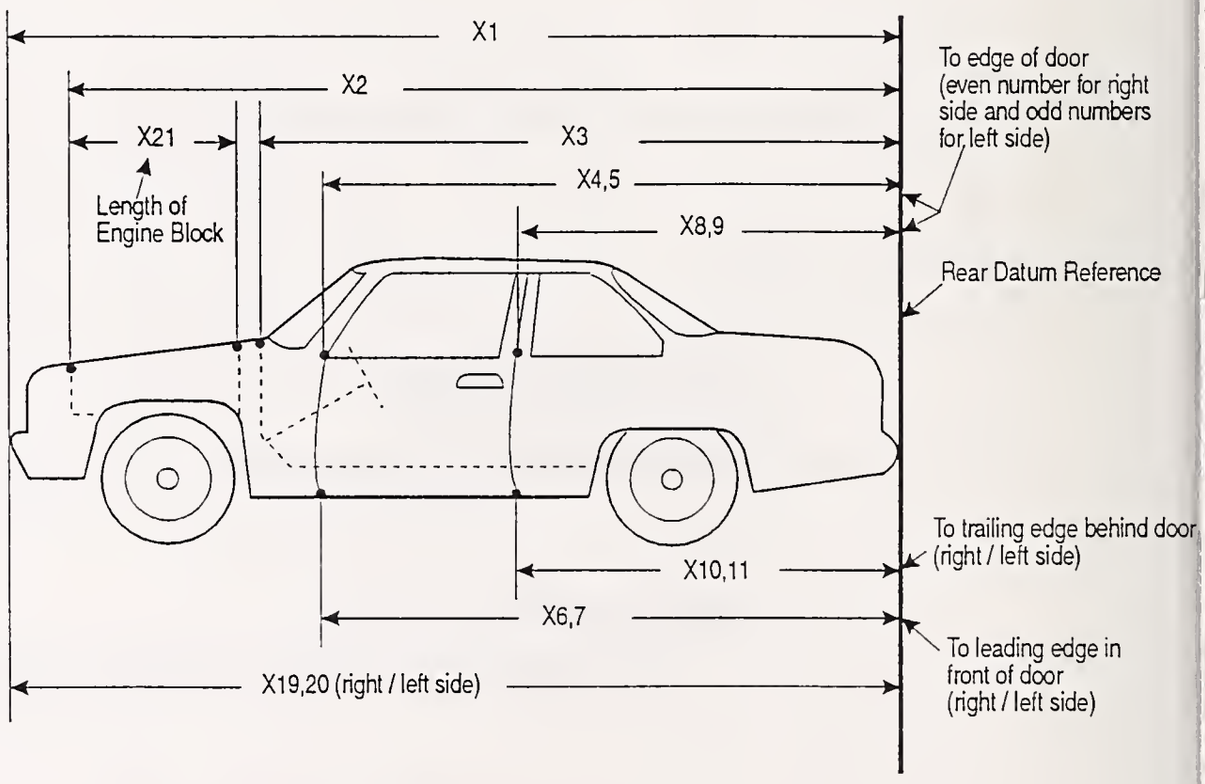
1.		
2.		
3.		

Section 4.0

Vehicle, Occupant, and Camera Information

Figure 6 Pre-test and Post-test Measurements Points





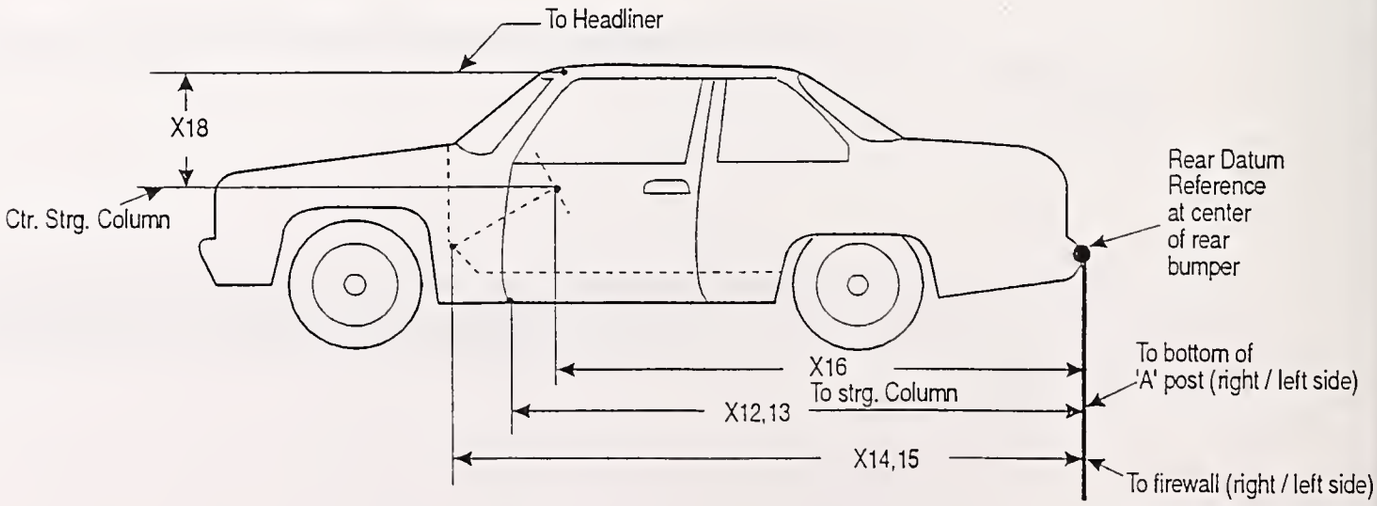


Table 7 Impacted Vehicle Measurements

Vehicle Make/Model: Solectria/E-10 Test Number: 941219

No.	Type of measurement	Pre-test	Post-test	Diff.
X1	Total length of vehicle at centerline	4782 mm	4036 mm	746 mm
X2	Rear surface of vehicle to front of engine block	4449 mm	3960 mm	489 mm
X3	Rear surface of vehicle to firewall	3666 mm	3378 mm	288 mm
X4	Rear surface of vehicle to upper leading edge of right door	3422 mm	3173 mm	249 mm
X5	Rear surface of vehicle to upper leading edge of left door	3410 mm	3280 mm	130 mm
X6	Rear surface of vehicle to lower leading edge of right door	3400 mm	3297 mm	103 mm
X7	Rear surface of vehicle to lower leading edge of left door	3400 mm	3384 mm	16 mm
X8	Rear surface of vehicle to upper trailing edge of right door	2269 mm	2176 mm	93 mm
X9	Rear surface of vehicle to upper trailing edge of left door	2264 mm	2189 mm	75 mm
X10	Rear surface of vehicle to lower trailing edge of right door	2272 mm	2192 mm	80 mm
X11	Rear surface of vehicle to lower trailing edge of left door	2272 mm	2236 mm	36 mm
X12	Rear surface of vehicle to bottom of "A" post on right side	3345 mm	3192 mm	153 mm
X13	Rear surface of vehicle to bottom of "A" post on left side	3348 mm	3210 mm	138 mm
X14	Rear surface of vehicle to firewall - right side	3643 mm	3439 mm	204 mm
X15	Rear surface of vehicle to firewall - left side	3586 mm	3437 mm	149 mm
X16	Rear surface of vehicle to steering wheel center	2922 mm	2747 mm	175 mm
X17	Center of steering column to "A" post	318 mm	253 mm	65 mm
X18	Center of steering column to headliner	490 mm	421 mm	69 mm
X19	Rear surface of vehicle to right side of front bumper	4654 mm	4019 mm	635 mm
X20	Rear surface of vehicle to left side of front bumper	4627 mm	4024 mm	603 mm
X21	Length of engine block	821 mm	821 mm	0 mm

Figure 7 Vehicle Target Locations

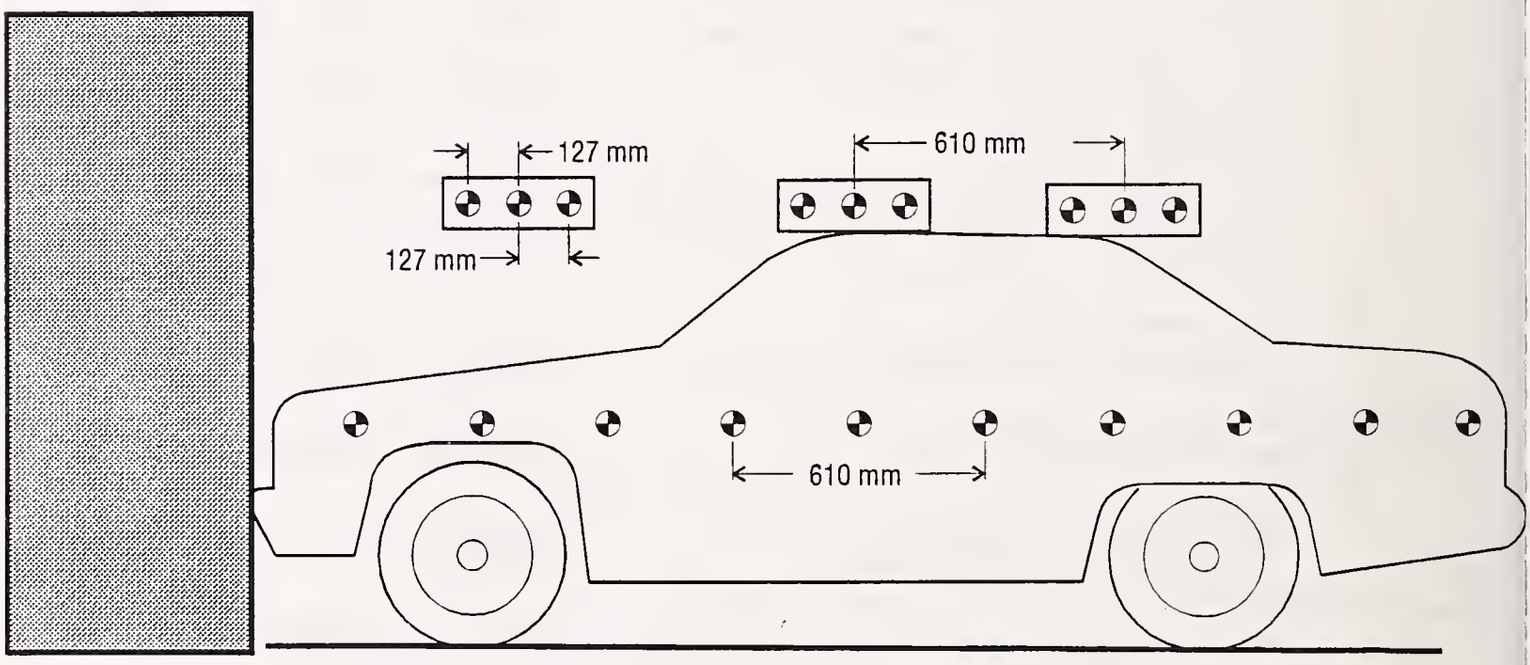
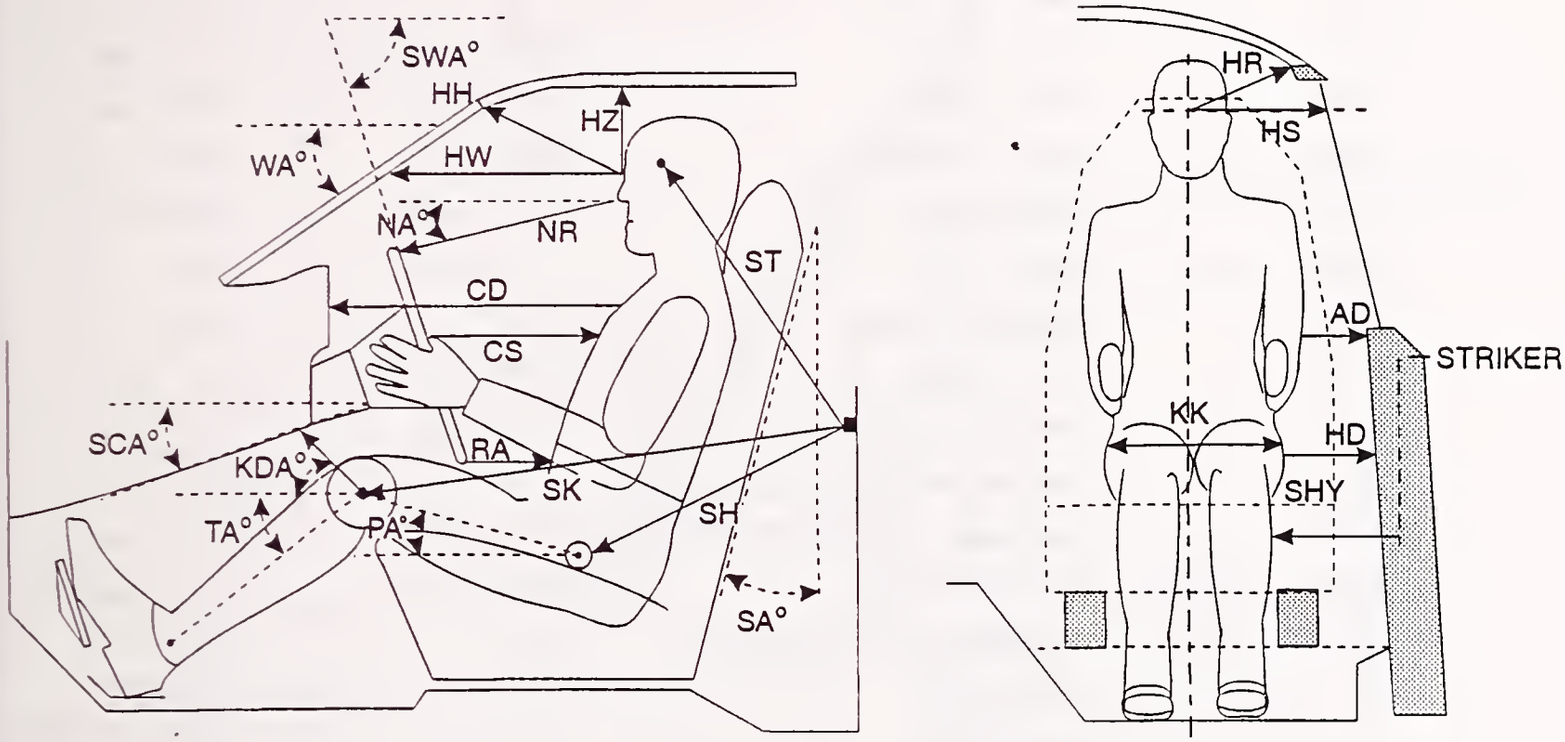


Figure 8 Dummy Measurement Locations for Front Seat Occupants



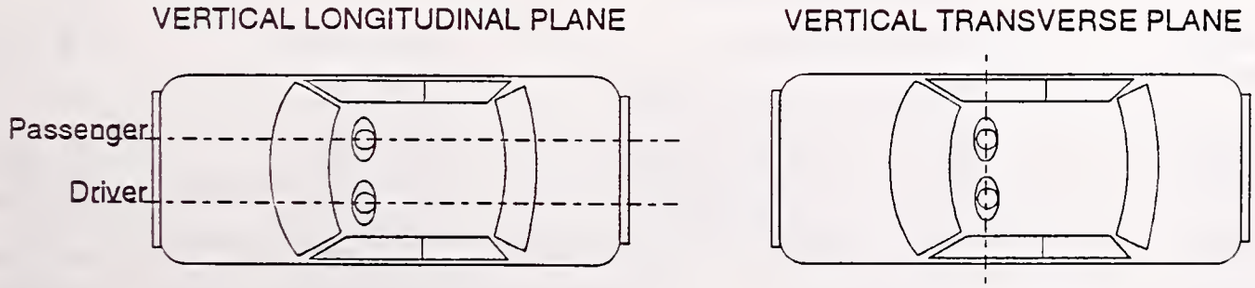


Table 8 Dummy Measurement Data for Front Seat Occupants

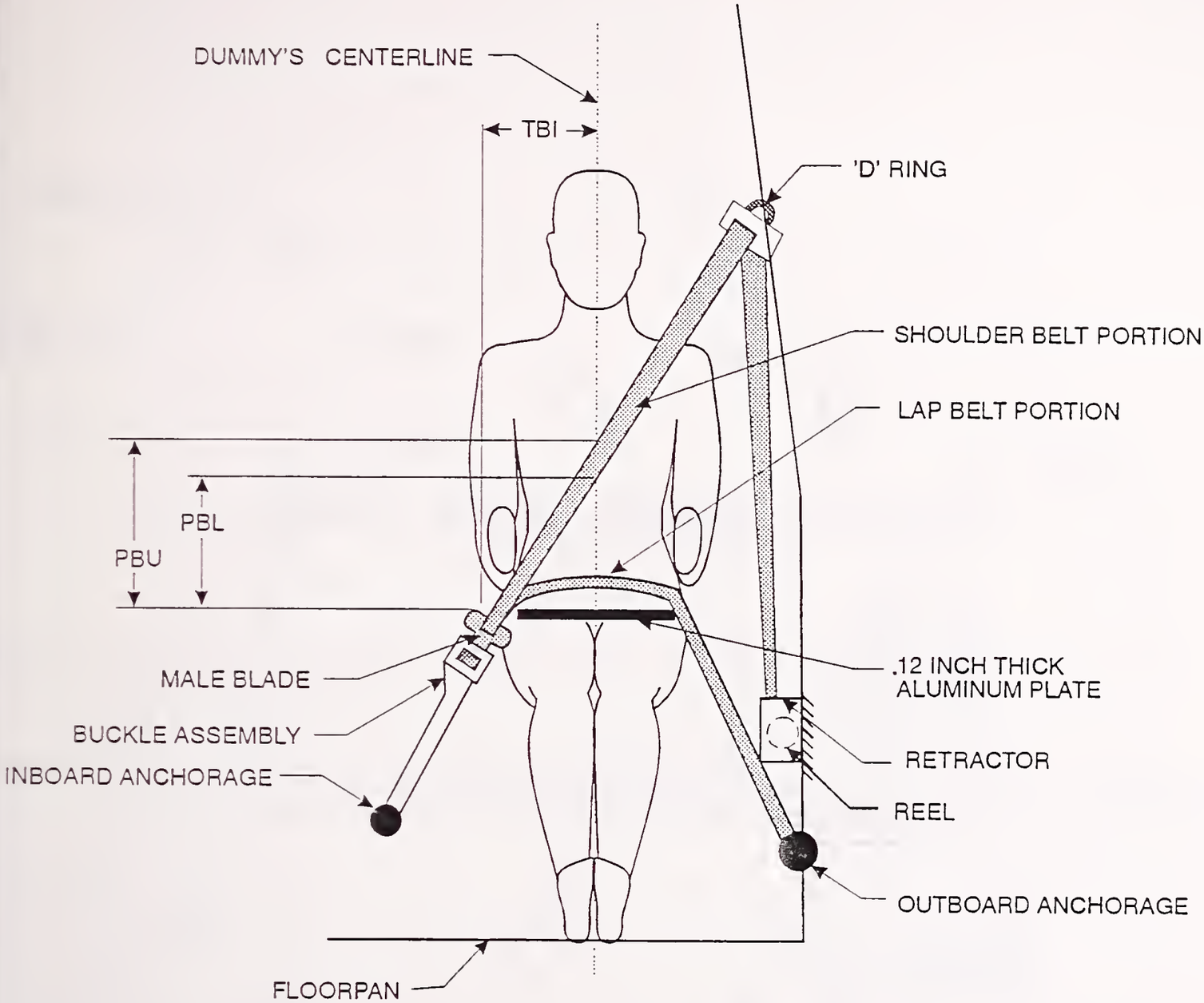
Designation	Type of Measurement	Driver[1] (Serial #551)	Passenger[1] (Serial #591)
WA	Windshield angle	34°	34°
SWA	Steering wheel angle	69°	NA
SCA	Steering column angle	21°	NA
SA	Seat back angle	20°	20°
HZ	Head to roof	209 mm	215 mm
HH	Head to header	449 mm	468 mm
HW	Head to windshield	652 mm	645 mm
HR	Head to side header	250 mm	264 mm
NR	Nose to rim	371 mm	NA
NA	Nose to rim angle	11°	NA
CD	Chest to dash	528 mm	571 mm
CS	Steering wheel to chest	328 mm	NA
RA	Rim to abdomen	180 mm	NA
KDL	Left knee to dash	183 mm	208 mm
KDR	Right knee to dash	187 mm	212 mm
KDA	Outboard knee to dash angle	30°	20°
PA	Pelvic angle	25°	25°
TA	Tibial angle	37°	35°
KK	Knee to knee	262 mm	251 mm
ST[2]	Striker to head	583 mm	589 mm
	Striker to head angle	-74°	-76°
SK[2]	Striker to knee	696 mm	694 mm
	Striker to knee angle	5°	-3°
SH[2]	Striker to H-point	291 mm	298 mm
	Striker to H-point angle	-2°	13°
SHY	Striker to H-point (Y dir.)	218 mm	261 mm
HS	Head to side window	363 mm	381 mm
HD	H-point to door	124 mm	140 mm
AD	Arm to door	118 mm	76 mm

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

[1] The seat was not positioned at the design midtrack location. See Test Procedure page.

[2] Angle measured from head restraint support.

Figure 9 Seat Belt Positioning Data



		Driver		Passenger	
PBU -	Top surface of aluminum plate to belt upper edge	356	mm	380	mm
PBL -	Top surface of aluminum plate to belt lower edge	280	mm	302	mm
TBI -	Dummy centerline to intersection of upper torso belt and lap belt	218	mm	216	mm

Figure 10 Camera Positions

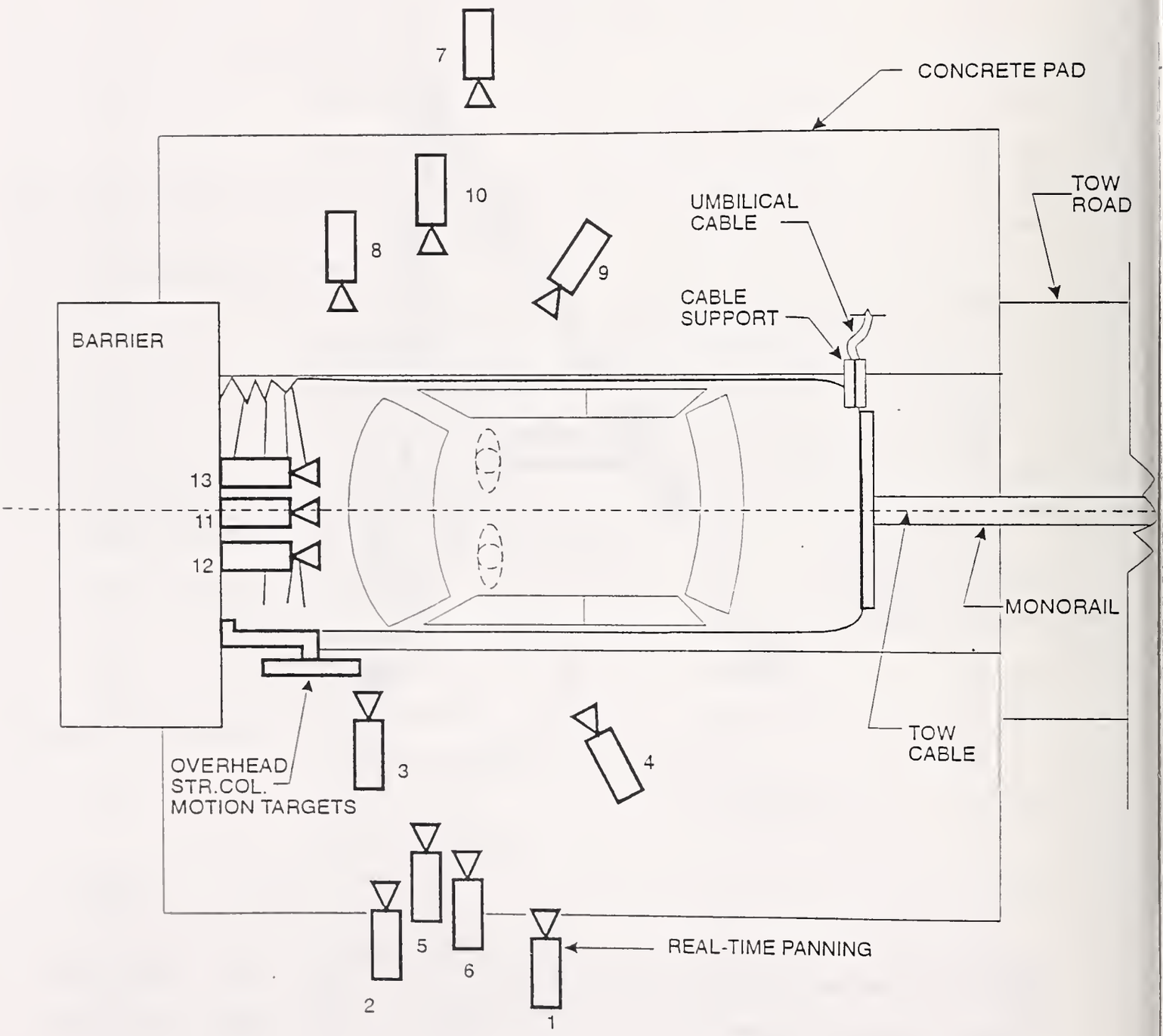
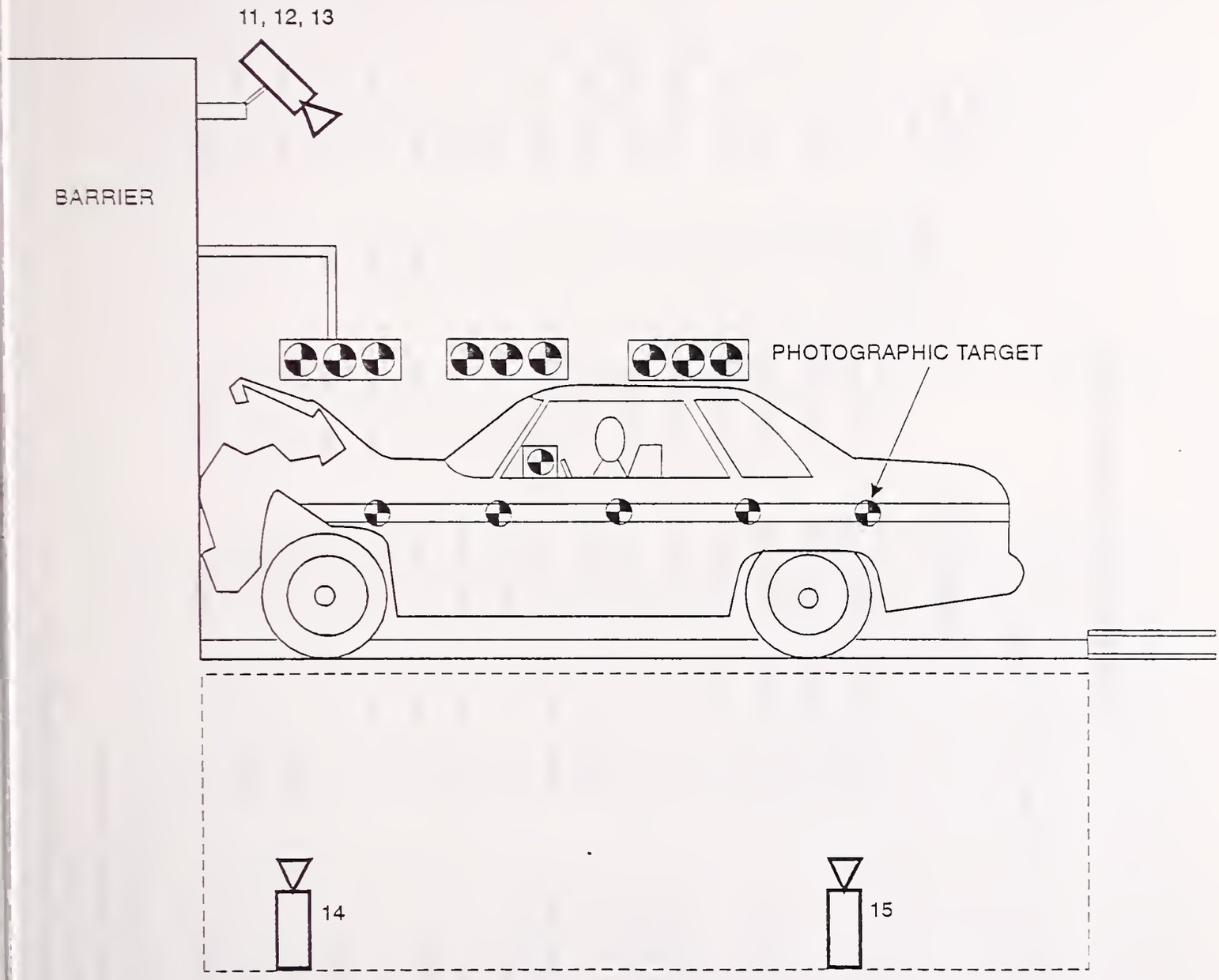


Figure 10 Camera Positions, Cont'd.



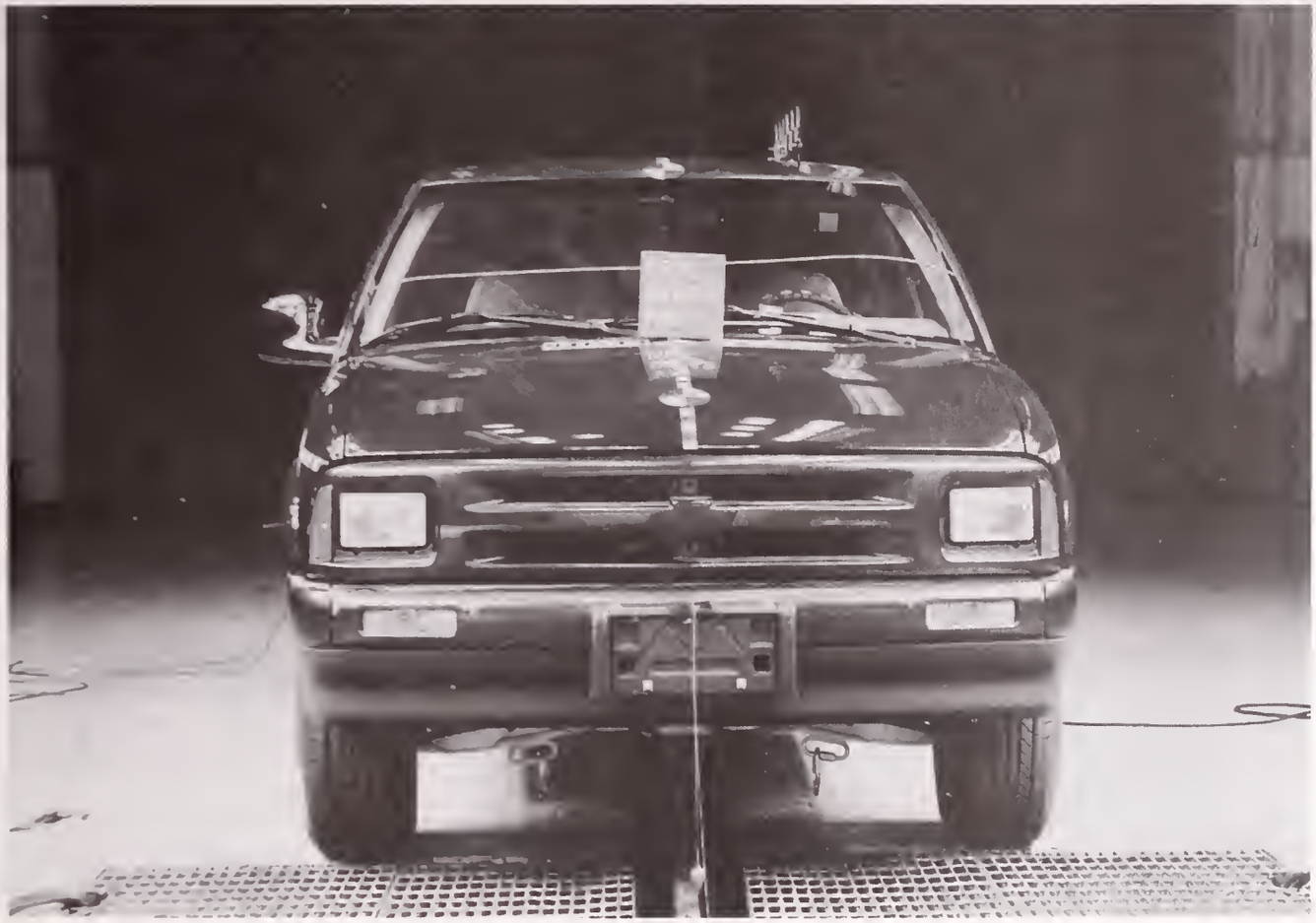


Figure A-1 Pre-test Front View

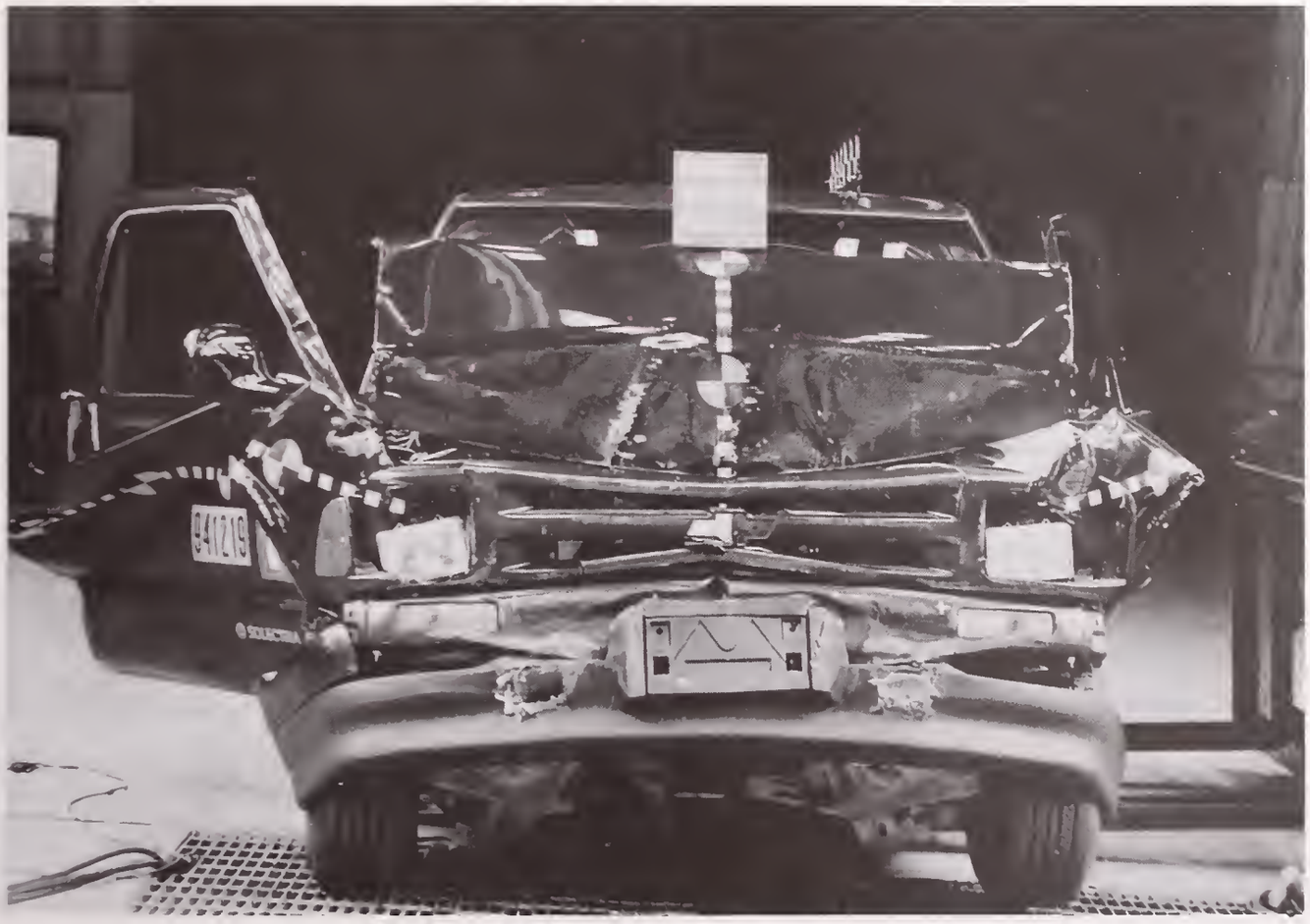


Figure A-2 Post-test Front View

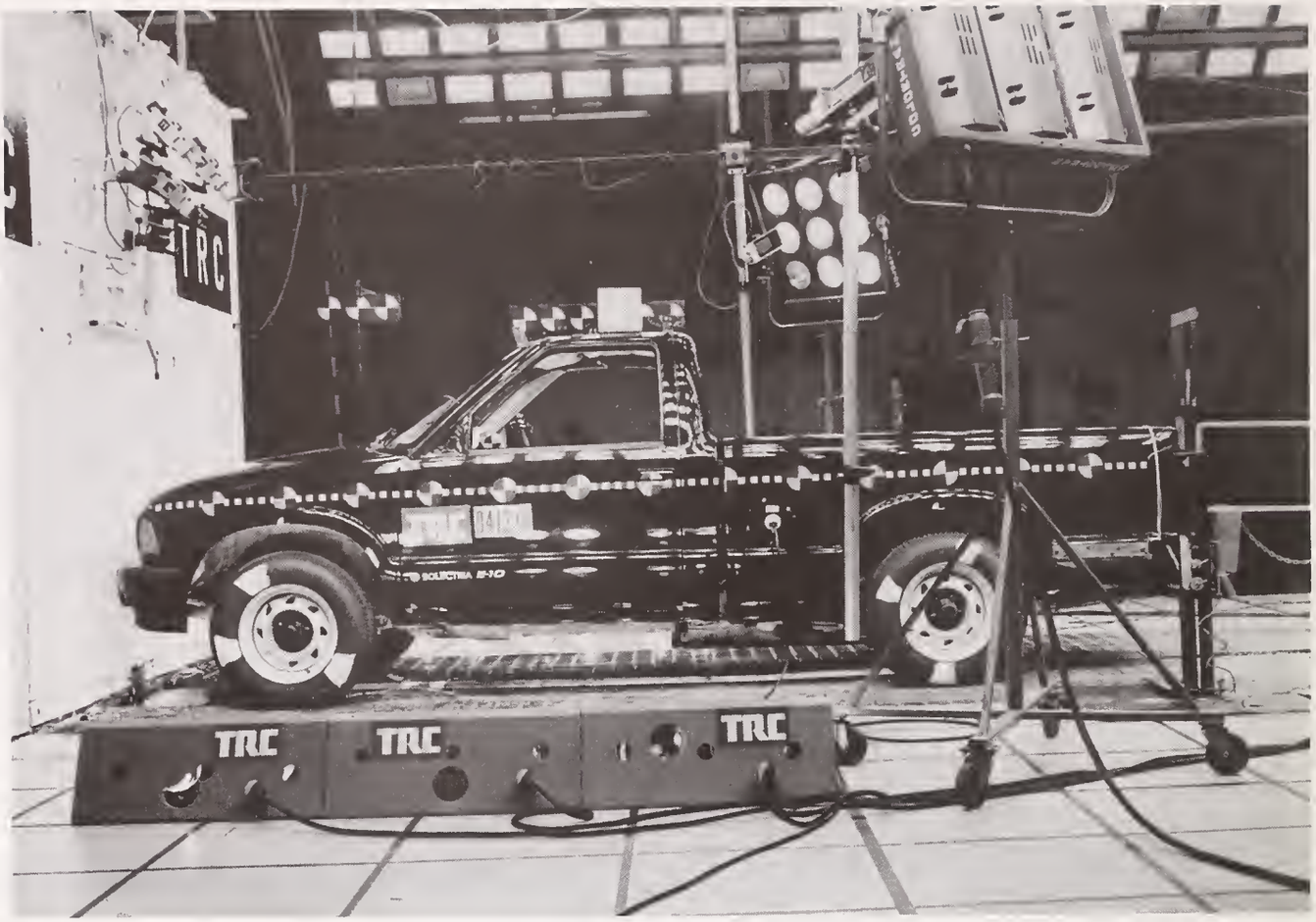


Figure A-3 Pre-test Left Side View

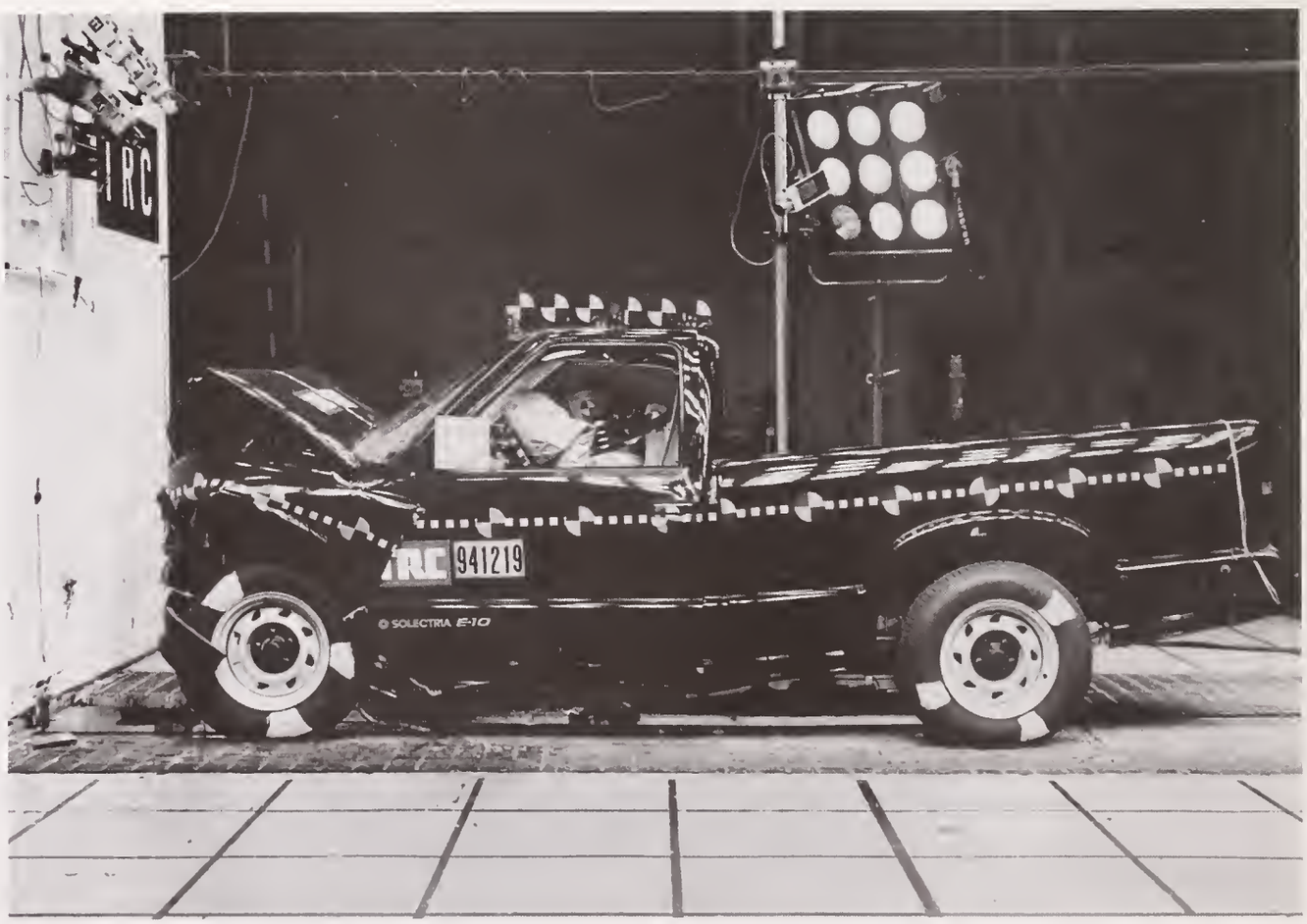


Figure A-4 Post-test Left Side View

Figure A-5 Pre-test Rear View

Figure A-6 Post-test Rear View

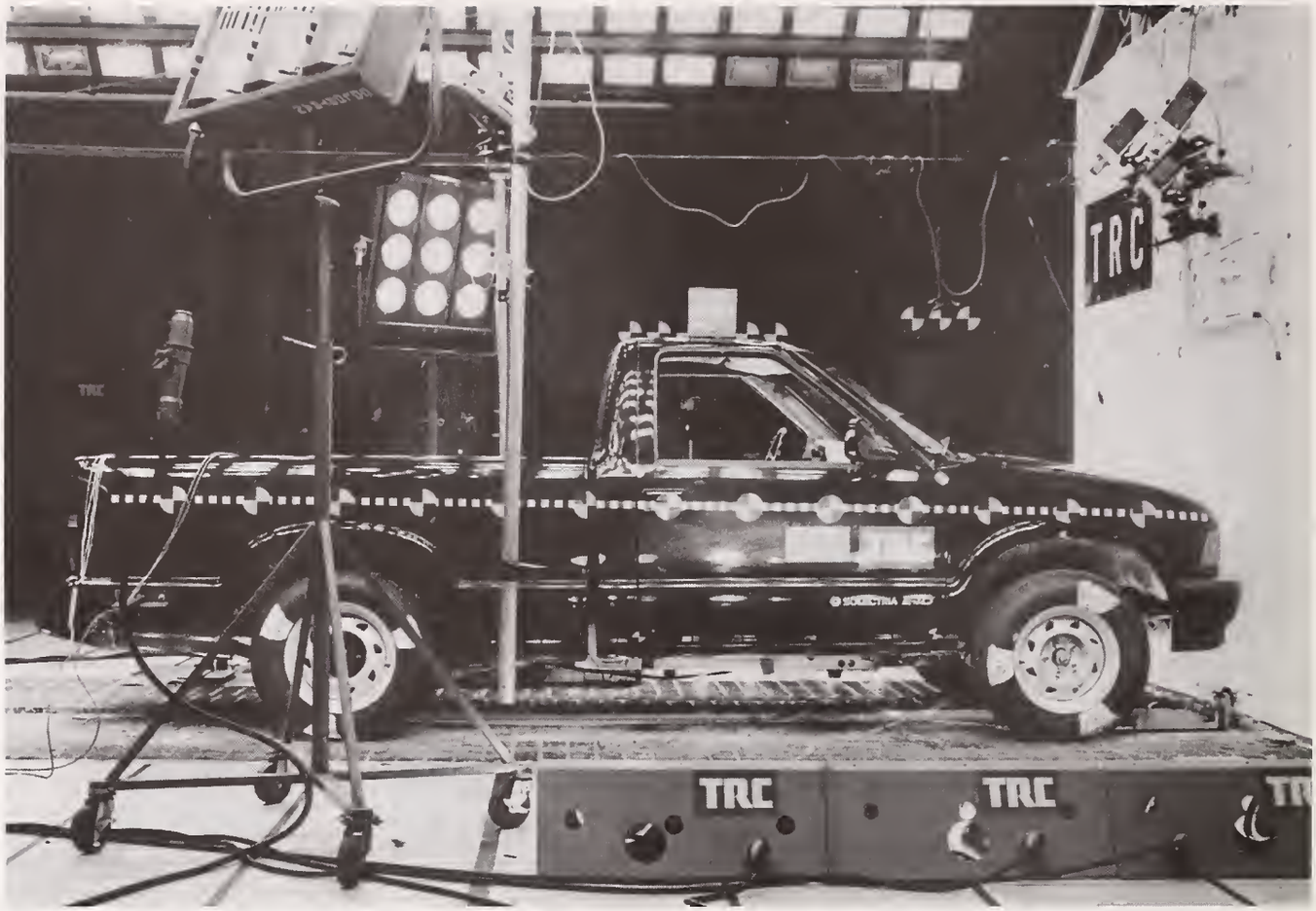


Figure A-7 Pre-test Right Side View

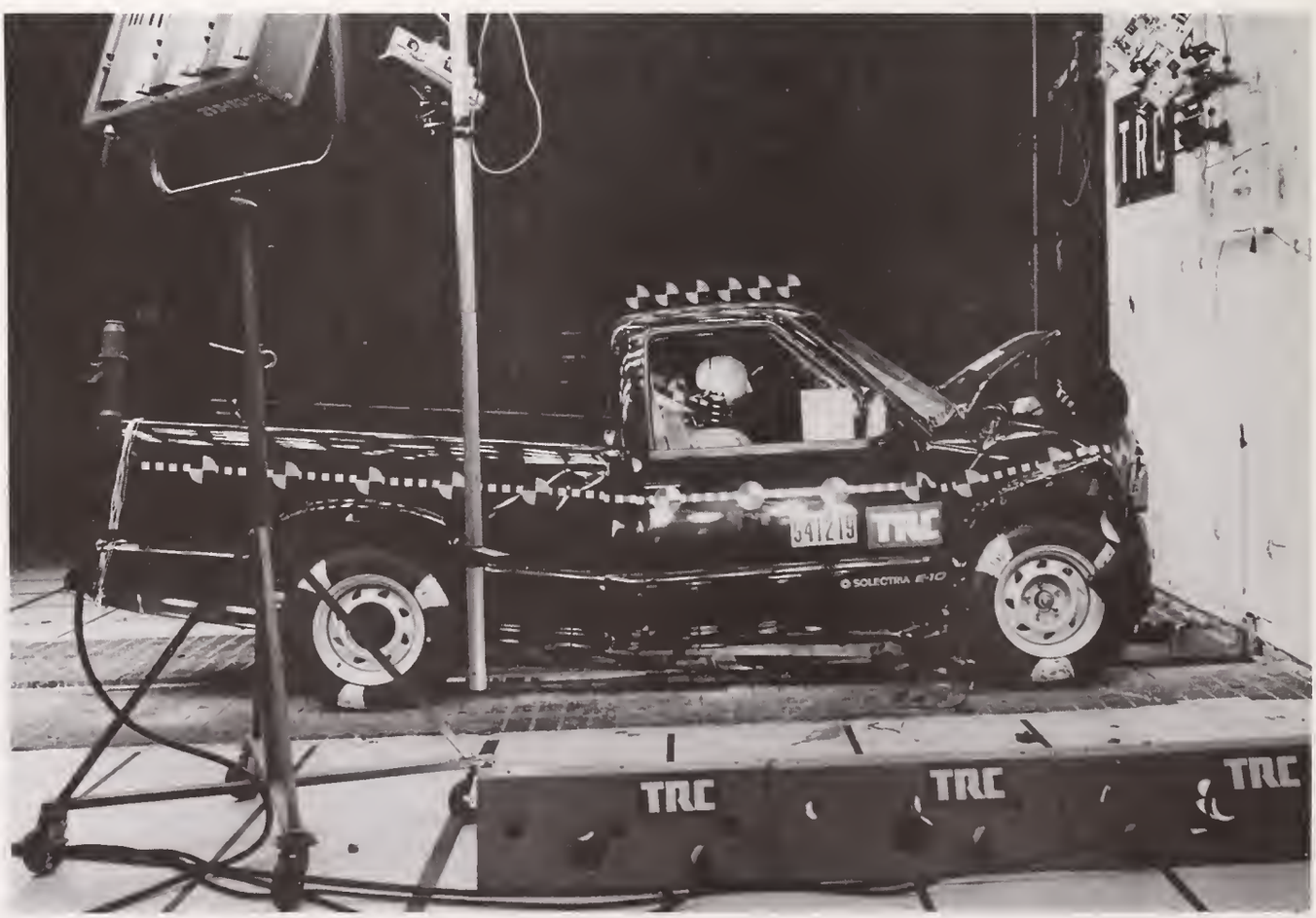


Figure A-8 Post-test Right Side View

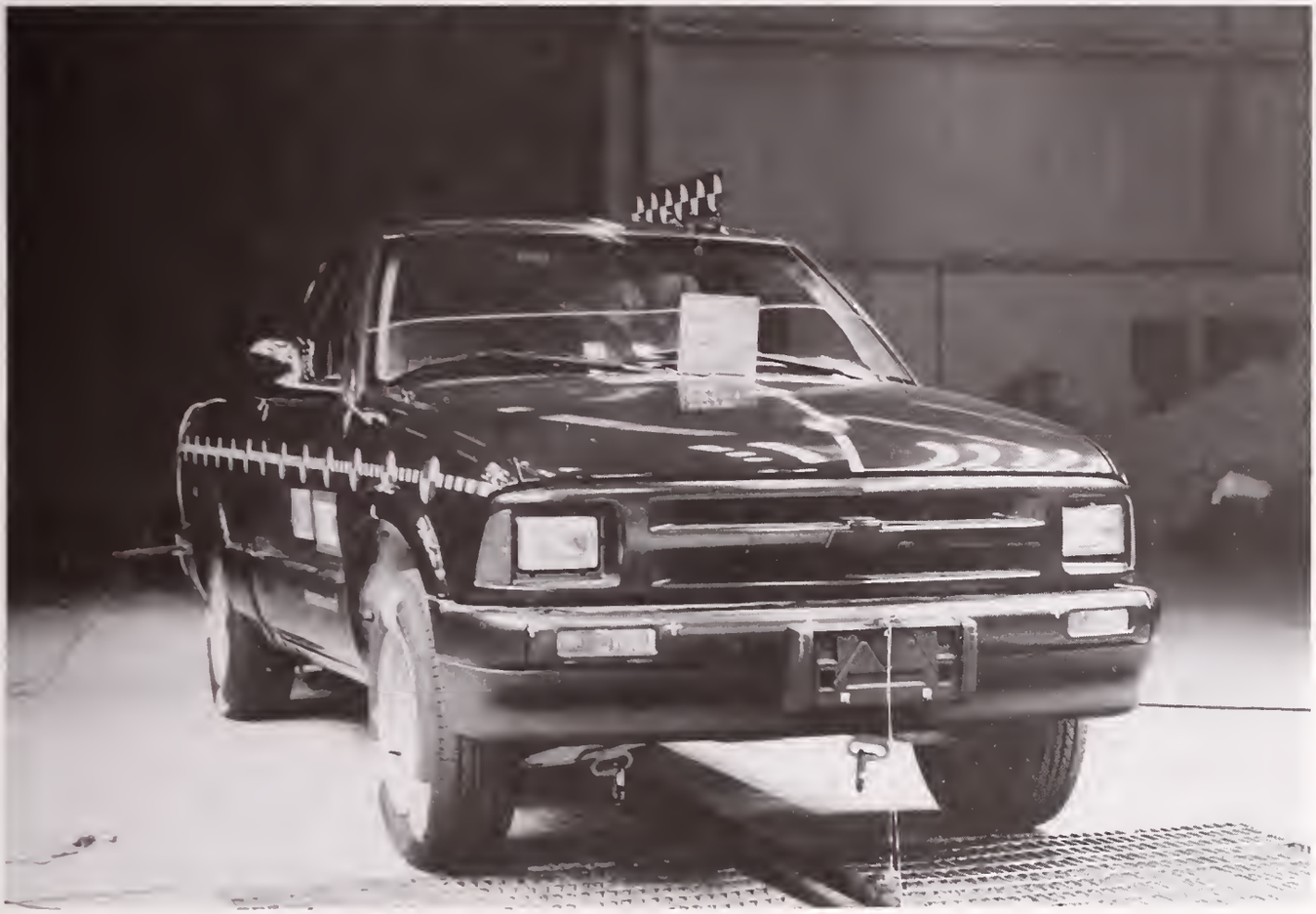


Figure A-9 Pre-test Right Front Three-quarter View

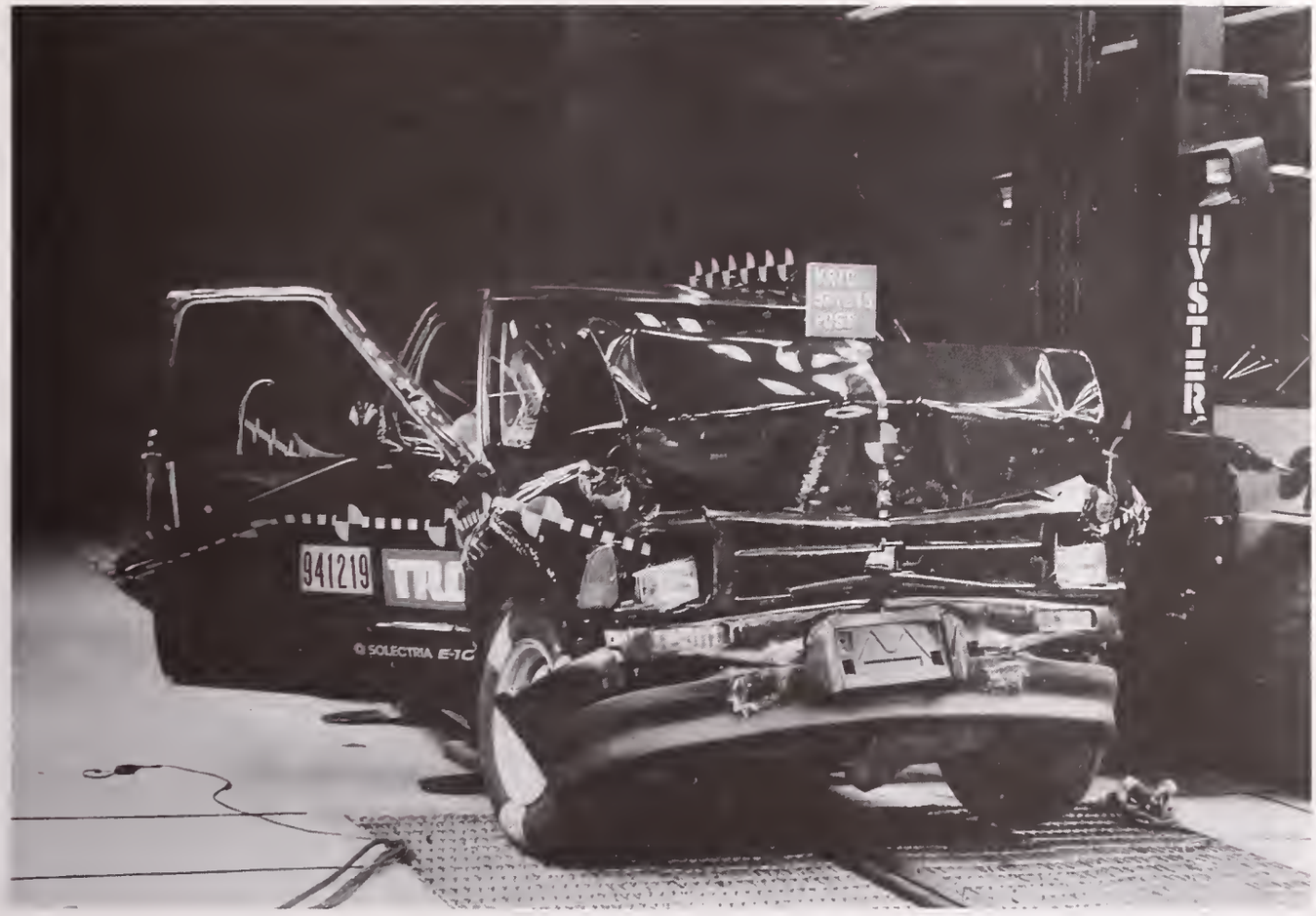


Figure A-10 Post-test Right Front Three-quarter View

Figure A-11 Pre-test Left Rear Three-quarter View

Figure A-12 Post-test Left Rear Three-quarter View

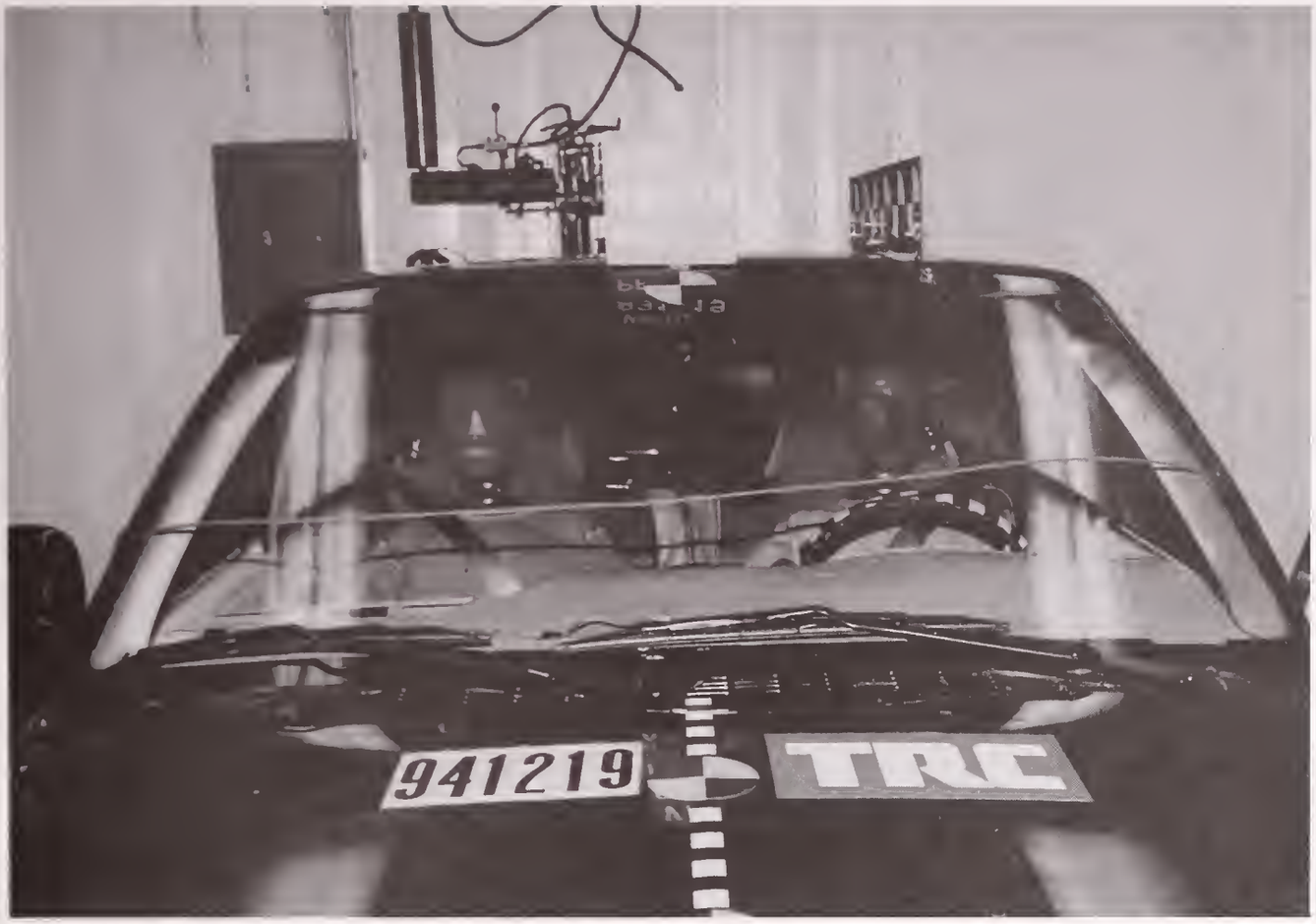


Figure A-13 Pre-test Windshield View

Figure A-14 Post-test Windshield View

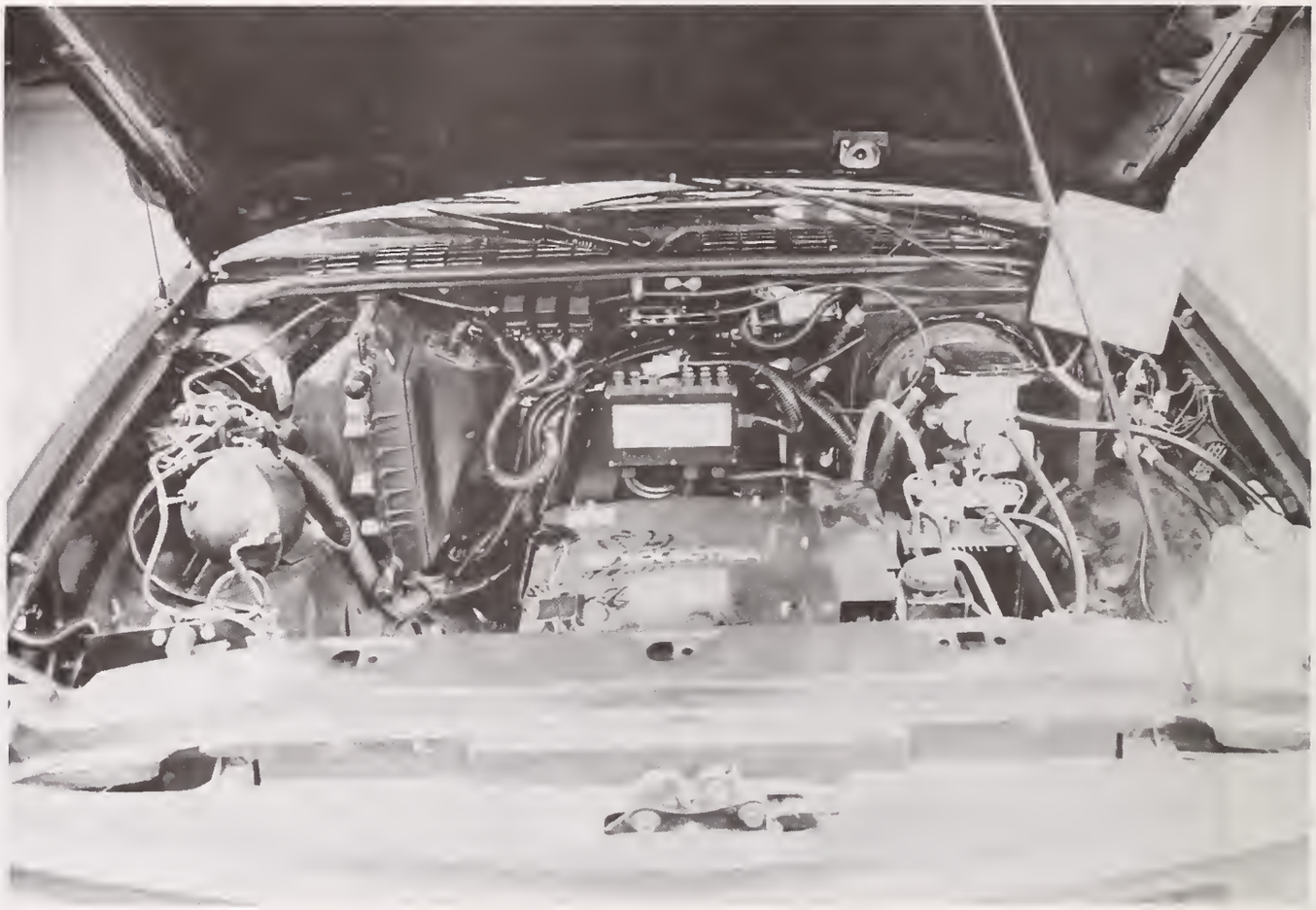


Figure A-15 Pre-test Underhood View

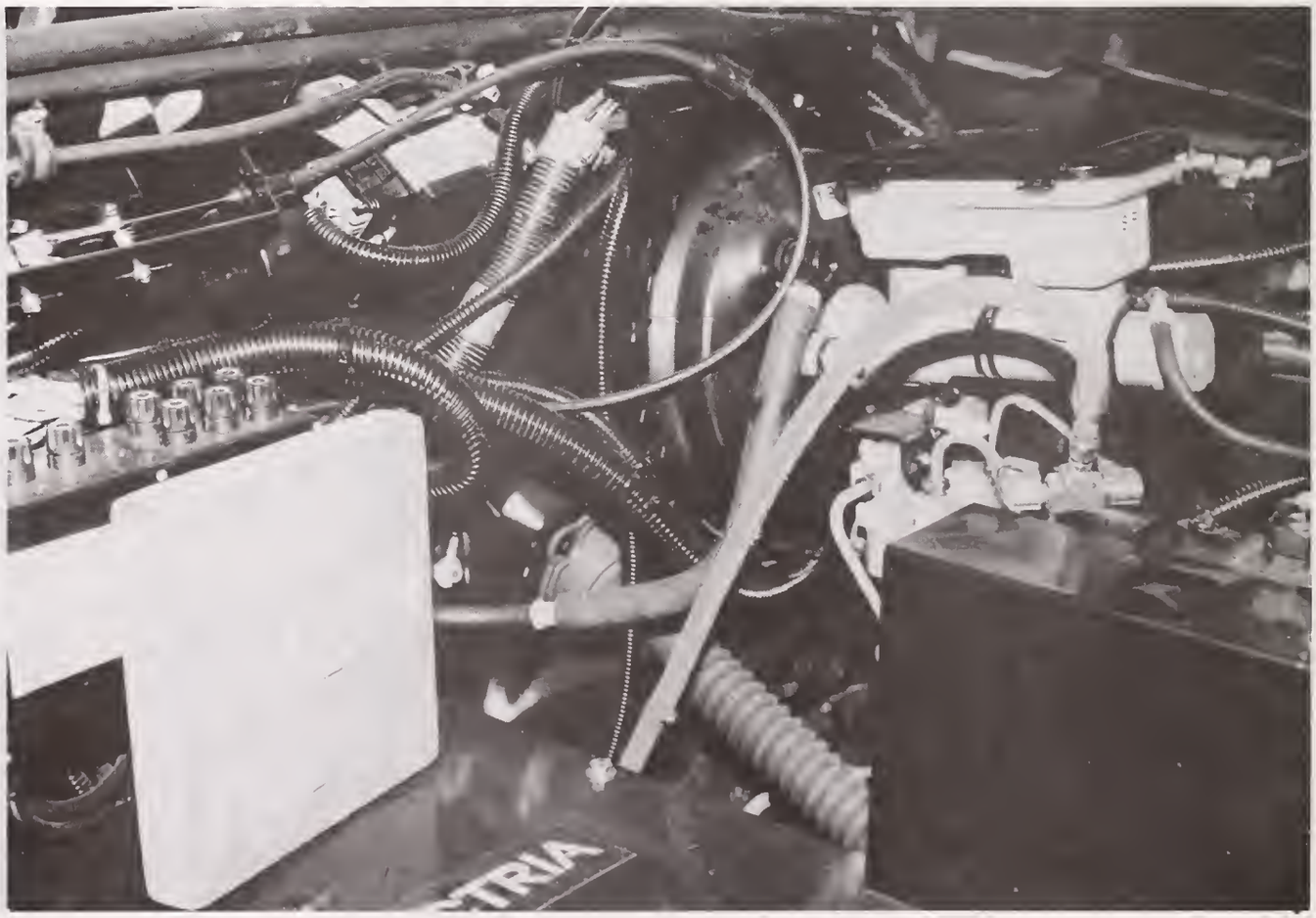


Figure A-16 Pre-test Underhood Close-up View

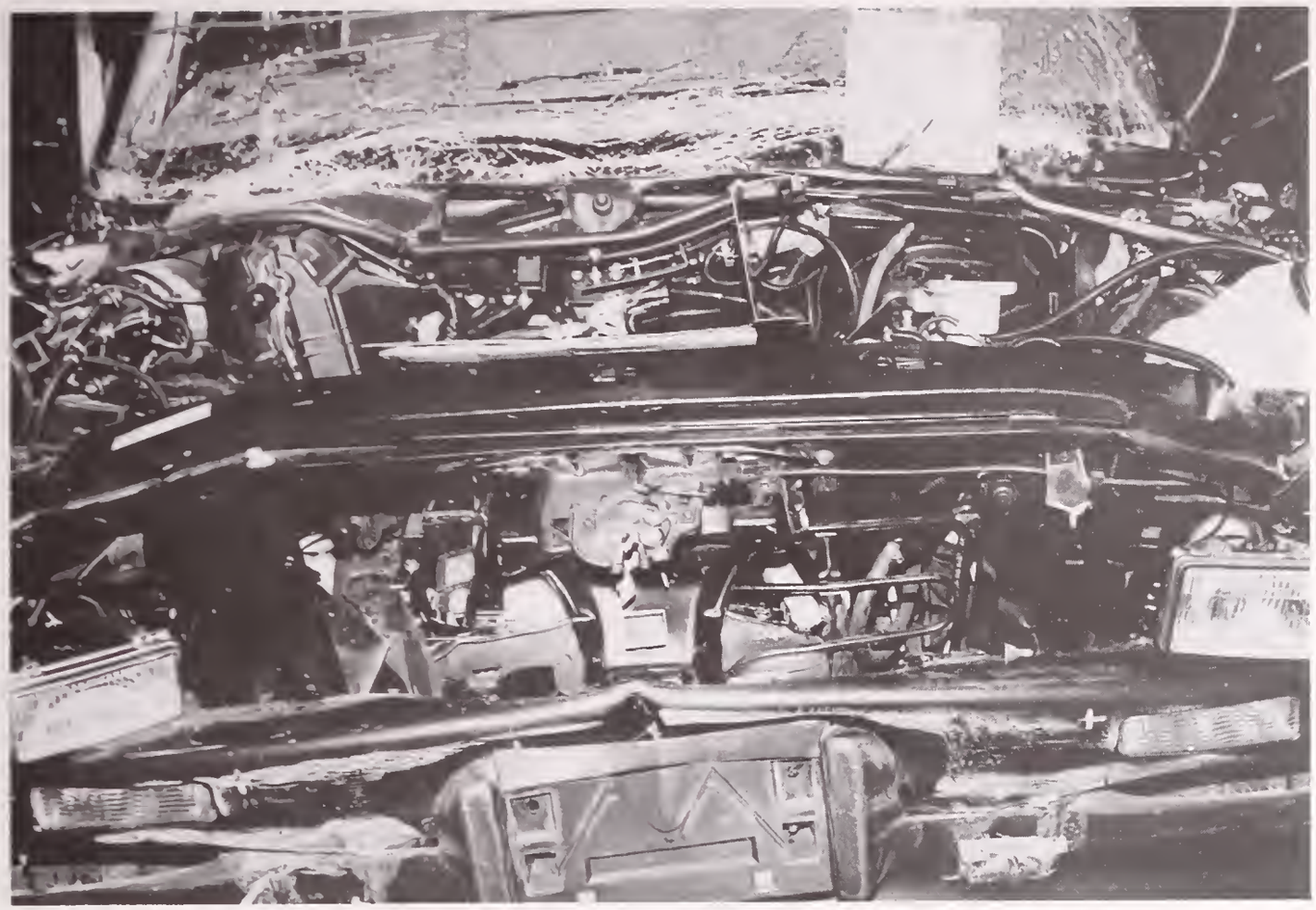


Figure A-17 Post-test Underhood View

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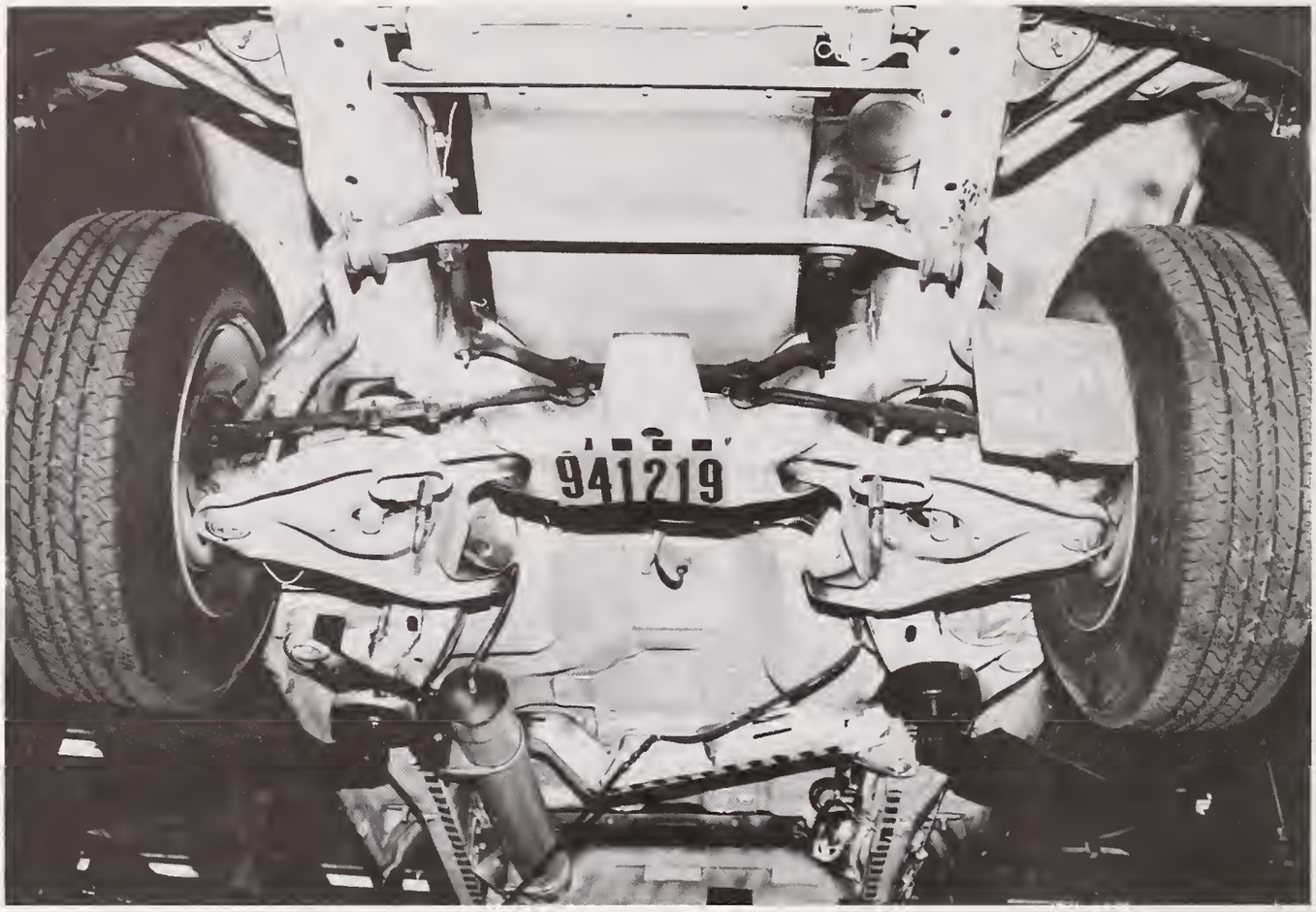

Figure A-18 Pre-test Front Underbody View

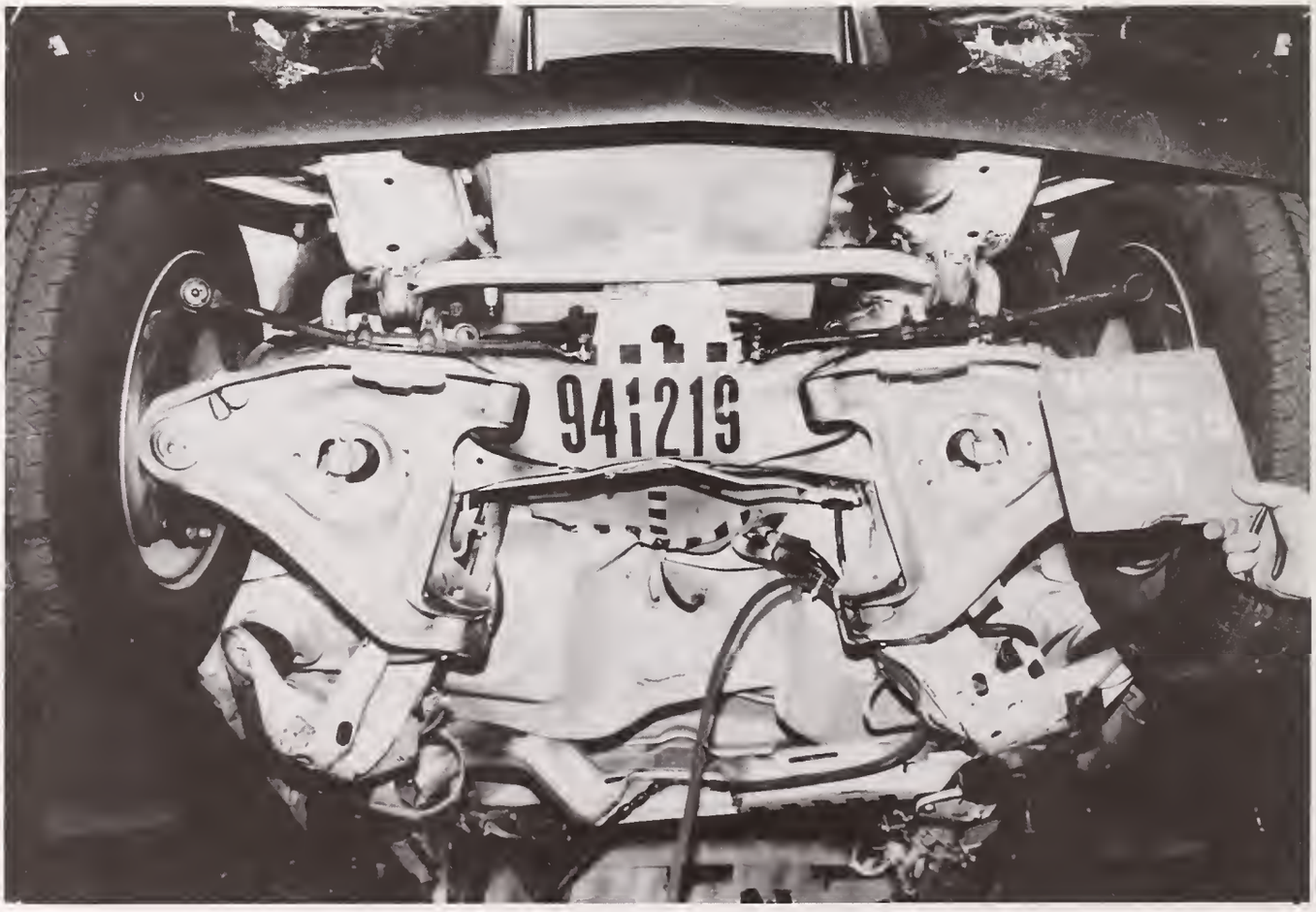

Figure A-19 Post-test Front Underbody View

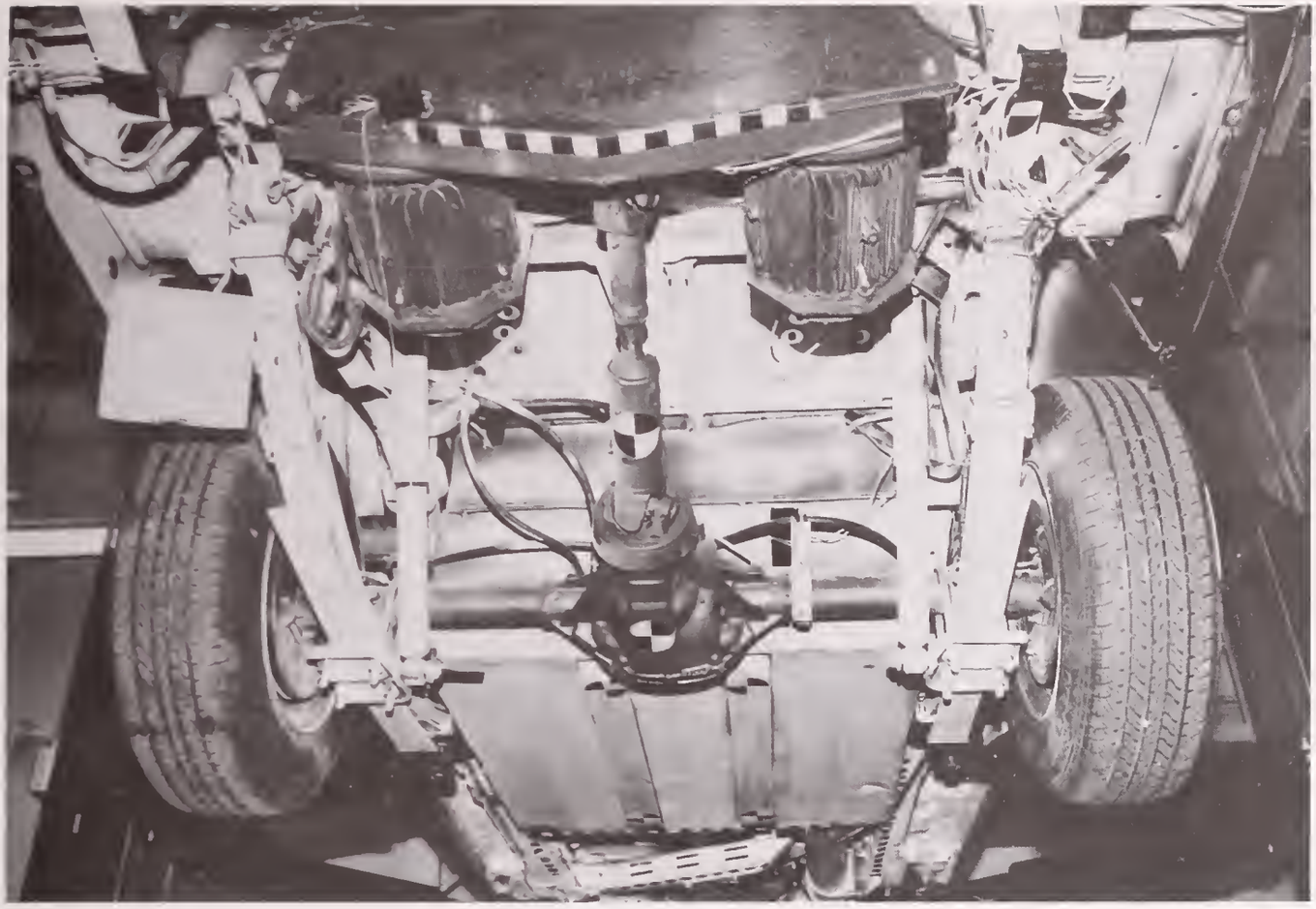

Figure A-20 Pre-test Rear Underbody View

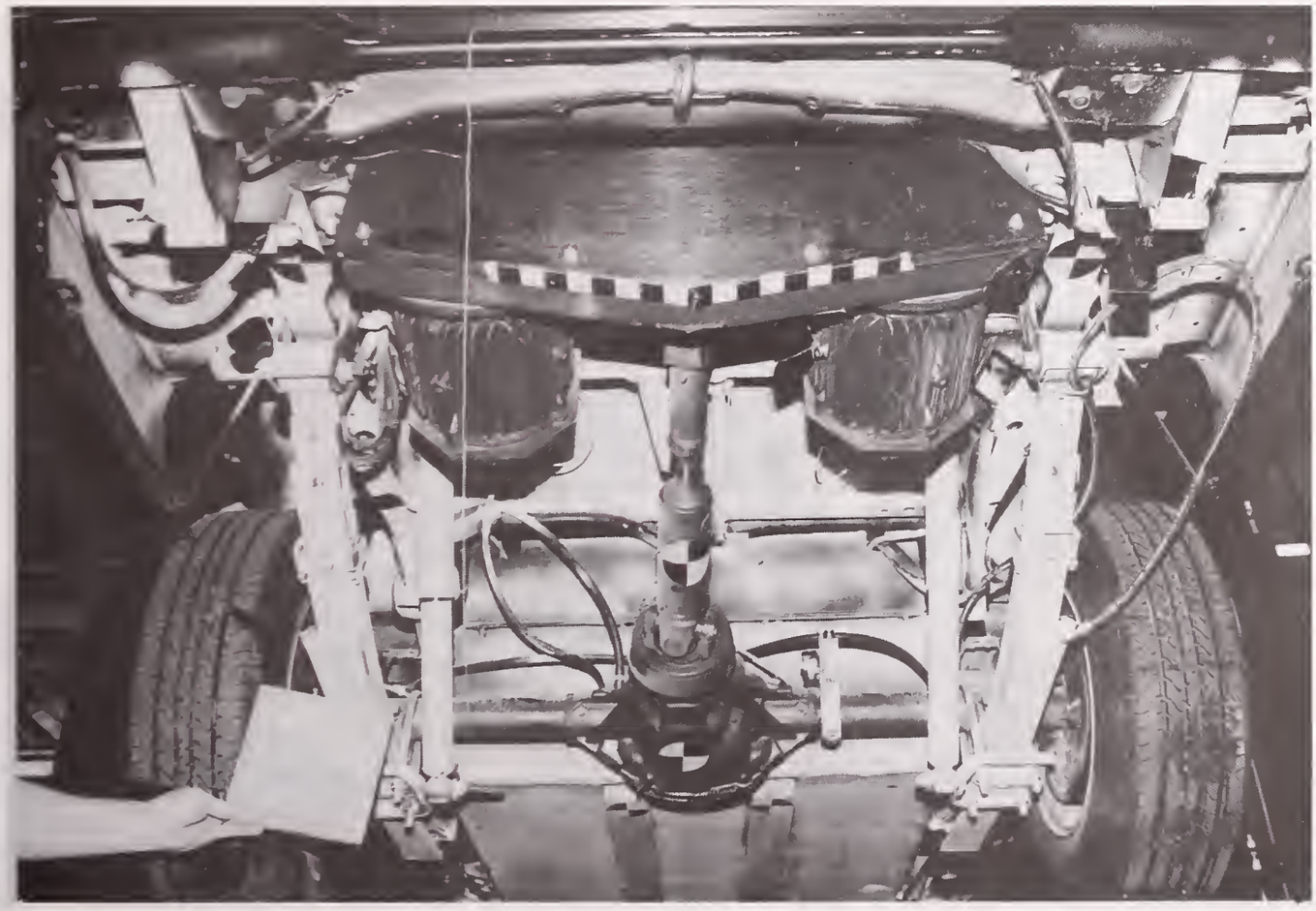

Figure A-21 Post-test Rear Underbody View

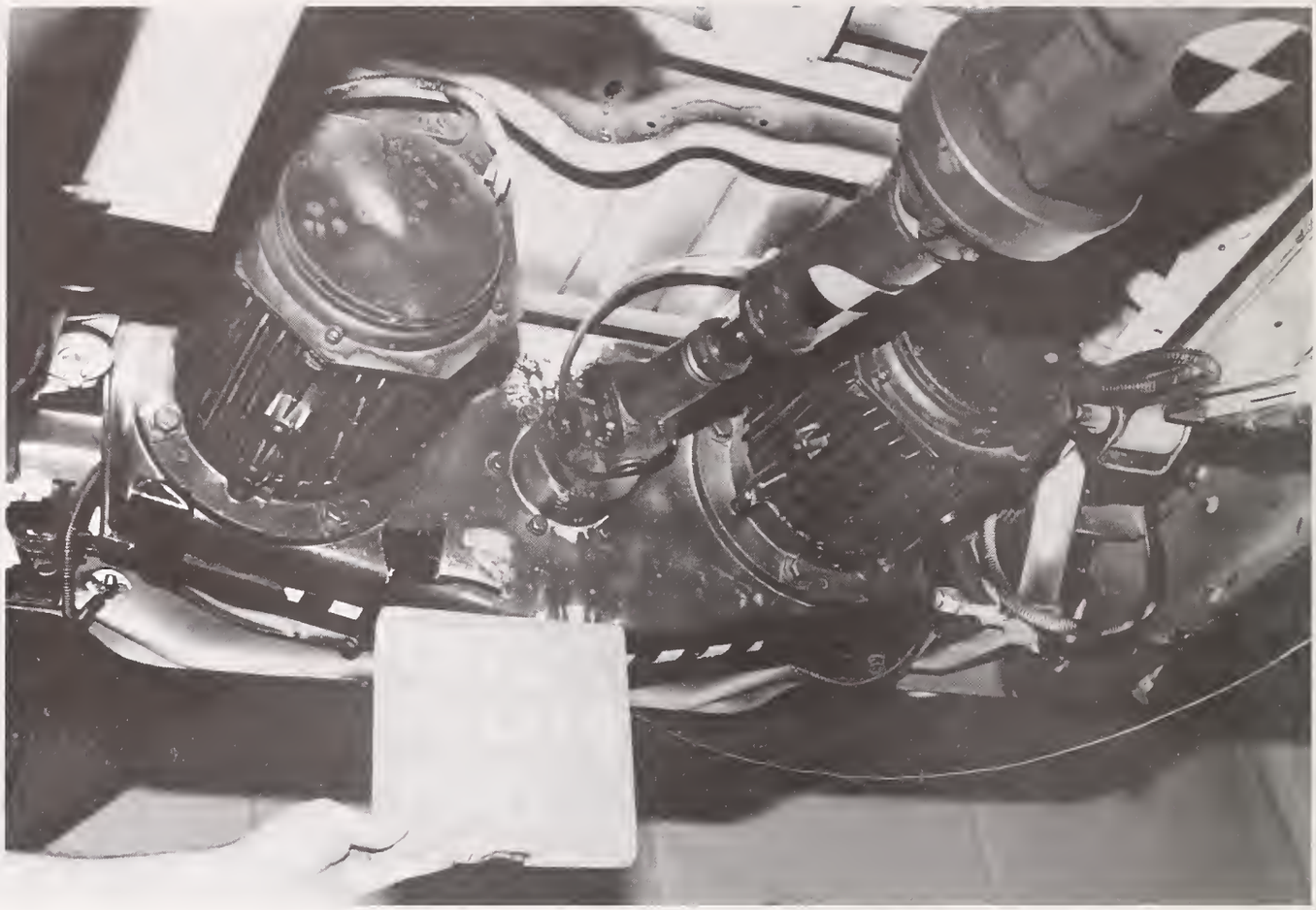

Figure A-22 Post-test Rear Underbody Close-up view

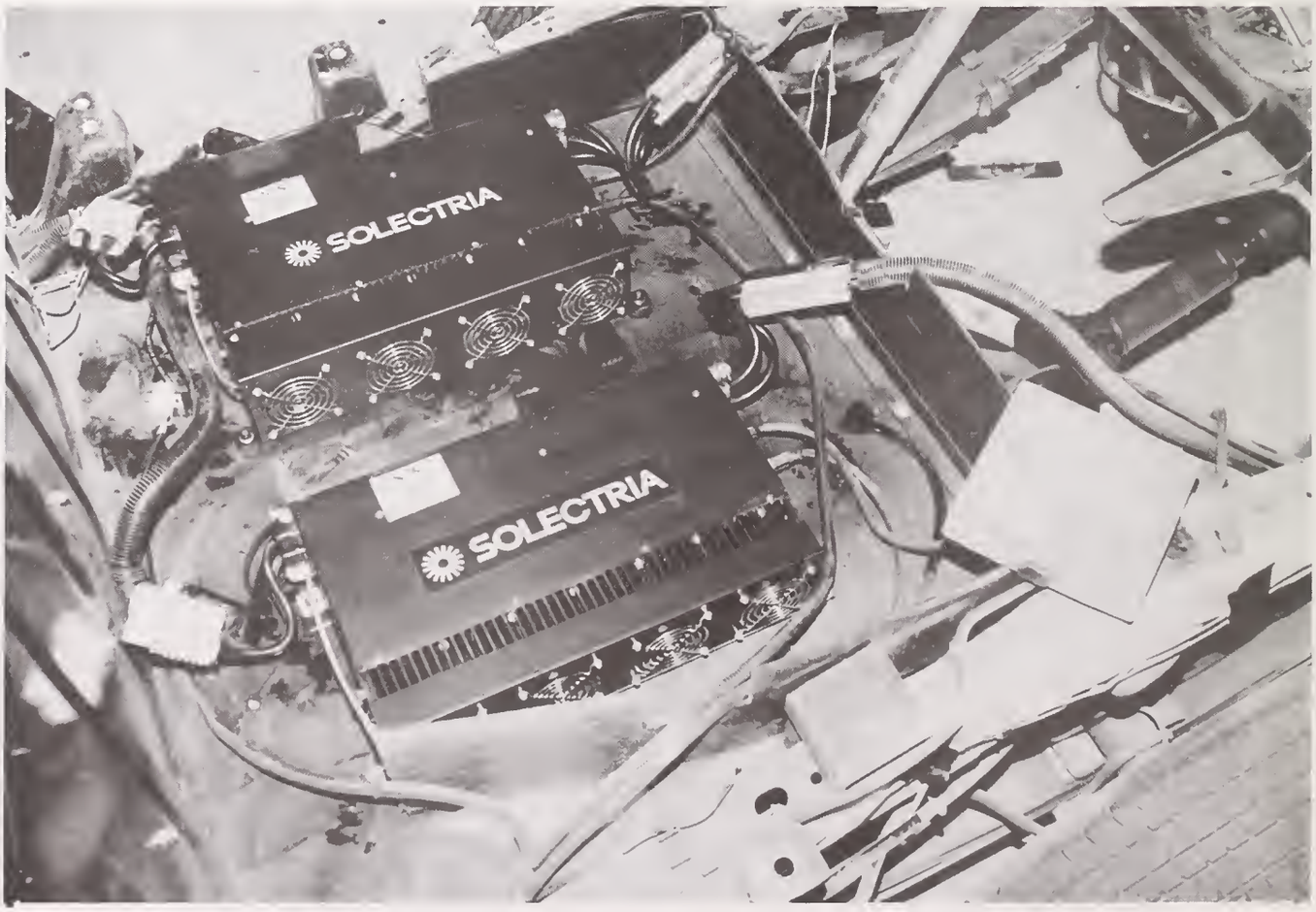

Figure A-23 Pre-test Rear Battery Box and Controller View

Figure A-24 Pre-test Circuit Breaker View

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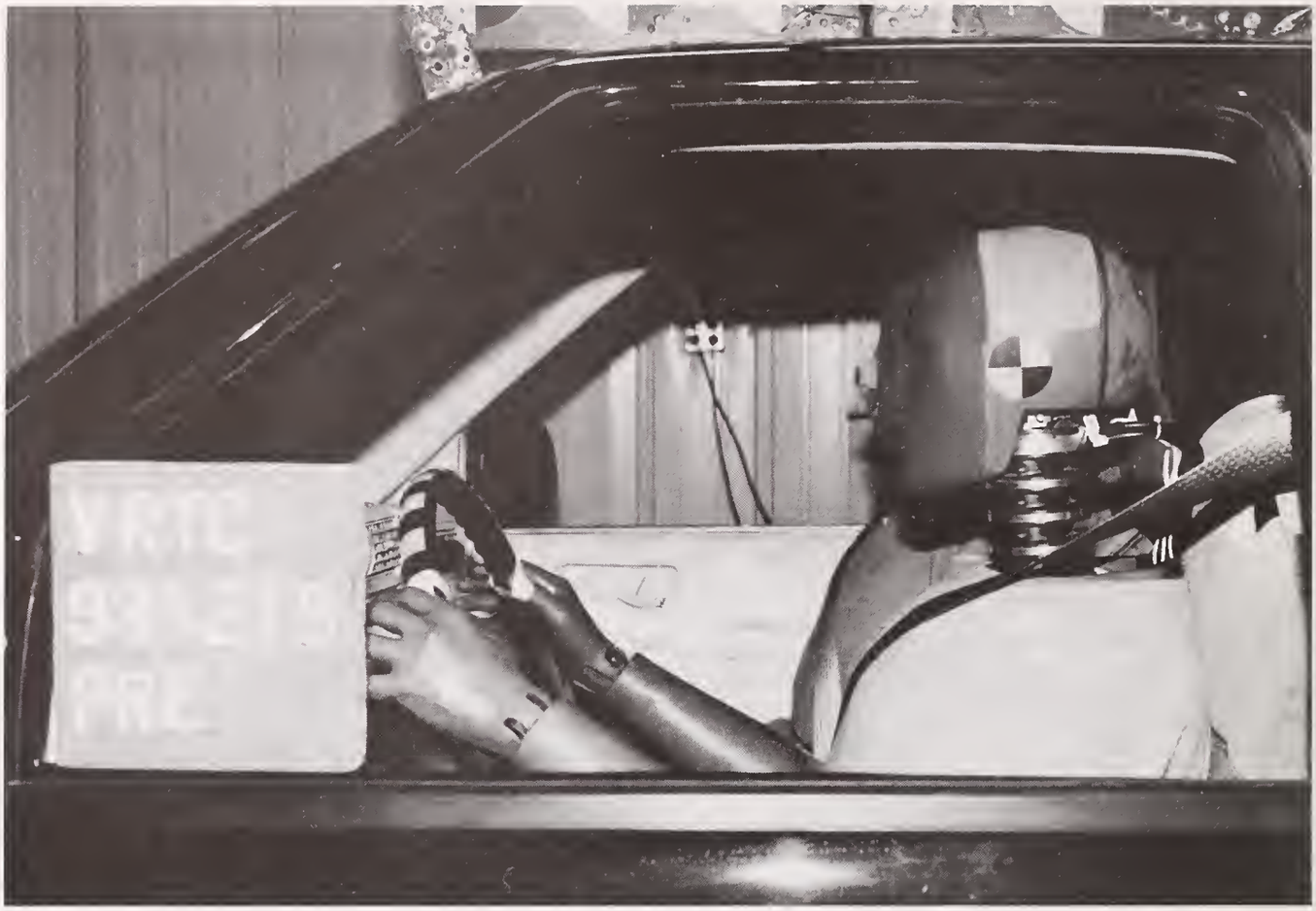


Figure A-25 Pre-test Driver Dummy Position View

Figure A-26 Post-test Driver Dummy Position View

Figure A-27 Pre-test Passenger Dummy Position View

Figure A-28 Post-test Passenger Dummy Position View

Figure A-29 Pre-test Driver Dummy and Vehicle Interior - View 1

Figure A-30 Post-test Driver Dummy and Vehicle Interior - View 1

Figure A-31 Pre-test Driver Dummy and Vehicle Interior - View 2

Figure A-32 Post-test Driver Dummy and Vehicle Interior - View 2

Figure A-33 Pre-test Passenger Dummy and Vehicle Interior - View 1

Figure A-34 Post-test Passenger Dummy and Vehicle Interior - View 1

Figure A-35 Pre-test Passenger Dummy and Vehicle Interior - View 2

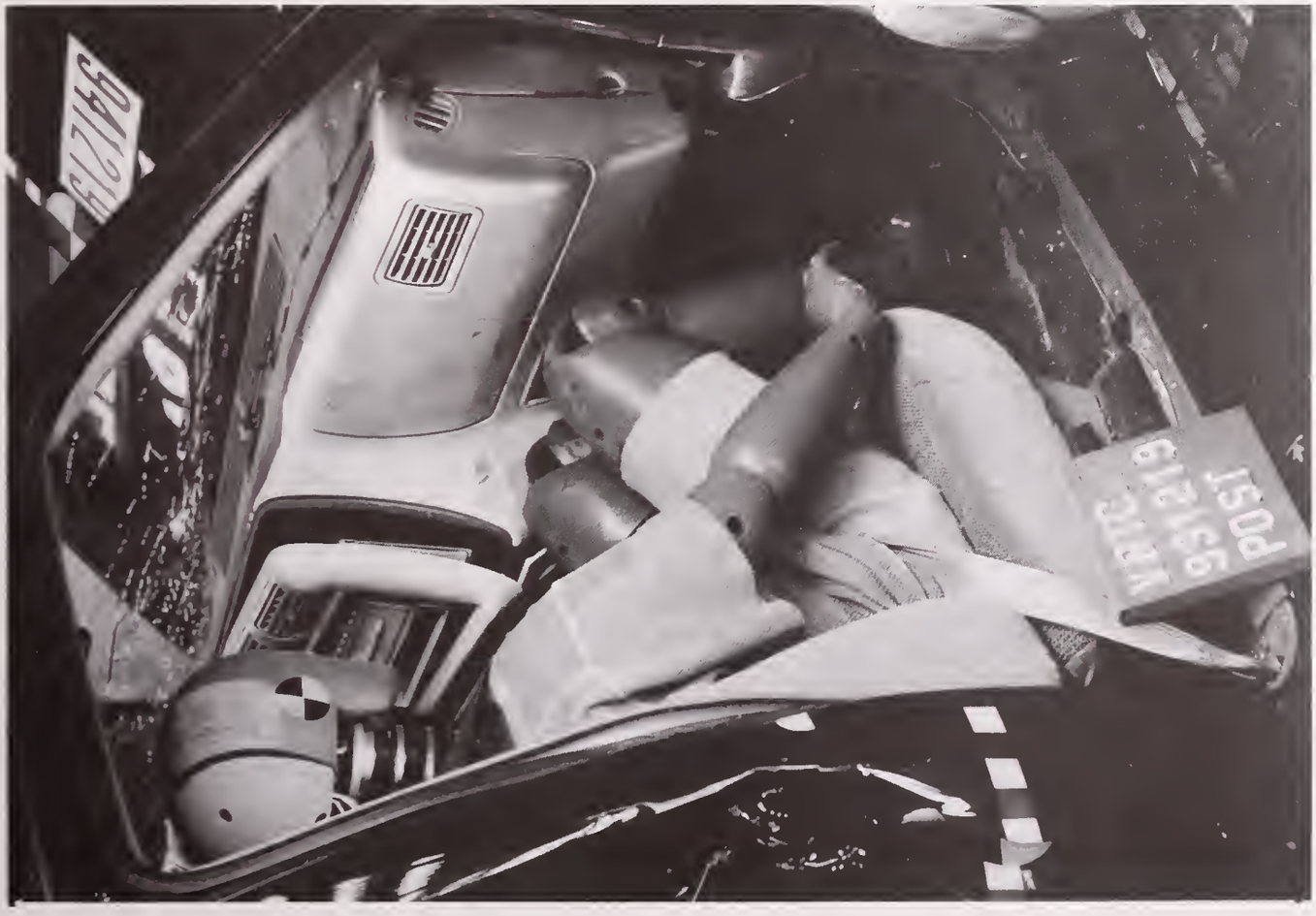


Figure A-36 Post-test Passenger Dummy and Vehicle Interior - View 2

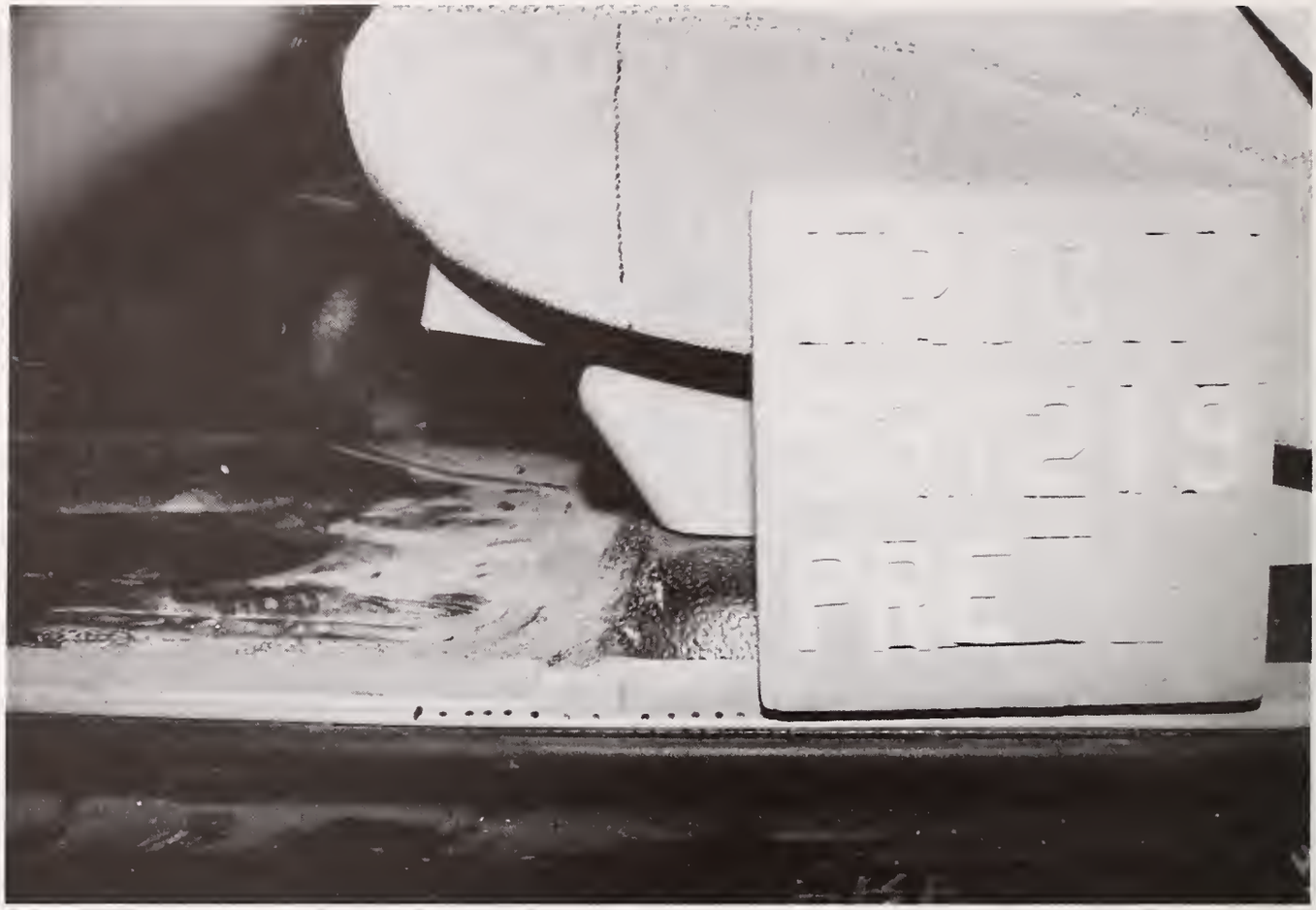


Figure A-37 Pre-test Driver Dummy's Seat Position View

Figure A-38 Post-test Driver Dummy's Seat Position View

Figure A-39 Pre-test Passenger Dummy's Seat Position View

Figure A-40 Post-test Passenger Dummy's Seat Position View

Figure A-41 Pre-test Driver Dummy's Knee Bolster View

Figure A-42 Pre-test Passenger Dummy's Knee Bolster View

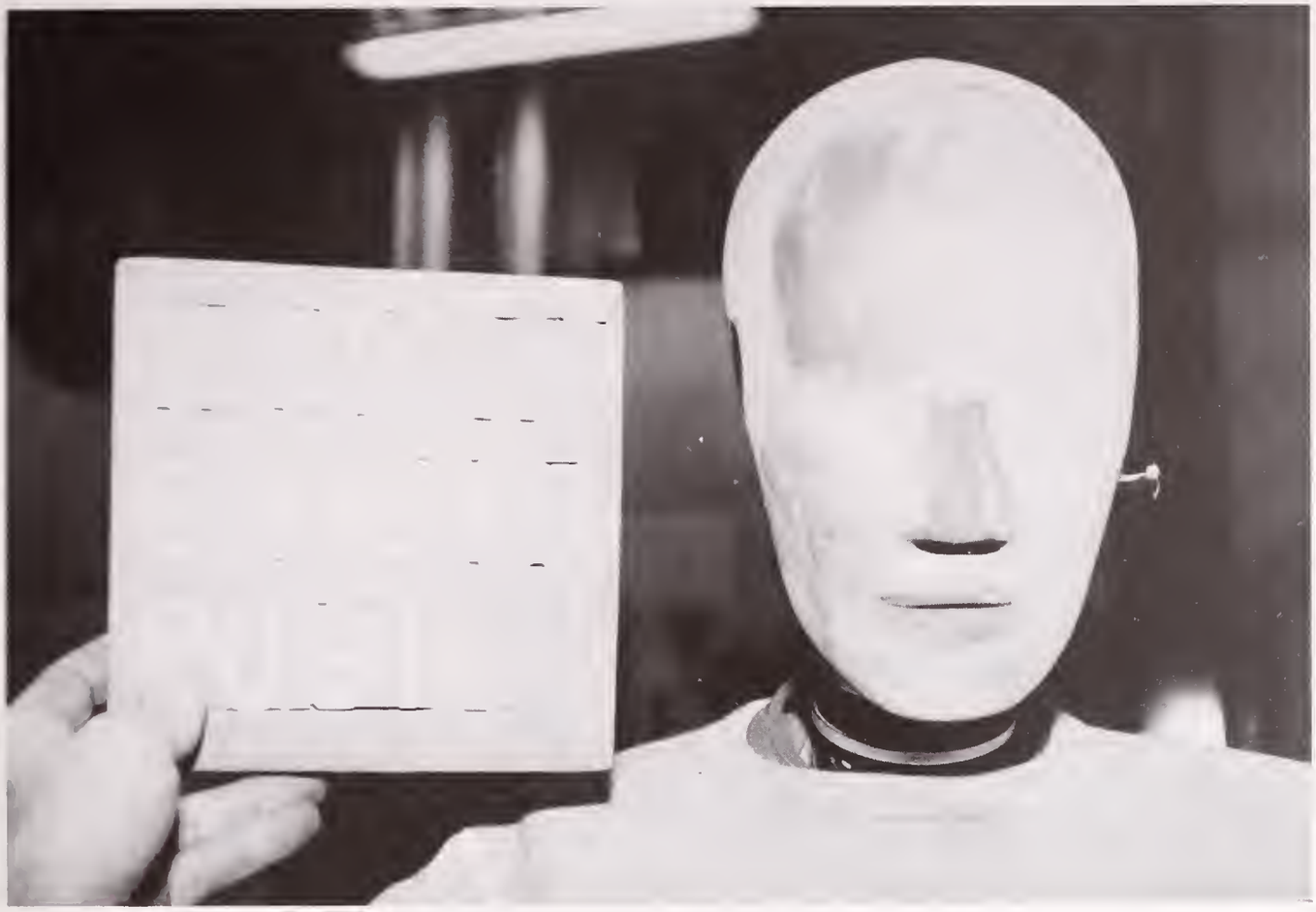


Figure A-43 Post-test Driver Dummy Head Contact - View 1

Figure A-44 Post-test Driver Dummy Head Contact - View 2

Figure A-45 Post-test Driver Dummy Head Contact - View 3

Figure A-46 Post-test Driver Dummy Head Contact - View 4

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

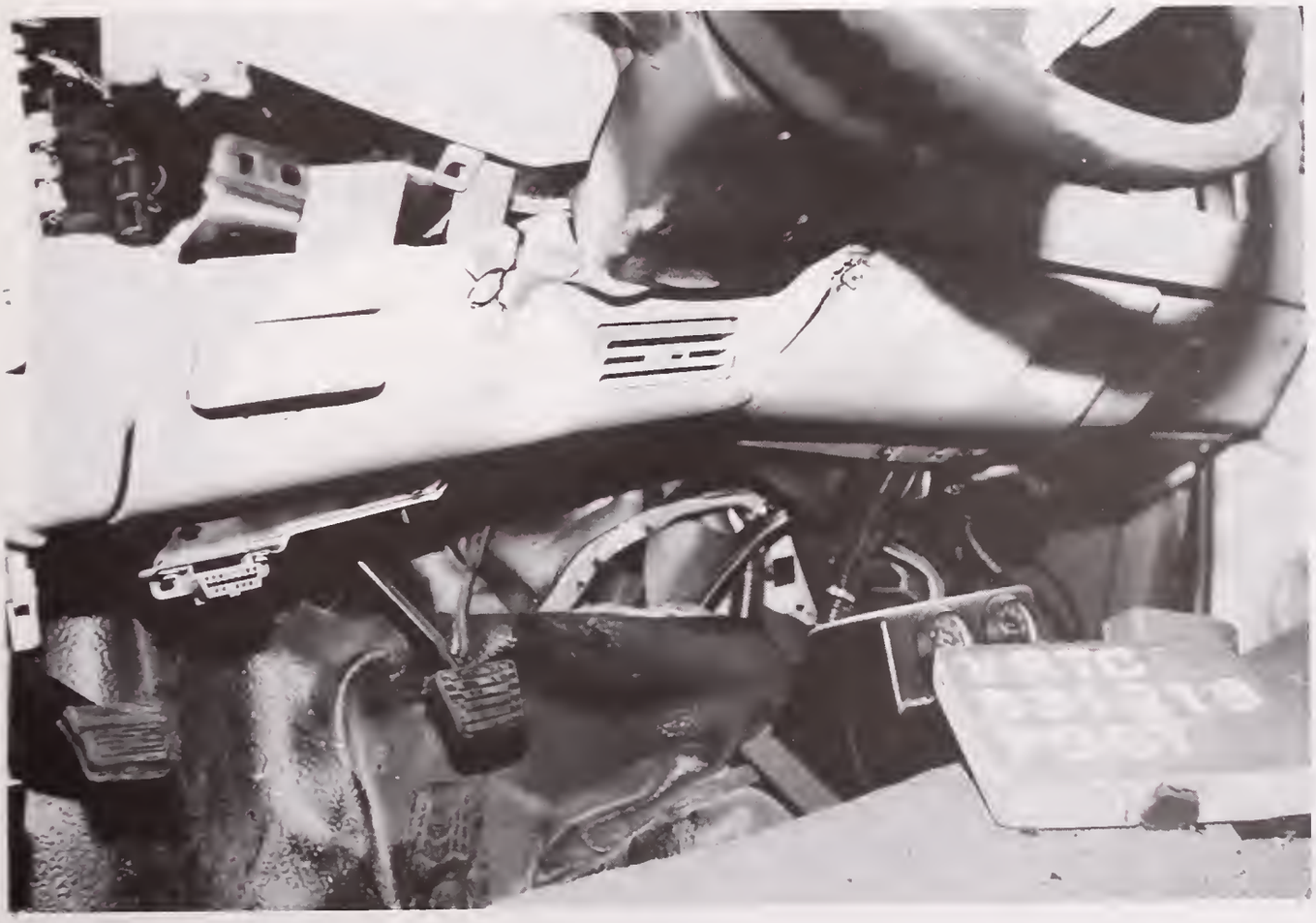


Figure A-48 Post-test Driver Dummy Knee Contact - View 2

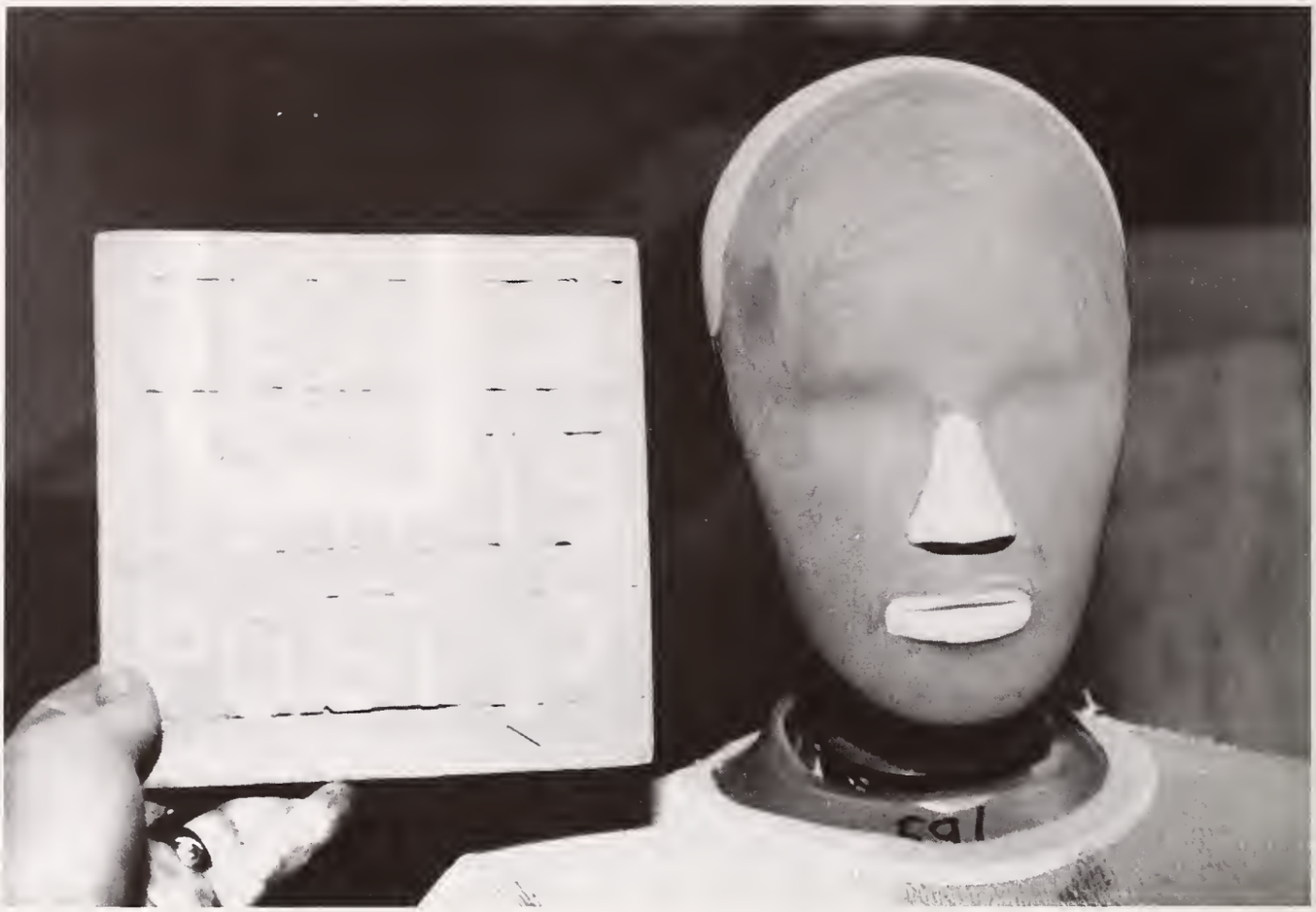


Figure A-49 Post-test Passenger Dummy Head Contact - View 1

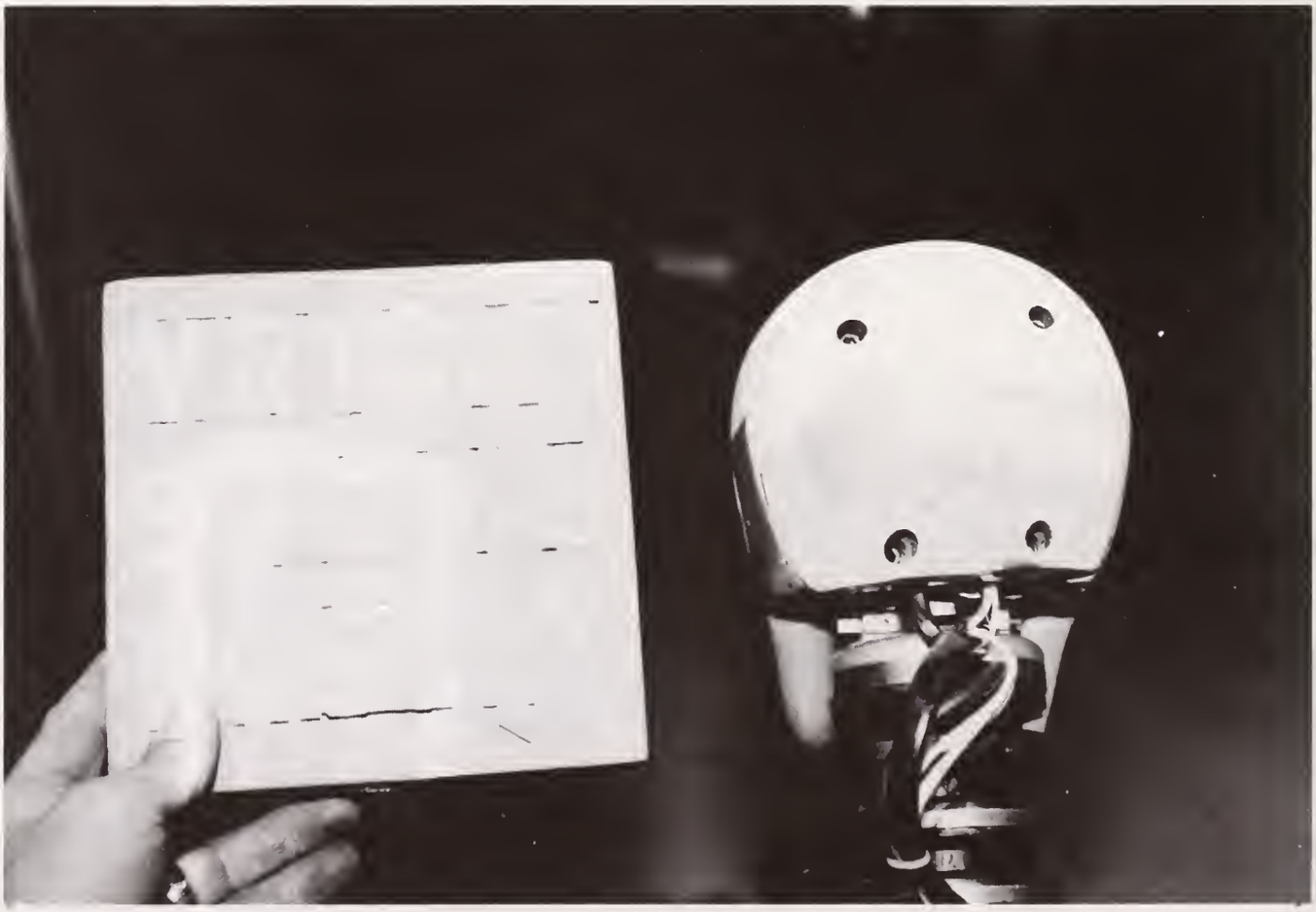


Figure A-50 Post-test Passenger Dummy Head Contact - View 2

Figure A-51 Post-test Passenger Dummy Head Contact - View 3

Intentionally Left Blank

Figure A-52 Post-test Passenger Dummy Knee Contact - View 1

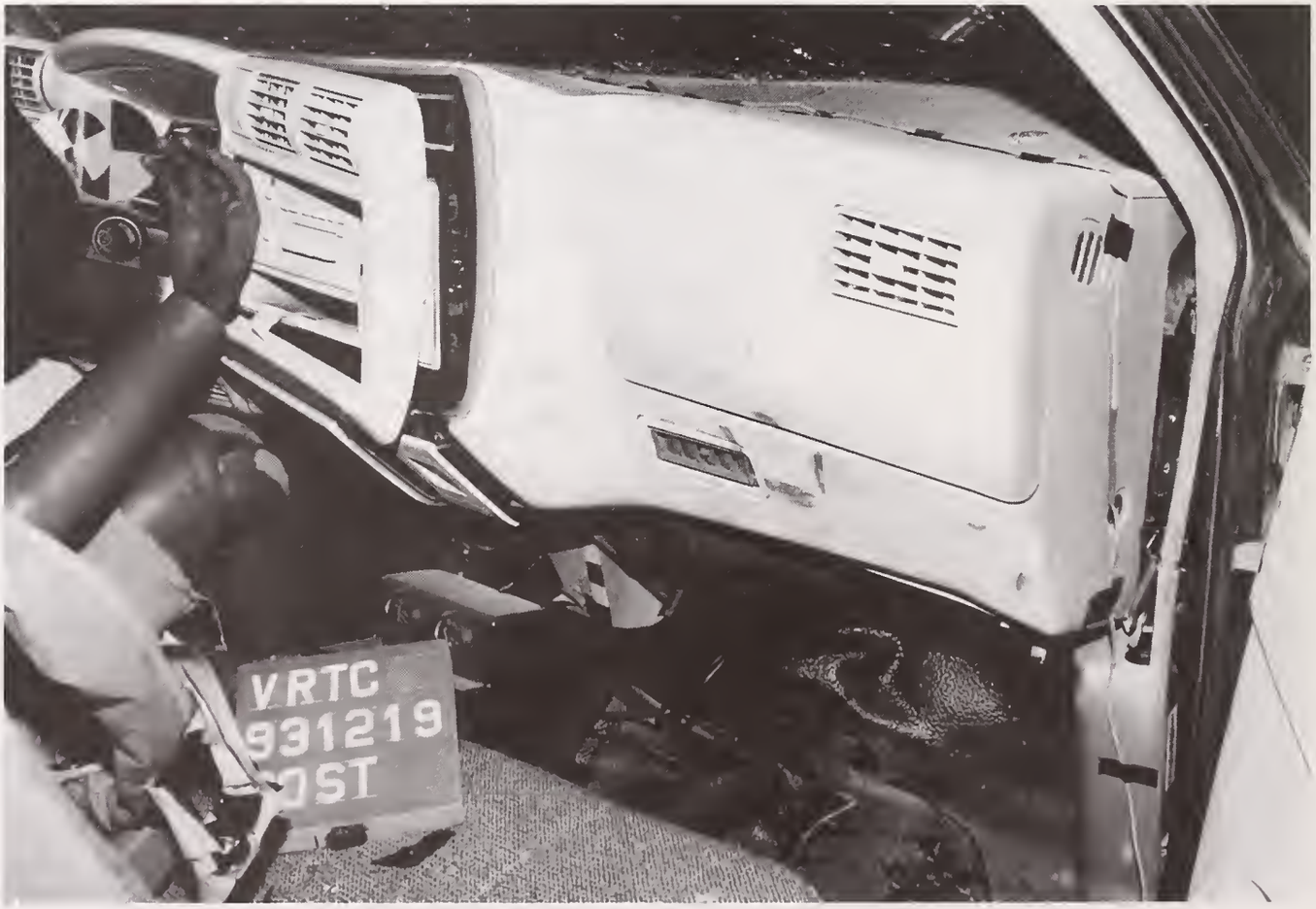


Figure A-53 Post-test Passenger Dummy Knee Contact - View 2

Figure A-54 Post-test Windshield Damage - View 1

Figure A-55 Post-test Windshield Damage - View 2

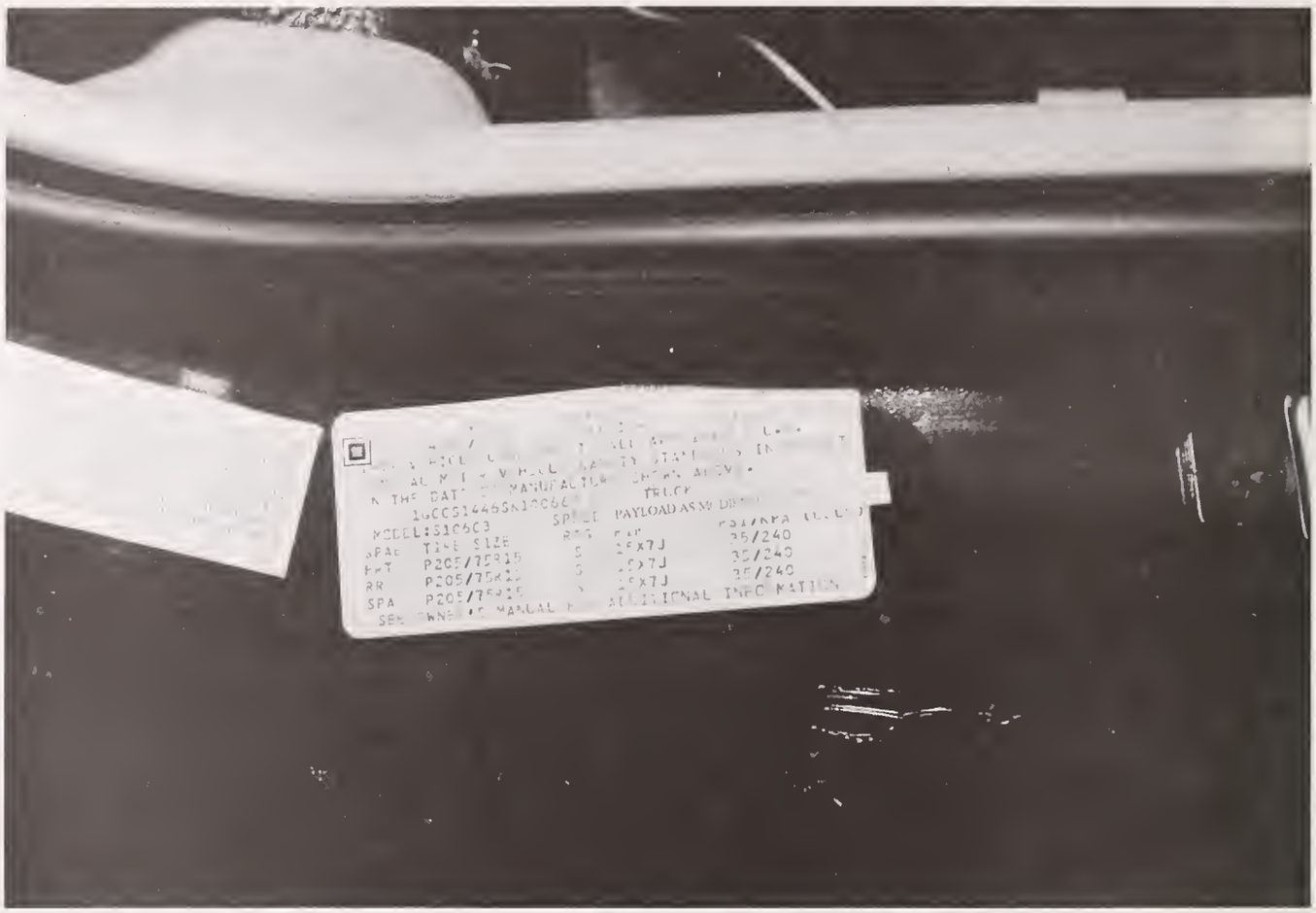


Figure A-56 Pre-test Vehicle Certification and Recommended Tire Pressure Labels

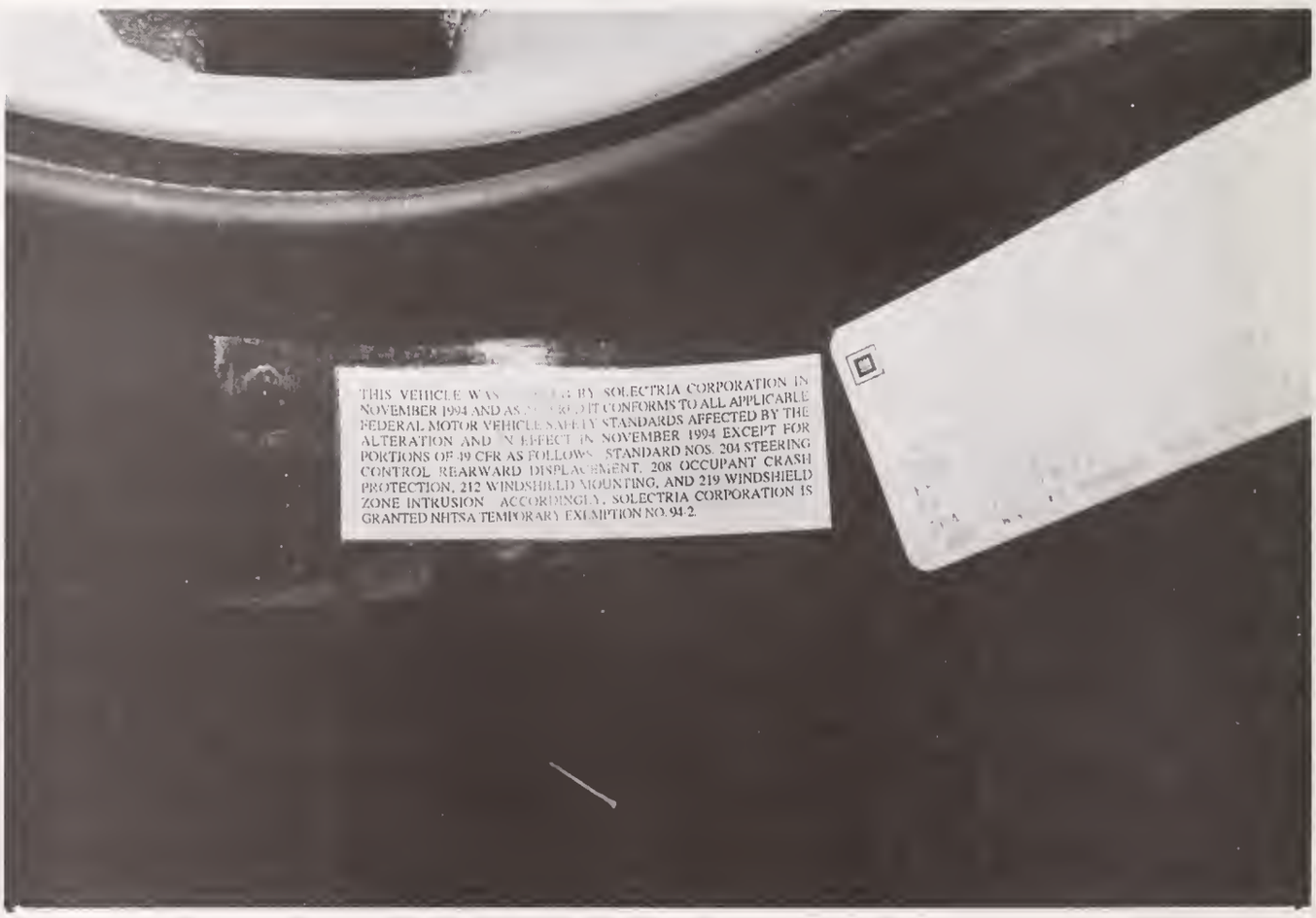


Figure A-57 Pre-test Vehicle Alterer's Vehicle Certification Label

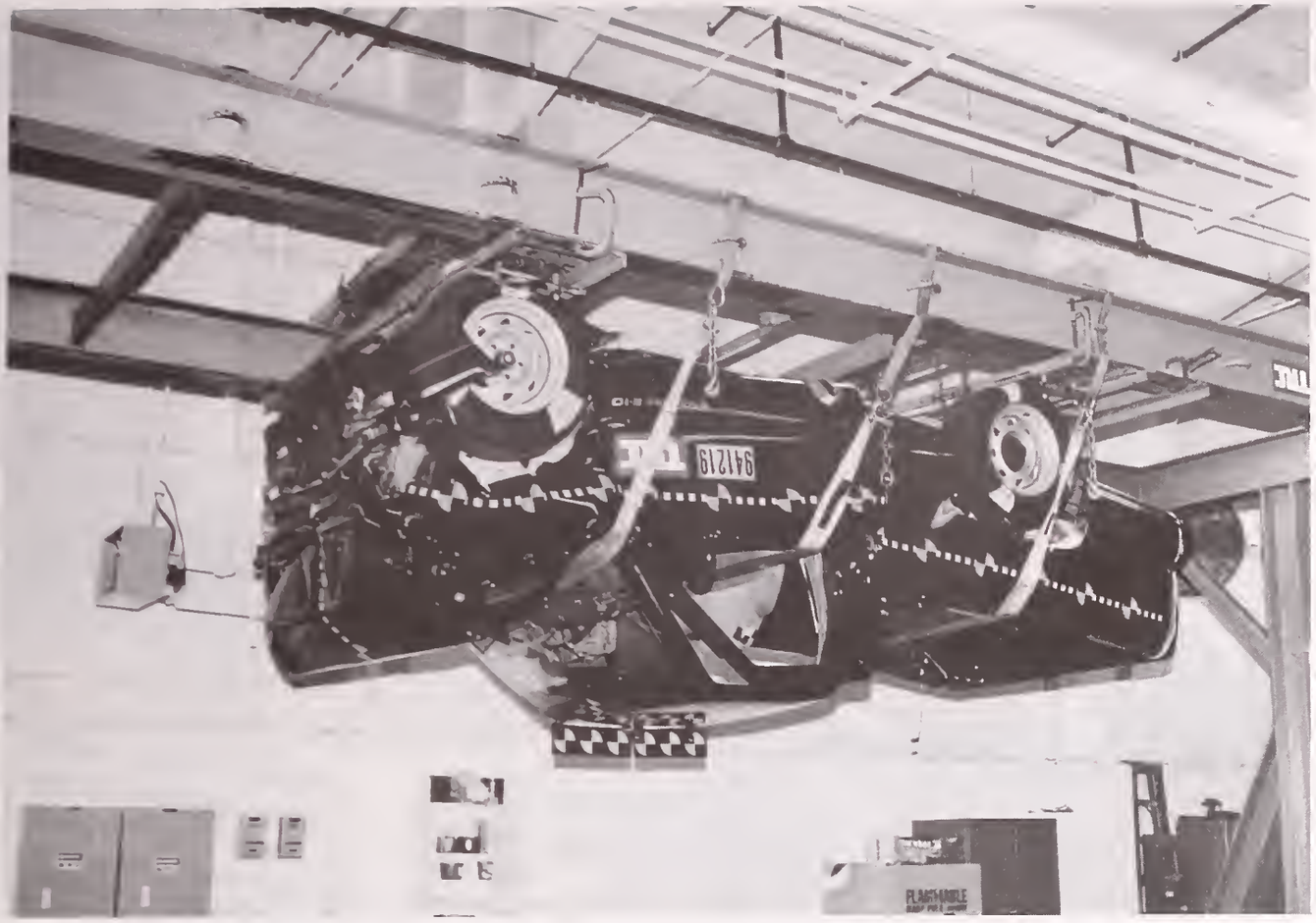


Figure A-58 Post-test Vehicle on Static Rollover Machine View

Figure A-59 Pre-test Front Battery Box Accelerometer Location View

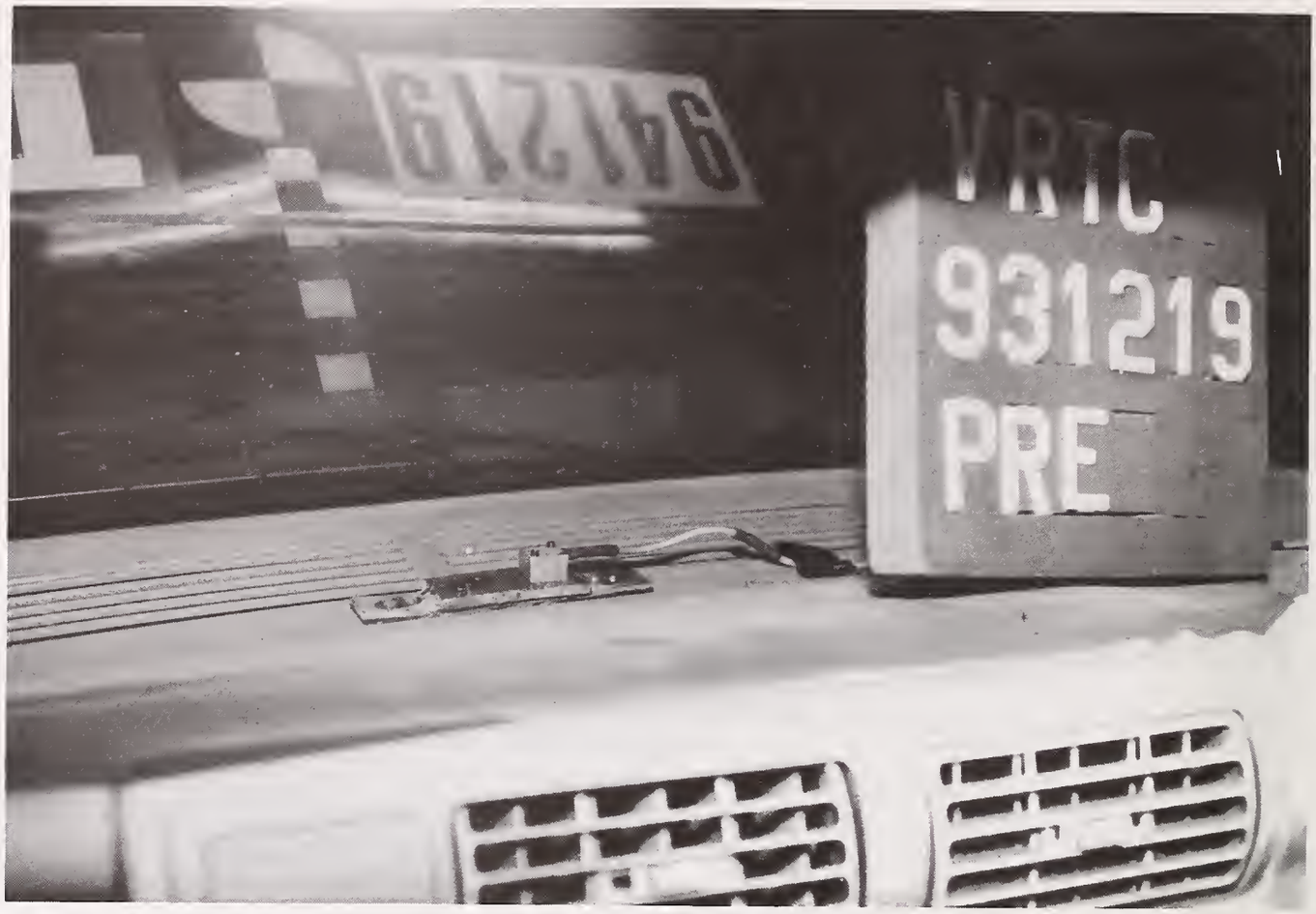


Figure A-60 Pre-test Instrument Panel Center Accelerometer Location View

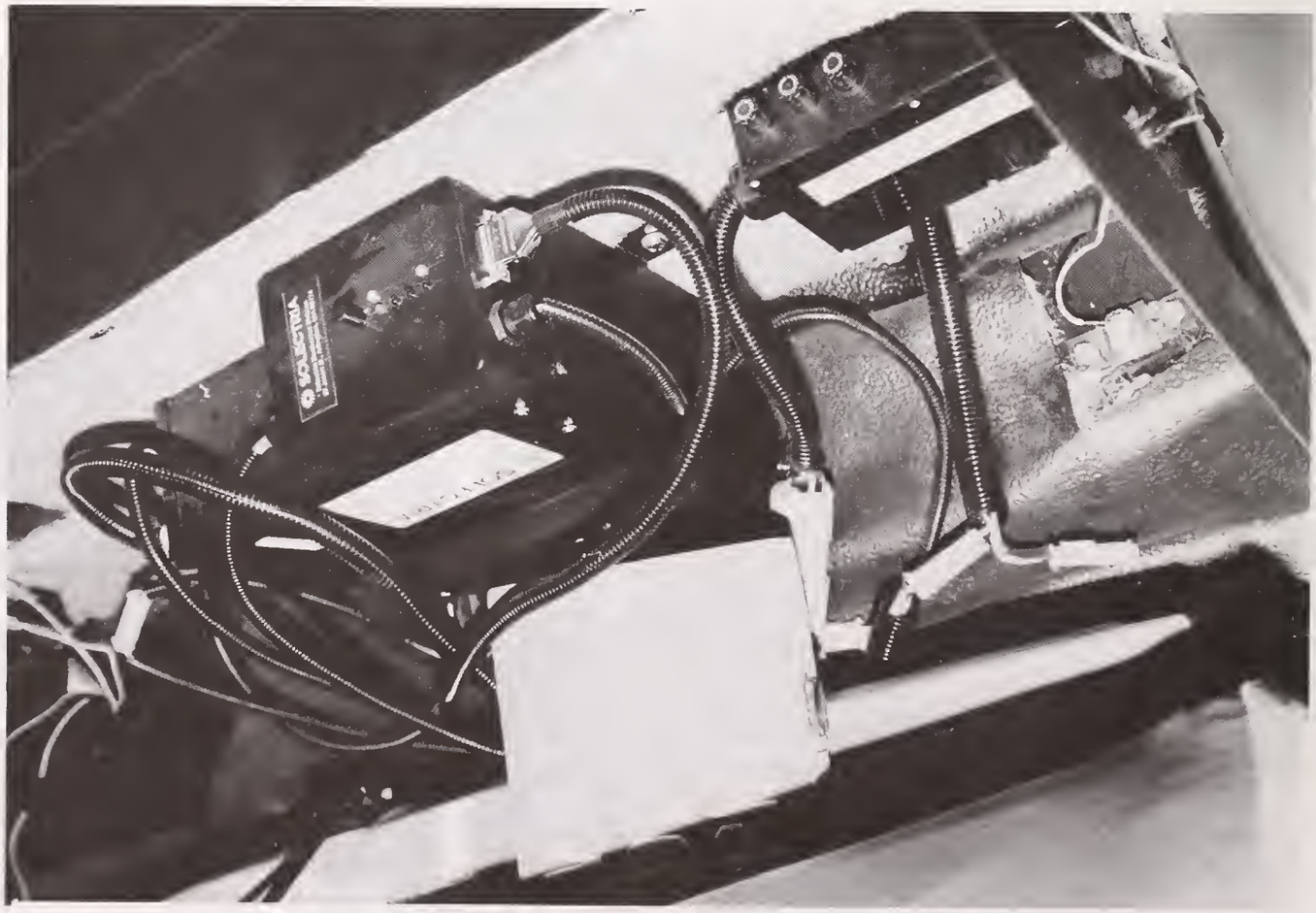


Figure A-61 Pre-test Left Rear Seat Accelerometer Location View

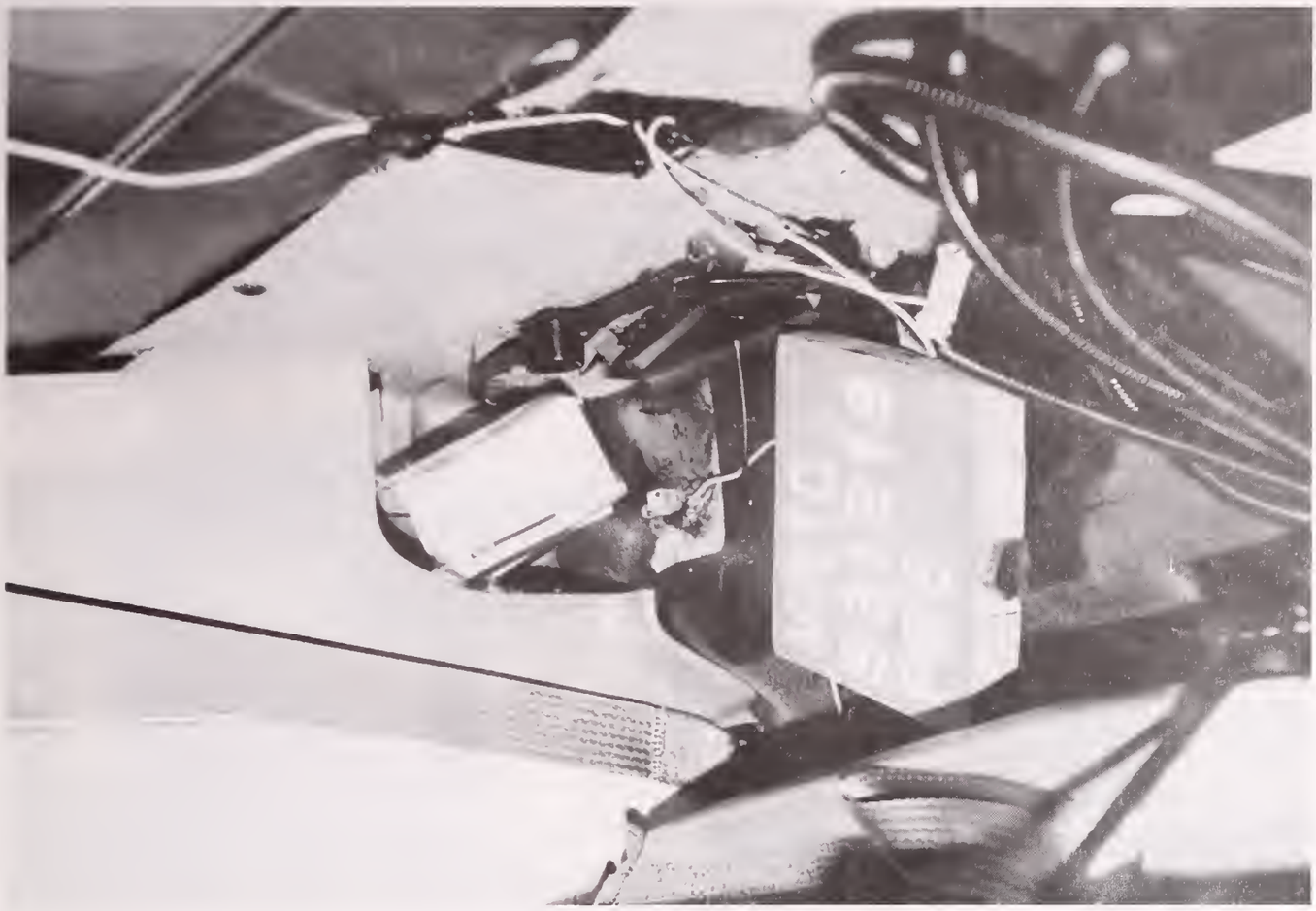


Figure A-62 Pre-test Right Rear Seat Accelerometer Location View

Figure A-63 Pre-test Rear Battery Box Front Accelerometer Location View

Figure A-64 Pre-test Rear Battery Box Rear Accelerometer Location View

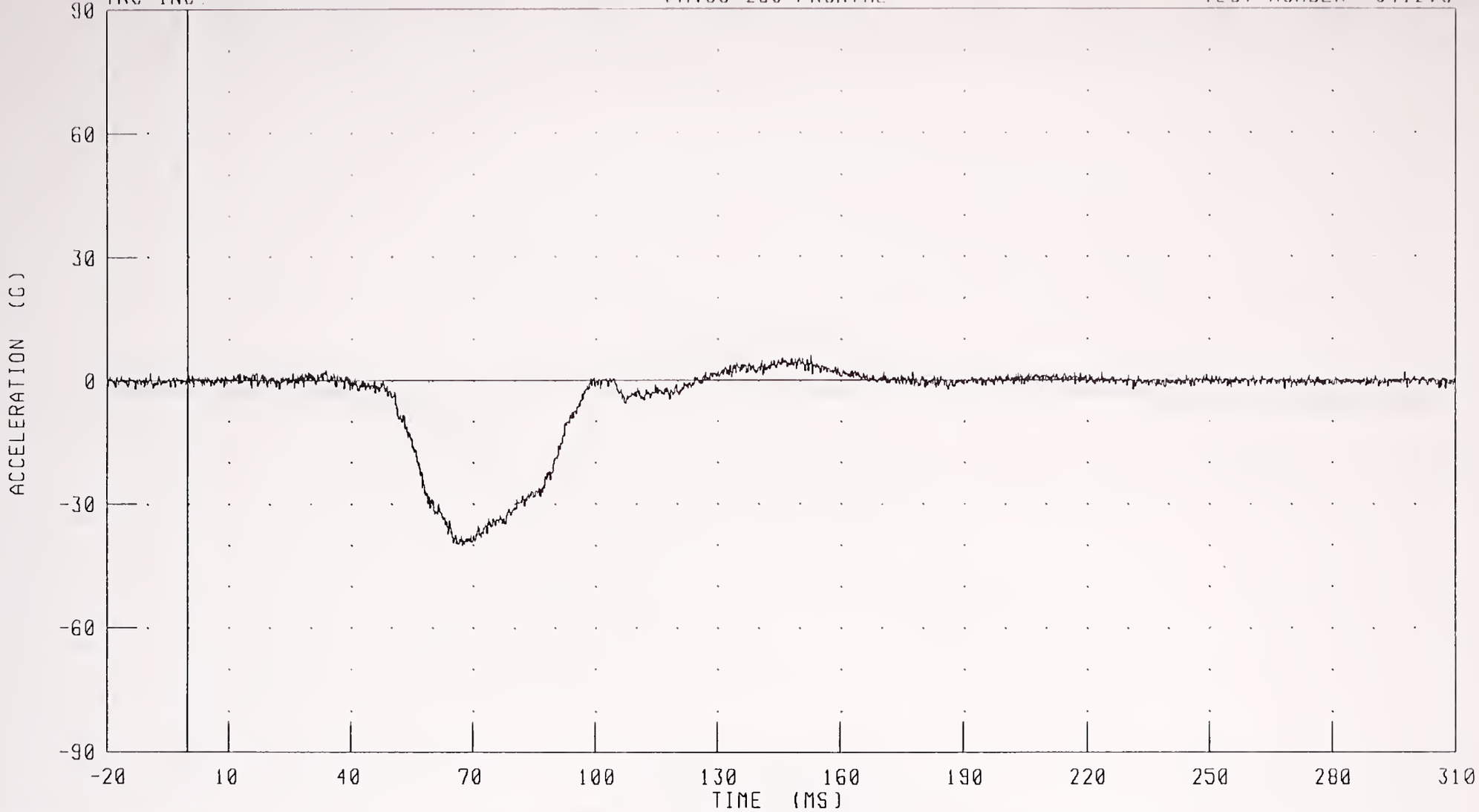
Figure A-65 Pre-test Gear Box Accelerometer Location View

Appendix B

Data Plots

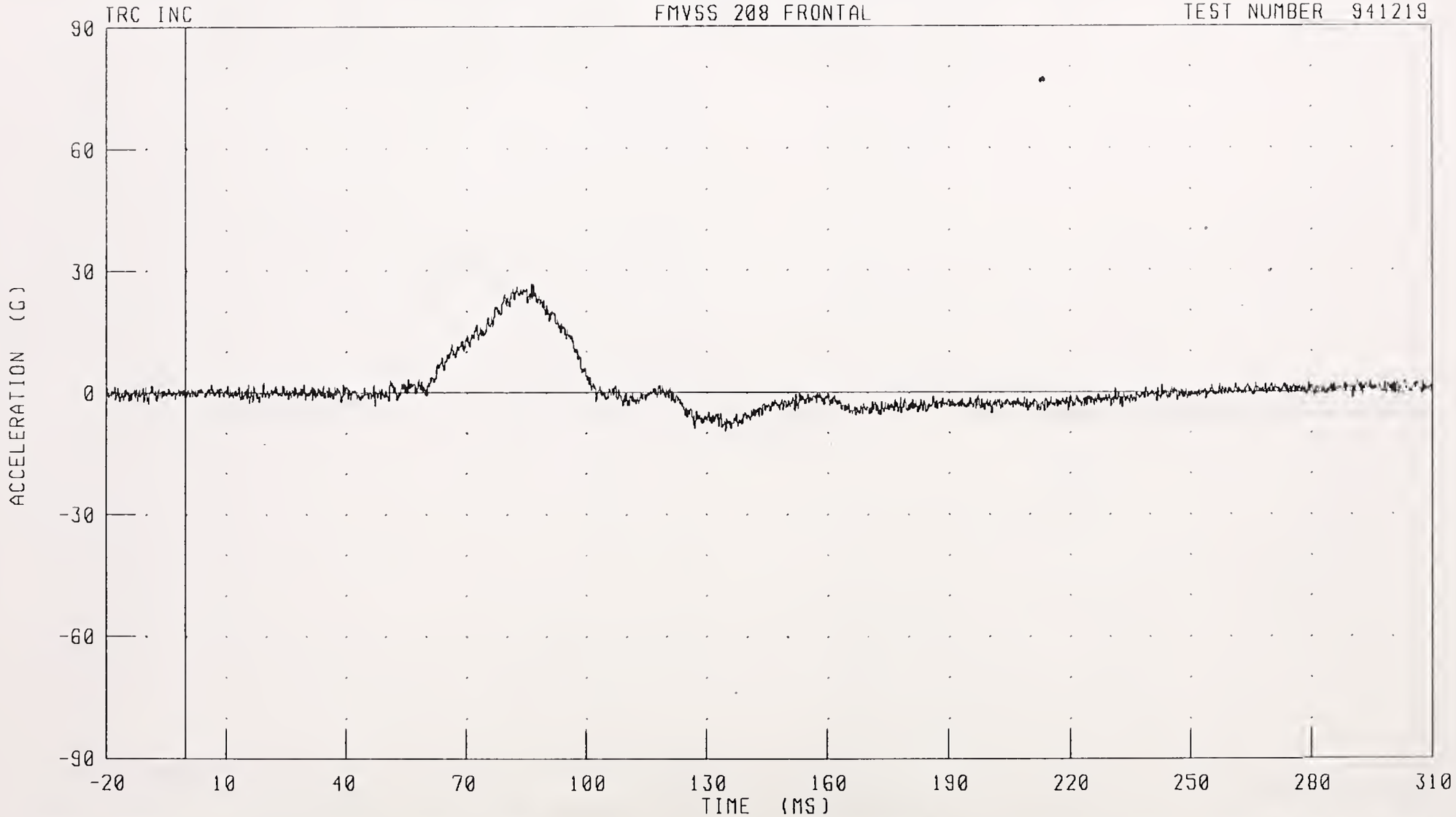
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER HEAD X-AXIS ACCELERATION

TRC INC. FMVSS 208 FRONTAL TEST NUMBER 941219



CHANNEL HEDXG1 FILTER CH CLASS 1000 PEAK DATA 6.02 G @ 152.80 MS; -40.16 G @ 67.44 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER HEAD Y-AXIS ACCELERATION
FMVSS 208 FRONTAL

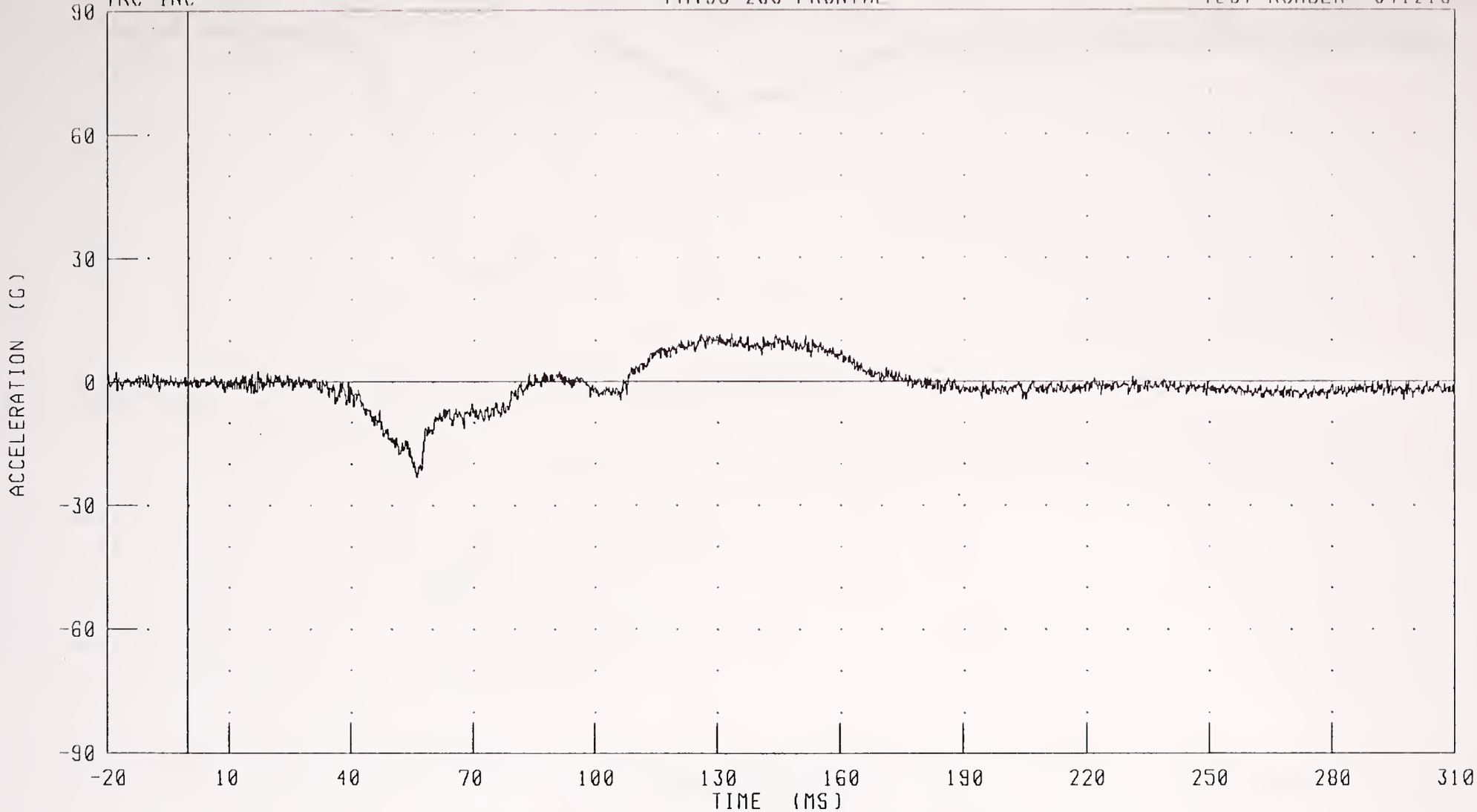


CHANNEL: HEDYG1 FILTER CH CLASS 1000 PEAK DATA 26 86 G @ 86 32 MS, -9 59 G @ 134 80 MS

1995 SOLECITRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER HEAD Z-AXIS ACCELERATION
FMVSS 208 FRONTAL

TRC INC

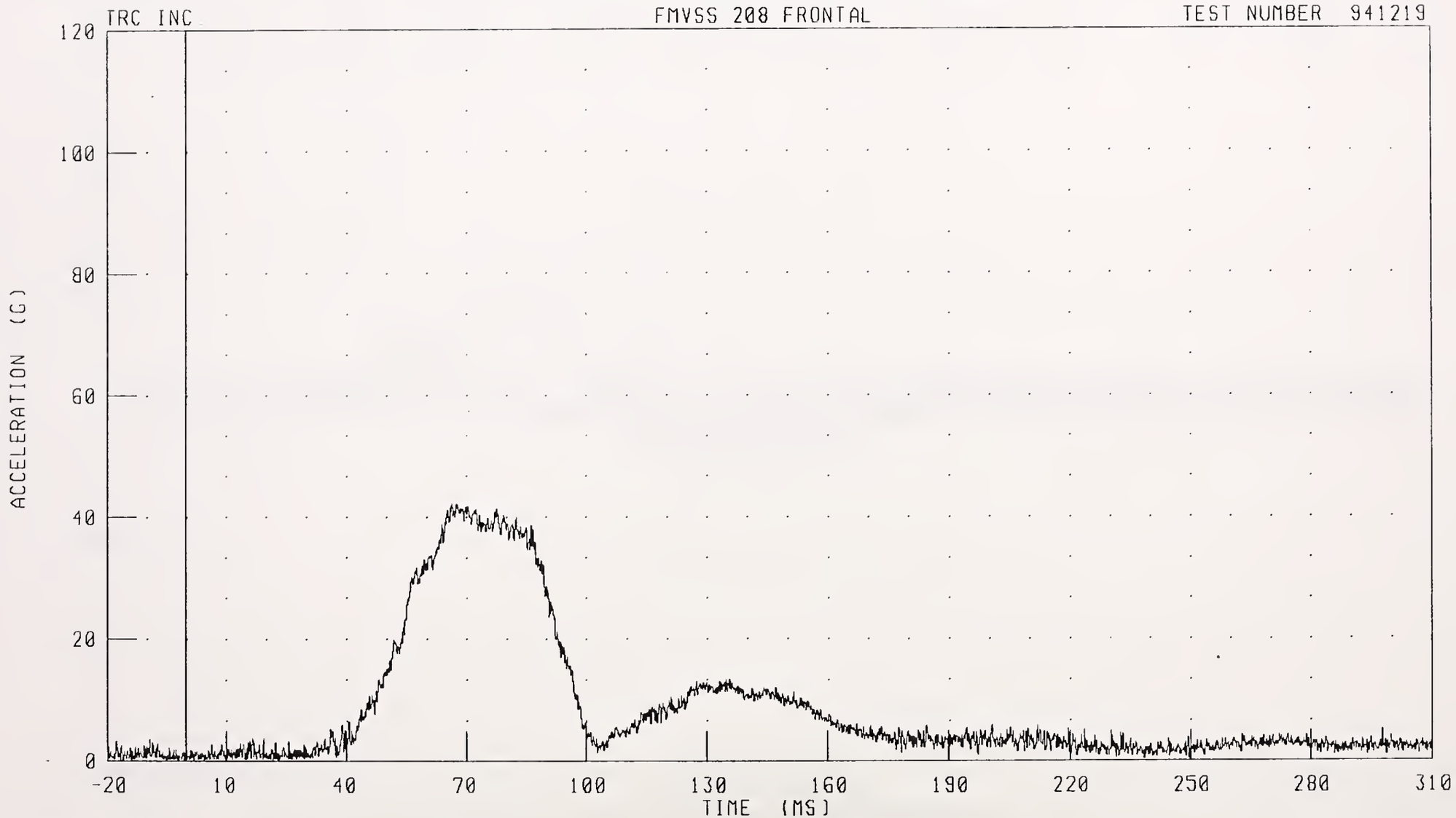
TEST NUMBER 941219



CHANNEL HEDZG1 FILTER CH. CLASS 1000

PEAK DATA 11 82 G @ 133 44 MS, -23 45 G @ 56 24 MS

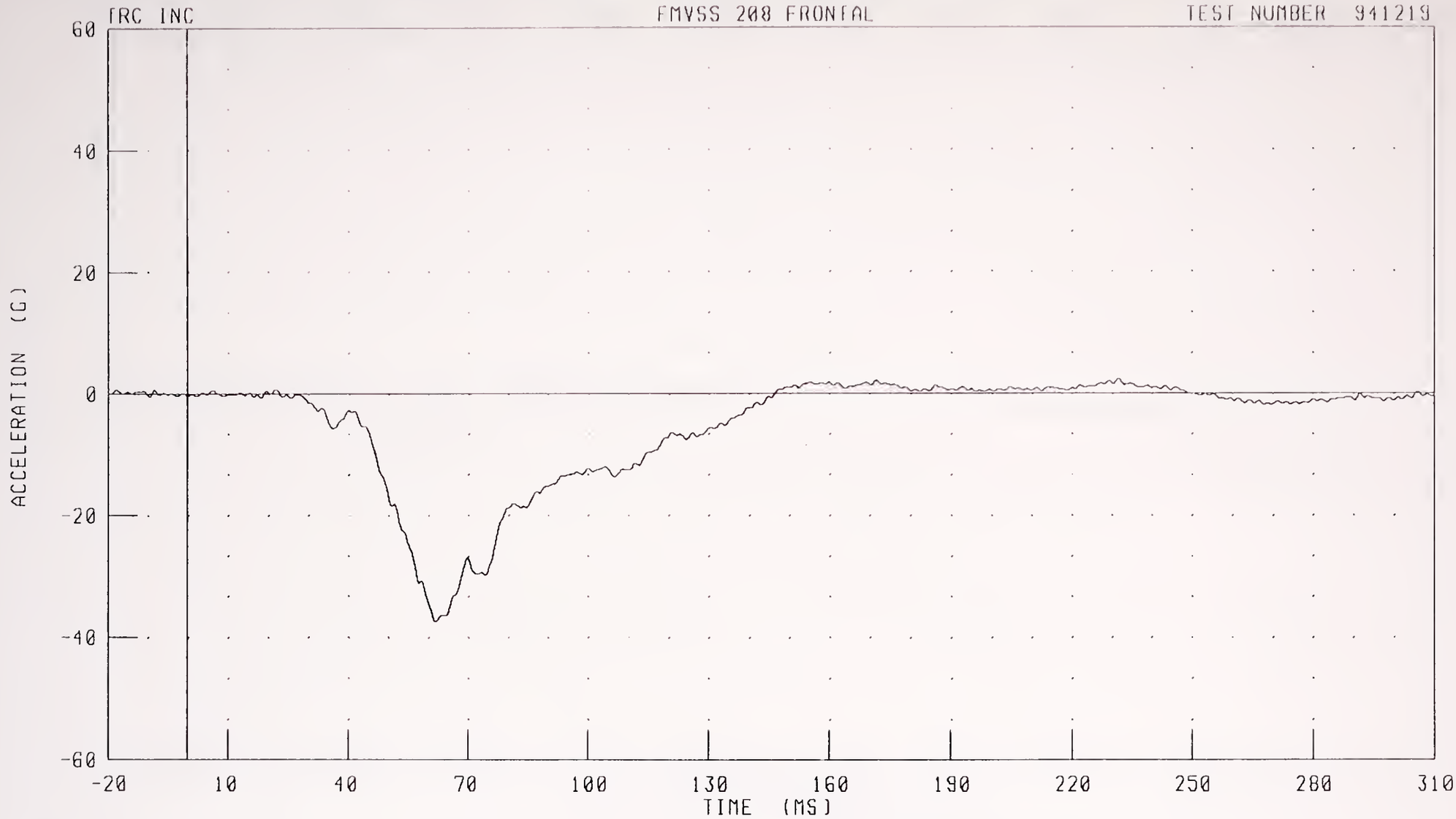
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER HEAD RESULTANT ACCELERATION
FMVSS 208 FRONTAL



CHANNEL HEDRG1 FILTER CH CLASS 1000

PEAK DATA 42 26 G @ 67 44 MS, 0 14 G @ 4 48 MS

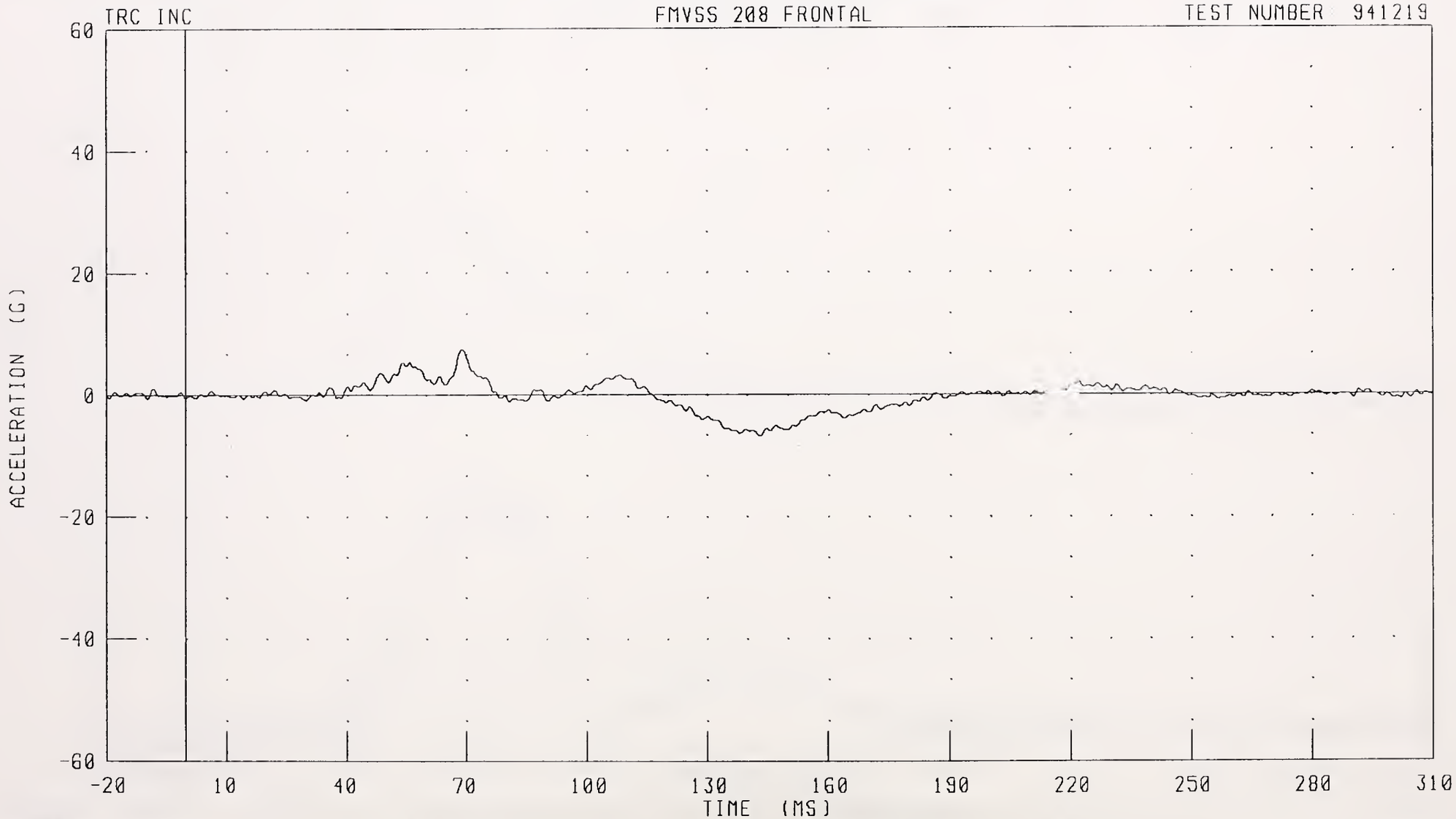
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER CHEST X-AXIS ACCELERATION
FMVSS 208 FRONTAL



CHANNEL CSTXG1 FILTER: CH CLASS 180

PEAK DATA: 2.42 G @ 231.60 MS, -37.48 G @ 61.84 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER CHEST Y-AXIS ACCELERATION
FMVSS 208 FRONTAL



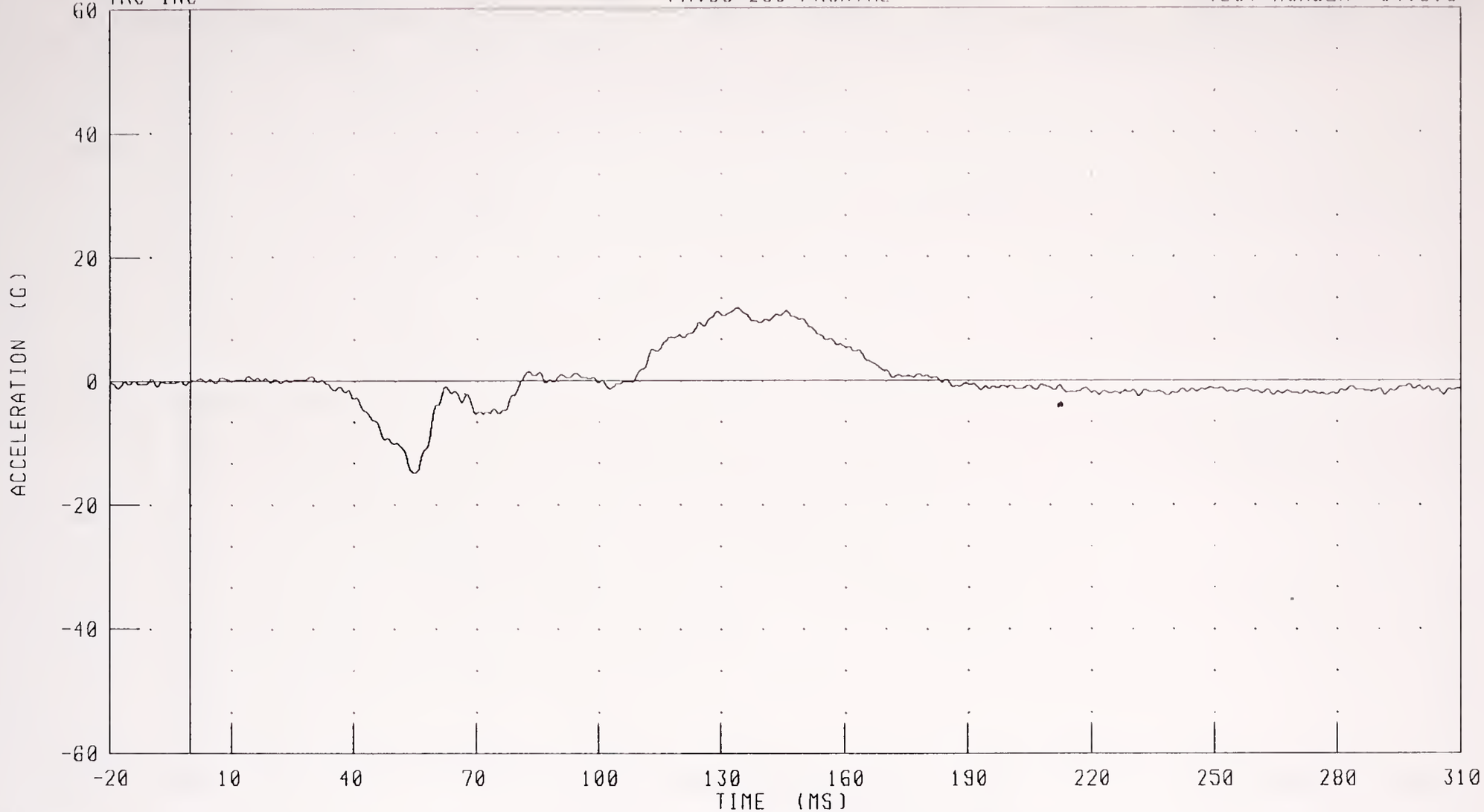
CHANNEL CSTYG1 FILTER CH CLASS 180

PEAK DATA: 7.45 G @ 68.96 MS, -6.83 G @ 143.20 MS

1995 SOLECITRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER CHEST Z-AXIS ACCELERATION
FMVSS 208 FRONTAL

TRC INC

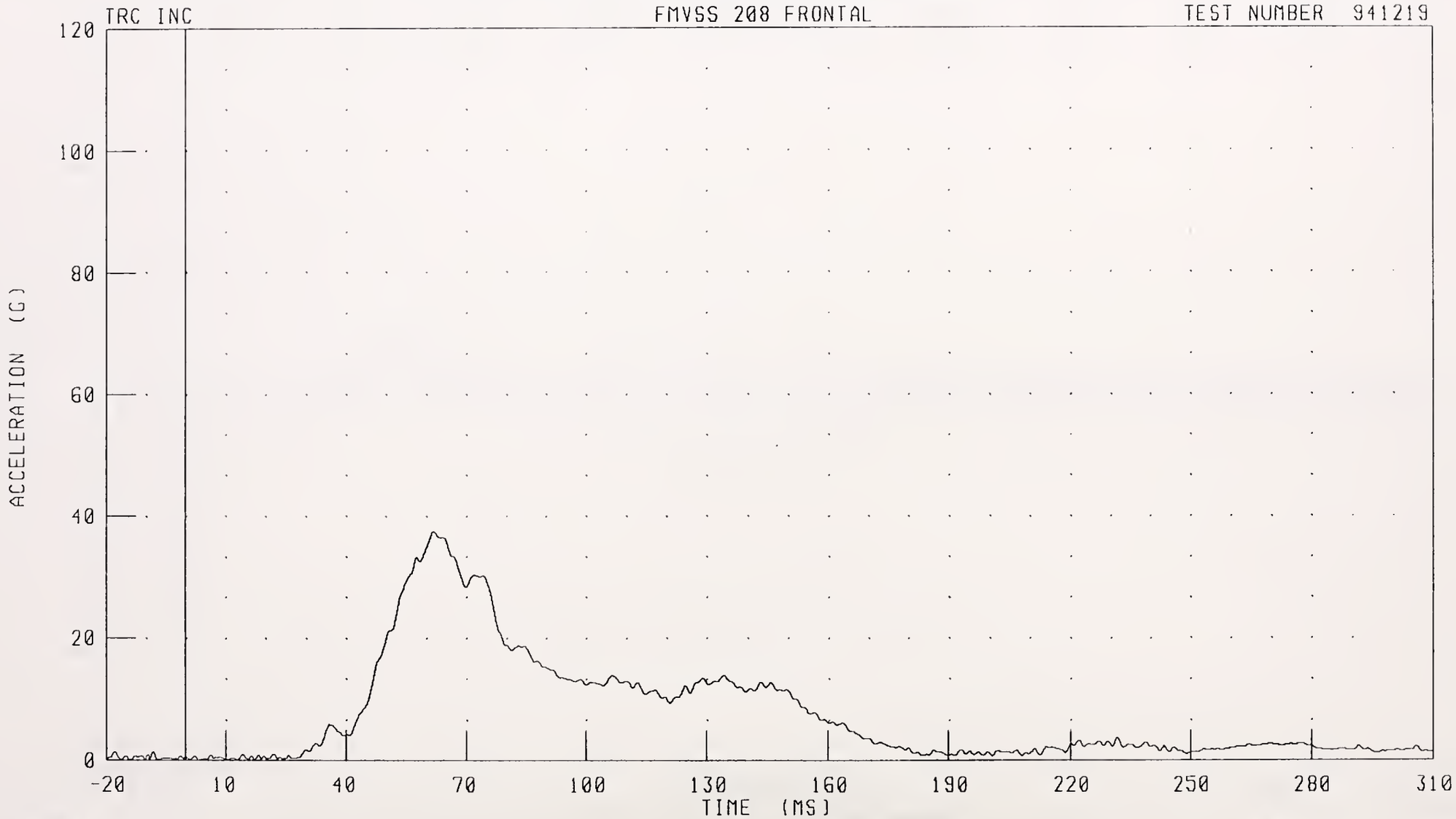
TEST NUMBER 941219



CHANNEL CSTZG1 FILTER CH CLASS 180

PEAK DATA 11.78 G @ 134.08 MS, -14.87 G @ 54.96 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER CHEST RESULTANT ACCELERATION
FMVSS 208 FRONTAL



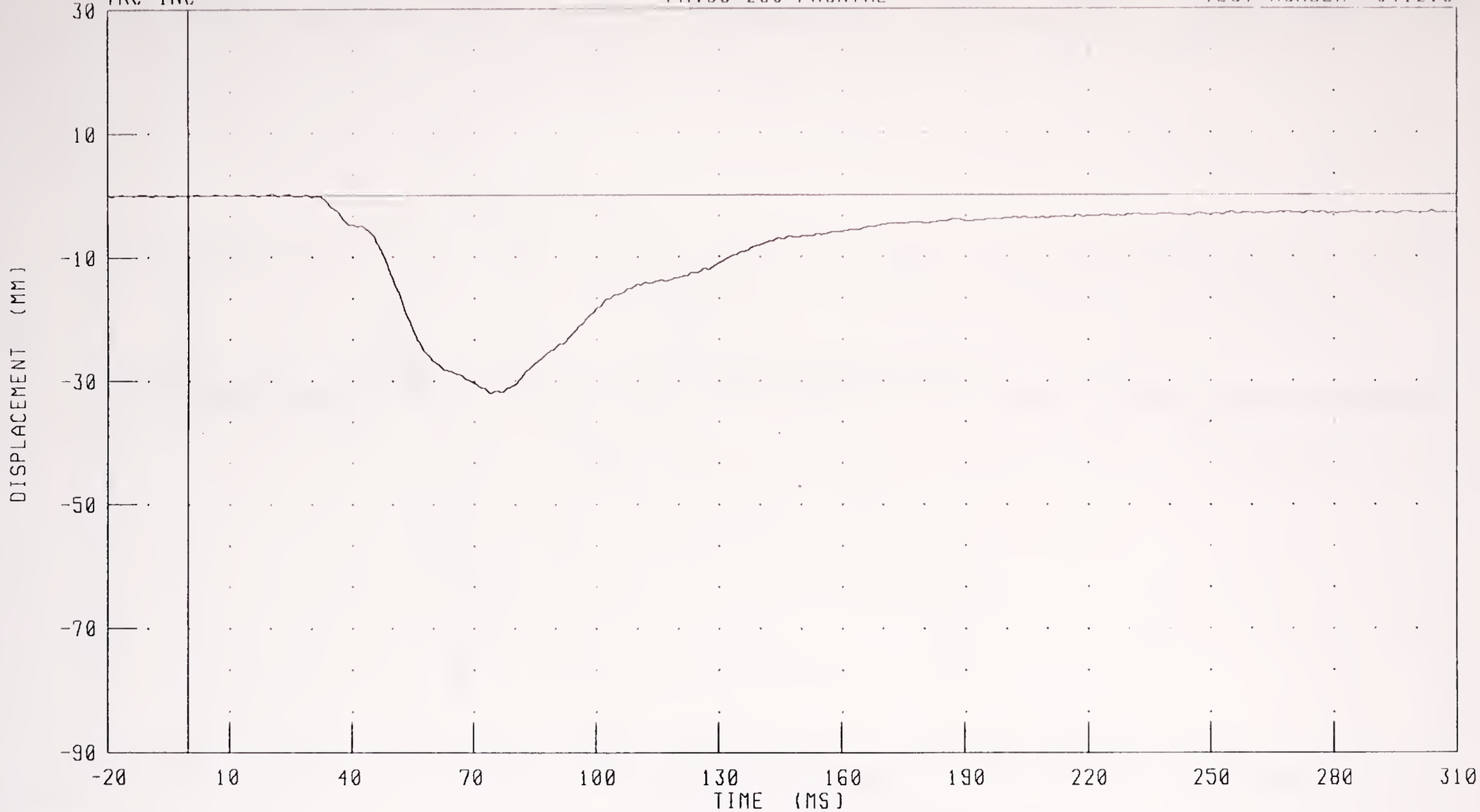
CHANNEL CSTRG1 FILTER: CH CLASS 180

PEAK DATA 37.55 G @ 61.84 MS; 0.07 G @ 3.12 MS

1995 SOLECITRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER CHEST DEFLECTION
FMVSS 208 FRONTAL

TRC INC

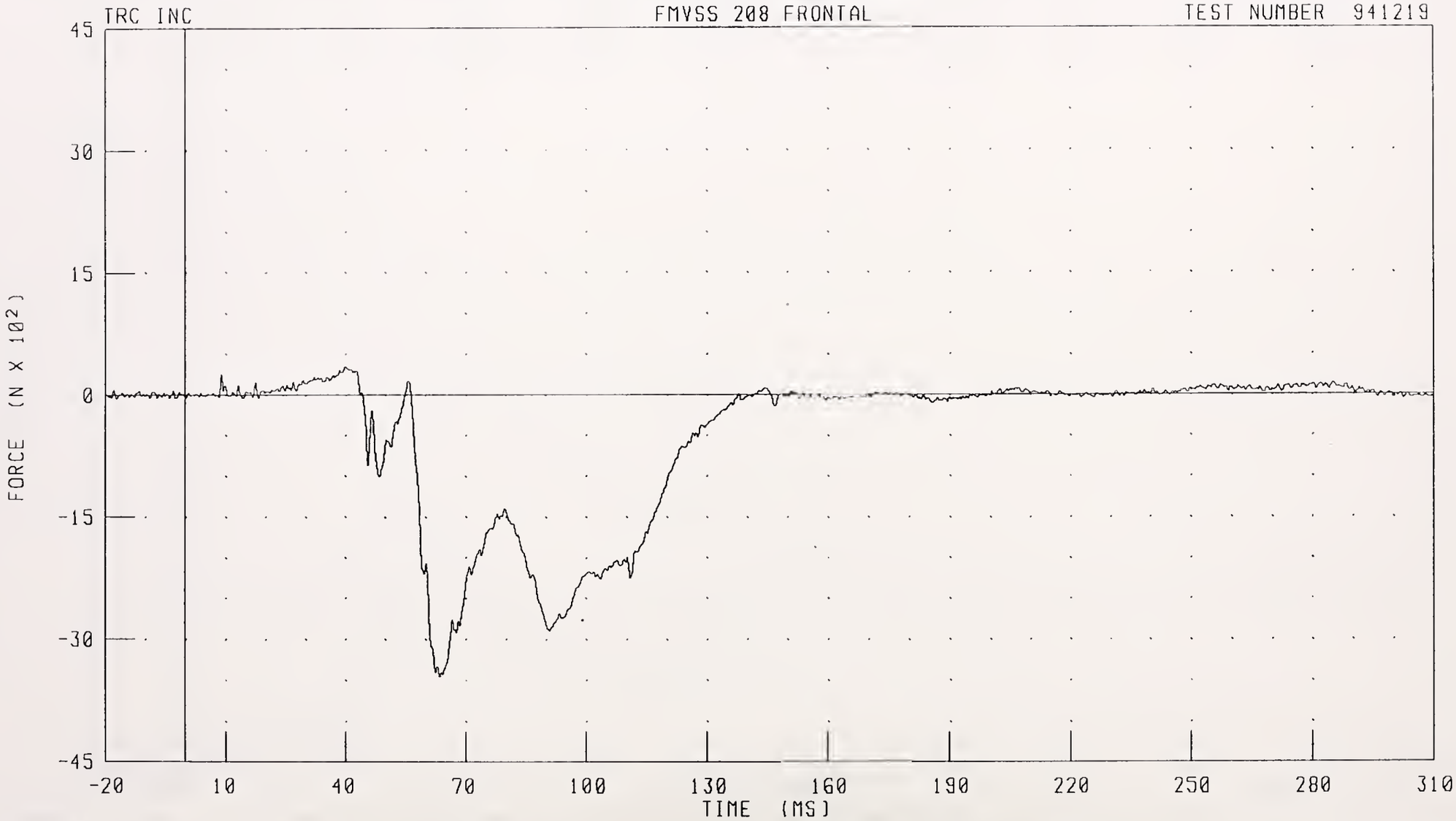
TEST NUMBER 941219



CHANNEL CSTXD1 FILTER: CH CLASS 180

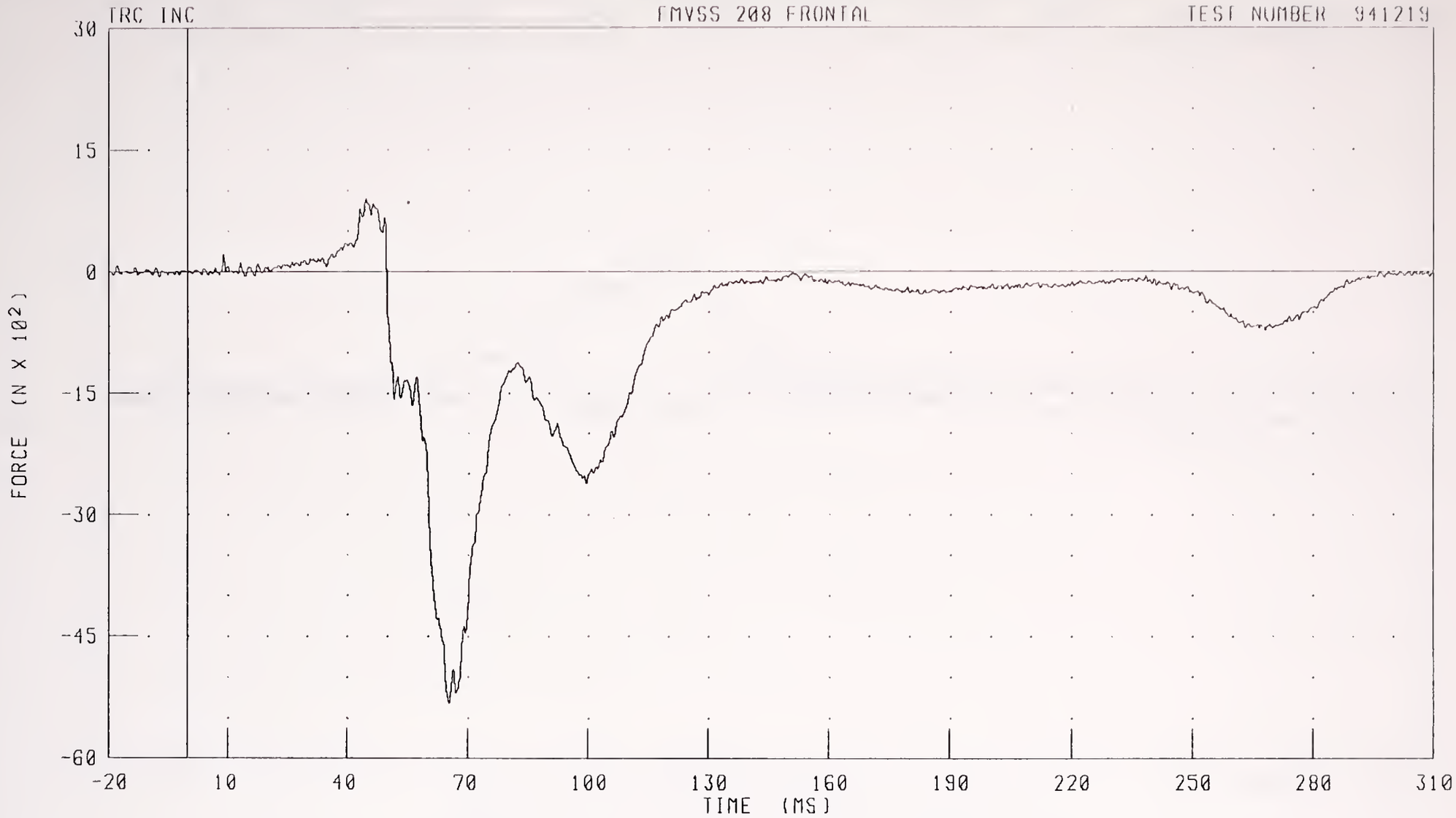
PEAK DATA: 0.28 MM @ 20.24 MS, -31.97 MM @ 74.08 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER LEFT FEMUR FORCE
FMVSS 208 FRONTAL



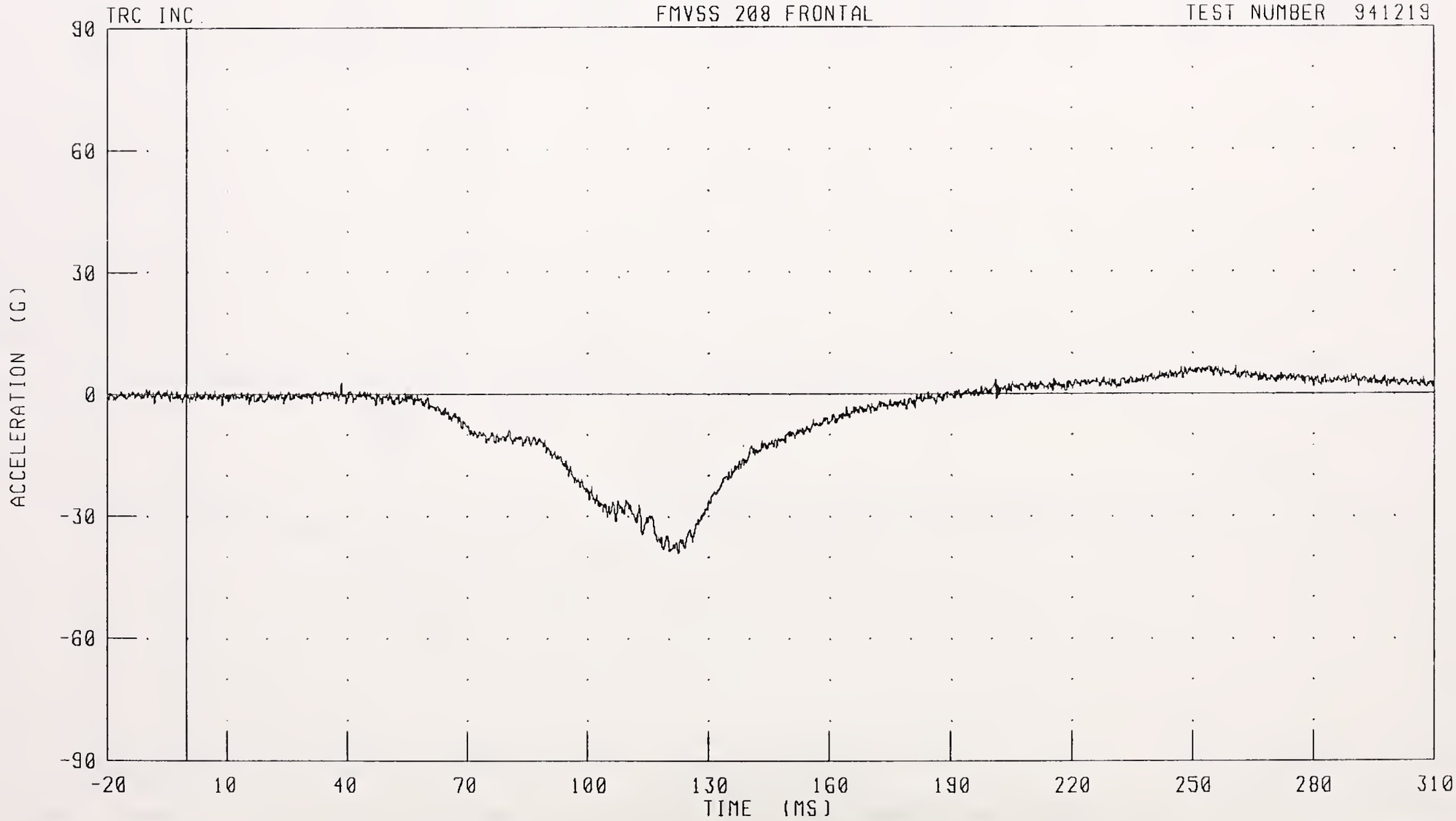
CHANNEL: LFMF1 FILTER: CH CLASS 600 PEAK DATA: 343.68 N @ 39.92 MS; -3458.51 N @ 63.44 MS

1995 SOLECTRIA E 10 PICKUP INTO FLAT FRONTAL BARRIER
DRIVER RIGHT FEMUR FORCE



CHANNEL: RFMFI FILTER CH CLASS 600 PEAK DATA 906 52 N @ 44 64 MS; -5320 07 N @ 65 44 MS

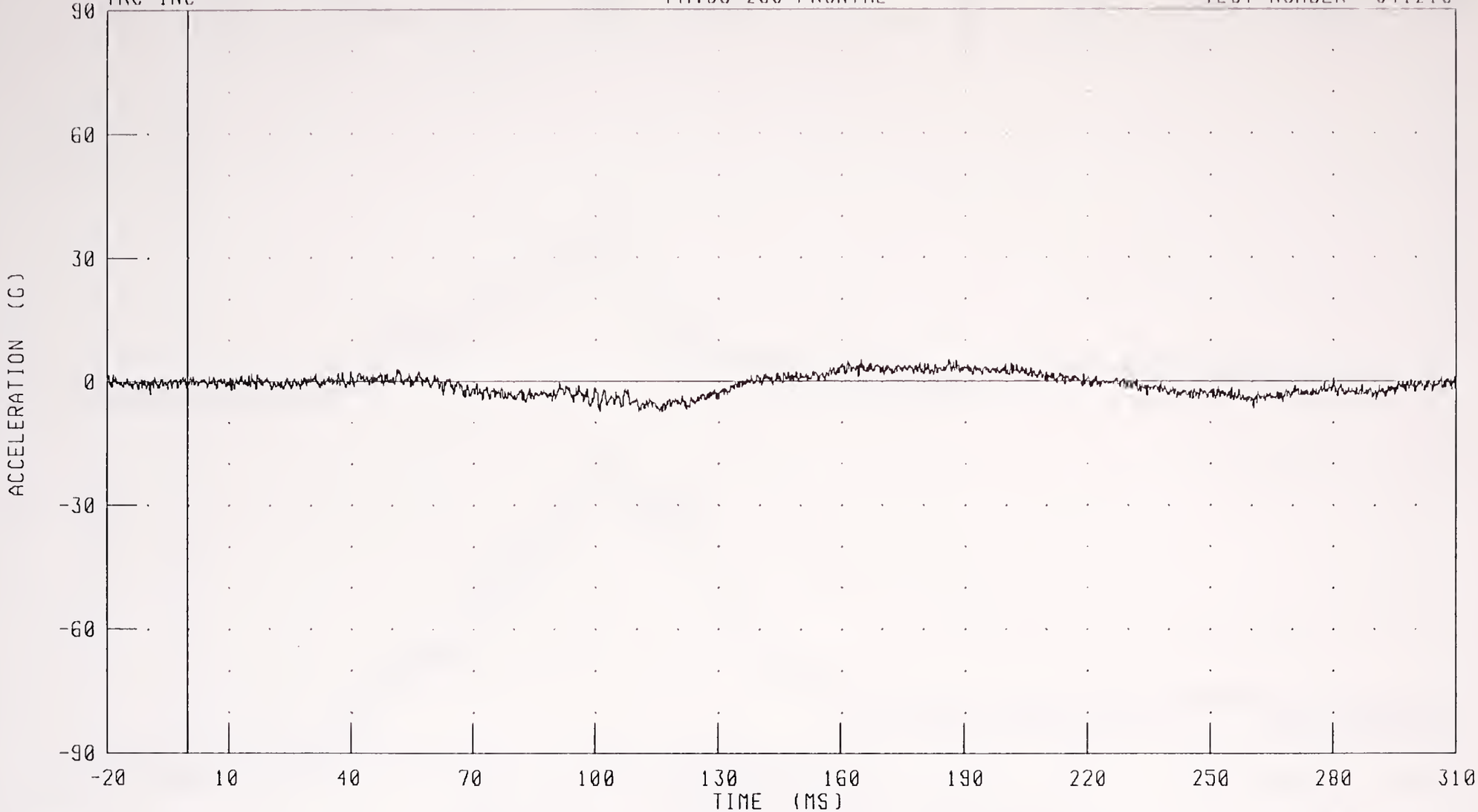
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD X-AXIS ACCELERATION



CHANNEL HEDXG2 FILTER: CH. CLASS 1000 PEAK DATA: 6 79 G @ 260 72 MS; -39 17 G @ 122 56 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Y-AXIS ACCELERATION

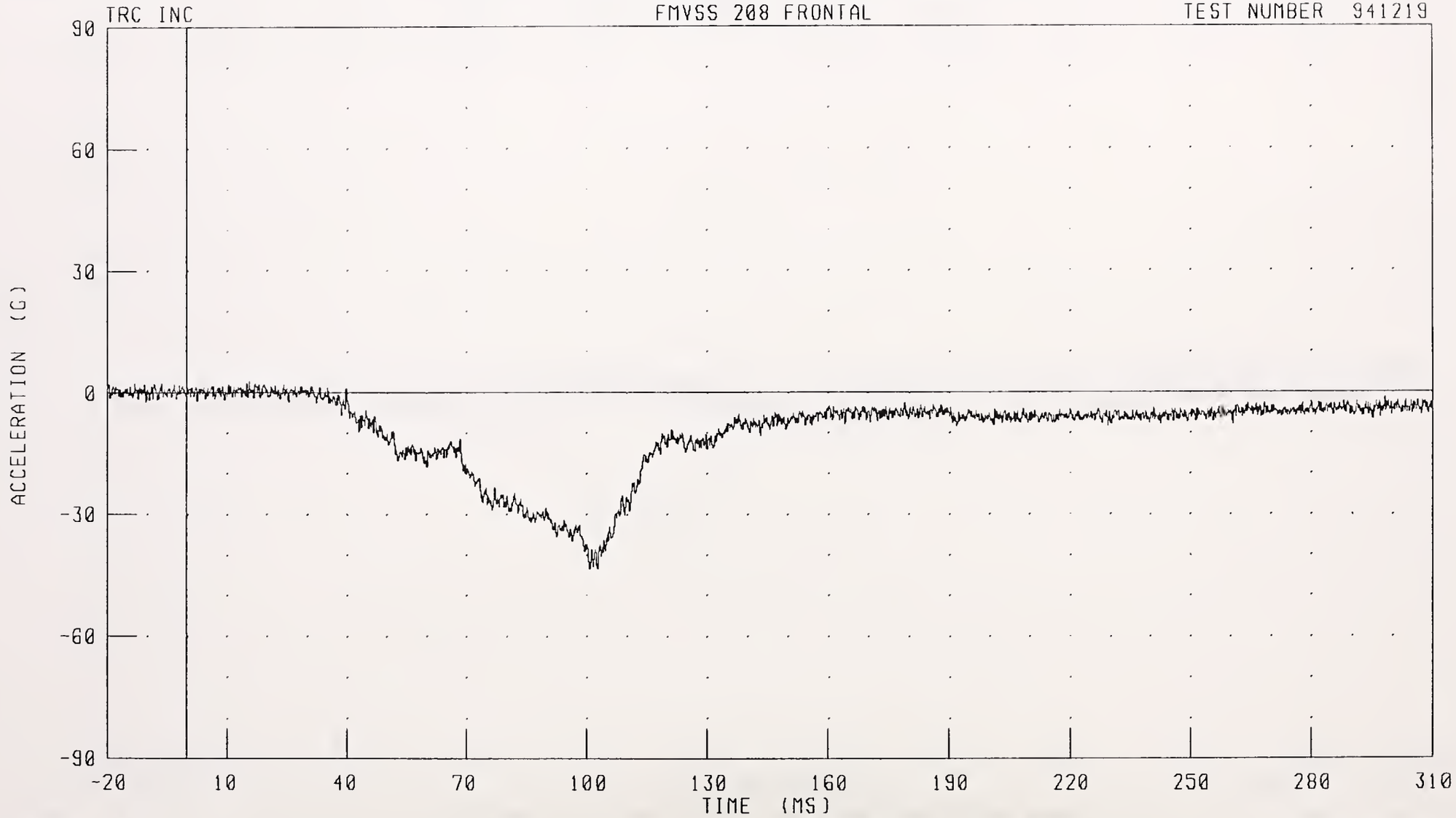
TRC INC | FMVSS 208 FRONTAL | TEST NUMBER 941219



CHANNEL HEDYG2 FILTER CH CLASS 1000

PEAK DATA: 5 41 G @ 165 04 MS; -7 32 G @ 115 68 MS

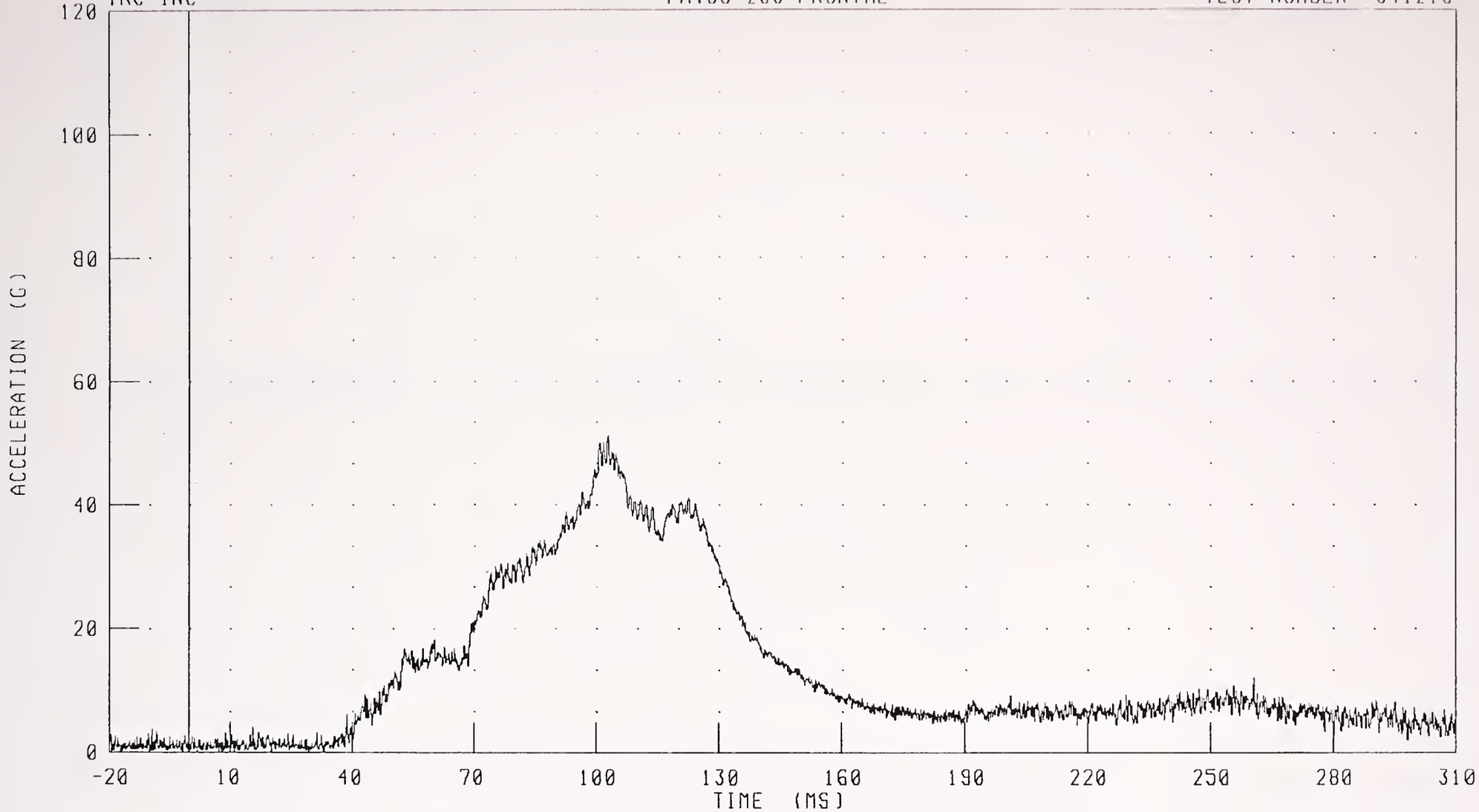
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD Z-AXIS ACCELERATION



CHANNEL: HEDZG2 FILTER: CH CLASS 1000 PEAK DATA: 2.76 G @ 15.60 MS, -43.46 G @ 100.80 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER HEAD RESULTANT ACCELERATION

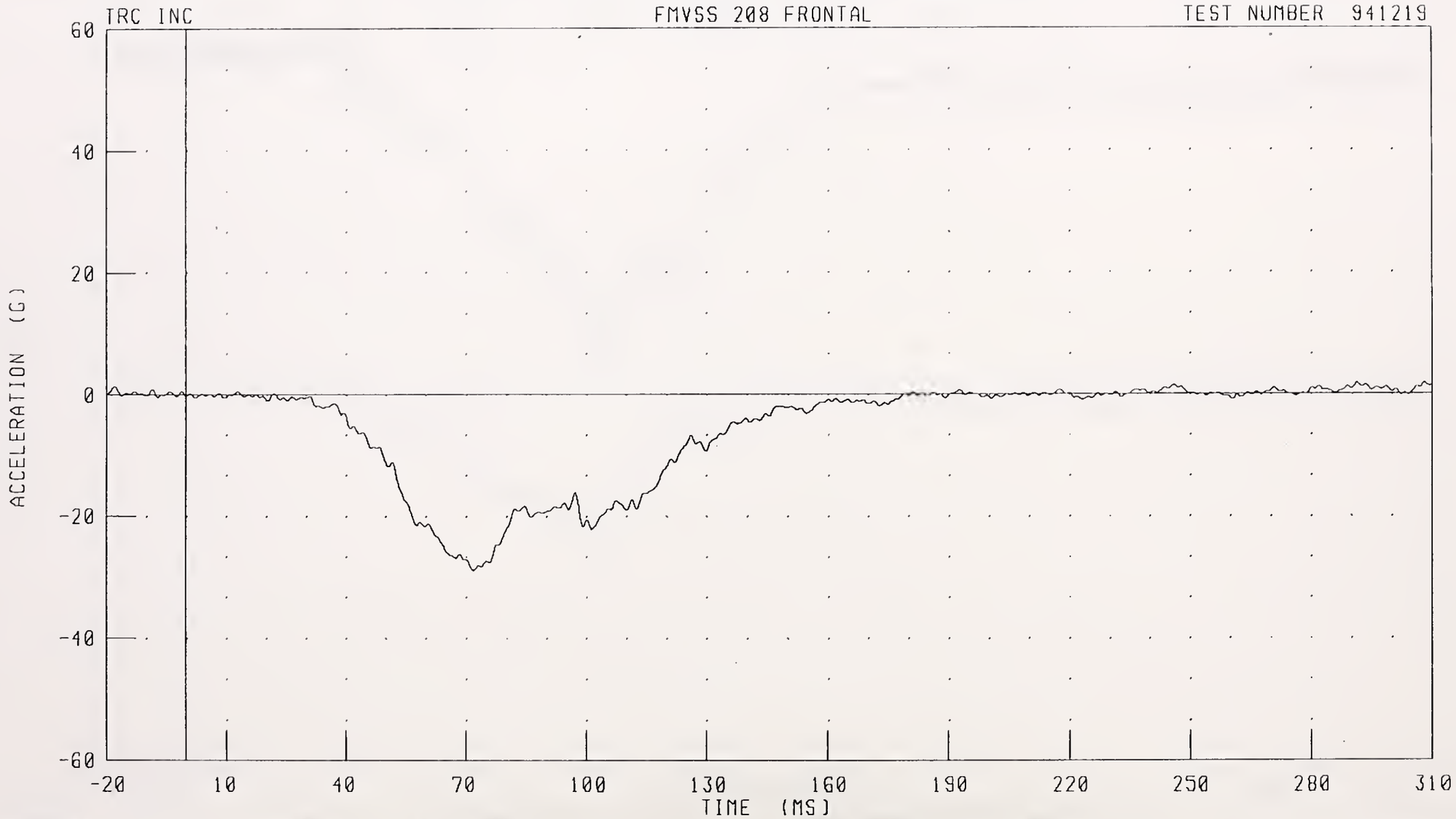
TRC INC | FMVSS 208 FRONTAL | TEST NUMBER 941219



CHANNEL HEDRG2 FILTER: CH CLASS 1000

PEAK DATA 51 19 G @ 102 88 MS, 0 17 G @ 33 20 MS

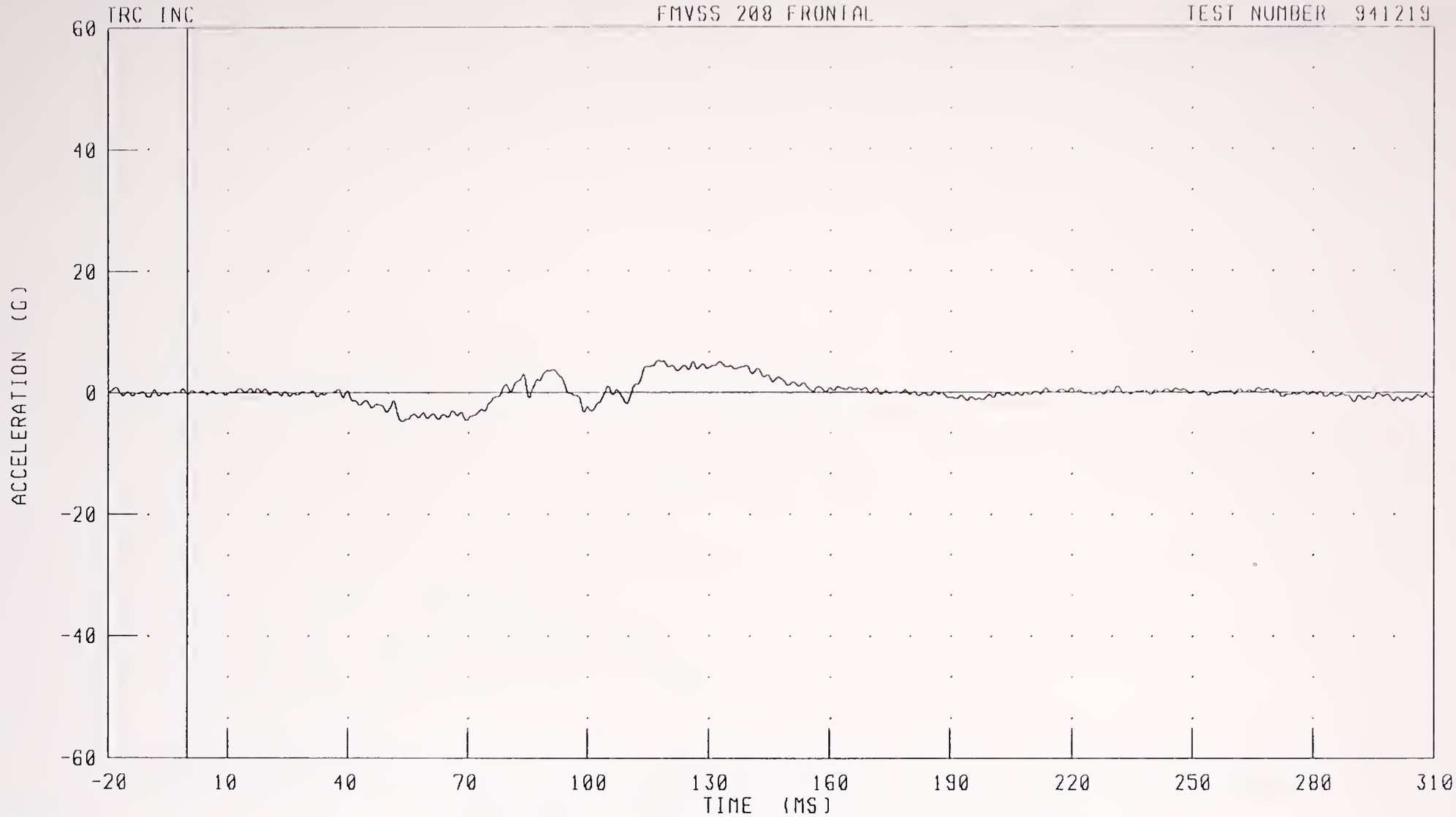
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST X-AXIS ACCELERATION



CHANNEL CSTXG2 FILTER: CH CLASS 180

PEAK DATA: 1.81 G @ 308 08 MS; -28 90 G @ 71 92 MS

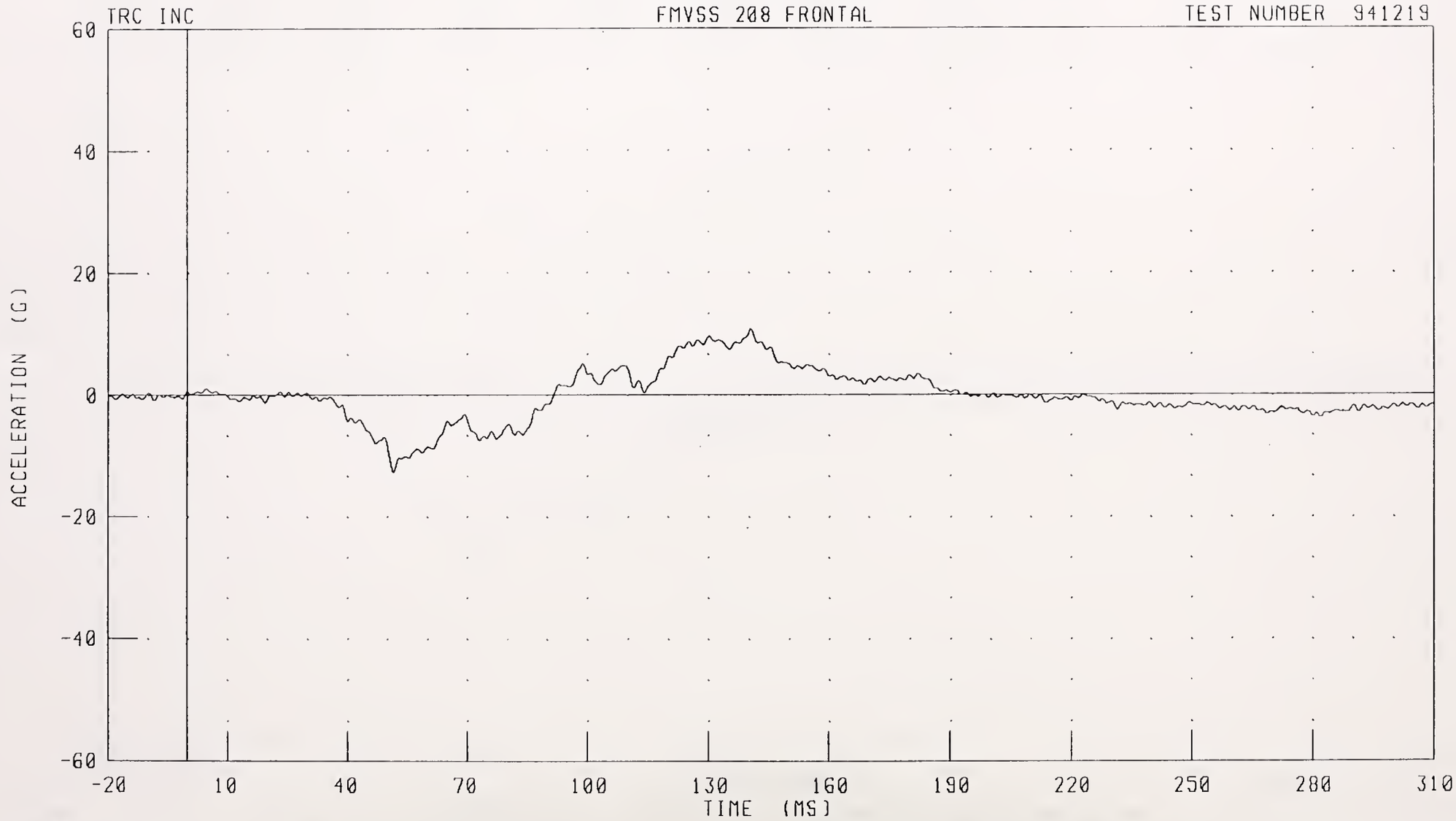
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Y-AXIS ACCELERATION



CHANNEL CSTYG2 FILTER CH CLASS 180

PEAK DATA 5 25 G @ 117 52 MS; -4 74 G @ 53 60 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST Z-AXIS ACCELERATION
FMVSS 208 FRONTAL

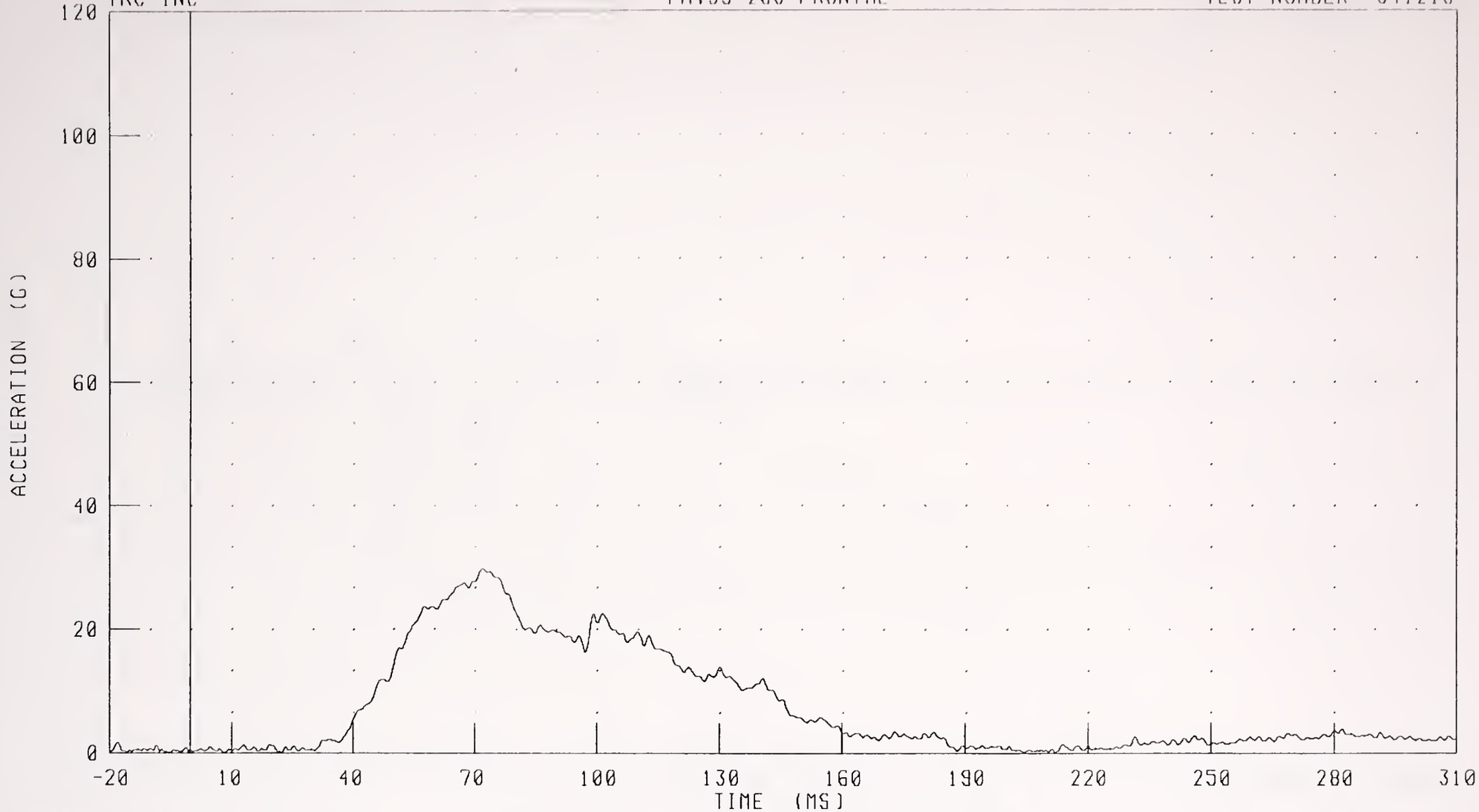


CHANNEL CSTZG2 FILTER CH CLASS 180 PEAK DATA 10.78 G @ 140 56 MS, -12 71 G @ 51 52 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST RESULTANT ACCELERATION
FMVSS 208 FRONTAL

TRC INC

TEST NUMBER 941219

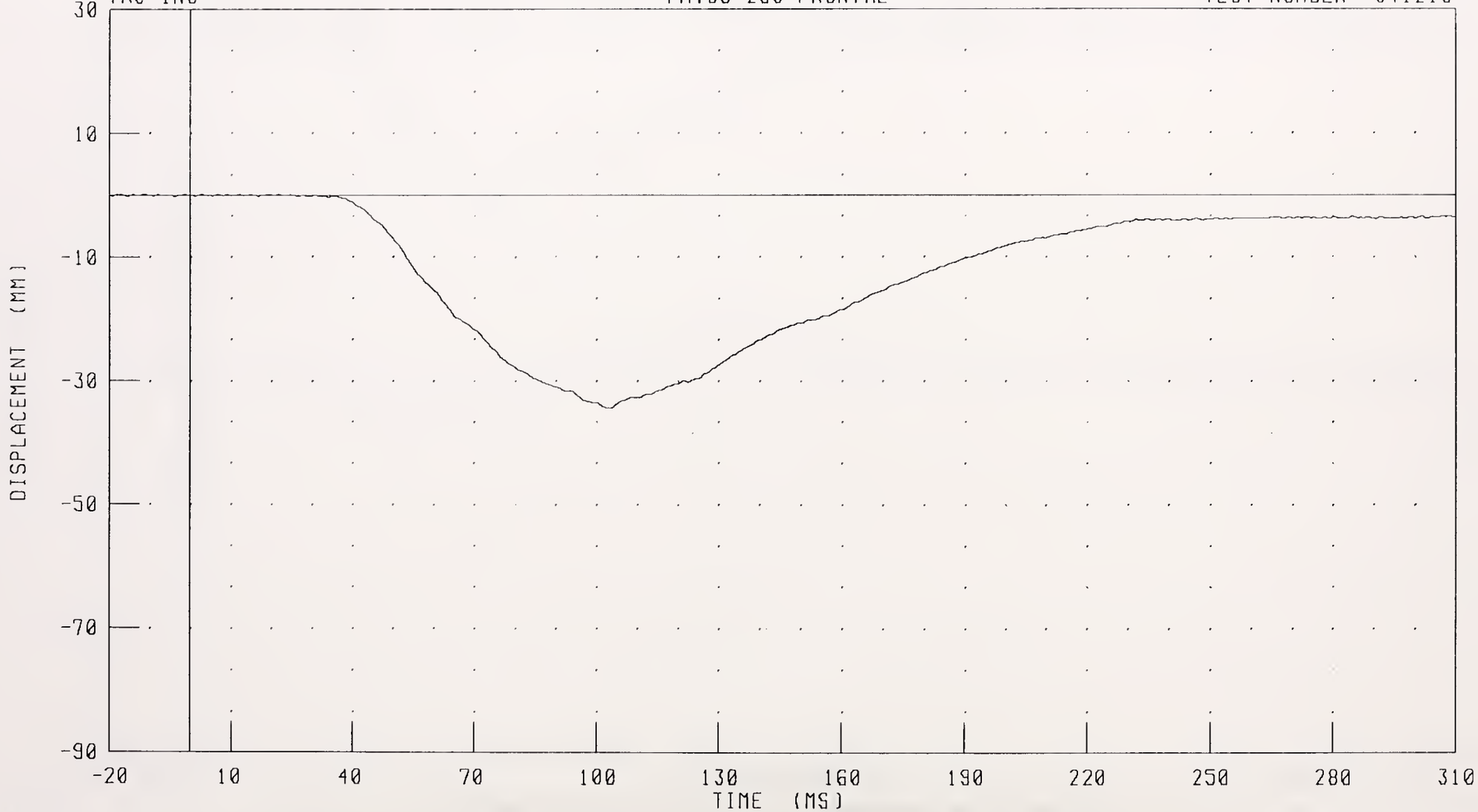


CHANNEL CSTRG2 FILTER CH CLASS 180

PEAK DATA 29 76 G @ 72 00 MS, 0 02 G @ -19 92 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER CHEST DEFLECTION

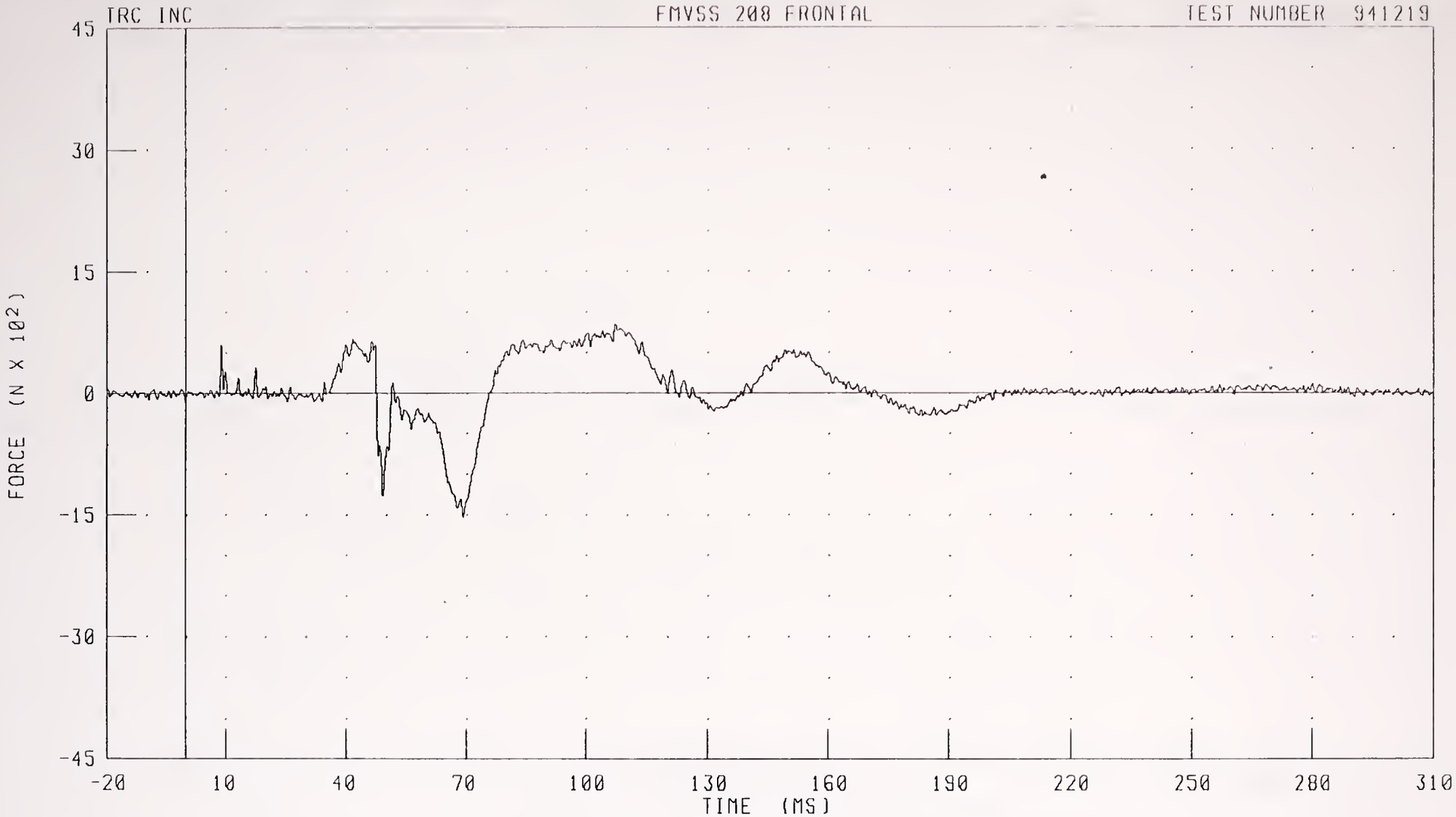
TRC INC | FMVSS 208 FRONTAL | TEST NUMBER 941219



CHANNEL CSTXD2 FILTER: CH CLASS 180

PEAK DATA: 0.21 MM @ 19.04 MS; -34.42 MM @ 103.52 MS

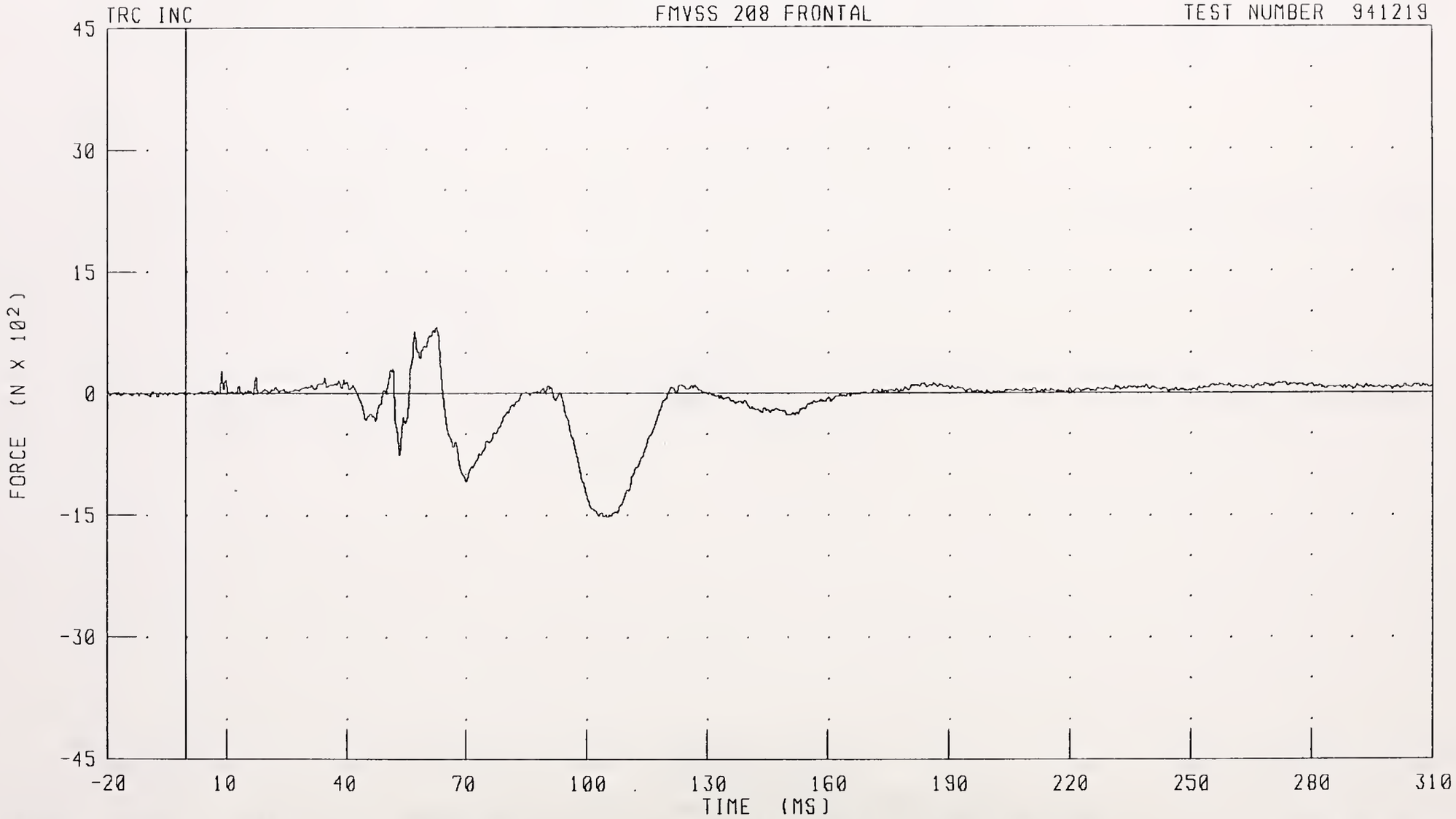
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER LEFT FEMUR FORCE



CHANNEL: LFMF2 FILTER CH CLASS 600

PEAK DATA: 858 01 N @ 107 28 MS; -1529 89 N @ 69 12 MS

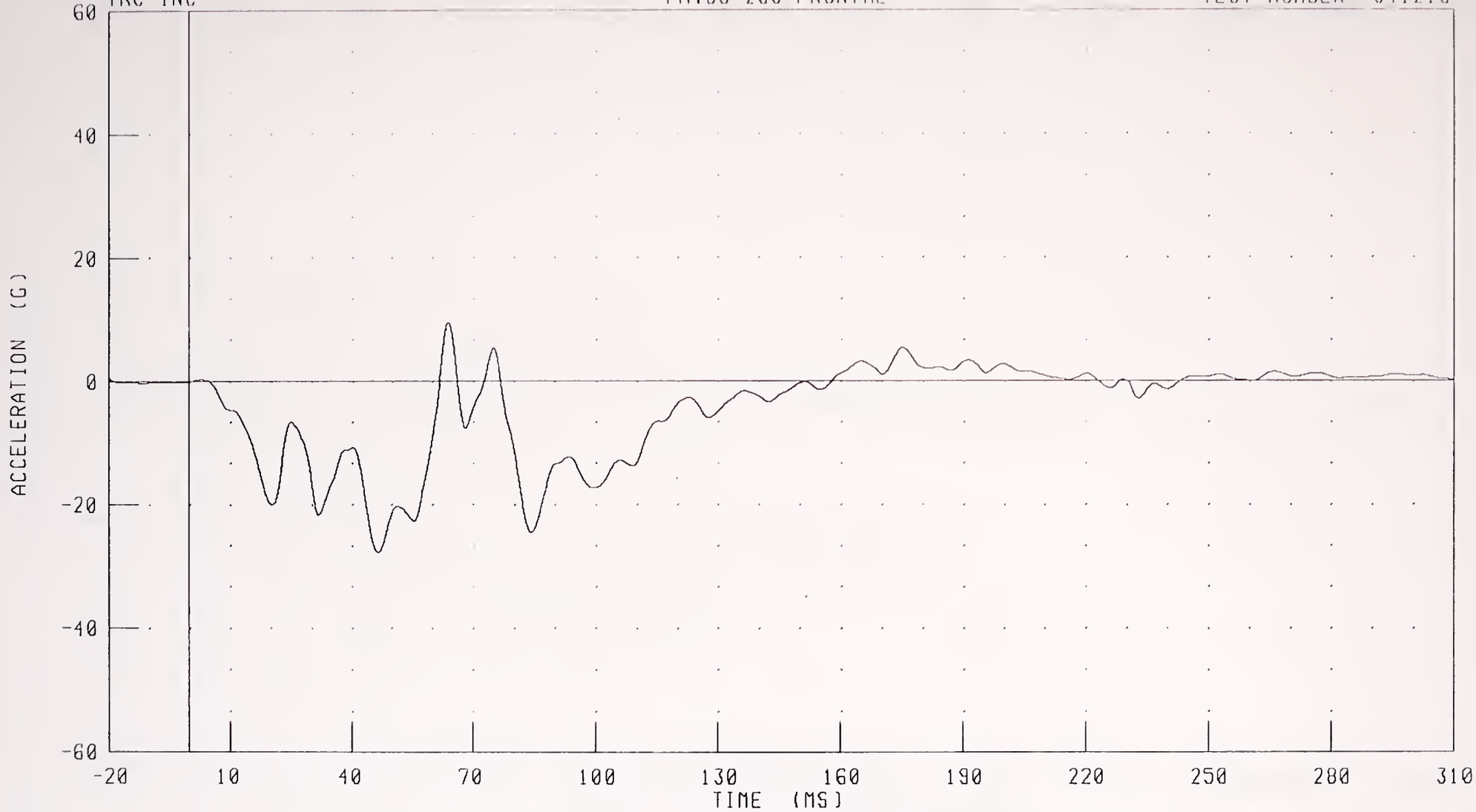
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT FRONT PASSENGER RIGHT FEMUR FORCE



CHANNEL: RFMF2 FILTER CH. CLASS 600 PEAK DATA: 812.06 N @ 62.64 MS; -1521.58 N @ 105.20 MS

1995 SOLECITRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
LEFT REAR SEAT X-AXIS ACCELERATION

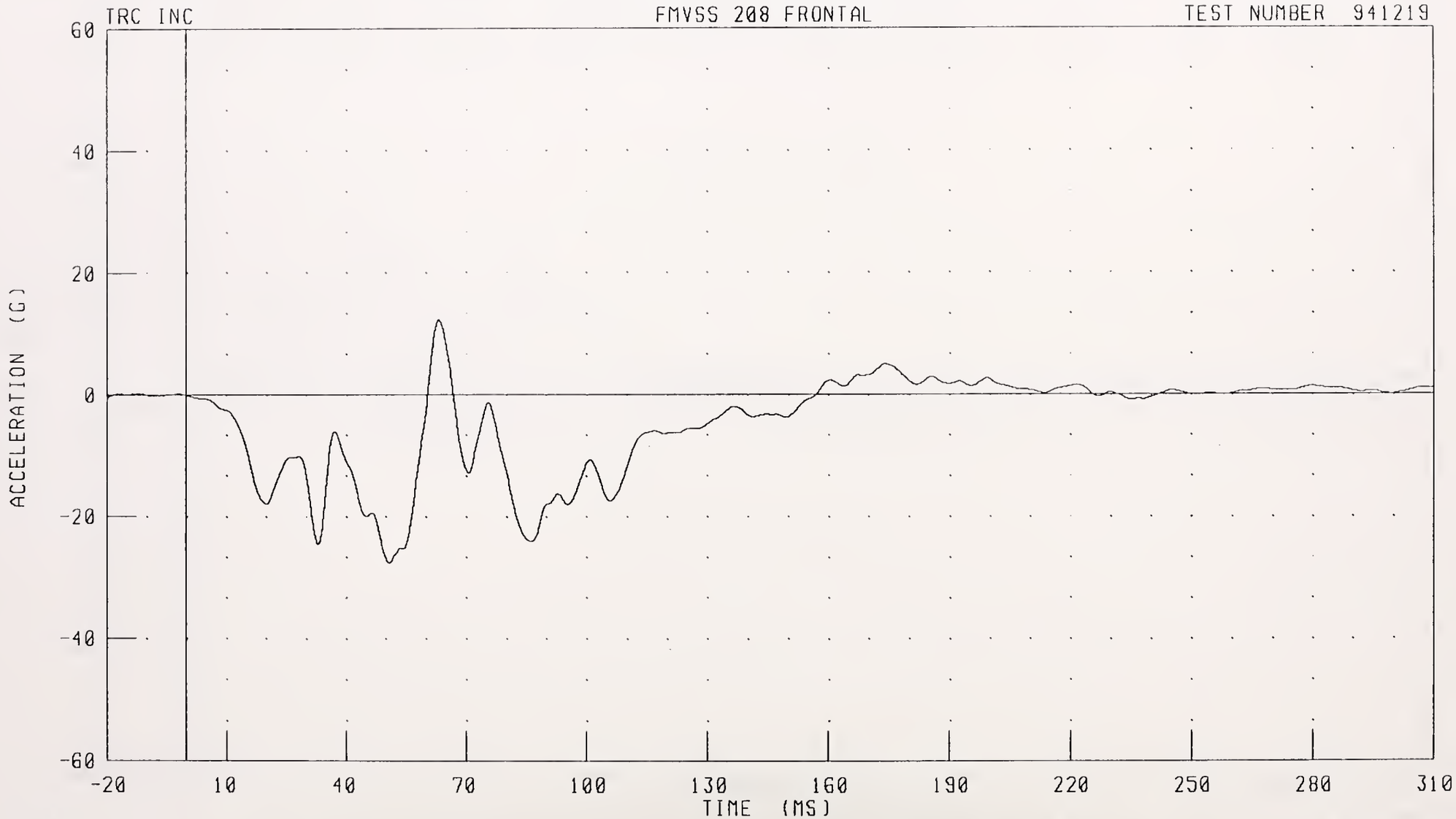
TRC INC | FMVSS 208 FRONTAL | TEST NUMBER 941219



CHANNEL TLRXG1 FILTER CH CLASS 60

PEAK DATA 9 48 G @ 63 92 MS, -27 73 G @ 46 56 MS

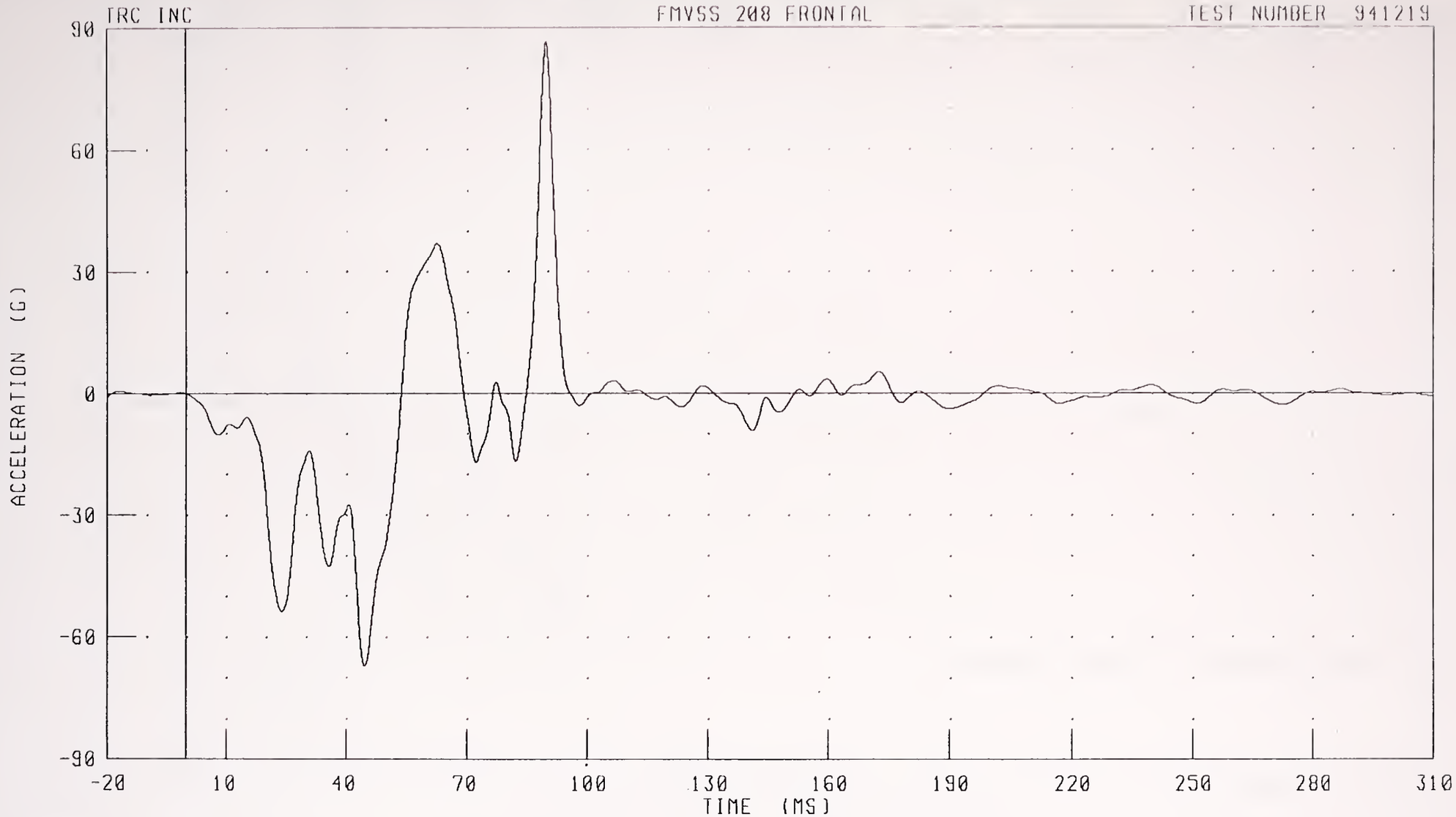
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT REAR SEAT X-AXIS ACCELERATION



CHANNEL TRRXG1 FILTER CH CLASS 60

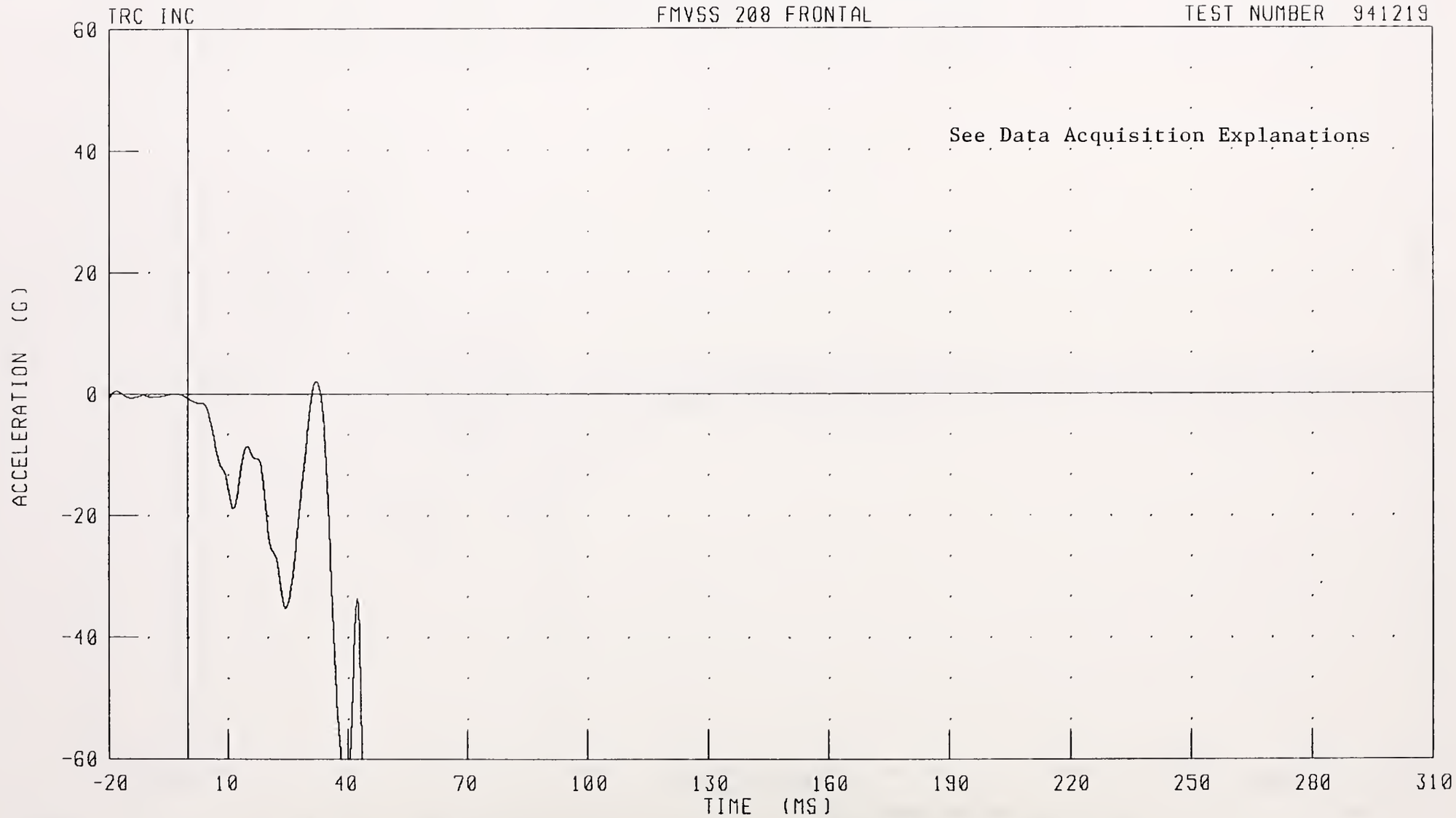
PEAK DATA: 12.30 G @ 63.20 MS; -27.54 G @ 50.88 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
RIGHT BRAKE CALIPER X-AXIS ACCELERATION



CHANNEL BCRXG1 FILTER CH. CLASS 60 PEAK DATA 86.74 G @ 89.60 MS, -67.14 G @ 44.64 MS

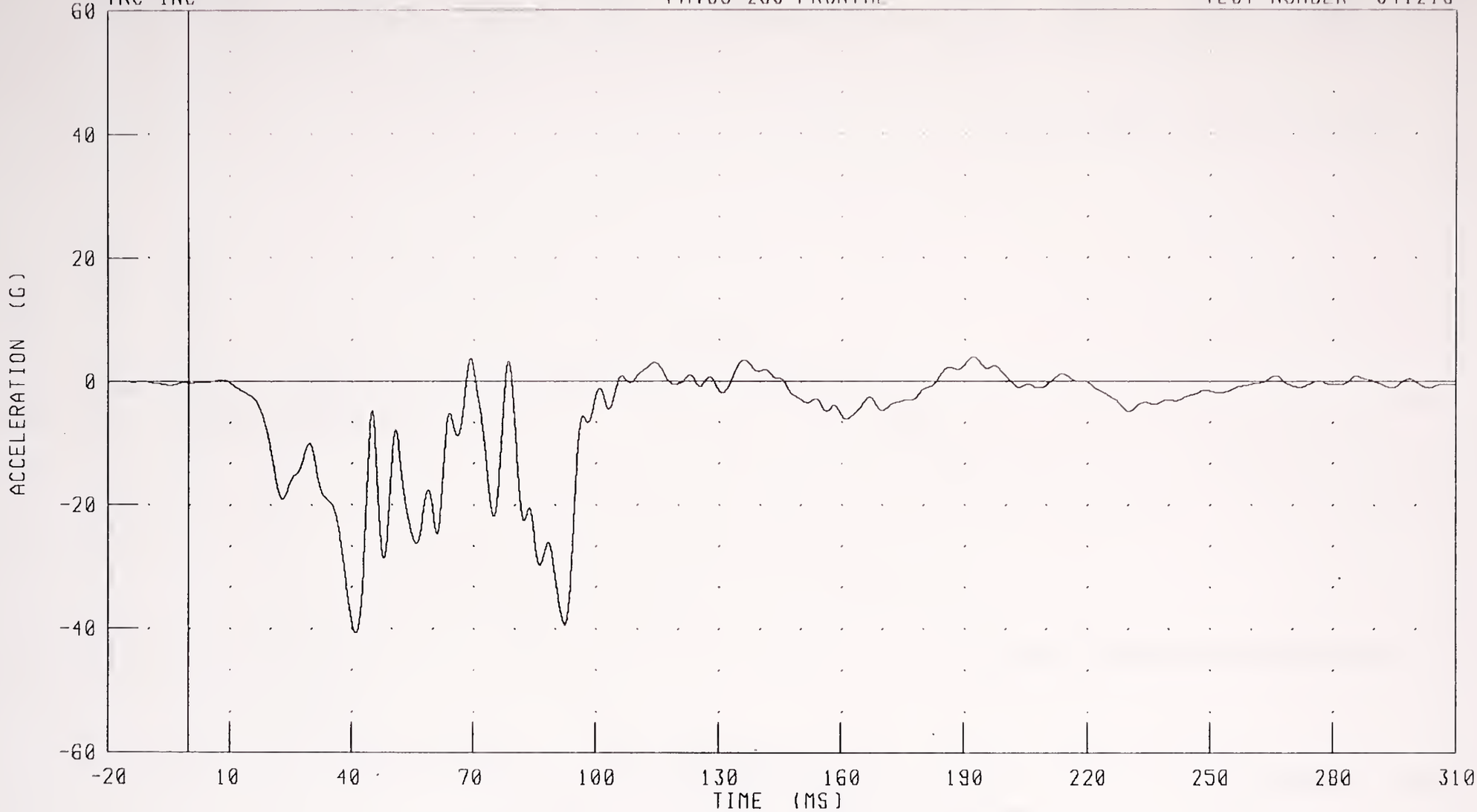
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
LEFT BRAKE CALIPER X-AXIS ACCELERATION



CHANNEL BCLXG1 FILTER: CH CLASS 60 PEAK DATA: 2 10 G @ 32.08 MS; -898.75 G @ 50 56 MS

1995 SOLECITRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
DASH PANEL CENTER X-AXIS ACCELERATION

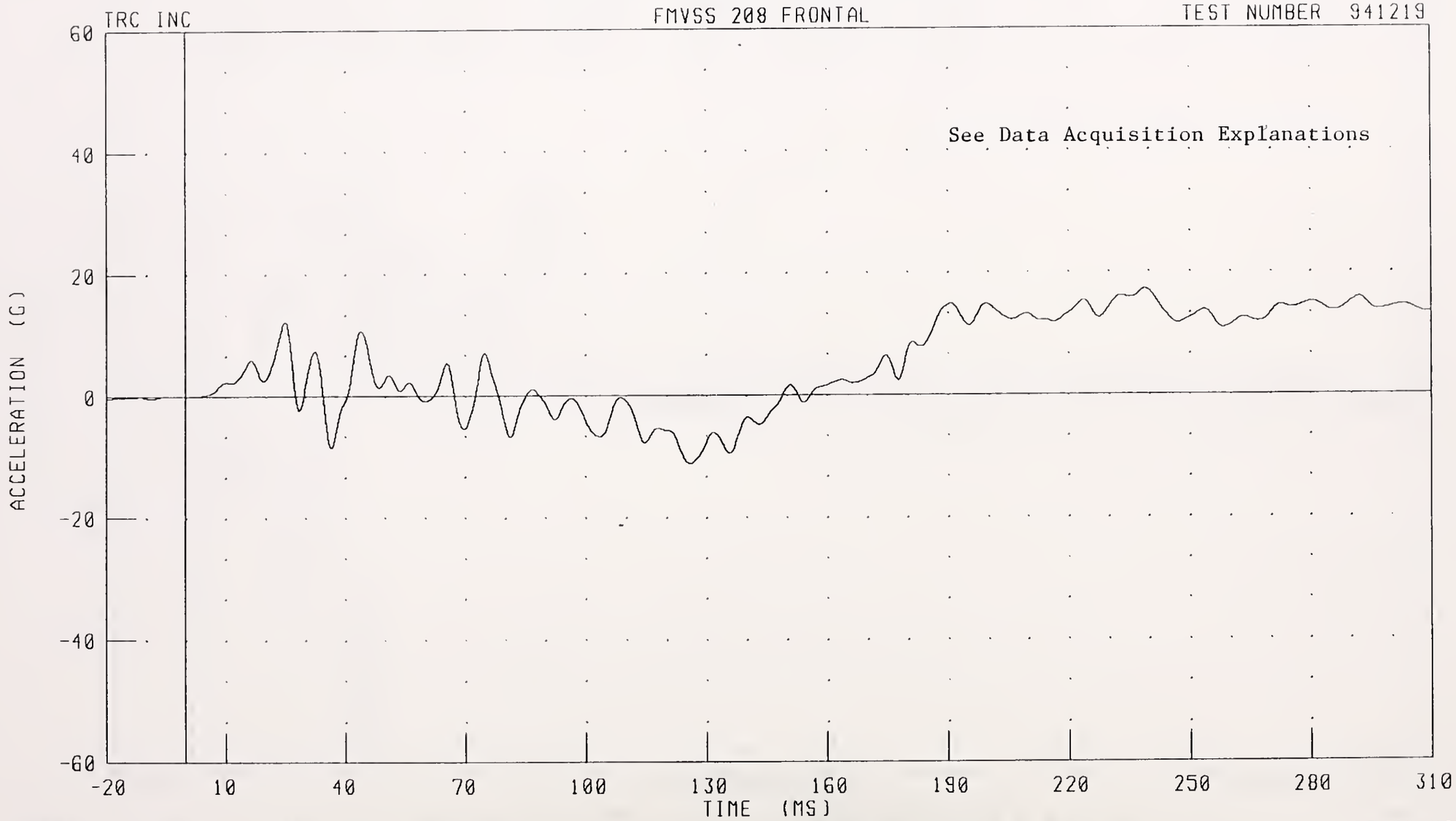
TRC INC | FMVSS 208 FRONTAL | TEST NUMBER 941219



CHANNEL DPCXG1 FILTER CH CLASS 60

PEAK DATA 3 95 G @ 192 24 MS; -40 68 G @ 41 12 MS

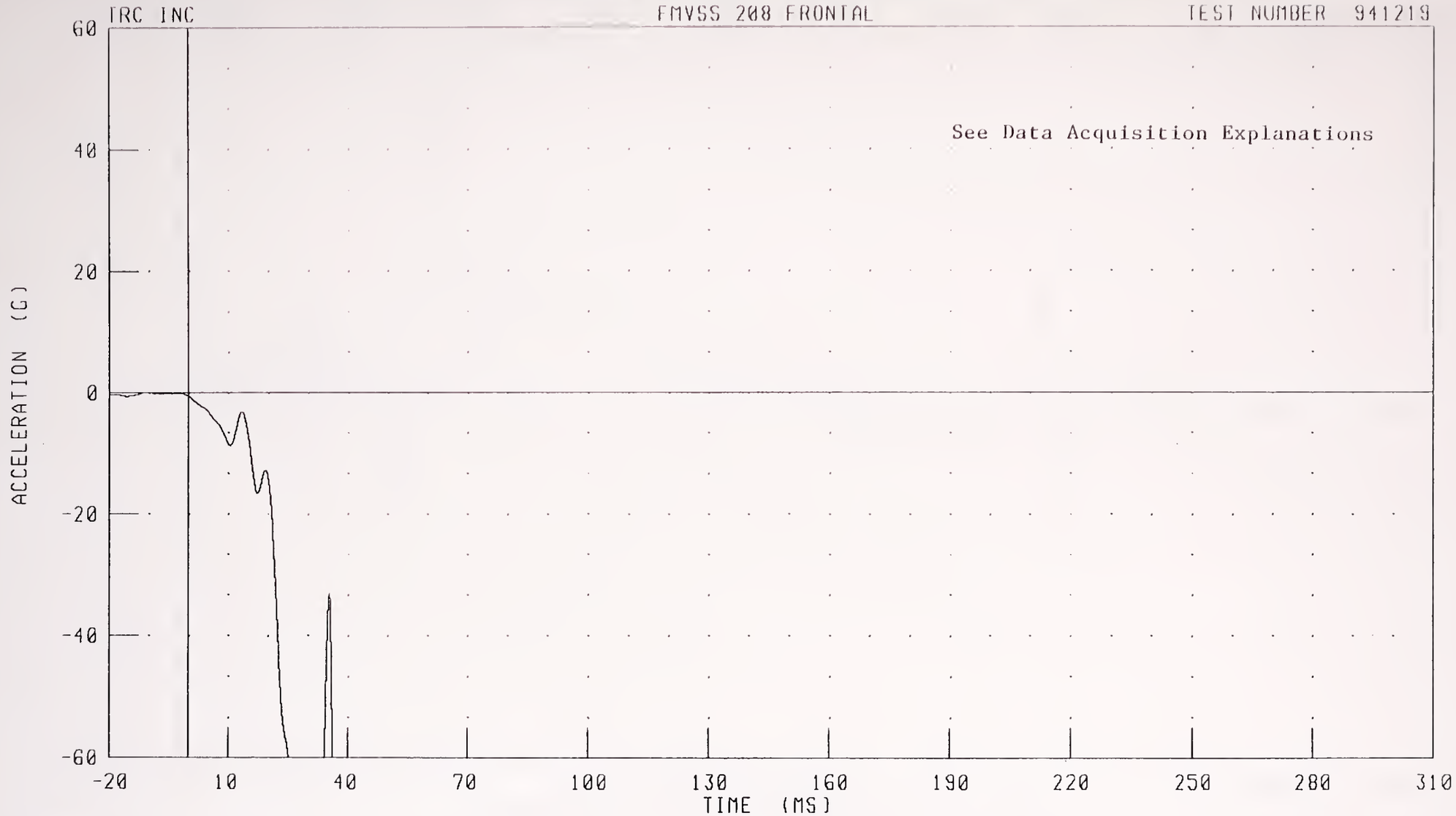
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
TRUNK FLOOR CENTER Z-AXIS ACCELERATION
FMVSS 208 FRONTAL



CHANNEL TFCZG1 FILTER CH CLASS 60

PEAK DATA 17 25 G @ 239 04 MS, -11 19 G @ 126 08 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
FRONT BATTERY BOX X-AXIS ACCELERATION

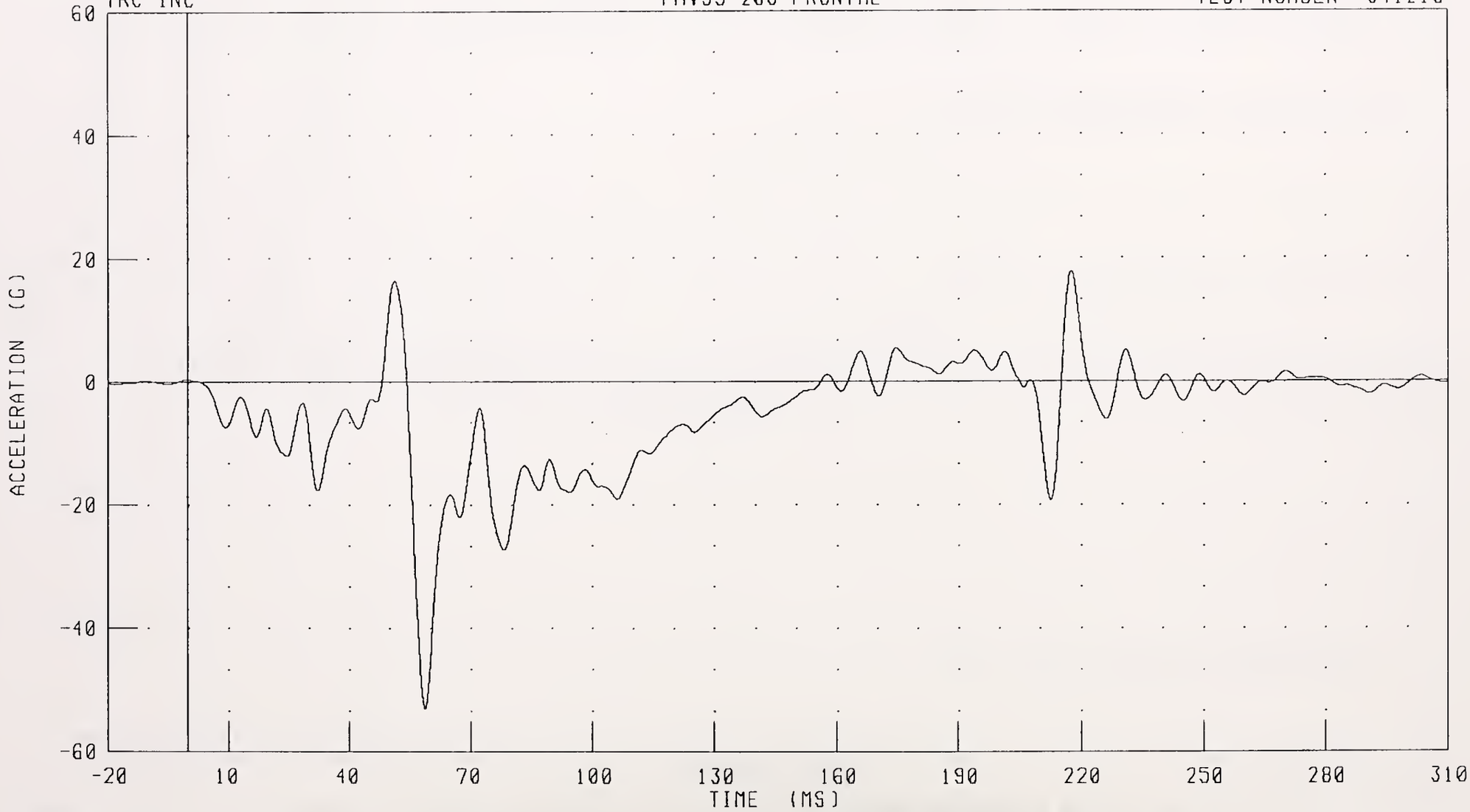


CHANNEL OTHXG1 FILTER: CH CLASS 60 PEAK DATA: 0.03 G @ -10.64 MS, -1100.44 G @ 42.80 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
REAR BATTERY BOX X-AXIS ACCELERATION - FRONT
FMVSS 208 FRONTAL

TRC INC

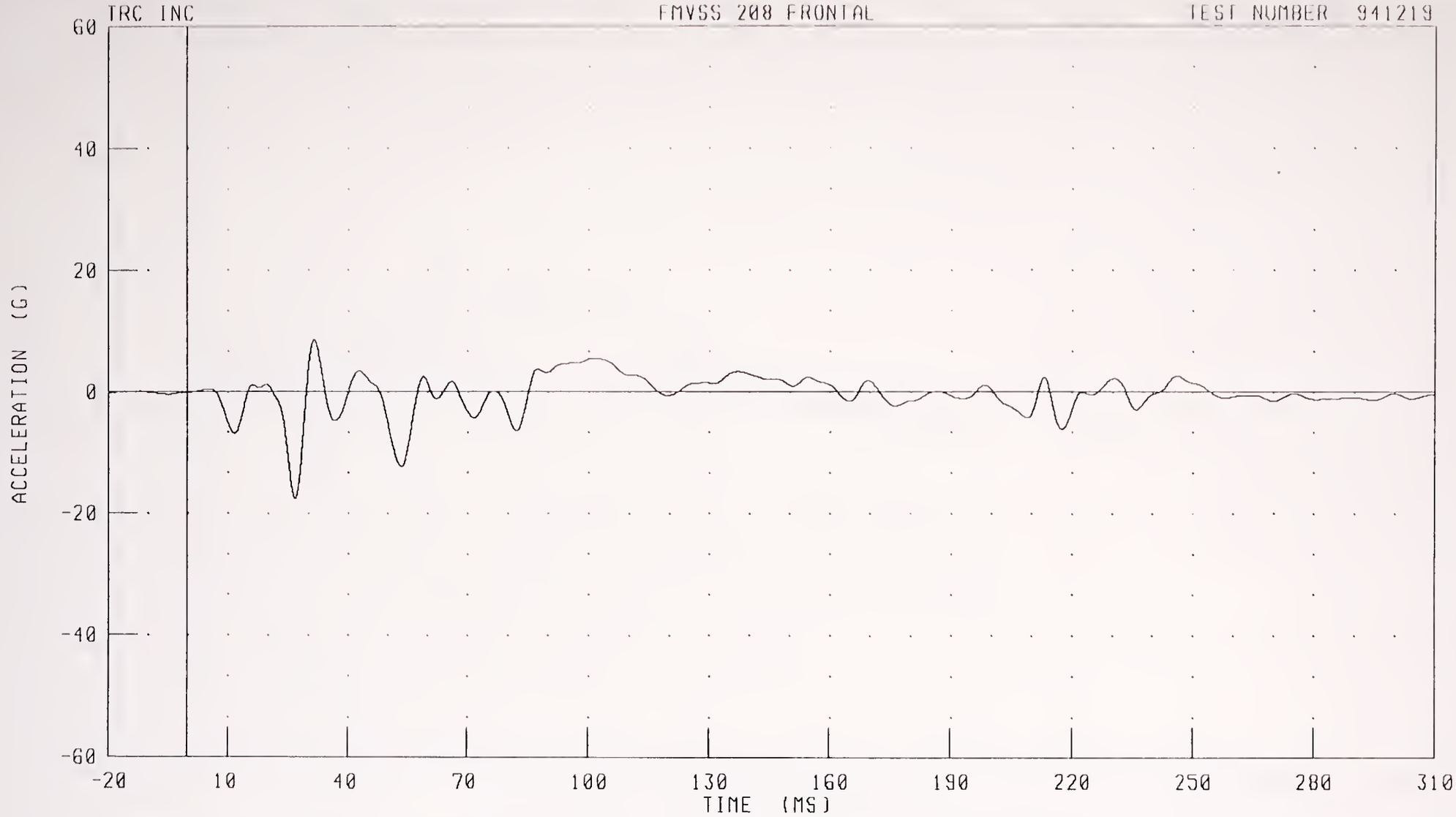
TEST NUMBER 941219



CHANNEL: OTHXG2 FILTER CH CLASS 60

PEAK DATA 17 87 G @ 217 76 MS; -52 97 G @ 58 72 MS

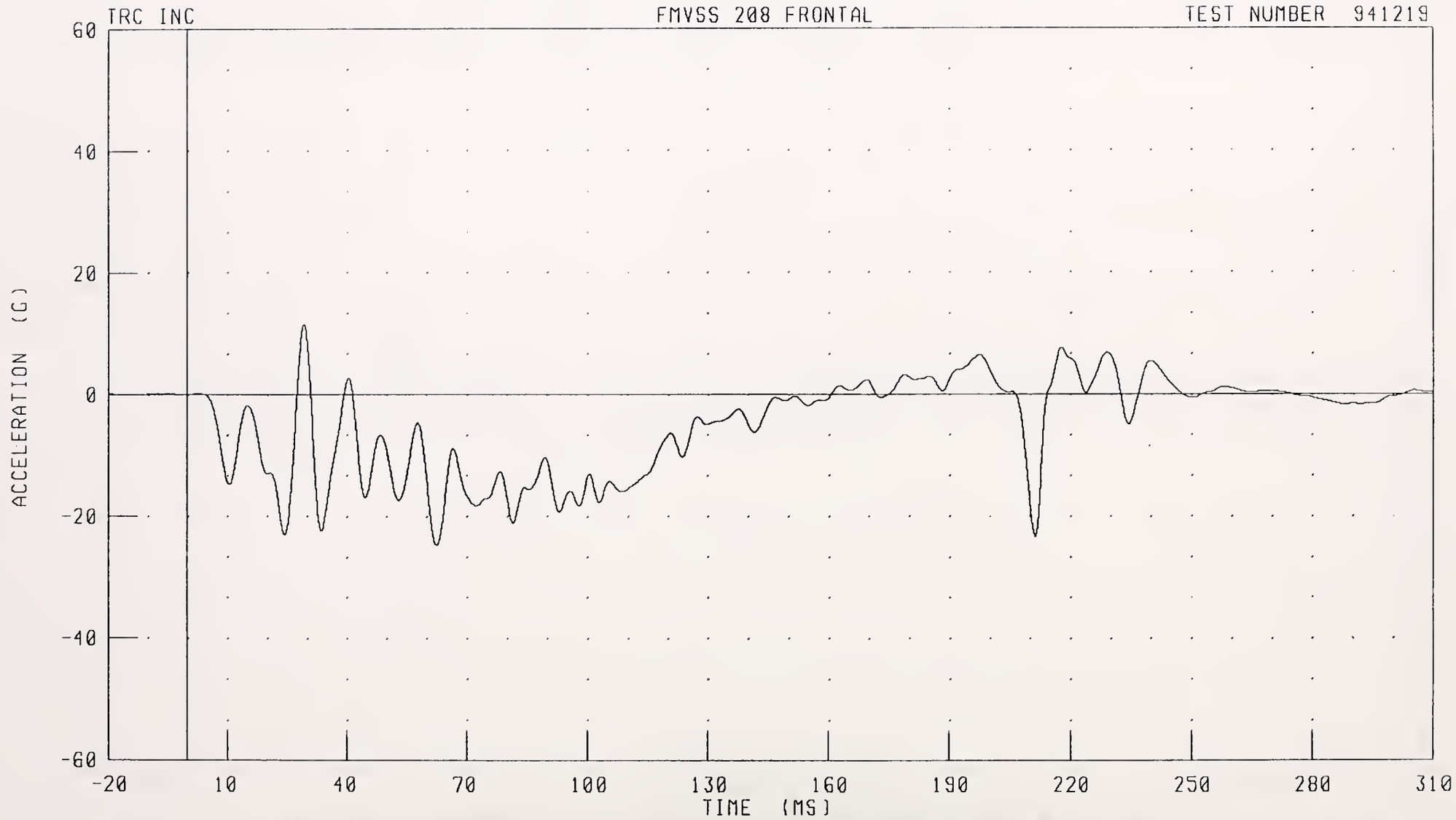
1995 SOLECITIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
REAR BATTERY BOX Z-AXIS ACCELERATION - FRONT



CHANNEL OTHZG3 FILTER CH CLASS 60

PEAK DATA 8 57 G @ 31 52 MS, -17 63 G @ 26 80 MS

1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
REAR BATTERY BOX X-AXIS ACCELERATION - REAR

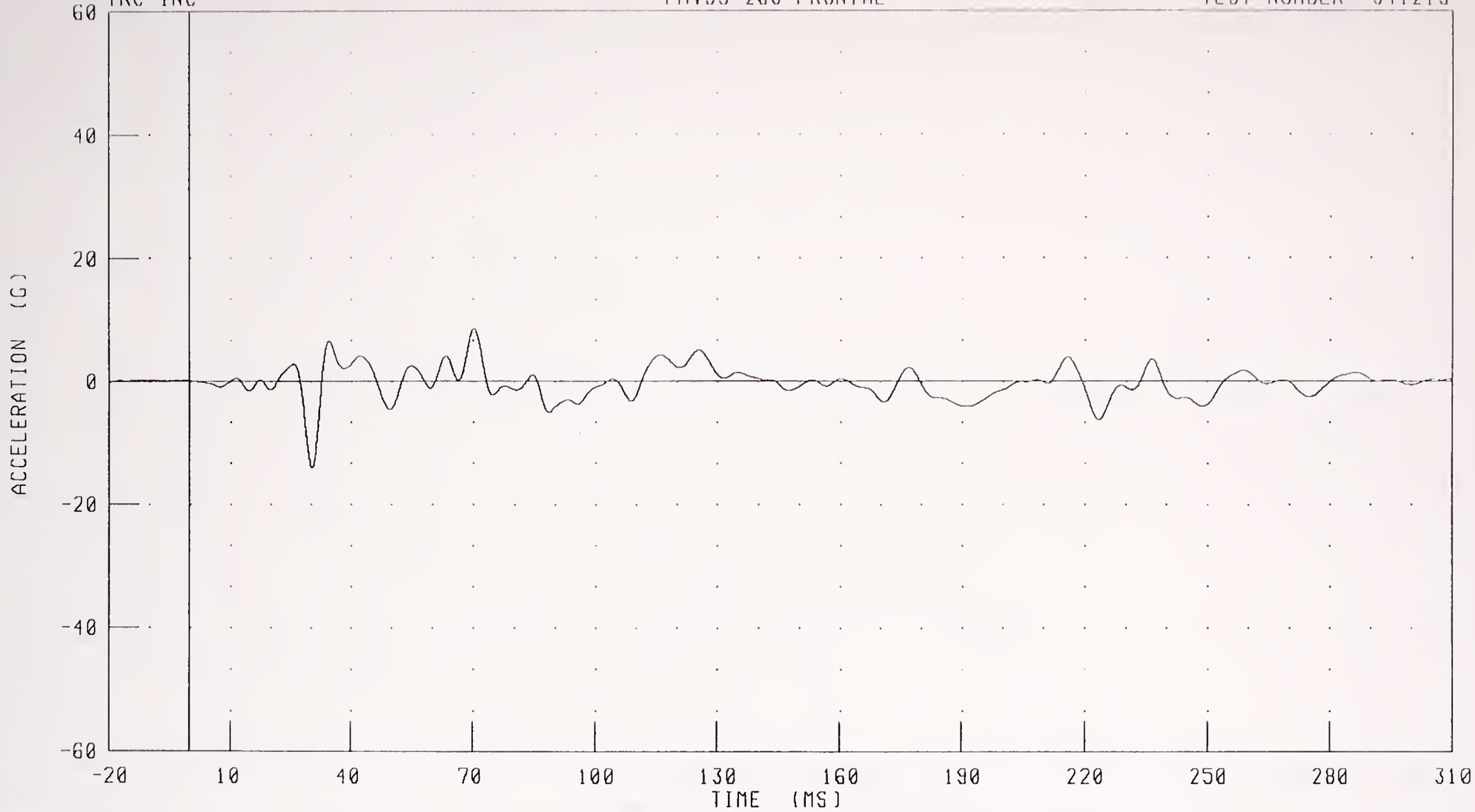


CHANNEL OTHXG4 FILTER CH CLASS 60

PEAK DATA 11 61 G @ 29 20 MS, -24 75 G @ 62 48 MS

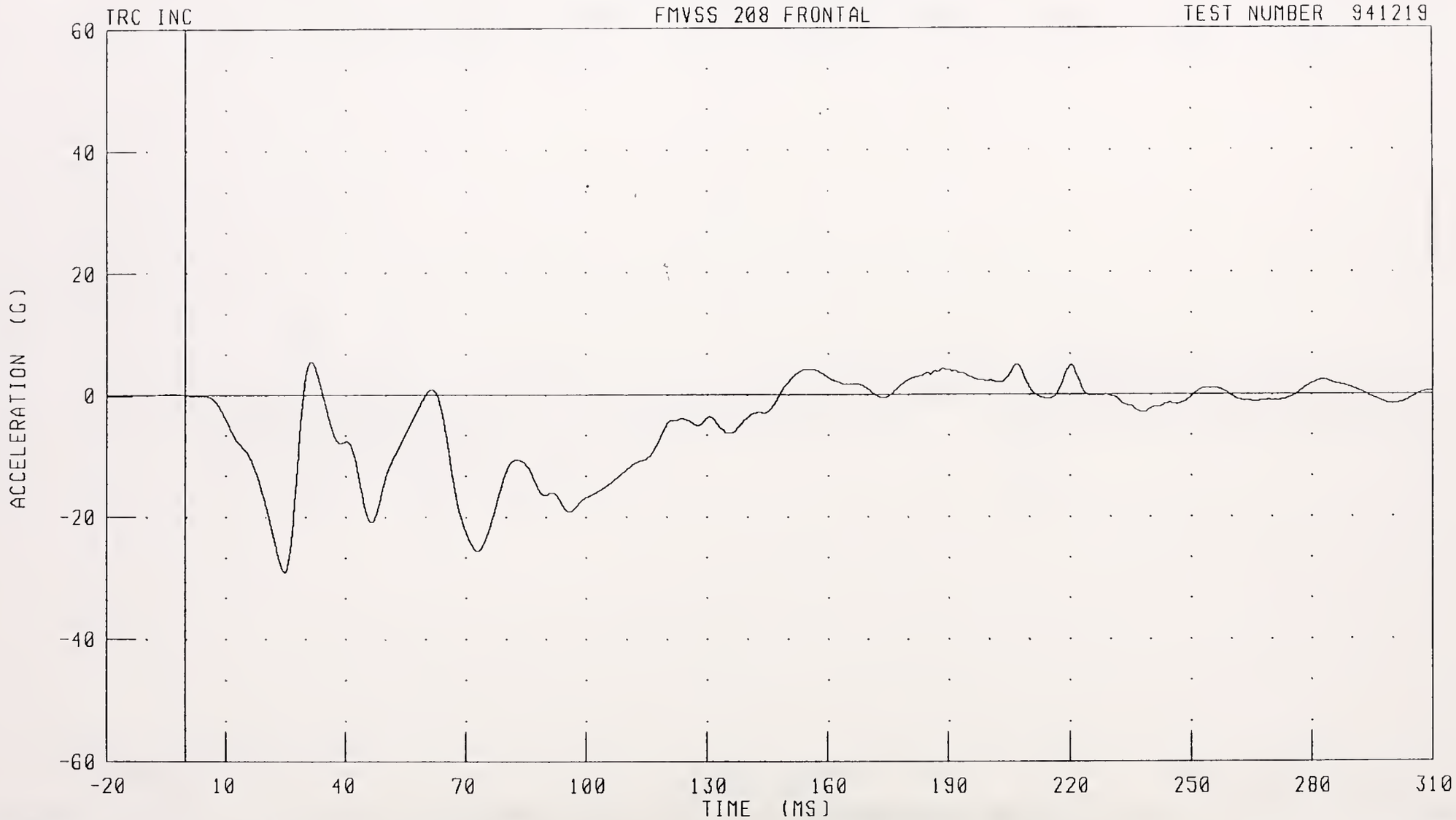
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
REAR BATTERY BOX Z-AXIS ACCELERATION - REAR

IRC INC FMVSS 208 FRONTAL TEST NUMBER 941219



CHANNEL OTHZG5 FILTER CH CLASS 60 PEAK DATA 8 56 G @ 70 24 MS, -14 12 G @ 30 40 MS

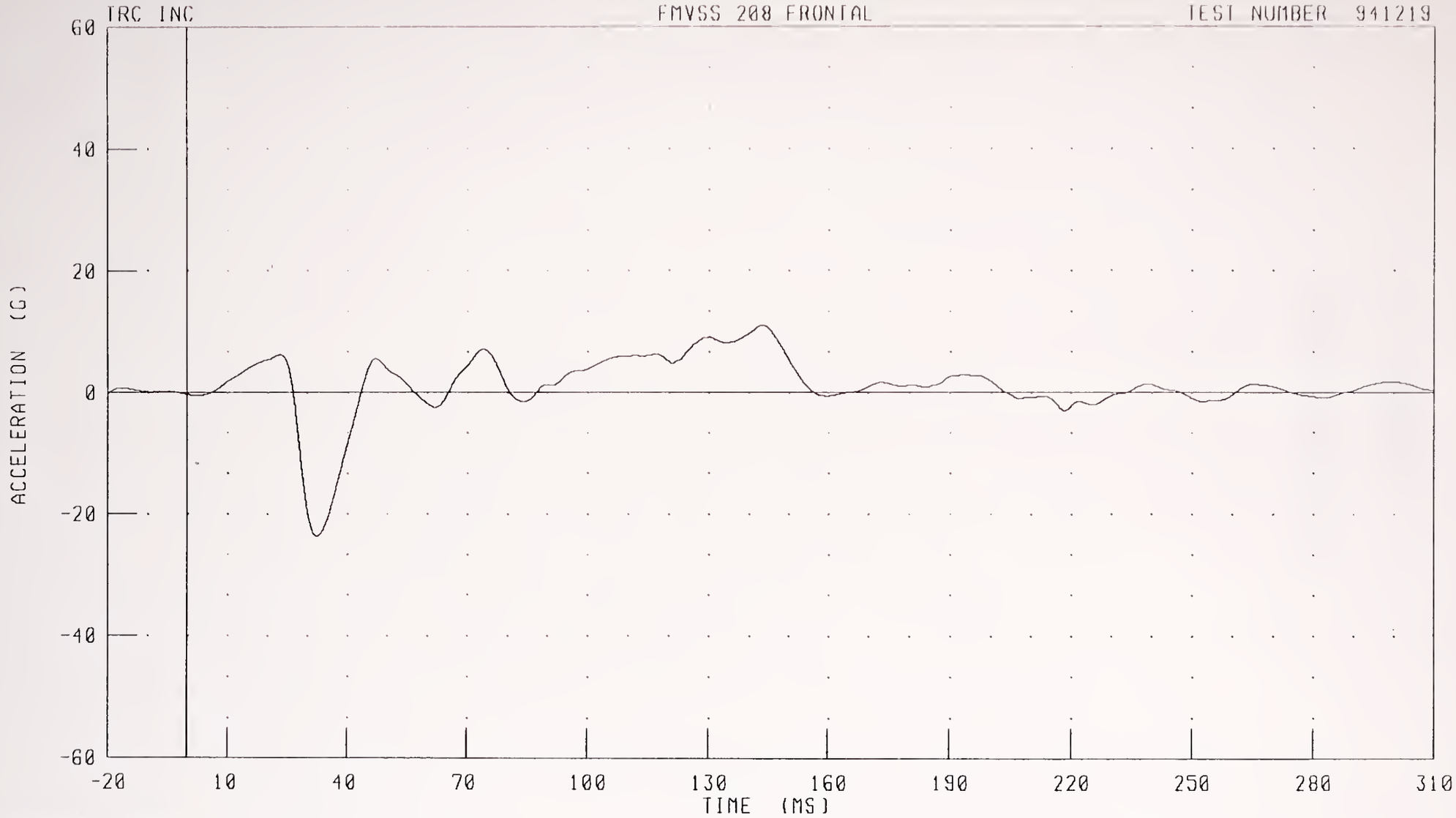
1995 SOLECTRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
GEAR BOX X-AXIS ACCELERATION
FMVSS 208 FRONTAL



CHANNEL: OTHXG6 FILTER CH CLASS 60

PEAK DATA 5 51 G @ 31 52 MS, -29 04 G @ 24 80 MS

1995 SOLECITRIA E-10 PICKUP INTO FLAT FRONTAL BARRIER
GEAR BOX Z-AXIS ACCELERATION



CHANNEL: OTHZG7 FILTER CH CLASS 60

PEAK DATA 11 04 G @ 143 36 MS; -23 69 G @ 32 48 MS

Appendix C

Dummy Certification Data

Pre-test Certification Data

Driver Dummy S/N: 551

TRANSPORTATION RESEARCH CENTER INC.
HYBRID III EXTERNAL DIMENSIONS
551 FIRST TECHNOLOGY 16-DEC-94

TRC INC. TEST NO: 551C9ED1 572E SN551 EXT.DIMENSION CAL09

TEST PARAMETER	(DIMEN.)	SPECIFICATION	TEST RESULTS
LOCATION FOR CHEST CIRCUMFERENCE	(AA)	429 - 434 MM	432. MM
LOCATION FOR WAIST CIRCUMFERENCE	(BB)	226 - 231 MM	229. MM
CHEST CIRCUMFERENCE	(Y)	970 -1001 MM	980. MM
WAIST CIRCUMFERENCE	(Z)	836 - 866 MM	848. MM
CHEST DEPTH	(O)	213 - 229 MM	221. MM
H-POINT HEIGHT	(C)	84 - 89 MM	89. MM
H-POINT FROM SEATBACK	(D)	135 - 140 MM	137. MM
SKULL CAP TO BACKLINE	(H)	41 - 46 MM	43. MM
TOTAL SITTING HEIGHT	(A)	879 - 889 MM	886. MM
THIGH CLEARANCE	(F)	140 - 155 MM	152. MM
BUTTOCK KNEE LENGTH	(K)	579 - 605 MM	602. MM
BUTTOCK POPLITEAL LENGTH	(N)	452 - 478 MM	472. MM
POPLITEAL HEIGHT	(L)	429 - 455 MM	442. MM
KNEE PIVOT HEIGHT	(M)	485 - 500 MM	493. MM
FOOT LENGTH	(P)	252 - 267 MM	262. MM
FOOT BREADTH	(W)	91 - 107 MM	99. MM
SHOULDER PIVOT FROM BACKLINE	(E)	84 - 94 MM	91. MM
SHOULDER BREADTH	(V)	422 - 437 MM	427. MM
SHOULDER PIVOT HEIGHT	(B)	506 - 521 MM	516. MM
ELBOW REST HEIGHT	(J)	191 - 211 MM	203. MM
SHOULDER-ELBOW LENGTH	(I)	330 - 345 MM	340. MM
BACK OF ELBOW TO WRIST PIVOT	(G)	290 - 305 MM	292. MM

DUMMY MEETS SPECIFICATIONS
TECHNICIAN Pete Fox RUN NUMBER: 121994.0730

TRANSPORTATION RESEARCH CENTER INC.

HEAD DROP TEST

HYBRID III 16-DEC-94

TRC INC. TEST NO: 551C9HD1 572E SN551 HEAD DROP CAL 09

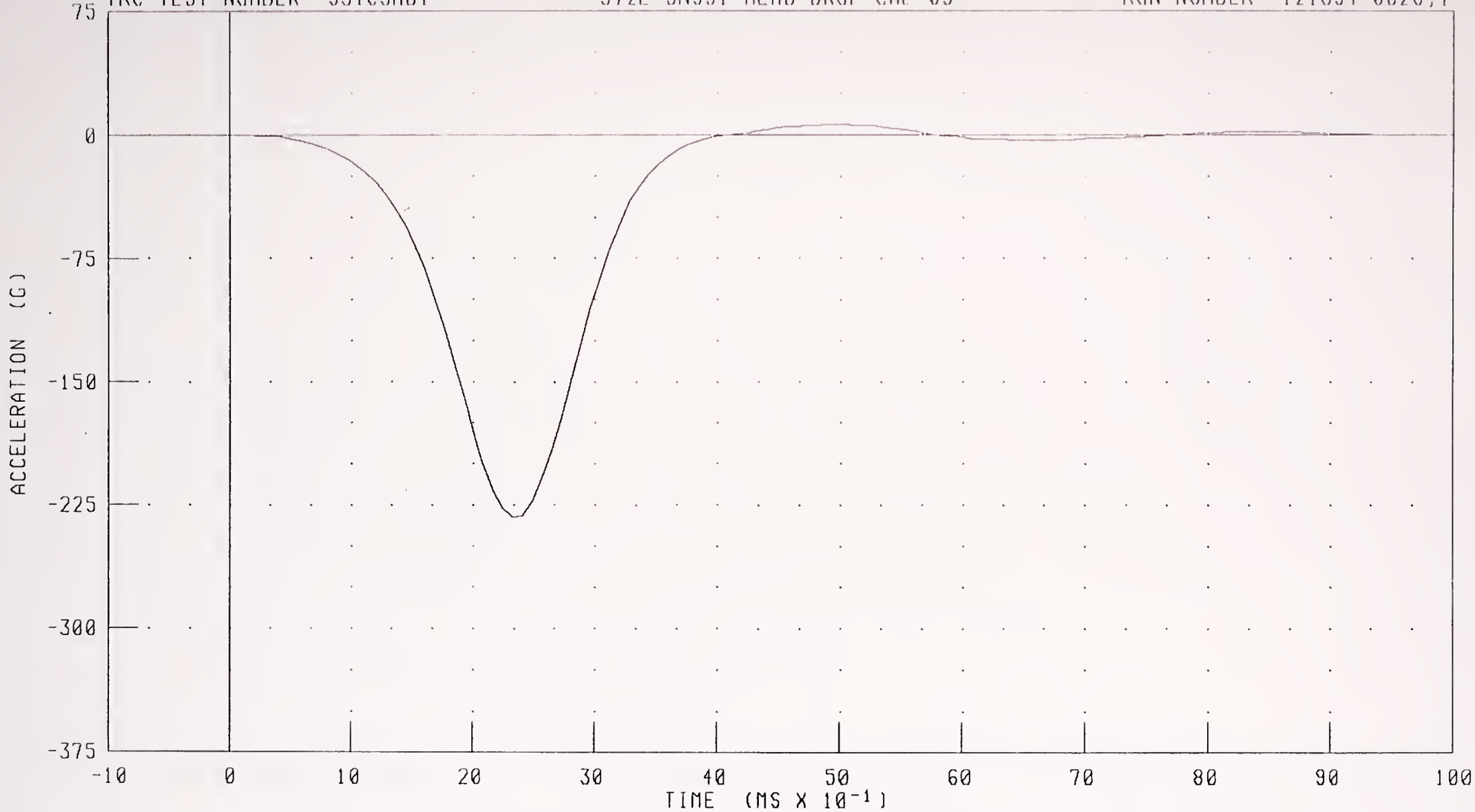
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	39.0 %
PEAK RESULTANT ACCELERATION	225 - 275 G	263.49 G
PEAK LATERAL ACCELERATION	15 G MAX	2.59 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foutz RUN NUMBER: 121694.0827;1

PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION X AXIS

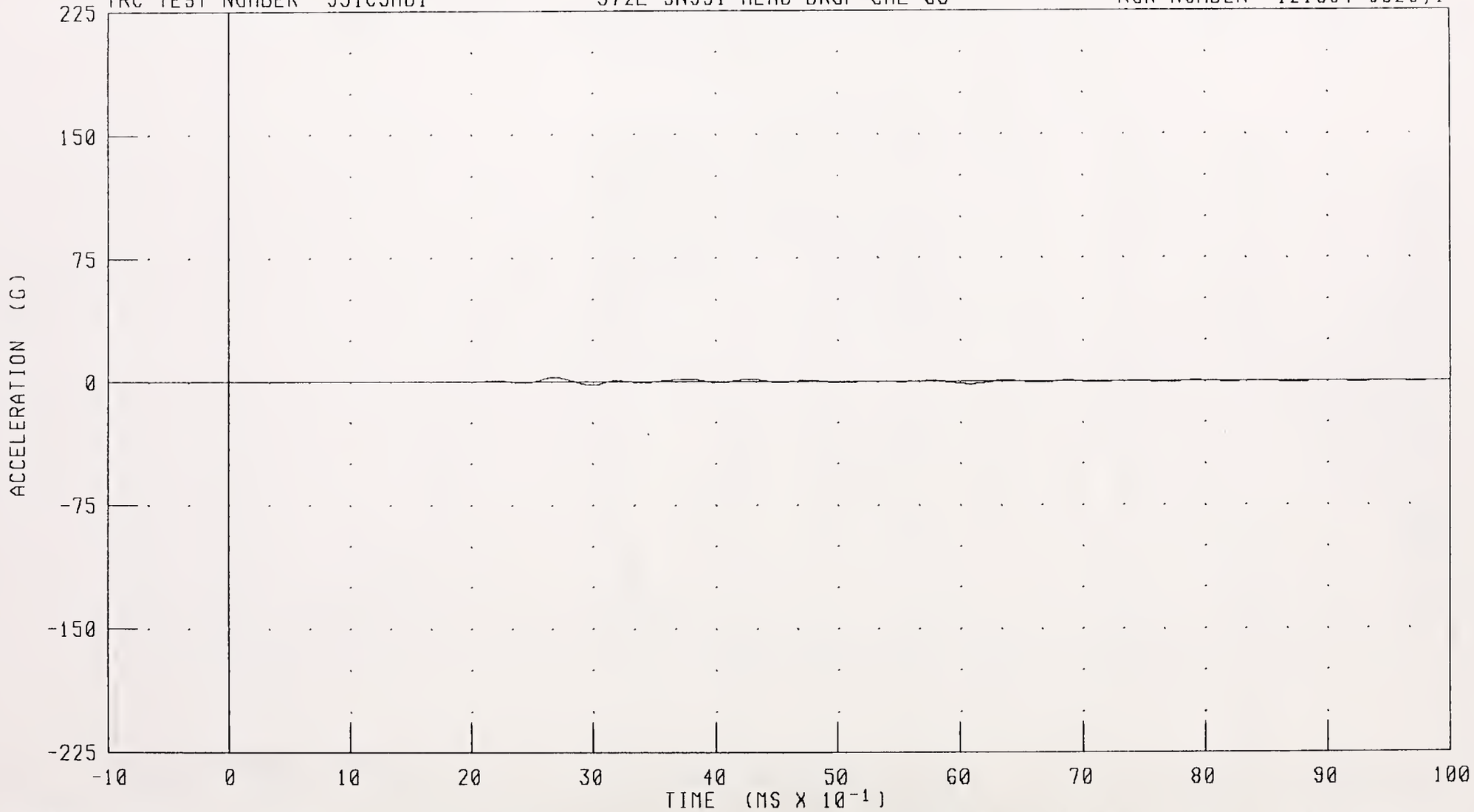
TRC TEST NUMBER 551C9HD1 572E SN551 HEAD DROP CAL 09 RUN NUMBER 121694 0828,1



CHANNEL: HEDXG FILTER CH CLASS 1000 PEAK DATA: 6 28 G @ 4 96 MS, -232 33 G @ 2 32 MS

PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION Y AXIS

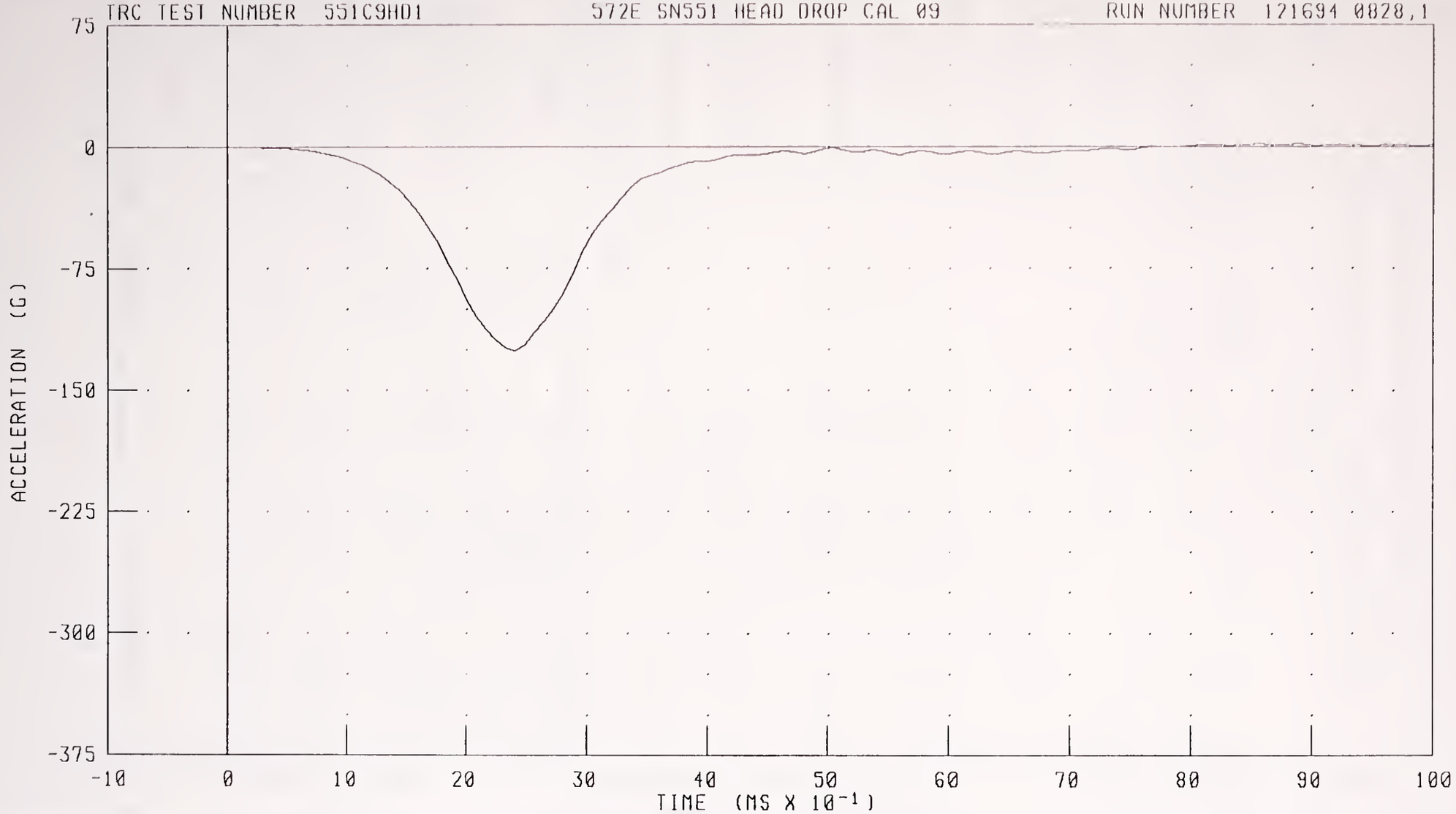
TRC TEST NUMBER 551C9HD1 572E SN551 HEAD DROP CAL 09 RUN NUMBER 121694 0828,1



CHANNEL HEDYG FILTER: CH CLASS 1000 PEAK DATA 2.59 G @ 2.72 MS; -1.94 G @ 2.96 MS

PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION Z AXIS

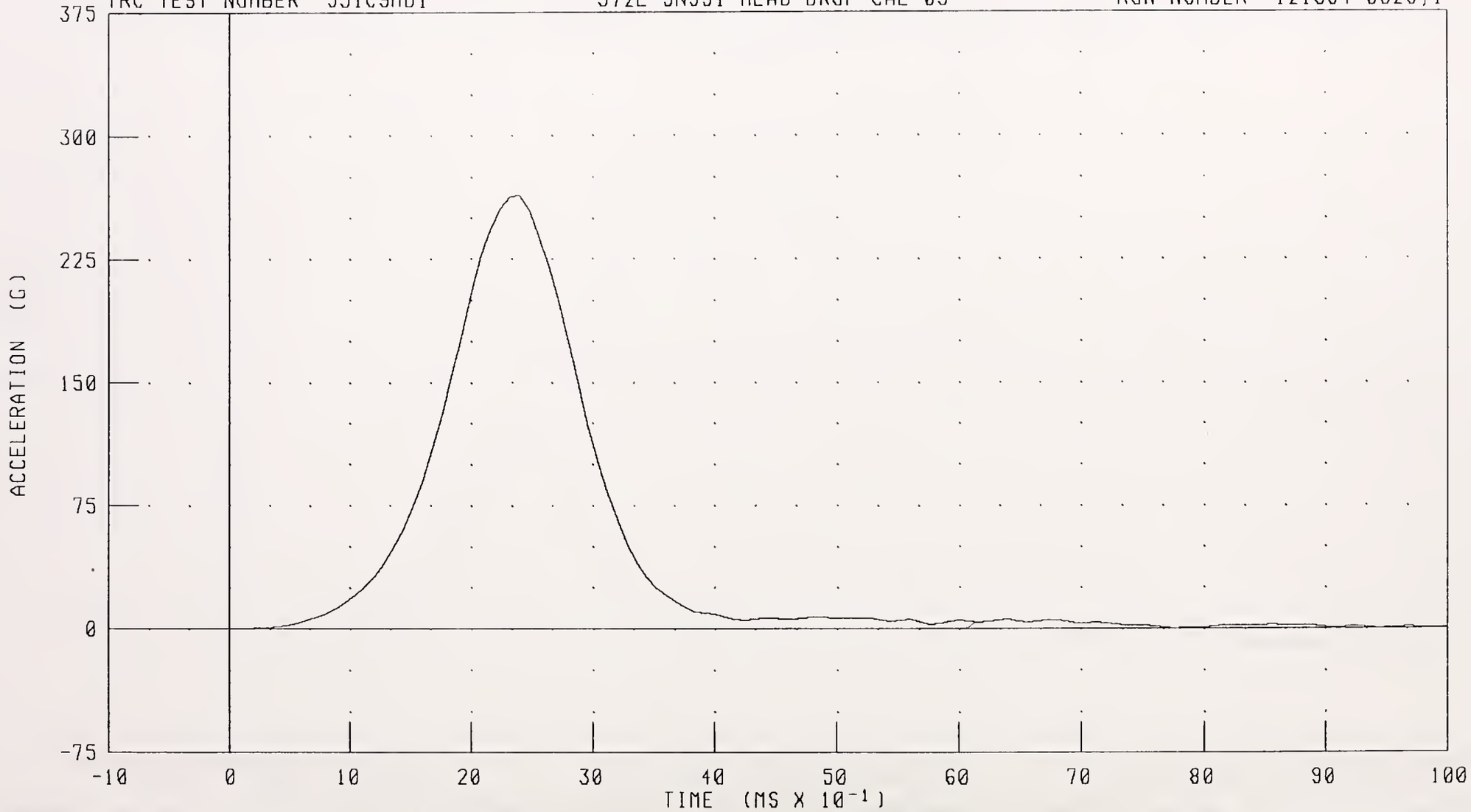
TRC TEST NUMBER 551C9HD1 572E SN551 HEAD DROP CAL 09 RUN NUMBER 121694 0828,1



CHANNEL HEDZG FILTER CH. CLASS 1000 PEAK DATA 1 53 G @ 8 88 MS, -125 60 G @ 2 40 MS

PART 572-E HYBRID III HEAD CALIBRATION
HEAD RESULTANT ACCELERATION

TRC TEST NUMBER 551C9HD1 572E SN551 HEAD DROP CAL 09 RUN NUMBER 121694 0828,1



CHANNEL: HEDRG FILTER CH CLASS 1000 PEAK DATA: 263.50 G @ 2.40 MS; 0.01 G @ -0.64 MS

TRANSPORTATION RESEARCH CENTER INC.

NECK FLEXION TEST - 6 CHANNEL TRANSDUCER

HYBRID III 16-DEC-94

TRC INC. TEST NO: 551C9NF1 572E SN551 NECK FLEXION CAL09

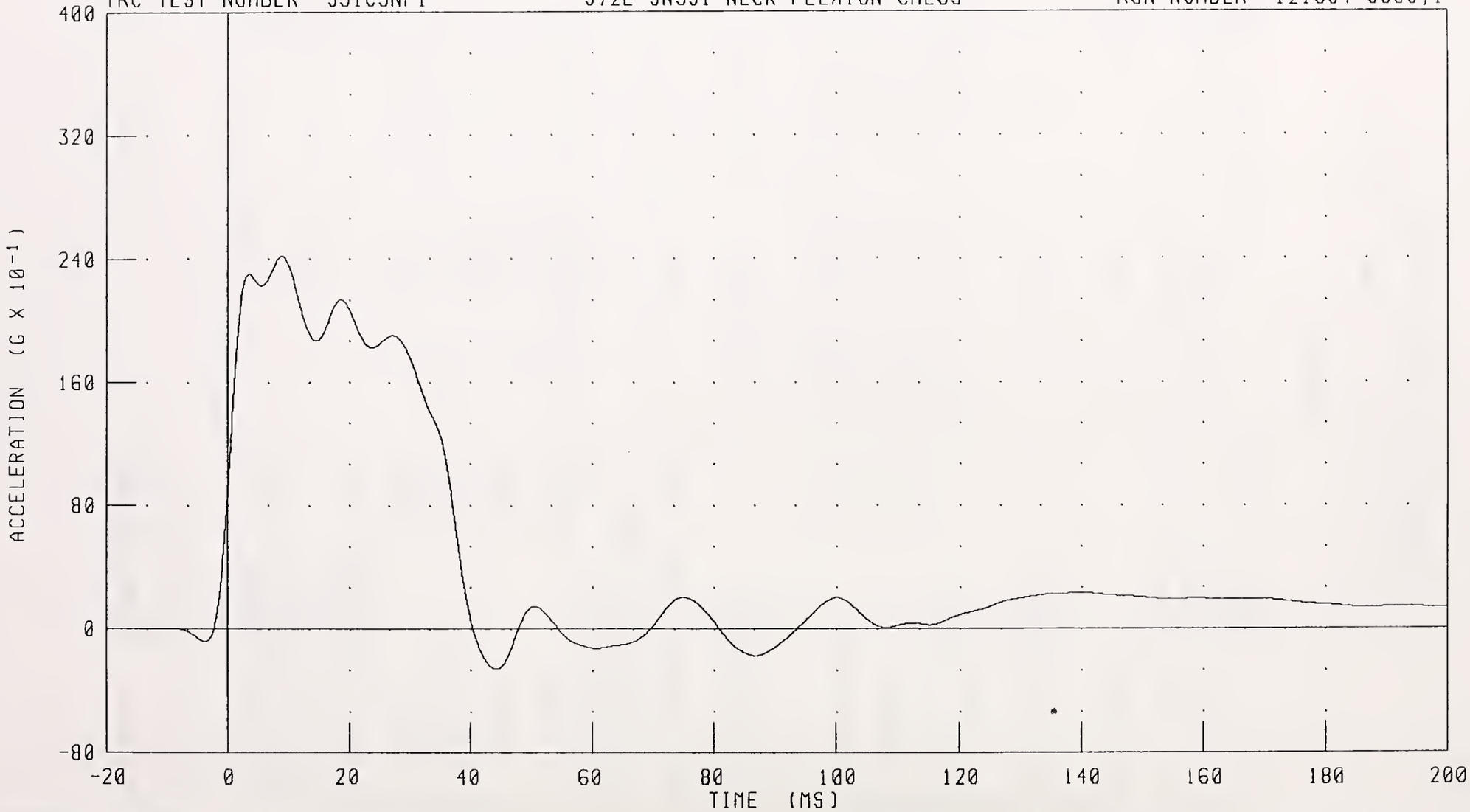
TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.6-22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY		10 - 70 %	39.0 %
IMPACT VELOCITY		6.89 - 7.13 M/S	7.06 M/S
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.60 G
	20 MS	17.60 - 22.60 G	20.72 G
	30 MS	12.50 - 18.50 G	17.70 G
MAX PENDULUM G		29 G MAX	24.19 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	17.62 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	38.08 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	71.72 DEG.
	TIME	57 - 64 MS	60.48 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	88.2 - 108.5 NM	94.69 NM
	TIME	47 - 58 MS	51.76 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	116.32 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	100.16 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Peter Foster RUN NUMBER: 121694.0858;1

PART 572-E HYBRID III NECK FLEXION CALIBRATION
PENDULUM DECELERATION

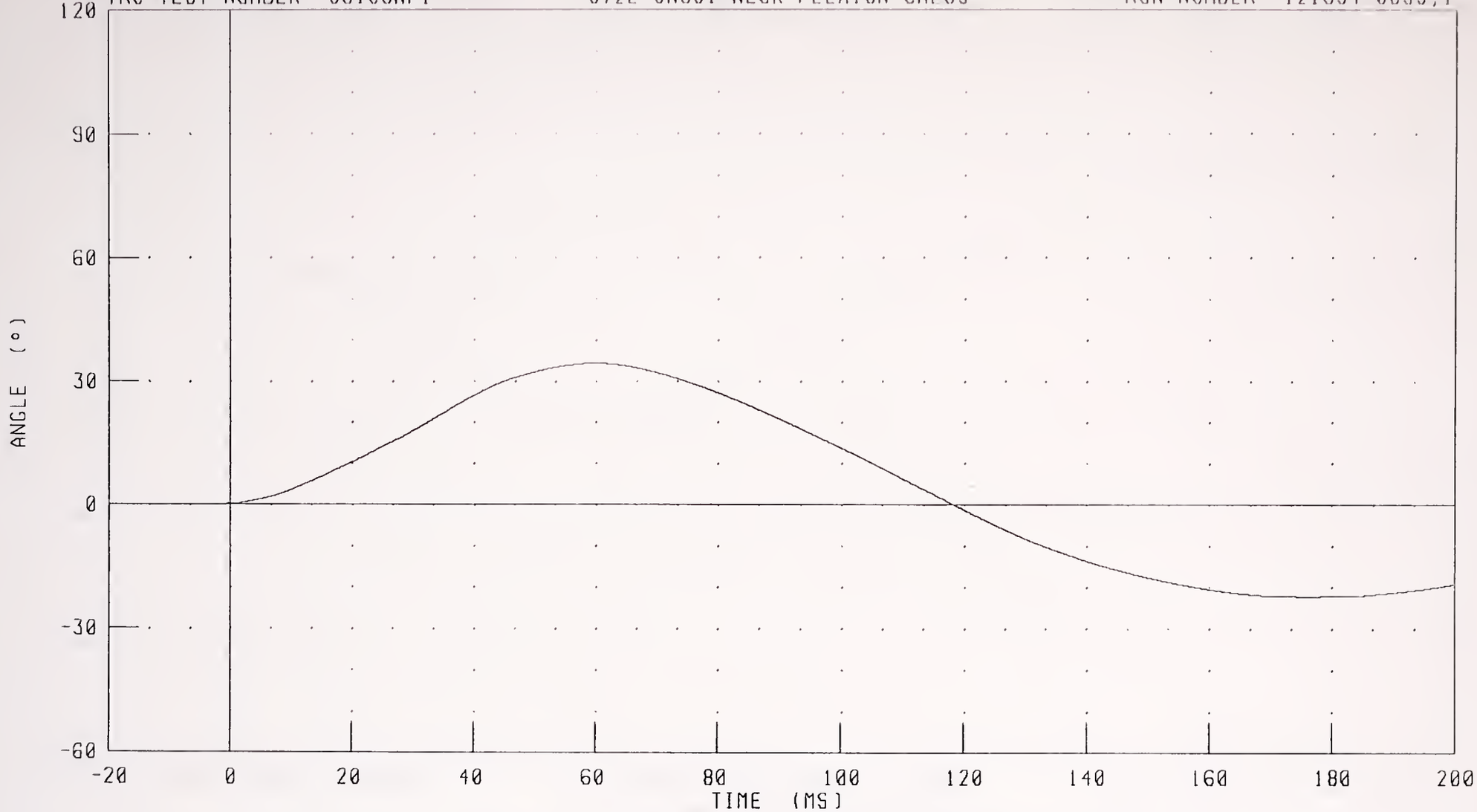
TRC TEST NUMBER 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859,1



CHANNEL: PENXG FILTER CH CLASS 60 PEAK DATA: 24.19 G @ 8.88 MS; -2.58 G @ 44.32 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
ROTATION ABOUT BASE OF NECK

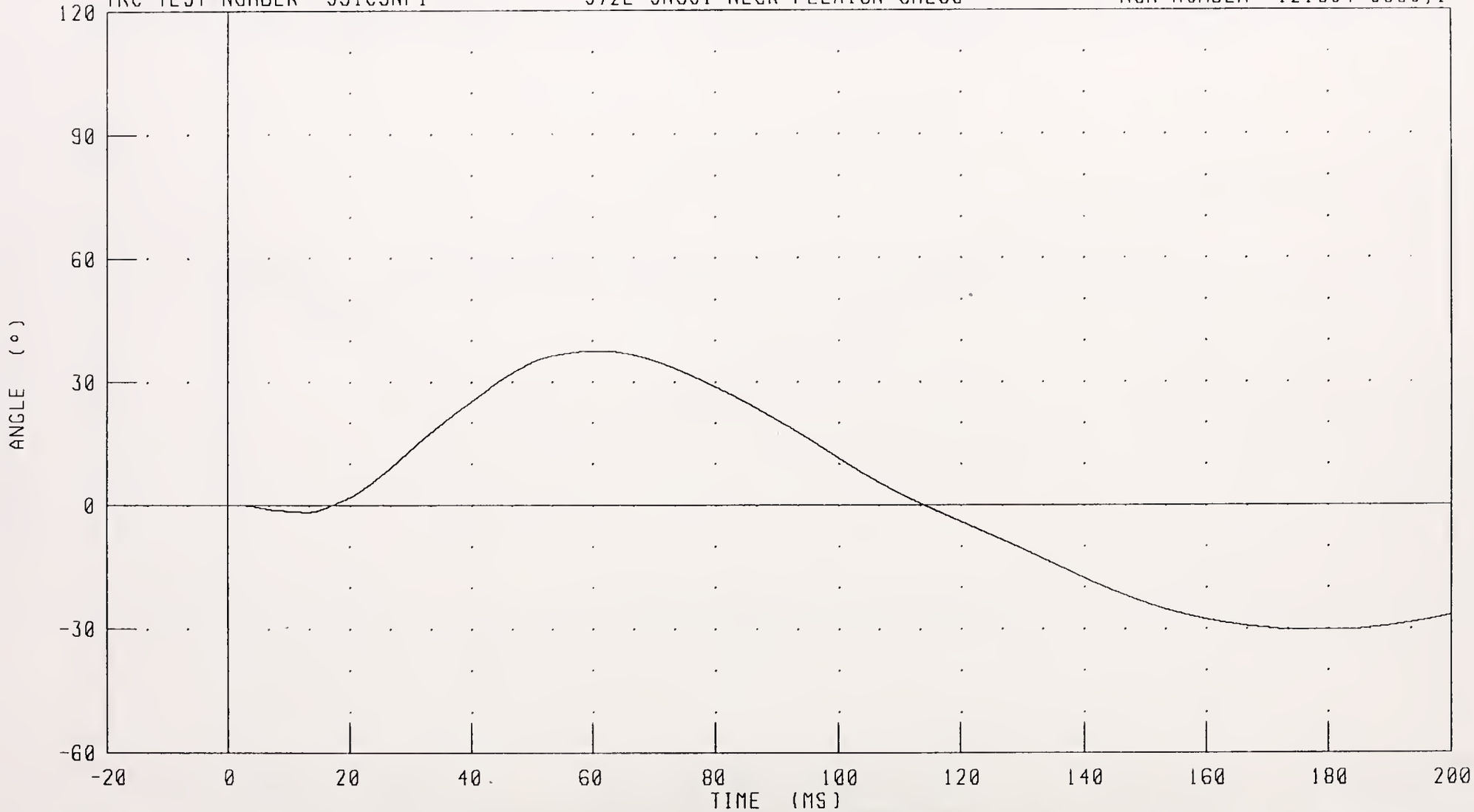
TRC TEST NUMBER 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859.1



CHANNEL: BETA FILTER CH CLASS 60 PEAK DATA 34 28 ° @ 59 92 MS, -22 23 ° @ 176 16 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859,1

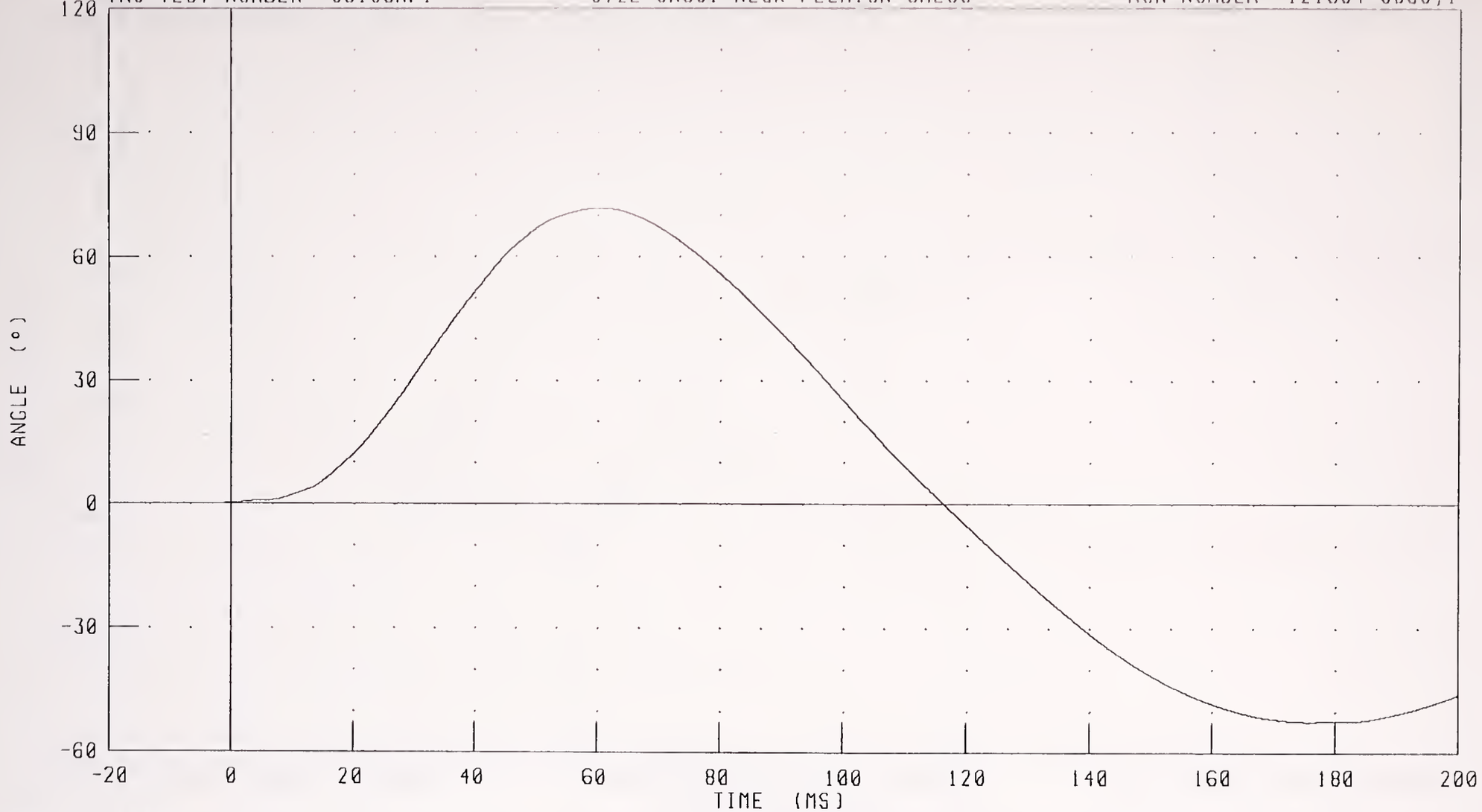


CHANNEL: THETA FILTER: CH. CLASS 60 PEAK DATA: 37.46 ° @ 61.20 MS; -30.21 ° @ 182.24 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION

TOTAL ROTATION

TRC TEST NUMBER 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859,1



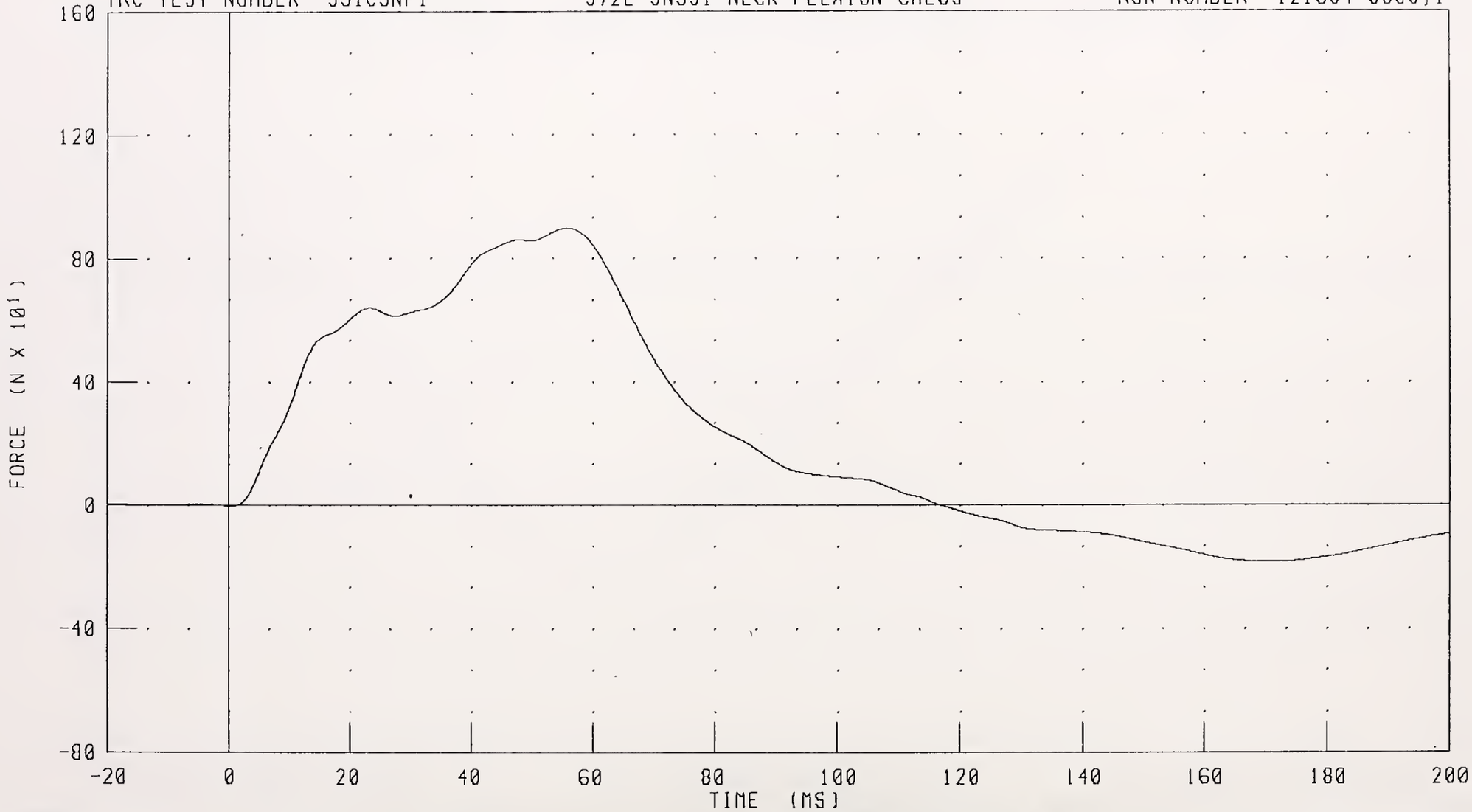
CHANNEL TOTAN FILTER CH CLASS 60

PEAK DATA: 71.73 ° @ 60 48 MS; -52 43 ° @ 175 92 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION

NECK FORCE X AXIS

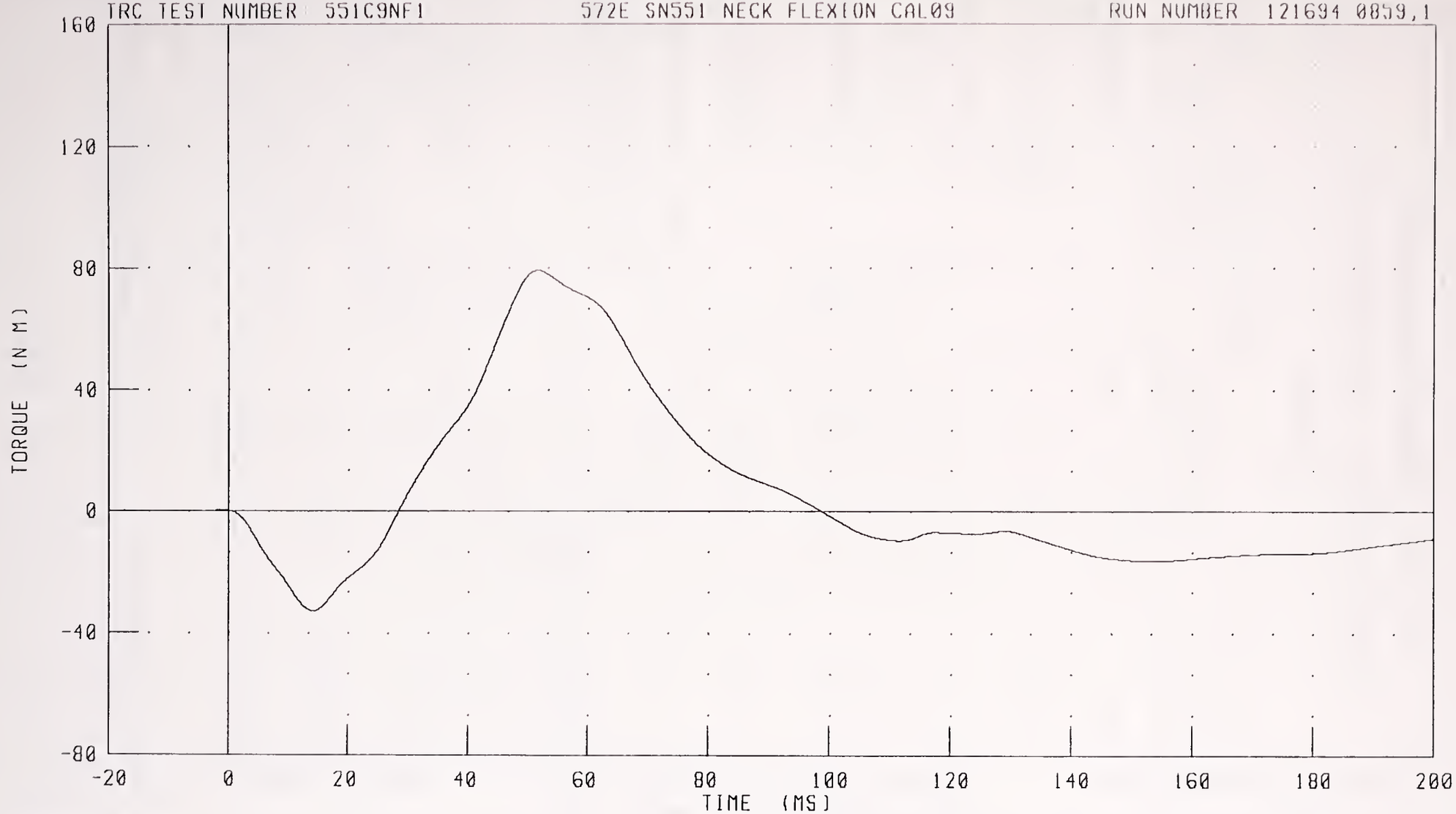
TRC TEST NUMBER 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859,1



CHANNEL: NEKXF FILTER: CH CLASS 60 PEAK DATA: 898 45 N @ 55 76 MS, -183.63 N @ 171 44 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
NECK MOMENT Y AXIS

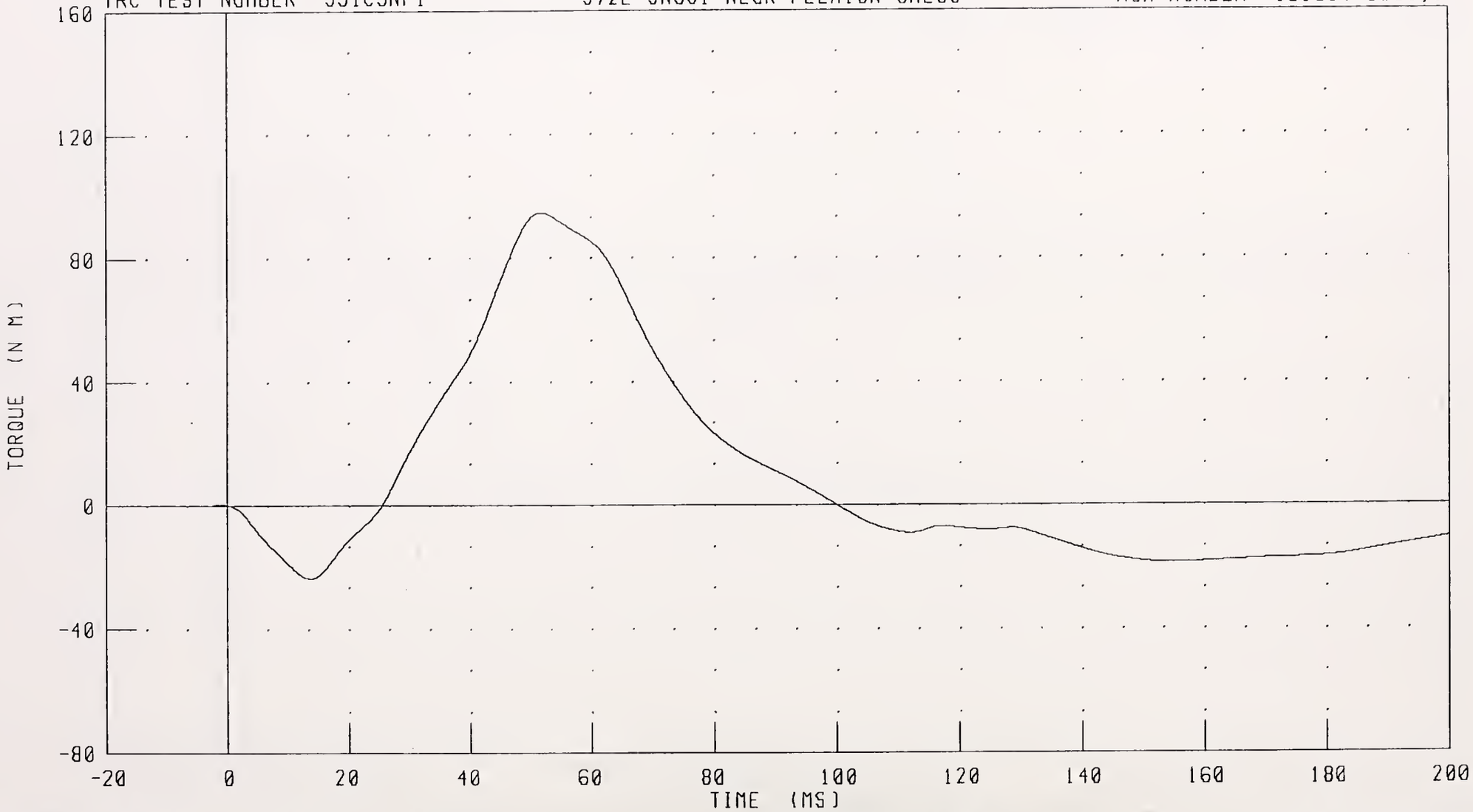
TRC TEST NUMBER: 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859,1



CHANNEL NEKYM FILTER: CH CLASS 60 PEAK DATA: 79 28 N M @ 51.60 MS; -32 78 N M @ 14 16 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER 551C9NF1 572E SN551 NECK FLEXION CAL09 RUN NUMBER 121694 0859,1



CHANNEL NEKOM FILTER CH CLASS 60 PEAK DATA 94 69 N M @ 51 76 MS; -23 57 N M @ 13 76 MS

TRANSPORTATION RESEARCH CENTER INC.

NECK EXTENSION TEST - 6 CHANNEL TRANSDUCER

HYBRID III 16-DEC-94

TRC INC. TEST NO: 551C9NE1 572E SN551 NECK EXT. CAL09

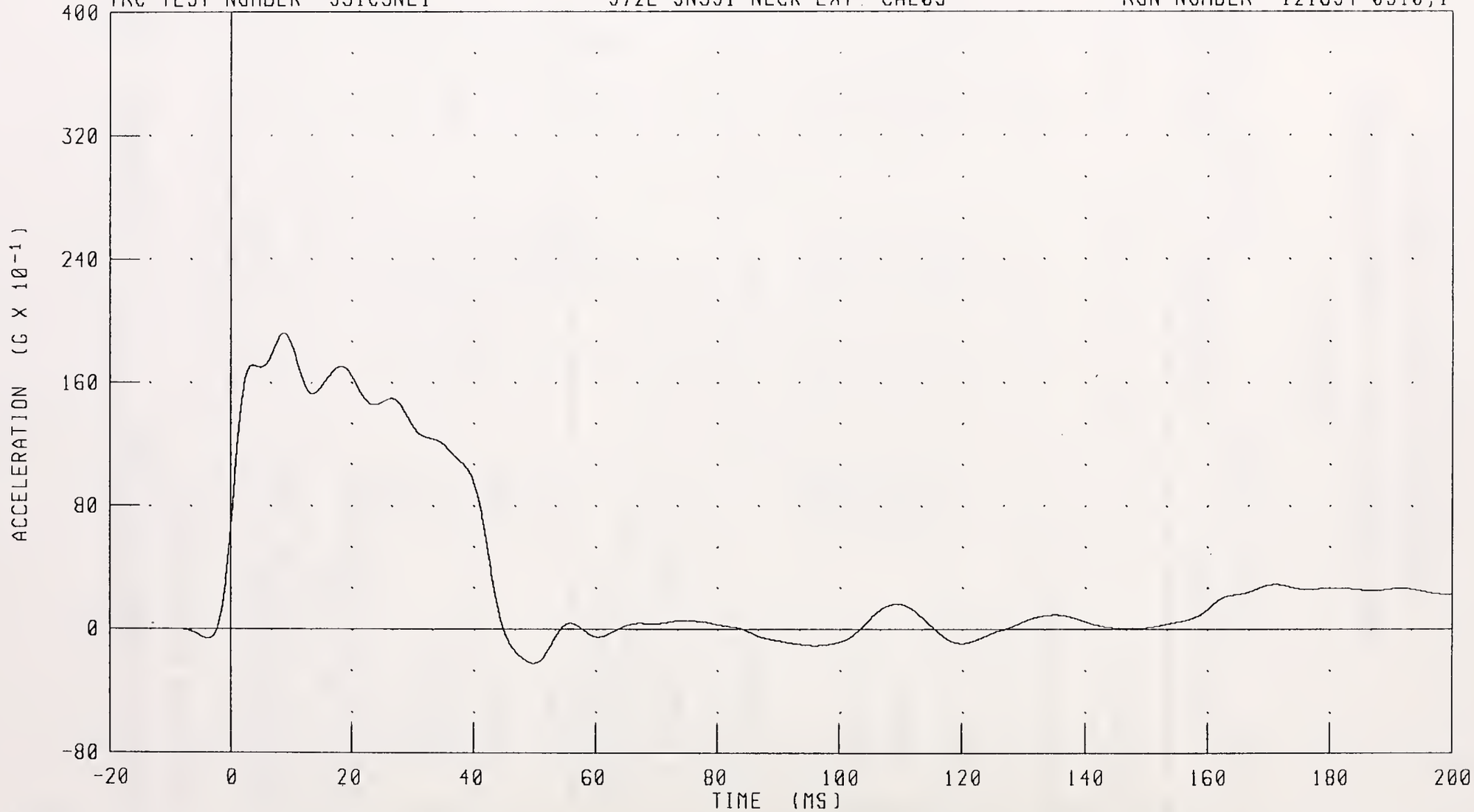
TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.6 - 22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY		10 - 70 %	39.0 %
IMPACT VELOCITY		5.95 - 6.19 M/S	6.02 M/S
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	18.56 G
	20 MS	14.00 - 19.00 G	16.45 G
	30 MS	11.00 - 16.00 G	13.24 G
MAX PENDULUM G		22 G MAX	19.18 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	13.19 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	42.32 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	99.56 DEG.
	TIME	72 - 82 MS	77.28 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MIN	-80.0/-52.9 NM	-68.99 NM
	TIME	65 - 79 MS	72.32 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	158.56 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	142.96 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Fo[illegible] RUN NUMBER: 121694.0909:1

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
PENDULUM DECELERATION

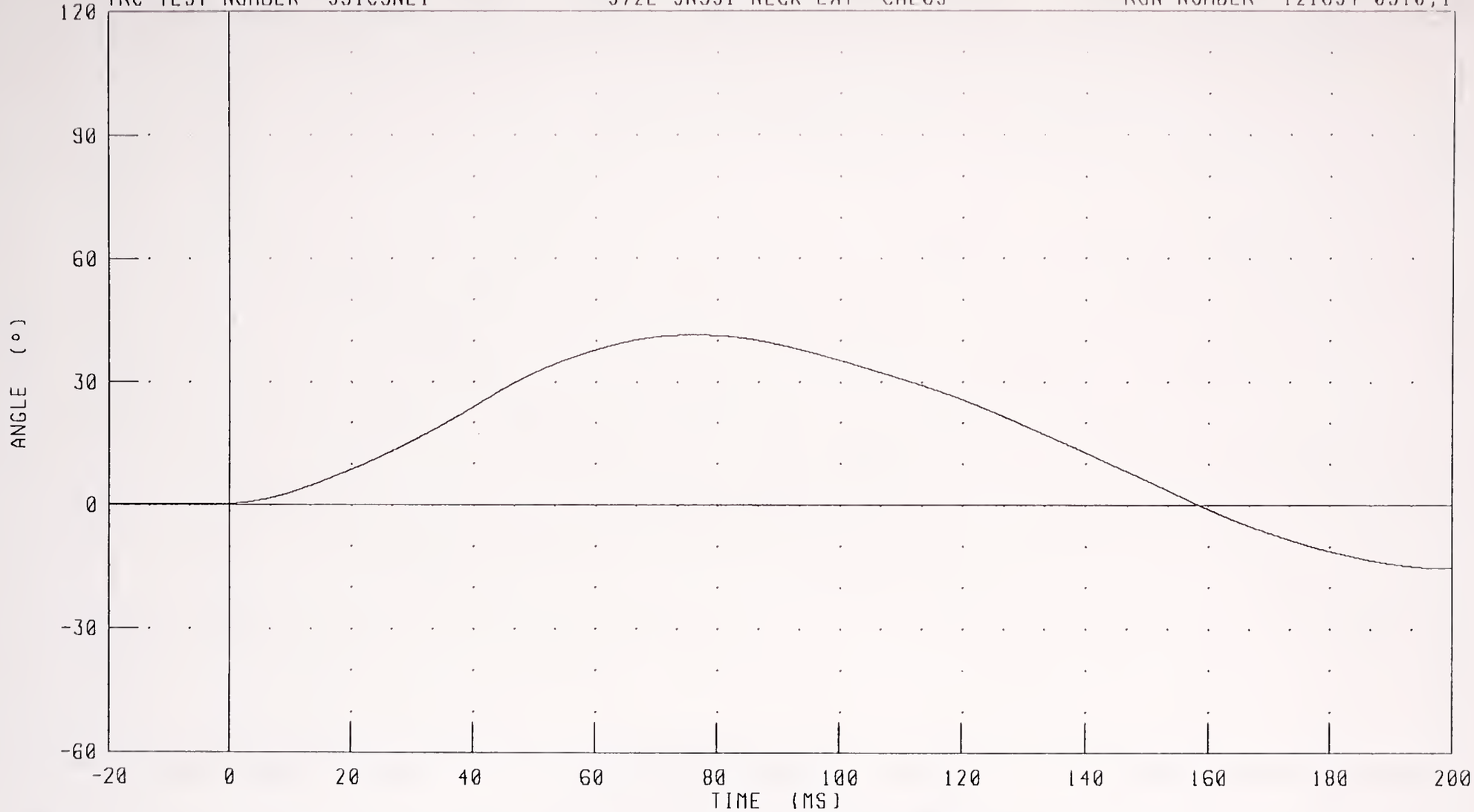
TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT. CAL09 RUN NUMBER 121694 0910,1



CHANNEL: PENXG FILTER: CH. CLASS 60 PEAK DATA: 19.19 G @ 8.80 MS; -2.19 G @ 49.76 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
ROTATION ABOUT BASE OF NECK

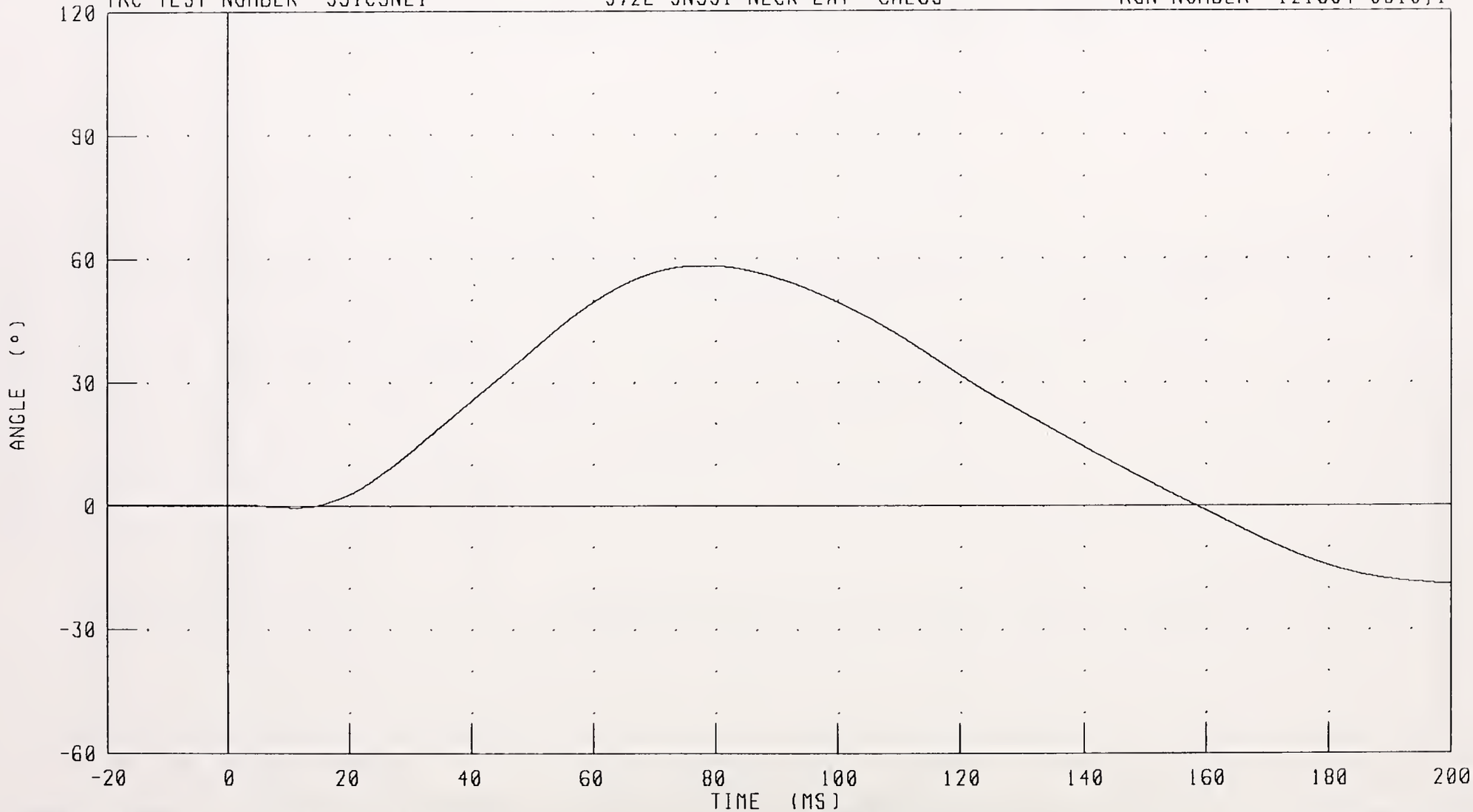
TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT CAL09 RUN NUMBER 121694 0910,1



CHANNEL BETA FILTER CH CLASS 60 PEAK DATA: 41.35 ° @ 75.68 MS; -15.28 ° @ 200.00 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT CAL09 RUN NUMBER 121694 0910,1

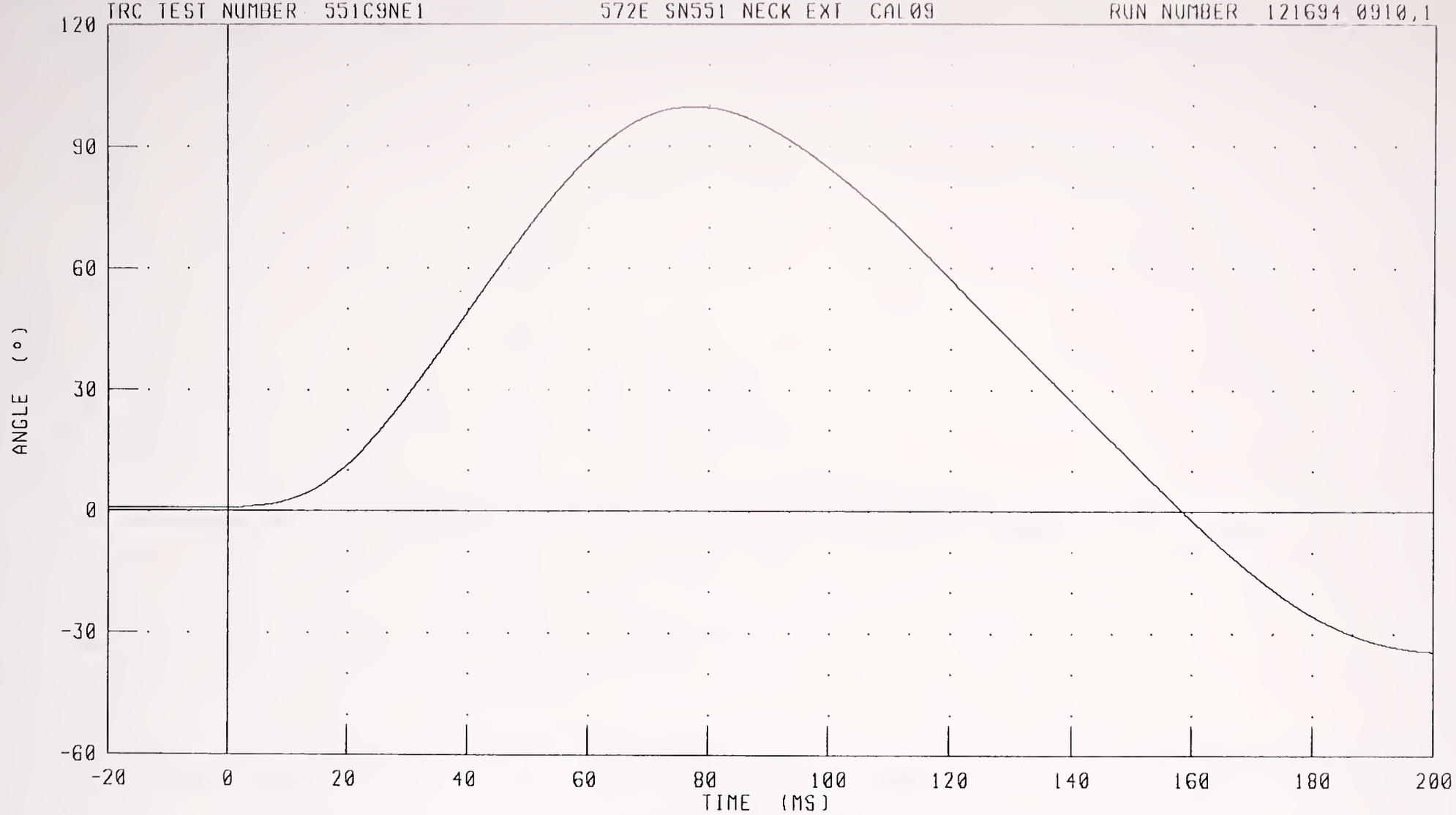


CHANNEL: THETA FILTER: CH. CLASS 60 PEAK DATA: 58.22 ° @ 77.92 MS; -19.12 ° @ 200.00 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION

TOTAL ROTATION

TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT CAL09 RUN NUMBER 121694 0910,1

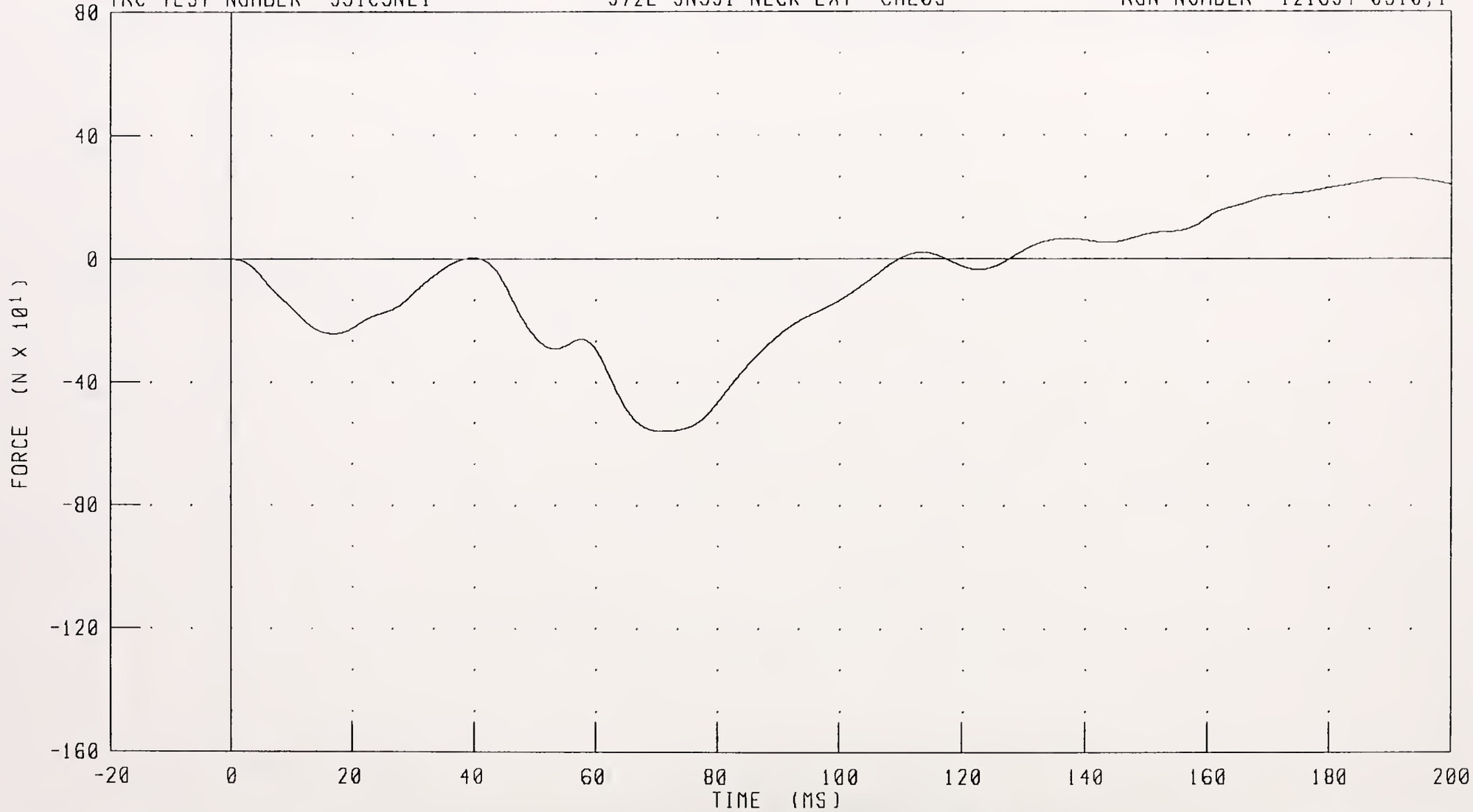


CHANNEL: TOTAN FILTER CH CLASS 60 PEAK DATA: 99.56 ° @ 77.28 MS, -34.41 ° @ 200.00 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION

NECK FORCE X AXIS

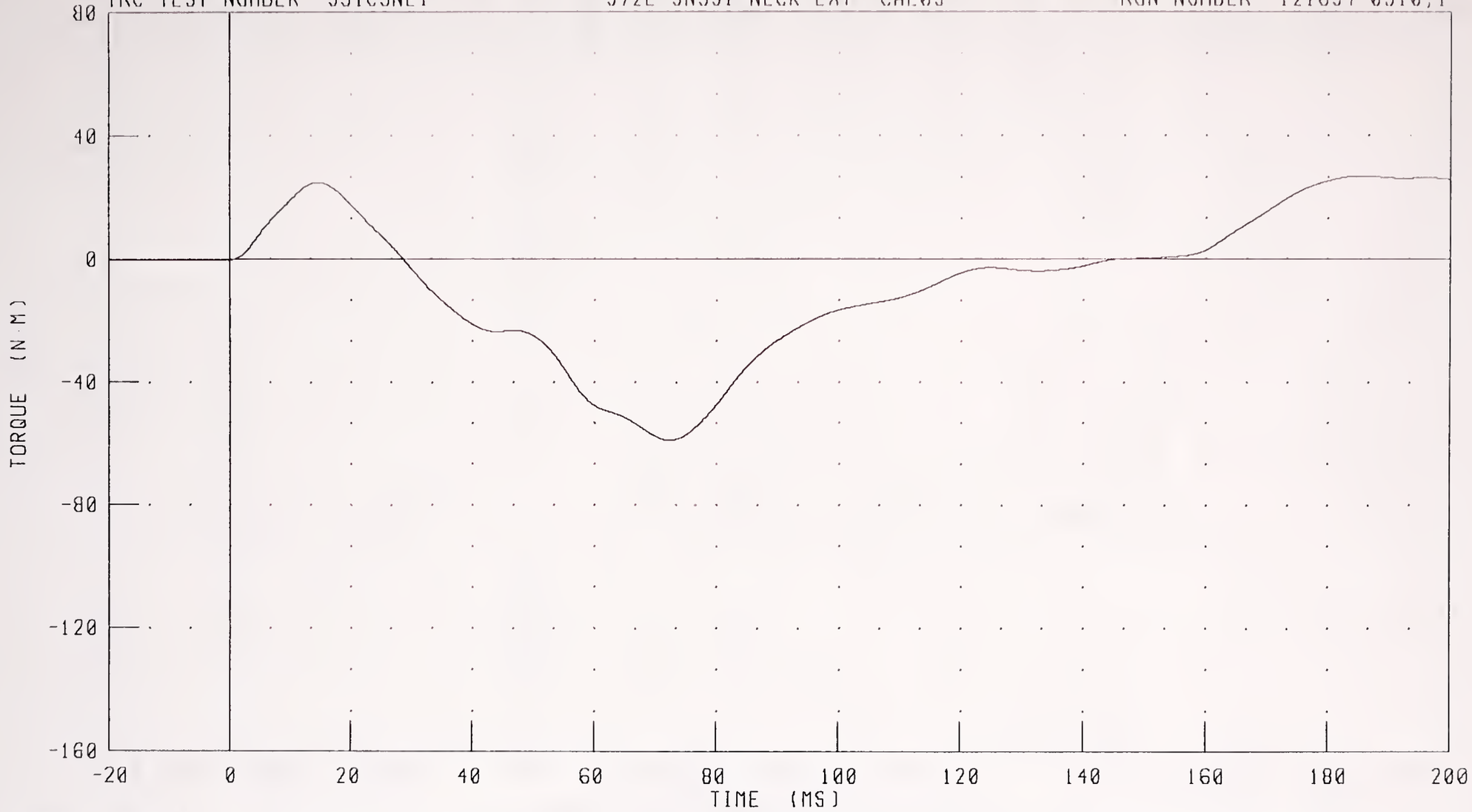
TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT CAL09 RUN NUMBER 121694 0910,1



CHANNEL NEKXF FILTER: CH CLASS 60 PEAK DATA: 262.25 N @ 191 28 MS, -560 51 N @ 71 04 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
NECK MOMENT Y AXIS

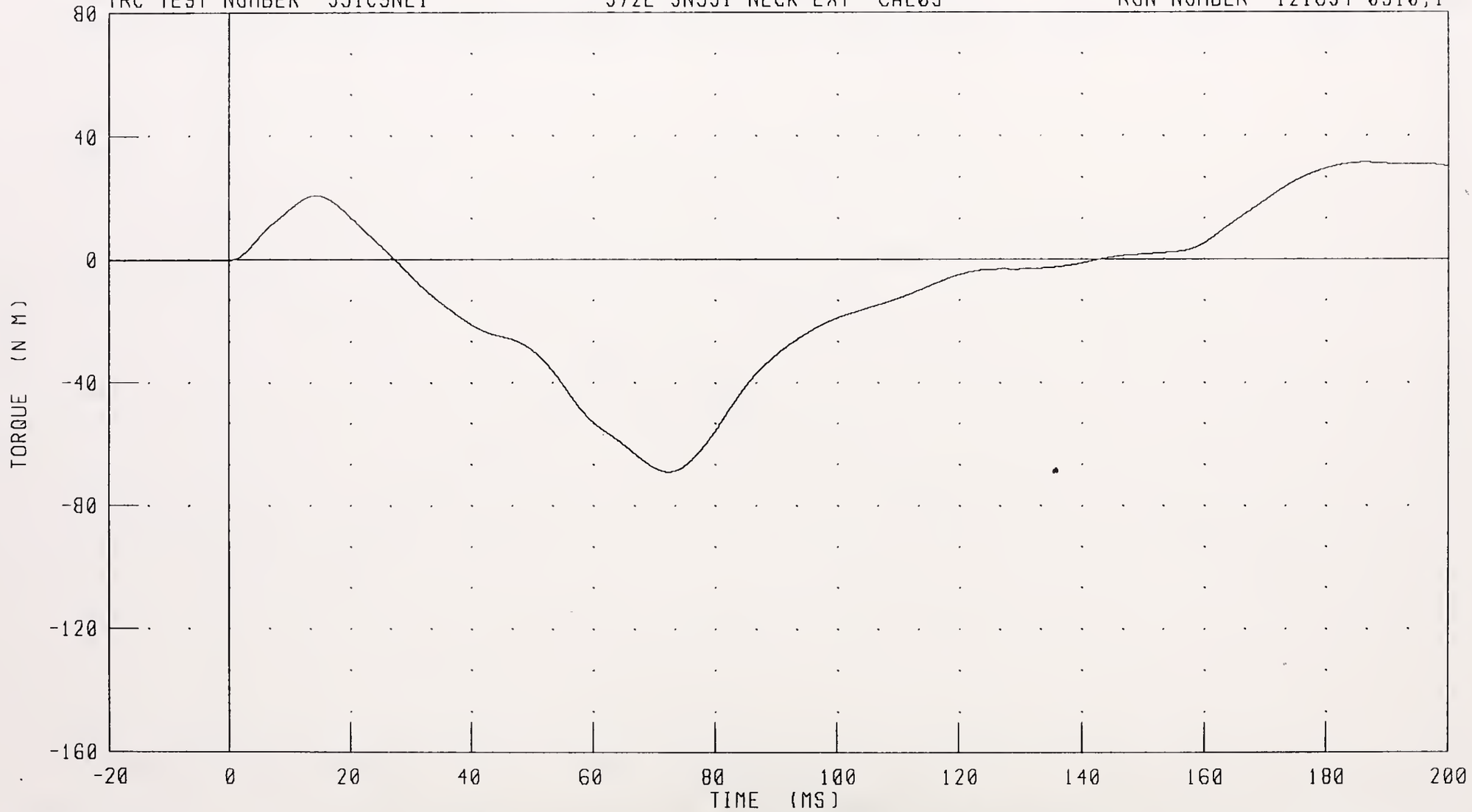
TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT CAL09 RUN NUMBER 121694 0910,1



CHANNEL NEKYM FILTER CH CLASS 60 PEAK DATA: 26 88 N M @ 185 60 MS; -59 04 N M @ 72.40 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER 551C9NE1 572E SN551 NECK EXT CAL09 RUN NUMBER 121694 0910,1



CHANNEL NEKOM FILTER CH CLASS 60 PEAK DATA: 31 34 N M @ 186.40 MS; -68 99 N·M @ 72.32 MS

TRANSPORTATION RESEARCH CENTER INC.

THORAX IMPACT TEST

HYBRID III 16-DEC-94

TRC INC. TEST NO: 551C9TH1 572E SN551 H.S.THORAX CAL09

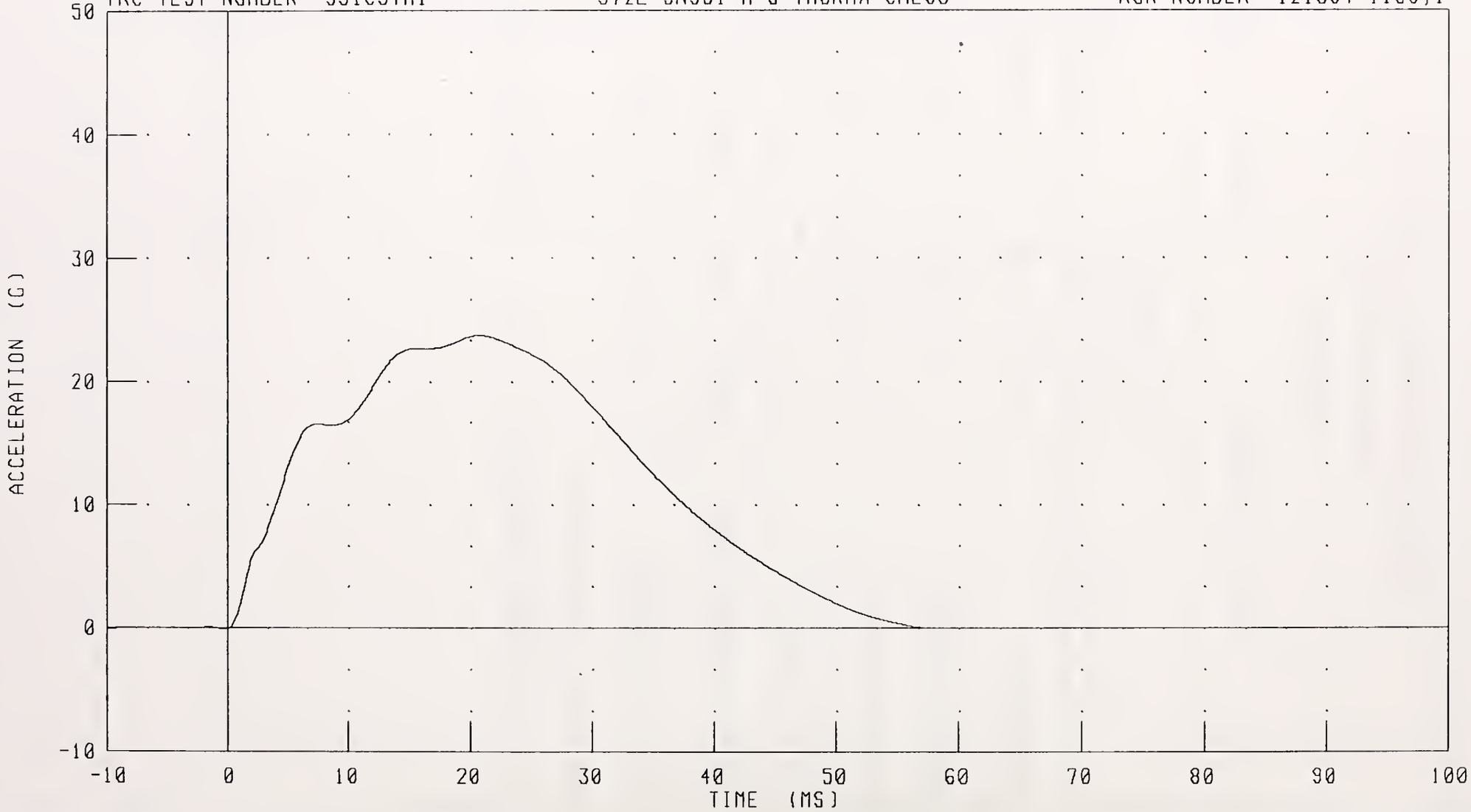
TEST PARAMETER	HIGH SPEED TEST SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6-22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	39.0 %
PENDULUM VELOCITY	6.59 - 6.83 M/S	6.68 M/S
MAXIMUM DEFLECTION	63.5 - 72.6 MM	70.6 MM
MAXIMUM RESISTIVE FORCE	5159 - 5894 N	5434. N
INTERNAL HYSTERESIS	69% - 85%	72.4%

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foss RUN NUMBER: 121694.1103;1

PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM DECELERATION

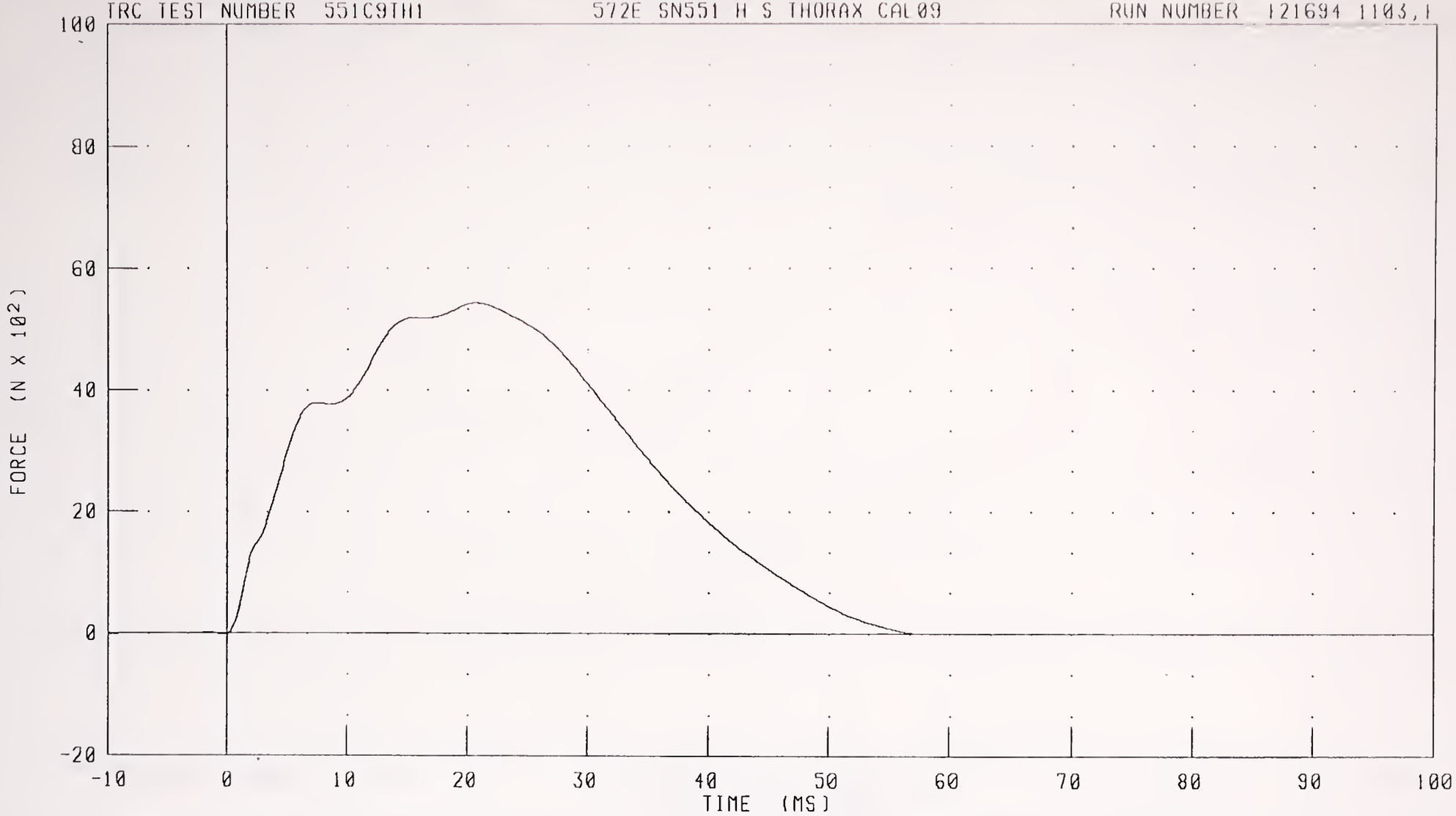
TRC TEST NUMBER 551C9TH1 572E SN551 H S THORAX CAL09 RUN NUMBER 121694 1103,1



CHANNEL: PENXG FILTER: CH CLASS 180 PEAK DATA: 23.72 G @ 20.64 MS; -0.07 G @ -0.32 MS

PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM FORCE

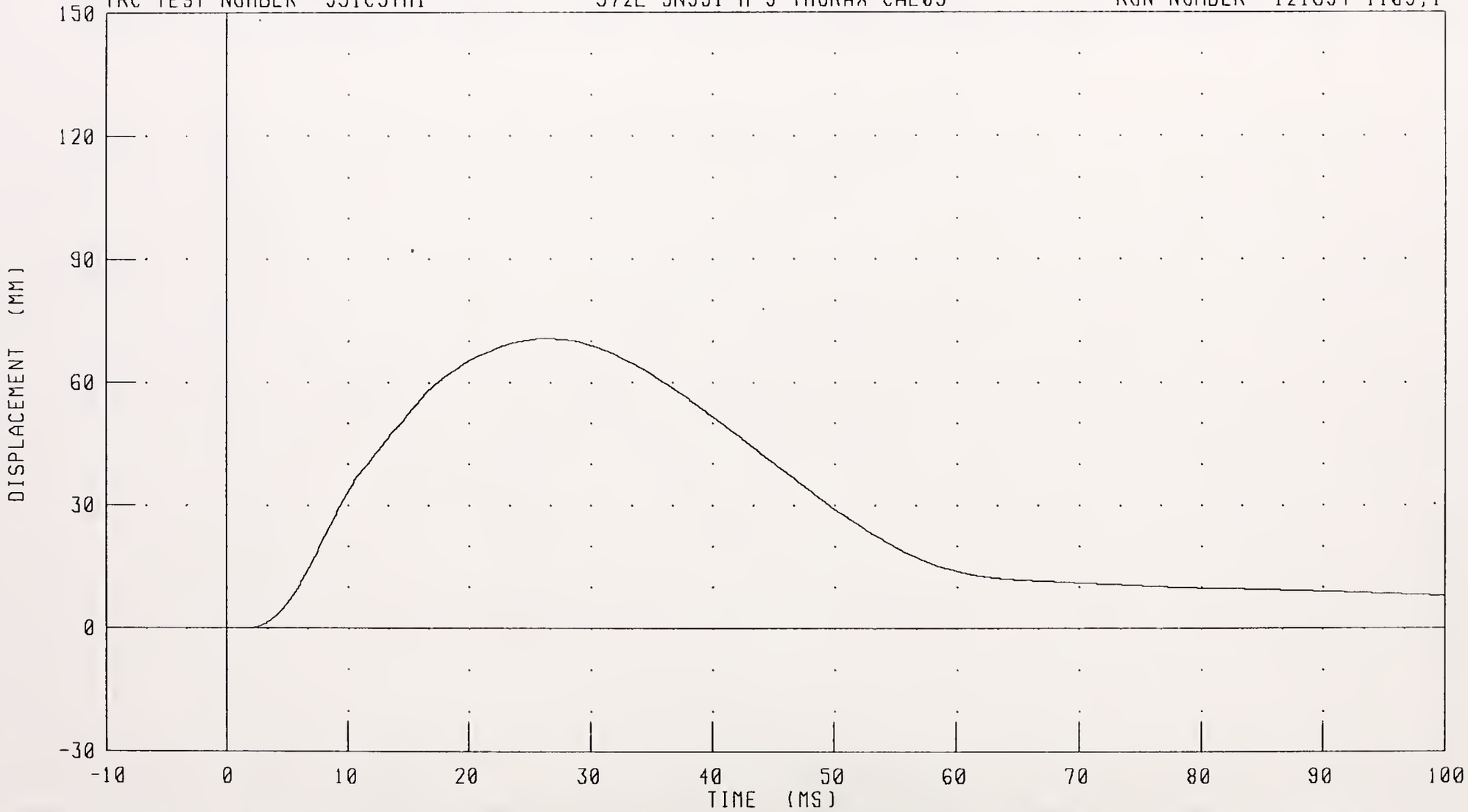
TRC TEST NUMBER 551C9TH1 572E SN551 H S THORAX CAL 09 RUN NUMBER 121694 1103,1



CHANNEL PENXF FILTER: CH CLASS 180 PEAK DATA 5434.78 N @ 20 64 MS, -16 16 N @ -0 32 MS

PART 572-E HYBRID III THORAX CALIBRATION
STERNUM DISPLACEMENT

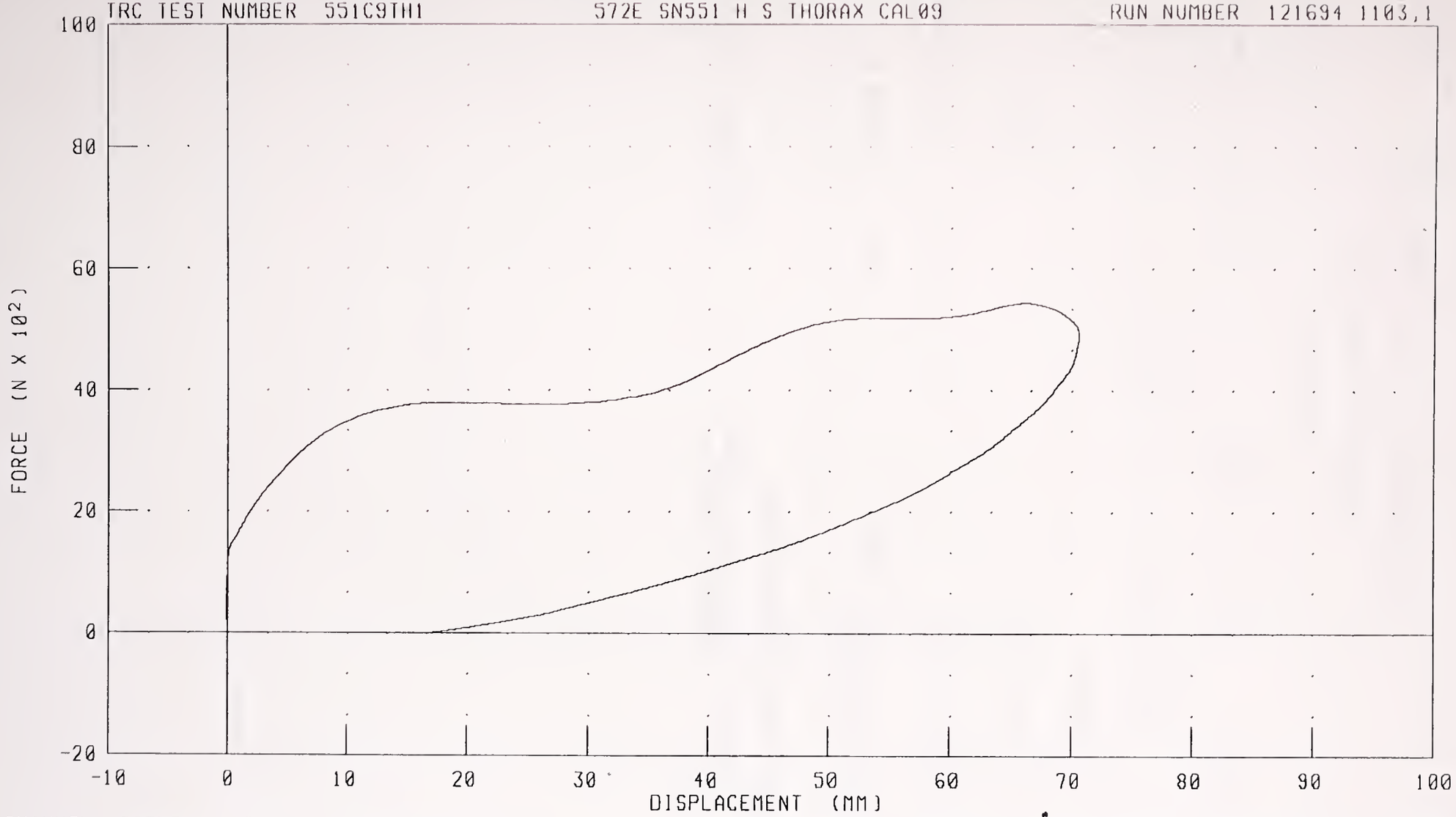
TRC TEST NUMBER 551C9TH1 572E SN551 H S THORAX CAL09 RUN NUMBER 121694 1103,1



CHANNEL: CSTXD FILTER: CH CLASS 180 PEAK DATA: 70.67 MM @ 26.24 MS; -0.03 MM @ 1.20 MS

PART 572-E HYBRID III THORAX CALIBRATION
CHEST DISPLACEMENT VS PENDULUM FORCE

TRC TEST NUMBER 551C9TH1 572E SN551 H S THORAX CAL09 RUN NUMBER 121694 1103,1



CHANNEL CSTXD FILTER CH CLASS 180 PEAK DATA 70 67 MM @ 26 24 MS, -0 03 MM @ 1 20 MS
PENXF CH CLASS 180 5434 78 N @ 20 64 MS; -16 16 N @ -0 32 MS

TRANSPORTATION RESEARCH CENTER INC.

RIGHT KNEE IMPACT TEST

HYBRID III 16-DEC-94

TRC INC. TEST NO: 551C9RK1 572E SN551 RIGHT KNEE CAL 09

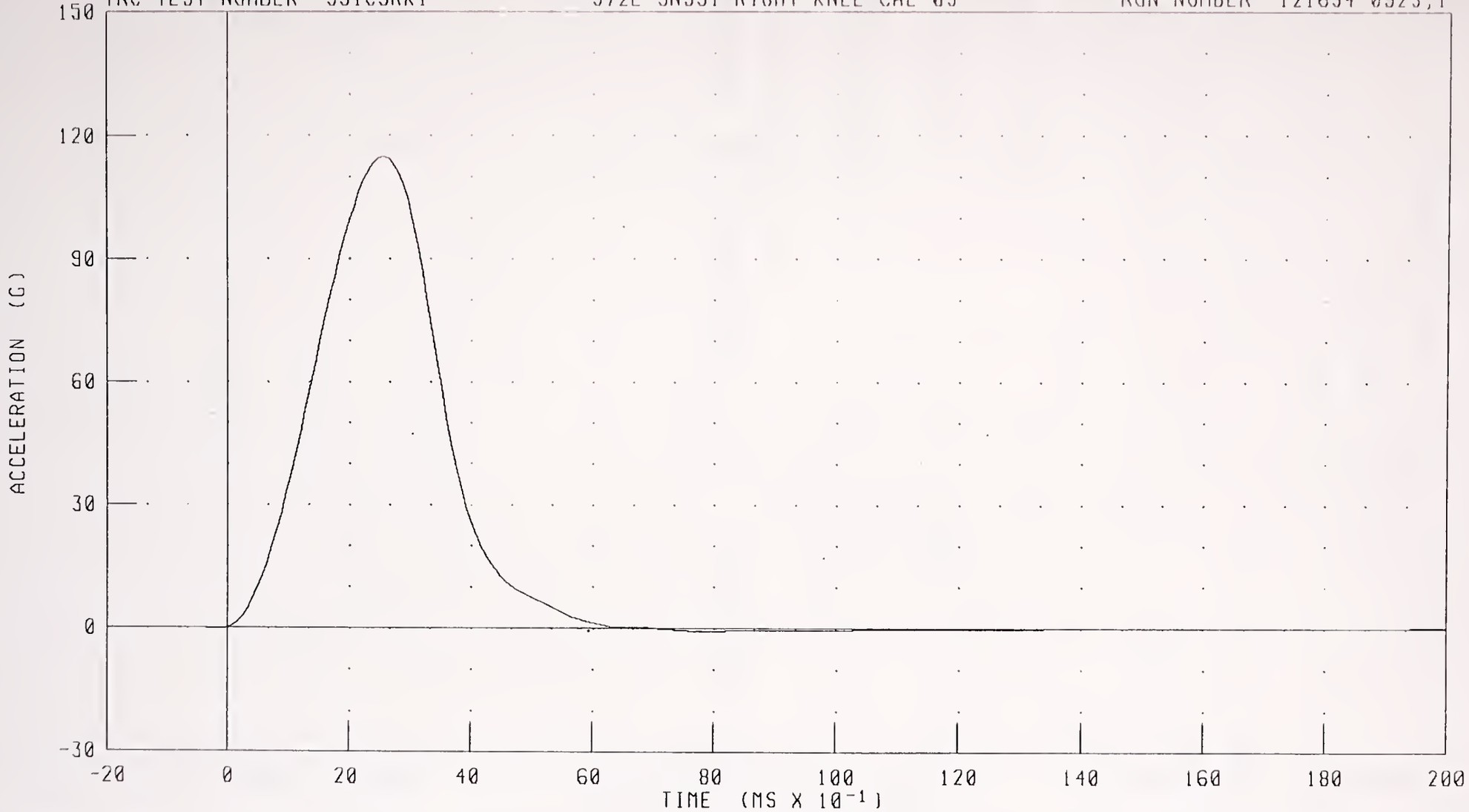
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	39.0 %
PROBE VELOCITY	2.07 - 2.13 M/S	2.12 M/S
PEAK KNEE IMPACT FORCE 5.0 KG PENDULUM	4714 - 5783 N	5624.8 N

TEST MEETS SPECIFICATIONS

TECHNICIAN Peter Foss RUN NUMBER: 121694.0922;1

PART 572-E HYBRID III RIGHT KNEE CALIBRATION
PENDULUM DECELERATION (5 KG PEND)

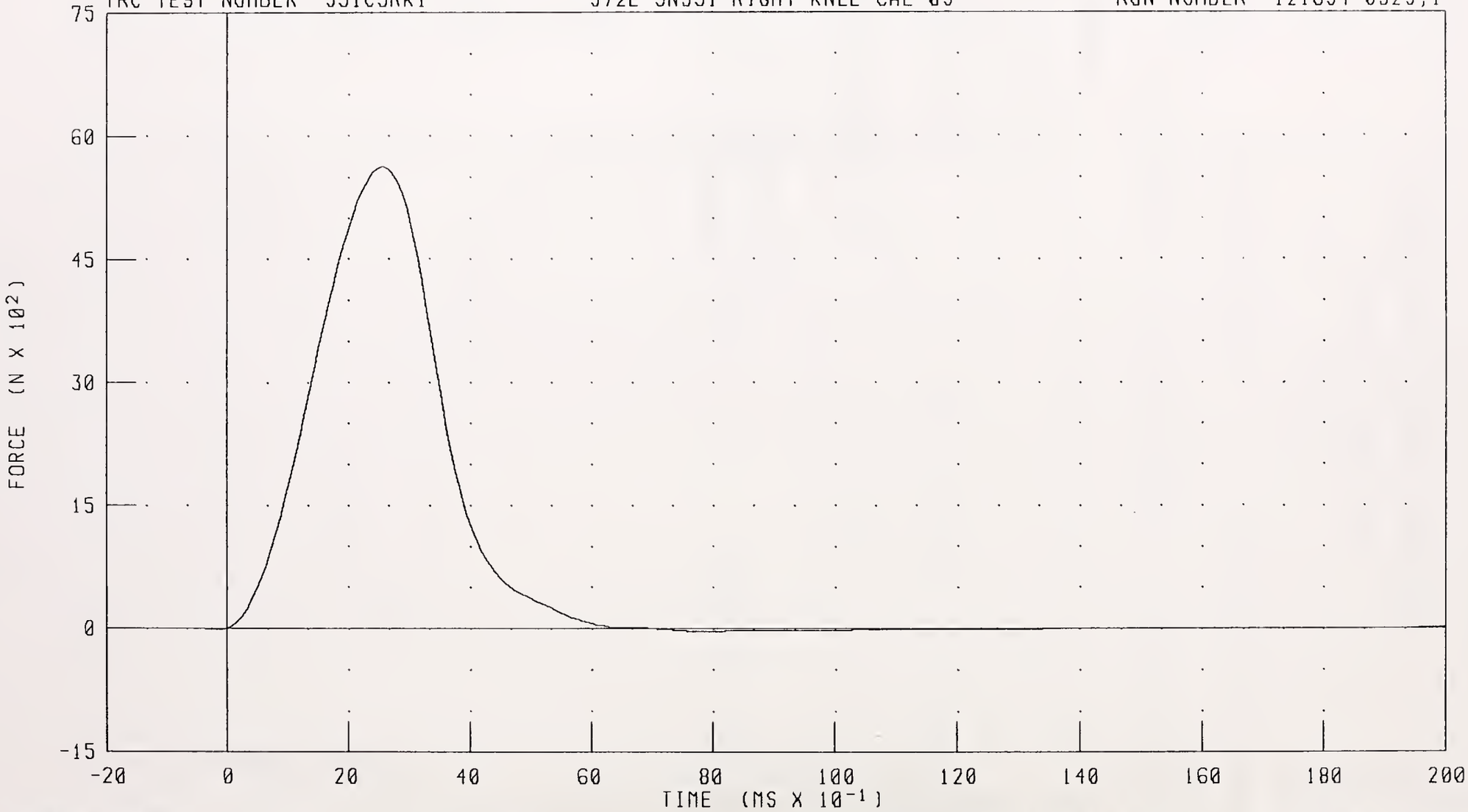
TRC TEST NUMBER 551C9RK1 572E SN551 RIGHT KNEE CAL 09 RUN NUMBER 121694 0923,1



CHANNEL PENXG FILTER CH CLASS 600 PEAK DATA 114 96 G @ 2 56 MS, -0 63 G @ 7 76 MS

PART 572-E HYBRID III RIGHT KNEE CALIBRATION
PENDULUM FORCE (5 KG PEND)

TRC TEST NUMBER 551C9RK1 572E SN551 RIGHT KNEE CAL 09 RUN NUMBER 121694 0923,1



CHANNEL: PENXF FILTER CH. CLASS 600 PEAK DATA: 5624.86 N @ 2.56 MS; -30.89 N @ 7.76 MS

TRANSPORTATION RESEARCH CENTER INC.

LEFT KNEE IMPACT TEST

HYBRID III 16-DEC-94

TRC INC. TEST NO: 551C9LK1 572E SN551 LEFT KNEE CAL 09

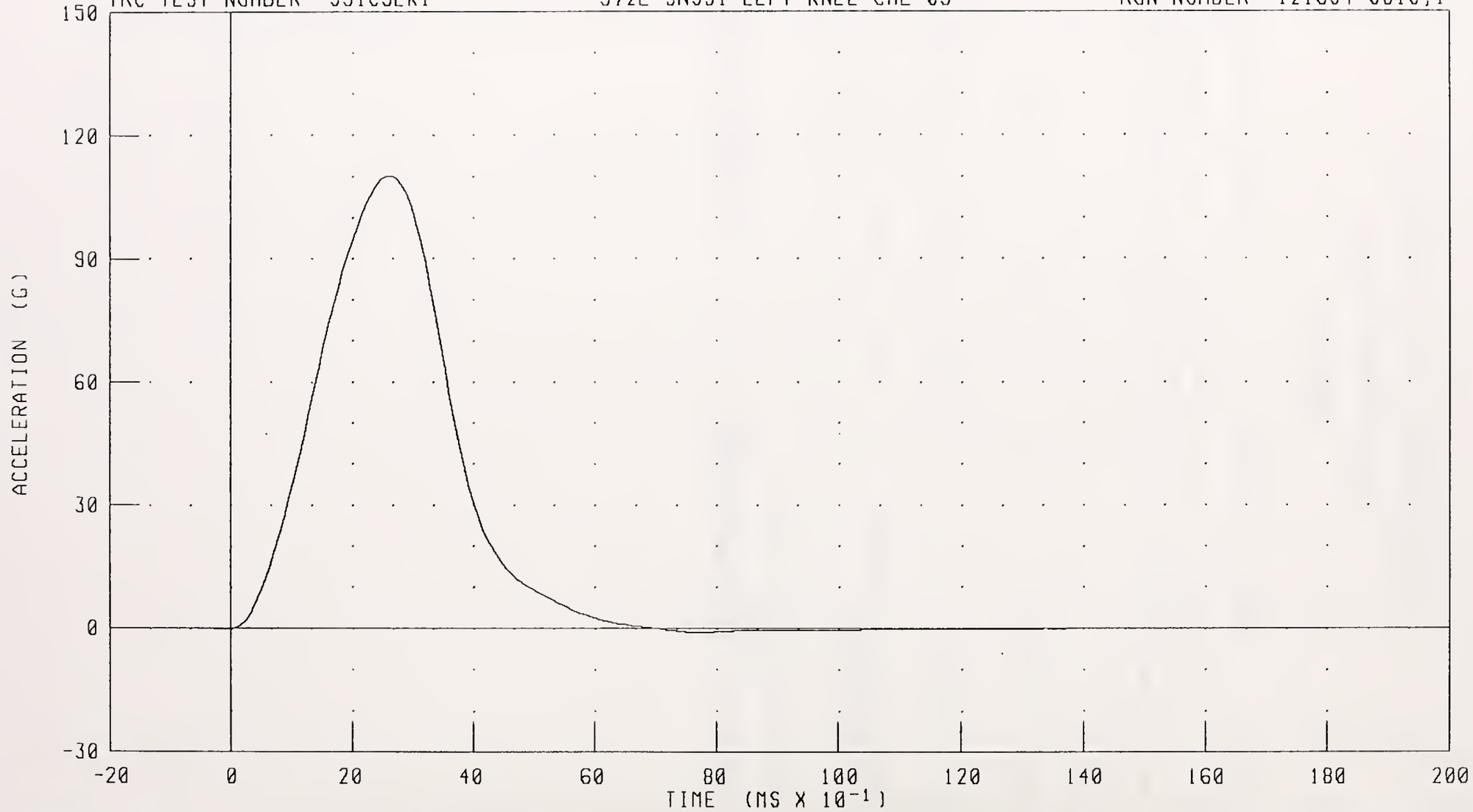
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	39.0 %
PROBE VELOCITY	2.07 - 2.13 M/S	2.11 M/S
PEAK KNEE IMPACT FORCE 5.0 KG PENDULUM	4714 - 5783 N	5387.9 N

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foss RUN NUMBER: 121694.0915;1

PART 572-E HYBRID III LEFT KNEE CALIBRATION
PENDULUM DECELERATION (5 KG PEND)

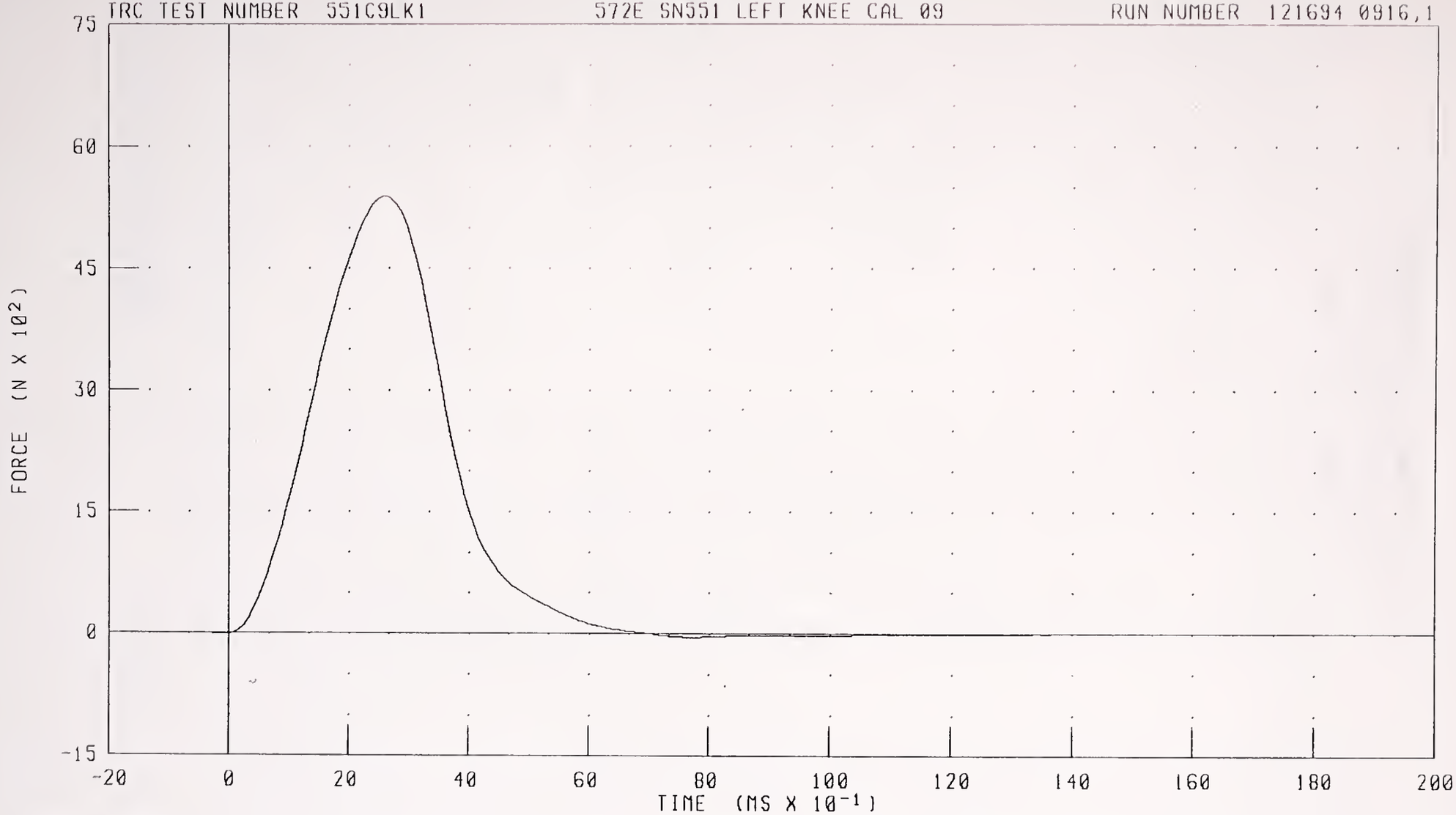
TRC TEST NUMBER 551C9LK1 572E SN551 LEFT KNEE CAL 09 RUN NUMBER 121694 0916,1



CHANNEL PENXG FILTER CH. CLASS 600 PEAK DATA 110.12 G @ 2.64 MS; -0.94 G @ 7.76 MS

PART 572-E HYBRID III LEFT KNEE CALIBRATION
PENDULUM FORCE (5 KG PEND)

TRC TEST NUMBER 551C9LK1 572E SN551 LEFT KNEE CAL 09 RUN NUMBER 121694 0916,1



CHANNEL PENXF FILTER CH CLASS 600 PEAK DATA 5387.99 N @ 2.64 MS; -46.07 N @ 7.76 MS

Pre-test Certification Data

Passenger Dummy S/N: 591

TRANSPORTATION RESEARCH CENTER INC.
HYBRID III EXTERNAL DIMENSIONS
591 FIRST TECHNOLOGY

14-DEC-94

TRC INC. TEST NO: 591C1ED1 572E SN591 EXT.DIMENSION CAL01

TEST PARAMETER	(DIMEN.)	SPECIFICATION	TEST RESULTS
LOCATION FOR CHEST CIRCUMFERENCE	(AA)	429 - 434 MM	432. MM
LOCATION FOR WAIST CIRCUMFERENCE	(BB)	226 - 231 MM	229. MM
CHEST CIRCUMFERENCE	(Y)	970 -1001 MM	980. MM
WAIST CIRCUMFERENCE	(Z)	836 - 866 MM	846. MM
CHEST DEPTH	(O)	213 - 229 MM	221. MM
H-POINT HEIGHT	(C)	84 - 89 MM	89. MM
H-POINT FROM SEATBACK	(D)	135 - 140 MM	137. MM
SKULL CAP TO BACKLINE	(H)	41 - 46 MM	43. MM
TOTAL SITTING HEIGHT	(A)	879 - 889 MM	889. MM
THIGH CLEARANCE	(F)	140 - 155 MM	152. MM
BUTTOCK KNEE LENGTH	(K)	579 - 605 MM	599. MM
BUTTOCK POPLITEAL LENGTH	(N)	452 - 478 MM	467. MM
POPLITEAL HEIGHT	(L)	429 - 455 MM	445. MM
KNEE PIVOT HEIGHT	(M)	485 - 500 MM	493. MM
FOOT LENGTH	(P)	252 - 267 MM	262. MM
FOOT BREADTH	(W)	91 - 107 MM	102. MM
SHOULDER PIVOT FROM BACKLINE	(E)	84 - 94 MM	91. MM
SHOULDER BREADTH	(V)	422 - 437 MM	424. MM
SHOULDER PIVOT HEIGHT	(B)	506 - 521 MM	516. MM
ELBOW REST HEIGHT	(J)	191 - 211 MM	208. MM
SHOULDER-ELBOW LENGTH	(I)	330 - 345 MM	343. MM
BACK OF ELBOW TO WRIST PIVOT	(G)	290 - 305 MM	292. MM

DUMMY MEETS SPECIFICATIONS

TECHNICIAN Pete Foot

RUN NUMBER: 121694.1524

TRANSPORTATION RESEARCH CENTER INC.

HEAD DROP TEST

HYBRID III 14-DEC-94

TRC INC. TEST NO: 591C1HD1 572E SN591 HEAD DROP CAL 01

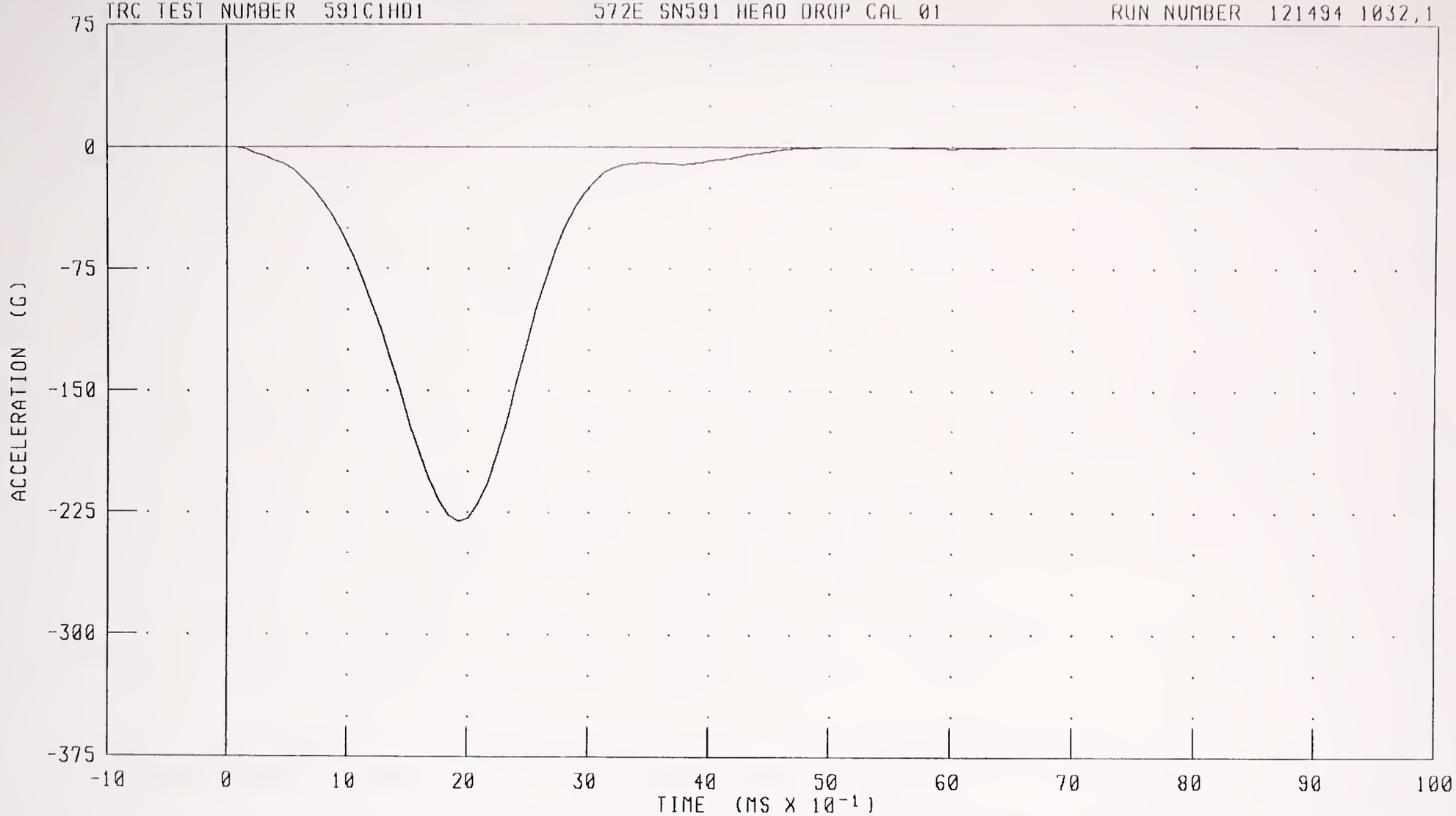
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	20.6 DEG. C
RELATIVE HUMIDITY	10 - 70 %	27.0 %
PEAK RESULTANT ACCELERATION	225 - 275 G	263.74 G
PEAK LATERAL ACCELERATION	15 G MAX	1.75 G
IS ACCELERATION CURVE UNIMODAL?	YES	YES

TEST MEETS SPECIFICATIONS

TECHNICIAN Peter Foster RUN NUMBER: 121494.1032;1

PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION X AXIS

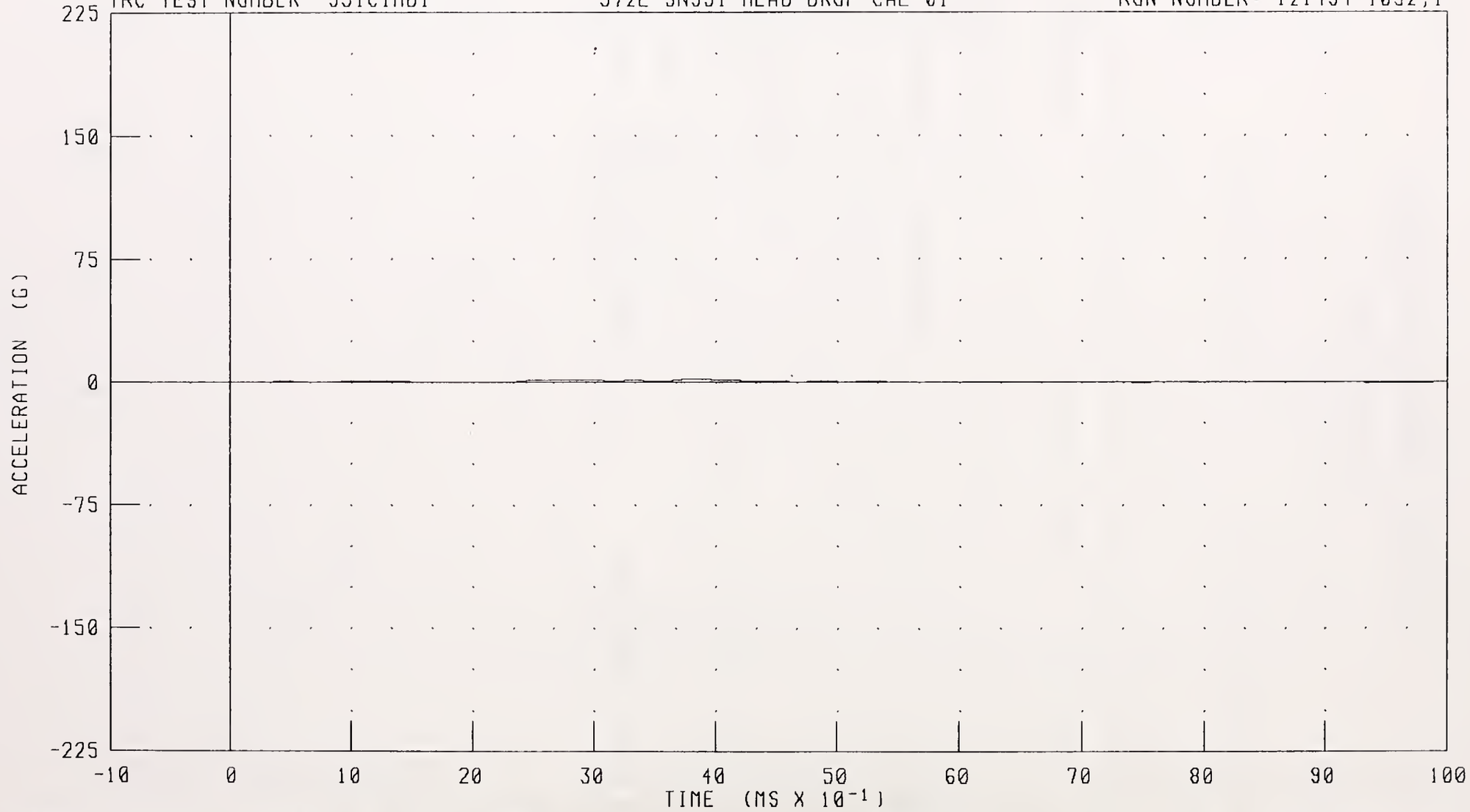
TRC TEST NUMBER 591C1HD1 572E SN591 HEAD DROP CAL 01 RUN NUMBER 121494 1032,1



CHANNEL: HEDXG FILTER: CH. CLASS 1000 PEAK DATA: 0 38 G @ 8 40 MS, -230.61 G @ 1 92 MS

PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION Y AXIS

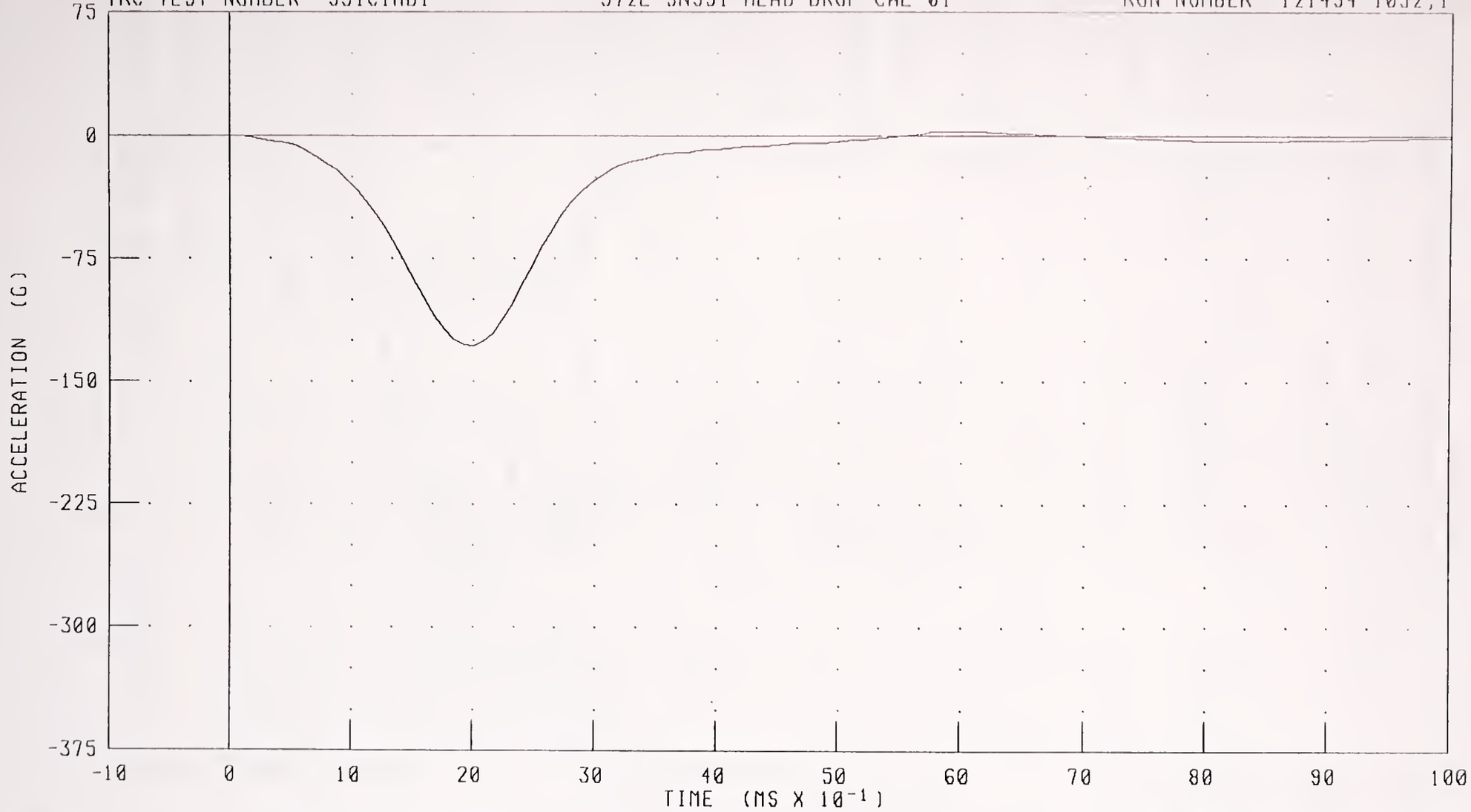
TRC TEST NUMBER 591C1HD1 572E SN591 HEAD DROP CAL 01 RUN NUMBER 121494 1032,1



CHANNEL: HEDYG FILTER: CH. CLASS 1000 PEAK DATA: 1 75 G @ 3 84 MS; -0.43 G @ 9 76 MS

PART 572-E HYBRID III HEAD CALIBRATION
HEAD ACCELERATION Z AXIS

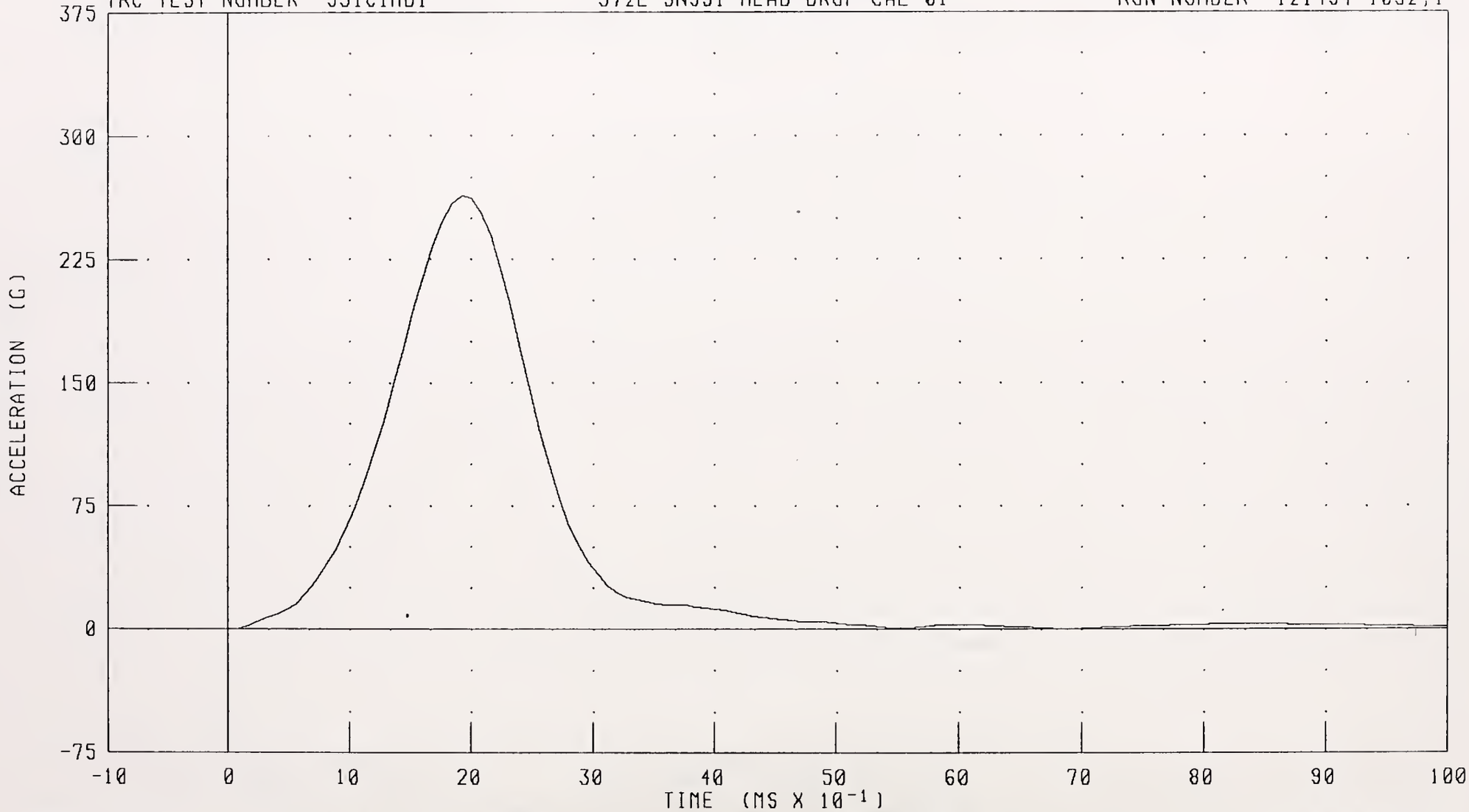
TRC TEST NUMBER 591C1HD1 572E SN591 HEAD DROP CAL 01 RUN NUMBER 121494 1032,1



CHANNEL HEDZG FILTER CH CLASS 1000 PEAK DATA: 2 59 G @ 6 08 MS, -128 41 G @ 2 00 MS

PART 572-E HYBRID III HEAD CALIBRATION
HEAD RESULTANT ACCELERATION

TRC TEST NUMBER 591C1HD1 572E SN591 HEAD DROP CAL 01 RUN NUMBER 121494 1032,1



CHANNEL: HEDRG FILTER: CH. CLASS 1000 PEAK DATA: 263.75 G @ 1.92 MS, 0.01 G @ -0.64 MS

TRANSPORTATION RESEARCH CENTER INC.

NECK FLEXION TEST - 6 CHANNEL TRANSDUCER

HYBRID III 14-DEC-94

TRC INC. TEST NO: 591C1NF1 572E SN591 NECK FLEXION CAL01

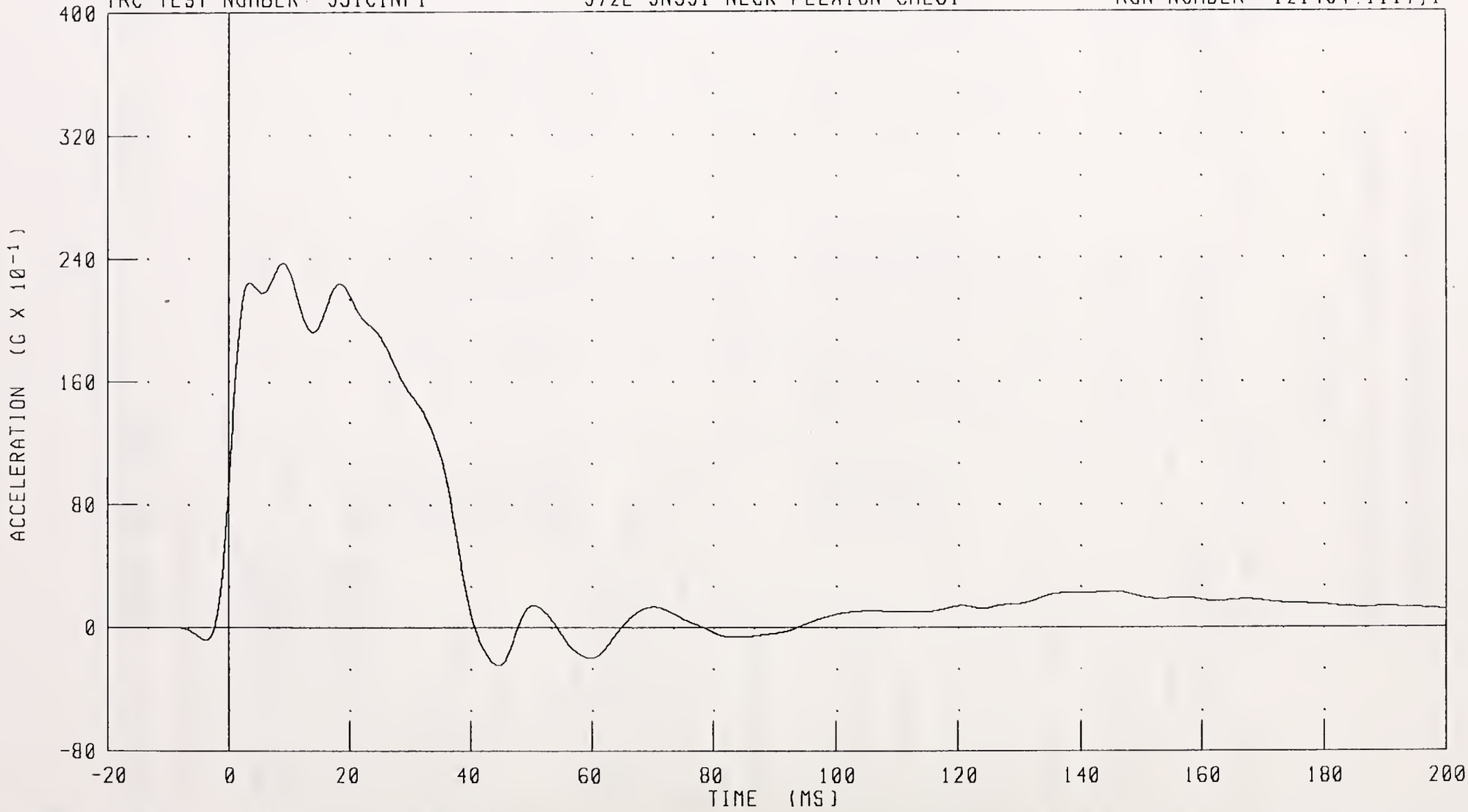
TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.6-22.2 DEG. C	20.6 DEG. C
RELATIVE HUMIDITY		10 - 70 %	27.0 %
IMPACT VELOCITY		6.89 - 7.13 M/S	6.99 M/S
PENDULUM DECELERATION	10 MS	22.50 - 27.50 G	23.20 G
	20 MS	17.60 - 22.60 G	21.64 G
	30 MS	12.50 - 18.50 G	15.27 G
MAX PENDULUM G		29 G MAX	23.70 G
MAX PENDULUM G ABOVE 30 MS		29 G MAX	15.23 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		34 - 42 MS	38.00 MS
D PLANE ROTATION	MAX	64 - 78 DEG.	66.70 DEG.
	TIME	57 - 64 MS	57.04 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MAX	88.2 - 108.5 NM	102.42 NM
	TIME	47 - 58 MS	50.80 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		113 - 128 MS	113.44 MS
POSITIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		97 - 107 MS	97.28 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Peter Fo St RUN NUMBER: 121494.1116:1

PART 572-E HYBRID III NECK FLEXION CALIBRATION
PENDULUM DECELERATION

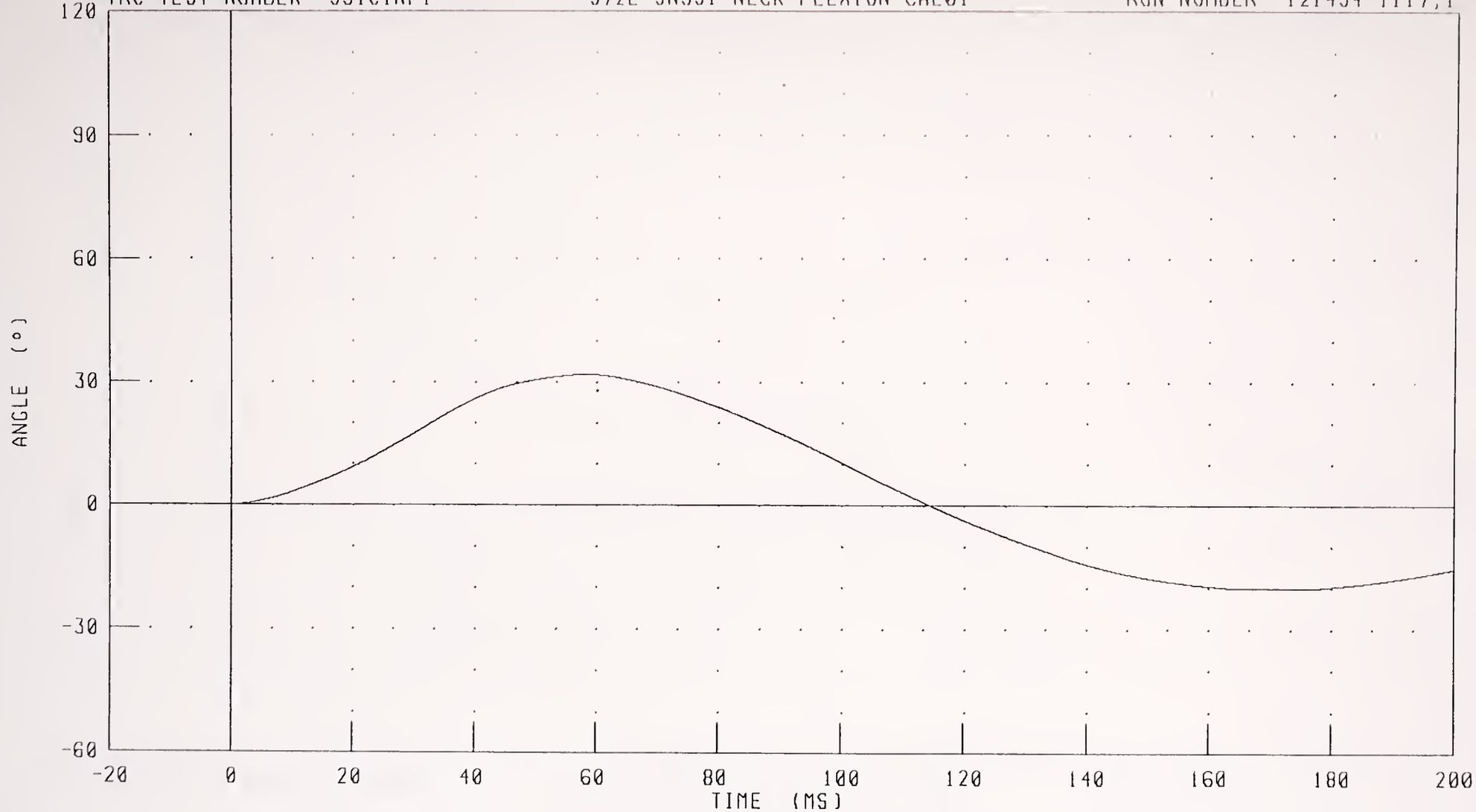
TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494.1117,1



CHANNEL: PENXG FILTER: CH CLASS 60 PEAK DATA: 23.70 G @ 8.96 MS, -2.45 G @ 44.56 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
ROTATION ABOUT BASE OF NECK

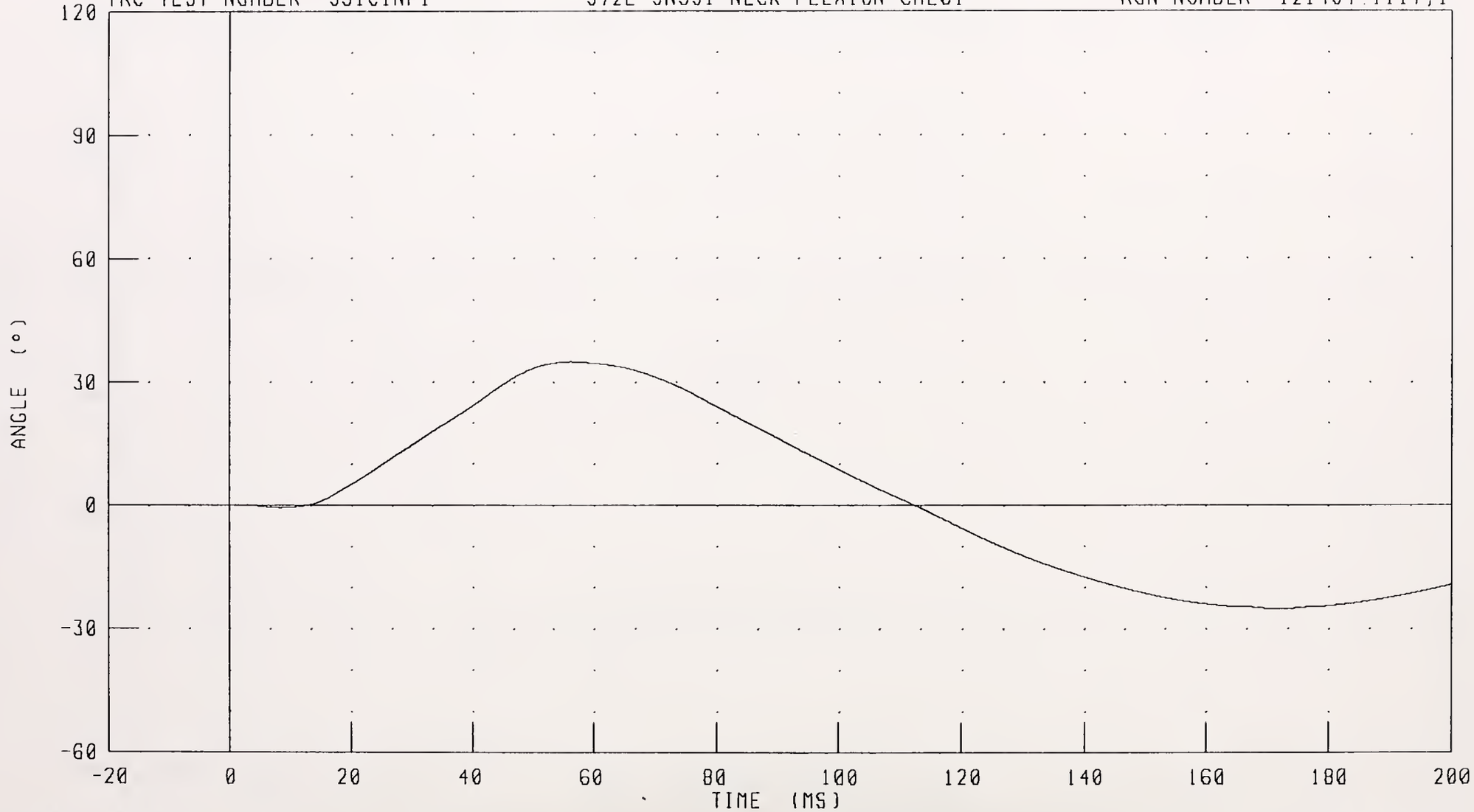
TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494 1117,1



CHANNEL BETA FILTER CH CLASS 60 PEAK DATA: 31 82 ° @ 58 40 MS, -20 04 ° @ 174 80 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

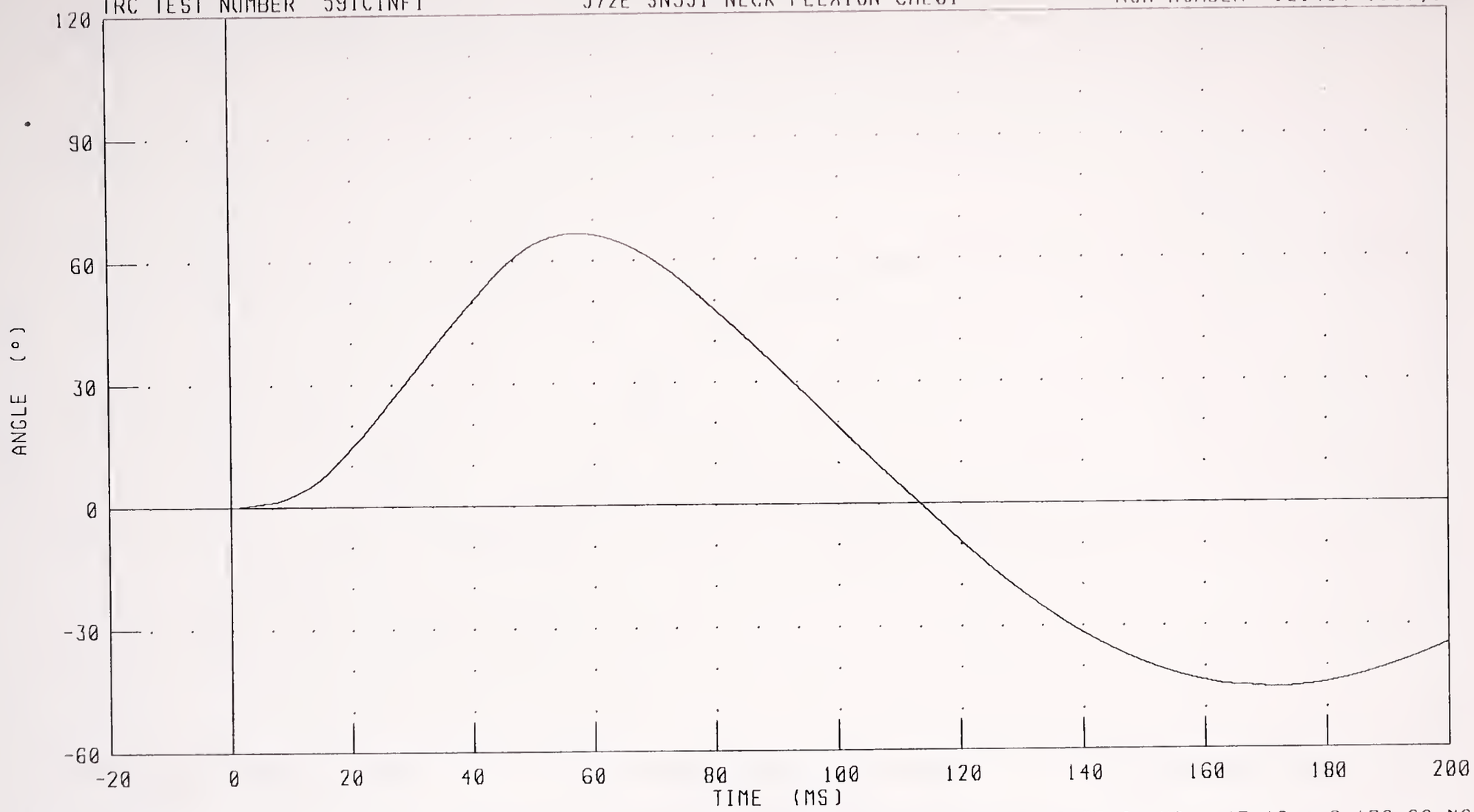
TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494.1117;1



CHANNEL THETA FILTER CH. CLASS 60 PEAK DATA: 34.97 ° @ 56.24 MS; -25.15 ° @ 172.00 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL ROTATION

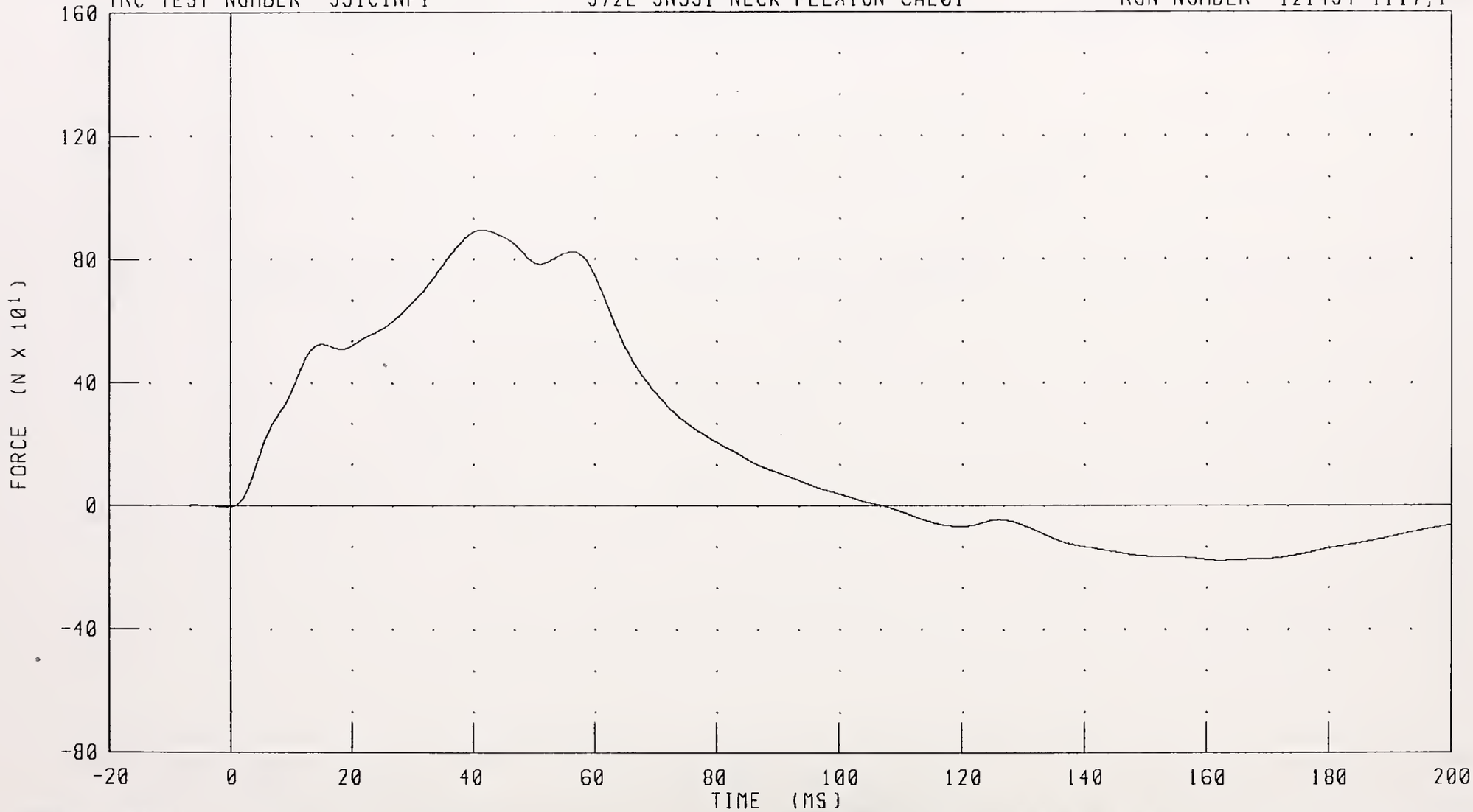
TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494 1117,1



CHANNEL TOTAN FILTER: CH CLASS 60 PEAK DATA: 66.71 ° @ 57 04 MS, -45 18 ° @ 172 00 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
NECK FORCE X AXIS

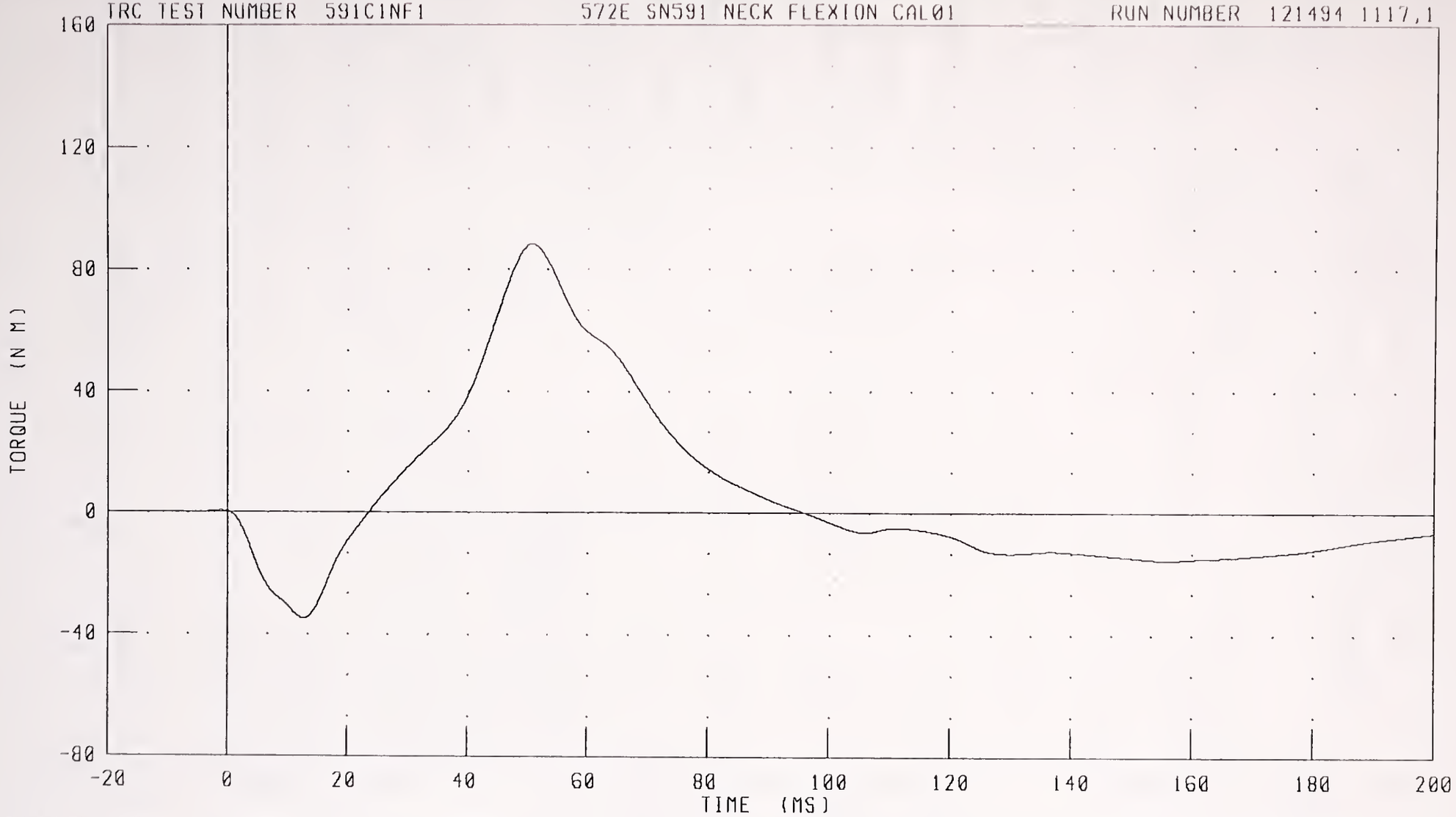
TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494 1117,1



CHANNEL: NEKXF FILTER: CH CLASS 60 PEAK DATA: 895.43 N @ 41.44 MS, -177.58 N @ 162 24 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
NECK MOMENT Y AXIS

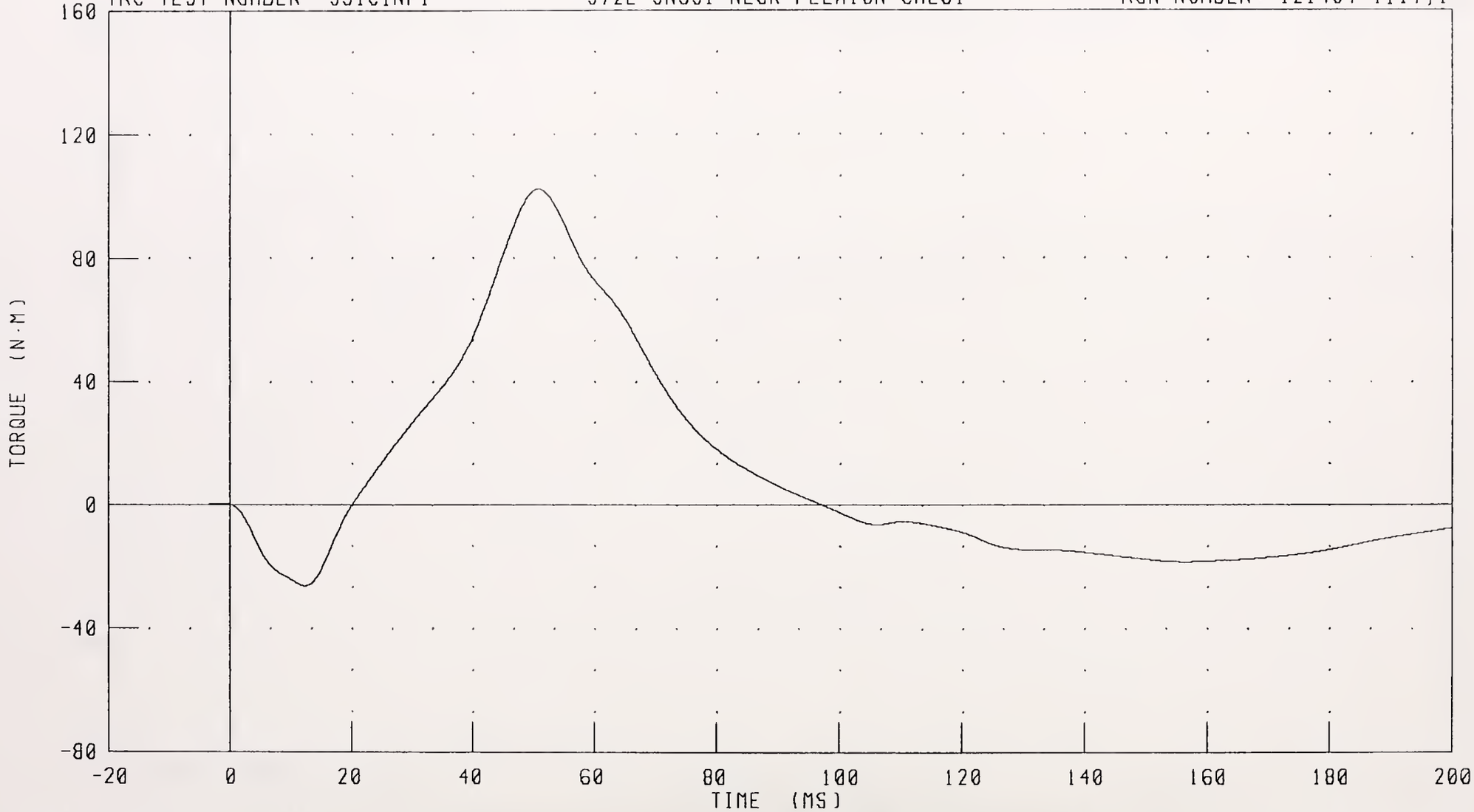
TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494 1117,1



CHANNEL NEKYM FILTER CH CLASS 60 PEAK DATA 88.47 N M @ 50.80 MS, -34.81 N M @ 12.72 MS

PART 572-E HYBRID III NECK FLEXION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER 591C1NF1 572E SN591 NECK FLEXION CAL01 RUN NUMBER 121494 1117,1



CHANNEL: NEKOM FILTER: CH CLASS 60 PEAK DATA: 102.42 N·M @ 50.80 MS, -26.23 N·M @ 12.32 MS

TRANSPORTATION RESEARCH CENTER INC.

NECK EXTENSION TEST - 6 CHANNEL TRANSDUCER

HYBRID III 14-DEC-94

TRC INC. TEST NO: 591C1NE1 572E SN591 NECK EXT. CAL01

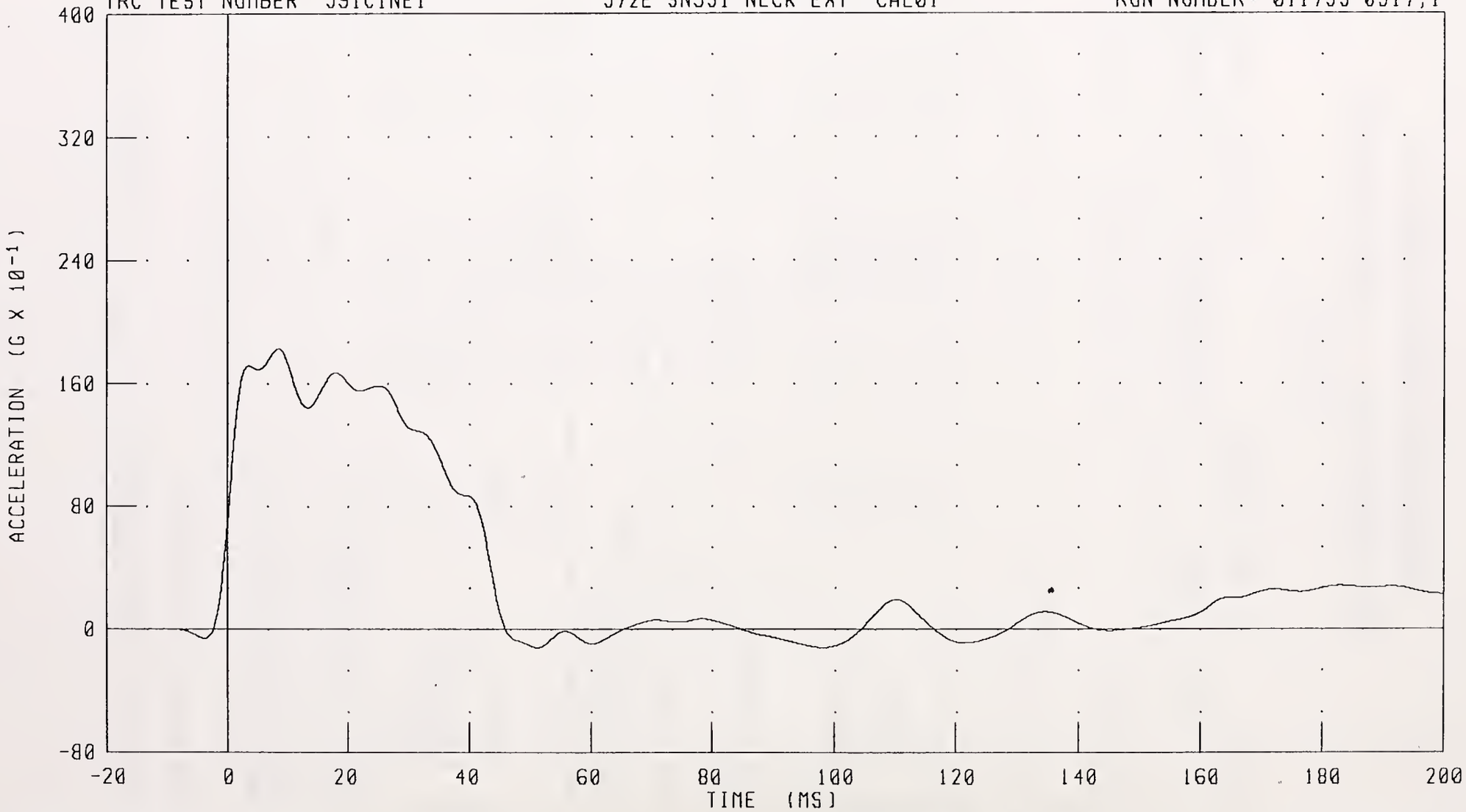
TEST PARAMETER		SPECIFICATION	TEST RESULTS
TEMPERATURE		20.6 - 22.2 DEG. C	20.6 DEG. C
RELATIVE HUMIDITY		10 - 70 %	27.0 %
IMPACT VELOCITY		5.95 - 6.19 M/S	6.00 M/S
PENDULUM DECELERATION	10 MS	17.20 - 21.20 G	17.30 G
	20 MS	14.00 - 19.00 G	16.04 G
	30 MS	11.00 - 16.00 G	13.14 G
MAX PENDULUM G		22 G MAX	18.24 G
MAX PENDULUM G ABOVE 30 MS		22 G MAX	13.11 G
DECELERATION-TIME CURVE DECAY TIME TO 5 G		38 - 46 MS	43.04 MS
D PLANE ROTATION	MAX	81 - 106 DEG.	93.84 DEG.
	TIME	72 - 82 MS	77.76 MS
MOMENT ABOUT OCCIPITAL CONDYLE	MIN	-80.0/-52.9 NM	-62.53 NM
	TIME	65 - 79 MS	71.84 MS
ROTATION ANGLE-TIME CURVE DECAY TIME TO ZERO		147 - 174 MS	159.84 MS
NEGATIVE MOMENT-TIME CURVE DECAY TIME TO ZERO		120 - 148 MS	141.92 MS

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foote RUN NUMBER: 121494.1127;1

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
PENDULUM DECELERATION

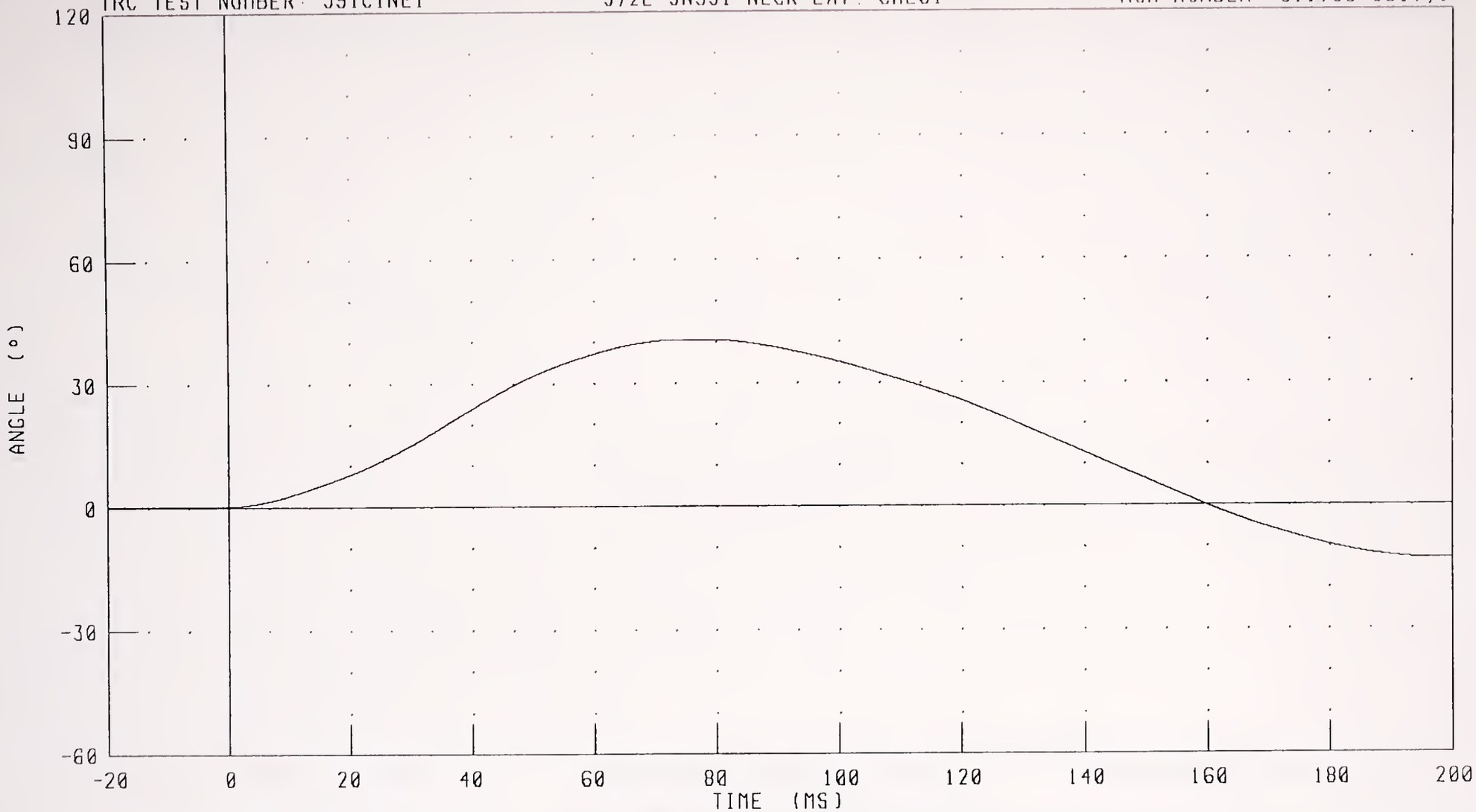
TRC TEST NUMBER 591C1NE1 572E SN591 NECK EXT CAL01 RUN NUMBER 011795 0917;1



CHANNEL: PENXG FILTER: CH CLASS 60 PEAK DATA: 18 24 G @ 8 48 MS; -1 19 G @ 98 00 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
ROTATION ABOUT BASE OF NECK

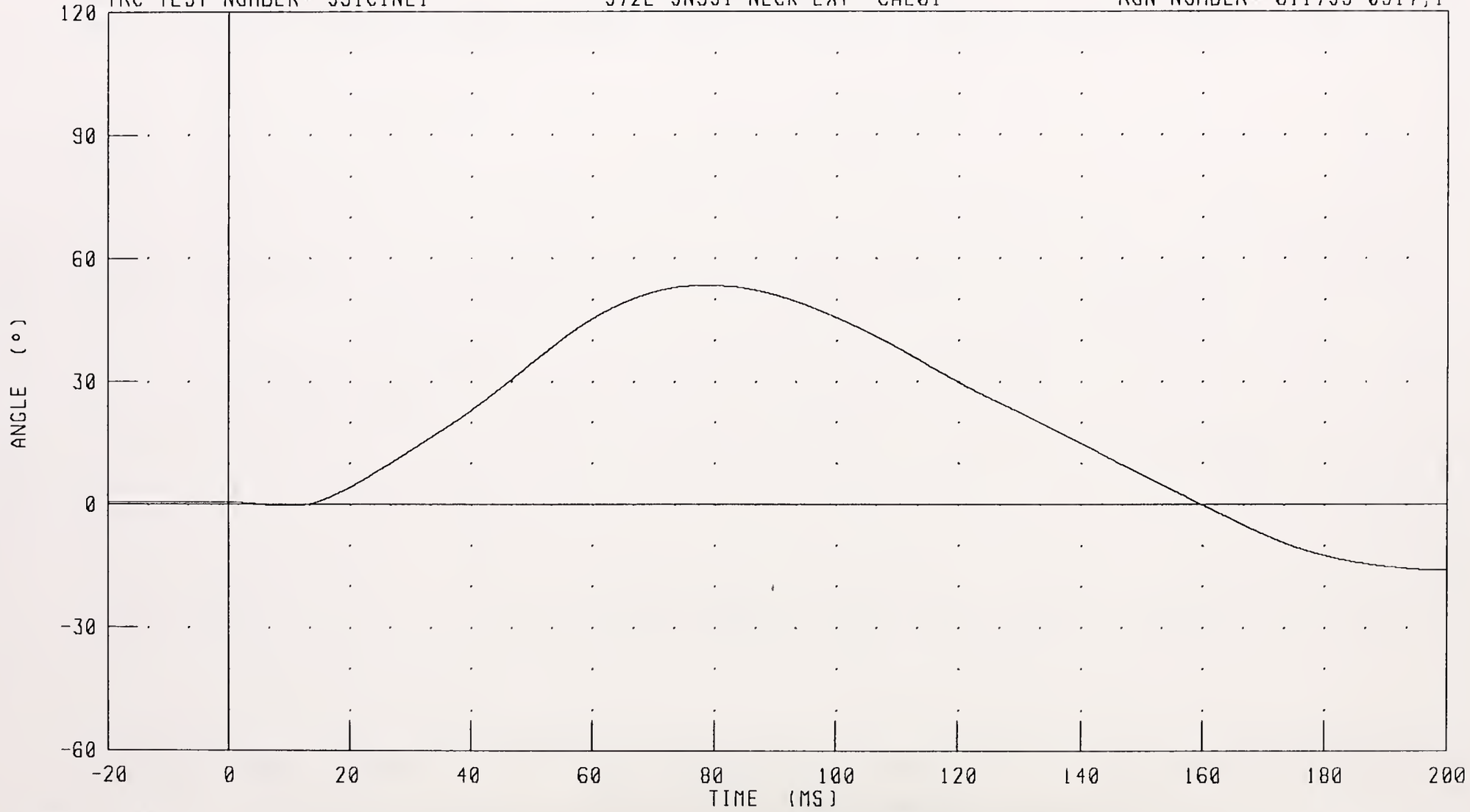
TRC TEST NUMBER: 591C1NE1 572E SN591 NECK EXT. CAL01 RUN NUMBER 011795 0917,1



CHANNEL BETA FILTER CH CLASS 60 PEAK DATA: 40.53 ° @ 75.04 MS; -12.95 ° @ 200.00 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
ROTATION ABOUT OCCIPITAL CONDYLE

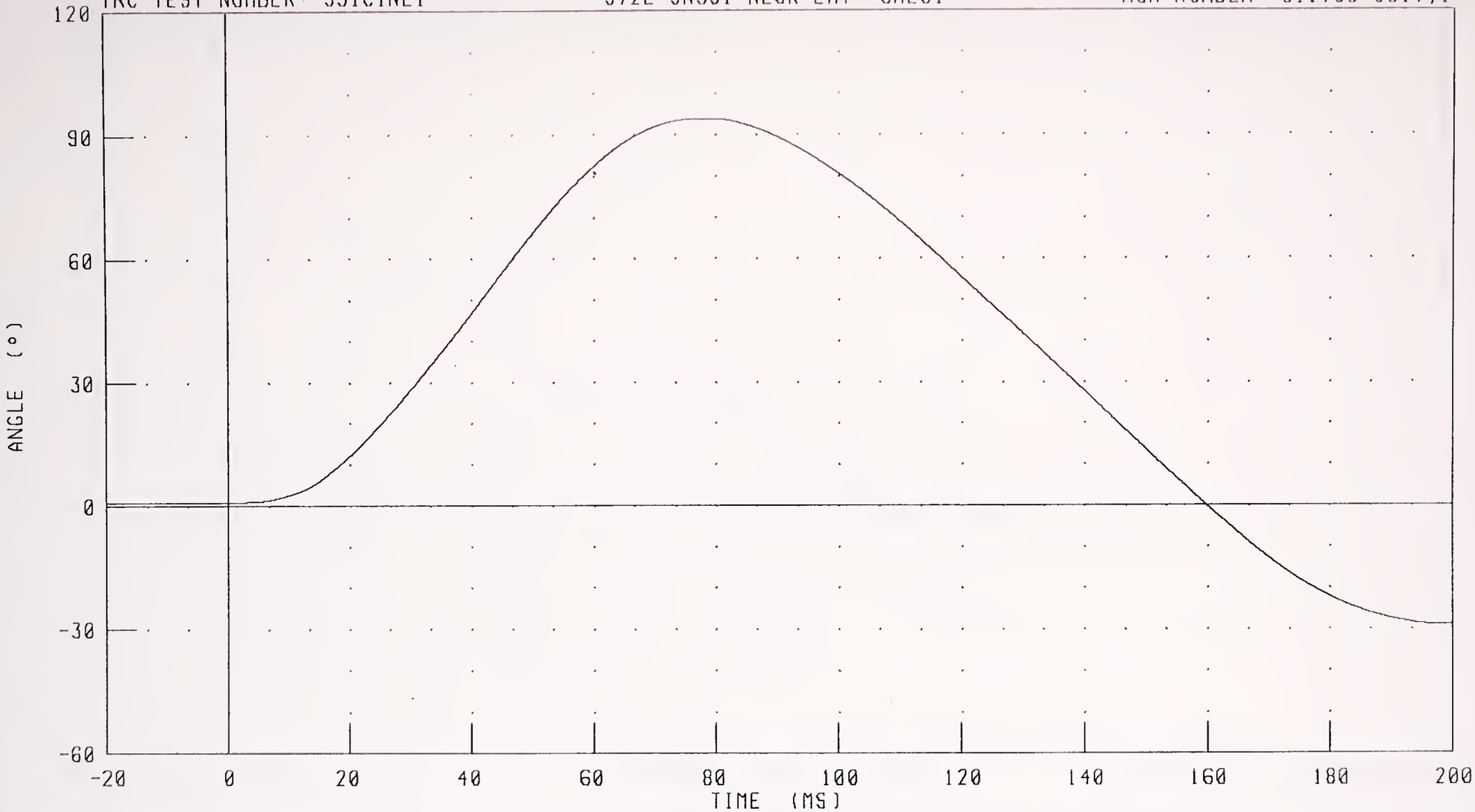
TRC TEST NUMBER 591C1NE1 572E SN591 NECK EXT CAL01 RUN NUMBER 011795 0917,1



CHANNEL THETA FILTER: CH CLASS 60 PEAK DATA: 53.31 ° @ 77.68 MS; -15.89 ° @ 197.76 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL ROTATION

TRC TEST NUMBER: 591C1NE1 572E SN591 NECK EXT CAL01 RUN NUMBER 011795 0917,1

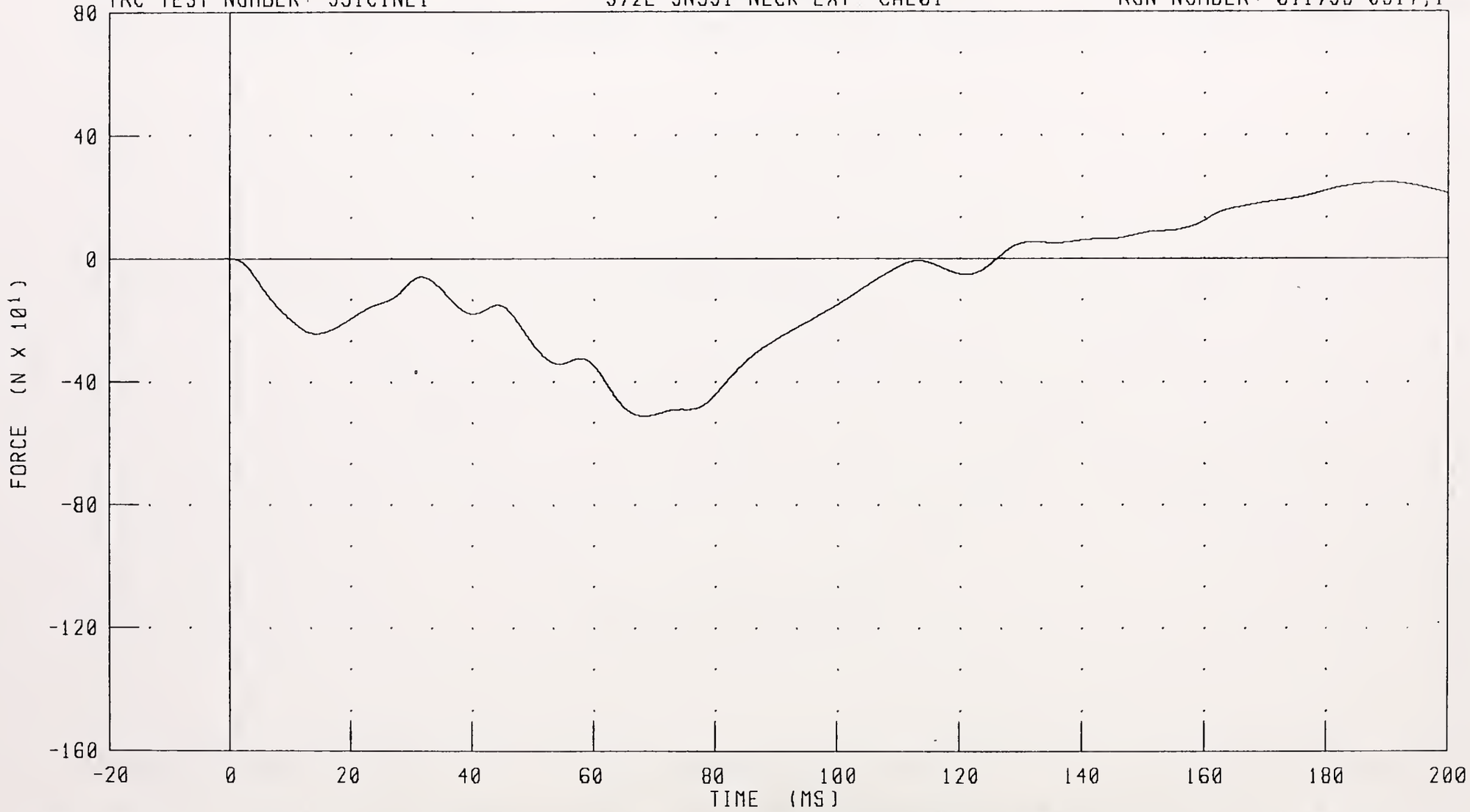


CHANNEL: TOTAN FILTER: CH CLASS 60 PEAK DATA: 93.84 ° @ 77 76 MS; -28 84 ° @ 200 00 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION

NECK FORCE X AXIS

TRC TEST NUMBER: 591C1NE1 572E SN591 NECK EXT CAL01 RUN NUMBER: 011795 0917,1

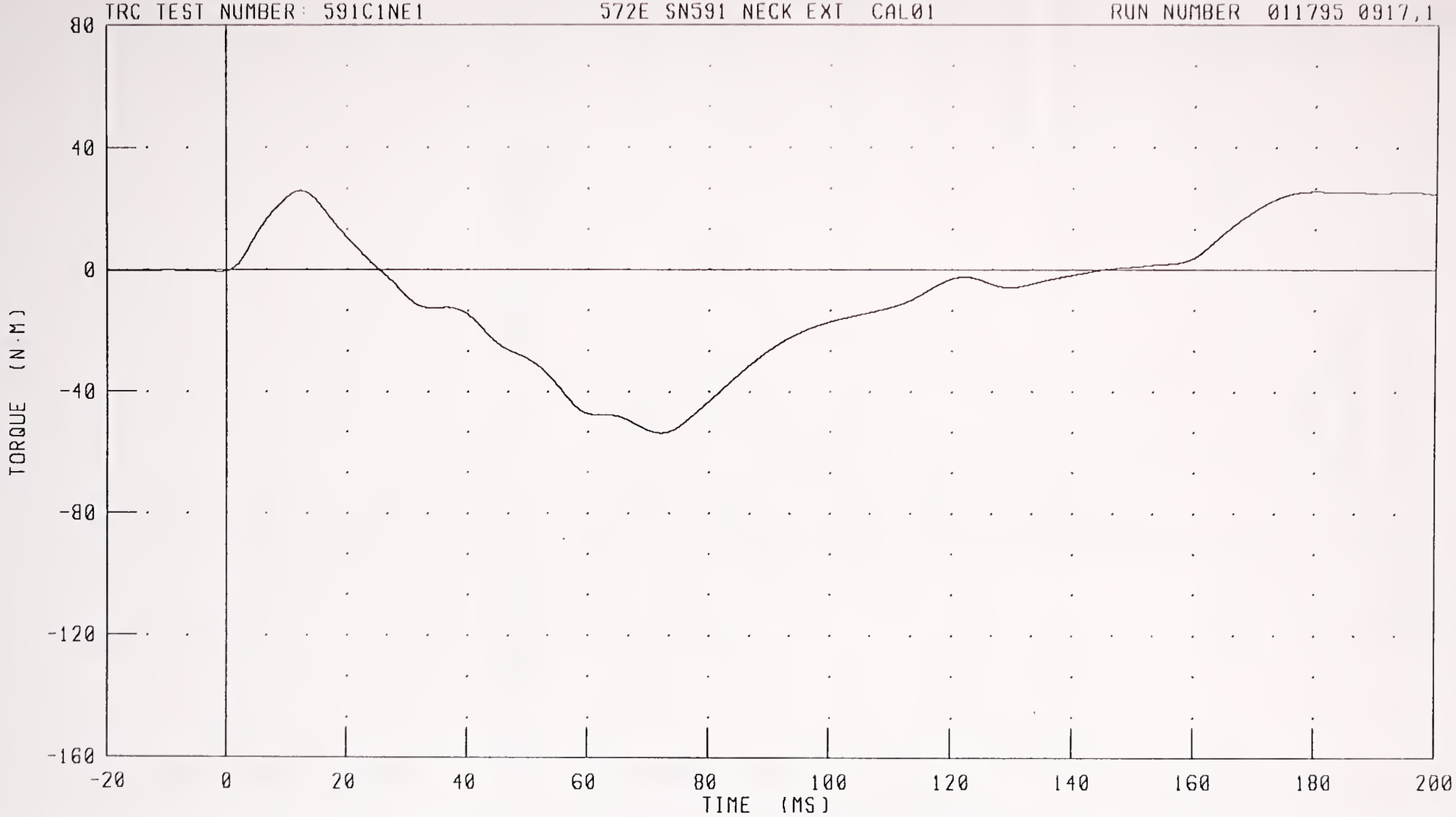


CHANNEL: NEKXF FILTER: CH CLASS 60 PEAK DATA: 246.78 N @ 189 68 MS; -511.46 N @ 68 24 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION

NECK MOMENT Y AXIS

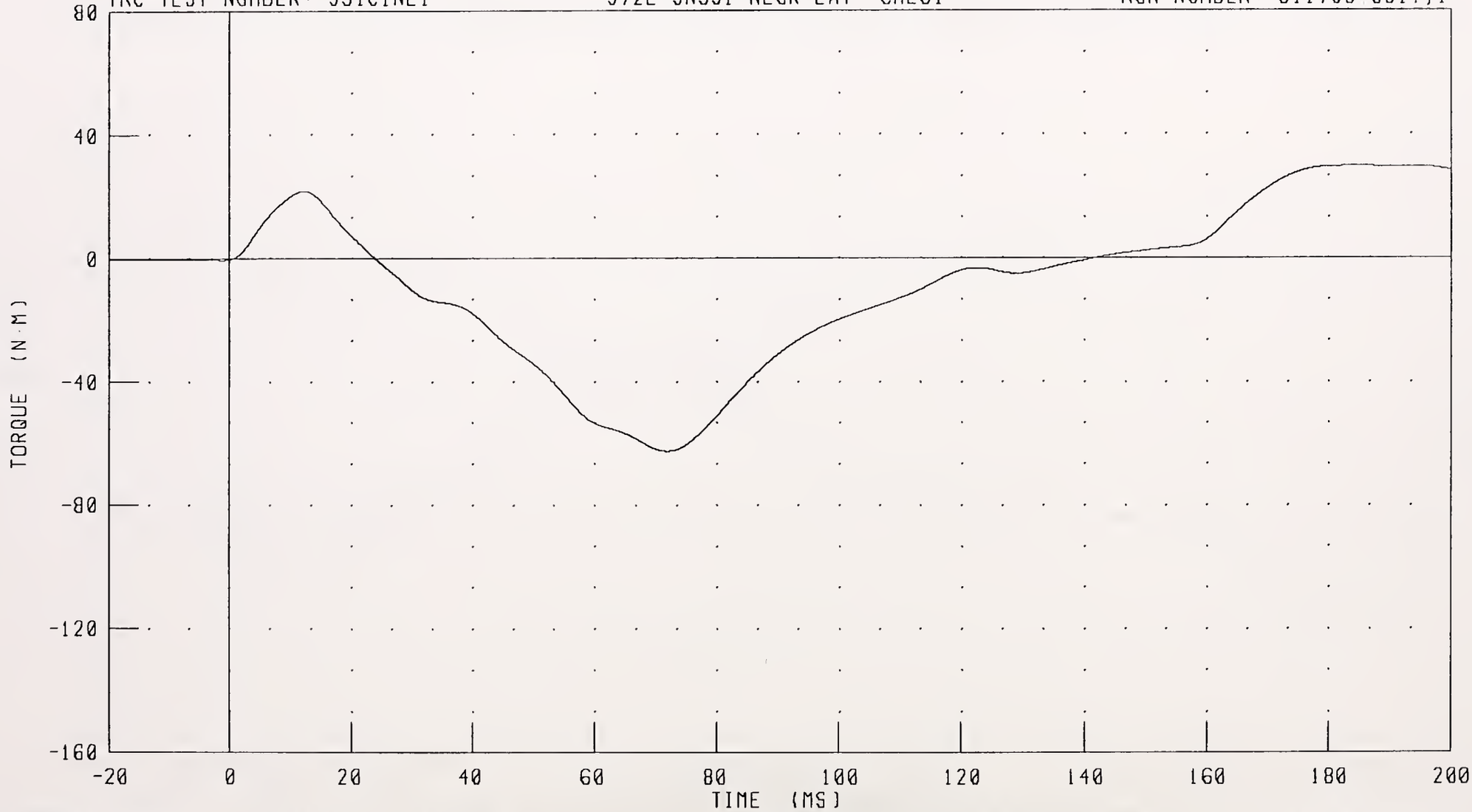
TRC TEST NUMBER: 591C1NE1 572E SN591 NECK EXT CAL01 RUN NUMBER 011795 0917,1



CHANNEL NEKYM FILTER: CH CLASS 60 PEAK DATA: 25.90 N·M @ 12.40 MS, -53.72 N·M @ 72.08 MS

PART 572-E HYBRID III NECK EXTENSION CALIBRATION
TOTAL MOMENT ABOUT OCCIPITAL CONDYLE

TRC TEST NUMBER: 591C1NE1 572E SN591 NECK EXT CAL01 RUN NUMBER: 011795 0917,1



CHANNEL: NEKOM FILTER: CH. CLASS 60 PEAK DATA: 29.67 N·M @ 184.80 MS; -62.53 N·M @ 71.84 MS

TRANSPORTATION RESEARCH CENTER INC.

THORAX IMPACT TEST

HYBRID III 16-DEC-94

TRC INC. TEST NO: 591C1TH1 572E SN591 H.S.THORAX CAL01

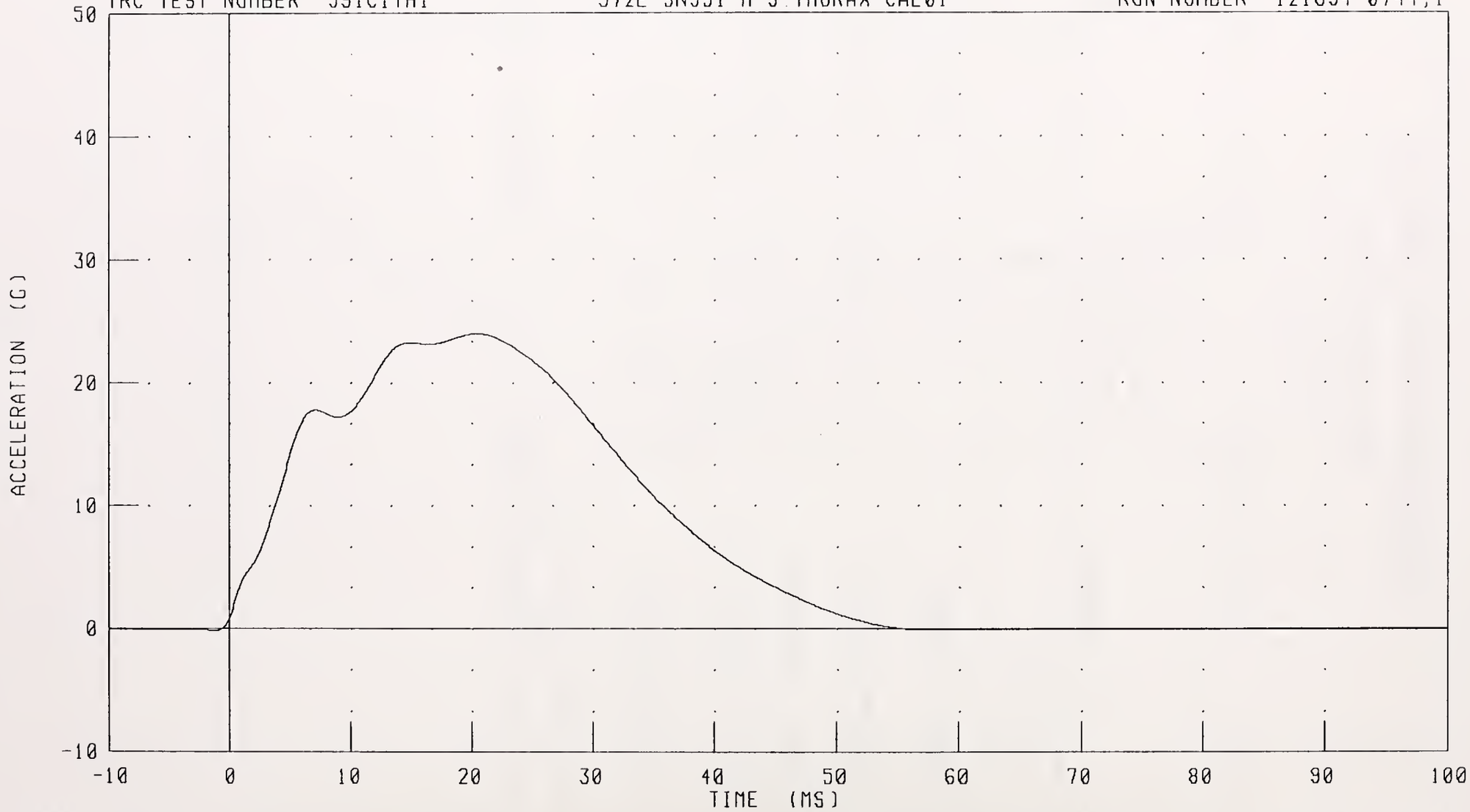
TEST PARAMETER	HIGH SPEED TEST SPECIFICATION	TEST RESULTS
TEMPERATURE	20.6-22.2 DEG. C	21.7 DEG. C
RELATIVE HUMIDITY	10 - 70 %	39.0 %
PENDULUM VELOCITY	6.59 - 6.83 M/S	6.68 M/S
MAXIMUM DEFLECTION	63.5 - 72.6 MM	68.3 MM
MAXIMUM RESISTIVE FORCE	5159 - 5894 N	5494. N
INTERNAL HYSTERESIS	69% - 85%	76.5%

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foss RUN NUMBER: 121694.0744;1

PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM DECELERATION

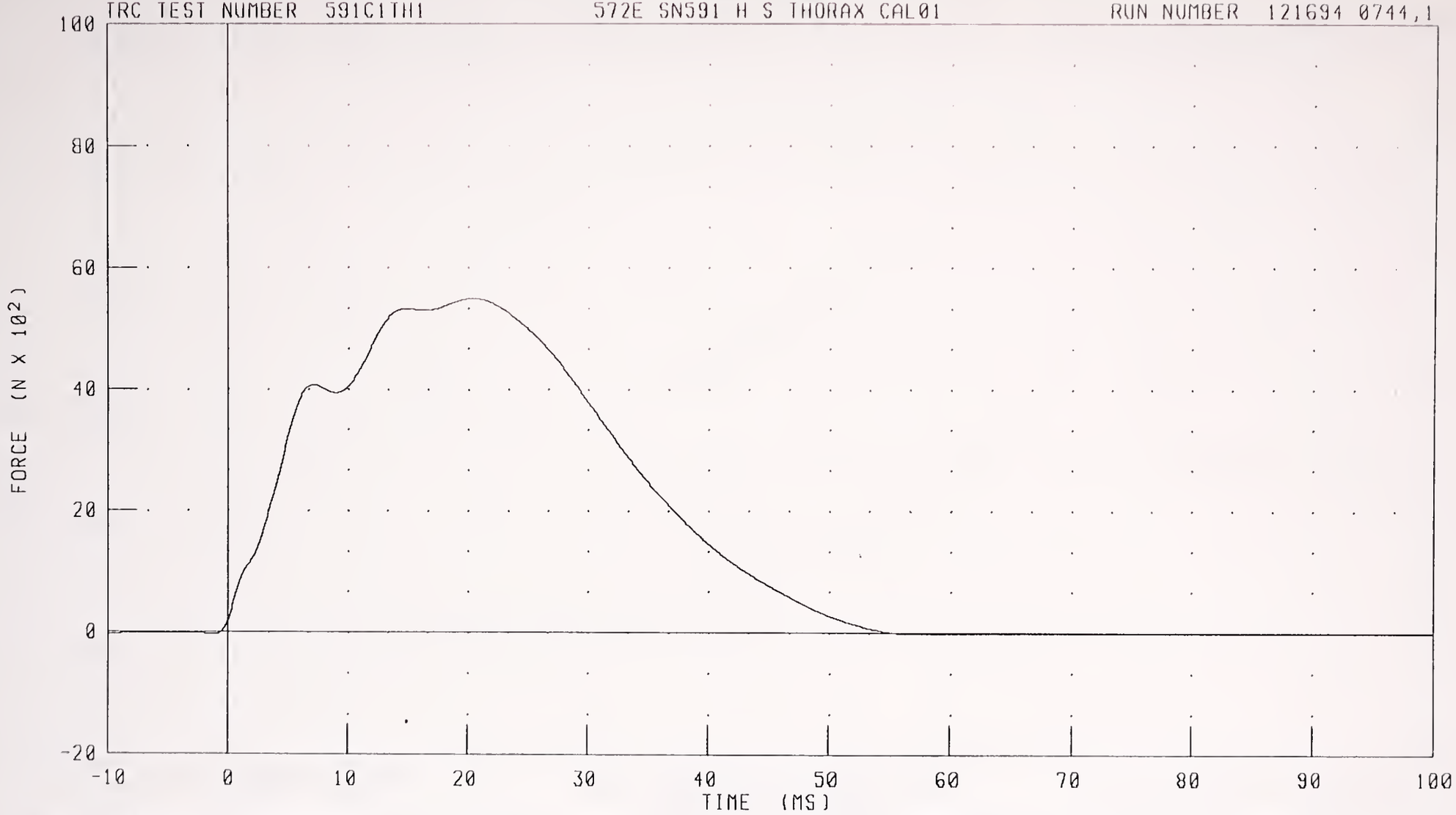
TRC TEST NUMBER 591C1TH1 572E SN591 H S THORAX CAL01 RUN NUMBER 121694 0744,1



CHANNEL: PENXG FILTER: CH CLASS 180 PEAK DATA 23.98 G @ 20.40 MS; -0.15 G @ -1 20 MS

PART 572-E HYBRID III THORAX CALIBRATION
PENDULUM FORCE

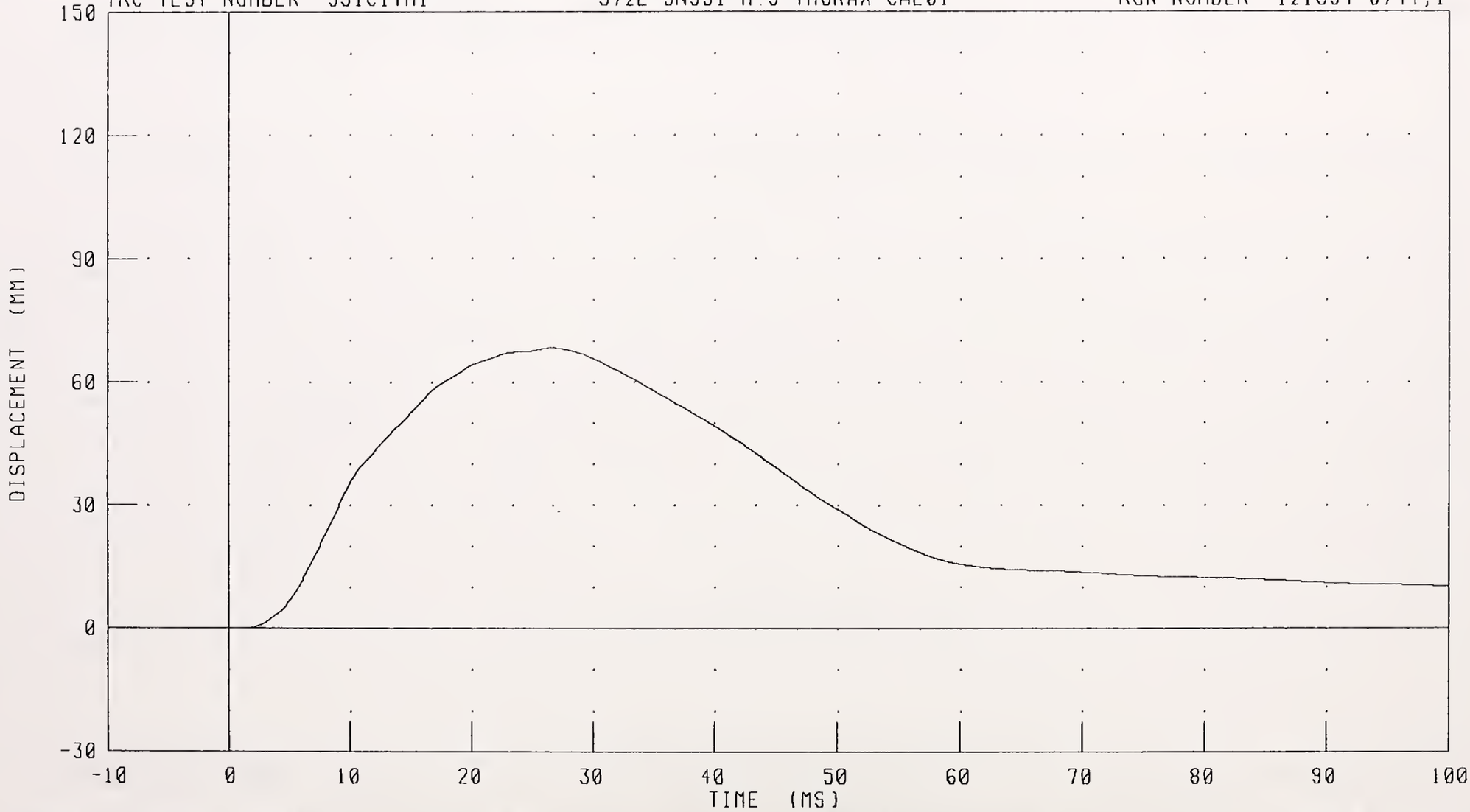
TRC TEST NUMBER 591C1TH1 572E SN591 H S THORAX CAL01 RUN NUMBER 121694 0744,1



CHANNEL PENXF FILTER: CH CLASS 180 PEAK DATA: 5494 27 N @ 20.40 MS, -33 70 N @ -1 20 MS

PART 572-E HYBRID III THORAX CALIBRATION
STERNUM DISPLACEMENT

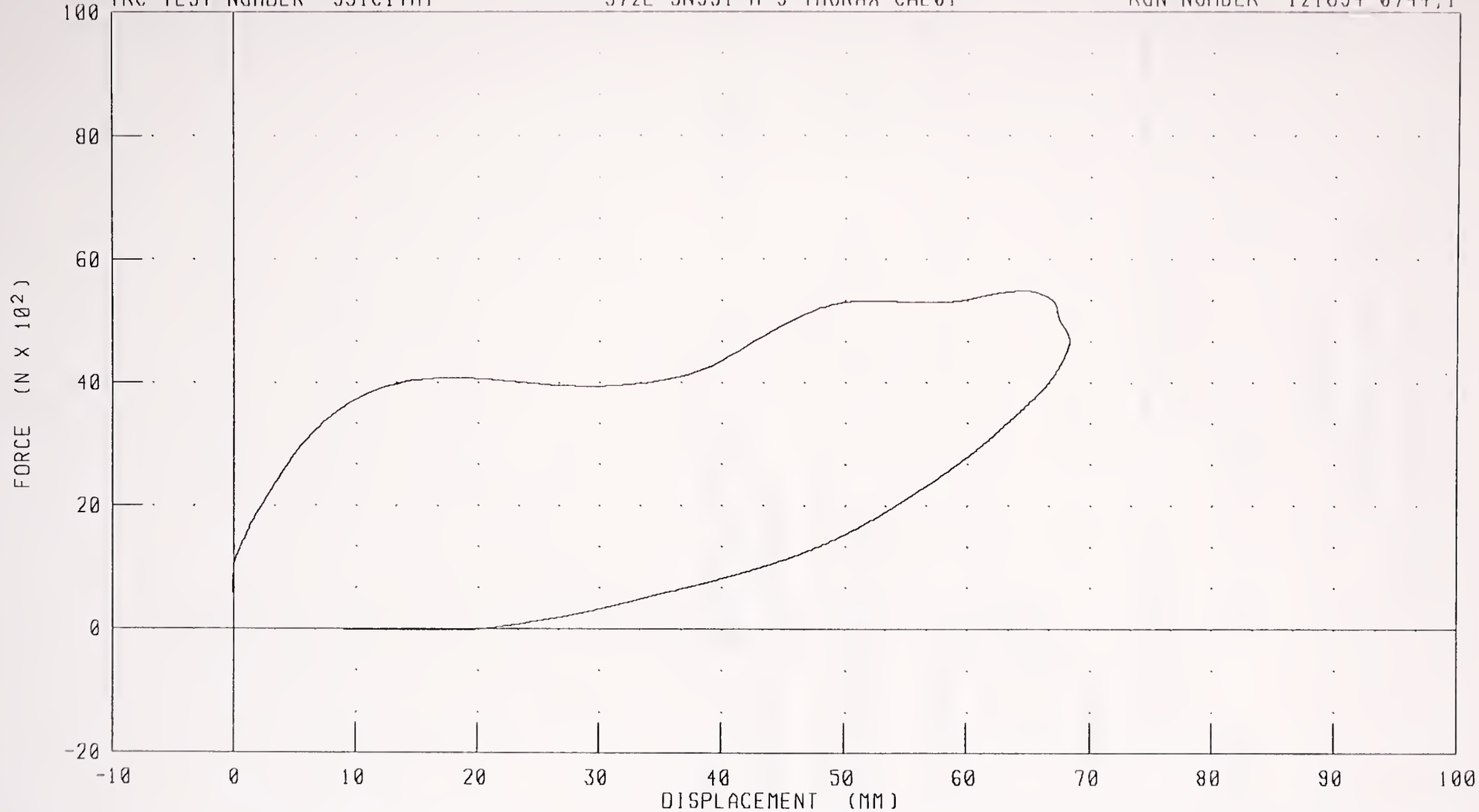
TRC TEST NUMBER 591C1TH1 572E SN591 H.S THORAX CAL01 RUN NUMBER 121694 0744,1



CHANNEL CSTXD FILTER: CH CLASS 180 PEAK DATA: 68.33 MM @ 26.56 MS, -0.03 MM @ 0.88 MS

PART 572-E HYBRID III THORAX CALIBRATION
CHEST DISPLACEMENT VS PENDULUM FORCE

TRC TEST NUMBER 591C1TH1 572E SN591 H S THORAX CAL01 RUN NUMBER 121694 0744,1



CHANNEL CSTXD FILTER: CH CLASS 180 PEAK DATA: 68 33 MM @ 26 56 MS, -0 03 MM @ 0 88 MS
PENXF CH CLASS 180 5494 27 N @ 20 40 MS; -33 70 N @ -1 20 MS

TRANSPORTATION RESEARCH CENTER INC.

RIGHT KNEE IMPACT TEST

HYBRID III 14-DEC-94

TRC INC. TEST NO: 591C1RK1 572E SN591 RIGHT KNEE CAL 01

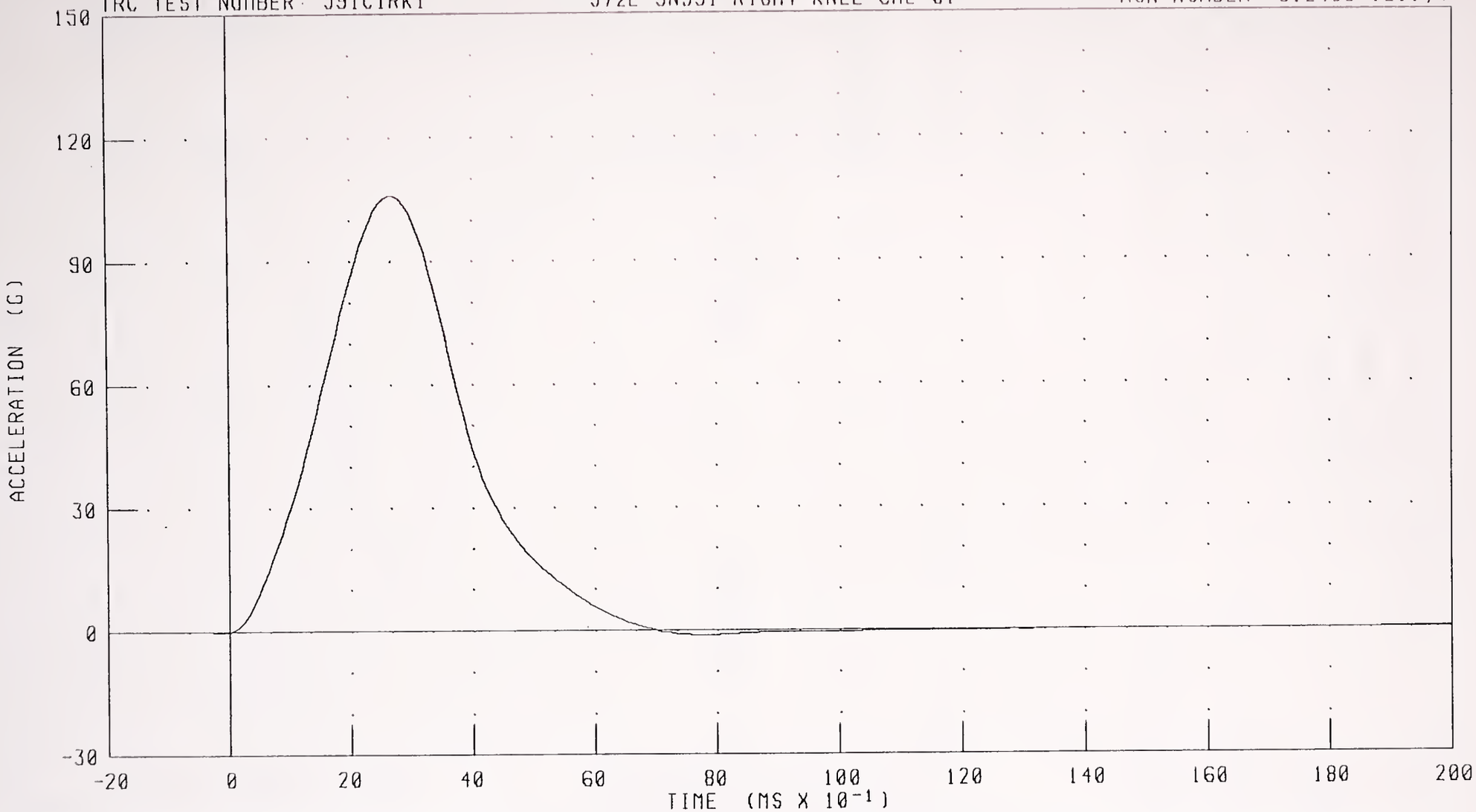
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	20.6 DEG. C
RELATIVE HUMIDITY	10 - 70 %	27.0 %
PROBE VELOCITY	2.07 - 2.13 M/S	2.12 M/S
PEAK KNEE IMPACT FORCE 5.0 KG PENDULUM	4714 - 5783 N	5186.2 N

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foss RUN NUMBER: 121494.1338;4

PART 572-E HYBRID III RIGHT KNEE CALIBRATION
PENDULUM DECELERATION (5 KG PEND)

TRC TEST NUMBER: 591C1RK1 572E SN591 RIGHT KNEE CAL 01 RUN NUMBER 012495 1211,4

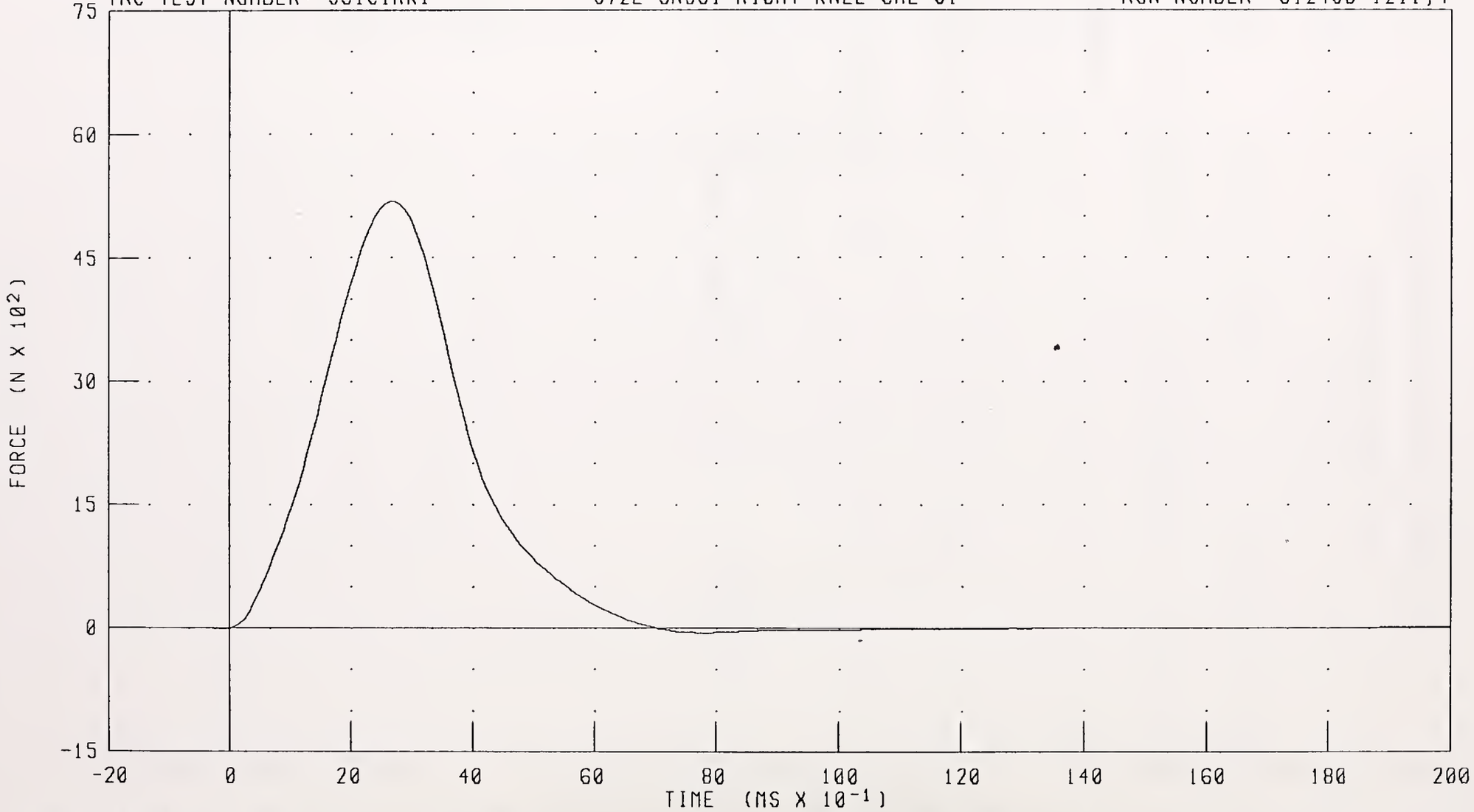


CHANNEL PENXG FILTER CH. CLASS 600 PEAK DATA: 106.00 G @ 2.64 MS; -1.13 G @ 7.84 MS

PART 572-E HYBRID III RIGHT KNEE CALIBRATION

PENDULUM FORCE (5 KG PEND)

TRC TEST NUMBER: 591C1RK1 572E SN591 RIGHT KNEE CAL 01 RUN NUMBER 012495 1211,4



CHANNEL: PENXF FILTER: CH. CLASS 600 PEAK DATA: 5186.21 N @ 2 64 MS; -55 38 N @ 7 84 MS

TRANSPORTATION RESEARCH CENTER INC.

LEFT KNEE IMPACT TEST

HYBRID III 14-DEC-94

TRC INC. TEST NO: 591C1LK1 572E SN591 LEFT KNEE CAL 01

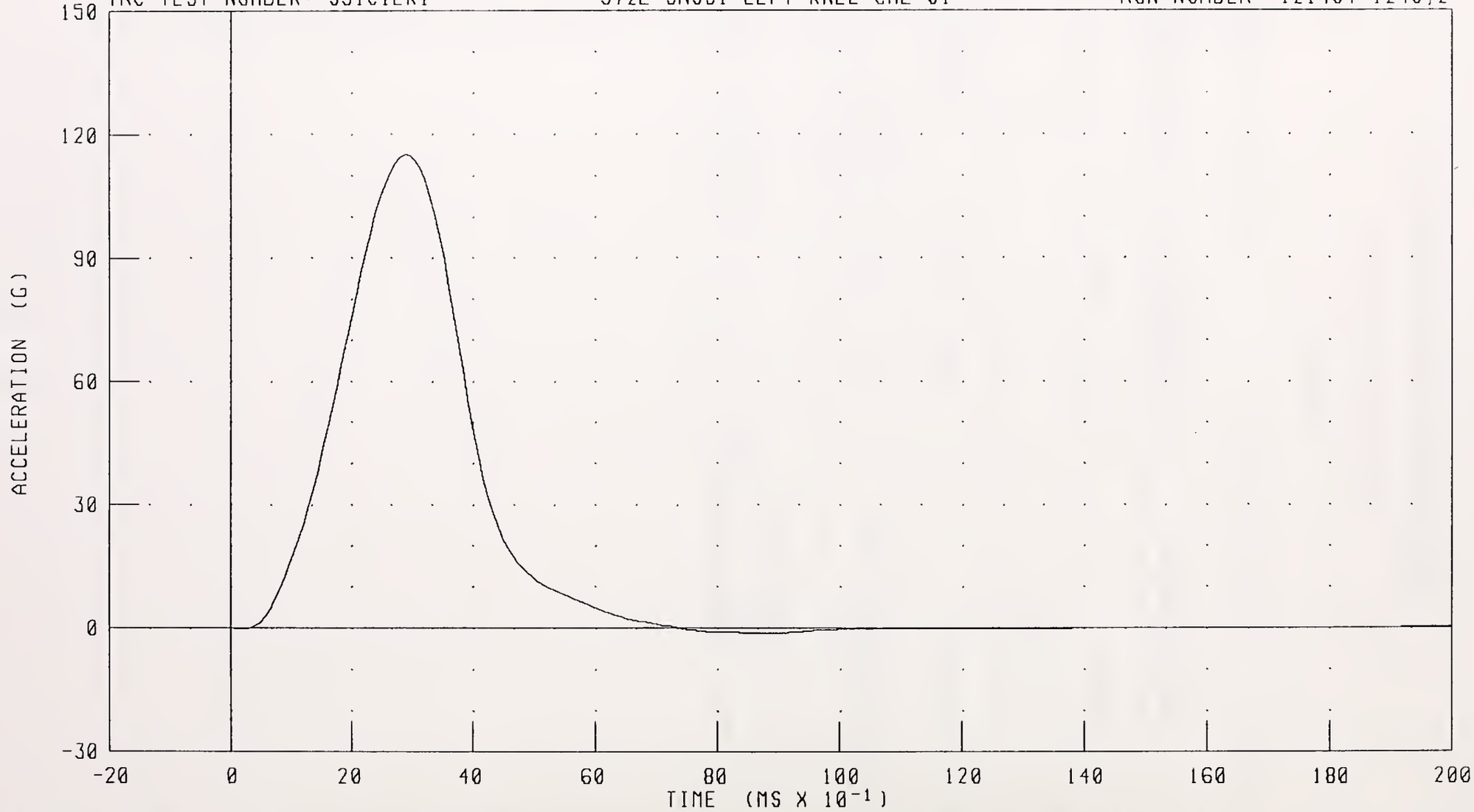
TEST PARAMETER	SPECIFICATION	TEST RESULTS
TEMPERATURE	18.9-25.6 DEG. C	20.6 DEG. C
RELATIVE HUMIDITY	10 - 70 %	27.0 %
PROBE VELOCITY	2.07 - 2.13 M/S	2.12 M/S
PEAK KNEE IMPACT FORCE 5.0 KG PENDULUM	4714 - 5783 N	5628.4 N

TEST MEETS SPECIFICATIONS

TECHNICIAN Pete Foster RUN NUMBER: 121494.1248;2

PART 572-E HYBRID III LEFT KNEE CALIBRATION
PENDULUM DECELERATION (5 KG PEND)

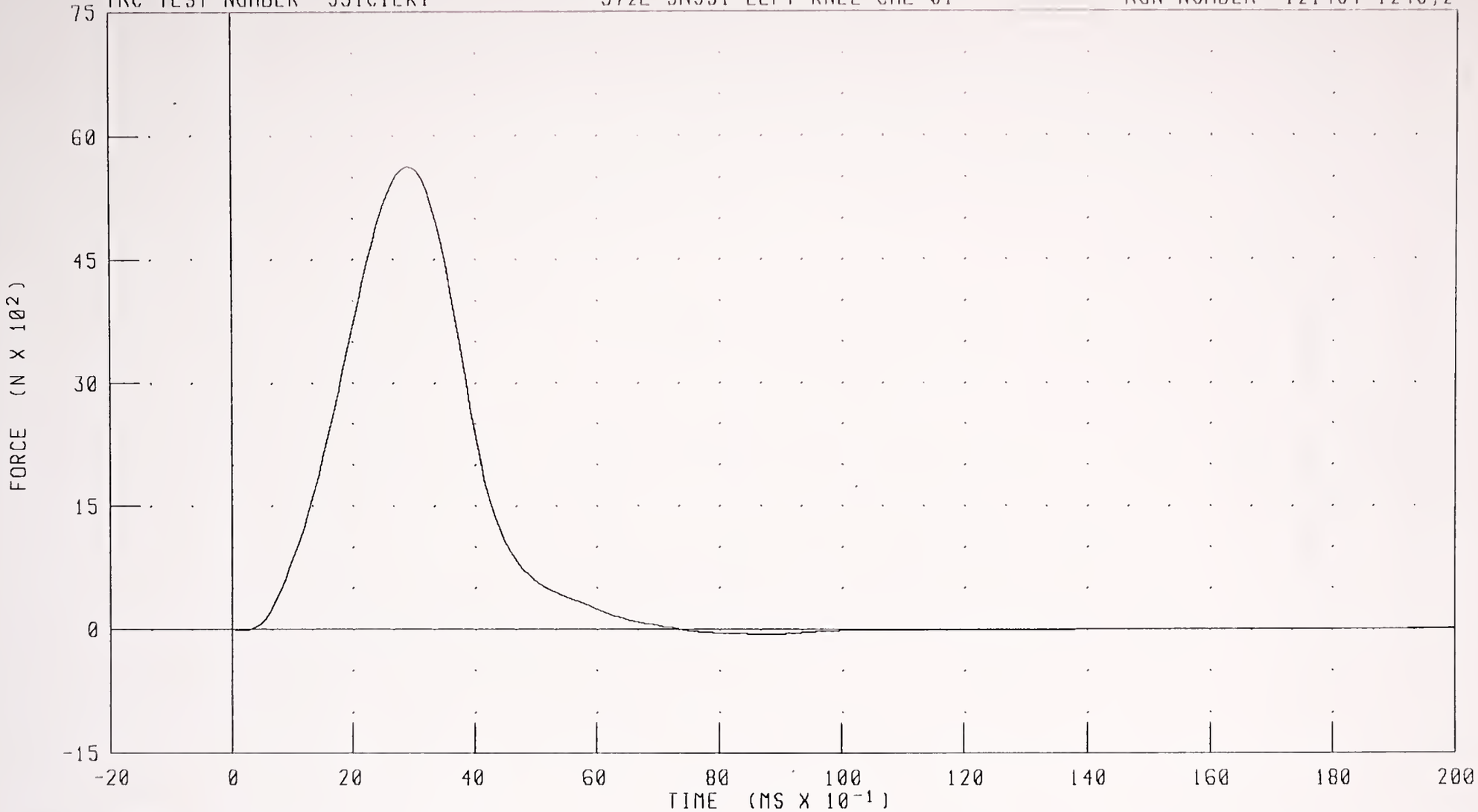
TRC TEST NUMBER 591C1LK1 572E SN591 LEFT KNEE CAL 01 RUN NUMBER 121494 1248,2



CHANNEL PENXG FILTER CH CLASS 600 PEAK DATA: 115 04 G @ 2.88 MS, -1 16 G @ 8 88 MS

PART 572-E HYBRID III LEFT KNEE CALIBRATION
PENDULUM FORCE (5 KG PEND)

TRC TEST NUMBER 591C1LK1 572E SN591 LEFT KNEE CAL 01 RUN NUMBER 121494 1248,2



CHANNEL PENXF FILTER CH CLASS 600 PEAK DATA 5628 46 N @ 2 88 MS, -56 89 N @ 8 88 MS

Appendix D

Miscellaneous Test Information

Dummy Instrumentation Placement

Dummy Manufacturer & S/N: Alderson Research Labs #551

Seating Position: Driver

Mnemonic	Location	Axis	Mfr.	Model	S/N	Orientation (+ Sensing)
HEDXG1	Head Acceleration	X	Endevco	7231C	GB86	Rear
HEDYG1	Head Acceleration	Y	Endevco	7231C	GB77	Left
HEDZG1	Head Acceleration	Z	Endevco	7231C	A54F	Up
CSTXG1	Chest Acceleration	X	Endevco	7231C	A98G	Forward
CSTYG1	Chest Acceleration	Y	Endevco	7231C	ADME5	Left
CSTZG1	Chest Acceleration	Z	Endevco	7231C	EM70	Down
CSTXD1	Chest Displacement	X	Servo	14CB1-2981	57	Outward
LFMF1	Left Femur Force		GSE	2430	160	Tension
RFMF1	Right Femur Force		GSE	2430	161	Tension

Dummy Instrumentation Placement

Dummy Manufacturer & S/N: Alderson Research Labs #591

Seating Position: Right Front Passenger

Mnemonic	Location	Axis	Mfr.	Model	S/N	Orientation (+ Sensing)
HEDXG2	Head Acceleration	X	Endevco	7231C	AH5C2	Rear
HEDYG2	Head Acceleration	Y	Endevco	7231C	AH5F6	Left
HEDZG2	Head Acceleration	Z	Endevco	7231C	AH5K7	Up
CSTXG2	Chest Acceleration	X	Endevco	7231C	AH5E0	Forward
CSTYG2	Chest Acceleration	Y	Endevco	7231C	AH484	Left
CSTZG2	Chest Acceleration	Z	Endevco	7231C	AD343	Down
CSTXD2	Chest Displacement	X	Vernitech	81422A	233	Outward
LFMF2	Left Femur Force		GSE	2430	224	Tension
RFMF2	Right Femur Force		GSE	2430	225	Tension

Vehicle Instrumentation Placement

Mnemonic	Location	Axis	Mfr.	Model	S/N	Orientation (+ Sensing)
TLRXG1	Left Rear Seat	X	Endevco	2264	EH78J	Rearward
TRRXG1	Right Rear Seat	X	Endevco	2264	AS95	Forward
BCRXG1	Right Brake Caliper	X	Endevco	2264	DP87	Forward
BCLXG1	Left Brake Caliper	X	Endevco	2264	BH37J	Forward
DPCXG1	Instrument Panel Center	X	Endevco	2264	AG24	Forward
OTHXG1	Front Battery Box	X	Endevco	2264	BG11J	Forward
OTHXG2	Rear Battery Box - Front	X	Endevco	2264	AK21	Forward
OTHZG3	Rear Battery Box - Front	Z	Endevco	2264	BH14J	Up
OTHXG4	Rear Battery Box - Rear	X	Endevco	2264	BC41J	Forward
OTHZG5	Rear Battery Box - Rear	Z	Endevco	2264	BI30J	Up
OTHXG6	Gear Box	X	Endevco	2264	BG20J	Forward
OTHZG7	Gear Box	Z	Endevco	2264	EJ60J	Up
TFCZG1	Trunk Floor Center	Z	Endevco	2264	AN45	Up

Sign Convention

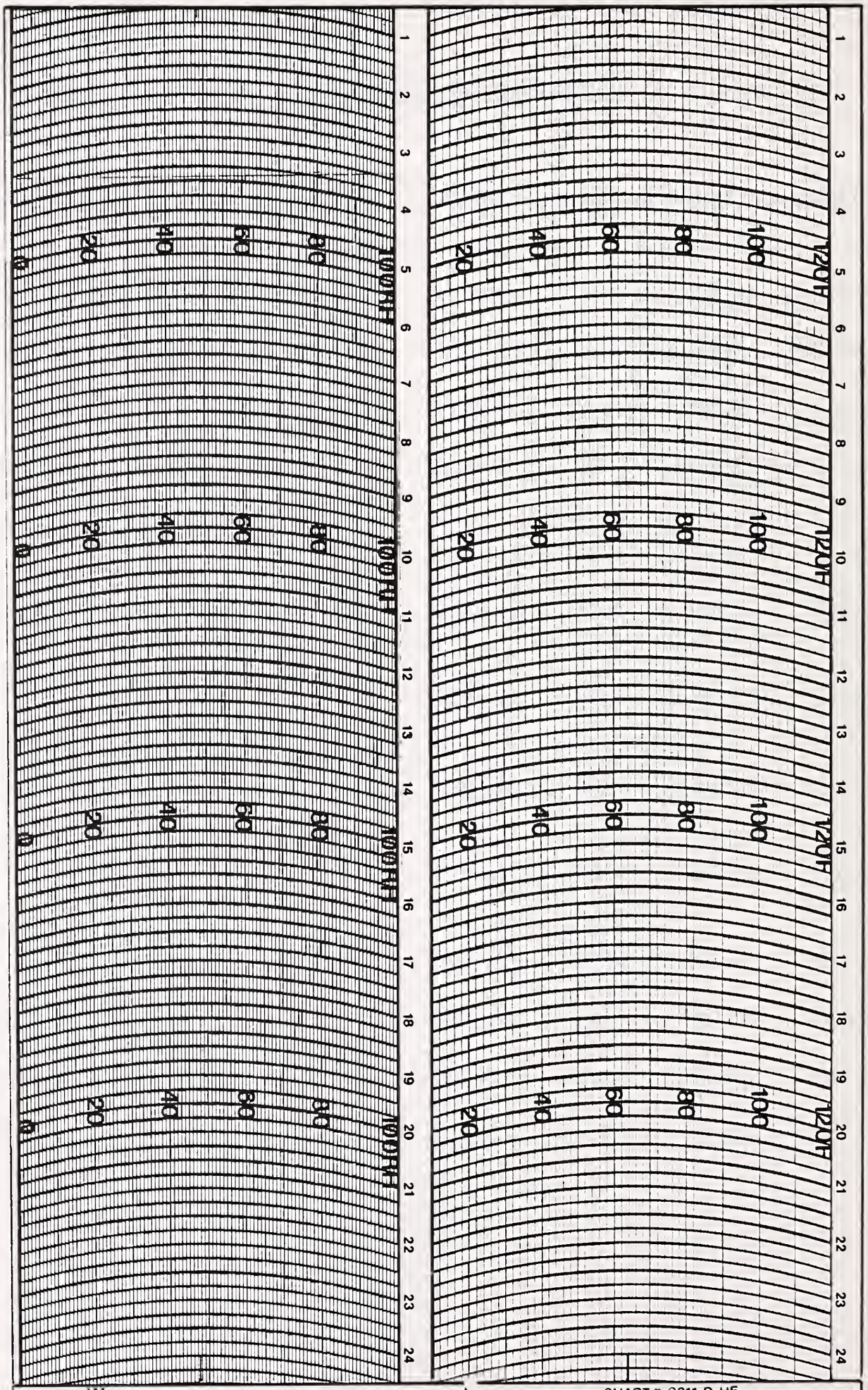
All Dummy, Barrier, And Vehicle Channels:

+X: Forward

+Y: Leftward

+Z: Upward

+Force: Tension



WEATHER MEASURE
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SACRAMENTO, CA. 95841
PHONE (916) 481-7565

HYGROTHERMOGRAPH
1 DAY

CHART # C311 D HF
PART # 699123

STATION _____ DATE ON _____ DATE OFF _____

Occupant Compartment Thermograph

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