



AETL

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APPROVED ENGINEERING TEST LABORATORIES / 1536 EAST VALENCIA / FULLERTON, CALIFORNIA 92631 / TEL. (714) 879-6110

A NATIONAL TECHNICAL SERVICES COMPANY

REPORT NOS. 212-AETL-81-019-971-3882-19
219-AETL-81-018-971-3882-18
301-AETL-81-038-971-3882-38

**NEW VEHICLE ASSESSMENT
AND
STANDARDS ENFORCEMENT INDICANT TESTING**

FMVSS NOS. 212, 219, AND 301-75

**AUDI NSU AUTO UNION AG
1981 AUDI 5000S - 4 DOOR SEDAN
NHTSA 810501**

**APPROVED ENGINEERING TEST LABORATORIES
1536 EAST VALENCIA DRIVE
FULLERTON, CALIFORNIA 92631**



JUNE 1981

FINAL REPORT

PREPARED FOR

**U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
- ENFORCEMENT -
OFFICE OF VEHICLE SAFETY COMPLIANCE
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WASHINGTON, D. C. 20590**



APPROVED ENGINEERING TEST LABORATORIES

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Date 30 June 1981

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Date 8/7/81

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9. Performing Organization Name and Address Approved Engineering Test Laboratories 1536 East Valencia Drive Fullerton, California 92631 Phone No.: (714) 879-6110				10. Work Unit. No.	
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16. Abstract New Vehicle Assessment and Standards Enforcement Inducant Test to the requirement of FMVSS 212, 219, and 301-75 on a 1981 Audi 5000S - 4 Door Sedan, NHTSA 810501, VIN-WAUGB043XBN049058 was conducted at Approved Engineering Test Laboratories test facility in Fullerton, California. The average vehicle impact speed was 34.70 mph in the frontal (0°) mode. Test date was June 12, 1981, and the ambient temperature was 73°F. The subject test vehicle appears to comply with all the requirements of FMVSS 212/219/301-75. The driver dummy experienced a HIC value of 1288 and the passenger dummy a HIC value of 1583; both are in excess of the limits specified in FMVSS 208. All other values appear to satisfy FMVSS 208.					
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APPROVED ENGINEERING TEST LABORATORIES

SECTION 1



SECTION 1

1.0 INTRODUCTION

This report contains information regarding a joint program for the Office of Vehicle Safety Compliance (OVSC), Office of Automotive Ratings (OAR), and Research and Development (R&D), for a vehicle assessment and standards enforcement indicant tests of windshield mounting, windshield zone intrusion, and fuel system integrity relative to Federal Motor Vehicle Safety Standard (FMVSS) No's. 212, 219 and 301-75. This test was performed under Contract Number DOT-HS-9-02273 by Approved Engineering Test Laboratories, 1536 East Valencia Drive, Fullerton, California, in accordance with the Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures (TP212-02).

The specific purpose of this test was to obtain research and vehicle rating data in conjunction with windshield mounting, windshield zone intrusion, and fuel system integrity indicant data, when a vehicle is impacted in excess of the velocity (30 mph) requirement of FMVSS 212, 219, and 301-75.

Section 2 contains general test and vehicle information, occupant/vehicle acceleration summary data, while Section 3 contains all compliance related data. Section 4 contains test dummy and vehicle measurements, along with camera positions. Section 5 discusses AETL's test facilities and data acquisition and reduction system. Appendix A contains additional



SECTION 1

photographs not related to vehicle compliance. Appendix B contains the computer-generated plots, while Appendix C contains the dummy certification reports if applicable.

1.1 ADMINISTRATIVE DATA

A. References

1. Federal Motor Vehicle Safety Standard No. 212 "Windshield Mounting" as published in the Federal Register, Volume 41, No. 36493, dated 30 August 1976.
2. Federal Motor Vehicle Safety Standard No. 219 "Windshield Zone Intrusion" as published in the Federal Register, Volume 40, No. 25462, dated 16 June 1975.
3. Federal Motor Vehicle Safety Standard No. 301-75 "Fuel System Integrity" as published in the Federal Register, Volume 40, No. 48352, dated 15 October 1975.
4. National Highway Traffic Safety Administration - Office of Vehicle Safety Compliance Laboratory Procedures for Vehicle Assessment and Standards Enforcement Indicant Testing for "Windshield Mounting", FMVSS 212 - "Windshield Zone Intrusion", FMVSS 219 - "Fuel System Integrity", FMVSS 301-75, TP 212-02, dated April 1, 1980.



APPROVED ENGINEERING TEST LABORATORIES

SECTION 1

B. Description of Test Vehicle

1. 1981 Audi 5000S - 4 Door Sedan
2. Vehicle Identification No.: WAUGB043XBN049058
3. NHTSA No.: 810501
4. Manufactured Date: February 1981
5. GVWR: 3,847 pounds

C. Dates

1. Vehicle Received: April 27, 1981
2. Start of Test: May 7, 1981
3. Completion of Test: June 12, 1981



APPROVED ENGINEERING TEST LABORATORIES

SECTION 2



SECTION 2

2.0 GENERAL TEST INFORMATION AND SUMMARY DATA

The 1981 Audi 5000S - 4 Door Sedan was subjected to a frontal fixed barrier impact and a static rollover maneuver as required by Federal Motor Vehicle Safety Standards Nos. 212/219/301-75.

Two (2) Part 572 test dummies were positioned in each front designated outboard seating position and were restrained by the belt system in the test vehicle. Just prior to the impact event, the driver dummy head was painted with red chalk and his knees were painted with yellow chalk. The passenger dummy head was painted with blue chalk and his knees were painted with red chalk to provide post-impact visual inspection of possible dummy head and knee contact with the interior components during the impact event.

2.1 INSTRUMENTATION MALFUNCTION

The driver dummy lap belt load response (Tape 1, channel 10) data was not acquired due to apparent cable failure.

TABLE I
SUMMARY OF TEST CONDITIONS

TEST VEHICLE INFORMATION:

Manufacturer: Audi NSU Auto Union AG
Make/Model: Audi 5000S
Body Style: 4 Door Sedan Model Year: 1981
VIN: WAUGB043XBN049058 Build Date: February 1981
NHTSA No.: 810501 Color: Black
Engine Data: Five (5) Cylinders; 131.0 Cu. In. Displ.
Transmission Data: Three (3) Speed () Manual (X) Automatic
Major Options: None

VEHICLE ATTITUDE:

Delivered Attitude: LF 26.5 in.; RF 27.0 in.; LR 26.5 in.; RR 26.5 in.
Test Attitude: LF 25.8 in.; RF 25.9 in.; LR 24.7 in.; RR 25.0 in.

VEHICLE TIRE DATA:

Recommended Cold Tire Pressure: Front = 28 psi
(Up to Vehicle Load Capacity) Rear = 32 psi
Recommended Tire Size: 185/70SR14 Load Range: 1210 @ 36 psi
Tires on Vehicle: 185/70SR14 - Goodyear
Spare Tire: X Yes; No; Space Saver: X Yes; No

Note: Minispare T115/70D15 -
Goodyear - 60 psi

TABLE Ia

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST CONDITIONS:

Date of Test: June 12, 1981 Time of Test: 1439
Ambient Temperature: 88 °F at Impact Area

VEHICLE CAPACITY:

Type of Seats: Bench; X Bucket; Split Bench

Designated Seating Capacity:	Front	<u>2</u>
	Center	<u>0</u>
	Rear	<u>3</u>
	Total	<u>5</u>

Cargo: 210 lbs.

Total 960 lbs. (Vehicle Capacity Weight)

GVWR: 3,847 lbs. (Taken From Certification Label)

GAWR: Front 2,116 lbs.; Rear 1,829 lbs.

VEHICLE DELIVERED WEIGHT: (Fuel - 93% of NFC)

Left Front	<u>922</u> lbs.	Left Rear	<u>507</u> lbs.
Right Front	<u>872</u> lbs.	Right Rear	<u>532</u> lbs.
Total Front Weight	<u>1,794</u> lbs.	(<u>63.3</u> % of Total Vehicle Weight)	
Total Rear Weight	<u>1,039</u> lbs.	(<u>36.7</u> % of Total Vehicle Weight)	
Total Delivered Weight	<u>2,833</u> lbs.		

CALCULATED VEHICLE TEST WEIGHT: 3,371 lbs.
(With Required Dummies and 210 lbs. Cargo)

ACTUAL VEHICLE TEST WEIGHT:

Left Front	<u>1,017</u> lbs.	Left Rear	<u>690</u> lbs.
Right Front	<u>950</u> lbs.	Right Rear	<u>704</u> lbs.
Total Front Weight	<u>1,967</u> lbs.	(<u>58.5</u> % of Total Vehicle Weight)	
Total Rear Weight	<u>1,394</u> lbs.	(<u>41.5</u> % of Total Vehicle Weight)	
Total Test Weight	<u>3,361</u> lbs.		

TABLE 1b

SUMMARY OF TEST CONDITIONS (Cont'd)

TEST FLUID DATA:

Test Fluid Type: Red Stoddard Solvent ; Specific Gravity: 0.764

Kinematic Viscosity: 1.31

Nominal Fuel Capacity: 20.00 gals. (NFC)

Test Volume: 18.41 gals. (92-94% of NFC)

Fuel System Capacity: 19.80 gals.
(Data from Owner's Manual)

Electric Fuel Pump: X Yes; No; Fuel Injection: X Yes; No

Does Electric Fuel Pump Operate with Ignition Switch "On"

And the Engine Not Operating: Yes; X No; N/A

Details of Fuel System: Fuel filler located on right rear fender aft of
wheel opening recessed behind a hinged door, fuel tank located horizon-
tally between frame side rails forward of the rear suspension under
rear seat floor pan.

VEHICLE TEST CONDITIONS:

Temperature in Occupant Compartment: 73 °F

Temperature of Windshield Glazing/Moulding: 77 °F

VEHICLE CRUSH AND REBOUND:

Overall Length of Test Vehicle: Pre-Test - Left 183.2 in.; Right 183.2 in.

Post-Test - Left 159.5 in.; Right 161.0 in.

Crush: Left 23.7 in.; Right 22.2 in.

Rebound (From Rigid Barrier Only): 17.0 in.

TABLE III

POST IMPACT SUMMARY

Vehicle 1981 Audi 5000S

NHTSA No. 810501 Test Date June 12, 1981

TYPE OF TEST: ☒ 0° Frontal Impact
☐ 30° Oblique Impact (Driver/Passenger) Side
☐ Rear Impact

REQUIRED IMPACT VELOCITY RANGE: 34.5 to 35.5 mph

IMPACT VELOCITY: (Traps within 5 feet of impact event)

Trap 1 = N/R mph

Trap 2 = 34.70 mph

Average 34.70 mph

Actual distance from vehicle front bumper to barrier
face when entering timing trap 59.0 in.

Actual distance from vehicle front bumper to barrier
face when exiting timing trap 35.0 in.

VEHICLE STATIC CRUSH: Driver's Side = 23.7 inches
Passenger's Side = 22.2 inches
Average = 22.95 inches

Crush Details: Windshield broken, roof buckled over both "B" posts,
front floor pan buckled, driver dummy impacted steering wheel and dash
assembly, passenger dummy impacted dash assembly.

VEHICLE REBOUND: (From rigid barrier only)

Driver's Side = 17.0 inches

Passenger's Side = 17.0 inches

Average = 17.0 inches



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SECTION 3



SECTION 3

3.0 TEST DATA

The 1981 Audi 5000S - 4 Door Sedan was subjected to a frontal fixed barrier impact and a static rollover maneuver as required by Federal Motor Vehicle Safety Standard Nos. 212/219/301-75.

Color motion picture coverage of the impact along with the static rollover test are considered part of the accumulated pertinent data. Where applicable still photographs are presented in this report; while the motion picture coverage is submitted separately.

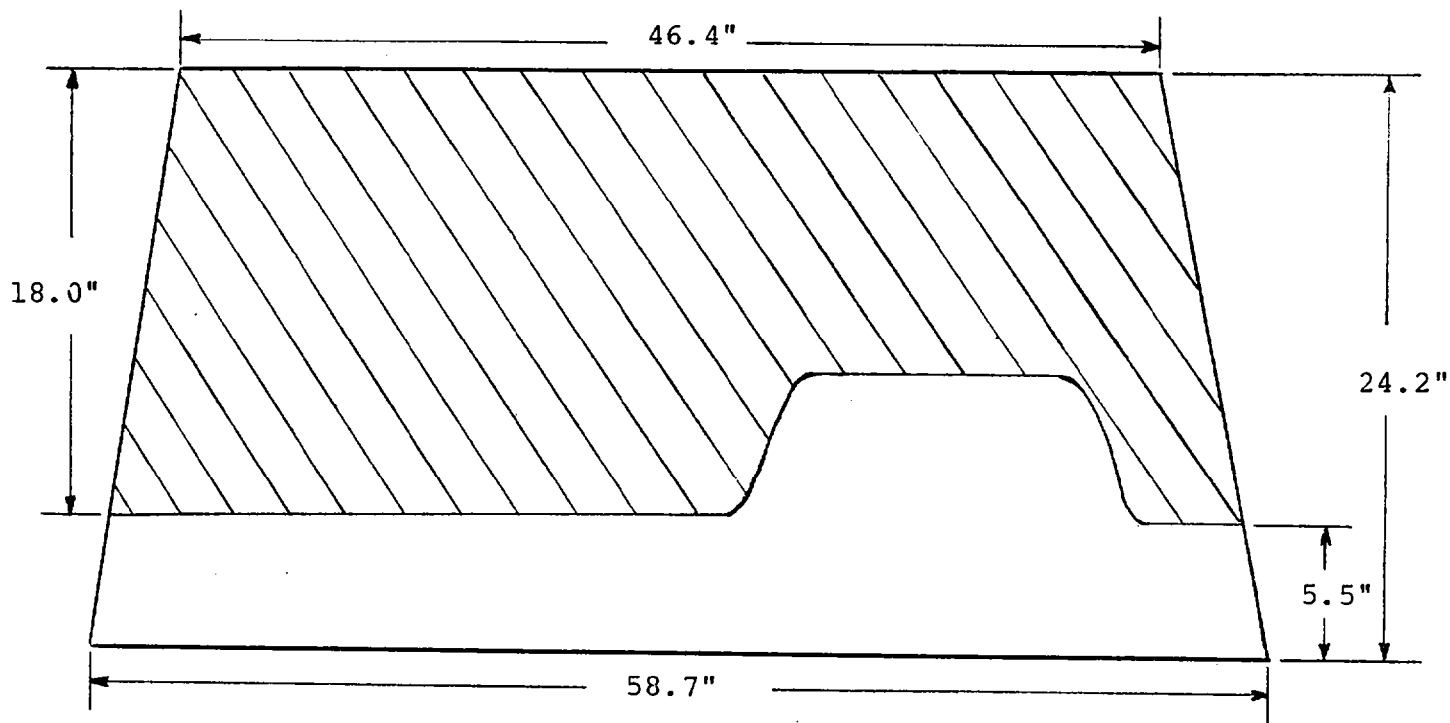
SUMMARY OF TEST CONDITIONS
WINDSHIELD ZONE INTRUSION FMVSS 219

Vehicle 1981 Audi 5000S

NHTSA No. 810501

Test Date June 12, 1981

PROTECTED AREA



FRONT VIEW OF WINDSHIELD

Provide all dimensions necessary to reproduce the protected zone.

Method of adhering styrofoam to the windshield _____

Panel and Foam Adhesive

Details of Special Windshield Retention Clips (If Applicable) _____

Not Applicable

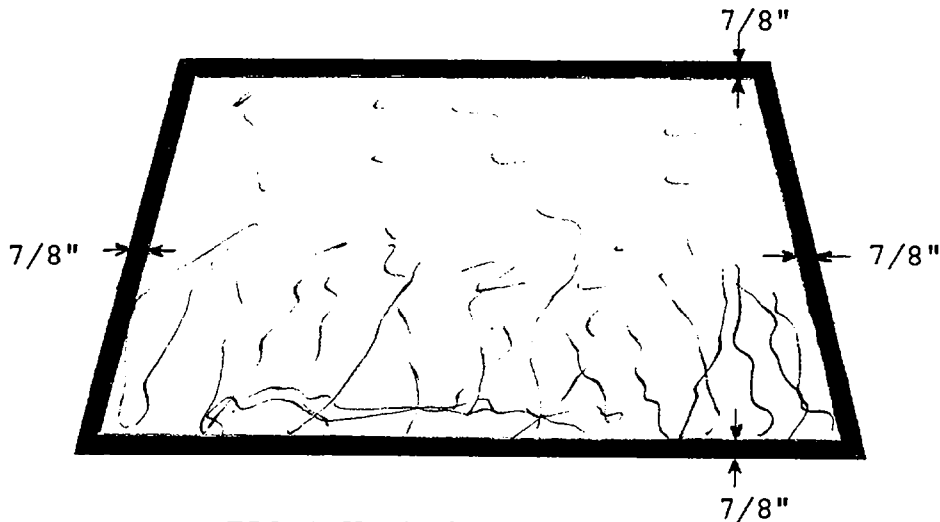
POST IMPACT SUMMARY

WINDSHIELD RETENTION - FMVSS 212

Vehicle 1981 Audi 5000S

NHTSA No. 810501

Test Date June 12, 1981



FRONT VIEW OF WINDSHIELD

	Windshield Periphery	
	Pre Test	Post Test
Left Side	77.7 in.	77.7 in.
Right Side	78.0 in.	78.0 in.
Total	155.7 in.	155.7 in.

Type of Occupant Restraints: Combination Lap/Shoulder

Windshield Retention:	Actual	Min. Allow
Left Side	100.0	37.5 percent
Right Side	100.0	37.5 percent
Total	100.0	75.0 percent

Details of Windshield Mounting: A chrome trim moulding encompasses the windshield glass and apparent adhesive is used between the glass and body opening.

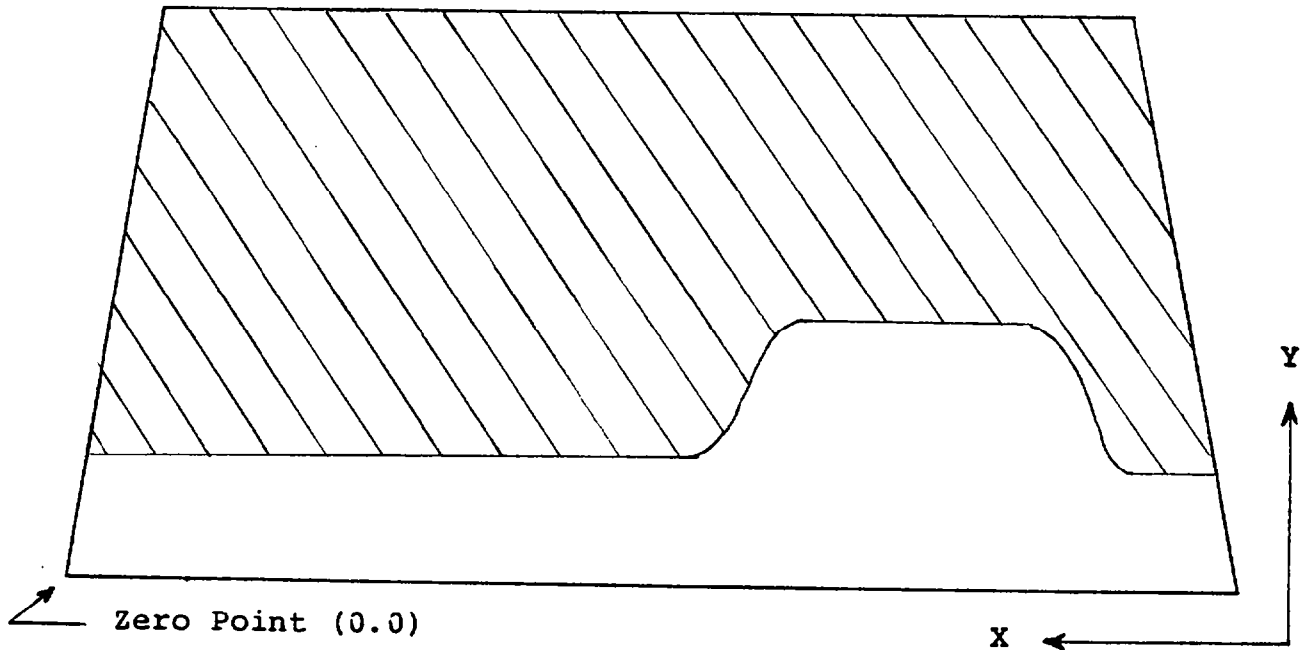
POST IMPACT SUMMARY

WINDSHIELD ZONE INTRUSION - FMVSS 219

Vehicle 1981 Audi 5000S

NHTSA No. 810501

Test Date June 12, 1981



FRONT VIEW OF WINDSHIELD

- (A) The area that the "Protected Zone" template was penetrated more than 0.25 inches by a vehicle component other than one which is normally in contact with the windshield

Not Applicable

Coordinates

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

- (B) The area beneath the "Protected Zone" that the inner surface of the windshield was penetrated by a vehicle component.

Not Applicable

Coordinates

X	Y
N/A	N/A
N/A	N/A
N/A	N/A
N/A	N/A

TABLE VI

POST IMPACT SUMMARY

FUEL SYSTEM INTEGRITY - FMVSS 301-75

Vehicle 1981 Audi 5000S

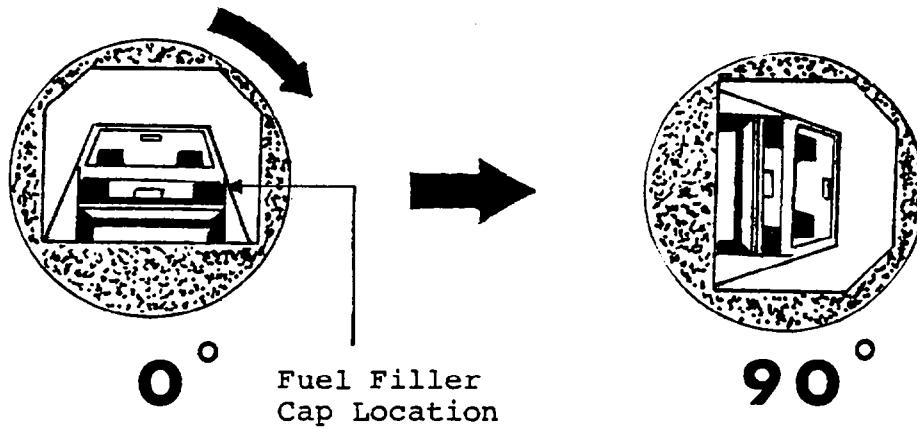
NHTSA No. 810501 Test Date June 12, 1981

	Actual	Max. Allow.
Fuel spillage from impact until vehicle motion ceases.	- 0 -	1 ounce
Fuel spillage for 5 minute period following cessation of vehicle motion after impact.	- 0 -	5 ounces
Fuel spillage for next 25 minute period.	- 0 -	1 ounce/ 1 minute
Time duration from impact until start of rollover test periods.	29 min. 15 sec.	30 minutes

Fuel Spillage Location: Not Applicable

TABLE VII
FUEL SYSTEM INTEGRITY - FMVSS 301-75
STATIC ROLLOVER

Vehicle 1981 Audi 5000S NHTSA No. 810501

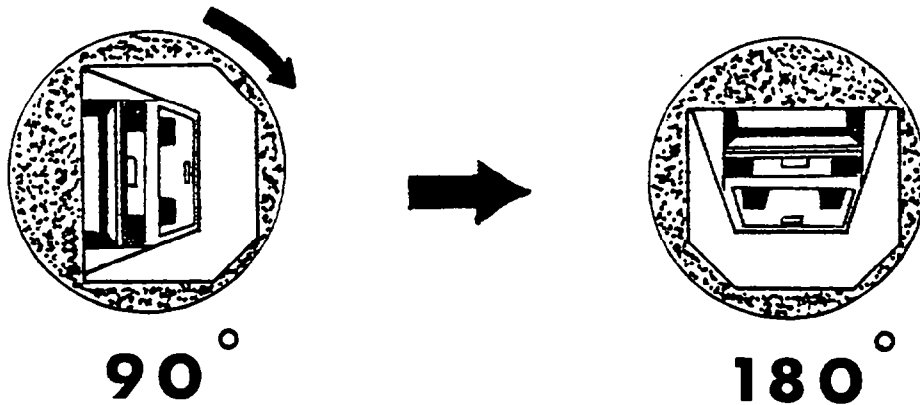


	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 12 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable

TABLE VIII
FUEL SYSTEM INTEGRITY - FMVSS 301-75
STATIC ROLLOVER

Vehicle 1981 Audi 5000S NHTSA No. 810501

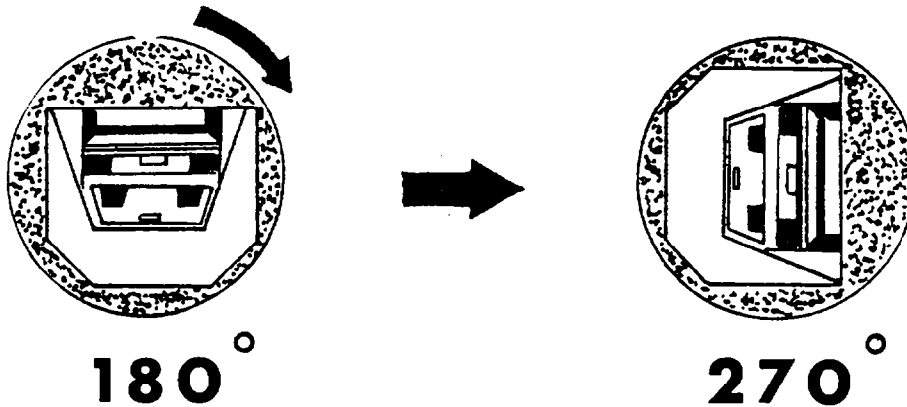


	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 11 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable

TABLE IX
FUEL SYSTEM INTEGRITY - FMVSS 301-75
STATIC ROLLOVER

Vehicle 1981 Audi 5000S NHTSA No. 810501

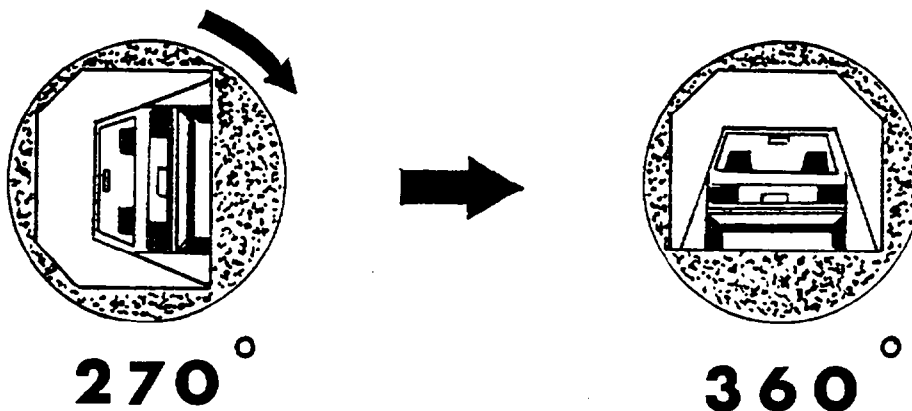


	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 18 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable

TABLE X
FUEL SYSTEM INTEGRITY - FMVSS 301-75
STATIC ROLLOVER

Vehicle 1981 Audi 5000S NHTSA No. 810501



	Actual	Max. Allowed
Rollover fixture 90° rotation time	2 min. 14 sec.	1 to 3 Minutes
Fuel spillage during 5 minute period from onset of rotation	- 0 -	5 ounces
Fuel spillage during 6th minute period from onset of rotation	- 0 -	1 ounce
Fuel spillage during 7th minute period from onset of rotation	- 0 -	1 ounce

Fuel Spillage Location: Not Applicable



SECTION 3

3.1 TEST RESULTS AND PHOTOGRAPHS

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Post-impact inspection of the test vehicle revealed almost all crush occurred forward of the rear doors. The roof buckled over both left and right "B" post. The front passenger compartment floor pan buckled and the front doors were jammed. The driver dummy head and chest made contact with the steering wheel assembly and both knees impacted the dash assembly. The passenger dummy head and both knees impacted the dash assembly.

The windshield assembly revealed no apparent retention loss during the impact event. The windshield had numerous cracks developed by the apparent cowl/body deformation. A chrome trim moulding encompasses the windshield glass, retained in the body opening with body clips. Apparent adhesive is used between the body opening and the windshield glass.

No windshield zone intrusion was recorded following the test vehicle impact. The protected windshield zone area did not appear to have been contacted by an object sufficiently to penetrate the styrofoam template outer surface. The unprotected windshield zone area was not penetrated by an object, although the windshield experienced numerous cracks developed by the apparent cowl/body deformation.



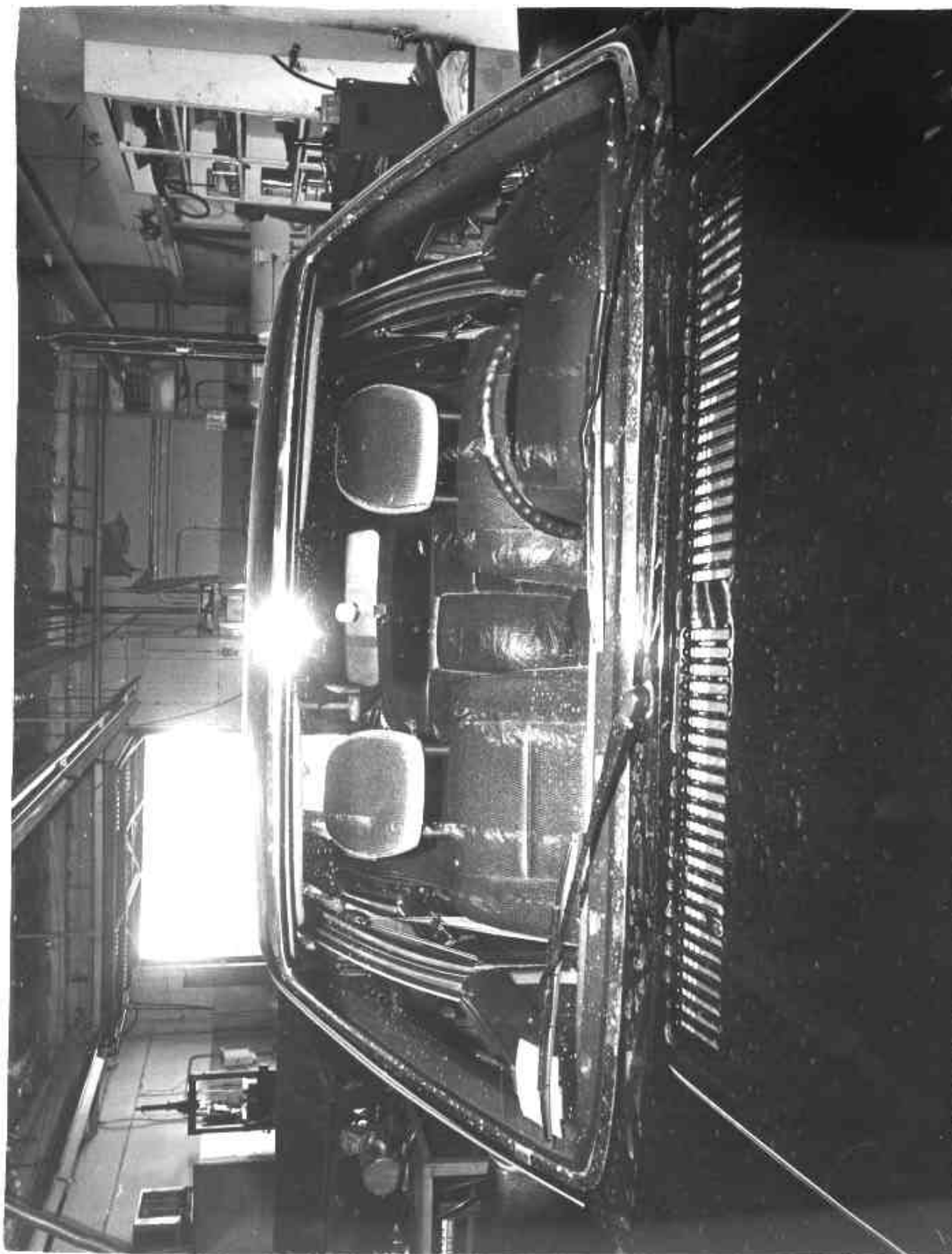
SECTION 3

No fuel spillage was recorded following the test vehicle impact, nor during the time period before the start of the rollover test. No fuel spillage was recorded during the rollover test increment time periods.

The 1981 Audi 5000S - 4 Door Sedan test vehicle appears to comply with all the requirements of FMVSS 212/219/301-75.



Figure 3-1
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Pre-Test, Windshield View





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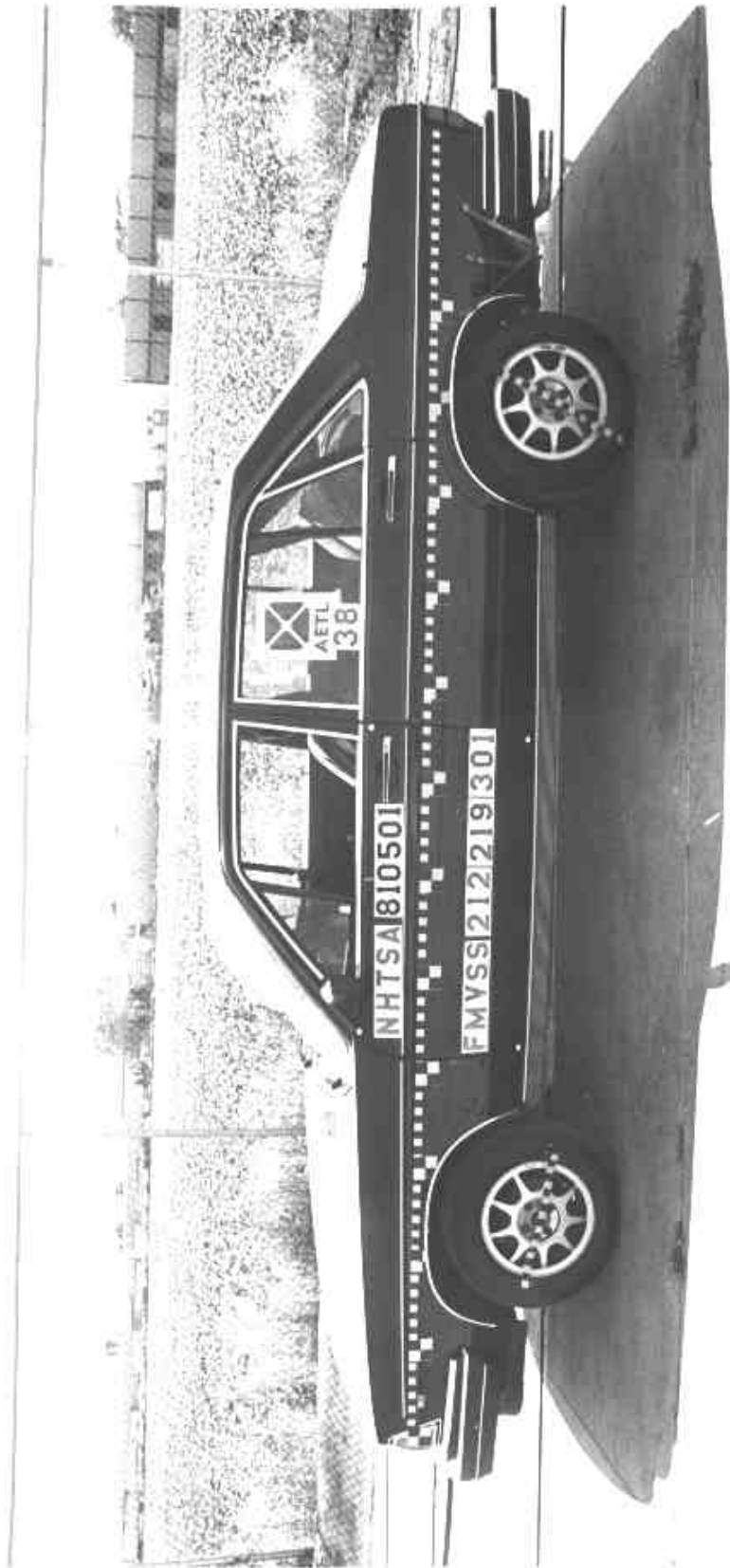
Figure 3-2
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Pre-Test, Windshield Template View





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Figure 3-3
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Pre-Test, Left Side View





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Figure 3-4
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Pre-Test, Full Front View





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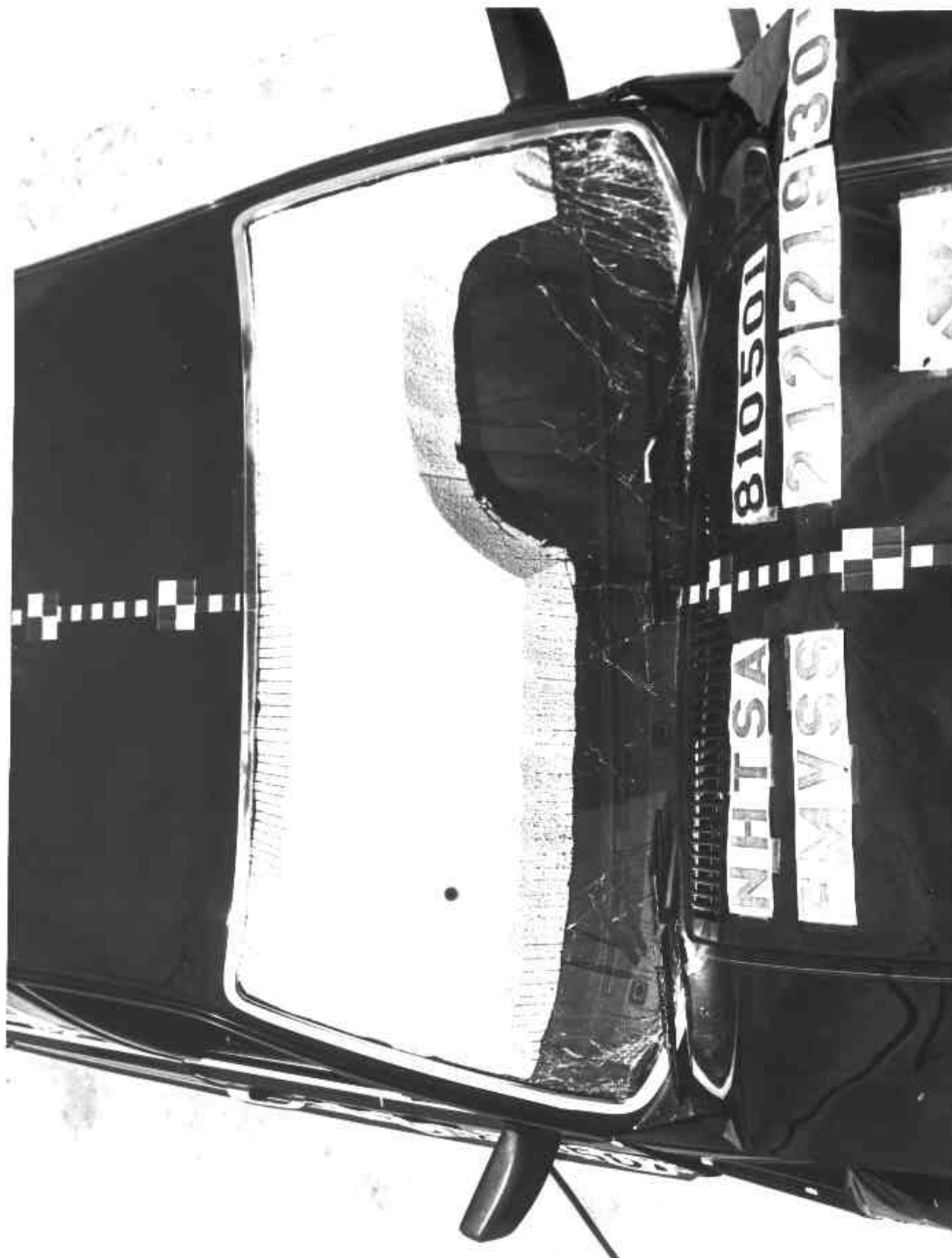
Figure 3-5
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Pre-Test, Right Side View





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Figure 3-6
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Post-Impact, Windshield View





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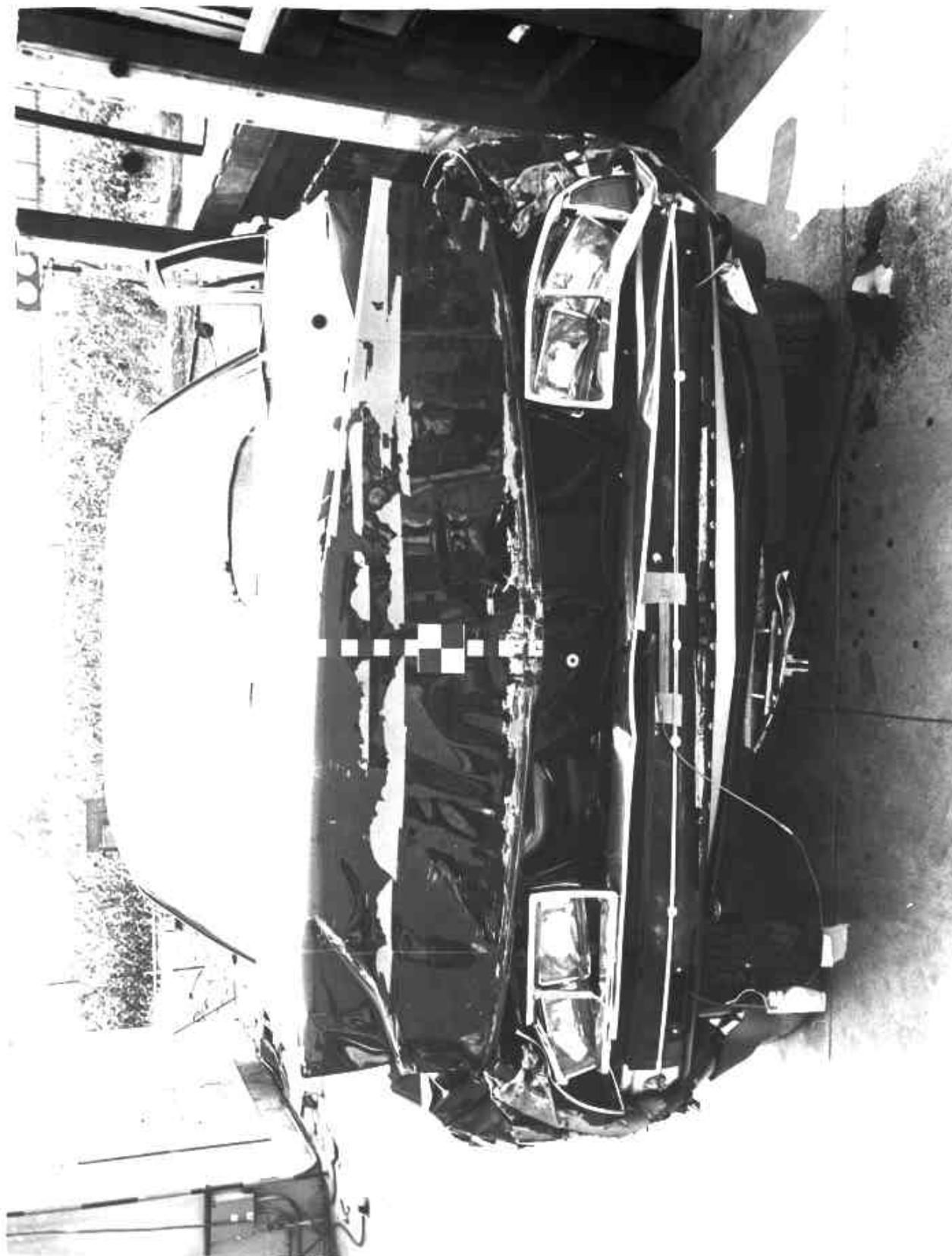
Figure 3-7
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Post-Impact, Left Side View





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Figure 3-8
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Post-Impact, Full Front View





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Figure 3-9
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Post-Impact, Right Side View





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Figure 3-10

1981 Audi 5000S - 4 Door Sedan

NHTSA 810501

Post-Impact, Rollover Test, 90° Increment





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Figure 3-11

1981 Audi 5000S - 4 Door Sedan

NHTSA 810501

Post-Impact, Rollover Test, 270° Increment





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SECTION 4



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SECTION 4

4.0 OCCUPANT RESPONSE AND VEHICLE ACCELERATION SUMMARY DATA

The following data sheets summarize:

- A. The Dummy Position Data (Part 572 Dummy In-Vehicle Position/Part 572 Dummy Pre-Test Clearance Distances Sheets)
- B. The Occupant Response Data (Part 572 Dummy Data Sheet)
- C. The Vehicle Acceleration Data (Vehicle Structural Data Sheet)
- D. The Pre and Post-Test Vehicle Dimensions Data (Vehicle Measurement Data Sheet)

More comprehensive data is presented in Appendix B in the form of computer-generated plots.



SECTION 4

The driver dummy experienced a HIC value of 1288 and the passenger dummy experienced a HIC value of 1583, both in excess of the limit specified in FMVSS 208 injury criteria. All other values from both test dummies satisfy the FMVSS 208 requirements.

In addition to the occupant and vehicle data, each shoulder belt was marked at the D-ring, after dummy positioning, to provide a static measurement of belt position after the impact event. Post-impact measurement of the driver shoulder belt was 2.8 inch and the passenger shoulder belt was 3.5 inch.

TABLE 4-1
PART 572 DUMMY IN-VEHICLE POSITION

VEHICLE 1981 Audi 5000S NHTSA NO. 810501

POSITIONING DATE: June 12, 1981 AMBIENT TEMP: 73 °F TIME 1314

SEAT TYPE: Bench
 X Bucket
 Split Bench

ADJUSTER TYPE: X Manual
 Power

BUCKET SEAT BACK TYPE: Fixed
 X Adjustable Reclining

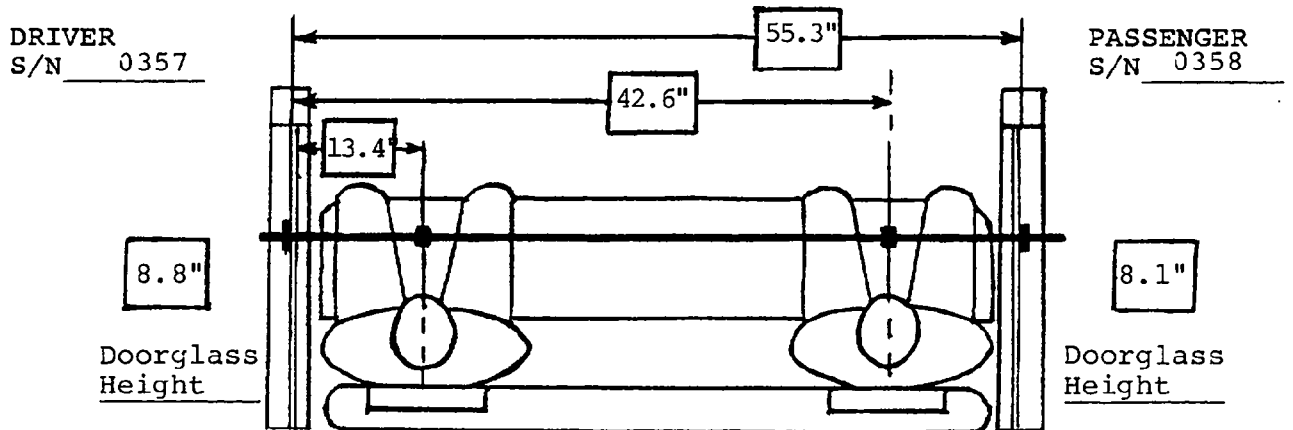
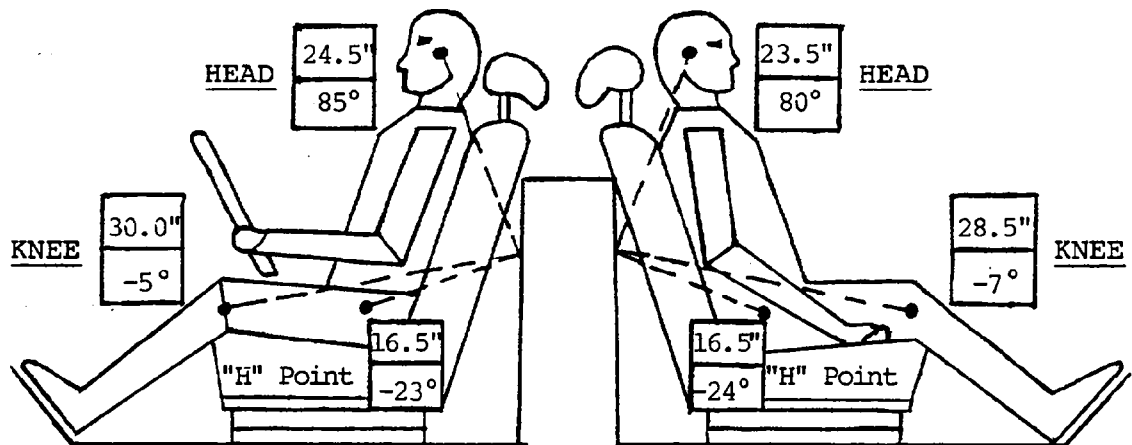


TABLE 4-2

PART 572 DUMMY PRE-TEST CLEARANCE DISTANCES

DRIVER

HH = 15.5 in.

HW = 20.0 in.

HR = 6.5 in.

HS = 9.0 in.

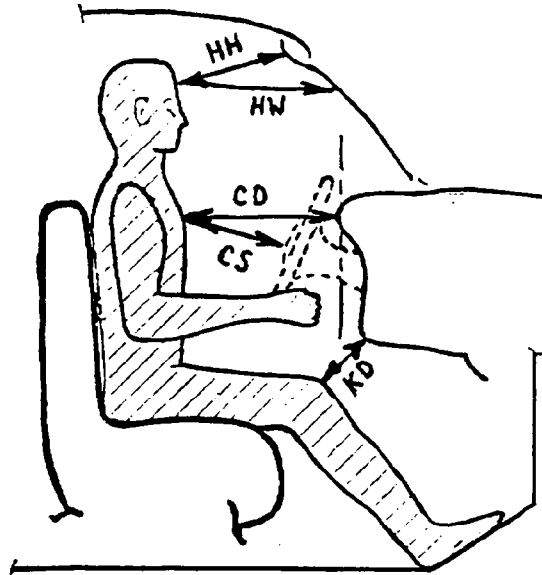
CD = 21.8 in.

CS = 14.3 in.

AD = 4.6 in.

HD = 7.9 in.

KD = 4.1 in.



PASSENGER

HH = 16.0 in.

HW = 21.0 in.

HR = 6.0 in.

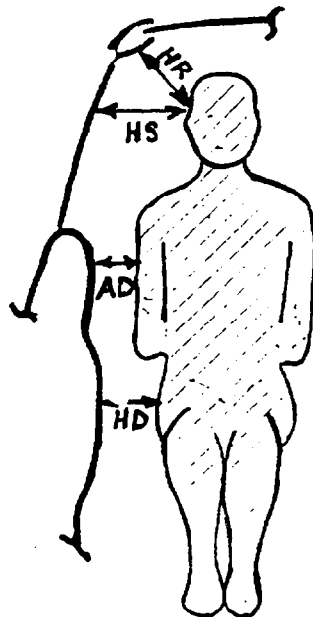
HS = 9.5 in.

CD = 22.0 in.

AD = 5.0 in.

HD = 8.0 in.

KD = 5.5 in.



MANUFACTURERS SEAT BELT INSTRUCTIONS

Safety belts

Lap/shoulder belts for front seats

Belt warning system

An audio-visual warning system is interconnected with the driver's safety belt.

Every time the ignition is turned on, the safety belt warning light will come on for about 6 seconds as a reminder to buckle up. If the driver does not fasten the safety belt, the bell will also ring for the duration of this six second period. With the driver's door closed, the bell will go off as soon as the driver has buckled up.

Inertia reel retractor

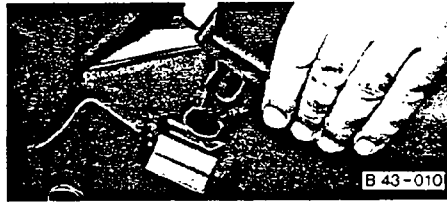
The one-piece lap/shoulder belt with inertia reel locking mechanism adjusts automatically to your size and movements as long as the pull on the belt is slow.

Rapid deceleration during hard braking or a collision locks the belt. The belt will also lock when you drive up or down a steep hill or in a sharp curve.

To release a locked belt, lean back to take the body pressure off the belt.

Notes

- For your and your passenger's protection, use safety belts at all times while the car is in motion.
- Do not strap in more than one person with each belt.
- Belts should not be worn twisted.
- For maximum effectiveness, the lap belt should be worn low across the pelvic crest.
- Do not wear belts over rigid or breakable objects in or on your clothing, such as eye glasses, pens, keys, etc. as these may cause injury.
- Several layers of heavy clothing may interfere with proper positioning of belts.
- Belts must not rub against sharp objects.
- Keep belt buckles free of any obstruction that may prevent secure locking.
- Make sure the belt of the unoccupied passenger seat is fully wound up on its retractor so that the belt tongue is in its stowed position. This reduces the possibility of the tongue becoming a striking object in case of a sudden stop.



- To fasten, grasp belt tongue and pull belt in continuous slow motion across your chest and lap.
- Insert belt tongue into buckle on inboard side of seat. Push down until it is securely locked with an audible click.
- Pull shoulder section to make sure belt fits snugly across the hips.
- Belts should fit snugly across lap and chest. Make sure any slack is wound on the retractor.
- Do not wear shoulder part of belt under your arm or otherwise out of position. This would increase the possibility of serious injury in case of an accident.
- To unfasten belt, push in release marked PRESS on buckle. Belt will spring out of buckle.
- To store lap/shoulder belt, allow belt to wind up on retractor as you guide belt tongue to its stowed position on doorpost.

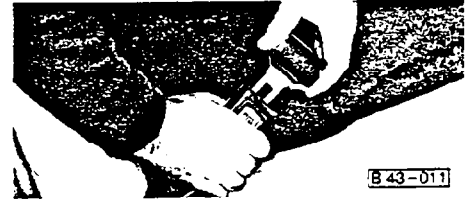
A shoulder belt should not be worn by a person less than 4'7" or 1.4 m in height, because it would not be in its most protective position, and therefore may increase the possibility of injury in a collision.

For a person between 4'7"/1.40 m and 5'7"/1.70 m in height, or with an erect seating height between 2'5"/74 cm and 2'11"/90 cm we recommend that the safety belt be fastened to the lower anchorage point on the doorpost. Ask your Audi dealer to mount the belt on this point.

Persons smaller than 4'7" or 1.40 m in height, and children who are able to sit upright by themselves, should use one of the rear seating positions and the lap belt provided.

Children who are not able to sit upright by themselves should use a child's seat.

A child's seat should not be fastened with the front seat safety belts as the diagonal belt portion will not provide the needed protection.



Lap belts for rear seats

The automatic retractor will lock the rear seat lap belt as soon as your passenger has buckled up.

Note

The belt can only be pulled out when it is fully retracted.

- To fasten lap belt; grasp belt tongue on outboard side of seat and slowly pull across lap. Insert belt tongue into buckle on inboard side of seat and push down until it is securely locked with an audible click.
- To unfasten belt, push in release marked PRESS in the buckle.
- To store belt, allow belt to wind up as you guide belt tongue to retractor.

Belt tongue and buckle should always be kept on top of seat for ready use.

Belt care

- Belts that have been subjected to excessive stretch forces in an accident should be replaced.
- If belts show damage to webbing, bindings, buckles or retractors, they should be replaced.
- If belts do not work properly, see your Audi dealer to have them repaired or replaced.
- Do not modify or disassemble the safety belts in your car.
- Keep belts clean, if they need cleaning, use a mild soap solution, but do not remove belts from car. DO NOT use other cleaning agents as they will weaken the webbing.
- NEVER bleach or dye safety belts.
- DO NOT allow safety belts to retract until they are completely dry.

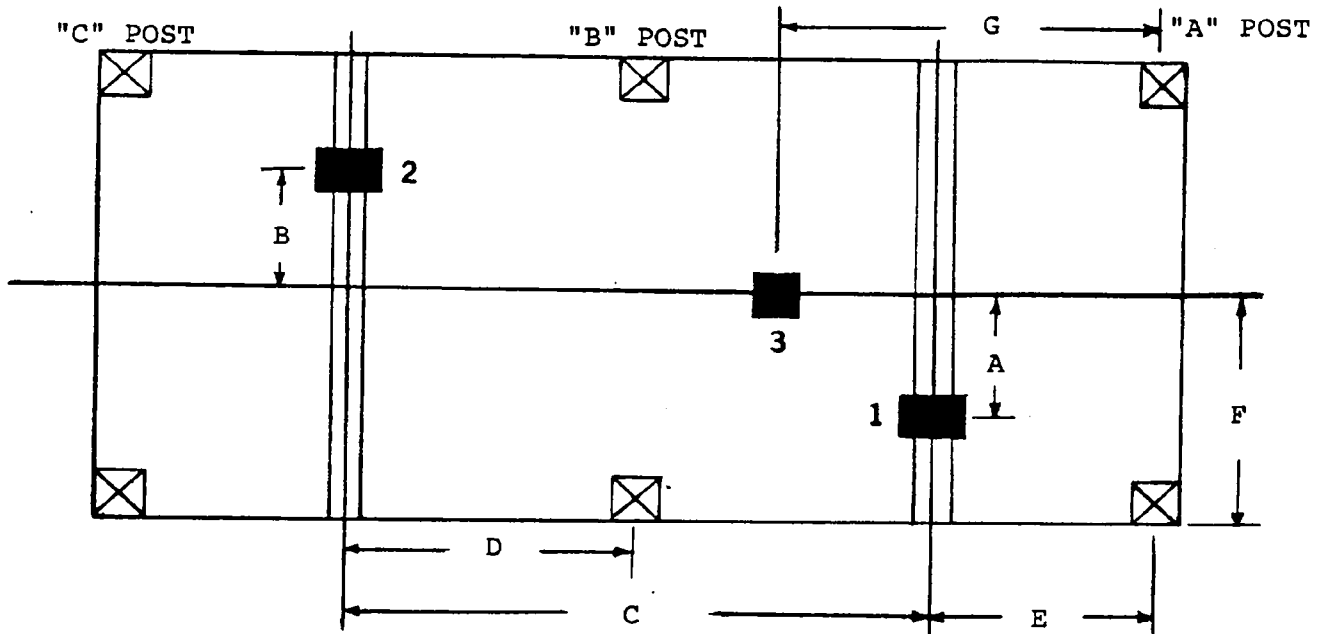
PART 572 DUMMY DATA

NHTSA No. 810501

Driver S/N <u>0357</u> Passenger S/N <u>0358</u>	DRIVER				PASSENGER			
	Positive* Direction		Negative* Direction		Positive* Direction		Negative* Direction	
	Peak G	Time (msec)	Peak G	Time (msec)	Peak G	Time (msec)	Peak G	Time (msec)
HEAD ACCELERATION								
Longitudinal	4.6	124.2	125.4	70.0	1.2	28.8	48.3	107.6
Lateral	21.6	72.0	28.9	64.2	4.8	204.0	19.1	107.2
Vertical	40.1	65.2	72.3	68.6	1.6	23.4	77.1	86.2
Resultant	131.8	70.2			83.9	86.2		
HIC	1288 (64 - 76 msec)				1583 (59 - 116 msec)			
CHEST ACCELERATION								
Longitudinal	13.1	95.2	43.3	56.4	2.3	169.2	53.2	79.0
Lateral	5.8	71.2	2.3	84.8	13.4	78.0	5.8	89.4
Vertical	17.0	69.0	13.0	42.6	9.7	133.2	10.4	56.4
Resultant	43.8	61.0			54.5	79.0		
CSI	341 (42.5 g - 3 msec clip)				569 (51.8 g - 3 msec clip)			
	(1b)	Time (msec)	(1b)	Time (msec)	(1b)	Time (msec)	(1b)	Time (msec)
FEMUR LOAD								
Left	345	75.6	480	37.6	263	66.8	628	50.6
Right	139	95.4	712	39.6	153	53.8	394	75.0
BELT LOAD								
Torso	1690	72.6			2268	80.6		
Lap	No	Data			2415	65.6		
Average Vehicle Impact Speed <u>34.70</u> mph								
*Positive Direction - Longitudinal: Forward Lateral: Leftward Vertical: Upward Femur: Tension *Negative Direction - Longitudinal: Rearward Lateral: Rightward Vertical: Downward Femur: Compression								

TABLE 4-5
VEHICLE STRUCTURAL DATA

VEHICLE 1981 Audi 5000S NHTSA NO. 810501



DIMENSIONS			
LOCATION	MEASUREMENT (IN.)	LOCATION	MEASUREMENT (IN.)
A	19.0	E	13.5
B	19.0	F	35.0
C	29.7	G	21.0
D	2.5		

ACCELERATION PEAKS				
ACCELEROMETER LOCATION	POSITIVE* DIRECTION		NEGATIVE* DIRECTION	
	PEAK "G"	TIME (MSEC)	PEAK "G"	TIME (MSEC)
NO. 1 LONGITUDINAL	4.2	15.8	53.4	36.4
NO. 2 LONGITUDINAL	5.1	9.6	29.8	41.2
NO. 3 LONGITUDINAL	18.6	7.8	48.5	54.2
*POSITIVE - LONGITUDINAL: FORWARD DIRECTION *NEGATIVE - LONGITUDINAL: REARWARD DIRECTION				

TABLE 4-6
PRE-TEST
VEHICLE MEASUREMENT DATA

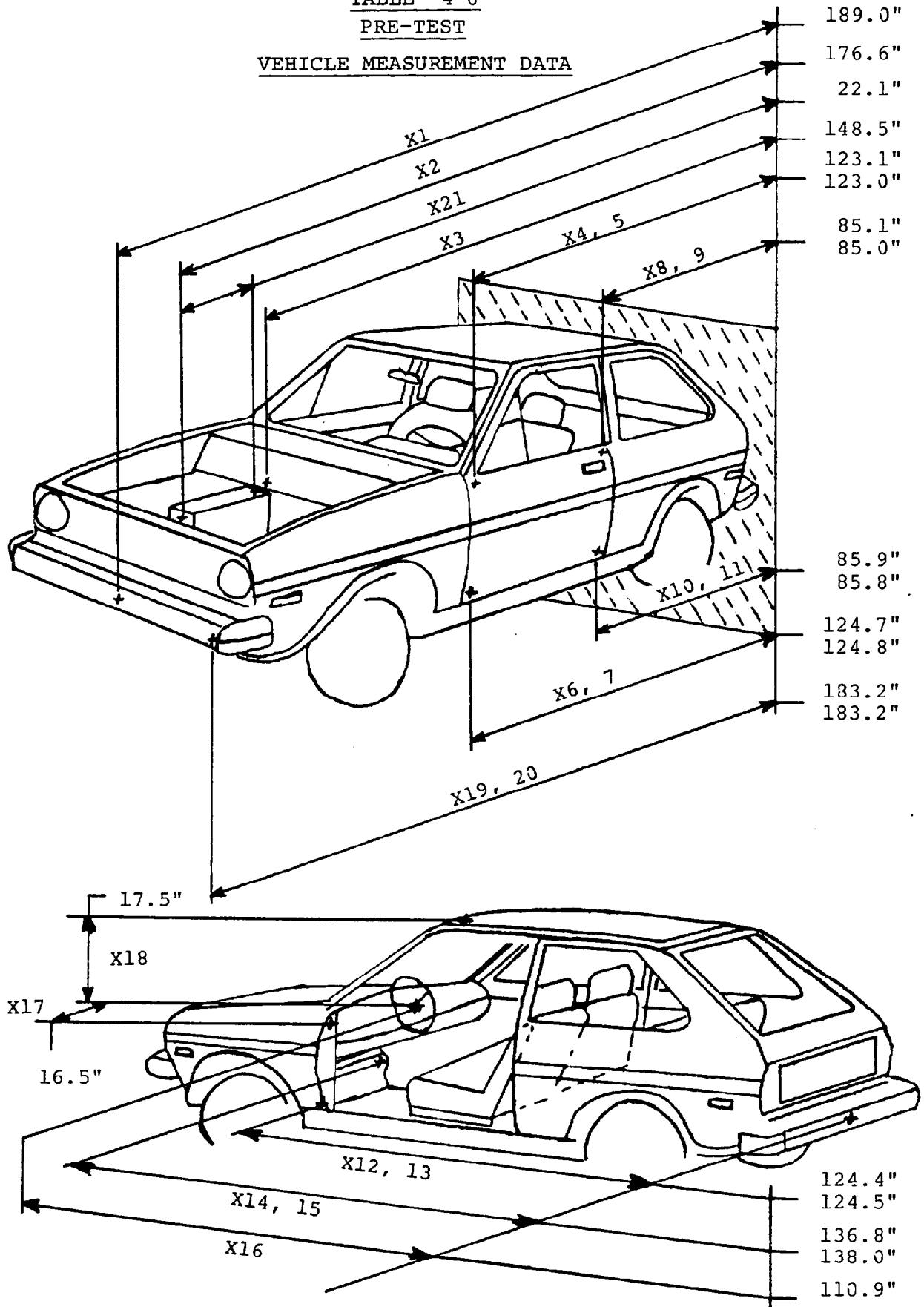
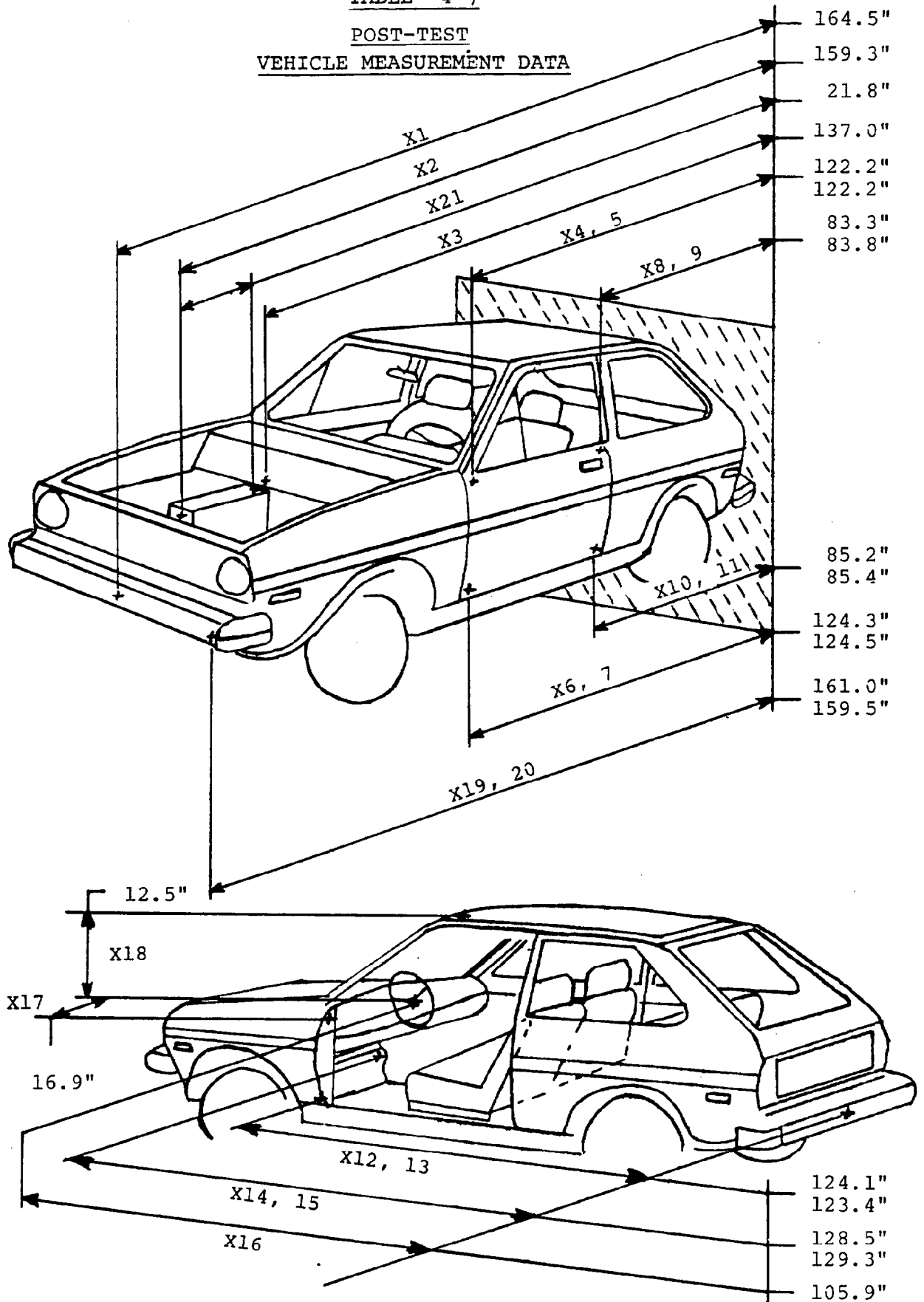


TABLE 4-7
POST-TEST
VEHICLE MEASUREMENT DATA





APPROVED ENGINEERING TEST LABORATORIES

TABLE 4-8

SUMMARY

PRE-TEST AND POST-TEST VEHICLE DIMENSIONS

<u>Measurement Point</u>	<u>Pre-Test</u>	<u>Post-Test</u>	<u>Difference</u>
X1	189.0"	164.5"	24.5"
X2	176.6"	159.3"	17.3"
X3	148.5"	137.0"	11.5"
X4	123.1"	122.2"	0.9"
X5	123.0"	122.2"	0.8"
X6	124.7"	124.3"	0.4"
X7	124.8"	124.5"	0.3"
X8	85.1"	83.3"	1.8"
X9	85.0"	83.8"	1.2"
X10	85.9"	85.2"	0.7"
X11	85.8"	85.4"	0.4"
X12	124.4"	124.1"	0.3"
X13	124.5"	123.4"	1.1"
X14	136.8"	128.5"	8.3"
X15	138.0"	129.3"	8.7"
X16	110.9"	105.9"	5.0"
X17	16.5"	16.9"	+0.4"
X18	17.5"	12.5"	5.0"
X19	183.2"	161.0"	22.2"
X20	183.2"	159.5"	23.7"
X21	22.1"	21.8"	0.3"

TABLE 4-9
FMVSS 212/219/301-75
CAMERA POSITIONS

VEHICLE 1981 Audi 5000S

NHTSA NO. 810501 TEST DATE June 12, 1981

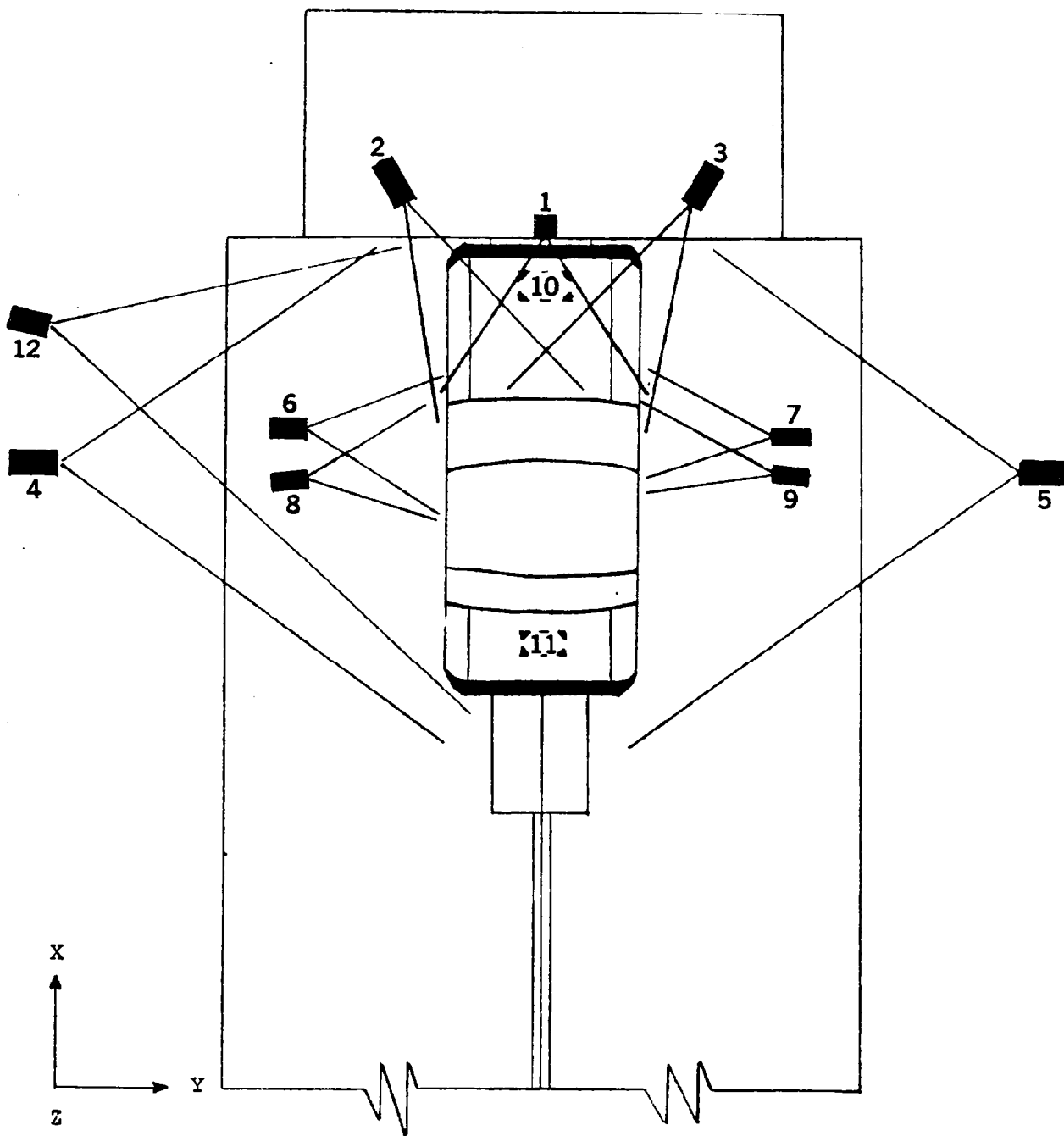


TABLE 4-10
FMVSS 212/219/301-75
CAMERA POSITIONS

VEHICLE 1981 Audi 5000S

NHTSA NO. 810501 TEST DATE June 12, 1981

1. Photo-Sonics	X	<u>11.0"</u>	2. Photo-Sonics	X	<u>-5.0"</u>
13mm 500FPS	Y	<u>- 0 -</u>	13mm 500FPS	Y	<u>8.0"</u>
	Z	<u>238.0"</u>		Z	<u>101.0"</u>
3. Hycam	X	<u>-41.0"</u>	4. Photo-Sonics	X	<u>38.0"</u>
10mm 500FPS	Y	<u>44.5"</u>	25mm 500FPS	Y	<u>496.0"</u>
	Z	<u>124.0"</u>		Z	<u>41.0"</u>
5. Photo-Sonics	X	<u>42.0"</u>	6. Locam	X	<u>82.5"</u>
13mm 500FPS	Y	<u>192.0"</u>	12.5mm 500FPS	Y	<u>108.5"</u>
	Z	<u>49.0"</u>		Z	<u>61.0"</u>
			Dummy Head		<u>94.0"</u>
7. Photo-Sonics	X	<u>97.0"</u>	8. Photo-Sonics	X	<u>94.0"</u>
13mm 500FPS	Y	<u>106.5"</u>	13mm 500FPS	Y	<u>104.5"</u>
	Z	<u>57.0"</u>		Z	<u>57.5"</u>
Dummy Head		<u>91.0"</u>	Dummy Head		<u>87.0"</u>
9. Locam	X	<u>97.5"</u>	10. Photo-Sonics	X	<u>- 0 -</u>
12.5mm 500FPS	Y	<u>102.5"</u>	13mm 500FPS	Y	<u>1.0"</u>
	Z	<u>60.5"</u>		Z	<u>-44.0"</u>
Dummy Head		<u>88.0"</u>			
11. Photo-Sonics	X	<u>181.0"</u>	12. Canon Scoopic		
13mm 500FPS	Y	<u>3.5"</u>	12.5 - 75mm 24FPS		
	Z	<u>-38.0"</u>	- Documentary -		



APPROVED ENGINEERING TEST LABORATORIES

SECTION 5



SECTION 5

5.0 TEST FACILITIES AND EQUIPMENT

Approved Engineering Test Laboratories (AETL) collision barriers, vehicle static rollover machine, and data processing/computer analysis test facilities are located at the Fullerton, California Division.

This section discusses these specialized facilities, along with associated equipment and instrumentation required for the performance of this test.

5.1 FRONTAL COLLISION BARRIER FACILITY

5.1.1 The frontal (fixed) collision barrier conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) and as defined in the Laboratory Procedures for FMVSS 212/219/301-75, TP219-02, dated January 9, 1979, with the following special characteristics.

5.1.2 The fixed collision barrier is a steel clad, steel reinforced concrete block with a 6'4" X 12' face. The face is 1" steel plate faced with 3/4 inch plywood. The total mass of the structure is approximately 200,000 pounds, with a substantial portion below ground to provide resistance against sliding or tipping of the barrier during impact.



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5.1.3 The facility consists of a 500 foot concrete paved runway, with a steel monorail embedded in the approach surface. Two camera pits are provided to allow photographing the test vehicle at impact. One pit is located immediately in front of the fixed collision barrier and is 36 inches wide (expandable to 48 inches), 7 feet deep, and 23 feet long (3 feet of the pit length extends under the barrier face). The second (mid) pit with removable monorail section is located approximately 160 feet from the fixed collision barrier and is 43 inches wide, 7 feet deep, and 23 feet long.

5.1.4 Tow propulsion is provided by a fixed prime mover and continuous cable drive system located near the mid camera pit position. The power plant for the tow cable system is a 200 h.p. synchronous electric motor, coupled to an electronically controlled Eddy Current Clutch and a 4:1 gear reduction transfer assembly.

The endless 1/2 inch diameter steel tow cable is wrapped around the drive pulley and is tensioned by a pneumatic loaded idler wheel. The tow cable passes through the fixed collision barrier and around fixed idler pulleys to complete the loop. The test vehicle or moving collision barrier is towed by a dolly assembly attached to the vehicle



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or moving collision barrier by a shear pin release mechanism. For a fixed collision barrier test, the test vehicle is towed within 20 feet of the fixed barrier, at which point the towing dolly assembly is disconnected from the test vehicle and the test vehicle proceeds under its own momentum for the final 20 feet to impact. For a moving collision barrier test, the moving collision barrier is towed within 5 feet of the test vehicle, at which point the towing dolly is disconnected from the moving collision barrier and the moving collision barrier proceeds under its own momentum for the final 5 feet to impact. Heavy steel stops actuate the tow cable release mechanism and prevent the towing dolly from continuing past the point of impact. The towing dolly is designed to fit inside the monorail such that it is constrained in the vertical and lateral directions, and capable of sliding freely along the monorail.

5.2 OBLIQUE ANGLE COLLISION BARRIER

- 5.2.1 The oblique angle collision barrier conforms to the requirements as set by NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02, with the following special characteristics.



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5.2.2 The oblique angle collision barrier is constructed of a flat 1 1/2 inch steel plate faced with 3/4 inch plywood. The barrier face is 6' X 12' and is adjustable for left or right angle impacts by means of seven tubular gussets that attach to the standard fixed frontal collision barrier to form a rigid buttress structure.

5.3 MOVING COLLISION BARRIER

5.3.1 The moving collision barrier conforms to the requirements as set by Federal Motor Vehicle Safety Standard No. 208, Paragraph S8.2 with the following special characteristics.

5.3.2 The chassis is constructed of 12 inch steel channel with tubular frame gussets. The flat impacting face plate is 1/2 inch steel plate faced with 3/4 inch plywood. The face plate is reinforced with 6 inch steel channel horizontally welded to the chassis to form a rigid symmetrical structure. A camera boom extends above the barrier face plane to provide a view of barrier to vehicle impact. The barrier assembly weighs 3,977 pounds and has a four wheel electric brake system.



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5.4 VEHICLE STATIC ROLLOVER MACHINE

5.4.1 The vehicle static rollover machine conforms to the requirements as set by the NHTSA Office of Vehicle Safety Compliance (OVSC) Laboratory Procedures TP219-02 with the following special characteristics.

5.4.2 The vehicle static rollover machine is constructed of 10 inch square tube with adjustable wheelbase and tread width platforms to accommodate the various test vehicles. The total usable platform area is 8 feet wide and 25 feet long with special design feature to accomodate vehicles with a gross vehicle weight rating (GVWR) of 10,000 pounds or less with various body configuration heights to 12 feet. The test vehicle can be rotated left or right and can turn each 90° rotational increment in approximately two (2) minutes.

5.5 IMPACT VELOCITY MEASUREMENT

The test vehicle impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the vehicle to fixed collision barrier face and to one side on the approach apron. Each timing



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trap system contains two (2) optical beams, mounted twenty four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the test vehicle traverses the impact apron, a blade attached to the test vehicle rear fender interrupts each optical beam providing the precise measurement of time interval for the test vehicle to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.

The moving collision barrier impact velocity is measured by two (2) separate certification timing trap systems located within five (5) feet of the moving collision barrier to vehicle impact location and to one side on the approach apron. Each timing trap system contains two (2) optical beams, mounted twenty-four (24) inches apart, in a mechanical housing assembly providing a start-stop signal to a digital display counter. As the moving barrier traverses the impact apron, a blade attached to the moving barrier side interrupts each optical beam providing the precise measurement of time interval for the moving barrier to advance the known distance between the optical beams. Each interval of time measurement is stored in the digital display counter and photographically recorded.



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5.6 PHOTOGRAPH COVERAGE

5.6.1 Because FMVSS 212/219/301-75 may be a combined test, it is necessary that all photographic coverage of the test vehicle be done at one time with specific photographs to document the areas for Vehicle Safety Compliance consideration; wind-shield area and the fuel system. Each report will utilize only those photographs pertaining to the Vehicle Safety Compliance Test being reported.

5.6.2 FIXED BARRIER IMPACT TEST

Motion picture coverage of the event employs eight (8) 16mm 1B Photo-Sonics cameras and two (2) 16mm 51 Redlake Locam cameras and one (1) 16mm 41 Redlake Hycam camera using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, vehicle in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. The eleven (11) high speed cameras are located at stationary positions near the point of impact. One is an overhead camera mounted on a tower above the fixed barrier face on centerline of the test vehicle at impact. Its field of view includes the barrier face and the front of the vehicle to a point about one foot aft of the



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windshield. A second and third camera are mounted on top of the fixed barrier with their field of view concentrating on the windshield area (FMVSS 212/219). The fourth and fifth camera each have a side view of the test vehicle at impact. The sixth, seventh, eight, and ninth camera are located adjacent to the test vehicle front passenger compartment and positioned to photograph motion of each test dummy at impact. The tenth and eleventh camera are located in the pit and positioned to photograph the underside of the engine compartment and fuel tank area.

5.6.3 MOVING BARRIER IMPACT TEST

Motion picture coverage of the event employs four (4) 16mm 1B Photo Sonics Cameras and Two (2) 16mm 51 Redlake Locam cameras using color film at 500 frames per second (fps). Also a 16mm Canon Scoopic 24 frames per second (fps) camera with color film is used to record vehicle pre-test condition, barrier in-run, impact, and post-impact vehicle conditions including the rollover increments for documentary purposes. Five (5) of the high speed cameras are located at stationary positions near the point of impact. Three (3) cameras are located in the pit and positioned to photograph the underside of the engine compartment, with overlapping field of views, aft to the fuel tank area. The fourth and fifth camera each have a side view of the test vehicle at impact.



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The sixth camera is attached to the moving collision barrier to photograph the contact between the barrier and the test vehicle.

5.6.4 TIME PULSE GENERATOR

Time data from two (2) sources are contained in the high speed film coverage. The first is a time reference of 100 pulse per second (pps) light emitting diode event mark along the film edge. This pulse is generated by the time pulse generator and fed to all high speed cameras. Thus, it is possible to relate film data to a real time base. The second time record is an indication of time zero (moment of impact). This is accomplished by a trip switch and event mark system. The trip switch is positioned at the impact point so that it triggers the light emitting diode event mark along the film edge at the moment of bumper-barrier contact. Thus, the particular film frame corresponding to the point of impact is clearly indicated on all the high speed film.



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5.7 DATA ACQUISITION AND REDUCTION

The data acquisition and analysis system used for acquiring occupant response and vehicle acceleration are shown schematically in Figure 5-1. A complete list of instrumentation is provided in Table 5-1. An itemized procedure for acquiring data is provided on Table 5-2.

Prior to the vehicle impact test the onboard instrumentation package is installed and a calibration and null reference check is performed to checkout all data analog devices including the FM magnetic tape recorders. The moment of impact trigger switch attached to the vehicle is also checked out. Immediately following vehicle impact a post-impact calibration and null reference check is performed.

The analog data is then played back into a Hewlett Packard Digital Fourier Analyzer (DFA) system using a HP 2100S mini computer with 32K word core storage. This system uses four program controlled analog filters which provides pre-digitizing filter capability of 48 db/octave above 1250 Hz.



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The DFA is a hard disc based system with standard HP design software for performing data acquisition and analysis functions. The HP software is programmed using direct keyboard functions to automate the data reduction process. The data is entered into temporary storage, four channels (one set) at a time. Table 5-3 defines each data channel and data set. The data sets are divided into driver and passenger tape recorder groups to facilitate simultaneous data acquisition for the head, chest and vehicle accelerometers to assure appropriate calibration of injury criteria and vehicle dynamics. At the time of entry, test personnel enter the appropriate calibration for each data channel and the computer then scales the data appropriately. When all data has been acquired it is moved as a vehicle set to permanent storage on a removable magnetic disc. (Nine vehicle sets are stored on each magnetic disc. All magnetic discs and FM recorder tapes are retained on file at AETL).

The only modifications to the data at the time of permanent storage is the filtering and digitizing process of the FM tape recorder (2500 Hz) and the DFA (1250 Hz sampling for a 200 ms window). After the data is moved to permanent storage it is recalled by test personnel and plotted with the appro-



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priate label and vehicle designation. As the data is recalled, the DFA is programmed to automatically filter the data with the appropriate SAE filter.

Figure 5-2 illustrates the SAE class 60, 180, 600 and 1000 filters applied to the data. These filters are in accordance with SAE J211a, Instrumentation for Impact Tests. These recommended filters are quadratic double pole with 65% damping and a 12 db/octave rolloff. They are applied to the data using a Fast Fourier Transform (FFT) of the data, frequency domain multiplication, and an inverse Fast Fourier Transform (FFT) of the product.

It should be noted that in Figure 5-2 the predigitizing analog filter attenuates all signals above the 1250 Hz cutoff frequency. This has no effect on the class 60 or class 180 data. The class 600 data is within SAE J211a recommendation to 1900 Hz and -20 db. Above 1900 Hz the class 600 data is attenuated at 48 db/octave instead of 24 db/octave. This has very negligible effect on the class 600 data. The modification of class 1000 data, by predigitizing filter, is attenuation of 48 db/octave above



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1250 Hz instead of 24 db/octave above 1650 Hz. Examination of typical class 1000 data shows the high frequency components between 1250 Hz and 1650 Hz are uniformly less than 3 percent of the largest components at lower frequencies. The effect of the predigitizing filter has a very slight smoothing of the plotted data.

Class 60 filters are applied to the vehicle acceleration and belt restraint forces, while the class 180 filter is applied to the chest acceleration forces. The class 600 filter is applied to the femur forces and class 1000 filter is applied to the head acceleration forces.

5.7.1 IMPACT DATA

All impact data is presented in computer plots of data digitized at 200 microseconds. Special SAE filters are applied to the appropriate data sets. Each data plot includes labeling, defining the test vehicle, filter class, and the complete identification of the data plotted.



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5.7.1.2 DUMMY HEAD DATA

The dummy head accelerations are processed as class 1000 data, and the Head Injury Criteria (HIC) calculation is performed. The HIC calculations are maximized for start time (T1) and end time (T2), using a manual iteration routine, usually requiring about ten iterations and between 5,000 and 10,000 combinations of start and end times. Data output is in the form of computer plots with the final HIC calculations. Listing of data value and HIC calculations are available, but not provided in the final report.

5.7.1.3 DUMMY CHEST DATA

The dummy chest accelerations are processed as class 180 data, and direct Chest Severity Index (CSI) calculations and the highest acceleration value of at least three millisecond duration (3 ms clip) are performed. Data output is in the form of computer plots with the 3 ms clip calculations.

5.7.1.4 FEMUR LOAD DATA

The dummy femur loads are processed as class 600 data, and presented as computer plots.



APPROVED ENGINEERING TEST LABORATORIES

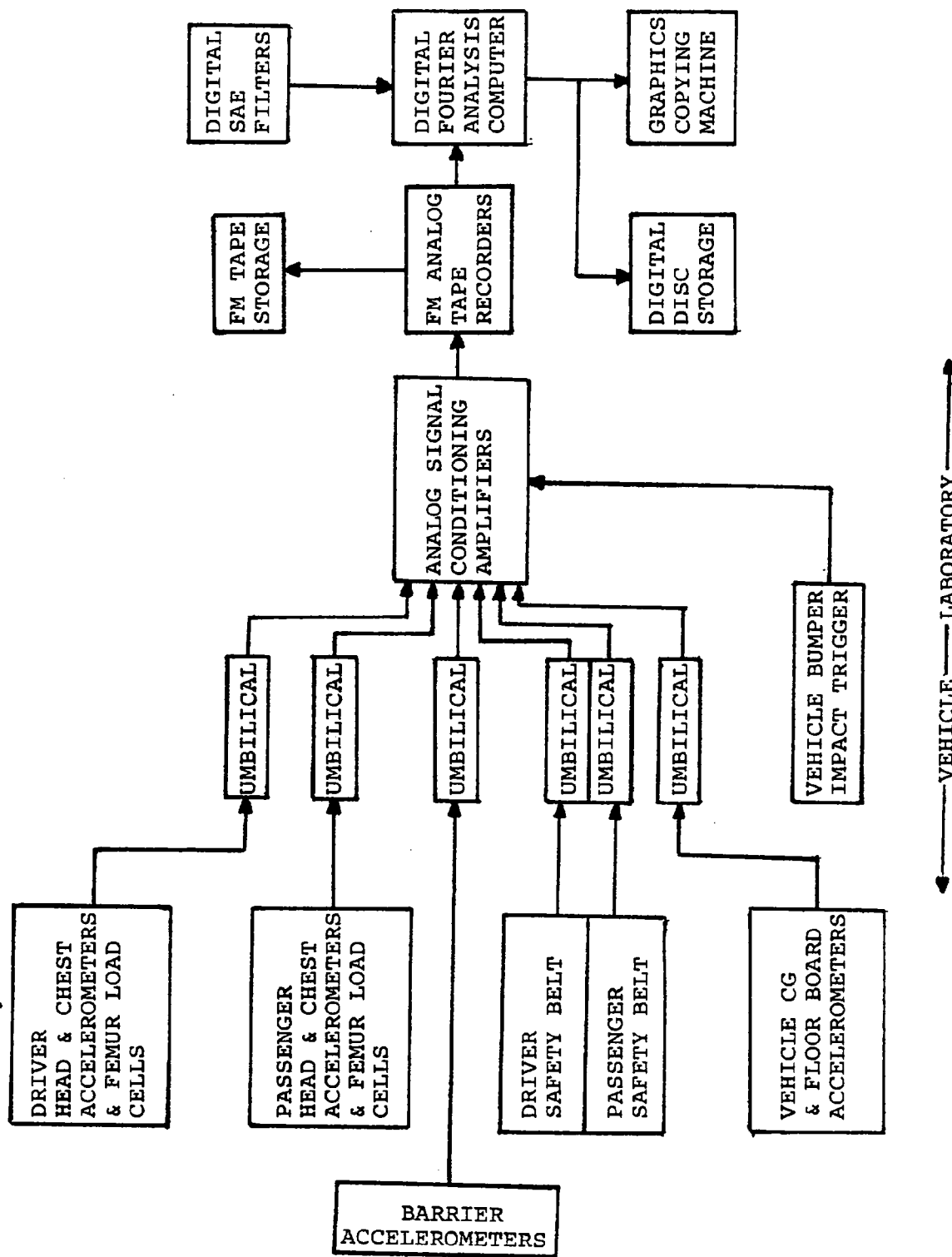
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5.7.1.5 RESTRAINT LOAD DATA

The dummy restraint loads are processed as class 60 data, and presented as computer plots.

5.7.1.6 VEHICLE ACCELERATION DATA

The vehicle accelerations are processed as class 60 data, and presented as computer plots. Additionally, the longitudinal vehicle acceleration is integrated to provide approximate vehicle velocity change and vehicle crush during the impact event.



VEHICLE AND OCCUPANT CRASH IMPACT DATA ACQUISITION SYSTEM

FIGURE 5-1

TABLE 5-1 INSTRUMENTATION FOR CRASH TEST

<u>Instrument</u>	<u>Manufacturer</u>	<u>Model No.</u>	<u>Full Scale</u>	<u>Accuracy</u>	<u>Frequency Max.</u>
Accelerometers, Head, Chest, Vehicle	Endevco	2262C-200	200g	±1%	3600 Hz
Load Cells, Femurs	GSE	2430	3000 lb	±1%	>3600 Hz
Load Cells, Safety Belts	GSE	2500	3000 lb	±1%	>3600 Hz
Contact Switch, Impact	AETL	-	2 V	-	<200 us rise time
FM Tape Recorder	Bell & Howell	4020	±2.8 V	47 db SNR	2500 Hz WB
Programmable Filter, All Data	Hewlett Packard	54440A	-	0.5%	1250 Hz, 48 db/oct
Analog-Digital Converter, All Data	Hewlett Packard	5466B	-	0.5%	200 us sampling
Analysis Computer, All Analysis	Hewlett Packard	2100S	32 K Words	16 Bit Word	-
Disc Drive	Hewlett Packard	7900A	5 Meg Words	-	-



APPROVED ENGINEERING TEST LABORATORIES

TABLE 5-2

DATA ACQUISITION AND REDUCTION PROCESS

<u>STEP</u>	<u>DESCRIPTION</u>
1	DA System Installation
2	DA System Pre-Impact Calibration
3	Impact Trigger Checkout
4	Vehicle Impact Performed
5	DA System Post-Impact Calibration
6	Data Reproduced From FM Tape Into Computer a) Data analog filtered at 1250 Hz b) Data digitized at 200 ms sample rate c) Data sychronized by impact trigger signal
7	Digitized Data Examined
8	Data Transferred Permanent Disc Storage
9	Appropriate SAE Filters Are Applied
10	Each Data Signal Plotted With Lables
11	Chest Severity Index Values Determined
12	Head Injury Criteria Values Determined
13	Vehicle Dynamics Evaluated (MPH & Crush)

TABLE 5-3

DATA DESIGNATIONS FOR VEHICLE CRASH IMPACT DATA ACQUISITION

DATA SET	TAPE NO.	CHANNEL NO.	DESCRIPTION
1	1	1	Driver Longitudinal Head Acceleration Ax
1	1	2	Driver Lateral Head Acceleration Ay
1	1	3	Driver Vertical Head Acceleration Az
1	1	4	Driver Right Femur Force
2	1	5	Driver Longitudinal Chest Acceleration Ax
2	1	6	Driver Lateral Chest Acceleration Ay
2	1	7	Driver Vertical Chest Acceleration Az
2	1	8	Driver Left Femur Force
3	1	9	Driver Shoulder Belt Force
3	1	10	Driver Lap Belt Force
3	1	11	Left Rear Floor Pan Longitudinal Acceleration Ax
3	1	12	Vehicle Longitudinal CG Acceleration Ax
5	2	1	Passenger Longitudinal Head Acceleration Ax
5	2	2	Passenger Lateral Head Acceleration Ay
5	2	3	Passenger Vertical Head Acceleration Az
5	2	4	Passenger Right Femur Force
6	2	5	Passenger Longitudinal Chest Acceleration Ax
6	2	6	Passenger Lateral Chest Acceleration Ay
6	2	7	Passenger Vertical Chest Acceleration Az
6	2	8	Passenger Left Femur Force
7	2	9	Passenger Shoulder Belt Force
7	2	10	Passenger Lap Belt Force
7	2	11	Right Front Floor Pan Longitudinal Acceleration Ax

DOT CRASH PROGRAM APPROVED ENGINEERING TEST LABS

COMPARISON PLOT OF SAE CLASS 60, 180, 600 AND 1000 FILTERS AND
 THE DATA ANALYSIS 1250 HZ PREDIGITIZING ANALOG FILTER

SAE FILTER ROLL OFF IS 12 DB/OCTAVE, ANALOG FILTER ROLL OFF IS 48 DB/OCTAVE

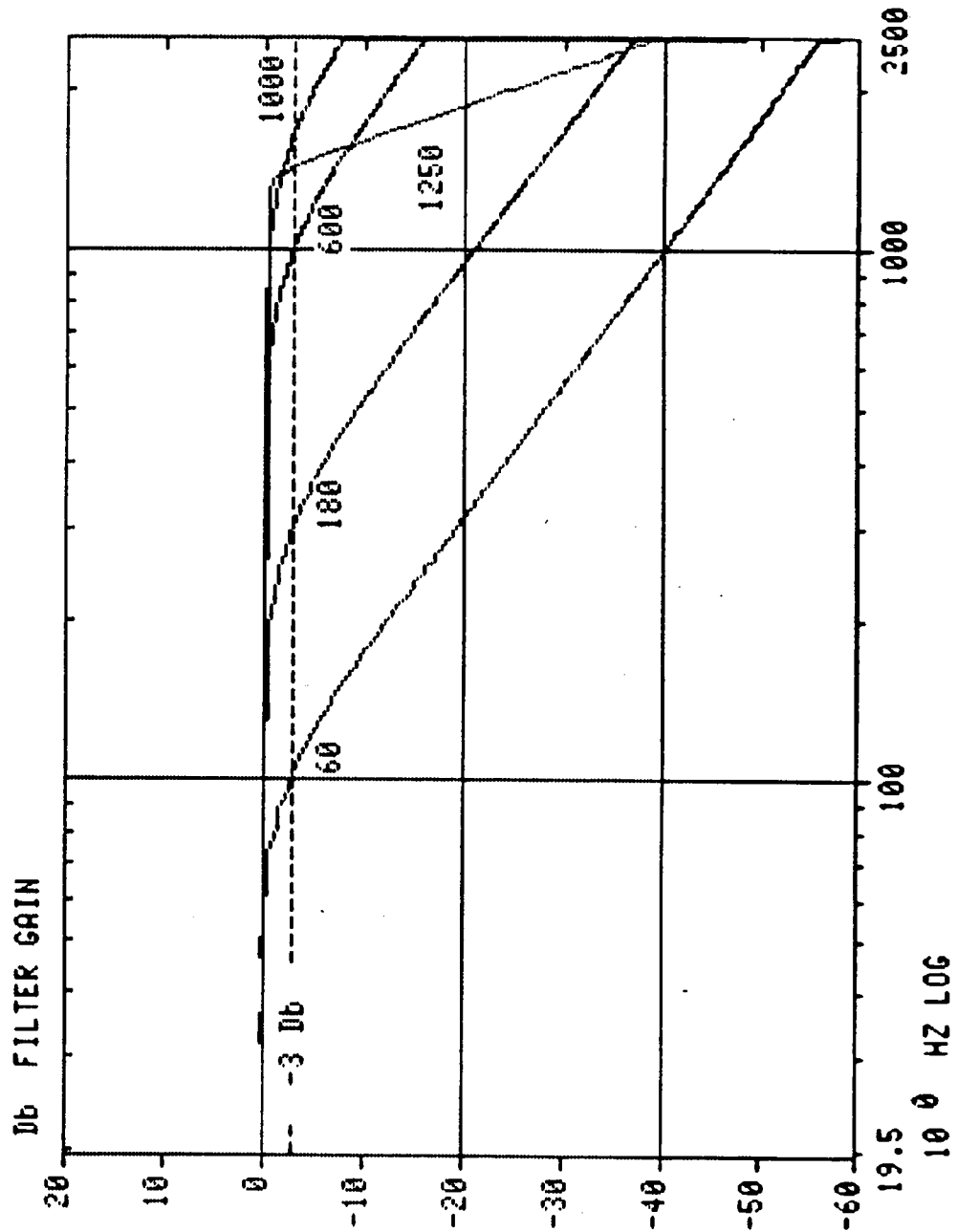


FIGURE 5-2



APPROVED ENGINEERING TEST LABORATORIES

APPENDIX A



APPROVED ENGINEERING TEST LABORATORIES

APPENDIX A

The following photographs are pre and post test dummy positions and interior compartment locations of dummy contact during the impact event.



APPROVED ENGINEERING TEST LABORATORIES

Figure A-1

1981 Audi 5000S - 4 Door Sedan

NHTSA 810501

Pre-Test, Driver Dummy View





APPROVED ENGINEERING TEST LABORATORIES

Figure A-2

1981 Audi 5000S - 4 Door Sedan

NHTSA 810501

Pre-Test, Passenger Dummy View





APPROVED ENGINEERING TEST LABORATORIES

Figure A-3
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Post-Impact, Driver Dummy View





APPROVED ENGINEERING TEST LABORATORIES

Figure A-4

1981 Audi 5000S - 4 Door Sedan

NHTSA 810501

Post-Impact, Driver Dummy Contact Area





APPROVED ENGINEERING TEST LABORATORIES

Figure A-5
1981 Audi 5000S - 4 Door Sedan
NHTSA 810501
Post-Impact, Passenger Dummy View





APPROVED ENGINEERING TEST LABORATORIES

Figure A-6

1981 Audi 5000S - 4 Door Sedan

NHTSA 810501

Post-Impact, Passenger Dummy Contact Area





APPROVED ENGINEERING TEST LABORATORIES

APPENDIX B



APPROVED ENGINEERING TEST LABORATORIES

APPENDIX B

The following computer plots provide complete and comprehensive occupant response and vehicle acceleration during the frontal fixed barrier impact test of a 1981 Audi 5000S - 4 Door Sedan - NHTSA 810501.

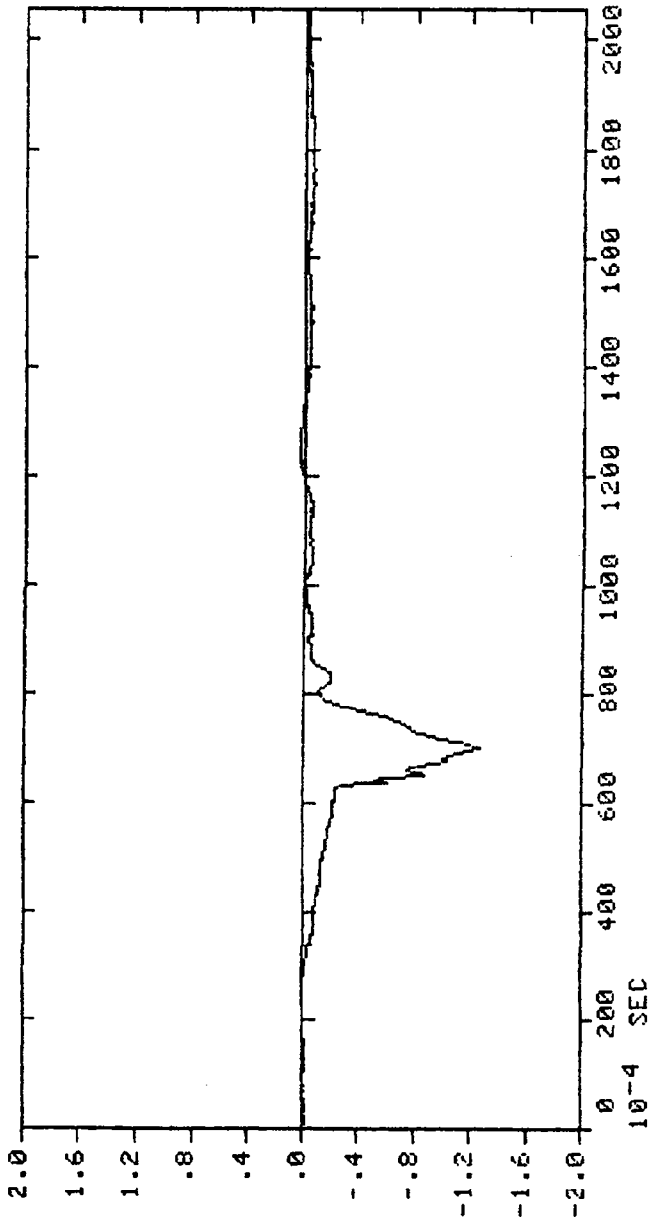
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 1000
 ACCELEROMETER: TAPE 1, CH 1
 DIRECTION: FORWARD
 LOCATION: DRIVER'S HEAD

10 2 G AX



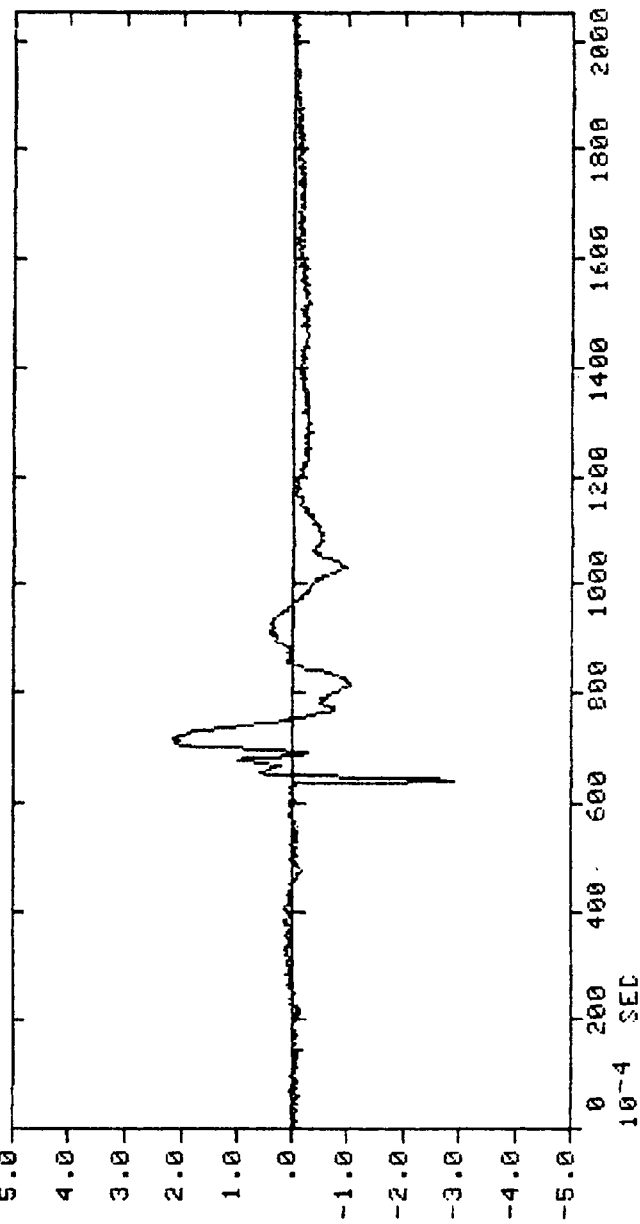
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

10 1 G AY

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 1000
 ACCELEROMETER: TAPR 1, CH 2
 DIRECTION: LEFT
 LOCATION: DRIVER'S HEAD



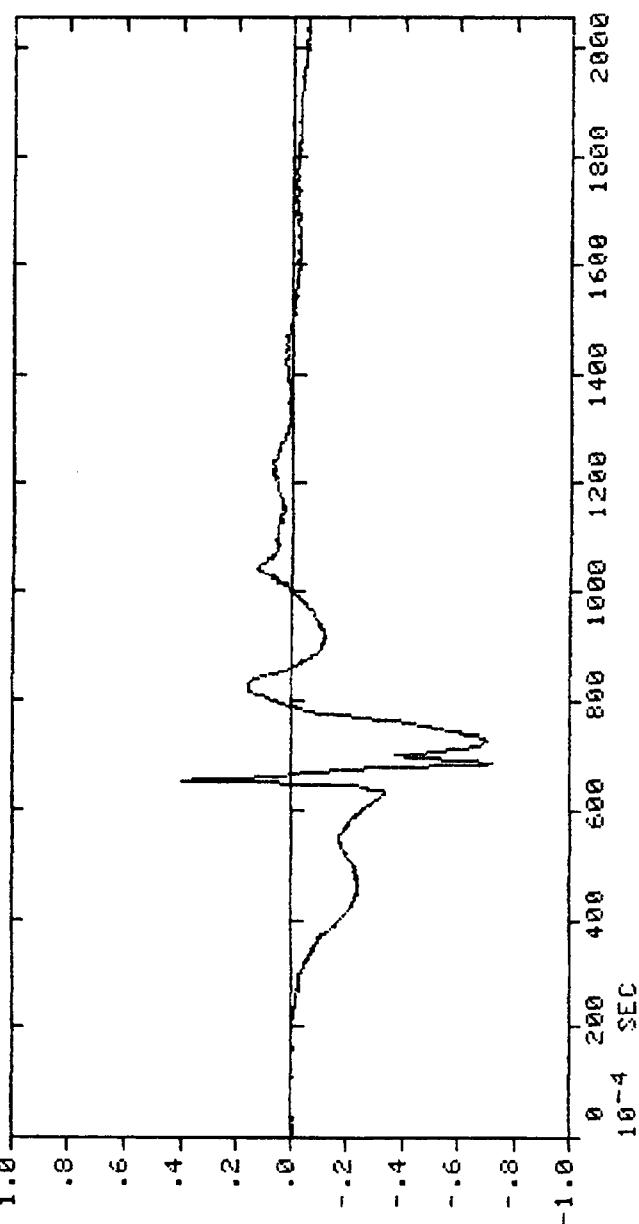
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AZ

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH3
DIRECTION: UPWARD
LOCATION: DRIVER'S HEAD



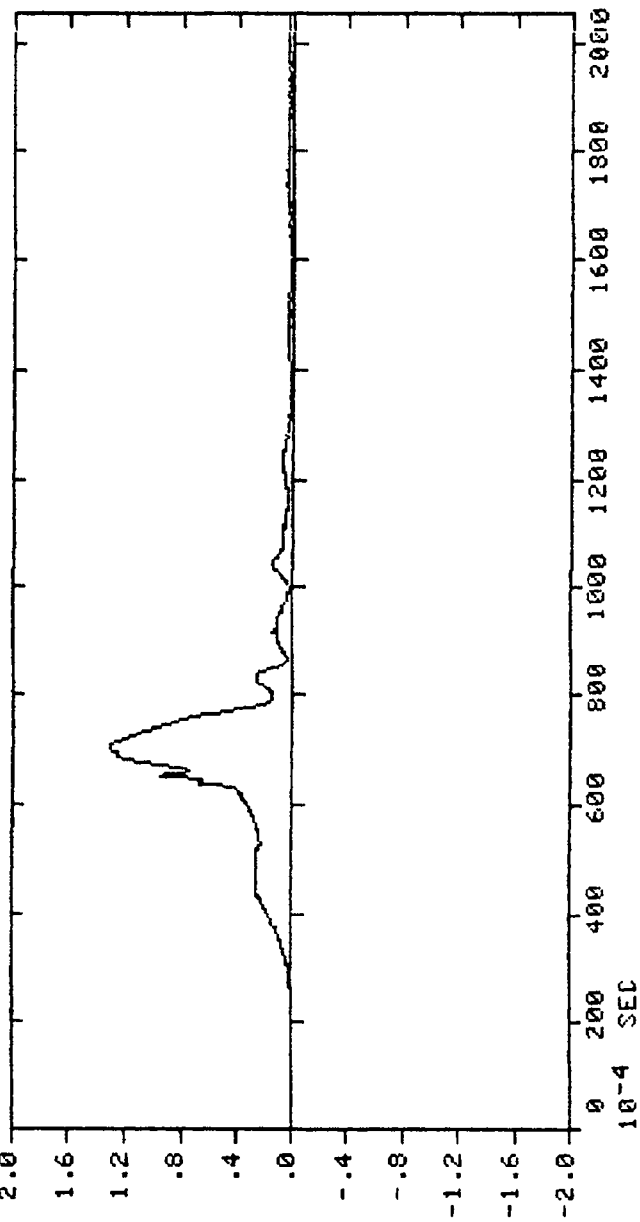
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

10 2 G AR RESULTANT

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 1000
 ACCELEROMETER: TAPE 1, CH 1-3
 DIRECTION: RESULTANT OF XYZ
 LOCATION: DRIVER'S HEAD

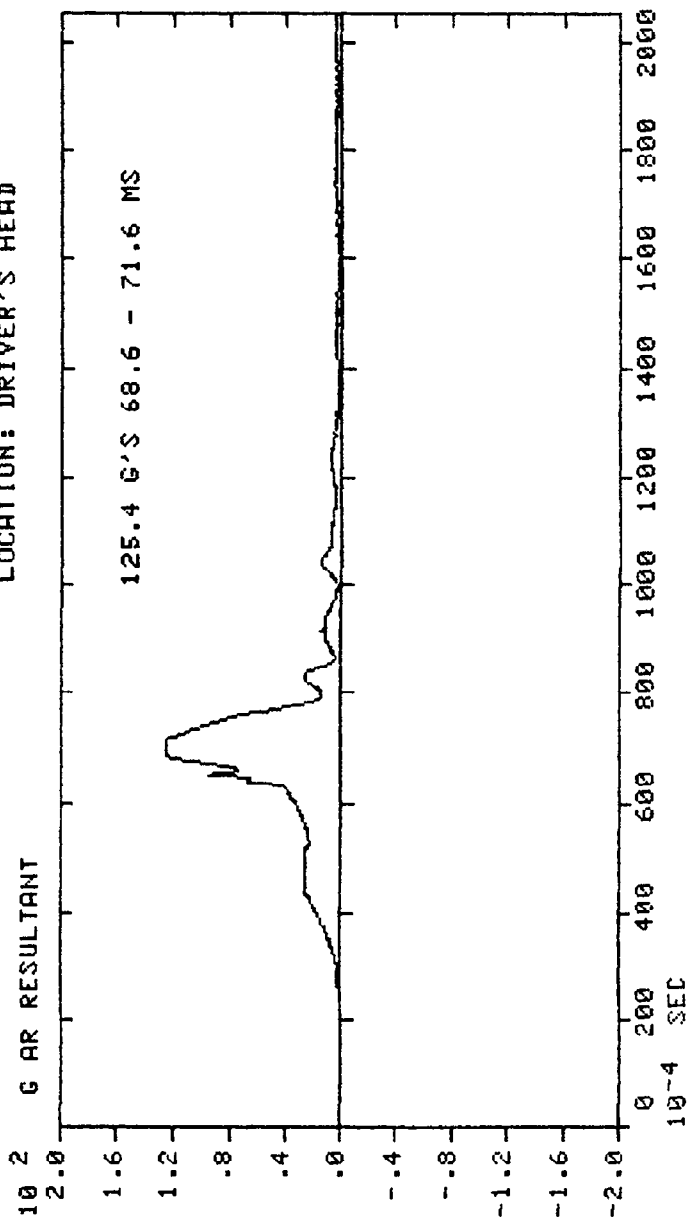


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 1, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S HEAD



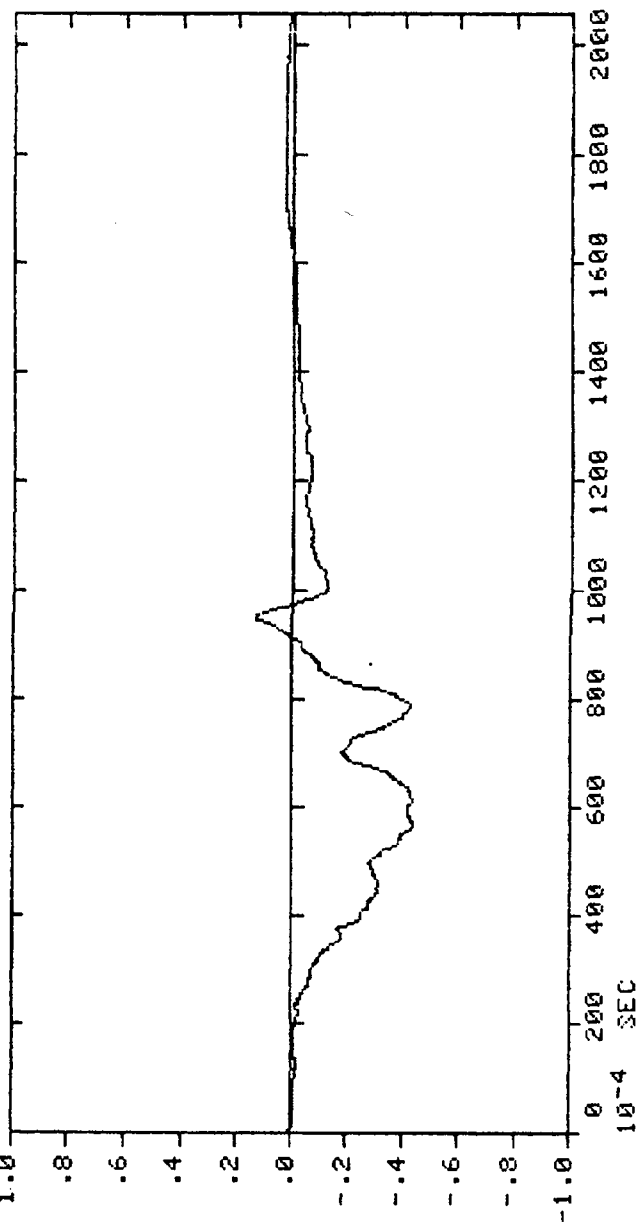
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO. 1 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AX

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5
DIRECTION: FORWARD
LOCATION: DRIVER'S CHEST

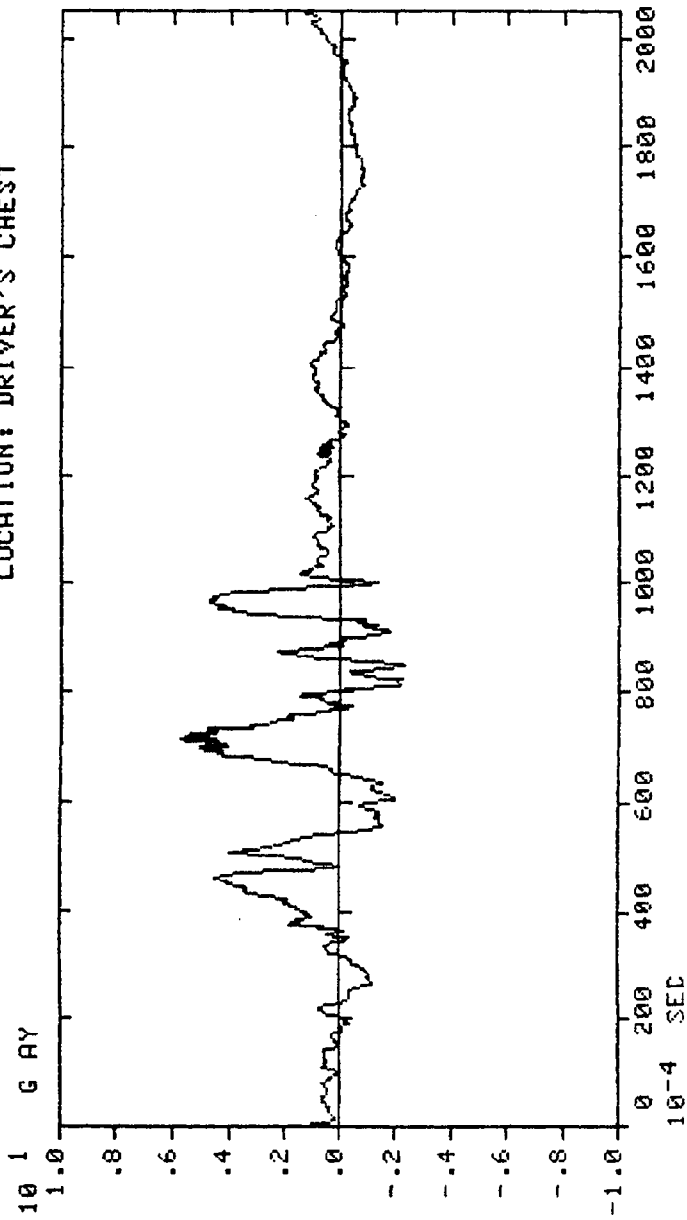


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 6
DIRECTION: LEFT
LOCATION: DRIVER'S CHEST

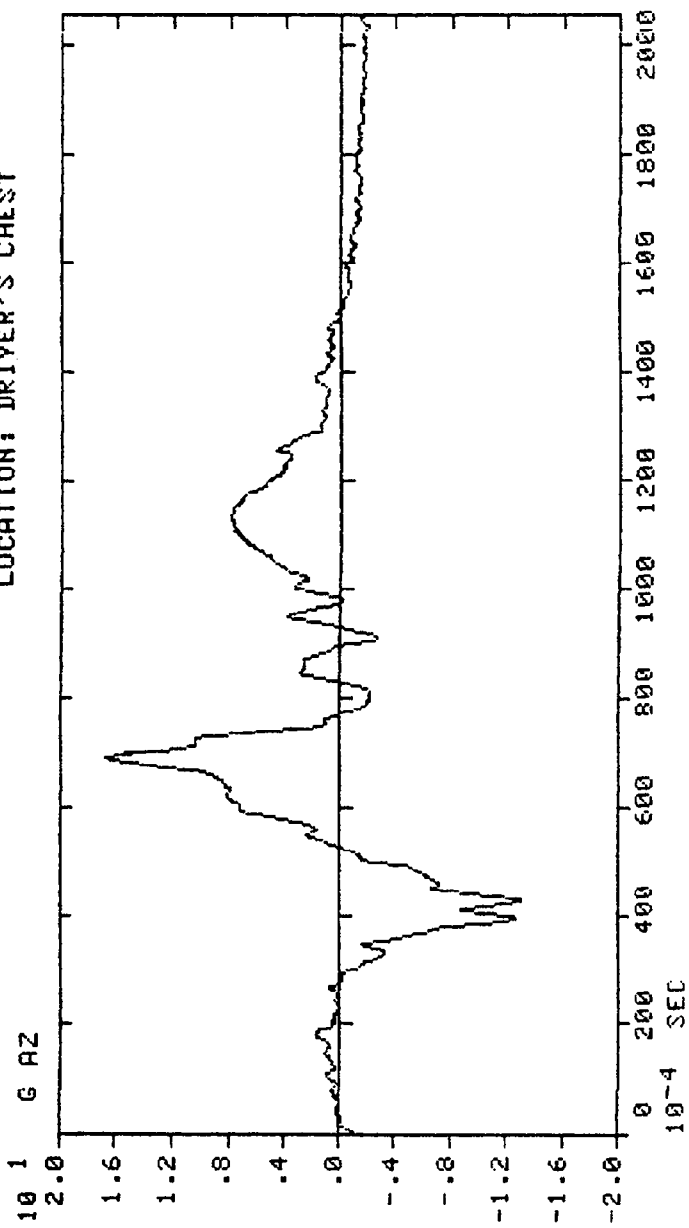


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA B10501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 7
DIRECTION: UPWARD
LOCATION: DRIVER'S CHEST



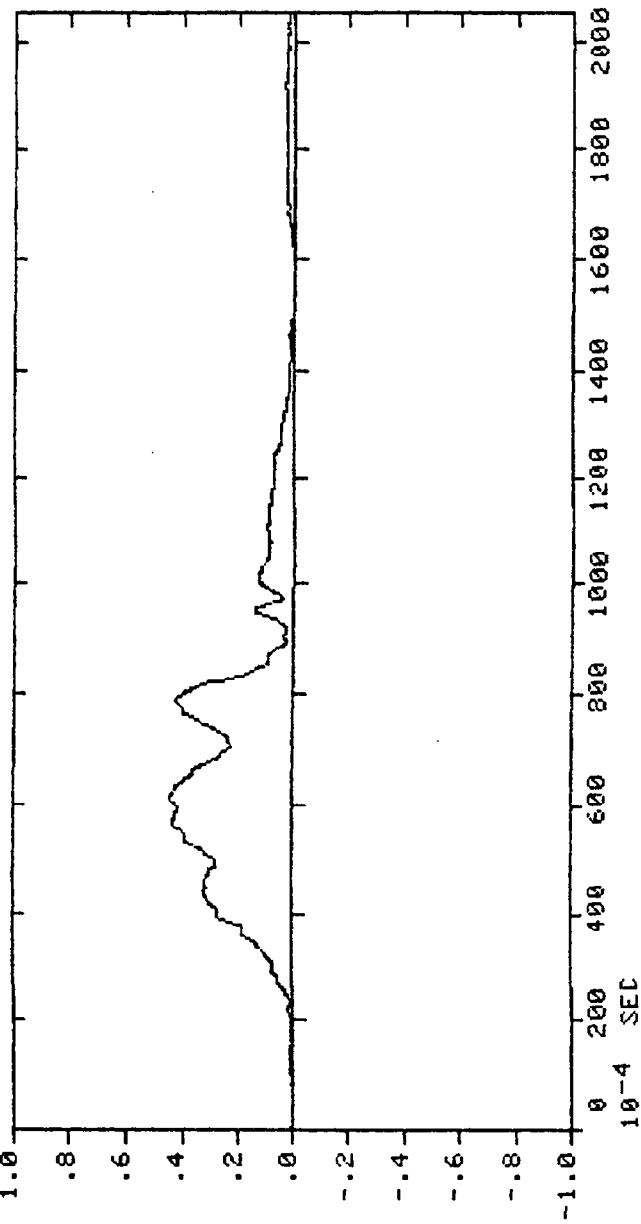
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 TEST FILE NO.: NHTSA 810501
 DATE: JUNE 12, 1981 FRONTAL

10 2 G AR RESULTANT

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-38
 FILTER: CLASS 180
 ACCELEROMETER: TAPE 1, CH 5-7
 DIRECTION: RESULTANT OF XYZ
 LOCATION: DRIVER'S CHEST



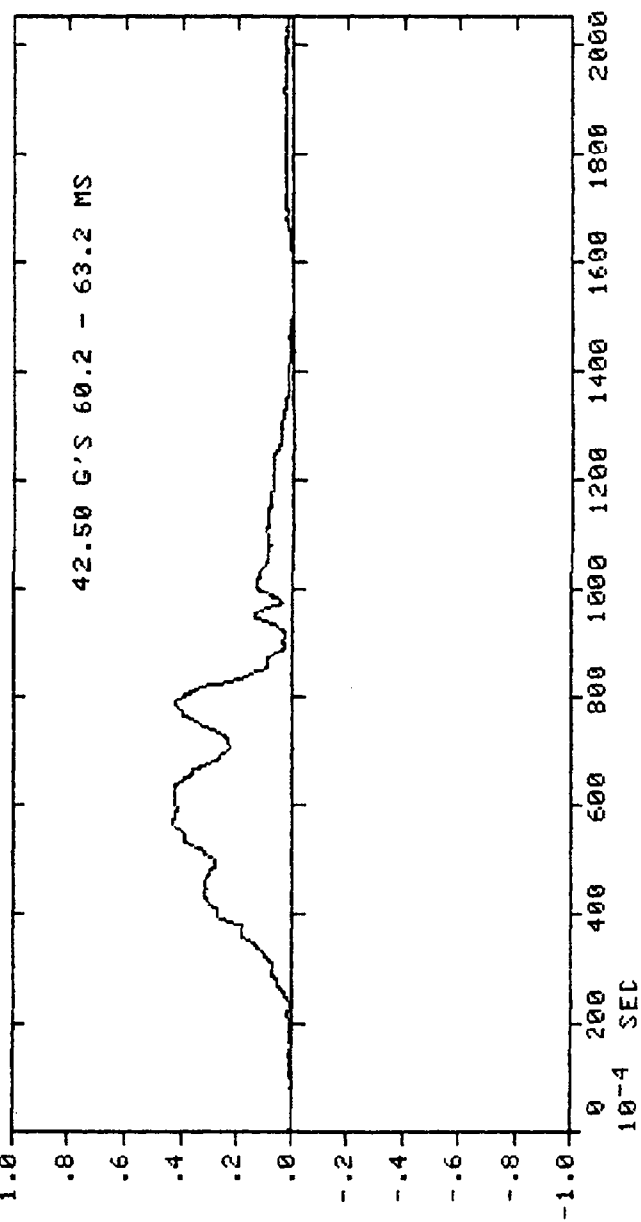
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10.2 G AR RESULTANT

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 1, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: DRIVER'S CHEST



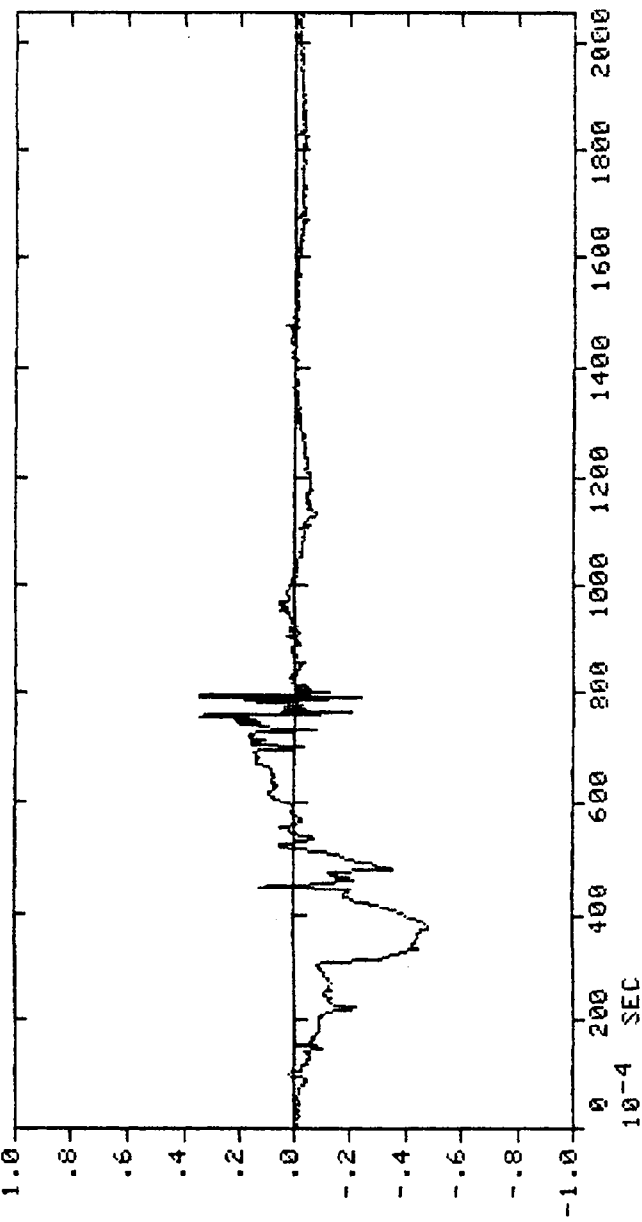
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 3 POUNDS

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 8
DIRECTION: TENSION
LOCATION: DRIVER'S LEFT FEMUR



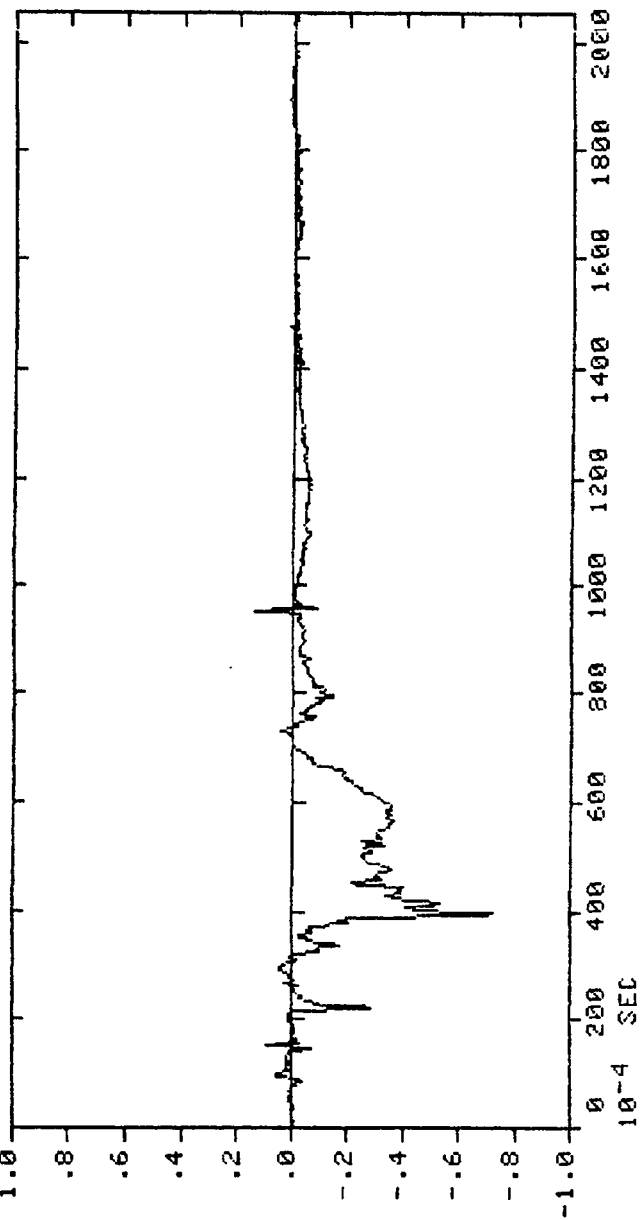
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 600
LOAD CELL: TAPE 1, CH 4
DIRECTION: TENSION
LOCATION: DRIVER'S RIGHT FEMUR

10 3 POUNDS

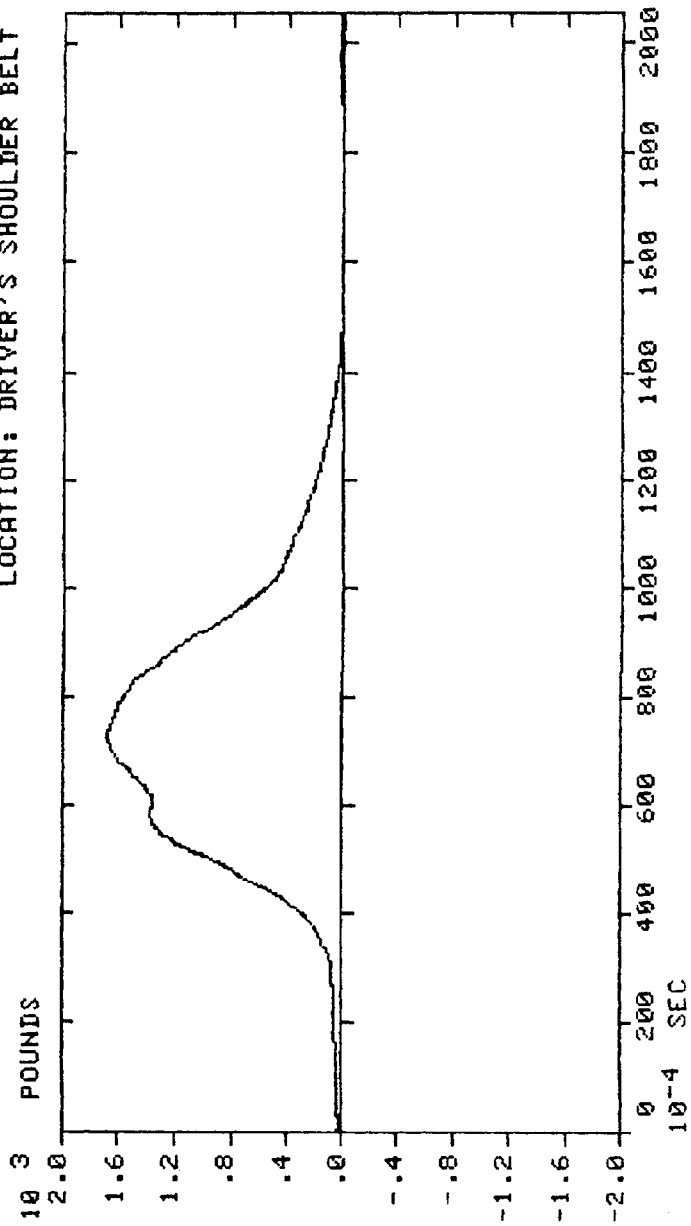


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 9
DIRECTION: TENSION
LOCATION: DRIVER'S SHOULDER BELT

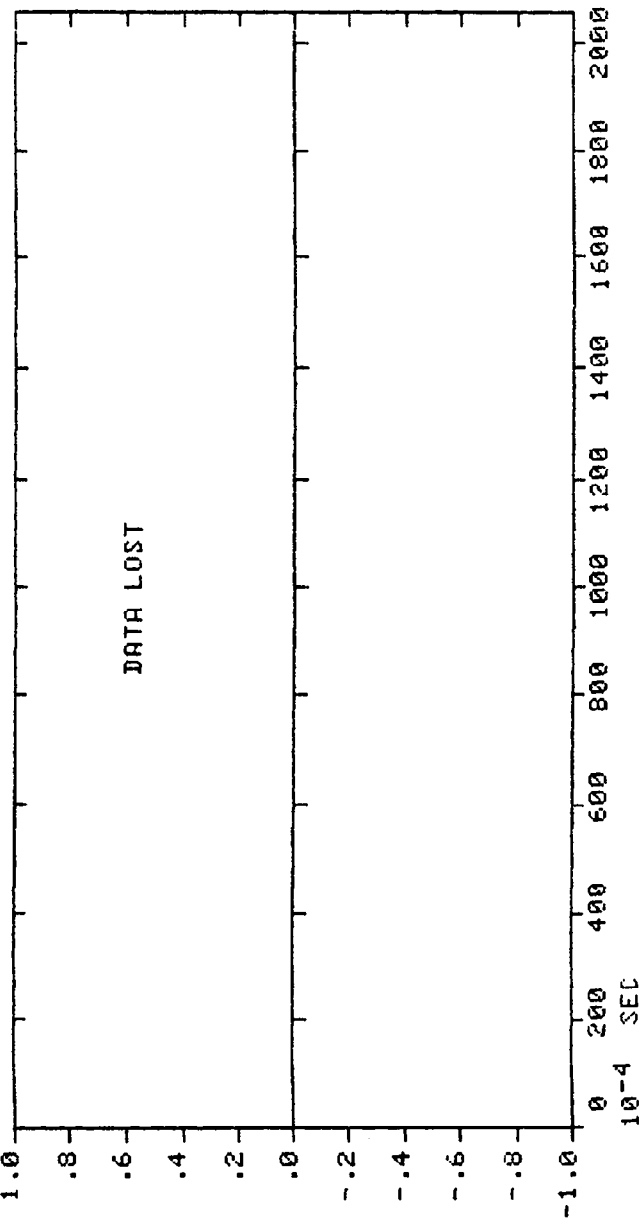


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL
10-513 POUNDS

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 60
LOAD CELL: TAPE 1, CH 10
DIRECTION: TENSION
LOCATION: DRIVER'S LAP BELT

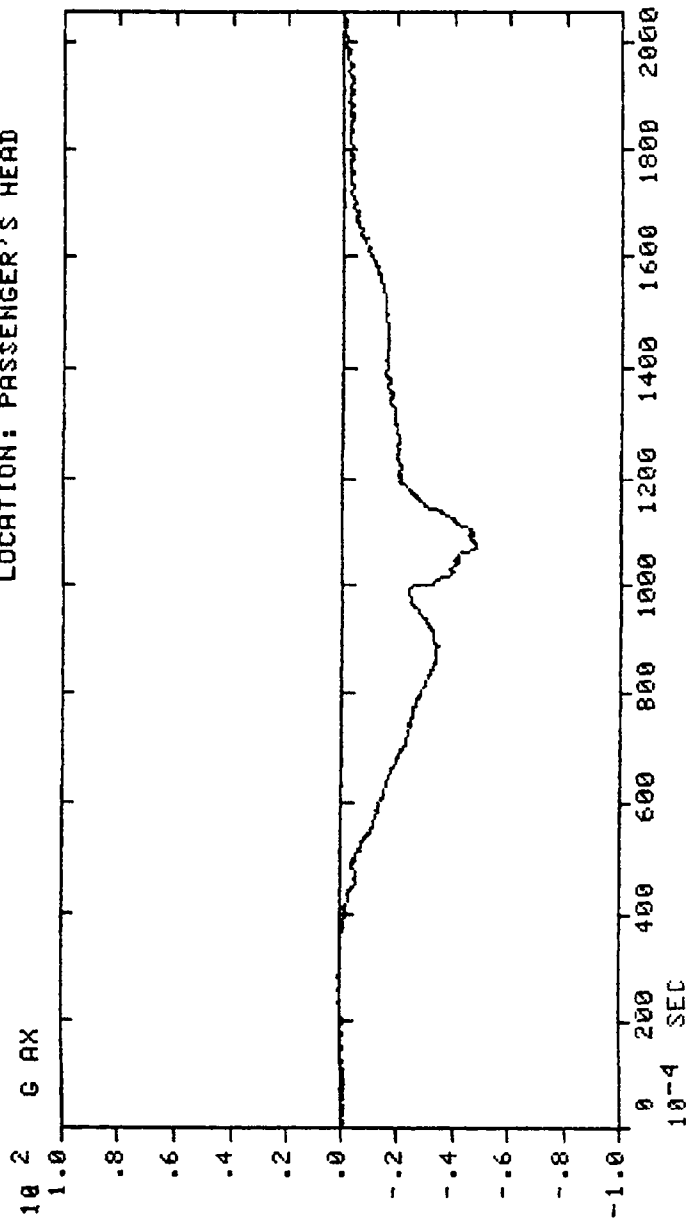


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1
DIRECTION: FORWARD
LOCATION: PASSENGER'S HEAD



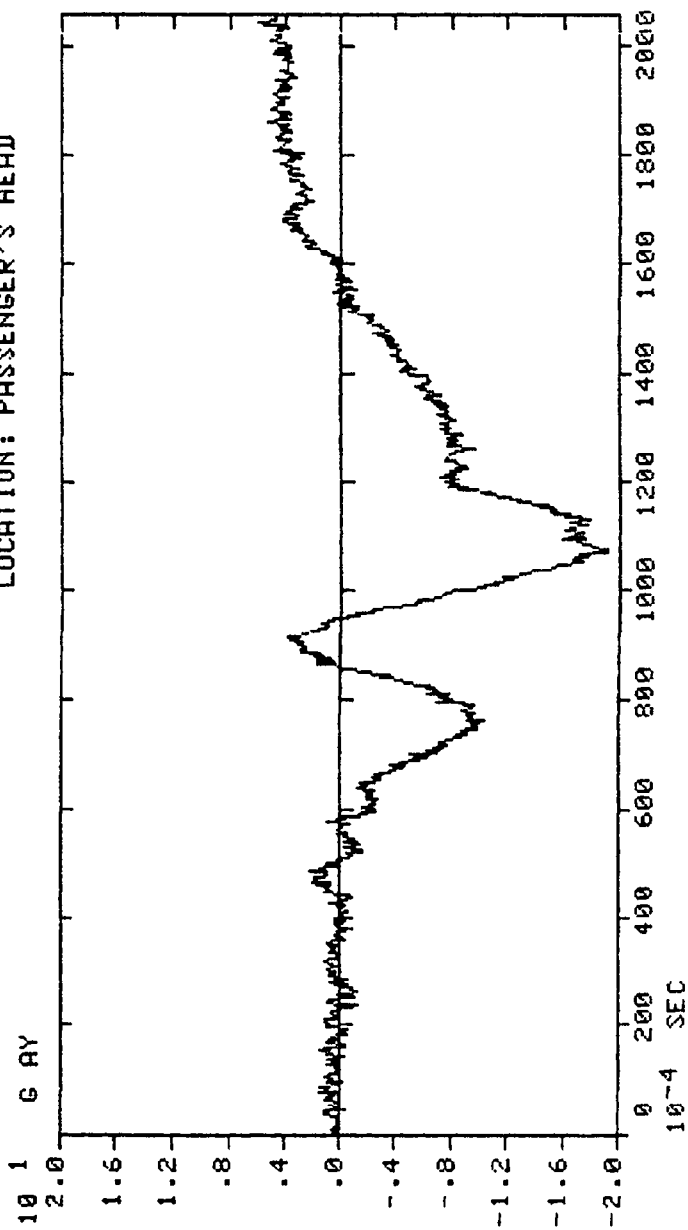
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 1 G AY

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 2
DIRECTION: LEFT
LOCATION: PASSENGER'S HEAD



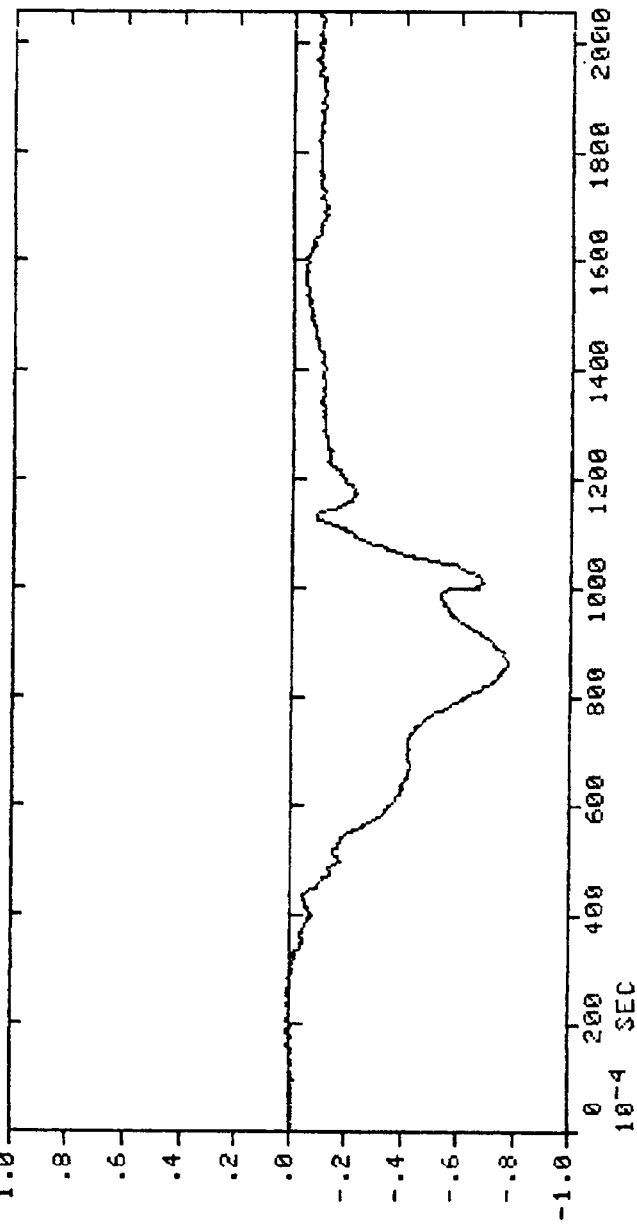
DOT CRASH PROGRAM

VEHICLE: AUDI 500S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AZ

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 3
DIRECTION: UPWARD
LOCATION: PASSENGER'S HEAD



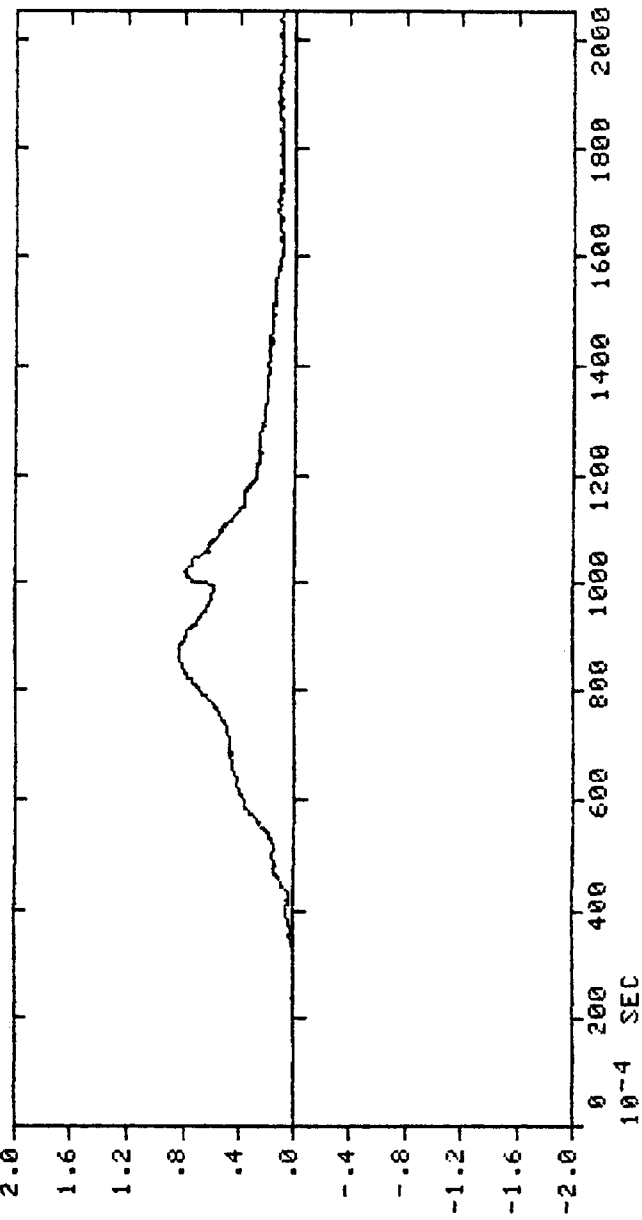
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AR RESULTANT

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 1-3
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S HEAD



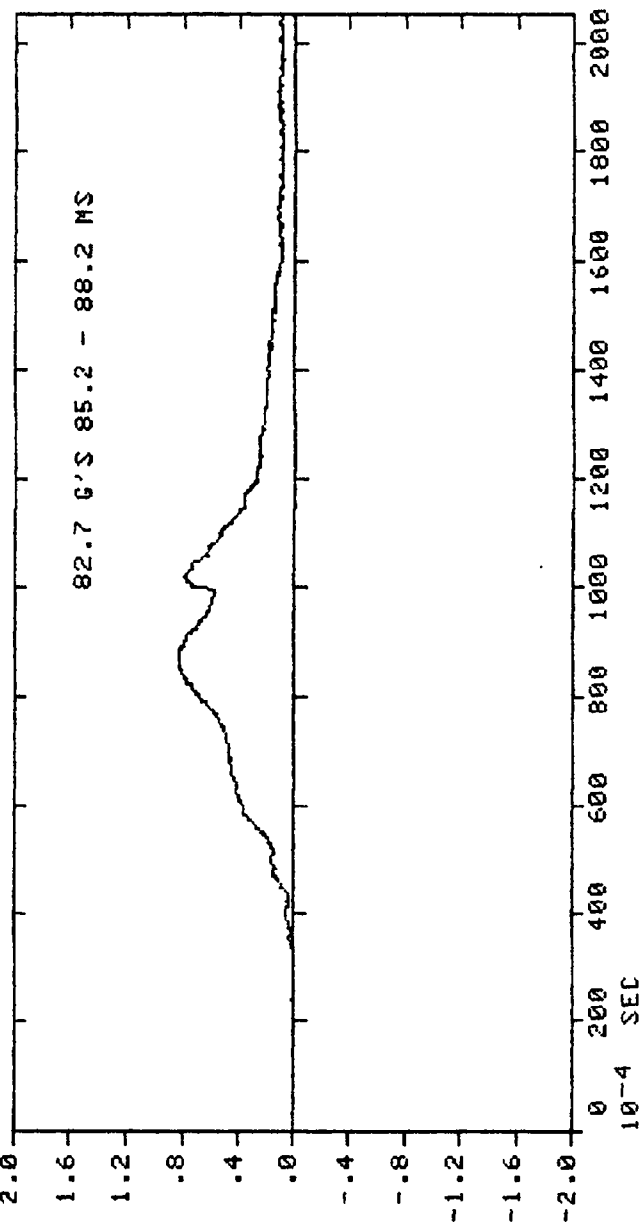
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 TEST FILE NO.: NHTSA 810501
 DATE: JUNE 12, 1981 FRONTAL

10 2 G AR RESULTANT

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 1000
 ACCELEROMETER: TAPE 2, CH 1-3
 DIRECTION: RESULTANT OF XYZ
 LOCATION: PASSENGER'S HEAD



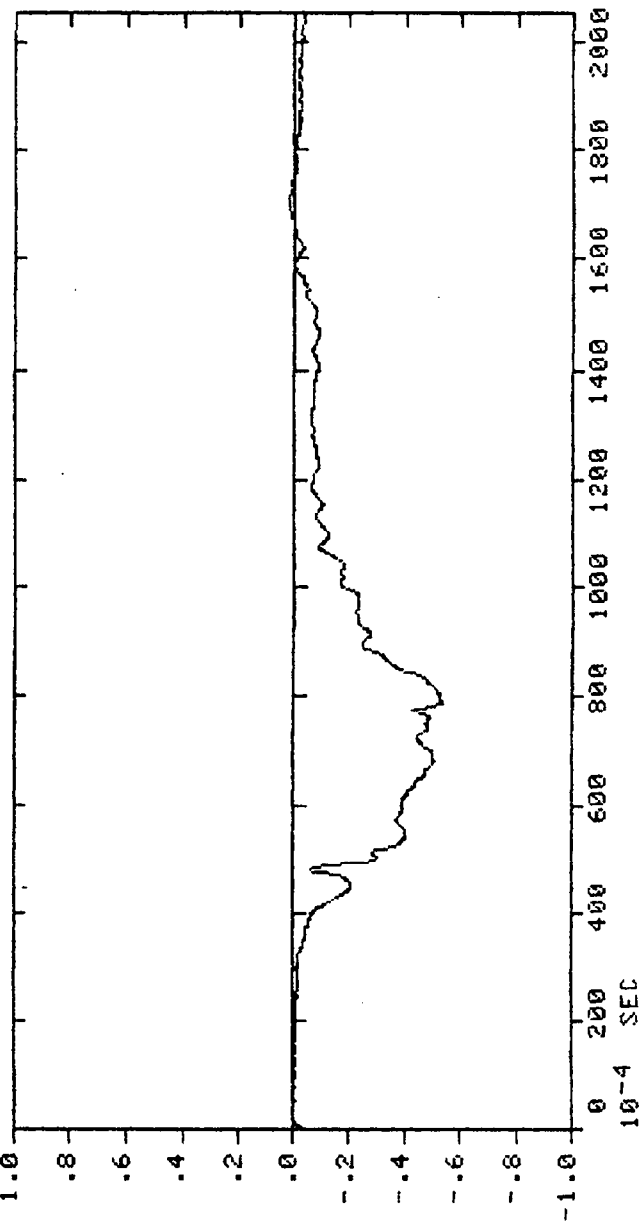
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AX

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 5
DIRECTION: FORWARD
LOCATION: PASSENGER'S CHEST



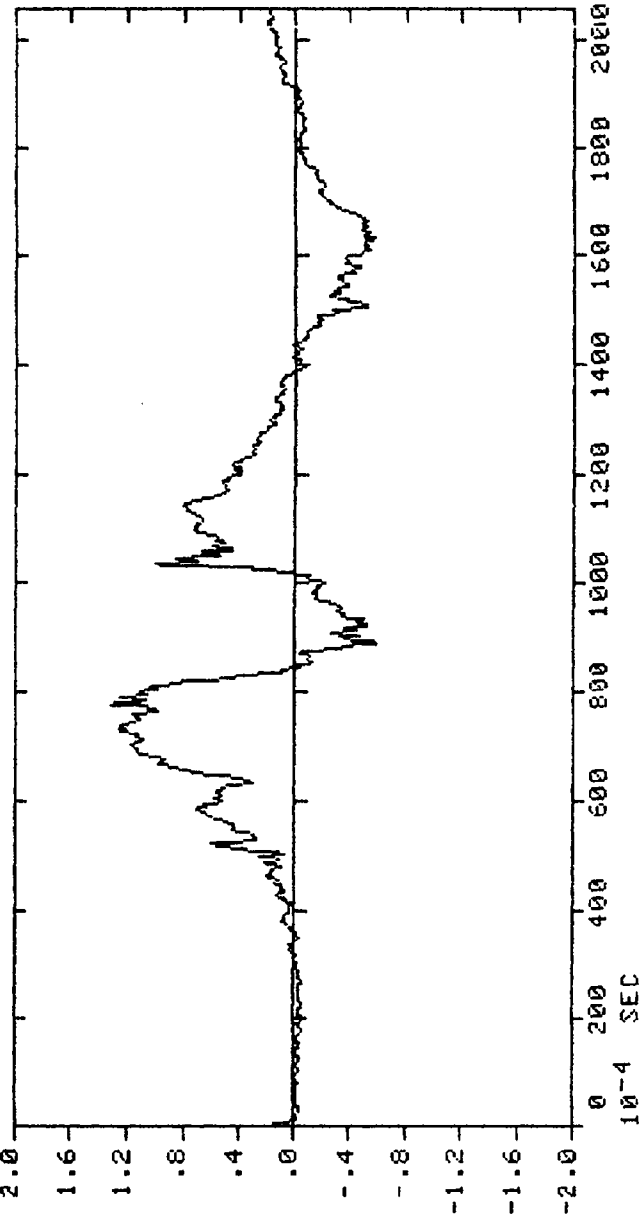
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

10 1 G AY

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 180
 ACCELEROMETER: TAPE: 2, CH 6
 DIRECTION: LEFT
 LOCATION: PASSENGER'S CHEST

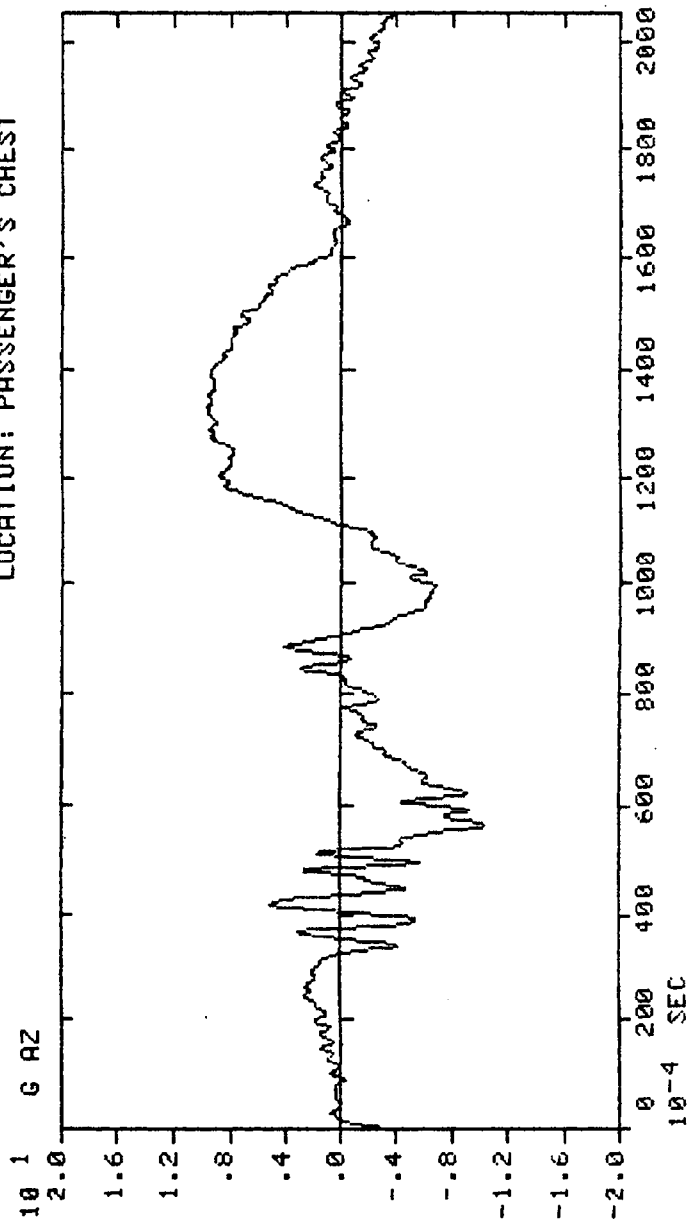


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 2, CH 7
DIRECTION: UPWARD
LOCATION: PASSENGER'S CHEST



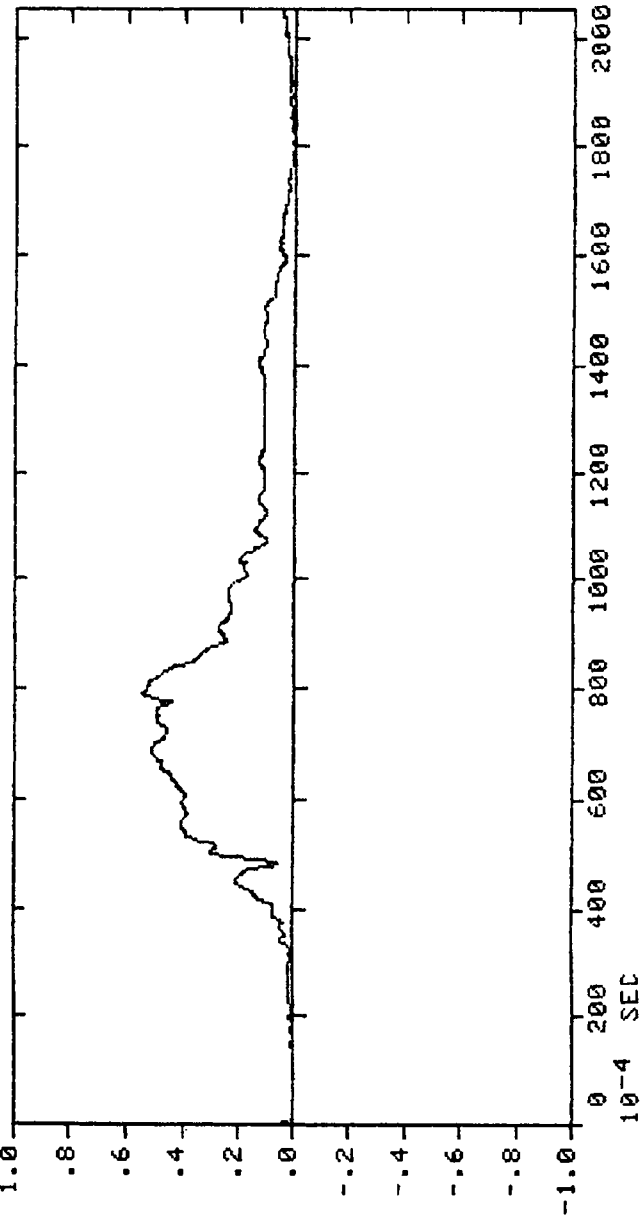
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AR

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 1000
ACCELEROMETER: TAPE 2, CH 5-7
DIRECTION: RESULTANT OF XYZ
LOCATION: PASSENGER'S CHEST

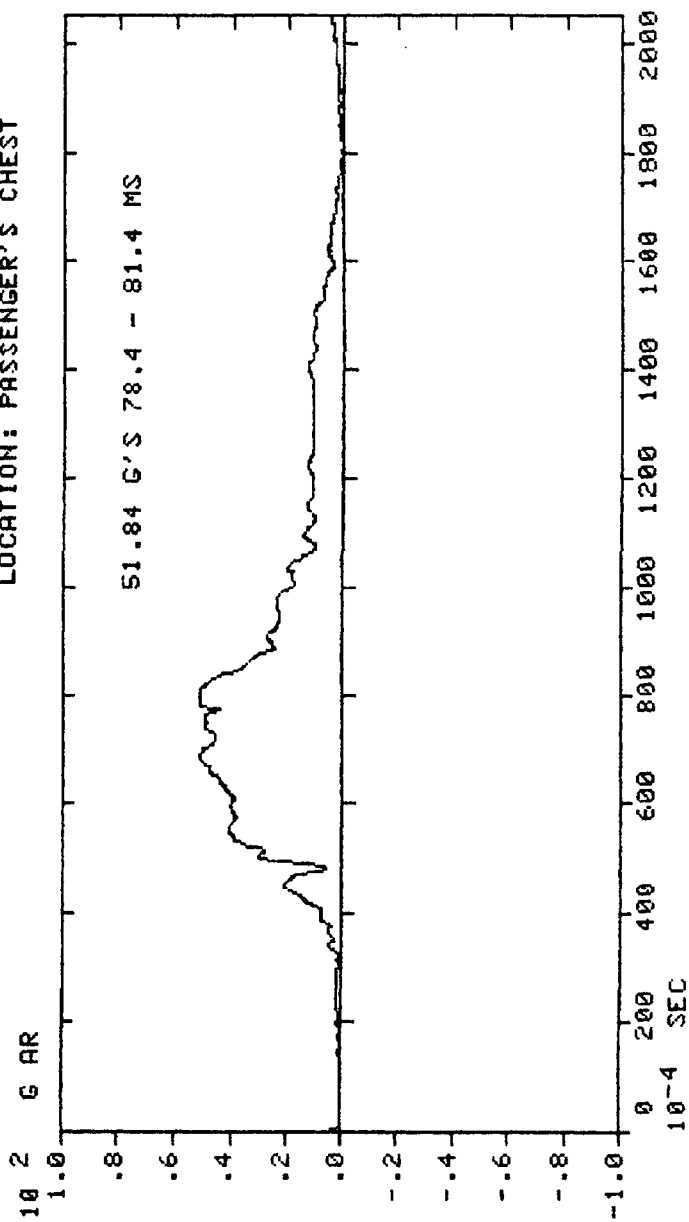


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 1000
 ACCELEROMETER: TAPE 2, CH 5-7
 DIRECTION: RESULTANT OF XYZ
 LOCATION: PASSENGER'S CHEST



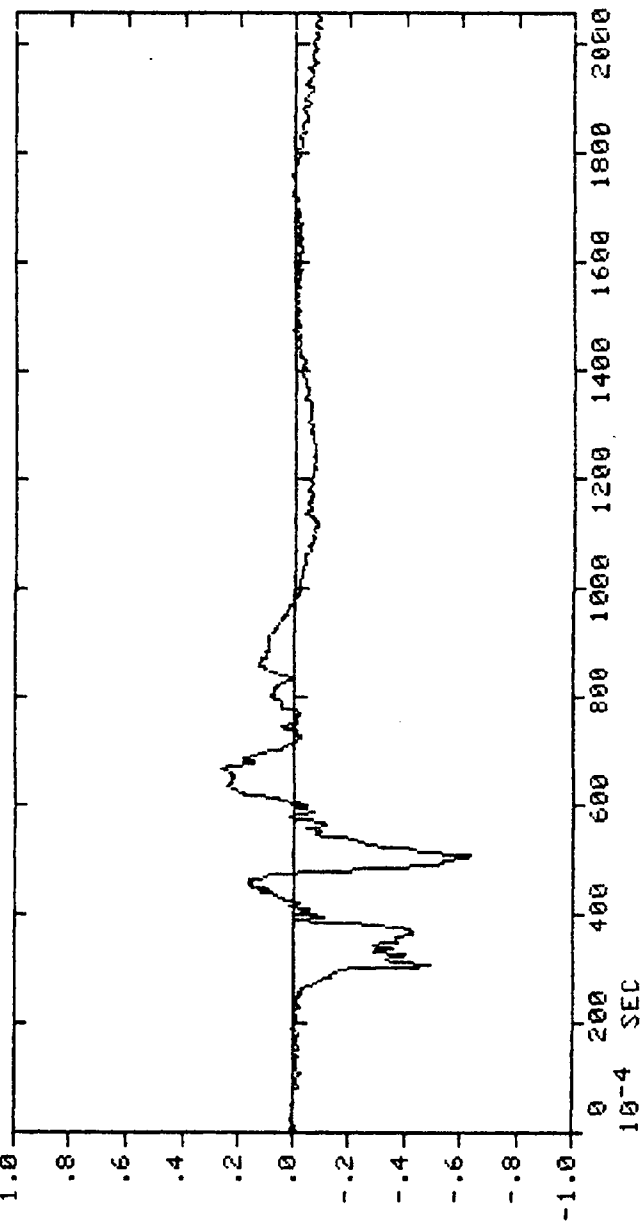
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 3 POUNDS

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 600
LOAD CELL: TAPE 2, CH 8
DIRECTION: TENSION
LOCATION: PASSENGER'S LEFT FEMUR

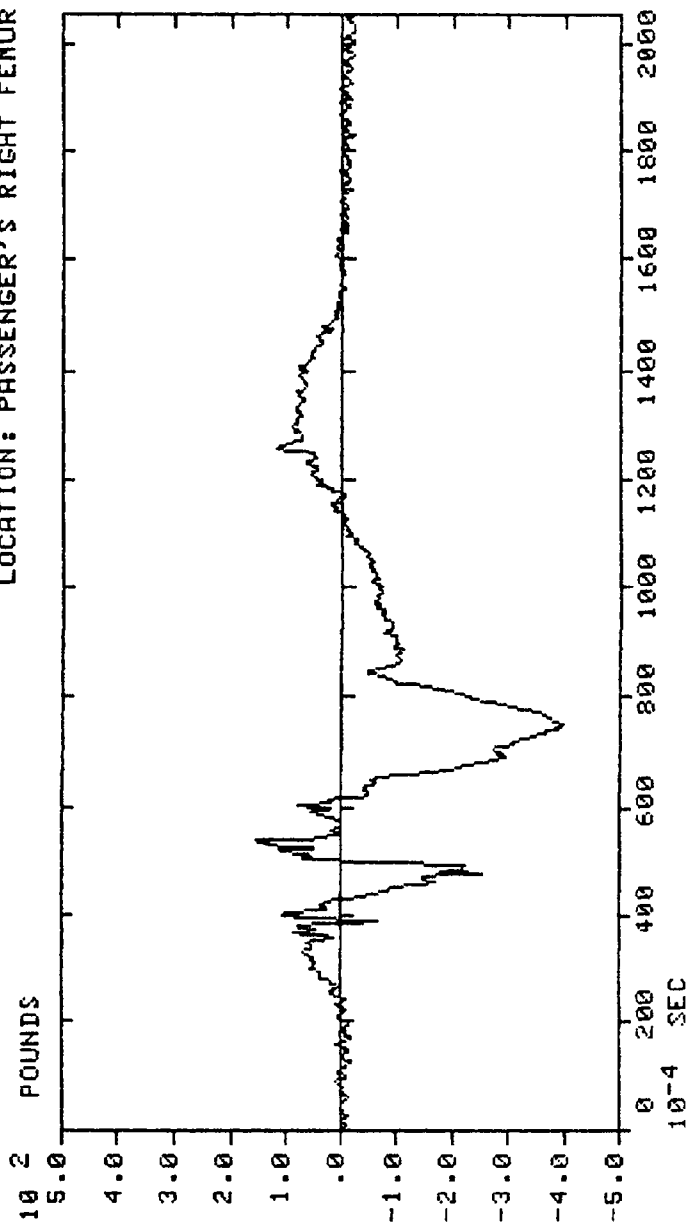


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 600
 LOAD CELL: TAPE 2, CH 4
 DIRECTION: TENSION
 LOCATION: PASSENGER'S RIGHT FEMUR



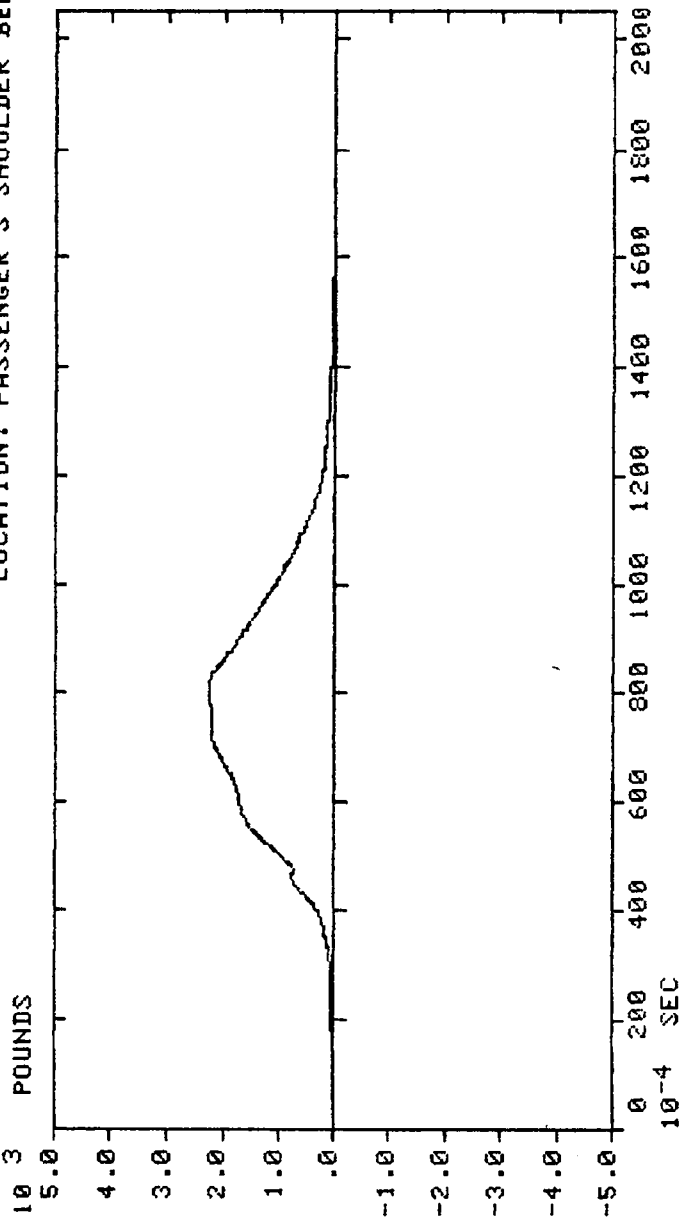
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 3 POUNDS

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 60
LOAD CELL: TAPE 2, CH 9
DIRECTION: TENSION
LOCATION: PASSENGER'S SHOULDER BELT

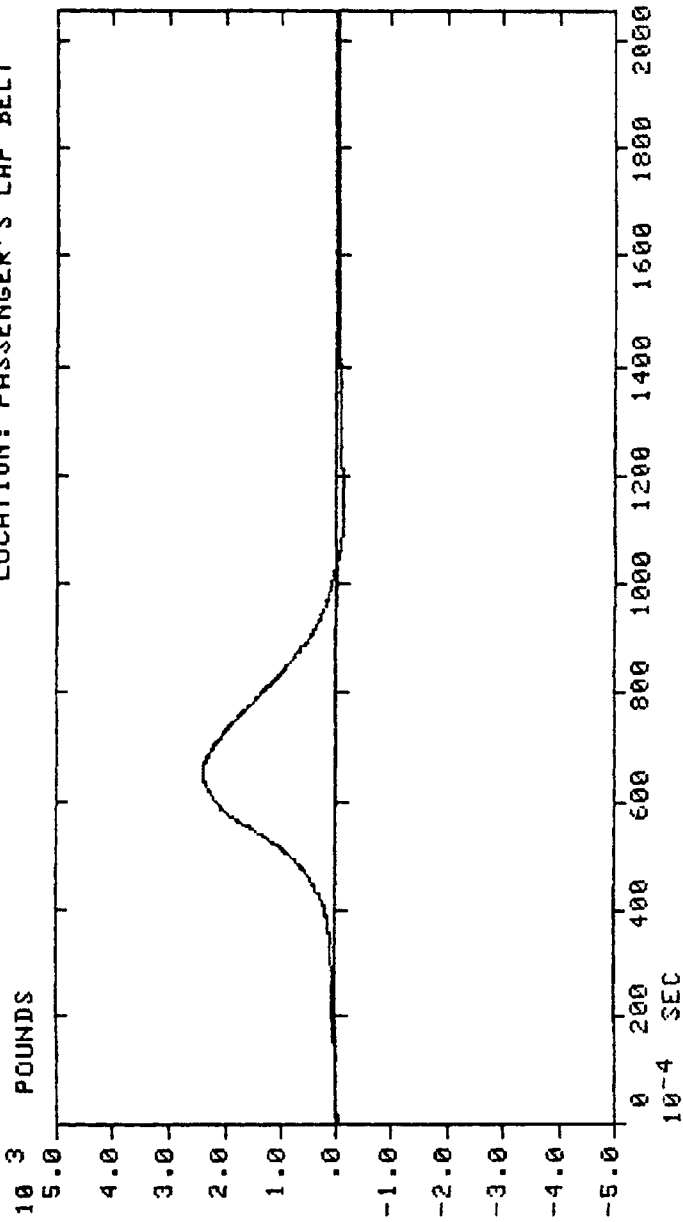


DOT CRASH PROGRAM

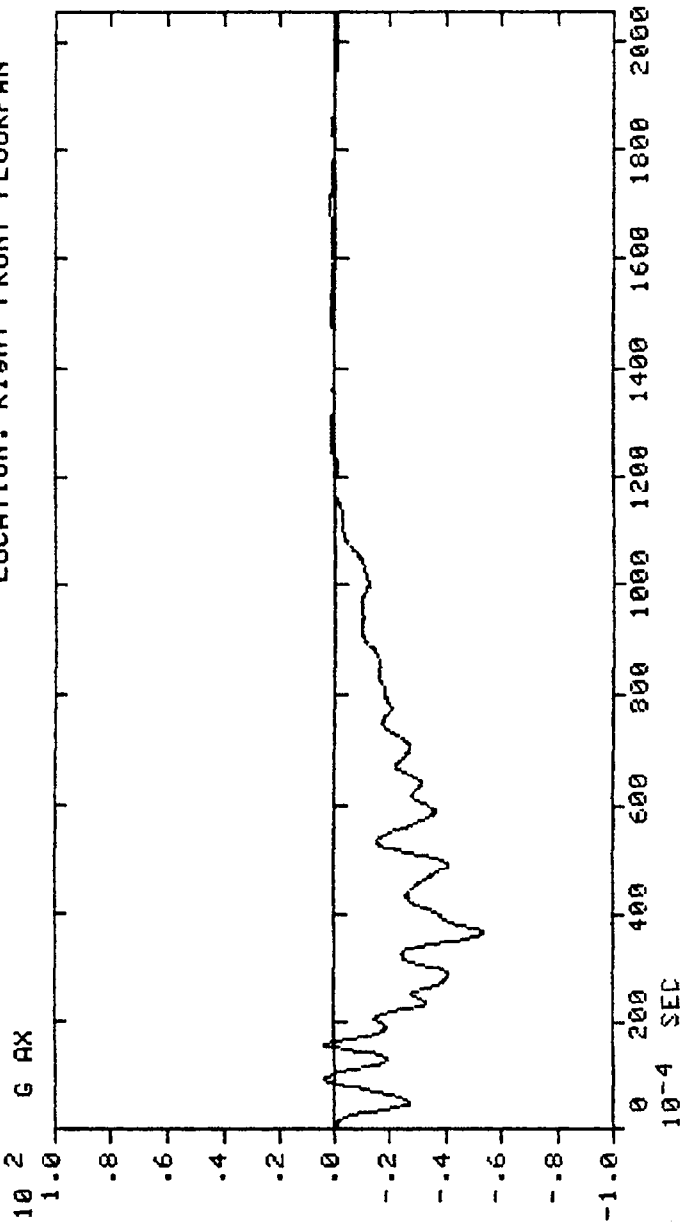
VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
FILTER: CLASS 60
LOAD CELL: TAPE 2, CH 10
DIRECTION: TENSION
LOCATION: PASSENGER'S LAP BELT



DOT CRASH PROGRAM
 VEHICLE: AUDI 5000S
 VEHICLE ID: WHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL
 10 2 G AX
 APPROVED ENGINEERING TEST LABS
 MJO NO.: 971-3882-38
 FILTER: CLASS 60
 ACCELEROMETER: TAPE 1, CH 12
 DIRECTION: FORWARD
 LOCATION: RIGHT FRONT FLOORPAN

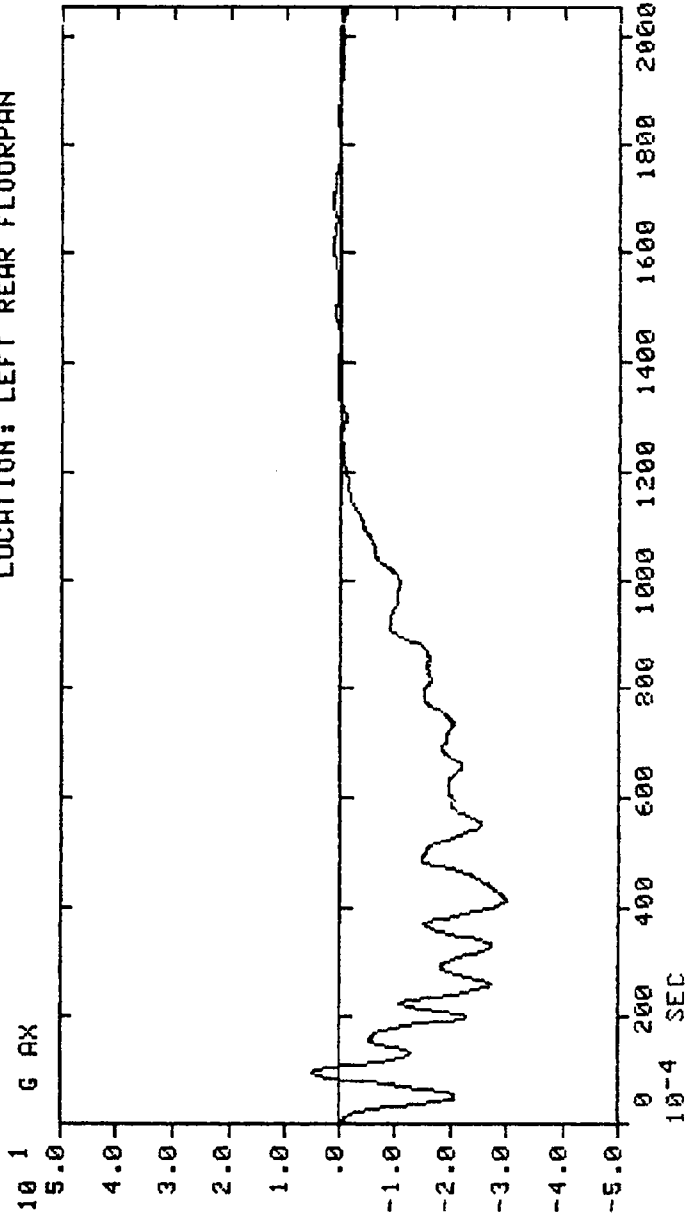


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 60
 ACCELEROMETER: TAPE 1, CH 10
 DIRECTION: FORWARD
 LOCATION: LEFT REAR FLOORPAN



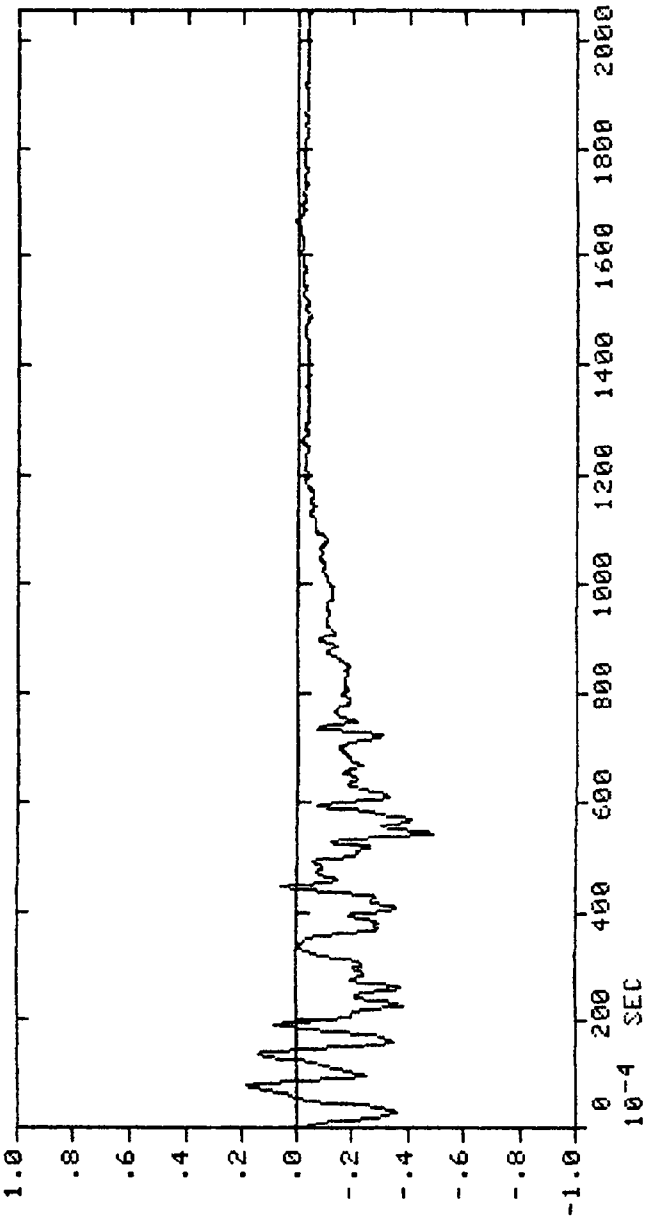
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
VEHICLE ID: NHTSA 810501
TEST FILE NO.: 149-14 34.70 MPH
DATE: JUNE 12, 1981 FRONTAL

10 2 G AX

APPROVED ENGINEERING TEST LABS

MJO NO. : 971-3882-38
FILTER: CLASS 180
ACCELEROMETER: TAPE 3, CH 5
DIRECTION: FORWARD
LOCATION: VEHICLE C.G.

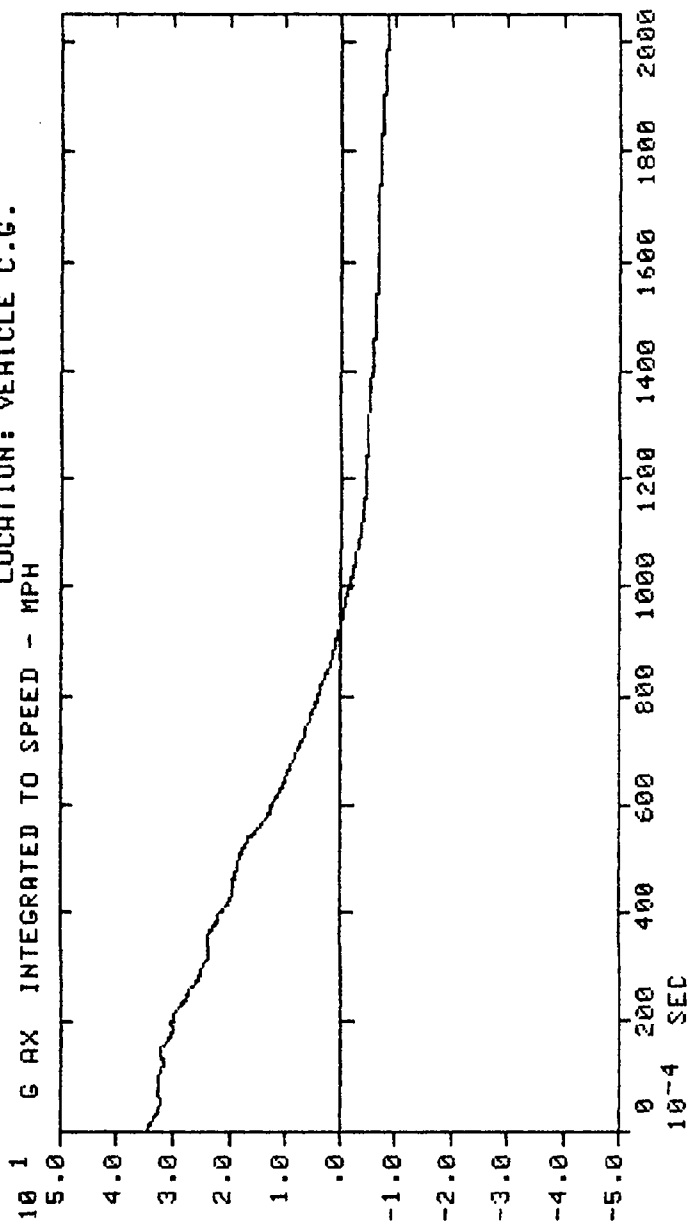


DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 180
 ACCELEROMETER: TAPE 3, CH 5
 DIRECTION: FORWARD
 LOCATION: VEHICLE C.G.



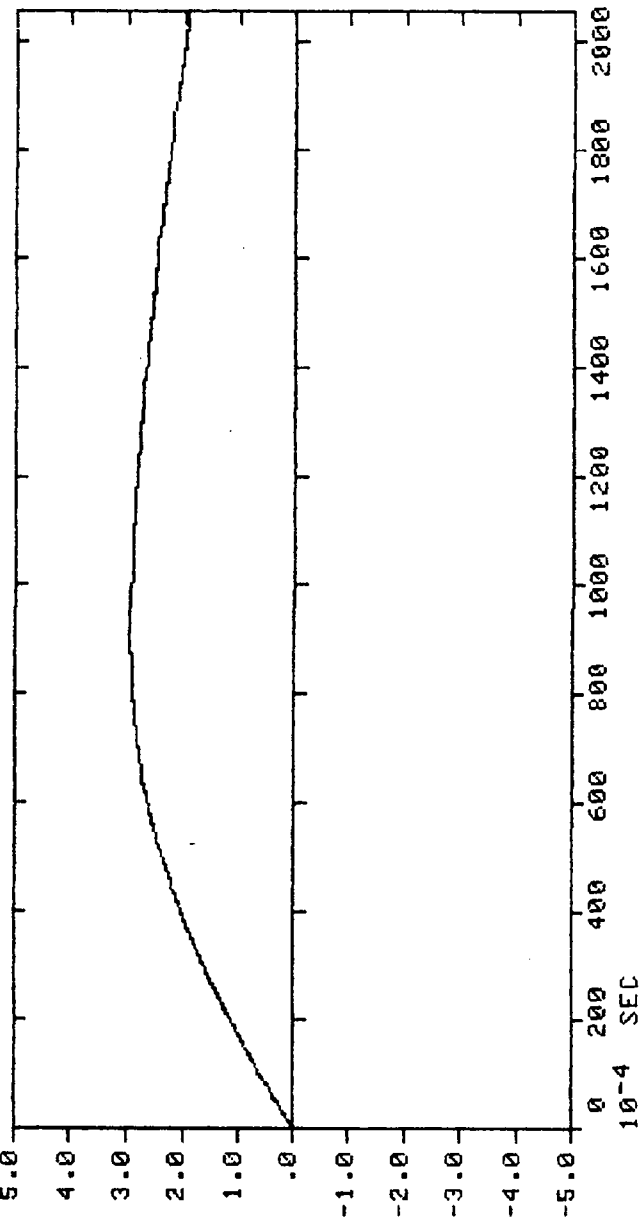
DOT CRASH PROGRAM

VEHICLE: AUDI 5000S
 VEHICLE ID: NHTSA 810501
 TEST FILE NO.: 149-14 34.70 MPH
 DATE: JUNE 12, 1981 FRONTAL

APPROVED ENGINEERING TEST LABS

MJO NO.: 971-3882-38
 FILTER: CLASS 180
 ACCELEROMETER: TAPE 3, CH 5
 DIRECTION: FORWARD
 LOCATION: VEHICLE C.G.

10 1 G AX INTEGRATED TO CRUSH - IN





APPROVED ENGINEERING TEST LABORATORIES

APPENDIX C



APPROVED ENGINEERING TEST LABORATORIES

APPENDIX C

The following report sheets are the part 572 test dummy calibration test data for the dummies used in the 1981 Audi 5000S - 4 Door Sedan, NHTSA 810501 frontal fixed barrier impact test.

PART 572 DUMMY CALIBRATION TEST DATA

Dummy S/N 0357

Calibration Laboratory Humanoid Systems

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration		1-22-81	
Calibration Sequential Number for Dummy		4	
Temperature in Lab. (Spec. = 66 to 78°F)		71°F	
Relative Humidity in Lab. (Spec. = 10 to 70%)		67%	
TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel.	210 to 260G	233.24 g	
b. Peak Lateral Accel.	≤ 10G	8.91 g	
c. Time above 100G	0.9 to 1.5 ms	1.36 ms	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed	21.5 to 25.5 fps	22.0 fps	
b. Pendulum Avg. Decel. (over t ₃ - t ₂)	20 to 24G	23.96 g	
c. Peak Resultant Head Acceleration	26G maximum	25.68 g	
d. Pendulum Decel. (t ₂ -t ₁)	≤ 3 ms	1.75 ms	
e. Pendulum Decel. (t ₃ -t ₂)	25 to 30 ms	26.07 ms	
f. Pendulum Decel. (t ₄ -t ₃)	≤ 10 ms	2.36 ms	
g. Pendulum Direction Reversal Time	≥ 123 ms	128.70 ms	
h. Max. Head Rotation	63 to 73°	66.01°	
i. Chordal Displacement: Head Rotation Angle			
0°	Time	-2 to 2 ms	0 ms
	Displ.	-.5 to .5 in.	0 in.
30°	Time	25.6 to 34.4 ms	28.59 ms
	Displ.	2.1 to 3.1 in.	2.59 in.

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N 0357

Calibration Laboratory Humanoid Systems

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. <u>NECK BENDING TEST</u> <u>Continued:</u>				
i. Chordal Displacement: Head Rotation Angle				
60°	Time	40.3 to 51.7 ms	47.91 ms	
	Displ.	4.3 to 5.3 in.	5.27 in.	
Maximum (°)	Time	53.2 to 66.8 ms	58.29 ms	
	Displ.	5.0 to 6.0 in.	5.93 in.	
60°	Time	67.0 to 83.0 ms	69.99 ms	
	Displ.	4.3 to 5.3 in.	5.28 in.	
30°	Time	85.4 to 104.6 ms	96.04 ms	
	Displ.	2.1 to 3.1 in.	2.72 in.	
0°	Time	101.0 to 123.0 ms	113.04 ms	
	Displ.	-.5 to 0.5 in.	+0.43 in.	
3. <u>ABDOMINAL COMPRESSION TEST:</u> (Preload = 10 pounds)				
a. Force @ .5"		23 to 37 lbs.	27.0 lbs.	
b. Force @ .75"		37 to 50 lbs.	38.5 lbs.	
c. Force @ 1.0"		50 to 63 lbs.	57.0 lbs.	
d. Force @ 1.3"		73 to 88 lbs.	82.5 lbs.	
4.. <u>LUMBAR FLEXION TEST:</u>				
a. Force @ 20°		22 to 34 lbs.	30.0 lbs.	
b. Force @ 30°		34 to 46 lbs.	39.0 lbs.	
c. Force @ 40°		46 to 58 lbs.	47.5 lbs.	
d. Return Angle		≤ 12° maximum	12.0°	

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N 0357

Calibration Laboratory Humanoid Systems

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
5. <u>CHEST IMPACT TESTS:</u>			
a. High Speed			
(1) Probe Speed	21.78-22.22 fps	22.00 fps	
(2) Peak Deflection	1.7" maximum	1.59 in.	
(3) Peak Resistive Force	2250 lbs. max.	2021.14 lbs.	
(4) Internal Hysteresis	50 to 70%	54.22%	
b. Low Speed			
(1) Probe Speed	13.86-14.14 fps	14.00 fps	
(2) Peak Deflection	1.1" maximum	1.02 in.	
(3) Peak Resistive Force	1450 lbs. max.	1210.99 lbs.	
(4) Internal Hysteresis	50 to 70%	55.09%	
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side			
(1) Probe Side	6.76 to 7.04 fps	6.90 fps	
(2) Maximum Force	1850 to 2500 lbs.	1950.08 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.76 ms	
b. Left Side			
(1) Probe Speed	6.76 to 7.04 fps	6.90 fps	
(2) Maximum Force	1850 to 2500 lbs.	1961.92 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.85 ms	

PART 572 DUMMY CALIBRATION TEST DATA

Dummy S/N 0358

Calibration Laboratory Humanoid Systems

		Pre-Test Calibration	Post-Test Calibration
Date of Dummy Calibration		1-16-81	
Calibration Sequential Number for Dummy		4	
Temperature in Lab. (Spec. = 66 to 78°F)		71°F	
Relative Humidity in Lab. (Spec. = 10 to 70%)		67%	
TEST PARAMETER	SPECIFICATION		
1. <u>HEAD DROP TEST:</u>			
a. Peak Resultant Accel.	210 to 260G	226.95 g	
b. Peak Lateral Accel.	$\leq 10G$	8.81 g	
c. Time above 100G	0.9 to 1.5 ms	1.29 ms	
2. <u>NECK BENDING TEST:</u>			
a. Pendulum Speed	21.5 to 25.5 fps	22.0 fps	
b. Pendulum Avg. Decel. (over $t_3 - t_2$)	20 to 24G	23.98 g	
c. Peak Resultant Head Acceleration	26G maximum	26.00 g	
d. Pendulum Decel. ($t_2 - t_1$)	≤ 3 ms	1.28 ms	
e. Pendulum Decel. ($t_3 - t_2$)	25 to 30 ms	25.41 ms	
f. Pendulum Decel. ($t_4 - t_3$)	≤ 10 ms	1.70 ms	
g. Pendulum Direction Reversal Time	≥ 123 ms	119.02 ms	
h. Max. Head Rotation	63 to 73°	66.94°	
i. Chordal Displacement: Head Rotation Angle			
0°	Time	-2 to 2 ms	0 ms
	Displ.	-.5 to .5 in.	0 in.
30°	Time	25.6 to 34.4 ms	27.22 ms
	Displ.	2.1 to 3.1 in.	3.00 in.

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N 0358

Calibration Laboratory Humanoid Systems

TEST PARAMETER		SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
2. <u>NECK BENDING TEST</u> <u>Continued:</u>				
i. Chordal Displacement: Head Rotation Angle				
60°	Time	40.3 to 51.7 ms	45.51 ms	
	Displ.	4.3 to 5.3 in.	5.27 in.	
Maximum (°)	Time	53.2 to 66.8 ms	55.42 ms	
	Displ.	5.0 to 6.0 in.	5.77 in.	
60°	Time	67.0 to 83.0 ms	68.12 ms	
	Displ.	4.3 to 5.3 in.	5.22 in.	
30°	Time	85.4 to 104.6 ms	93.42 ms	
	Displ.	2.1 to 3.1 in.	2.62 in.	
0°	Time	101.0 to 123.0 ms	110.17 ms	
	Displ.	-.5 to 0.5 in.	+0.16 in.	
3. <u>ABDOMINAL COMPRESSION TEST:</u> (Preload = 10 pounds)				
a. Force @ .5"		23 to 37 lbs.	25.0 lbs.	
b. Force @ .75"		37 to 50 lbs.	38.5 lbs.	
c. Force @ 1.0"		50 to 63 lbs.	53.5 lbs.	
d. Force @ 1.3"		73 to 88 lbs.	75.5 lbs.	
4.. <u>LUMBAR FLEXION TEST:</u>				
a. Force @ 20°		22 to 34 lbs.	33.8 lbs.	
b. Force @ 30°		34 to 46 lbs.	44.0 lbs.	
c. Force @ 40°		46 to 58 lbs.	55.0 lbs.	
d. Return Angle		≤ 12° maximum	11.0°	

PART 572 DUMMY CALIBRATION TEST DATA
(Continued)

Dummy S/N 0358

Calibration Laboratory Humanoid Systems

TEST PARAMETER	SPECIFICATION	Pre-Test Calibration	Post-Test Calibration
5. <u>CHEST IMPACT TESTS:</u>			
a. High Speed			
(1) Probe Speed	21.78-22.22 fps	22.00 fps	
(2) Peak Deflection	1.7" maximum	1.53 in.	
(3) Peak Resistive Force	2250 lbs. max.	2151.02 lbs.	
(4) Internal Hysteresis	50 to 70%	67.15%	
b. Low Speed			
(1) Probe Speed	13.86-14.14 fps	14.00 fps	
(2) Peak Deflection	1.1" maximum	1.02 in.	
(3) Peak Resistive Force	1450 lbs. max.	1333.34 lbs.	
(4) Internal Hysteresis	50 to 70%	58.67%	
6. <u>KNEE IMPACT TESTS:</u>			
a. Right Side			
(1) Probe Side	6.76 to 7.04 fps	6.90 fps	
(2) Maximum Force	1850 to 2500 lbs.	2098.60 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.91 ms	
b. Left Side			
(1) Probe Speed	6.76 to 7.04 fps	6.90 fps	
(2) Maximum Force	1850 to 2500 lbs.	2361.81 lbs.	
(3) Time Above 1000#	1.7 ms minimum	1.82 ms	



APPROVED ENGINEERING TEST LABORATORIES

SERVICE FOR: U. S. Department of Transportation
National Highway Traffic Safety Administration
Enforcement
Office of Vehicle Safety Compliance
400 Seventh Street S. W.
Washington, D. C. 20590

CONTRACT NUMBER: DOT-HS-9-02273

I hereby certify that the preceding report is true and correct to the best of my knowledge.

APPROVED ENGINEERING TEST LABORATORIES

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rmh