

REPORT NUMBER 216-GTL-04-005

**SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 216
ROOF CRUSH RESISTANCE**

**FORD MOTOR CO. IN U.S.A.
2004 LINCOLN LS, PASSENGER CAR
NHTSA NO. C40204**

**GENERAL TESTING LABORATORIES, INC.
1623 LEEDSTOWN ROAD
COLONIAL BEACH, VIRGINIA 22443**



JUNE 3, 2004

FINAL REPORT

PREPARED FOR

**U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Approval Date: 6/3/04

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2004 Lincoln LS Passenger Car was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 216 testing to determine if the vehicle was in compliance with the requirements of the standard. The purpose of this standard is to reduce deaths and injuries due to the crushing of the roof into the occupant compartment in rollover crashes.

1.1 The test vehicle was a 2004 Lincoln LS Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: 1LNHM86S34Y630130

B. NHTSA No.: C40204

C. Manufacturer: FORD MOTOR CO. IN U.S.A.

D. Manufacture Date: 11-03

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 216 testing on May 25, 2004.

SECTION 2

COMPLIANCE TEST RESULTS SUMMARY

2.0 TEST RESULTS

All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedure, TP-216-05 and General Testing Laboratories Procedure, TP-216-05B with the following modifications requested by the COTR:

- 1) The vehicle was rigidly mounted in the test fixture by welding vertical supports to the vehicle jack points to prevent any vehicle movement. Chains were not used in an effort to reduce and/or eliminate "pre-stressing" of the vehicle due to the tightening of chains.
- 2) Dial gauges were placed at the vehicle corners and at the passenger door to track overall vehicle motion and the ability of the alternate tie-down procedure to restrict motion of the vehicle.

The data for this portion of the test can be found on Data Sheet 6.

Based on the test performed, the 2004 Lincoln LS appears to meet the requirements of FMVSS 216.

SECTION 3**COMPLIANCE TEST DATA****3.0 TEST RESULTS**

The following data sheets document the results of testing on the 2004 Lincoln LS.

DATA SHEET 1
FMVSS 216
SUMMARY OF RESULTS

VEH. MOD YR/MAKE/MODEL/BODY: 2004 LINCOLN LS PASSENGER CAR

VEH. NHTSA NO: C40204; VIN: 1LNHM86S34Y630130

VEH. BUILD DATE: 11-03 TEST DATE: MAY 25, 2004

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

A. VISUAL INSPECTION OF TEST VEHICLE

Upon receipt, inspect vehicle for completeness, function, and discrepancies or damage which might influence the testing.

RESULTS:

B. VEHICLE DATA

(1) Vehicle type as shown on certification label: PASSENGER CAR

(2) Vehicle UVW as recorded on Data Table 2: 1663 kg

C. STATIC LOAD TEST OF DRIVER SIDE OF ROOF

Minimum roof crush resistance required by FMVSS 216 for the vehicle tested:

MCCR as recorded on Data Table 2: 22,241 N

Maximum roof crush resistance measured during test was
42,042 N at 83.6 mm

PASS

FAIL

X

D. POST TEST VISUAL INSPECTION

Driver side roof rail flattened from windshield rearward 43". Windshield shattered.

RESULTS:

REMARKS:

RECORDED BY: [Signature]

DATE: 05/25/04

APPROVED BY: [Signature]

DATA SHEET 2
FMVSS 216
RECEIVING INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2004 LINCOLN LS PASSENGER CAR

VEH. NHTSA NO: C40204; VIN: 1LNHM86S34Y630130

VEH. BUILD DATE: 11-03; TEST DATE: MAY 25, 2004

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Upon receipt, the vehicle will be examined visually for completeness, function, and damage. The roof and supporting structures such as the doors and windows should be checked for proper operation and any discrepancies which may influence the testing. The vehicle will be weighed and the minimum roof crush resistance determined.

RESULTS:

(1) Unloaded Vehicle Weight (UVW)

Left Front	<u>427</u>	kg	Left Rear	<u>402</u>	kg
Right Front	<u>437</u>	kg	Right Rear	<u>397</u>	kg
Front Axle	<u>864</u>	kg	Rear Axle	<u>799</u>	kg

TOTAL UVW 1663 kg

(2) Vehicle type as shown on vehicle certification label: PASSENGER CAR

(3) Minimum Roof Crush Resistance (MCRR):

Passenger Car:

$UVW \times 1.5 \times 9.8 = \underline{24,446} \text{ N}$

MCRR = 22,241 N (UVW x 1.5 x 9.8 or 22,241 N whichever is less)

MPV, Truck or Bus:

MCRR = $UVW \times 1.5 \times 9.8 = \underline{N/A} \text{ N}$

(4) Other Comments: _____

REMARKS:

RECORDED BY: [Signature]

DATE: 05/25/04

APPROVED BY: [Signature]

DATA SHEET 3
FMVSS 216
PRE-TEST PREPARATION

VEH. MOD YR/MAKE/MODEL/BODY: 2004 LINCOLN LS PASSENGER CAR
VEH. NHTSA NO: C40204; VIN: 1LNHM86S34Y630130
VEH. BUILD DATE: 11-03; TEST DATE: MAY 25, 2004
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Prior to testing, the following will be accomplished:

- A. Secure any convertible top, movable or removable roof structure in their weather tight positions OK
- B. Close all windows OK
- C. Close and lock all doors OK
- D. State Side of Roof Tested Driver
- E. Measure the lateral angle of the test device at sufficient points to determine that it has a 25 degree (plus zero degree, minus one degree) angle 25°
- F. Measure the longitudinal angle of the loading device at sufficient points to determine that it has a 5 degree (plus zero minutes, minus 20 minutes) 5°
- G. The test device will initially contact the roof at 457 mm aft from top center of windshield
- H. If the test device was relocated based on the requirements of Chapter 12.3 paragraph F, describe where the test device will initially contact the roof as relocated N/A
- I. Ambient temperature 51 mm from the vehicle roof in the immediate area of the test device: 30 degrees C.

REMARKS:

RECORDED BY: G. Farrand

DATE: 05/25/04

APPROVED BY: A. Monica

DATA SHEET 4
FMVSS 216

VEH. MOD YR/MAKE/MODEL/BODY: 2004 LINCOLN LS PASSENGER CAR

VEH. NHTSA NO: C40204; VIN: 1LNHM86S34Y630130

VEH. BUILD DATE: 11-03; TEST DATE: MAY 25, 2004

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

RESULTS: Plots of load versus displacement and time versus displacement showed that:

- (1) The maximum roof crush resistance was 42,042 N at 83.8 mm
- (2) The rate of loading was 5.08 mm/sec (.2 in/sec)
- (3) The required roof crush resistance of 24,446 N was at 22.6 mm

REMARKS:

RECORDED BY: *G. Farrand*

DATE: 05/25/04

APPROVED BY: *D. Murrice*

DATA SHEET 5
FMVSS 216
POST TEST VISUAL INSPECTION

VEH. MOD YR/MAKE/MODEL/BODY: 2004 LINCOLN LS PASSENGER CAR

VEH. NHTSA NO: C40204; VIN: 1LNHM86S34Y830130

VEH. BUILD DATE: 11-03; TEST DATE: MAY 25, 2004

TEST LABORATORY: GENERAL TESTING LABORATORIES

OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Upon completion of testing, a detailed visual inspection of the vehicle shall be made. Describe all damage and deformation that occurred during the test.

RESULTS: Driver side roof rail flattened from windshield rearward 43". Windshield shattered.

RECORDED BY: 

DATE: 05/25/04

APPROVED BY: 

DATA SHEET 6
FMVSS 216 MODIFIED PORTION POST TEST

VEH. MOD YR/MAKE/MODEL/BODY: 2004 LINCOLN LS PASSENGER CAR
VEH. NHTSA NO: C40204; VIN: 1LNHM86S34Y630130
VEH. BUILD DATE: 11-03; TEST DATE: MAY 25, 2004
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE, AMANDA PRESCOTT

Maximum Load Applied = 42,042 N @ 83.6 mm
Maximum Displacement = 93 mm @ 41,000 N

Left Front Dial Indicator Displacement = .051 mm
Right Front Dial Indicator Displacement = .025 mm
Left Rear Dial Indicator Displacement = 8.41 mm
Right Rear Dial Indicator Displacement = 9.98 mm
Right Door Sill Dial Indicator Displacement = 4.85 mm

NOTES:

RECORDED BY: *G. Farrand*

DATE: 05/25/04

APPROVED BY: *D. Meric*

SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

TABLE 1 - INSTRUMENTATION & EQUIPMENT LIST

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
COMPUTER	AT&T	486D88	BEFORE USE	BEFORE USE
TEST FIXTURE	GTL	N/A	N/A	N/A
A/D INTERFACE	METRABYTE	DAS-16(F)	BEFORE USE	BEFORE USE
SIGNAL CONDITIONER	METRABYTE	EXP-RES	BEFORE USE	BEFORE USE
LOAD CELL	REVERE	544351	11/03	11/04
DIAL INDICATOR	MITUTOYO	2424-10	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	SERVO SYSTEMS	20/69	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	SERVO SYSTEMS	20/70	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	SERVO SYSTEMS	20/72	BEFORE USE	BEFORE USE
LINEAR POTENTIOMETER	ELECTRIC ASSOC. INC.	11A4A6	BEFORE USE	BEFORE USE

SECTION 5
PHOTOGRAPHS

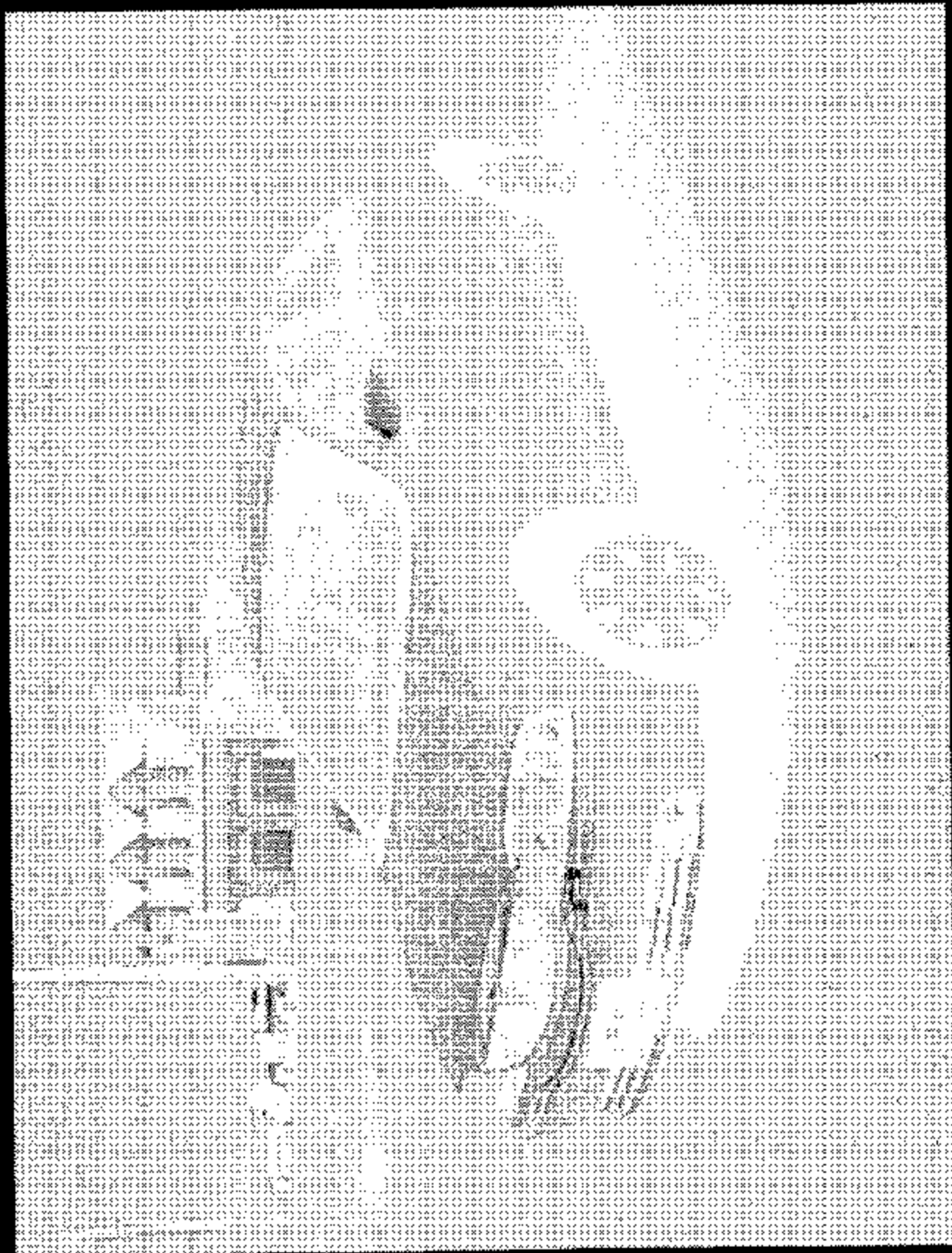


FIGURE 5.1
¾ FORWARD VIEW OF VEHICLE ON TESTED
SIDE BEFORE TESTING

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

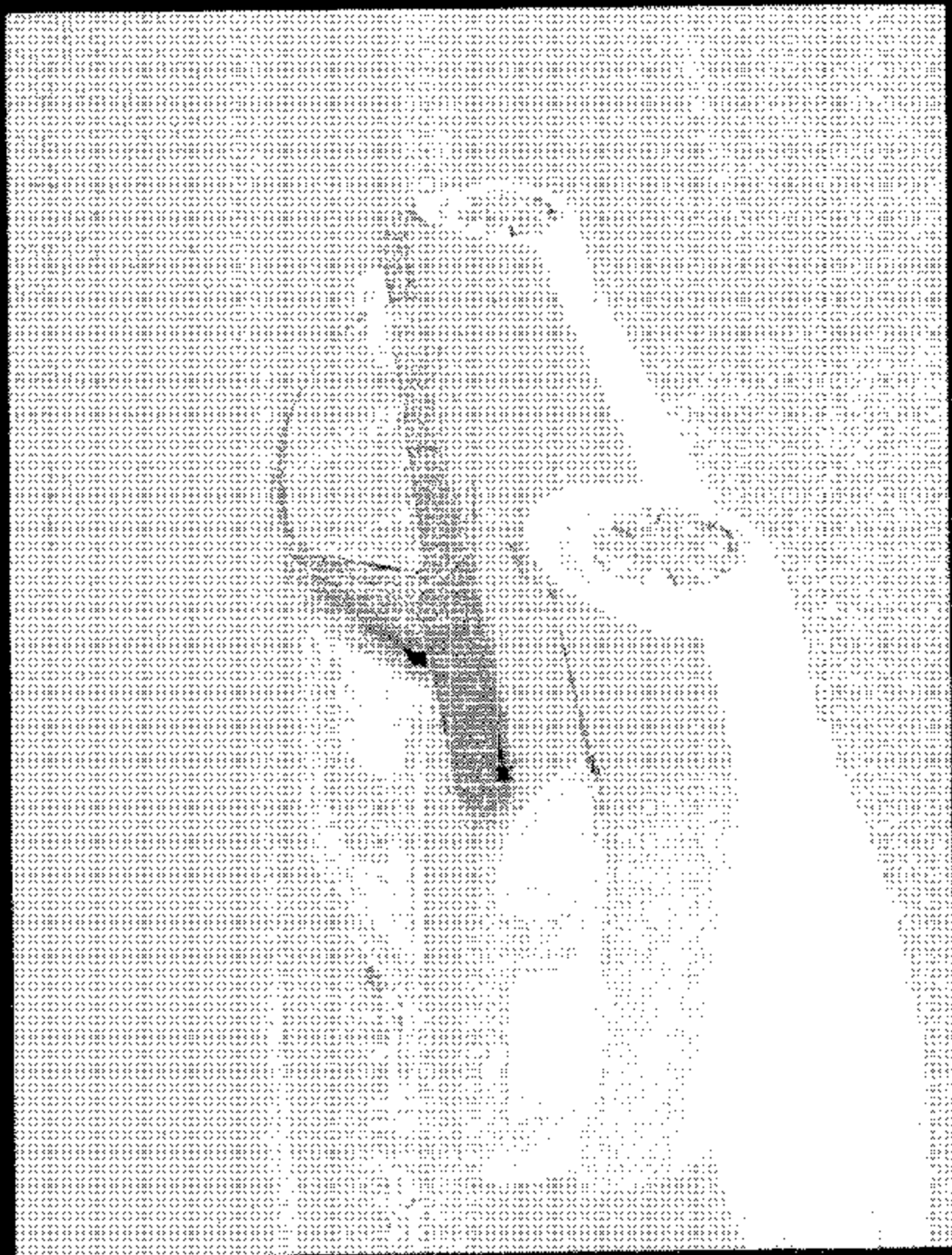


FIGURE 5.2
¾ REARWARD VIEW OF VEHICLE ON TESTED
SIDE BEFORE TESTING

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

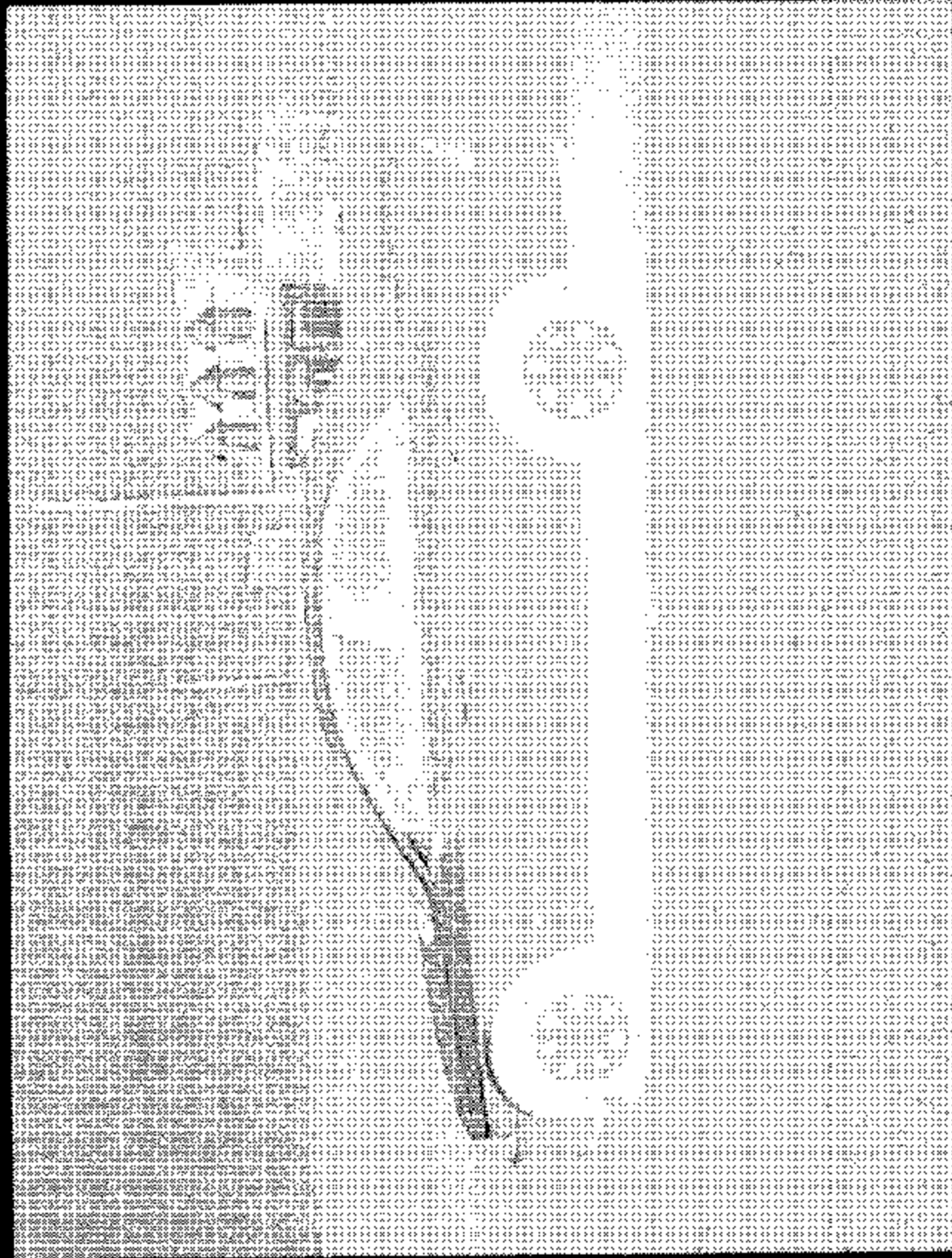
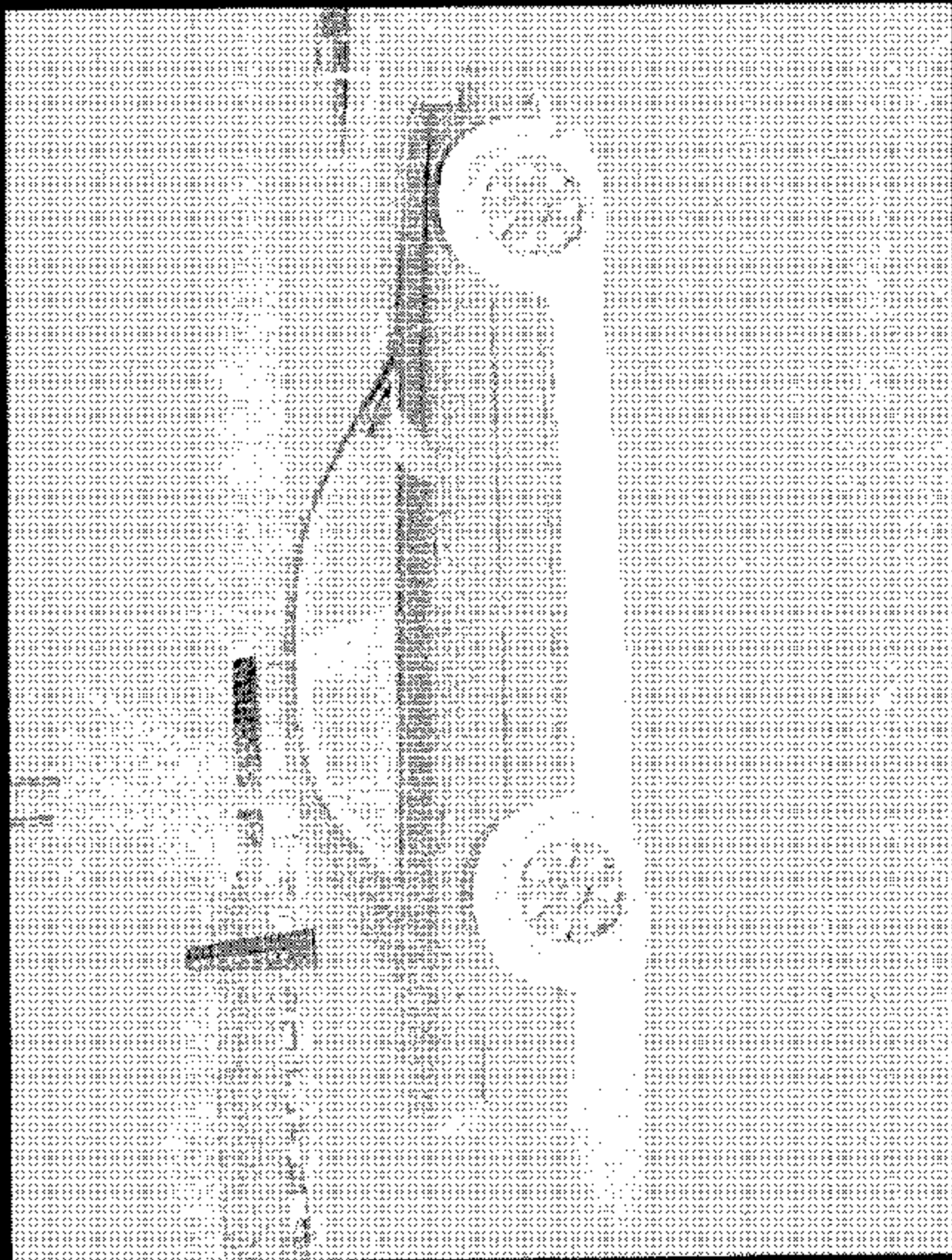


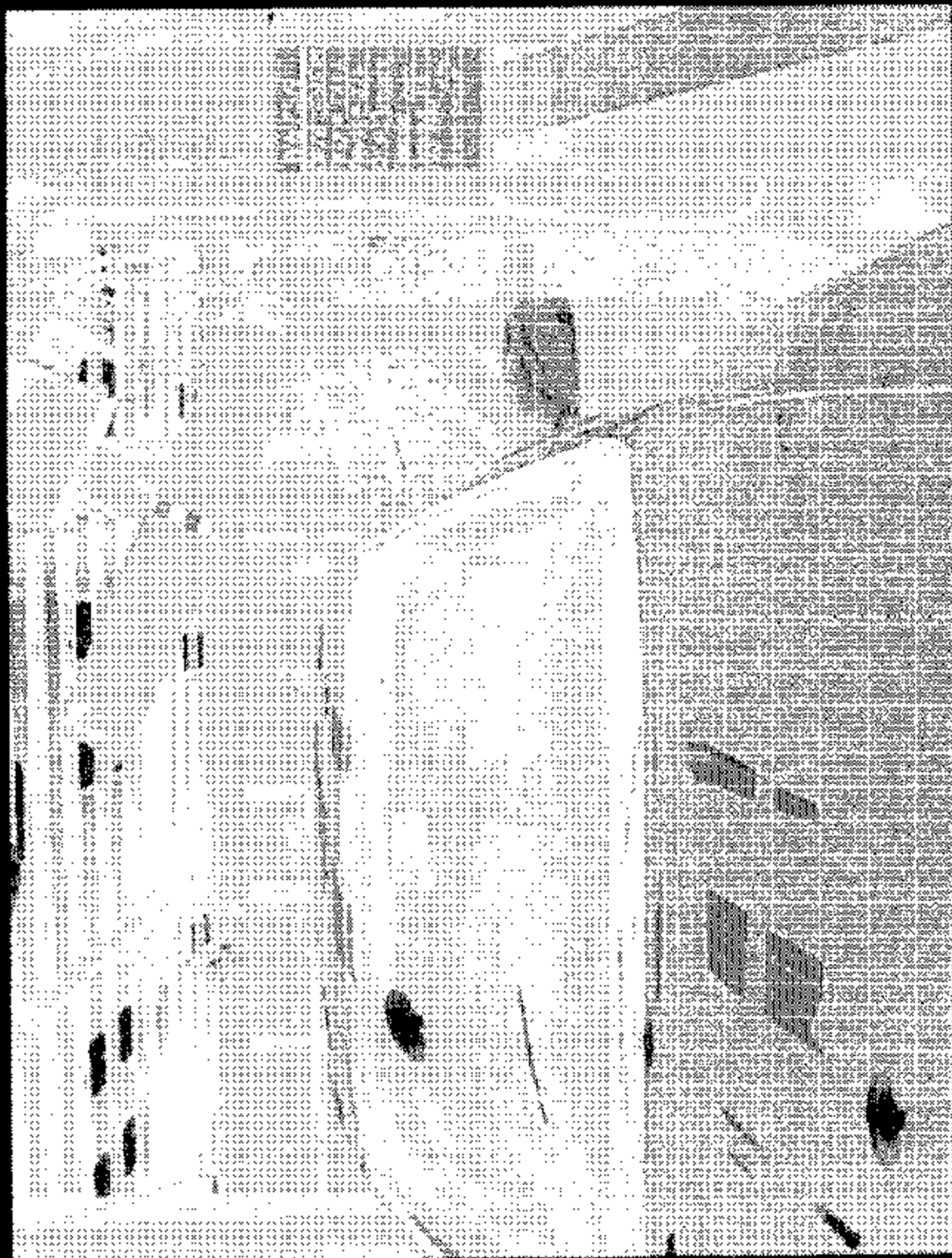
FIGURE 5.3
LEFT SIDE VIEW OF VEHICLE BEFORE TESTING

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.4
RIGHT SIDE VIEW OF VEHICLE BEFORE
TESTING



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.5
FRONT VIEW OF TEST SET-UP PRE-TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.6
LEFT FRONT VIEW OF TEST SET-UP PER-TEST

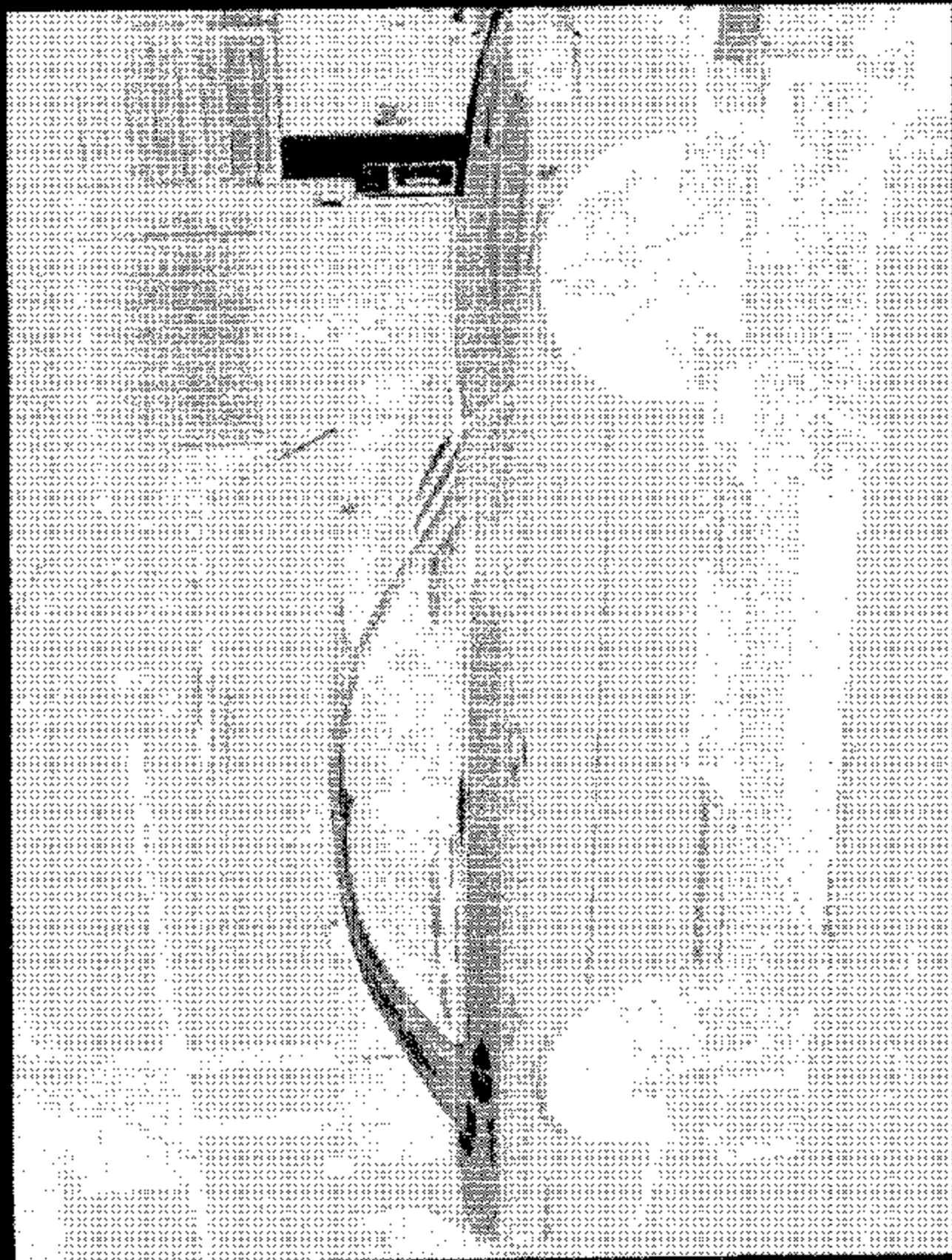


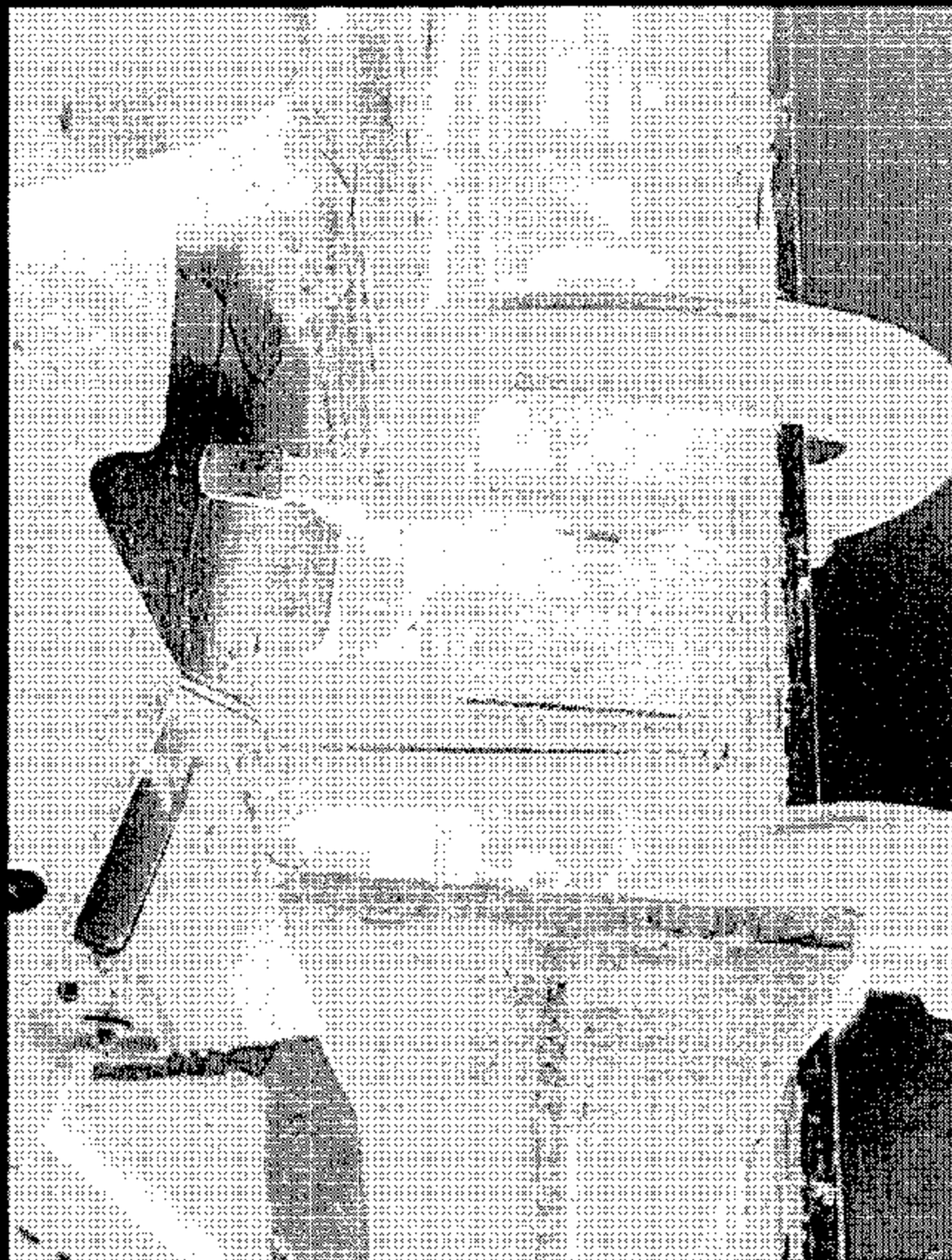
FIGURE 5.7
VEHICLE IN 218 TEST RIG PRE-TEST

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.8
LEFT FRONT VEHICLE MOUNTING



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 6.9
RIGHT FRONT VEHICLE MOUNTING



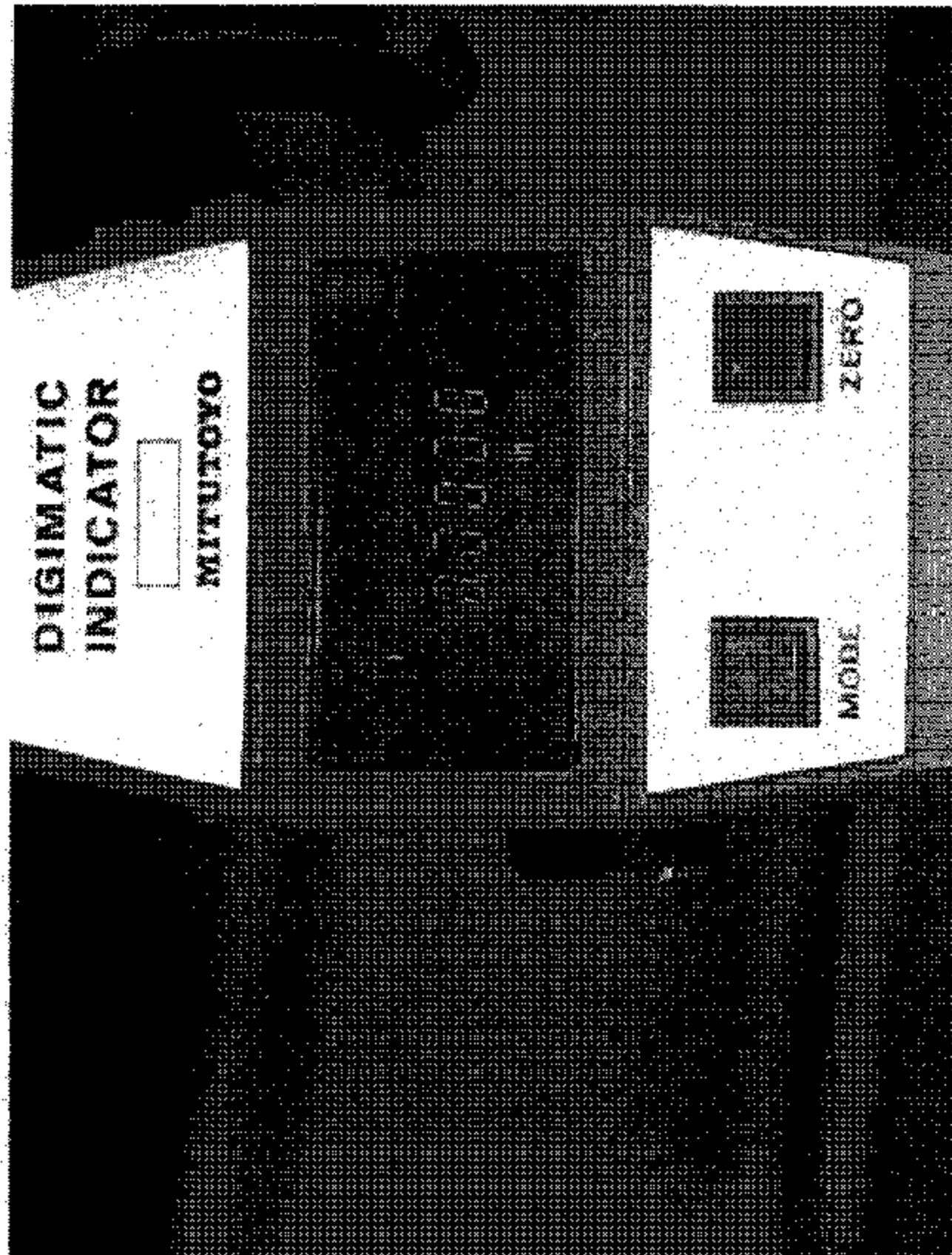
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.10
RIGHT REAR VEHICLE MOUNTING



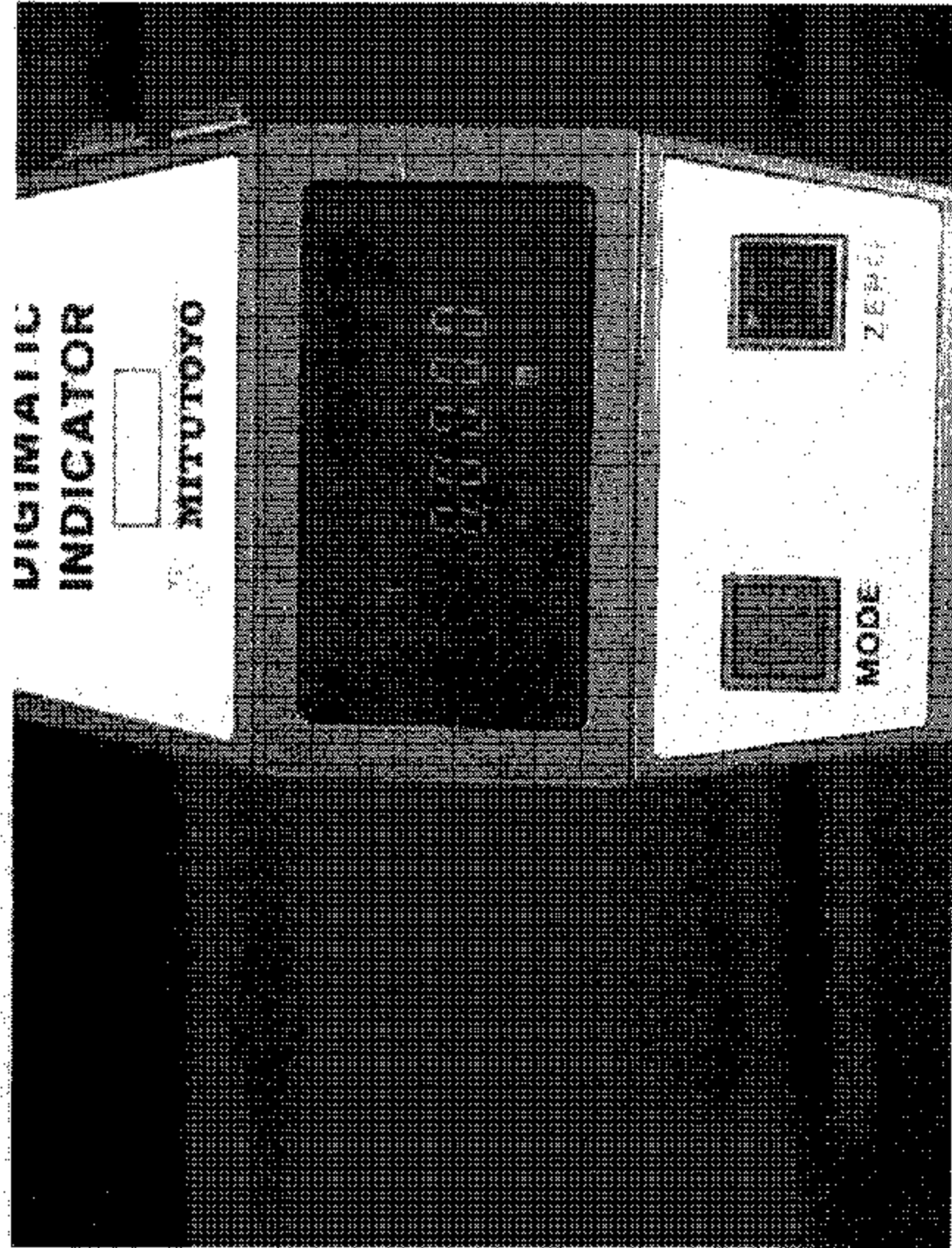
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.11
LEFT REAR VEHICLE MOUNTING



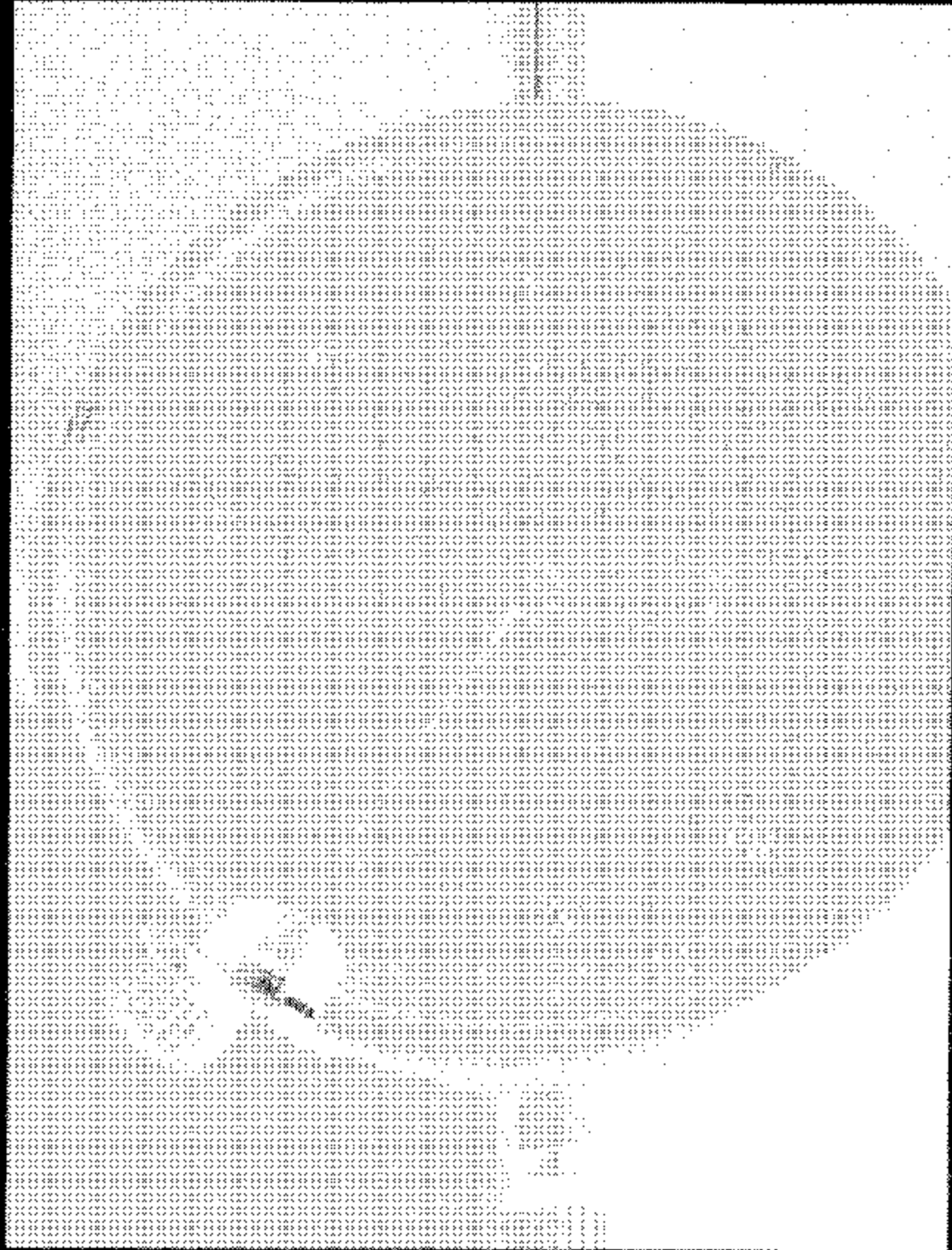
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.12
LEFT FRONT DISPLACEMENT PRE-TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.13
RIGHT FRONT DISPLACEMENT PRE-TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.14
PASSENGER DOOR DISPLACEMENT PRE-TEST

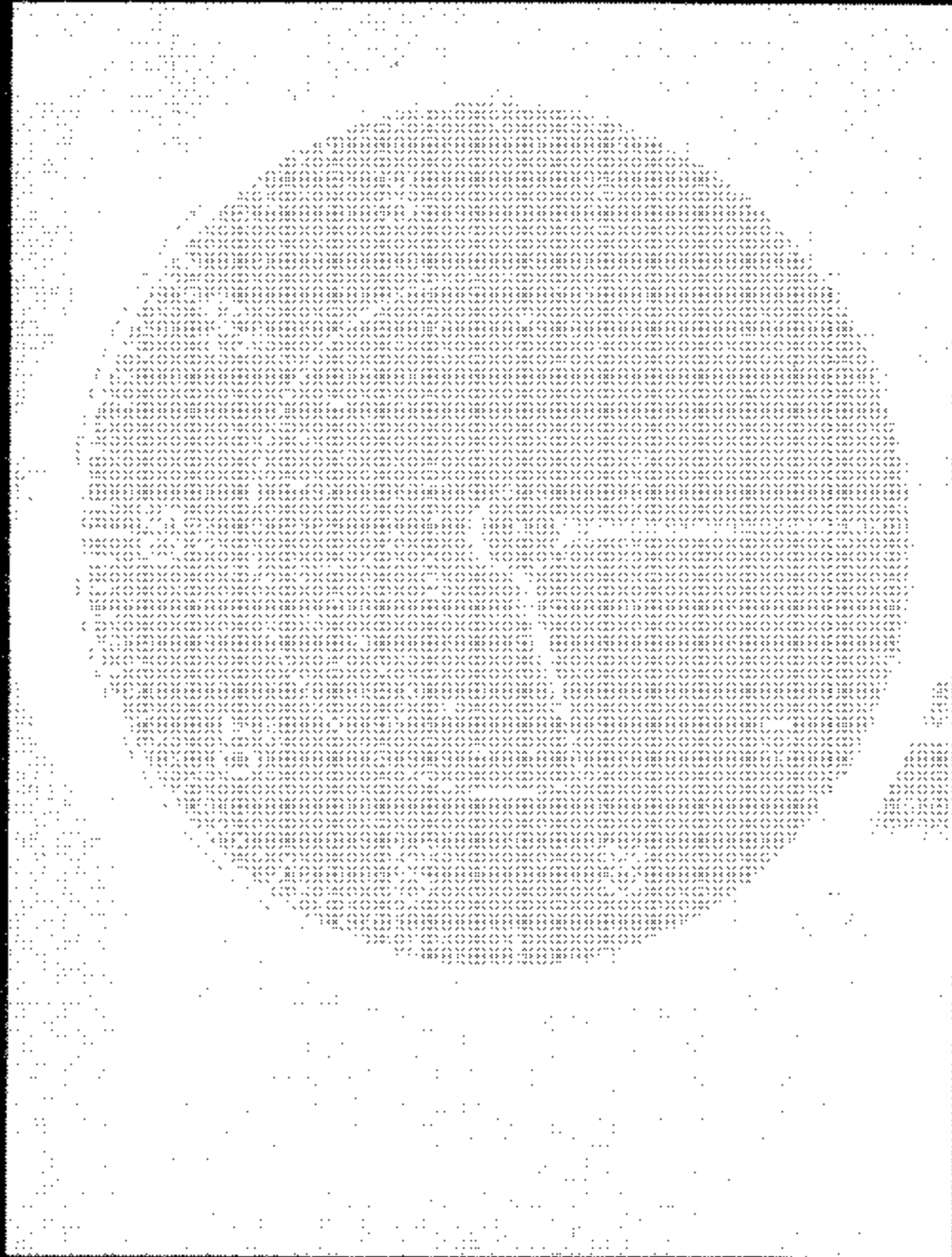


FIGURE 5.15
RIGHT REAR DISPLACEMENT PRE-TEST

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

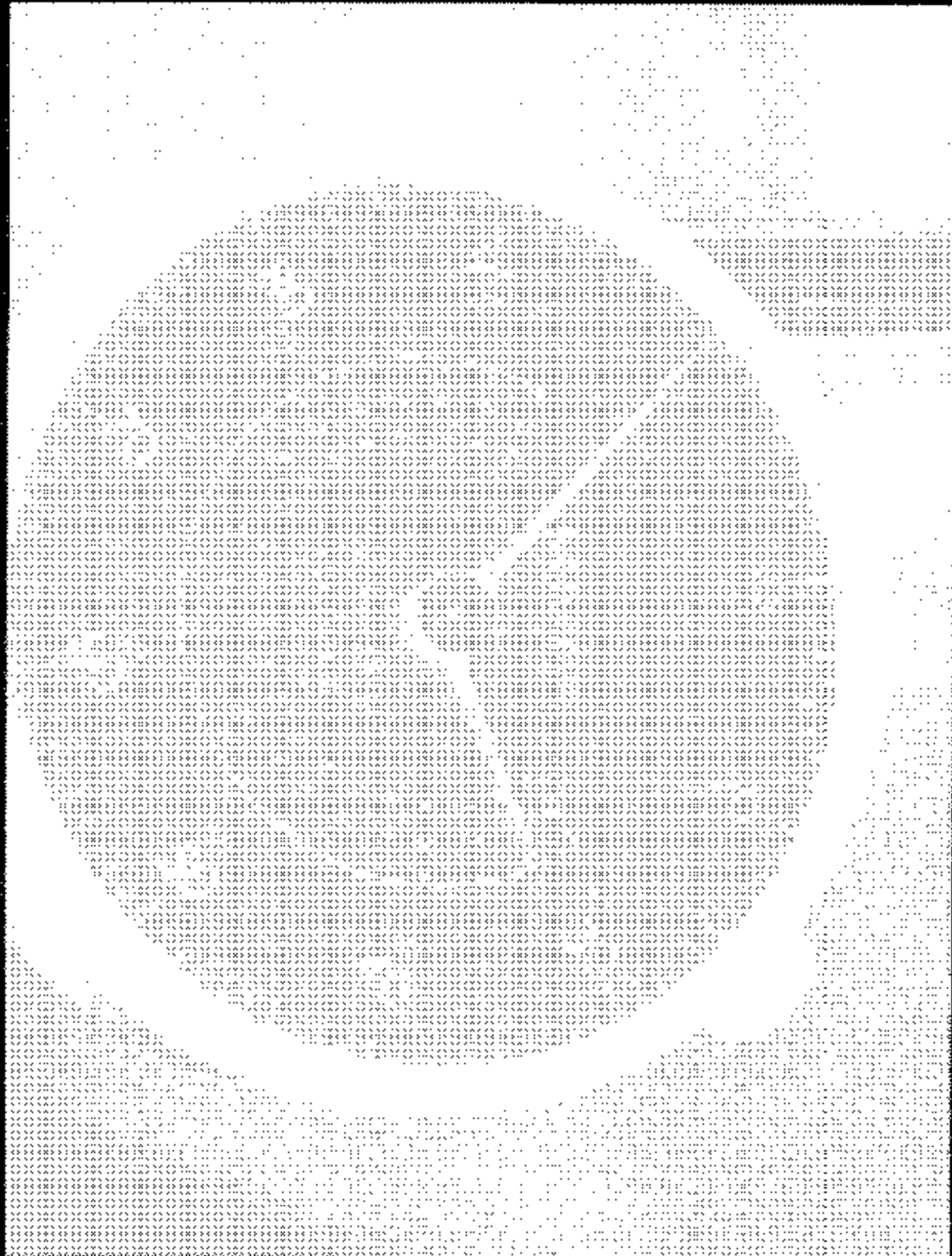
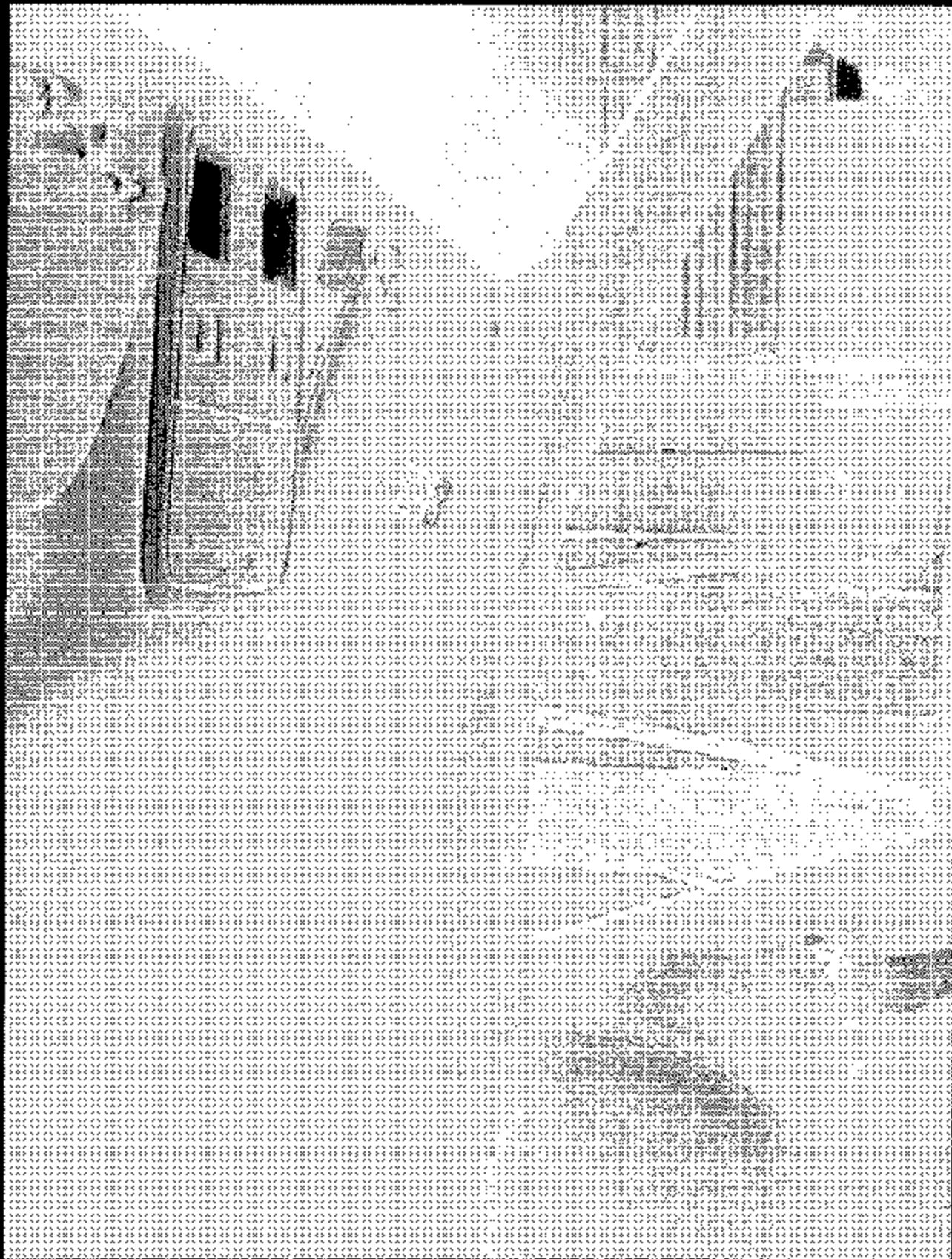


FIGURE 5.16
LEFT REAR DISPLACEMENT PRE-TEST

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.17
INTERIOR SIDE VIEW PRE-TEST

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



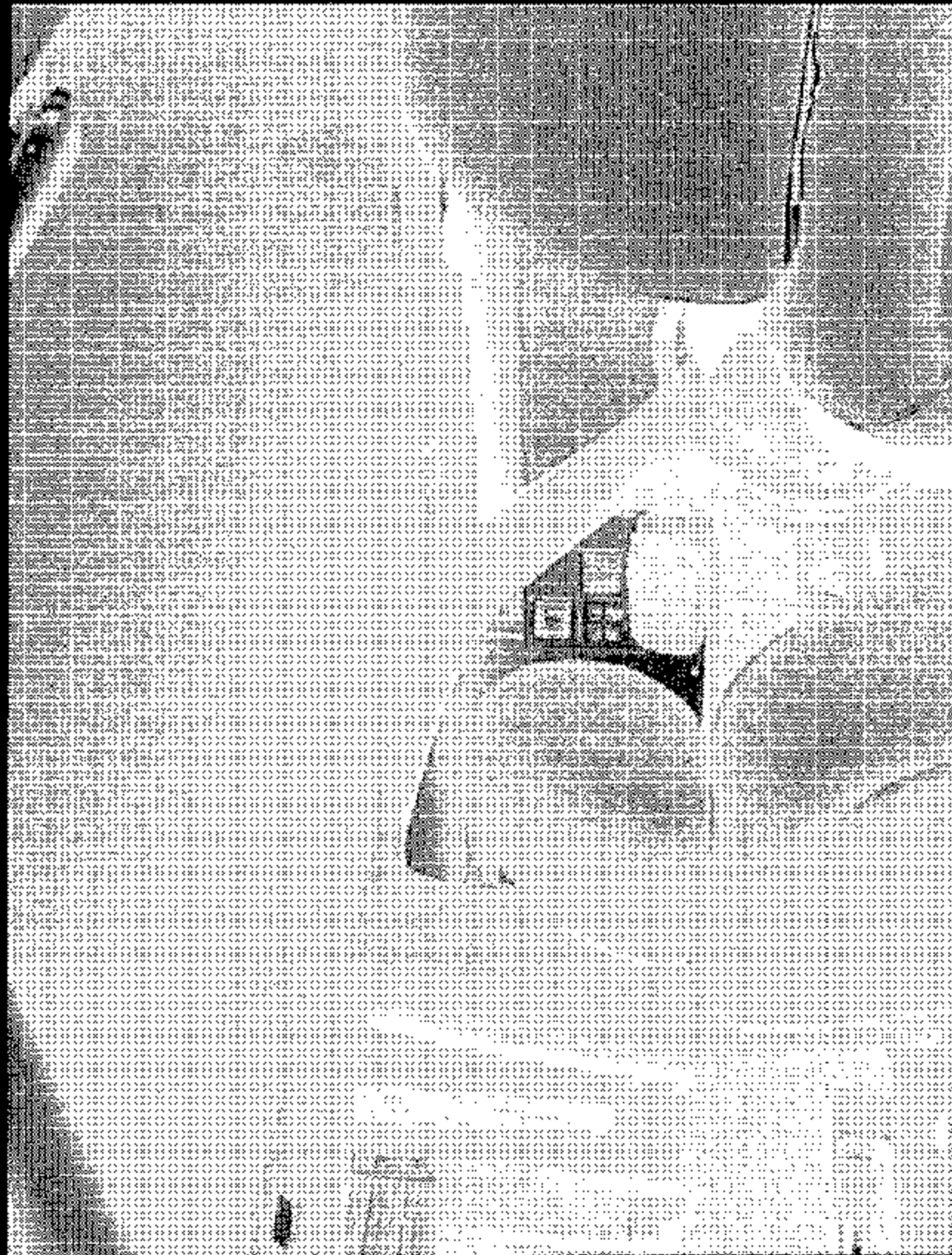


FIGURE 5.18
INTERIOR REAR VIEW PRE-TEST

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 218

FIGURE 5.18
CONTACT POINT WITH PLATE SIDE VIEW



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.20
CONTACT POINT WITH PLATE FRONT VIEW



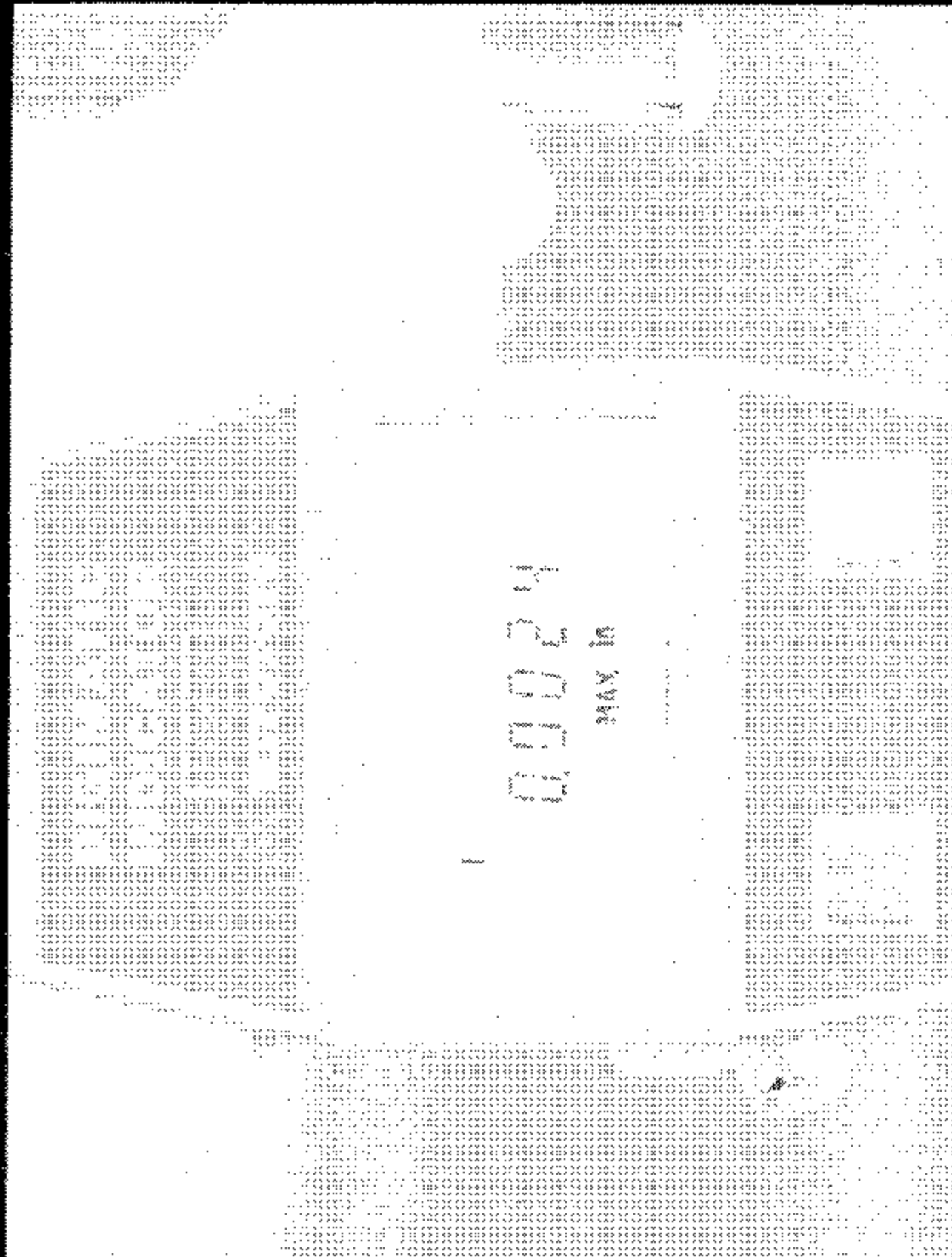
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.21
FRONT VIEW AT FULL LOAD



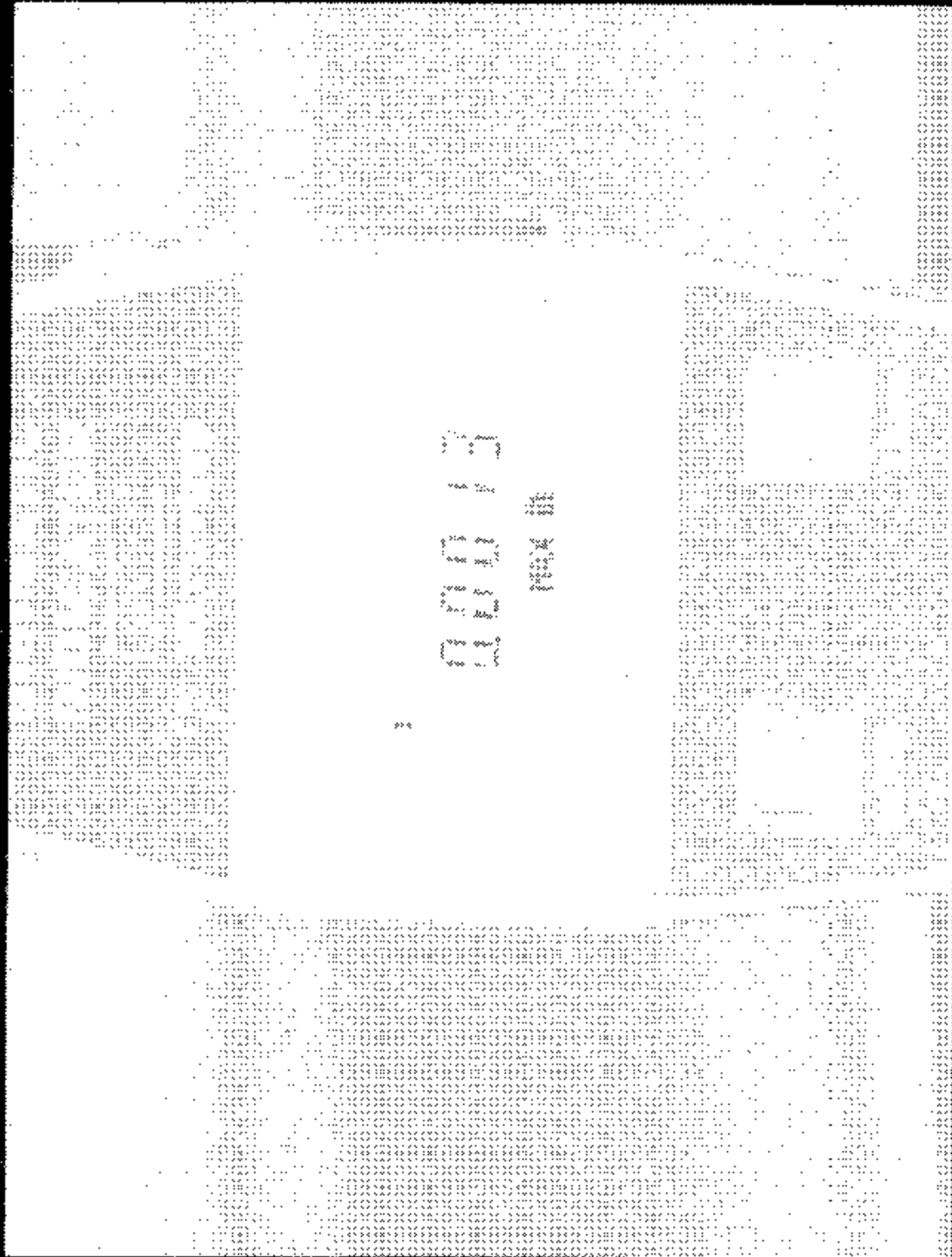
FIGURE 5.22
SIDE VIEW FULL LOAD

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



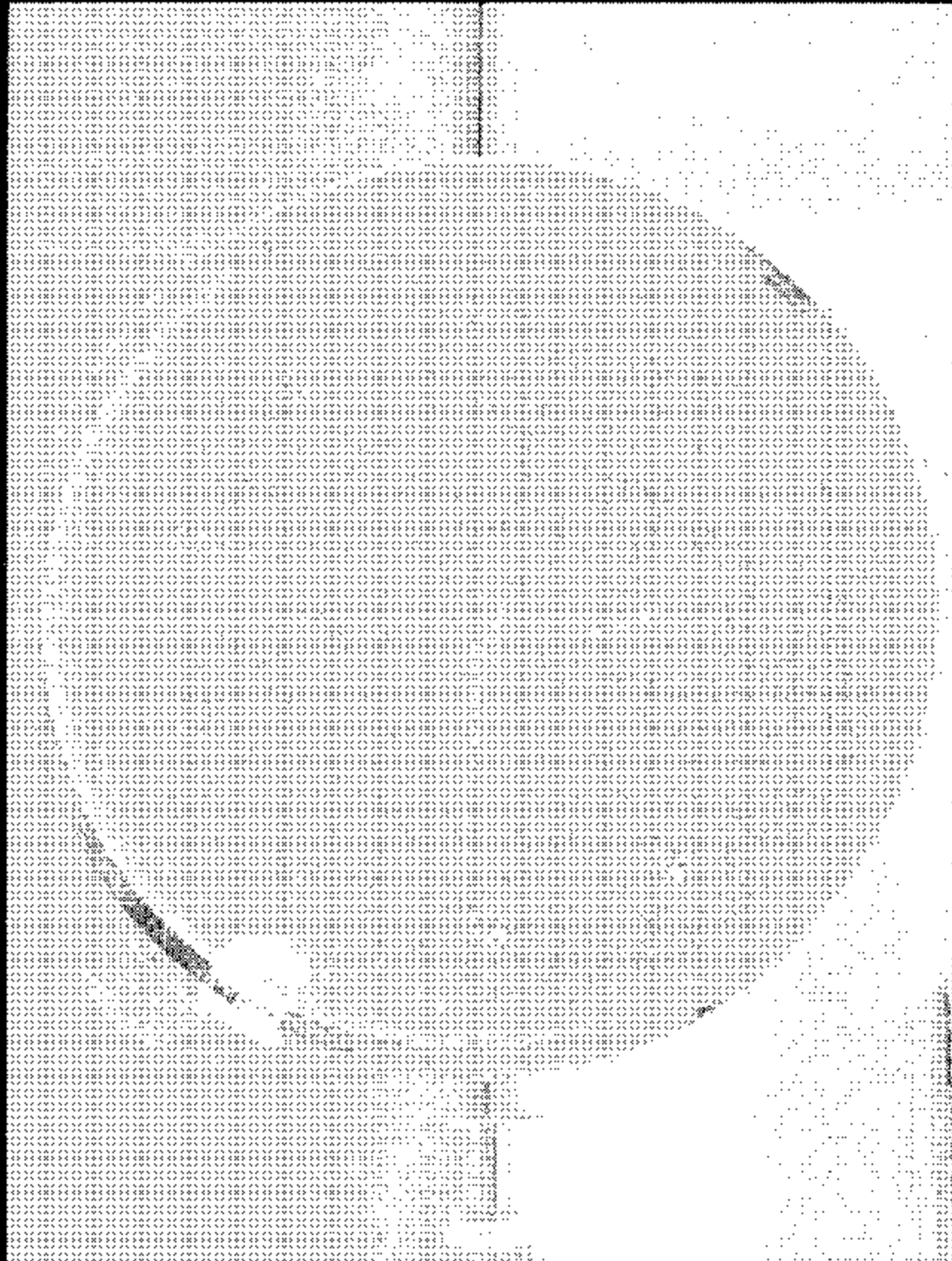
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.23
FRONT LEFT DISPLACEMENT AT FULL LOAD
(INCHES)



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.24
RIGHT FRONT DISPLACEMENT AT FULL LOAD
(INCHES)



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.25
PASSENGER DOOR DISPLACEMENT AT FULL
LOAD (INCHES)

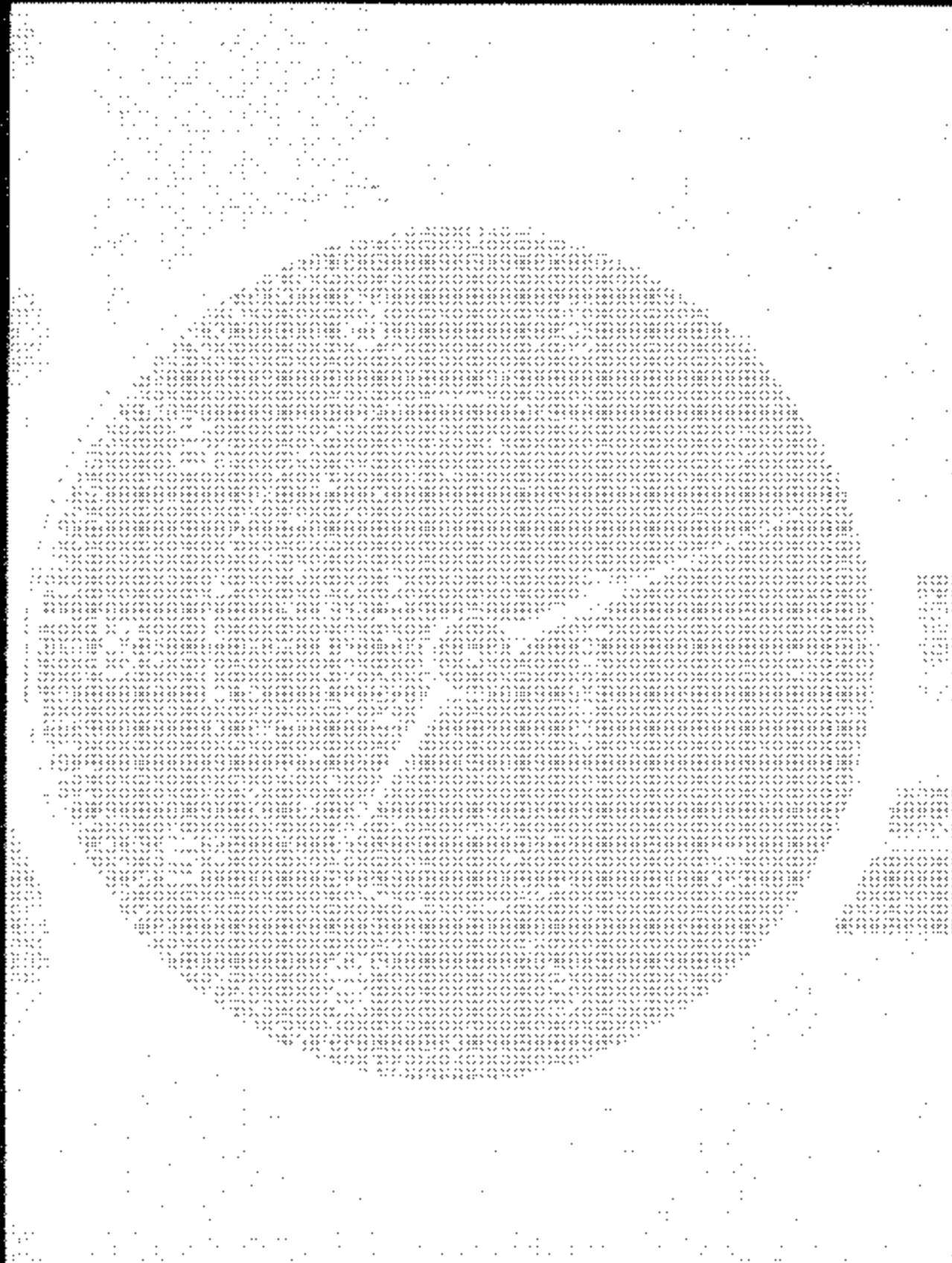


FIGURE 5.26
RIGHT REAR DISPLACEMENT AT FULL LOAD
(INCHES)

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

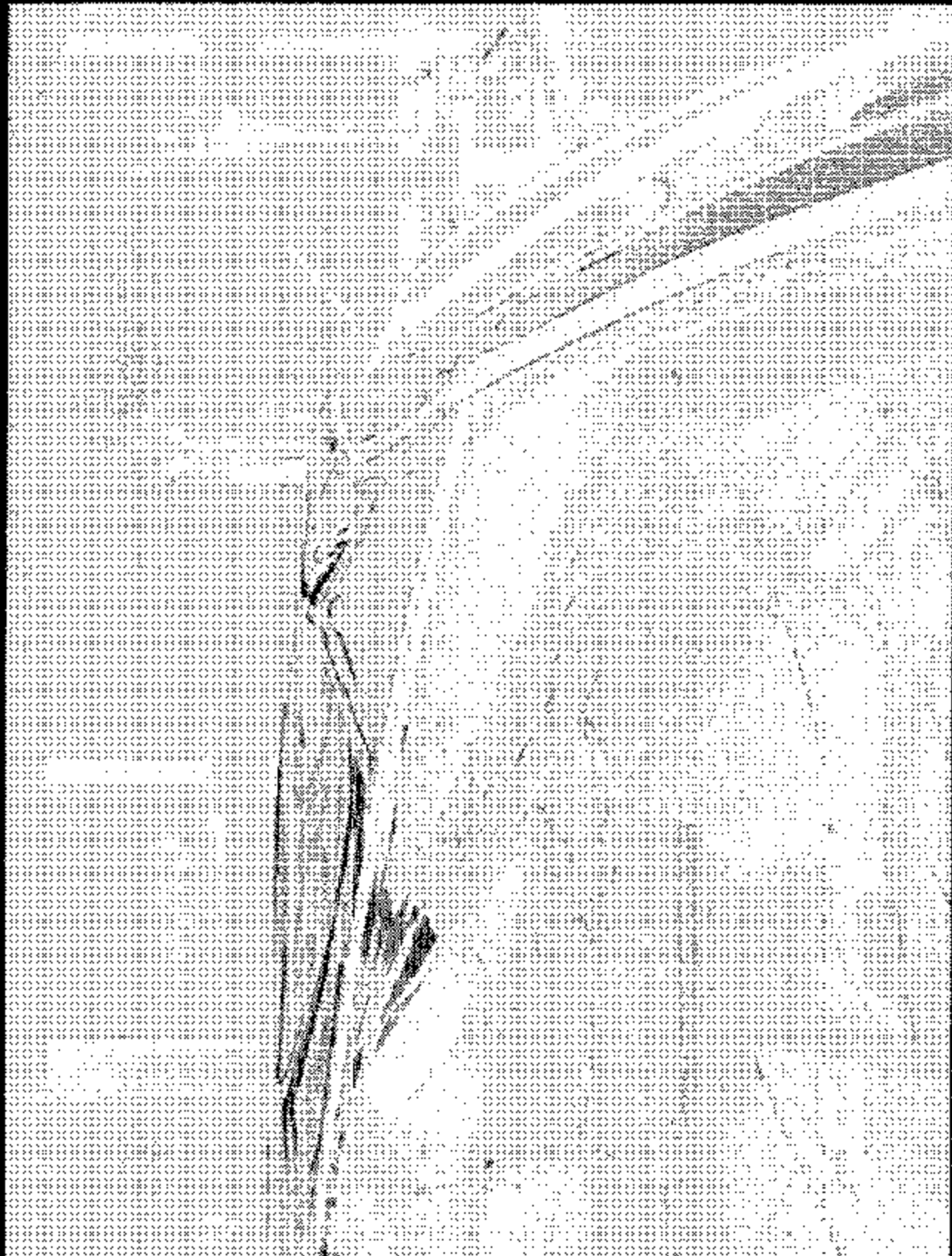
FIGURE 5.27
LEFT REAR DISPLACEMENT AT FULL LOAD
(INCHES)

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



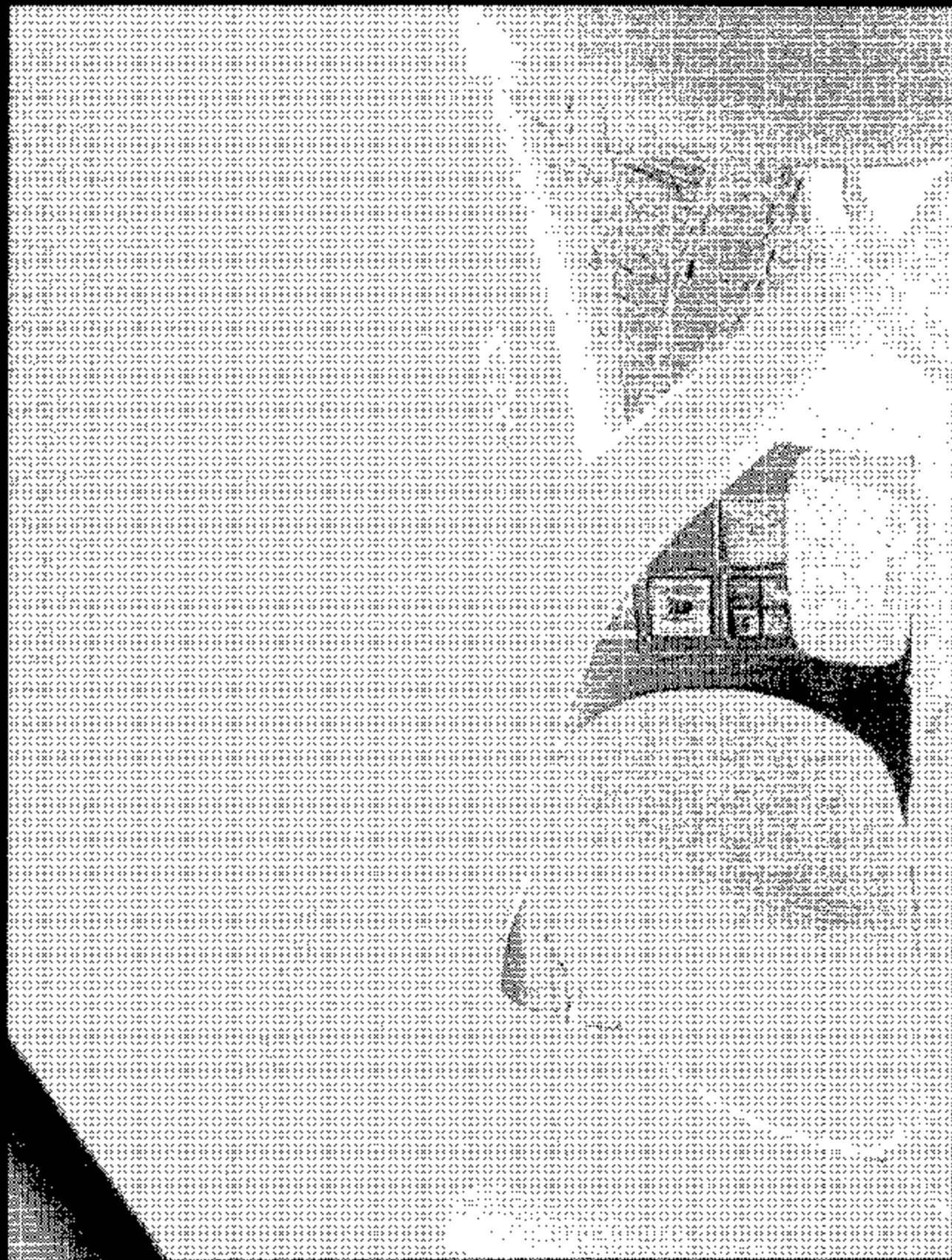
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.28
FRONT VIEW OF ROOF POST TEST



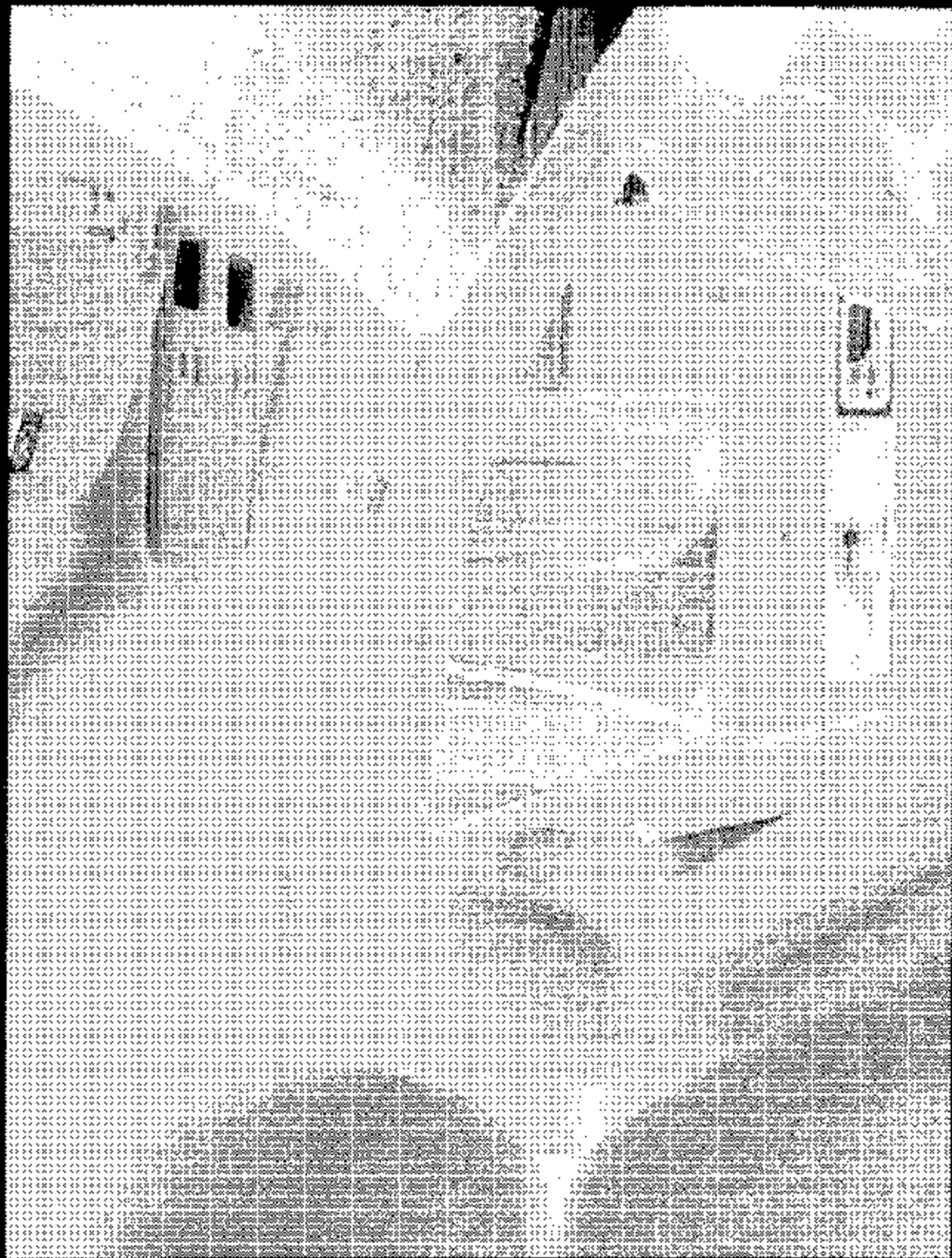
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.29
FRONT VIEW CLOSE-UP OF ROOF POST TEST



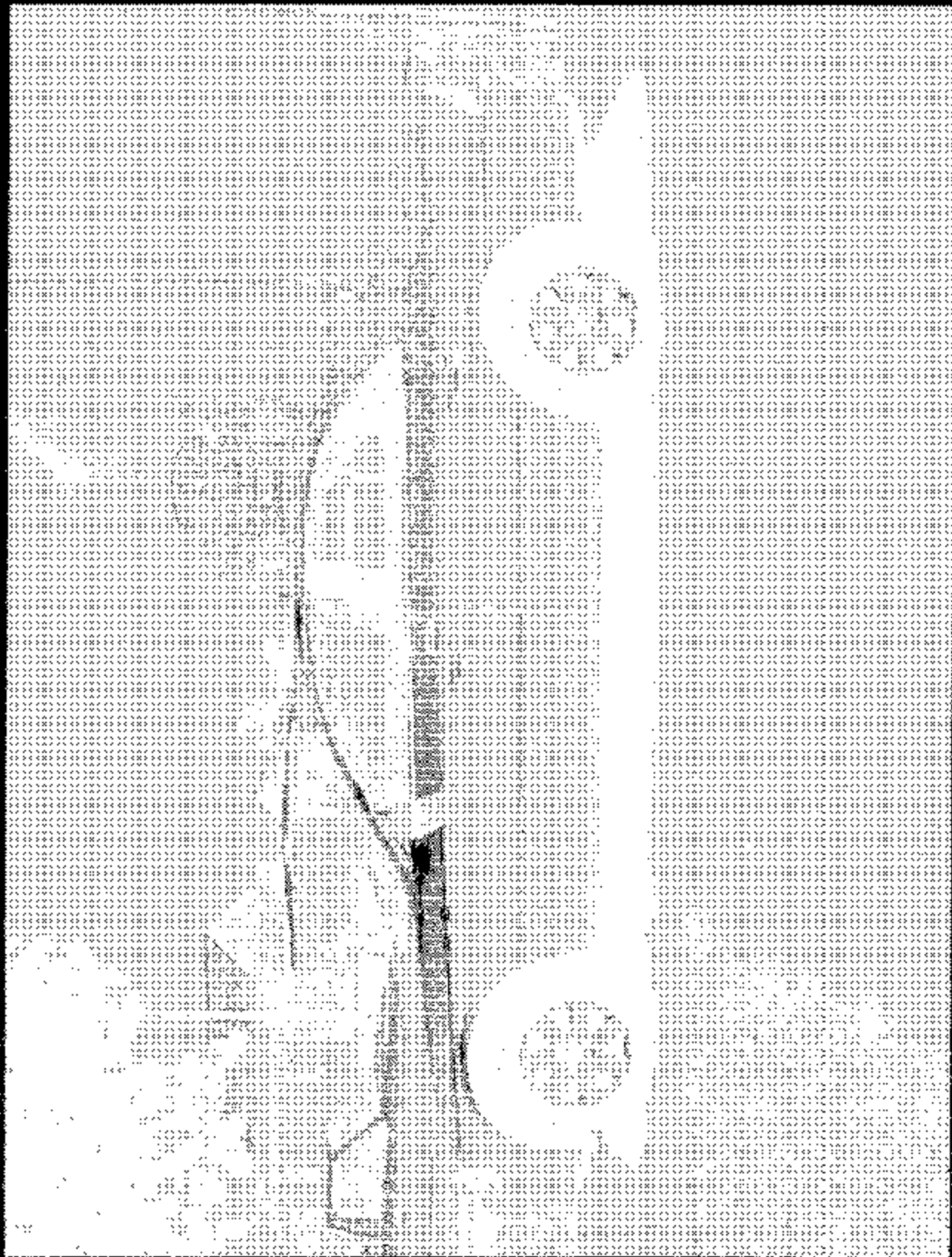
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.3D
INTERIOR REAR VIEW POST TEST



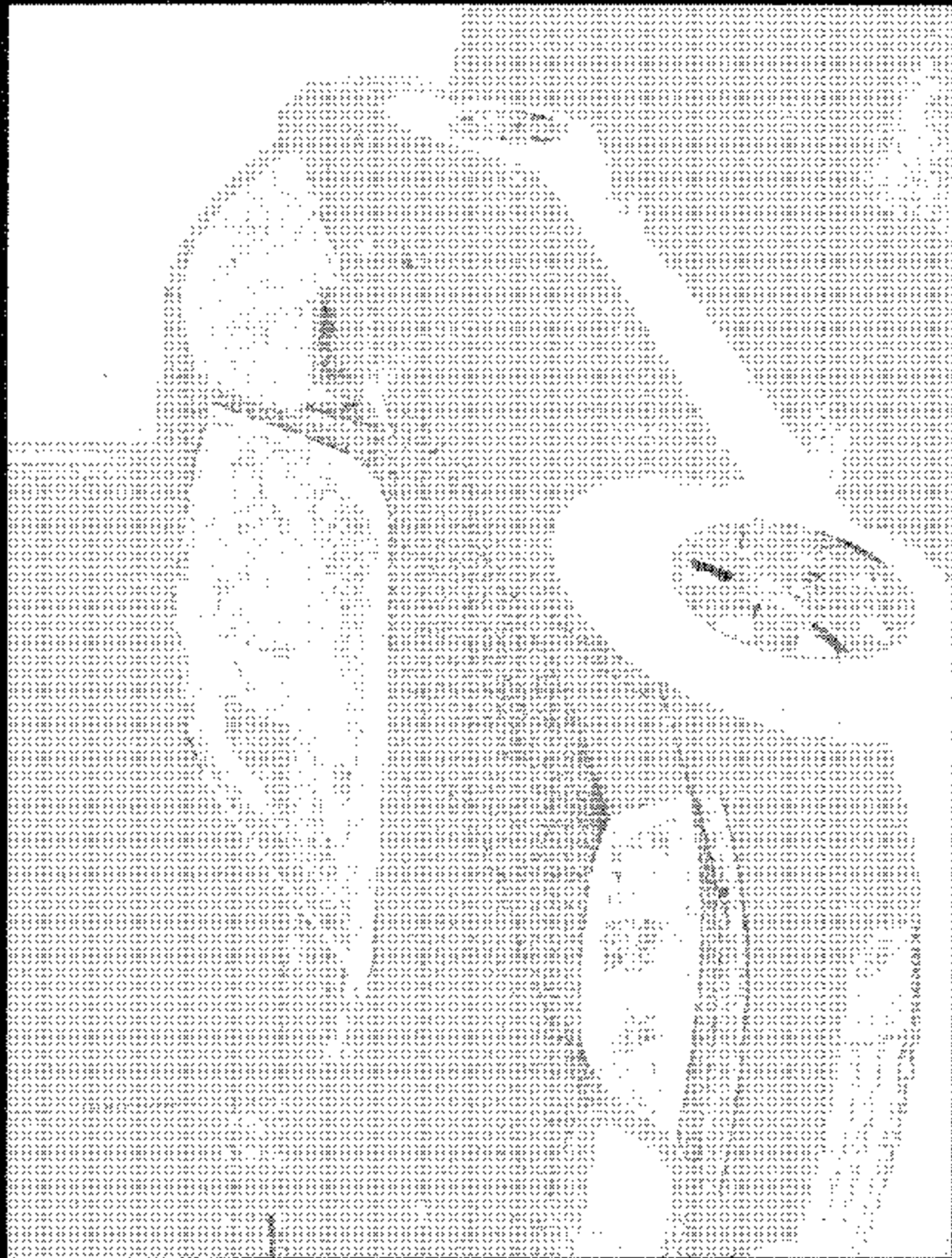
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.31
INTERIOR SIDE VIEW POST TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.32
LEFT SIDE VIEW OF VEHICLE POST TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.33
% LEFT FRONT VIEW OF VEHICLE POST TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.34
% LEFT REAR VIEW OF VEHICLE POST TEST



2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.35
RIGHT SIDE VIEW OF VEHICLE POST TEST

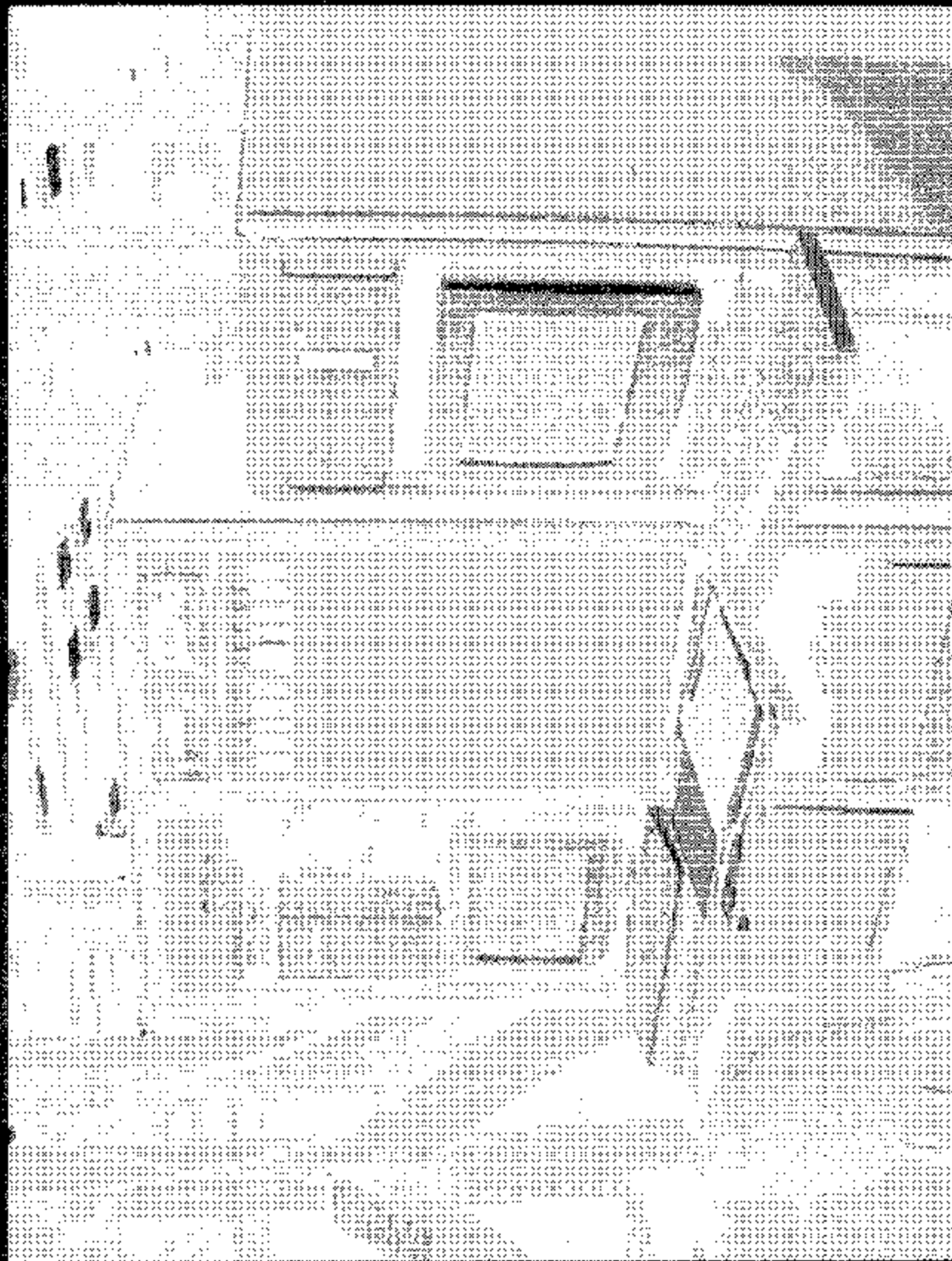
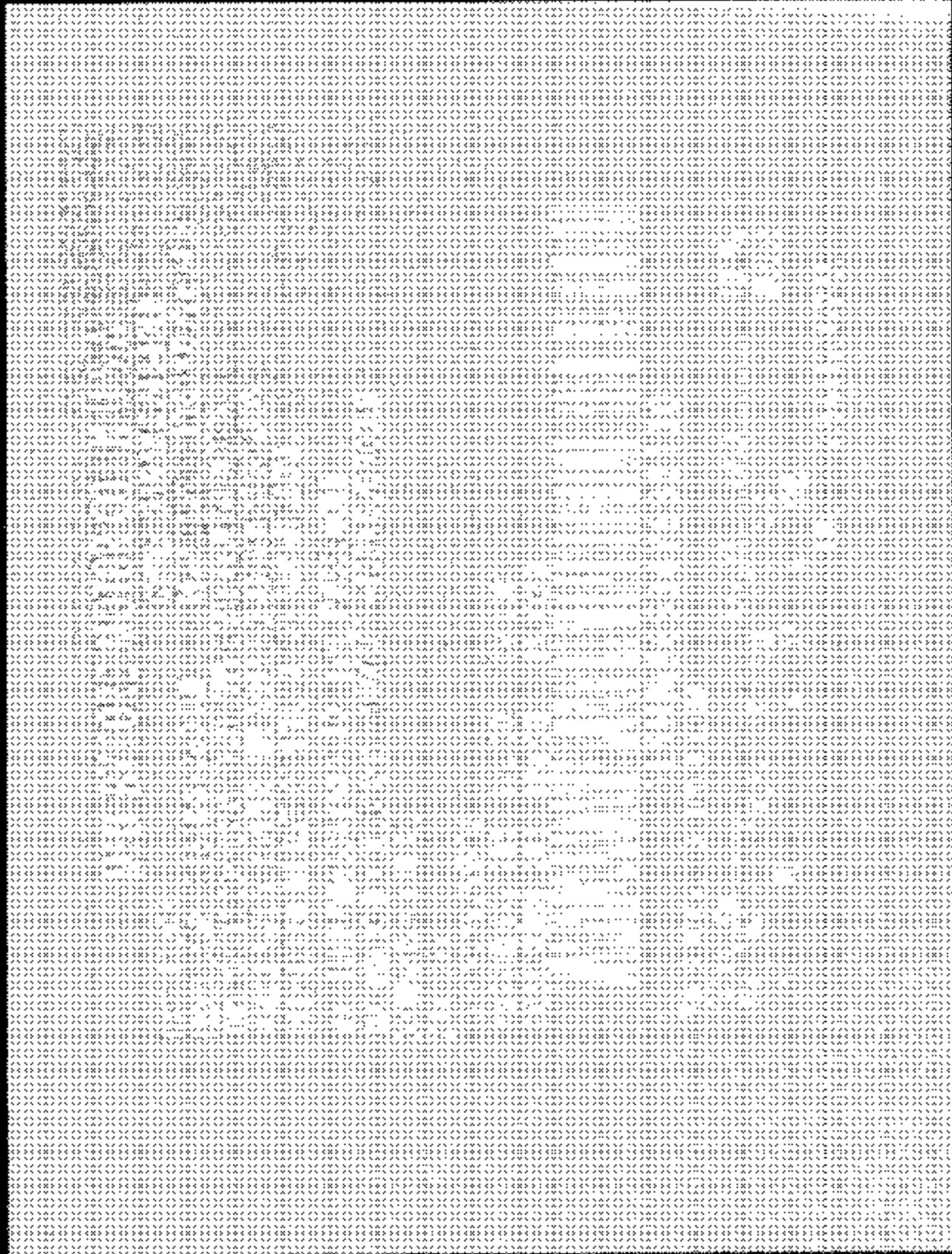


FIGURE 5.38
218 INSTRUMENTATION SET-UP

2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216



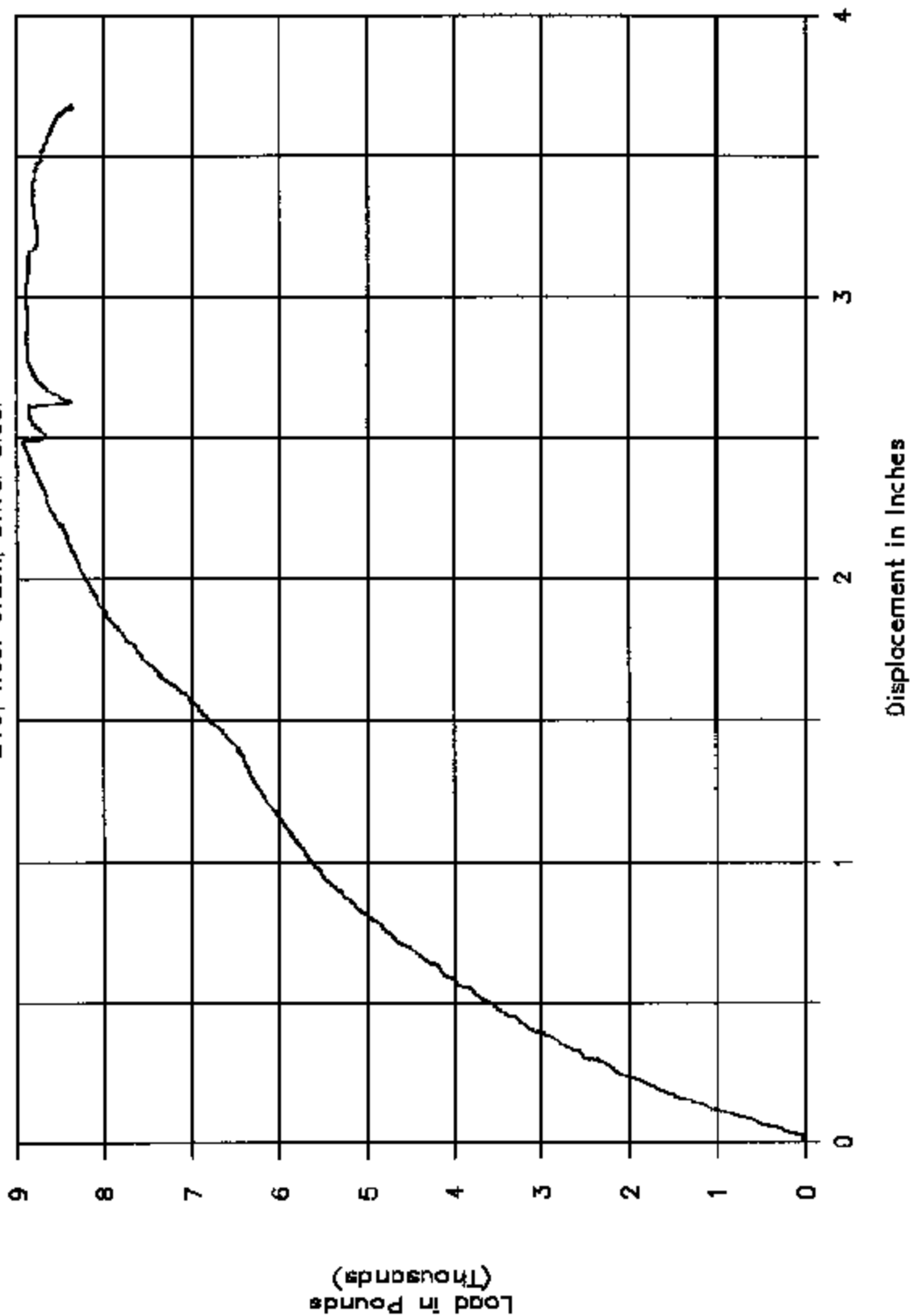
2004 LINCOLN LS
NHTSA NO. C40204
FMVSS NO. 216

FIGURE 5.37
CLOSE-UP VIEW OF VEHICLE CERTIFICATION
AND TIRE INFORMATION LABEL

SECTION 6
TEST PLOTS

GTL 5240

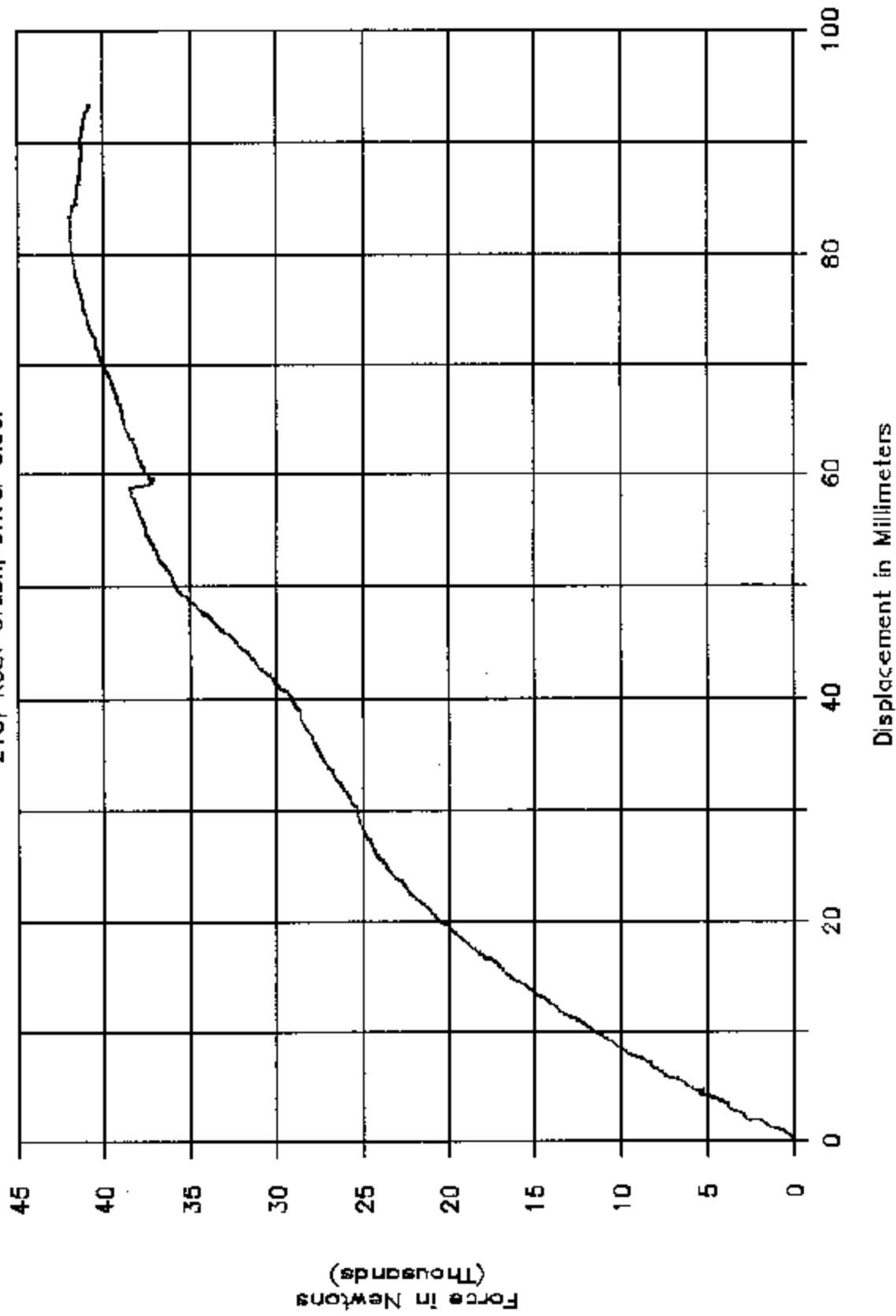
216, Roof Crush, Driver Side.



7-12-04
REV
Lincoln LS
#220610
#17574

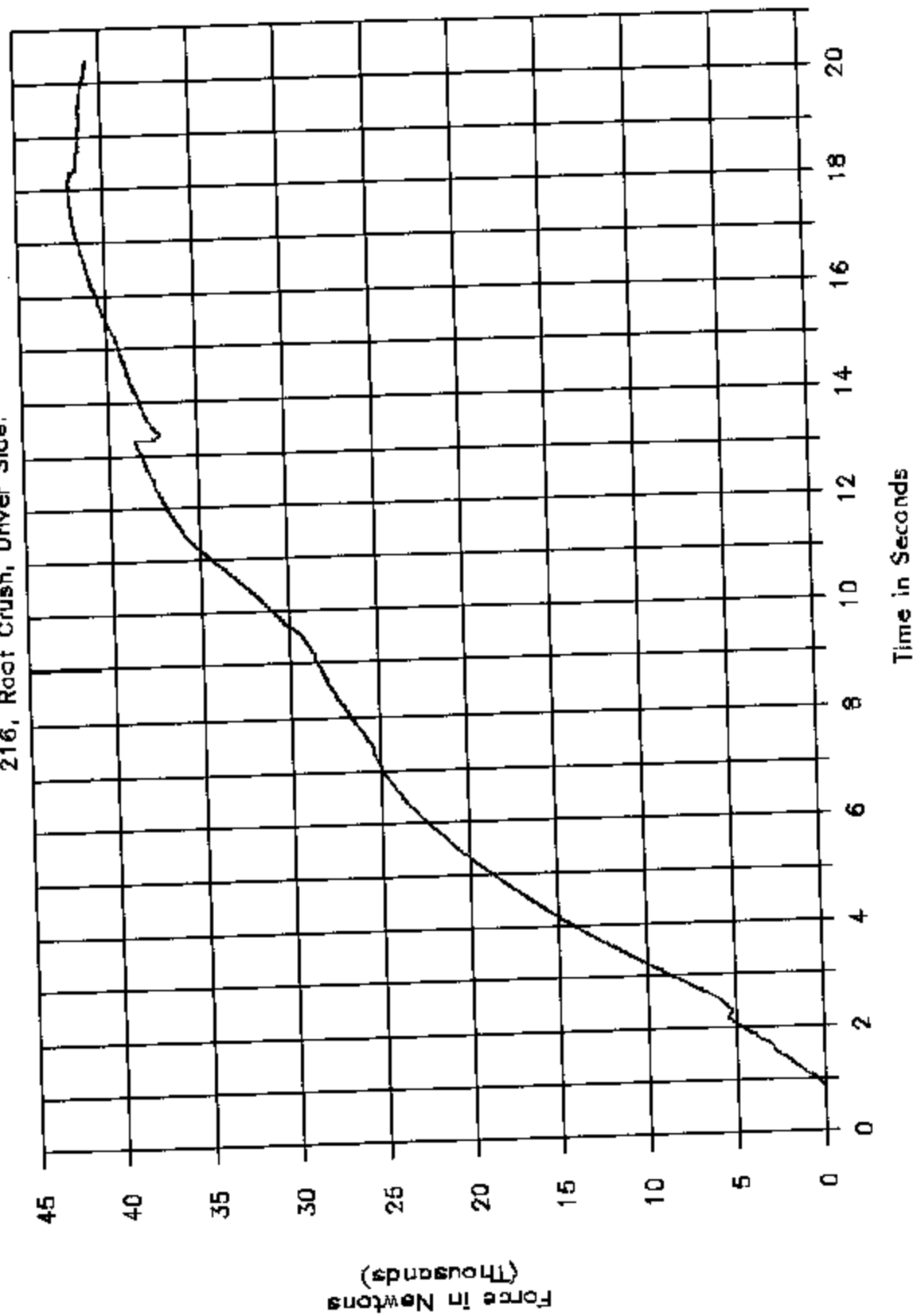
GTL 5202

216, Roof Crush, Driver Side.



GTL 5202

216, Roof Crush, Driver Side.



GTL 5202

216, Roof Crush, Driver Side.

