HSNO. 657565

REPORT NUMBER 103-GTL-04-006

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 103 WINDSHIELD DEFROSTING AND DEFOGGING SYSTEMS

GM DAEWOO AUTO & TECHNOLOGY COMPANY
REPUBLIC OF KOREA
2004 CHEVROLET AVEO, PASSENGER CAR
NHTSA NO. C40120

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

DECEMBER 20, 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: 12/20/04

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: [signature]

Acceptance Date: 12/29/04

Technical Report Documentation Page

1. Report No. 103-GTL-04-006	2. Government Accession No. N/A	3. Recipient's Catalog No. N/A
4. Title and Subtitle Final Report of FMVSS 103 Compliance Testing of 2004 CHEVROLET AVEO, PASSENGER CAR NHTSA No. C40120		5. Report Date December 20, 2004 6. Performing Organ. Code GTL
7. Author(s) Grant Farrand, Project Engineer Debbie Messick, Project Manager		8. Performing Organ. Rep# GTL-DOT-04-103-006
9. Performing Organization Name and Address General Testing Laboratories, Inc. 1623 Leedstown Road Colonial Beach, Va 22443		10. Work Unit No. (TRAIS) N/A 11. Contract or Grant No. DTNH22-01-C-11025
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Admin. Enforcement Office of Vehicle Safety Compliance (NVS-220) 400 7th Street, S.W., Room 6115 Washington, DC 20590		13. Type of Report and Period Covered Final Test Report November 21-23, 2004 14. Sponsoring Agency Code NVS-220
15. Supplementary Notes		
16. Abstract Compliance tests were conducted on the subject, 2004 Chevrolet Aveo Passenger Car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-103-13 for the determination of FMVSS 103 compliance. Test failures identified were as follows: None		
17. Key Words Compliance Testing Safety Engineering FMVSS 103	18. Distribution Statement Copies of this report are available from NHTSA Technical Information Services (TIS) Room 2336 (NPO-405) 400 7th St., S.W. Washington, DC 20590 Telephone No. (202) 366-4947	
19. Security Classif. (of this report) UNCLASSIFIED	21. No. of Pages 32	22. Price
20. Security Classif. (of this page) UNCLASSIFIED		

Form DOT F 1700.7 (8-72)

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PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2004 Chevrolet Aveo Passenger Car was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 103 testing to determine if the vehicle was in compliance with the requirements of the standard. All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedure, TP-103-13 dated 26 June 1996 and General Testing Laboratories, Inc. (GTL) Test Procedure, "Windshield Defrosting and Defogging Systems – Passenger Vehicles, Multipurpose Vehicles, Trucks and Buses".

1.1 TEST VEHICLE

The test vehicle was a 2004 Chevrolet Aveo Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: KL1TD62604B159642

B. NHTSA No.: C40120

C. Manufacturer: GM DAEWOO AUTO & TECHNOLOGY REPUBLIC OF KOREA

D. Manufacture Date: 12/03

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 103 testing on November 21-23, 2004.

SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2004 Chevrolet Aveo 4-door passenger car, NHTSA No. C40120 was subjected to FMVSS No. 103 tests on November 21-23, 2004. Photographs of the test vehicle are shown in Figures 5.1 through 5.4. The manufacturer's certification and tire information labels are shown in Figures 5.5 and 5.6. The test instrumentation and instrument panel setups are depicted in Figures 5.7 and 5.8. Figures 5.9 through 5.17 depict the windshield pre and post test defrost conditions.

2.1 TEST PROCEDURE

Prior to test the test vehicle was inspected for completeness, systems operability, and appropriate fuel and liquid levels, i.e., oil and coolant to include antifreeze protection. The vehicle was then photographically documented as required by the DOT/NHTSA test procedure. The windshield patterns for areas A, B and C had been furnished prior to testing and these areas were outlined on the windshield with a marker. The vehicle was then installed in the cold chamber and pre-conditioned for a 14-hour minimum, 0° ±5° F temperature soak for the first test run. After the pre-condition, the hood was raised to assure engine coolant and lubricant were stabilized within the test temperature range for a minimum of 2 hours.

At the end of the 2-hour minimum stabilization period, the entire windshield was sprayed evenly with 0.010 ounces of water per square inch of glass area. Refer to Section 3, Compliance Test Data, for test specifics such as total amount of water sprayed, spray gun identification, and air pressure regulation. The vehicle soak continued for an additional 30 minutes minimum but no more than 40 minutes after the windshield was sprayed.

At the conclusion of the additional soak time the vehicle's engine was started and operated at a target speed of 1500-1600 rpm or at the manufacturer's specification if different as noted on data sheets. The defroster blower was turned on to the high speed setting with the heater selector in the de-ice (defrost) position, and the temperature control in the maximum temperature position. All doors and windows were closed. The heater air intake was fully open and the vehicle's hood closed. At no time during the test were the windshield wipers used. Air ventilation vents on the dash were manually closed for Test #1 and open for Test #2.

At start of testing and during test, at each 5-minute interval after engine start, cold chamber, engine coolant, heater coolant in and defroster air left/defroster air right temperatures were recorded. Likewise at each 5-minute interval the boundary of the defrosted area was marked on the inside surface of the windshield. The test was run for a maximum of 40 minutes from engine start, or until such time as 100 percent windshield clearance was achieved. Photographs were made of the windshield at the pre-test frosted state and 20-minute and 25-minute intervals. Post test actions included placing a vellum pattern on the windshield and tracing the windshield's 5-minute interval defrosted area boundary lines onto the vellum pattern.

After the traces were obtained, the windshield was again thoroughly cleaned and the vehicle engine coolant and lubricant stabilization period at 0° ±5° F temperature commenced for a repeat of the procedure discussed. The windshield patterns for both tests were used subsequently to determine the cleared area percentages.

2.2 SUMMARY OF RESULTS

Based on the test performed, the test vehicle appears to be in compliance with the requirements of FMVSS 103.

SECTION 3

COMPLIANCE TEST DATA

3.0 TEST RESULTS

The following data sheets document the results of testing on the 2004 Chevrolet Aveo.

SUMMARY DATA SHEET
FMVSS 103, WINDSHIELD DEFROSTING AND DEFOGGING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2004 CHEVROLET AVEO PASSENGER CAR
VEH. NHTSA NO: C40120; VIN: KL1TD62604B159642
VEH. BUILD DATE: 12/03 TEST DATE: NOVEMBER 21-23, 2004
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

WINDSHIELD AREA: 1770 in^2 AREA C = 220 in^2 AREA D = 220 in^2 AREA A = 1015 in^2

MANUFACTURER'S WINDSHIELD PATTERN USED: Yes X No ____

ENGINE THERMOSTAT NOMINAL REGULATING TEMPERATURE: 190 °F

HEATER-DEFROSTER SYSTEM INCLUDES AIR CONDITIONER: YES X NO ____

DESCRIBE UNUSUAL FEATURES OF DEFROSTING SYSTEM: NONE

DESCRIBE UNUSUAL FEATURES OF TEST CAR: NONE

DESIGNATION	AREA PERCENT DEFROSTED					
	TEST 1	TEST 2	AVG	REQ'D	PASS	FAIL
CRITICAL AREA C AT 20 MINUTES	100%	100%	100%	80% MINIMUM	PASS	
PASSENGER AREA D AT 25 MINUTES	100%	100%	100%	80% MINIMUM	PASS	
TOTAL AREA A AT 40 MINUTES	100%	100%	100%	95% MINIMUM	PASS	

REMARKS:

RECORDED BY: L. Torrez DATE: 11/23/04

APPROVED BY: D. Mesa

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 1

VEH. MOD YR/MAKE/MODEL/BODY: 2004 CHEVROLET AVEO PASSENGER CAR
VEH. NHTSA NO: C40120; VIN: KL1TD62604B159642
VEH. BUILD DATE: 12/03 ; TEST DATE: NOVEMBER 21, 2004
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

If 1st Test Run, chamber conditioned 24 hours @ 0° ±5° F (14 hrs. min.)

Cold Soak Period: 40 HOURS

Time engine coolant and lubricant remained stabilized at 0° F: 38 hrs. 0 minutes

Water Spray Gun and Nozzle Type: BINKS #66

Spray Gun Pressure: 50 psi (50 psi ± 3 psi)

Water used: 17.7 fluid oz. (0.010 ounces per square inch of windshield area)

Soak Period Between Ice Application and Test Start: 31 minutes (30 to 40 minutes)

Engine Speed: 1550 rpm (Target engine speed 1500 to 1600 rpm)

Wind at specified location in front of windshield: .25 to 1.25 mph (0 to 2 mph)

Number of Vehicle Occupants: 1 (2 maximum)

Describe window openings, if any: NONE

TIME FROM START (minutes)	MOTOR VOLTAGE (volts)	TEMPERATURE, °F					DEFROSTED AREA, %		
		TEST ROOM	ENGINE WATER	HEATER WATER IN	DEFROSTER AIR DRVR	DEFROSTER AIR PSGR	A	C	D
0	13.4	-2.0	-1.1	-1.1	-.2	-.3	0%	0%	0%
5	14.7	-1.3	82.2	89.7	48.9	53.0	0%	0%	0%
10	14.6	0.8	114.6	119.0	72.3	77.8	18.3%	1.3%	3.0%
15	14.6	0.6	132.4	135.3	86.4	92.6	55.5%	67.5%	73.3%
20	14.5	1.4	145.6	147.4	97.5	104.4	97.0%	100%	100%
25	14.5	2.9	156.1	156.9	104.9	112.4	100%		

REMARKS: Dash Board air vents were closed for this test.

RECORDED BY: T. Farrand DATE: 11/21/04

APPROVED BY: D. Mont

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 2

VEH. MOD YR/MAKE/MODEL/BODY: 2004 CHEVROLET AVEO PASSENGER CAR
VEH. NHTSA NO: C40120; VIN: KL1TD62604B159642
VEH. BUILD DATE: 12/03 ; TEST DATE: NOVEMBER 23, 2004
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

If 1st Test Run, chamber conditioned N/A hours @ 0° ±5° F (14 hrs. min.)

Cold Soak Period: 24 HOURS

Time engine coolant and lubricant remained stabilized at 0° F: 21 hrs. ___ minutes

Water Spray Gun and Nozzle Type: BINKS #66

Spray Gun Pressure: 50 psi (50 psi ± 3 psi)

Water used: 17.7 fluid oz. (0.010 ounces per square inch of windshield area)

Soak Period Between Ice Application and Test Start: 32 minutes (30 to 40 minutes)

Engine Speed: 1550 rpm (Target engine speed 1500 to 1600 rpm)

Wind at specified location in front of windshield: .5 to 1.5 mph (0 to 2 mph)

Number of Vehicle Occupants: 2 (2 maximum)

Describe window openings, if any: NONE

TIME FROM START (minutes)	MOTOR VOLTAGE (volts)	TEMPERATURE, °F					DEFROSTED AREA, %		
		TEST ROOM	ENGINE WATER	HEATER WATER IN	DEFROSTER AIR DRVR	DEFROSTER AIR PSGR	A	C	D
0	13.5	-2.0	-0.8	-1.3	-0.2	-0.1	0%	0%	0%
5	14.7	-0.3	93.8	98.0	56.9	61.7	0%	0%	0%
10	14.6	1.8	121.6	123.5	76.0	83.0	24.1%	8.1%	12.9%
15	14.6	1.4	136.3	137.9	88.7	95.7	59.8%	76.1%	80.9%
20	14.5	5.6	146.5	147.8	98.7	105.7	97.0%	100%	100%
25	14.5	7.5	156.8	157.8	107.6	114.8	100%	100%	100%

REMARKS: Dash Board air vents were open for this test.

RECORDED BY: _____ DATE: 11/23/04

APPROVED BY: _____

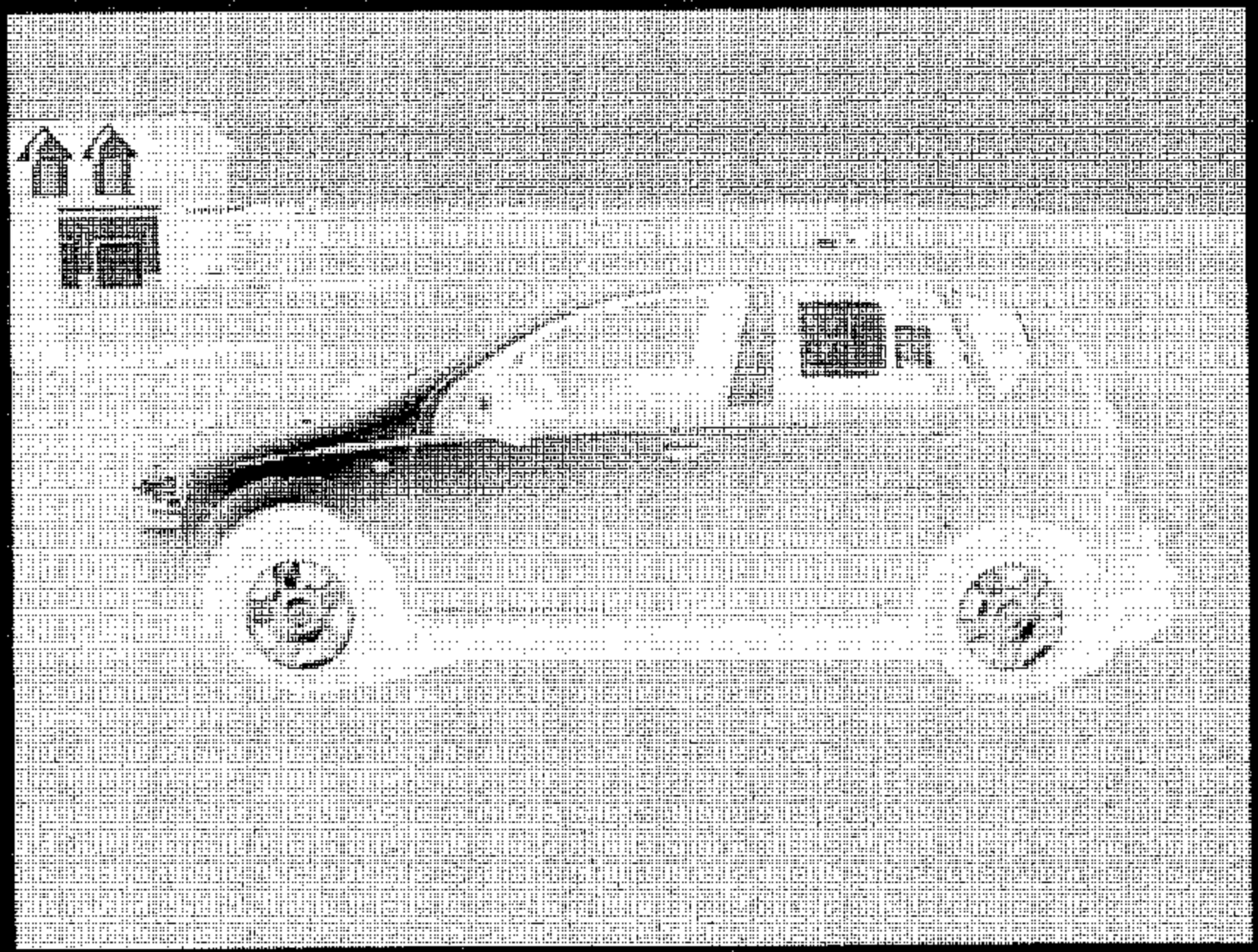
SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

TABLE 1 - INSTRUMENTATION & EQUIPMENT LIST

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
TIMER	ACCU-SPLIT	ACT2	07/04	07/05
TEMPERATURE READOUT	OMEGA	43P	03/04	03/05
TEMPERATURE RECORDER	OMEGA	CT91	03/04	03/05
SPRAY GUN	BINKS	6655	BEFORE USE	BEFORE USE
ANEMOMETER	HASTINGS	RM-1, 46	05/04	05/05
AIR PRESSURE GAGE	BINKS	0-160	02/04	02/05
SCALE	METTLER	200A4M	02/04	02/05
TACHOMETER	MONARCH	ACT-3	07/04	07/05
GRADUATED BEAKER	PHOTAX	N/A	N/A	N/A
EVENT RECORDER	COMPUTER	GEO1	BEFORE USE	BEFORE USE
DATA LOGGER	FLUKE	7471026	03/04	03/05

SECTION 5

PHOTOGRAPHS



2004 CHEVROLET AVEO
NHTSA NO. C40120
FMVSS NO. 103

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE

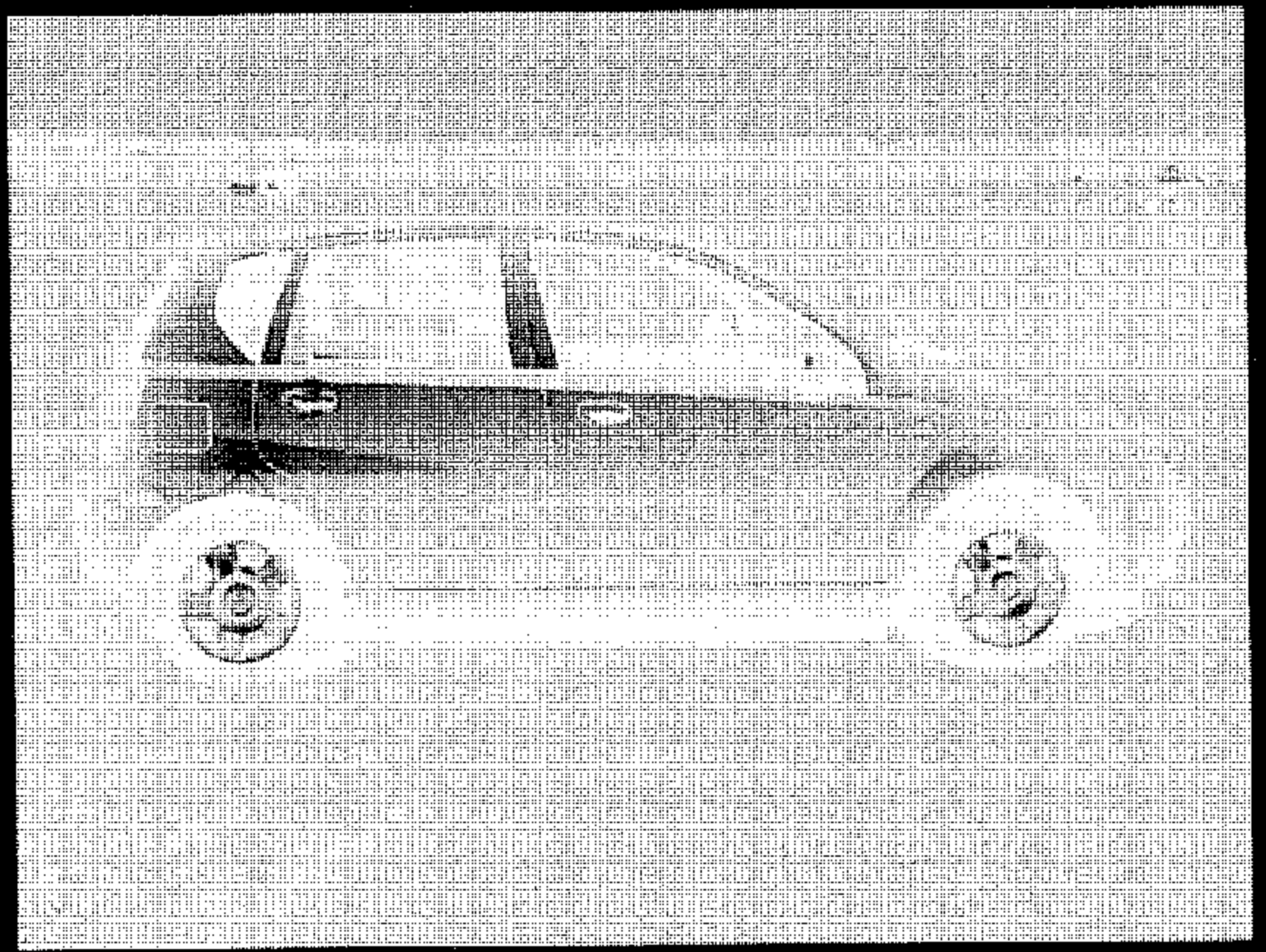


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FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE

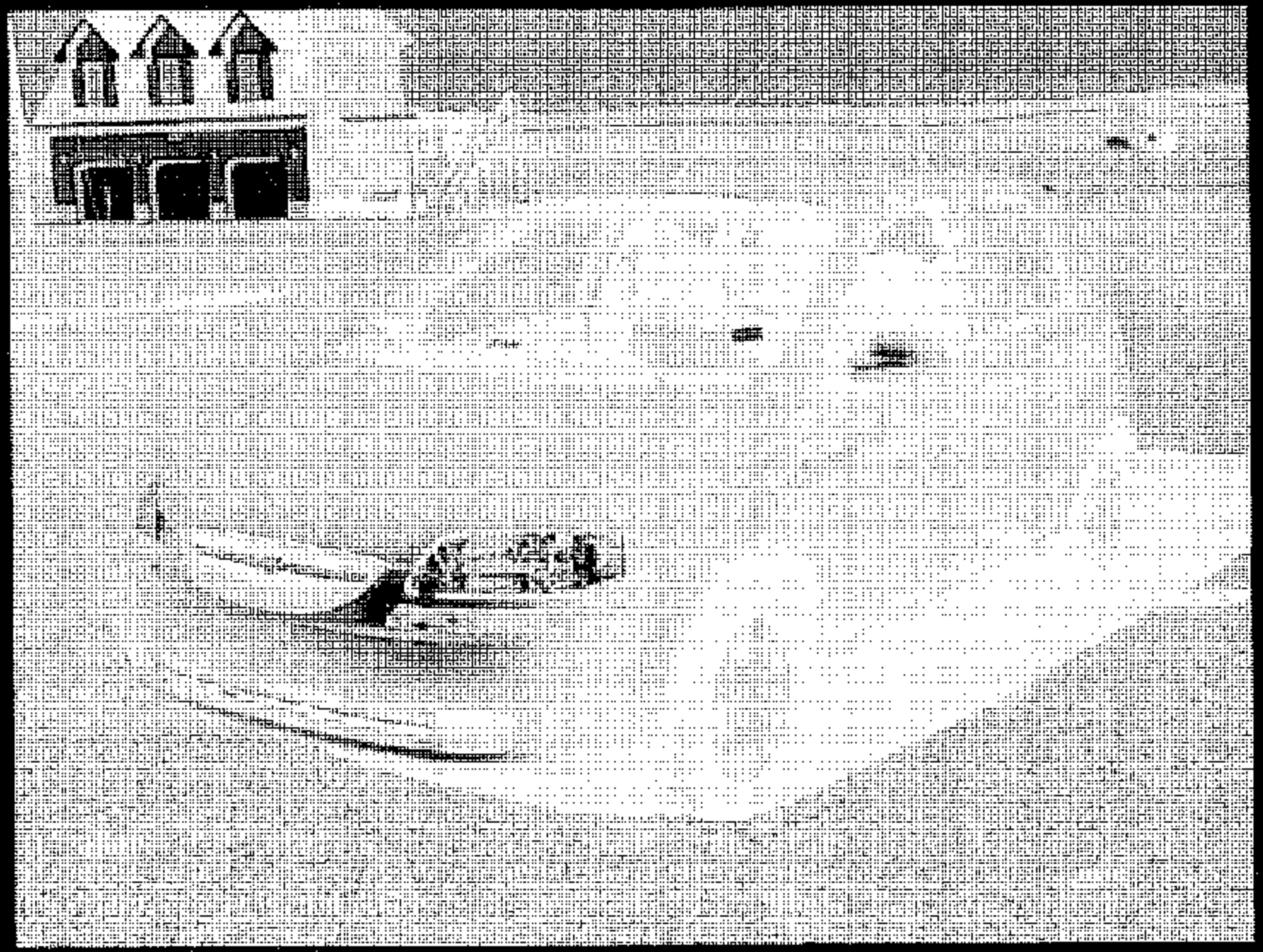

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FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE VIEW OF VEHICLE

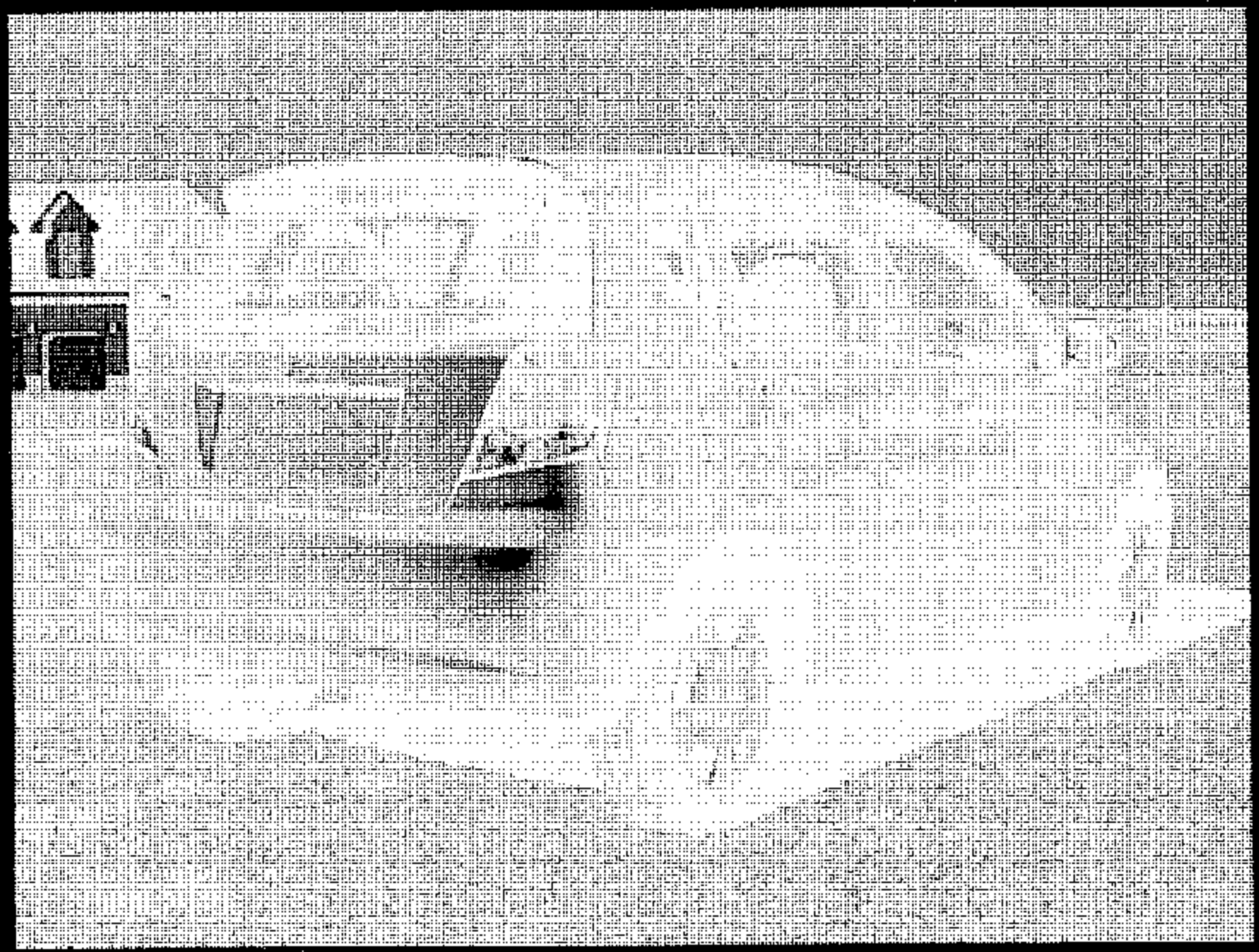

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FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE

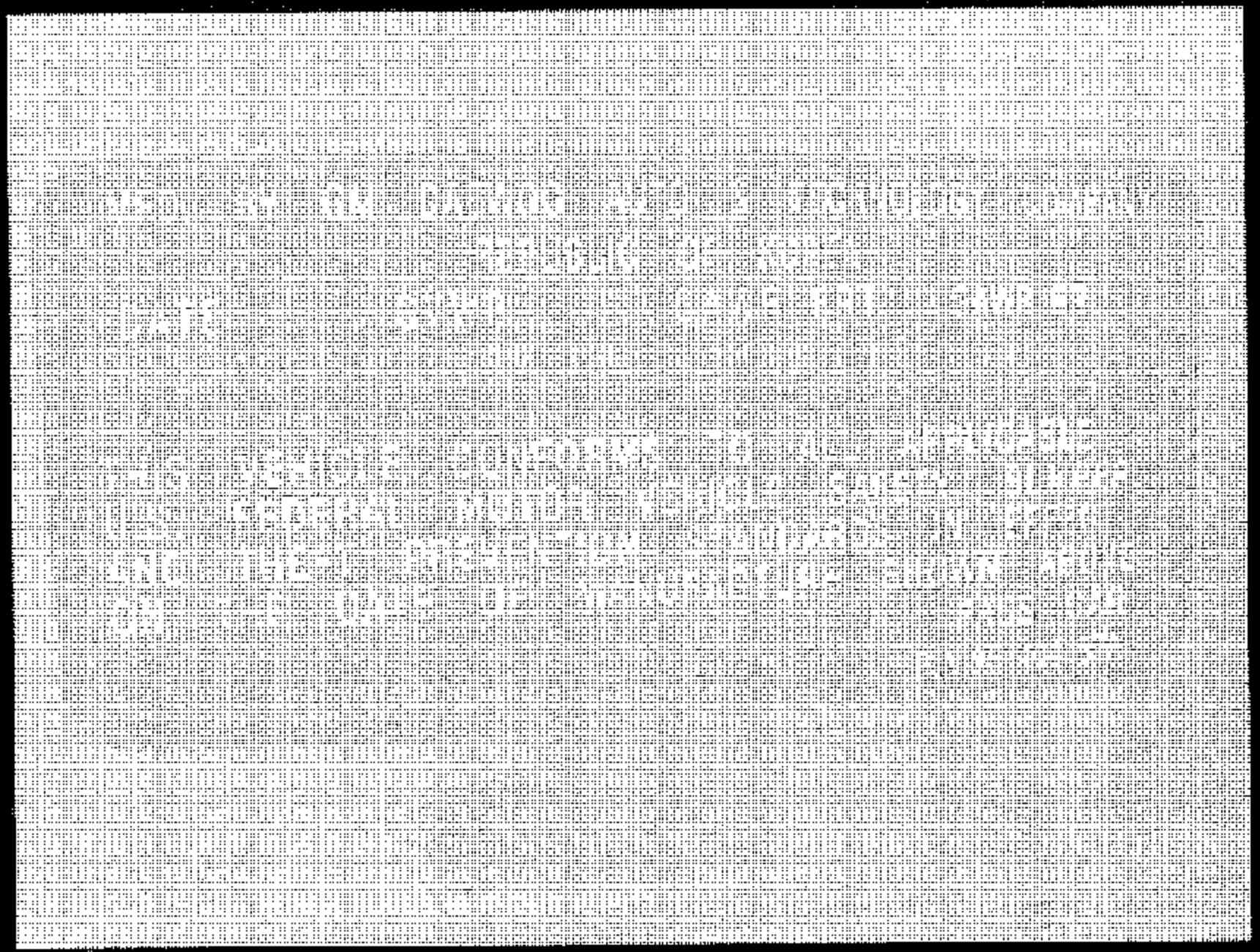

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FIGURE 5.5
VEHICLE CERTIFICATION LABEL

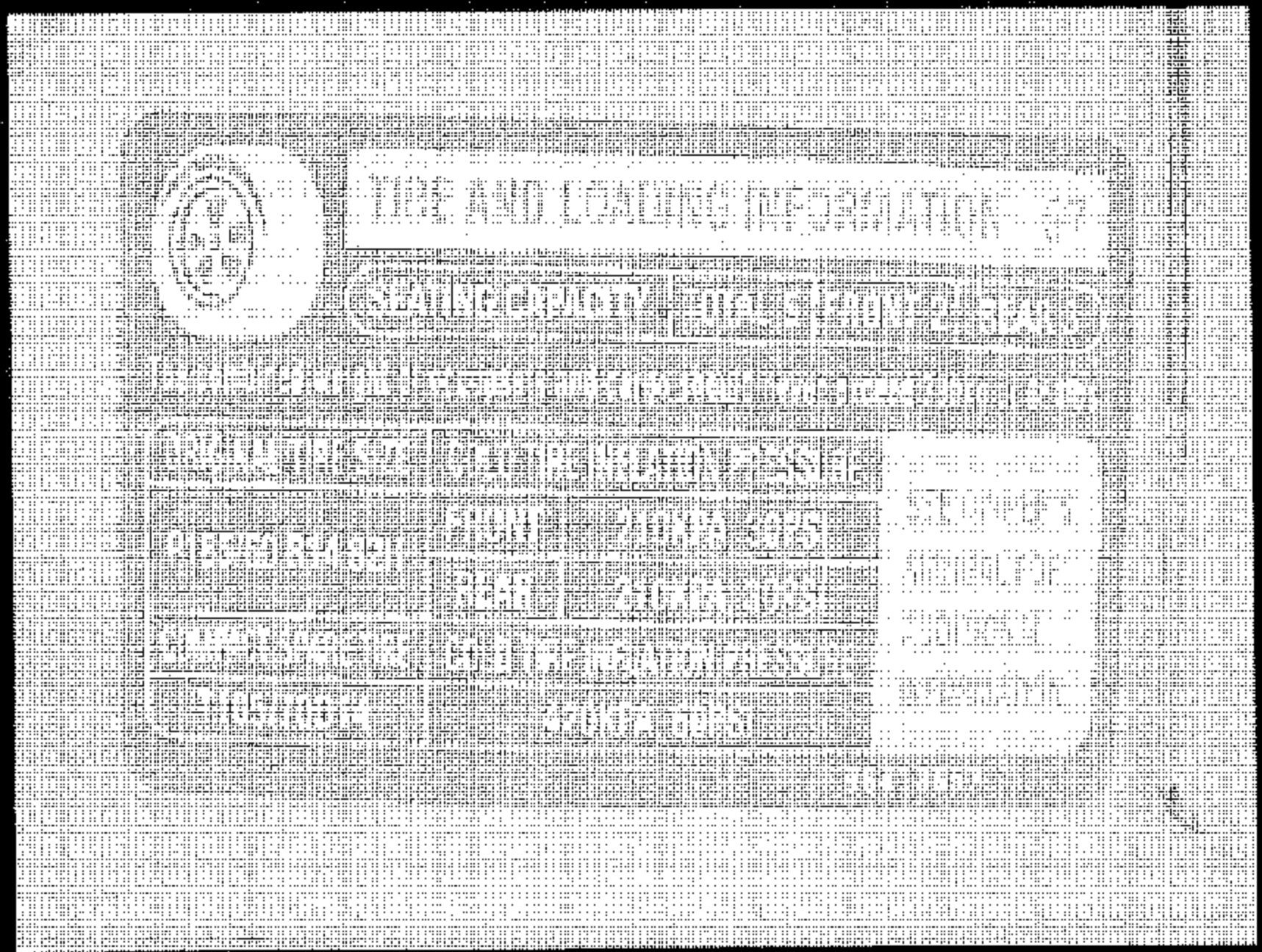

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FIGURE 5.8
VEHICLE TIRE INFORMATION LABEL

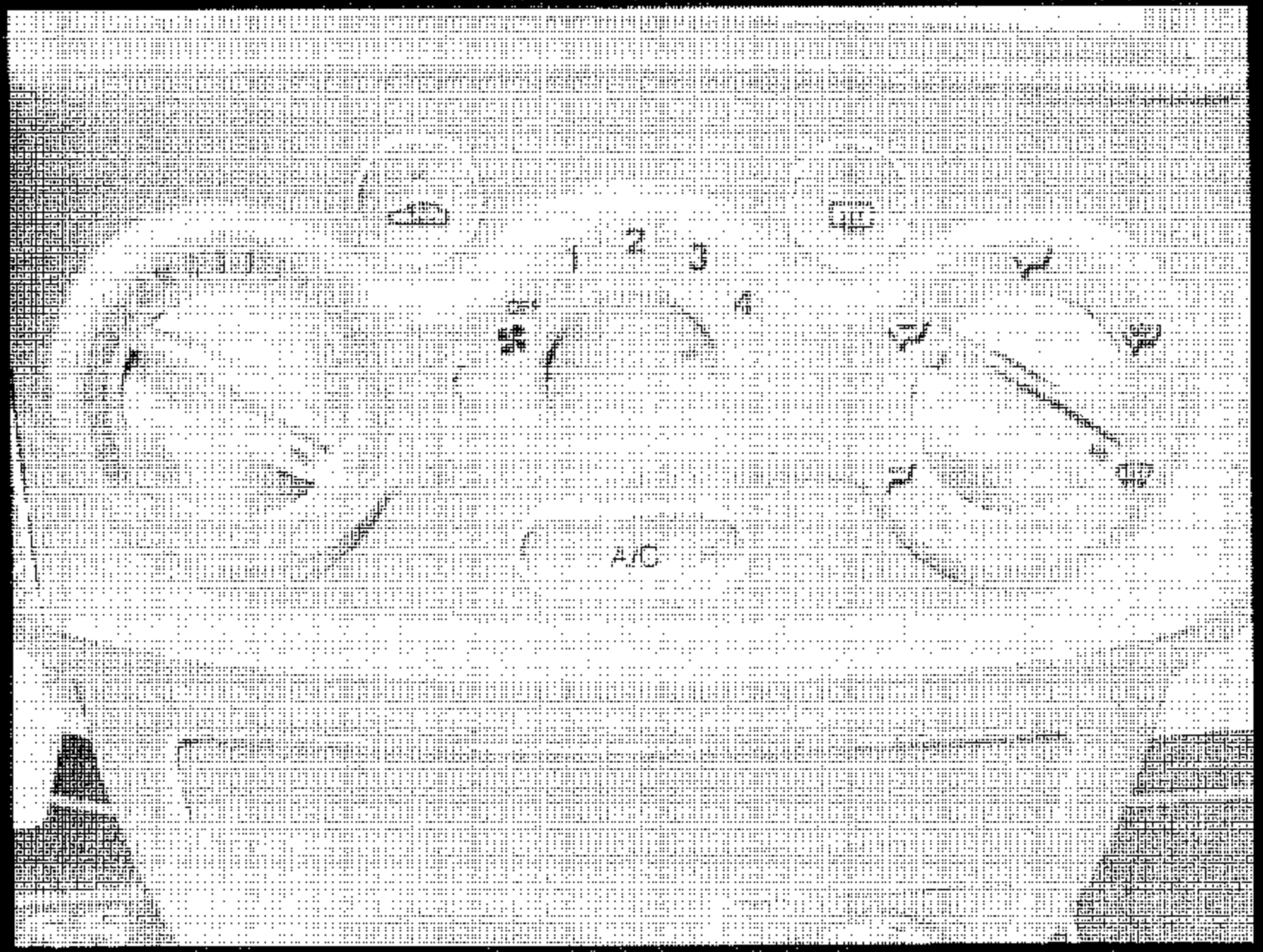

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FIGURE 5.7
CLOSE-UP VIEW OF DEFROSTER CONTROL SETTINGS ON DASH

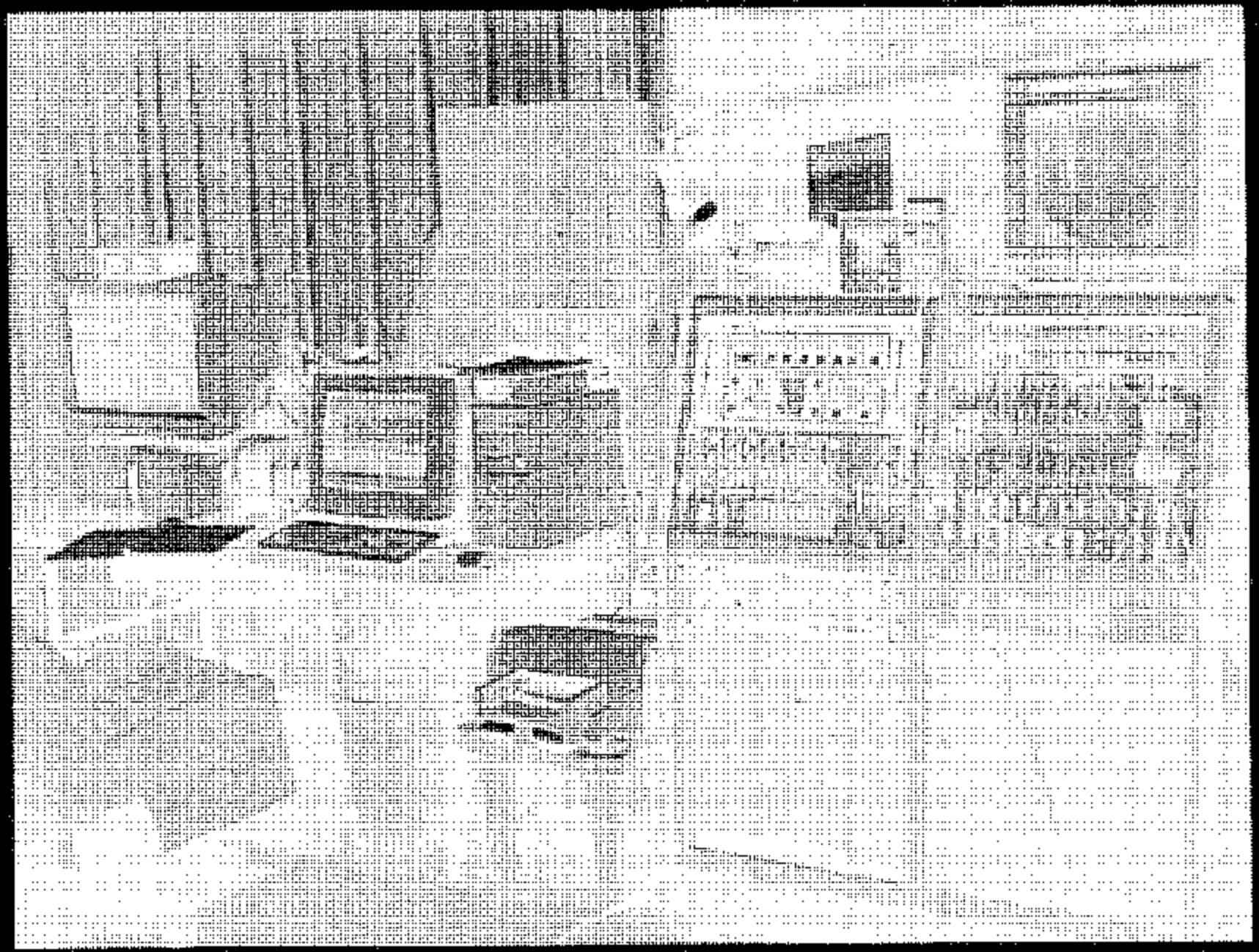

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FIGURE 5.8
INSTRUMENTATION SET-UP

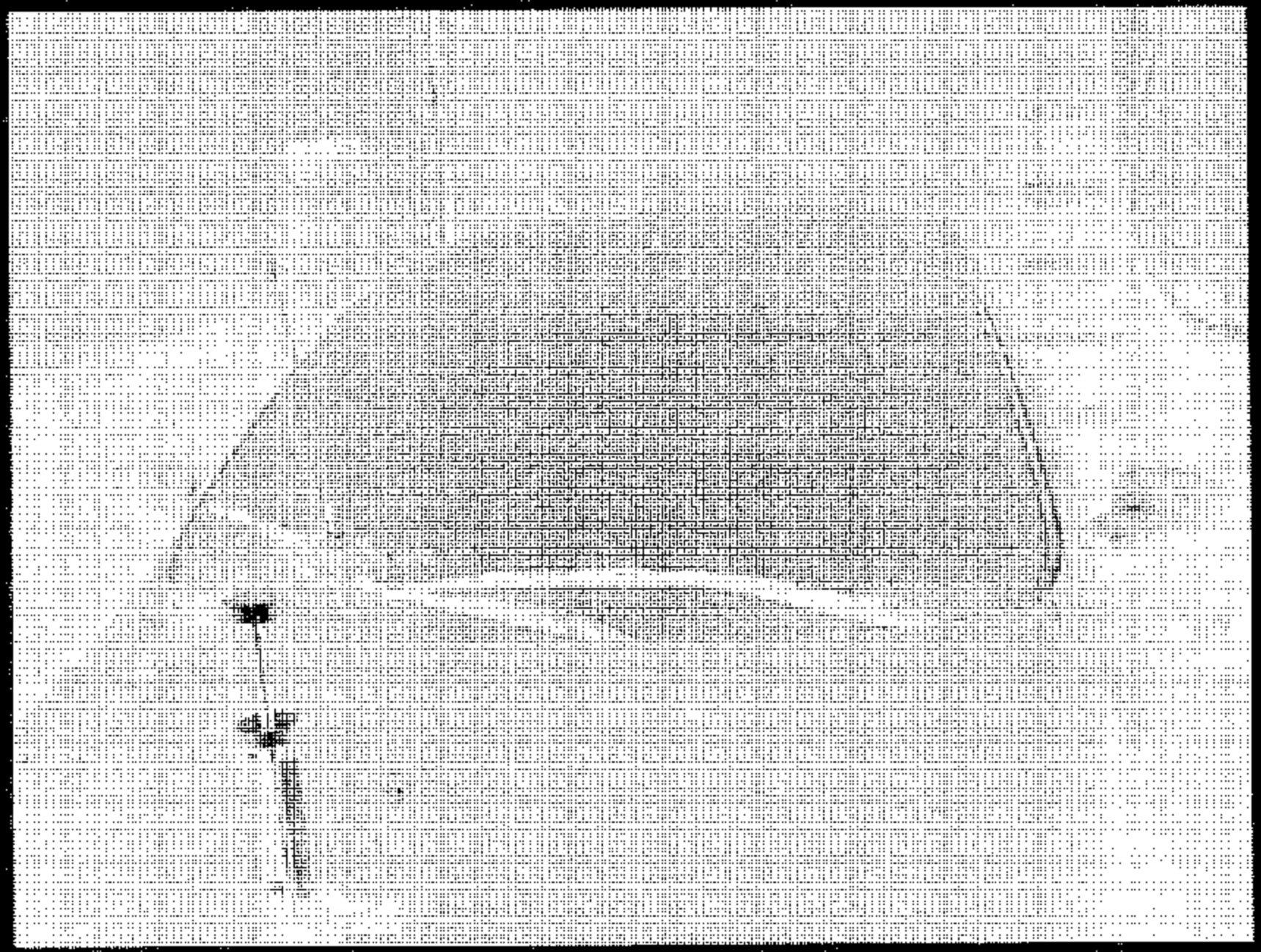

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FIGURE 5.9
WINDSHIELD PRE-TEST FROSTED STATE
TEST #1

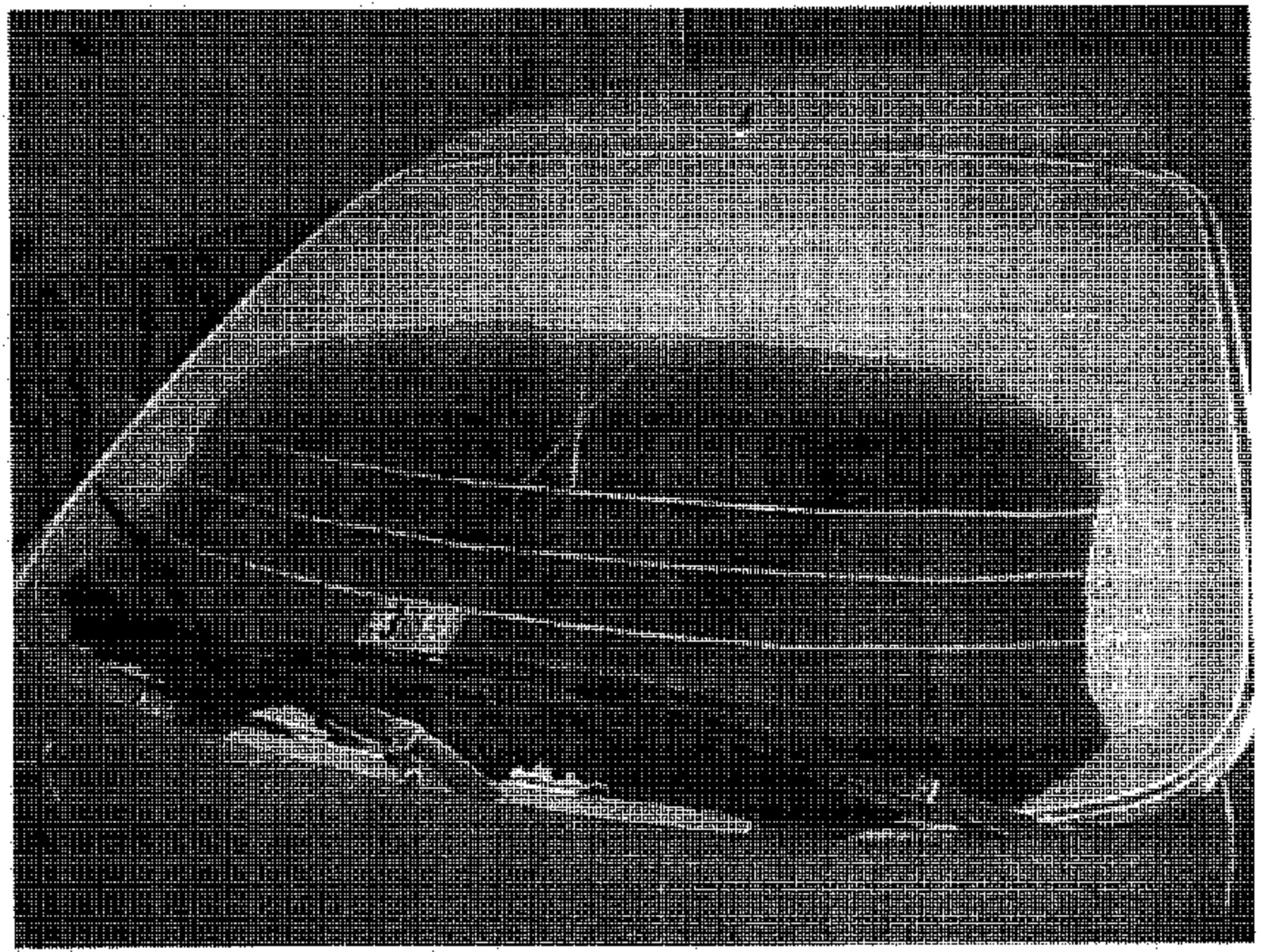

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FIGURE 5.10
DEFROSTED AREA AT 15 MINUTES TEST #1

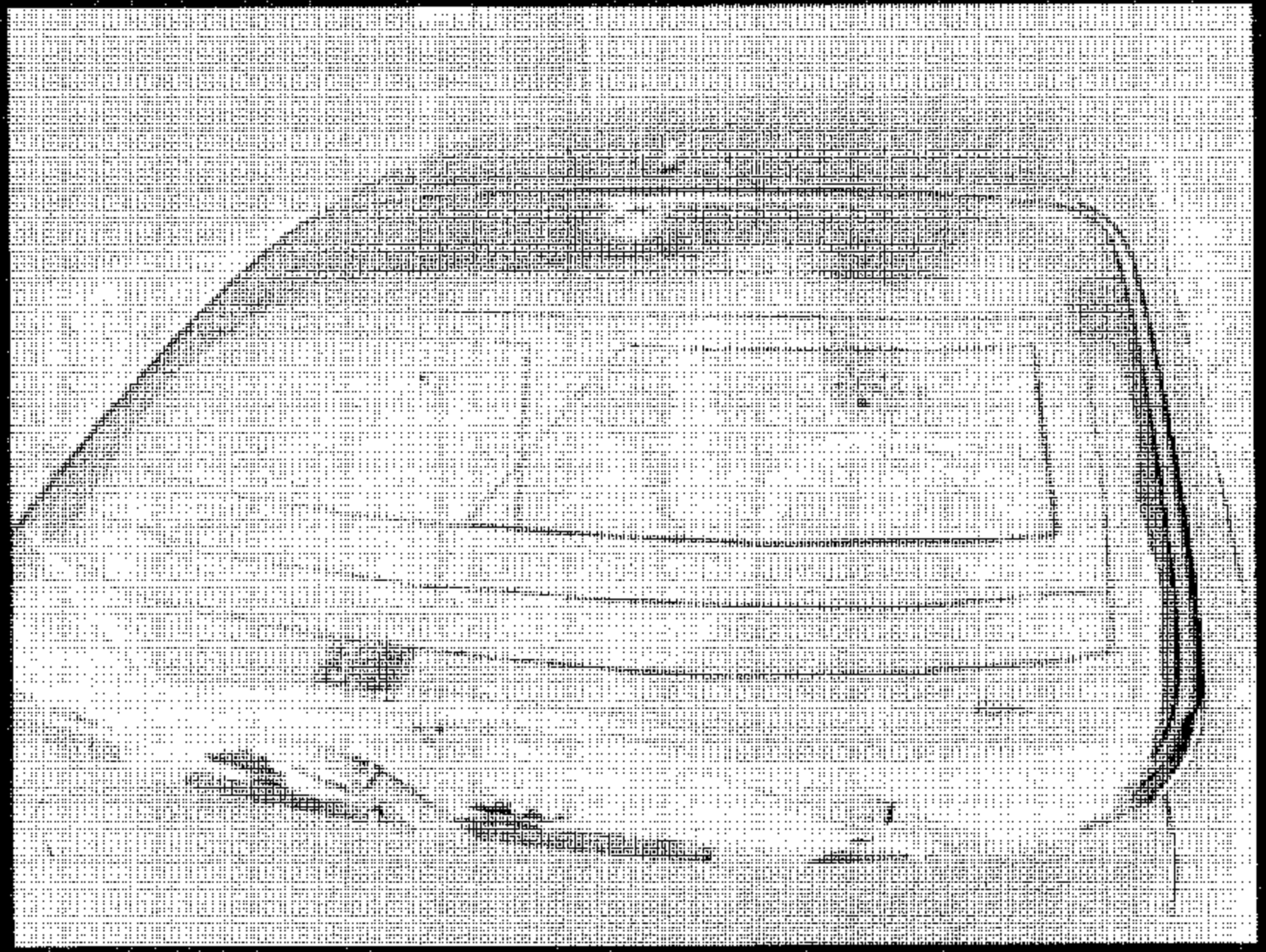

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FIGURE 5.11
DEFROSTED AREA AT 20 MINUTES TEST #1

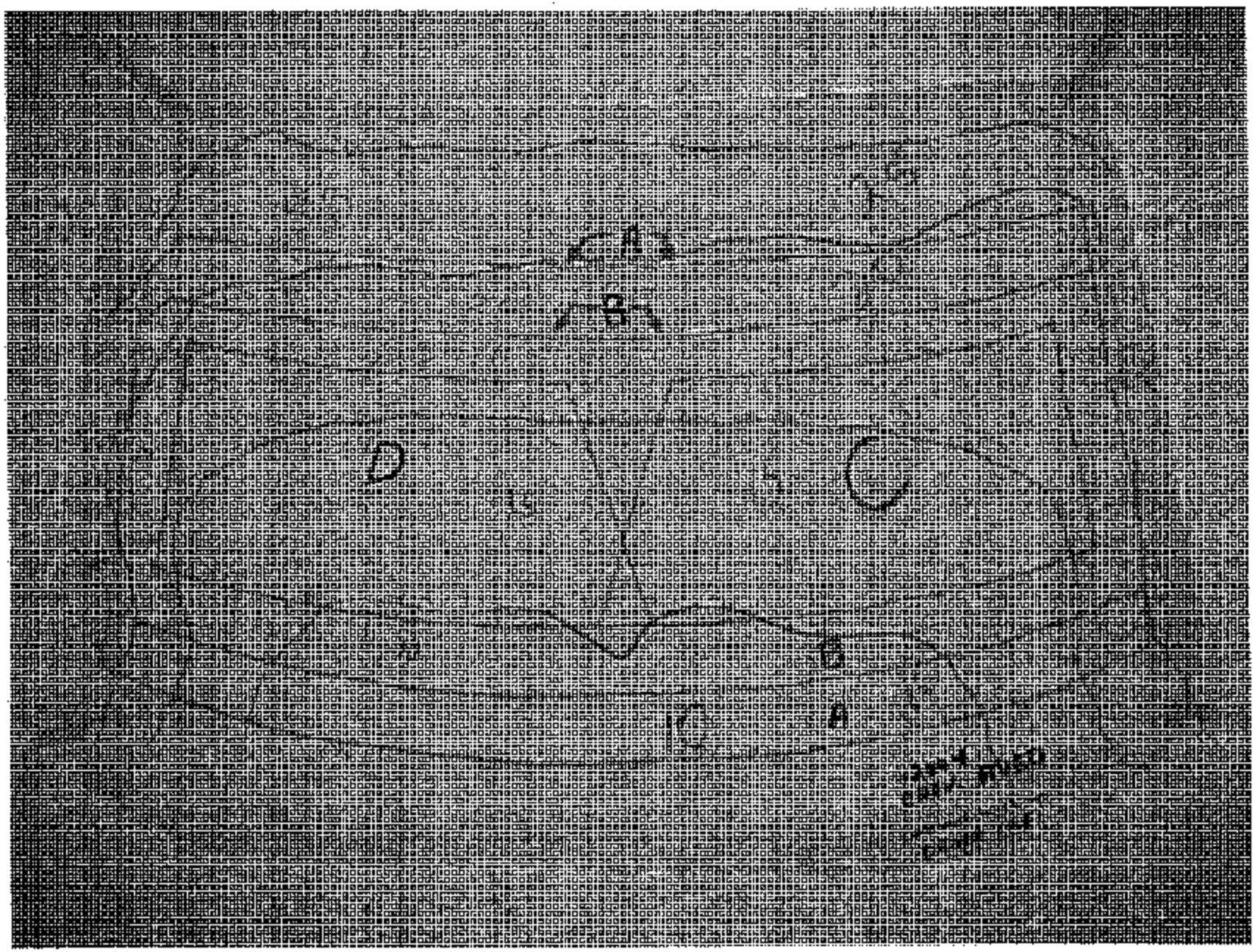

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FIGURE 5.12
WINDSHIELD VELLUM PATTERN POST TEST #1

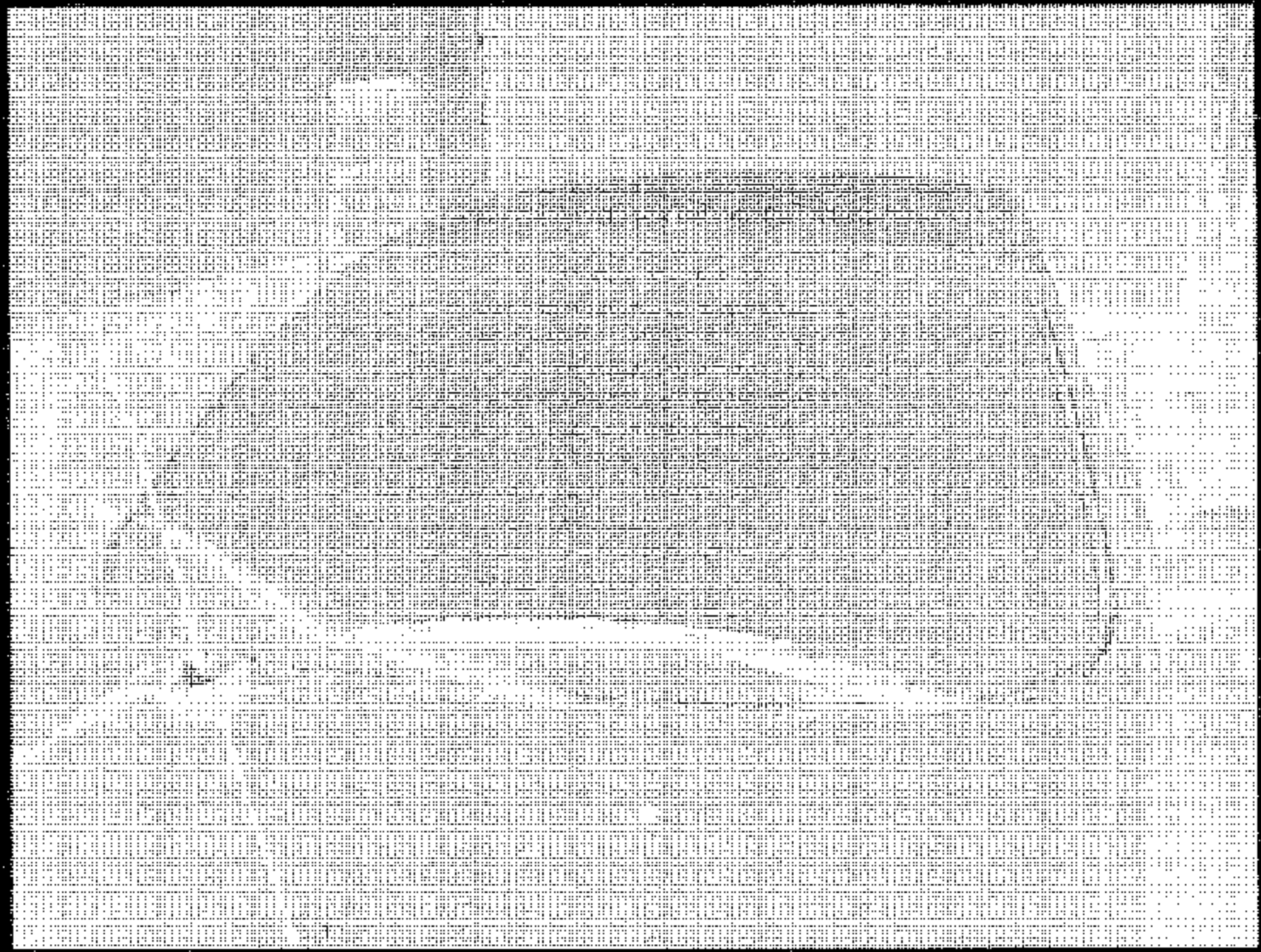

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FIGURE 5.13
WINDSHIELD PRE-TEST FROSTED STATE
TEST #2

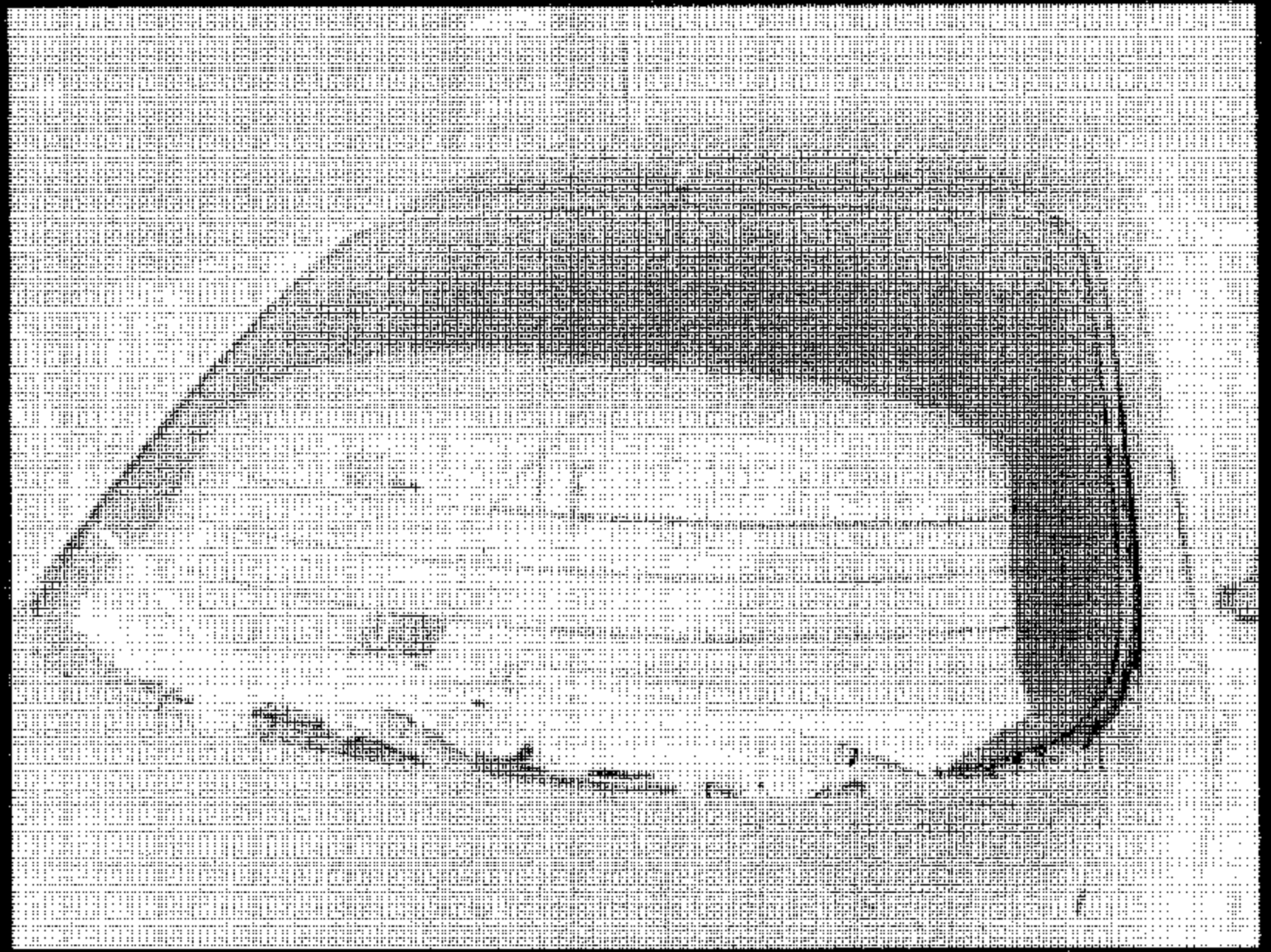

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FIGURE 5.14
DEFROSTED AREA AT 15 MINUTES TEST #2

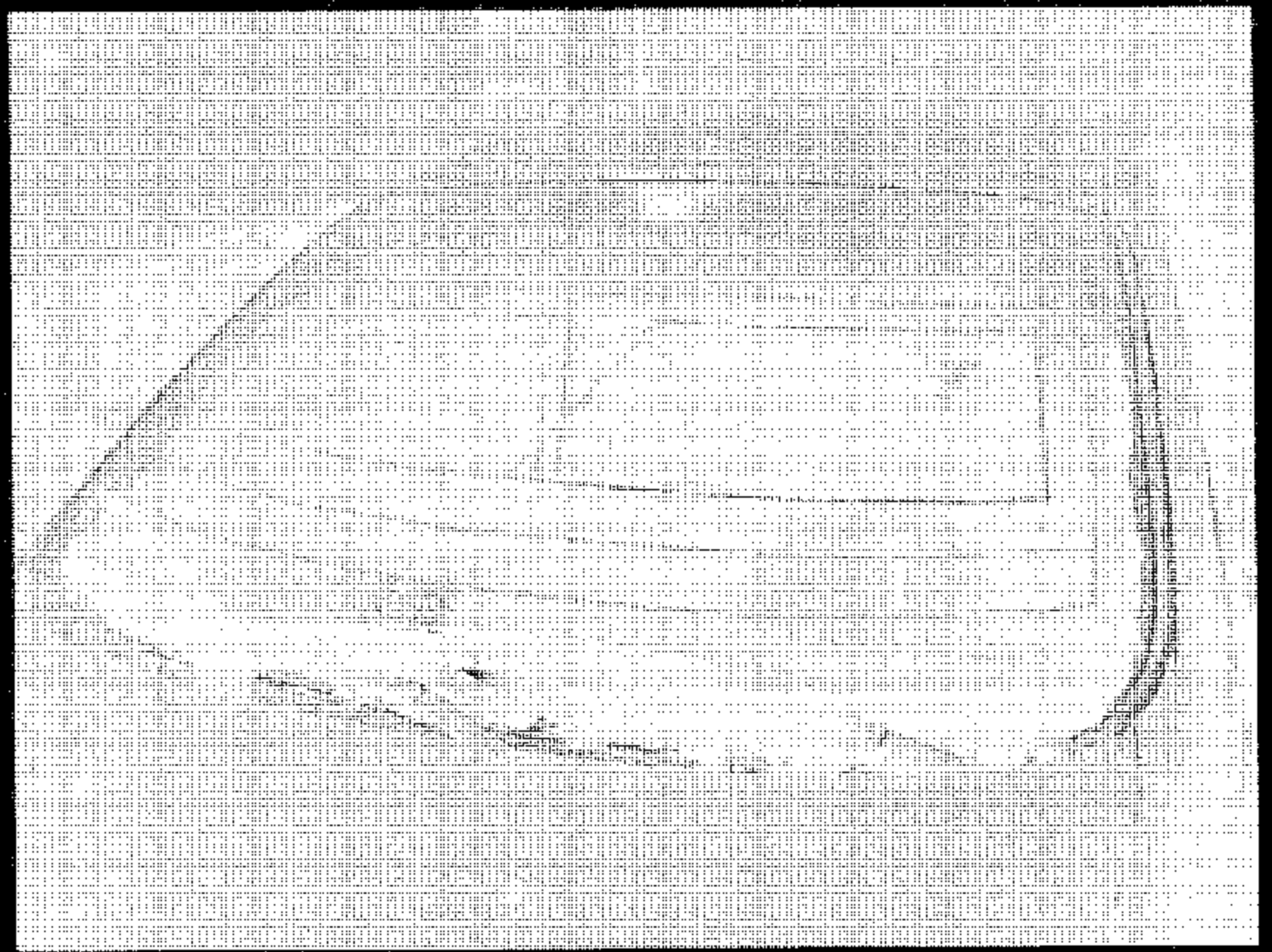

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FIGURE 5.15
DEFROSTED AREA AT 20 MINUTES TEST #2

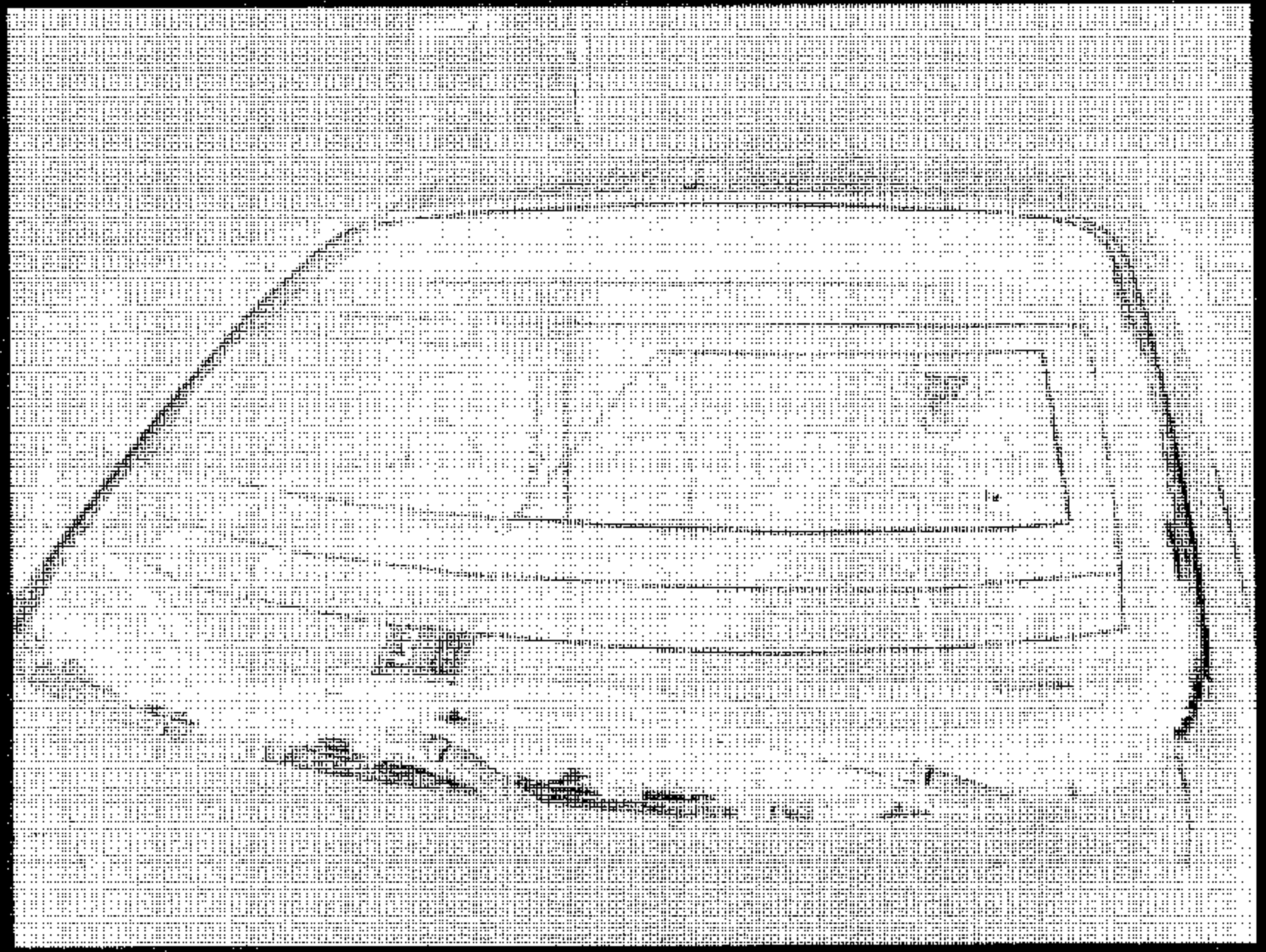

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FIGURE 5.16
DEFROSTED AREA AT 25 MINUTES TEST #2

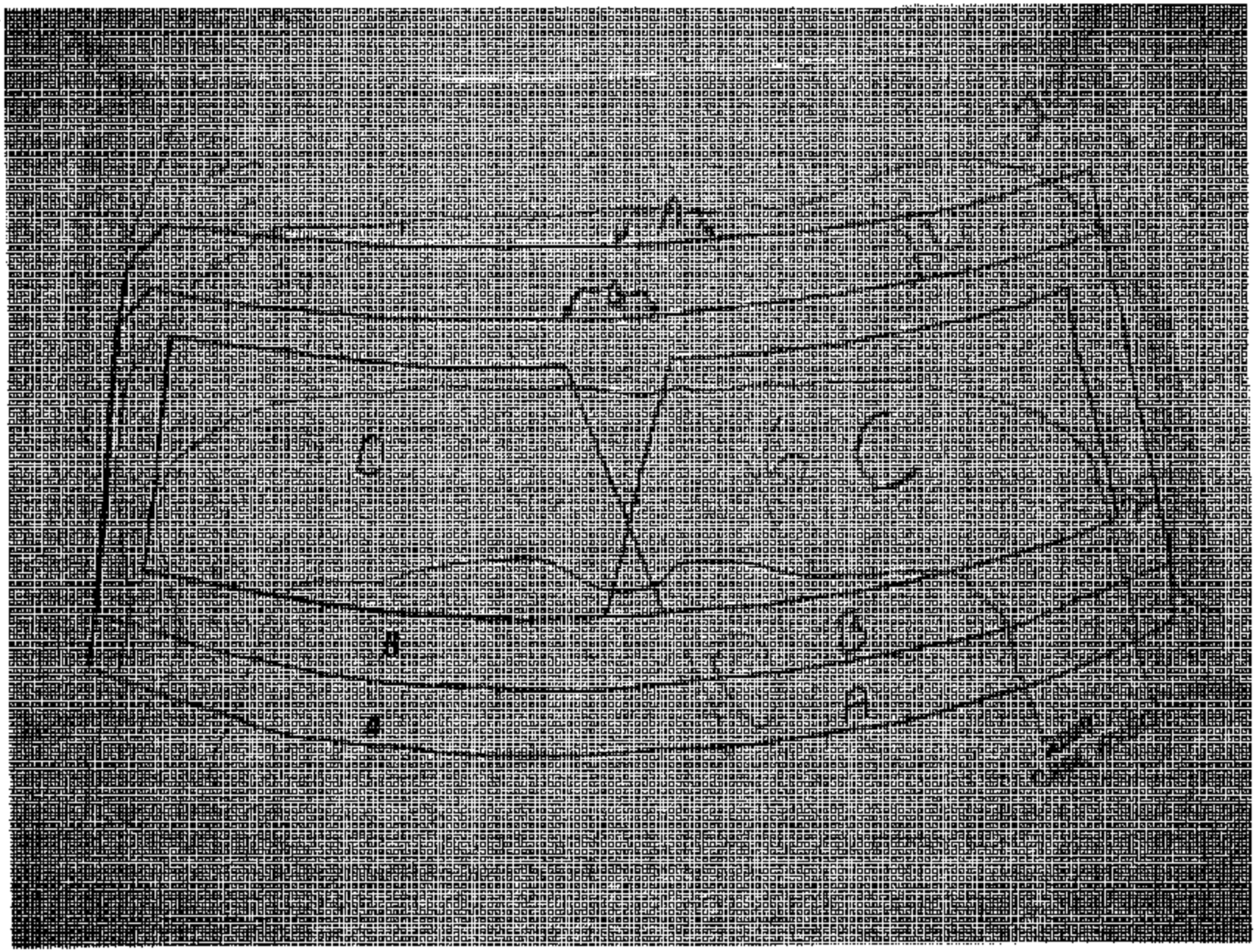

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FIGURE 5.17
WINDSHIELD VELLUM PATTERN POST TEST #2

SECTION 6

OWNER'S MANUAL DEFROSTER INSTRUCTIONS

For quick cool down on hot days, do the following:

1. Select the vent mode.
2. Select the highest fan speed.
3. Press the A/C button.
4. Select the recirculation mode.
5. Select the coolest temperature.

Using these settings together for long periods of time may cause the air inside of your vehicle to become too dry. To prevent this from happening, after the air in your vehicle has cooled, turn the recirculation mode off.

The air conditioning system removes moisture from the air, so you may sometimes notice a small amount of water dripping underneath your vehicle while idling or after turning off the engine. This is normal.

Defogging and Defrosting

Fog on the inside of windows is a result of high humidity or moisture condensing on the cool window glass. This can be minimized if the climate control system is used properly. There are two modes to clear fog or frost from your windshield. Use the defog mode to clear the windows of fog or moisture and warm the passengers. Use the defrost mode to remove fog or frost from the windshield more quickly.

For best results, clear all snow and ice from the windshield before defrosting.

Select one of these available modes from the right knob.

(Defog): This mode directs most of the air to the windshield and the floor outlets. A small amount of air is also directed to the outboard outlets for the side windows.

To help clear the side windows quickly, do the following:

1. Select the bi-level mode.
2. Select the highest fan speed.
3. Select A/C.
4. Select the temperature.

(Defrost): This mode directs the air to the windshield and the outboard outlets for the side windows.

To help clear the windshield quickly, do the following:

1. Select the defrost mode.
2. Select the highest temperature.
3. Select the highest fan speed.

Do not drive the vehicle until all windows are clear.