REPORT NUMBER 103-GTL-09-005

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

TOYOTA MOTOR CORPORATION
2009 LEXUS ES 350, PASSENGER CAR
NHTSA NO. C95104

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

JUNE 30, 2009

FINAL REPORT

PREPARED FOR

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NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2009 LEXUS ES 350 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, Mulitpurpose Vehicles, Trucks and Buses".

1.1 TEST VEHICLE

The test vehicle was a 2009 LEXUS ES 350 Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: JTHBJ46GX92295416

B. NHTSA No.: C95104

C. Manufacturer: TOYOTA MOTOR CORPORATION

D. Manufacture Date: 10/08

E. Color: Smoky Granite Mica

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 103 testing on June 15-16, 2009.

SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2009 LEXUS ES 350 4-door passenger car, NHTSA No. C95104 was subjected to FMVSS No. 103 tests on June 15-16, 2009. 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 5.14 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, C, and D 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, 0º ±5º 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.

SECTION 2 continued

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 0º ± 5º 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 2009 LEXUS ES 350.

SUMMARY DATA SHEET
FMVSS 103, WINDSHIELD DEFROSTING AND DEFOGGING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 LEXUS ES 350 PASSENGER CAR
VEH. NHTSA NO: C95104; VIN: JTHBJ46GX92295416
VEH. BUILD DATE: 10/08 TEST DATE: JUNE 15-16, 2009
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

WINDSHIELD AREA: 1901 in^2 AREA C = 256 in^2 AREA D = 256 in^2 AREA A= 1080 in^2

MANUFACTURER'S WINDSHIELD PATTERN USED: Yes X No

ENGINE THERMOSTAT NOMINAL REGULATING TEMPERATURE: 179 ºF

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: G. FARRAND DATE: 06/16/09

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 1

VEH. MOD YR/MAKE/MODEL/BODY: 2009 LEXUS ES 350 PASSENGER CAR
VEH. NHTSA NO: C95104; VIN: JTHBJ46GX92295416
VEH. BUILD DATE: 10/08 ; TEST DATE: JUNE 15, 2009
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

If 1st Test Run, chamber conditioned 50 hours @ 0º ±5º F (14 hrs. min.)

Cold Soak Period: 50 HOURS

Time engine coolant and lubricant remained stabilized at 0º F: 12 hrs. ___ minutes

Water Spray Gun and Nozzle Type: BINKS #66 S

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

Water used: 19.0 fluid oz. (0.010 ounces per square inch of windshield area)

Soak Period Between Ice Application and Test Start: 35 minutes (30 to 40 minutes)

Engine Speed: 2500* rpm (Target engine speed 1500 to 1600 rpm)
*2500 for first five minutes then 1500.

Wind at specified location in front of windshield: .3 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, ºF					DEFROSTED AREA, %		
		TEST ROOM	ENGINE WATER	HEATER WATER IN	DEFROSTER AIR		A	C	D
					DRVR	PSGR			
0	13.4	-3.8	-3.8	-3.1*	-2.7	-2.5	0%	0%	0%
5	14.2	-2.2	17.0	56.5*	94.5	93.9	20.8%	13.2%	16.96%
10	14.1	-0.3	62.3	97.6*	118.6	117.6	90.1%	99.7%	100%
15	13.9	1.8	116.8	117.8*	135.0	133.2	100%	100%	100%

REMARKS: *Heater Water In thermocouple is located on outside of heater hose connectors.

RECORDED BY: G. FARRAND DATE: 06/15/09

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 2

VEH. MOD YR/MAKE/MODEL/BODY: 2009 LEXUS ES 350 PASSENGER CAR
VEH. NHTSA NO: C95104; VIN: JTHBJ46GX92295416
VEH. BUILD DATE: 10/08 ; TEST DATE: JUNE 16, 2009
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

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

Cold Soak Period: 24.0 HOURS

Time engine coolant and lubricant remained stabilized at 0º F: 12 hrs. ___ minutes

Water Spray Gun and Nozzle Type: BINKS #66S

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

Water used: 19 fluid oz. (0.010 ounces per square inch of windshield area)

Soak Period Between Ice Application and Test Start: 35 minutes (30 to 40 minutes)

Engine Speed: 2500* rpm (Target engine speed 1500 to 1600 rpm)
*2500 for first five minutes then 1500.

Wind at specified location in front of windshield: .3 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, ºF					DEFROSTED AREA, %		
		TEST ROOM	ENGINE WATER	HEATER WATER IN	DEFROSTER AIR				
					DRVR	PSGR	A	C	D
0	13.1	-3.5	-3.4	-3.5*	-2.7	-2.8	0%	0%	0%
5	14.2	-2.5	12.3	50.4*	90.3	86.2	14.0%	5.5%	8.1%
10	14.1	-0.8	55.1	92.3*	113.4	112.6	72.0%	89.5%	88.7%
15	14.0	1.4	84.6	114.2*	131.5	130.5	100%	100%	100%

REMARKS: *Heater Water In thermocouple is located on outside of heater hose connectors.

RECORDED BY: G. FARRAND DATE: 06/16/09

APPROVED BY: D. MESSICK

SECTION 4
INSTRUMENTATION AND EQUIPMENT LIST

TABLE 1 - INSTRUMENTATION & EQUIPMENT LIST

EQUIPMENT	DESCRIPTION	MODEL/ SERIAL NO.	CAL. DATE	NEXT CAL. DATE
TIMER	ACCU-SPLIT	ACT1	05/09	05/10
TAC/RECORDER	MONARCH	1444664	05/09	05/10
TEMPERATURE RECORDER	FLUKE	7471026	10/08	10/09
SPRAY GUN	BINKS	66S	BEFORE USE	BEFORE USE
ANEMOMETER	OMEGA	HH-600	05/09	05/10
AIR PRESSURE GAGE	BINKS	0-160	05/09	05/10
SCALE	METTLER	H315/ 445951	05/09	05/10
GRADUATED BEAKER	PHOTAX	N/A	N/A	N/A
EVENT RECORDER	COMPUTER	GEO1	BEFORE USE	BEFORE USE

SECTION 5

PHOTOGRAPHS

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

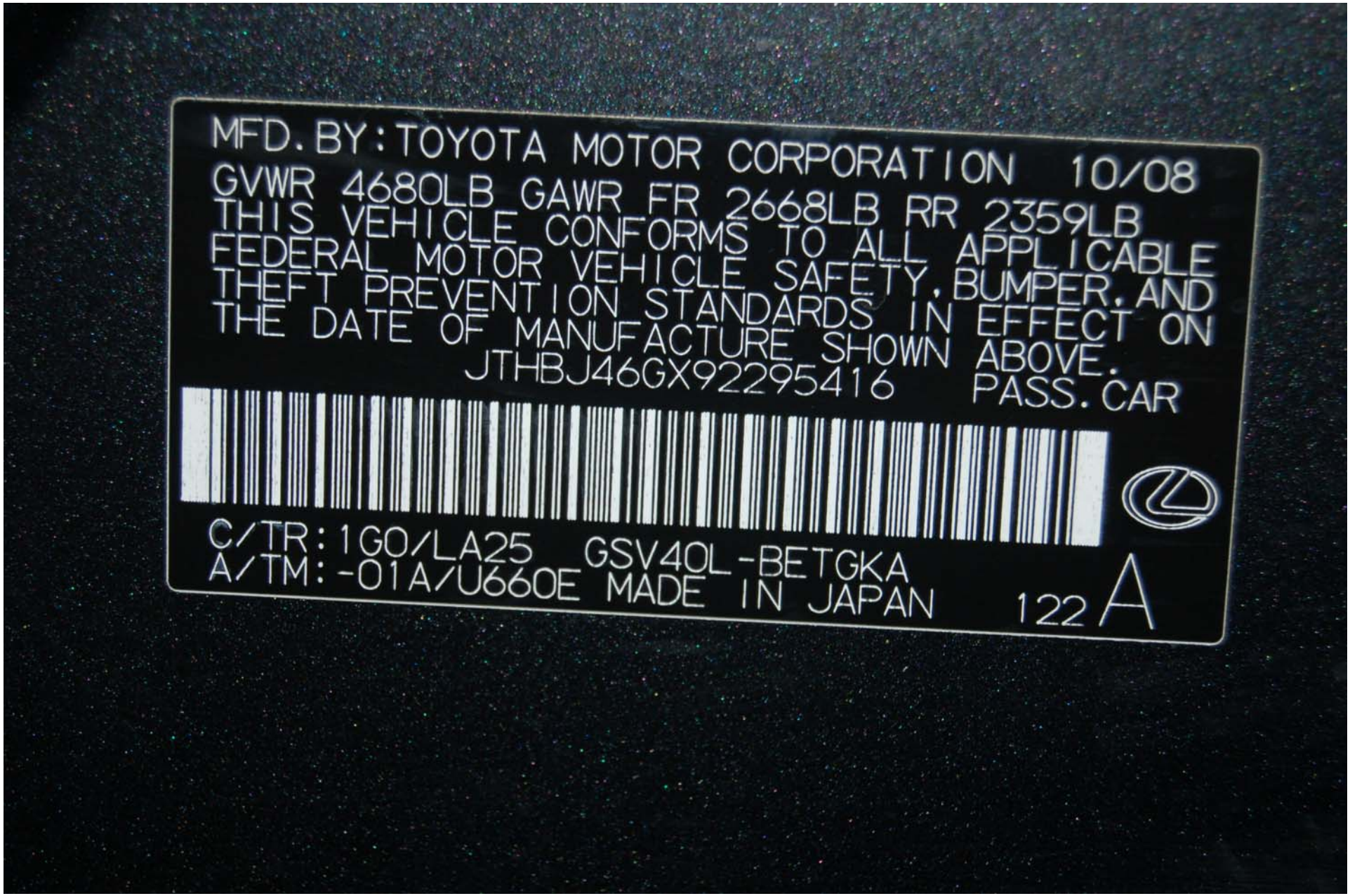
FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

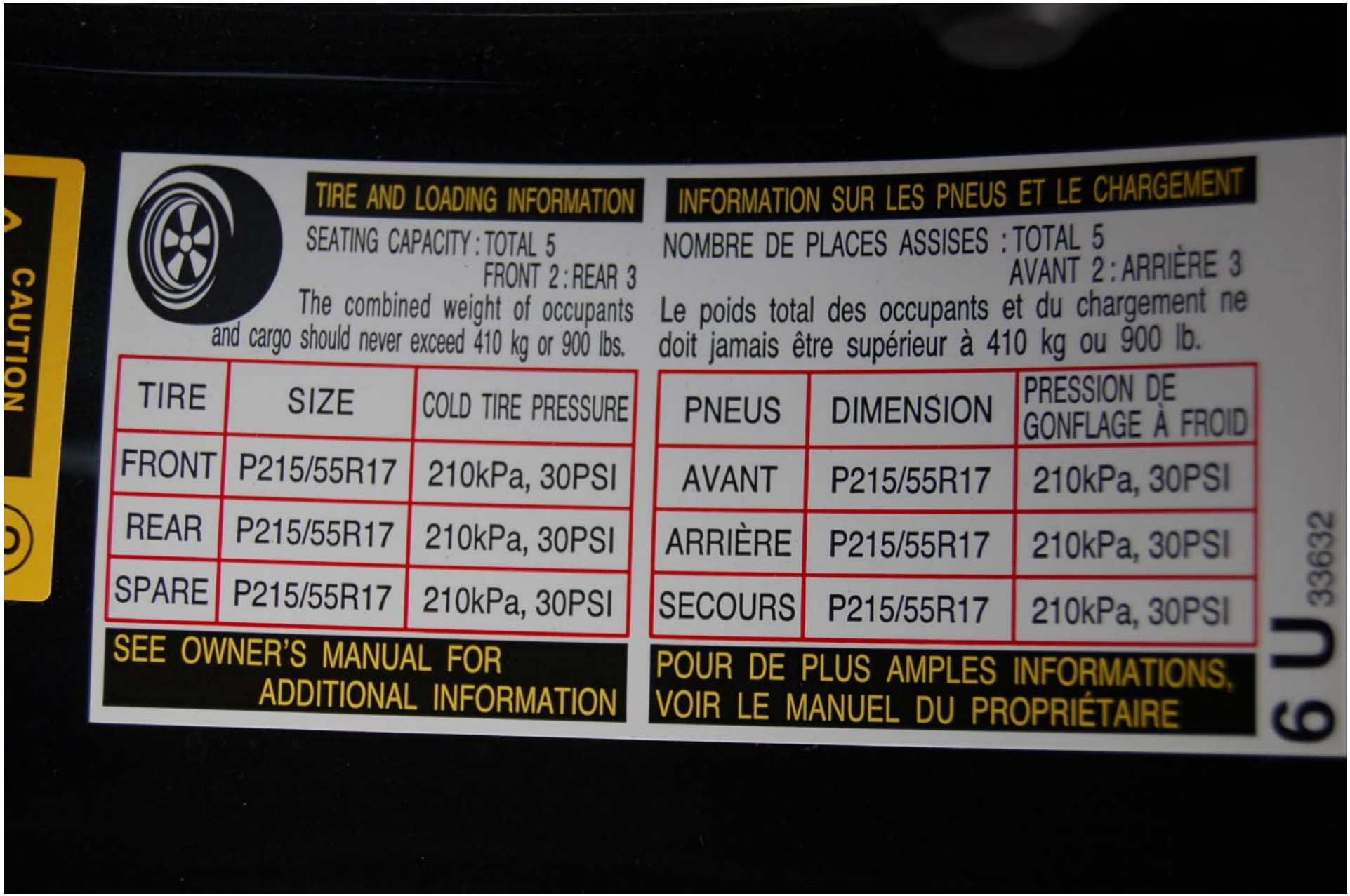
2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE



2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.5
VEHICLE CERTIFICATION LABEL



2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.6
VEHICLE TIRE INFORMATION LABEL

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

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

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

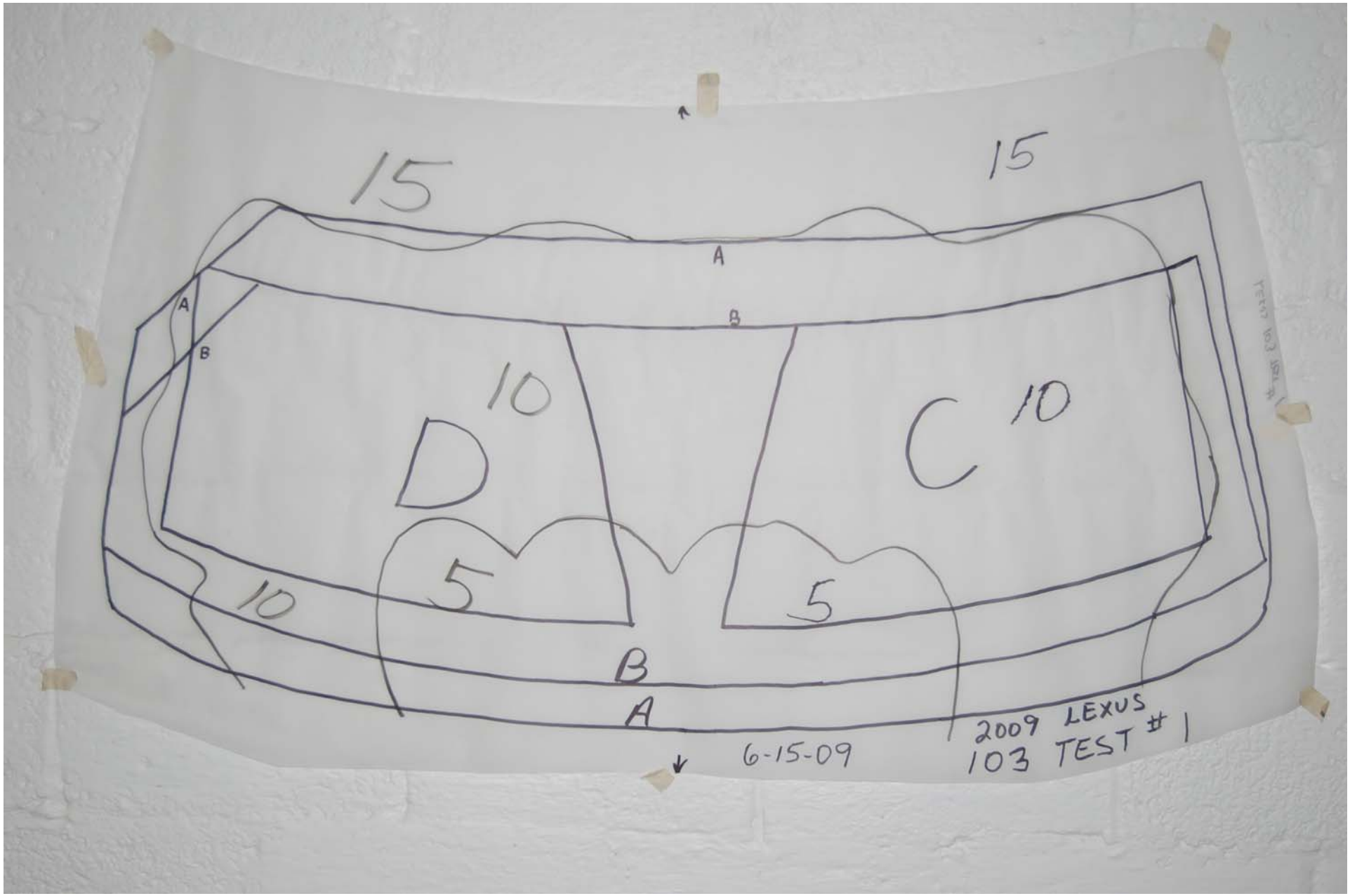
FIGURE 5.8
INSTRUMENTATION SET-UP

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.9
WINDSHIELD, PRE-TEST FROSTED STATE TEST #1

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.10
DEFROSTED AREA AT 15 MINUTES TEST #1



2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

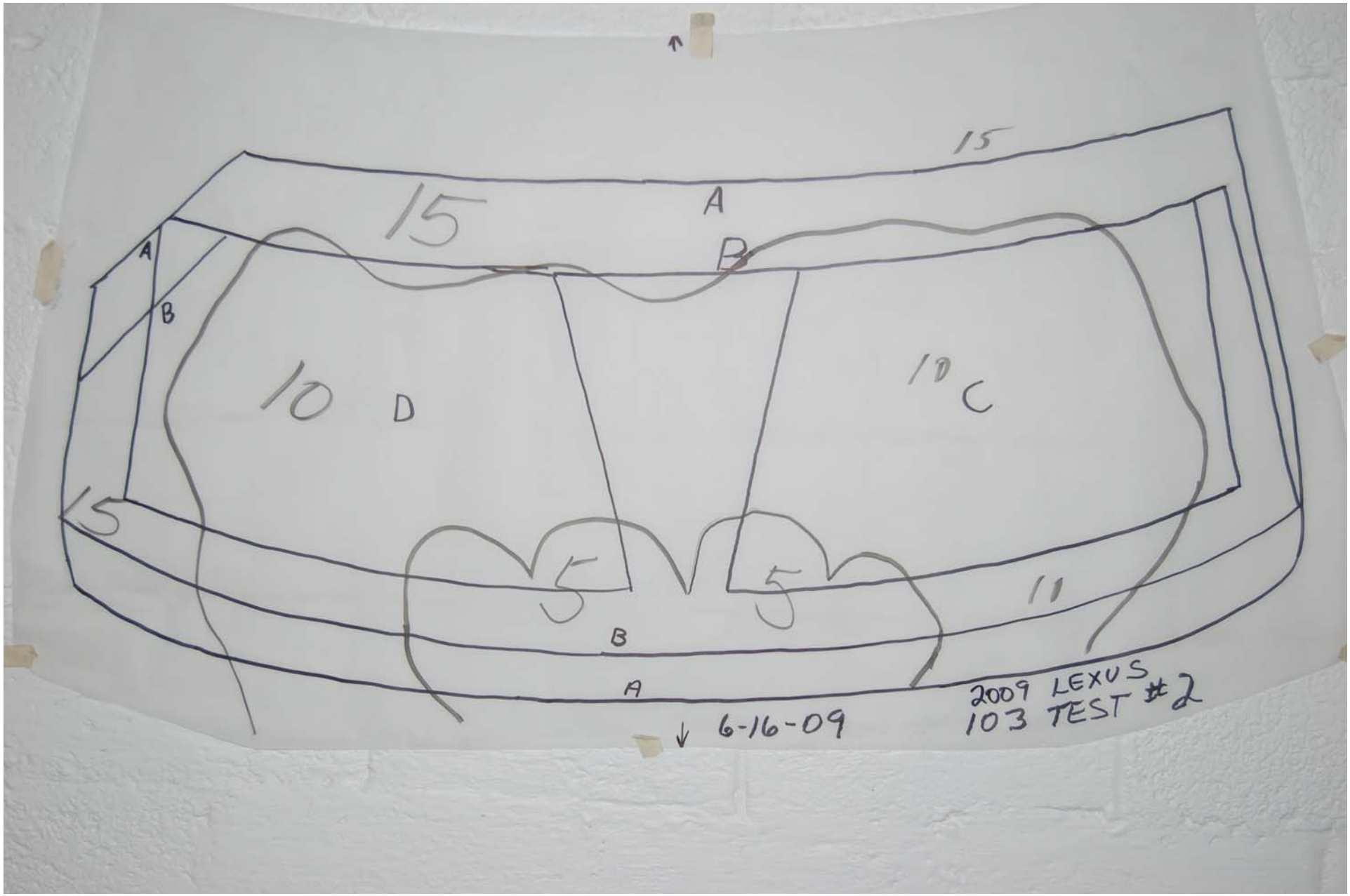
FIGURE 5.11
WINDSHIELD VELLUM PATTERN, POST TEST #1

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.12
WINDSHIELD PRE-TEST FROSTED STATE #2

2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.13
DEFROSTED AREA AT 15 MINUTES TEST #2



2009 LEXUS ES 350
NHTSA NO. C95104
FMVSS NO. 103

FIGURE 5.14
WINDSHIELD VELLUM PATTERN, POST TEST #2

SECTION 6

OWNER'S MANUAL DEFROSTER INSTRUCTIONS

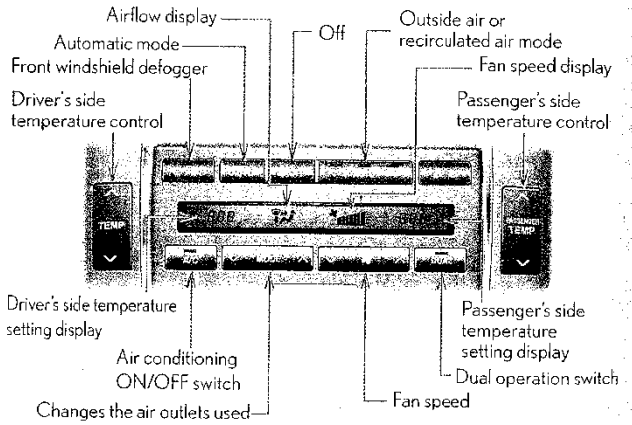
Automatic air conditioning system

Airflow and outlets are automatically adjusted according to the temperature setting.

▶ With navigation system

Owners of models equipped with a navigation system should refer to the "Navigation System Owner's Manual".

▶ Without navigation system



Using the automatic mode

Step 1 Press AUTO.

➪ The air conditioning system will begin to operate. Air outlets and fan speed are automatically adjusted according to the temperature setting.

Step 2 Press AUTO to switch to automatic mode.

➪ Automatically switches between outside air and recirculated air modes.

Step 3 Press ∧ to increase the temperature and ∨ to decrease the temperature on the TEMP switch.

The temperature for the driver and passenger seats can be set separately.

Adjusting the settings

■ Adjusting the temperature setting

Press ∧ to increase the temperature and ∨ to decrease the temperature on the TEMP switch.

Press ∧ (increase) or ∨ (decrease) on the TEMP switch to separately adjust the temperature for the passenger and driver sides (dual mode). Press DUAL to return the driver and passenger side temperatures to the same setting (simultaneous mode).

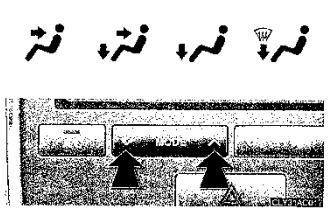
The air conditioning system switches between individual and simultaneous modes each time DUAL is pressed.

■ Adjusting the fan speed

Press ∧ (increase) or ∨ (decrease) on FAN.

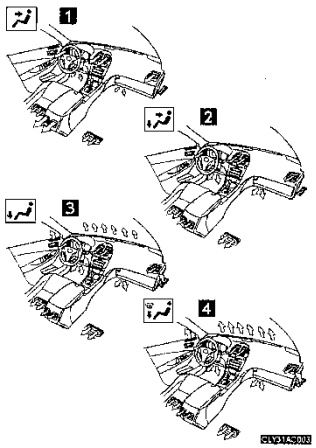
Press OFF to turn the fan off.

Changing the air outlets



Press ∧ or ∨ on the switch.

The air outlets switch each time the switch is pressed.



- 1 Air flows to the upper body.
- 2 Air flows to the upper body and feet.
- 3 Air flows to the feet.
- 4 Air flows to the feet and the front windshield defogger operates.

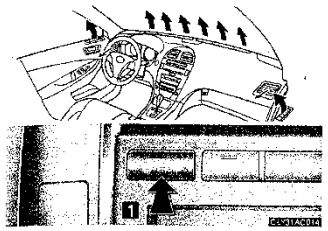
Switching between outside air and recirculated air modes

Press .

The mode switches between (recycles air inside the vehicle), AUTO and (introduces air from outside the vehicle) modes each time the switch is pressed.

When the system is switched to automatic mode, the air conditioning system operates automatically.

Defogging the front windshield

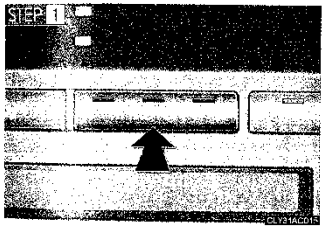


1 Defogging

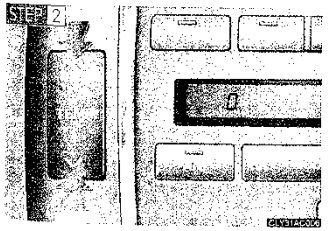
The air conditioning system control operates automatically.

Recirculated air mode will automatically switch to outside air mode. It is not possible to return to recirculated air mode when the switch is on.

Adjusting the sensitivity of the air intake control in automatic mode



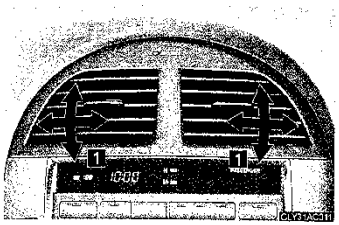
Press for 2 or more seconds.



Press ∧ (increase) or ∨ (decrease) on the switch.

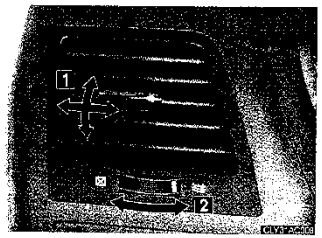
From −3 (low) to 3 (high) can be set.

Adjusting the position of and opening and closing the air outlets



▶ Center outlets

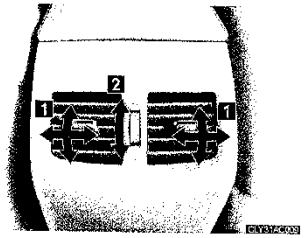
1 Direct air flow to the left or right, up or down



▶ Front outlets (right and left side)

1 Direct air flow to the left or right, up or down

2 Turn the knob right to open the vent and left to close the vent



▶ Rear outlets

1 Direct air flow to the left or right, up or down

2 Turn the knob up to open the vent and down to close the vent

Using the automatic mode

Fan speed is adjusted automatically in accordance with the temperature setting and ambient conditions. As a result, the following may occur.

- The system may switch automatically to recirculated mode when the coolest temperature setting is selected in summer.
- Immediately after the switch is pressed, the fan may stop for a while until warm or cool air is ready to flow.
- Cool air may flow to the area around the upper body when the heater is on.

Using the system in recirculated air mode

The windows will fog up more easily if the recirculated air mode is used for an extended period.

Window defogger feature

Recirculated air mode may automatically switch to (outside air) mode in situations where the windows need to be defogged.

Outside air temperature approaches 32°F (0°C).

The air conditioning system may not operate even when is pressed.

When the indicator light on flashes

Press and turn off the air conditioning system before turning it on once more. There may be a problem in the air conditioning system if the indicator light continues to flash. Turn the air conditioning system off and have it inspected by your Lexus dealer.

Automatic mode for air intake control

In automatic mode, the system detects exhaust gas and other pollutants and automatically switches between outside air and recirculated air modes.

⚠ CAUTION

To prevent the windshield from fogging up

Do not use during cool air operation in extremely humid weather. The difference between the temperature of the outside air and that of the windshield can cause the outer surface of the windshield to fog up, blocking your vision.