

REPORT NUMBER 103-GTL-11-002

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

**NISSAN MOTOR CO., LTD.
2011 NISSAN LEAF, PASSENGER CAR
NHTSA NO. CB5200**

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



July 8, 2011

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: 07/08/11

FINAL REPORT ACCEPTANCE BY OVSC:

Accepted By: Henry Thompson

Acceptance Date: 7/8/2011

1. Report No. 103-GTL-11-002	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 2011 NISSAN LEAF PASSENGER CAR NHTSA No. CB5200		5. Report Date July 08, 2011
		6. Performing Organ. Code GTL
7. Author(s) Grant Farrand, Project Engineer Debbie Messick, Project Manager		8. Performing Organ. Rep# GTL-DOT-11-103-002
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. DTNH22-06-C-00032
12. Sponsoring Agency Name and Address U.S. Department of Transportation National Highway Traffic Safety Administration Enforcement Office of Vehicle Safety Compliance (NVS-220) 1200 New Jersey Ave., S.E. Washington, DC 20590		13. Type of Report and Period Covered Final Test Date June 20-21, 2011
		14. Sponsoring Agency Code NVS-220
15. Supplementary Notes		
16. Abstract Compliance tests were conducted on the subject, 2011 NISSAN LEAF 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 W45-212 (NPO-411) 1200 New Jersey Ave., S.E. Washington, DC 20590 Telephone No. (202) 366-4947
19. Security Classif. (of this report) UNCLASSIFIED	21. No. of Pages 37	22. Price
20. Security Classif. (of this page) UNCLASSIFIED		

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2011 NISSAN LEAF 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, Multpurpose Vehicles, Trucks and Buses".

1.1 TEST VEHICLE

The test vehicle was a 2011 NISSAN LEAF Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: JN1AZ0CPXBT002457

B. NHTSA No.: CB5200

C. Manufacturer: NISSAN MOTOR CO., LTD.

D. Manufacture Date: 04/11

E. Color: Super Black

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 103 testing on June 20-21, 2011.

SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2011 NISSAN LEAF 4-door passenger car, NHTSA No. CB5200 was subjected to FMVSS No. 103 tests on June 20-21, 2011. 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 5.20 depict the windshield pre and post test defrost conditions.

Note: This vehicle is an all electric vehicle which uses electric resistive heaters for defrosting and occupant compartment heat. The electric drive motor and drive batteries are heated/cooled with liquid antifreeze coolant same as an internal combustion engine. Motor coolant temperature was recorded on data sheets.

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, $0^{\circ} \pm 5^{\circ}$ F temperature soak for the first test run. After the pre-condition, the hood was raised to assure motor 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 system was started and operated. 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 system start, cold chamber, motor coolant, left/defroster and right defroster air 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 system 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 5-minute, 10-minute and 15-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 motor coolant and lubricant stabilization period at $0^{\circ} \pm 5^{\circ}$ 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 2011 NISSAN LEAF.

SUMMARY DATA SHEET
FMVSS 103, WINDSHIELD DEFROSTING AND DEFOGGING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2011 NISSAN LEAF PASSENGER CAR
 VEH. NHTSA NO: CB5200; VIN: JN1AZ0CPXBT002457
 VEH. BUILD DATE: 04/11 TEST DATE: JUNE 20-21, 2011
 TEST LABORATORY: GENERAL TESTING LABORATORIES
 OBSERVERS: GRANT FARRAND, DEBBIE MESSICK

WINDSHIELD AREA: 1859 in² AREA C = 240 in² AREA D = 240 in² AREA A = 1044 in²

MANUFACTURER'S WINDSHIELD PATTERN USED: Yes X No _____

ENGINE THERMOSTAT NOMINAL REGULATING TEMPERATURE: 0 °F

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

DESCRIBE UNUSUAL FEATURES OF DEFROSTING SYSTEM: _____

DESCRIBE UNUSUAL FEATURES OF TEST CAR: All electric vehicle

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: 06/21/11

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 1

VEH. MOD YR/MAKE/MODEL/BODY: 2011 NISSAN LEAF PASSENGER CAR
 VEH. NHTSA NO: CB5200; VIN: JN1AZ0CPXBT002457
 VEH. BUILD DATE: 04/11; TEST DATE: JUNE 20, 2011
 TEST LABORATORY: GENERAL TESTING LABORATORIES
 OBSERVERS: GRANT FARRAND, DEBBIE MESSICK

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

Cold Soak Period: 24 HOURS

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

Water Spray Gun and Nozzle Type: BINKS #66S

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

Water used: 18.6 fluid oz. (0.010 ounces per square inch of windshield area)

Soak Period Between Ice Application and Test Start: 33 minutes (30 to 40 minutes)

Engine Speed: 0 rpm (1500 to 1600 rpm)

Wind at specified location in front of windshield: 1.0 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		A	C	D
					DRVR	PSGR			
0	14.8	0	0		1.0	1.0	0%	0%	0%
5	14.8	1.4	1.0		80.3	82.0	6.4%	0%	0%
10	14.8	2.0	2.4		93.7	94.3	43.7%	52.7%	41.8%
15	14.8	4.4	2.4		99.9	99.9	95.5%	100%	100%
20	14.8	5.7	2.7		102.6	102.4	100%	100%	100%

REMARKS:

RECORDED BY: G. FARRAND

DATE: 06/20/11

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 2

VEH. MOD YR/MAKE/MODEL/BODY: 2011 NISSAN LEAF PASSENGER CAR
 VEH. NHTSA NO: CB5200; VIN: JN1AZ0CPXBT002457
 VEH. BUILD DATE: 04/11; TEST DATE: JUNE 21, 2011
 TEST LABORATORY: GENERAL TESTING LABORATORIES
 OBSERVERS: GRANT FARRAND, DEBBIE MESSICK

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

Cold Soak Period: 20.0 HOURS

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

Water Spray Gun and Nozzle Type: BINKS #66S

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

Water used: 18.6 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: 0 rpm (1500 to 1600 rpm)

Wind at specified location in front of windshield: 1.0 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		A	C	D
					DRVR	PSGR			
0	13.9	-1.2	-2.0		-2.0	-1.5	0%	0%	0%
5	14.8	-1.1	-2.0		76.2	76.2	7.4%	0%	0%
10	14.8	0.4	-.8		91.7	91.8	42.4%	58.8%	27.7%
15	14.8	1.1	-.8		95.9	95.7	88.4%	100%	98.1%
20	14.8	2.3	-.7		98.8	98.9	100%	100%	100%

REMARKS:

RECORDED BY: G. FARRAND

DATE: 06/21/11

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	05/11	05/12
TAC/RECORDER	MONARCH	1444664	05/11	05/12
TEMPERATURE RECORDER	FLUKE	7471026	09/11	09/12
SPRAY GUN	BINKS	66S	BEFORE USE	BEFORE USE
ANEMOMETER	OMEGA	HH-600	05/11	05/12
AIR PRESSURE GAGE	BINKS	0-160	05/11	05/12
SCALE	METTLER	H315/ 445951	BEFORE USE	BEFORE USE
GRADUATED BEAKER	PHOTAX	N/A	N/A	N/A
EVENT RECORDER	COMPUTER	GEO1	BEFORE USE	BEFORE USE

SECTION 5
PHOTOGRAPHS



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE



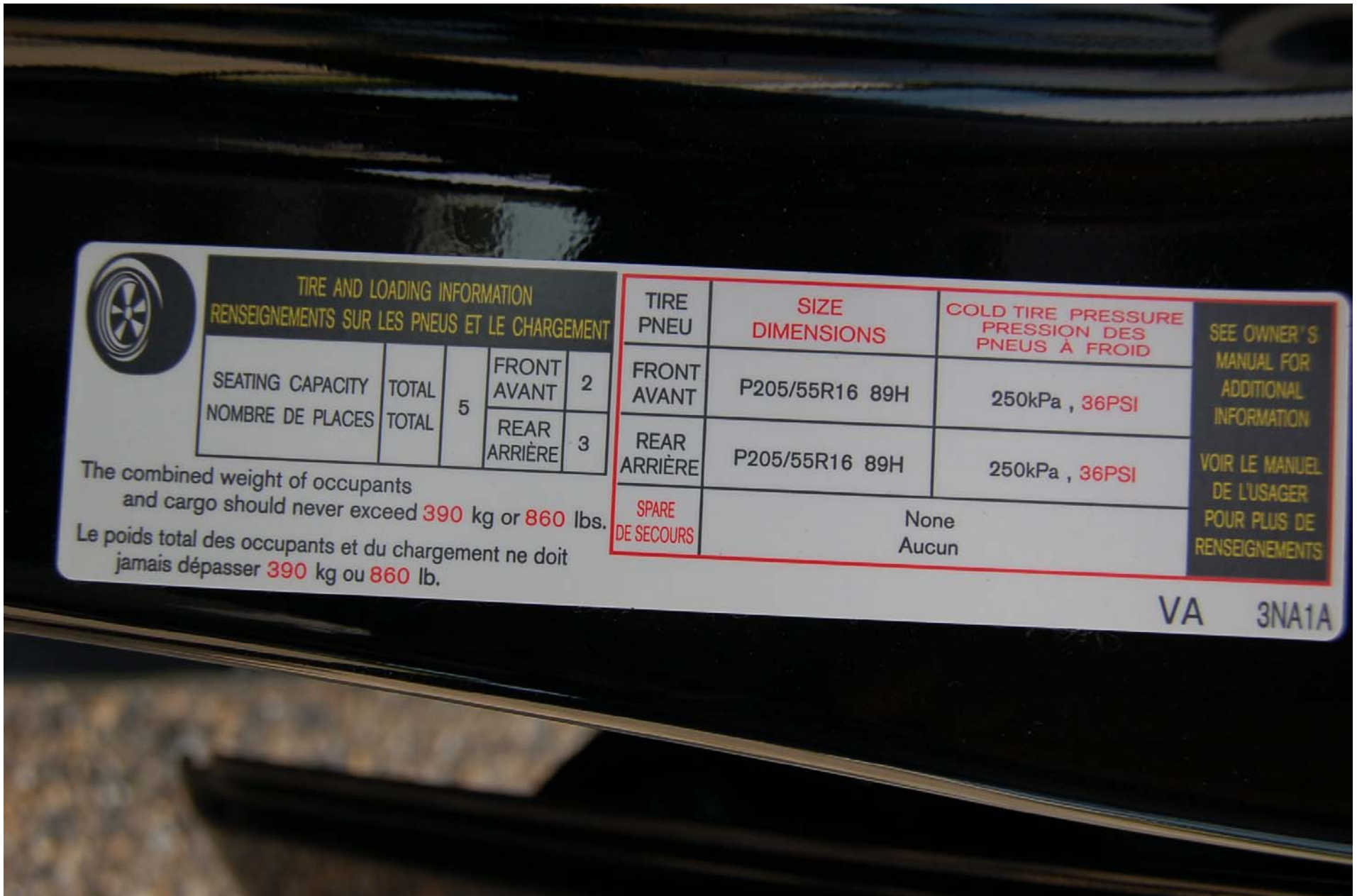
2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE



2011 NISSAN LEAF
 NHTSA NO. CB5200
 FMVSS NO. 103

FIGURE 5.5
 VEHICLE CERTIFICATION LABEL



TIRE AND LOADING INFORMATION
RENSEIGNEMENTS SUR LES PNEUS ET LE CHARGEMENT

SEATING CAPACITY NOMBRE DE PLACES	TOTAL TOTAL	5	FRONT AVANT	2
			REAR ARRIÈRE	3

The combined weight of occupants
 and cargo should never exceed **390 kg** or **860 lbs.**
 Le poids total des occupants et du chargement ne doit
 jamais dépasser **390 kg** ou **860 lb.**

TIRE PNEU	SIZE DIMENSIONS	COLD TIRE PRESSURE PRESSION DES PNEUS À FROID
FRONT AVANT	P205/55R16 89H	250kPa , 36PSI
REAR ARRIÈRE	P205/55R16 89H	250kPa , 36PSI
SPARE DE SECOURS	None Aucun	

SEE OWNER'S
 MANUAL FOR
 ADDITIONAL
 INFORMATION
 VOIR LE MANUEL
 DE L'USAGER
 POUR PLUS DE
 RENSEIGNEMENTS

VA 3NA1A

FIGURE 5.6
 VEHICLE TIRE INFORMATION LABEL



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

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



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.8
INSTRUMENTATION SET-UP



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

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



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.10
DEFROSTED AREA AT 5 MINUTES TEST #1



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.11
DEFROSTED AREA AT 10 MINUTES TEST #1



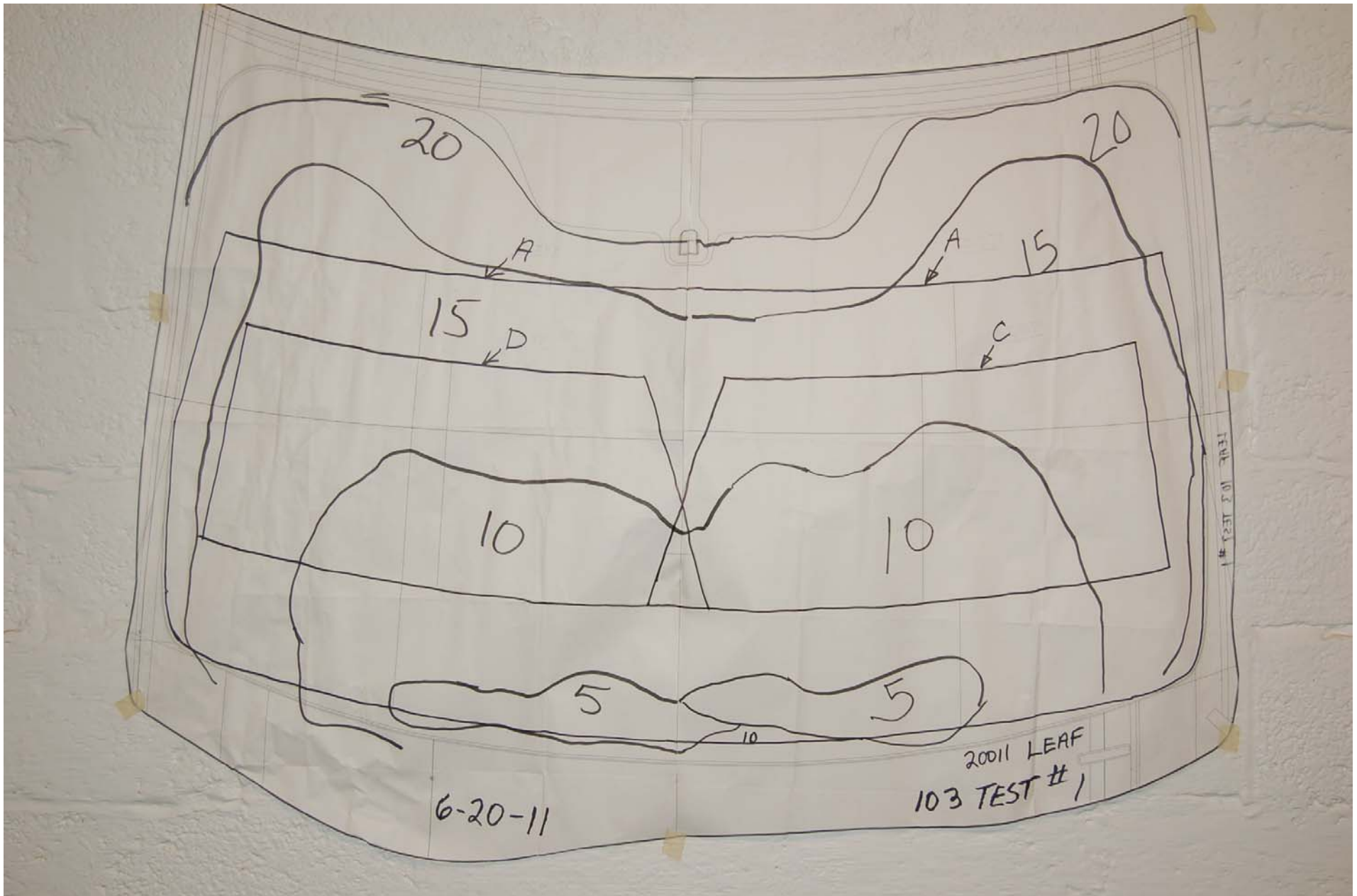
2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.12
DEFROSTED AREA AT 15 MINUTES TEST #1



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.13
DEFROSTED AREA AT 20 MINUTES TEST #1



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.14
WINDSHIELD VELLUM PATTERN, POST TEST #1



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.15
WINDSHIELD PRE-TEST FROSTED STATE #2



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.16
DEFROSTED AREA AT 5 MINUTES TEST #2



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.17
DEFROSTED AREA AT 10 MINUTES TEST #1



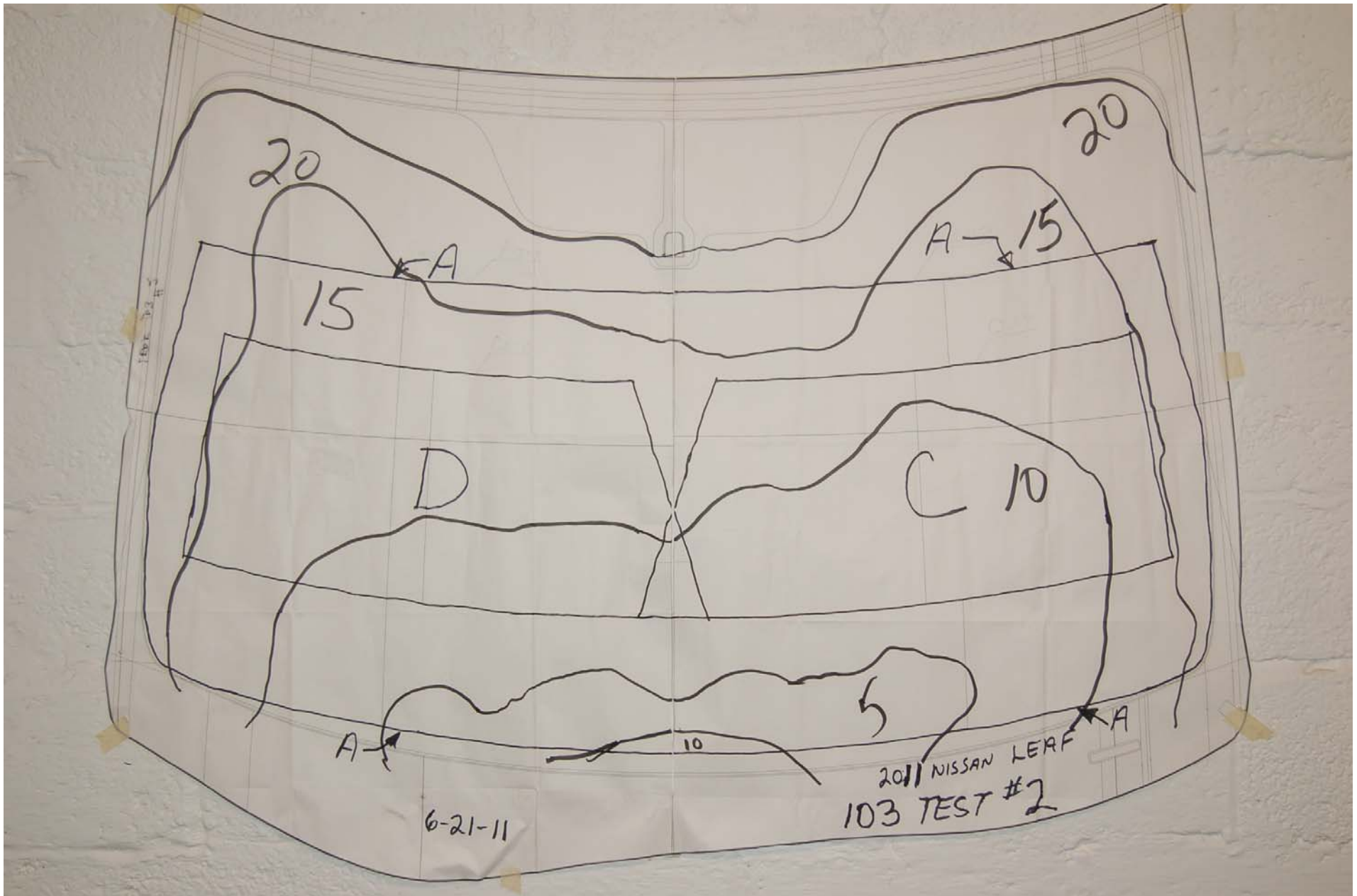
2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.18
DEFROSTED AREA AT 15 MINUTES TEST #2



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.19
DEFROSTED AREA AT 20 MINUTES TEST #2



2011 NISSAN LEAF
NHTSA NO. CB5200
FMVSS NO. 103

FIGURE 5.20
WINDSHIELD VELLUM PATTERN, POST TEST #2

SECTION 6

OWNER'S MANUAL DEFROSTER INSTRUCTIONS

CLIMATE CONTROL SYSTEM

WARNING

- The air conditioner cooling function operates only when the **READY** to drive indicator light is **ON**.
- Do not leave children or adults who would normally require the support of others alone in your vehicle. Pets should not be left alone either. On hot, sunny days, temperatures in a closed vehicle could quickly become high enough to cause severe or possibly fatal injuries to people or animals.
- Do not use the recirculation mode for long periods as it may cause the interior air to become stale and the windows to fog up.

The climate control system (air conditioner and heater functions) can be operated when the **READY** to drive light is illuminated. However, while charging, the climate control system can be used when the power switch is in the **ON** position.

The fan, heater and air conditioning can be turned on manually, using the timer function and

using the remote climate control function.

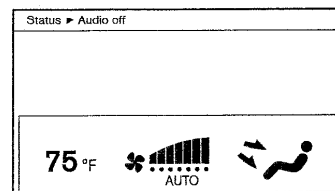
These functions operate in the following conditions.

Ventilators and climate control systems 4-3

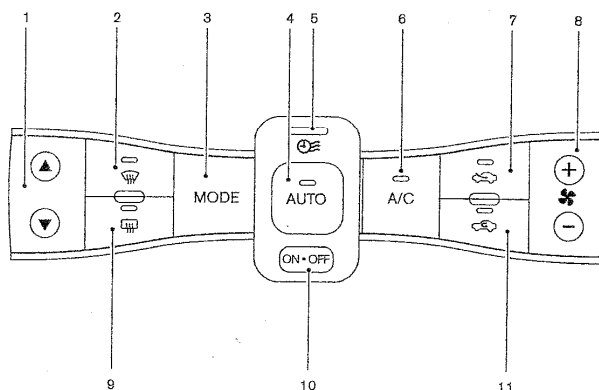
Power switch position	LOCK/OFF	ACC	ON	READY to drive
Fan	-	-	Available	Available
Heater and air conditioner	-	-	Available*1	Available
Timer (Climate Ctrl. Timer)	Available*2	-	-	-
Remote control	Available	-	-	-

*1: Can only be used during charging.

*2: The charger must be connected.



Push the **STATUS** button to display the climate control system status on the navigation system screen. (See the LEAF Navigation System Owner's Manual.)



1. Temperature control button
2. (front defroster) button
3. MODE (manual air flow control) button
4. AUTO climate control ON button
5. Climate Ctrl. Timer indicator
6. A/C (air conditioner) ON-OFF button
7. (fresh air intake) button
8. (fan speed control) button
9. (rear window defroster) button (See "Rear window and outside mirror defroster switch" in the "2. Instruments and controls" section.)
10. A/C-Heater ON-OFF button
11. (air recirculation) button

4. To set the automatic control mode, perform one of the following operations.
 - When the outside air circulation mode is on, push and hold the outside air circulation button for more than 1.5 seconds.
 - When the air recirculation mode is on, push and hold the air recirculation button for more than 1.5 seconds.

When setting the automatic control mode, both indicator lights will blink twice indicating that the system is in the automatic control mode.

A visible mist may be seen coming from the ventilators in hot, humid conditions as the air is cooled rapidly. This does not indicate a malfunction.

Heating (A/C off):

1. Push the AUTO button. The AUTO indicator will be displayed.
2. If the A/C indicator light illuminates, push the A/C button. The A/C indicator light will turn off.
3. Push the temperature control , button to set the desired temperature. The temperature range is between 64°F (18°C)

4-6 Ventilators and climate control systems

AUTOMATIC CLIMATE CONTROL

Automatic operation (AUTO)

The AUTO mode may be used year-round as the system automatically controls constant temperature, air flow distribution and fan speed.

To turn off the climate control, push the A/C-Heater ON-OFF button.

When the climate control is turned on again by pushing the A/C-Heater ON-OFF button after turning off the climate control using the A/C-Heater ON-OFF button, the climate control will activate as it did just before it is turned off.

When pushing any operating buttons while the climate control is activating in the AUTO mode, the climate control turns to the manual mode.

Cooling and/or dehumidified heating:

1. Push the AUTO button. The AUTO indicator will be displayed.
2. If the A/C indicator light does not illuminate, push the A/C button. The A/C indicator light will illuminate.
3. Push the temperature control , button to set the desired temperature. The temperature range is between 64°F (18°C) and 90°F (32°C).

Ventilators and climate control systems 4-5

and 90°F (32°C).

- Do not set the temperature lower than the outside air temperature. Doing so may prevent the temperature from being controlled properly.
- If the windows fog up, use dehumidified heating instead of the A/C off heating.

Dehumidified defrosting/defogging:

1. Push the front defroster button. (The indicator light will illuminate.)
2. Turn the temperature control , button to set the desired temperature.
 - To remove moisture or fog on the front window quickly, set the temperature to the high temperature and the fan speed to their maximum level.
 - After the windshield is cleared, push the front defroster button again. (The indicator light will turn off.)
 - When the front defroster button is pushed, the air conditioner will automatically turn on to defog the windshield. The outside air circulation mode will be selected to improve the defogging performance.

Manual operation

The manual mode can be used to control the heater and air conditioner to your desired settings.

To turn off the heater and air conditioner, push the A/C-Heater ON-OFF button.

Fan speed control:

Push "+" of the fan speed control button to increase the fan speed.

Push "-" of the fan speed control button to increase the fan speed.

Push the AUTO button to change the fan speed to the automatic mode.

Air flow control:

Push the MODE button to change the air flow mode.


- Air flows from the center and side ventilators.
- Air flows from the center and side ventilators and foot outlets.
- Air flows mainly from the foot outlets.
- Air flows from the defroster outlets and foot outlets.

Temperature control:


Push the temperature control ▲, ▼ button to set the desired temperature.

The temperature range is between 64°F (18°C) and 90°F (32°C).

Air recirculation:



Push the air recirculation  button to change the air circulation mode. When the indicator light illuminates, the flowing air is recirculated inside the vehicle.

Outside air circulation:

Push the outside air circulation  button to change the air circulation mode. When the indicator light illuminates, the flowing air is drawn from outside the vehicle.

Automatic air intake control:

To set the automatic control mode, perform one of the following operations.

- When the outside air circulation mode is on, push and hold the outside air circulation  button for more than 1.5 seconds.
- When the air recirculation mode is on, push and hold the air recirculation  button for more than 1.5 seconds.

When setting the automatic control mode, both indicator lights will blink twice indicating that the

system is in the automatic control mode.

CLIMATE CTRL. TIMER

The air conditioner starts to operate at the time of day and day of the week specified in the settings. This pre heats or pre cools the vehicle to a factory preset temperature in the passenger compartment before driving while the charger is connected to vehicle. This help reduce power consumption from the Li-ion battery.

As the temperature is set to the factory default setting, the user cannot adjust the temperature.

The Climate Ctrl. Timer operates the air conditioner using power from the charger. Electric power from the Li-ion battery is not used.

The Climate Ctrl. Timer function allows two different timer settings. Each timer charge function can be set to activate on a different day of the week.

Once the Climate Ctrl. Timer is set, it automatically starts when the set time is reached. It is therefore not necessary to set the Climate Ctrl. Timer everyday.

⚠ WARNING

Even if the Climate Ctrl. Timer is set, the temperature in the passenger compartment may become high or low if the system automatically stops. Do not leave children or adults who would normally require the support of others alone in your vehicle. Pets should not be left alone either. On hot, sunny days, temperatures in a closed vehicle could quickly become high enough to cause severe or possibly fatal injuries to people or animals. Also on cold days, temperature in a vehicle could become low enough to cause sever or possible fatal injuries to people or animals.