REPORT NUMBER 103-GTL-09-003

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

HYUNDAI MOTOR COMPANY
2009 HYUNDAI GENESIS, PASSENGER CAR
NHTSA NO. C90501

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

JUNE 30, 2009

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2009 HYUNDAI GENESIS 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 HYUNDAI GENESIS Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: KMHGC46E89U025598

B. NHTSA No.: C90501

C. Manufacturer: HYUNDAI MOTOR COMPANY

D. Manufacture Date: JUN/20/08

E. Color: Silver

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 103 testing on June 9-10, 2009.

SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2009 HYUNDAI GENESIS 4-door passenger car, NHTSA No. C90501 was subjected to FMVSS No. 103 tests on June 9-10, 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 HYUNDAI GENESIS.

SUMMARY DATA SHEET
FMVSS 103, WINDSHIELD DEFROSTING AND DEFOGGING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2009 HYUNDAI GENESIS PASSENGER CAR
VEH. NHTSA NO: C90501; VIN: KMHGC46E89U025598
VEH. BUILD DATE: JUN/20/08 TEST DATE: JUNE 9-10, 2009
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

WINDSHIELD AREA: 1818 in^2 AREA C = 237 in^2 AREA D = 237 in^2 AREA A= 1045 in^2

MANUFACTURER'S WINDSHIELD PATTERN USED: Yes X No

ENGINE THERMOSTAT NOMINAL REGULATING TEMPERATURE: 180 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: 06/10/09

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 1

VEH. MOD YR/MAKE/MODEL/BODY: 2009 HYUNDAI GENESIS PASSENGER CAR
VEH. NHTSA NO: C90501; VIN: KMHGC46E89U025598
VEH. BUILD DATE: JUN/20/08; TEST DATE: JUNE 9, 2009
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

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

Cold Soak Period: 24 HOURS

Time engine coolant and lubricant remained stabilized at 0º F: 11 hrs. ___ minutes

Water Spray Gun and Nozzle Type: BINKS #66 S

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

Water used: 18.2 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: 2000* rpm (Target engine speed 1500 to 1600 rpm)
*2000 for first five minutes then 1500.

Wind at specified location in front of windshield: .1 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	-2.1	0.1	0.0*	.4	.2	0%	0%	0%
5	14.5	-1.0	46.5	56.5*	69.9	74.3	10.9%	0%	3.0%
10	14.5	1.3	92.5	90.4*	100.3	95.2	75.9%	89.5%	95.8%
15	14.5	3.8	116.1	110.9*	112.0	117.4	100%	100%	100%

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

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

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 2

VEH. MOD YR/MAKE/MODEL/BODY: 2009 HYUNDAI GENESIS PASSENGER CAR
VEH. NHTSA NO: C90501; VIN: KMHGC46E89U025598
VEH. BUILD DATE: JUN/20/08; TEST DATE: JUNE 10, 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: 9 hrs. 30 minutes

Water Spray Gun and Nozzle Type: BINKS #66S

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

Water used: 18.2 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: 2000* rpm (Target engine speed 1500 to 1600 rpm)
*2000 for first five minutes then 1500.

Wind at specified location in front of windshield: .2 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	13.4	-4.0	-2.5	-2.6*	-2.2	-2.4	0%	0%	0%
5	14.5	-2.4	23.0	33.3*	50.6	55.8	4.8%	0%	0%
10	14.5	-0.2	80.5	84.7*	89.0	94.3	56.0%	60.3%	75.4%
15	14.5	2.4	110.3	104.9*	105.6	111.0	100%	100%	100%

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

RECORDED BY: G. FARRAND DATE: 06/10/09

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	JUN/20/08	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 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

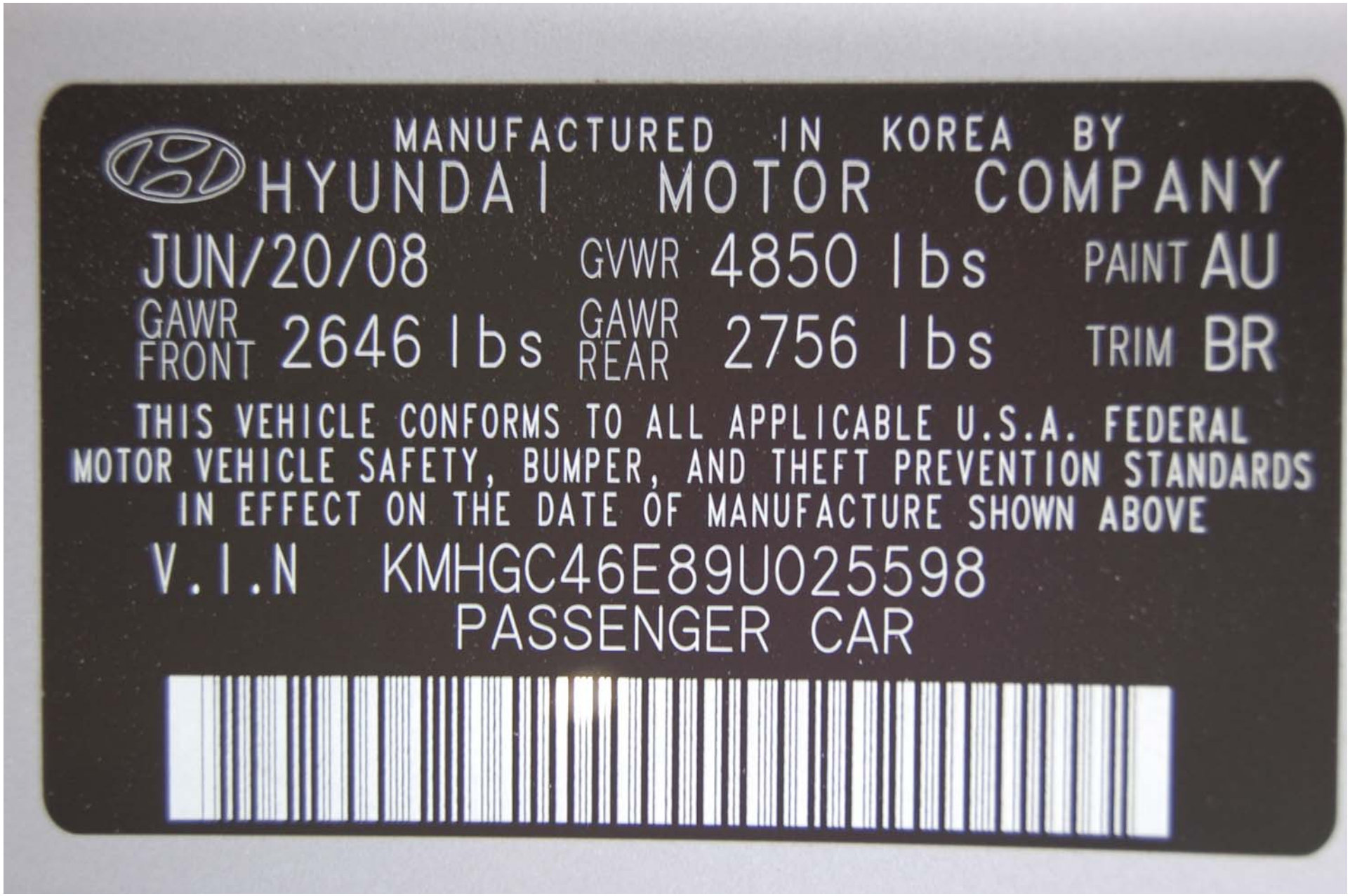
FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

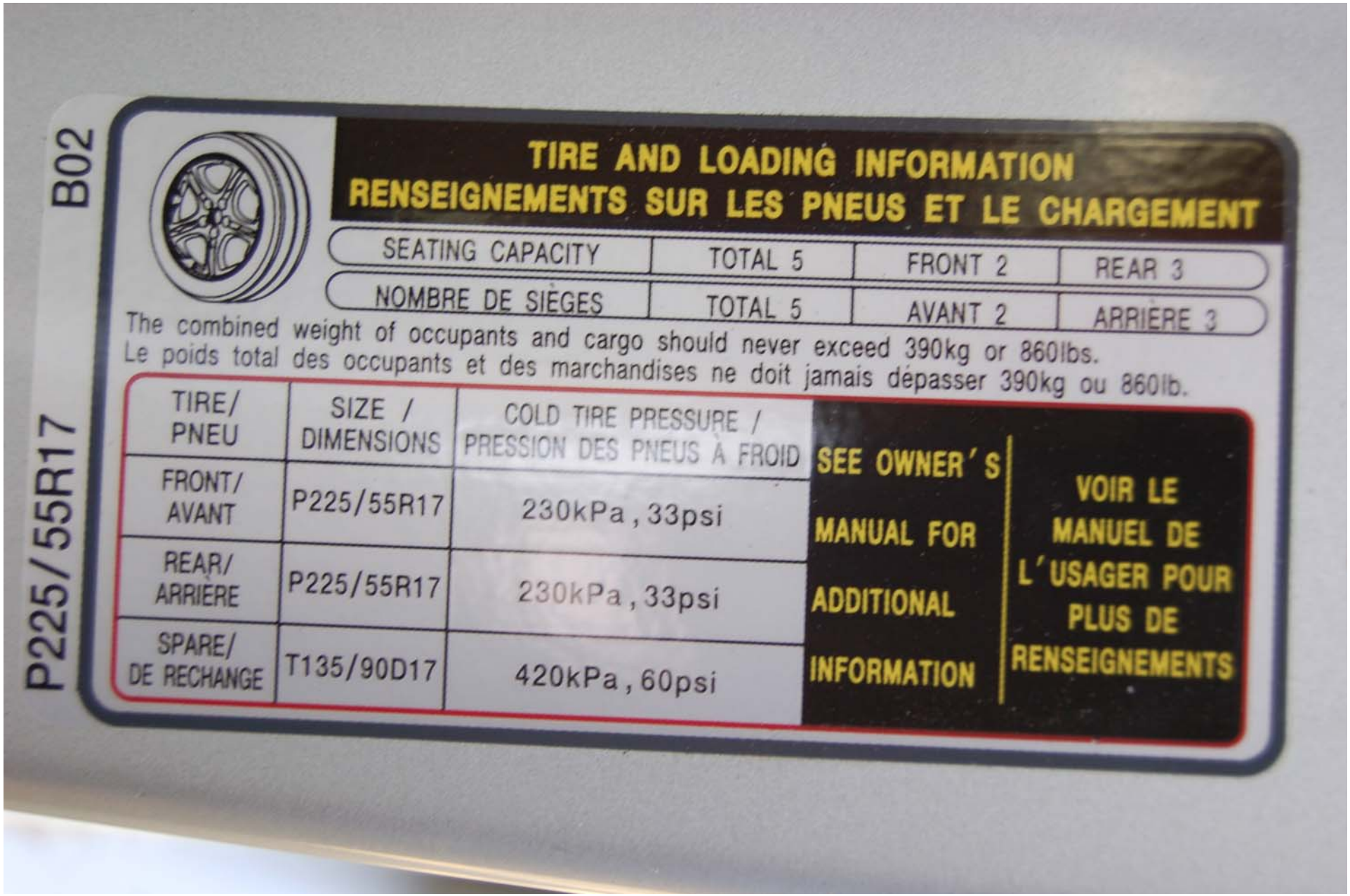
2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE



2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.5
VEHICLE CERTIFICATION LABEL



2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.6
VEHICLE TIRE INFORMATION LABEL

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

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

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

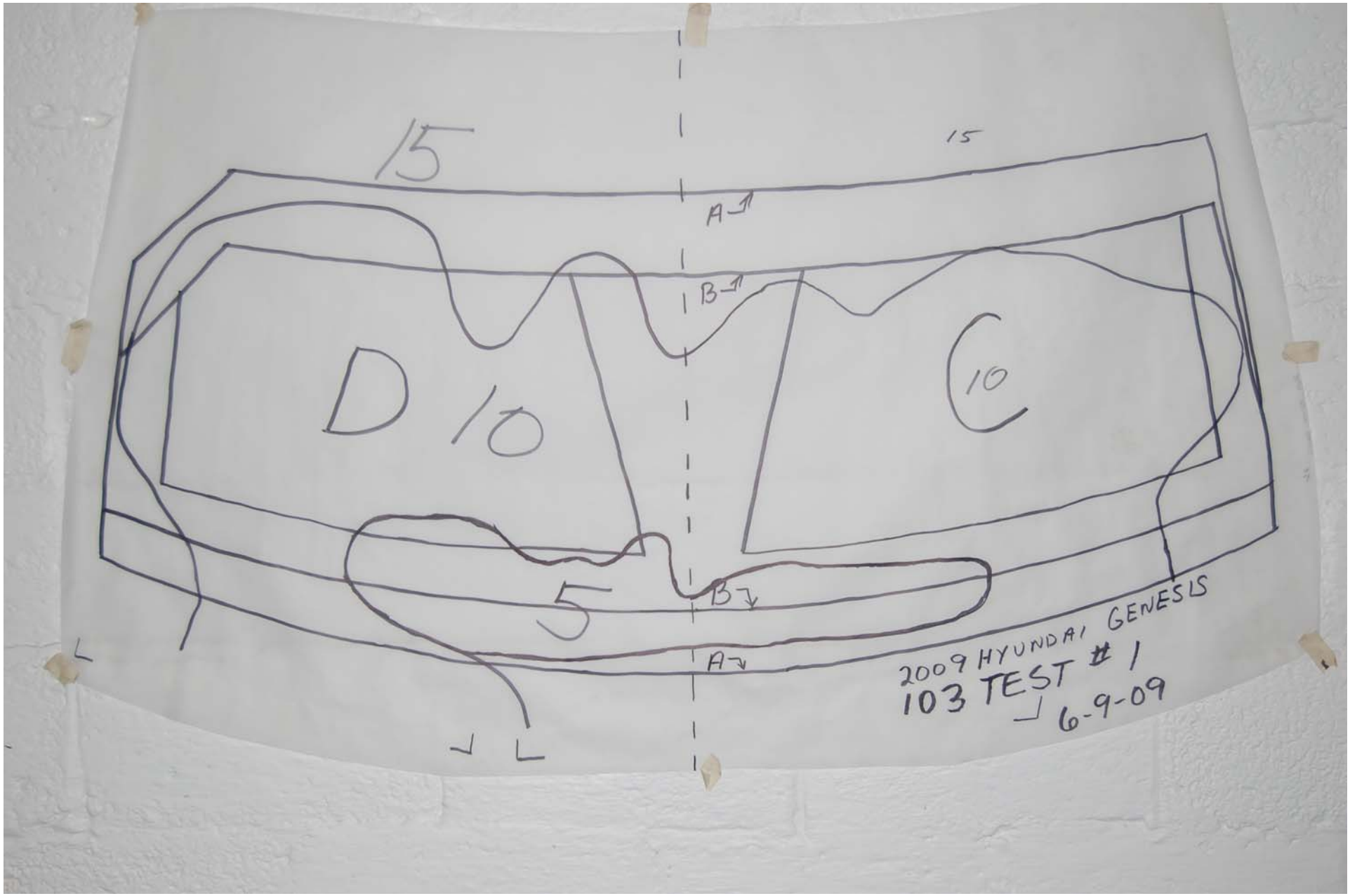
FIGURE 5.8
INSTRUMENTATION SET-UP

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

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

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.10
DEFROSTED AREA AT 15 MINUTES TEST #1



2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

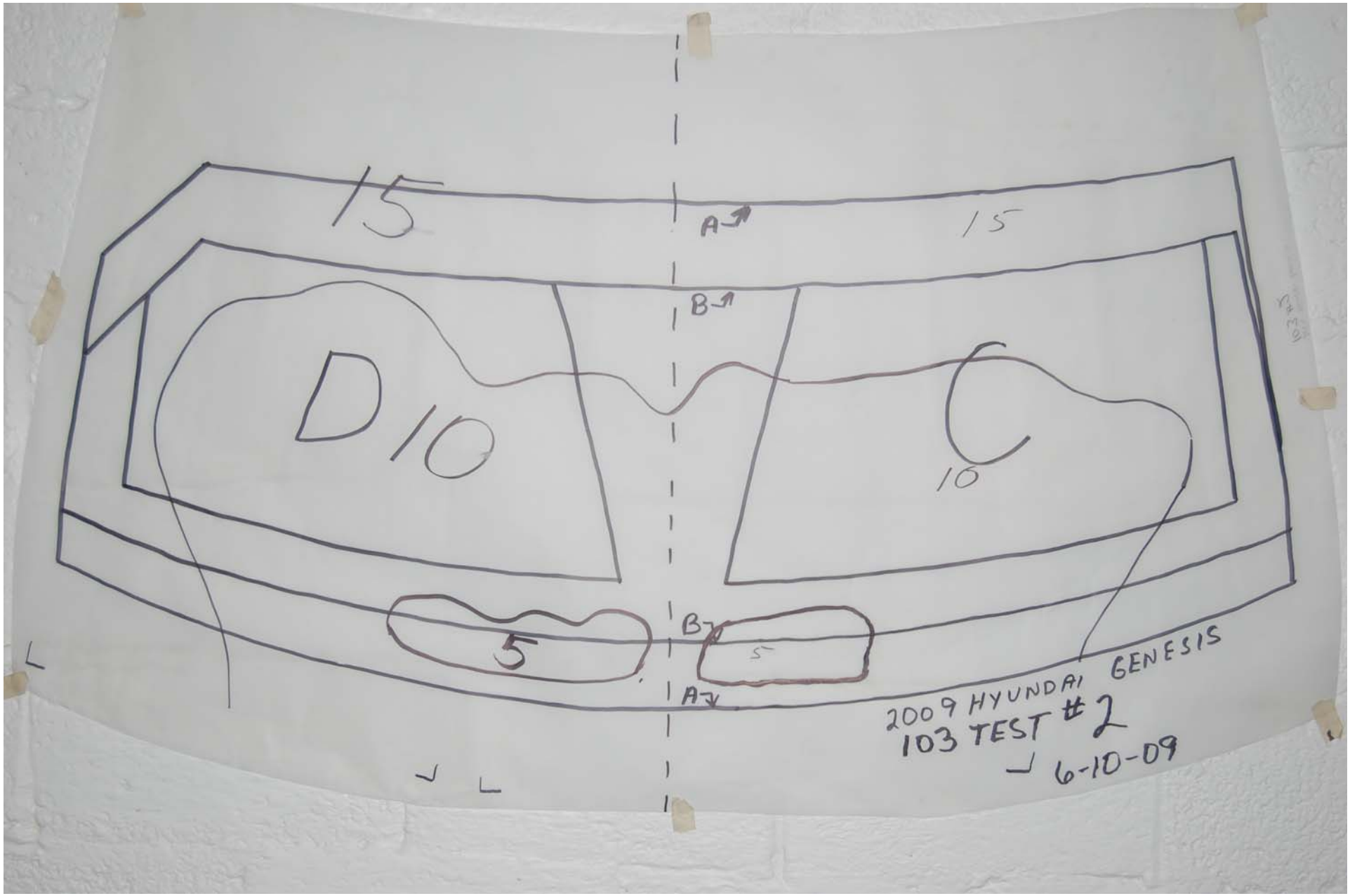
FIGURE 5.11
WINDSHIELD VELLUM PATTERN, POST TEST #1

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.12
WINDSHIELD PRE-TEST FROSTED STATE #2

2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.13
DEFROSTED AREA AT 15 MINUTES TEST #2



2009 HYUNDAI GENESIS
NHTSA NO. C90501
FMVSS NO. 103

FIGURE 5.14
WINDSHIELD VELLUM PATTERN, POST TEST #2

SECTION 6

OWNER'S MANUAL DEFROSTER INSTRUCTIONS

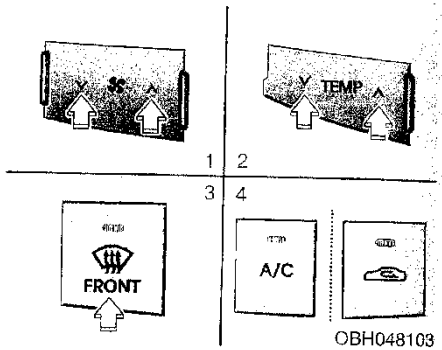
WINDSHIELD DEFROSTING AND DEFOGGING

D250000AEN

⚠ WARNING - Windshield heating

Do not use the or position during cooling operation in extremely humid weather. The difference between the temperature of the outside air and that of the windshield could cause the outer surface of the windshield to fog up, causing loss of visibility. In this case, set the mode selection knob or button to the position and fan speed control knob or button to the lower speed.

- For maximum defrosting, set the temperature control to the extreme right/hot position and the fan speed control to the highest speed.
- If warm air to the floor is desired while defrosting or defogging, set the mode to the floor-defrost position.
- Before driving, clear all snow and ice from the windshield, rear window, outside rear view mirrors, and all side windows.
- Clear all snow and ice from the hood and air inlet in the cowl grill to improve heater and defroster efficiency and to reduce the probability of fogging up the inside of the windshield.



OBH048103

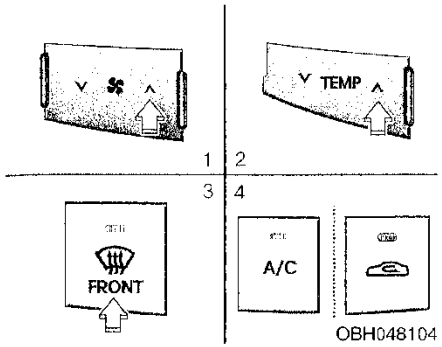
D250201AEN-EU

To defog inside windshield

1. Select desired fan speed.
2. Select desired temperature.
3. Press the defrost button ( ).
4. The outside (fresh) air position will be selected automatically.

If the outside (fresh) air position is not selected automatically, adjust the corresponding button manually.

If the position is selected, lower fan speed is adjusted to a higher fan speed.



OBH048104

D250202AEN-EU

To defrost outside windshield

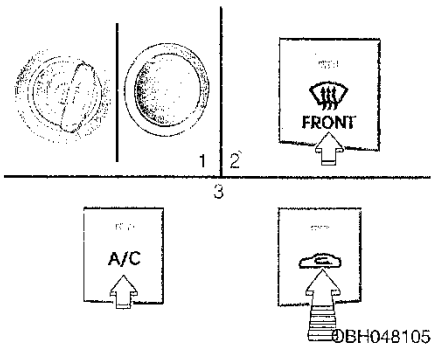
1. Set the fan speed to the highest (extreme right) position.
2. Set the temperature to the extreme hot (HI) position.
3. Press the defrost button ( ).
4. The outside (fresh) air position will be selected automatically.

If the position is selected, lower fan speed is adjusted to a higher fan speed.

D250300AUN-EU

Defogging logic

To reduce the probability of fogging up the inside of the windshield, the air intake is controlled automatically according to certain conditions such as or position. To cancel or return the defogging logic, do the following.



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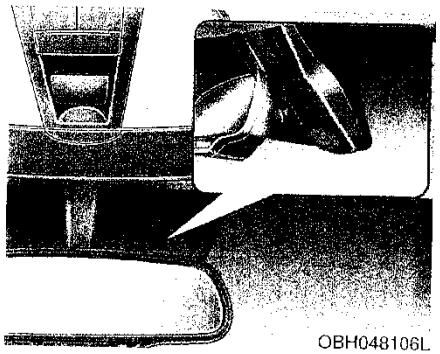
1. Turn the ignition switch to the ON position.
2. Select the defrost position pressing defrost button ( ).
3. While holding the air conditioning button (A/C) pressed, press the air intake control button at least 5 times within 3 seconds.

The A/C display blinks 3 times with 0.5 second of interval. It indicates that the defogging logic is canceled or returned to the programmed status.

If the battery has been discharged or disconnected, it resets to the defog logic status.



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D250305ABH

Auto defogging system (if equipped)

Auto defogging reduces the probability of fogging up the inside of the windshield by automatically sensing the moisture of inside the windshield.

This indicator illuminates when the auto defogging system senses the moisture of inside the windshield and operates.

If more moisture is in the vehicle, the higher steps operate as follows. For example if auto defogging does not defog inside the windshield at step 1 Outside air position, it tries to defog again at step 2 Blowing air toward the windshield.

Step 1 : Outside air position
Step 2 : Blowing air toward the windshield
Step 3 : Increasing air flow toward the windshield
Step 4 : Operating the air conditioning
Step 5 : Maximizing the air conditioning

✻ NOTICE

- **If the A/C off or recirculated air position is manually selected while the auto defogging system is on, the auto defogging indicator will blink 3 times to give notice that manual operation is canceled.**
- **If the air quality system (AQS) is selected while the auto defogging system is operating at the step 1 outside air position, the recirculated air position may operate when the outside air is polluted.**

⚠ CAUTION

Do not remove the sensor cover located on the upper end of the passenger side windshield glass. Damage to system parts could occur and may not be covered by your vehicle warranty.