REPORT NUMBER 103-GTL-07-001

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

HYUNDAI MOTOR COMPANY
2007 HYUNDAI ELANTRA, PASSENGER CAR
NHTSA NO. C70502

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

MARCH 3, 2008

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
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16. Abstract Compliance tests were conducted on the subject, 2007 Hyundai Elantra 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		
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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2007 Hyundai Elantra 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 2007 Hyundai Elantra Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: KMHDU46D97U035111

B. NHTSA No.: C70502

C. Manufacturer: HYUNDAI MOTOR COMPANY

D. Manufacture Date: SEP/13/06

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 103 testing on October 15-16, 2007.

SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2007 Hyundai Elantra 4-door passenger car, NHTSA No. C70502 was subjected to FMVSS No. 103 tests on October 15-16, 2007. 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 5.15 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 2007 Hyundai Elantra.

SUMMARY DATA SHEET
FMVSS 103, WINDSHIELD DEFROSTING AND DEFOGGING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2007 HYUNDAI ELANTRA PASSENGER CAR
VEH. NHTSA NO: C70502; VIN: KMHDU46D97U035111
VEH. BUILD DATE: SEP/13/06 TEST DATE: OCTOBER 15-16, 2007
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

WINDSHIELD AREA: 1878 in^2 AREA C = 250.0 in^2 AREA D = 250.0 in^2 AREA A= 1058 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: 10/16/07

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 1

VEH. MOD YR/MAKE/MODEL/BODY: 2007 HYUNDAI ELANTRA PASSENGER CAR
VEH. NHTSA NO: C70502; VIN: KMHDU46D97U035111
VEH. BUILD DATE: SEP/13/06; TEST DATE: OCTOBER 15-16, 2007
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: 12 HOURS

Time engine coolant and lubricant remained stabilized at 0º F: 10 hrs. 0 minutes

Water Spray Gun and Nozzle Type: BINKS #66 S

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

Water used: 18.8 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 (first 5 minutes, then 1500-1600) (Target engine speed 1500 to 1600 rpm)

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	13.5	-1.6	.3	-1.0*	1.3	1.7	0%	0%	0%
5	14.6	0	23.4	49.0*	57.6	56.9	0%	0%	0%
10	14.6	.2	71.5	89.5*	84.7	82.6	43.7%	42.0%	38.0%
15	14.6	1.7	94.8	103.4*	96.7	94.2	94.7%	100%	100%
20	14.5	2.0	104.9	109.0*	101.0	98.8	100%	100%	100%

REMARKS: * Heater Water In thermocouple is located on outside of heater hose due to location of hose fittings.

RECORDED BY: G. FARRAND DATE: 10/15/07

APPROVED BY: D. MESSICK

FMVSS 103 TEST DATA RECORD – TEST RUN NO. 2

VEH. MOD YR/MAKE/MODEL/BODY: 2007 HYUNDAI ELANTRA PASSENGER CAR
VEH. NHTSA NO: C70502; VIN: KMHDU46D97U035111
VEH. BUILD DATE: SEP/13/06; TEST DATE: OCTOBER 15-16, 2007
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: 20.0 HOURS

Time engine coolant and lubricant remained stabilized at 0º F: 14 hrs. ____ minutes

Water Spray Gun and Nozzle Type: BINKS #66S

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

Water used: 18.8 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 (first 5 minutes, then 1500-1600) (Target engine speed 1500 to 1600 rpm)

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	13.5	.4	-.1	-.1*	.6	.8	0%	0%	0%
5	14.6	.1	30.1	56.9*	64.3	63.4	0%	0%	0%
10	14.6	-1.0	69.8	85.8*	81.9	80.0	34.1%	30.3%	19.2%
15	14.5	.2	92.0	98.1*	92.3	90.1	74.1%	93.0%	78.3%
20	14.4	0	104.8	105.4*	99.4	96.9	99.4%	100%	100%
25	14.4	1.1	114.9	111.8*	106.0	103.2	100%	100%	100%

REMARKS: * Heater Water In thermocouple is located on outside of heater hose due to location of hose fittings.

RECORDED BY: G. FARRAND DATE: 10/16/07

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	10/07	10/08
TAC/RECORDER	MONARCH	1444664	08/07	08/08
TEMPERATURE RECORDER	OMEGA	B/55662	06/07	06/08
SPRAY GUN	BINKS	66S	BEFORE USE	BEFORE USE
ANEMOMETER	OMEGA	53668	06/07	06/08
AIR PRESSURE GAGE	BINKS	0-160	10/07	10/08
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

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE OF VEHICLE

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.5
VEHICLE CERTIFICATION LABEL

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.6
VEHICLE TIRE INFORMATION LABEL

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

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

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

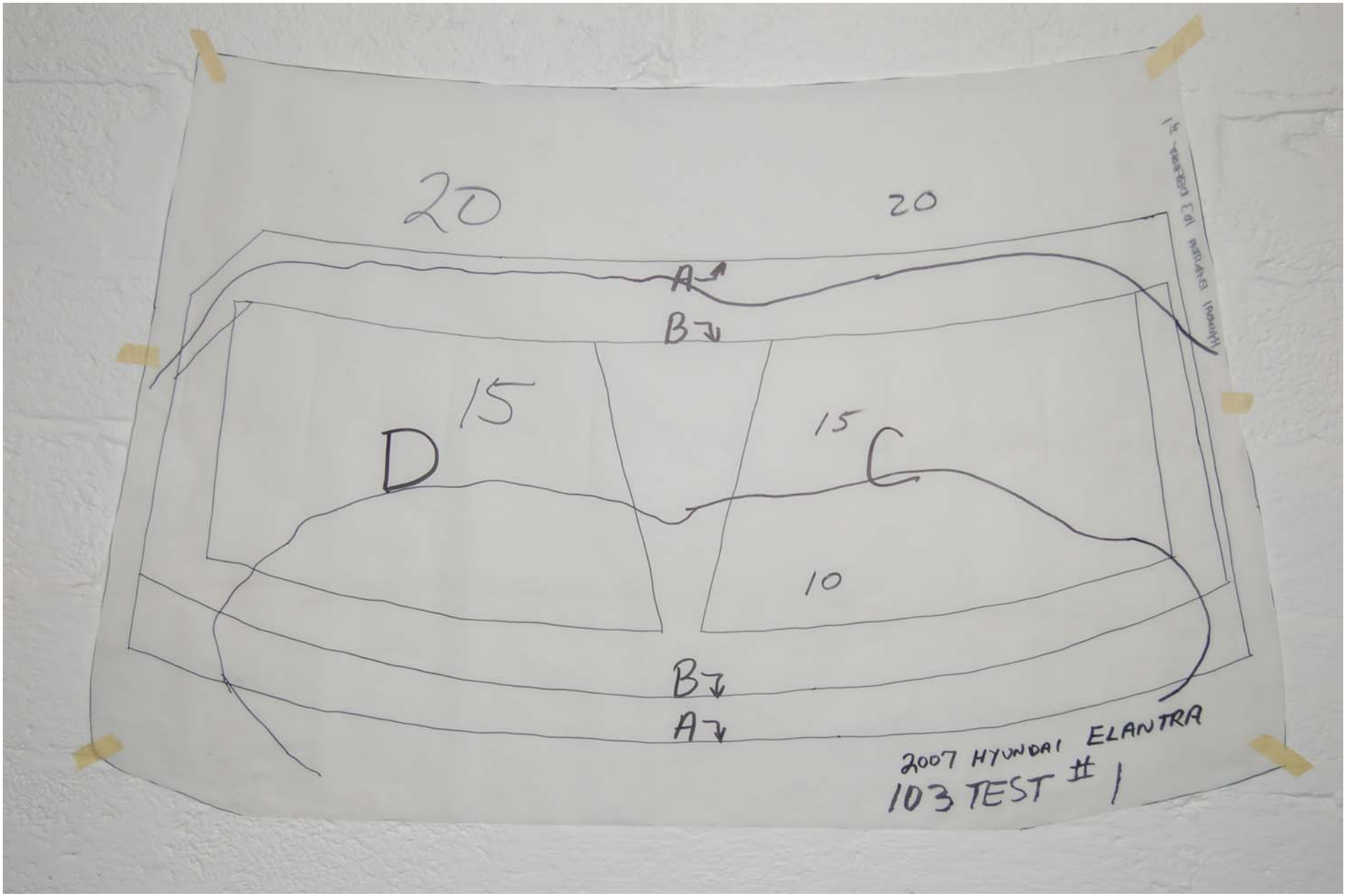
FIGURE 5.8
INSTRUMENTATION SET-UP

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

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

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.10
DEFROSTED AREA AT 20 MINUTES TEST #1



2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.11
WINDSHIELD VELLUM PATTERN POST TEST #1

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

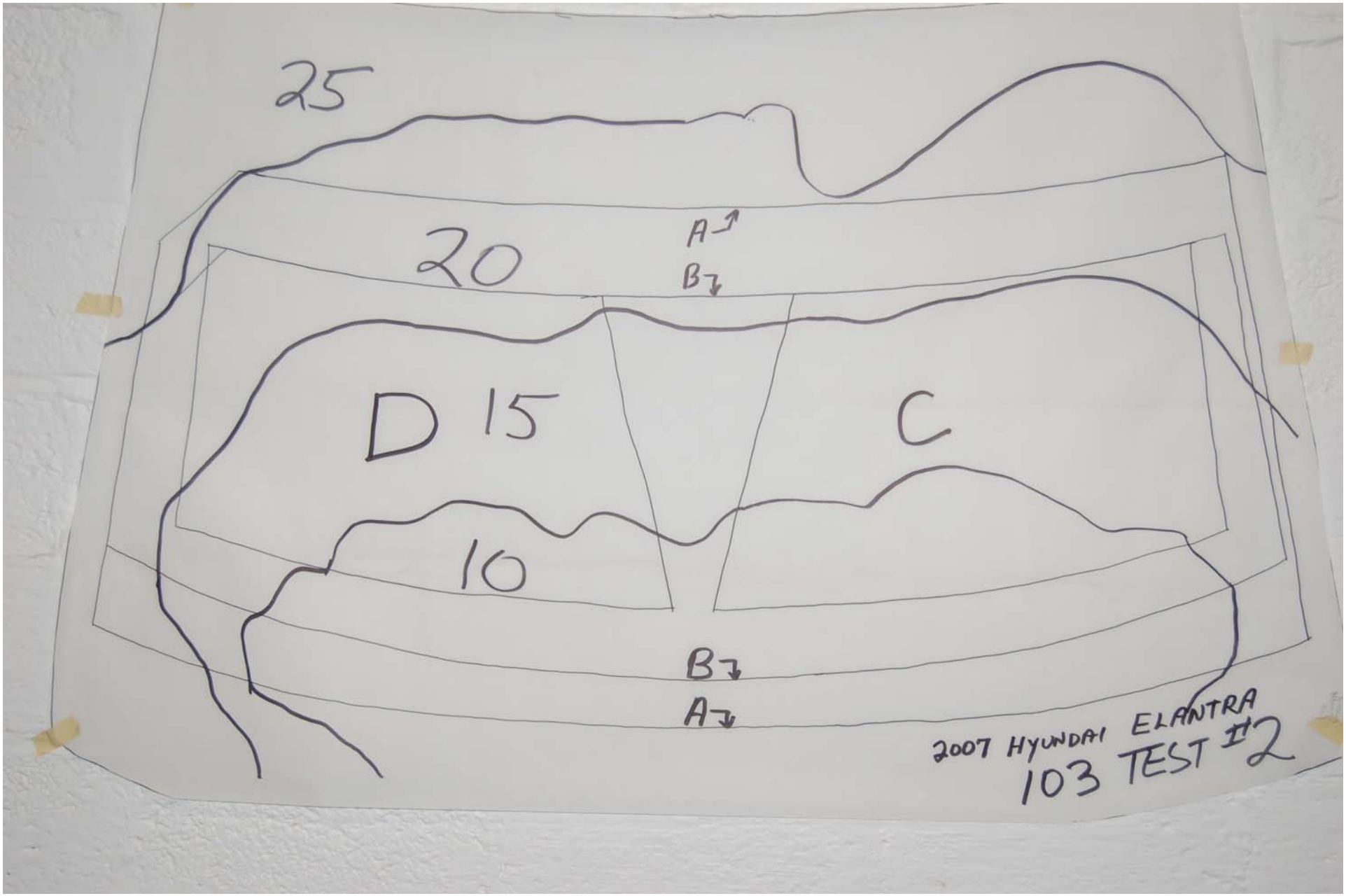
FIGURE 5.12
WINDSHIELD PRE-TEST FROSTED STATE TEST #2

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.13
DEFROSTED AREA AT 20 MINUTES TEST #2

2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.14
DEFROSTED AREA AT 25 MINUTES TEST #2



2007 HYUNDAI ELANTRA
NHTSA NO. C70502
FMVSS NO. 103

FIGURE 5.15
WINDSHIELD VELLUM PATTERN, POST TEST #2

SECTION 6

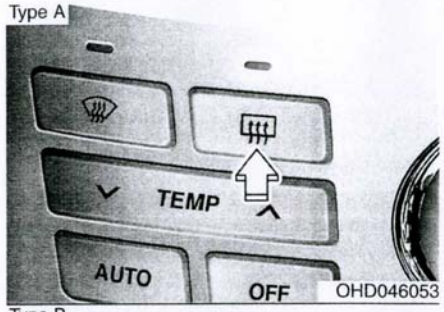
OWNER'S MANUAL DEFROSTER INSTRUCTIONS

DEFROSTER

⚠ CAUTION

- ***To prevent damage to the conductors bonded to the inside surface of the rear window, never use sharp instruments or window cleaners containing abrasives to clean the window.***
- ***If you want to defrost and defog on the front windshield, refer to "Windshield Defrosting and Defogging" in this section.***

Type A



OHD046053

Type B

OHD046054N

Rear window defroster

The defroster heats the window to remove frost, fog and thin ice from the interior and exterior of the rear window, while engine is running.

To activate the rear window defroster, press the rear window defroster button located in the center facia switch panel. The indicator on the rear window defroster button illuminates when the defroster is ON.

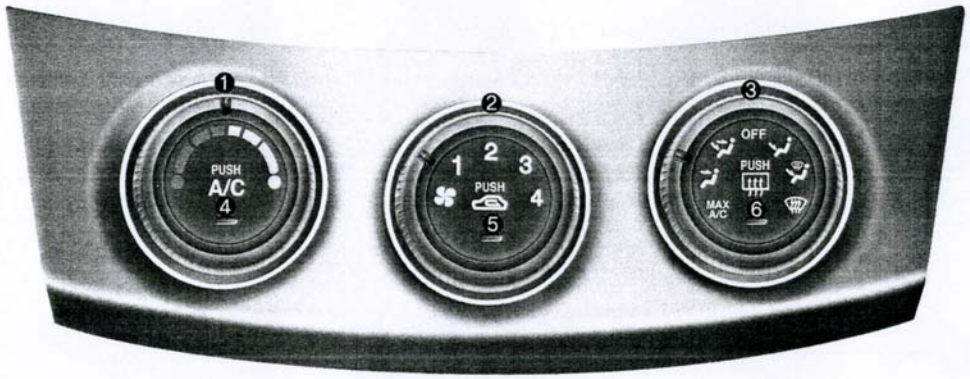
If there is heavy accumulation of snow on the rear window, brush it off before operating the rear defroster.

The rear window defroster automatically turns off after 20 minutes or when the ignition switch is turned off. To turn off the defroster, press the rear window defroster button again.

Outside mirror defroster (if equipped)

If your vehicle is equipped with the outside mirror defroster, it will be operating at the same time when you operate the rear window defroster.

MANUAL CLIMATE CONTROL SYSTEM (IF EQUIPPED)



1. Temperature control knob
2. Fan speed control knob
3. Mode selection knob
4. Air conditioning button (if equipped)
5. Air intake control button
6. Rear window defroster button

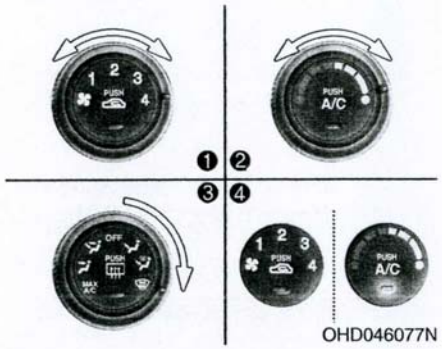
OHD046056N

WINDSHIELD DEFROSTING AND DEFOGGING

⚠ CAUTION - 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 inside of the windshield.



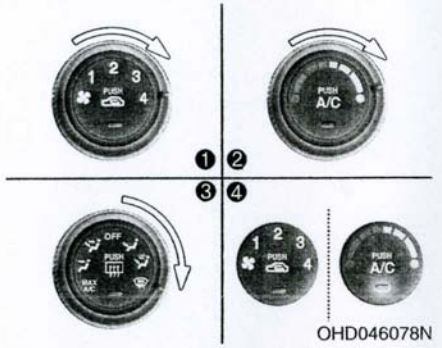
OHD046077N

Manual climate control system

To defog inside windshield

1. Select any fan speed except 0 position.
2. Select desired temperature.
3. Select the or position.
4. The outside (fresh) air and air conditioning will be selected automatically.

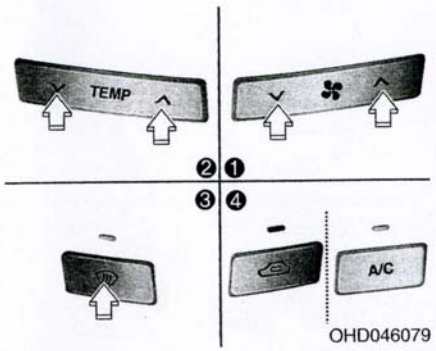
If the air-conditioning and outside (fresh) air position are not selected automatically, press the corresponding button manually.



OHD046078N

To defrost outside windshield

1. Set the fan speed to the highest (extreme right) position.
2. Set the temperature to the extreme hot position.
3. Select the position.
4. The outside (fresh) air and air conditioning will be selected automatically.



OHD046079

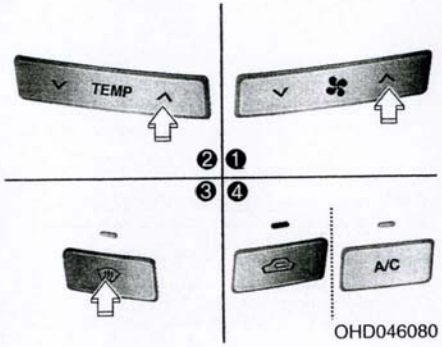
Automatic climate control system

To defog inside windshield

1. Select desired fan speed.
2. Select desired temperature.
3. Press the defrost button ( ).
4. The air-conditioning will be turned on according to the detected ambient temperature, outside (fresh) air position and higher fan speed will be selected automatically.

If the air-conditioning, outside (fresh) air position and higher fan speed are not selected automatically, adjust the corresponding button or knob manually.

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



OHD046080

To defrost outside windshield

1. Set fan speed to the highest (extreme right) position.
2. Set temperature to the extreme hot (HI) position.
3. Press the defrost button ( ).
4. The air-conditioning will be turned on according to the detected ambient temperature and outside (fresh) air position will be selected automatically.

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

Defogging logic

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