REPORT NUMBER 118-GTL-08-002

SAFETY COMPLIANCE TESTING FOR FMVSS NO. 118 POWER-OPERATED WINDOW, PARTITION AND ROOF PANEL SYSTEMS

HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC
2008 HYUNDAI SONATA, PASSENGER CAR
NHTSA NO. C80507

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

JULY 01, 2008

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
1200 NEW JERSEY AVE., SE
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Technical Report Documentation Page

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7. Author(s) Grant Farrand, Project Engineer Debbie Messick, Project Manager		8. Performing Organ. Rep# GTL-DOT-08-118-002
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15. Supplementary Notes

16. Abstract

Compliance tests were conducted on the subject 2008 Hyundai Sonata 4-door passenger car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-118-06 for the determination of FMVSS 118 compliance.

Test failures identified were as follows:
None

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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF TEST

A model year 2008 Hyundai Sonata passenger car was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 118 testing to determine if the vehicle was in compliance with the requirements of the standard. FMVSS 118 specifies requirements for power-operated window, partition, and roof panel systems to minimize the likelihood of death or injury from their accidental operation.

1.1 The test vehicle was a 2008 Hyundai Sonata Passenger Car. The vehicle was identified as follows:

A. Vehicle Identification Number: 5NPET46C28H355451

B. NHTSA No.: C80507

C. Manufacturer: HYUNDAI MOTOR MANUFACTURING ALABAMA, LLC.

D. Manufacture Date: Jul/27/07

E. Color: Bright Silver

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 118 testing on June 4, 2008.

SECTION 2

TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 TEST PROCEDURE

All tests were conducted in accordance with NHTSA, Office of Vehicle Safety Compliance (OVSC) Laboratory Procedure TP-118-06 dated 12 April 2006 and General Testing Laboratories, Inc. (GTL) Test Procedure, TP-118-03A, “Power Operated Window, Partition and Roof Panel Systems”.

FMVSS 118 Compliance Testing was performed in the following sequence:

A. Test Vehicle Identification/Documentation
B. Power Window, partition and roof panel identification/documentation
C. Interior, exterior and remote control switch identification/documentation
D. Pre-test operation of all power windows, partitions and roof panels
E. Photograph vehicle and interior, exterior and remote control devices
F. Perform Interior Locking System Off Test
G. Perform Interior Locking System with Key Removed Test
H. Perform Exterior Locking System Test
I. Perform Remote Actuation Device Test
J. Perform Occupant Compartment Actuation Device Test(Sphere Test/Pull up or Pull Out Test)
K. Perform Automatic Reversal System Test

Above tests H and I were not required on this vehicle due to no exterior or remote actuation devices. Tests J and K were performed for information purposes only.

2.1 SUMMARY OF RESULTS

The power window operational test resulted in no anomalies being noted. Test data indicate the FMVSS 118 requirements appear to have been satisfied. All test data resulting from the tests were recorded on test data sheets in Section 3.

SECTION 3

TEST DATA

3.0 TEST RESULTS

The following data sheets document the results of FMVSS 118 testing on the 2008 Hyundai Sonata.

FMVSS 118
COMPLIANCE DATA SUMMARY SHEET

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA

VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451

VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07

LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

REQUIREMENT	PASS	FAIL	N/A
S4 Interior Locking system in Off Position(s)	X		
S4 Interior Locking System with Key Removed	X		
S4 Exterior Locking System			X
S4 Remote Actuation Device			X
S6 Occupant Compartment Actuation Devices (Sphere Test/Pull Up or Pull Out Test)	X		
S5 Automatic Reversal System			X

REMARKS:

RECORDED BY: G. Farrand **DATE: 06/04/08**

APPROVED BY: D. Messick

WPRP PRE-OPERATIONAL CHECK

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA

VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451

VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07

LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

Identify power-operated WPRP and WPRP actuation devices

	LEFT FRONT	LEFT REAR	RIGHT FRONT	RIGHT REAR	TAIL GATE	LEFT VENT	RIGHT VENT	ROOF PANEL
Power WPRP Installed	X	X	X	X				
Individual Interior Actuation Devices	X	X	X	X				
Master Control Panel Actuation Devices	X							
WPRP Operated by Exterior Locking System								
WPRP Operated by Remote Control								
WPRP with Auto-Reverse Capability	X							
WPRP with Express-Up Capability	X							

Master Control Panel Location: DRIVER'S DOOR PANEL

Exterior Locking System Location: _____

Remote Control Type: ( ) Line of Sight ( ) Non-line of Sight

WPRP Actuation Device Design (Toggle, Rocker, Push/Pull (Lever) or describe other):

Master Control Panel Push/Pull
Individual Window Push/Pull
Roof Panel _____
Vents _____

Interior Locking System Key Positions (clockwise): LOCK, ACCESSORY, IGNITION "ON" START

All WPRP open/close cycles are satisfactory with key in "ON" position:
(X) YES ( ) NO

All WPRP open/close cycles are satisfactory with key in "ACCESSORY" position:
( ) YES (X) Not Applicable –No power to WPRP's

REMARKS:

RECORDED BY: G. Farrand DATE: 06/04/08
APPROVED BY: D. Messick

DATA SHEET 1
INTERIOR LOCKING SYSTEM TEST

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA

VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451

VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07

LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

Key lock position at start of test execution: (X) ON ( ) ACCESSORY, Then to:
Key lock off position during test execution: (X) LOCK ( ) OFF ( ) ACCESSORY

ACTUATION DEVICES	DOORS CLOSED		LEFT DOOR OPEN		RIGHT DOOR OPEN		PASS/ FAIL
	INOP.	OPER.	INOP.	OPER.	INOP.	OPER.	
MASTER CONTROL PANEL ACTUATION DEVICES							
Left Front (LF)		X	X		X		P
Right Front (RF)		X	X		X		P
Left Rear (LR)		X	X		X		P
Right Rear (RR)		X	X		X		P
Tail Gate (TG)							
Vents							
Roof Panel (RP)							
INDIVIDUAL ACTUATION DEVICES							
Left Front (LF)		X	X		X		P
Right Front (RF)		X	X		X		P
Left Rear (LR)		X	X		X		P
Right Rear (RR)		X	X		X		P
Tail Gate (TG)							
Vents							
Roof Panel (RP)							

REMARKS:

RECORDED BY: G. Farrand **DATE:** 06/04/08

APPROVED BY: D. Messick

DATA SHEET 2
INTERIOR LOCKING SYSTEM WITH KEY REMOVED TEST

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA

VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451

VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07

LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

Key lock position at start of test execution: (X) ON ( ) ACCESSORY, Then to:
Key lock off position during test execution: (X) LOCK ( ) OFF ( ) ACCESSORY

ACTUATION DEVICES	DOORS CLOSED		LEFT DOOR OPEN		RIGHT DOOR OPEN		PASS/ FAIL
	INOP.	OPER.	INOP.	OPER.	INOP.	OPER.	
MASTER CONTROL PANEL ACTUATION DEVICES							
Left Front (LF)		X	X		X		P
Right Front (RF)		X	X		X		P
Left Rear (LR)		X	X		X		P
Right Rear (RR)		X	X		X		P
Tail Gate (TG)							
Vents							
Roof Panel (RP)							
INDIVIDUAL ACTUATION DEVICES							
Left Front (LF)		X	X		X		P
Right Front (RF)		X	X		X		P
Left Rear (LR)		X	X		X		P
Right Rear (RR)		X	X		X		P
Tail Gate (TG)							
Vents							
Roof Panel (RP)							

REMARKS:

RECORDED BY: G. Farrand DATE: 06/04/08

APPROVED BY: D. Messick

DATA SHEET 3
OCCUPANT COMPARTMENT ACTUATION DEVICE TEST
SPHERE TEST

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA
VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451
VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07
LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

ACTUATION DEVICES	APPLICABLE (YES/NO*)	SPHERE ACTIVATED ACTUATION DEVICE CLOSES WPRP (YES/NO)	TEST RESULT PASS/FAIL	COMPLIANCE REQUIRED (Y/N**)
MASTER CONTROL PANEL ACTUATION DEVICES				
Left Front (LF)	Yes	No	Pass	No
Right Front (RF)	Yes	No	Pass	No
Left Rear (LR)	Yes	No	Pass	No
Right Rear (RR)	Yes	No	Pass	No
Tail Gate (TG)				
Vent Window(s)				
Partition (P)				
Roof Panel (RP)				
INDIVIDUAL ACTUATION DEVICES				
Left Front (LF)	Yes	No	Pass	No
Right Front (RF)	Yes	No	Pass	No
Left Rear (LR)	Yes	No	Pass	No
Right Rear (RR)	Yes	No	Pass	No
Tail Gate (TG)				
Vent Window (s)				
Partition(P)				
Roof Panel (RP)				

*This requirement does not apply to actuation devices that are mounted in a vehicle's roof, headliner, or overhead console and that can close a window, partition, or roof panel only by continuous rather than momentary switch actuation or actuation devices that comply with the reversing requirement of FMVSS 118, S5.
** Requirement is effective 1 October 2008. Early compliance is voluntary and test results are used for information only.

RECORDED BY: G. Farrand DATE: 06/04/08
APPROVED BY: D. Messick

DATA SHEET 4
OCCUPANT COMPARTMENT ACTUATION DEVICE TEST
FOR POWER-OPERATED WINDOWS ONLY
PULL UP OR PULL OUT TEST

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA
VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451
VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07
LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

ACTUATION DEVICES	SWITCH ORIENTATION A – horizontal B – vertical C - angled	CLOSES POWER-OPERATED WINDOW ONLY IF: PULL UP OR PULL OUT	TEST RESULT PASS/FAIL	COMPLIANCE REQUIRED (Y/N**)
MASTER CONTROL PANEL ACTUATION DEVICES				
Left Front (LF)	A	Pull Up	Pass	No
Right Front (RF)	A	Pull Up	Pass	No
Left Rear (LR)	A	Pull Up	Pass	No
Right Rear (RR)	A	Pull Up	Pass	No
Vent Window(s)				
INDIVIDUAL ACTUATION DEVICES				
Left Front (LF)	A	Pull Up	Pass	No
Right Front (RF)	A	Pull Up	Pass	No
Left Rear (LR)	A	Pull Up	Pass	No
Right Rear (RR)	A	Pull Up	Pass	No
Vent Window(s)				

** Requirement is effective 1 October 2008. Early compliance is voluntary and test results are used for information only.

RECORDED BY: G. Farrand DATE: 06/04/08
APPROVED BY: D. Messick

DATA SHEET 5
WPRP PHYSICAL CONTACT REVERSAL CAPABILITY

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA
VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451
VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07
LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/30/08

WPRs equipped with reversal capability: Left Front Window

WPRPs that must meet reversal requirements: None

Window, Partition, Roof Panel	Test Rod Placement In Window, Partition or Roof Panel	Test Rod Size (mm)	Window, Partition or Roof Panel Opening Before/After Closing (mm)	Maximum Force Measured on Test Rod (Newtons)	Window, Partition or Roof Panel Reversing Distance (mm)	Pass/Fail *
Driver Window	Top	5	200 / 380	154	375	**
Driver Window	Top	25	200 / 380	123	355	**
Driver Window	Top	50	200 / 380	106	330	**
Driver Window	Top	200	220 / 380	100	180	**

*WPRP must reverse direction before contacting or exerting a squeezing force of 100 Newtons. Upon such reversal, the WPRP must open to one of the following positions.

A. A position that is at least as open as the position at the time closing was initiated.
B. A position that is not less than 125 mm more open than the position at the time the window reversed direction, or
C. A position that permits a semi-rigid cylindrical rod that is 200 mm in diameter to be placed through the opening at the same location as the test rod.

REMARKS: **Not required to meet reversal requirements.

RECORDED BY: G. Farrand DATE: 06/30/08
APPROVED BY: D. Messick

SECTION 4
TEST EQUIPMENT LIST

VEHICLE MAKE/MODEL/BODY STYLE: 2008 HYUNDAI SONATA

VEHICLE NHTSA NO: C80507 VIN: 5NPET46C28H355451

VEHICLE TYPE: PASSENGER CAR DATE OF MANUFACTURE: Jul/27/07

LABORATORY: GENERAL TESTING LABORATORIES TEST DATE: 06/04/08

ITEM	MFR	MODEL	S/N	CAL. PERIOD	DATE OF LAST CALIB.	REMARKS
SLR DIGITAL CAMERA	NIKON	D50	N/A	N/A	N/A	
PINCH FORCE SENSOR	SENSOR DEVELOPMENTS, INC.	10293	179104	12 MO.	06/08	

REMARKS:

RECORDED BY: G. FARRAND DATE: 06/04/08

APPROVED BY: D. MESSICK

SECTION 5

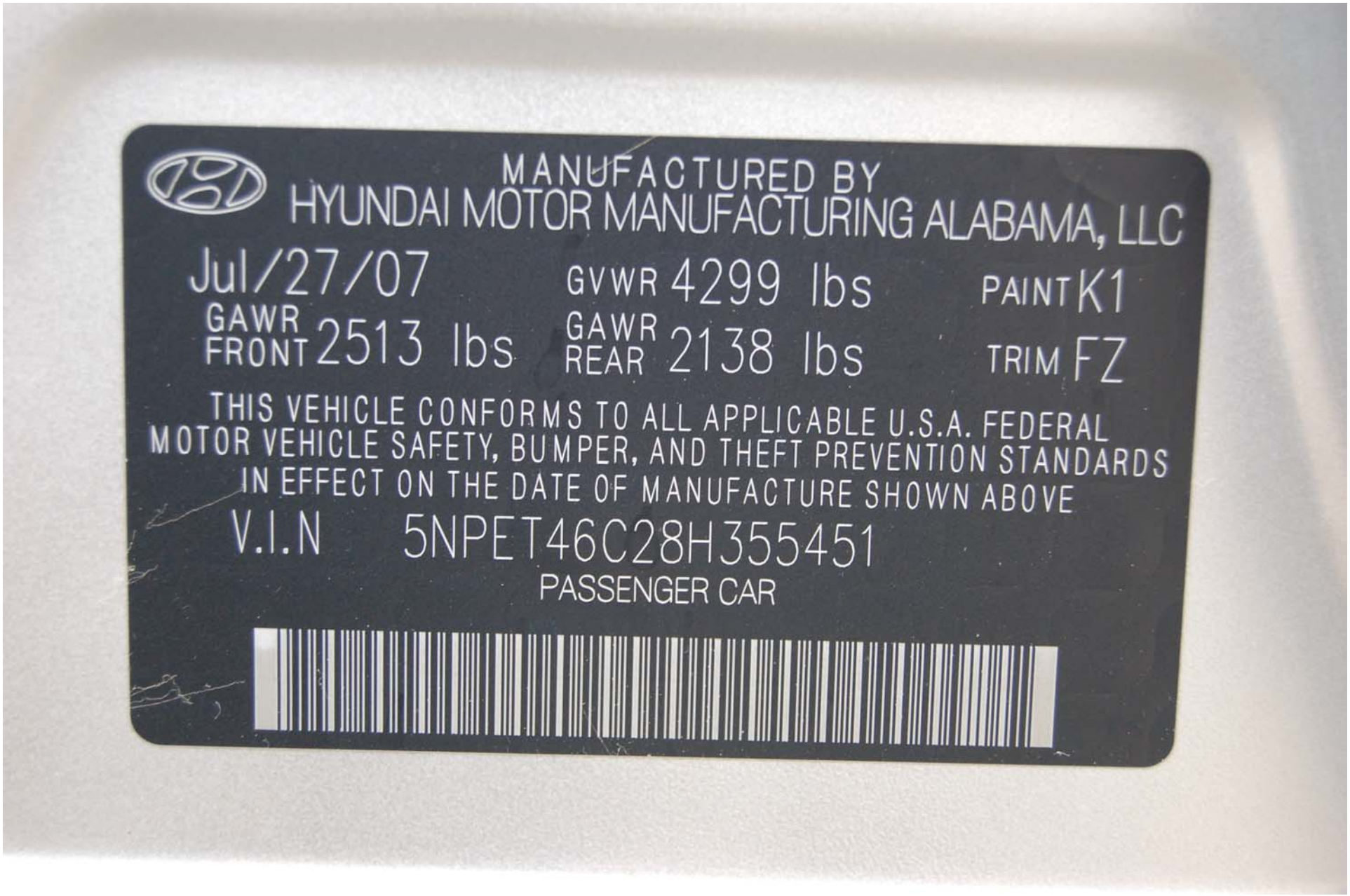
PHOTOGRAPHS

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.1
¾ FRONTAL VIEW FROM RIGHT SIDE OF VEHICLE

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.2
¾ REAR VIEW FROM LEFT SIDE OF VEHICLE



2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.3
CLOSE-UP VIEW OF VEHICLE CERTIFICATION LABEL

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.4
CLOSE-UP VIEW OF TIRE INFORMATION PLACARD

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.5
CLOSE-UP VIEW OF VEHICLE IGNITION SWITCH

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.6
CLOSE-UP VIEW OF LEFT FRONT POWER WINDOW SWITCH

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.7
CLOSE-UP VIEW OF RIGHT FRONT POWER WINDOW SWITCH

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.8
CLOSE-UP VIEW OF LEFT REAR POWER WINDOW SWITCH

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.9
CLOSE-UP VIEW OF RIGHT REAR POWER WINDOW SWITCH

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.10
CLOSE-UP VIEW OF POWER WINDOW MASTER SWITCH

2008 HYUNDAI SONATA
NHTSA NO. C80507
FMVSS NO. 118

FIGURE 5.11
PINCH FORCE SENSOR

SECTION 6
OWNER'S MANUAL INFORMATION

WINDOWS

11

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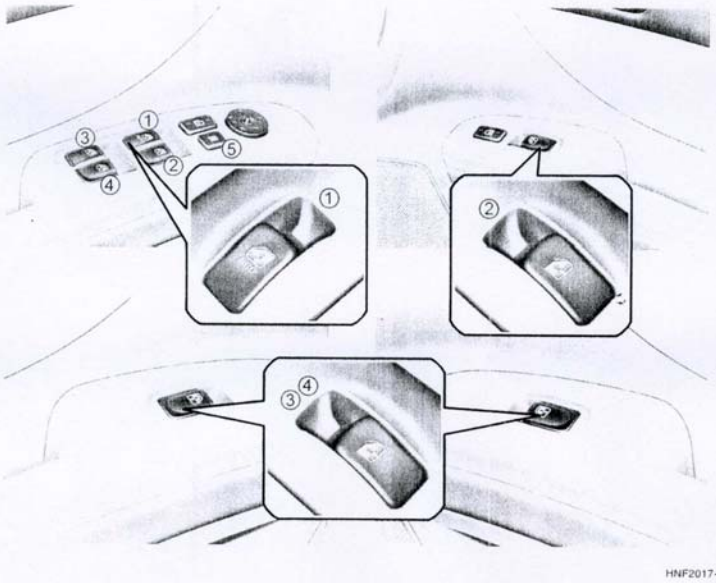

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1. Driver's door power window switch
2. Front passenger's door power window switch
3. Rear passenger's door power window switch (left side)
4. Rear passenger's door power window switch (right side)
5. Window lock switch

12

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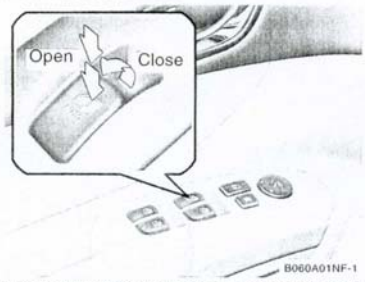
POWER WINDOWS



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The power windows operate when the ignition key is in the "ON" position. The main switches are located on the driver's armrest and control the front and rear windows on both sides of the vehicle. The windows may be opened by depressing the appropriate window switch and closed by pulling up the switch. To open the window on the driver's side, press the switch halfway down. The window moves as long as the switch is operated.

Auto Up/Down Window (Driver's side)

The auto up/down window is controlled by the main switch on the driver's armrest.
To fully open the window automatically, press the switch fully down. To fully close the window automatically, pull the switch fully up. In automatic operation, the window will fully open or close even if you let go of the switch. To stop the window at the desired position while the window is in operation, pull up or depress and release the switch to the opposite direction of the movement.

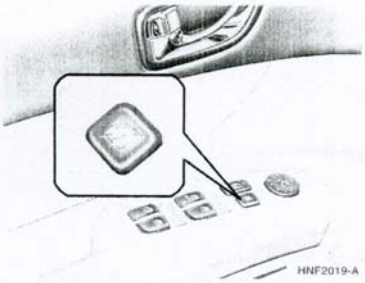
NOTE:

If the battery has been recharged or disconnected, the auto up/down window system must be reset as follows;

1. **Turn the ignition key to "ON" position.**
2. **Pull up the driver's window switch until the window is fully closed and continue pulling up the driver's window switch for at least 0.2 second.**

If the auto up/down window is not reset, the feature may not operate properly.

Window lock (Driver's side)



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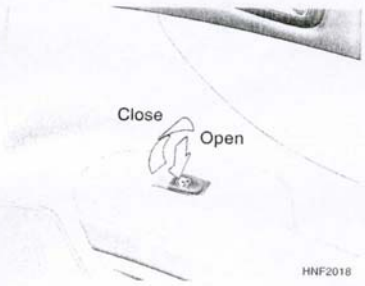
In order to prevent operation of the passenger front and rear windows, a window lock switch is provided on the armrest of the driver's door. To disable the power windows, press the window lock switch. To revert to normal operation, press the window lock switch a second time.

NOTE:
The power windows can be operated for 30 seconds after the ignition key is turned to the "ACC" or "LOCK" positions, or removed from the ignition switch.
If the front doors are opened during this 30 second period, the power windows can no longer be operated without the ignition key turned to the "ON" position.



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Automatic Reverse Window (Driver's side)

If the upward movement of the window is blocked by an object or part of the body, the window will detect the resistance and will stop upward movement. The window will then lower approximately 11.8 in.(30cm) to allow the object to be cleared.

WARNING:
- **The automatic reverse feature for the driver's window is only active when the "auto up" feature is used by fully pulling up the switch. The automatic reverse feature will not operate if the window is raised using the halfway position on the power window switch.**
- **Always check for obstructions before raising any window to avoid injuries or vehicle damage. If an object less than 0.16 in. (4 mm) in diameter is caught between the window glass and the upper window channel, the automatic reverse window may not detect the resistance and will not stop and reverse direction.**

WARNING:
- **Passengers can be injured if their head, hands or other body parts are trapped by a closing window. Always check for obstructions before raising any window.**
- **NEVER leave the ignition key in the vehicle.**
- **NEVER leave any child unattended in the vehicle. Even very young children may inadvertently cause the vehicle to move, entangle themselves in the windows, or otherwise injure themselves or others.**
- **Do not attempt to operate the main switch on the driver's door and a switch on another door in opposing directions at the same time. If this is done, the window will stop and cannot be opened or closed.**

4 KEY POSITIONS

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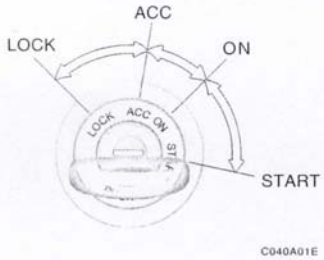

CAUTION:
The engine should not be turned off or the key removed from the ignition key cylinder while the car is in motion. The steering wheel is locked by removing the key.

o "START"

The engine is started in this position. It will crank until you release the key.

NOTE:
Do not hold the key in the "START" position for more than 15 seconds.

o "ON"

When the key is in the "ON" position, the ignition is on and all accessories may be turned on. If the engine is not running, the key should not be left in the "ON" position. This will discharge the battery and may also damage the ignition system.

o "ACC"

With the key in the "ACC" position, some electrical accessories (radio, etc.) may be operated.

o "LOCK"

The key can be removed or inserted in this position.
To protect against theft, the steering wheel locks by removing the key.

NOTE:
If difficulty is experienced in turning the ignition key to the START position, turn the steering wheel right and left to release the tension and then turn the key.

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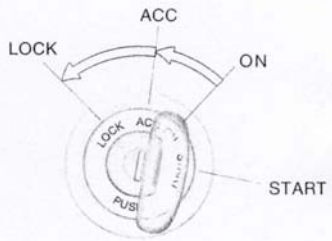
To remove the ignition key



1. Turn the ignition key to the "ACC" position.
2. Simultaneously push and turn the ignition key counterclockwise from the "ACC" position to the "LOCK" position.
3. The key can be removed in the "LOCK" position.

STARTING

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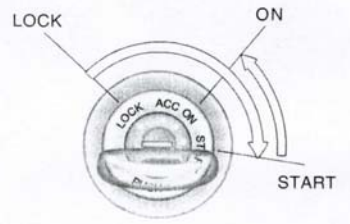

C050A01E

WARNING:
Never run the engine in a closed or poorly ventilated area any longer than is needed to move your car in or out of the area. The carbon monoxide gas emitted is odorless and can cause serious injury or death.

C050B02A-AAT

Normal Conditions:

The Starting Procedure:

1. Insert key, and fasten the seat belt.
2. Depress the clutch pedal fully and place the gearshift lever (manual transaxle) in neutral or the selector lever (automatic transaxle) in "P" (park) position.
3. After turning the ignition key to the "ON" position, make certain all warning lights and gauges are functioning properly before starting the engine.

WARNING:
Be sure that the clutch is fully depressed when starting a manual transaxle vehicle. Your manual transaxle equipped vehicle will not start unless the clutch pedal is fully depressed. On a manual transaxle equipped vehicle that can be started without depressing the clutch, there is the potential to cause damage to the vehicle or injury to someone inside or outside the vehicle as a result of the forward or backward movement of the vehicle that will occur if the clutch is not depressed when the vehicle is started.

4. Turn the ignition key to the "START" position and release it when the engine starts. After the engine has started, allow the engine to run for 10 to 20 seconds prior to placing the vehicle in gear. The starter should not be operated for more than 15 seconds at a time. Wait 15-30 seconds between starting attempts to protect the starter from overheating.

WARNING:
Always fully depress the brake pedal before and while shifting out of the "P" Park position into another position to avoid inadvertent motion of the vehicle which could injure persons in or around the car.