SAFETY COMPLIANCE TESTING FOR
FMVSS NO. 104
WINDSHIELD WIPING AND WASHING SYSTEMS

HYUNDAI MOTOR COMPANY
2006 HYUNDAI SONATA, PASSENGER CAR
NHTSA NO. C60502

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

JUNE 16, 2006

FINAL REPORT

PREPARED FOR
U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Final Report of FMVSS 104 Compliance Testing of 2006 HYUNDAI SONATA, PASSENGER CAR
NHTSA No. C60502

Compliance tests were conducted on the subject 2006 Hyundai Sonata Passenger Car in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-104-08 for the determination of FMVSS 104 compliance. Test failures identified were as follows:
NONE

Compliance Testing
Safety Engineering
FMVSS 104
<table>
<thead>
<tr>
<th>SECTION</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Purpose of Compliance Test</td>
</tr>
<tr>
<td>2</td>
<td>Compliance Test Procedure and Summary of Results</td>
</tr>
<tr>
<td>3</td>
<td>Compliance Test Data</td>
</tr>
<tr>
<td>4</td>
<td>Test Equipment List</td>
</tr>
<tr>
<td>5</td>
<td>Photographs</td>
</tr>
<tr>
<td>5.1</td>
<td>Left Side View of Vehicle</td>
</tr>
<tr>
<td>5.2</td>
<td>Right Side View of Vehicle</td>
</tr>
<tr>
<td>5.3</td>
<td>¾ Frontal View From Left Side of Vehicle</td>
</tr>
<tr>
<td>5.4</td>
<td>¾ Rear View From Right Side of Vehicle</td>
</tr>
<tr>
<td>5.5</td>
<td>Vehicle Certification and Tire Information Label</td>
</tr>
<tr>
<td>5.6</td>
<td>Vehicle Tire Information Label</td>
</tr>
<tr>
<td>5.7</td>
<td>Instrumentation Set-up</td>
</tr>
<tr>
<td>5.8</td>
<td>Equipment Set-up</td>
</tr>
<tr>
<td>5.9</td>
<td>Wiped Area Test</td>
</tr>
<tr>
<td>5.10</td>
<td>Wiped Area Test Pattern</td>
</tr>
<tr>
<td>5.11</td>
<td>Capability Test #1 Pre-Coated Windshield</td>
</tr>
<tr>
<td>5.12</td>
<td>Capability Test #1 in Progress</td>
</tr>
<tr>
<td>5.13</td>
<td>Capability Test #2 Pre-Coated Windshield</td>
</tr>
<tr>
<td>5.14</td>
<td>Capability Test #2 in Progress</td>
</tr>
<tr>
<td>5.15</td>
<td>Wiped Area Vellum Pattern</td>
</tr>
<tr>
<td>5.16</td>
<td>Capability Test #1 &amp; #2 Vellum Pattern</td>
</tr>
<tr>
<td>6</td>
<td>Vehicle Owner’s Manual Information</td>
</tr>
</tbody>
</table>
SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2006 Hyundai Sonata Passenger Car was subjected to Federal Motor Vehicle Safety Standard (FMVSS) No. 104 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-104-08 dated 26 June 1996 and General Testing Laboratories, Inc. (GTL) Test Procedure, TP-104-08A dated 4 April 1997.

1.1 The test vehicle was a 2006 Hyundai Sonata Passenger Car. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: KMHET46C96A162388
B. NHTSA No.: C60502
C. Manufacturer: HYUNDAI MOTOR COMPANY
D. Manufacture Date: OCT/31/05

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 104 testing on April 26-27, 2006.
SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2006 Hyundai Sonata 4-door passenger car, NHTSA No. C60502 was subjected to FMVSS No. 104 tests on April 26-27, 2006. The selected portions of FMVSS No. 104 tests used were as amplified in the following subparagraphs. The test vehicle was positioned in the test system with three water spray nozzles suspended in line with the center of the longitudinal axis of the windshield and horizontal left/right center of the windshield to provide an even distribution of spray to the entire windshield. The height of the nozzles was approximately 22 inches above the glazing surface.

2.1 WIPER FREQUENCY TEST

The wiper frequency test was performed with the engine operating and with a minimum of 50 cubic inches per minute of water from the spray nozzles. The wiper frequency was measured at the low and high wiper speed settings with the engine operating at idle RPM and 2,000 RPM.

2.2 WIPED AREA TEST

The test was conducted with the windshield wiper system operating at the high speed setting, engine at idle RPM and the spray nozzles spraying water at a minimum of 50 cubic inches per minute. The wiper blade wipe pattern was outlined on the glazing surface and then transferred to a windshield pattern. The wiped area was determined for areas A, B and C from the windshield pattern.

2.3 CAPABILITY TEST

The windshield glazing surface was coated with a mixture of water and fine grade test dust. Within 15 seconds following application of the water-dust mixture, the windshield wiper and washing system was activated in the high speed mode for ten complete cycles. The vehicle’s engine was operating at idle RPM. The cleared areas of the windshield were marked on the inside windshield surface. After ten complete cycles the system was deactivated and the wiped area transferred to a windshield pattern.

The glazing surface was cleaned and dried. The water dust mixture was re-applied and the test repeated.

The windshield patterns were used subsequently to determine the cleared area percentages.

2.4 SUMMARY OF RESULTS

Based on the test performed, the test vehicle’s windshield wiping and washing system appears to meet the requirements of FMVSS 104.
SECTION 3
COMPLIANCE TEST DATA

3.0 TEST RESULTS

The following data sheets document the results of testing on the 2006 Hyundai Sonata.
SUMMARY OF DATA
FMVSS 104, WINDSHIELD WIPING AND WASHING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2006 HYUNDAI SONATA PASSENGER CAR
VEH. NHTSA NO: C60502; VIN: KMHET46C96A162388
VEH. BUILD DATE: OCT/31/05 TEST DATE: APRIL 26-27, 2006
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

WIPER TYPE: 2 SPEED ELECTRIC WITH DELAY & MIST
WASHER TYPE: HIGH PRESSURE ELECTRIC WITH 6 SPRAY NOZZLES
WINDSHIELD AREAS: A = 1141.7 in² B = 790.3 in² C = 263.1 in²
MANUFACTURER’S WINDSHIELD PATTERN USED: Yes X No
ACCESSIBILITY:
(1) Washer Control Accessible: Yes X No
(2) Wiper Control Accessible: Yes X No
(3) Washer Reservoir Filler Accessible: Yes X No

DESCRIBE UNUSUAL FEATURES OF WIPING AND WASHING SYSTEMS:

PERFORMANCE:

<table>
<thead>
<tr>
<th>TEST</th>
<th>PASS</th>
<th>FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>WIPER FREQUENCY</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>WIPED AREA</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>WASHER CAPABILITY</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

RECORDED BY: ___________________ DATE: 05/01/06
APPROVED BY: ___________________
VEH. MOD YR/MAKE/MODEL/BODY: 2006 HYUNDAI SONATA PASSENGER CAR
VEH. NHTSA NO: C60502; VIN: KMHET46C96A162388
VEH. BUILD DATE: OCT/31/05 TEST DATE: APRIL 26, 2006
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

Water Hardness: 7.0 grains/gallon (12 max.); Date Certified: 04/26/06

Water Spray Flow Rate: 65.0 in³/min. (specified range = 50 to 100 in³/min.)

Ambient Air Temp.: 69 ºF (50-100ºF); Water Temp.: 63 ºF (100ºF max.)

Manufacturer’s Recommended Engine Idle Speed: 650 rpm

RUN 1, MAXIMUM WIPER FREQUENCY TEST:

<table>
<thead>
<tr>
<th>TIME</th>
<th>ENGINE SPEED</th>
<th>TOTAL CYCLES</th>
<th>AVG. CYCLES/MIN. (45 MINIMUM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST 3 minutes</td>
<td>650 (idle ± 50 rpm)</td>
<td>217</td>
<td>72.3</td>
</tr>
<tr>
<td>2ND 3 minutes</td>
<td>2000 (2000 rpm ± 50 rpm)</td>
<td>218</td>
<td>72.7</td>
</tr>
</tbody>
</table>

Frequency at least 45 cycles/minute regardless of engine speed: Yes X No __

RUN 2, LOWER WIPER FREQUENCY TEST:

<table>
<thead>
<tr>
<th>TIME</th>
<th>ENGINE SPEED</th>
<th>TOTAL CYCLES</th>
<th>AVG. CYCLES/MIN. (20 MINIMUM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1ST 3 minutes</td>
<td>650 (idle ± 50 rpm)</td>
<td>138</td>
<td>46</td>
</tr>
<tr>
<td>2ND 3 minutes</td>
<td>2000 (2000 rpm ± 50 rpm)</td>
<td>138</td>
<td>46</td>
</tr>
</tbody>
</table>

Highest and lower frequency differ by at least 15 cycles/minute, and lower frequency is at least 20 cycles/minute regardless of engine speed: Yes X No __

REMARKS:

RECORDED BY: ___________________________ DATE: 04/26/06
APPROVED BY: ___________________________
VEH. MOD YR/MAKE/MODEL/BODY: 2006 HYUNDAI SONATA PASSENGER CAR
VEH. NHTSA NO: C60502; VIN: KMHET46C96A162388
VEH. BUILD DATE: OCT/31/05; TEST DATE: APRIL 26, 2006
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

Air Temperature in test area = 69 ºF (specified range of 50 to 100ºF)

Air Velocity at windshield = 0.5 mph (specified range of 0 to 1 mph)

Engine speed = 650 rpm (manufacturer’s recommended idle ± 50 rpm)

Temperature of water spray = 63 ºF (100º F maximum)

Water spray flow rate = 65 in³/min. (specified range of 50 to 100 in³/min.)

Windshield wiper frequency = 72 cycles/min. (45 cpm minimum)

TEST RESULTS:

<table>
<thead>
<tr>
<th>WINDSHIELD AREA</th>
<th>ACTUAL %</th>
<th>REQUIRED %</th>
<th>PASS</th>
<th>FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93.4%</td>
<td>80%</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>95.0%</td>
<td>94%</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>100%</td>
<td>99%</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

REMARKS:

RECORDED BY: ____________________________ DATE: 05/01/06
APPROVED BY: ____________________________
CAPABILITY TEST DATA
FMVSS 104 – WINDSHIELD WASHER SYSTEM

VEH. MOD YR/MAKE/MODEL/BODY: 2006 HYUNDAI SONATA PASSENGER CAR
VEH. NHTSA NO: C60502; VIN: KMHET46C96A162388
VEH. BUILD DATE: OCT/31/05; TEST DATE: APRIL 26, 2006
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

Air Temperature in test area = 69°F (specified range of 70 to 80°F)
Washer reservoir fluid temperature = 75°F (specified range of 70 to 80°F)
Air Velocity at windshield = .5 mph (specified range of 0 to 1 mph)
Engine speed = 650 rpm (manufacturer’s recommended idle ± 50 rpm)
Number of windshield washer nozzles on the vehicle = 6

Windshield washer system activation coordinated with components of the wiper system:
Yes    X    No

TEST RESULTS:

<table>
<thead>
<tr>
<th>WINDSHIELD AREA</th>
<th>TEST 1</th>
<th>TEST 2</th>
<th>AVG</th>
<th>REQ'D*</th>
<th>PASS</th>
<th>FAIL</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>93.9</td>
<td>93.9</td>
<td>93.9</td>
<td>75%</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>95.3</td>
<td>95.3</td>
<td>95.3</td>
<td>75%</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>75%</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

*NOTE FOR REFERENCE ONLY: SAE 942b, revised Jul72, recommends capability to clear 80% of the total wash area and 90% of the wash area included in AREA C.

REMARKS:

RECORDED BY: ____________________________ DATE: 04/26/06
APPROVED BY: ____________________________
## TABLE 1 - INSTRUMENTATION & EQUIPMENT LIST

<table>
<thead>
<tr>
<th>EQUIPMENT</th>
<th>DESCRIPTION</th>
<th>MODEL/ SERIAL NO.</th>
<th>CAL. DATE</th>
<th>NEXT CAL. DATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>TIMER</td>
<td>ACCU-SPLIT</td>
<td>ACT2</td>
<td>04/06</td>
<td>04/07</td>
</tr>
<tr>
<td>TEMPERATURE READOUT</td>
<td>OMEGA</td>
<td>43P</td>
<td>04/06</td>
<td>04/07</td>
</tr>
<tr>
<td>TEMPERATURE Recorder</td>
<td>OMEGA</td>
<td>CT91</td>
<td>04/06</td>
<td>04/07</td>
</tr>
<tr>
<td>SPRAY SYSTEM</td>
<td>GTL</td>
<td>N/A</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>AIR VELOCITY METER</td>
<td>OMEGA</td>
<td>HHF-616</td>
<td>04/06</td>
<td>04/07</td>
</tr>
<tr>
<td>CYCLE COUNTER</td>
<td>GTL</td>
<td>GTL</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
<tr>
<td>SOFT WATER</td>
<td>N/A</td>
<td>N/A</td>
<td>04/06</td>
<td>04/07</td>
</tr>
<tr>
<td>TACHOMETER</td>
<td>MONARCH</td>
<td>ACT-3</td>
<td>04/06</td>
<td>04/07</td>
</tr>
<tr>
<td>TEST DUST</td>
<td>AC</td>
<td>GM FINE</td>
<td>CALIBRATED DUST</td>
<td>CALIBRATED BY VENDOR*</td>
</tr>
<tr>
<td>EVENT RECORDER</td>
<td>COMPUTER</td>
<td>GEO1</td>
<td>BEFORE USE</td>
<td>BEFORE USE</td>
</tr>
</tbody>
</table>

*AC Inspection #503, Batch #1943, Measured with particle size roller analyzer.
SECTION 5

PHOTOGRAPHS
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.5
VEHICLE CERTIFICATION LABEL
The combined weight of occupants and cargo should never exceed 390 kg or 860 lbs.

<table>
<thead>
<tr>
<th>TIRE</th>
<th>SIZE</th>
<th>COLD TIRE PRESSURE</th>
<th>SEE OWNER’S MANUAL FOR ADDITIONAL INFORMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRONT</td>
<td>P215/60R16</td>
<td>210KPA, 30PSI</td>
<td></td>
</tr>
<tr>
<td>REAR</td>
<td>P215/60R16</td>
<td>210KPA, 30PSI</td>
<td></td>
</tr>
<tr>
<td>SPARE</td>
<td>T125/80D16</td>
<td>420KPA, 60PSI</td>
<td></td>
</tr>
</tbody>
</table>
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.9
WIPE AREA TEST
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.10
WIPPED AREA TEST PATTERN
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.11
CAPABILITY TEST #1 PRE-COATED WINDSHIELD
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.12
CAPABILITY TEST #1 IN PROGRESS
2006 HYUNDAI SONATA
NHTSA NO. C60502
FMVSS NO. 104

FIGURE 5.14
CAPABILITY TEST #2 IN PROGRESS
SECTION 6

OWNER’S MANUAL INFORMATION
**FRONT FOG LIGHT SWITCH**

To turn on the front fog lights, place the switch in the "ON" position. They will light when the headlight switch is in the second position.

**NOTE:**
If you turn on the headlight high beams, the front fog lights will be turned off.

---

**WINDSHIELD WIPER AND WASHER SWITCH**

The windshield wiper switch has three positions:

1. Intermittent wiper operation
2. Low-speed operation
3. High-speed operation

**NOTE:**
To prevent damage to the wiper system, do not attempt to wipe away heavy accumulations of snow or ice. Accumulated snow and ice should be removed manually. If there is only a light layer of snow or ice, operate the heater in the defrost mode to melt the snow or ice before using the wiper.

---

**Windshield Washer Operation**

To use the windshield washer, pull the wiper/washer lever toward the steering wheel. When the washer lever is operated, the wipers automatically make two passes across the windshield. The washer continues to operate until the lever is released.

**NOTE:**
- Do not operate the washer more than 15 seconds at a time or when the fluid reservoir is empty.
- In icy or freezing weather, be sure the wiper blades are not frozen to the glass prior to operating the wipers.
- In areas where water freezes in winter, use windshield washer antifreeze.
Mist Wiper Operation

If a single wipe is desired to clear mist, push the windshield wiper and washer control lever upwards.

Adjustable Intermittent Wiper Operation

To use the intermittent wiper feature, place the wiper switch in the "INT" position. With the switch in this position, the interval between wipes can be varied from approximately 1 to 18 seconds by turning the interval adjuster barrel.

The hazard warning system should be used whenever you find it necessary to stop the car in a hazardous location. When you must make such an emergency stop, always pull off the road as far as possible.

The hazard warning lights are turned on by pushing in the hazard switch. This causes all turn signal lights to blink. The hazard warning lights will operate even though the key is not in the ignition.

To turn the hazard warning lights off, push the switch a second time.
WINDSHIELD WIPER BLADES

The wiper blades should be carefully inspected from time to time and cleaned to remove accumulations of road film or other debris. To clean the wiper blades and arms, use a clean sponge or cloth with a mild soap or detergent and water. If the wipers continue to streak or smear the glass, replace them with genuine Hyundai replacement parts or their equivalent.

⚠️ CAUTION:
- Do not operate the wipers on dry glass. This can result in more rapid wear of the wiper blades and may scratch the glass.
- Keep the blade rubber out of contact with petroleum products such as engine oil, gasoline, etc.

Replacing the Wiper Blades
To replace the wiper blades, raise the wiper to the vertical position.

To remove the wiper blade

1. Push down the wiper blade with the locking clip (1) pressed to detach it from the wiper arm.

2. Raise the wiper blade lightly and pull it up.

G080AQX-AKT
0000001HR-DAT
G080AQX-1NF-A
To install the wiper blade

1. Put a new wiper blade onto the wiper arm and lower the wiper blade at the level of the wiper arm as shown in the drawing.

2. Pull up the wiper blade until you hear an audible "click" to engage in the end of the wiper arm.

**NOTE:**
Do not allow the wiper arm to fall against the windshield.

---

**FILLING THE WASHER RESERVOIR**

The washer fluid reservoir supplies fluid to the windshield washer system.