REPORT NUMBER 104-GTL-15-002

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

KIA MOTORS CORPORATION
2015 KIA SOUL EV, MPV
NHTSA NO. C20154200

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

July 20, 2015

FINAL REPORT

PREPARED FOR

U. S. DEPARTMENT OF TRANSPORTATION
NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION
ENFORCEMENT
OFFICE OF VEHICLE SAFETY COMPLIANCE
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Technical Report Documentation Page

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16. Abstract Compliance tests were conducted on the subject 2015 Kia Soul EV MPV in accordance with the specifications of the Office of Vehicle Safety Compliance Test Procedure No. TP-104-08. Test failures identified were as follows: NONE		
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SECTION 1

PURPOSE OF COMPLIANCE TEST

1.0 PURPOSE OF COMPLIANCE TEST

A 2015 Kia Soul EV MPV 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 2015 Kia Soul EV MPV. Nomenclature applicable to the test vehicle are:

A. Vehicle Identification Number: KNDJP3AE0F7002276

B. NHTSA No.: C20154200

C. Manufacturer: KIA MOTORS CORPORATION

D. Manufacture Date: 12/14

E. Color: White

1.2 TEST DATE

The test vehicle was subjected to FMVSS No. 104 testing on July 10, 2015.

SECTION 2

COMPLIANCE TEST PROCEDURE AND SUMMARY OF RESULTS

2.0 GENERAL

The 2015 Kia Soul EV MPV, NHTSA No. C20154200 was subjected to FMVSS No. 104 tests on July 10, 2015. 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 0 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 2015 Kia Soul EV.

SUMMARY OF DATA
FMVSS 104, WINDSHIELD WIPING AND WASHING SYSTEMS

VEH. MOD YR/MAKE/MODEL/BODY: 2015 KIA SOUL EV MPV
VEH. NHTSA NO: C20154200; VIN: KNDJP3AE0F7002276
VEH. BUILD DATE: 12/14 TEST DATE: JULY 10, 2015
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

WIPER TYPE: 2-SPEED ELECTRIC WITH DELAY

WASHER TYPE: HIGH PRESSURE ELECTRIC PUMP

WINDSHIELD AREAS: A = 954.8 in^2 B = 652.6 in^2 C = 221.6 in^2

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:

TEST	PASS	FAIL
WIPER FREQUENCY	X	
WIPED AREA	X	
WASHER CAPABILITY	X	

RECORDED BY: G. FARRAND DATE: 07/13/15

APPROVED BY: D. MESSICK

FREQUENCY TEST DATA
FMVSS 104 – WINDSHIELD WIPER SYSTEM

VEH. MOD YR/MAKE/MODEL/BODY: 2015 KIA SOUL EV MPV
VEH. NHTSA NO: C20154200; VIN: KNDJP3AE0F7002276
VEH. BUILD DATE: 12/14 TEST DATE: JULY 10, 2015
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

Water Hardness: 7.0 grains/gallon (12 max.); Date Certified: 07/09/15

Water Spray Flow Rate: 83 in^3/min. (specified range = 50 to 100 in^3/min.)

Ambient Air Temp.: 86 ºF (50-100ºF); Water Temp.: 82.0 ºF (100ºF max.)

Manufacturer's Recommended Engine Idle Speed: 0 rpm

RUN 1, MAXIMUM WIPER FREQUENCY TEST:

TIME	ENGINE SPEED	TOTAL CYCLES	AVG. CYCLES/MIN. (45 MINIMUM)
1ST 3 minutes	0 (idle ± 50 rpm)	193	64.3
2nd 3 minutes	0 (2000 rpm ± 50 rpm)	195	65.0

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

RUN 2, LOWER WIPER FREQUENCY TEST:

TIME	ENGINE SPEED	TOTAL CYCLES	AVG. CYCLES/MIN. (20 MINIMUM)
1ST 3 minutes	0 (idle ± 50 rpm)	138	46
2nd 3 minutes	0 (2000 rpm ± 50 rpm)	139	46.3

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: ELECTRIC VEHICLE

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

APPROVED BY: D. MESSICK

WIPED AREA TEST DATA
FMVSS 104 – WINDSHIELD WIPER SYSTEM

VEH. MOD YR/MAKE/MODEL/BODY: 2015 KIA SOUL EV MPV
VEH. NHTSA NO: C20154200; VIN: KNDJP3AE0F7002276
VEH. BUILD DATE: 12/14; TEST DATE: JULY 10, 2015
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

Air Temperature in test area = 83.0 ºF (specified range of 50 to 100ºF)

Air Velocity at windshield = .3 mph (specified range of 0 to 1 mph)

Engine speed = 0 rpm (manufacturer's recommended idle ± 50 rpm)

Temperature of water spray = 82.0 ºF (100º F maximum)

Water spray flow rate = 83 in^3/min. (specified range of 50 to 100 in^3/min.)

Windshield wiper frequency = 65 cycles/min. (45 cpm minimum)

TEST RESULTS:

PERCENT WIPED				
WINDSHIELD AREA	ACTUAL	REQUIRED	PASS	FAIL
A	92.9%	80%	X	
B	95.0%	94%	X	
C	100%	99%	X	

REMARKS: ELECTRIC VEHICLE

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

APPROVED BY: D. MESSICK

CAPABILITY TEST DATA
FMVSS 104 – WINDSHIELD WASHER SYSTEM

VEH. MOD YR/MAKE/MODEL/BODY: 2015 KIA SOUL EV MPV
VEH. NHTSA NO: C20154200; VIN: KNDJP3AE0F7002276
VEH. BUILD DATE: 12/14; TEST DATE: JULY 10, 2015
TEST LABORATORY: GENERAL TESTING LABORATORIES
OBSERVERS: GRANT FARRAND, JIMMY LATANE

Air Temperature in test area = 83.0 ºF (specified range of 70 to 80ºF)

Washer reservoir fluid temperature = 75 ºF (specified range of 70 to 80ºF)

Air Velocity at windshield = .2 mph (specified range of 0 to 1 mph)

Engine speed = 0 rpm (manufacturer's recommended idle ± 50 rpm)

Number of windshield washer nozzles on the vehicle = 2

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

TEST RESULTS:

CLEARED AREA PERCENTAGES						
WINDSHIELD AREA	TEST 1	TEST 2	AVG	REQ'D*	PASS	FAIL
A	95.8	96.6	96.2	75%	X	
B	97.8	98.3	98.1	75%	X	
C	100	100	100	75%	X	

*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: G. FARRAND DATE: 07/10/15
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	ACT2	02/15	02/16
TEMPERATURE READOUT	FLUKE	7471026	03/15	03/16
SPRAY SYSTEM	GTL	N/A	BEFORE USE	BEFORE USE
ANEMOMETER	OMEGA	HH-600	03/15	03/17
CYCLE COUNTER	GTL	GTL	BEFORE USE	BEFORE USE
SOFT WATER	N/A	N/A	07/15	07/16
TEST DUST	AC	GM FINE	CALIBRATED DUST	CALIBRATED BY VENDOR*

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

SECTION 5

PHOTOGRAPHS

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.1
LEFT SIDE VIEW OF VEHICLE

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.2
RIGHT SIDE VIEW OF VEHICLE

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

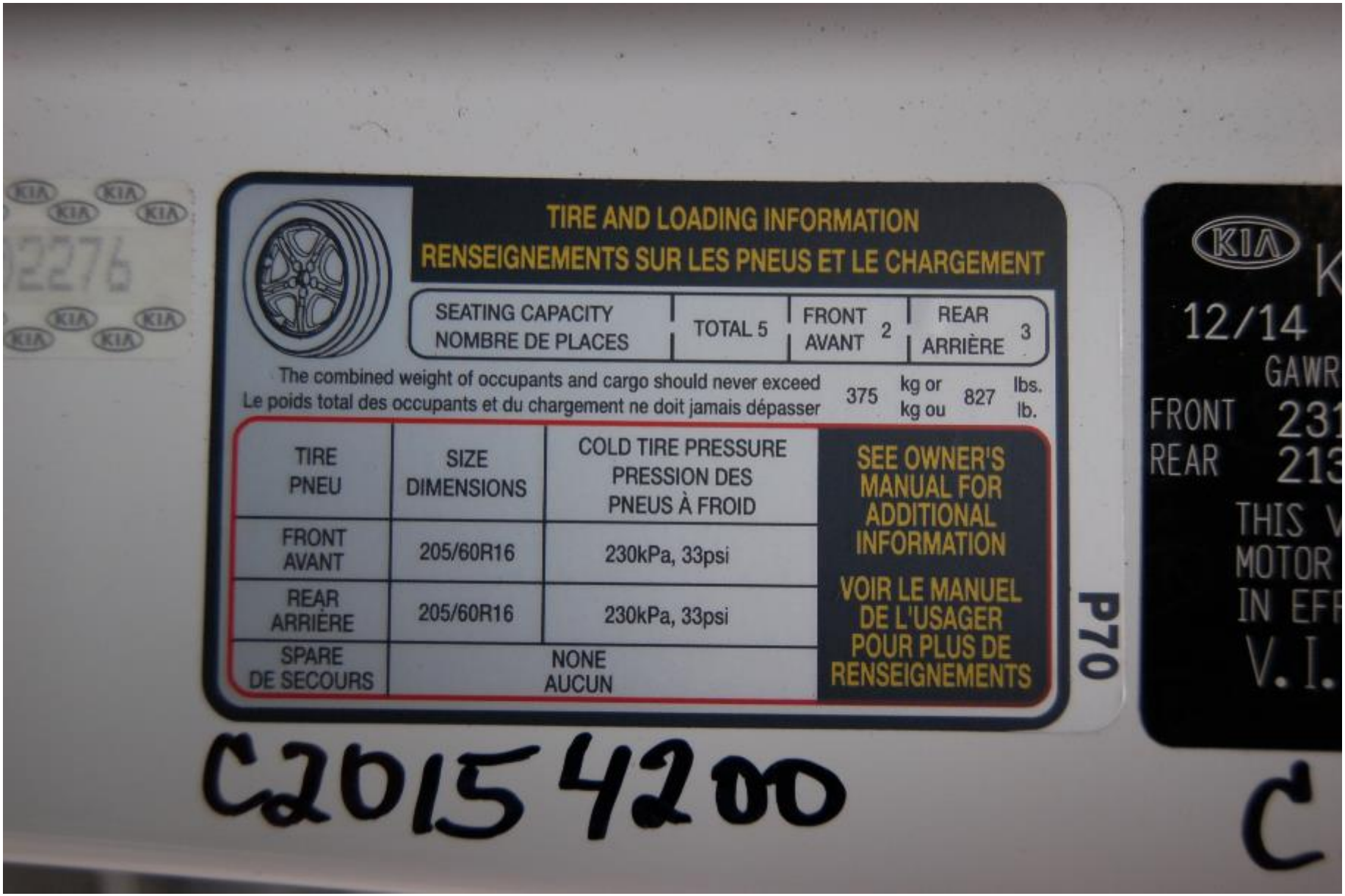
FIGURE 5.3
¾ FRONTAL VIEW FROM LEFT SIDE OF VEHICLE

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.4
¾ REAR VIEW FROM RIGHT SIDE VIEW OF VEHICLE

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.5
VEHICLE CERTIFICATION LABEL



2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.6
VEHICLE TIRE INFORMATION LABEL

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

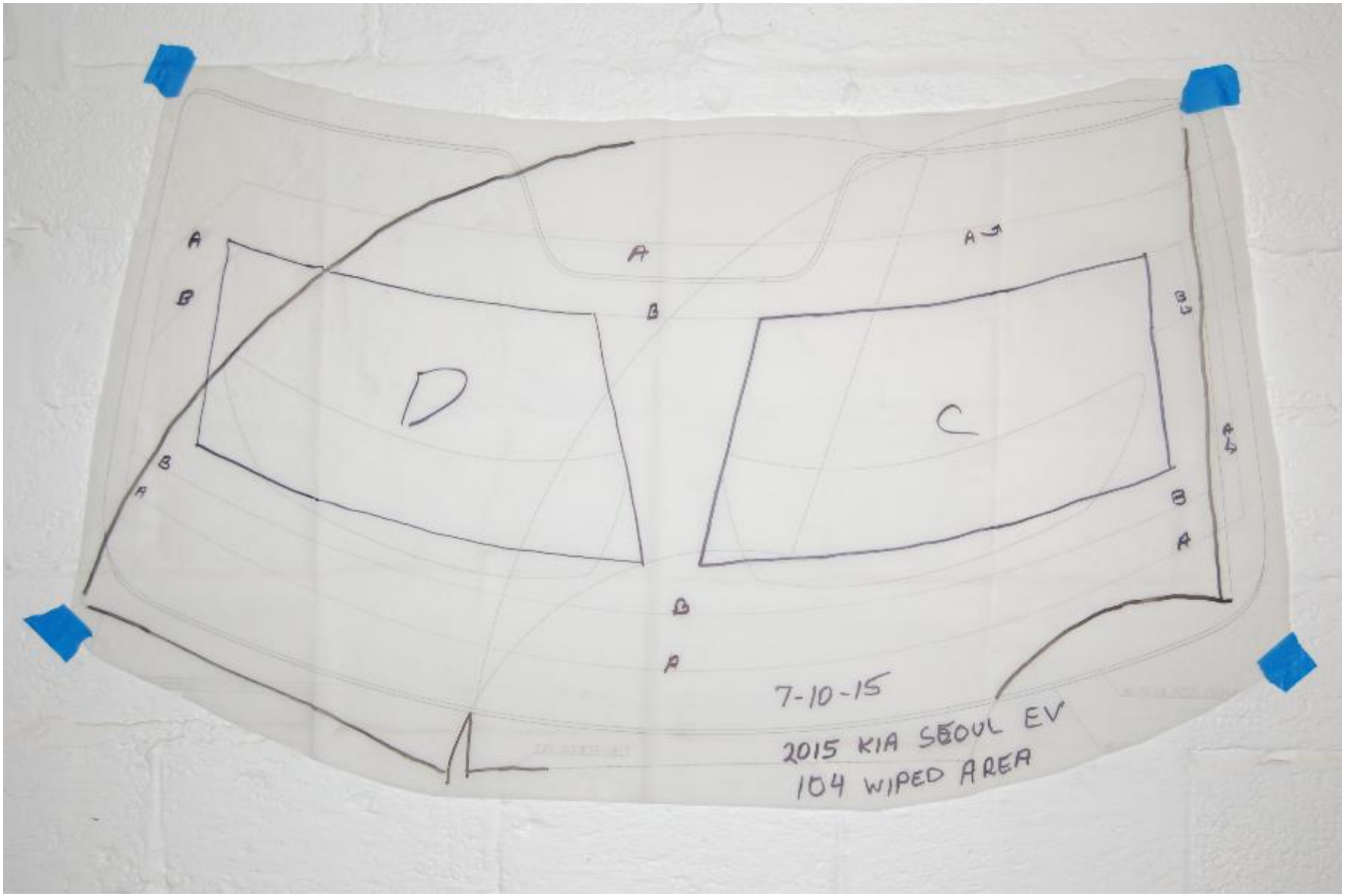
FIGURE 5.7
INSTRUMENTATION AND EQUIPMENT SET-UP

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.8
WIPER AND WASHER CONTROL

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.9
WIPED AREA TEST IN PROGRESS



2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.10
WIPED AREA TEST PATTERN

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.11
CAPABILITY TEST #1 PRE-COATED WINDSHIELD

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

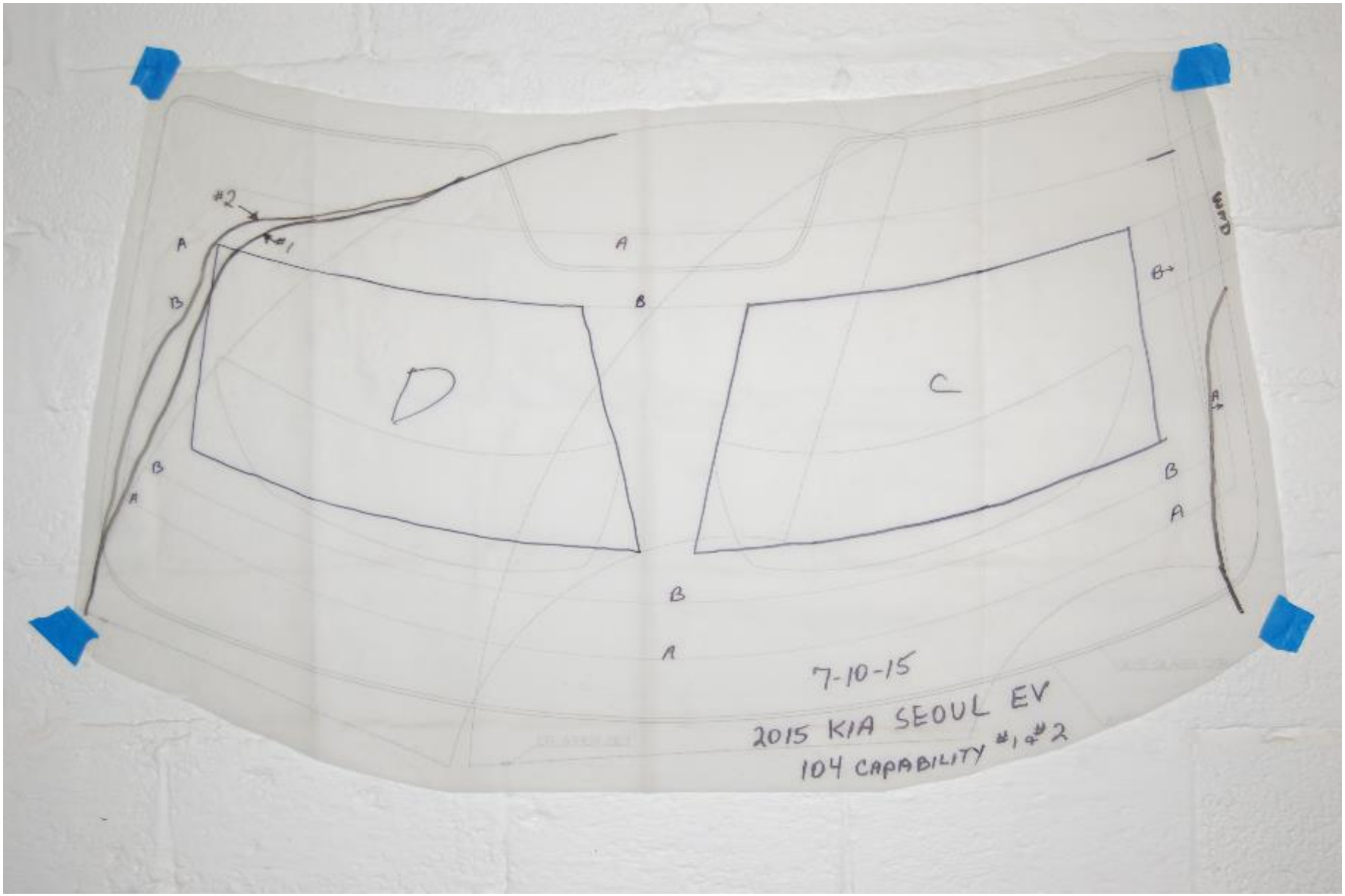
FIGURE 5.12
CAPABILITY TEST #1 IN PROGRESS

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.13
CAPABILITY TEST #2 PRE-COATED WINDSHIELD

2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

FIGURE 5.14
CAPABILITY TEST #2 IN PROGRESS



2015 KIA SOUL EV
NHTSA NO. C20154200
FMVSS NO. 104

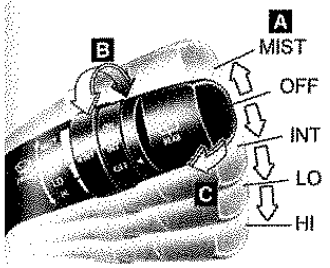
FIGURE 5.15
CAPABILITY TEST #1 AND #2 PATTERN

SECTION 6

OWNER'S MANUAL INFORMATION

WIPERS AND WASHERS

Windshield wiper/washer



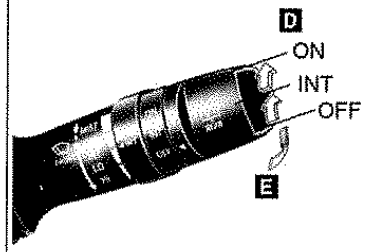
A : Wiper speed control

- MIST – Single wipe
- OFF – Off
- INT – Intermittent wipe
- LO – Low wiper speed
- HI – High wiper speed

B : Intermittent wipe time adjustment

C : Wash with brief wipes (front)

Rear window wiper/washer



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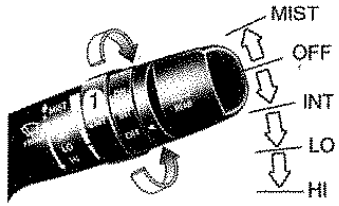
D : Rear wiper/washer control

- ON – Continuous wipe
- INT – Intermittent wipe (if equipped)
- OFF – Off

E : Wash with brief wipes (rear)

Windshield wipers



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Operates as follows when the POWER button is turned ON.

MIST : For a single wiping cycle, push the lever upward and release it with the lever in the OFF position. The wipers will operate continuously if the lever is pushed upward and held.

OFF : Wiper is not in operation

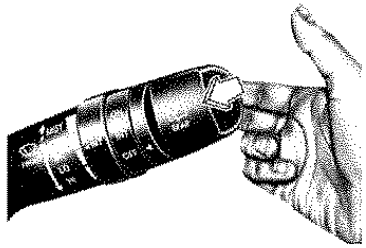
INT : Wiper operates intermittently at the same wiping intervals. Use this mode in light rain or mist. To vary the speed setting, turn the speed control knob (1).

LO : Normal wiper speed

HI : Fast wiper speed

If there is heavy accumulation of snow or ice on the windshield, defrost the windshield for about 10 minutes, or until the snow and/or ice is removed before using the windshield wipers to ensure proper operation.

Windshield washers



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In the OFF position, pull the lever gently toward you to spray washer fluid on the windshield and to run the wipers 1-3 cycles.

Use this function when the windshield is dirty.

The spray and wiper operation will continue until you release the lever.

If the washer does not work, check the washer fluid level. If the fluid level is not sufficient, you will need to add appropriate non-abrasive windshield washer fluid to the washer reservoir.

The reservoir filler neck is located in the front of the motor compartment on the passenger side.

⚠ CAUTION - Washer pump

To prevent possible damage to the washer pump, do not operate the washer when the fluid reservoir is empty.

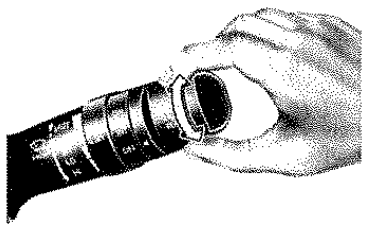
⚠ WARNING - Obscured visibility

Do not use the washer in freezing temperatures without first warming the windshield with the defrosters; the washer solution could freeze on the windshield and obscure your vision.

⚠ CAUTION - Wipers& windshields

- *To prevent possible damage to the wipers or windshield, do not operate the wipers when the windshield is dry.*
- *To prevent damage to the wiper blades, do not use gasoline, kerosene, paint thinner, or other solvents on or near them.*
- *To prevent damage to the wiper arms and other components, do not attempt to move the wipers manually.*

Rear window wiper and washer switch



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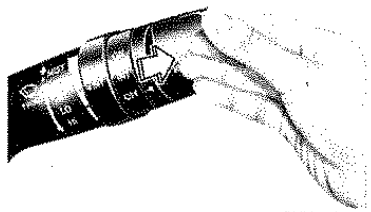
The rear window wiper switch is located at the end of the wiper and washer switch lever. Turn the switch to the desired position to operate the rear wiper and washer.

ON - Normal wiper operation

INT - Intermittent wiper operation (if equipped)

OFF - Wiper is not in operation



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Push the lever away from you to spray rear washer fluid and to run the rear wipers 1~3 cycles. The spray and wiper operation will continue until you release the lever.