

## WIPER AND WASHER SYSTEM

7810-00/7810-01/7810-07/7820-00/7820-01/7820-35/  
7830-00/7830-01/7830-03/8530-01/8610-09/

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# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



**WIPER AND WASHER SYSTEM****7810-00****GENERAL INFORMATION****1. WIPER SYSTEM SPECIFICATIONS**

Category	Item			Specifications
Windshield wiper motor	Rated voltage			12 V
	Operation voltage range			10 to 15 V
	Lowest operating voltage			Min. 8 V
Rear wiper motor	Rated voltage			12 V
	Operation voltage range			10 to 15 V
	Lowest operating voltage			Min. 8 V
Wiper arm and blade	Wiper blade length	Front	Driver's seat	600 mm
			Passenger's seat	400 mm
		Rear		275 mm
	Wiper blade change interval			Change every 3 months or every 5,000 km of driving. Service more frequently when the wiper blades are used on a contaminated (oil, wax, dust, etc.) or dry windshield, or in rainy season.
	Washer fluid reservoir tank	Capacity		

**2. RAIN SENSOR SPECIFICATIONS**

Category	Item		Specifications
Rain sensor	Operating voltage		9 to 16 V
	Rated load		Max. 200 mA (relay load)
	Operating temperature		-30°C to +85°C
	Mounting location		Top center of inner side of windshield glass

Modification basis	
Application basis	
Approval basis	

### 3. PRECAUTIONS

- During winter time, check if wiper blades are frozen to the windshield.
- Wiper operation with the blades frozen can damage the wiper blade and motor.
- The wiper operation on the dry windshield can scratch the glass and wear the blade prematurely. Do not operate the wiper when the windshield is dry.
- When it does not rain, turn the wiper switch into the "OFF" position.
- Turn the wiper switch to the "OFF" position before any car wash to avoid unwanted operation of the wipers.
- Check if the rain sensor is in position securely when removing, fitting and checking it.
- Be sure to use the wiper blade with specified size.
- Be careful so a maldetection does not occur due to the sticker and foreign materials in the rain sensor sensing part at the windshield glass.

#### CAUTION

When cleaning the windshield over the sensor with damp clothes, the wiper may operate suddenly. It could cause serious injury. Make sure to place the wiper switch to the OFF position and ignition switch OFF when not in use.

#### ► Irregular operation (abrupt operation)

- Check if the sensor is not displaced.
- Check if the rain sensor cover is securely installed.
- Check if the customer is familiar with how to control the wiper sensitivity. Check if the wiper sensitivity control is set to the FAST side (step 5).
- Check the wiper blades for wear.
- If the wiper blade cannot wipe the glass uniformly and clearly, it may cause the rain sensor to work irregularly. Therefore, in this case, replace the wiper blade with a new one.

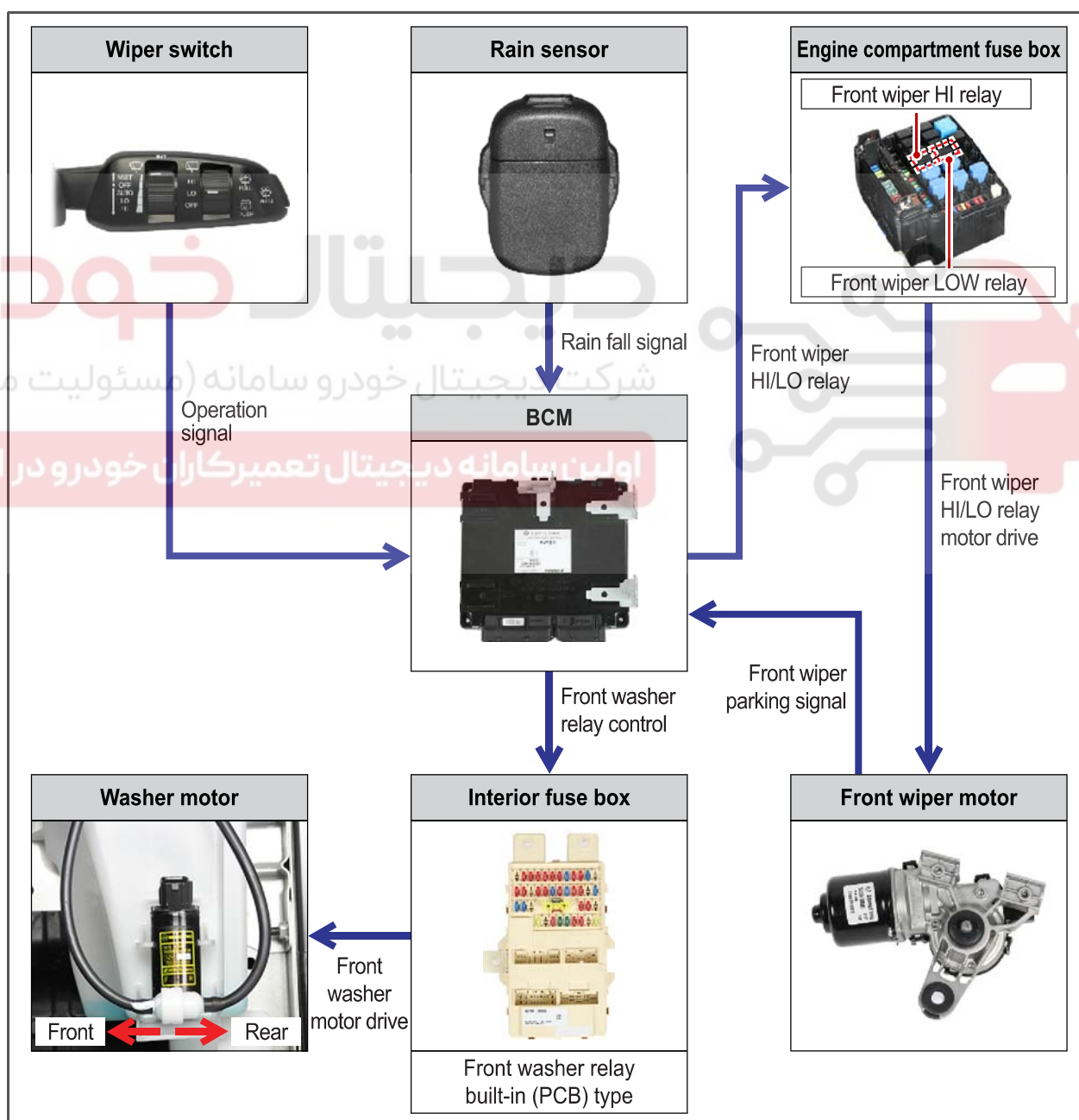


## OVERVIEW AND OPERATING PROCESS

### 1. OVERVIEW

#### 1) Windshield Wiper System

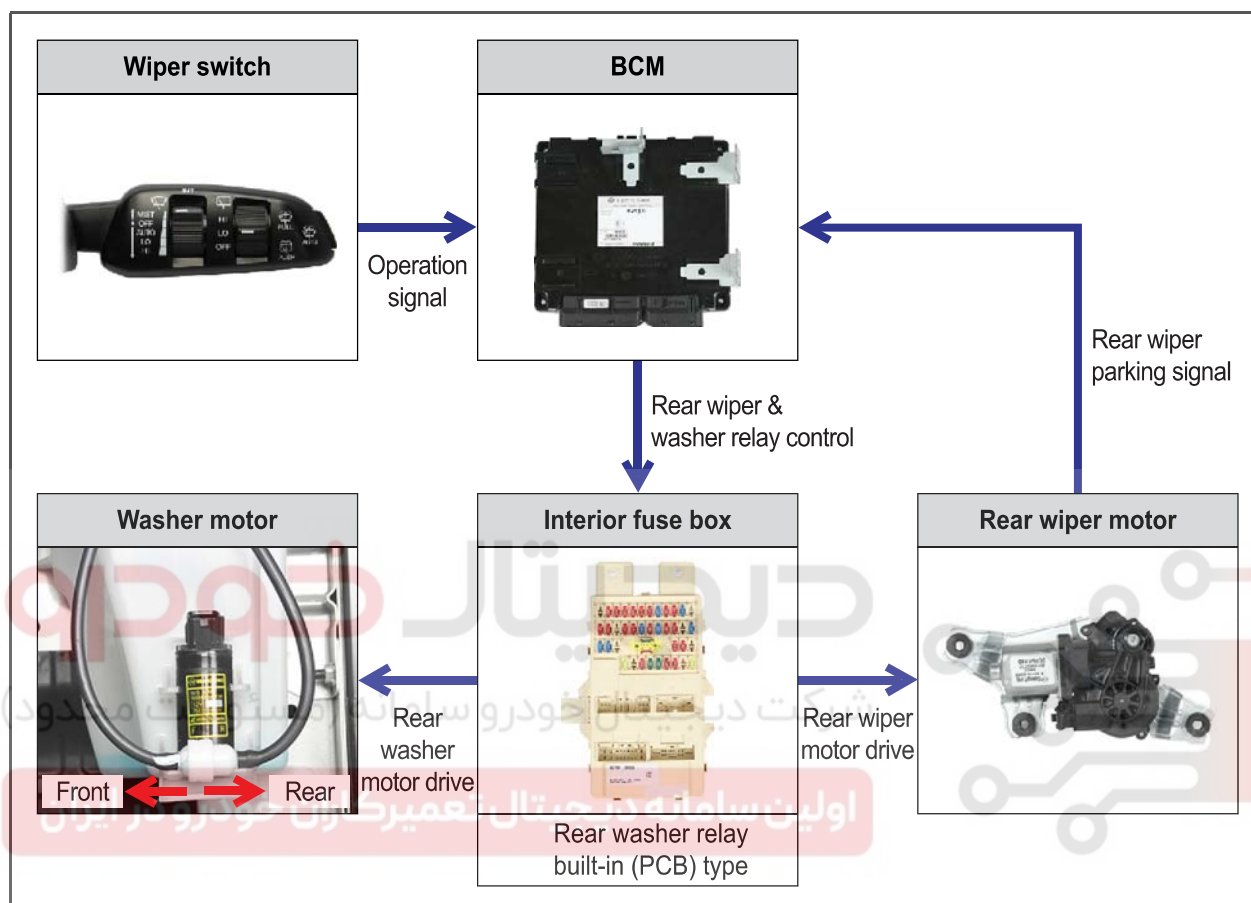
The wiper and rain sensor system consists of the wiper switch, windshield wiper motor and linkage, wiper arm and blade, rain sensor, wiper relay (LO/HI) and washer tank. The rain sensor does not directly operate the rain sensing wiper and it sends only the data of the rainfall to the BCM. The basic operation of the wiper and washer is controlled by the BCM according to the signals from the multifunction switch operation (MIST, AUTO, LO/HI, washer, sensitivity adjustment).



Modification basis	
Application basis	
Approval basis	

## 2) Rear Wiper System

The rear wiper system consists of the wiper switch, rear wiper motor, wiper arm and blade, rear wiper relay. The basic operation of the wiper and washer is controlled by the BCM according to the signals from the multifunction switch operation (LO/HI, washer).



### 3) Rain Sensor System

In the rain sensing wiper operation system, the rain sensing unit only sends the information about the amount of rain drops to the BCM, and it does not operate the wiper directly. The wiper and washer are controlled by the BCM according to the driver's choice.

AUTO light and rain sensor module	AUTO operation and sensitivity control
	
<p>This sensor emits infrared rays through LED and then detects the amount of rain drops by receiving the rays reflected off the sensing section (rain sensor mounting section on the windshield) with photodiode.</p>	<p><b>AUTO:</b> Wiper operates automatically by rain sensor</p> <p><b>FAST &lt;—&gt; SLOW:</b> Auto delay/auto speed control.</p> <p>timberlake96: A position that can control the sensitivity for the amount of rains on the windshield and transmit the wiping request signal accordingly.</p>

BCM	Rain sensor unit
	

#### ► BCM اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

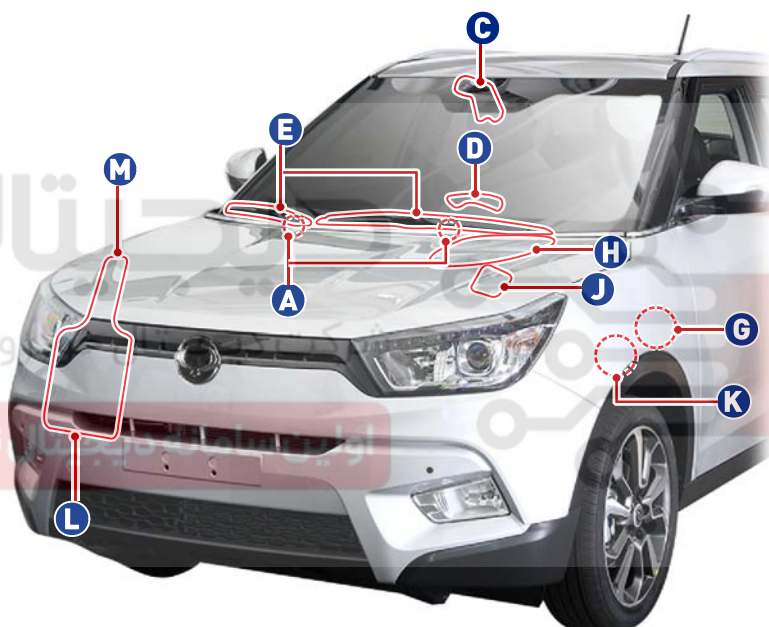
The rain sensor detects the amount of rain drops and sends the operating request signal to the BCM, which drives the wiper directly. At this moment, the BCM also sends the information on whether the wiper is in operation mode or whether the multifunction wiper switch is in AUTO position to the rain sensor.







Modification basis	
Application basis	
Application basis	

## 2. COMPONENTS

Washer nozzle		
A	Front	B Rear
With spoiler		Without spoiler
		
		

C	Rain sensor unit
	
D	Wiper switch
	



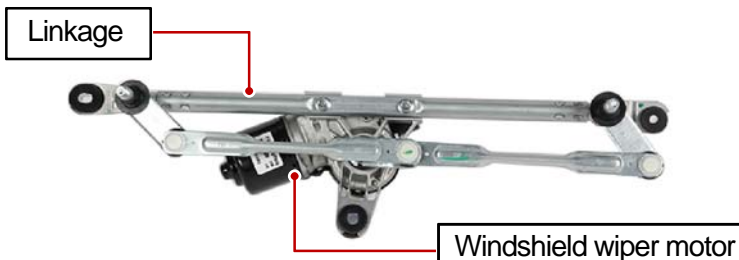
Wiper arm and blade	
E	F
Front	Rear
Wiper arm	
	
	
	
	
Wiper blade	
Wiper arm	
	
	
Wiper blade	



**G** Interior fuse box



**H** Windshield wiper motor and linkage assembly



**I** Rear wiper motor



**J** Wiper (HI, LO) relay



**M** Washer fluid reservoir tank



**L** Windshield/rear washer motor



**K** BCM



Modification basis	
Application basis	
Accessories	

### 3. OPERATING PROCESS

#### 1) Multifunction Wiper Switch Operation Mode



##### 1. MIST

- When the wiper switch is pushed up to the mist position, the windshield wipers cycle once and then stop in the parking position.

##### 2. OFF

- Stops the windshield wiper operation.

##### 3. AUTO

- When the wiper switch is set to the AUTO position, the wiper speed is adjusted automatically according to the amount of rain detected by the rain sensor mounted on the windshield.

##### 4. LO/HI

- When the wiper switch is set to the LO position, the wiper speed is decreased. When the switch is set to the HI position, the wiper speed is increased.

##### 5. Front wiper volume sensitivity switch

- When the wiper switch is in AUTO position, the wiper speed can be adjusted as follows:
  - \* FAST: increases wiper speed
  - \* SLOW: decreases wiper speed

##### 6. AUTO washer switch

- When the AUTO washer switch is pressed, the washer fluid is sprayed once and the wiper cycles 4 times. Then, the fluid is sprayed once again with 3 cycles of the wiper.

##### 7. Rear wiper switch

- Operates the rear wiper.

##### 8. Pull

- The windshield washer fluid is sprayed out and front wiper operates only when the switch is being pulled.

##### 9. Push

- The rear washer fluid is sprayed out and rear wiper operates only when the switch is being pressed down.

## Memo

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## 2) BCM Operation Mode

### (1) Windshield washer switch coupled windshield wiper operation

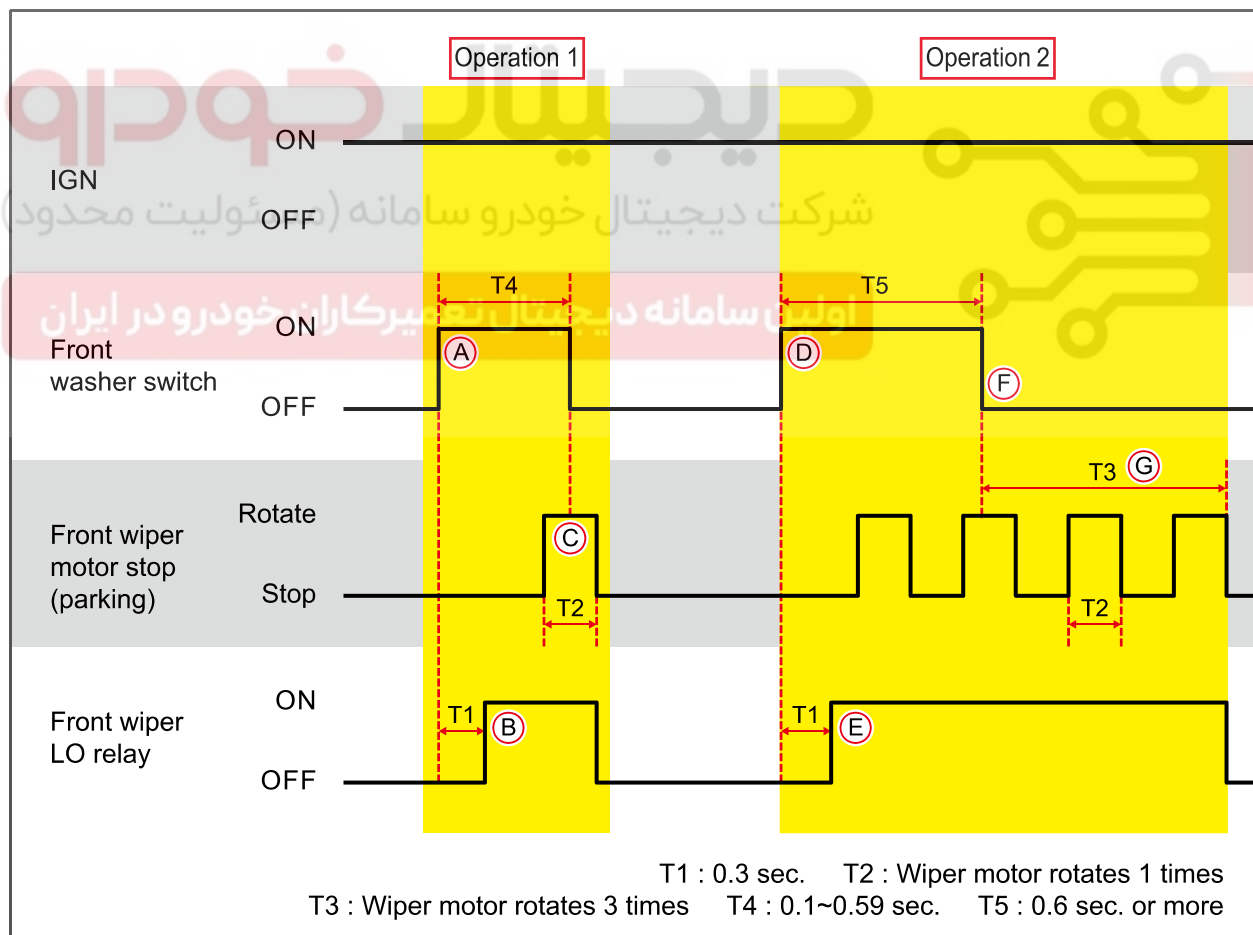
Basic condition	IGN ON
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**Operation 1.** (windshield washer switch pulled for 0.1 to 0.59 sec.)

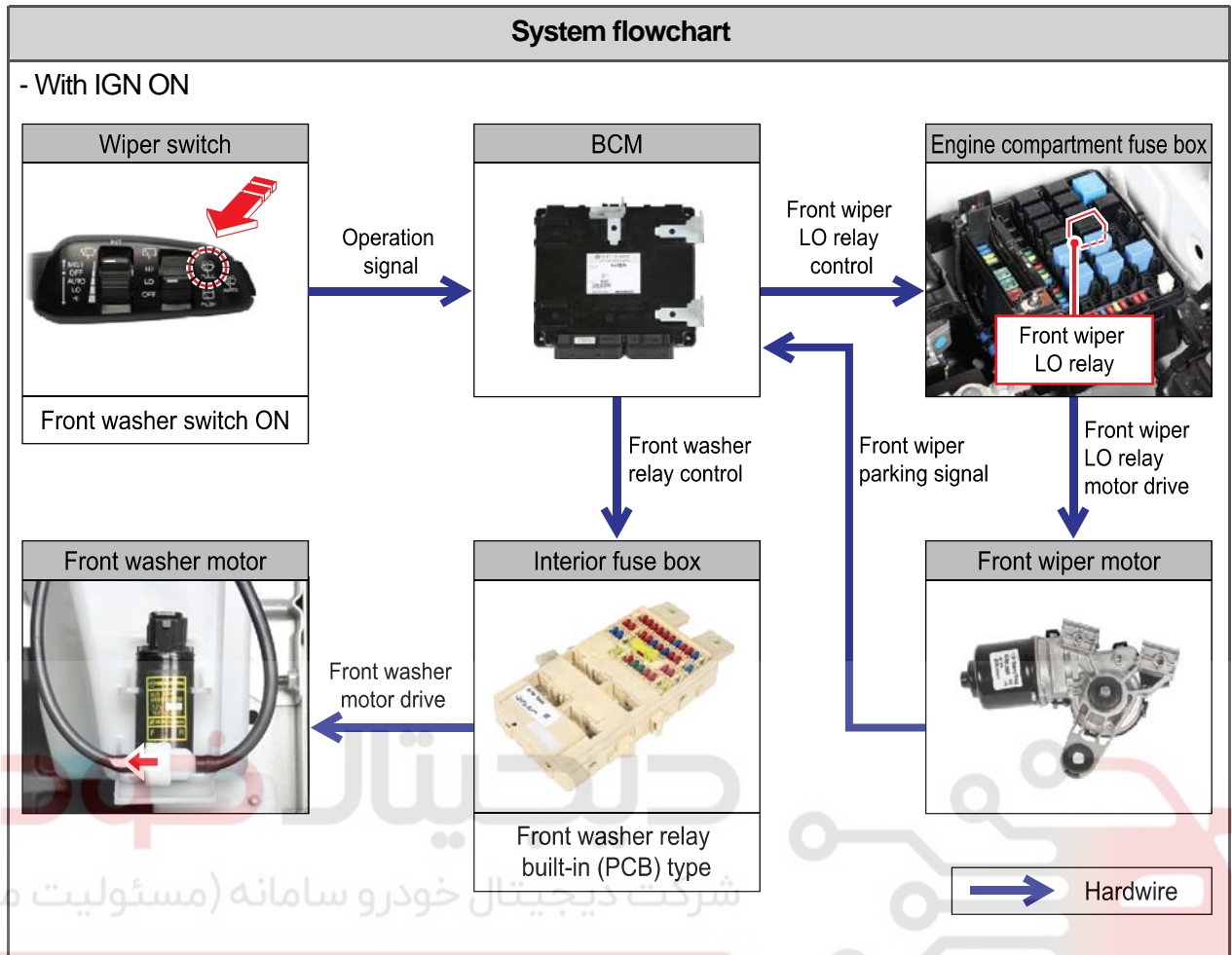
- A. Windshield washer switch ON for 0.1 to 0.59 sec. (T4)
- B. After 0.3 sec. (T1), windshield wiper LO relay is activated.
- C. Windshield wiper LO relay is deactivated after windshield wiper motor rotates 1 turn (T2).

**Operation 2.** (windshield washer switch pulled for 0.6 seconds or more)

- D. Windshield washer switch is ON for more than 0.6 sec. (T5)
- E. After 0.3 sec. (T1), windshield wiper LO relay is activated.
- F. Windshield washer switch is OFF.
- G. Windshield wiper LO relay is deactivated after windshield wiper motor rotates 3 turns (T3).







FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

WIPER AND

AVN

MP3 AUDIO

LCD AUDIO

ISG SYSTEM

Modification basis	
Application basis	
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WIPER AND WASHER SYSTEM

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## (2) Windshield washer switch coupled wiper operation during intermittent wiper operation

### Basic condition

- Windshield intermittent wiper operates with IGN ON and wiper AUTO switch in ON position.

### Operation 1. (windshield washer switch pulled for 0.1 to 0.59 sec.)

- A. Windshield washer switch is ON for 0.1 to 0.59 sec. (T2)
- B. After 0.5 sec. (T1), windshield wiper LO relay is activated.
- C. Windshield wiper LO relay is deactivated after windshield wiper motor rotates 1 turn (T5).
- D. Intermittent wiper operation is started by windshield wiper LO relay after rest time (T6).

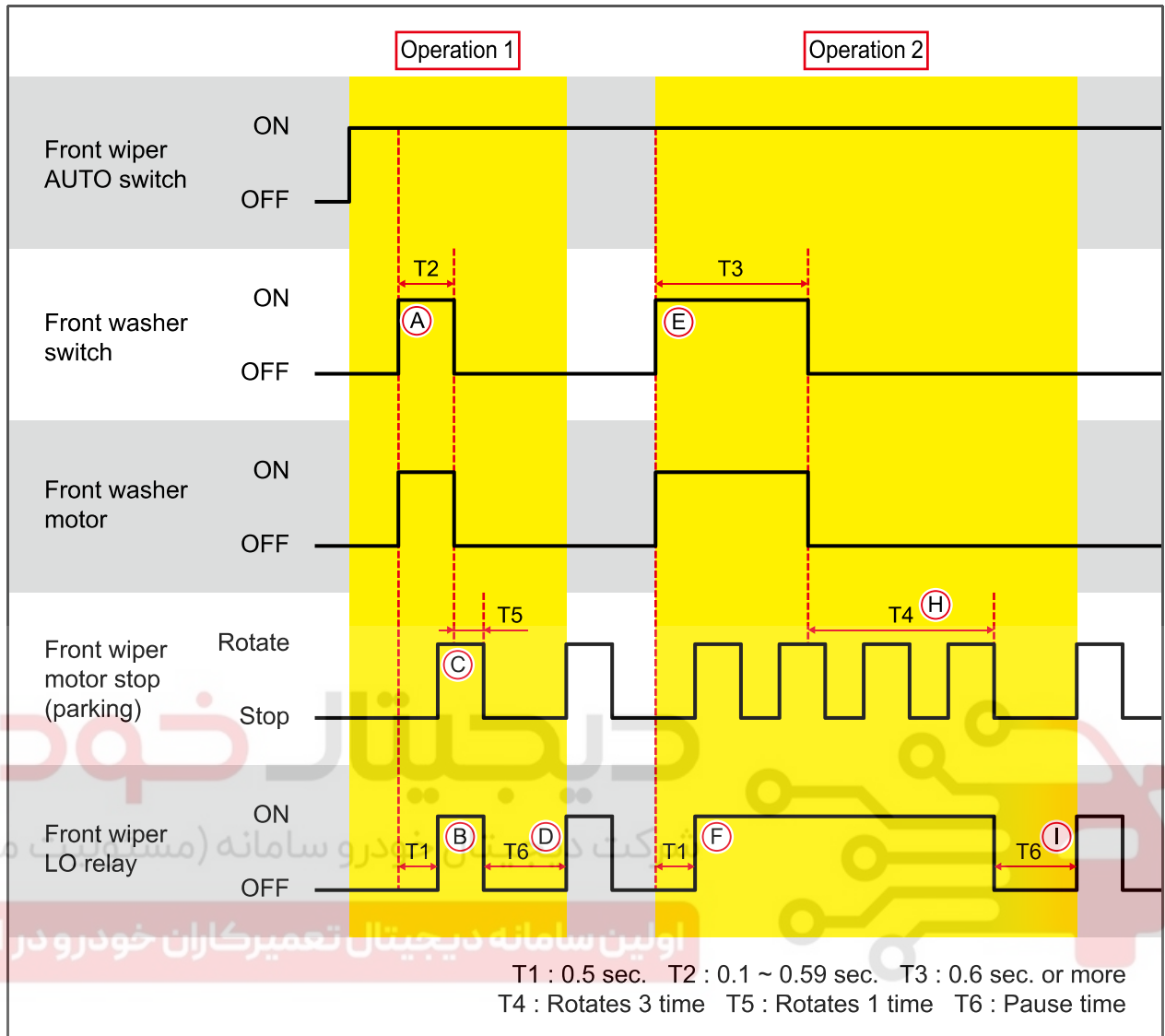
### Operation 2. (windshield washer switch pulled for 0.6 seconds or more)

- E. Windshield washer switch is ON for 0.6 (T3) seconds or more.
- F. After 0.5 sec. (T1), windshield wiper LO relay is activated.
- G. Windshield washer switch is OFF.
- H. Windshield wiper LO relay is deactivated after windshield wiper motor rotates 3 turns (T4).
- I. Intermittent wiper operation is started by windshield wiper LO relay after rest time (T6).

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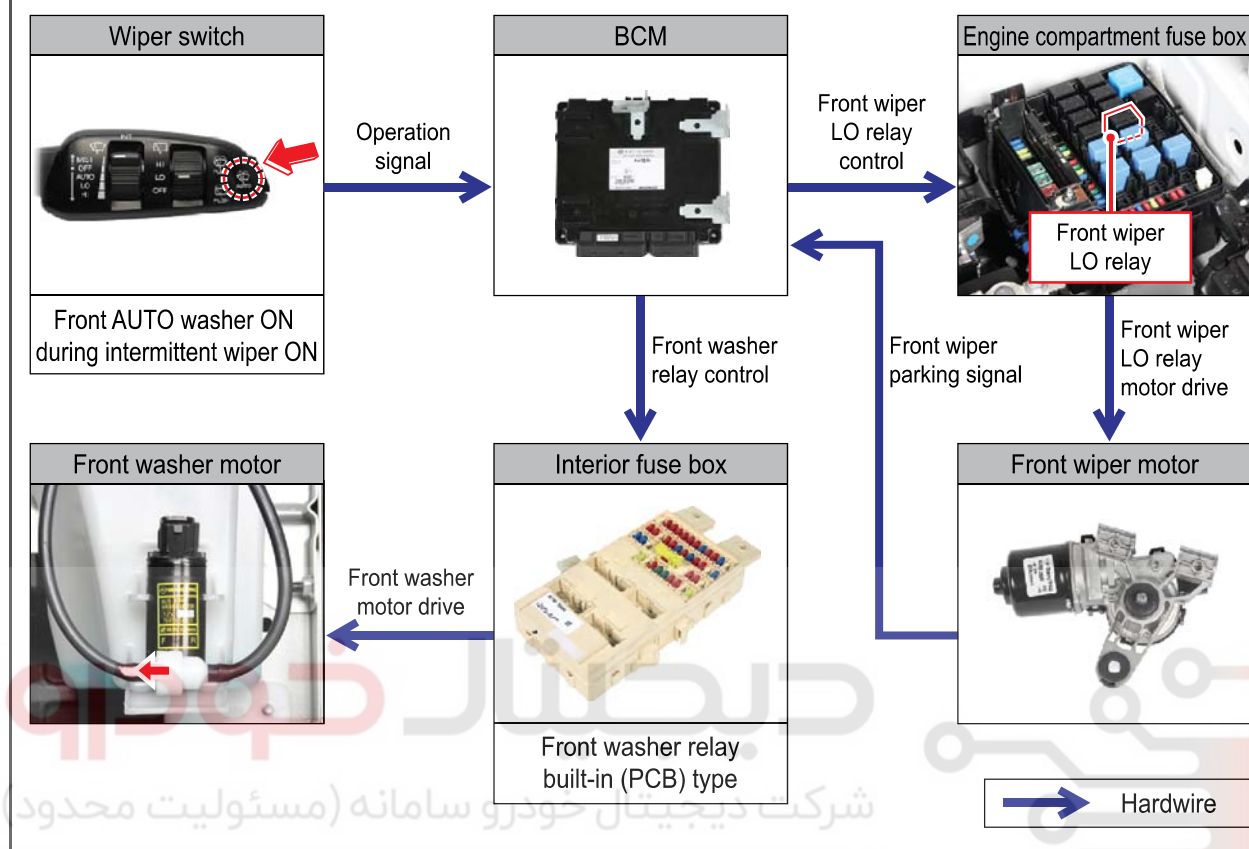




Modification basis	
Application basis	
Approved by	

## System flowchart

- With IGN ON and Wiper auto switch ON



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Modification basis	
Application basis	
Affected VIN	021 62 99 92 92

### (3) Windshield auto washer switch coupled windshield wiper operation

#### Operation 1.

- A. With IGN ON and windshield wiper auto switch is OFF.
- B. Windshield auto washer switch is ON for 0.1 seconds or more (T1) and windshield washer motor is ON for 2.0 seconds (T2).
- C. The windshield wiper LO relay is operated 4 times (T5) 0.5 seconds (T4) after the windshield washer motor has been activated.
- D. Windshield washer motor is activated for 1.5 seconds (T3) and the windshield wiper LO relay is deactivated after 3 times (T6) of operation.



#### NOTE

- Input from windshield auto washer is overridden during windshield washer motor operation.
- The second input from windshield auto washer is overridden during windshield auto washer linked windshield wiper operation.
- Input from windshield auto washer is overridden during speed sensitive intermittent wiper operation.
- When ON signal of windshield intermittent wiper switch is received during windshield auto washer operation, windshield auto washer stops operation and windshield intermittent wiper operation starts.
- Input from windshield washer switch is overridden during windshield auto washer operation.

FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

WIPER AND

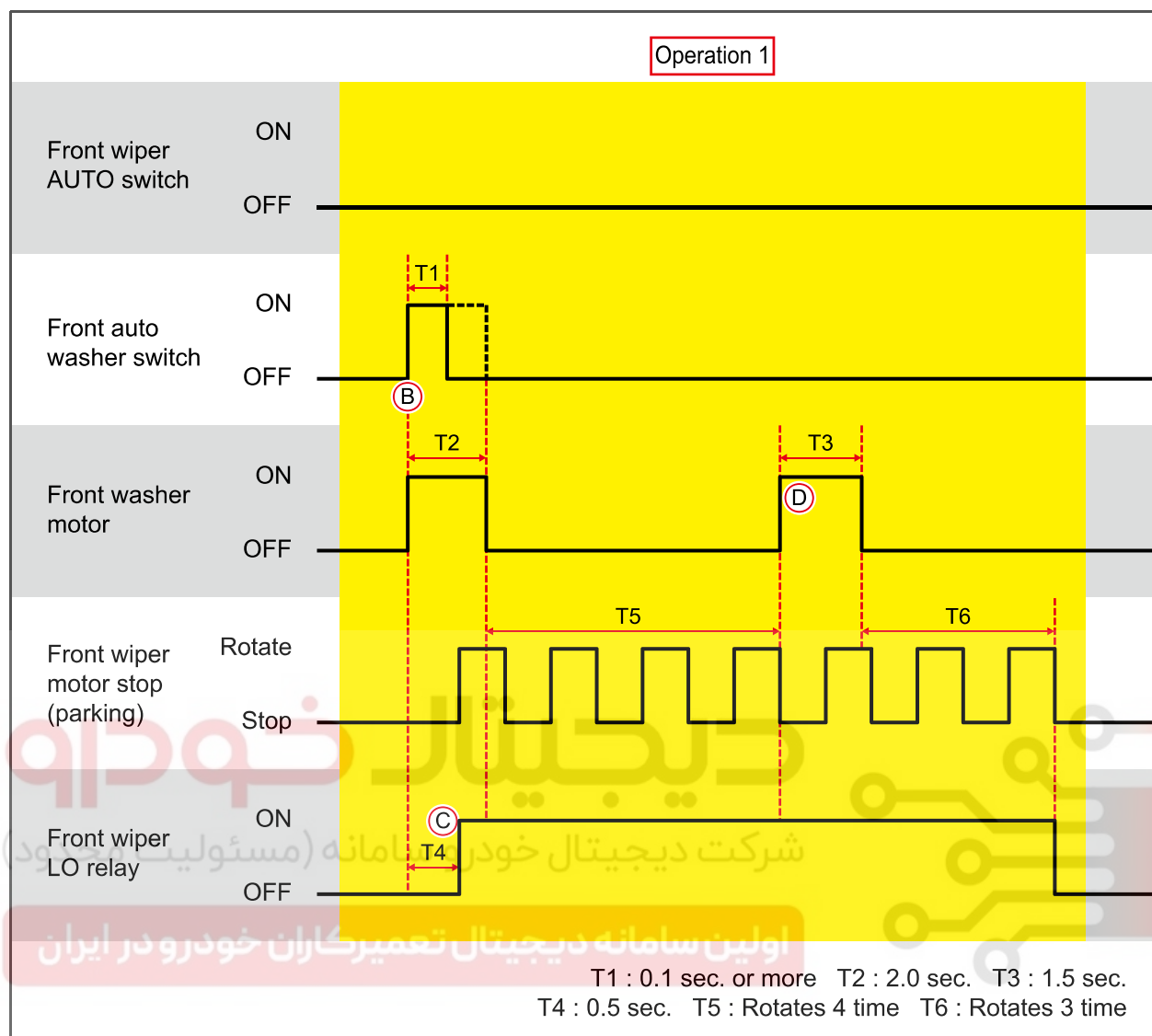
AVN

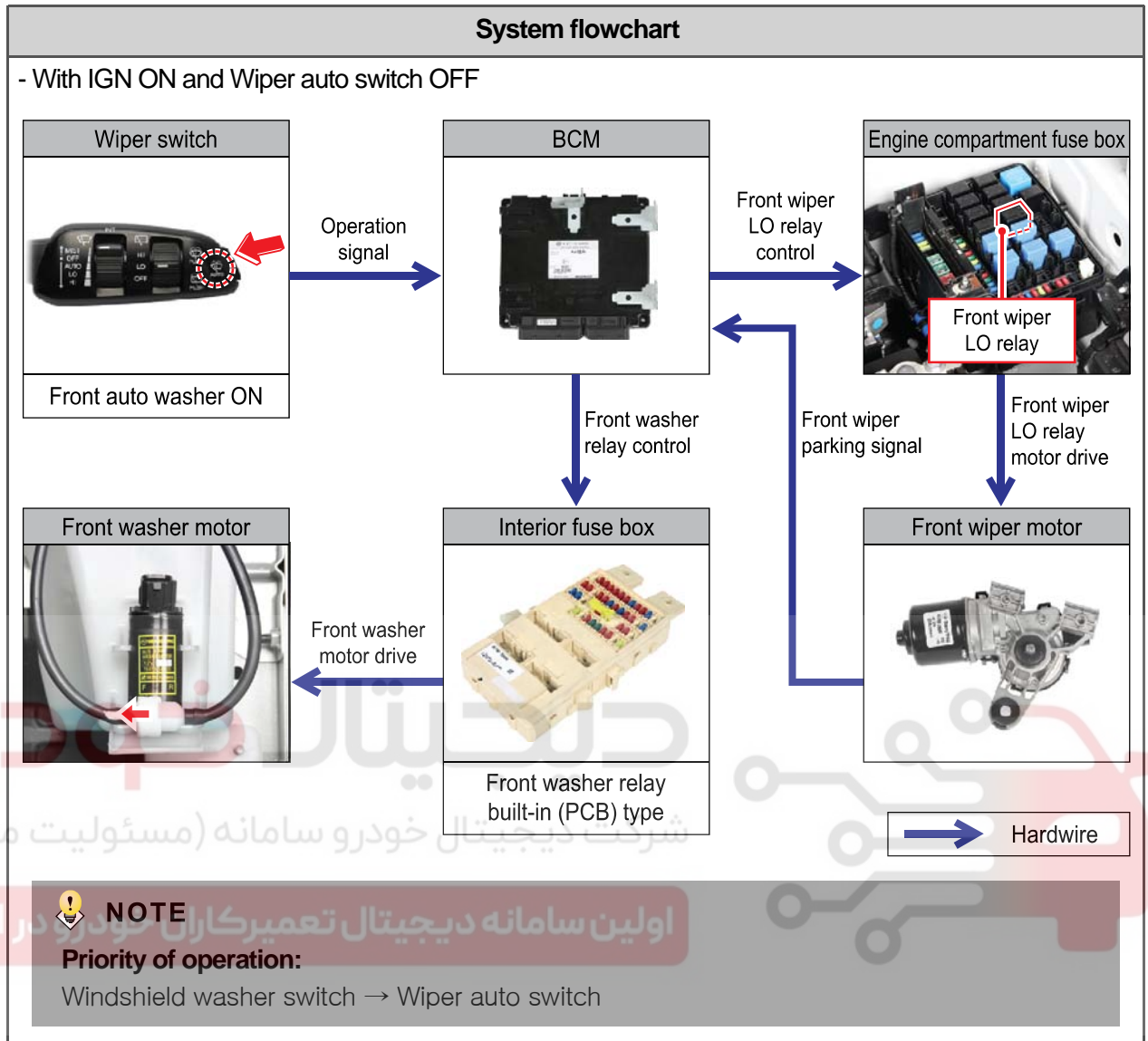
MP3 AUDIO

LCD AUDIO

ISG SYSTEM

Modification basis	
Application basis	
Approved by	





Modification basis	
Application basis	
Effective date	

**(4) Rear wiper operation**

<b>Basic condition</b>	IGN ON
------------------------	--------

**Operation 1.** (Rear wiper switch)

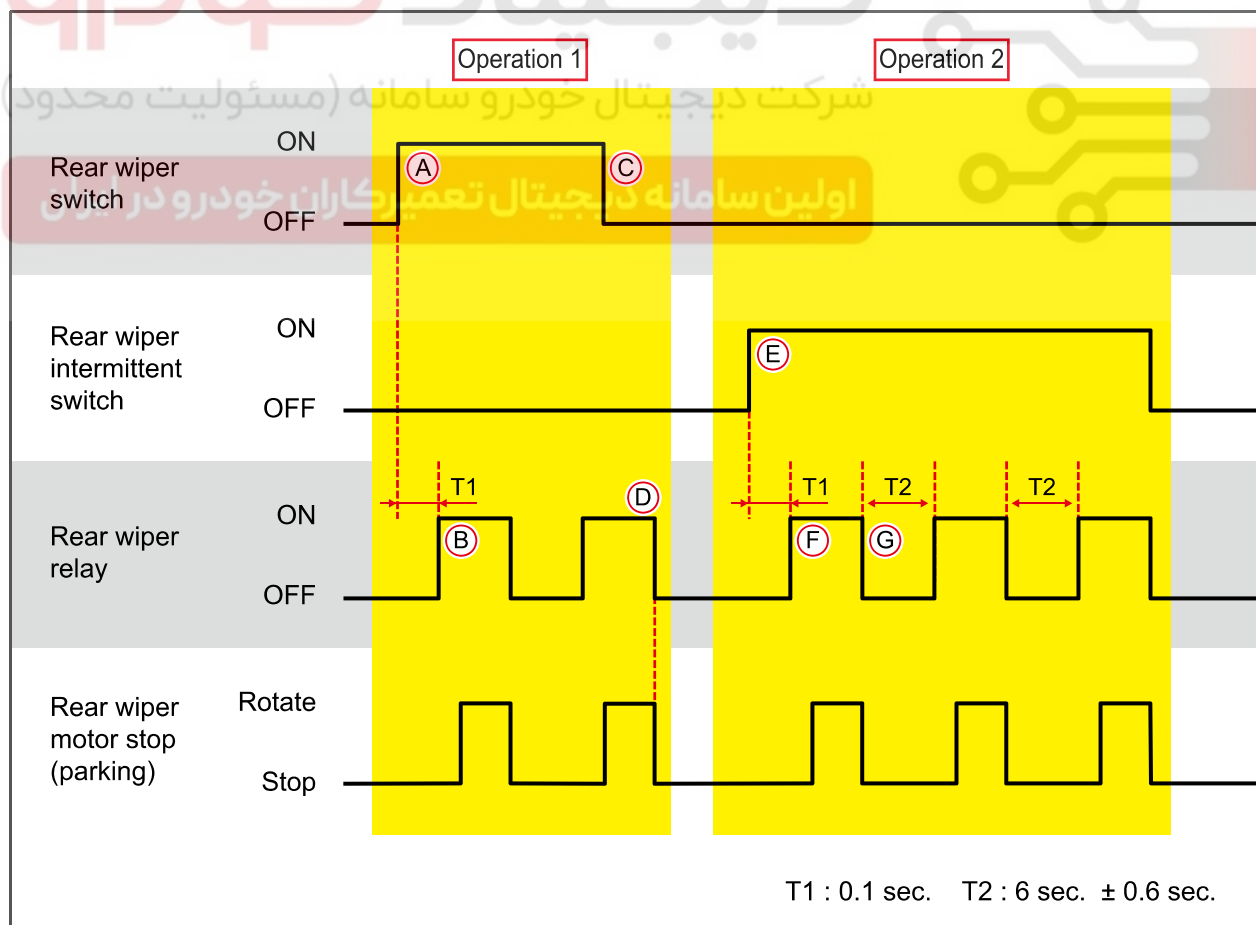
- A. Rear wiper switch is ON.
- B. After 0.1 sec. (T1), rear wiper relay is activated.
- C. Rear wiper switch is OFF.
- D. Rear wiper relay is deactivated upon receiving rear wiper motor parking signal.

**Operation 2.** (Rear wiper intermittent switch)

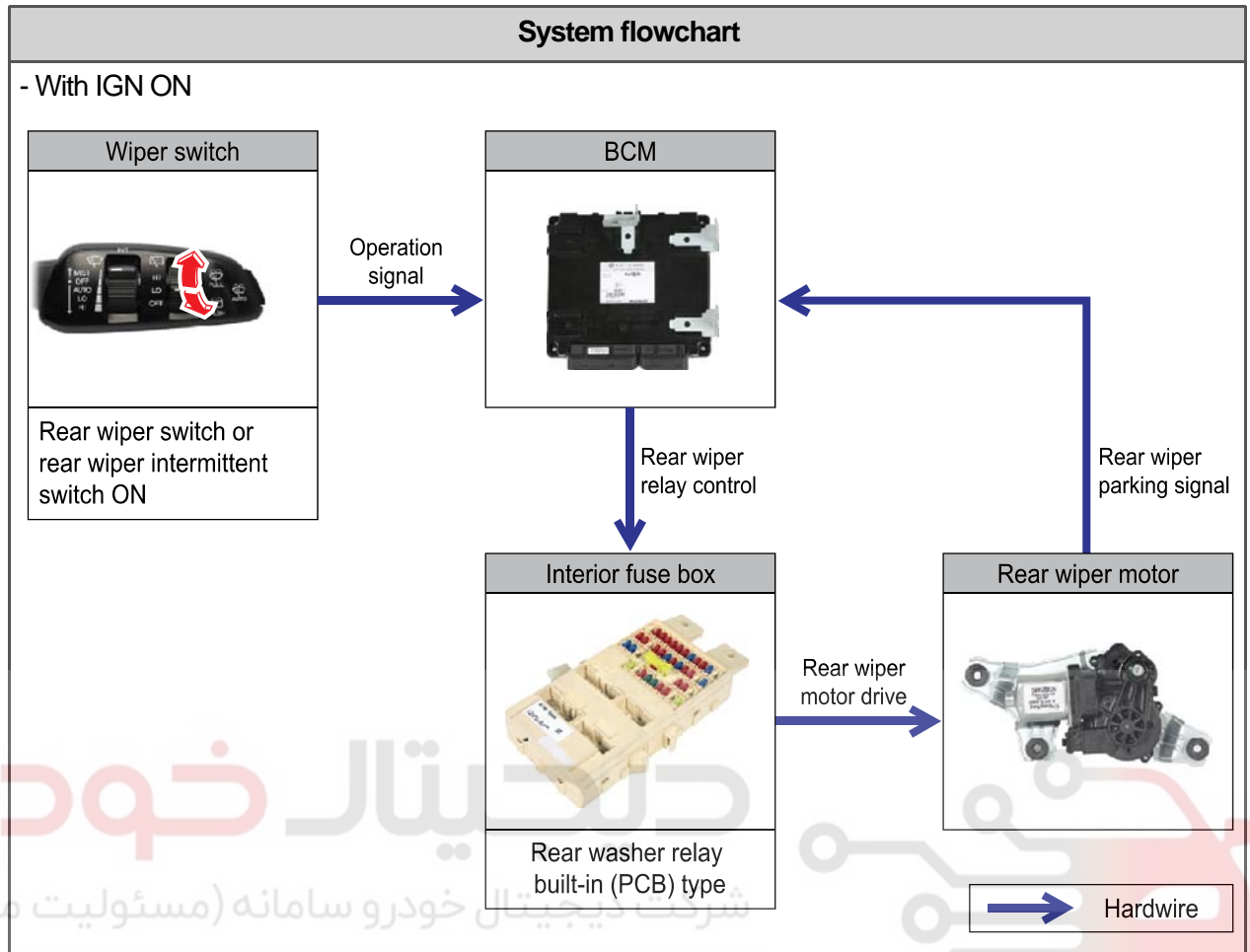
- E. Rear wiper intermittent switch is ON.
- F. After 0.1 sec. (T1), rear wiper relay is activated once.
- G. After 6 sec. (T2) of deactivation, rear wiper relay is activated once again.

**NOTE**

When turning ignition off during the rear wiper operation, the rear wiper operates until the rear wiper motor parking signal is received.







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Modification basis	
Application basis	
Accessories	

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**(5) Rear washer coupled rear wiper operation**

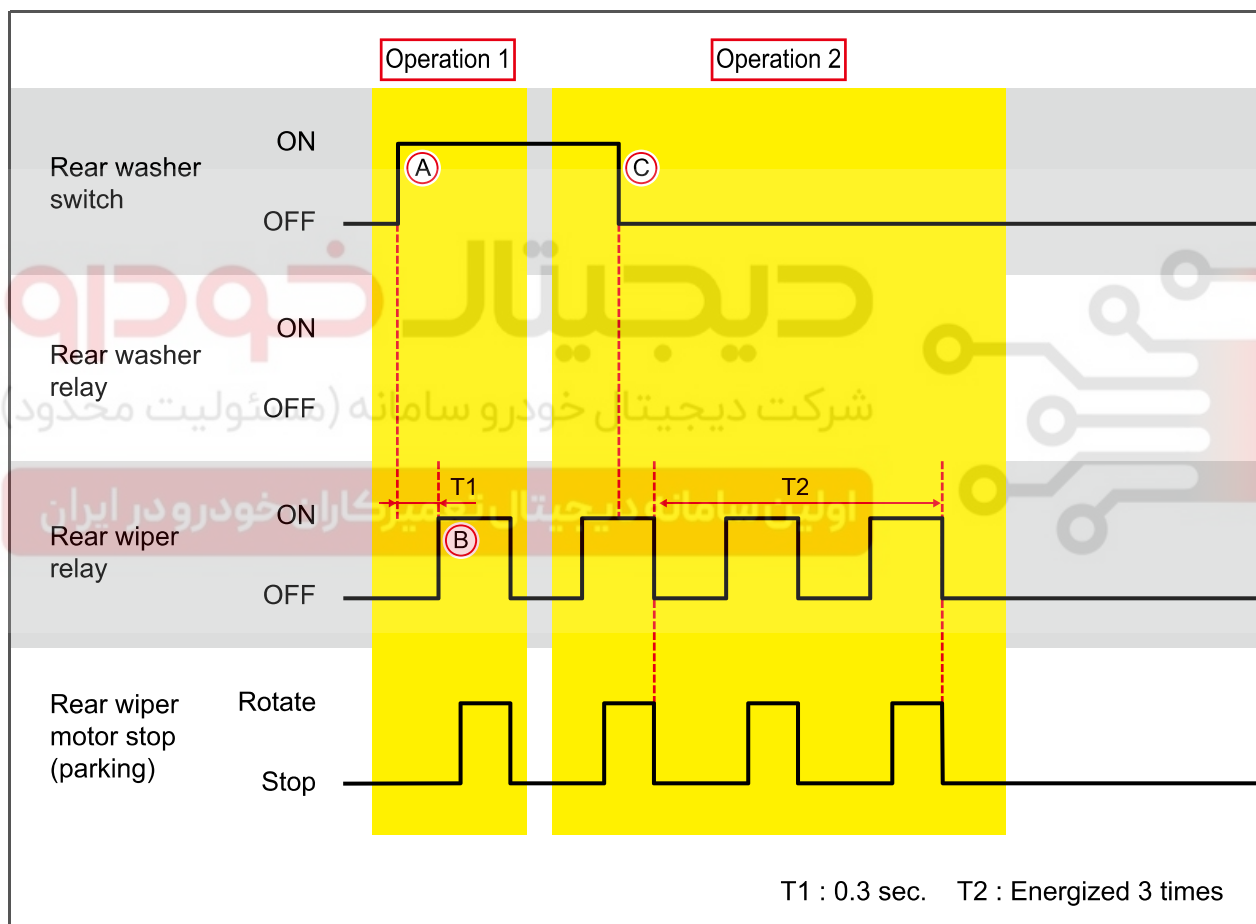
<b>Basic condition</b>	IGN ON
------------------------	--------

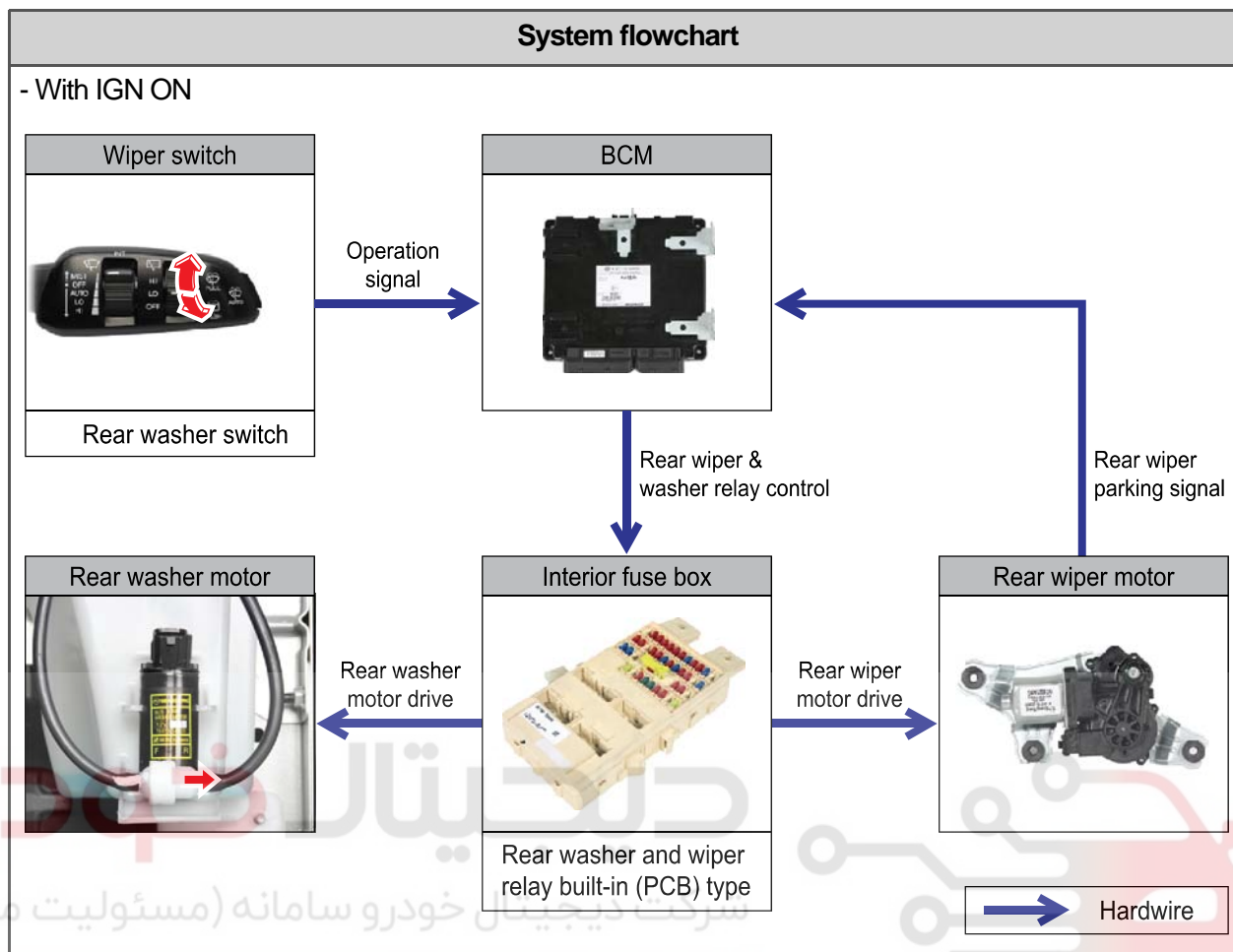
**Operation 1.**

- A. Rear washer relay is ON when rear washer switch is ON.  
 B. After 0.3 sec. (T1), rear wiper relay is ON.

**Operation 2.**

- C. Rear washer motor is turned OFF when rear washer switch is OFF.  
 D. Rear wiper relay cycles 3 times (T2) and stops after rear washer switch is turned off.





FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

WIPER AND

AVN

MP3 AUDIO

LCD AUDIO

ISG SYSTEM

Modification basis	
Application basis	
Life cycle	

WIPER AND WASHER SYSTEM

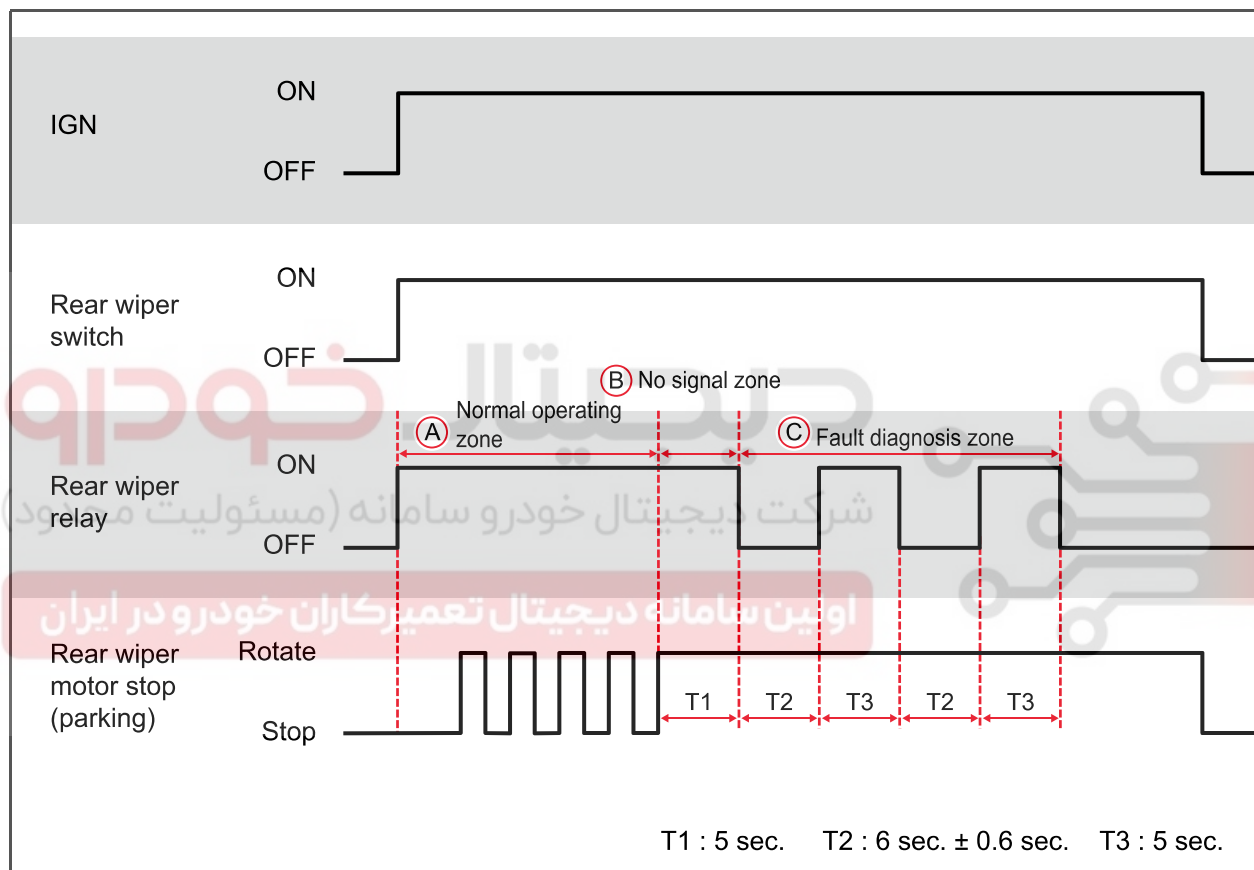
TIVOLI 2015.03

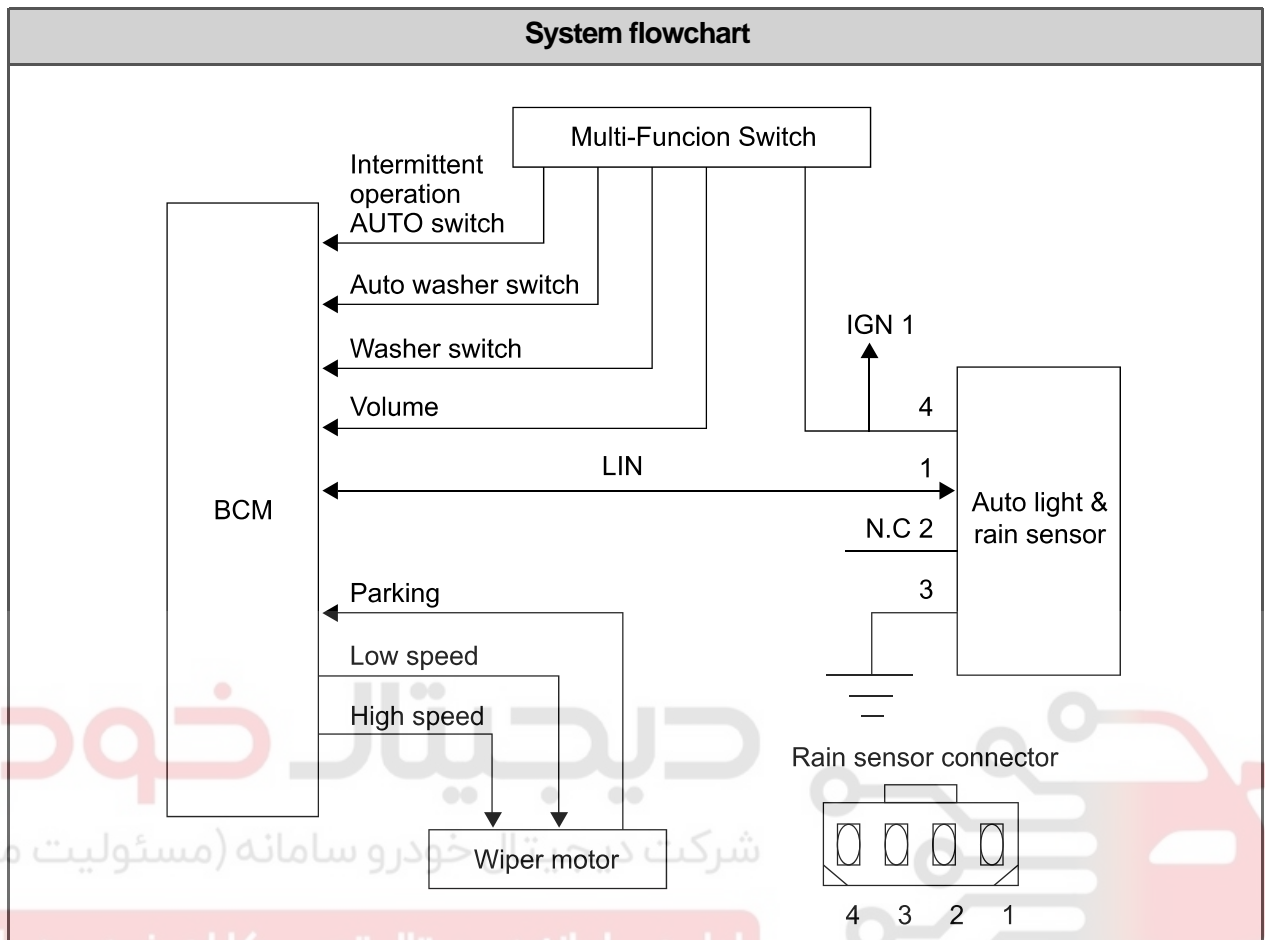
**(6) Rear wiper malfunction indicator**

<b>Basic condition</b>	IGN ON, rear wiper switch and rear wiper intermittent switch are ON.
------------------------	--

**Operation 1.** (DTC set)

- A. Rear wiper is operating normally.
- B. No change in rear wiper motor parking signal for 5 sec. (T3) or longer.
- C. Rear wiper stops after 2 cycles of rear wiper parking for 6 sec. (T2) and rear wiper operating for 5 sec. (T1).



**(7) Rain sensor operation****Data recognition time**

The LIN communication is established when the ignition is turned ON, regardless of the wiper and light switch operation. Then the function for the LIN data is carried out with the wiper AUTO switch or AUTO light switch in the AUTO position.

The data from the rain sensor is recognized as 2 consecutive data.

**Operation when data is recognized**

Data OFF: Lo/Hi relay output OFF.

Low speed signal: LO relay output ON (ON for at least 1 revolution), HI relay output OFF.

High speed signal: HI relay output ON (ON for at least 1 revolution), LO relay output ON.

The washer input is overridden during continuous operation of wiper (washer coupled wiper operation during intermittent operation).

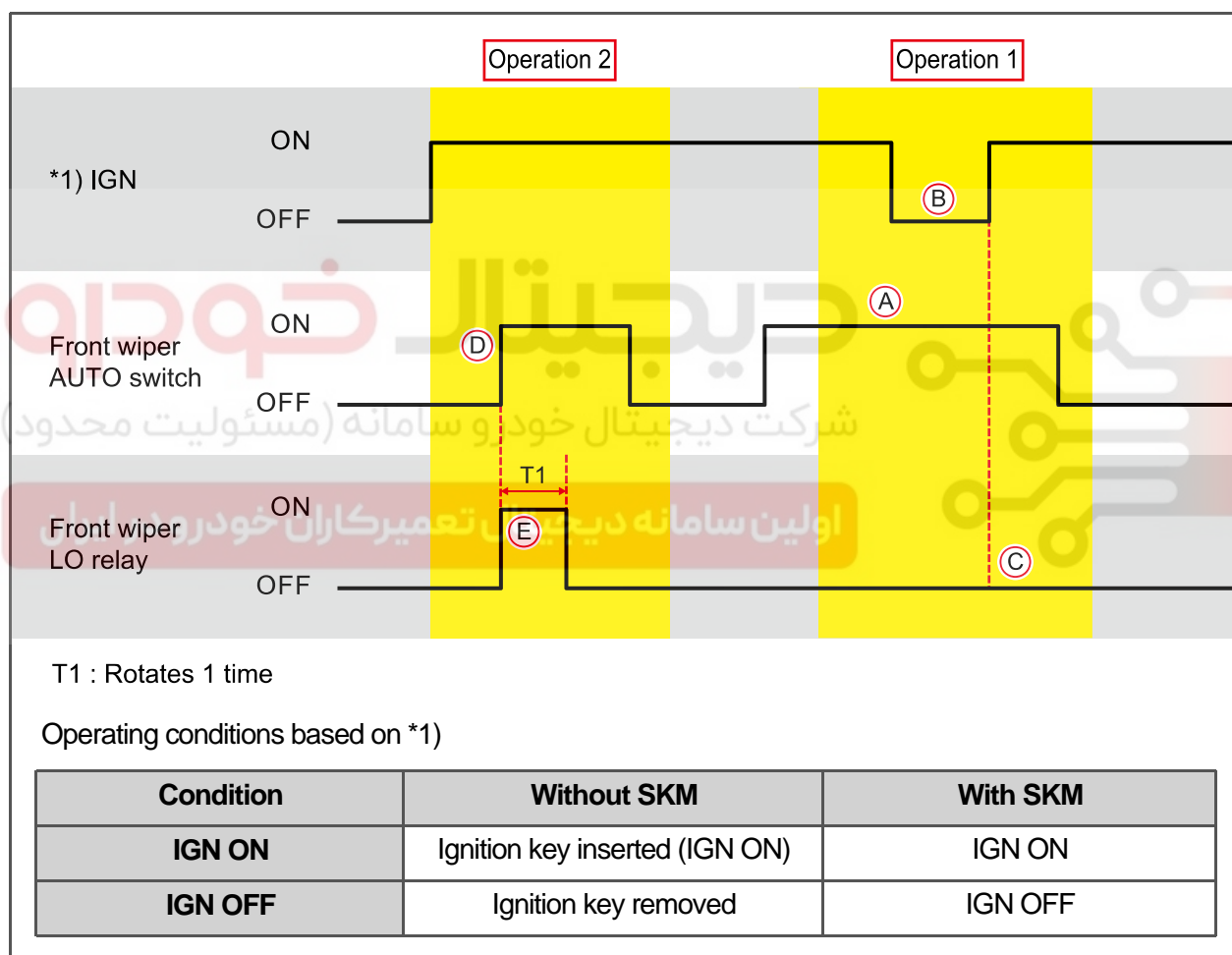
Modification basis	
Application basis	
Effect on LIN	

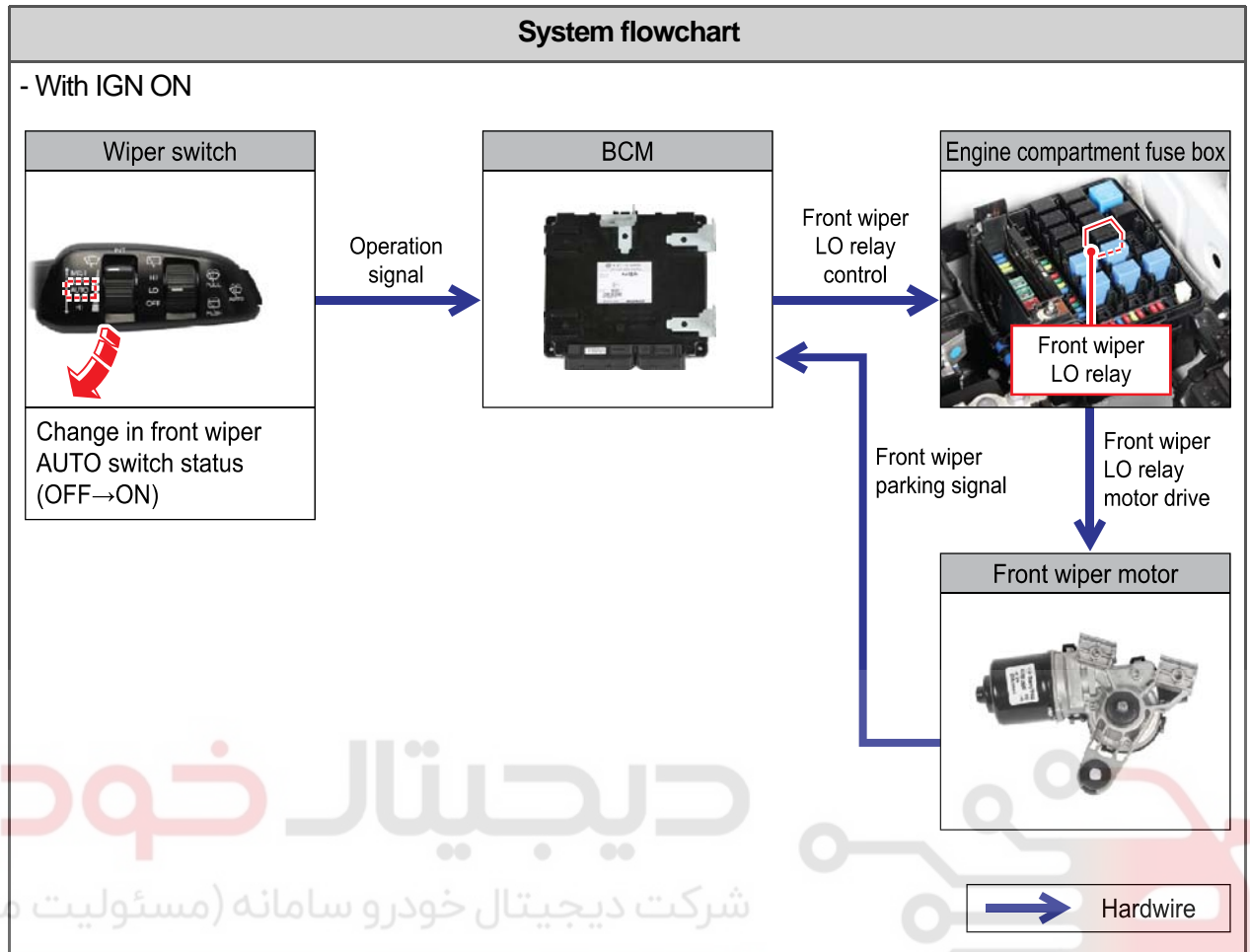
**(8) Power-up reminder wiper****Operation 1.**

- A. Windshield wiper auto switch is ON.
- B. Ignition key is cycled (ON → OFF → ON).
- C. Windshield wiper LO relay is not operated.

**Operation 2.**

- D. With IGN ON, windshield wiper auto switch is turned from OFF to ON.
- E. Windshield wiper LO relay is activated, and windshield wiper motor rotates once (T1) and then stops.





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Modification basis	
Application basis	
Life cycle	

**(9) Washer switch operation during rain sensor coupled operation****Basic conditions**

Intermittent operation with IGN ON and wiper AUTO switch ON

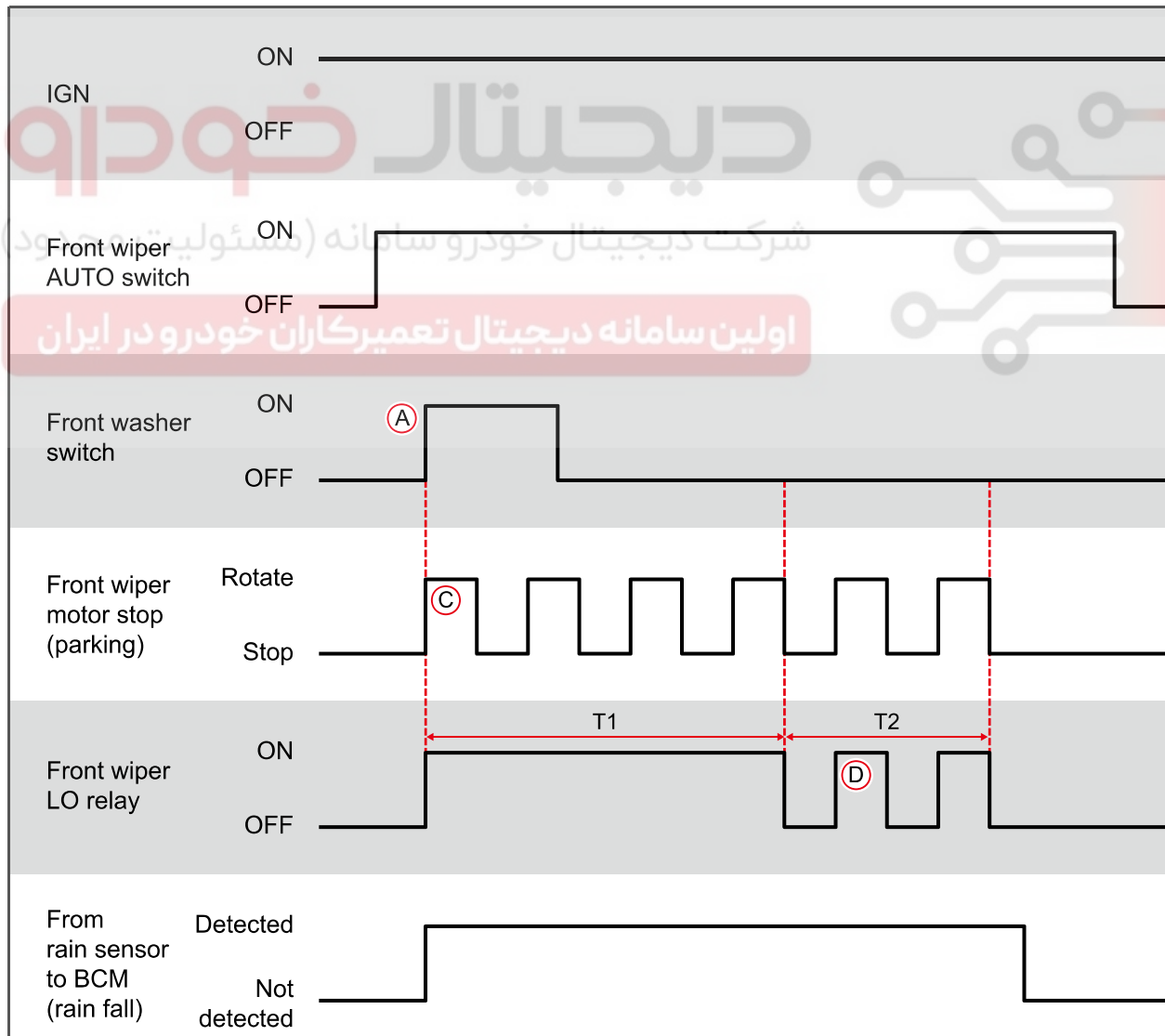
**Operation 1.**

- If rain sensor linked data does not indicate continuous wiper operation

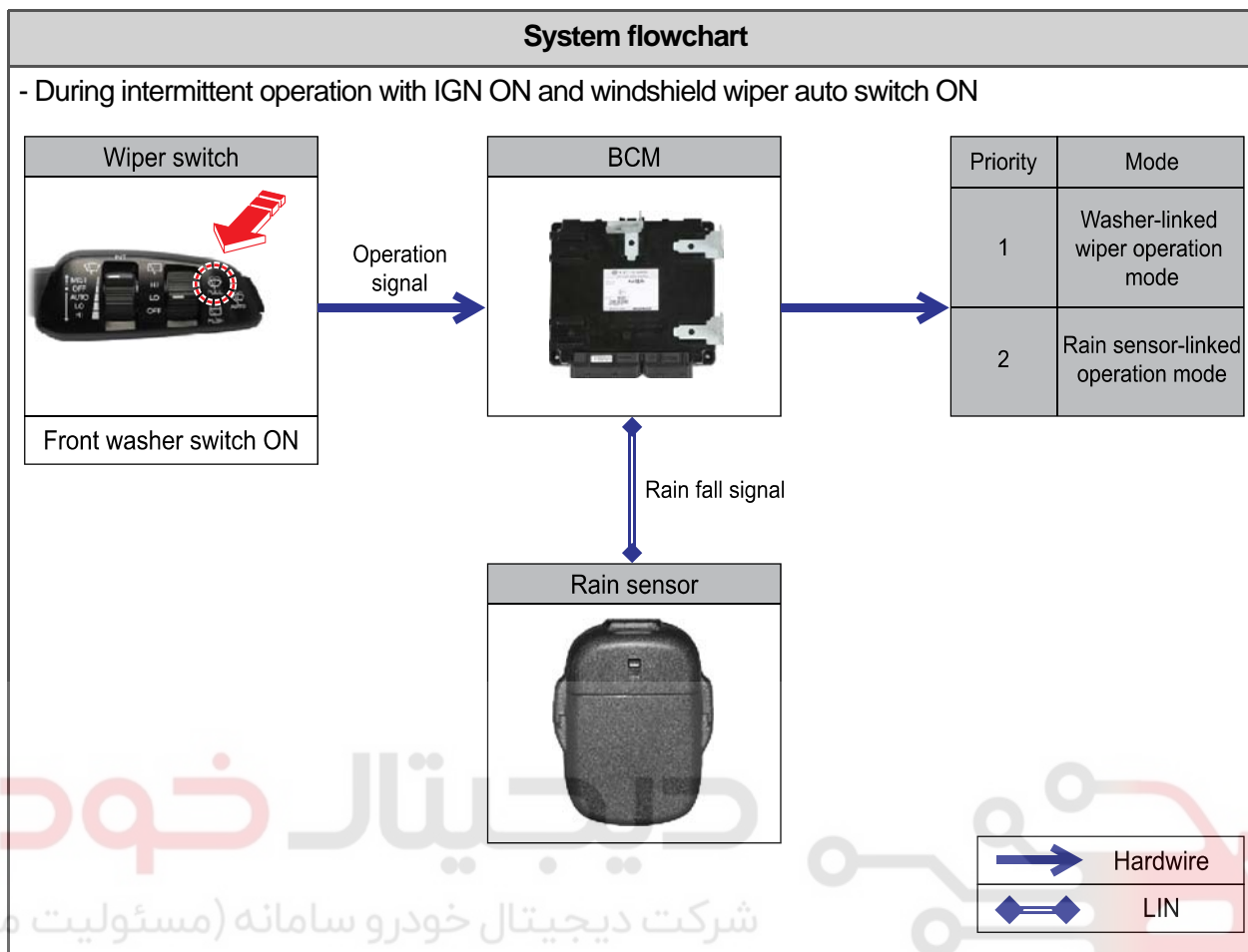
- A. Windshield washer switch is ON.
  - B. Communication with rain sensor is ignored. (can misread washer fluid as rain drops)
  - C. Windshield washer linked wiper operation (T1)
  - D. Rain sensor linked wiper operation (T2) starts after windshield washer linked wiper operation.
- However, if rain sensor linked wiper operation indicates washer linked wiper operation, only the windshield washer relay is activated while the windshield wiper keeps cycling.

**NOTE**

Even when the washer linked wiper operation is activated, the BCM sends the operation data to rain sensor.







Modification basis	
Application basis	
Approved by	

**(10) Wiper sensitivity control****Basic conditions**

IGN ON/Wiper AUTO switch ON/Wiper motor in parking position

**Operation 1.**

– Increasing the sensitivity (ex: sensitivity level 0 → sensitivity level 1)

A. The amount of rain is detected by the rain sensor.

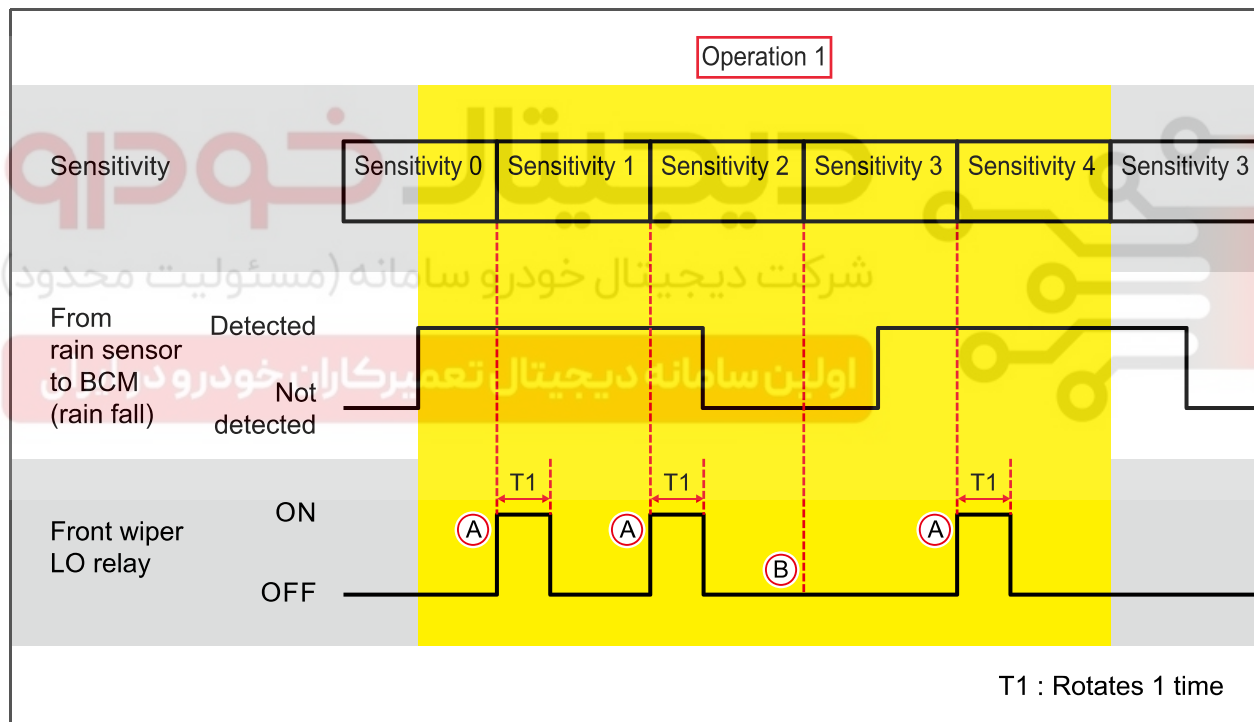
The windshield wiper LO relay is operated once (T1).

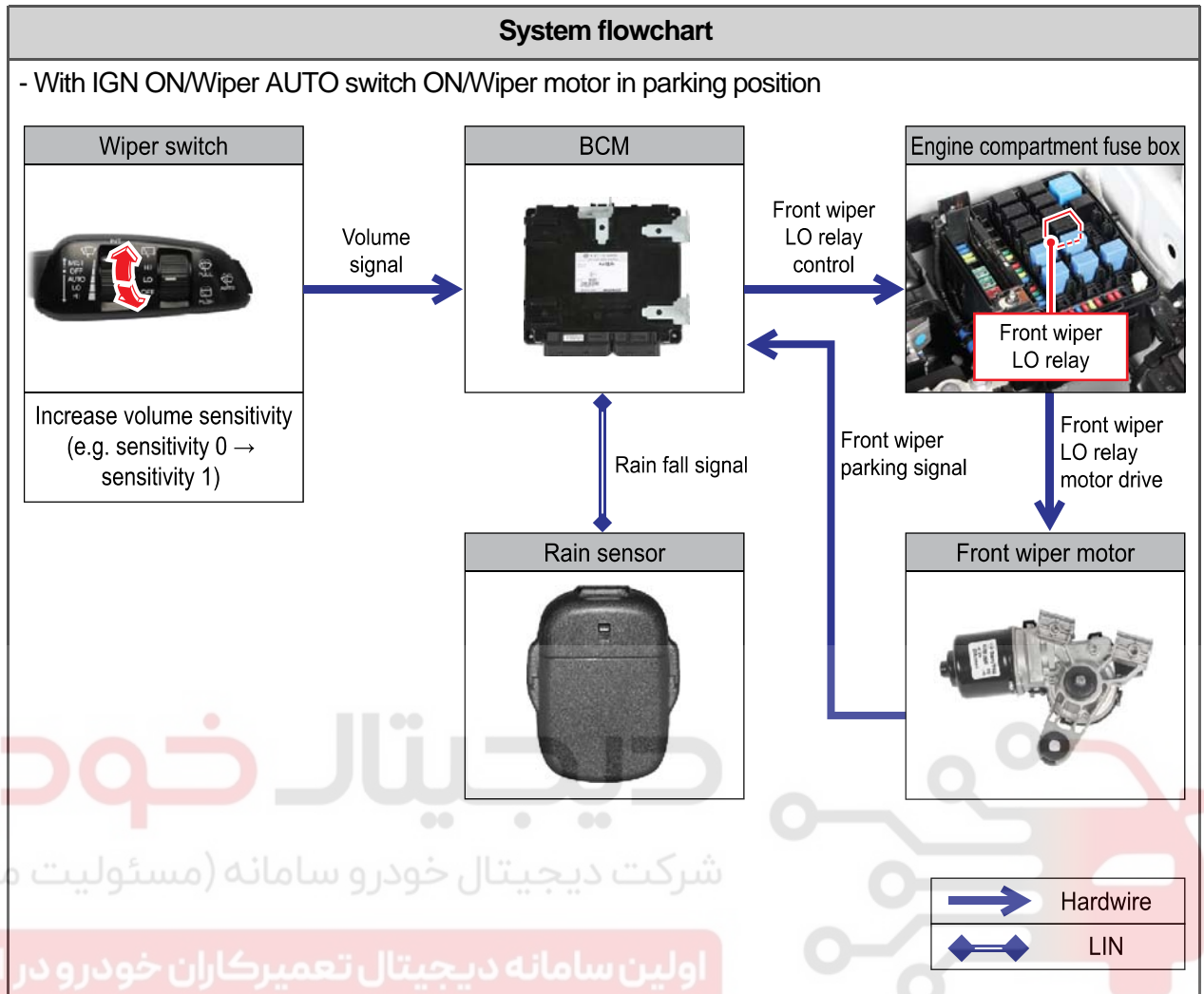
B. The amount of rain is not detected by the rain sensor.

The windshield wiper LO relay is not operated.

**NOTE**

Even if the sensitivity level is changed more than 1 stage within 2 seconds, the windshield wiper motor runs only one cycle.

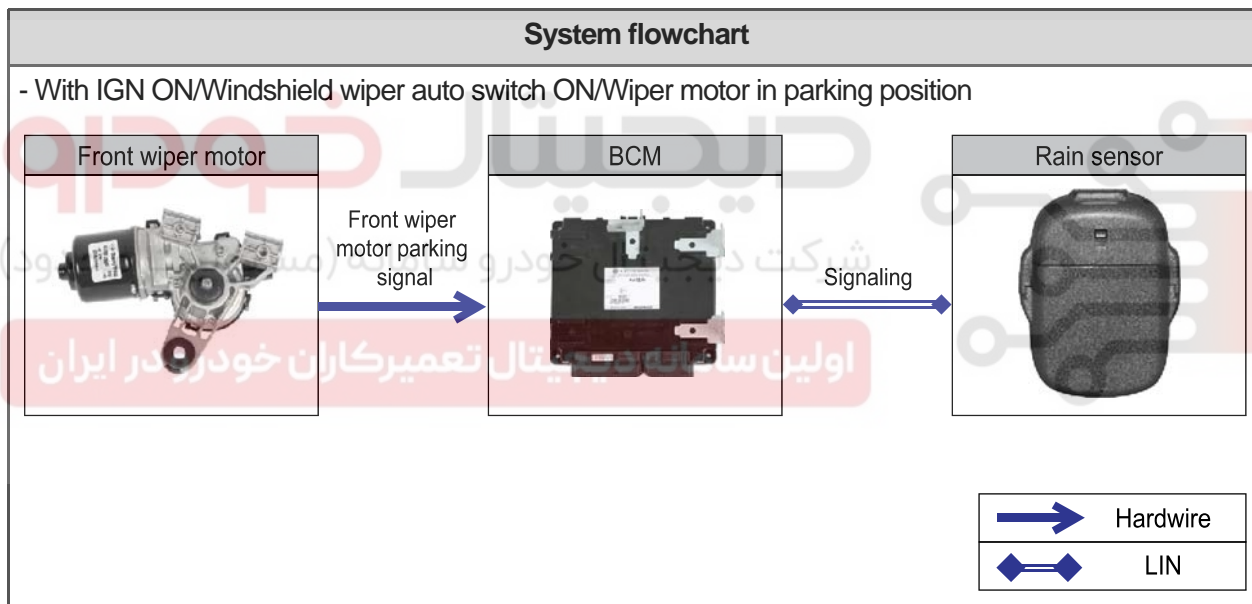
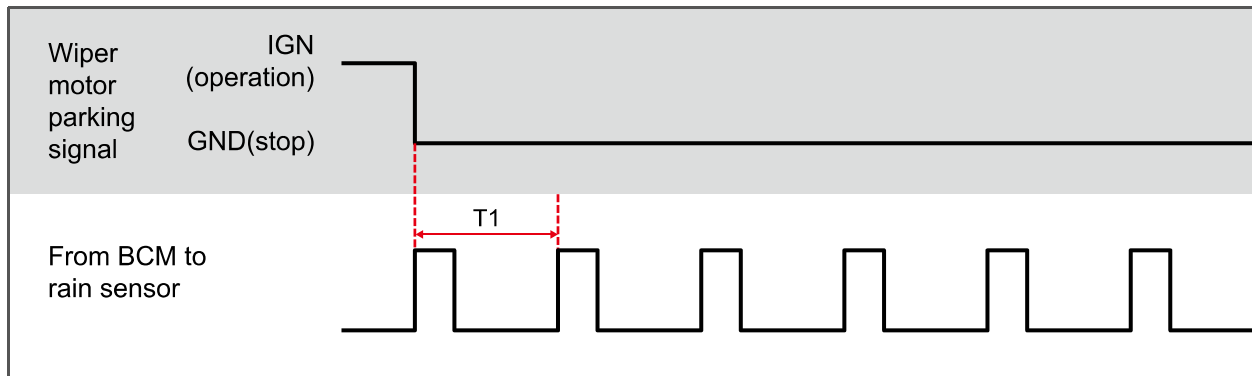




Modification basis	
Application basis	
Life cycle	

**(11) Abnormal wiper parking signal stop (GND)****Operation 1.** (When the wiper motor parking signal stuck at GND)

- A. The wiper system sends the corresponding signal of current status with IGN ON and wiper AUTO switch ON. (The wiper motor is operated only when the request signal from the rain sensor is received.)



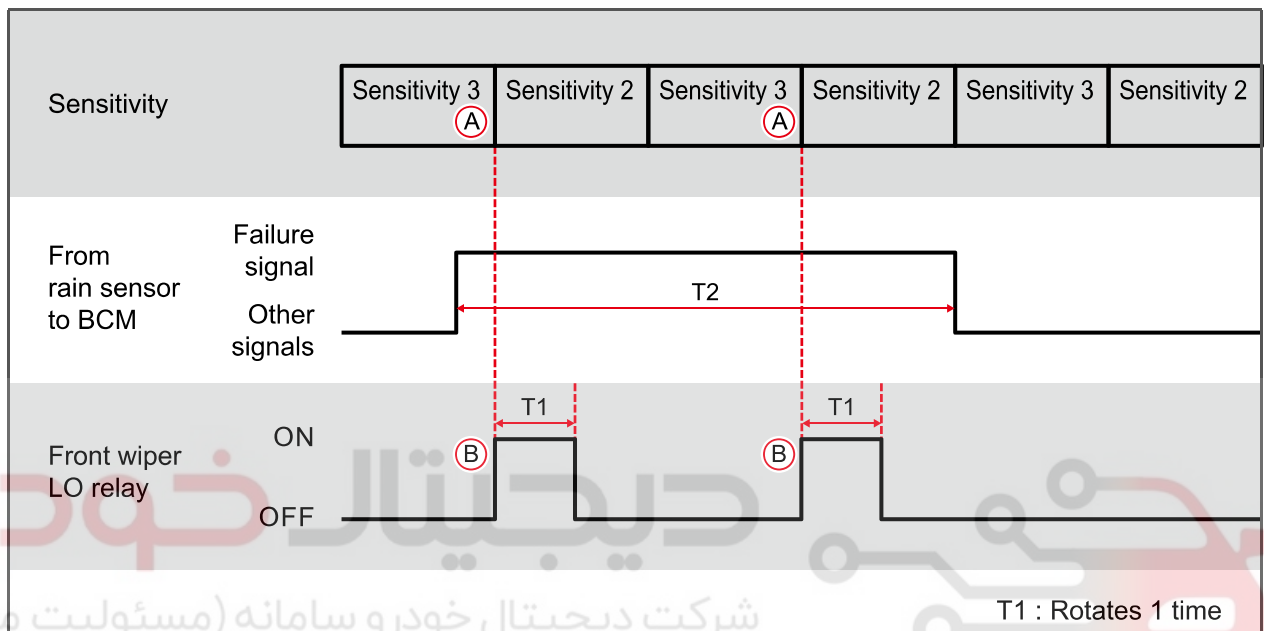
**(12) Rain sensor malfunction (rain sensor external malfunction)**

<b>Basic conditions</b>	IGN ON and wiper AUTO switch ON
-------------------------	---------------------------------

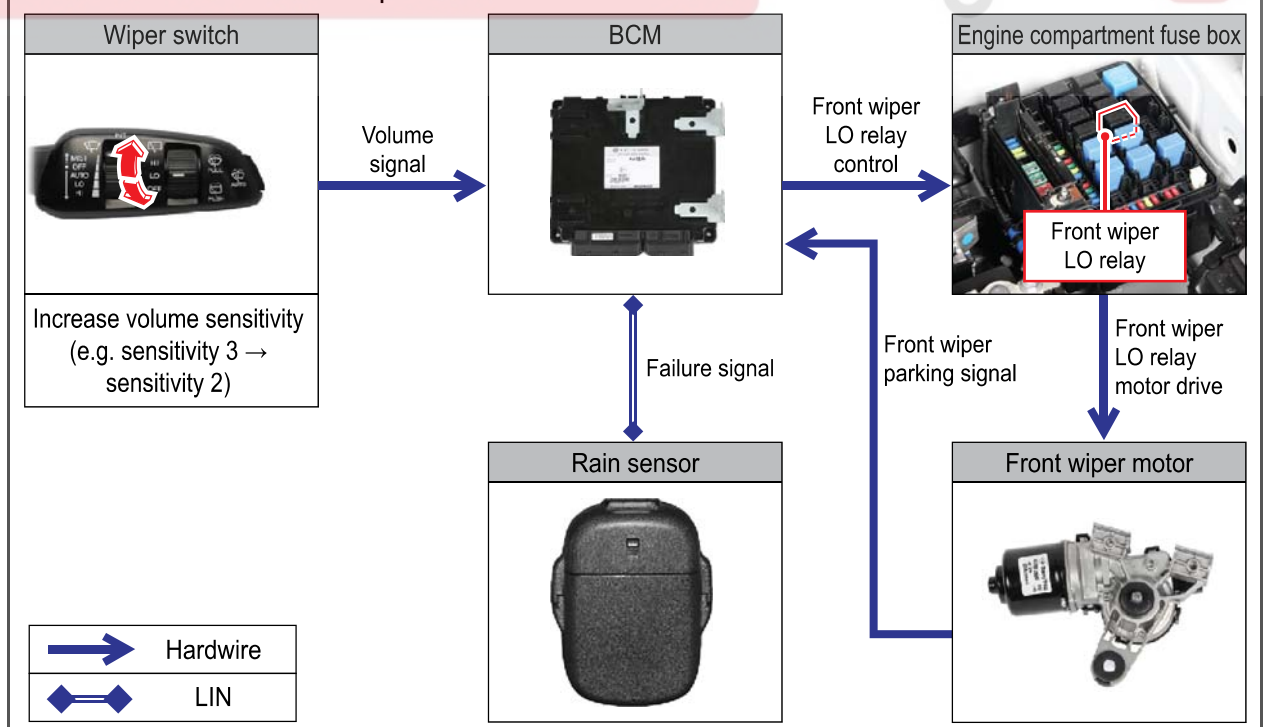
**Operation 1.** ("rain sensor installed improperly" signal received from the rain sensor)

A. The wiper AUTO switch sensitivity level is adjusted (sensitivity level 3 → sensitivity level 2).

B. The wiper LO relay is operated for one cycle (T1).

**System flowchart**

- With IGN ON / Windshield wiper AUTO switch ON



Modification basis	
Application basis	
Approval basis	

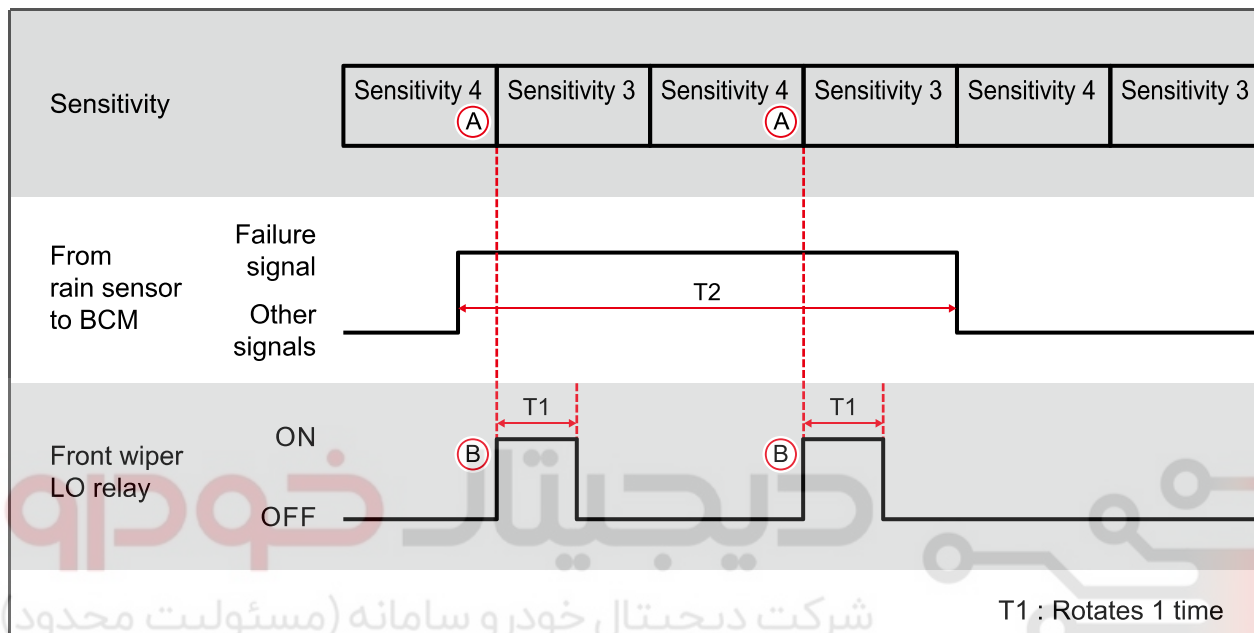
**(13) Rain sensor malfunction (no rain sensor signal)**

<b>Basic conditions</b>	IGN ON and AUTO switch ON
-------------------------	---------------------------

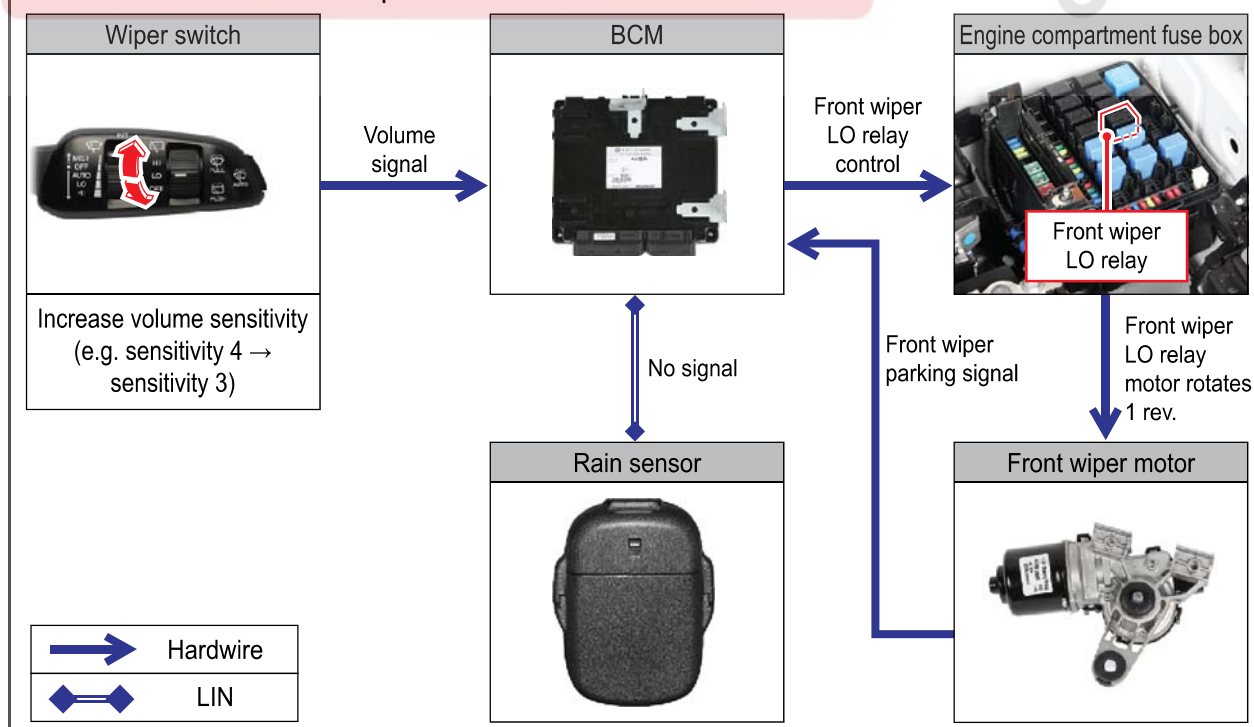
**Operation 1.** ("no signal detected" signal received from the rain sensor)

A. The AUTO switch sensitivity level is adjusted (ex: sensitivity level 4 → sensitivity level 3).

B. The wiper LO relay is operated for one cycle (T1).

**System flowchart**

- With IGN ON / Windshield wiper AUTO switch ON



**(14) Speed sensitive AUTO wiper****Operation 1.** (At vehicle speed of 0 km/h)

- A. Windshield wiper auto switch is ON with IGN ON  
(or IGN ON with windshield wiper auto switch ON).  
B. Wiper LO relay is operated within 0.3 sec. (T1)

**Operation 2.**

- C. The windshield wiper LO relay operation time changes depending on the windshield wiper intermittent switch volume settings and vehicle speed.

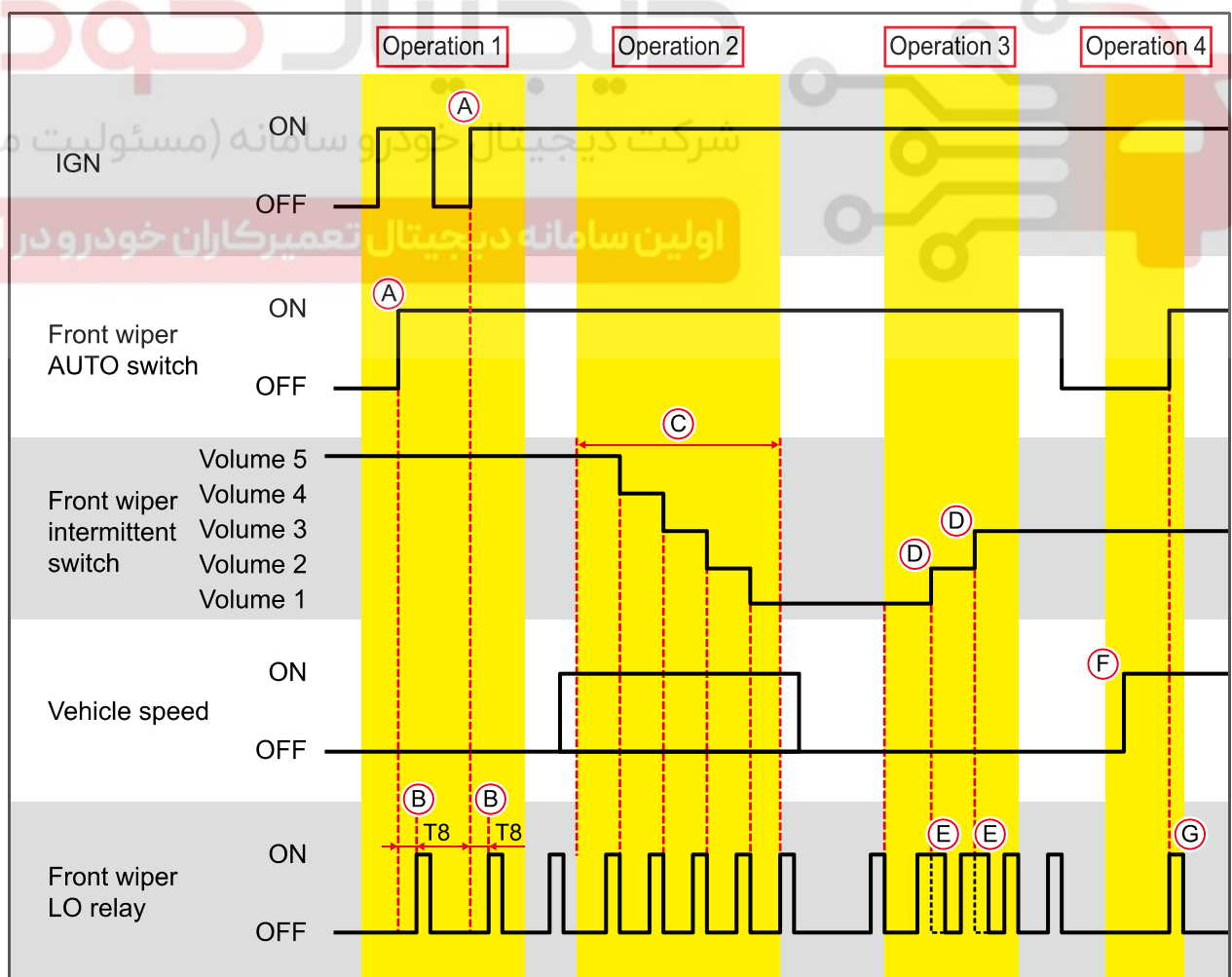
**reference** See the graph for correlation between windshield wiper auto switch rest time and vehicle speed.

**Operation 3.**

- D. Increase windshield intermittent wiper interval (volume 1 → volume 2)  
E. The windshield wiper LO relay operates once.

**Operation 4.**

- F. When windshield wiper auto switch is ON position at vehicle speed of above 0 km/h.  
G. Windshield wiper LO relay is activated immediately.

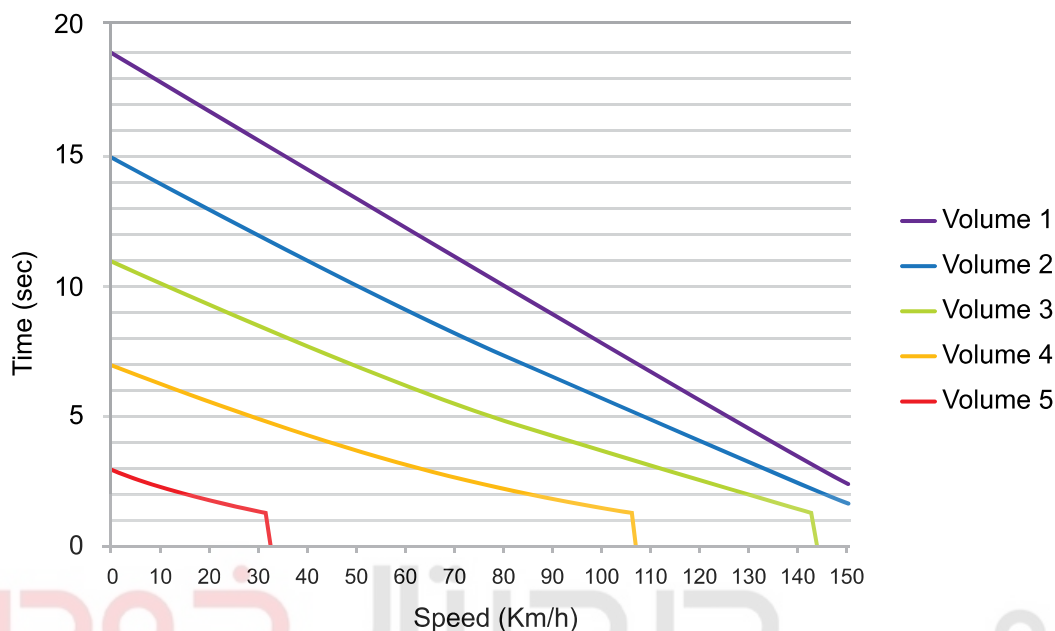


Modification basis	
Application basis	
Approval basis	



**NOTE**

**Graph for correlation between windshield wiper auto switch rest time and vehicle speed**



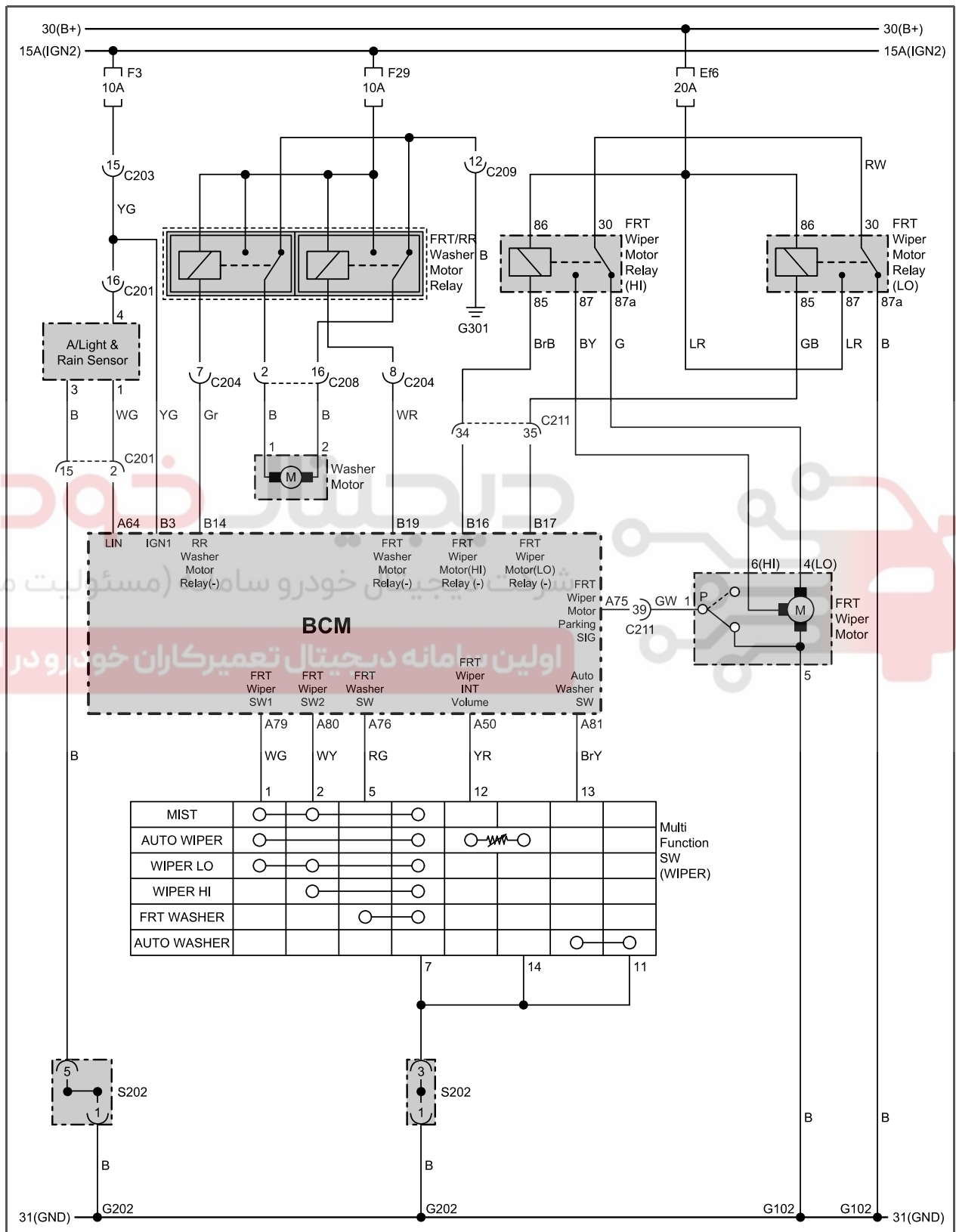
**Wiper rest time depending on vehicle speed and volume settings**

Vehicle speed	Volume 5	Volume 4	Volume 3	Volume 2	Volume 1
0 km/h	Approx. 3 sec.	Approx. 7 sec.	Approx. 11 sec.	Approx. 15 sec.	Approx. 19 sec.
70 km/h	Approx. 0 sec.	Approx. 3 sec.	Approx. 6 sec.	Approx. 8 sec.	Approx. 11 sec.



## 4. CIRCUIT DIAGRAM

### ► Windshield wiper, washer

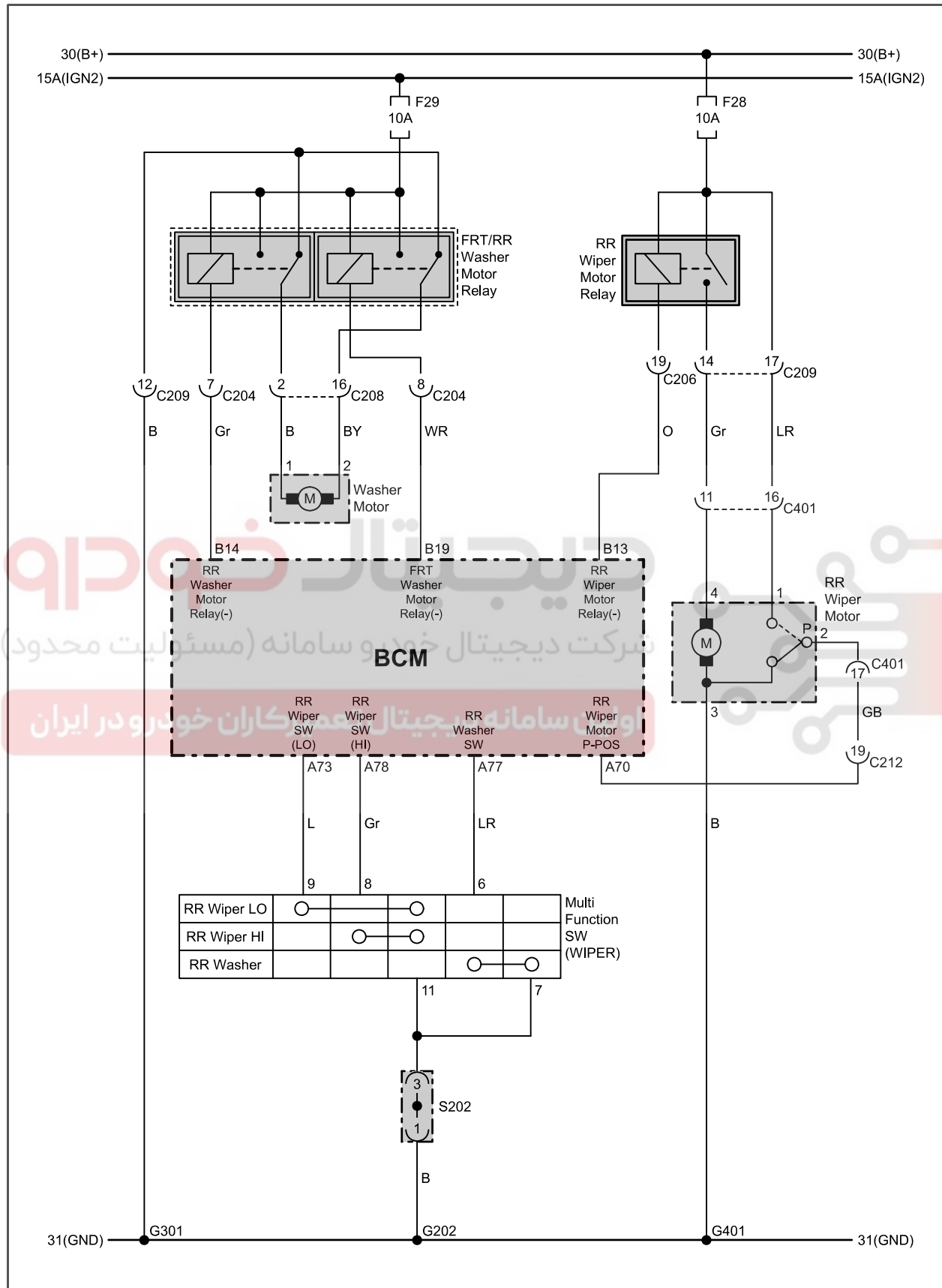


Modification basis	
Application basis	
Approval basis	

WIPER AND WASHER SYSTEM

TIVOLI 2015.03

## ► Rear wiper, washer



Modification basis	
Application basis	
Affected VIN	021 62 99 92 92

## CONFIGURATION AND FUNCTIONS

S.G.N.

### 8530-01 MULTIFUNCTION WIPER SWITCH

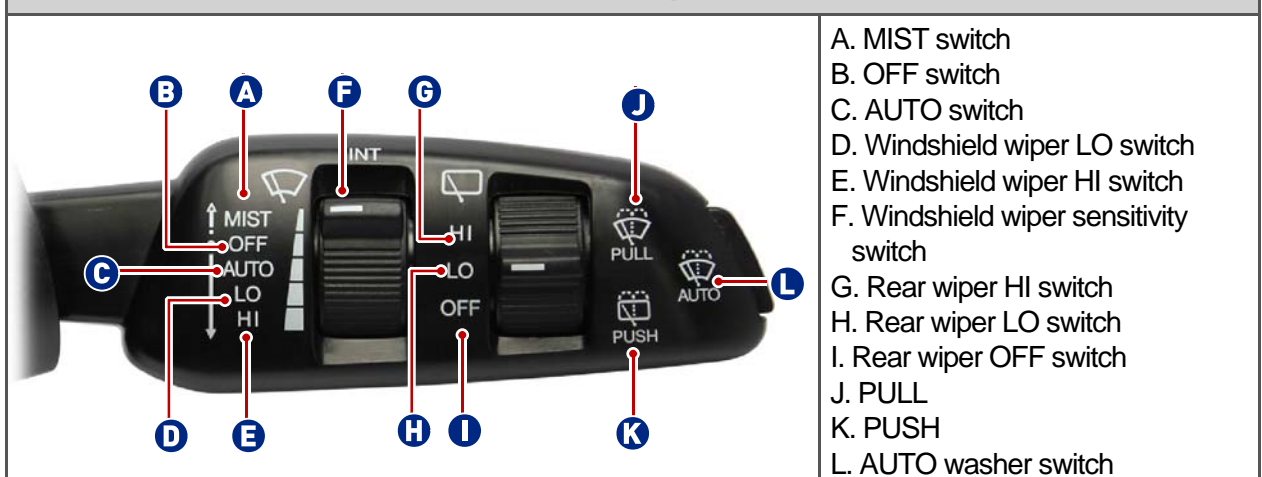
#### 1) Overview

The multifunction wiper switch controls the windshield wipers, windshield washer, rear wiper, and rear washer operations. The functions for the windshield wipers include MIST, OFF, AUTO, LO/Hi, washer, and wiper sensitivity, while the functions for the rear wiper include HI/LO, OFF, and washer.

#### 2) Mounting Location



Multifunction wiper switch

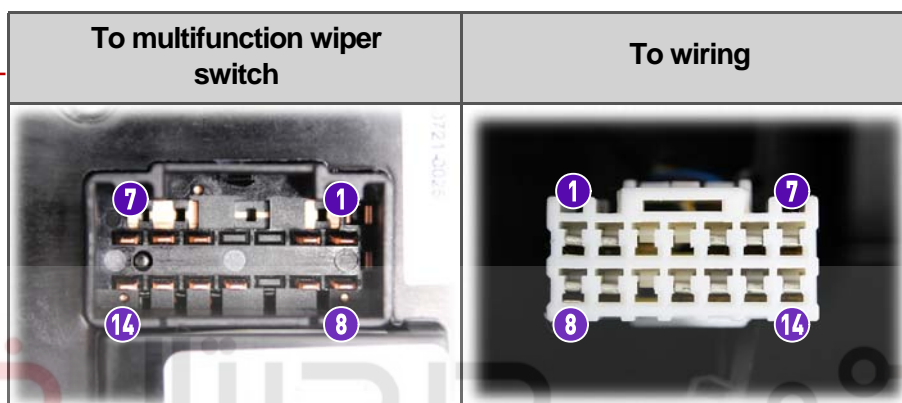


Modification basis	
Application basis	
Approval basis	

WIPER AND WASHER SYSTEM

TIVOLI 2015.03

#### 4) Connector

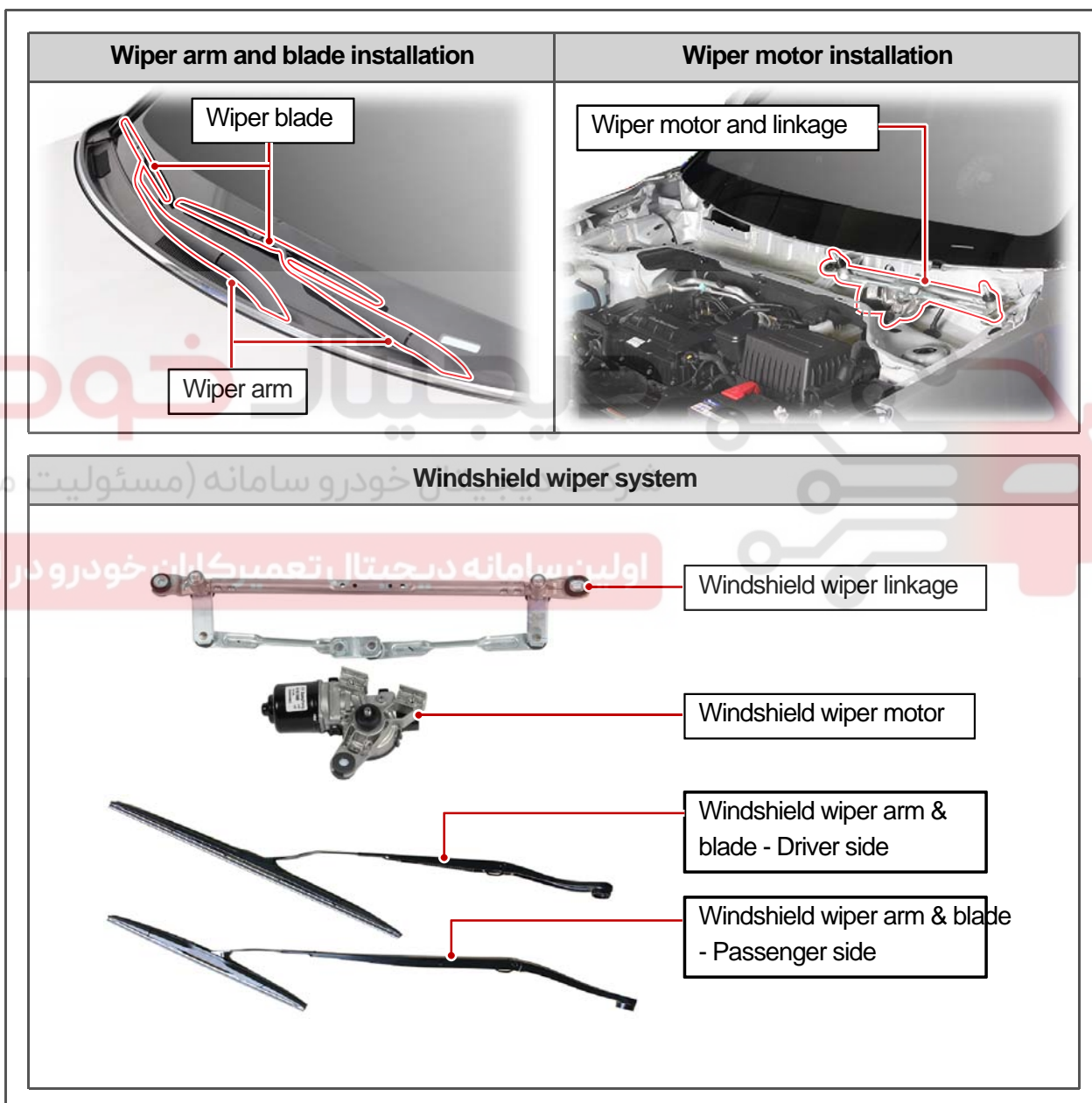


Pin No.	Function	Pin No.	Function
1	Windshield wiper switch signal 1	8	Rear wiper HI switch signal
2	Windshield wiper switch signal 2	9	Wiper low LO switch signal
3	-	10	-
4	-	11	-
5	Windshield washer switch signal	12	Wiper volume switch signal
6	Rear washer switch signal	13	AUTO washer switch signal
7	-	14	-

S.G.N.

**7810-00 WINDSHIELD WIPER SYSTEM****1) Overview**

The windshield wiper system is controlled by the BCM and consists of wiper motor, linkage, wiper arm, and blade.

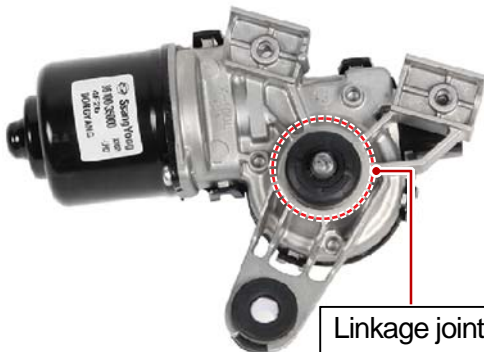
**2) Mounting Location**

Modification basis	
Application basis	
Life cycle	



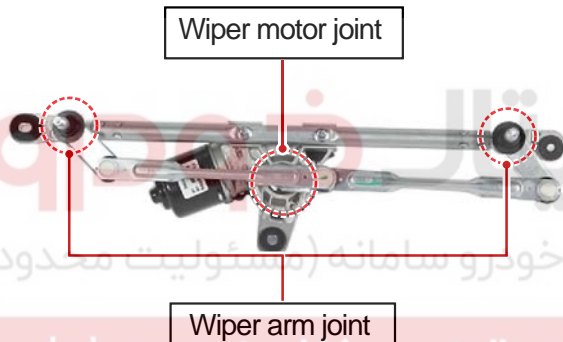
### 3) Features

**Windshield wiper motor**



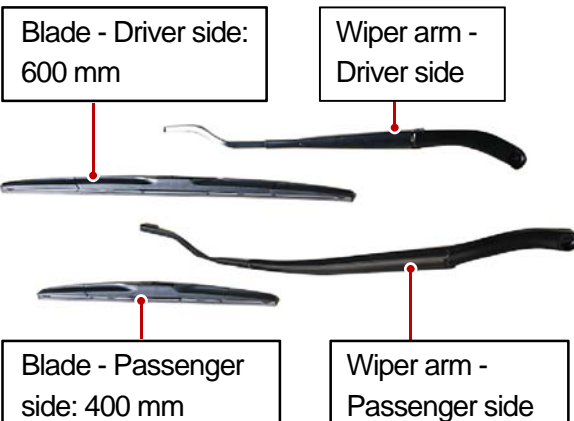
The windshield wiper motor transmits the power to the wiper linkage according to the switch input by the driver to operate the wiper arm and blade. The wiper motor operates at different speeds according to the activated terminal (HI or LO). The motor also incorporates a parking switch which receives the signal from the wiper switch and returns the wiper to the parking position during the wiper operation.

**Windshield wiper linkage**



The wiper linkage connects the wiper motor and wiper arm. This linkage converts the rotational movement of the motor to back and forth movement to activate the wiper arms.

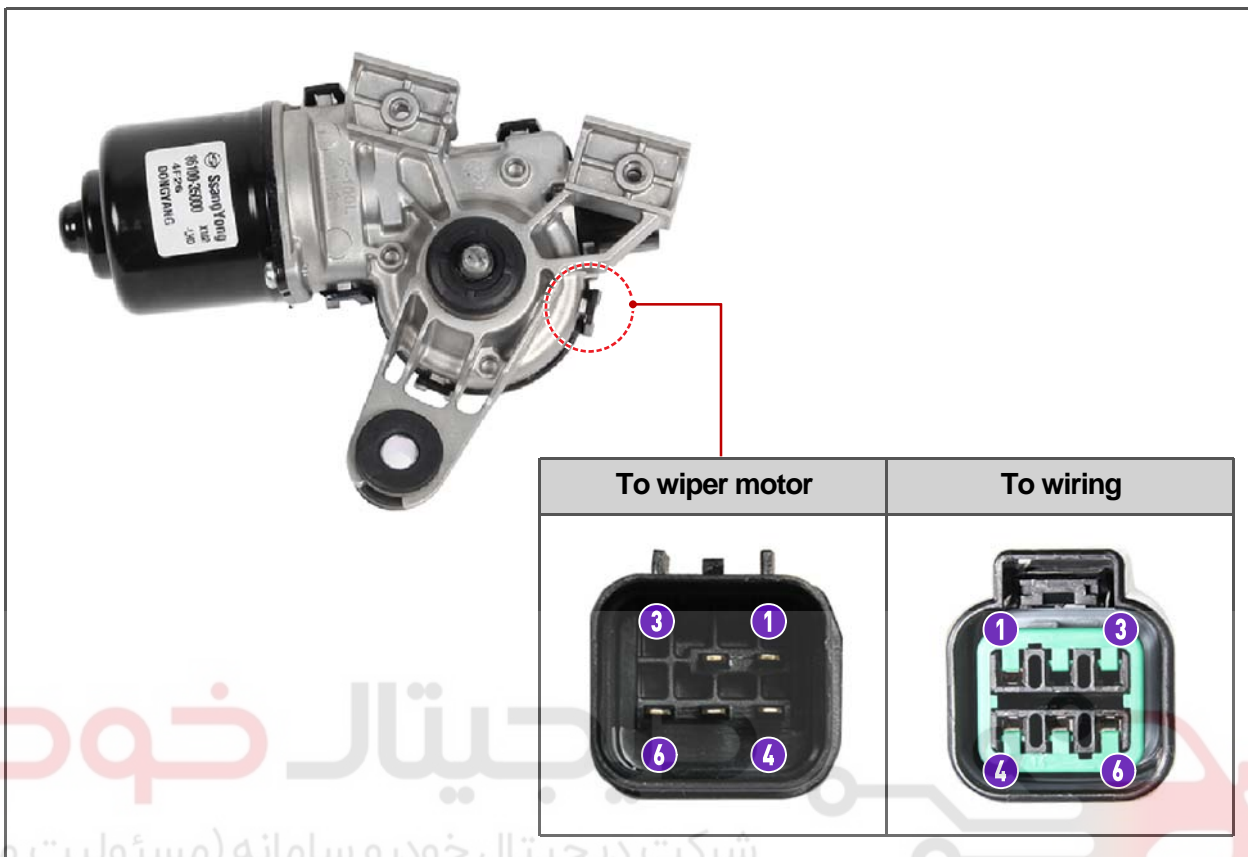
**Windshield wiper arm and blade**



The wiper blade can be easily removed from or installed to the wiper arm which is connected to the wiper linkage. The blades wipe out water drops or foreign materials on the windshield glass to aid visibility.

The wiper blade is made of rubber. Regular maintenance is required to keep the angle between the blade and glass surface at 90 degrees.

## 4) Connector



Pin No.	Function	Pin No.	Function
1	Windshield wiper motor parking signal	4	Windshield wiper (low speed)
2	-	5	Ground
3	-	6	Windshield wiper (high speed)

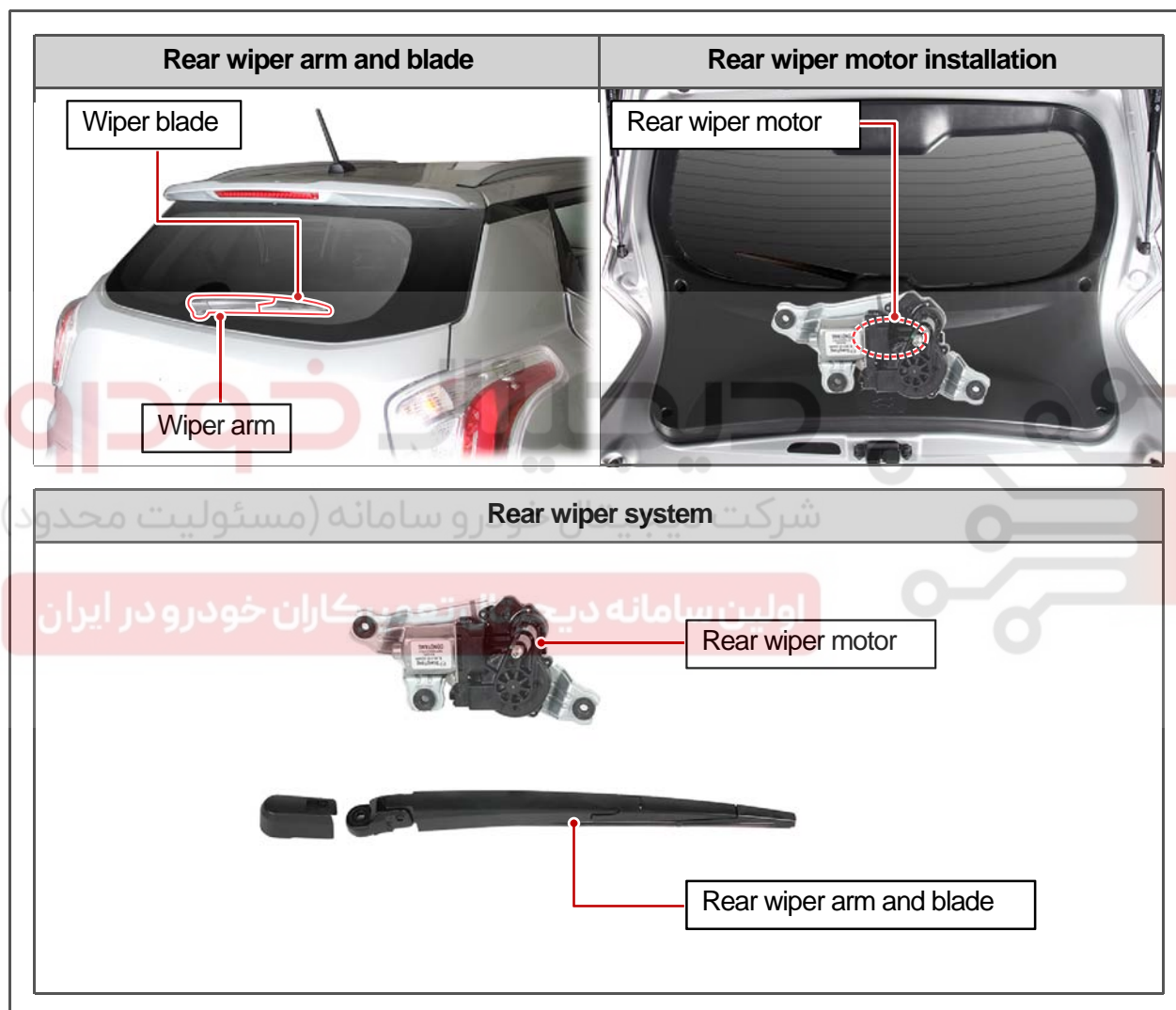
Modification basis	
Application basis	
Approval	



S.G.N.

**7830-00 REAR WIPER SYSTEM****1) Overview**

The rear wiper system is controlled by the BCM and consists of rear wiper motor, wiper arm, and blade.

**2) Mounting Location**

### 3) Features

Rear wiper motor



Rear wiper arm joint

The rear wiper motor transmits the power to the wiper according to the switch input by the driver to operate the rear wiper arm and blade. The rear wiper motor operates at different speeds according to the activated terminal (HI or LO). The motor also incorporates a parking switch which receives the signal from the wiper switch and returns the wiper to the parking position during the wiper operation.

Rear wiper arm and blade



The rear wiper blade can be easily removed from or installed to the rear wiper arm. The blades wipe out water drops or foreign materials on the rear glass to aid visibility.

The wiper blade is made of rubber. Regular maintenance is required to keep the angle between the blade and glass surface at 90 degrees.

FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

WIPER AND

AVN

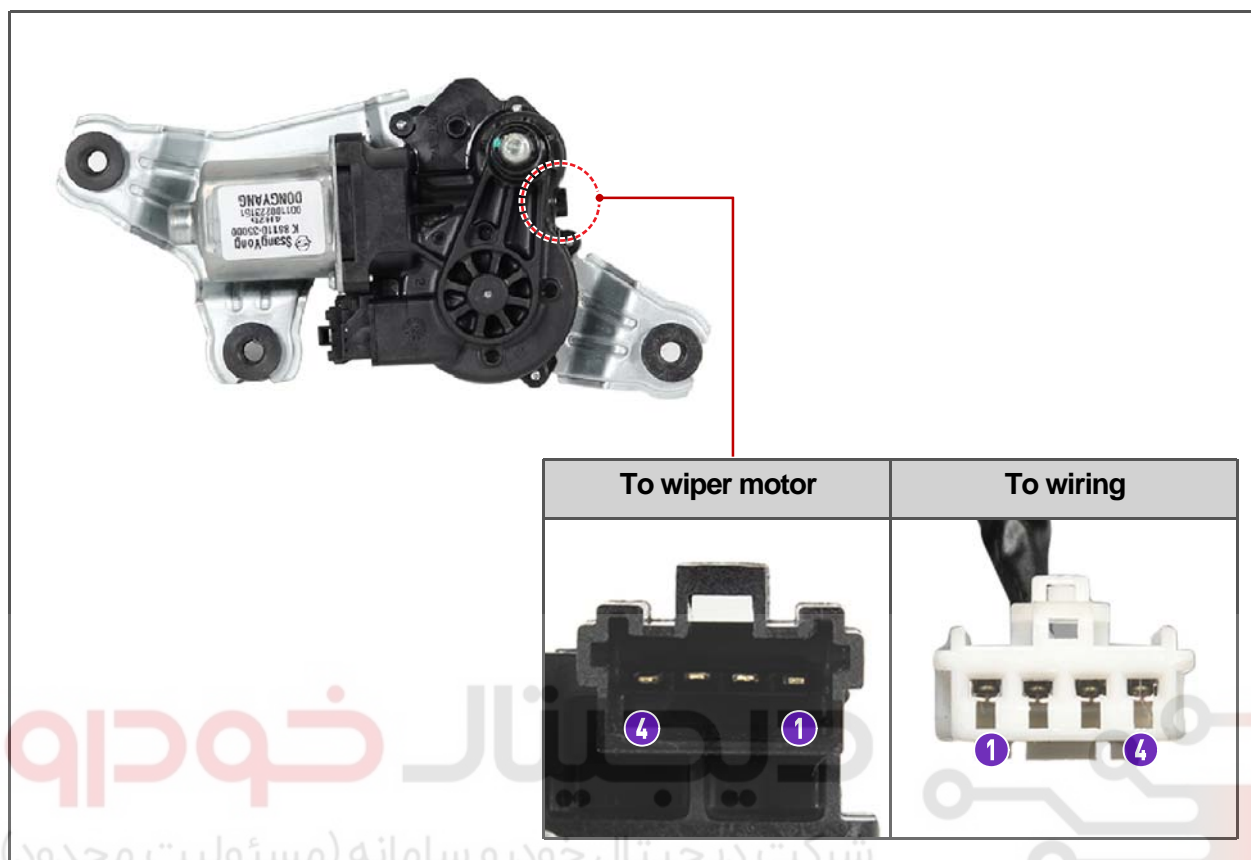
MP3 AUDIO

LCD AUDIO

ISG SYSTEM

Modification basis	
Application basis	
Effective date	

#### 4) Connector



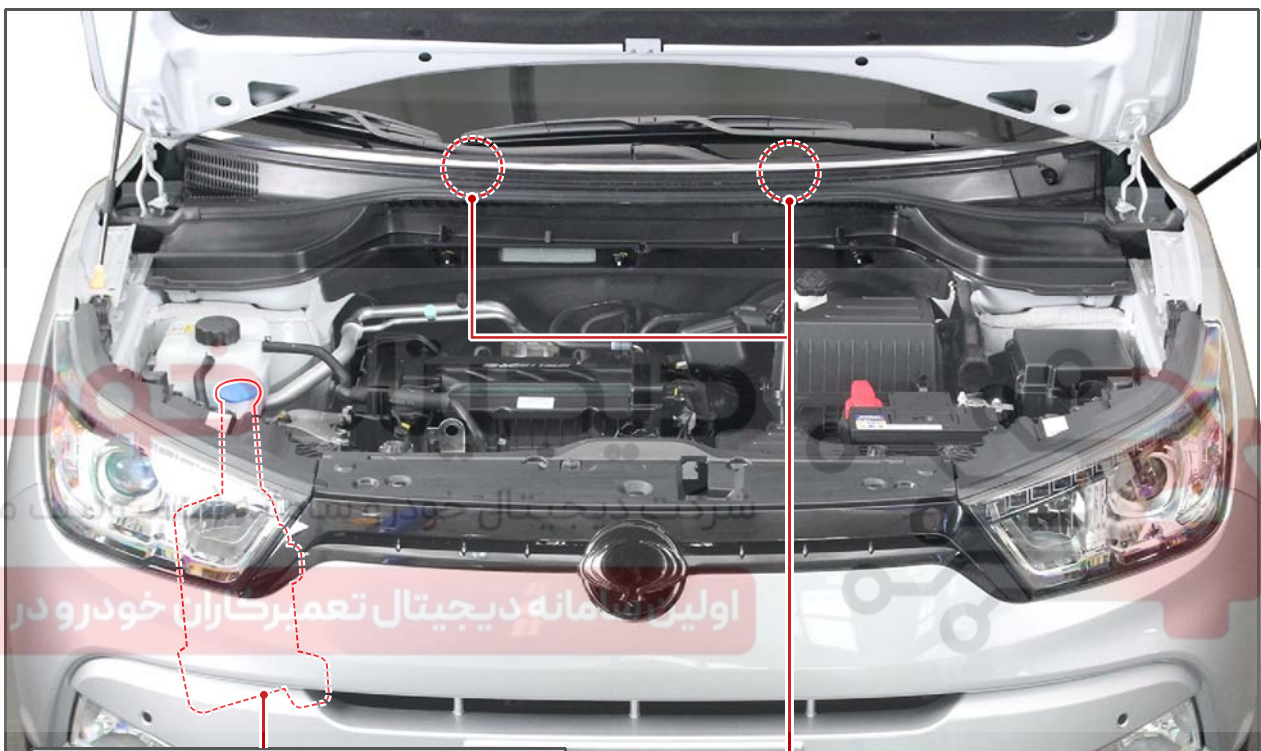
Pin No.	Function	Pin No.	Function
1	B+	3	Ground
2	Rear wiper motor parking signal	4	Rear wiper motor power supply

S.G.N.

**7820-00 WASHER SYSTEM****1) Overview**

The washer system sprays the washer fluid onto the windshield and rear glass surfaces.

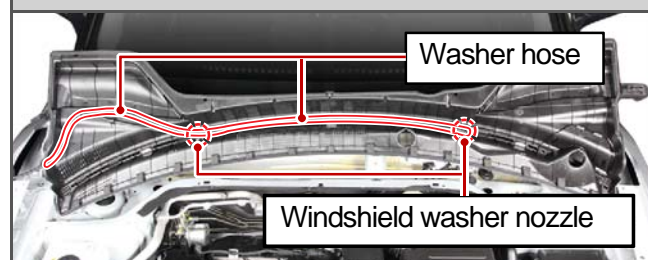
The windshield washer fluid reservoir tank supplies the washer fluid for both the windshield and rear washer systems.

**2) Mounting Location****Washer fluid reservoir tank and motor**

Washer fluid  
reservoir cap

Washer fluid reservoir  
tank

Windshield/rear  
washer motor

**Washer hose and nozzle installed to rear side of cowl grille****Windshield washer nozzle**

Modification basis	
Application basis	
Approval basis	

WIPER AND WASHER SYSTEM

TIVOLI 2015.03



## Rear washer

With rear spoiler



## Washer fluid reservoir tank and motor



Rear side

## Washer hose and nozzle installation



## Rear washer nozzle



Without rear spoiler



## Washer fluid reservoir tank and motor



Rear side

## Washer hose and nozzle installation



## Rear washer nozzle



### 3) Features

#### Windshield washer nozzle



The windshield washer nozzles are installed on both sides of the hood panel (one on each side). The nozzle sprays washer fluid in fan-shape to cover the windshield area as much as possible.

#### Rear washer nozzle

With spoiler



Without spoiler



For a vehicle with spoiler, the rear washer nozzle is integrated with high mounted stop lamp. For a vehicle without spoiler, the nozzle is mounted on top of the tailgate.

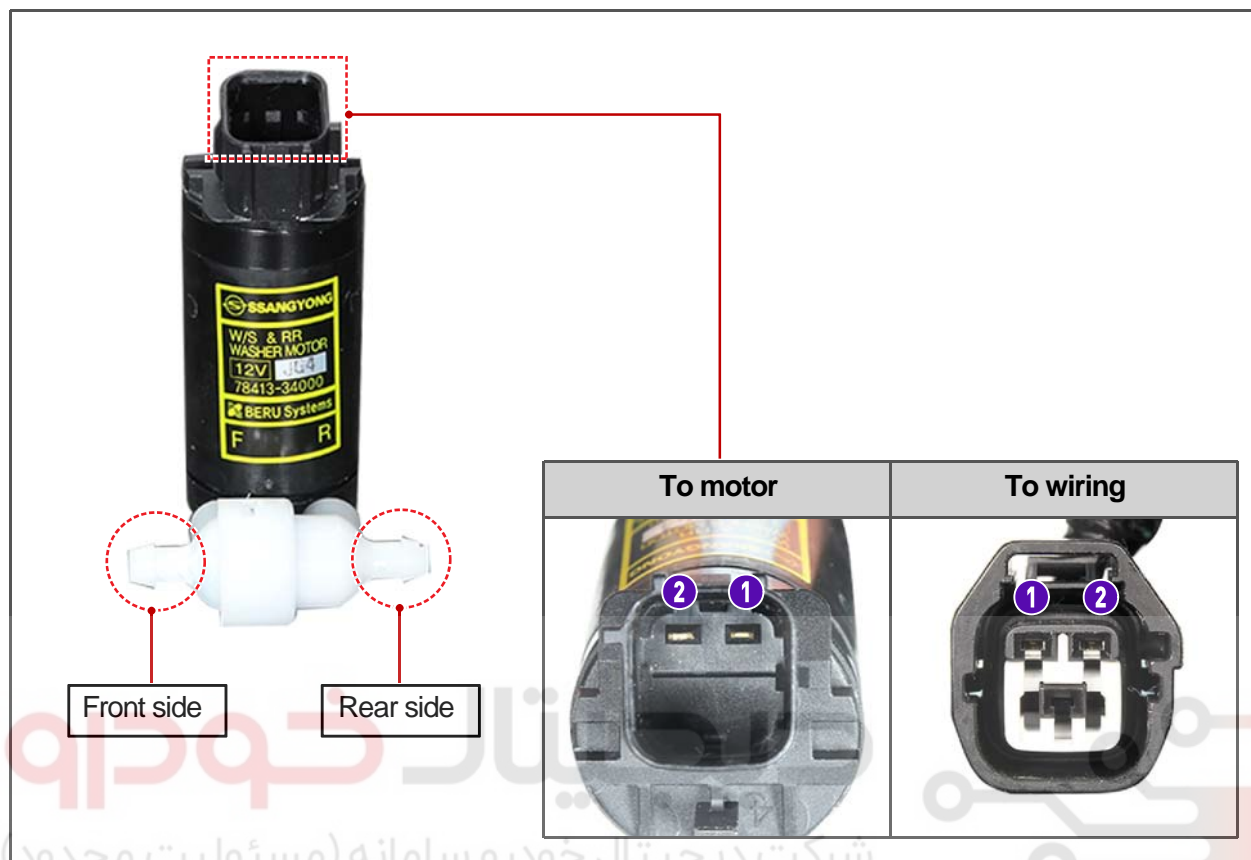
#### Washer fluid reservoir tank and motor



The reservoir tank stores and supplies washer fluid, and has front and rear washer motor. The windshield washer fluid reservoir supplies the rear washer fluid without additional washer fluid reservoir.

Modification basis	
Application basis	
Accessories	

### 3) Connector



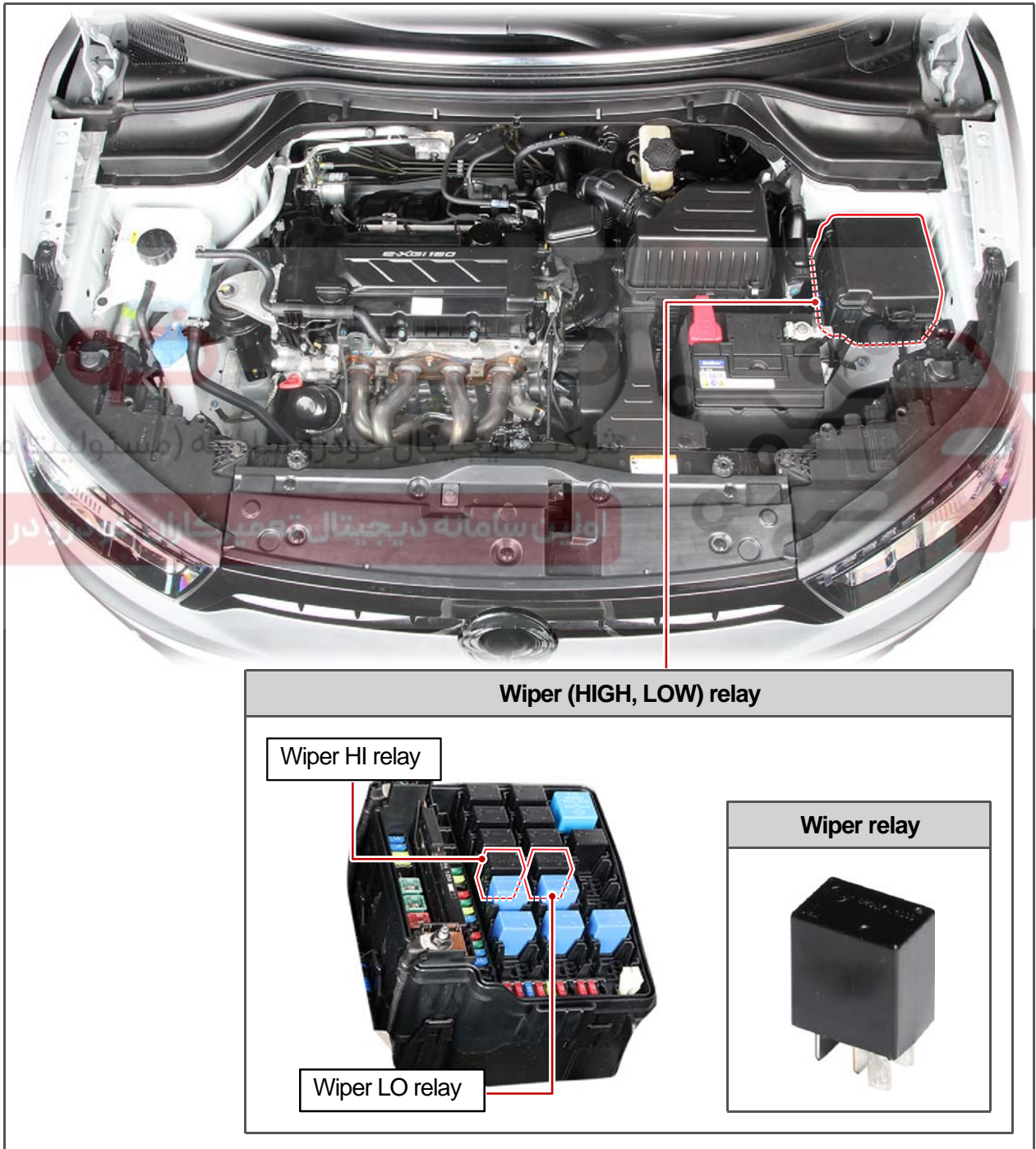
Front		Rear	
Pin No.	Function	Pin No.	Function
1	Ground	1	Power supply
2	Power supply	2	Ground



S.G.N.

**7810-00 WIPER (HIGH, LOW) RELAY****1) Overview**

There are two wiper relays: HIGH and LOW. These relays are a 5-pin and 3-way type. The relay is connected to the ground in normal conditions and connected to the motor only when it is activated (supplied with power).

**2) Mounting Location and Components**

Modification basis	
Application basis	
Life cycle	

WIPER AND WASHER SYSTEM

TIVOLI 2015.03

S.G.N.

8610-09

## AUTO LIGHT AND RAIN SENSOR SYSTEM

### 1) Overview

The rain sensor is located in the center on the top of the windshield. It communicates with BCM and makes the wipers to operate automatically in the rain sensing mode (multifunction switch wiper: AUTO mode). The emitting section of the rain sensor unit emits infrared rays against the windshield and then detects the amount of rain drops by receiving reflected rays with photodiode. Then, the unit operates the wipers at high or low speed based on this data for the driver's convenience.

### 2) Mounting Location



Multifunction wiper switch

Rain sensor

AUTO



### 3) Features

#### Multifunction wiper switch



#### AUTO:

The wiper operates automatically by rain sensor.

#### FAST <—> SLOW:

Auto delay/auto speed control.

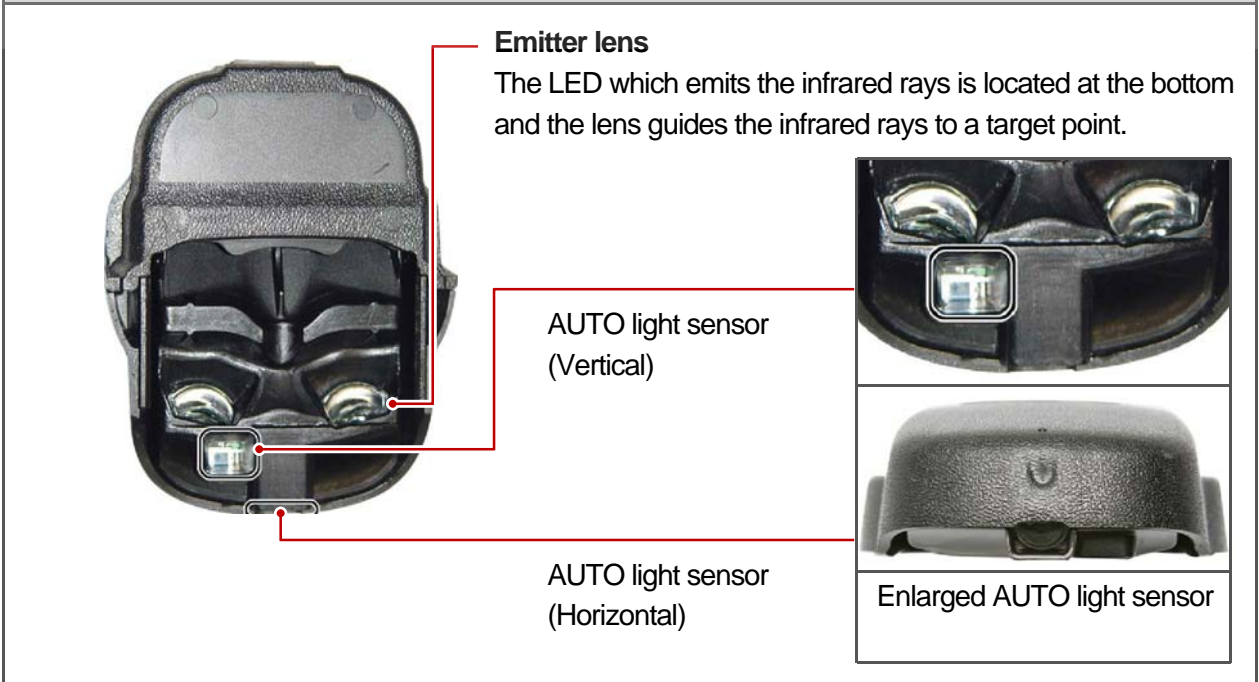
timberlake96: A position that can control the sensitivity for the amount of rains on the windshield and transmit the wiping request signal accordingly.

#### Rain sensor (integrated with AUTO light sensor)



The rain sensor communicates with the BCM and activates the wiper automatically in the rain sensing mode (multifunction switch wiper: AUTO mode). This sensor module emits infrared rays through the windshield glass and then detects the amount of rain drops by receiving the rays reflected off the sensing section (rain sensor mounting section on the windshield) with photodiode. The sensing section on the windshield is located just above the center point between the LED and photodiode.

#### AUTO light and rain sensor



Modification basis	
Application basis	
Life cycle	



## 5) Connector



Pin No.	Function
1	LIN communication (BCM)
2	-
3	Ground
4	IGN 1

## 6) Features

### (1) Windshield glass and coupler attachment

Check the sensing area on the outer windshield surface for excessive wear, damage or scratch. The sensor is able to compensate the wear up to a specific level. Check if there are too many air pockets left between the surfaces of the coupler and windshield. If the porosity exists, the sensor cannot function properly.



#### NOTE

If the installed wiper blade is not as specified (size and length), the wiper cannot wipe the rain sensing area clearly.  
In this case, the sensitivity of the rain sensor could be decreased and the wiper could be malfunctioning.

### (2) Recognition of AUTO wiper mode

The wiper cycles once when the multifunction wiper switch is turned from OFF to AUTO.  
This wiper operation is performed only for the first time. If the switch is turned from OFF to AUTO again, the wiper is operated only when raining to prevent the wiper blade from wearing.  
The wiper is operated up to 3 minutes after the rain stops.  
If this operation is not performed, check the terminal no. 2 of the rain sensor. If the terminal is intact, check the wiper relay (LOW).



#### NOTE

As described above, the BCM recognizes the wiper switch AUTO position.  
If there is no problem, enter the diagnostic mode for BCM, check the terminal which receives the signals from the wiper, or check the communication line between the rain sensor unit and BCM.

### (3) Instant wiping

Each time the speed control of the multifunction wiper switch is turned by one step from LOW to HIGH, the wiper cycles one time.  
As with power-up function described above, the wiper continues works if it's rainy or for up to 3 minutes after the rain stops.



#### NOTE

The wiper also cycles one time when the variable resistance knob is turned straight from the 0 to step 4, from 0 to step 1, from step 1 to step 2, and from step 2 to step 3.

Modification basis	
Application basis	
Effective date	

#### (4) Washer coupled wiper operation

Check the washer coupled wiper operation by pressing the washer switch.

#### (5) Irregular operation (abrupt operation)

- Check the rain sensor is correctly positioned.
- Check if the rain sensor cover is securely installed.
- Check if the customer is familiar with how to control the wiper sensitivity.

That is, check if the customer knows how to select the desired sensitivity by selecting one of the 5 variable resistance values (step 1 to step 5). Check if the wiper sensitivity control is set to the FAST side (step 5).

- Check the wiper blades for wear.

If the wiper blade cannot wipe the glass uniformly and clearly, it may cause the rain sensor to work irregularly. Therefore, in this case, replace the wiper blade with a new one.

#### (6) Self diagnosis

##### ► Poor sensing

When the wiper speed control switch is turned to step 2 from step 3 the wiper motor cycles one time at low speed, provided that the BCM receives a faulty sensor signal from the rain sensor unit with IGN ON and the INT/AUTO switch ON.

##### ► Poor sensor

When the wiper speed control switch is turned to step 3 from step 4 the wiper motor cycles one time at low speed, provided that the BCM receives a communication error signal from the rain sensor unit with IGN ON and the INT/AUTO switch ON.

## 5) System Troubleshooting Procedures

1. Check if the coupler is properly attached to the glass.



2. Check the power-up function.



3. Check the instant wiping function.



4. Check the washer coupled wiper operation.



5. Check for high speed operation.



6. Find out the cause of the irregular operations (abrupt operations).



7. Check the system with self-diagnosis function.

### ► DTC check

Symptom 1. The wiper does not cycle one time when turning the multifunction wiper switch from OFF to AUTO position or when starting the engine with the multifunction wiper switch in AUTO position.

1. When starting the engine with the multifunction wiper switch in AUTO position, the wiper always cycles one time to remind the driver of system in AUTO mode.
2. Also, the wiper cycles once when the multifunction wiper switch is turned from OFF to AUTO. This wiper operation is performed only for the first time. If the switch is turned from OFF to AUTO again, the wiper is operated only when raining to prevent the wiper blade from wearing. The wiper cycles once when the multifunction wiper switch is turned from OFF to AUTO position during 5 minutes after the rain stops. If the wiper does not work as specified, check the pin no. 8. If the pin is intact, check the terminals related to the wiper relay.

Modification basis	
Application basis	
Effective date	



Symptom 2. It rains but the wipers do not work with the wiper switch in AUTO position.

1. Check if the multi-function wiper switch is in AUTO position.
2. Check the power to the sensor. That is, check the pin no. 3 (ground) and pin no. 4 (IGN).
3. Check the wiper relay.

Symptom 3. The wiper cycles 3 or 4 times at high speed abruptly.

Check if the variable resistance knob of the multifunction wiper switch is set to the FAST side. The sensitivity is highest in FAST position. Therefore, the wiper can be easily operated for the small change of the rain drops. To avoid this, adjust the knob to lower the sensitivity level.

Symptom 4. The wiper continues work even if the windshield glass is dry.

1. Check the wiper blades for wear. If the wiper blade cannot wipe the glass uniformly and clearly, this problem could occur. In this case, replace the wiper blade with a new one.
2. Check whether the variable resistance knob on the multifunction wiper switch is set in "FAST". The sensitivity is highest in FAST position. Therefore, the wiper can be easily operated for very small of water. To avoid this, adjust the knob to lower the sensitivity level.

Symptom 5. The wiper does not work at high speed during heavy rain.

You should check the pin no. 1 and no. 2 unless the wiper cycles at higher speed during heavy rain. The wiper should cycle at high speed if the pins no. 1 and no. 2 are grounded.

Symptom 6. The overall wiper response is too fast or slow.

Check if the variable resistance knob of the wiper switch is set to the FAST or SLOW side. Inform the customer that the desired sensitivity can be set by using the variable resistance. And select a proper step for the customer.

## REMOVAL AND INSTALLATION

S.G.N.  
7810-00

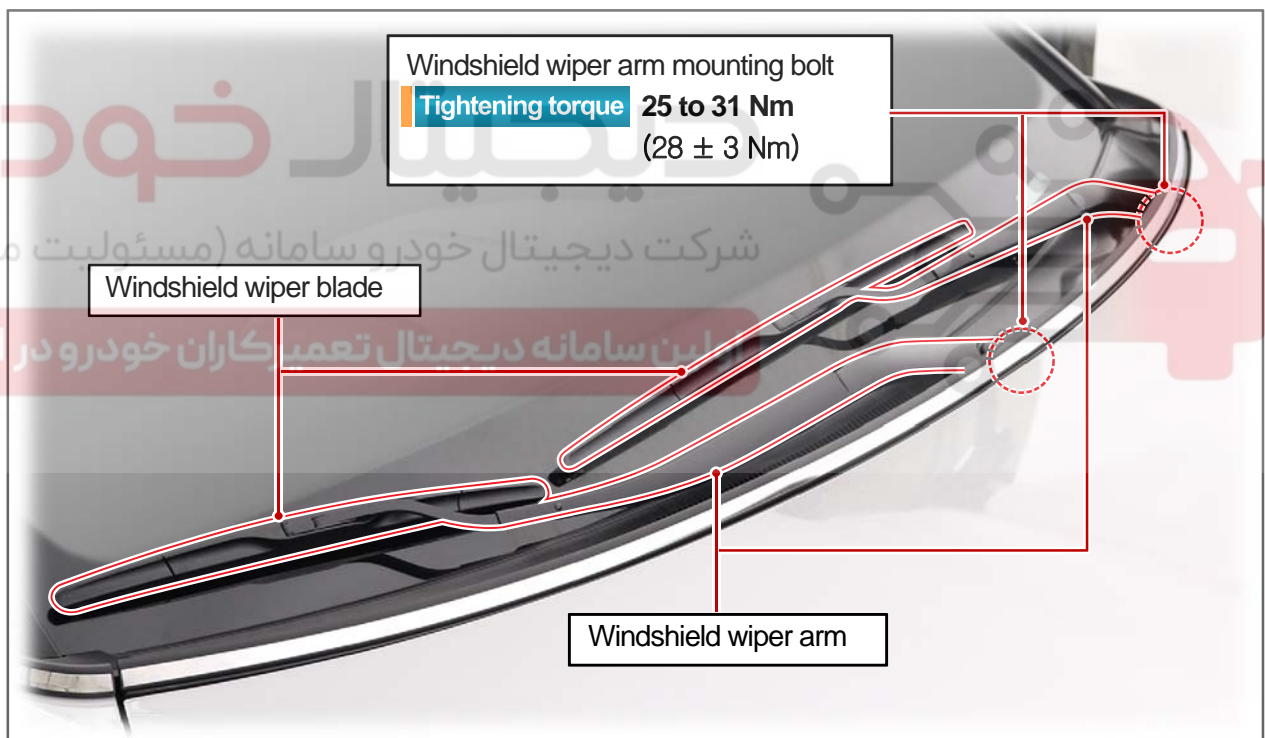
## HOW TO ADJUST WINDSHIELD WIPER ARM ANGLE

## (1) Overview

The wiper blade should be replaced depending on its material and usage. However, poor tightening torque for the mounting bolt of the wiper arm or deformed wiper arm may cause the change interval to be shortened or the wiper not to wipe the windshield evenly.

It is important for these vehicles to measure the attack angles of the windshield glass and wiper blade (including movement angle of wiper arm) to adjust the wiper arm angle with a separate adjuster (see illustration below) by using the following procedures.

However, it would be extremely rare to correct the angle using the adjuster, since the most wiper arms are installed to the vehicle by considering the angle for the windshield glass. Please refer to the following information on mounting angle to check the wiper for abnormal wiping.

**CAUTION**



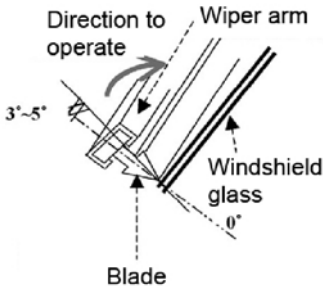
- Note that the wiper may not operate properly with normal angle and wiper arm if the wiper blade has been worn or the windshield glass is coated, before measuring the wiper arm's attach angle. The following wiper attack angle and return angle are based on the angle for the windshield glass
- line, as viewed from the pivot center line.

Modification basis	
Application basis	
Approval	

## (2) How to adjust







The following are how to measure and adjust the wiper arm angle.

### ► Tools

Protractor	Adjuster	Adjuster
		

- How to use the protractor: Read measurements anticlockwise after zeroing
- Wiper arm angle specification: Driver side – 5.4° / Passenger side – 4.9°

### ► How to adjust

1. Install the protractor (end part of the wiper arm) to the windshield glass.	2. Zero the protractor after installation. (Install the protractor to the windshield glass)	3. Install the protractor set to "0°" on the upper side of the wiper arm and check the mounting angle.
		
4. Check if the angle is within the specified range. (Install it to the upper part of the wiper arm)	5. If the wiper arm angle is out of the specified range, adjust it using the JIG.	6. Deliver the vehicle after adjusting the wiper arm angle to meet the specification.
		



S.G.N.

8530-01

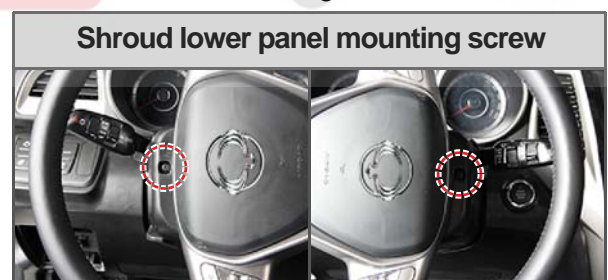
## MULTIFUNCTION WIPER SWITCH

Preceding work

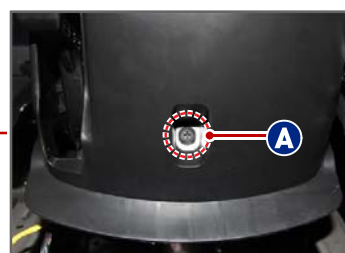
- Disconnect the negative battery cable.



1. Remove the 2 mounting screws for the shroud lower panel after rotating the steering wheel to make room for working.



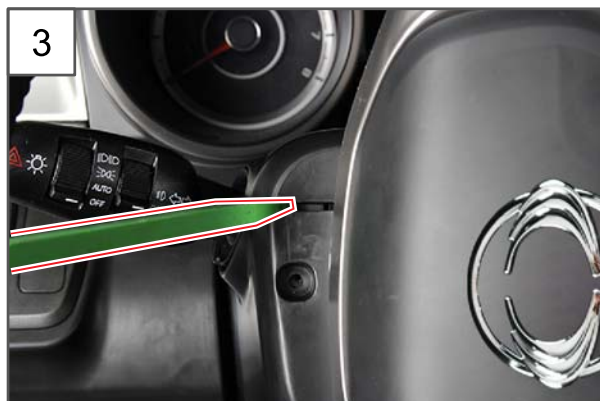
2. Unscrew the mounting screw (A) for the shroud lower panel, and push down the steering column tilting lever in the direction of the arrow.



Modification basis	
Application basis	
Approval basis	

WIPER AND WASHER SYSTEM

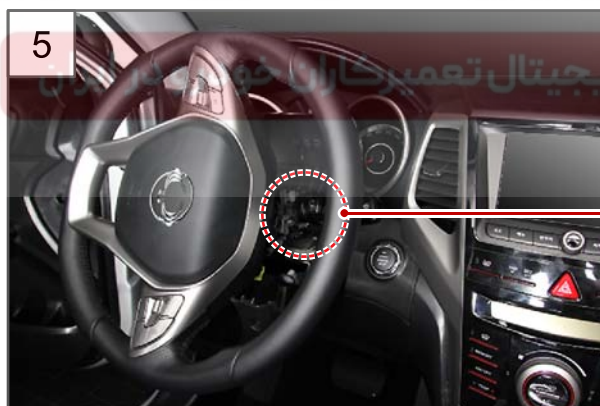
TIVOLI 2015.03



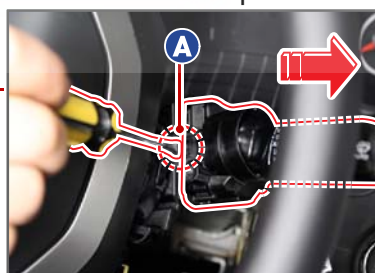
3. Separate the shroud upper and lower panels with a hand remover.



4. Disconnect the multifunction wiper switch connector (A).



5. Prise apart the mounting (A) with a flat bladed screwdriver to remove the multifunction wiper switch.



6. Install in the reverse order of removal.



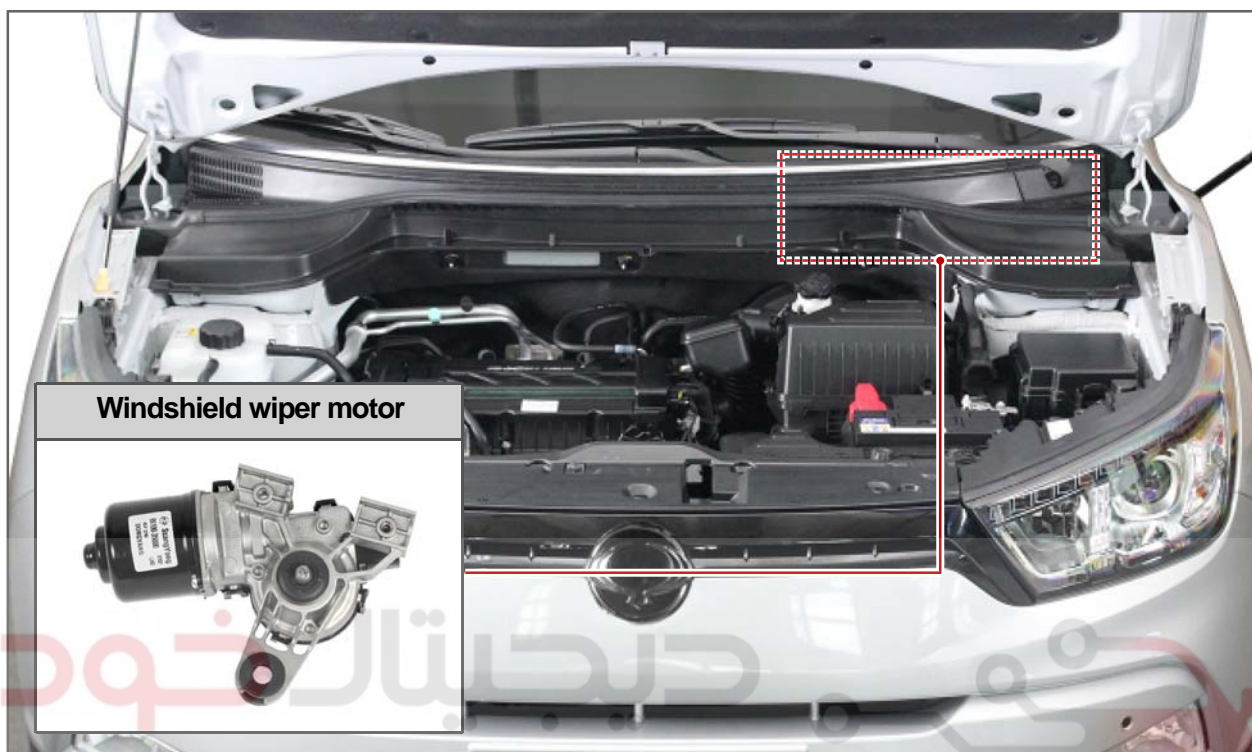
S.G.N.

7810-01

## WINDSHIELD WIPER MOTOR

Preceding work

- Disconnect the negative battery cable.



1. Lift out the windshield wiper arm cap.



2. Remove the windshield wiper arm mounting nut (14 mm).

**Tightening torque** 25 to 31 Nm  
(28 ± 3 Nm)

Modification basis	
Application basis	
Life cycle	

WIPER AND WASHER SYSTEM

TIVOLI 2015.03

FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

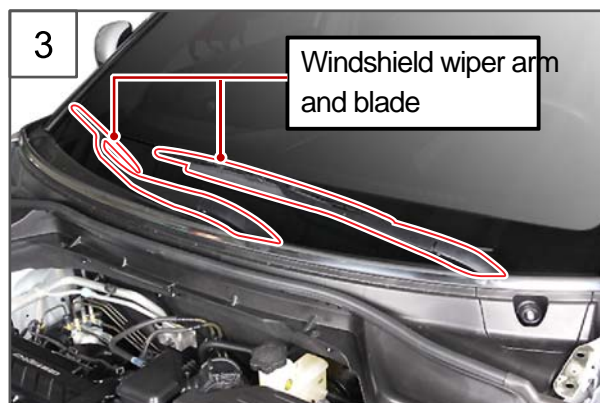
WIPER AND

AVN

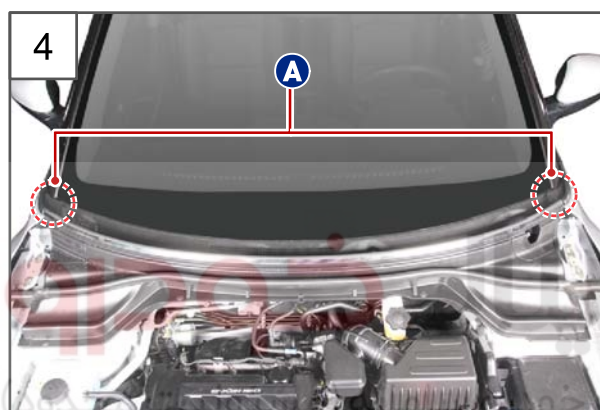
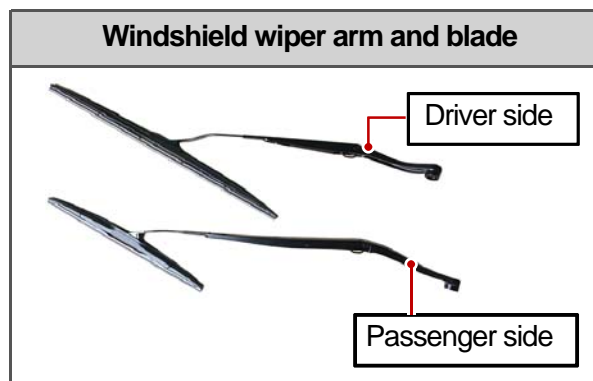
MP3 AUDIO

LCD AUDIO

ISG SYSTEM



3. Remove the windshield wiper arm and blade.



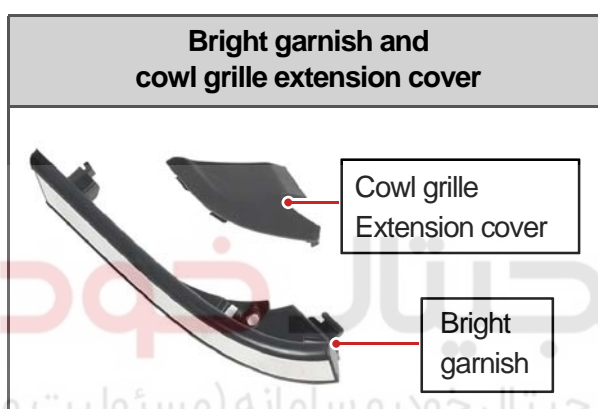
4. Prise off the cowl grille extension cover (A) with a hand remover and remove the bright garnish mounting screw (B).







5. Slide out the LH/RH bright garnishes forwards.



### CAUTION

Make sure that the cowl grille is pressed against the fender panel during assembly.



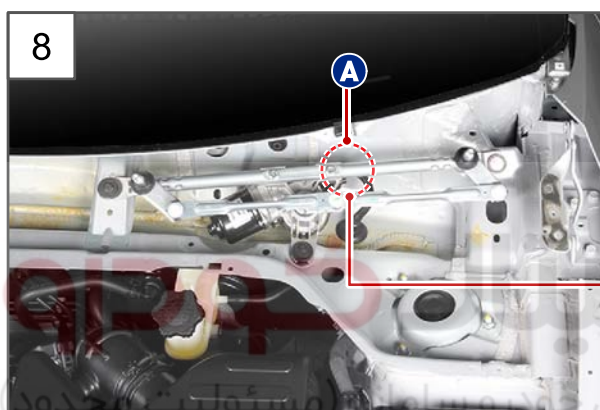
6. Remove the 4 screw rivets.



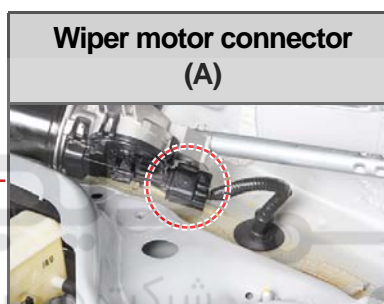
Modification basis	
Application basis	
Effective date	



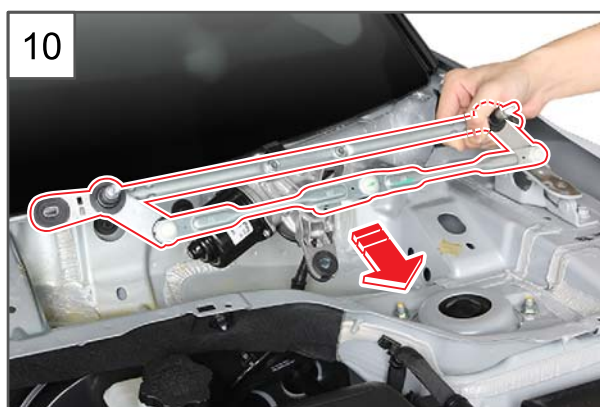
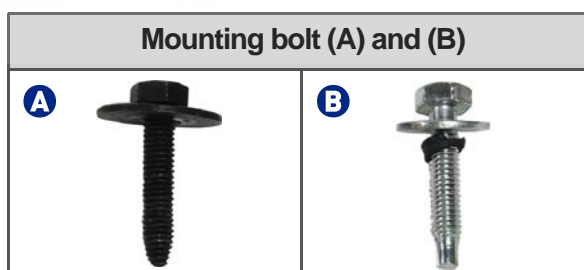
7. Pull the cowl grille to the front side of the vehicle.



8. Disconnect the windshield wiper motor connector (A).



9. Unscrew the 2 mounting bolts (A, 10 mm) and the mounting bolt (B, 10 mm) for the windshield wiper linkage.

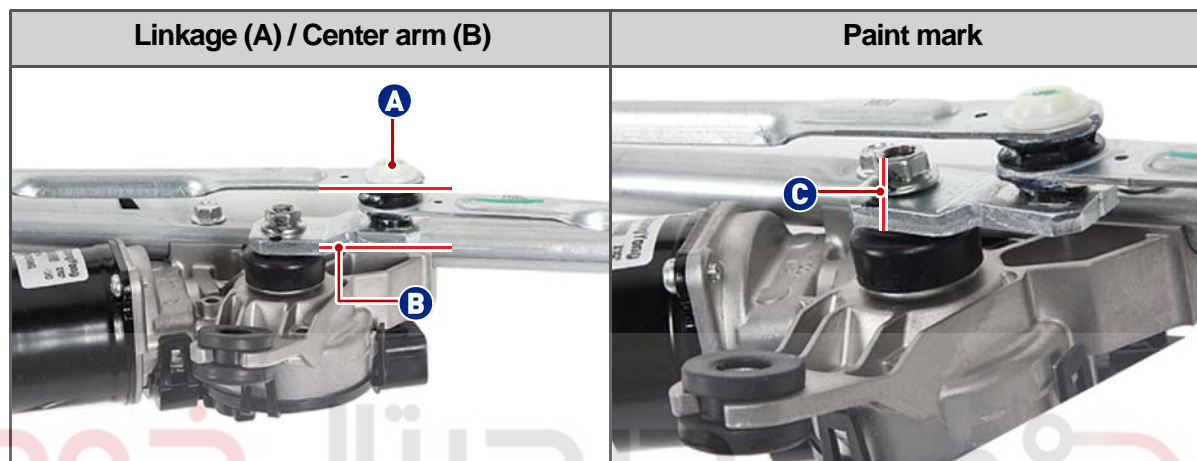


10. Remove the windshield wiper motor and linkage.



**CAUTION**

Make sure that the linkage (A) and wiper motor center arm (B) are parallel to one another and make a paint mark on the point (C) before removing the windshield wiper motor center mounting nut. This is to ease the aligning of linkage parking when reinstalling.



11



11. Unscrew the center mounting nut (12 mm) for the windshield wiper motor.

12



12. Unscrew the 2 mounting bolts (10 mm) for the windshield wiper motor.

Modification basis	
Application basis	
Life cycle	

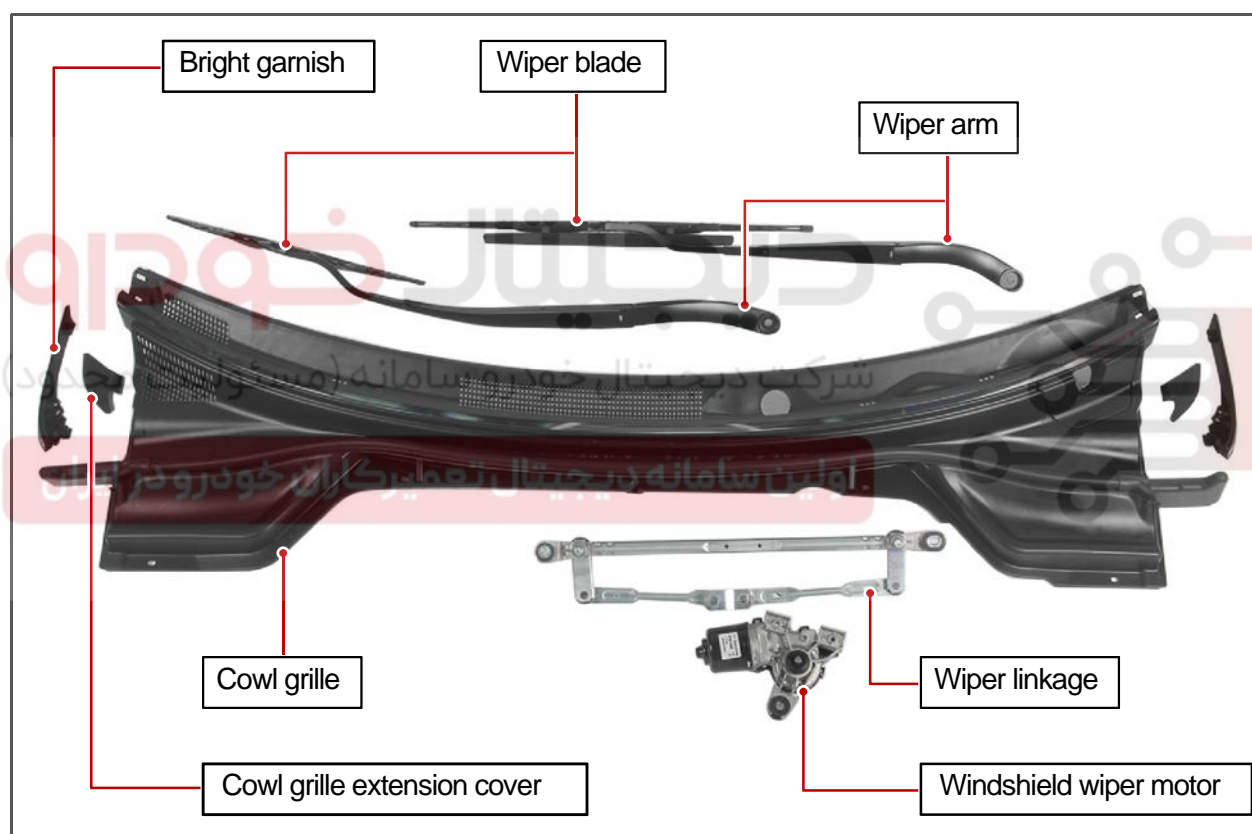


13



13.Remove the windshield wiper motor from the linkage.

14.Install in the reverse order of removal.

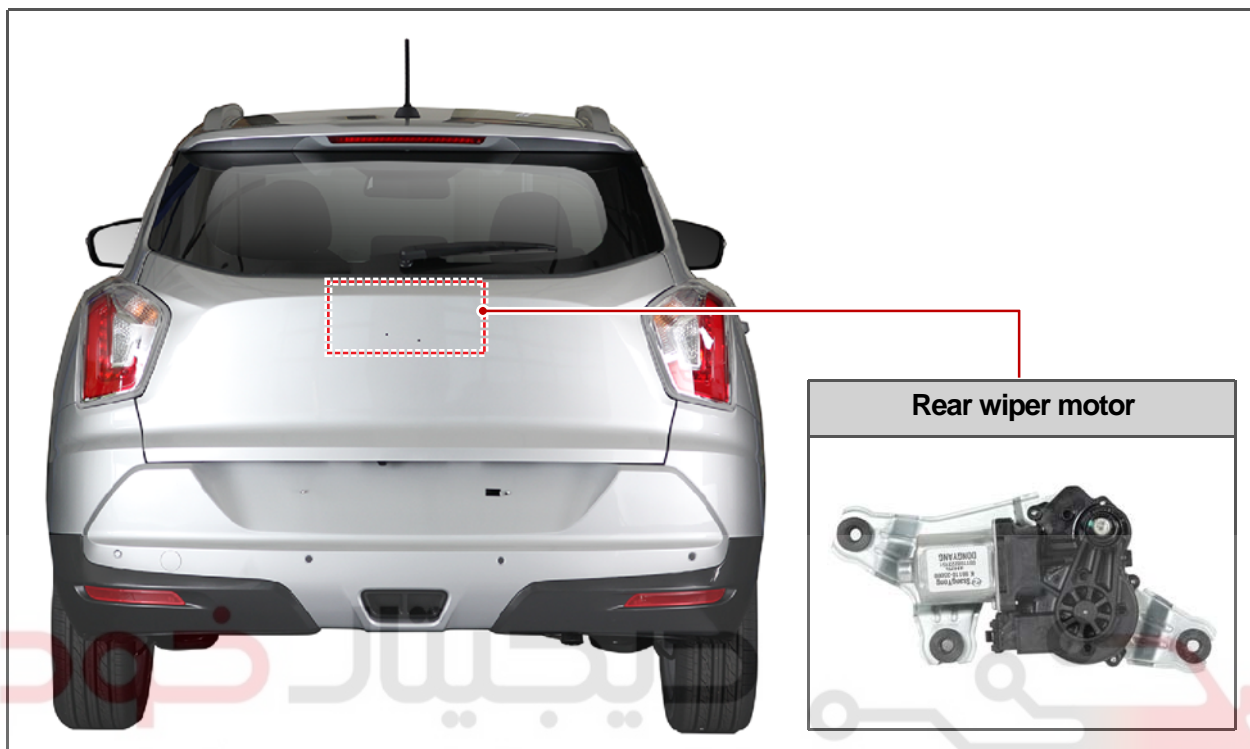


S.G.N.

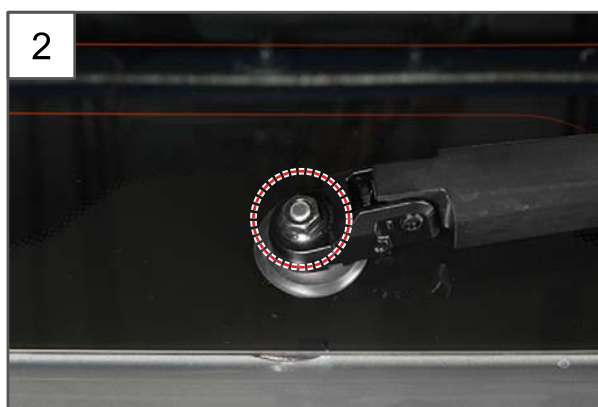
**7830-03 REAR WIPER MOTOR**

Preceding work

- Disconnect the negative battery cable.



1. Remove the rear wiper arm cap.



2. Remove the rear wiper arm mounting nut (12 mm).

**Tightening torque** 14 to 20 Nm  
(17 ± 3 Nm)

Modification basis	
Application basis	
Life cycle	

WIPER AND WASHER SYSTEM

TIVOLI 2015.03

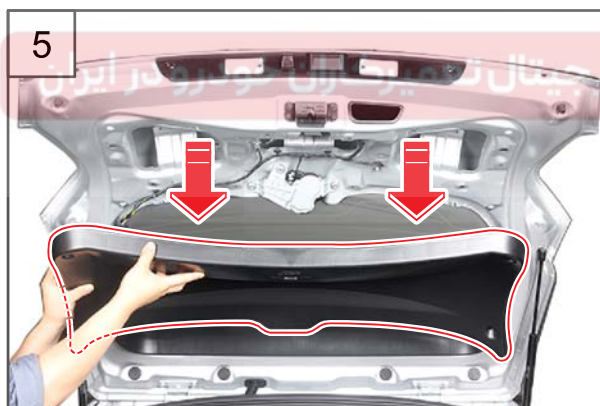


3. Remove the rear wiper arm and blade assembly.

**Rear wiper arm and blade**

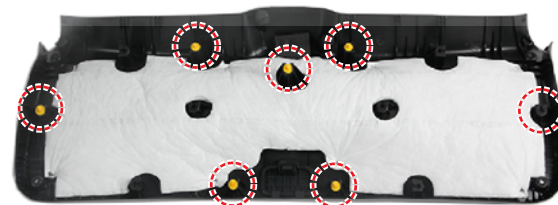


4. Open the tailgate and remove the 4 mounting screws for the tailgate lower trim.



5. Remove the tailgate lower trim.

**Tailgate lower trim retaining clip**

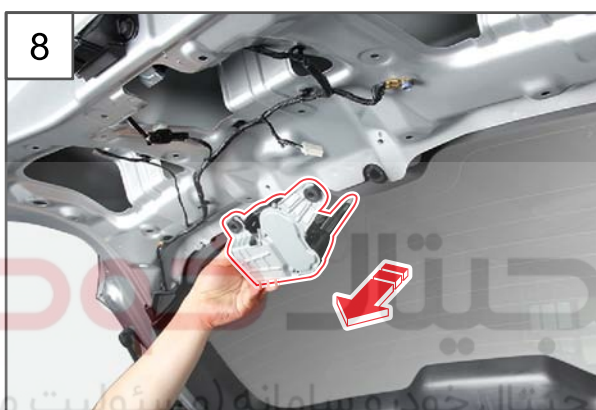


6. Disconnect the rear wiper motor connector.





7. Unscrew the 3 mounting bolts (10 mm) for the rear wiper motor.



8. Remove the rear wiper motor assembly.

9. Install in the reverse order of removal.



Modification basis	
Application basis	
Aftermarket VIN	

S.G.N.

7820-01

## WASHER FLUID RESERVOIR TANK

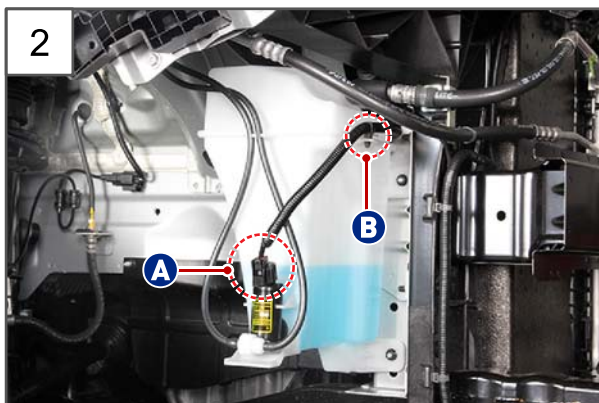
## Preceding work

- Disconnect the negative battery cable.
- Remove the passenger side wheel house cover.

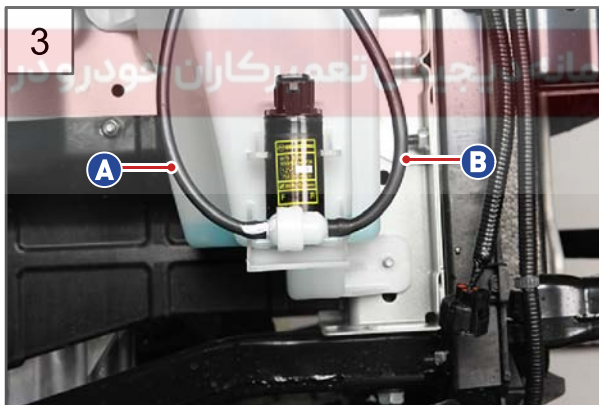
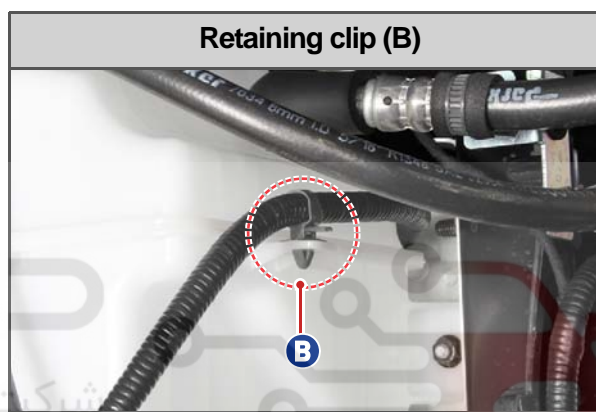
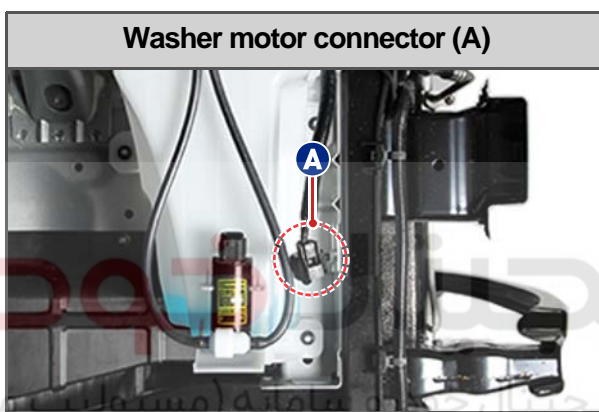


1. Separate the coolant hose from the washer fluid reservoir tank.





2. Disconnect the washer fluid reservoir tank motor connector (A) and remove the wiring retaining clip (B) connected to the washer fluid reservoir tank.



3. Disconnect the windshield washer hose (A) and rear washer hose (B) from the washer fluid reservoir tank.

#### CAUTION

If washer fluid is still left in the washer fluid reservoir tank, drain the fluid by disconnecting the windshield washer hose.

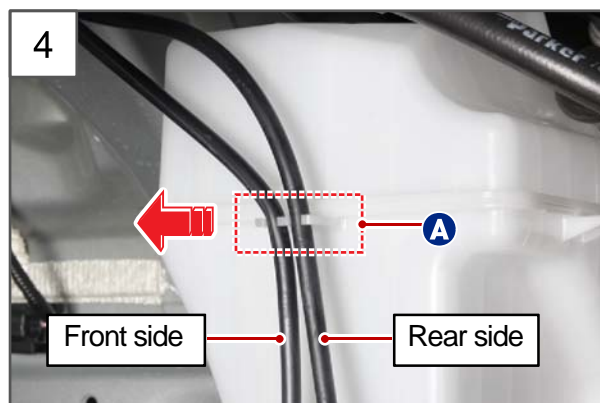
#### CAUTION

Make a paint mark on the windshield washer hose to distinguish between the windshield and rear washer hoses before disconnecting the hoses.

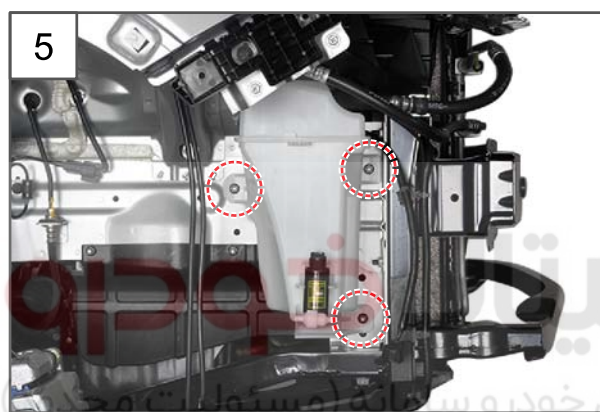


Modification basis	
Application basis	
Approval basis	

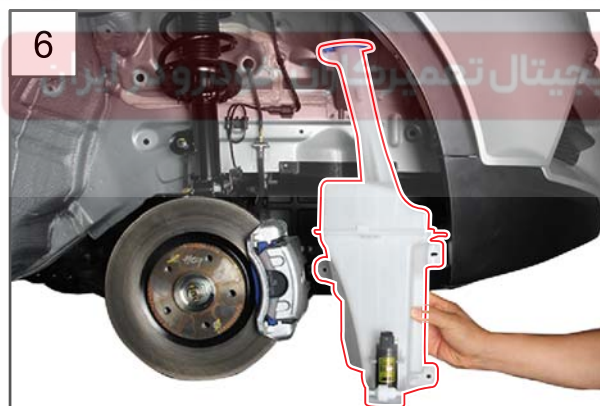




4. Detach the windshield and rear hoses from the connection on the washer fluid reservoir tank.



5. Unscrew the 3 mounting bolts (10 mm) for the washer fluid reservoir tank.



6. Remove the washer fluid reservoir tank.



7. Install in the reverse order of removal.

S.G.N.

**7820-35 REAR WASHER NOZZLE****1) For a Vehicle With Rear Spoiler**

1. Remove the 4 blind plugs after opening the tailgate.



2. Remove the 4 rear spoiler mounting nuts (10 mm).



Modification basis	
Application basis	
Approval	

WIPER AND WASHER SYSTEM

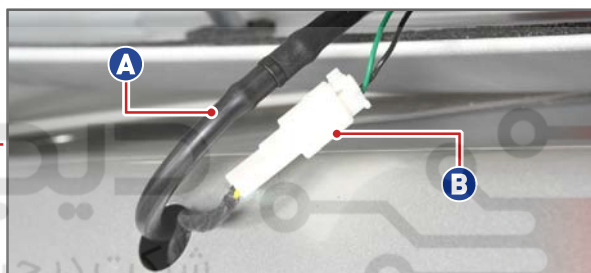
TIVOLI 2015.03



3. Swing the rear spoiler up.



4. Disconnect the rear washer hose (A) and the high mounted stop lamp connector (B).



5. Remove the rear spoiler.



6. Remove the high mounted stop lamp cover fitted to the rear spoiler.







7. Disconnect the hose from the rear washer nozzle.

**CAUTION**

Take care not to damage the lamp and nozzle when removing the washer nozzle.



8. Remove the rear washer nozzle by turning it in the direction of the arrow.



9. Install in the reverse order of removal.

**CAUTION**

Take care not to damage the lamp and nozzle when removing the washer nozzle.

FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

WIPER AND

AVN

MP3 AUDIO

LCD AUDIO

ISG SYSTEM

Modification basis	
Application basis	
Accessories	

## 2) For a Vehicle Without Rear Spoiler



شرکت دیجیتال خودرو (مسئولیت محدود)



1. Prise apart the tailgate upper trim using a hand remover.



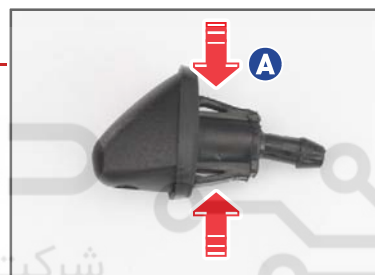
2. Remove the tailgate upper trim.



2. Disconnect the rear washer nozzle hose.



3. Pinch the rear washer nozzle keys (A) and remove the washer nozzle (B).



4. Install in the reverse order of removal.

Modification basis	
Application basis	
Life cycle	

S.G.N.

8610-09

## AUTO LIGHT AND RAIN SENSOR MODULE

Preceding work

- Disconnect the negative battery cable.



1. Insert a screwdriver into the service holes at both sides of the styling cover to remove the cover.

**CAUTION**

Otherwise, the cover or internal housing could be damaged.



2. Disconnect the connector from the AUTO light and rain sensor module.





3. Insert a screwdriver into the service holes at both sides of the cover to separate between the upper and lower covers.



4. Pull out the AUTO light sensor module in the direction of the arrow to remove it.



5. Install in the reverse order of removal.



Modification basis	
Application basis	
Accessories	

S.G.N.

7810-07

## WINDSHIELD WIPER BLADE

Preceding work

- Turn the wiper switch to the OFF position.



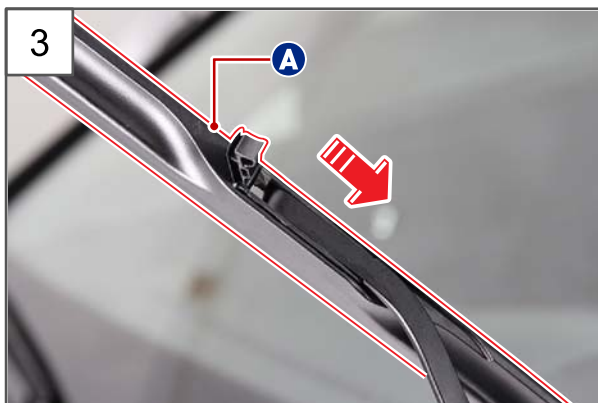
1. Lift up the windshield wiper arm.



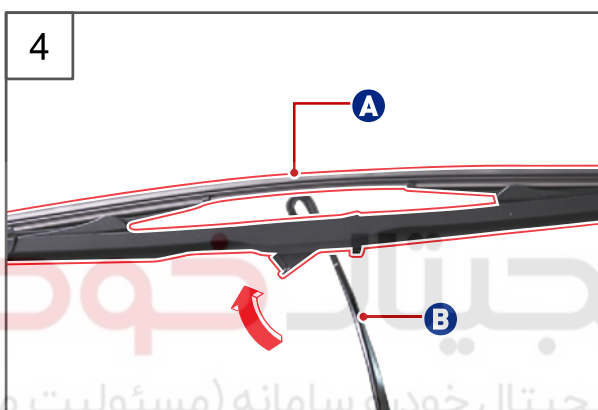
2. Flip up the mounting clip (A) for the windshield wiper blade.







3. Hold the wiper blade (A) and pull it downward.



4. Swing the wiper blade (A) so that it is perpendicular to the wiper arm (B).



5. Remove the wiper blade (A) from the wiper arm. Use the same procedures for the passenger side.



6. Install in the reverse order of removal.

Modification basis	
Application basis	
Life cycle	

S.G.N.

**7830-01 REAR WIPER BLADE****Preceding work**

- Turn the wiper switch to the OFF position.



1. Lift up the wiper arm.



2. Raise the wiper blade at an angle.

Modification basis	
Application basis	
Affected VIN	021 62 99 92 92



3. Remove the wiper blade in the direction of the arrow.



4. Install in the reverse order of removal.

دیجیتال خودرو  
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران



FUSE

BCM

SKM

INSTRUMENT

SWITCH

LAMP

WIPER AND

AVN

MP3 AUDIO

LCD AUDIO

ISG SYSTEM

Modification basis	
Application basis	
Accessories	

## Memo

# دیجیتال خودرو

شرکت دیجیتال خودرو سامانه (مسئولیت محدود)

اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

