# Wipers and Washer

# **S**pecifications

Torque

Description	Value
Nut - Front Windshield Wiper Arm	20-30 Nm
Screw - Wiper Mounting Bracket	4-10 Nm
Bolt - Windshield Washer System	4-6 Nm

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## **Description and Operation** System Component Layout Wiper and Washer Component Layout



- I. Wiper/Washer Lever Switch
- 2. Body Control Module (BCM)
- 3. Windshield Wiper and Motor Assembly

- 4. Front Windshield Washer Nozzle
- 5. Washer Fluid Reservoir and Washer Pump

Wiper Exploded View



- 2. Passenger Side Wiper Blade Assembly
- 3. Driver Side Wiper Blade Assembly

- 5. Shaft Cover
- 6. Wiper Motor

## Washer Exploded View



- I. Front Windshield Washer Hose
- 2. Front Windshield Washer Nozzle
- 3. Washer Fluid Reservoir Neck

- 4. Washer Fluid Reservoir
- 5. Windshield Washer Pump
- 6. Washer Fluid Reservoir Hose

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## System Control Diagram Wiper and Washer Control Diagram



A = Hard Wire; B = CAN High Speed Bus Line

- I. ABS Control Module
- 2. Wiper Motor
- 3. Wiper/Washer Lever Switch

- 4. Washer Pump
- 5. Ignition Switch
- 6. Body Controller Module (**BCM**)

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# Description General Description

Wiper and washer system is controlled by the body control module (**BCM**), and operates after it received a command from the driver or rain sensor (if equipped). Wiper functions are all controlled by wiper/washer lever switch assembly on the right side of the steering wheel. Wiper and washer system contains:

- Wiper Motor
- Wiper Link Mechanism
- Two Wiper Arms and Blades
- Two Washer Nozzles
- Washer Fluid Reservoir and Washer Pump
- Wiper/Washer Lever Switch

It is possible to operate the wiper function after the wireless key is inserted. The wiper functions are all paused immediately after starting engine.

# Body Control Module, Load Management.

Read the diagnosis messages of the wiper and washer system by T5 scan tool.

# Wiper/Washer Lever Switch

Wiper lever switch contains a 5th toggle switch and a rotary switch. The switch position of intermittent, low speed and high speed wiper operation and "OFF" position are locked, but the temporary operation switch and programmed washer/wiper operation switch are unlocked. Rotary switch is used for selecting the intermittent delay time.

# Wiper Operation Mode

This wiper system supports the following operation mode:

- Programmed Washer/Wiper Operation
- Temporary Operation
- Low Speed Wiper Operation
- High Speed Wiper Operation
- Automatic (intermittent) Wiper Operation

# Programmed Washer/Wiper Operation

Pull the lever switch towards the steering wheel, then the washer operates immediately. After a short interval, wiper and washer operate together. The wiper will continue to operate for 3 times after the lever switch is released. After a few seconds, the wiper will operate one more time to remove the washer fluid on the windshield.

# Temporary Operation

When push upward the wiper/washer lever switch once from the stop position and release it quickly, the wiper will complete a low speed wiper operation. If the switch remains on, the wiper will operate at high speed, if the switch is off, the wiper will complete wiper operation once at low speed until the motor reaches the stop position.

## Low Speed Wiper Operation

When the switch is on and locked in the low speed position, wiper will operate continuously at low speed.

# High Speed Wiper Operation

When the switch is on and is locked in the high speed position, wiper will operate continuously at high speed.

# Automatic (intermittent) Wiper Operation

Select this mode when the wiper cannot operate continuously due to insufficient rain, so that the wiper blade will stay in the stop position until the selected delay time between twice wiper operations is ended. The delay time is determined by the toggle switch, the position of the intermittent delay rotary switch (four rotary switches, located at the wiper arm end) and vehicle sensors together.

When programmed wiper/washer operation mode is selected again after the intermittent wiper operation mode is selected, the programmed wiper/washer operation starts immediately, but the intermittent wiper operation restarts after the programmed wiper/washer operation is ended and motor reaches the stop position.

## Wiper and Washer, Delay Time Related to Vehicle Speed

When the switch is in the intermittent, low speed, or high speed operation position,**BCM** will adjust the intermittent time according to the vehicle speed.**ABSECU** monitors the wheel speed signal and transmits it to**BCM** by HS**CAN** bus line. If the wiper switch is in the intermittent operation position,**BCM** compares the resistance related to vehicle speed and intermittent delay rotary switch position, and adjusts the selected delay time accordingly.

If the wiper switch is on and locked in the low speed position, and the vehicle driving speed is lower than 8 km/h,**BCM** will activate intermittent operation, the appropriate intermittent delay time is determined by the intermittent rotary switch that has been set.

## Note: If a longer time delay is reselected during intermittent operation, the time delay will be carried out when the next wiper operation starts; if a shorter time delay is reselected during the time delay, the new time delay will be carried out immediately.

If the wiper switch is on and locked in the high speed position and the vehicle driving speed is lower than 8 km/h, the wiper speed will change to low speed operation. When the speed is higher than 8 km/h, the wiper will return to the intermittent operation which has the speed sensing function.

## Wipers and Washer

#### Wiper

The wiper motor is located in the lower side of the air intake grille under the windshield. This motor is fitted on a link mechanism on the bracket between inner and outer bulkhead. The motor is a DC motor which drives the worm wheel by the worm gear attached to the motor main shaft. External worm wheel is connected with the link mechanism, which can drive the wiper arm attached to the worm wheel block at the end of the link mechanism.

The motor receives two input signals from a 4-pin connector on the wire. The first input signal is 12V DC, which enables the motor to operate at high speed. The second input signal is 12V DC too, need a resistor in series, in order to reduce the voltage applied to the motor, making the motor speed become slower. The motor is grounded by the orbit of the internal gear.

The fourth pin of the motor connector is connected with the return control chip and handle the return switch of the motor.

The wiper arm is fitted on the link mechanism output shaft. There is a fulcrum between the wiper arms mounting points. Connect a spring at the both ends of the fulcrum, and apply appropriate pressure to the windshield wiper blade.

The blade of the boneless wiper is secured to the wiper arm with the clip, and it can turns freely at the mounting point of the wiper arm. This kind of structure ensures that the glass can be cleaned neatly in any wiper operation mode. Also it reduces noises and the wind resistance.

## Windshield Washer

Windshield washer system contains the washer fluid reservoir, washer fluid reservoir neck, washer pump, washer nozzle, check valve, hose and hose joint.

The washer fluid reservoir is located inside the vehicle wheel house RH with capacity of approximately 3.8 L. Add washer fluid to washer fluid reservoir by the funnel neck with sealing cap in the engine bay. A washer pump is under the washer fluid reservoir.

When the washer pump starts to operate, the fluid in the pump will be sent to the washer nozzle at the rear edge of the engine cover by the pressure. Check valve in the line prevents the fluid of the nozzle and hose from flowing back into the washer fluid reservoir, thus ensuring the wiper is instant available.

## Operation



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- I. Programmed Washer/Wiper Operation
- 2. Automatic (intermittent) Wiper Operation
- 3. Low Speed Wiper Operation (LO)
- 4. High Speed Wiper Operation (HI)
- 5. Intermittent Delay Rotary Switch FAST—SLOW
- 6. Temporary Operation (MIST)

#### Wiper

Intermittent, low speed, high speed and temporary wiper operation switches are all form a ground close loop with**BCM** through either wire of the switch unions I and 2. Combination ground loop is monitored by**BCM** via one or two signals from selected functions. Refer to the table below for combination condition.

Switch Position	Switch I	Switch 2	
Stop	0	0	
Temporary Operation	I	I	
Intermittent Wiper Operation	I	0	
Low Speed Wiper Operation	0	0	
High Speed Wiper Operation	I	I	
0 = Open Circuit I = Closed Circuit			

### **Programmed Washer/Wiper Operation**

Programmed washer/wiper operation function is controlled by **BCM**. When the switch is on, the washer pump operates the washer fluid to windshield immediately by washer nozzle. The washer pump operates once after 750 ms. If the switch is still ON, perform the lower speed wiper operation for three times, and the wipe operation will continue until the motor stops. The washer pump keeps working when the switch is

ON, even if the switch is OFF, it still operates three times, and then operates once again after a short delay. If other wiper functions is selected before finishing the programmed washer/wiper operation, it will be cancelled, causing the wiper to operate according to the new selected function.

### Low Speed Operation

The power source is supplied to the wiper motor through two normal close relays of the wiper (start relay and speed relay). Both relay coils are controlled by the BCM.BCM circuit provides the start relay coil of the wiper with the ground connection when the low speed wiper operation mode is selected. The voltage is applied to the relay contact points by the start relay coil, in order to allow signals from fuse EFI in engine bay fuse box to transmit to start relay contact points. The signal is sent to the motor through the wiper relay and a resistor. The resistor makes the motor run in low speed by reducing the power supply. The motor ground device is grounded by the connecting the motor casing and ball joint. During intermittent wiper operation, BCM make the wiper operate in low speed by the resistance. When wiper is off, BCM converts the wiper relay to complete the cycle in low speed.

### **High Speed Operation**

When high speed operation is selected, electronic switch will apply voltage to wiper start relay as in low speed operation.**BCM** can also apply voltage to wiper speed relay coil by using of another electronic switch in**BCM** to provide ground connection. The signal from fuse EFI, which passes through wiper relay contact point and then rounds the resistance that used for decelerating, is connected with motor directly, so that the wiper can operate at high speed.

### Automatic (intermittent) Wiper Operation

Intermittent rotary switch can form a complete ground loop via the switch on **BCM**. Each switch corresponds to different resistances that monitored by **BCM.BCM** selects the appropriate timer according to the resistance value that has been measured to determine the delay time.

After**BCM** timer reaches a selected delay time, the wiper will operate once in low speed before it returns to the stop position. After that,**BCM** will turn on timer for another selected delay time before the following operation.

The correspondence between delay time and rotary switch position changes according to the position of wiper/washer lever switch and vehicle speed. When wiper/washer lever switch is in intermittent position, the correspondence of

Rotary Switch	Vehicle Speed km/h (mph)					
Position (resistance $k\Omega$ )	<8 (<5)	<32 (<20)	<64 (<40)	<92 (<57)	<128 (<80)	≥ 128 (≥ 80)
0	8	6	5	4	3	3
( -3)	26	19	17	15	15	13
2 (3-5)	7	12	11	10	9	7
3 (5-7)	10	6	6	5	4	3
4 (7-9)	5	3	3	2	2	2

(s) of the wiper blade is shown in the table below.

vehicle speed, delay rotary switch position and the delay time

When wiper/washer lever switch is in low speed position and the vehicle speed is lower than 8 km/h, the correspondence between the delay time of the wiper blade twice operation and the rotary switch position is shown in the table below.

Rotary Switch Position	Vehicle Speed km/h (mph)
(resistance $k\Omega$ )	<8 (<5)
0	8
1 (1-3)	30
2 (3-5)	26
3 (5-7)	17
4 (7-9)	10

Note: The rotary switch position 0 indicates the resistance detected by BCM is out of  $I-9 K\Omega$ , i.e. the rotary switch is in a wrong position. And the time delay for this position will only be applied in the next wiper delay cycle.

### **Return Switch**

Return switch contains an incomplete control chip (on the worm gear inside the wiper motor). The motor, motor ground control chip and worm gear are connected together. Input from**BCM** is connected with one contact point of the wiper motor; the motor and return control chip are connected together to complete ground connection in**BCM** when the wiper in the return position. Closed circuit will provide ground function for the output from BCM.**BCM** will interpret the ground signal into of the wiper in the stop position signal.

### Windshield Washer

Once the programmed washer/wiper operation is on, a complete ground route will be formed through**BCM** and washer pump on single wire via switch. Closed ground loop sends requirement of programmed control washer/wiper operation to **BCM**, and operates wiper accordingly. When closed ground loop is formed, washer pump is turned on.

When wireless key is inserted or the ignition switch is turned on, the washer pump receives 12V power by fuse F21 in the passenger compartment fuse box and fuse EF30 in the engine bay fuse box. When programmed washer/wiper operation is selected by wiper arm switch, a ground loop is formed through switch and washer pump, and it will operate at that time. The washer pump operates at least 750 ms whenever the switch is ON.

## **Service Procedures**

## Windshield Wiper Blade Assembly Removal

- I. Lift the wiper blade from the windshield.
- 2. Press the setting clamp, and slide downward the wiper blade along the wiper arm and remove the blade simultaneously.

### Refit

- I. Slide the blade to the wiper until the setting clamp is engaged. Thus fit the blade.
- 2. Hold the wiper arm to the windshield.

## Windshield Wiper Arm Assembly Removal

- I. Open the bonnet.
- 2. Remove the wiper arm shaft cover to expose the wiper arm nut.



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- Remove the nut fitting the wiper arm to the link 3. mechanism.
- 4. Remove the wiper arm.

#### Refit

- I. Fit the wiper arm.
- 2. Fit the nut to mandrel, and the torque is 20-30 Nm.
- 3. Cover the wiper arm shaft cover.
- 4. Close the bonnet.

## Windshield Wiper Link Mechanism Assembly - with Motor

### Removal

- I. Disconnect the battery negative terminal.
- 2. Remove the windshield wiper arm assembly.

### 🐨 Windshield Wiper Arm Assembly

- 3. Remove the air intake grille assembly.
- 4. Unscrew the bolts of the windshield wiper link mechanism assembly.



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5. Remove the windshield.

#### Refit

- 1. Fit the windshield wiper link mechanism assembly with bolts, and the torque is **4-10 Nm**.
- 2. Fit the air intake grille assembly.
- 3. Fit the windshield wiper arm assembly.

#### 🗇 Windshield Wiper Arm Assembly

4. Connect the battery negative terminal.

# Windshield Wiper Motor

#### Removal

- I. Disconnect the battery negative terminal.
- 2. Remove the windshield wiper arm assembly.

## TWindshield Wiper Arm Assembly

- 3. Remove the air intake grille assembly.
- 4. Remove the windshield wiper link mechanism assembly.



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5. Remove the connector, motor and link mechanism from the windshield wiper motor.

### Refit

I. Connect the connector to the windshield wiper motor.

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- 2. Fit the motor and link mechanism with bolts.
- 3. Fit the air intake grille assembly.
- 4. Fit the windshield wiper arm assembly.

#### FWindshield Wiper Arm Assembly

5. Connect the battery negative terminal.

### Washer Fluid Reservoir Assembly

#### Removal

- I. Disconnect the battery negative terminal.
- Prepare a container that is used for collecting spilled 2. fluid.
- 3. Loosen the snap fits from the engine bay wire to the washer fluid reservoir.



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- Unscrew the bolts positioning the washer fluid 4. reservoir neck to the body, and remove the washer fluid reservoir neck from the washer fluid reservoir.
- 5. Remove the bolts securing the washer fluid reservoir to the body.

## Washer Pump Assembly

#### Removal

- I. Disconnect the battery negative terminal.
- 2. Remove the washer fluid reservoir.

#### Washer Fluid Reservoir

- 3. Disconnect the washer hose from the washer fluid reservoir.
- 4. Disconnect the electrical connector.
- 5. Remove the washer fluid pump.

#### Refit

- I. Connect the washer hose to the washer fluid pump.
- Fit the washer fluid pump. 2.
- 3. Connect the washer fluid reservoir.

#### F Washer Fluid Reservoir

4. Connect the battery negative terminal.



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- Disconnect the washer hose from the washer fluid 6. reservoir.
- Disconnect the washer pump connector and remove 7. the washer fluid reservoir.

#### Refit

- I. Hold the washer fluid reservoir to the body with bolts, and tighten them to 4-6 Nm.
- Connect the engine compartment wire to the washer 2. fluid reservoir with snap fits.
- Connect the washer pump electrical connector. 3.
- Connect the washer hose to the washer pump. 4.
- Connect the battery negative terminal. 5.

### Front Windshield Washer Nozzle

#### Removal

- I. Open the bonnet.
- 2. Remove bonnet sound-insulating mat.

## Bonnet Sound-insulating Mat

- 3. Disconnect the washer hose from the nozzle.
- 4. Remove the washer nozzle and shim from the bonnet.

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I. Fit	it the shim and washer nozzle to the bonnet.
2. C	Connect the washer hose to the nozzle.
3 Fir	it honnet sound-insulating mat

3. Fit bonnet sound-insulating mat.

## Bonnet Sound-insulating Mat

4. Cover the bonnet.