

Description of ESP

Electronic Stability Control (ESC) recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by individual wheel braking and engine control input.

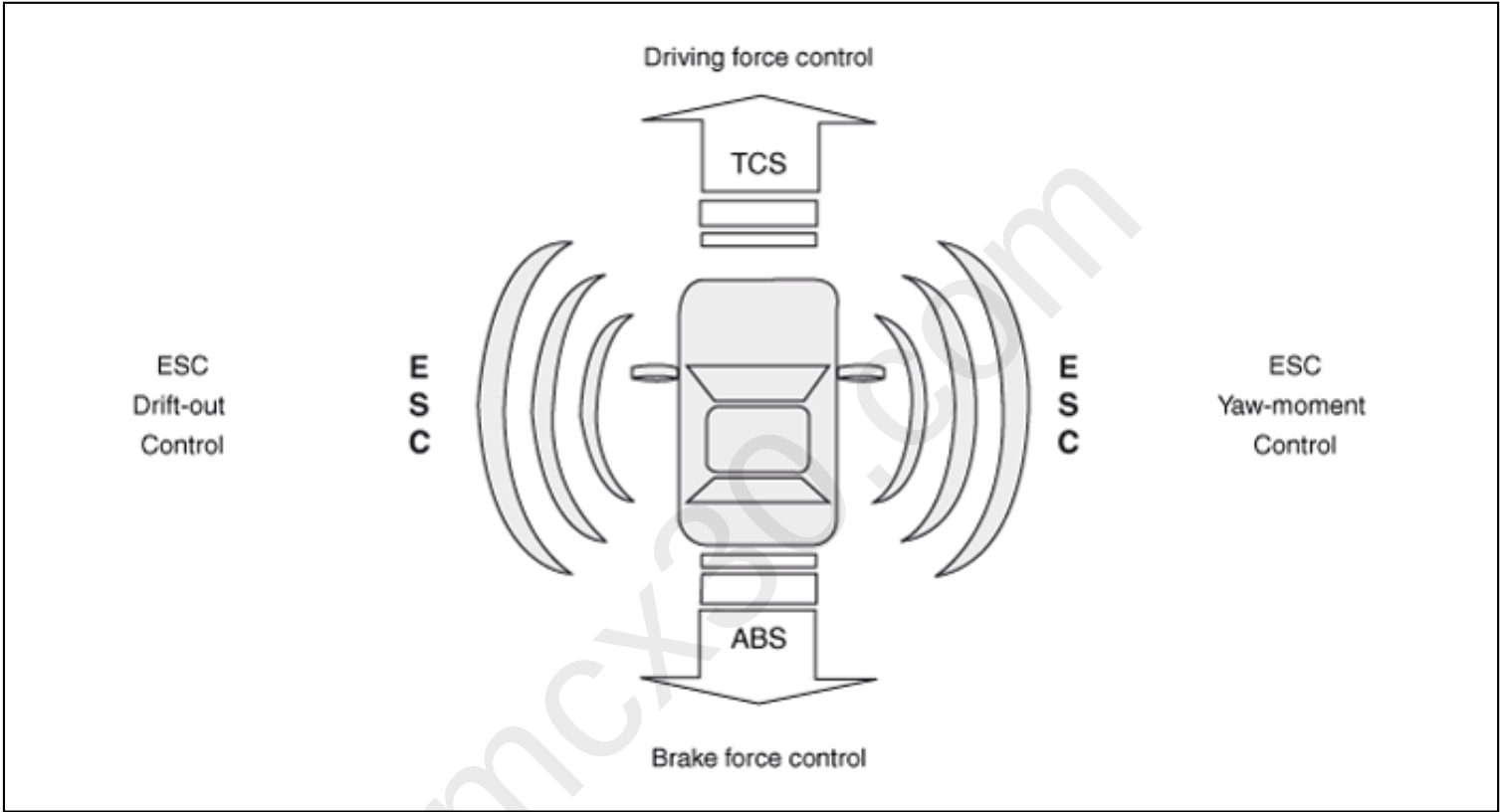
ESC adds an additional function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESC functions. On contrary, the ABS/TCS function controls wheel slip during braking and accelerating, and thus, mainly intervenes in the longitudinal dynamics of the vehicle, and the active yaw control stabilizes the vehicle on the vertical axis.

This is achieved by individual wheel brake intervention and adaptation of momentary engine torque with no need for any action to be taken by the driver.

ESC essentially consists of three assemblies : the sensors, the electronic control unit and the actuators.

The stability control feature works under all driving and operating conditions. Under certain driving conditions, the ABS/TCS function can be activated simultaneously with the ESC function in response to a command by the driver.

In the event of a failure of the stability control function, the basic safety function, ABS, is still maintained.



Description of ESP Control

ESC system consists of ABS/EBD, TCS and AYC functions.

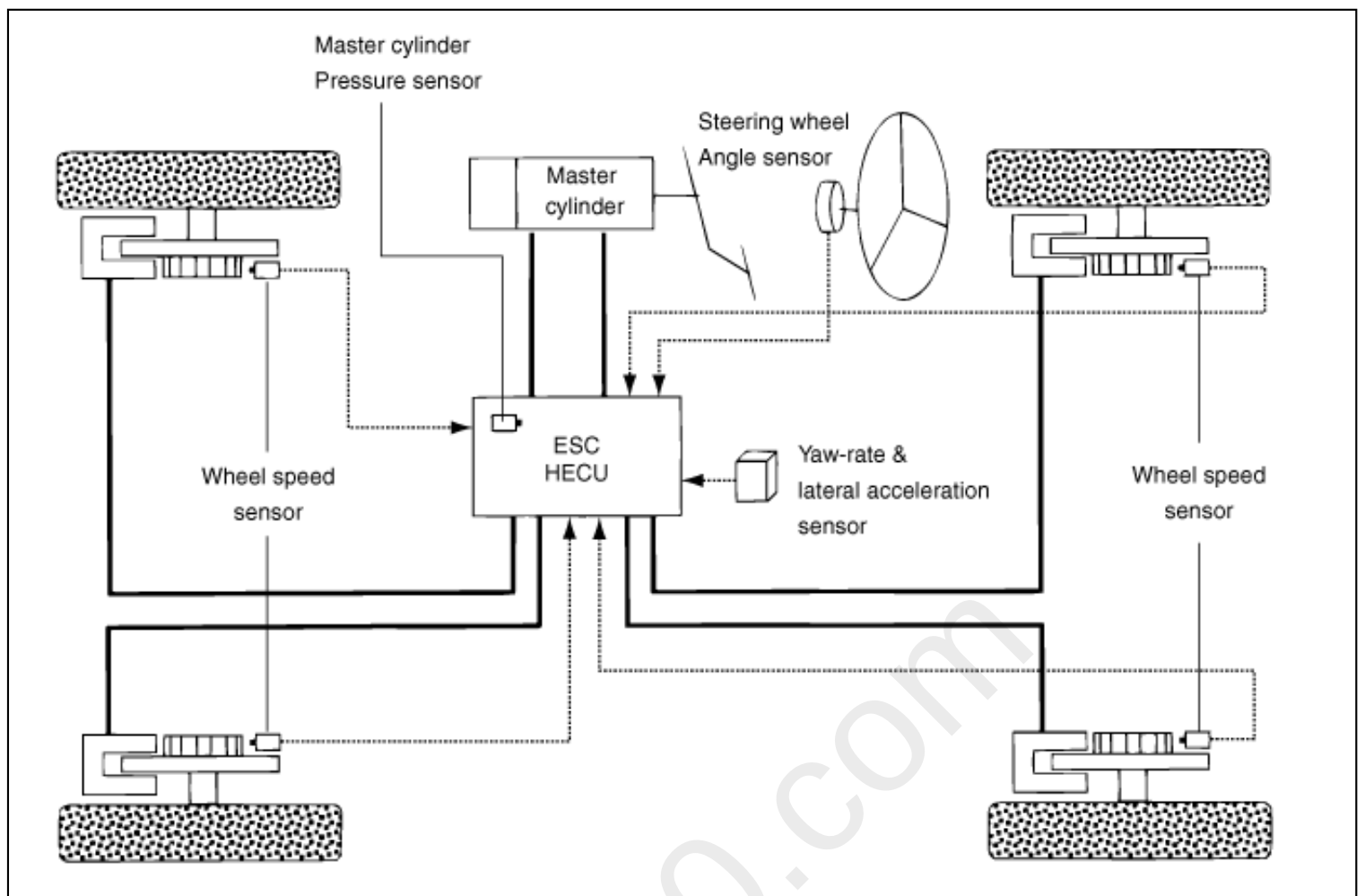
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors into square waves. By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU determines whether the ABS/EBD should be actuated or not.

TCS function prevents the wheel slip of drive direction by adding the brake pressure and engine torque reduction via CAN communication. TCS function uses the wheel speed sensor signal to determine the wheel slip as far as ABS function.

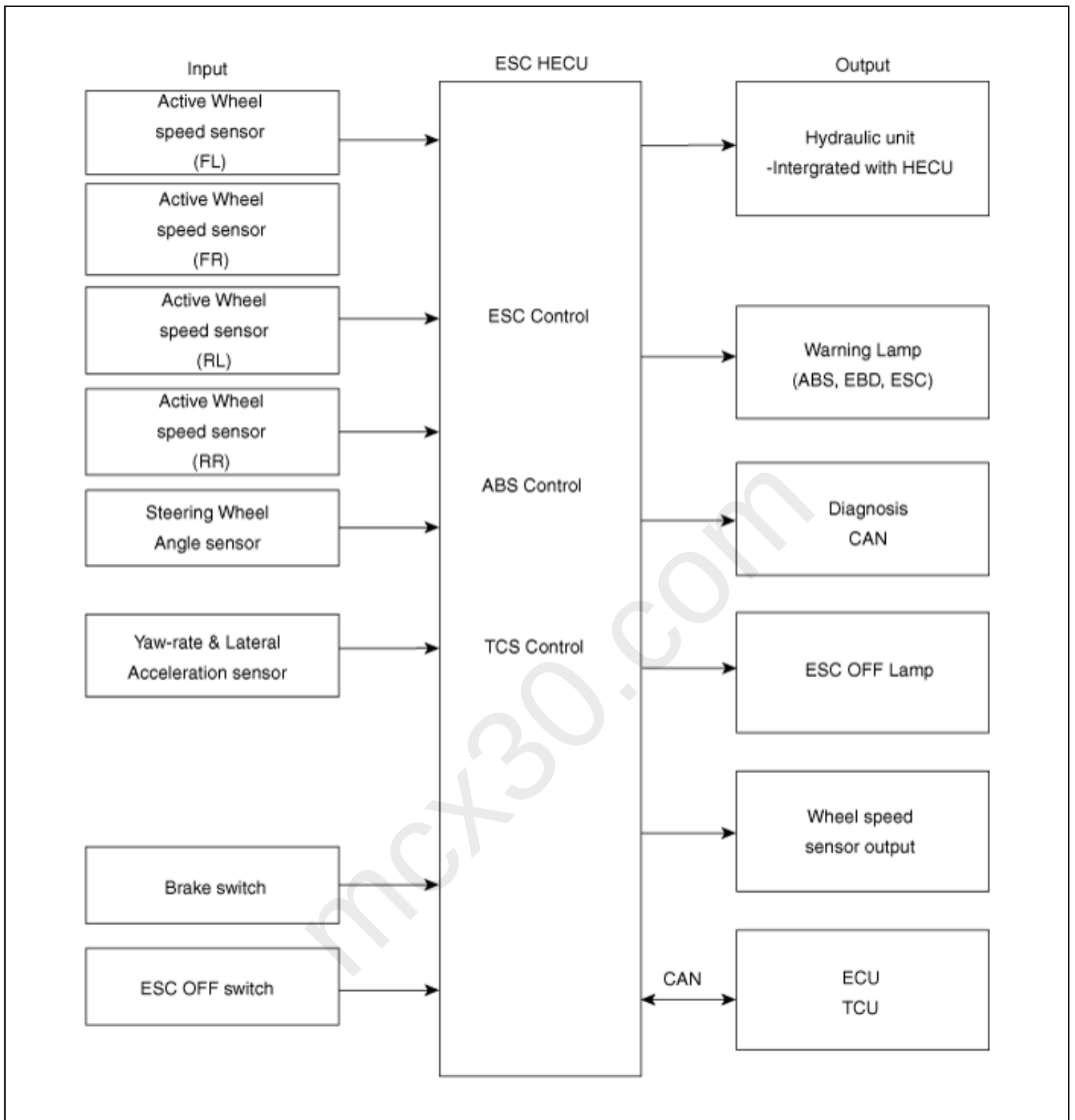
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals (Yaw Rate Sensor, Lateral Acceleration Sensor, and Steering Wheel Angle Sensor).

If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and sends engine torque reduction signal by CAN.

After the ignition on, the ECU continuously diagnoses the system for failures (self-diagnosis). If a system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESC warning lamp (fail-safe warning).



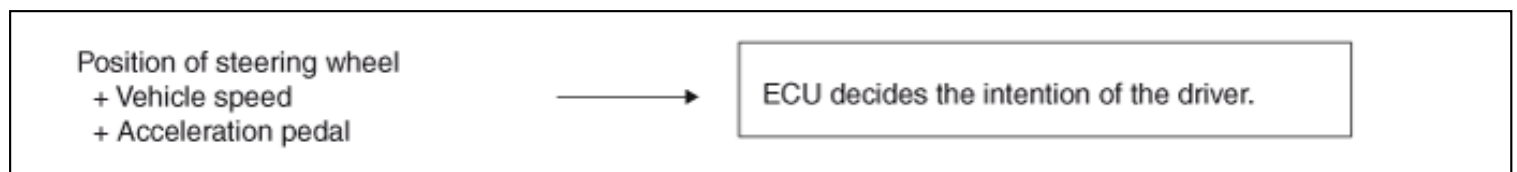
Input and Output Diagram



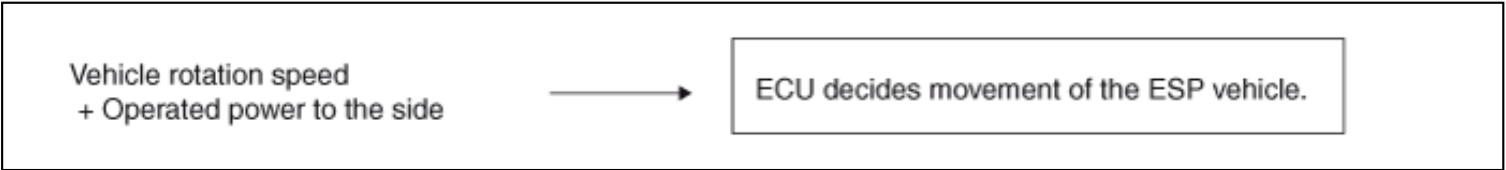
ESC Operation Mode

1. STEP 1

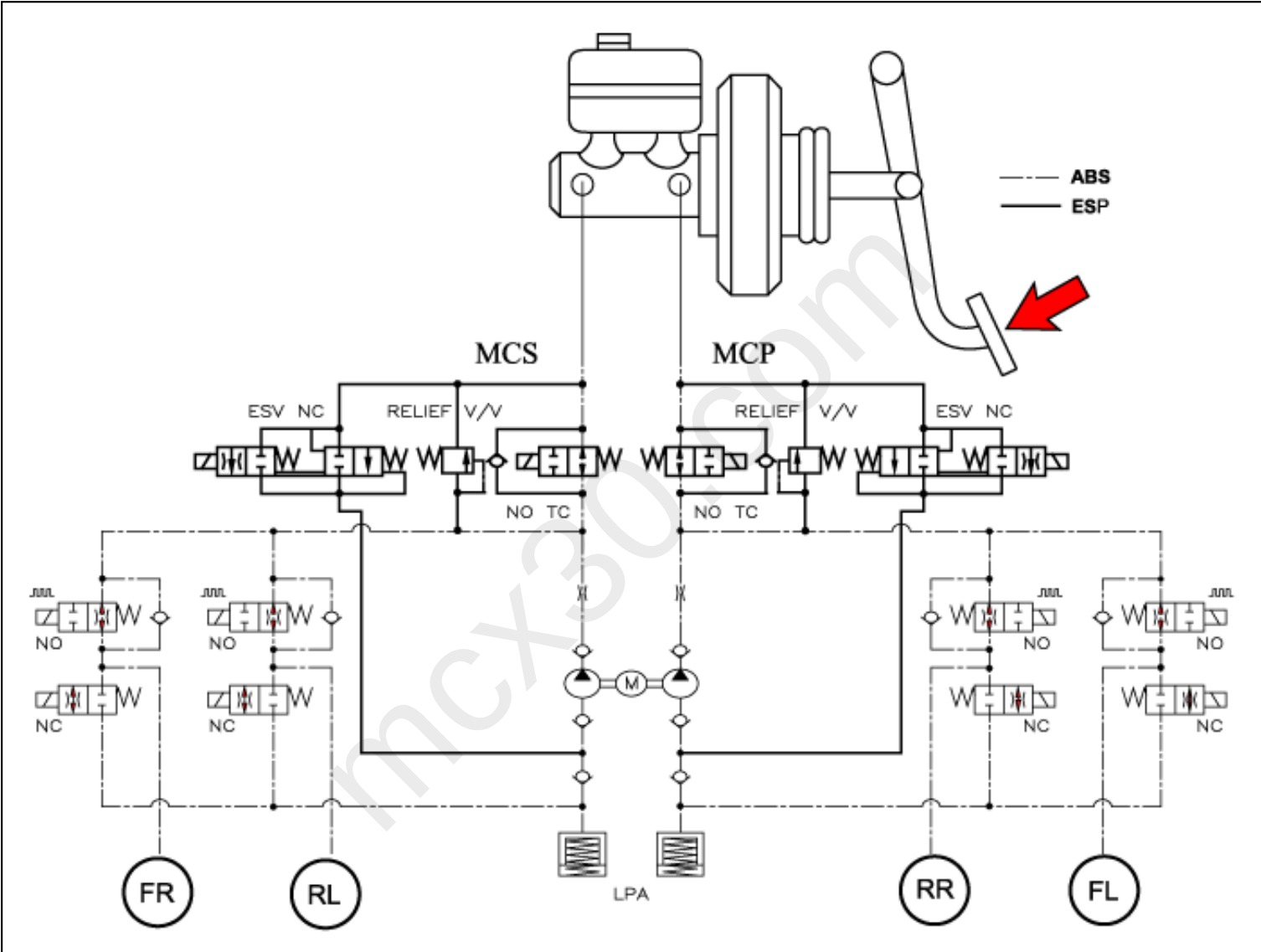
The ESC analyzes the intention of the driver.



2. STEP 2
It analyzes the movement of the ESC vehicle.



3. STEP 3
The HECU calculates the required strategy, then actuates the appropriate valves and sends torque control requests via CAN to maintain vehicle stability.



ESC Hydraulic System Diagram

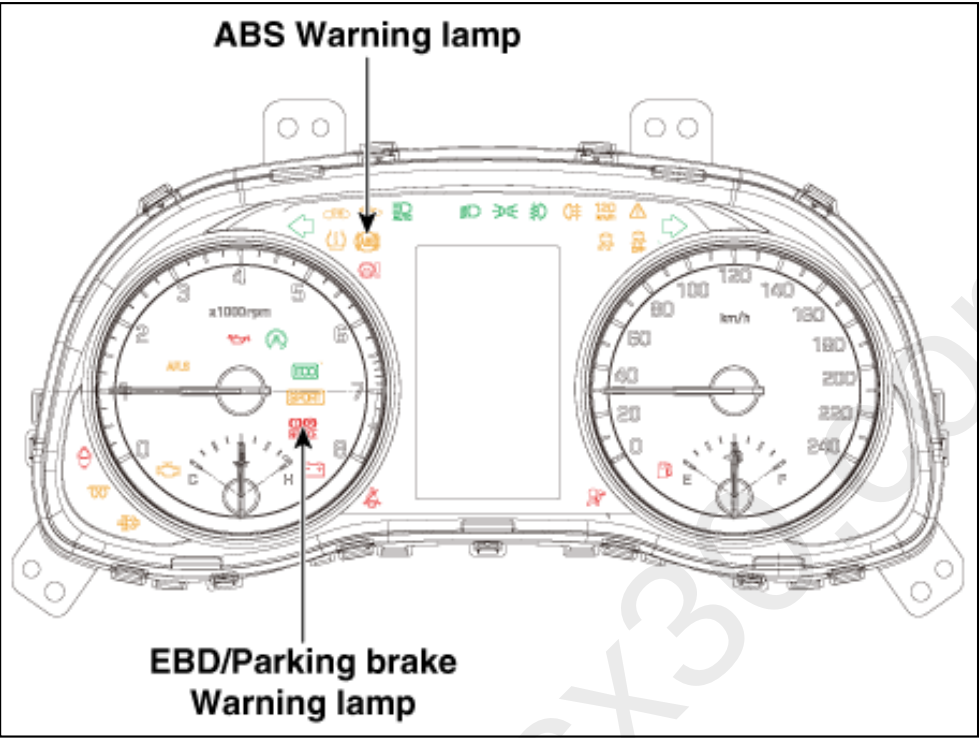
1. ESC Non-operation : Normal braking.

Solenoid Valve	Continuity	Valve	Motor Pump	TC Valve
IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

2. ESC operation

Solenoid Valve		Continuity	Valve	Motor Pump	TC Valve
Understeering (Only inside of rear wheel)	IN (NO)	OFF	OPEN	ON	ON
	OUT (NC)	OFF	CLOSE		
Oversteering (Only outside of front wheel)	IN (NO)	OFF	OPEN		
	OUT (NC)	OFF	CLOSE		

Warning Lamp Control



ABS Warning Lamp module

- The active ABS warning lamp module indicates the self-test and failure status of the ABS. The ABS warning lamp shall be on :
- During the initialization phase after IGN ON. (continuously 3 seconds).
 - In the event of inhibition of ABS functions by failure.
 - During diagnostic mode.
 - When the ECU Connector is seperated from ECU.
 - Cluster lamp is ON when communication is impossible with CAN module.

EBD/Parking Brake Warning Lamp Module

- The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shallbe on :
- During the initialization phase after IGN ON. (continuously 3 seconds).
 - When the Parking Brake Switch is ON or brake fluid level is low.
 - When the EBD function is out of order .
 - During diagnostic mode.
 - When the ECU Connector is seperated from ECU.
 - Cluster lamp is ON when communication is impossible with CAN module.

ESC Function / Warning Lamp (ESC System)

The ESC function/warning lamp indicates the self-test and failure status of the ESC.

The ESC function/warning lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC function is inhibited by system failure.
- When the ESC control is operating. (Blinking - 2Hz)
- During diagnostic mode.(Except standard mode)
- Cluster lamp is ON when communication is impossible with CAN module.

ESC OFF Lamp (ESC System)

The ESC Off lamp indicates the self-test and operating status of the ESC.

The ESC Off lamp operates under the following conditions :

- During the initialization mode after IGN ON. (continuously 3 seconds).
- ESC Off lamp is On when driver input the ESC Off switch.

ESC ON / OFF Switch (ESC System)

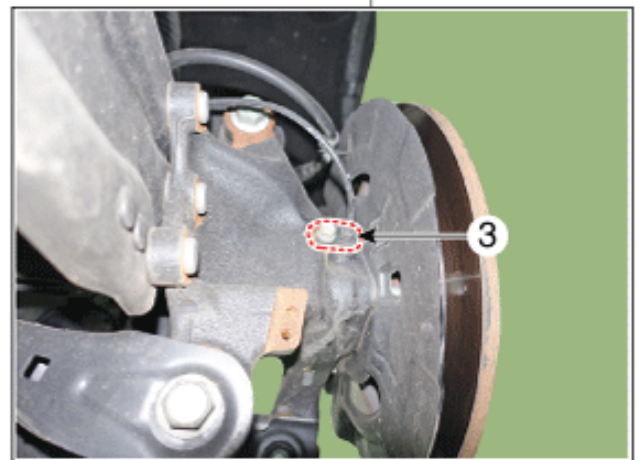
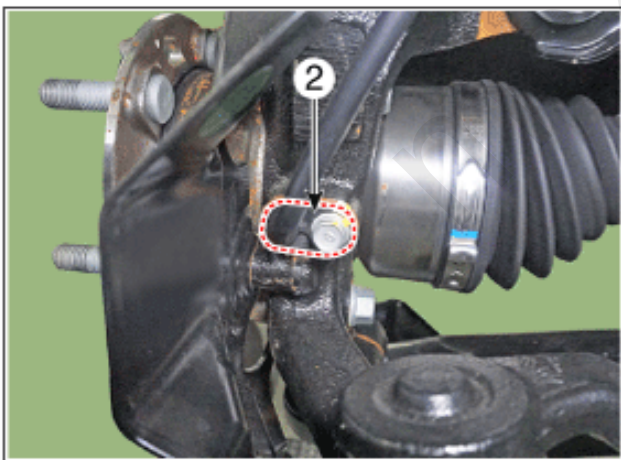
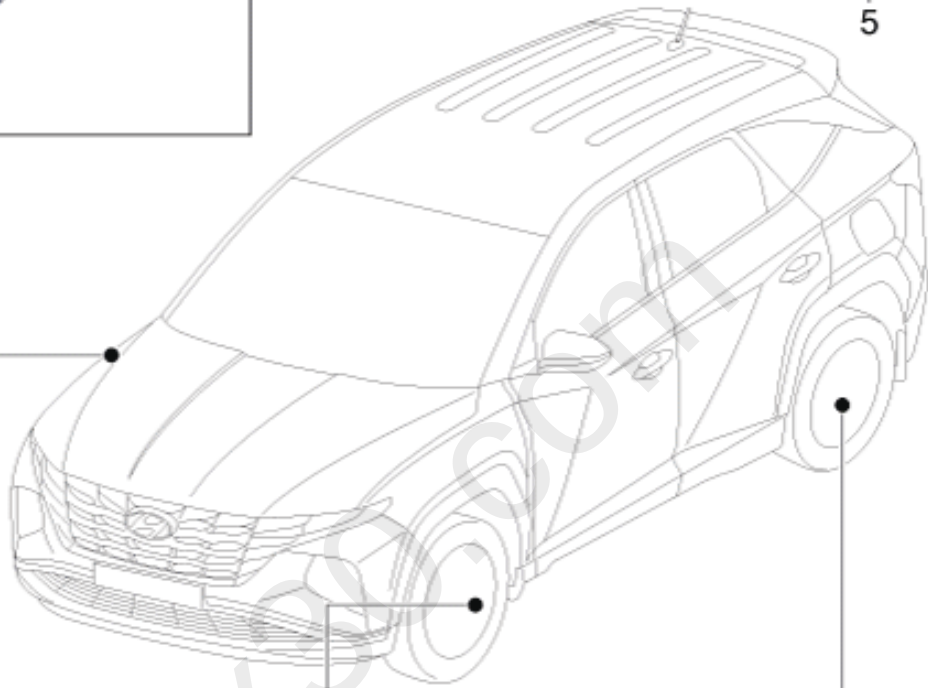
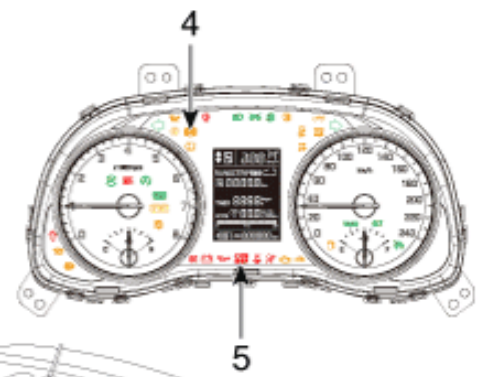
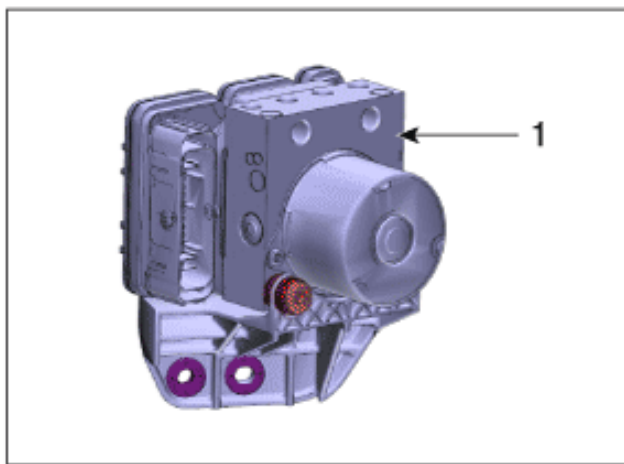
The ESC On/Off Switch shall be used to toggle the ESC function between On/Off states based upon driver input.

The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition.

Initial status of the ESC function is on and switch toggle the state.

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Components



- 1. ESC Control unit (HECU)
- 2. Front wheel speed sensor
- 3. Rear wheel speed sensor

- 4. ABS warning lamp
- 5. Parking brake / EBD

Failure

Diagnosis

1. In principle, ESC and TCS controls are prohibited in case of ABS failure.
2. When ESC or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESC failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESC is not installed.

Memory of Fail Code

1. It keeps the code as far as the backup lamp power is connected. (O)
2. It keeps the code as far as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.

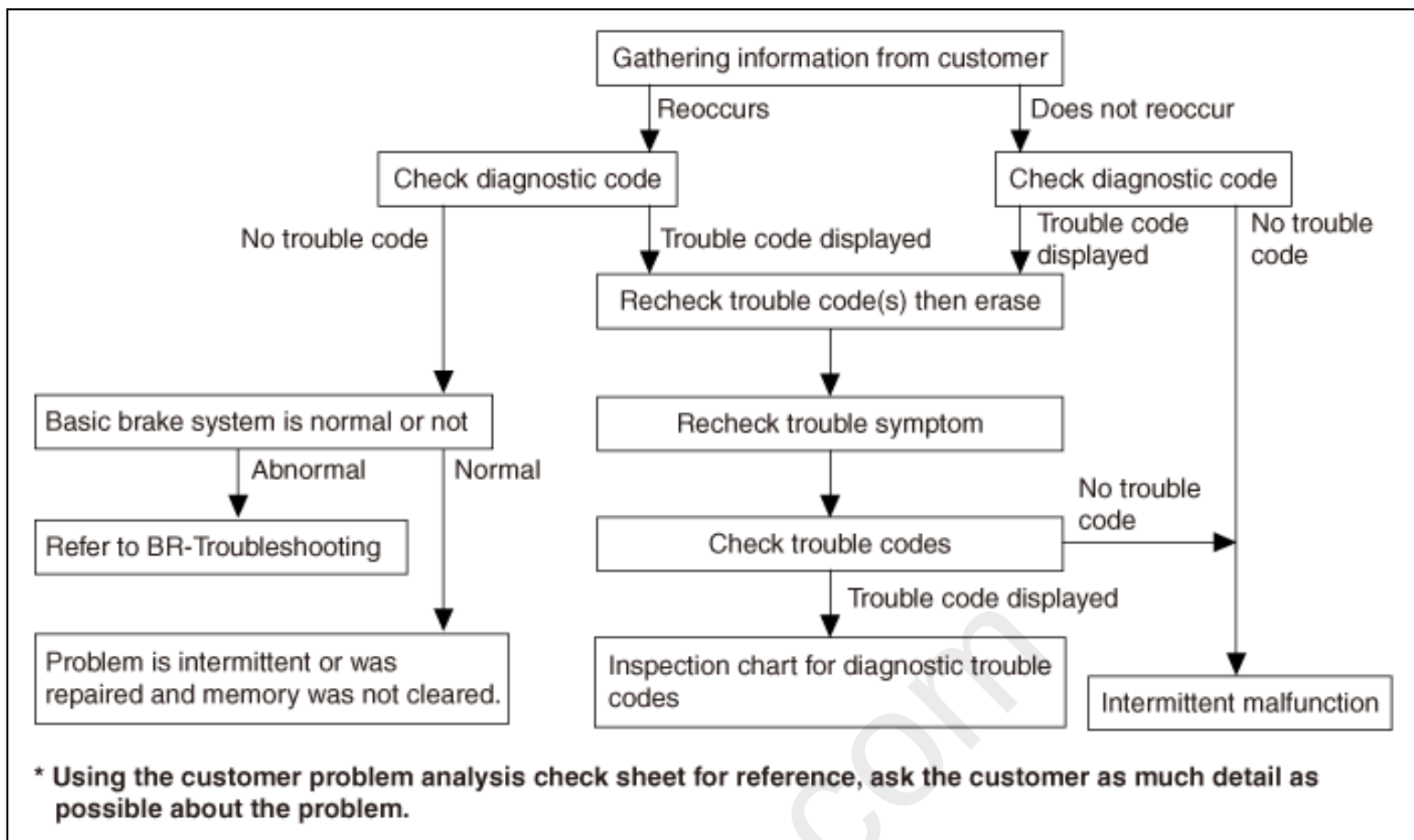
Countermeasures in Fail

1. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

Warning Lamp ON

1. ESC warning lamp turn on for 3sec after IGN ON.
2. ESC function lamp blinks when ESC Act.
3. If ESC fail occurred, ESC warning turns ON.
4. ESC OFF lamp turn on in case of
 - ESC Switch OFF
 - 3sec after IGN ON

Standard Flow of Diagnostic Troubleshooting



Notes With Regard to Diagnosis

The phenomena listed in the following table are not abnormal.

Condition	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1) Sound of the motor inside the ABS hydraulic unit operation (whine). 2) Sound is generated along with vibration of the brake pedal (scraping). 3) When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak : tires)
ABS operation (Long braking distance)	For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.

Inspection method

With the IGN OFF, set the IGN to ON position : If the ABS/Brake Warning Light illuminates and distinguishes after 3 seconds, the warning lamp and ABS system are all normal.

1. If the Warning Light does not illuminate when IGN is set to ON position

(1) Remove the ABS ECU connector (located in the engine room).

(2) Set the IGN to ON position.

(3) If the ABS/Brake Warning Light does not illuminate: The failure is related to the Warning Light. Check the instrument cluster and wiring.

(4) If the ABS/Brake Warning Light illuminates and stays on :

The Warning Light is normal and judged to be failure of the VDC system. Inspect the VDC system using diagnostic tool.

2. If the Warning Light does not distinguish after its illumination when IGN is set to ON position.
 - (1) Self-diagnose using diagnostic tool.
 - (2) Record fault code.
 - (3) Self-diagnose after erasing the fault code.
 - (4) If the result of self-diagnosis is normal after erasing the fault code :
Set the IGN to OFF, then to ON position and check whether the Warning Light operates normally.
 - (5) If the result of self-diagnosis continues to display error after erasing the fault code :
Check according to the inspection sheet of the fault code.
3. Even if the Warning Light and VDC system are all normal, erase all the memorized fault codes using diagnostic tool (if there is no memorized fault code, record the fault code).



- 1) When removing or engaging all the connectors set the IGN to OFF position.
- 2) During the driving test, record on the inspection sheet when the Warning Light illuminates or every time any event is occurred.

ABS Check Sheet

ABS Check Sheet

Inspector's
Name _____

Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles

Date the Problem First Occurred	/ /
Frequency of Occurrence of Problem	☐ Continuous ☐ Intermittent (times a day)

Symptoms	☐ ABS does not operate.	
	☐ ABS does not operate efficiently.	☐ Intermittent (times a day)
	ABS Warning Light Abnormal ☐ Remains ON ☐ Does not light up	

Diagnostic Trouble Code	1st Time	☐ Normal Code ☐ Malfunction Code (Code)

Diagnostic Trouble Code Check	1st Time	☐ Normal Code	☐ Malfunction Code (Code)
	2nd Time	☐ Normal Code	☐ Malfunction Code (Code)

Problem Symptoms Table

Symptom	Suspect Area
ABS does not operate.	Only when 1 - 4 are all normal and the problem is still occurring, replace the HECU. 1)Check the DTC reconfirming that the normal code is output. 2)Power source circuit. 3)Speed sensor circuit. 4)Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1 - 4 are all normal and the problem is still occurring, replace the ABS actuator assembly. 1)Check the DTC reconfirming that the normal code is output. 2)Wheel speed sensor circuit. 3)Stop lamp switch circuit. 4)Check the hydraulic circuit for leakage.
Communication with diagnostic tool is not possible. (Communication with any system is not possible)	1)Power source circuit 2)CAN line
Communication with diagnostic tool is not possible. (Communication with ABS only is not possible)	1)Power source circuit 2)CAN line 3)HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1)ABS warning lamp circuit 2)HECU
Even after the engine is started, the ABS warning lamp remains ON.	1)ABS warning lamp circuit 2)HECU

- ☐
 - During ABS operation, the brake pedal may vibrate or may not be able to be depressed. Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.
 - Such phenomena are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking and is not an abnormality.

ABS Does Not Operate.

Detecting condition

Trouble Symptoms	Possible Cause

Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESC control module.

- Faulty power source circuit
- Faulty wheel speed sensor circuit
- Faulty hydraulic circuit for leakage
- Faulty HECU

Inspection procedures

DTC Inspection

1. Connect the diagnostic tool with the data link connector and turn the ignition switch ON.
2. Verify that the DTC code is output.
3. Is the DTC code output?

NO

► Check the power source circuit.

YES

► Erase the DTC and recheck using diagnostic tool.

Check the power source circuit

1. Disconnect the connector from the ESC control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ESC control module harness side connector and body ground.

Specification : approximately B+

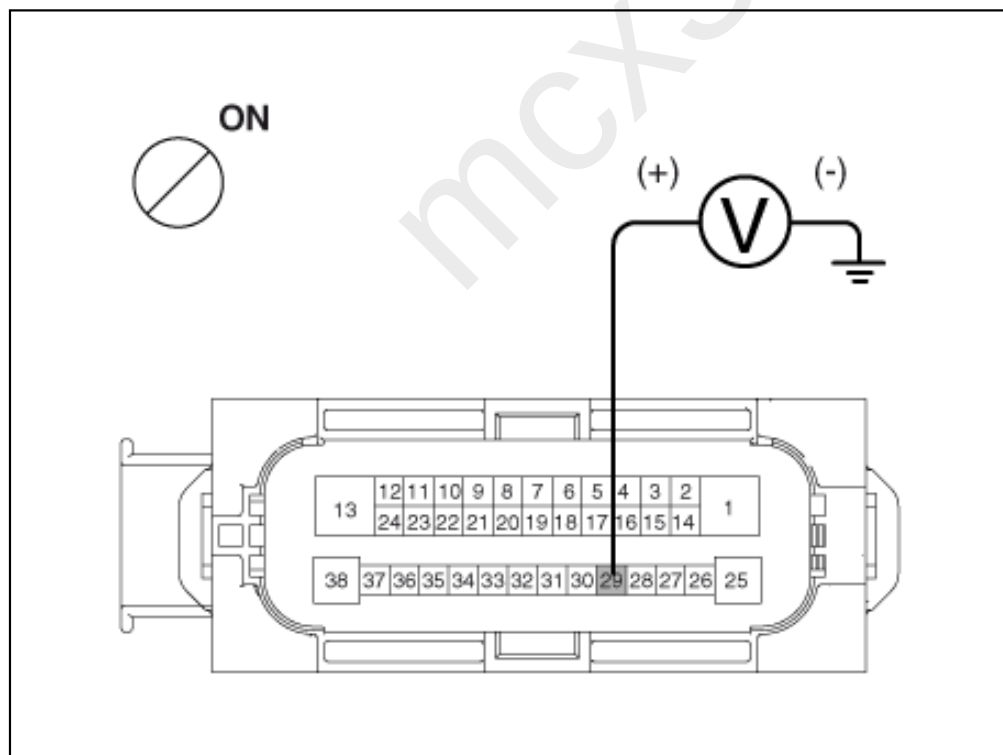
Is the voltage within specification?

YES

► Check the ground circuit.

NO

► Check the harness or connector between the fuse (7.5A) in the engine compartment junction block and the ESC control module. Repair if necessary.



Check the ground circuit

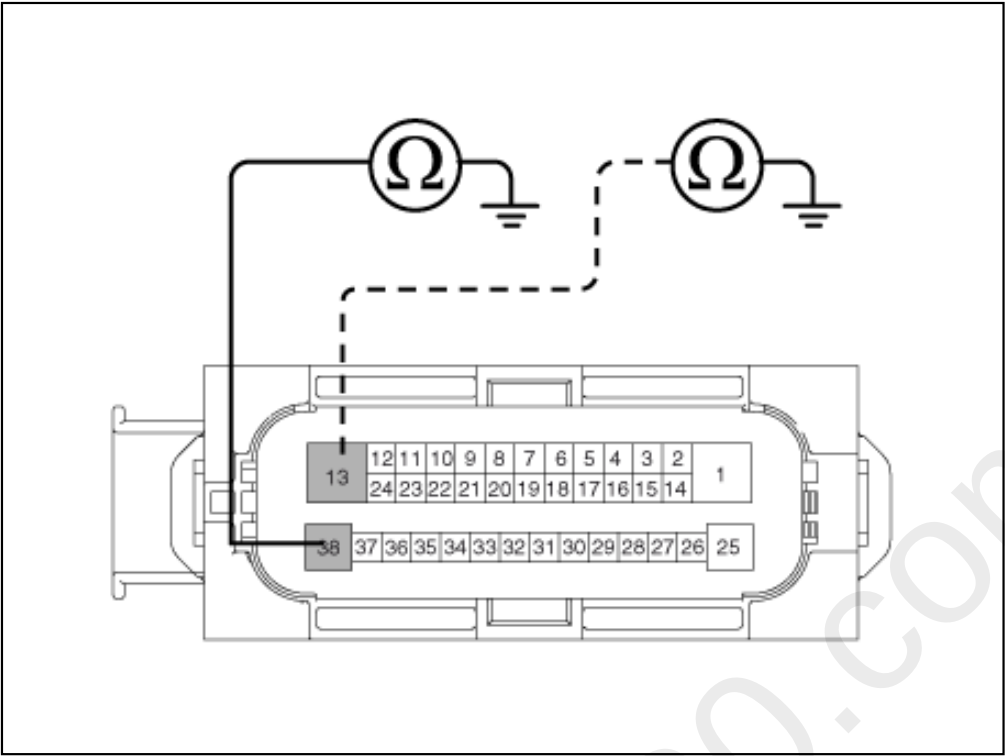
1. Disconnect the connector from the ESC control module.

2. Check for continuity between terminals 13, 38 of the ESC control module harness side connector and ground point.
Is there continuity?

- YES

▶ Check the wheel speed sensor circuit.
- NO

▶ Repair an open in the wire and ground point.



Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.
2. Is it normal?

- YES

▶ Check the hydraulic circuit for leakage.
- NO

▶ Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage

1. Inspect leakage of the hydraulic lines.
2. Is it normal?

- YES

▶ The problem is still occurring, replace the ESC control module.
- NO

▶ Repair the hydraulic lines for leakage.

ABS Does Not Operate (Intermittently).

Detecting condition

Trouble Symptoms	Possible Cause

Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESC control module.

- Faulty power source circuit
- Faulty wheel speed sensor circuit
- Faulty hydraulic circuit for leakage
- Faulty HECU

Inspection procedures

DTC Inspection

1. Connect the diagnostic tool with the data link connector and turn the ignition switch ON.
2. Verify that the DTC code is output.
3. Is the DTC code output?

NO

▶ Check the wheel speed sensor circuit.

YES

▶ Erase the DTC and recheck using diagnostic tool.

Check the wheel speed sensor circuit

1. Refer to the DTC troubleshooting procedures.
2. Is it normal?

YES

▶ Check the stop lamp switch circuit.

NO

▶ Repair or replace the wheel speed sensor.

Check the stop lamp switch circuit

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 23 of the ESC control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

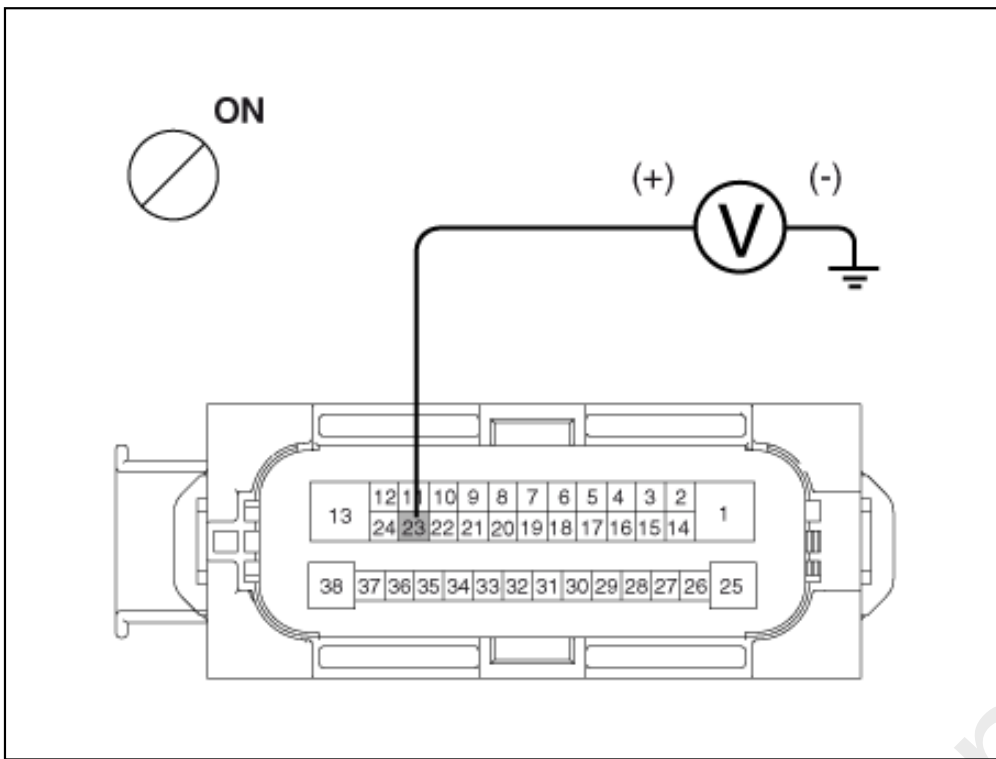
Is the voltage within specification?

YES

▶ Check the hydraulic circuit for leakage.

NO

▶ Repair the stop lamp switch. Repair an open in the wire between the ESC control module and the stop lamp switch.



Check the hydraulic circuit for leakage

1. Refer to the hydraulic lines.
2. Inspection leakage of the hydraulic lines.
3. Is it normal?

YES

► The problem is still occurring, replace the ESC control module.

NO

► Repair the hydraulic lines for leakage.

**Communication with KDS is not possible.
(Communication with any system is not possible)**

Detecting condition

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	–An open in the wire –Poor ground –Faulty power source circuit

Inspection procedures

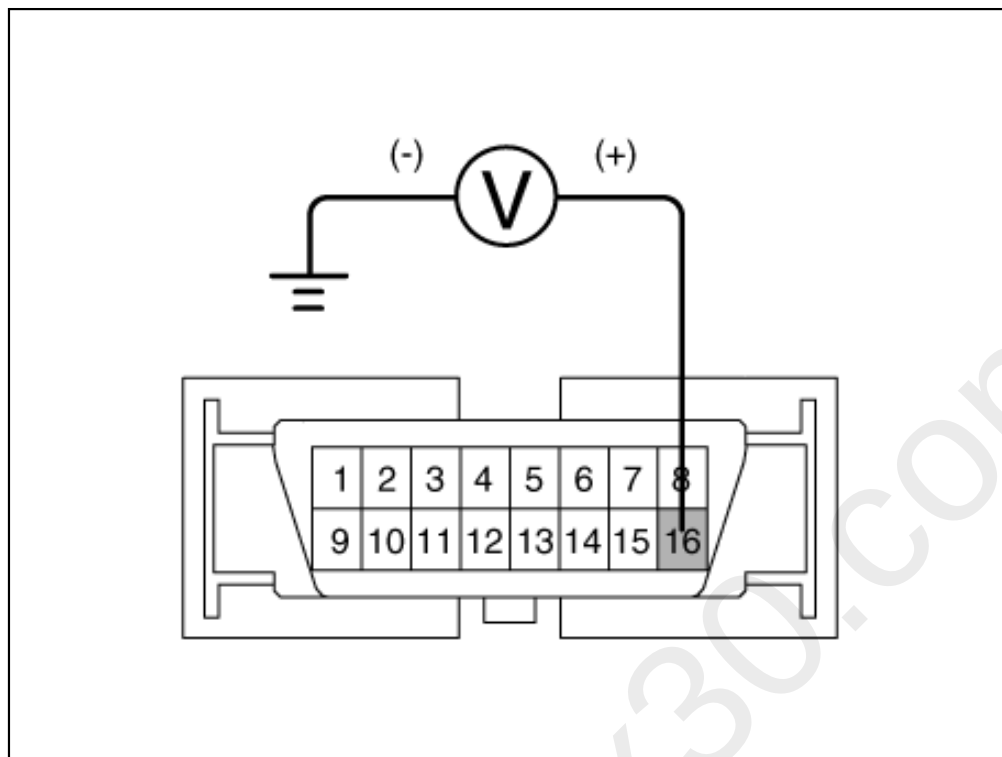
Check The Power Supply Circuit For The Diagnosis

1. Measure the voltage between terminal 16 of the data link connector and body ground.

Specification : approximately B+

Is voltage within specification?

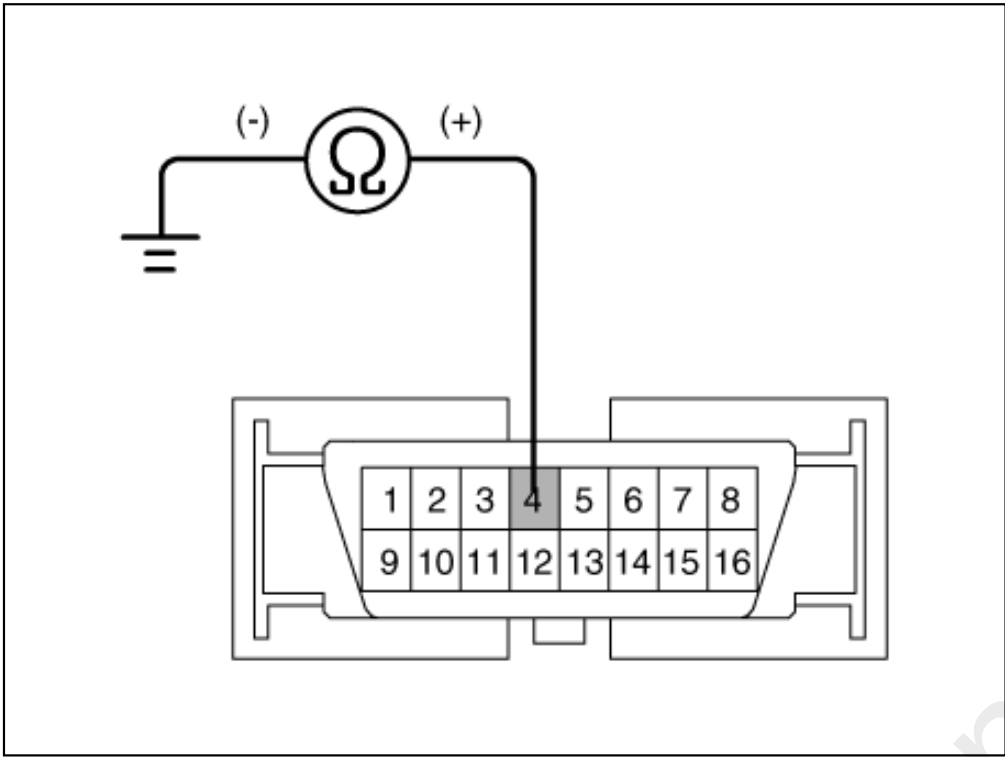
- YES** ► Check the ground circuit for the diagnosis.
- NO** ► Repair an open in the wire. Check and replace fuse from the engine compartment junction block.



Check the ground circuit for the diagnosis

1. Check for continuity between terminal 4 of the data link connector and body ground.
Is there continuity?

- NO** ► Repair an open in the wire between terminal 4 of the data link connector and ground point.



**Communication with KDS is not possible.
(Communication with ABS only is not possible)**

Detecting condition

Trouble Symptoms	Possible Cause
When communication with diagnostic tool is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	–An open in the wire –Faulty HECU –Faulty power source circuit

Inspection procedures

Check for Continuity in the CAN Line

1. Disconnect the connector from the ESC control module.
2. Check for continuity between terminals 26, 14 of the ESC control module connector and 3, 11 of the data link connector.
3. Is there continuity?

YES

► Check the power source of ESC control module.

NO

► Repair an open in the wire.

Check the power source of ESC control module

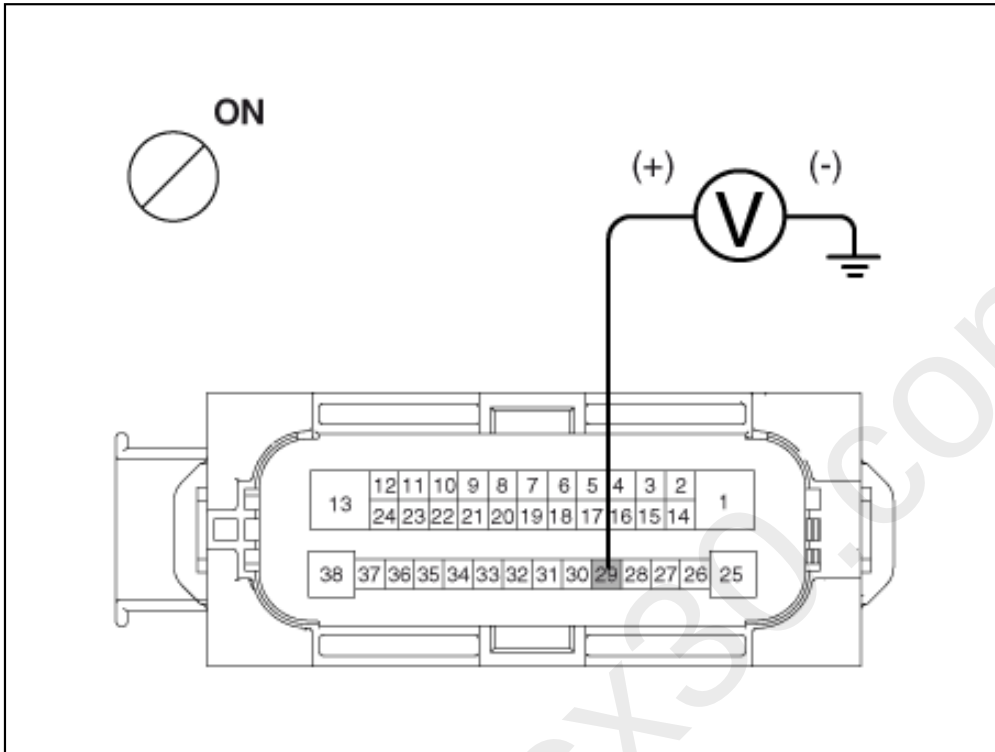
1. Disconnect the connector from the ESC control module.

2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ESC control module harness side connector and body ground.

Specification : approximately B+

Is voltage within specification?

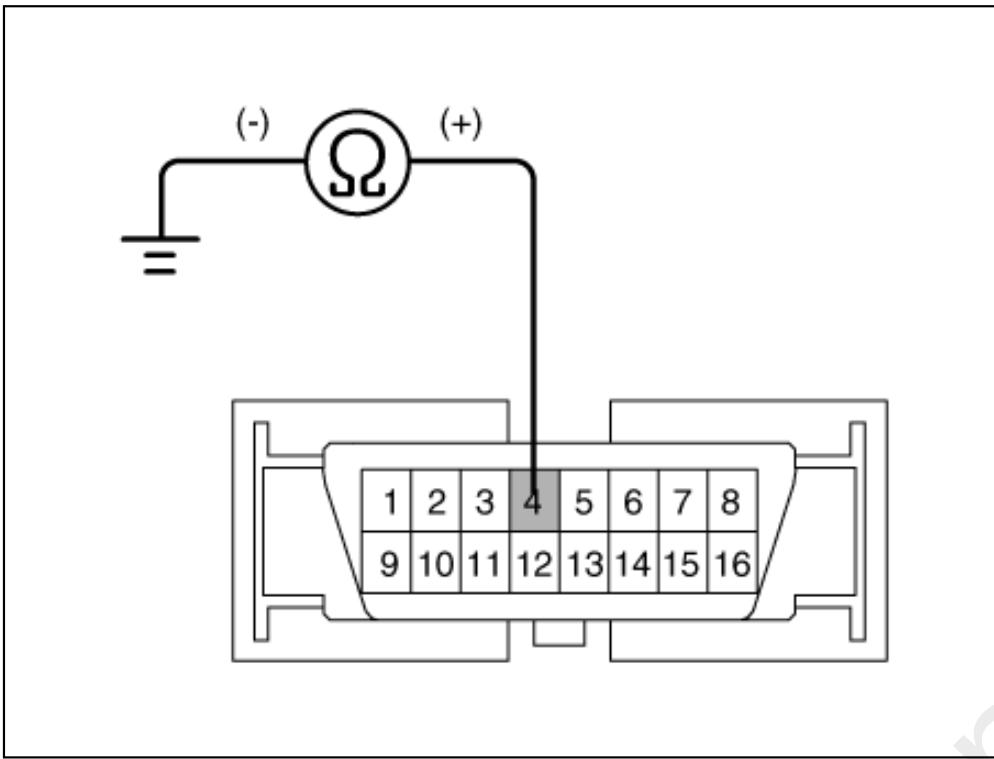
- | | |
|------------|---|
| YES | ► Check for poor ground. |
| NO | ► Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ESC control module. Repair if necessary. |



Check for poor ground

1. Check for continuity between terminal 4 of the data link connector and ground point.
2. Is the electric current applied between groundings?

- | | |
|------------|---|
| YES | ► Replace the ESC control module and recheck. |
| NO | ► Repair an open in the wire or poor ground |



When Ignition Key Is Turned ON (engine OFF), The ABS Warning Lamp Does Not Light Up.

Detecting condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	–Faulty ABS warning lamp bulb –Blown fuse is related to ABS in the engine compartment junction block –Faulty ABS warning lamp damaged –Faulty ABS warning lamp module –Faulty HECU

Inspection procedures

Problem verification

1. Disconnect the connector from the ESC control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

YES

► Inspect again after replacing the ESC HECU.

NO

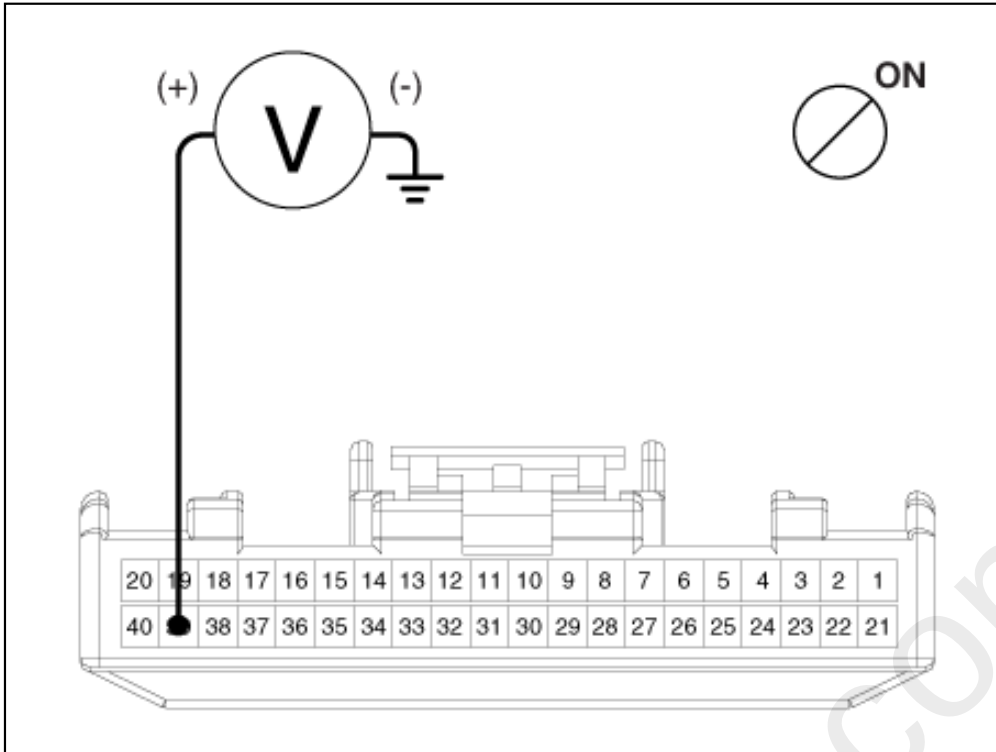
► Check the power source for the ABS warning lamp.

Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch ON.

2. Measure the voltage between terminal (M08) 39 of the cluster harness side connector and body ground.

Specification : approximately B+



3. Is voltage within specification?

YES

► Check the CAN circuit resistance for ABS warning lamp.

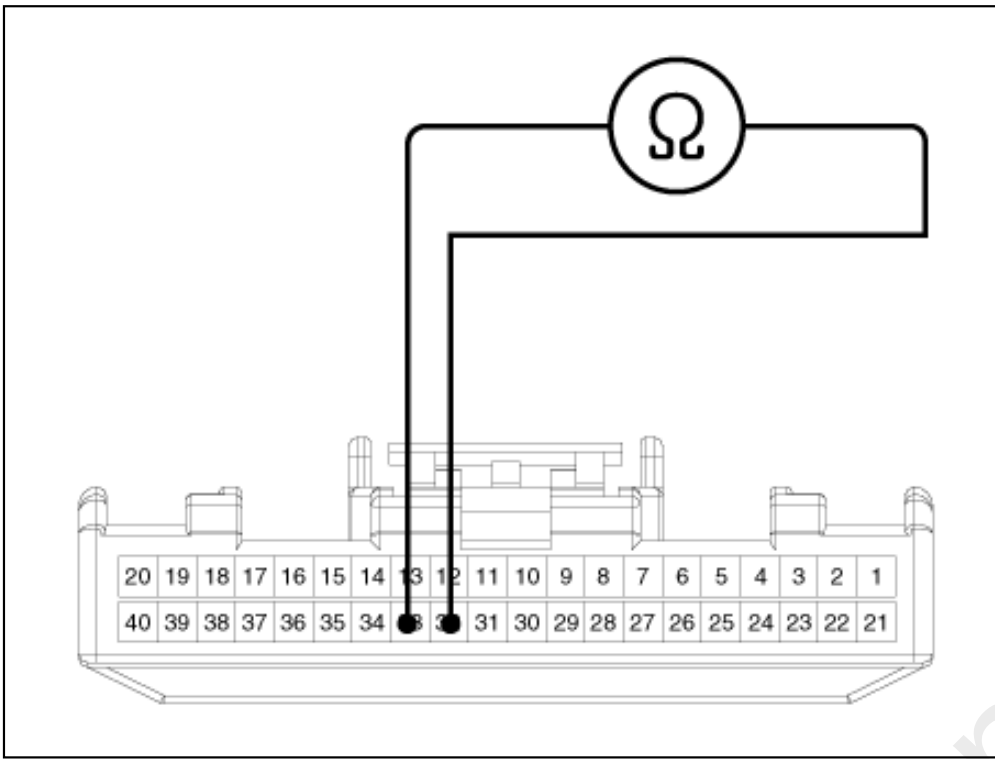
NO

► Check for blown fuse.

Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M08) 32 and 33 of the cluster harness side connector.

Specification : 60Ω



3. Is resistance within specification?

YES

► Repair ABS warning lamp bulb or instrument cluster assembly.

NO

► Check the CAN circuit wiring for ABS warning lamp.

Check the CAN circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and ESC HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M08) 32 of the cluster harness side connector and terminal 26 of ESC HECU harness side.

Check for continuity between terminal (M08) 33 of the cluster harness side connector and terminal 14 of ESC HECU harness side.

Specification : Below 1Ω

3. Is resistance within specification?

YES

► Repair short of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module.

NO

► Repair open of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module.

Even After The Engine Is Started, The ABS Warning Lamp Remains ON.

Detecting condition

Trouble Symptoms	Possible Cause

If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.

- An open in the wire
- Faulty instrument cluster assembly
- Faulty ABS warning lamp module
- Faulty HECU

Inspection procedures

Check DTC Output

1. Connect the diagnostic tool to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using diagnostic tool.
3. Is DTC output?

YES

▶ Perform the DTC troubleshooting procedure (Refer to DTC troubleshooting).

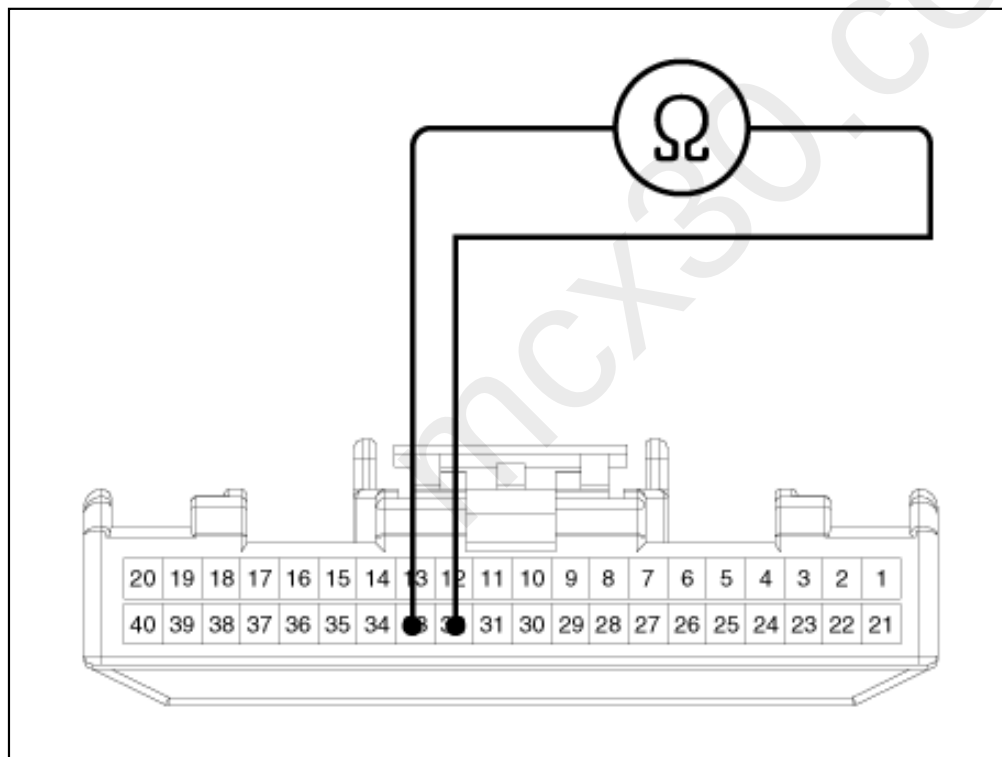
NO

▶ Check the CAN circuit resistance for ABS warning lamp.

Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M08) 32 and 33 of the cluster harness side connector.

Specification : 60Ω



3. Is resistance within specification?

YES

▶ Repair ABS warning lamp bulb or instrument cluster assembly.

NO

▶ Check the CAN circuit wiring for ABS warning lamp.

Check the CAN circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and ESC HECU connector, and then turn the ignition switch OFF.

2. Check for continuity between terminal (M08) 32 of the cluster harness side connector and terminal 26 of ESC HECU harness side.

Check for continuity between terminal (M08) 33 of the cluster harness side connector and terminal 14 of ESC HECU harness side.

Specification : Below 1Ω

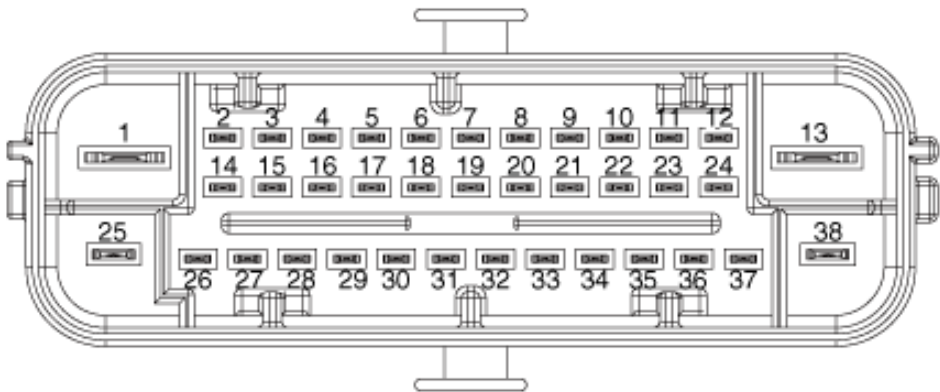
3. Is resistance within specification?

- | | |
|------------|---|
| YES | ► Repair short of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module. |
| NO | ► Repair open of wiring between terminal 26, 14 of ESC HECU harness connector and ABS warning lamp module. |

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Terminal
Function

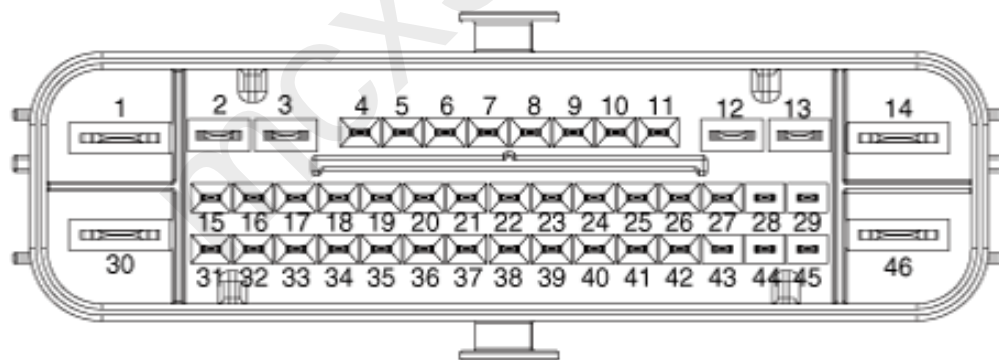
ABS / ESC



PIN No	Desciption	Current	Resistance
1	Pump motor supply voltage	137 A	10 MΩ
2	Main CAN Low	30 mA	250 mΩ
3	-	-	-
4	-	-	-
4	-	-	-
5	-	-	-
6	-	-	-
7	-	-	-
8	-	-	-
9	-	-	-
10	-	-	-
11	-	-	-
12	-	-	-
13	Recycle pump ground	137 A	10 MΩ
14	Main CAN High	30 mA	250 mΩ
15	-	-	-
16	Stop lamp switch signal	10 mA	250 MΩ
17	Wheel speed sensor output #1	16 mA	250 MΩ
18	Wheel speed sensor supply voltage (FR)	30 mA	250 MΩ
19	Wheel speed sensor supply voltage (FL)	30 mA	250 MΩ
20	Wheel speed sensor ground (RL)	17 mA	250 MΩ
21	Wheel speed sensor ground (FL)	17 mA	250 MΩ

22	Sub CAN High	30 mA	250 MΩ
23	ESC OFF switch signal	10 mA	250 MΩ
24	-	-	-
25	Voltage supply for solenoid valves	40 A	10 MΩ
26	-	-	-
27	-	-	-
28	-	-	-
29	IGN 1	50 mA	60 MΩ
30	DRV TERRAIN MODE	200 mA	250 MΩ
31	Wheel speed sensor ground (FR)	17 mA	250 MΩ
32	Wheel speed sensor ground (RR)	17 mA	250 MΩ
33	Wheel speed sensor supply voltage (RL)	30 mA	250 MΩ
34	Wheel speed sensor supply voltage (RR)	30 mA	250 MΩ
35	Sub CAN Low	30 mA	250 MΩ
36	Pedal sensor voltage	50 mA	250 MΩ
37	Clutch switch signal	10 mA	250 MΩ
38	-	-	-

ESC MOCI



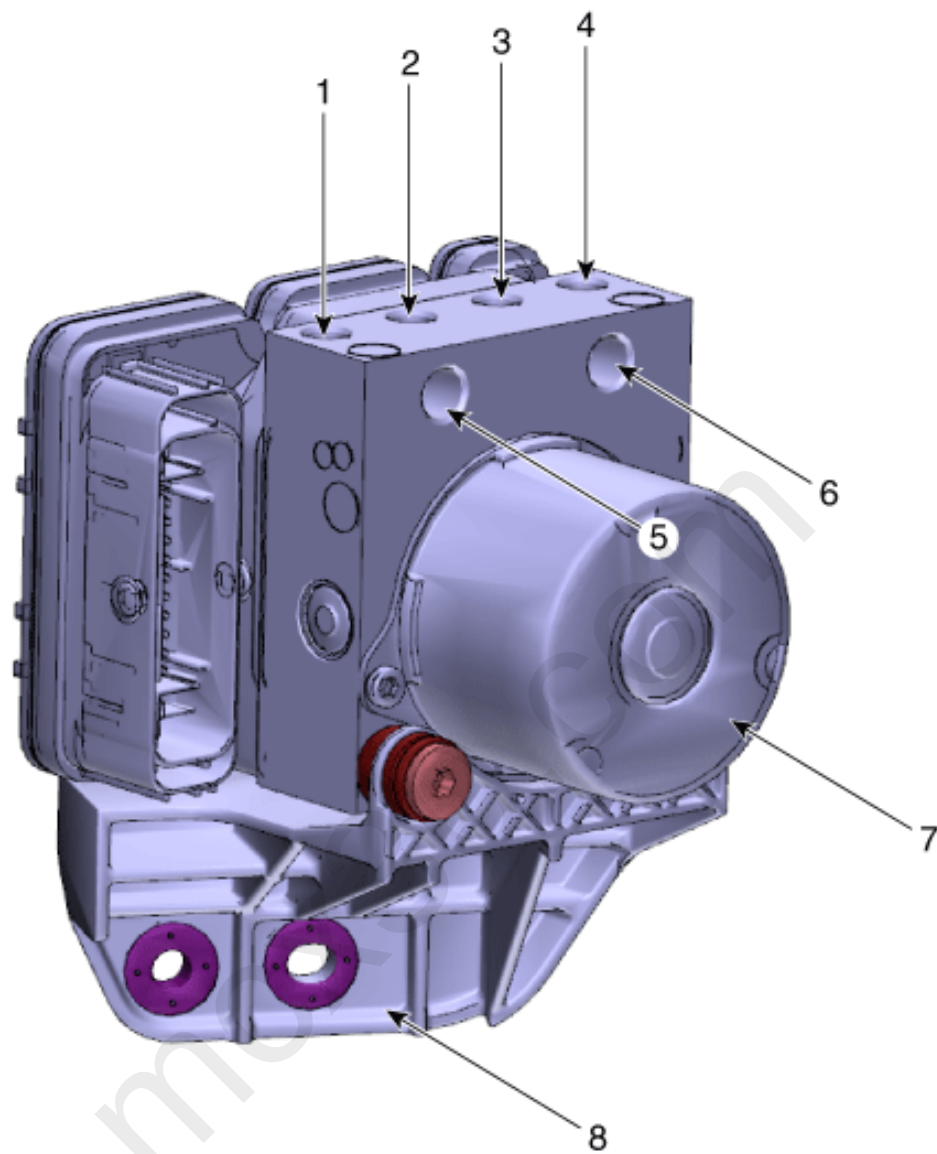
PIN No	Description	Current	Resistance
1	Voltage supply for pump motor	137 A	10 MΩ
2	RR EPB motor ground	20 A	10 MΩ
3	RR EPB motor power	20 A	10 MΩ
4	IGN 1	50 mA	60 MΩ
4	DBC switch signal	250 mA	250 MΩ
5	Main CAN High	30 mA	250 MΩ

6	Main CAN Low	30 mA	250 MΩ
7	AVH switch signal	10 mA	250 MΩ
8	Clutch sensor signal input 2	2 mA	250 MΩ
9	Clutch sensor signal input 1	2 mA	250 MΩ
10	Electronic vacuum pump output	200 mA	250 MΩ
11	RL EPB motor ground	20 A	250 MΩ
12	RL EPB motor power	20 A	10 MΩ
13	Pump motor ground	137 A	10 MΩ
14	Vacuum pump voltage 5V	50 mA	10 MΩ
15	Clutch sensor signal input (PWM)	10 mA	250 MΩ
16	Chassis sensor ground	250 MΩ	250 MΩ
17	Electronic parking brake signal 1 [Connect]	30 mA	250 MΩ
18	Electronic parking brake signal 2 [Connect]	30 mA	250 MΩ
19	Wheel speed sensor ground (FR)	40 mA	250 MΩ
20	Wheel speed sensor supply voltage (FR)	150 mA	250 MΩ
21	Wheel speed sensor supply voltage (FR)	0.5 mA	250 MΩ
22	Vacuum sensor signal	10 mA	250 MΩ
23	Vacuum pump switch signal input	30 mA	250 MΩ
24	Sub CAN High	30 mA	250 MΩ
25	Sub CAN Low	10 mA	250 MΩ
26	VDC OFF switch signal	40 mA	250 MΩ
27	Wheel speed sensor ground (RL)	150 mA	250 MΩ
28	Wheel speed sensor supply voltage (RL)	40 mA	250 MΩ
29	Wheel speed sensor ground (RR)	40 mA	250 MΩ
30	Solenoid valve, EPB Voltage	40 A	10 MΩ
31	Electronic vacuum pump motor monitor	10 mA	250 MΩ
32	Stop lamp switch signal	10 mA	250 MΩ
33	Vacuum sensor ground	50 mA	250 MΩ
34	Electronic parking brake signal 3 [Release]	30 mA	250 MΩ
35	Electronic parking brake signal 4 [Release]	30 mA	250 MΩ
36	Pedal sensor ground	50 mA	250 MΩ
37	Wheel speed sensor output #1	16 mA	250 MΩ
38	Vacuum switch signal input	10 mA	250 MΩ
39	Wheel speed sensor output #2	16 mA	250 MΩ

40	Electronic vacuum pump monitor, Pedal sensor voltage	10 mA / 50 mA	250 MΩ
41	Vacuum pump output	10 mA	250 MΩ
42	Wheel speed sensor ground (FL)	17 mA	250 MΩ
43	Wheel speed sensor supply voltage (FL)	17 mA	250 MΩ
44	N Gear switch signal input	10 mA	250 MΩ
45	Wheel speed sensor supply voltage (RR)	17 mA	250 MΩ
46	Ground	40 A	10 MΩ

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Components

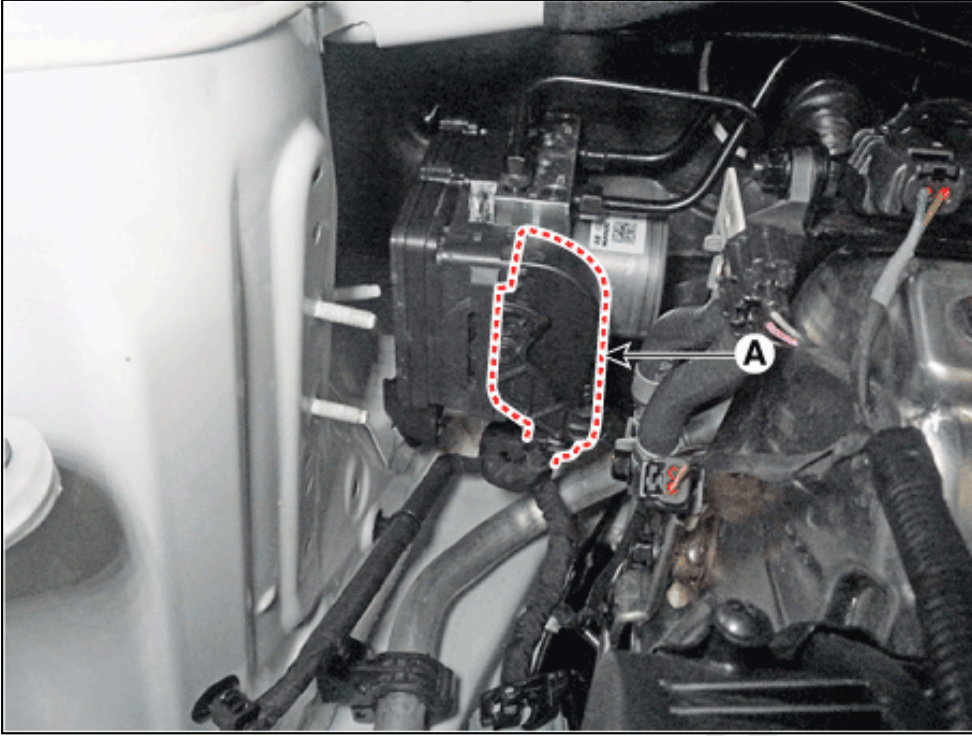


- 1. Front - right (FR)
- 2. Rear - left (RL)
- 3. Rear - right (RR)
- 4. Front - left (FL)

- 5. MC2
- 6. MC1
- 7. ESC Control unit (HECU) connector
- 8. Bracket

Removal

1. Disconnect the battery negative (-) terminal.
2. Remove the glow relay unit assembly. [U 1.6]
(Refer to Engine Electrical System - "Glow Relay Unit Assembly")
3. Pull up the lock of the ESC control unit (HECU) connector and then disconnect the connector (A).



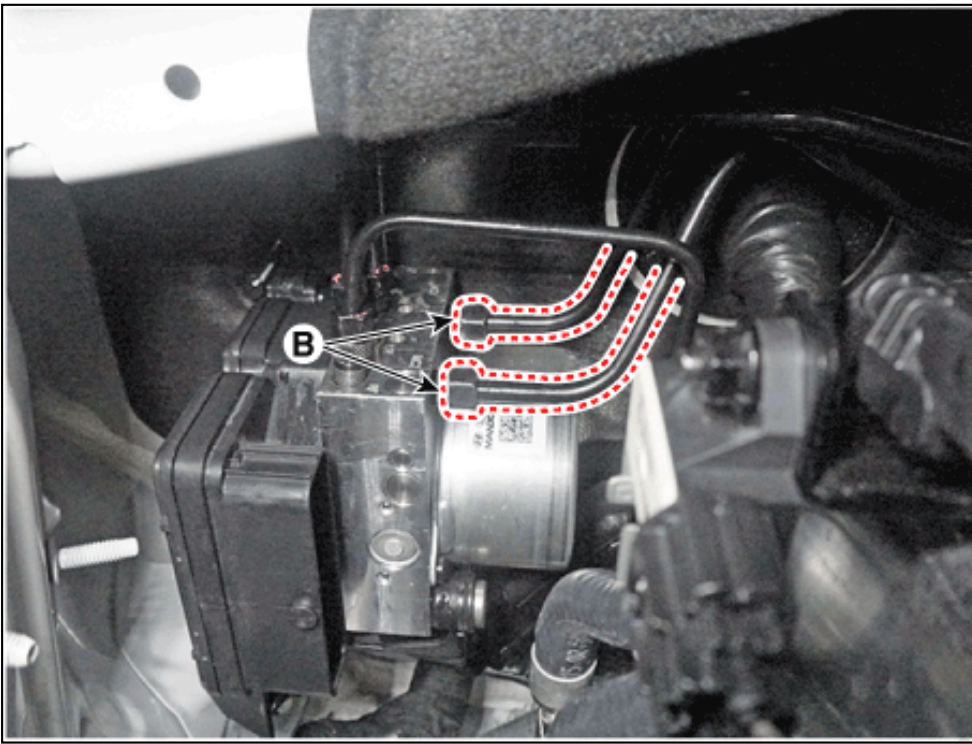
4. Separate the brake tube by removing the flare nuts (A), (B) connected to the ESC control unit (HECU).

Tightening torque :

(A) : 13.7 - 16.7 N·m (1.4 - 1.7 kgf·m, 10.1 - 12.3 lb·ft)

(B) : 18.6 - 22.6 N·m (1.9 - 2.3 kgf·m, 13.7 - 16.6 lb·ft)

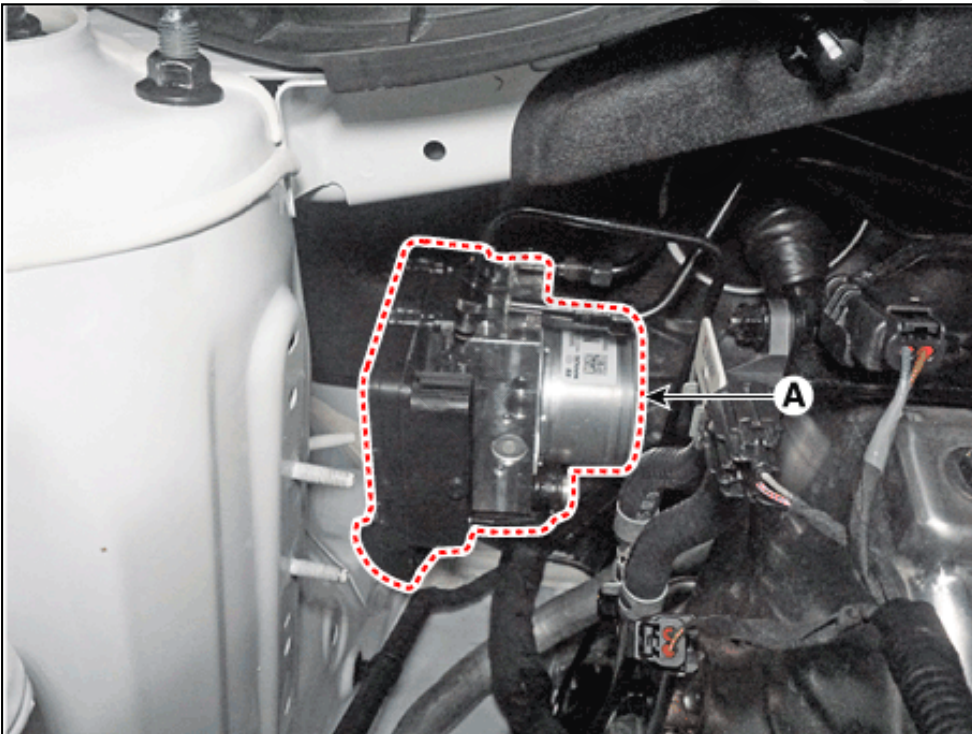




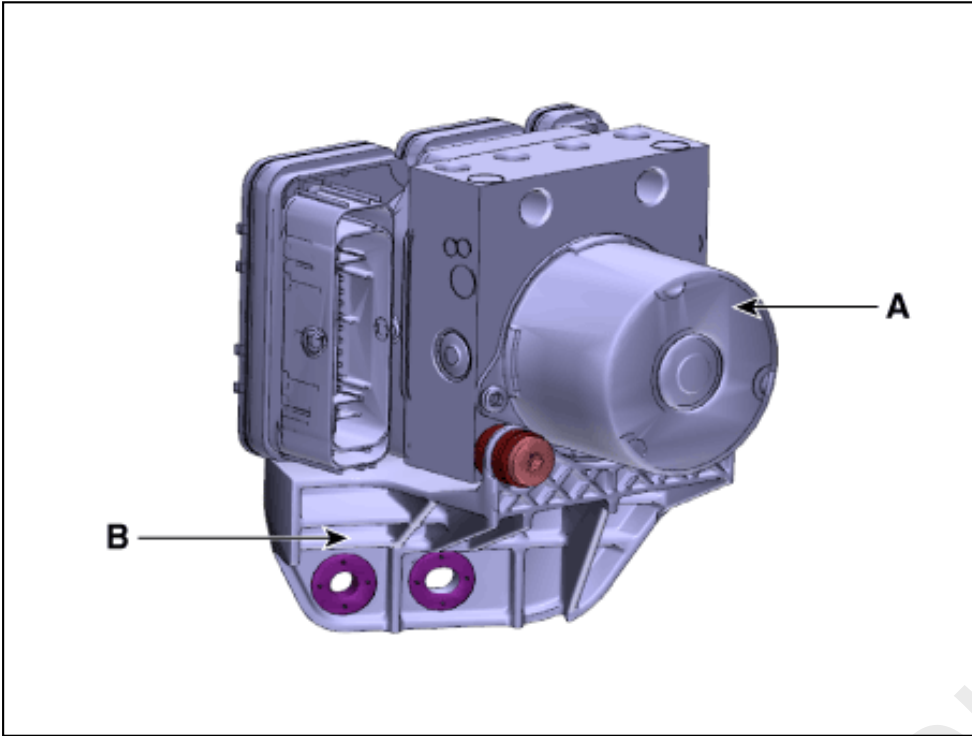
5. Remove the bracket mounting nuts and remove the ESC control unit (HECU) (A) from the vehicle.

Tightening torque :

16.7 - 25.5 N·m (1.7 - 2.6 kgf·m, 12.3 - 18.8 lb·ft)



6. Remove the bolts to remove the bracket (B) from the ESC control unit (HECU) (A).



Installation

1. Install in the reverse order of removal.
2. After installation, bleed the brake system.
(Refer to Brake System - "Brake Bleeding Procedures")
3. Conduct the Variant Coding.
4. Conduct the Auto Detected Sensor Calibration.
5. Conduct the Longitudinal G Sensor Calibration.
6. After replacing the ESC control unit execute the "Assembly Check (ECU replacement)" of the additional function to check that the mounting is successful.

Adjustment

Perform diagnostic procedure by using diagnostic device as shown below :

1. Connect self-diagnosis connector (16pins) located under the driver side crash pad to self-diagnosis device, and then turn the self-diagnosis device after key is ON.
2. Select the "vehicle model" and "ABS/ESC" on diagnostic tool vehicle selection screen, then select OK.

[Variant Code Reset]

S/W Management	
Systems	Components
■ Engine Control	↓
■ Automatic Transaxle	↓
■ ABS/ESC	↑
■ System Identification	Ⓞ
■ HCU Air Bleeding Mode	Ⓞ
■ Auto Detected Configuration(ESC Only)	Ⓞ
■ Longitudinal G Sensor Calibration(HAC/DBC Only)	Ⓞ
■ Steering Angle Sensor(SAS) Calibration	Ⓞ
■ Variant Coding	Ⓞ
■ SCC/AEB	↓
■ Airbag(Event #1)	↓
■ Airbag(Event #2)	↓
■ Occupant Detection Sensor	↓
■ Air Conditioner	↓
■ Motor Driven Power Steering	↓
■ Tire Pressure Monitoring System(High Type)	↓
■ Tire Pressure Monitoring System(Low Type)	↓

[Variant Coding]



■ Engine Control	
■ Automatic Transaxle	
■ ABS/ESC	
■ System Identification	
■ HCU Air Bleeding Mode	
■ Auto Detected Configuration(ESC Only)	
■ Longitudinal G Sensor Calibration(HAC/DBC Only)	
■ Steering Angle Sensor(SAS) Calibration	
■ Variant Coding	
■ SCC/AEB	
■ Airbag(Event #1)	
■ Airbag(Event #2)	
■ Occupant Detection Sensor	
■ Air Conditioner	
■ Motor Driven Power Steering	
■ Tire Pressure Monitoring System(High Type)	
■ Tire Pressure Monitoring System(Low Type)	

S/W Management

■ Variant Coding

● [Variant Coding]

This function resets variant code and input the new one in ESP. Perform this function when you replace ESP or occur C1702 with MIL On.(ESP/EBD/ABS)

● [Condition]

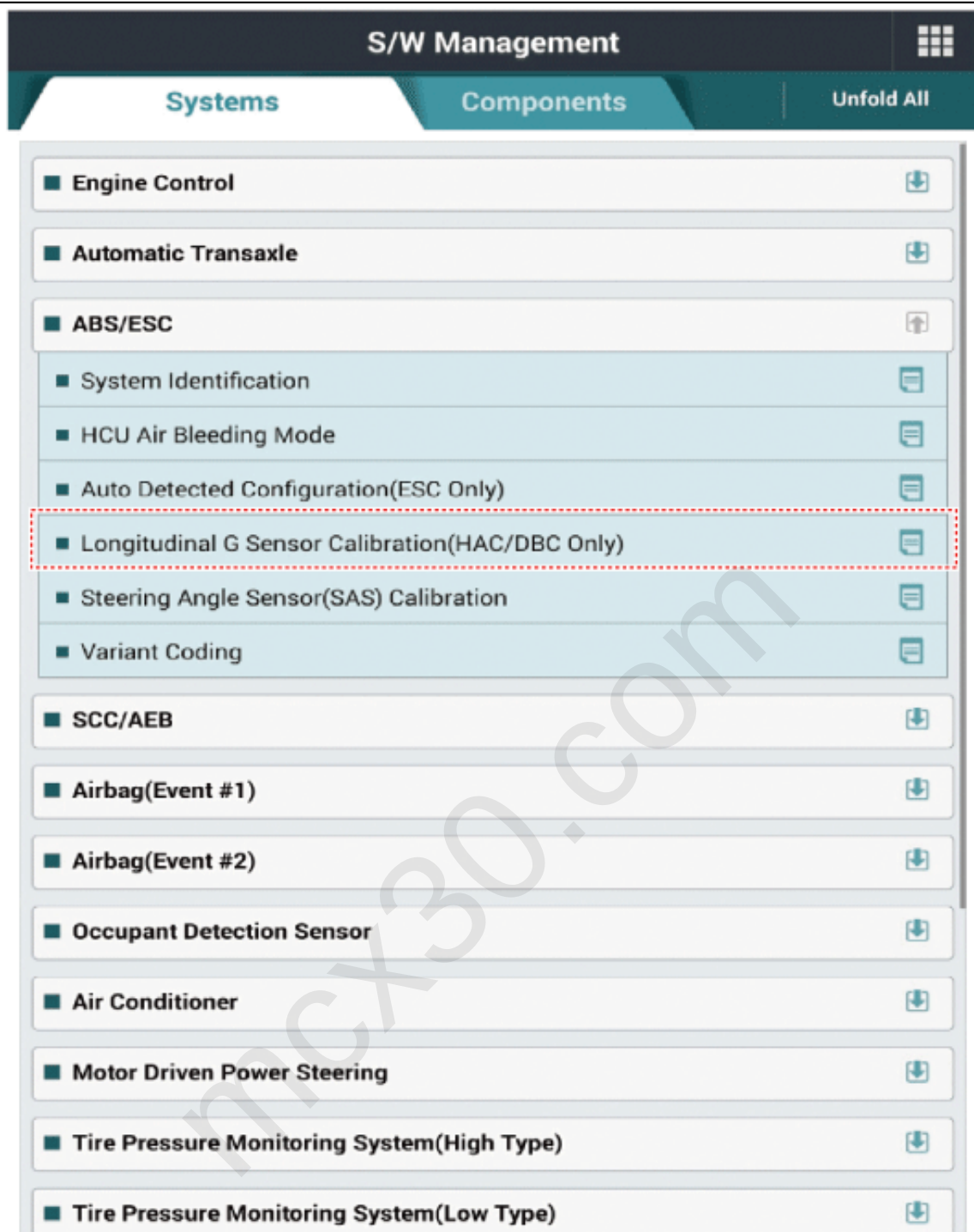
1. Ignition key on
2. Engine Stop

Press **[OK]** button, if you are ready
Press **[CANCEL]** button to exit.

OK

Cancel

[Longitudinal G Sensor Calibration]



Assembly Check (ECU replacement)



■ ABS/ESP	
■ System Identification	
■ HCU Air Bleeding Mode	
■ Auto Detected Configuration(ESC Only)	
■ Longitudinal G Sensor Calibration(HAC/DBC Only)	
■ Steering Angle Sensor(SAS) Calibration	
■ Assembly Check(ECU replacement)	
■ Variant Coding	
■ Deactivate factory mode	
■ Change Mode of DIH and MoD actuator	



Do not touch any system buttons while performing this function.

Description

1. The ESC OFF switch is for the user to turn off the ESC system.
2. The ESC OFF lamp is on when ESC OFF switch is engaged.

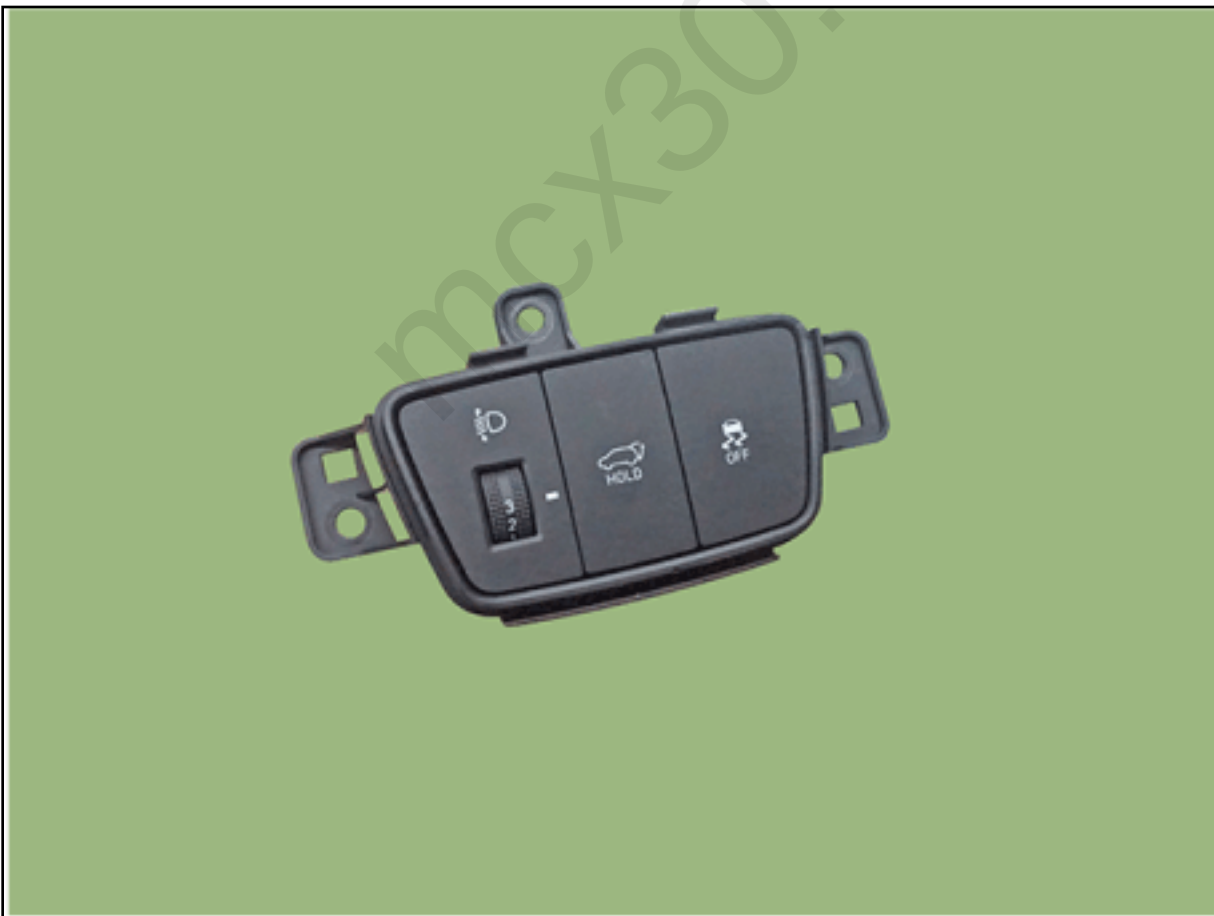
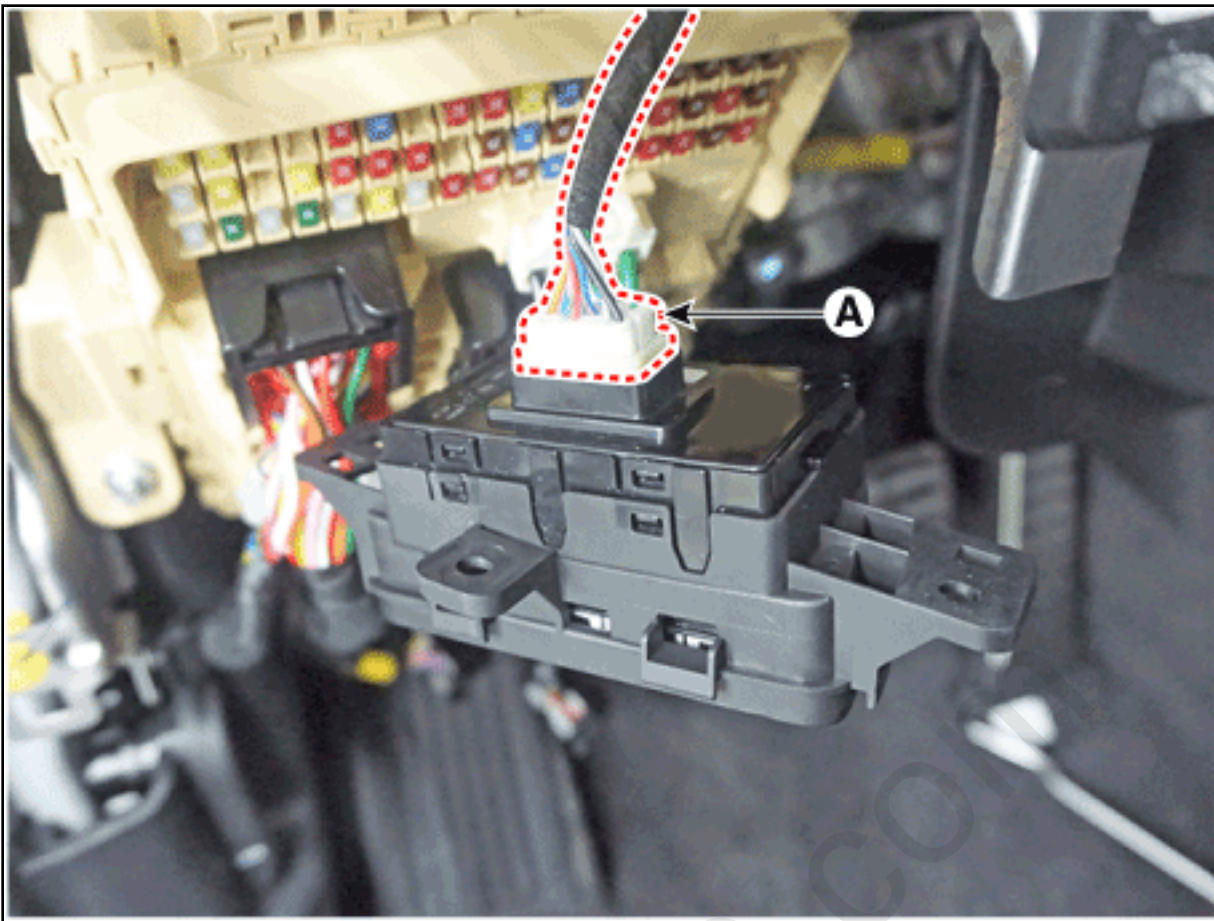
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Removal

1. Disconnect the battery negative (-) terminal.
2. Remove the crash pad lower panel.
(Refer to Body - "Crash Pad Lower Panel")
3. Remove the screws and remove the ESC OFF switch (A).



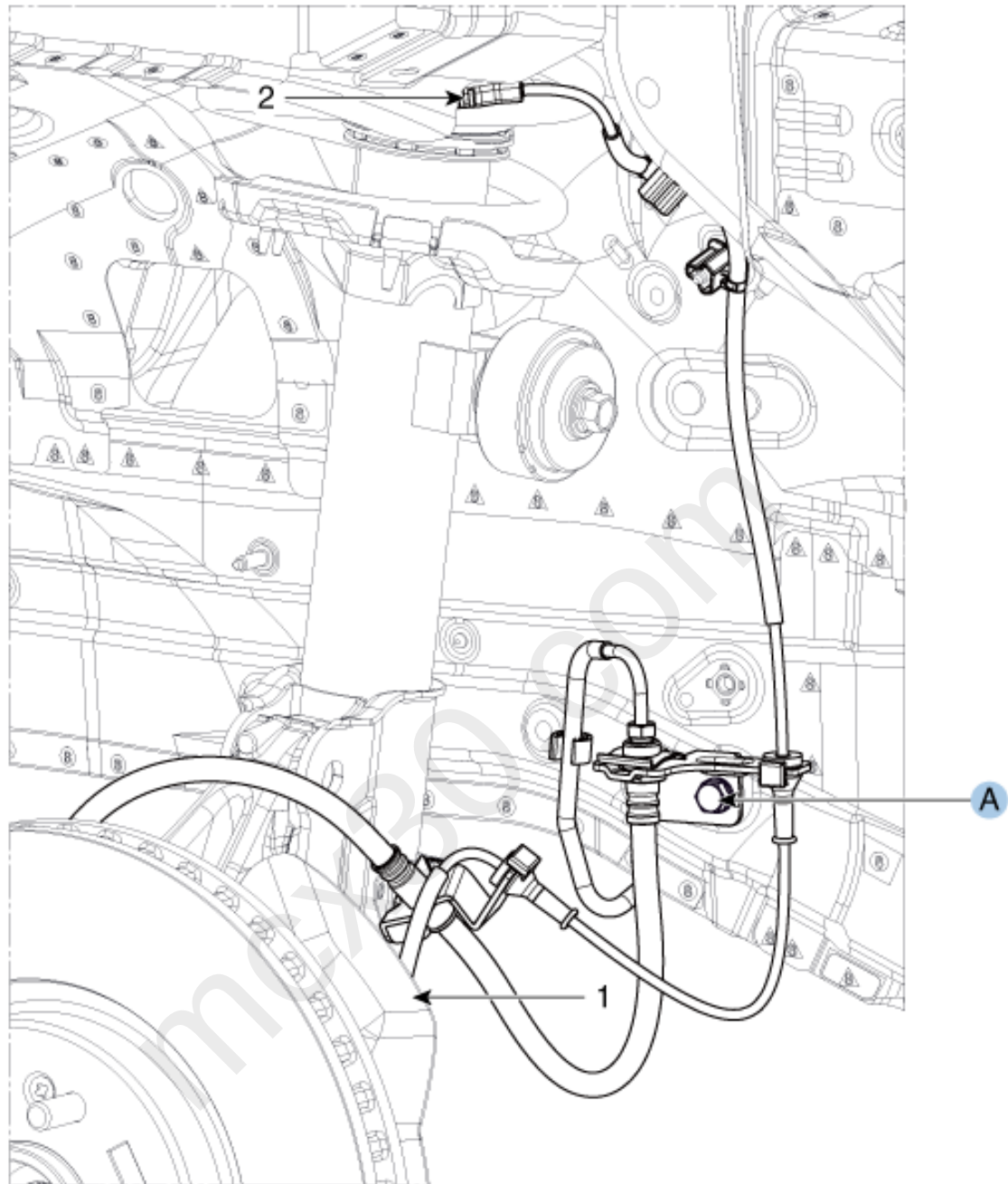
4. Remove the ESC OFF switch connector (A) by pressing the locking pin.



Installation

1. Install in the reverse order of removal.

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Tightening torque :
A : 19.6 - 29.4 N.m (2.0 - 3.0 kgf.m, 14.5 - 21.7 lb-ft)

1. Front wheel speed sensor

2. Front wheel speed sensor connector

Removal

1. Loosen the wheel nuts slightly.
Raise the vehicle, and make sure it is securely supported.
2. Remove the front wheel and tire (A) from the front hub.

Tightening torque :

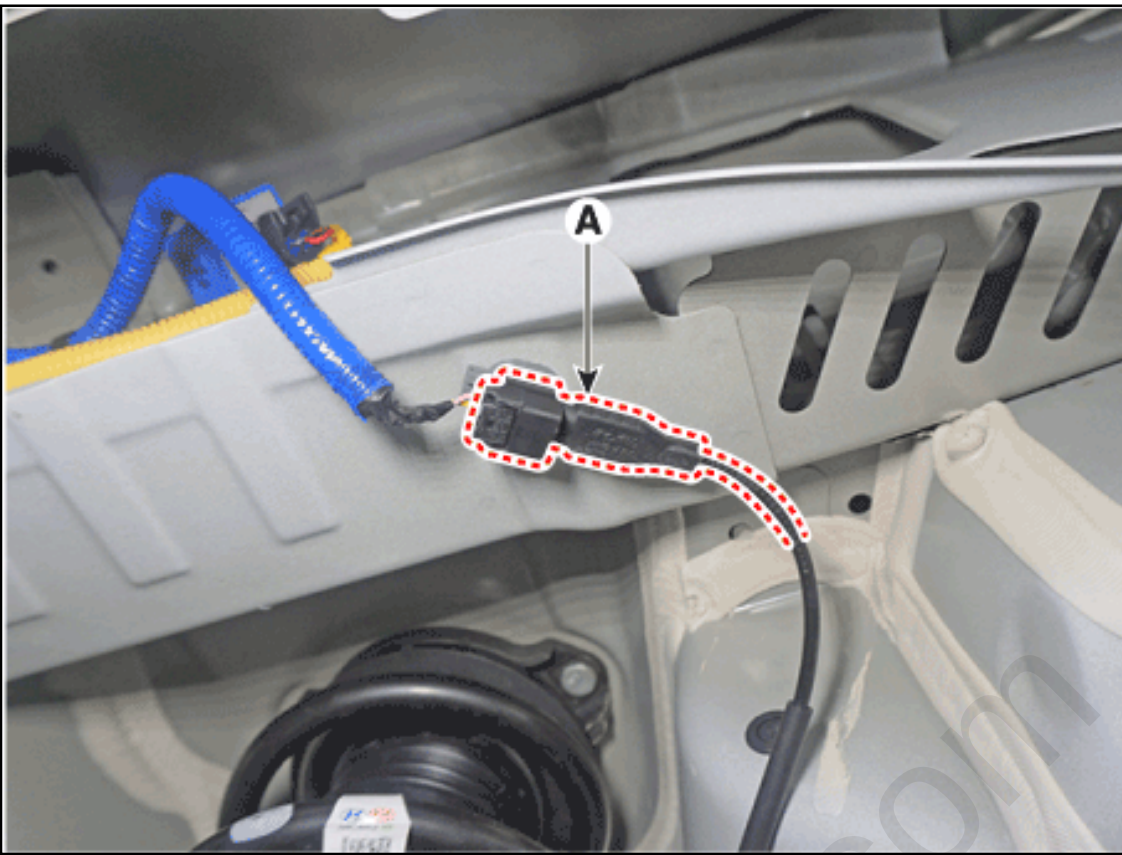
107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)



- Be careful not to damage the hub bolts when removing the front wheel and tire (A).



3. Remove the front wheel guard.
(Refer to Body - "Front Wheel Guard")
4. Disconnect the front wheel speed sensor connector (A).



5. Loosen the bolt and then disconnect the front wheel speed sensor (A).

Tightening torque :

8.8 - 13.7 N.m (0.9 - 1.4 kgf.m, 6.5 - 10.1 lb-ft)

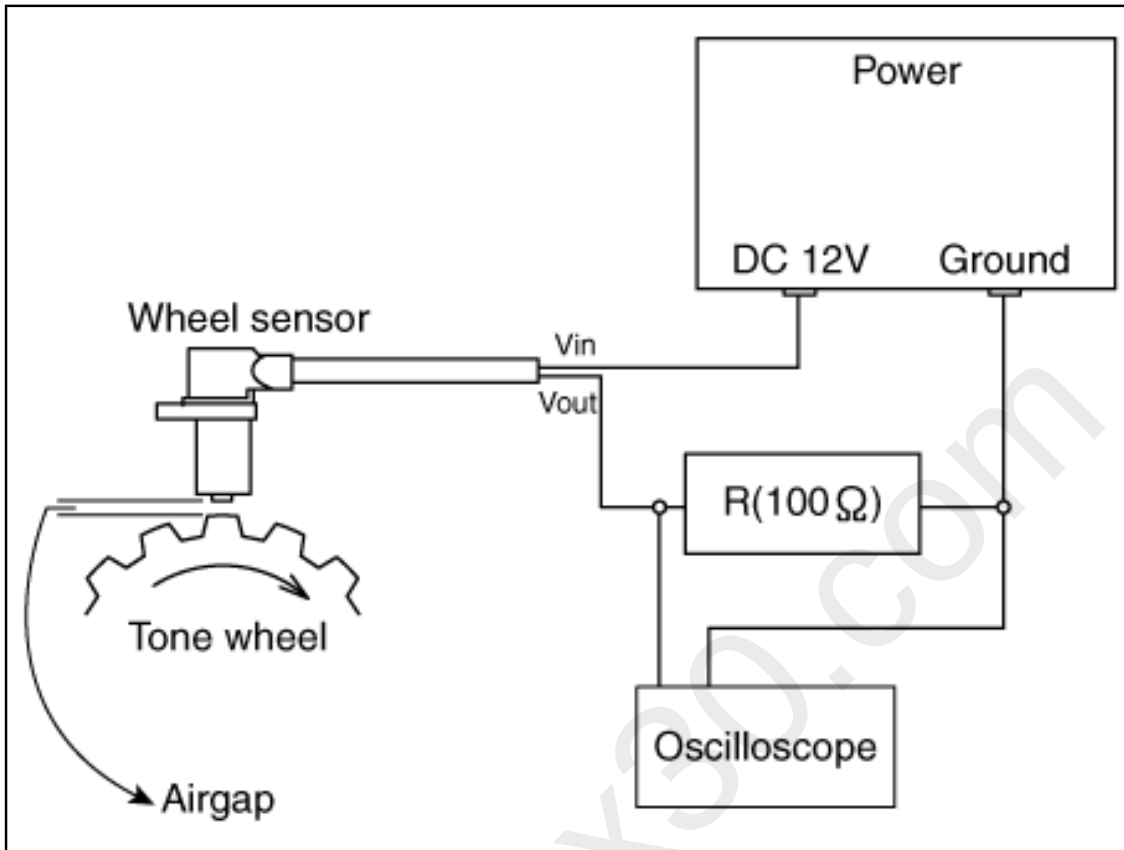


Inspection

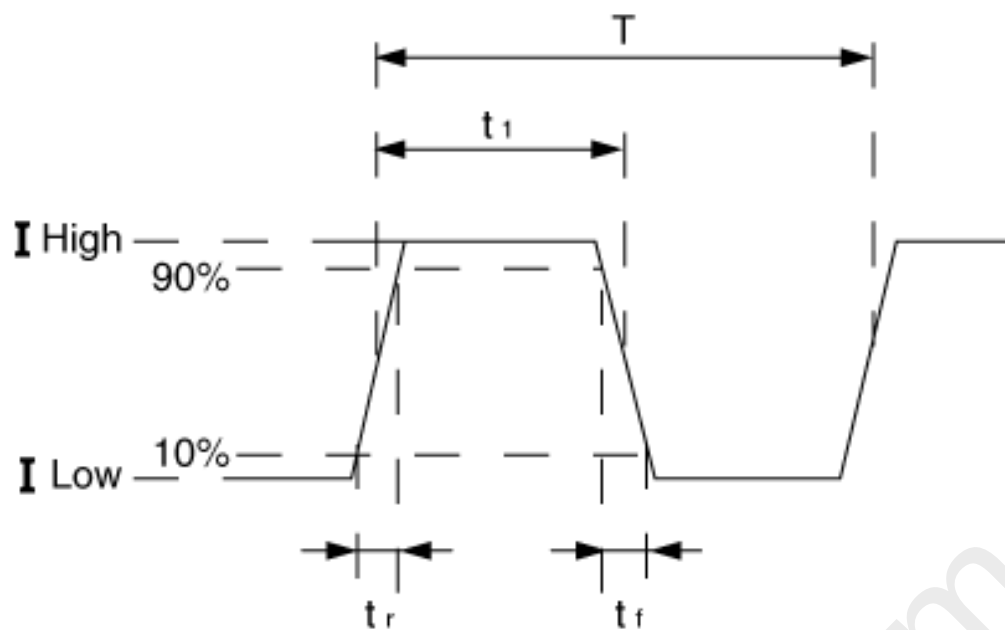
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.



- In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.

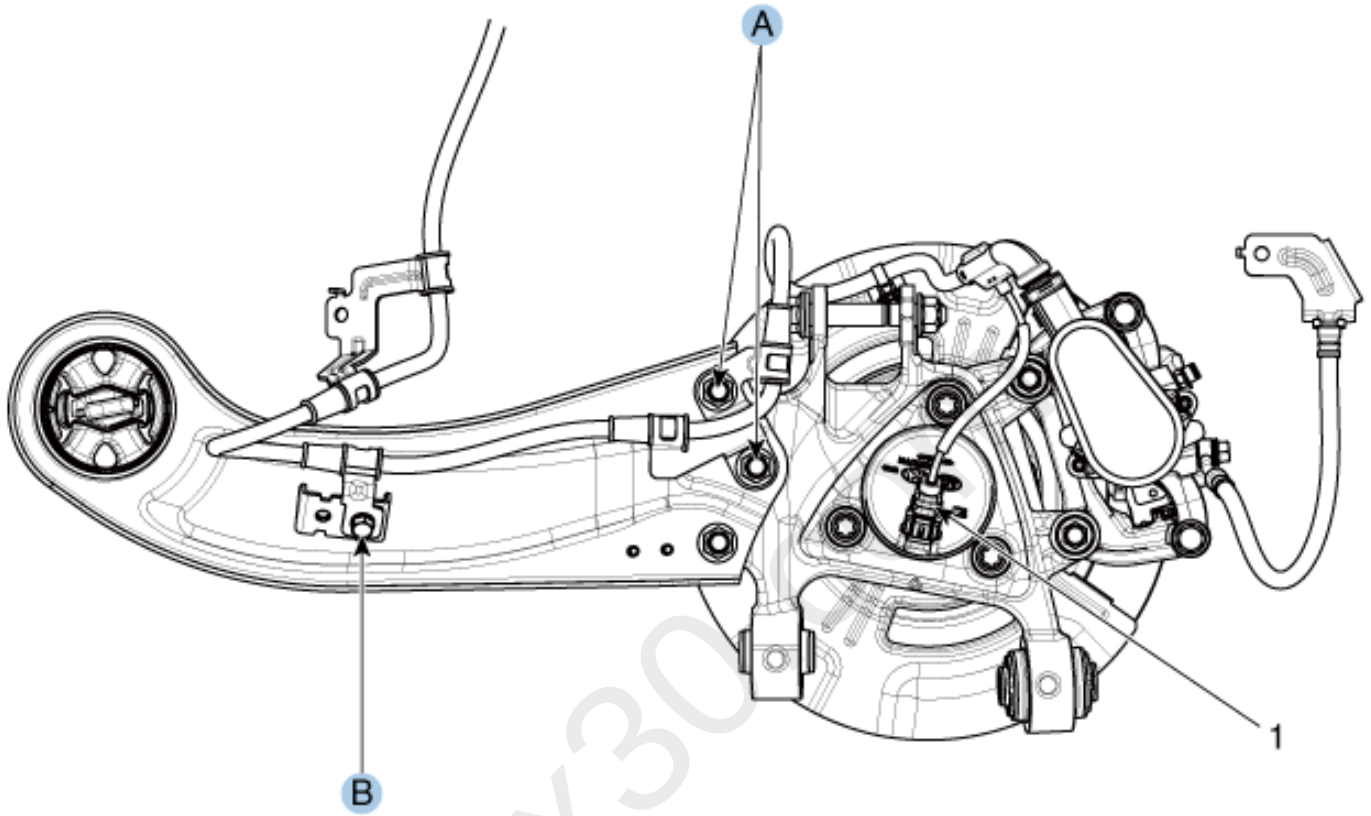


- I low : 5.95 ~ 8.05 mA
- I High : 11.9 ~ 16.1 mA
- Frequency range : 0.03 ~ 3000 HZ

Installation

1. Install in the reverse order of removal.

[2WD]



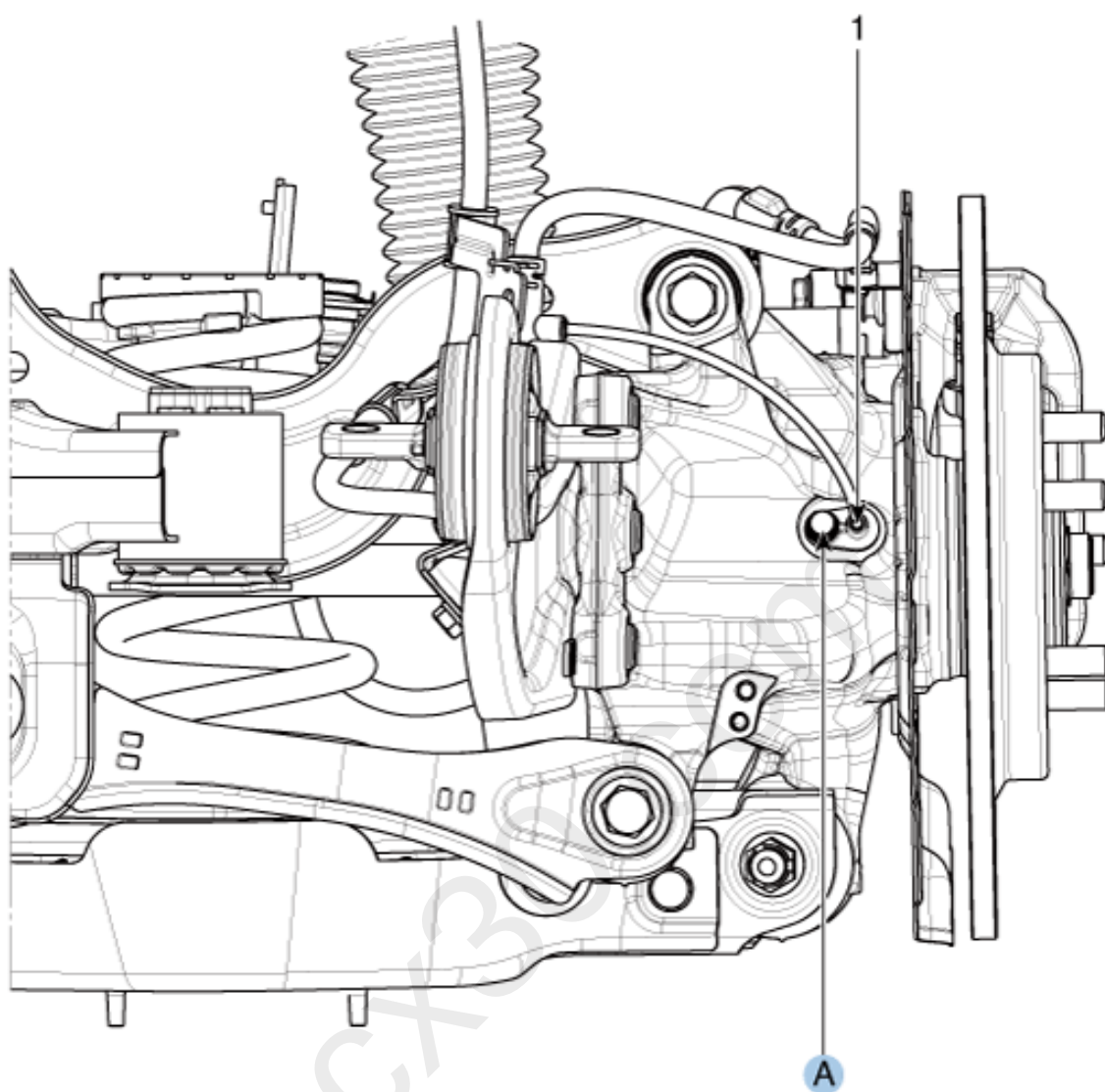
Tightening torque :

A : 98.1 - 117.7 N.m (10.0 - 12.0 kgf.m, 72.3 - 86.8 lb-ft)

B : 12.7 - 16.7 N.m (1.3 - 1.7 kgf.m, 9.4 - 12.3 lb-ft)

1. Rear wheel speed sensor

[4WD]



Tightening torque :

A : 8.8 - 13.7 N.m (0.9 - 1.4 kgf.m, 6.5 - 10.1 lb-ft)

1. Rear wheel speed sensor

Removal

[2WD]

1. Loosen the wheel nuts slightly.
Raise the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from the rear hub.

Tightening torque :

107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)



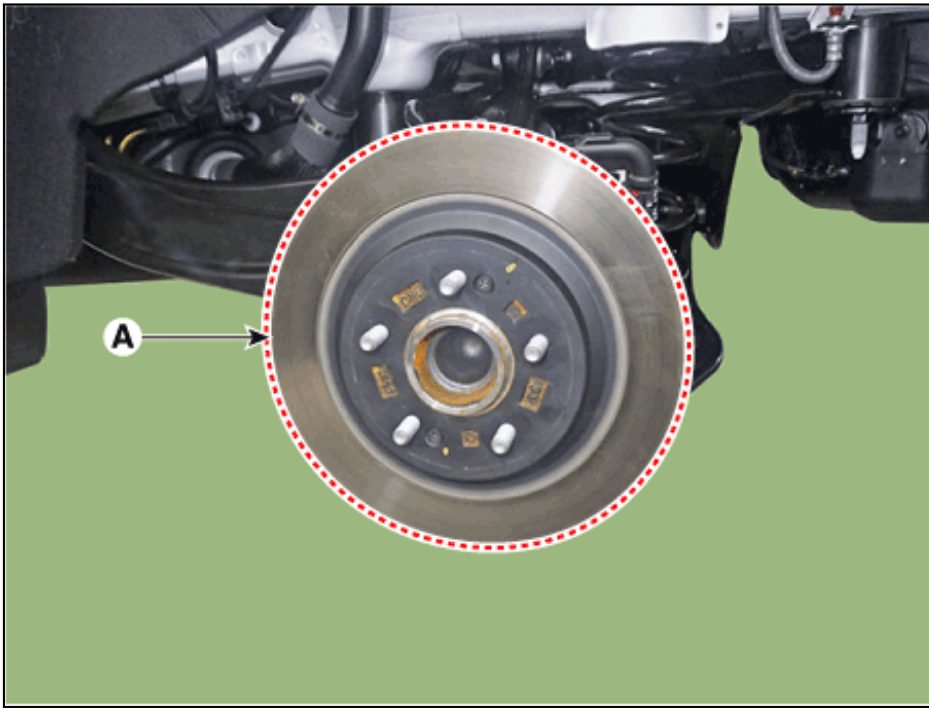
- Be careful not to damage the hub bolts when removing the front wheel and tire (A).



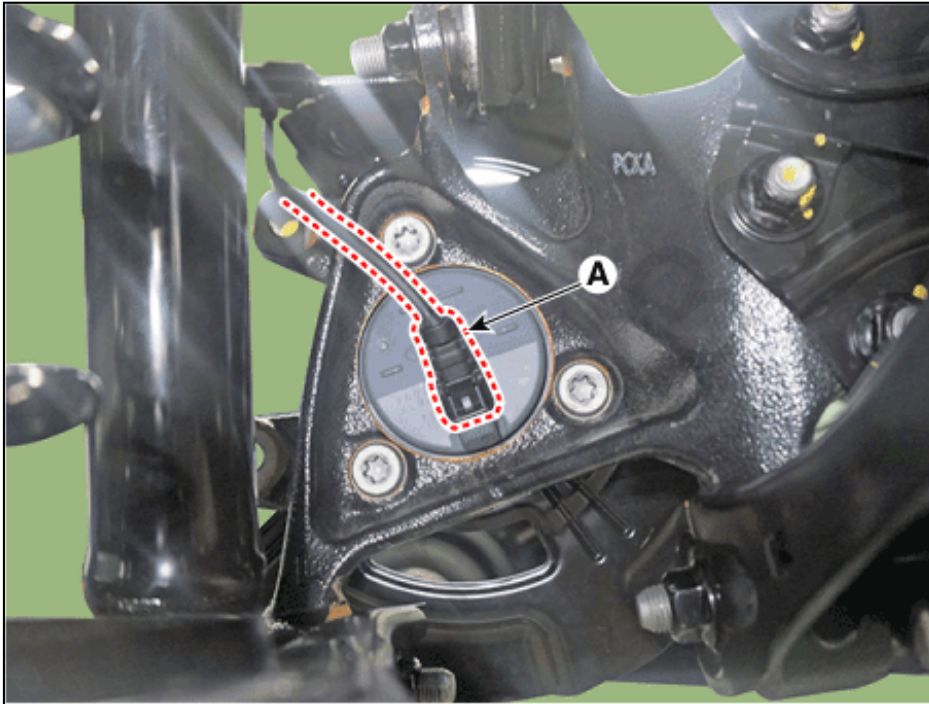
3. Remove the rear brake caliper.
(Refer to Brake System - "Rear Disc Brake")
4. Loosen the screw and the remove the rear break disc.

Tightening torque :

4.9 - 5.9 N.m (0.5 - 0.6 kgf.m, 3.6 - 4.3 lb-ft)



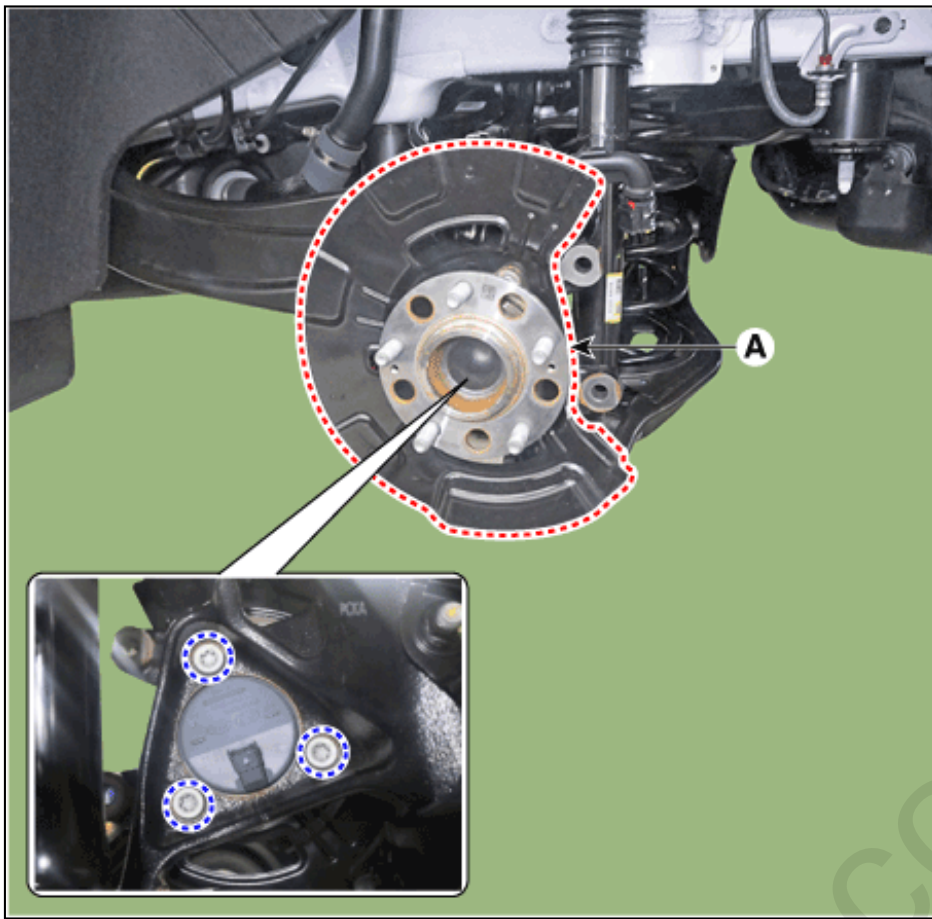
5. Disconnect the rear wheel speed sensor connector (A).



6. Loosen the bearing mounting bolts and then remove the hub bearing assembly & dust cover (A).

Tightening torque :

98.1 - 117.7 N.m (10.0 - 12.0 kgf.m, 72.3 - 86.8 lb-ft)



[4WD]

1. Loosen the wheel nuts slightly.
Raise the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire (A) from the rear hub.

Tightening torque :

107.9 - 127.5 N.m (11.0 - 13.0 kgf.m, 79.6 - 94.0 lb-ft)



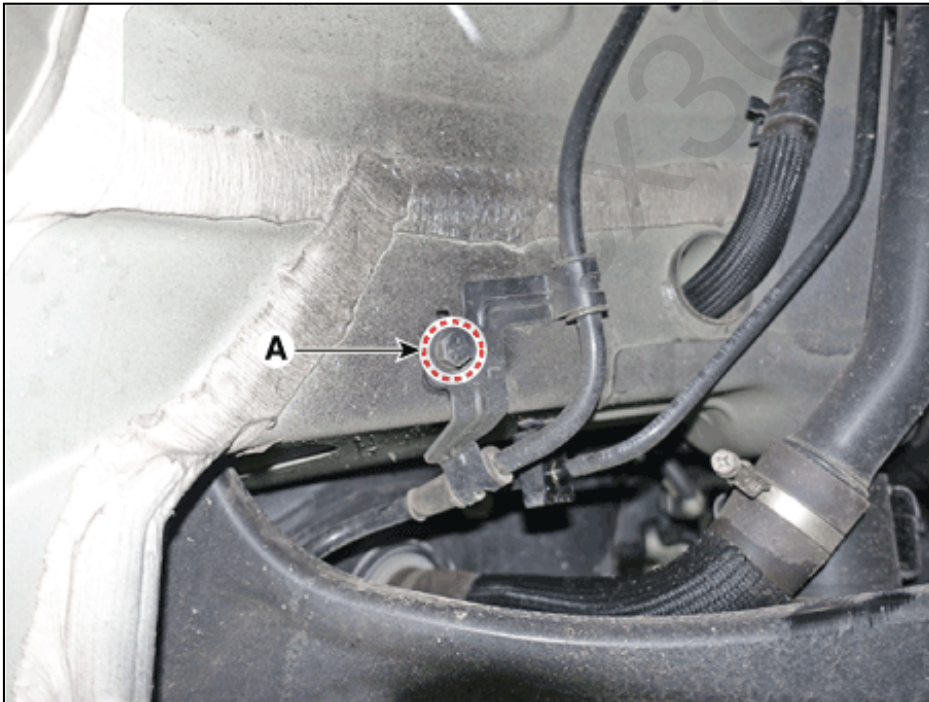
- Be careful not to damage the hub bolts when removing the rear wheel and tire (A).



3. Remove the rear wheel guard.
(Refer to Body - "Rear Wheel Guard")
4. Remove the rear wheel speed sensor cable bracket bolt (A).

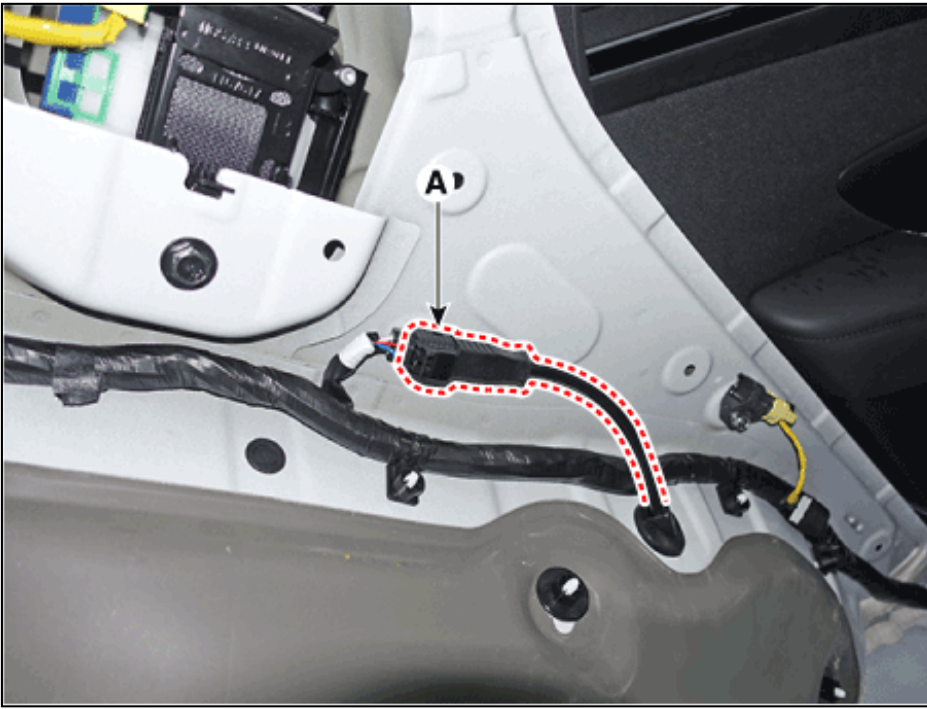
Tightening torque :

19.6 - 29.4 N.m (2.0 - 3.0 kgf.m, 14.5 - 21.7 lb-ft)

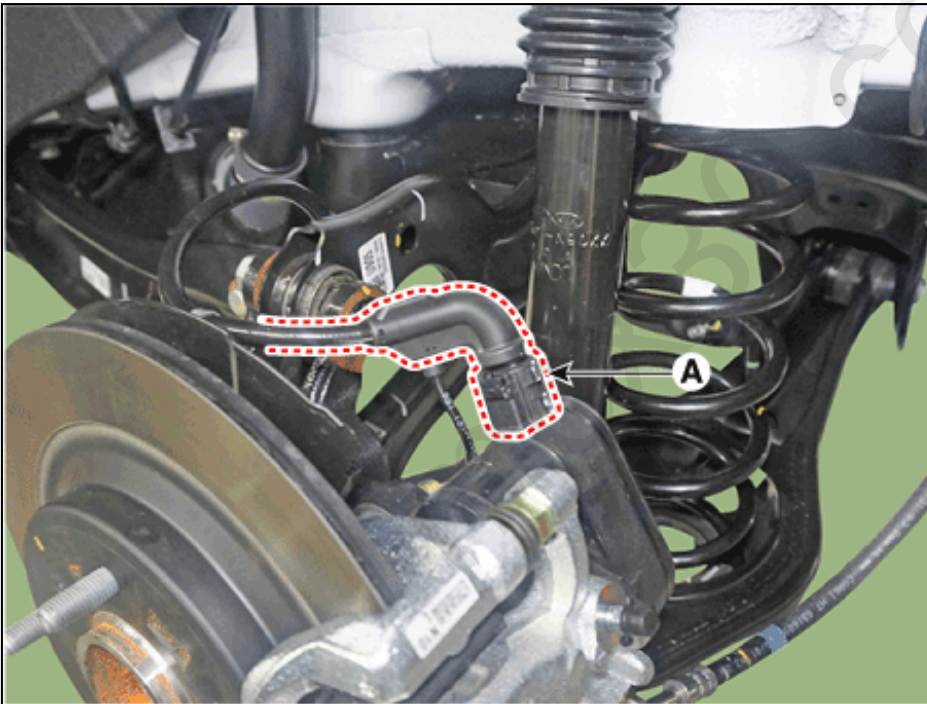


5. Remove the luggage side trim.
(Refer to Body - "Luggage Side Trim")

6. Disconnect the rear wheel speed sensor connector (A).



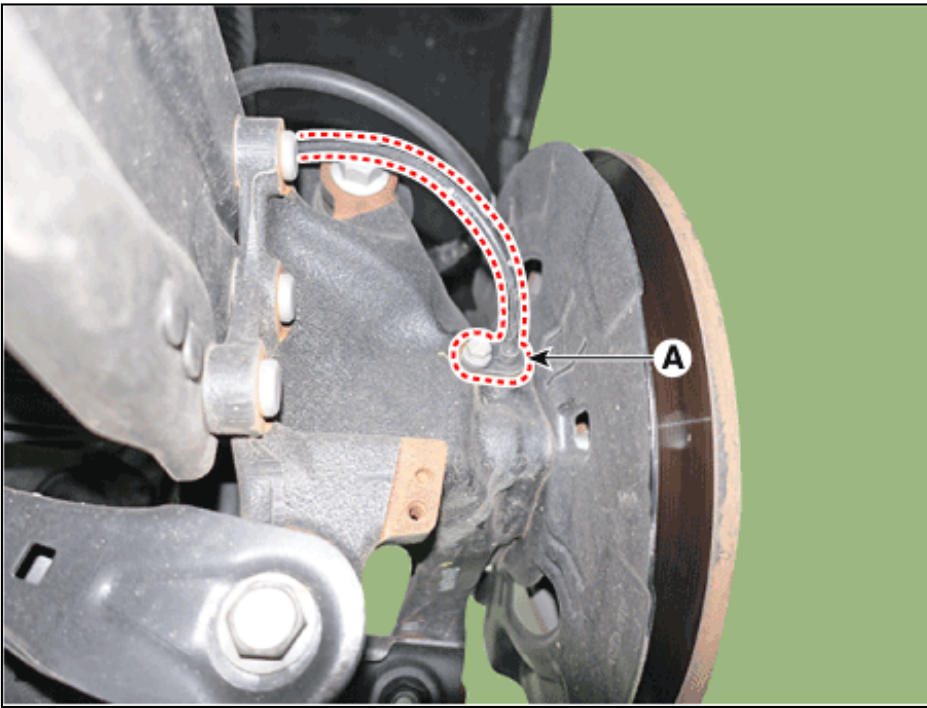
7. Disconnect the EPB actuator connector (A).



8. Remove the bolt and then disconnect the rear wheel speed sensor (A).

Tightening torque :

8.8 - 13.7 N.m (0.9 - 1.4 kgf.m, 6.5 - 10.1 lb-ft)

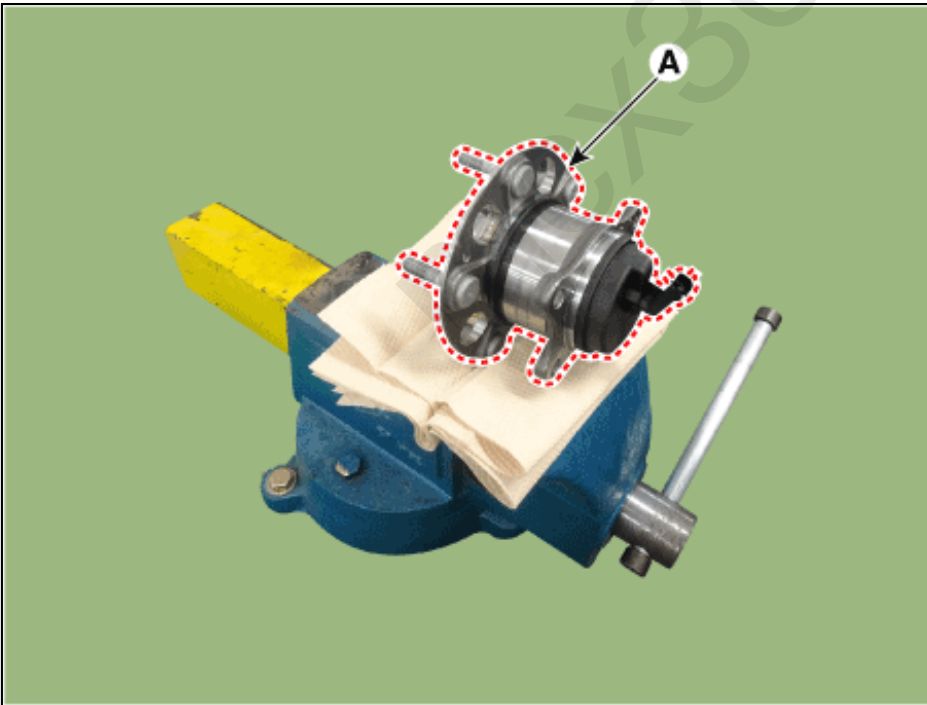


Replacement

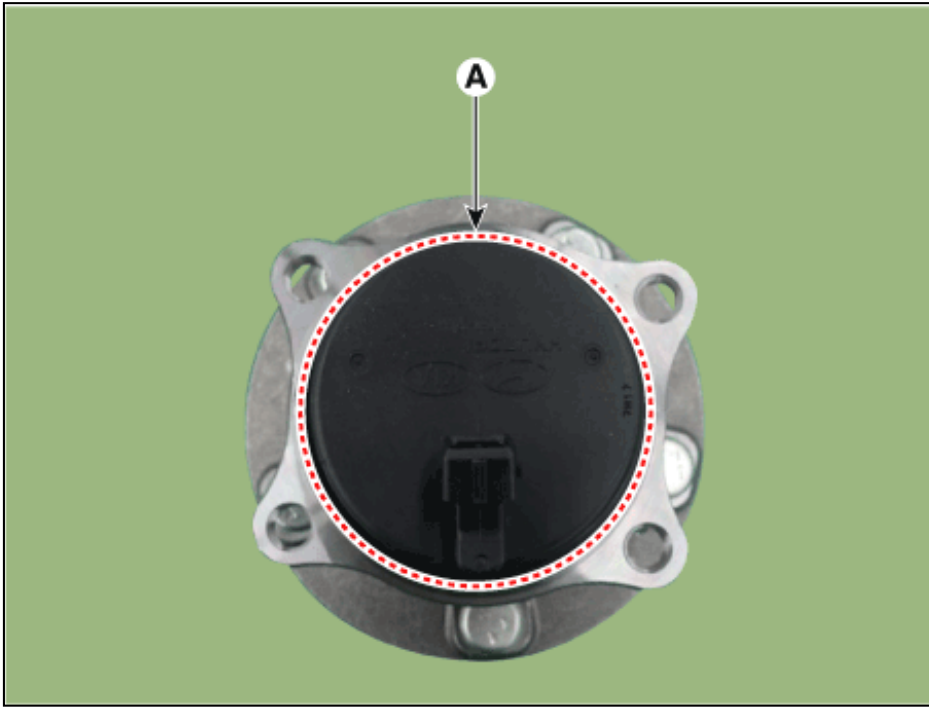
1. Remove the rear wheel hub bearing assembly.
(Refer to Driveshaft and Axle - "Rear Hub - Carrier")
2. Fix the rear hub bearing assembly (A) on the vise.



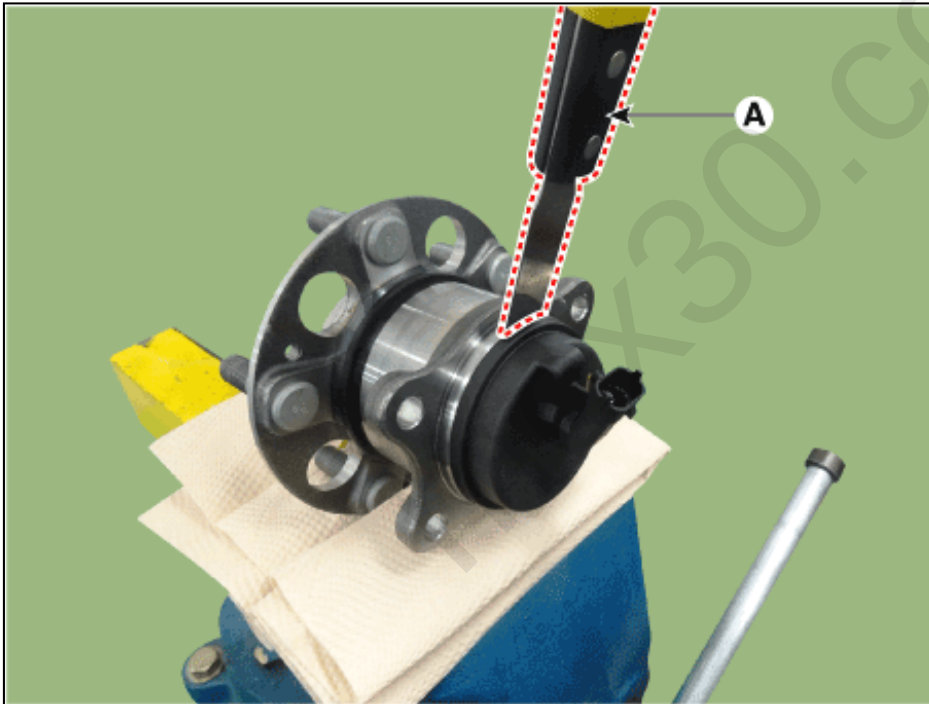
- When fixing on the vise, use a cloth not to be damaged the hub bearing assembly.
- Be careful if excessive force for fixing on the vise may damage the hub bearing assembly.



3. Check the direction of the sensor cap (A).



4. Remove the sensor cap by hammering on a gap between sensor cap and hub bearing assembly using a scraper (A).



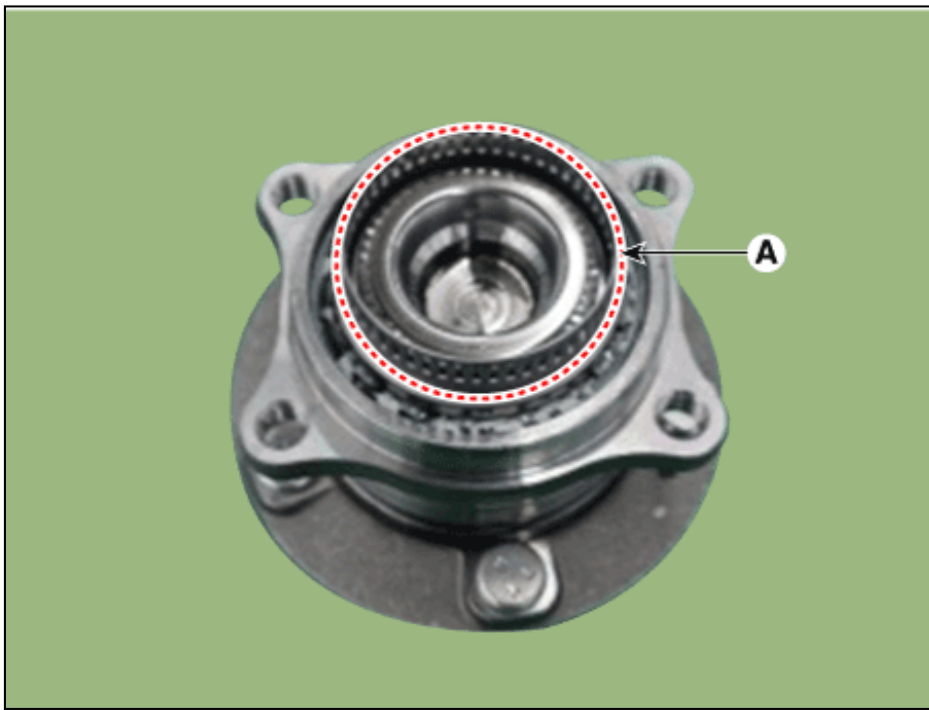
- In order to widen the gap little by little, hammering around the bearing cap 10-20 times.



- When removing the sensor cap, remove it in a straight direction not to damage the tone wheel or encoder.



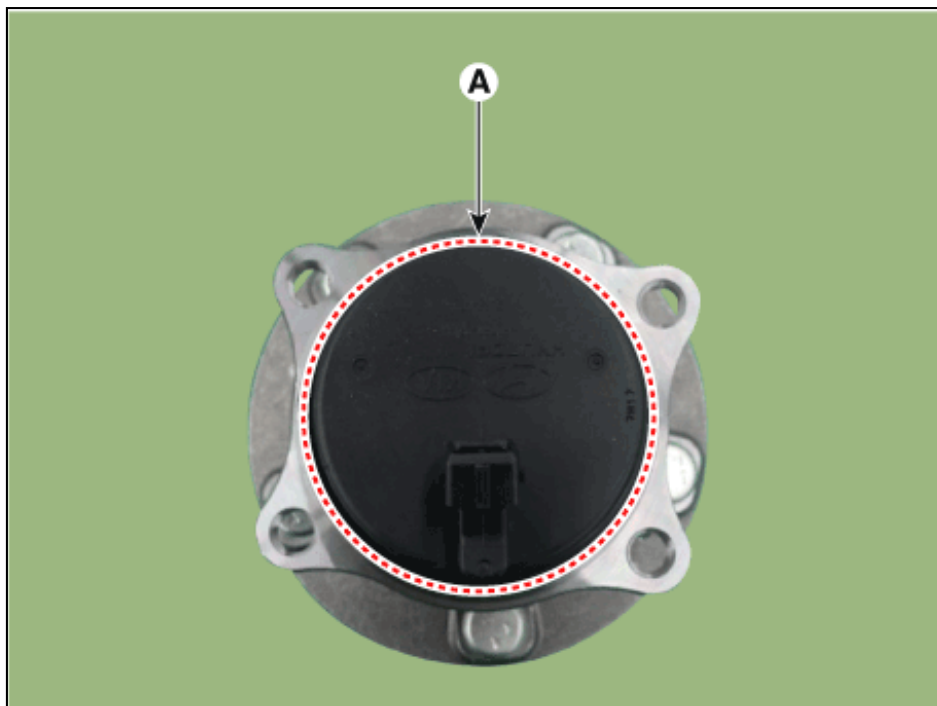
5. Check if distorted or damaged the tone wheel or encoder (A).



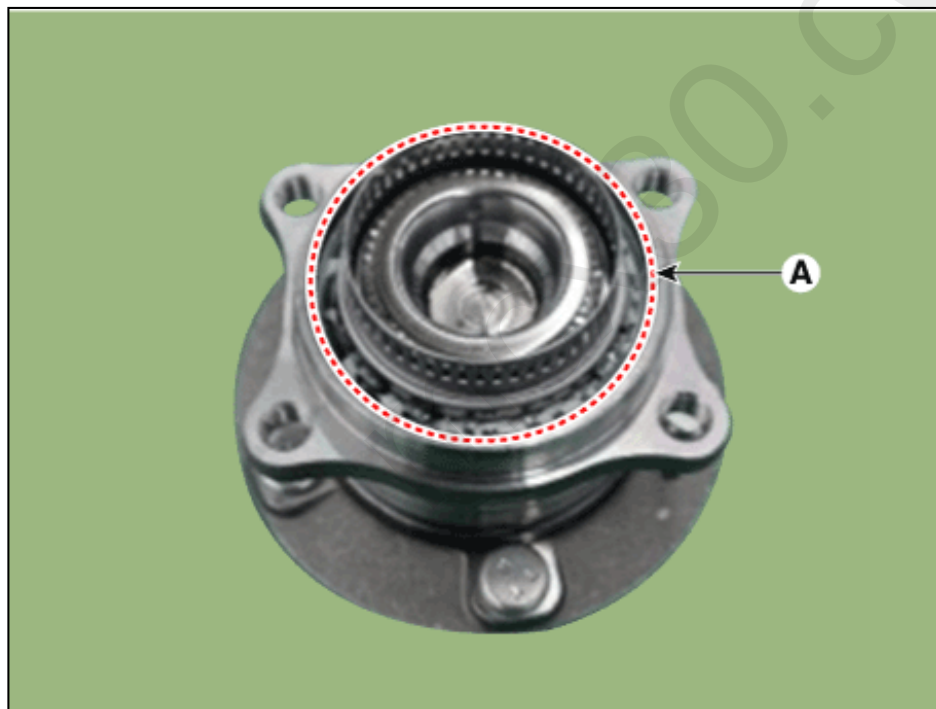
- Check if damaged the tone wheel or encoder after removing the sensor cap and replace the hub bearing if it was deformed.
- If the tone wheel is deformed, it may trigger the MIL ON or other problems.



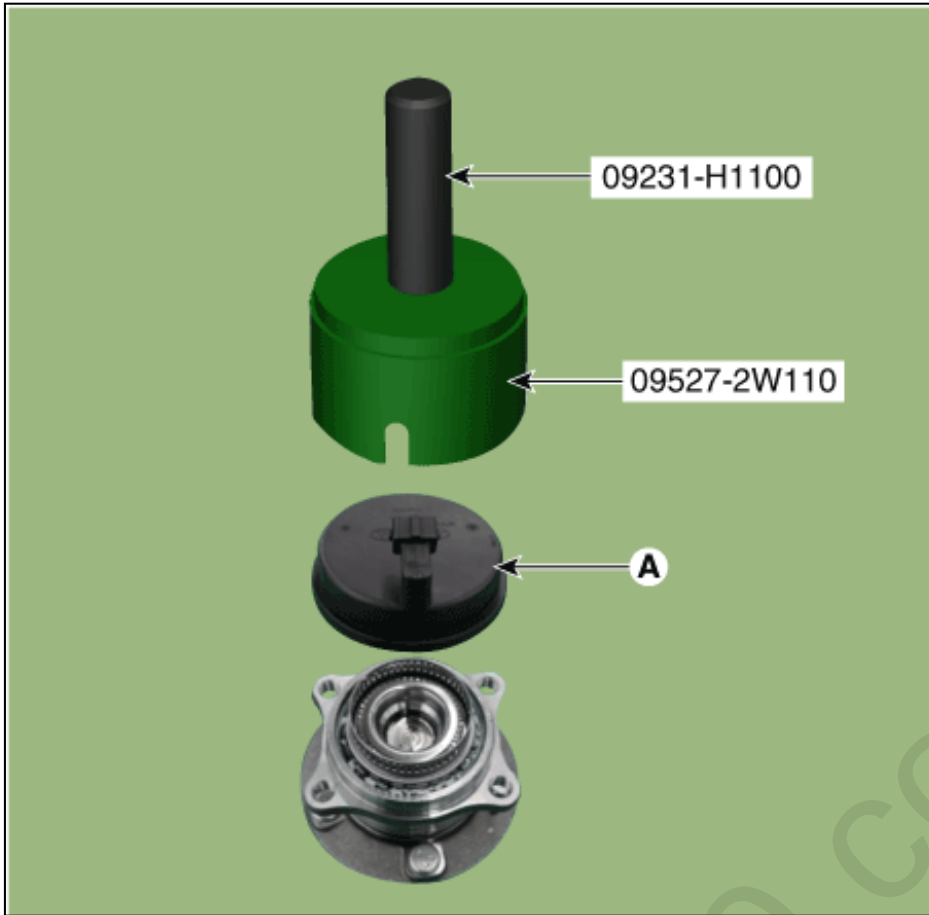
6. Position the sensor cap to the same direction of sensor cap connector (A) as you checked before removing.



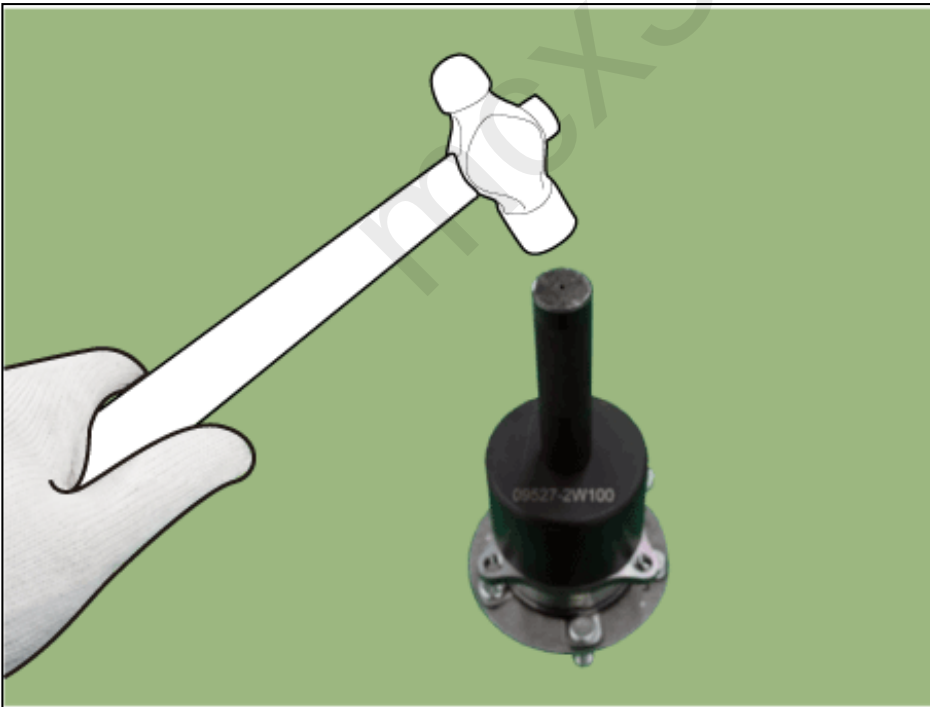
•Before installing the sensor cap, do not let any foreign material and contaminant into the hub bearing (A) assembly.



7. Install the sensor cap (A) with the special service tool (09527-2W110).

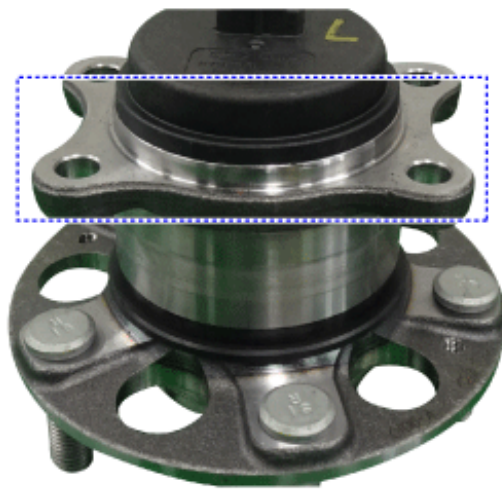


•Hammer until there is no gap between the SST and hub bearing assembly and install the sensor cap.

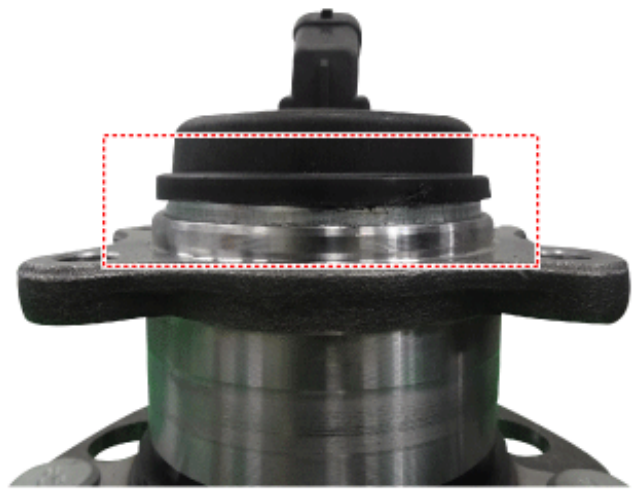


•Be careful not to tilt to one side when installing the sensor cap as it may damage the tone wheel or encoder.

- When sensor cap installation, hammering it until the gap disappeared between the sensor cap and hub bearing assembly.



[OK]



[NG]

8. Install the rear wheel hub bearing assembly.

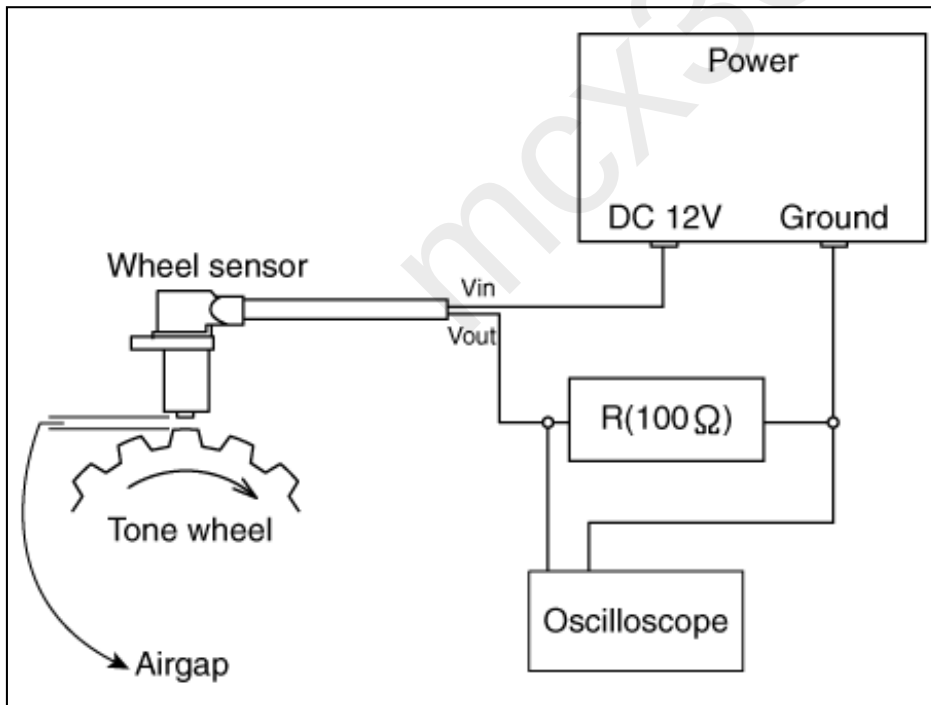
(Refer to Driveshaft and Axle - "Rear Hub - Carrier")

Inspection

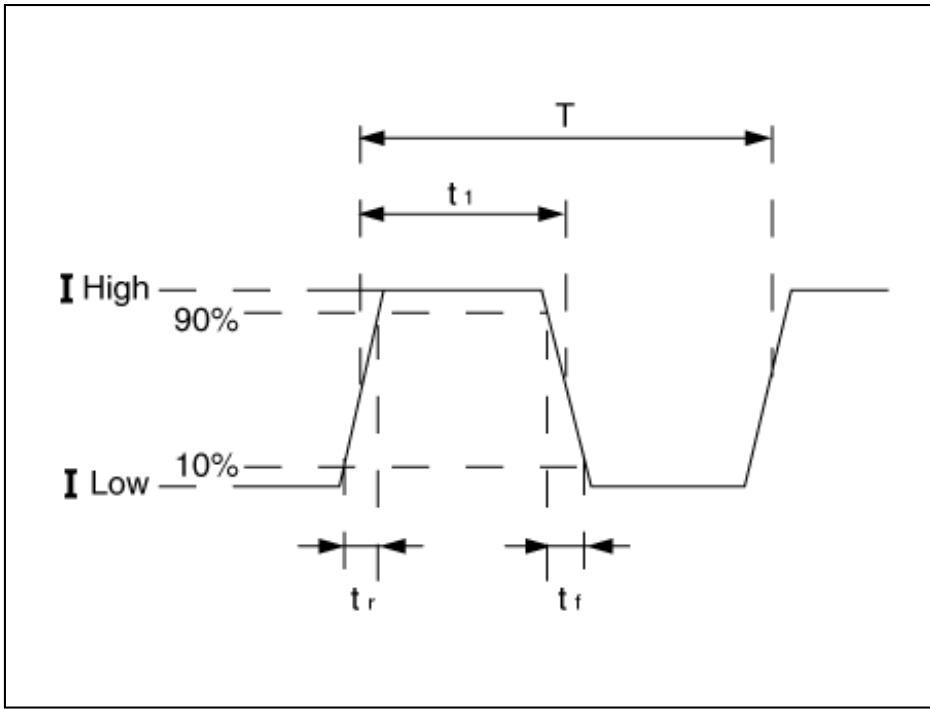
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.



- In order to protect the wheel speed sensor, when measuring output voltage, a 100Ω resistor must be used as shown.



2. Compare the change of the output voltage of the wheel speed sensor to the normal change of the output voltage as shown below.



- I low : 5.95 ~ 8.05 mA
- I High : 11.9 ~ 16.1 mA
- Frequency range : 0.03 ~ 3000 HZ

Installation

1. Install in the reverse order of removal.

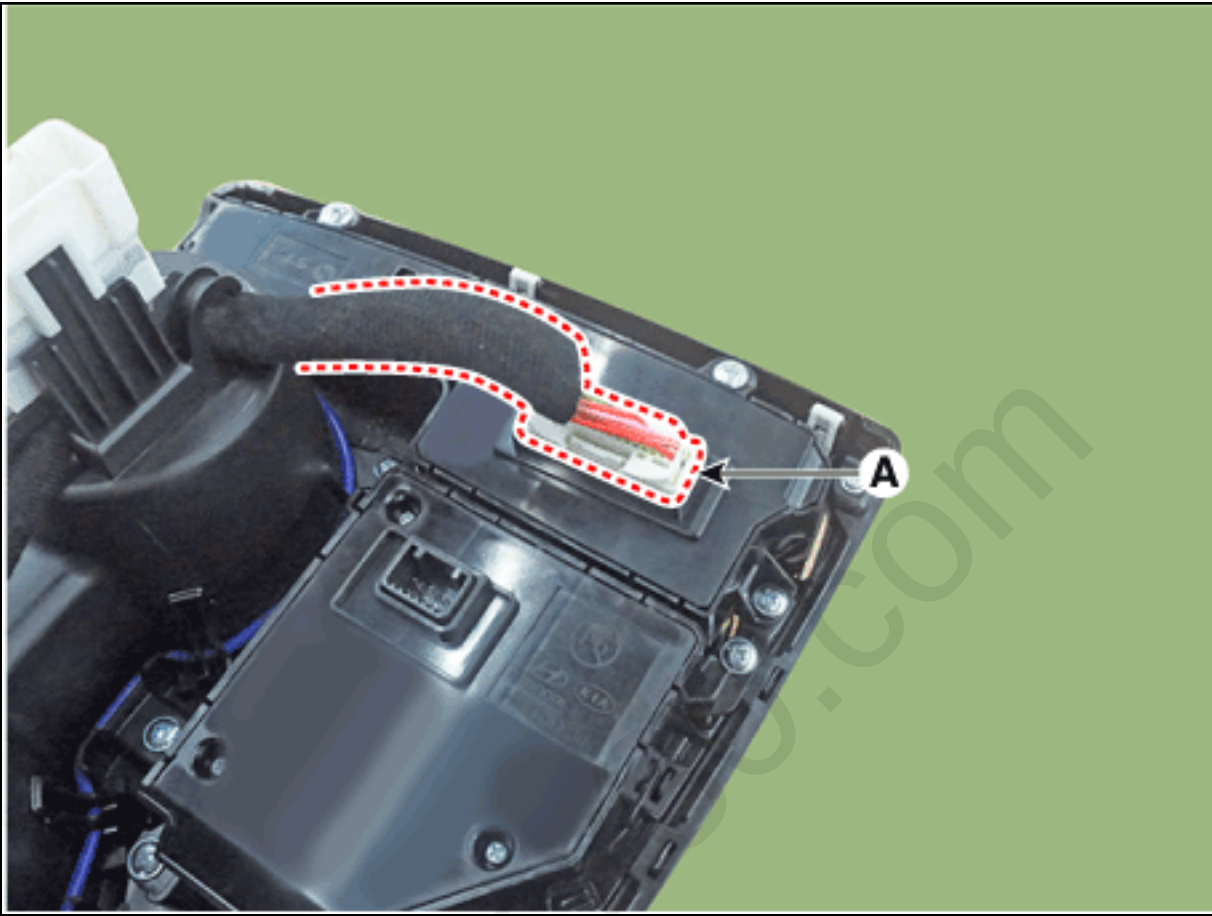
Description

The DBC function is the acronym word of Downhill Brake Control function. When a vehicle goes down the hill, just pushing the DBC switch enables the car to keep its vehicle's speed at a constant value without operating the brake pedal. The DBC function is operated when the vehicle is on the decline and its velocity is under the predetermined speed.

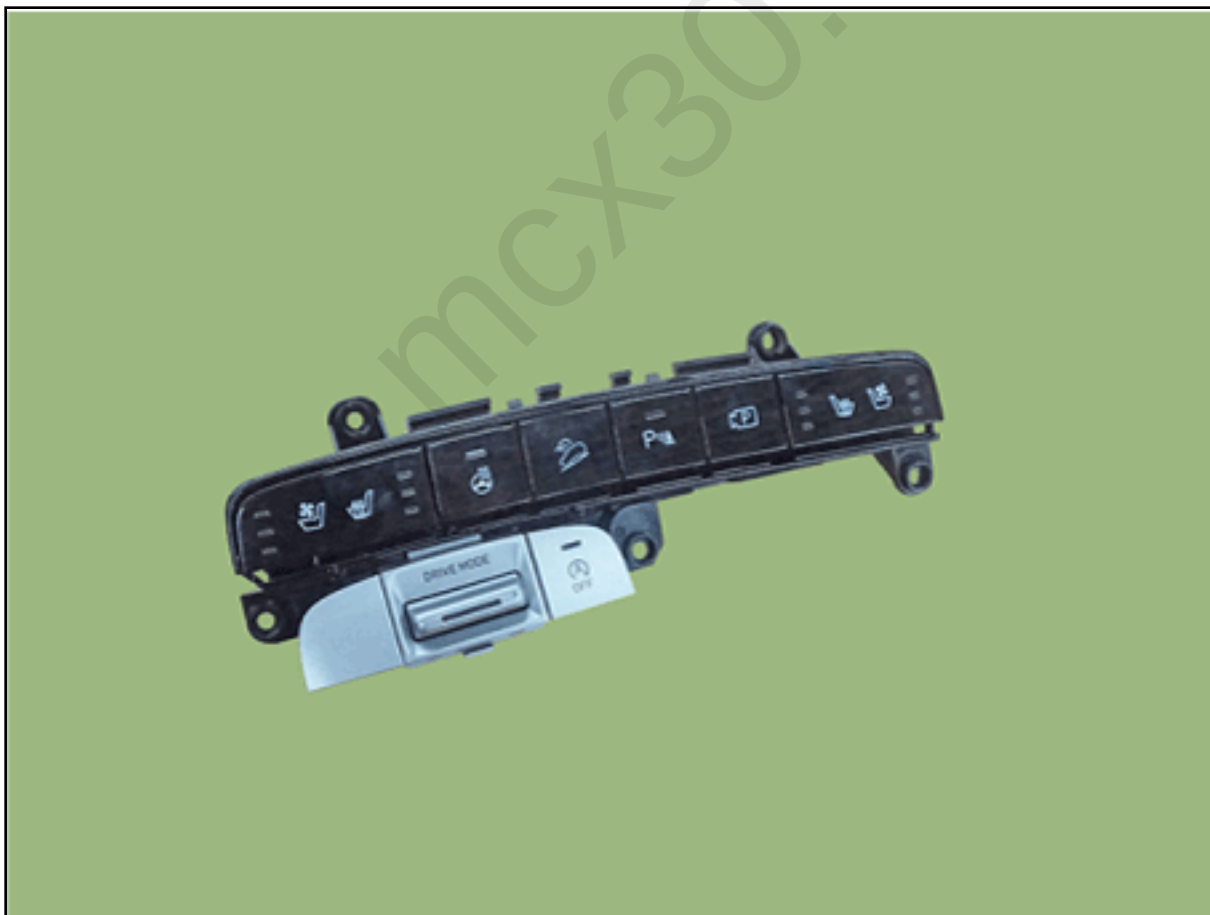
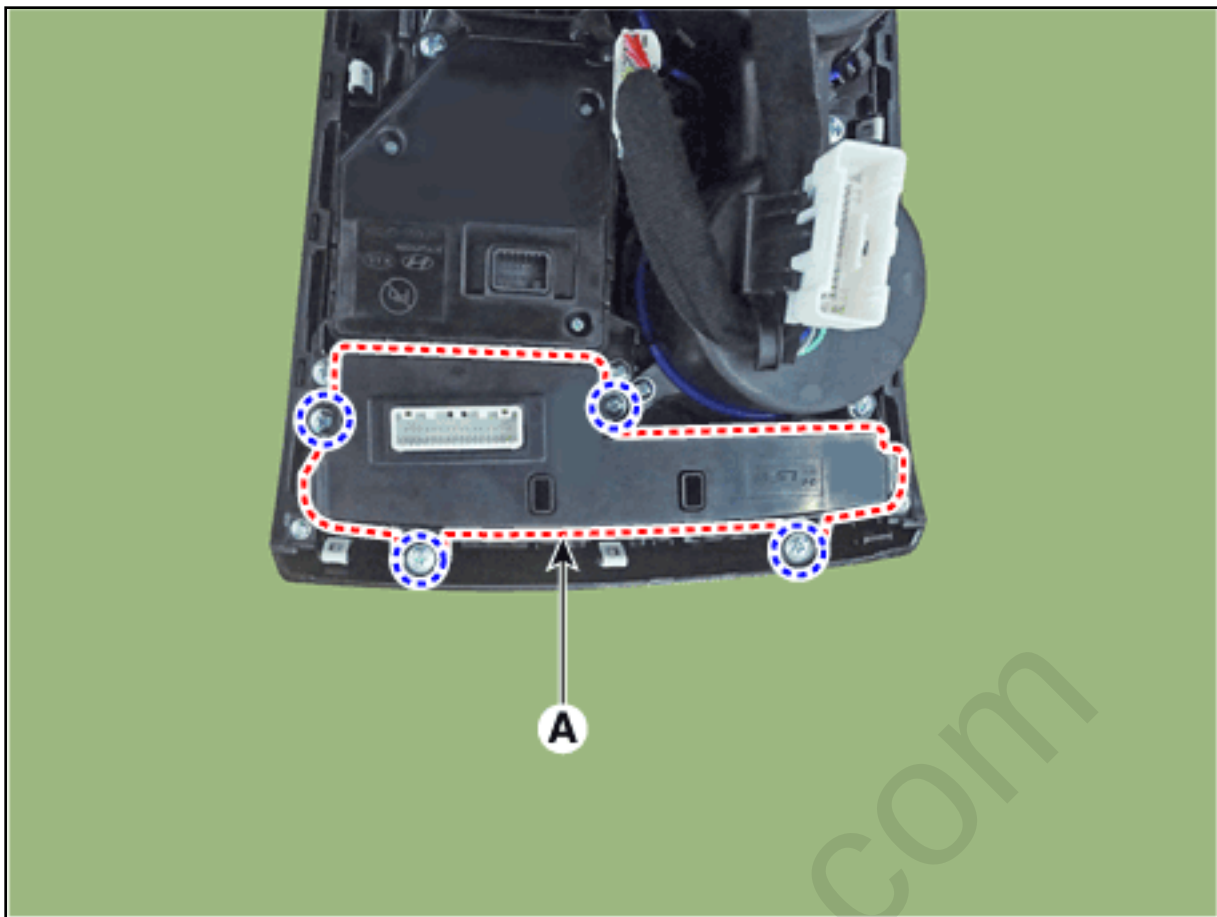
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Removal

1. Disconnect the battery negative (-) terminal.
2. Remove the floor console upper cover.
(Refer to Body - "Floor Console Assembly")
3. Disconnect the floor console upper cover switch connector (A).



4. Remove the screws and remove the floor console upper cover switch (A).



Installation

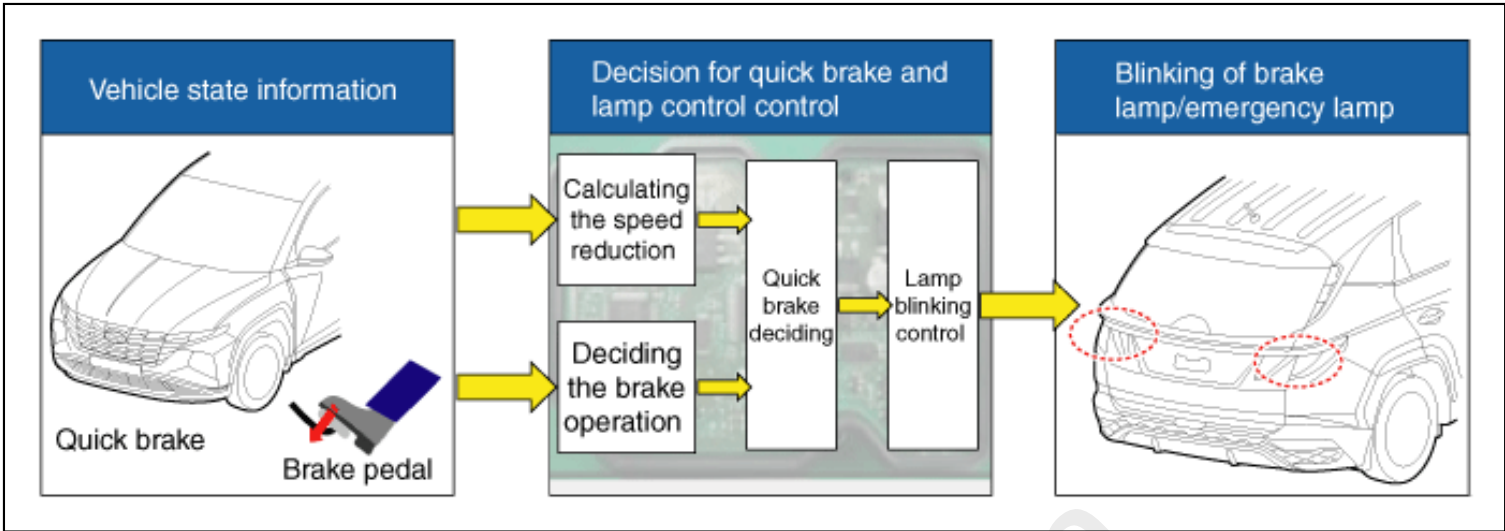
1. Install in the reverse order of removal.

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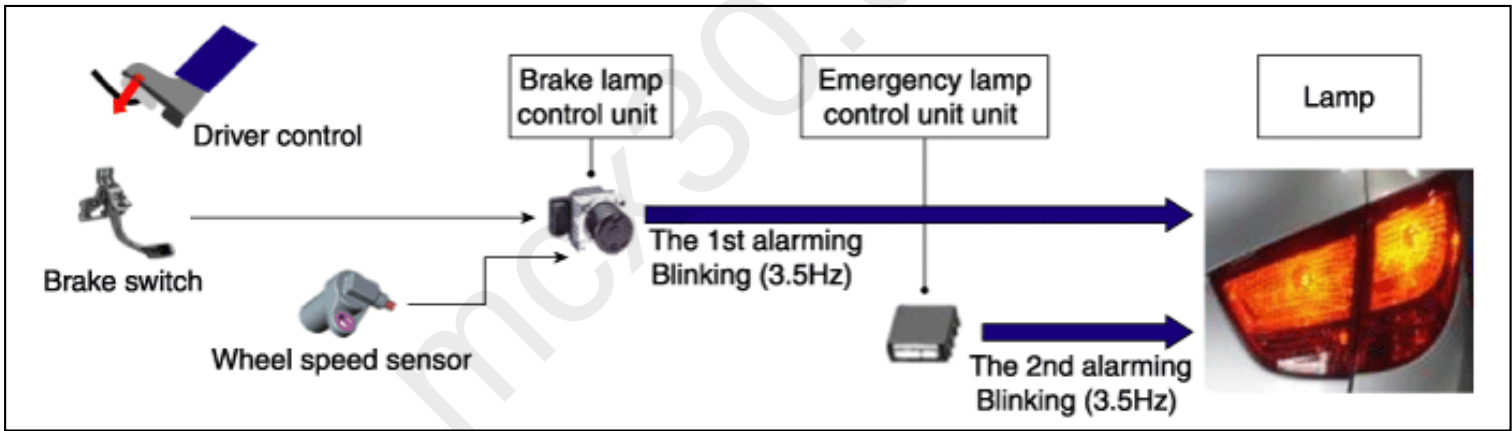
Description

Introduction of Quick Brake Warning System (ESS)

In case of quick brake by driver, the brake lamp or turn signal is blinked to warn against the vehicle at rear.



1. Basic function (Blinking the brake lamp/emergency lamp)
 - Operation condition : In case of quick brake or operation of ABS above in a certain speed
 - Releasing condition : In case of stopping the quick brake or releasing the ABS operation
2. Additional function (Blinking the turn signal)
 - Operation condition : In case of quick brake in low speed
 - Releasing condition : Releasing at the start of driving



System Configuration

