DTC Chart

Number	DTC	Description		
1	0000	Internal error		
2	0001	Sensor Right Hand Front(Airgap)		
3	0002	Sensor Left Hand Rear(Airgap)		
4	0003	Sensor Left Hand Front(Airgap)		
5	0004	Sensor Right Hand Rear(Airgap)		
6	0009	ut Valve Right Hand Front(Short To Ubatt/Uvent)		
7	000A	Output Valve Right Hand Front(Short To Ubatt/Uvent)		
8	000B	Input Valve Left Hand Front(Short To Ubatt/Uvent)		
9	000C	Output Valve Left Hand Front(Short To Ubatt/Uvent)		
10	000D	Input Valve Right Hand Rear(Short To Ubatt/Uvent)		
11	000E	Output Valve Right Hand Rear(Short To Ubatt/Uvent)		
12	000F	Input Valve Left Hand Rear(Short To Ubatt/Uvent)		
13	0010	Output Valve Left Hand Rear(Short To Ubatt/Uvent)		
14	0011	Endurance Brake Relay(Short To Ubatt/Uvent)		
15	0017	Sensor Right Hand Front(Impedance)		
16	0018	Sensor Left Hand Rear(Impedance)		
17	0019	Sensor Left Hand Front(Impedance)		
18	001A	Sensor Right Hand Rear(Impedance)		
19	001B	Input Valve Right Hand Front(Open Circuit)		
20	001C	Output Valve Right Hand Front(Open Circuit)		
21	001D	Input Valve Left Hand Front(Open Circuit)		
22	001E	Output Valve Left Hand Front(Open Circuit)		
23	001F	Input Valve Right Hand Rear(Open Circuit)		
24	0020	Output Valve Right Hand Rear(Open Circuit)		
25	0021	Input Valve Left Hand Rear(Open Circuit)		
26	0022	Output Valve Left Hand Rear(Open Circuit)		
27	0023	Endurance Brake Relay(Open Circuit)		
28	0024	Brake Light Relay(Open Circuit)		
29	0029	Input Valve Right Hand Front(Short To Ground)		
30	002A	Output Valve Right Hand Front(Short To Ground)		
31	002B	Input Valve Left Hand Front(Short To Ground)		
32	002C	Output Valve Left Hand Front(Short To Ground)		
33	002D	Input Valve Right Hand Rear(Short To Ground)		
34	002E	Output Valve Right Hand Rear(Short To Ground)		

Number	DTC	Description	
35	002F	Input Valve Left Hand Rear(Short To Ground)	
36	0030	Output Valve Left Hand Rear(Short To Ground)	
37	0032	Endurance Brake Relay(Short To Ground)	
38	0033	Brake Light Relay(Short To Ground)	
39	0037	Valve Relay(Can't Switch Off)	
40	0038	Valve Relay(Can't Switch On)	
41	0039	Reference Ground Connection	
42	003B	ABS Warning Light Bulb	
43	003C	Brake Warning Light Bulb	
44	003D	High Voltage	
45	003F	Sensor Right Hand Front(Tire Combination)	
46	0040	Sensor Left Hand Rear(Tire Combination)	
47	0041	Sensor Left Hand Front(Tire Combination)	
48	0042	Sensor Right Hand Rear(Tire Combination)	
49	0043	Pump Motor Does Not Switch On	
50	0044	Pump Motor Does Not Switch Off	
51	0045	Pump Motor Does Not Turn	
52	0046	Pump Motor Supply Voltage Missing	
53	0047	Pump Motor Relay Voltage Missing	
54	0049	Sensor Right Hand Front(No Trigger At All)	
55	004A	Sensor Left Hand Rear(No Trigger At All)	
56	004B	Sensor Left Hand Front(No Trigger At All)	
57	004C	Sensor Right Hand Rear(No Trigger At All)	
58	004D	J1939 Internal Error	
59	004E	J1939 Bus	
60	004F	J1939 Message	
61	0050	Inlet Valve(Right Hand Front) Actuation Time Unplausible	
62	0051	Inlet Valve(Left Hand Rear) Actuation Time Unplausible	
63	0052	Inlet Valve(Left Hand Front) Actuation Time Unplausible	
64	0053	Inlet Valve(Right Hand Rear) Actuation Time Unplausible	
65	0054	Pole Wheel Right Hand Front(Cyclic Failure)	
66	0055	Pole Wheel Left Hand Rear(Cyclic Failure)	
67	0056	Pole Wheel Left Hand Front(Cyclic Failure)	
68	0057	Pole Wheel Right Hand Rear(Cyclic Failure)	
69	0058	Clamp Transistor Failure	

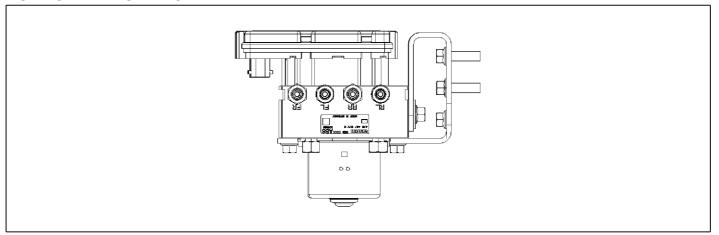
BR-106

Brake System

Number	DTC	Description	
70	0059	ıll Up Down Failure	
71	005A	Sensor Right Hand Front(Signal Disturbed)	
72	005B	nsor Left Hand Rear(Signal Disturbed)	
73	005C	Sensor Left Hand Front(Signal Disturbed)	
74	005D	Sensor Right Hand Rear(Signal Disturbed)	

0000 Internal error

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes]		

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.

	1.2. CURRENT	DATA	08/22
×	ECU SUPPLY VOLTAGE	22.9	v
×	WHEEL SPEED RHF	1.8	Km∕h
×	WHEEL SPEED LHR	1.8	Km/h ■
×	WHEEL SPEED LHF	1.8	Km∕h
×	WHEEL SPEED RHR	1.8	Km∕h
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	BRAKE WARNING LAMP	OFF	
			₩.
	FIX PART TOT HEL	P LINE	REC

- 2. Turn the ignition ON.
- 3. Monitor the service data on the scan tool.

	1.2. CURRENT DATA 01/	22
		A
×	SENSOR VOLTAGE RHF 2.2 V	
×	SENSOR VOLTAGE LHR 2.2 V	
×	SENSOR VOLTAGE LHF 2.2 V	
×	SENSOR VOLTAGE RHR 2.2 V	
×	ECU SUPPLY VOLTAGE 22.7 V	
×	DBR RELAY OFF	
×	ABS WARNING LAMP OFF	
×	BRAKE WARNING LAMP OFF	
		T
	FIX PART TOT HELP LINE REC	

SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

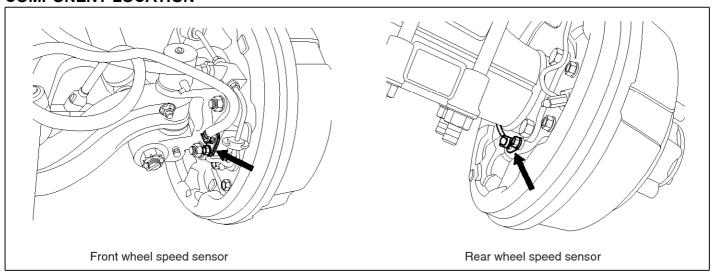
YES

► Go to the applicable DTC procedure.

NO

0001 Sensor Right Hand Front(Airgap)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			•	Check air gap.
Enable Conditions	Ignition ON	Ignition ON			•	Check bearing play and tone ring run
Threshold Value	Vehicle speed >	Vehicle speed > 5.0 kph. Air gap 0.2 ∼ 1.7 mm				out.
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			•	Check tone ring for
Fail Safe	Fuel Cut	No		ABS function disa	-	damage.
	Fuel Limit	Yes		bled for concerned wheel	t	
	MIL	Yes				

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20°C)		
Air gap	0.2 ~ 1.7 mm		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.

	1.2. CURRENT DATA	08/22
		A
×	SENSOR VOLTAGE RHF 4.2	v
×	SENSOR VOLTAGE LHR 0.6	v
×	SENSOR VOLTAGE LHF 0.6	v 🚛
×	SENSOR VOLTAGE RHR 1.2	v
×	WHEEL SPEED RHF 10.0	s Km∕h
×	WHEEL SPEED LHR 10.6	5 Km∕h
×	WHEEL SPEED LHF 10.8	3 Km∕h
×	WHEEL SPEED RHR 10.0	5 Km∕h
		▼
	FIX PART TOT HELP LINE	E REC

- 3. Drive the vehicle straight at a constant speed in the normal road surface.
- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT I)ATA	08/22
×	SENSOR VOLTAGE RHF	0.8	v
×	SENSOR VOLTAGE LHR	4.7	v
×	SENSOR VOLTAGE LHF	0.0	v 📗
×	SENSOR VOLTAGE RHR	0.7	v –
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km∕h
×	WHEEL SPEED RHR	20.9	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of

Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the right hand front when sensor connector.
- 3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).
 - Specification: $830 \sim 2,100 \Omega$ (At 20° C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

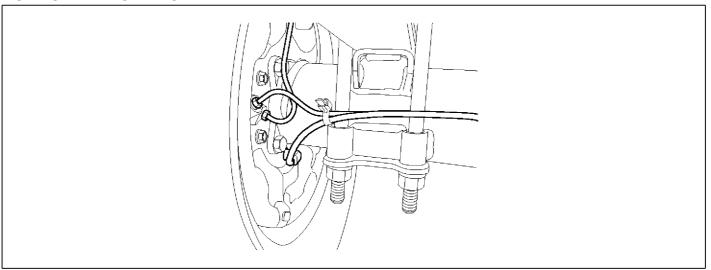
YES

▶ Go to the applicable DTC procedure.

NO

0002 Sensor Left Hand Rear(Airgap)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Check air gap. Check bearing play
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ∼ 1.7 mm				and tone ring run out.
Diagnosis Time	Below 1,000 ms			•	Check tone ring for
Fail Safe	Fuel Cut	No	ABS function disabled for concerned wheel.		damage.
	Fuel Limit	Yes			
	MIL	Yes			

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)		
Air gap	0.2 ~ 1.7 mm		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.

	1.2. CURRENT	DATA	08/22
			1
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v 💂
×	SENSOR VOLTAGE RHR	1.2	v
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km/h
×	WHEEL SPEED RHR	10.6	Km∕h
	FIX PART TOT HELP	LINE	REC

- 3. Drive the vehicle straight at a constant speed in the normal road surface.
- 4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1.	2. (CURRENT	DATA	08/	22
							•
×	SENSOR	VOLT	AGE	RHF	0.8	v	
×	SENSOR	VOLT	AGE	LHR	4.7	v	
×	SENSOR	VOLT	AGE	LHF	0.0	v	_
×	SENSOR	VOLT	AGE	RHR	0.7	v	
×	WHEEL	SPEED	RH	F	21.0	Km∕h	
×	WHEEL	SPEED	LH	R	20.7	Km∕h	
×	WHEEL	SPEED	LH	F	21.0	Km∕h	
×	WHEEL	SPEED	RH	R	20.9	Km∕ h	
							Ŧ
	FIX	PART	TO:	r HELI	PLINE	REC	

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the left hand rear connector (C37).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).
 - Specification: 830 \sim 2100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

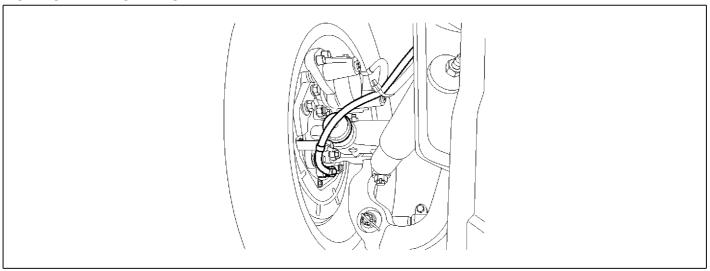
YES

► Go to the applicable DTC procedure.

NO

0003 Sensor Left Hand Front(Airgap)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause	
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	Vehicle speed >	Vehicle speed > 5.0 kph. Air gap 0.2 ∼ 1.7 mm				
Diagnosis Time	Below 1,000 ms				•	Check tone ring for
Fail Safe	Fuel Cut	No		ABS function disa	-	damage.
	Fuel Limit	Yes		bled for concerned	1	
	MIL	Yes		- wheel.		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.

	1.2. CURRENT DATA 08/	22
		1
×	SENSOR VOLTAGE RHF 4.2 V	
×	SENSOR VOLTAGE LHR 0.6 V	
×	SENSOR VOLTAGE LHF Ø.6 V	
×	SENSOR VOLTAGE RHR 1.2 V	
×	WHEEL SPEED RHF 10.6 Km/h	
×	WHEEL SPEED LHR 10.6 Km/h	
×	WHEEL SPEED LHF 10.8 Km/h	
×	WHEEL SPEED RHR 10.6 Km/h	
		▼
	FIX PART TOT HELP LINE REC	

- 3. Drive the vehicle straight at a constant speed in the normal road surface.
- 4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22
×	SENSOR VOLTAGE RHF	0.8	U
×	SENSOR VOLTAGE LHR	4.7	v
×	SENSOR VOLTAGE LHF	0.0	U 💂
×	SENSOR VOLTAGE RHR	0.7	v
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km∕h
×	WHEEL SPEED RHR	20.9	Km∕h
			v
	FIX PART TOT HELP	LINE	REC

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the left hand front connector (C31).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.
 - Specification: 830 \sim 2,100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

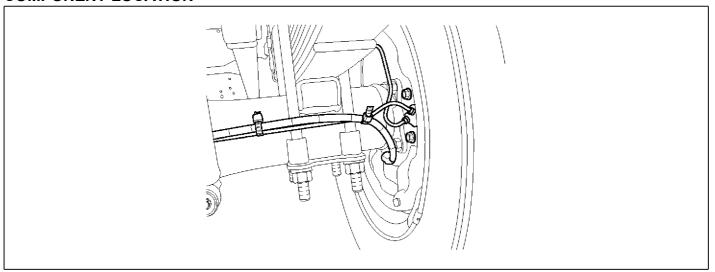
YES

▶ Go to the applicable DTC procedure.

NO

0004 Sensor Right Hand Rear(Airgap)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause	
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	Vehicle speed > 5.0 kph. Air gap 0.2 ∼ 1.7 mm					and tone ring run out.
Diagnosis Time	Below 1,000 ms					Check tone ring for
Fail Safe	Fuel Cut	No		ABS function disa	-	damage.
	Fuel Limit	Yes		bled for concerned	t	
	MIL	Yes		wheel		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.

	1.2. CURRENT D	ATA	08/22
			1
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v 📕
×	SENSOR VOLTAGE RHR	1.2	v
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km/h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 3. Drive the vehicle straight at a constant speed in the normal road surface.
- 4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	0.8	Ų
×	SENSOR VOLTAGE LHR	4.7	v
×	SENSOR VOLTAGE LHF	0.0	v 📗
×	SENSOR VOLTAGE RHR	0.7	v
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km∕h
×	WHEEL SPEED RHR	20.9	Km∕h
			▼
	FIX PART TOT HEL	PLINE	REC

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the right hand rear connector (C36).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
 - Specification: 830 \sim 2100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

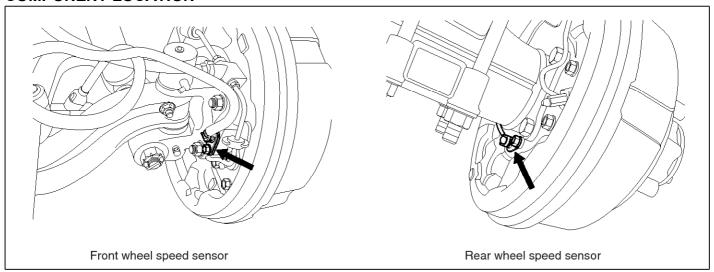
YES

▶ Go to the applicable DTC procedure.

NO

0009 Input Valve Right Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detect				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

DUAL DISPLAY					
	CURREN	T DATA			
× INPUT VALU	JE RHF	OFF	A		
× OUTPUT VAI	VE RHF	OFF			
× INPUT VALU	E LHF	OFF	-		
× OUTPUT VAI	* OUTPUT VALUE LHF OFF				
	ACTUAT I	ON TEST			
INLET VALVE	E RIGHT-	HAND FRONT			
1 SECONDS	3	SOUND CHECK			
KEY.ON / VEH.STOP ENG. STOP					
STRT	FIX	LINE			

- 4. Check the right hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL 1	DISPLAY	
	CURRE	T DATA	
× INPUT	VALVE RHF	ON	Α
× OUTPU	UALUE RHF	OFF	
× INPUT	VALUE LHF	OFF	
× OUTPU	C VALVE LHF	OFF	T.
	ACTUAT	ON TEST	
INLET	JALVE RIGHT	HAND FRONT	
1 SE	CONDS	SOUND CHECK	
KEY.ON	✓ VEH.STOP	ENG. STOP	
	W2 3	200	
STRT	FIX	LINE	

SUDWAB9009L

- Fig1) Right hand front inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

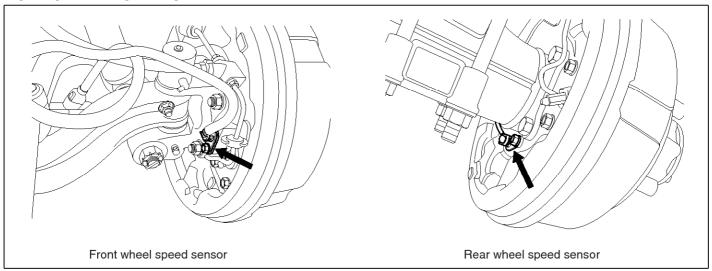
YES

▶ Go to the applicable DTC procedure.

NO

000A Output Valve Right Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms					
Fail Safe	Fuel Cut	No	ABS disabled			
	Fuel Limit	Yes				
	MIL	Yes]			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

	DUAL DISPLAY						
		CURR	ENT DAT	A			
×	INPUT	VALVE RHF		OFF	A		
×	OUTPUT	VALVE RH	F	OFF			
×	INPUT	VALVE LHF		OFF	-		
×	OUTPUT	VALUE LH	F	OFF	₩		
		ACTUA	TION TE	ST	•		
	DUTLET	VALVE RIG	HT-HAND	FRONT			
	1 SEC	ONDS	SOUN	D CHECK			
	KEY.ON / VEH.STOP ENG. STOP						
	STRT	FIX	LINE				

- 4. Check the right hand front outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY						
		(URRE	NT DATA	À		
×	INPUT	VALVE	RHF		OFF		•
×	OUTPU	T VALVE	RHF		ON		
×	INPUT	VALVE	LHF		OFF		
×	OUTPU	IT VALVE	E LHF		OFF		₹
		AC	TUAT	ION TES	ST		
	OUTLET	VALVE	RI GH	r-Hand	FRONT		
	1 SE	CONDS		SOUNI	СНЕСК		
	KEY.ON / VEH.STOP ENG. STOP						
	STRT		FIX	LINE			

SUDWAB9010L

- Fig1) Right hand front outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

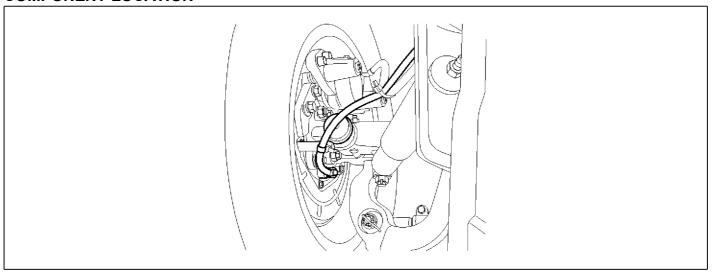
YES

► Go to the applicable DTC procedure.

NO

000B Input Valve Left Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detect	rol system			
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

	DUAL DISPLAY							
		(URREI	NT DATA	1			
×	I NPU1	' VALVE	RHF		OFF	A		
×	OUTPU	JT VALVI	RHF		OFF			
×	I NPUT	' VALVE	LHF		OFF			
×	OUTPU	JT VALVI	LHF		OFF	▼		
		AC	CTUAT	ION TES	ST .	•		
	INLET	VALVE I	EFT-I	HAND FE	RONT			
	1 SI	ECONDS		SOUNI	CHECK			
П	KEY.ON / VEH.STOP ENG. STOP							
	STRT		FIX	LINE				

- 4. Check the left hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY							
		CU:	RREN	T DATA				
×	INPUT	VALVE R	HF		OFF		П	
×	OUTPUT	VALVE 1	RHF		OFF			
×	INPUT	VALVE L	HF		ON			
×	OUTPUT	VALVE 1	LHF		OFF		J	
	•	ACT	UAT I	ON TES	T	•		
	INLET	JALVE LE	FT-H	AND FR	ONT			
	1 SEC	CONDS		SOUND	CHECK			
	KEY.ON / VEH.STOP ENG. STOP							
	STRT	F	ΙX	LINE				

SUDWAB9011L

- Fig1) Left hand front inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

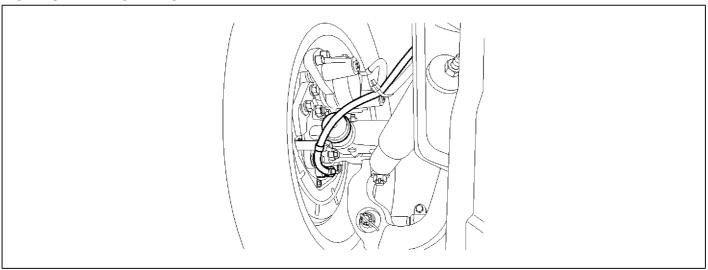
YES

► Go to the applicable DTC procedure.

NO

000C Output Valve Left Hand Front(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms					
Fail Safe	Fuel Cut	No	ABS disabled			
	Fuel Limit	Yes				
	MIL	Yes]			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"
 - DUAL DISPLAY CURRENT DATA **× INPUT VALVE RHF** OFF **OUTPUT VALVE RHF** OFF INPUT VALVE LHF OFF OUTPUT VALVE LHF OFF ACTUATION TEST **OUTLET VALVE LEFT-HAND FRONT** SECONDS SOUND CHECK KEY.ON / VEH.STOP ENG. STOP FIX LINE STRT
- 4. Check the left hand front outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

		DUAL I	DISPLAY	
		CURREN	IT DATA	
×	INPUT VAI	VE RHF	OFF	A
×	OUTPUT VA	ALUE RHF	OFF	
×	INPUT VAI	VE LHF	OFF	
×	OUTPUT VA	ALVE LHF	ON	T V
		ACTUAT I	ON TEST	
(OUTLET VAL	VE LEFT-	HAND FRONT	
	1 SECONI)S	SOUND CHECK	
1	ŒY.ON ∠ U	JEH. STOP	ENG. STOP	
			200	
-	STRT	FIX	LINE	

SUDWAB9012L

Fig1) Left hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

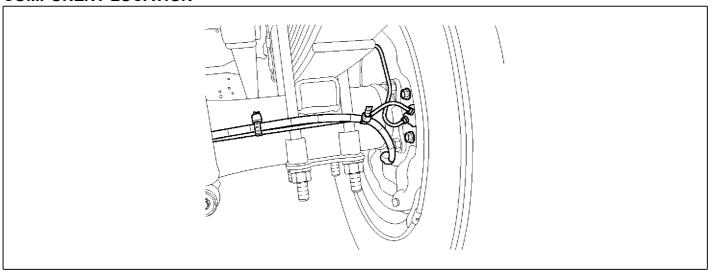
YES

► Go to the applicable DTC procedure.

NO

000D Input Valve Right Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detect	rol system			
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

	DUAL DISPLAY							
		CURREN	T DATA					
×	INPUT VALVE	RHR		OFF	A			
×	OUTPUT VALV	E RHR		OFF				
×	INPUT VALVE	LHR		OFF				
×	OUTPUT VALV	E LHR		OFF	▼			
	A	CTUAT I	ON TEST	Γ				
	INLET VALVE	RIGHT-	HAND RI	EAR				
	1 SECONDS		SOUND	CHECK				
	KEY.ON / UEH.STOP ENG. STOP							
	STRT	FIX	LINE					

- 4. Check the right hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY							
		CURREN	IT DATA					
×	INPUT VAI	VE RHR	ON	A				
×	OUTPUT VA	ALVE RHR	OFF					
×	INPUT VAI	VE LHR	OFF					
×	OUTPUT VA	ALVE LHR	OFF					
		ACTUAT	ON TEST					
	INLET VALU	Æ RIGHT-	HAND REAR					
	1 SECONI	08	SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP							
	STRT	FIX	LINE					

SUDWAB9013L

- Fig1) Right hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

- **TERMINAL & CONNECTOR INSPECTION**
- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

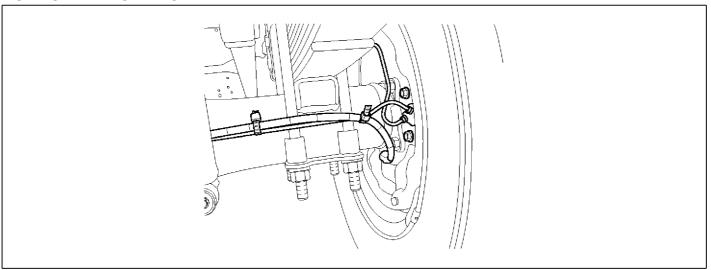
YES

▶ Go to the applicable DTC procedure.

NO

000E Output Valve Right Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring				Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

	DUAL DISPLAY						
	CURRENT DATA						
×	INPUT VALVE RHR				OFF	A	
×	× OUTPUT VALVE RHR				OFF		
×	* INPUT VALVE LHR				OFF		
×	OUTPU	JT VALVI	E LHR	:	OFF	₩	
	ACTUATION TEST						
	OUTLET VALVE RIGHT-HAND REAR						
	1 SECONDS SOUND CHECK						
	KEY.ON / VEH.STOP ENG. STOP						
	STRT		FIX	LINE			

- 4. Check the right hand rear outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY						
	CURRENT DATA						
×	INPUT VAL	VE RHR	OFF	A			
×	OUTPUT VA	LVE RHR	ON				
×	INPUT VAL	VE LHR	OFF				
×	OUTPUT VA	LVE LHR	OFF	▼			
	ACTUATION TEST						
	OUTLET VALVE RIGHT-HAND REAR						
1 SECONDS SOUND CHECK							
	KEY.ON / VEH.STOP ENG. STOP						
	STRT	FIX	LINE				

SUDWAB9014L

- Fig1) Right hand rear outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

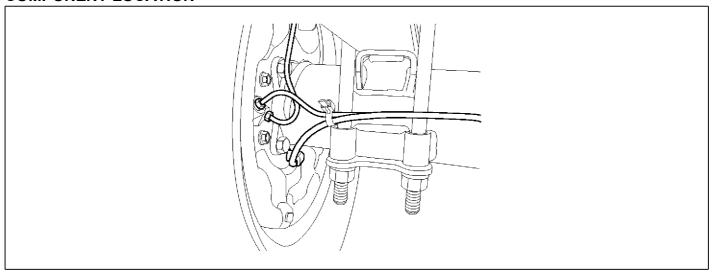
YES

▶ Go to the applicable DTC procedure.

NO

000F Input Valve Left Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the HECU detect	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

DUAL DISPLAY				
CUR	RRENT DATA			
× INPUT VALVE RH	IR OFF	A		
* OUTPUT VALVE R	RHR OFF			
* INPUT VALVE LH	ir off			
* OUTPUT VALVE L	LHR OFF	▼		
ACTU	JATION TEST	•		
INLET VALVE LEF	T-HAND REAR			
1 SECONDS SOUND CHECK				
KEY.ON / VEH.STOP ENG. STOP				
STRT FI	X LINE			

- 4. Check the left hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY				
		CURREN	IT DATA		
×	INPUT VALV	E RHR		OFF	A
×	OUTPUT VAL	VE RHR		OFF	
×	× INPUT VALVE LHR			ON	
×	OUTPUT VAL	VE LHR		OFF	▼
		ACTUAT I	ON TES	T	
	INLET VALVE	LEFT-H	IAND RE	AR	
	1 SECONDS		SOUND	СНЕСК	
	KEY.ON / UEH.STOP ENG. STOP				
	STRT	FIX	LINE		

SUDWAB9015L

- Fig1) Left hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

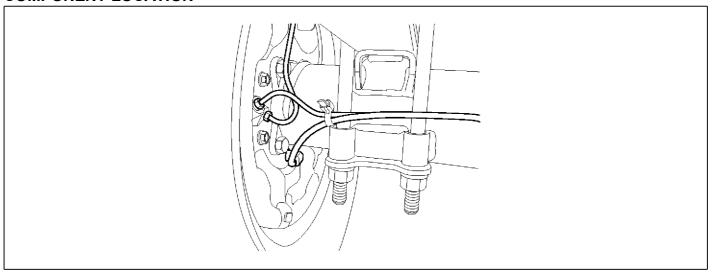
YES

▶ Go to the applicable DTC procedure.

NO

0010 Output Valve Left Hand Rear(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON	gnition ON			
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes]		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY					
		(CURRE	NT DATA	À	
×	I NPU	' VALVE	RHR		OFF	A
×	OUTPU	JT VALVI	E RHR		OFF	
×	I NPU?	" VALVE	LHR		OFF	
×	OUTPU	JT VALVI	E LHR		OFF	▼ ▼
		AC	CTUAT	ION TES	ST	
	OUTLET	C VALVE	LEFT	-HAND I	REAR	
	1 SI	ECONDS		SOUNI	CHECK	
	KEY.ON / VEH.STOP ENG. STOP					
	STRT		FIX	LINE		

- 4. Check the left hand rear outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY				
		CURREN	T DATA		
×	INPUT VALVI	ERHR		OFF	A
×	OUTPUT VAL	JE RHR		OFF	
×	INPUT VALVI	ELHR		OFF	
×	OUTPUT VAL	JE LHR		ON	▼
	f	ACTUAT I	ON TEST	1	
	OUTLET VALVI	E LEFT-	HAND RE	EAR	
	1 SECONDS SOUND CHECK				
	KEY.ON / VEH.STOP ENG. STOP				
	STRT	FIX	LINE		

SUDWAB9016L

Fig1) Left hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

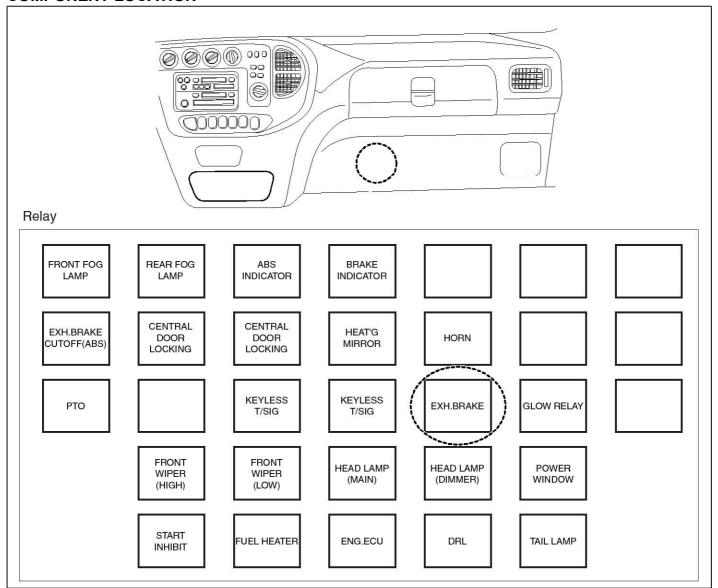
YES

▶ Go to the applicable DTC procedure.

NO

0011 Endurance Brake Relay(Short To Ubatt/Uvent)

COMPONENT LOCATION



SUDWAB9003L

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				Poor connection of
Enable Conditions	Ignition ON	Ignition ON				connector and wiri- ng damage
Threshold Value	When short to the co	When short to the control circuit of DBR relay is detected			7.	Short to power of
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				control circuit Defective DBR rel-
Fail Safe	Fuel Cut	No		The ABS function	ון	ay
	Fuel Limit	Yes		works normally.		
	MIL	Yes				

SPECIFICATION

ABS relay coil resistance	200 ∼ 450 Ω (At 20˚C)
---------------------------	-----------------------

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test" on the scan tool.

DUAL DISPLAY						
CURR	CURRENT DATA					
* ECU SUPPLY VOLT	AGE 22.7 V ▲					
× DBR RELAY	OFF					
* ABS WARNING LAM	P OFF					
* BRAKE WARNING L	AMP OFF ▼					
ACTUA	TION TEST					
DBR RELAY						
1 SECONDS	SOUND CHECK					
KEY.ON / VEH.STOP ENG. STOP						
STRT FIX	LINE					

- 4. Select the data "DBR relay" and perform actuation test
 - Specification: Normal if the activating sound is heard.

		DUAL I) I SPLAY			
		CURREN	IT DATA			
×	ECU SUPP	LY VOLTAG	SE .	22.7	V	A
×	DBR RELA	¥		0N		
×	ABS WARN	ING LAMP		OFF		
×	BRAKE WA	RNING LAN	1P	OFF		Ţ
-	DBR RELAY	ACTUAT I	ON TEST	ľ		
-	1 SECON	DS	SOUND	СНЕСК		
ŀ	⟨EY.ON ✓	VEH.STOP	ENG.	STOP		
=i	STRT	FIX	LINE			

SUDWAB9017L

5. Can you hear the activating sound from the DBR relay?

YES

▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

► Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the DBR relay connector (M15) and HECU connector (C60).
- 3. Measure the voltage between the terminal 3 of DBR relay (M15) and chassis ground.
 - Specification: Below 0~0.1 V
- 4. Is the voltage measured within specification?

YES

► Go to "Component Inspection" procedure.

NO

▶ Repair short to power between terminal of HECU and terminal of DBR relay control and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the DBR relay connector (M15).
- 3. Measure the resistance between terminals 3 and 5 of DBR relay component.
 - Specification: DBR relay coil resistance: 200 \sim 450 Ω (At 20 $^{\circ}$ C)
- 4. Measure the resistance between terminals 1 and 4 of DBR relay while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.
 - Specification

Continuity (When applying power)

Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.

▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

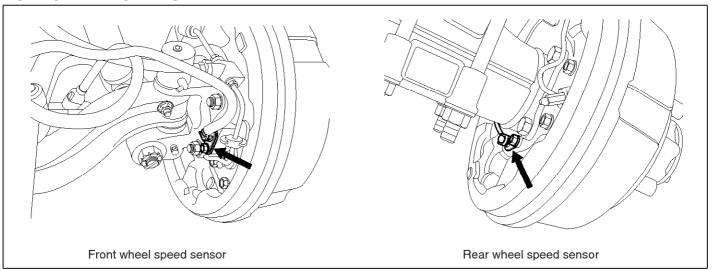
YES

► Go to the applicable DTC procedure.

NO

0017 Sensor Right Hand Front(Impedance)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the front right wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Defective sensor
Enable Conditions	Ignition ON	Ignition ON			wiring. Defective sensor.
Threshold Value	Sensor impedan	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω			Delective sensor.
Diagnosis Time	1,000 ms				
Fail Safe	Fuel Cut	No	ABS function d	isa-	
	Fuel Limit	No	bled for concern wheel.	ned	
	MIL	Yes	WIICEI.		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT DATA	08/22
×	SENSOR VOLTAGE RHF 4.2	v
×	SENSOR VOLTAGE LHR 0.6	V
×	SENSOR VOLTAGE LHF 0.6	v 📗
×	SENSOR VOLTAGE RHR 1.2	v
×	WHEEL SPEED RHF 10.6	Km∕h
×	WHEEL SPEED LHR 10.6	Km∕h
×	WHEEL SPEED LHF 10.8	Km∕h
×	WHEEL SPEED RHR 10.6	Km∕h
	FIX PART TOT HELP LINE	REC

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2.	CURRENT	DATA	08/2	22
					A
×	SENSOR VOLTAG	E RHF	0.8	V	
×	SENSOR VOLTAG	E LHR	4.7	v	
×	SENSOR VOLTAG	E LHF	0.0	v	
×	SENSOR VOLTAG	E RHR	0.7	v	_
×	WHEEL SPEED F	RHF	21.0	Km/h	
×	WHEEL SPEED L	HR	20.7	Km∕h	
×	WHEEL SPEED L	HF.	21.0	Km/h	
×	WHEEL SPEED F	HR	20.9	Km∕h	
					Ŧ
	FIX PART T	OT HELI	PLINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 25 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C30).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

Signal (-) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 30 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C30).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

► Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the right hand front when sensor connector.
- Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).
 - Specification: 830 \sim 2,100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

YES

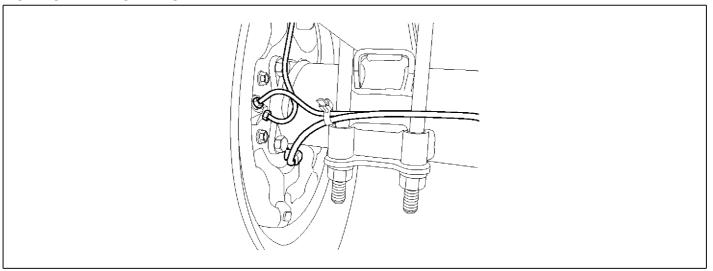
▶ Go to the applicable DTC procedure.

NO

System OK

0018 Sensor Left Hand Rear(Impedance)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the rear left wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				Defective sensor
Enable Conditions	Ignition ON				wiring Defective sensor	
Threshold Value	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω				Delective sensor	
Diagnosis Time	1,000 ms					
Fail Safe	Fuel Cut	No	•	ABS function disa-		
	Fuel Limit	No		bled for concerned wheel		
	MIL	Yes		- wneer		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	∪ _
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22	?
				L
×	SENSOR VOLTAGE RHF	0.8	U	
×	SENSOR VOLTAGE LHR	4.7	v	
×	SENSOR VOLTAGE LHF	0.0	v _	
×	SENSOR VOLTAGE RHR	0.7	v	
×	WHEEL SPEED RHF	21.0	Km∕h	
×	WHEEL SPEED LHR	20.7	Km∕h	
×	WHEEL SPEED LHF	21.0	Km∕h	
×	WHEEL SPEED RHR	20.9	Km∕h	
			T	,
	FIX PART TOT HEL	P LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 28 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C37).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

► Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Signal (-) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 23 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C37).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

► Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the left hand rear connector (C37).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).
 - Specification: 830 \sim 2100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

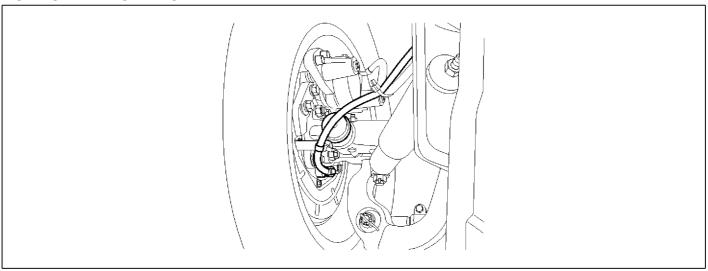
YES

▶ Go to the applicable DTC procedure.

NO

0019 Sensor Left Hand Front(Impedance)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the front left wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				Defective sensor
Enable Conditions	Ignition ON				wiring. Defective sensor.	
Threshold Value	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω				Delective sensor.	
Diagnosis Time	1,000 ms					
Fail Safe	Fuel Cut	No		ABS function disa-		
	Fuel Limit	No		bled for concerned wheel.		
	MIL	Yes		- wileel.		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	V
×	SENSOR VOLTAGE LHF	0.6	v 📕
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			v
	FIX PART TOT HEL	P LINE	REC

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1	2. (CURRENT	DATA	08/	22
							1
× SEI	ISOR	VOLT	AGE	RHF	0.8	Ų	
× SEI	ISOR	VOLT	AGE	LHR	4.7	v	
× SEI	ISOR	UOLT	AGE	LHF	0.0	v	
× SEI	ISOR	VOLT	AGE	RHR	0.7	V	
× WH	EEL	SPEED	RHI	F	21.0	Km∕h	
× WHJ	EL	SPEED	LHE	3	20.7	Km∕h	
× WH3	EL	SPEED	LHE	?	21.0	Km∕h	
× WH3	EL	SPEED	RHE	3	20.9	Km∕h	
							Ŧ
FI	7	PART	TOI	r HELI	P LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 24 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C31).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

► Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

Signal (-) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 29 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C31).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the left hand front connector (C31).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.
 - Specification: 830 \sim 2,100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

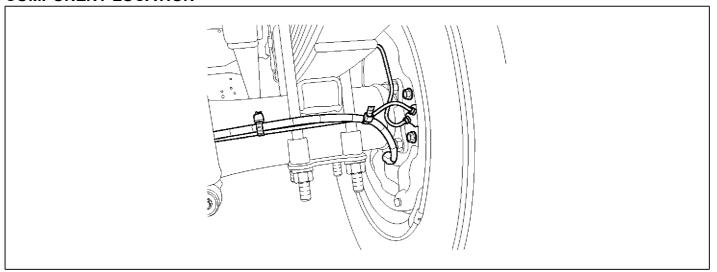
YES

▶ Go to the applicable DTC procedure.

NO

001A Sensor Right Hand Rear(Impedance)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the resistance value in the rear right wheel sensor signal line is abnormal, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Defective sensor
Enable Conditions	Ignition ON	Ignition ON			wiring. Defective sensor.
Threshold Value	Sensor impedan	Sensor impedance < 830 Ω, Sensor impedance>2,100 Ω			
Diagnosis Time	1,000 ms	1,000 ms			
Fail Safe	Fuel Cut	No	ABS function d	isa-	
	Fuel Limit	No	bled for concern wheel.	ned	
	MIL	Yes	WIICEI.		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT DA	TA	08/2	22
				•
×	SENSOR VOLTAGE RHF	4.Z	v	
×	SENSOR VOLTAGE LHR	0.6	v	
×	SENSOR VOLTAGE LHF	0.6	v	
×	SENSOR VOLTAGE RHR	1.2	v	
×	WHEEL SPEED RHF	10.6	Km/h	
×	WHEEL SPEED LHR	10.6	Km∕h	
×	WHEEL SPEED LHF	10.8	Km/h	
×	WHEEL SPEED RHR	10.6	Km∕h	
				7
	FIX PART TOT HELP	LINE	REC	

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22
			A
×	SENSOR VOLTAGE RHF	0.8	v
×	SENSOR VOLTAGE LHR	4.7	V
×	SENSOR VOLTAGE LHF	0.0	V 📕
×	SENSOR VOLTAGE RHR	0.7	v -
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km/h
×	WHEEL SPEED RHR	20.9	Km∕h
			₩
	FIX PART TOT HELP	LINE	REC

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

SIGNAL CIRCUIT INSPECTION

Signal (+) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 22 of HECU harness connector (C60) and the terminal 1 of wheel speed sensor harness connector (C36).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

► Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Signal (-) Open Inspection

- 1. Disconnect the HECU connector and the wheel speed sensor connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Measure the resistance between the terminal 27 of HECU harness connector (C60) and the terminal 2 of wheel speed sensor harness connector (C36).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to next procedure.

NO

▶ Repair open circuit and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the right hand rear connector (C36).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
 - Specification: 830 \sim 2100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

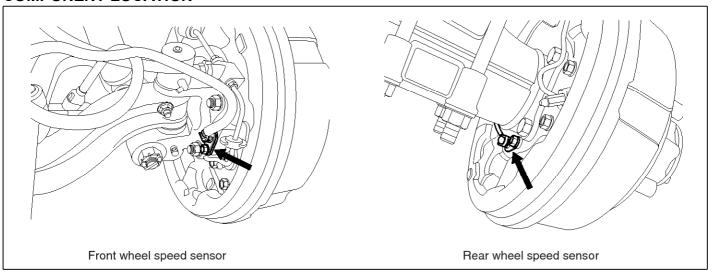
YES

▶ Go to the applicable DTC procedure.

NO

001B Input Valve Right Hand Front(Open Circuit)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring				Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit Yes orarily disabled for concerned wheel.				
	MIL	Yes	_ concerned wheel.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY						
CURRENT DATA						
× INPUT VALVE RHE	OFF 🛕					
* OUTPUT VALVE RH	F OFF					
× INPUT VALVE LHE	OFF -					
* OUTPUT VALVE LH	F OFF ▼					
ACTUA	TION TEST					
INLET VALVE RIGH	IT-HAND FRONT					
1 SECONDS	SOUND CHECK					
KEY.ON / VEH.STOP ENG. STOP						
STRT	LINE					

- 4. Check the right hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL 1	DISPLAY	
	CURREN	IT DATA	
× INPUT V	ALVE RHF	ON	A
× OUTPUT	VALUE RHF	OFF	
× INPUT V	ALVE LHF	OFF	- -
* OUTPUT	VALVE LHF	OFF	T.
	ACTUAT 1	ON TEST	
INLET VA	LVE RIGHT-	HAND FRONT	
1 SECO	NDS	SOUND CHECK	
KEY.ON /	VEH. STOP	ENG. STOP	
		Au	
STRT	FIX	LINE	

SUDWAB9018L

- Fig1) Right hand front inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

► Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

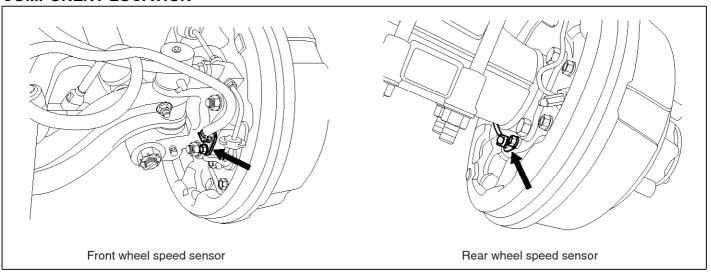
YES

► Go to the applicable DTC procedure.

NO

001C Output Valve Right Hand Front(Open Circuit)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detect				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit Yes orarily disabled for concerned wheel.				
	MIL	Yes	Concerned whice.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY						
		CURRE	NT DATA	À			
×	INPUT VA	ALVE RHF		OFF	A		
×	OUTPUT	JALVE RHF		OFF			
×	INPUT VA	ALVE LHF		OFF	-		
×	OUTPUT	JALVE LHF	ı	OFF	▼		
		ACTUAT	ION TES	ST			
	OUTLET VA	ALVE RIGH	T-HAND	FRONT			
	1 SECON	NDS	SOUNI	СНЕСК			
]	KEY.ON / VEH.STOP ENG. STOP						
	STRT	FIX	LINE				

- 4. Check the right hand front outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

DUAL DISPLAY							
		(URRE	NT DATA	À		
×	INPUT	VALVE	RHF		OFF		•
×	OUTPU	T VALVE	RHF		ON		
×	INPUT	VALVE	LHF		OFF		
×	OUTPU	IT VALVE	E LHF		OFF		₹
		AC	TUAT	ION TES	ST		
	OUTLET	VALVE	RI GH	r-Hand	FRONT		
	1 SECONDS SOUND CHECK						
	KEY.ON / VEH.STOP ENG. STOP						
	STRT		FIX	LINE			

SUDWAB9019L

- Fig1) Right hand front outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

► Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

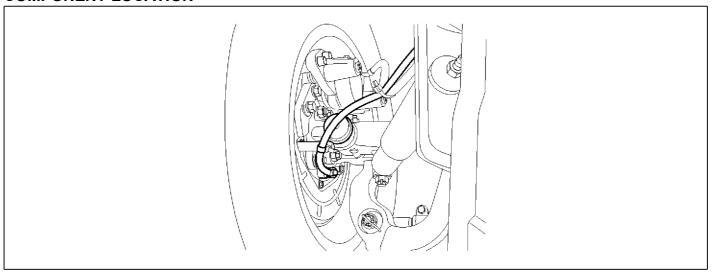
YES

► Go to the applicable DTC procedure.

NO

001D Input Valve Left Hand Front(Open Circuit)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function disa-		
	Fuel Limit Yes bled for concerned wheel				
	MIL	Yes	Willow		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY						
CURR	ENT DATA					
* INPUT VALVE RHF	0FF ▲					
× OUTPUT VALVE RHI	OFF					
* INPUT VALUE LHF	OFF					
× OUTPUT VALVE LH	F OFF ▼					
ACTUA:	TION TEST					
INLET VALVE LEFT	HAND FRONT					
1 SECONDS	SOUND CHECK					
KEY.ON / VEH.STOP ENG. STOP						
STRT FIX	LINE					

- 4. Check the left hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
	CL	IRREN	IT DATA			
×	INPUT VALVE F	HF	OFF	A		
×	OUTPUT VALVE	RHF	OFF			
×	* INPUT VALUE LHF ON					
×	OUTPUT VALVE	LHF	OFF	▼		
	ACT	UAT I	ON TEST	·		
	INLET VALVE LE	FT-F	AND FRONT			
Г	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	'ΙΧ	LINE			

SUDWAB9020L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

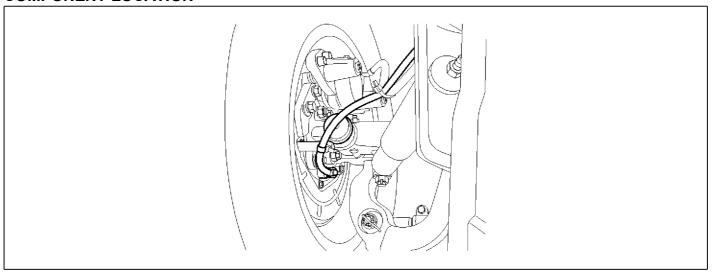
YES

▶ Go to the applicable DTC procedure.

NO

001E Output Valve Left Hand Front(Open Circuit)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detect				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit Yes orarily disabled for concerned wheel.		•		
	MIL	Yes	Concerned whice.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY							
CURRENT DATA							
×	× INPUT VALVE RHF OF				OFF		A
×	× OUTPUT VALVE RHF				OFF		
×	I NPU	VALVE I	LHF		OFF		
×	× OUTPUT VALVE LHF				OFF		▼
	ACTUATION TEST						
	OUTLET VALVE LEFT-HAND FRONT						
	1 SECONDS SOUND CHECK						
KEY.ON / VEH.STOP ENG. STOP							
	STRT	J	XIX	LINE			

- 4. Check the left hand front outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	CURREN	T DATA	
¥ INPUT VAI	VE RHF	OFF	A
¥ OUTPUT VA	LUE RHF	OFF	
¥ INPUT VAL	VE LHF	OFF	
< OUTPUT VA	LVE LHF	ON	T T
	ACTUAT I	ON TEST	
OUTLET VAL	VE LEFT-	HAND FRONT	
1 SECONE	S	SOUND CHECK	
KEY.ON / U	EH. STOP	ENG. STOP	
70 VO 70 10 4			
STRT	FIX	LINE	

SUDWAB9021L

- Fig1) Left hand front outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

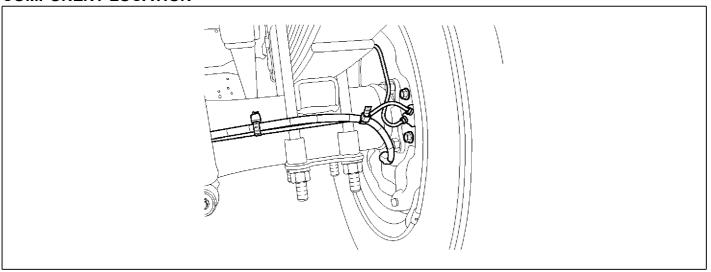
YES

▶ Go to the applicable DTC procedure.

NO

001F Input Valve Right Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause			
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU de	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp			
	Fuel Limit	Yes	orarily disabled fo concerned wheel.	r		
	MIL	Yes	Concerned wheel.			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY							
CURRENT DATA							
×II	NPUT VALVE	RHR		OFF	A		
× 01	UTPUT VALV	E RHR		OFF			
* []	NPUT VALVE	LHR		OFF			
× oı	* OUTPUT VALUE LHR OFF				v		
	A	CTUAT I	ON TEST	ľ			
INLET VALVE RIGHT-HAND REAR							
1 SECONDS SOUN				СНЕСК			
KEY.ON / VEH.STOP ENG. STOP							
S'	r r t	FIX	LINE				

- 4. Check the right hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

DUAL DISPLAY								
	CURRENT DATA							
×	INPUT VALVE	UT VALVE RHR ON			\blacksquare			
×	OUTPUT VALVE		OFF					
×	* INPUT VALVE LHR			OFF				
×	* OUTPUT VALVE LHR			OFF		▼		
	ACTUATION TEST							
]	INLET VALVE F	RI GHT-	-HAND I	REAR				
	1 SECONDS		SOUNI	СНЕСК				
KEY.ON / VEH.STOP ENG. STOP								
	STRT	FIX	LINE					

SUDWAB9022L

- Fig1) Right hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

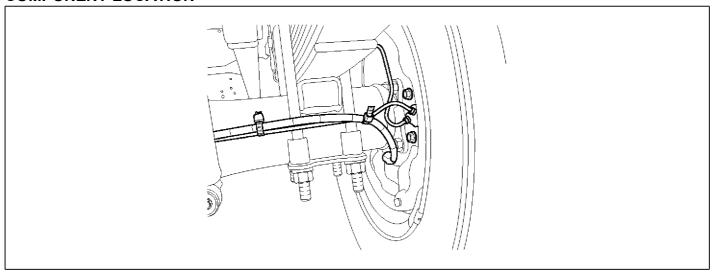
YES

► Go to the applicable DTC procedure.

NO

0020 Output Valve Right Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit	Yes	orarily disabled for concerned wheel.		
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY					
		(URRE	NT DATA	À	
×	INPUT	VALVE	RHR		OFF	A
×	OUTPU	T VALVI	RHR		OFF	
×	× INPUT VALVE LHR OFF ■					
×	OUTPU	T VALVE	E LHR		OFF	▼
	•	AC	TUAT	ION TES	ST	
	OUTLET	VALVE	RI GH	T-HAND	REAR	
	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT		FIX	LINE		

- 4. Check the right hand rear outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
		CURREN	IT DATA			
×	INPUT VAI	VE RHR	OFF	A		
×	OUTPUT VA	ALVE RHR	ON			
×	INPUT VALVE LHR OFF					
×	OUTPUT VA	ALVE LHR	OFF	▼		
		ACTUAT I	ON TEST	•		
	OUTLET VAI	VE RIGHT	-HAND REAR			
	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

SUDWAB9023L

- Fig1) Right hand rear outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

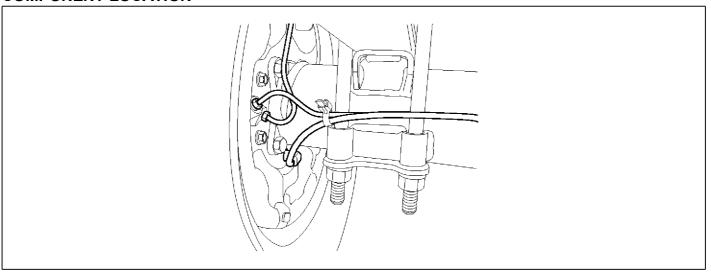
YES

▶ Go to the applicable DTC procedure.

NO

0021 Input Valve Left Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

ltem		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS function temp		
	Fuel Limit	Yes	orarily disabled fo concerned wheel.	^	
	MIL	Yes	Confectined wheel.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".
 - DUAL DISPLAY **CURRENT DATA** * INPUT VALVE RHR OFF OUTPUT VALVE RHR OFF × INPUT VALUE LHR OFF * OUTPUT VALVE LHR OFF Ŧ ACTUATION TEST INLET VALUE LEFT-HAND REAR SECONDS SOUND CHECK KEY.ON / VEH.STOP ENG. STOP FIX LINE STRT
- 4. Check the left hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
		CURREN	T DATA	1		
×	INPUT VALVE	RHR		OFF		.
×	OUTPUT VALV	E RHR		OFF		
×	* INPUT VALVE LHR ON					ı
×	* OUTPUT VALVE LHR			OFF	▼	٠
	A	CTUAT I	ON TES	T	•	
	INLET VALVE	LEFT-H	IAND RE	AR		\Box
	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

SUDWAB9024L

- Fig1) Left hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

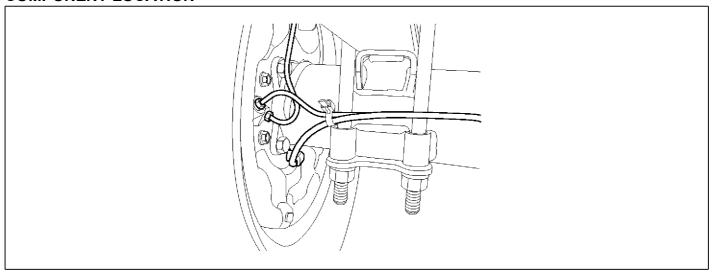
YES

► Go to the applicable DTC procedure.

NO

0022 Output Valve Left Hand Rear(Open Circuit)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit	Yes	orarily disabled for concerned wheel.		
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY							
CURRE	CURRENT DATA						
* INPUT VALVE RHR	OFF ▲						
× OUTPUT VALVE RHE	OFF						
* INPUT VALVE LHR	OFF						
× OUTPUT VALVE LHE	OFF ▼						
ACTUAT	ION TEST						
OUTLET VALVE LEFT	-HAND REAR						
1 SECONDS	SOUND CHECK						
KEY.ON / VEH.STOP ENG. STOP							
STRT FIX	LINE						

- 4. Check the left hand rear outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
	(URREI	NT DATA	1		
×	INPUT VALVE	RHR		OFF		•
×	OUTPUT VALVE	RHR		OFF		
×	INPUT VALVE	LHR		OFF		
×	OUTPUT VALVE	ELHR		ON		₹
	AC	CTUAT	ION TES	ST T		
	OUTLET VALVE	LEFT-	-HAND I	REAR		
	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

SUDWAB9025L

- Fig1) Left hand rear outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

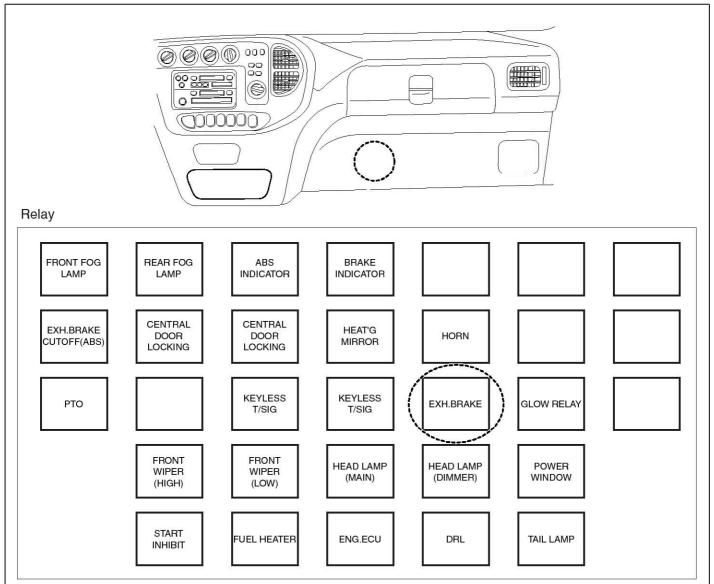
YES

▶ Go to the applicable DTC procedure.

NO

0023 Endurance Brake Relay(Open Circuit)

COMPONENT LOCATION



SUDWAB9003I

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				•	Poor contact of co-
Enable Conditions	Ignition ON	Ignition ON					nnector and wiring damage. Open of power of control circuit.
Threshold Value	When the ABS relay	When the ABS relay control circuit is open				•	
Diagnosis Time	Below 1,000 ms	Below 1,000 ms					
Fail Safe	Fuel Cut	No			he ABS function]	Defective DBR relay.
	Fuel Limit	Yes		works normally.			
	MIL	Yes					

SPECIFICATION

ABS relay coil resistance	200 ∼ 450Ω (At 20℃)
---------------------------	---------------------

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test" on the scan tool.
- 4. Select the data "DBR relay" and perform actuation test.
 - Specification: Normal if the activating sound is heard.
- 5. Can you hear the activating sound from the DBR relay?

YES

- ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Short to Control Power Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the DBR relay (M15) and HECU connector (C60).
- 3. Measure the resistance between the terminal 3 of DBR relay harness connector (M15) and terminal 2 of HECU harness connector (C60).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to control power between terminal of HECU harness connector and terminal of DBR relay harness connector and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the DBR relay connector (M15).
- 3. Measure the resistance between terminals 3 and 5 of DBR relay component.
 - Specification: DBR relay coil resistance: 200 \sim 450 Ω (At 20 $^{\circ}$ C)
- 4. Measure the resistance between terminals 1 and 4 while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.
 - Specification

Continuity (When applying power) Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.
- ▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

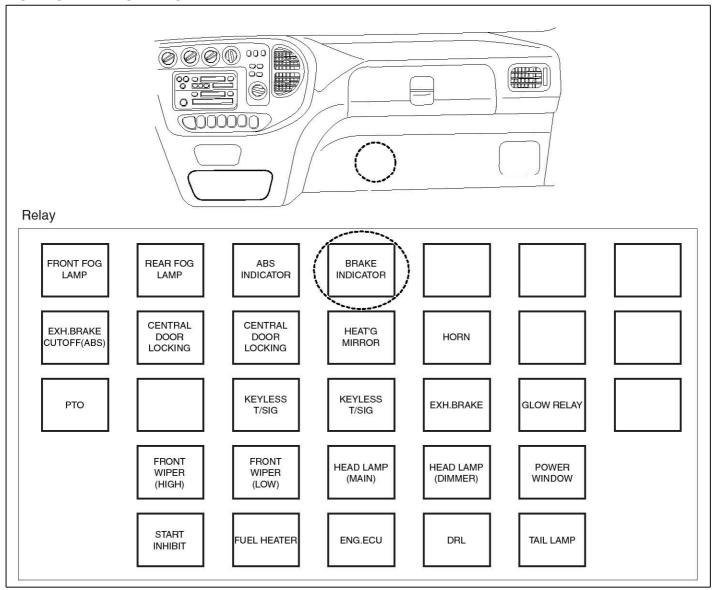
YES

▶ Go to the applicable DTC procedure.

NO

0024 Brake Light Relay(Open Circuit)

COMPONENT LOCATION



SUDWAB9004L

GENERAL DESCRIPTION

Stop lamp relay is a relay that controls brakes, etc.

DTC DESCRIPTION

HECU continues to monitor the relay control signals, such as brakes. In case of a short-circuit being detected in relay control lines such as brakes, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring		•	Poor contact of co-	
Enable Conditions	Ignition ON	Ignition ON				nnector and wiring damage.
Threshold Value	When the brake I	When the brake light relay control circuit is open			•	Open of power of
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			control circuit.	
Fail Safe	Fuel Cut	No			•	Defective brake lig- ht control relay.
	Fuel Limit	Yes				
	MIL	Yes				

SPECIFICATION

Brake light relay coil resistance	200 ∼ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test" on the scan tool.
- 4. Select the data "Brake light relay" and perform actuation test.
 - Specification: Normal if the activating sound is heard.

1.	5. ACTUATION TEST 10/	13
BRAKE LIGHT	r relay	
DURATION	1 SECONDS	
METHOD	ACTIVATION	
CONDITION	KEY.ON / VEH.STOP ENG. STOP	
PRESS [ST	TRT1, IF YOU ARE READY !	
STRT		

SUDWAB9027L

5. Can you hear the activating sound from the brake light relay?

YES

- ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

► Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Short to Control Power Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the brake light relay (M102) and HECU connector (C60).
- 3. Measure the resistance between the terminal 3 of brake light relay harness connector (M102) and terminal 20 of HECU harness connector (C60).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair short to control power between terminal of HECU harness connector and terminal of brake light relay control harness connector and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the brake light relay connector (M102).
- 3. Measure the resistance between terminals 3 and 5 of ABS relay component.
 - Specification: Brake light relay coil resistance: 200 \sim 450 Ω (At 20 $^{\circ}$ C)
- 4. Measure the resistance between terminals 1 and 4 of brake light relay while applying and cutting off B+ power to terminals 3 and 5 of ABS light relay.
 - Specification:

Continuity (When applying power)

Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.
- ▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

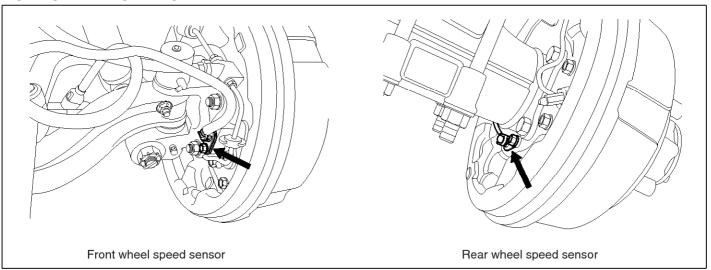
YES

► Go to the applicable DTC procedure.

NO

0029 Input Valve Right Hand Front(Short To Ground)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring				Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit	Yes	orarily disabled for concerned wheel.		
	MIL	Yes	Contochiled Wileel.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

DUAL DISPLAY						
CURRENT DATA						
× INPUT VALU	JE RHF	OFF	A			
× OUTPUT VAI	VE RHF	OFF				
× INPUT VALU	E LHF	OFF	-			
× OUTPUT VAI	VE LHF	OFF	▼			
	ACTUAT I	ON TEST	·			
INLET VALVE	E RIGHT-	HAND FRONT				
1 SECONDS	3	SOUND CHECK				
KEY.ON / VE	EH. STOP	ENG. STOP				
STRT	FIX	LINE				

- 4. Check the right hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

* INPUT VALVE RHF ON OUTPUT VALVE RHF OFF INPUT VALVE LHF OFF OUTPUT VALVE LHF OFF	
Sec. 10 million and an analysis of the second of the second of the second	
¥ OUTDUT HATHE THE OFF	
~ OUTOI VHLVE LIIF	V
ACTUATION TEST	
INLET VALUE RIGHT-HAND FRONT	
1 SECONDS SOUND CHECK	
KEY.ON / VEH.STOP ENG. STOP	

SUDWAB9028L

- Fig1) Right hand front inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

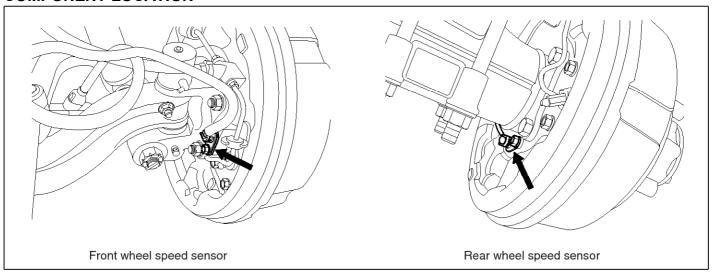
YES

▶ Go to the applicable DTC procedure.

NO

002A Output Valve Right Hand Front(Short To Ground)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring			•	Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit	Yes	orarily disabled for concerned wheel.		
	MIL	Yes	concerned wheel.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY							
	CURRENT DATA							
×	INPUT	VALVE RHF		OFF	A			
×	OUTPUT	VALVE RH	F	OFF				
×	INPUT	VALVE LHF		OFF	-			
×	OUTPUT	VALUE LH	F	OFF	▼			
		ACTUA	TION TE	ST	•			
	DUTLET	VALVE RIG	HT-HAND	FRONT				
	1 SEC	ONDS	SOUN	D CHECK				
	KEY.ON	✓ VEH.STO	P ENG.	STOP				
	STRT	FIX	LINE					

- 4. Check the right hand front outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY						
	CURRENT DATA						
×	INPUT	VALVE	RHF		OFF		•
×	OUTPU	T VALVE	RHF		ON		
×	INPUT	VALVE	LHF		OFF		
×	OUTPU	IT VALVE	E LHF		OFF		₹
		AC	TUAT	ION TES	ST		
	OUTLET	VALVE	RI GH	r-Hand	FRONT		
	1 SE	CONDS		SOUNI	СНЕСК		
	KEY . ON	I ∕ VEH.	STOP	ENG.	STOP		
	STRT		FIX	LINE			

SUDWAB9029L

- Fig1) Right hand front outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

► Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

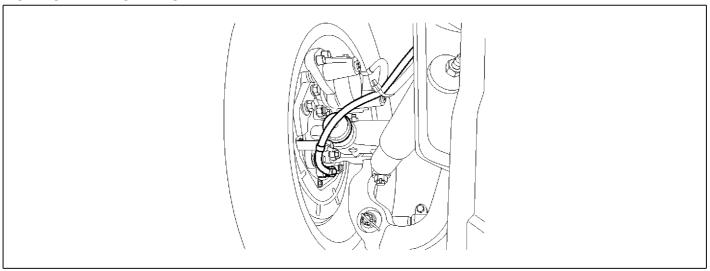
YES

▶ Go to the applicable DTC procedure.

NO

002B Input Valve Left Hand Front(Short To Ground)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition			
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	low 1,000 ms			
Fail Safe	Fuel Cut	No	ABS function temp		
	Fuel Limit Yes orarily disabled for concerned wheel.		•		
	MIL	Yes	Concented wheel.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".
 - DUAL DISPLAY **CURRENT DATA × INPUT VALVE RHF** OFF OUTPUT VALVE RHF OFF * INPUT VALUE LHF OFF * OUTPUT VALVE LHF OFF ¥ ACTUATION TEST INLET VALUE LEFT-HAND FRONT SECONDS SOUND CHECK KEY.ON / VEH.STOP ENG. STOP FIX LINE STRT
- 4. Check the left hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY							
		CU:	RREN	T DATA				
×	INPUT	VALVE R	HF		OFF		П	
×	OUTPUT	VALVE 1	RHF		OFF			
×	INPUT	VALVE L	HF		ON			
×	* OUTPUT VALVE LHF OFF						J	
	•	ACT	UAT I	ON TES	T	•		
	INLET	JALVE LE	FT-H	AND FR	ONT			
	1 SEC	CONDS		SOUND	CHECK			
	KEY.ON	✓ VEH.S'	тор	ENG.	STOP			
	STRT	F	ΙX	LINE				

SUDWAB9030L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

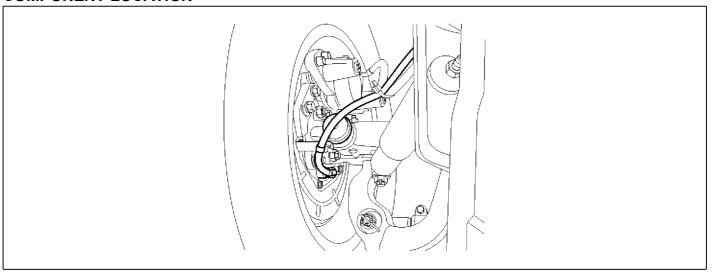
YES

▶ Go to the applicable DTC procedure.

NO

002C Output Valve Left Hand Front(Short To Ground)

COMPONENT LOCATION



SUDWAB9049I

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring					Replace ECU.
Enable Conditions	Conditions Ignition ON					
Threshold Value	When the HECU detects malfunction in the control system					
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No		ABS function temp-		
	Fuel Limit	Yes		orarily disabled for concerned wheel.		
	MIL	Yes		- concerned wheel.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY						
CURRENT DATA						
× INPUT VALVE RHF OFF						
× OUTPUT VALVE RHI	F OFF					
× INPUT VALVE LHF	OFF ■					
* OUTPUT VALVE LH	F OFF \blacktriangledown					
ACTUA:	TION TEST					
OUTLET VALVE LEFT	T-HAND FRONT					
1 SECONDS	SOUND CHECK					
KEY.ON / VEH.STO	P ENG. STOP					
STRT FIX	LINE					

- 4. Check the left hand front outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

		DUAL I	ISPLAY	
		CURREN	IT DATA	
×	INPUT VAI	VE RHF	OFF	A
×	OUTPUT VA	LUE RHF	OFF	
×	INPUT VAI	VE LHF	OFF	
×	OUTPUT VA	ALVE LHF	ON	T T
		ACTUAT I	ON TEST	
Ç	OUTLET VAI	VE LEFT-	HAND FRONT	
	1 SECONI	os e	SOUND CHECK	
)	ŒY.ON ∠ U	EH. STOP	ENG. STOP	
	317		NY 2 549	
	STRT	FIX	LINE	

SUDWAB9031L

Fig1) Left hand front outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

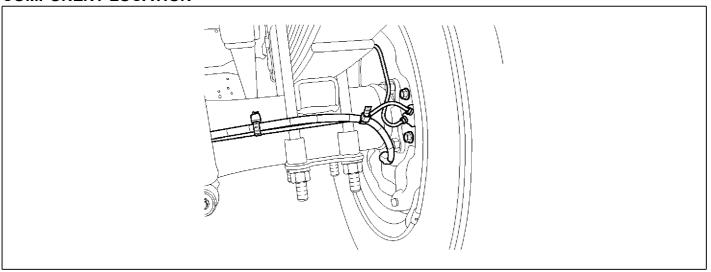
YES

▶ Go to the applicable DTC procedure.

NO

002D Input Valve Right Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition				
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU de	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp			
	Fuel Limit	Yes	orarily disabled fo concerned wheel.	r		
	MIL Yes					

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY								
	CURRENT DATA								
×	× INPUT VALVE RHR OFF								
×	× OUTPUT VALVE RHR OFF								
×	* INPUT VALUE LHR				OFF				
×	* OUTPUT VALVE LHR OFF						▼		
		AC	CTUAT	ON TES	ST				
- :	INLET	VALVE I	RI GHT-	-HAND I	REAR				
	1 SI	ECONDS		SOUNI	CHECK				
]	KEY.ON / VEH.STOP ENG. STOP								
	STRT		FIX	LINE					

- 4. Check the right hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY							
	CURRENT DATA							
×	× INPUT VALVE RHR ON							
×	OUTPUT VALVE RH	R OFF						
×	INPUT VALVE LHR	OFF						
×	* OUTPUT VALVE LHR OFF							
	ACTUA	TION TEST						
	INLET VALVE RIGH	T-HAND REAR						
Г	1 SECONDS	SOUND CHECK						
	KEY.ON / VEH.STOP ENG. STOP							
	STRT FIX	LINE						

SUDWAB9032L

- Fig1) Right hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

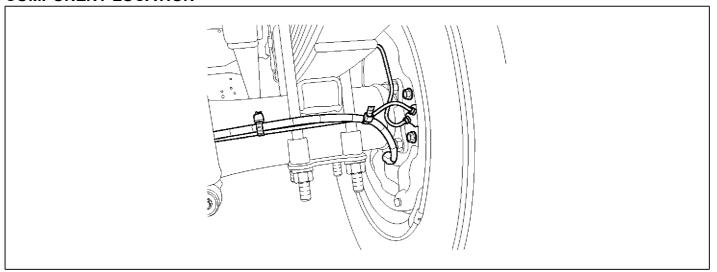
YES

▶ Go to the applicable DTC procedure.

NO

002E Output Valve Right Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition					
DTC Strategy	Signal monitoring	Signal monitoring					
Enable Conditions	Ignition ON	Ignition ON					
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system					
Diagnosis Time	Below 1,000 ms	Below 1,000 ms					
Fail Safe	Fuel Cut	No	ABS function temp-				
	Fuel Limit	Yes	orarily disabled for concerned wheel.				
	MIL	Yes	Concerned wheels				

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY							
	CURRENT DATA							
×	* INPUT VALUE RHR OFF							
×	OUTPU	JT VALVI	E RHR		OFF			
×	× INPUT VALVE LHR				OFF	-		
×	* OUTPUT VALVE LHR OFF				₩			
		AC	CTUAT	ION TES	ST .			
	DUTLET	VALVE	RI GH	I-HAND	REAR			
	1 SE	CONDS		SOUNI	СНЕСК			
	KEY.ON / VEH.STOP ENG. STOP							
	STRT		FIX	LINE				

- 4. Check the right hand rear outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY							
	CURRENT DATA							
×	INPUT VALVI	OFF		A				
×	OUTPUT VAL	JE RHR		ON				
×	INPUT VALVI	E LHR		OFF				
×	OUTPUT VALVE LHR OFF					Ŧ		
	ſ	ACTUAT I	ION TES	ST .	·			
	OUTLET VALVI	E RIGHT	r-Hand	REAR				
	1 SECONDS		SOUNI	СНЕСК				
	KEY.ON / VEH.STOP ENG. STOP							
	STRT	FIX	LINE					

SUDWAB9033L

- Fig1) Right hand rear outlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

► Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

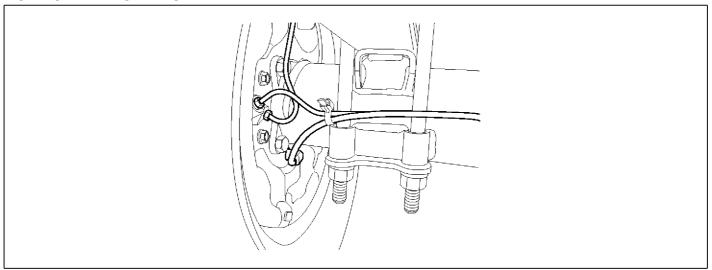
YES

▶ Go to the applicable DTC procedure.

NO

002F Input Valve Left Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

DTC DETECTING CONDITION

Item		Detecting Condition				
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU de	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp			
	Fuel Limit	Yes	orarily disabled fo concerned wheel.	r		
	MIL Yes					

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

DUAL DISPLAY							
CURRENT DATA							
× INPUT VALVE RH	A						
* OUTPUT VALVE R	RHR OFF						
* INPUT VALVE LH	ir off						
* OUTPUT VALVE LHR OFF							
ACTU	JATION TEST	•					
INLET VALVE LEF	T-HAND REAR						
1 SECONDS	SOUND CHECK						
KEY.ON / VEH.ST	KEY.ON / VEH.STOP ENG. STOP						
STRT FI	X LINE						

- 4. Check the left hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY								
	CURRENT DATA								
×	× INPUT VALVE RHR OFF						\blacksquare		
×	× OUTPUT VALVE RHR OFF								
×	* INPUT VALUE LHR ON								
×	* OUTPUT VALVE LHR OFF						▼		
	•	AC	TUAT:	ION TES	ST				
	INLET	VALVE I	EFT-I	HAND RI	EAR				
	1 S	ECONDS		SOUNI	СНЕСК				
	KEY.ON / VEH.STOP ENG. STOP								
	STRT		FIX	LINE					

SUDWAB9034L

- Fig1) Left hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

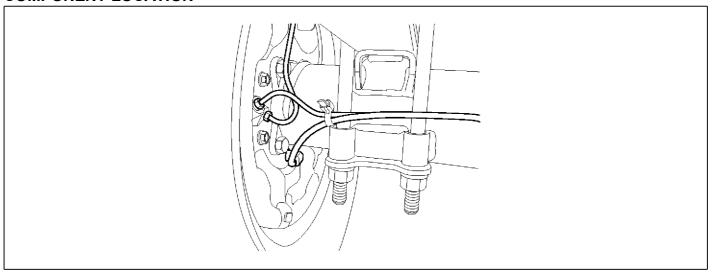
YES

▶ Go to the applicable DTC procedure.

NO

0030 Output Valve Left Hand Rear(Short To Ground)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring				Replace ECU.
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS function temp-		
	Fuel Limit	Yes	orarily disabled for concerned wheel.		
	MIL	Yes	Concerned whice.		

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"
 - DUAL DISPLAY **CURRENT DATA** * INPUT VALVE RHR OFF **OUTPUT VALVE RHR** OFF * INPUT VALVE LHR OFF OUTPUT VALVE LHR OFF ACTUATION TEST **OUTLET VALUE LEFT-HAND REAR** SECONDS SOUND CHECK KEY.ON / VEH.STOP ENG. STOP FIX LINE STRT
- 4. Check the left hand rear outlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY						
		CURREN	T DATA				
×	INPUT VALVI	ERHR		OFF	A		
×	OUTPUT VAL	JE RHR		OFF			
×	INPUT VALVI	ELHR		OFF			
×	OUTPUT VAL	JE LHR		ON	▼		
	f	ACTUAT I	ON TEST	1			
	OUTLET VALVI	E LEFT-	HAND RE	EAR			
	1 SECONDS		SOUND	СНЕСК			
	KEY.ON / VEH.STOP ENG. STOP						
	STRT	FIX	LINE				

SUDWAB9035L

Fig1) Left hand rear outlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ▶ And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

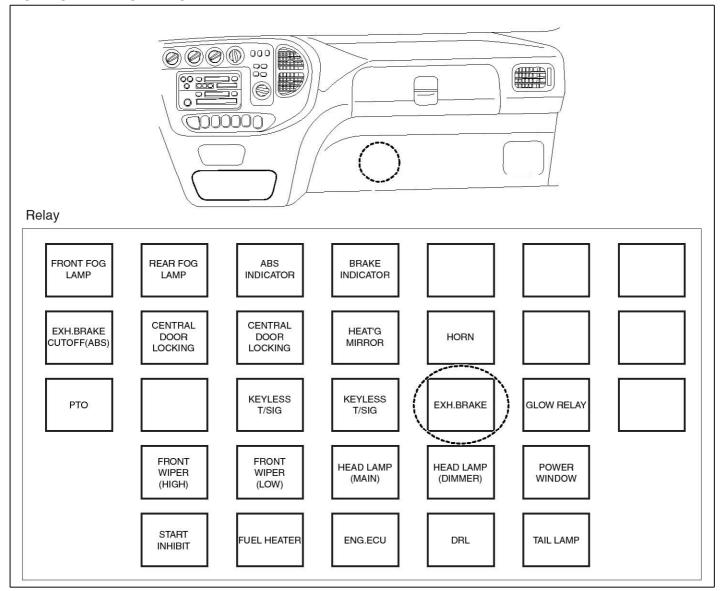
YES

▶ Go to the applicable DTC procedure.

NO

0032 Endurance Brake Relay(Short To Ground)

COMPONENT LOCATION



SUDWAB9003L

GENERAL DESCRIPTION

The Endurance Brake Relay (DBR) is a device with which ABS ECU forcefully disengages any third brake applied by the driver, such as a supplementary brake like endurance brake, during the operation of ABS, and is installed in vehicles of 2.5t or larger where both the endurance brake and ABS are applied. In case when ABS is operational on a very slippery road and when a skid occurs on the rear wheels not by the main brake but by endurance brake, ABS ECU cannot control the rear wheel. Therefore, this function is applied for smooth ABS control.

DTC DESCRIPTION

HECU continues to monitor the DBR control signal. If a short-circuit in the power source is detected in the DBR control line, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	Signal monitoring			
Enable Conditions	Ignition ON				connector and wiri- ng damage.
Threshold Value	When short to the cor	When short to the control circuit of ABS relay is detected			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			control circuit.
Fail Safe	Fuel Cut	No	The ABS function	ו	Defective ABS control relay.
	Fuel Limit	Yes	works normally.		
	MIL	Yes]		

SPECIFICATION

DBR relay coil resistance	200 \sim 450 Ω (At 20 $^{\circ}$ C)
---------------------------	--

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test" on the scan tool.
 - DUAL DISPLAY CURRENT DATA ECU SUPPLY VOLTAGE 22.7 V A DBR RELAY OFF ABS WARNING LAMP OFF BRAKE WARNING LAMP OFF ACTUATION TEST DBR RELAY SECONDS SOUND CHECK KEY.ON / VEH.STOP ENG. STOP STRT FIX LINE
- 4. Select the data "DBR relay" and perform actuation test
 - Specification: Normal if the activating sound is heard.

		DUAL D	I SPLAY			
		CURREN	C DATA			
× ECU ∶	SUPPLY	VOLTAG	E	22.7	V	Α
× DBR	RELAY			ON		
* ABS	WARNI N	G LAMP		OFF		
* BRAK	E WARN	ING LAM	P	OFF		v
DRR R	ELAY	ACTUATI	ON TES	T		
77.7	ECONDS	1/3	SOUND	СНЕСК		
	N / VE	H.STOP	ENG.			
STRT		FIX	LINE			

SUDWAB9036L

5. Can you hear the activating sound from the DBR relay?

YES

- ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Control Short to Ground Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the DBR relay connector (M15) and HECU connector (C60).
- 3. Measure the resistance between the terminal 3 of DBR relay harness connector (M15) and chassis ground.
 - Specification: Infinite
- 4. Is the resistance measured within specification?

YES

► Go to "Component Inspection" procedure.

NO

▶ Repair short to ground between terminal of HECU harness connector and terminal of DBR relay control and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the DBR relay connector (M15).
- 3. Measure the resistance between terminals 3 and 5 of DBR relay component.
 - Specification: DBR relay coil resistance: 200 \sim 450 Ω (At 20 $^{\circ}$ C)
- 4. Measure the resistance between terminals 1 and 4 of DBR relay while applying and cutting off B+ power to terminals 3 and 5 of DBR relay.
 - Specification:

Continuity (When applying power) Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.
- ▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

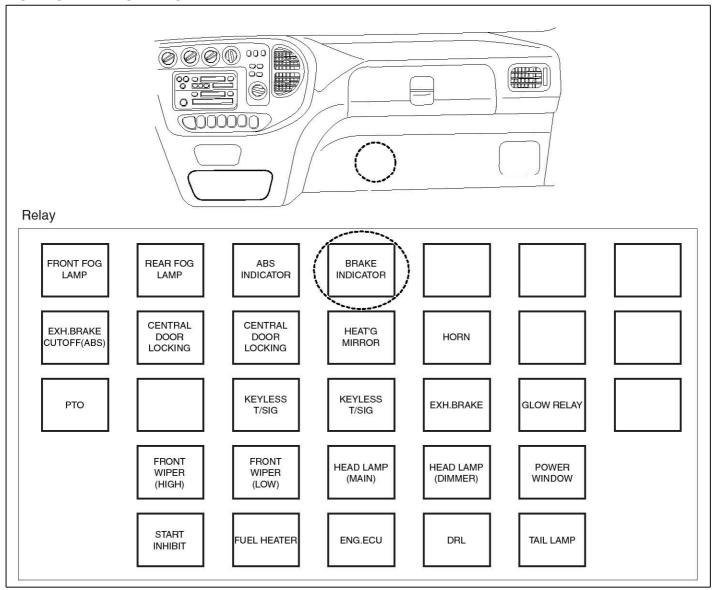
YES

▶ Go to the applicable DTC procedure.

NO

0033 Brake Light Relay(Short To Ground)

COMPONENT LOCATION



SUDWAB9004L

GENERAL DESCRIPTION

Stop lamp relay is a relay that controls brakes, etc.

DTC DESCRIPTION

HECU continues to monitor the relay control signals, such as brakes. In case of a short-circuit being detected in relay control lines such as brakes, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the brake light relay control circuit is short					damage. Short to ground of
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				control circuit. Defective brake lig-
Fail Safe	Fuel Cut	No	·	The ABS function		ht relay.
	Fuel Limit	Yes		works normally.		
	MIL	Yes				

SPECIFICATION

Brake light relay coil resistance	200 ∼ 450 Ω (At 20℃)

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test" on the scan tool.
- 4. Select the data "Brake light relay" and perform actuation test.
 - Specification: Normal if the activating sound is heard.

1.	5. ACTUATION TEST 1	.0/13			
BRAKE LIGHT	RELAY				
DURATION	1 SECONDS				
METHOD	ACTIVATION				
CONDITION	KEY.ON / VEH.STOP				
	ENG. STOP				
PRESS [STRT], IF YOU ARE READY !					
STRT					

SUDWAB9037L

5. Can you hear the activating sound from the brake light relay?

YES

- ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination,

deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Short to Control Power Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the brake light relay (M102) and HECU connector (C60).
- 3. Measure the resistance between the terminal 3 of brake light relay harness connector (M102) and chassis ground.
 - Specification: Infinite
- 4. Is the resistance measured within specification?

YES

► Go to "Component Inspection" procedure.

NO

▶ Repair short to control circuit between terminal of HECU harness connector and terminal of brake light relay control harness and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the brake light relay connector (M102).
- 3. Measure the resistance between terminals 3 and 5 of ABS light relay component.
 - Specification: Brake light relay coil resistance: 200 \sim 450 Ω (At 20 $^{\circ}$ C)
- 4. Measure the resistance between terminals 1 and 4 of brake light relay while applying and cutting off B+ power to terminals 3 and 5 of ABS light relay.
 - Specification:

Continuity (When applying power)

Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.
- ▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

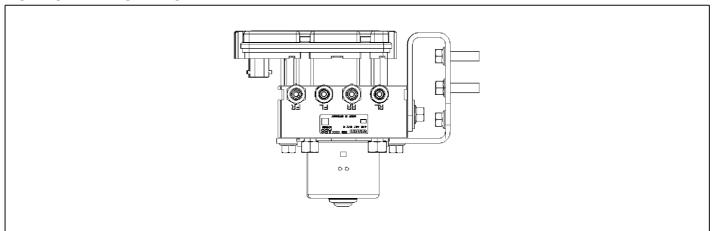
YES

► Go to the applicable DTC procedure.

NO

0037 Valve Relay(Can't Switch Off)

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU determines whether the switch that operates the valve relay is turned on/off while the power to the system is on. If the switch OFF does not work, a fail code is output.

DTC DETECTING CONDITION

Item		Detecting Condition			
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	Valve relay switch	Valve relay switch is not turned OFF.			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of

Vehicle Repair" procedure.



► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Control Power Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Measure the voltage between the terminal 17 of HECU harness connector (C60) and chassis ground.
 - Specification: Battery voltage

YES

► Go to "Ground Circuit Inspection" procedure.

NO

▶ Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open of terminal 17 of ABS control module harness connector and short to ground. Repair it if there is any problem and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

► Go to "Component Inspection" procedure.

NO

▶ Check open or poor contact between the solenoid valve ground of ABS control module harness connector and chassis ground. And go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

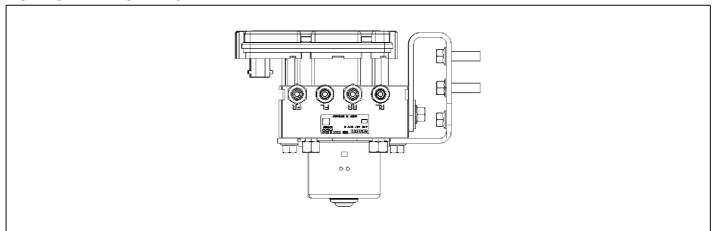
YES

▶ Go to the applicable DTC procedure.

NO

0038 Valve Relay(Can't Switch On)

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU determines whether the switch that operates the valve relay is turned on/off while the power to the system is on. If the switch ON does not work, a fail code is output.

DTC DETECTING CONDITION

Item		Detecting Condition			
DTC Strategy	Signal monitoring	Signal monitoring			Replace ECU.
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	Valve relay switch	Valve relay switch is not turned ON.			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of

Vehicle Repair" procedure.



► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Control Power Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Measure the voltage between the terminal 17 of HECU harness connector (C60) and chassis ground.
 - Specification: Battery voltage

YES

► Go to "Ground Circuit Inspection" procedure.

NO

▶ Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open of terminal 17 of ABS control module harness connector and short to ground. Repair it if there is any problem and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

► Go to "Component Inspection" procedure.

NO

▶ Check open or poor contact between the solenoid valve ground of ABS control module harness connector and chassis ground. And go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

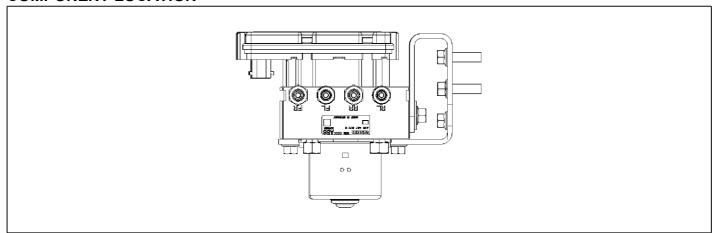
YES

▶ Go to the applicable DTC procedure.

NO

0039 Reference Ground Connection

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

It is used as a ground connection to find out the basic value of the ground connection of HECU.

DTC DESCRIPTION

If the difference between the ground connection of HECU and that of the reference is more than -1.6 V and smaller than 1.0 V, a fail code is output.

DTC DETECTING CONDITION

Item		Detecting Condition			
DTC Strategy	Signal monitoring	Signal monitoring			
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value		Difference between ECU ground and reference should be higher than - 1.6 V and lower than 1.0 V			
Diagnosis Time	Below 500 ms	Below 500 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of

Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

GROUND CIRCUIT INSPECTION

- 1. Turn the ignition OFF.
- 2. Measure the resistance between the terminals 6 of HECU harness connector (C60) and chassis ground.
 - Specification: Continuity
- 3. Is the resistance measured within specification?

YES

▶ Replace with a known-good HECU. If there is no

problem, replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair open between the reference ground of ABS control module harness connector and chassis ground and check poor contact. If there is any problem repair poor contact. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

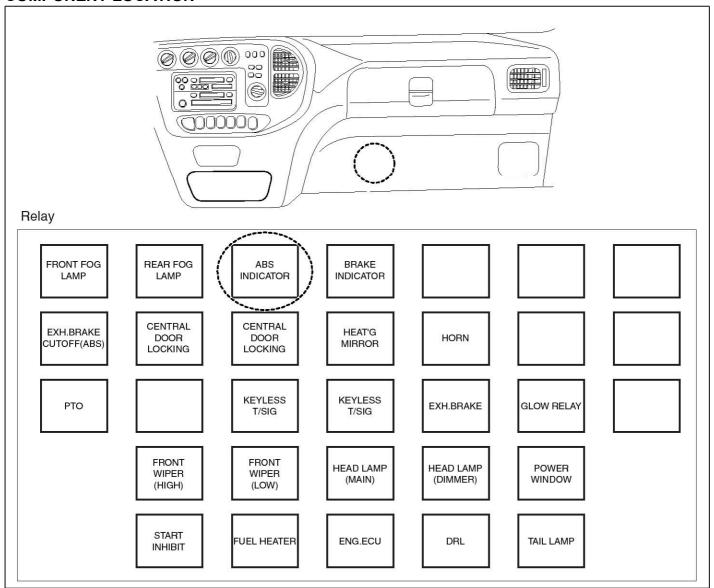
YES

▶ Go to the applicable DTC procedure.

NO

003B ABS Warning Light Bulb

COMPONENT LOCATION



SUDWAB9005L

GENERAL DESCRIPTION

The ABS warning light, which is installed in the dashboard, is turned on to notify the driver when ABS control is malfunctioning and requires repairing.

DTC DESCRIPTION

HECU outputs a fail code when the ABS warning light is not turned on.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	ABS warning lamp do	ABS warning lamp does not work.				
Diagnosis Time	5,000 ms	5,000 ms				cuit.
Fail Safe	Fuel Cut	No		The ABS function		Defective ABS wa- rning lamp relay.
	Fuel Limit	Yes		works normally.		
	MIL	Yes				

SPECIFICATION

ABS warning lamp relay coil resistance	200 ∼ 450 Ω (At 20˚C)
--	-----------------------

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test".

			DUAL	DI SPLA	¥		
			CURRE	NT DAT	A		
×	ECU :	SUPPLY	VOLTA	GE	22.7	Ų	A
×	DBR 1	RELAY			OFF		
×	ABS (WARNI NO	G LAMP		OFF		
×	BRAK	E WARNI	ING LA	MP	OFF		₹
		f	ACTUAT	ION TE	ST		
ď	ABS-W	ARNI NG	LAMP				
	1 SECONDS WARNING LAMP CHECK						
}	KEY.ON / UEH.STOP ENG. STOP						
	STRT		FIX	LINE			

- 4. Select "ABS warning lamp" and perform actuation test..
 - Specification: Normal if the warning lamp in the gauge comes on.

			DUAL	DISPLAY	!		
			CURRE	NT DATA	ì		
×	ECU SI	UPPLY	VOLTA	GE	22.7	Ų	A
×	DBR R	ELAY			OFF		
×	ABS W	ARNI NO	LAMP		ON		
×	BRAKE	WARNI	NG LA	MP	OFF		Ŧ
		f	ACTUAT	ION TES	ST T		
	ABS-WAI	RNING	LAMP				
	1 SECONDS WARNING LAMP CHECK						
	KEY.ON / UEH.STOP ENG. STOP						
	STRT		FIX	LINE			

SUDWAB9038L

5. Does the warning lamp in the gauge come on?

YES

- ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Ground the terminal 21 of HECU harness connector (C60) to chassis ground.
- 5. Does the ABS warning lamp come on?

YES

▶ Go to "Control Open Inspection" procedure.

NO

- ▶ Remove the gauge panel and check the bulb condition of ABS warning lamp.
- ▶ Replace the bulb if necessary. If normal, check open circuit between meter fuse and warning lamp.
- ▶ Repair it as necessary. Go to "Verification of Vehicle Repair" procedure.

Control Open Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the ABS warning lamp relay (M101) and HECU (C60).
- 3. Measure the resistance between the terminal 3 of relay harness connector (M101) and the terminal 21 of HECU harness connector (C60).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open circuit between the terminal 3 of relay harness connector (M101) and the terminal 21 of HECU harness connector (C60) and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the ABS warning lamp relay connector (M101).
- 3. Measure the resistance between terminals 3 and 5 of ABS warning lamp relay component.
 - Specification: ABS warning lamp relay coil resistance: $200 \sim 450 \Omega$ (At 20° C)
- 4. Measure the resistance between terminals 1 and 4 of ABS warning lamp relay while applying and cutting off B+ power to terminals 3 and 5 of ABS warning lamp relay.
 - Specification:

Continuity (When applying power)
Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.
- ▶ Repeat "Component Inspection" procedure several

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

YES

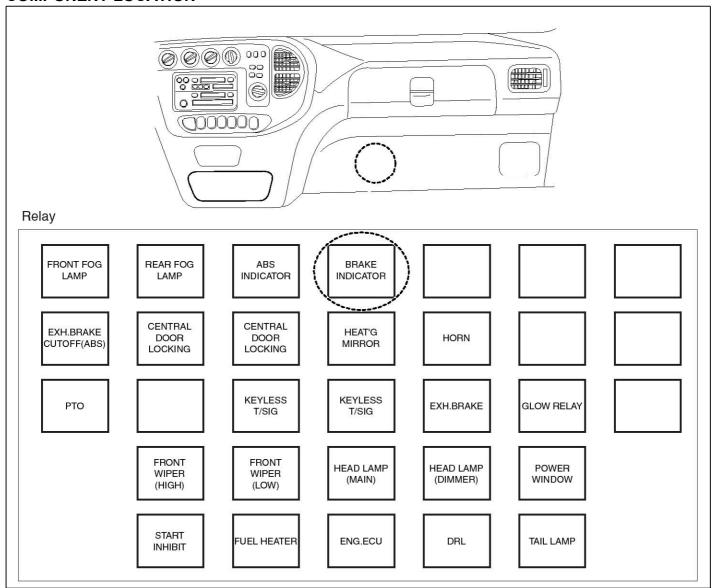
▶ Go to the applicable DTC procedure.

NO

System OK

003C Brake Warning Light Bulb

COMPONENT LOCATION



SUDWAB9004L

GENERAL DESCRIPTION

The BRAKE warning light, which is installed in the dashboard, is turned on to notify the driver when the vehicle is abnormal and requires repairing.

DTC DESCRIPTION

HECU outputs a fail code when the break warning light is not turned on even though the vehicle is in the conditions in which the light should be on.

DTC DETECTING CONDITION

Item			Possible Cause			
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON		connector and wiri- ng damage.			
Threshold Value	ABS warning lamp does not work.				Open of control cir-	
Diagnosis Time	5,000 ms	5,000 ms				
Fail Safe	Fuel Cut	No		The ABS function		
	Fuel Limit	Yes	works normally.			
	MIL	Yes				

SPECIFICATION

Brake warning lamp relay coil resistance $200 \sim 450 \ \Omega$ (At $20 \ U$)		Brake warning lamp relay coil resistance	200 ∼ 450 Ω (At 20°C)
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MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON. Leave the engine OFF.
- 3. Select the data "Actuation test".
 - DUAL DISPLAY **CURRENT DATA** * ECU SUPPLY VOLTAGE 22.7 V A DBR RELAY OFF * ABS WARNING LAMP OFF * BRAKE WARNING LAMP OFF ACTUATION TEST BRAKE WARNING LAMP SECONDS WARNING LAMP CHECK KEY.ON / VEH.STOP ENG. STOP STRT FIX LINE
- 4. Select "Brake warning lamp" and perform actuation test
 - Specification: Normal if the warning lamp in the gauge comes on.

			TALLAT	TAT (ווא זמר			
<u> </u>			DUAL	DI 3	SPLAY			
			CURRE	NT	DATA			
×	ECU	SUPPLY	VOLTA	GE		22.7	Ų	A
×	DBR	RELAY				OFF		
×	ABS	WARNING	G LAMP	i		OFF		
×	BRAI	(E WARN)	ING LA	MP		0N		Ţ
	ACTUATION TEST							
I	3RAK]	E WARNII	NG LAM	P				
	1 SECONDS WARNING LAMP CHECK							
]	KEY.ON / VEH.STOP ENG. STOP							
	STRI	[FIX] [1	LINE			

SUDWAB9039L

5. Does the warning lamp in the gauge come on?

YES

- ▶ There may be the defective HECU or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

Go to next procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Ground the terminal 21 of HECU harness connector (C60) to chassis ground.
- 5. Does the brake warning lamp come on?

YES

► Go to "Control Open Inspection" procedure.

NO

- ▶ Remove the gauge panel and check the bulb condition of brake warning lamp.
- ▶ Replace the bulb if necessary. If normal, check open circuit between meter fuse and warning lamp.
- ▶ Repair it as necessary. Go to "Verification of Vehicle Repair" procedure.

Control Open Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the brake warning lamp relay (M102) and HECU (C60).
- 3. Measure the resistance between the terminal 3 of relay connector (M102) and the terminal 21 of HECU harness connector (C60).
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Repair open circuit between terminal of HECU harness connector and terminal of brake warning lamp relay control harness connector and go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the brake warning lamp relay connector (M102).
- 3. Measure the resistance between terminals 3 and 5 of brake warning lamp relay component.
 - Specification: Brake warning lamp relay coil resistance: 200 \sim 450 Ω (At 20 $^{\circ}$ C)
- 4. Measure the resistance between terminals 1 and 4 while applying and cutting off B+ power to terminals 3 and 5 of brake warning lamp relay.
 - Specification:

Continuity (When applying power) Infinite (When cutting off power)

5. Is the resistance measured within specification?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Replace the relay and go to "Verification of Vehicle Repair" procedure.
- ▶ Repeat "Component Inspection" procedure several times.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

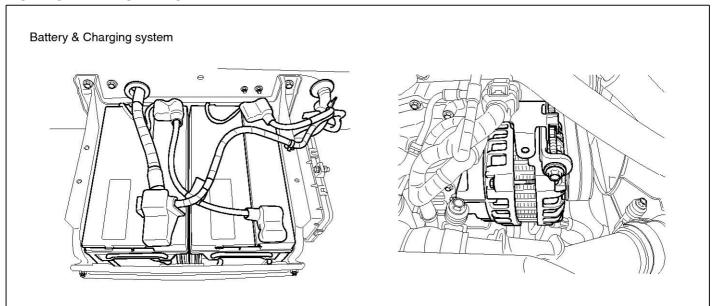
YES

Go to the applicable DTC procedure.

NO

003D High Voltage

COMPONENT LOCATION



SUDWAB9006L

GENERAL DESCRIPTION

The battery voltage of a normal vehicle fluctuates between 23.5 V and 28.5 V.

DTC DESCRIPTION

Particularly, the voltage fluctuation is closely related to the pump and solenoids related to ABS, and HECU monitors such a battery voltage change.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause		
DTC Strategy	Signal monitoring	Signal monitoring			Alternator Battery		
Enable Conditions	Ignition ON	Ignition ON					
Threshold Value	Voltage is higher than 32 V in 24 V HECU.						
Diagnosis Time	Below 500 ms	Below 500 ms					
Fail Safe	Fuel Cut	No	The ABS function				
	Fuel Limit	Yes	works normally.		works normally.		
	MIL	Yes					

SPECIFICATION

Regulator temperature(℃)	Regulating voltage(V)
20 ~ 30	27.5~28.5 V

Brake System

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

► Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Alternator Connector Supply Power Inspection

- 1. Leave the alternator connector connected.
- 2. Turn the ignition ON. Leave the engine ON.
- 3. Measure the voltage of terminal 1 of alternator connector.
 - Specification: Charging voltage B+ V
- 4. Is the voltage measured within specification?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Alternator B+ Cable Voltage Drop Inspection" procedure.

Alternator B+ Cable Voltage Drop Inspection

- 1. Run the engine.
- Measure the voltage drop between the terminal of alternator B+ and the terminal of battery B+. (Connect terminal + (positive) of multi-meter to terminal B+ of alternator, terminal - (negative) of multi-meter to terminal B+ of battery.)
 - Specification: Within 200 mV
- 3. Is the voltage drop measured within specification?

YES

► Go to "Component Inspection" procedure.

NO

► Check the corrosion and degradation of alternator B+ cable terminal and replace the cable as necessary.

COMPONENT INSPECTION

Alternator Charging Voltage Inspection

- 1. Turn the ignition OFF. Leave the engine OFF.
- 2. Check the belt tension of alternator.
- 3. Check battery terminal, fusible link, alternator B+ terminal for looseness and corrosion.
- 4. Start the engine.
- 5. Operate electric system such as head lamp, hot-wire, blower motor etc.

6.

■ Specification:

Regulator temperature(℃)	Regulating voltage(V)
20 ~ 30	25.5~26.5 V

Measure battery voltage at engine 750 rpm or higher.

7. Is the voltage measured within specification?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the regulator and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

YES

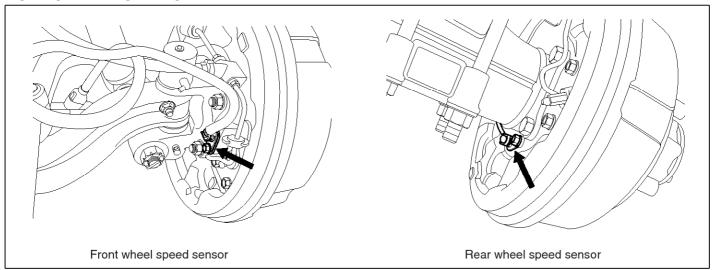
▶ Go to the applicable DTC procedure.

NO

System OK

003F Sensor Right Hand Front(Tire Combination)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring			٠	Check that tire size
Enable Conditions	Ignition ON		is within specification range.		
Threshold Value	Tire alignment correction factor > 20%				Check the number
Diagnosis Time	Below 5 minutes				of teeth on tone ri-
Fail Safe	Fuel Cut	No	ABS function temp-		ngs.
	Fuel Limit	Yes	orarily disabled for concerned wheel.		
	MIL	Yes	oonochied wheel.		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.
- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.
- 5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Check Tire Size

- 1. Turn the ignition OFF.
- 2. Check tires and wheel size.
- 3. Are tires installed within specification?

YES

► Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on right hand front tone ring.
- 3. Is the number of tone wheel correct?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

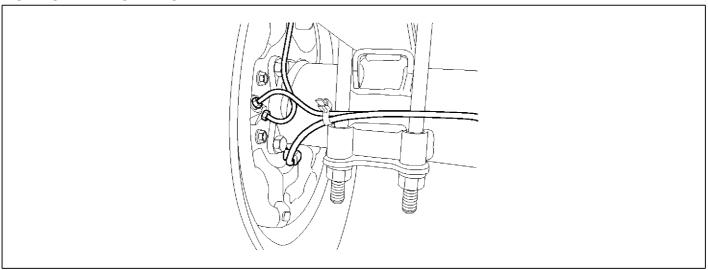
YES

Go to the applicable DTC procedure.

NO

0040 Sensor Left Hand Rear(Tire Combination)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause		
DTC Strategy	Signal monitoring	Signal monitoring			Check that tire size		
Enable Conditions	Ignition ON		is within specification range.				
Threshold Value	Tire alignment correction factor>20%				Check the number		
Diagnosis Time	Below 5 minutes				of teeth on tone ri-		
Fail Safe	Fuel Cut	No	ABS function temp-		ngs.		
	Fuel Limit	Yes	orarily disabled for concerned wheel		orarily disabled for		
	MIL	Yes	- concerned wheel				

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I)ATA	08/22
			A
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v _
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22
			A
×	SENSOR VOLTAGE RHF	0.8	v
×	SENSOR VOLTAGE LHR	4.7	V
×	SENSOR VOLTAGE LHF	0.0	v 📗
×	SENSOR VOLTAGE RHR	0.7	v
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km/h
×	WHEEL SPEED RHR	20.9	Km∕h
			₩.
	FIX PART TOT HELP	LINE	REC

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Check tires and wheel size.
- 3. Are tires installed within specification?

YES

▶ Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on left hand rear tone ring.
- 3. Is the number of tone wheel correct?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

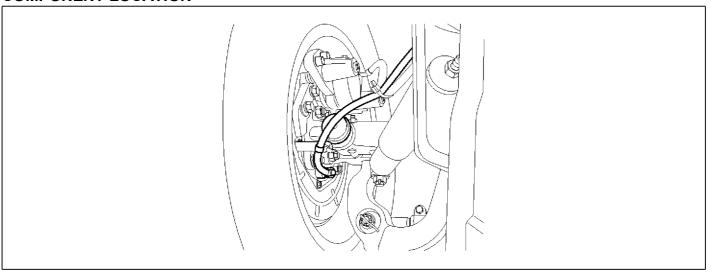
YES

▶ Go to the applicable DTC procedure.

NO

0041 Sensor Left Hand Front(Tire Combination)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	•	Check that tire size		
Enable Conditions	Ignition ON		is within specification range.		
Threshold Value	Tire alignment correction factor>20%				Check the number
Diagnosis Time	Below 5 minutes				of teeth on tone ri-
Fail Safe	Fuel Cut	No	ABS function tem-		ngs.
	Fuel Limit	Yes	porarily disabled f- or concerned whe-		
	MIL	Yes	el.		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT DATA	08/22
		•
×	SENSOR VOLTAGE RHF 4.2	V
×	SENSOR VOLTAGE LHR 0.6	v
×	SENSOR VOLTAGE LHF 0.6	∪ _
×	SENSOR VOLTAGE RHR 1.2	v -
×	WHEEL SPEED RHF 10.6	Km∕h
×	WHEEL SPEED LHR 10.6	Km∕h
×	WHEEL SPEED LHF 10.8	Km∕h
×	WHEEL SPEED RHR 10.6	Km∕h
		▼
	FIX PART TOT HELP LINE	REC

- 4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22	2
			4	L
×	SENSOR VOLTAGE RHF	0.8	v	
×	SENSOR VOLTAGE LHR	4.7	v	
×	SENSOR VOLTAGE LHF	0.0	v	
×	SENSOR VOLTAGE RHR	0.7	v	
×	WHEEL SPEED RHF	21.0	Km∕h	
×	WHEEL SPEED LHR	20.7	Km∕h	
×	WHEEL SPEED LHF	21.0	Km∕h	
×	WHEEL SPEED RHR	20.9	Km∕h	
			١,	,
	FIX PART TOT HELP	LINE	REC	

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Check tires and wheel size.
- 3. Are tires installed within specification?

YES

▶ Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on left hand rear tone ring.
- 3. Is the number of tone wheel correct?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

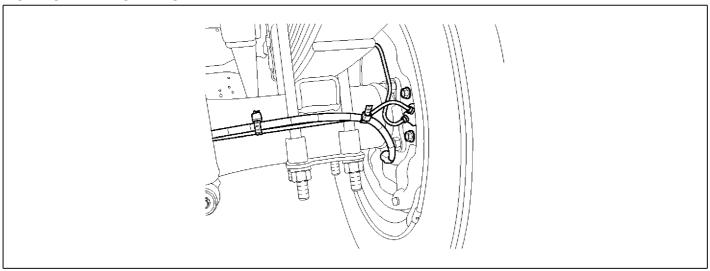
YES

► Go to the applicable DTC procedure.

NO

0042 Sensor Right Hand Rear(Tire Combination)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU outputs a fail code when the tire alignment correction value is over 20% while the wheel size is abnormal or the number of teeth in the tone wheel is different.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				Check that tire size is within specificati-
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	Tire alignment correction factor>20%				•	on range. Check the number of teeth on tone ri-
Diagnosis Time	Below 5 minutes					
Fail Safe	Fuel Cut	No		ABS function tem-		ngs.
	Fuel Limit	Yes		porarily disabled f- or concerned whe-		
	MIL	Yes		el		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	U
×	SENSOR VOLTAGE LHR	0.6	V
×	SENSOR VOLTAGE LHF	0.6	v _■
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1.2. (CURRENT	DATA	08/2	22
						•
×	SENSOR VO	LTAGE	RHF	0.8	Ų	
×	SENSOR VO	LTAGE	LHR	4.7	V	
×	SENSOR VO	LTAGE	LHF	0.0	U	
×	SENSOR VO	LTAGE	RHR	0.7	v	_
×	WHEEL SPE	ED RH	F	21.0	Km∕h	
×	WHEEL SPE	ED LH	R	20.7	Km∕h	
×	WHEEL SPE	ED LHI	F	21.0	Km∕h	
×	WHEEL SPE	ED RHI	R	20.9	Km∕h	
						Ŧ
	FIX PAR	TO	r HELI	PLINE	REC	

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Turn the ignition OFF.
- 2. Check tires and wheel size.
- 3. Are tires installed within specification?

YES

► Go to next procedure.

NO

▶ Replace tires and wheel size in specification and go to "Verification of Vehicle Repair" procedure.

Check the Number of Teeth on Tone Rings

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on right hand rear tone ring.
- 3. Is the number of tone wheel correct?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

▶ Repair or replace the tone ring and check the condition of vehicle. If normal, replace with new one and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

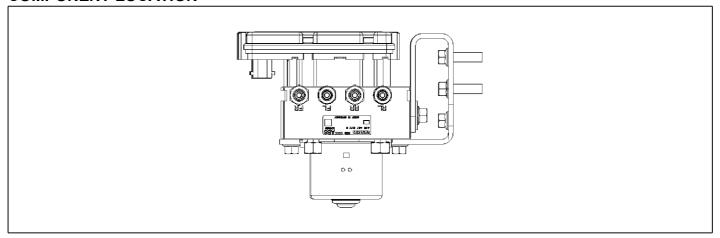
YES

▶ Go to the applicable DTC procedure.

NO

0043 Pump Motor Does Not Switch On

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the pump motor	When the pump motor in HECU does not work			
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test"

- 4. Check the pump motor for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

1.	5. ACTUATION TEST 13/13			
PUMP				
DURATION	1 SECONDS			
METHOD	SOUND CHECK			
CONDITION	KEY.ON / VEH.STOP			
	ENG. STOP			
PRESS [STRT], IF YOU ARE READY !				
STRT				

SUDWAB9040L

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

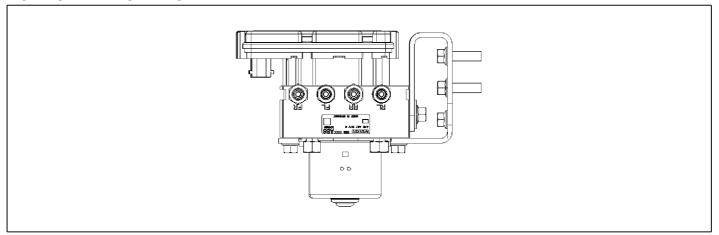
YES

► Go to the applicable DTC procedure.

NO

0044 Pump Motor Does Not Switch Off

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring				Replace ECU.
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the pump motor in HECU will not stop				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

- 4. Check the pump motor for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

1.	5. ACTUATION TEST 13/13							
PUMP								
DURATION	1 SECONDS							
METHOD	SOUND CHECK							
CONDITION	KEY.ON / VEH.STOP							
	ENG. STOP							
PRESS [STRT], IF YOU ARE READY !								
STRT								

SUDWAB9041L

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

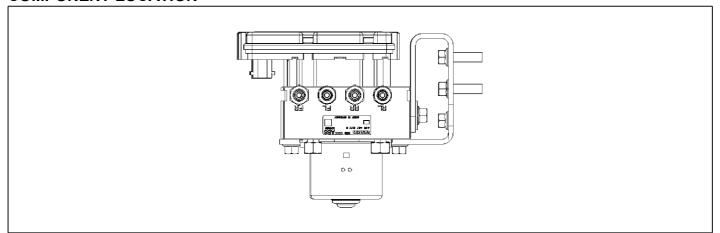
YES

► Go to the applicable DTC procedure.

NO

0045 Pump Motor Does Not Turn

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the pump motor in HECU does not work				
Diagnosis Time	1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

- 4. Check the pump motor for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

1.	5. ACTUATION TEST 13/13					
PUMP						
DURATION	1 SECONDS					
METHOD	SOUND CHECK					
CONDITION	KEY.ON / VEH.STOP					
	ENG. STOP					
PRESS [STRT], IF YOU ARE READY !						
STRT						

SUDWAB9042L

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

► Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

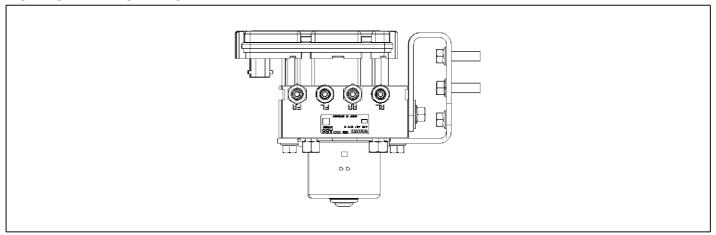
YES

▶ Go to the applicable DTC procedure.

NO

0046 Pump Motor Supply Voltage Missing

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

HECU supplies the battery voltage to all solenoid valves through the valve relay controlled by ECU. All solenoid valves and valve relay are installed in HECU.

DTC DESCRIPTION

HECU monitors the incoming system power, and if the pump motor does not function due to no power, it outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring Ignition ON When there is no power in pump motor			
Enable Conditions	Ignition ON				
Threshold Value	When there is no				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

CONTROL CIRCUIT INSPECTION

Control Circuit inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Measure the voltage between the terminal 16 of HECU connector (C60) and chassis ground.
 - Specification: Battery voltage
- 5. Is the voltage measured within specification?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check the fuse 30A. If it is burnt, replace it. When the fuse is normal, check open circuit between terminal (+) of battery and terminal 16 of HECU connector (C60) and short to ground. Repair if there is any problem and go to "Verification of Vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION

- 1. Turn the ignition OFF.
- 2. Disconnect the HECU connector (C60).
- 3. Measure the resistance between the terminals 18, 19 of HECU harness connector (C60) and chassis ground.
 - Specification: Continuity
- 4. Is the resistance measured within specification?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check open or poor contact between the solenoid valve ground of HECU harness connector and chassis ground. And go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

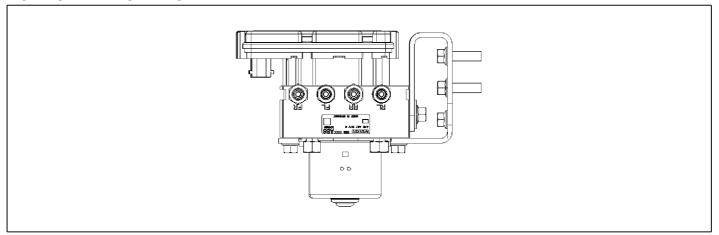
YES

▶ Go to the applicable DTC procedure.

NO

0047 Pump Motor Relay Voltage Missing

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			
Enable Conditions	Ignition ON	Ignition ON			
Threshold Value	When the pump motor	When the pump motor in HECU does not work			
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

- 4. Check the pump motor for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

1.	5. ACTUATION TEST 13/13					
PUMP						
DURATION	1 SECONDS					
METHOD	SOUND CHECK					
CONDITION	KEY.ON / VEH.STOP					
	ENG. STOP					
PRESS [STRT], IF YOU ARE READY !						
STRT						

SUDWAB9043L

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

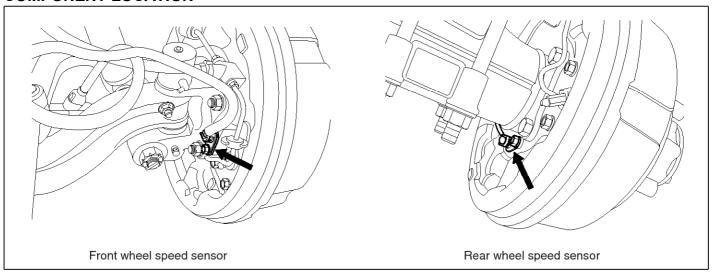
YES

► Go to the applicable DTC procedure.

NO

0049 Sensor Right Hand Front(No Trigger At All)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	.Vehicle speed > 15.0k		and tone ring run out.			
Diagnosis Time	1,000 ms	•	Check tone ring for			
Fail Safe	Fuel Cut	No	ABS function disa-		damage.	
	Fuel Limit	Yes	bled for concerned wheel			
	MIL	Yes	WINCO			

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	V
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	∪ _
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1.	2 . C	URRENT	DATA	08/2	22
							A
×	SENSO	R VOLT	AGE	RHF	0.8	V	
×	SENSO	R VOLT	AGE	LHR	4.7	v	
×	SENSO	R VOLT	AGE	LHF	0.0	v	
×	SENSO	R VOLT	AGE	RHR	0.7	v	
×	WHEEL	SPEED	RHF	•	21.0	Km∕h	
×	WHEEL	SPEED	LHR	}	20.7	Km∕h	
×	WHEEL	SPEED	LHF	1	21.0	Km∕h	
×	WHEEL	SPEED	RHR	ŀ	20.9	Km∕h	
							Ŧ
	FIX	PART	TOT	HELI	LINE	REC	

SUDWAB9008L

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

▶ Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of

Vehicle Repair" procedure.

▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle Repair" procedure.

Right Hand Front Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the right hand front when sensor connector.
- 3. Measure the resistance between positive (+) and negative (-) of the right hand front wheel sensor (C30).
 - Specification: 830 \sim 2,100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

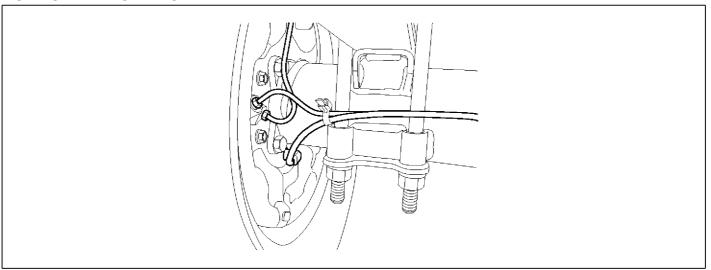
YES

▶ Go to the applicable DTC procedure.

NO

004A Sensor Left Hand Rear(No Trigger At All)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause	
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	.Vehicle speed >	.Vehicle speed > 15.0 kph.Air gap 0.2 ~ 1.7 mm				and tone ring run out.
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			•	Check tone ring for
Fail Safe	Fuel Cut	No		ABS function disa	-	damage.
	Fuel Limit	Yes		bled for concerned wheel		
	MIL	Yes		WIIGGI		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20℃)		
Air gap	0.2 ~ 1.7 mm		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT DATA	08/22
×	SENSOR VOLTAGE RHF 4.2	v
×	SENSOR VOLTAGE LHR 0.6	V
×	SENSOR VOLTAGE LHF 0.6	v 📗
×	SENSOR VOLTAGE RHR 1.2	v
×	WHEEL SPEED RHF 10.6	Km∕h
×	WHEEL SPEED LHR 10.6	Km∕h
×	WHEEL SPEED LHF 10.8	Km∕h
×	WHEEL SPEED RHR 10.6	Km∕h
	FIX PART TOT HELP LINE	REC

- 4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2.	CURRENT	DATA	08/2	22
					A
×	SENSOR VOLTAG	E RHF	0.8	V	
×	SENSOR VOLTAG	E LHR	4.7	v	
×	SENSOR VOLTAG	E LHF	0.0	v	
×	SENSOR VOLTAG	E RHR	0.7	v	_
×	WHEEL SPEED F	RHF	21.0	Km/h	
×	WHEEL SPEED L	HR	20.7	Km∕h	
×	WHEEL SPEED L	HF.	21.0	Km/h	
×	WHEEL SPEED F	HR	20.9	Km∕h	
					Ŧ
	FIX PART T	OT HELI	LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Left Hand Rear Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the left hand rear connector (C37).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand rear wheel sensor (C37).
 - Specification: 830 \sim 2100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

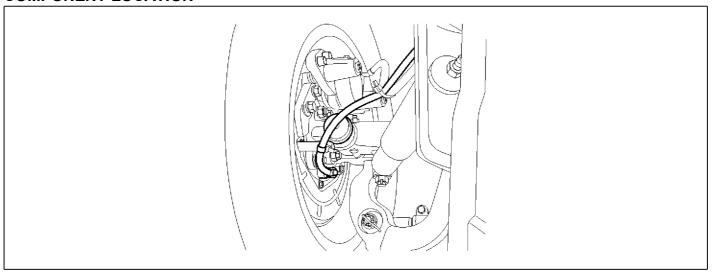
YES

► Go to the applicable DTC procedure.

NO

004B Sensor Left Hand Front(No Trigger At All)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	g			•	Check air gap. Check bearing play
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	.Vehicle speed >	.Vehicle speed > 15.0 kph. Air gap 0.2 ~ 1.7 mm				and tone ring run out.
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				Check tone ring for
Fail Safe	Fuel Cut	No		ABS function disa	-	damage.
	Fuel Limit	Yes		bled for concerned wheel	d	
	MIL	Yes		- WIICCI		

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20°C)		
Air gap	0.2 ~ 1.7 mm		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I)ATA	08/22
			A
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v _
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22
			A
×	SENSOR VOLTAGE RHF	0.8	V
×	SENSOR VOLTAGE LHR	4.7	V
×	SENSOR VOLTAGE LHF	0.0	V 📗
×	SENSOR VOLTAGE RHR	0.7	v -
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km∕h
×	WHEEL SPEED RHR	20.9	Km∕h
			₩
	FIX PART TOT HELP	LINE	REC

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Left Hand Front Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the left hand front connector (C31).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the left hand front wheel sensor.
 - Specification: 830 \sim 2,100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

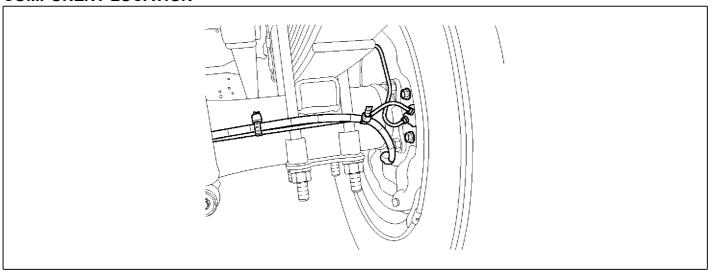
YES

► Go to the applicable DTC procedure.

NO

004C Sensor Right Hand Rear(No Trigger At All)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause	
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	.Vehicle speed > 15.0 k	.Vehicle speed > 15.0 kph. Air gap 0.2 ~ 1.7 mm				
Diagnosis Time	Below 1,000 ms	•	Check tone ring for			
Fail Safe	Fuel Cut	No	ABS function disa-		damage.	
	Fuel Limit	Yes	bled for concerned wheel	d		
	MIL	Yes	WIIGGI			

SPECIFICATION

Wheel sensor resistance	830 ~ 2,100 Ω (At 20°C)		
Air gap	0.2 ~ 1.7 mm		

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	V
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	∪ _
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22
			4
×	SENSOR VOLTAGE RHF	0.8	v
×	SENSOR VOLTAGE LHR	4.7	V
×	SENSOR VOLTAGE LHF	0.0	v 📗
×	SENSOR VOLTAGE RHR	0.7	v
×	WHEEL SPEED RHF	21.0	Km∕h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km∕h
×	WHEEL SPEED RHR	20.9	Km∕h
			7
	FIX PART TOT HELI	PLINE	REC

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Right hand rear Wheel Sensor Inspection

- 1. Turn the ignition OFF.
- 2. Disconnect the right hand rear connector (C36).
- 3. Measure the resistance between terminal positive (+) and terminal negative (-) of the right hand rear wheel sensor (C36).
 - Specification: 830 \sim 2100 Ω (At 20 $^{\circ}$ C)
- 4. Is the resistance measured within specification?

YES

- ▶ After checking the HECU for contamination or damage, install a known-good HECU and check it good or not.
- ▶ Replace the HECU if the vehicle is normal condition and go to "Verification of Vehicle Repair" procedure.

NO

▶ Replace the sensor if the vehicle is normal after temporarily installing a known-good sensor and go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

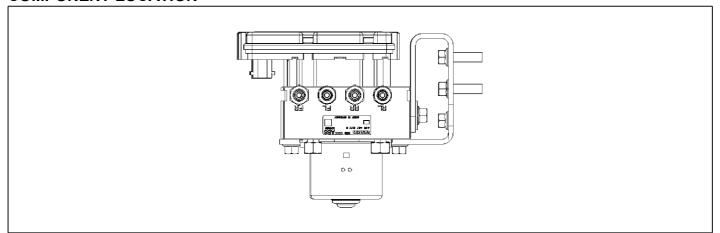
YES

► Go to the applicable DTC procedure.

NO

004D J1939 Internal Error

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition				Possible Cause	
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON					
Threshold Value	When the HECU detec	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled			
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.

	1.2. CURRENT	DATA	08/22
×	ECU SUPPLY VOLTAGE	22.9	v
×	WHEEL SPEED RHF	1.8	Km∕h
×	WHEEL SPEED LHR	1.8	Km/h ■
×	WHEEL SPEED LHF	1.8	Km∕h
×	WHEEL SPEED RHR	1.8	Km∕h
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	BRAKE WARNING LAMP	OFF	
			₩.
	FIX PART TOT HEL	P LINE	REC

- 2. Turn the ignition ON.
- 3. Monitor the service data on the scan tool.

	1.2. CURRENT	DATA	01/2	22
				<u> </u>
×	SENSOR VOLTAGE RHF	2.2	V	
×	SENSOR VOLTAGE LHR	2.2	v	
×	SENSOR VOLTAGE LHF	2.2	v	
×	SENSOR VOLTAGE RHR	2.2	v	
×	ECU SUPPLY VOLTAGE	22.7	v	
×	DBR RELAY	OFF		
×	ABS WARNING LAMP	OFF		
×	BRAKE WARNING LAMP	OFF		
				Ŧ
	FIX PART TOT HEL	P LINE	REC	

SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

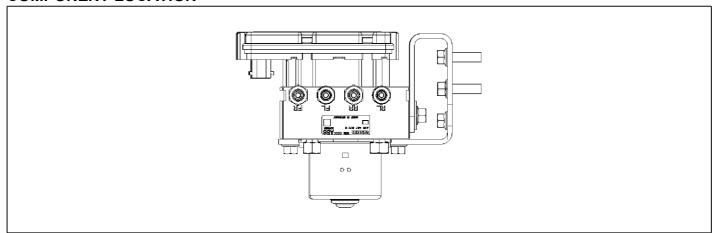
YES

▶ Go to the applicable DTC procedure.

NO

004E J1939 Bus

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes any malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item			Possible Cause		
DTC Strategy	Signal monitoring	•	Replace ECU.		
Enable Conditions	Ignition ON				
Threshold Value	When the HECU detec				
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disabled		
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.

	1.2. CURRENT	DATA	08/22
×	ECU SUPPLY VOLTAGE	22.9	v
×	WHEEL SPEED RHF	1.8	Km∕h
×	WHEEL SPEED LHR	1.8	Km/h ■
×	WHEEL SPEED LHF	1.8	Km∕h
×	WHEEL SPEED RHR	1.8	Km∕h
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	BRAKE WARNING LAMP	OFF	
			₩.
	FIX PART TOT HEL	P LINE	REC

- 2. Turn the ignition ON.
- 3. Monitor the service data on the scan tool.

Г	1.2. CURRENT DATA 01/	′22
		A
×	SENSOR VOLTAGE RHF 2.2 V	
×	SENSOR VOLTAGE LHR 2.2 V	
×	SENSOR VOLTAGE LHF 2.2 V	
×	SENSOR VOLTAGE RHR 2.2 V	
×	ECU SUPPLY VOLTAGE 22.7 V	
×	DBR RELAY OFF	
×	ABS WARNING LAMP OFF	
×	BRAKE WARNING LAMP OFF	
		₹
	FIX PART TOT HELP LINE REC	1

SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

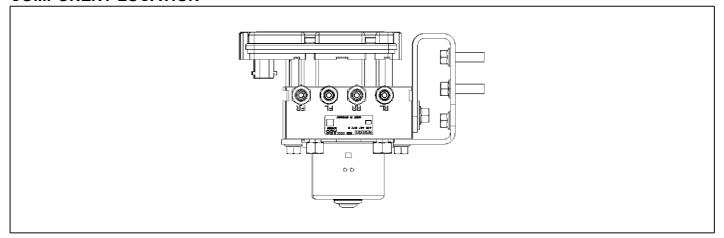
YES

► Go to the applicable DTC procedure.

NO

004F J1939 Message

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause	
DTC Strategy	Signal monitoring	Replace ECU.			
Enable Conditions	Ignition ON				
Threshold Value	When the HECU	When the HECU detects malfunction in the control system			
Diagnosis Time	Below 1,000 ms				
Fail Safe	Fuel Cut	No	ABS disable	d	
	Fuel Limit	Yes			
	MIL	Yes			

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.

	1.2. CURRENT	DATA	08/22
			•
×	ECU SUPPLY VOLTAGE	22.9	v
×	WHEEL SPEED RHF	1.8	Km∕h
×	WHEEL SPEED LHR	1.8	Km∕h ■
×	WHEEL SPEED LHF	1.8	Km∕h
×	WHEEL SPEED RHR	1.8	Km∕h
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	Brake Warning Lamp	OFF	
			▼
	FIX PART TOT HEL	P LINE	REC

- 2. Turn the ignition ON.
- 3. Monitor the service data on the scan tool.

	1.2. CURRENT DATA 01/	22
		1
×	SENSOR VOLTAGE RHF 2.2 V	
×	SENSOR VOLTAGE LHR 2.2 V	
×	SENSOR VOLTAGE LHF 2.2 V	
×	SENSOR VOLTAGE RHR 2.2 V	
×	ECU SUPPLY VOLTAGE 22.7 V	
×	DBR RELAY OFF	
×	ABS WARNING LAMP OFF	
×	BRAKE WARNING LAMP OFF	
		T
	FIX PART TOT HELP LINE REC	1

SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

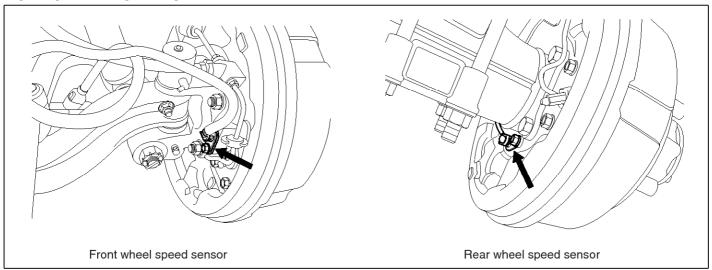
YES

▶ Go to the applicable DTC procedure.

NO

0050 Inlet Valve(Right Hand Front) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	.When the HECU 2~1.7 mm	.When the HECU detects malfunction in the control system.Air gap : 0. 2~1.7 mm				
Diagnosis Time	Below 1,000 ms					
Fail Safe	Fuel Cut	No	• ABS	S disabled		
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

		DUAL	DISPLAY	
		CURRE	NT DATA	
×	INPUT V	ALVE RHF	OFF	A
×	OUTPUT	VALUE RHF	OFF	_
×	INPUT V	ALVE LHF	OFF	
×	OUTPUT	VALVE LHF	OFF	▼
		ACTUAT	ION TEST	·
	INLET VA	LVE RIGHT	-HAND FRONT	
	1 SECO	NDS	SOUND CHECK	
	KEY.ON /	VEH.STOP	ENG. STOP	
	STRT	FIX	LINE	

- 4. Check the right hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

×	INPUT VA	LVE RHF	ON	A
×	OUTPUT V	ALUE RHF	OFF	
×	INPUT VA	LVE LHF	OFF	
×	OUTPUT V	ALVE LHF	OFF	v
		ACTUAT I	ON TEST	
_]	NLET VAL	VE RIGHT-	HAND FRONT	
	1 SECON	DS	SOUND CHECK	
	EY.ON /	VEH. STOP	ENG. STOP	
}				

SUDWAB9044L

Fig1) Right hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

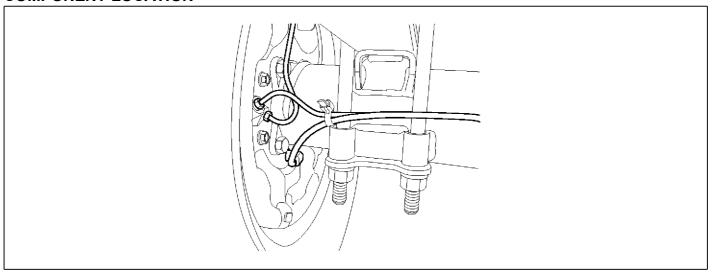
YES

▶ Go to the applicable DTC procedure.

NO

0051 Inlet Valve(Left Hand Rear) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause	
DTC Strategy	Signal monitoring			•	Replace ECU.	
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU detection ~1.7 mm					
Diagnosis Time	Below 1,000 ms					
Fail Safe	Fuel Cut	No	ABS disabled			
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY					
		CURRE	NT DATA			
×	INPUT V	ALVE RHR	OFF	A		
×	OUTPUT	VALVE RHE	OFF			
×	INPUT V	OFF				
×	* OUTPUT VALVE LHR OFF					
	•	ACTUAT	ION TEST			
	INLET VA	LVE LEFT-	HAND REAR			
	1 SECO	NDS	SOUND CHECK			
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

- 4. Check the left hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
		CURREN	IT DATA			
×	INPUT VALVI	E RHR		OFF	A	
×	OUTPUT VAL	JE RHR		OFF		
×	INPUT VALVI	E LHR		ON		
×	* OUTPUT VALVE LHR OFF				▼	
	1	ACTUAT I	ON TES	T	·	
	INLET VALVE	LEFT-H	IAND RE	AR		
	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

SUDWAB9045L

- Fig1) Left hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

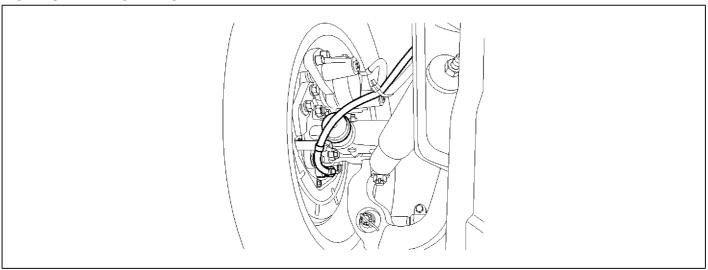
YES

▶ Go to the applicable DTC procedure.

NO

0052 Inlet Valve(Left Hand Front) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and failure memory circuit that memorizes malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring			•	Replace ECU.
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system.Air gap : 0.2 ~1.7 mm					
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No		ABS disabled		
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY					
		CURREN	IT DATA			
×	INPUT VALV	E RHF	0	FF 🔺		
×	OUTPUT VAL	VE RHF	0	FF		
×	INPUT VALV	0	FF			
×	* OUTPUT VALVE LHF OFF					
		ACTUAT I	ON TEST	•		
	INLET VALVE	LEFT-H	IAND FRON	T		
	1 SECONDS		SOUND C	НЕСК		
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

- 4. Check the left hand front inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
		CURREN	IT DATA			
×	INPUT VALVI	E RHF		OFF	A	
×	OUTPUT VAL	JE RHF		OFF		
×	INPUT VALVI	E LHF		ON		
×	* OUTPUT VALVE LHF OFF				▼	
	1	ACTUAT I	ON TES	T		
	INLET VALVE	LEFT-H	IAND FR	ONT		
	1 SECONDS SOUND CHECK					
	KEY.ON ∕ VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

SUDWAB9046L

Fig1) Left hand front inlet valve Actuation test at IG ON

5. Does the valve activate normally?

YES

- ▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.
- ► And go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

► Repair as necessary and then go to "Verification of

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

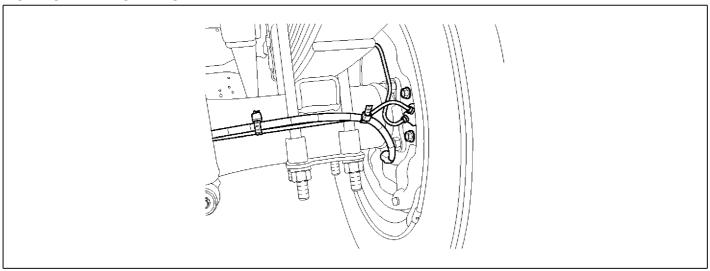
YES

▶ Go to the applicable DTC procedure.

NO

0053 Inlet Valve(Right Hand Rear) Actuation Time Unplausible

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and circuit that memorizes failure memory malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				Replace ECU.
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU detects malfunction in the control system. Air gap : 0.2 \sim 1.7 mm					
Diagnosis Time	Below 1,000 ms					
Fail Safe	Fuel Cut	No		ABS disabled		
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

- 1. Connect the scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.
- 3. Select the data "Actuation test".

	DUAL DISPLAY						
		(CURREI	NT DATA	À		
×	I NPU1	' VALVE	RHR		OFF		•
×	OUTPU	JT VALVI	ERHR		OFF		
×	I NPU1	UALUE	LHR		OFF		
×	* OUTPUT VALVE LHR OFF					¥	
		AC	CTUAT	ON TES	ST	•	
	INLET	VALVE I	RI GHT	-HAND I	REAR		
	1 SI	ECONDS		SOUNI	CHECK		
	KEY.ON / VEH.STOP ENG. STOP						
	STRT		FIX	LINE			

- 4. Check the right hand rear inlet valve for operation when activating the actuator.
 - Specification: Normal if the activating sound is heard.

	DUAL DISPLAY					
		CURREN	IT DATA			
×	INPUT VAL	VE RHR	ON	A		
×	OUTPUT VA	LVE RHR	OFF			
×	INPUT VAL	VE LHR	OFF			
×	* OUTPUT VALVE LHR OFF					
	•	ACTUAT I	ON TEST	·		
	INLET VALV	E RIGHT-	HAND REAR			
	1 SECONDS SOUND CHECK					
	KEY.ON / VEH.STOP ENG. STOP					
	STRT	FIX	LINE			

SUDWAB9022L

- Fig1) Right hand rear inlet valve Actuation test at IG ON
- 5. Does the valve activate normally?

YES

▶ There may be a transient trouble due to defective valve or a past trouble which did not erase the memory of HECU after having repair.

And go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

- TERMINAL & CONNECTOR INSPECTION
- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of

NO

▶ Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

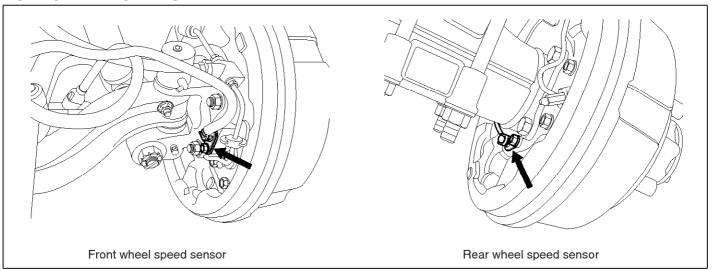
YES

▶ Go to the applicable DTC procedure.

NO

0054 Pole Wheel Right Hand Front(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause	
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	•	Check bearing play and tone ring run			
Threshold Value	Vehicle speed > 5.0 kph. Air gap : 0.2∼1.7 mm				out.	
Diagnosis Time	Below 1,000 ms			•	Check tone ring for	
Fail Safe	Fuel Cut	No	ABS function disabled for concerned wheel		damage.	
	Fuel Limit	Yes				
	MIL	Yes				

Air gap	0.2 ~ 1.7 mm
5 .	

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	U
×	SENSOR VOLTAGE LHR	0.6	V
×	SENSOR VOLTAGE LHF	0.6	v ∎
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			₩
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2.	CURRENT	DATA	08/2	22
					A
×	SENSOR VOLTAG	E RHF	0.8	V	
×	SENSOR VOLTAG	E LHR	4.7	v	
×	SENSOR VOLTAG	E LHF	0.0	v	
×	SENSOR VOLTAG	E RHR	0.7	v	_
×	WHEEL SPEED F	RHF	21.0	Km/h	
×	WHEEL SPEED L	HR	20.7	Km∕h	
×	WHEEL SPEED L	HF.	21.0	Km∕h	
×	WHEEL SPEED F	HR	20.9	Km∕h	
					Ŧ
	FIX PART T	OT HELI	LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on right hand front tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

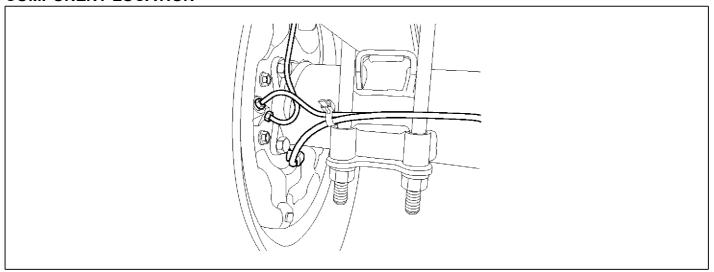
YES

▶ Go to the applicable DTC procedure.

NO

0055 Pole Wheel Left Hand Rear(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the rear left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause	
DTC Strategy	Signal monitoring			•	Check air gap.	
Enable Conditions	Ignition ON			•	Check bearing play and tone ring run	
Threshold Value	Vehicle speed > 5.0 kp	h. Air gap : 0.2∼1.7 mm			out.	
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			Check tone ring for	
Fail Safe	Fuel Cut	No	ABS function disa-		damage.	
	Fuel Limit	Yes	bled for concerned wheel	l		
	MIL	Yes	WINCO			

_ <u></u>	
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I	DATA	08/2	22
				A
×	SENSOR VOLTAGE RHF	4.2	v	
×	SENSOR VOLTAGE LHR	0.6	v	
×	SENSOR VOLTAGE LHF	0.6	v	
×	SENSOR VOLTAGE RHR	1.2	v	_
×	WHEEL SPEED RHF	10.6	Km/h	
×	WHEEL SPEED LHR	10.6	Km∕h	
×	WHEEL SPEED LHF	10.8	Km/h	
×	WHEEL SPEED RHR	10.6	Km∕h	
				Ŧ
	FIX PART TOT HELP	LINE	REC	

- 4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT	DATA	08/22	?
				L
×	SENSOR VOLTAGE RHF	0.8	U	
×	SENSOR VOLTAGE LHR	4.7	v	
×	SENSOR VOLTAGE LHF	0.0	v _	•
×	SENSOR VOLTAGE RHR	0.7	v	
×	WHEEL SPEED RHF	21.0	Km∕h	
×	WHEEL SPEED LHR	20.7	Km∕h	
×	WHEEL SPEED LHF	21.0	Km∕h	
×	WHEEL SPEED RHR	20.9	Km∕h	
			T	,
	FIX PART TOT HEL	P LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on left hand rear tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

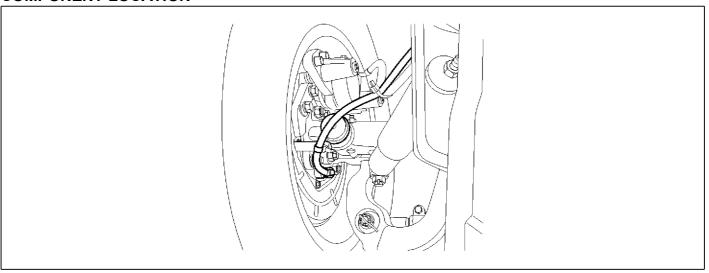
YES

▶ Go to the applicable DTC procedure.

NO

0056 Pole Wheel Left Hand Front(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the front left wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition			Possible Cause	
DTC Strategy	Signal monitoring			•	Check air gap.	
Enable Conditions	Ignition ON			•	Check bearing play and tone ring run	
Threshold Value	Vehicle speed > 5.0 kp	h. Air gap : 0.2∼1.7 mm			out.	
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			Check tone ring for	
Fail Safe	Fuel Cut	No	ABS function disa-		damage.	
	Fuel Limit	Yes	bled for concerned wheel.		bled for concerned	
	MIL	Yes	WIIGOI.			

Air gap	0.2 ∼ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	V
×	SENSOR VOLTAGE LHF	0.6	v 📕
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			v
	FIX PART TOT HEL	P LINE	REC

- 4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1.	2. C	URRENT	DATA	08/	22
							A
×	SENSO:	R VOLT	AGE	RHF	0.8	V	
×	SENSO:	R VOLT	AGE	LHR	4.7	V	
×	SENSO:	R VOLT	AGE	LHF	0.0	V	
×	SENSO:	R VOLT	AGE	RHR	0.7	v	
×	WHEEL	SPEED	RHF	•	21.0	Km∕h	
×	WHEEL	SPEED	LHR		20.7	Km∕h	
×	WHEEL	SPEED	LHF		21.0	Km∕h	
×	WHEEL	SPEED	RHR		20.9	Km∕h	
							Ŧ
	FIX	PART	TOT	HELI	PLINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on left hand front tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

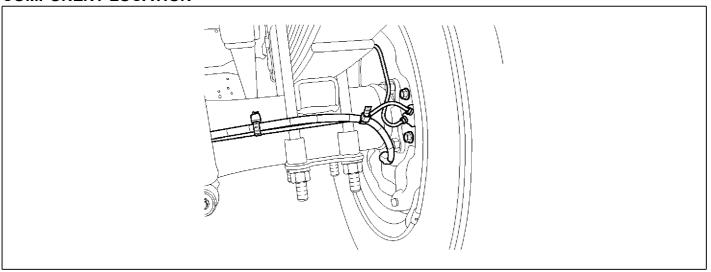
YES

▶ Go to the applicable DTC procedure.

NO

0057 Pole Wheel Right Hand Rear(Cyclic Failure)

COMPONENT LOCATION



SUDWAB9050L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

HECU continues to monitor the input signal from the wheel sensor. If the ABS control state changes abnormally when the sensor output voltage becomes low because the air gap in the Rear right wheel sensor is too big, HECU determines it as a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting (Condition			Possible Cause
DTC Strategy	Signal monitoring	g			•	Check air gap.
Enable Conditions	Ignition ON				•	Check bearing play and tone ring run
Threshold Value	Vehicle speed >	5.0 kph. Air gap : 0.2	~1.7 mm			out.
Diagnosis Time	Below 1,000 ms				•	Check tone ring for
Fail Safe	Fuel Cut	No		ABS function disa	-	damage.
	Fuel Limit	Yes		bled for concerned wheel	t	
	MIL	Yes		WIICCI		

_ <u></u>	
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT DA	TA 08/2	22
			1
×	SENSOR VOLTAGE RHF	4.2 U	
×	SENSOR VOLTAGE LHR	0.6 V	
×	SENSOR VOLTAGE LHF	0.6 V	
×	SENSOR VOLTAGE RHR	1.2 V	
×	WHEEL SPEED RHF	10.6 Km/h	
×	WHEEL SPEED LHR	10.6 Km/h	
×	WHEEL SPEED LHF	10.8 Km/h	
×	WHEEL SPEED RHR	10.6 Km⁄h	
			Ŧ
	FIX PART TOT HELP	LINE REC	

- 4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	:	L. 2. CU:	RRENT	DATA	08/	22
						•
×	SENSOR VOI	LTAGE R	HF	0.8	V	
×	SENSOR VOI	LTAGE L	HR	4.7	V	
×	SENSOR VOI	LTAGE L	HF	0.0	U	
×	SENSOR VOI	LTAGE R	HIR	0.7	V	
×	WHEEL SPE	ED RHF		21.0	Km∕h	
×	WHEEL SPE	ED LHR		20.7	Km∕h	
×	WHEEL SPE	ED LHF		21.0	Km∕h	
×	WHEEL SPE	ED RHR		20.9	Km∕ h	
						Ŧ
	FIX PAR	г Тот	HELF	LINE	REC	

SUDWAB9008L

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on right hand rear tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

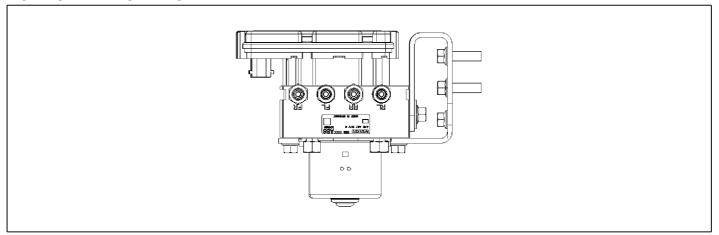
YES

▶ Go to the applicable DTC procedure.

NO

0058 Clamp Transistor Failure

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item		Detecting Condition				Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU de	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms					
Fail Safe	Fuel Cut	No		ABS disabled		
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

- 1. Connect scan tool to the self-diagnosis connector.
- 2. Turn the ignition ON.

	1.2. CURRENT	DATA	08/22
×	ECU SUPPLY VOLTAGE	22.9	U
×	WHEEL SPEED RHF	1.8	Km∕h
×	WHEEL SPEED LHR	1.8	Km/h ■
×	WHEEL SPEED LHF	1.8	Km∕h
×	WHEEL SPEED RHR	1.8	Km∕h
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	BRAKE WARNING LAMP	OFF	
			▼
	FIX PART TOT HEL	P LINE	REC

3. Monitor the service data on the scan tool.

	1.2. CURRENT	DATA	01/22
			A
×	SENSOR VOLTAGE RHF	2.2	v 📮
×	SENSOR VOLTAGE LHR	2.2	V
×	SENSOR VOLTAGE LHF	2.2	U
×	SENSOR VOLTAGE RHR	2.2	U
×	ECU SUPPLY VOLTAGE	22.7	v
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	BRAKE WARNING LAMP	OFF	
			₹
	FIX PART TOT HELP	LINE	REC

SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

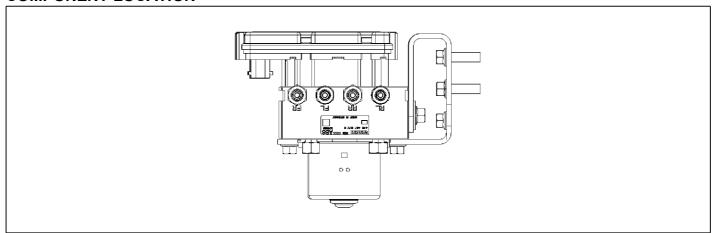
YES

▶ Go to the applicable DTC procedure.

NO

0059 Pull Up Down Failure

COMPONENT LOCATION



SUDWAB9001L

GENERAL DESCRIPTION

The Antilock Brake System (ABS) prevents the skid phenomenon that may occurs during a sudden brake while the vehicle is driving or when there is snow or water on the road. By preventing the wheels from sticking or skidding on the road while the brake is applied, ABS maintains the directional stability of the vehicle, secures the steer ability, provides the maximum braking power so as to reduce the braking distance and to pursue the overall safety of the driver and passengers. As the main device to perform ABS' braking function, HECU consists of an input amplifier circuit that processes the input signal, an ABS control and SAFETY circuit that calculates the control and performs FAIL SAFE, an output circuit that drives the pressure control valve, a voltage adjustment circuit that regulates the voltage, and memory circuit that memorizes any failure malfunctioning. In case of a system malfunctioning, the warning light is turned on, and at the same time, the power to the pressure control valve is cut off, and the operation of ABS is stopped.

DTC DESCRIPTION

HECU continues to monitor the internal components, such as memory, input and output circuits. In case of an error during the operation of the control system, HECU determines whether it is a failure state and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring				
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	When the HECU de	When the HECU detects malfunction in the control system				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				
Fail Safe	Fuel Cut	No		ABS disabled		
	Fuel Limit	Yes				
	MIL	Yes				

MONITOR SCAN TOOL DATA

1. Connect scan tool to the self-diagnosis connector.

	1.2. CURRENT	DATA	08/22
×	ECU SUPPLY VOLTAGE	22.9	v
×	WHEEL SPEED RHF	1.8	Km∕h
×	WHEEL SPEED LHR	1.8	Km∕h ■
×	WHEEL SPEED LHF	1.8	Km/h
×	WHEEL SPEED RHR	1.8	Km∕h
×	DBR RELAY	OFF	
×	ABS WARNING LAMP	OFF	
×	BRAKE WARNING LAMP	OFF	
	FIX PART TOT HELP	LINE	REC

- 2. Turn the ignition ON.
- 3. Monitor the service data on the scan tool.

	1.2. CURRENT DAT	A 01 /22
		<u> </u>
×	SENSOR VOLTAGE RHF 2	.2 V -
×	SENSOR VOLTAGE LHR 2	.2 V
×	SENSOR VOLTAGE LHF 2	.2 U
×	SENSOR VOLTAGE RHR 2	.2 V
×	ECU SUPPLY VOLTAGE 2	2.7 V
×	DBR RELAY O	FF
×	ABS WARNING LAMP 0	FF
×	BRAKE WARNING LAMP 0	FF
		-
	FIX PART TOT HELP L	INE REC

SUDWAB9007L

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.

3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

- 1. Start the engine.
- 2. Drive the vehicle with approx. 15km/h or higher.
- 3. Turn the ignition ON. Leave the engine OFF.
- 4. Connect the scan tool and check the diagnostic trouble codes by using self-diagnosis.
- 5. Using the scan tool erase the diagnostic trouble codes stored in the HECU.
- 6. Check that there are any diagnostic trouble codes by using self-diagnosis with the scan tool.
- 7. Are any diagnostic trouble codes (DTCs) detected?

YES

▶ Check that the DTCs have disappeared after replacing with a known-good HECU. If the problem has solved, we may guess the HECU is problem. Replace the HECU and go to "Verification of Vehicle Repair" procedure.

NO

▶ There may be a defective valve component or a transient trouble due to a past trouble which did not erase the memory of HECU after having repair. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

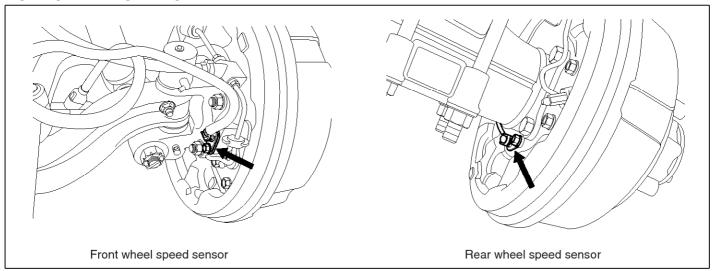
YES

▶ Go to the applicable DTC procedure.

NO

005A Sensor Right Hand Front(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9002L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the front right wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring Ignition ON				
Enable Conditions	Ignition ON					
Threshold Value	Vehicle speed >	Vehicle speed > 5.0 kph				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				Check tone ring for
Fail Safe	Fuel Cut No • ABS function temp	ABS function temp-		damage. Brake chatter.		
	Fuel Limit	Yes		orarily disabled for concerned wheel.		
	MIL	Yes		- concerned wheel.		

Air gap	0.2 ∼ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	V
×	SENSOR VOLTAGE LHF	0.6	v 📕
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km∕h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			v
	FIX PART TOT HEL	P LINE	REC

- 4. Monitor the data "Wheel speed RHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1.	2 . C	URRENT	DATA	08/2	22
							A
×	SENSO	R VOLT	AGE	RHF	0.8	V	
×	SENSO	R VOLT	AGE	LHR	4.7	v	
×	SENSO	R VOLT	AGE	LHF	0.0	v	
×	SENSO	R VOLT	AGE	RHR	0.7	v	
×	WHEEL	SPEED	RHF	•	21.0	Km∕h	
×	WHEEL	SPEED	LHR	}	20.7	Km∕h	
×	WHEEL	SPEED	LHF	1	21.0	Km∕h	
×	WHEEL	SPEED	RHR	ŀ	20.9	Km∕h	
							Ŧ
	FIX	PART	TOT	HELI	LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ► Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.

Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness, and terminals.

Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.

- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on right hand front tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

- 1. Turn the ignition OFF.
- 2. Check the pad and drum of the right hand front brake.
- 3. Is the condition of the brake normal?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of the vehicle.
- ▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

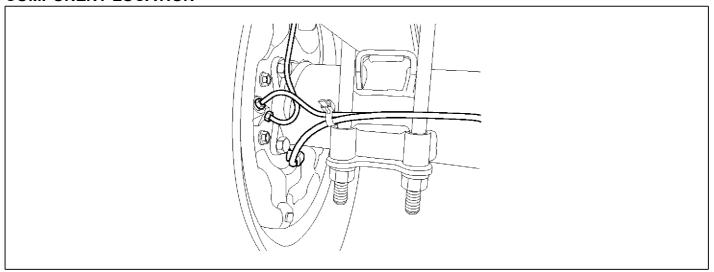
YES

► Go to the applicable DTC procedure.

NO

005B Sensor Left Hand Rear(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9048L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the rear left wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	g			•	Check air gap. Check bearing play
Enable Conditions	Ignition ON	Ignition ON				
Threshold Value	Vehicle speed >	Vehicle speed > 5.0 kph				
Diagnosis Time	Below 1,000 ms	Below 1,000 ms				Check tone ring for
Fail Safe	Fuel Cut	No		ABS function temp-		damage. Brake chatter.
	Fuel Limit	Yes		orarily disabled for concerned wheel.	or	
	MIL	Yes		oonocined which.		

_ <u></u>	
Air gap	0.2 ~ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	ν
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v _■
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km/h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed LHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

		1.	2. (URRENT	DATA	08/	22
							A
×	SENSO	R VOLT	AGE	RHF	0.8	V	
×	SENSO	R VOLT	AGE	LHR	4.7	v	
×	SENSO	R VOLT	AGE	LHF	0.0	v	
×	SENSO	R VOLT	AGE	RHR	0.7	v	
×	WHEEL	SPEED	RHI	F	21.0	Km∕h	
×	WHEEL	SPEED	LHE	3	20.7	Km∕h	
×	WHEEL	SPEED	LHE	ŗ	21.0	Km∕h	
×	WHEEL	SPEED	RHE	3	20.9	Km ∕h	
							Ŧ
	FIX	PART	TOI	HELI	P LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on left hand rear tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

- 1. Turn the ignition OFF.
- 2. Check the pad and drum of the left hand rear brake.
- 3. Is the condition of the brake normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of the vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

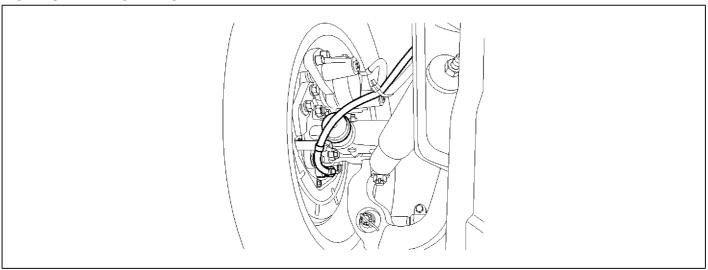
YES

▶ Go to the applicable DTC procedure.

NO

005C Sensor Left Hand Front(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9049L

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the front left wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	g			•	Check air gap.
Enable Conditions	Ignition ON				•	Check bearing play and tone ring run
Threshold Value	Vehicle speed >	Vehicle speed > 5.0 kph				out.
Diagnosis Time	Below 1,000 ms	Below 1,000 ms			•	Check tone ring for
Fail Safe	Fuel Cut	No		ABS function tem		damage. Brake chatter.
	Fuel Limit	Yes		orarily disabled for concerned wheel	rarily disabled for	
	MIL	Yes		Torrocttica wileer		

Air gap	0.2 ∼ 1.7 mm

Brake System

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I)ATA	08/22
			A
×	SENSOR VOLTAGE RHF	4.2	v
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v _
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km∕h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed LHF" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2	. CUR	RENT	DATA	08/	22
						•
×	SENSOR VOLTA	ige Rh	F	0.8	V	
×	SENSOR VOLTA	AGE LH	R	4.7	v	
×	SENSOR VOLTA	AGE LH	F	0.0	v	
×	SENSOR VOLTA	AGE RH	R	0.7	v	
×	WHEEL SPEED	RHF		21.0	Km∕h	
×	WHEEL SPEED	LHR		20.7	Km∕h	
×	WHEEL SPEED	LHF		21.0	Km∕h	
×	WHEEL SPEED	RHR		20.9	Km∕h	
						Ŧ
	FIX PART	TOT	HELF	LINE	REC	

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between left hand front tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on left hand front tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

- 1. Turn the ignition OFF.
- 2. Check the pad and drum of the left hand front brake.
- 3. Is the condition of the brake normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of the vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

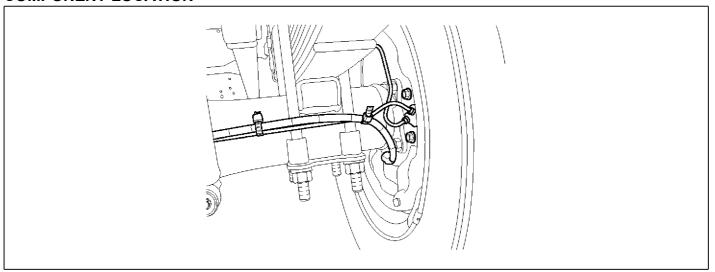
YES

▶ Go to the applicable DTC procedure.

NO

005D Sensor Right Hand Rear(Signal Disturbed)

COMPONENT LOCATION



SUDWAB9050I

GENERAL DESCRIPTION

The wheel sensor is crucial for HECU to calculate the speed of the vehicle and determine whether the wheel is in 'Lock' mode or not. For example, in case of a front-wheel drive vehicle, the signal of the rear wheel speed is used as a reference value for the speed of the vehicle. If there occurs the difference in speed between the front and rear wheels, ABS control is performed. The wheel sensor creates a sine curve based on the magnetic field created by the permanent magnet inside the sensor when the tone wheel rotates. The frequency and the AC voltage change by a certain ratio depending on the wheel speed, and HECU determines the speed of the vehicle by calculating the frequency of the signal.

DTC DESCRIPTION

If the sensor output voltage becomes too low because of larger air gap on the rear right wheel sensor or the ABS control status changes abnormally due to too much vibration or noise in the brake, HECU determines it as a failure and outputs a fail code.

DTC DETECTING CONDITION

Item	Detecting Condition					Possible Cause
DTC Strategy	Signal monitoring	Signal monitoring Ignition ON				
Enable Conditions	Ignition ON					
Threshold Value	.Vehicle speed > 5.0 kph Below 1,000 ms				-	and tone ring run out. Check tone ring for
Diagnosis Time						
Fail Safe	Fuel Cut	No		ABS function temp-	- • в	damage. Brake chatter.
	Fuel Limit	Yes		orarily disabled for concerned wheel.		
	MIL	Yes		Concerned wheel.		

Air gap	0.2 ∼ 1.7 mm

MONITOR SCAN TOOL DATA

- 1. Start the engine.
- 2. Connect the scan tool to the self-diagnosis connector. Select the service data.
- 3. Drive the vehicle straight at a constant speed in the normal road surface.

	1.2. CURRENT I	DATA	08/22
			•
×	SENSOR VOLTAGE RHF	4.2	ν
×	SENSOR VOLTAGE LHR	0.6	v
×	SENSOR VOLTAGE LHF	0.6	v _■
×	SENSOR VOLTAGE RHR	1.2	v -
×	WHEEL SPEED RHF	10.6	Km/h
×	WHEEL SPEED LHR	10.6	Km∕h
×	WHEEL SPEED LHF	10.8	Km/h
×	WHEEL SPEED RHR	10.6	Km∕h
			▼
	FIX PART TOT HELP	LINE	REC

- 4. Monitor the data "Wheel speed RHR" parameter on the scan tool.
 - Specification: Normal if its speed is nearly in accordance with the speed in the gauge.

	1.2. CURRENT I	DATA	08/22
			A
×	SENSOR VOLTAGE RHF	0.8	v
×	SENSOR VOLTAGE LHR	4.7	V
×	SENSOR VOLTAGE LHF	0.0	v 📗
×	SENSOR VOLTAGE RHR	0.7	v
×	WHEEL SPEED RHF	21.0	Km/h
×	WHEEL SPEED LHR	20.7	Km∕h
×	WHEEL SPEED LHF	21.0	Km/h
×	WHEEL SPEED RHR	20.9	Km∕h
			₩
	FIX PART TOT HELP	LINE	REC

SUDWAB9008L

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Signal Circuit Inspection" procedure.

COMPONENT INSPECTION

Sensor Air Gap Inspection

- 1. Turn the ignition OFF.
- 2. Check the air gap between right hand rear tone wheel and wheel sensor with a thickness gauge.
 - Specification: 0.2~1.7 mm
- 3. Is the value measured within specification?

YES

Go to next procedure.

NO

- ▶ Repair it after checking wheel sensor installation condition and go to "Verification of Vehicle Repair" procedure.
- ▶ Repair or replace it after checking the condition of rotor and wheel bearing and go to "Verification of Vehicle Repair" procedure.
- ▶ Adjust it after checking the air gap between wheel sensor and rotor and go to "Verification of Vehicle

5. Is the data measured within specification?

YES

- ▶ There may be the poor contact of wheel sensor circuit or a past trouble which did not erase the memory of HECU after having repaired. Totally check the connector for looseness, poor contact, bent, corrosion, contamination, deformation, or damage.
- ► Repair or replace it if necessary and go to "Verification of Vehicle Repair" procedure.

NO

► Go to "Terminal & Connector Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION

- 1. Many malfunctions in the electrical system are caused by poor harness, and terminals.
 - Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
- 2. Thoroughly check connectors for looseness, poor connection, bent, corrosion, contamination, deterioration, or damage.
- 3. Has a problem been found?



Repair" procedure.

Check Number of Teeth on Tone Ring

- 1. Turn the ignition OFF.
- 2. Check the number of teeth on right hand rear tone ring.
- 3. Is the number of teeth normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of vehicle.
- ▶ If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

Check Brake Chatter

- 1. Turn the ignition OFF.
- 2. Check the pad and drum of the right hand rear brake.
- 3. Is the condition of the brake normal?

YES

► Go to "Verification of Vehicle Repair" procedure.

NO

- ▶ Repair it or replace with known-good one and check the condition of the vehicle.
- ► If normal, replace with new one. And go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

- 1. Connect the scan tool and perform the self diagnosis. Check diagnostic trouble codes.
- 2. Clear the diagnostic trouble codes (DTCs) stored in the ECM by using the scan tool.
- 3. Drive the vehicle under conditions noted in failure records.
- 4. Check that there are any DTCs by performing self diagnosis with the scan tool.
- 5. Did the DTC return?

YES

▶ Go to the applicable DTC procedure.

NO