

Brake System



Specifications

Item		Specification	
Master cylinder	Type	Tandem	
	Cylinder I.D.	23.81mm (0.94in)	
	Piston stroke	43±1mm (1.69±0.039in)	
	Fluid level switch	Provided	
Brake booster	Type	7" + 8" Tandem	
	Boosting ratio	9 : 1	
Front Disc brake	Caliper Type	General Disc Brake	Brembo Disc Brake
	Type	Ventilated disc	Ventilated disc
	Disc O.D	320mm(12.60in)	340mm(13.39in)
	Disc thickness	28mm(1.10in)	28mm(1.10in)
	Caliper piston	Single	4piston
	Cylinder I.D	Φ60mm(2.36in)	Φ(42mm+42mm(1.65in+1.65in))X2
Rear Disc brake	Caliper Type	General Disc Brake	Brembo Disc Brake
	Type	Solid disc	Ventilated disc
	Disc O.D	314mm(12.36in)	330mm(12.99in)
	Disc thickness	13mm(0.51in)	20mm(0.79in)
	Caliper piston	Single	4piston
	Cylinder I.D	Φ42.9mm(1.69in)	Φ(32mm+28mm(1.26in+1.10in))X2
Parking brake	Type	DIH (Drum in hat)	
	Drum I.D.	Ø 190mm (7.48in)	

NOTICE

O.D. : Outer Diameter

I.D : Inner Diameter

Specification (ESC)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESC)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16V	
	Operating Temperature	-40 ~ 120°C(-40 ~ 248°F)	
	Motor power	270W	
Warning lamp	Min. Operating Voltage	12V	

	Max. Current consumption	Max. 200mA	
Active Wheel speed sensor	Supply voltage	DC 4.5 ~ 20V	
	Output current low	5.9 ~ 8.4mA	
	Output current high	11.8~ 16.8mA	
	Output range	1 ~ 2500Hz	
	Tone wheel	Front : 46 teeth Rear : 47 teeth	
	Air gap	0.5 ~ 1.5mm	
Steering Wheel Angle Sensor	Operating Voltage	8 ~ 16V	
	Current consumption	Max. 100mA	
	Output measurement range	-780 ~ +799.9°	
	Operating Angular velocity	1500°/sec	
Yaw rate & Lateral G sensor (CAN TYPE)	Operating Voltage	8 V ~ 17V	
	Current Consumption	Max. 140mA	
	Yaw rate sensor measurement range	-75 ~ 75°/sec	
	Lateral G sensor measurement range	-1.5 ~ 1.5gN	

Service Standard

Items		Standard vale	
Brake pedal stroke		AT : 132.1mm (5.20in) MT : 132.9mm (5.23in)	
Stop lamp clearance		1.0 ~ 1.5mm (0.04 ~ 0.06in)	
Brake pedal free play		3 ~ 8 mm (0.12 ~ 0.13in)	
Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force)		5 Notch	
Front brake disc	disc thickness	General	28mm(1.10in)
		Brembo	28mm(1.10in)
	pad thickness	General	11mm(0.43in)
		Brembo	8.5mm(0.33in)
Rear brake disc	disc thickness	General	13mm(0.51in)
		Brembo	20mm(0.79in)
	pad thickness	General	9mm(0.35in)
		Brembo	9.1mm(0.36in)

Tightening Torques

--	--	--	--

Items	N.m	kgf.m	lb-ft
Master cylinder to brake booster	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake booster mounting nuts	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6
Air bleeding screw	General 6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
	Brembo 16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Brake tube flare nuts	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Front caliper guide rod bolts	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Rear caliper guide rod bolts	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Front caliper assembly to knuckle	General 78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
	Brembo 88.3 ~ 103.0	9.0 ~ 10.5	65.1 ~ 75.9
Rear caliper assembly to knuckle	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member bracket bolts	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6
Brake pedal shaft nut	8.8 ~ 13.7	0.9 ~ 1.4	6.5 ~ 10.1
Stop lamp switch lock nut	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
HECU bracket mounting bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Yaw rate&G sensor mounting bolts	7.8 ~ 10.8	0.8 ~ 1.1	5.8 ~ 8.0

Lubricants

Items	Recommended	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and bolt	Chassis grease	As required
Parking brake shoe and backing plate contacting surface	Heat resistance grease	As required
Front caliper guide rod and boot	AI-11P	1.2 ~ 1.7g
Rear caliper guide rod and boot	AI-11P	0.8 ~ 1.3g

Brake System



Special Service Tools

Tool (Number and Name)	Illustration	Use
09581-11000 Piston expander		Spreading the front disc brake piston



Brake System



Troubleshooting

Problem Symptoms Table

Use the table below to help you find the cause of the problem. The numbers indicate the priority of the like cause of the problem. Check each part in order. If necessary, replace these parts.

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	<ol style="list-style-type: none"> 1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance (Out of adjustment) 5. Master cylinder (Inoperative) 	repair air-bleed replace adjust replace
Brake drag	<ol style="list-style-type: none"> 1. Brake pedal free play (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance (Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Inoperative) 9. Booster system (Vacuum leaks) 10. Master cylinder (Inoperative) 	adjust adjust repair adjust replace replace replace replace replace repair replace
Brake pull	<ol style="list-style-type: none"> 1. Piston (Sticking) 2. Pad or lining (Oily) 3. Piston (Frozen) 4. Disc (Scored) 5. Pad or lining (Cracked or distorted) 	replace replace replace replace replace
	<ol style="list-style-type: none"> 1. Brake system (Fluid leaks) 2. Brake system (Air in) 	repair air-bleed

Hard pedal but brake inefficient	<ol style="list-style-type: none"> 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks) 	<p>replace</p> <p>replace</p> <p>adjust</p> <p>adjust</p> <p>replace</p> <p>replace</p> <p>repair</p>
Noise from brake	<ol style="list-style-type: none"> 1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage) 	<p>replace</p> <p>adjust</p> <p>replace</p> <p>replace</p> <p>clean</p> <p>replace</p> <p>replace</p> <p>replace</p> <p>replace</p>
Brake fades	<ol style="list-style-type: none"> 1. master cylinder 	<p>replace</p>
Brake vibration, pulsation	<ol style="list-style-type: none"> 1. brake booster 2. pedal free play 3. master cylinder 4. caliper 5. master cylinder cap seal 6. damaged brake lines 	<p>replace</p> <p>adjust</p> <p>replace</p> <p>replace</p> <p>replace</p>
Brake Chatter	<p>Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.</p>	

Brake System



Operation and Leakage Check

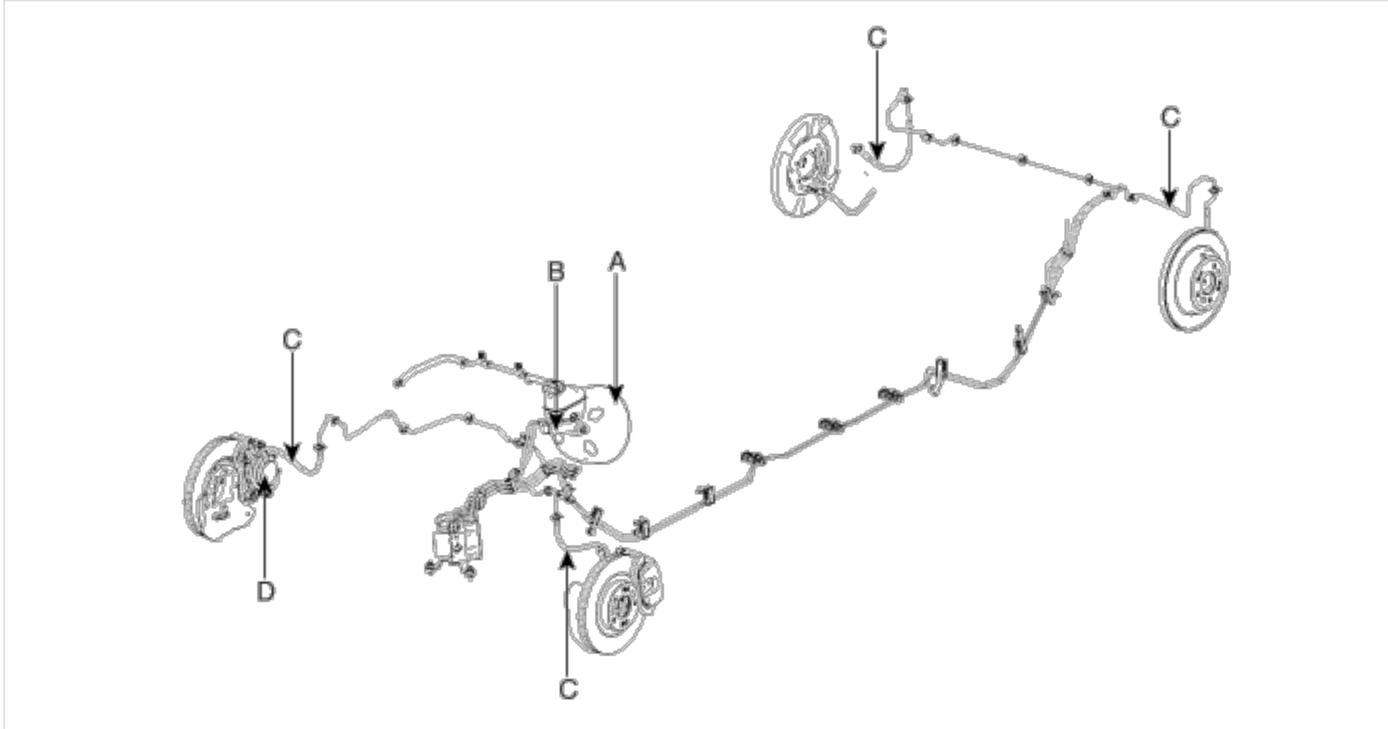
Check all of the following items

Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	<ul style="list-style-type: none"> • Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. Replace the master cylinder as an assembly if the pedal does not work properly or if there is damage or signs of fluid leakage. • Check for a difference in brake pedal stroke between quick and slow brake applications. Replace the master cylinder if there is a difference in pedal stroke.
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.

Caliper piston seal and piston boots (D)

Check brake operation by applying the brakes.

Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.



Brake System Bleeding

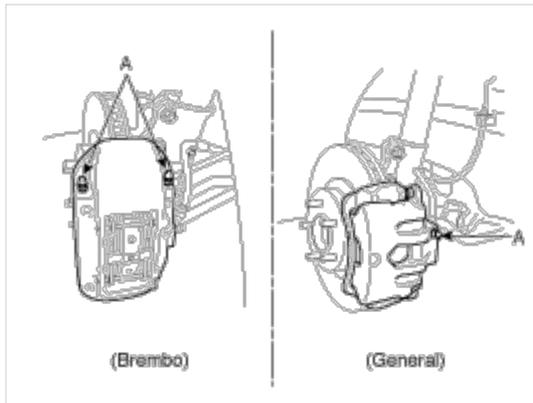
⚠ CAUTION

- Do not reuse the drained fluid.
- Always use genuine DOT3/DOT4 brake Fluid.
Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
- The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.

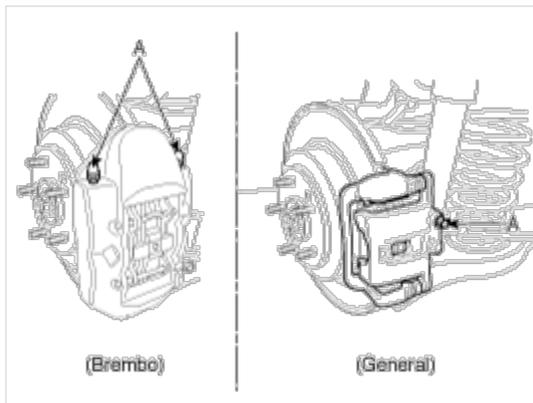
1. Make sure the brake fluid in the reservoir is at the MAX(upper) level line.

2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

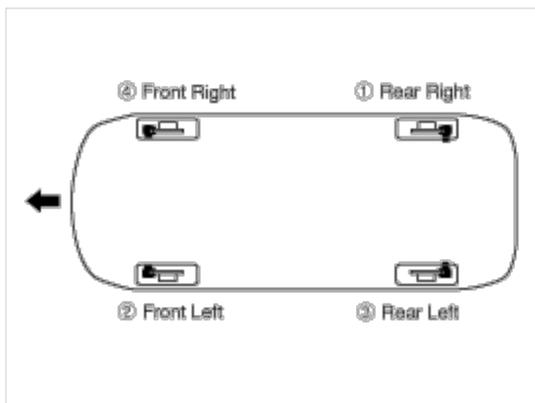
Front



Rear



4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.

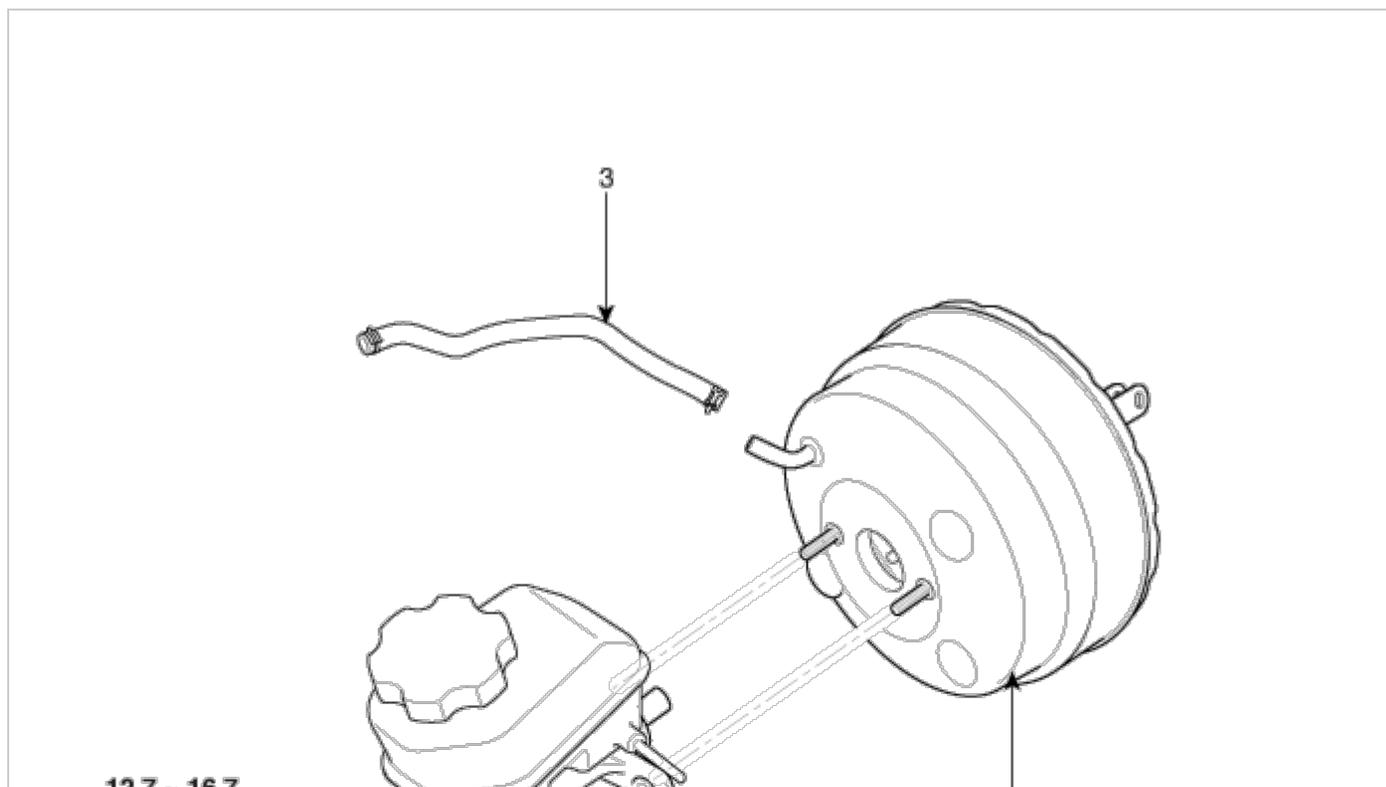


5. Refill the master cylinder reservoir to MAX(upper) level line.

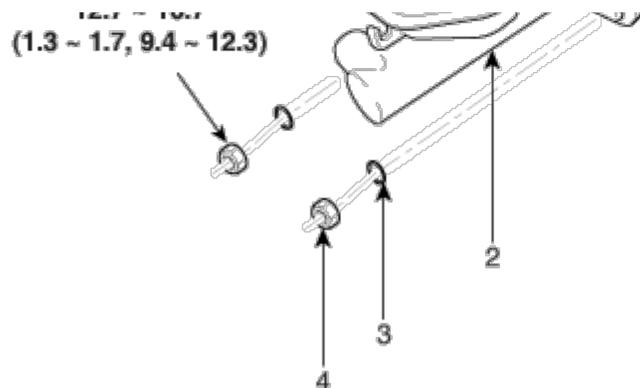
Brake System



Components



127 - 167



Torque : N.m (kgf.m, lb-ft)

1. Brake booster
2. Master cylinder assembly
3. Washer

4. Nut
5. Vacuum hose

Brake System



Installation

1. Installation is the reverse of removal.

CAUTION

- Before installing the pin, apply the grease to the joint pin.
- Use a new snap pin whenever installing.

2. After installing, bleed the brake system.
(Refer to Brake system bleeding)
3. Adjust the brake pedal height and free play.
(Refer to Brake pedal height and free play adjustment)

Brake System



Description

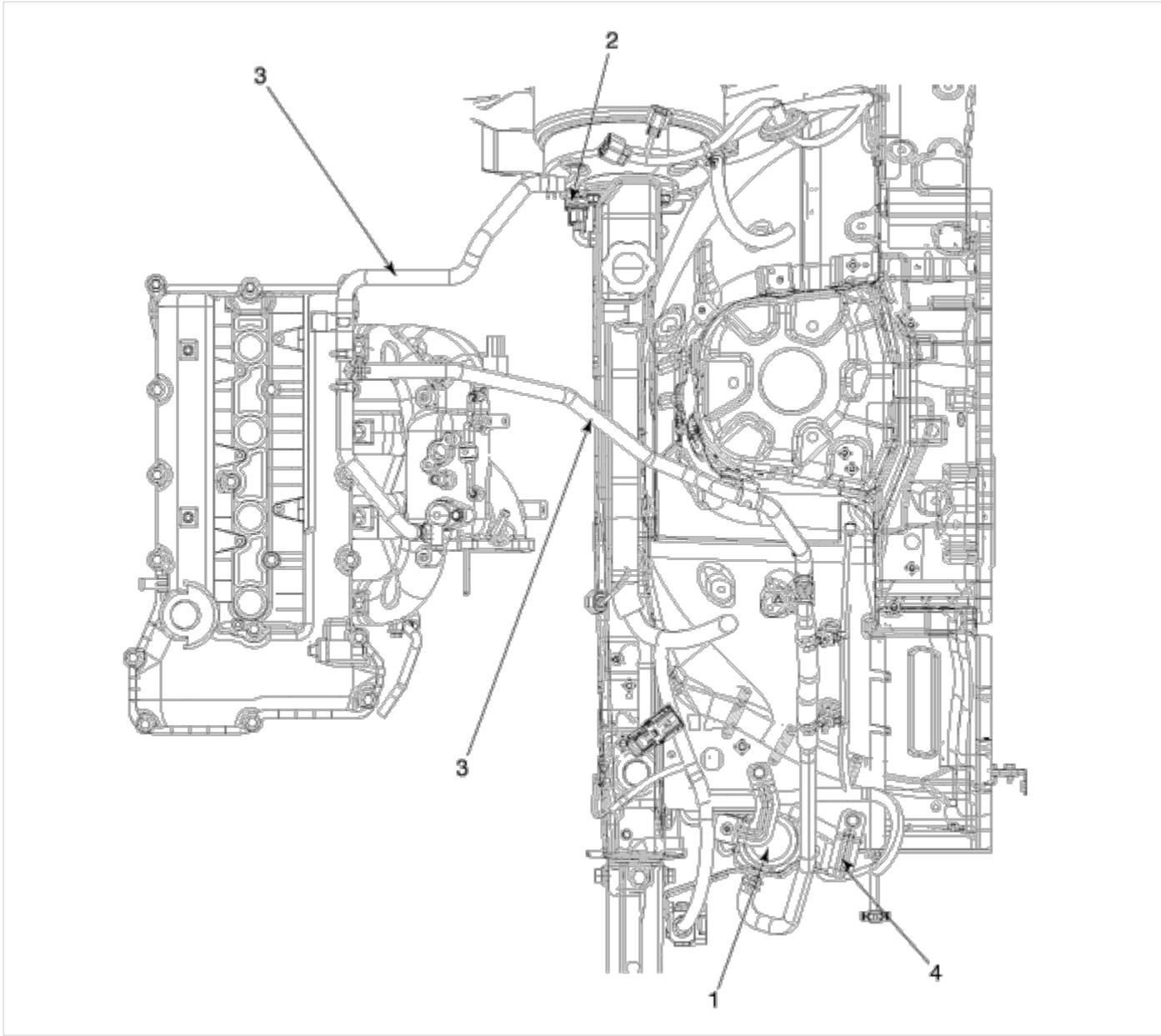
The Vacuum Pump System is set up in a vehicle in order to make the vacuum enough when a driver presses the brake pedal on the high ground. To operate this system, the vacuum pump is installed on a vehicle.

If the vacuum is not sufficient to press the brake pedal, the HECU senses it through the vacuum switch, which is installed on booster. And then the HECU supplies the power to the vacuum pump by grounding the circuit of the vacuum pump relay. When the vacuum pump is supplied with electric power, it makes the vacuum and supplements it to the booster.

Brake System



Components



1. Vacuum pump
2. Vacuum switch

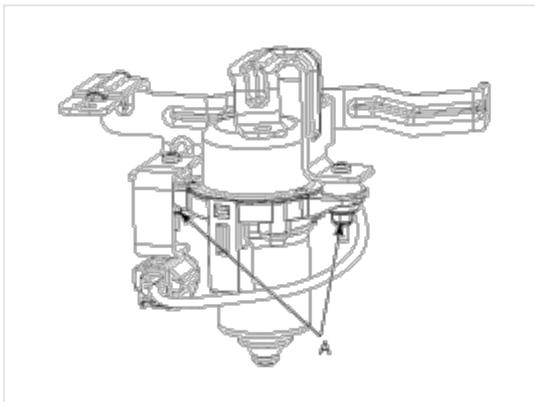
3. Vacuum hose
4. Vacuum pump bracket

Brake System

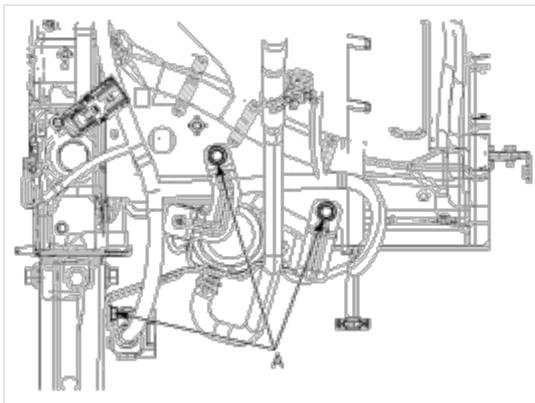


Installation

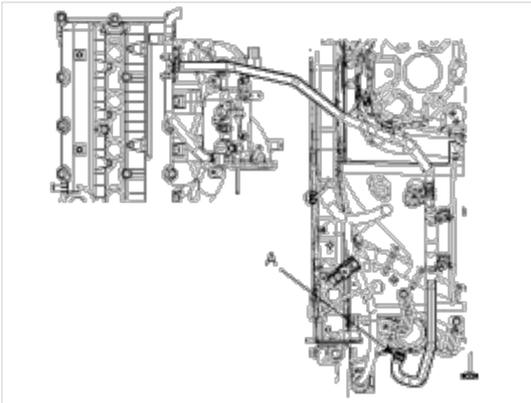
1. Install the Vacuum pump to the bracket.



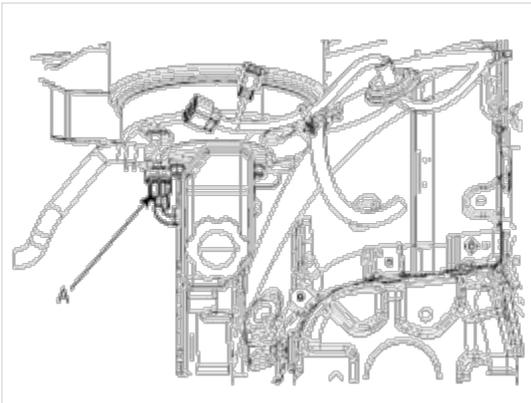
2. Install the Vacuum pump & bracket bolt.



3. Install the Vacuum hose.



4. Connect the Vacuum pump connector.

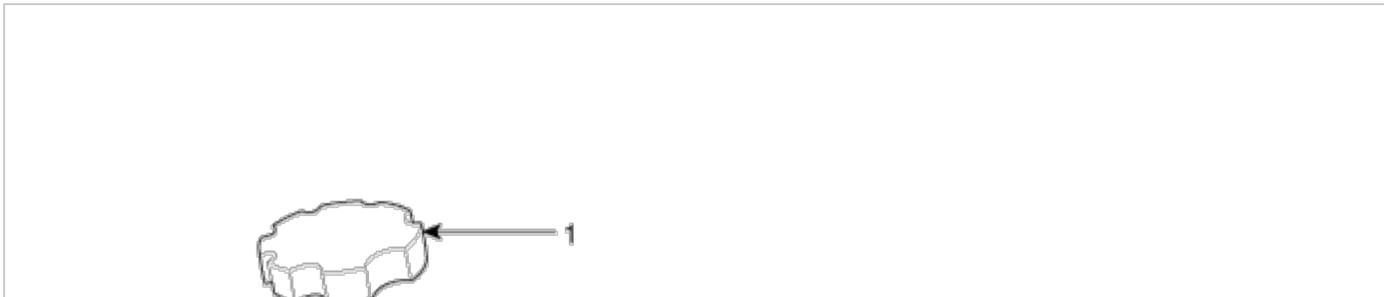


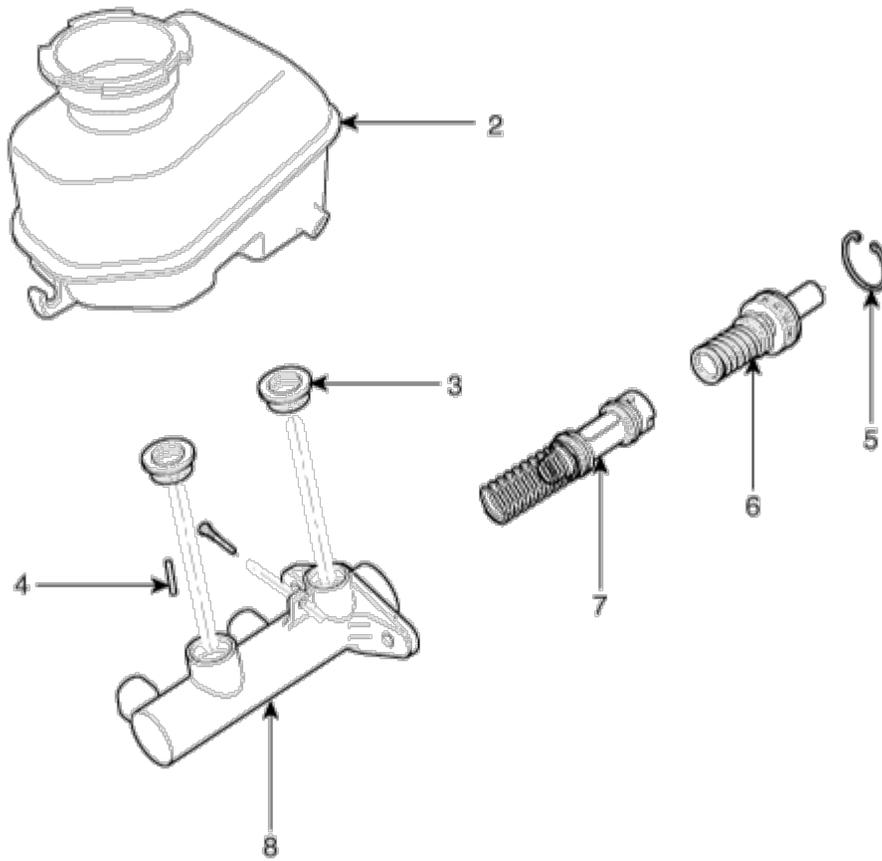
5. Install the front bumper cover.
(Refer to Body group - "Bumper")

Brake System



Components





1. Reservoir cap
2. Reservoir
3. Grommet
4. Cylinder pin

5. Retainer
6. Primary piston assembly
7. Secondary piston assembly
8. Master cylinder body



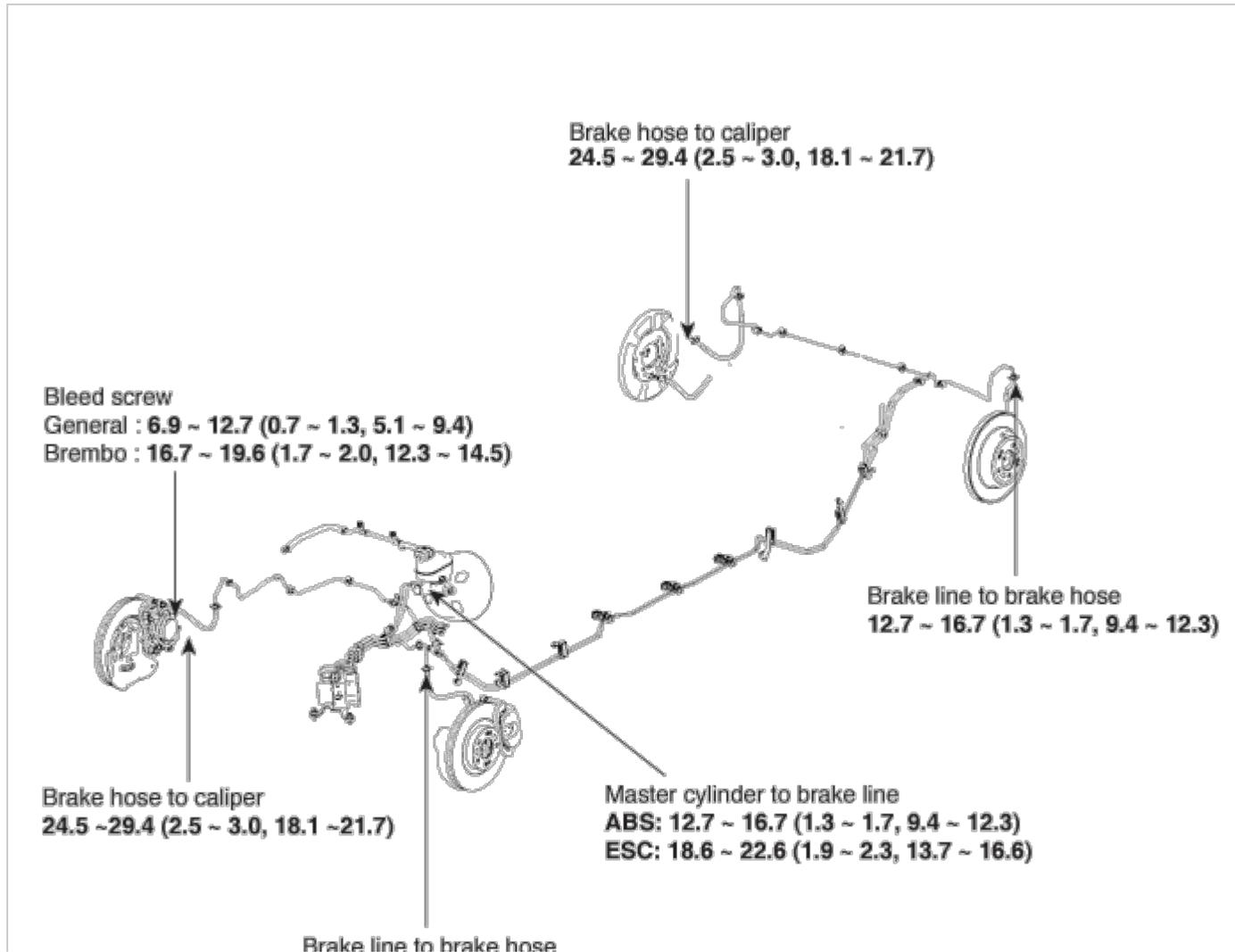
Installation

1. Installation is the reverse of removal.
2. After installation, bleed the brake system.
(Refer to Brake system bleeding)

Brake System



Components



12.7 ~ 16.7 (1.3 ~ 1.7, 9.4 ~ 12.3)

Torque : Nm (kgf.m, lb-ft)

▲ WARNING

When installing brake hose, be sure to comply with the torque specification to prevent twisted hose.

Brake System

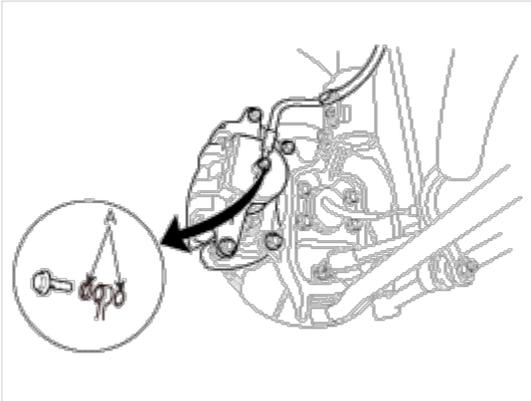


Installation

1. Installation is the reverse of removal.

▲ CAUTION

Use a new washer (A) whenever installing.



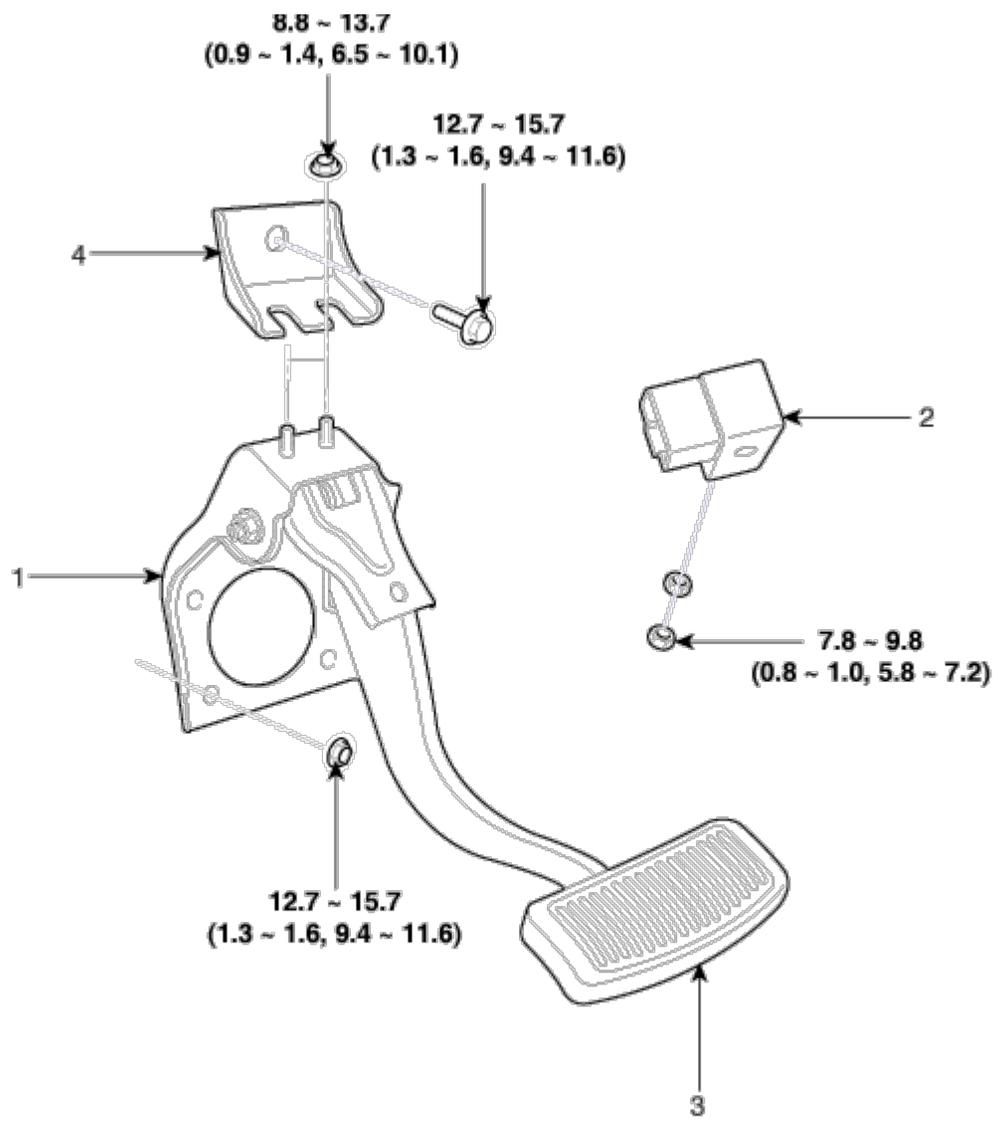
2. After installation, bleed the brake system.
(Refer to Brake system bleeding)
3. Check the spilled brake oil.

Brake System



Components





Torque : N.m (kgf.m, lb-ft)

1. Brake pedal member assembly
2. Stop lamp switch

3. Brake pedal
4. Brake bracket

Brake System



Installation

1. Installation is the reverse of removal.

CAUTION

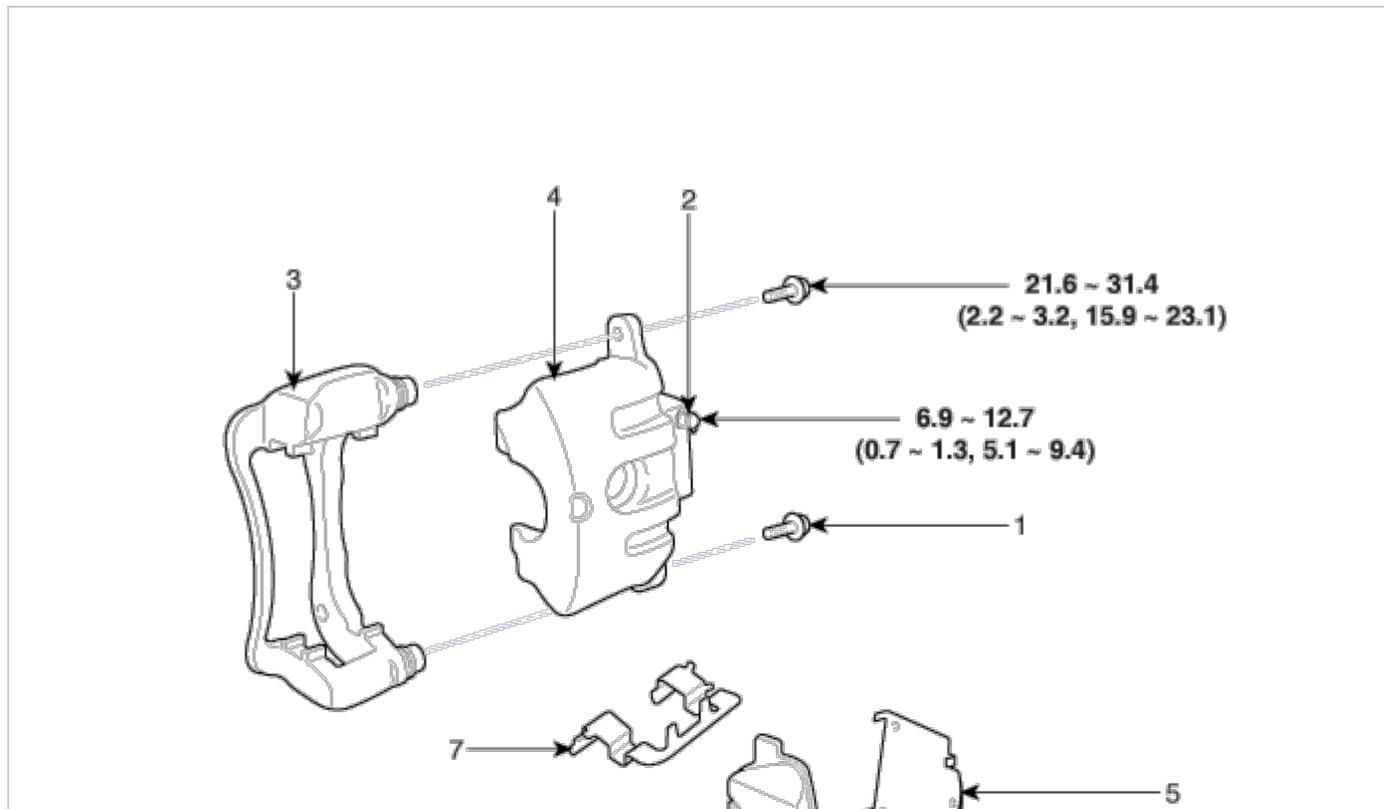
- Before installing the pin, apply the grease to the clevis pin.
- Use a new snap pin whenever installing.

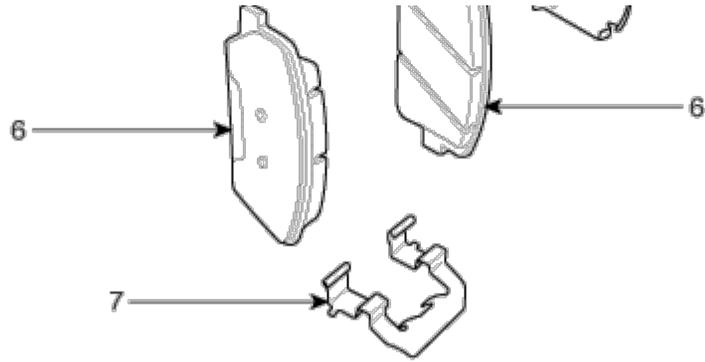
2. Check the brake pedal operation.

Brake System



Components (1)

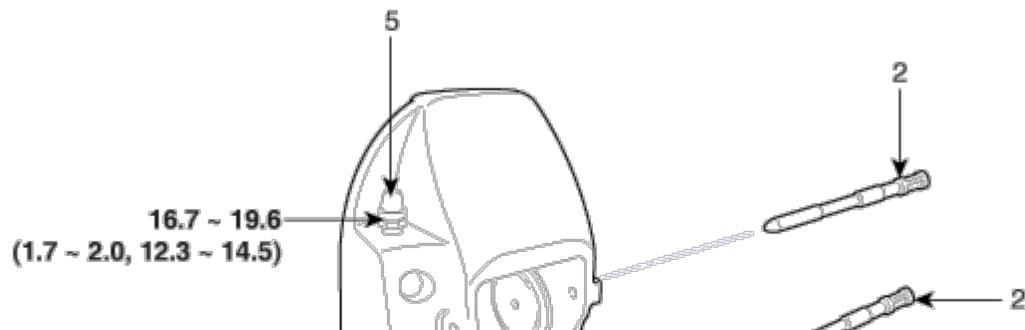


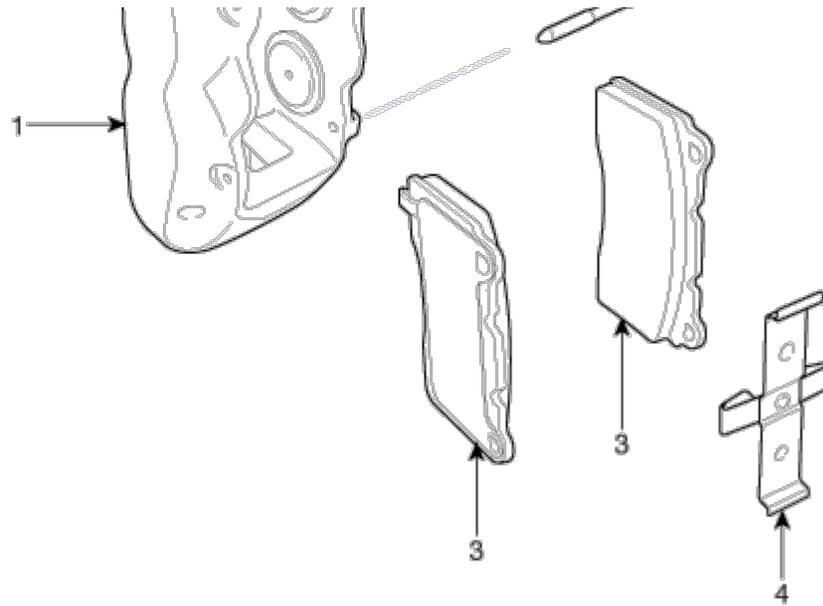


Torque : N.m (kgf.m, lb-ft)

- | | |
|--------------------|-------------------|
| 1. Guide rod bolt | 5. Inner pad shim |
| 2. Bleed screw | 6. Brake pad |
| 3. Caliper bracket | 7. Pad retainer |
| 4. Caliper body | |

Components (2)





Torque : N.m (kgf.m, lb-ft)

1. Caliper body
2. Guide pin
3. Brake pad

4. Retraction spring
5. Bleed screw

Brake System



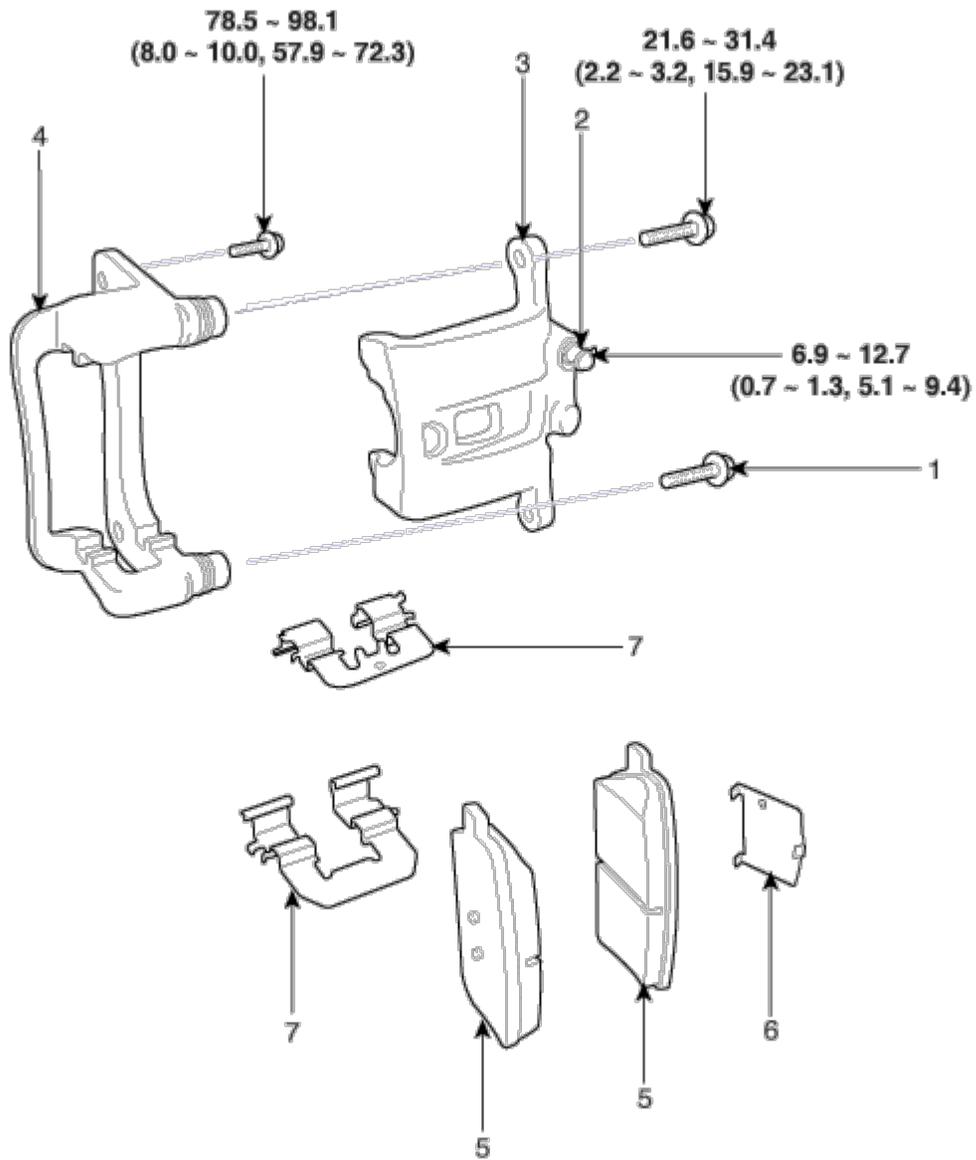
Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system.
(Refer to Brake system bleeding)

Brake System



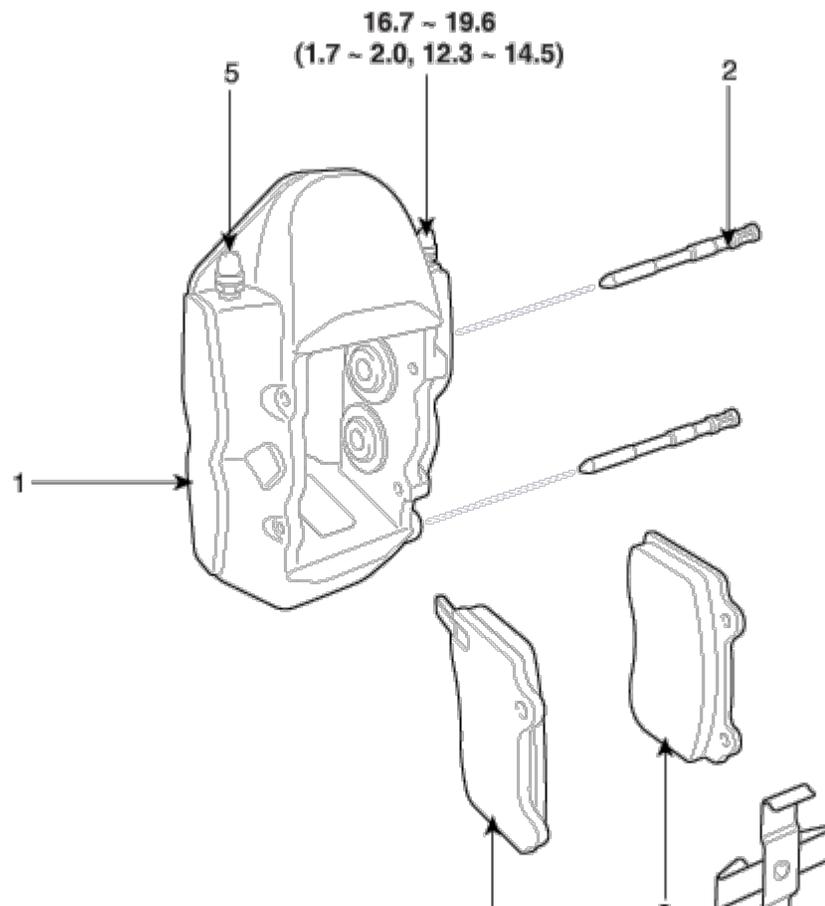
Components (1)



Torque : N.m (kgf.m, lb-ft)

1. Guide rod bolt
2. Bleed screw
3. Caliper body
4. Caliper bracket

5. Inner pad shim
6. Brake pad
7. Pad retainer

Components (2)



Torque : N.m (kgf.m, lb-ft)

1. Caliper body
2. Guide pin
3. Brake pad

4. Retraction spring
5. Bleed screw

Brake System



Installation

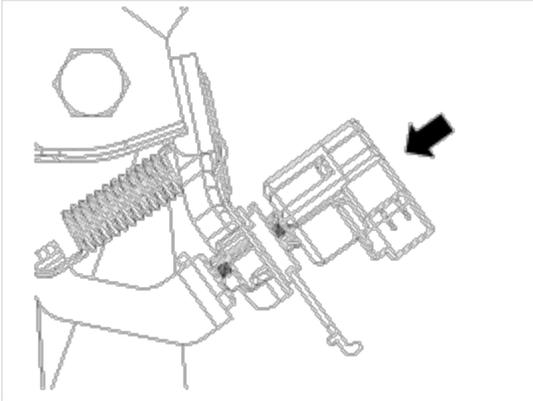
1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.
3. After installation, bleed the brake system.
(Refer to Brake system bleeding)

Brake System

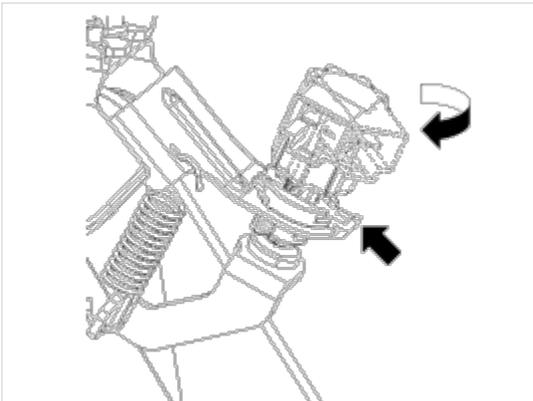


Installation

1. Fix the brake pedal arm and insert fully the stop lamp switch as hiding contact part.

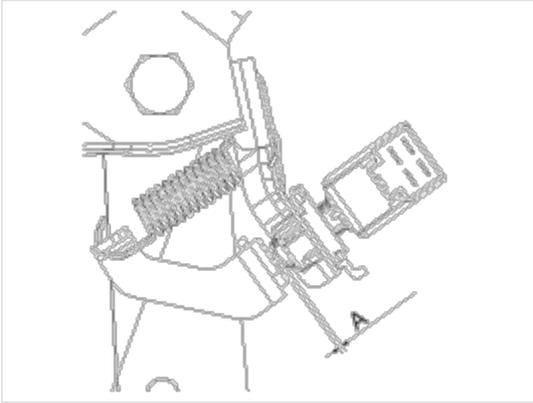


2. After inserting, turn the stop switch (A) 45° clockwise, and then assemble locking plate (B) by pushing.



3. Confirm the gap between stop lamp switch and bracket.

Stop lamp clearance :1.0 ~ 2.0 mm (0.04~ 0.08 in.)

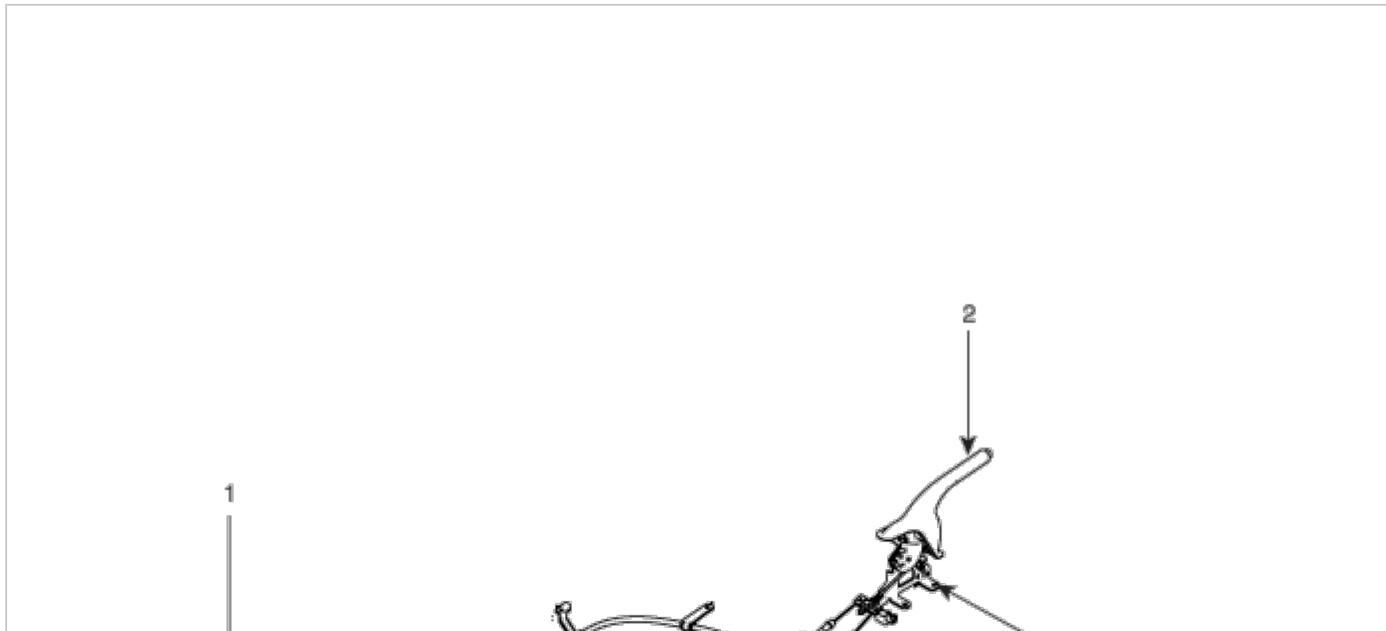


4. Connect the stop lamp switch connector.

NOTICE

If the gap between stop lamp switch and bracket is not 1.0 ~ 2.0mm(0.04~ 0.08in), perform the above process again.

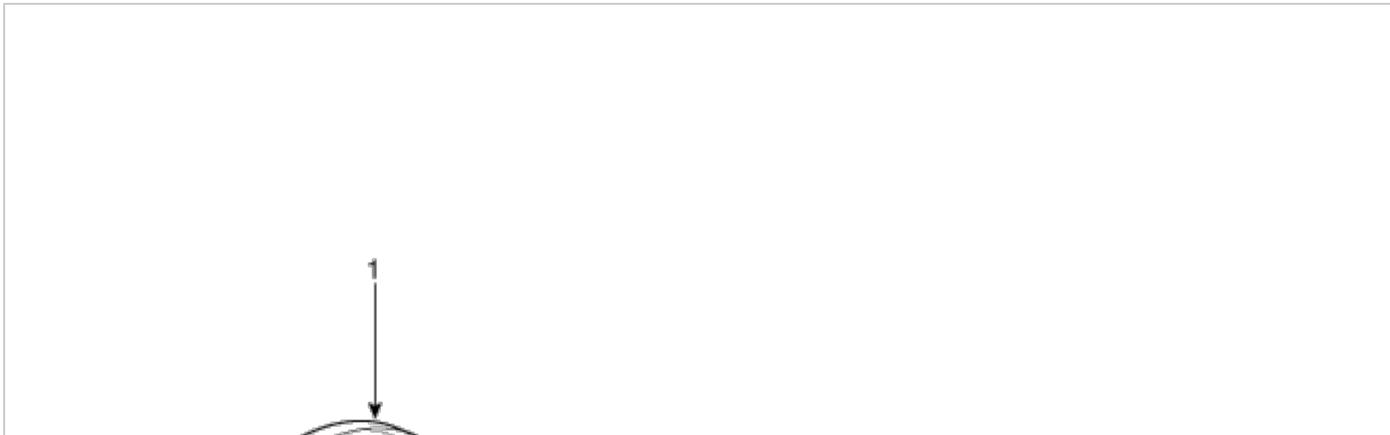
5. Install the lower crash pad.
(Refer to the Body - "Crash Pad")

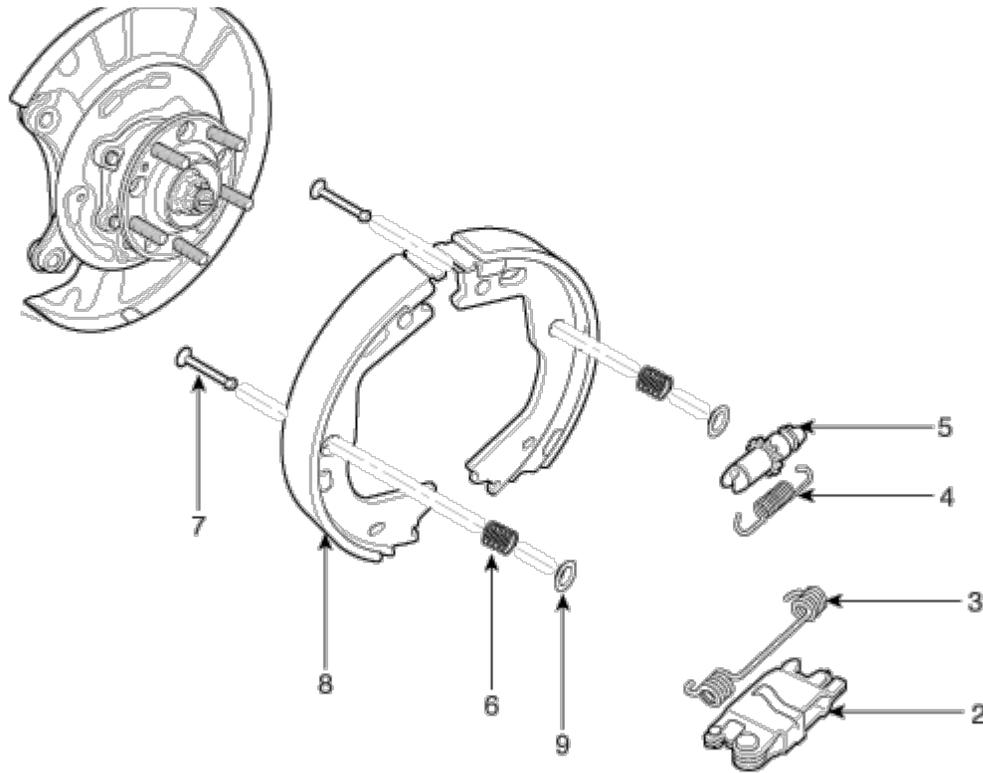
Brake System**Components (1)**



- | | |
|------------------------|-------------------------|
| 1. Rear parking brake | 3. Parking brake switch |
| 2. Parking brake lever | 4. Parking brake cable |

Components (2)





1. Backing plate
2. Operating lever
3. Upper spring

4. Lower spring
5. Adjuster
6. Shoe hold down spring

7. Shoe hold down pin
8. Parking brake shoe
9. Cup washer

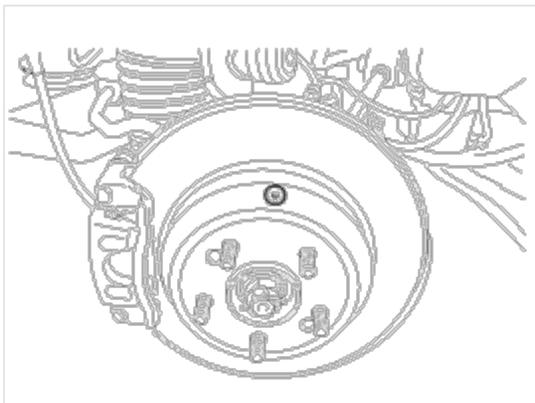
Brake System



Adjustment

Parking Brake Shoe Clearance Adjustment

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.



4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 5 notches in the opposite direction.
5. Install the plug on disc and then rear wheel & tire.

Parking Brake Lever Stroke Adjustment

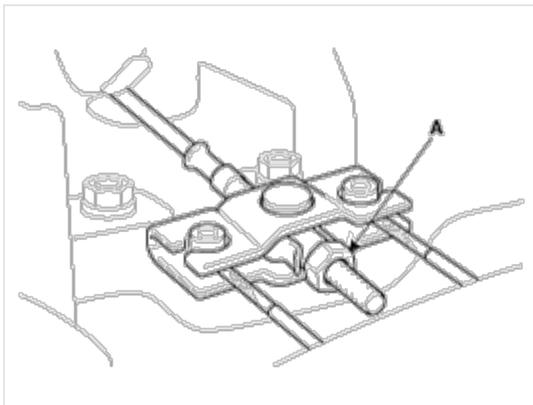
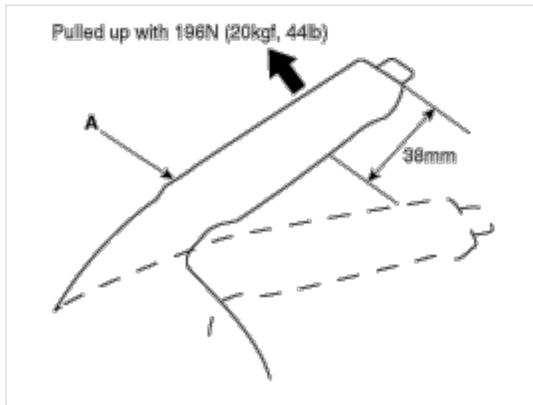
1. Raise the vehicle, and make sure it is securely supported.
2. Remove the floor console.
(Refer to Body group - "Floor console")
3. Adjust the parking brake lever stroke by turning adjusting nut (A).

Parking brake lever stroke :

5 clics (Pull the lever with 20kg)

NOTICE

After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke. (Refer to "Parking brake shoe installation")



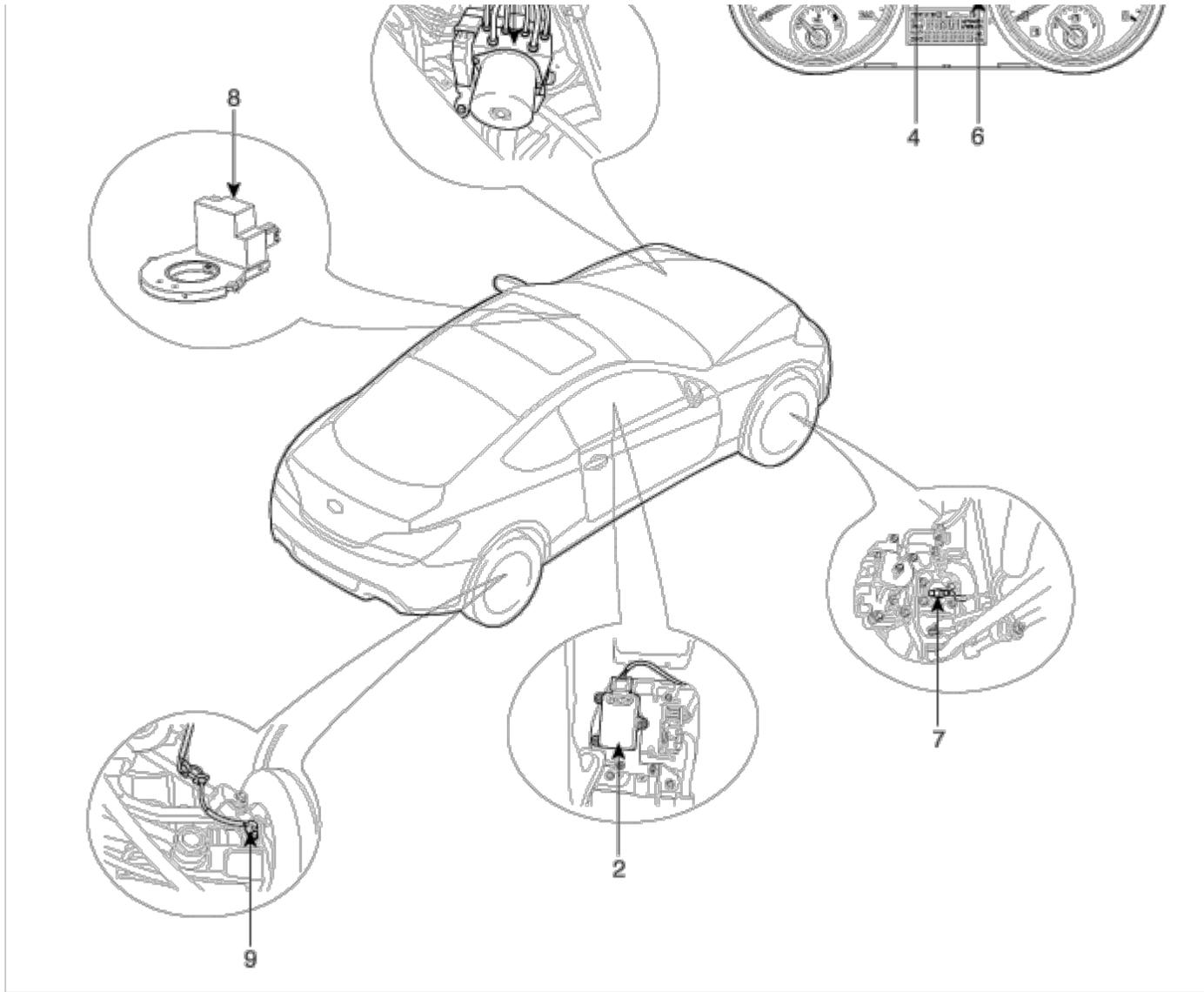
4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Install the floor console.
(Refer to Body group - "Floor console")

Brake System



Components





- 1. HECU module
- 2. Yaw rate & Lateral G sensor
- 3. Parking brake/EBD warning lamp
- 4. ABS warning lamp
- 5. ESC function / warning lamp

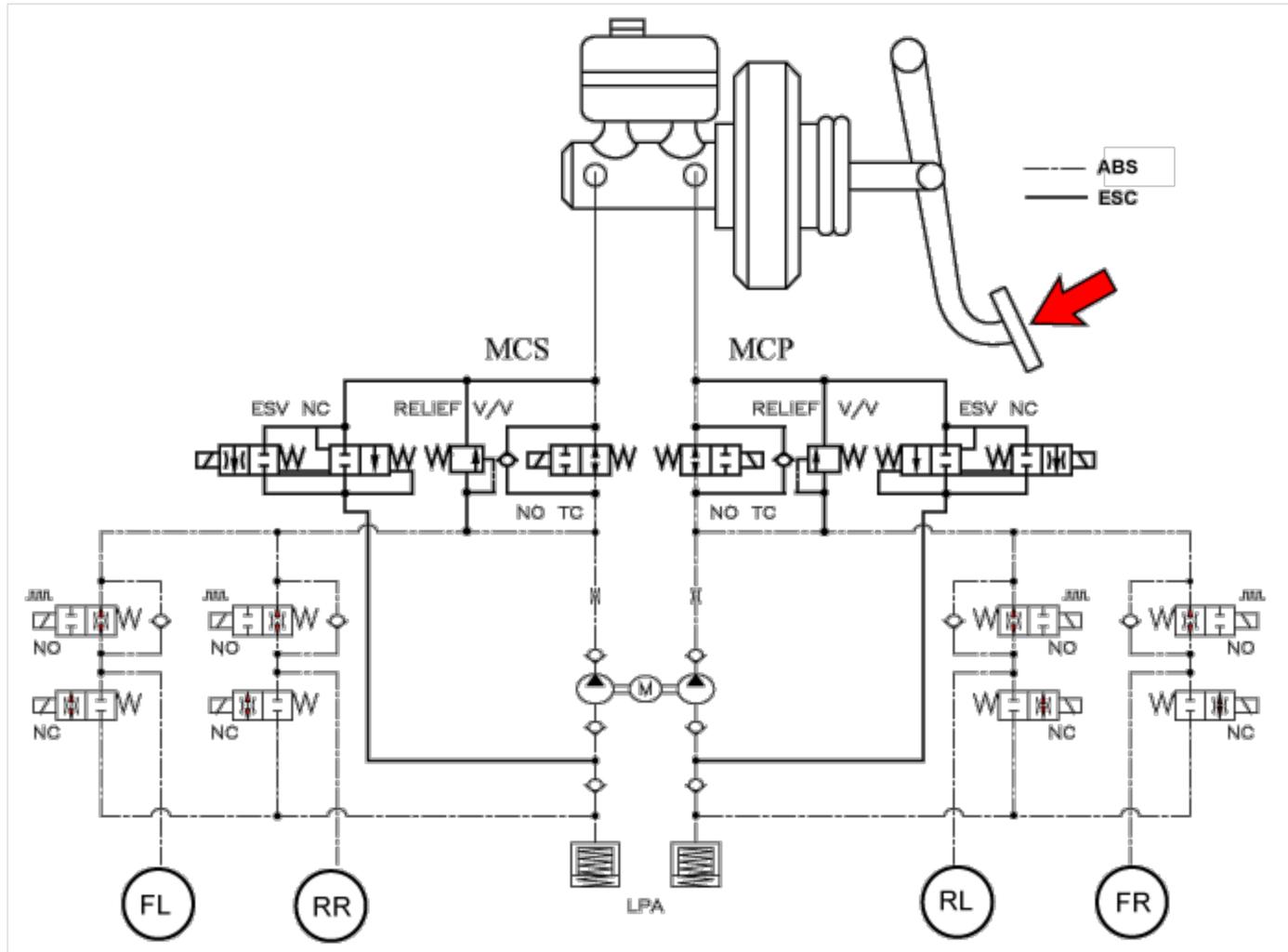
- 6. ESC OFF warning lamp
- 7. Front wheel speed sensor
- 8. Steering angle sensor
- 9. Rear wheel speed sensor

Brake System



ESC Operation mode

ESC Hydraulic system diagram



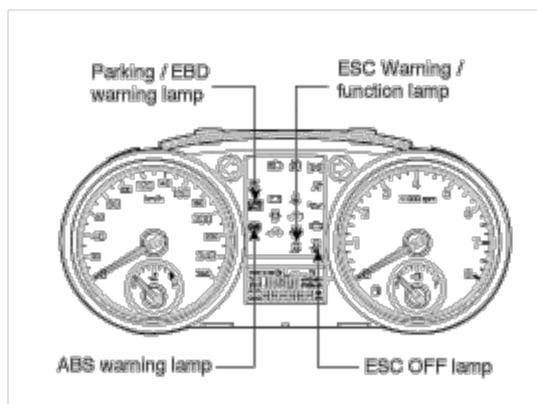
1. ESC Non-operation : Normal braking.

Solenoid valve	Continuity	Valve	Motor pump	TC Valve

IN (NO)	OFF	OPEN	OFF	OFF
OUT (NC)	OFF	CLOSE		

2. ESC operation

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



ABS Warning lamp module

The active ABS warning lamp module indicates the self-test and failure status of the ABS. The ABS warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ABS functions by failure.
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

EBD/Parking brake warning lamp module

The active EBD warning lamp module indicates the self-test and failure status of the EBD. However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions. The EBD warning lamp shall be on:

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.

- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is separated from ECU.

ESC Warning lamp (ESC system)

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

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

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESC functions by failure.
- When driver trun off the ESC function by on/off switch.
- During diagnostic mode.

ESC Function lamp (ESC system)

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

The ESC Function lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the ESC control is operating. (Blinking - 2Hz)

ESC On/Off switch (ESC system)

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

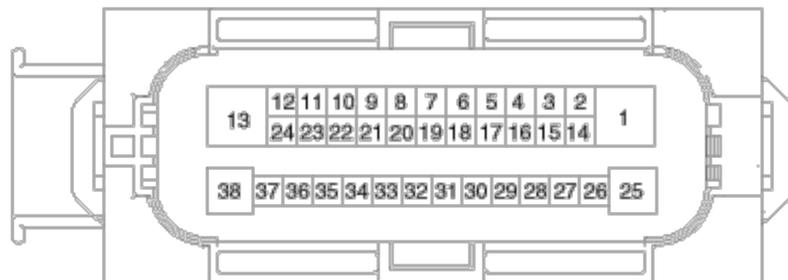
The On/Off switch shall be a normally open, momentary contact switch.Closed contacts switch the circuit to ignition.

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

Brake System



ESP Connector Input/Output



Connector Terminal		Specification
No	Description	
29	IGNITION1(+)	High level of wake up voltage : $4.5V < V < 16.0V$ Low level of wake up voltage : $V < 2.4V$ Max. current : $I < 50mA$
25	POS. BATTERY 1.(SOLENOID)	Over voltage range : $17.0 \pm 0.5V$ Operating voltage range : $10.0 \pm 0.5V < V < 16.0 \pm 0.5V$ Low voltage range : $7.0 \pm 0.5V < V < 9.5 \pm 0.5V$ Max. current : $I < 40A$ Max. leakage current : $I < 0.25mA$
1	POS. BATTERY 2.(MOTOR)	Operating voltage range: $10.0 \pm 0.5V < V < 16.0 \pm 0.5V$ Rush current : $I < 110A$ Max. current : $I < 40A$ Max. leakage current : $I < 0.25mA$
38	GROUND	Rated current : $I < 550mA$ Max. current: $I < 40A$
13	PUMP MOTOR GROUND	Rush current : $I < 110A$ Max. current : $I < 40A$
23	BRAKE LIGHT SWITCH	Input voltage (Low) : $V < 2V$
9	BRAKE SWITCH	Input voltage (High) : $V > 6V$
11	SENSOR GROUND	Max. Input current : $I < 3mA$ Rated current : $I < 250mA$
4	SENSOR POWER	Max. current Capability : $I < 250mA$ Max. voltage : $V_BAT1 -0.8V$
10	ESC ON/OFF SWITCH	

22	PARKING BRAKE SWITCH	Input voltage (Low) : $V < 2V$
37	VACCUM SWITCH	Input voltage (High) : $V > 6V$ Max input current : $I < 5mA$ (@12.8V)
8	VACCUM PUMP DRIVE	Max. Input current : 200mA Max. output voltage (Low) : $V < 1.2V$
28	SENSOR FRONT RIGHT OUTPUT	External pull up resistance : $1 K\Omega < R$
17	SENSOR REAR RIGHT OUTPUT	Output duty : $50 \pm 20\%$
14	CAN BUS LINE(LOW)	Max. Input current : $I < 10mA$
26	CAN BUS LINE(HIGH)	
18	SENSOR FRONT LEFT POWER	Output voltage : $V_{BAT1} - 0.6V \sim V_{BAT1} - 1.1V$ Output current : Max. 30mA
34	SENSOR FRONT RIGHT POWER	
19	SENSOR REAR LEFT POWER	
33	SENSOR REAR RIGHT POWER	
31	SENSOR FRONT LEFT SIGNAL	Input current Low : 5.9 ~ 8.4mA
21	SENSOR FRONT RIGHT SIGNAL	Input current High : 11.8 ~ 16.8mA
32	SENSOR REAR LEFT SIGNAL	Frequency range : 1 ~ 2500Hz
20	SENSOR REAR RIGHT SIGNAL	Input duty : $50 \pm 10\%$
12	CAN SENSOR LINE (HIGH)	Max. input current : $I < 10mA$ Input duty (STG A, STG B) : $50 \pm 10\%$
24	CAN SENSOR LINE (LOW)	
15	STEERING ANGLE SENSOR PHASE A	phase Difference (STG A, STG B) $2 \pm 0.6deg$ High voltage : $3.0V < V_H < 4.1V$ Low voltage : $1.3V < V_L < 2.0V$
16	STEERING ANGLE SENSOR PHASE B	
27	STEERING ANGLE SENSOR PHASE Z	

Brake System



Failure Diagnosis

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

Memory of Fail Code

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

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.

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

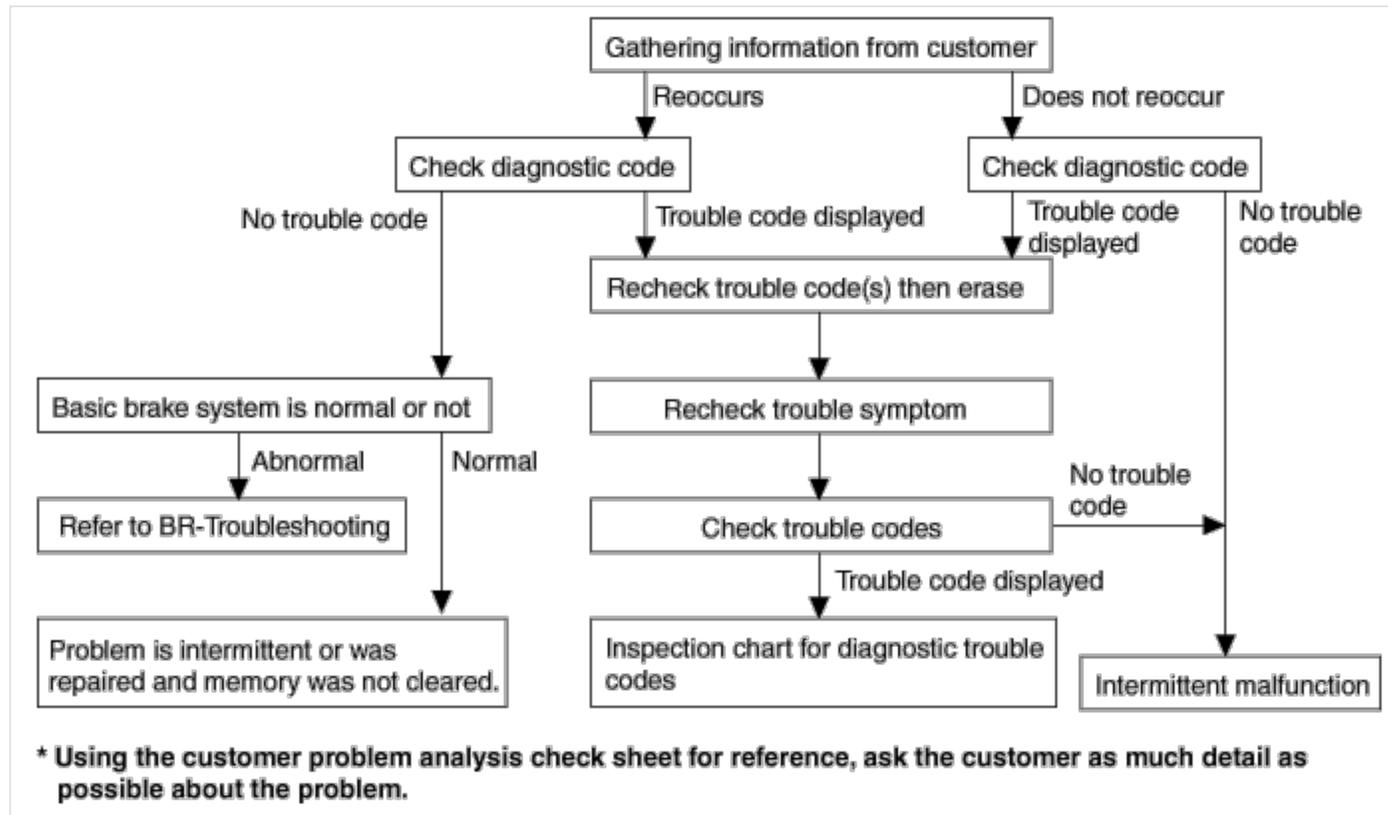
Countermeasures In Fail

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

Warning Lamp ON

1. ESC operation lamp turn on for 3sec after IGN ON.
2. ESC operation lamp blinks when ESC Act.
3. ESC OFF lamp turn on in case of
 - A. ESC Switch OFF
 - B. ESC Failure Detect
 - C. 3sec after IGN ON

Standard flow of diagnostic troubleshooting



Notes with regard to diagnosis

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	<ol style="list-style-type: none"> 1. Sound of the motor inside the ABS hydraulic unit operation (whine). 2. Sound is generated along with vibration of the brake pedal (scraping). 3. When ABS operates, sound is generated from the vehicle chassis due to repeated brake application and release (Thump : suspension; squeak: tires)
ABS operation (Long braking distance)	

For road surfaces such as snow-covered and gravel roads, the braking distance for vehicles with ABS can sometimes be longer than that for other vehicles. Accordingly, advise the customer to drive safely on such roads by lowering the vehicle speed.

Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.

ABS Check sheet

ABS Check Sheet		Inspector's Name _____	
Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles
Date the Problem First Occurred	/ /		
Frequency of Occurrence of Problem	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (times a day)		
Symptoms	<input type="checkbox"/> ABS does not operate.		
	<input type="checkbox"/> ABS does not operate efficiently. <input type="checkbox"/> Intermittent (times a day)		
	ABS Warning Light Abnormal	<input type="checkbox"/> Remains ON <input type="checkbox"/> Does not light up	

Diagnostic Trouble Code Check	1st Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code)
	2nd Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code)

Problem symptoms table

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

CAUTION

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

ABS Does Not Operate.

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESC control module.	<ul style="list-style-type: none"> - Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

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

NO	▶ Check the power source circuit.
YES	▶ Erase the DTC and recheck using GDS.

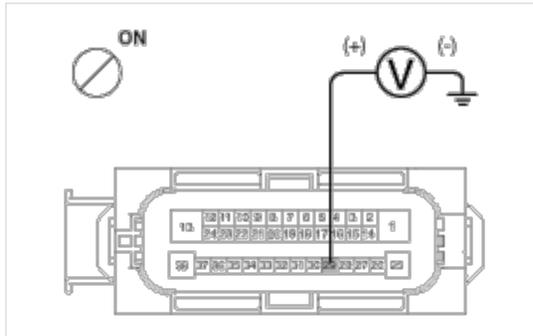
Check the power source circuit

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

Specification: approximately B+

3. Is the voltage within specification?

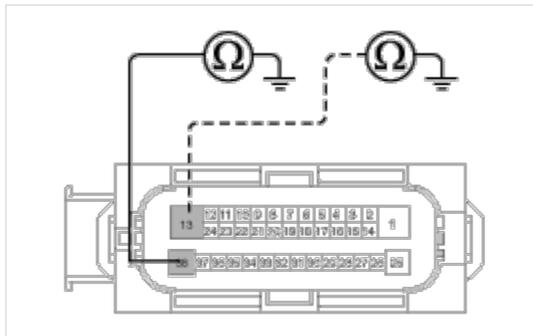
YES	▶ Check the ground circuit.
NO	▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ESC control module. Repair if necessary.



Check the ground circuit

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

YES	▶ Check the wheel speed sensor circuit.
NO	▶ Repair an open in the wire and ground point.



Check the wheel speed sensor circuit

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

YES	▶ Check the hydraulic circuit for leakage.
NO	▶ Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage

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

YES	▶ The problem is still occurring, replace the ESC control module.
NO	▶ Repair the hydraulic lines for leakage.

ABS Does Not Operate (Intermittently).

Detecting condition

Trouble Symptoms	Possible Cause
Brake operation varies depending on driving conditions and road surface conditions, so diagnosis can be difficult. However if a normal DTC is displayed, check the following probable cause. When the problem is still occurring, replace the ESC control module.	<ul style="list-style-type: none"> - Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

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

NO	▶ Check the wheel speed sensor circuit.
YES	▶ Erase the DTC and recheck using GDS.

Check the wheel speed sensor circuit

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

YES	▶ Check the stop lamp switch circuit.
NO	▶ Repair or replace the wheel speed sensor.

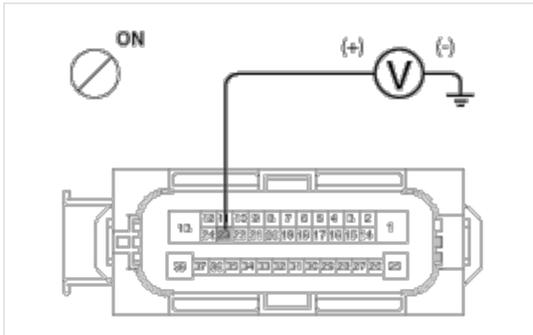
Check the stop lamp switch circuit

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

Specification :approximately B+

3. Is the voltage within specification?

YES	▶ Check the hydraulic circuit for leakage.
NO	▶ Repair the stop lamp switch. Repair an open in the wire between the ESC control module and the stop lamp switch.



Check the hydraulic circuit for leakage

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

YES	▶ The problem is still occurring, replace the ESC control module.
NO	▶ Repair the hydraulic lines for leakage.

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

Detecting condition

Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	<ul style="list-style-type: none"> - An open in the wire - Poor ground - Faulty power source circuit

Inspection procedures

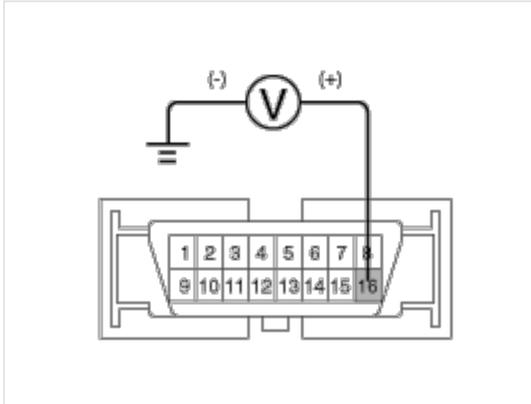
Check The Power Supply Circuit For The Diagnosis

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

Specification :approximately B+

2. Is voltage within specification?

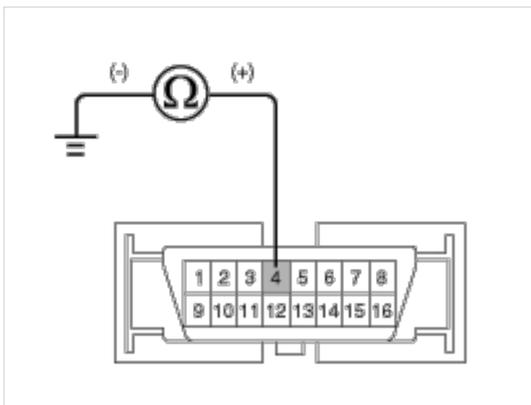
YES	▶ Check the ground circuit for the diagnosis.
NO	▶ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



Check the ground circuit for the diagnosis

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

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



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

Detecting condition

Trouble Symptoms	Possible Cause
When communication with GDS is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	<ul style="list-style-type: none"> - An open in the wire - Faulty HECU - Faulty power source circuit

Inspection procedures

Check for Continuity in the Diagnosis Line

1. Disconnect the connector from the ESC control module.
2. Check for continuity between terminals 26, 14 of the ESC control module connector and 6, 14 of the data link connector.
3. Is there continuity?

YES	▶ Check the power source of ESC control module.
NO	▶ Repair an open in the wire.

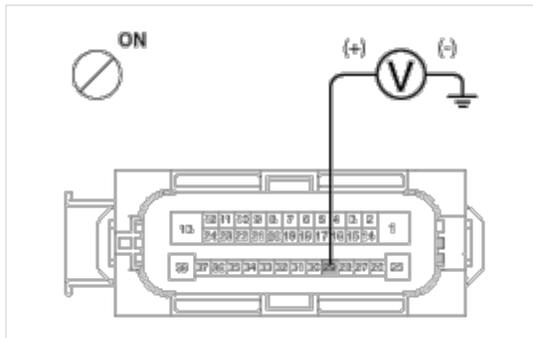
Check the power source of ESC control module

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

Specification :approximately B+

3. Is voltage within specification?

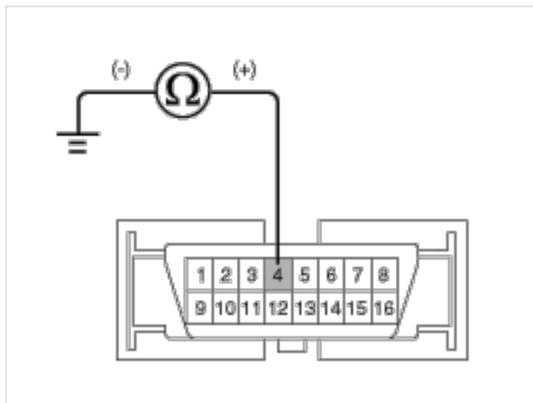
YES	▶ Check for poor ground.
NO	▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ESC control module. Repair if necessary.



Check for poor ground

1. Check for continuity between terminal 4 of the data link connector and ground point.

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



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

Detecting condition

Trouble Symptoms	Possible Cause
When current flows in the HECU the ABS warning lamp turns from ON to OFF as the initial check. Therefore if the lamp does not light up, the cause may be an open in the lamp power supply circuit, a blown bulb, an open in the both circuits between the ABS warning lamp and the HECU, and the faulty HECU.	<ul style="list-style-type: none"> - Faulty ABS warning lamp bulb - Blown fuse is related to ABS in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Problem verification

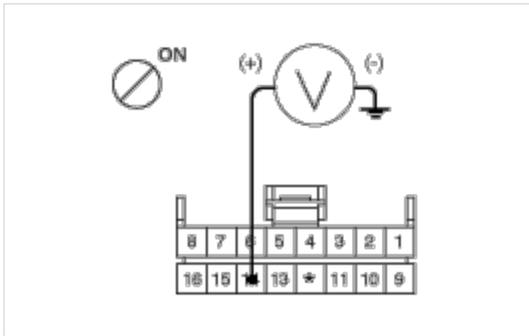
1. Disconnect the connector from the ESC control module and turn the ignition switch ON.
2. Does the ABS warning lamp light up?

YES	▶ Inspect again after replacing the ESC HECU.
NO	▶ Check the power source for the ABS warning lamp.

Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M11-B) and turn the ignition switch ON.
2. Measure the voltage between terminal (M11-B) 14 of the cluster harness side connector and body ground.

Specification :approximately B+



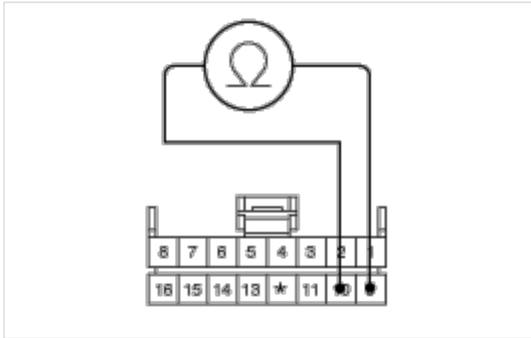
3. Is voltage within specification?

YES	▶ Check the CAN circuit resistance for ABS warning lamp.
NO	▶ Check for blown fuse.

Check the can circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M11-B) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M11-B) 9 and 10 of the cluster harness side connector.

Specification :60Ω



3. Is resistance within specification?

YES	▶ Repair ABS warning lamp bulb or instrument cluster assembly.
NO	▶ Check the CAN circuit wiring for ABS warning lamp.

Check the can circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M11-B) and HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M11-B) 9 of the cluster harness side connector and terminal 14 of HECU harness side.
Check for continuity between terminal (M11-B) 10 of the cluster harness side connector and terminal 26 of HECU harness side.

Specification :Below 1Ω

3. Is resistance within specification?

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

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

Detecting condition

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	<ul style="list-style-type: none"> - An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Check DTC Output

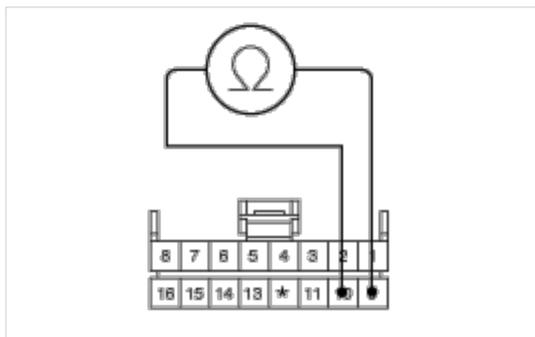
1. Connect the GDS to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using GDS.
3. Is DTC output?

YES	▶ Perform the DTC troubleshooting procedure (Refer to DTC troubleshooting).
NO	▶ Check the CAN circuit resistance for ABS warning lamp.

Check the can circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M11-B) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M11-B) 9 and 10 of the cluster harness side connector.

Specification :60Ω



3. Is resistance within specification?

YES	▶ Repair ABS warning lamp bulb or instrument cluster assembly.
NO	▶ Check the CAN circuit wiring for ABS warning lamp.

Check the can circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M11-B) and HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M11-B) 9 of the cluster harness side connector and terminal 14 of ESC HECU harness side.
Check for continuity between terminal (M11-B) 10 of the cluster harness side connector and terminal 26 of ESC HECU harness side.

Specification :Below 1Ω

3. Is there continuity?

YES	▶ Repair short of wiring between terminal 14, 26 of HECU harness connector and ABS warning lamp module.If no trouble in wiring, inspect again after replacing the HECU.
NO	▶ Repair short of wiring between terminal 14, 26 of HECU harness connector and ABS warning lamp module.If no trouble in wiring, inspect again after replacing the HECU.

Bleeding of Brake System

This procedure should be followed to ensure adequate bleeding of air and filling of the ESC unit, brake lines and master cylinder with brake fluid.

1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

CAUTION

If there is any brake fluid on any painted surface, wash it off immediately.

NOTICE

When pressure bleeding, do not depress the brake pedal.

Recommended fluid..... DOT3 or DOT4

2. Disconnect the vacuum switch connector.
(2.0 AT & ESC Only)
3. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
4. Connect the GDS to the data link connector located underneath the dash panel.
5. Select and operate according to the instructions on the GDS screen.

CAUTION

You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from burning.

- (1) Select vehicle name.
- (2) Select Anti-Lock Brake system.
- (3) Select HCU air bleeding mode.



- (4) Press "OK" to operate motor pump and solenoid valve.