

BR-2**Brake System****General Information****Specifications**

Item		Specification
Master cylinder	Type	Single
	Cylinder I.D.	22.22mm
	Piston stroke	45±1 mm (1.77±0.039 in)
	Fluid level switch	Provided
Brake booster	Type	11" Single
	Boosting ratio	9:1
Front disc brake	Type	Ventilated disc
	Disc O.D.	Ø 300 mm (11.81 in)
	Disc thickness	28 mm (1.10 in)
	Caliper piston	Single
	Cylinder I.D.	Ø 60 mm (2.36 in)
Rear disc brake	Type	Solid disc
	Disc O.D.	Ø 284 mm (11.18 in)
	Disc thickness	10 mm (0.39 in)
	Caliper piston	Single
	Cylinder I.D.	Ø 34 mm (1.34 in)
Parking brake	Type	DIH (Drum in hat)
	Drum I.D.	Ø 168 mm (6.61 in)

NOTICE

O.D. : Outer Diameter

I.D : Inner Diameter

General Information

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Specification(ABS)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 120 °C (-40 ~ 248°F)	
	Motor power	195W	
Active Wheel speed sensor	Supply voltage	DC 4.5 ~ 20 V	
	Output current low	5.9 ~ 8.4 mA	
	Output current high	11.8~ 16.8 mA	
	Output range	1 ~ 2500 Hz	
	Tone wheel	47 teeth	
	Air gap	0.4 ~ 1.0 mm	

Specification(ESP)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESP)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 120 °C (-40 ~ 248°F)	
	Motor power	290 W	
Active Wheel speed sensor	Supply voltage	DC 4.5 ~ 20 V	
	Output current low	5.9 ~ 8.4 mA	
	Output current high	11.8~ 16.8 mA	
	Output range	1 ~ 2500 Hz	
	Tone wheel	47 teeth	
	Air gap	0.4 ~ 1.0 mm	
Steering Wheel Angle Sensor	Operating Voltage	8 ~ 16 V	
	Current Consumption	Max. 150 mA	
	Output measurement range	-780 ~ +779.9 °	
	Operating Angular velocity	0 ~ 1016 °/sec	
Yaw rate & Lateral & G sensor (CAN TYPE)	Operating Voltage	7 ~ 18 V	
	Current Consumption	Max. 120 mA	
	Yaw rate sensor measurement range	-100 ~ +100 °/sec	
	Lateral G sensor measurement range	-1.8 +1.8g	

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Brake System

Service Standard

Items	Standard value
Brake pedal Full stroke	135 mm (5.31 in)
Stop lamp switch clearance	1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Brake pedal free play	3 ~ 8 mm (0.12 ~ 0.31 in)
Front brake disc thickness	28 mm (1.10in)
Front brake disc pad thickness	11 mm (0.43 in)
Rear brake disc thickness	10 mm (0.39 in)
Rear brake disc pad thickness	10 mm (0.39 in)

Tightening Torques

Items	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Master cylinder to brake booster	9.8 ~ 15.6	1.0 ~ 1.6	7.2 ~ 11.6
Brake booster mounting nuts	12.7 ~ 15.6	1.3 ~ 1.6	9.4 ~ 11.6
Air bleeding screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
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	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
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 nut	9.8 ~ 14.7	1.0 ~ 1.5	7.2 ~ 10.8
Brake pedal shaft nut	29.4 ~ 34.3	3.0 ~ 3.5	21.7 ~ 25.3
Wheel speed sensor mounting bolt	6.9 ~ 9.8	0.7 ~ 1.0	5.0 ~ 7.2
HECU bracket mounting bolt and nut	19.6 ~ 29.4	2.0 ~ 3.0	14.5 ~ 21.7
Yaw rate & G sensor mounting bolts	4.9 ~ 7.8	0.5 ~ 0.8	3.6 ~ 5.8

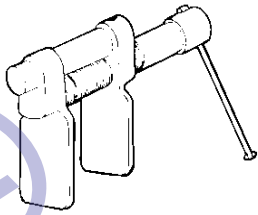
General Information

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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	1.0 ~ 1.5g
Rear Caliper guide rod and boot	AI-11P	0.8 ~ 1.3g

Special Service Tools

Tool(Number and Name)	Illustration	Use
09581-11000 Piston expander	 EJDA043A	Spreading the front and rear disc brake piston.

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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	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	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 shoe (Inoperative) 9. Booster system (Vacuum leaks) 10. Master cylinder (Inoperative)	adjust adjust repair adjust replace replace replace replace replace replace
Brake pull	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
Hard pedal but brake inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 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)	repair air-bleed replace replace adjust adjust replace replace replace

General Information

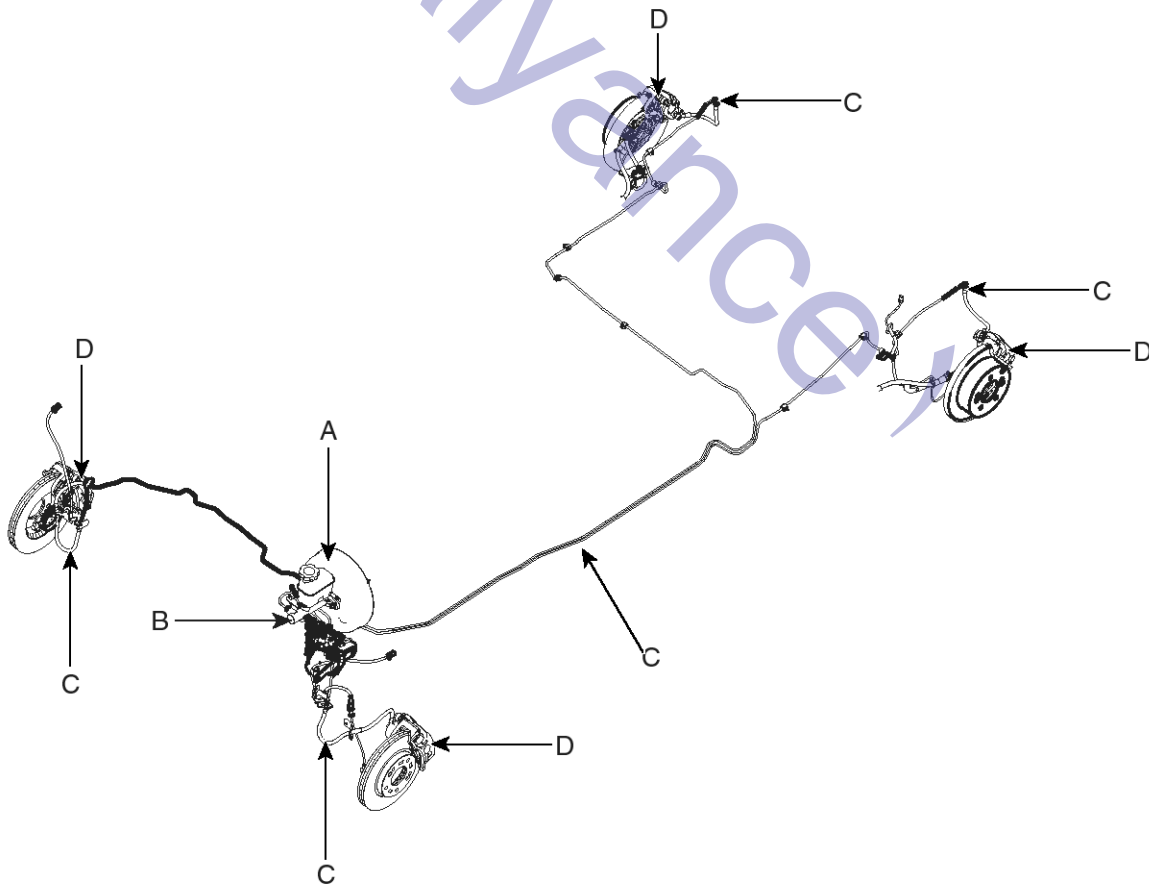
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Symptom	Suspect Area	Reference
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or shoe (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	replace adjust replace replace clean replace replace replace replace
Brake fades	1. Master cylinder (Inoperative)	replace
Brake vibration, pulsation	1. Brake booster (Vacuum leaks) 2. Pedal free play 3. Master cylinder (Inoperative) 4. Caliper (Damage) 5. Master cylinder cap seal 6. Damaged brake lines	replace adjust replace replace replace replace
Brake Chatter	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.	

BR-8**Brake System****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)	- 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

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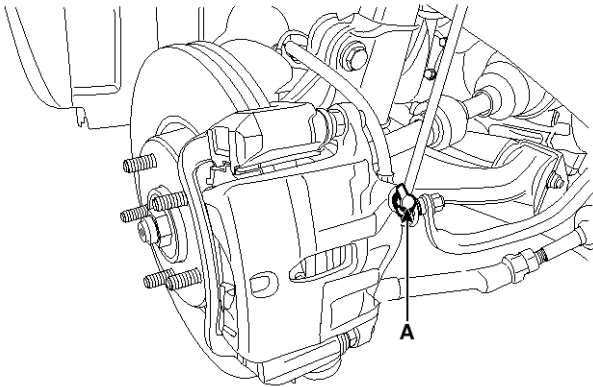
Brake System Bleeding

⚠ 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.

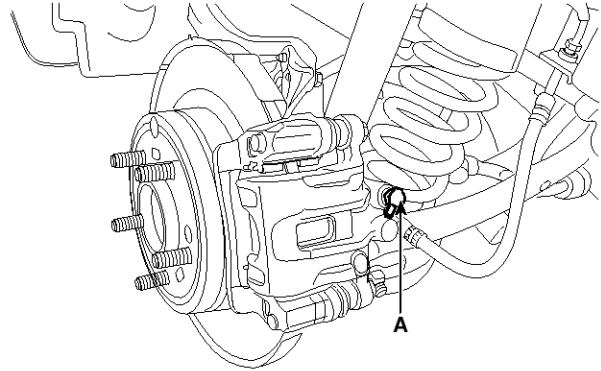
1. Make sure the brake fluid in the reservoir is at the MAX(upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.

Front



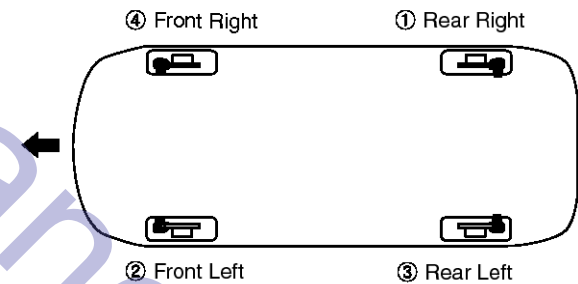
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Rear



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



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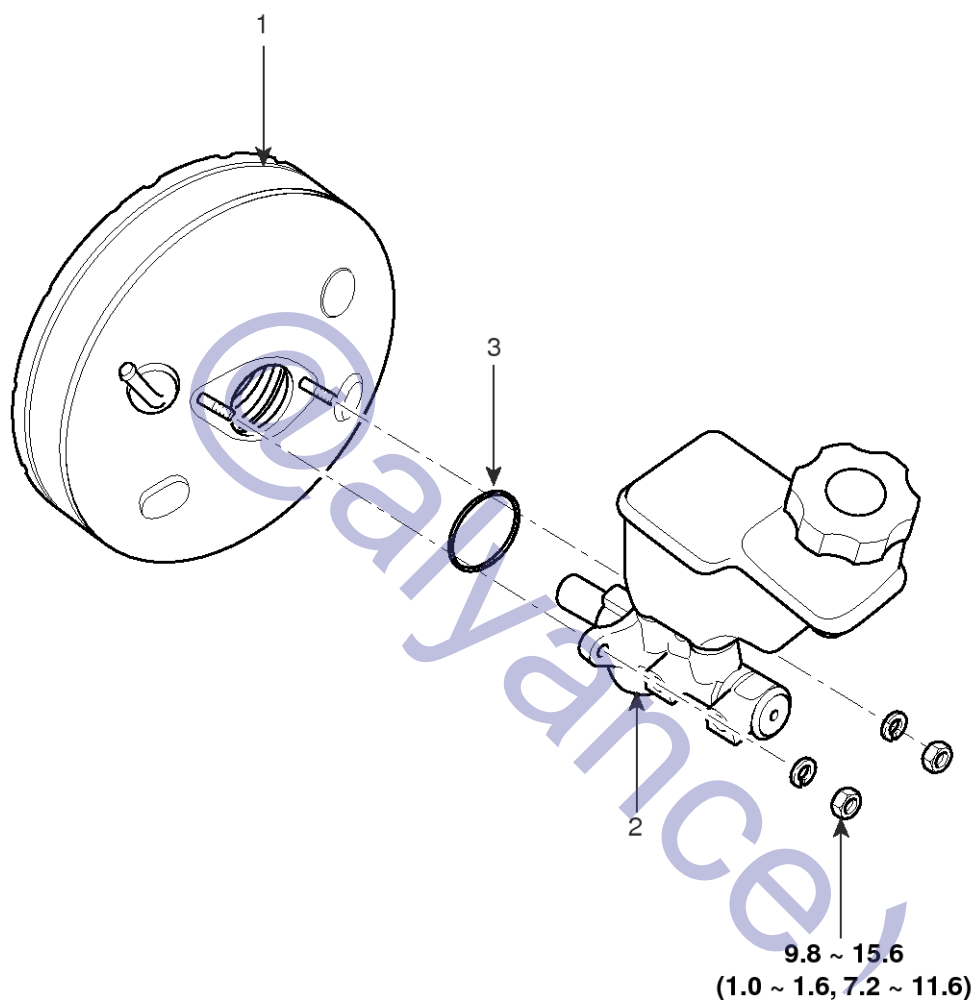
5. Refill the master cylinder reservoir to MAX(upper) level line.

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Brake System

Brake Booster

Components



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

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- 1. Brake booster
- 2. Master cylinder assembly

- 3. O-ring

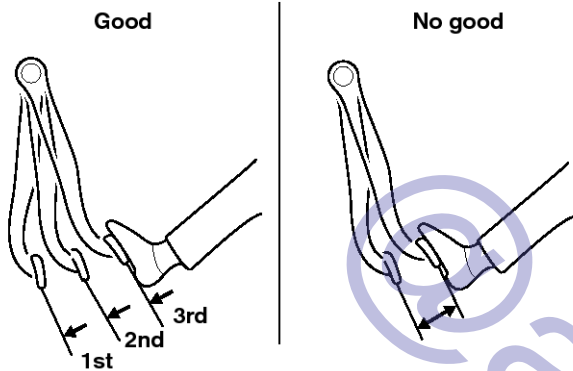
Brake System

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Brake Booster Operating Test

For simple checking of the brake booster operation, carry out the following tests.

1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is inoperative.

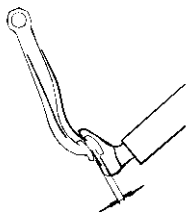


EJRF500B

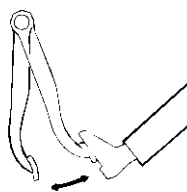
2. With the engine stopped, step on the brake pedal several times.

Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is inoperative.

When engine is stopped



When engine is started

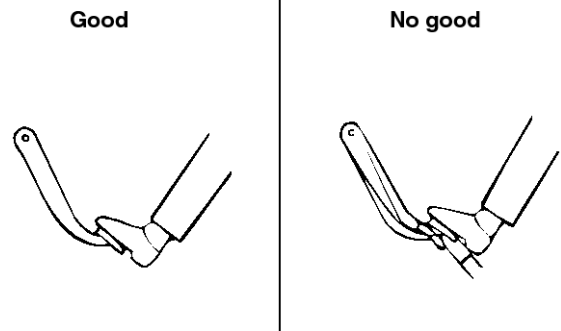


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3. With the engine running, step on the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal falls, the booster is inoperative.

If the above three tests are okay, the booster performance can be determined as good.

Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.



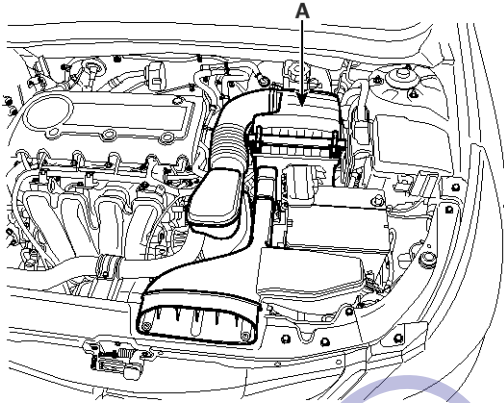
EJRF500C

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Brake System

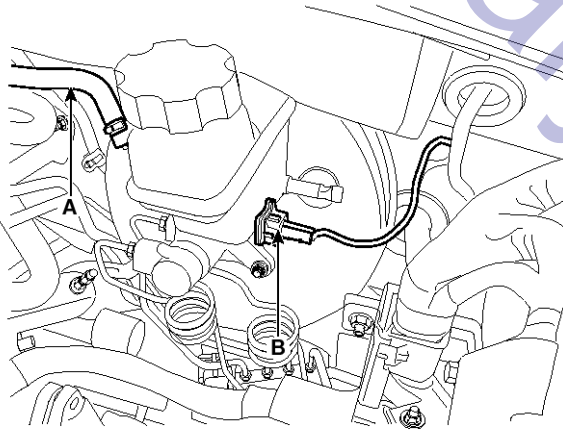
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the air cleaner assembly (A).



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3. Disconnect the vacuum hose (A) from the brake booster.



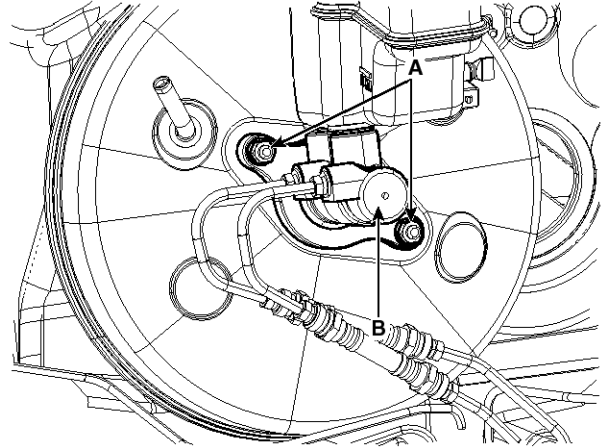
SYFBR0012L

4. Disconnect the brake fluid level switch connector (B).

5. Remove the master cylinder (B) from the brake booster after loosening the mounting nuts (A).

Tightening torque:

9.8 ~ 15.6 N.m (1.0 ~ 1.6 kgf.m, 7.2 ~ 11.6 lb-ft)



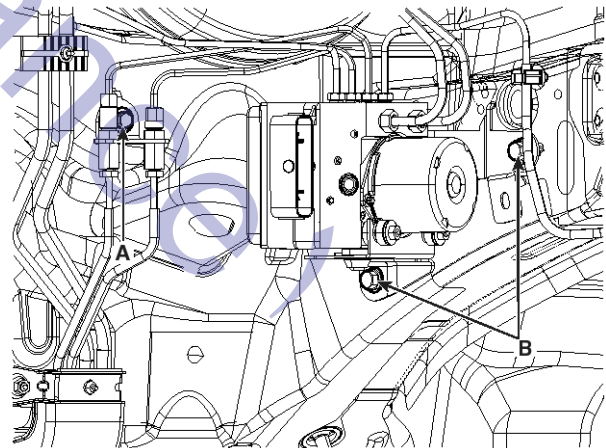
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6. Loosen the brake tube mounting bolt (A) and HECU bracket bolts (B).

Tightening torque:

Bolt (A): 7.8 ~ 11.8 N.m (0.8 ~ 1.2 kgf.m, 5.8 ~ 8.7 lb-ft)

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

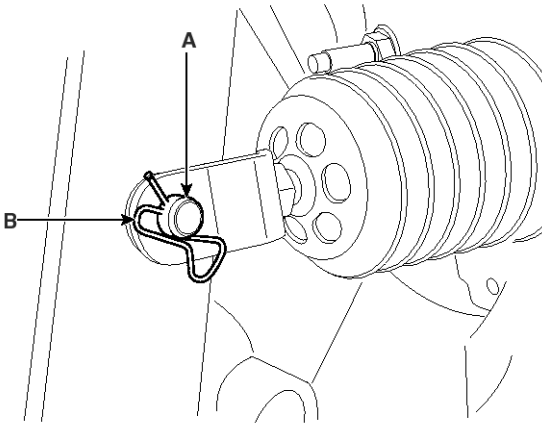


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Brake System

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7. Remove the snap pin (A) and clevis pin (B).

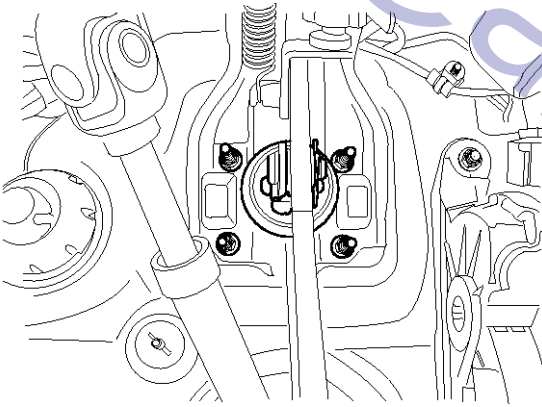


SYFBR0013D

8. Remove the mounting nuts.

Tightening torque:

12.7 ~ 15.6 N.m (1.3 ~ 1.6 kgf.m, 9.4 ~ 11.6 lb-ft)



SYFBR0014D

9. Remove the brake booster.

Inspection

1. Inspect the check valve in the vacuum hose.

⚠ CAUTION

Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Installation

1. Installation is the reverse of removal.

⚠ CAUTION

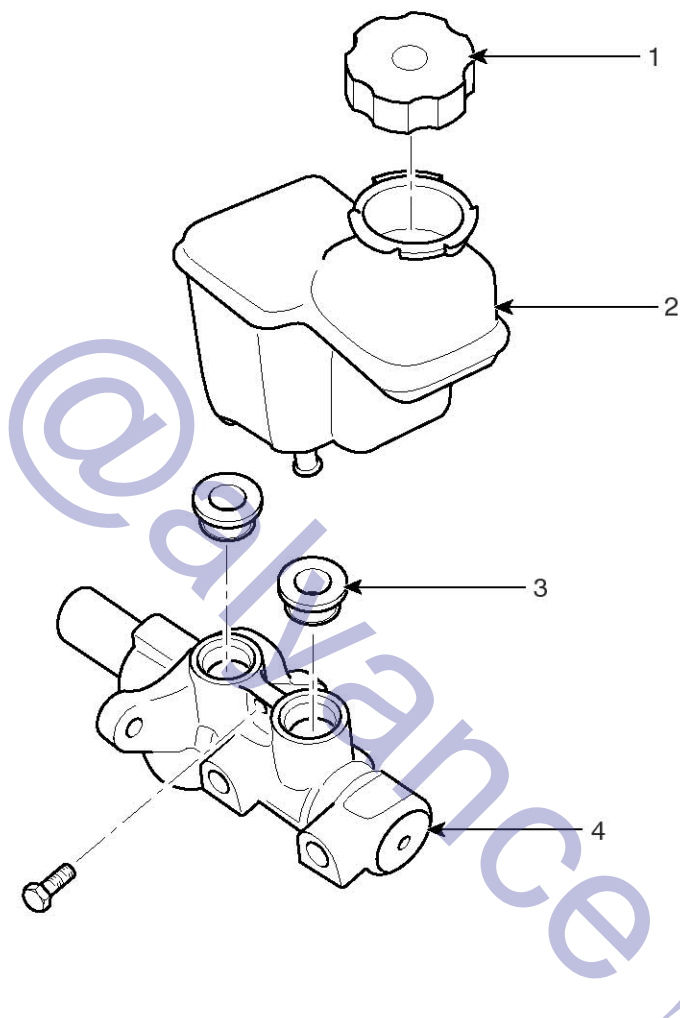
- Before installing the pin, apply the grease to the joint pin.
 - Use a new snap pin whenever installing.
2. Adjust the brake pedal height and free play. (Refer to Brake pedal height and free play adjustment)

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Brake System

Master Cylinder

Components



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- 1. Reservoir cap
- 2. Reservoir

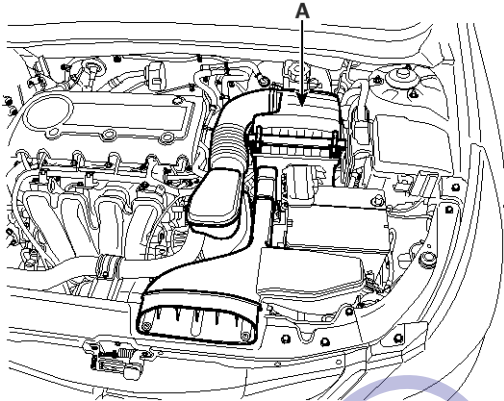
- 3. Grommet
- 4. Master cylinder

Brake System

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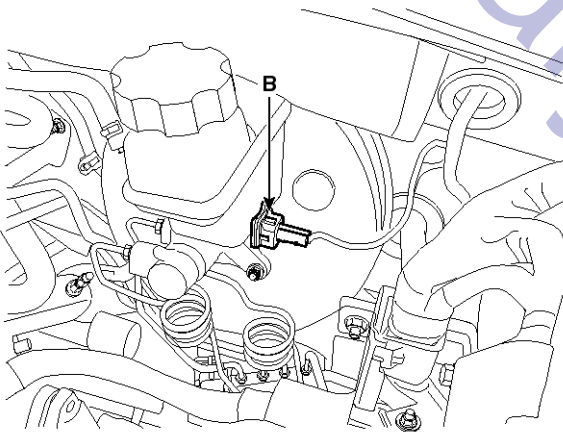
Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the air cleaner assembly (A).



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3. Disconnect the brake fluid level switch connector (B), and remove the reservoir cap.



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4. Remove the brake fluid from the master cylinder reservoir with a syringe.

CAUTION

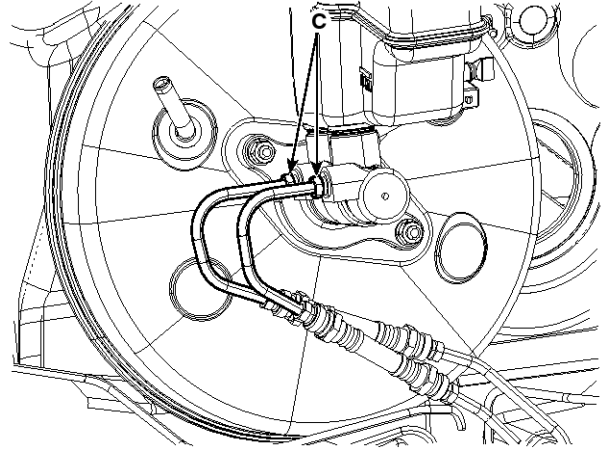
- Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

5. Disconnect the brake tube (C) from the master cylinder by loosening the tube flare nut.

Tightening torque:

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

ESP : 18.6 ~ 22.6N.m (1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)

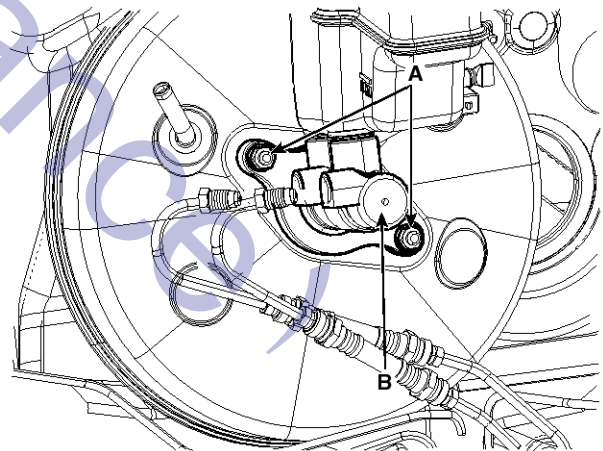


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6. Remove the master cylinder (B) from the brake booster after loosening the mounting nuts (A).

Tightening torque:

9.8 ~ 15.6N.m (1.0 ~ 1.6kgf.m, 7.2 ~ 11.6lb-ft)



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Installation

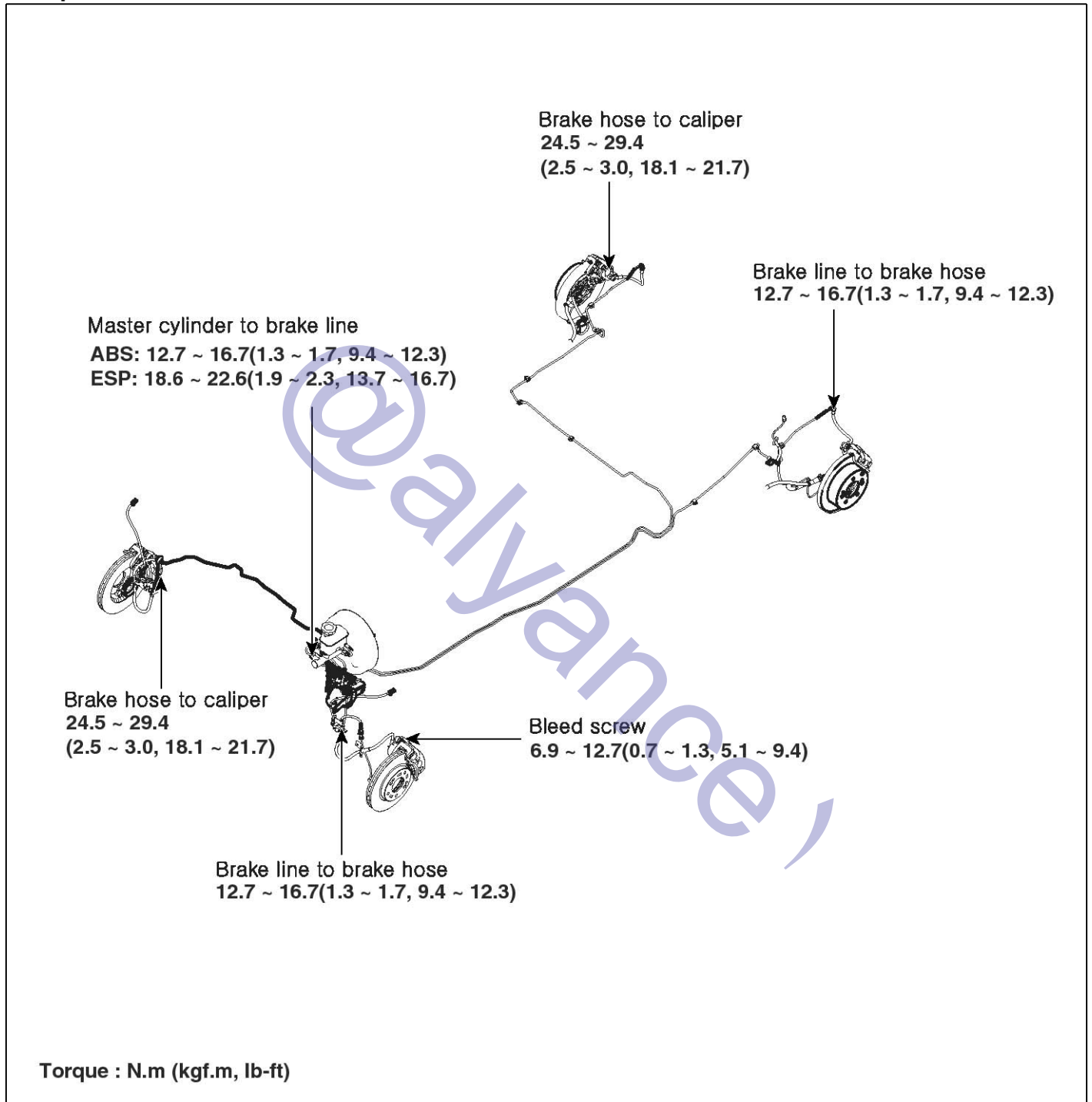
1. Installation is the reverse of removal.
2. After installation, bleed the brake system. (Refer to Brake system bleeding)

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Brake System

Brake Line

Components



Brake System

BR-17

Removal

1. Disconnect the brake fluid level switch connector, and remove the reservoir cap.
2. Remove the brake fluid from the master cylinder reservoir with a syringe.

⚠ CAUTION

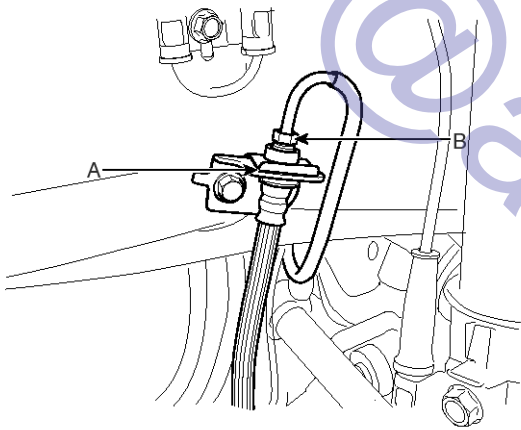
Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

3. Remove the wheel & tire.
4. Disconnect the brake tube by loosening the tube flare nut (B).

Tightening torque:

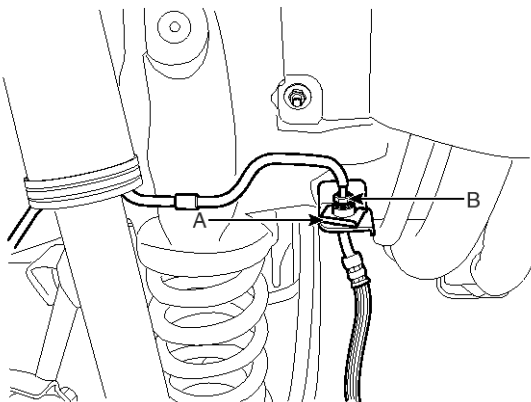
12.7 ~16.7 N.m (1.3 ~1.7 kgf.m, 9.4 ~12.3 lb-ft)

Front



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Rear



SYFBR0042D

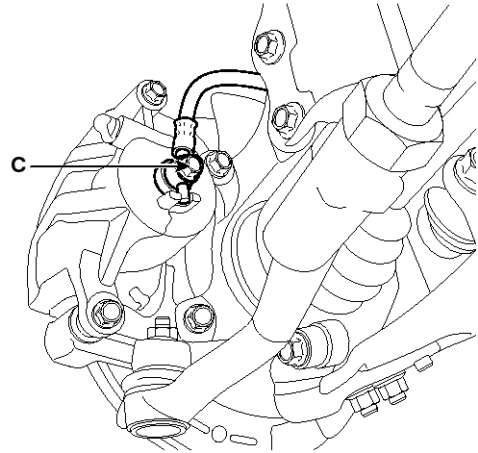
5. Remove the brake hose clip (A).

6. Disconnect the brake hose from the brake caliper by loosening the bolt (C).

Tightening torque:

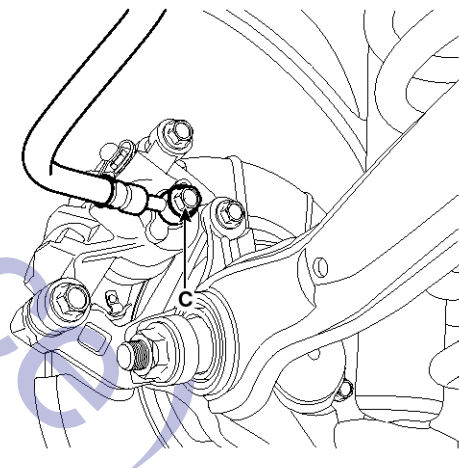
24.5 ~29.4 N.m (2.5 ~3.0 kgf.m, 18.1 ~21.7 lb-ft)

Front



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Rear



SVGBR0044D

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Brake System

Inspection

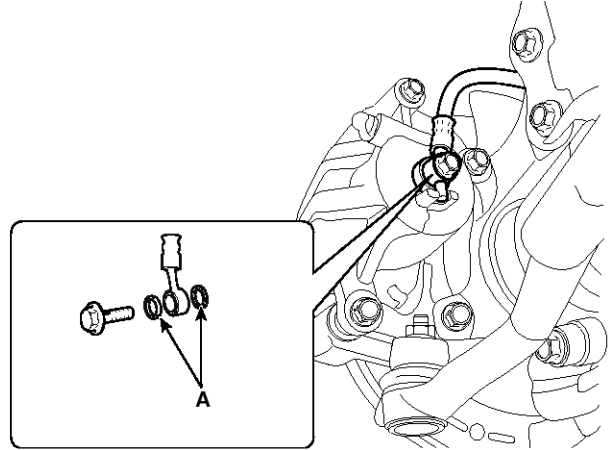
1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damage and fluid leakage.
3. Check the brake tube flare nuts for damage and fluid leakage.
4. Check brake hose mounting bracket for crack or deformation.

Installation

1. Installation is the reverse of removal.

⚠ CAUTION

Use a new washer (A) whenever installing.



SVGBR0045D

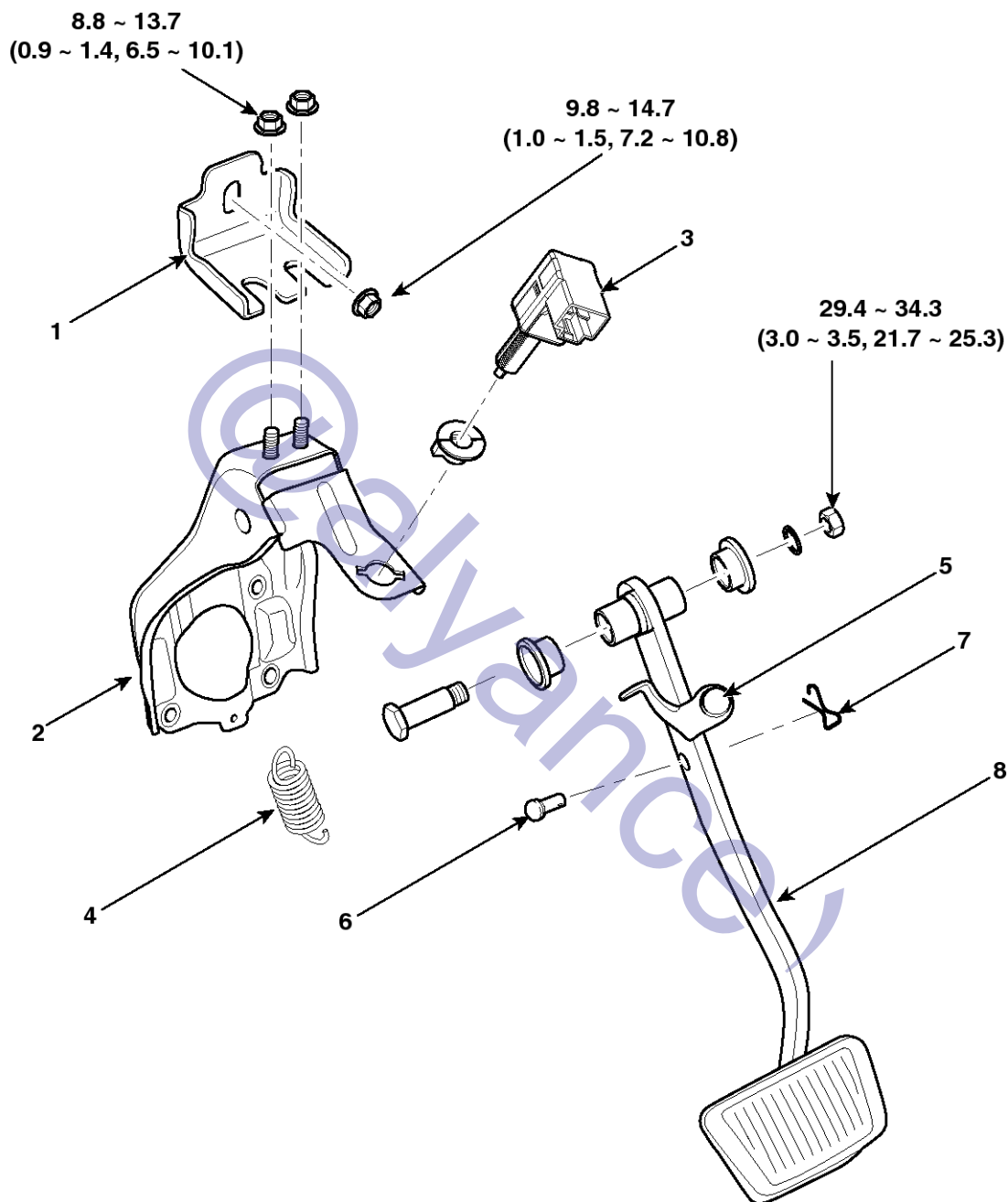
2. After installation, bleed the brake system. (Refer to Brake system bleeding)
3. Check the spilled brake oil.

Brake System

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Brake Pedal

Components



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

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1. Cowl bracket
2. Brake pedal member assembly
3. Stop lamp switch
4. Return spring

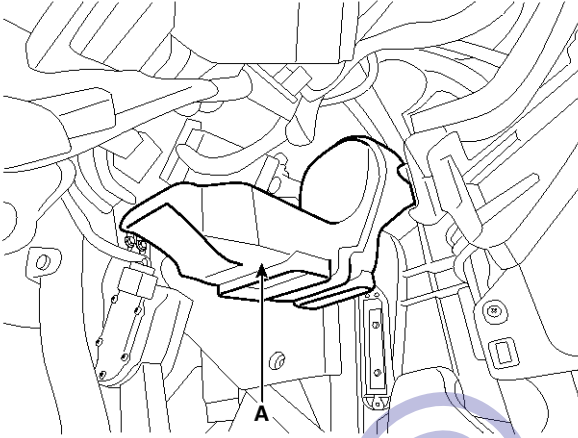
5. Brake pedal stopper
6. Clevis pin
7. Snap pin
8. Brake pedal

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Brake System

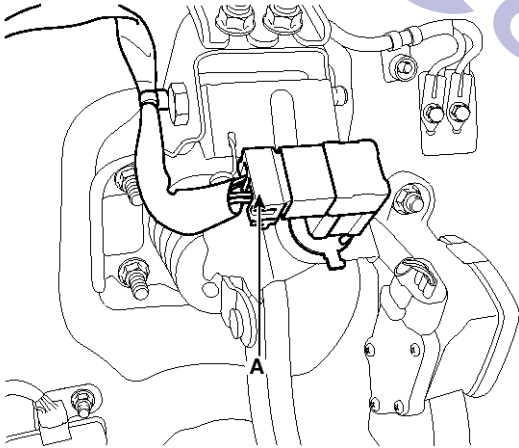
Removal

1. Remove the crash pad lower panel. (Refer to the Body group- crash pad).
2. Remove the shower duct (A).



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3. Disconnect the stop lamp switch connector (A).

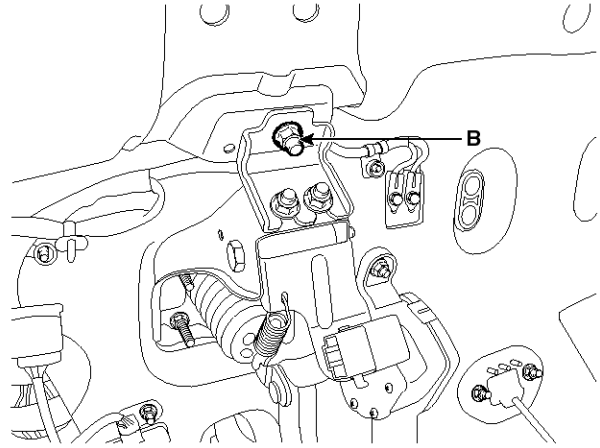


SVGBR0051D

4. Remove the brake pedal member mounting nut (B).

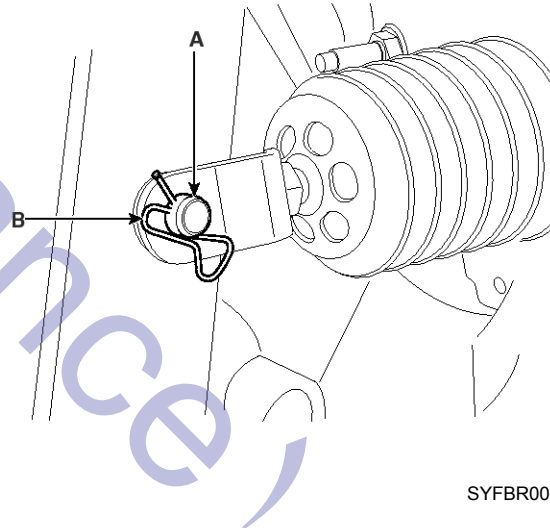
Tightening torque:

9.8 ~ 14.7 N.m (1.0 ~ 1.5 kgf.m, 7.2 ~ 10.8lb-ft)



SVGBR0052D

5. Remove the snap pin (A) and clevis pin (B).



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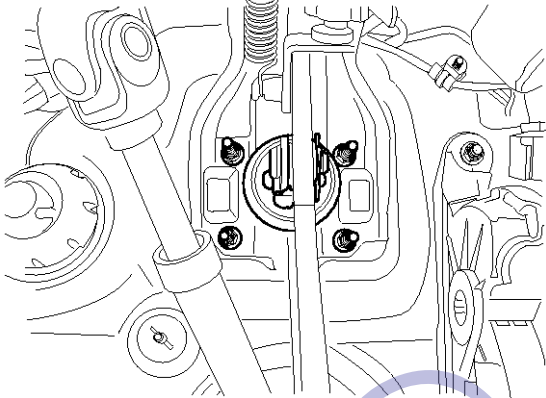
Brake System

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6. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

Tightening torque:

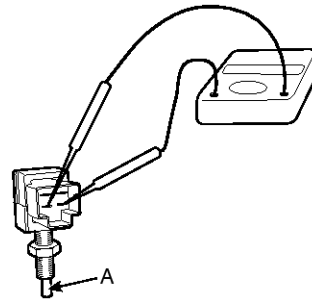
12.7 ~ 15.6 N.m (1.3 ~ 1.6 kgf.m, 9.4 ~ 11.6 lb-ft)



SYFBR0014D

Inspection

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.
4. Check the stop lamp switch.
 - 1) Connect a circuit tester to the connector of stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released.
 - 2) The stop lamp switch is in good condition if there is no continuity when plunger(A) is pushed.



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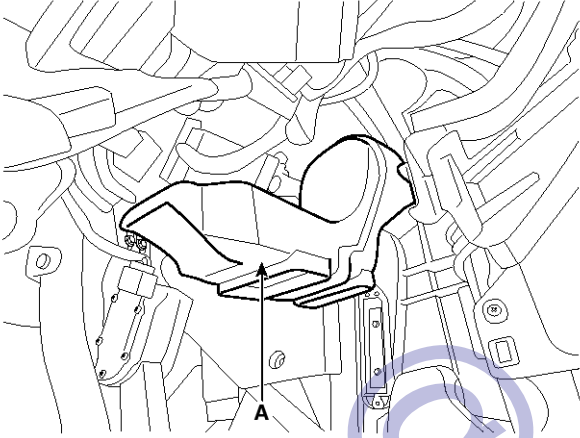
Brake System

Adjustment

Stop lamp switch clearance adjustment

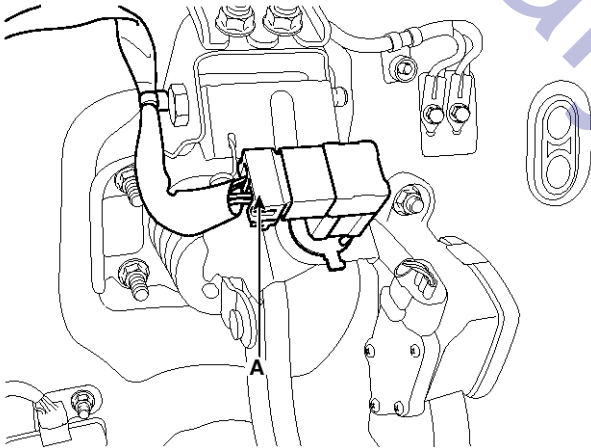
If the gap between stop lamp switch and bracket is not 1.0 ~ 2.0mm(0.04~ 0.08in), conform to below.

1. Remove the shower duct (A).



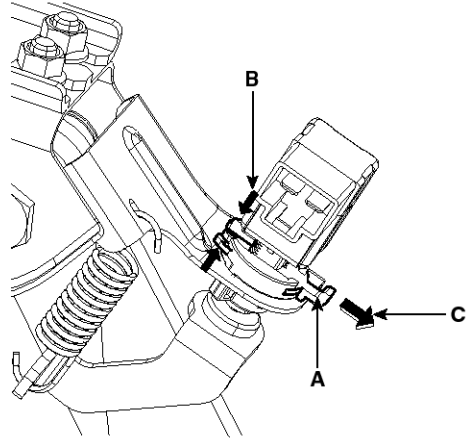
SVGBR0055D

2. Disconnect the stop lamp switch connector (A).



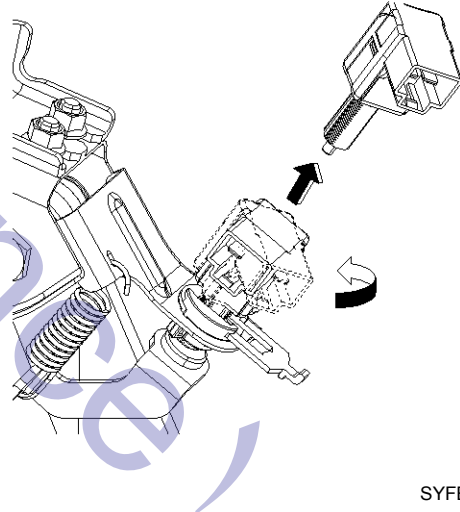
SVGBR0051D

3. Release locking plate by pushing the hooks (B) carefully, and then pull the locking plate (A) as indicated by the arrow (C).



SYFBR0055N

4. Turn stop lamp switch 45° counterclockwise and remove it.

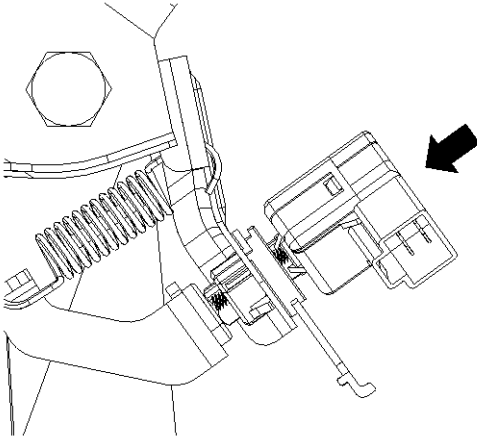


SYFBR0056N

Brake System

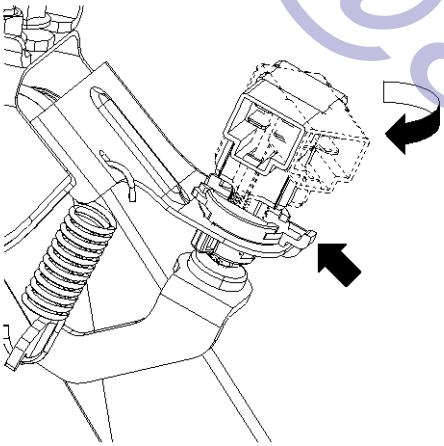
BR-23

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



SYFBR0057N

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

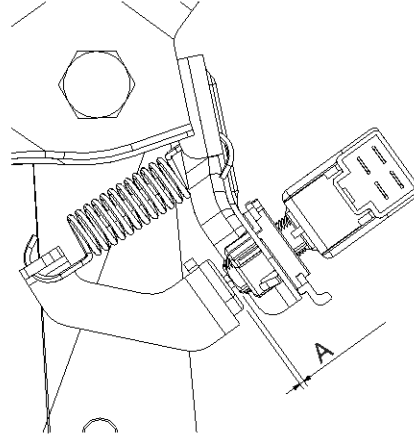


SYFBR0058N

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

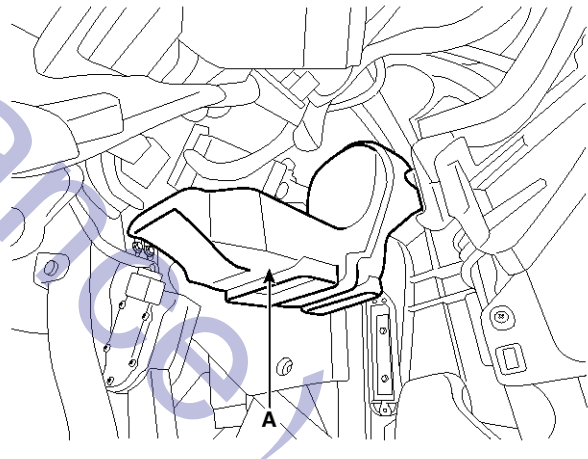
Stop lamp clearance:

1.0~2.0mm(0.04~ 0.08in.)



SYFBR0059N

8. Connect the stop lamp switch connector.
9. Install the shower duct (A).



SVGBR0055D

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.

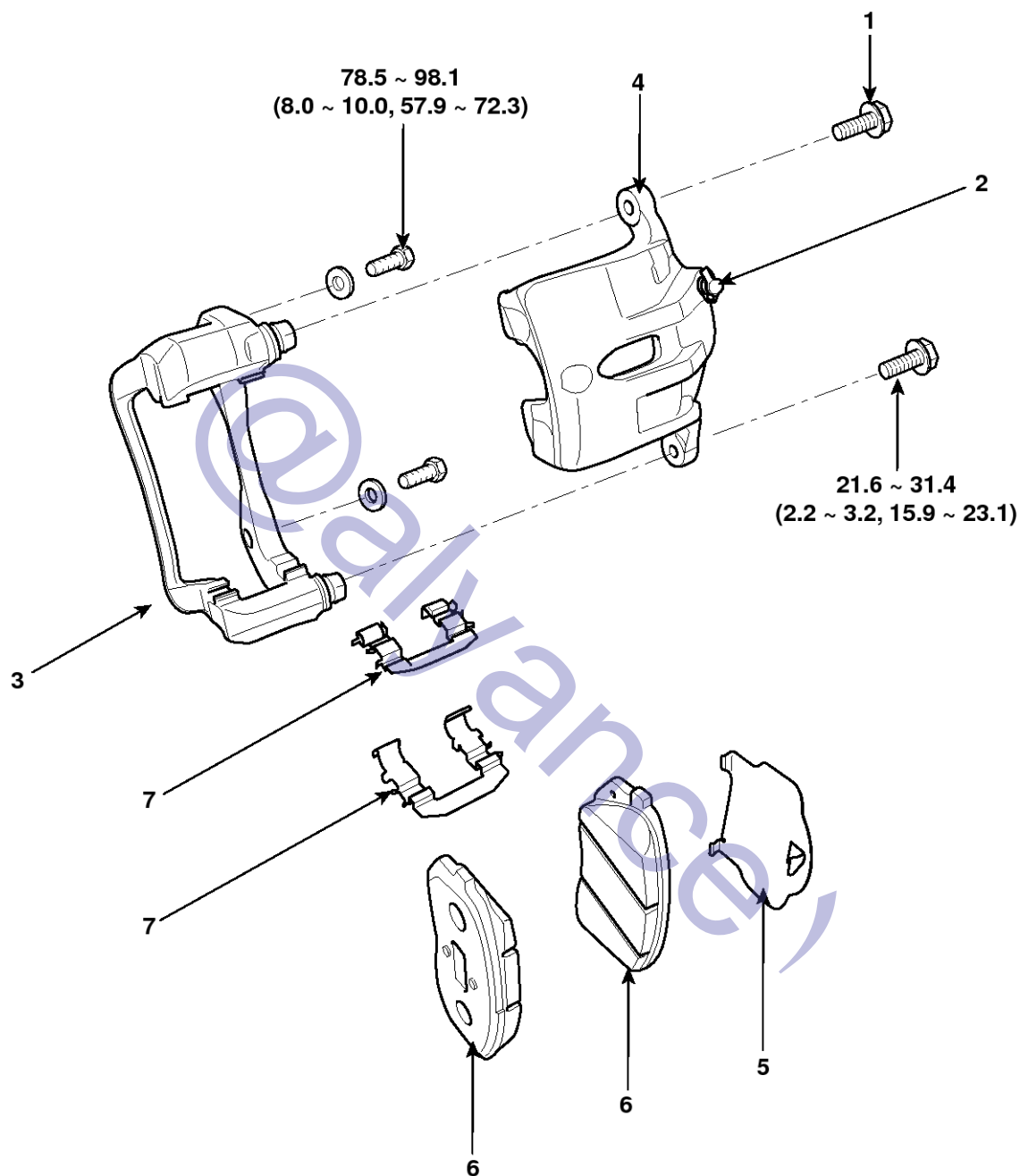
2. Adjust the brake pedal height and free play.
3. Check the brake pedal operation.

BR-24

Brake System

Front Disc Brake

Components



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

SVGBR0060L

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

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

Brake System

BR-25

Removal

1. Remove the front wheel & tire.

Tightening torque:

88.3 ~107.9 N.m (9.0 ~11.0 kgf.m, 65.1 ~79.6 lb-ft)

2. Loosen the hose eyebolt (B) and caliper mounting bolts (C), then remove the front caliper assembly (A).

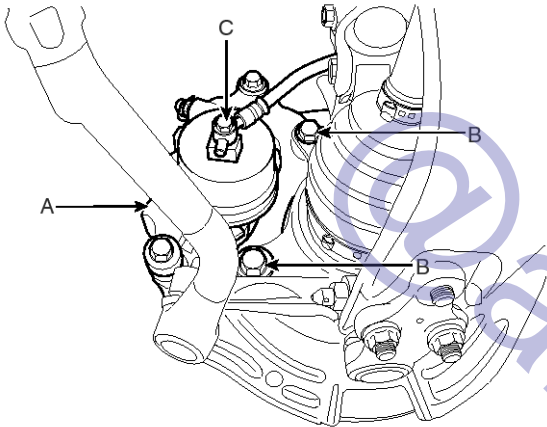
Tightening torque:

Brake hose to caliper(B):

24.5 ~29.4 N.m (2.5 ~3.0 kgf.m, 18.1 ~21.7 lb-ft)

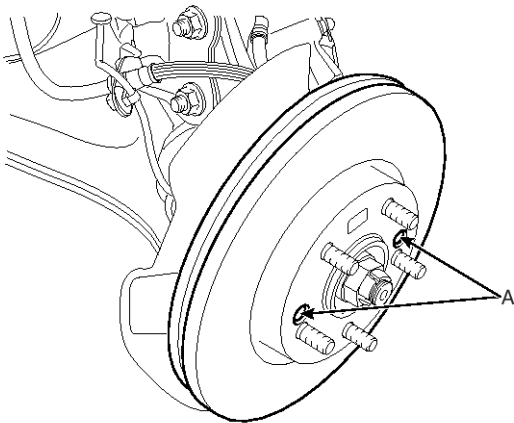
Caliper assembly to knuckle(C):

78.5 ~98.1 N.m (8.0 ~10.0 kgf.m, 57.9 ~72.3 lb-ft)



SYFBR0061D

3. Remove the front brake disc by loosening the screws (A).

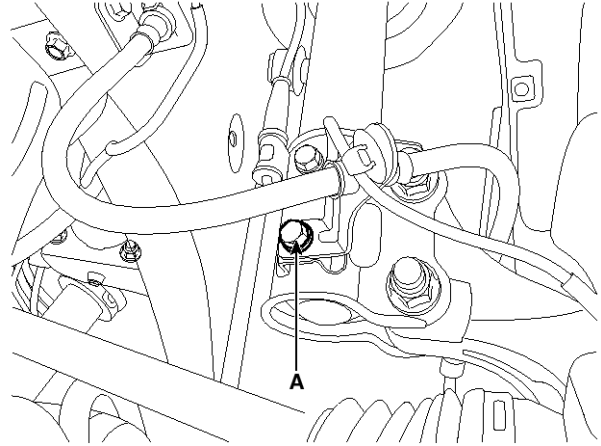


SYFBR0062D

Replacement

Front brake pads

1. Remove the brake hose mounting bracket bolt (A).

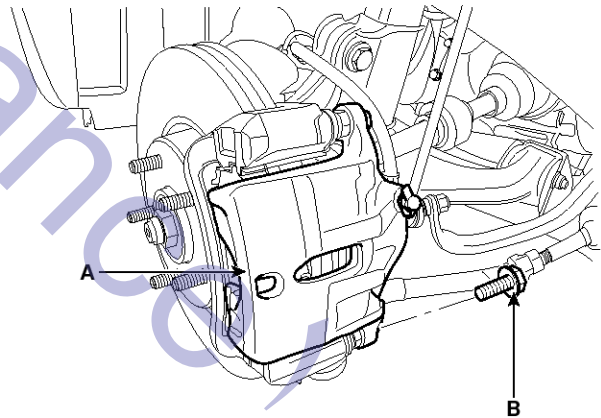


SYFBR0063N

2. Loosen the guide rod bolt (B) and pivot the caliper (A) up out of the way.

Tightening torque:

21.6 ~31.4 N.m (2.2 ~3.2 kgf.m, 15.9 ~23.1 lb-ft)

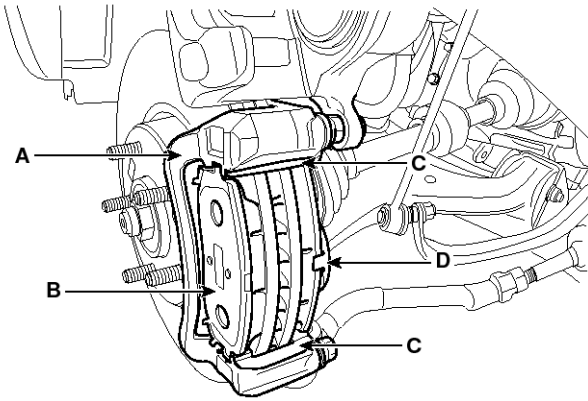


SVGBR0063D

BR-26

Brake System

3. Replace pad shim (D), pad retainers (C) and brake pads (B) in the caliper carrier (A).



SVGBR0064D

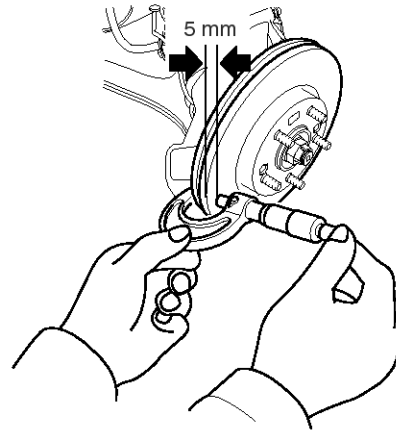
Inspection

Front brake disc thickness check

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Front brake disc thickness

- Standard: 28mm (1.10in)
- Service limit: 26.4mm (1.04in)
- Deviation: Less than 0.005mm (0.0002in)



SYFBR0065D

4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

Brake System

BR-27

Front Brake Pad Check

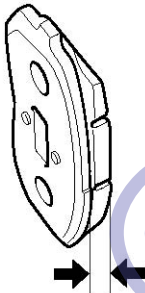
1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness

Standard value: 11 mm (0.43 in)

Service limit: 2.0 mm (0.0787 in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.



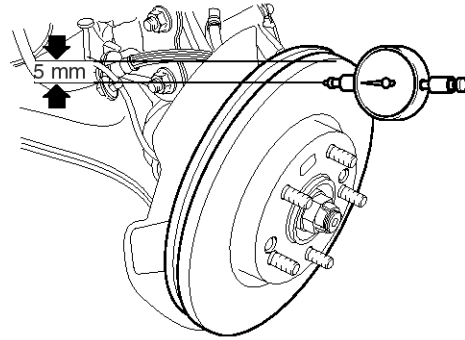
SVGBR0066D

Front brake disc runout check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout

Limit: 0.040 mm (0.0016 in.) or less (new one)



SYFBR0067D

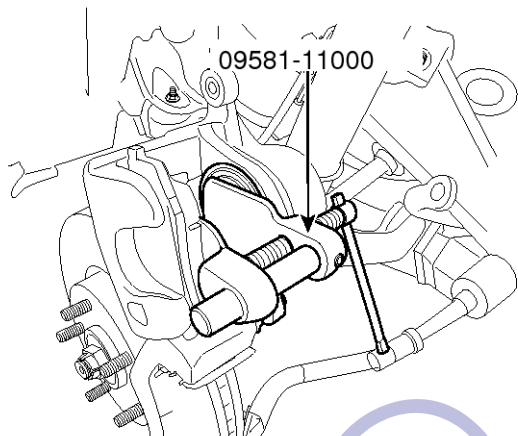
2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the runout does not exceed the limit specification, install the brake disc after turning it 180° and then check the runout of the brake disc again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

BR-28

Brake System

Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



SYFBR0068D

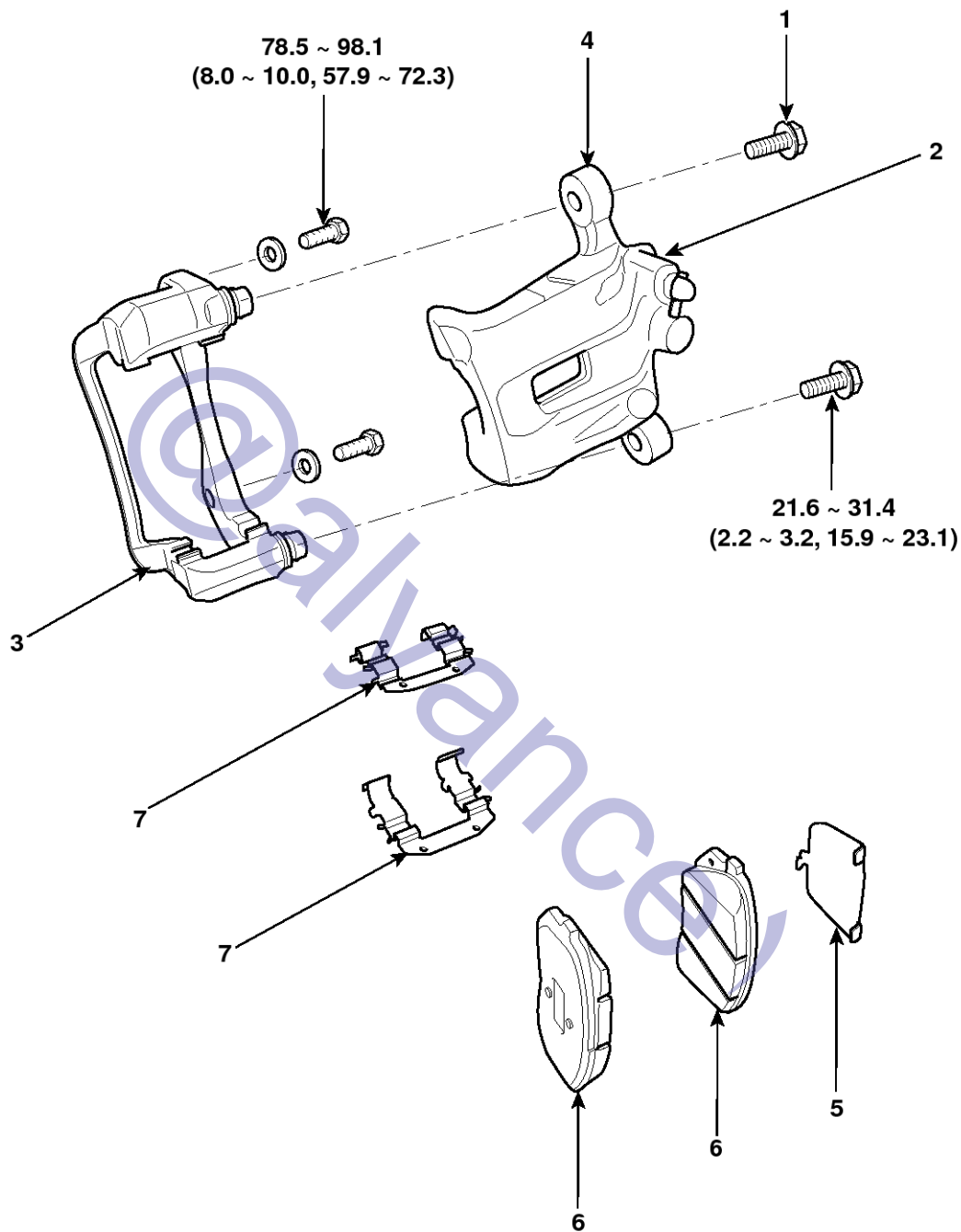
3. After installation, bleed the brake system. (Refer to Brake system bleeding)

Brake System

BR-29

Rear Disc Brake

Components



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

SVGBR0080L

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

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

BR-30

Brake System

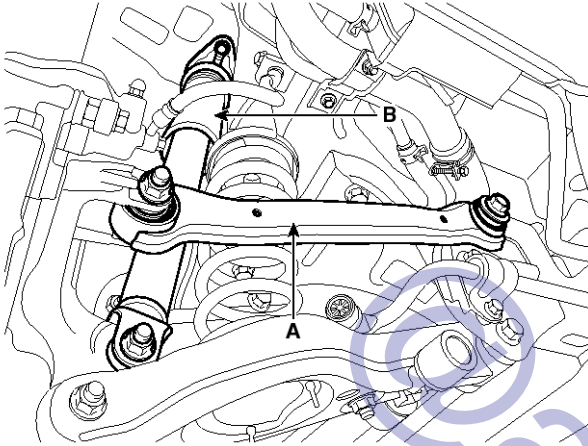
Removal

1. Remove the rear wheel & tire.

Tightening torque:

88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

2. Remove the rear shock absorber (B).
(Refer to the Suspension group - rear shock absorber)



SVGBR0081D

3. Remove the rear upper arm (A).

4. Loosen the hose eyebolt (B) and caliper mounting bolts (C), then remove the rear caliper assembly (A).

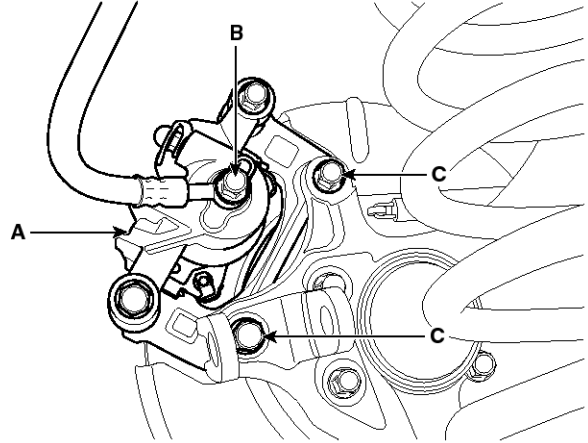
Tightening torque:

Brake hose to caliper(B):

24.5 ~ 29.4 N.m (2.5 ~ 3.0 kgf.m, 18.1 ~ 21.7 lb-ft)

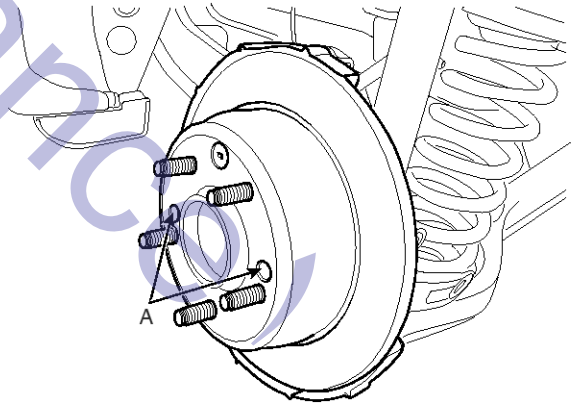
Caliper assembly to carrier(C):

78.5 ~ 98.1 N.m (8.0 ~ 10.0 kgf.m, 57.9 ~ 72.3 lb-ft)



SVGBR0082D

5. Remove the rear brake disc by loosening the screws (A).



SYFBR0083D

Brake System

BR-31

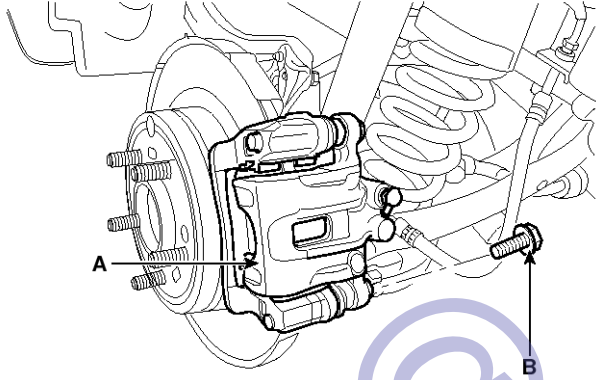
Replacement

Rear brake pads

1. Loosen the guide rod bolt (B) and pivot the caliper (A) up out of the way.

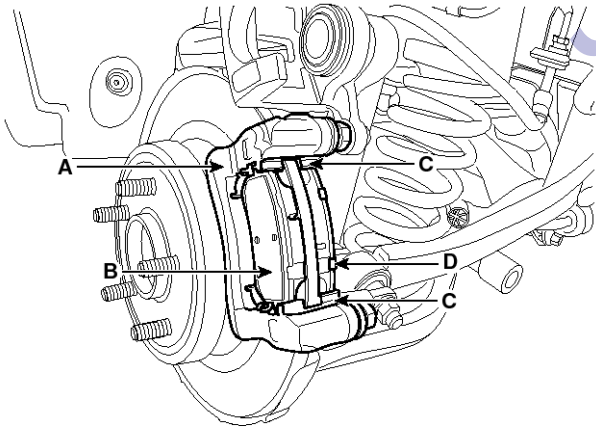
Tightening torque:

21.6 ~31.4 N.m (2.2 ~3.2 kgf.m, 15.9 ~23.1 lb-ft)



SVGBR0084D

2. Replace pad shim (D), pad retainers (C) and brake pads (B) in the caliper bracket (A).



SVGBR0085D

Inspection

Rear Brake Disc Thickness Check

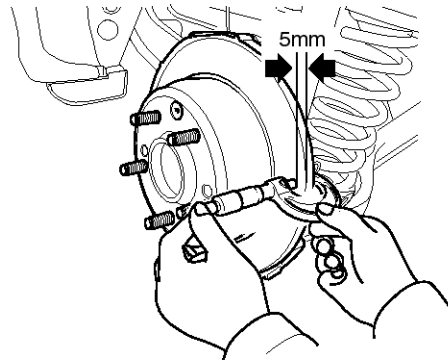
1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Remove all rust and contamination from the surface, and measure the disc thickness at 8 points, at least, of same distance (5mm) from the brake disc outer circle.

Rear Brake disc thickness

Standard: 10 mm (0.39 in)

Service limit: 8.4 mm (0.33 in)

Deviation: less than 0.01 mm (0.00039 in)



SYFBR0086D

4. If wear exceeds the limit, replace the discs and pad assembly left and right of the vehicle.

BR-32

Brake System

Rear Brake Pad Check

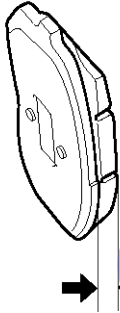
1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

Pad thickness

Standard value: 10 mm (0.393 in)

Service limit: 2.0 mm (0.0787 in)

2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.



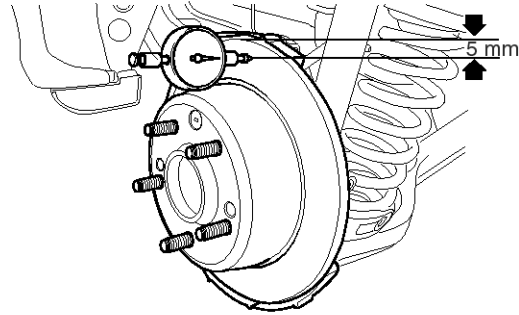
SVGBR0089D

Rear Brake Disc Runout Check

1. Place a dial gauge about 5mm (0.2 in.) from the outer circumference of the brake disc, and measure the runout of the disc.

Brake disc runout

Limit: 0.05 mm (0.00197 in.) or less (new one)



SYFBR0087D

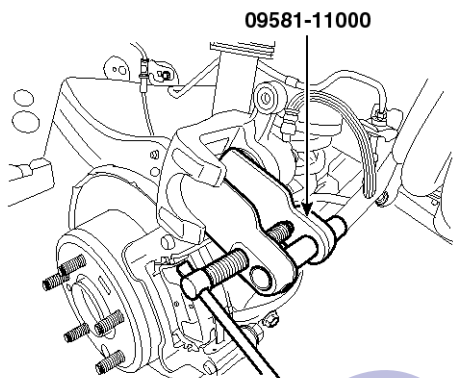
2. If the runout of the brake disc exceeds the limit specification, replace the disc, and then measure the runout again.
3. If the runout exceeds the limit specification, install the brake disc after turning it 180° and then check the runout of the brake disc again.
4. If the runout cannot be corrected by changing the position of the brake disc, replace the brake disc.

Brake System

BR-33

Installation

1. Installation is the reverse of removal.
2. Use a SST (09581-11000) when installing the brake caliper assembly.



SYFBR0088D

3. After installation, bleed the brake system. (Refer to Brake system bleeding)

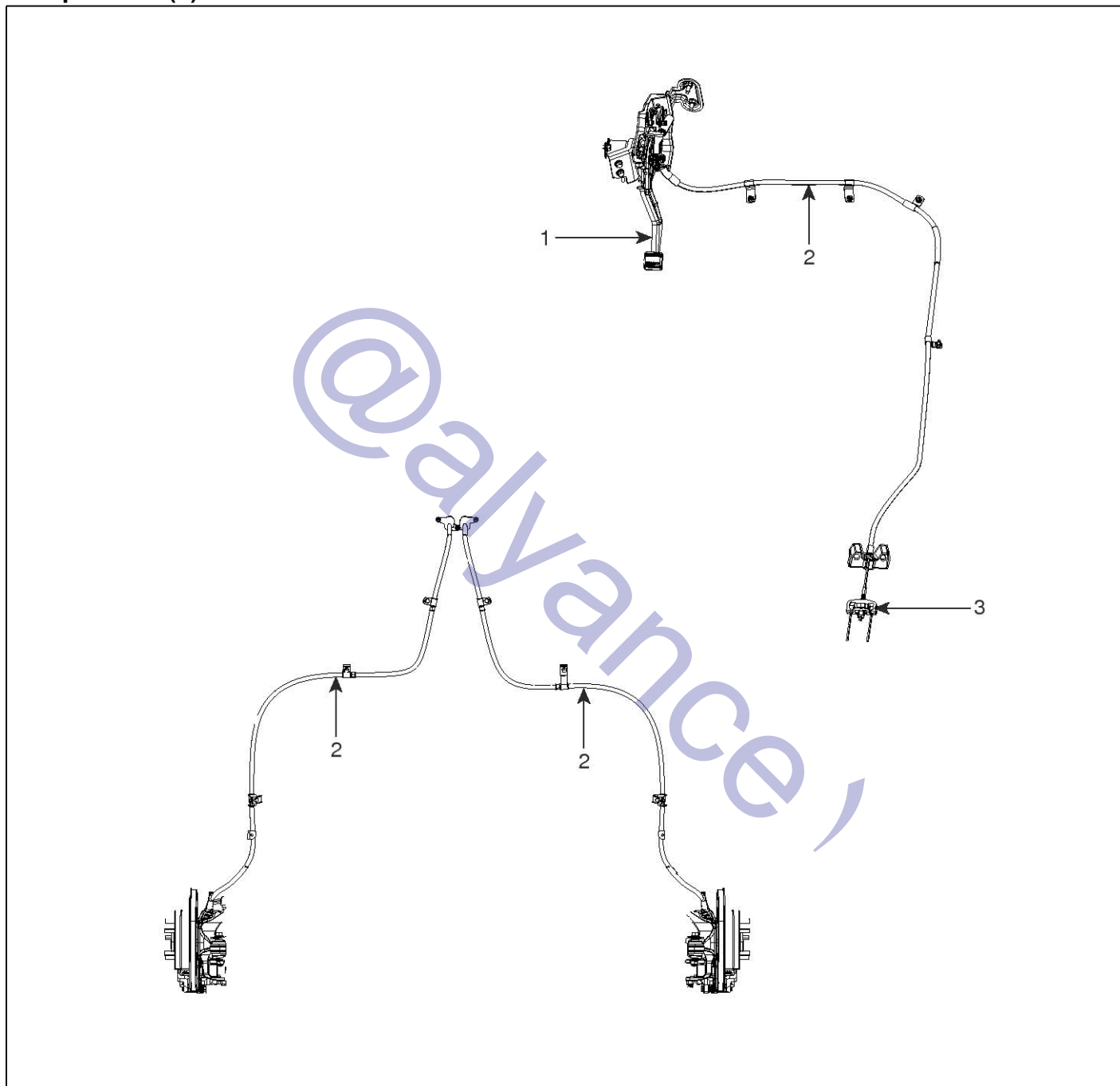
BR-34

Brake System

Parking Brake System

Parking Brake Assembly

Components (1)



SVGBR0100D

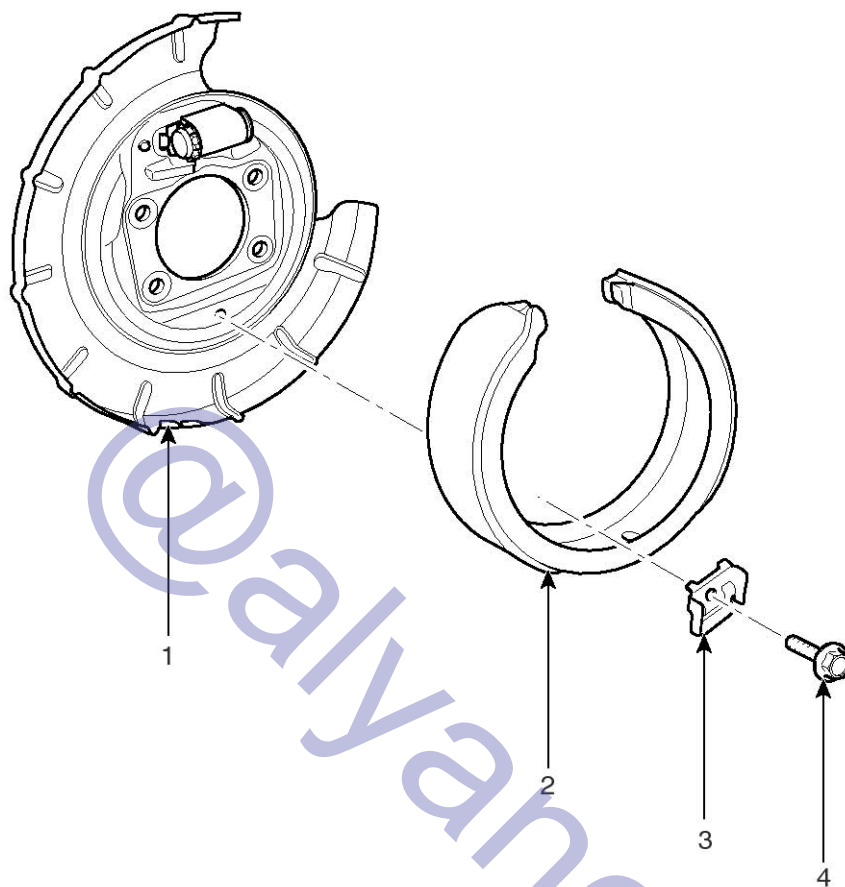
1. Parking brake pedal
2. Parking brake cable

3. Equalizer assembly

Parking Brake System

BR-35

Components (2)



- 1. Backing plate
- 2. Brake shoe

- 3. Shoe hold clip
- 4. Bolt

SYFBR0103D

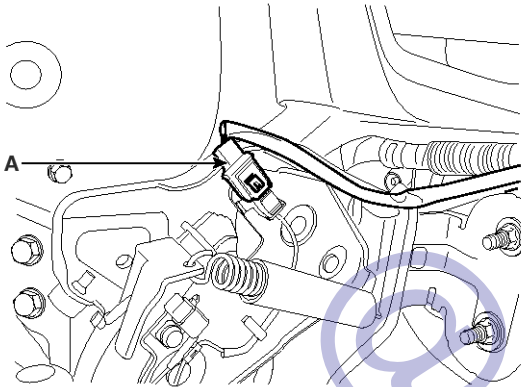
BR-36

Brake System

Removal

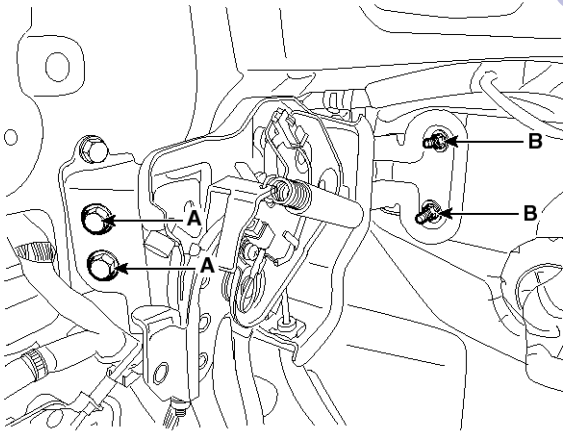
Parking Brake Pedal

1. Remove the main crash pad. (Refer to the Body group-crash pad)
2. Remove the cowl cross bar. (Refer to the Body group - Crash pad)
3. Disconnect the parking brake switch connector (A).



SYFBR0111D

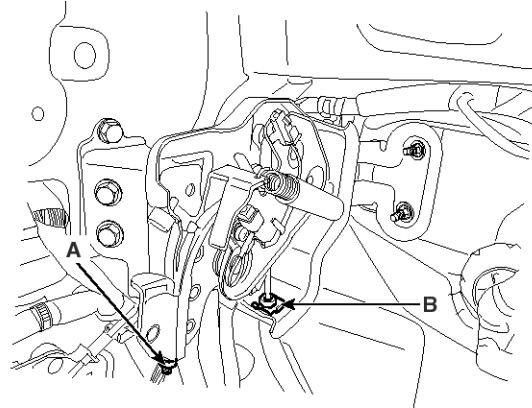
4. Remove the parking brake pedal mounting bolts (A) and nut.(B)



SYFBR0112N

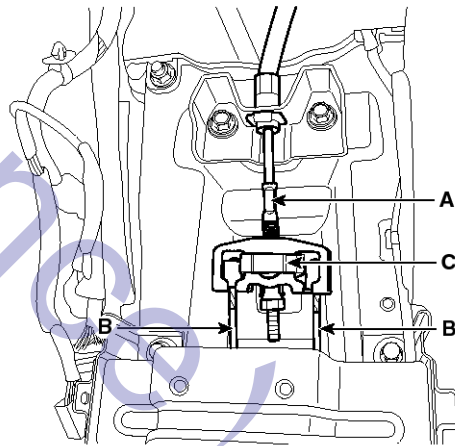
5. Remove the parking brake cable mounting bolts.

6. Remove the parking brake cable adjusting nut(A) and the fixing clip(B), and then remove the parking brake pedal.



SYFBR0113D

7. Remove the floor console. (Refer to the Body group - Console)
8. Remove the parking brake cable (A, B) after removing the cable retainer (C).



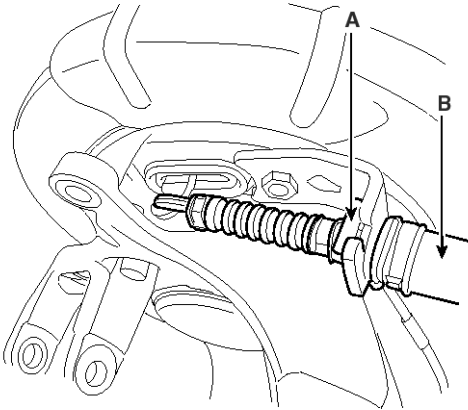
SVGBR0115D

9. Loosen the cable fixing clip and bolts and remove front parking brake cable.
10. Raise the vehicle, and make sure it is securely supported.
11. Remove the rear tire and wheel.

Parking Brake System

BR-37

12. Remove the parking brake cable (B) after removing the fixing clip (A).

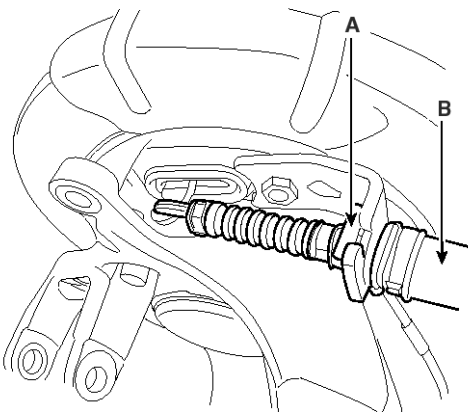


SYFBR0109D

13. Loosen the parking brake cable bracket bolts and remove the rear parking brake cable.

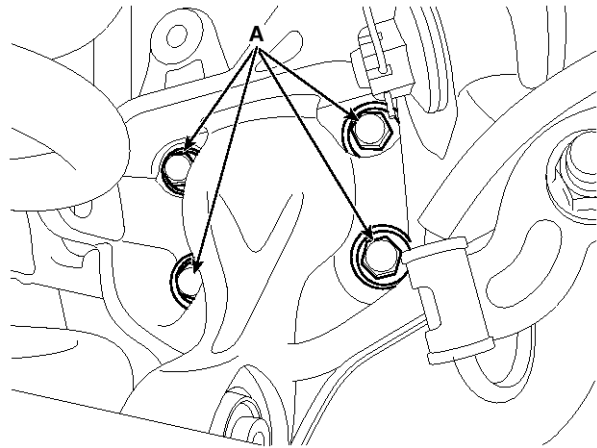
Parking Brake Shoe

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the rear brake caliper and Rear disc brake. (Refer to "Rear disc brake removal")
4. Remove the parking brake cable (B), after removing the fixing clip (A).



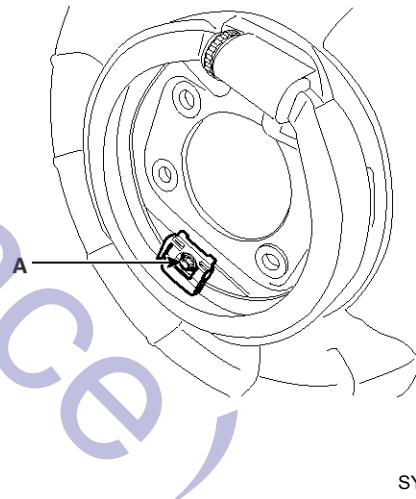
SYFBR0109D

5. Loosen the hub assembly mounting bolts (A), and the remove the hub assembly and parking brake assembly.



SYFBR0114N

6. Loosen the shoe hold clip mounting bolt (A), and then remove the brake shoe.



SYFBR0115D

BR-38

Brake System

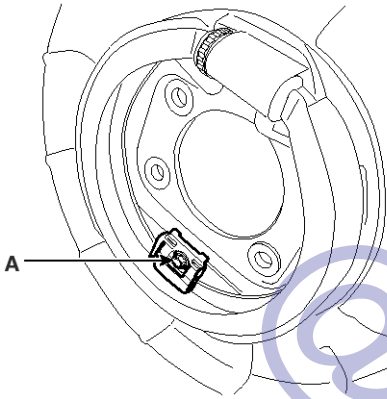
Installation

Parking Brake Shoe

1. Install the brake shoe.
2. Fix the brake shoe with shoe hold clip, and then install the bolt (A).

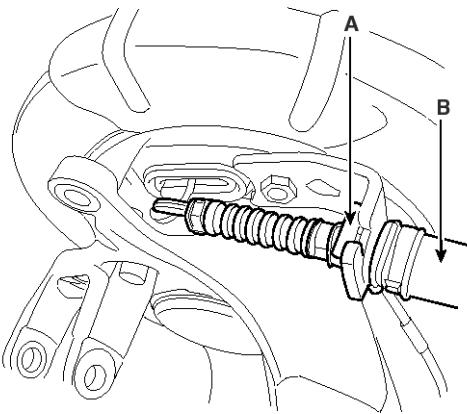
Tightening torque:

2.0 ~ 4.9N.m (0.2 ~ 0.5kgf.m, 1.4 ~ 3.6lb-ft)



SYFBR0115D

3. Install parking brake assembly and hub assembly.
4. Install the parking brake cable (B), then install the fixing clip (A).



SYFBR0109D

5. Install the rear brake disc, then adjust the rear brake shoe clearance.
 - 1) Remove the plug from the disc.
 - 2) 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.
6. Install the brake caliper assembly. (Refer to "Rear brake installation")
7. Install the tire and wheel, after installing the plug on the disc.
8. If the parking brake shoe or the brake disc are replaced a newly one, perform the brake shoe bed-in procedure.
 - 1) While operating the parking brake lever for 98N (10kgf, 22lbf) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 60kph (37 mph).
 - 2) Repeat the above procedure more than three times.
 - 3) Must be held on 20% uphill.

⚠ CAUTION

After adjusting parking brake, notice following matter;

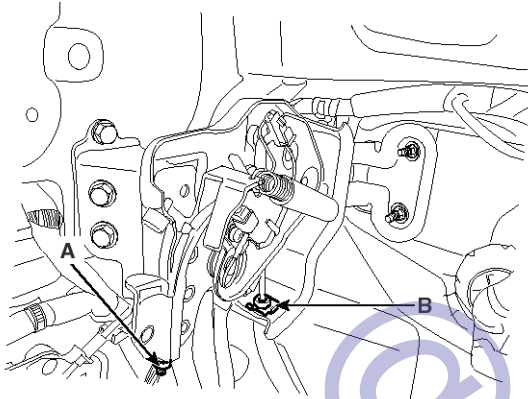
1. Must be free from troubles when the parking pedal is operated at 980 N (100 kgf, 154 lbf).
2. Check that all parts move smoothly.
3. The parking brake indicator lamp must be on after the parking pedal is worked and must be off after the pedal is released.

Parking Brake System

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Parking Brake Pedal

1. Install the parking brake cable.
2. Install the floor console. (Refer to the Body group - console)
3. Install the holding clip (B) and the cable adjusting nut(A) after fixing the parking brake cable.



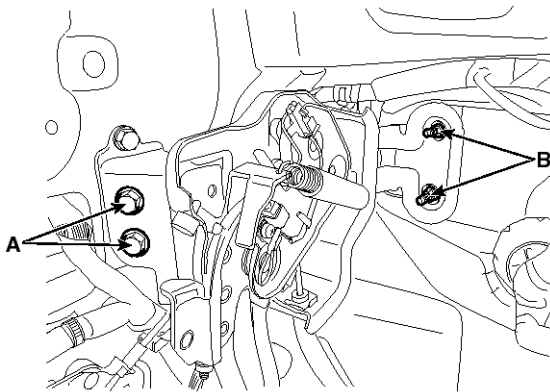
SYFBR0113D

4. Install the parking brake pedal, and then install the parking brake pedal mounting bolts (A) and nuts (B).

Tightening torque:

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

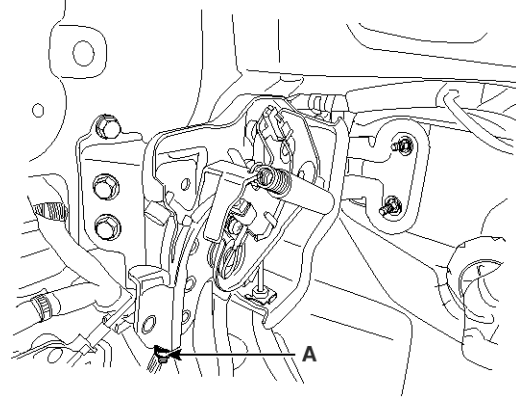
Nuts (B): 9.8 ~ 14.7N.m (1.0 ~ 1.5 kgf.m, 7.2 ~ 10.8 lb-ft)



SYFBR0119D

5. Adjust the parking brake pedal stroke by turning the adjusting nut (A).

- 1) Operate the parking brake pedal through a full stroke over 3 times for setting the parking cables.



SYFBR0118D

- 2) Adjust the adjusting nut (A) for parking brake pedal stroke 4~5notches when operating effort is 196N(20kgf.44lb).

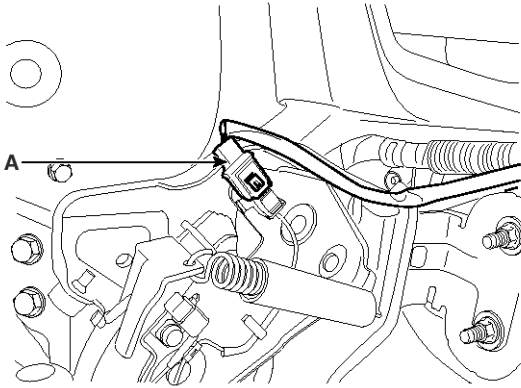
CAUTION

1. The parking brake adjustment must be carried out after adjusting the rear shoe.
2. After adjusting parking brake, notice following matter.
 - a. Must be free from clearance between adjusting nut and pin.
 - b. Check securely that the brake is not dragging.

BR-40

Brake System

6. Reconnect the parking brake switch connector(A).



SYFBR0111D

7. Install the cowl cross bar. (Refer to the Body group - Crash pad)
8. Install the main crash pad. (Refer to Body group - Crash pad)

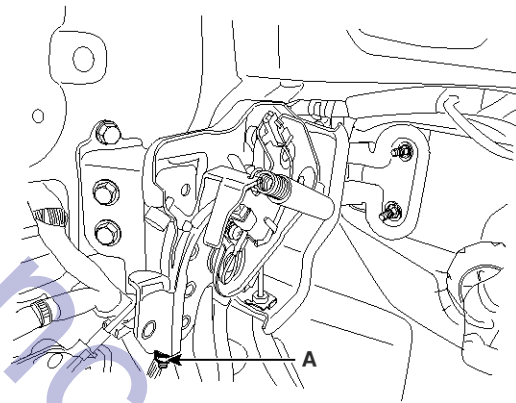
Adjustment

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 (A) 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 rear wheel & tire after installing the plug on the disc.

Parking Brake Pedal Stroke Adjustment

1. Operate the parking brake pedal through a full stroke over 3 times for setting the parking cables.
2. Adjust the adjusting nut(A) for parking brake pedal stroke 4~5 notches when operating effort is 196N(20kgf, 44lbf)



SYFBR0118D

⚠ CAUTION

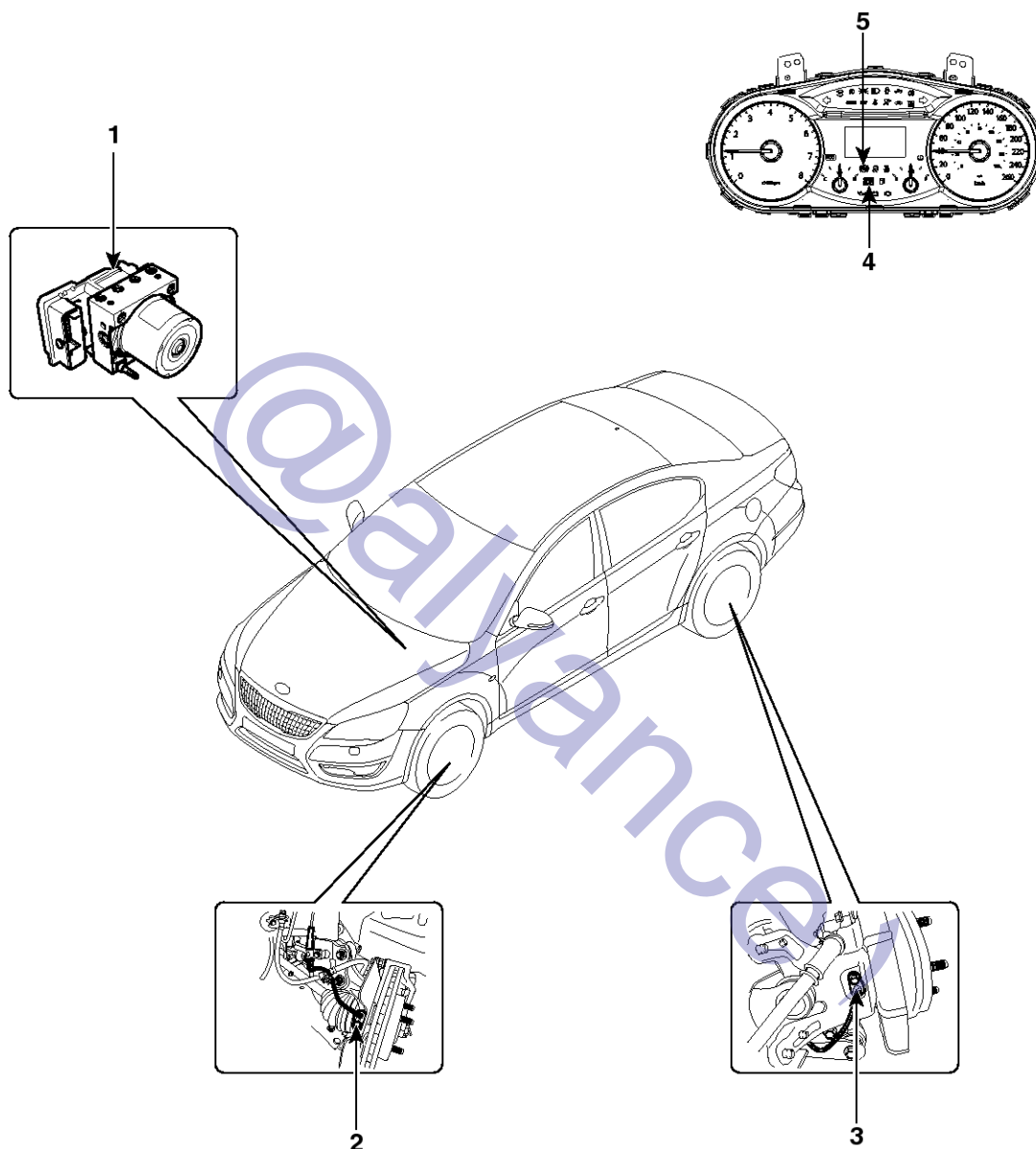
1. The parking brake adjustment must be carried out after adjusting the rear shoe.
2. After adjusting parking brake, notice following matter.
 - a. Must be free from clearance between adjusting nut and pin.
 - b. Check securely that the brake is not dragging.

ABS(Anti-Lock Brake System)

BR-41

ABS(Anti-Lock Brake System)

Components



1. ABS Control Module(HECU)
2. Front Wheel Speed Sensor
3. Rear Wheel Speed Sensor

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

SVGBR0130D

BR-42**Brake System****Description**

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)

This specification is for the wiring design and installation of ABS ECU.

This unit has the functions as follows.

- Input of signal from the wheel speed sensors attached to each wheel.
- Control of braking force.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation Position : Engine Compartment

- Brake tube length from Master cylinder port to HECU inlet port should be max. 1m
- The position should not be close to the engine block and not lower than the wheel.

Operation

The ECU shall be put into operation by switching on the operating voltage (IGN).

On completion of the initialization phase, the ECU shall be ready for operation.

In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

Wheel Sensor Signal Processing

The ECU shall receive wheel speed signal from the four active wheel sensors.

The wheel signals are converted to voltage signal by the signal conditioning circuit after receiving current signal from active wheel sensors and given as input to the MCU.

Solenoid Valve Control

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.

The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

Voltage Limits

- Overvoltage

When overvoltage is detected(above 16.8 V), the ECU switches off the valve relay and shuts down the system.

When voltage is returned to operating range, the system goes back to the normal condition after the initialization phase.

- Undervoltage

In the event of undervoltage(below 9.3 V), ABS control shall be inhibited and the warning lamp shall be turned on.

When voltage is returned to operating range, the warning lamp is switched off and ECU returns to normal operating mode.

Pump Motor Checking

The ECU performs a pump motor test at a speed of 30km/h once after IGN is switched on.

Diagnostic Interface

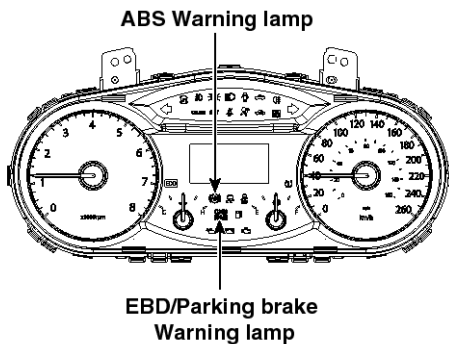
Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.

The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU (Air-bleeding line or Roll and Brake Test line).

ABS(Anti-Lock Brake System)

BR-43

Warning Lamp Module



SVGBR0131L

1. ABS Warning Lamp

The active ABS warning lamp indicates the selftest 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.

2. EBD/Parking brake Warning Lamp

The active EBD warning lamp indicates the selftest 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.

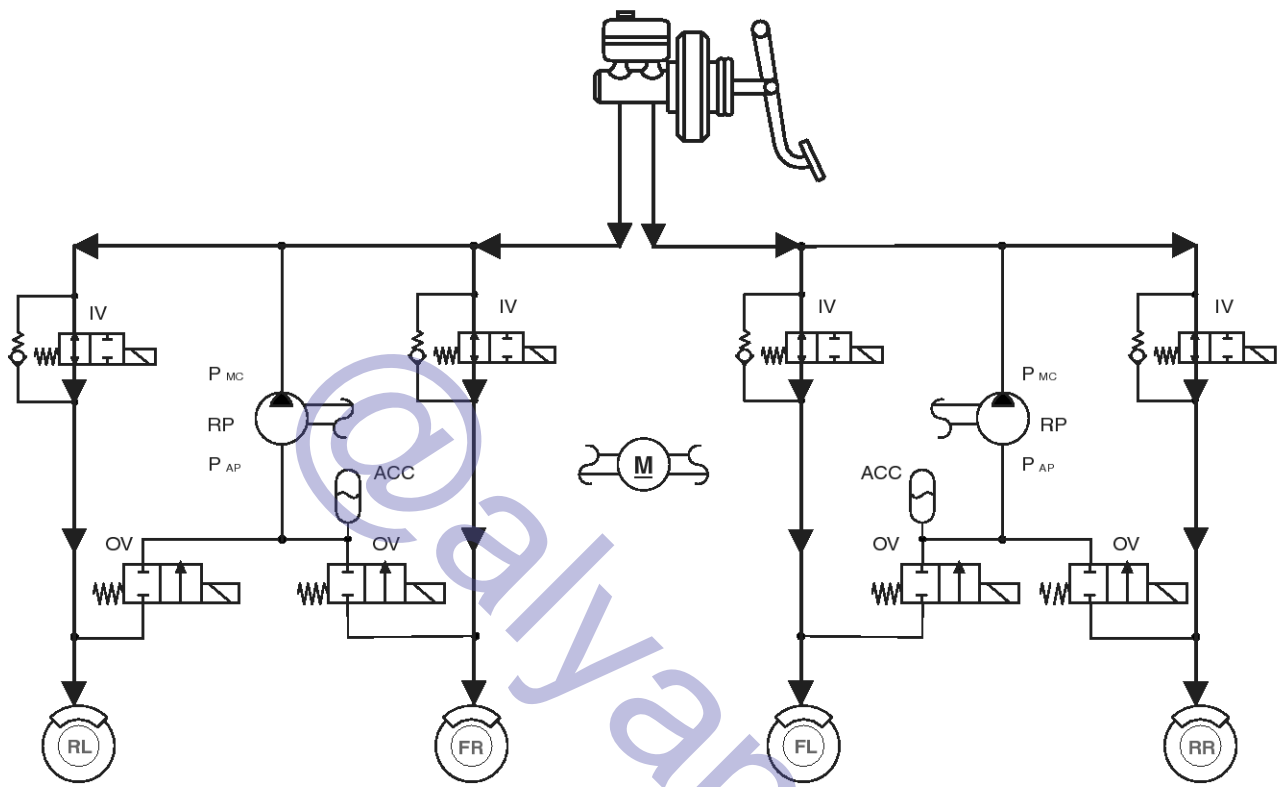
BR-44

Brake System

ABS Control

1. Normal Braking without ABS

	Inlet valve(IV)	Outlet valve(OV)	Return pump
Operation	Open	Close	OFF



STDBR9135C

NOTICE

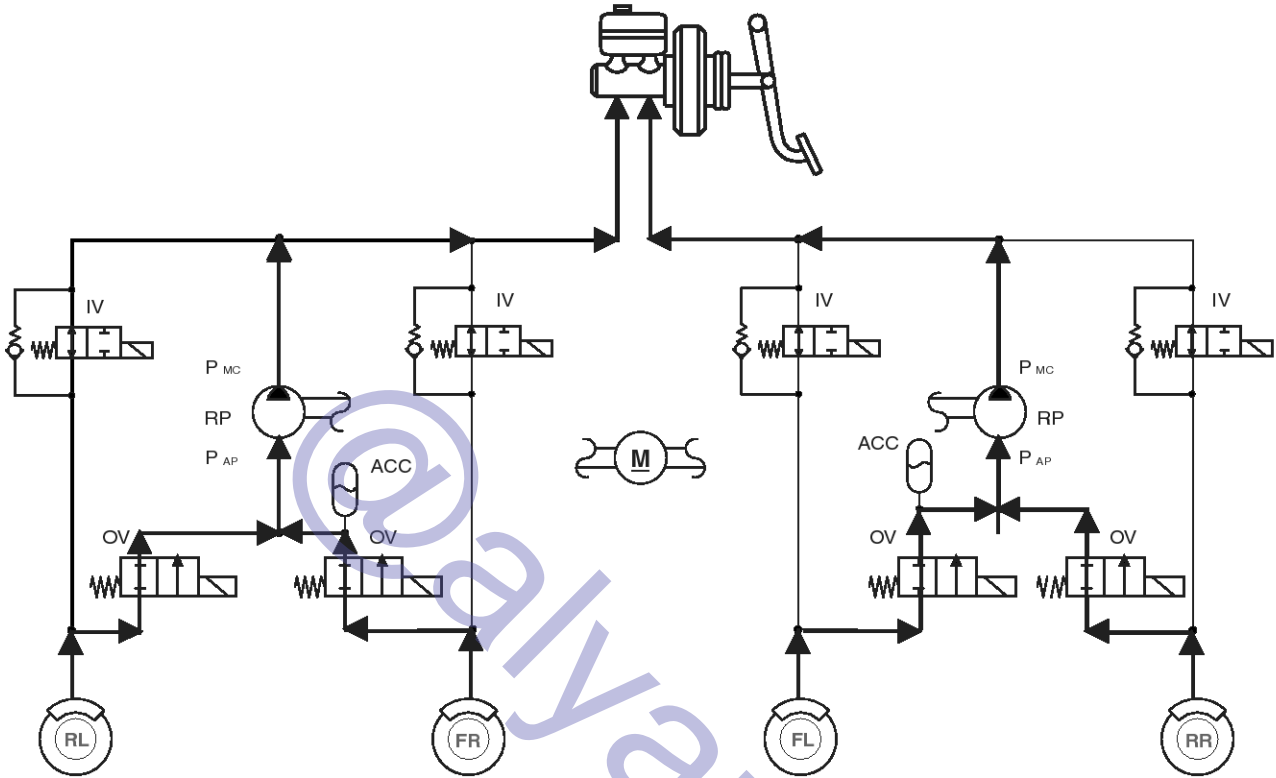
- IV : Inlet Valve
- OV : Outlet Valve
- RL : Rear left wheel
- FR : Front right wheel
- FL : Front left wheel
- RR : Rear right wheel
- RP : Return pump

ABS(Anti-Lock Brake System)

BR-45

2. Decrease Mode

	Inlet valve(IV)	Outlet valve(OV)	Return pump
Operation	Close	Open	ON(Motor speed control)



STDBR9136C

NOTICE

IV : Inlet Valve

OV : Outlet Valve

RL : Rear left wheel

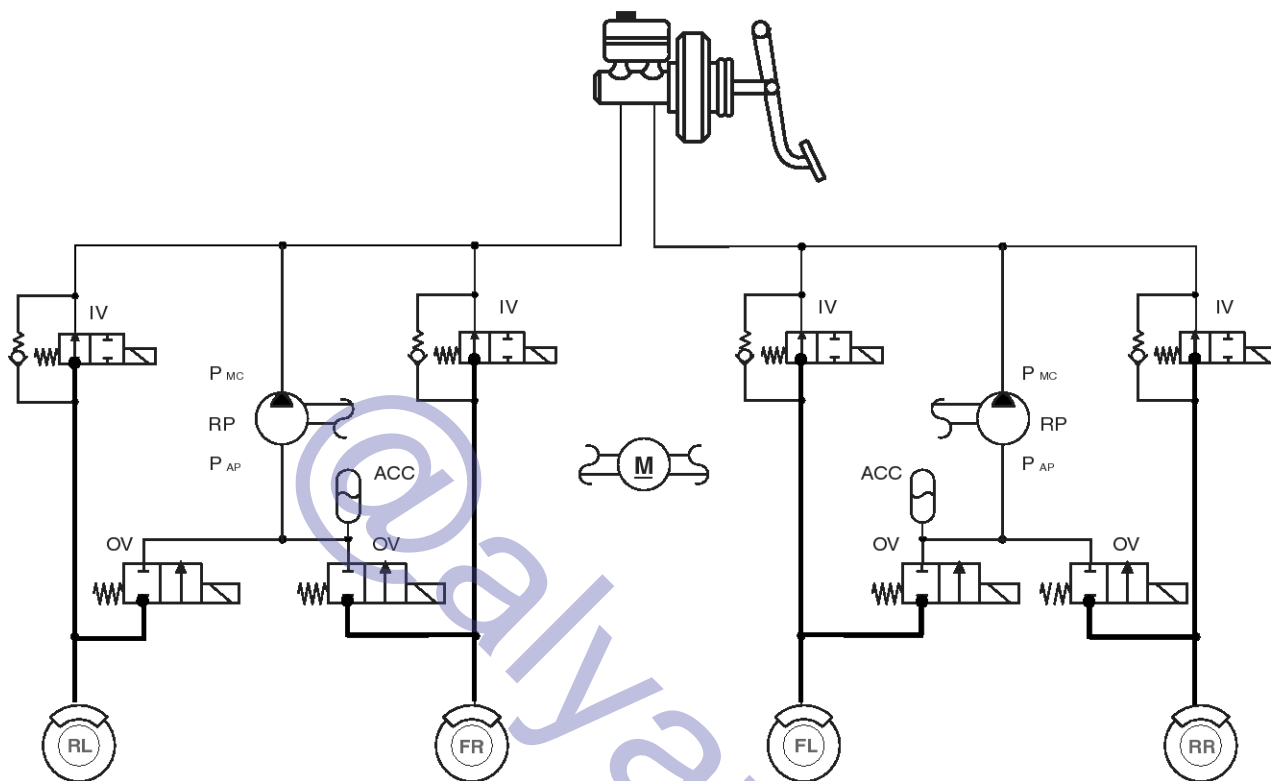
FR : Front right wheel

FL : Front left wheel

RR : Rear right wheel

RP : Return pump

	Inlet valve(IV)	Outlet valve(OV)	Return pump
Operation	Close	Close	ON(Motor speed control)

 **NOTICE**

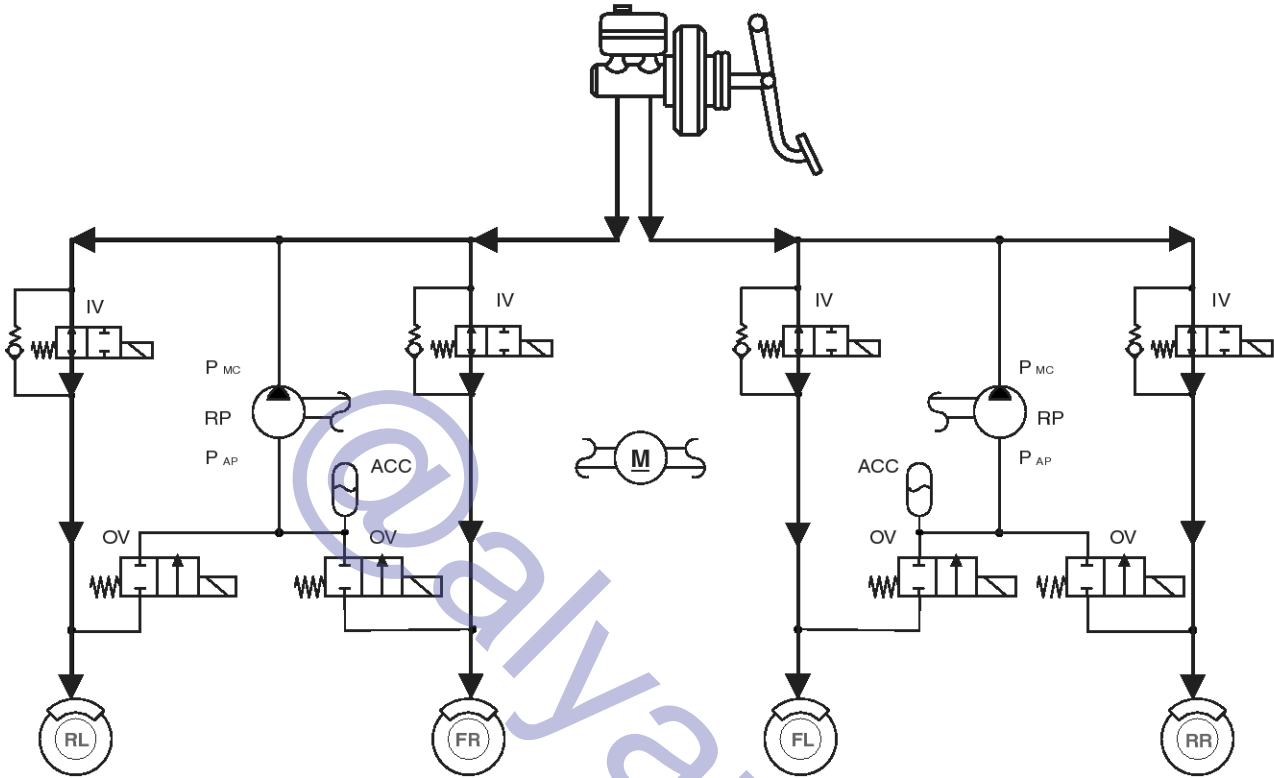
RP : Return pump

ABS(Anti-Lock Brake System)

BR-47

4. Increase Mode

	Inlet valve(IV)	Outlet valve(OV)	Return pump
Operation	Open	Close	ON(Motor speed control)



STDBR9138C

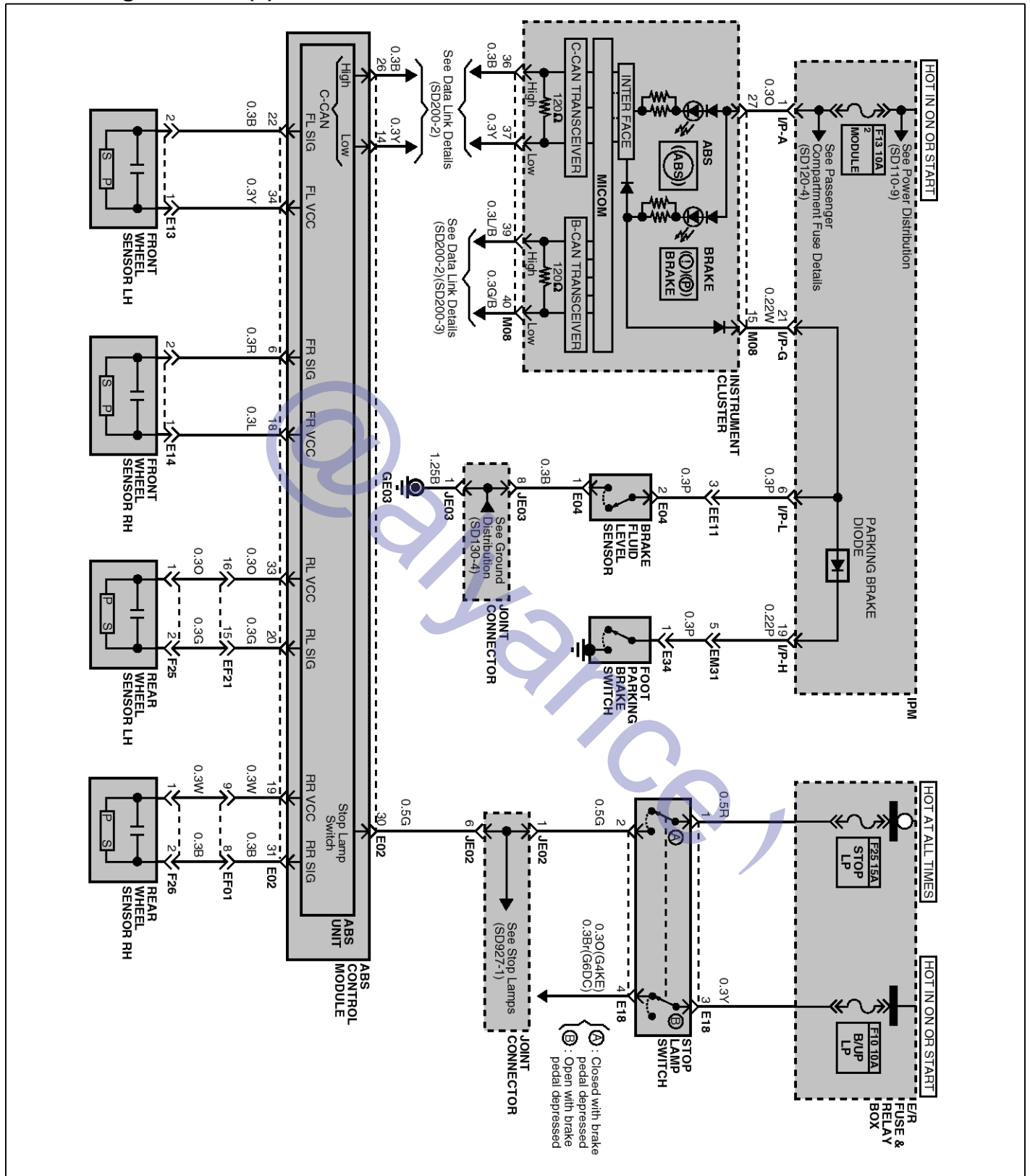
NOTICE

IV : Inlet Valve
 OV : Outlet Valve
 RL : Rear left wheel
 FR : Front right wheel
 FL : Front left wheel
 RR : Rear right wheel
 RP : Return pump

BR-48

Brake System

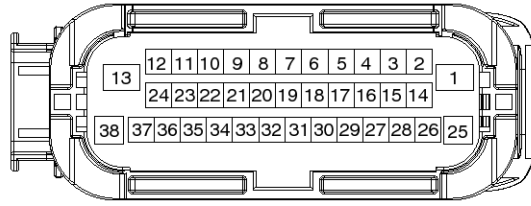
Circuit Diagram - ABS(1)



BR-50

Brake System

ECU Connector Input/Output (ABS)



STDBR9134C

Wire No.	Designation	Current		max.permissible wire resistance R _L (mΩ)
		max	min	
13	Ground for recirculation pump	20 ~ 39 A	10 A	-
38	Ground for solenoid valves and ECU	5 ~ 15 A	2 A	-
1	Voltage supply for pump motor	20 ~ 39 A	10 A	-
25	Voltage supply for solenoid valves	5 ~ 15 A	2 A	-
32	Voltage for hybrid ECU	1 A	500 mA	60
22,6,20,31	signal wheel speed sensor FL, FR, RL,RR	16 mA	6 mA	250
34,18,33,19	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	16 mA	6 mA	250
30	Brake light switch (Signal)	10 mA	5 mA	250
14	CAN Low	30 mA	20 mA	250
26	CAN High	30 mA	20 mA	250
27, 3	Wheel speed sensor output	20 mA	10 mA	250

ABS(Anti-Lock Brake System)

BR-51

ABS Hecu Connector

Connector terminal		Specification	Condition
Number	Description		
13	Ground for recirculation pump	Current range: Min.10A Max. 39A	Always
38	Ground for solenoid valves and ECU	Current range: Min.2A Max. 15A	Always
1	Voltage supply for pump motor	Battery voltage	Always
25	Voltage supply for solenoid valves		
34	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG On
18			
33			
19			
22	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.26 ~ 0.37 V Voltage (Low) : 0.13 ~ 0.18 V	On driving
16			
20			
31			
32	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
30	Brake light switch	Voltage (High) $\geq 4.5 * IG ON$ Voltage (Low) $\leq 2.0 * IG ON$	Brake On/Off

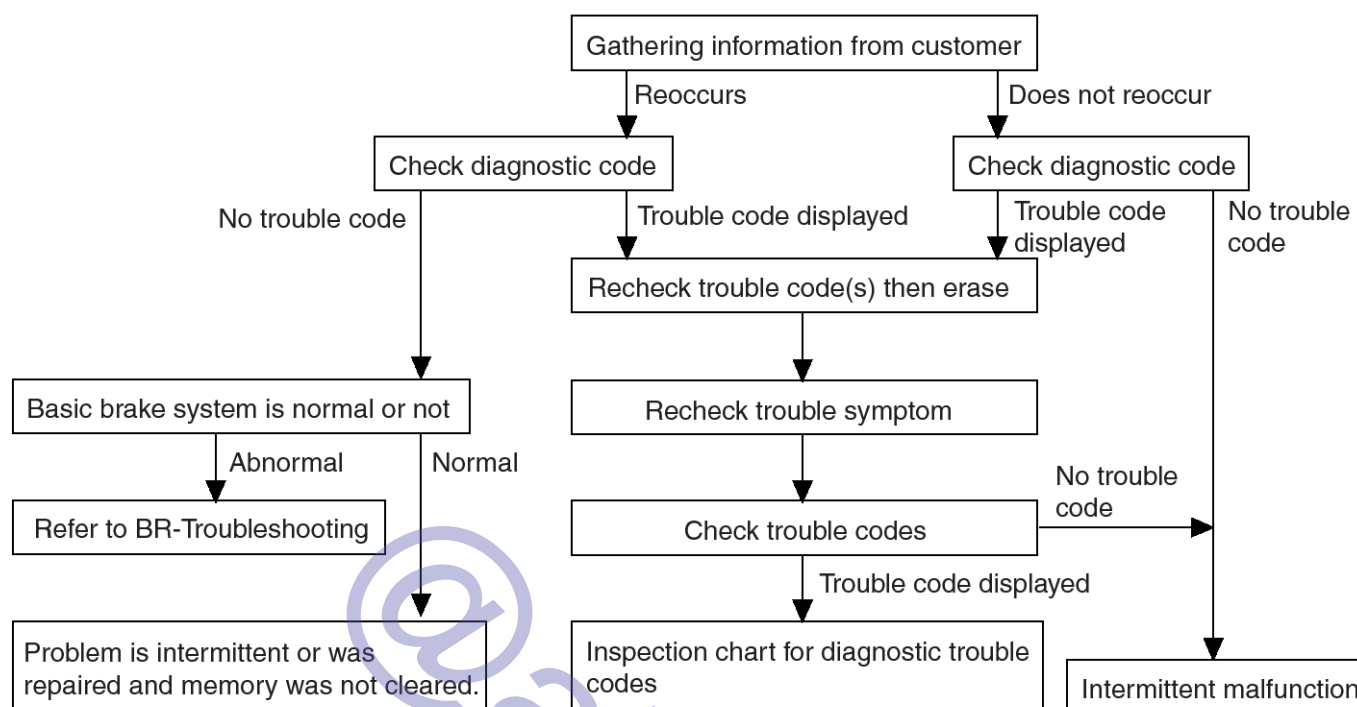
BR-52**Brake System****Sensor Output On GDS(ABS)**

	Description	Abbreviation	Unit	Remarks
1	Vehicle speed sensor	VEH. SPD	Km/h	
2	Battery voltage	BATT. VOL	V	
3	FL Wheel speed sensor	FL WHEEL	Km/h	
4	FR Wheel speed sensor	FR WHEEL	Km/h	
5	RL Wheel speed sensor	RL WHEEL	Km/h	
6	RR Wheel speed sensor	RR WHEEL	Km/h	
7	ABS Warning lamp	ABS LAMP	-	
8	EBD Warning lamp	EBD LAMP	-	
9	Brake Lamp	B/LAMP	-	
10	Pump relay state	PUMP RLY	-	
11	Valve relay state	VALVE RLY	-	
12	Motor	MOTOR	-	
13	Front Left valve(IN)	FL INLET	-	
14	Front Right valve (IN)	FR INLET	-	
15	Rear Left valve (IN)	RL INLET	-	
16	Rear Right valve (IN)	RR INLET	-	
17	Front Left valve (OUT)	FL OUTLET	-	
18	Front Right valve (OUT)	FR OUTLET	-	
19	Rear Left valve(OUT)	RL OUTLET	-	
20	Rear Right valve (OUT)	RR OUTLET	-	

ABS(Anti-Lock Brake System)

BR-53

Standard Flow of Diagnostic Troubleshooting



* Using the customer problem analysis check sheet for reference, ask the customer as much detail as possible about the problem.

EJKB055A

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	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.

BR-54

Brake System

ABS Check Sheet

ABS Check Sheet

Inspector's
Name _____

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

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

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

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

ABS(Anti-Lock Brake System)

BR-55

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.

BR-56

Brake System

ABS Does Not Operate.

STQBR8319L

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 ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

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

NO ▶ Check the power source circuit.

YES ▶ Erase the DTC and recheck using GDS.

Check the power source circuit

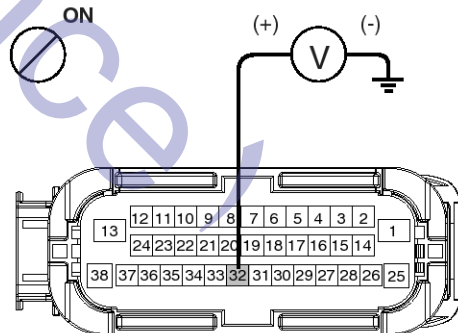
1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 32 of the ABS control module harness side connector and body ground.

Specification: approximately B+

Is the voltage within specification?

YES ▶ Check the ground circuit.

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



STDBR9140C

ABS(Anti-Lock Brake System)

BR-57

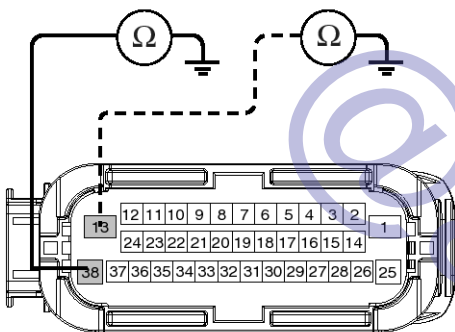
Check the ground circuit

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 13, 38 of the ABS control module harness side connector and ground point.

Is there continuity?

YES ▶ Check the wheel speed sensor circuit.

NO ▶ Repair an open in the wire and ground point.



STDBR9141C

Check the wheel speed sensor circuit

1. Inspect the wheel speed sensor circuit. (Refer to the DTC troubleshooting procedures)

Is it normal?

YES ▶ Check the hydraulic circuit for leakage.

NO ▶ Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage

1. Inspect leakage of the hydraulic lines.

Is it normal?

YES ▶ The problem is still occurring, replace the ABS control module.

NO ▶ Repair the hydraulic lines for leakage.

BR-58

Brake System

ABS Does Not Operate (Intermittently).

STQBR8320L

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 ABS control module.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty HECU

Inspection procedures

DTC Inspection

1. Connect the GDS with the data link connector and turn the ignition switch ON.

2. Verify that the DTC code is output.

Is the DTC 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.

Is it normal?

YES ▶ Check the stop lamp switch circuit.

NO ▶ Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage

1. Inspection leakage of the hydraulic lines.

Is it normal?

YES ▶ The problem is still occurring, replace the ABS control module.

NO ▶ Repair the hydraulic lines for leakage.

ABS(Anti-Lock Brake System)

BR-59

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

SVIBR0321L

Detecting condition

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

Inspection procedures

Check The Power Supply Circuit For The Diagnosis

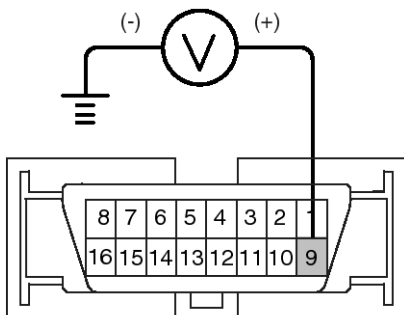
1. Measure the voltage between terminal 9 of the data link connector and body ground.

Specification : approximately B+

Is voltage within specification?

YES ► Check the ground circuit for the diagnosis.

NO ► Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



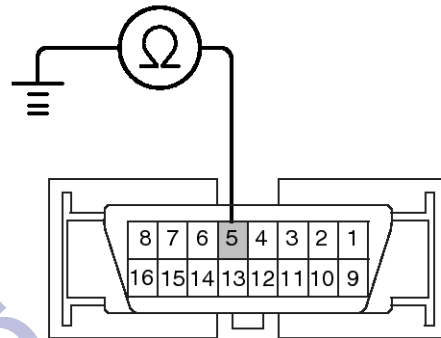
SUNBR6519L

Check the ground circuit for the diagnosis

1. Check for continuity between terminal 5 of the data link connector and body ground.

Is there continuity?

NO ► Repair an open in the wire between terminal 5 of the data link connector and ground point.



SUNBR6520L

BR-60

Brake System

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

SVIBR0322L

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.	- An open in the wire - Faulty HECU - Faulty power source circuit

Inspection procedures

Check for Continuity in the CAN Line

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

Is there continuity?

YES ▶ Check the power source of ABS control module.

NO ▶ Repair an open in the wire.

Check the power source of ABS control module

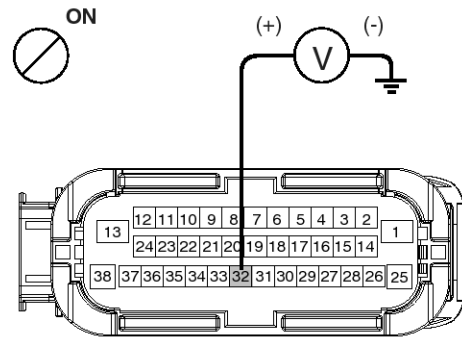
1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 32 of the ABS control module harness side connector and body ground.

Specification : approximately B+

Is voltage within specification?

YES ▶ Check for poor ground.

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



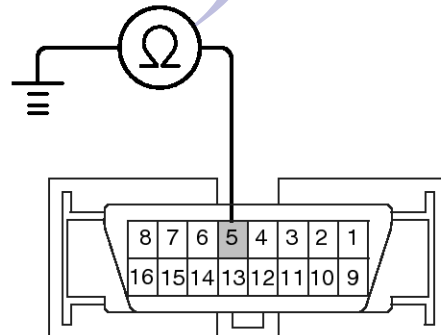
STDBR9140C

Check for poor ground

1. Check for continuity between terminal 5 of the data link connector and ground point.

YES ▶ Replace the ABS control module and recheck.

NO ▶ Repair an open in the wire or poor ground



SUNBR6520L

ABS(Anti-Lock Brake System)

BR-61

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

STQBR8323L

Detecting condition

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

Inspection procedures

Problem verification

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

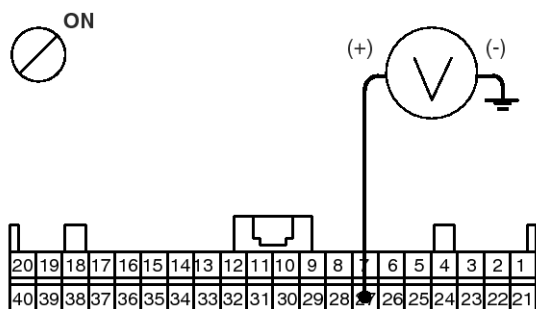
YES ▶ Inspect again after replacing the ABS HECU .

NO ▶ Check the power source for the ABS warning lamp.

Check the power source for the ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch ON.
2. Measure the voltage between terminal (M08) 27 of the cluster harness side connector and body ground.

Specification : approximately B+



SVGBR0135D

Is voltage within specification?

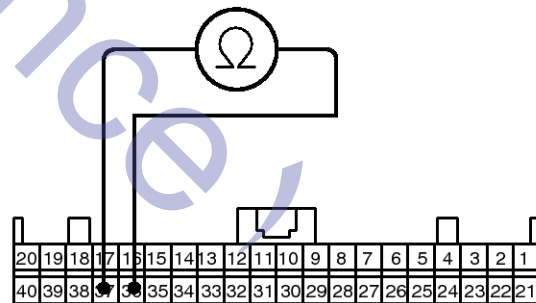
YES ▶ Check the CAN circuit resistance for ABS warning lamp.

NO ▶ Check for blown fuse.

Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M08) 36 and 37 of the cluster harness side connector.

Specification : 60Ω



SVGBR0136D

Is resistance within specification?

YES ▶ Repair ABS warning lamp bulb or instrument cluster assembly.

NO ▶ Check the CAN circuit wiring for ABS warning lamp.

BR-62**Brake System****Check the CAN circuit wiring for ABS warning lamp**

1. Disconnect the instrument cluster connector (M08) and ABS HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M08) 36 of the cluster harness side connector and terminal 26 of ABS HECU harness side.

Check for continuity between terminal (M08) 37 of the cluster harness side connector and terminal 14 of ABS HECU harness side.

Specification : Below 1Ω

Is resistance within specification?

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

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

ABS(Anti-Lock Brake System)

BR-63

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

STQBR8324L

Detecting condition

Trouble Symptoms	Possible Cause
If the HECU detects trouble, it lights the ABS warning lamp while at the same time prohibiting ABS control. At this time, the HECU records a DTC in memory. Even though the normal code is output, the ABS warning lamp remains ON, then the cause may be probably an open or short in the ABS warning lamp circuit.	- An open in the wire - Faulty instrument cluster assembly - Faulty ABS warning lamp module - Faulty HECU

Inspection procedures

Check DTC Output

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

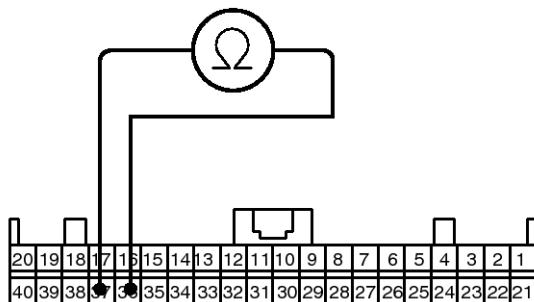
YES ▶ Perform the DTC troubleshooting procedure (Refer to DTC troubleshooting).

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

Check the CAN circuit resistance for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M08) 36 and 37 of the cluster harness side connector.

Specification : 60Ω



SVGBR0136D

Is resistance within specification?

YES ▶ Repair ABS warning lamp bulb or instrument cluster assembly.

NO ▶ Check the CAN circuit wiring for ABS warning lamp.

Check the CAN circuit wiring for ABS warning lamp

1. Disconnect the instrument cluster connector (M08) and ABS HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M08) 36 of the cluster harness side connector and terminal 26 of ABS HECU harness side.

Check for continuity between terminal (M08) 37 of the cluster harness side connector and terminal 14 of ABS HECU harness side.

Specification : Below 1Ω

Is there continuity?

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

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

BR-64

Brake System

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.

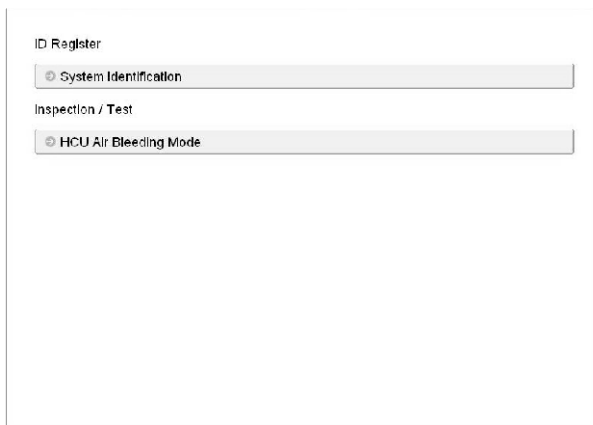
Recommended fluid..... DOT3 or DOT4

2. 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.
3. Connect the GDS to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the GDS screen.

CAUTION

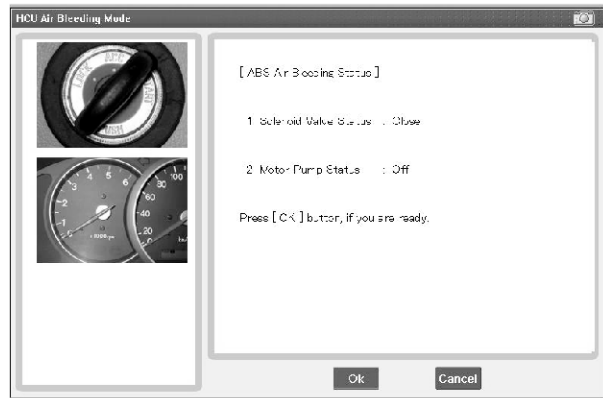
You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from burning.

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



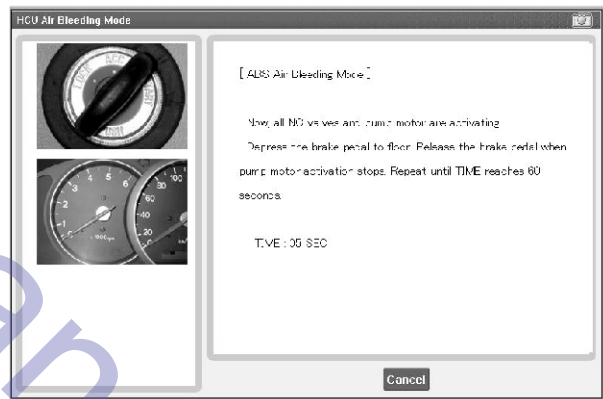
SBKBR9141N

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



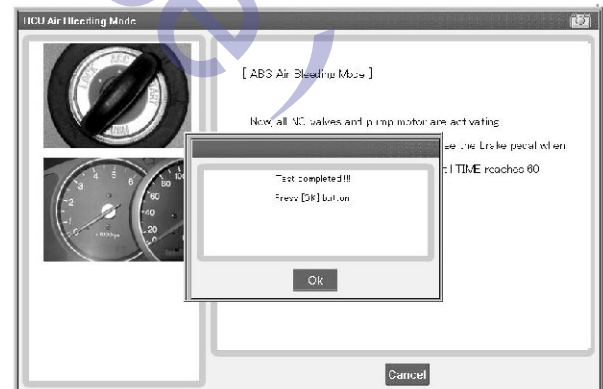
SBKBR9142N

- 5) Wait 60 sec. before operating the air bleeding. (If not, you may damage the motor.)



SBKBR9143N

- 6) Perform the air bleeding.



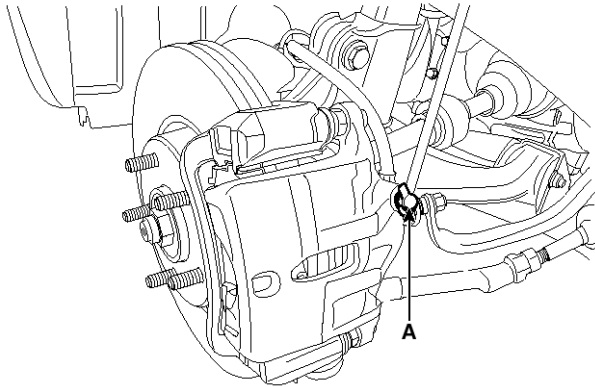
SBKBR9144N

ABS(Anti-Lock Brake System)

BR-65

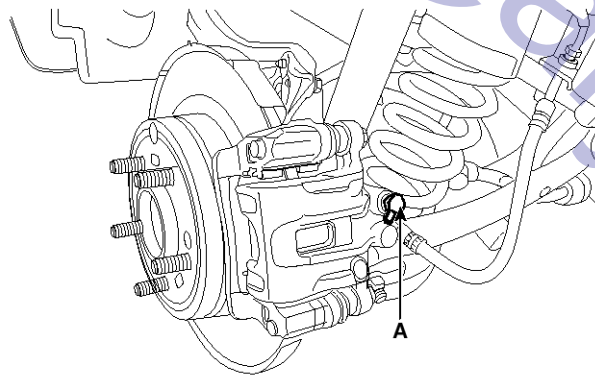
5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw(A).

Front



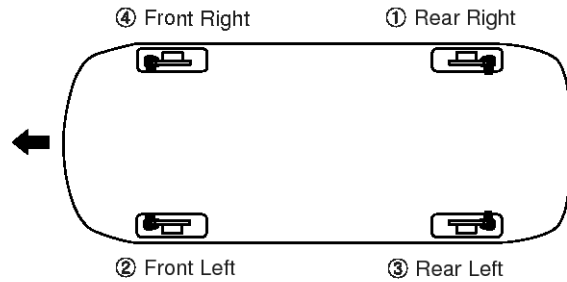
SVGBR0001D

Rear



SVGBR0002D

6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



SKMBR7302L

7. Tighten the bleeder screw.

Bleed screw tightening torque:

7 ~ 13 Nm (0.7 ~ 1.3 kgf.m, 5.4 ~ 9.5 lb-ft)

EBD(Electronic Brake-force Distribution)

Description

The EBD system (Electronic Brake force Distribution) as a sub-system of the ABS system is to control the effective adhesion utilization by the rear wheels.

It further utilizes the efficiency of highly developed ABS equipment by controlling the slip of the rear wheels in the partial braking range.

The brake force is moved even closer to the optimum and controlled electronically, thus dispensing with the need for the proportioning valve.

The proportioning valve, because of a mechanical device, has limitations to achieve an ideal brake force distribution to the rear wheels as well as to carry out the flexible brake force distribution proportioning to the vehicle load or weight increasing. And in the event of malfunctioning, driver cannot notice whether it fails or not.

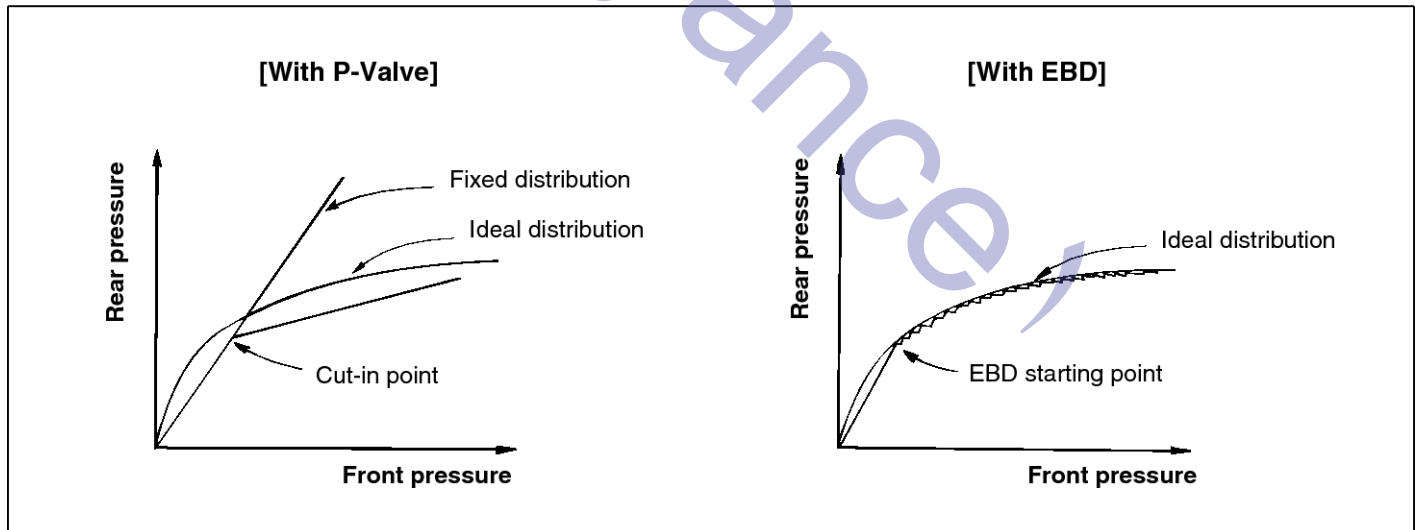
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

If the EBD fails, the EBD warning lamp (Parking brake lamp) lights up.

Advantages

- Function improvement of the base-brake system.
- Compensation for the different friction coefficients.
- Elimination of the proportioning valve.
- Failure recognition by the warning lamp.

Comparison between Proportioning valve and EBD

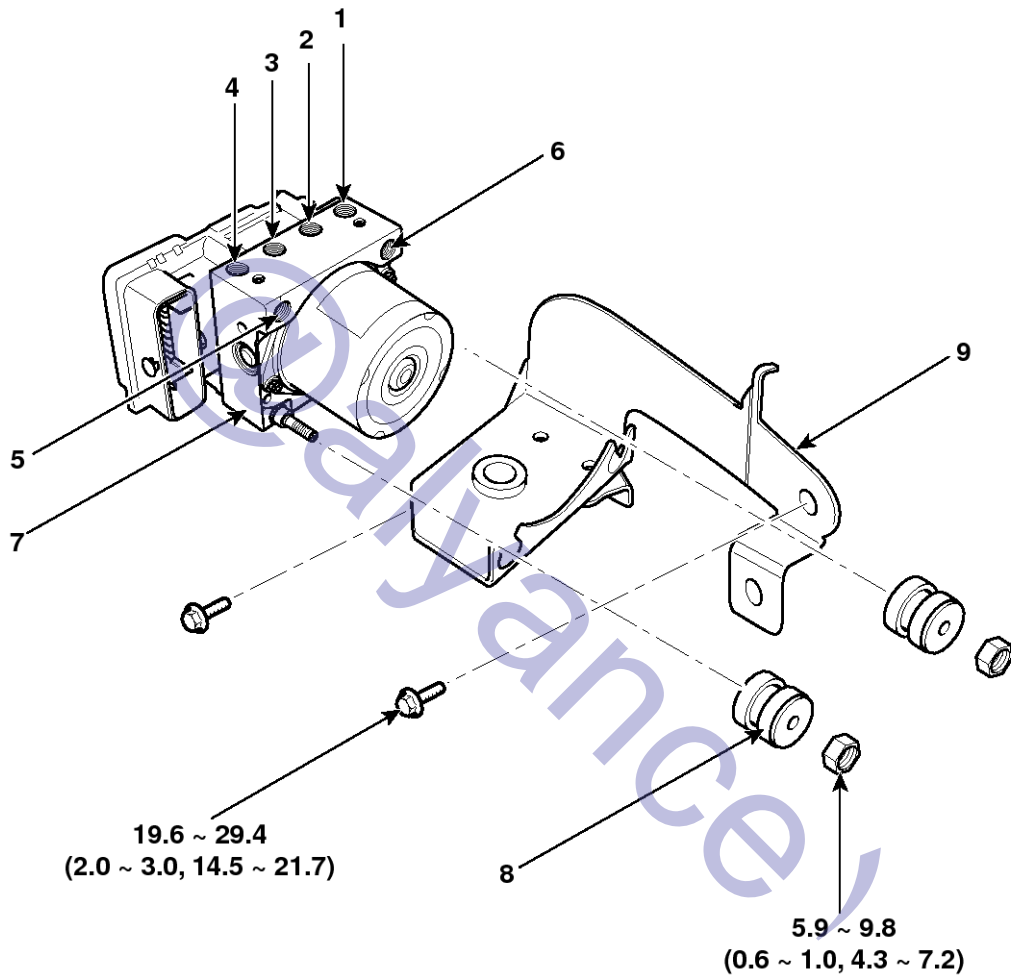


ABS(Anti-Lock Brake System)

BR-67

ABS Control Module

Components



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

SYFBR0160L

1. Front - left tube
2. Rear - right tube
3. Rear - left tube
4. Front - right tube
5. MC2

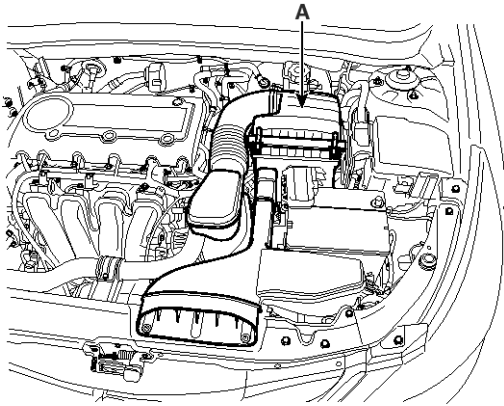
6. MC1
7. ABS control module(HECU)
8. Damper
9. Bracket

BR-68

Brake System

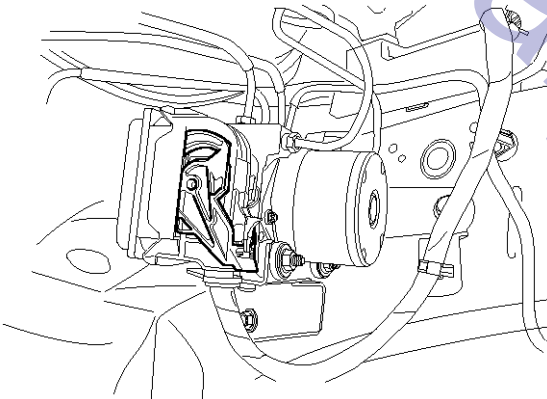
Removal

1. Turn the ignition switch OFF.
2. Remove the air cleaner assembly (A).



SYFBR0011D

3. Pull up the lock of the HECU connector , then disconnect the connector.



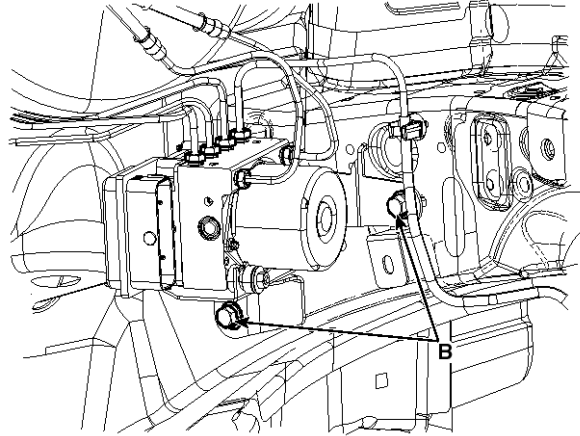
SYFBR0162D

4. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.

Tightening torque :

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

ESP : 18.6 ~ 22.6N.m(1.9 ~ 2.3kgf.m, 13.7 ~ 16.6lb-ft)



SVGBR0161D

5. Loosen the HECU bracket bolts (B), then remove HECU and bracket.

Tightening torque :

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

⚠ CAUTION

1. Never attempt to disassemble the HECU.
2. Never shock to the HECU.
6. Remove the 2 bolts, then remove the bracket from HECU.

Tightening torque :

5.9 ~ 9.8N.m(0.6 ~ 1.0kgf.m, 4.3 ~ 7.2lb-ft)

Installation

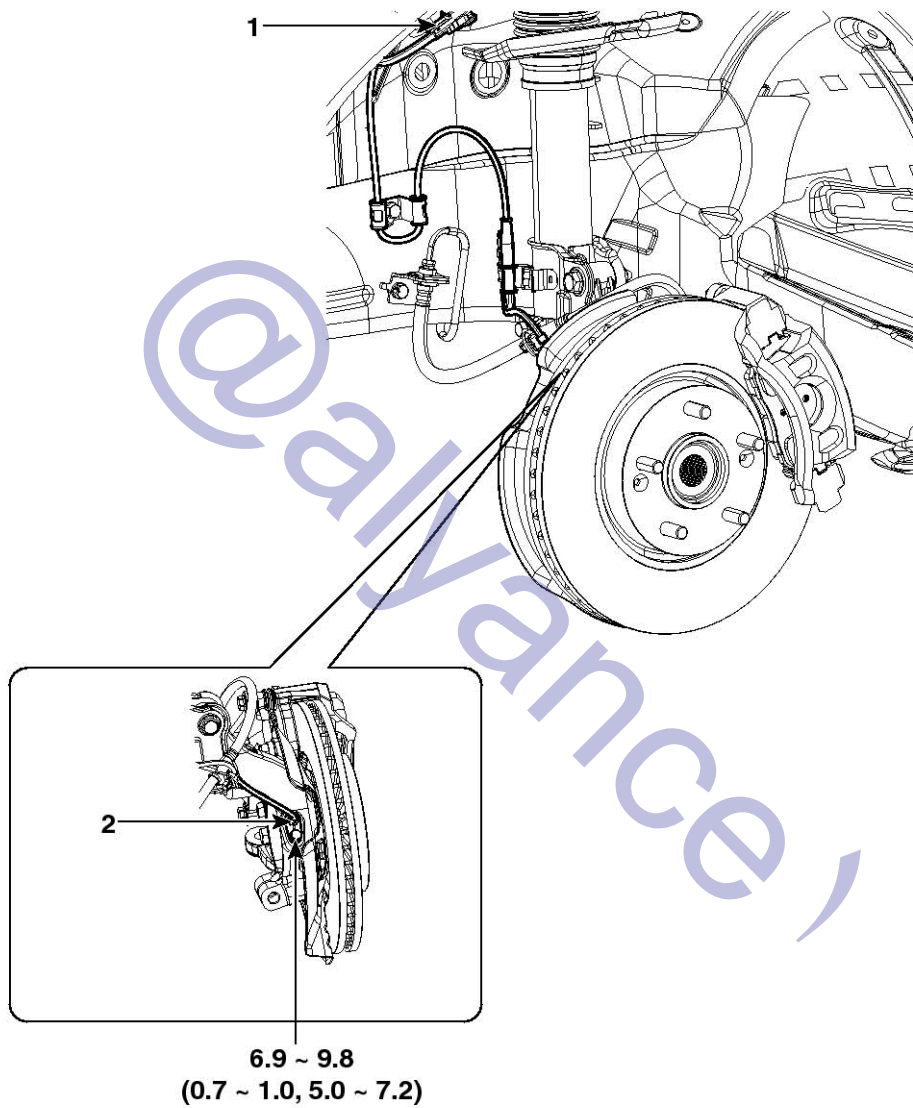
1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and nuts to the specified torque.
3. After installation, bleed the brake system.(Refer to ABS bleeding)

ABS(Anti-Lock Brake System)

BR-69

Front Wheel Speed Sensor

Components



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

SVGBR0170L

1. Front wheel speed sensor connector
2. Front wheel speed sensor

BR-70

Brake System

Removal

1. Remove the front wheel and tire.

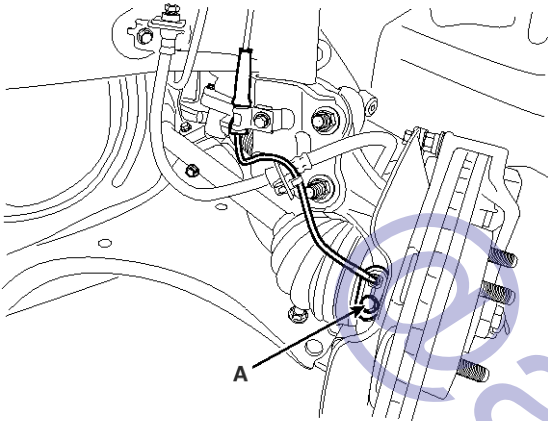
Tightening torque:

88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

2. Remove the front wheel speed sensor mounting bolt (A).

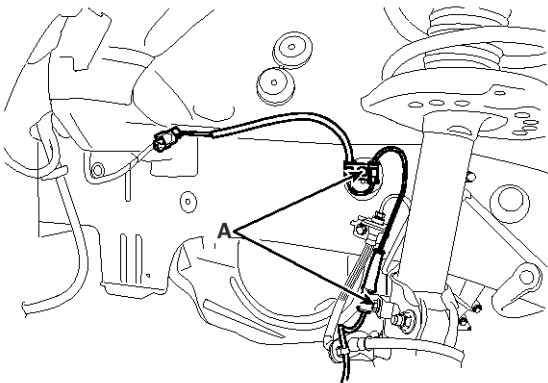
Tightening torque:

6.9 ~ 9.8 N.m (0.7 ~ 1.0 kgf.m, 5.0 ~ 7.2 lb-ft)



SYFBR0171D

3. Remove the front wheel guard .
4. Remove the front wheel speed sensor cable mounting bolt (A).



SYFBR0172D

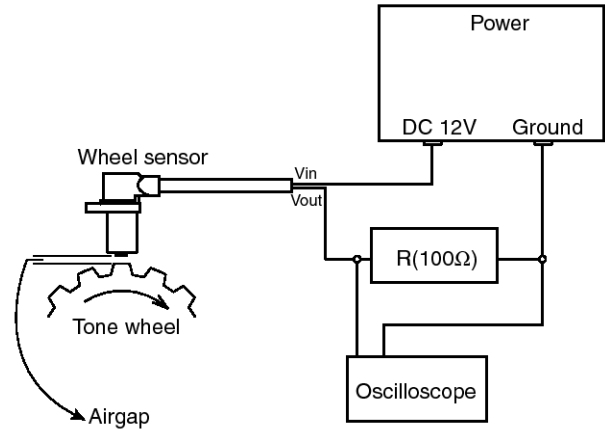
5. Disconnect the front wheel speed sensor connector, then remove the front wheel speed sensor.
6. Installation is the reverse of removal.

Inspection

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

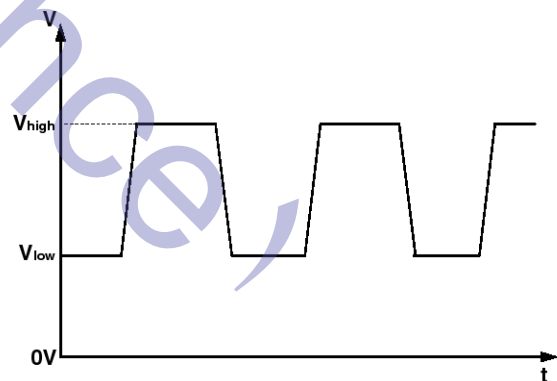
CAUTION

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



SYFBR0172N

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



ARJE503Z

V_{low} : 0.59V ~ 0.84V

V_{high} : 1.18V ~ 1.68V

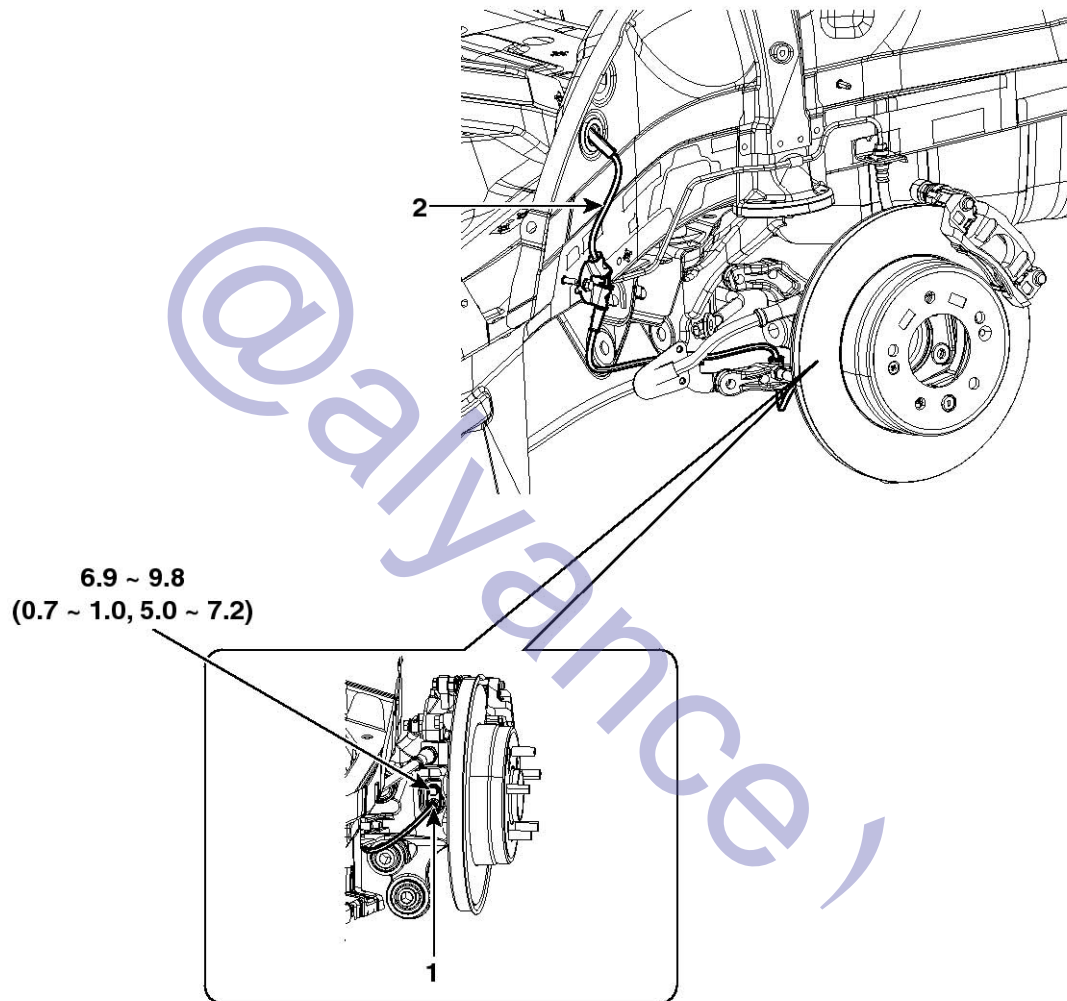
Frequency range : 1 ~ 2,500Hz

ABS(Anti-Lock Brake System)

BR-71

Rear Wheel Speed Sensor

Components



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

SVGBR0180L

1. Rear wheel speed sensor
2. Rear wheel speed sensor cable

BR-72

Brake System

Removal

1. Remove the rear wheel and tire.

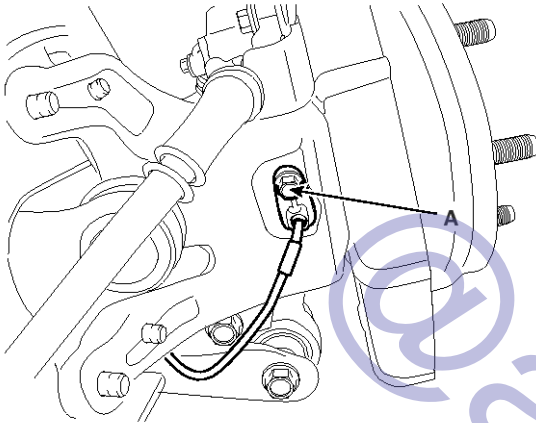
Tightening torque:

88.3 ~ 107.9 N.m (9.0 ~ 11.0 kgf.m, 65.1 ~ 79.6 lb-ft)

2. Remove the rear wheel speed sensor mounting bolt (A).

Tightening torque:

6.9 ~ 7.8 N.m (0.7 ~ 1.0 kgf.m, 5.0 ~ 7.2 lb-ft)



SYFBR0181D

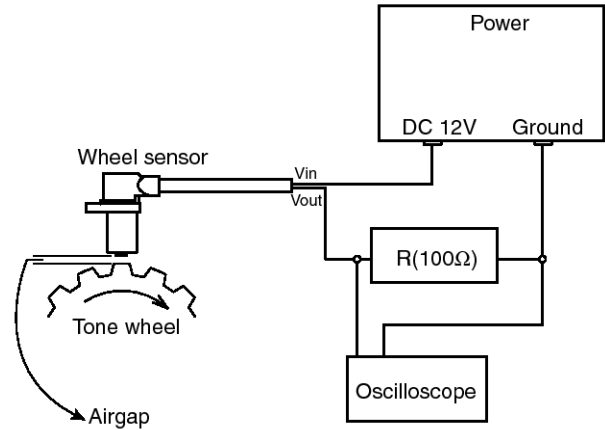
3. Remove the rear seat back. (Refer to the Body group - Seat)
4. Disconnect the rear wheel speed sensor connector.
5. Installation is the reverse of removal.

Inspection

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

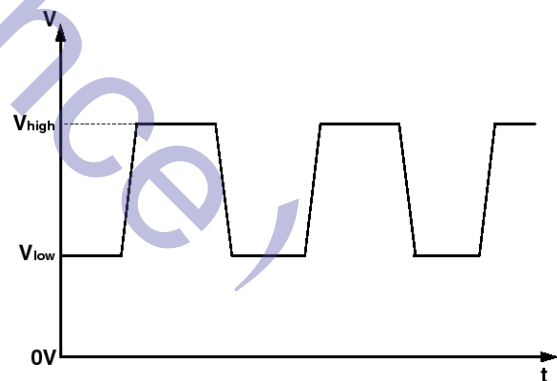
CAUTION

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



SYFBR0172N

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



ARJE503Z

V_{low} : 0.59V ~ 0.84V

V_{high} : 1.18V ~ 1.68V

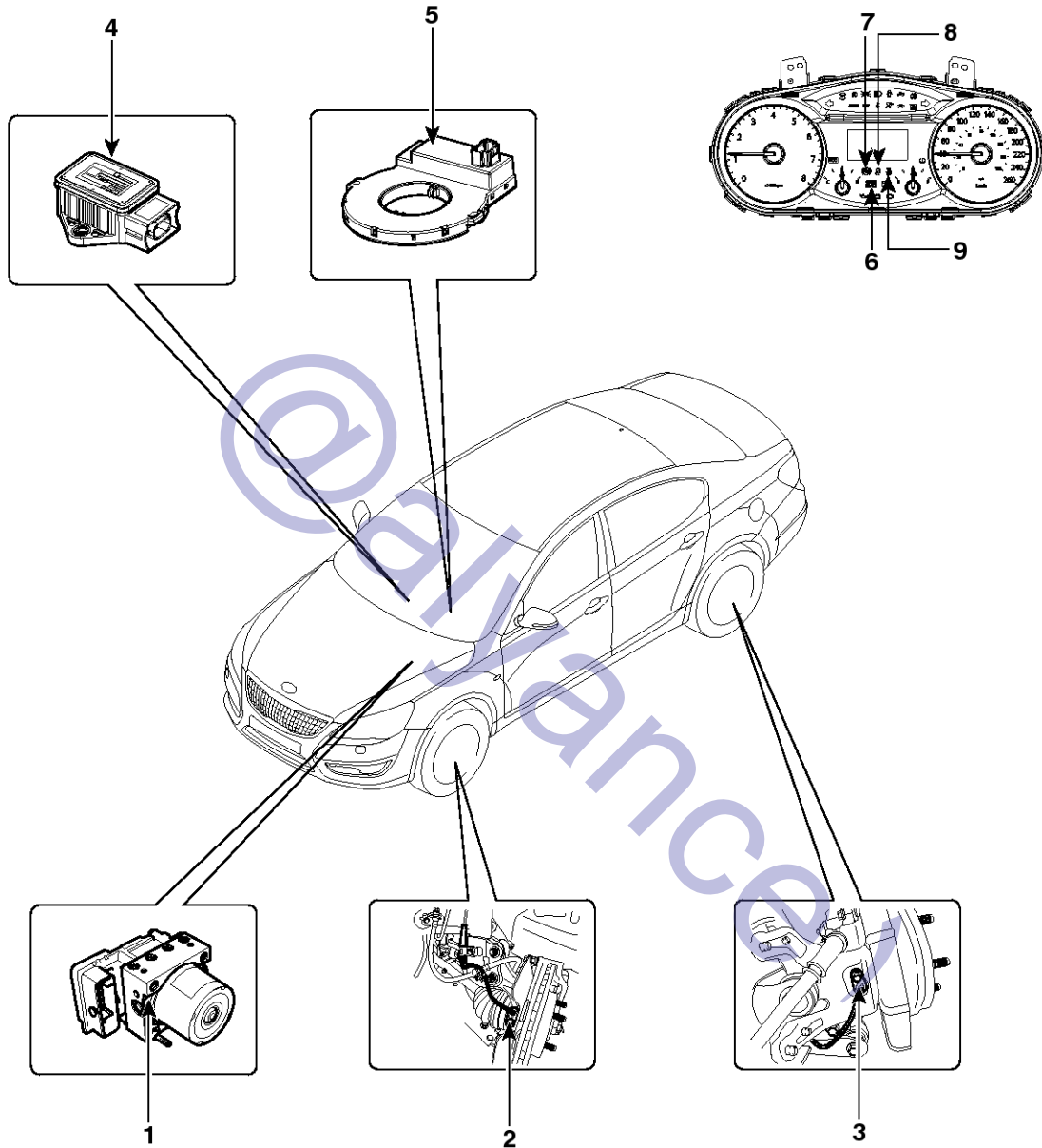
Frequency range : 1 ~ 2,500Hz

ESP(Electronic Stability Program) System

BR-73

ESP(Electronic Stability Program) System

Components



SVGBR0200D

1. ESP Control Module (HECU)
2. Front Wheel Speed Sensor
3. Rear Wheel Speed Sensor
4. Yaw-late & Lateral G Sensor
5. Steering Wheel Angle Sensor

6. EBD/Parking brake Warning Lamp
7. ABS Warning Lamp
8. ESP Function/Warning Lamp
9. ESP OFF Lamp

BR-74

Brake System

Description of ESP

Optimum driving safety now has a name : ESP, the Electronic Stability Program.

ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake or the gas pedal.

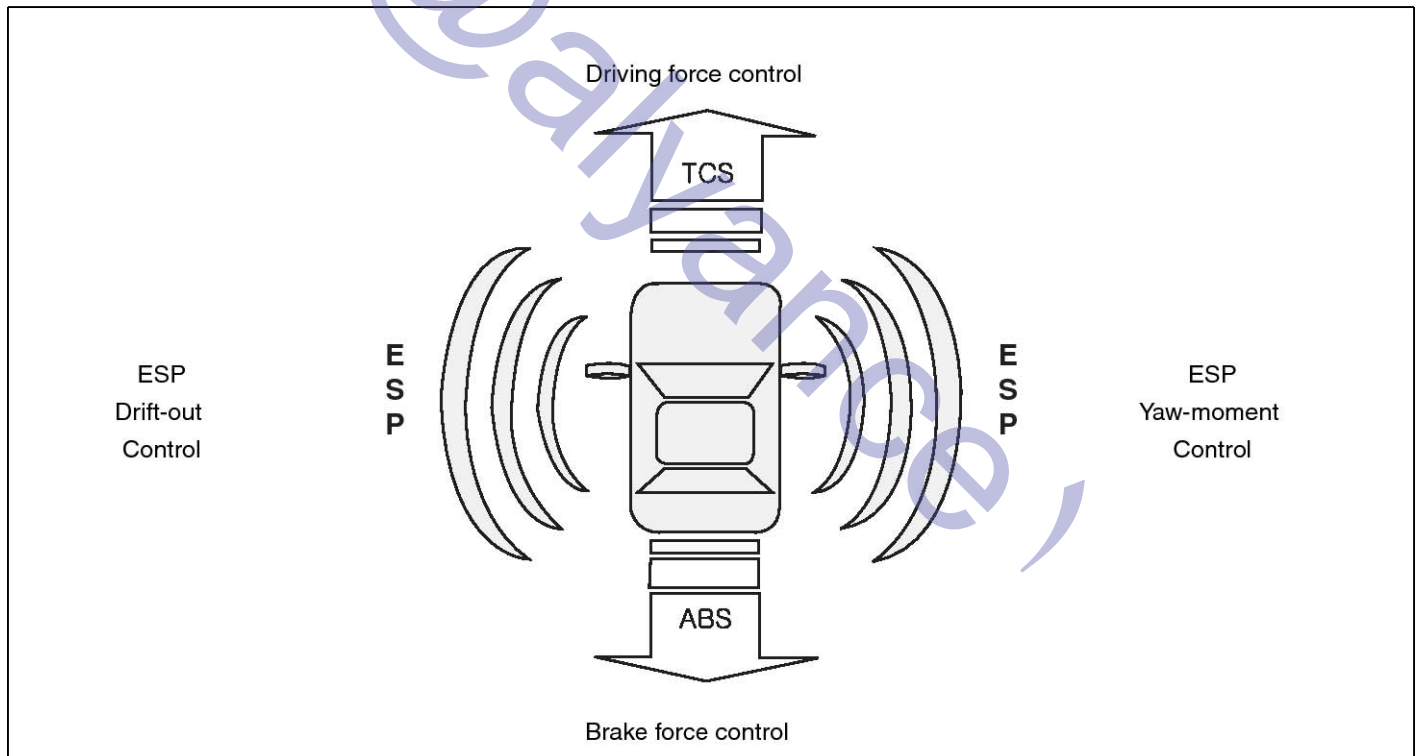
ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESP functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about its vertical axis.

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

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

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

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



ESP(Electronic Stability Program) System

BR-75

Description of ESP Control

ESP system includes ABS/EBD, TCS and AYC (Active yaw control) function.

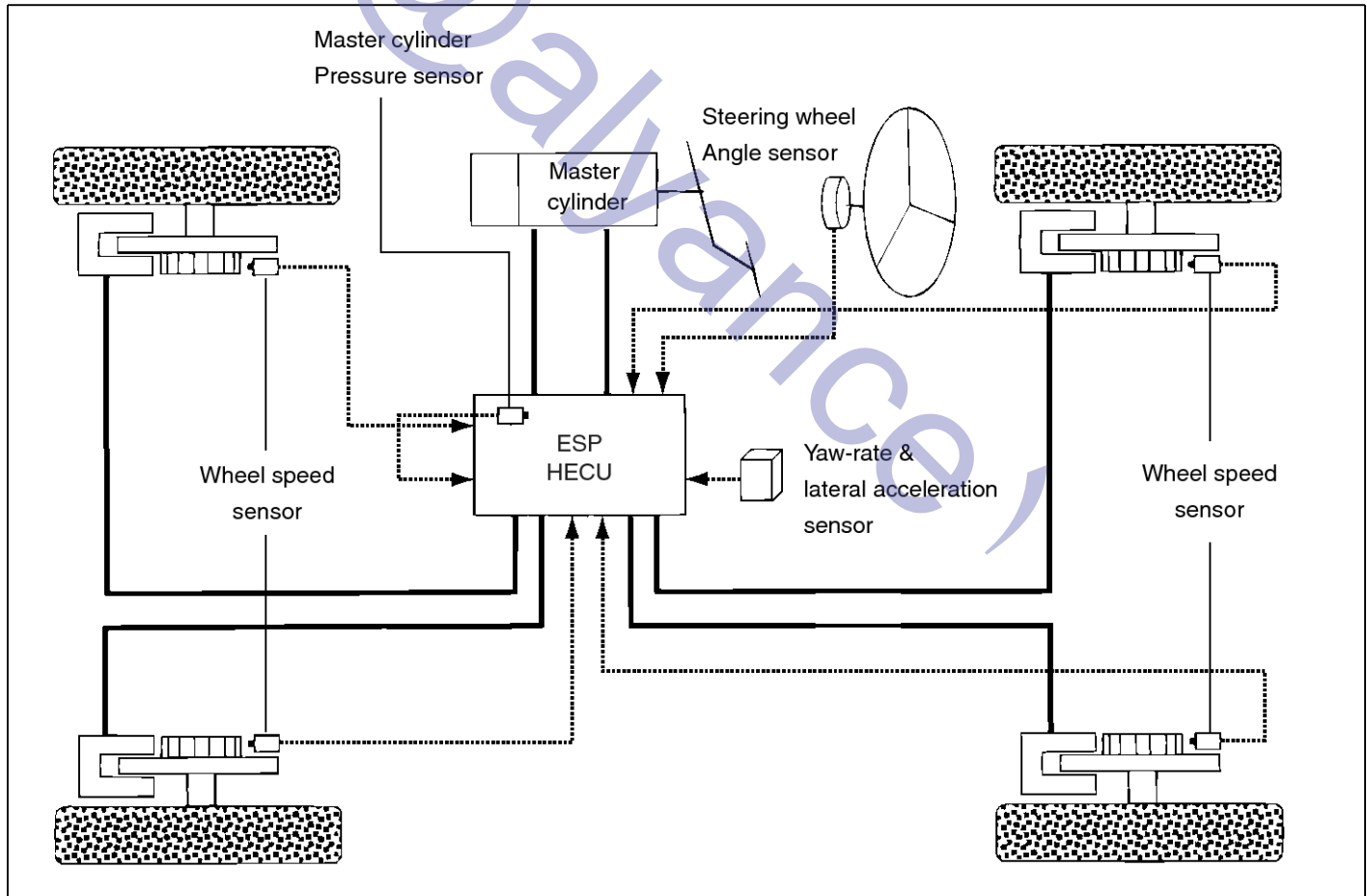
ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square waveform. By using the input of above signals, the ECU calculates the vehicle speed and the acceleration & deceleration of the four wheels. And, the ECU judges whether the ABS/EBD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

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

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

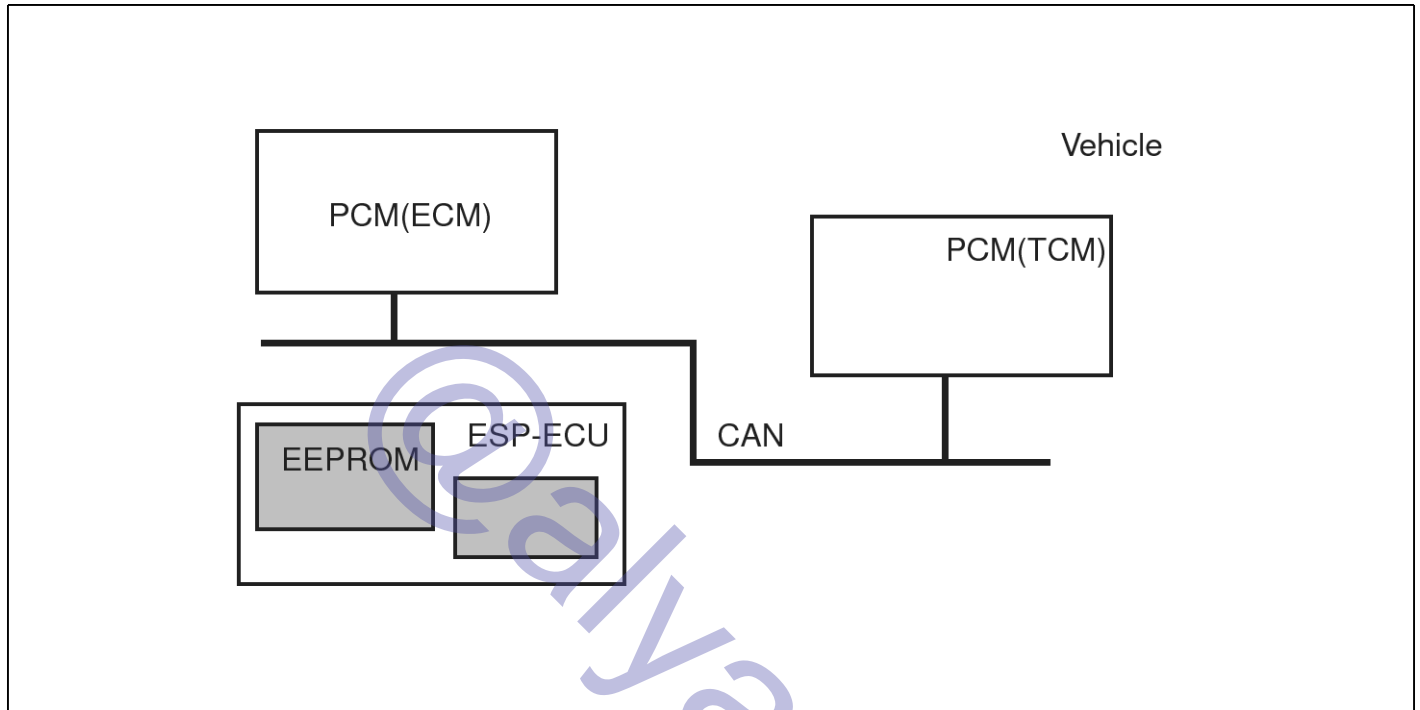
If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.

After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis) If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESP warning lamp. (fail-safe warning)



BR-76**Brake System****Variant Coding**

The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESP calculations. Variant code programming should be performed whenever an HECU is replaced.



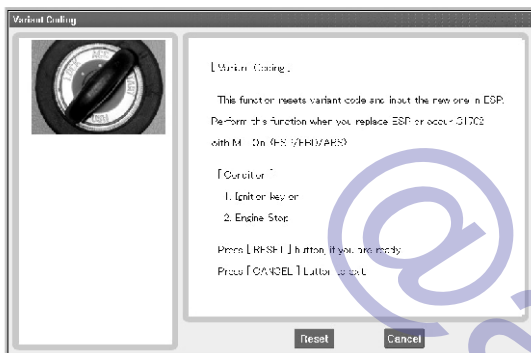
LJKG500Y

ESP(Electronic Stability Program) System

BR-77

Procedure of Variant Coding

1. Install a PCM(ECM & TCM)/ESP normally.
2. Connect the GDS to the data link connector located underneath the crash pad.
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.
6. Ignition "ON" & Engine "OFF".
7. Perform variant coding.



SVQBR0209L

8. Ignition "OFF" and then ignition "ON".
9. The variant coding is completed.

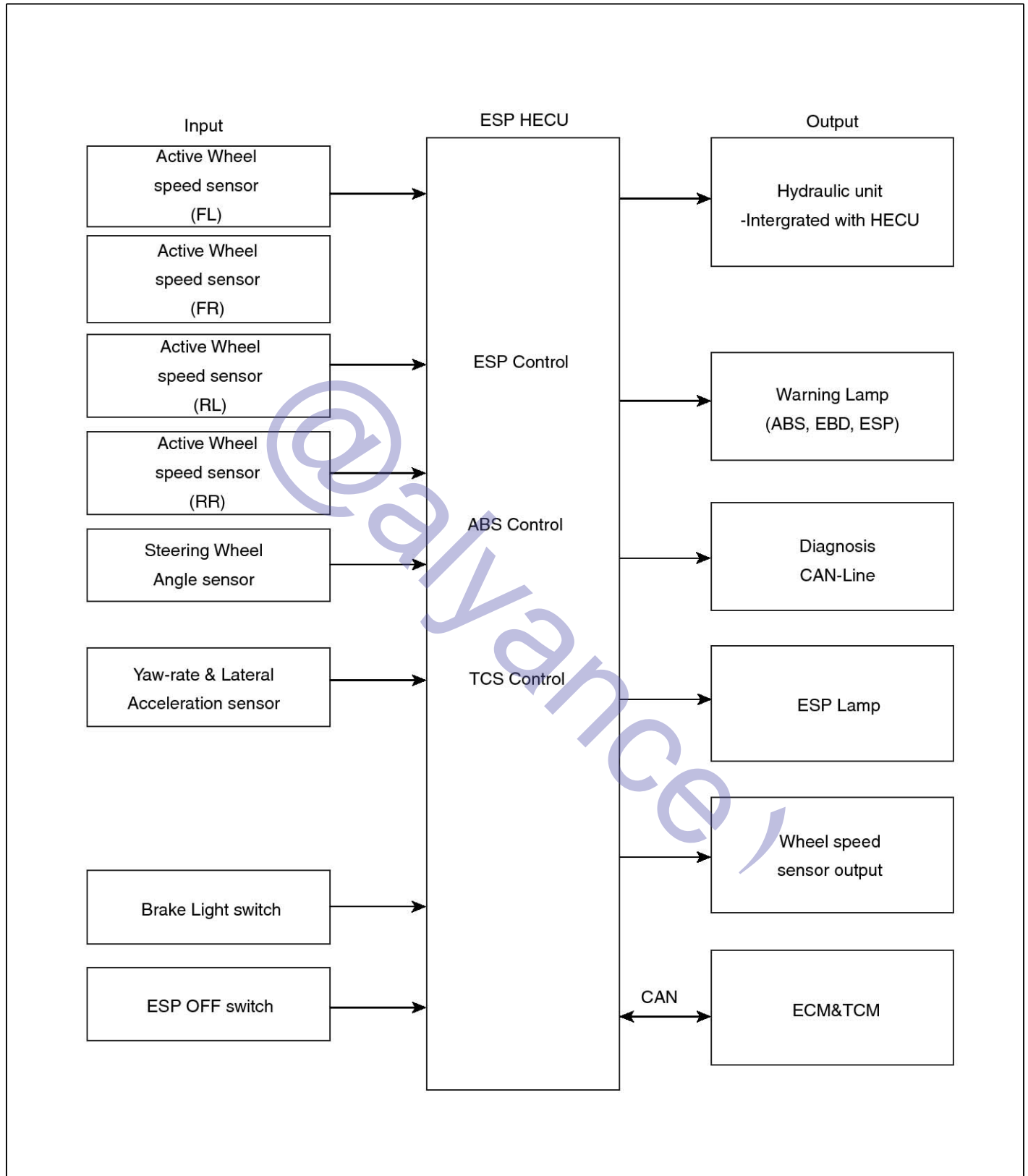
⚠ CAUTION

- If the warning lamp(ESP, EBD, ABS) is illuminated, follow the "Variant coding" again.

BR-78

Brake System

Input and Output Diagram



ESP(Electronic Stability Program) System

BR-79

ESP Operation Mode

1. STEP 1

The ESP analyzes the intention of the driver.

Position of steering wheel
+ Vehicle speed
+ Acceleration pedal



ECU decides the intention of the driver.

EJRF502B

2. STEP 2

It analyzes the movement of the ESP vehicle.

Vehicle rotation speed
+ Operated power to the side



ECU decides movement of the ESP vehicle.

EJRF502C

3. STEP 3

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

@alyance

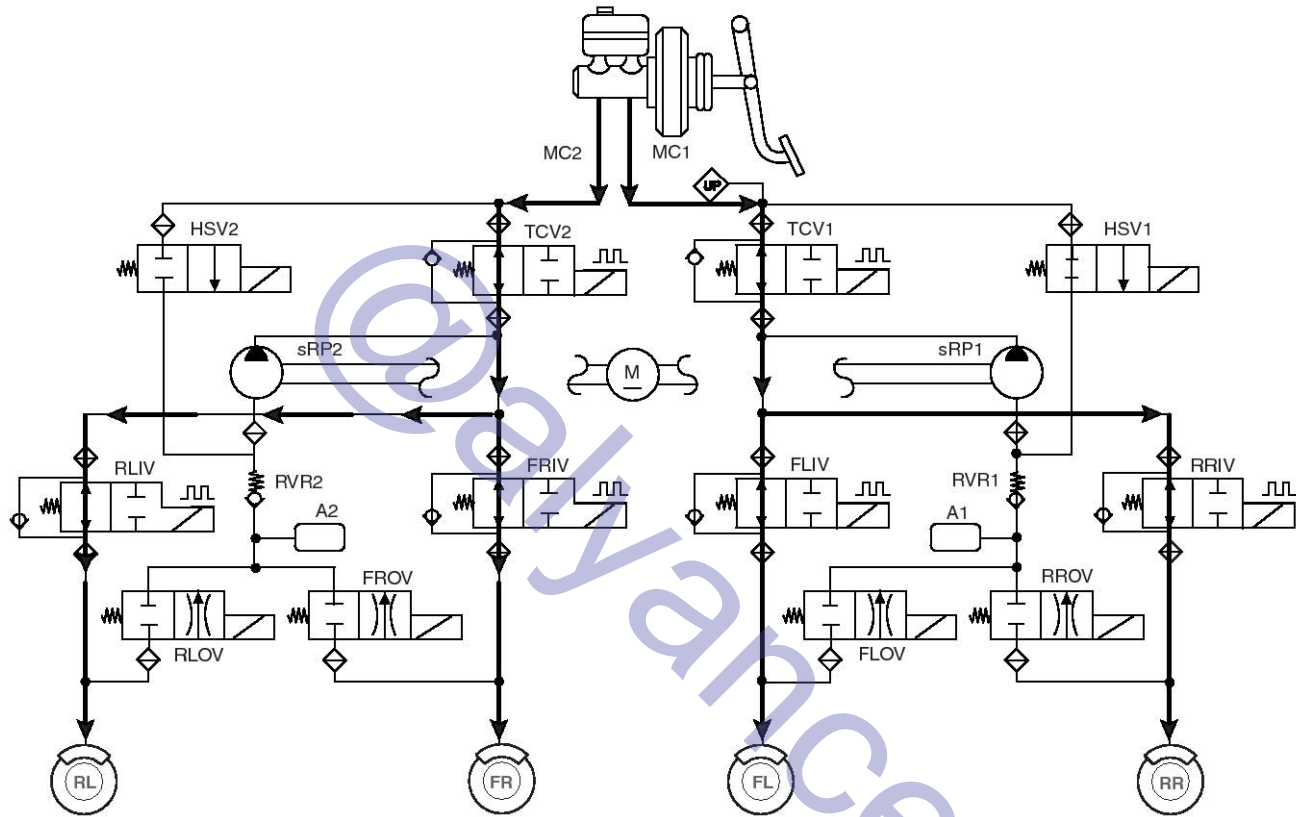
BR-80

Brake System

ESP Operation Mode

1. ESP Non-operation-Normal braking.

	Inlet valve(IV)	Outlet valve(OV)	Traction Control Valve(TCV)	High pressure switch valve(HSV)	Return pump
Normal braking	Open	Close	Open	Close	OFF



STDBR9206C

NOTICE

IV : Inlet Valve

OV : Outlet Valve

RL : Rear left wheel

FR : Front right wheel

FL : Front left wheel

RR : Rear right wheel

RP : Return pump

TCV : Traction Control Valve

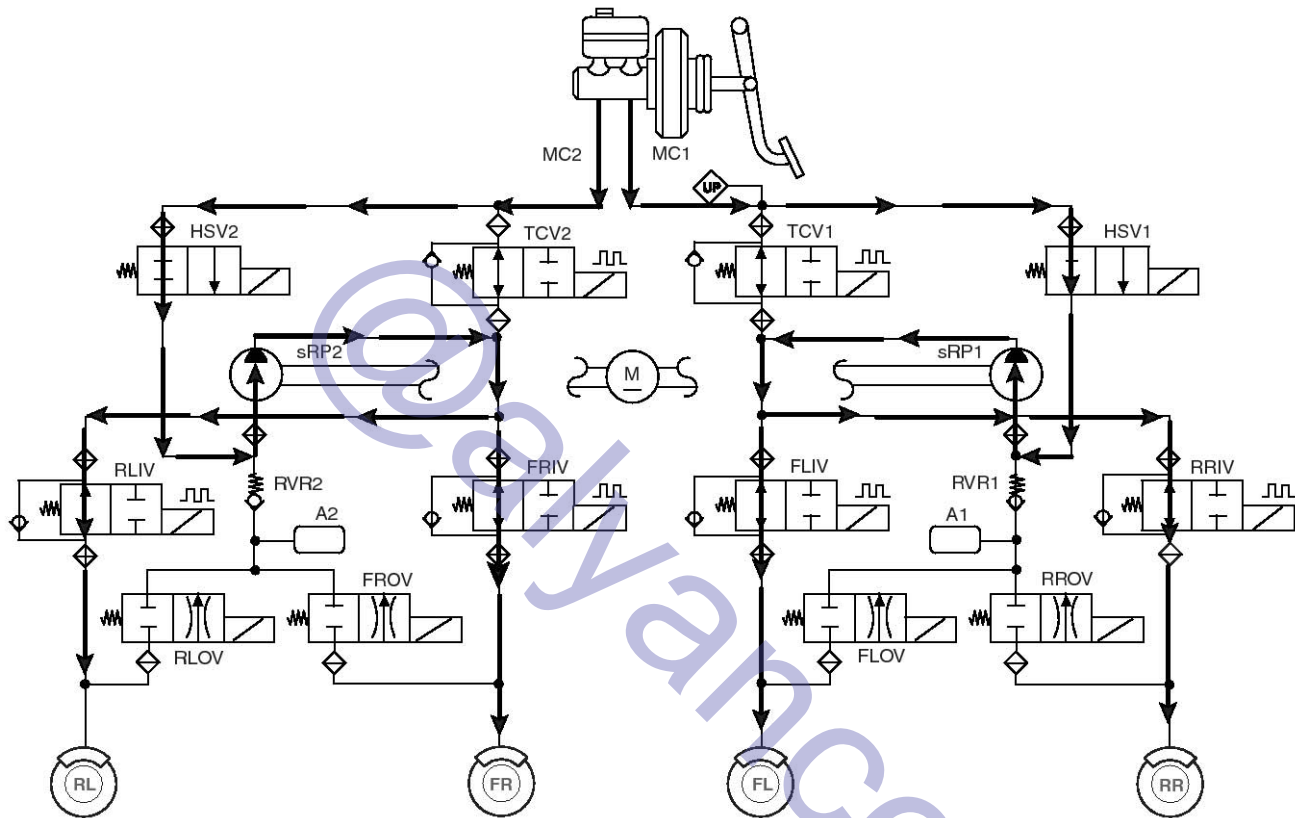
HSV : High pressure Switch Valve

ESP(Electronic Stability Program) System

BR-81

2. ESP Increase Mode

	Inlet valve(IV)	Outlet valve(OV)	Traction Control Valve(TCV)	High pressure switch valve(HSV)	Return pump
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)



STDBR9207C

NOTICE

IV : Inlet Valve

OV : Outlet Valve

RL : Rear left wheel

FR : Front right wheel

FL : Front left wheel

RR : Rear right wheel

RP : Return pump

TCV : Traction Control Valve

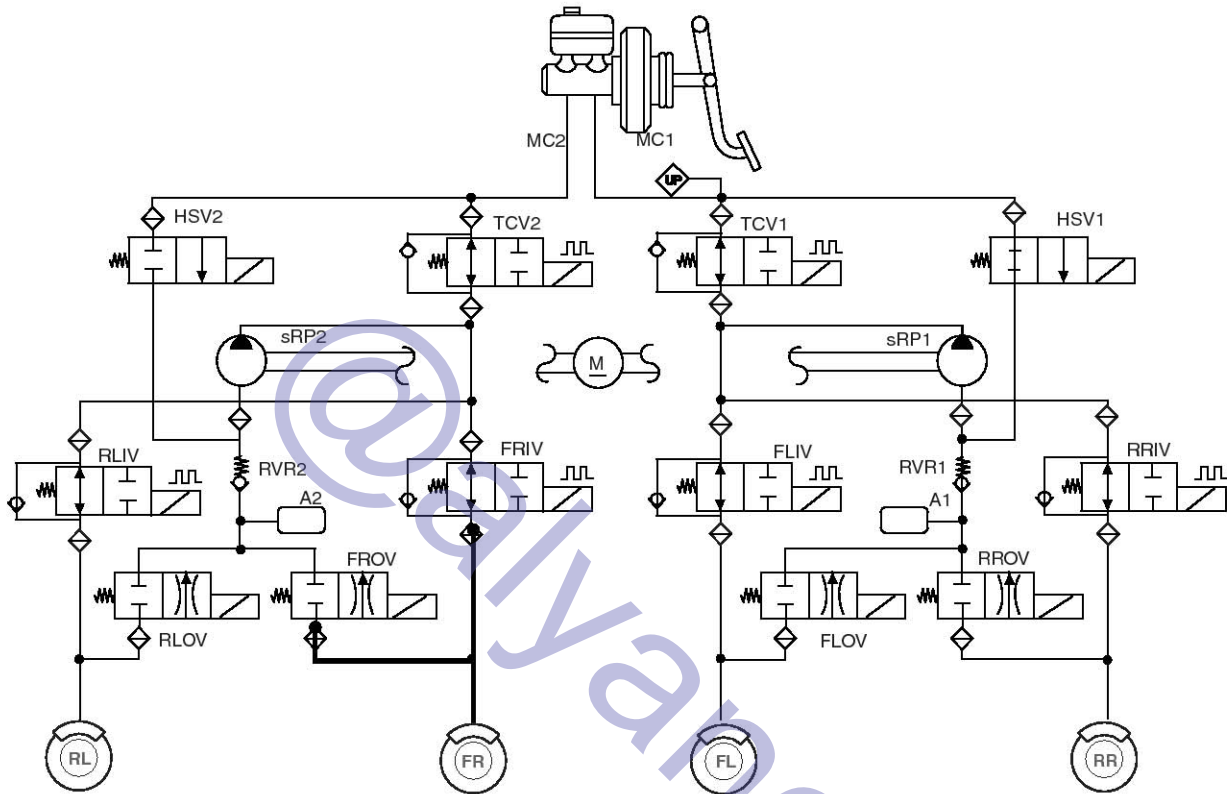
HSV : High pressure Switch Valve

BR-82

Brake System

3. ESP Hold Mode (FR is only controlled.)

	Inlet valve(IV)	Outlet valve(OV)	Traction Control Valve(TCV)	High pressure switch valve(HSV)	Return pump
Normal braking	Close	Close	Close(Partial)	Open	OFF



STDBR9208C

NOTICE

IV : Inlet Valve

OV : Outlet Valve

RL : Rear left wheel

FR : Front right wheel

FL : Front left wheel

RR : Rear right wheel

RP : Return pump

TCV : Traction Control Valve

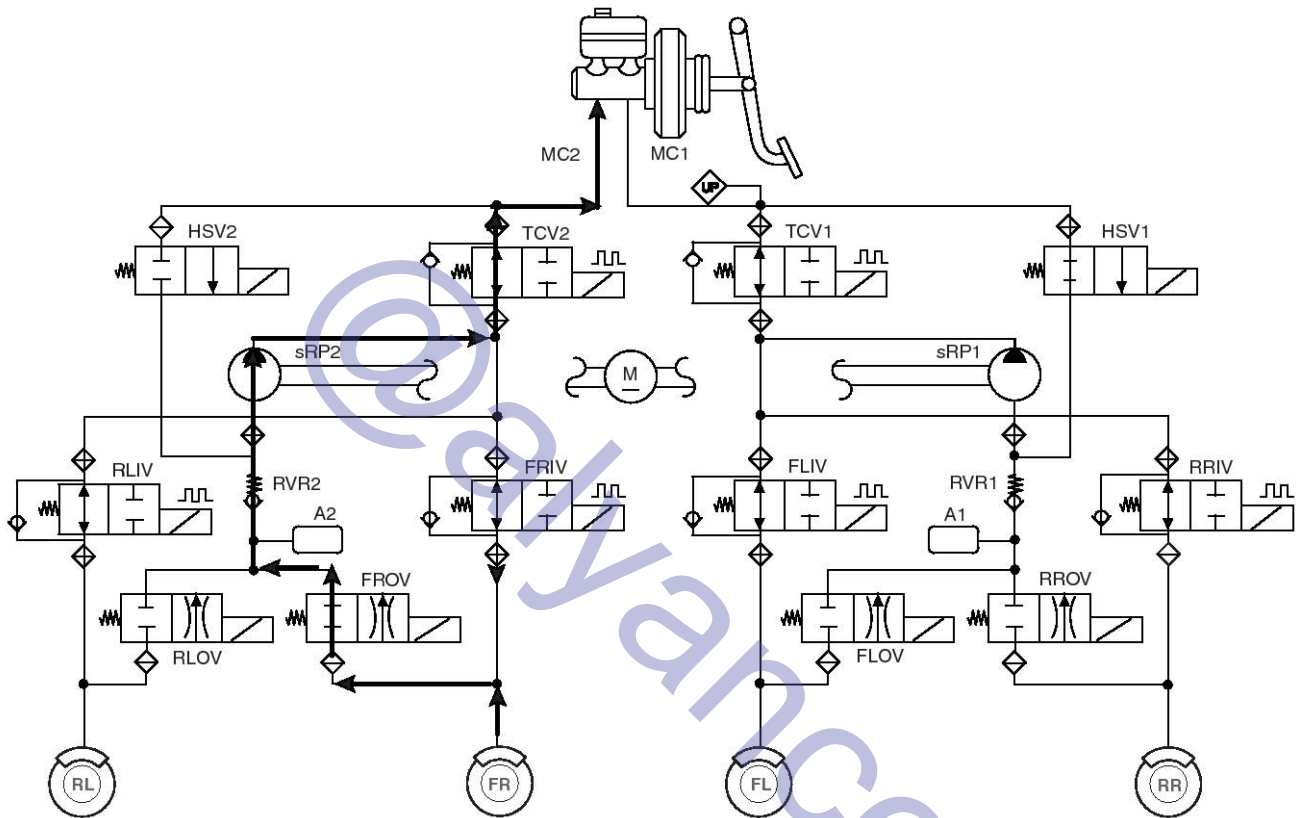
HSV : High pressure Switch Valve

ESP(Electronic Stability Program) System

BR-83

4. ESP Decrease Mode (FR is only controlled)

	Inlet valve(IV)	Outlet valve(OV)	Traction Control Valve(TCV)	High pressure switch valve(HSV)	Return pump
Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



STDBR9209C

NOTICE

IV : Inlet Valve

OV : Outlet Valve

RL : Rear left wheel

FR : Front right wheel

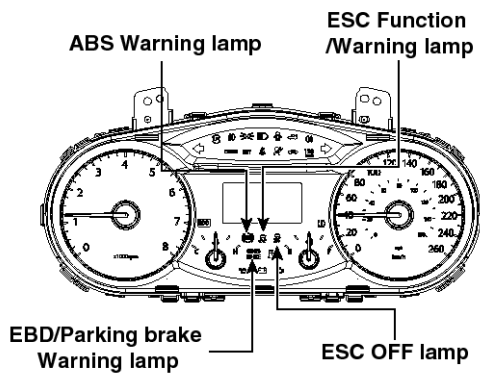
FL : Front left wheel

RR : Rear right wheel

RP : Return pump

TCV : Traction Control Valve

HSV : High pressure Switch Valve



SVGBR0201L

ABS Warning lamp

The active ABS warning lamp 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

The active EBD warning lamp 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.

ESP Function/Warning Lamp (ESP System)

The ESP Function/Warning lamp indicates the self-test and failure status of the ESP.

The ESP Function/Warning lamp operates under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- In the event of inhibition of ESP functions by failure.
- During diagnostic mode.
- When the ESP control is operating. (Blinking - 2Hz)

ESP OFF Lamp (ESP system)

The ESP OFF lamp indicates the self-test and operating status of the ESP.

The ESP OFF lamp is turned on under the following conditions :

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When driver turn off the ESP function by on/off switch.

ESP On/Off Switch (ESP system)

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

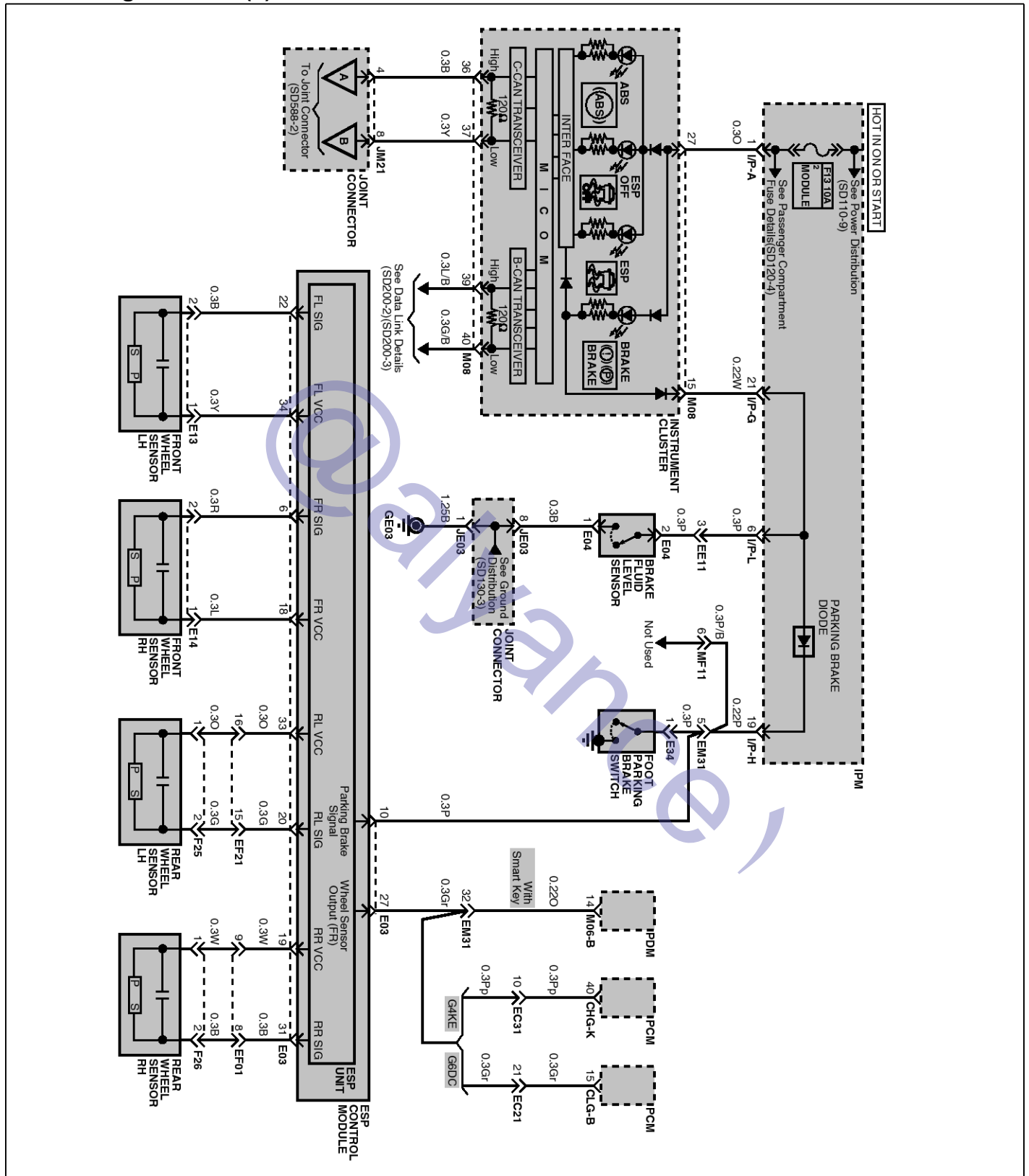
The On/Off switch shall be a normally open, momentary contact switch.

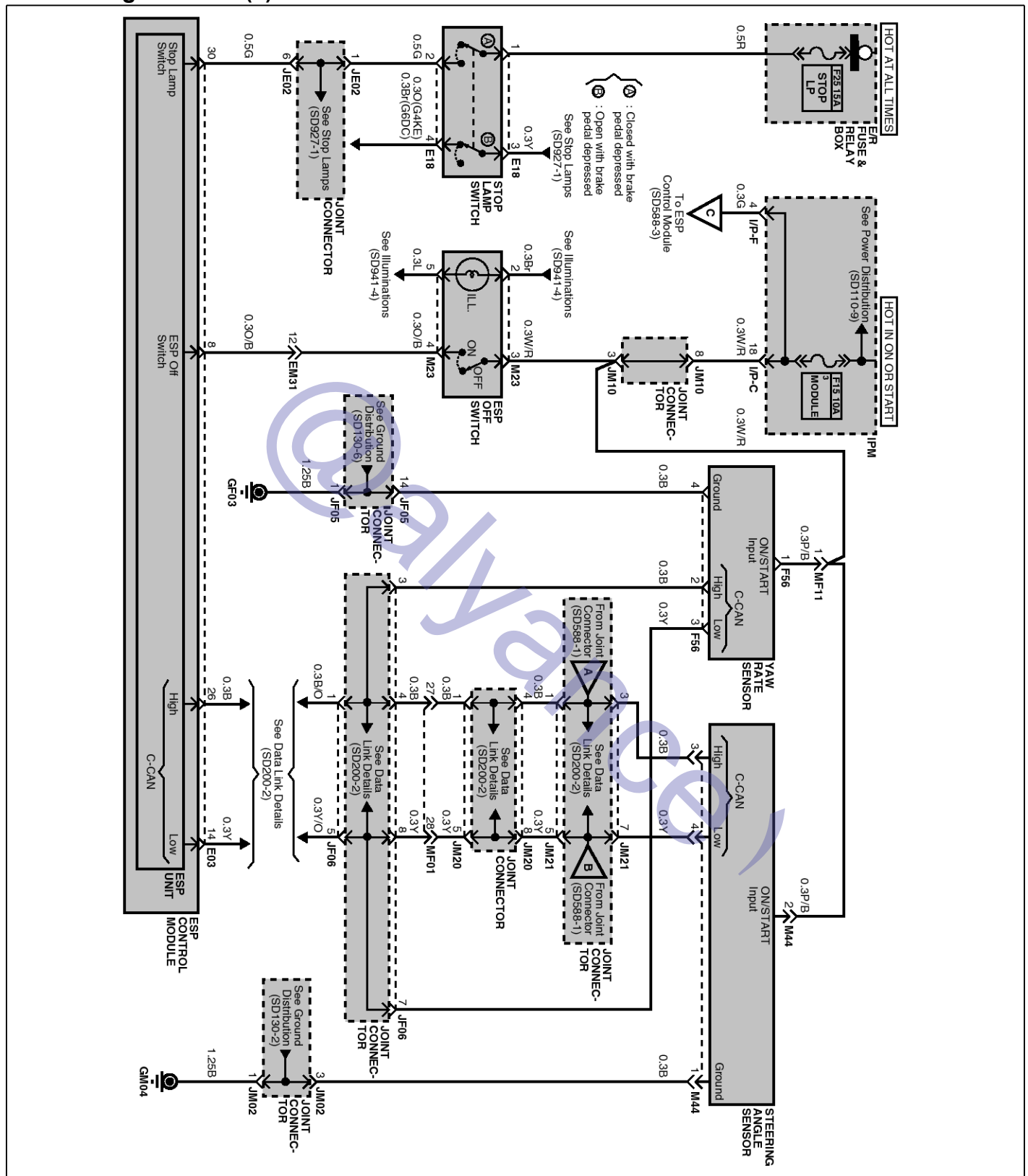
Initial status of the ESP function is on and the switch is used to request an ESP status change.

ESP(Electronic Stability Program) System

BR-85

Circuit Diagram - ESP(1)

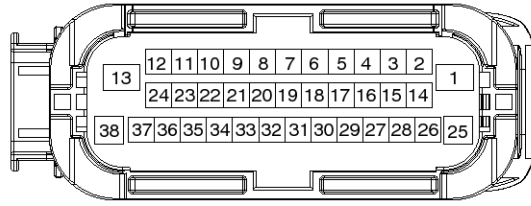




BR-88

Brake System

ESP Connector Input/ Out put



STDBR9134C

Wire No.	Designation	Current		max.permissible wire resistance R _L (mΩ)
		max	min	
13	Ground for recirculation pump	20 ~ 39 A	10 A	-
38	Ground for solenoid valves and ECU	5 ~ 15 A	2 A	-
1	Voltage supply for pump motor	20 ~ 39 A	10 A	-
25	Voltage supply for solenoid valves	5 ~ 15 A	2 A	-
32	Voltage for hybrid ECU	1 A	500 mA	60
22,6,20,31	signal wheel speed sensor FL, FR, RL,RR	16 mA	6 mA	250
34,18,33,19	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	16 mA	6 mA	250
30	Brake light switch (Signal)	10 mA	5 mA	250
14	CAN Low	30 mA	20 mA	250
26	CAN High	30 mA	20 mA	250
27, 3	Wheel speed sensor output	20 mA	10 mA	-
8	ESP Passive switch (Signal)	10 mA	5 mA	250
10	Parking Brake switch (Signal)	10 mA	5 mA	250

ESP(Electronic Stability Program) System

BR-89

Failure Diagnosis

1. In principle, ESP and TCS controls are prohibited in case of ABS failure.
2. When ESP or TCS fails, only the failed system control is prohibited.
3. However, when the solenoid valve relay should be turned off in case of ESP failure, refer to the ABS fail-safe.
4. Information on ABS fail-safe is identical to the fail-safe in systems where ESP 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 long 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.
4. Initial checkup is made in the following cases.
 - 1) When no failure is detected
 - 2) When ABS and ESP are not in control.
 - 3) Initial checkup is not made after ECU power on.
 - 4) If the vehicle speed is over 5 mph(8 km/h) when the brake lamp switch is off.
 - 5) When the vehicle speed is over 24.8 mph(40 km/h).
5. Though, it keeps on checkup even if the brake lamp switch is on.
6. When performing ABS or ESP control before the initial checkup, stop the initial checkup and wait for the HECU power input again.
7. Judge failure in the following cases.
 - 1) When the power is normal.
 - 2) From the point in which the vehicle speed reaches 4.9 mph(8 km/h) after HECU power on.

Countermeasures In Fail

1. Shut the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Do not perform any ABS/TCS/ESP functions until normal operating condition is restored.

Warning Lamp On

1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESP function/ warning lamp turns on when ESP is malfunctioning.

When power voltage and valve relay voltage are abnormal, input/output related failure judgment is not made.

BR-90

Brake System

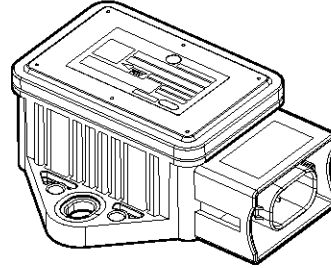
Yaw-rate and Lateral G Sensor

Description

When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electronically by the vibration change of plate fork inside the yaw rate sensor.

If yaw velocity reaches the specific velocity after it detects the vehicle yawing, the ESP control is reactivated.

The lateral G sensor senses vehicle's lateral G. A small element inside the sensor is attached to a deflectable lever arm by lateral G.

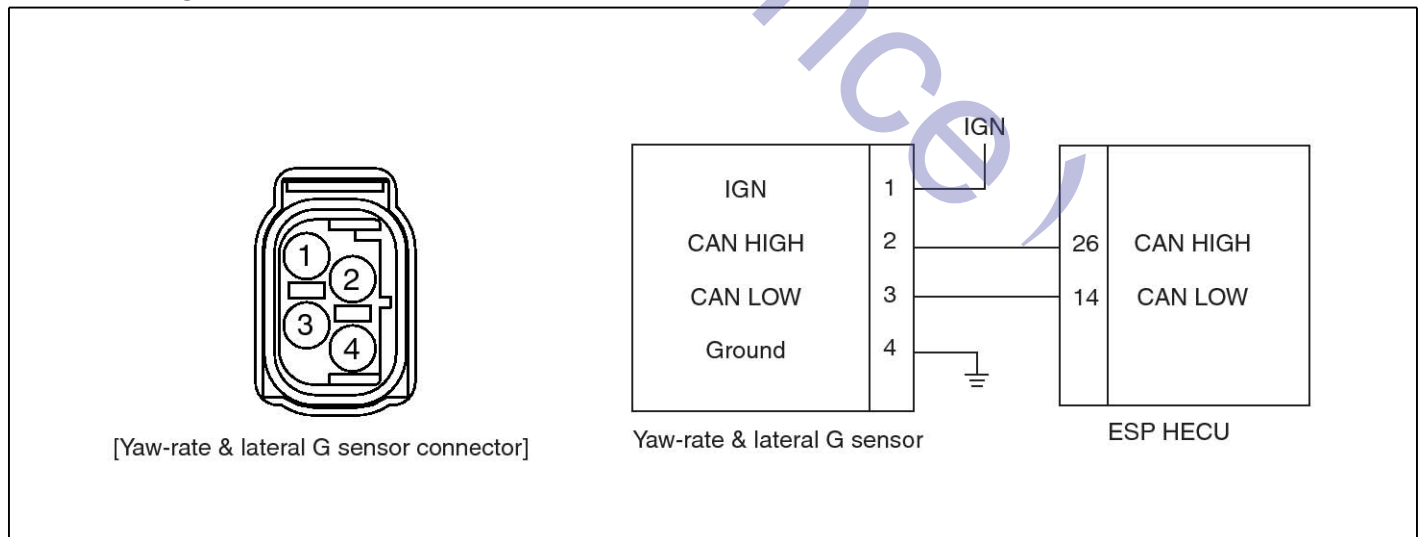


SVGBR0230D

Specifications

Description	Specification	Remarks
Operating voltage	7 ~ 18V	
Output signal	CAN Interface	
Operating temperature	-40 ~ 85°C (-40 ~ 185°C)	
Yaw-rate sensor Measurement range	-100 ~ 100°/sec	
Lateral G sensor Measurement range	-1.8 ~ +1.8g	

External Diagram



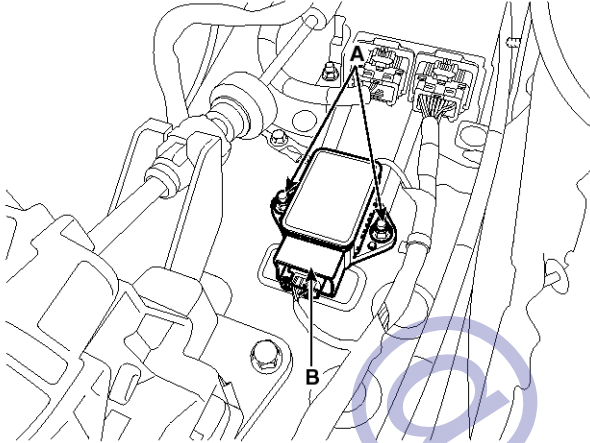
SPBBR9306L

ESP(Electronic Stability Program) System

BR-91

Removal

1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
2. Remove the floor console.
3. Disconnect the yaw rate & lateral G sensor connector (B).



SVGBR0231D

4. Remove the mounting bolts (A).

Tightening torque:

4.9 ~ 7.8 N.m (0.5 ~ 0.8 kgf.m, 3.6 ~ 5.8 lb-ft)

5. Installation is the reverse of removal.

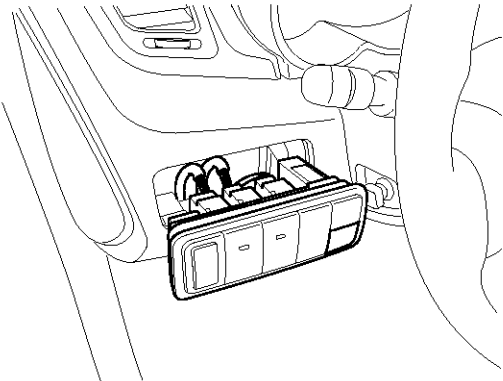
ESP OFF Switch

Description

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

Inspection

- 1. Turn ignition switch OFF and disconnect the negative (-) battery cable.
- 2. Remove the crash pad side switch assembly.



SVGBR0250D

- 3. Check the continuity between the switch terminals as the ESP OFF switch is engaged.

Terminal Position	3	4	5	2
ON				
OFF				

SVGBR0251L

ESP(Electronic Stability Program) System

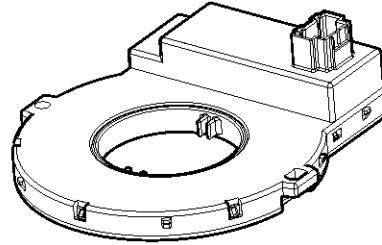
BR-93

Steering Angle Sensor

Description

Steering Wheel Angle Sensor detects rotating direction of the vehicle. Rotating direction detected by the sensor is communicated with HECU as CAN signal involving information about the angle through CAN communication line.

HECU detects speed of the steering wheel handling and the angle with this CAN signal. HECU also uses this signal as the input signal to control anti-roll.

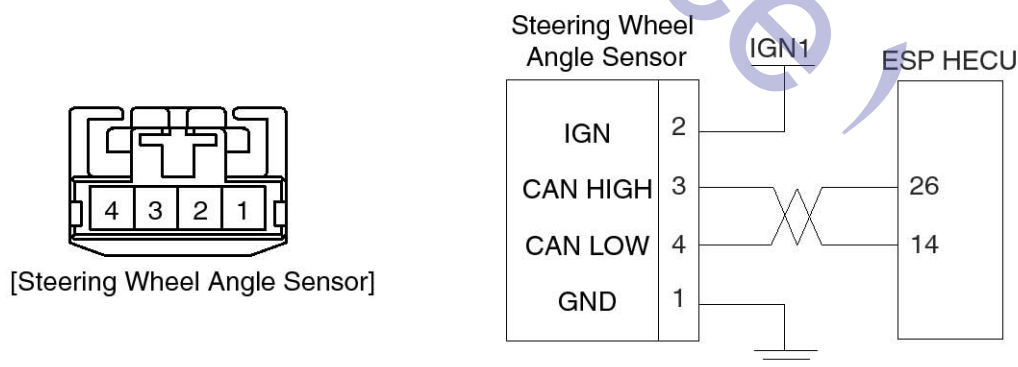


SVIBR9270D

Specification

Description		Specification
Operating voltage		8 ~ 16V
Operating temperature		-40 ~ 85℃(-40 ~ 185°F)
Current consumption		Max.150mA
Measuring range	Angle	-780 ~ 779.9°
	Angular velocity	0 ~ 1016°/sec
Output signal		CAN Interface

Circuit Diagram



SYFBR0271L

BR-94

Brake System

Calibration (Setting up the zero angle)

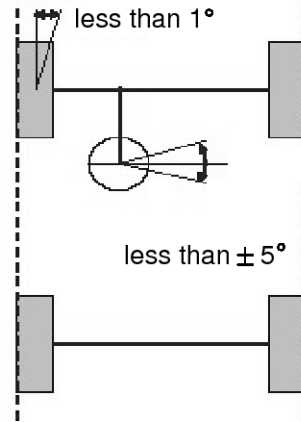
Steering Wheel Angle Sensor of a absolute angle type (CAN type) measures the angle under the standard of the zero angle set.

Calibration must be performed as following cases.

- Replacement of the Steering Wheel Angle Speed Sensor
- Replacement or repair of the Steering column
- Detection of DTC codes (C1260, C1261)
- Replacement of the sensor cluster
- Replacement of HECU

Calibration procedure

Perform wheel alignment and stand the steering wheel in a line within $\pm 5^\circ$ error.



SHMBR9327L

1. Connect the GDS.(CAN line or OBD connector)
2. Turn ignition switch on.
3. Press calibration button of the Steering Wheel Angle Sensor.
4. HECU calibration procedure is performed.
(Calibration records, DTC codes erasure)
5. Turn ignition switch off after calibration procedure.
6. Confirm success or failure of calibration.
 - Warning lamp must not be lighted when driving test (Turning left and right).
 - The ESP system will light the ESP Warning lamp when the system detects a sensor error.