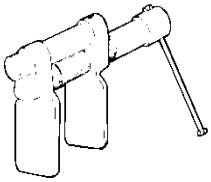
General Information

SPECIAL TOOLS

Tool (Number and Name)	Illustration	Use
09581 - 11000 Piston expander		Pushing back of the front disc and rear disc brake piston

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	Remedy
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Master cylinder (Faulty)	Repair Air bleeding Replace Replace
Brake drag	1. Brake pedal free play (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Pad or lining (Cracked or distorted) 5. Piston (Stuck) 6. Piston (Frozen) 7. Return spring (Faulty) 8. Booster system (Vacuum leaks) 9. Master cylinder (Faulty)	Adjust Adjust Repair 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. Pad or lining (Oily) 6. Pad or lining (Glazed) 7. Disc (Scored) 8. Booster system (Vacuum leaks)	Repair Air bleeding Replace Replace Replace Replace Replace Replace

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. Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	Replace Retighten Replace Replace Clean Replace Replace Replace Replace
Brake fades	1. Master cylinder	Replace
Brake vibration, pulsation	1. Disc (Excessive thickness variation) 2. Disc (Faulty run-out) 3. Disc (Uneven worn or crack) 4. Pad or lining (Uneven worn and contact) 5. Caliper (Faulty pad sliding)	Replace 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.	

SPECIFICATIONS

Item	Specification
Master cylinder	
Type	Tandem type
I.D.	22.22 mm (0.875 in)
Piston stroke	45 mm (1.77 in)
Fluid level warning sensor	Provided
Brake booster	
Type	Vacuum
Boosting ratio	9 : 1
Front brake(Disc)	
Type	Floating type with ventilated disc
Disc O.D.(15" Disc)	280 mm(11.02 in)
Disc I.D.(15" Disc)	172 mm(6.77 in)
Disc thickness(15" Disc)	26 mm(1.02 in)
Disc O.D.(16" Disc)	300 mm(11.02 in)
Disc I.D.(16" Disc)	172 mm(6.77 in)
Disc thickness(16" Disc)	28 mm(1.10 in)
Pad thickness	11 mm(0.43 in)
Cylinder type	Single piston
Cylinder I.D.	Ø57.15 mm(2.25 in)

Rear brake(Disc)	
Type	Floating type with solid disc
Disc O.D.	262 mm (10.31 in)
Disc I.D.	185 mm (7.28 in)
Disc thickness	10 mm (0.39 in)
Pad thickness	10 mm (0.39 in)
Cylinder type	Single piston
Cylinder I.D.	Ø34.0 mm (1.34 in)
Parking brake	
Actuation	DIH (Drum in hat)
Type	Lever
Drum I.D.	168 mm(6.61 in)

NOTICE

ABS : Anti-lock Brake System

CBS : Conventional Brake System

SERVICE STANDARD

Item	Standard value
Standard value	
Brake pedal height	174.3 mm (6.86 in) [LHD] 167.5 mm (6.59 in) [RHD]
Brake pedal stroke	135 mm (5.31 in)
Stop lamp switch outer case to pedal stopper clearance	1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Brake pedal free play	3 ~ 8 mm (0.11 ~ 0.31 in)
Booster push rod to master cylinder piston clearance	0mm (at 500 mmHg vacuum)
Parking brake lever stroke when lever assembly is pulled with 196N (20Kg, 44lb force)	7 clicks
Front disc brake pad thickness	11 mm (0.43 in.)
Front disc thickness	26 mm (1.02 in)
Rear disc brake pad thickness	10 mm (0.4 in)
Rear disc brake disc thickness	10 mm (0.4 in)
Rear brake lining thickness	3.3 mm (0.13 in)

TIGHTENING TORQUE

Item	Nm	kgf.m	lb-ft
Master cylinder to booster mounting nut	9.8 ~ 15.7	1.0 ~ 1.6	7.2 ~ 11.6
Brake booster mounting nut	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6
Bleeder screw	6.9 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube to HECU(M10 nut)-ABS	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Brake tube to HECU(M12 nut)-ESP	18.6 ~ 22.6	1.9 ~ 2.3	13.7 ~ 16.6
Caliper guide rod bolt	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Caliper mounting bolt (Front)	78.5 ~ 98.1	8.0 ~ 10.0	57.9 ~ 72.3
Caliper mounting bolt (Rear)	49.0 ~ 58.8	5.0 ~ 6.0	36.2 ~ 43.4
Brake hose to caliper	24.5 ~ 29.4	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal member assembly bracket mounting nut (cowl side upper mounting)	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal member bracket to booster mounting nut	12.7 ~ 15.7	1.3 ~ 1.6	9.4 ~ 11.6
Stop lamp switch mounting nut	7.9 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.1 ~ 8.0
HECU mounting bracket bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
HECU bracket mounting nut	5.9 ~ 9.8	0.6 ~ 1.0	4.3 ~ 7.2
Yaw rate & Lateral G sensor mounting bolt	4.9 ~ 7.8	0.5 ~ 0.8	3.6 ~ 5.8

SPECIFICATION (ABS)

Part	Item		Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type		Motor, valve relay inte-rgrated type	
	Operating voltage		10 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 ˚C (-40 ~ 248 ˚F)	
Warning lamp	Operating voltage		12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, b-rake oil, EBD failure
	Current consumption		80 mA	
Acitve wheel speed s-ensor	Supply voltage		DC 4.5 ~ 20 V	
	Operating temperature		-40 ~ 150 ˚C (-40 ~ 302 ˚F)	
	Output current low		5.9 ~ 8.4 mA	Typ.7 mA
	Output current High		11.8 ~ 16.8 mA	Typ.14 mA
	Frequency range		1 ~ 2500 HZ	
	Air gap	Front	0.7 mm (0.027 in)	Typ.0.7 mm(0.03 in)
		Rear	0.5 mm (0.019 in)	Typ.0.7 mm(0.03 in)
	Tone wheel		46 teeth	
	Output duty		30~70 %	

SPECIFICATION(ESP)

Part	Item		Standard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor(S-olenoid)	·Total control(ABS, E-BD, TCS, ESP)
	Type		Motor, valve relay inte-rgrated type	
	Operating voltage		10 V ~ 16 V(DC)	
	Operating temperature		-40 ~ 120 °C (-40 ~ 248 °F)	
Warning lamp	Operating voltage		12 V	·ESP Operating Lamp ·ESP Warning Lamp
	Current consumption		80 mA	
Active wheel speed s-ensor	Supply voltage		DC 4.5 ~ 20V	
	Operating temperature		-40 ~ 150 °C (-40 ~ 302 °F)	
	Output current low		5.9 ~ 8.4 mA	
	Output current high		11.8 ~ 16.8 mA	
	Tone wheel		46 teeth	
	Frequency range		1 ~ 2500 HZ	
	Airgap	Front	0.7 mm (0.027 in)	Typ.0.7 mm(0.03 in)
		Rear	0.5 mm (0.019 in)	Typ.0.7 mm(0.03 in)
Steering Wheel Angle Sensor	Operating Voltage		8V ~ 16 V	
	Current Consumption		Max 150 mA	
	Operating Angular velocity		Max ± 780 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage		8 V ~ 16 V	
	Current Consumption		Max. 120 mA	
	Output Voltage high		4.35 V~ 4.65 V	Typ. 4.5 V
	Output Voltage low		0.35 ~ 0.65 V	Typ. 0.5 V
	Yaw Sensor Operating Range		±100 ° /s	
	G Sensor Operating Range		±1.8 G	
	Reference voltage output		2.464 ~ 2.536 V	Typ. 2.5 V

LUBRICANT

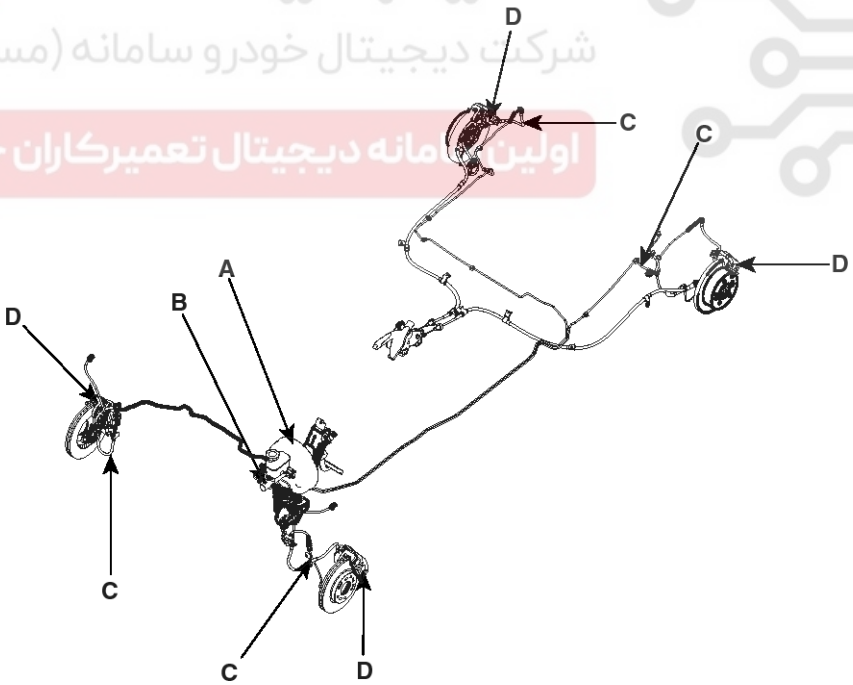
Item	Recommended lubricant	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and brake pedal bolt	Chassis grease	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease	As required
Front caliper guide rod bolt and boot	AI-11P grease	1.2 ~ 2.2g
Rear caliper guide rod and boot	AI-11P grease	1.0 ~ 2.0g (Trailing) 0.8 ~ 2.0g (Leading)

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.

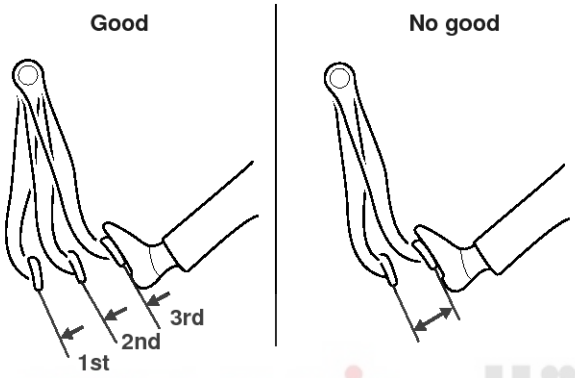


SEDBR7553L

BRAKE BOOSTER OPERATING TEST

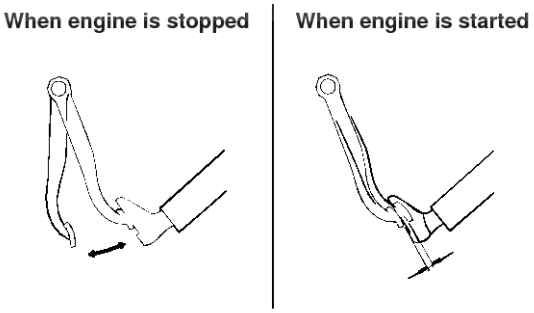
For simple checking of the brake booster operation, carry out the following tests :

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 defective.



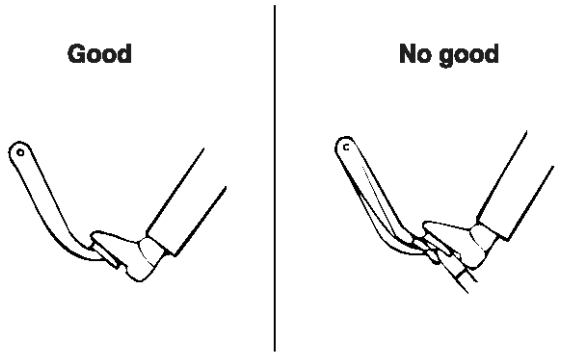
EJRF500B

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 defective.



EGGB700B

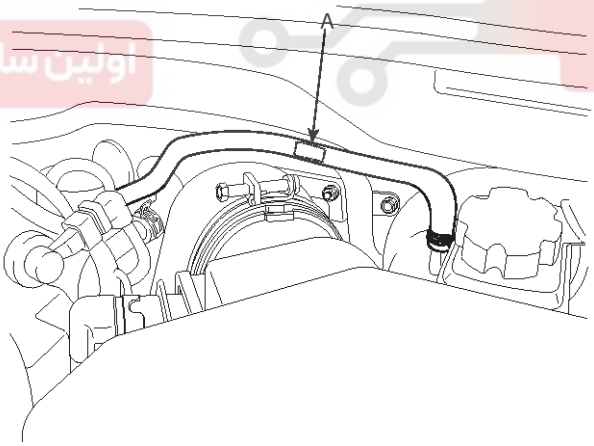
3. With the engine running, step on the brake pedal and then stop the engine. Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective. If the above three tests are okay, the booster performance can be determined as good. Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for defect.



EGGE700C

VACUUM HOSE (CHECK VALVE) INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster .
2. Start the engine and let it idle. There should be vacuum available. If no vacuum is available, the check valve is not working properly. Replace the brake booster vacuum hose and check valve and retest.



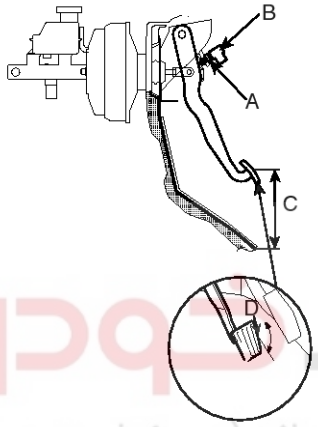
SUNBR6001D

BRAKE PEDAL & BRAKE SWITCH ADJUSTMENT

PEDAL HEIGHT

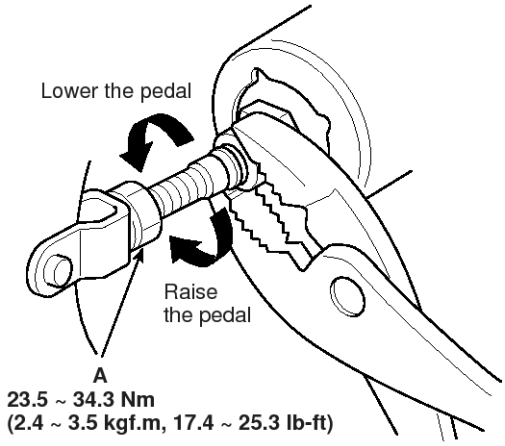
1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.
2. Measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height (on the carpet) :
174.3 mm (6.86 in) [LHD]
167.5 mm (6.59 in) [RHD]



SEDBR7552L

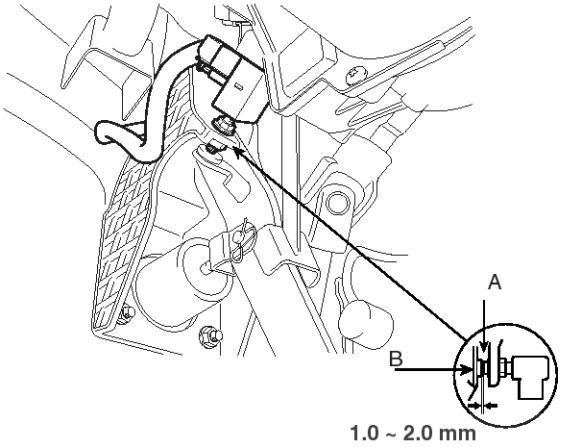
3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



SHDBR6537N

STOP LAMP SWITCH CLEARANCE

Screw in the stop lamp switch until its switch rod is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 1.0~2.0 mm(0.04~0.08 in.) of clearance between the stop lamp switch pad. Make sure that the brake lights go off when the pedal is released.

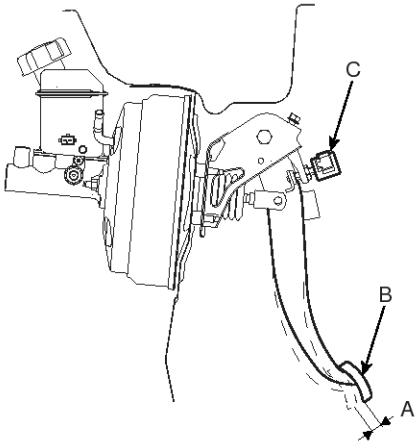


SEDBR7500L

PEDAL FREE PLAY

1. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal(B) down by hand, and confirm that the amount of movement(A) before resistance is met (the free play) is within the standard value.

Standard value : 3 ~ 8 mm (0.117 - 0.312 in.)



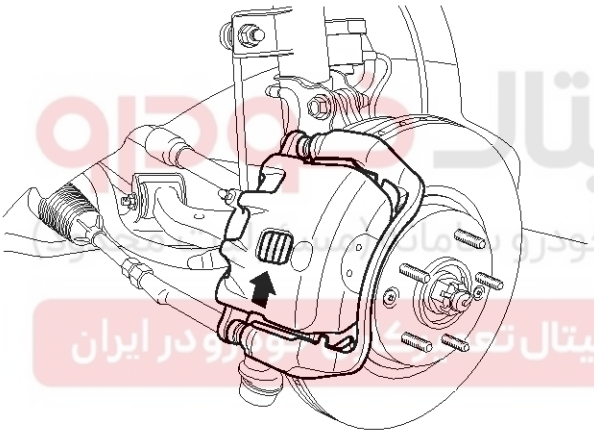
AJLG500D

2. If free play does not reach the standard value, check that clearance between the outer case of stop lamp switch(C) and brake pedal is within the standard value. If free play exceeds the standard value, it is probably due to excessive clearance between the clevis pin and brake pedal arm. Check for excessive clearance and replace faulty parts as required.
3. Start the engine, depress the brake pedal with approximately 120kg(1176.8N, 264.5 lb) of force, and check for oil leakage in the master cylinder, brake line and each connecting part. Repair the faulty parts as required.

INSPECTION OF FRONT DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 11.0 mm (0.43 in.)
Service limit : 2.0 mm (0.0787 in.)



AJLG500E

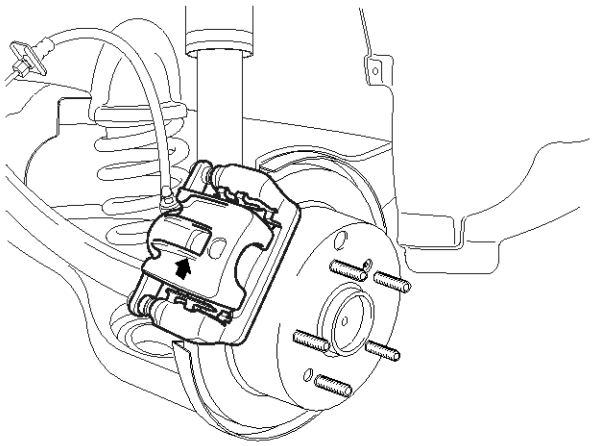
⚠CAUTION

- **If the pad lining thickness is out of specification, left and right pads must be replaced as a complete set.**
- **When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.**

INSPECTION OF REAR DISC BRAKE PAD

1. Check the brake pad thickness through the caliper body inspection hole.

Pad thickness
Standard value : 10.0 mm (0.39 in.)
Service limit : 2.0 mm (0.0787 in.)



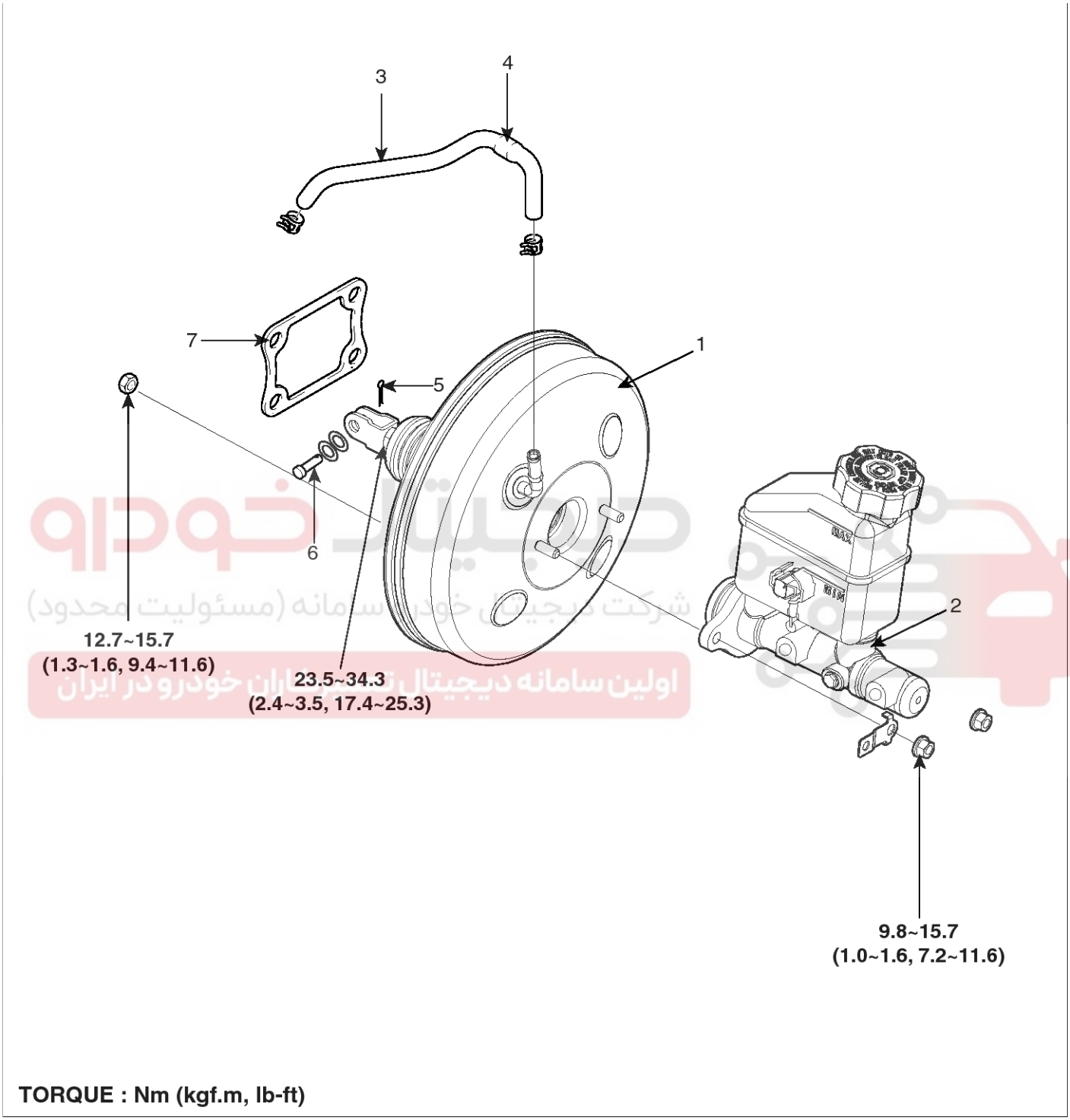
AJLG500F

⚠CAUTION

- **If the pad thickness is out of specification, left and right pads must be replaced as a complete set.**
- **When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.**

Brake Booster

COMPONENTS



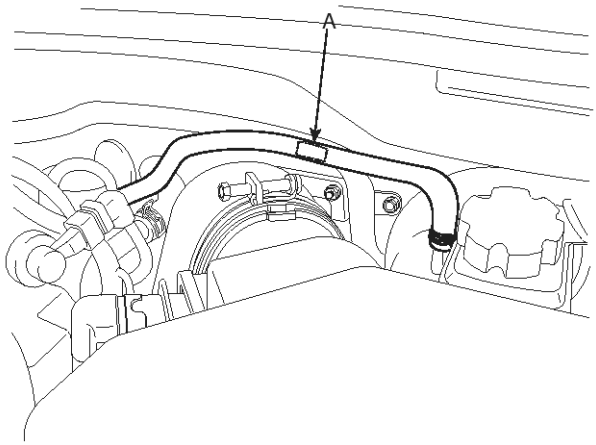
TORQUE : Nm (kgf.m, lb-ft)

1. Brake booster
2. Master cylinder
3. Vaccum hose
4. Check valve
5. Snap pin
6. Clevis pin
7. Seal

SEDBR7501L

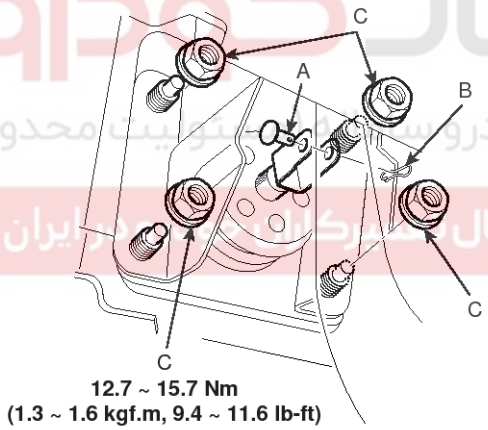
REMOVAL

1. Disconnect the vacuum hose (B) from the brake booster (A).



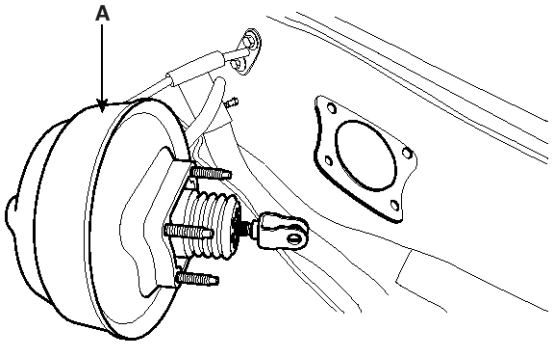
SUNBR6001D

2. Remove the master cylinder.
   (Refer to "Master cylinder - Removal")
3. Remove the clevis pin (A) and snap pin (B).



LJLG500D

4. Remove the four booster mounting nuts (C).
5. Remove the brake booster (A) from the engine compartment.

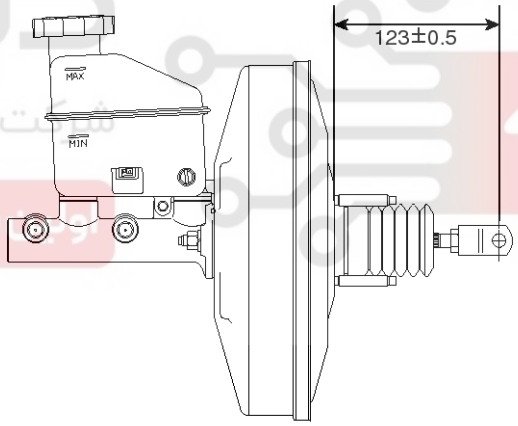


ARJE500H

INSTALLATION

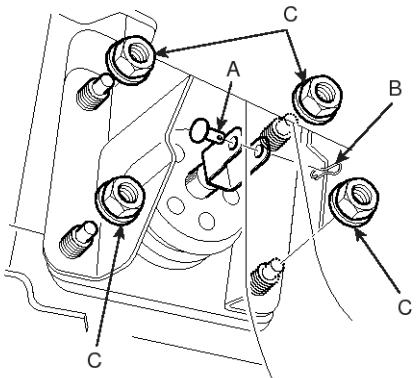
1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length(A) : 123 ± 0.5 mm (4.84 ± 0.02 in)



SHDBR6569L

2. Insert the booster and tighten the nuts (C).



LJLG500D

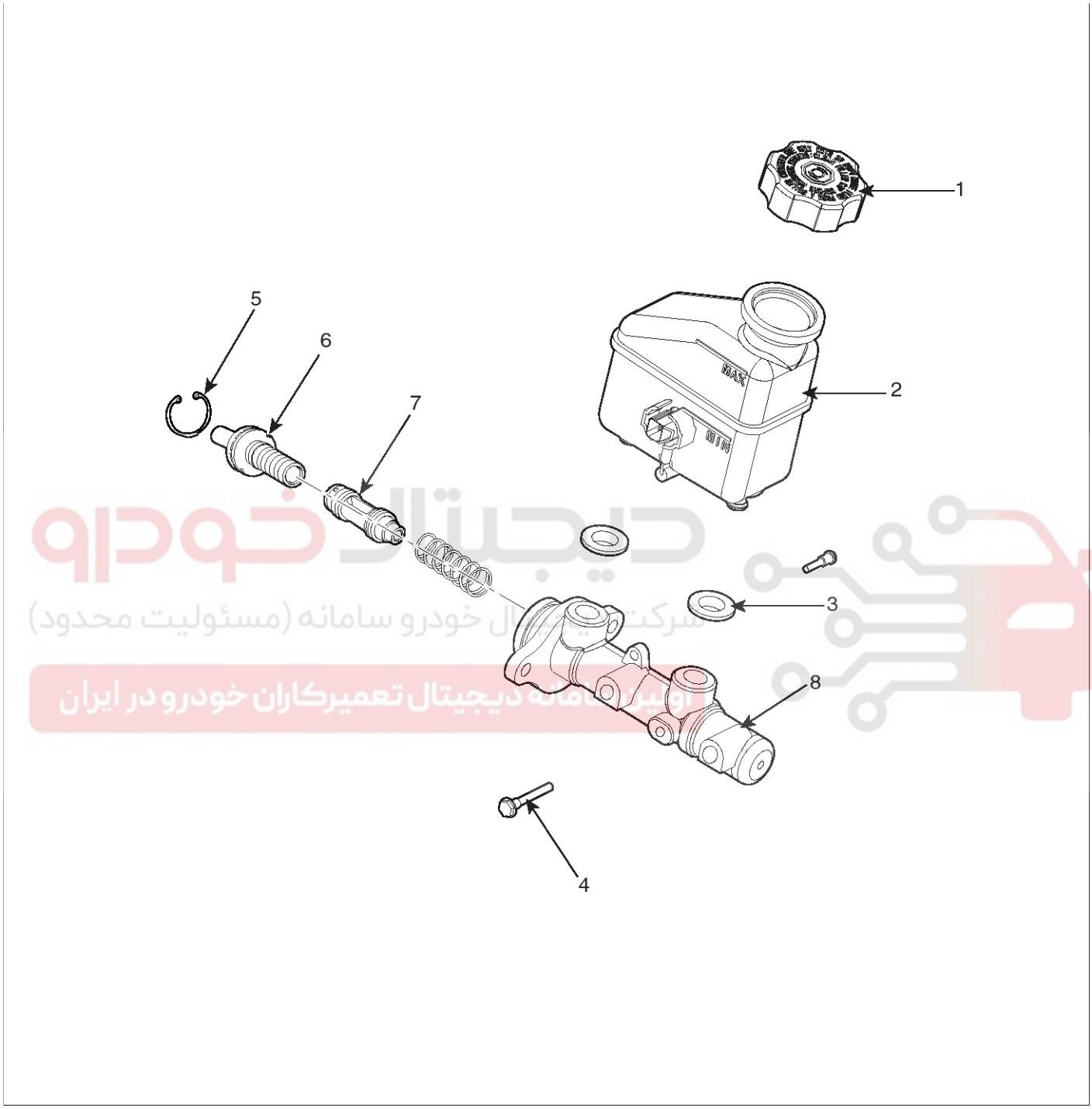
3. Connect the booster push rod and brake pedal with a clevis pin (A) and install a snap pin (B) to the clevis pin (A).

   ⚠CAUTION
   Grease the pin before installing the snap pin.
   Always use a new snap pin.

4. Install the master cylinder, then install the brake tubes to the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system.
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

Master Cylinder

COMPONENTS

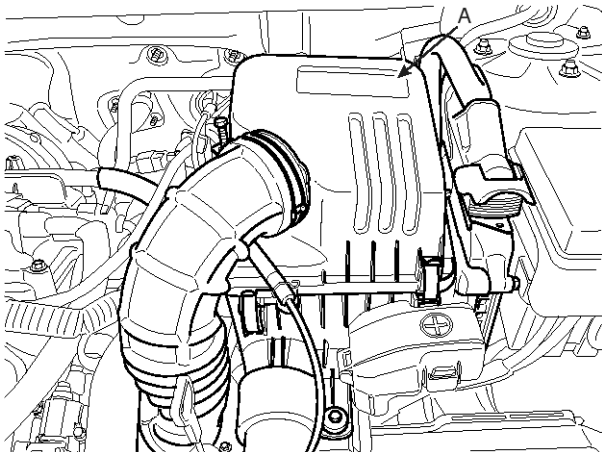


1. Reservoir cap
2. Reservoir
3. Grommet
4. Cylinder pin
5. Retainer
6. Primary piston assembly
7. Secondary piston assembly
8. Master cylinder body

SEDBR7508L

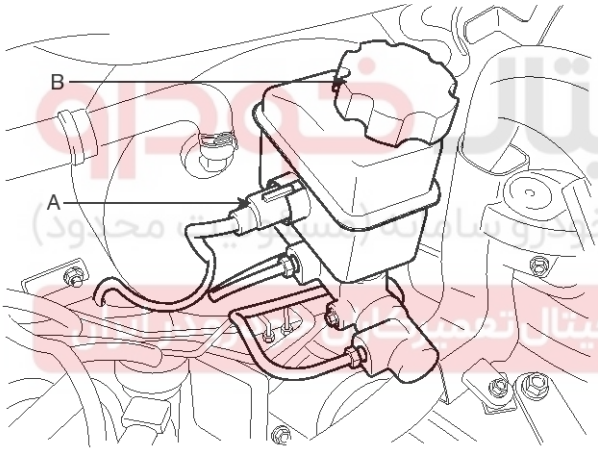
REMOVAL

1. Remove air cleaner assembly (A). (Refer to EM Gr.)



SHDBR6510D

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



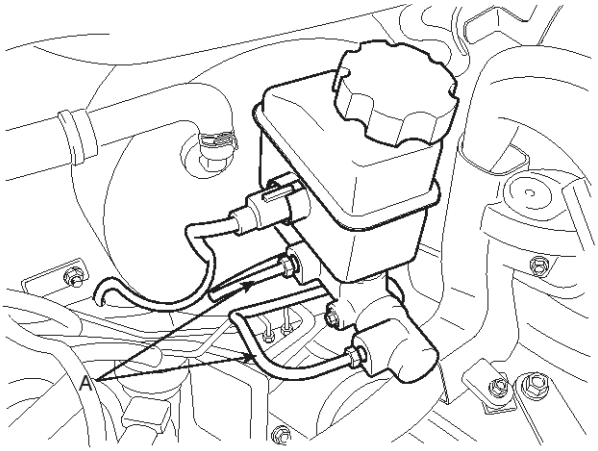
SEDBR7002L

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

NOTICE

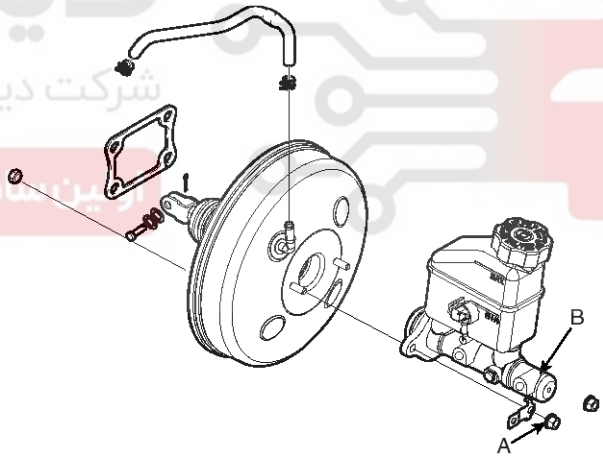
Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

4. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.



SEDBR7509L

5. Remove the master cylinder mounting nuts (A) and washers.
6. Remove the master cylinder (B) from the brake booster. Be careful not to bend or damage the brake lines when removing the master cylinder.

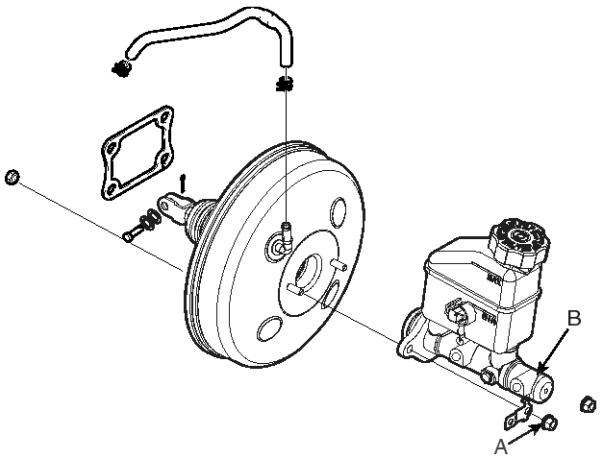


SEDBR7510L

INSTALLATION

1. Install the master cylinder (B) to the brake booster.
2. Install the master cylinder mounting nuts (A) and washers.

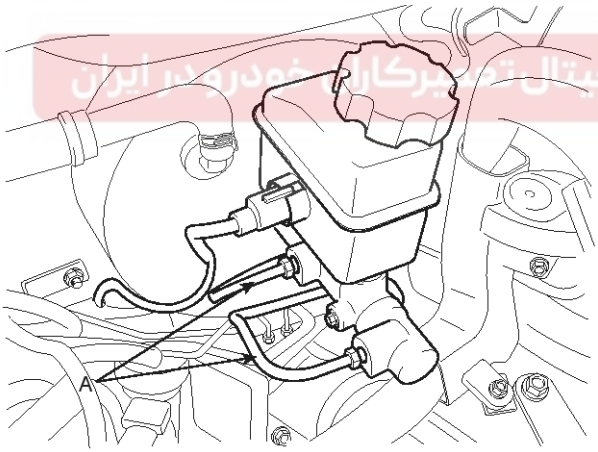
Tightening torque : N.m (kgf.m, lb-ft)
9.8~15.7 (1.0~1.6, 7.2~11.6)



SEDBR7510L

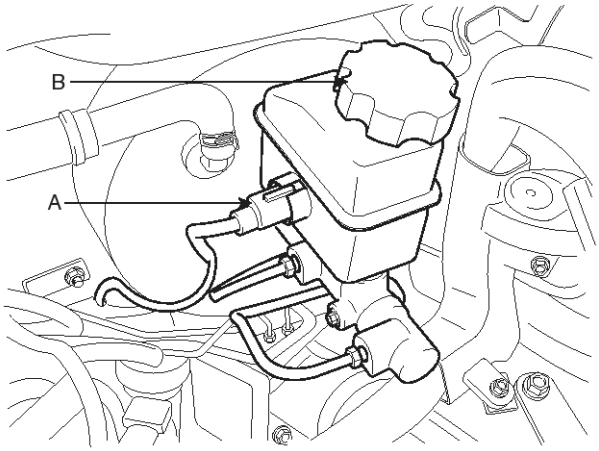
3. Connect the brake lines (A) to the master cylinder.

Tightening torque : N.m (kgf.m, lb-ft)
12.7~16.7 (1.3~1.7, 9.4~12.3) M10
18.6~22.6 (1.9~2.3, 13.7~18.6) M12



SEDBR7509L

4. Connect the brake fluid level switch connector (A).

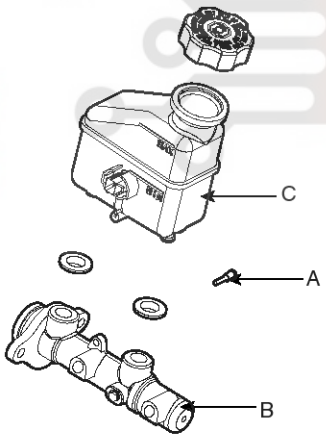


SEDBR7002L

5. Refill the master cylinder reservoir to the MAX line.
6. Bleed the brake system. (Refer to "Bleeding of brake system")

DISASSEMBLY

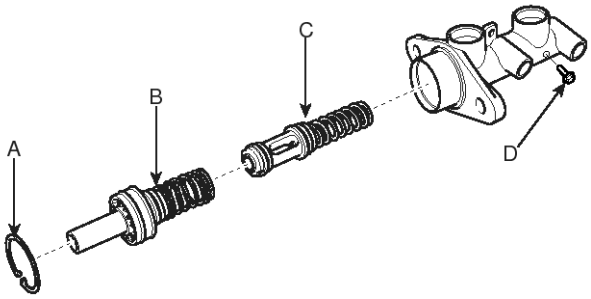
1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. Remove the reservoir (C) from the master cylinder (B) after remove the mounting screw (A).



SEDBR7511L

3. Remove the retainer ring (A) by using the snap ring pliers.
4. Remove the primary piston assembly (B).

5. Remove the pin (D) with the secondary piston (C) pushed completely using a screwdriver. Remove the secondary piston assembly (C).



SUNBR6515D

NOTICE

Do not disassemble the primary and secondary piston assembly.

INSPECTION

1. Check the master cylinder bore for rust or scratch.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

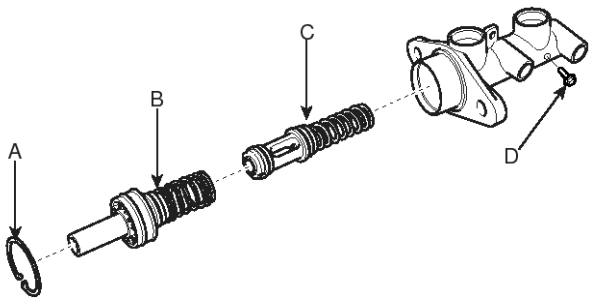
CAUTION

1. If the cylinder bore is damaged, replace the master cylinder assembly.

2. Wash the contaminated parts in alcohol.

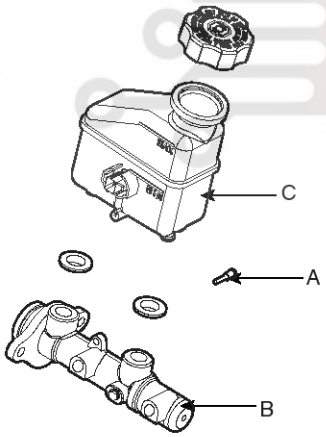
REASSEMBLY

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.
2. Carefully insert the springs and pistons in the proper direction.
3. Press the secondary piston (C) with a screwdriver and install the cylinder pin (D).



SUNBR6515D

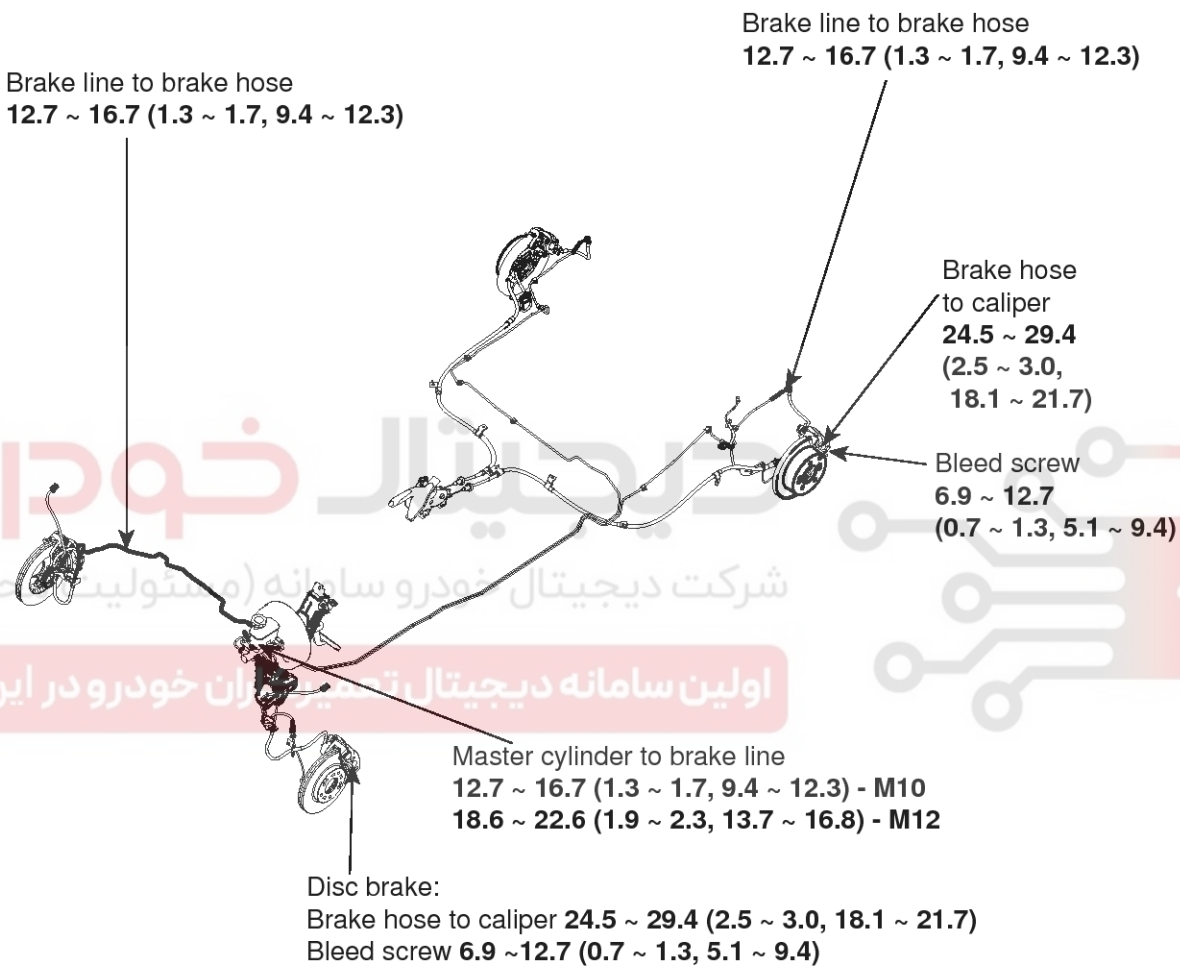
4. Install the primary piston assembly (B) and the retainer ring (A).
5. Mount two grommets (D).
6. Install the reservoir (C) to the master cylinder (B) and tighten the screw (A).



SEDBR7511L

Brake Line

components

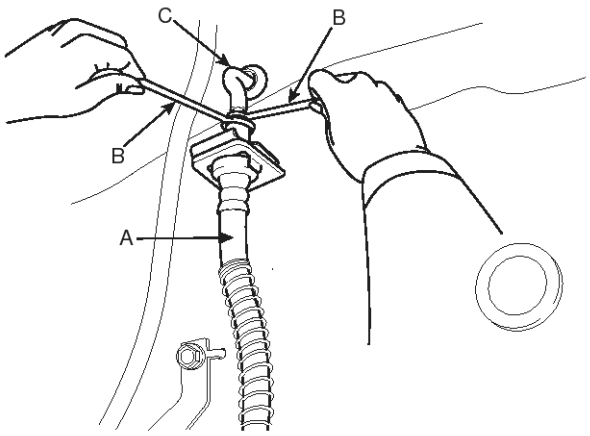


TORQUE : Nm (kgf.m, lb-ft)

SFDBR8103L

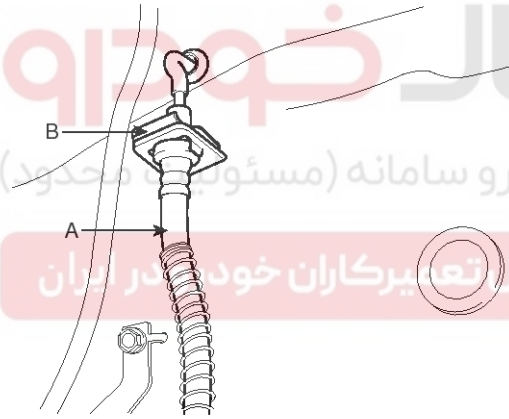
REMOVAL

1. Disconnect the brake hose (C) from the brake line (A) using a flare-nut wrench (B).



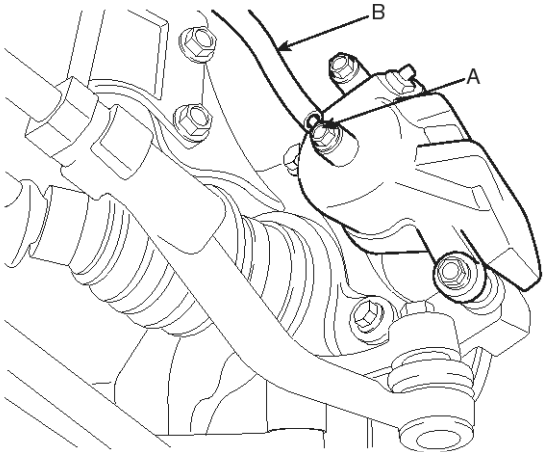
SUNBR6505D

2. Remove the brake hose clip (B), and then remove the brake hose (A).



SHDBR6501L

3. Remove the connector bolt (A) from the caliper, and disconnect the brake hose (B) from the caliper.

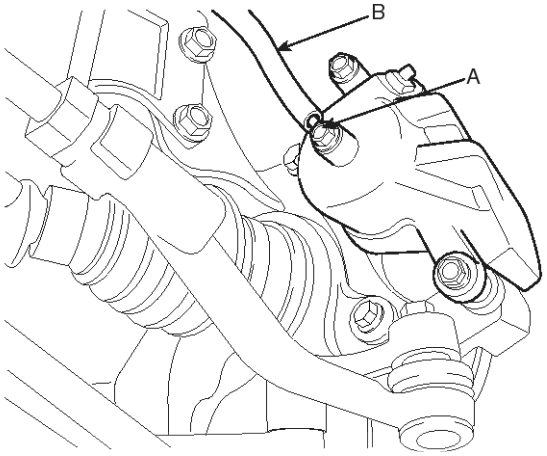


SUNBR6528D

INSTALLATION

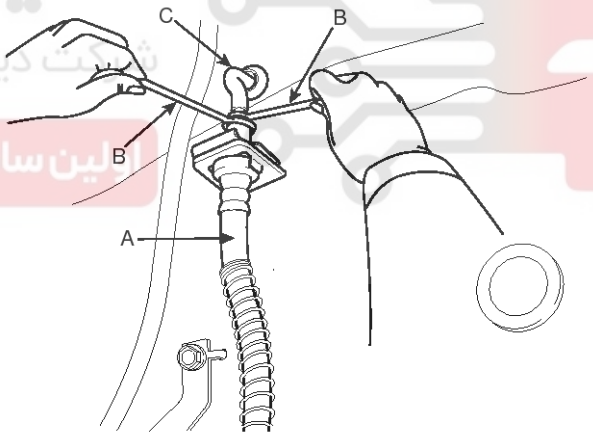
1. Install a brake hose (B) on the caliper with tightening brake hose bolt (A) and washer.

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



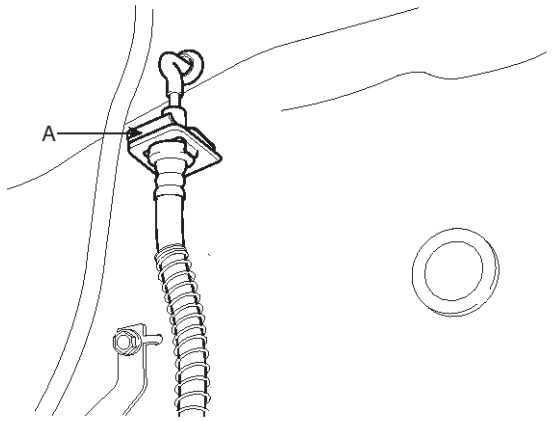
SUNBR6528D

2. Connect the brake hose (A) to the brake line (C) using a flare-nut wrench (B).



SUNBR6505D

3. Install the brake hose clip (A) to the brake hose bracket.



SUNBR6506D

4. After installing the brake hose, bleed the brake system.

CAUTION

- **Check the brake hoses for interference and twisting.**
- **Check the brake hose and line joint for leaks, and tighten if necessary.**

INSPECTION

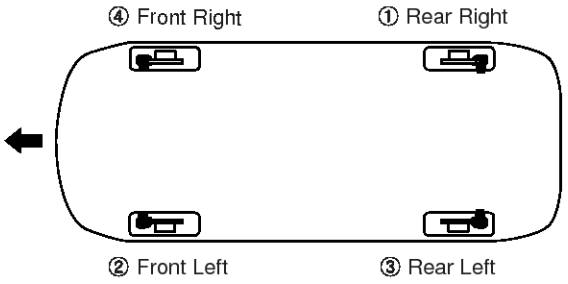
1. Check the brake tubes for cracks, crimps and corrosion.
2. Check the brake hoses for cracks, damaged and oil leakage.
3. Check the brake tube flare nuts for damage and oil leakage.

Brake System Bleeding

NOTICE

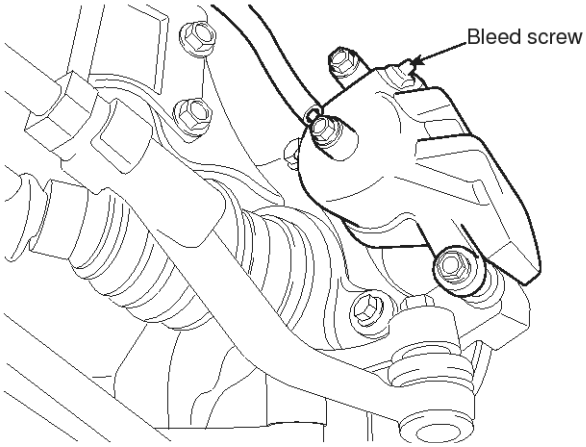
- *Do not reuse the drained fluid.*
- *Always use Genuine DOT3/DOT4 or Brake Fluid. Using a non-Genuine DOT3/DOT4 or brake fluid can cause corrosion and decrease the life of the system.*
- *Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.*
- *Do not spill brake fluid 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 level in the reservoir is at the MAX (upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply steady pressure.
3. Loosen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.
4. Repeat the procedure for each wheel in the sequence shown below until air bubbles no longer appear in the fluid.
5. Refill the master cylinder reservoir to the MAX (upper) level line.



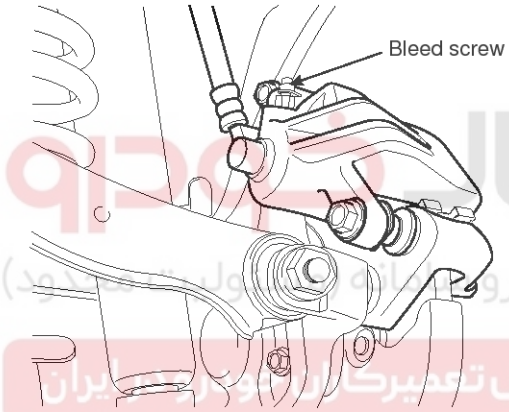
EJKE003B

Front disc brake :



SHDBR6502L

Rear disc brake

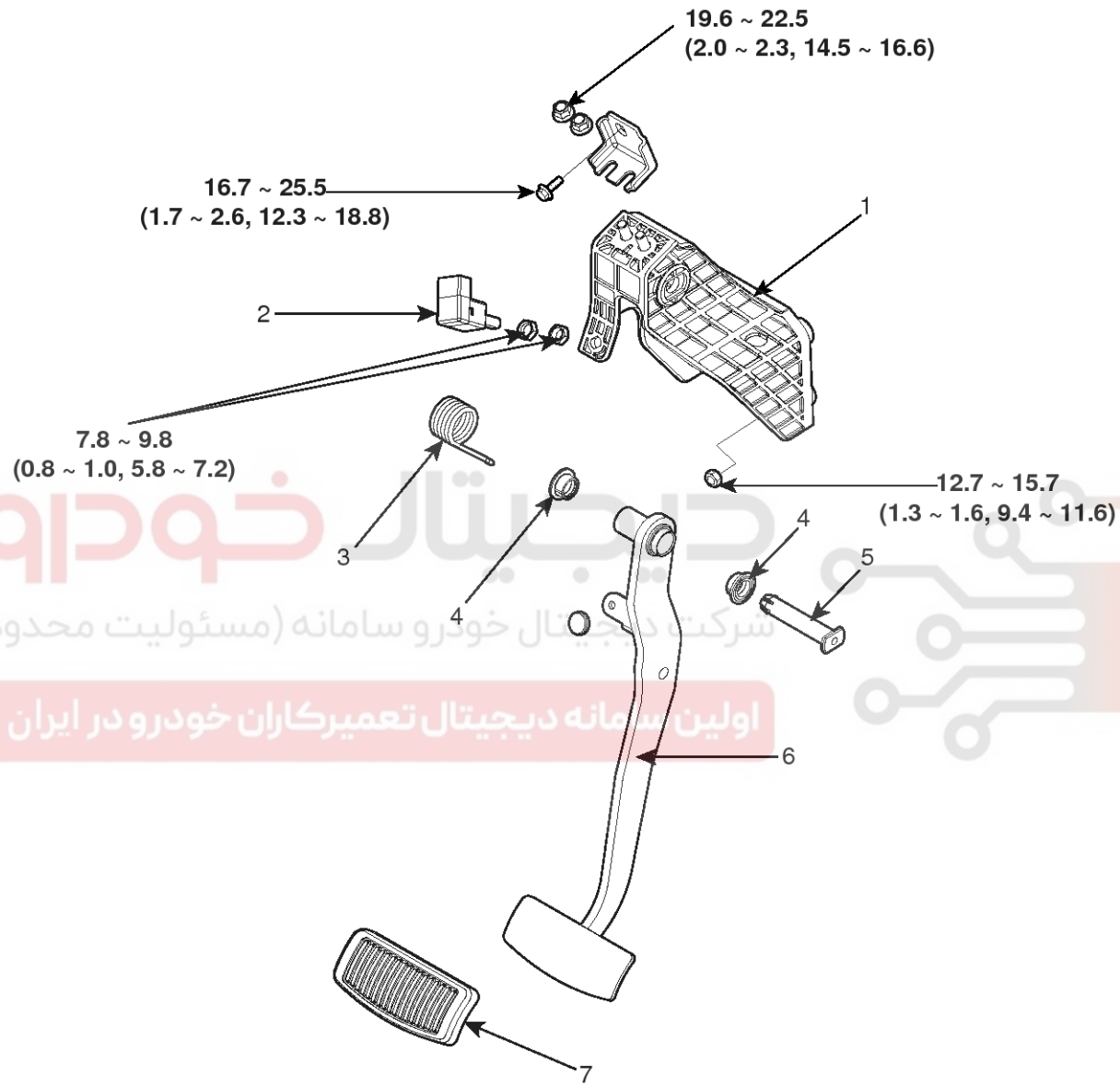


SHDBR6503L

Brake Pedal

COMPONENTS(1)

[LHD] - COMMON PEDAL



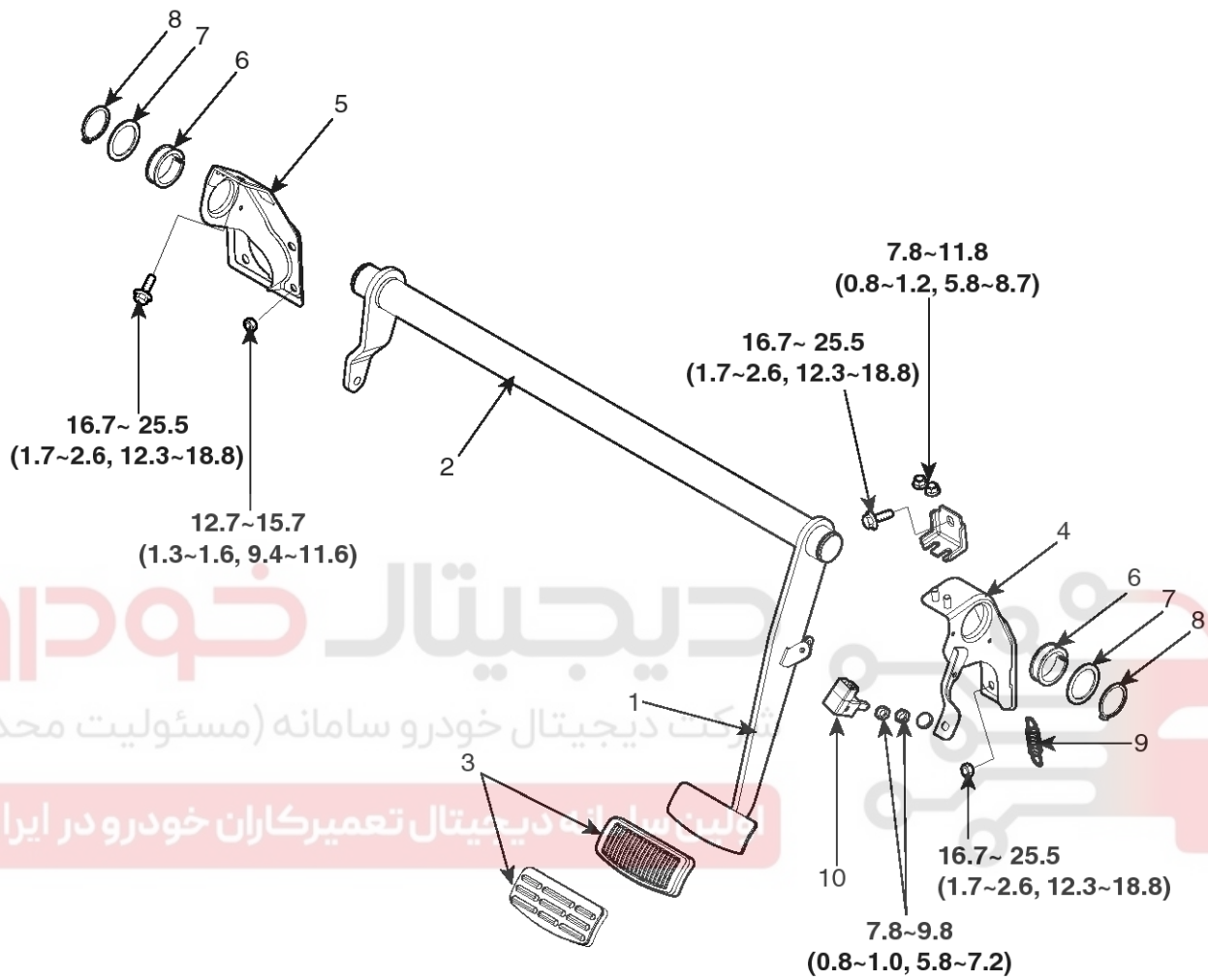
TORQUE : Nm (kgf.m, lb-ft)

1. Member assembly bracket
2. Stop lamp switch
3. Return spring
4. Bushing
5. Brake pedal

SFDBR8104L

components(2)

[RHD]



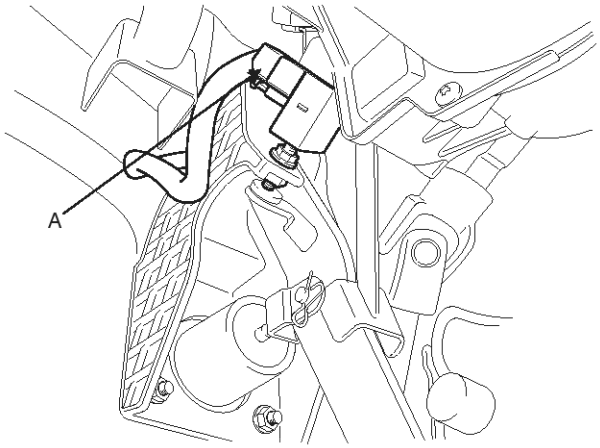
TORQUE : kgf.m (Nm, lb-ft)

1. Brake pedal arm
2. Pipe
3. Pedal pad
4. Pedal support bracket
5. Support bracket
6. Bushing
7. Washer
8. Snap ring
9. Spring
10. Stop lamp switch

SEDBR7503L

REMOVAL

1. Remove the lower crash pad.(Refer to BD "crash pad")
2. Pull down steering column shaft after removing 4 bolts.
3. Remove the stop lamp switch connector (A).



SEDBR7504L

4. Remove the clevis pin and snap pin.
5. Remove the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

INSTALLATION

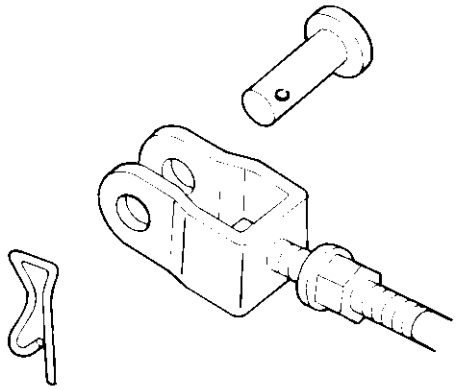
1. Installation is the reverse of removal.

Grease : LiG-2

CAUTION

Coat the inner surface of the bushings with the specified grease.

2. Before inserting the pin, apply the specified grease to the joint pin.



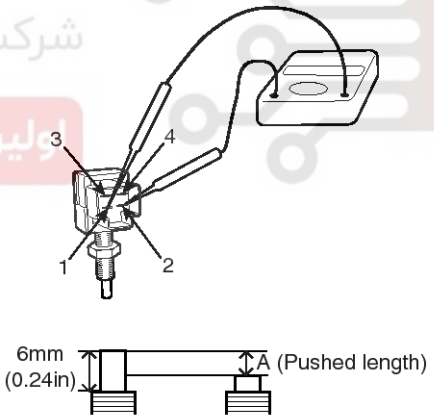
ARJE500U

3. Adjust the brake pedal height and free play.(Refer to "Brake pedal & stop lamp switch adjustment")
4. Install the stop lamp switch.

INSPECTION

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting
3. Check all parts for crack and wear.
4. Check the stop lamp switch.
   1) Connect a circuit tester to the connector (1-2 terminals) of stop lamp switch, and check whether or not there is continuity when the switch rod 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 the switch rod is pushed.

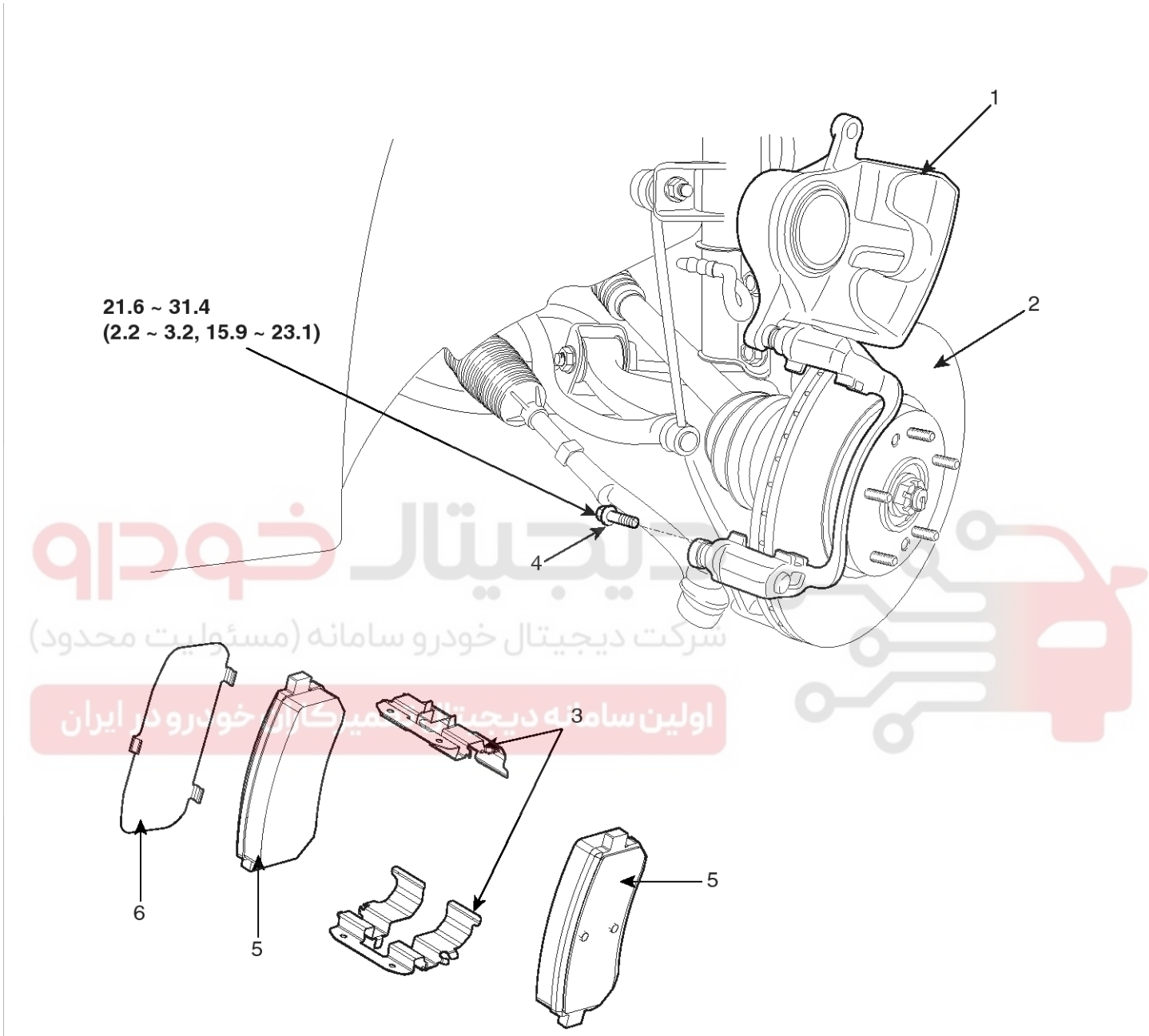
Item	Terminal	Pushed length(A)	Continuity
Stop lamp switch	1-2	2.3±0.25mm (0.09±0.01in)	ON→OFF
Cruise control switch	3-4	1.8±0.25mm (0.07±0.01in)	OFF→ON



SHDBR6534N

Front Disc Brake

COMPONENTS(1)

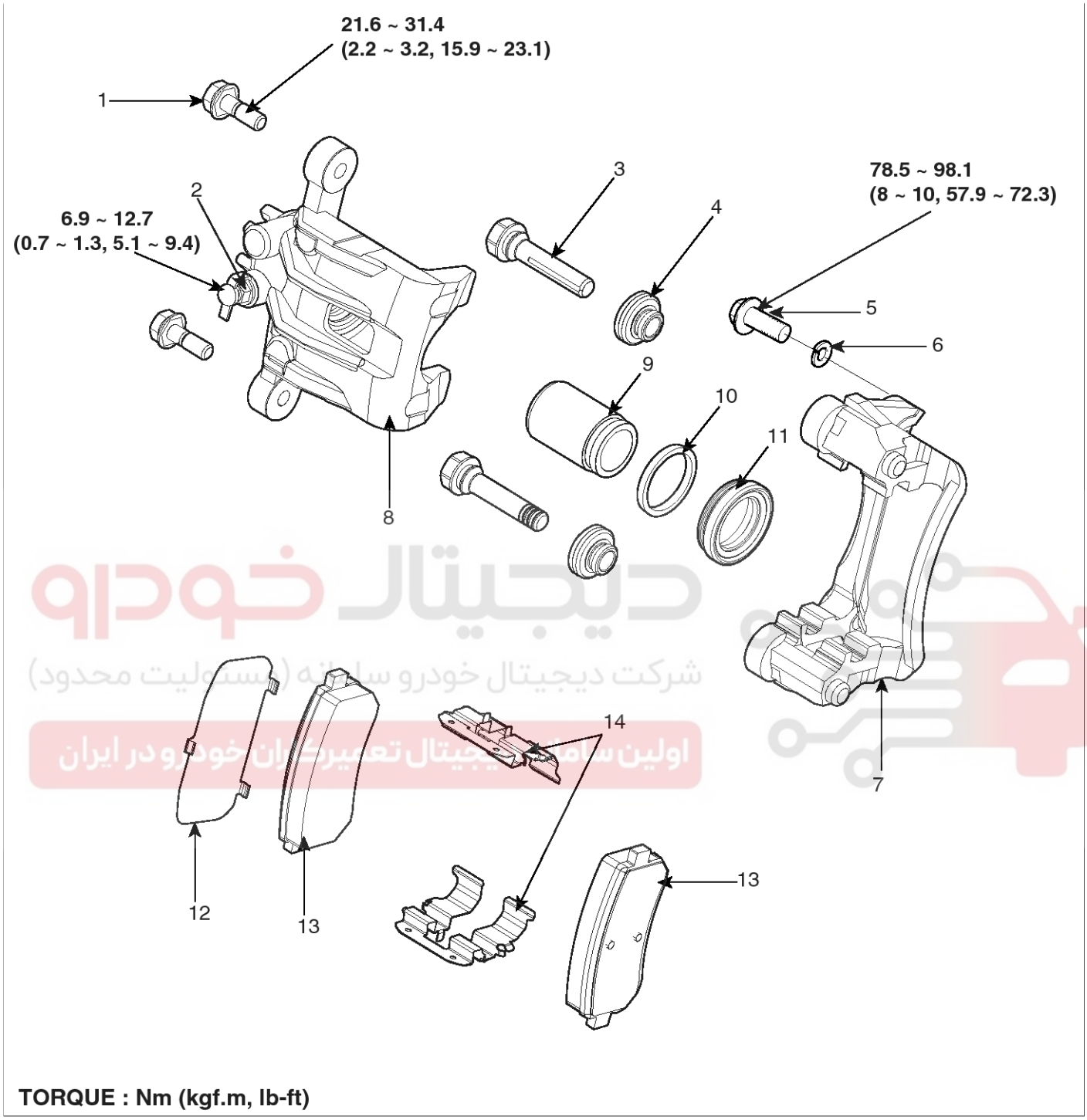


TORQUE : Nm (kgf.m, lb-ft)

1. Brake caliper
2. Brake disc
3. Pad spring
4. Guide rod bolt
5. Brake pad
6. Brake pad shim

SEDBR7505L

COMPONENTS(2)



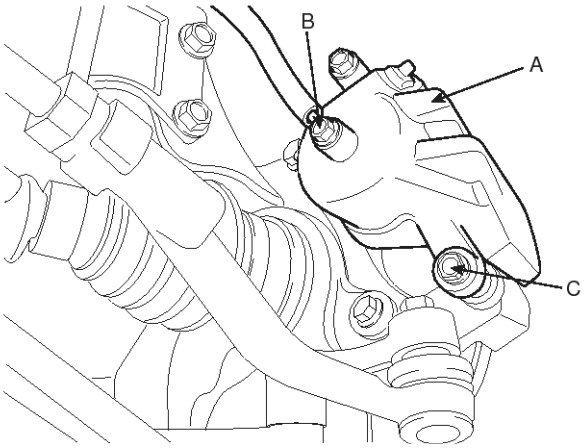
TORQUE : Nm (kgf.m, lb-ft)

1. Guide rod bolt
2. Bleeder screw
3. Guide rod
4. Boot
5. Caliper mounting bolt
6. Washer
7. Caliper carrier
8. Caliper housing
9. Piston
10. Piston seal
11. Piston boot
12. Shim
13. Brake pad
14. Pad spring

SEDBR7506L

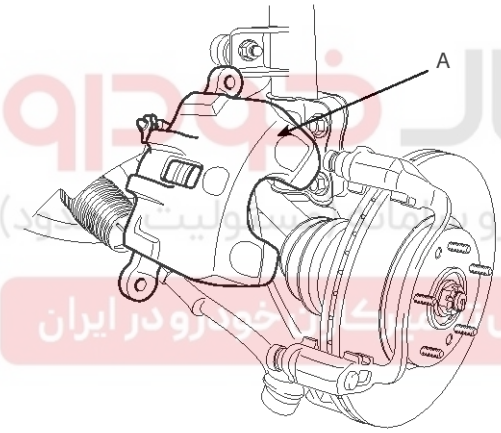
REMOVAL

1. Remove the brake hose bolt (B) and the guide rod bolts (C) from the caliper assembly (A).



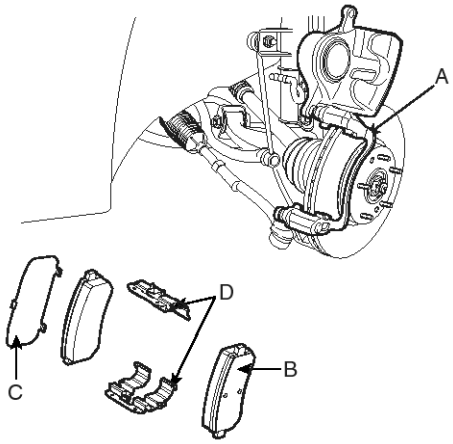
SUNBR6530D

2. Remove the caliper assembly (A).



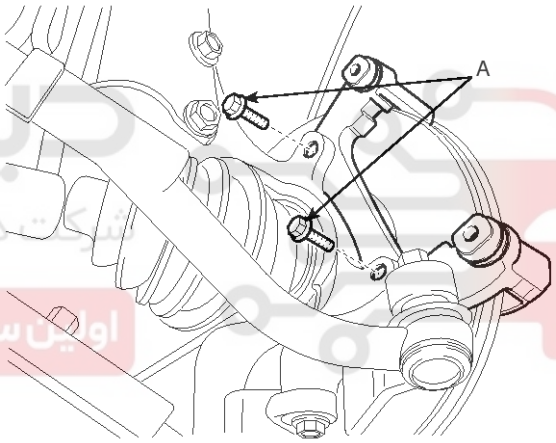
SUNBR6006D

3. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

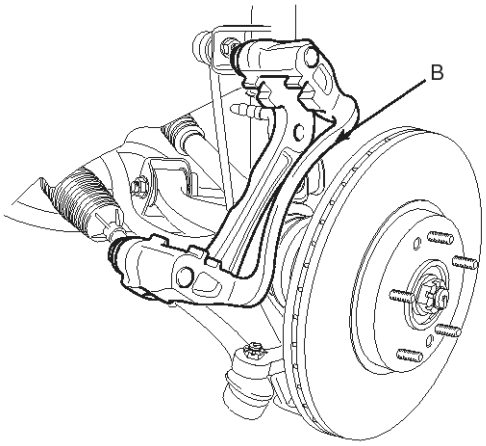


SEDBR7507L

4. Remove the caliper carrier (B) and the caliper mounting bolts (A).

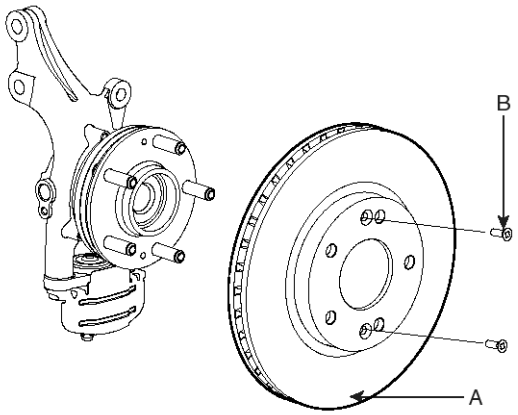


SUNBR6007D



SUNBR6008D

5. Remove the brake disc (A) and the screw (B).

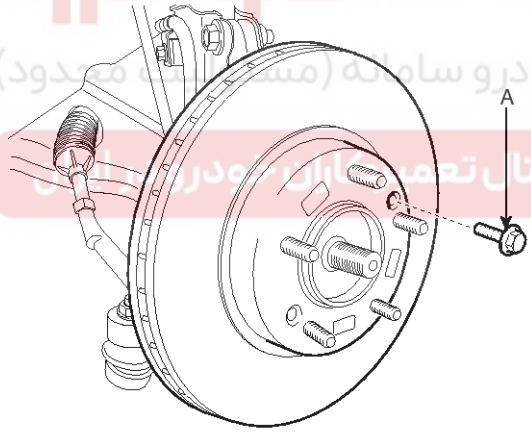


SEDDS7501L

NOTICE

Remove the brake disc from hub using M8 bolt (A) if the brake disc has been seized with the hub due to corrosion or overheat.

Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.



SUNBR6010D

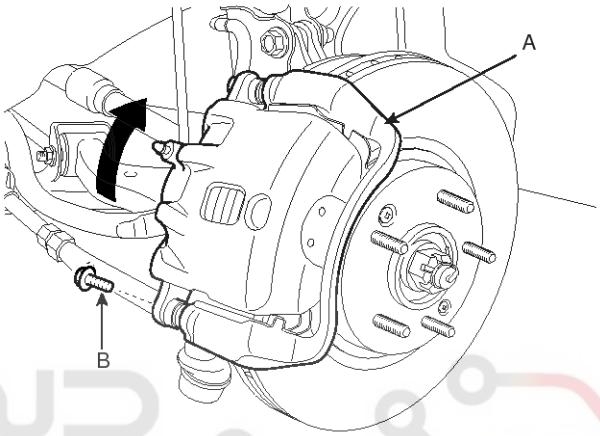
REPLACEMENT

CAUTION

Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.

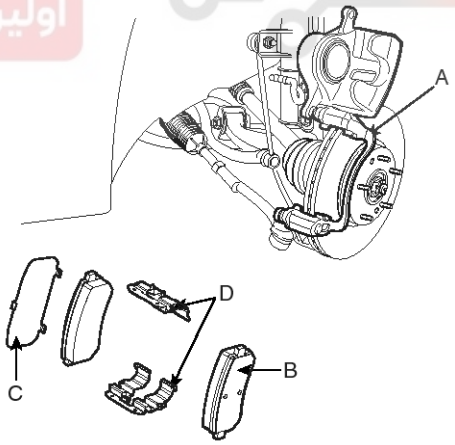
- **Avoid breathing dust particles.**
- **Never use on air hose or brush to clean brake assemblies.**

1. Remove guide rod bolt (B) and raise the caliper assembly (A).



AJLG500X

2. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

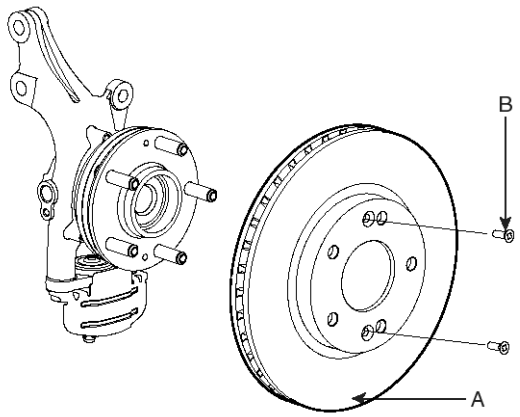


SEDBR7507L

INSTALLATION

1. Install the brake disc (A) and tighten the screw (B).

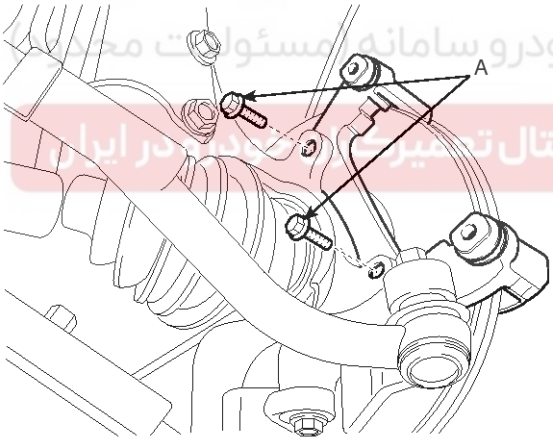
Tightening torque : N.m (kgf.m, lb-ft)
4.9~5.9 (0.5~0.6, 3.6~4.3)



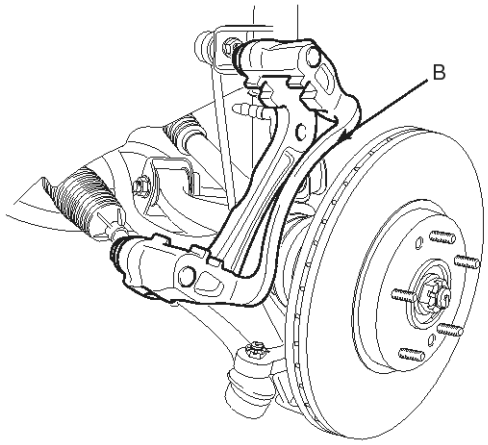
SEDDS7501L

2. Install the caliper carrier (B) and tighten the caliper mounting bolts (A).

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



SUNBR6007D



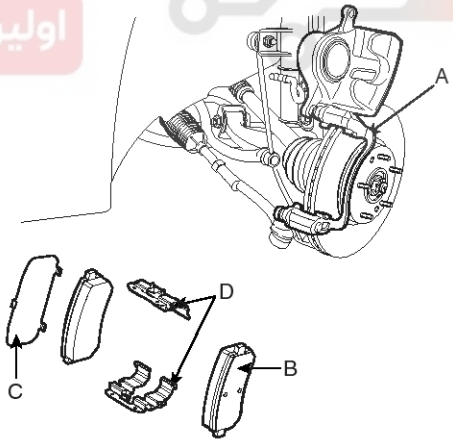
SUNBR6008D

3. Install the pad springs (D) to the caliper carrier (A).
4. Install the brake pads (B) and pad shims (C) on the pad springs correctly. Install the pad with the wear indicator on the inside. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.

NOTICE

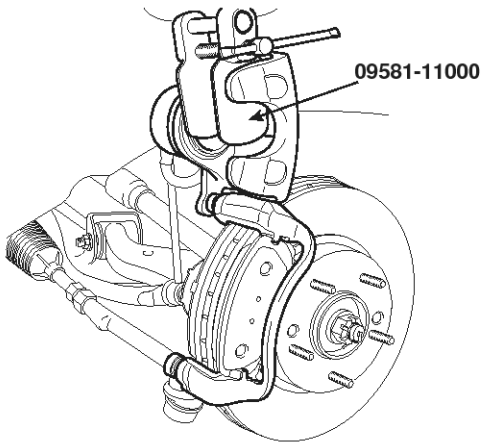
Check the foreign material at the pad shims (A) and the back of the pads (B).

Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.



SEDBR7507L

5. Push in the piston using the SST(09581-11000) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when installing the caliper.

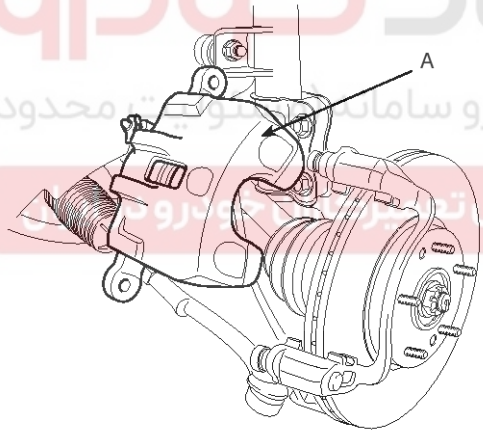


AJLG501E

6. Install the caliper assembly(A).

NOTICE

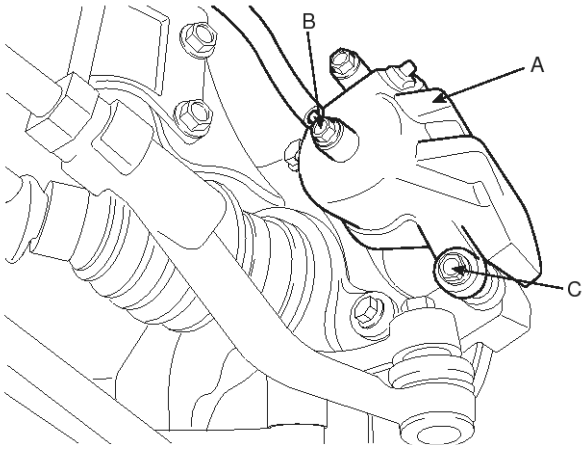
Be careful not to damage the piston pin boot.



SUNBR6006D

7. Install the brake hose bolt (B) and the guide rod bolts (C) to the caliper assembly (A).

Tightening torque : N.m (kgf.m, lb-ft)
Bolt (B) : 24.5~29.4 (2.5~3.0, 18.1~21.7)
Bolt (C) : 21.6~31.4 (2.2~3.2, 15.9~23.1)



SUNBR6530D

8. Refill the master cylinder reservoir to the MAX line.
9. Bleed the brake system. (Refer to "Bleeding of brake system")
10. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTICE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake will restore the normal pedal stroke.

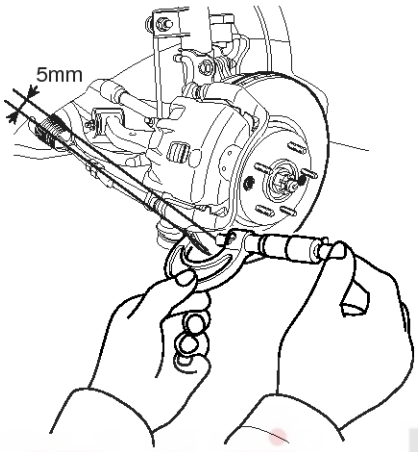
11. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

INSPECTION

FRONT BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 positions at least.

Front brake disc thickness
Standard value : 26.0 mm (1.02 in)
Limit : 24.0 mm (0.94 in)



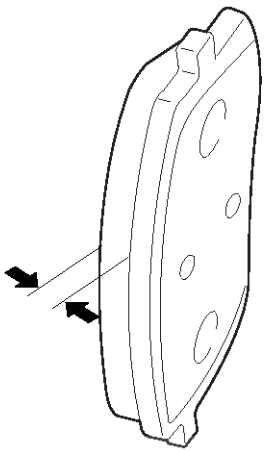
SUNBR6531D

2. Thickness variation should not exceed 0.005 mm (0.0002in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assemblies for left and right of the vehicle.

FRONT BRAKE PAD CHECK

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

Pad thickness
Standard value : 11.0 mm (0.43 in)
Service limit : 2.0 mm (0.0787 in)



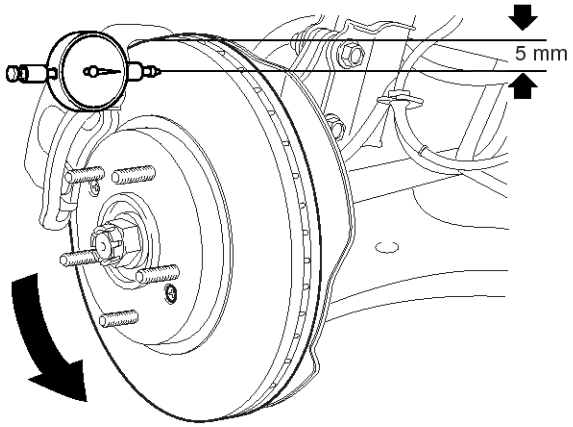
SUNBR6512D

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

FRONT BRAKE DISC RUN OUT CHECK

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

Brake disc run out
Limit : 0.04 mm (0.0020 in) or less

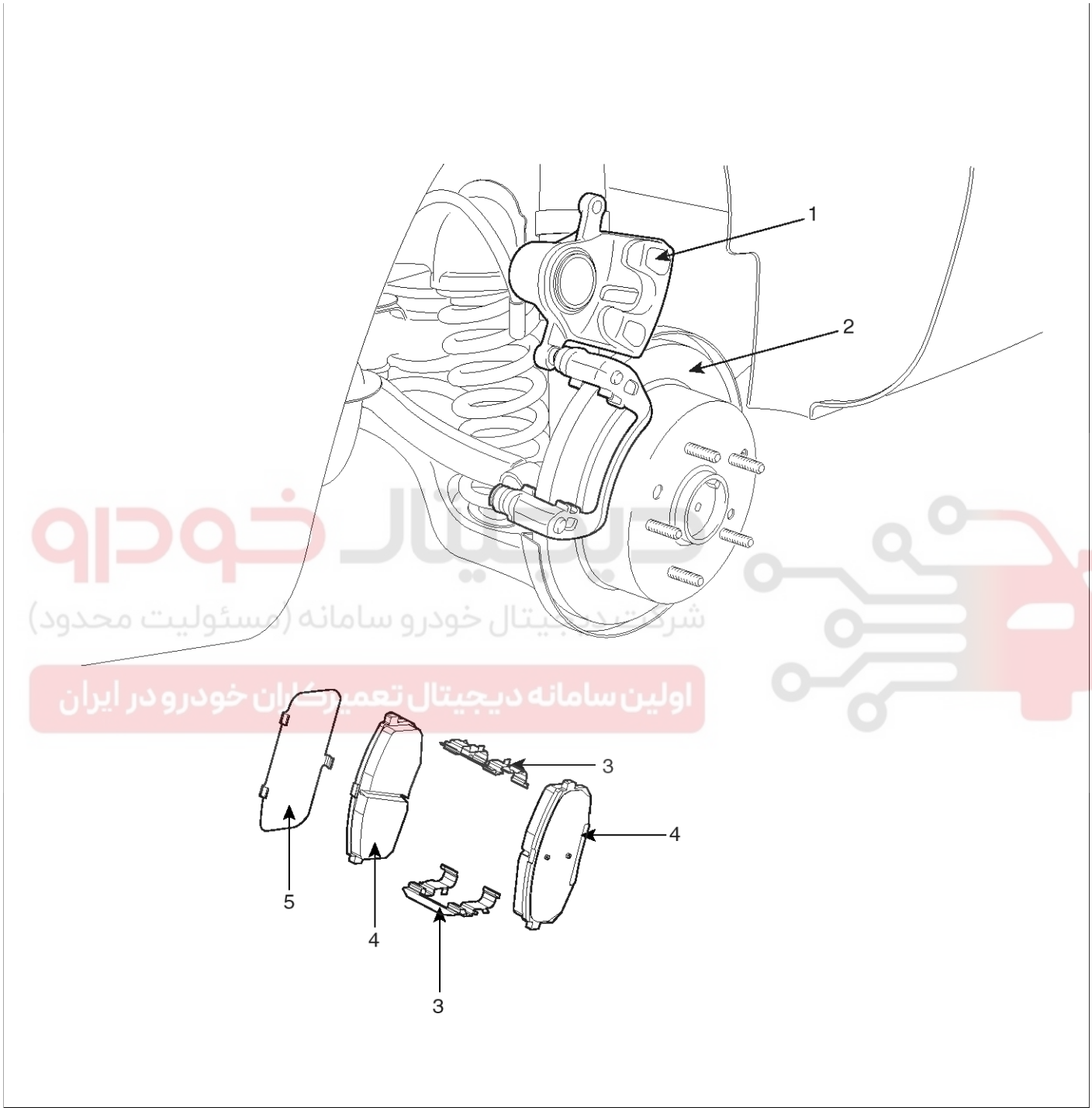


SUNBR6532D

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

Rear Disc Brake

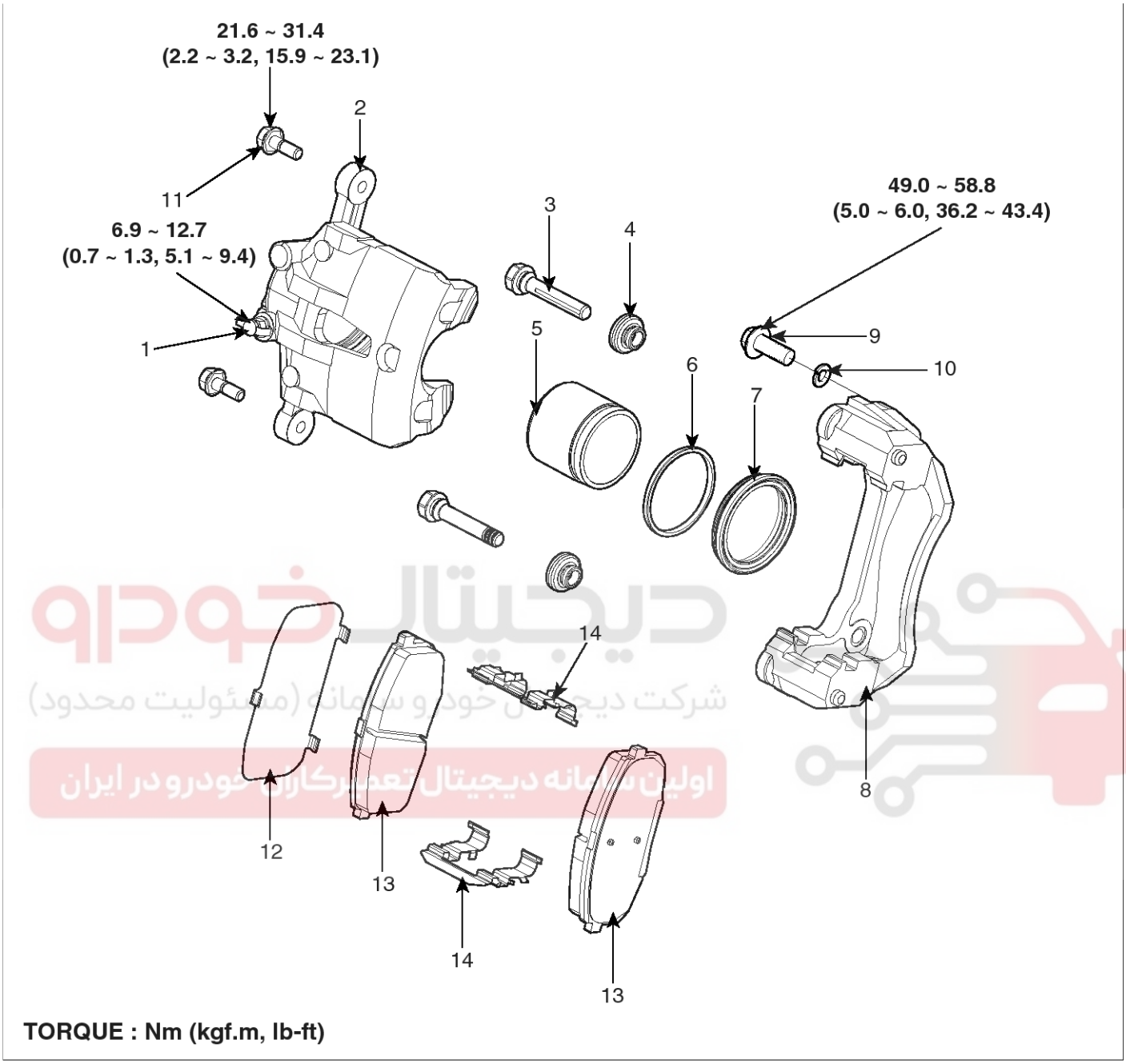
COMPONENT LOCATION



1. Brake caliper
2. Brake disc
3. Pad spring
4. Brake pad
5. Brake pad shim

SEDBR7512L

COMPONENTS

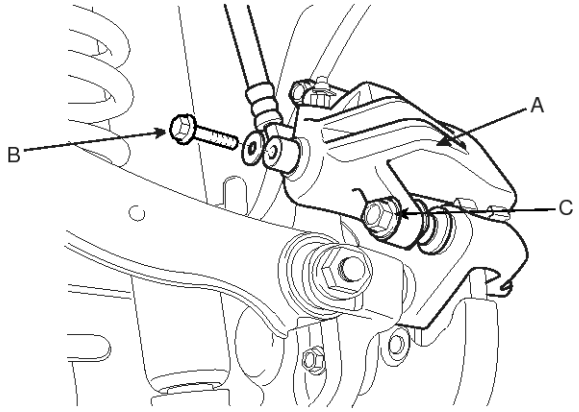


1. Bleeder screw
2. Caliper housing
3. Guide rod
4. Boot
5. Piston
6. Piston seal
7. Piston boot
8. Caliper carrier
9. Caliper mounting bolt
10. Washer
11. Guide rod bolt
12. Inner shim
13. Brake Pad
14. Pad spring

SEDBR7513L

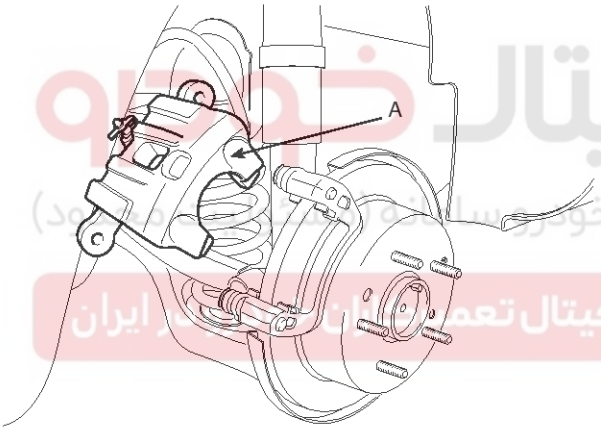
REMOVAL

1. Remove the brake hose bolt (B) and the guide rod bolts (C) from the caliper assembly (A).



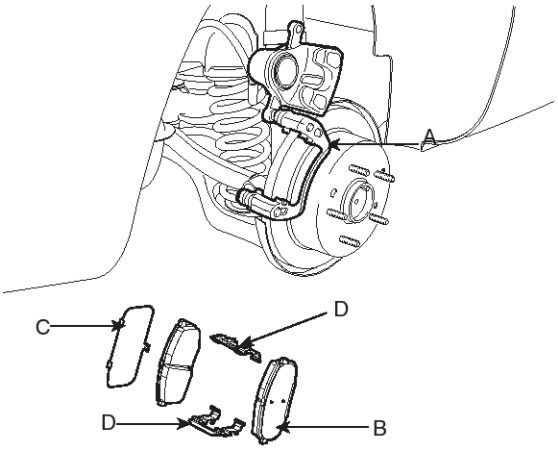
SHDBR6538D

2. Remove the caliper assembly (A).



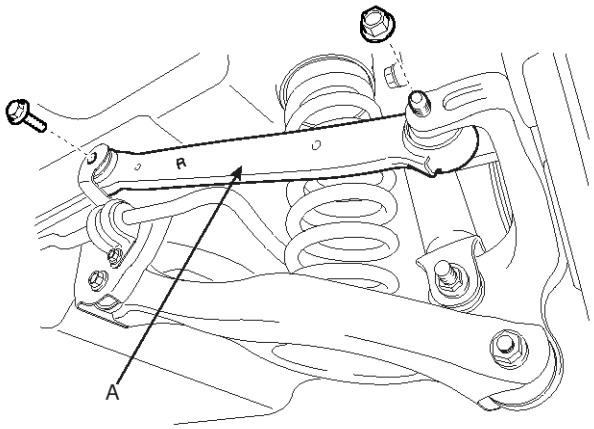
SUNBR6015D

3. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).



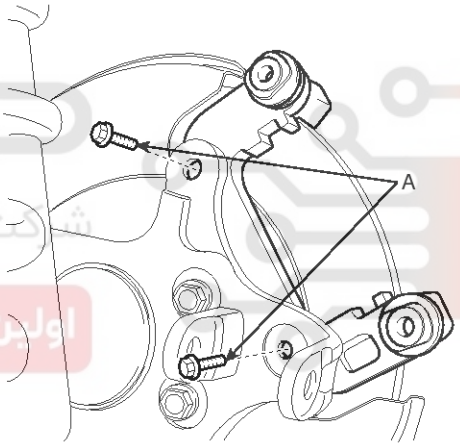
SEDBR7514L

4. Remove the rear upper arm (A).

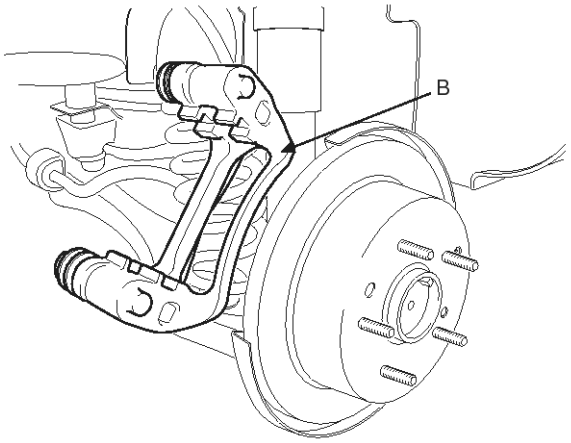


SUNBR6518D

5. Remove the caliper carrier (B) and the caliper mounting bolts (A).

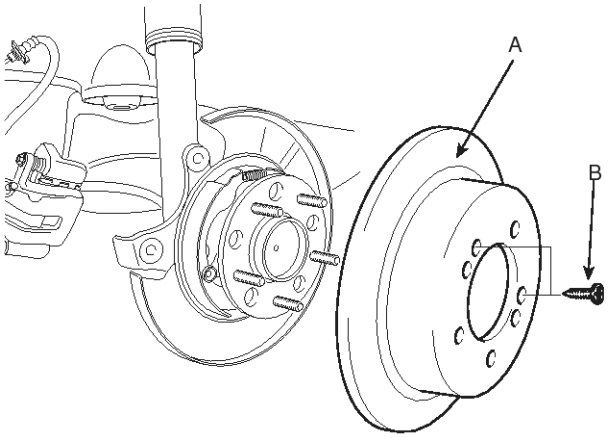


SUNBR6016D



SUNBR6017D

6. Remove the brake disc (A) and the screw (B).

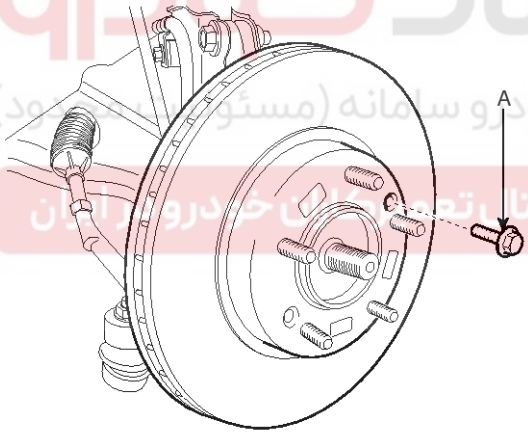


SUNBR6527D

NOTICE

Remove the brake disc from hub using M8 bolt (A) if the brake disc has been seized with the hub due to corrosion or overheat.

Be careful not to use the hammer. The disc can be damaged if you remove the disc from the hub by hammer.



SUNBR6010D

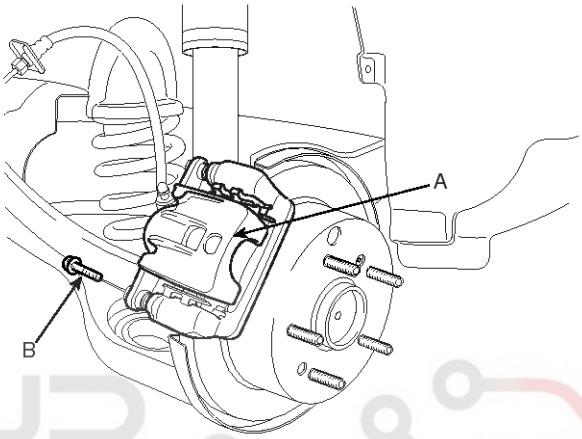
REPLACEMENT

CAUTION

Frequent inhalation of brake pad dust, regardless of material composition, could be hazardous to your health.

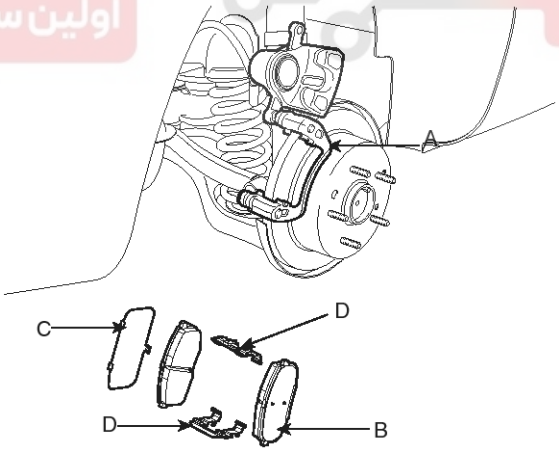
- **Avoid breathing dust particles.**
- **Never use on air hose or brush to clean brake assemblies.**

1. Remove guide rod bolt (B) and raise the caliper assembly (A).



SUNBR6535D

2. Remove the pads (B), the pad shims (C) and the pad springs (D) from the caliper carrier (A).

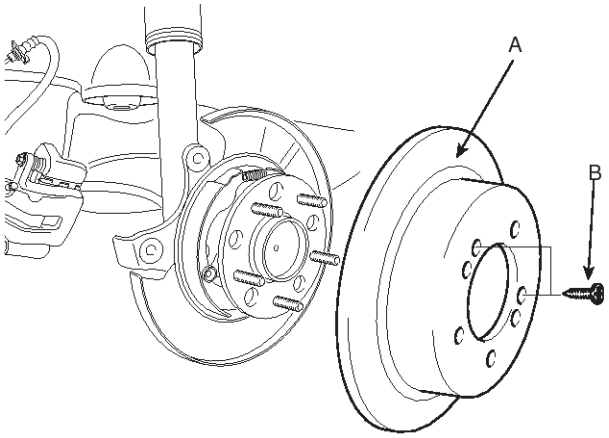


SEDBR7514L

INSTALLATION

1. Install the brake disc (A) and tighten the screw (B).

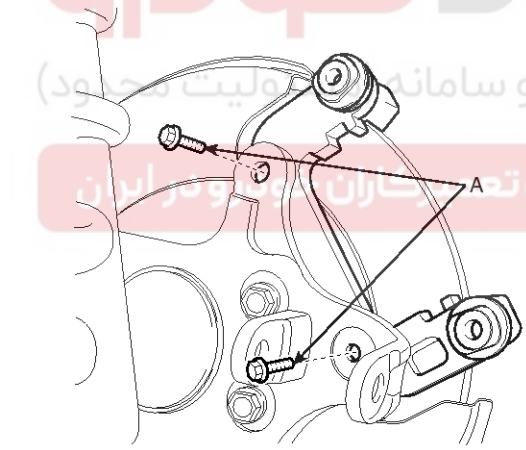
Tightening torque : N.m (kgf.m, lb-ft)
4.9~5.9 (0.5~0.6, 3.6~4.3)



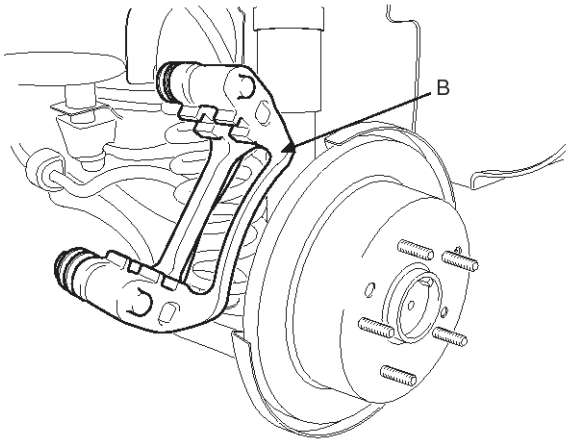
SUNBR6527D

2. Install the caliper carrier (B) and tighten the caliper mounting bolts (A).

Tightening torque : N.m (kgf.m, lb-ft)
49.0~58.8 (5.0~6.0, 36.2~43.4)

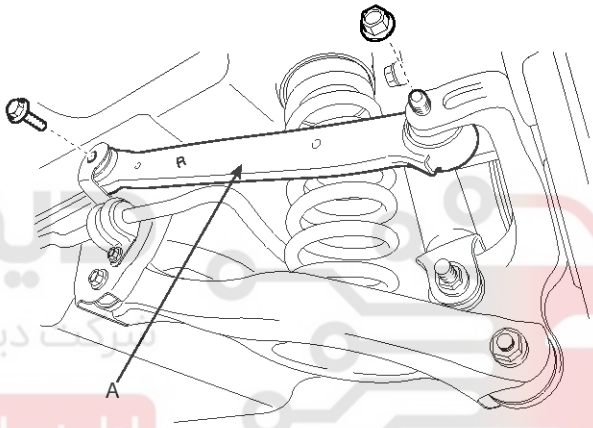


SUNBR6016D



SUNBR6017D

3. Install the rear upper arm (A).



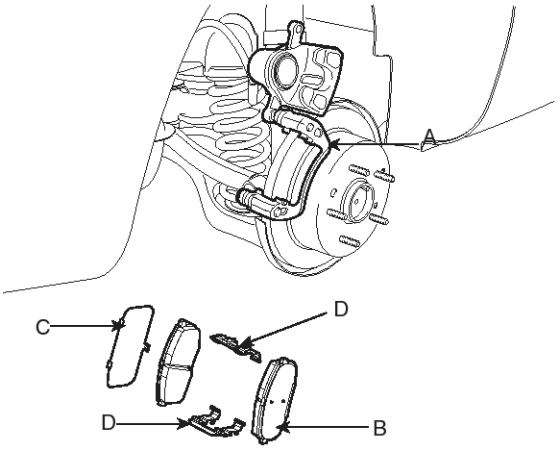
SUNBR6518D

4. Install the pad springs (D) to the caliper carrier (A).
5. Install the brake pads (B) and pad shims (C) on the pad springs correctly. Install the pad with the wear indicator on the inside. If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.

NOTICE

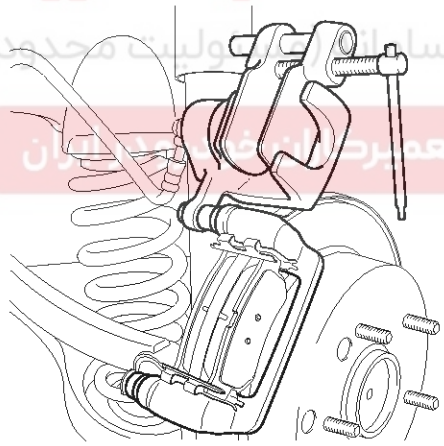
Check the foreign material at the pad shims (A) and the back of the pads (B).

Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.



SEDBR7514L

6. Push in the piston using the SST(09581-11000) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when installing the caliper.

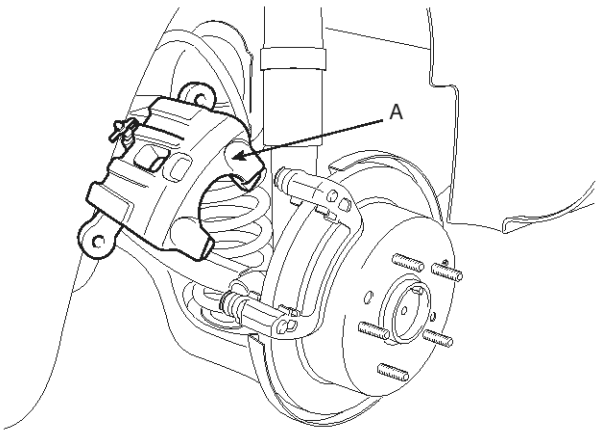


AJLG501P

7. Install the caliper assembly (A).

NOTICE

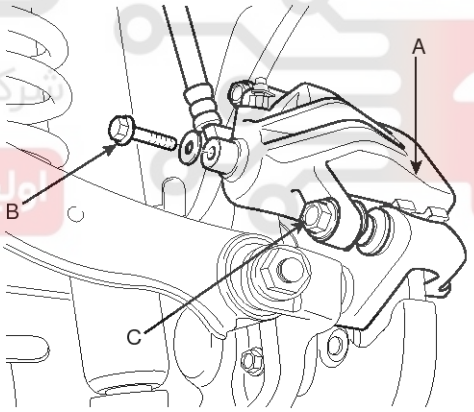
Be careful not to damage the piston pin boot.



SUNBR6015D

8. Install the brake hose bolt (B) and the guide rod bolts (C) to the caliper assembly (A).

Tightening torque : N.m (kgf.m, lb-ft)
Bolt (B) : 24.5~29.4 (2.5~3.0, 18.1~21.7)
Bolt (C) : 21.6~31.4 (2.2~3.2, 15.9~23.1)



SUNBR6520D

9. Refill the master cylinder reservoir to the MAX line.
10. Bleed the brake system. (Refer to "Bleeding of brake system")
11. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTICE

Engagement of the brake may require a greater pedal stroke immediately after the brake pads have been replaced as a set. Several applications of the brake will restore the normal pedal stroke.

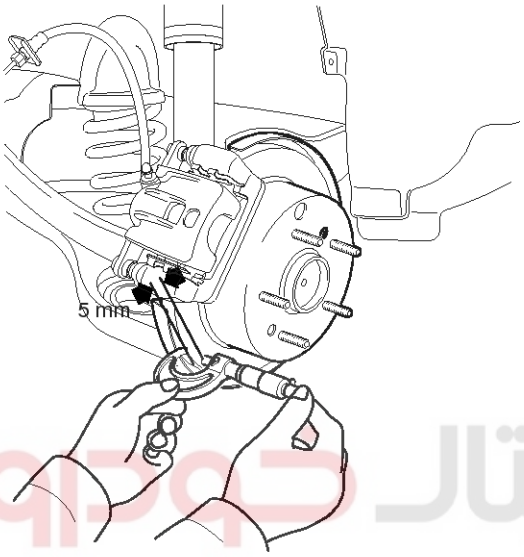
12. After installation, check for leaks at hose and line joints or connections, and retighten if necessary.

INSPECTION

REAR BRAKE DISC THICKNESS CHECK

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 positions at least.

Rear brake disc thickness
Standard value : 10.0 mm (0.39 in)
Limit : 8.4 mm (0.33 in)



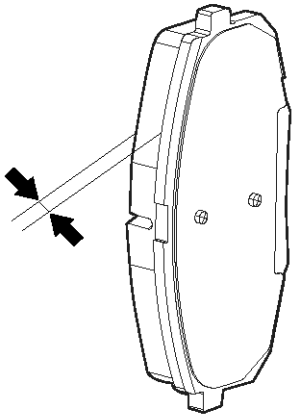
SUNBR6536D

2. Thickness variation should not exceed 0.01 mm (0.0004in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assemblies for left and right of the vehicle.

REAR BRAKE PAD CHECK

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

Pad thickness
Standard value : 10.0 mm (0.39 in)
Service limit : 2.0 mm (0.0787 in)



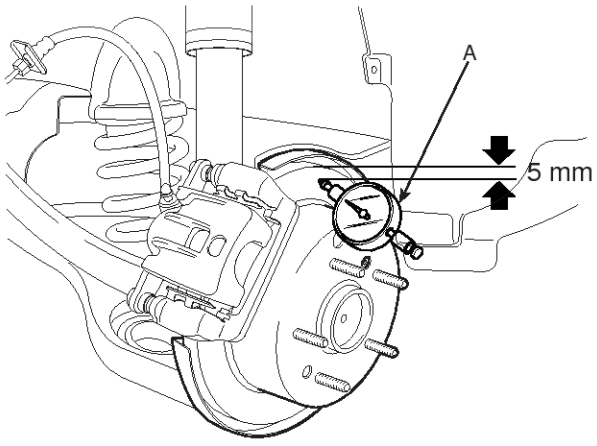
SEDBR7515L

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

REAR BRAKE DISC RUN OUT CHECK

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

Brake disc run out
Limit : 0.05 mm (0.0020 in) or less



SUNBR6537D

2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.

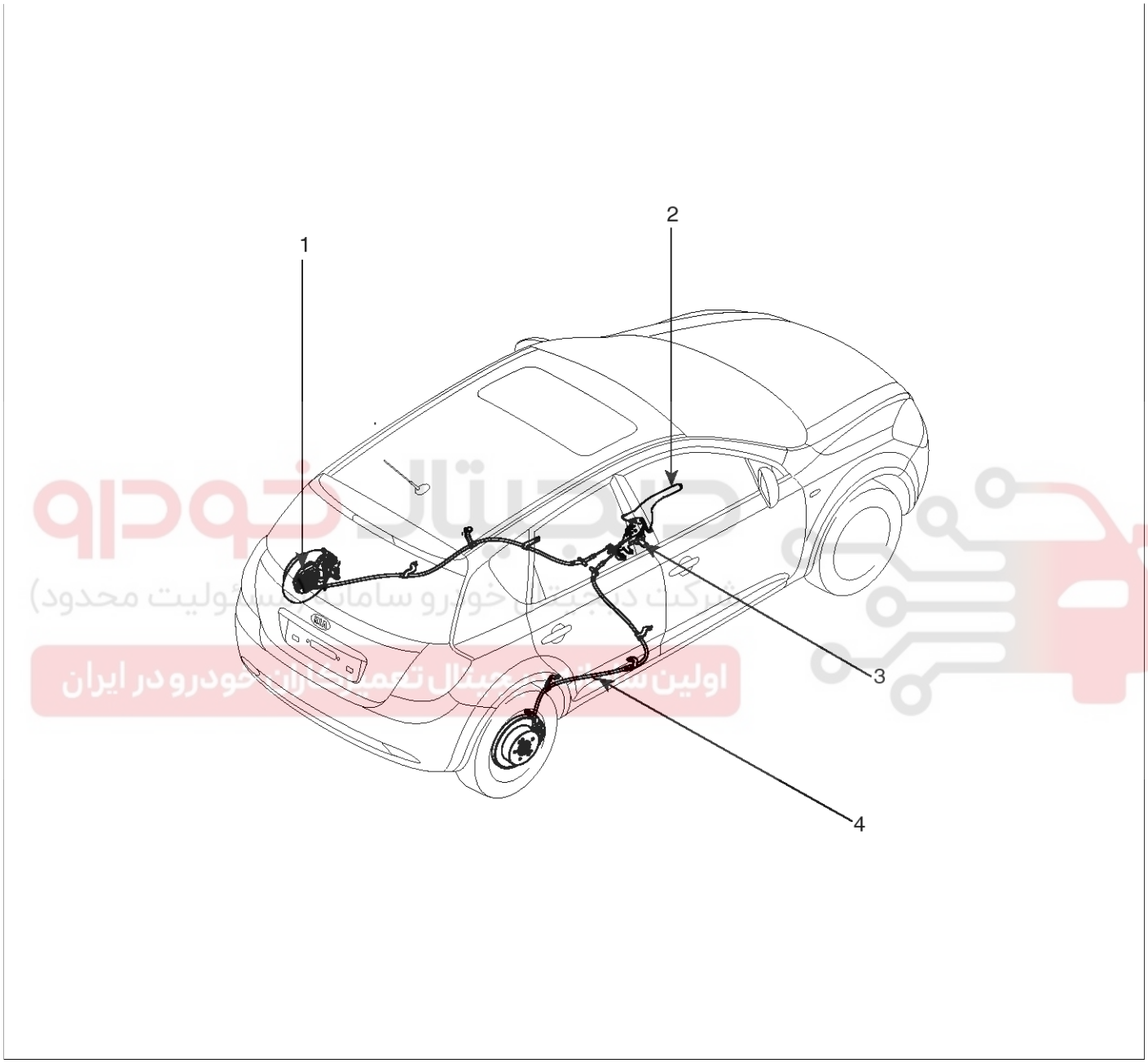
3. If the run out does not exceed the limit specification, install the brake disc after turning it and then check the run out of the brake disc again.
4. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

Parking Brake System

Parking Brake System

Parking Brake Assembly

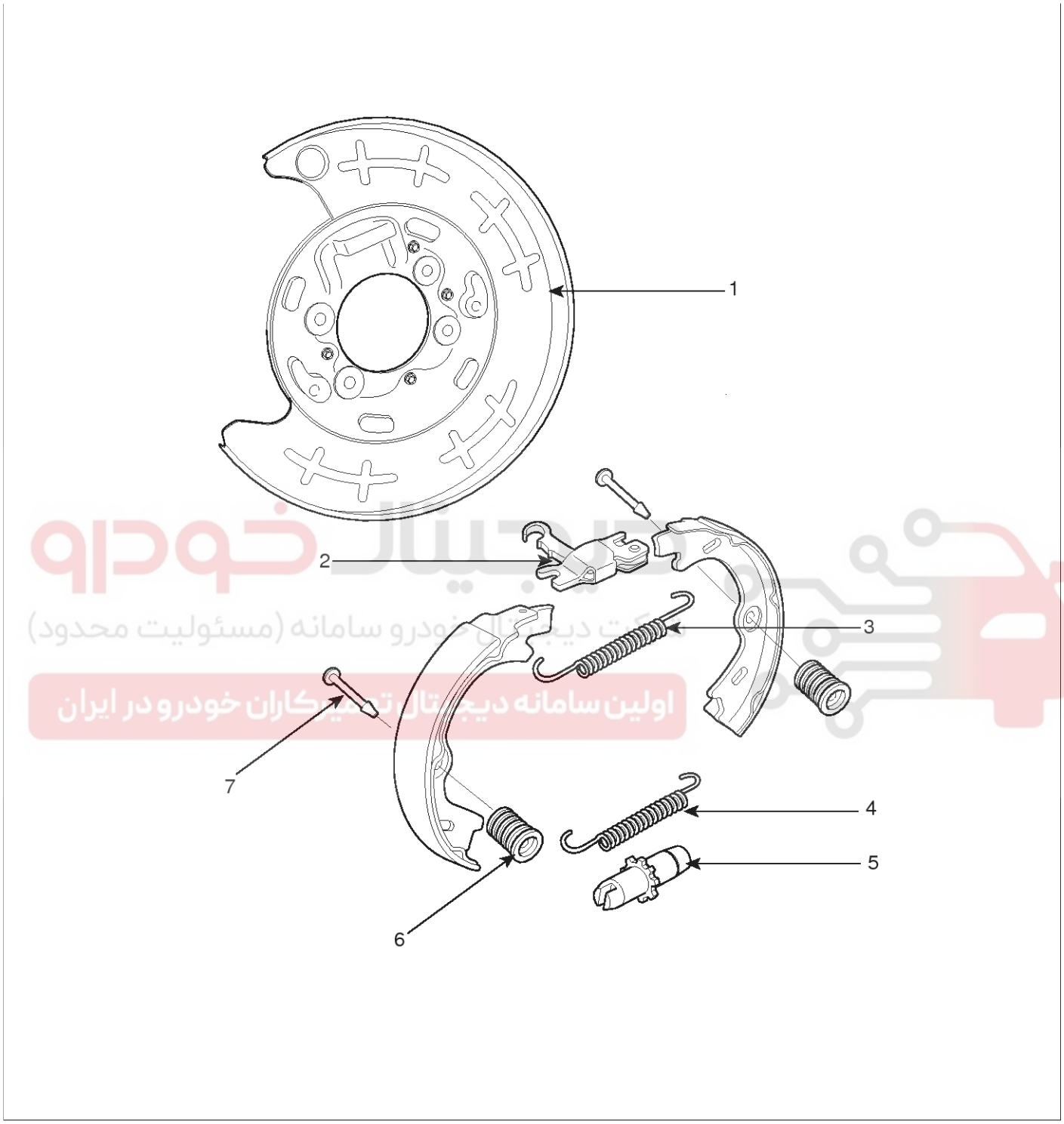
COMPONENT LOCATION



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

SEDBR7518L

COMPONENT
DISC BRAKE TYPE



1. Backing plate
2. Operating lever
3. Upper spring
4. Lower spring
5. Adjuster
6. Shoe hold down spring
7. Shoe hold down pin

SHDBR6512L

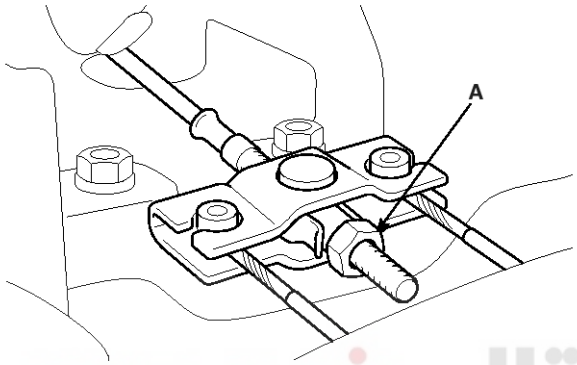
REMOVAL

PARKING BRAKE LEVER

NOTICE

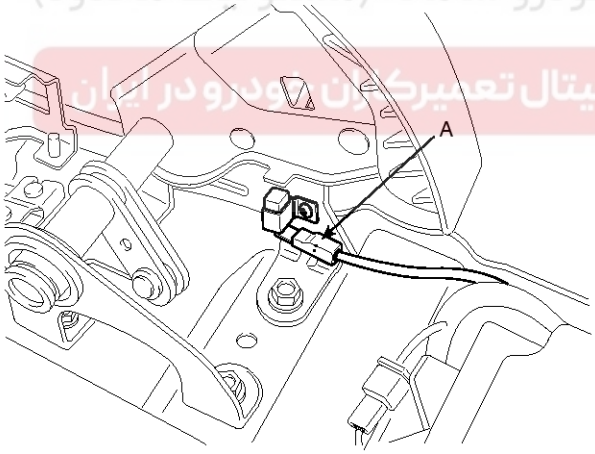
The parking brake cables must not be bent or distorted. This will lead to stiff operation and premature failure.

1. Remove the floor console. (Refer to BD Gr. -"Floor console")
2. Loosen the adjusting nut (A) and the parking brake cables.



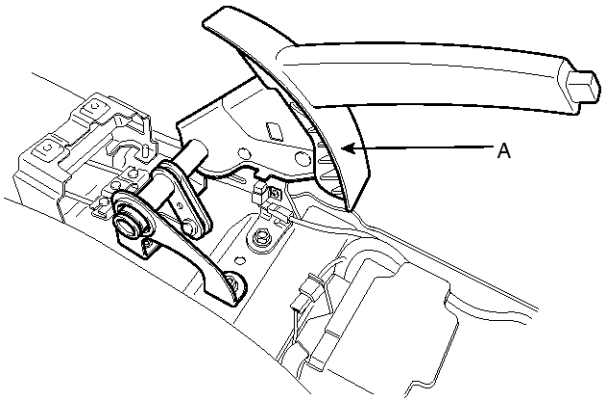
ARJE502S

3. Disconnect the connector (A) of parking brake switch.



SEDBR7003L

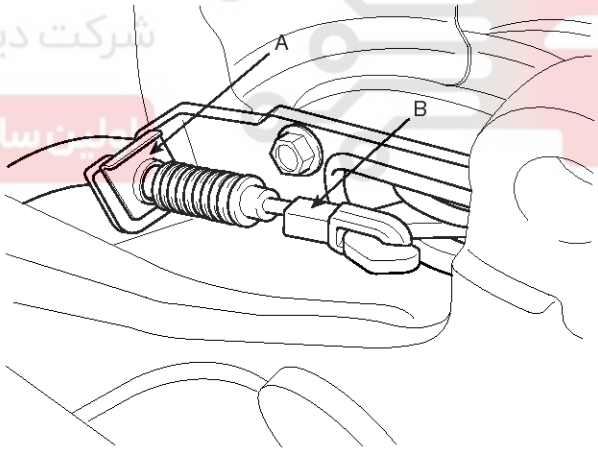
4. Remove the parking brake lever assembly (A) with loosening the bolts.



SEDBR7004L

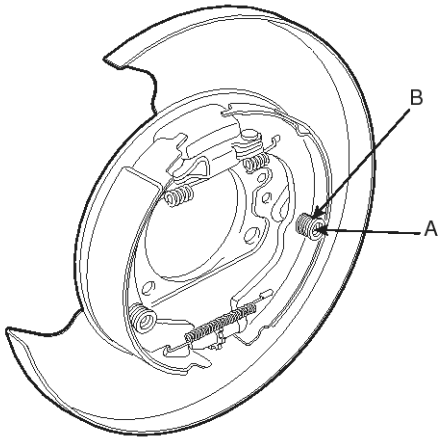
PARKING BRAKE SHOE (DISC BRAKE TYPE)

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



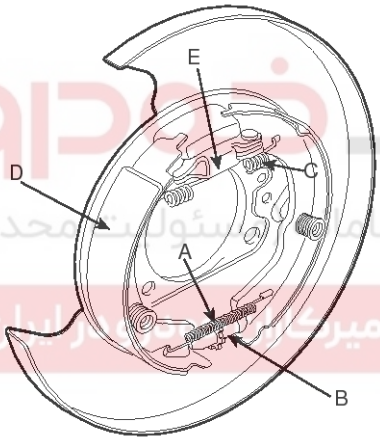
SUNBR6027D

4. Remove the shoe hold down pin (A) and spring (B) by pressing and rotating the spring.



SUNBR6523D

5. Remove the adjuster assembly (B) and the lower return spring (A).



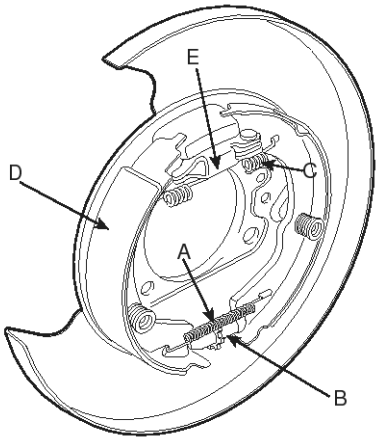
SHDBR6541D

6. Remove the upper return spring (C) and the brake shoes (D).
7. Remove the operating lever assembly (E).

INSTALLATION

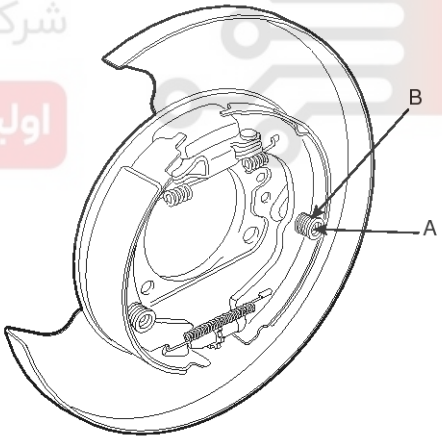
PARKING BRAKE SHOE (DISC BRAKE TYPE)

1. Install the operating lever assembly (E).



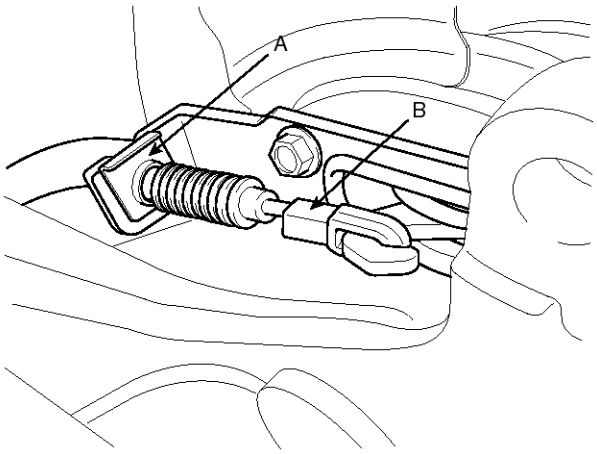
SUNBR6524D

2. Install the upper return spring (C) and the brake shoes (D).
3. Install the adjuster assembly (B) and the lower return spring (A).
4. Install the shoe hold down pin (A) and spring (B) by pressing and rotating the spring.



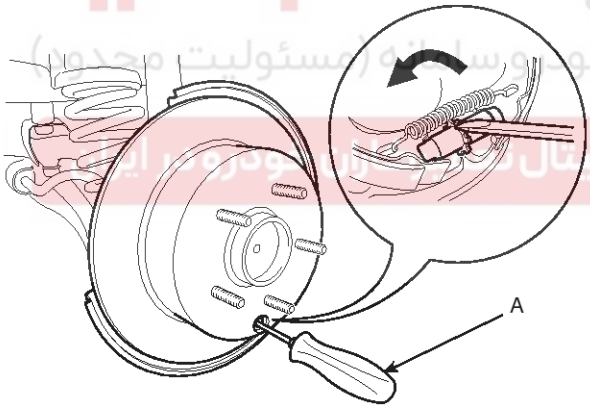
SUNBR6523D

5. Install the parking brake cable (B), then install the clip (A).



SUNBR6027D

6. 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.



SUNBR6029D

7. Install the brake caliper. (Refer to "Rear brake installation")
8. Install the tire and wheel.
9. Adjust the parking brake lever.
10. 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 69 N(7 kgf, 15 lb) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 60 kph (37.3 mph).
    2) Repeat the above procedure more than two times.
    3) Must be held on at 30% grade.

⚠CAUTION

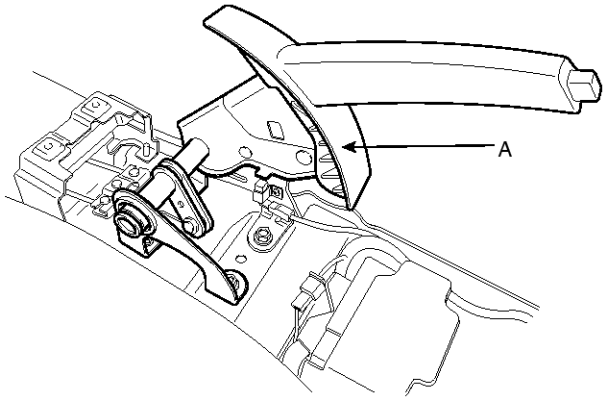
After adjusting parking brake, verify the following;

1. **Must be free from malfunction when the parking pedal is operated at 686N(70 kgf, 154 lb).**
2. **Check that all parts move smoothly.**
3. **The parking brake indicator lamp must be on after the parking lever is applied and must be off after the lever is released.**

PARKING BRAKE LEVER

1. Install the parking brake lever assembly, then tighten the mounting bolts.

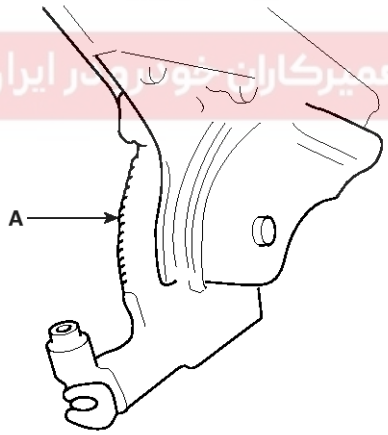
Tightening torque : N.m (kgf.m, lb-ft)
8.8 ~ 13.7(0.9 ~ 1.4, 6.5 ~ 10.1)



SEDBR7004L

2. Apply a coating of the specified grease to each sliding parts (A) of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease RheoGel 429 (MS511-54, LT2)



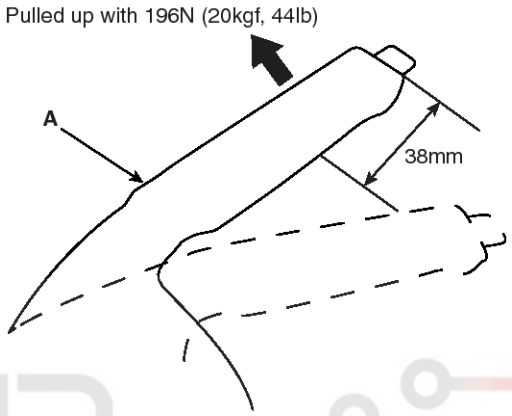
ARJE502X

3. Install the parking brake cable adjuster, then adjust the parking brake lever stroke by turning adjusting nut (A).

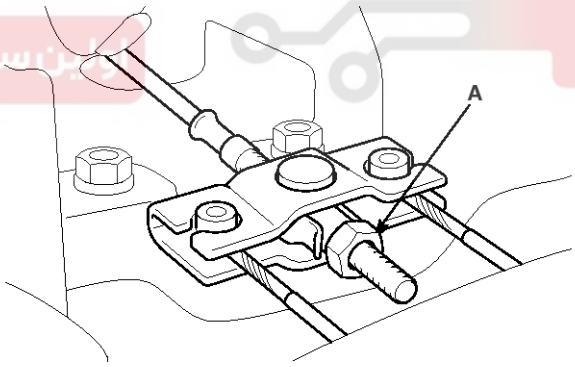
Parking brake lever stroke :
7 cliks (Pull the lever with 20kg)

NOTICE

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

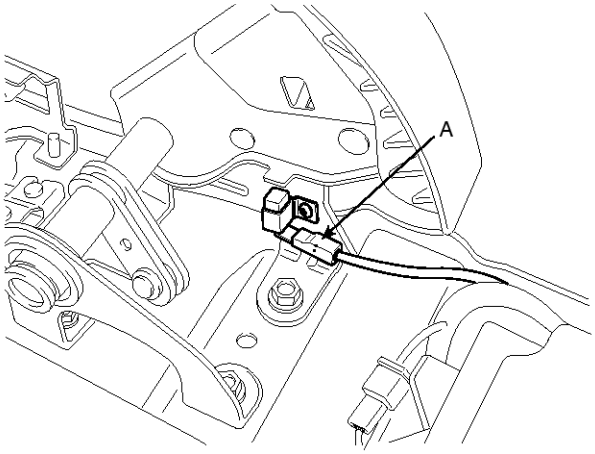


SHDBR6567L



ARJE502S

4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Reconnect the connector (A) of parking brake switch.



SEDBR7003L

NOTICE

Inspect the continuity of parking brake switch.

When the brake lever is pulled : continuity
When the brake lever is released : no continuity

7. Install the floor console.

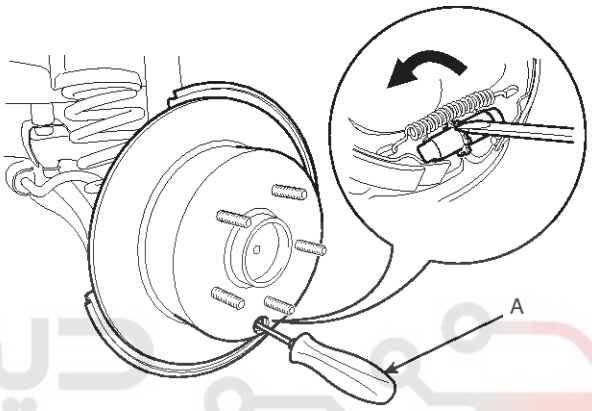
(Refer to BD Gr. - "Floor console")

ADJUSTMENT

PARKING BRAKE SHOE CLEARANCE ADJUSTMENT

DISC BRAKE TYPE

1. Raise the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.
4. Rotate the toothed wheel of adjuster by a screw driver until the disc is not moving, and then return it by 5 notches in the opposite direction.



SUNBR6029D

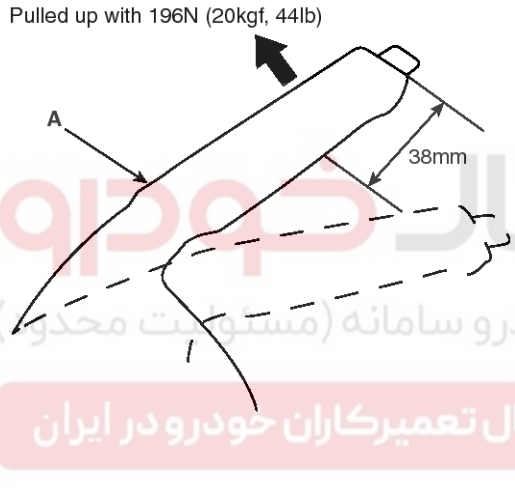
PARKING BRAKE LEVER STROKE ADJUSTMENT

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

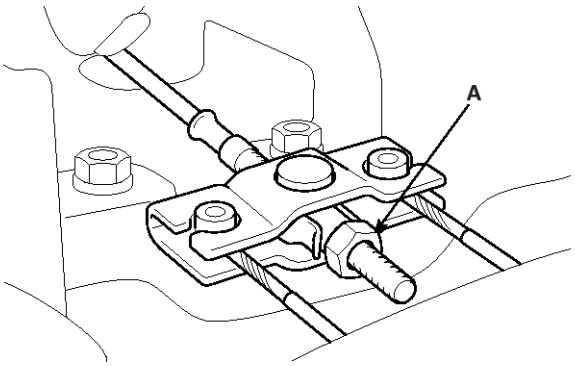
Parking brake lever stroke :
7 cliks (Pull the lever with 20kg)

NOTICE

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



SHDBR6567L

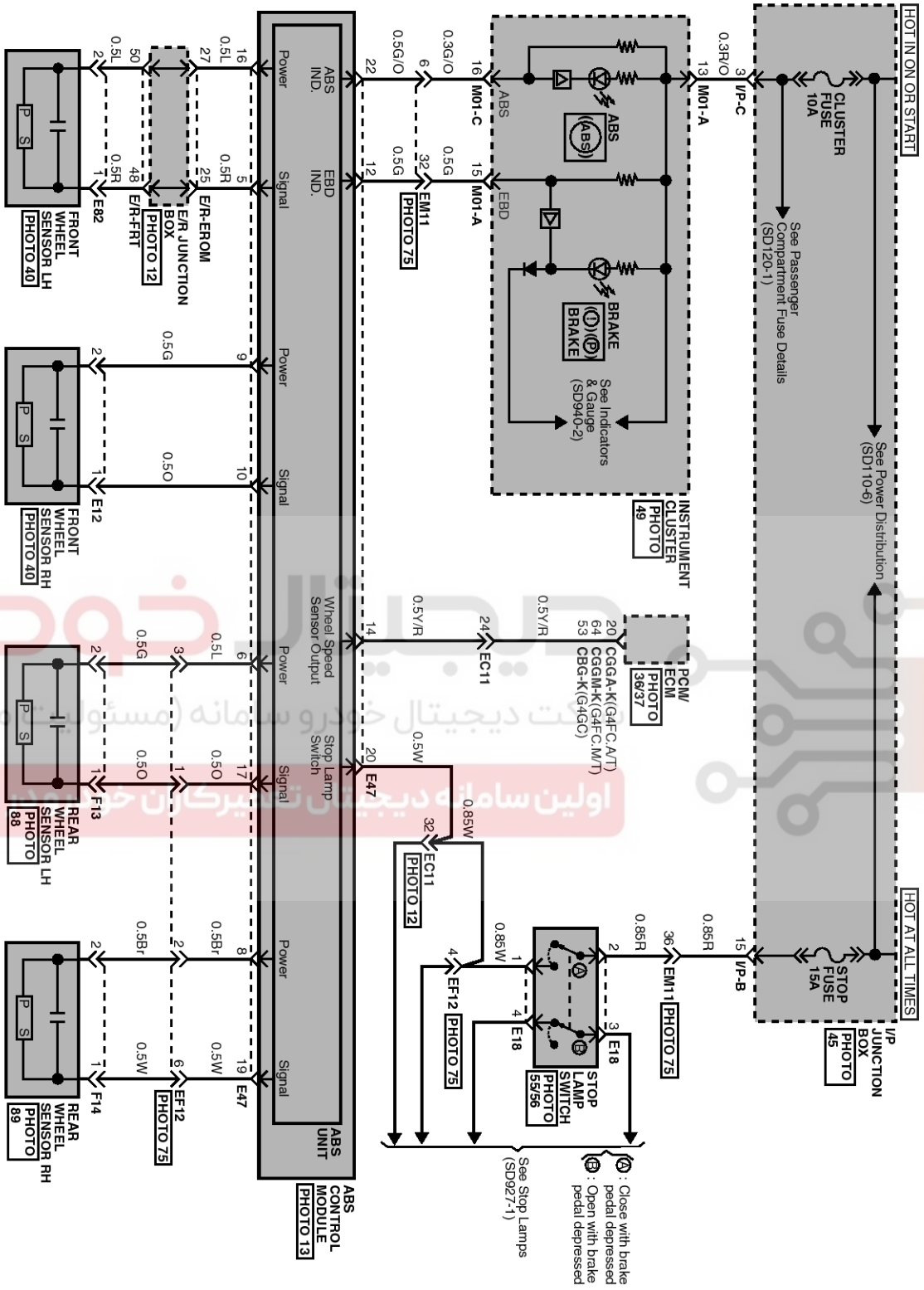


ARJE502S

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

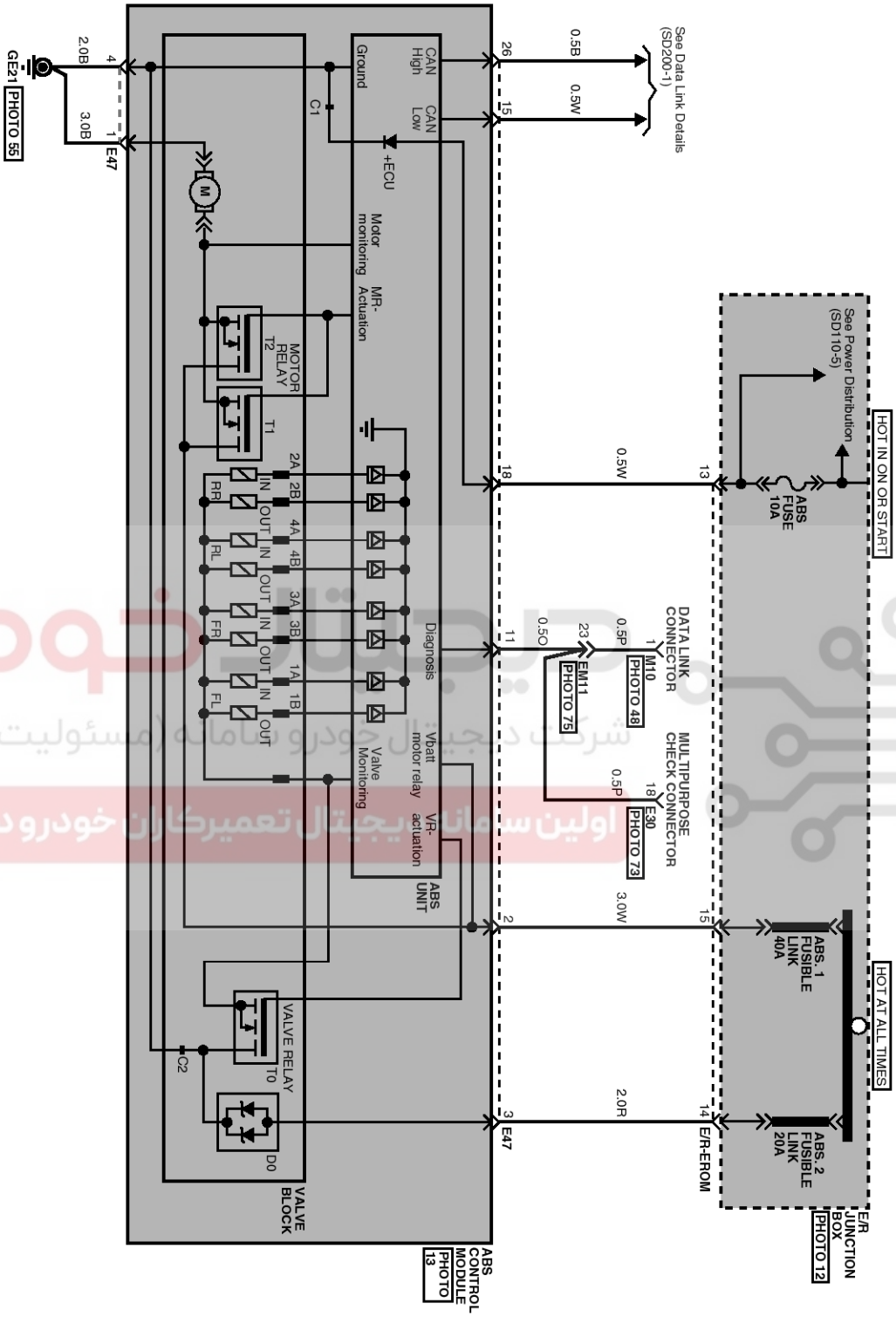
ABS(Anti-Lock Brake System)

ABS CIRCUIT DIAGRAM(1)



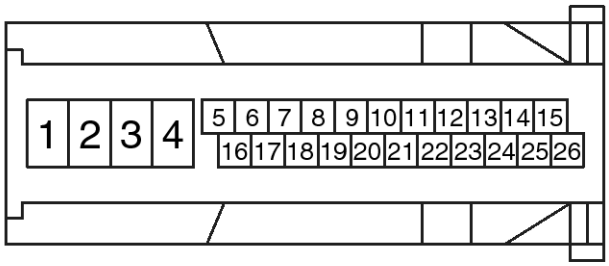
SEDBR7555L

ABS CIRCUIT DIAGRAM(2)



SEDBR7556L

ECU CONNECTOR INPUT/OUTPUT(ABS)



SHDBR6562L

Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and E-CU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200
3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	16 mA	6 mA	250	200 to ground 1.5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	10 mA	6 mA	250	200 to ground 1.5M to bat
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and E-CU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.2 * IG ON	On SCAN TOOL communic-ation
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) ≥ 4.5 * IG ON Voltage (Low) ≤ 2.0 * IG ON	BRAKE ON/OFF

SENSOR OUTPUT ON SCAN TOOL(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	-	

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/TCS/ESC ECU.

This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- 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

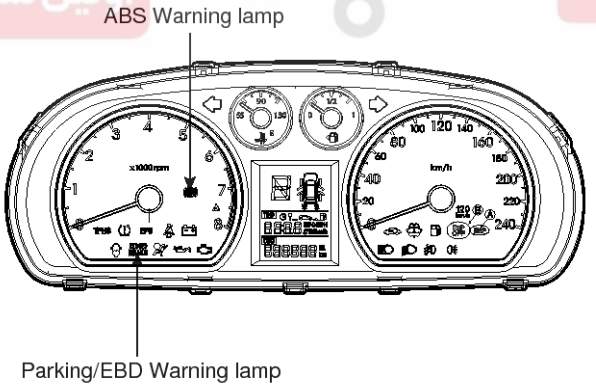
The ECU performs a pump motor test at a speed of 30km/h once after IGN is switched on.

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).

Warning Lamp module



SFDBR8100L

1. ABS WARNING LAMP MODULE

   The active ABS warning lamp module 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 seperated from ECU.

2. PARKING/EBD WARNING LAMP MODULE

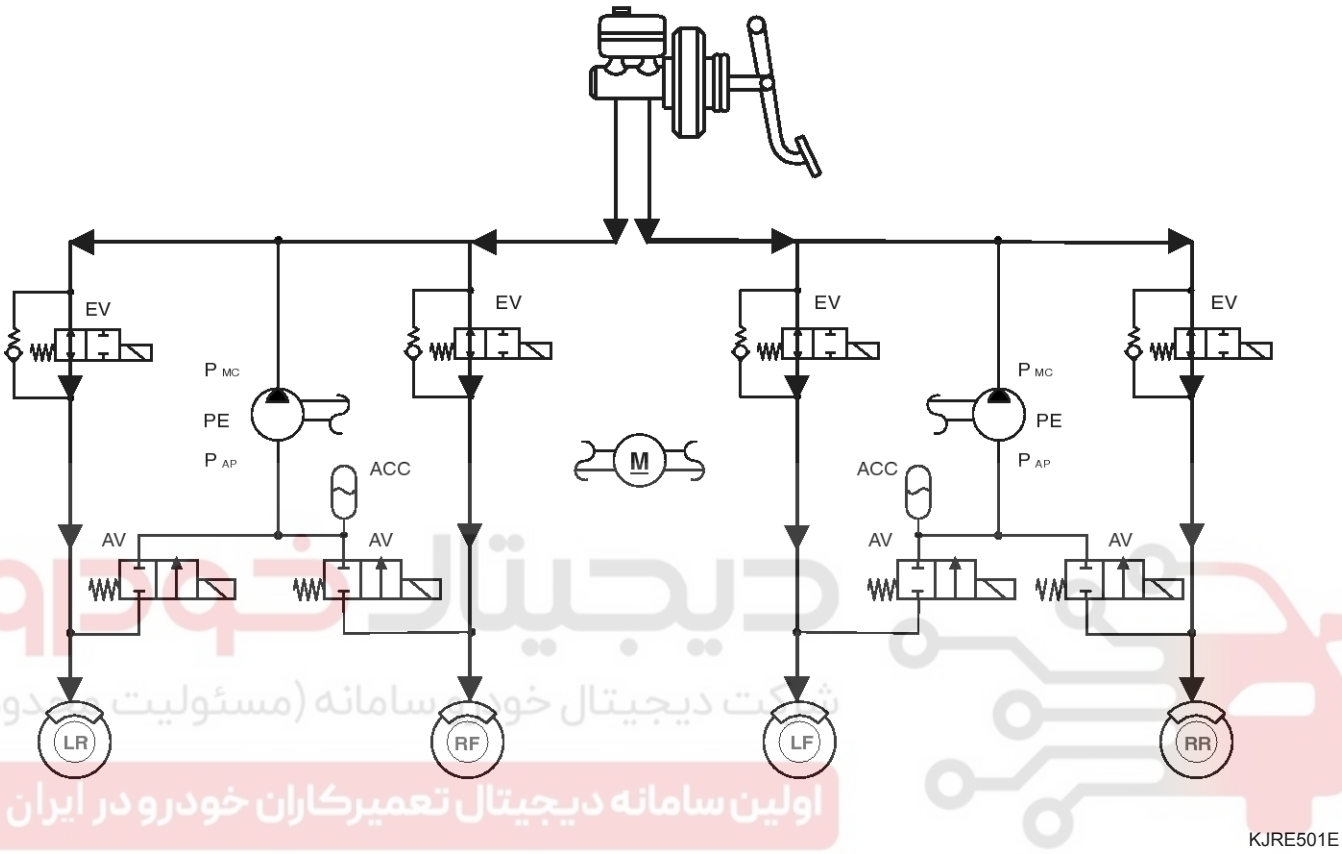
   The active EBD warning lamp module indicates the selftest and failure status of the EBD.However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.The EBD warning lamp shall be on:

   - 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 seperated from ECU.

ABS CONTROL

1. NORMAL BRAKING without ABS

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	OFF



KJRE501E

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

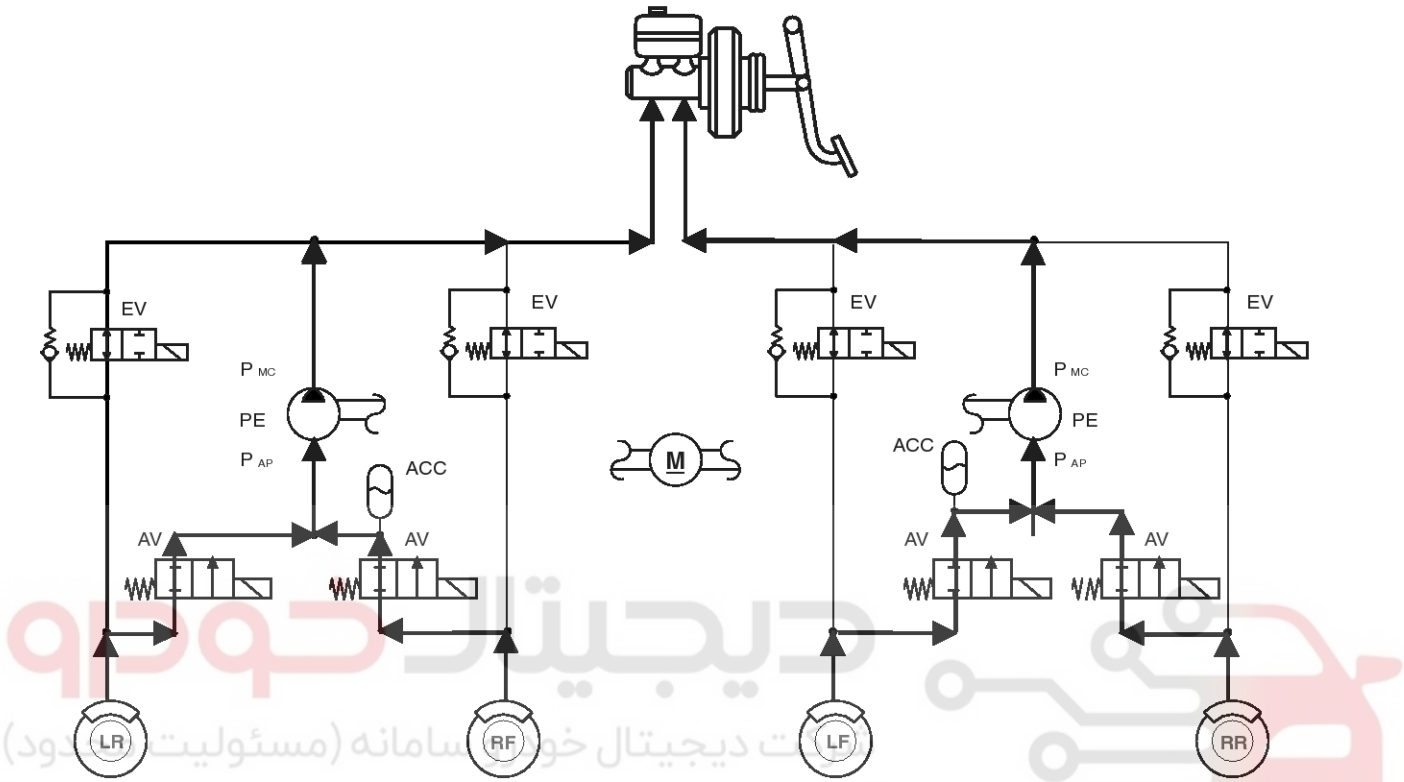
LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

2. DECREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Open	ON(Motor speed control)



KJRE501F

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

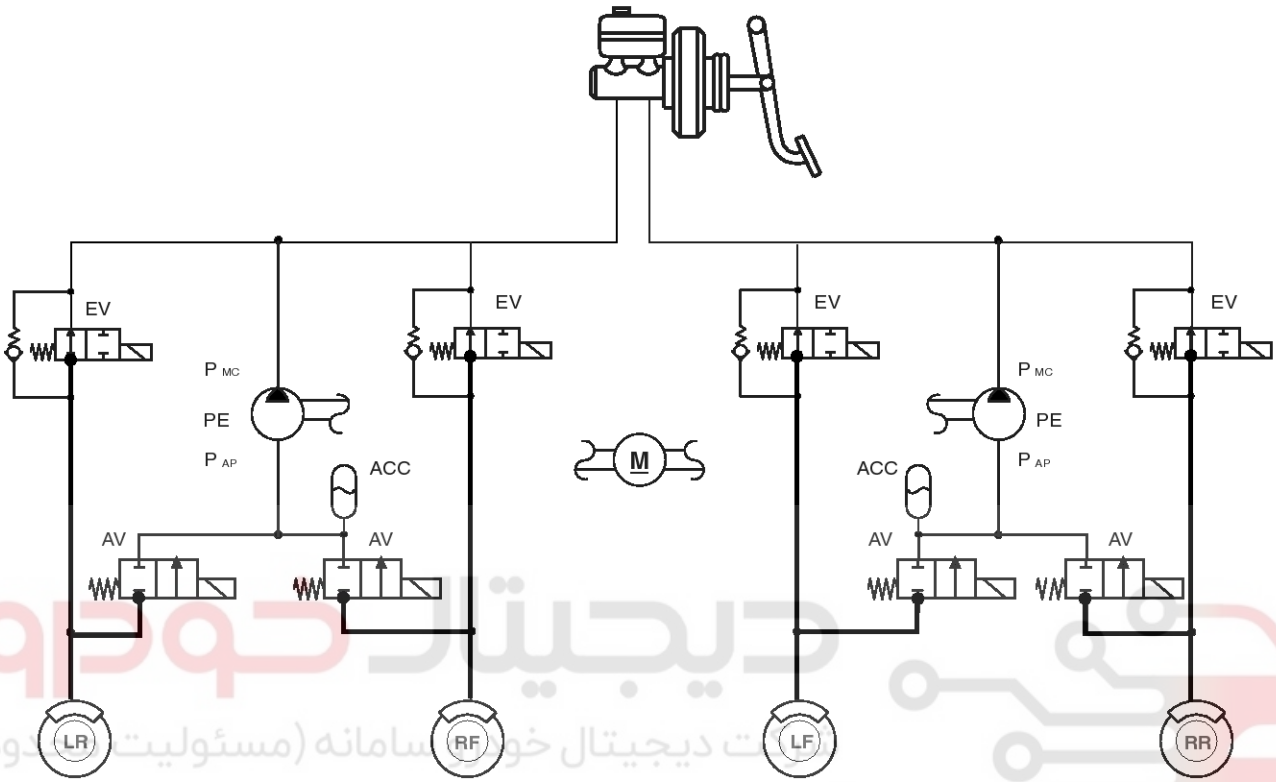
LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

3. HOLD MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Close	Close	ON(Motor speed control)



KJRE501G

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

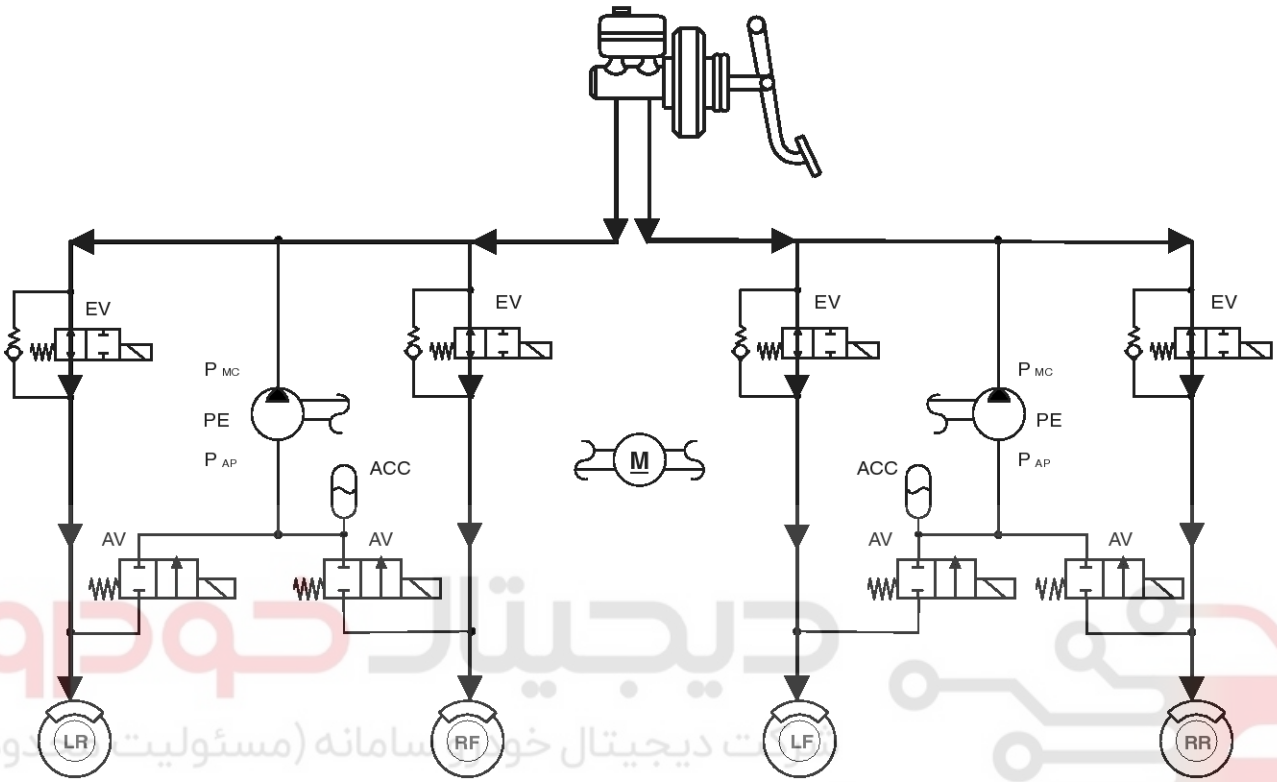
LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

4. INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pump motor
Operation	Open	Close	ON(Motor speed control)



KJRE501H

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

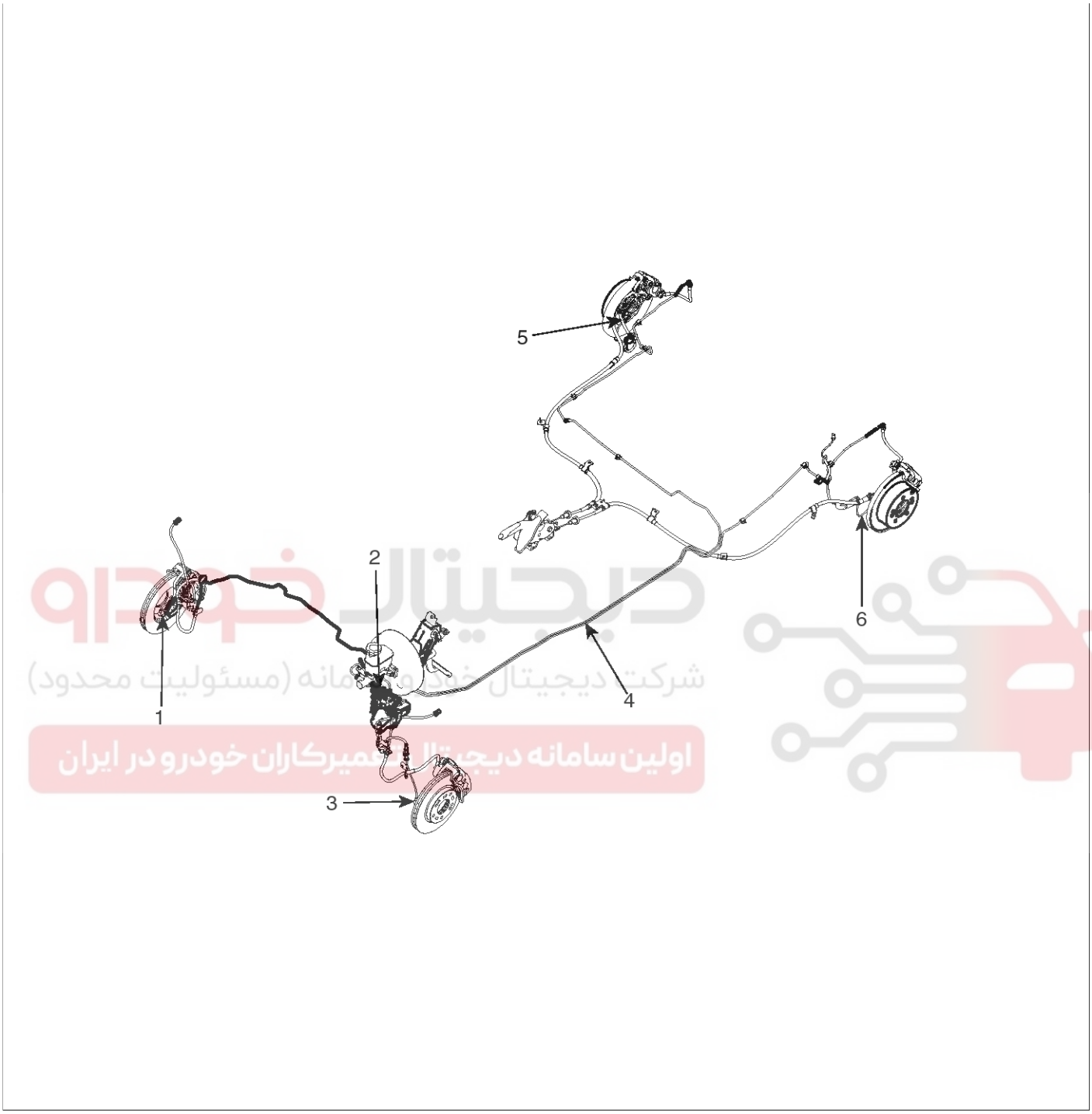
RF : Front right wheel

LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

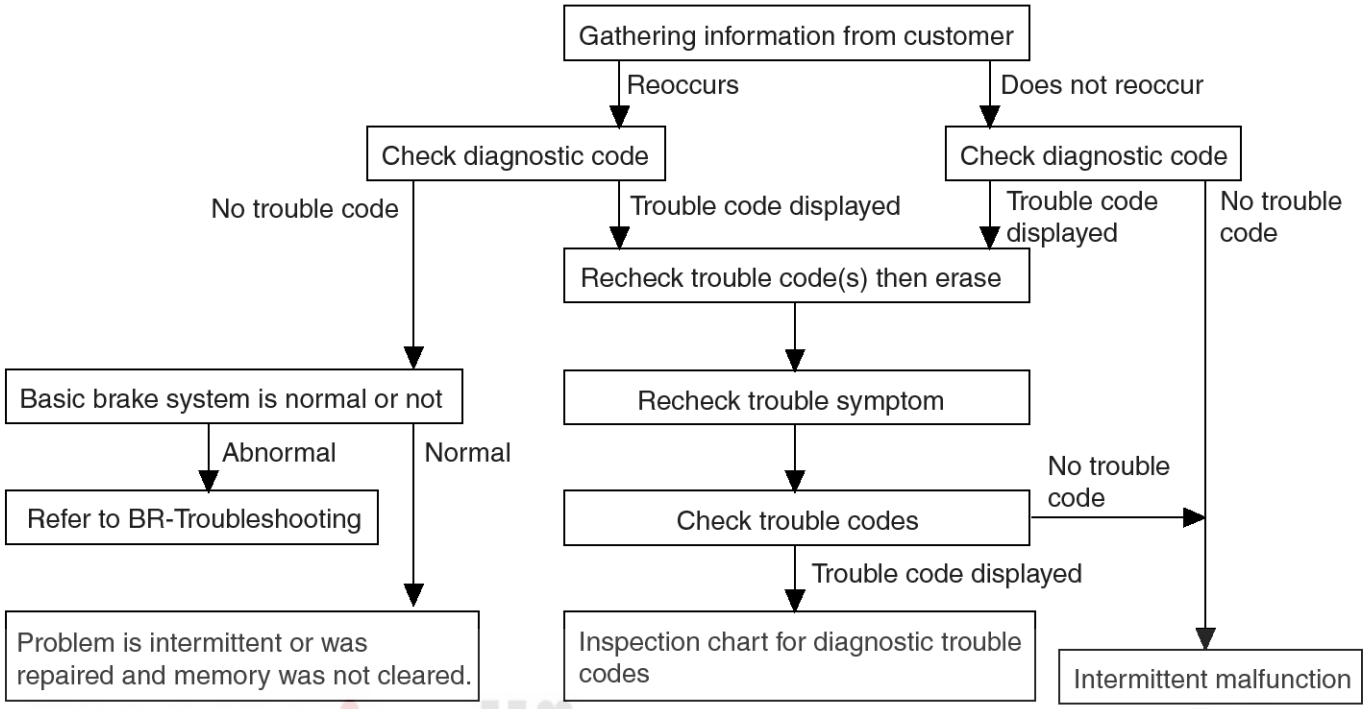
COMPONENTS



1. Front left wheel speed sensor
2. ABS control module(HECU)
3. Front right wheel speed sensor
4. Hydrauric line
5. Rear right wheel speed sensor
6. Rear left wheel speed sensor

SHDBR6515L

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

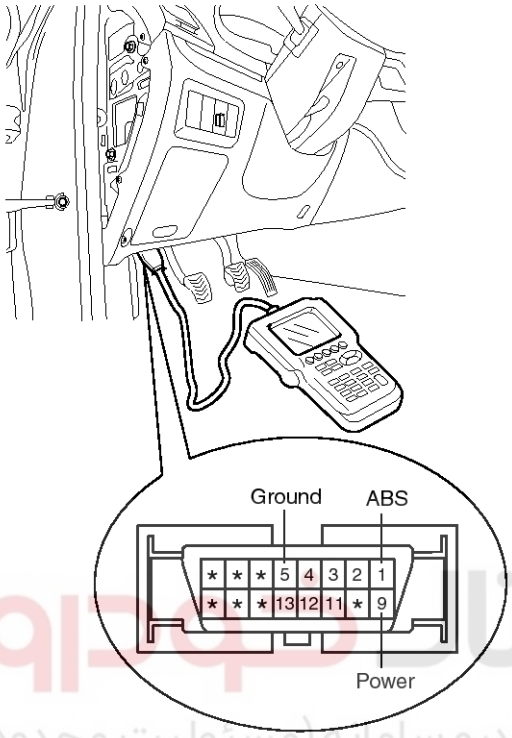
NOTES WITH REGARD TO DIAGNOSIS

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.	

SCAN TOOL CHECK

1. Turn the ignition switch OFF.
2. Connector the Scan tool to the 16P data link connector located the driver's side kick panel.



SHDBR6519L

3. Turn the ignition switch ON.
4. Check for DTC using the Scan tool
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes using the scan tool.
6. Disconnect the Scan tool from the 16P data link connector.

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 Occurence 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)

EJDA017A

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 system is operating to specifications. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with Scan tool is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line
Communication with Scan tool is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU

⚠CAUTION

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

ABS Does Not Operate.

EJBF505T

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.	- Inoperative power source circuit - Inoperative wheel speed sensor circuit - Inoperative hydraulic circuit for leakage - Inoperative HECU

INSPECTION PROCEDURES

DTC INSPECTION

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.

   Is the system operating to specifications?

NO

▶ Check the power source circuit.

YES

▶ Erase the DTC and recheck using Scan Tool.

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 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

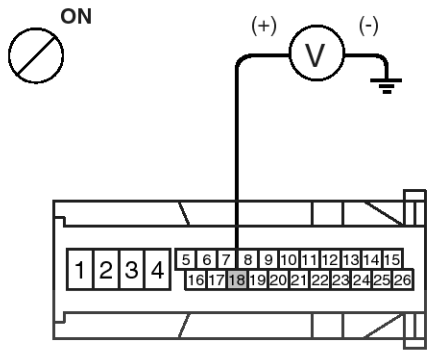
Is the voltage within specification?

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.



SHDBR6550D

CHECK THE GROUND CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.

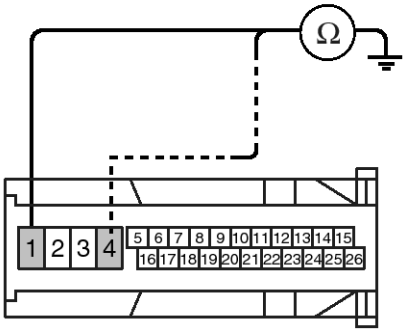
   Is there continuity?

YES

▶ Check the wheel speed sensor circuit.

NO

▶ Repair an open in the wire and ground point.



SHDBR6551D

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.

Is the system operating to specifications?

YES

▶ Check the hydraulic circuit for leakage.

NO

▶ Repair or replace the wheel speed sensor.

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is the system operating to specifications?

YES

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

NO

▶ Replace the leaking hydraulic lines.

ABS Does Not Operate (Intermittently).

BJKG500R

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.	- Inoperative power source circuit - Inoperative wheel speed sensor circuit - Inoperative hydraulic circuit for leakage - Inoperative HECU

INSPECTION PROCEDURES

DTC INSPECTION

1. Connect the Scan Tool with the data link connector and turn the ignition switch ON.
2. Verify that the system is operating to specifications.

Is the system operating to specifications?

NO

▶ Check the wheel speed sensor circuit.

YES

▶ Erase the DTC and recheck using Scan Tool.

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.

Is the system operating to specifications?

YES

▶ Check the stop lamp switch circuit.

NO

▶ Repair or replace the wheel speed sensor.

CHECK THE STOP LAMP SWITCH CIRCUIT.

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 20 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification: approximately B+

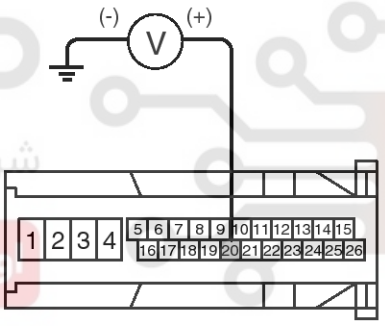
Is the voltage within specification?

YES

▶ Check the hydraulic circuit for leakage.

NO

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



SHDBR6552D

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is the system operating to specifications?

YES

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

NO

▶ Replace the leaking hydraulic lines.

Communication with Scan-Tool is not possible.
(Communication with any system is not possible)

BJKG500S

DETECTING CONDITION

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

INSPECTION PROCEDURES

CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

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

Specification: approximately B+

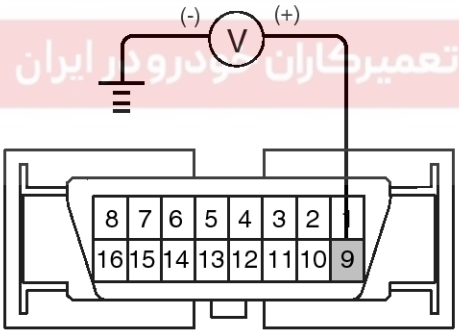
Is voltage within specification?

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.



SHDBR6553D

CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

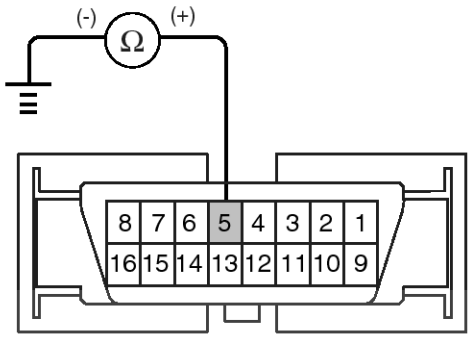
Check for continuity between terminal 5 of the data link connector and body ground.

Is there continuity?

NO

▶ Repair an open in the wire between terminal 5 of the data link connector and ground point.

Communication with Scan Tool is not possible.
(Communication with ABS only is not possible)



SHDBR6554D

BJKG500T

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Scan Tool is not possible, the cause may be probably an open in the HECU power circuit or an open in the diagnosis output circuit.	- An open in the wire - Inoperative HECU - Inoperative power source circuit

INSPECTION PROCEDURES

CHECK FOR CONTINUITY IN THE DIAGNOSIS LINE

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 11 of the ABS control module connector and 1 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 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

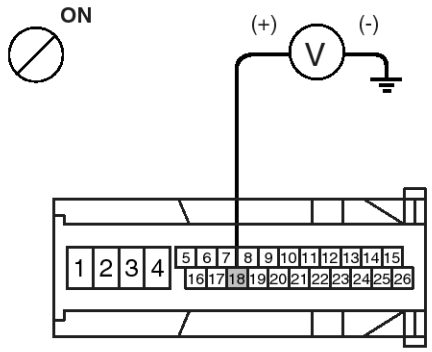
Is voltage within specification?

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.



SHDBR6555D

CHECK FOR POOR GROUND

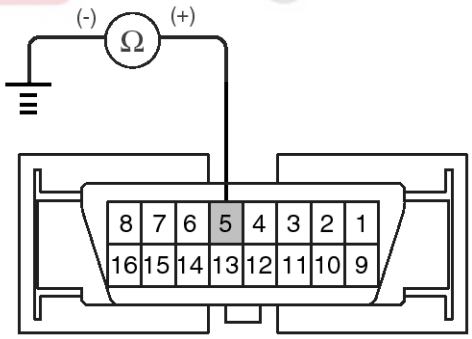
Check for continuity between terminal 5 of the data link connector and ground point.

YES

▶ Replace the ABS control module and recheck.

NO

▶ Repair an open in the wire or poor ground.



SHDBR6556D

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

EJBF505X

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 H-ECU, and the inoperative HECU.	- Inoperative ABS warning lamp bulb - Blown No.2 fuse (10A) in the engine comp-artment junction block - Inoperative ABS warning lamp module - Inoperative HECU

INSPECTION PROCEDURES

PROBLEM VERIFICATION

Disconnect the connector from the ABS control module and turn the ignition switch ON.

Does the ABS warning lamp light up?

YES

▶ It is normal. Recheck the ABS control module.

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(M01-C) and turn the ignition switch ON.
2. Measure the voltage between terminal 16 of the cluster harness side connector(M01-C) and body ground.

Specification: approximately B+

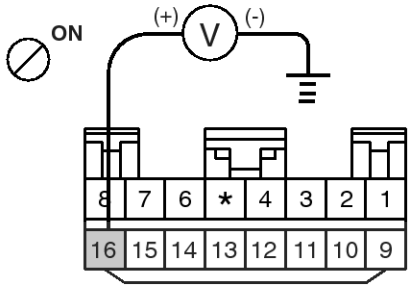
Is voltage within specification?

YES

▶ Repair bulb or instrument cluster assembly.

NO

▶ Check for blown fuse.



SEDBR7557L

CHECK FOR BLOWN FUSE

Check continuity of fuse (10A) from the engine compartment junction block.

Is there continuity?

YES

▶ Repair an open in the wire between ABS fuse and 13 of cluster connector(M01-A).

NO

▶ Replace the blown fuse.

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

EJBF505Y

DETECTING CONDITION

Trouble Symptoms	Possible Cause

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 D-TC 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 - Inoperative instrument cluster assembly - Inoperative ABS warning lamp module - Inoperative HECU

INSPECTION PROCEDURES

CHECK DTC OUTPUT.

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

   Is DTC output?

   YES

   ▶ Repair circuit indicated by code output.

   NO

   ▶ Check instrument cluster.

CHECK INSTRUMENT CLUSTER

Disconnect the cluster connector and turn the ignition switch ON.

Does the ABS warning lamp remains ON?

YES

▶ Replace the instrument cluster.

NO

▶ Check for open the wire.

CHECK FOR OPEN IN THE WIRE

Check for continuity in the wire between cluster and ABS control module.

Is there continuity?

YES

▶ Replace the ABS control module and recheck.

NO

▶ Repair an open in the wire between cluster and ABS control module.

BLEEDING OF BRAKE SYSTEM

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 brake caliper bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the scan tool to the data link connector located underneath the dash panel.
4. Select and operate according to the instructions on the scan tool screen.

   CAUTION

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

   1) Select Kia vehicle diagnosis.
   2) Select vehicle name.
   3) Select Anti-Lock Brake system.
   4) Select air bleeding mode.
   5) Press "YES" to operate motor pump and solenoid valve.

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	CLOSE
02. MOTOR PUMP STATUS	OFF
DO YOU WANT TO START ? (PRESS [YES] KEY)	

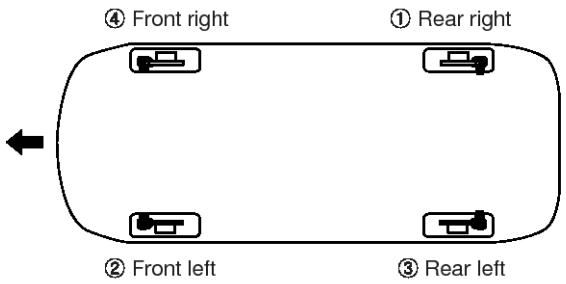
EJDA014F

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

1.6 AIR BLEEDING MODE	
ABS AIR BLEEDING STATUS	
01. SOLENOID VALVE STATUS	OPEN
02. MOTOR PUMP STATUS	ON
TIME : AUTOMATIC COUNT (1-60 SEC.)	

EJDA014G

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



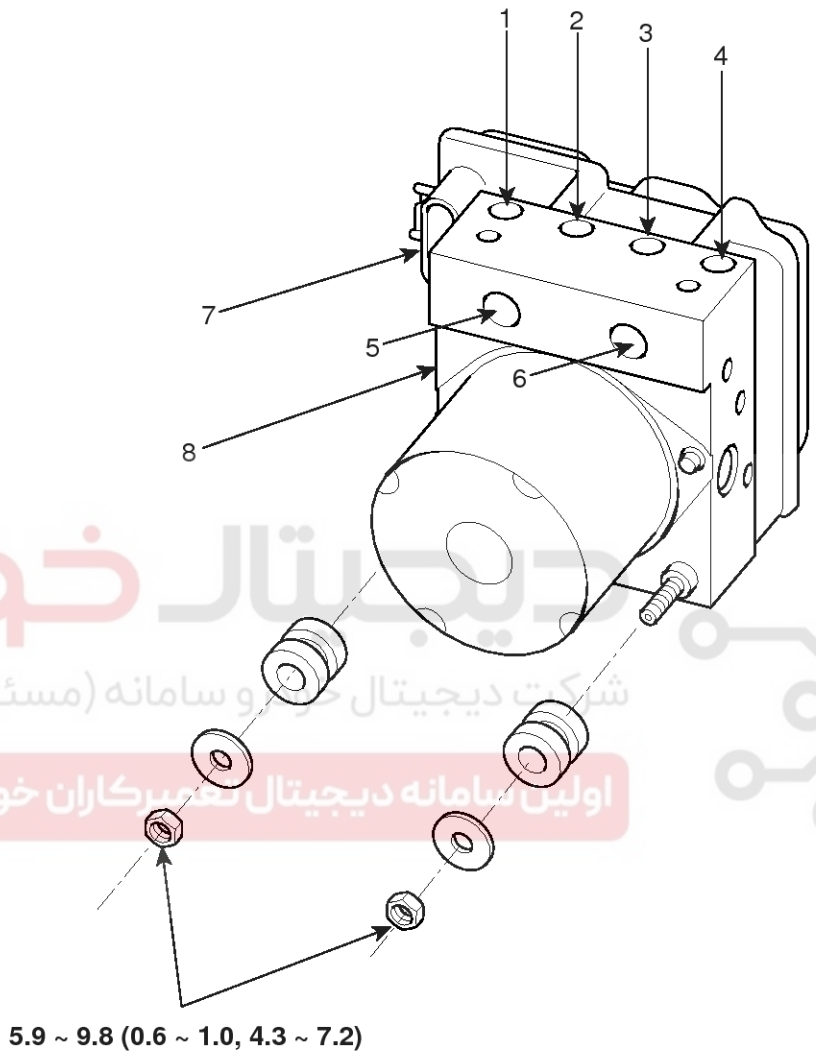
SBLBR6504L

7. Tighten the bleeder screw.

Bleed screw tightening torque:
7~1 3 Nm (0.7 ~1.3 kgf·m, 5.1 ~ 9.4 lb-ft)

ABS Control Unit

COMPONENTS



TORQUE : Nm (Kgf.m, lb-ft)

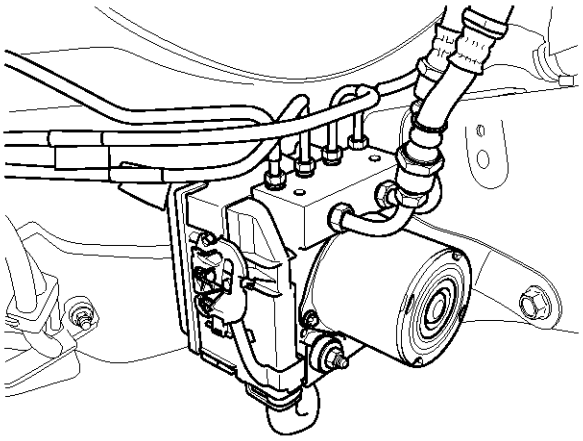
1. Front - right tube
2. Rear - left tube
3. Rear - right tube
4. Front - left tube
5. Master cylinder tube2
6. Master culinder tube1
7. ABS control module connector (26P)
8. ABS control module (HECU)

SBLBR6532L

REMOVAL

1. Disconnect the battery(-) terminal.
2. Disconnect the brake tubes from the HECU.

Tightening torque Nm (kgf.m, lb-ft):
5.9 ~ 9.8 (0.6 ~ 1.0, 4.3 ~ 7.2)



SHDBR6551L

3. Disconnect the HECU connector.
4. Remove the HECU by loosening the bracket mounting bolts.

Tightening torque Nm (kgf.m, lb-ft):
16.7 ~ 25.5 (1.7 ~ 2.6, 12.3 ~ 18.8)

⚠CAUTION

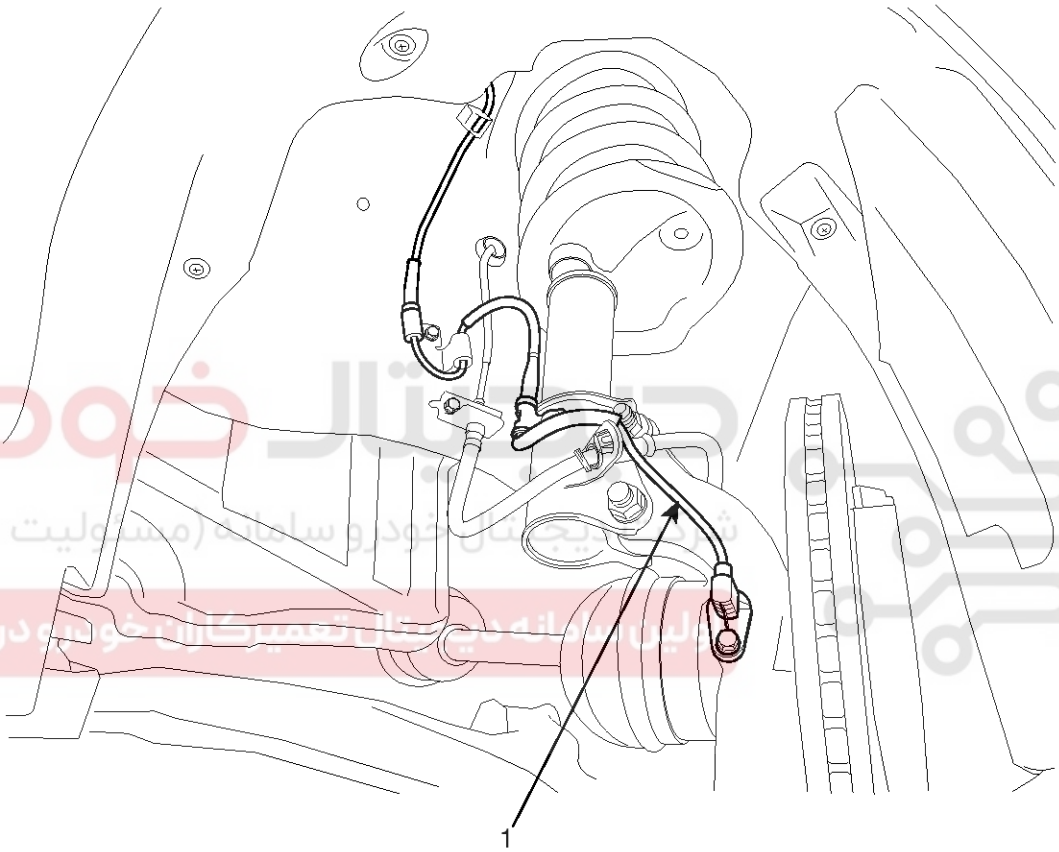
- **Never attempt to disassemble the HECU.**
- **The HECU must be protected during storage and transport, and must not be subjected to excessive shock.**

INSTALLATION

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

Front Wheel Speed Sensor

COMPONENTS



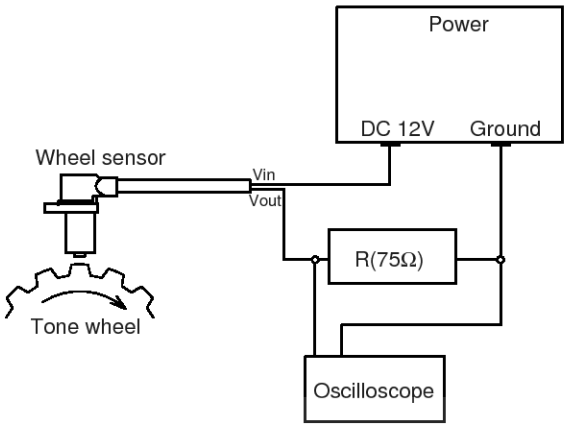
1. Front wheel speed sensor

SFDBR8105L

INSPECTION

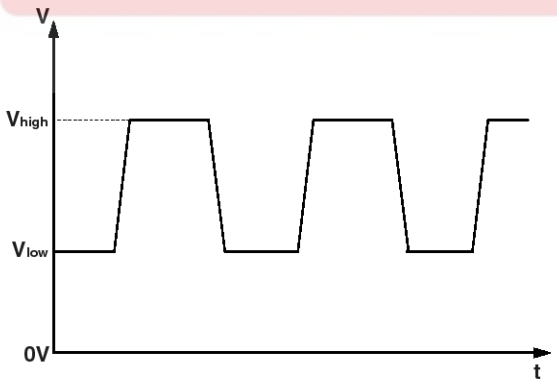
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

⚠CAUTION
In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



EJRF501Z

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

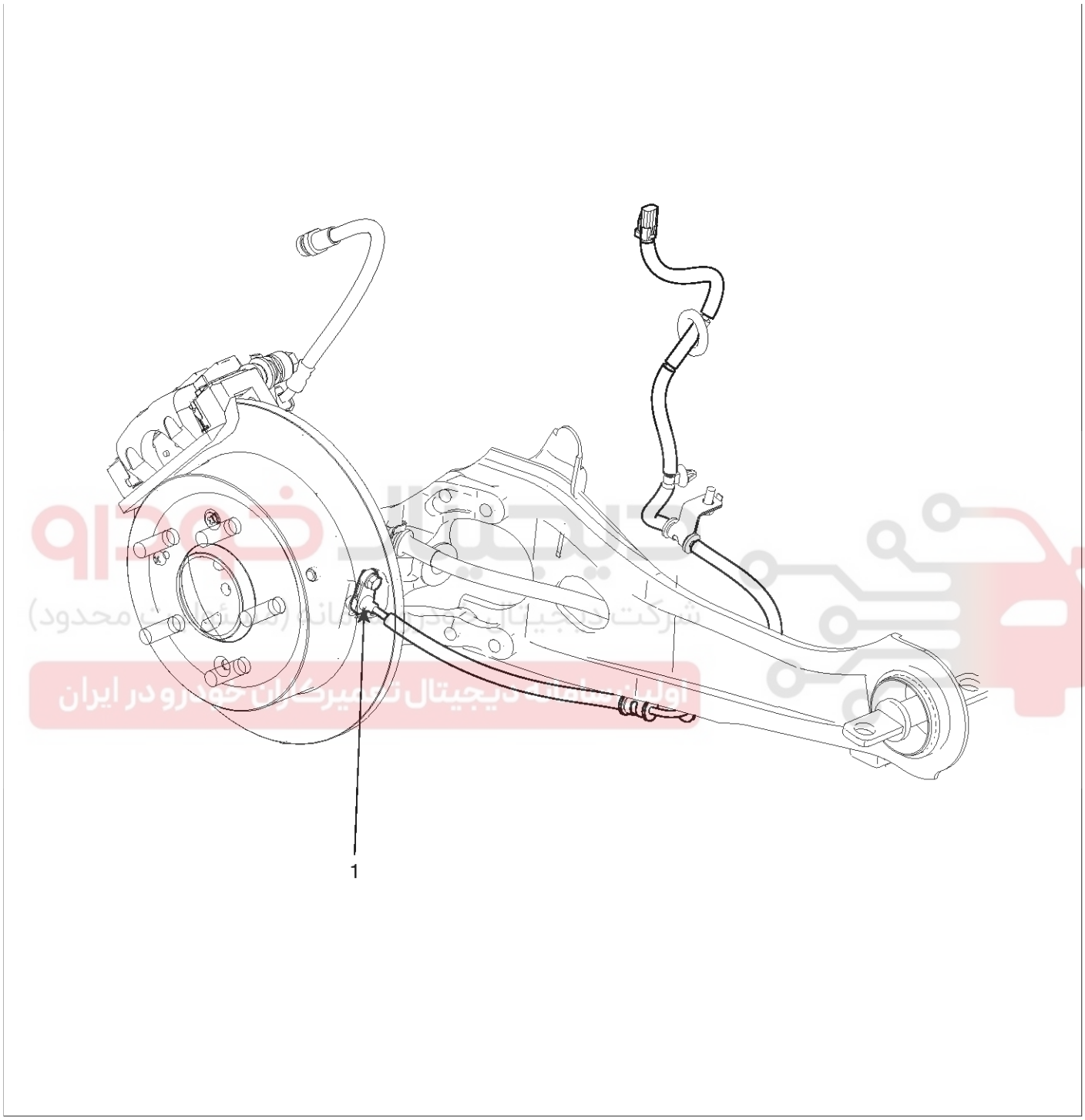


KJQE260B

- V_low : 0.44 V ~ 0.63 V
- V_high : 0.885 V ~ 1.26 V
- Frequency range : 1~2,500 Hz

Rear Wheel Speed Sensor

COMPONENTS



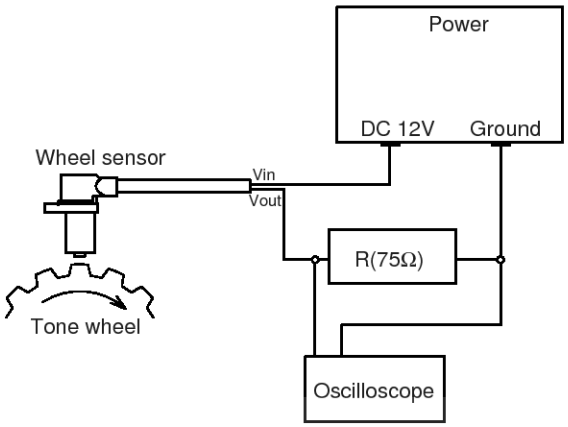
1. Rear wheel speed sensor

SHDBR6553L

INSPECTION

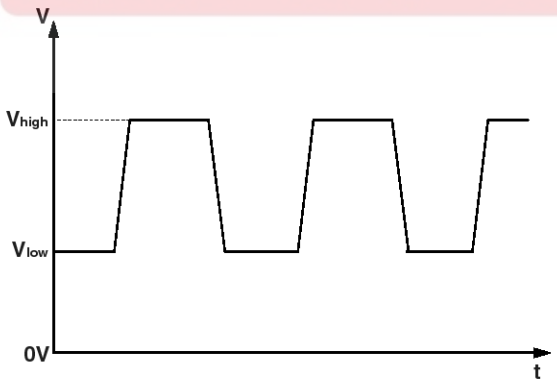
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

⚠CAUTION
In order to protect the wheel speed sensor, when measuring output voltage, a 75Ω resistor must be used as shown.



EJRF501Z

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



KJQE260B

- V_low : 0.44 V ~ 0.63 V
- V_high : 0.885 V ~ 1.26 V
- Frequency range : 1~2,500 Hz

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 tothe 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.

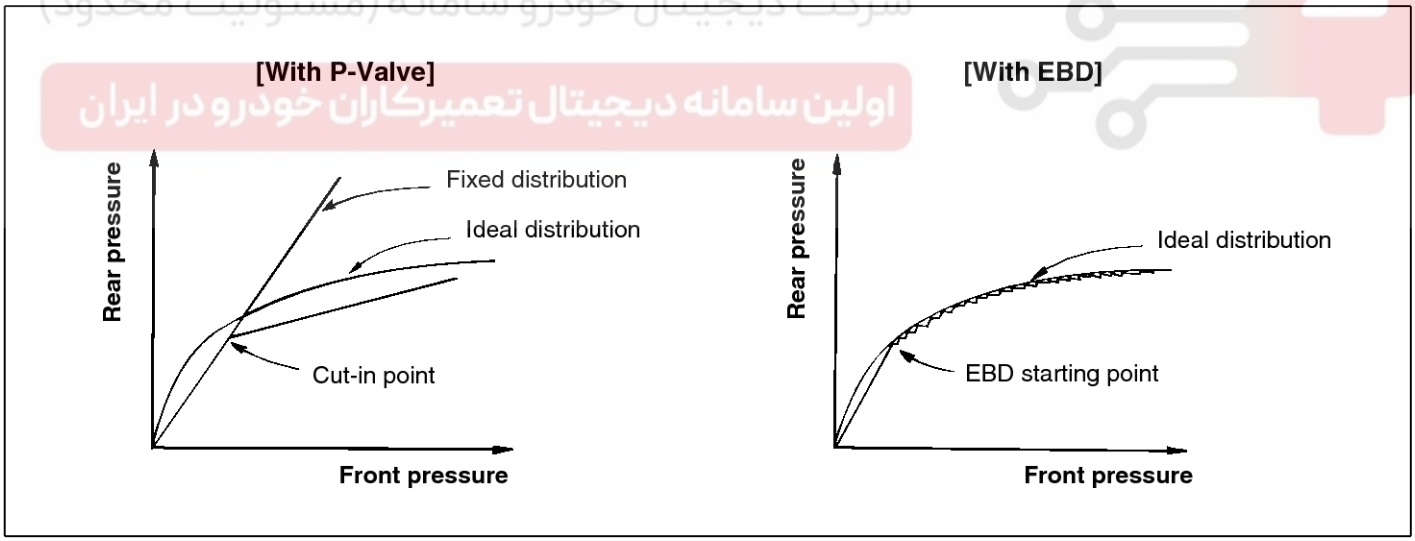
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

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.

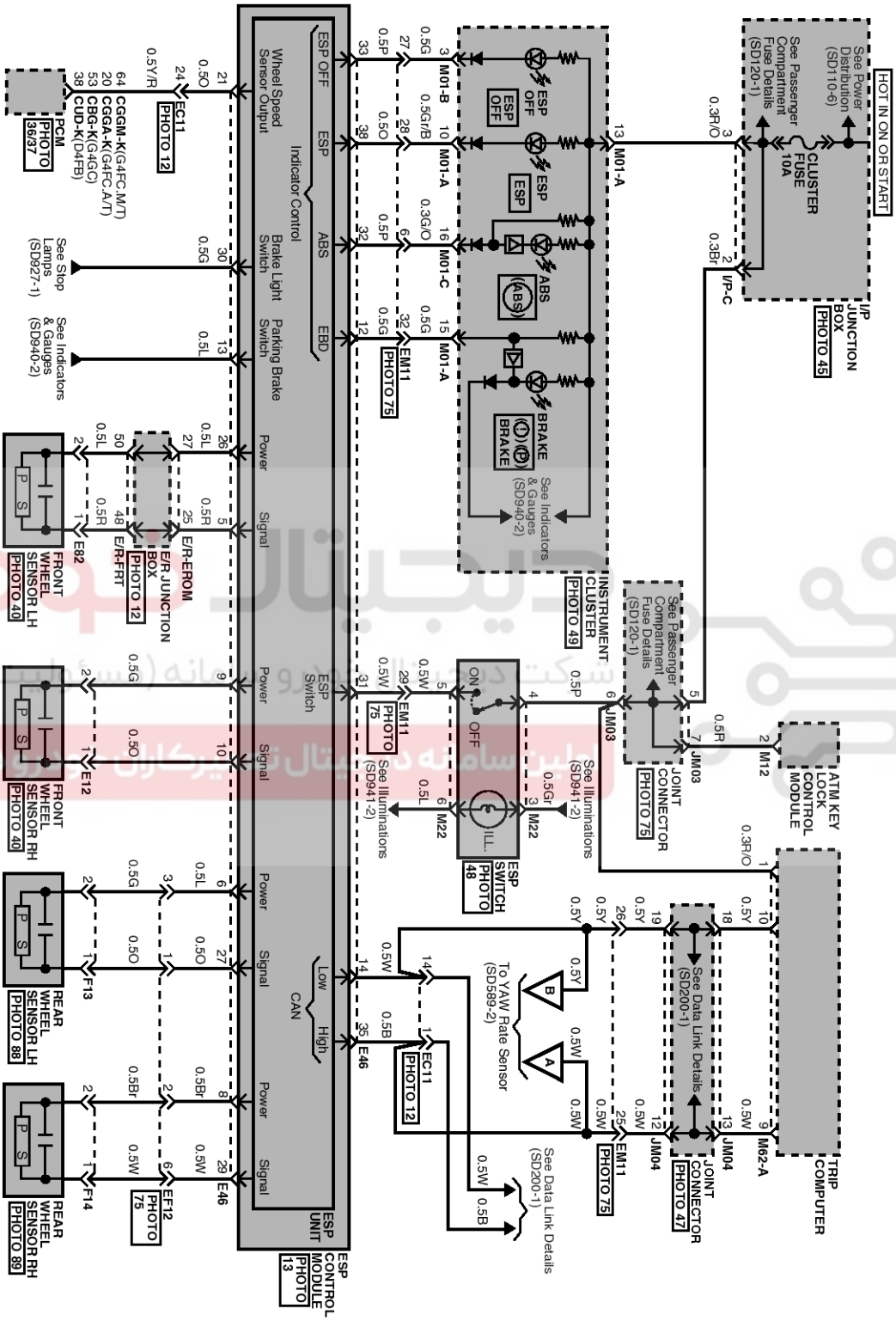
Comparison between Proportioning valve and EBD



EJA0032A

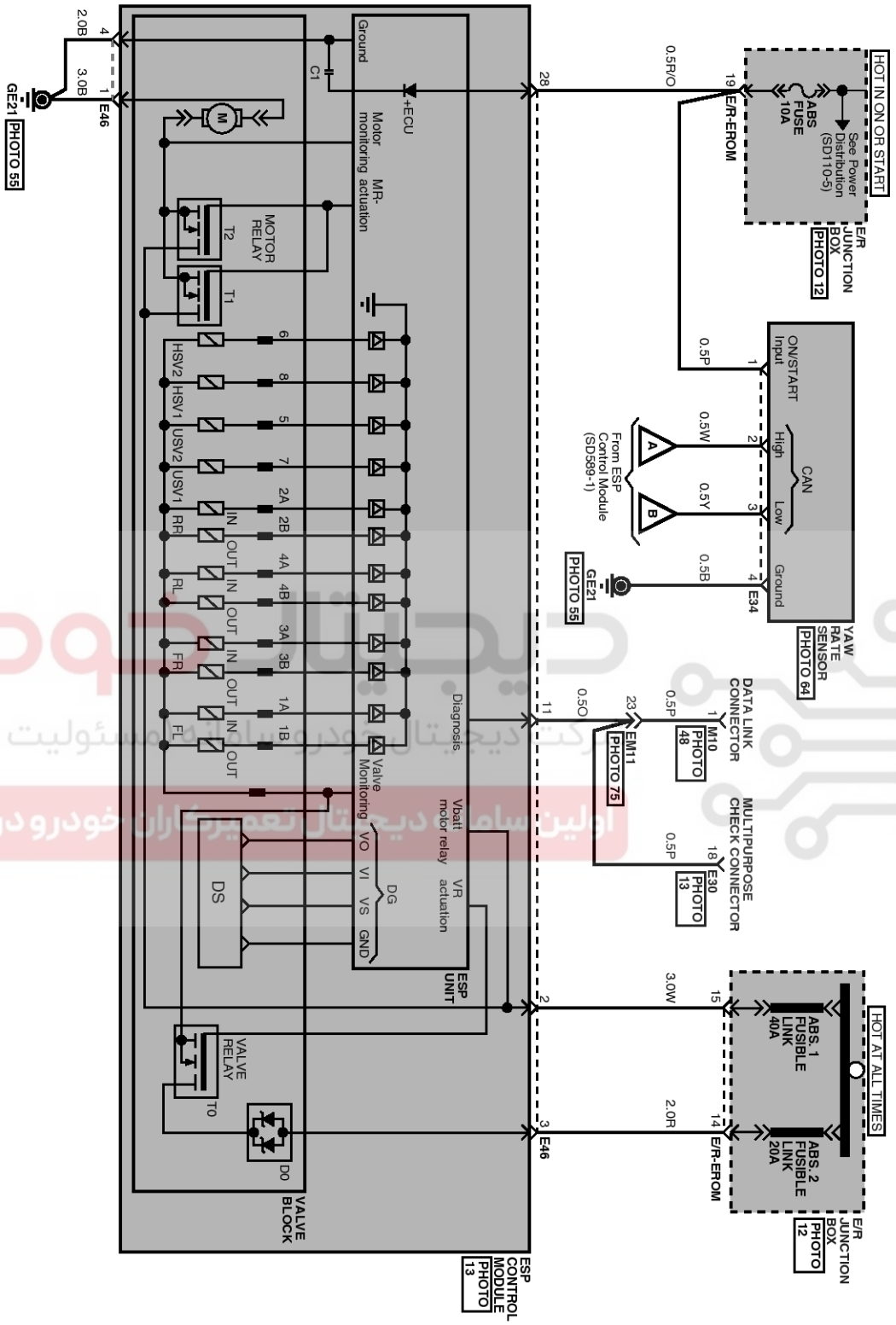
ESP(Electronic Stability Program) System

ESP circuit DIAGRAM(1)



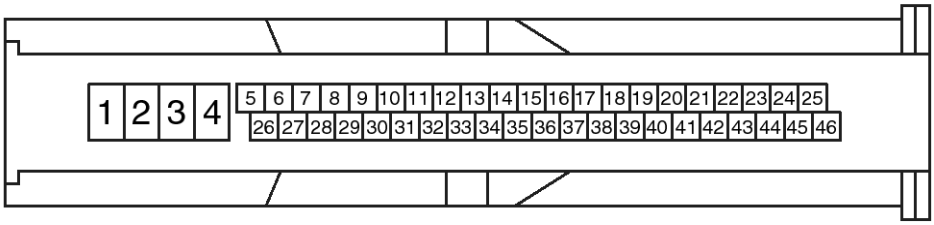
SEDBR7561L

ESP circuit DIAGRAM(2)

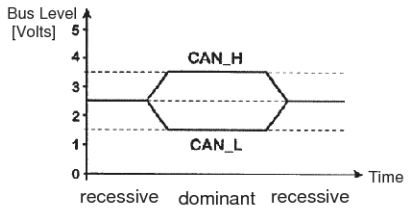


SEDBR7562L

ESP HECU CONNECTOR INPUT / OUTPUT



SHDBR6563L

Connector Terminal		Specifications	Conditions
No	Description		
1	Ground(Pump)	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Battery voltage	Always
3	Supply voltage(Valve)		
26	Wheel sensor voltage(FL)	Battery voltage	IG ON
9	Wheel sensor voltage(FR)		
6	Wheel sensor voltage(RL)		
8	Wheel sensor voltage(RR)		
5	Wheel sensor signal(FL)	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal(FR)		
27	Wheel sensor signal(RL)		
29	Wheel sensor signal(RR)		
11	Diagnosis Input/oupput	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	SCAN TOOL Communication
28	Ignition	Battery voltage	KEY ON/OFF
31	ESP Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
35	CAN High	not communicating:2.5 ± 0.5 V communication : 	IG ON
14	CAN Low		
30	BRAKE LIGHT SWITCH	voltage(High) : 0.8 * IG ON more voltage(Low) : 0.3 * IG ON lower	BRAKE ON/OFF

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 needfor actuating the brake or the gas pedal.

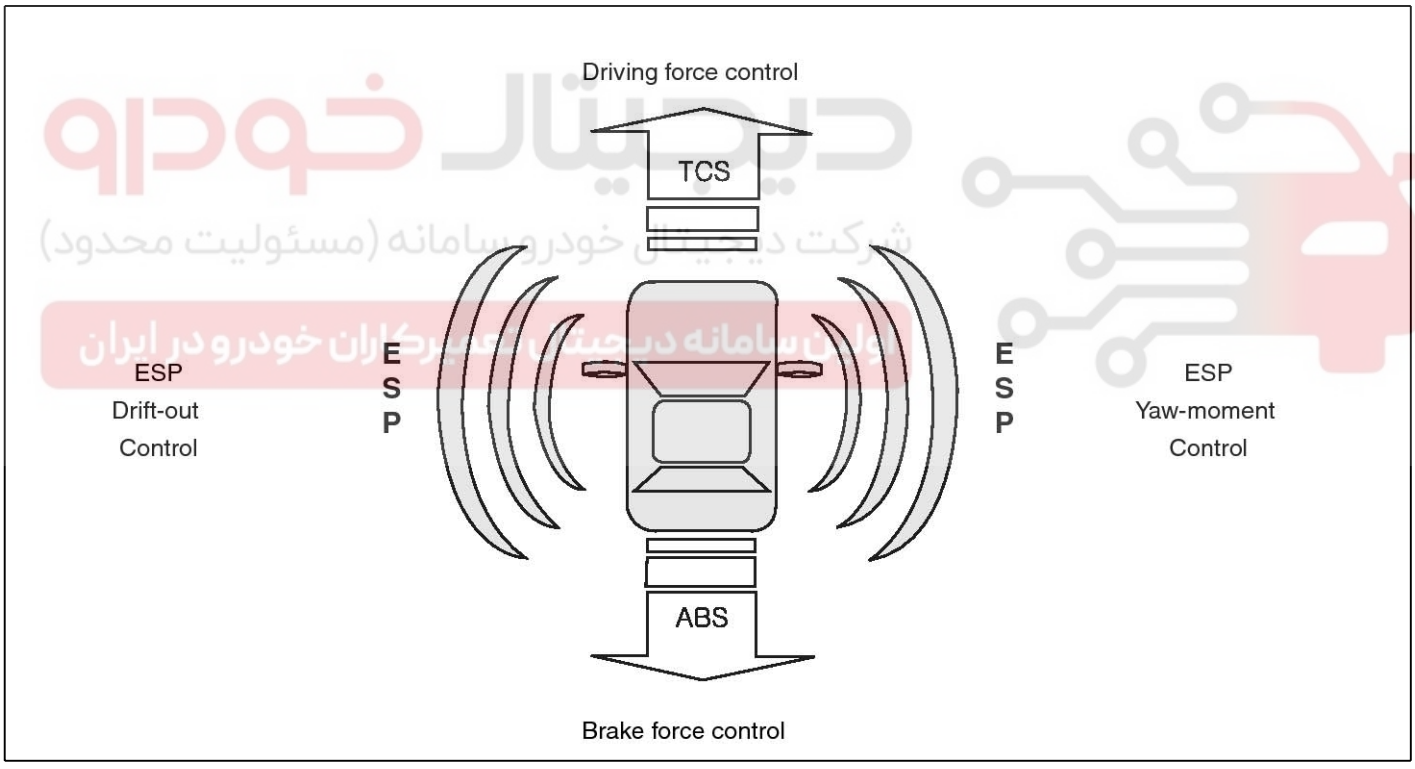
ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESP functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about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



LJCD201A

DESCRIPTION OF ESP CONTROL

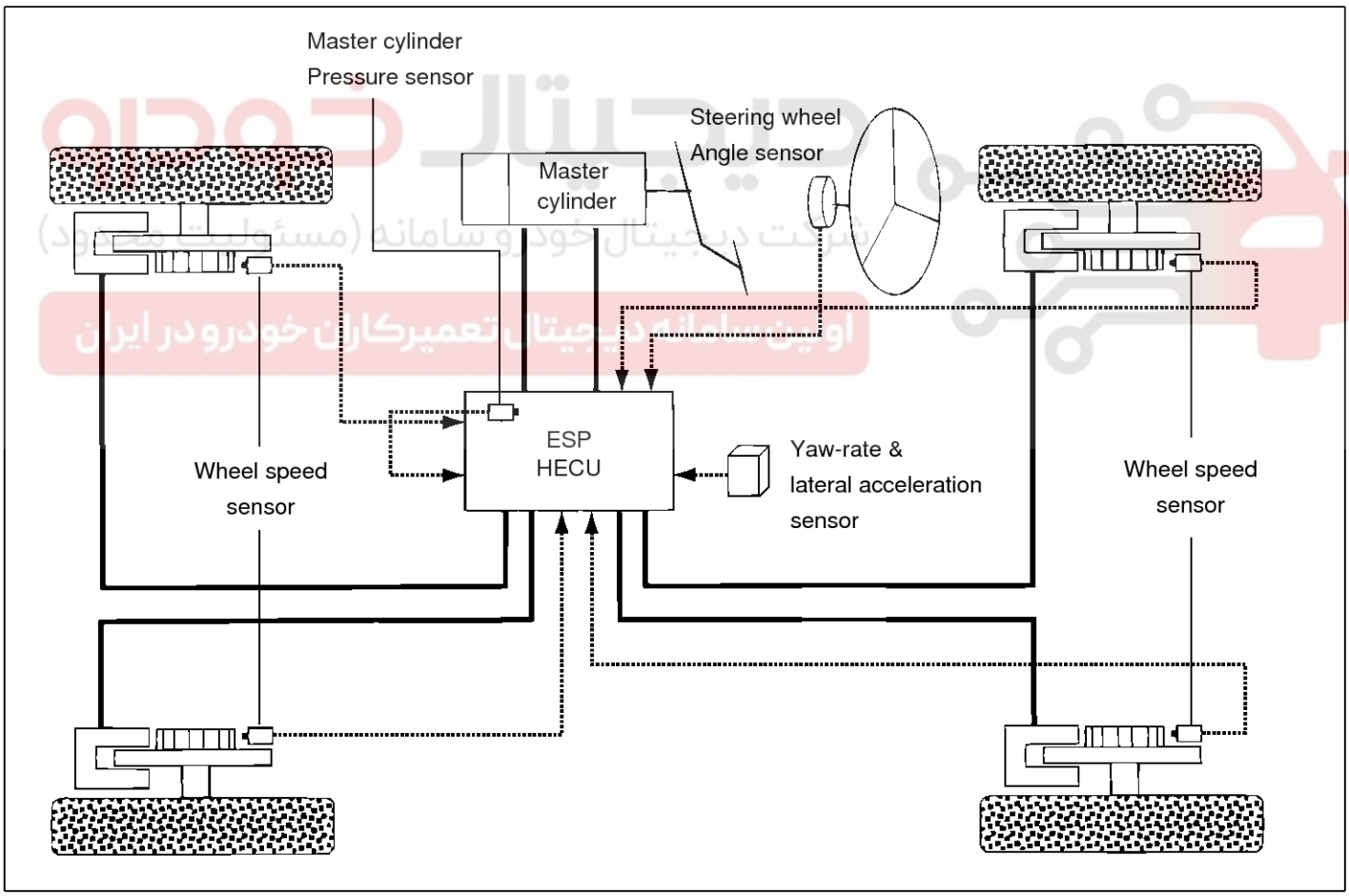
ESP system includes ABS/EBD, TCS and AYC (Active yaw control) function.

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.

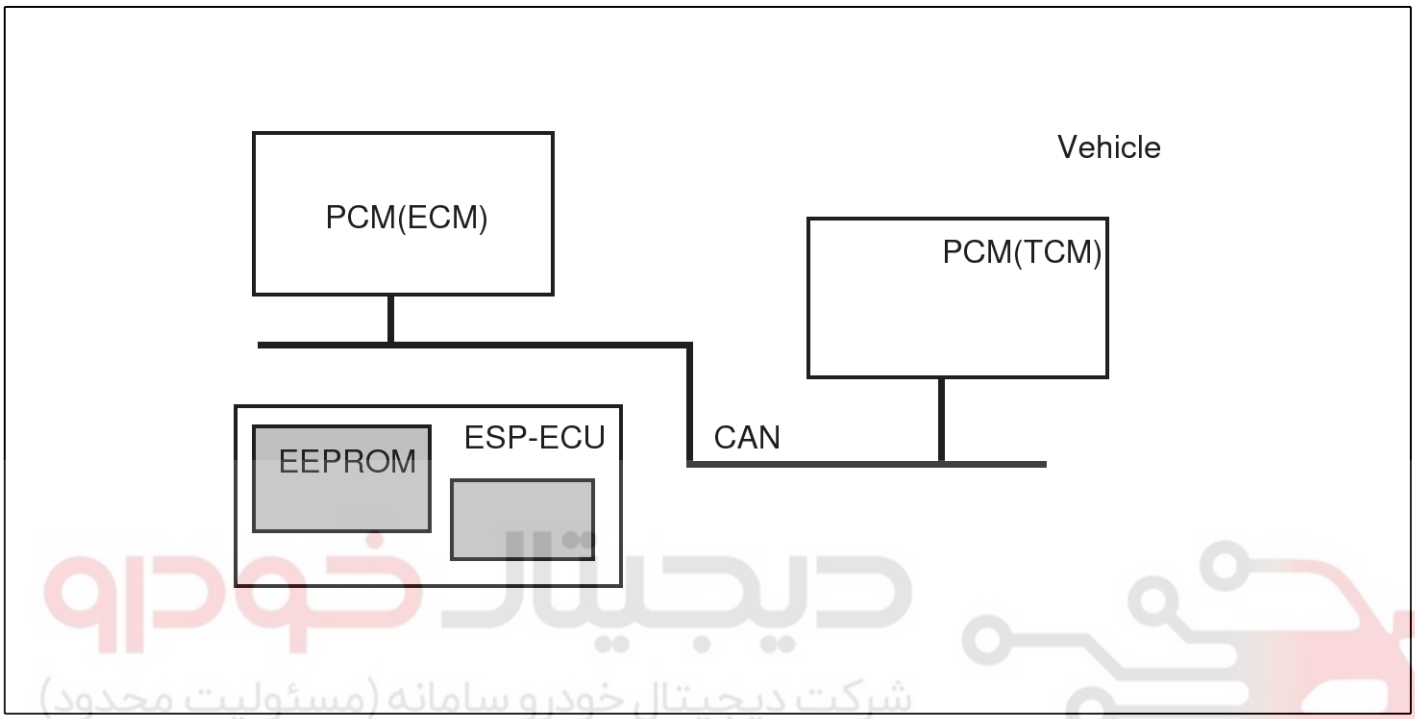
After the key-on, the ECU continually diagnoses the system failure. (self-diagnosis)If the system failure is detected, the ECU informs driver of the system failure through the BRAKE/ABS/ESP warning lamp. (fail-safe warning)



EJRF502K

VARIANT CODING

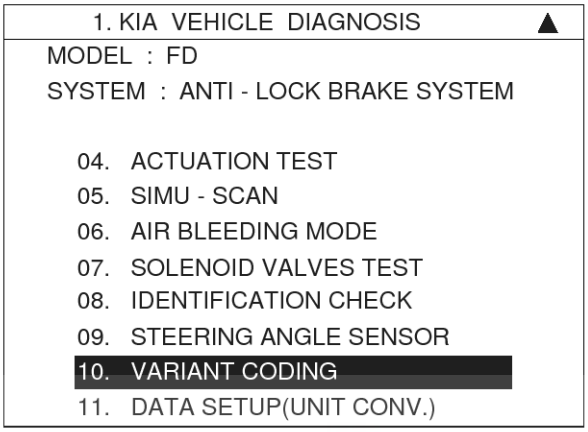
The HECU is programmed with a variant code based on the vehicle powertrain configuration. This variant code is used to determine the appropriate ESP calculations. Variant code programming should be performed whenever an HECU is replaced.



LJKG500Y

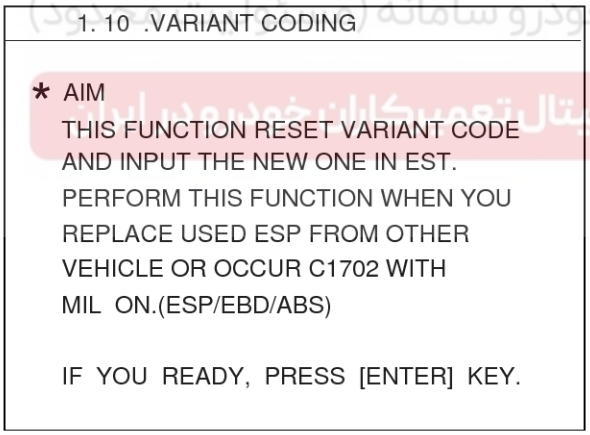
PROCEDURE OF VARIANT CODING

1. Install a PCM(ECM & TCM)/ESP normally.
2. Connect the scan tool to the data link connector located underneath the dash panel.
3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.



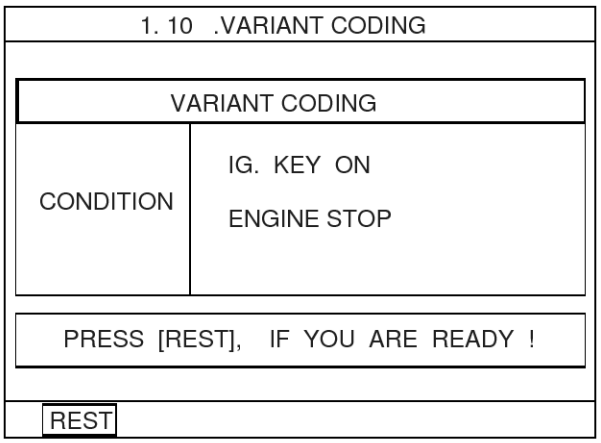
SFDBR8112L

6. Follow the next procedure according to the comment .



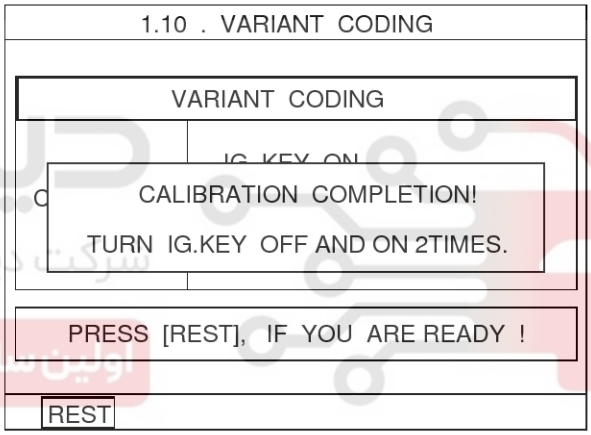
EJBF505O

7. Confirm the condition , and then push the "REST".



EJRF703J

8. If the procedure is finished, the screen is displayed as shown below.



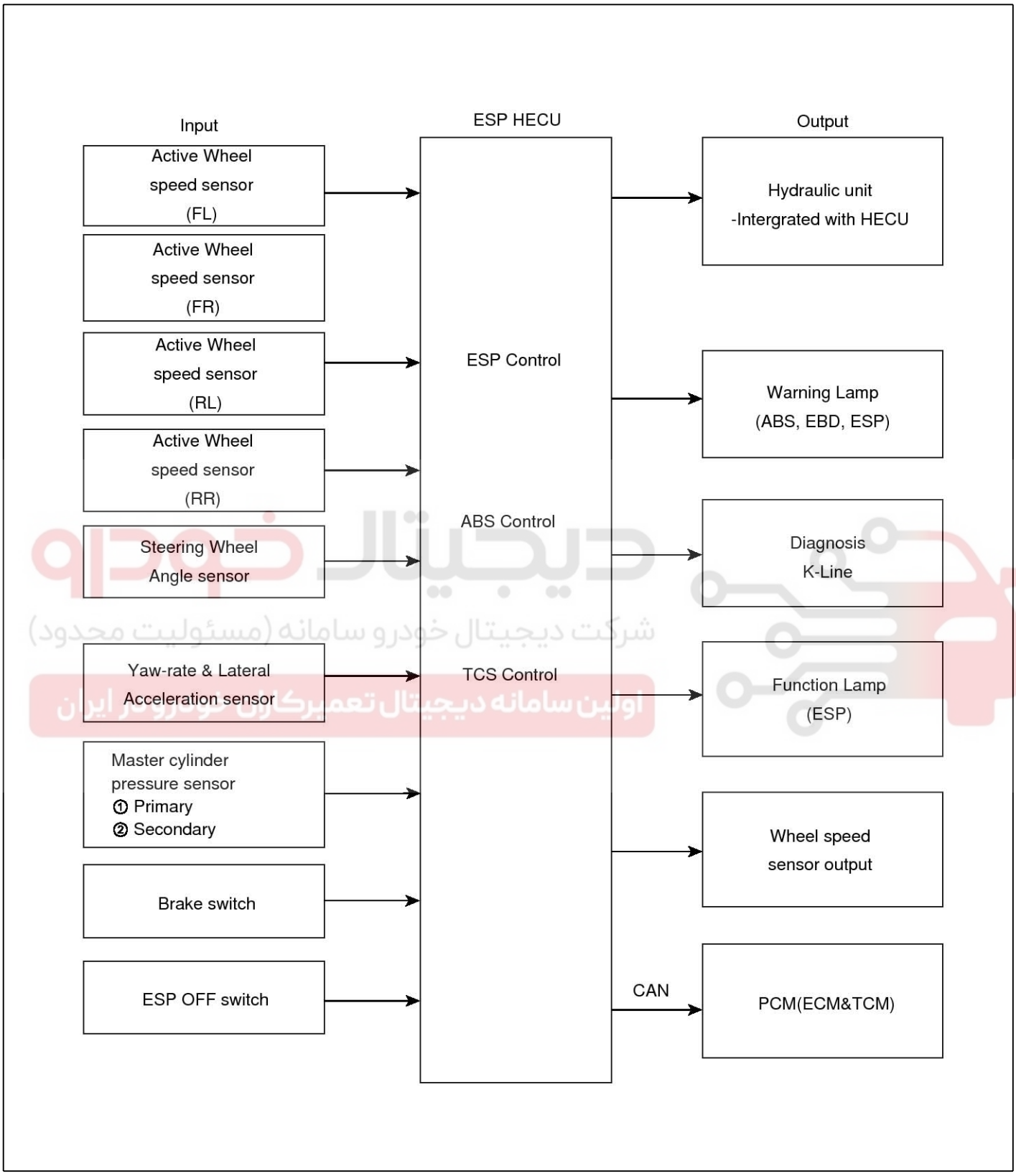
EJRF703K

9. IGN off.
10. IGN on.
11. The variant coding is completed.

⚠CAUTION

- **If the warning lamp(ESP, EBD, ABS) is illuminated, follow the "Variant coding" again.**
- **For the vehicle equipped 4WD, delete the DTC(s) memorized in 4WD ECU when variant coading is completed.**

INPUT AND OUTPUT DIAGRAM



LJKG500X

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

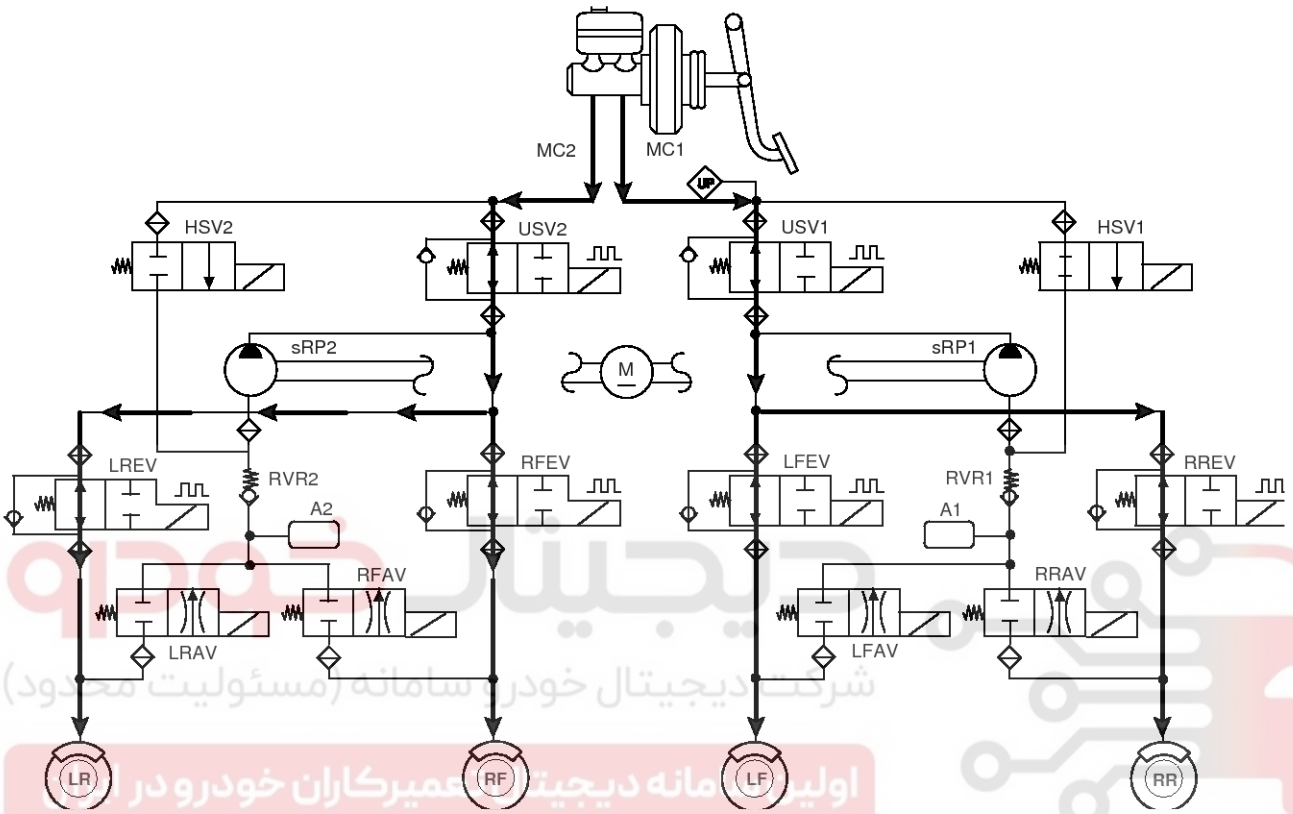
3. STEP 3

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

ESP OPERATION MODE

1. ESP Non-operation-Normal braking.

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure swi-tch valve(HSV)	Pump motor
Normal braking	Open	Close	Open	Close	OFF



EJRF703R

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

LF : Front left wheel

RR : Rear right wheel

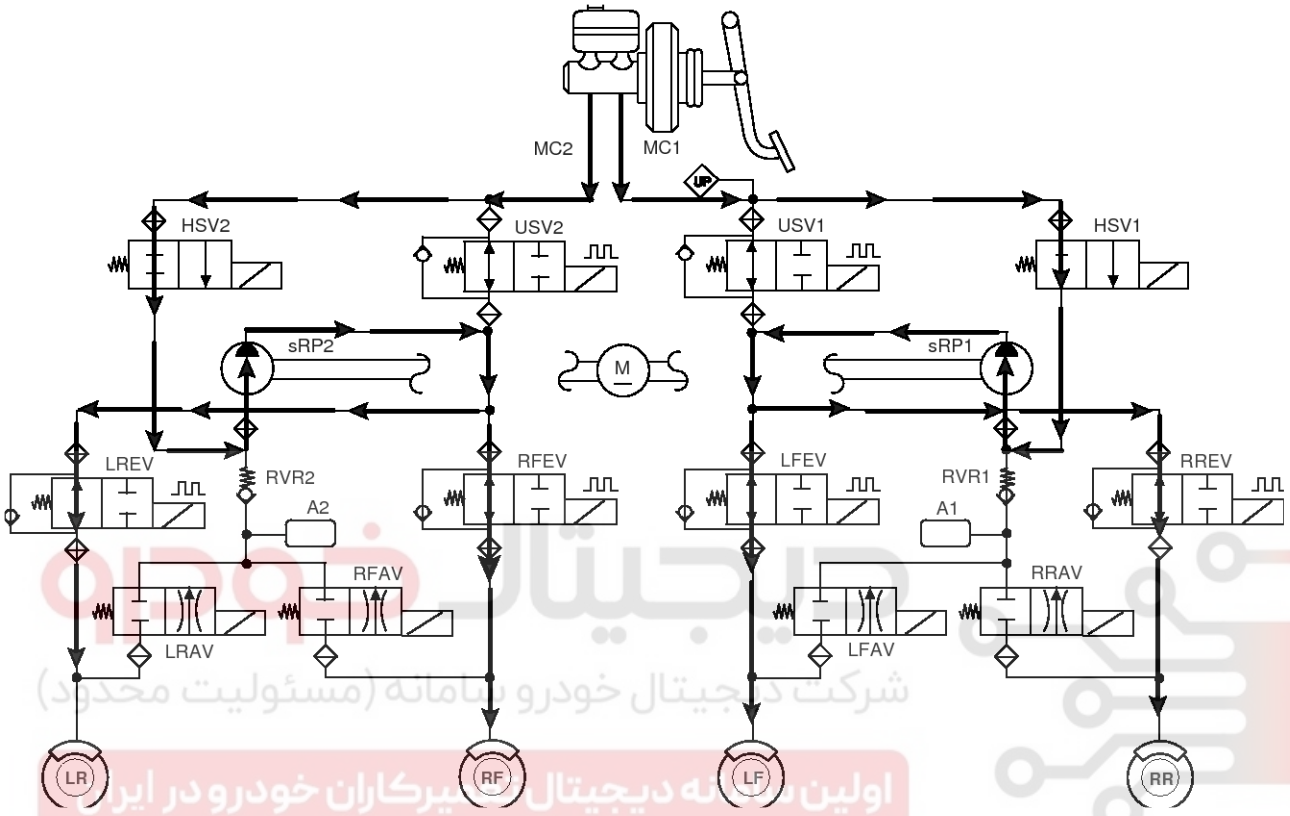
PE : Pump motor

USV : Pilot Valve

HSV : High pressure Switch Valve

2. ESP INCREASE MODE

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure swi-tch valve(HSV)	Pump motor
Normal braking	Open	Close	Close(Partial)	Open	ON(Motor speed control)



EJRF703S

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

LF : Front left wheel

RR : Rear right wheel

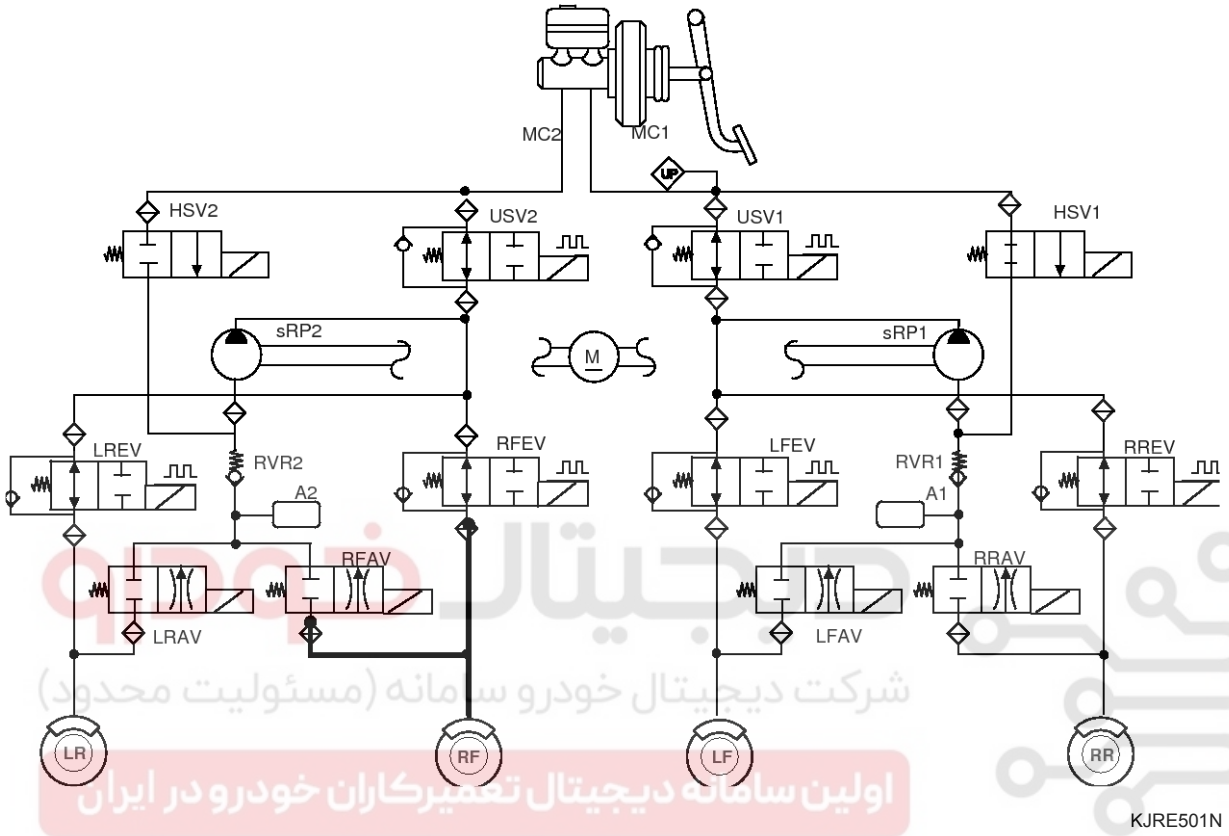
PE : Pump motor

USV : Pilot Valve

HSV : High pressure Switch Valve

3. ESP HOLD MODE (FR is only controlled.)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Close	Close(Partial)	Open	ON(Motor speed low control)



NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

LF : Front left wheel

RR : Rear right wheel

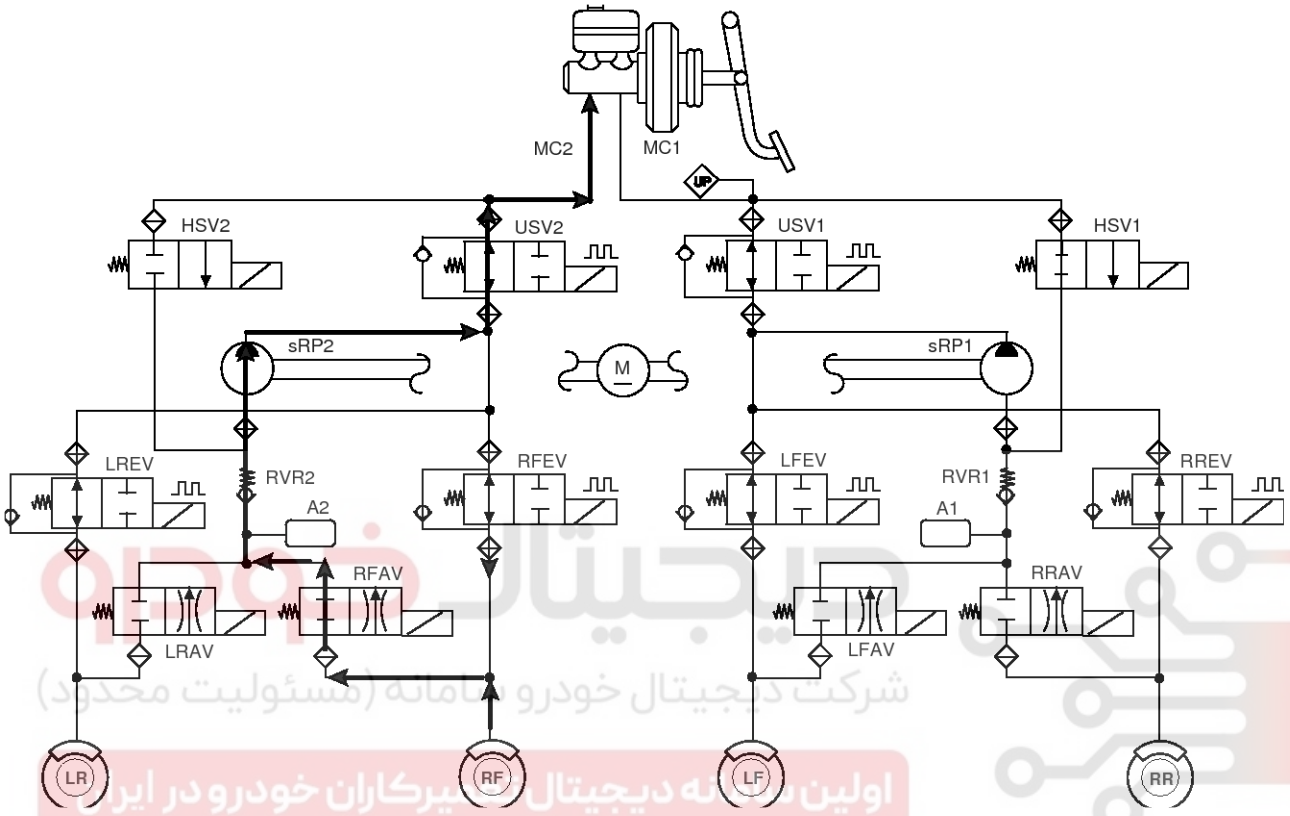
PE : Pump motor

USV : Pilot Valve

HSV : High pressure Switch Valve

4. ESP DECREASE MODE (FR is only controlled)

	Inlet valve(EV)	Outlet valve(AV)	Pilot valve(USV)	High pressure switch valve(HSV)	Pump motor
Normal braking	Close	Open	Close(Partial)	Open	ON(Motor speed low control)



EJRF703T

NOTICE

EV : Inlet Valve

AV : Outlet Valve

LR : Rear left wheel

RF : Front right wheel

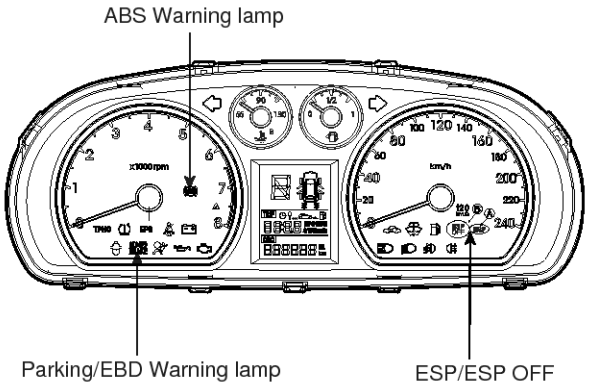
LF : Front left wheel

RR : Rear right wheel

PE : Pump motor

USV : Pilot Valve

HSV : High pressure Switch Valve



SFDBR8101L

ABS Warning Lamp module

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

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

EBD/PARKING BRAKE WARNING LAMP MODULE

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

- During the initialization phase after IGN ON. (continuously 3 seconds).
- When the Parking Brake Switch is ON or brake fluid level is low.
- When the EBD function is out of order .
- During diagnostic mode.
- When the ECU Connector is seperated from ECU.

ESP Warning Lamp (ESP system)

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

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

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

ESP Function Lamp (ESP system)

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

The ESP Function lamp operates under the following conditions :

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

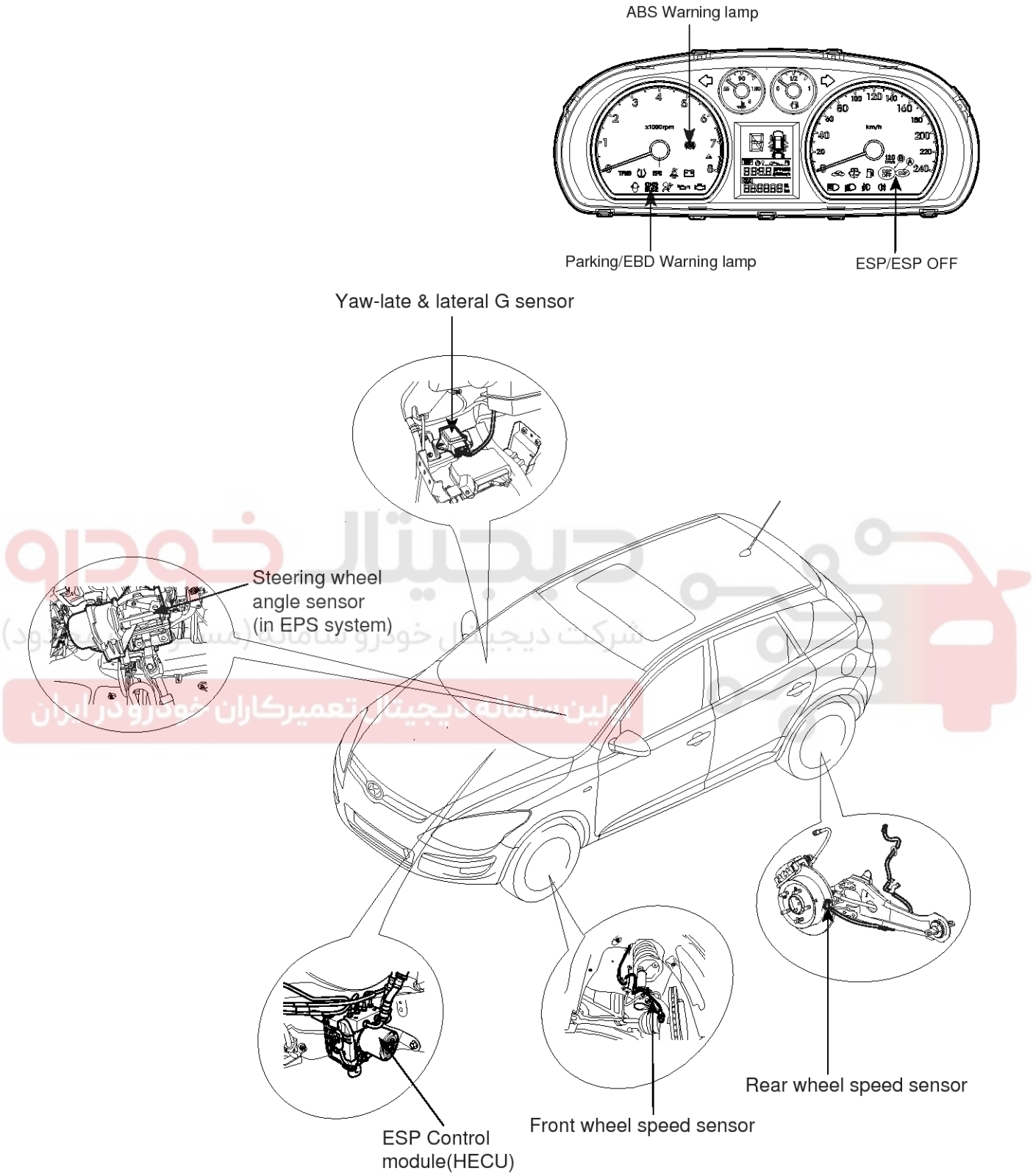
ESP On/Off Switch (ESP system)

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 ESC status change.

COMPONENTS



SFDBR8102L

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/ESC functions until normal operating condition is restored.

WARNING LAMP ON

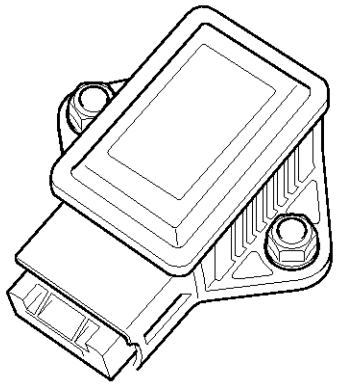
1. ABS warning lamp turns on when ABS is malfunctioning.
2. ESP operation lamp turns on when ESP is malfunctioning.

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

Yaw-rate and Lateral G Sensor

DESCRIPTION

1. The yaw-rate & lateral G sensor is applied for the ESP system.
2. The yaw-rate is the angular velocity, when a vehicle turns a corner, and the lateral G is the acceleration to move a vehicle out of the way when cornering.
3. The sensor is located in the crash pad lower floor on vehicle.

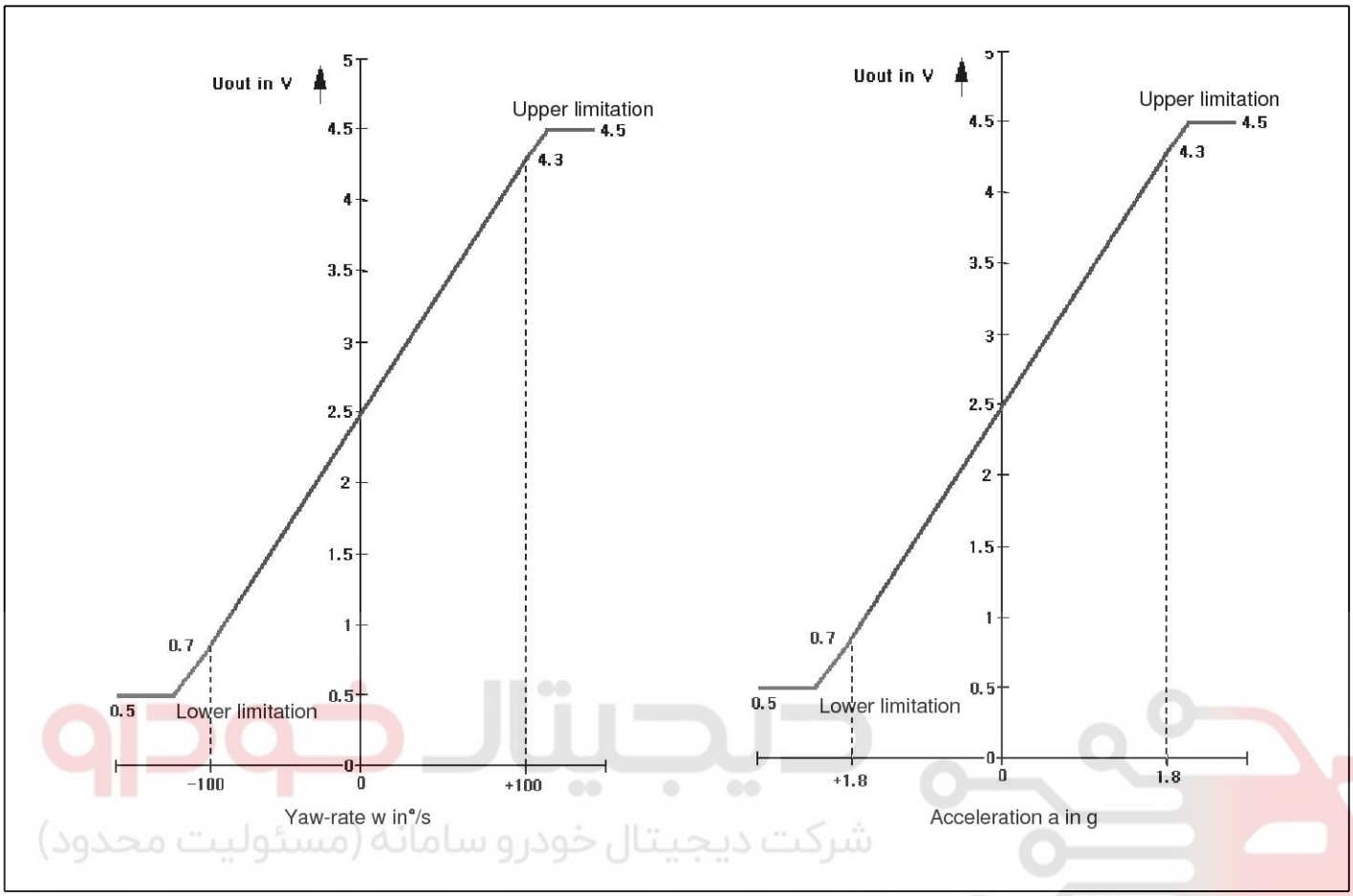


KJRE504E

SPECIFICATION

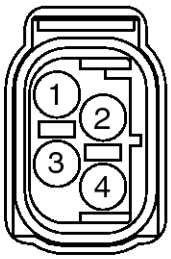
Description			Specification	Remark
Nominal supply voltage			11.5 ~ 12.5 V	
Supply voltage range			8 ~ 16 V	
Supply current			Max. 120 mA	Typ. 75 mA
Reference Voltage Output			2.464 ~ 2.536 V	Typ. 2.5 V
Operating temperature range			-40 ~ 85℃	
Yaw-late sensor	Measurement range	+w direction, left turn	Min.100 °/s	Typ. 111 °/S
		-w direction, right turn	Min.-100 °/s	Typ. -111 °/S
	Non-linearity		-1 ~ 1 %	
	Offset (within life,within operating temperature)		3.75 °/S	
	Upper cut-off frequency		Min. 45 Hz	Typ. 60 Hz
Lateral G sensor	Measurement range	+y direction, left turn	Min.1.8 g	Typ. 2 g
		-y direction, right turn	Min. -1.8 g	Typ. -2 g
	Non-linearity		-4 ~ 4 %	
	Offset (within life,within operating temperature)		-0.09 ~ 0.09 g	
	Upper cut-off frequency		Min. 20 Hz	Typ. 40 Hz

OUTPUT CHARACTERISTIC

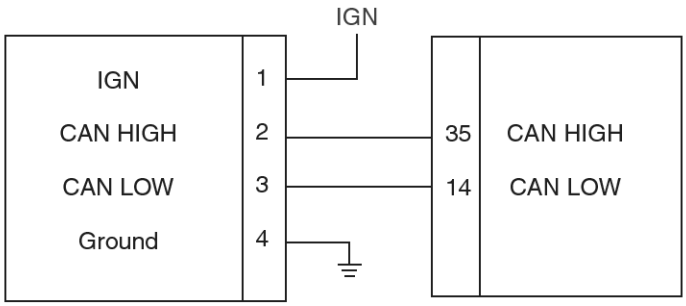


EJRF502E

CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



[Yaw-rate & lateral G sensor connector]



SEDBR7563L

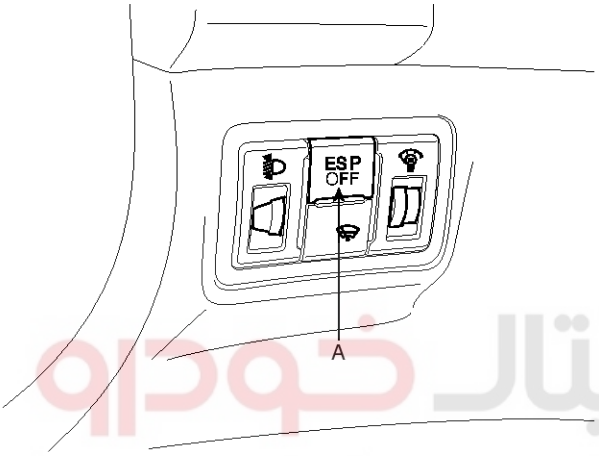
ESP OFF Switch

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.

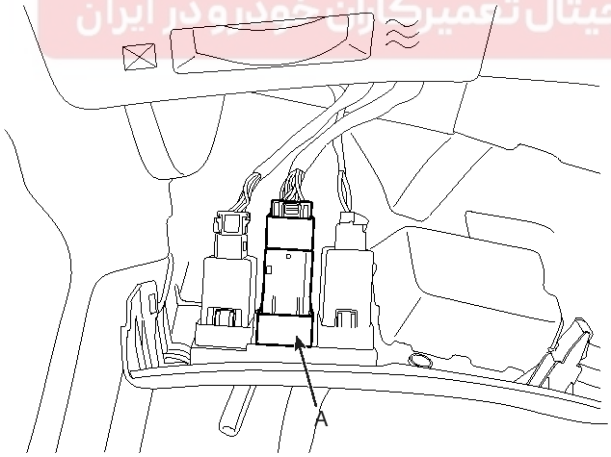
INSPECTION

1. Disconnect the negative (-) battery terminal.
2. Remove the lower side crash pad swith assembly (A) by using the trim remover tool.



SFDBR8106L

3. Disconnect the "ESP OFF" switch connector (A).



SFDBR8107L

4. Check the continuity between the switch terminals as the ESP OFF switch is engaged. (Refer to circuit diagram)

Steering Angle Sensor

DESCRIPTION

GENERAL DATA

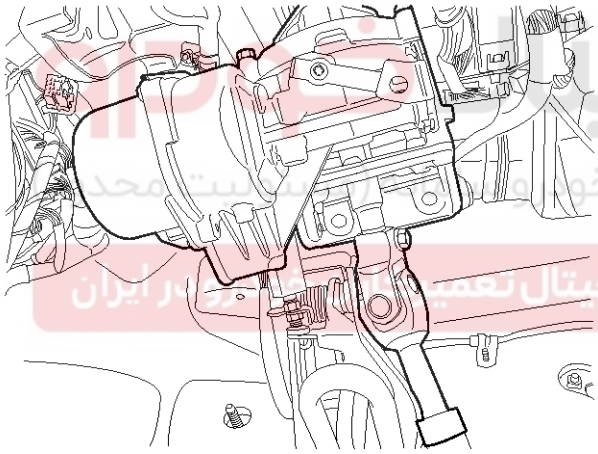
The Steering Angle Sensor (SAS) is installed in EPS (Electric Power Steering) and it sends messages to HECU through CAN communication line.

The SAS is used to determine turning direction and speed of the steering wheel.

The HECU uses the signals from the SAS when performing ESP-related calculations.

Components (Steering Angle Sensor, Torque Sensor, Failsafe relay, etc.) of the EPS system are located inside the steering column & EPS unit assembly and the steering column & EPS unit assembly must not be disassemble to inspect or replace them. (Refer to “ST (Steering system) Gr.”)

COMPONENT LOCATION



SEDBR7566L