General Information

Specifications

Item		Specification
Master cylinder	Type	Tandem
	Cylinder I.D.	26.99 mm (1.063 in)
	Piston stroke	30 mm (1.18 in)
	Fluid level switch	Provided
Brake booster	Type	9" + 10" Tandem
	Boosting ratio	8: 1
Front brake	Type	Ventilated disc
	Disc O.D.	321 mm (12.64 in)
	Disc thickness	For Europe : 32mm (1.26 in) Except Europe : 28 mm (1.10 in)
	Caliper piston	Double
Rear brake	Type	Solid disc
	Disc O.D.	324 mm (12.76 in)
	Disc thickness	For Europe : 18mm (0.71 in) Except Europe : 12mm (0.47 in)
	Caliper piston	Single
Parking brake	Type	DIH (Drum in hat)
	Drum I.D.	210 mm (8.27 in)
Brake fluid		DOT 3 or DOT 4

NOTICE

O.D. : Outer Diameter

I.D : Inner Diameter

Specification (ABS)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	
	Type	ABS + EBD	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-25 ~ 120 °C	
	Motor power	270 W	
Warning lamp	Min. Operating Voltage	1.2 V	
	Max. Current consumption	200 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20 V	
	Output current low	5.9 ~ 8.4 mA	Typ. 7 mA
	Output current high	11.8 ~ 16.8 mA	Typ. 14 mA
	Output range	1 ~ 2500 Hz	
	Tone wheel	52 teeth	
	Air gap	0.4 ~ 1.5 mm	

Specification(ESP)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (Solenoid)	Total control (ABS, EBD, TCS, ESP)
	Type	Motor, valve relay intergrate-d type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-25 ~ 120 °C	
	Motor power	270 W	
Warning lamp	Min. Operating Voltage	1.2 V	
	Max. Current consumption	200 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 4.5 ~ 20 V	
	Output current low	5.9 ~ 8.4 mA	Typ. 7 mA
	Output current high	11.8 ~ 16.8 mA	Typ. 14 mA
	Output range	1 ~ 2000 Hz	
	Tone wheel	52 teeth	
	Air gap	0.4 ~ 1.5 mm	
Steering Wheel Angle Sensor	Operating Voltage	9 ~ 16 V	
	Output Voltage (High)	3.0 V ~ 4.1 V	
	Output Voltage (Low)	1.3 V ~ 2.0 V	
	Operating Angular velocity	Max. 1500 °/sec	
Yaw rate & Lateral G sensor (CAN TYPE)	Operating Voltage	8 V ~ 17 V	
	Current Consumption	Max. 140 mA	
	Yaw rate sensor measurement range	± 75 °/sec	
	Lateral G sensor measurement range	± 1.5 g	

Service Standard

Items	Standard vale
Brake pedal height (Common pedal)	210.4 mm (8.28 in)
Brake pedal height (Adjustable pedal)	210.4 mm (8.28 in)
Brake pedal stroke (Common pedal)	118.3 mm (4.66 in)
Brake pedal stroke (Adjustable pedal)	120.3 mm (4.74 in)
Stop lamp clearance	1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Brake pedal free play	3 ~ 8 mm (0.12 ~ 0.31 in)
Front brake disc thickness	For Europe : 32 mm (1.26 in) Except Europe : 28mm (1.10 in)
Front brake disc pad thickness	10.5 mm (0.41 in)
Rear brake disc thickness	For Europe : 18 mm (0.71 in) Except Europe : 12 mm (0.47 in)
Rear brake disc pad thickness	For Europe : 10 mm (0.39 in) Except Europe : 9 mm (0.35 in)

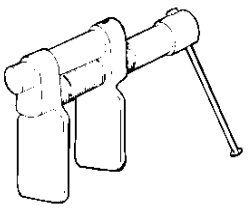
Tightening Torques

Items	N.m	kgf.m	lb-ft
Hub nut	88.3 ~ 107.9	9.0 ~ 11.0	65.1 ~ 79.6
Master cylinder to brake booster	9.8 ~ 15.7	1.0 ~ 1.6	7.2 ~ 11.6
Brake booster mounting nuts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Air bleeding screw	6.7 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Brake tube flare nuts	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Front caliper guide rod bolts	25.5 ~ 37.3	2.6 ~ 3.8	18.8 ~ 27.5
Rear caliper guide rod bolts	21.6 ~ 31.4	2.2 ~ 3.2	15.9 ~ 23.1
Front caliper assembly to knuckle	73.5 ~ 83.4	7.5 ~ 8.5	54.2 ~ 61.5
Rear caliper assembly to knuckle	63.7 ~ 73.5	6.5 ~ 7.5	47.0 ~ 54.2
Brake hose to caliper	16.7 ~ 19.6	1.7 ~ 2.0	12.3 ~ 14.5
Brake pedal member bracket bolts	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake pedal shaft nut	24.5 ~ 34.3	2.5 ~ 3.5	18.1 ~ 25.3
Stop lamp switch lock nut	7.8 ~ 9.8	0.8 ~ 1.0	5.8 ~ 7.2
Wheel speed sensor mounting bolt	6.9 ~ 10.8	0.7 ~ 1.1	5.0 ~ 8.0
HECU bracket bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
HECU bracket nut	5.9 ~ 9.8	0.6 ~ 1.0	4.3 ~ 7.2
Yaw rate & G sensor mounting bolts	3.9 ~ 5.9	0.4 ~ 0.6	2.9 ~ 4.3

Lublicants

Items	Recommended	Quantity
Brake pedal bushing and bolt	Chassis grease	As required
Parking brake shoe and backing plate contacting surface	Heat resistance grease	As required
Caliper guide rod and boot	AI-11P	0.8 ~ 2.0 g (Front) 0.7 ~ 1.5 g (Rear)

Special Service Tools

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

Troubleshooting

Problem Symptoms Table

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Inoperative)	repair air·bleed replace adjust replace
Brake drag	1. Brake pedal freeplay (Minimum) 2. Parking brake lever travel (Out of adjustment) 3. Parking brake wire (Sticking) 4. Rear brake shoe clearance(Out of adjustment) 5. Pad or lining (Cracked or distorted) 6. Piston (Stuck) 7. Piston (Frozen) 8. Anchor or Return spring (Inoperative) 9. Booster system (Vacuum leaks) 10.Master cylinder (Inoperative)	adjust adjust repair adjust replace replace replace replace repair 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 i-nefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	repair air·bleed replace replace adjust adjust replace replace repair
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or Return spring (Faulty) 8. Brake pad shim (Damage) 9. Shoe hold-down spring (Damage)	replace adjust replace replace clean replace replace replace replace
Brake fades	1. master cylinder	replace
Brake vibration, pulsa-tion	1. brake booster 2. pedal free play 3. master cylinder 4. caliper 5. master cylinder cap seal 6. damaged brake lines	replace adjust replace replace replace replace

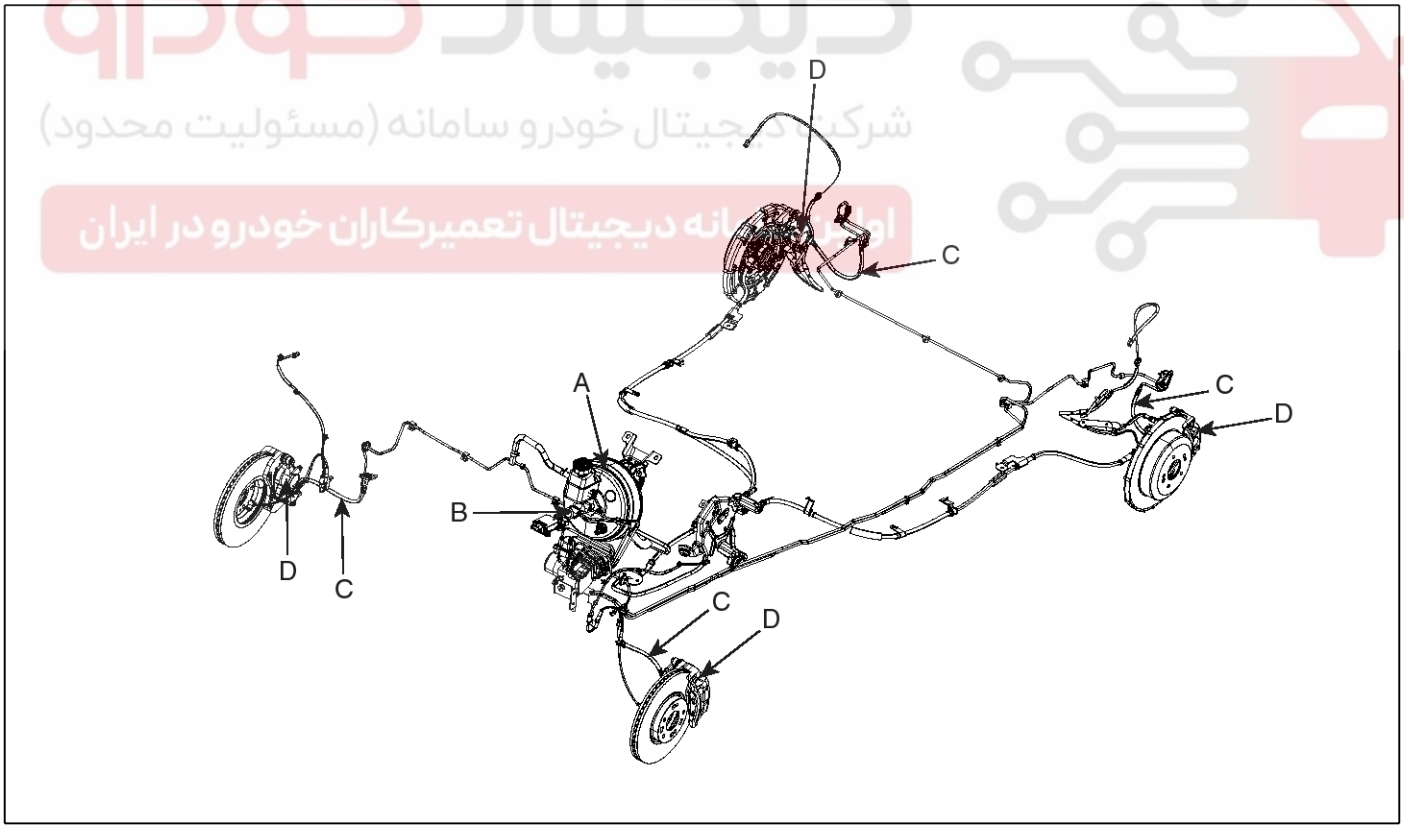
Symptom	Suspect Area	Reference
Brake Chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes, loose wheel bearings and contaminated brake lining.	

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.



SENBR7630D

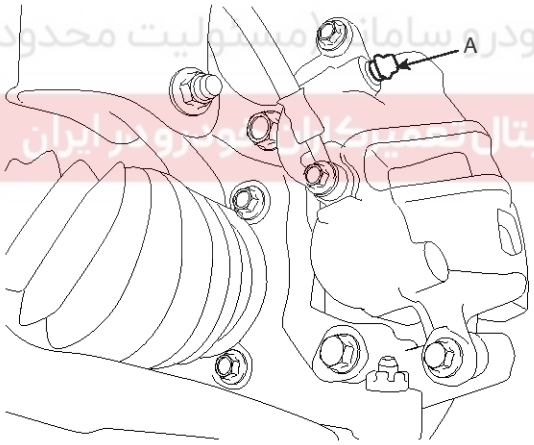
Brake System Bleeding

⚠CAUTION

- **Do not reuse the drained fluid.**
- **Always use genuine DOT3/DOT4 brake Fluid.**

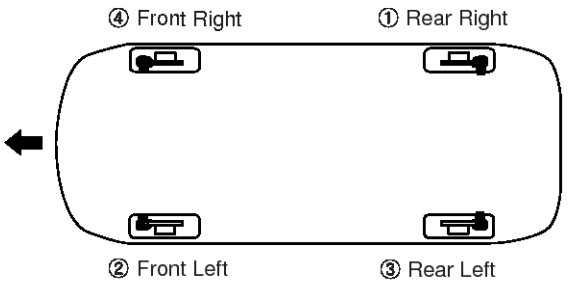
  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- **Make sure no dirt of other foreign matter is allowed to contaminate the brake fluid.**
- **Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash 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 in the reservoir is at the MAX (upper) level line.
2. Have someone slowly pump the brake pedal several times, and then apply pressure.
3. Loosen the right-rear brake bleed screw (A) to allow air to escape from the system. Then tighten the bleed screw securely.



SCMBR6501D

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

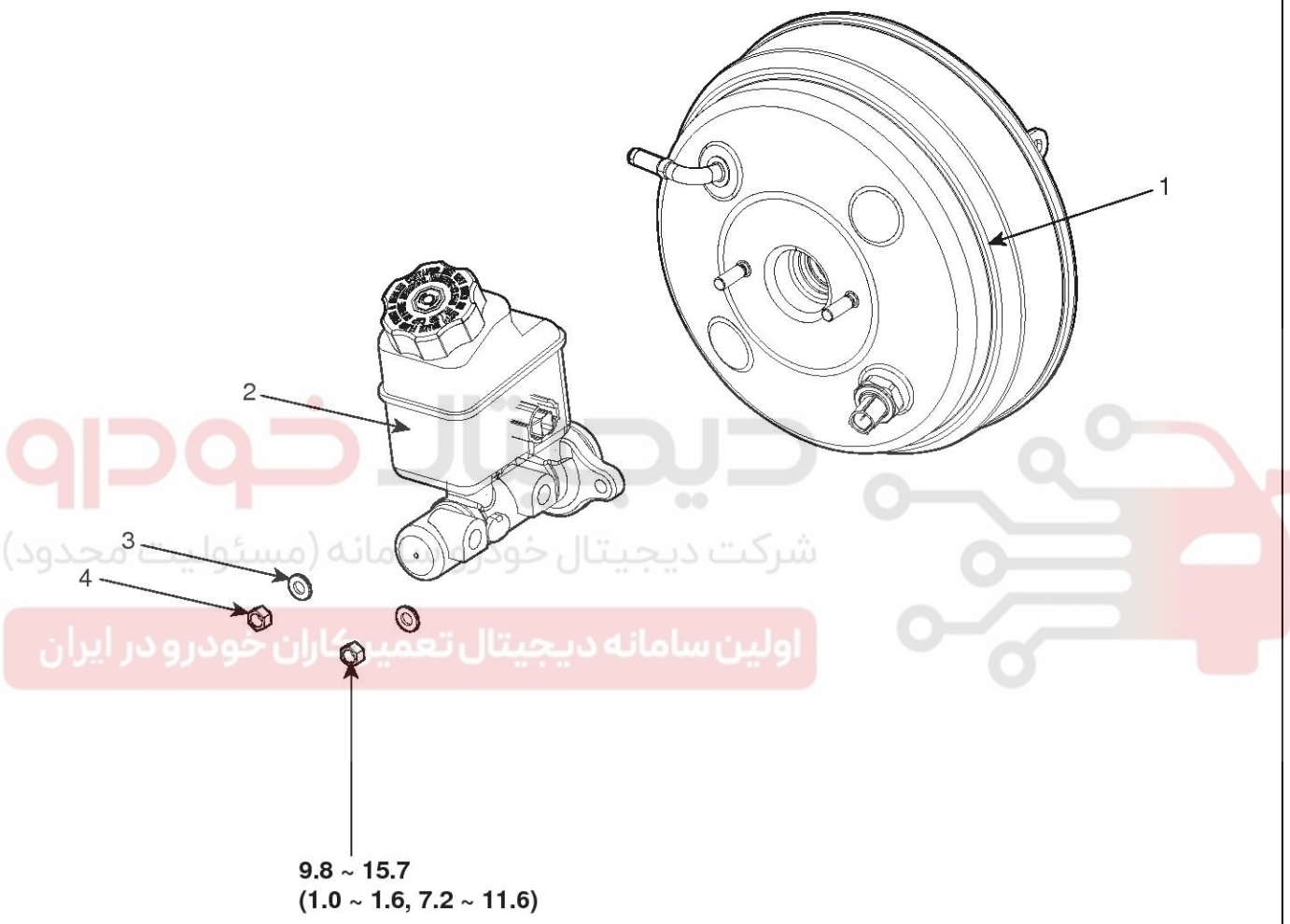


EJKE003B

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

Brake Booster

Components



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

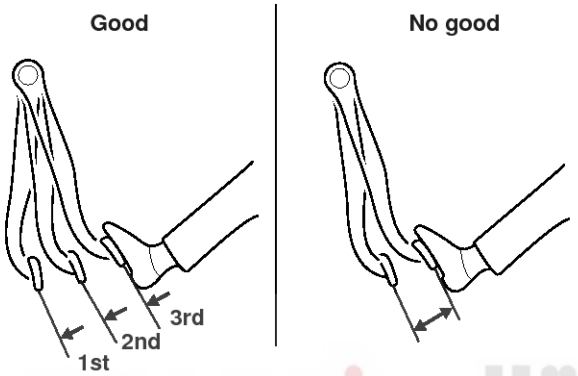
SENBR9300L

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

Brake Booster Operating Test

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

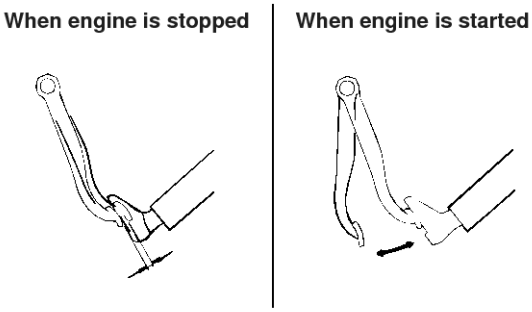
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, thebooster is inoperative.



EJRF500B

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

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



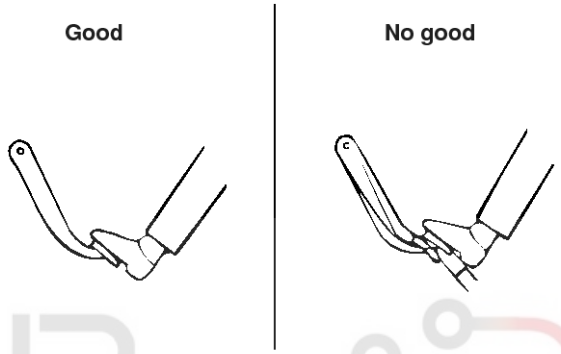
SCMBR6500L

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 inoperative.

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

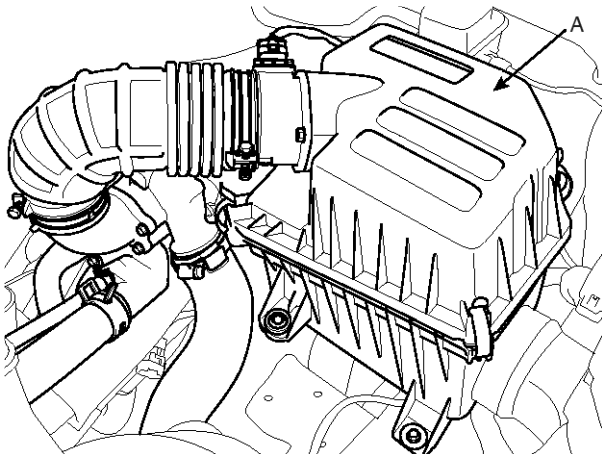
   Even if one of the above three tests is not okay, check the check valve, vacuum hose and booster for malfunction.



EJRF500C

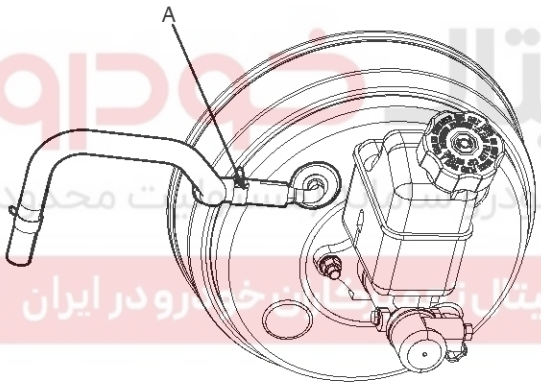
Removal

1. Remove the air cleaner assembly.



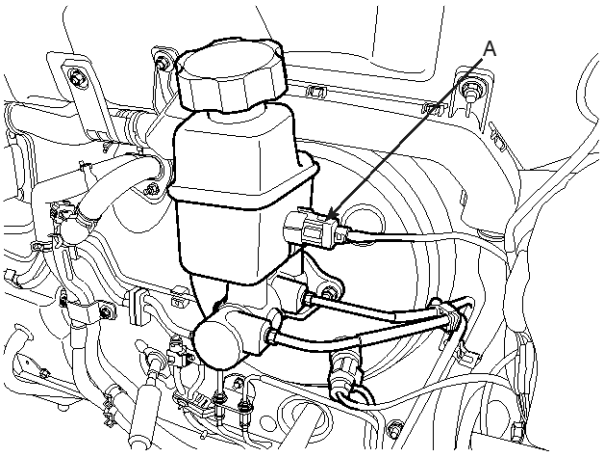
SENBR7505D

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



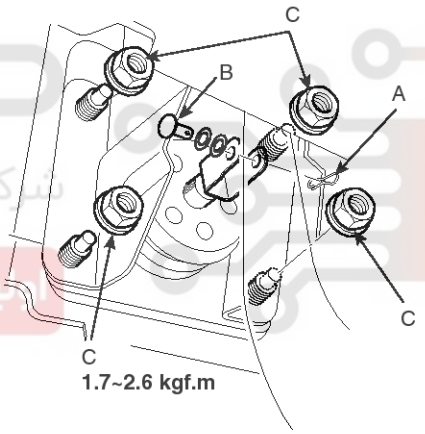
SENBR7501D

3. Disconnect the brake fluid level switch connector (A from the reservoir.



SENBR7502D

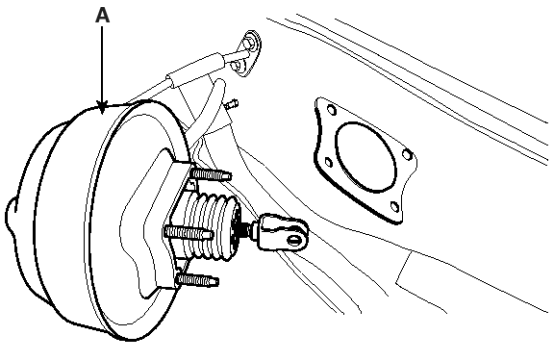
4. Remove the master cylinder. (Refer to Master cylinder)
5. Remove the snap pin (A) and joint pin (B).



SENBR7503D

6. Remove the brake booster (A) by loosening the mounting nuts.

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



ARJE500H

Inspection

1. Inspect the check valve in the vacuum hose.

   ⚠CAUTION
   Do not remove the check valve from the vacuum hose.

2. Check the boot for damage.

Installation

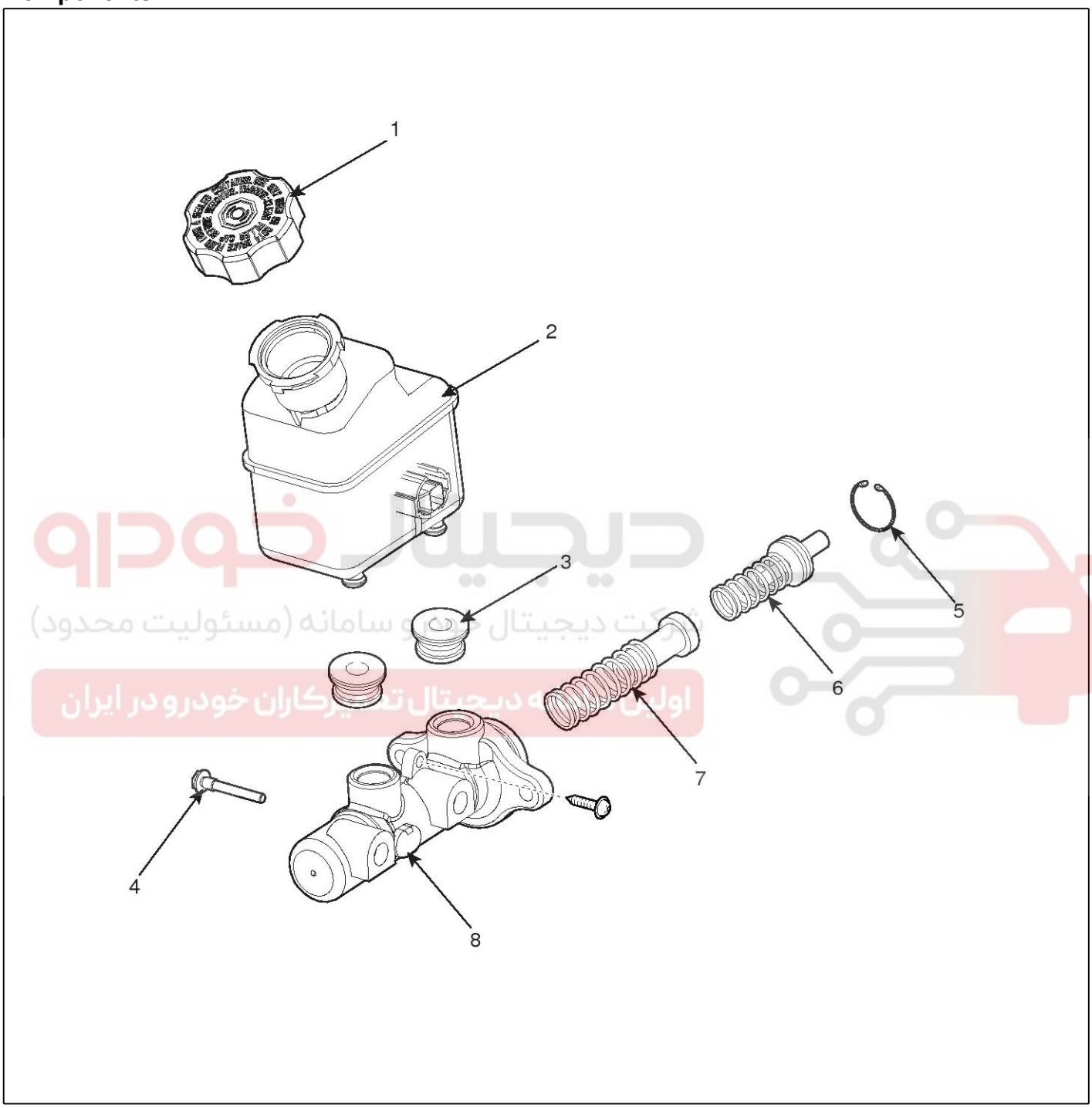
1. Installation is the reverse of removal.

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

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

Master Cylinder

Components

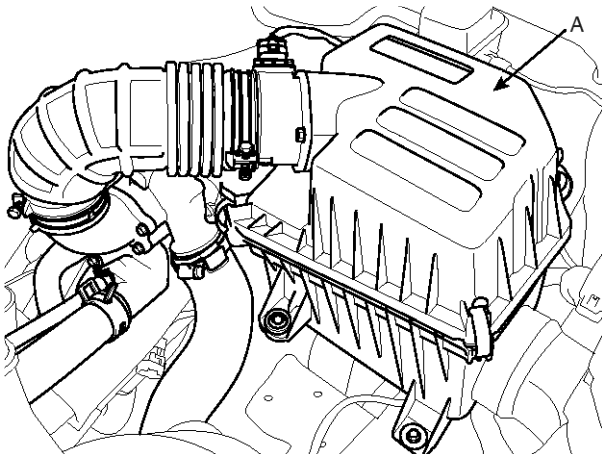


SENBR9301L

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

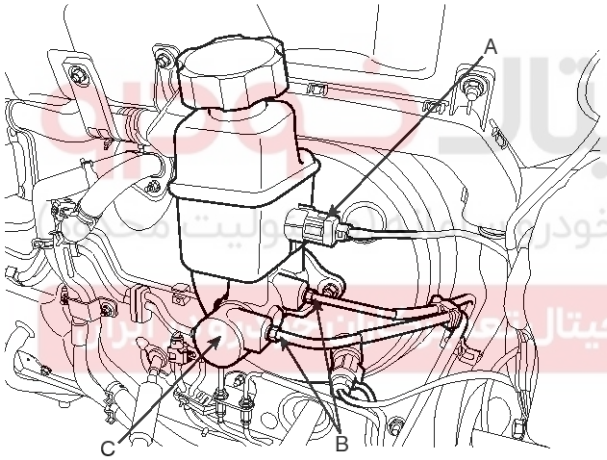
Removal

1. Remove the air cleaner assembly (A).



SENBR7505D

2. Disconnect the brake fluid level switch connector (A) from the reservoir.



SENBR7634D

CAUTION

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

3. Disconnect the brake tube (B) from the master cylinder by loosening the tube flare nut.

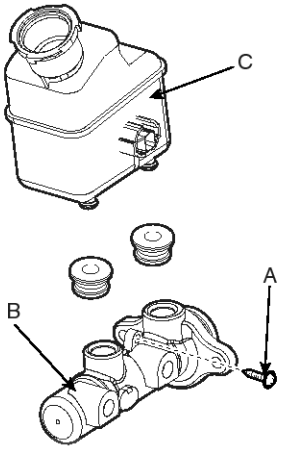
Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)

4. Remove the master cylinder (C) from the brake booster after loosening the mounting nuts.

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

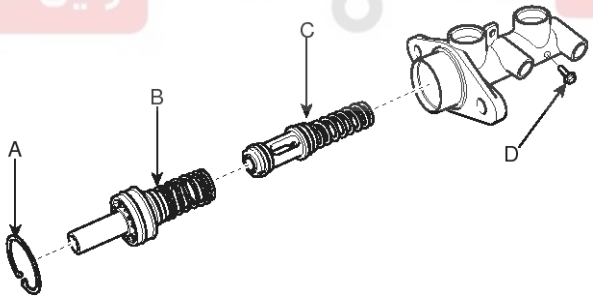
Disassembly

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



SENBR7508D

4. Remove the retainer ring (A) by using the snap ring pliers.
5. Remove the primary piston assembly (B).
6. 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

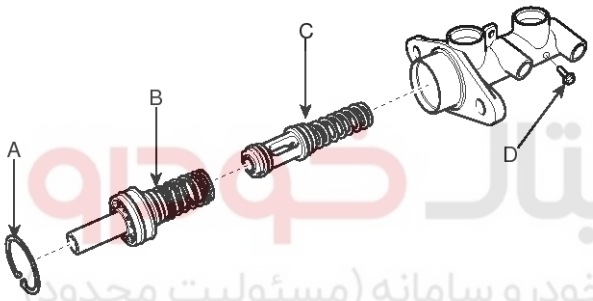
1. Check the master cylinder bore for rust or scratching.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

⚠CAUTION

- **If the cylinder bore is damaged, replace the master cylinder assembly.**
- **Wash the contaminated parts in alcohol.**

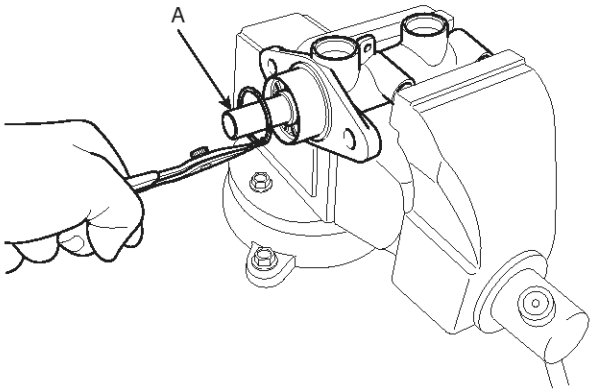
Reassembly

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).



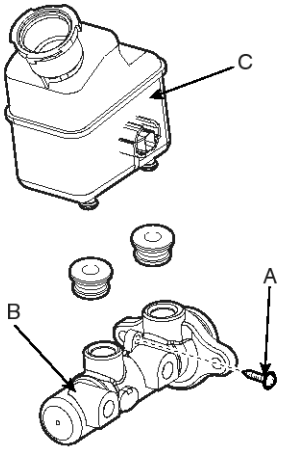
SUNBR6515D

4. Install the retainer ring (A) after installing primary piston assembly.



AJKF601X

5. Mount two grommets.
6. Install the reservoir (C) on the cylinder (B), and then install the mounting screw (A).



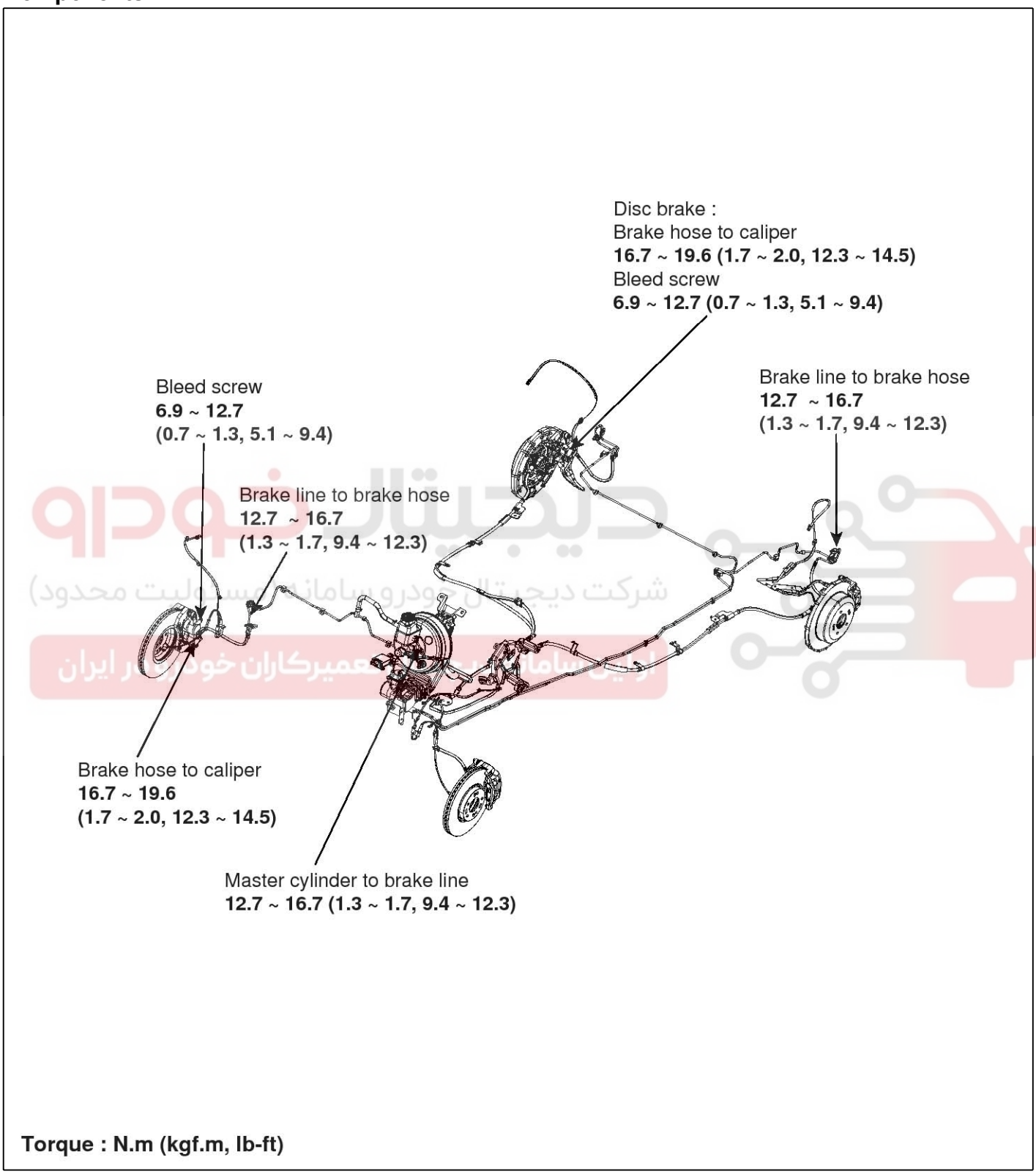
SENBR7509D

Installation

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

Brake Line

Components

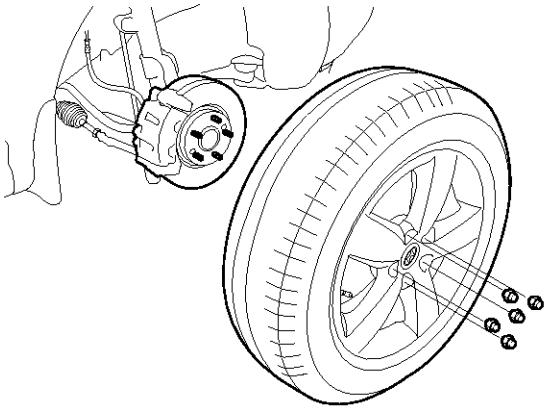


Torque : N.m (kgf.m, lb-ft)

SENBR9302L

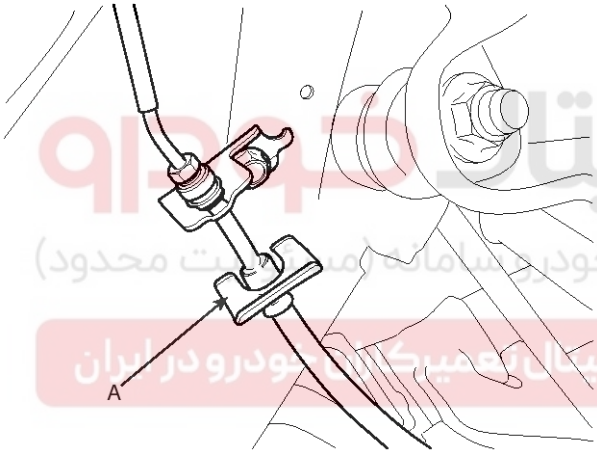
Removal

1. Remove the wheel & tire.



SCMBR6532D

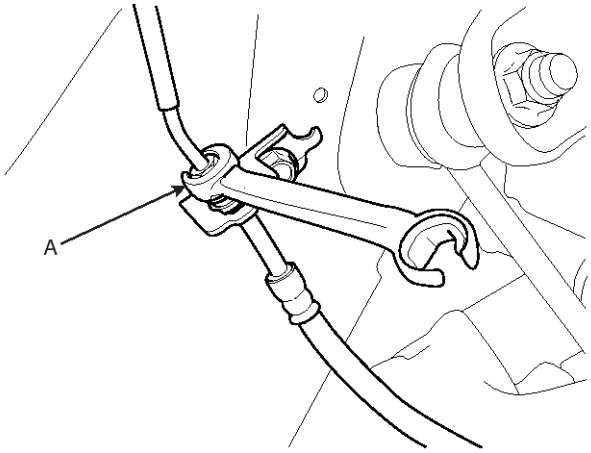
2. Remove the brake hose clip (A).



SCMBR6006D

3. Disconnect the brake tube by loosening the tube flare nut (A).

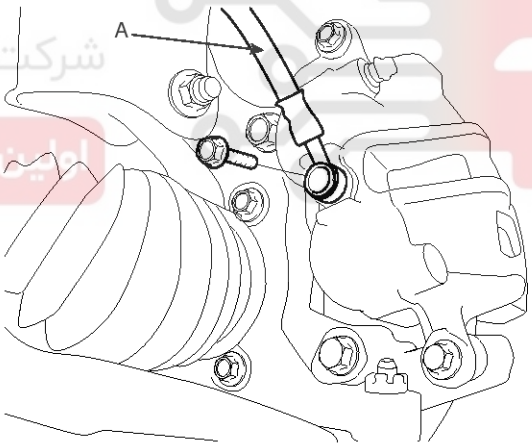
Tightening torque :
12.7 ~ 16.7N.m (1.3 ~ 1.7kgf.m, 9.4 ~ 12.3lb-ft)



SCMBR6007D

4. Disconnect the brake hose (A) from the brake caliper by loosening the bolt.

Tightening torque :
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)



SCMBR6503L

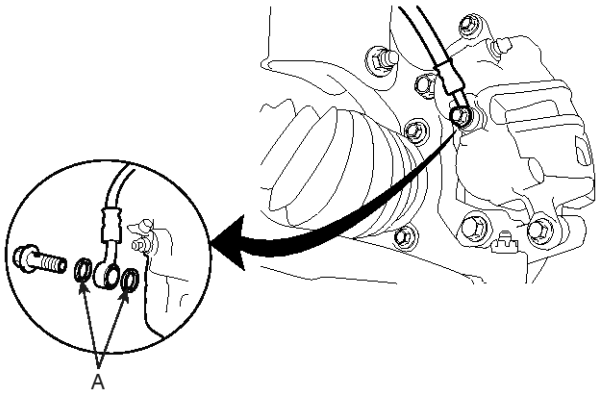
Inspection

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

Installation

1. Installation is the reverse of removal.

⚠CAUTION
Use a new washer (A) whenever installing.



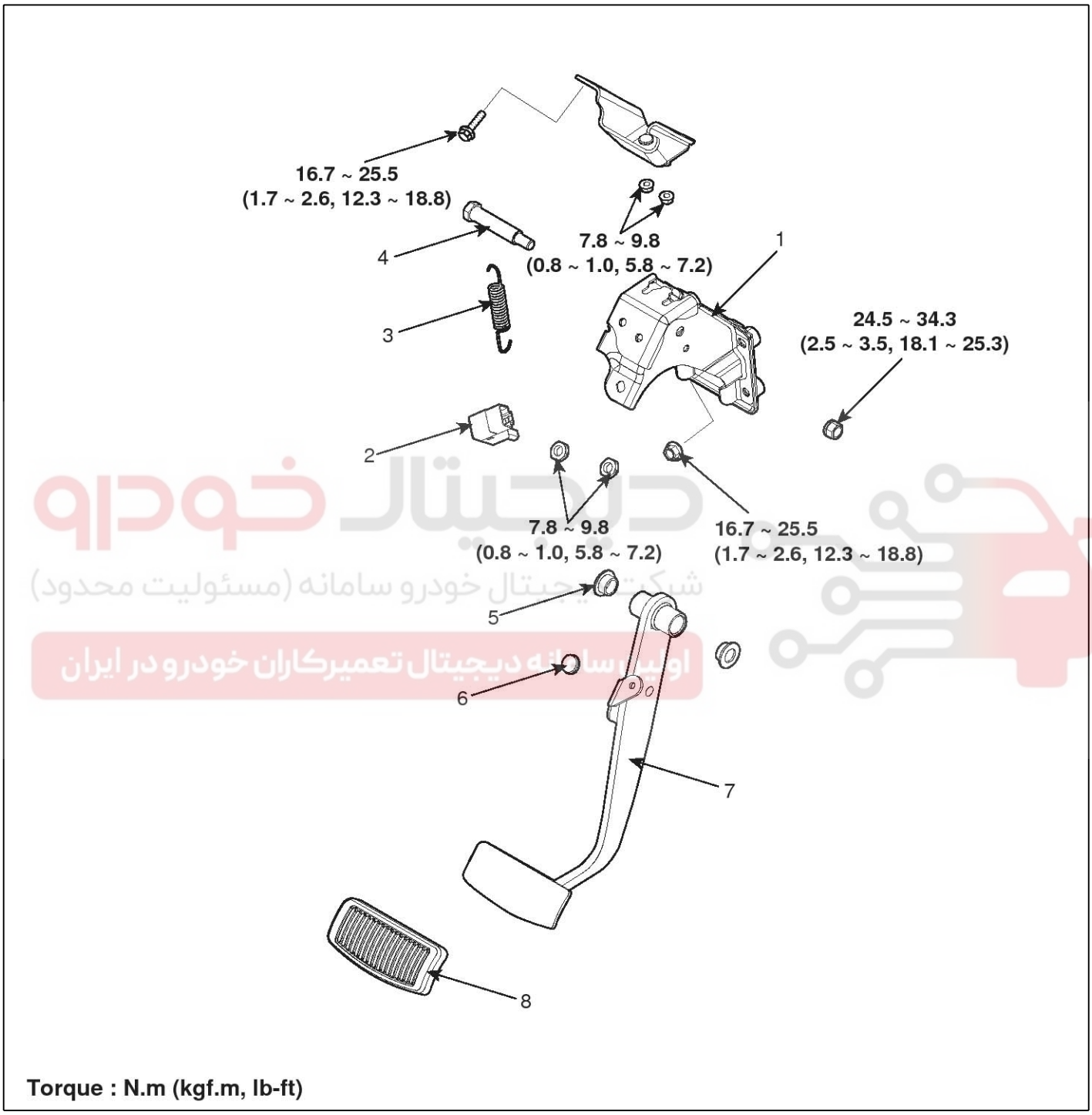
SENBR7625D

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

Brake Pedal

Components

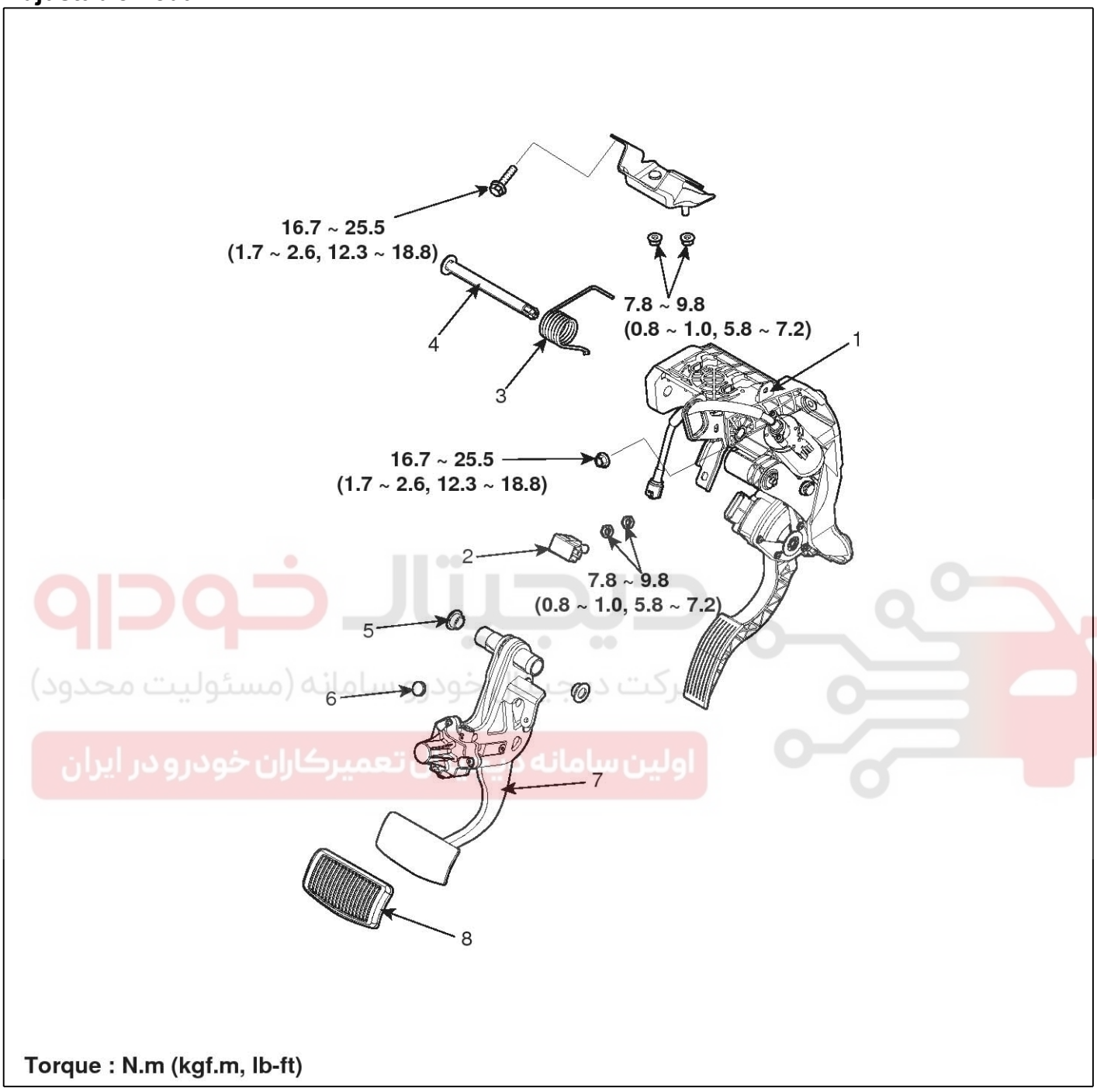
Common Pedal



SENBR9303L

1. Brake pedal member assembly
2. Stop lamp switch
3. Return spring
4. Bolt
5. Bushing
6. Brake pedal stopper
7. Brake pedal
8. Pedal pad

Adjustable Pedal

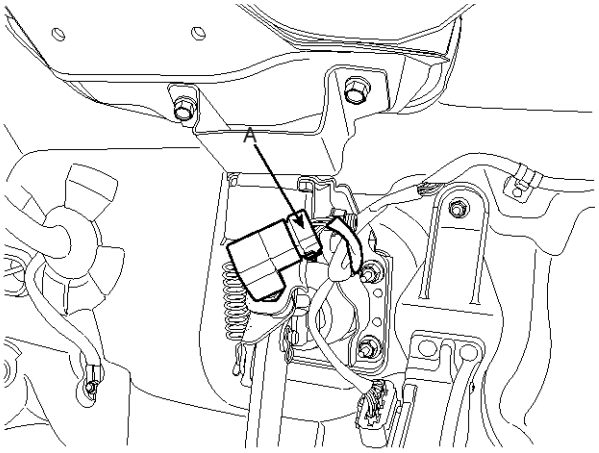


SENBR9304L

1. Brake pedal member assembly
2. Stop lamp switch
3. Return spring
4. Pin shaft
5. Bushing
6. Brake pedal stopper
7. Brake pedal
8. Pedal pad

Brake Pedal Height and Free Play Adjustment

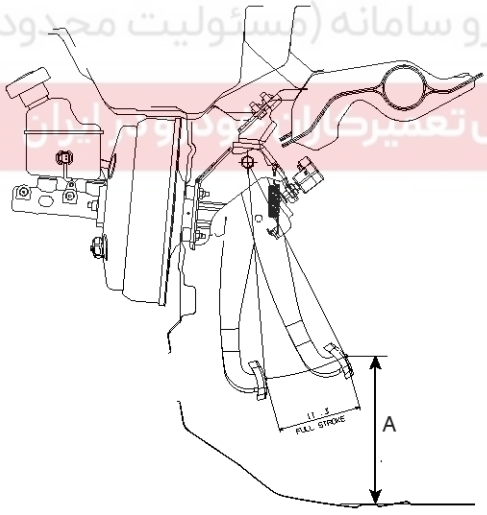
1. Disconnect the stop lamp switch connector (A) and loosen the stop lamp switch lock nut.



SENBR7635D

2. Adjust the brake pedal height (A) as illustration below.

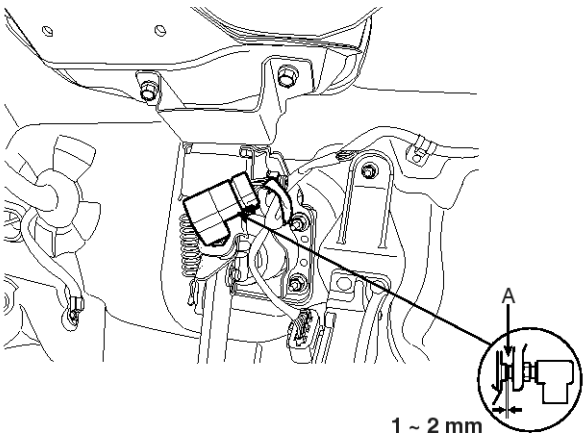
Pedal height
Common pedal : 210.4 mm (8.28 in)
Adjustable pedal : 210.4 mm (8.28 in)



SENBR7514D

3. Adjust the stop lamp switch clearance (A) and brake pedal free play.

Stop lamp clearance: 1.0 ~ 2.0 mm (0.04 ~ 0.08 in)
Pedal free play: 3.0 ~ 8.0 mm (0.12 ~ 0.31 in)

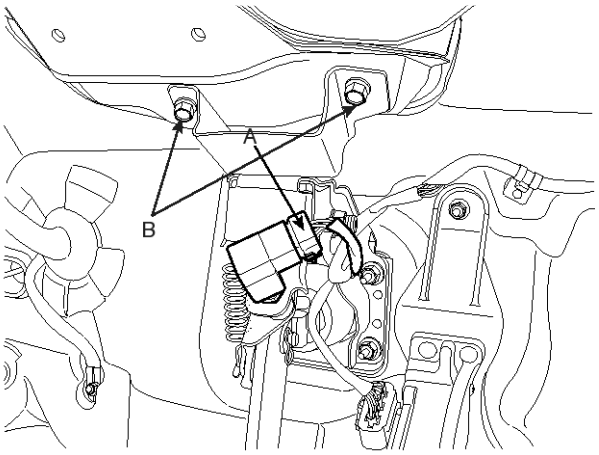


SENBR7515D

NOTICE
Adjust the brake pedal free play using the stop lamp switch lock nut.

Removal

1. Remove the lower crash pad. (Refer to BD Gr.)
2. Disconnect the stop lamp switch connector (A).

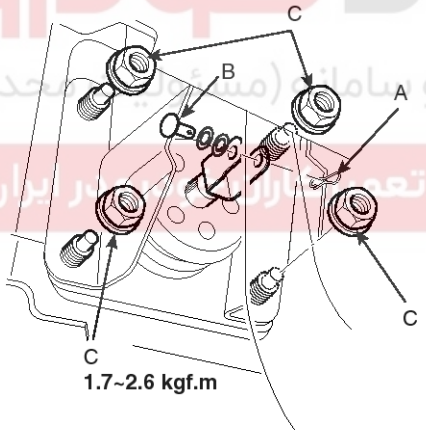


SENBR7513D

3. Remove the mounting bracket bolts (B).

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

4. Remove the snap pin (A) and joint pin (B).



SENBR7624D

5. Remove the brake pedal member assembly mounting nuts (C) and then remove the brake pedal assembly.

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

Installation

1. Installation is the reverse of removal.

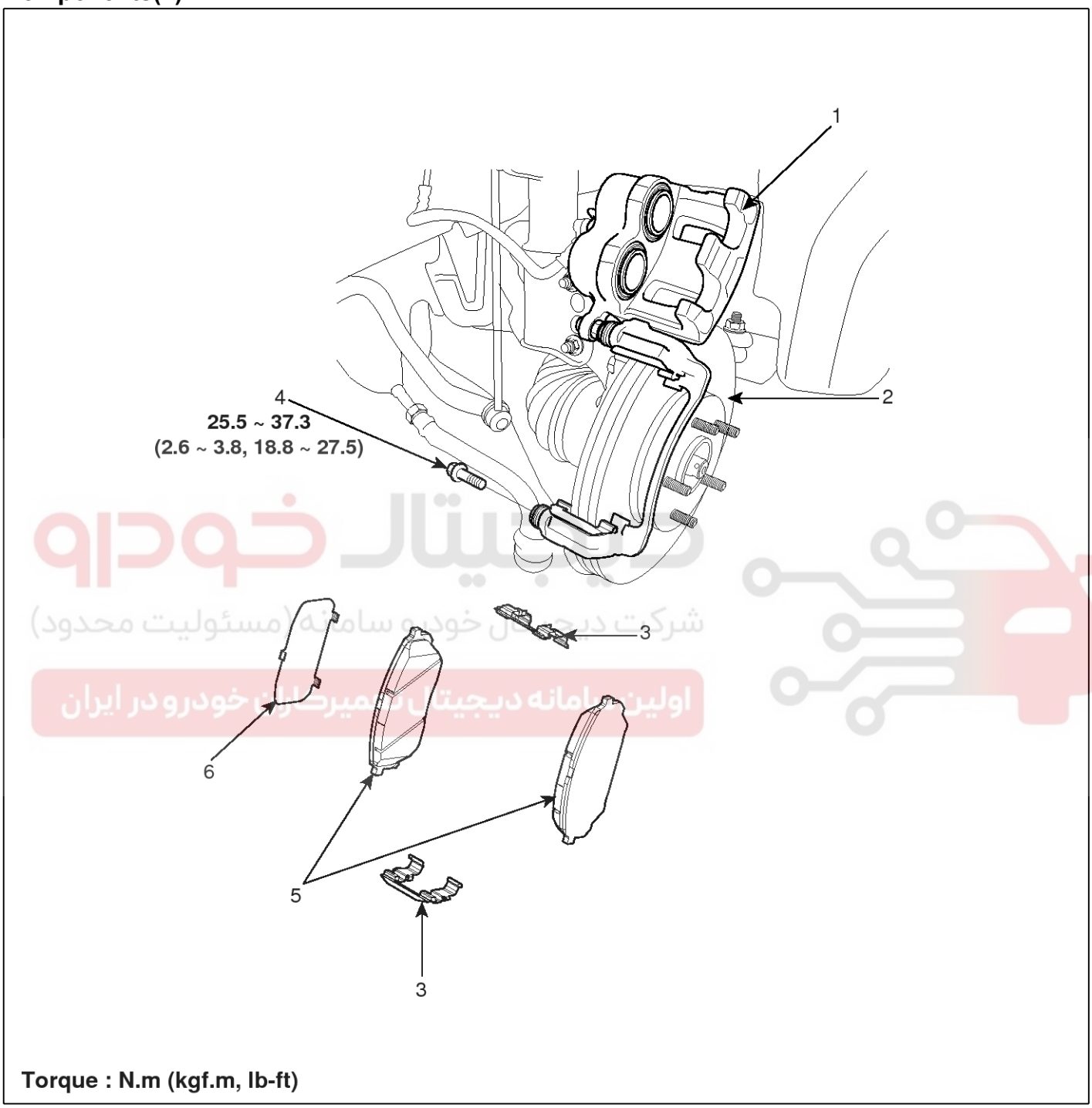
⚠CAUTION

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

2. Check the brake pedal operation.

Front Disc Brake

Components(1)

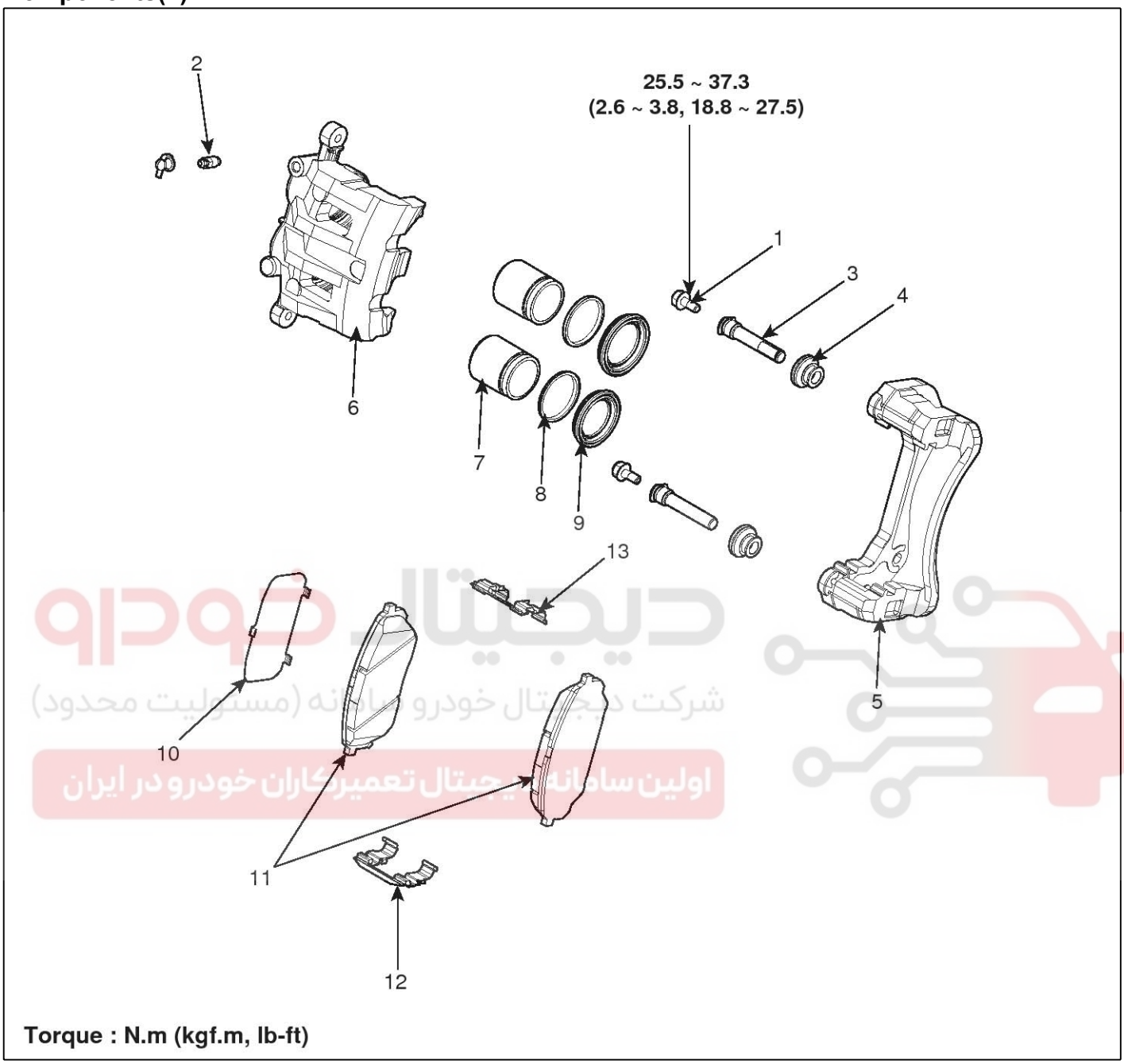


Torque : N.m (kgf.m, lb-ft)

SENBR9305L

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

Components(2)



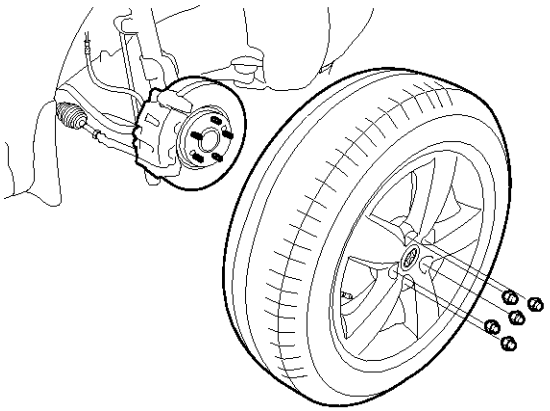
SENBR9306L

1. Guide rod bolt
2. Bleed screw
3. Guide rod
4. Boot
5. Caliper bracket
6. Caliper body
7. Piston
8. Piston seal
9. Piston boot
10. Inner pad shim
11. Brake pad
12. Pad retainer

Removal

1. Remove the front wheel & tire.

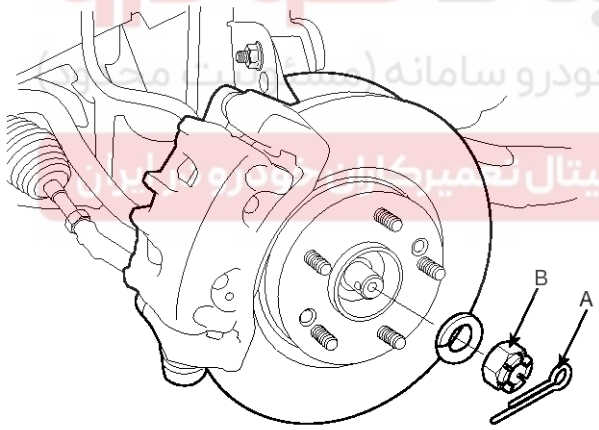
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



SCMBR6532D

2. Remove the split pin (A) and castle nut (B).

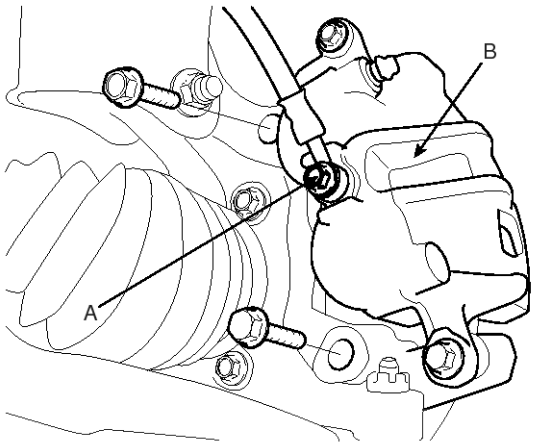
Tightening torque :
196.1 ~ 274.6N.m (20 ~ 28kgf.m, 144.7 ~ 202.5lb-ft)



SCMBR6508D

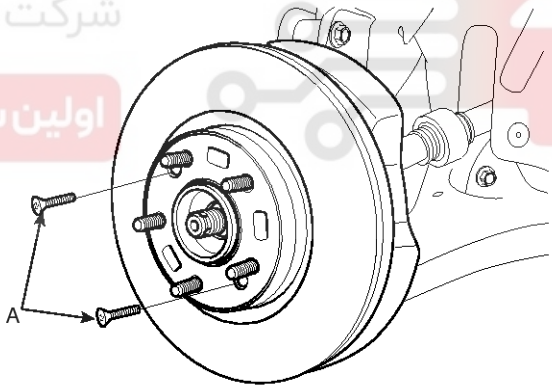
3. Loosen the hose eye-bolt (A) and caliper mounting bolts, then remove the front caliper assembly (B).

Tightening torque :
Brake hose to caliper:
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)
Caliper assembly to knuckle:
73.5 ~ 83.4N.m (7.5 ~ 8.5kgf.m, 54.2 ~ 61.5lb-ft)



SCMBR6510D

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

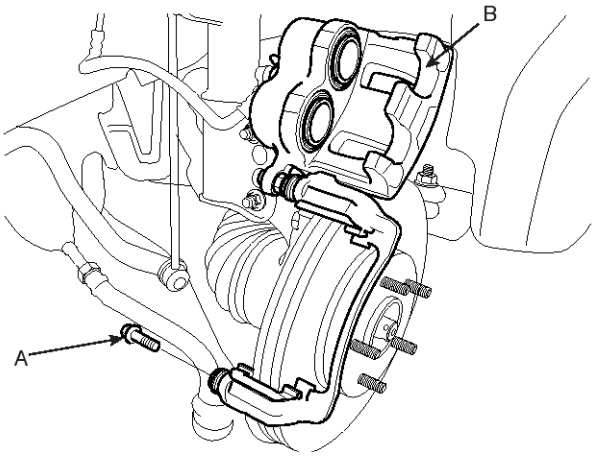


SCMBR6511D

Replacement

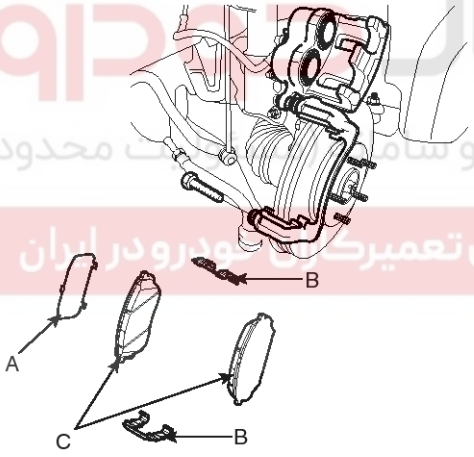
Front Brake Pads

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



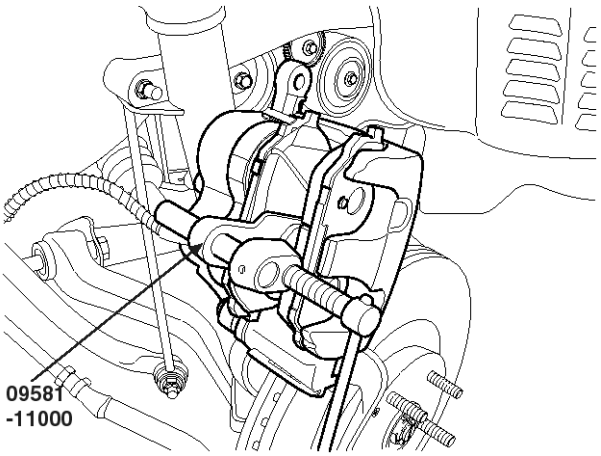
SENBR7543L

2. Replace shims (A), pad retainers (B), and brake pads (C).



SENBR7518D

3. Push the piston in the cylinder using a SST (09581-11000)



SENBR7519D

4. Pivot the caliper down and tighten the guide rod bolt.

Tightening torque :
25.5 ~ 37.3N.m (2.6 ~ 3.8kgf.m, 18.8 ~ 27.5lb-ft)

Inspection

1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Check the thickness of the brake disc and run-out using a micrometer and a dial gauge on the part dotted line in the illustration below.

Brake disc thickness

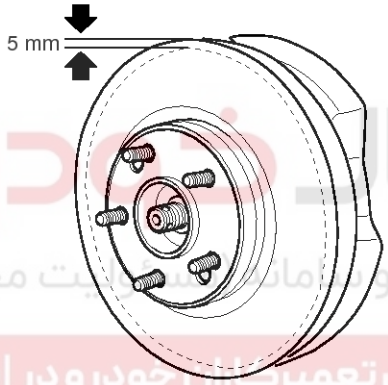
[For Europe]
- Standard : 32mm (1.26 in)
- Service limit : 30.4mm (1.20 in)

[Except Europe]
- Standard : 28mm (1.10 in)
- Service limit : 26.4mm (1.04 in)

Deviation: Less than 0.01 mm (0.00039 in)

Run-out

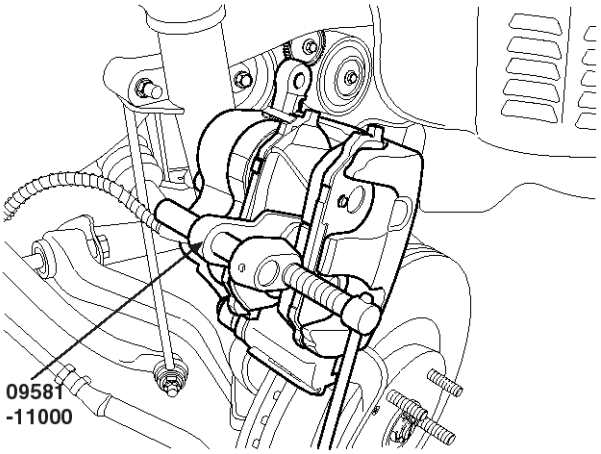
Standard: 0.03 mm (0.00118 in) or less



SCMBR6510L

Installation

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

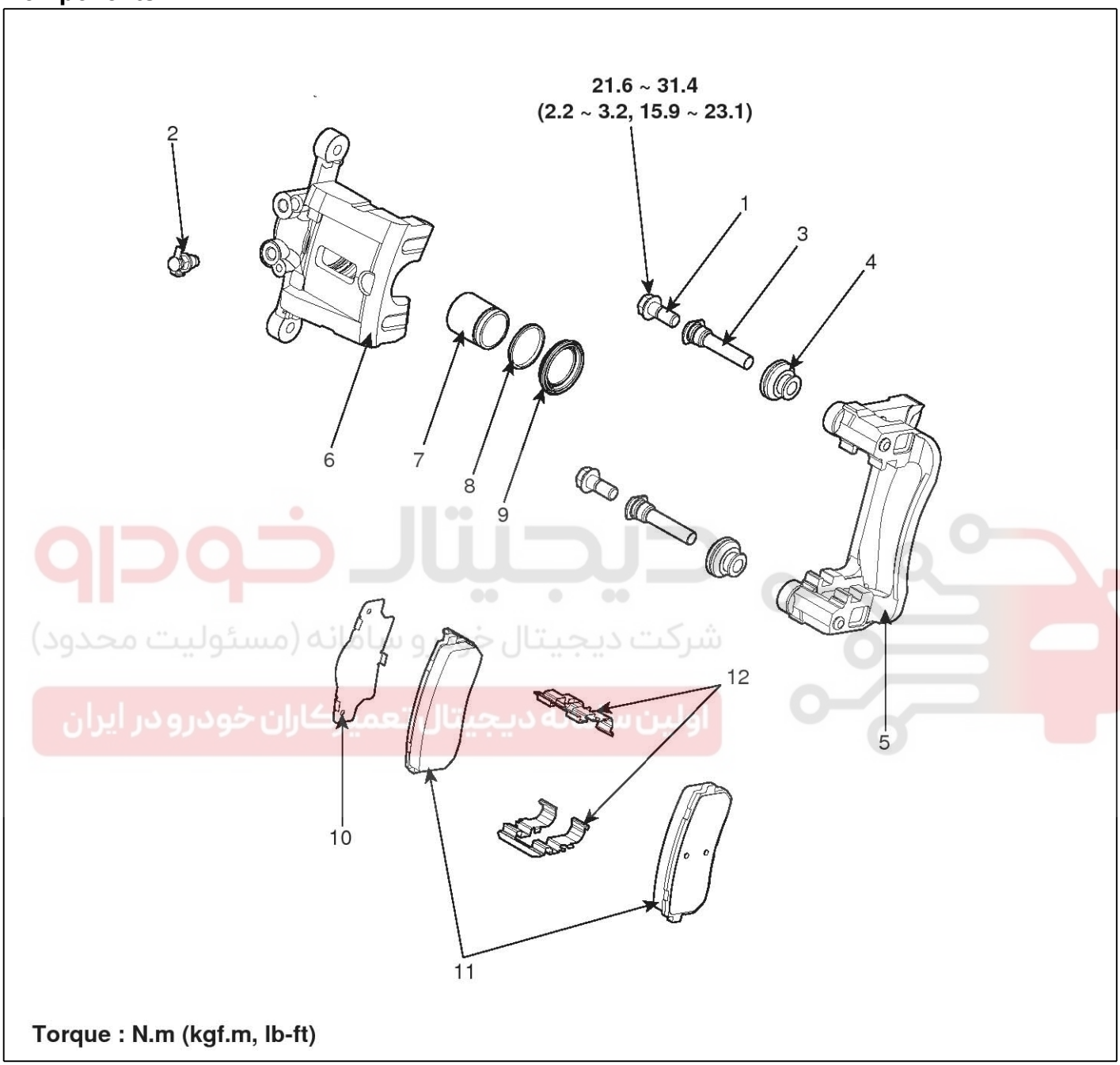


SENBR7519D

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

Rear Disc Brake

Components



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

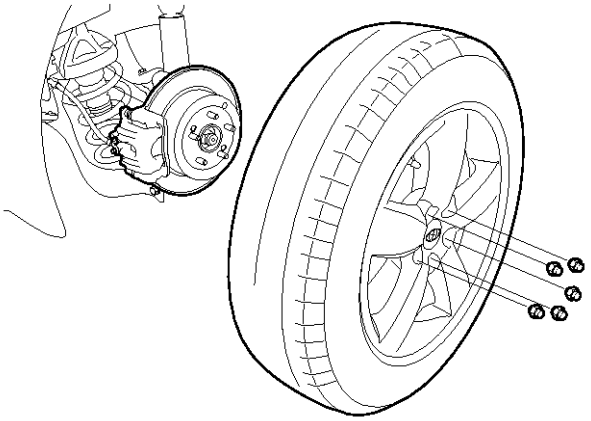
SENBR9307L

1. Guide rod bolt
2. Bleed screw
3. Guide rod
4. Boot
5. Caliper bracket
6. Caliper body
7. Piston
8. Piston seal
9. Piston boot
10. Inner pad shim
11. Brake pad
12. Pad retainer

Removal

1. Remove the rear wheel & tire.

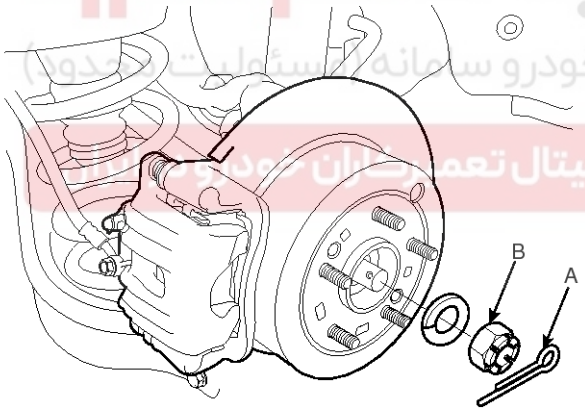
Tightening torque :
88.3 ~ 107.9N.m (9.0 ~ 11.0kgf.m, 65.1 ~ 79.6lb-ft)



SCMBR6513D

2. Remove the split pin (A) and castle nut (B).

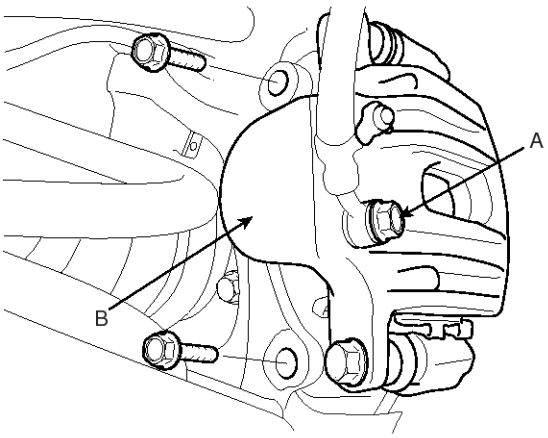
Tightening torque :
196.1 ~ 274.6N.m (20 ~ 28kgf.m, 144.7 ~ 202.5lb-ft)



SCMBR6514D

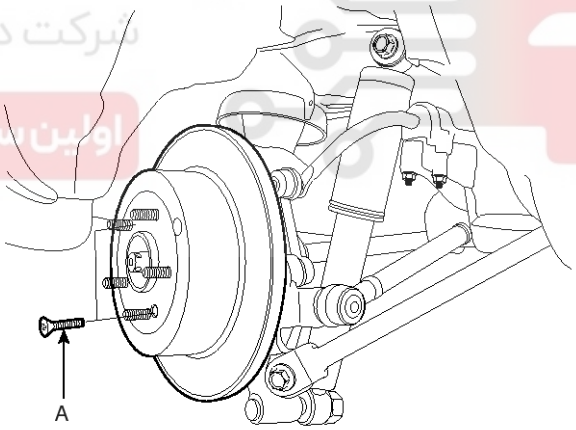
3. Loosen the hose eye-bolt (A) and caliper mounting bolts, then remove the rear caliper assembly (B).

Tightening torque :
Brake hose to caliper:
16.7 ~ 19.6N.m (1.7 ~ 2.0kgf.m, 12.3 ~ 14.5lb-ft)
Caliper assembly to carrier:
63.7 ~ 73.5N.m (6.5 ~ 7.5kgf.m, 47.0 ~ 54.2lb-ft)



SCMBR6515D

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

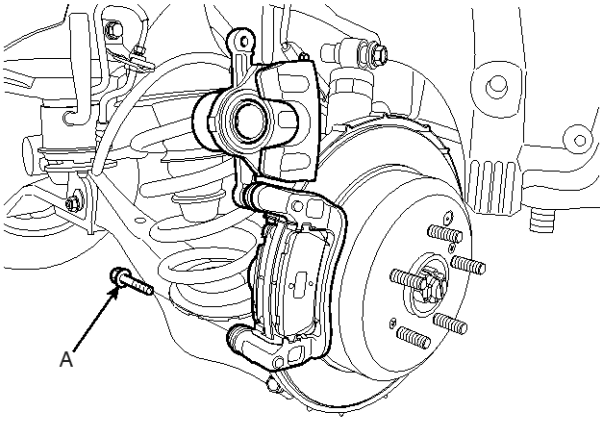


SCMBR6516D

Replacement

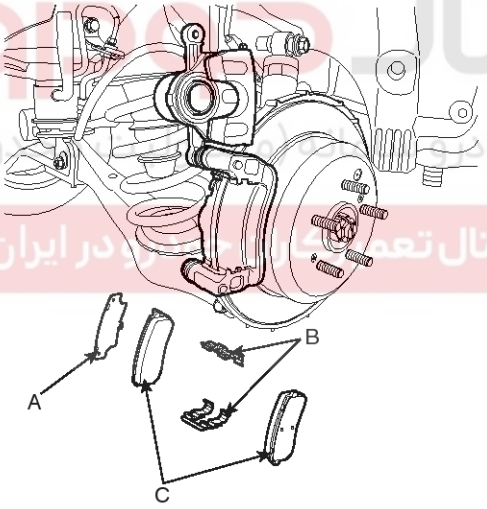
Rear Brake Pads

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



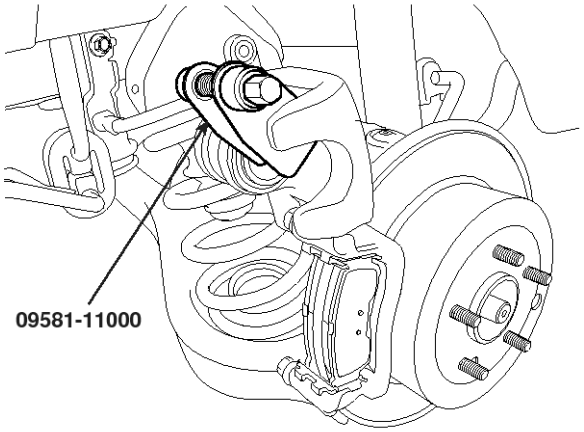
SENBR7521D

2. Replace shims (A), pad retainers (B), and brake pads (C).



SENBR7564L

3. Push the piston in the cylinder using a SST (09581-11000)



SCMBR6519D

4. Pivot the caliper down and tighten the guide rod bolt.

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

Inspection

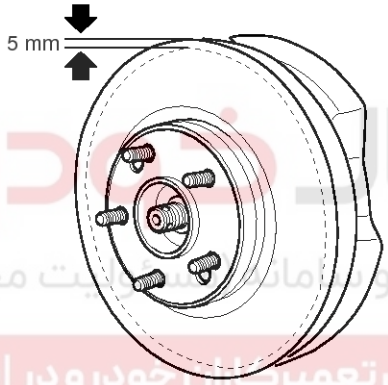
1. Check the brake pads for wear and fade.
2. Check the brake disc for damage and cracks.
3. Check the thickness of the brake disc and run-out using a micrometer and a dial gauge on the part dotted line in the illustration below.

Brake disc thickness
[For Europe]
- Standard : 18mm (0.71 in)
- Service limit : 16.4mm (0.65 in)

[Except Europe]
- Standard : 12mm (0.47 in)
- Service limit : 10.4mm (0.14 in)

Deviation: less than 0.01mm (0.000039 in)

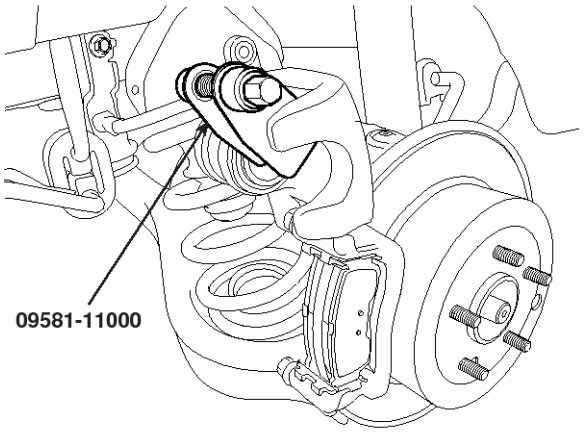
Run-out
Standard: 0.03mm (0.00118 in) or less



SCMBR6510L

Installation

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



SCMBR6519D

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

Parking Brake System

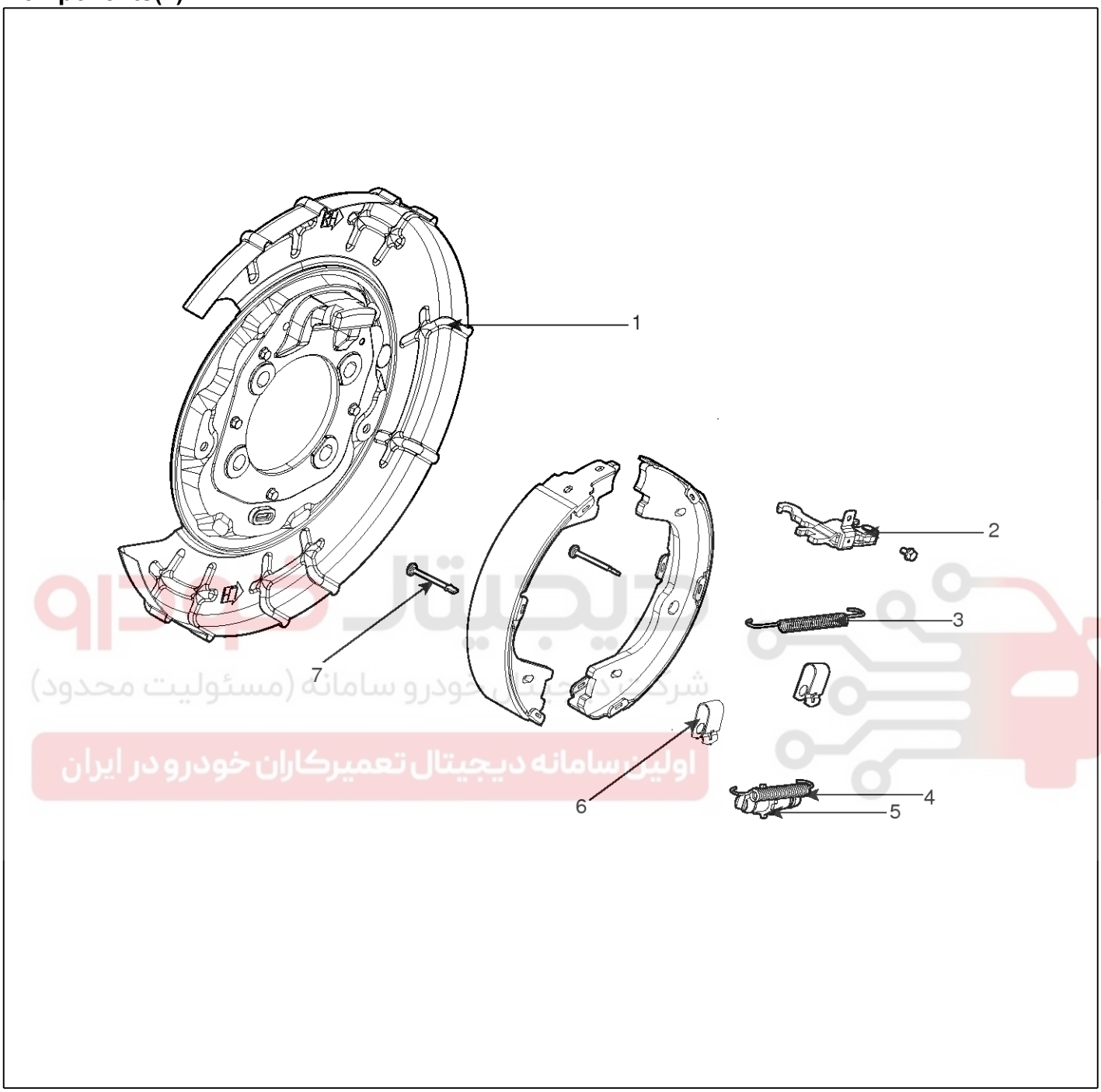
Parking Brake Assembly

Components(1)

SENBR9308L

1. Parking brake pedal
2. Front parking brake cable
3. Equalizer assembly
4. Rear parking brake cable

Components(2)



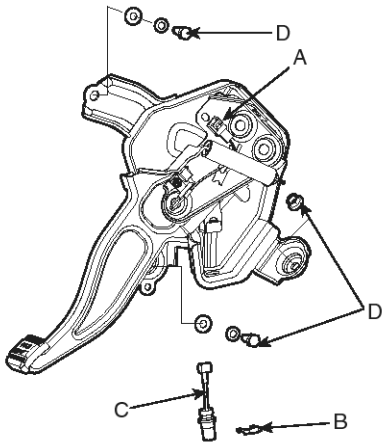
SENBR9309L

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

Removal

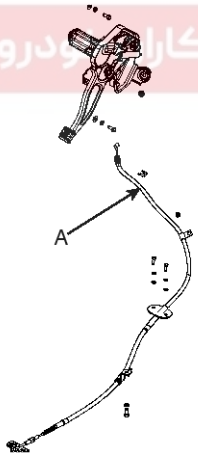
Parking Brake Pedal

1. Disconnect the parking brake switch connector(A).



SENBR7525D

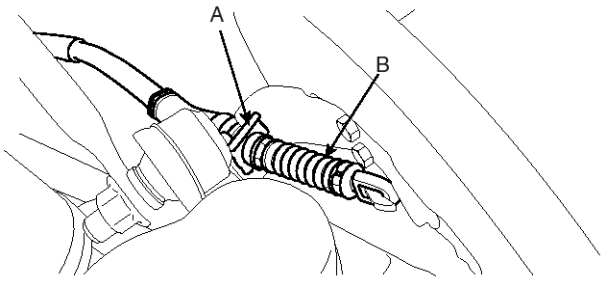
2. Remove the mounting clip(B), then remove the parking brake cable(C).
3. Remove the parking brake pedal mounting bolts and nut(D), then remove the parking brake pedal.
4. Remove the floor console. (Refer to BD Gr. 'Console').
5. Remove the floor carpet.
6. Remove the parking brake cable(A).



SENBR7526D

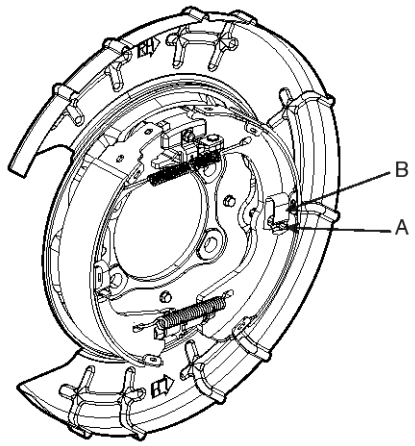
Parking Brake Shoe

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).



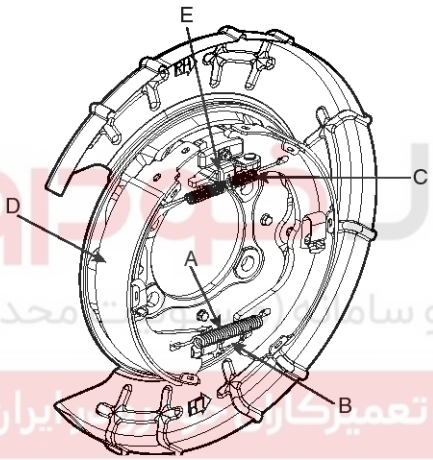
SENBR7626D

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



SENBR7527D

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



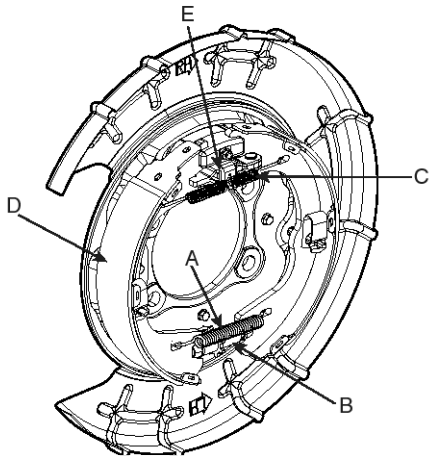
SENBR7565L

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

Installation

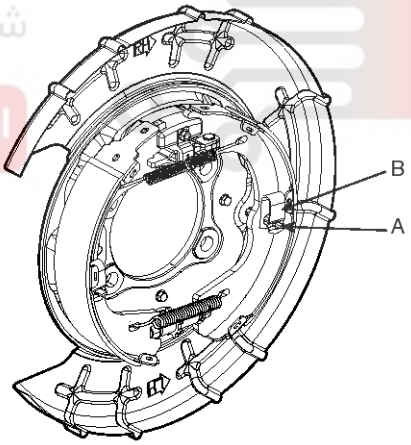
Parking Brake Shoe

1. Install the operating lever assembly (E).



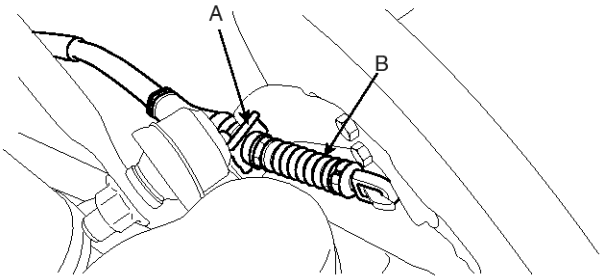
SENBR7565L

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.



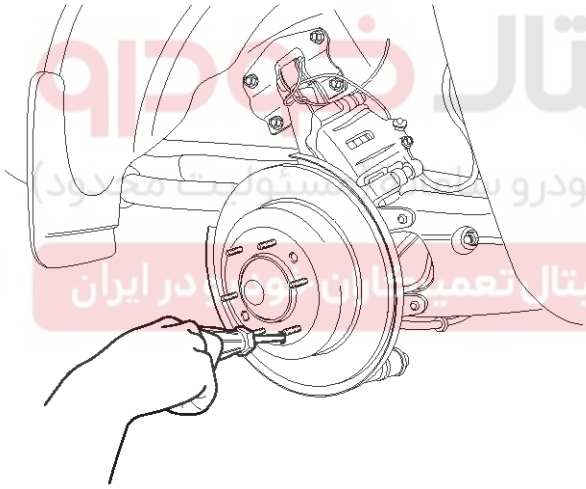
SENBR7527D

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

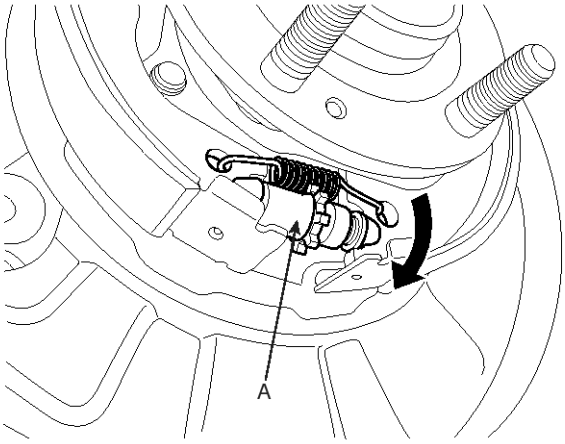


SENBR7626D

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.



SCMBR6533D



SCMBR6534D

7. Install the brake caliper. (Refer to "Rear brake installation")
8. Install the tire and wheel.
9. 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 pedal 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% uphill.

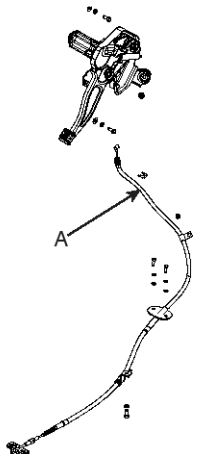
⚠CAUTION

After adjusting parking brake, notice following matter;

1. **Must be free from troubles when the parking pedal is operated at 981N(100 kgf, 220 lb).**
2. **Check that all parts move smoothly.**
3. **The parking brake indicator lamp must be on after the parking pedal is worked and must be off after the pedal is released.**

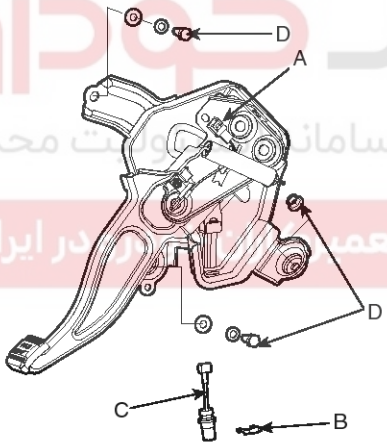
Parking Brake Pedal

1. Install the parking brake cable(A).



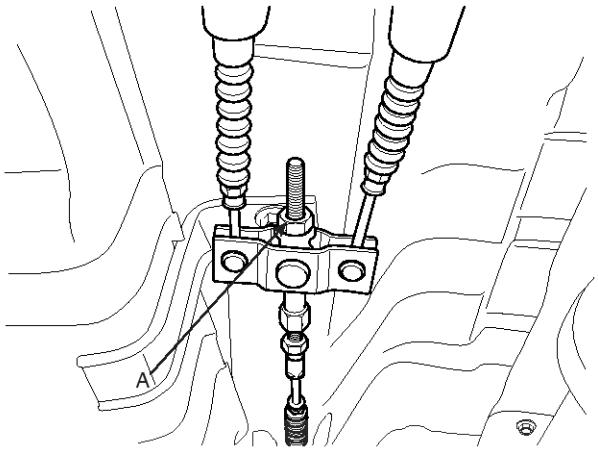
SENBR7526D

2. Install the floor carpet.
3. Install the floor console. (Refer to BD Gr. 'Console').
4. Install the parking brake pedal , and then install the parking brake pedal mounting bolts and nut(D).



SENBR7525D

5. Install the parking brake cable(C) , and then install the mounting clip(B).
6. Adjust the parking brake pedal stroke by turning the adjusting nut(A).
   1) Adjust the adjusting nut(A) so that parking brake pedal stroke is to be 88~98mm (3.46~3.86in) when operating effort is 196 N(20 kgf, 44 lb) after full stroke operation of parking brake pedal over 3 times for setting parking wire.



SENBR7530D

NOTICE

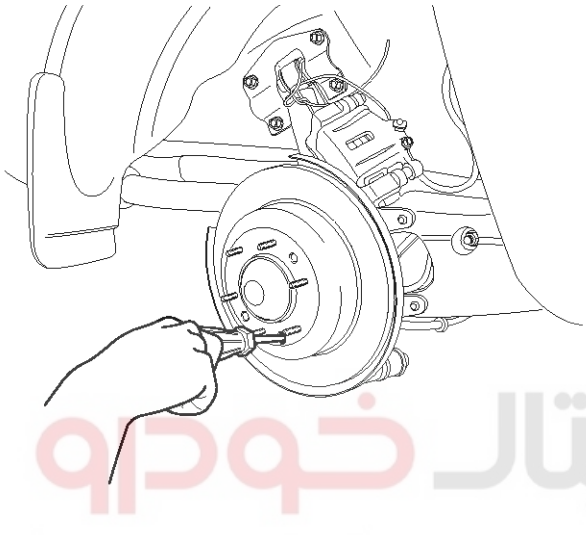
1. *The parking brake adjustment must be carried out after adjusting the rear shoe.*
2. *After adjusting parking brake, notice following matter.*
   a. *Must be free from clearance between adjusting nut and pin.*
   b. *Check securely that the brake is not dragging.*

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

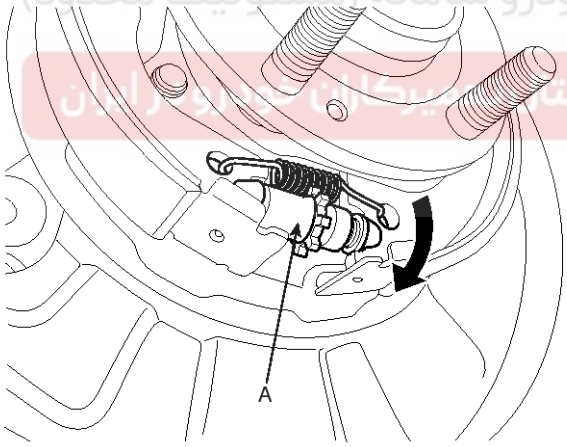
Adjustment

Parking Brake Shoe Clearance Adjustment

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



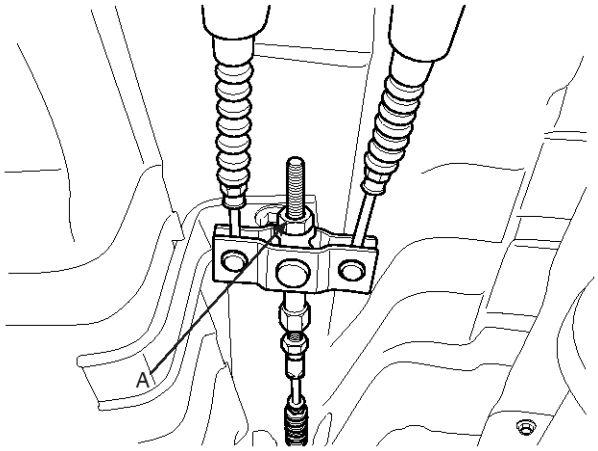
SCMBR6533D



SCMBR6534D

Parking Brake Pedal Stroke Adjustment

1. Adjust the adjusting nut(A) so that parking brake pedal stroke is to be 88~98mm (3.46~3.86in) when operating effort is 196 N(20 kgf, 44 lb) after full stroke operation of parking brake pedal over 3 times for setting parking wire.



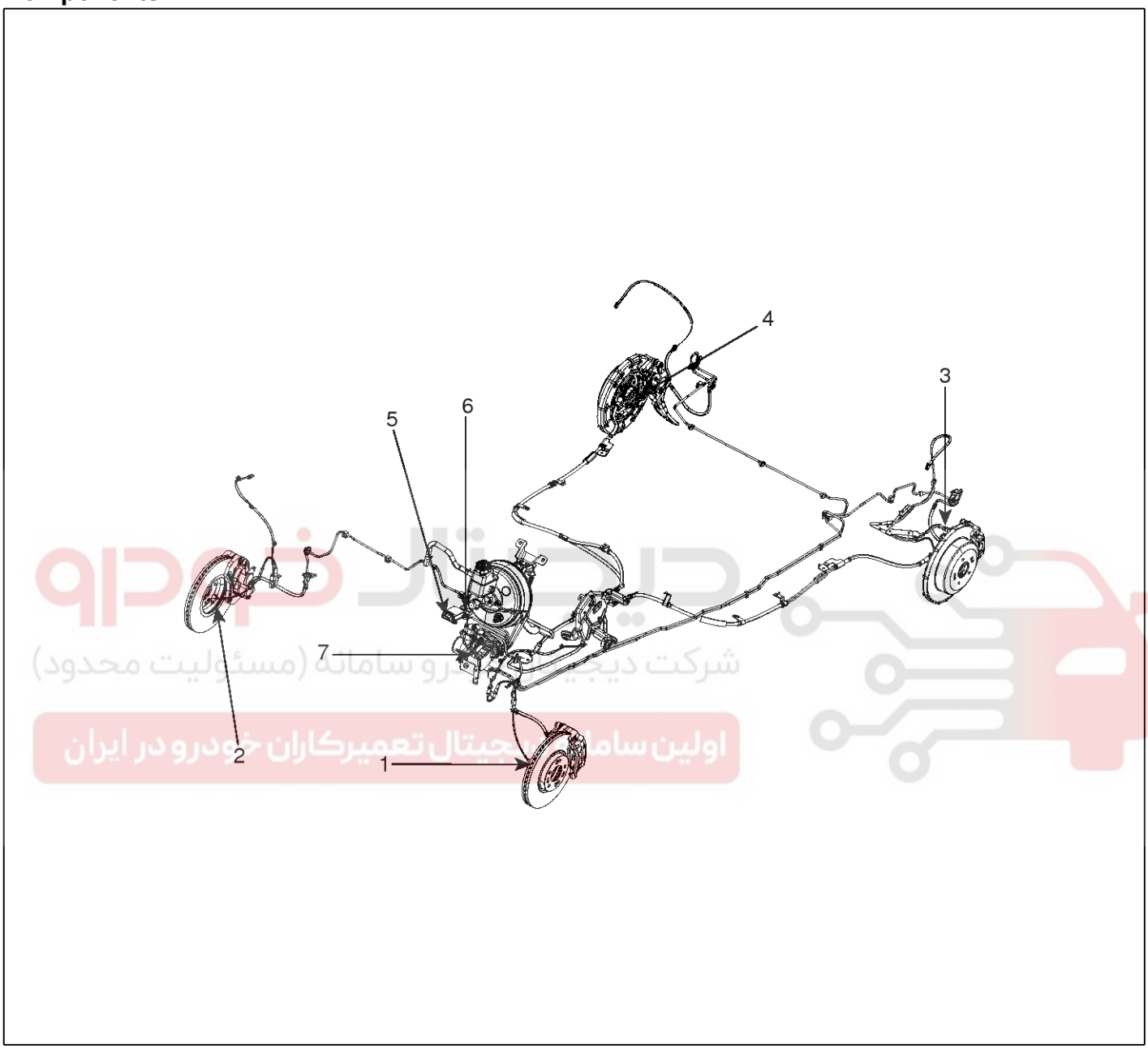
SENBR7530D

NOTICE

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

ABS(Anti-Lock Brake System)

Components



SENBR9310L

1. Front left wheel speed sensor
2. Front right wheel speed sensor
3. Rear left wheel speed sensor
4. Rear right wheel speed sensor
5. Yaw-rate & lateral G sensor
6. Longitudinal G sensor
7. ABS control module (HECU)

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/ESP 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 17 ± 0.5 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 10V), 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

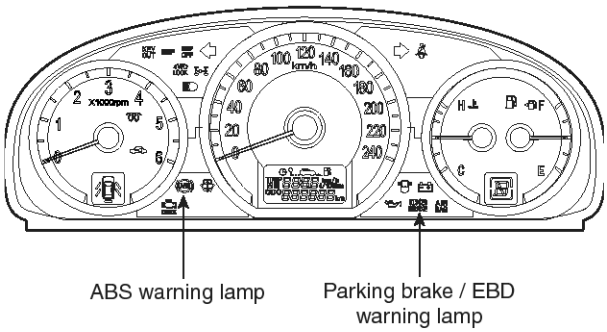
The ECU performs a pump motor test at a speed of 12 km/h(7 MPH) once after IGN is switched on.

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 in the test line of manufactories (Air-bleeding line or Roll and Brake Test line).

Warning Lamp Module



SENBR7548L

1. 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.

2. PARKING/EBD 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:

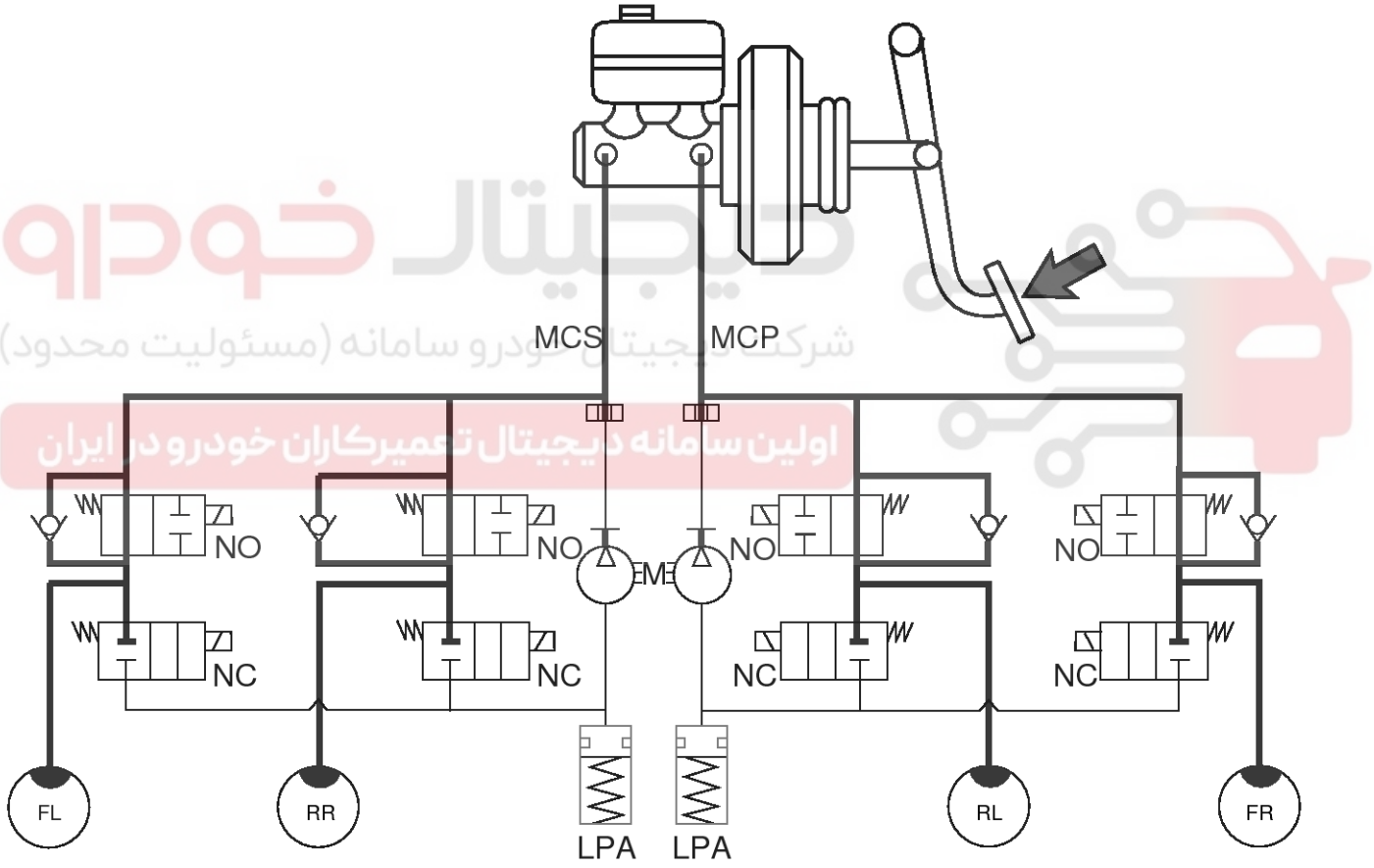
   - During the initialization phase after IGN ON. (continuously 3 seconds).
   - When the Parking Brake Switch is ON or brake fluid level is low.
   - When the EBD function is out of order.
   - During diagnostic mode.
   - When the ECU Connector is seperated from ECU.

ABS Control

1. NORMAL BRAKING without ABS

   Under the normal braking, voltage is not supplied to solenoid valve, inlet valve is opened and outlet valve is closed.When the brake is depressed, brake fluid is supplied to the wheel cylinder via solenoid valve to activate the brake.When the brake is released, brake fluid is back to the master cylinder via inlet valve and check valve.

Solenoid valve	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder ⇔ Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder ⇔ Reservoir	

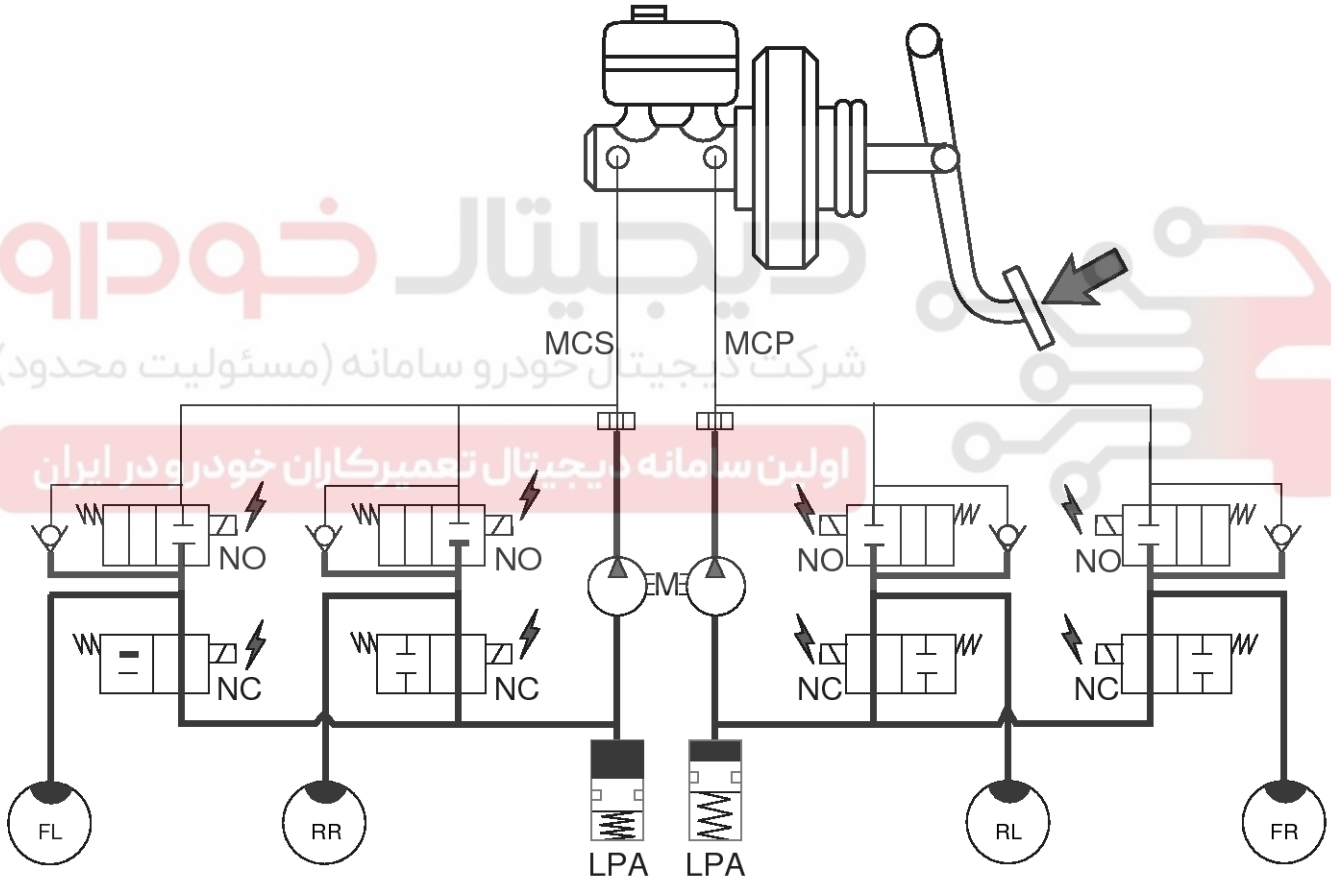


LJJF500W

2. DUMP MODE

Under the emergency braking, if the wheels start to lock up, HECU sends a signal to the solenoid valve to decrease the brake fluid, then voltage is supplied to each solenoid. At this time inlet valve is closed and brake fluid is blocked from the master cylinder. Conversely outlet valve is opened and brake fluid passes through wheel cylinder to reservoir, resulting in pressure decrease.

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	Close	Master cylinder ⇔ Wheel cylinder	ON
Outlet valve (NC)	ON	Open	Wheel cylinder ⇔ Reservoir	

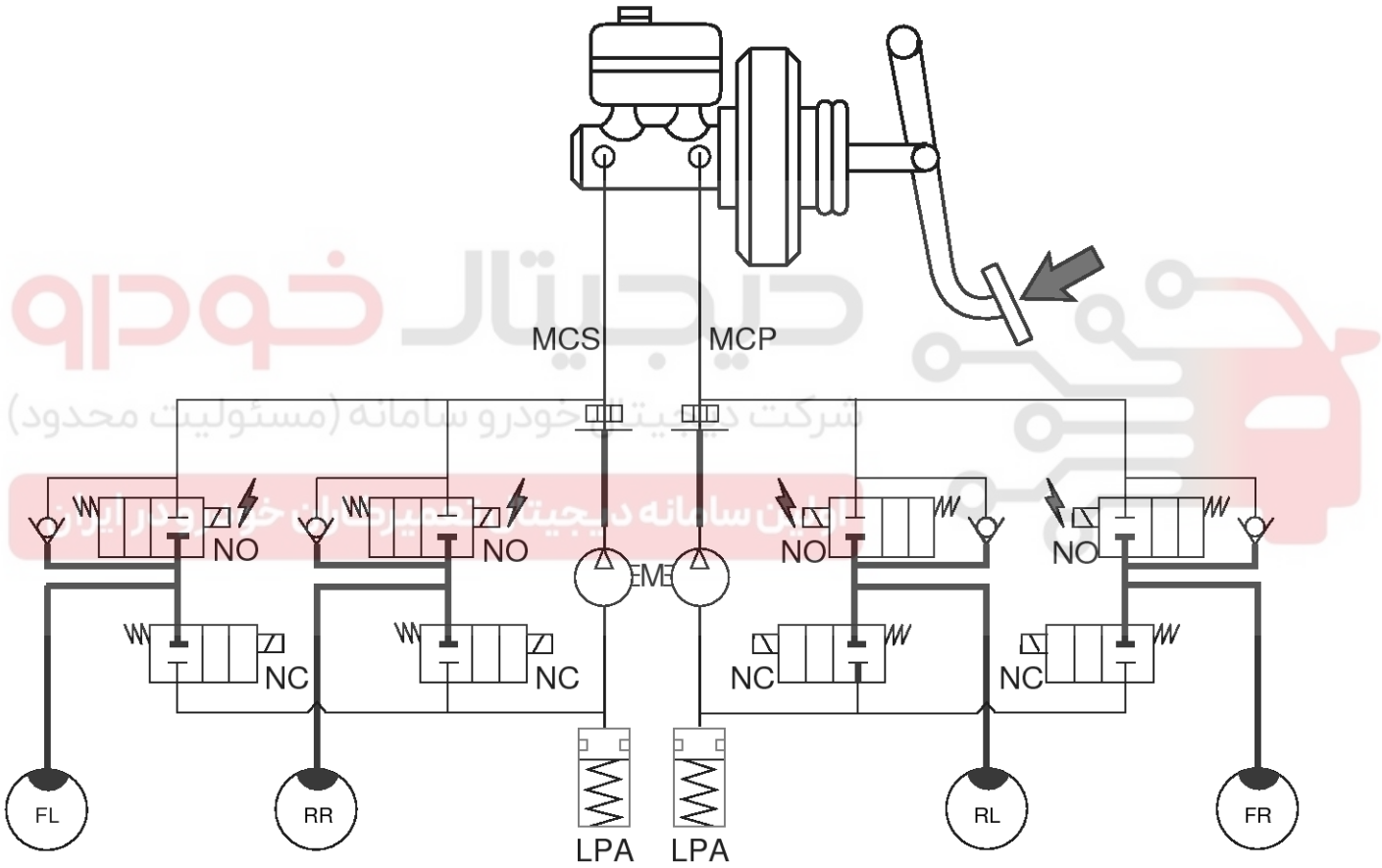


LJJF500X

3. HOLD MODE

When the brake fluid pressure is maximally decreased in wheel cylinder, HECU sends a signal to solenoid valve to keep the fluid pressure, voltage is supplied to inlet valve but it is not supplied to outlet valve. At this time inlet and outlet valves are closed and brake fluid is kept in wheel cylinder.

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	Close	Master cylinder ⇔ Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder ⇔ Reservoir	

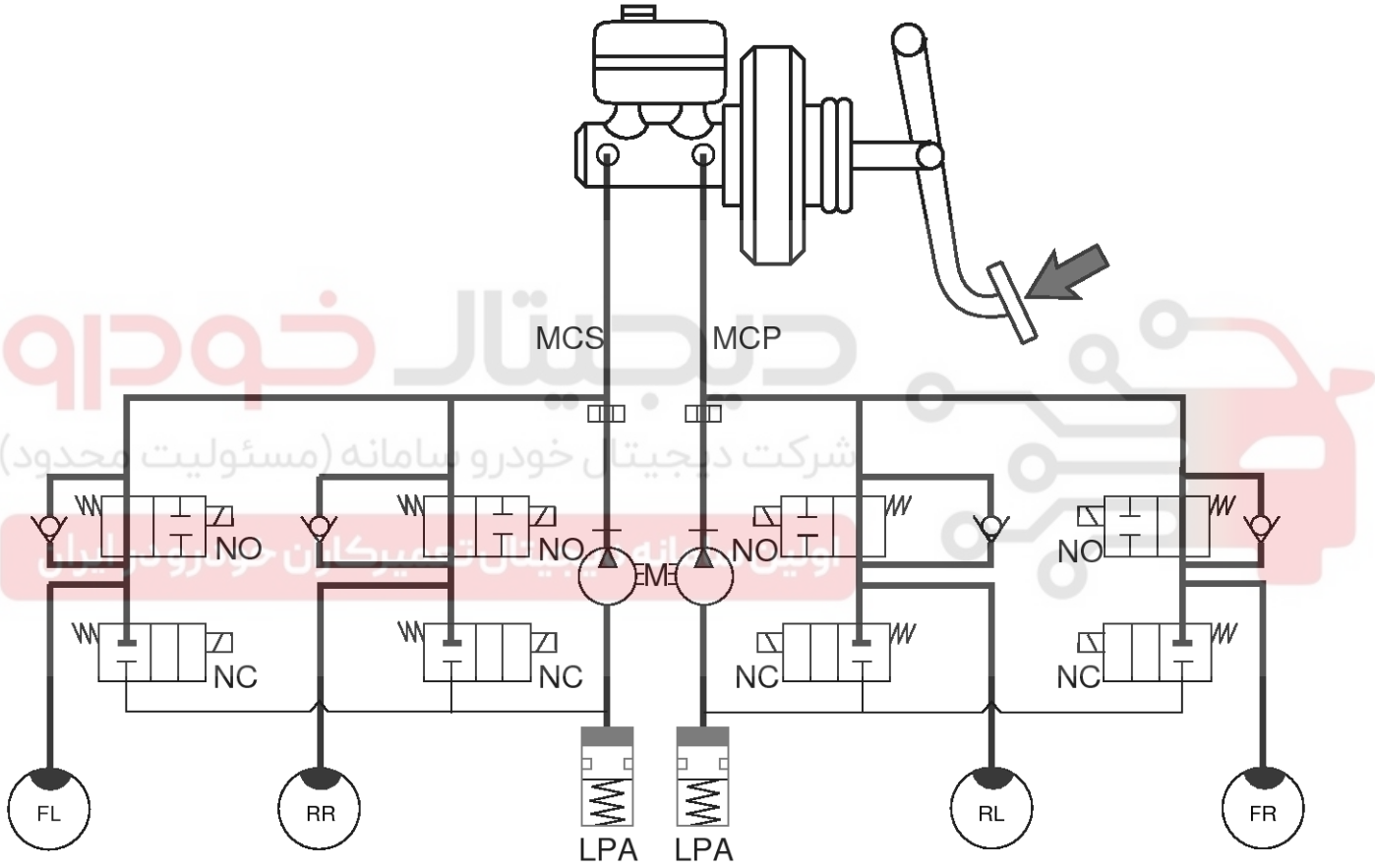


LJJF500Y

4. INCREASE MODE

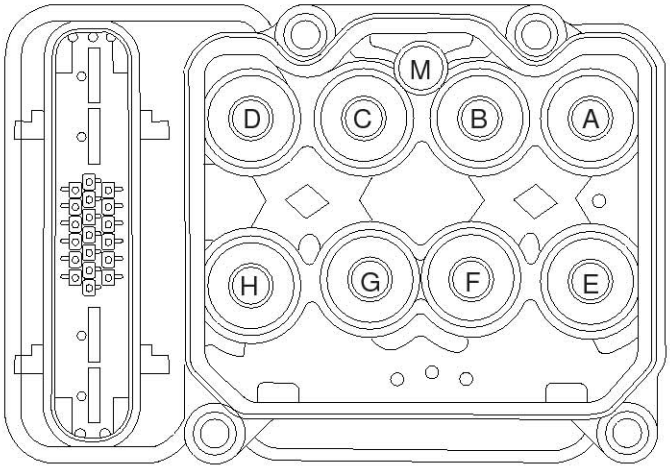
If HECU determines there's no lock-up in the wheel, HECU cuts voltage to solenoid valve. So voltage is not supplied to each solenoid valve, brake fluid passes through the inlet valve to wheel cylinder, resulting in pressure increase.

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	Open	Master cylinder ⇔ Wheel cylinder	ON
Outlet valve (NC)	OFF	Close	Wheel cylinder ⇔ Reservoir	



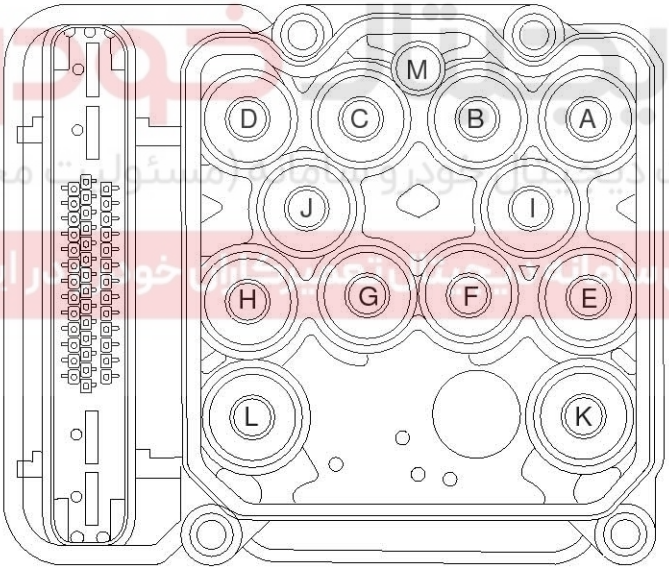
LJJF500Z

ABS Hecu External Diagram



A : INLET VALVE (FR)
B : INLET VALVE (RL)
C : INLET VALVE (RR)
D : INLET VALVE (FL)
E : OUTLET VALVE (FR)
F : OUTLET VALVE (RL)
G : OUTLET VALVE (RR)
H : OUTLET VALVE (FL)
M : MOTOR Connector

<ABS HECU>

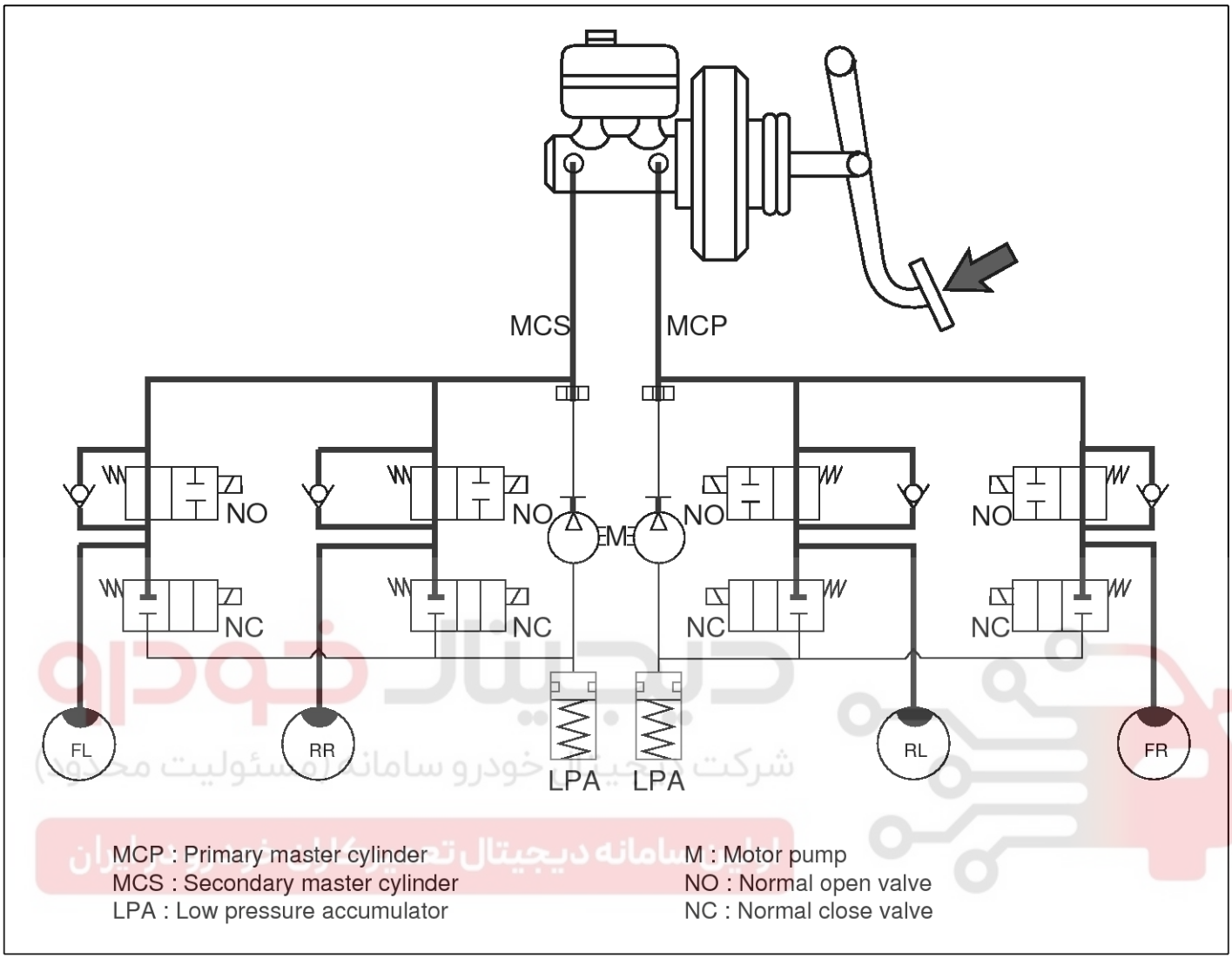


A : INLET VALVE (FR)
B : INLET VALVE (RL)
C : INLET VALVE (RR)
D : INLET VALVE (FL)
E : OUTLET VALVE (FR)
F : OUTLET VALVE (RL)
G : OUTLET VALVE (RR)
H : OUTLET VALVE (FL)
I : ELECTRIC SHUTTLE VALVE (ESV-R)
J : ELECTRIC SHUTTLE VALVE (ESV-L)
K : TRACTION VALVE (TCR)
L : TRACTION VALVE (TCL)
M : MOTOR Connector

<VDC HECU>

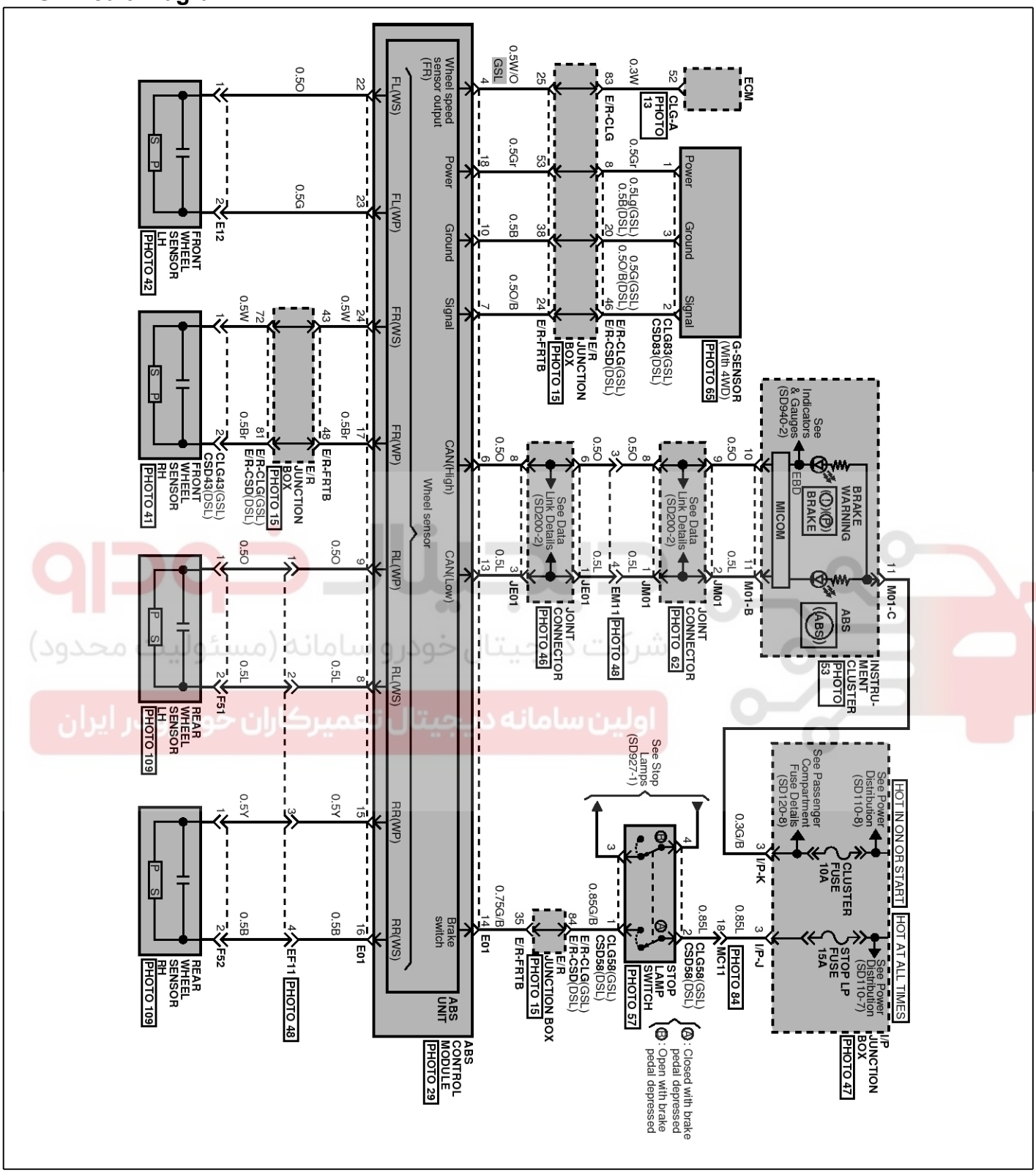
SENBR7600D

Hydraulic System Diagram

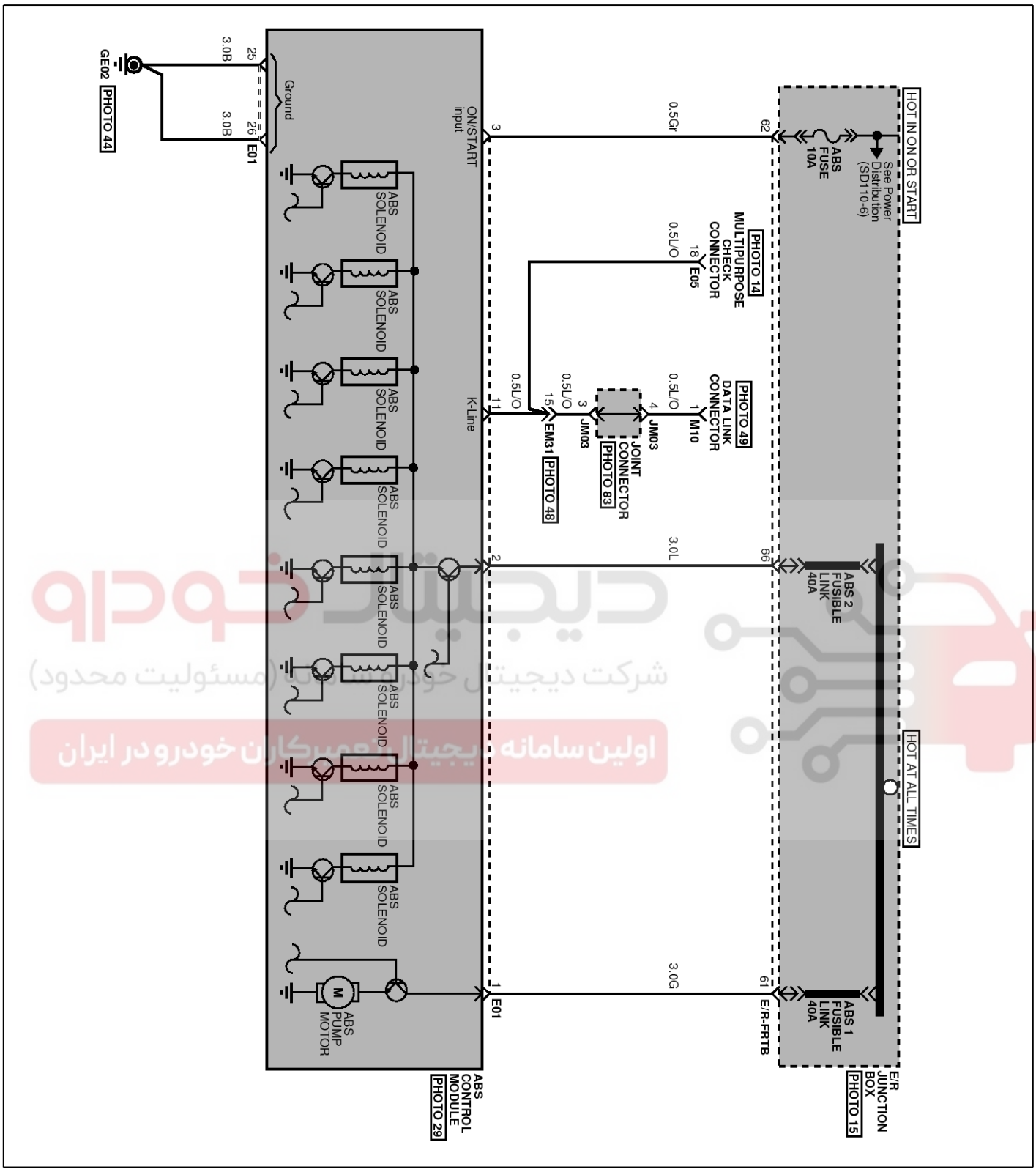


LJJF501B

ABS Circuit Diagram

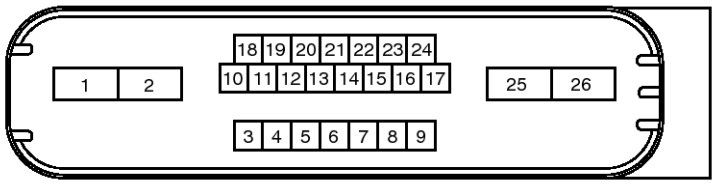


SENBR7549L



SENBR7550L

ABS CONNECTOR INPUT/OUTPUT

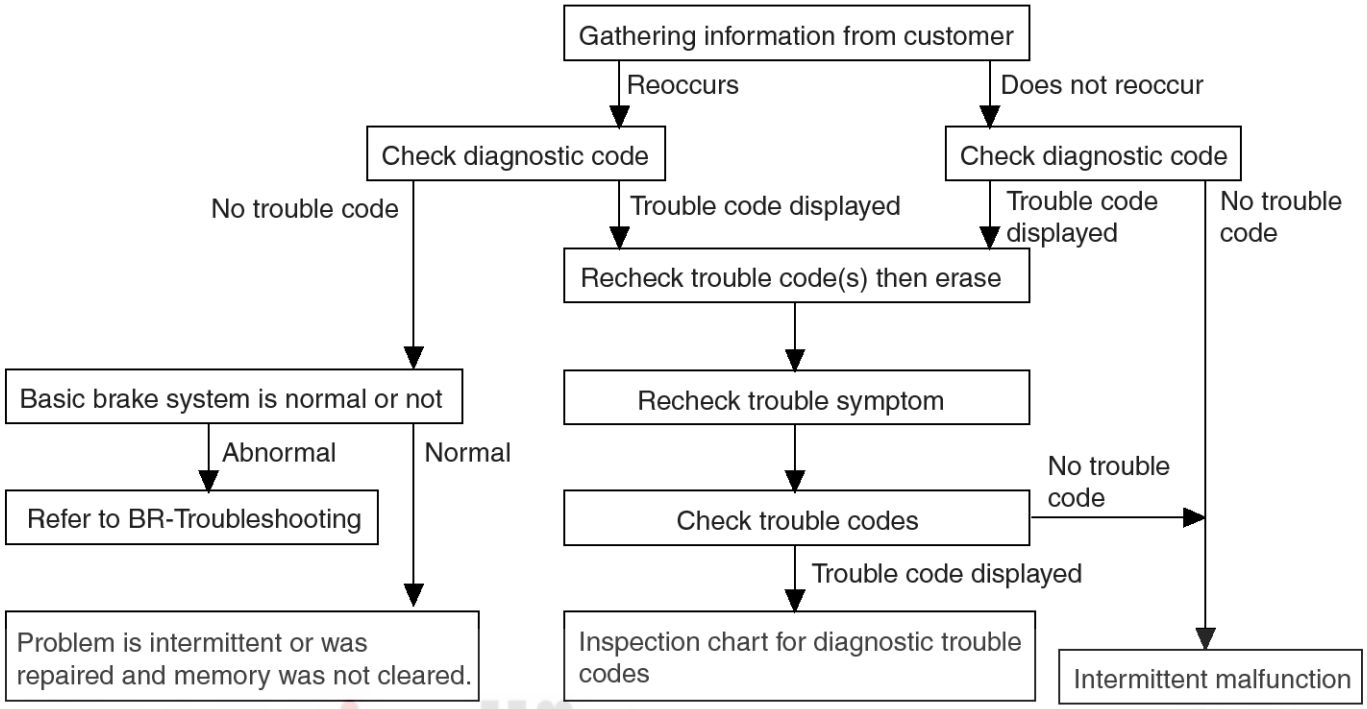


SENBR7602D

Connector Terminal		Specification	Remark
No	Description		
3	IGNITION1(+)	Over voltage range: 17 ± 0.5V Operating voltage range: 9.5 ± 0.5V < V < 17 ± 0.5V Low voltage range: 7.0 ± 0.5V < V < 9.5 ± 0.5V Max. current: I < 300mA	
2	POS. BATTERY.(SOLENOID)	Max leakage current : I < 0.8mA Operating voltage range: 9.5 ± 0.5V < V < 17 ± 0.5V Max current : I < 40A	
1	POS, BATTERY.(MOTOR)	Operating voltage range: 9.5 ± 0.5V < V < 16.5 ± 0.5V Rush current : I < 100A Max current : I < 40A Max leakage current : I < 0.2mA	
26	GROUND	Rated current : I < 300mA Max. current: I < 30A	
25	PUMP MOTOR GROUND	Rush current : I < 100A Max current : I < 40A	
10	G SENSOR GROUND (4WD Only)	- Rated current : I < 10mA	
18	G SENSOR POWER (4WD Only)	- Max Output current : I < 10mA - Max Output voltage : 4.75V ≤ V ≤ 5.25V	
7	G SENSOR SIGNAL (4WD Only)	- Input voltage : 0V ≤ V ≤ 5.0V - Zero offset voltage : 2.5 ± 0.1V	
14	BRAKE LIGHT SWITCH	Input voltage low: 0V ≤ V ≤ 3.0V Input voltage High: 7.0V ≤ V ≤ 16.0V	
23	SENSOR FRONT LEFT POWER	- Output voltage : IGN[V] ± 1V - Output current : Max 30mA	
17	SENSOR FRONT RIGHT POWER		
9	SENSOR REAR LEFT POWER		
15	SENSOR REAR RIGHT POWER		

Connector Terminal		Specification	Remark
No	Description		
22	SENSOR FRONT LEFT SIGNAL	- Input current LOW : 5.9 ~ 8.4mA - Input current HIGH : 11.8 ~ 16.8mA - Frequency range : 1 ~ 2000Hz - Input duty : 50 ± 20%	
24	SENSOR FRONT RIGHT SIGNAL		
8	SENSOR REAR LEFT SIGNAL		
16	SENSOR REAR RIGHT SIGNAL		
11	DIAGNOSIS INPUT/OUTPUT	Input voltage : VIL < 0.3 IGN[V] VIH > 0.7 IGN[V] Output voltage : VOL < 0.2 IGN[V] VOH > 0.8 IGN[V]	
13	CAN BUS LINE (LOW)	Max. current : I < 10mA	
6	CAN BUS LINE (HIGH)		
4	SENSOR FRONT RIGHT OUTPUT	Max. current : I < 16mA External pull up resister : 1kΩ < R Output duty : 50 ± 20%	

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.	

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

If a normal code is displayed during the DTC check but the problem still occurs, check the circuits for each problem symptom in the order given in the table below and proceed to the relevant troubleshooting page.

Symptom	Suspect Area
ABS does not operate.	Only when 1~4. are all normal and the problem is still occurring, replace the HECU. 1. Check the DTC reconfirming that the normal code is output. 2. Power source circuit. 3. Speed sensor circuit. 4. Check the hydraulic circuit for leakage.
ABS does not operate intermittently.	Only when 1~4. are all normal and the problem is still occurring, replace the ABS actuator assembly. 1. Check the DTC reconfirming that the normal code is output. 2. Wheel speed sensor circuit. 3. Stop lamp switch circuit. 4. Check the hydraulic circuit for leakage.
Communication with 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.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty 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 normal code is output.

   Is the normal code output?

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

Specification : approximately B+

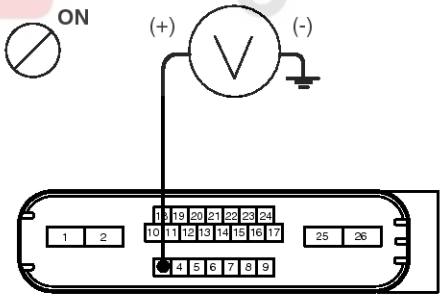
Is the voltage within specification?

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.



SENBR7603D

Check the Ground Circuit

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 25, 26 of the ABS control module harness side connector and ground point.

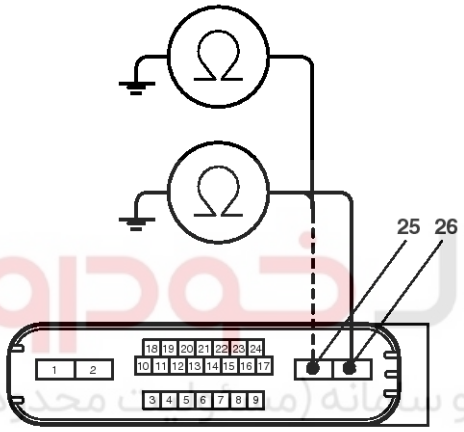
   Is there continuity?

YES

▶ Check the wheel speed sensor circuit.

NO

▶ Repair an open in the wire and ground point.



SENBR7604D

Check the Wheel Speed Sensor Circuit

Refer to the DTC troubleshooting procedures.

Is it normal?

YES

▶ Check the hydraulic circuit for leakage.

NO

▶ Repair or replace the wheel speed sensor.

Check the Hydraulic Circuit for Leakage

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is it normal?

YES

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

NO

▶ Repair the hydraulic lines for leakage.

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.	- Faulty power source circuit - Faulty wheel speed sensor circuit - Faulty hydraulic circuit for leakage - Faulty 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 normal code is output.

   Is the normal code output?

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 it normal?

YES

▶ Check the stop lamp switch circuit.

NO

▶ Repair or replace the wheel speed sensor.

Check the Stop Lamp Switch Circuit

1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 14 of the ABS control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

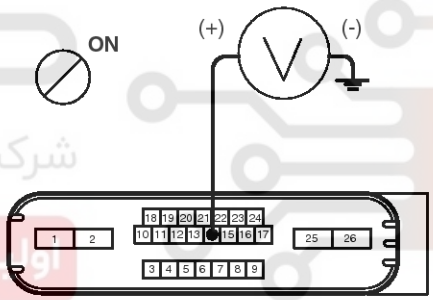
Is the voltage within specification?

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.



SENBR7605D

Check the Hydraulic Circuit for Leakage

Refer to the hydraulic lines.

Inspect leakage of the hydraulic lines.

Is it normal?

YES

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

NO

▶ Repair the hydraulic lines for leakage.

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

BJKG500S

Detecting Condition

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

Inspection Procedures

Check the Power Supply Circuit for the Diagnosis

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

Specification : approximately B+

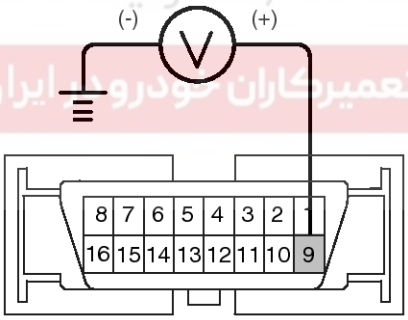
Is voltage within specification?

YES

▶ Check the ground circuit for the diagnosis.

NO

▶ Repair an open in the wire. Check and replace fuse (15A) from the engine compartment junction block.



SUNBR6519L

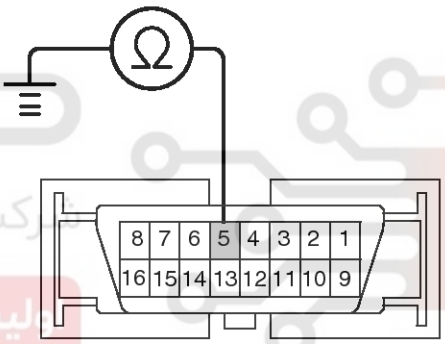
Check the Ground Circuit for the Diagnosis

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

Is there continuity?

NO

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



SUNBR6520L

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

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 - Faulty HECU - Faulty 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 7 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 3 of the ABS control module harness side connector and body ground.

Specification : approximately B+

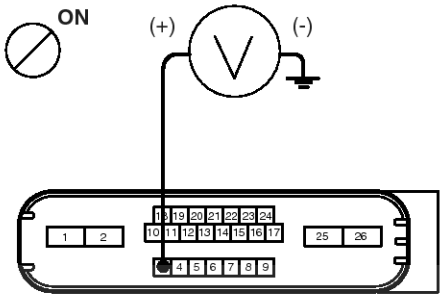
Is voltage within specification?

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.



SENBR7603D

Check For Poor Ground

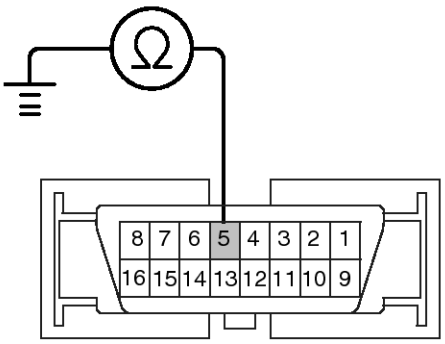
Check for continuity between terminal 5 of the data link connector and ground point.

YES

▶ Replace the ABS control module and recheck.

NO

▶ Repair an open in the wire or poor ground.



SUNBR6520L

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 HECU, and the faulty HECU.	- Faulty ABS warning lamp bulb - Blown fuse is related to ABS in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

Inspection Procedures

Problem Verification

Disconnect the connector the ABS HECU and turn the ignition switch ON.

Does the ABS waring lamp light up?

NO

▶ Check the power source for the ABS warning lamp.

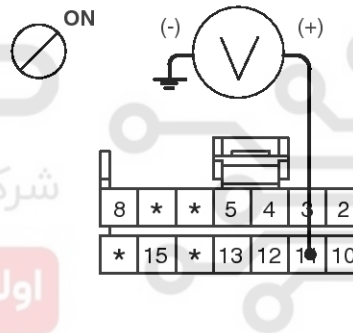
YES

▶ Inspect again after replacing the ABS HECU.

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 (M01-C) 11 of the cluster harness side connector and body ground.

Specification : approximately B+



SENBR7606D

Is voltage within specification?

NO

▶ Check for blown fuse.

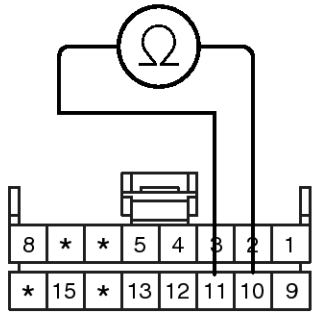
YES

▶ Check the CAN circuit resistance for ABS warning lamp.

Check the Can Circuit Resistance for ABS Warning Lamp

1. Disconnect the instrument cluster connector (M01-B) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M01-B) 10 and 11 of the cluster harness side connector.

Specification : 60Ω



SENBR7607D

Is resistance within specification?

NO

▶ Check the CAN circuit wiring for ABS warning lamp.

YES

▶ Repair ABS warning lamp bulb or instrument cluster assembly.

Check the Can Circuit Wiring for ABS Warning Lamp

1. Disconnect the instrument cluster connector (M01-B) and ABS HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M01-B) 10 of the cluster harness side connector and terminal 6 of ABS HECU harness side.

   Check for continuity between terminal (M01-B) 11 of the cluster harness side connector and terminal 13 of ABS HECU harness side.

Specification : Below 1Ω

Is resistance within specification?

NO

▶ Repair open of wiring between terminal 11, 13 of ABS HECU harness connector and ABS warning lamp module.

YES

▶ Repair short of wiring between terminal 11, 13 of ABS HECU harness connector and ABS warning lamp module.

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

EJBF505Y

Detecting Condition

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

Inspection Procedures

Check DTC Output

1. Connect the 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?

NO

▶ Check the CAN circuit resistance for ABS warning lamp.

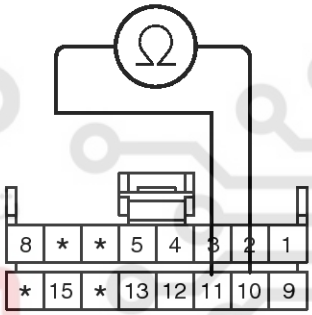
YES

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

Check the Can Circuit Resistance for ABS Warning Lamp

1. Disconnect the instrument cluster connector (M01-B) and turn the ignition switch OFF.
2. Measure the resistance between terminal (M01-B) 10 and 11 of the cluster harness side connector.

Specification : 60Ω



SENBR7607D

Is resistance within specification?

NO

▶ Check the CAN circuit wiring for ABS warning lamp.

YES

▶ Repair ABS warning lamp bulb or instrument cluster assembly.

Check The Can Circuit Wiring For Abs Warning Lamp

1. Disconnect the instrument cluster connector (M01-B) and ABS HECU connector, and then turn the ignition switch OFF.
2. Check for continuity between terminal (M01-B) 10 of the cluster harness side connector and terminal 6 of ABS HECU harness side.

   Check for continuity between terminal (M01-B) 11 of the cluster harness side connector and terminal 13 of ABS HECU harness side.

Specification : Below 1Ω

Is resistance within specification?

NO

▶ Repair open of wiring between terminal 11 ,13 of ABS HECU harness connector and ABS warning lamp module.

YES

▶ Repair short of wiring between terminal 11 ,13 of ABS HECU harness connector and ABS warning lamp module.

If no trouble in wiring, inspect again after replacing the ABS HECU.

Bleeding Of Brake System

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

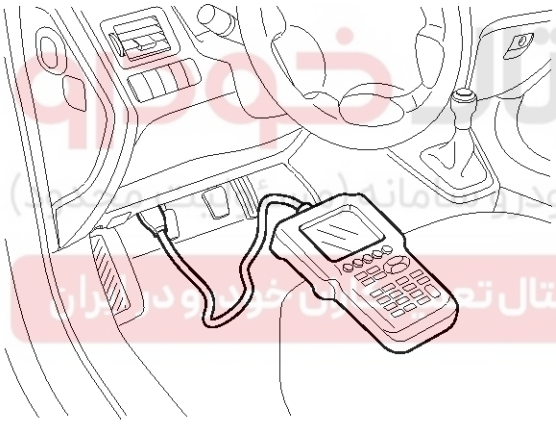
1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

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

   NOTICE
   When pressure bleeding, do not depress the brake pedal.

   Recommended fluid..... DOT3 or DOT4

2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.
3. Connect the scan tool to the data link connector located underneath the dash panel.



ARJE503N

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 HYUNDAI 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.

```
          < PRE BLEEDING >

1. Perform the bleeding of conventiona
   parts certainly.

2. Press [ENTER] key to activate pump
   motor and all NC valves.
```

SUNBR6522L

   6) Wait 120 sec. before operating the air bleeding. (If not, you may damage the motor.)

```
 NOW, ALL NC VALVES AND PUMP MOTOR
ARE ACTIVATING. DURING THIS TIME,
IT SHOULD BE REPEATED THAT DEPRESS-
ING THE BRAKE PEDAL UNTIL IT REACHES
TO THE BOTTOM OF FLOOR WITHOUT REA-
CTION AND RELEASING THE BRAKE PEDAL
UNTIL THE KICK BACK SITUATION IS
OVER.
 PLEASE WAIT 120 SECONDS.
```

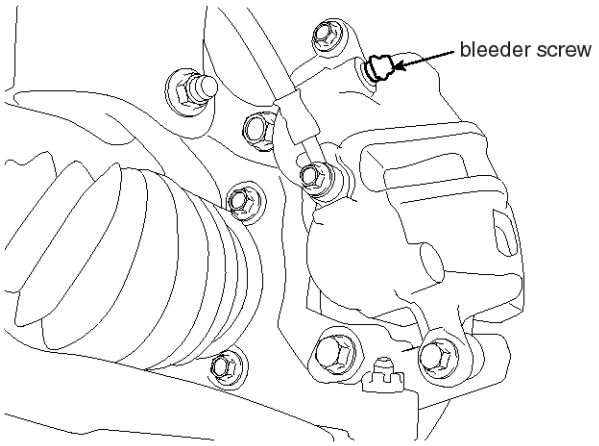
SUNBR6523L

   7) Perform the air bleeding.

```
          < FINAL BLEEDING >
1. Perform the bleeding of conventiona
   parts certainly.
2. If the brake pedal stroke is not so
   good after above procedure, perform
   the all procedure more some times
   and recheck the brake pedal stroke.
3. Press [ENTER] key to return the
   first bleeding mode.
```

SUNBR6621L

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.



SENBR7563L

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

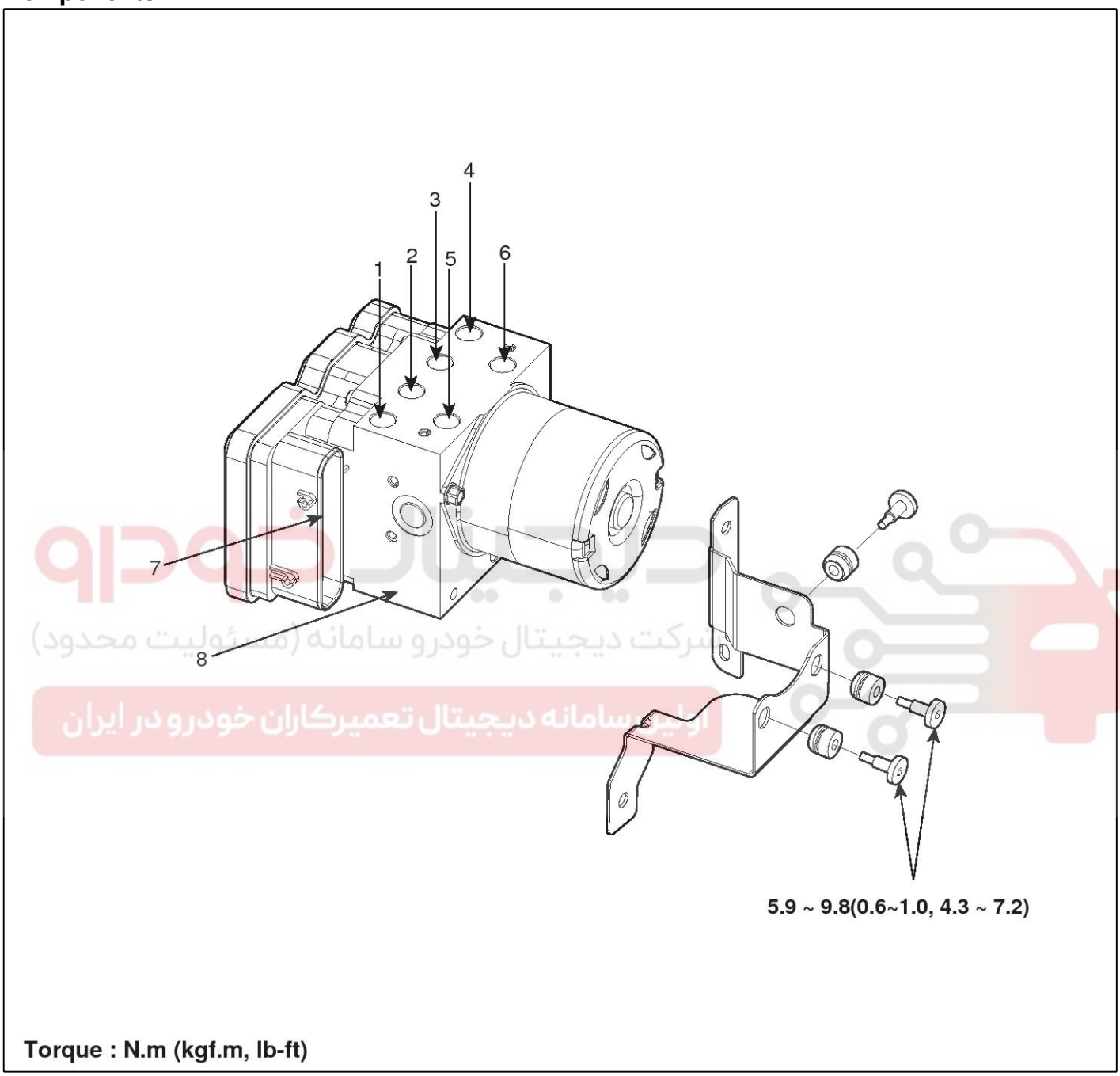
KJKE003B

7. Tighten the bleeder screw.

Bleed screw tightening torque:
6.86 ~ 12.74 N.m (0.7 ~ 1.3 kgf.m, 5.09 ~ 9.45 lb-ft)

ABS Control Unit

Components

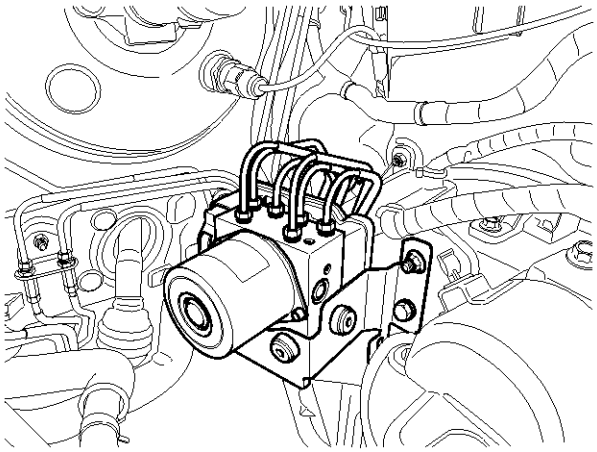


SENBR9311L

1. Front-left tube
2. Rear-right tube
3. Rear-left tube
4. Front-right tube
5. MC2
6. MC1
7. ABS control module connector (26P)
8. ABS control module(HECU)

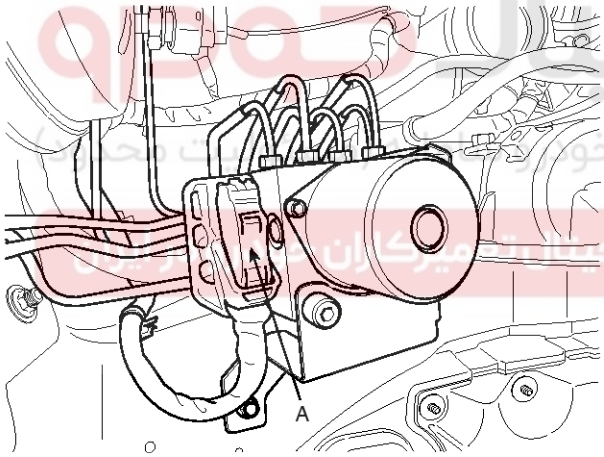
Removal

1. Turn the ignition switch OFF.
2. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.



SENBR7005D

3. Pull up the lock (A) of the ABS control unit 26P connector , then disconnect the connector.



SENBR7006D

4. Loosen the 3 ABS HECU bracket bolts, then remove HECU and bracket.

⚠CAUTION

1. **Never attempt to disassemble the HECU.**
2. **The HECU must be transported and stored in.**
3. **Never shock to the HECU.**

5. Remove the 3 bolts, then remove the bracket from HECU.

Installation

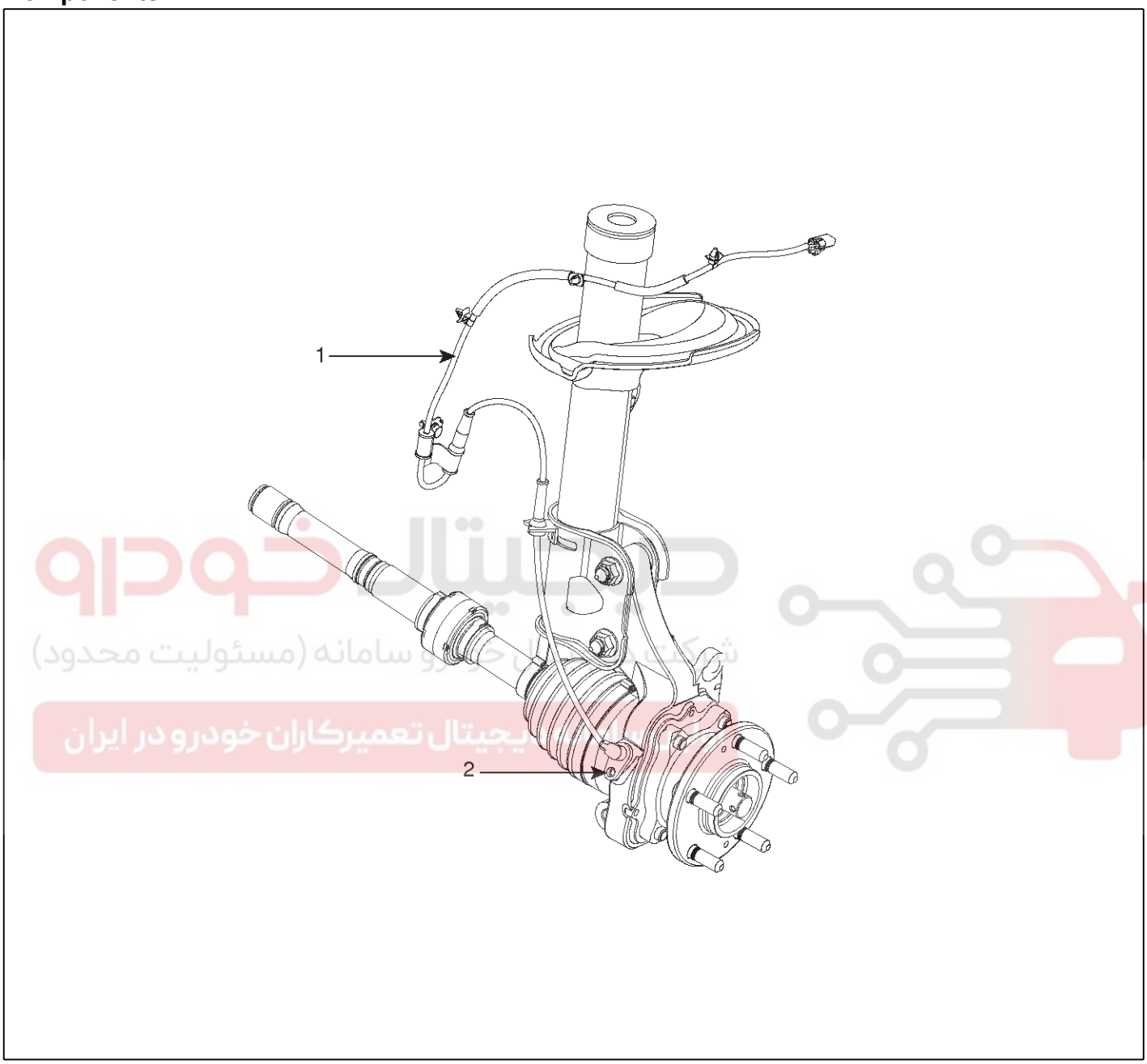
1. Installation is the reverse of removal.
2. Tighten the HECU mounting bolts and nuts to the specified torque.

Tightening torque

HECU bracket nuts :
5.9 ~ 9.8 N.m (0.6 ~ 1.0 kgf.m, 4.3 ~ 7.21 lb-ft)
HECU bracket mounting bolt :
16.7 ~ 25.5 N.m (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)

Front Wheel Speed Sensor

Components

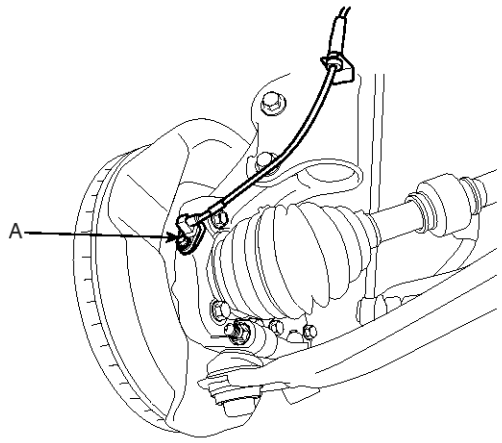


SENBR9312L

1. Front wheel speed sensor cable
2. Front wheel speed sensor

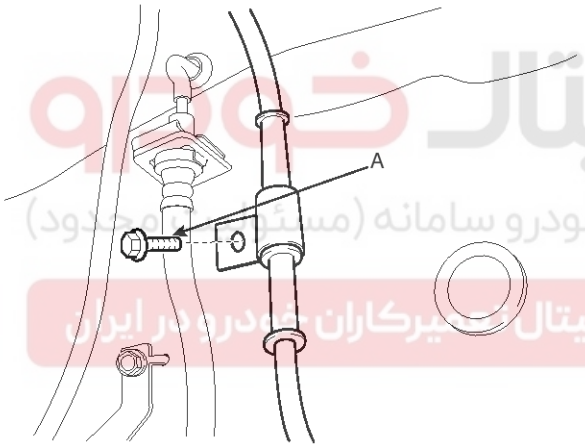
Removal

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



SENBR7611D

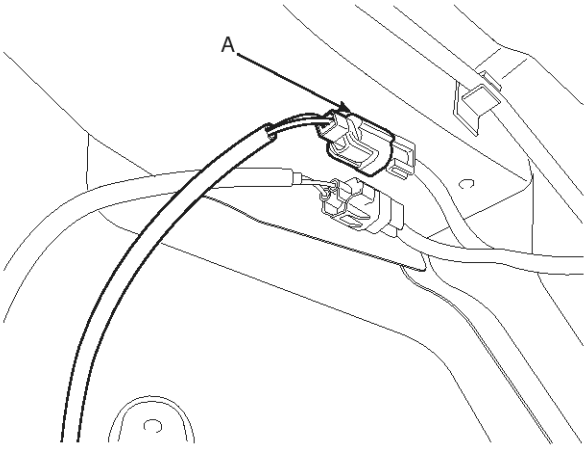
2. Remove the front wheel speed sensor bracket (A).



AJLG502E

3. Remove the front wheel guard .

4. Disconnect the front wheel speed sensor connector (A) , then remove the front wheel speed sensor.

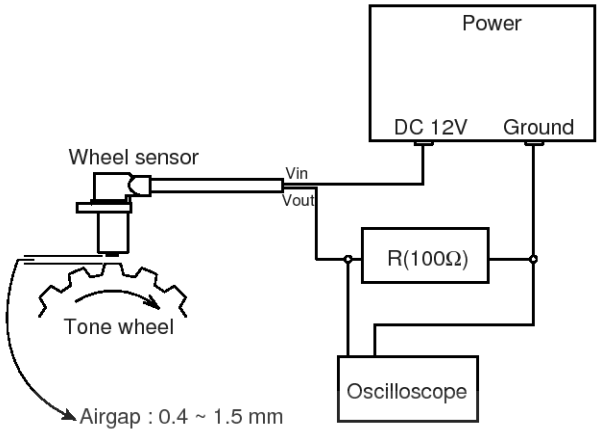


AJLG502F

Inspection

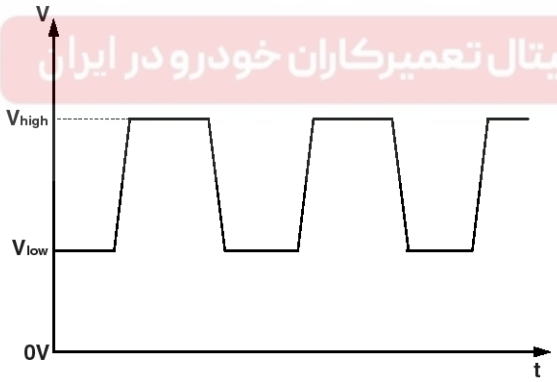
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

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



LJJF501M

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

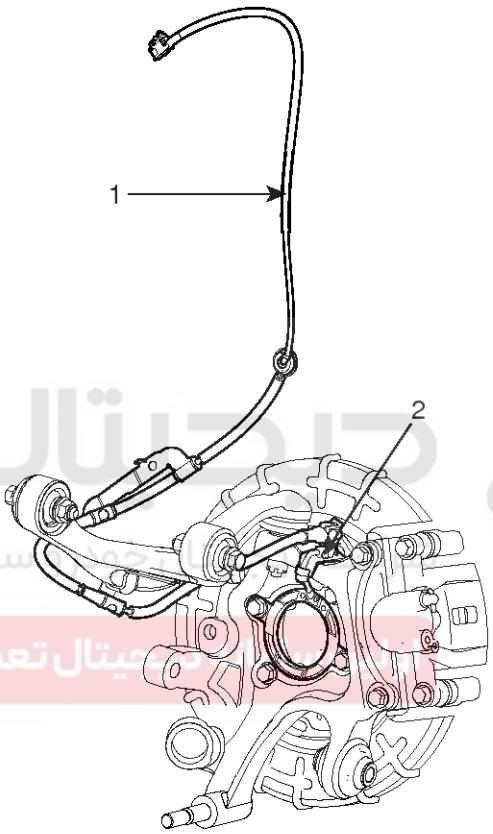


ARJE503Z

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

Rear Wheel Speed Sensor

Components



SENBR9313L

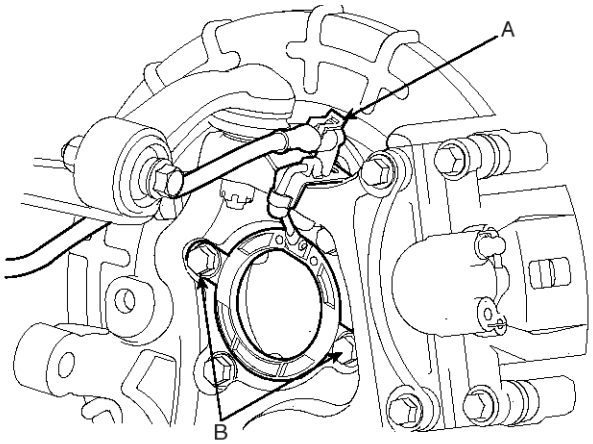
1. Rear wheel speed sensor cable
2. Rear wheel speed sensor

Removal

1. Remove the rear driveshaft.

   (Refer to DS Gr. - "Rear driveshaft assembly removal")

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



SENBR7554L

3. Remove the rear wheel speed sensor after remove the hub assembly mounting bolts (B).

Tightening torque :
78.5 ~ 88.3N.m (8.0 ~ 9.0kgf.m, 57.9 ~ 65.1lb-ft)

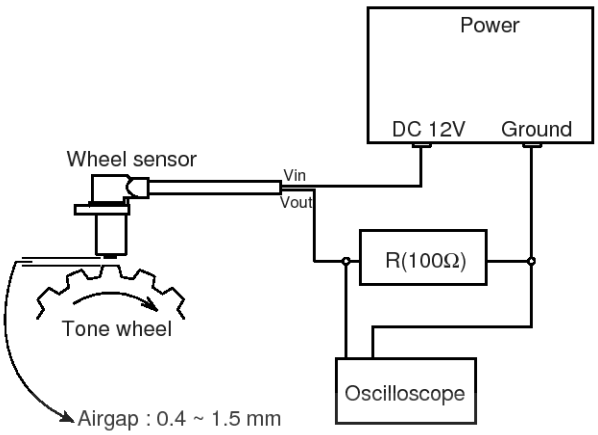
4. Installation is the reverse of removal.

NOTICE
For 2WD rear wheel speed sensor is in the hub assembly.

Inspection

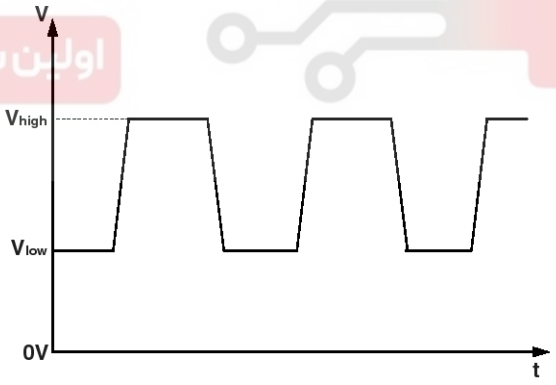
1. Measure the output voltage between the terminal of the wheel speed sensor and the body ground.

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



LJJF501M

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



ARJE503Z

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

EBD(Electronic Brake-force Distribution)

EBD (Electronic Brake-force Distribution) Operation

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.

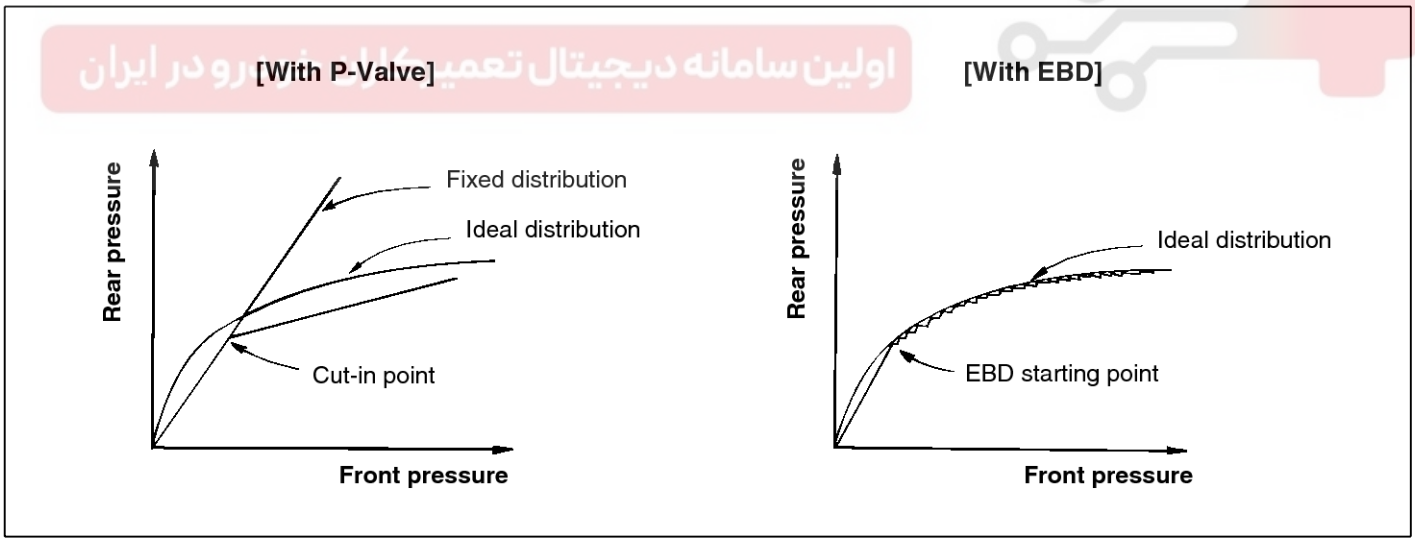
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

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.

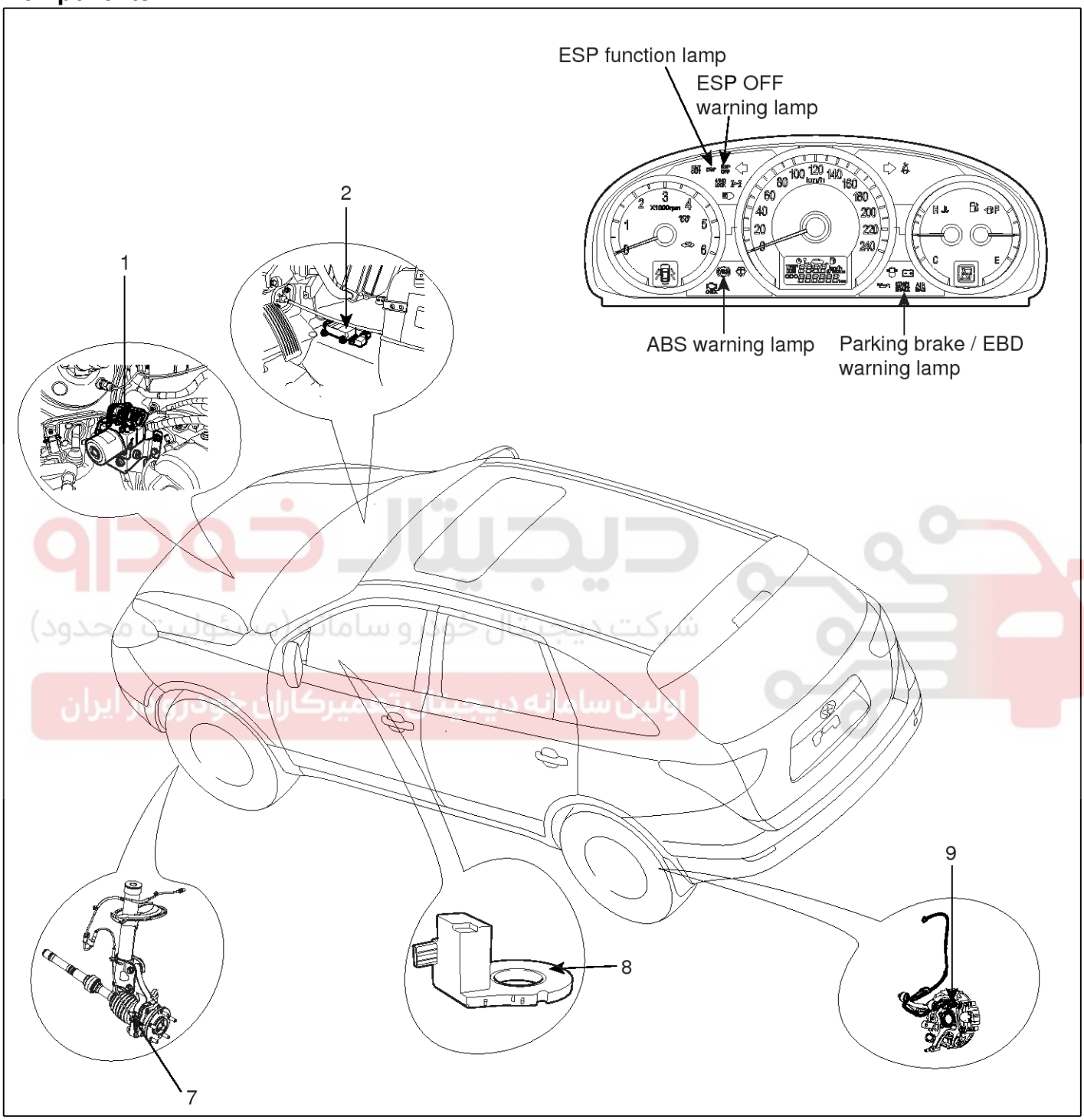
Comparison Between Proportioning Valve and EBD



EJA0032A

ESP(Electronic Stability Program) System

Components



SENBR9314L

1. HECU module
2. Yaw rate & Lateral G sensor
3. Parking brake/EBD warning lamp
4. ABS Warning lamp
5. ESP function lamp
6. ESP OFF warning lamp
7. Front wheel speed sensor
8. Steering angle sensor
9. Rear wheel speed sensor

Description of ESP

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

ESP is based on the MGH 40 ABS Hydraulic System. ESP recognizes critical driving conditions, such as panic reactions in dangerous situations, and stabilizes the vehicle by wheel-individual braking and engine control intervention with no need for actuating the brake or the gas pedal.

ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and EDC 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.

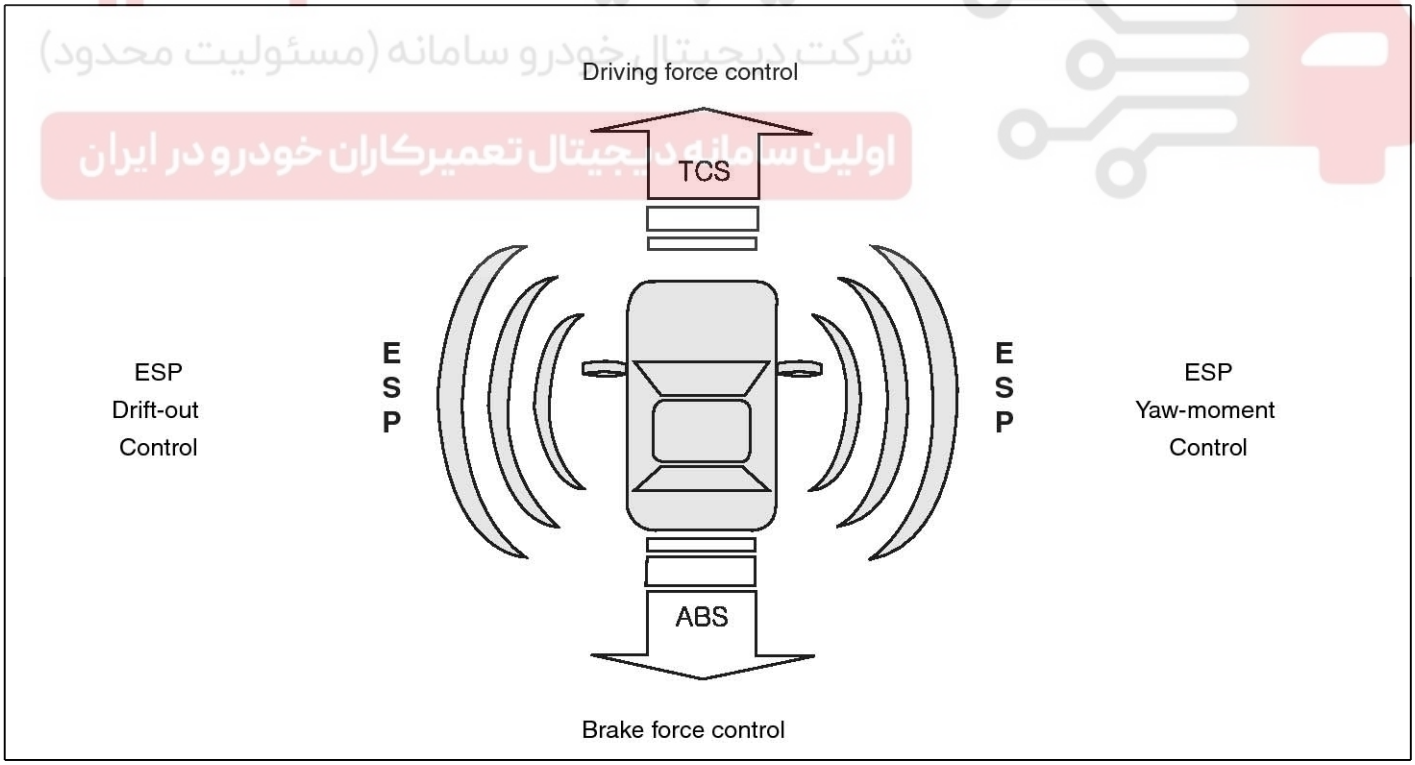
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

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

The electronic control unit incorporates the technological experience accumulated in connection with the MGH 40 system, but has been substantially expanded in terms of capacity and monitoring concept in order to permit the additional sensor signals and arithmetic operations to be processed and converted into corresponding valve, pump and engine control commands. Two 16-bit processors and one 8-bit processor, which monitor each other, cooperate to handle these requirements.

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

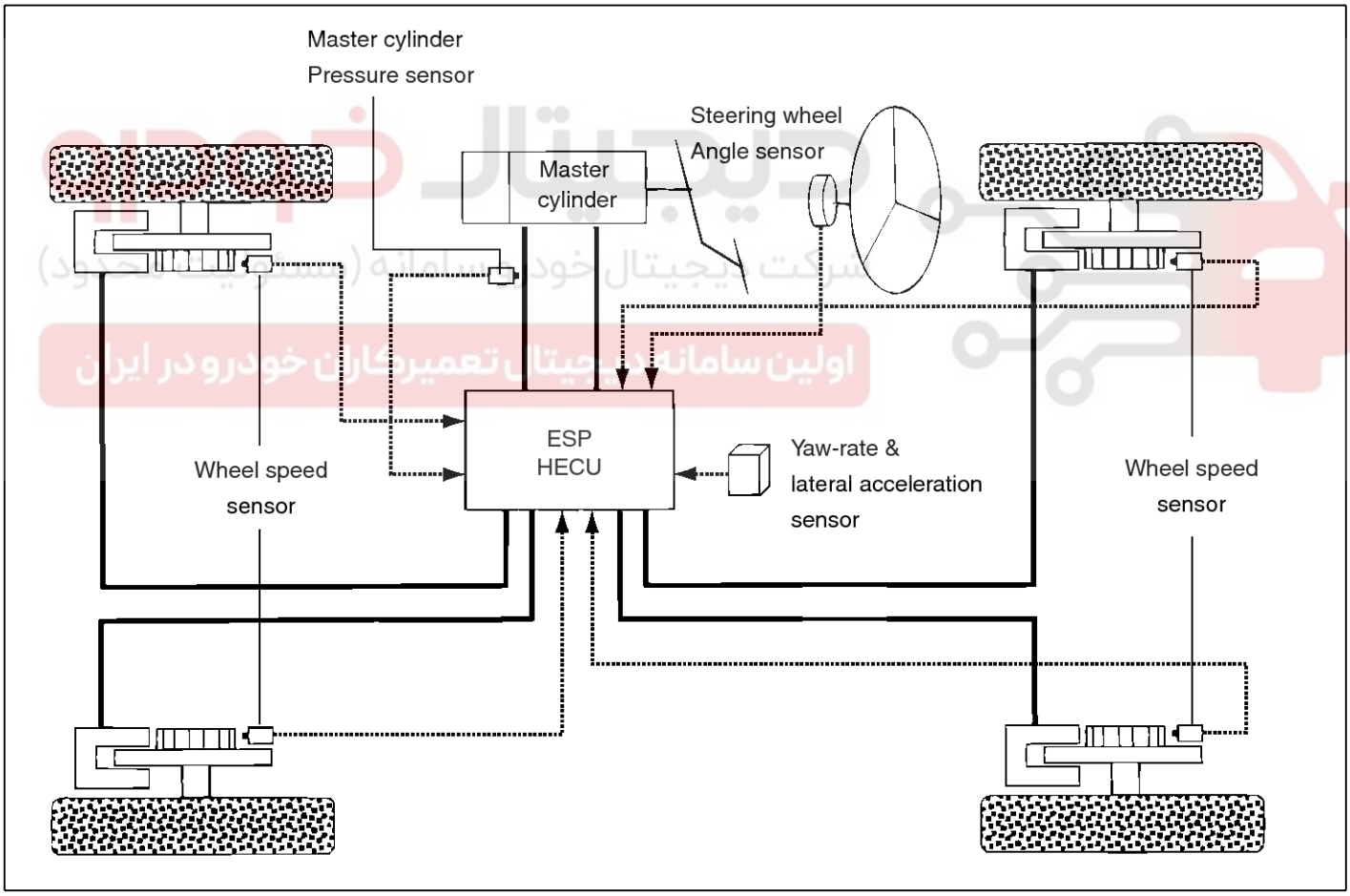
ESP system includes ABS/EBD, TCS and AYC function.

ABS/EBD function : The ECU changes the active sensor signal (current shift) coming from the four wheel sensors to the square wave.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)



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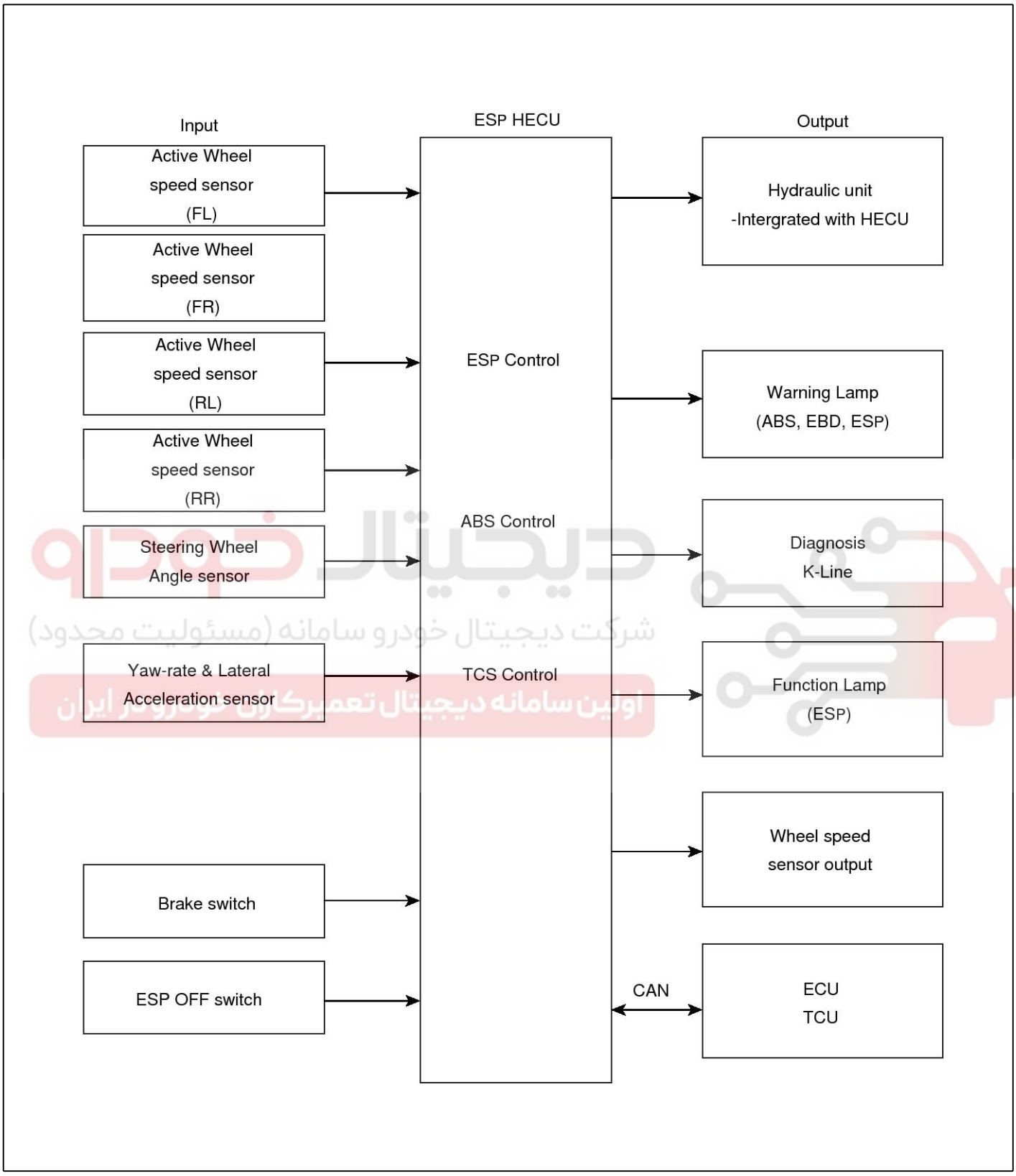
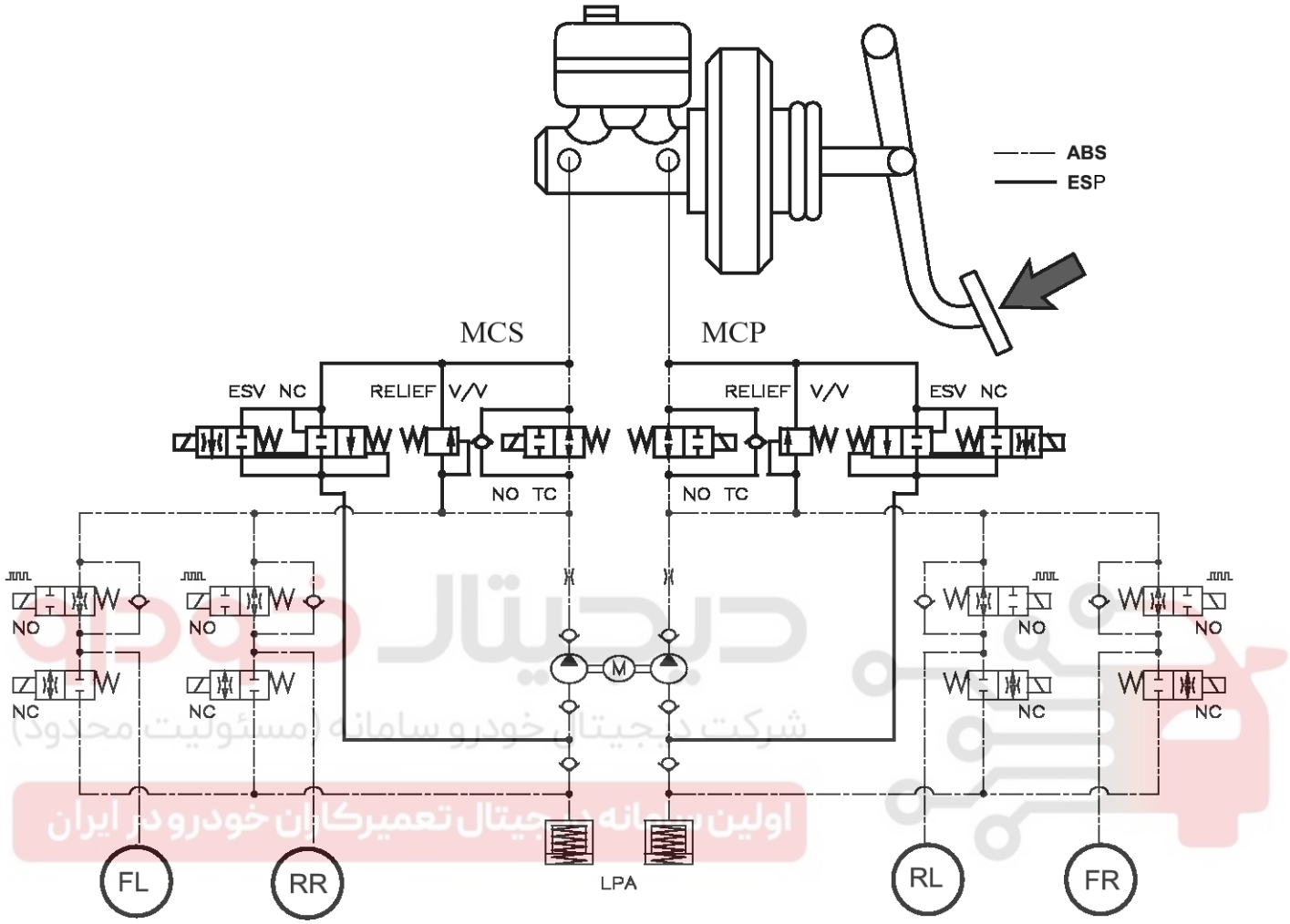
Input and Output Diagram



SENBR9315L

ESP Operation Mode

ESP Hydraulic System Diagram



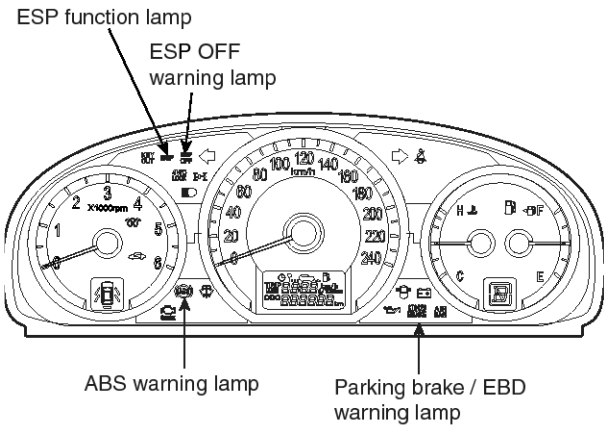
LJJF501P

1. ESP Non-operation : Normal braking.

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

2. ESP operation

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



SENBR7556L

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 shallbe on:

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

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 trun 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)

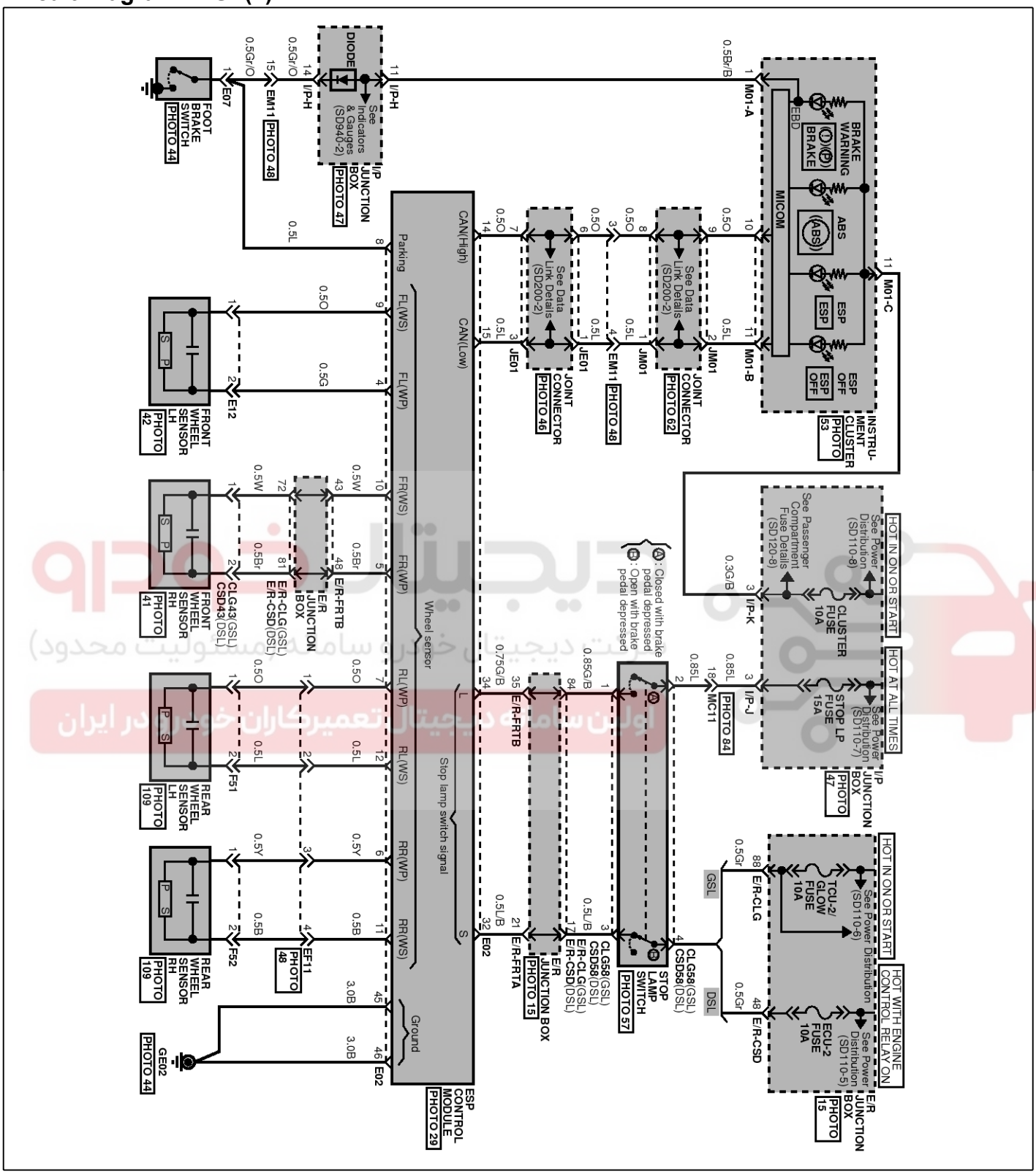
ESP On/Off Switch (ESP System)

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.Closed contacts switch the circuit to ignition.

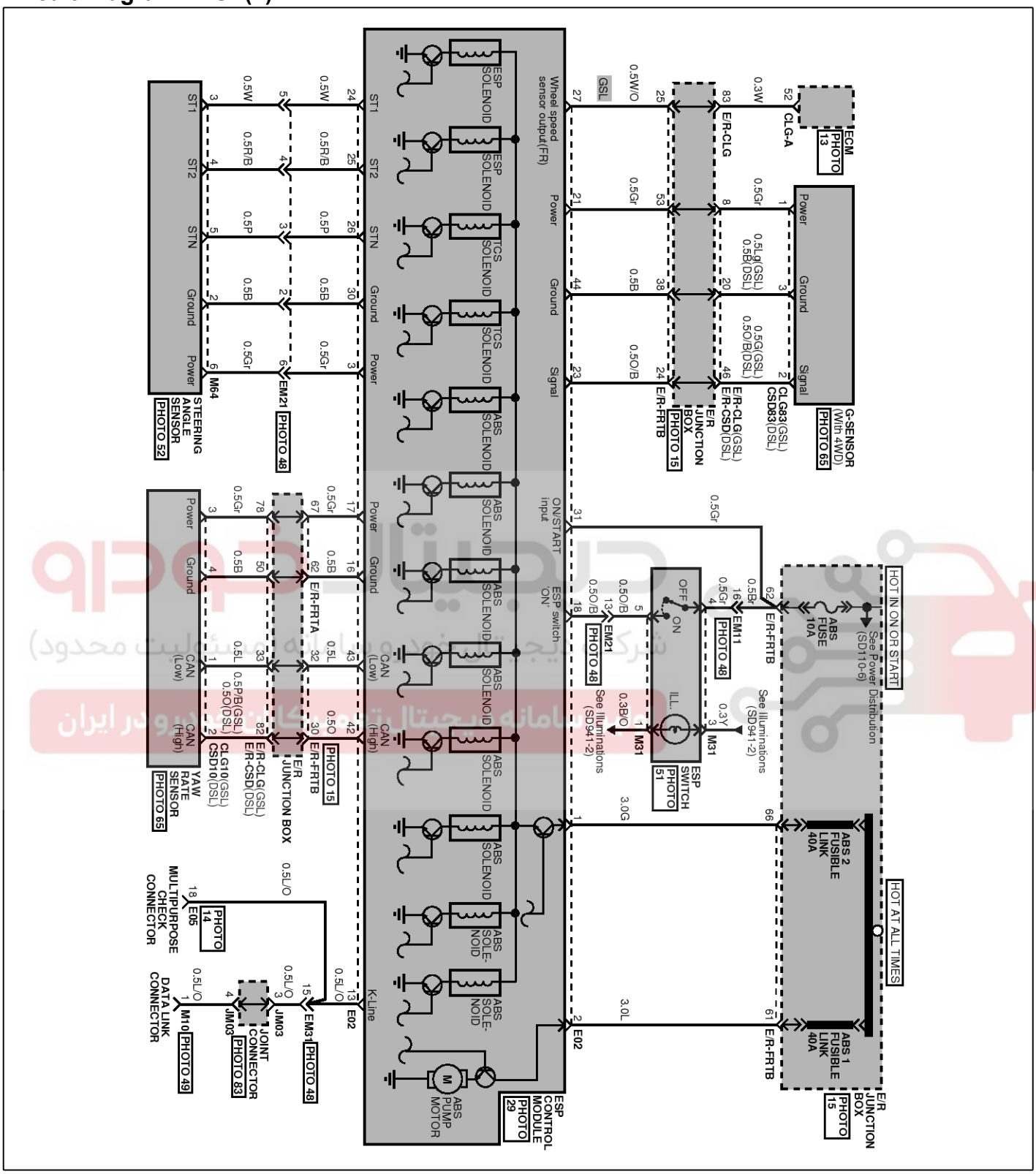
Initial status of the ESP function is on and switch toggle the state.

Circuit Diagram - ESP(1)



SENBR7557L

Circuit Diagram - ESP(2)



SENBR7558L

ESP Connector Input/Output

Connector Terminal		Specification	Remark
No	Description		
31	IGNITION1(+)	Over voltage range : 17 ± 0.5V Operating voltage range : 9.5 ± 0.5V < V < 17 ± 0.5V Low voltage range : 7.0 ± 0.5V < V < 9.5 ± 0.5V Max. current : I < 500mA	
1	POS.BATTERY.(SOLENOID)	Max leakage current : I < 0.8mA Operating voltage range : 9.5 ± 0.5V < V < 17 ± 0.5V Max. current : I < 40A	
2	POS.BATTERY.(MOTOR)	Operating voltage range: 9.5 ± 0.5V < V < 16.5 ± 0.5V Rush current : I < 100A Max current : I < 40A Max leakage current : I < 0.2mA	
46	GROUND	Rated current : I <500mA Max. current: I < 30A	
45	PUMP MOTOR GROUND	Rush current : I < 100A Max current : I < 30A	
16	YAW & LATERAL G SENSOR GROUND	Rated current : I <150mA	
30	STEERING ANGLE SENSOR GROUND	Rated current : I <100mA	
17	YAW SENSOR POWER	Max Output current : I < 150mA Max Output voltage : V(IGN) ± 1V	
3	STEERING ANGLE SENSOR POWER	Max Output current : I < 100mA Max Output voltage : V(IGN) ± 1V	
34	BRAKE LIGHT SWITCH	Input voltage (Low) : 0V ≤ V ≤ 3.0V Input voltage (High) : 7.0V ≤ V ≤ 16.0V	
32	BRAKE SWITCH		
8	PARKING BRAKE SWITCH	Input voltage (Low) : 0V ≤ V_Low ≤ 3.0V Input voltage (High) : 7.0V ≤ V_High ≤ 16.0V Max input current : I < 10mA	
27	SENSOR FRONT RIGHT OUTPUT	Max current : I < 16mA External pull up resistance :1 KΩ < R Output duty :50 ± 20%	
18	ESP ON/OFF SWITCH	Input voltage (Low) :0V ≤ V ≤ 3.0V Input voltage (High) : 7.0V ≤ V ≤ 16.0V Max input current:I <10mA	
15	CAN BUS LINE(LOW)	Max. current : I < 10mA	
14	CAN BUS LINE(HIGH)		

Connector Terminal		Specification	Remark
No	Description		
4	SENSOR FRONT LEFT POWER	Output voltage : IGN (V) ± 1V Output current : Max 30mA	
5	SENSOR FRONT RIGHT POWER		
7	SENSOR REAR LEFT POWER		
6	SENSOR REAR RIGHT POWER		
9	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH :11.8 ~ 16.8mA Frequency range :1 ~ 2000Hz Input duty : 50 ± 20%	
10	SENSOR FRONT RIGHT SIGNAL		
12	SENSOR REAR LEFT SIGNAL		
11	SENSOR REAR RIGHT SIGNAL		
24	STEERING ANGLE SENSOR PHASE 1	Input duty (ST1, ST2): 50 ± 10 Phase difference (ST1, ST2): 2 ± 0.6deg High voltage: 3.0 V < V < 4.1V Low voltage: 1.3 V < V < 2.0V	
25	STEERING ANGLE SENSOR PHASE 2		
26	STEERING ANGLE SENSOR PHASE N		
13	DIAGNOSIS INPUT/OUTPUT	Input voltage IL(V) < 0.3 IGN (V) IH(V) > 0.7 IGN (V) Output voltage OL(V) < 0.2 IGN (V) OH(V) > 0.8 IGN (V)	
44	G SENSOR GROUND (4WD Only)	- Rated current : I < 10mA	
21	G SENSOR POWER (4WD Only)	- Max output current : I < 10mA - Max output voltage : 4.75V ≤ V ≤ 5.25V	
23	G SENSOR SIGNAL (4WD Only)	- Input voltage : 0V ≤ V ≤ 5.0V - Zero offset voltage : 2.5 ± 0.1V	

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 far as the HCU power is on. (X)

Failure Checkup

1. Initial checkup is performed immediately after the HECU power on.
2. Valve relay checkup is performed immediately after the IG2 ON.
3. It executes the checkup all the time while the IG2 power is on.
4. Initial checkup is made in the following cases.
   1) When the failure is not detected now
   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. Turn the system down and perform the following actions and wait for HECU power OFF.
2. Turn the valve relay off.
3. Stop the control during the operation and do not execute any until the normal condition recovers.

Warning Lamp On

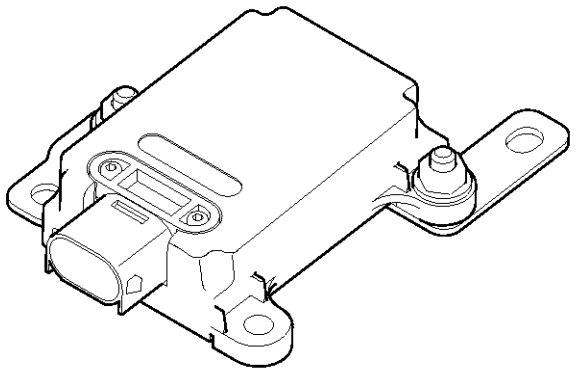
1. ABS warning lamp turns on when ABS is fail.
2. ESP operation lamp turns on and ESP OFF warning lamp blinks when ESP is fail.

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 front passenger seat lower floor on vehicle.

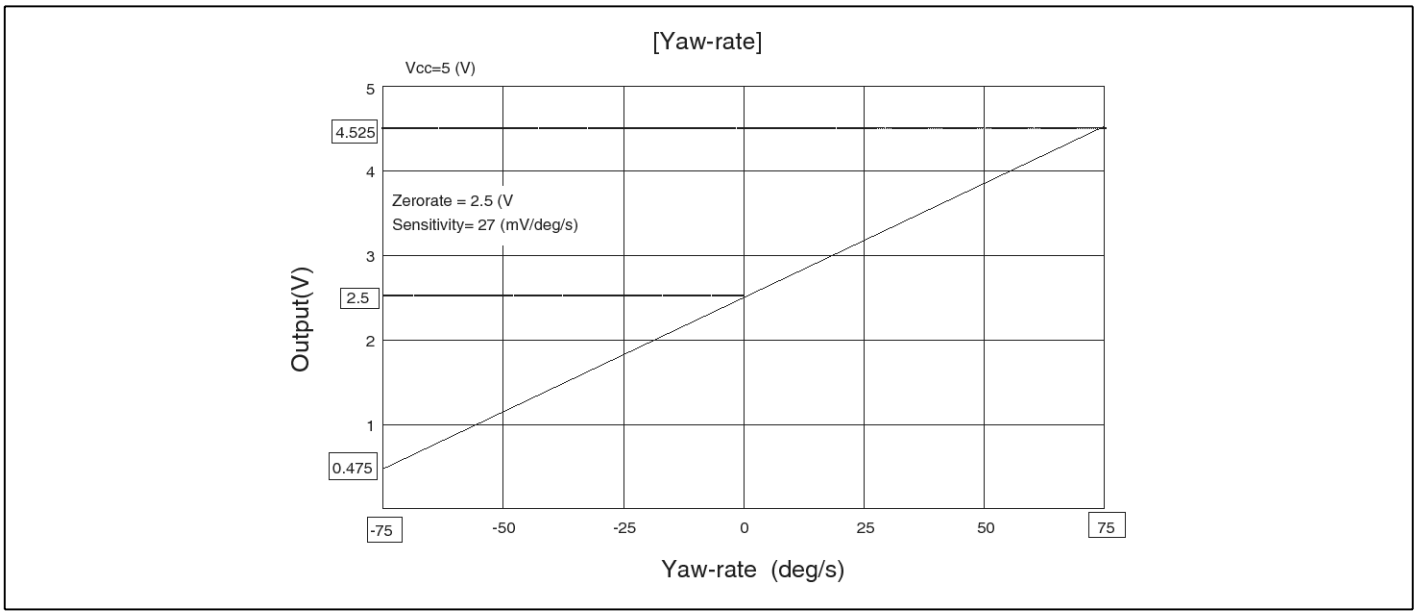


ARJE504E

Specifications

Description		Specification	Remarks
Operating voltage		8 ~ 17V	
Current consumption		Max. 140mA	
Operating temperature		-40 ~ 85°C	
Yaw-rate sensor	Measurement range	-75 ~ 75°/sec	
	Frequency response	18 ~ 22Hz	
Lateral G sensor	Measurement range	-14.715 ~ +14.715m/s²	
	Frequency response	50Hz	

Output Characteristic



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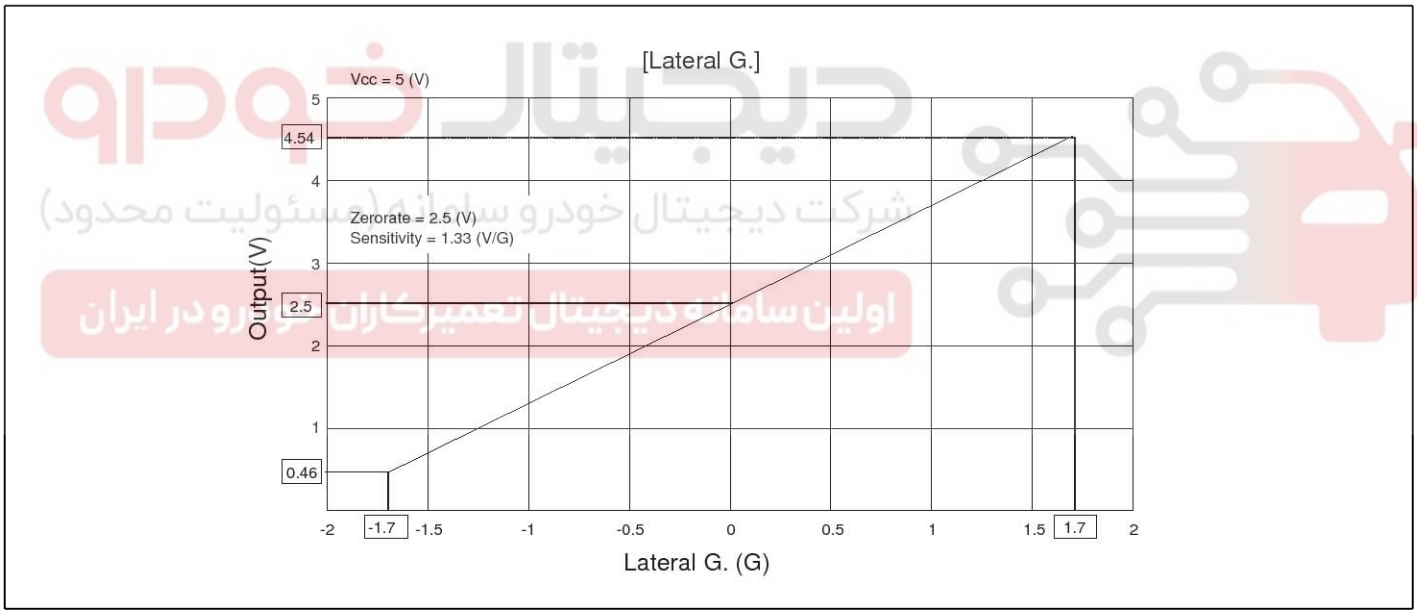

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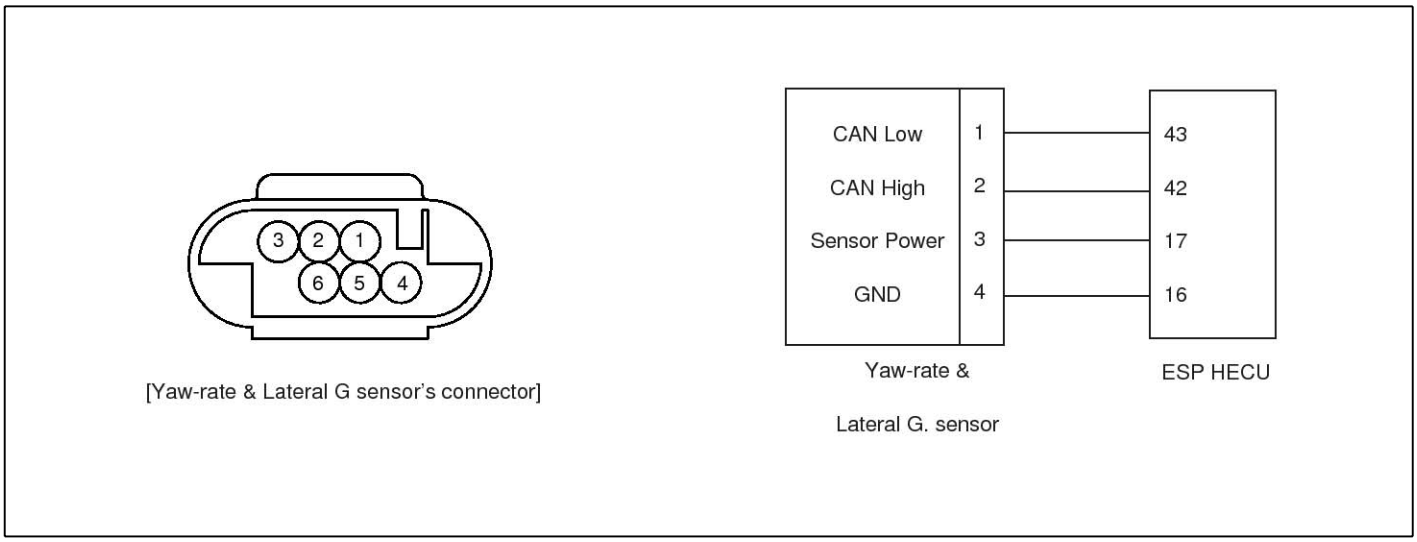
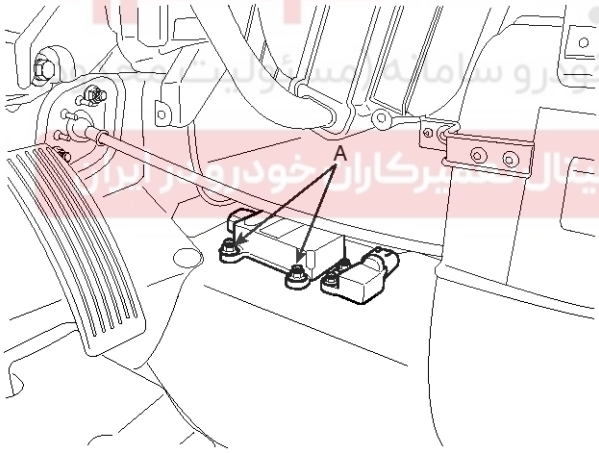
External Diagram



SENBR7559L

Replacement

1. Remove the floor console. (refer to BD- "console")
2. Disconnect the yaw rate & lateral G sensor connector.
3. Remove the mounting bolts(A).



SENBR7009D

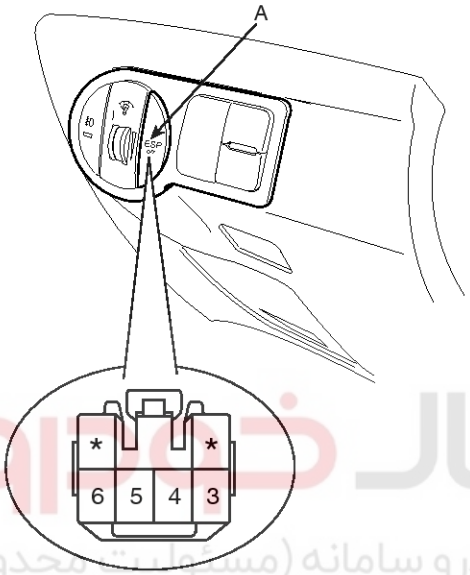
ESP OFF Switch

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. Remove the ESP OFF switch from the switch panel.



SENBR7562L

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

Terminal / Function	4	5	3	1
ON	○	○	○	○
OFF				

SENBR7560L

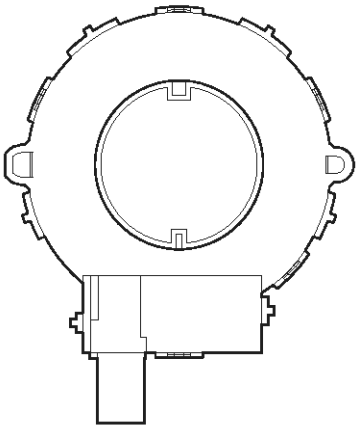
Steering Angle Sensor

Description

The steering angle speed sensor detects the angle of the steering wheel in order to which direction a user chooses.The sensor is detached on the MPS(Mutil-Function Switch) under the steering wheel.

Measureing Principle

The split of the steering angle sensor detects a steering angle of the steering wheel by a ON/OFF pulse caused by whether or not the LED lights go through the hole of the split, rotating as the steering wheel revolves. There are three LEDs, two(ST1, ST2) for detecting a steering direction, and the other for the neutral position.The HECU calculates the steering angle by the pulse from the steering angle sensor.

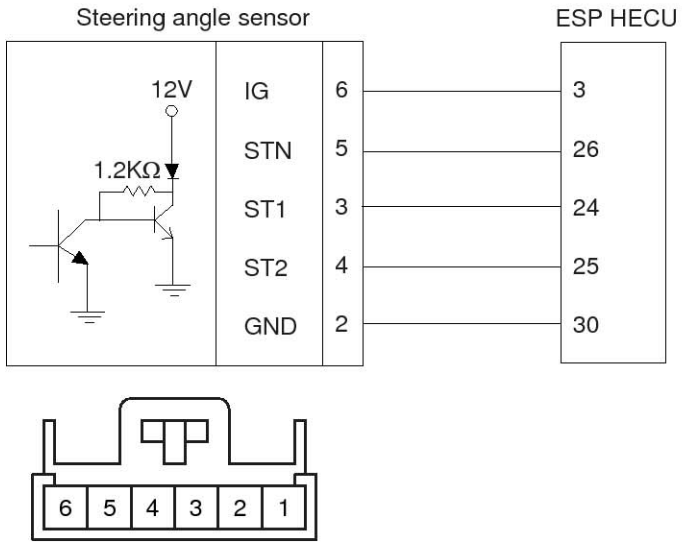


LJJF501V

Specification

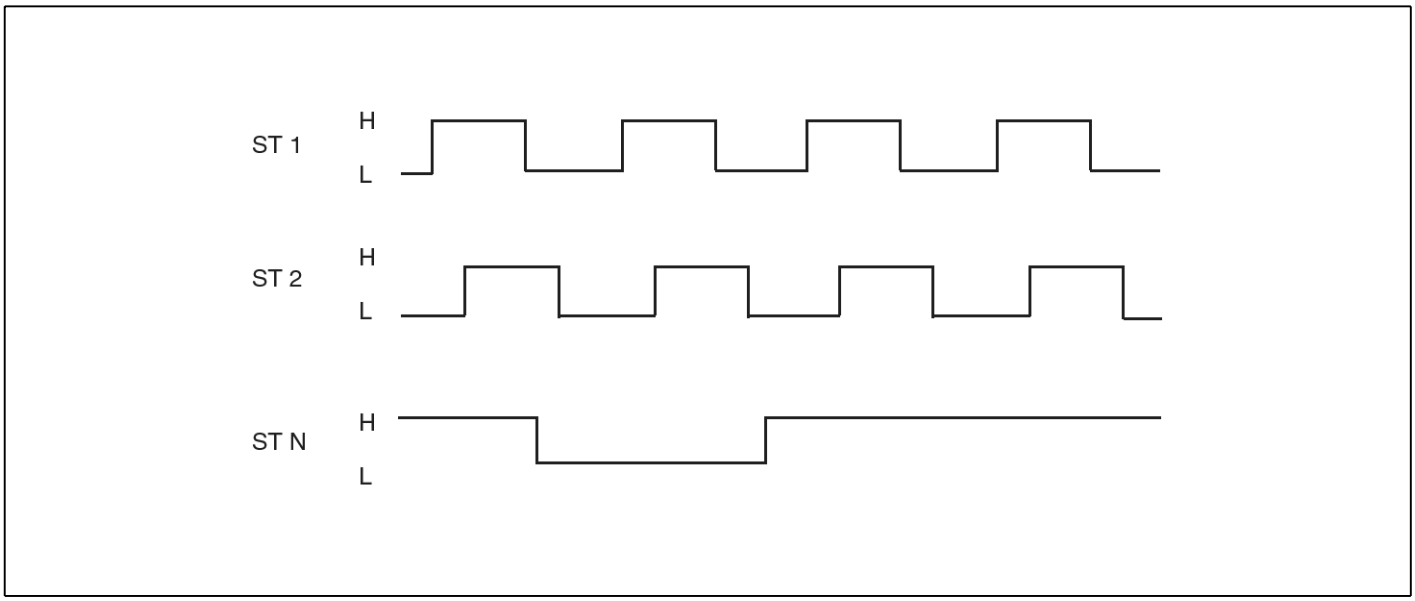
Description	Specification
Operating voltage	9 ~ 16V
Operating temperature	-30 ~ 75℃
Current consumption	Max.100mA
Steering angle velocity	Max. ± 1500°/sec
Voltage(high)	3.0V ~ 4.1V
Voltage(low)	1.3V ~ 2.0V
Pulse duty	40 ~ 60%

Circuit Diagram(Steering Wheel Speed Angle Sensor)



SENBR7561L

Output Characteristic



ARCD204A

No.	INPUT		OUTPUT	Steering direction	Remark
1	ST1	L	L	Right	
	ST2	L	H		
	ST1	L	H	Left	
	ST2	L	L		
2	ST1	L	L	Left	
	ST1	H	L		
	ST1	L	H	Right	
	ST2	H	H		
3	ST1	H	H	Left	
	ST2	L	H		
	ST1	H	L	Right	
	ST2	L	L		
4	ST1	H	H	Right	
	ST2	H	L		
	ST1	H	L	Left	
	ST2	H	H		