General Information

Specifications

Item	Specification
Master cylinder · Type · I.D. mm(in.)(CBS/ABS) · Piston stroke mm(in) · Output port(CBS/ABS) · Fluid level warning sensor	 Tandem type 23.8/25.4(0.937/1.0) 30~32(1.18~1.26) 4port/4port Provided
Proportioning valve · Cut-in pressure(Split point) · Decompression ratio	 15Kgf /㎠ 0.27:1(2WD) 0.32:1(4WD)
Brake booster · Type · Effective dia. mm(in.) · Boosting ratio	 Vacuum 8+9 in 9:1
Front brake(Disc) · Type · Disc O.D. · Disc I.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	 Floating type with ventilated disc 280 mm 172 mm (6.77 in.) 26 mm 11 mm single piston 60 mm (2.36 in.)
Rear brake(Drum) · Type · Drum I.D. · Brake lining thickness · Clearance adjustment	 Leading trailing drum 228.6 mm (9.0 in.) 4.5 mm (0.17 in.) Automatic
Rear brake(Disc) · Type · Disc O.D. (2WD/4WD) · Parking Brake Drum I.D · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	 Floating type with solid disc 262/284 mm (10.31/11.18 in.) 190mm(7.48 in.) 10 mm (0.39 in.) 10 mm (0.39 in.) single piston 34 mm (1.34 in.)
Parking brake · Type · Actuation · Cable arrangement	 Mechanical brake acting on rear wheels Lever V type

NOTICE

O.D. : Outer Diameter

I.D : Inner Diameter

CBS : Conventional Brake System

Specification (ABS)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (MGH-60)	
	Type	ABS + EBD	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 110 °C (-40 ~ 230 °F)	
	Motor power	210 W	
Warning lamp	Min. Operating Voltage	12 V	
	Max. Current consumption	80 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 6 ~ 16 V	
	Operating temperature	-40 ~ 120 °C (-40 ~ 248 °F)	
	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	48 teeth	
	Air gap	0.5 ~ 1.5 mm	

Specification(ESP)

Part	Item	Standard value	Remark
HECU	System	4 Channel 4 Sensor (MGH-60)	Total control (ABS, EBD, ESP)
	Type	Motor, valve relay intergrated type	
	Operating Voltage	10 ~ 16 V	
	Operating Temperature	-40 ~ 110 °C (-40 ~ 230 °F)	
	Motor power	270 W	
Warning lamp	Min. Operating Voltage	12 V	
	Max. Current consumption	80 mA	
Active Wheel speed sensor (ABS)	Supply voltage	DC 6 ~ 16 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	48 teeth	
Steering Wheel Angle Sensor	Operating Voltage	9 ~ 16 V	
	Operating Angular velocity	Max. 1500 °/sec	
	Operating temperature	-30 ~ 75 °C (-22 ~ 167 °F)	
	Max Consumption Current	100 mA	
	Max Output Current	10 mA	
	Max Output Absorption Current	50 mA	
Yaw rate & Lateral G sensor (CAN TYPE)	Operating Voltage	8 V ~ 17 V	
	Current Consumption	Max. 140 mA	
	Operating Temperature	-40 ~ 85 °C (-40 ~ 185 °F)	
	Yaw rate sensor measurement range	± 75 °/sec	
	Lateral G sensor measurement range	± 1.5 g	

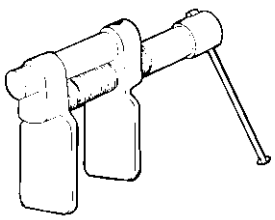
Service Standard

Item	Standard value	Service limit
Brake pedal height	163mm(6.42 in.)	
Brake pedal full stroke	128 mm (5.04 in.)	
Brake pedal free play	3~8mm(0.11~0.31in.)	
Brake pedal to floorboard clearance	82mm(3.23 in.)	
Stop lamp switch outer case to pedal stopper clearance	1.2 ~ 1.7mm(0.047 ~ 0.067in.)	
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg vacuum)	
Parking brake lever stroke when lever assembly is pulled with 196N (20Kgf, 44lb force)	7~8 clicks	
Front disc brake pad thickness	11 mm (0.43 in.)	2 mm (0.079 in.)
Front disc thickness (minimum)	26 mm (1.02 in.)	24.4 mm (0.961in.)
Front disc runout		Max.0.03 mm (0.001in.)
Front disc thickness variation		Max.0.005 mm (0.0002in.)
Rear drum brake lining thickness	4.5 mm (0.177 in.)	1.0 mm (0.039 in.)
Rear drum brake drum I.D.	228.6 mm (9 in.)	Max.230.6mm (9.079 in.)
Rear disc brake pad thickness	10 mm (0.394 in.)	2 mm (0.079 in.)
Rear disc brake disc thickness	10 mm (0.394 in.)	8 mm (0.315 in.)
Rear disc runout		Max.0.03mm (0.001in.)
Rear disc thickness variation		Max.0.005 mm (0.0002in.)

Tightening Torque (ABS & ESP)

Item	N.m	kgf.m	lbf-ft
Active wheel speed sensor mounting bolt on the brake plate	3.8 ~ 11	0.7 ~ 1.1	5.1 ~ 8.1
Hydraulic & electronic control unit mounting bolt	11 ~ 14	1.1~1.4	8.1~10.3
Hydraulic & electronic control unit mounting bracket bolt	16.7 ~ 25.5	1.7 ~ 2.6	12.3 ~ 18.8
Brake tubes nut	12.7 ~ 16.7	1.3 ~ 1.7	9.4 ~ 12.3
Air bleeder screw	6.8 ~ 12.7	0.7 ~ 1.3	5.1 ~ 9.4
Yaw rate & lateral acceleration sensor Nut	5 ~ 7	5.7 ~ 7.1	3.7 ~ 5.2

Special Service Tool

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

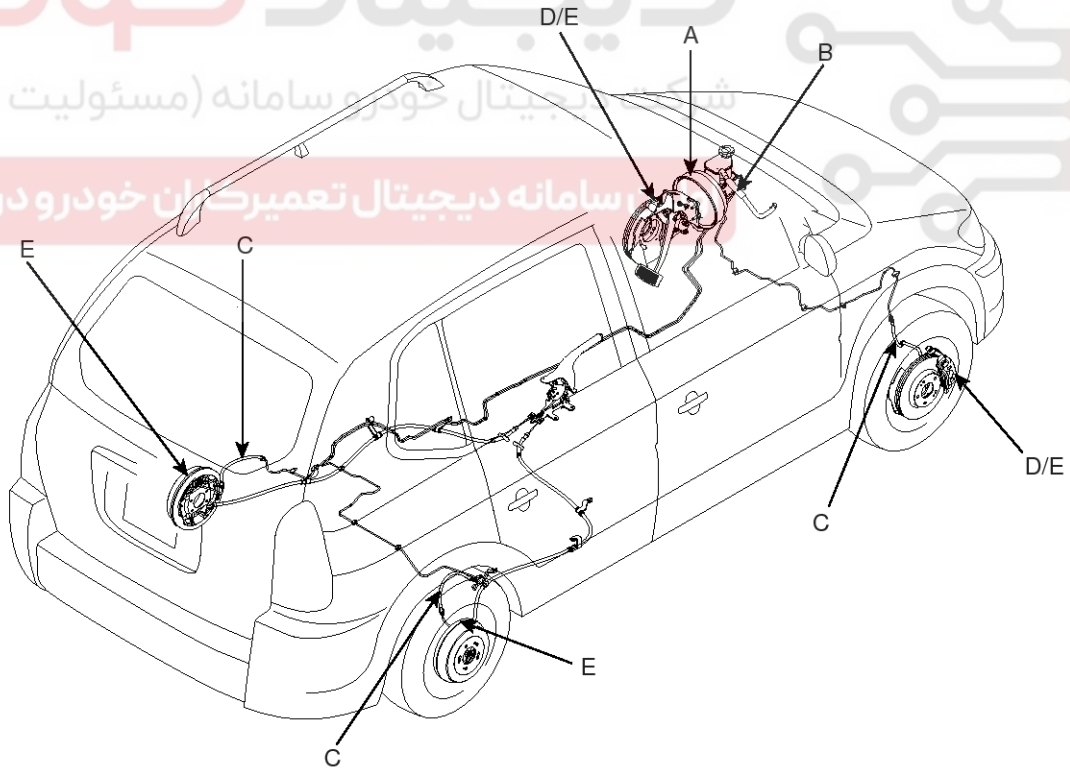
Symptom	Suspect Area	Reference
Brake Chatter	Brake chatter is usually caused by loose or worn components, or glazed or burnt linings. Rotors with hard spots can also contribute to brake chatter. Additional causes of chatter are out-of-tolerance rotors, brake lining not securely attached to the shoes,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



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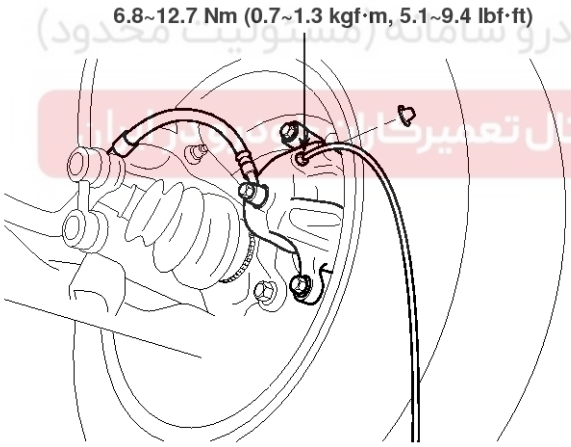
Brake System Bleeding

CAUTION

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

  Using a non-genuine DOT3/DOT4 brake fluid can cause corrosion and decrease the life of the system.
- **Make sure no dirt 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.



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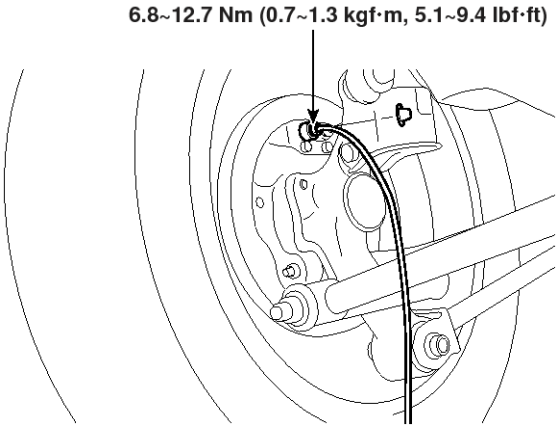

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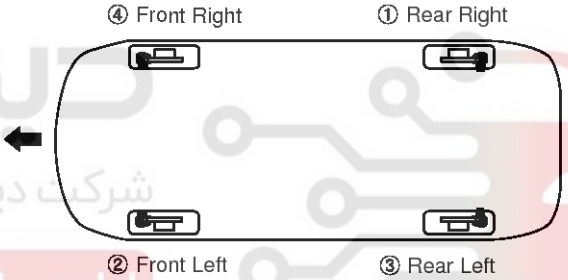
4. Repeat the procedure for wheel in the sequence shown below unit air bubbles no longer appear in the fluid.



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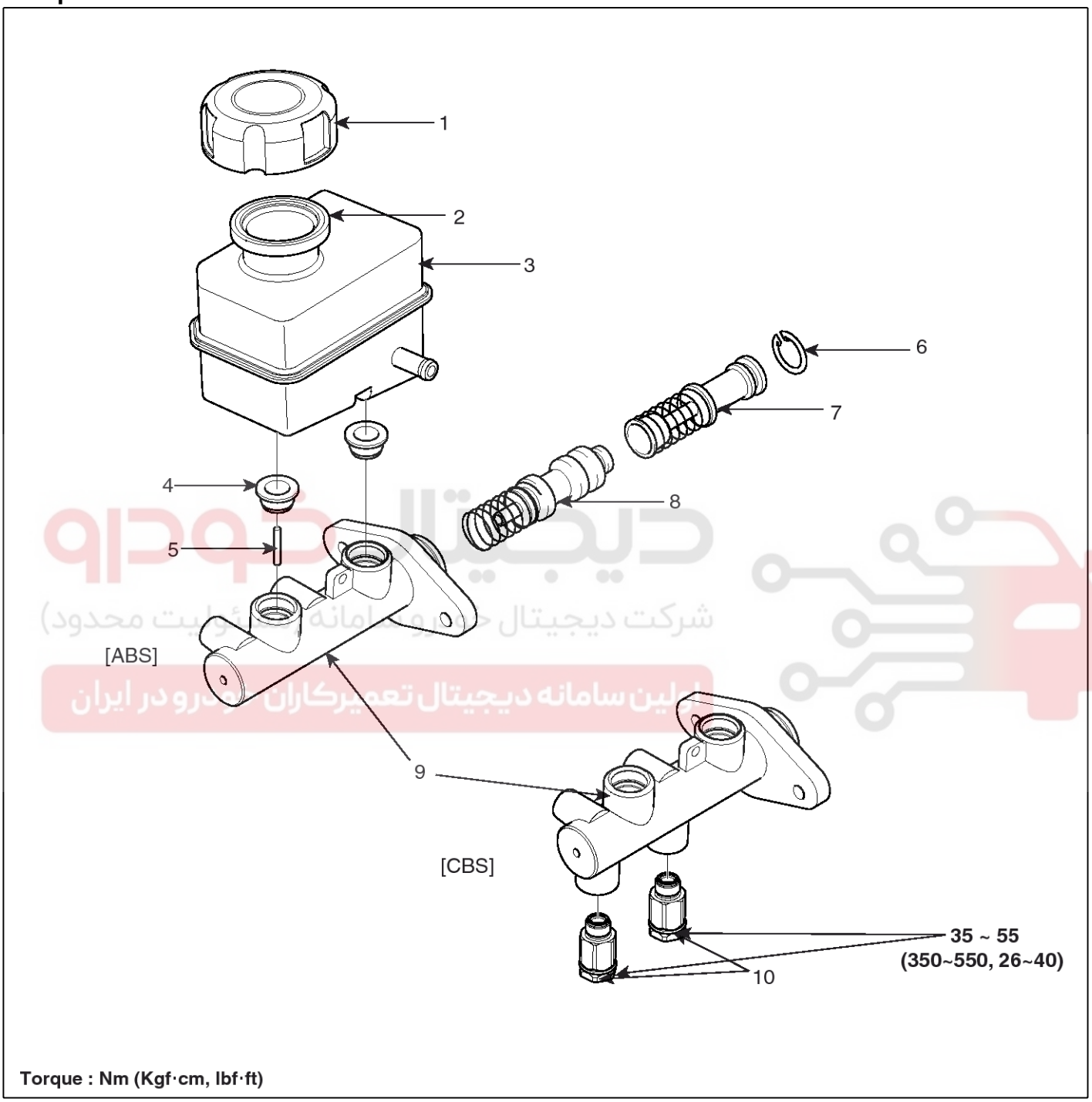
5. Refill the master cylinder reservoir to MAX (upper) level line.

Master Cylinder

Components



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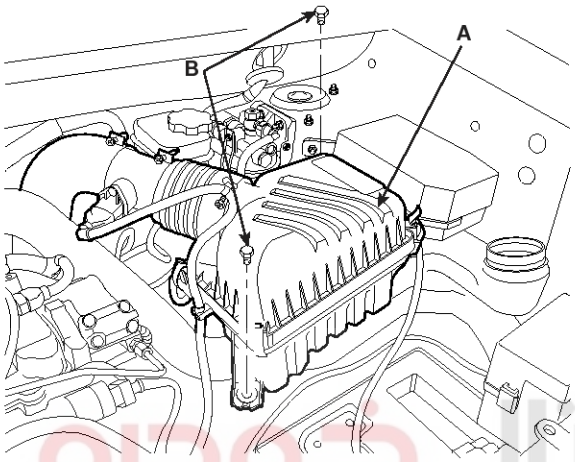
1. Reservoir cap
2. Brake fluid filter
3. Reservoir
4. Grommet
5. Cylinder pin
6. Retainer
7. Primary piston assembly
8. Secondary piston assembly
9. Master cylinder body
10. Proportioning valve

Removal

NOTICE

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

1. Remove air cleaner mounting bolts (B) from the air cleaner mounting bracket and air cleaner body (A).



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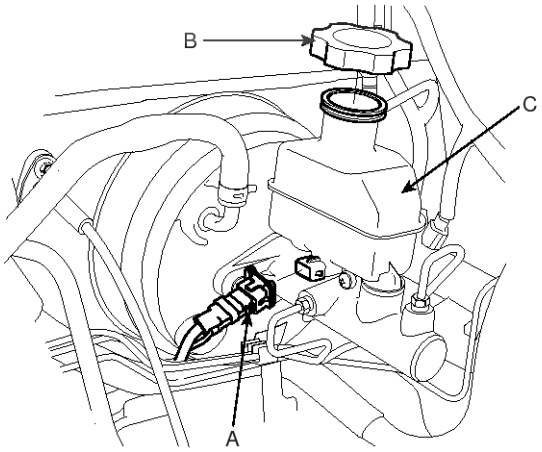
2. Disconnect the brake fluid level switch connectors (A), and remove the reservoir cap (B).



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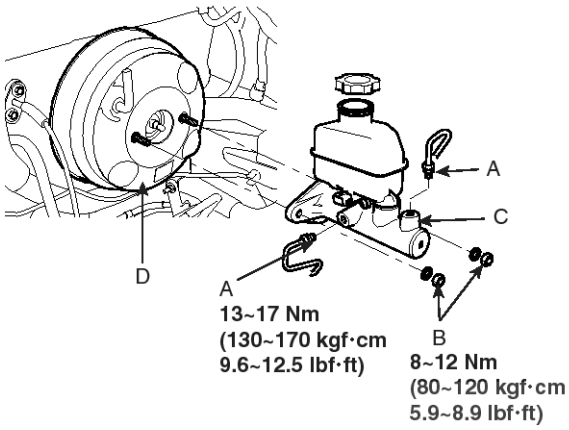
3. Remove the brake fluid from the master cylinder reservoir (C) with a syringe.
4. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.



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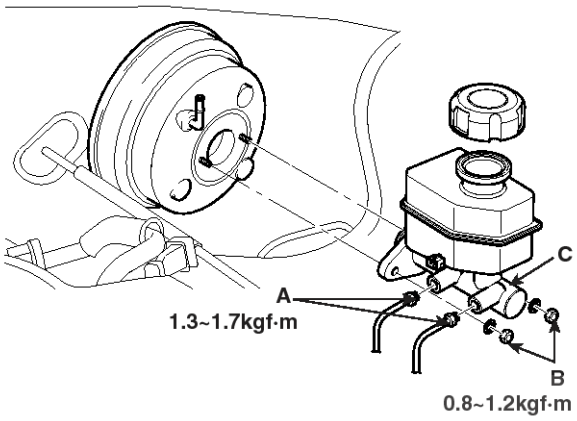
5. Remove the master cylinder mounting nuts (B) and washers.
6. Remove the master cylinder(C) from the brake booster (D). Be careful not to bend or damage the brake lines when removing the master cylinder.

Installation

1. Install the master cylinder on the brake booster with 2 nuts.
2. Connect 2 brake tubes and the brake fluid level sensor connector.



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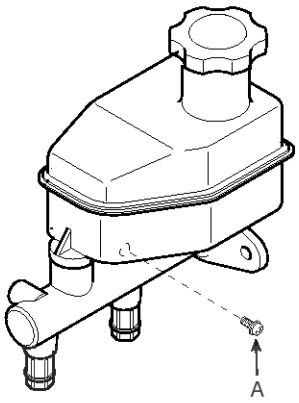
3. Fill the brake reservoir with the brake fluid and bleed the brake system.

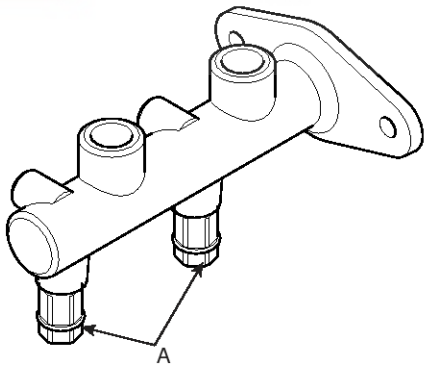
Disassembly

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



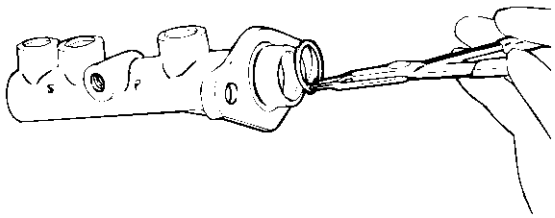
EGGE700D

4. Remove the proportioning valves (A) - CBS only.



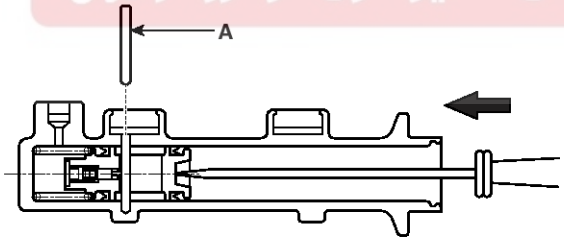
EGGE700E

5. Remove the retainer ring by using the snap ring pliers then remove the primary piston assembly.



EJA9009C

6. Remove the pin with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.



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NOTICE

Do not disassemble the primary and secondary piston assembly.

Inspection

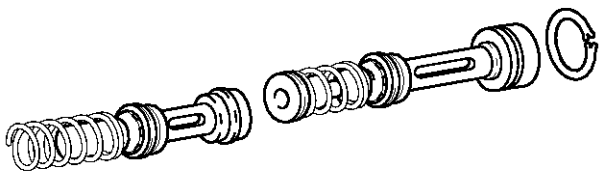
1. Check the master cylinder bore for rust or scratch.
2. Check the master cylinder for wear or damage. If necessary, clean or replace the cylinder.

CAUTION

- **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.



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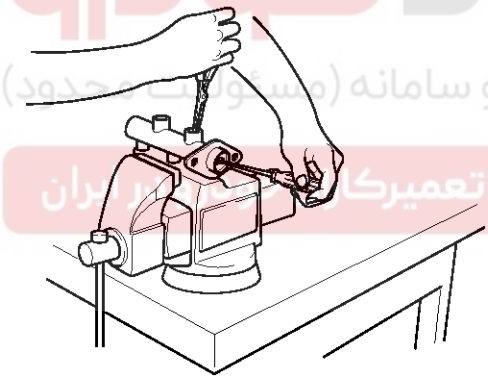
3. Press the piston with a screwdriver and install the cylinder pin.



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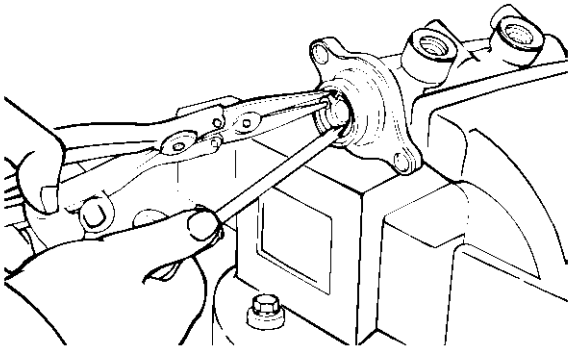
4. Press the piston with a screwdriver and install the retainer ring.



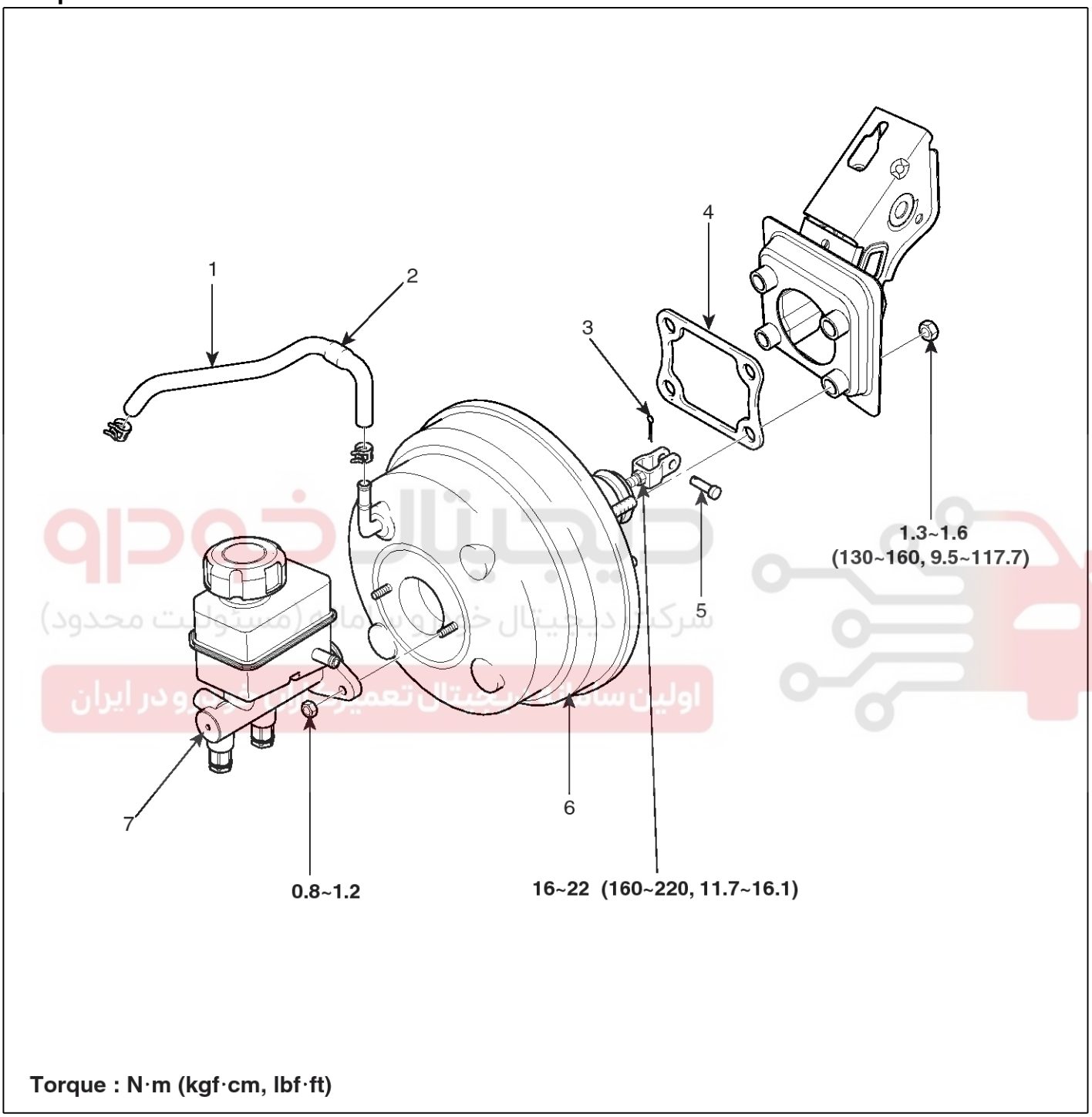
EGGE700G

5. Mount two grommets.
6. Install the reservoir on the cylinder.

Tightening torque
: 1.5~3.0 N·m(15~30kg·cm, 1.2~2.1 lbf·ft)

Brake Booster

Components



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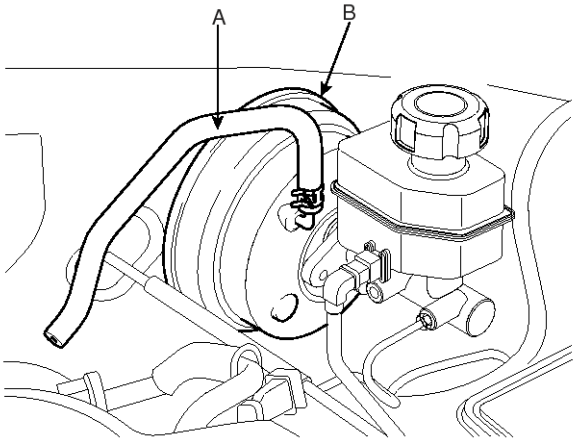
1. Vacuum hose
2. Check valve
3. Snap pin
4. Seal
5. Clevis pin
6. Brake booster
7. Master cylinder

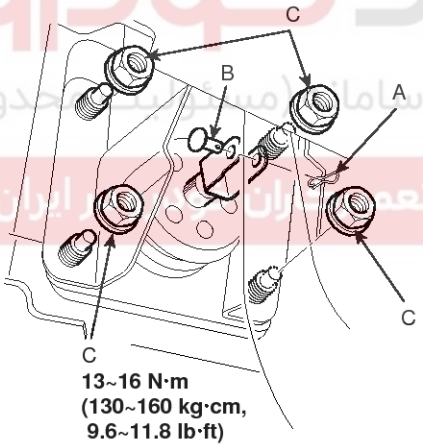
Removal

1. Remove the master cylinder.
2. Disconnect the vacuum hose (A) from the brake booster (B).



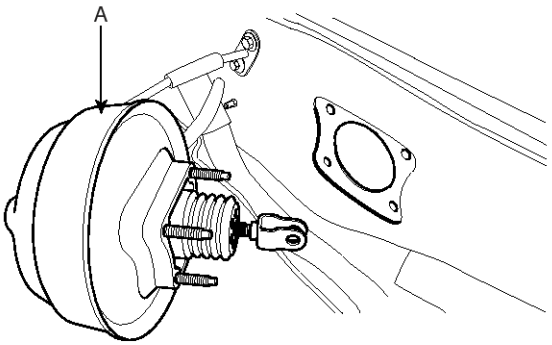
LJIF501U

3. Remove the snap pin (A) and pin (B).



EJQE040A

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



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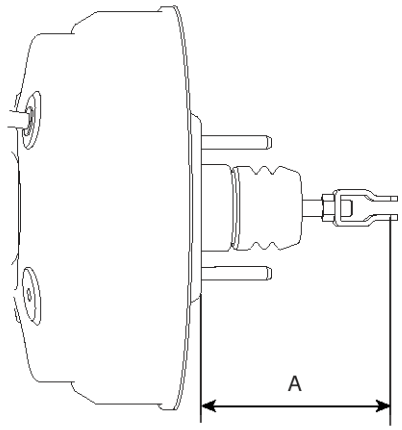
Installation

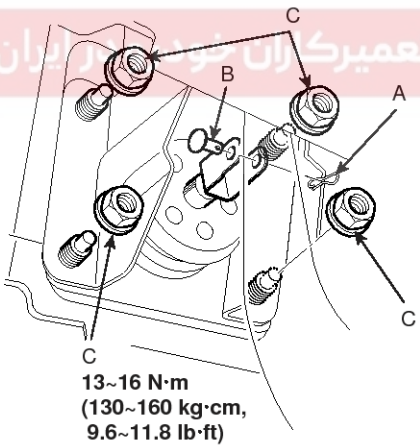
1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A): 106± 0.5 mm (4.173 ± 0.019 in.)



KJQE050C

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



EJQE040A

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

   ⚠CAUTION
   Grease the pin before installing the snap pin.
   Always use a new snap pin.
3. Install the master cylinder.
4. Connect the vacuum hose to the brake booster.
5. After filling the brake reservoir with brake fluid, bleed the system.
6. Check for fluid leakage.
7. Check and adjust the brake pedal for proper operation.

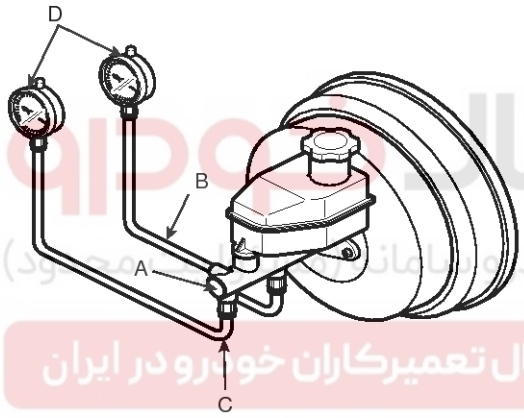
Proportioning Valve

Description

Do not disassemble the proportioning valve. The proportioning valve makes the ideal distribution of fluid pressure to the front and rear brakes to prevent the brakes from skidding in the event of rear wheel lock up and to obtain a higher brake efficiency within the range of service brake application.

Inspection

1. Remove the front brake tube (B) and rear brake tube (C) from the master cylinder (A).
2. Connect two pressure gauges (D); one to the output valve of the front (B) and rear (C) brake.



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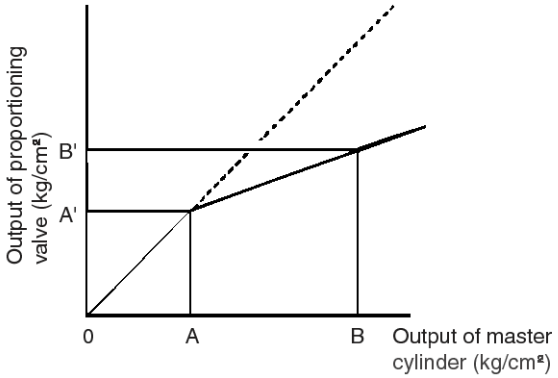
NOTICE

Be sure to bleed the system after connecting the pressure gauges.

3. With the brake applied, measure the front pressure and the rear pressure.

   If the measured pressures are within the specified range as illustrated, the proportioning valve is good.



EGGE700I

4. Reconnect the brake lines in their original positions and bleed the system.

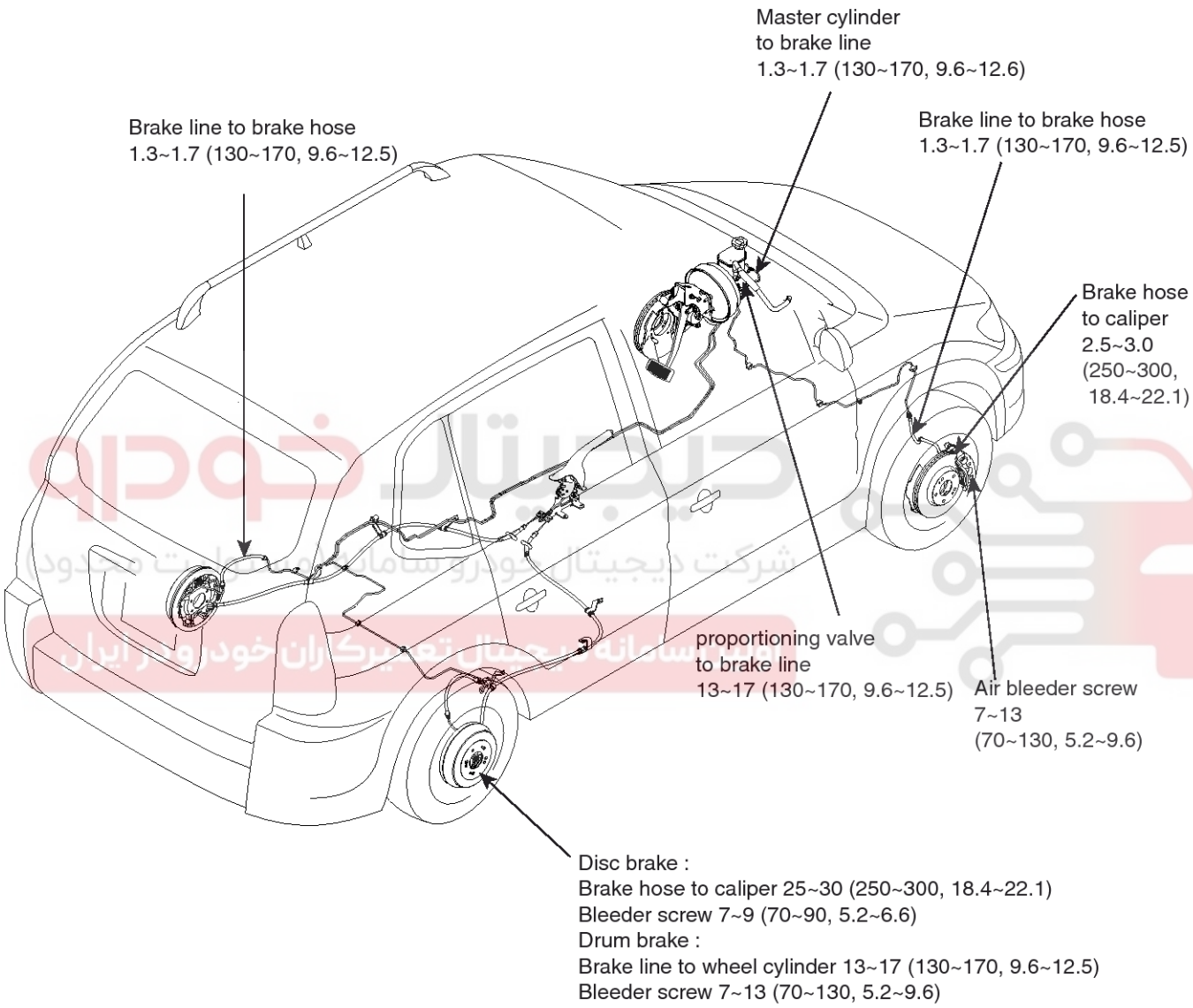
NOTICE

This table shows characteristics of the proportioning valve as the pressure increases.

Front (Output of master cylinder)	Rear (Output of proportioning valve)
A : 26 kg/cm² (2.55MPa, 370psi)	A' : 26 kg/cm² (2.55MPa, 370psi)
B : 80 kg/cm² (7.84MPa, 1137psi)	B' : 40.6 ± 3 kg/cm² (3.98 ± 0.3MPa, 577 ± 42 psi)

Brake Line

Component



Torque : Nm (kgf·cm. lbf·ft)

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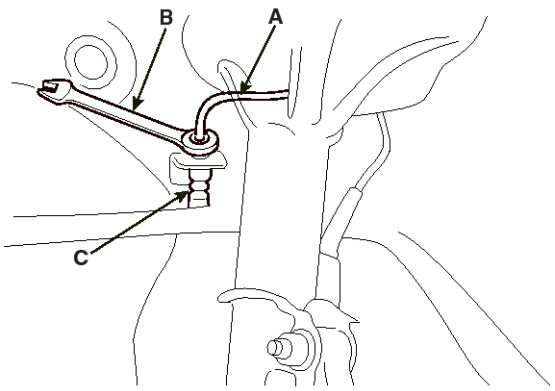
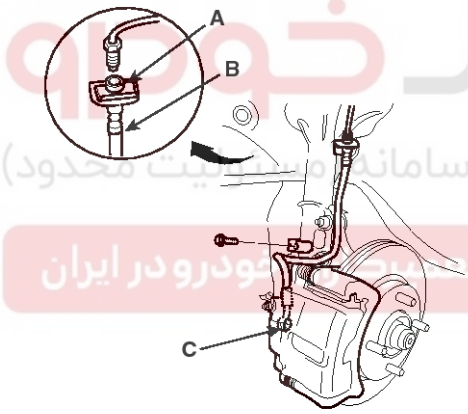
Removal

1. Disconnect the brake hose(C) from the brake line(A) using a 10mm flare-nut wrench(B).



ARJE050A

2. Remove the brake hose clip(A) from the brake hose(B).

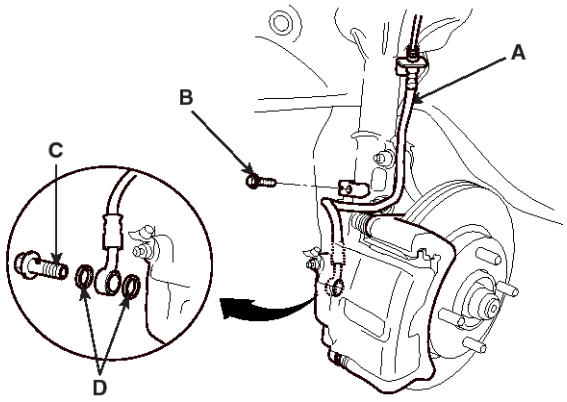


ARJE050B

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

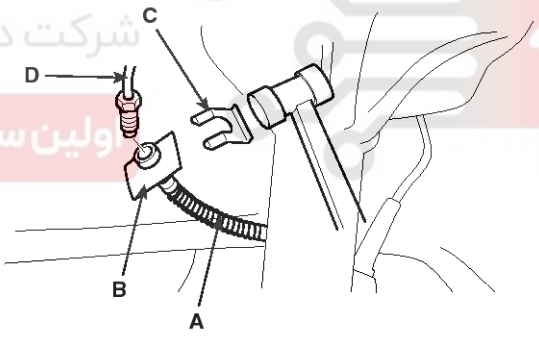
Installation

1. Install the brake hose(A) on the knuckle with 12mm flange bolt (B) first, then connect the brake hose to the caliper with the connector bolt (C) and new sealing washers (D).



ARJE050C

2. Install the brake hose (A) on the upper brake hose bracket (B) with a new brake hose clip (C).



ARJE050D

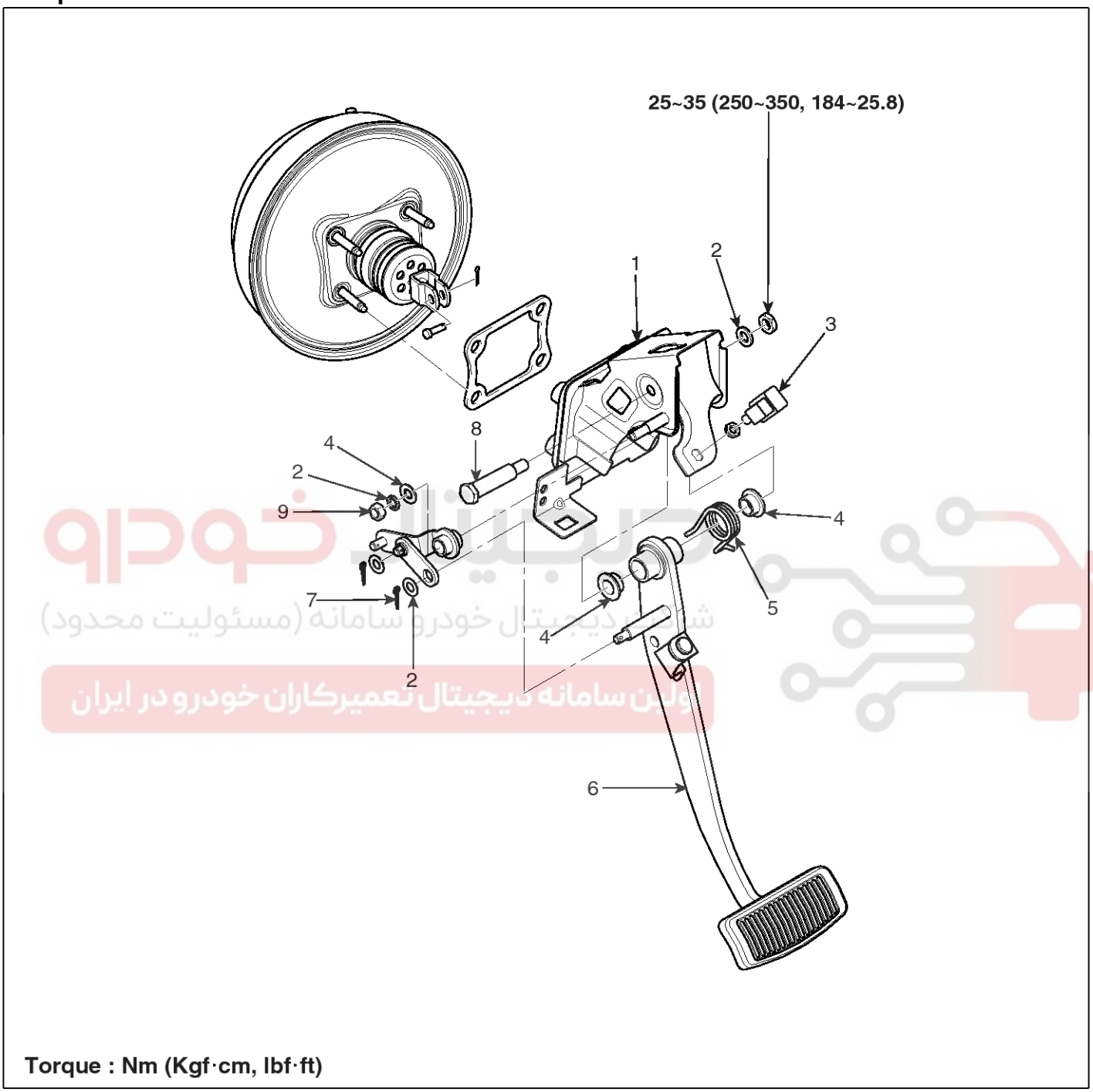
3. Connect the brake hose (D) to the brake line.
4. After installing the brake hose, bleed the brake system.

Inspection

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

Brake Pedal

Components

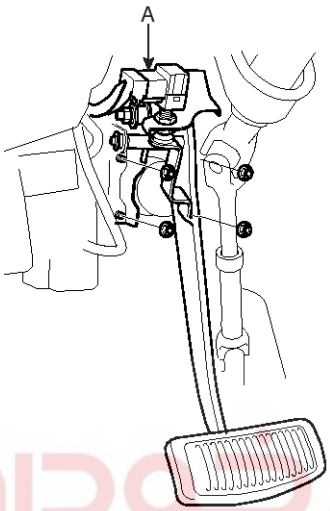


SKMBR0004L

1. Member assembly bracket
2. Washer
3. Stop lamp switch
4. Bushing
5. Return spring
6. Brake pedal
7. Snap pin
8. Bolt
9. Nut

Removal

1. Remove the lower crash pad.(reference to BD-"crash pad")
2. Pull down steering column shaft after removing 4 bolts.
3. Remove the stop lamp switch connector (A).
4. Remove the shift lock cable (A/T).

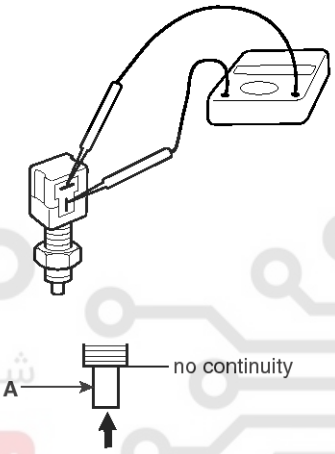


KJQE010A

5. Remove the pin and snap pin.
6. Loosen the brake pedal member assembly mounting nuts and then remove the brake pedal assembly.

Inspection

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



EJQE020D

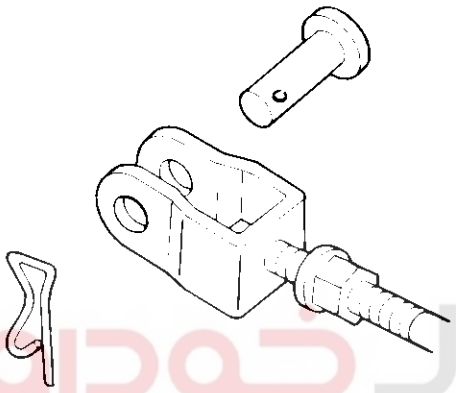
Installation

1. Installation is the reverse of removal.

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

Specified grease:Chassis grease MS 511-3

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



EJQE008R

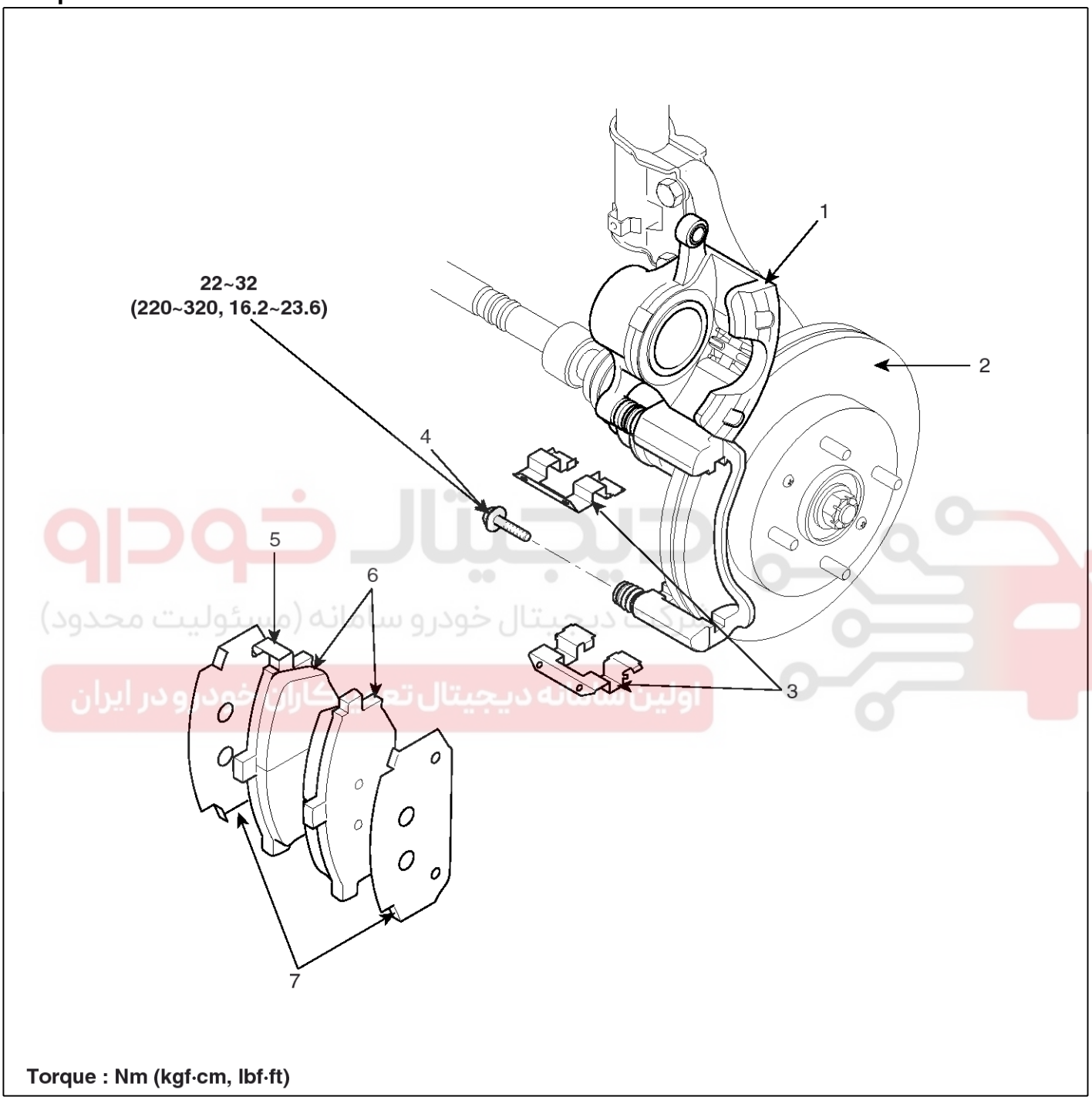
3. Install the nuts with specified torque, when installing the brake pedal.

Tightening torque
: 13~16Nm (130~160kgf·cm, 9.6~11.8,lbf·ft)

4. Adjust the brake pedal height and free play.
5. Install the stop lamp switch.

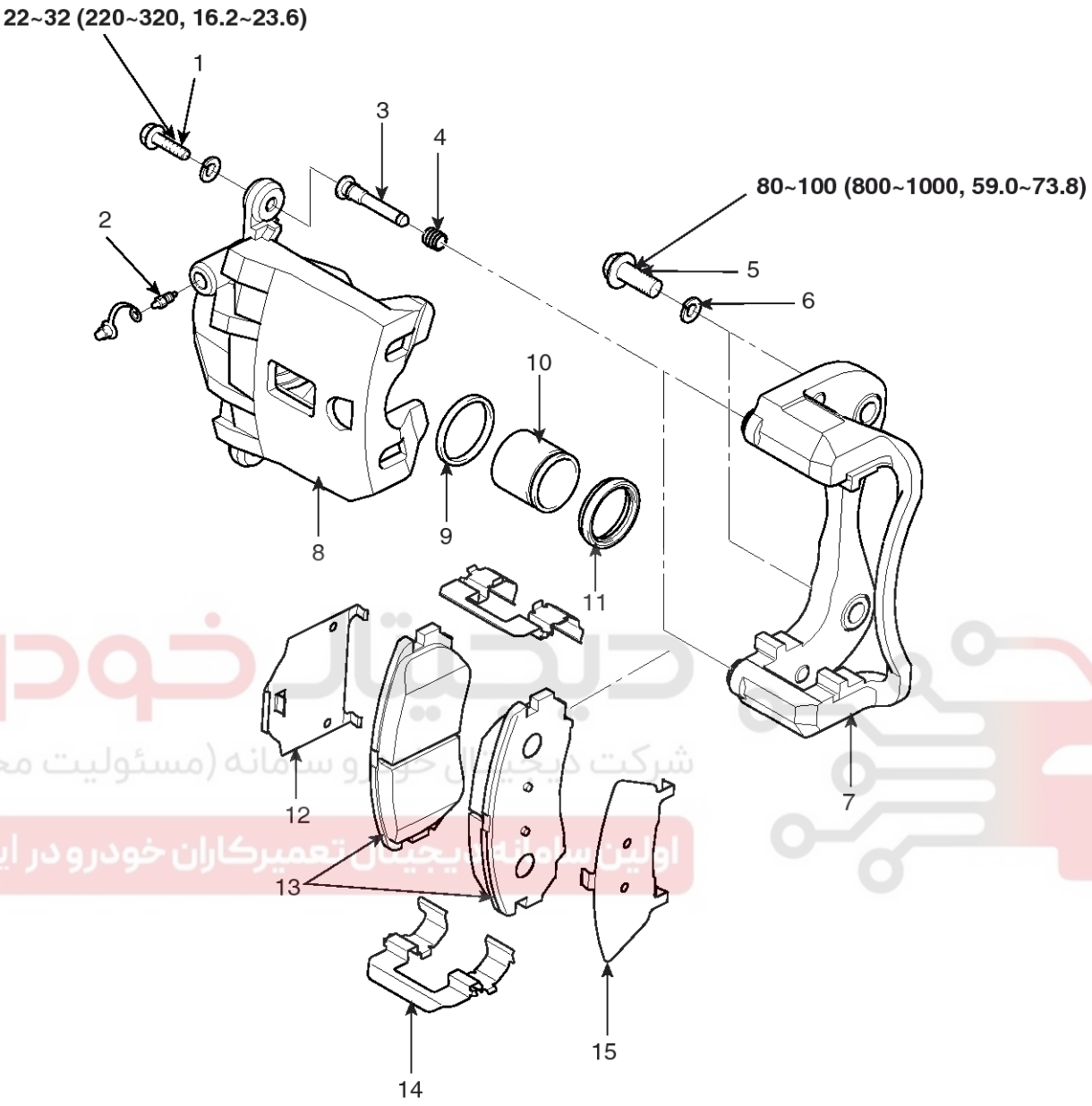
Front Disc Brake

Components



SKMBR0005L

1. Brake caliper
2. Brake disc
3. Pad retainers
4. Guide rod bolt
5. Indicator
6. Brake pads
7. Brake pad shims



SKMBR0006L

1. Guide rod bolt
2. Bleeder screw
3. Guide rod
4. Boot
5. Caliper mounting bolt
6. Washer
7. Caliper bracket
8. Caliper body
9. Piston seal
10. Piston
11. Piston boot
12. Inner shim
13. Brake pad
14. Pad retainer
15. Outer shim

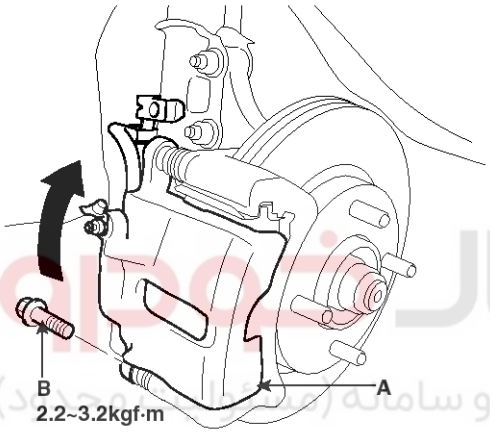
Removal

CAUTION

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

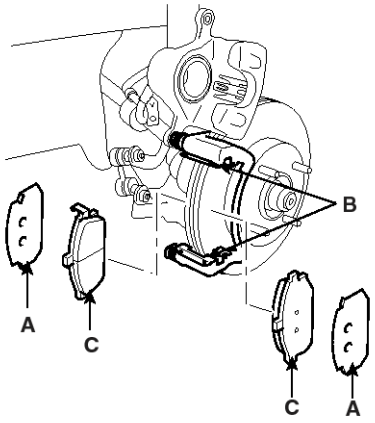
- **Avoid breathing dust particles.**
- **Never use on air hose or brush to clean brake assemblies.**

1. Lossen the front wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported. Remove the front wheels.
2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.



ARJE501K

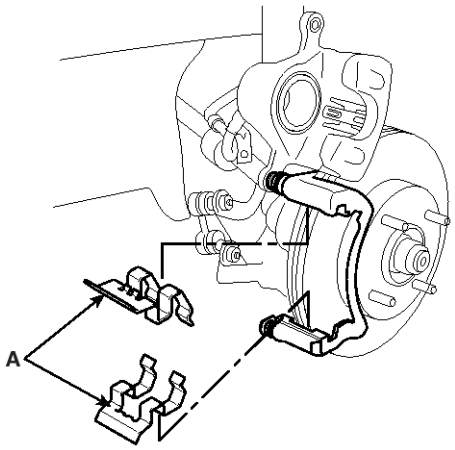
3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.



ARJE501L

Installation

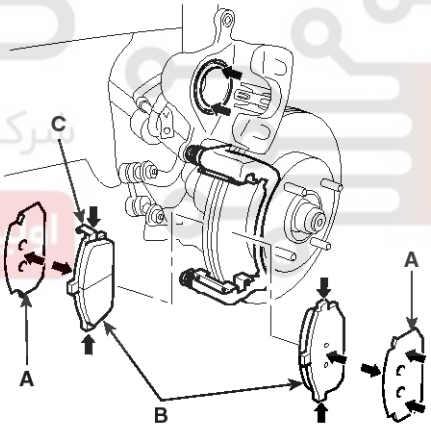
1. Install the pad retainers (A) on the caliper bracket.



ARJE501M

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

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



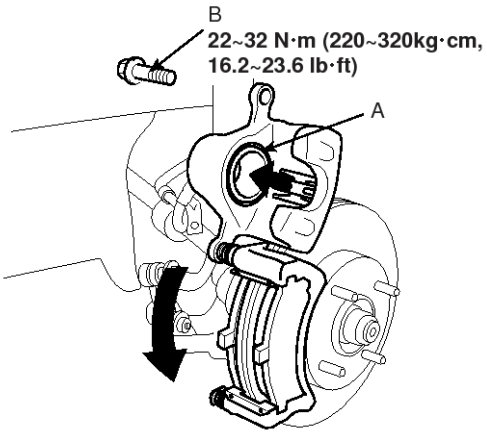
ARJE501N

3. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.

   If you are reusing the pads, always reinstall the brake pads in their original positions to prevent a momentary loss of braking efficiency.

4. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.

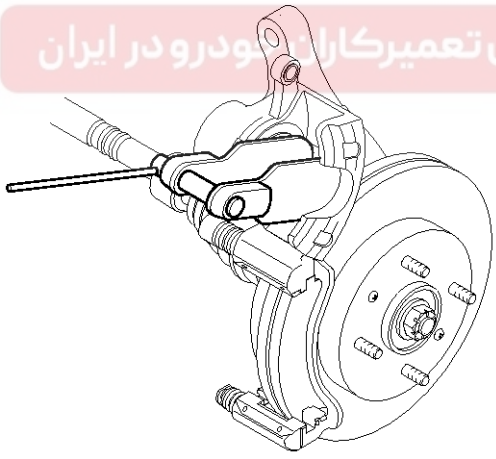
5. Pivot the caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification.



EGGE700K

NOTICE

Insert the piston in the cylinder using the special tool (09581-11000).



EGGE700L

6. Depress the brake pedal several times to make sure the brakes work, then test-drive.

NOTICE

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

Be sure to do this before driving the vehicle.

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

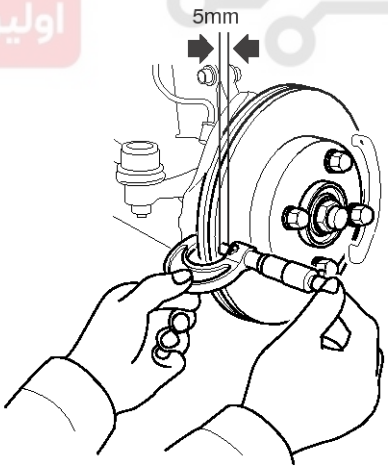
Inspection

Front brake disc thickness check

1. Remove all rust and contramination from the surface, and measure the disc thickness at 8points, at least, of same distance (5mm) front the brake disc outer circle.

Front brake disc thickness
Standard value : 26.0mm(1.024 in.)
Limit : 24.4mm(0.961 in.)

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

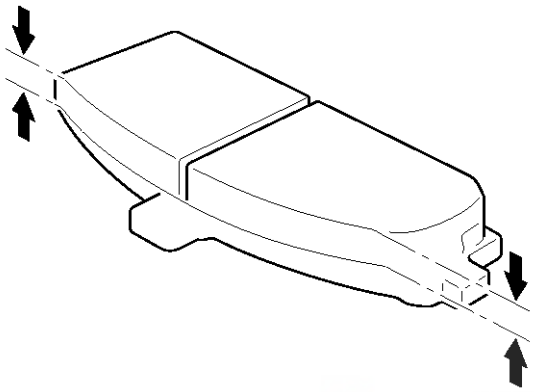


KJQE100D

Front Brake PAD Check

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

Pad thickness
Standard value : 11 mm (0.43 in.)
Service limit : 2.0 mm (0.0787 in.)



KJQE088A

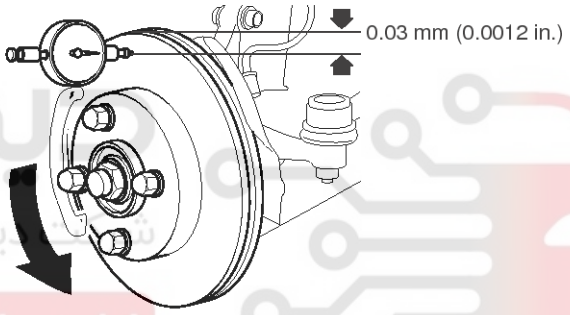
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

Front Brake Disc Run out Check

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

Brake disc run out
Limit : 0.03 mm (0.0012 in.) or less

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



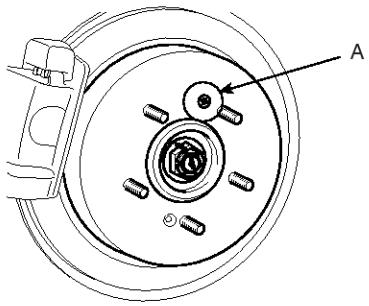
EJQE100C

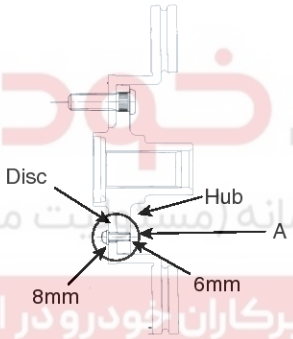
Seize of Front Brake Disc

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

   NOTICE

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

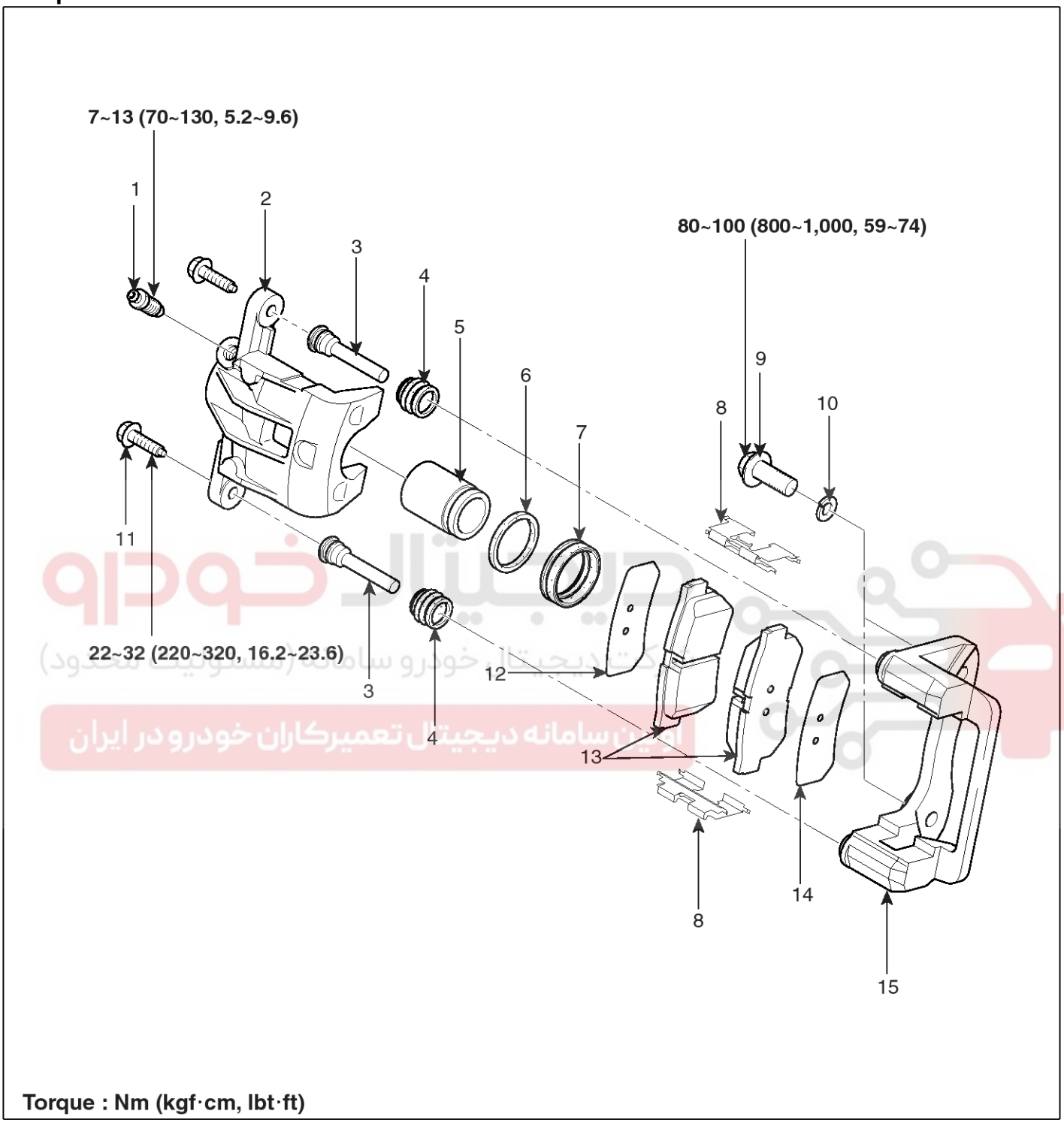




LJIF500G

Rear Disc Brake

Components

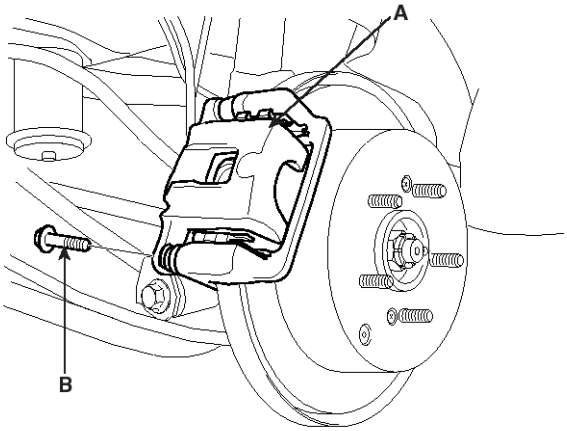


SKMBR0007L

1. Bleeder screw
2. Caliperbody
3. Guide rod
4. Boot
5. Piston
6. Piston seal
7. Piston boot
8. Pad retainer
9. Caliper mounting bolt
10. Washer
11. Guide rod bolt
12. Inner shim
13. Brake Pad
14. Outer shim
15. Caliper bracket

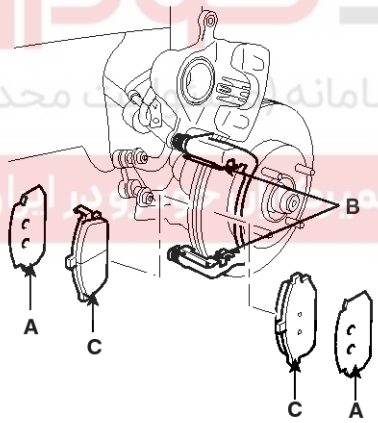
Removal

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.



ARJE501U

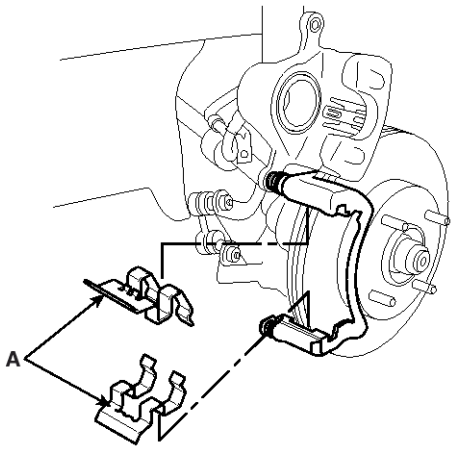
3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.



ARJE501V

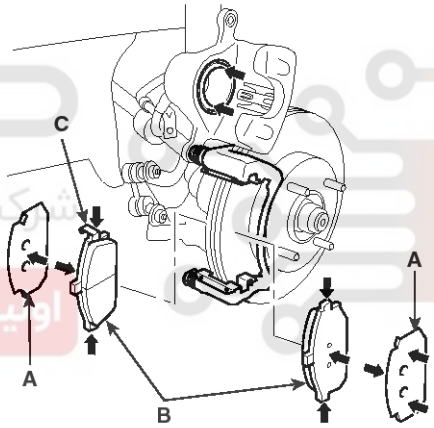
Installation

1. Install the pad retainers(A) on the caliper bracket.



ARJE501M

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

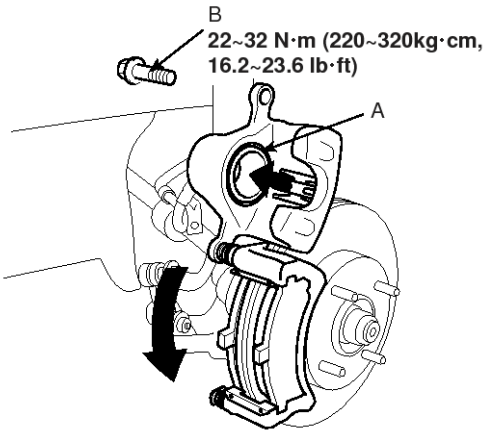


ARJE501N

3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.
4. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.

   If you are reusing the pads, always reinstall the brake pads in their original position to prevent a momentary loss of braking efficiency.
5. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.

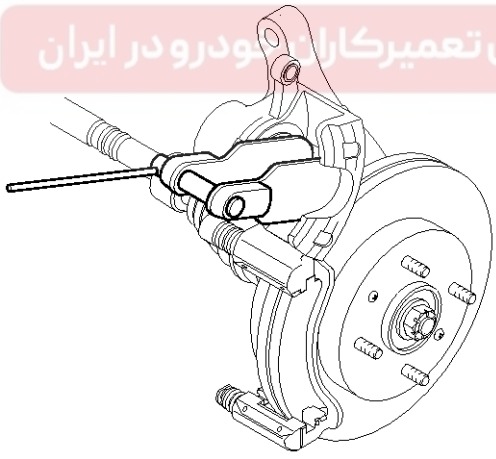
6. Pivot caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification



EGGE700K

NOTICE

Insert the piston in the cylinder using the special tool(09581-11000).



EGGE700L

7. Depress the brake pedal several time to make sure the brakes work, then test-drive.

NOTICE

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

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

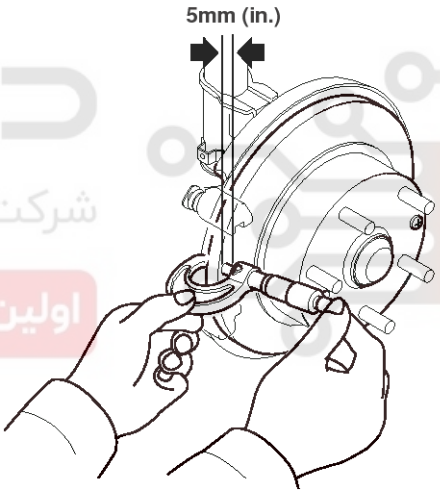
Inspection

Rear brake disc thickness check

1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 points, al least, of the same distance (5mm) from the brake disk outer circle.

Rear brake disc thickness
Standard value : 10.0mm (0.39 in.)
Limit : 8.0mm (0.315 in.)

2. Thickness variation should not exceed 0.005mm(0.0002 in.) (circumference) and 0.01mm(0.0020 in.) (radius) at any directions.
3. If wear exceeds the limit, replace the discs and pad assembly for left and right of the vehicle.

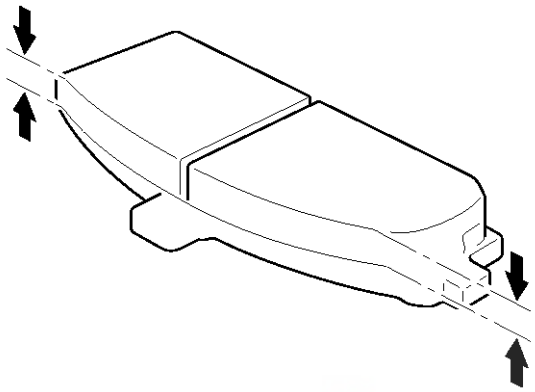


LJIF501R

Rear Brake Pad Check

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

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



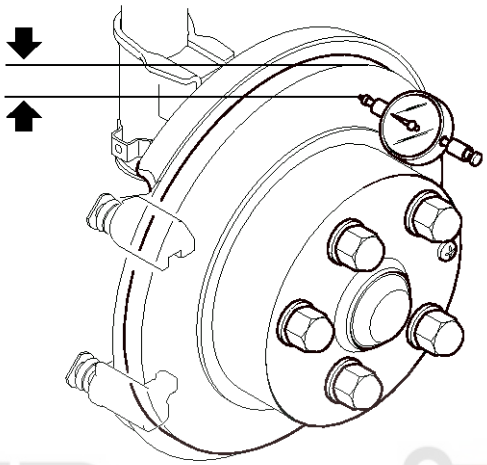
KJQE088A

2. Check that grease is applied, and the pad and backing metal for damage.

Rear Brake Disc Run Out Check

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

Brake disc run out
Limit : 0.03 mm (0.0012 in.) or less



KJQE100E

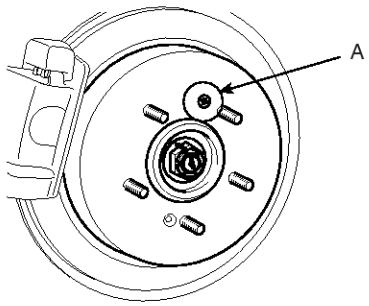
2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot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

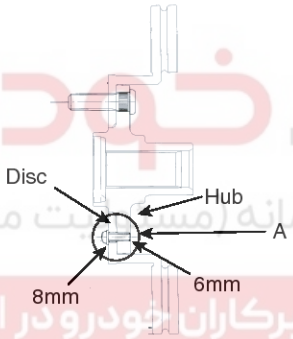
Seize of Rear brake disc

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

   NOTICE

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

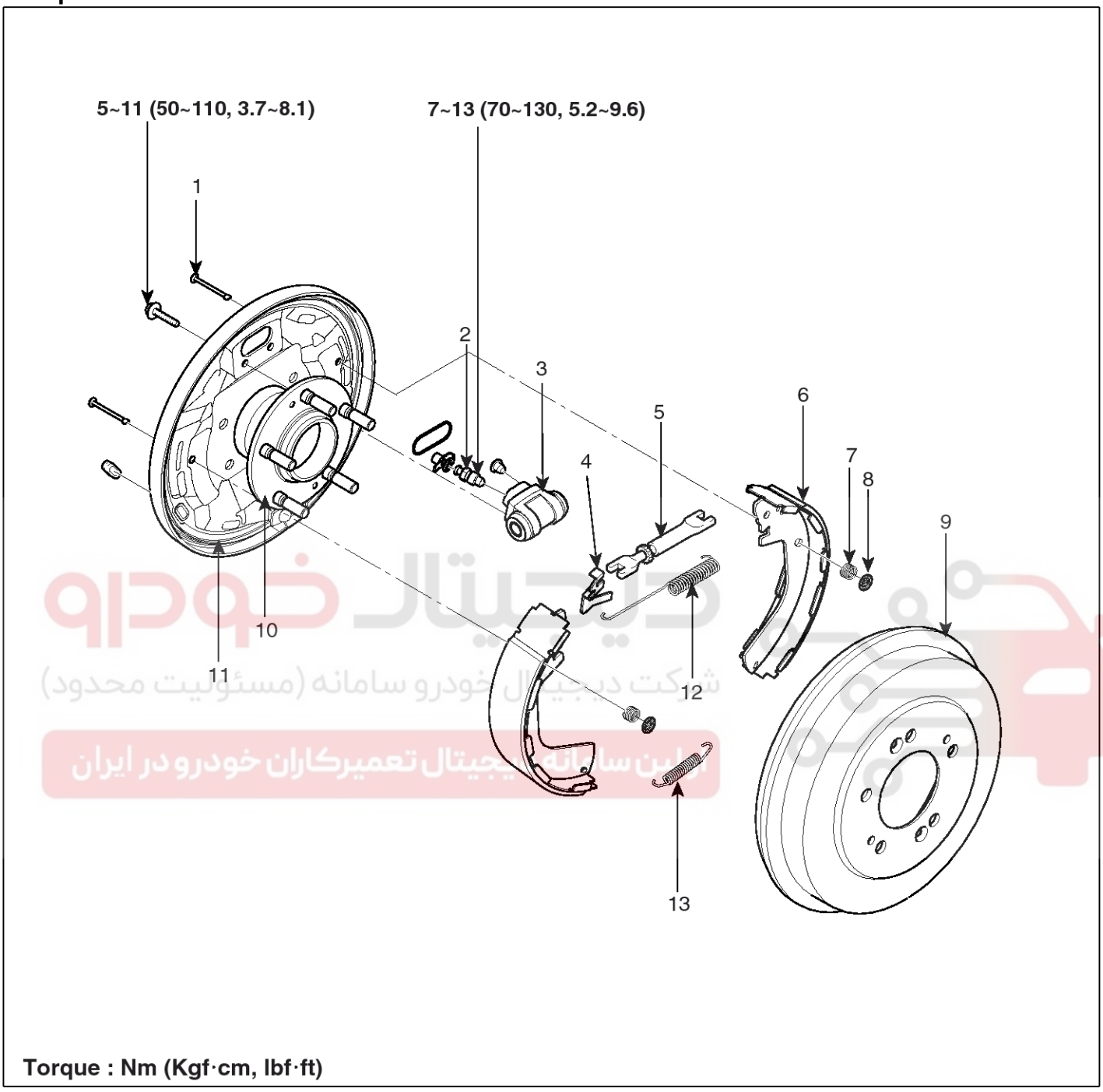




LJIF500I

Rear Drum Brake

Components



SKMBR0008L

1. Shoe hold down pin
2. Bleeder screw
3. Wheel cylinder
4. Shoe adjuster lever
5. Shoe adjuster
6. Shoe & lining assembly
7. Shoe hold down spring
8. Cup washer
9. Brake drum
10. Rear hub
11. Rear brake backing plate
12. Upper shoe return spring
13. Lower shoe return spring

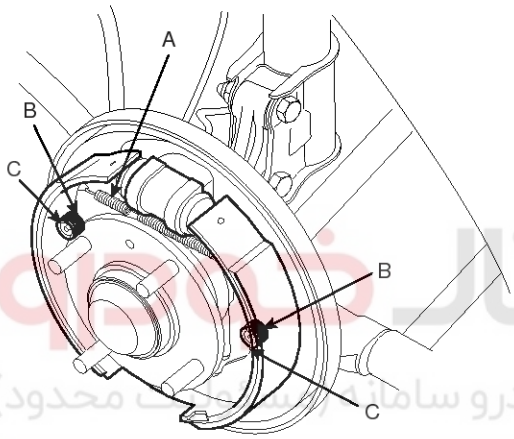
Removal

CAUTION

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

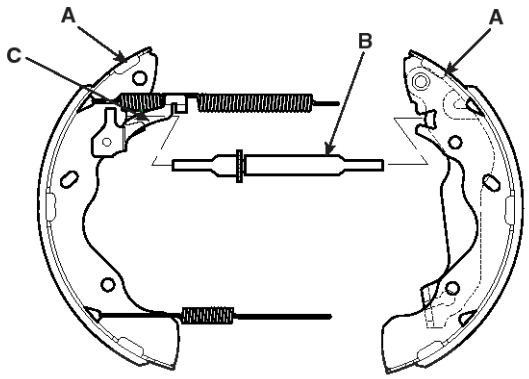
- **Avoid breathing dust particles.**
- **Never use an air hose or brush to clean brake assemblies.**

1. Remove the shoe hold down pins (B) by pushing the shoe hold cup washer (C) and turning them.
2. Disengage the upper return spring (A).



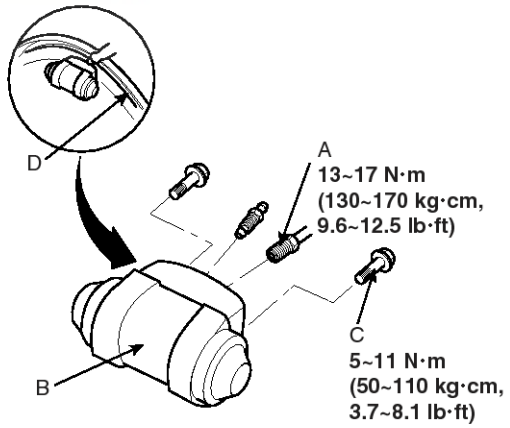
EGGE700T

3. Remove the lower shoe return spring (B) as removing the brake shoe assembly(A). Make sure not to damage the dust cover on the wheel cylinder.
4. Disconnect the parking brake cable from the parking brake lever.
5. Remove the brake shoe assembly.
6. Remove shoe adjuster (B) and lever (C) from the brake shoes.



ARJE502H

7. Disconnect the brake tube (A) from the wheel cylinder.
8. Remove the bolt (C) and the wheel cylinder from the backing plate(D).



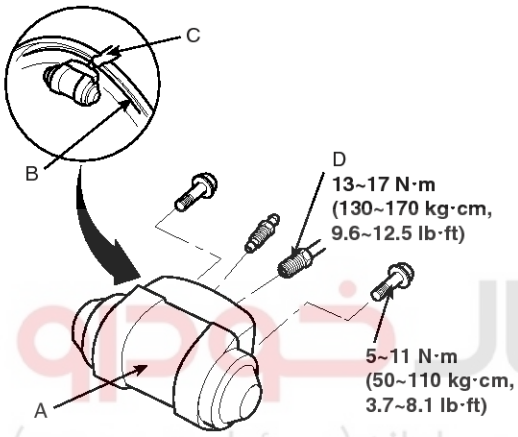
LJIF501W

Installation

NOTICE

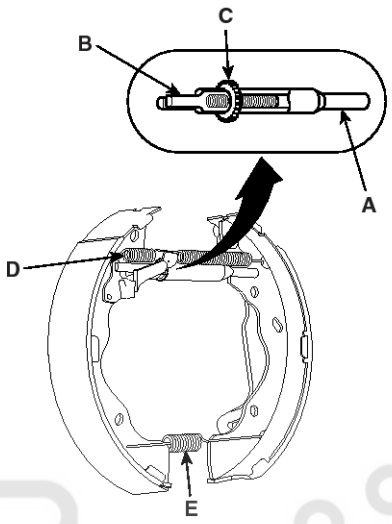
- *Do not spill brake fluid on the vehicle: it may damage the paint; if brake fluid does contact the paint. Wash it off immediately with water.*
- *To prevent spills, cover the hose joints with rags or shop towels.*
- *Use only a genuine wheel cylinder special bolt.*

1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.



LJIF501X

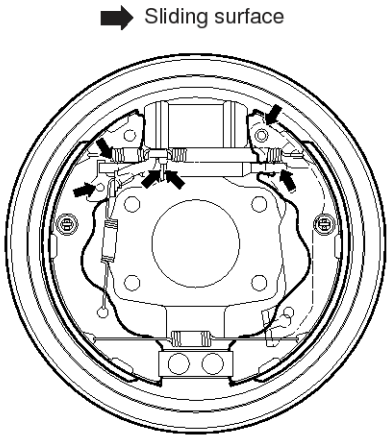
2. Connect the brake tubes (D) to the wheel cylinder.
3. Connect the parking brake cable to the parking brake lever.
4. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Grease the threads of the adjuster assembly,turn the adjuster bolt (C), adjusting the length of the shoe adjuster assembly.



LJIF501Y

5. Hook the shoe adjuster then install to the brake shoe.
6. Install the shoe adjuster assembly and upper return spring (D), noting the installation direction. Be careful not to damage the wheel cylinder dust covers.
7. Install the lower return spring (E).

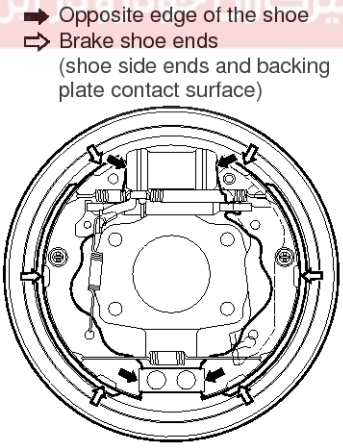
8. Grease brake cylinder to the sliding surfaces as shown below. Wipe off any excess. Don't get grease on the brake linings.



EGGE700V

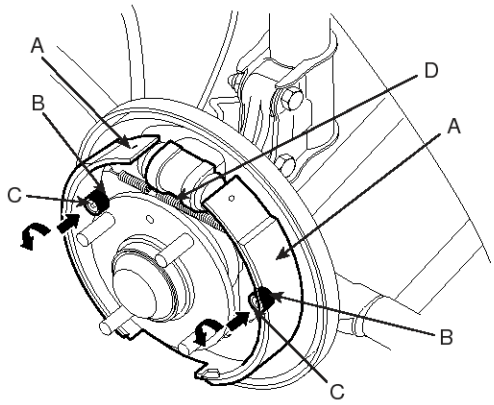
9. Grease brake cylinder to the brake shoe ends and opposite edges of the as shoes as shown below.

   Wipe off any excess. Don't get grease on the brake linings.



EGGE700W

10. Grease brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.
11. Install the shoe hold down pins (B), shoe hold down spring and the shoe hold down cup (C).



EJKE803F

12. Install the brake drum.
13. Bleed the brake system,after refilling the brake fluid.
14. Depress the brake pedal several times to set the self-adjusting brake.
15. Adjust the parking brake.

Inspection

CAUTION

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

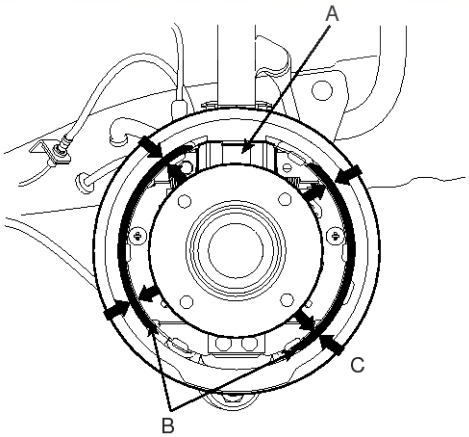
- **Avoid breathing dust particles.**
- **Never use an air hose or brush to clean brake assemblies.**

NOTICE

- *Contaminated brake linings or drums reduce stopping ability.*
- *Block the front wheels before jacking up the rear of the vehicle.*

1. Raise the rear of the vehicle, and make sure it is securely supported.
2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.
4. Check the brake linings (B) for cracking, glazing, wear, and contamination.
5. Measure the brake lining thickness (C).
   Measurement does not include brake shoe thickness.

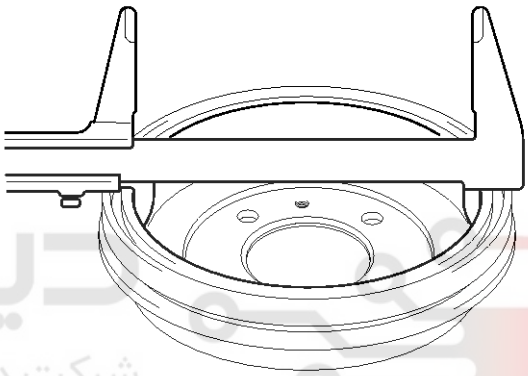
Brake lining thickness
Standard : 4.5 mm (0.177 in.)
Service limit : 1.0 mm (0.039 in.)



EGGE700R

6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.
8. Measure the inside diameter of the brake drum with inside vernier calipers.

Drum inside diameter:
Standard : 228.6 mm (9 in.)
Service limit : 230.6 mm (9.079in.)
Drum roundness
Service limit : 0.06mm (0.00236in.)

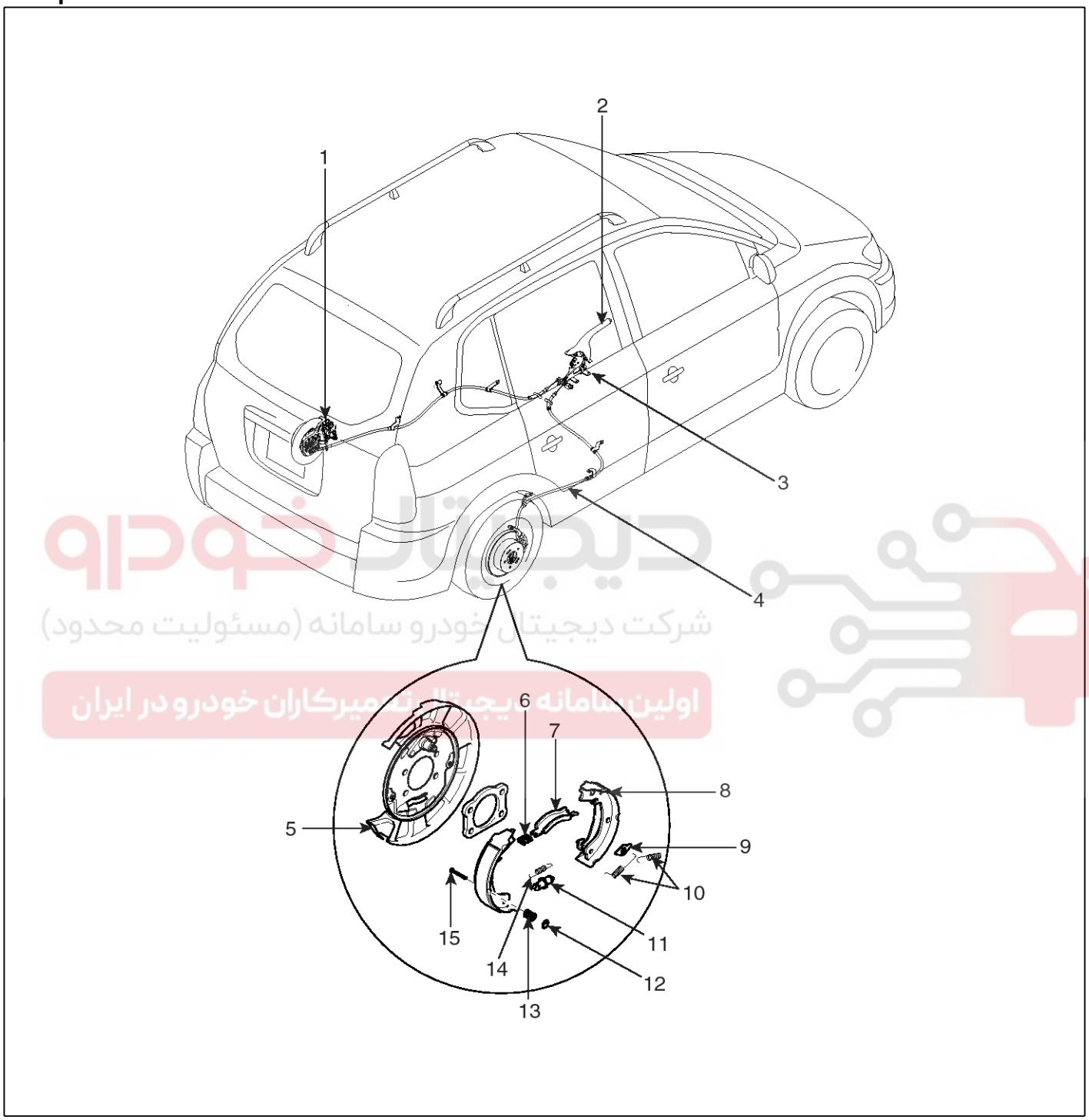


EGGE700S

9. If the inside diameter of the brake drum is more than the service limit, replace the brake drum.
10. Check the brake drum for scoring, grooves, and cracks.

Parking Brake System

Components



SKMBR0009L

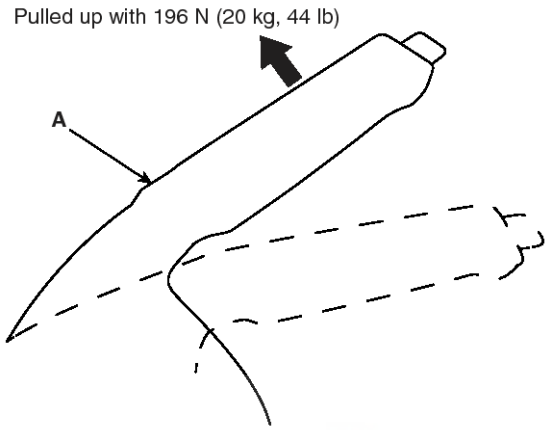
1. Rear brake caliper
2. Parking brake lever
3. Parking brake switch
4. Parking brake cable
5. Backing plate
6. Thrust spring
7. Thrust
8. Shoes & linings
9. Shoe guide
10. Return spring
11. Adjuster
12. Cup washer
13. Shoe hold down spring
14. Return spring
15. Shoe hold down pin

Parking Brake Check and Adjustment

Inspection

1. Pull the parking brake lever (A) with 196 N (20 kg, 44lbf) force to fully apply the parking brake. The parking brake lever should be locked within the specified number of clicks.

Lever locked clicks:7~8



LJIF500M

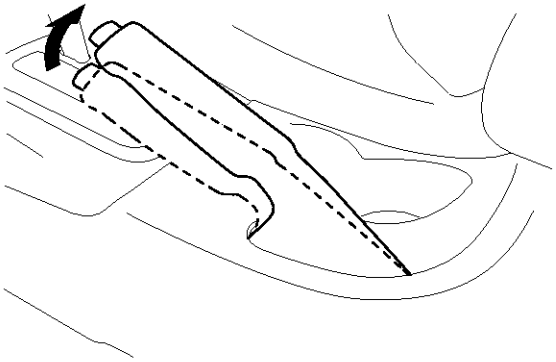
2. Adjust the parking brake if the lever clicks are out of specification.

Adjustment

NOTICE

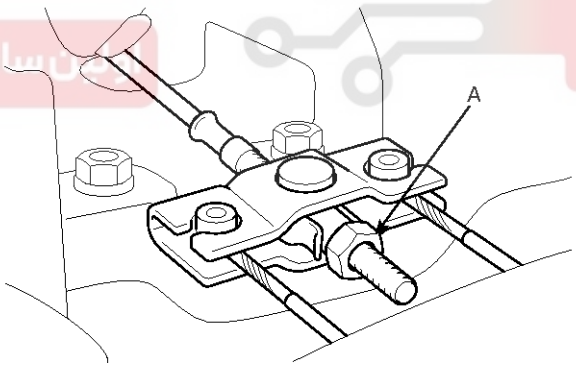
After rear brake caliper servicing, loosen the parking brake adjusting nut, start the engine and depress the brake pedal several times to set the self-adjusting brake before adjusting the parking brake.

3. Block the front wheels, then raise the rear of the vehicle and make sure it is securely supported.
4. Pull the parking brake lever up one click.



EJKE002C

5. Remove the floor console.
6. Tighten the adjusting nut (A) until the parking brakes are dragged slightly when the rear wheels are turned.



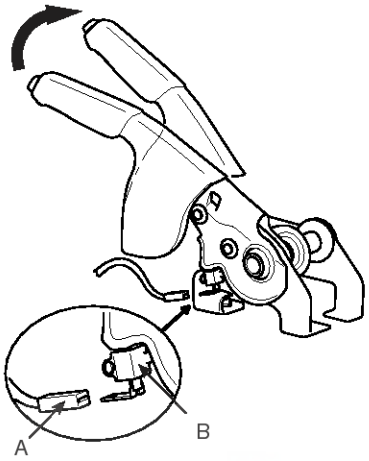
EJKE002D

7. Release the parking brake lever completely, and check if parking brakes are not dragged when the rear wheels are turned. Readjust if necessary.
8. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up completly.
9. Reinstall the floor console.

Parking Brake Switch

Inspection

1. Remove the floor console and the switch (B) from the connector (A).



EJQE004R

2. Inspect the continuity between (-) terminal and the ground.
   - When the brake lever is pulled, there should be the continuity between them.
   - When the brake lever is released, there should be no continuity between them.

Parking Brake Assembly

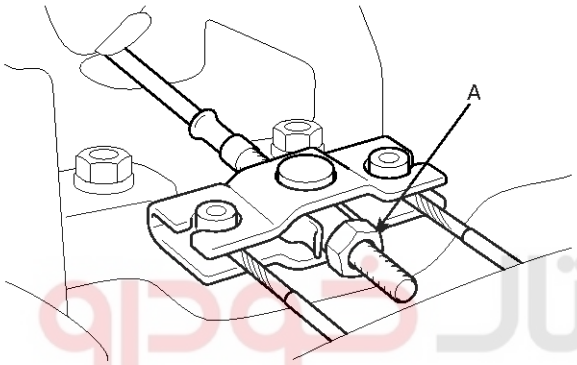
Removal

NOTICE

The parking brake cables must not be bent or distorted.

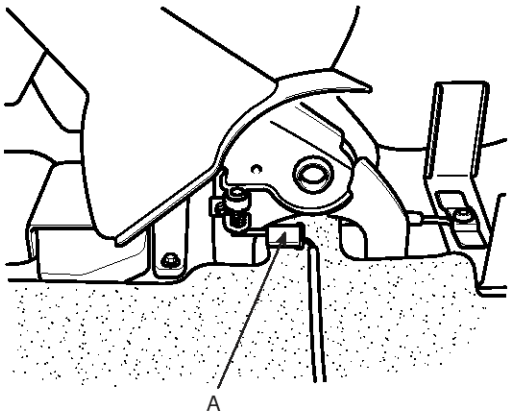
This will lead to stiff operation and premature failure.

1. Remove the floor console.
2. Loosen the adjusting nut (A) and remove the parking brake cables.



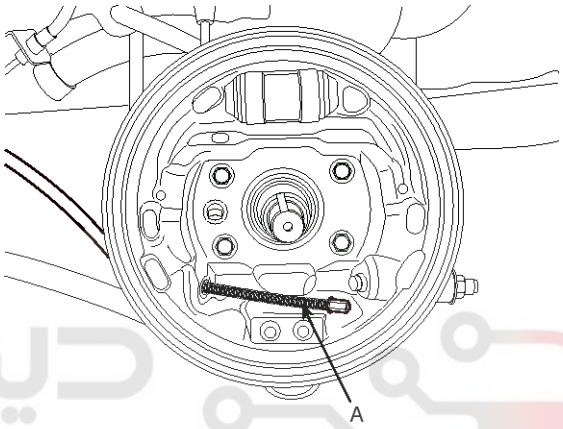
EJKE002D

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



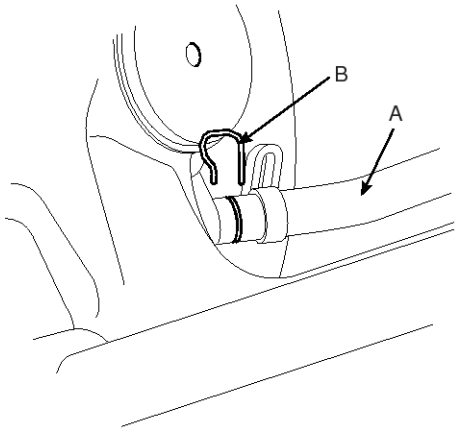
EGGE700X

4. Remove the bolts and parking brake lever assembly(A).
5. Remove the wheel and tire.
6. Remove the brake drum and the brake shoe (Refer to the rear drum brake).
7. Remove the parking brake cable(A) from the brake shoe.



KJQE040K

8. Remove the parking brake cable retaining ring (B), from the parking brake cable (A).



EJKE900B

9. Remove the parking brake cable assembly.

Installation

1. Install the removed parts in the reverse order of removal.
2. Apply the specified grease to each sliding parts of the ratchet plate or the ratchet pawl.

Specified grease :
Multi purpose grease SAE J310, NLGI No.2

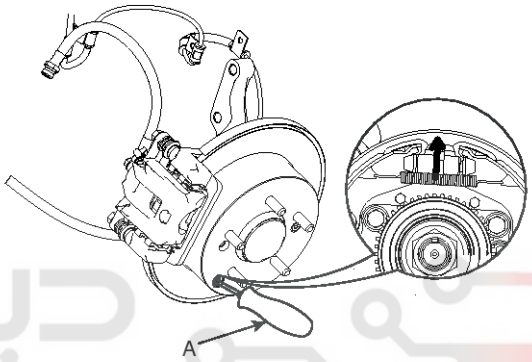
3. After installing the parking brake cable adjuster, adjust the parking brake lever stroke (Refer to the parking brake check and adjustment).

Adjustment

Parking Brake Shoe Clearance Adjustment

Disc brake type

1. Lift the vehicle, and make sure it is securely supported.
2. Remove the rear tire and wheel.
3. Remove the plug from the disc.
4. Turn the adjusting wheel in arrow direction as shown until the disc won't be rotated by tangential force of 29.4N(3kgf, 6.6lb) using the (-)screw driver (A). Then turn back the adjusting wheel by 5 notches.

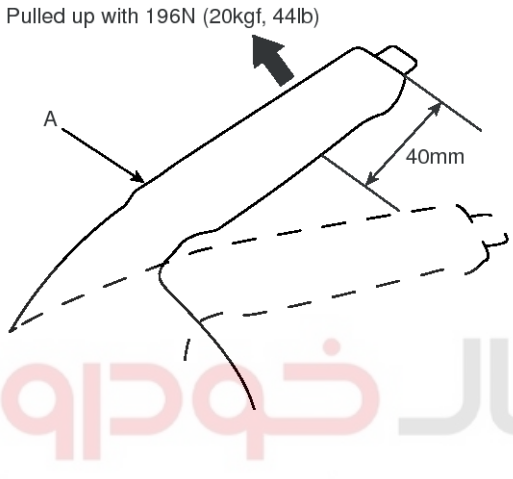


SJMBR8300D

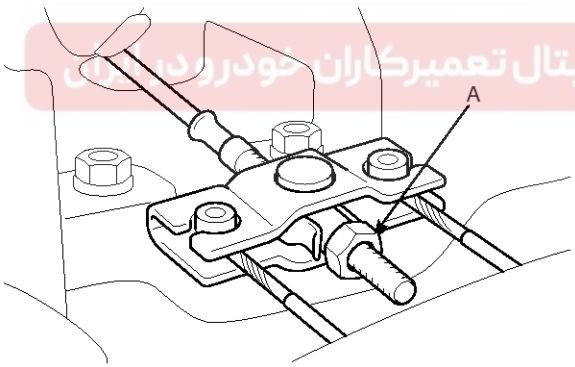
5. Install the rear tire and wheel after installing the plug.

Parking Brake Lever Stroke Adjustment

1. Lift the vehicle, and make sure it is securely supported.
2. Remove the floor console. (Refer to BD Gr. - "Floor console")
3. After the full stroke operation of the brake lever over 3 times for setting the cable, the travel must be between 8 notches when applying a force of 196N(20kgf, 44lb) at 40mm from the end of lever assembly (excluding button) by adjusting nut (A).



SJBBR8301L



SJBBR8302D

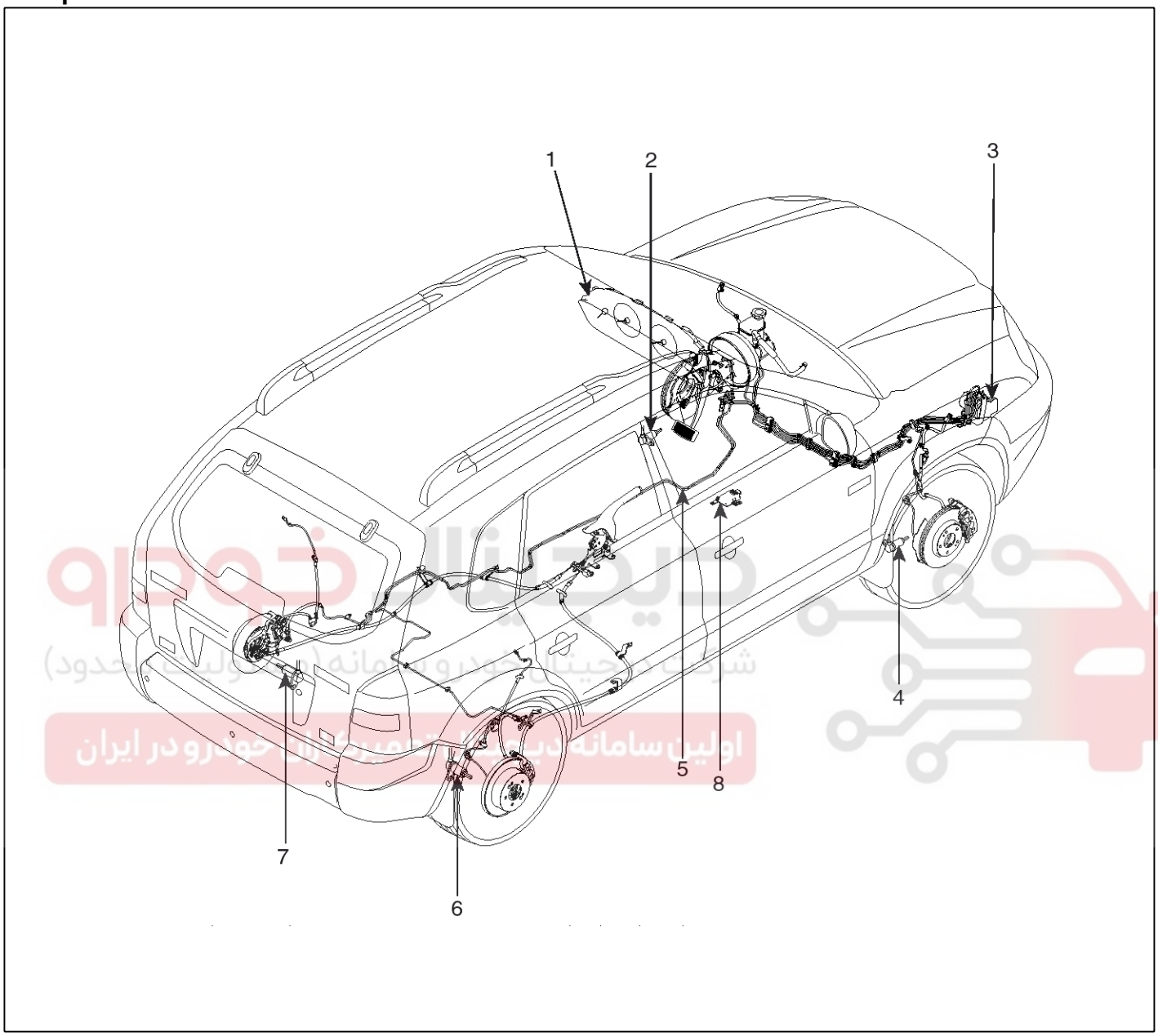
4. Release the parking brake lever fully, and check that parking brakes do not drag when the rear wheels are turned. Readjust if necessary.
5. Make sure that the parking brakes are fully applied when the parking brake lever is pulled up fully.
6. Parking indicator lamp must be “OFF”when the lever assembly is released. It must be “ON” when the lever assembly is operated by 1 notch.
7. Install the floor console. (Refer to BD Gr. - "Floor console")

⚠CAUTION

After repairing the parking brake shoe, adjust the brake shoe clearance, and then adjust the parking brake lever stroke.

ABS(Anti-Lock Brake System)

Components



SKMBR0130D

1. Cluster
2. Front left wheel speed sensor
3. ABS Control module (HECU)
4. Front right wheel speed sensor
5. Hydraulic fluid line
6. Rear right wheel speed sensor
7. Rear left wheel speed sensor
8. Longitudinal G sensor (4WD)

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

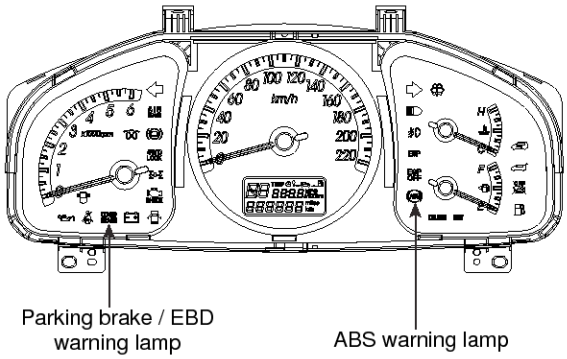
The ECU performs a pump motor test at a speed of 12 km/h(7 MPH) once after IGN is switched on.

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



SKMBR7304L

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:

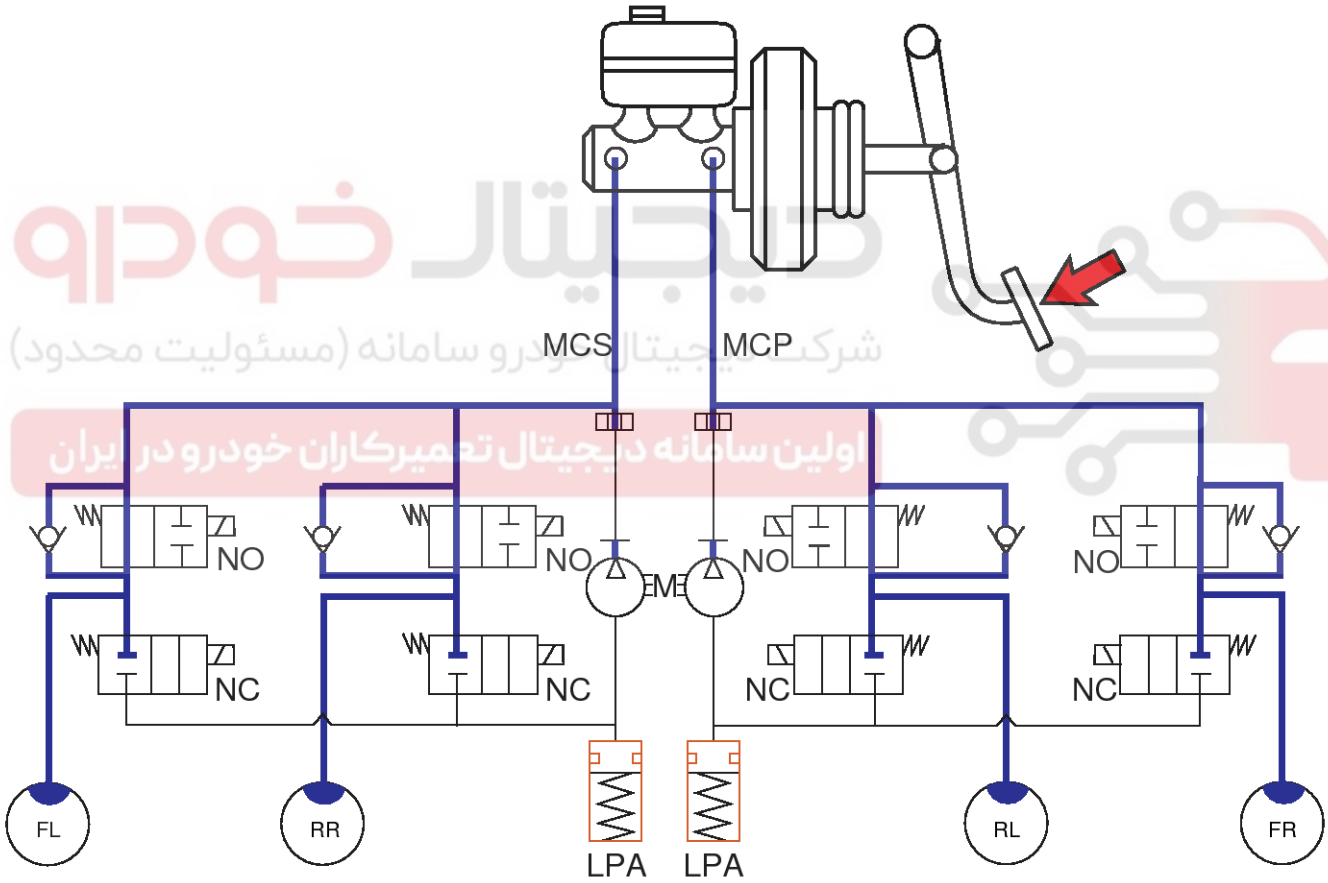
   - During the initialization phase after IGN ON. (continuously 3 seconds).
   - When the Parking Brake Switch is ON or brake fluid level is low.
   - When the EBD function is out of order.
   - During diagnostic mode.
   - When the ECU Connector is seperated from ECU.

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 m-otor
Inlet valve (NO)	OFF	Open	Master cylinder ⇔ Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder ⇔ Reservoir	

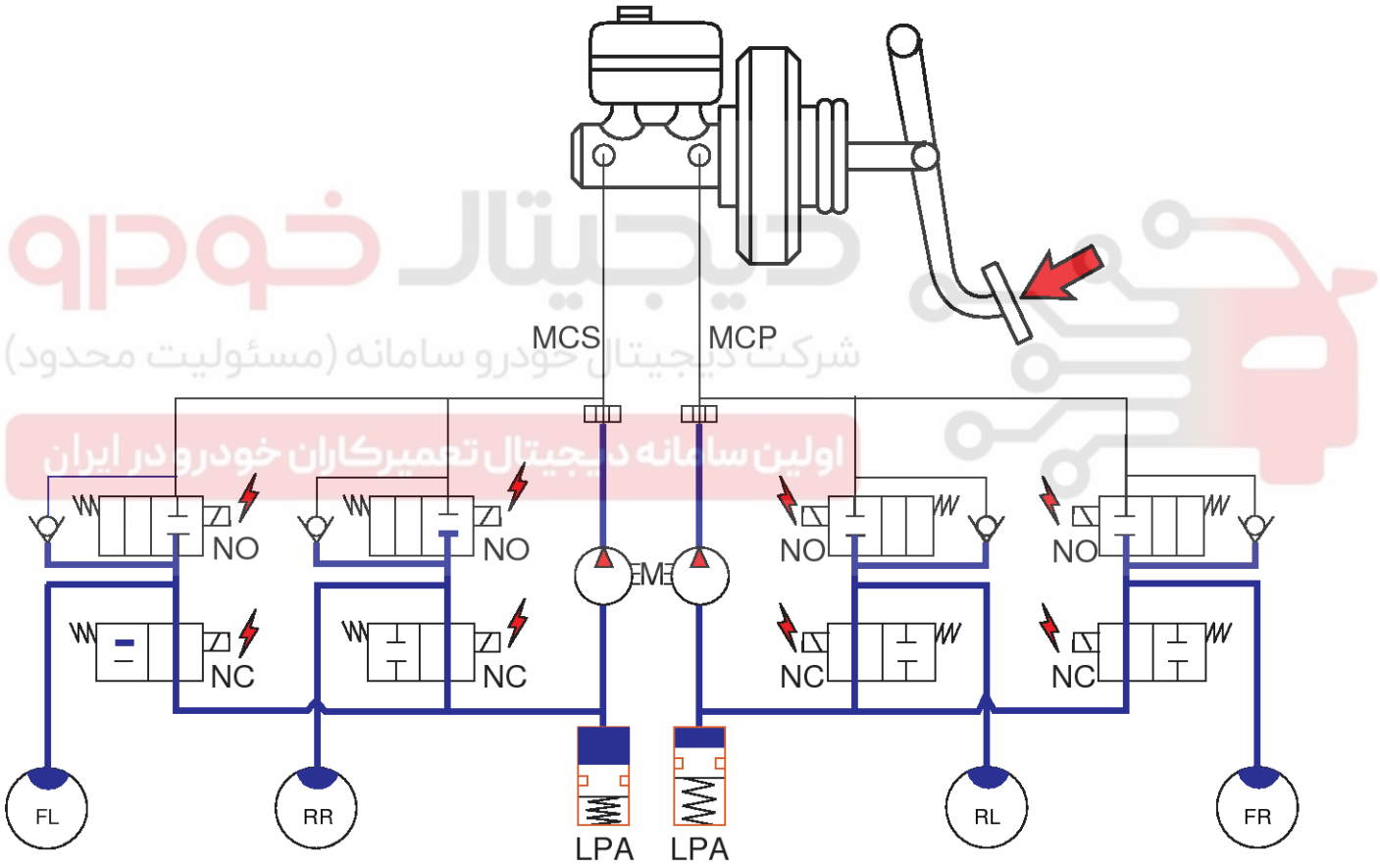


LJJF500W

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 m-otor
Inlet valve (NO)	ON	Close	Master cylinder ⇔ Wheel cylinder	ON
Outlet valve (NC)	ON	Open	Wheel cylinder ⇔ Reservoir	

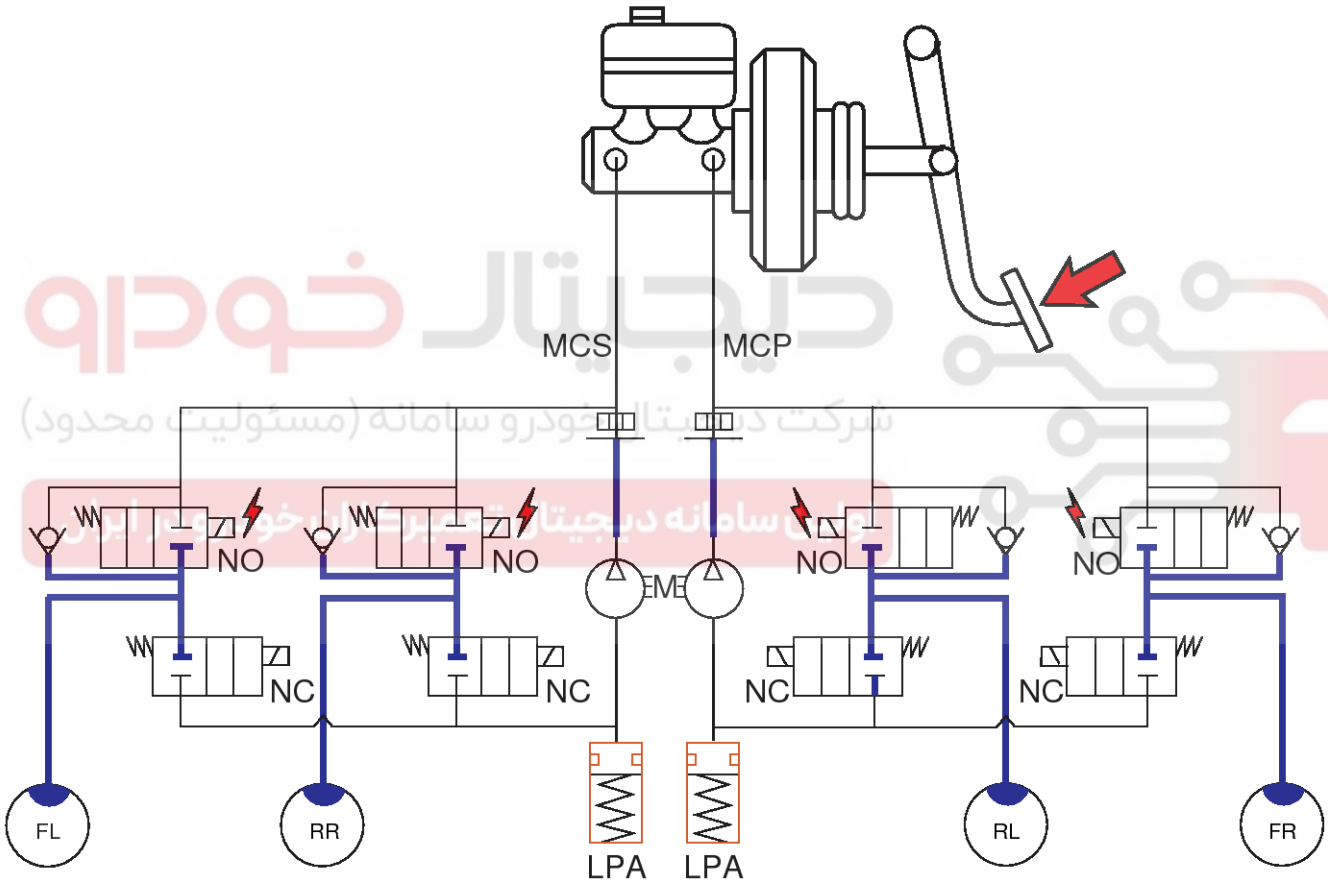


LJJF500X

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 m-otor
Inlet valve (NO)	ON	Close	Master cylinder ⇔ Wheel cylinder	OFF
Outlet valve (NC)	OFF	Close	Wheel cylinder ⇔ Reservoir	

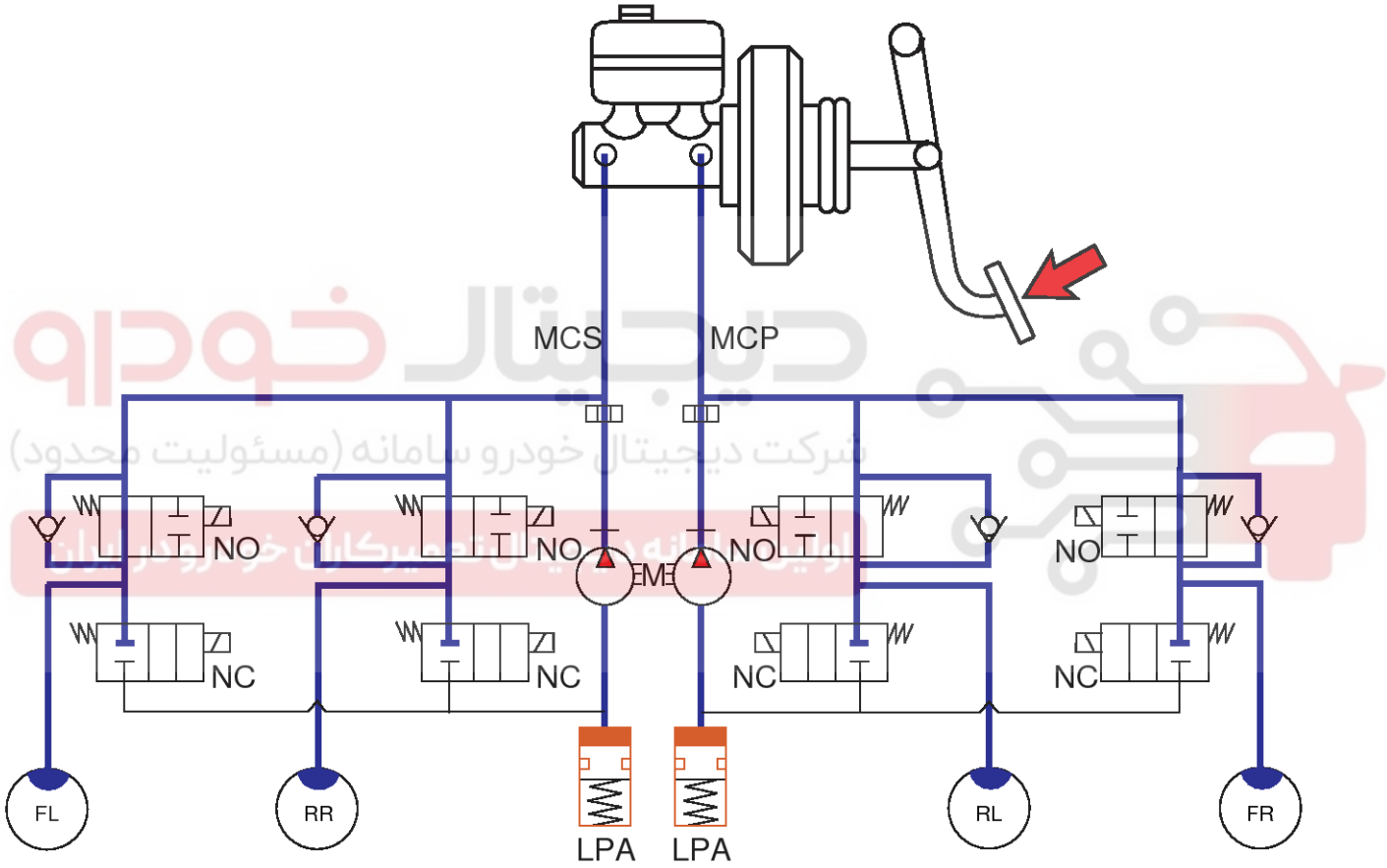


LJJF500Y

4. Increase mode

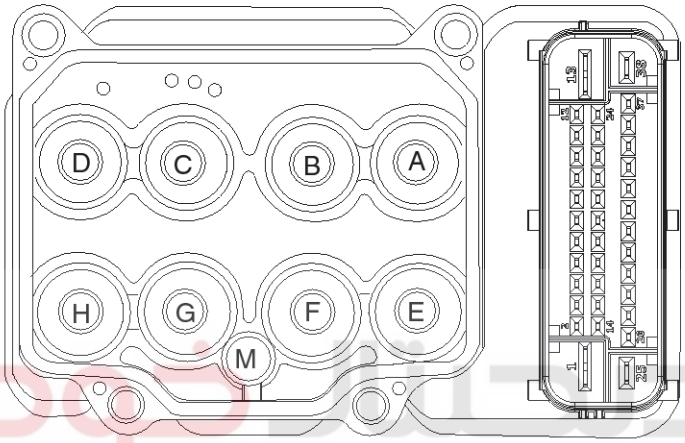
   If HECU determines there's no lock-up in the wheel, HECU cuts voltage to solenoid valve. So voltage is not supplied to each solenoid valve, brake fluid passes through the inlet valve to wheel cylinder, resulting in pressure increase.

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



LJJF500Z

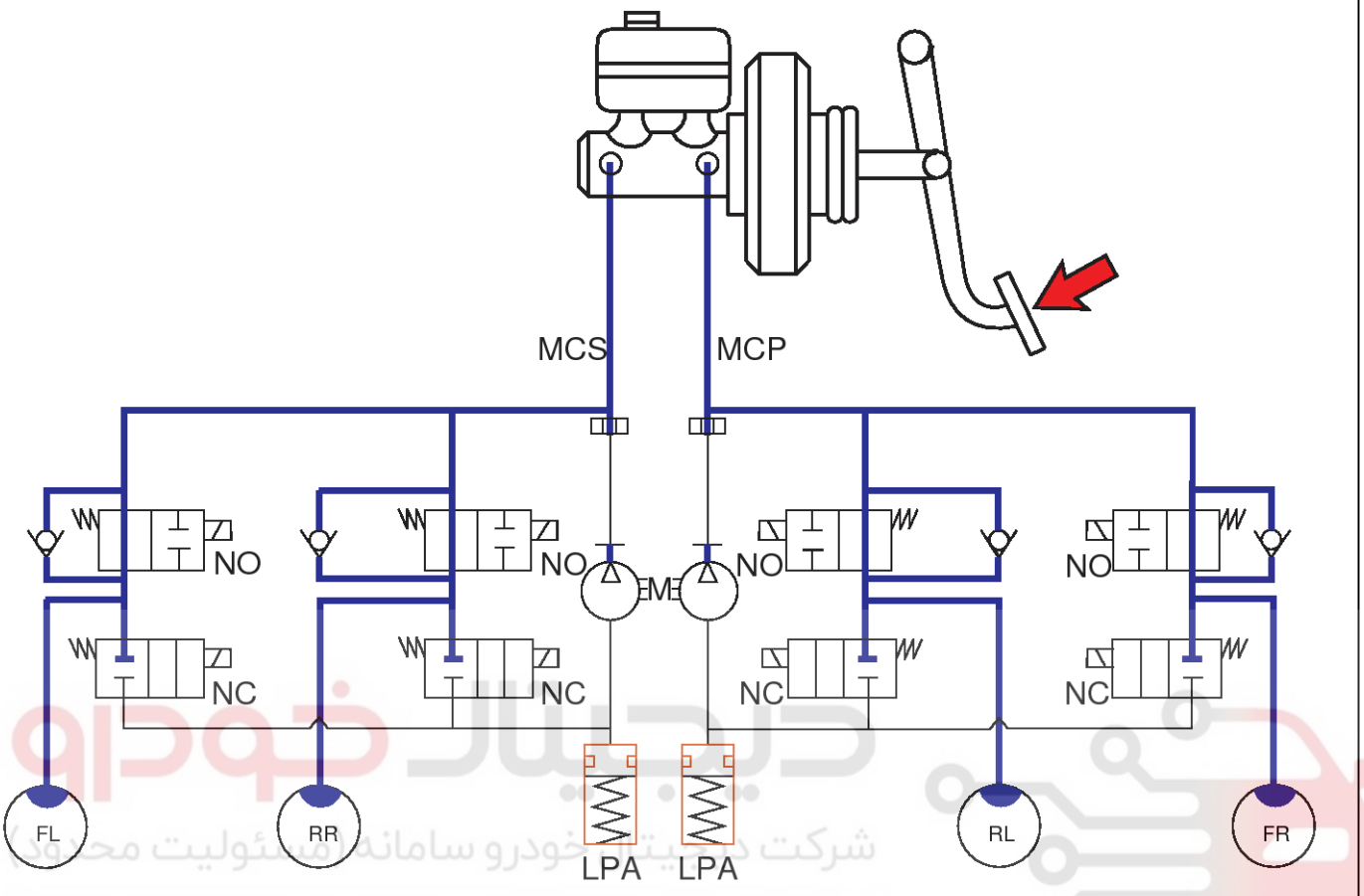
ABS HECU External diagram



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

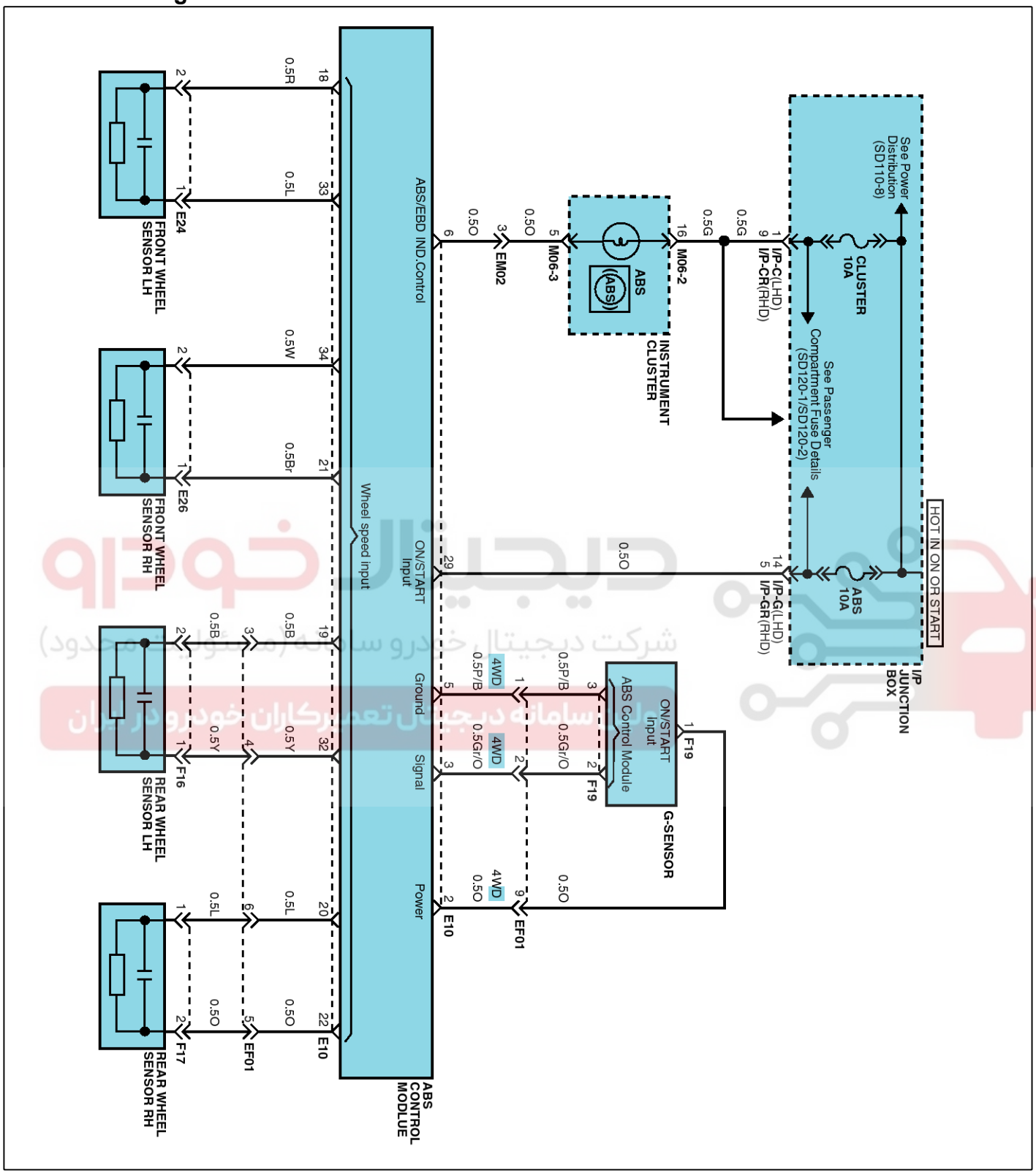
SKMBR0135D

Hydraulic System Diagram

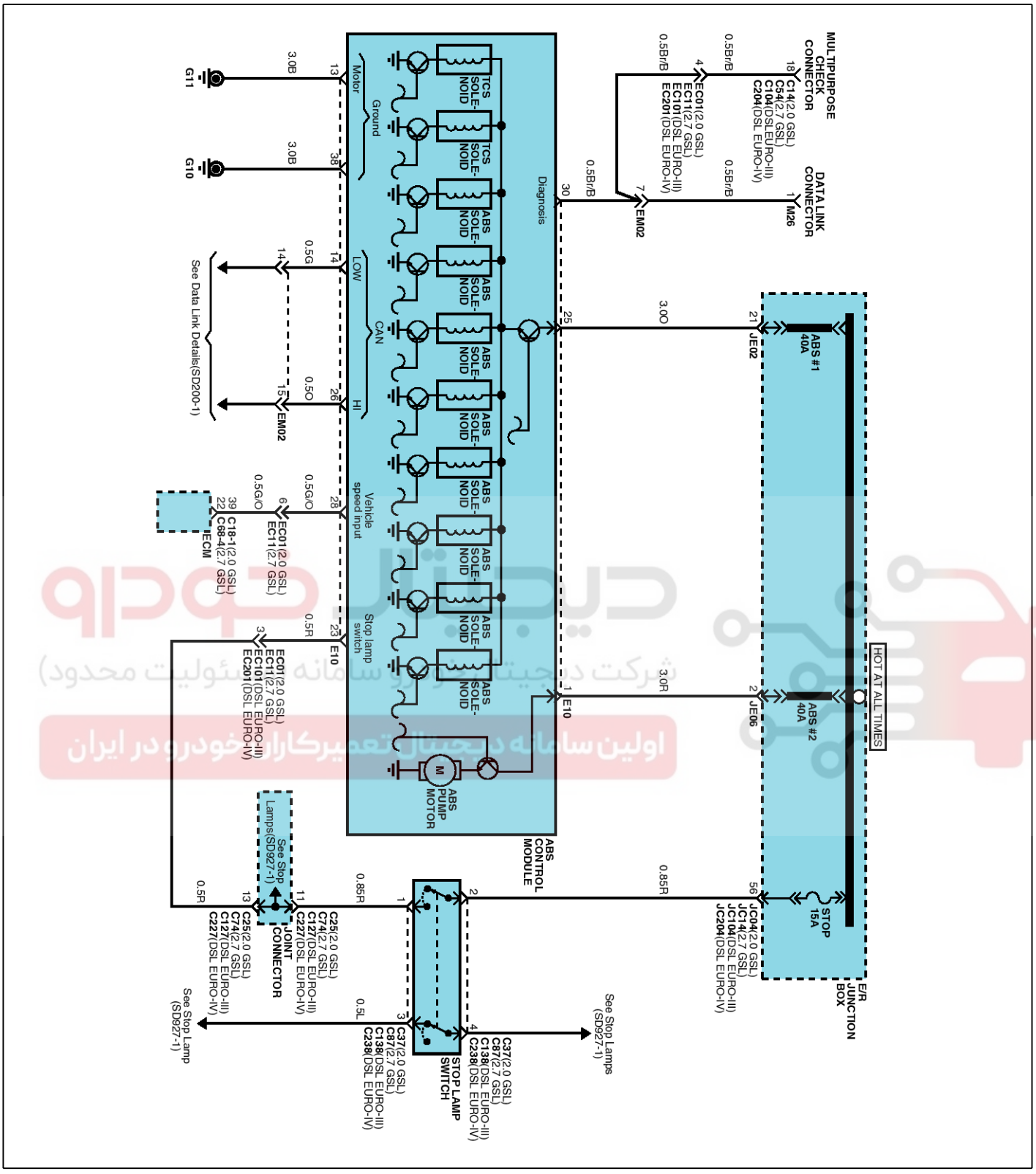


LJJF501B

ABS Circuit diagram

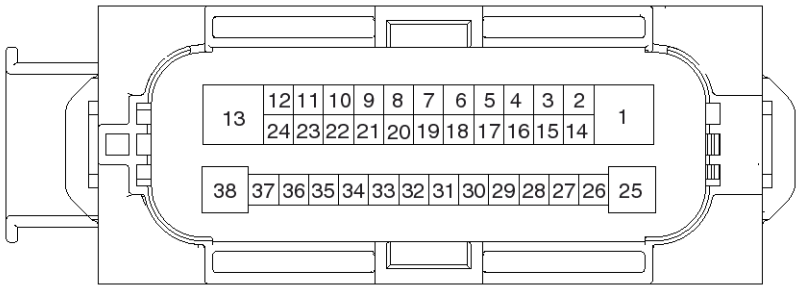


SKMBR0010L



SKMBR0011L

ABS Connector Input/output

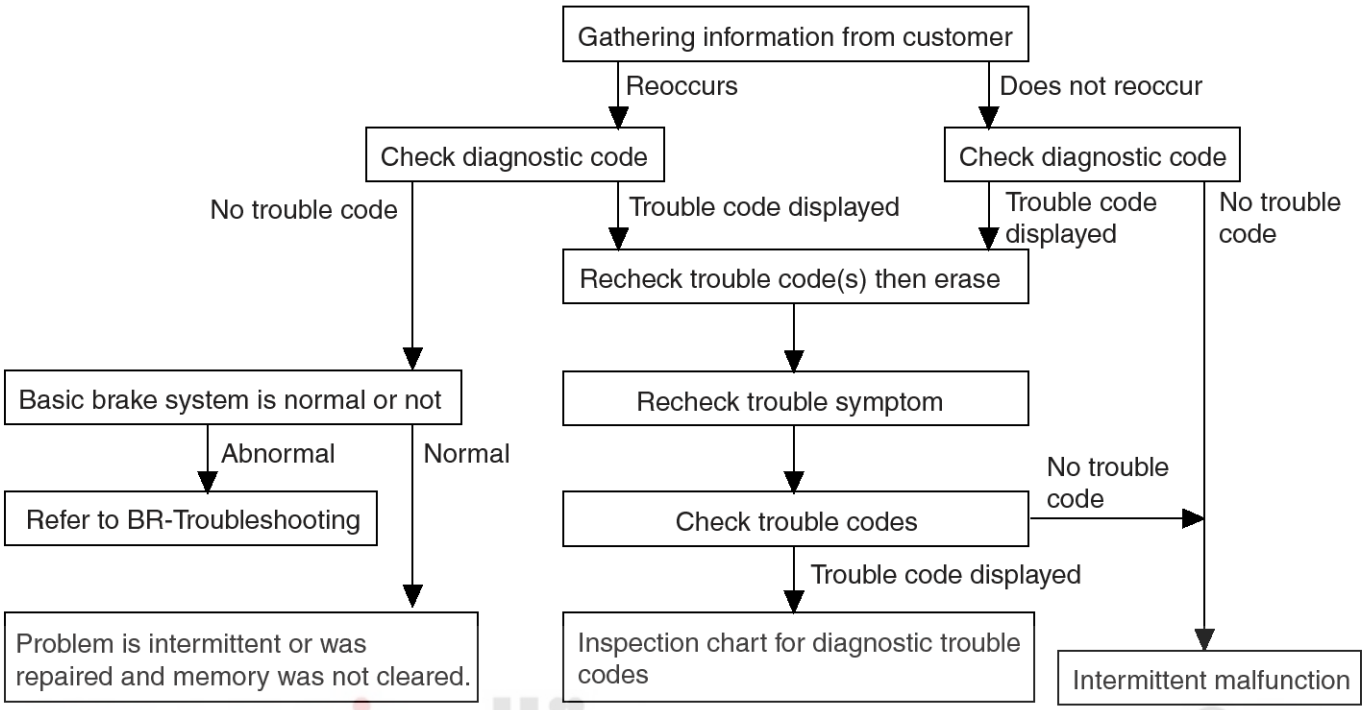


SKMBR0134D

Connector Terminal		Specification	Remark
No	Description		
29	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	
25	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	
38	GROUND	Rated current : I < 300mA Max. current: I < 40A	
13	PUMP MOTOR GROUND	Rush current : I < 100A Max current : I < 40A	
5	G SENSOR GROUND (4WD Only)	- Rated current : I < 10mA	
2	G SENSOR POWER (4WD Only)	- Max Output current : I < 10mA - Max Output voltage : 4.75V ≤ V ≤ 5.25V	
3	G SENSOR SIGNAL (4WD Only)	- Input voltage : 0V ≤ V ≤ 5.0V - Zero offset voltage : 2.5 ± 0.1V	
23	BRAKE LIGHT SWITCH	Input voltage low: 0V ≤ V ≤ 3.0V Input voltage High: 7.0V ≤ V ≤ 16.0V	

Connector Terminal		Specification	Remark
No	Description		
18	SENSOR FRONT LEFT POWER	- Output voltage : IGN[V] ± 1V - Output current : Max 30mA	
34	SENSOR FRONT RIGHT POWER		
19	SENSOR REAR LEFT POWER		
33	SENSOR REAR RIGHT POWER		
31	SENSOR FRONT LEFT SIGNAL	- Input current LOW : 5.9 ~ 8.4mA - Input current HIGH : 11.8 ~ 16.8mA - Frequency range : 1 ~ 2500Hz - Input duty : 50 ± 20%	
21	SENSOR FRONT RIGHT SIGNAL		
32	SENSOR REAR LEFT SIGNAL		
20	SENSOR REAR RIGHT SIGNAL		
30	DIAGNOSIS INPUT/OUTPUT	Input voltage (Low) : V < 0.3V (IGN) [V] Input voltage (High) : V > 0.7V (IGN) [V] Output voltage (Low) : V < 0.2V (IGN) [V] Output voltage (High) : V > 0.8V (IGN) [V]	
14	CAN BUS LINE (LOW)	Max. current : I < 10mA	
26	CAN BUS LINE (HIGH)		
28	SENSOR FRONT RIGHT OUTPUT	Max. current : I < 16mA External pull up resister : 1kΩ < R Output duty : 50 ± 20%	
6	ABS/EBD W/LAMP DRIVE	Current : I < 300mA (12V) Voltage Range : 0 ~ 18V Min. shunt Resistance : 500kΩ	

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 GDS is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line
Communication with GDS 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 GDS with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.

   Is the normal code output?

▶ Check the power source circuit.

▶ Erase the DTC and recheck using GDS.

Check the power source circuit

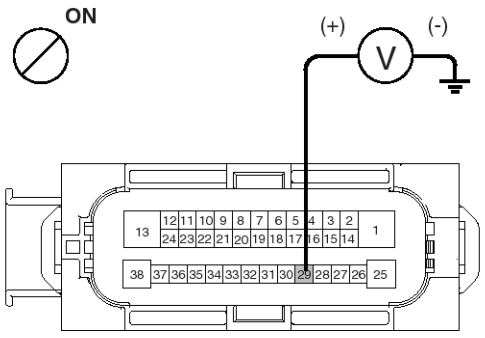
1. Disconnect the connector from the ABS(ESP) control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ABS(ESP) control module harness side connector and body ground.

Specification : approximately B+

3. Is the voltage within specification?

▶ Check the ground circuit.

▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS(ESP) control module. Repair if necessary.



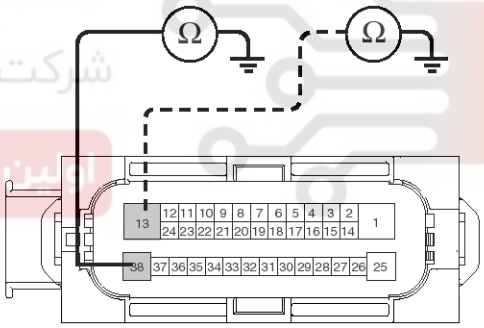
SKMBR0140D

Check the ground circuit

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

▶ Check the wheel speed sensor circuit.

▶ Repair an open in the wire and ground point.



SKMBR0141D

Check the wheel speed sensor circuit

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

▶ Check the hydraulic circuit for leakage.

▶ Repair or replace the wheel speed sensor.

Check the hydraulic circuit for leakage

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

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

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

▶ Check the wheel speed sensor circuit.

▶ Erase the DTC and recheck using GDS.

Check the wheel speed sensor circuit

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

▶ Check the stop lamp switch circuit.

▶ Repair or replace the wheel speed sensor.

Check the stop lamp switch circuit

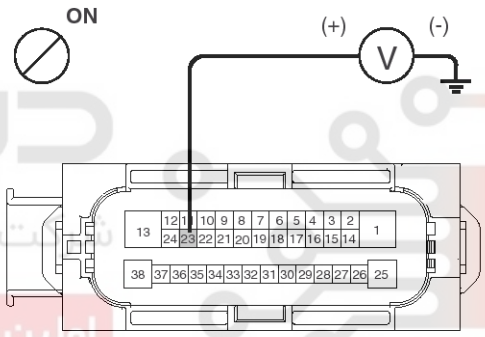
1. Check that stop lamp lights up when brake pedal is depressed and turns off when brake pedal is released.
2. Measure the voltage between terminal 23 of the ABS(ESP) control module harness side connector and body ground when brake pedal is depressed.

Specification : approximately B+

3. Is the voltage within specification?

▶ Check the hydraulic circuit for leakage.

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



SKMBR0142D

Check the hydraulic circuit for leakage

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

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

▶ Repair the hydraulic lines for leakage.

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

SVIBR0321L

Detecting Condition

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

Inspection Procedures

Check the power supply circuit for the diagnosis

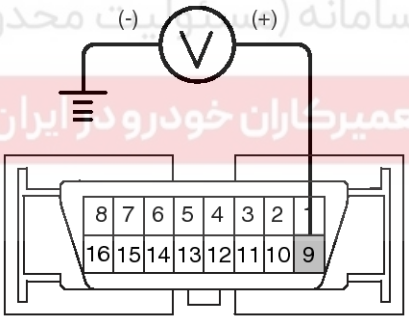
1. Measure the voltage between terminal 9 of the data link connector and body ground.

Specification : approximately B+

2. Is voltage within specification?

▶ Check the ground circuit for the diagnosis.

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

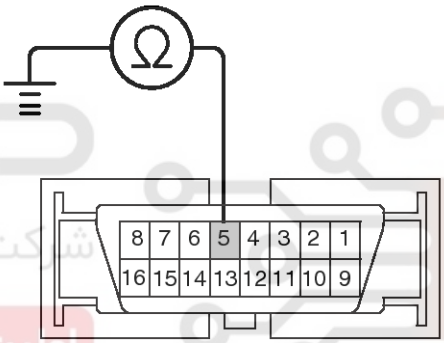


SUNBR6519L

Check the ground circuit for the diagnosis

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

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



SUNBR6520L

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

SVIBR0322L

Detecting Condition

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

Inspection Procedures

Check for continuity in the diagnosis line

1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 30 of the ABS(ESP) control module connector and 1 of the data link connector.
3. Is there continuity?

▶ Check the power source of ABS(ESP) control module.

▶ Repair an open in the wire.

Check the power source of ABS(ESP) control module

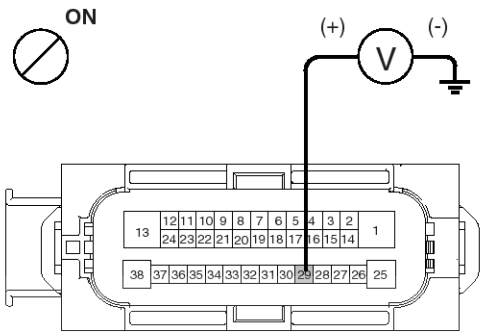
1. Disconnect the connector from the ABS(ESP) control module.
2. Turn the ignition switch ON, measure the voltage between terminal 29 of the ABS(ESP) control module harness side connector and body ground.

Specification : approximately B+

3. Is voltage within specification?

▶ Check for poor ground.

▶ Check the harness or connector between the fuse (10A) in the engine compartment junction block and the ABS(ESP) control module.Repair if necessary.



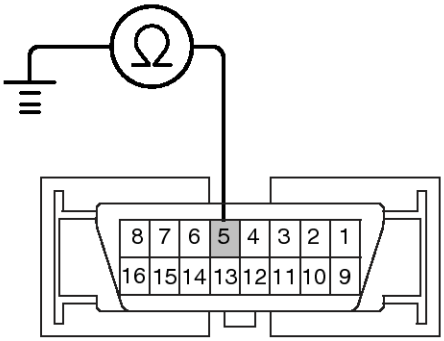
SKMBR0140D

Check for poor ground

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

▶ Replace the ABS(ESP) control module and recheck.

▶ 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

1. Disconnect the connector the ABS(ESP) HECU and turn the ignition switch ON.
2. Does the ABS waring lamp light up?

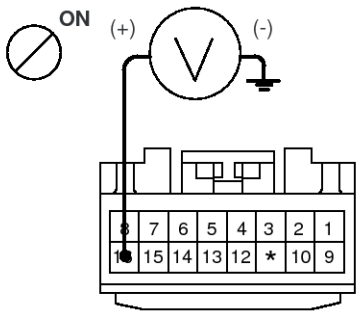
▶ Check the power source for the ABS warning lamp.

▶ Inspect again after replacing the ABS(ESP) HECU.

Check the power source for the abs warning lamp

1. Disconnect the instrument cluster connector (M06-2) and turn the ignition switch ON.
2. Measure the voltage between terminal (M06-2) 16 of the cluster harness side connector and body ground.

Specification : approximately B+



SKMBR7308L

3. Is voltage within specification?

▶ Check for blown fuse.

▶ Check the CAN circuit resistance for ABS warning lamp.

Check for blown fuse

1. Check continuity of fuse (10A) from the engine compartment junction block.
2. Is there continuity?

▶ Repair an open in the wire between ABS fuse and (M06-2)16 of cluster connector.

▶ Replace the blown fuse.

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

Inspection Procedures

Check DTC output

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

▶ Repair circuit indicated by code output.

▶ Check instrument cluster.

Check instrument cluster

1. Disconnect the cluster connector and turn the ignition switch ON.
2. Does the ABS warning lamp remains ON?

▶ Replace the instrument cluster.

▶ Check for open the wire.

Check for open in the wire

1. Check for continuity in the wire between cluster and ABS control module.
2. Is there continuity?

▶ Replace the ABS control module and recheck.

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

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.

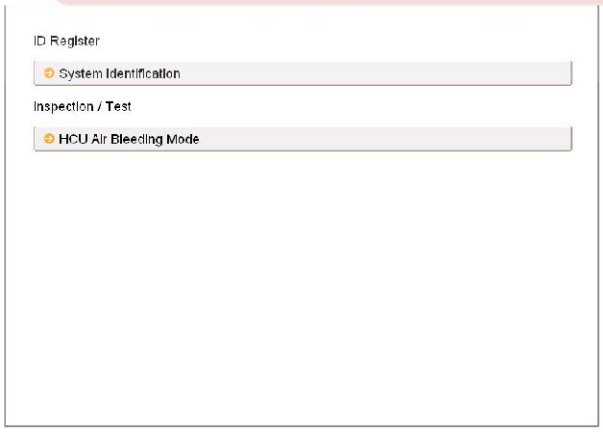
   NOTICE
   When pressure bleeding, do not depress the brake pedal.

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

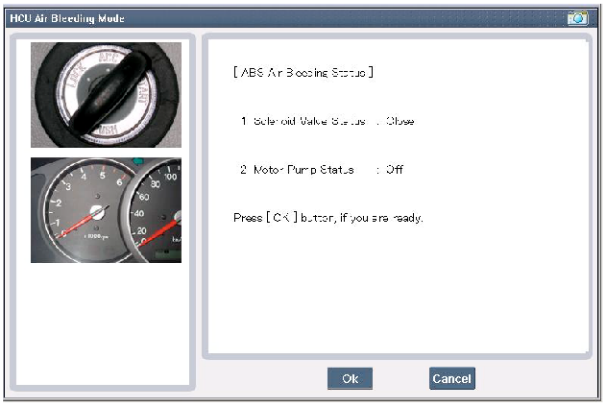
   CAUTION
   You must obey the maximum operating time of the ABS motor with the GDS to prevent the motor pump from burning.

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



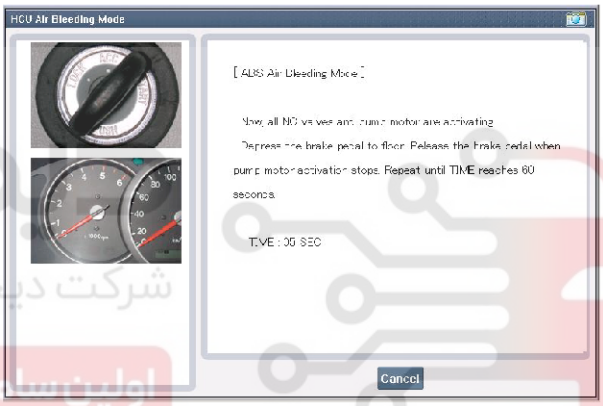
SBKBR9141N

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



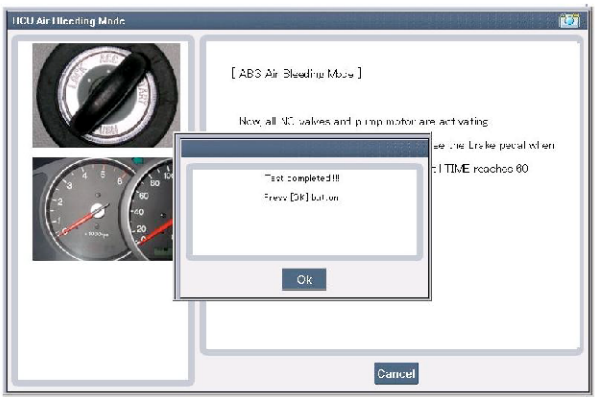
SBKBR9142N

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



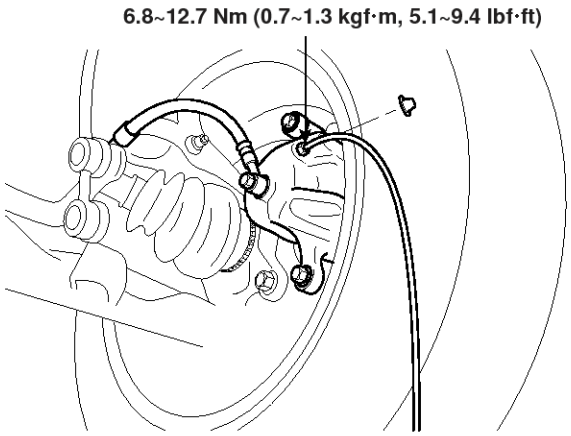
SBKBR9143N

6) Perform the air bleeding.



SBKBR9144N

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.



SKMBR7310L

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

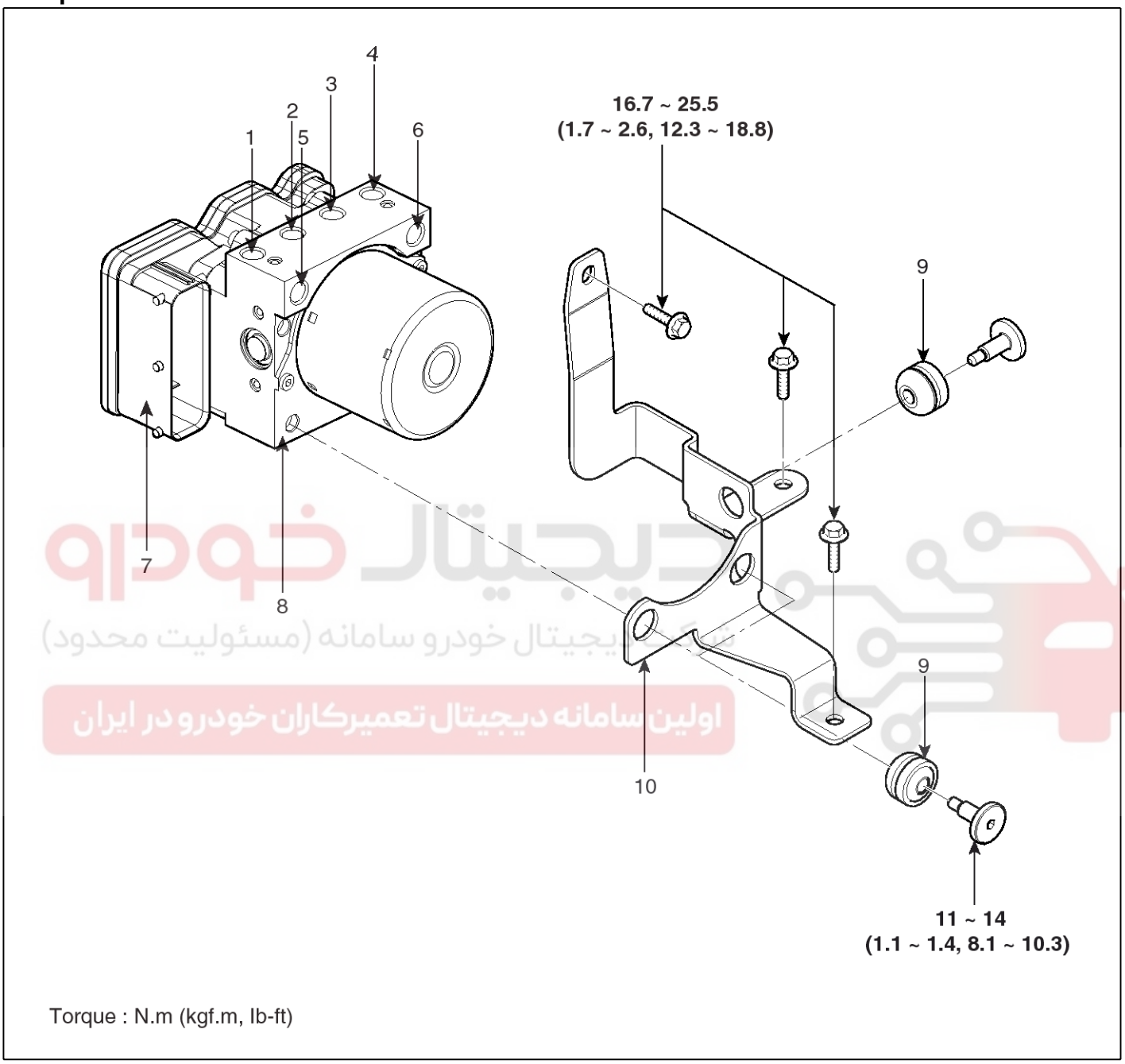
SKMBR7302L

7. Tighten the bleeder screw.

Bleed screw tightening torque:
7 ~ 13 Nm (0.7 ~ 1.3 kgf.m, 5.4 ~ 9.5 lb-ft)

ABS Control Unit

Components



SKMBR0160L

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
8. ABS control module(HECU)
9. Damper
10. Bracket

Removal

1. Turn the ignition switch OFF.
2. Pull up the lock (A) of the ABS control unit connector , then disconnect the connector.
3. Disconnect the brake tubes from the HECU by unlocking the nuts counterclockwise with a spanner.
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 :
11 ~ 14 Nm (1.1 ~ 1.4 kgf.m, 8.1 ~ 10.3 lb-ft)
HECU bracket mounting bolt :
16.7 ~ 25.5 Nm (1.7 ~ 2.6 kgf.m, 12.3 ~ 18.8 lb-ft)

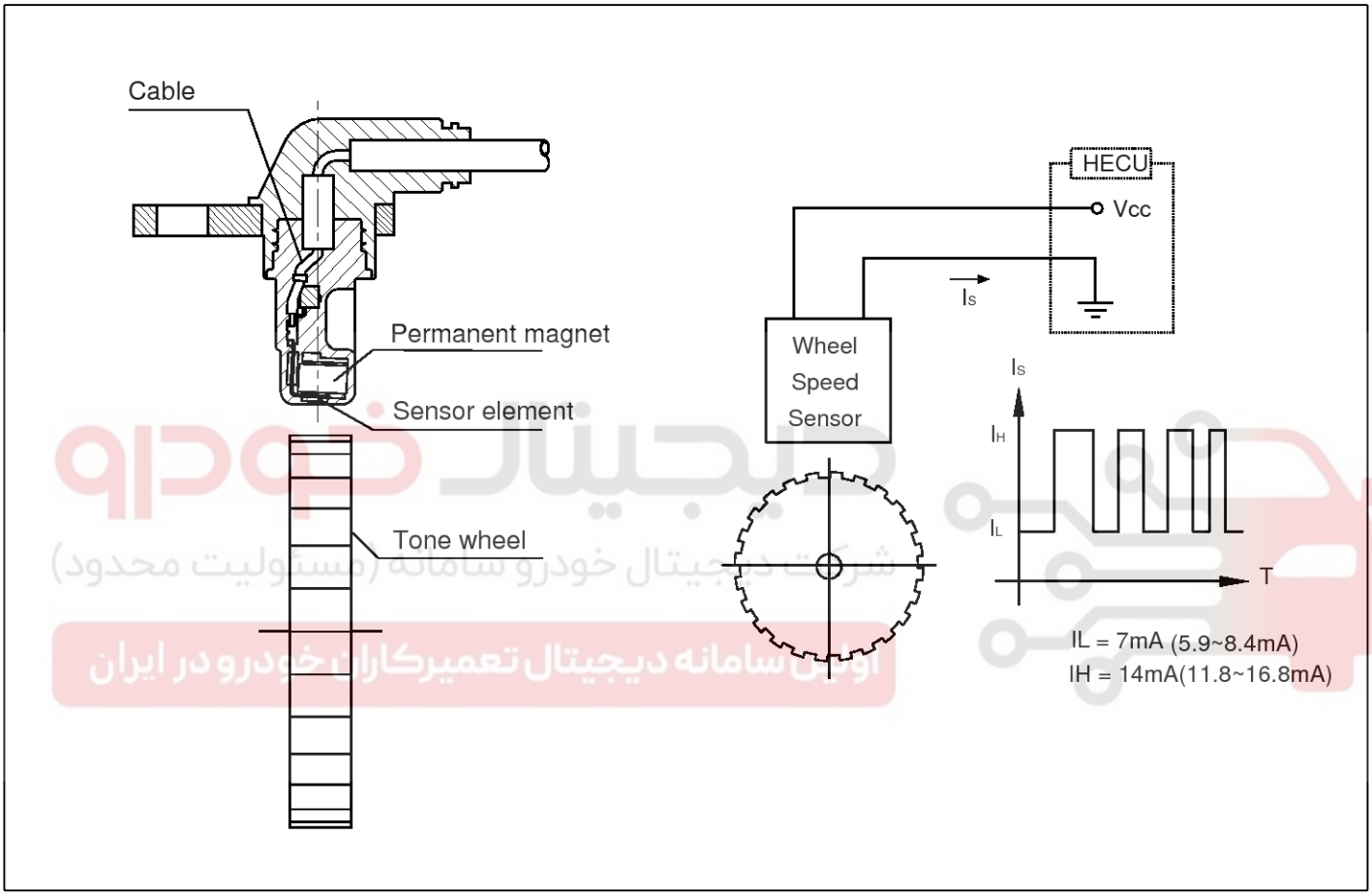
Front Wheel Speed Sensor

Description

A toothed rotor is fixed to the rotating member of the wheel, and the sensor is fixed to the static member of the suspension. As the wheel rotates the toothed rotor causes magnetic flux changes in the magnetic field of the permanent magnet. The sensor element senses these changes.

Depending on the flux changes the sensor sends a signal out to the ECU. The change in magnet flux thus the sensor signal is directly related to the wheel speed.

The controller monitors the sensor signal, compares the four wheel-speed signals and initiates action as required.

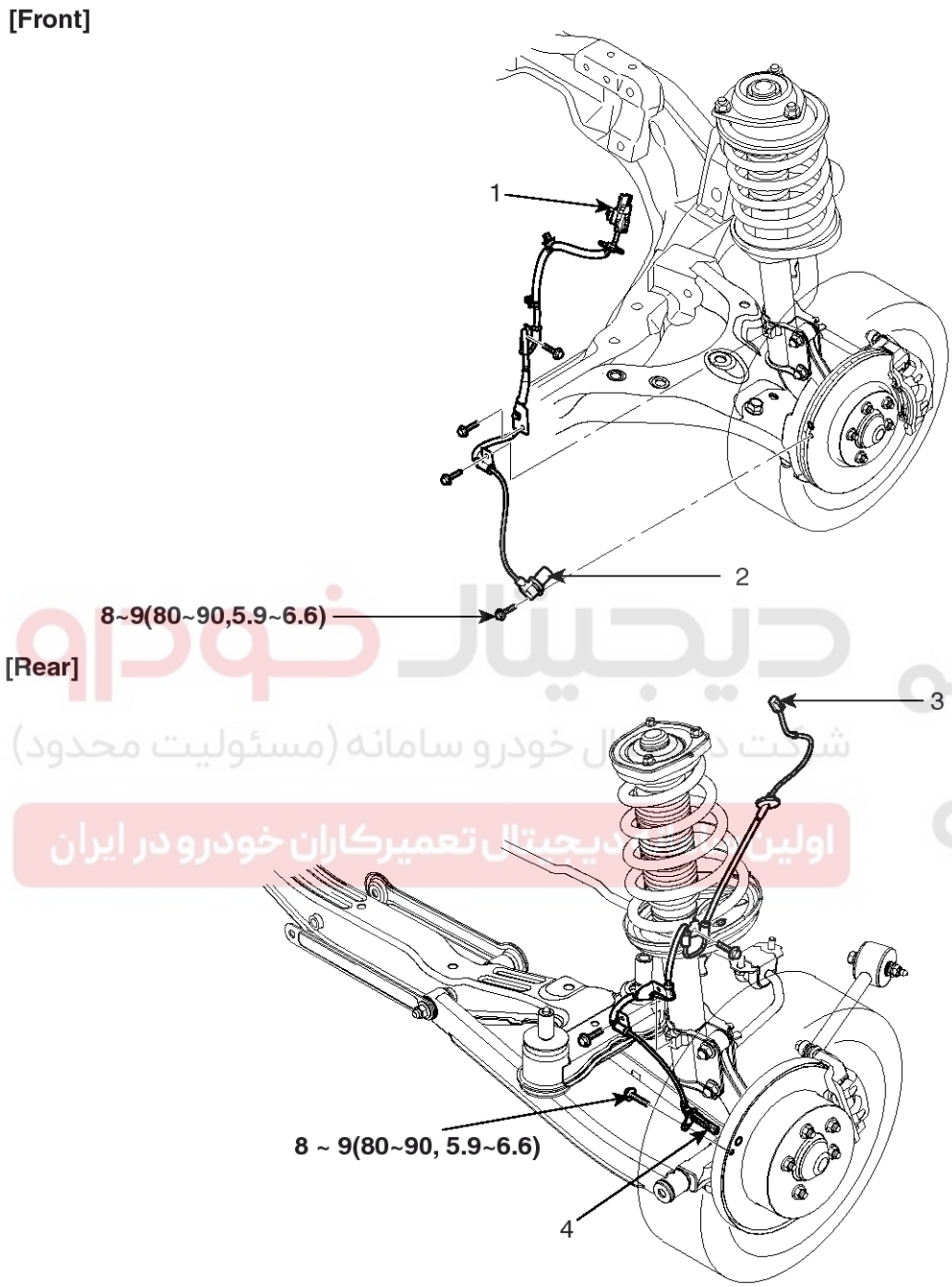


LJIF502E

Specifications

Item		Standard Value		Remark
Supply voltage		DC 12V		
Operating temperature		-40~120°C		R=100Ω
Output current range		Low	7mA(5.9~8.4mA)	
		High	14mA(11.8~16.8mA)	
Frequency range		1~2000 Hz		
Airgap		0.5~1.5mm(0.0197~0.0591 in.)		
Tone wheel	Number	48		

Components



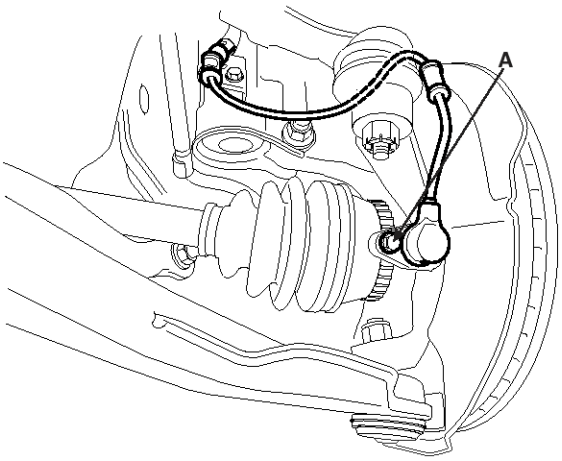
SKMBR0012L

1. Front wheel speed sensor connector
2. Front wheel speed sensor
3. Rear wheel speed sensor connector
4. Rear wheel speed sensor

Removal

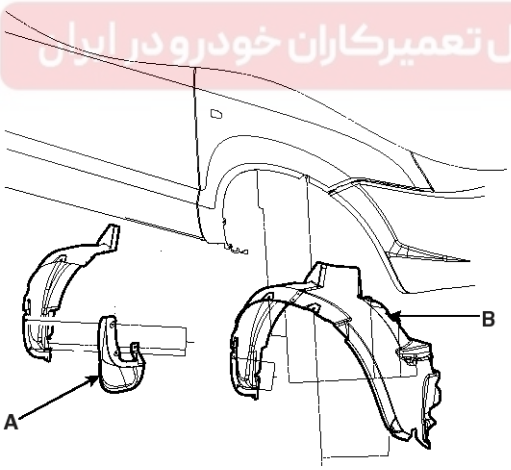
Front Wheel Speed Sensor

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



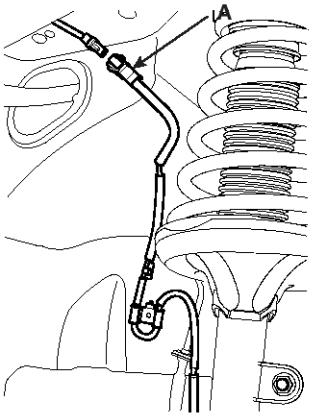
KJKD220A

2. Remove the front wheel guard (B), after removing the mud guard (A).



KJQE160C

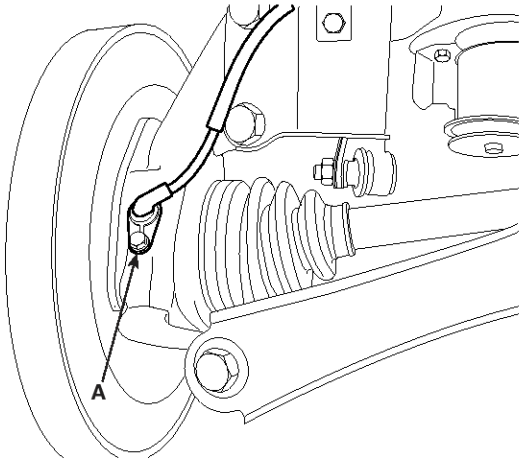
3. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector (A).



KJQE710A

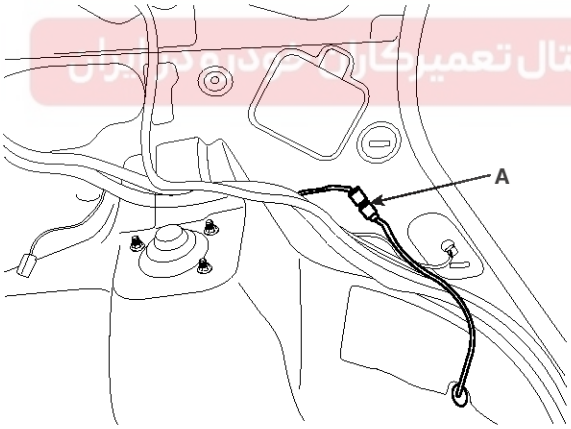
Rear Wheel Speed Sensor

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



KJQE710B

2. Remove the rear seat side pad then disconnect the rear wheel speed sensor connector (A).

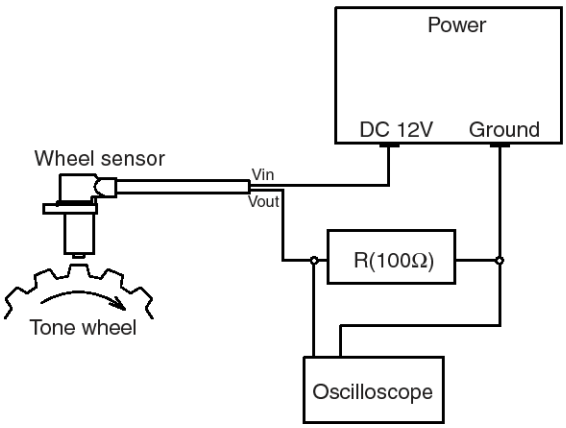


KJQE710C

Inspection

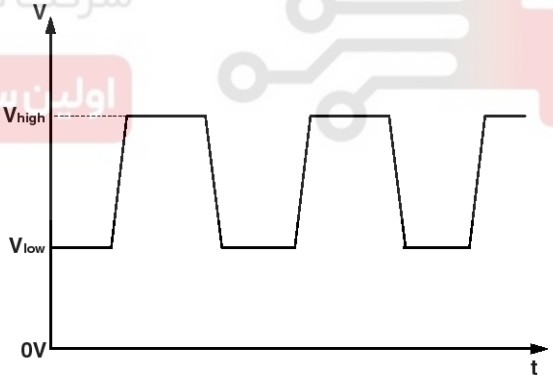
1. Measure the output voltage between the teminal of the wheel speed sensor and the body ground.

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



EJQE260A

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



KJQE260B

- V_low : 590mV ~ 840mV
- V_high : 1.18V ~ 1.68V
- Frequency range : 1~2,000Hz

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.

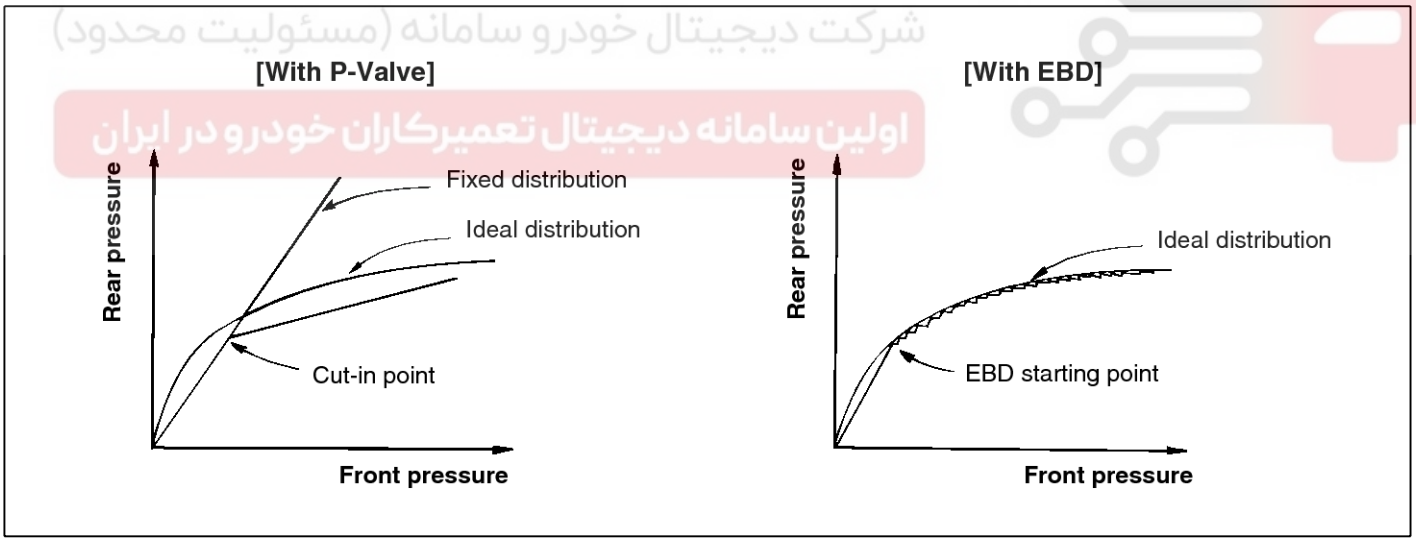
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

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

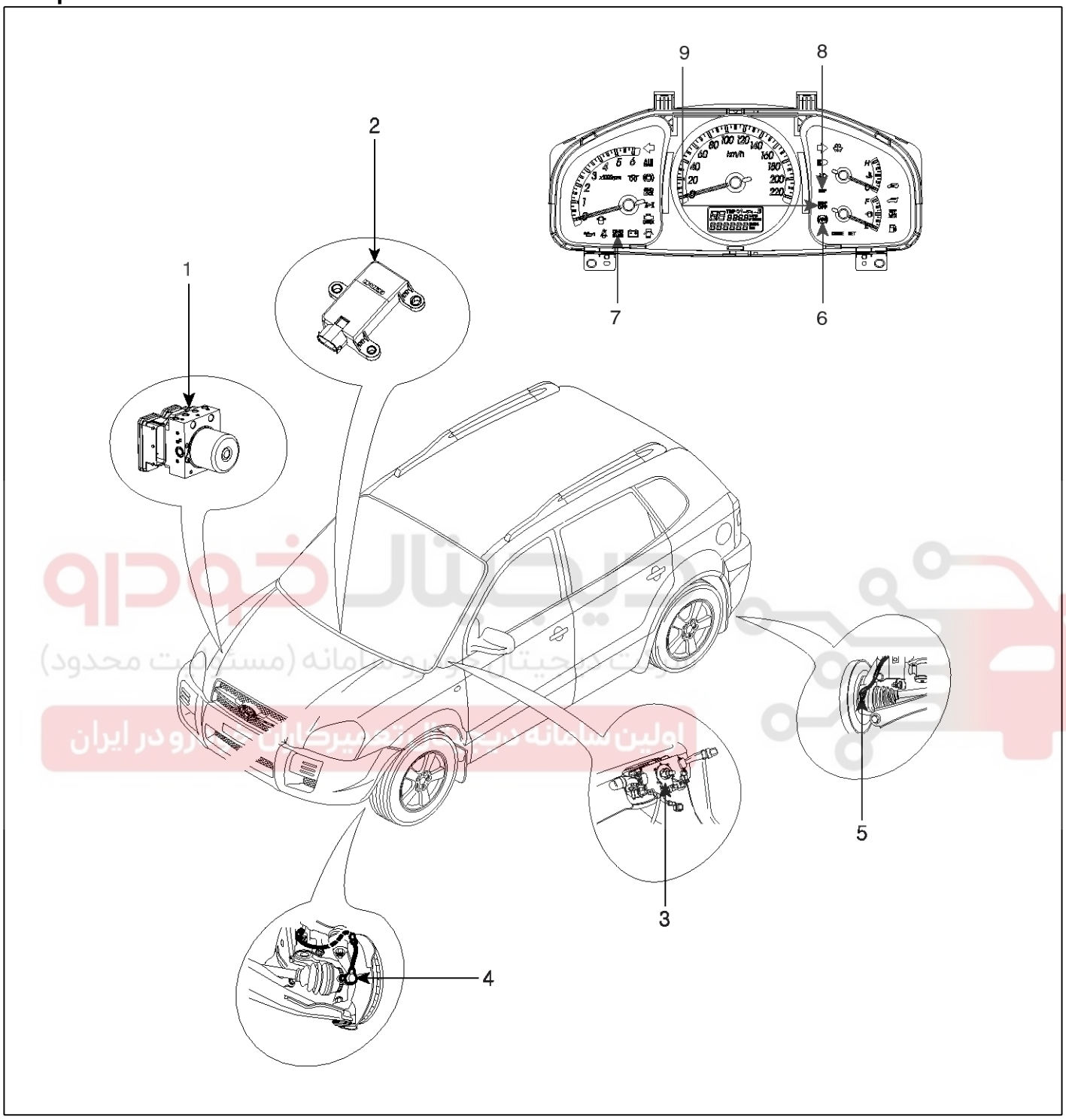


EJA0032A

ESP(Electronic Stability Program) System BR-81

ESP(Electronic Stability Program) System

Components



SKMBR0200D

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

description of ESP

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

ESP is based on the MGH 60 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.

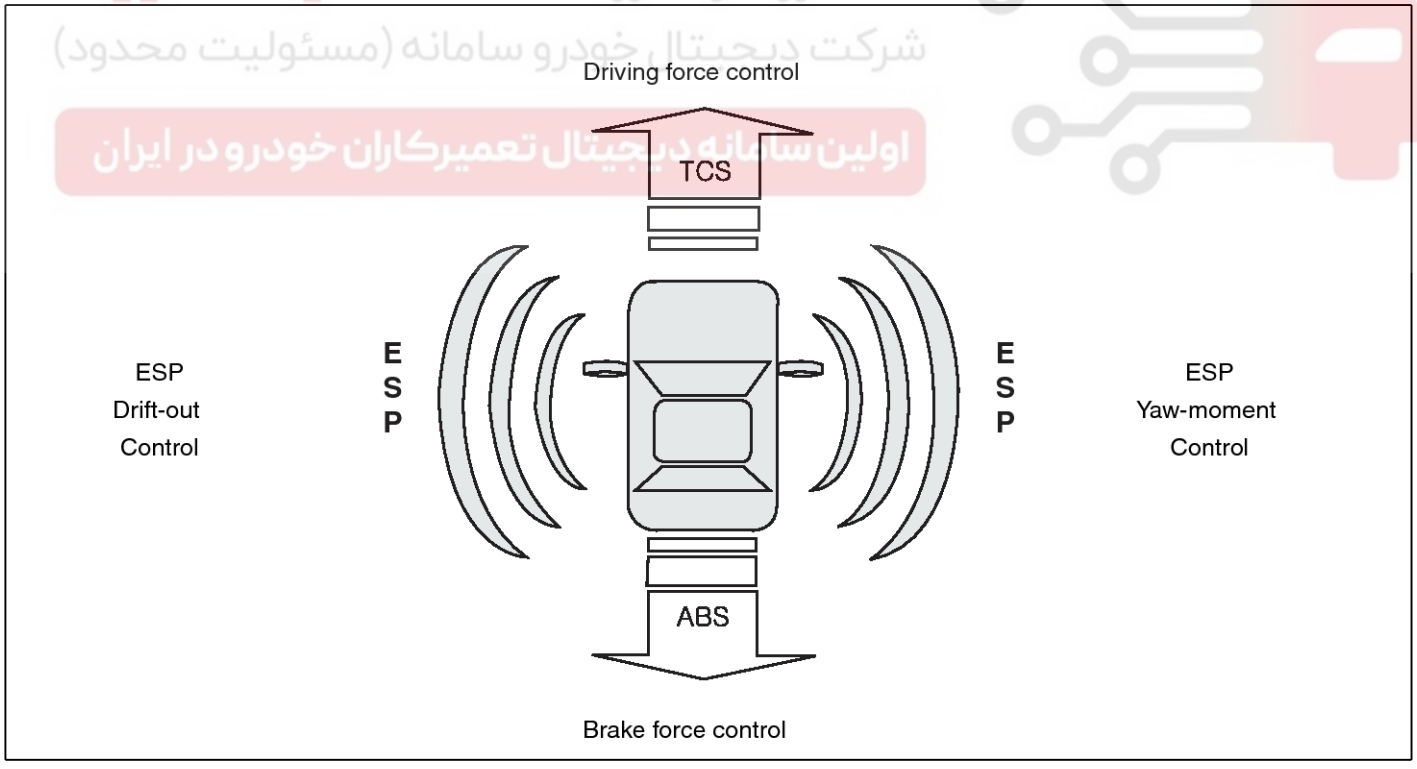
This is achieved by wheel individual brake intervention and adaptation of the momentary engine torque with no need for any action to be taken by the driver.

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 60 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

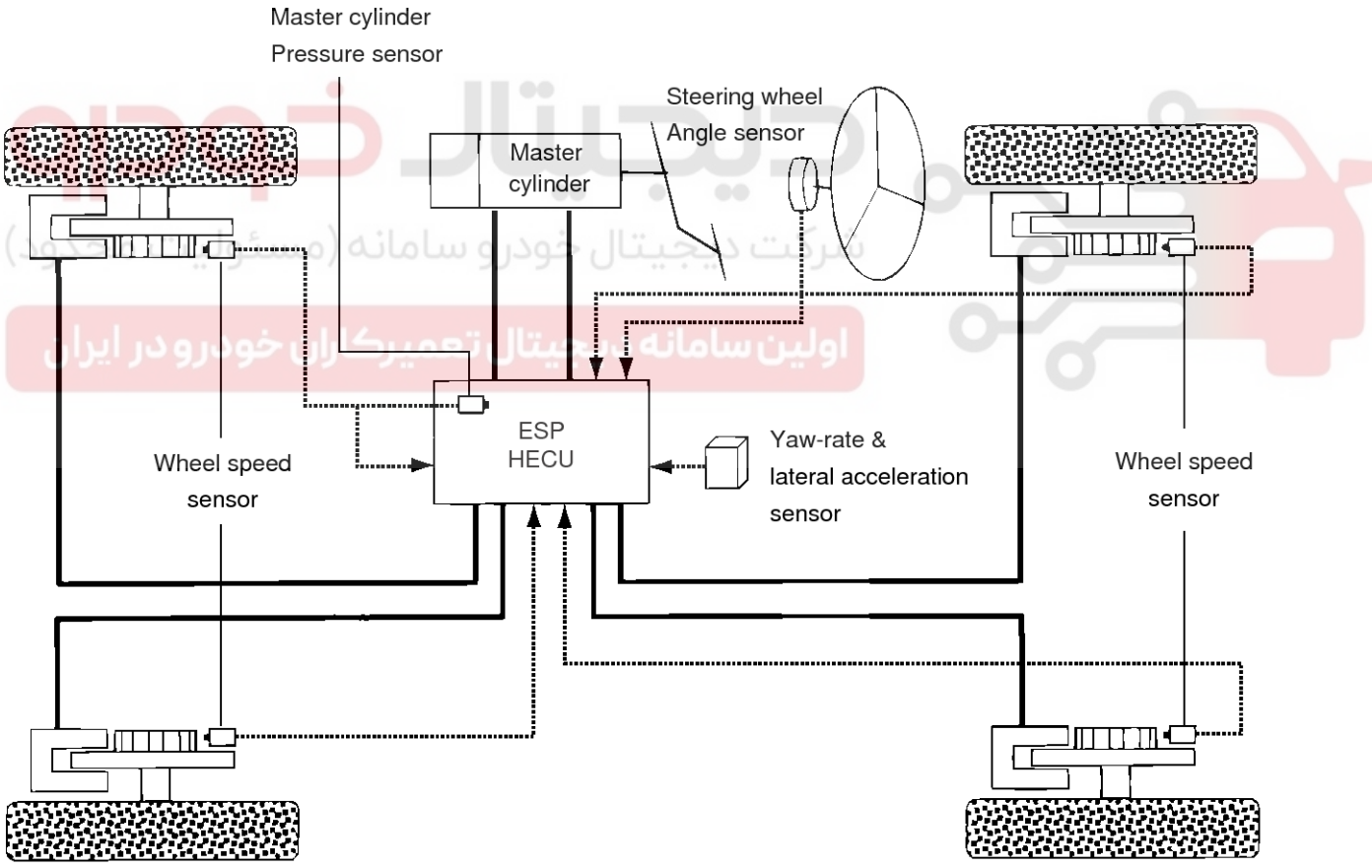
ESP system includes ABS/EBD, TCS and AYC function.

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.

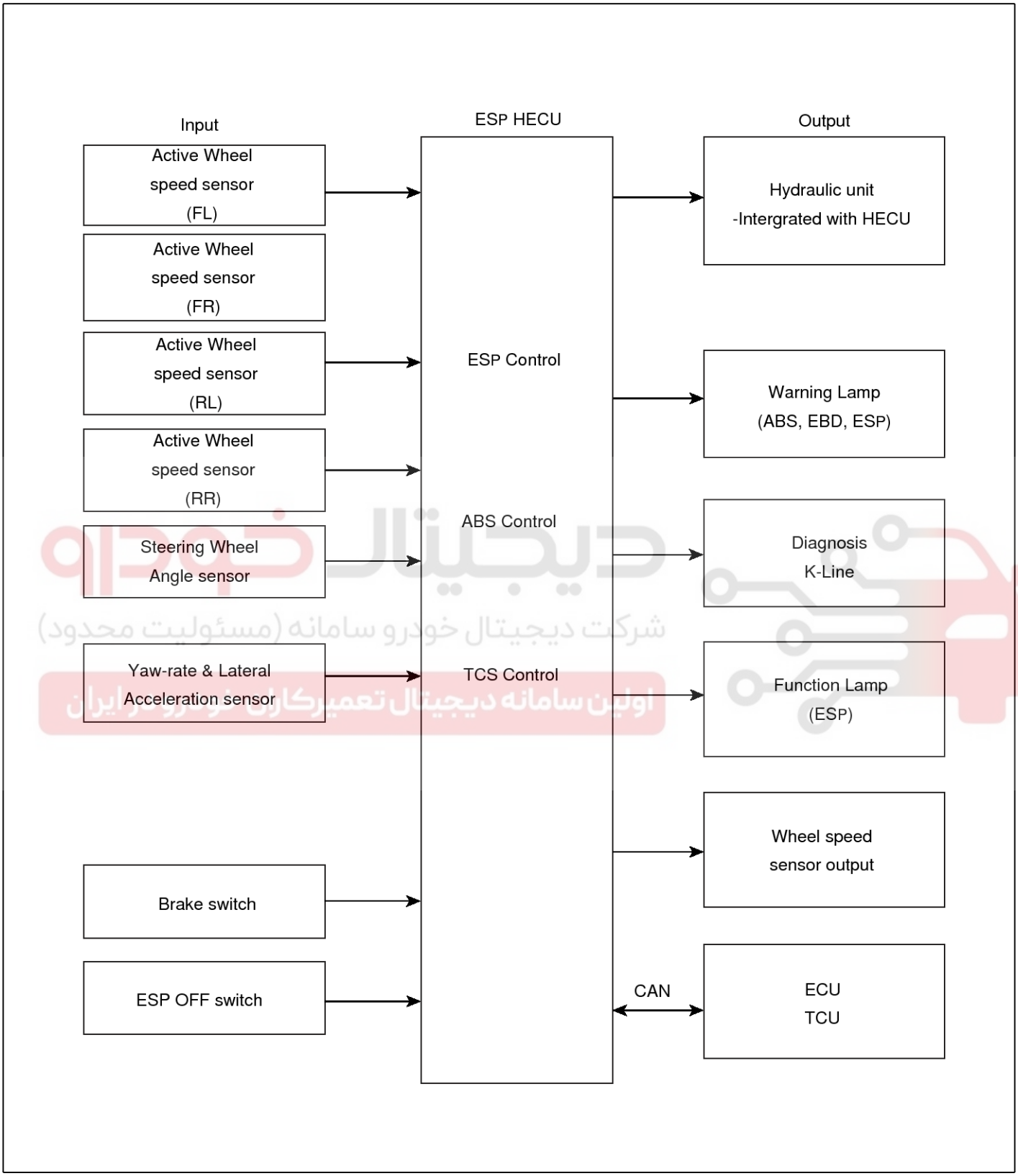
AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake 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)



SKMBR7402L

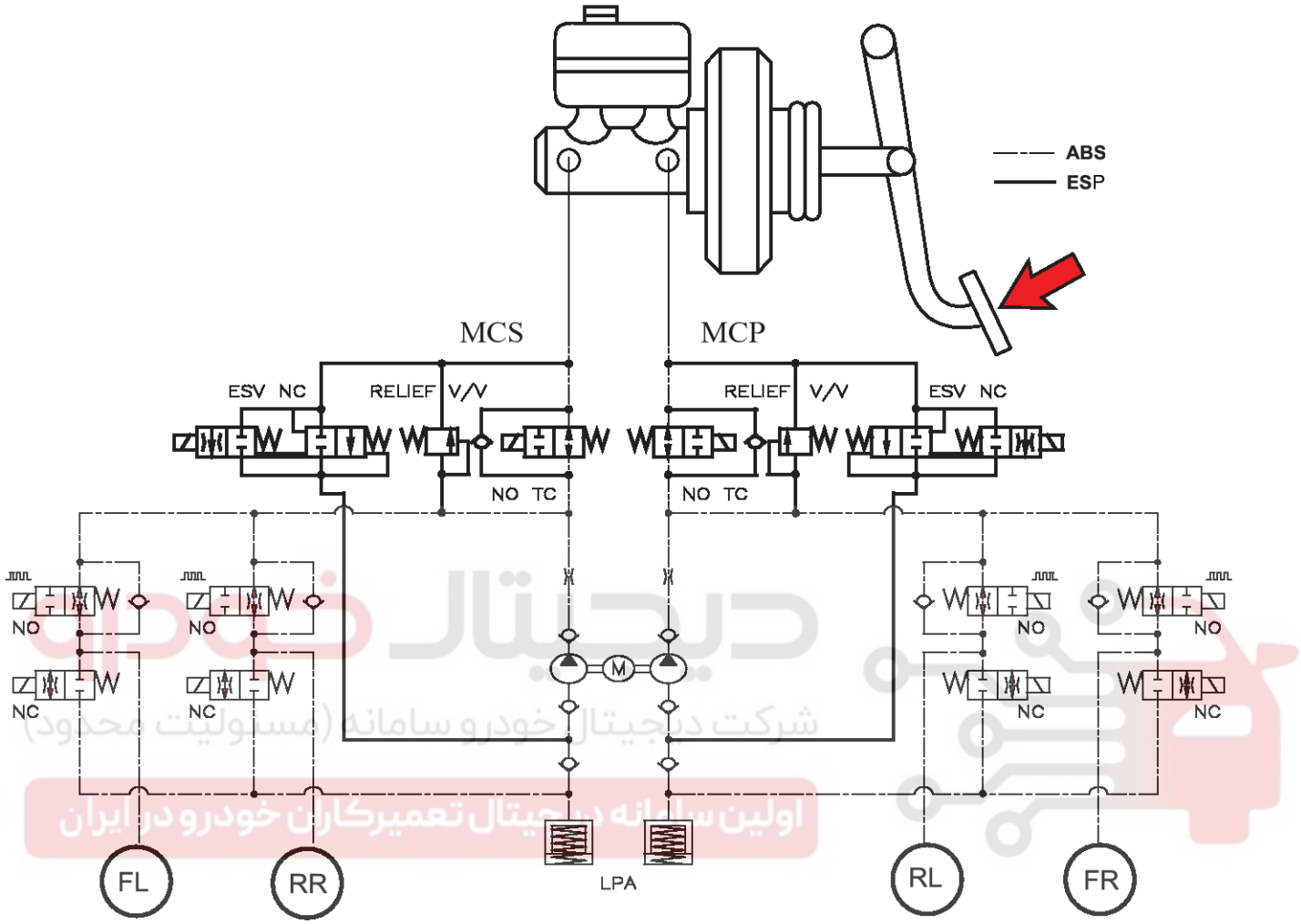
Input and Output Diagram



SKMBR7403L

ESP Operation Mode

ESP Hydraulic System Diagram



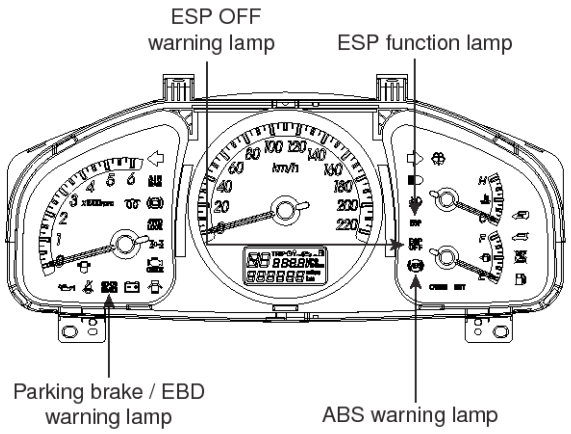
LJJF501P

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		



SKMBR7313L

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)

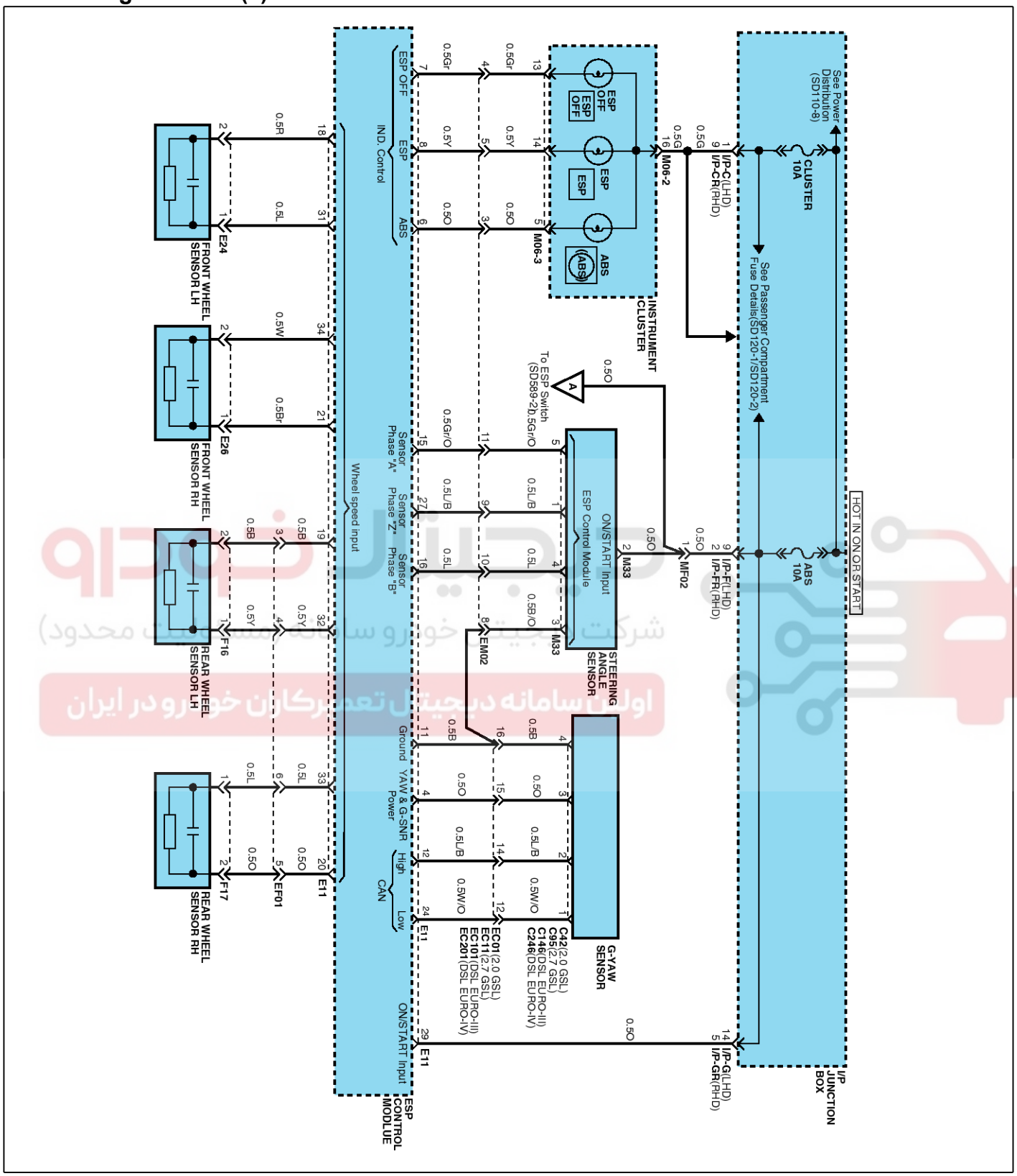
ESP On/Off Switch (ESP system)

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.

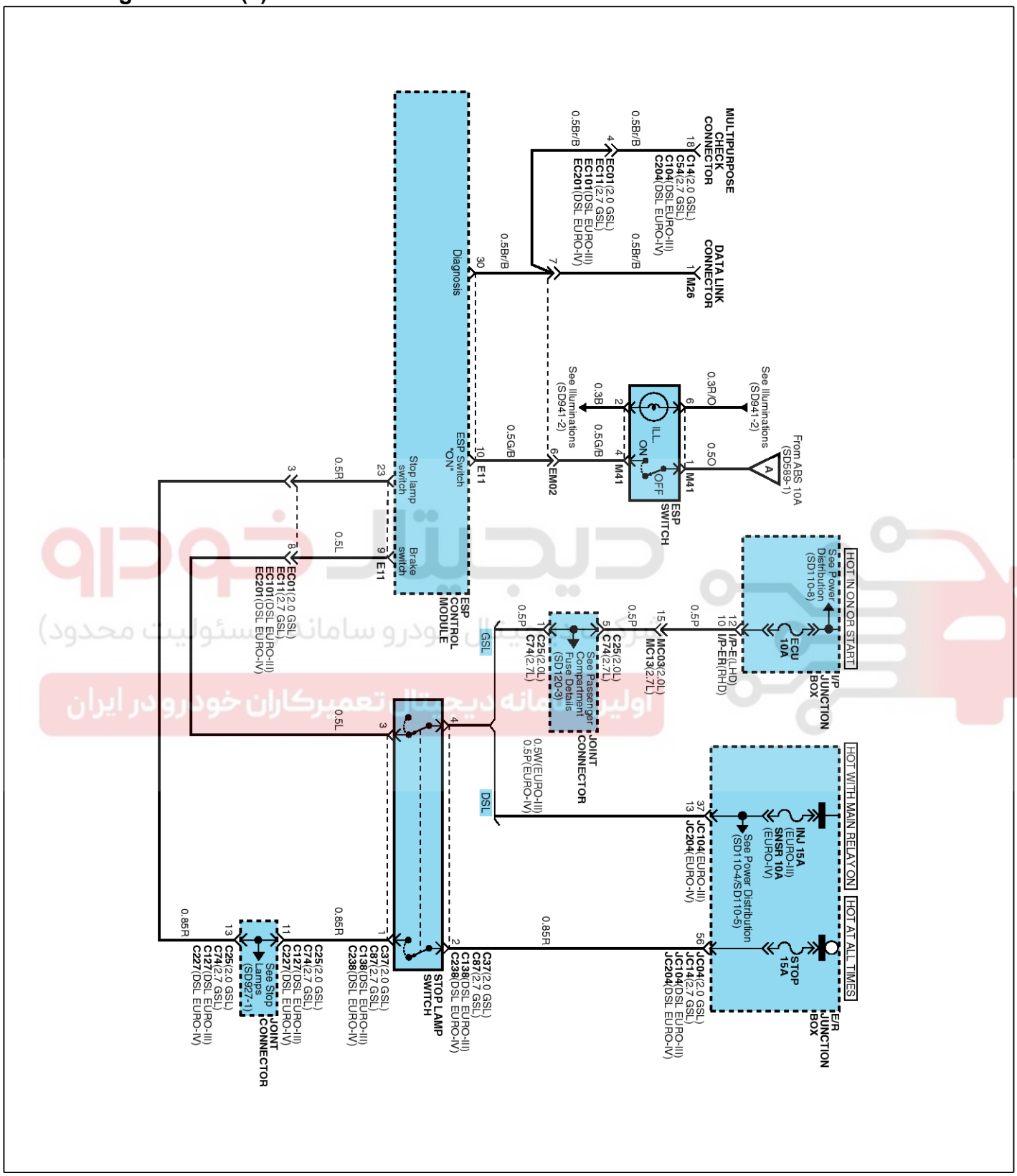
Initial status of the ESP function is on and switch toggle the state.

Circuit Diagram - ESP(1)



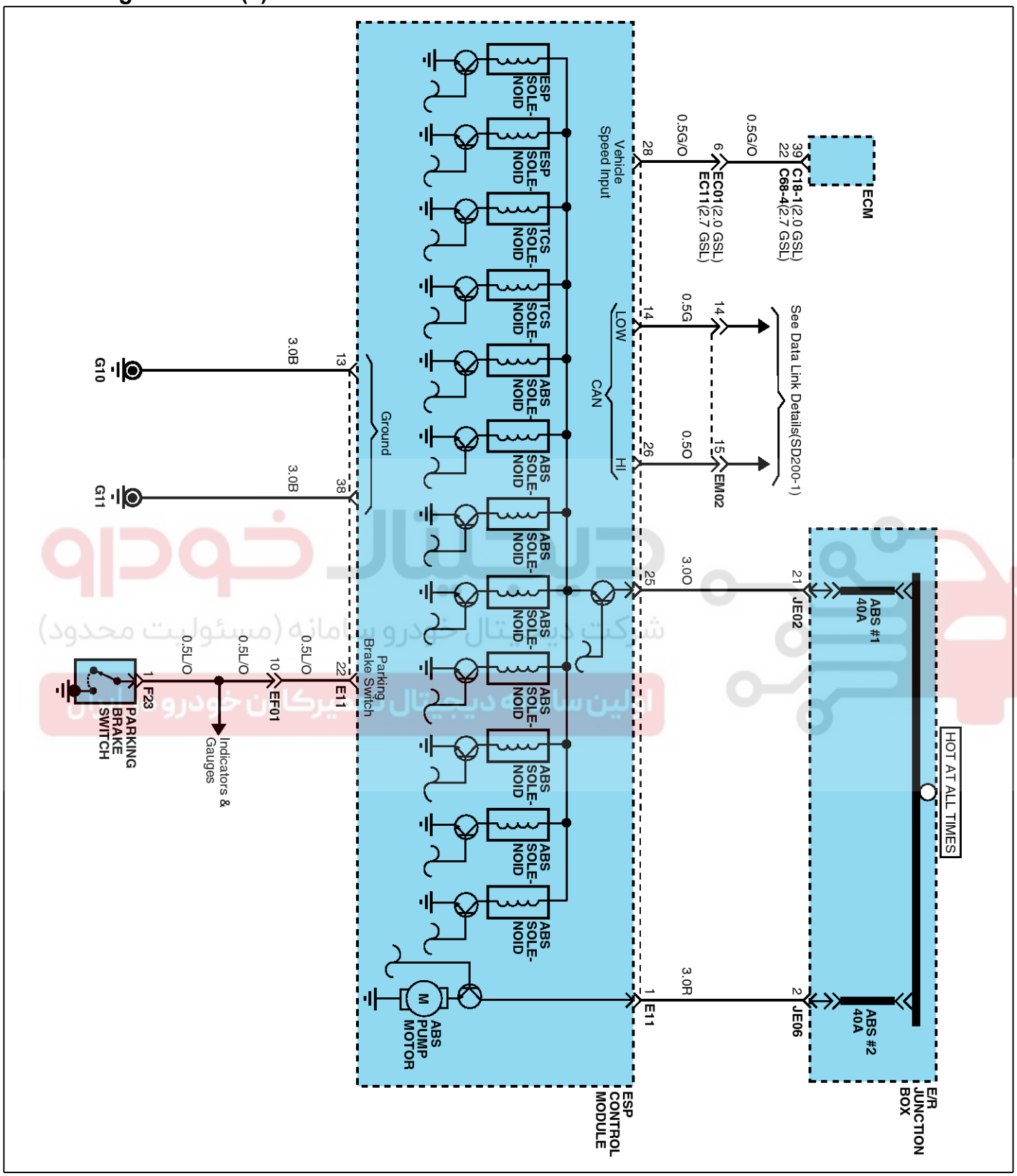
SKMBR0201L

Circuit Diagram - ESP(2)



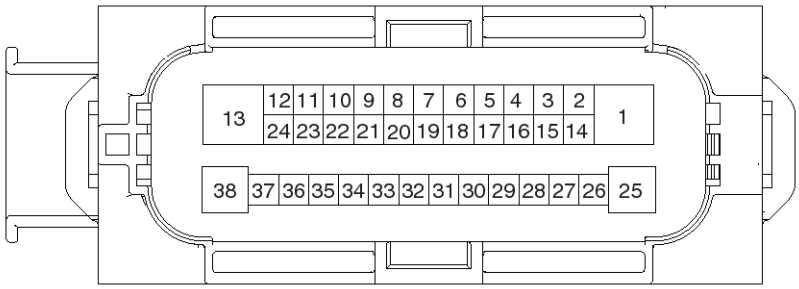
SKMBR0202L

Circuit Diagram - ESP(3)



SKMBR0203L

ESP Connector input/output



SKMBR0134D

Connector Terminal		Specification	Remark
No	Description		
29	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	
25	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	
38	GROUND	Rated current : I <500mA Max. current: I < 40A	
13	PUMP MOTOR GROUND	Rush current : I < 100A Max current : I < 40A	
11	SENSOR GROUND	Rated current : I <150mA	
4	YAW SENSOR POWER	Max Output current : I < 150mA Max Output voltage : V(IGN) ± 1V	
23	BRAKE LIGHT SWITCH	Input voltage (Low) : 0V ≤ V ≤ 3.0V Input voltage (High) : 7.0V ≤ V ≤ 16.0V	
9	BRAKE SWITCH		
22	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	

Connector Terminal		Specification	Remark
No	Description		
28	SENSOR FRONT RIGHT OUTPUT	Max current : I < 16mA External pull up resistance :1 KΩ < R Output duty :50 ± 20%	
10	ESP ON/OFF SWITCH	Input voltage (Low) :0V ≤ V ≤ 3.0V Input voltage (High) : 7.0V ≤ V ≤ 16.0V Max input current:I <10mA	
14	CAN BUS LINE(LOW)	Max. current : I < 10mA	
26	CAN BUS LINE(HIGH)		
18	SENSOR FRONT LEFT POWER	Output voltage : IGN (V) ± 1V Output current : Max 30mA	
34	SENSOR FRONT RIGHT POWER		
19	SENSOR REAR LEFT POWER		
33	SENSOR REAR RIGHT POWER		
31	SENSOR FRONT LEFT SIGNAL	Input current LOW : 5.9 ~ 8.4mA Input current HIGH :11.8 ~ 16.8mA Frequency range :1 ~ 2500Hz Input duty : 50 ± 20%	Typ. 7mA Typ. 14mA
21	SENSOR FRONT RIGHT SIGNAL		
32	SENSOR REAR LEFT SIGNAL		
20	SENSOR REAR RIGHT SIGNAL		
15	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	Typ. 20deg Typ. 3.5V Typ. 1.5V
16	STEERING ANGLE SENSOR PHASE 2		
27	STEERING ANGLE SENSOR PHASE N		
30	DIAGNOSIS INPUT/OUTPUT	Input voltage (Low) : V < 0.3V (IGN) [V] Input voltage (High) : V > 0.7V (IGN) [V] Output voltage (Low) : V < 0.2V (IGN) [V] Output voltage (High) : V > 0.8V (IGN) [V]	
7	ESP W/LAMP DRIVE	Current : I < 300mA (12V) Voltage range : 0 ~ 18V Min. shunt resistance : 500KΩ	
6	ABS/EBD W/LMAP DRIVE		
8	ESP F/LAMP DRIVE		
24	SENSOR CAN BUS LINE(LOW)	Max. current : I < 10mA	
12	SENSOR CAN BUS LINE(HIGH)		

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

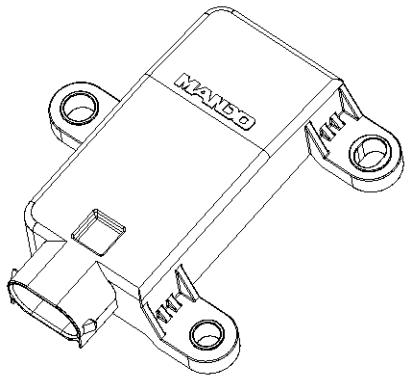
When the vehicle is turning with respect to a vertical axis the yaw rate sensor detects the yaw rate electroniclly by the vibration change of plate fork inside the yaw rate sensor.

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

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

Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G.

The sensor is located in the front passenger seat lower floor on vehicle.

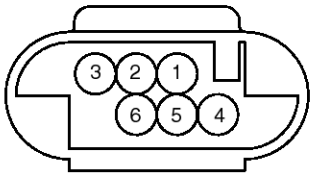


SKMBR0230D

Specifications

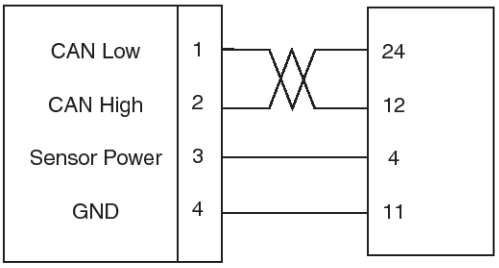
Description		Specification	Remarks
Operating voltage		8 ~ 17V	
Current consumption		Max. 140mA	
Operating temperature		-40 ~ 85°C	
Yaw-rate sensor	Measurement range	-75 ~ 75°/sec	
	Frequency response	18 ~ 22Hz	
Lateral G sensor	Measurement range	-14.715 ~ +14.715m/s²	
	Frequency response	50Hz ± 60% (-3dB)	

External Diagram



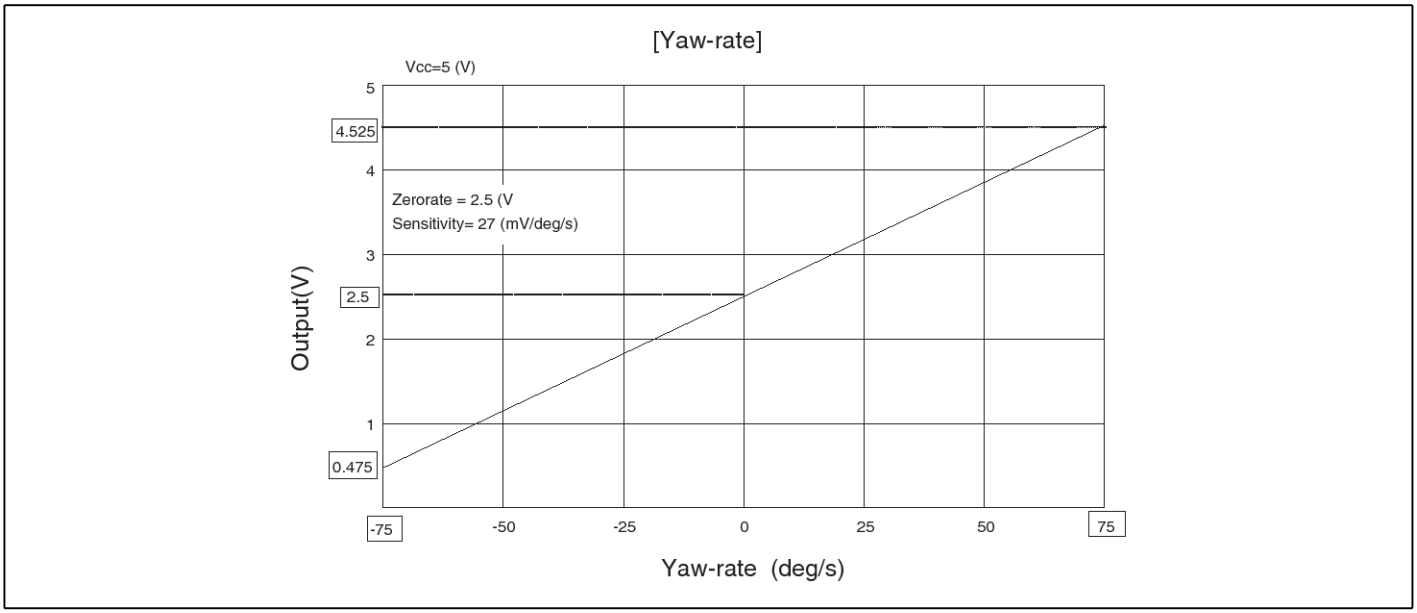
(Yaw-rate & Lateral G sensor's)

[Harness Connector]

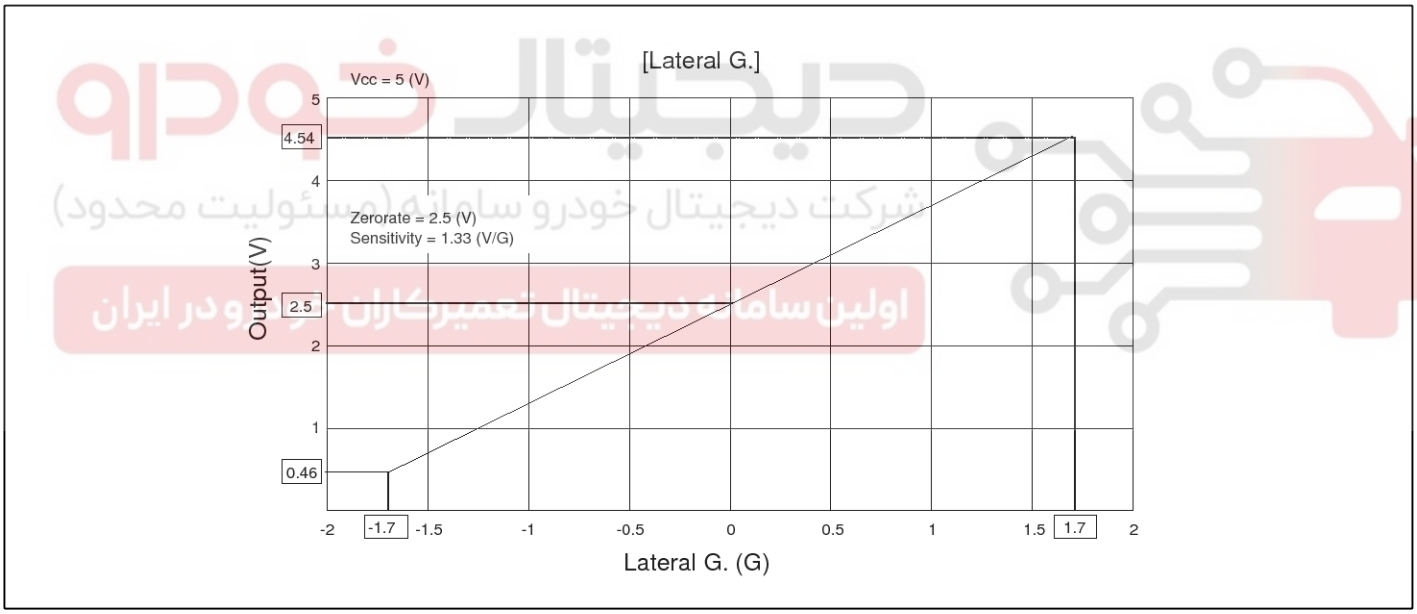


SKMBR0013L

Output Characteristic



EJQE206A



LJJF502D

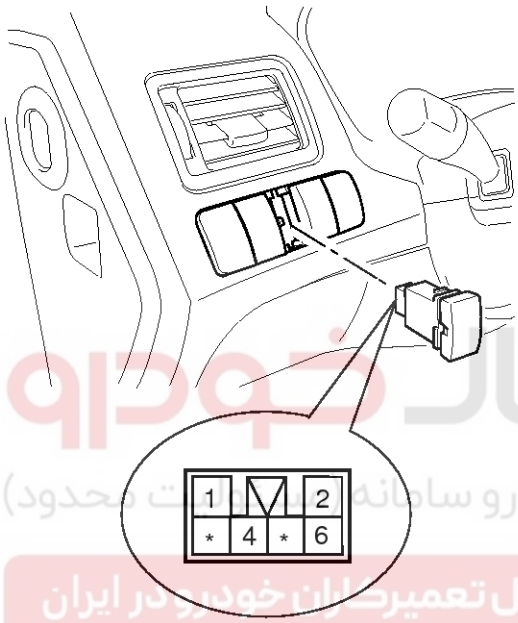
ESP OFF Switch

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 on the crushpad of the driver's side.



LJIF501J

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

Terminal / Function	1	4	6	2
ON	○	○	○	○
OFF				

LJIF501K

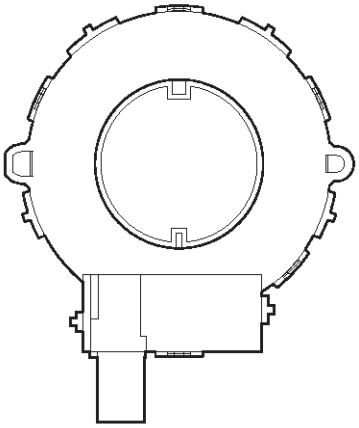
Steering Angle Sensor

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.

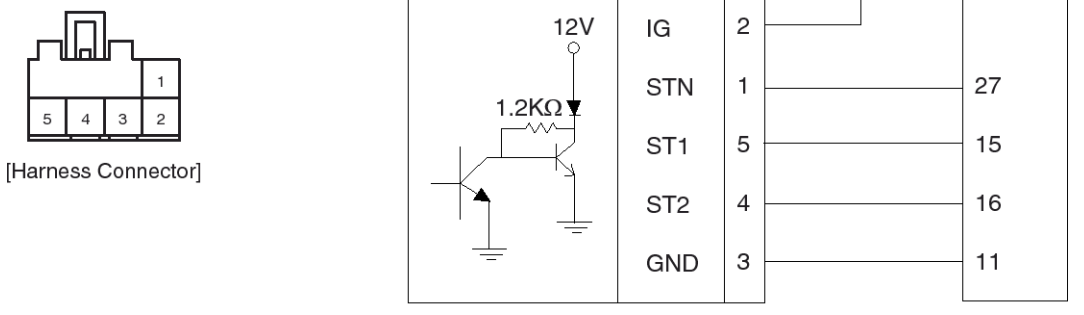


LJJF501V

Specification

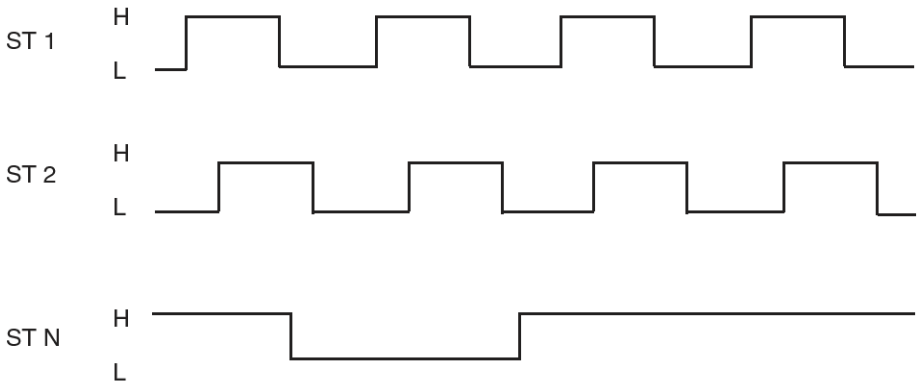
Description	Specification
Operating voltage	9 ~ 16V
Operating temperature	-30 ~ 75℃
Current consumption	Max.100mA
Steering angle velocity	Max. ± 1500°/sec
Voltage(high)	3.0V ~ 4.1V
Voltage(low)	1.3V ~ 2.0V
Pulse duty	40 ~ 60%

Circuit Diagram(Steering Wheel Speed Angle Sensor)



SKMBR0014L

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		