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Brake System

GENERAL

BRAKE SYSTEM
- BRAKE BOOSTER
- BRAKE LINE
- BRAKE PEDAL
- FRONT DISC BRAKE
- MASTER CYLINDER
- PROPORTIONING VALVE
- REAR DISC BRAKE

PARKING BRAKE SYSTEM
- PARKING BRAKE
- PARKING BRAKE SWITCH

ABS (ANTI-LOCK BRAKE SYSTEM)
- ANTI-LOCK BRAKING SYSTEM CONTROL MODULE
- FRONT WHEEL SPEED SENSOR
- REAR WHEEL SPEED SENSOR

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION)

ESP(ELECTRONIC STABILITY PROGRAM) SYSTEM
- YAW-RATE SENSOR & G-SENSOR
- ESP SWITCH
- STEERING WHEEL ANGLE SPEED SENSOR

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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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GENERAL

SPECIFICATIONS E4ED36DC

Item	Specification
Master cylinder · Type · I.D. mm(in) · Piston stroke mm(in) · Fluid level warning sensor	 Tandem type 25.4/(1.0) 29 ~ 31(1.14 ~ 1.22) Provided
Proprotioning valve · Cut-in pressure · Decompression ratio	 2.94 MPa (30 kg/㎠, 426.7 psi) 0.32 : 1
Brake booster · Type · Boosting ratio	 Vacuum 8 : 1
Front brake(Disc) · Type · Disc O.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	 Floating type with ventilated disc 303 mm (11.8 in) 28 mm (1.10 in) 11 mm (0.43 in) Single piston Ø60 mm (Ø2.36 in)
Rear brake(Disc) · Type · Disc O.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	 Floating type with solid disc 284 mm (10.31 in) 10 mm (0.39 in) 15 mm (0.59 in) Single piston Ø34 mm (Ø1.34 in)
Parking brake · Type · Actuation · Drum	 Mechanical brake acting on rear wheels Lever Ø19 mm (Ø0.75 in)

O.D=Outer Diameter
I.D=Inner Diameter

NOTE

ABS : Anti-lock Brake System
ESP : Electronic Stability Program

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SPECIFICATION (ABS) E4D532FB

Part	Item	Standard value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor (Solenoid)	·ABS system:ABS & EBD control
	Type	Motor, valve relay intergrated type	
	Operating voltage	10 V ~ 16 V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ABS W/L:ABS failure ·Brake W/L:Parking, brake oil, EBD failure
	Current consumption	80 mA	
Acitve wheel speed sensor(ABS)	Supply voltage	DC 4.5 ~ 2.0 V	
	Output current low	5.9 ~ 8.4 mA	Typ.7 mA
	Output current High	11.8 ~ 16.8 mA	Typ.14 mA
	Frequency range	1 ~ 2500 HZ	
	Air gap	0.4 ~ 1.0 mm (0.0157 ~ 0.04 in.)	
	Tone wheel	48 teeth	
	Output duty	30~70 %	

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SPECIFICATION(ESP)

Part	Item	Standard Value	Remark
HECU(Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor(Solenoid)	·Total control(ABS, EBD, TCS, ESP)
	Type	Motor, valve relay intergrated type	
	Operating voltage	8V ~ 16V(DC)	
	Operating temperature	-40 ~ 120 °C(-40 ~ 248 °F)	
Warning lamp	Operating voltage	12 V	·ESP Operating Lamp ·ESP Warning Lamp
	Current consumption	80 mA	
Active wheel speed sensor	Supply voltage	DC4.5 ~ 20V	
	Output current low	5.9~8.4 mA	
	Output current high	11.8 ~ 16.8 mA	
	Tone wheel	48 teeth	
	Frequency range	1~2500 HZ	
	Airgap	0.4 ~ 1.0 mm (0.02~0.04 in)	
Steering Wheel Angle Sensor	Operating Voltage	8V ~ 16 V	
	Current Consumption	Max 150 mA	
	Operating Angular velocity	Max ±2000 °/sec	
Yaw-rate & Lateral G sensor	Operating Voltage	8 V ~ 16 V	
	Current Consumption	Max. 120 mA	
	Output Voltage	0.35V ~ 4.65 V	
	Yaw Sensor Operating Range	±100 ° /s	
	G Sensor Operating Range	±1.8 G	
	Reference voltage output	2.464 ~ 2.536 V	Typ. 2.5 V

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SERVICE STANDARD E9AAB886

Items	Standard value
Brake pedal height	184.5 mm(7.264 in)
Brake pedal full stroke	128 mm (5.04 in)
Adjust Brake pedal full stroke	76.2 ± 2 mm (3 ± 0.078 in)
Brake pedal free play	3 ~ 8 mm(0.11 ~ 0.31 in)
Stop lamp switch outer case to pedal stopper clearance	0.5 ~ 1.0 mm (0.02 ~ 0.04 in)
Booster push rod to master cylinder piston clearance	0 (at 500 mmHg)
Parking brake lever stroke when lever assembly is pulled with 196N (20kgf, 44lb force)	88 ~ 98 mm (3.46 ~ 3.86 in)
Front disc brake pad thickness	11 mm (0.43 in)
Front disc thickness	28 mm (1.1 in)
Rear disc brake pad thickness	15 mm (0.59 in)
Rear disc brake disc thickness	10 mm (0.394 in)

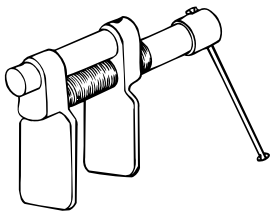
TIGHTENING TORQUE

Items	Nm	kgf.m	lb-ft
Master cylinder to booster mounting nut	8 ~ 12	0.8 ~ 1.2	5.89 ~ 8.68
Brake booster mounting nut	13 ~ 16	1.3 ~ 1.6	9.4 ~ 11.6
Bleeder screw	7 ~ 13	0.7 ~ 1.3	5.06 ~ 9.4
Brake tube nut, brake hose	14 ~ 17	1.4 ~ 1.7	10.1 ~ 12.3
Caliper assembly to knuckle	80 ~ 100	8 ~ 10	57.9 ~ 72.3
Brake hose to front caliper	25 ~ 30	2.5 ~ 3.0	18.1 ~ 21.7
Caliper guide rod bolt	22 ~ 32	2.2 ~ 3.2	15.9 ~ 23.1
Stop lamp switch mounting nut	8 ~ 10	0.8 ~ 1.0	5.89 ~ 7.23
Brake pedal assembly bracket mounting nut	25 ~ 30	2.5 ~ 3.0	18.1 ~ 21.7
Brake pedal mounting nut	13 ~ 16	1.3 ~ 1.6	9.4 ~ 11.6
Active wheel speed sensor mounting bolt on the brake plate	8 ~ 9	0.8 ~ 0.9	5.89 ~ 6.51
HECU mounting nut	6 ~ 10	0.6 ~ 1	4.34 ~ 7.23
HECU mounting bracket bolt	17 ~ 26	1.7 ~ 2.6	12.3 ~ 18.8
HECU port	12.2 ~ 16.3	1.22 ~ 1.63	8.82 ~ 11.79
Yaw rate & lateral acceleration sensor bolt	5 ~ 8	0.5 ~ 0.8	3.62 ~ 5.89

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SPECIAL TOOL E2AB95FA

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

TROUBLESHOOTING EF908339

PROBLEM SYMPTOMS TABLE

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

Symptom	Suspect Area	Reference
Lower pedal or spongy pedal	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Piston seals (Worn or damaged) 4. Rear brake shoe clearance(Out of adjustment) 5. Master cylinder (Faulty)	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 (Faulty) 9. Booster system (Vacuum leaks) 10. Master cylinder (Faulty)	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 inefficient	1. Brake system (Fluid leaks) 2. Brake system (Air in) 3. Pad or lining (Worn) 4. Pad or lining (Cracked or distorted) 5. Rear brake shoe clearance(Out of adjustment) 6. Pad or lining (Oily) 7. Pad or lining (Glazed) 8. Disc (Scored) 9. Booster system (Vacuum leaks)	repair air·bleed replace replace adjust adjust replace replace repair

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Symptom	Suspect Area	Reference
Noise from brake	1. Pad or lining (Cracked or distorted) 2. Installation bolt (Loosen) 3. Disc (Scored) 4. Sliding pin (Worn) 5. Pad or lining (Dirty) 6. Pad or lining (Glazed) 7. Anchor or 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, pulsation	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
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.	

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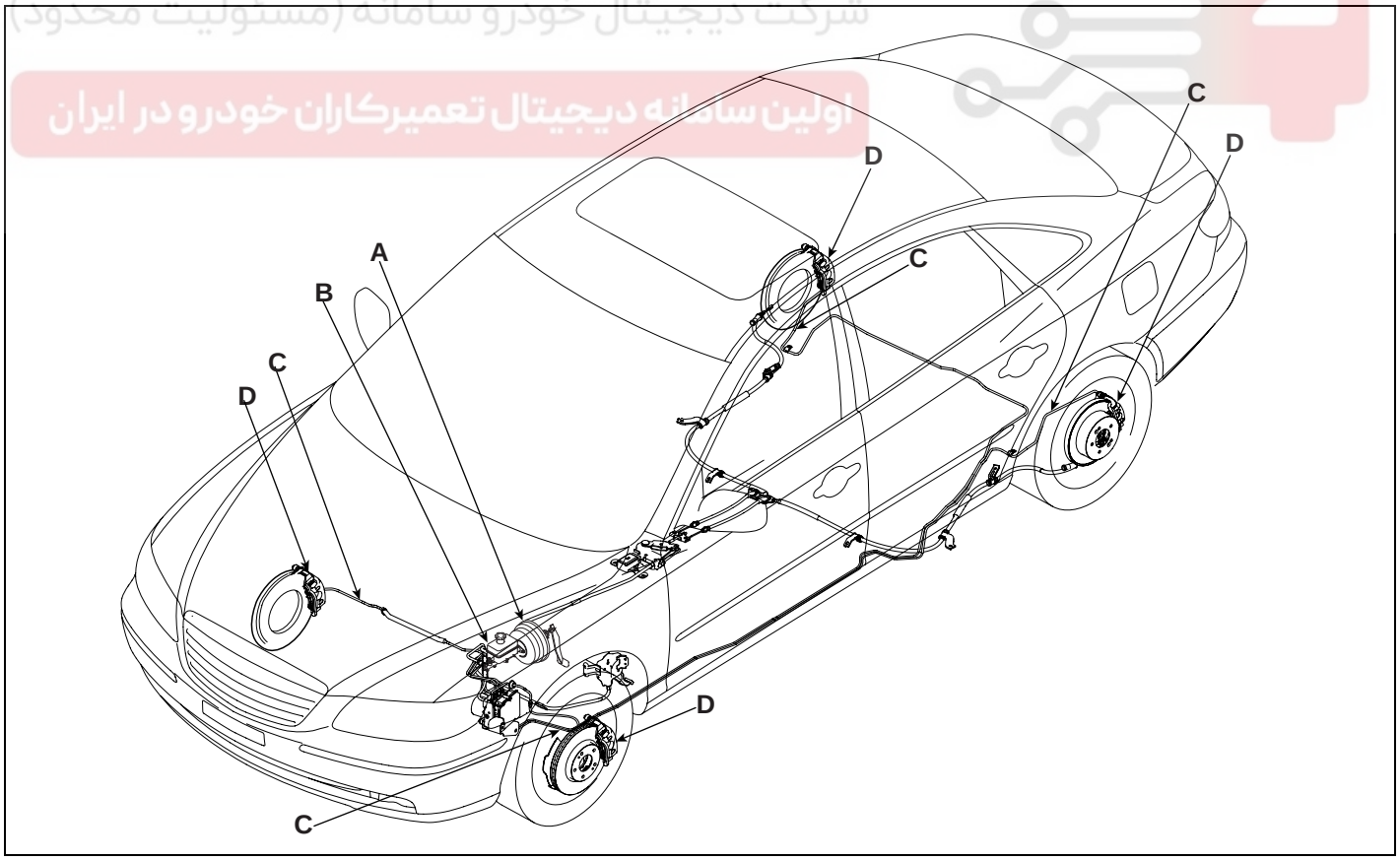
BRAKE SYSTEM

OPERATION AND LEAKAGE

CHECK EBA960B6

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 thebrake caliper is disassembled.



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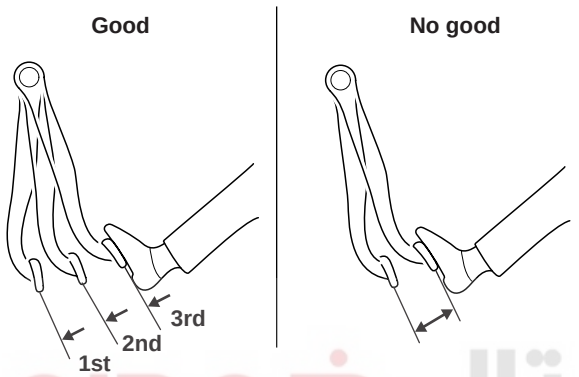
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BRAKE BOOSTER OPERATING TEST

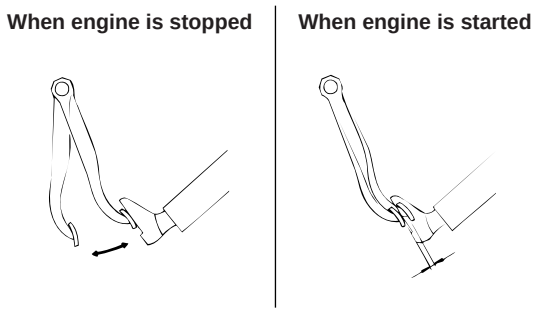
For simple checking of the brake booster operation, carry out the following tests

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



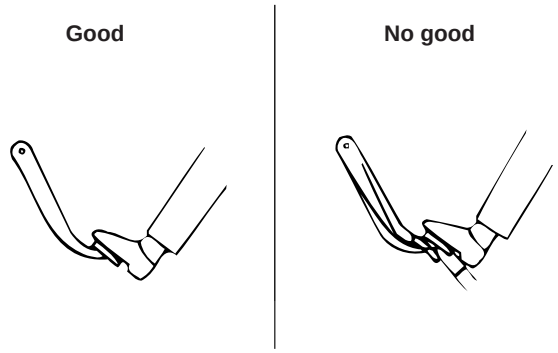
EJRF500B

2. With the engine stopped, step on the brake pedal several times.
   Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.



EGGB700B

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



EJRF500C

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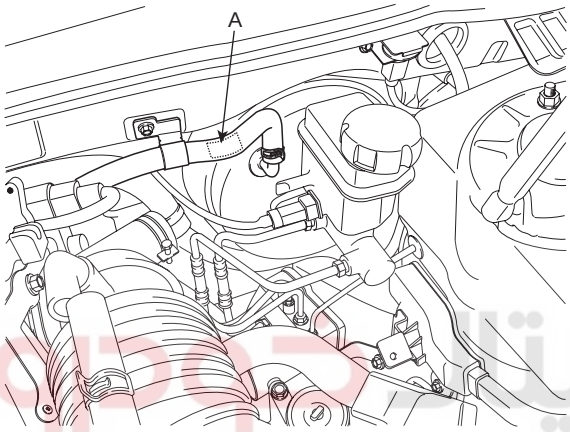
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VACUUM HOSE (CHECK VALVE)

INSPECTION

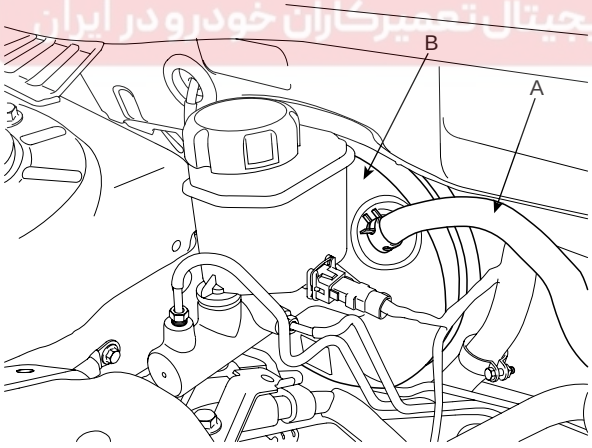
1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster (B).
2. Start the engine and let it idle. There should be vacuum available. If no vacuum is available, the check valve is not working properly. Replace the brake booster vacuum hose and check valve and retest.

[LHD]



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[RHD]



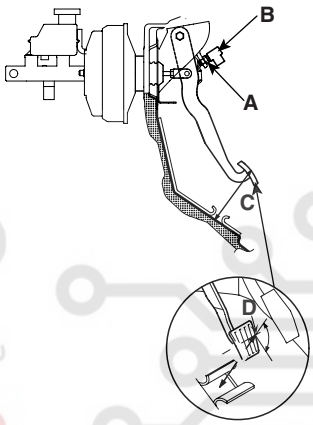
EJRF503L

BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

PEDAL HEIGHT

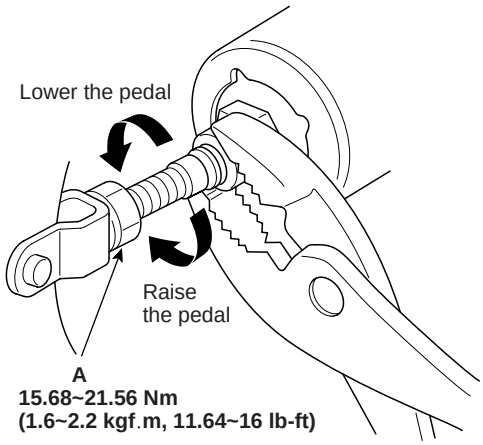
1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and brake off the brake switch (B) until it is no longer touching the brake pedal.
2. Lift up the carpet. At the insulator cutout, measure the pedal height (C) from the middle of the left-side center of the pedal pad (D).

Standard pedal height(with carpet removed): 184.5mm(7.26 in.)



ARJE500P

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



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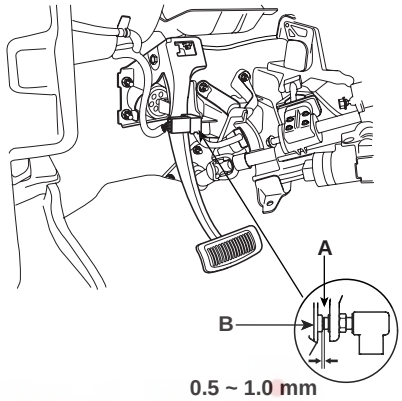
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BRAKE SWITCH CLEARANCE

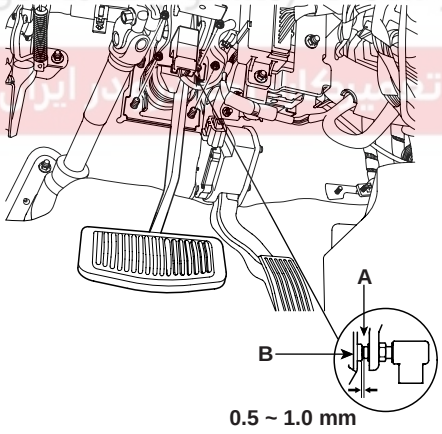
Screw in the brake switch until its plunger is fully depressed (threded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 0.5 ~ 1.0 mm(0.0197 ~ 0.0394 in.) of clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.

[LHD]



KJBF500B

[RHD]

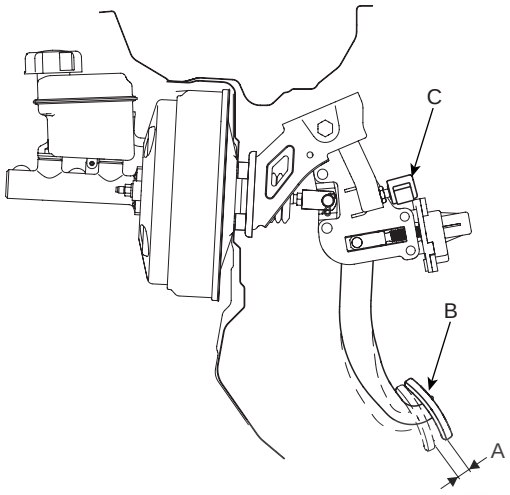


EJBF505Z

PEDAL FREE PLAY

1. With the engine off, inspect the pedal free play (A) on the pedal pad (B) by pushing the pedal by hand.

Free play: 3 ~ 8 mm (0.12 ~ 0.31 in.)



KJBF500C

2. If the pedal free play is out of specification, adjust the brake switch (C). If the pedal free play is insufficient, it may result in brake drag.

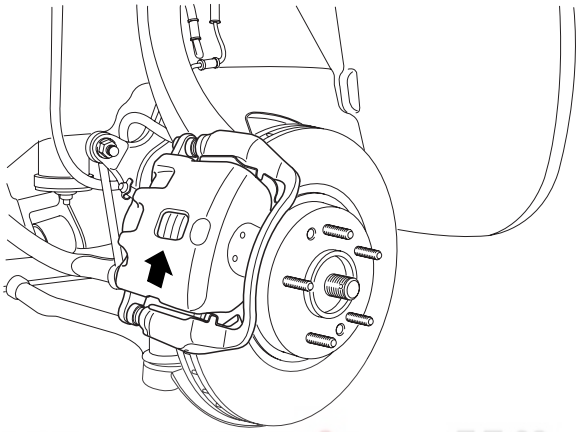
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INSPECTION OF FRONT DISC BRAKE PAD

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

Pad thickness
Standard value : 11.0 mm (0.43 in)
Service limit : 2 mm (0.0787 in)



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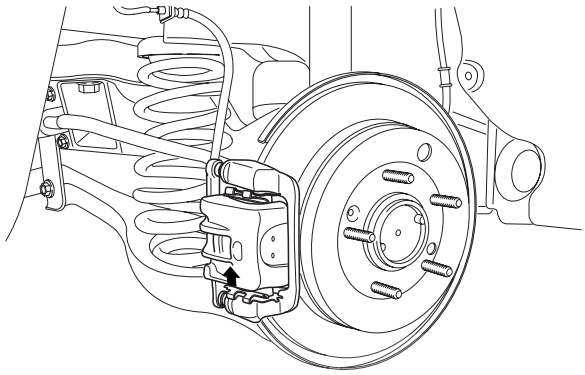
CAUTION

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

INSPECTION OF REAR DISC BRAKE PAD

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

Pad thickness
Standard value : 15.0 mm (0.59 in.)
Service limit : 2.0 mm (0.0787 in.)



KJBF502A

CAUTION

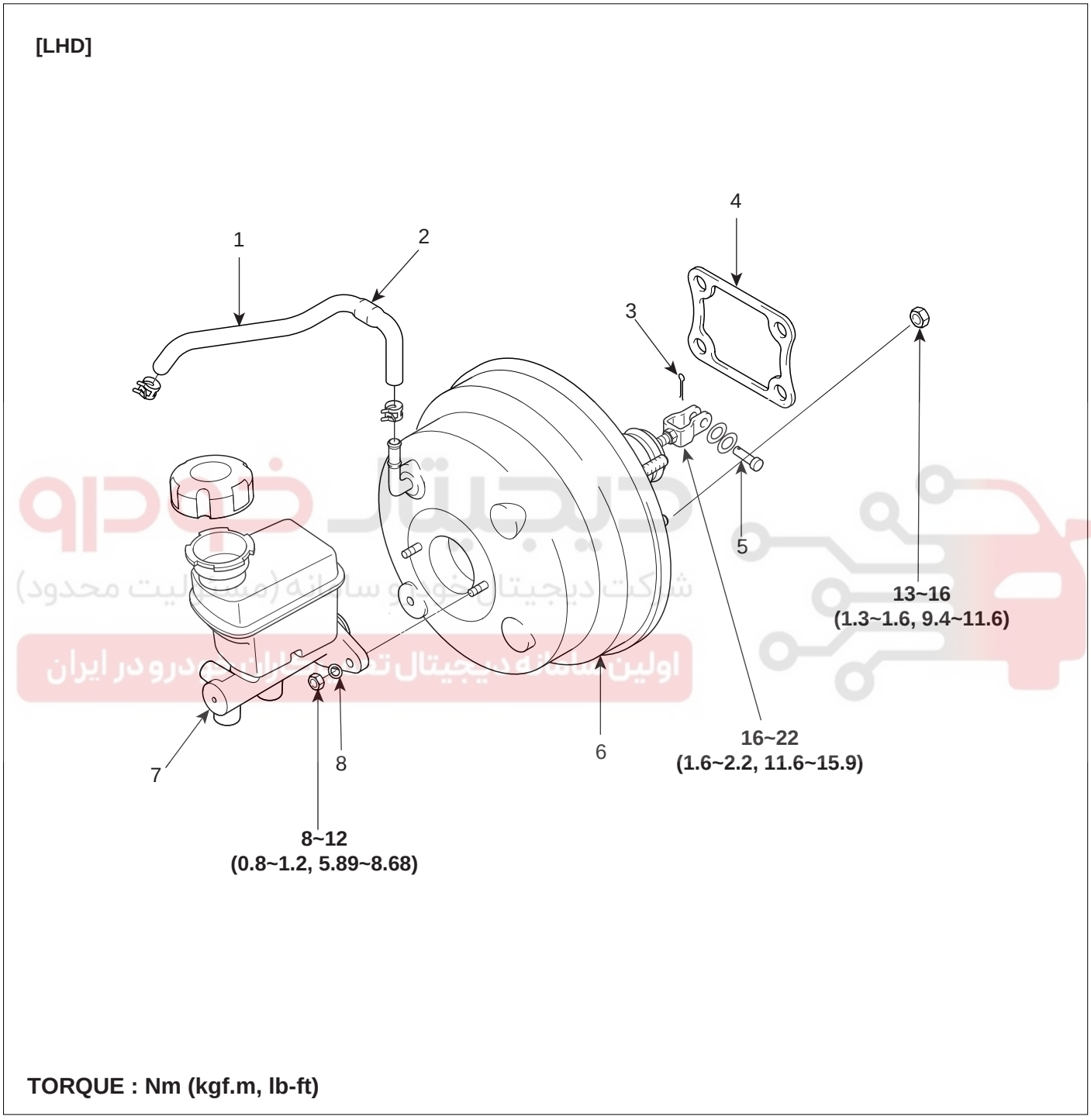
- ***If the pad thickness is out of specification, left and right pads must be replaced as a complete set.***
- ***When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.***

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BRAKE BOOSTER

COMPONENTS ED4FAF09



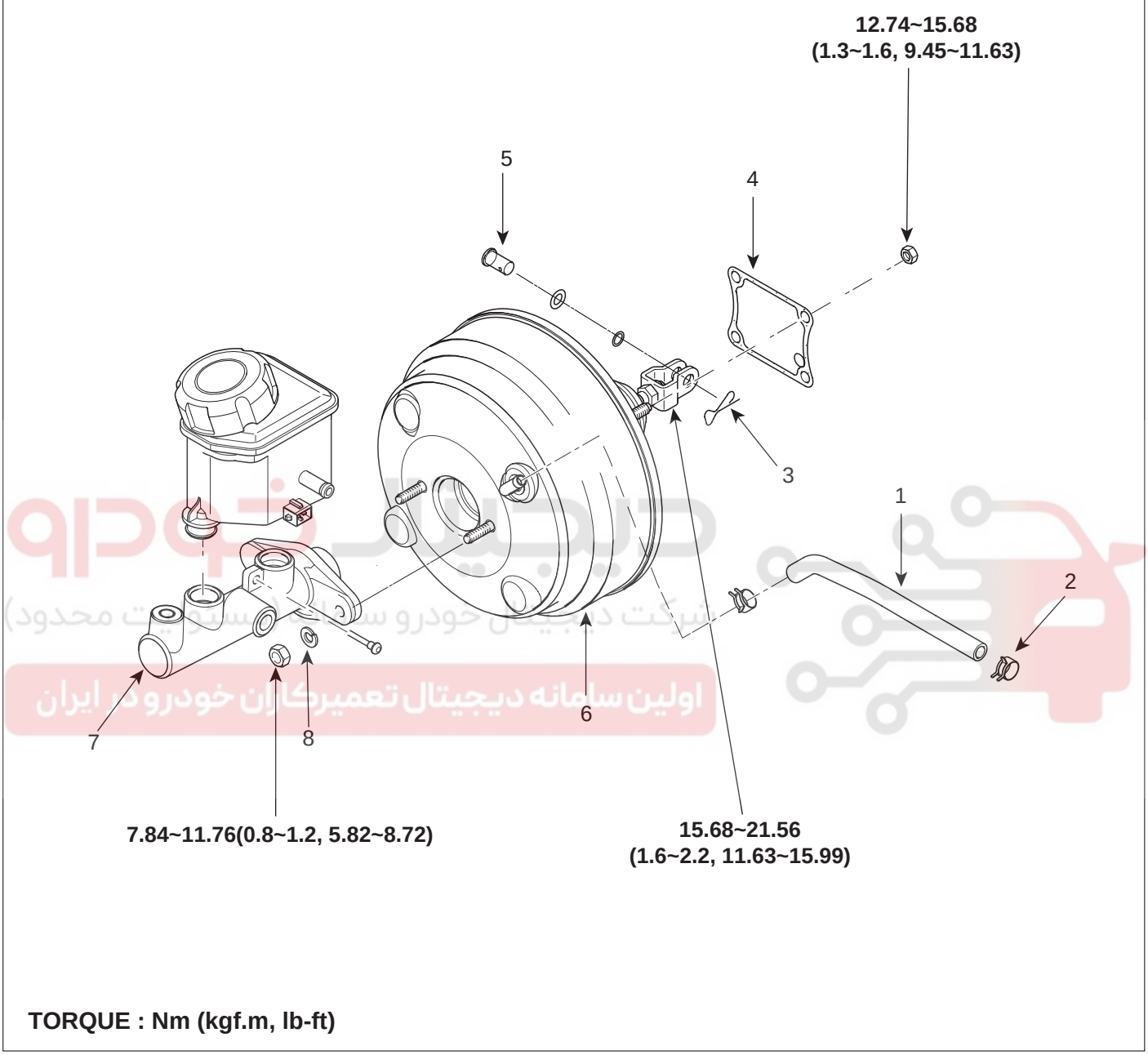
1. Vacuum hose
2. Check valve
3. Snap pin
4. Seal
5. Clevis pin
6. Brake booster
7. Master cylinder
8. Washer

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[RHD]



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

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

EJRF502Z

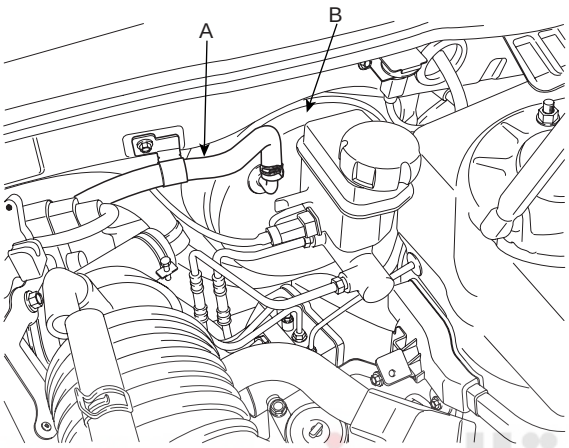
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REMOVAL EBC912AC

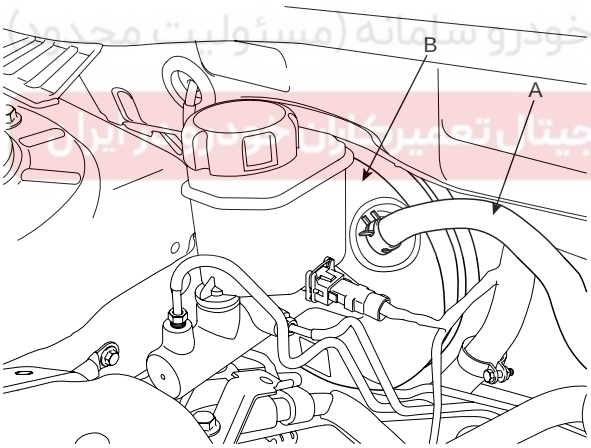
1. Remove the master cylinder (Refer to 'Master cylinder removal' BR-32).
2. Disconnect the vacuum hose (A) from the brake booster (B).

[LHD]



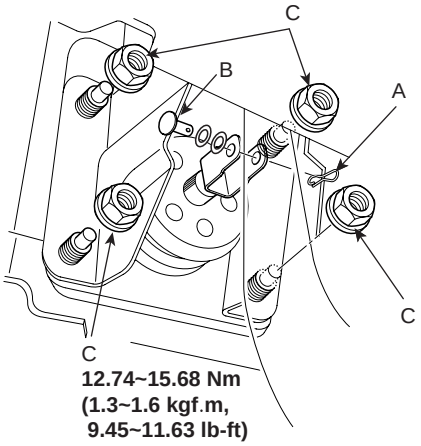
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[RHD]



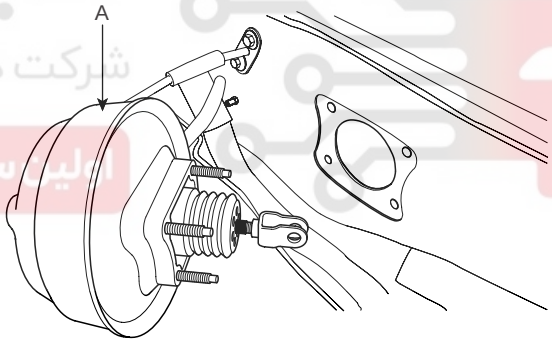
EJRF503A

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



EJRF700C

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



EJKE305D

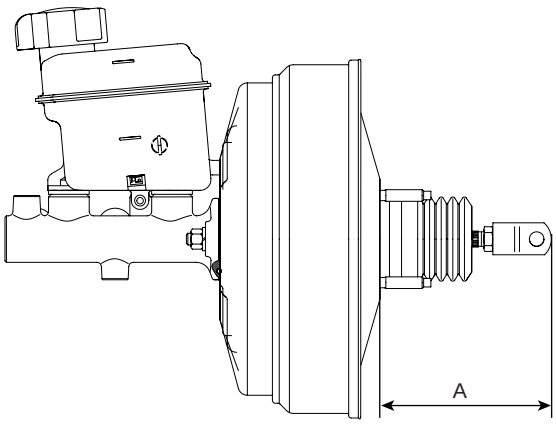
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INSTALLATION E207F695

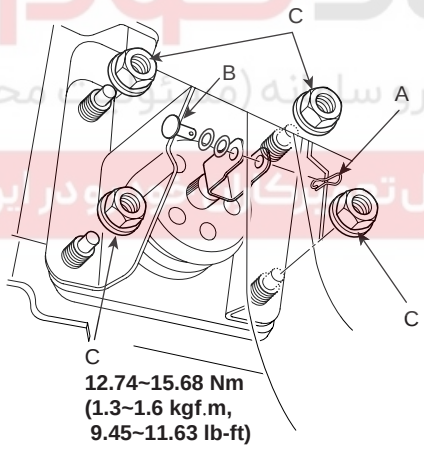
1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A): 108± 0.5 mm (4.25 ± 0.019 in.)



KJBF500F

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



EJRF700D

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

CAUTION

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

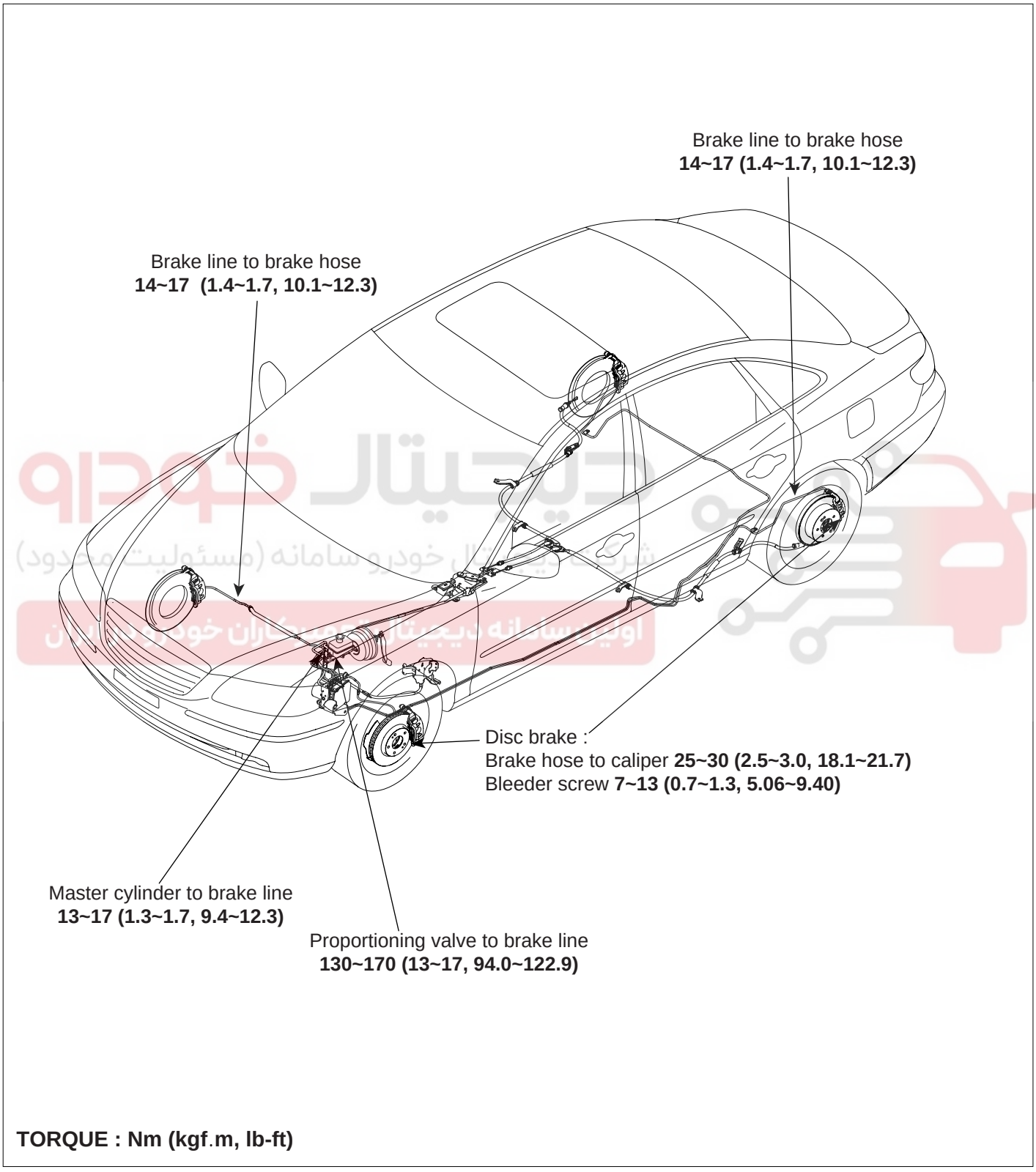
4. Install the master cylinder.
5. Connect the vacuum hose to the brake booster.
6. After filling the brake reservoir with brake fluid, bleed the system (Refer to 'Bleeding of brake system', BR-68).
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

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BRAKE LINE

COMPONENT E0FAB0B3



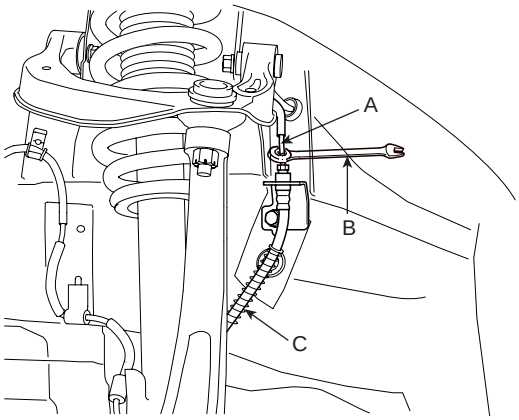
EJBF500B

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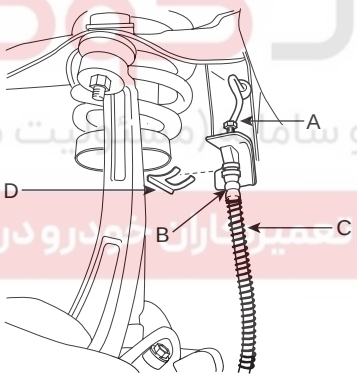
REMOVAL EBE10BC9

1. Loosen the brake tube(A) nut holding the brake hose(C) nut with a wrench(B).



KJRE050A

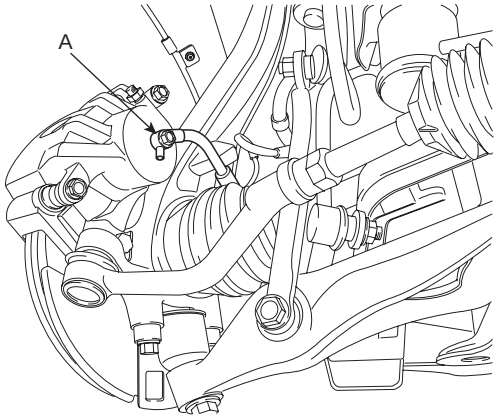
2. Remove the brake hose clip(D) and remove the brake hose(C) from the brake line(A) with a wrench.



KJBF500H

3. Remove the brake hose bracket mounting bolt from the body.

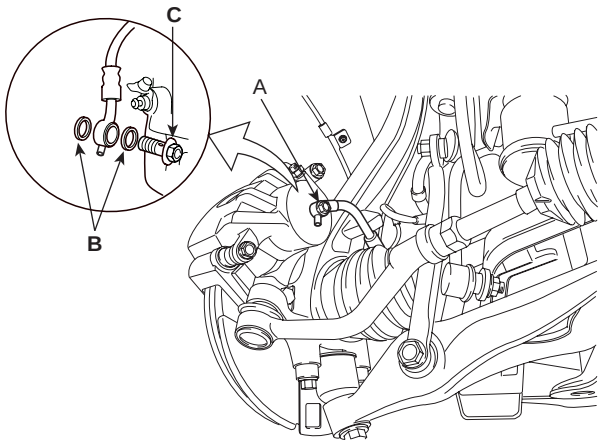
4. Remove the brake hose connecting bolt(A) from the caliper assembly.



KJBF518A

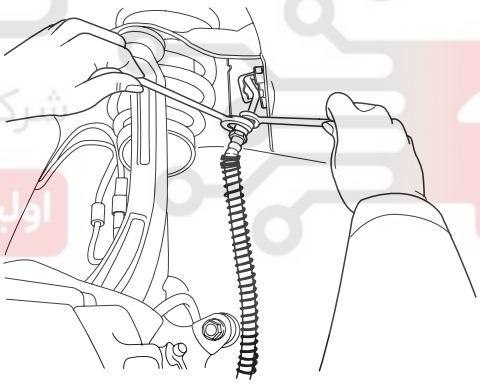
INSTALLATION E0CBDA65

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



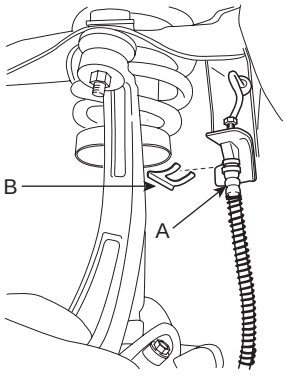
KJBF500I

2. Install the bracket and the brake hose mounting bolt.



KJBF521A

3. Connect the brake hose(A) and the clip(B) to the brake line.



KJBF520A

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

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INSPECTION EC374D0C

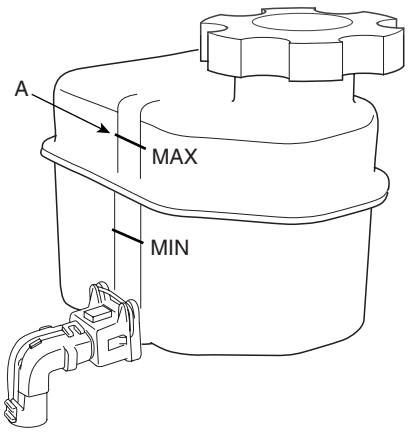
- Check the brake tubes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damaged and oil leakage.
- Check the brake tube flare nuts for damage and oil leakage.

BRAKE SYSTEM BLEEDING E0C44ECF

NOTE

- *Do not reuse the drained fluid.*
- *Always use Genuine DOT3 or DOT 4 Brake Fluid. Using a non-Genuine DOT or 4 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 (A).



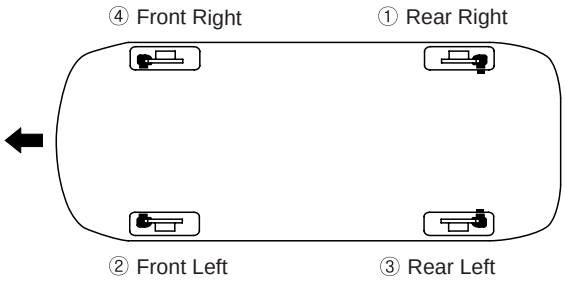
EJQE003A

2. Have someone slowly pump the brake pedal several times, then apply pressure.

3. Lossen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.

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

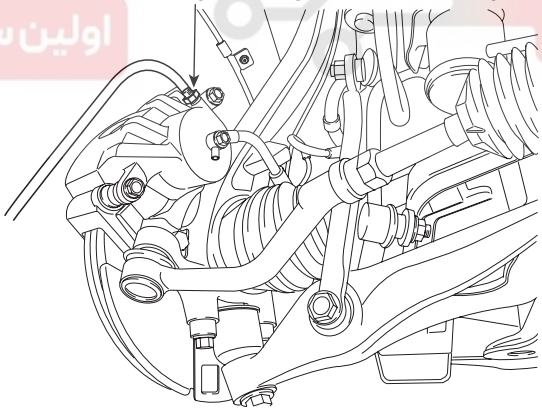
5. Refill the master cylinder reservoir to MAX(upper) level line.



EJKE003B

FRONT DISC BRAKE

6.86~12.74 Nm (0.7~1.3 kgf.m, 5.09~9.45 lb-ft)



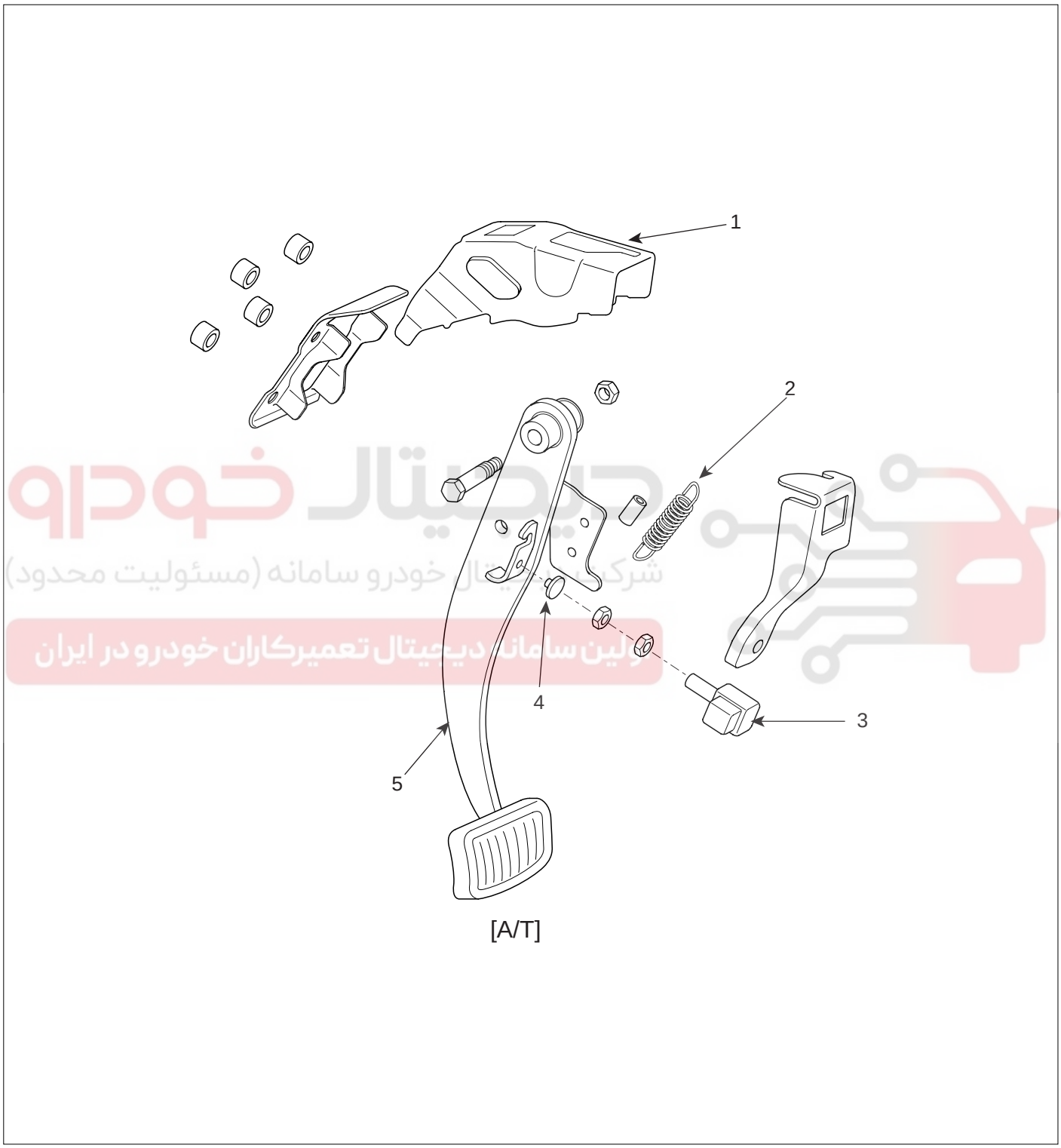
EJBF500C

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BRAKE PEDAL

COMPONENTS EF92A270



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

EJBF500D

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COMPONENTS (ADJUSTABLE PEDAL)



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

EJRF500N

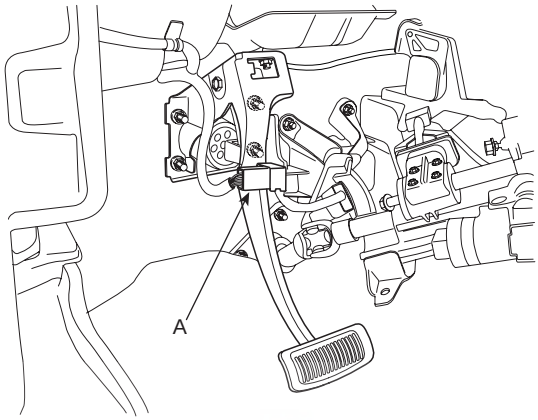
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REMOVAL EF8DBA4F

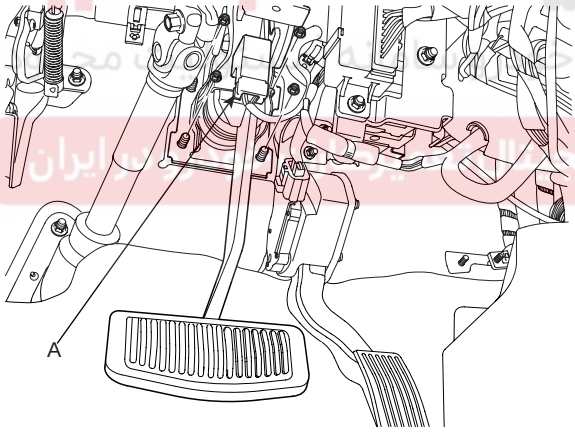
1. Remove the lower crash pad.(Refer to BD-"crash pad")
2. Pull down steering column shaft after removing 4 bolts.

[LHD]



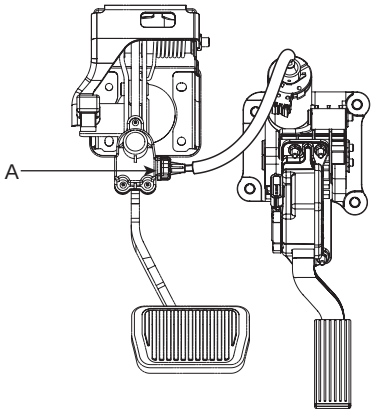
KJBF503A

[RHD]



EJBF506B

3. Remove the stop lamp switch connector (A).
4. Remove the shift lock cable (A) in case of the adjustable brake pedal.



KJBF505R

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

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INSTALLATION E261059C

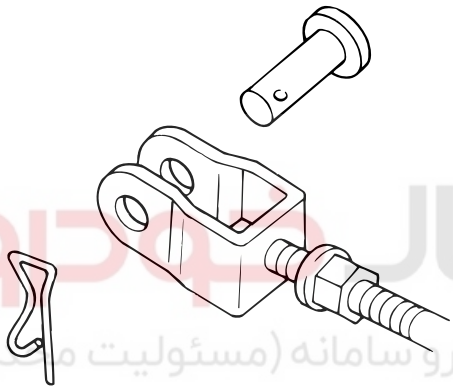
1. Installation is the reverse of removal.

CAUTION

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

Specified grease : SAE J310

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



EJQE008R

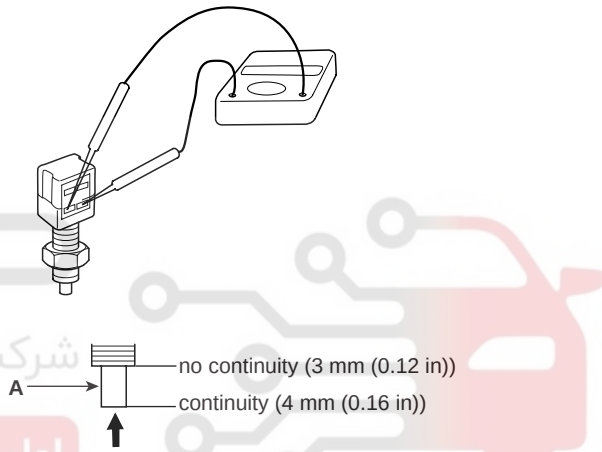
3. Install the snap pin.
4. Install the nuts with specified torque, when installing the brake pedal.

TORQUE : Nm(kgf·m,lb-ft);
12.74~15.68(1.3~1.6, 9.45~11.63)

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

INSPECTION E90D4C56

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



EJRF500O

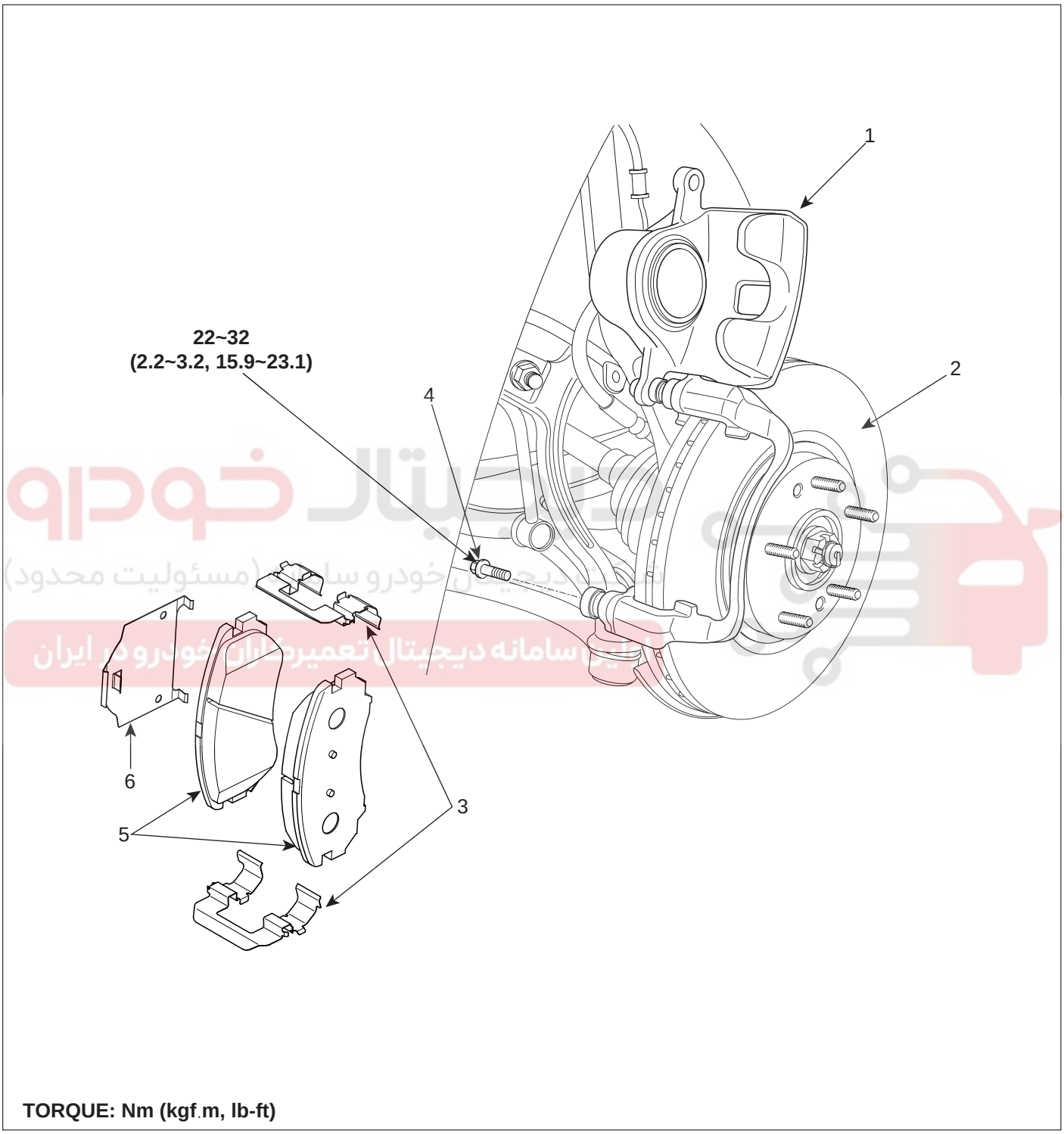
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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FRONT DISC BRAKE

COMPONENTS E7A1EE0C

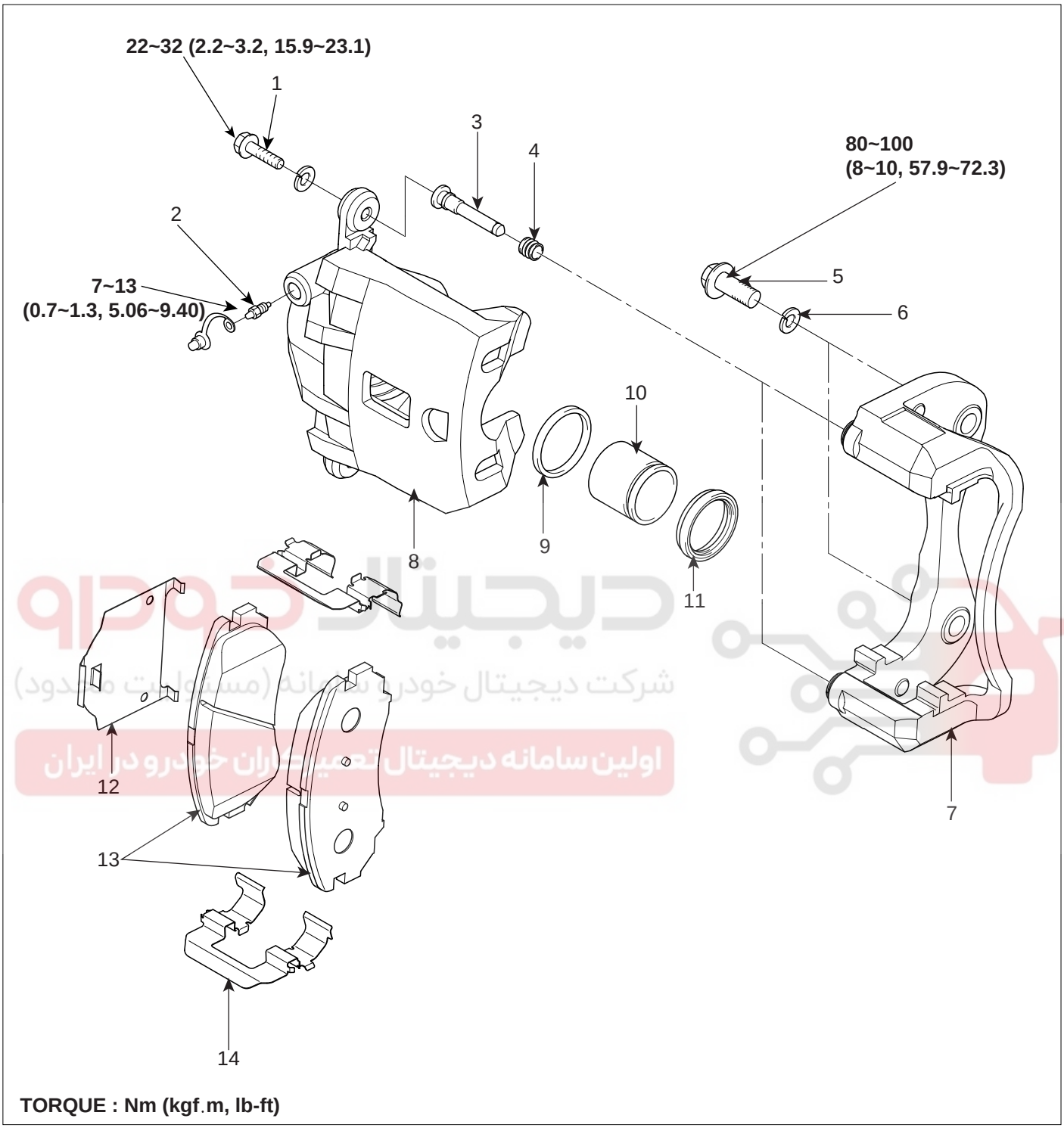


1. Brake caliper
2. Brake disc
3. Pad retainers
4. Guide rod bolt
5. Brake pads
6. Brake pad shims

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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

EJBF500F

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REMOVAL EACFB385

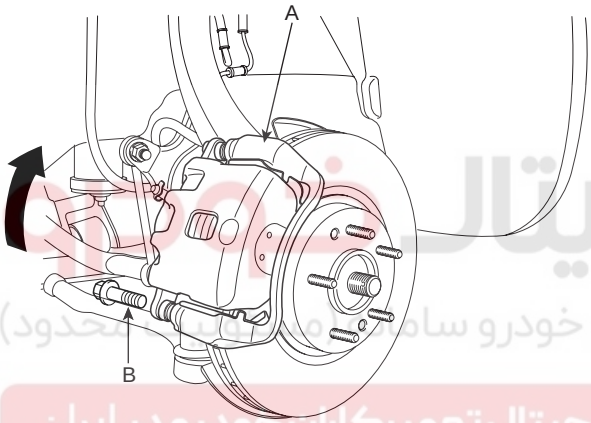
CAUTION

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.***

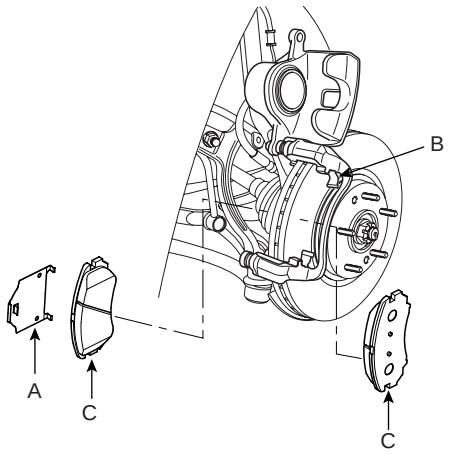
1. Lossen the front wheel nuts slightly. Raise the front of the vehicle, and make sure it is securely supported. Remove the front wheels.

2. Remove the guide rod bolt(B), After raise the caliper assembly(A), support it with a wire.



KJBF500N

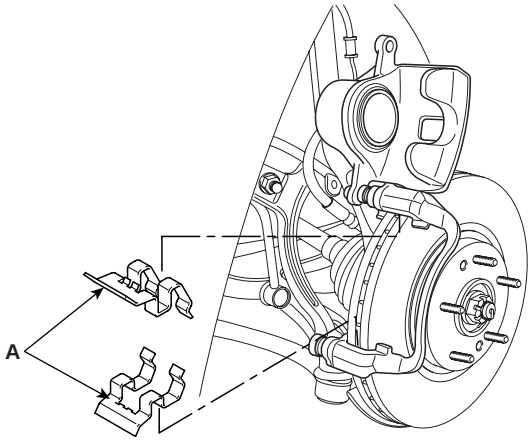
3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.



KJBF500O

INSTALLATION E1EE2839

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

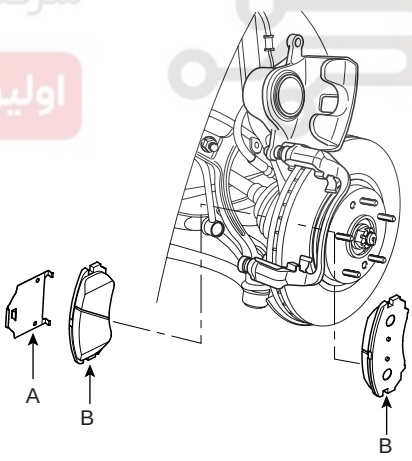


KJBF500S

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

CAUTION

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

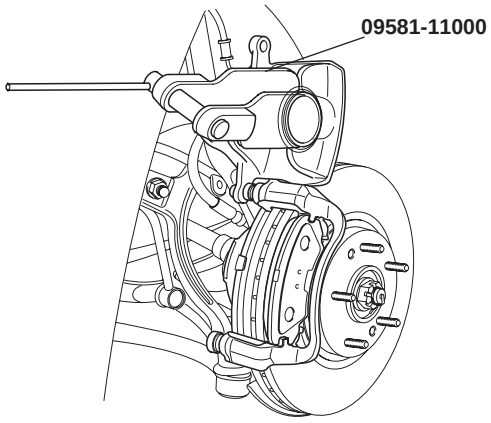


KJBF505G

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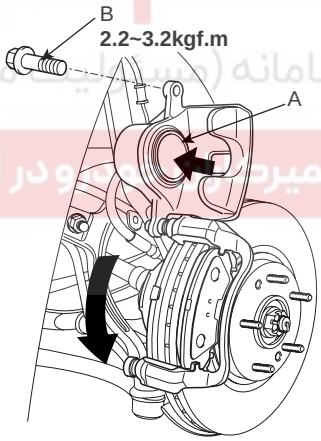
3. Insert the piston in the cylinder using the special tool (09581-11000).



KJBF500U

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. Being careful not to damage the pin boot, install the guide rod bolt (B) with the specified torque.



KJBF500V

6. If caliper assembly was removed, install the brake hose to the caliper.

7. Refill the master cylinder reservoir to the MAX line.

8. Bleed the brake system.(Refer to 'Bleeding of ABS system')

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

NOTE

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.

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

INSPECTION E6FAC369

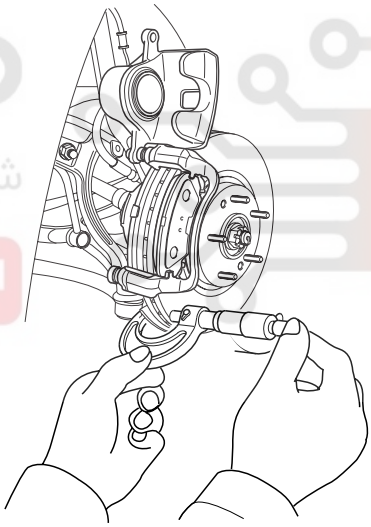
FRONT BRAKE DISC THICKNESS CHECK

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

Front brake disc thickness Standard value : 28.0 mm(1.10 in) Limit : 26.4 mm(1.04 in)

2. Thickness variation should not exceed 0.005mm (0.0002 in) (circumference) and 0.01 mm (0.0004 in)(radius) at any directions.

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



KJBF500P

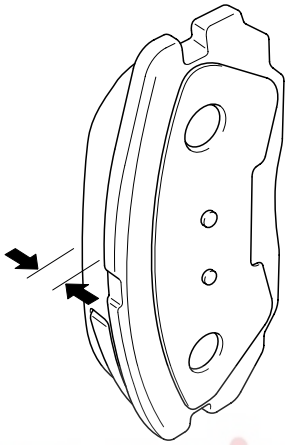
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FRONT BRAKE PAD CHECK

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 mm (0.0787 in)



EJRF702K

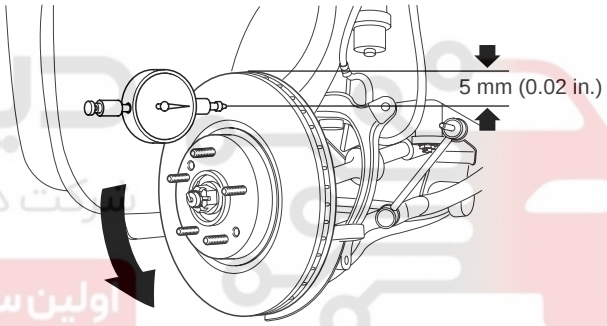
2. Check that grease is applied, to sliding contact points and the pad and backing metal for damage.

FRONT BRAKE DISC RUN OUT CHECK

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

Brake disc run out
Limit : 0.04 mm (0.0016 in.) or less (new one)

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.



EJBF500G

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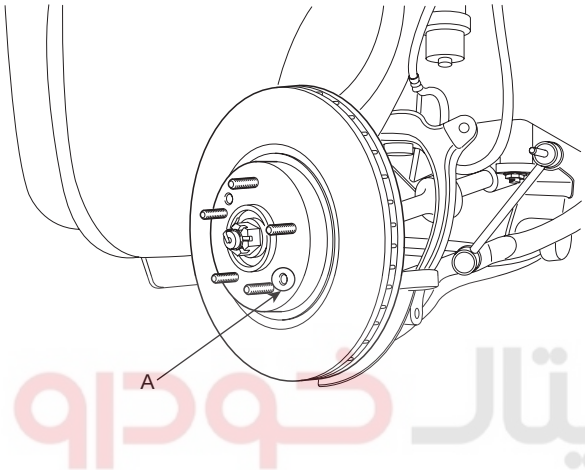
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SEIZING OF FRONT BRAKE DISC

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

   NOTE

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



KJBF500R

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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

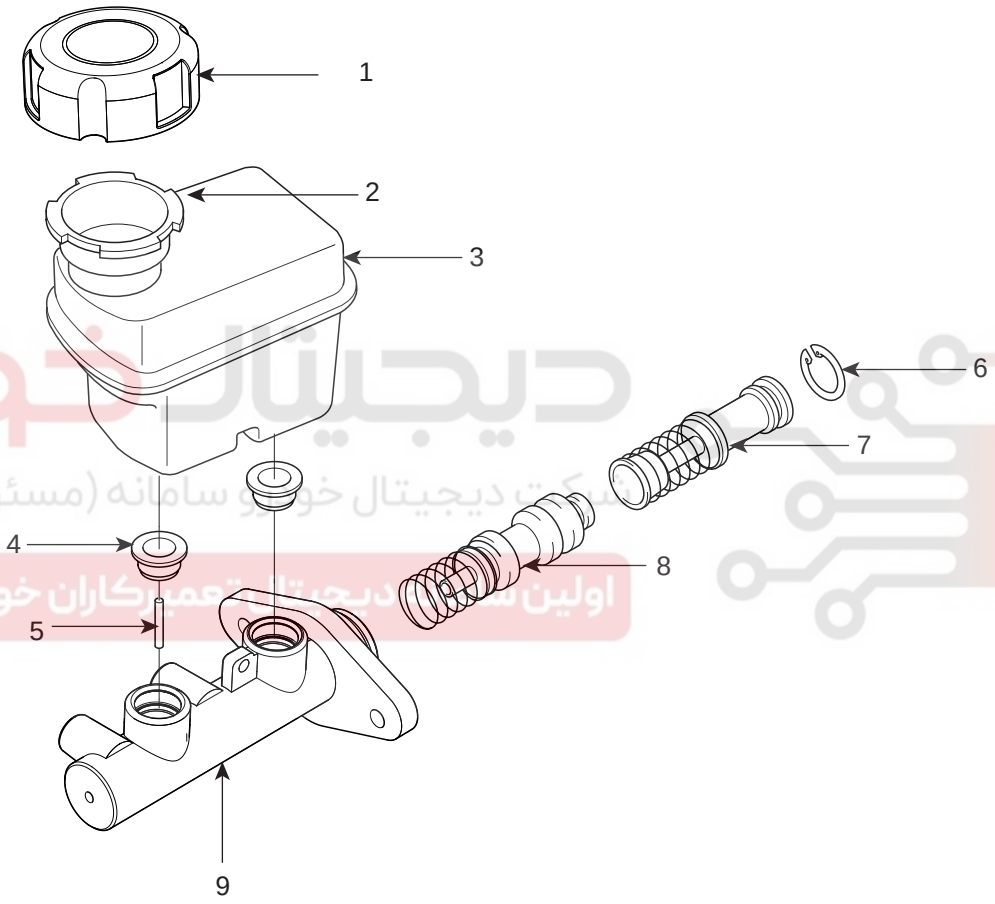
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MASTER CYLINDER

COMPONENTS ECF0E831

[LHD]



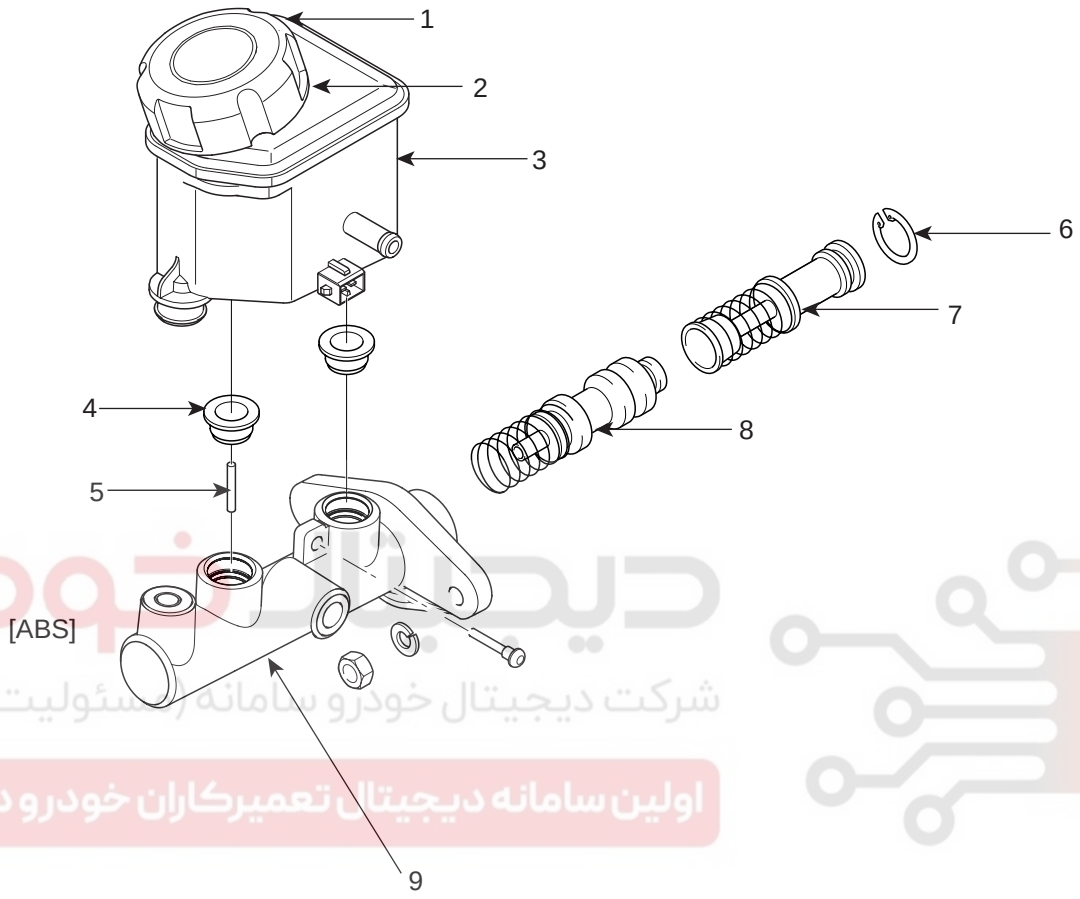
1. Reservoir cap
2. Brake fluid filter
3. Reservoir
4. Grommet
5. Cylinder pin
6. Retainer
7. Primary piston assembly
8. Secondary piston assembly
9. Master cylinder body

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[RHD]



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

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

EJRF503D

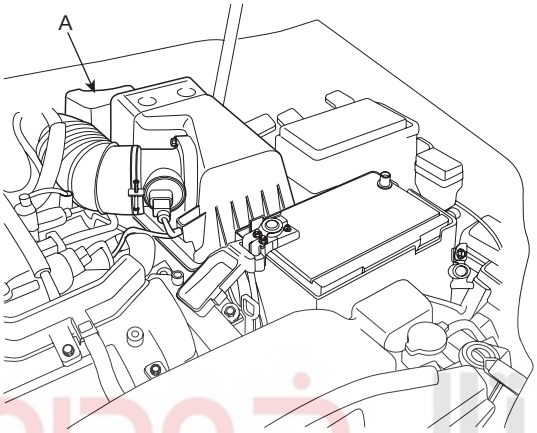
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REMOVAL E33E25CE

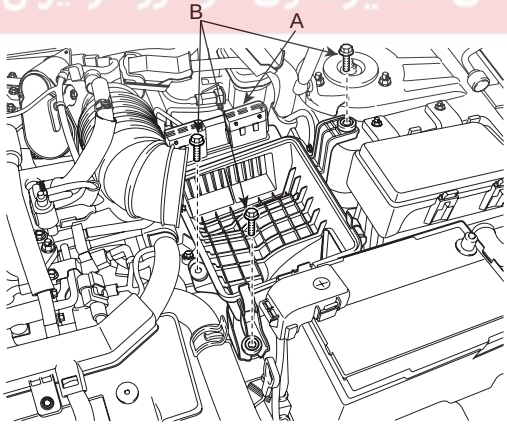
> ***NOTE***
>
> *Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.*

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



KJBF507A

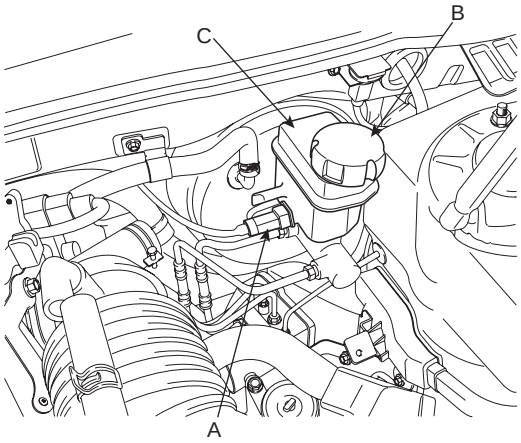
2. Remove the air cleaner assembly(A) by removing the air cleaner mounting bolt(B) from the bracket.
   -LHD only



KJBF506A

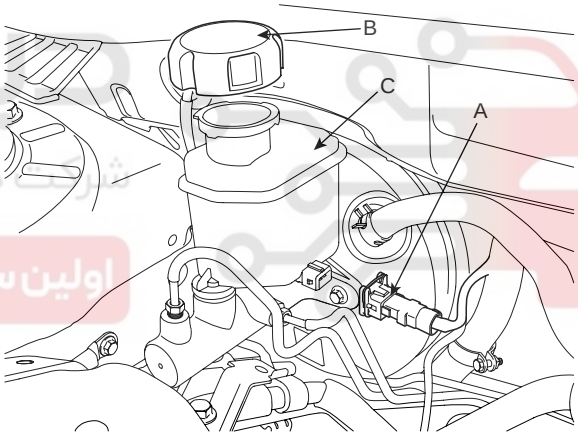
3. Disconnect the brake fluid level switch connector (A), and remove the reservoir cap (B).

[LHD]



KJBF501U

[RHD]



EJRF503E

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

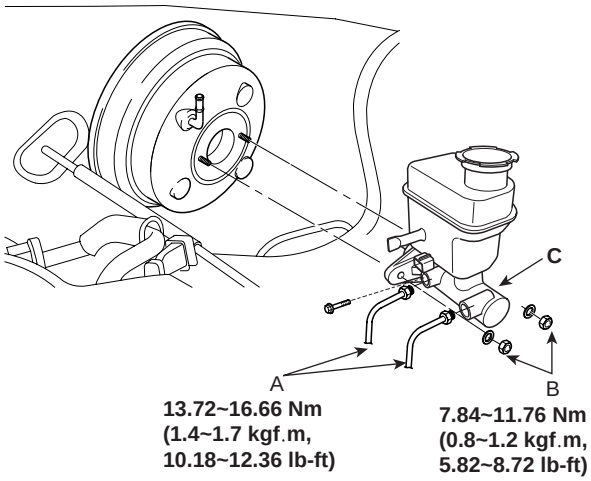
5. Disconnect the brake lines (A) from the master cylinder. To prevent spills, cover the hose joints with rags or shop towels.

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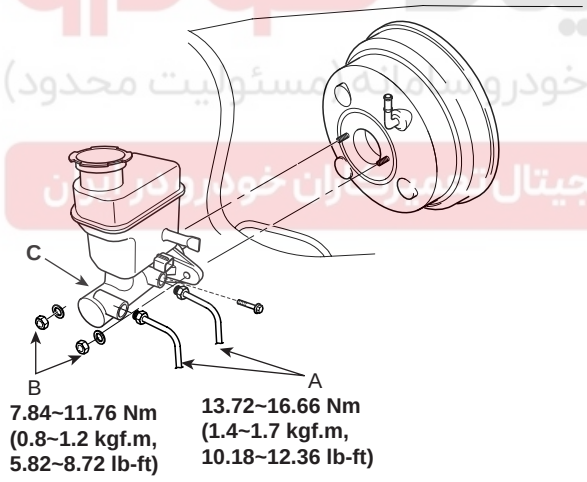
6. Remove the master cylinder mounting nuts (B) and washers.

[LHD]



EJBF500I

[RHD]



EJBF506D

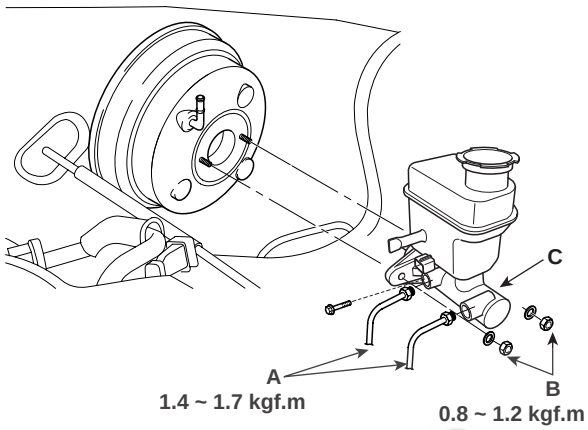
7. Remove the master cylinder(C) from the brake booster. Be careful not to bend or damage the brake lines when removing the master cylinder.

INSTALLATION EEF4E71E

1. Install the master cylinder on the brake booster with 2 nuts.

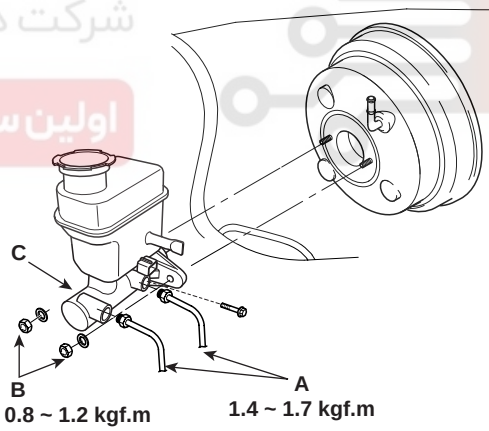
2. Connect the two brake tubes and the brake fluid level sensor connector.

[LHD]



EJBF505S

[RHD]



EJBF506E

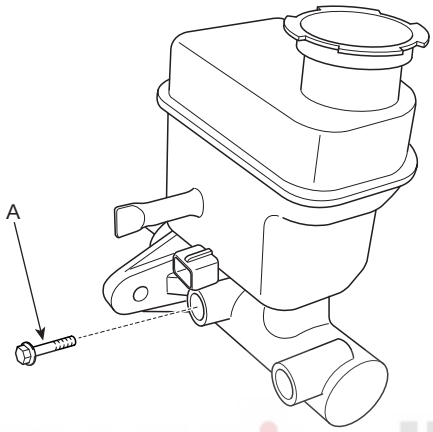
3. Fill the brake reservoir with the brake fluid and bleed the brake system (Refer to 'Bleeding of brake system', BR-69).

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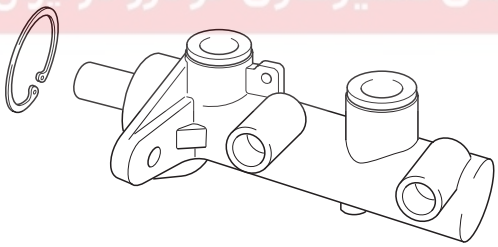
DISASSEMBLY E941DD67

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).



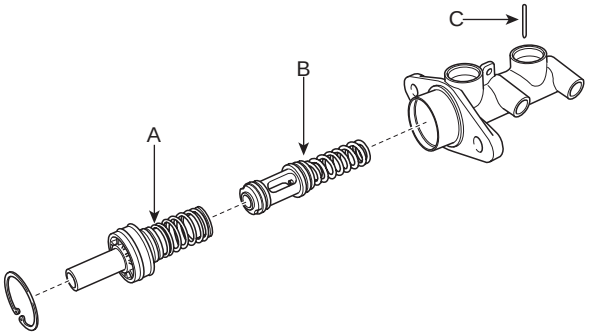
KJBF526A

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



EJRF703U

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



KJBF528A

NOTE

Do not disassemble the primary and secondary piston assembly.

INSPECTION E1A849D8

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

CAUTION

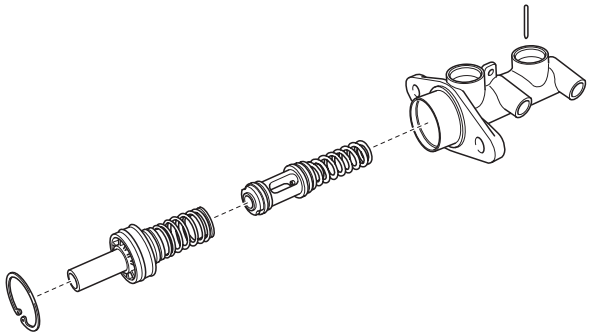
- ***If the cylinder bore is damaged, replace the master cylinder assembly.***
- ***Wash the contaminated parts in alcohol.***

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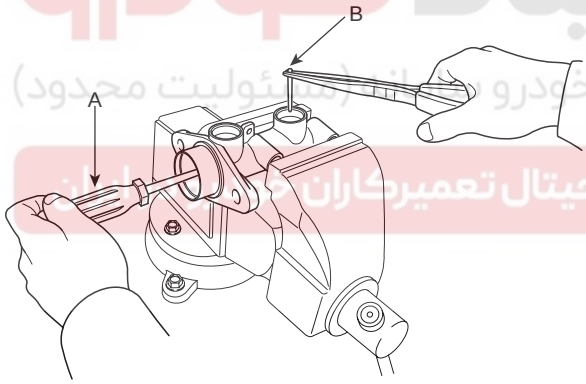
REASSEMBLY EF33C3A6

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.



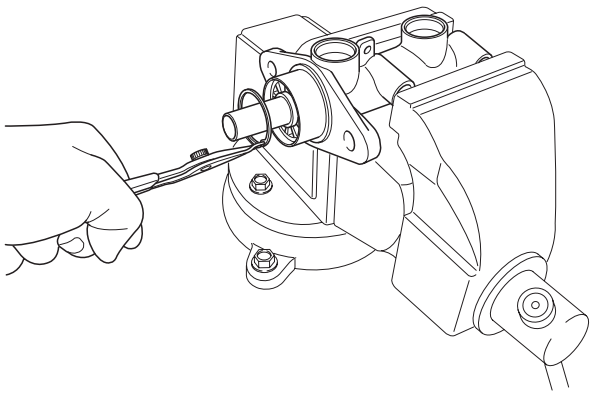
EJRF703V

3. Press the piston with a screwdriver(A) and install the cylinder pin(B).



EJRF703W

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



EJRF703X

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

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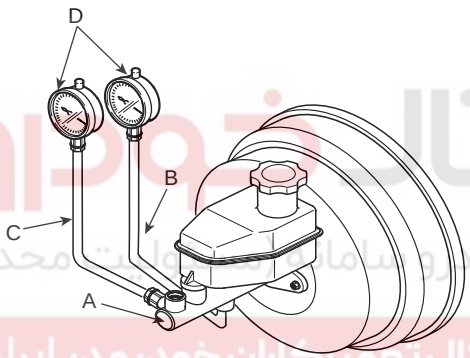
PROPORTIONING VALVE

DESCRIPTION EE3522F9

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 higher brake efficiency within the range of service brake application.

INSPECTION EA45DD74

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.



EJRF700O

NOTE

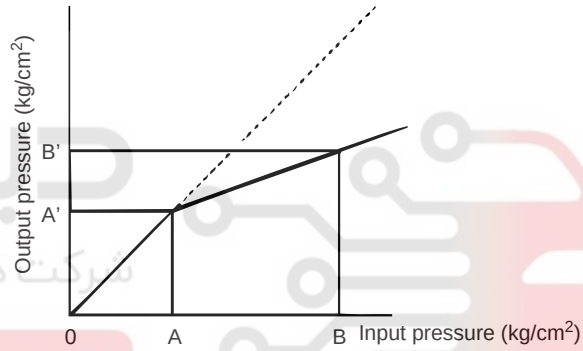
Be sure to bleed the system after connecting the pressure gauges.

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

NOTE

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

Front (Output of master cylinder)	Rear (Output of proportioning valve)
A : 30 kg/㎠ (2.94 MPa, 427 psi)	A' : 30 kg/㎠ (2.94 MPa, 427 psi)
B : 80 kg/㎠ (7.84 MPa, 1137 psi)	B' : 43.5 ± 3.0 kg/㎠ (4.26 ± 0.3 MPa, 618 ± 43 psi)



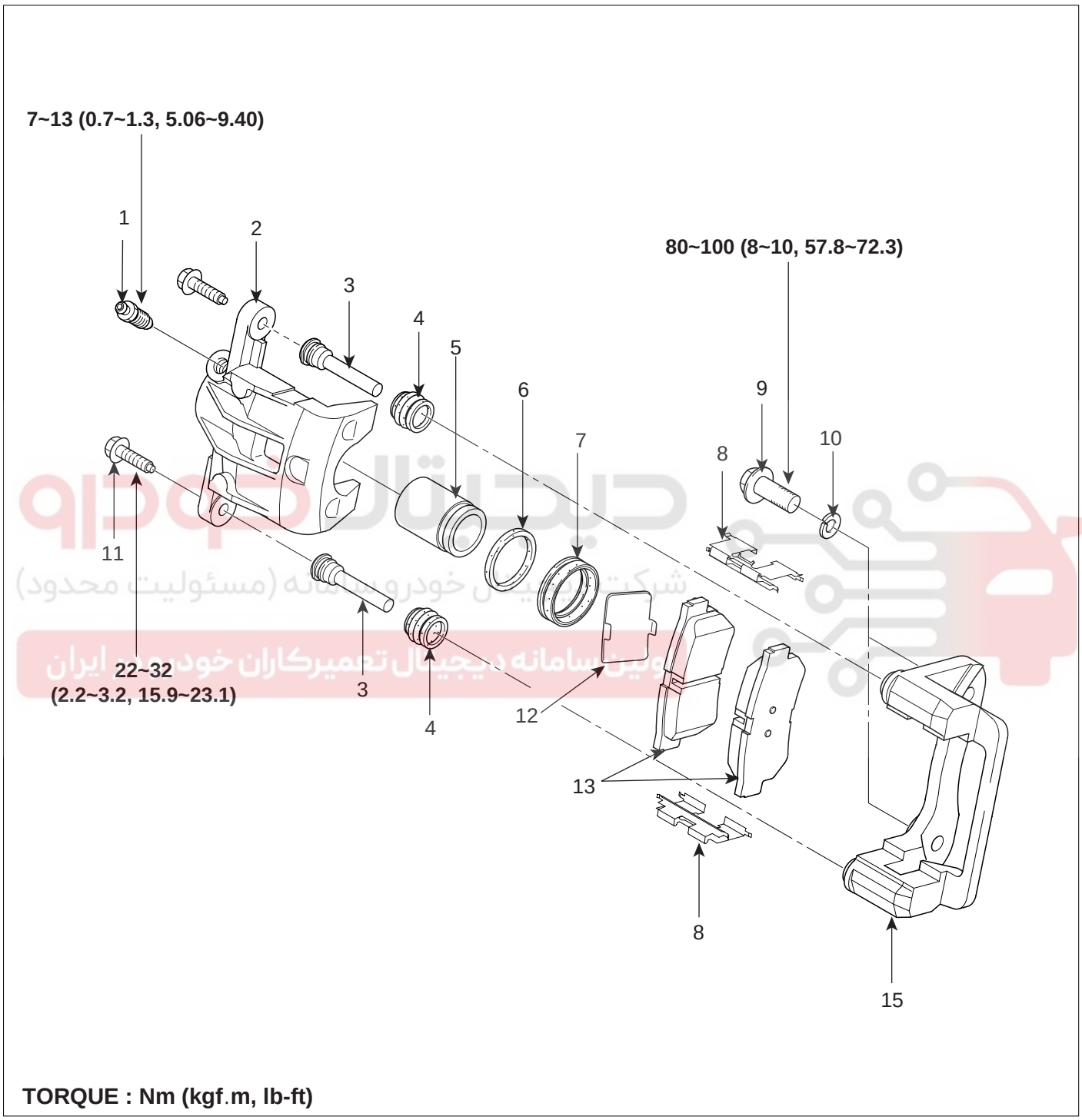
LJJF500O

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REAR DISC BRAKE

COMPONENTS EFD1FEAF



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

1. Bleeder screw
2. Caliper body
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

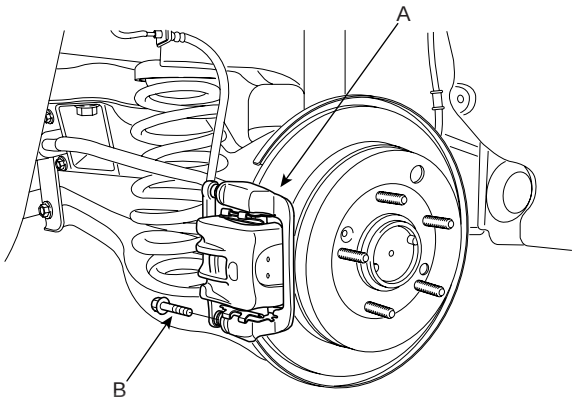
EJBF500J

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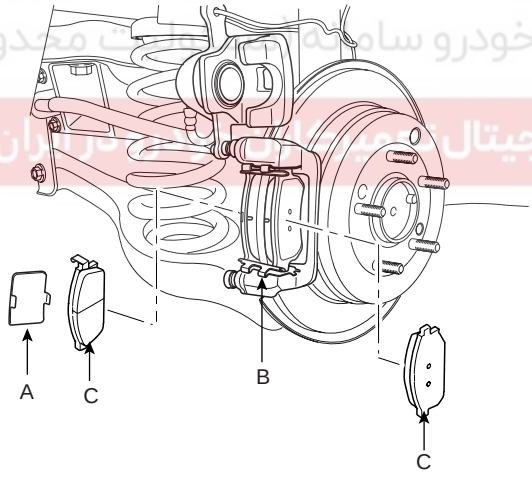
REMOVAL EBA88C4B

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 raising the caliper assembly(A), support it with a wire.



KJBF500Z

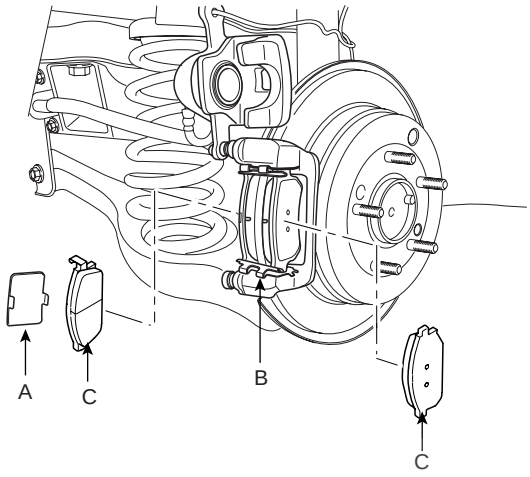
3. Remove pad shim(A), pad retainer(B) and pad assembly(C) in the caliper bracket.



KJBF501B

INSTALLATION E6894814

1. Install the pad retainers(A) on the caliper bracket.
2. Check for foreign material between the pad shim (A) and the back of the pads (B).



KJBF501B

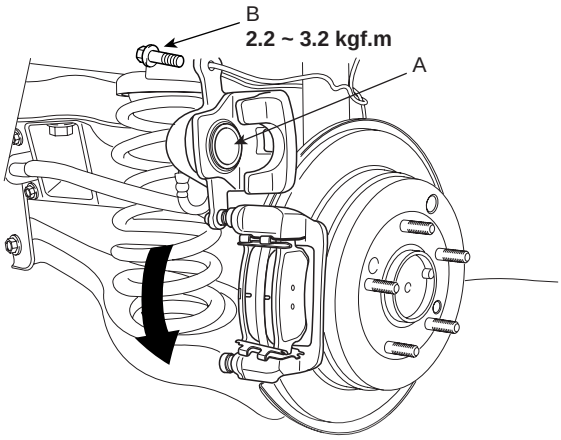
3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.
4. Install the brake pads (B) and pad shims (A) correctly. Install the pad with the wear indicator (C) on the inside.
   If you are reusing the pads, always reinstall the brake pads in their original position to prevent a momentary loss of braking efficiency.

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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.

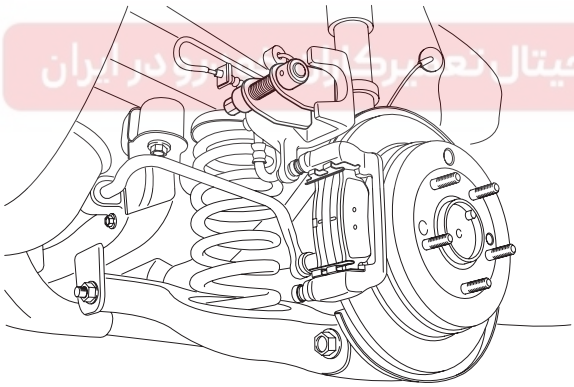
6. Pivot caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification



KJBF501F

NOTE

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



KJBF510A

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

NOTE

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 EE1C6DC8

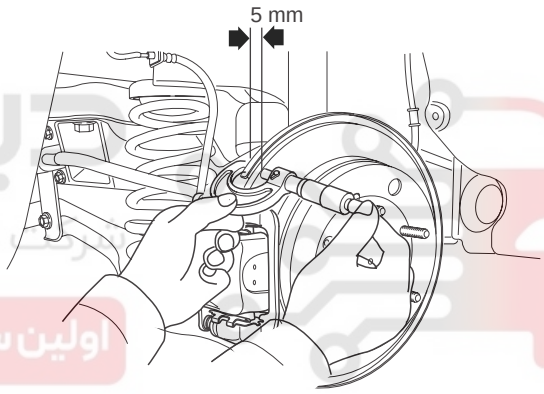
REAR BRAKE DISC THICKNESS CHECK

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 (5 mm(0.12 in)) from the brake disk outer circle.

Rear brake disc thickness Standard value : 10.0 mm (0.39 in) Limit : 8.0 mm (0.31 in)

2. Thickness variation should not exceed 0.01 mm(0.0004 in) (circumference) and 0.01 mm(0.0004 in) (radius) at any directions.

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



KJBF501C

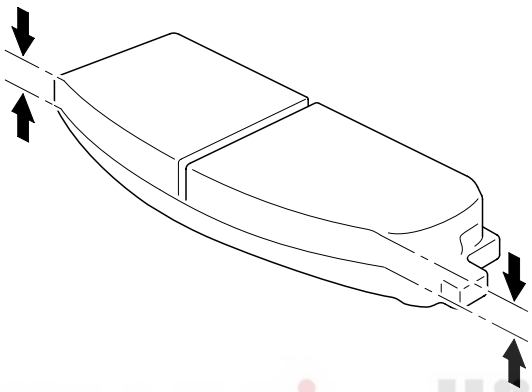
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REAR BRAKE PAD CHECK

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

Pad thickness Standard value : 15.0 mm (0.59 in) Service limit : 2.0 mm (0.08 in)



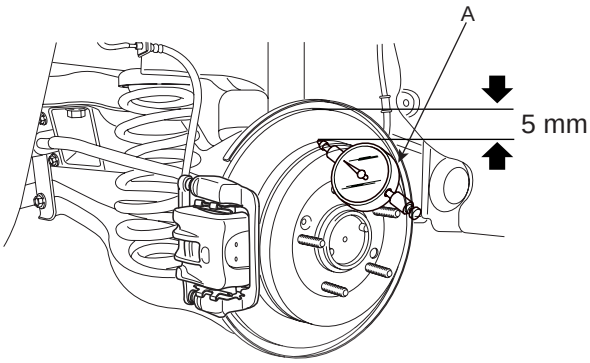
KJRE503B

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 5 mm (0.2 in) from the outer circumference of the brake disc, and measure the run out of the disc.

Brake disc run out Limit : 0.05 mm (0.002 in) or less (new one)



KJBF501D

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.

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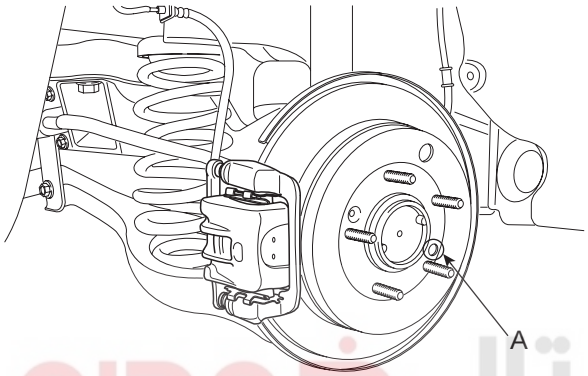
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SEIZING OF REAR BRAKE DISC

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

NOTE

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



KJBF501E

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اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

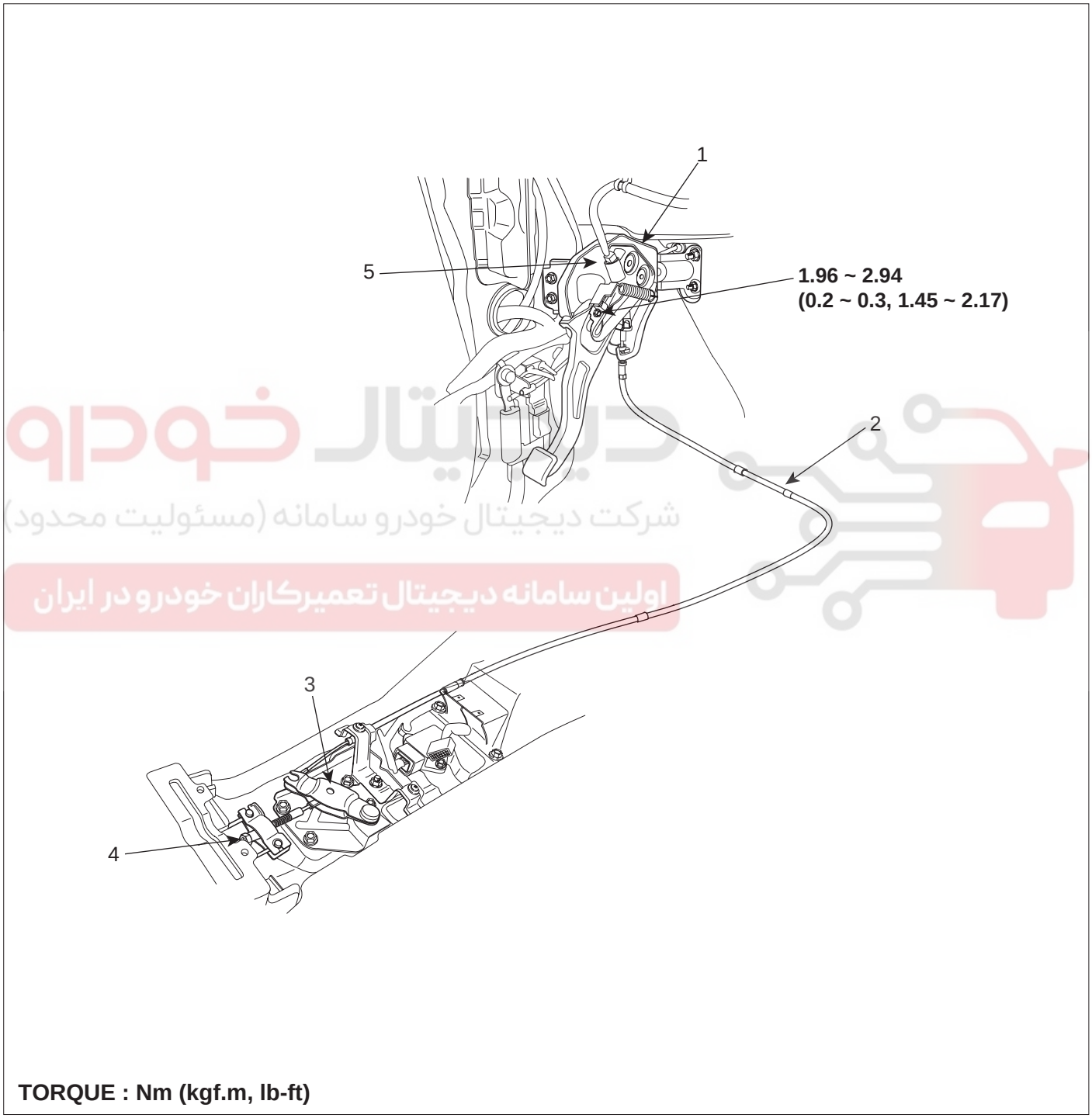
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PARKING BRAKE SYSTEM

PARKING BRAKE

COMPONENTS(1) E2D15413



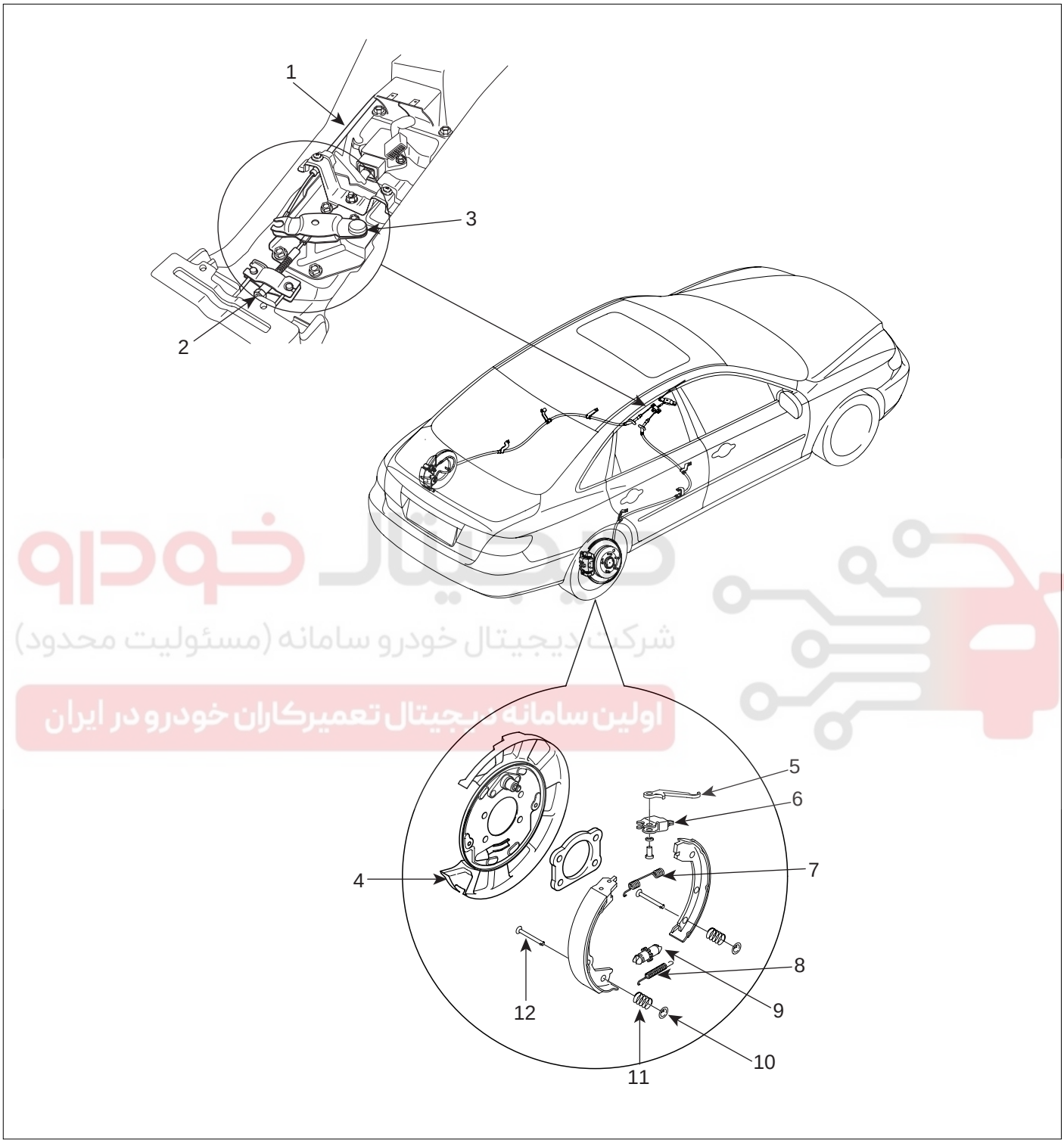
1. Parking brake pedal assembly
2. Parking brake cable
3. Equalizer assembly
4. Adjusting nut
5. Parking brake switch assembly

EJBF500L

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COMPONENTS(2)



1. Parking brake cable
2. Adjusting nut
3. Equalizer assembly
4. Backing plate
5. Operating lever
6. Strut
7. Upper spring
8. Lower spring
9. Adjuster
10. Cup washer
11. Shoe hold down spring
12. Shoe hold down pin

EJBF500K

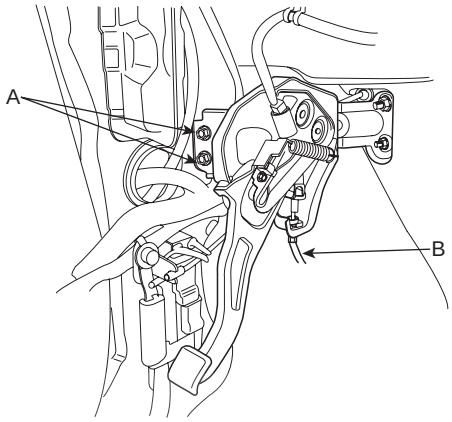
شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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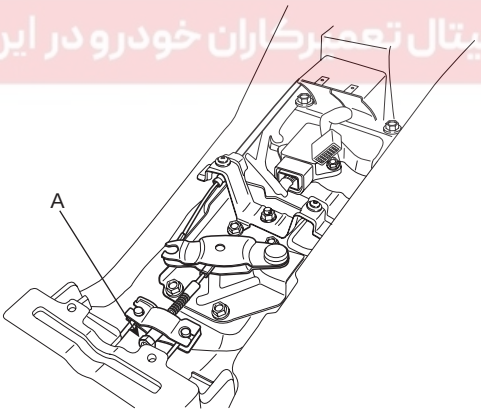
REMOVAL E0DB13ED

1. Remove the lower panel, after loosening the parking lever (Refer to BD Gr. 'Crash pad')
2. Remove the parking brake mounting bolt(A) and the wire(B).



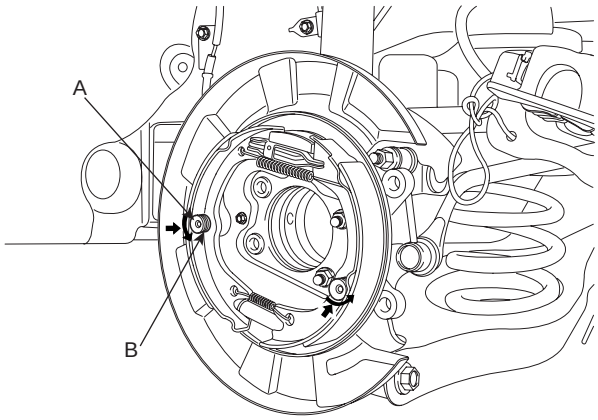
KJBF501I

3. Remove the floor console (Refer to BD Gr. 'Console').
4. Remove the parking brake wire by removing the adjusting nut(A).



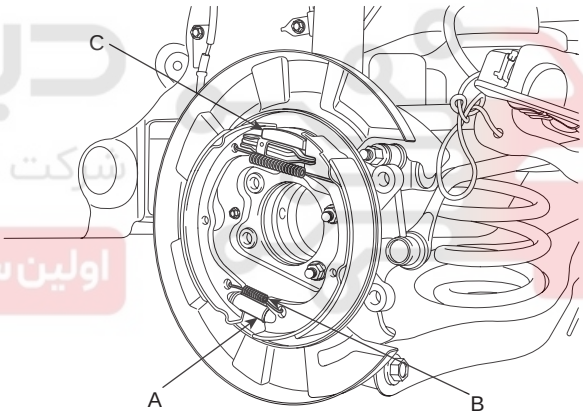
KJBF501J

5. Raise the front of the vehicle, and make sure it is securely supported.
6. Remove the rear wheel and tire from the rear hub.
7. Remove the caliper assembly from the carrier and suspend it with wire.
8. Remove the brake disk and the rear axle hub (Refer to DS Gr. 'Rear axle')
9. While fastening the spring, remove the shoe hold down pin(A) and spring(B).



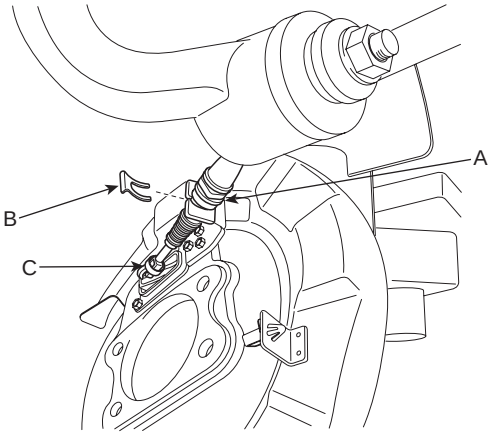
KJBF538A

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



KJBF501K

11. Remove the strut assembly(C).
12. Remove the retaining ring(B) from the parking brake wire(A) which is in the rear side of the backing plate.



KJBF501L

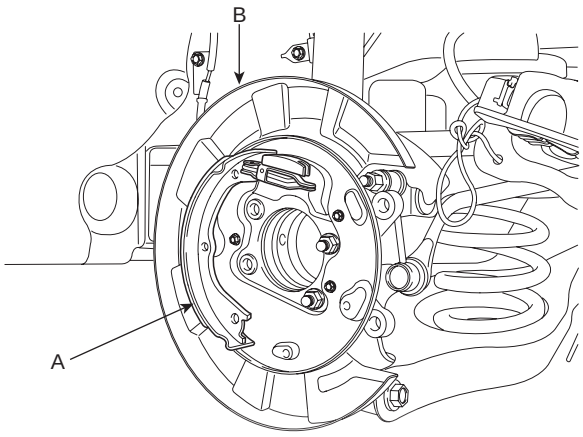
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13. Remove the parking brake wire connecting hook(C) from the brake shoe.

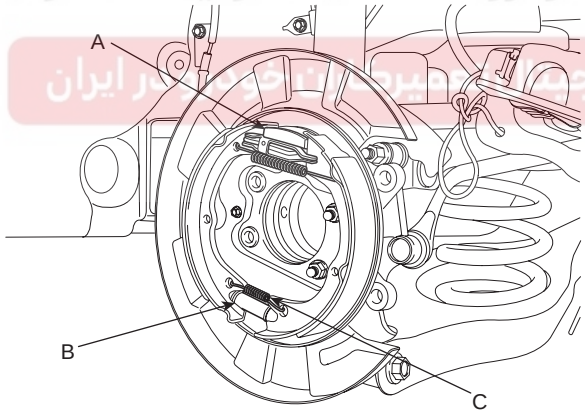
INSTALLATION ED088A72

1. Install the brake shoe(A) to the backing plate(B).



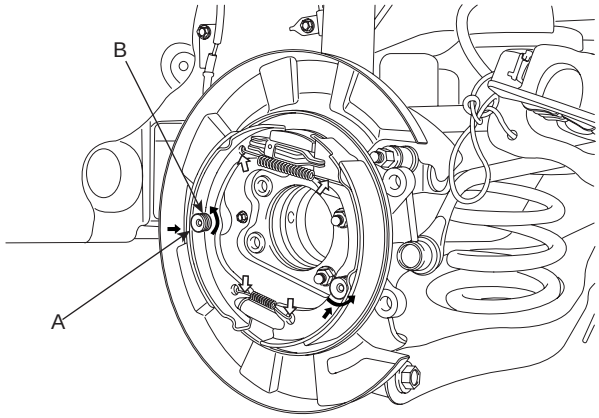
KJBF501M

2. Connect the parking brake wire to the brake shoe.
3. After installing the strut assembly(A), install the adjuster assembly(B) and the lower return spring(C).



KJBF501N

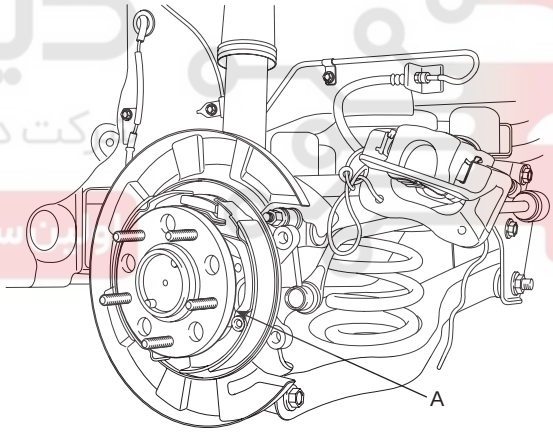
4. While pressing the spring, install the brake shoe hold down pin(A) and spring(B).



⇨: Grease

EJBF505R

5. Grease where it is necessary.
6. Install the rear axle hub(A) and the brake disk(Refer to DS Gr. 'Rear axle').



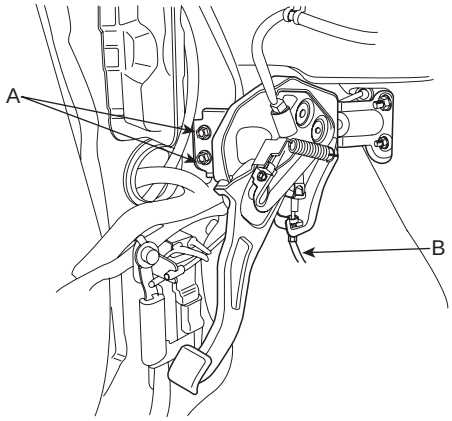
KJBF501P

7. Install the rear wheel and tire to the rear hub.
8. Tighten the parking brake adjusting nut.
9. Install the floor console (Refer to BD Gr. 'Console').

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10. Install the parking brake mounting bolt(A) and the wire(B).

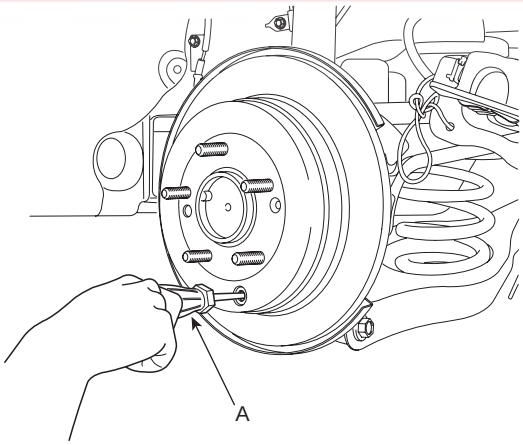


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ADJUSTMENT EDE1A28B

ADJUSTMENT OF REAR BRAKE SHOE CLEARANCE

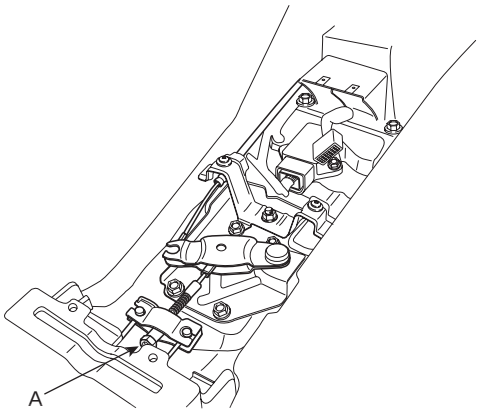
1. Raise the front of the vehicle, and make sure it is securely supported.
2. Remove the rear wheel and tire from the rear hub.
3. After removing the plug from the disk, rotate the toothed wheel by a screw driver until the disk is not moving, and then return it by 5 notches.



KJBF501Q

ADJUSTMENT PRECEDURE OF DIH FOOT PARKING BRAKE

1. Adjust the adjusting nut(A) so that parking pedal stoke is to be 88 ~ 98 mm(3.46 ~ 3.86 in) when operating effort is 200 N(20 kgf, 44 lb) after full stroke operation of parking pedal over 3 times for setting parking wire.



KJBF501R

CAUTION

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

BED-IN PROCEDURE FOR DIH FOOT PARKING BRAKE

1. While operating the parking brake pedal for 100 N(10 kgf, 22 lb) effort, drive the vehicle 500 meters (0.31 miles) at the speed of 60 kph (37.3 mph).
2. Repeat the above procedure more than two times.
3. Must be held on at 30% uphill.

CAUTION

After adjusting parking brake, notice following matter;

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

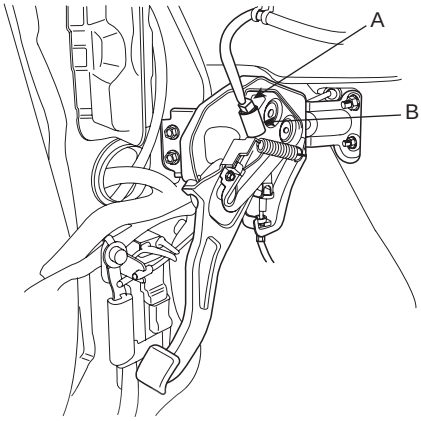
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PARKING BRAKE SWITCH

INSPECTION E9139D03

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



KJBF501S

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.

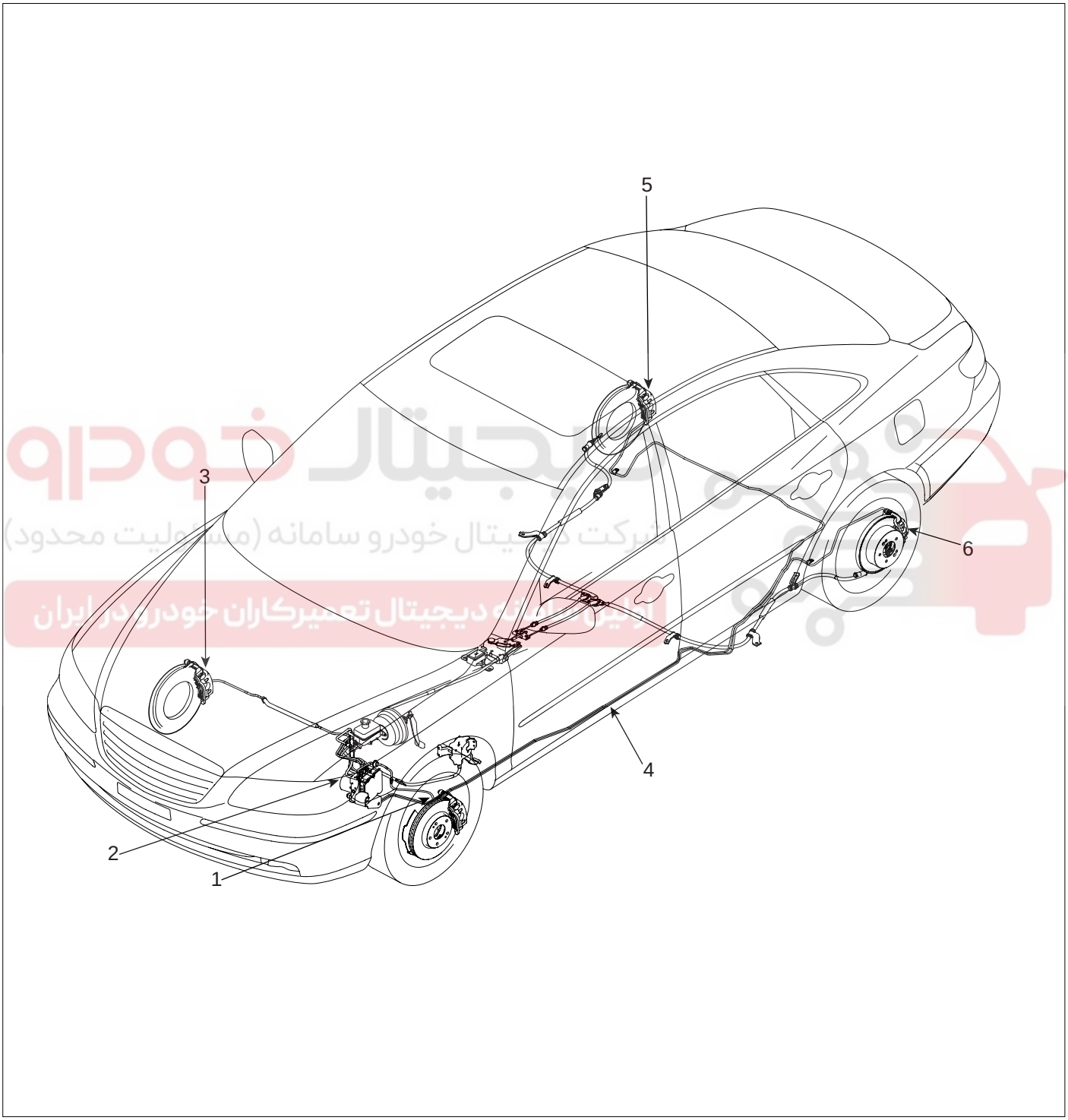
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شرکت دیجیتال نرم افزار خودرو (سهامی خاص)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

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ABS (ANTI-LOCK BRAKE SYSTEM)

COMPONENTS ECF845BE



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

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DESCRIPTION EDF1DB1C

This specification applies to HCU(Hydraulic Control Unit) and ECU(Electronic Control Unit) of the HECU.(Hydraulic and Electronic Control Unit)
This specification is for the wiring design and installation of ABS/TCS/ESC ECU.
This unit has the functions as follows.

- Input of signal from Pressure sensor, Steering angle sensor, Yaw & Lateral G sensor, the wheel speed sensors attached to each wheel.
- Control of braking force / traction force/ yaw moment.
- Failsafe function.
- Self diagnosis function.
- Interface with the external diagnosis tester.

Installation position : engine compartment

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

OPERATION

The ECU shall be put into operation by switching on the operating voltage (IGN).
On completion of the initialization phase, the ECU shall be ready for operation.
In the operating condition, the ECU shall be ready, within the specified limits (voltage and temperature), to process the signals offered by the various sensors and switches in accordance with the control algorithm defined by the software and to control the hydraulic and electrical actuators.

WHEEL SENSOR SIGNAL PROCESSING

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

SOLENOID VALVE CONTROL

When one side of the valve coil is connected to the positive voltage that is provided through the valve relay and the other side is connected to the ground by the semiconductor circuit, the solenoid valve goes into operation.
The electrical function of the coils are always monitored by the valve test pulse under normal operation conditions.

VOLTAGE LIMITS

- Overvoltage
  When overvoltage is detected(above 16V), 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 15km/h once after IGN is switched on.

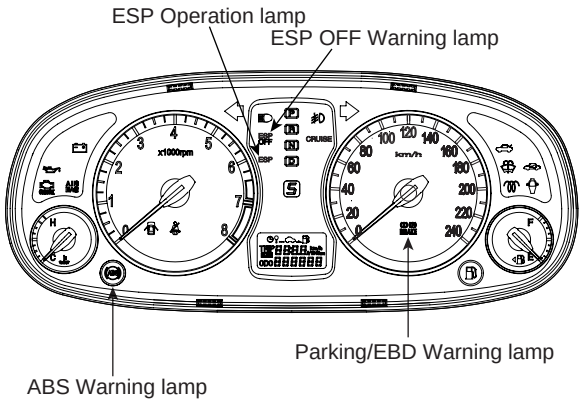
DIAGNOSTIC INTERFACE

Failures detected by the ECU are encoded on the ECU, stored in a EEPROM and read out by diagnostic equipment when the ignition switch is turned on.
The diagnosis interface can also be used for testing the ECU during production of the ECU and for actuating the HCU in the test line of manufactories (Air-bleeding line or Roll and Brake Test line).

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WARNING LAMP MODULE



EJBF500N

1. ABS WARNING LAMP MODULE
   The active ABS warning lamp module indicates the selftest and failure status of the ABS.The ABS warning lamp shall be on:
   - During the initialization phase after IGN ON. (continuously 3 seconds).
   - In the event of inhibition of ABS functions by failure.
   - During diagnostic mode.
   - When the ECU Connector is seperated from ECU.

2. PARKING/EBD WARNING LAMP MODULE
   The active EBD warning lamp module indicates the selftest and failure status of the EBD.However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.The EBD warning lamp shall be on:
   - During the initialization phase after IGN ON. (continuously 3 seconds).
   - When the Parking Brake Switch is ON or brake fluid level is low.
   - When the EBD function is out of order.
   - During diagnostic mode.
   - When the ECU Connector is seperated from ECU.

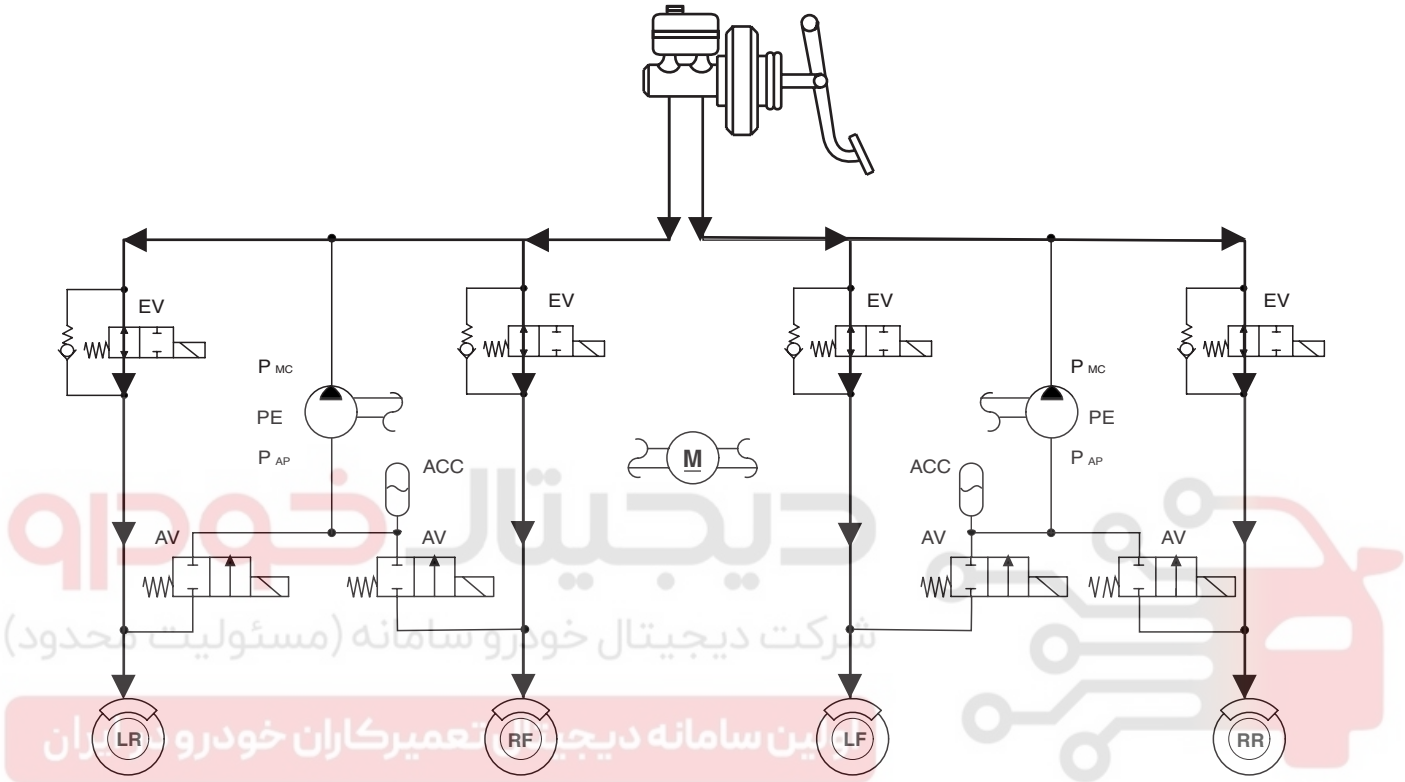
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ABS CONTROL ECB6DC94

1. NORMAL BRAKING without ABS

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



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NOTE

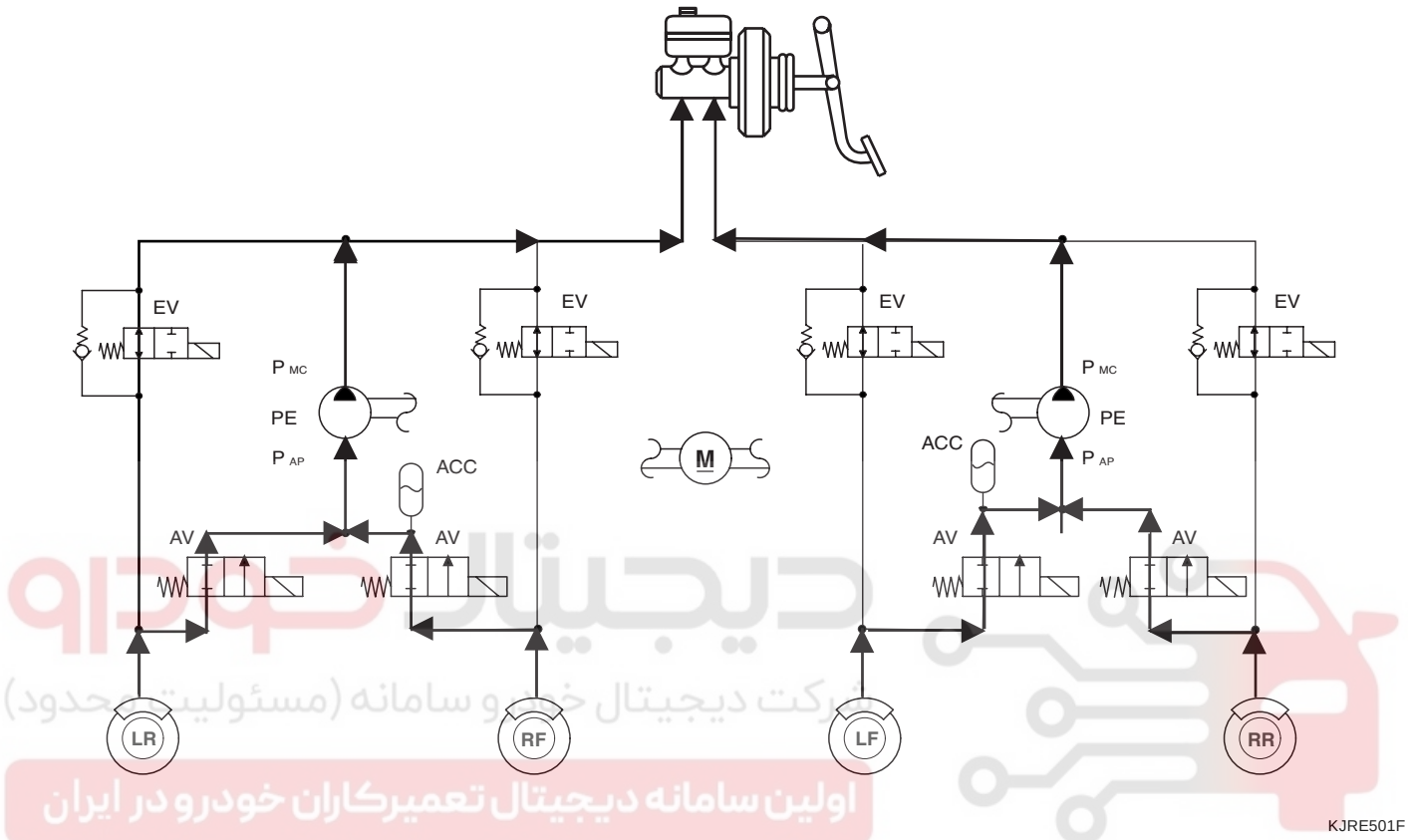
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

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2. DECREASE MODE

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



NOTE

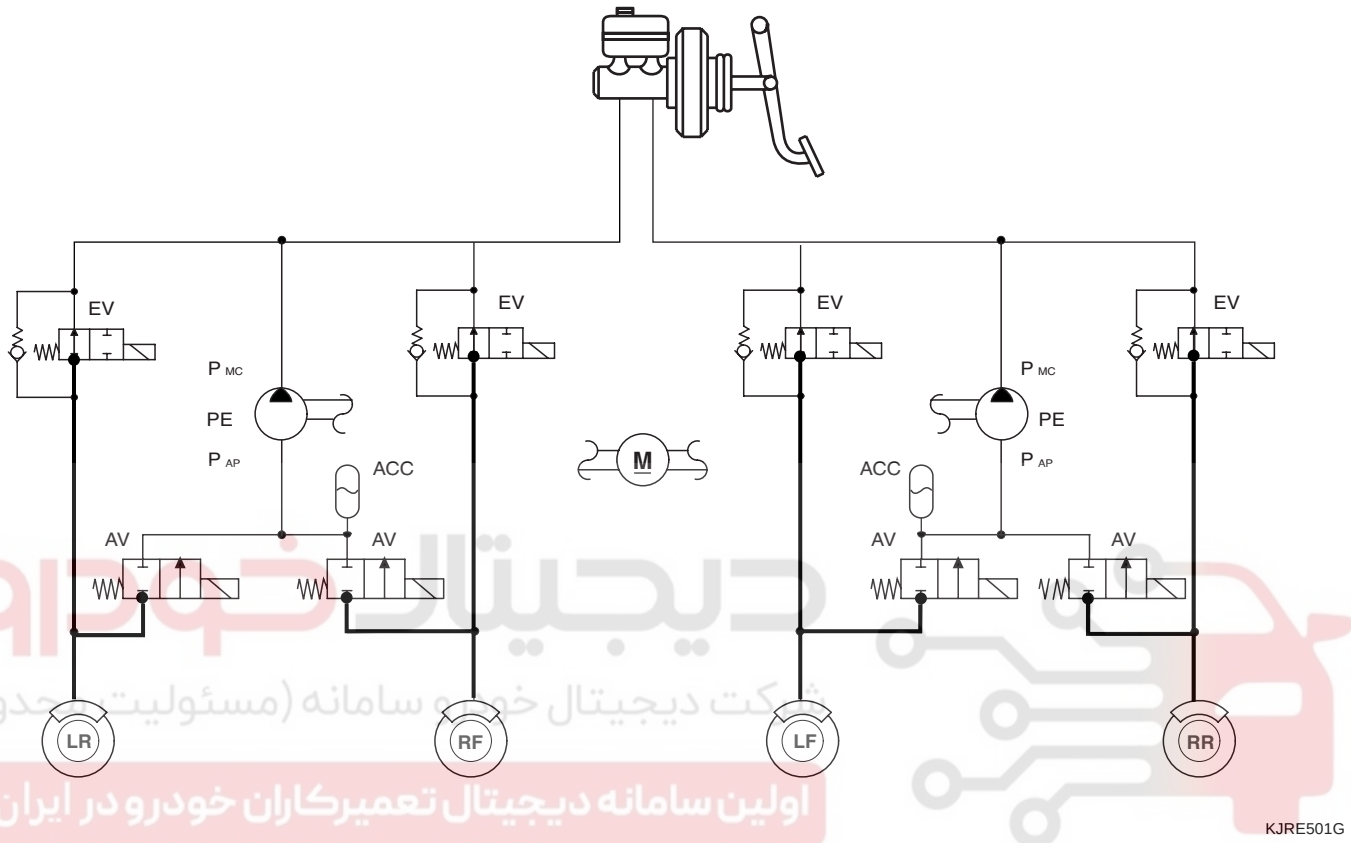
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

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3. HOLD MODE

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



NOTE

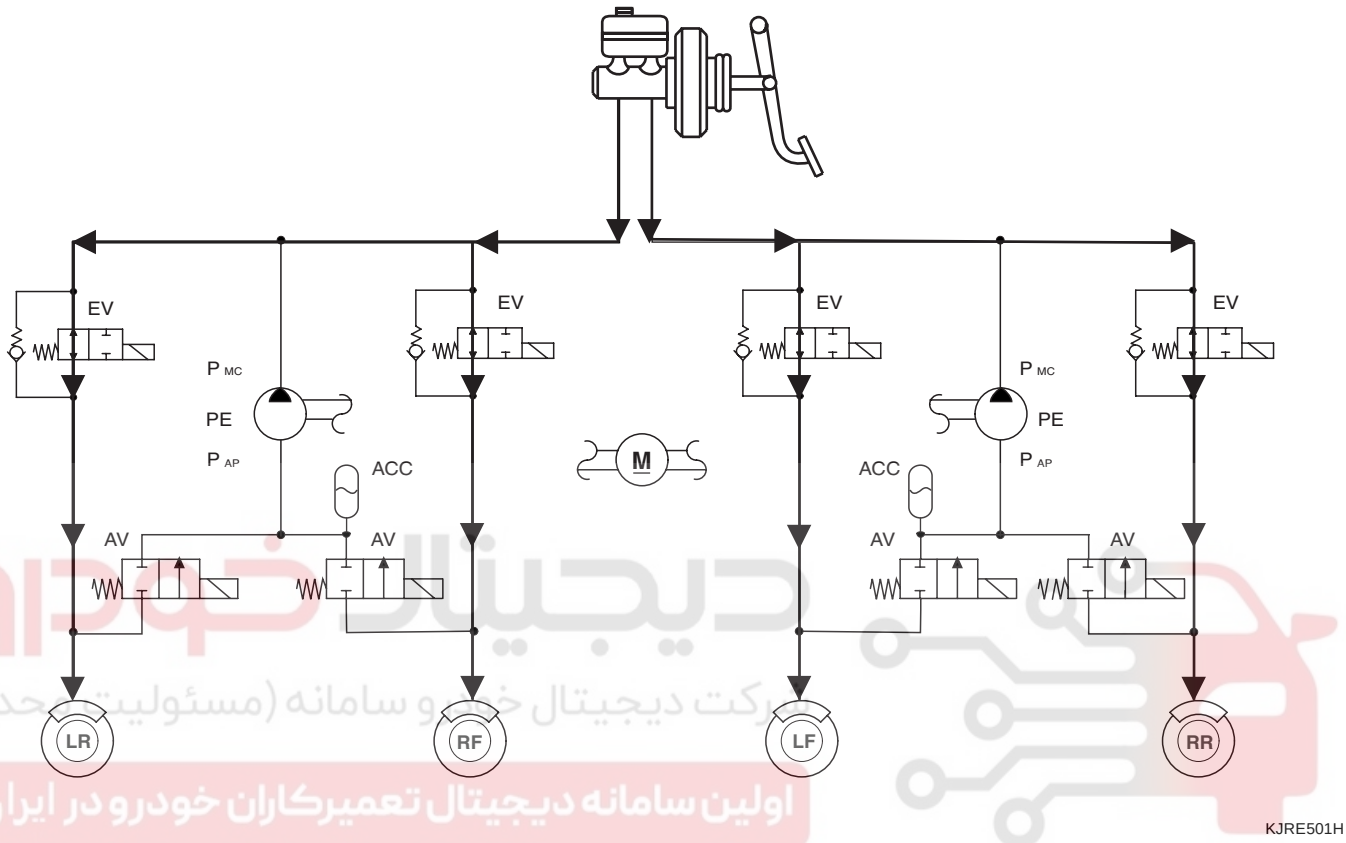
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

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4. INCREASE MODE

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



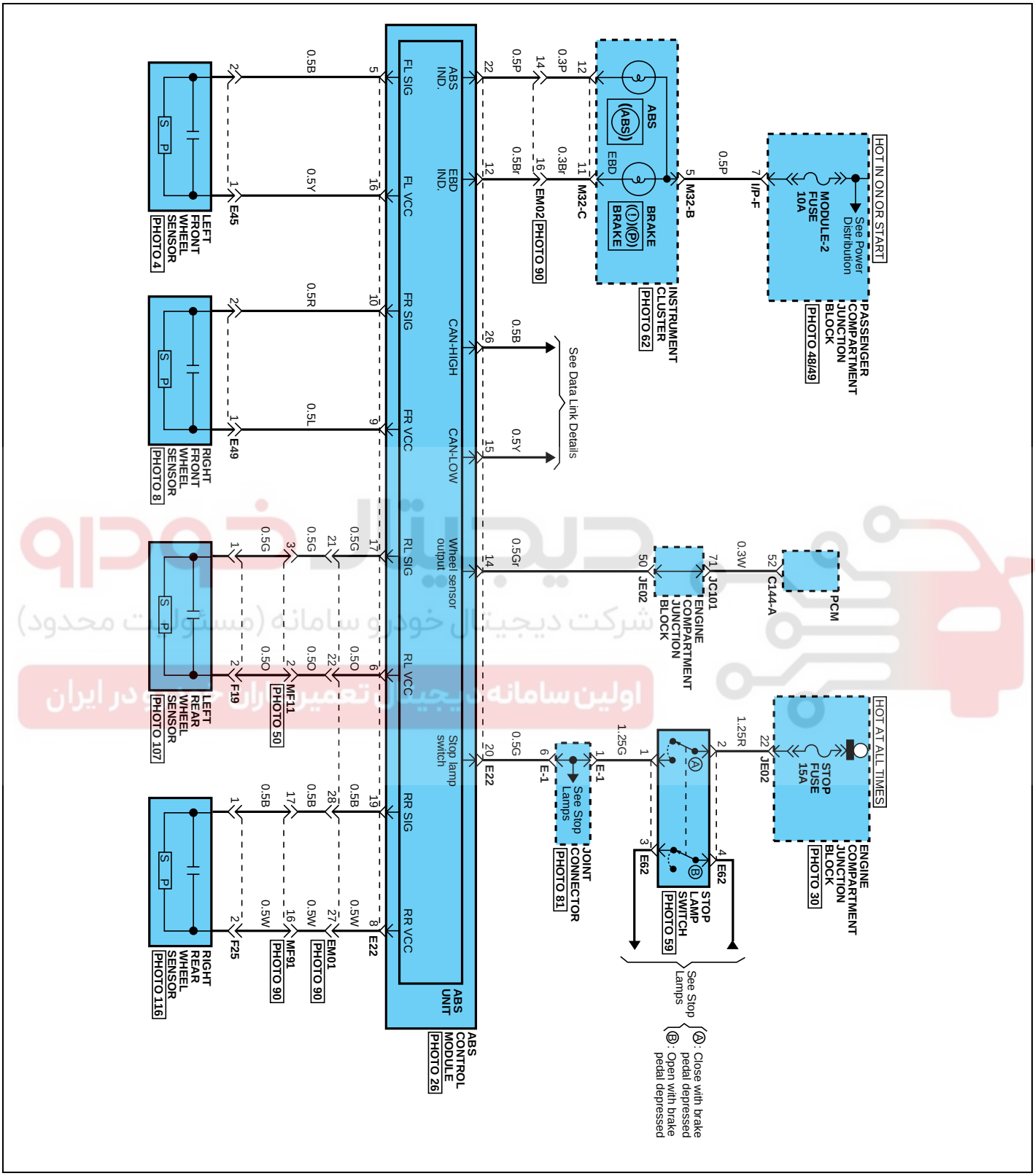
NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor

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ABS CIRCUIT DIAGRAM(1) ED4D3D56

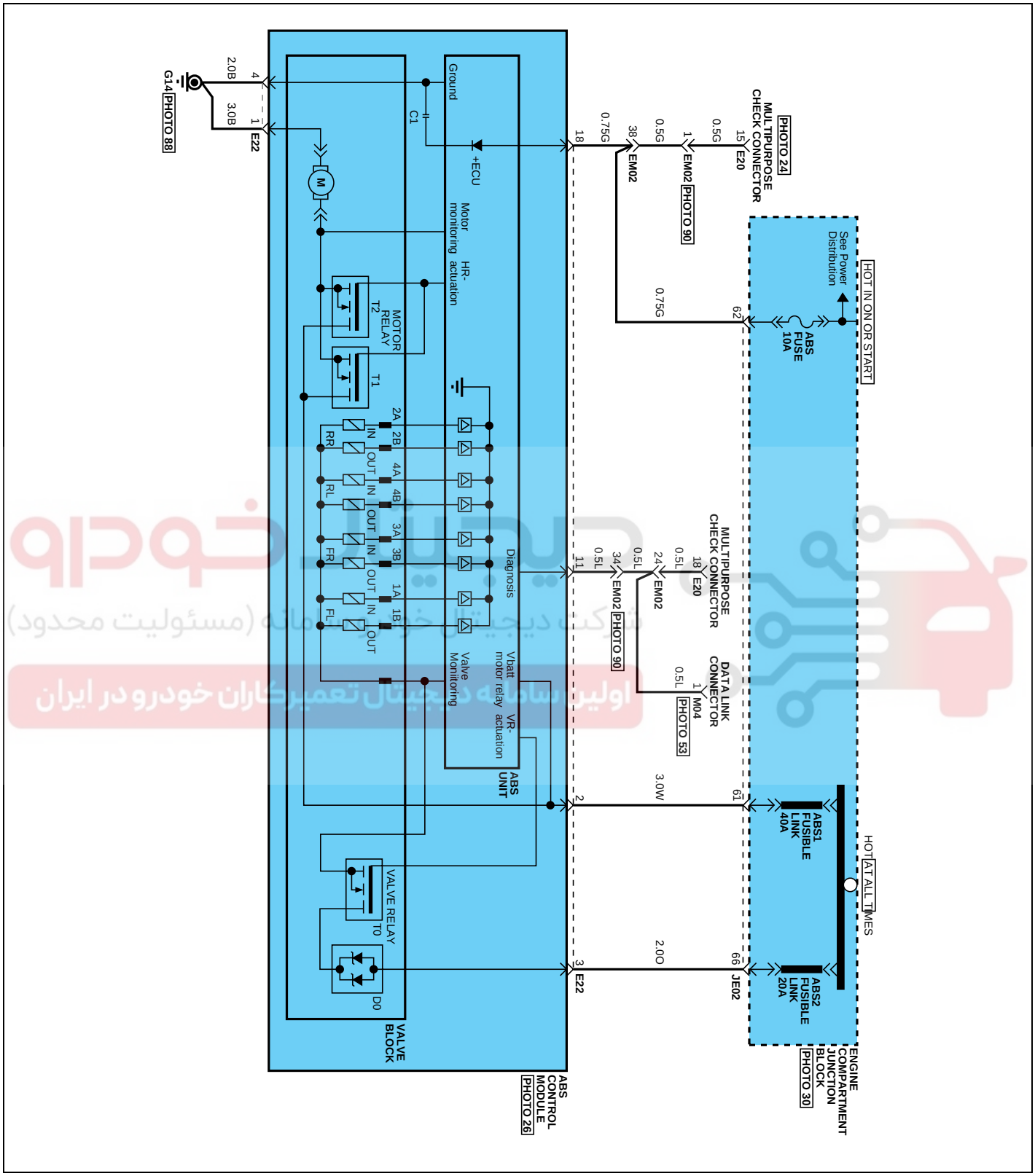


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ABS CIRCUIT DIAGRAM(2)

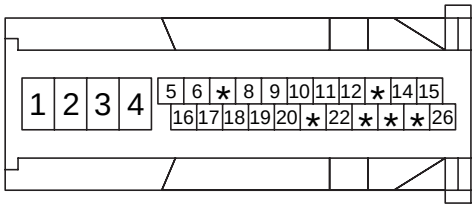


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ECU CONNECTOR
INPUT/OUTPUT(ABS) E6513856



EJRF702M

Wire No.	Designation	Current		max.permissible wire resistance R_L (mΩ)	min.leakage resistance R_P (kΩ)
		max	min		
1	Ground for recirculation pump	20~39 A	10 A	10	
4	Ground for solenoid valves and ECU	5~15 A	2.5 A	10	
2	Voltage supply for pump motor	20~39 A	10 A	10	200
3	Voltage supply for solenoid valves	5~15 A	2 A	10	200
18	Voltage for hybrid ECU	1 A	500 mA	60	200
5,10,17,19	signal wheel speed sensor FL, FR, RL,RR	6 mA	16 mA	250	200 to ground 1.5M to bat
16,9,6,8	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	6 mA	16 mA	250	200 to ground 1.5M to bat
14,24	wheel speed sensor output (FR, RL)	20 mA	10 mA	250	200
11	Diagnostic wire K	6 mA	3 mA	250	200
22	ABS-warning lamp actuation	30 mA	5 mA	250	200
12	EBD-warning lamp actuation	30 mA	5 mA	250	200
20	brake light switch	10 mA	5 mA	250	200
15	CAN Low	30 mA	20 mA	250	200
26	CAN High	30 mA	20 mA	250	200

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ABS HECU CONNECTOR

Connector terminal		Specification	Condition
Number	Description		
1	Ground for recirculation pump	Current range: Min.10A Max.20~39A	Always
4	Ground for solenoid valves and ECU	Current range: Min.2.5A Max.5~15A	Always
2	Voltage supply for pump motor	Battery voltage	Always
3	Voltage supply for solenoid valves		
16	Voltage supply for the active wheel speed sensor FL,FR, RL, RR	Battery voltage	IG ON
9			
6			
8			
5	signal wheel speed sensor FL, FR, RL,RR	Voltage(High) : 0.89~1.26 V Voltage (Low) : 0.44~0.63 V	On driving
10			
17			
19			
11	Diagnostic wire K	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.2 * IG ON	On HI-SCAN commu-nication
18	Voltage for hybrid ECU	Battery voltage	KEY ON/OFF
20	Brake light switch	Voltage (High) ≥ 0.8 * IG ON Voltage (Low) ≤ 0.3 * IG ON	BRAKE ON/OFF

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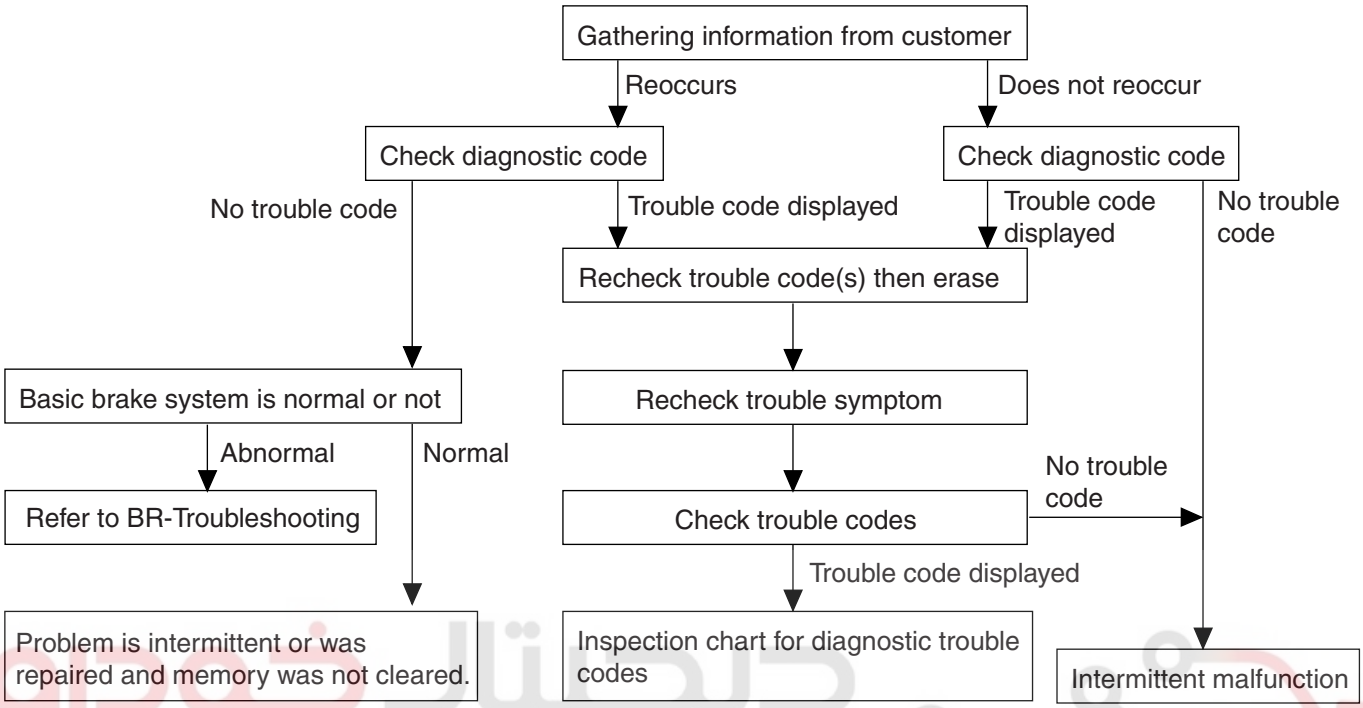
SENSOR OUTPUT ON HI-SCAN(ABS)

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

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STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING E0FBECCD



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

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NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

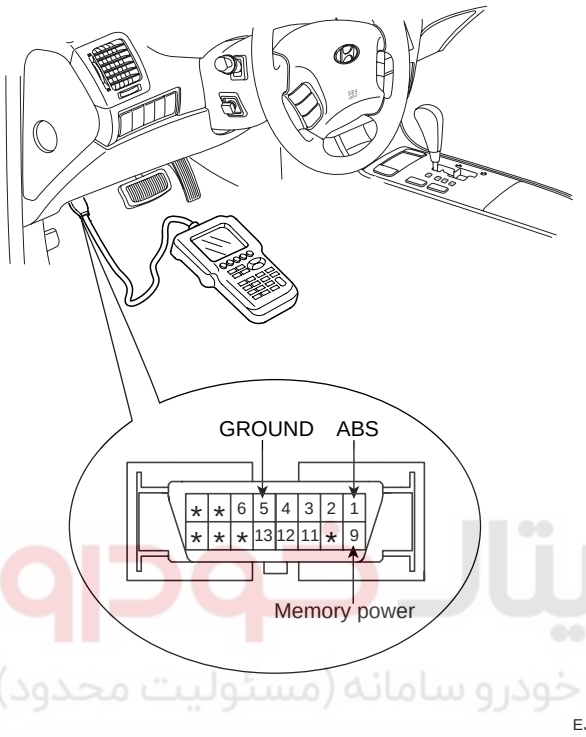
Phenomenon	Explanation
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment. This is because the system operation check is being performed.
ABS operation sound	1. Sound of the motor inside the ABS hydraulic unit operation (whine). 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.	

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HI-SCAN (PRO) CHECK

1. Turn the ignition switch OFF.
2. Connector the Hi-scan(pro) to the 16P data link connector located the driver's side kick panel.



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3. Turn the ignition switch ON.
4. Check for diagnostic trouble using the Hi-scan(pro)
5. After completion trouble of the repair or correction of the problem, erase the stored fault codes the clear key on the Hi-scan(pro).
6. Disconnect the Hi-scan(pro) from the 16P data link connector.

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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)

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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	See page
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.	BR - 65
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.	BR - 67
Communication with Hi-scan (pro) is not possible. (Communication with any system is not possible)	1. Power source circuit 2. Diagnosis line	BR - 68
Communication with Hi-scan (pro) is not possible. (Communication with ABS only is not possible)	1. Power source circuit 2. Diagnosis line 3. HECU	BR - 69
When ignition key is turned ON (engine OFF), the ABS warning lamp does not light up.	1. ABS warning lamp circuit 2. HECU	BR - 70
Even after the engine is started, the ABS warning lamp remains ON.	1. ABS warning lamp circuit 2. HECU	BR - 71

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.

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ABS Does Not Operate.

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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 Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

NO

▶ Check the power source circuit.

YES

▶ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE POWER SOURCE CIRCUIT.

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

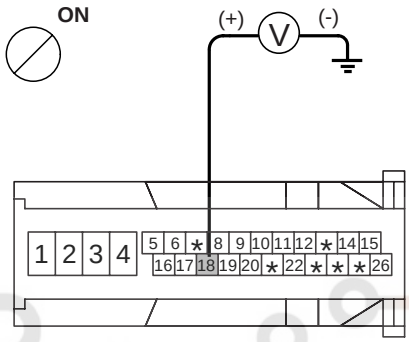
Is the voltage within specification?

YES

▶ Check the ground circuit.

NO

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



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CHECK THE GROUND CIRCUIT.

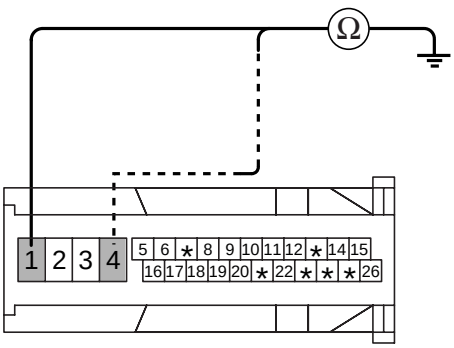
1. Disconnect the connector from the ABS control module.
2. Check for continuity between terminals 1,4 of the ABS control module harness side connector and ground point.
   Is there continuity?

YES

▶ Check the wheel speed sensor circuit.

NO

▶ Repair an open in the wire and ground point.



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CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES

▶ Check the hydraulic circuit for leakage.

NO

▶ Repair or replace the wheel speed sensor.

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

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

YES

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

NO

▶ Repair the hydraulic lines for leakage.

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ABS Does Not Operate Intermittently.

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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 Hi-Scan (pro) with the data link connector and turn the ignition switch ON.
2. Verify that the normal code is output.
   Is the normal code output?

NO

▶ Check the wheel speed sensor circuit.

YES

▶ Erase the DTC and recheck using Hi-Scan (pro).

CHECK THE WHEEL SPEED SENSOR CIRCUIT.

Refer to the DTC troubleshooting procedures.
Is it normal?

YES

▶ Check the stop lamp switch circuit.

NO

▶ Repair or replace the wheel speed sensor.

CHECK THE STOP LAMP SWITCH CIRCUIT.

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

Specification: approximately B+

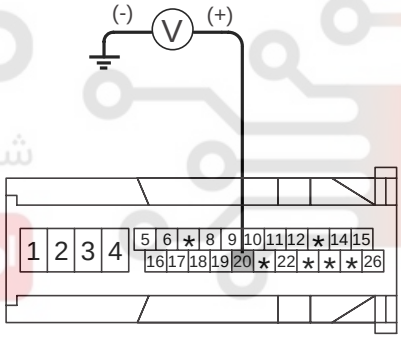
Is the voltage within specification?

YES

▶ Check the hydraulic circuit for leakage.

NO

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



EJRF702Q

CHECK THE HYDRAULIC CIRCUIT FOR LEAKAGE.

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

YES

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

NO

▶ Repair the hydraulic lines for leakage.

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Communication with Hi-scan (pro) is not possible.
(Communication with any system is not possible)

EJBF505V

DETECTING CONDITION

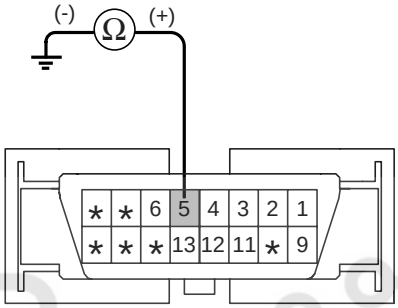
Trouble Symptoms	Possible Cause
Possible defect in the power supply system (including ground) for the diagnosis line.	- An open in the wire - Poor ground - Faulty power source circuit

INSPECTION PROCEDURES

CHECK THE POWER SUPPLY CIRCUIT FOR THE DIAGNOSIS

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

Specification: approximately B+



EJRF702S

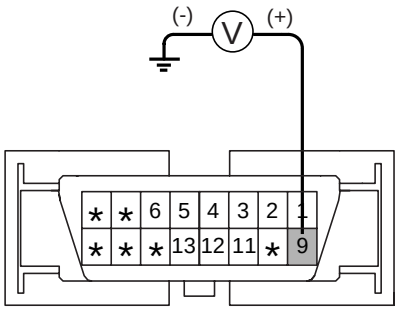
Is voltage within specification?

YES

▶ Check the ground circuit for the diagnosis.

NO

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



EJRF702R

CHECK THE GROUND CIRCUIT FOR THE DIAGNOSIS

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

NO

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

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Communication with Hi-scan (pro) is not possible.
(Communication with ABS only is not possible)

EJBF505W

DETECTING CONDITION

Trouble Symptoms	Possible Cause
When communication with Hi-Scan (pro) 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 11 of the ABS control module connector and 1 of the data link connector.
   Is there continuity?

YES

▶ Check the power source of ABS control module.

NO

▶ Repair an open in the wire.

CHECK THE POWER SOURCE OF ABS CONTROL MODULE

1. Disconnect the connector from the ABS control module.
2. Turn the ignition switch ON, measure the voltage between terminal 18 of the ABS control module harness side connector and body ground.

Specification: approximately B+

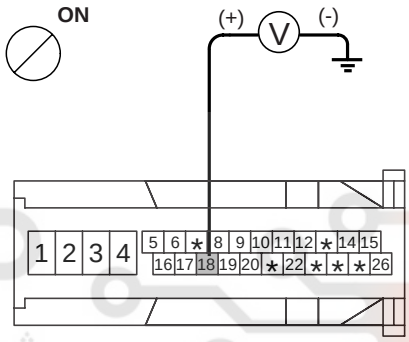
Is voltage within specification?

YES

▶ Check for poor ground.

NO

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



EJRF702O

CHECK FOR POOR GROUND

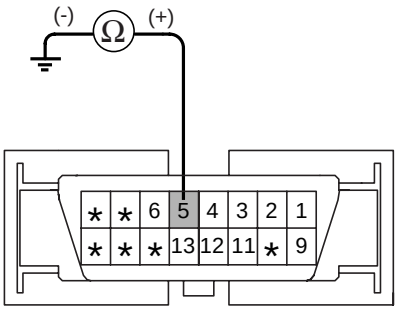
Check for continuity between terminal 5 of the data link connector and ground point.

YES

▶ Replace the ABS control module and recheck.

NO

▶ Repair an open in the wire or poor ground.



EJRF702S

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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 No.2 fuse (10A) in the engine compartment junction block - Faulty ABS warning lamp module - Faulty HECU

INSPECTION PROCEDURES

PROBLEM VERIFICATION

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

YES

▶ It is normal. Recheck the ABS control module.

NO

▶ Check the power source for the ABS warning lamp.

CHECK THE POWER SOURCE FOR THE ABS WARNING LAMP

1. Disconnect the instrument cluster connector and turn the ignition switch ON.
2. Measure the voltage between terminal 5 of the cluster harness side connector and body ground.

Specification: approximately B+

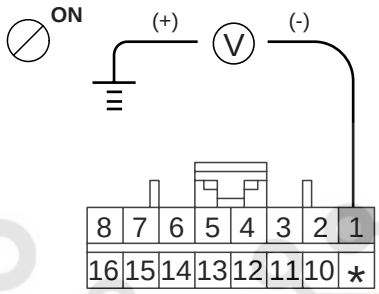
Is voltage within specification?

YES

▶ Repair bulb or instrument cluster assembly.

NO

▶ Check for blown fuse.



EJRF702V

CHECK FOR BLOWN FUSE

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

YES

▶ Repair an open in the wire between ABS fuse and 1 of cluster connector.

NO

▶ Replace the blown fuse.

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

EJBF505Y

DETECTING CONDITION

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

INSPECTION PROCEDURES

CHECK DTC OUTPUT.

1. Connect the Hi-Scan (pro) to the 16P data link connector located behind the driver's side kick panel.
2. Check the DTC output using Hi-Scan (pro).
   Is DTC output?

YES

▶ Repair circuit indicated by code output.

NO

▶ Check instrument cluster.

CHECK INSTRUMENT CLUSTER

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

YES

▶ Replace the instrument cluster.

NO

▶ Check for open the wire.

CHECK FOR OPEN IN THE WIRE

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

YES

▶ Replace the ABS control module and recheck.

NO

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

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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.

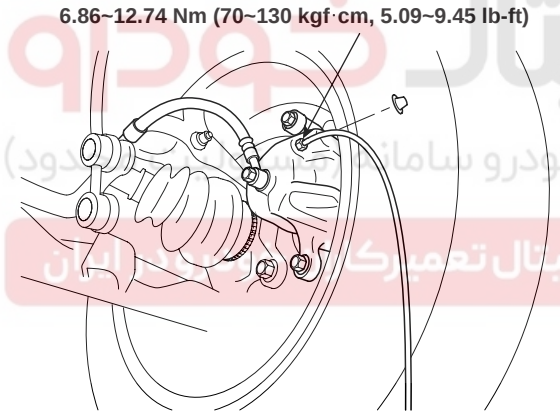
CAUTION

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

NOTE

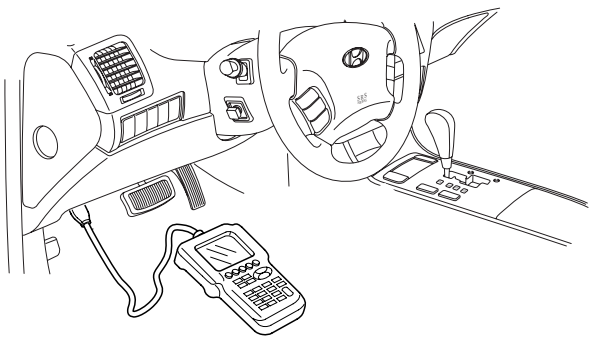
When pressure bleeding, do not depress the brake pedal.
Recommended fluid..... DOT3 or DOT4

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.



EJRF501H

3. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



EJBF500R

4. Select and operate according to the instructions on the hi-scan (Pro) screen.

CAUTION

You must obey the maximum operating time of the ABS motor with the hi-scan (Pro) to prevent the motor pump from burning.

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

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

EJDA014F

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

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

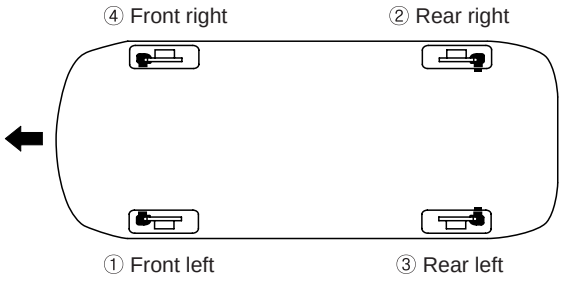
EJDA014G

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

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



EJRF702W

7. Tighten the bleeder screw.

Bleed screw tightening torque: 6.86~12.74 Nm (70 ~130 kgf·cm, 5.09 ~ 9.45 lb-ft)

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DIAGNOSTIC TROUBLE CODE CHART(DTC)

DTC	DESCRIPTION	WARNING LAMP			REMARK	SEE PAGE
		ABS	EBD	ESP		
C1101	BATTERY VOLTAGE HIGH	O	O	O		BR - 76
C1102	BATTERY VOLTAGE LOW	O		O		BR - 81
C1200	FL WHEEL SPEED SENSOR- OPEN/SHORT	O		O		BR - 84
C1201	FL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		BR - 90
C1202	FL WHEEL SPEED SENSOR-NO SIGNAL	O		O		BR - 93
C1203	FR WHEEL SPEED SENSOR- OPEN/SHORT	O		O		BR - 84
C1204	FR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		BR - 90
C1205	FR WHEEL SPEED SENSOR-NO SIGNAL	O		O		BR - 93
C1206	RL WHEEL SPEED SENSOR- OPEN/SHORT	O		O		BR - 84
C1207	RL WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		BR - 90
C1208	RL WHEEL SPEED SENSOR-NO SIGNAL	O		O		BR - 93
C1209	RR WHEEL SPEED SENSOR- OPEN/SHORT	O		O		BR - 84
C1210	RR WHEEL SENSOR- RANGE/ PERFORMANCE	O		O		BR - 90
C1211	RR WHEEL SPEED SENSOR-NO SIGNAL	O		O		BR - 93
C1213	WHEEL SPEED FREQUENCY ERROR	O		O		BR - 97
C1235	PRESSURE SENSOR-ELECTRICAL			O	ESP	BR - 100
C1237	PRESSURE SENSOR-SIGNAL FAULT			O	ESP	BR - 103
C1260	STEERING ANGLE SENSOR-SIGNAL			O	ESP	BR - 104
C1261	STEERING ANGLE SENSOR NOT CALIBRATED			O	ESP	BR - 109
C1282	YAW RATE & LATERAL G SENSOR-ELECTRICAL			O	ESP	BR - 112
C1283	YAW RATE & LATERAL G SENSOR-SIGNAL			O	ESP	BR - 118
C1503	ESP SWITCH ERROR			O	ESP	BR - 122
C1513	BRAKE LIGHT SWITCH MALFUNCTION			O	ESP	BR - 125
C1604	ECU HARDWARE ERROR	O	O	O		BR - 130
C1605	CAN CONTROL HARDWARE ERROR			O	ESP	BR - 131
C1611	CAN TIME OUT-ECM			O	ESP	BR - 132
C1612	CAN TIME OUT-TCU			O	ESP	BR - 133
C1616	CAN BUS OFF			O	ESP	BR - 134

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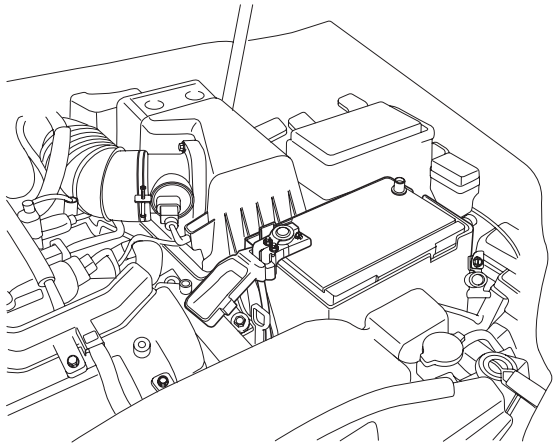
DTC	DESCRIPTION	WARNING LAMP			REMARK	SEE PAGE
		ABS	EBD	ESP		
C1623	CAN TIMEOUT STEERING ANGLE SENSOR			O	ESP	BR - 136
C1625	CAN TIME OUT-ESC			O	ESP	BR - 140
C1626	IMPLAUSIBLE CONTROL	O		O	ESP	BR - 141
C1702	VARIANT CODING	O	O	O	ESP	BR - 142
C2112	VALVE RELAY MALFUNCTION	O	O	O		BR - 144
C2308	FL INLET VALVE MALFUNCTION	O	O	O		BR -147
C2312	FL OUTLET VALVE MALFUNCTION	O	O	O		BR - 151
C2316	FR INLET VALVE MALFUNCTION	O	O	O		BR - 147
C2320	FR OUTLET VALVE MALFUNCTION	O	O	O		BR - 151
C2324	RL INLET VALVE MALFUNCTION	O	O	O		BR - 147
C2328	RL OUTLET VALVE MALFUNCTION	O	O	O		BR - 151
C2332	RR INLET VALVE MALFUNCTION	O	O	O		BR - 147
C2336	RR OUTLET VALVE MALFUNCTION	O	O	O		BR - 151
C2366	TC VALVE PRIMARY(USV1) ERROR	O	O	O	ESP	BR - 153
C2370	TC VALVE SECONDARY (USV2) ERROR	O	O	O	ESP	BR - 153
C2372	ESP VALVE 1(HSV1) ERROR	O	O	O	ESP	BR - 153
C2374	ESP VALVE 2 (HSV2) ERROR	O	O	O	ESP	BR - 153
C2402	MOTOR-ELECTRICAL	O	O	O		BR - 155

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DTC C1101 BATTERY VOLTAGE HIGH

COMPONENT LOCATION EFEBF39F



EJBF501A

GENERAL DESCRIPTION E71B0EA7

The ABS ECU(Electronic Control Unit) checks the battery voltage to determine, as a safety issue, whether the ABS system can operate normally or not. The normal battery voltage range is essential for controlling the ABS system as instended.

DTC DESCRIPTION E0F88E5D

The ABS ECU monitors battery voltage by reading the value of voltage. When the voltage is higher than the expected normal value, this code is set, and the ABS/EBD/ESP functions are prohibited. If the voltage recovers, to within normal operating ranges, then the controller returns to normal operation as well.

DTC DETECTING CONDITION E9F448CD

Item	Detecting Condition	Possible cause
DTC Strategy	• Battery Voltage Monitoring	• Poor connection in power supply circuit (IGN+) • Faulty Alternator • Faulty HECU
Monitoring Period	• Continuous (Over voltage faults will be always stored.)	
Enable Conditions	• When Vign is higher than 16.8 V. - If the voltage is recovered to 16.6 V, the controller returns to normal state. - The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.	
Fail Safe	• The ABS/EBD/ESP functions are inhibited. - The proper function of valves and return pump is not guaranteed. • The ABS/EBD/ESP warning lamps are activated. • The supply voltage to wheel speed sensor is interrupted.	

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MONITOR SCANTOOL DATA E3EDF0B0

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.

Specification : Approx. 14.5 ± 0.3 V (25°C)

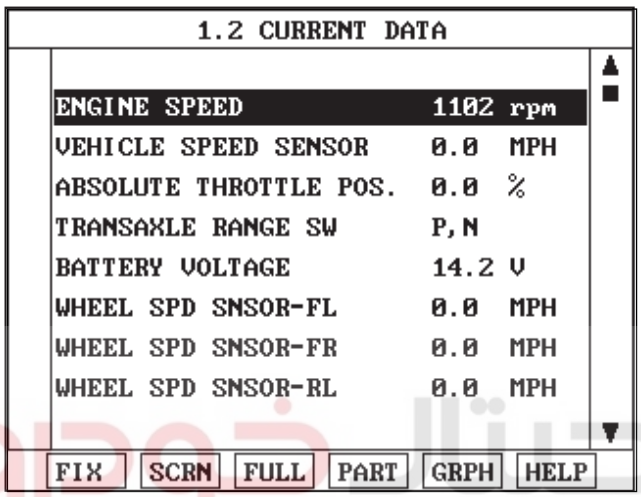


Fig1

Veltage regulator ambient temperature ℃	Regulating voltage
-30	14.2 ~ 15.3
25	14.2 ~ 14.8
135	13.3 ~ 14.8

Fig2

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal Data
Fig 2) "Temperature & Regulating Voltage" Specification.

EJBF501B

4. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

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TERMINAL & CONNECTOR INSPECTION E3A043D2

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

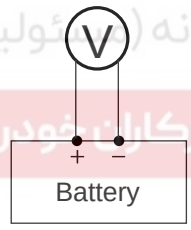
NO

▶ Go to "Alternator Output Voltage Inspection" procedure.

ALTERNATOR OUTPUT VOLTAGE INSPECTION

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and the battery terminal(-).

Specification : Approx. 14.5 ± 0.3 V (25 ℃)



1. Battery Terminal(+)
2. Battery Terminal(-)

Veltage regulator ambient temperature ℃	Regulating voltage
-30	14.2 ~ 15.3
25	14.2 ~ 14.8
135	13.3 ~ 14.8

EJBF501C

3. Is the measured voltage within specifications?

YES

▶ Go to "Power Circuit Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between alternator and battery. If OK repair or replace alternator and then go to "Verification of vehicle Repair" procedure.

POWER SUPPLY CIRCUIT INSPECTION E651915E

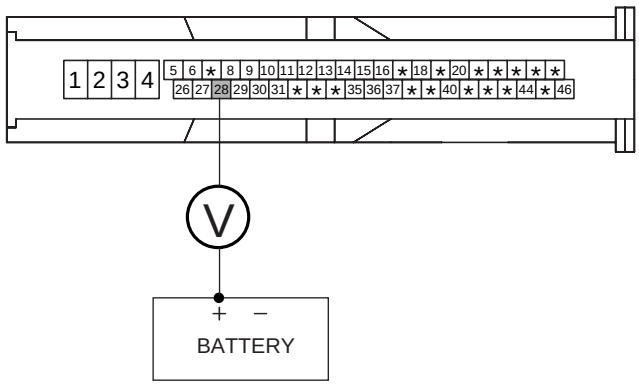
1. Engine "ON".
2. Measure voltage between the battery terminal(+) and terminal "28" of the HECU harness connector.

Specification : Approx. below 0.2 V

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<E41>



<ABS>
18. IGNITION(+)

<ESP>
28. IGNITION(+)

EJBF501D

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

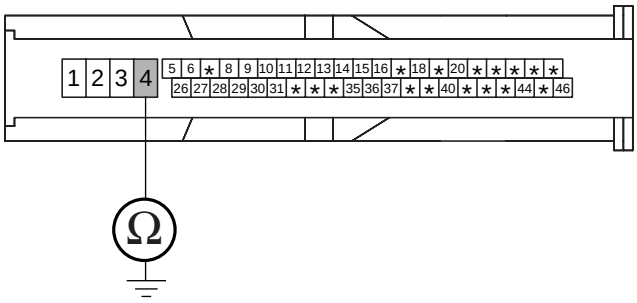
▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "28" of the HEC Uharness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EBFBEEEF

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω

<E41>



4. Ground

EJBF501E

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4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E8B253A3

1. Ignition "OFF"
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable roubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EF5084AA

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information
4. Are any DTCs present?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

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DTC C1102 BATTERY VOLTAGE LOW

COMPONENT LOCATION ED7D859F

Refer to DTC C1101.

GENERAL DESCRIPTION EAB758CB

Refer to DTC C1101.

DTC DESCRIPTION EA1E5DB1

Refer to DTC C1101.

DTC DETECTING CONDITION E689EEDA

Item		Detecting Condition	Possible cause
DTC Strategy		• Battery Voltage Monitoring	• Poor connection in power supply circuit (IGN+) • Faulty HECU
Monitoring Period		• Continuous (Under voltage faults are only entered in the EEPROM if the vehicle speed is > 6 km/h.)	
Case1 (Low voltage)	Enable Conditions	• When Vign is lower than 9.3 V outside ABS/ESP control. • When Vign is lower than 9.2V inside ABS/ESP control. - If IGN voltage is recovered to 9.6 V, the system recovers to normal state. - The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.	
	Fail Safe	• The ABS/ESP functions are inhibited. • The ABS/ESP warning lamps are activated.	
Case2 (Under voltage)	Enable Conditions	• When Vign is lower than 7.7 V. - If IGN voltage is recovered to 7.8 V, the system recovers to normal state. - The monitored supply voltage is filtered and limited to a rise time of 4 volts per second.	
	Fail Safe	• The ABS/EBD/ESP functions are inhibited. • The ABS/EBD/ESP warning lamps are activated.	

MONITOR SCANTOOL DATA EB1BD348

1. Connect scantool to Data Link Connector(DLC)
2. Engine "ON".
3. Monitor the "BATTERY VOLTAGE" parameter on the scantool.

Specification : Approx. B+

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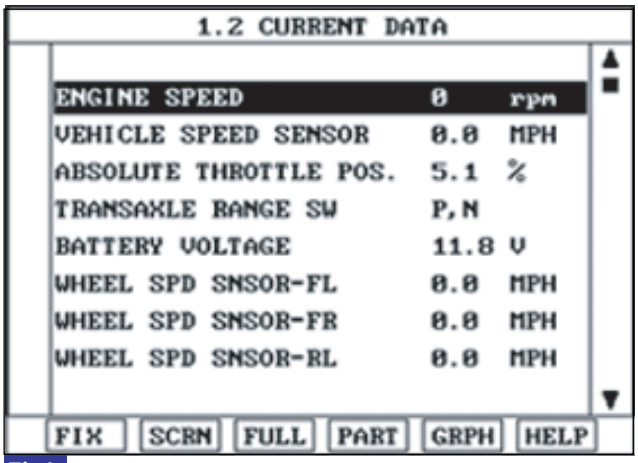


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF" Normal Data

EJBF501G

4. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in power harness (IGN+) and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E330E6E0

1. Many malfunctions in the electrical system are caused by poor harness(es) and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES

▶ Repair as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Power Circuit Inspection" procedure.

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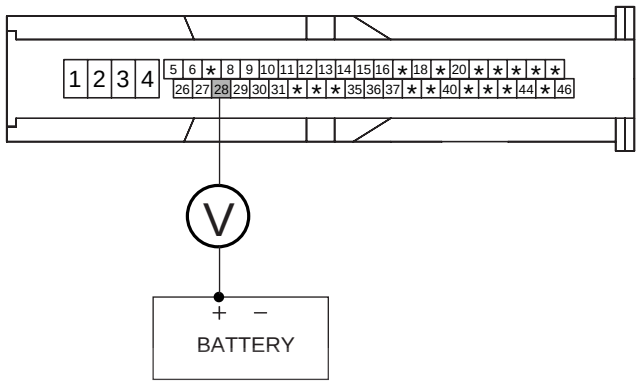
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POWER SUPPLY CIRCUIT INSPECTION ECE289C7

1. Engine "ON".
2. Measure voltage between the battery terminal(+) and terminal "28" of the HECU harness connector.

Specification : Approx. B+

<E41>



<ABS>
18. IGNITION(+)

<ESP>
28. IGNITION(+)

EJBF501D

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "28" of the HECU harness connector. Check for open or blown 10 A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION E73C37CE

Refer to DTC C1101.

COMPONENT INSPECTION EBBCFCD0

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E4CC26DE

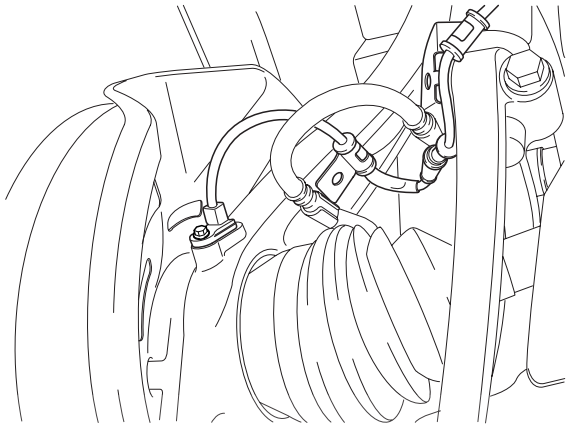
Refer to DTC C1101.

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DTC C1200 FL WHEEL SPEED SENSOR-OPEN/SHORT
DTC C1203 FR WHEEL SPEED SENSOR-OPEN/SHORT
DTC C1206 RL WHEEL SPEED SENSOR-OPEN/SHORT
DTC C1209 RR WHEEL SPEED SENSOR-OPEN/SHORT

COMPONENT LOCATION E59E7CC5



EJBF501J

GENERAL DESCRIPTION E8F79EE1

The wheel speed sensor is the essential component the ABS ECU uses to calculate vehicle speed and to determine whether wheel lock occurs. For example, rear wheel speed signal is used as a referecnce value, for vehicle speed, in front wheel drive vehicles, and if a difference between front and rear wheel speed occurs, then ABS control is performed. Wheel speed sensor is active hall-sensor type and good at temperature and noise charireristic. Digital wave is produced as tone wheel rotate according as hall sensor principle. Frequency of duty wave is changed in proportion to rotation of tone wheel and HECU calculate vehicle speed by this frequency.

DTC DESCRIPTION EBCD6D7B

The ABS ECU monitors the wheel speed sensor circuit continuously. A direct current is supplied in the wheel-speed sensor by a power source in the input amplifier of the control unit. If the WSS circuit is broken, in that case a fault is detected by detecting abnormal input current. HECU cut off the voltage supply to wheel sensor channel which had a fault and prevent vehicle's damage due to super heated harness. If one or more defects has detected, DTC code of defected wheel will be stored. Mutual short between sensors is detected by executing self diagnosis successively at corresponding wheel when ignition ON. Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again.

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DTC DETECTING CONDITION E86B1338

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage monitoring	• Open or short of Wheel speed sensor circuit • Faulty Wheel speed sensor • Faulty HECU
Case1	Monitoring Period	• Once after power up.	
	Enable Conditions	• Shorts between WSS lines and shorts to UZ can be detected by switching single WSS channels in sequence. If there is an error after end of test, a failure is reconized.	
Case2	Monitoring Period	• Continuous	
	Enable Conditions	• When the sensor current levels are out of permissible range(LOW : 7 mA, HIGH : 14 mA) for 200 ms.	
Fail Safe		• Sensor failure outside of the ABS control cycle 1) Only one wheel failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 2) Two wheels failure : Only the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 3) More than 3 wheels failure :System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated. • Sensor failure inside the ABS control cycle 1) One front wheel failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 2) Two wheels failure : Inhibit the ABS/ESP control. Pressure is increased on a front wheel, Pressure is decreased on a rear wheel. After the ABS/ESP control, the ABS/ESP functions are inhibited. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. 3) 3More than 3 wheels failure : System down. The ABS/EBD/ESP functions are inhibited. The ABS/EBD/ESP warning lamps are activated.	

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MONITOR SCANTOOL DATA EABCFCA0

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 10 km/h or more (6 mph or more)

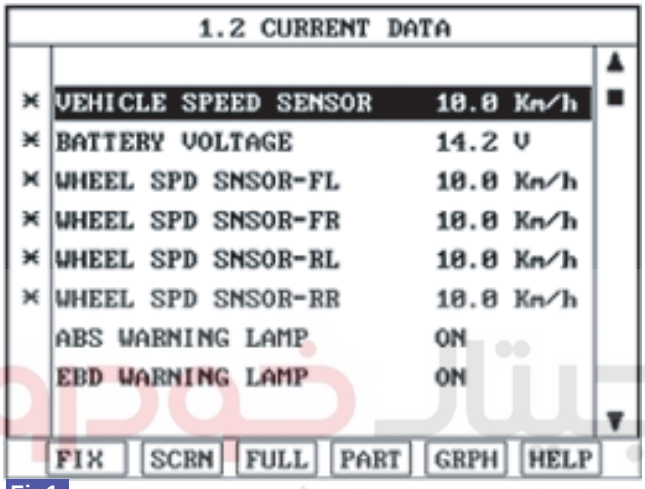


Fig1

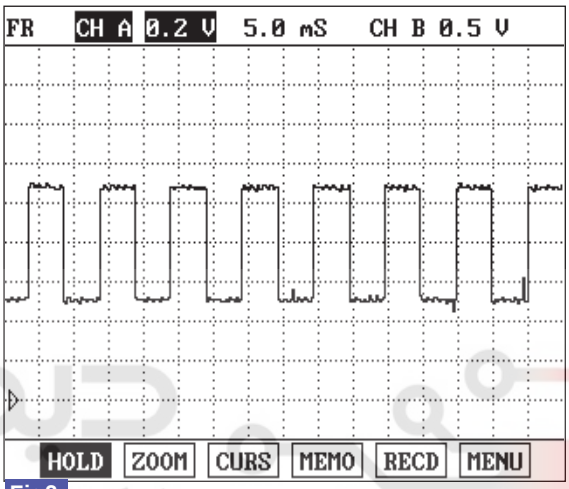


Fig2

Fig 1) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal wave

EJBF501K

5. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION ECC92A27

Refer to DTC C1102.

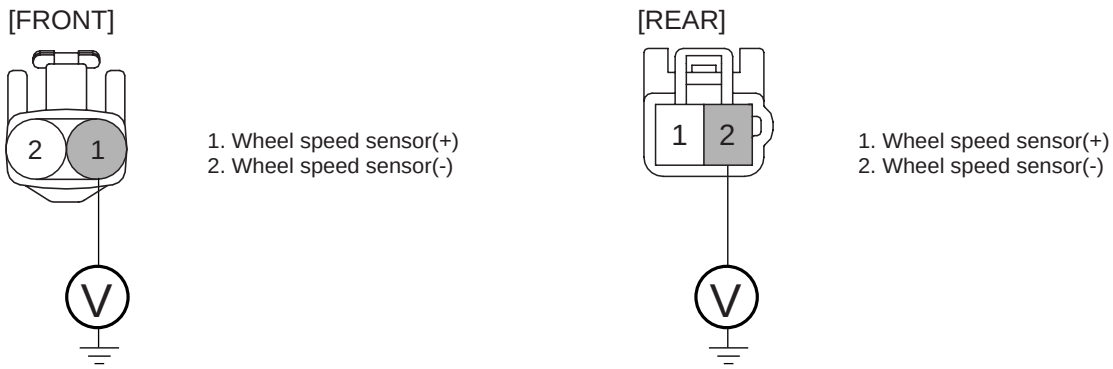
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POWER SUPPLY CIRCUIT INSPECTION EC9FC2AB

1. Ignition "ON".
2. Measure voltage between terminal (front:"1", rear:"2") of the wheel speed sensor harness connector and chassis ground.

Specification : Approx. B+



EJBF501L

3. Is the measured voltage within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

NO

▶ Check for open or short to GND in wheel speed sensor harness between terminal (front:"1", rear:"2") of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, go to "Component inspection" procedure.

DTC	LOCATION	HECU harness connector (Voltage)	
		ABS	ESP
DTC C1200	Front Left	16	26
DTC C1203	Front Right	9	9
DTC C1206	Rear Left	6	6
DTC C1209	Rear Right	8	8

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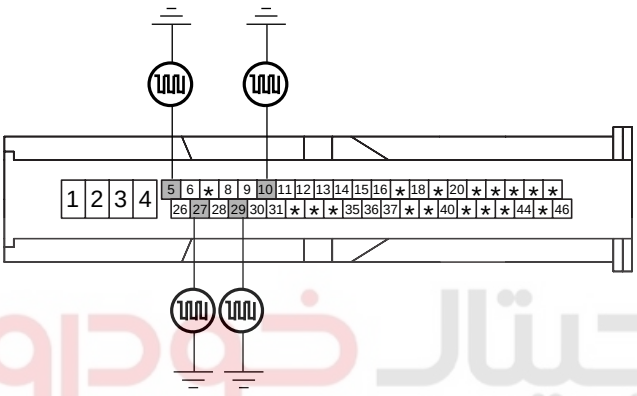
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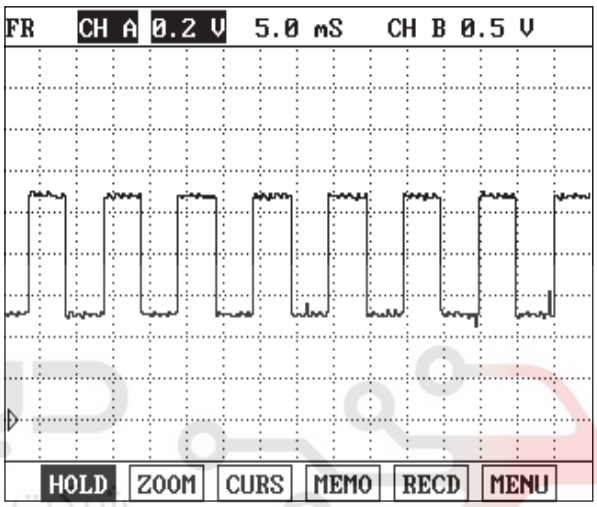
SIGNAL CIRCUIT INSPECTION ECA51DA3

1. Lift the vehicle by lift.
2. Ignition "ON".
3. Turn the wheel with hand.
4. Measure wave between terminal of the HECU harness connector and chassis ground.

Specification : High : 1.4 V , Low : 0.7 V

<ESP>





EJBF501M

DTC	LOCATION	HECU harness connector (Signal)	
		ABS	ESP
DTC C1200	Front Left	5	5
DTC C1203	Front Right	10	10
DTC C1206	Rear Left	17	27
DTC C1209	Rear Right	19	29

5. Is the measured wave within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short to GND in wheel speed sensor harness between terminal (front:"2", rear:"1") of the wheel speed sensor harness connector and terminal of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
If OK, substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.

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COMPONENT INSPECTION E622E3CF

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E6C88AEE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more))
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

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DTC C1201 FL WHEEL SENSOR-RANGE/PERFORMANCE
DTC C1204 FR WHEEL SENSOR-RANGE/PERFORMANCE
DTC C1207 RL WHEEL SENSOR-RANGE/PERFORMANCE
DTC C1210 RR WHEEL SENSOR-RANGE/PERFORMANCE

COMPONENT LOCATION E3793CBD

Refer to DTC C1200.

GENERAL DESCRIPTION EC1060FC

Refer to DTC C1200.

DTC DESCRIPTION E0D07AE7

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when an abnormal signal due to air gap problem or an abnormal speed change ratio are detected at the vehicle speed between 10 km/h to 80 km/h. Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC DETECTING CONDITION E5F5BBC8

<table>
<tr><th colspan="2">Item</th><th>Detecting Condition</th><th>Possible cause</th></tr>
<tr><td colspan="2">DTC Strategy</td><td>• Signal monitoring</td><td rowspan="6">• Improper installation of wheel speed sensor
• Abnormal Rotor and wheel bearing
• Faulty Wheel speed sensor
• Faulty HECU</td></tr>
<tr><td rowspan="2">Case1</td><td>Monitoring Period</td><td>• The monitoring is active from 10 km/h to 80 km/h and if no ABS-control is active at a front wheel and a rear wheel.</td></tr>
<tr><td>Enable Conditions</td><td>• Every time, if a gap in the wheel speed sensor signal occurs cyclically with one wheel rotation, a fault counter is increased by one. If the fault counter exceeds its limit of 6, a wheel specific fault is stored in the EEPROM.</td></tr>
<tr><td rowspan="2">Case2</td><td>Monitoring Period</td><td>• Continuous</td></tr>
<tr><td>Enable Conditions</td><td>• If following interference and signal disturbance is detected, a failure is set after 10 s.
non-plausible high frequency received.
non-plausible high wheel acceleration.
non-plausible high wheel jurk.
non-plausible delta T and edges at low speed.</td></tr>
<tr><td colspan="2">Fail Safe</td><td>Refer to DTC C1200.</td></tr>
</table>

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MONITOR SCANTOOL DATA E1AF7F83

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 12 km/h or more (7 mph or more)

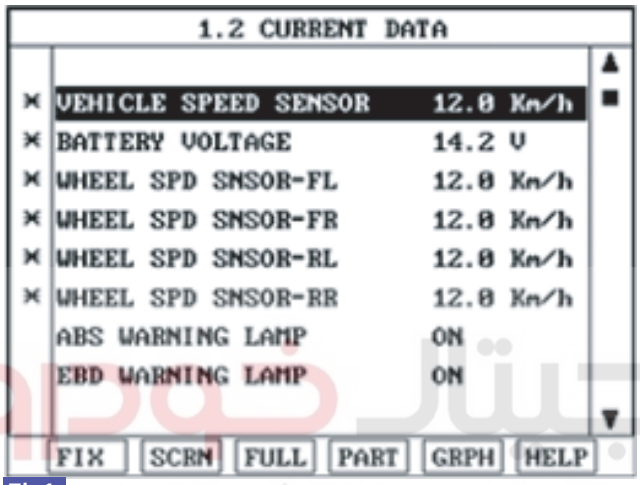


Fig1

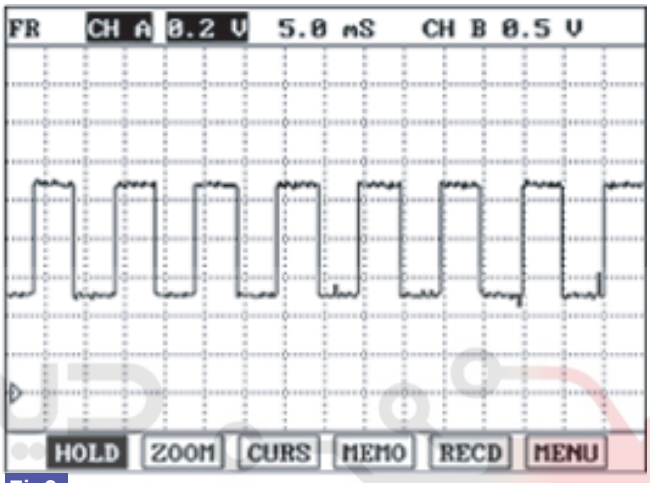


Fig2

Fig 1) Test Condition : Drive vehicle in 12 km/h or more. (7 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 12 km/h or more. (7 mph or more) Normal wave

EJBF501O

5. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Go to "Compont Inspection" procedure.

NO

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" Procedure.

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COMPONENT INSPECTION E1F10357

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more).
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR ED7A9CBE

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 12 km/h or more(7 mph or more))
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

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DTC C1202 FL WHEEL SPEED SENSOR-NO SIGNAL
DTC C1205 FR WHEEL SPEED SENSOR-NO SIGNAL
DTC C1208 RL WHEEL SPEED SENSOR-NO SIGNAL
DTC C1211 RR WHEEL SPEED SENSOR-NO SIGNAL

COMPONENT LOCATION E80D225F

Refer to DTC P1200.

GENERAL DESCRIPTION EF913A42

Refer to DTC P1200.

DTC DESCRIPTION ECA0C812

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set when there is no wheel speed signals within 10 ms to 20 ms at a vehicle speed > 43.2 km/h or a deviation between sensors exceed the threshold or one or two wheels are at 2.75 km/h while the vehicle speed is at 12 km/h. Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 12 Km/h.

DTC DETECTING CONDITION EF5FFAA3

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
Case1	Monitoring Period	• Continuous (only no under voltage is not detected)	
	Enable Conditions	• If one (or two) wheel are at 2.75 km/h and the other wheels are above 12 km/h for longer than 1s. • During driving, when the vehicle accelerates 18 km/h after a particular wheel speed gets to 2.75 km/h and stays there. At that time, If one (or two) wheel are at 2.75 km/h. - This monitoring is performed at the following condition. 1) At the time the vehicle is accelerated to 12 km/h 2) Once after energizing the system. 3) If the vehicle was stationary for approx. 2 s. • If one (or two) wheels are under 5 km/h and the two fastest wheels have a velocity above 12 km/h for more than 20 s.	

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Item		Detecting Condition	Possible cause
Case2	Monitoring Period	• Continuous (If vehicle speed > 12 m/s) - but this monitoring is disabled in the following event 1) aquaplaning. 2) interference. 3) supply voltage below 7.1 or above 18 Volts	
	Enable Conditions	• No wheel speed signals within 10 ms to 20 ms at a vehicle speed > 12 m/s (43.2 km/h). - If the dynamic sensor monitor responses, the failures will be stored into failure memory immediately after a waiting period of 60 ms. - If occurs low voltage active sensors during the waiting period of 60 ms no failure is stored in the EEPROM.	
Case3	Monitoring Period	• Main Monitoring The main monitor needs additional information of the ESP-sensors and is active for a velocity > 20 km/h and no under voltage is detected. • Backup Monitoring - Continuous	
	Enable Conditions	• Main Monitoring 1) If the maximum difference of wheel speeds related to maximum wheel speed exceeds 5 %. 2) detection filter time : - the above conditions apply for 20 s for 1 defective wheel speed sensor. - the above conditions apply for 40 s for 2 defective wheel speed sensor. • Backup Monitoring 1) If the deviation between the fastest and the slowest wheel is below 6 % related to the fastest wheel when the velocity is higher than 50 km/h. 2) When the velocity is below 50 km/h, if the deviation is an absolute value of 3 km/h. 3) detection filter time : normally 20 s - In case of a detected curve, the threshold is increased with an additional value of 4 km/h.	
Case4	Monitoring Period	• Continuous	
	Enable Conditions	• The pulse width of wheel speed sensor is below 2 ms when vehicle speed is > 0km/h and < 20 km/h.	
Fail Safe		Refer to DTC C1200.	

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MONITOR SCANTOOL DATA EBEA2CFF

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 50 km/h or more (31 mph or more)

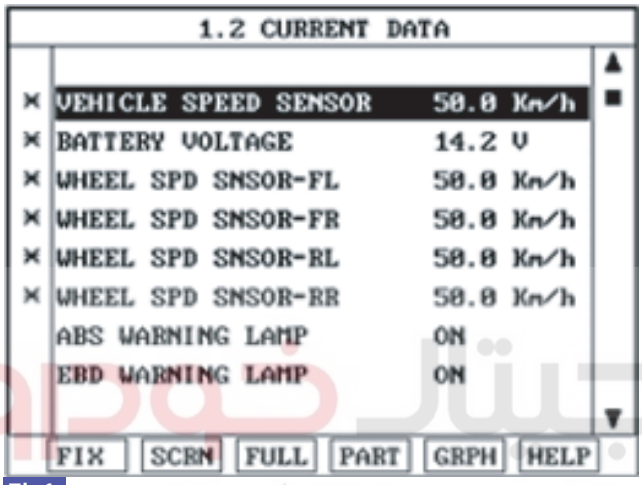


Fig1

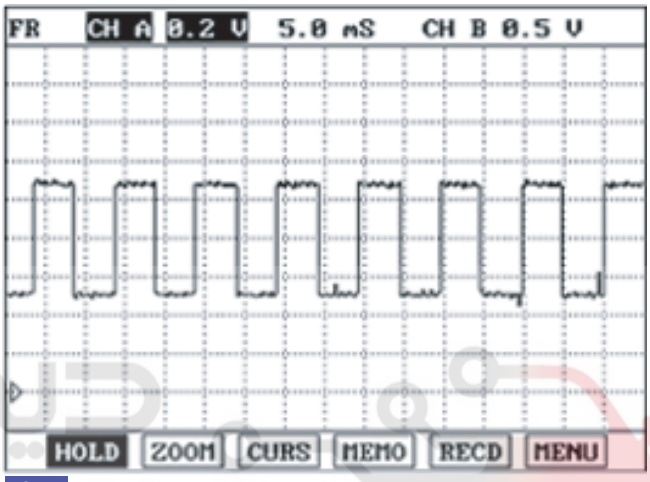


Fig2

Fig 1) Test Condition : Drive vehicle in 50 km/h or more. (31 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 50 km/h or more. (31 mph or more) Normal wave

EJBF501Q

5. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Go to "Compont Inspection" procedure.

NO

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" Procedure.

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COMPONENT INSPECTION E4DB6AD9

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more).
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E29A63CB

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scantool and select "Diagnostic Trouble Codes(DTCs)" mode
2. Using a scantool, Clear DTC.
3. Operate the vehicle within DTC Detecting Condition in General Information.(Start and drive vehicle in gear and maintain vehicle speed is approx. 50 km/h or more(31 mph or more))
4. Are any DTCs present ?

YES

▶ Go to the applicable troubleshooting procedure.

NO

▶ System performing to specification at this time.

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DTC C1213 WHEEL SPEED FREQUENCY ERROR

COMPONENT LOCATION EC3A7F0F

Refer to DTC C1200.

GENERAL DESCRIPTION E7453BDA

Refer to DTC C1200.

DTC DESCRIPTION EDE27C3C

The ABS ECU monitors the wheel speed sensor signal continuously. This code is set, if the speed difference with adjacent wheel is out of permissible range or the ABS control cycle is continued abnormally.

DTC DETECTING CONDITION ED9BCA2E

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	• Signal motorning	• Improper installation of wheel speed sensor • Abnormal Rotor and wheel bearing • Faulty Wheel speed sensor • Faulty HECU
	Monitoring Period	• Continous	
	Enable Conditions	• When short cut between the wheel speed sensor supply and the battery.	
	Fail Safe	• Wheel speed sensor signals are not reliable.	
Case 2	DTC Strategy	• Signal motorning	
	Monitoring Period	• Continous	
	Enable Conditions	• The monitoring reports a failure if the ABS target slip is exceeded for a time period > = 10 s at one or more wheels. - If the driver brakes or the velocity is lower than 50 km/h the detection time is enlarged to 60 s.	
	Fail Safe	• Reduced function of the ESP system	

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MONITOR SCANTOOL DATA EE717FE3

1. Engine "ON".
2. Connect scantool to Data Link Connector(DLC).
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more)
4. Monitor the "Wheel speed sensor" parameter on the Scantool.

Specification : Approx. 10 km/h or more (6 mph or more)

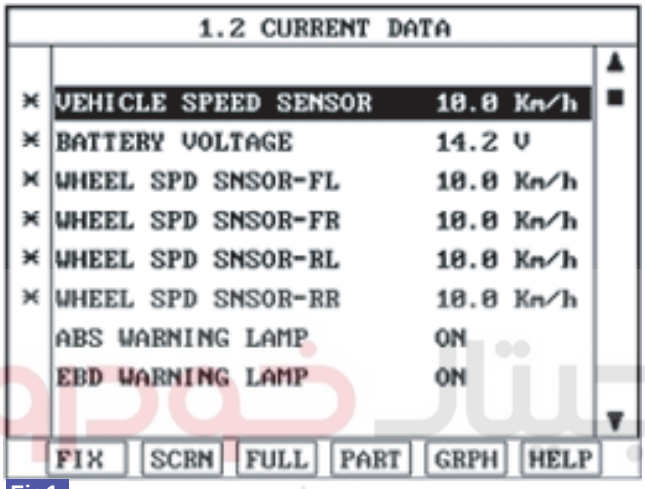


Fig1

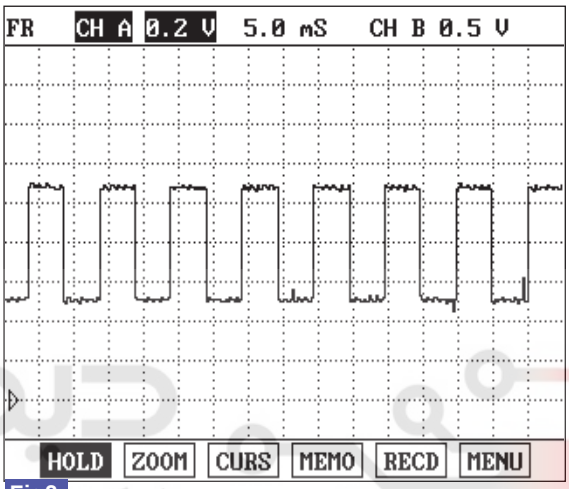


Fig2

Fig 1) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal Data
Fig 2) Test Condition : Drive vehicle in 10 km/h or more. (6 mph or more) Normal wave

EJBF501K

5. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in wheel speed sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Go to "Compont Inspection" procedure.

NO

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Check for damage of rotor teeth or wheel bearing. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ Substitute with a known-good Wheel speed sensor and check for proper operation. If problem is corrected, replace Wheel speed sensor and then go to "Verification of Vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" Procedure.

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COMPONENT INSPECTION EDB92025

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 10 km/h or more(6 mph or more).
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR ECAD0AC0

Refer to DTC C1200.

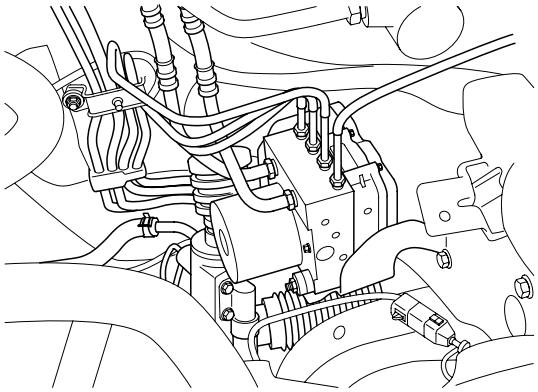
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DTC C1235 PRESSURE SENSOR(PRIMARY)-ELECTRICAL

COMPONENT LOCATION EE7E2AD5



EJBF502R

GENERAL DESCRIPTION EDA0DBEF

The pressure sensor, installed in the HECU, sense the brake oil pressure to judge driver's brake intention when ESP is operating. If pressure of master cyclinder is applied to pressure sensor, the strain of the piezo element is changed and then the resistance of brige circuit is chanded according to changed strain. Therefore this changed resistance changes output voltage of brige circuit and output voltage changes linerly. The sensor output is a analog signal in proportion to supply voltage, and the HECU recognizes a pressure value according to signal ratio about supply voltage.

DTC DESCRIPTION ED26004E

Each unfiltered input signal voltage is monitored to be in the range of 4.7 V < input signal voltage < 5.3 V. A failure is detected if the output signal value is out of specified range for more than 100 ms or pressure sensor self test form is against to specification during self test.

DTC DETECTING CONDITION EEB8D23F

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage Monitoring	• Open or short of pressure sensor circuit • Faulty pressure sensor • Faulty HECU
Case 1	Monitoring Period	• Continuous	
	Enable Conditions	• A sensor supply failure is detected if Sensor Supply Voltage > 5.3 V or Sensor Supply Voltage < 4.7 V for t > = 60 ms.	
Case 2	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is set if the DSO signal is voltage of DSO > 4.7 V or voltage of DSO < 0.3V for a time t > = 100 ms. - DSO : original pressure value.	

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Item		Detecting Condition	Possible cause
Case 3	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is set if the DSI signal is voltage of DSI > 4.7 V or voltage of DSI < 0.3V for a time t >= 100 ms. - DSI : inverted pressure value.	
Case 4	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is set if the voltage of DSO + DSI > 5.5V or voltage of DSO + DSI < 4.5V for a time t >= 100ms. - DSO : original pressure value. - DSI : inverted pressure value.	
Case 5	Monitoring Period	• Once during Power Up	
	Enable Conditions	• POS detects internal sensor malfunctions (sensor element, amplification, etc.). The POS is triggered if no low voltage is present and supply voltage is switched on. The test phase is divided in two 60 ms parts. DSO signal must be < 0.5 V for 30 ms. In phase 2 DSO signal must be between 1.9V and 3.1V for also 30 ms then the POS Test is passed. The test phase is divided in two 60 ms parts. DSO and DSI signal must be < 0.5 V for 30 ms. In phase 2 DSO and DSI signal must be between 1.9 V and 3.1 V for also 30 ms then the POS Test is passed. A fault is set if POS does not satisfy the above conditions - POS : Power on selftest.	
Fail Safe		• No Pressure Signal available.. • Sensor failure outside the ABS control cycle - Only the ABS/ESP functions are inhibited, allow the EBD. The ABS/ESP warning lamps are activated and the EBD warning lamp is not activated. • Sensor failure inside the ABS control cycle - Inhibit the ESP control, allow the EBD. The ESP warning lamps are activated. After the control, the ABS functions are inhibited. The ABS warning lamps are activated.	

MONITOR SCANTOOL DATA E88C440F

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Press the brake pedal.
4. Monitor the "Pressure sensor" parameter on the Scantool.

Specification : Approx. 60 bar ~150 bar (There are difference in displayed parameter according to braking force)

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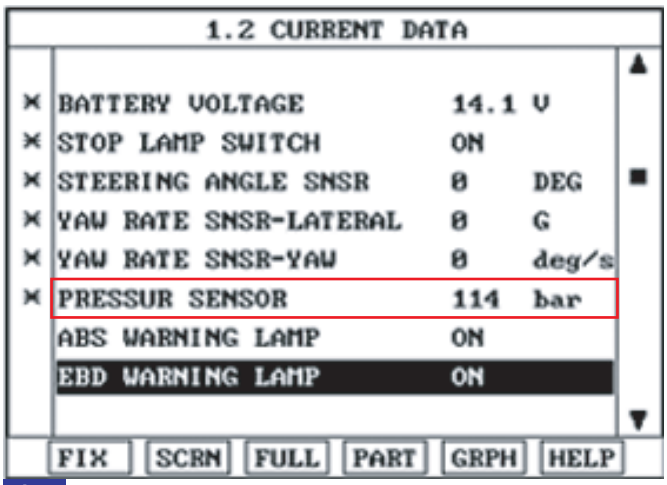


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed parameter according to braking force)

EJBF502S

5. Whenever brake pedal is pushed down, is the pressure sensor's scantool data changed?

YES

▶ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EFC0EAD9

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by open or short of wheel speed sensor harness, faulty wheel speed sensor. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E39C8C6A

Refer to DTC C1101.

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DTC C1237 PRESSURE SENSOR-OTHER

COMPONENT LOCATION EE789630

Refer to DTC C1235.

GENERAL DESCRIPTION E02E9666

Refer to DTC C1235.

DTC DESCRIPTION E637A8A1

With the driver torque demand and the lateral acceleration a driver braking demand is calculated. Unless the pump motor is opreating or there is a brake signal, The offset compensation is executed. A failure is detected if offset value exceeded ±15 bar.

DTC DETECTING CONDITION E0A7CBD1

Item	Detecting Condition	Possible cause
DTC Strategy	• Voltage Monitoring	• Open or short of pressure sensor circuit • Faulty pressure sensor • Faulty HECU
Monitoring Period	• After Pressure sensor initialization. • No under voltage • No pumps are running. • No BLS-signal is set.	
Enable Conditions	• The pressure sensor-offset value must be in the range of ± 15 bar. A failure is detected if this range is exceeded.	
Fail Safe	• Reduced function caused by faulty pressure sensor signal. • Sensor failure outside the ABS control cycle - Only the ABS/ESP functions are inhibited, allow the EBD. The ABS/ESP warning lamps are activated and the EBD	

MONITOR SCANTOOL DATA ECEAAC68

Refer to DTC C1235.

COMPONENT INSPECTION E9A5FA8E

Refer to DTC C1235.

VERIFICATION OF VEHICLE REPAIR E6ACE439

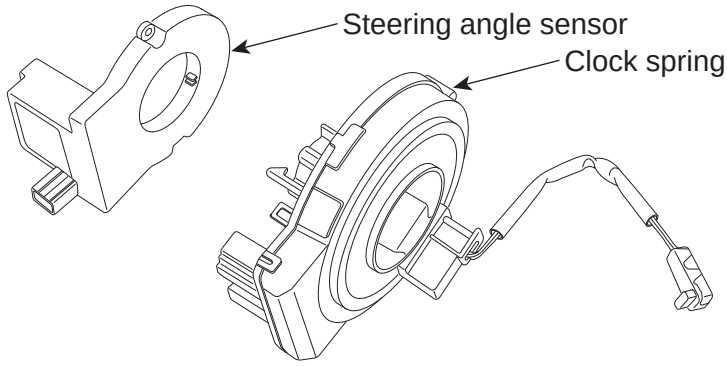
Refer to DTC C1101.

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DTC C1260 STEERING ANGLE SENSOR-SIGNAL

COMPONENT LOCATION EDDB308E



EJBF502V

GENERAL DESCRIPTION ECBFF81F

The Steering angle sensor(SAS) is composed of main gear, serve gear1 and serve gear2 to determine the turning direction. The SAS is a CAN communication type sensor. If main gear is rotated according to the rotation of steering wheel serve gear1 and serve gear2, which is contact with main gear, will be rotated. The HECU detects the absolute angle by using magnetic MR effect and the difference gear ratio of each serve gear and then send to the CAN comunication line. The HECU detects the steering wheel's operating speed and operating angle by using absolute angle, and this signal is used in a input signal of anti-roll control.

DTC DESCRIPTION E1CC7A4E

If the SAS signal is different from calculated value by yaw-rate sensor and wheel speed sensor, mechanically impossible SAS signal is detected, there is a difference between SAS signal and driving condition of the vehicle calculated from yaw-rate sensor and later G sensor, a failure is detected.

DTC DETECTING CONDITION E6EFD1D2

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage Monitoring	• Open or short of steering angle sensor circuit • Faulty steering angle sensor • Faulty HECU
Case 1	Monitoring Period	• Continuous	
	Enable Conditions	• During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered SAS-value is equivalent to the offset. If the offset value exceeds a threshold of approximately 15 deg a SAS-fault is determined. Failure detection time depends on the driving distance, vehicle speed and on the amount of failed SAS signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.	

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Item		Detecting Condition	Possible cause
Case 2	Monitoring Period	• Continous (If the following conditions are satisfied) 1) After SAS-initialization and vehicle reference speed > 1.4 m/s 2) No under voltage 3) At least one SAS-message was sent in the current 20 ms-cycle.]	
	Enable Conditions	• A SAS-gradient-failure is set, if 1) Signal gradient (steering angle velocity) from one 20 ms-cycle to another is higher than 40° or 2) Change of this gradient (steering angle acceleration) is higher than 15° : | (LwInK0K1 . LwInK1K2)| > 15° and | (LwInK0K1 + LwInK1K2)| > 15° - LwInK0K1 : Difference of the LWS-signal between the current 20 ms-cycle and the last 20 ms-cycle. - LwInK1K2 : Difference of the LWS-signal between the last 20 ms-cycle and 20 ms-cycle before.	
Case 3	Monitoring Period	• Continuous (After initialization and no under voltage detected)	
	Enable Conditions	• If value is higher than 665° + 90° tolerance for more than 300 ms a fault is determined.	
Case 4	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• Based on a vehicle model a reference SAS signal is build. The difference between measured SAS signal and SAS signal calculated from yaw-rate sensor signal is evaluated for fault detection. Dependent on the driving conditions failures in size of [10 + 60 m/s / vehicle reference speed] deg at steering angle are recognized within 400 ~ 4800 ms through three possible recognition paths: 1) Curve Branch (lateral G > 2 m/s² and left and right curve driving) 2) Stability Branch (no large wheel speed differences and stable acceleration) 3) Straight ahead Branch (lateral G < 0.5 m/s² and yaw rate < 2 deg/s). The recognition time depends on the active branch (the time is shorter in a relation 1.:2.:3.-4:2:1) and the value of the permissible time threshold dependent on the deviation between the compared signals (small deviation → long detection time, large deviation → small detection time).	

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Item		Detecting Condition	Possible cause
Case 5	Monitoring Period	• Initialization once in every ignition cycle. • The monitoring is active until a reset by a change in the SAS signal or until a right and left cornering can be recognized.	
	Enable Conditions	• If there is no change in the signal, but a right and left cornering has been recognized, a fault is determined. (lateral G > 2 m/s² in combination with a yaw rate > 6 °/s in both directions). - At a minimum change of e.g. 5° in the signal, the monitoring is reset.	
Case 6	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• The measured yaw rate and the yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals don't fit and forwards driving is detected, a fault is determined.	
Case 7	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• Under normal conditions, two SAS messages are sent in one 20 ms cycle, which is shown by an increase of the message counter by 2. If the message counter shows an increase higher than 3 or lower than 1 in one 20 ms-cyle, a fault is stored after 160 ms.	
Fail Safe		• Reduced controller function caused by faulty SAS signal. Allow the ABS/EBD control. • The ESP warning lamp is activated.	

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MONITOR SCANTOOL DATA ECB42EDA

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Turn the steering wheel to the left or right.
4. Monitor the "steering sensor" parameters on the Scantool.

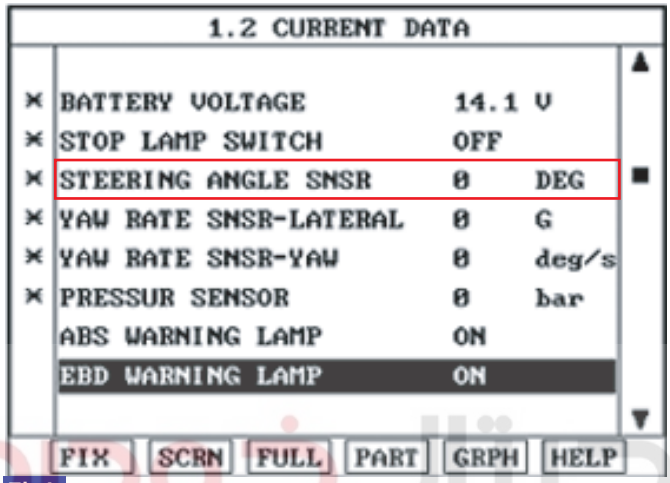


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed Normal data

EJBF502W

5. Whenever steering wheel is turned, is the steering sensor's scantool data changed?

YES

▶ Fault is intermittent caused by poor connection in steering sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

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COMPONENT INSPECTION EDD1E6FE

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good steering angle sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by caused by open or short of steering angle sensor harness, faulty steering angle sensor.Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4FBDA50

Refer to DTC C1101.

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DTC C1261 STEERING ANGLE SENSOR IS NOT CALIBRATED

COMPONENT LOCATION EE47B5CE

Refer to DTC C1260.

GENERAL DESCRIPTION E3FC32FC

Refer to DTC C1260.

DTC DESCRIPTION EAF4A85D

The SAS used for ESP control needs zero point adjustment because the SAS measures a absolute angle. zero point adjustment is done by using the scantool device. If abnormal zero point adjustment is detected, a failure is reconized.

DTC DETECTING CONDITION E2D7930E

Item	Detecting Condition	Possible cause
DTC Strategy	• Signal Monitoring	• A fail of SAS zero point adjustment • Faulty HECU
Monitoring Period	• During SAS zero point adjustment.	
Enable Conditions	• The position of steering wheel is out of specified range (straight positon, a max. error ±5°) during SAS zero point adjustment.	
Fail Safe	• Reduced controller function caused by faulty SAS signal. Allow the ABS/EBD control. • The ESP warning lamp is activated.	

MONITOR SCANTOOL DATA EBCEA199

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON".
3. Turn the steering wheel to the left or right until can't turn the steering wheel any more.
4. Monitor the "steering sensor" parameters on the Scantool.

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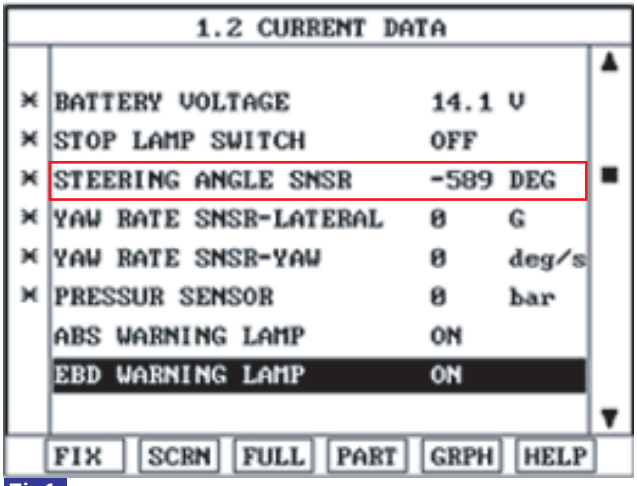


Fig1

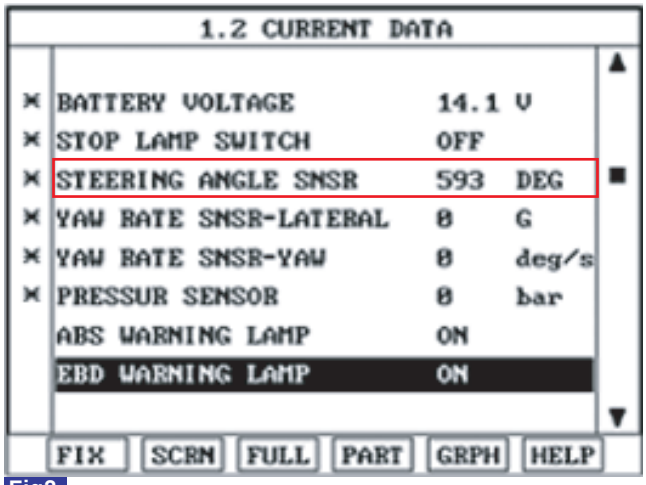


Fig2

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (Right side)
Fig 2) Test Condition : Ignition "ON" & Engine "ON" Normal data (Left side)

EJBF503A

5. Is parameter displayed within specifications?

YES

▶ Fault is caused by having been repaired and HECU memory was not cleared. Clear the DTC and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EAE7F9BE

1. Line up wheels like (figure 1).
   1) Perform the wheel alignment.
   2) Line up the steering wheel in a straight.
   3) Go ahead and Go back the vehicle 2~3 times without holding steering wheel.
2. Connect scantool to Data Link Connector(DLC).
3. Go in Anti-Rock brake system. (figure 2).
4. Perform steering angle sensor calibration. (figure 3).
5. Disconnect scantool.
6. Check the condition of SAS zero point adjustment by opreating the vehicle (turn right and left at least 1 time)

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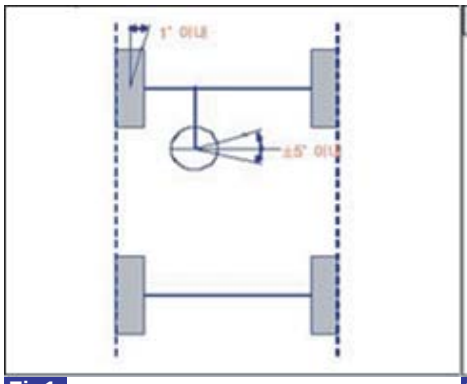


Fig1

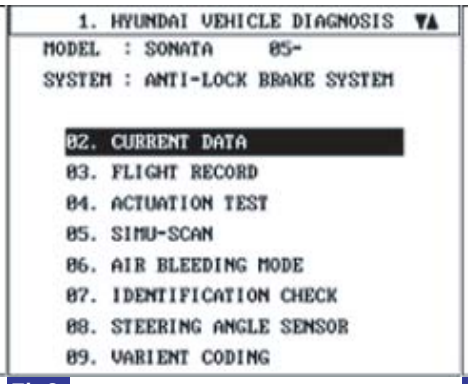


Fig2

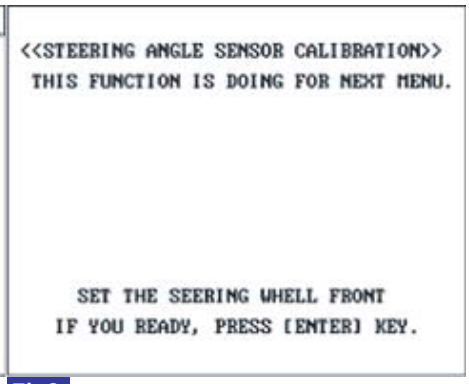


Fig3

EJBF503B

7. Is zero point adjustment completed?

YES

▶ Go to "Verification of Vehicle Repair" procedure.

NO

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E6947F90

Refer to DTC C1101.

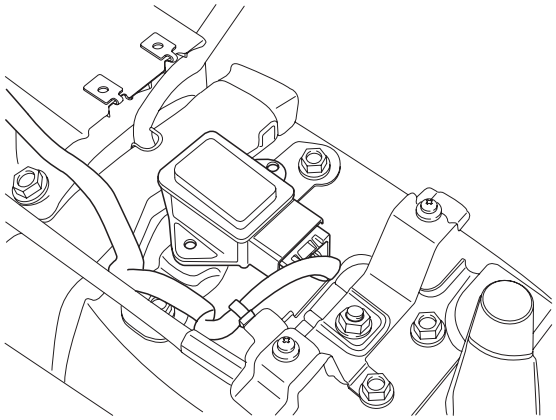
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DTC C1282 YAW RATE AND LATERAL G SENSOR-ELECTRICAL

COMPONENT LOCATION EABBFC68



EJBF503C

GENERAL DESCRIPTION E8CE77F9

Both the yaw-rate sensor and later G sensor is installed in lower floor. The yaw-rate sensor detecting the rotation angular velocity calculates a difference with a target amount of turing, the lateral G sensor detecting slip of the vehicle compensates a target amount of turning. Direction and magnitude of lateral G loaded to vehicle can be known with electrostatic capacity changing according to lateral G. The output voltage of the lateral G sensor is 2.5 V when the vehicle is at a standstill.

DTC DESCRIPTION E8A5633E

The HECU monitors a signal voltage of either yaw-rate sensor or later G sensor to detect open or short to battery or short to ground. A failure is detected if the lateral acceleration sensor or yaw rate sensor signal voltage stays in the fault range longer than the 100 ms or the lateral acceleration sensor or yaw rate sensor reference voltage stays in the fault range longer than the 200 ms, or the self test form is against specification during self test.

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DTC DETECTING CONDITION EB32B515

Item		Detecting Condition	Possible cause
Case 1	DTC Strategy	• Voltage Monitoring	• Faulty Yaw Rate & Lateral G sensor • Open or short of Yaw Rate & Lateral G sensor • Faulty HECU
	Monitoring Period	• Continous	
	Enable Conditions	• A line fault is detected if V[LG] < 0.3 V or V[LG] > 4.7 V for a time t >= 100ms. • A line fault is detected if V[YAW] < 0.225 V OR V[YAW] > 4.774 V for a time t >= 100 ms. • A line fault is detected if V[YAW REFERENCE] < 2.1 V OR V[YAW REFERENCE] > 2.9 V for a time t >= 200 ms.	
Case 2	DTC Strategy	• Selftest Monitoring	
	Monitoring Period	• Once after power up and no low voltage.	
	Enable Conditions	• A line fault is detected if 0.2 V < V[LG] < 0.8 V isn't continued for a time t >= 60 ms during POS (POS : power on selftest)	
Fail Safe		• Reduced controller function. • Inhibit the ESP control and allow the ABS/EBD control. • The ESP warning lamps are activated..	

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MONITOR SCANTOOL DATA E86FC6B0

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON".
3. Monitor the "Yaw rate sensor-lateral & Yaw rate sensor-yaw" parameter on the Scantool.

Specification : Lateral G sensor : ± 0 G, YAW rate Sensor : ± 0 deg/s

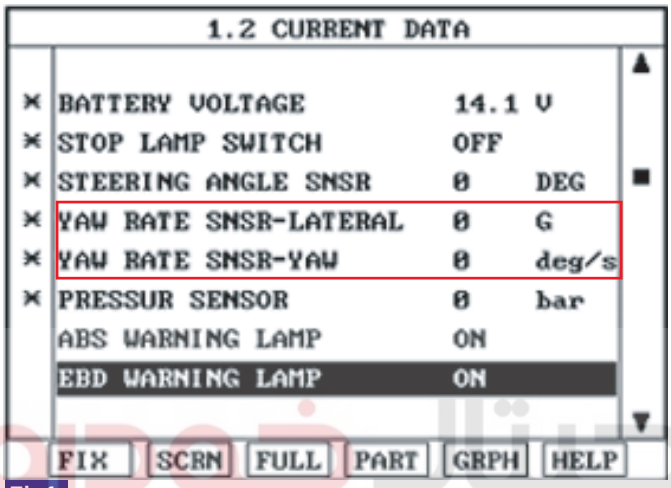


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "ON" Normal data (There are difference in displayed Normal data)

EJBF503J

4. Is parameter displayed within specifications?

YES

▶ Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E0CFCB19

Refer to DTC C1102.

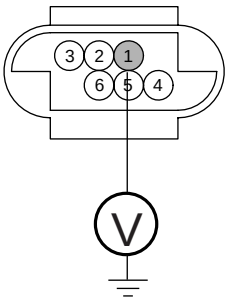
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POWER SUPPLY CIRCUIT INSPECTION EB5ECCFD

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. B+



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

EJBF503E

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

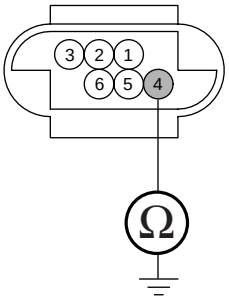
NO

▶ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "1" of the Yaw Rate & Lateral G sensor harness connector and battery +. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION ED70016D

1. Ignition "OFF".
2. Disconnect Yaw Rate & Lateral G sensor connector.
3. Measure resistance between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. below 1Ω



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

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4. Is the measured resistance within specifications?

YES

▶ Go to "Signal Circuit Inspection" procedure.

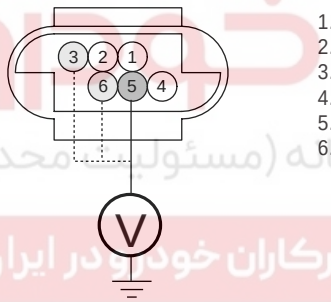
NO

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "4" of the Yaw Rate & Lateral G sensor harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

SIGNAL CIRCUIT INSPECTION E05CB621

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3,5,6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5 V (Voltage between terminal "5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

EJBF503G

3. Is the measured resistance within specifications?

YES

▶ Go to "Self Test Circuit Inspection" procedure.

NO

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "3, 5, 6" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 18, 20" of thechassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.

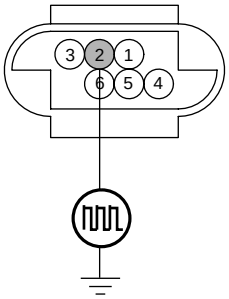
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SELF TEST CIRCUIT INSPECTION

1. Measure wave between terminal "2" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 0.2V < Voltage < 0.8V (during Ignition "ON")



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

EJBF503H

2. Is the measured wave within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for open or short to GND in the Yaw Rate & Lateral G sensor harness between terminal "2" of the Yaw Rate & Lateral G sensor harness connector and terminal "37" of thechassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION EBFE6A33

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor circuit and/or faulty Yaw Rate & Lateral G sensor or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E51AEB95

Refer to DTC C1101.

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DTC C1283 YAW RATE AND LATERAL G SENSOR-SIGNAL

COMPONENT LOCATION E3E9BF06

Refer to DTC C1282.

GENERAL DESCRIPTION ECD88E2A

Refer to DTC C1282.

DTC DESCRIPTION EDFFFE46

A lateral acceleration reference signal is calculated from the wheel speeds, the steering angle and the yaw rate signals to observe the lateral acceleration sensor signal. The difference between the reference signal and the sensor signal is evaluated for failure detection. A yaw rate reference signal is calculated from the wheel speeds, the steering angle and the lateral acceleration signals to observe the yaw rate sensor signal. The difference between the reference signal and the sensor signal, and the gradient of the measured sensor signal is evaluated for the failure detection. If the difference between estimated value and measured value of the sensor is larger than predefined value for predefined time, the failure is recognized. Also impossible signal according to sensor characteristic is detected the failure is recognized.

DTC DETECTING CONDITION E8E91CBA

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal Monitoring	• Faulty Yaw Rate & Lateral G sensor • Open or short of Yaw Rate & Lateral G sensor • Faulty HECU
Case 1	Monitoring Period	• Continuous (during stable driving)	
	Enable Conditions	• By building a reference lateral G from the yaw-rate sensor, wheel speed sensor and the SAS it is possible to test the later G Signal on plausibility. If during stable vehicle behavior an later G Failure larger than approximately 2.5 m/s2 occurs, the ESP controller will disregard the later G sensor information so that a false ESP intervention is prevented. A fault is recognized after 1.6 s during model validity. • The measured and offset compensated yaw rate signal is compared to the reference yaw rate signal calculated from yaw rate sensor, later G sensor, SAS and wheel speed sensor. If the measured yaw rate deviates more than 2.5 °/s plus a dynamic threshold from the reference yaw rate during model validity, a failure is recognized after 1.6 s. The dynamic threshold is between 2.5°/s and more than 5°/s. A typical value is 3°/s. - During the possibility to observe the recognition time depends on the amount of failure.	

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Item		Detecting Condition	Possible cause
Case 2	Monitoring Period	• Continuous (during driving)	
	Enable Conditions	• During normal driving conditions the long time filtered driving direction is straight ahead. The long time filtered later G value is equivalent to the offset. If the offset value exceeds a threshold of approximately 2.25 m/s² an later G fault is determined.Failure detection time depends on the driving distance, vehicle speed and on the amount of failed later G signal. Within 30 km of symmetrical driving the calculated offset corresponds to the sensor offset.	
Case 3	Monitoring Period	• Continuous (If no under voltage is detected)	
	Enable Conditions	• A fault is detected If the lateral G is higher than 15 m/s² for more than 800 ms.	
Case 4	Monitoring Period	• Continuous (during standstill)	
	Enable Conditions	• If the filtered value of |lateral G| is larger than 7 m/s² for more than 400 m/s a fault is set.	
Case 5	Monitoring Period	• Continuous (dependent on driving situation)	
	Enable Conditions	• Standstill compensation : - The offset corresponds to the measured and filtered input value. Failure threshold 5.25 °/s. • Fast compensation (during driving if no standstill compensation could be completed): - The offset corresponds to the slightly filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, later G sensor and wheel speed sensor. Failure threshold is 7.5 °/s. • Long-term ("normal") compensation (during driving after succeeded standstill or fast offset compensation): - The offset corresponds to the strong filtered deviation between measured yaw rate and the reference yaw rate calculated from SAS, later G sensor and wheel speed sensor. Failure threshold is 7.5 °/s	
Case 6	Monitoring Period	• After every standstill.	
	Enable Conditions	• The measured yaw rate and the model yaw rates, calculated from the wheel speed sensor and SAS are compared. If the signals doesn.t fit and forward driving is recognized, a fault is determined.	

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Item		Detecting Condition	Possible cause
Case 7	Monitoring Period	• Continuous (after initialization of the YRS and if no under voltage is detected)	
	Enable Conditions	• The yaw rate sensor BITE logic evaluates the BITE-signal by extraction of the measured yaw rate of the vehicle. The allowed range for the BITE-signal is 25 °/s ± 7 °/s. If the BITE-signal is not in the allowed range, a suspected failure bit is set after 200 ms. A failure is set within 400 ms.	
Case 8	Monitoring Period	• After YRS-initialization, no under voltage	
	Enable Conditions	• Depending on the driving conditions a signal gradient higher than 10 ~ 23 °/s / 40 ms sets a suspected failure bit after 280 ms, unless a single signal peak is recognized by a peakfilter. A failure is set, if the good check is not settled successfully after 10 s.	
Case 9	Monitoring Period	• Continuous (except spinning, use of handbrake, unsteady driving conditions or a detected under voltage)	
	Enable Conditions	• During standstill - The allowed range of the yaw rate sensor signal is ±30 °/s. Leaving this range for 5 s sets a fault. In case of driving off after the failure was present for longer than 500 ms during standstill, the fault is detected immediately. • While driving - The allowed range of the yaw rate sensor signal is ±94.75 °/s and a suspected failure bit is set, if the signal is out of this range for 500 ms. A fault is set after 1 s.	
Fail Safe		• Reduced controller function. • Inhibit the ESP control and allow the ABS/EBD control. • The ESP warning lamps are activated.	

MONITOR SCANTOOL DATA E3AE3B8B

Refer to DTC C1282.

TERMINAL & CONNECTOR INSPECTION E62DE558

Refer to DTC C1102.

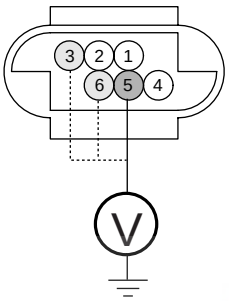
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SIGNAL CIRCUIT INSPECTION EF2CE383

1. Ignition "ON" & Engine "OFF".
2. Measure voltage between terminal "3, 5, 6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.

Specification : Approx. 2.5V (Voltage between terminal "5,6" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)
Specification : Approx. above 2.1V and below 2.9V (Voltage between terminal "3" of the Yaw Rate & Lateral G sensor harness connector and chassis ground.)



1. Battery +
2. Yaw-Rate self test line
3. Yaw-Rate reference line
4. Ground
5. Lateral G sensor signal
6. Yaw-Rate sensor signal

EJBF503K

3. Is the measured resistance within specifications?

YES

▶ Go to "Self Test Circuit Inspection" procedure.

NO

▶ Check for open or short in the Yaw Rate & Lateral G sensor harness between terminal "3, 5, 6" of the Yaw Rate & Lateral G sensor harness connector and terminal "16, 18, 20" of thechassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, Substitute with a known-good Yaw Rate & Lateral G sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.

COMPONENT INSPECTION E225EBB9

Refer to DTC C1282.

VERIFICATION OF VEHICLE REPAIR EFEA3166

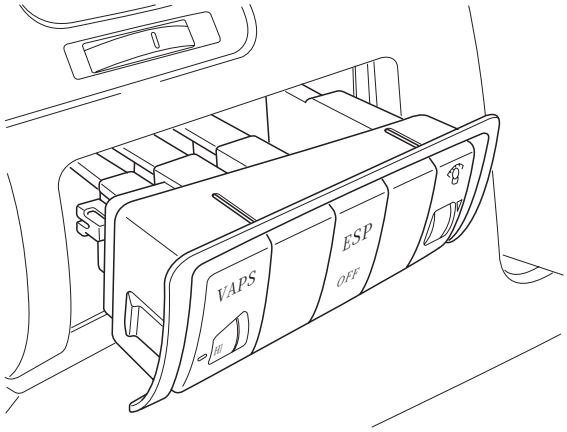
Refer to DTC C1101.

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DTC C1503 TCS/ESP SWITCH ERROR

COMPONENT LOCATION EB26B31D



EJBF503L

GENERAL DESCRIPTION EFAA8DDD

Driver can inhibit the ESP control by ESP switch. When switch signal send into HECU, ESP warning lamp go ON and ESP control is stopped and if next switch signal is inputted again, ESP control is ready. This function is used for sporty driving or vehicle inspection.

DTC DESCRIPTION EE88B42D

Trouble code is set when the condition that the level of ESP switch is high is continued for 60sec.When the ESP switch failure is set there is no signal in the warning lamp and HECU inhibit the ESP control and allow the ABS/EBD control.

DTC DETECTING CONDITION EDBC1FDC

Item	Detecting Condition	Possible cause
DTC Strategy	• Short circuit monitoring	• Open or short ESP switch • Faulty ESP switch
Monitoring Period	• Continuous	
Enable Conditions	• When the ESP switch is ON for 60 sec.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the ESP control. • The ESP warning lamps are activated.	

TERMINAL & CONNECTOR INSPECTION E788FDE0

Refer to DTC C1102.

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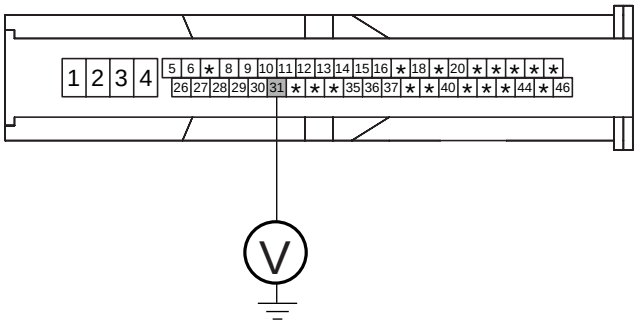
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POWER SUPPLY CIRCUIT INSPECTION E9432D16

1. Ignition "ON" & Engine "OFF" & ESP Switch"ON".
2. Measure voltage between terminal "31" of the HECU harness connector and chassis ground.

Specification : Approx B+

<E41>



31. ESP Switch

EJBF503M

3. Is the measured voltage within specifications?

YES

▶ Fault is intermittent caused by open or short in ESP switch line, faulty ESP switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "31" of the HECU harness connector . Check for open or blown 10 A fuse referring to "Circuit Diagram" . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

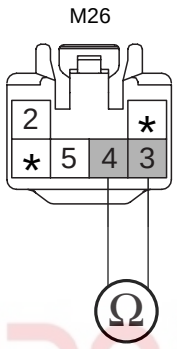
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COMPONENT INSPECTION E4F0AACF

1. Ignition "ON".
2. Disconnect ESP switch connector.
3. Press the ESP switch.
4. Measure resistance between terminal "3" of the ESP switch harness connector and terminal "4" of the ESP switch harness connector.

Specification : Approx. below 1 Ω



3. POWER SUPPLY
4. SIGNAL

EJBF503N

5. Is the measured resistance within specifications?

YES

▶ Fault is intermittent caused by faulty ESP switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Substitute with a known-good ESP switch and check for proper operation. If problem is corrected, replace ESP switch and then go to "Verification of Vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR EF22263F

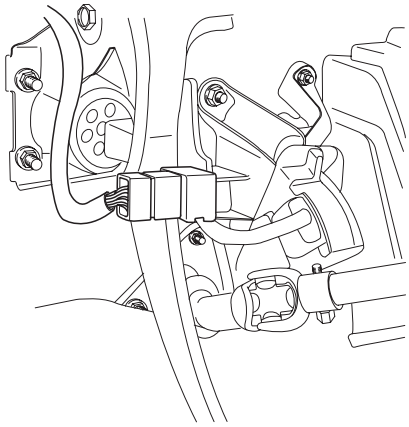
Refer to DTC C1101.

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DTC C1513 BRAKE SWITCH ERROR

COMPONENT LOCATION EE2BA130



EJBF503P

GENERAL DESCRIPTION E63E2A27

The brake light switch indicates brake pedal status to the ABS control unit. The brake light switch which is dual switch type send brake light signal to HECU. The switch is turned on when brake is depressed. The brake light switch runs to battery voltage when brake depressed. but The brake light switch doesn't run to battery voltage when brake is not depressed. On the contrary, The brake switch is normally close type which doesn't run to battery voltage when brake depressed.

DTC DESCRIPTION E73C23F8

The brake light signal is a reference to judge driver's intention for braking and The HECU checks open or short circuit of brake light switch for normal ABS/ESP control. If the brake light switch have an error, warning ramp will be turned ON.

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DTC DETECTING CONDITION EB2B4743

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage monitoring	• Open circuit in brake switch line • Faulty brake light switch • Faulty HECU
Case 1	Monitoring Period	• Continuous (only no under voltage is not detected)	
	Enable Conditions	• If the BLS-signals is high for 60 s, while the gas pedal is stepped, with vehicle speed > 10.8 km/h, offset compensated pressure < 5 bar and no control is active, a fault is set.	
Case 2	Monitoring Period	• Continuous (only normal voltage)	
	Enable Conditions	• For redundancy reasons an additional BLSpVor-signal is created by the pressure sensor signal. If the pressure sensor is compensated, the threshold for generating the BLSpVor signal is 10 bar. If the pressure sensor is not compensated, the threshold is increased by 15 bar. If this signal is set without any hardware-BLS-signals being set for at least 1 s. • If the pressure signal is higher than 80bar and not both of the hardware-BLS are set, a fault is stored after 1 s.	
Fail Safe		• Inhibit the ESP control and allow the ABS/EBD control. • The ESP warning lamps are activated.	

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MONITOR SCANTOOL DATA EB9C87DE

1. Connect scantool to Data Link Connector(DLC).
2. Ignition "ON" & Engine "ON"
3. Press the brake pedal.
4. Monitor the "STOP LAMP SWITCH" parameter on the scantool.

Specification : Lateral G sensor : ± 0 G, YAW rate Sensor : ± 0 deg/s

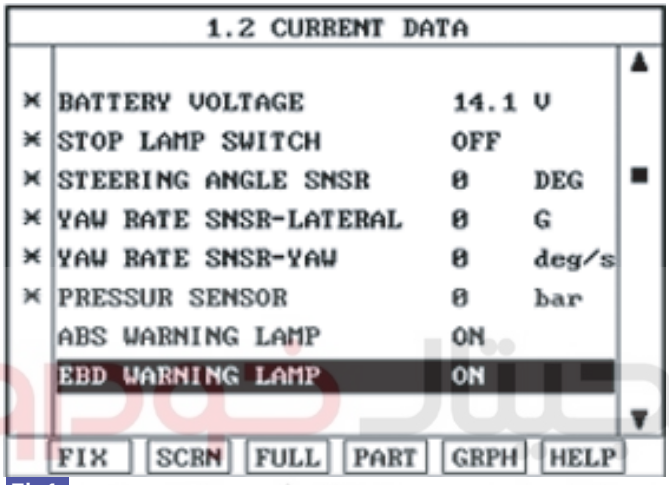


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF" Normal data (There are difference in displayed Normal data

EJBF503Q

5. Whenever brake pedal is pushed down, is the brake switch's scantool data changed ON/OFF?

YES

▶ Fault is intermittent caused by poor connection in Yaw Rate & Lateral G sensor harness and/or HECU's connector or was repaired and HECU memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination.

NO

▶ Go to "W/Harness Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION EE815AB1

Refer to DTC C1102.

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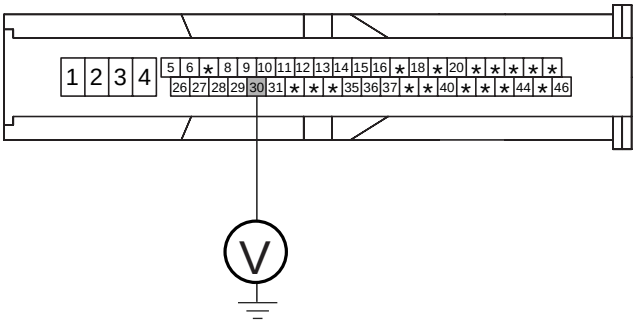
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SIGNAL CIRCUIT INSPECTION E62D5A31

1. Ignition "ON" & Engine "OFF".
2. Press the brake pedal.
3. Measure voltage between the terminal "30" of the HECU harness connector and chassis ground.

Specification : Brake Switch - Approx. B+

<E41>



30. Brake switch

EJBF503R

4. Is the measured voltage within specifications?

YES

▶ Fault is intermittent caused by open or short harness in brake light switch, faulty brake lamp switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Check for open or blown 15 A STOP fuse referring to "Circuit Diagram" . Check for damaged harness and poor connection in the power harness between the battery terminal(+) and the terminal "30" of the HECU harness connector . Repair as necessary and then go to "Verification of vehicle Repair" procedure. If OK, Go to "Component Inspection" Precedure.

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COMPONENT INSPECTION E6DE71EB

1. Connect a ohmmeter to the connector of brake light switch, and check whether or not there is continuity when the plunger of the brake light switch is pushed in and when it is released. The switch is in good condition if there is no continuity when the plunger is pushed

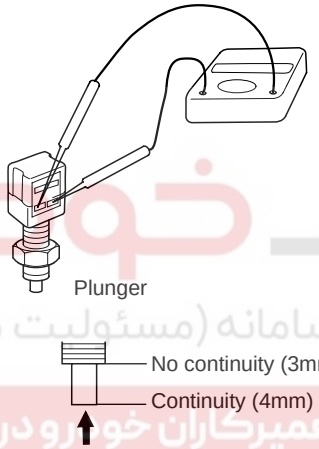
2. Is there no continuity when the plunger is pushed?

YES

▶ Fault is intermittent caused by open harness in brake light switch line, faulty brake lamp switch or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Substitute with a known-good brake lamp switch and check for proper operation. If problem is corrected, replace brake light switch and then go to "Verification of Vehicle Repair" procedure.



EJBF503S

VERIFICATION OF VEHICLE REPAIR E2EAD2A1

Refer to DTC C1101.

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DTC C1604 ECU HARDWARE ERROR

COMPONENT LOCATION EEC55059

Refer to DTC C1235.

GENERAL DESCRIPTION EECE64BA

The HECU is composed of a ECU (Electronic Control Unit) and a HCU(Hydraulic Control Unit) , HCU is composed of a source of hydraulic pressure and modulator valve block. Increase and decrease of hydraulic pressure is opreated by electronic motor, According to a detected signal by wheel speed sensor, The hydraulic pressure which is needed for control is supplied by pump. The HCU' function which is composed of a accumulator, return pump, solenoid valve is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder by operating return pump according to HECU control signal while ABS control.

DTC DESCRIPTION E29D2415

The HECU monitors the operation of the IC components such as memory, register, A/D converter and so on. The ECU sets this code when the EEPROM data read by the master processor is different than prior data writed, or when the master/slave processor detects abnormal operation in RAM, Status Register, Interrupt, Timer, A/D converter or cycle time.

DTC DETECTING CONDITION EAEF89DD

Item		Detecting Condition	Possible cause
DTC Strategy		• Internal monitoring	• Faulty HECU
Case 1	Monitoring Period	• Continuous	
	Enable Conditions	• If Internal control unit failures of the master/slave processor or peripheral integrated circuits is detected.	
Case 2	Monitoring Period	• Directly after ignition on, during reading of EEPROM-values	
	Enable Conditions	• Failure is set if checksum not correct or PSW-EEPROM-Handler reported unknown failure during EEPROM-value reading. • If EEPROM reading sequence take longer then 3 s, a failure is set.	
Fail Safe		• The ABS/EBD/ESP functions are inhibited. • The ABS/EBD/ESP warning lamps are activated.	

COMPONENT INSPECTION EB4DD94D

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E372988D

Refer to DTC C1101.

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DTC C1605 CAN HARDWARE ERROR

COMPONENT LOCATION E787A328

Refer to DTC C1235.

GENERAL DESCRIPTION E3A087FD

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the Engine ECU & TCU through CAN bus line. The Engine ECU performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The TCU maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

DTC DESCRIPTION E13D6E59

The HECU checks the CAN control module for normal TCS control, and sets this code if CAN control module malfunction is detected.

DTC DETECTING CONDITION EF54169A

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN control module monitoring	• Faulty HECU
Monitoring Period	• Immediate during start up	
Enable Conditions	• Faults are detected immediately if the initialization software can't have write access to the configuration registers of the CAN-controller module.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the ESP control.	

COMPONENT INSPECTION E74F2FFF

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E6E029F1

Refer to DTC C1101.

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DTC C1611 CAN TIME-OUT ECM

COMPONENT LOCATION EFD9C292

Refer to DTC C1235.

GENERAL DESCRIPTION E3F855B3

Refer to DTC C1605.

DTC DESCRIPTION EA039E6E

The HECU checks the CAN communcation lines for normal TCS control, and sets this code if an ECM message is not received within predefined time.

DTC DETECTING CONDITION EF29EF2D

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN massage monitoring	• Faulty ECM • Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if ECM message was not received on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control.Meanwhile, stop checking the ESP switch failure under the ESP control.	

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COMPONENT INSPECTION E177AA95

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR ECAFE361

Refer to DTC C1101.

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DTC C1612 CAN TIME-OUT TCU

COMPONENT LOCATION E1CEEFBC

Refer to DTC C1235.

GENERAL DESCRIPTION EE0AE696

Refer to DTC C1605.

DTC DESCRIPTION E048421B

The HECU checks the CAN communcation lines for normal TCS control, and sets this code if an TCM message is not received within predefined time.

DTC DETECTING CONDITION EABA82EB

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN control module monitoring	• Faulty TCU • Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if TCU message was not received on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control.Meanwhile, stop checking the ESP switch failure under the ESP control.	

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COMPONENT INSPECTION EE6C61D9

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E3FD38BB

Refer to DTC C1101.

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DTC C1616 CAN BUS OFF

COMPONENT LOCATION E0CC6A6E

Refer to DTC C1235.

GENERAL DESCRIPTION E8AAF29F

Refer to DTC C1605.

DTC DESCRIPTION E763D711

The HECU checks the CAN communication lines for normal TCS control, and sets this code if re-initialization is tried for 15 times in sequence without success.

DTC DETECTING CONDITION EF4502F8

Item	Detecting Condition	Possible cause
DTC Strategy	• Open or short monitoring	• Open or short circuit in CAN line
Monitoring Period	• Continuous	
Enable Conditions	• A CAN BUS off fault is established if re-initialization is tried for 15 times in sequence without success.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control.Meanwhile, stop checking the ESP switch failure under the ESP control.	

TERMINAL & CONNECTOR INSPECTION E28F8FBF

Refer to DTC C1102.

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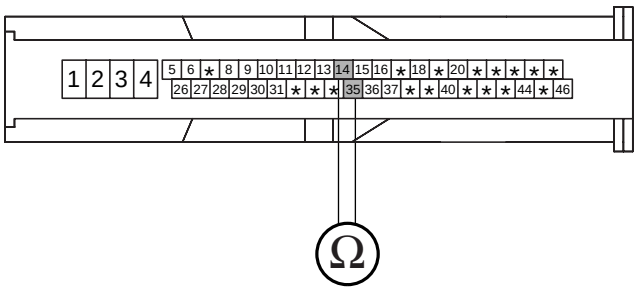
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SIGNAL CIRCUIT INSPECTION EAFB06D6

1. Ignition "OFF".
2. Measure resistance between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector.

Specification : Approx. 60 Ω

<E41>



<ESP>
14. CAN (LOW)
35. CAN (HIGH)

<ABS>
15. CAN (LOW)
26. CAN (HIGH)

EJBF503Y

3. Is the measured resistance within specifications?

YES

▶ Fault is intermittent caused by open or short in CAN signal harnessor was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

NO

▶ Check for open or short in CAN signal harness between terminal "14" of the HECU harness connector and terminal "35" of the HECU harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

VERIFICATION OF VEHICLE REPAIR E4F211F4

Refer to DTC C1101.

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DTC C1623 CAN TIME-OUT STEERING ANGLE SENSOR

COMPONENT LOCATION E439DB4F

Refer to DTC C1235.

GENERAL DESCRIPTION EA0EAEB8

The Steering angle sensor(SAS) is composed of main gear, serve gear1 and serve gear2 to determine the turning direction. The SAS is a CAN communication type sensor. If main gear is rotated according to the rotation of steering wheel serve gear1 and serve gear2, which is contact with main gear, will be rotated. The HECU detects the absolute angle by using magnetic MR effect and the difference gear ratio of each serve gear and then send to the CAN comunication line. The HECU detects the steering wheel's operating speed and operating angle by using absolute angle, and this signal is used in a input signal of anti-roll control.

DTC DESCRIPTION E86FFA4F

The HECU checks the CAN communcation lines for normal ESP control, and sets this code if an WAS message is not received within predefined time.

DTC DETECTING CONDITION EF9F5986

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN massage monitoring	• Faulty SAS • Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if SAS message was not received on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the ESP control.	

TERMINAL & CONNECTOR INSPECTION E42CCC5E

Refer to DTC C1102.

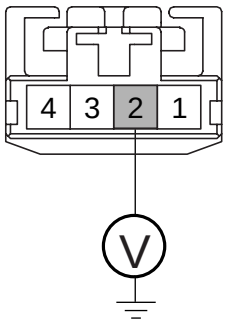
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POWER SUPPLY CIRCUIT INSPECTION EA2DAB89

1. Ignition "ON".
2. Measure voltage between terminal "2" of the steering angle sensor harness connector and chassis ground.

Specification : Approx. B+



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

EJBF504A

3. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

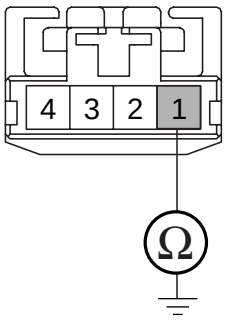
NO

▶ Check for damaged harness and poor connection between the battery terminal(+) and terminal "2" of the steering angle sensor harness connector. Check for open or blown 10 A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

GROUND CIRCUIT INSPECTION EAE101FA

1. Ignition "OFF".
2. Disconnect SAS connector.
3. Measure resistance between terminal "1" of the steering angle sensor harness connector and chassis ground.

Specification : Approx. below 1 Ω



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

EJBF504B

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4. Is the measured resistance within specifications?

YES

▶ Go to "CAN Circuit Inspection" procedure.

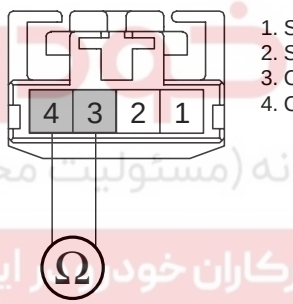
NO

▶ Check for damaged harness and poor connection between terminal "15" of the HECU harness connector and terminal "1" of the steering angle sensor harness connector . Repair as necessary and then go to "Verification of vehicle Repair" procedure.

CAN CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect SAS connector.
3. Measure resistance between terminal "3, 4" of the steering angle sensor harness connector.

Specification : Approx. 60 Ω



1. Steering Angle Sensor Ground
2. Steering Angle Sensor Supply
3. CAN Line (HIGH)
4. CAN Line (LOW)

EJBF504C

4. Is the measured resistance within specifications?

YES

▶ Check for improper installation of wheel speed sensor. If NG, repair as necessary and then go to "Verification of vehicle Repair" procedure.
▶ If OK, Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal "3, 4" of the steering angle sensor harness connector. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

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COMPONENT INSPECTION E67ABFFE

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good steering angle sensor and check for proper operation. If problem is corrected, replace sensor and then go to "Verification of Vehicle Repair" procedure.
▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure

NO

▶ Fault is intermittent caused by poor connection in power harness (IGN+), faulty Alternator and/or faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable roubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E92B3513

Refer to DTC C1101.

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DTC C1625 CAN TIME-OUT ABS/TCS/ESP

COMPONENT LOCATION E7AAAE47

Refer to DTC C1235.

GENERAL DESCRIPTION EE97EC4B

Refer to DTC C1605.

DTC DESCRIPTION EAAA2FEF

The HECU checks the CAN communcation lines for normal ESP control, and sets this code if an CAN message is not transmitted within predefined time.

DTC DETECTING CONDITION ECA34A4E

Item	Detecting Condition	Possible cause
DTC Strategy	• CAN massage monitoring	• Faulty HECU
Monitoring Period	• Continuous	
Enable Conditions	• Faults are detected if CAN message was not transmitted on time by the CAN controller of HECU.	
Fail Safe	• Inhibit the ESP control and allow the ABS/EBD control. Meanwhile, stop checking the ESP switch failure under the ESP control.	

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COMPONENT INSPECTION EA0CE3BE

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E29BDF86

Refer to DTC C1101.

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DTC C1626 IMPLAUSIBLE CONTROL

COMPONENT LOCATION ECF4A2AA

Refer to DTC C1235.

GENERAL DESCRIPTION EEF90EEE

The HECU send requirement data, such as Torque reduction, the number of fuel cut cylinders, and TCS control requests, to the Engine ECU & TCU through CAN bus line. The Engine ECU performs fuel cut functions according to requests from the HECU and retards ignition timing by torque reduction requests. The TCU maintains current gear positions during TCS control time, in order not to increase power which causes a Kickdown shift.

DTC DESCRIPTION E699DDBA

Under normal conditions, the inlet valves of all four wheels are not closed during control for longer than 1,28s or If the controller requests pressure-hold or pressure-decrease for longer than 1,28s, a fault is detected. The ABS/ESP warning ramp is turned ON and the EBD warning ramp is turned OFF.

DTC DETECTING CONDITION E0340516

Item		Detecting Condition	Possible cause
DTC Strategy		• Signal monitoring	• Faulty HECU
Case 1	Monitoring Period	• Continuous	
	Enable Conditions	• If the controller requests pressure-hold or pressure-decrease for longer than 1,28 s, a fault is stored.	
Case 2	Monitoring Period	• Continuous (at vehicle reference speed > 6 m/s, no detected under voltage and a fault is not already detected)	
	Enable Conditions	• The monitoring reports a failure if continuous ESP control occurs for a time period > = 10 s.	
Fail Safe		• The ABS/ESP functions are inhibited, allow the EBD control. • The ABS/ESP warning lamps are activated.	

COMPONENT INSPECTION ED41C9BF

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR EFCC5FE6

Refer to DTC C1101.

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DTC C1702 VARIANT CODING ERROR

COMPONENT LOCATION E9831A4A

Refer to DTC C1235.

GENERAL DESCRIPTION E4D6DDBD

There is no hardware difference of the HECU according to the vehicle's specification, just software is changed by the vehicle parameter used for ESP control. The HECU stores a classified varient code value according to the received data(a kind of engine, engine displacement, a kind of T/M). After then the HECU read a various parameter according to the stored varient value in the memory to use for the ESP control.

DTC DESCRIPTION EB3A8460

The HECU checks the varient code after ignition. If a inappropriate varient code is detected or there is no varient code, a fault is detected.

DTC DETECTING CONDITION ECFD5F3D

Item	Detecting Condition	Possible cause
DTC Strategy	• Internal monitoring	• Faulty HECU • Replacement of EMS, T/M ECU
Monitoring Period	• Once during startup.	
Enable Conditions	• During intialization, there is no inputed valid varient code. • The EEPROM didn't have variant coed. • Receieved variant code is invalid. • There is a difference between pre-inputted variant code and re-inputted variant code.	
Fail Safe	• The ABS/EBD/ESP functions are inhibited. • The ABS/EBD/ESP warning lamps are activated.	

MONITOR SCANTOOL DATA E946244A

VARIANT CODE

1. Check for improper installation of EMS/TCU/ESP.
2. Connect scantool to Data Link Connector(DLC).
3. Ignition "ON".
4. Go in Anti-Lock brake system (figure 1).
5. Perform variant code.
6. Disconnect scantool.
7. Ignition "OFF" and then ignition "ON". Go to "Component Inspection"Procedure.

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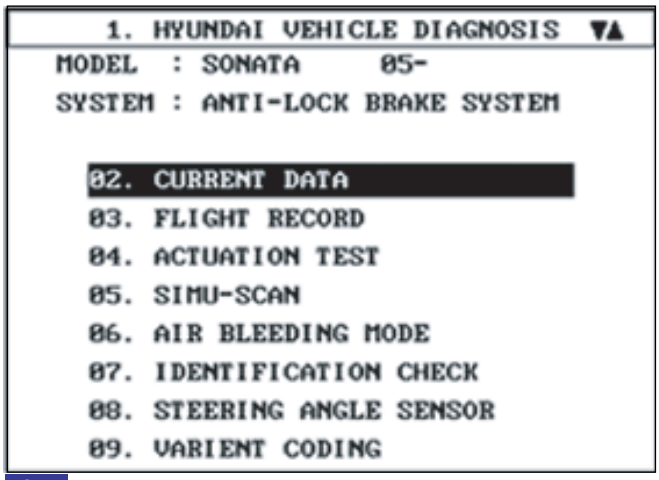


Fig1

Fig 1) Vehicle diagonosis : ANTI-LOCK brake system.

EJBF504G

COMPONENT INSPECTION ED3317EB

1. Ignition "OFF".
2. Engine "ON".
3. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR E0AC52E7

Refer to DTC C1101.

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DTC C2112 VALVE RELAY ERROR

COMPONENT LOCATION E7ABDAD2

Refer to DTC C1235.

GENERAL DESCRIPTION EAE0DADA

The HECU supplies battery power to all solonid valves with a valve relay which is controlled by the Electronic Control UNIT(ECU). The valve relay and all solenoid valves are installed inside the HECU (Hydraulic and Electronic Control Unit).

DTC DESCRIPTION E5CDCBE6

The HECU monitors voltage of the valve relay to check if the HECU can perform ABS control normally. When the valve relay is switched to ON, the HECU will set this code if the solenoid drive voltage is below permissible voltage ranges for a period of time. When the valve relay is switched to OFF, the HECU sets this code if the solenoid drive voltage is over the permissible voltage range for a period of time.

DTC DETECTING CONDITION E3A50E1D

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage monitoring	• Open or short in power supply circuit (IGN+)
Case 1	Monitoring Period	• Once during startup.	
	Enable Conditions	• Watchdog and valve relay function is tested during startup.A failure is detected if the valve relay/Enable remains in off position when it is turned on and vice versa. Reason could be short to GND or UZ, interrupted lines or a defective output stage etc.	
Case 2	Monitoring Period	• Continuous	
	Enable Conditions	• A Fault is detected if valve relay voltage < 0.8 * battery voltage for a time 500 ms.	
Case 3	Monitoring Period	• Continuous	
	Enable Conditions	• If valve relay malfunction and supply solenoid valve short to battery or supply solenoid valve and medium or high ohmic short of valve relay (or a valve) to valve relay voltage, solenoid valve voltage or GND are detected.	
Fail Safe		• No valve actuation possible. • The ABS/EBD/ESP functions are inhibited. • The ABS/EBD/ESP warning lamps are activated.	

TERMINAL & CONNECTOR INSPECTION E342FD28

Refer to DTC C1102.

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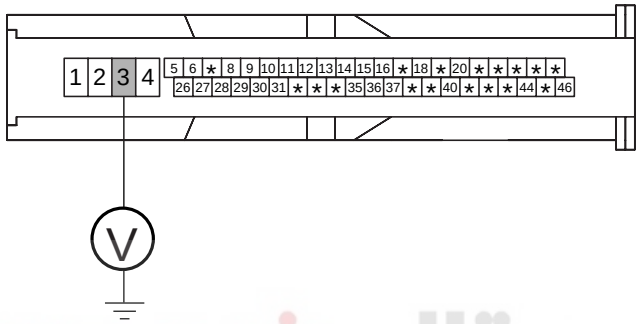
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POWER SUPPLY CIRCUIT INSPECTION EE1ABEE4

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Ignition "ON".
4. Measure voltage between terminal "3" of the HECU harness connector and chassis ground.

Specification : Approx. B+

<E41>



3. Battery(+)

EJBF504I

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check for damaged harness and open or short to GND between the battery terminal(+) and terminal "3" of the HECU harness connector. Check for open or blown 20 A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

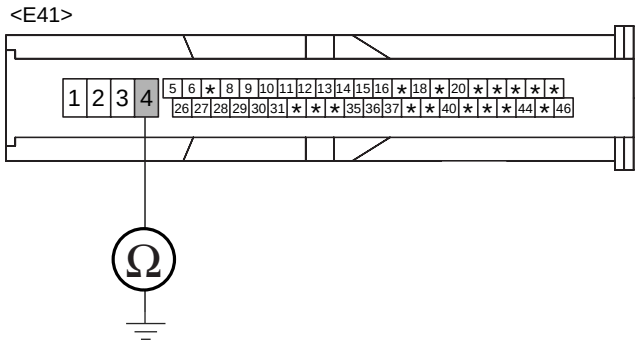
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GROUND CIRCUIT INSPECTION E7A60B91

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "4" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω



4. Ground

EJBF504J

4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal "4" of the HECU harness connector and chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E5EF4CDC

Refer to DTC C1101.

VERIFICATION OF VEHICLE REPAIR E9842ECE

Refer to DTC C1101.

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DTC C2308 FL INLET VALVE MALFUNCTION
DTC C2316 FR INLET VALVE MALFUNCTION
DTC C2324 RL INLET VALVE MALFUNCTION
DTC C2332 RR INLET VALVE MALFUNCTION

COMPONENT LOCATION E2EDFE20

Refer to DTC C1235.

GENERAL DESCRIPTION E6A0CE75

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC DESCRIPTION EFA3E48E

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

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DTC DETECTING CONDITION E4B5784B

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case 1	Monitoring Period	• Continuous	
	Enable Conditions	• The electrical feedback signal does not match the actuation signal for the corresponding valve for more than 30 ms. - Current controlled valves and under voltage conditions :detection time is 80 ms	
Case 2	Monitoring Period	• Immediately after power on • every 20 s - The Test is canceled if any control, valve actuation takes place or if the Vehicle is in motion and the BLS is on.	
	Enable Conditions	• A Fault is found if UVR is not within 0.1*battery voltage < valve relay voltage < 0.8*battery voltage • A Fault is found if valve relay voltage ≥ 0.2*battery voltage. - After that all valves are switched on sequential, valve relay voltage and valve feedback is measured.	
Case 3	Monitoring Period	• The Valve and Pump motor Test is performed once after ignition on if vehicle speed is > = 15 km/h.	
	Enable Conditions	• The valve and pump motor test detects electrical actuation malfunction of ABS valves. The test actuates all valves in series (to detect short cuts or shunts between the valve lines). Faults are detected if there is an error during the test.	
Case 4	Monitoring Period	• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10min after power up or end of control 1) No BLS is applied 2) Brake pressure is < 10 bar 3) Vehicle speed > 15 km/h 4) Vehicle acceleration > 0.5 m/s² 5) Supply voltage > 11 volts.	
	Enable Conditions	• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost defective coils or malfunction of the valve driver, a failure is reconized.	
Fail Safe		• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESP function is prohibited. • ABS/EBD/ESP warning lamp is turned ON.	

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MONITOR ACTUATION TEST EEF90251

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

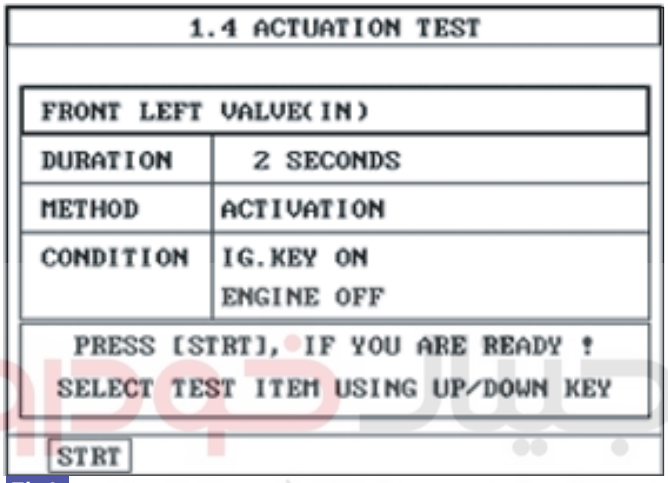


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"
Ex) Actuation Test on Front left valve(in)

EJBF504L

5. Does a inlet valve operate normally?

YES

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to the pplicable troubleshooting procedure.

NO

▶ Go to "Component Inspection" procedure.

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COMPONENT INSPECTION E04AD91C

1. Ignition "OFF".
2. Engine "ON".
3. Start and drive vehicle in gear and maintain vehicle speed is approx. 15 km/h or more(9 mph or more).
4. Does warning lamp remain On?

YES

▶ Substitute with a known-good HECU and check for proper operation. If problem is corrected, replace HECU and then go to "Verification of Vehicle Repair" procedure.

NO

▶ Fault is intermittent caused by faulty HECU or was repaired and HECU memory was not cleared. Go to the applicable troubleshooting procedure.

VERIFICATION OF VEHICLE REPAIR EF8FAFBD

Refer to DTC C1101.

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DTC C2312 FL OUTLET VALVE MALFUNCTION
DTC C2320 FR OUTLET VALVE MALFUNCTION
DTC C2328 RL OUTLET VALVE MALFUNCTION
DTC C2336 RR OUTLET VALVE MALFUNCTION

COMPONENT LOCATION E07DF69D

Refer to DTC C1235.

GENERAL DESCRIPTION EDA2E3B7

Refer to DTC C2308.

DTC DESCRIPTION EAA8CB86

Refer to DTC C2308.

DTC DETECTING CONDITION EEDA39AA

Refer to DTC C2308.

MONITOR ACTUATION TEST E7199AF4

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

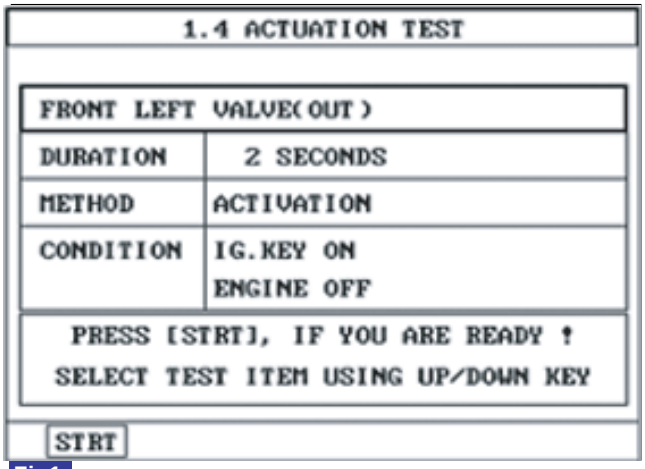


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"
Ex) Actuation Test on Front left valve(out)

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5. Does a inlet valve operate normally?

YES

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to the pplicable troubleshooting procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION E5968882

Refer to DTC C2308.

VERIFICATION OF VEHICLE REPAIR EF3EAA84

Refer to DTC C1101.

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DTC C2366 TCS VALVE PRIMARY (USV1) ERROR
DTC C2370 TCS VALVE SECONDARY (USV2) ERROR
DTC C2372 ESP VALVE 1 (HSV1) ERROR
DTC C2374 ESP VALVE 2 (HSV2) ERROR

COMPONENT LOCATION EFC2F71C

Refer to DTC C1235.

GENERAL DESCRIPTION E1487F9A

The HECU is composed of a ECU (Electronic Control Unit) and an HCU(Hydraulic Control Unit), so the HECU hardware includes all solenoid valves inside the unit as well as the ECU. Solenoid valves are switched to ON, OFF by HECU when the ABS is activated. Solenoid valves function is to increase, decrease or maintain the hydralic pressure supplied to a wheel cylinder.

DTC DESCRIPTION EB893B66

The HECU monitors the operation of the valves by checking the drive circuit of the solenid valves, and then sets this code when the unexpcted drive voltage is detected. For example, the HECU sets the DTC if the electrical feedback signal does not match the actuation signal for the corresponding valve.

DTC DETECTING CONDITION EA4BCA75

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage monitoring	• Faulty HECU
Case 1	Monitoring Period	• Once after ignition on at standstill if the BLS is off • At vehicle speed ≥ 15 km/h if the BLS is on.	
	Enable Conditions	• The test actuates all valves in series to detect shorts or shunts between the valve lines. Faults are detected if there is an error during the test.	
Case 2	Monitoring Period	• The drift test executes only once during an ignition Cycle. The test is triggered if the following conditions are fulfilled : 10 min after power up or end of control 1) No BLS is applied 2) Brake pressure is < 10 bar 3) Vehicle speed > 15 km/h 4) Vehicle acceleration > 0.5 m/s² 5) Supply voltage > 11 volts.	
	Enable Conditions	• The drift test is executed only once during an ignition Cycle.If it detects partly shorted valve coils,almost defective coils or malfunction of the valve driver, a failure is reconized.	
Fail Safe		• Valve cannot be actuated or valve is incorrectly actuated. This may result in locked wheels or wheels without pressure. • ABS/EBD/ESP function is prohibited. • ABS/EBD/ESP warning lamp is turned ON.	

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MONITOR ACTUATION TEST EF242E85

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

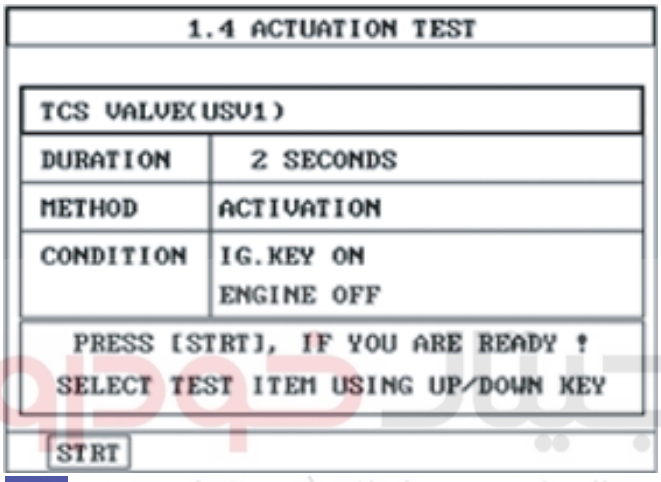


Fig 1) Test Condition : Ignition "ON" & Engine "OFF"
Ex) Actuation Test on TCS(USV) valve #1

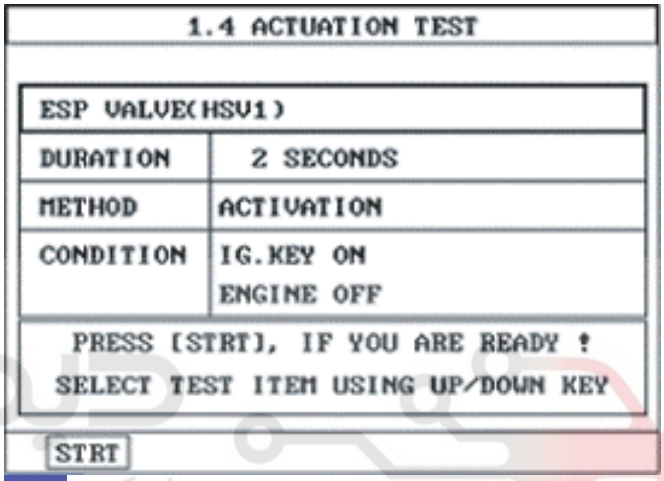


Fig 2) Test Condition : Ignition "ON" & Engine "OFF"
Ex) Actuation Test on ESP(HSV) valve #1

EJBF505B

5. Does a inlet valve operate normally?

YES

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to the pplicable troubleshooting procedure.

NO

▶ Go to "Component Inspection" procedure.

COMPONENT INSPECTION EDEB0B36

Refer to DTC C2308.

VERIFICATION OF VEHICLE REPAIR E99F31B5

Refer to DTC C1101.

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DTC C2402 MOTOR-ELECTRICAL

COMPONENT LOCATION ECF27E4C

Refer to DTC C1235.

GENERAL DESCRIPTION E2E7EBCC

The HECU supplies battery power to the electric motor with a motor relay which is controlled by the Electronic Control Unit(ECU). The electric motor pump supplies hydraulic pressure to all wheel brake calipers by operating the piston inside the pump.

DTC DESCRIPTION E0E3A242

The HECU monitors the pump motor relay or fuse open, open or short in motor or motor lock and then sets this code if a malfunction is detected. Warning lamp is turned OFF unless fault is detected any more when the IG KEY is turned ON again, and wheel speed is more than 15 km/h.

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DTC DETECTING CONDITION EC3B2B48

Item		Detecting Condition	Possible cause
DTC Strategy		• Voltage monitoring	• Open or short of power supply circuit (ABS1) • Faulty HECU
Case1 (Stop monitor)	Monitoring Period	• Stop monitor is active if the pump is off i.e. not actuation and no Slowdown.	
	Enable Conditions	• A failure is detected if the pump motor voltage > 2.0 V for more than 1 s.	
	Fail Safe	• The return pump does not work correct. • The ABS/ESP functions are inhibited, reduced function of the EBD system. • The ABS/EBD/ESP warning lamps are activated.	
Case2 (Pump run monitor)	Monitoring Period	• The monitor is active if the pump is switched on	
	Enable Conditions	• A failure is detected if the pump motor voltage < (battery voltage - 4.0 V) for more than 100ms.	
	Fail Safe	• Pressure decrease (outlet valve) is no longer possible. • The ABS/ESP functions are inhibited, reduced function of the EBD system. • The ABS/EBD/ESP warning lamps are activated.	
Case3 (Pump slowdown monitor)	Monitoring Period	• Monitor is always active in the transition "pump on → pump off"	
	Enable Conditions	• After the end of the actuation of the motor relay has, the pump motor is still in motion and is generating a Voltage during it.s slowdown. The generated UM is monitored for a certain time on high level. The time depends on the supply voltage and is in the range of t = 30 ms to t = 125 ms.If the slow down condition isn.t met, the pump is activated again (see actuation times below) and the slowdown time is measured again. This is repeated for maximum n = 3 times. If, after the last pump activation, the pump motor slowdown time is still to short, a failure is detected. Actuation times: 1st actuation: 200 ms 2nd actuation: 1000 ms 3rd actuation: 3000 ms	
	Fail Safe	• Pressure decrease (outlet valve) is no longer possible. • The ABS/ESP functions are inhibited, reduced function of the EBD system. • The ABS/EBD/ESP warning lamps are activated.	

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MONITOR ACTUATION TEST EA6AF371

1. Connect scantool to Data Link Connector(DLC)
2. Ignition "ON" & Engine "OFF".
3. Select the "Actuation Test" mode on the scantool.
4. Inspect opearating status of inlet valve with Actuation Test.

Specification : It's normal if operating sound is heard.

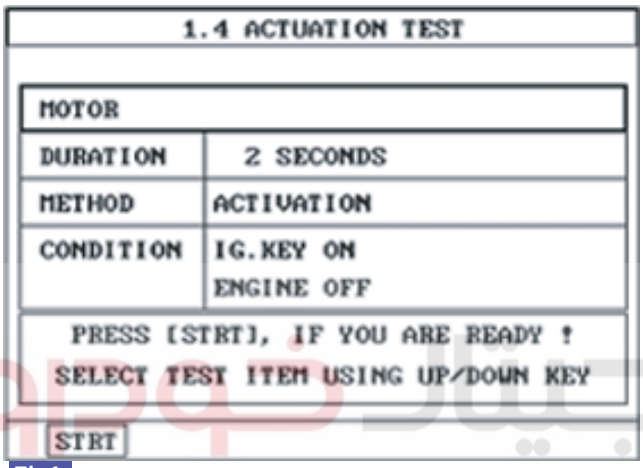


Fig1

Fig 1) Test Condition : Ignition "ON" & Engine "OFF"
Ex) Actuation Test on motor

EJBF505J

5. Does a inlet valve operate normally?

YES

▶ Fault is intermittent caused by faulty valve or was repaired and HECU memory was not cleared. Go to the pplicable troubleshooting procedure.

NO

▶ Go to "Component Inspection" procedure.

TERMINAL & CONNECTOR INSPECTION E5F5C0DD

Refer to DTC C1102.

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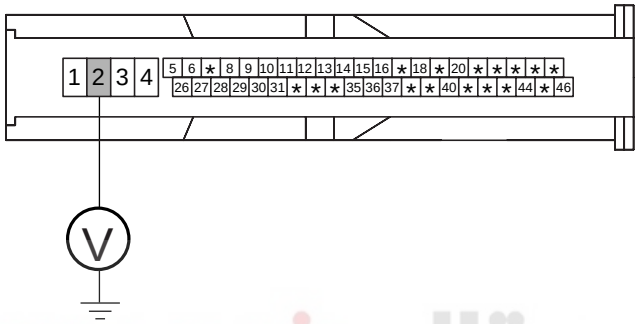
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POWER SUPPLY CIRCUIT INSPECTION E4BC141A

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Ignition "ON".
4. Measure voltage between terminal "2" of the HECU harness connector and chassis ground.

Specification : Approx. B+

<E41>



2. Battery(+)

EJBF505K

5. Is the measured voltage within specifications?

YES

▶ Go to "Ground Circuit Inspection" procedure.

NO

▶ Check for damaged harness and open or short to GND between the battery terminal(+) and terminal "2" of the HECU harness connector. Check for open or blown 40A ABS fuse referring to "Circuit Diagram". Repair as necessary and then go to "Verification of vehicle Repair" procedure.

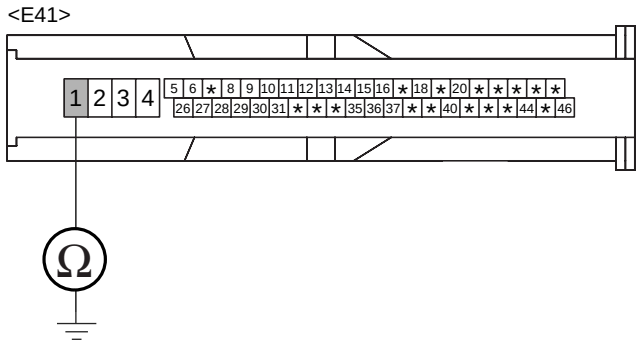
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GROUND CIRCUIT INSPECTION E88A059B

1. Ignition "OFF".
2. Disconnect HECU connector.
3. Measure resistance between terminal "1" of the HECU harness connector and chassis ground.

Specification : Approx. below 1 Ω



1. Ground

EJBF505L

4. Is the measured resistance within specifications?

YES

▶ Go to "Component Inspection" procedure.

NO

▶ Check for damaged harness and poor connection between terminal "1" of the HECU harness connectorand chassis ground. Repair as necessary and then go to "Verification of vehicle Repair" procedure.

COMPONENT INSPECTION E925A7D1

Refer to DTC C2308.

VERIFICATION OF VEHICLE REPAIR EAD700FD

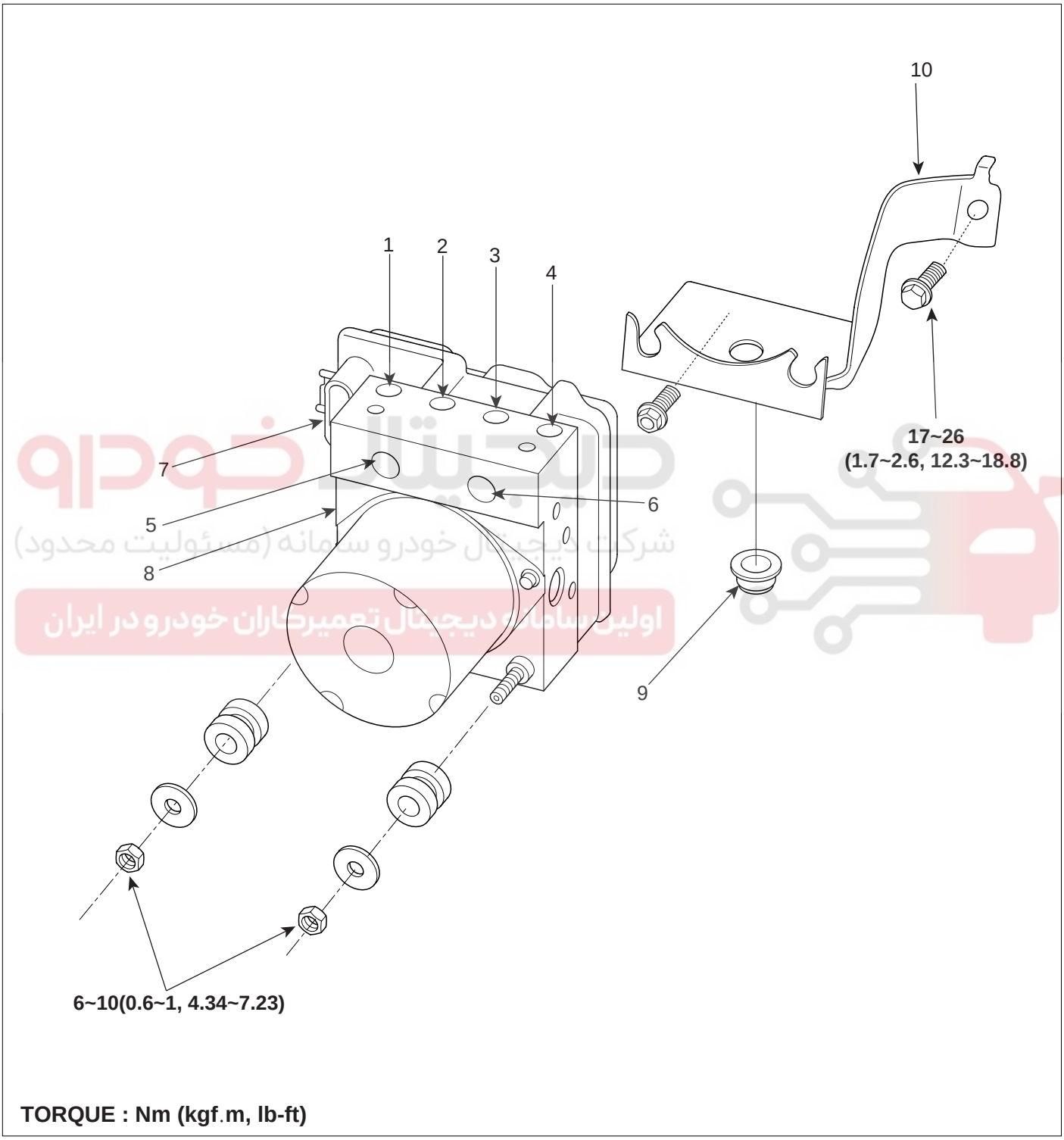
Refer to DTC C1101.

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ANTI-LOCK BRAKING SYSTEM CONTROL MODULE

COMPONENTS E02FD3A6



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

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

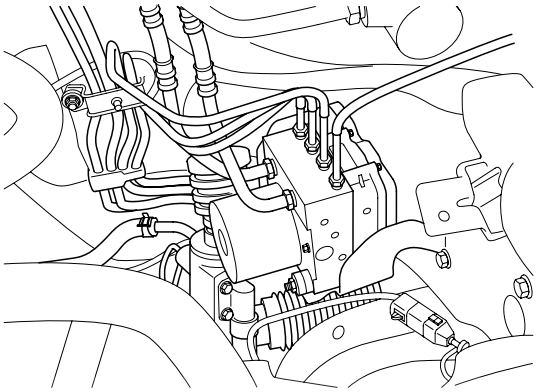
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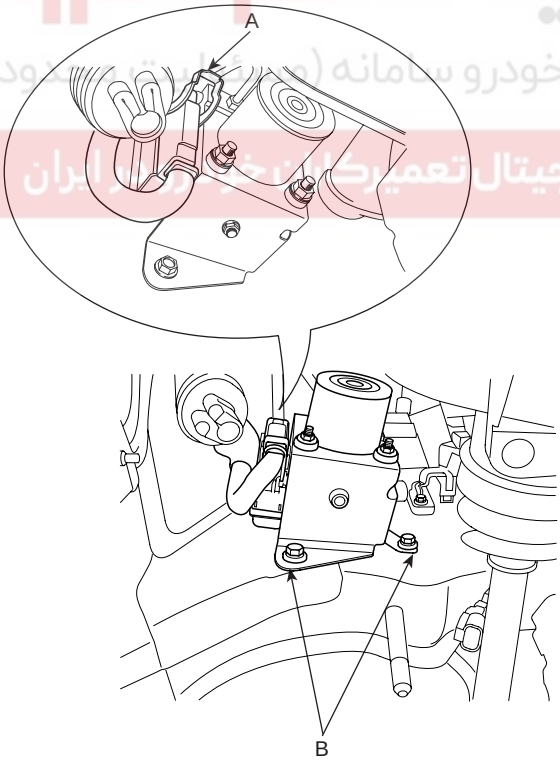
REMOVAL E93F3ECB

1. Remove the air cleaner. (Reger to 'Master cylinder Removal')
2. Disconnect the brake tube from the HECU by unlocking the nuts counterclockwise with a spanner.



KJRE502T

3. Disconnect the connector(A) from the HECU.



KJBF502K

4. Remove the two HECU brake mounting bolts(B) , and then disassemble the HECU with the 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 two HECU mounting nuts and washer, and then remove the bracket.

INSTALLATION E976137A

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

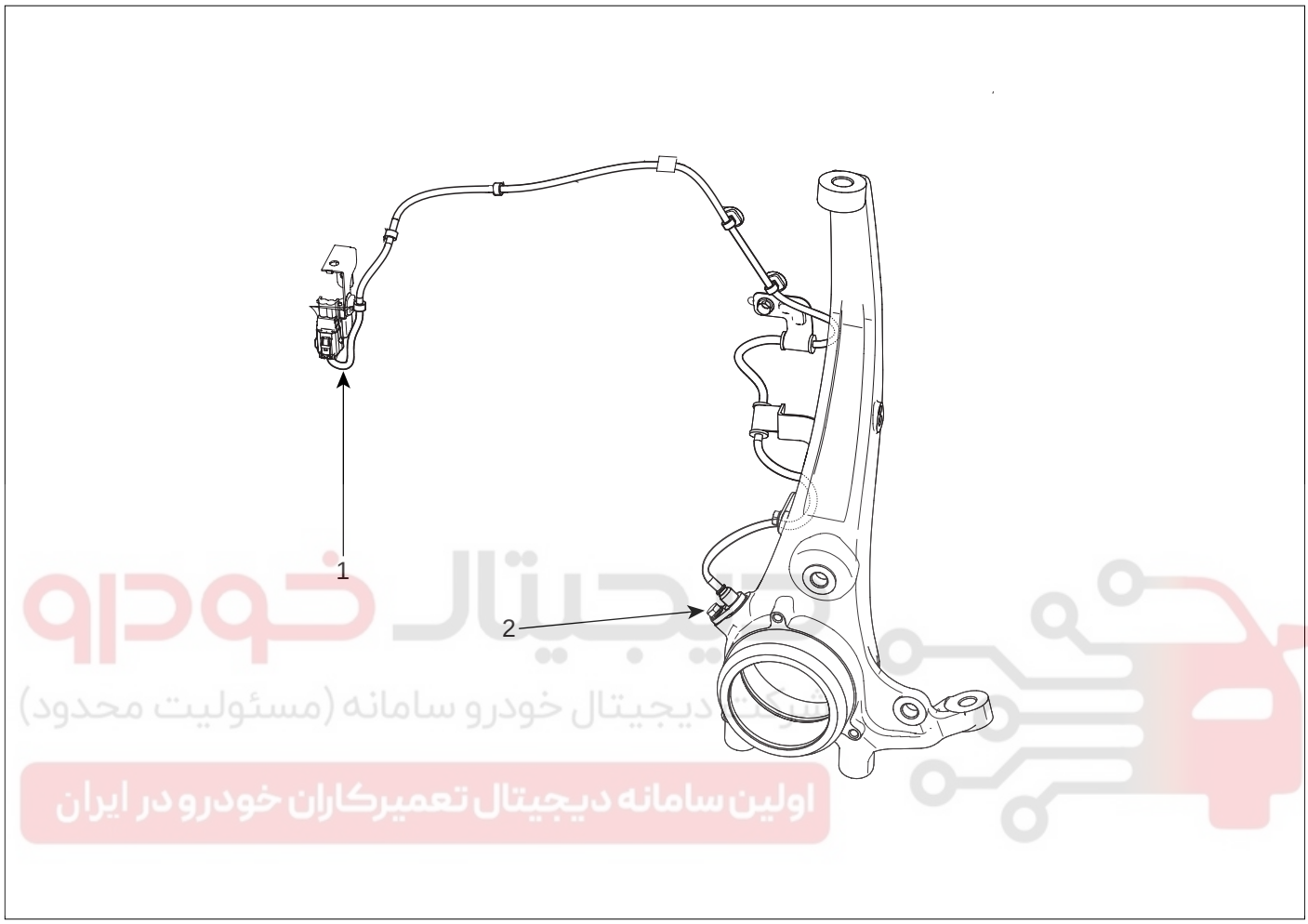
Tighterning torque
HECU mounting nut :
6~10 Nm (0.6~1 kgf·m, 4.34~7.23 lb-ft)
HECU bracket mounting bolt:
17~26 Nm (1.7~2.6 kgf·m, 12.3~18.8 lb-ft)

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FRONT WHEEL SPEED SENSOR

COMPONENTS E810AEE9



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

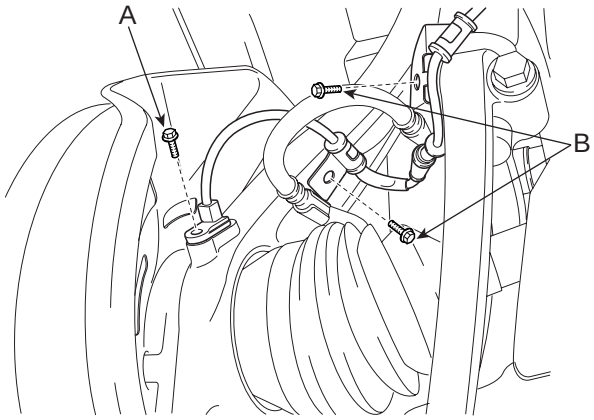
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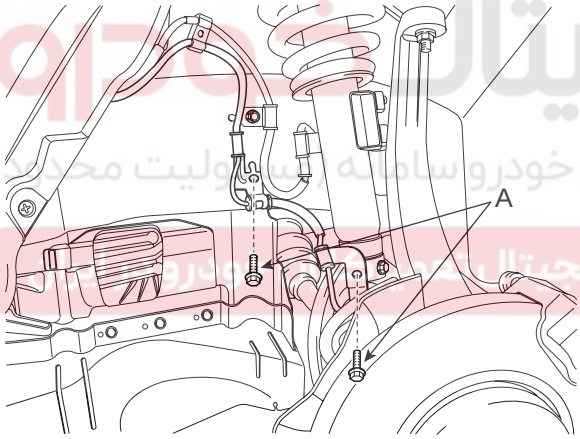
REMOVAL EBED7949

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



KJBF534A

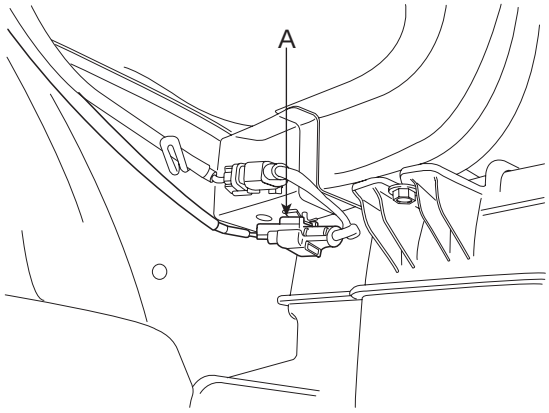
2. Remove the two wire bracket bolts(A).



EJBF500S

3. Remove the front wheel guard.

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



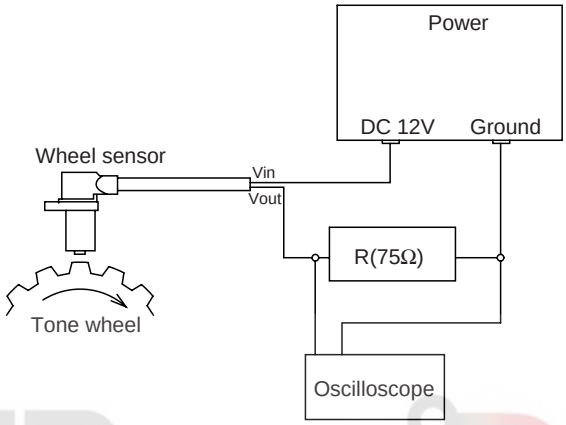
KJBF532A

INSPECTION E9BCD8AA

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

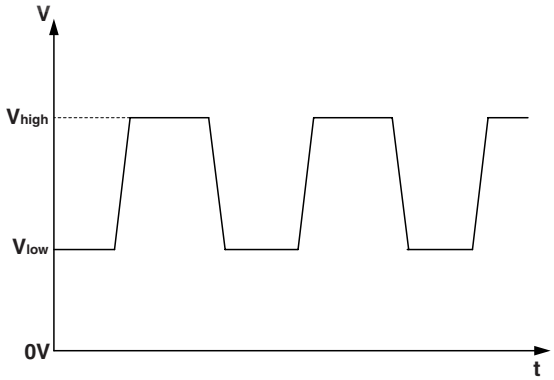
CAUTION

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



EJRF501Z

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



KJQE260B

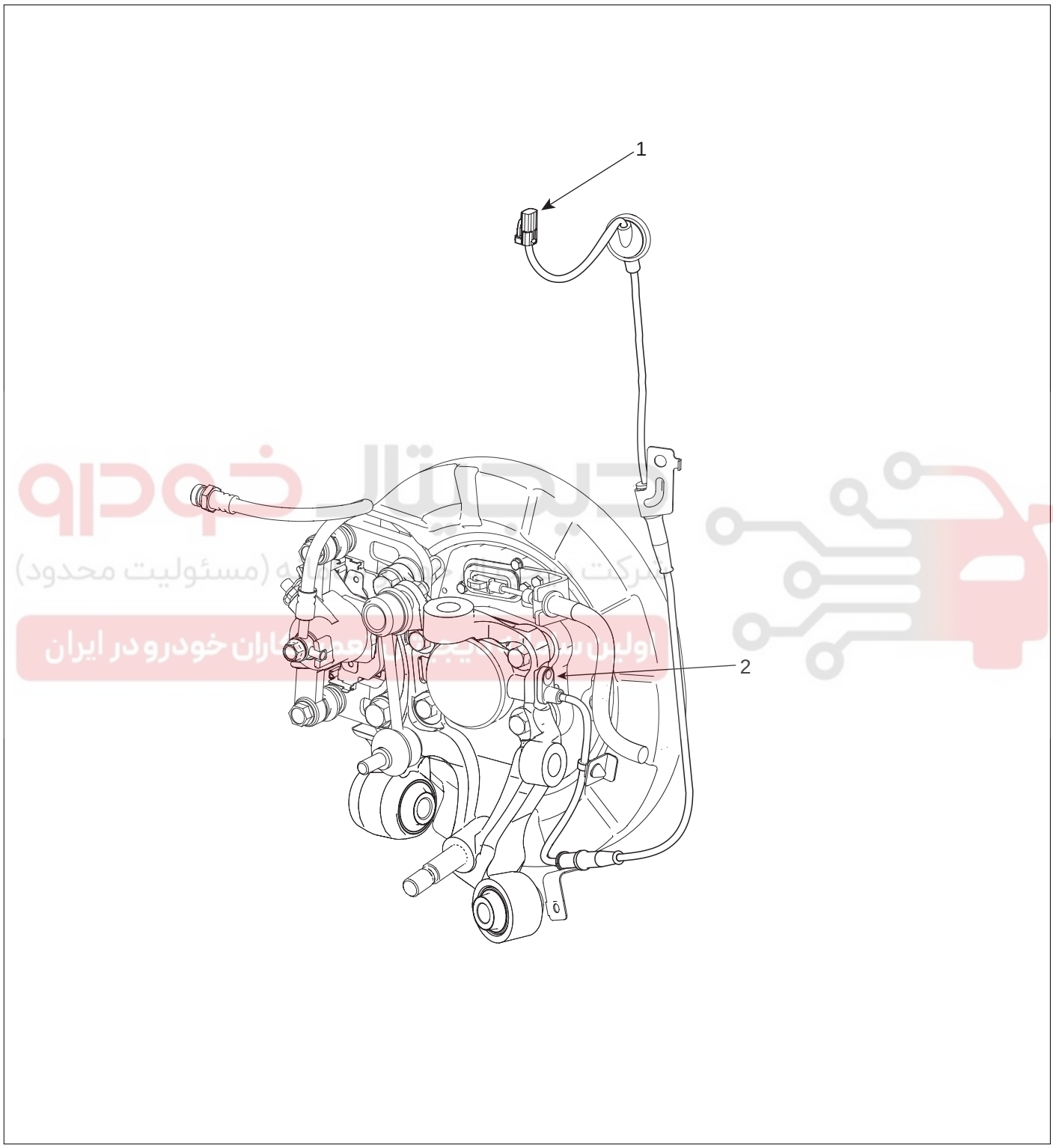
- V_low : 0.44 V ~ 0.63 V
- V_high : 0.885 V ~ 1.26 V
- Frequency range : 1~2,500 Hz

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REAR WHEEL SPEED SENSOR

COMPONENTS EE75F6B4



1. Rear wheel speed sensor connector
2. Rear wheel speed sensor

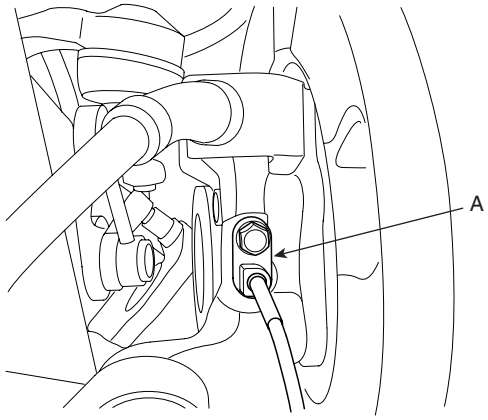
EJBF500T

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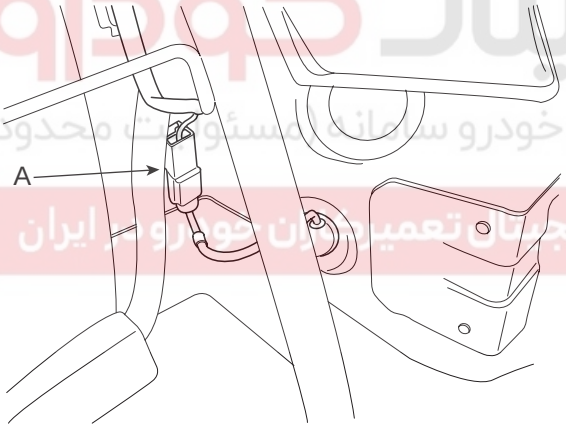
REMOVAL EEF61CCE

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



KJRE503W

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



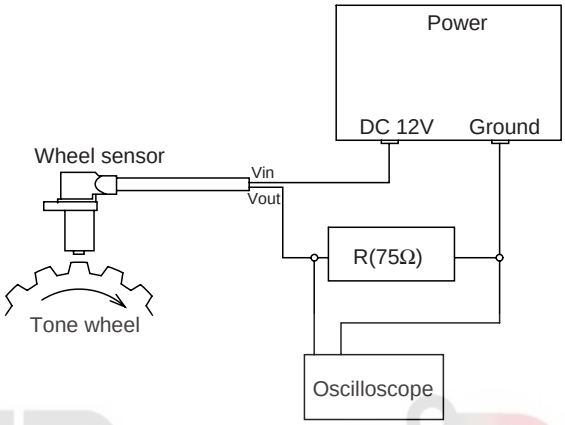
KJBF517A

INSPECTION EFD3016E

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

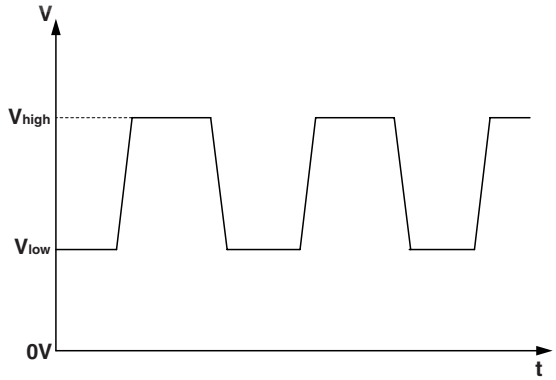
CAUTION

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



EJRF501Z

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



KJQE260B

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

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EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION)

DESCRIPTION E3DD0C34

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.

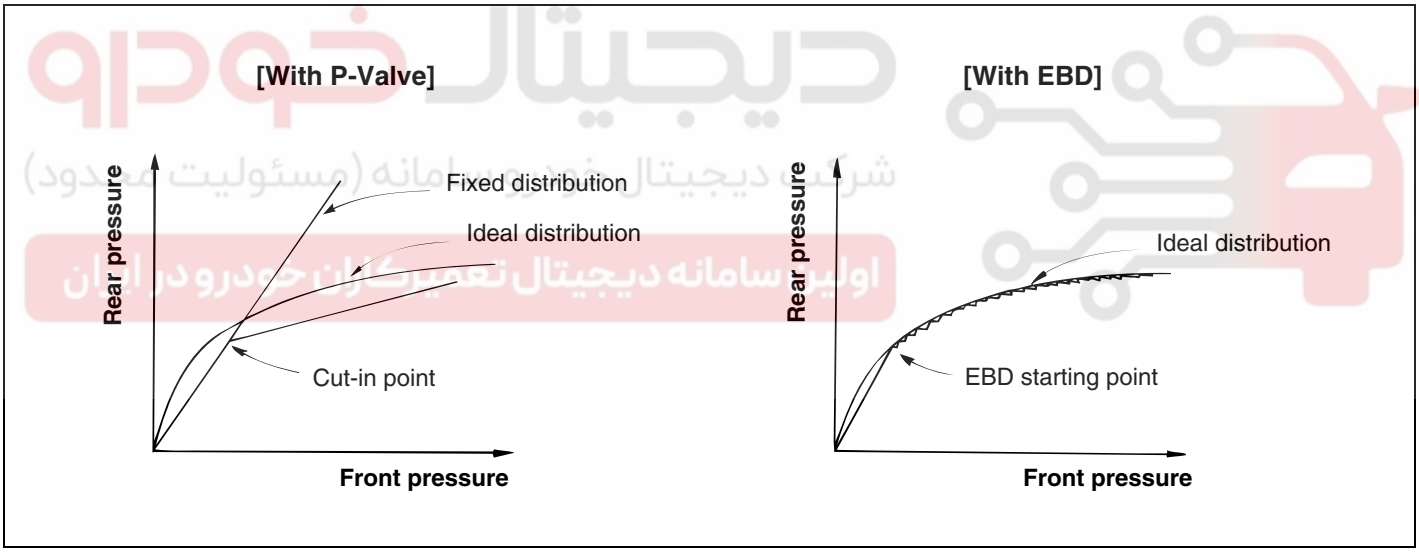
EBD controlled by the ABS Control Module, calculates the slip ratio of each wheel at all times and controls the brake pressure of the rear wheels not to exceed that of the front wheels.

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

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ESP(ELECTRONIC STABILITY PROGRAM) SYSTEM

DESCRIPTION OF ESP E7575EF0

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

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

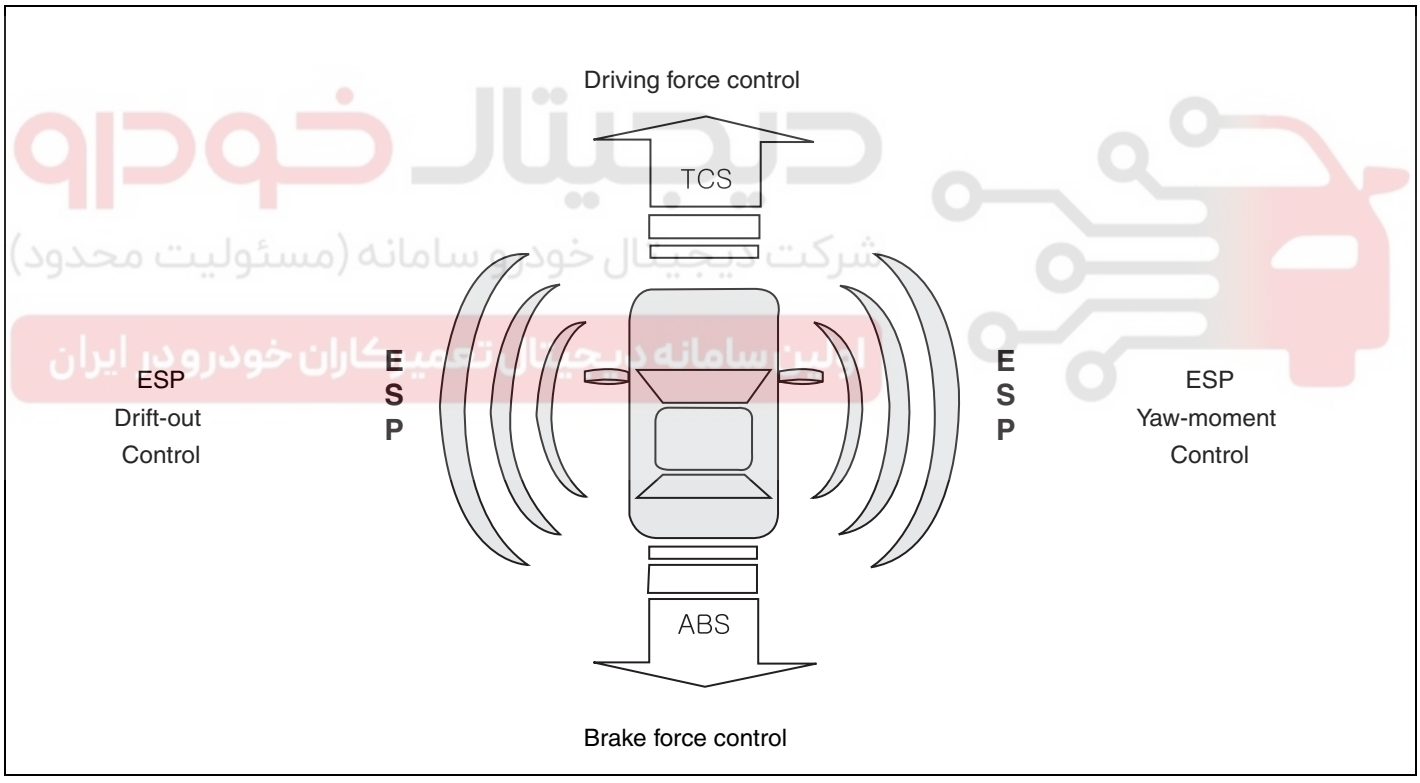
ESP adds a further function known as Active Yaw Control (AYC) to the ABS, TCS, EBD and ESP functions. Whereas the ABS/TCS function controls wheel slip during braking and acceleration and, thus, mainly intervenes in the longitudinal dynamics of the vehicle, active yaw control stabilizes the vehicle about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

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

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

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

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



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DESCRIPTION OF ESP CONTROL

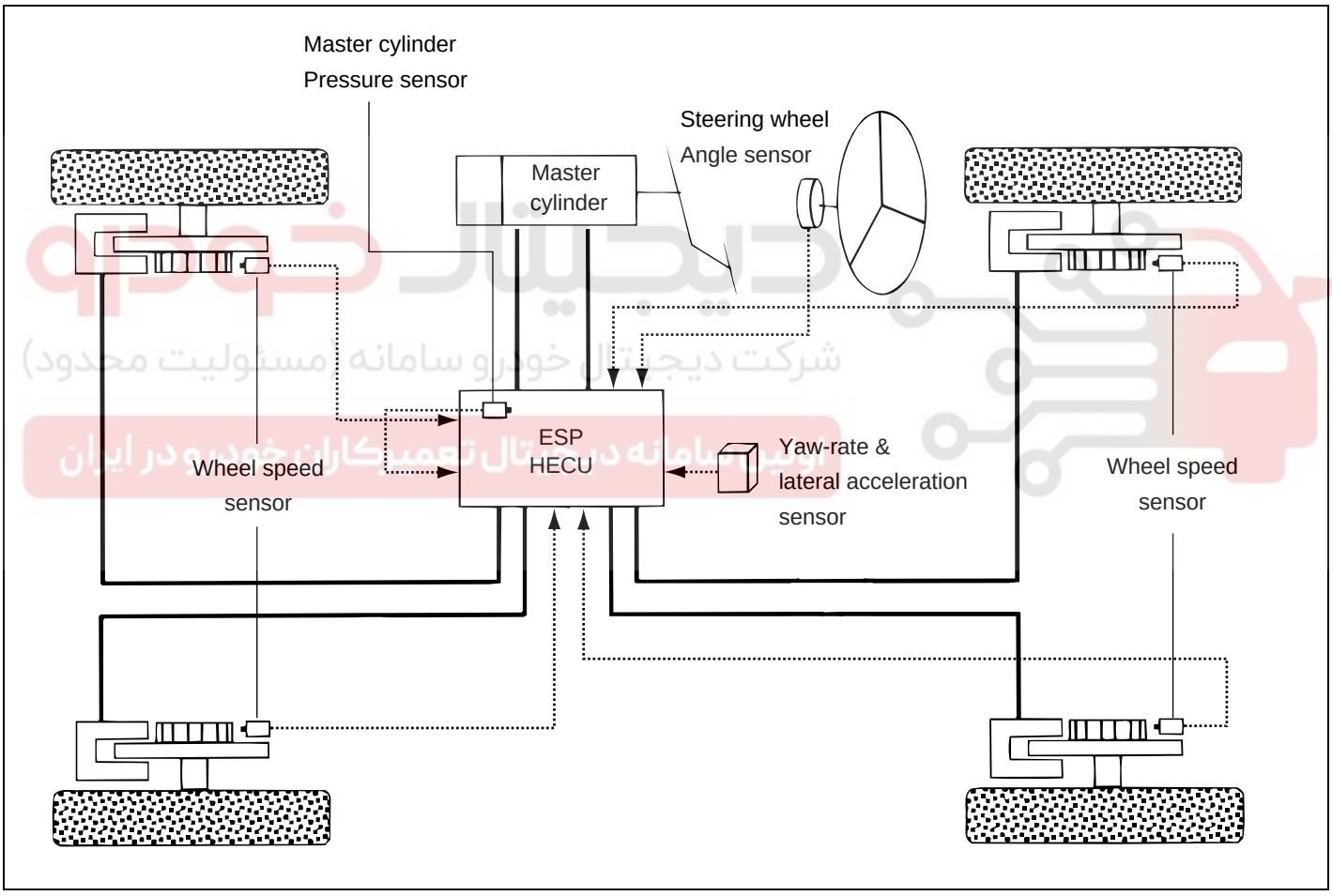
ESP system includes ABS/EBD, TCS and AYC function.

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

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

AYC function prevents unstable maneuver of the vehicle. To determine the vehicle maneuver, AYC function uses the maneuver sensor signals(Yaw Rate Sensor, Lateral Acceleration Sensor, Steering Wheel Angle Sensor).If vehicle maneuver is unstable (Over Steer or Under Steer), AYC function applies the brake pressure on certain wheel, and send engine torque reduction signal by CAN.

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



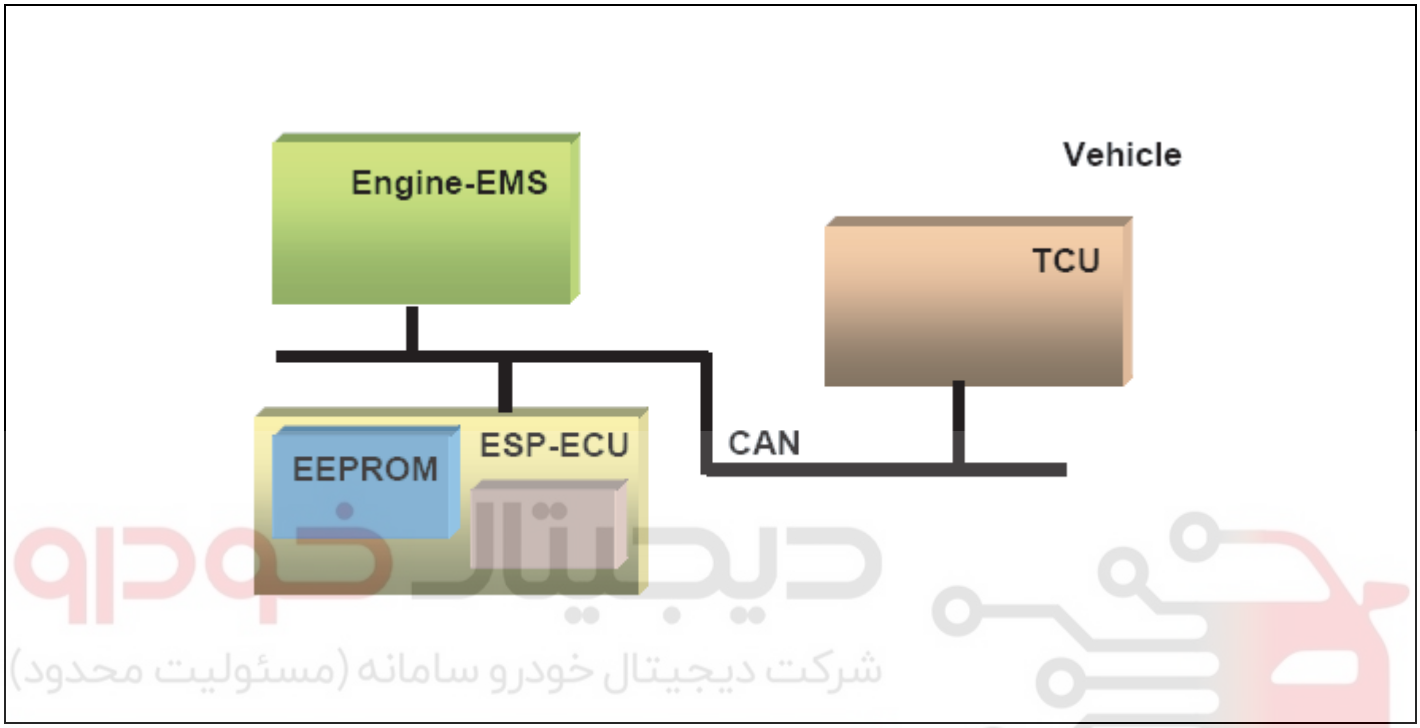
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VARIANT CODING

A hardware difference of ECU does not exist according to the specification of the vehicle, but a software changes according to deference of vehicle parameter. The ESP stores variant code (data of engine, displacement volume , T/M) at the ECU memory. Since then an ESP uses the stored data.

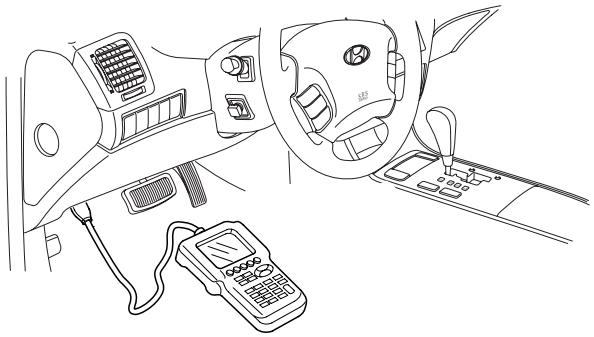


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شرکت دیجیتال خودرو سامانه (مسئولیت محدود)
اولین سامانه دیجیتال تعمیرکاران خودرو در ایران

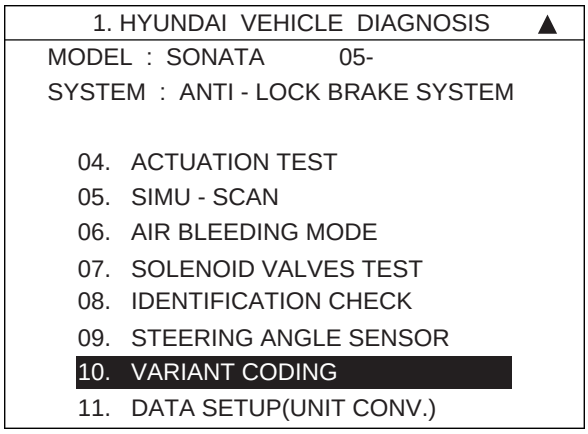
***PROCEDURE**

1. Install a EMS/TCU/ESP normally.
2. Connect the hi-scan (pro) to the data link connector located underneath the dash panel.



EJBF500R

3. Select vehicle name.
4. Select ANTI-LOCK BRAKE SYSTEM.
5. Select the variant coding.

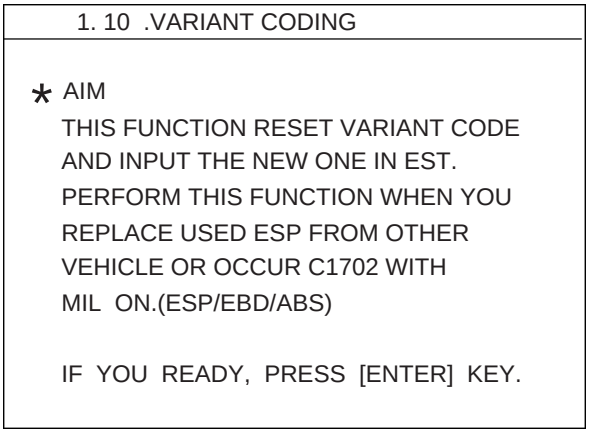


EJRF703H

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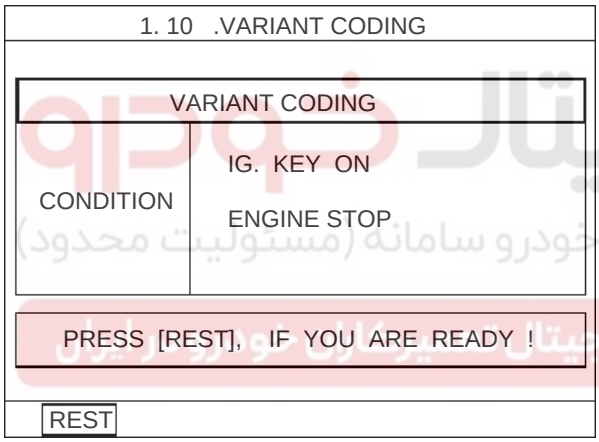
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6. Follow the next procedure according to the comment .



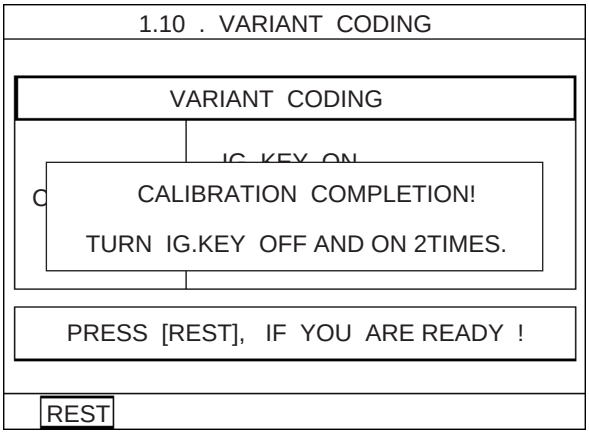
EJBF505O

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



EJRF703J

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



EJRF703K

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

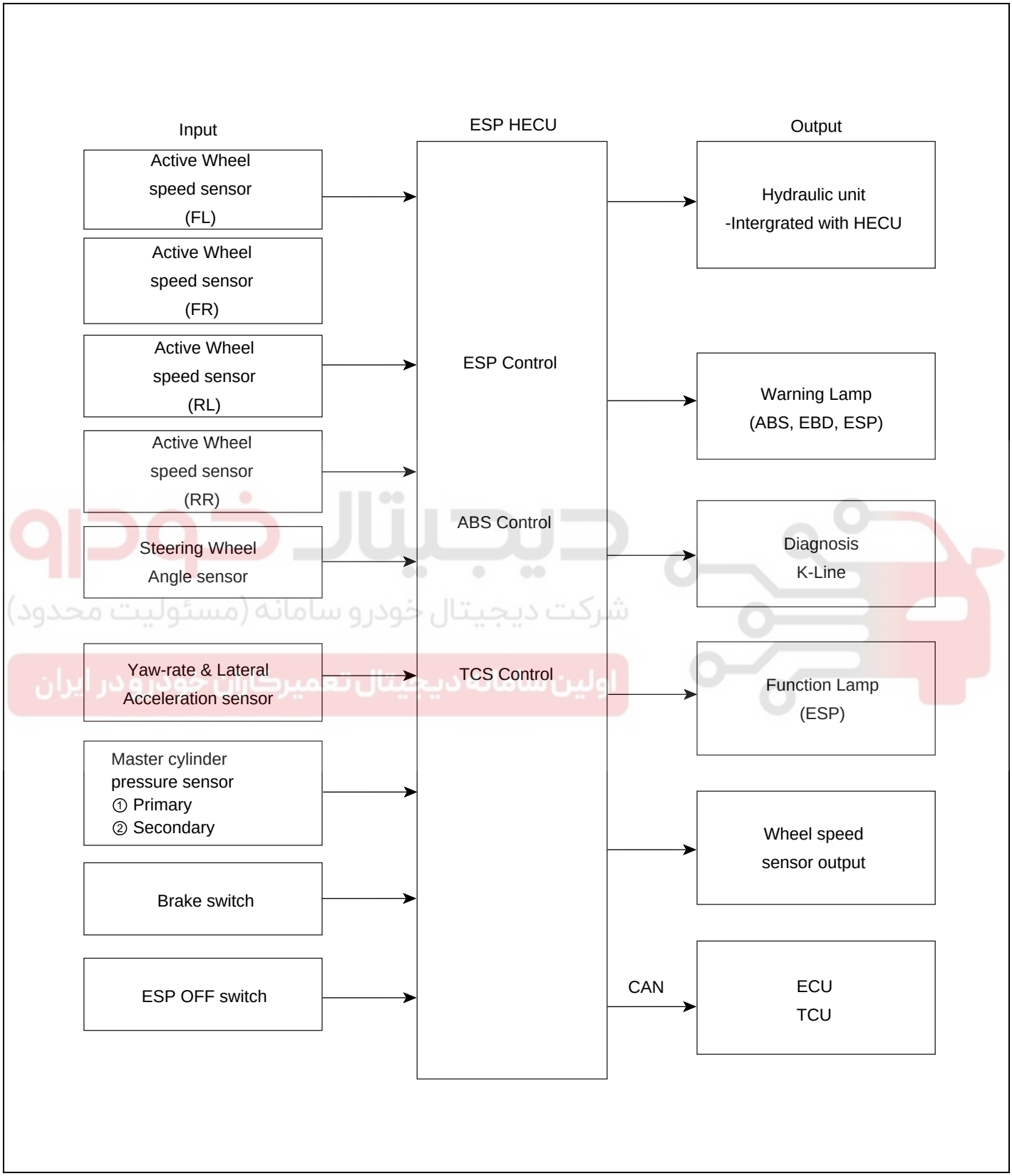
CAUTION

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

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INPUT AND OUTPUT DIAGRAM



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ESP OPERATION MODE E0CBEBB5

1. STEP 1
   The ESP analyzes the intention of the driver.

Position of steering wheel
+ Vehicle speed
+ Acceleration pedal → ECU decides the intention of the driver.

EJRF502B

2. STEP 2
   It analyzes the movement of the ESP vehicle.

Vehicle rotation speed
+ Operated power to the side → ECU decides movement of the ESP vehicle.

EJRF502C

3. STEP 3
   It controls a vehicle posture control through the ESP braking power.
   - The ECU calculates the needed countermeasure.
   - The hydraulic unit controls Independently the braking power of each wheel.
   - The ESP adjusts engine output through an engine and communication line to be connected.

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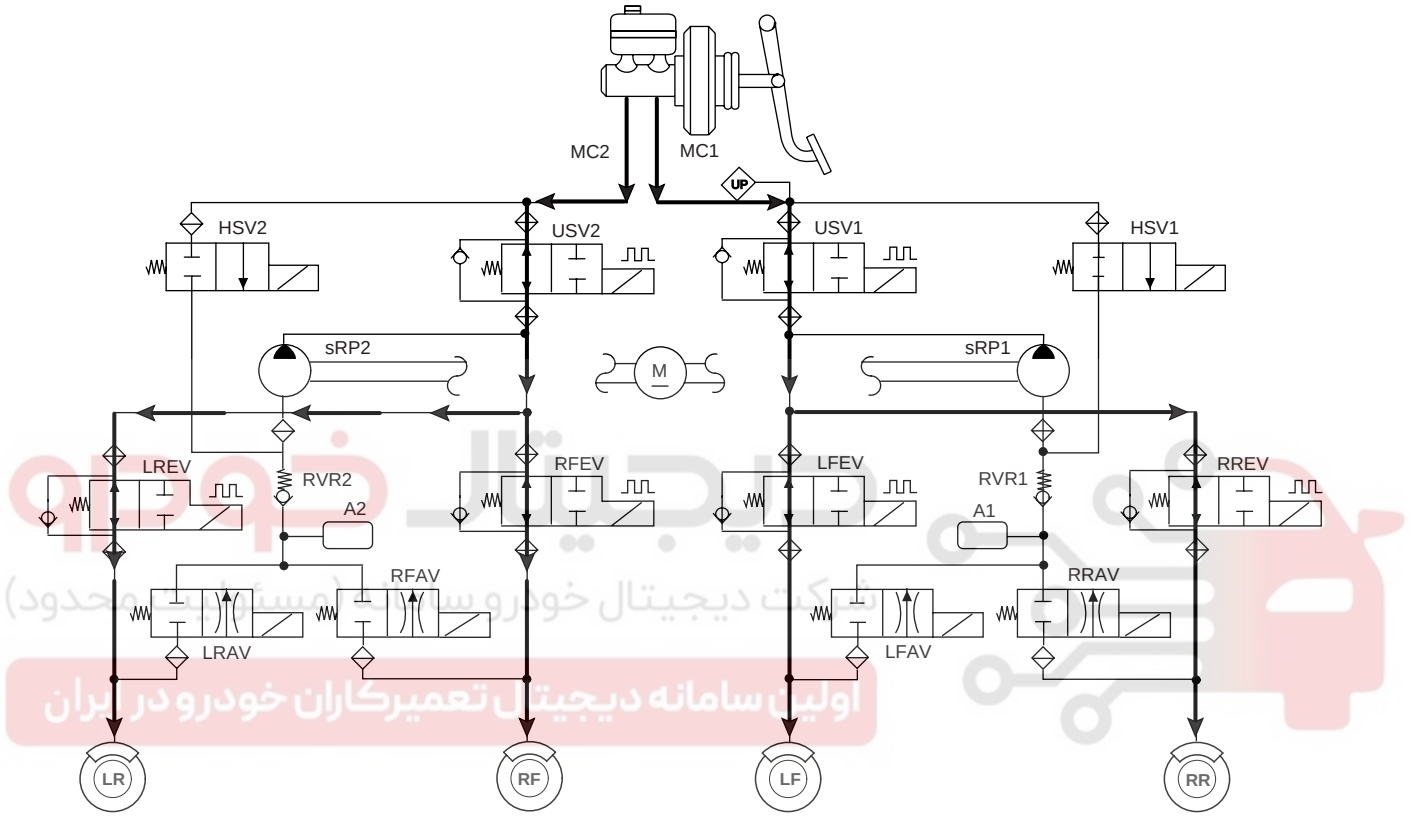
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ESP OPERATION MODE

1. ESP Non-operation-Normal braking.

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



EJRF703R

NOTE

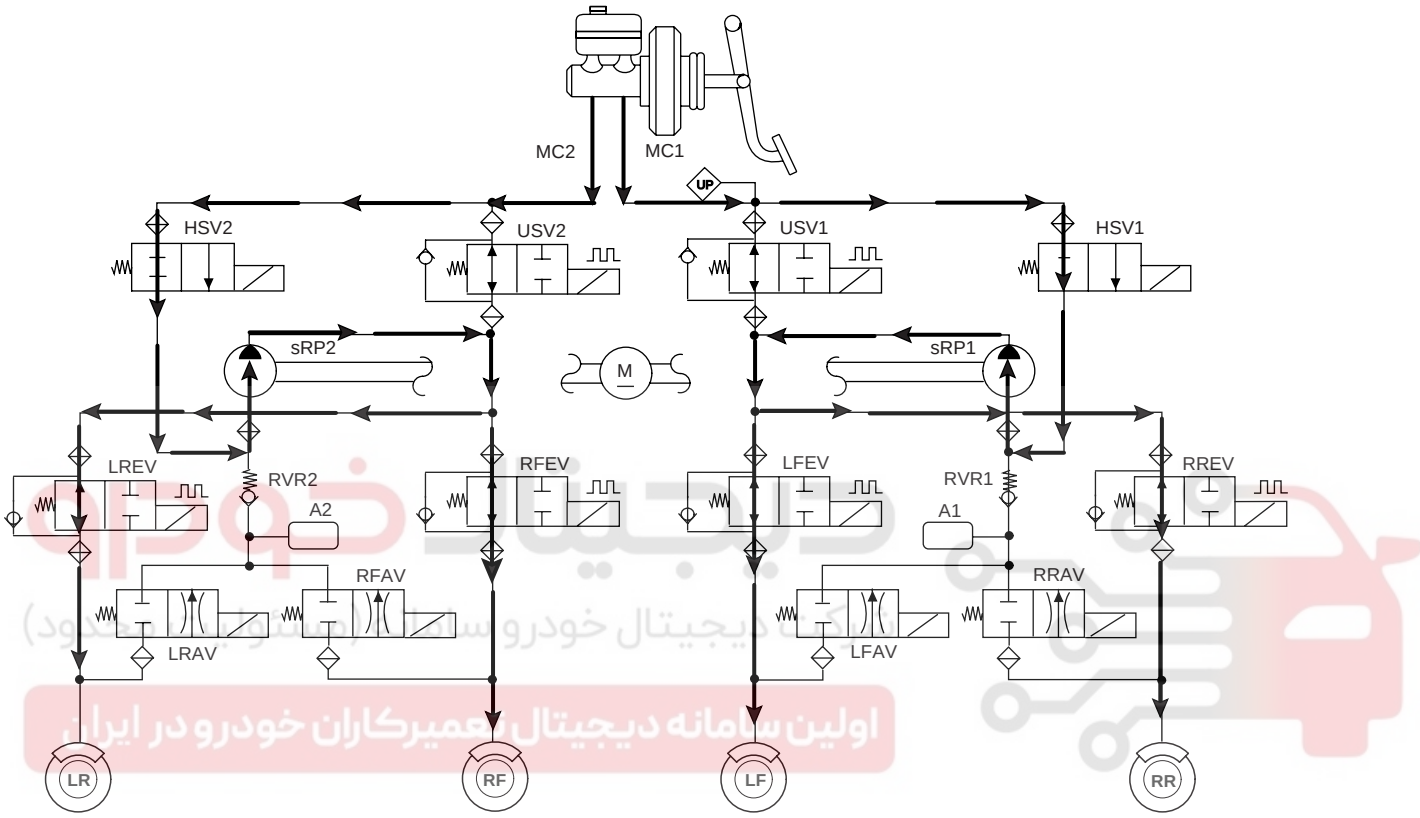
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

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2. ESP INCREASE MODE

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



EJRF703S

NOTE

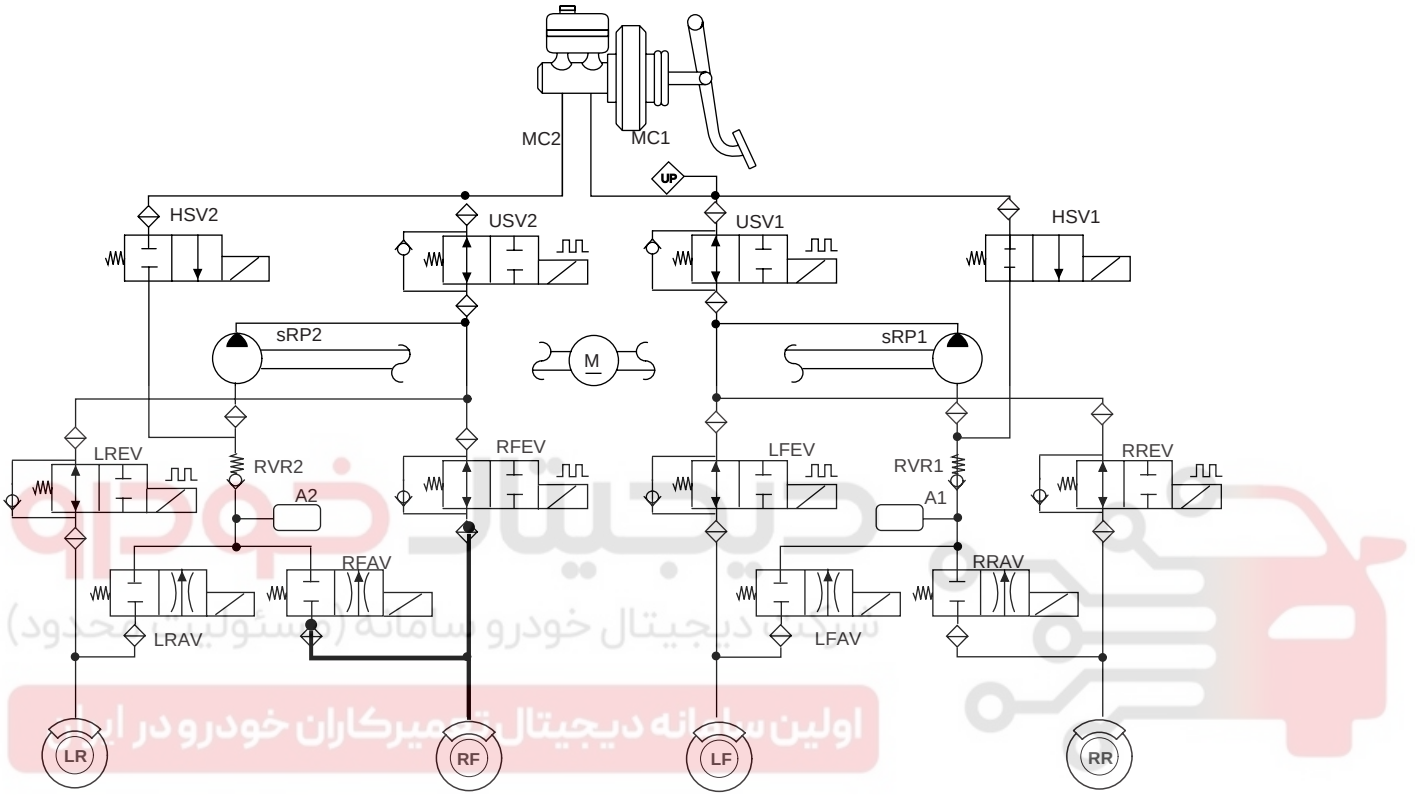
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

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

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



KJRE501N

NOTE

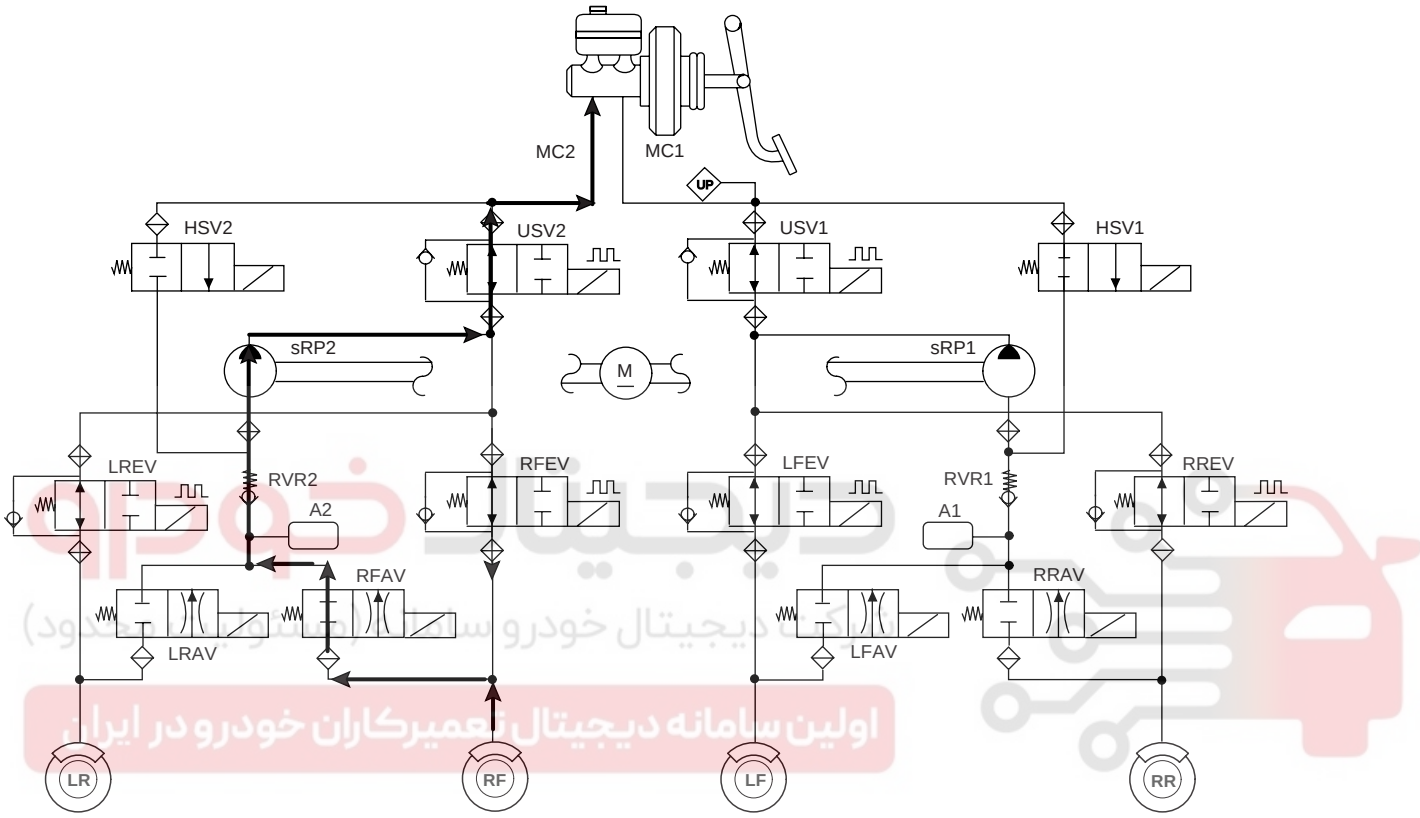
EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

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4. ESP DECREASE MODE (FR is only controlled)

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



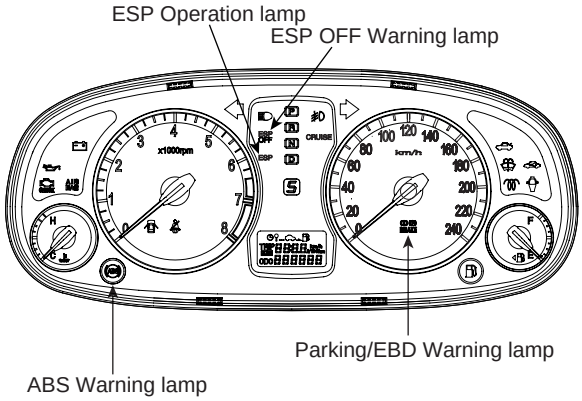
EJRF703T

NOTE

EV : Inlet Valve
AV : Outlet Valve
LR : Rear left wheel
RF : Front right wheel
LF : Front left wheel
RR : Rear right wheel
PE : Pump motor
USV : Pilot Valve
HSV : High pressure Switch Valve

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EJBF500N

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)

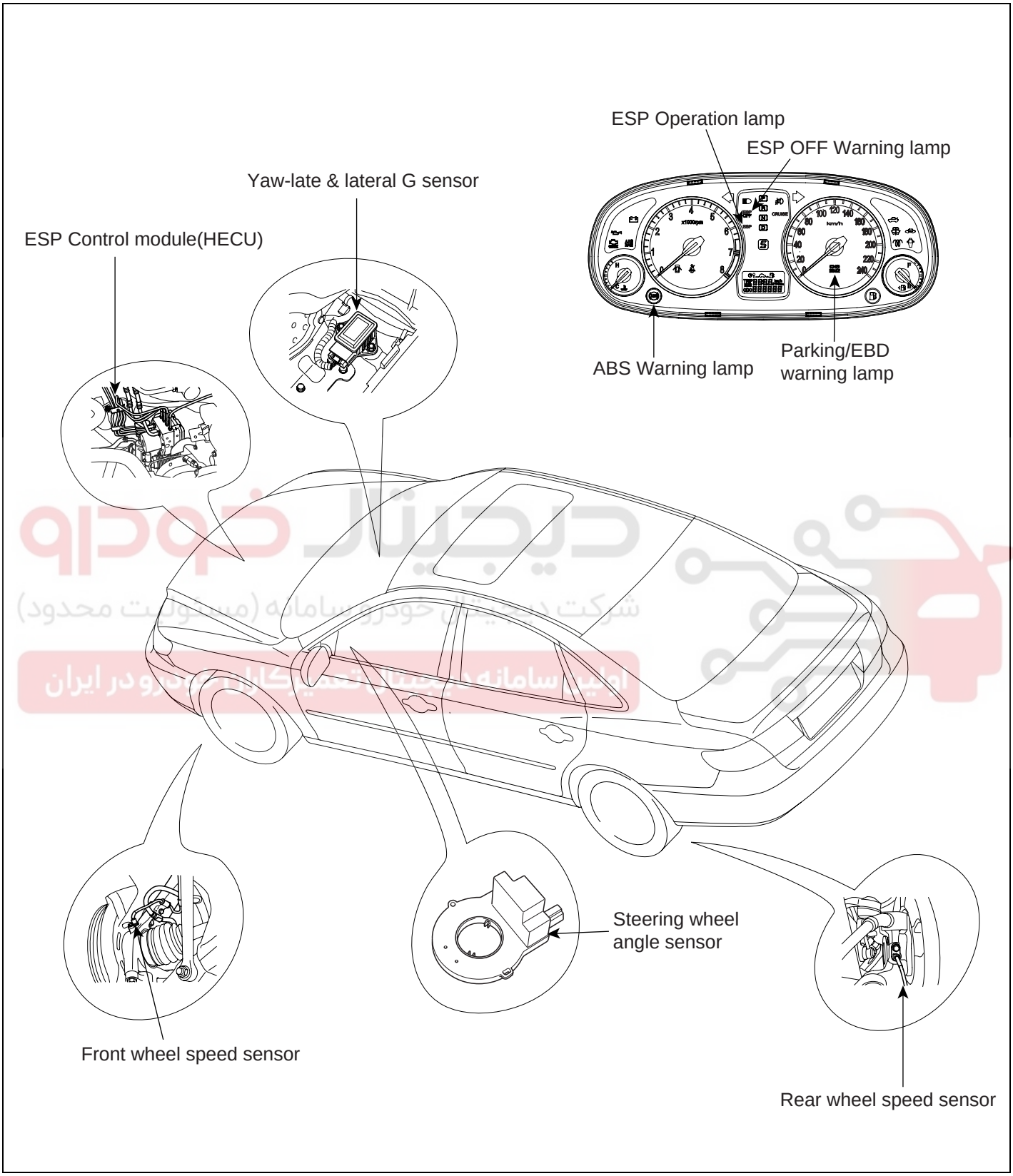
ESP ON/OFF SWITCH (ESP SYSTEM)

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.

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COMPONENTS EB2C3FE0

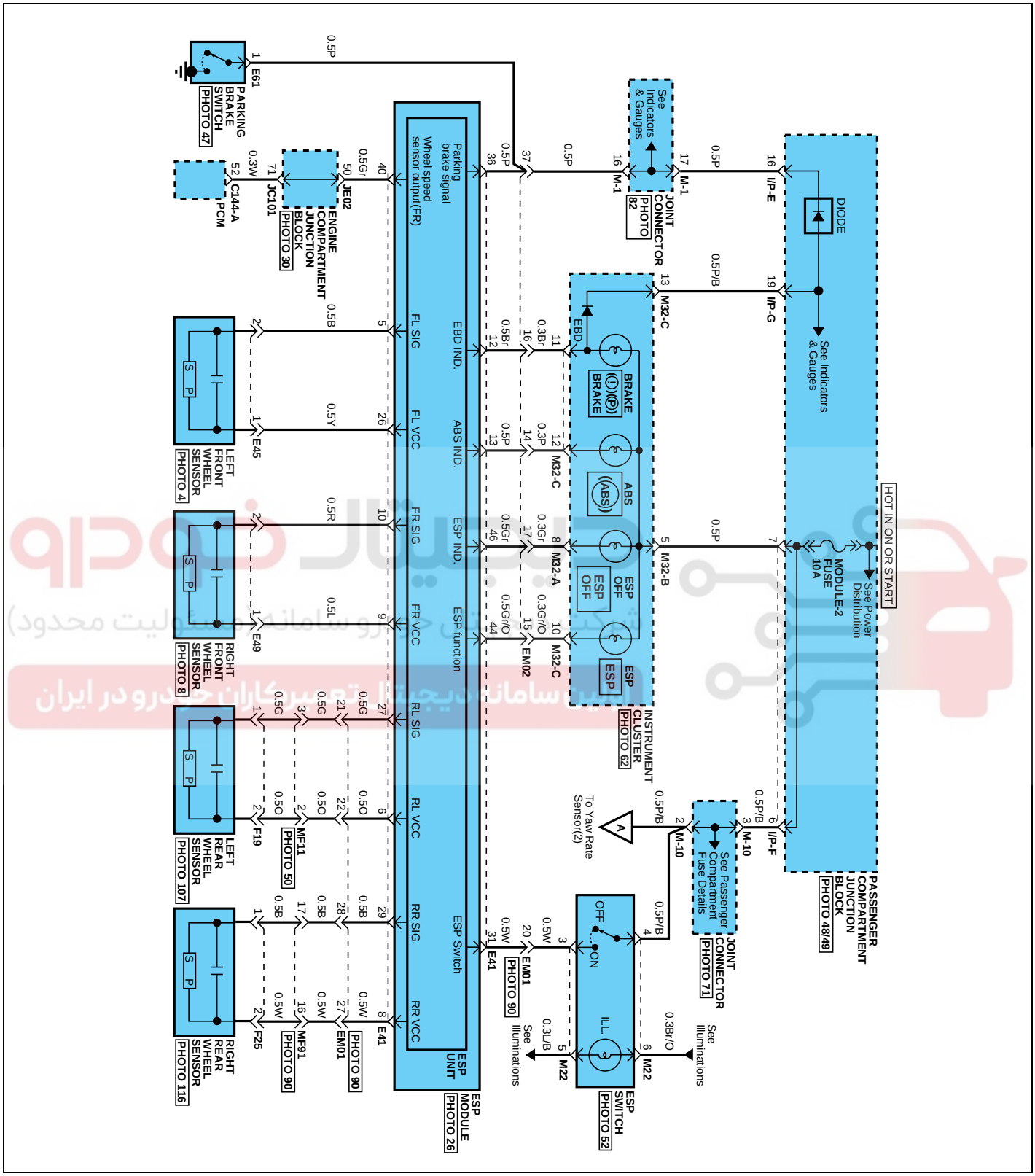


EJBF500U

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ESP CIRCUIT DIAGRAM(1) EAB16CCB

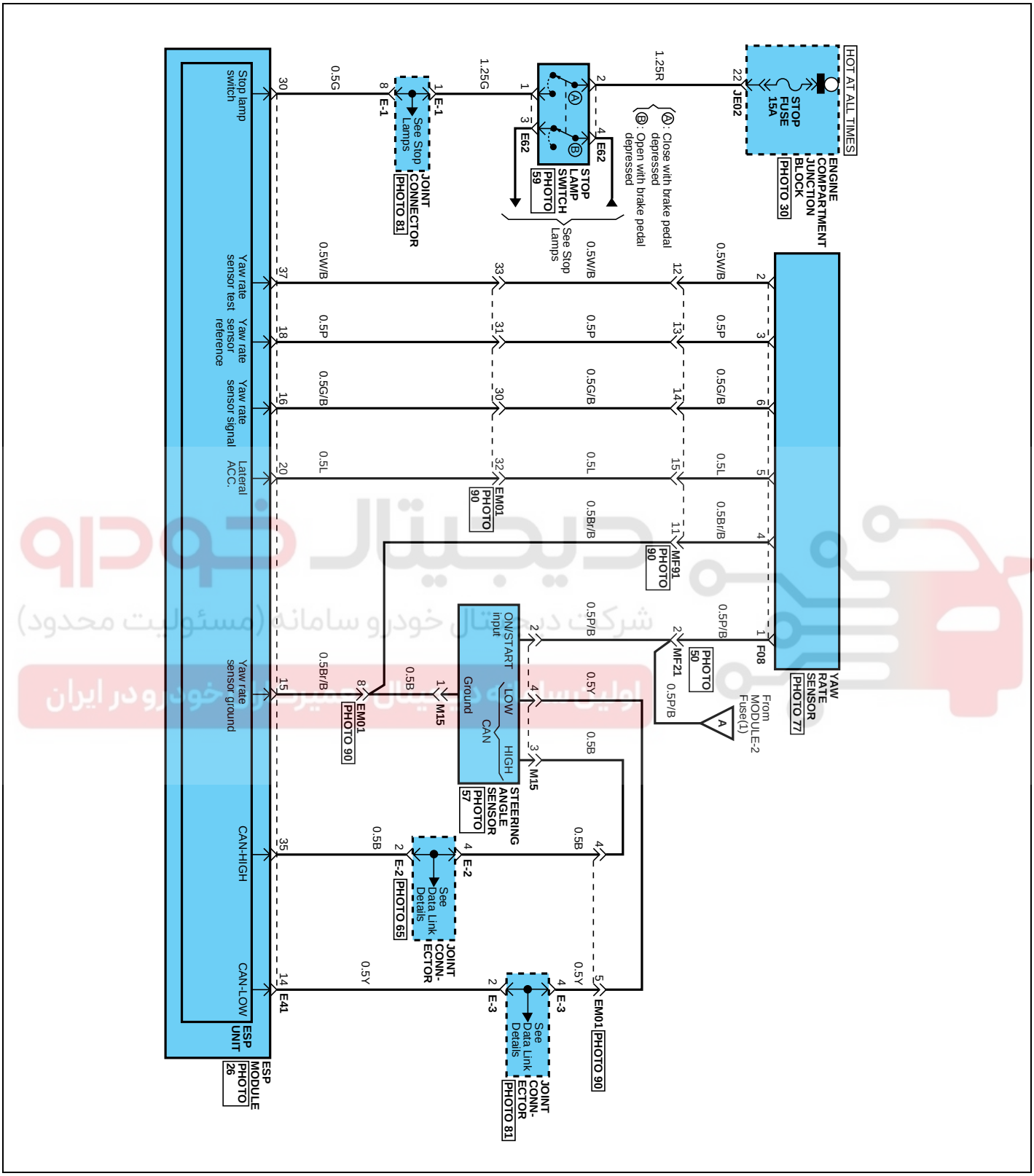


EJBF500V

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ESP CIRCUIT DIAGRAM(2)

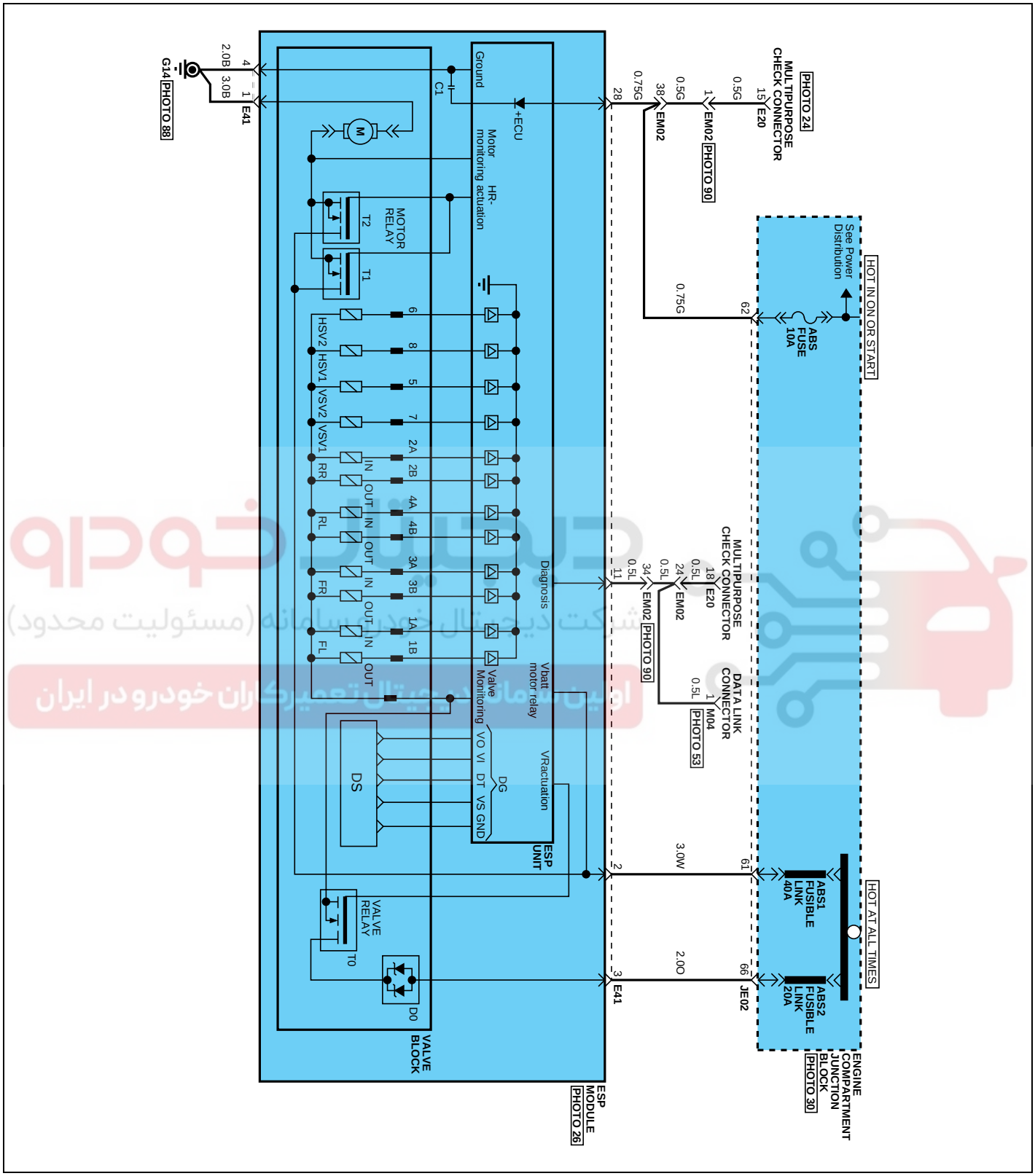


EJBF500W

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ESP CIRCUIT DIAGRAM(3)

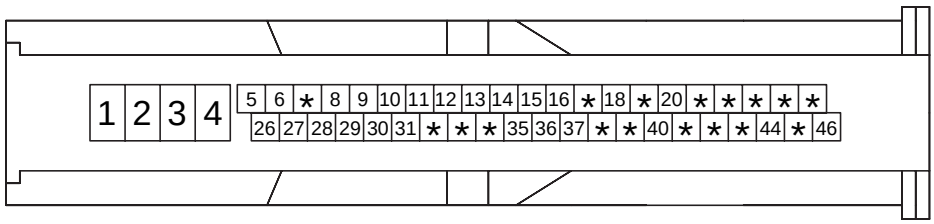


EJBF500X

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ESP HECU CONNECTOR INPUT / OUTPUT E603C607

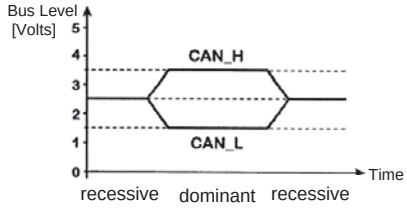


AJKF603X

Connector Terminal		Specifications	Conditions
No	Description		
1	Ground(Pump)	Current range : Min-10 A Max-20 ~ 39 A	Always
4	Ground(Valve,ECU)	Current range : Min-2.5 A Max-5 ~ 15 A	Always
2	Supply voltage(Pump)	Battery voltage	Always
3	Supply voltage(Valve)		
26	Wheel sensor voltage(FL)	Battery voltage	IG ON
9	Wheel sensor voltage(FR)		
6	Wheel sensor voltage(RL)		
8	Wheel sensor voltage(RR)		
5	Wheel sensor signal(FL)	Voltage(High) : 0.89~1.26 V Voltage(Low) : 0.44~0.63 V	RUNNING
10	Wheel sensor signal(FR)		
27	Wheel sensor signal(RL)		
29	Wheel sensor signal(RR)		
11	Diagnosis Input/oupput	Voltage(High) : 0.8 * IG ON more Voltage(Low) : 0.2 * IG ON lower	HI-SCAN Communication
28	Ignition	Battery voltage	KEY ON/OFF
31	ESP Passive switch	Voltage(High) : 0.6 * IG ON more Voltage(Low) : 0.4 * IG ON lower	Switch ON/OFF
36	Hand brake switch	Voltage(High) : 0.7 * IG ON more Voltage(Low) : 0.3 * IG ON lower	Switch ON/OFF
37	Yaw Rate Sensor Test	Voltage(High) : 4.1 V more Voltage(Low) : 1 V lower	IG ON
18	Yaw Rate Sensor Reference	2.464 V ~ 2.536 V	IG ON
16	Yaw Rate Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-100 ~ 100 ° /s)	IG ON
20	Acceleration Sensor Signal	Offset voltage :2.5 V range : 0.35 V ~ 4.65 V(-1.8 g ~ 1.8 g)	IG ON
15	Yaw Rate Sensor Ground	GND LEVEL	Always

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Connector Terminal		Specifications	Conditions
No	Description		
35	CAN High	not communication:2.5 ± 0.5 V communication :  EJRF502L	IG ON
14	CAN Low		
30	BRAKE LIGHT SWITCH	voltage(High) : 0.8 * IG ON more voltage(Low) : 0.3 * IG ON lower	BRAKE ON/OFF

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FAILURE DIAGNOSIS E6DEDE5E

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 when ESP is fail.

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

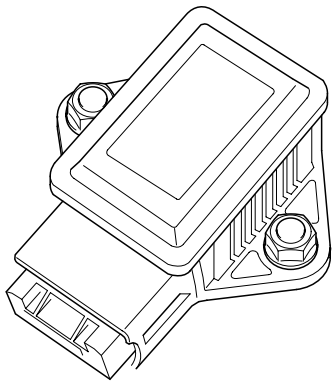
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YAW-RATE SENSOR & G-SENSOR

DESCRIPTION EF8FF7D0

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



KJRE504E

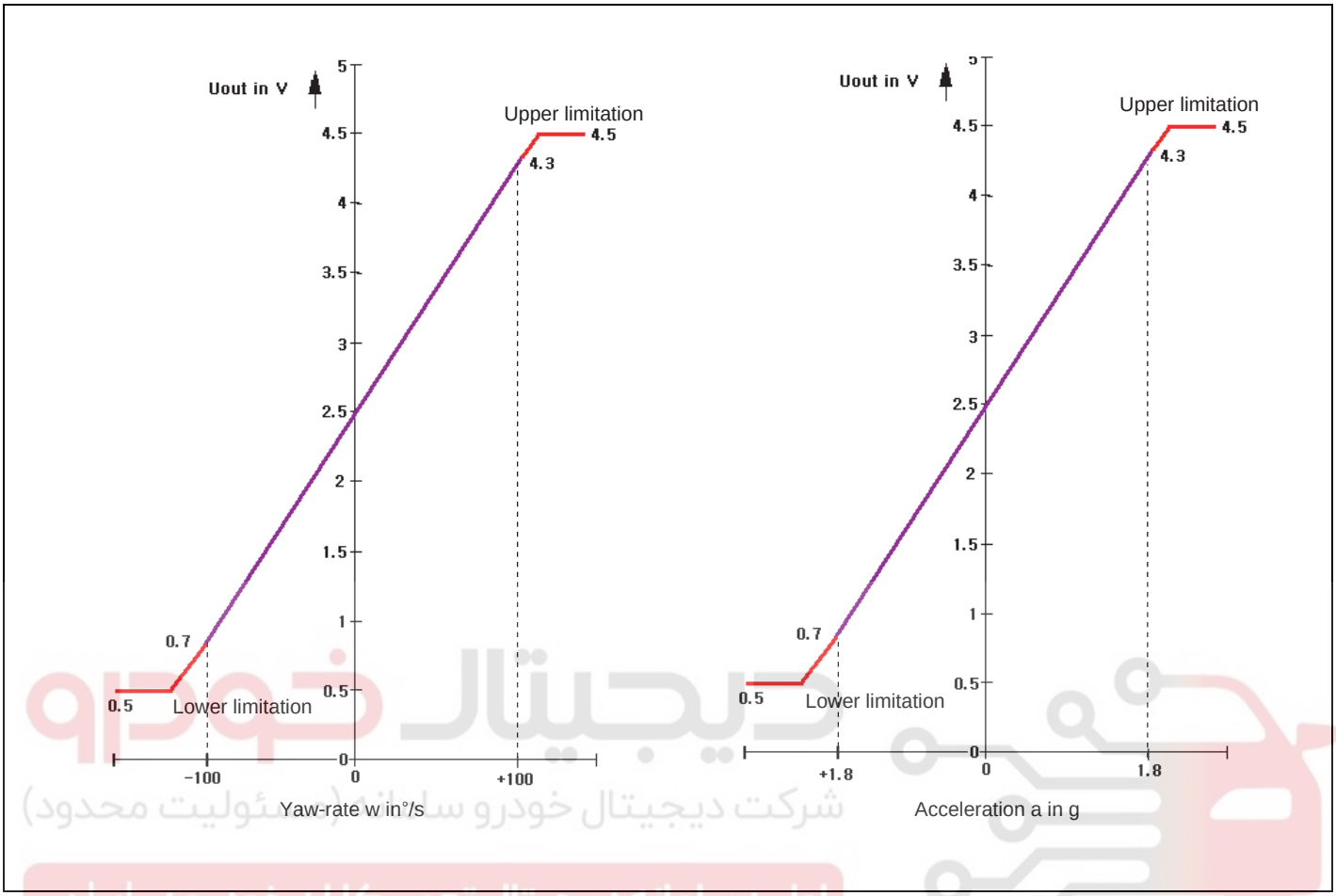
SPECIFICATION

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

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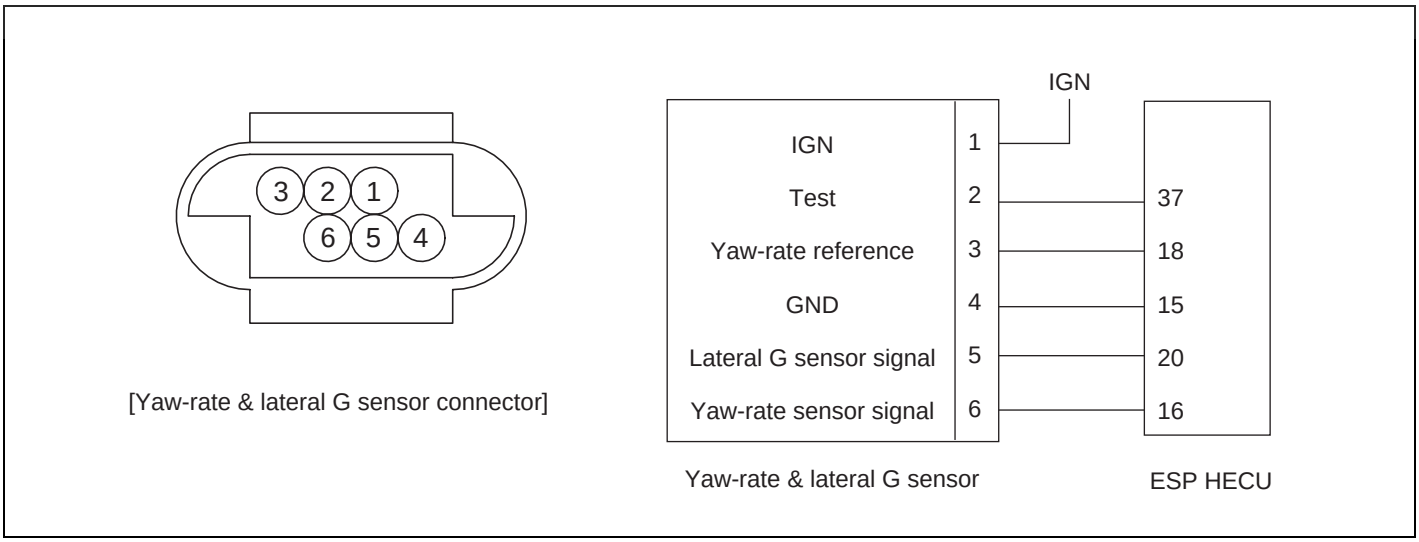
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OUTPUT CHARACTERISTIC



EJRF502E

CIRCUIT DIAGRAM (YAW-RATE & LATERAL G SENSOR)



EJRF502F

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ESP SWITCH

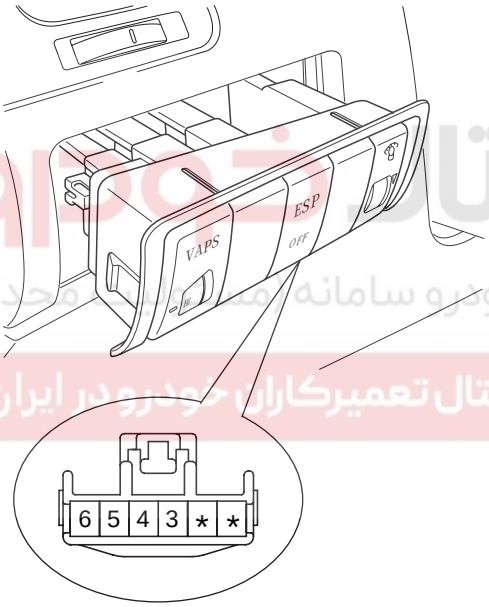
DESCRIPTION EE5F6910

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 ECA76161

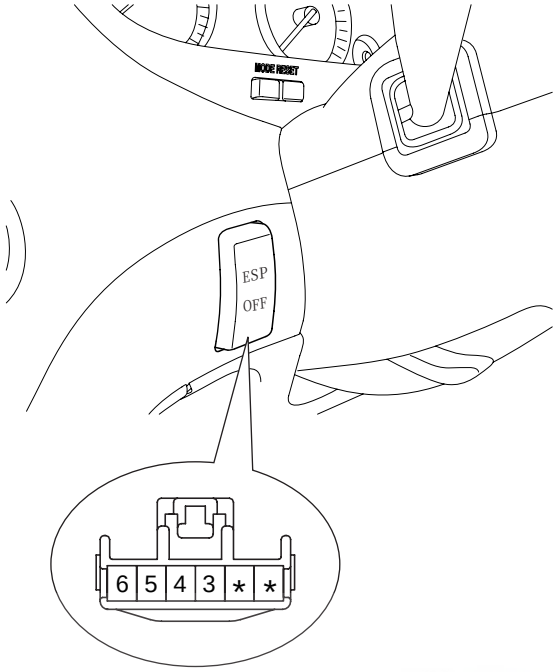
1. Remove the ESP OFF switch from the switch panel on the crushpad of the driver's side.

[LHD]



EJBF505P

[RHD]



EJBF506F

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

Position \ Terminal	5	6	3	4
ON	○	○	○	○
OFF				

EJBF500Y

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STEERING WHEEL ANGLE SPEED SENSOR

DESCRIPTION EB79D5CC

GENERAL DATA

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.

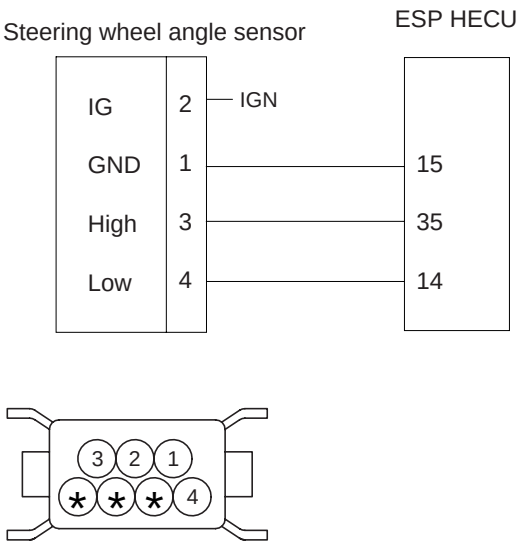
MEASUREING PRINCIPLE

A non contact, analog angle sensor carrying out absolute measuring by the use of the Anisotropic-Magneto-Resistive effect (AMR).Measuring of the absolute angle by means of a toothed measuring gear with magnetic properties in combination with different ratios. Corresponding AMR elements that change their electrical resistance according to the magnetic field direction detect the angle position of the measuring gears.A micro-controller decodes the measured voltage signals after A/D converting with the help of a mathematical function. Output of the digital angle value and velocity via CAN-interface.

SPECIFICATION

Description		Specification
Operating voltage		8~16 V
Operating temperature		-40 ~ 85 ℃
Current consumption		Max.150 mA
Steering angle velocity		Max. ±2000 °/sec
Connection delay time		t < 200 ms
Reverse voltage		-13.5 V
Measuring range	Angle	-780 ° ~ 779 °
	Angular velocity	0~ 1016 °/s
Nonlinearity angle		-2.5 ° ~ +2.5 °
Hysteresis angle		0 ° ~ 5 °
Rotational friction torque measuring		10 °/s

CIRCUIT DIAGRAM(STEERING WHEEL SPEED ANGLE SENSOR)



EJRF502I

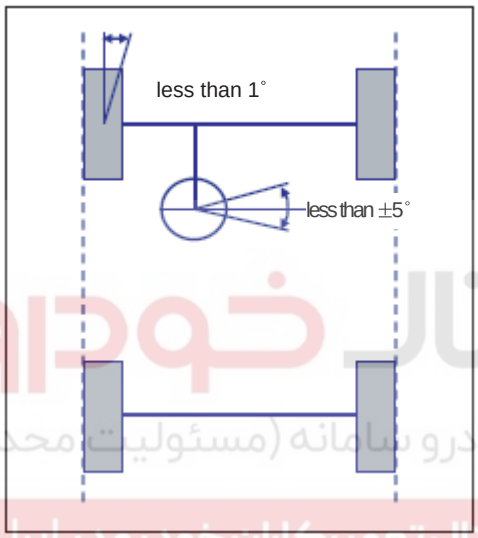
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STEERING ANGLE SENSOR (SAS) CALIBRATION

1. PURPOSE OF calibration
   - On vehicle control, an ESC analyzes the intention of the driver.
   - An ESC recognizes a steering angle which a driver rotates through the steering angle sensor.
   - A steering angle sensor used in ESC8 adjusts 0° setting of steering wheel through K-line or CAN communication.

2. STEERING ANGLE SENSOR (SAS) CALIBRATION METHOD



EJRF502J

1) Align the wheel to the straight line. (steering wheel < ± 5°)
ex) Perform the wheel alignment first.
Align the wheel to the straight line.
A driver moves the vehicle to the front and back about 5 meters twice or three times.

2) Connect Hi-scan to the vehicle.

3) Select Brake system.

4) Select Steering angle sensor(SAS) calibration.

1. HYUNDAI VEHICLE DIAGNOSIS ▲
MODEL : GRANDEUR 05-
SYSTEM : ANTI - LOCK BRAKE SYSTEM
01. DIAGNOSTIC TROUBLE CODES
02. CURRENT DATA
03. FLIGHT RECORD
04. ACTUATION TEST
05. SIMU-SCAN
06. AIR BLEEDING MODE
07. IDENTIFICATION CHECK
08. STEERING ANGLE SENSOR

EJBF505Q

5) Perform the Steering angle sensor(SAS) calibration.

1. 9 .STEERING ANGLE SENSOR
* AIM THIS FUNCTION RESET THE SAS VALVE TO ZERO-SET. PERFORM THIS FUNCTION WHEN YOU REPLACE SENSOR OR STEERING COLUMN. IF YOU READY, PRESS [ENTER] KEY.

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6) Perform the procedure continuously.

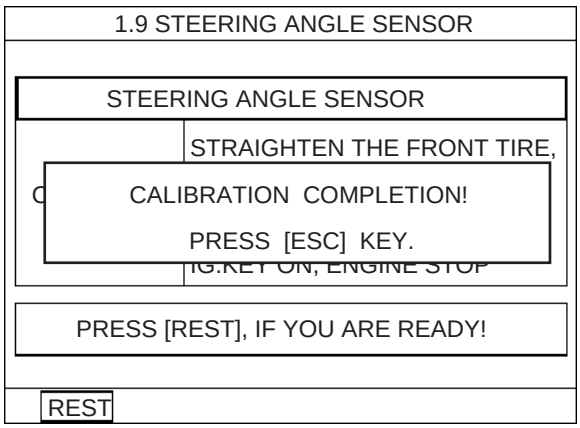
1.9 STEERING ANGLE SENSOR	
STEERING ANGLE SENSOR	
CONDITION	STRAIGHTEN THE FRONT TIRE, AND ARRANGE THE STEERING WHEEL AT THE CENTER POSITION. IG.KEY ON, ENGINE STOP
PRESS [REST], IF YOU ARE READY!	
REST	

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7) The procedure is finished. Push the "ESC" key.



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8) Scanner OFF.

9) Remove the scanner from the vehicle.

10) Confirm the Steering angle sensor(SAS) calibration as driving the vehicle.(turn left once, turn right once)

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