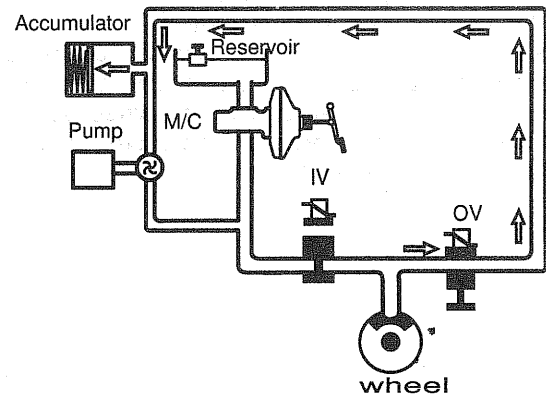


2. With ABS  
1) DUMP MODE

Solenoid	State	Valve	Passage	Pump motor
Inlet valve (NO)	ON	CLOSE	Master cylinder $\leftrightarrow$ Wheel cylinder	ON
Outlet valve (NC)	ON	OPEN	Wheel cylinder $\leftrightarrow$ Reservoir	

If the wheel speed decreases, there is still a tendency to lock; the brake pressure on the corresponding wheel must be reduced accordingly. For this, the outlet valve OV is opened, the inlet valve IV remains closed.

The brake pressure to the low-pressure accumulator is reduced. The wheel in danger of locking gains speed again.



# Brake System

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# GENERAL


## SPECIFICATIONS

EAA87808

Item	Specification
Master cylinder · Type · I.D. mm(in.)(CBS/ABS) · Piston stroke mm(in) · Output port(CBS/ABS) · Fluid level warning sensor	Tandem type 22.22(0.875) 3.1(1.22) 4port/2port Provided
Proportioning valve · Cut-in pressure(Split point) · Decompression ratio	15Kgf /cm <sup>2</sup> 0.27:1(2WD) 0.32:1(4WD)
Brake booster · Type · Effective dia. mm(in.) · Boosting ratio	Vacuum 8+9 in 9:1
Front brake(Disc) · Type · Disc O.D. · Disc I.D. · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D.	Floating type with ventilated disc 280 mm 172 mm (6.77 in.) 26 mm 11 mm single piston 60 mm (2.36 in.)
Rear brake(Drum) · Type · Drum I.D. · Brake lining thickness · Clearance adjustment	Leading trailing drum 228.6 mm (9.0 in.) 4.5 mm (0.17 in.) Automatic
Rear brake(Disc) · Type · Disc O.D. (2WD/4WD) · Disc thickness · Pad thickness · Cylinder type · Cylinder I.D	Floating type with solid disc 262/284 mm (10.31/11.18 in.) 10 mm (0.39 in.) 10 mm (0.39 in.) single piston 34 mm (1.34 in.)
Parking brake · Type · Actuation · Cable arrangement	V type Mechanical brake acting on rear wheels Lever

O.D=Outer Diameter

I.D=Inner Diameter

 **NOTE**

CBS : Conventional Brake System

## SPECIFICATION (ABS &amp; TCS)

PART	ITEM		STANDARD VALVE	REMARK
HECU (Hydraulic and Electronic Control Unit)	System		4 channel 4 sensor (MGC-25)	·ABS system: ABS & EBD control ·FTCS system: ABS & EBD control (Both Brake and Engine control)
	Type		Mortor, valve relay intergrated type	
	Operating voltage		10V~16V(DC)	
	Operating temperature		-40~110°C(-40~230°F)	
	Motor power		180W	
	Pump orifice		Ø0.5mm(0.0197 in.)	
	Accumul ator capacity	LPA	MCS: 2.5cc/MCP2.5cc	LPA: Low pressure accumulator
		HPA	0.13cc	HPA:High pressure accumulator
	Valve	Inlet valve (NO)	Font: Ø 0.71mm (0.0280in.) Rear: Ø 0.315mm (0.0124 in.)	NO valve: 4
		Outlet valve (NC)	Font: Ø 0.56mm (0.0220 in.) Rear: Ø 0.355mm (0.0140 in.)	NC valve: 4
Traction Control valve relief pressure		120bar	With TCS	
Warning lamp	Operating voltage		12V	· ABS W/L: ABS failure · Brake W/L: Parking, brake oil, EBD failure · TCS W/L: TCS failure
	Current consumption		80mA	
wheel speed sensor (CBS)	Internal reistance		1385±110Ω	23±5°C
	Output range		15~2000HZ	
	Min.Voltage peak		130mVp.p(15HZ) 200mVp.p(1000HZ)	Max.air gap
	Air gap		0.2~1.3mm (0.0079~0.0512 in.)	
Active wheel speed sensor (ABS)	Supply voltage		DC12V	
	Operating temperature		-40~120°C	
	Output current low		5.9~8.4mA	
	Output current high		11.8~16.8mA	
	Frequency range		1~2000HZ	
	Air gap		0.5~1.5mm (0.019~0.0591in)	

## SPECIFICATION (ESP)

PART	ITEM	STANDARD VALVE	REMARK	
HECU (Hydraulic and Electronic Control Unit)	System	4 channel 4 sensor (MGC-25)	·ABS system: ABS & EBD control ·FTCS system: ABS & EBD control (Both Brake and Engine control)	
	Type	Mortor, valve relay intergrated type		
	Operating voltage	10V~16V(DC)		
	Operating temperature	-40~110°C(- 40~230°F)		
	Motor power	250W		
	Pump orifice	Ø0.5mm(0.0197 in.)		
	Accumul ator capacity	LPA	MCS: 3.0cc/MC3.0cc	LPA: Low pressure accumulator
		HPA	0.13cc	HPA:High pressure accumulator
	Valve	Inlet valve (NO)	Font: Ø 0.71mm (0.0280in.) Rear: Ø 0.315mm (0.0124 in.)	NO valve: 4
		Outlet valve (NC)	Font: Ø 0.56mm (0.0220 in.) Rear: Ø 0.355mm (0.0140 in.)	NC valve: 4
	Traction Control valve relief pressure	120~150bar	With TCS	
Warning lamp	Operating voltage	12V	· ABS W/L: ABS failure · Brake W/L: Parking, brake oil, EBD failure · TCS W/L: TCS failure	
	Current consumption	80mA		
Active wheel speed sensor	Supply voltage	DC12V		
	Operating temperature	-40~120°C		
	Output current low	5.9~8.4mA		
	Output current high	11.8~16.8mA		
	Frequency range	1~2000HZ		
	Airgap	0.5~1.5mm		
Steering Wheel Angle Sensor	Operating Voltage Current Consumption High output voltage Low output voltage Operating Angular velocity	9V~16V Max 100mA 3.0V~4.1V 1.3V~2.0V Max 1500°/sec		

## SERVICE STANDARD

	Standard value	Service limit
Brake pedal height	163mm( 0.209in.)	
Brake pedal stroke	128 mm (5.04 in.)	
Brake pedal free play	3~8mm(0.11~0.31in.)	
Brake pedal to floorboard clearance	82mm( 3.23in.)	
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 vacuum)	
Parking brake lever stroke when lever assembly is pulled with 196N (20Kgf, 44lb force)	7~8 clicks	
Front disc brake pad thickness	11 mm (0.43 in.)	2 mm (0.079 in.)
Front disc thickness (minimum)	26 mm (10.24 in.)	24.4 mm ( 0.961in.)
Front disc runout		Max.0.03 mm ( 0.001in.)
Front disc parallelism		Max.0.005 mm (0.0002in.)
Rear drum brake lining thickness	4.5 mm (0.177 in.)	1.0 mm (0.039 in.)
Rear drum brake drum I.D.	228.6 mm (9 in.)	Max.230.6mm (9.079 in.)
Rear disc brake pad thickness	10 mm (0.394 in.)	2 mm (0.079 in.)
Rear disc brake disc thickness	10 mm (0.394 in.)	8 mm (0.315 in.)
Rear disc runout		Max.0.03mm ( 0.001in.)
Rear disc parallelism		Max.0.005 mm ( 0.0002in.)

## TIGHTENING TORQUE

EAA87808

	Nm	Kgf-cm	lbf-ft
Proportioning valve to master cylinder	35~55	350~550	25.8~40.6
Master cylinder to booster mounting nut	8~12	80~120	5.9~8.9
Brake booster mounting nut	13~16	130~160	9.6~11.8
Brake booster vacuum hose fitting to surge tank	15~18	150~180	11.1~13.3
Bleeder screw	7~13	70~130	5.2~9.6
Brake tube nut, brake hose	13~17	130~170	9.6~12.5
Caliper guide rod bolt	22~32	220~320	16.2~23.6
Caliper pin bolt	35~45	350~450	25.8~33.2
Caliper assembly to knuckle	80~100	800~1000	59.0~73.8
Brake hose to front caliper	25~30	250~300	18.4~22.1
Brake hub flange nut	200~260	2000~2600	147.5~191.8
Push rod locking nut	16~22	160~220	11.8~16.2

 **CAUTION**

*Replace self-locking nuts with new one after removal.*

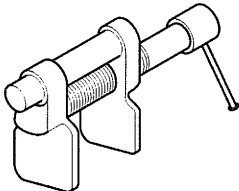
## TIGHTENING TORQUE (ABS &amp; TCS)

ITEM	N·m	kgf·cm	lbf·ft
Active wheel speed sensor mounting bolt on the brake plate	8~9	80~90	5.6~6.6
·Front	8~9	80~90	5.6~6.6
·Rear			
Hydraulic & electronic control unit mounting bolt	8~10	80~100	5.6~6.9
Hydraulic & electronic control unit mounting bolt	17~26	170~260	12~19
Break tubes nut	12~16	120~160	9~12
Air bleeder screw	7~13	70~130	5~9.6

## TIGHTENING TORQUE (ESP)

ITEM	N·m	kgf·cm	lbf·ft
Yaw rate & lateral acceleration sensor bolt	4~6	40~60	2.9~4.4
Steering wheel nut	40~50	400~500	28.9~36.9
Master cylinder pressure sensor	22.4~26.5	224~265	16.5~19.5

## SPECIAL TOOL EE6F8D10

TOOL(Numder and Name)	IIIUSTRATION	USE
09581-11000 Piston expander	 <p style="text-align: right;">EJDA043A</p>	Spreading the front brake piston

## TROUBLESHOOTING EBEFCC25

## 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	<ol style="list-style-type: none"> <li>1. Brake system (Fluid leaks)</li> <li>2. Brake system (Air in)</li> <li>3. Piston seals (Worn or damaged)</li> <li>4. Rear brake shoe clearance(Out of adjustment)</li> <li>5. Master cylinder (Faulty)</li> </ol>	repair air-bleed relace adjust replace
Brake drag	<ol style="list-style-type: none"> <li>1. Brake pedal freeplay (Minimal)</li> <li>2. Parking brake lever travel (Out of adjustment)</li> <li>3. Parking brake wire (Sticking)</li> <li>4. Rear brake shoe clearance(Out of adjustment)</li> <li>5. Pad or lining (Cracked or distorted)</li> <li>6. Piston (Stuck)</li> <li>7. Piston (Frozen)</li> <li>8. Anchor or Return spring (Faulty)</li> <li>9. Booster system (Vacuum leaks)</li> <li>10. Master cylinder (Faulty)</li> </ol>	adjust adjust repair adjust replace replace replace replace repair replace
Brake pull	<ol style="list-style-type: none"> <li>1. Piston (Sticking)</li> <li>2. Pad or lining (Oily)</li> <li>3. Piston (Frozen)</li> <li>4. Disc (Scored)</li> <li>5. Pad or lining (Cracked or distorted)</li> </ol>	replace replace replace replace replace
Hard pedal but brake inefficient	<ol style="list-style-type: none"> <li>1. Brake system (Fluid leaks)</li> <li>2. Brake system (Air in)</li> <li>3. Pad or lining (Worn)</li> <li>4. Pad or lining (Cracked or distorted)</li> <li>5. Rear brake shoe clearance(Out of adjustment)</li> <li>6. Pad or lining (Oily)</li> <li>7. Pad or lining (Glazed)</li> <li>8. Disc (Scored)</li> <li>9. Booster system (Vacuum leaks)</li> </ol>	repair air-bleed replace replace adjust adjust replace replace replace repair
Noise from brake	<ol style="list-style-type: none"> <li>1. Pad or lining (Cracked or distorted)</li> <li>2. Installation bolt (Loosen)</li> <li>3. Disc (Scored)</li> <li>4. Sliding pin (Worn)</li> <li>5. Pad or lining (Dirty)</li> <li>6. Pad or lining (Glazed)</li> <li>7. Anchor or Return spring (Faulty)</li> <li>8. Brake pad shim (Damage)</li> <li>9. Shoe hold-down spring (Damage)</li> </ol>	replace adjust replace replace clean replace replace replace replace

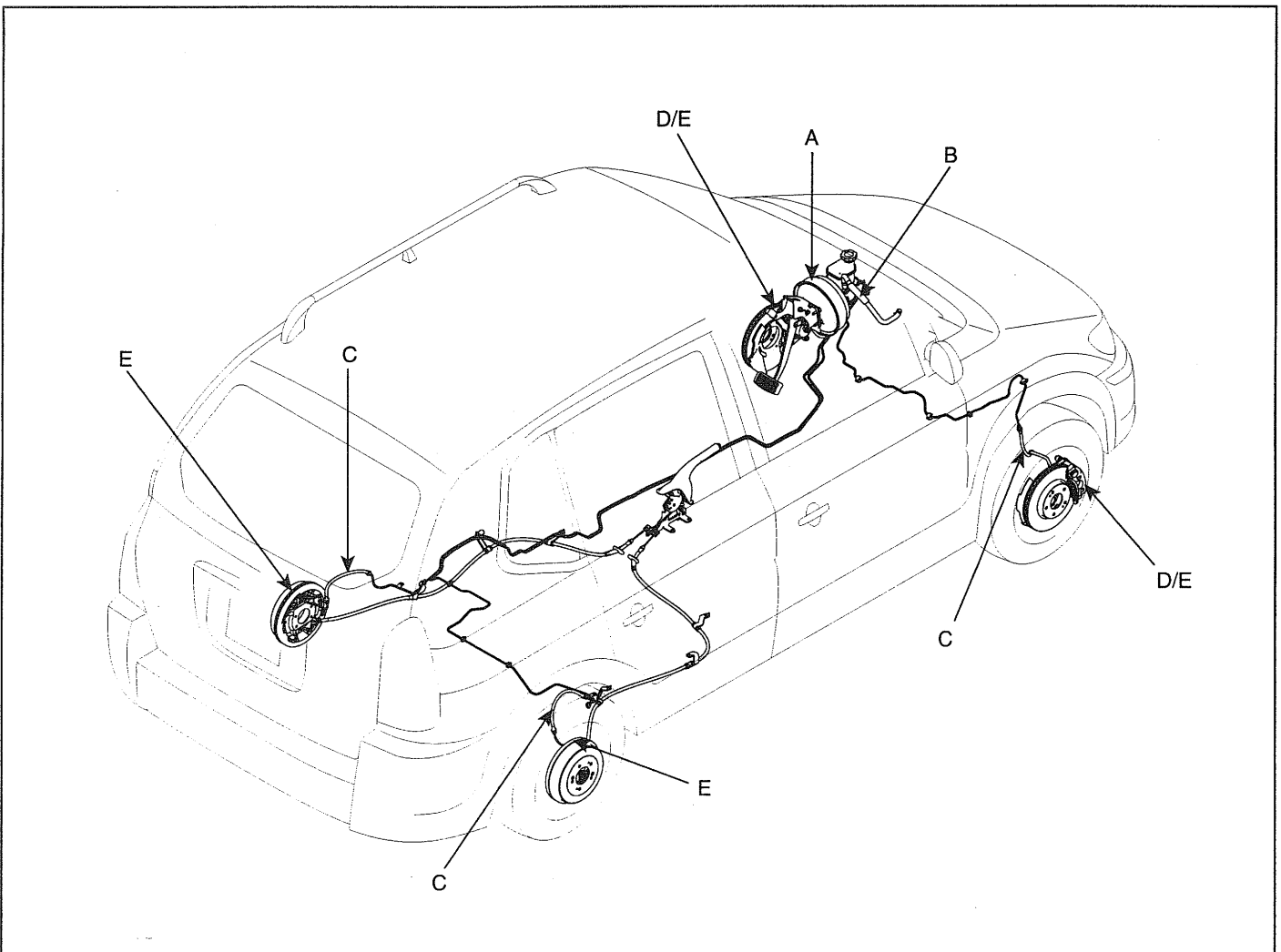


## OPERATION AND LEAKAGE CHECK

EDCFBA2B

## CHECK ALL OF THE FOLLOWING ITEMS:

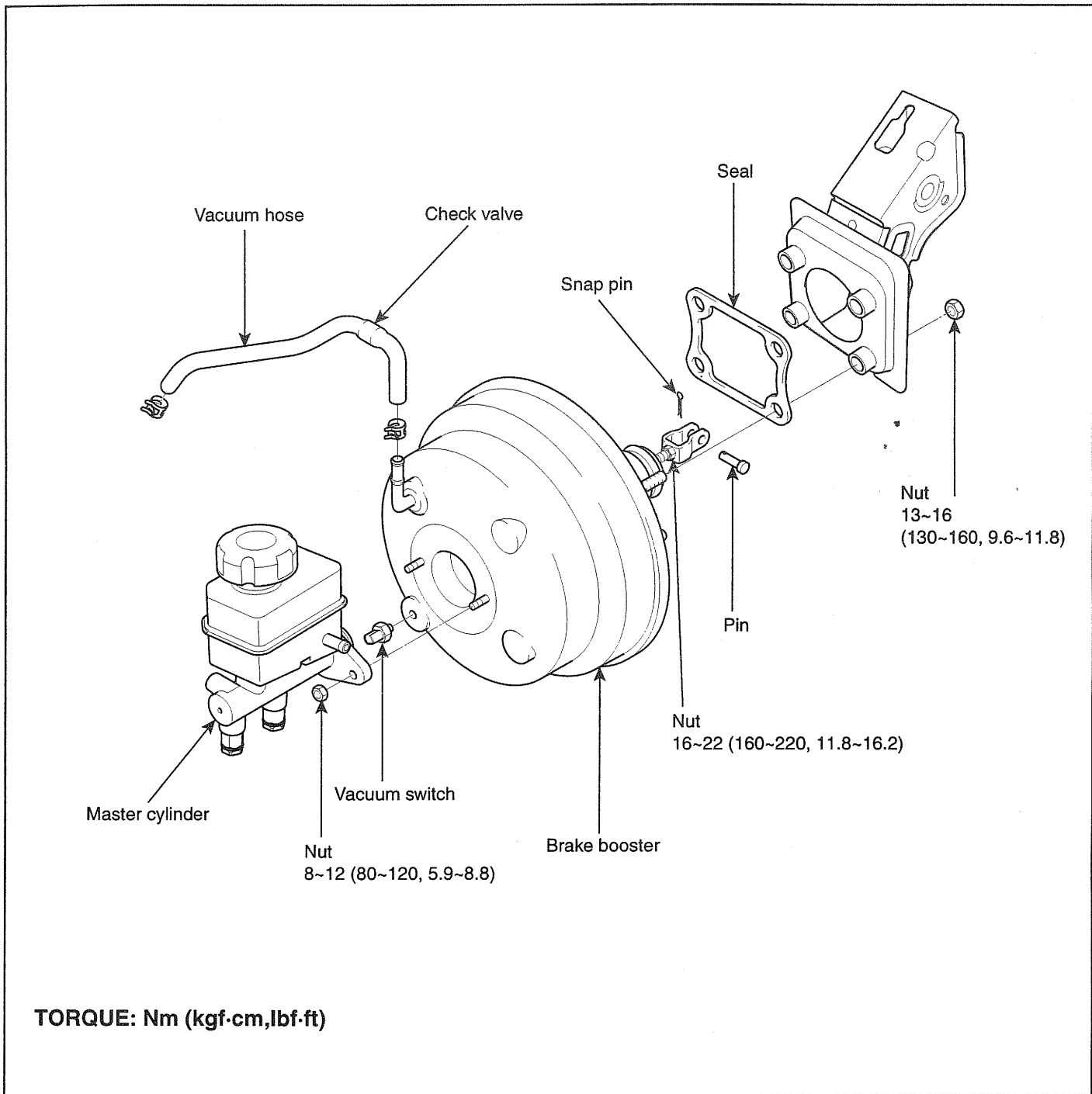
Component	Procedure
Brake Booster (A)	Check brake operation by applying the brakes during a test drive. If the brakes do not work properly, check the brake booster. Replace the brake booster as an assembly if it does not work properly or if there are signs of leakage.
Piston cup and pressure cup inspection (B)	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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.</li> </ul>
Brake hoses (C)	Look for damage or signs of fluid leakage. Replace the brake hose with a new one if it is damaged or leaking.
Caliper piston seal and piston boots (D)	Check brake operation by applying the brakes. Look for damage or signs of fluid leakage. If the pedal does not work properly, the brakes drag, or there is damage or signs of fluid leakage, disassemble and inspect the brake caliper. Replace the boots and seals with new ones whenever the brake caliper is disassembled.
Wheel cylinder piston cup and dust cover (E)	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, replace the wheel cylinder.



# BRAKE SYSTEM

## BRAKE BOOSTER

### COMPONENTS E2131FB8



**BRAKE BOOSTER OPERATING TEST**

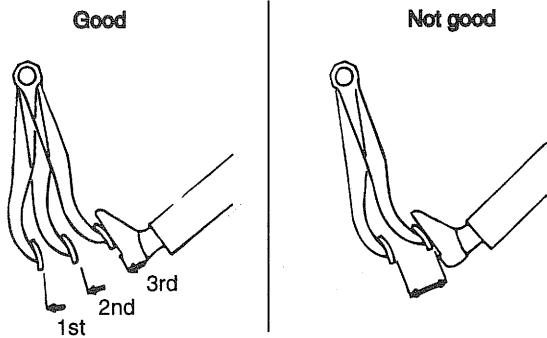
E2EA0EF6 2.

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.

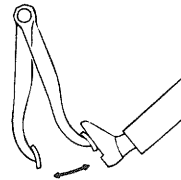
For simple checking of the brake booster operation, carry out the following tests

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

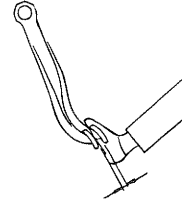


EGGE700A

When engine is stopped



When engine is started



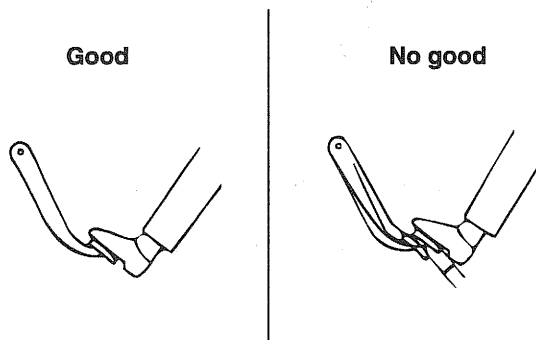
EGGB700B

3. With the engine running, step on the brake pedal and then stop the engine.

Hold the pedal depressed for 30 seconds. If the pedal height does not change, the booster is in good condition, if the pedal rises, the booster is defective.

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

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

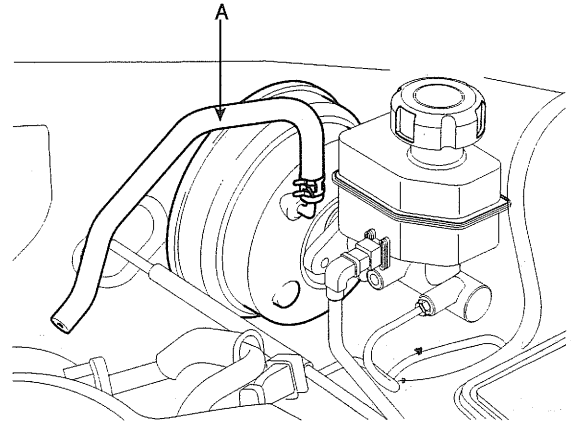


EGGE700C

### VACUUM HOSE (CHECK VALVE)

#### INSPECTION

1. Disconnect the brake booster vacuum hose (check valve built in) (A) at the booster (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.



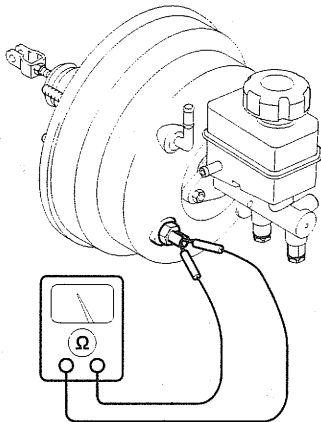
KJQE050A

### VACUUM SWITCH (ONLY DIESEL ENGINE)

For simple checking of the vacuum switch operation, carry out the following tests:

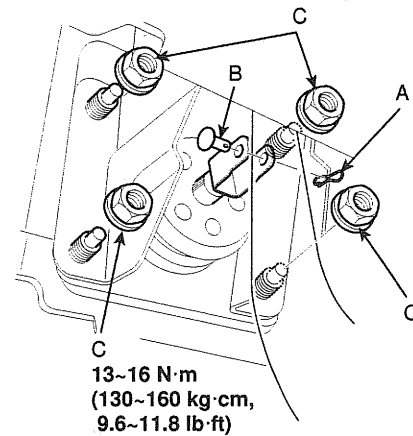
1. Block the tire with a suitable block.
2. Release the parking brake and check the brake fluid level.
3. With the engine stopped, step on the brake pedal more than 20 times.
4. When IG ON, check whether parking brake pedal warning lamp turn on.
5. If the parking brake warning lamp is not off, stop the engine, and step on the brake pedal more than 20 times.
6. Check the continuity between terminals of the vacuum switch, after disconnecting the connector from the vacuum switch.

7. If there is no continuity, replace vacuum switch.



KJQE750A

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

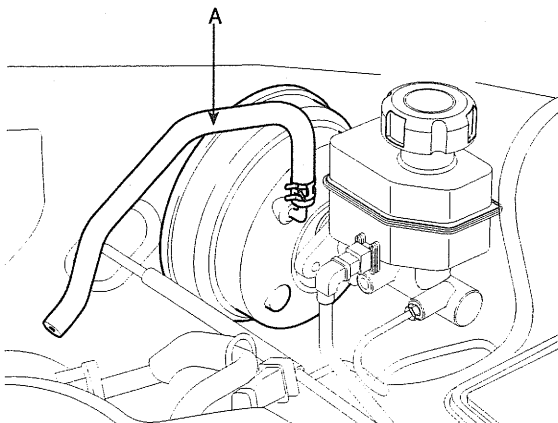


EJQE040A

## REMOVAL

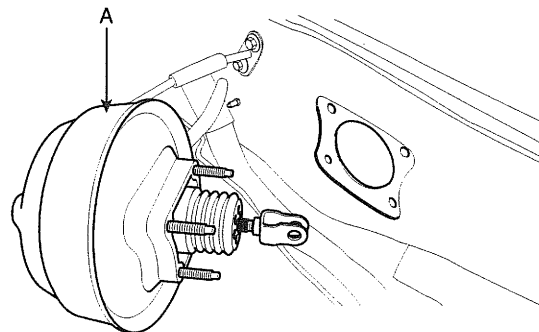
E1570C4B

1. Remove the master cylinder. (Reference to BR- 25)
2. Disconnect the vacuum hose (A) from the brake booster (B).



KJQE050A

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

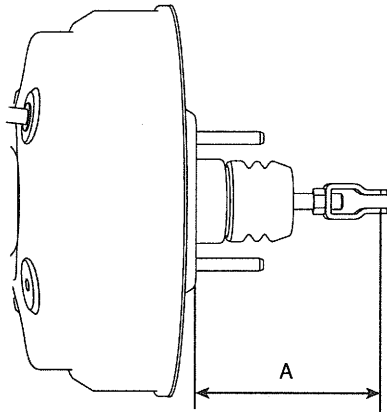


EJKE305D

**INSTALLATION** E74C7153

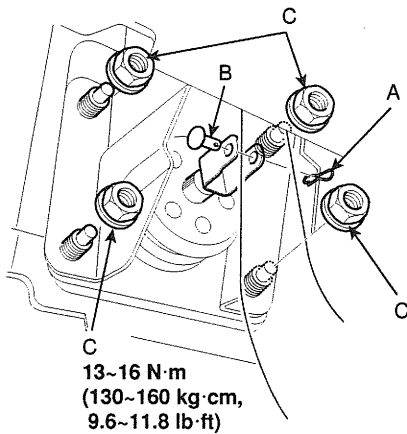
1. Adjust push rod length of the booster, and then install the seal on the booster assembly.

Standard length (A):  $106 \pm 0.5$  mm (  $4.173 \pm 0.019$  in.)



KJQE050C

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



EJQE040A

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

 **CAUTION**

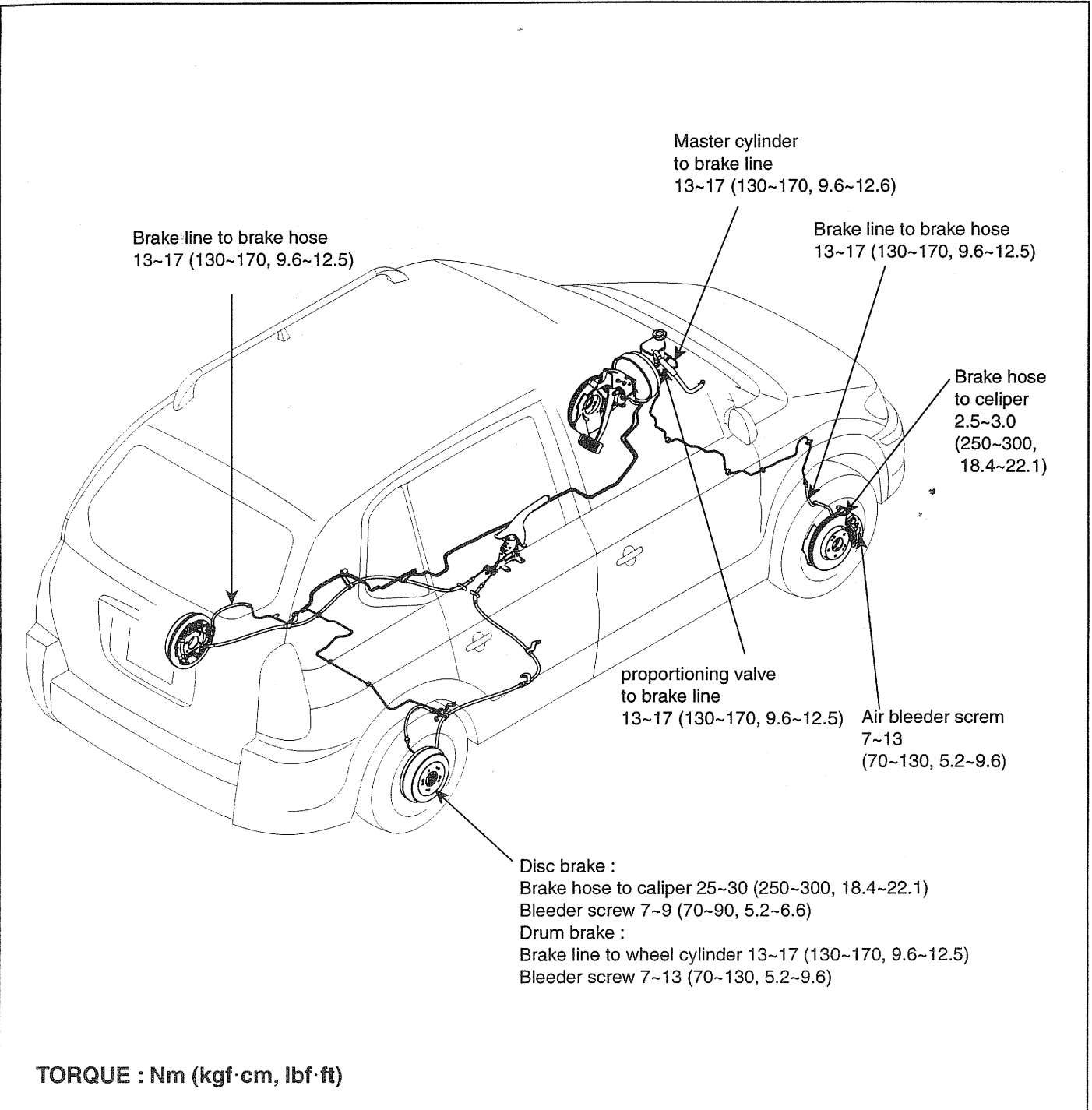
*Grease the pin before installing the snap pin.*

*When installing the snap pin, it must be used new one.*

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.
7. Check for fluid leakage.
8. Check and adjust the brake pedal for proper operation.

## BRAKE LINE

COMPONENT EAF885D



**INSPECTION**

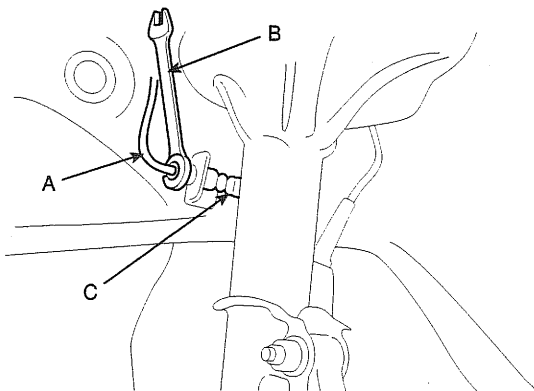
E48DB66D

- 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.

**REMOVAL**

E93DE4EF

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



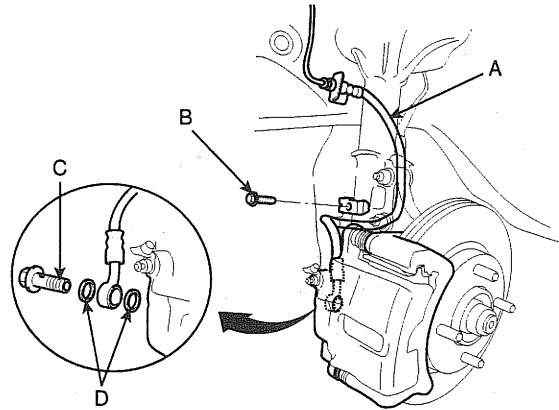
EJKE050A

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

**INSTALLATION**

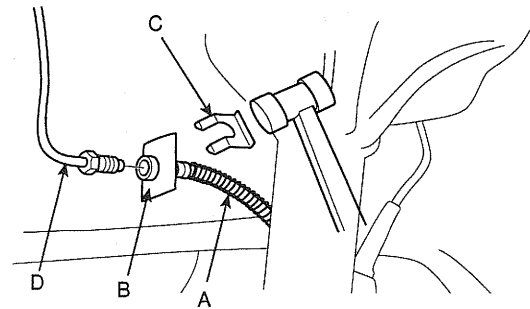
ED22CAE0

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



EJKE050C

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



EJKE050D



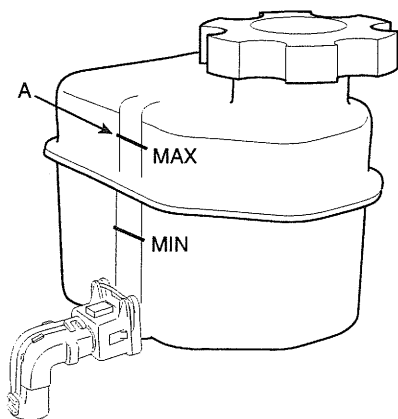
3. Connect the brake line (D) to the brake hose.
4. After installing the brake hose, bleed the brake system.

## BRAKE SYSTEM BLEEDING

E20E2F86

### NOTE

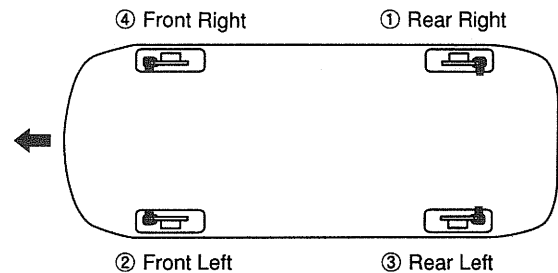
- Do not reuse the drained fluid.
  - Always use Genuine DOT3 or DOT 4 Brake Fluid. Using a non-Genuine DOT or 4 brake fluid can cause corrosion and decrease the life of the system.
  - Make sure no dirt or other foreign matter is allowed to contaminate the brake fluid.
  - Do not spill brake fluid on the vehicle, it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.
  - The reservoir on the master cylinder must be at the MAX (upper) level mark at the start of bleeding procedure and checked after bleeding each brake caliper. Add fluid as required.
1. Make sure the brake fluid in the reservoir is at the MAX (upper) level line (A).



EJQE003A

2. Have someone slowly pump the brake pedal several times, then apply pressure.
3. Loosen the right-rear brake bleed screw to allow air to escape from the system. Then tighten the bleed screw securely.

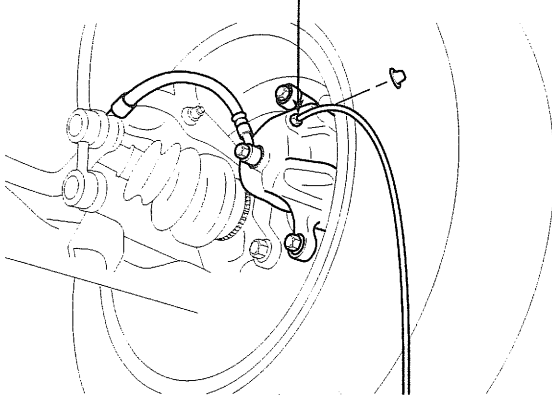
4. Repeat the procedure for wheel in the sequence shown below until air bubbles no longer appear in the fluid.
5. Refill the master cylinder reservoir to MAX(upper) level line.



EJKE003B

**FRONT DISK BRAKE**

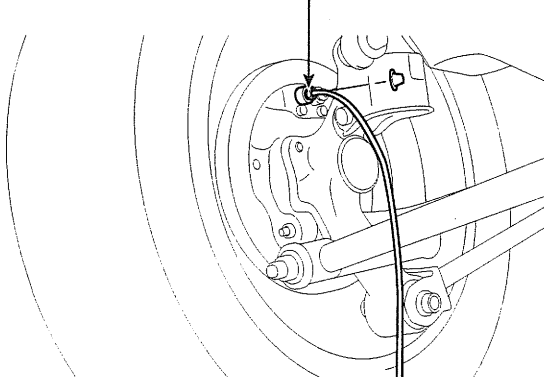
7-13 Nm (70-130 kgf·cm, 5.2-9.6 lbf·ft)



EJKE003C

**REAR DRUM BRAKE**

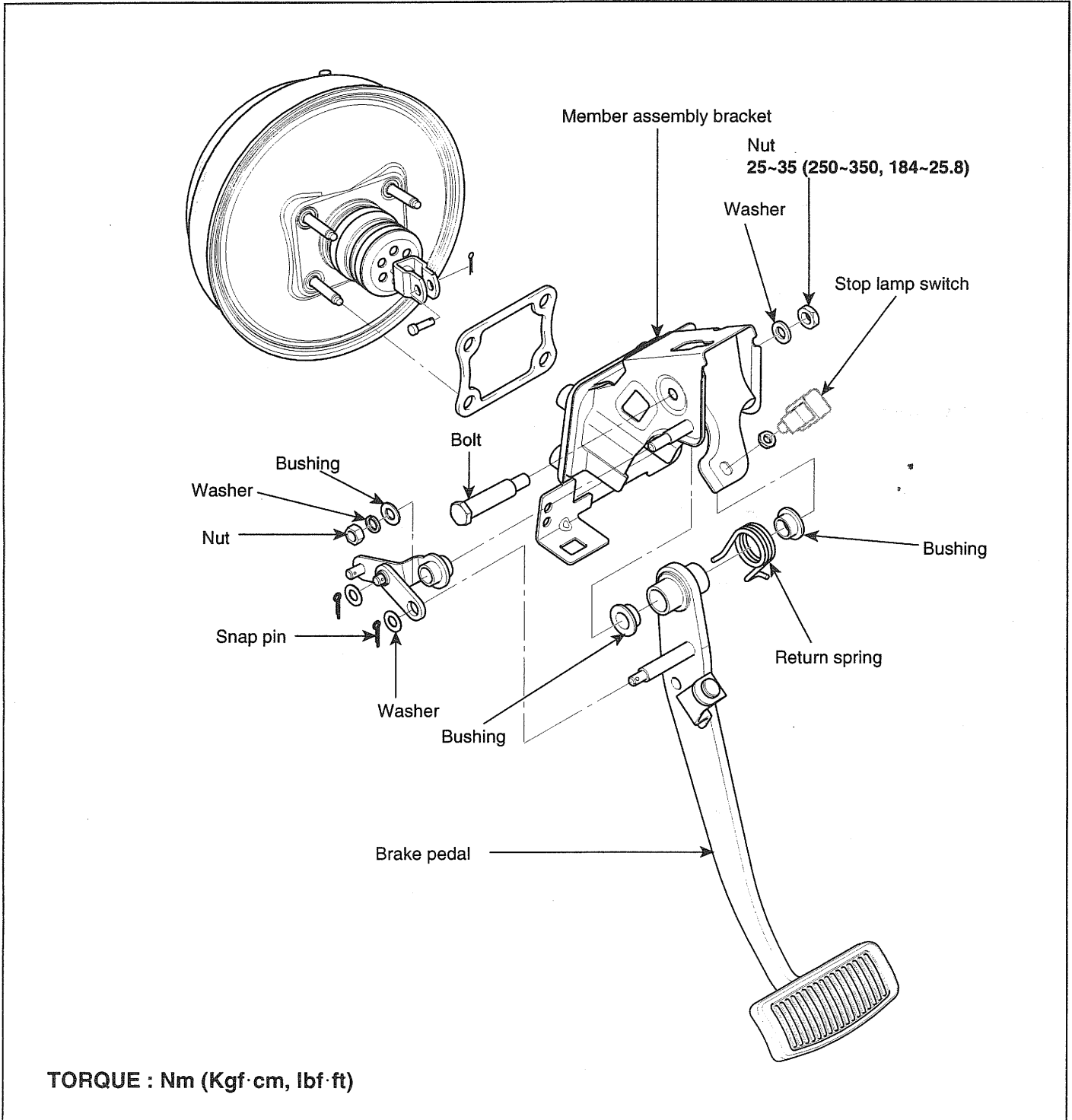
7-13 Nm (70-130 kgf·cm, 5.2-9.6 lbf·ft)



EJKE003E

# BRAKE PEDAL

COMPONENTS EE3ADDF5



TORQUE : Nm (Kgf·cm, lbf·ft)

## BRAKE PEDAL BRAKE SWITCH ADJUSTMENT

EBCA1C90

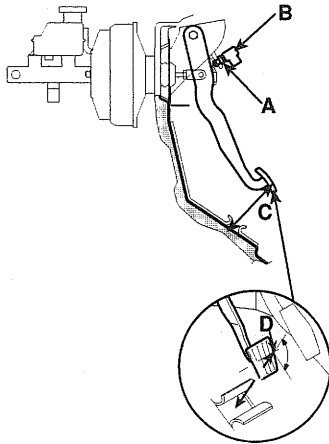
### PEDAL HEIGHT

1. Disconnect the brake switch connector, loosen the brake switch locknut (A), and back 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).

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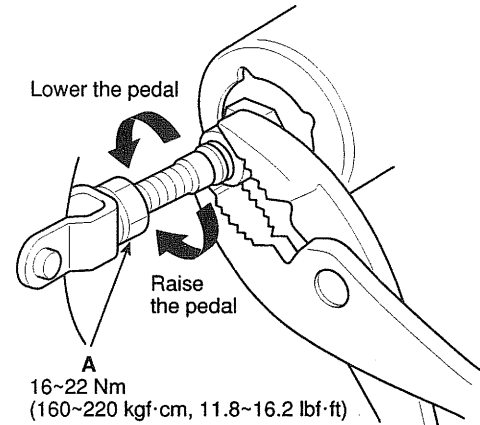
Standard pedal height( with carpet removed): 163mm(6.41 in.)

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EJKE001A

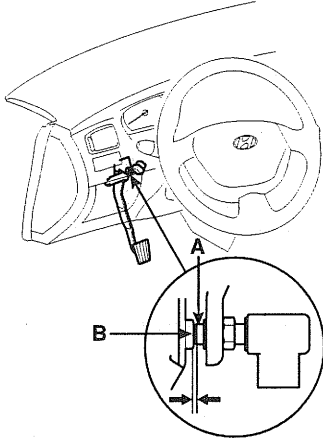
3. Loosen the pushrod locknut (A), and screw the pushrod in or out with pliers until the standard pedal height from the floor is reached. After adjustment, tighten the locknut firmly. Do not adjust the pedal height with the pushrod depressed.



EJKE001B

**BRAKE SWITCH CLEARANCE**

Screw in the brake switch until its plunger is fully depressed (threaded end (A) touching the pad (B) on the pedal arm) then brake off the switch 3/4 turn to make 0.5~1.0mm(0.0-197~0.0394 in.) of clearance between the brake switch connector. Make sure that the brake lights go off when the pedal is released.



EJKE001C

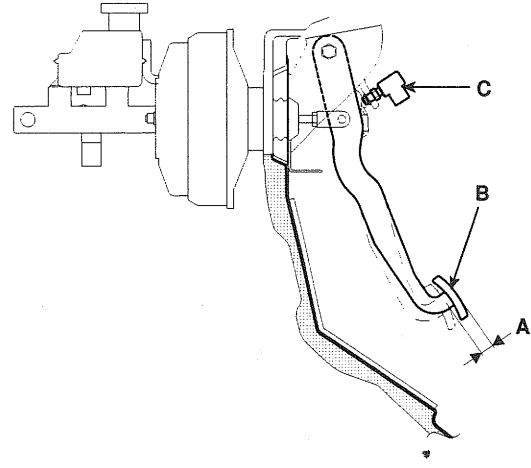
**PEDAL FREE PLAY**

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

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Free play: 3~8mm (0.11~0.31 in.)

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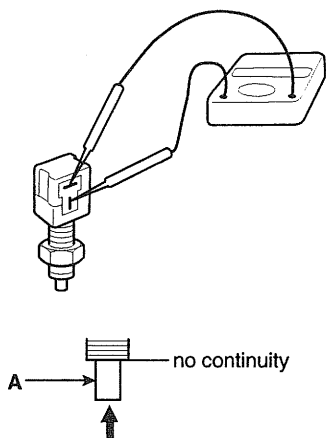
EJKE001D

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.

## INSPECTION

EEC8E00A

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

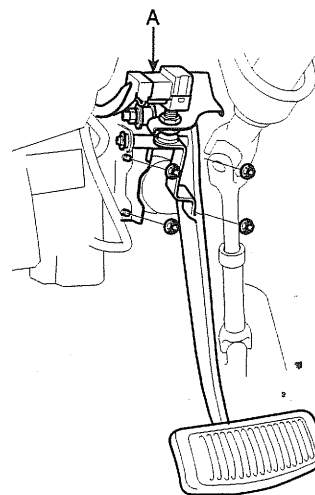


EJQE020D

## REMOVAL

E184FFA4

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



KJQE010A

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

**INSTALLATION**

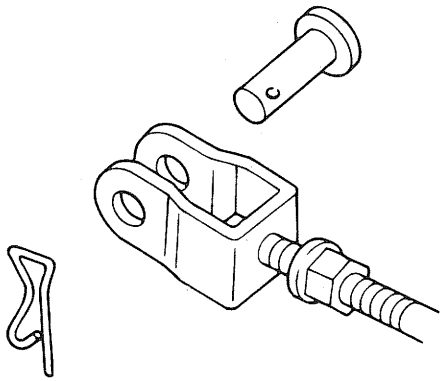
ED1826A3

1. Installation is the reverse of removal.

 **CAUTION**

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

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



EJQE008R

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

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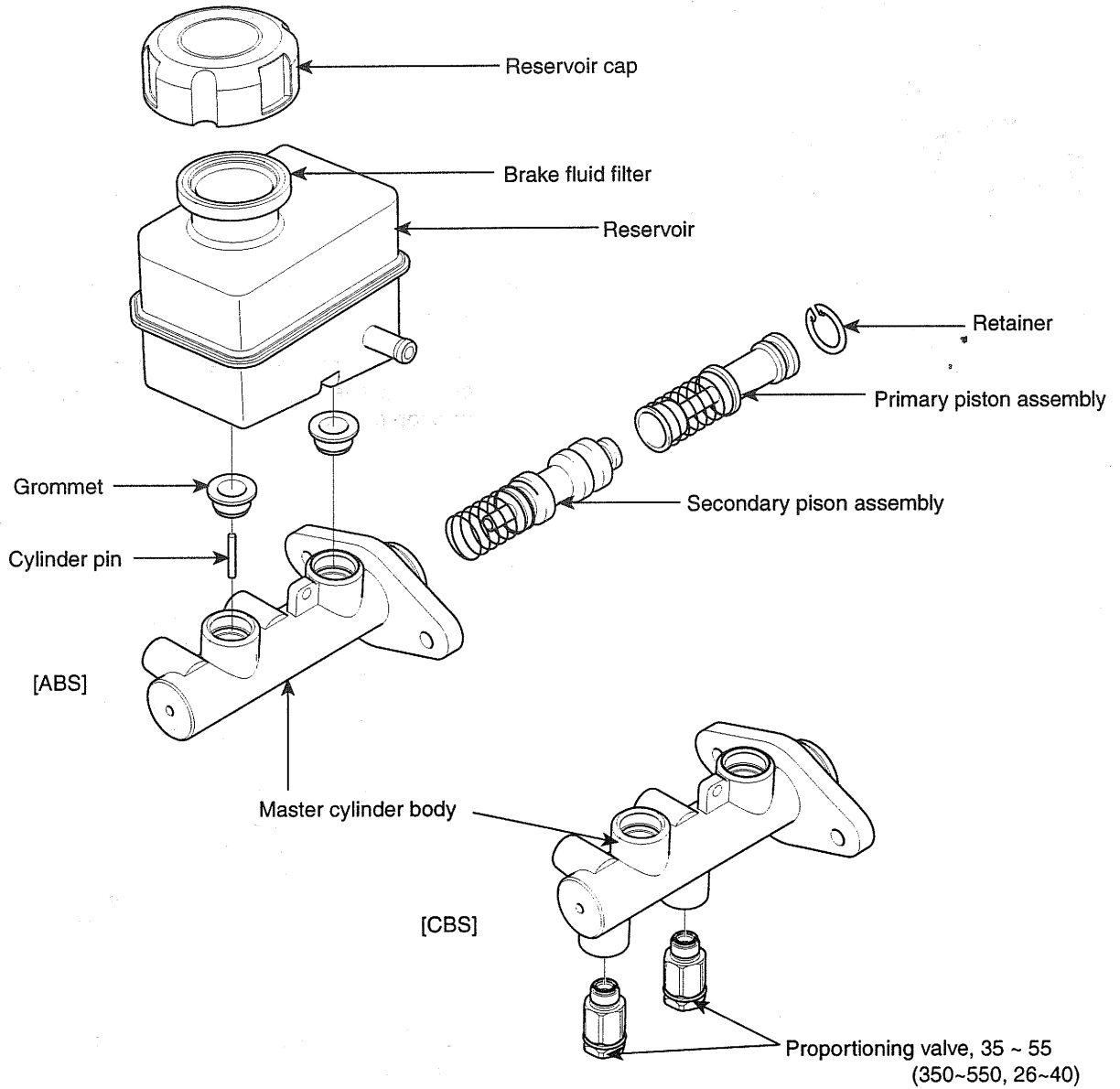
**TORQUE Nm(kgf·cm, lbf·ft); 13~16(1.3~1.6, 9.6~11.8)**

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

# MASTER CYLINDER

## COMPONENTS EA28ECBE



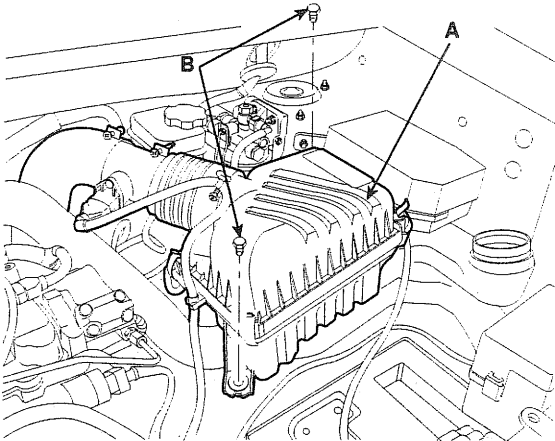
TORQUE : Nm (Kgf·cm, lbf·ft)



**REMOVAL** E61DC1B8**NOTE**

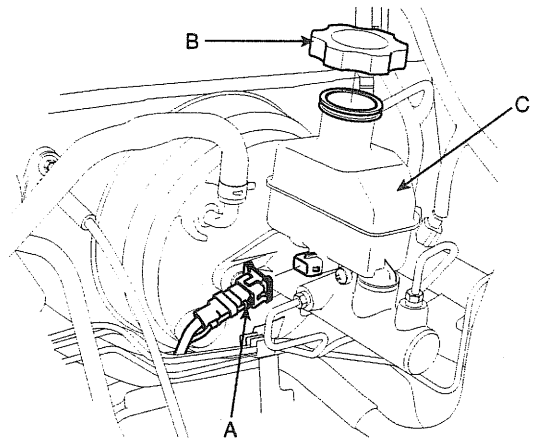
Do not spill brake fluid on the vehicle; it may damage the paint; if brake fluid does contact the paint, wash it off immediately with water.

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



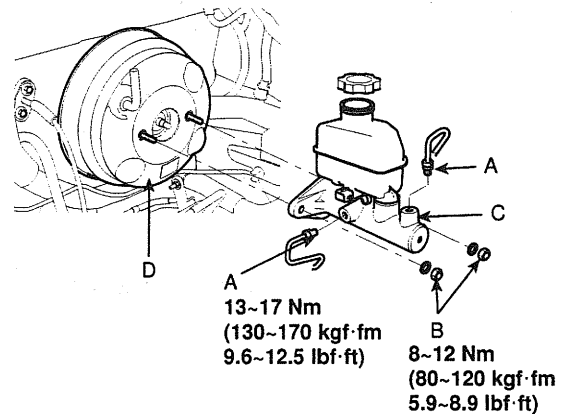
KJQE050M

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



EJKE200F

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



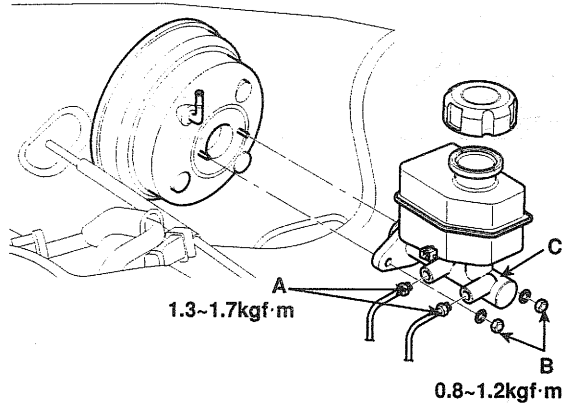
EJKE200C

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

## INSTALLATION

EBF0383C

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



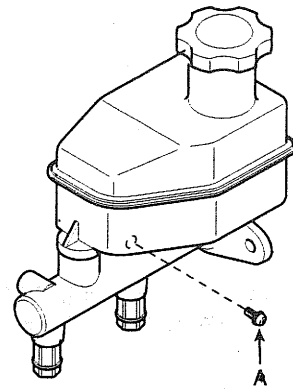
KJQE050F

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

## DISASSEMBLY

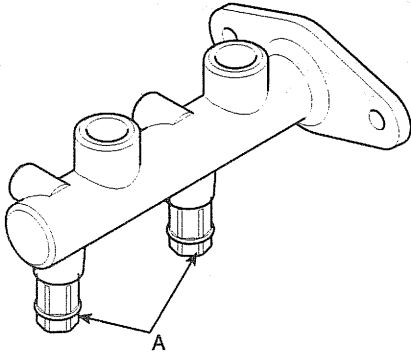
E7B3ED3C

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 mounting screw (A).



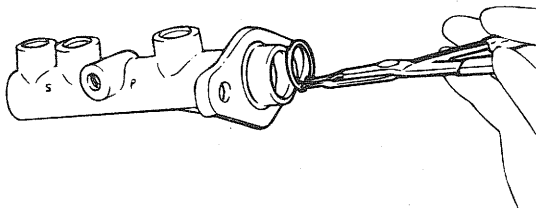
EGGE700D

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



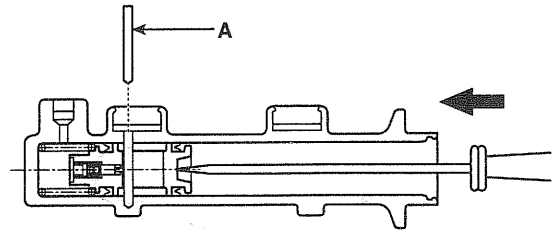
EGGE700E

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



EJA9009C

6. Remove the pin with the secondary piston pushed completely using a screwdriver. Remove the secondary piston assembly.-ABS/TCS/ESP



KJQE014B

 **NOTE**

*Do not disassemble the primary and secondary piston assembly.*

**INSPECTION** E2C4BCCF

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

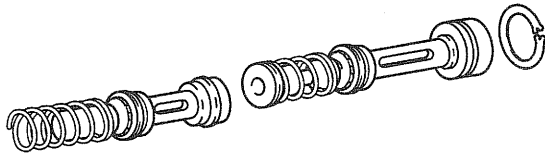
 **CAUTION**

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

**REASSEMBLY**

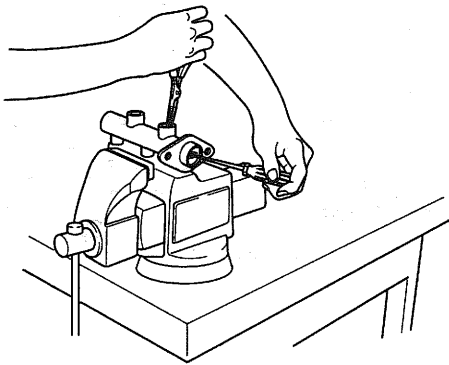
E4F41A45

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.



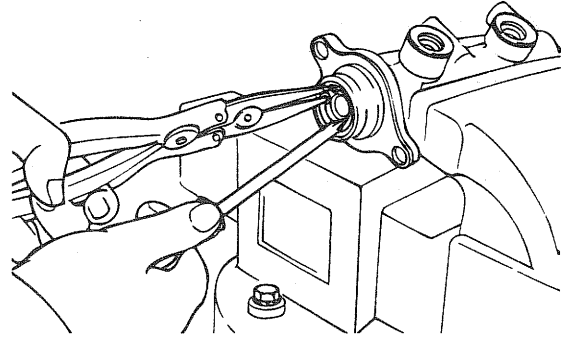
KFW8016A

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



EGGE700F

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



EGGE700G

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

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

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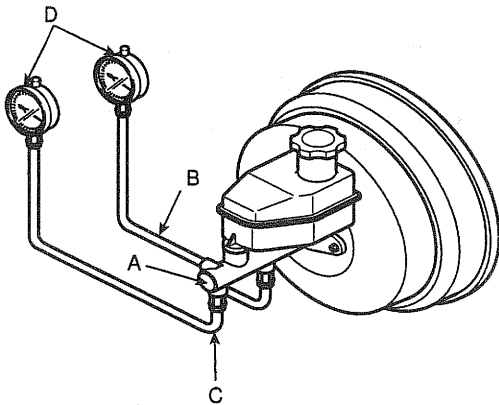
# PROPORTIONING VALVE

## DESCRIPTION EA7EAFD2

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

## INSPECTION ED0B3DD0

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.



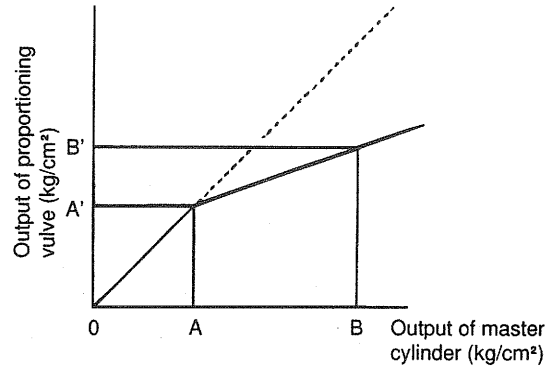
EGGE700H

**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



EGGE700I

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

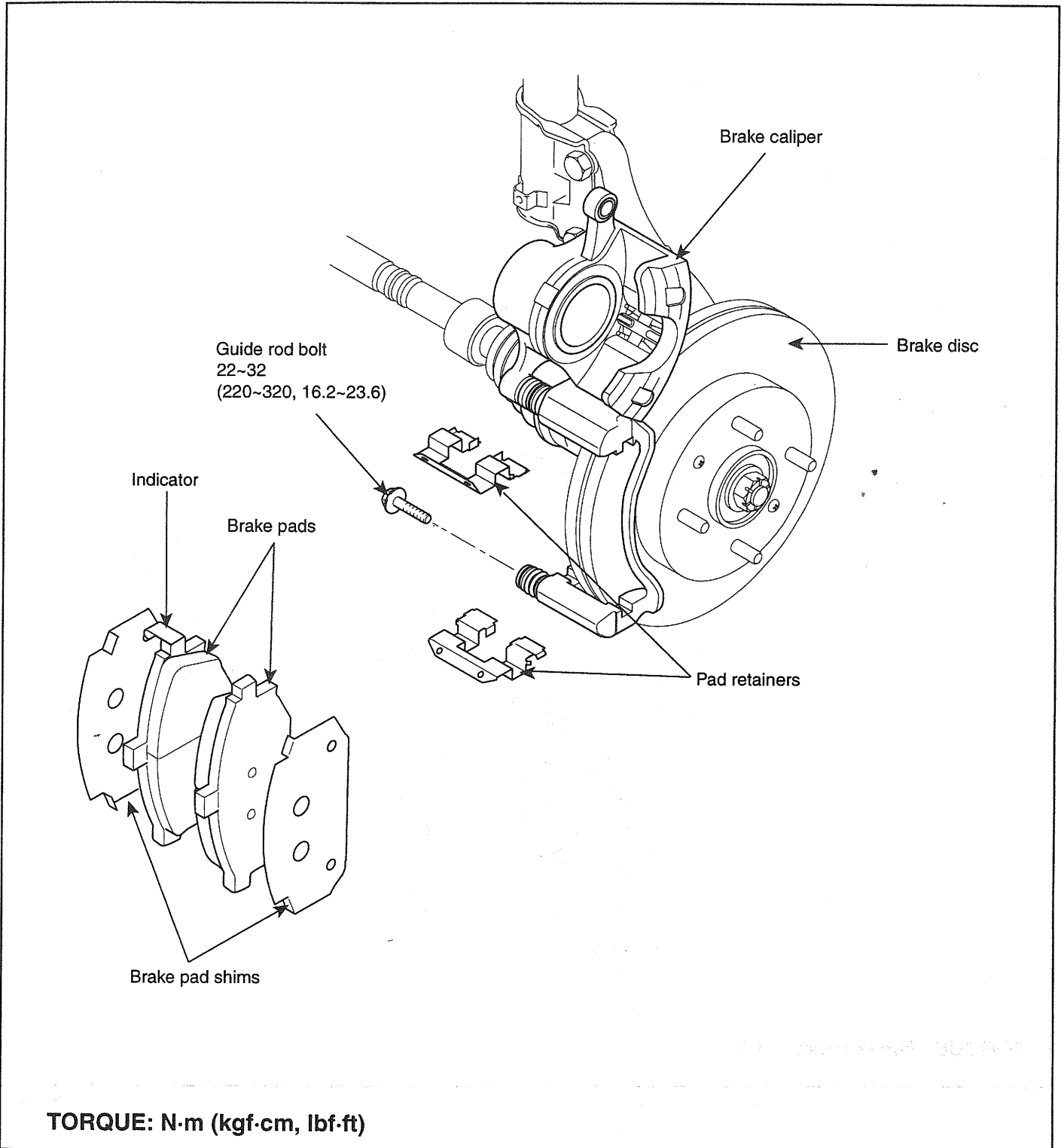
**NOTE**

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

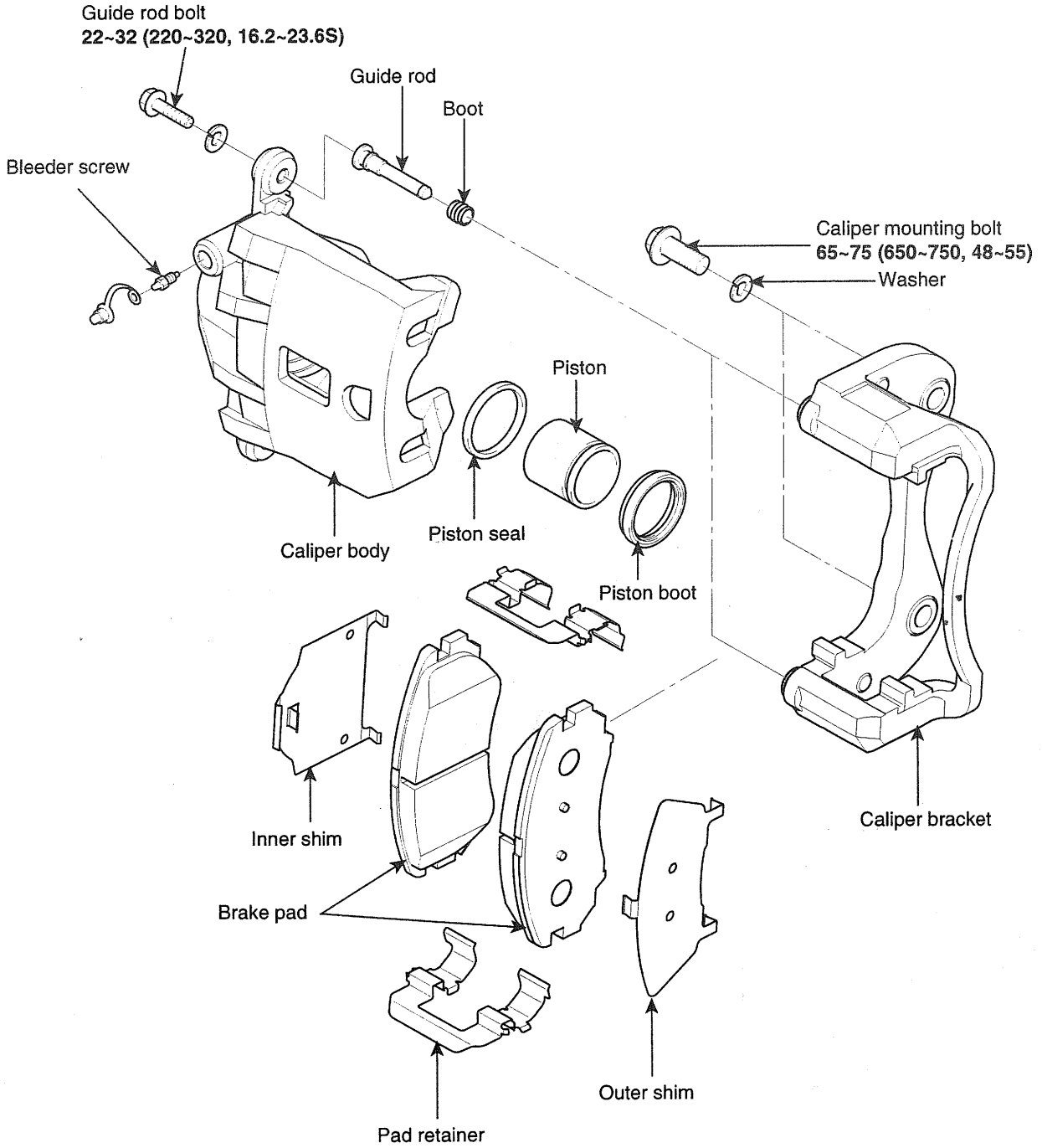
Front (Output of master cylinder)	Rear (Output of proportioning valve)
A : 26 kg/cm <sup>2</sup> (2.55MPa, 370psi)	A' : 26 kg/cm <sup>2</sup> (2.55MPa, 370psi)
B : 80 kg/cm <sup>2</sup> (7.84MPa, 1137psi)	B' : 40.6 ± 3 kg/cm <sup>2</sup> (3.98 ± 0.3MPa, 577 ± 42psi)

# FRONT DISC BRAKE

## COMPONENTS EAABFC65



**TORQUE: N·m (kgf·cm, lbf·ft)**



**TORQUE : Nm (kgf·cm, lbf·ft)**

## INSPECTION OF FRONT DISC BRAKE PAD

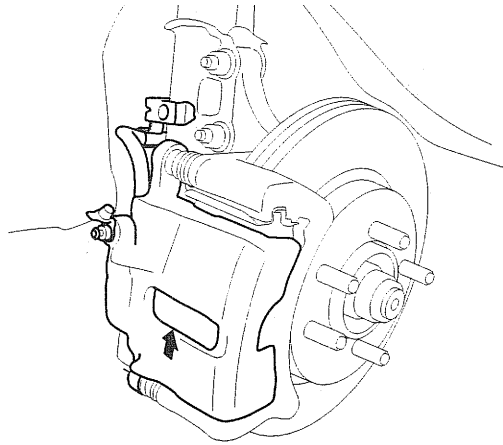
EEA9517D

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

### Pad thickness

Standard value : 11.0 mm ( 0.43 in.)

Service limit : 2.0 mm (0.0787 in.)

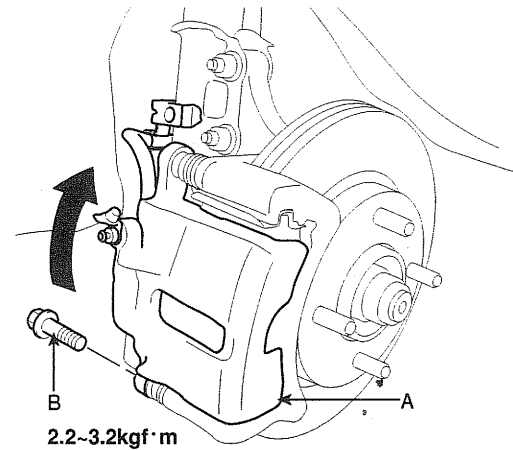


KJQE050H

## REMOVAL

E9567F79

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Release the parking brake.
3. Remove the two guide rod bolt (B) and support the caliper assembly with a piece of wire so that it does not hang from the brake hose.



KJQE050J

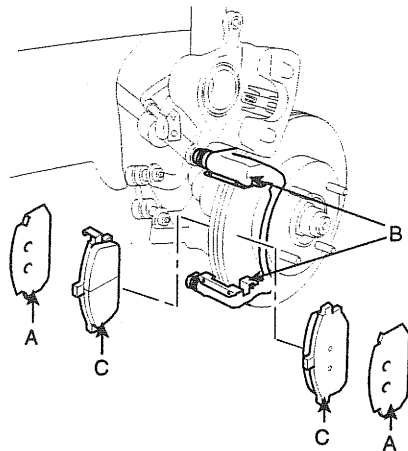


### CAUTION

- 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 right pad is large, check the sliding condition of the piston and the guide rod.



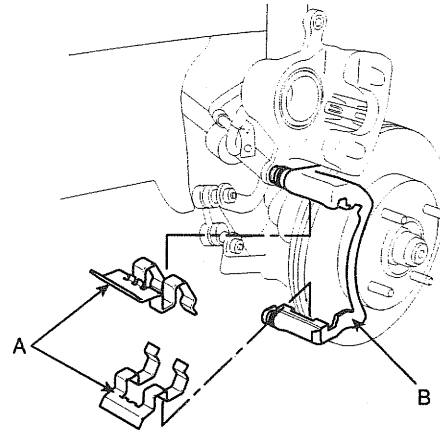
4. Remove the pad shims (A), pad retainers(B), and pads (C).



EJKE400B

## INSTALLATION E7AE7D81

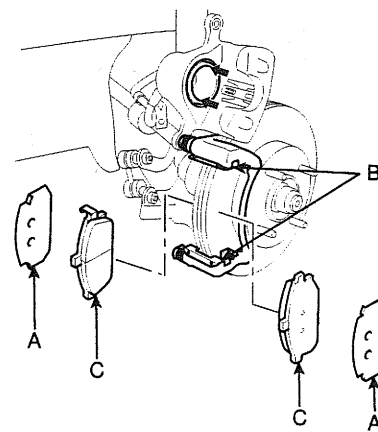
1. Install the pad retainers (A) on the caliper bracket(B)



KJQE400D

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

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

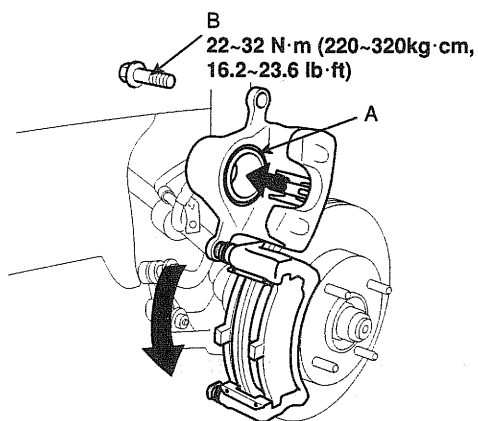


EGGE700J

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

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

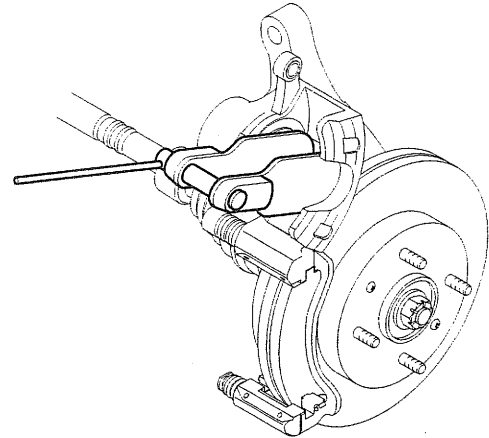
4. Push in the piston (A) so that the caliper will fit over the pads. Make sure that the piston boot is in position to prevent damaging it when pivoting the caliper down.
5. Pivot the caliper down into position. Being careful not to damage the pin boot, install the guide rod bolt (B) and torque it to proper specification.



EGGE700K

 **NOTE**

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



EGGE700L

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

 **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.

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

**INSPECTION**

E227B3F6

**FRONT BRAKE DISC THICKNESS CHECK**

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

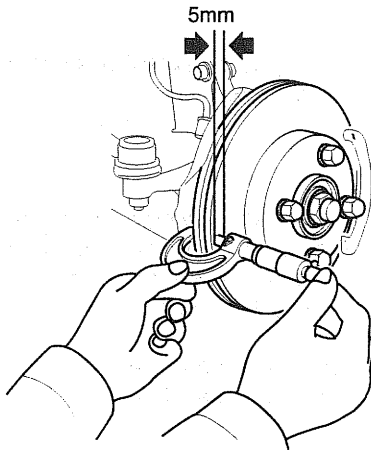
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 Front brake disc thickness

Standard value : 26.0mm(1.024 in.)

Limit : 24.4mm(0.961 in.)

2. Thickness variation should not exceed 0.005mm (0.-0004 in.) (circumference) and 0.01mm ( in.)(radius) at any directions.
3. If wear exceeds the limit, replace the disc and pad assembly left and right of the vehicle.



KJQE100D

**FRONT BRAKE PAD CHECK**

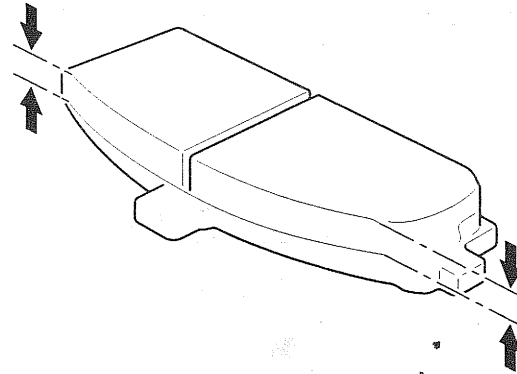
1. Check the pad wear. Measure the pad thickness and replace it, if it is less than the specified value.

---

 Pad thickness

Standard value : 9.0 mm (0.35 in.)

Service limit : 2.0 mm (0.0787 in.)



KJQE088A

2. Check that grease is applied, 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.

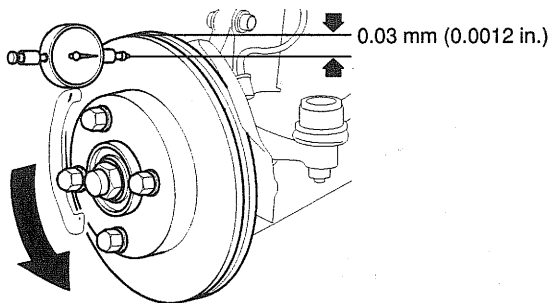
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Brake disc run out

Limit : 0.03 mm (0.0012 in.) or less

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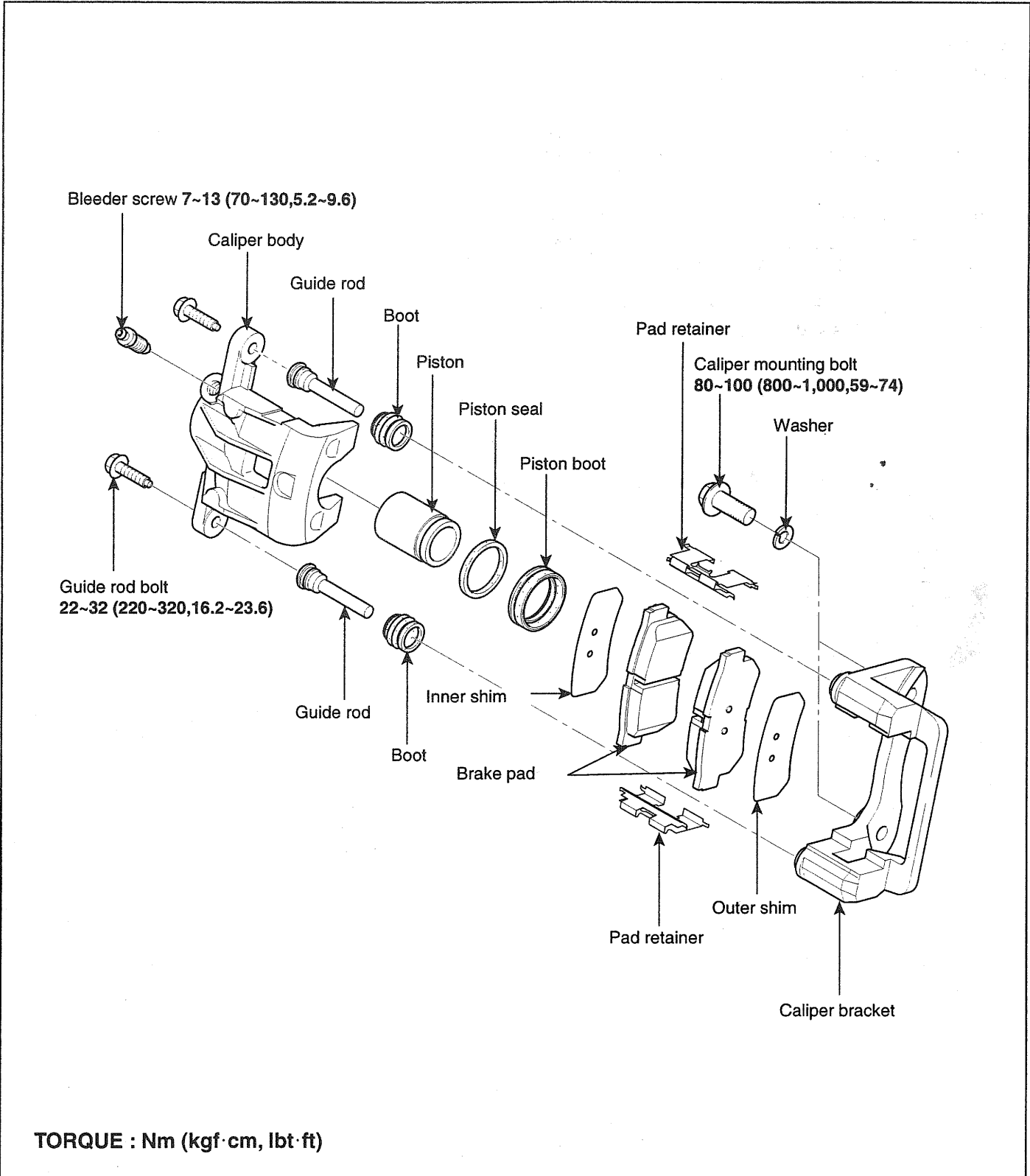
2. If the run out of the brake disc exceeds the limit specification, replace the disc, and then measure the run out again.
3. If the run out does not exceed the limit specification, install the brake disc after turning it 180° and then check the run out of the brake disc again.
4. If the run out cannot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



EJQE100C

# REAR DISC BRAKE

## COMPONENTS EFD3C70



## INSPECTION OF REAR DISC BRAKE PAD

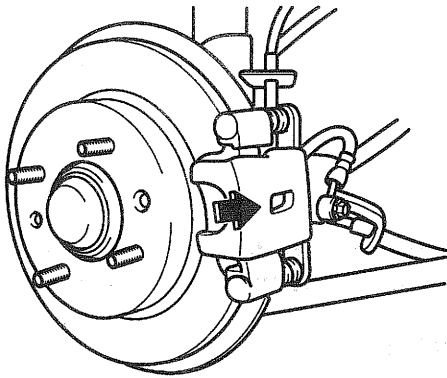
ED4BBAF6

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

### Pad thickness

Standard value : 10.0 mm (0.39 in.)

Service limit : 2.0 mm (0.0787 in.)

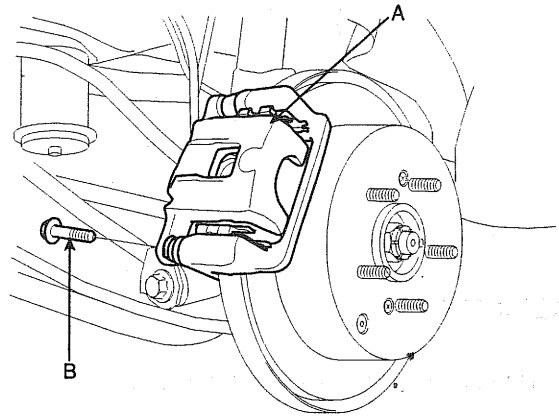


EGGE700M

## REMOVAL

E96659F5

1. Raise the rear of the vehicle and make sure it is securely supported. Remove the rear wheel.
2. Release the parking brake.
3. Remove the two guide rod bolt (B) and support the caliper assembly with a piece of wire so that it does not hang from the brake hose.

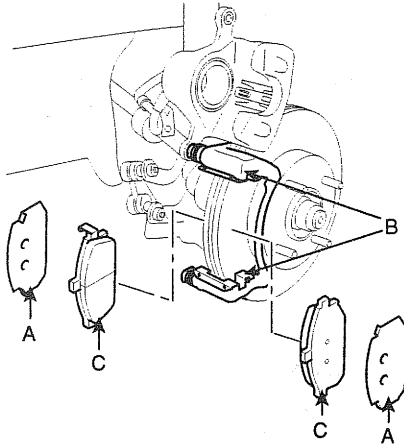


KJQE100B

### CAUTION

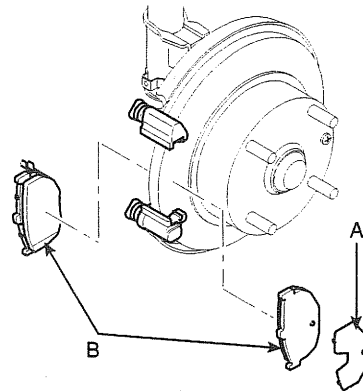
- If the pad thickness is out of specification, left and right pads must be replaced as a complete set.
- When the thickness difference between the left pad and right pad is large, check the sliding condition of the piston and the guide rod.

4. Remove the pad shims (A), pad retainers (B), and pads (C).



EJKE400B

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

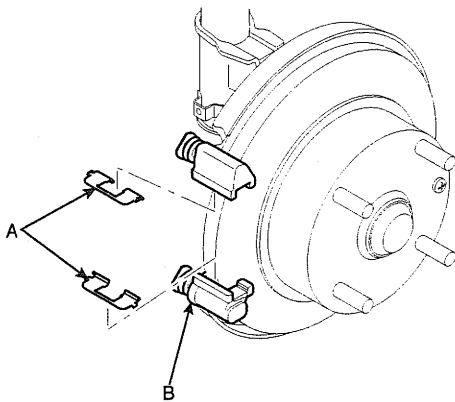


EGGE7000

## INSTALLATION

E4E6AD00

1. Install the pad springs (A) to the carrier (B).

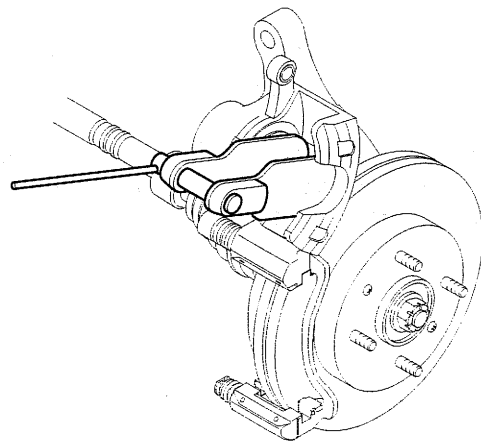


EGGE700N

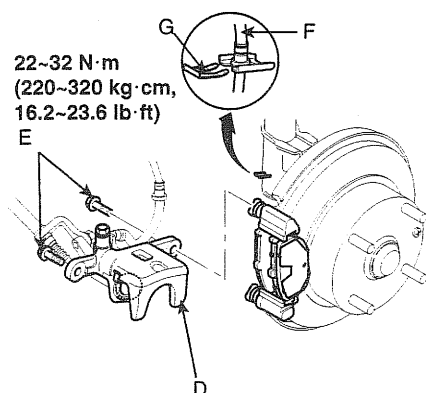
3. Contaminated brake discs or pads reduce stopping ability. Keep grease off the discs and pads.

### NOTE

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



EGGE700L



EGGE700Q

4. Install the brake pads (B) and pad shim (A) on the caliper bracket.

Install the inner pad with its wear indicator (C) facing down ward.

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

5. Rotate the caliper piston (A) clockwise into the cylinder, then align the cutout (B) in the piston with the tab (C) on the inner pad by turning the piston back.

Lubricate the boot with rubber grease to avoid twisting the piston boot.

If the piston boot is twisted, back it out so it is positioned properly.

6. Install the brake caliper (D).
7. Install and torque the guide rods (E) to proper specification.
8. Install the brake hose (F) onto the suspension arm with the brake hose clip (G).
9. After installation, check for leaks at hose and line joints and connections, and retighten if necessary.
10. 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 pedal will restore the normal pedal stroke.

## INSPECTION E07C730A

### REAR BRAKE DISC THICKNESS CHECK

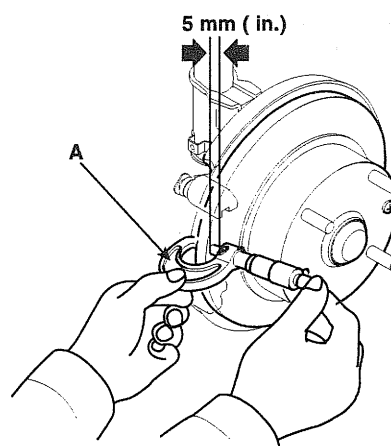
1. Remove all rust and contamination from the disc surface, and then measure the disc thickness at 8 points, at least, of the same distance (5mm) from the brake disk outer circle.

Rear brake disc thickness

Standard value : 10.0 mm ( 0.39 in.)

Limit : 8.0 mm (0.315 in.)

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



KJQE100F



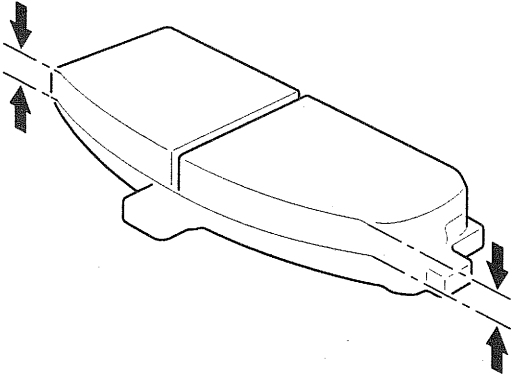
**REAR BRAKE PAD CHECK**

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

**Pad thickness**

Standard value : 10.0 mm ( 0.39in.)

Service limit : 2.0 mm (0.0787 in.)



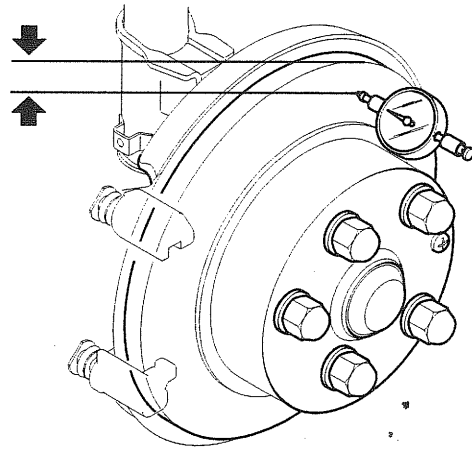
KJQE088A

**REAR BRAKE DISC RUN OUT CHECK**

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

**Brake disc run out**

Limit : 0.03 mm (0.0012 in.) or less



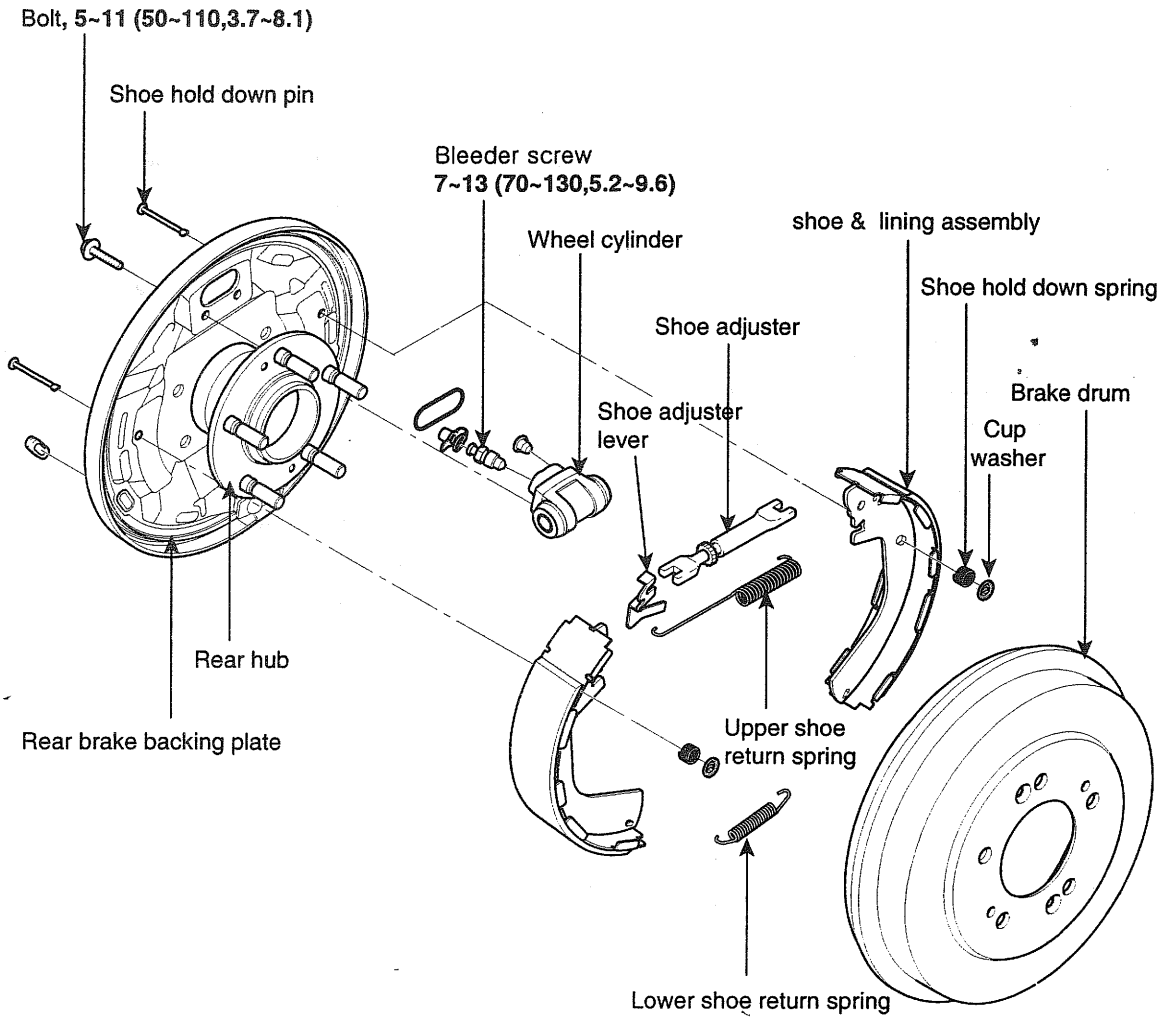
KJQE100E

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

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.

# REAR DRUM BRAKE

## COMPONENTS E29B305C



**TORQUE : Nm (Kgf·cm, lbf·ft)**

## INSPECTION

EAAE9A2C

**CAUTION**

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

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

**NOTE**

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

1. Raise the rear of the vehicle, and make sure it is securely supported.
2. Release the parking brake, and remove the rear brake drum.
3. Check the wheel cylinder (A) for leakage.
4. Check the brake linings (B) for cracking, glazing, wear, and contamination.

5. Measure the brake lining thickness (C).

Measurement does not include brake shoe thickness.

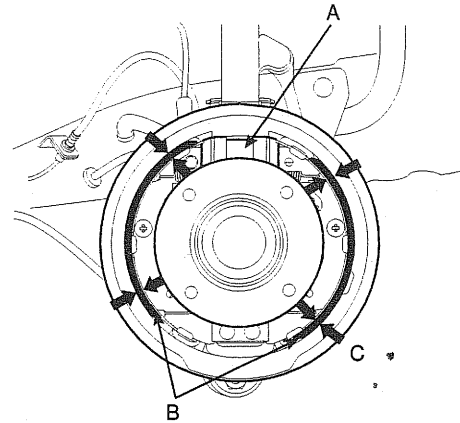
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Brake lining thickness

Standard : 4.5 mm (0.177 in.)

Service limit : 1.0 mm (0.039 in.)

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EGGE700R

6. If the brake lining thickness is less than the service limit, replace the brake shoes as a set.
7. Check the bearings in the hub unit for smooth operation. If it requires servicing, replace it.

8. Measure the inside diameter of the brake drum with inside vernier calipers.

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**Drum inside diameter:**

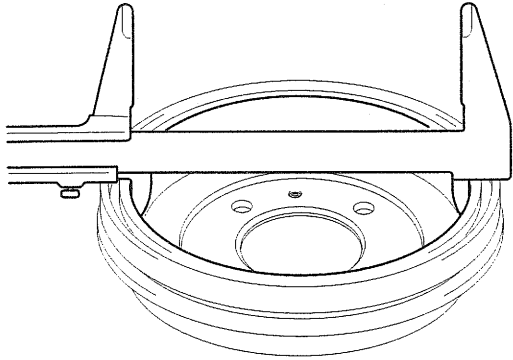
Standard : 228.6 mm (9 in.)

Service limit : 230.6 mm (9.079in.)

**Drum roundness**

Service limit : 230.6mm (0.0024in.)

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EGGE700S

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

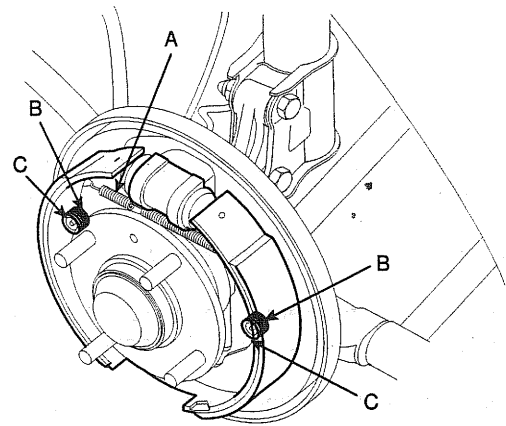
**REMOVAL** EE61FEB0

**CAUTION**

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

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

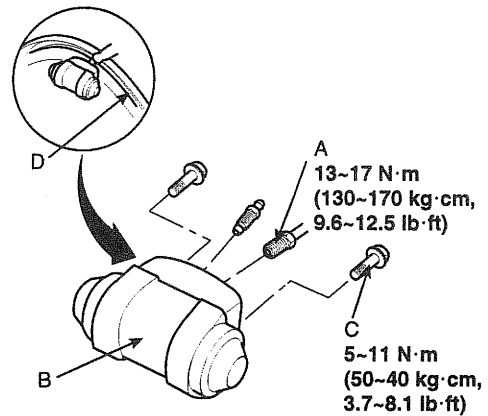
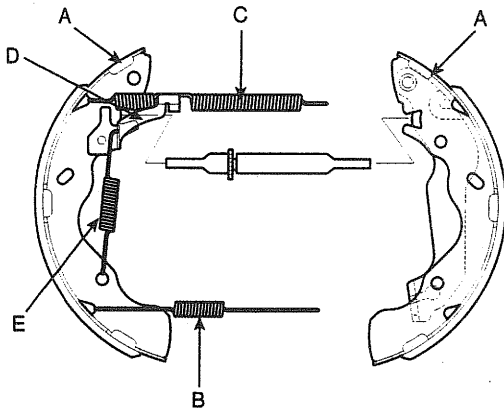
1. Remove the shoe hold down pins (B) by pushing the shoe hold cup washer (C) and turning them.
2. Disengage the upper return spring (A).



EGGE700T

3. Remove the lower shoe return spring (B) as removing the brake shoe assembly(A). Make sure not to damage the dust cover on the wheel cylinder.

8. Remove the bolt (C) and the wheel cylinder from the backing plate(D).



KJQE040C

EJQE040D

4. Disconnect the parking brake cable from the parking brake lever.
5. Remove the brake shoe assembly.
6. Remove the upper return spring (C), shoe adjuster lever (D), and separate the brake shoes.
7. Disconnect the brake line (A) from the wheel cylinder (B).

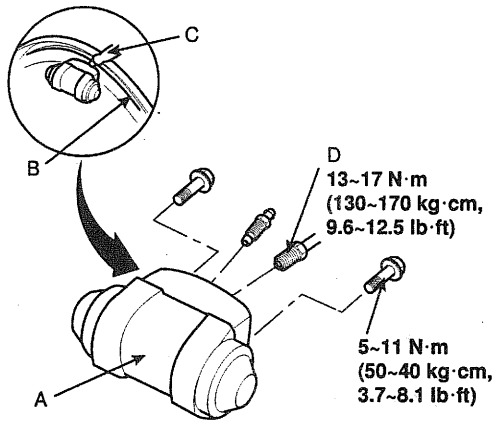
## INSTALLATION

E1F515C8

 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.
- To prevent spills, cover the hose joints with rags or shop towels.
- Use only a genuine wheel cylinder special bolt

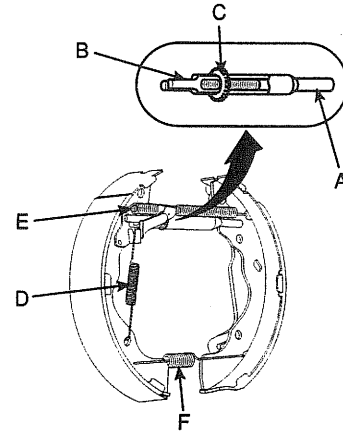
1. Apply sealant (C) between the wheel cylinder (A) and backing plate (B), and install the wheel cylinder.



EGGE700U

2. Connect the brake tubes (D) to the wheel cylinder.
3. Connect the parking brake cable to the parking brake lever.

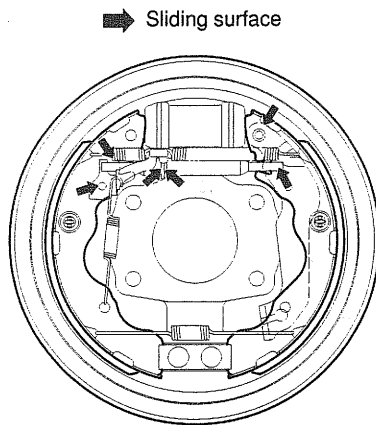
4. Clean the threaded portions of adjuster sleeve (A) and push rod female (B). Grease the threads of the adjuster assembly, turn the adjuster bolt (C), adjusting the length of the shoe adjuster assembly.



KJQE040H

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

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

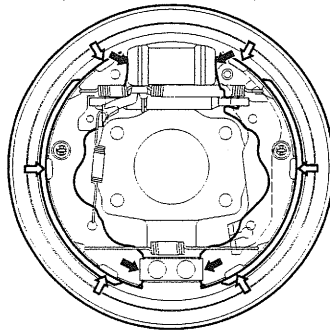


EGGE700V

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

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

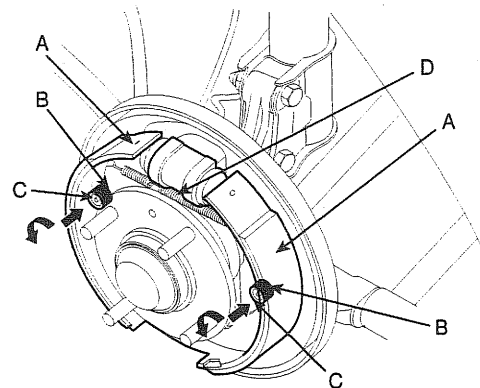
- ➡ Opposite edge of the shoe  
 ⇨ Brake shoe ends  
 (shoe side ends and backing plate contact surface)



EGGE700W

10. Grease brake shoes (A) onto the backing plate. Be careful not to damage the wheel cylinder dust covers.

11. Install the shoe hold down pins (B) and the shoe hold down washers (C).



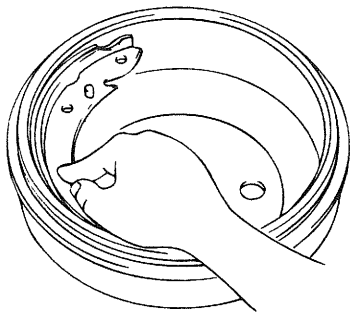
EJKE803F

12. Install the upper return spring (D).
13. Install the brake drum.
14. Bleed the brake system, after refilling the brake fluid.
15. Depress the brake pedal several times to set the self-adjusting brake.
16. Adjust the parking brake.

**INSPECTION**

E6056B43

1. Inspect the brake lining and drum for proper contact.
2. Inspect the wheel cylinder outside for excessive wear and damage.
3. Inspect the backing plate for wear or damage.

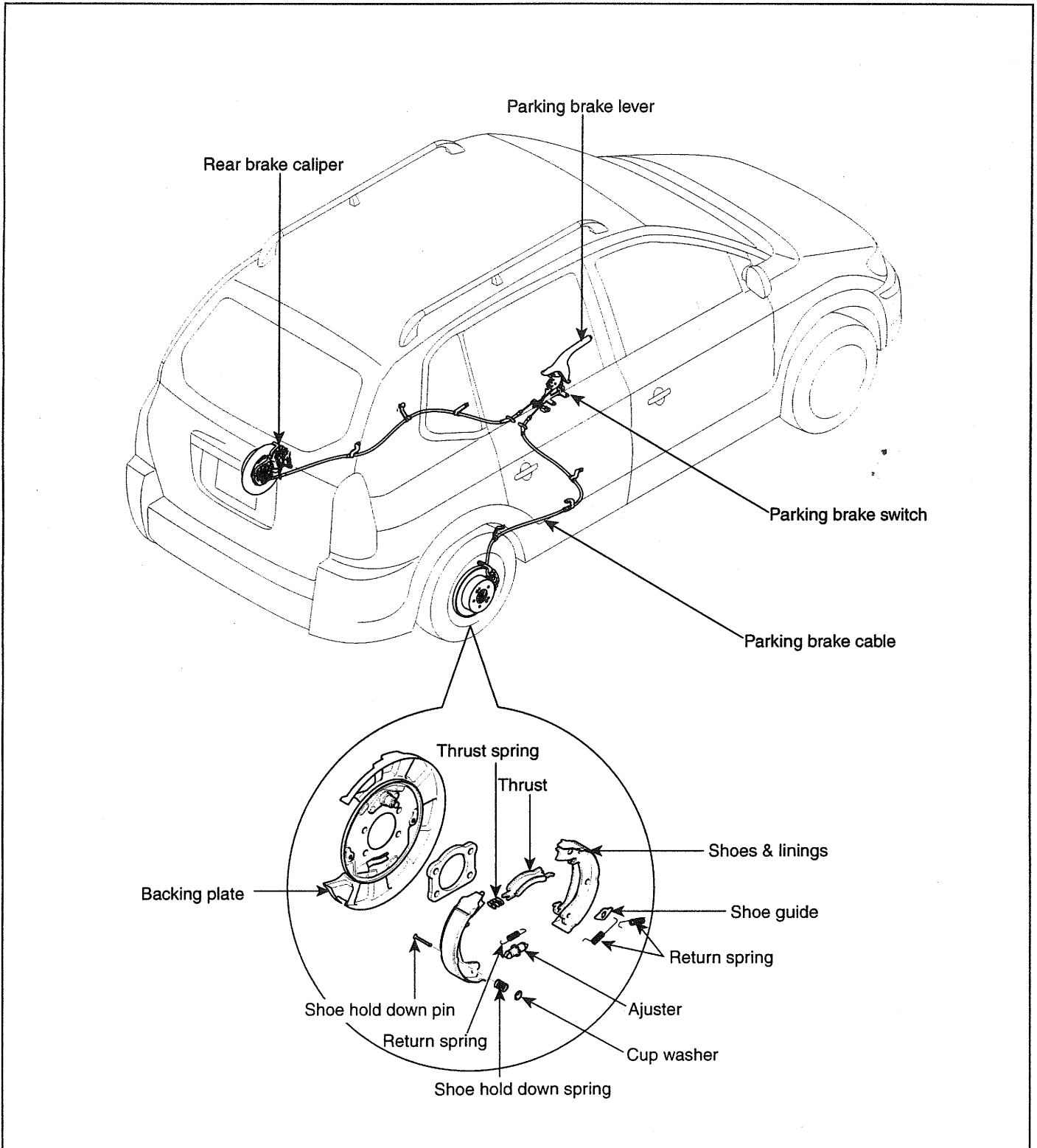


EJDA038C



# PARKING BRAKE SYSTEM

COMPONENTS ECB09114



**PARKING BRAKE CHECK AND ADJUSTMENT**

E8CCB913

**INSPECTION**

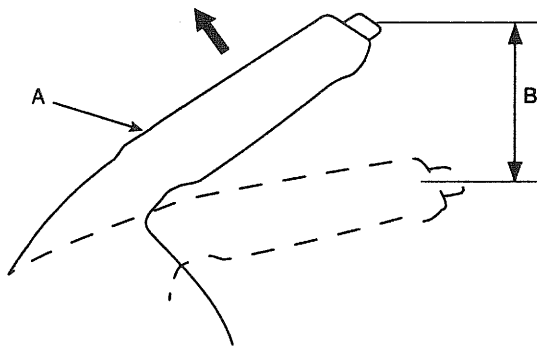
1. Pull the parking brake lever (A) with 196 N (20 kg, 44lb) force to fully apply the parking brake. The parking brake lever should be locked within the specified number of clicks (B).

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Lever locked clicks:7~8

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Pulled up with 196 N (20 kg, 44 lb)



EJKE002A

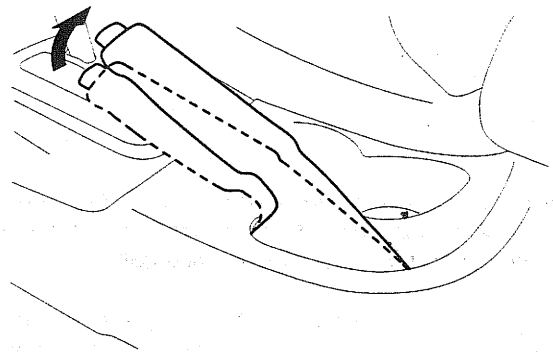
2. Adjust the parking brake if the lever clicks are out of specification.

**ADJUSTMENT**

 **NOTE**

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

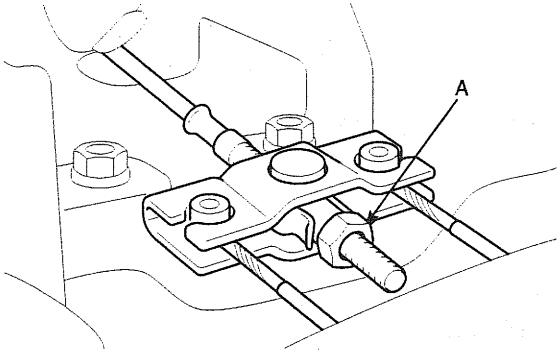
3. Block the front wheels, then raise the rear of the vehicle and make sure it is securely supported.
4. Pull the parking brake lever up one click.



EJKE002C

5. Remove the floor console.

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



EJKE002D

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

## PARKING BRAKE

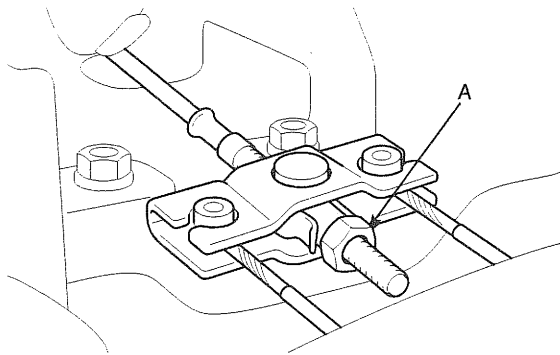
### REMOVAL E36C76BE

#### NOTE

The parking brake cables must not be bent or distorted.

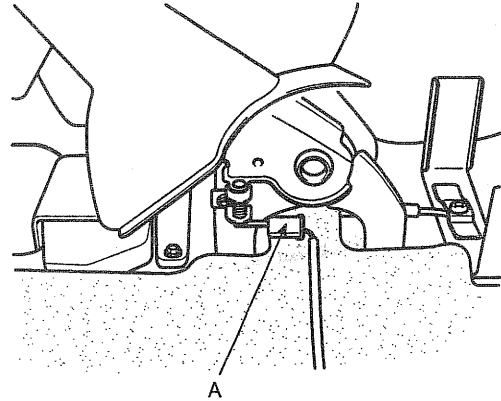
This will lead to stiff operation and premature failure.

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



EJKE002D

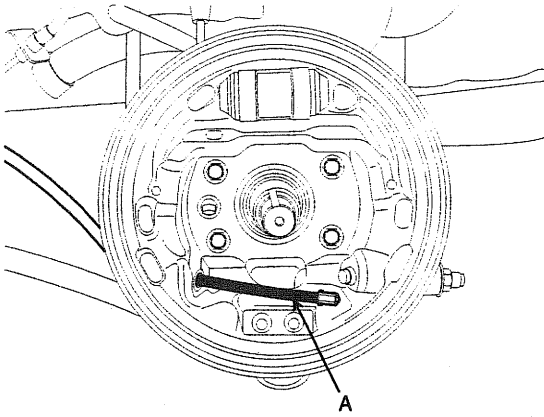
3. Disconnect the connector(A) of the parking brake switch.



EGGE700X

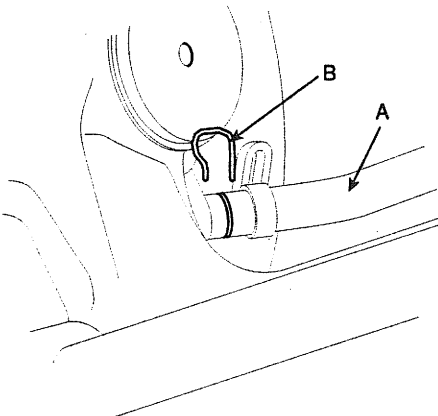
4. Remove the 4 bolts and parking brake lever assembly(A).
5. Remove the wheel and tire.
6. Remove the brake drum and the brake shoe (Refer to the rear drum brake).

7. Remove the parking brake cable(A) from the brake shoe.



KJQE040K

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



EJKE900B

## INSTALLATION EF514CB8

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

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Specified grease :

Multi purpose grease SAE J310, NLGI No.2

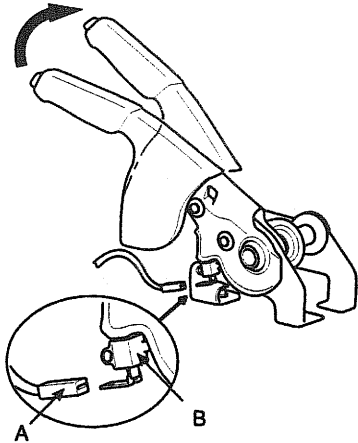
---

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

## PARKING BRAKE SWITCH

### INSPECTION E63D3A3C

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



EJQE004R

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

# ABS (ANTI-LOCK BRAKE SYSTEM)

## DESCRIPTION EA6F6FCC

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/ESP ECU.

This unit has the functions as follows.

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

### Installation position : engine room

- Brake Pipe 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.

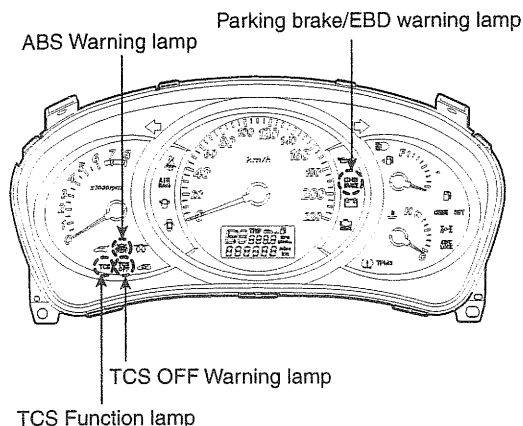
## PUMP MOTOR CHECKING

The ECU performs a pump motor test at a speed of 12km/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).



EJQE300A

### 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 separated from ECU.

### EBD WARNING LAMP MODULE

The active EBD warning lamp module indicates the self-test and failure status of the EBD.

However, in case the Parking Brake Switch is turned on, the EBD warning lamp is always turned on regardless of EBD functions.

The EBD warning lamp shall be on:

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

### TCS WARNING LAMP (TCS SYSTEM)

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

The TCS 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 TCS functions by failure
- When driver turn off the TCS function by on/off switch.
- During diagnostic mode.

### TCS FUNCTION LAMP (TCS SYSTEM)

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

The TCS Function lamp operates under the following conditions :

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

### TCS ON/OFF SWITCH (TCS SYSTEM)

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

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

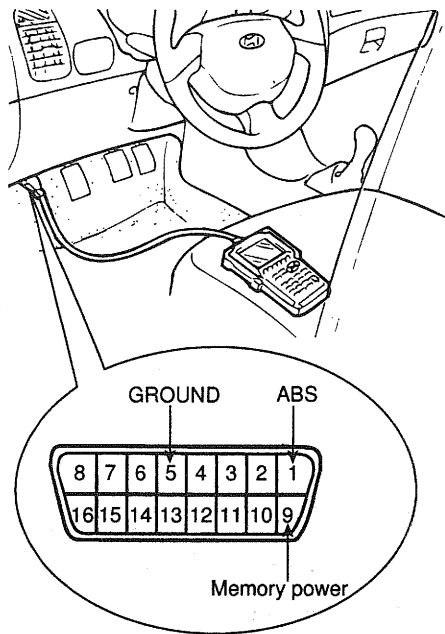
Closed contacts switch the circuit to ignition.

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



**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'd side kick panel.



EJKD057A

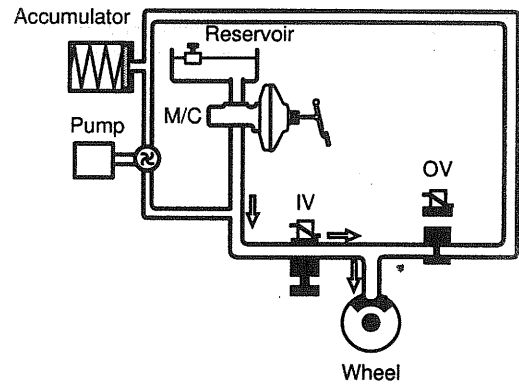
3. Turn the ignition switch ON.
4. Check for diagnostic trouble using the Hi-scan(pro)
5. After completion trouble of the repair or correction of the problm, erase the stored fault codes the clear key on the Hi-scan(pro).
6. Disconnect the Hi-scan (pro) from the 16P date link connector.

**ABS CONTROL** E4AF58FB

1. NORMAL BRAKING without ABS

Solenoid valve	State	Valve	Passage	Pump motor
Inlet valve (NO)	OFF	OPEN	Master cylinder $\leftrightarrow$ Wheel cylinde	OFF
Outlet valve (NC)	OFF	CLOSE	Wheel cylinder $\leftrightarrow$ Reservoir	

When braking, the hydraulic pressure in the TMC is increased. The pressure reaches the wheel brake via the current less open inlet valve IV. The current less closed outlet valve OV is closed. For the sake of simplicity the diagram is limited to only the solenoid valve pair of one brake circuit. The wheel speed is reduced as the brake pressure increases, in the extreme case until the wheel locks.



EJQE015A