

Brake System

GENERAL	BR -2
BRAKE SYSTEM	BR -9
PARKING BRAKE SYSTEM	BR -31
ABS (ANTI-LOCK BRAKE SYSTEM)	BR -33

GENERAL

EJJB0010

SPECIFICATIONS**Master cylinder**

Type	Tandem type
I.D.	23.8 mm (0.94 in.) : CBS (Conventional Brake System) 25.4 mm (1.0 in.) : ABS (Antilock Brake System)
Fluid level sensor	Provided

Brake booster

Type	Vacuum type with tandem booster
Effective dia.	8 + 9 in.
Boosting ratio	7.0 : 1 (CBS), 7.5 : 1 (ABS)

Front brake

Type	Floating type with ventilated disc
Disc O.D.	276 mm (10.87in.) : 2WD 294 mm (11.57in.) : 4WD
Disc thickness	26 mm (1.02 in.)
Pad thickness	10.5 mm (0.41 in.)
Cylinder I.D.	42,9 mm (1.689 in.) (X2)

Rear disk brake

Type	Floating type with solid disc
Disc O.D.	284 mm (11.18 in.)
Disc thickness	10 mm (0.39 in.)
Pad thickness	10 mm (0.39 in.)
Cylinder I.D.	38.2 mm (1.50 in.)

Parking brake

Actuation	Mechanical brake acting on rear wheels
Type	Lever

Rear drum brake

Type	Dual mode drum
Drum I.D.	254 mm (10 in.)
Cylinder I.D.	20.64 mm (0.81 in.)
Clearance adjustment	Automatic
Lining thickness	4.5 mm (0.18 in.)

O.D. = Outer diameter

I.D. = Inner diameter

SERVICE STANDARDEJJB0020

Standard value

Brake pedal height	208 (+5, -0) mm, (8.22 (+2, -0) in.)
Clearance between stop lamp switch outer case and pedal stopper	0.5-1.0 mm (0.020-0.040 in.)
Brake pedal free play	3-8 mm (0.117-0.312 in.)
Clearance between booster push rod and master cylinder piston	0 (at 500 mmHg vacuum)
Clearance between brake pedal and floor board	44 mm (1.73 in.)
Parking brake lever stroke (when lever assembly is pulled with 196N (20kg, 44lb) force 7 clicks	44 mm (1.73 in.)

Service limit

Front disc brake pad thickness	2.0 mm (0.079 in.)
Front disc thickness (minimum)	24.4 mm (0.96 in.)
Front disc runout	0.04 mm (0.0016 in.)
Front disc thickness variation	0.005 mm (0.0002 in.)
Rear disc brake pad thickness	2.0 mm (0.079 in.)
Rear disc thickness	8.4 mm (0.33 in.)
Rear drum I.D.	256 mm (10.08 in.)
Rear brake lining thickness	1.5 mm (0.059 in.)

TIGHTENING TORQUE

EJJB0030

	Nm	Kg-cm	lb-ft
Master cylinder to booster mounting	8-12	80-120	5.9-8.8
Brake booster mounting nut	13-16	130-160	9.4-11.6
Brake booster vacuum hose fitting to surge tank	15-18	150-180	11-13
Bleeder screw	7-9	70-90	5-6.6
Brake flare nut, brake hose	13-17	130-170	9-12
Proportioning valve mounting bolt	35-55	350-550	26-41
Caliper guide rod bolt	22-32	220-320	16-24
Caliper assembly to knuckle			
Front	80-100	800-1000	58-73
Rear	50-60	500-600	36-43
Brake hose to front caliper	25-30	250-300	18.5-22.2
Wheel cylinder mounting bolt	12-18	120-180	8.8-13
Parking brake mounting bolt	17-26	170-260	12-19

CAUTION

Replace the self-locking nuts with new ones after removal.

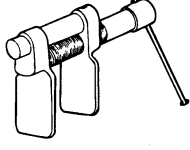
LUBRICANT

EJHA0150

	Recommended lubricant	Quantity
Brake fluid	DOT 3 or DOT 4	As required
Brake pedal bushing and brake pedal bolt	Chassis grease SAE J310, NLGI No.0	As required
Clevis pin	Wheel bearing grease SAE J310, NLGI No.2	As required
Parking brake shoe and backing plate contact surfaces	Bearing grease, NLGI No.0-1	As required

SPECIAL TOOLS

EJHA0200

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

TROUBLESHOOTING

EJJB0040

Trouble symptom	Probable cause	Remedy
Noise or vibration when brakes are applied	Caliper improperly mounted	Correct
	Loose caliper mounting bolts	Retighten
	Unevenly worn or cracked brake drum or brake disc	Replace
	Foreign material in brake drum	Clean
	Seized pad or lining contact surface	Replace
	Excessive clearance between pad assembly and caliper	Correct
	Uneven pad contact	Correct
	Lack of lubrication in sliding parts	Lubricate
	Loose suspension parts	Retighten
	Excessive of disc runout	Replace disc
Excessive variation of disc thickness	Replace disc	
Vehicle pulls to one side when brakes are applied	Difference in left and right tire inflation pressure	Adjust
	Inadequate contact of pad or lining	Correct
	Grease or oil on pad or lining surface	Replace
	Drum warped or uneven wear	Replace
	Incorrect wheel cylinder installation	Correct
	Auto adjuster malfunction	Correct

Trouble symptom	Probable cause	Remedy
Insufficient braking power	Low or deteriorated brake fluid Air in the brake system Brake booster malfunction Inadequate contact of pad or lining Grease or oil on pad or lining surface Auto adjuster malfunction Overheated brake rotor due to dragging of pad or lining Restricted brake line Proportioning valve malfunction	Refill or change Bleed the system Correct Correct Replace Correct Correct Replace Replace
Increased pedal stroke required (Reduced clearance between pedal and floorboard)	Air in the system Brake fluid leaks Excessive push rod to master cylinder clearance	Bleed the system Correct Adjust
Brake drag	Incomplete release of parking brake Incorrect parking brake adjustment Worn brake pedal return spring Restricted master cylinder return port Broken rear drum brake shoe return spring Lack of lubrication in sliding parts Defective master cylinder check valve or piston return spring	Adjust Adjust Replace Correct Replace Lubricate Replace
Insufficient parking brake function	Worn brake lining or pad Grease or oil on lining or pad surface Parking brake cable sticking Auto adjuster malfunction Excessive parking brake lever stroke	Replace Replace Replace Correct Adjust the parking brake lever stroke or check the parking brake cable routing

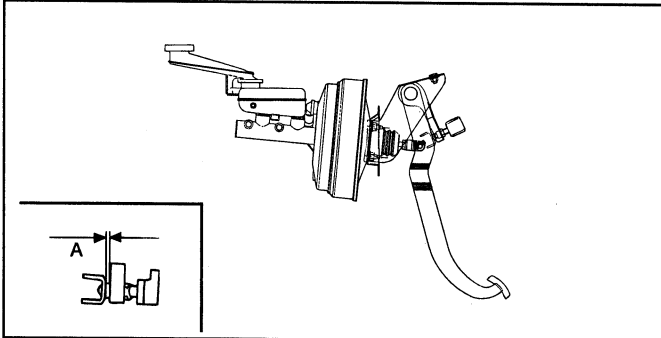
SERVICE BRAKE PEDAL INSPECTION AND ADJUSTMENT

EJJB0050

1. Turn the stop lamp switch until the clearance between the outer case of the stop lamp switch and pedal arm reaches the standard value, and then secure the stop lamp switch with the lock nut.

Clearance between pedal and stop lamp switch "A" :

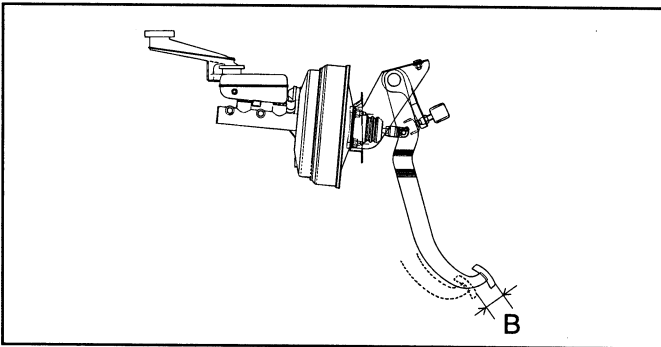
0.5-1.0 mm (0.02-0.039 in.)



EJHA001A

2. Adjust the stop lamp switch until the free play of the brake pedal reaches the standard value.

Brake pedal free play "B" : 3-8 mm (0.12-0.32 in.)



EJHA230A

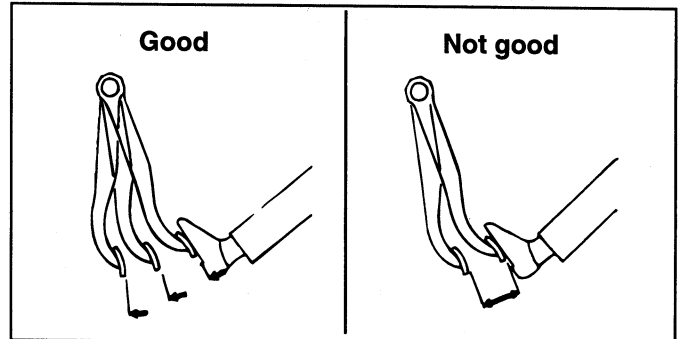
BRAKE BOOSTER OPERATION TEST WITHOUT A TESTER

For a simple check of brake booster operation, perform the following tests.

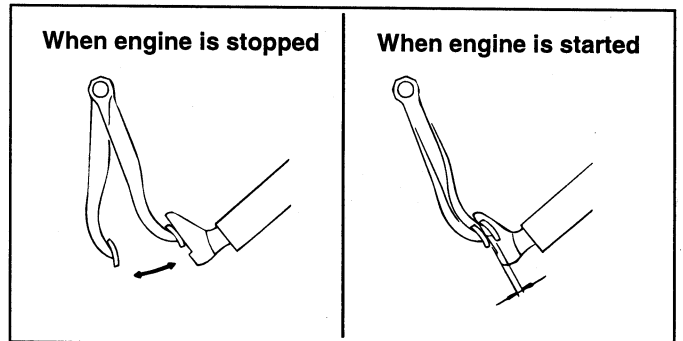
1. Run the engine for one or two minutes, and then shut it off. Depress the brake pedal several times at normal foot pressure. If the pedal goes down completely the first time, but rises gradually, the brake booster is functioning properly. If the height of the pedal doesn't change, the booster may be damaged.
2. After checking that the height of the pedal changes when depressing the brake pedal several times with

the engine stopped, start it keeping the brake pedal depressed. At this time, if it goes down slightly, the booster is good but if the height of it doesn't change, it is damaged.

3. With the engine running, depress 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 up, it is damaged.
4. If one of the above three tests is not OK, check the vacuum hoses, the check valve and the brake booster. Make any necessary corrections. If all tests are OK, the unit is in good condition.



EJA9002A



EJA9002B

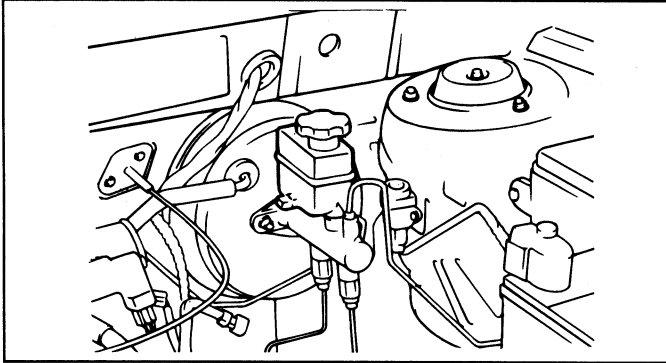
BLEEDING THE BRAKE SYSTEM

EJJB0070

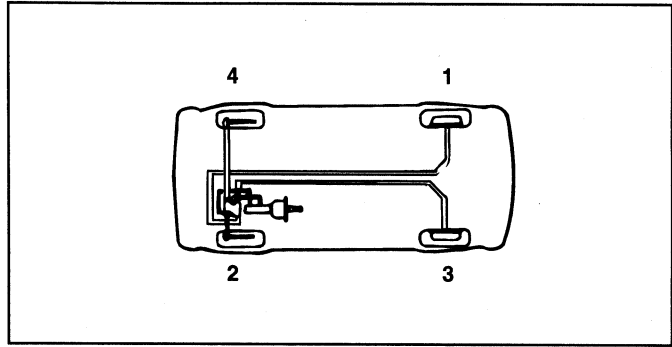
1. Remove the reservoir cap and fill the brake reservoir with brake fluid.

CAUTION

Do not allow brake fluid to remain on a painted surface. Wash it off immediately.

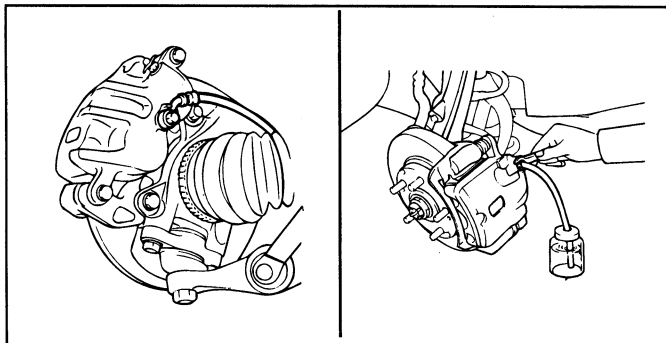


EJJA010G



EJA9004A

2. Connect a vinyl tube to the wheel cylinder bleeder plug and insert the other end of the tube in a container of brake fluid which is half full.
3. Start the engine.
4. Slowly depress the brake pedal several times.
5. While depressing the brake pedal fully, loosen the bleeder plug until fluid runs out. Then close the bleeder screw and release the brake pedal.



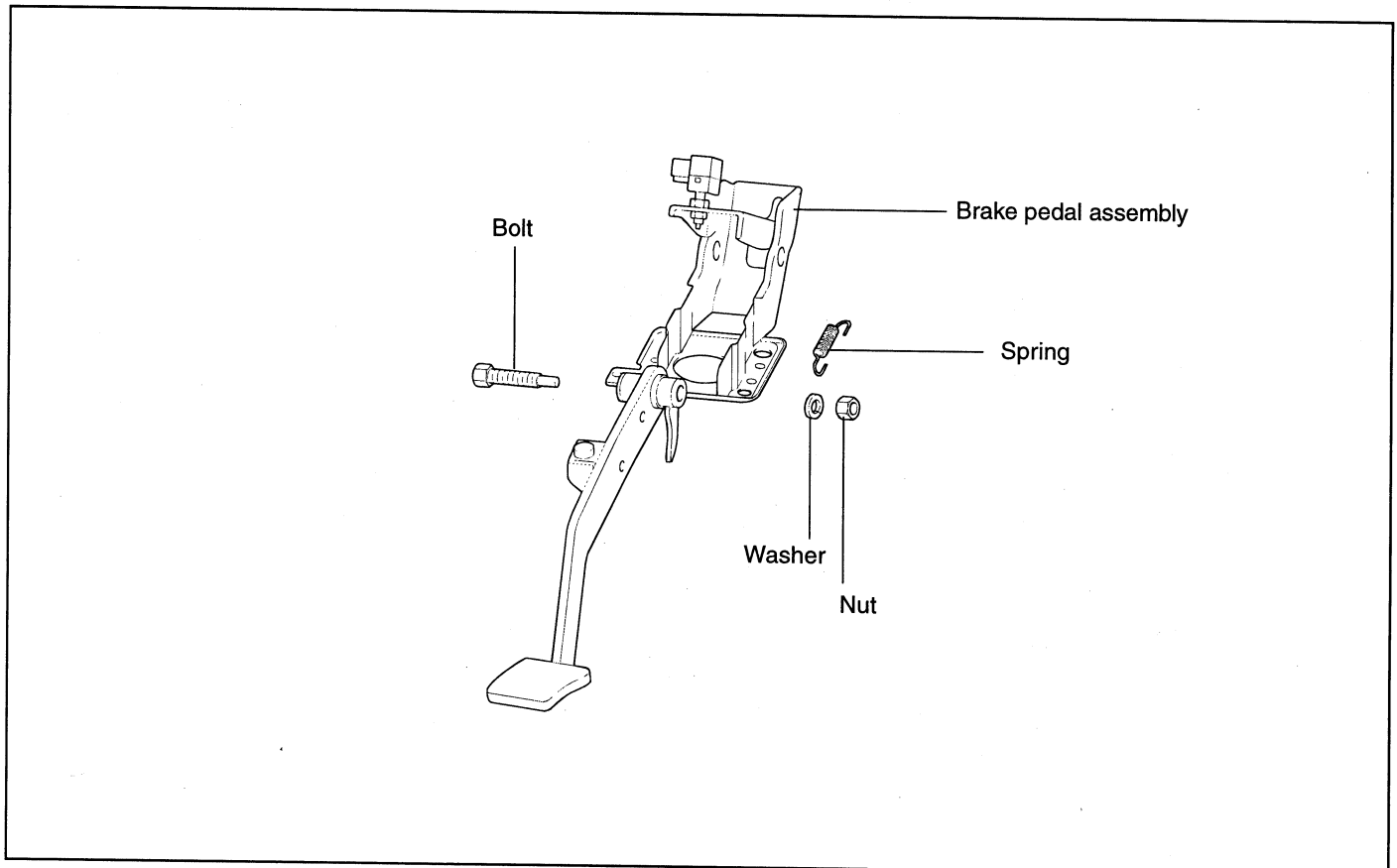
KFW8006A

6. Repeat steps 4 and 5 until there are no more bubbles in the fluid.
7. Tighten the bleeder plug screw.

Bleeder screw tightening torque :

7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

8. Repeat the above procedure for each wheel in the sequence shown in the illustration.

BRAKE SYSTEM**BRAKE PEDAL****COMPONENT** EJJB0080

AJJA010C

REMOVAL EJJB0090

1. Remove the lower crash pad assembly.
2. Remove the stop lamp switch connector and disconnect the shift lock cable (Vehicle equipped with cruise control system only).
3. Remove the cotter pin and clevis pin.
4. Remove the brake pedal member assembly mounting nut.
5. Remove the brake pedal assembly.

4. Check all parts for crack and wear.

INSPECTION EJJB0095

1. Check the bushing for wear.
2. Check the brake pedal for bending or twisting.
3. Check the brake pedal return spring for damage.

INSTALLATION EJJB0100

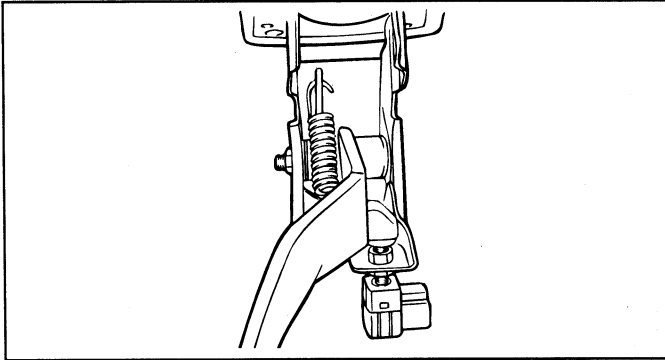
Installation is the reverse of removal.

NOTE

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

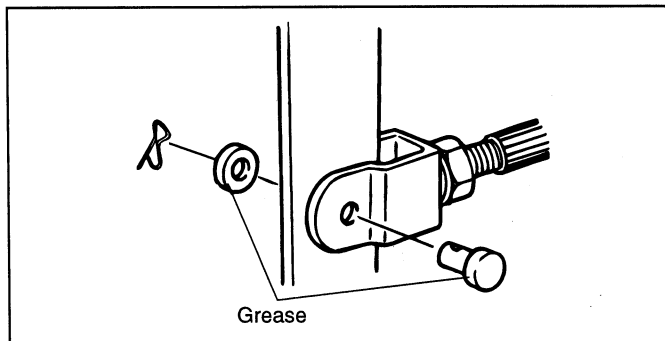
Specified grease :

Chassis grease SAE J310, NLGI No. 0



EJJA010D

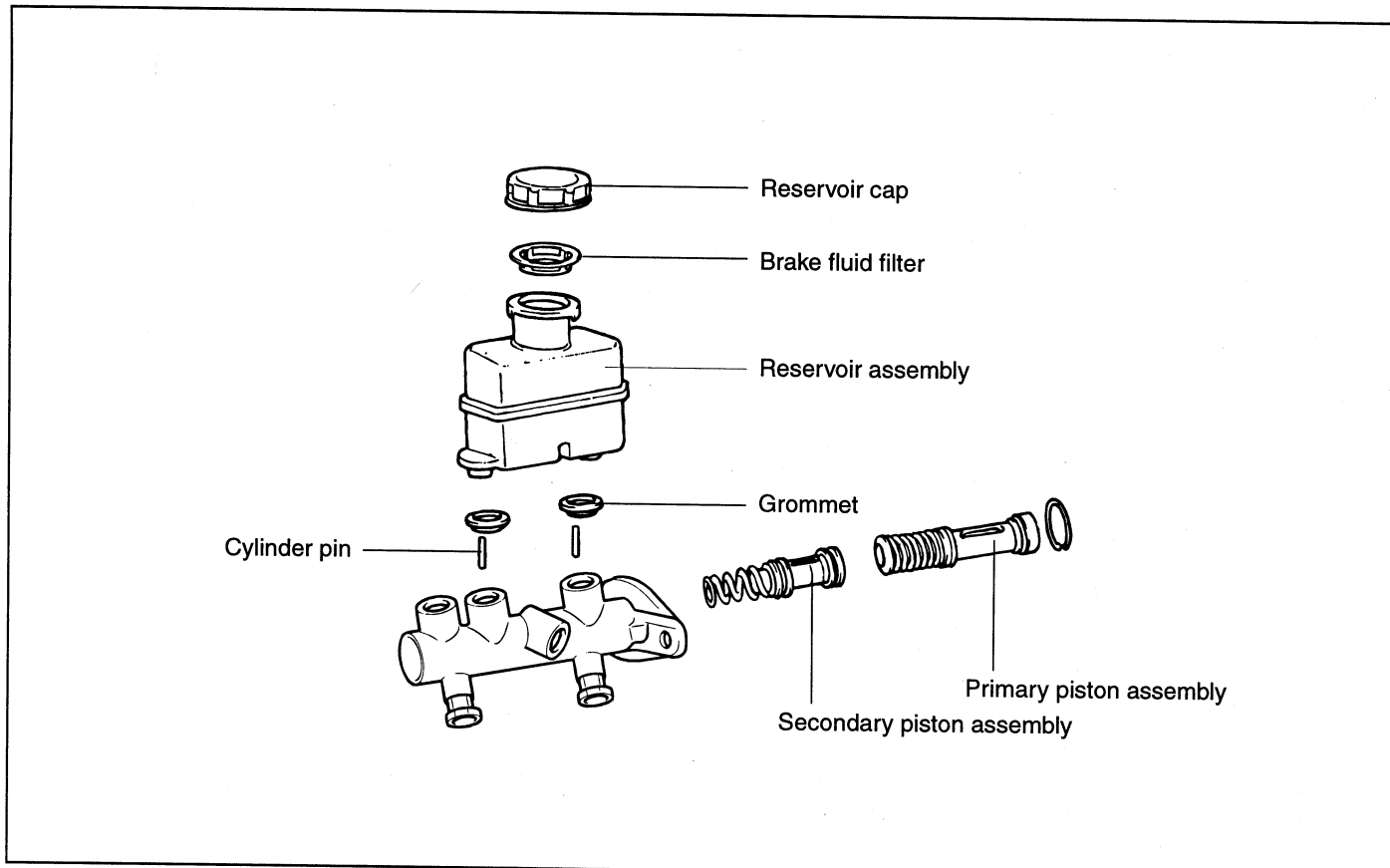
2. Before inserting the clevis pin, apply the specified grease to the clevis pin and washer.



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MASTER CYLINDER

COMPONENTS EJJB0110



AJJA010E

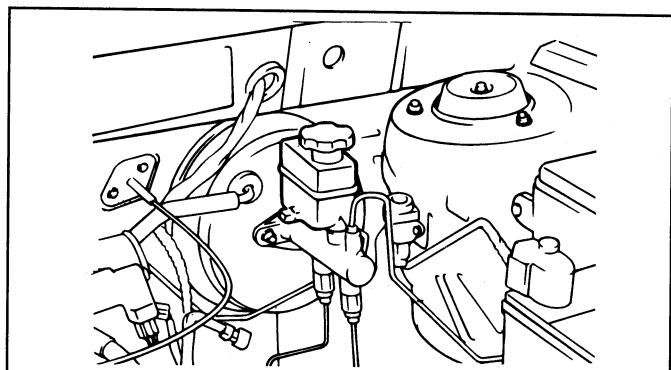
REMOVAL EJJB0120

1. Detach the brake tubes from the master cylinder, and then install the plug.

CAUTION

Do not allow brake fluid to remain on a painted surface. Wash it off immediately.

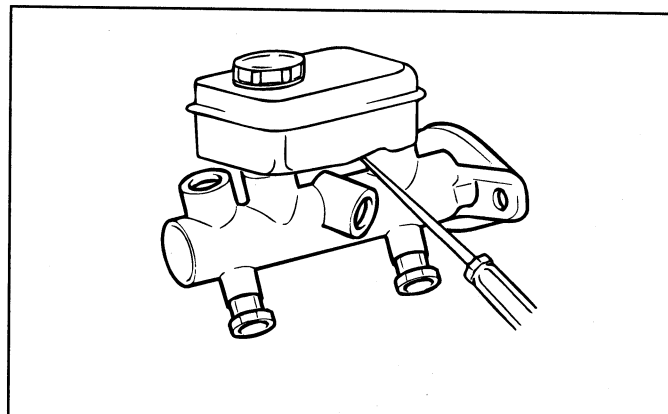
2. Remove master cylinder mounting nuts and then lift out the master cylinder.



EJJA010G

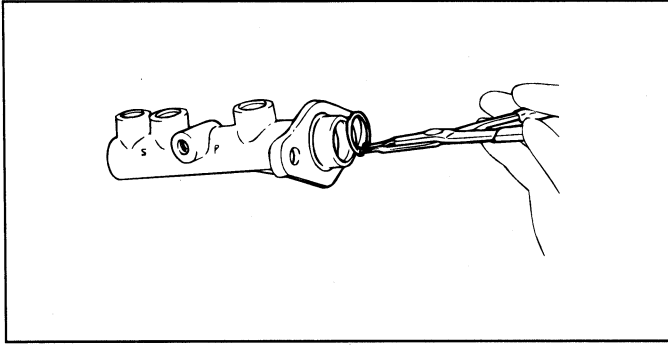
DISASSEMBLY EJJB0130

1. Remove the reservoir cap and drain the brake fluid into a suitable container.
2. After disconnecting the mounting screws, pay the reservoir free from the master cylinder.



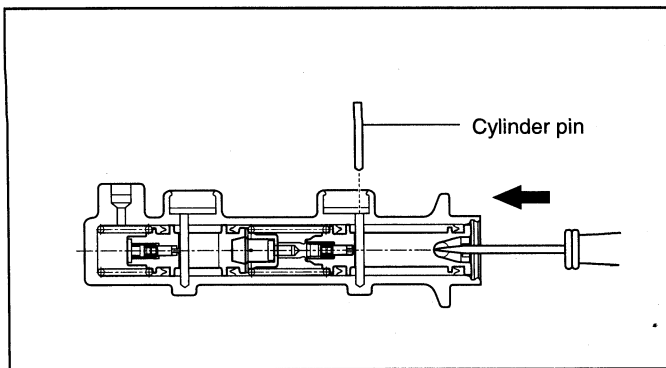
EJJA010F

3. Using a snap ring pliers, remove the retainer ring.



EJA9009C

4. Remove the primary cylinder pin. Push the primary piston with a screwdriver and remove the primary piston assembly.

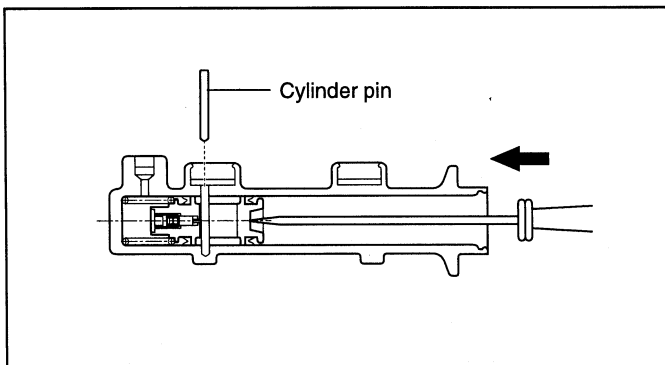


AFW8013A

5. Remove the secondary cylinder pin. Push the secondary piston with a screwdriver and remove the secondary piston assembly.

NOTE

Do not disassemble the primary and secondary piston assembly.



KFW8014A

INSPECTION

EJJB0140

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

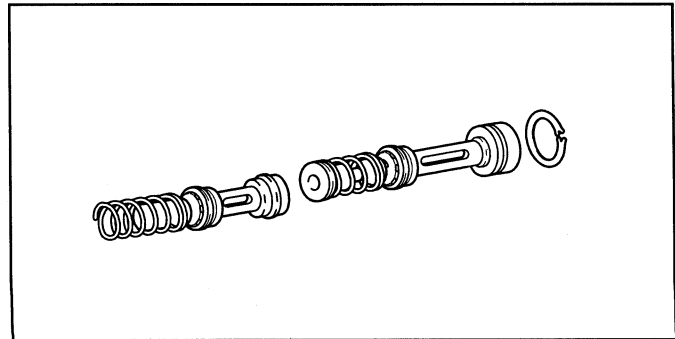
NOTE

1. If the cylinder bore is damaged, replace the master cylinder assembly.
2. Wash the parts in alcohol.

ASSEMBLY

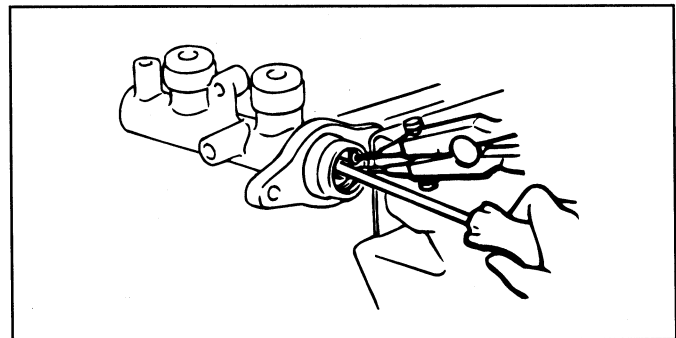
EJJB0150

1. Apply genuine brake fluid to the rubber parts of the cylinder kit and grommets.



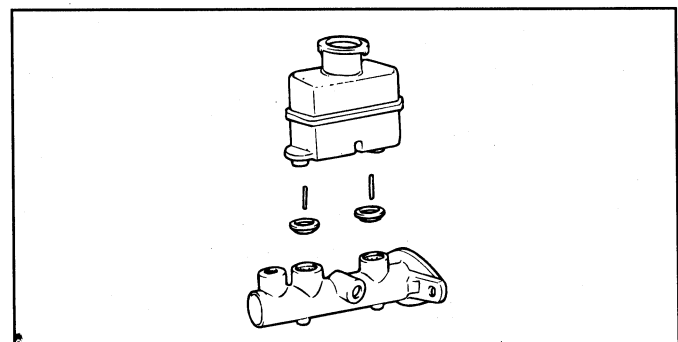
KFW8016A

2. Carefully insert the springs and pistons in the proper direction.
3. Press against the pistons with a screwdriver and install the retainer ring.



HE58-11

4. With the piston pushed completely home by a screwdriver, install the piston pin.
5. Mount two grommets.
6. Install the reservoir on the cylinder.



KFW8017A

INSTALLATION EJJB0160

1. Install the master cylinder to the brake booster.
2. Install the booster and master cylinder to the dash panel.
3. Connect the brake tubes to the master cylinder.
4. Install the vacuum hose tightly.
5. Connect the operating rod to the brake pedal.
6. After filling the brake reservoir with the brake fluid, bleed the system.

CAUTION

Don't disassemble the brake booster.

PROPORTIONING VALVE

PROPORTIONING VALVE EJJB0170

The proportioning valve distributes the proper fluid pressure to the front and rear wheel to obtain greater braking efficiency and prevents premature rear wheel lock-up and skid. You should not disassemble it because the performance of the valve is closely connected with the mounting tension of the spring.

PROPORTIONING VALVE FUNCTION TEST

1. Remove the proportioning valve from the master cylinder.
2. There are two pressure gauges. Connect one to the input side of the proportioning valve and the other to the output side of it.

NOTE

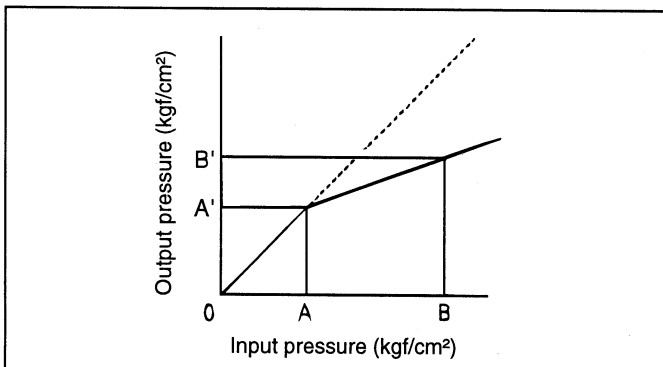
Be sure to bleed the system after connecting the pressure gauges.

3. With the brakes applied, measure the input pressure and the output 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 system.

NOTE

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

ITEMS	STANDARD VALUE
A (35)	A' (35 ± 3)
B (80)	B' (49.2 ± 3)



AJJA025A

INSTALLATION OF PROPORTIONING VALVE EJJB0180

1. Install the master cylinder according to the illustration.
2. Tighten the flare nuts and bleed the system.

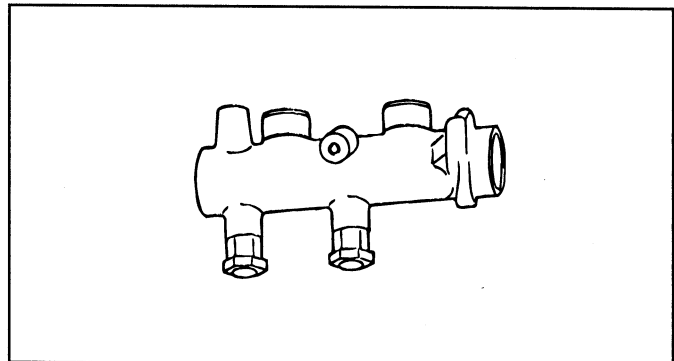
Tightening torque

Brake tube flare nut :

13-17 Nm (130-170 kg.cm, 9-12 lb.ft)

Proportioning valve mounting nut :

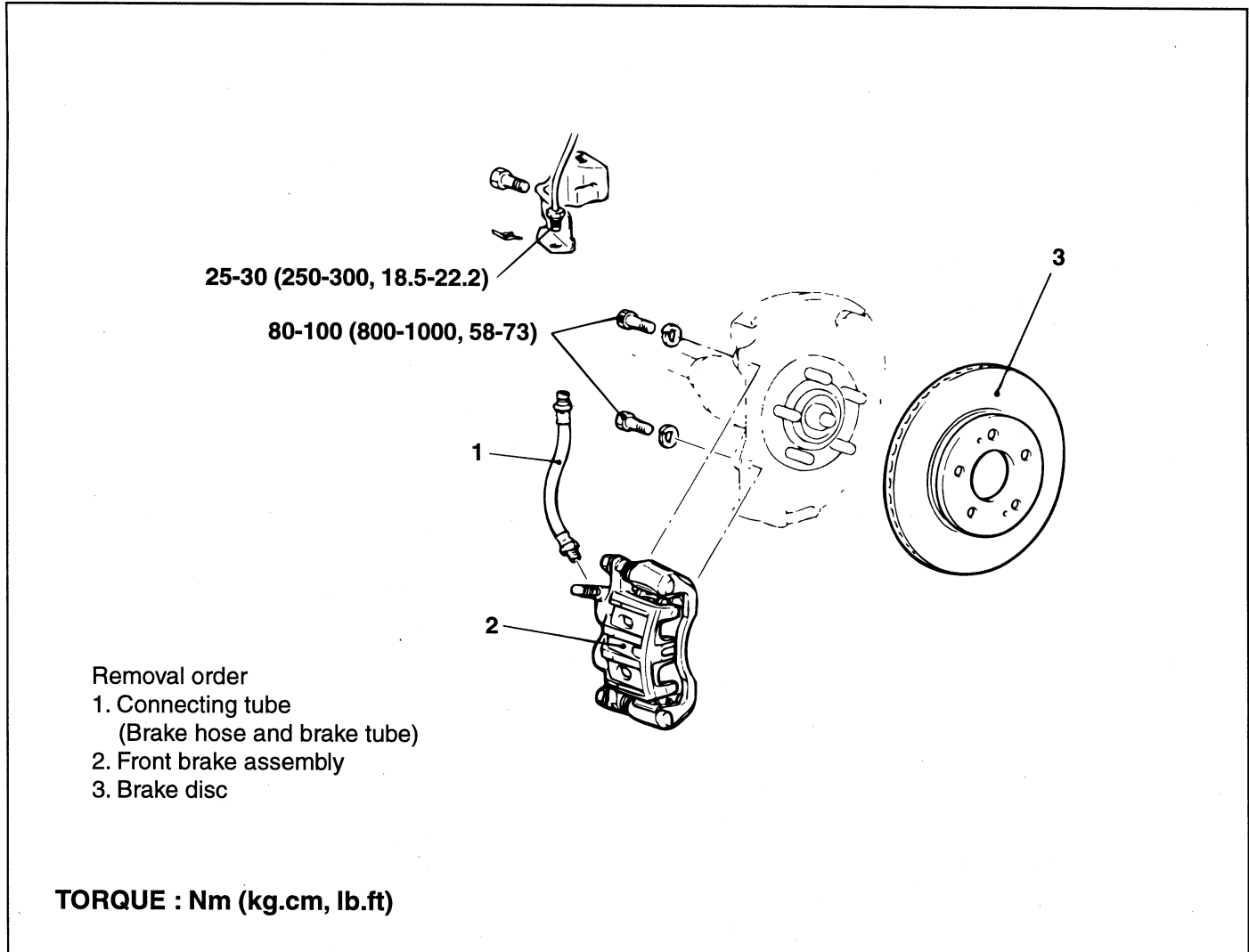
35-55 Nm (350-550 kg.cm, 30-40 lb.ft)



EJJA025B

FRONT DISC BRAKE

COMPONENTS EJJB0190



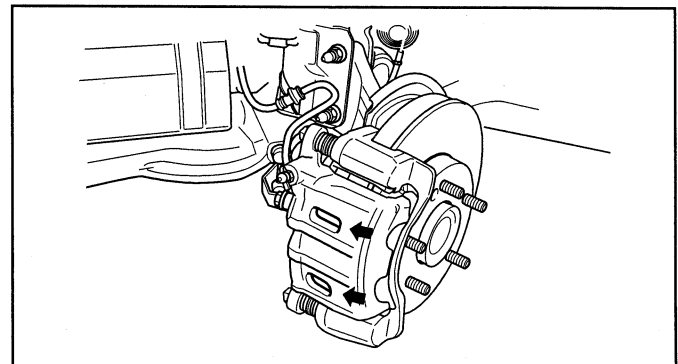
AGX8022A

INSPECTION AND REPLACEMENT EJJB0200

INSPECTION AND REPLACEMENT OF FRONT DISC BRAKE PADS

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

ITEM	Standard value	Service limit
Pad lining thickness mm (in.)	10.5 (0.413)	2.0 (0.079)



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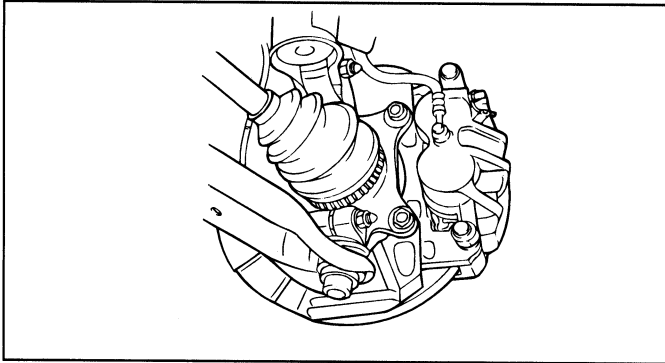
CAUTION

1. If the pad lining thickness is out of specification, left and right pads must be replaced as a complete set.

2. When the thickness difference between the left pad and the right pad is large, check the sliding condition of the piston, the lock pin and the guide pin.
2. Remove the guide pin, lift the caliper assembly up and suspend it with a wire.

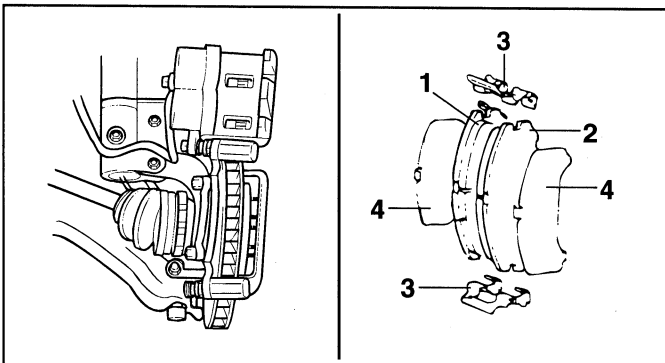
CAUTION

Be careful not to contaminate the lock pin and the guide pin with grease.

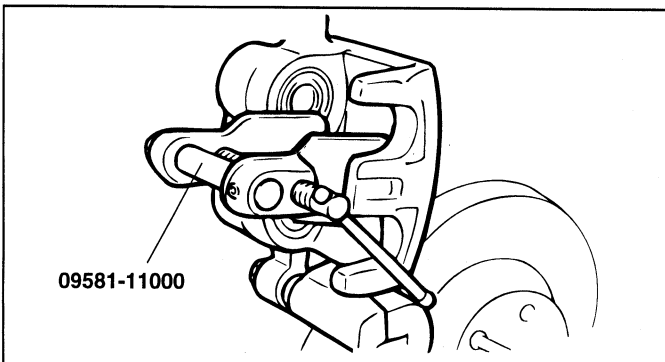


EJJA005B

3. Remove the following parts from the caliper support.
 1. Pad and wear sensor assembly
 2. Pad assembly
 3. Clip
 4. Outer shim



AJJA005C



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FRONT BRAKE DISC THICKNESS CHECK

EJJB0210

1. Using a caliper, measure nominal disc thickness at eight positions, approximately 45° apart and 10 mm (0.39 in.) from the outer edge of the disc.

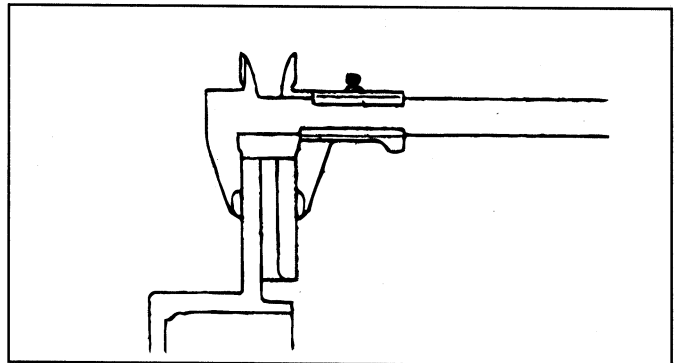
Brake disc thickness

Standard value : 26 mm (1.02 in.)

Limit : 24.4 mm (0.96 in.)

Thickness variation (at least 8 positions)

2. Wherever you measure the thickness value use a micrometer. The pad must be less than 0.005mm in the direction of the circumference and less than 0.05mm in the direction of radius.
3. If the disc is beyond the limits for thickness or unevenness remove it and install a new one.



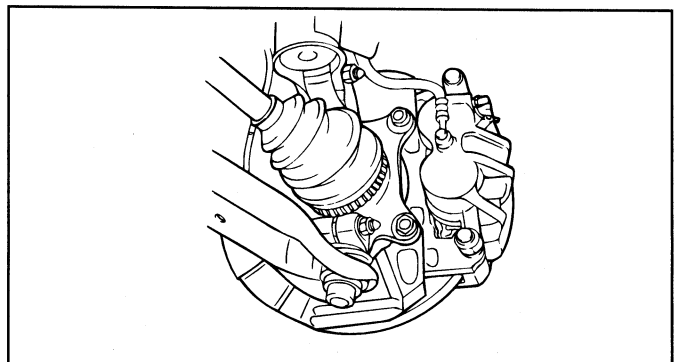
KGX8031A

FRONT BRAKE DISC RUN-OUT CHECK

1. Remove the caliper support, then raise the caliper assembly upward and suspend with wire.

NOTE

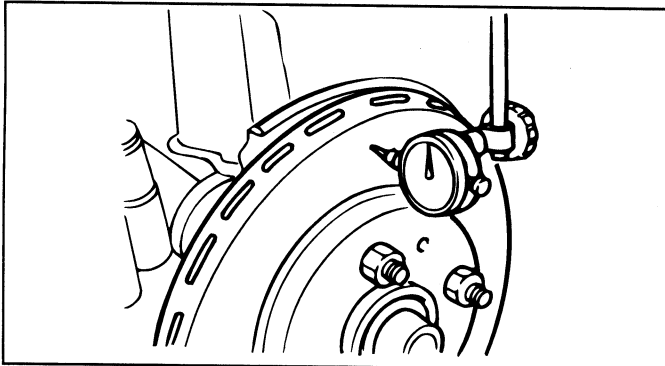
Tighten the nuts in order to mount the disc to the hub.



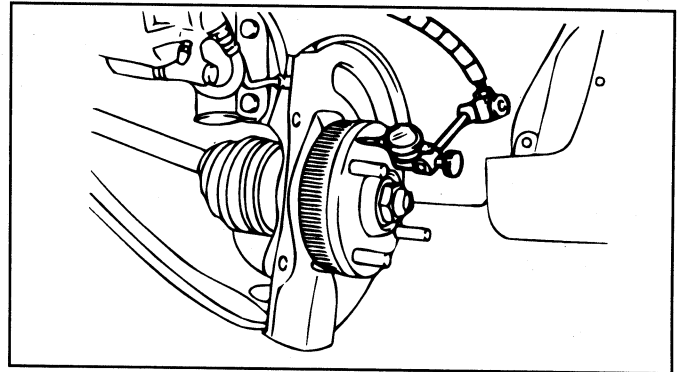
EJJA005B

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

Limit : 0.04 mm (0.0016 in.)

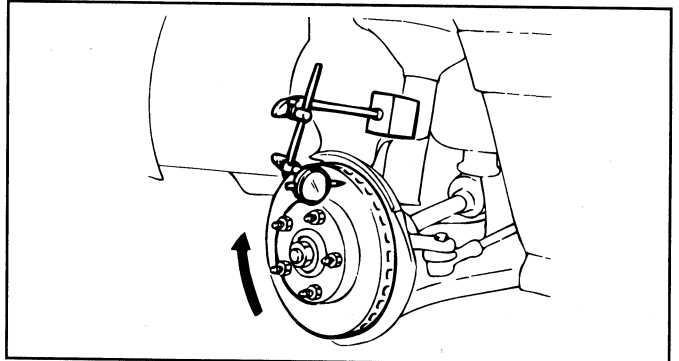


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KGX8035A

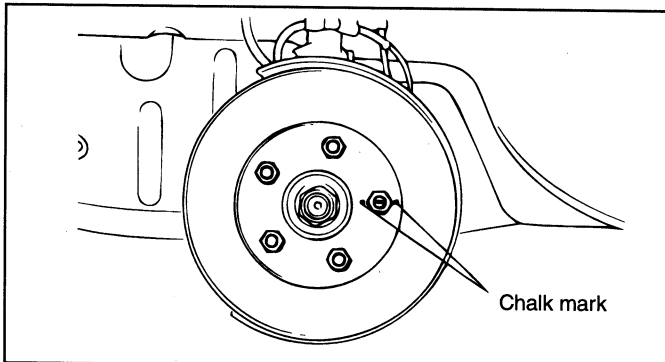
- 3) If the play does not exceed the limit specification, install the brake disc after turning it 180° from the chalk mark, and then check the run out of the brake disc again.



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FRONT BRAKE DISC RUN OUT CORRECTION

1. If the run out of the brake disc is equivalent to or exceeds the limit specification, replace the disc and hub, and then measure the run out again.
 - 1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which the run out is greatest.



AGX8034A

- 2) Remove the brake disc, and then place a dial gauge as shown in the illustration; then move the hub in the axial direction and measure the run out.

Limit : 0.05 mm (0.0020 in.)

If it is equivalent to or exceeds the limit, disassemble the hub knuckle and check each part.

2. If the run out cannot be corrected by changing the position of the brake disc, replace the brake disc.

INSTALLATION EJB0220

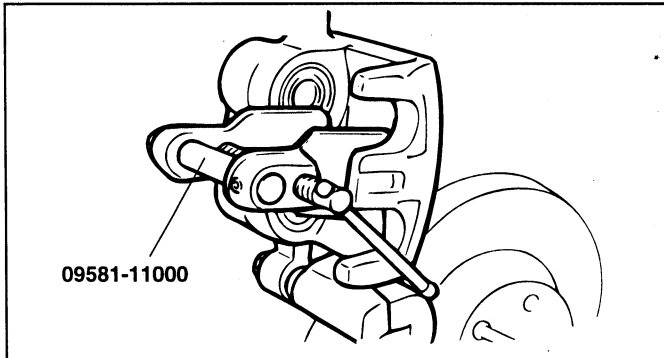
1. Install the pad clips.
2. Install the pads on each pad clip.

NOTE

1. **All four pads must be replaced as a complete set.**
2. **When replacing the brake pads, check for deformation. When replacing the guide spring, use a new one or thoroughly clean the used one.**
3. Press in the piston with a hammer handle or the special tool.
4. Lower and insert the brake cylinder carefully so as not to damage the boot.
5. Tighten the two guide rod bolts to the specified torque.

Guide rod bolt :

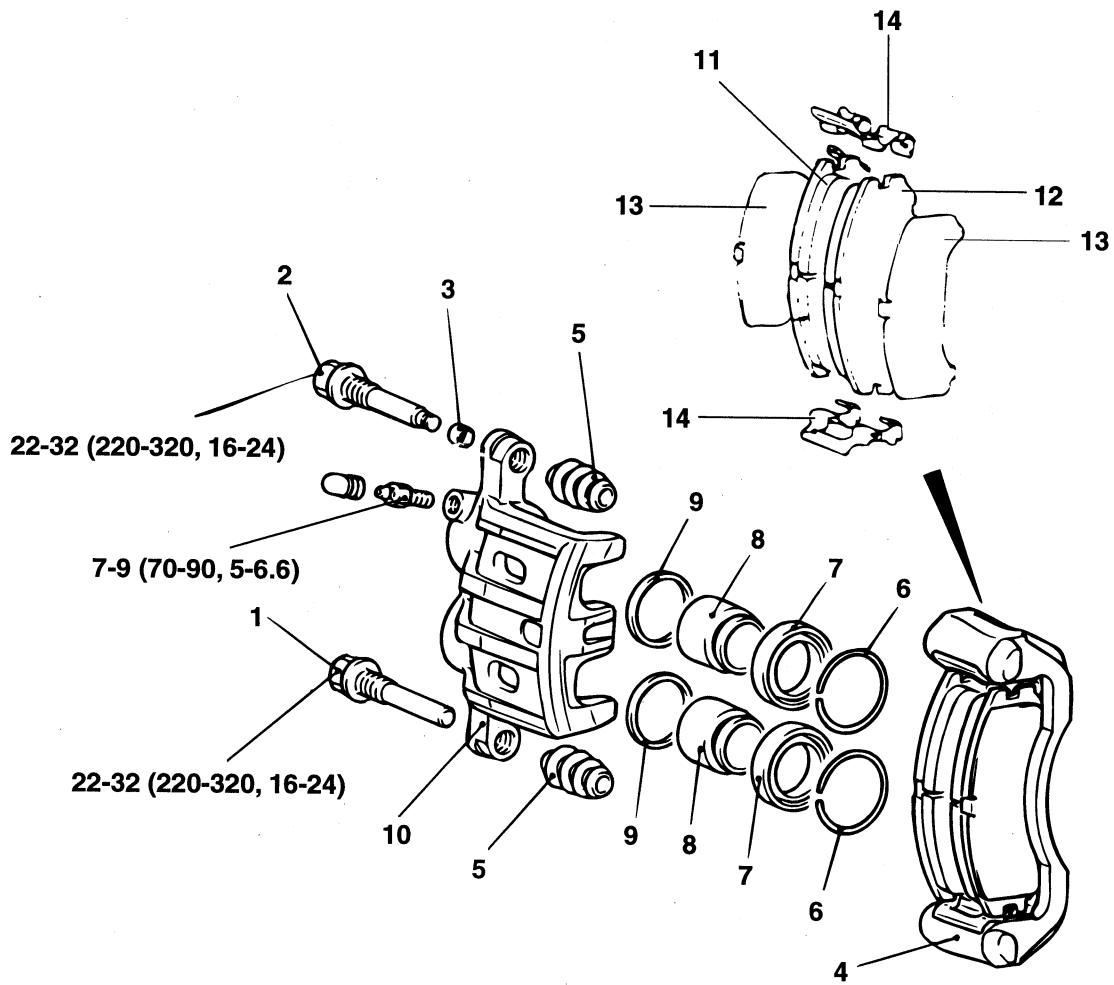
22-32 Nm (220-320 kg·cm, 16-24 lb·ft)



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DISASSEMBLY AND REASSEMBLY

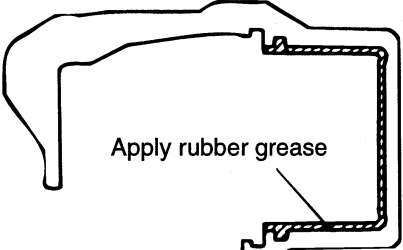
EJJB0230



- | | |
|--------------------|-------------------------------------|
| 1. Guide bolt | 8. Piston |
| 2. Lock pin | 9. Piston seal |
| 3. Bushing | 10. Caliper body |
| 4. Caliper support | 11. Pad and wear indicator assembly |
| 5. Boot | 12. Pad assembly |
| 6. Boot ring | 13. Outer shim |
| 7. Piston boot | 14. Clip |

TORQUE : Nm (kg.cm, lb.ft)

LUBRICATION POINTS EJB0240

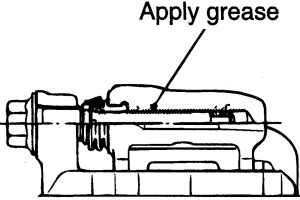


Apply rubber grease

Apply castor oil

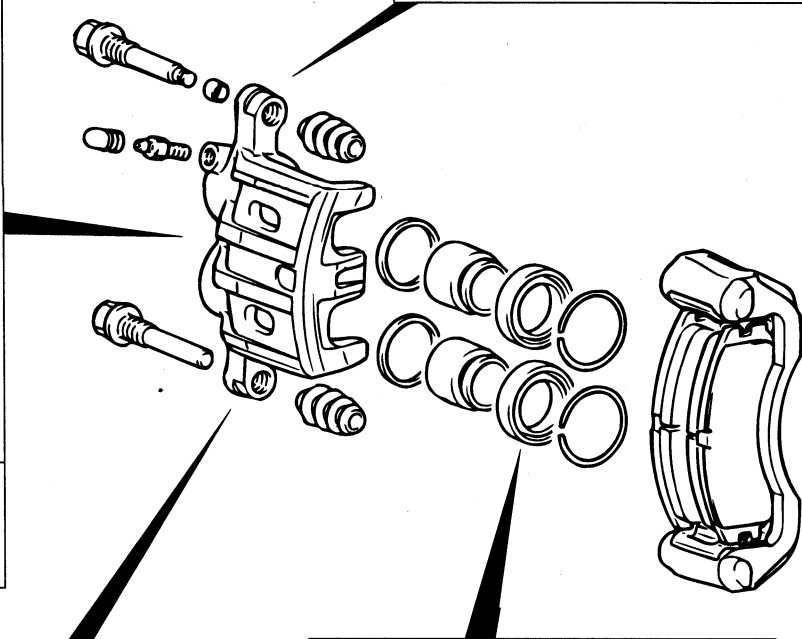
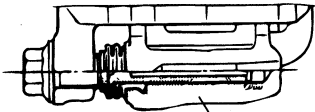
CAUTION
Be careful not to wash off special grease.

Cylinder inner surface :
Rubber grease
Piston : Castor oil



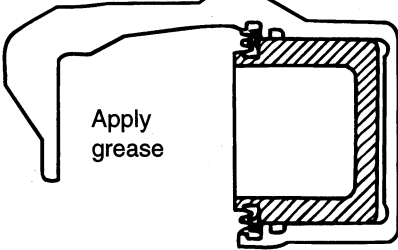
Apply grease

Grease : RX-2

Apply grease

Grease : RX-2 (MES 4-3-065)



Apply grease

Grease : Rubber grease

DISASSEMBLY EJJB0250

Front disc brakes should be disassembled separately.

Do not mix right-hand and left-hand parts.

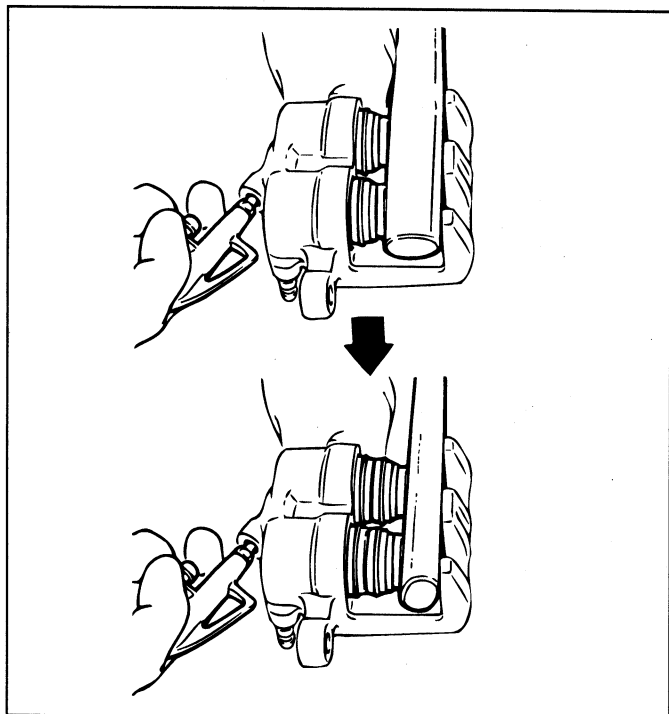
1. Remove the piston boot/piston.

Blow compressed air into the brake hose seating hole. Remove the piston and the piston boot.

CAUTION

Remove the piston using a plastic hammer handle. Blow air slowly, adjusting the heights of the two pistons to push them out equally.

The secondary piston should not be removed before the primary piston is removed completely. Otherwise the secondary piston can't be removed.



KGX8039A

2. Remove the piston seal.

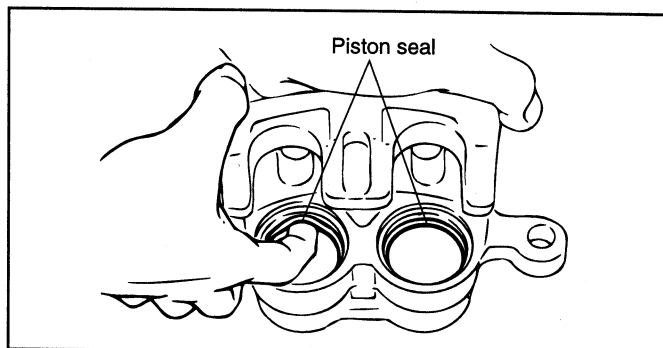
- 1) Remove the piston seal with your finger.

CAUTION

Do not use a screwdriver or another tool because it may damage the cylinder.

- 2) Clean the piston surface and cylinder using the alcohol or the specified brake fluid.

Brake fluid : DOT 3 or DOT 4

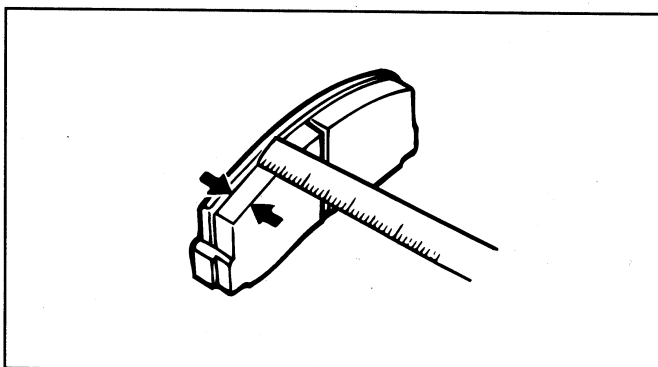


KGX8040A

INSPECTION EJJB0260

1. Check the cylinder for wear, damage and rust.
2. Check the piston surface for wear, damage and rust.
3. Check the caliper body and sleeve for wear.
4. Check that grease is applied, and the pad and backing metal are not damaged.
5. Check the pad wear. Check the pad thickness and replace it if it is less than the specified value.

Item	Specification	Service limit
Pad thickness	10.0 mm (0.39 in.)	2.0 mm (0.08 in.)

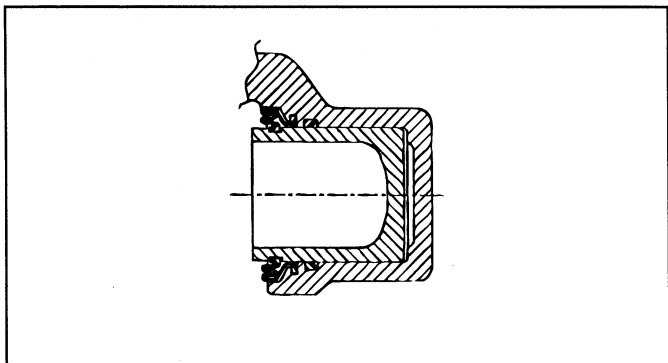


KGX8041A

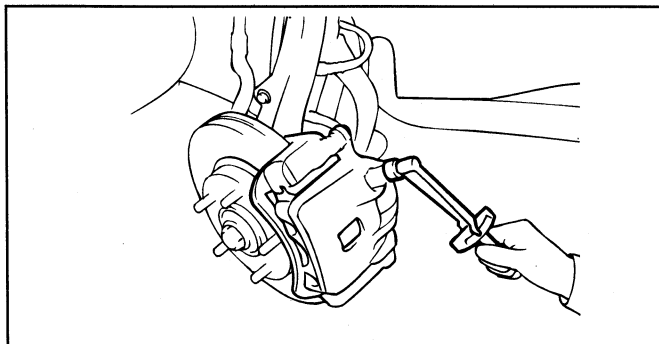
REASSEMBLY

EJJB0270

1. Clean all components with isopropyl alcohol except for the pad and shim.
2. Install the piston seal.
3. After applying the specified brake fluid to the piston outer surface, install the piston into the cylinder.
4. Install the piston boot and boot ring.

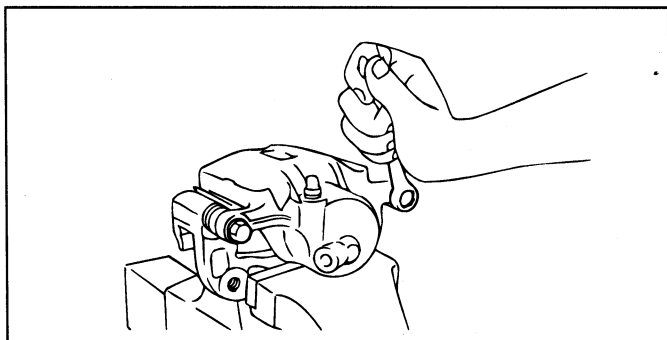


EJHA008A



KFW8026A

5. Install the guide pin boots and guide pin.



EJA9015J

INSTALLATION

EJHA1500

1. Install the pads and brake cylinder.
2. Install the brake hose to the caliper.

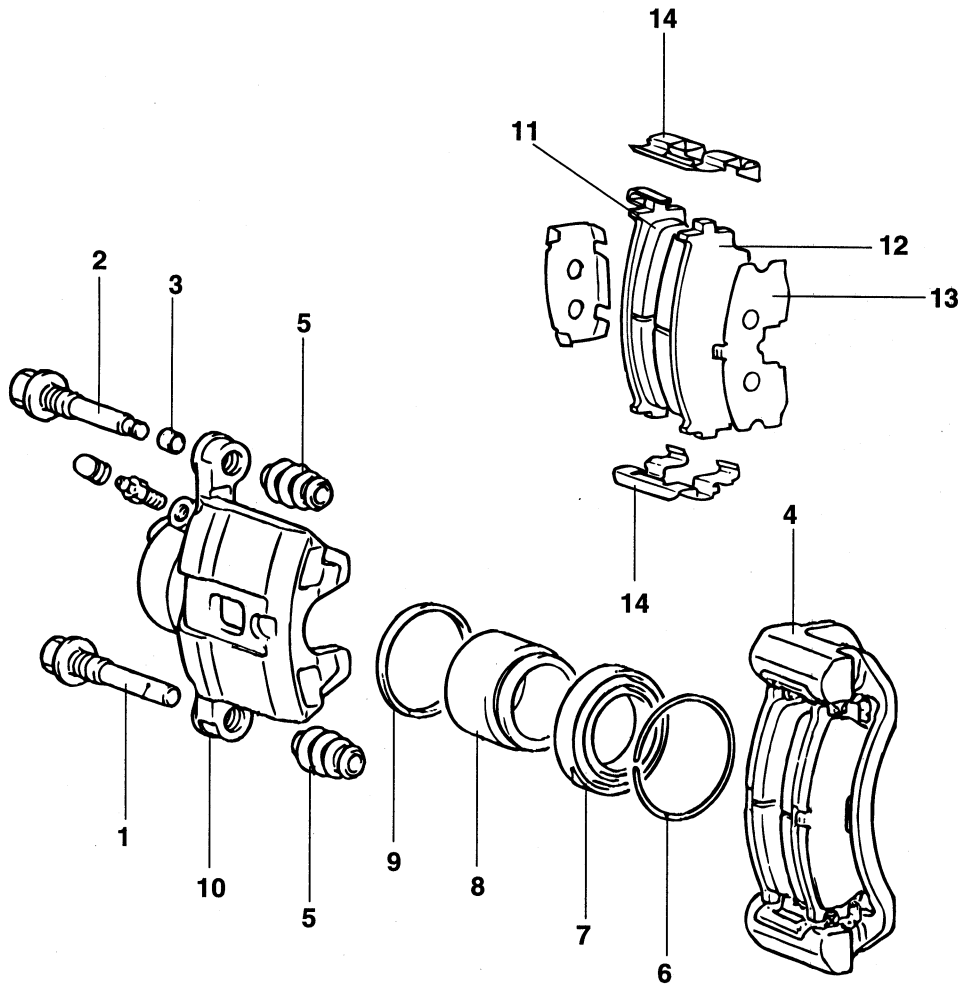
Bleeder screw tightening torque :

7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

3. Fill the brake reservoir with brake fluid.
4. Bleed the system.

REAR DISC BRAKE

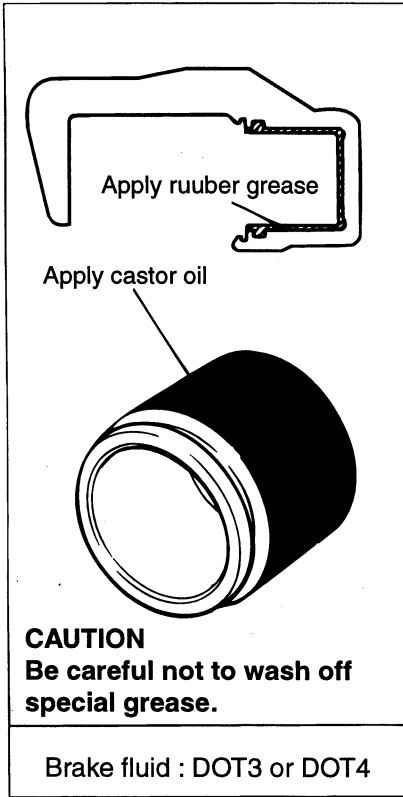
COMPONENTS EJJB0290



- | | |
|--------------------|------------------|
| 1. Guide bolt | 8. Piston |
| 2. Lock pin | 9. Piston seal |
| 3. Bushing | 10. Caliper body |
| 4. Carrier support | 11. Pad |
| 5. Boot | 12. Pad |
| 6. Boot ring | 13. Shim |
| 7. Piston boot | 14. Clip |

LUBRICATION POINTS

EJJB0300

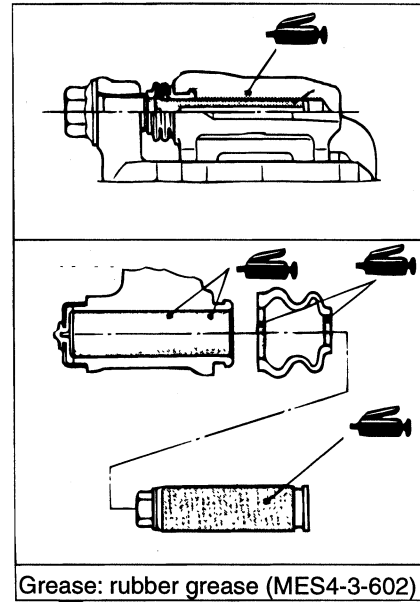


Apply rubber grease

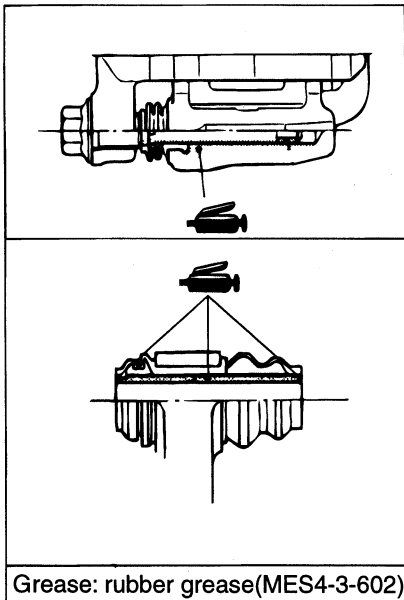
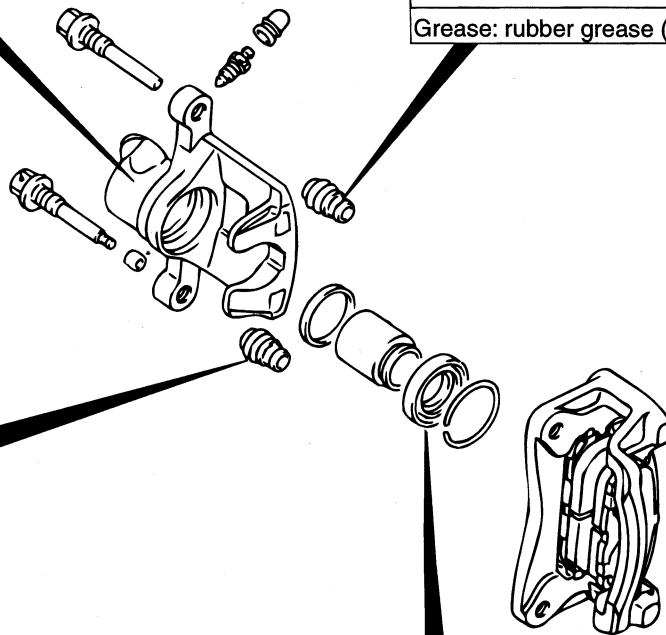
Apply castor oil

CAUTION
Be careful not to wash off special grease.

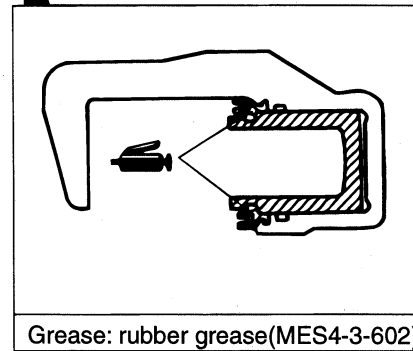
Brake fluid : DOT3 or DOT4



Grease: rubber grease (MES4-3-602)



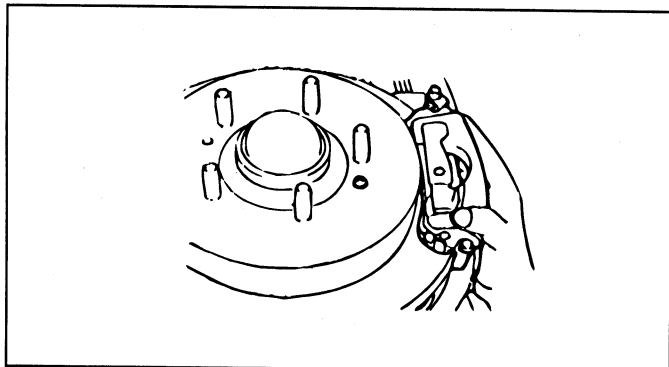
Grease: rubber grease(MES4-3-602)



Grease: rubber grease(MES4-3-602)

REMOVAL EJJB0310

1. Remove the wheel.
2. Remove the guide bolt, lift up the caliper assembly, and remove the pad assembly.



EJJA030B

DISASSEMBLY EJJB0320

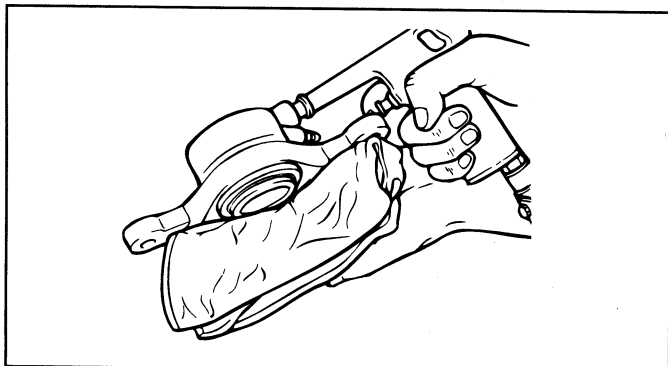
Rear disc brakes should be disassembled separately as a set of left and right.

1. Remove the piston boot/piston.

Wrap the caliper body with a rag. Blow compressed air into the brake hose, opening and remove the piston and the piston boot.

CAUTION

Blow air slowly.



KGX8057A

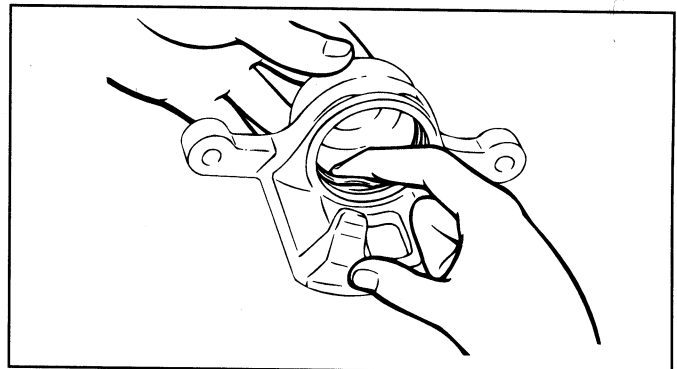
2. Remove the piston seal.
 - 1) Remove the piston seal with your finger.

CAUTION

Do not use a screwdriver or another tool in order to avoid damage inside the cylinder.

- 2) Clean the piston surface and the inside of the cylinder using alcohol or the specified brake fluid.

Brake fluid : DOT 3 or DOT 4



KGX8058A

CHECKING EJJB0330

1. Check the cylinder for wear, damage and rust.
2. Check the piston surface for wear, damage and rust.
3. Check the caliper body and sleeve for wear.
4. Check that grease is applied, and the pad and backing metal are damaged.

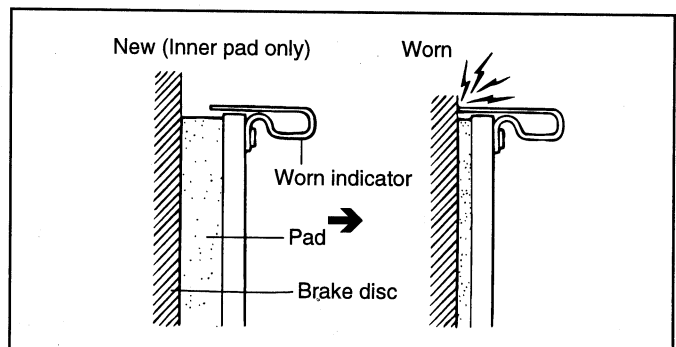
INSPECTION EJJB0340

1. Check the pads for wear or oil contamination and replace if necessary.

NOTE

The pads for the right and left wheels should be replaced at the same time.

Pad thickness wear limit : 2.0mm (0.08 in.)



EJA9015E

2. Check for worn or damaged dust boots. If dust or mud had entered the caliper assembly through this seal, the caliper assembly must be replaced or rebuilt.

INSTALLATION

EJJB0350

1. Before replacing the brake pads, drain brake fluid from the master cylinder reservoir until it is half full.
2. Install two caliper guide rods and tighten to the specified torque.

Specified torque :

22-32 Nm (220-320 kg.cm, 16.3-23.7 lb.ft)

3. After filling the master cylinder reservoir with the fluid, bleed the brake line.

Recommended brake fluid : DOT 3, DOT 4

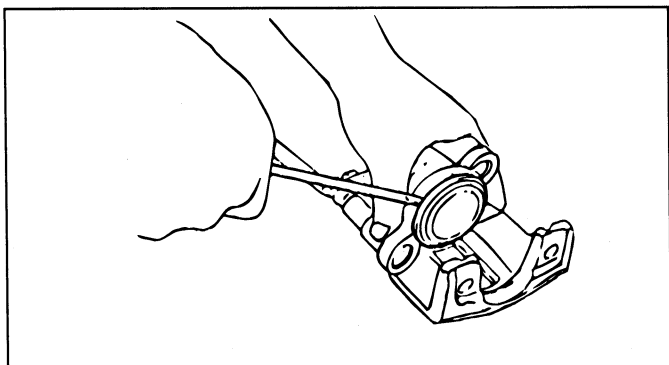
REMOVAL

EJJB0360

1. Remove the rear wheel.
2. Remove the caliper assembly.
3. Remove the brake hose from the caliper assembly.

DISASSEMBLY

1. Remove the pad.
2. Remove the piston boot from the housing, and remove the piston.

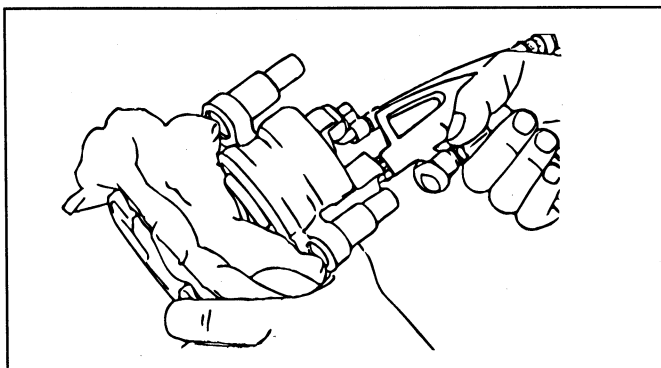


EJJA035D

3. Remove the piston by applying compressed air through the brake hose fitting.

CAUTION

Do not place your fingers in front of the piston when using compressed air.



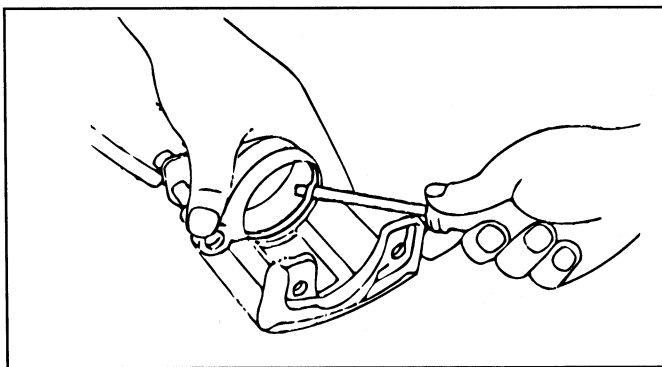
EJJA035E

4. Using a screwdriver, remove the piston seal carefully so as not to damage the cylinder wall.
5. Clean all removed parts with the specified fluid.

ITEM	SPECIFIED FLUID
Metal section	Alcohol or brake fluid
Piston seal	If the oil level is low, add fluid (about 70cc).
Piston boot and other rubber part	Alcohol

CAUTION

Rubber parts should be replaced with new ones but if you want to reuse them, don't put them in alcohol for more than thirty minutes.



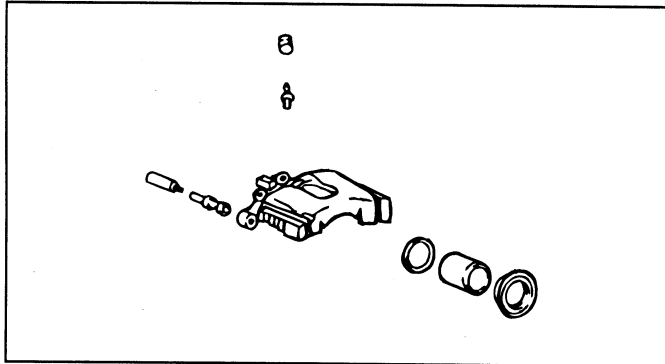
EJJA035F

INSPECTION EJJB0370

1. Check the piston and its inside for wear, damage and rust.

Replace the damaged parts if necessary.

2. Check the piston seal, boot, and pin insulators for wear and damage.



EJJA035G

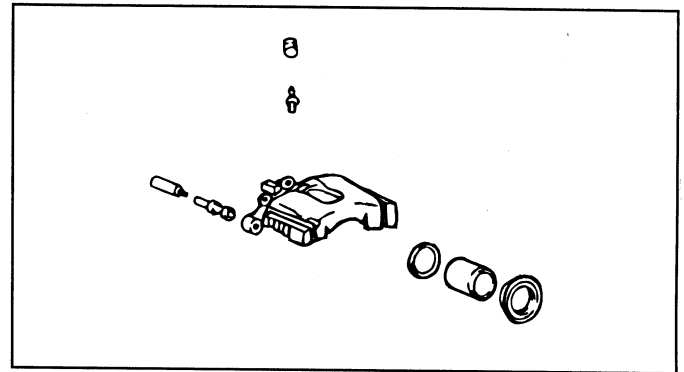
REASSEMBLY EJJB0380

1. When disassembling the caliper assembly, use a new piston seal and boot.
2. Apply the recommended fluid to the bearing part of the piston seal and piston. Insert the piston seal into grooves inside the caliper, being careful not to twist the seal.

Description	Recommended fluid	Quantity
Piston seal	Brake fluid (DOT3, DOT4)	As required
Inside of piston cylinder	Brake fluid (DOT3, DOT4)	As required
Piston boot	Brake fluid (DOT3, DOT4)	As required
Locating pin insulator	White silicone grease	As required

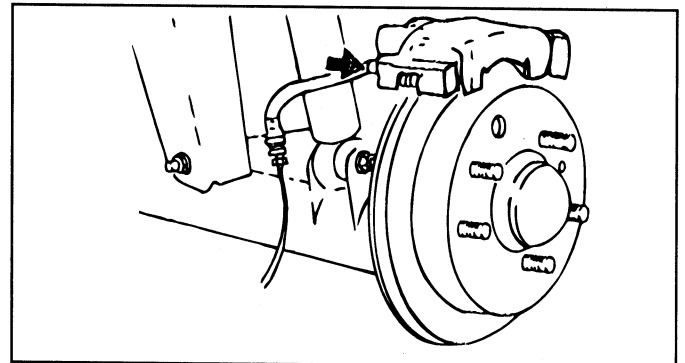
3. Install the piston boot to the piston.

Confirm that the concave part of the piston is situated outward and the boot fits in grooves of the piston well.



EJJA035G

4. Install the piston and boot in the caliper housing. Insert the boot flange in the caliper housing and check that the boot fits in grooves around the piston.



EJJA035H

5. Apply the recommended oil to the inside of the locating pin insulator.

INSTALLATION EJJB0390

1. Refer to "Installation" page BR-17.
2. Perform a road test.

NOTE

If there is a small quantity of air in the brake line, it can affect the brake pedal stroke so you must bleed the system carefully.

CAUTION

When replacing the piston seal, check the pedal stroke.

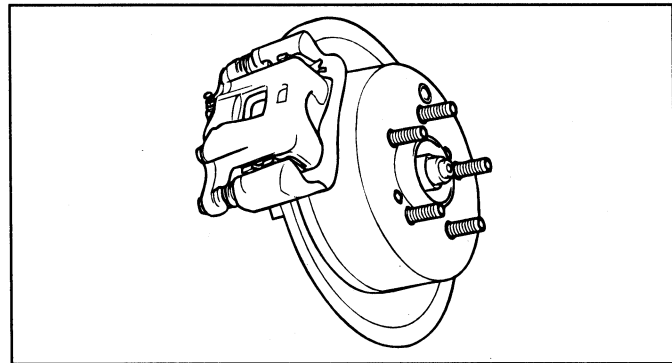
If the pedal stroke is too great, the piston may not retain the piston seal.

Adjust as follows :

1. After removing the pad from the piston, push the piston into the cylinder 3-5mm. Put a lever or steel plate between the piston and disc, being careful not to damage the contact surface of the disc or the piston end.
2. Install the pad. Restore the brake pedal to the original position and step on it 2-3 times.
3. Repeat the above procedure more than 5 times and move the piston outward and inward to assure that the piston seal is properly installed.
4. Before driving a vehicle, step on the brake pedal and release it many times.
5. Perform the road test.

BRAKE DISC EJJB0400**REMOVAL**

1. Remove the wheel.
2. Remove the caliper assembly from the anchor plate and suspend it with a wire.
3. After loosening the 2 screws on the disc, remove the disc.

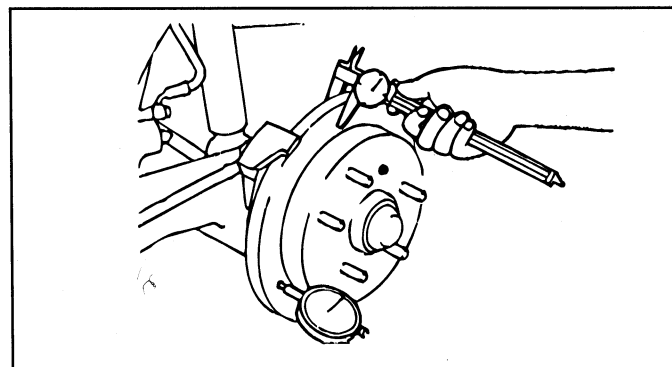


EJJA030E

INSPECTION EJJB0410

Check the disc for wear or damage and replace if necessary.

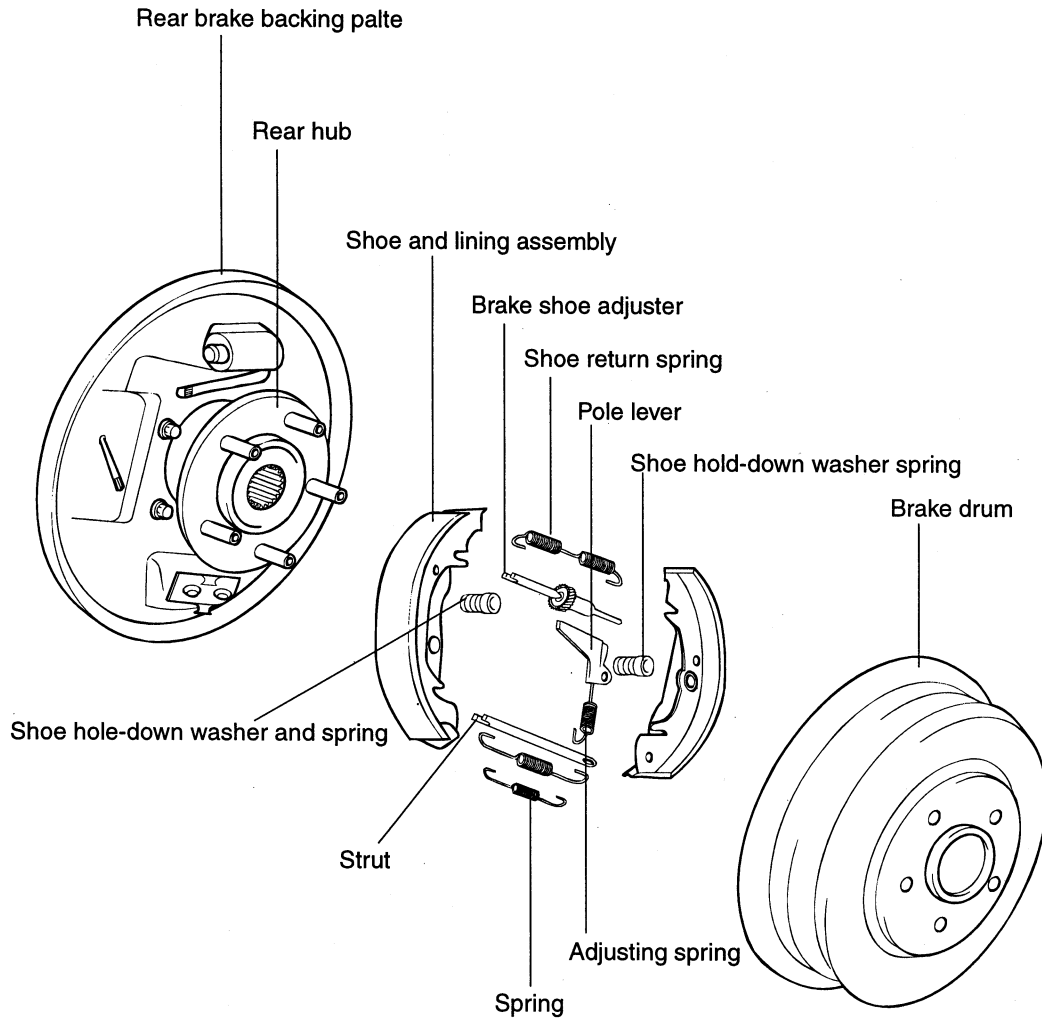
ITEMS	Standard value	Service limit
Thickness of disc	10mm (0.39 in.)	8.4mm (0.33 in.)
Runout	-	0.04mm (0.0016 in.)



EJJA035J

REAR DRUM BRAKE

COMPONENTS EJB0440

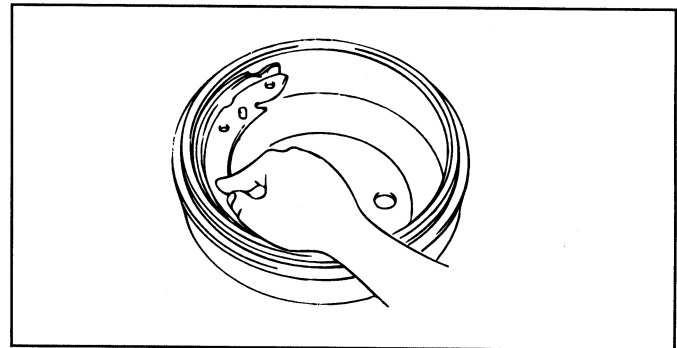
**Removal steps**

1. Wheel and tire
2. Brake drum
3. Shoe hold-down spring
4. Strut
5. Shoe return spring
6. Shoe and lining assembly

INSPECTION EJJB0450

1. Measure the brake drum inside diameter. Check the runout of the brake drum using a dial indicator.

ITEM	Standard value	Service limit
Inside diameter mm (in.)	254 (100)	256 (10.08)

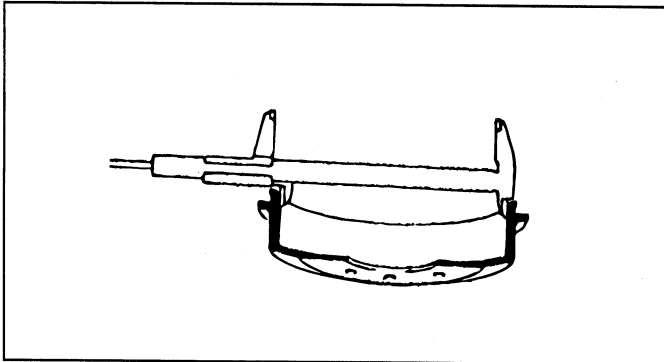


EJA9018E

CAUTION

If the brake drum inside diameter is greater than the service limit, replace the brake drum.

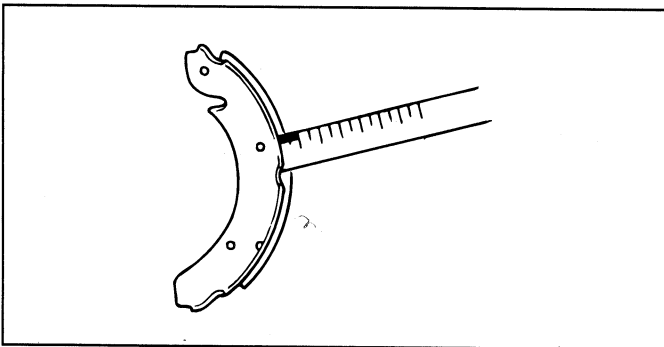
4. Inspect the outside of the wheel cylinder for excessive corrosion and damage.



EJA9018C

2. Measure the brake shoe lining thickness.

	Standard value	Service limit
Lining thickness mm (in.)	4.5 (0.18)	1.5 (0.059)



EJA9018D

CAUTION

If the brake lining thickness is less than the service limit, replace the brake shoe.

3. Inspect the brake lining and drum for proper contact.

PARKING BRAKE SYSTEM

PARKING BRAKE

ADJUSTMENT PROCEDURE EJJB0420

PARKING BRAKE STROKE ADJUSTMENT

1. Pull the brake lever with force of 200N (20kg, 44lbs) and count the number of notches.

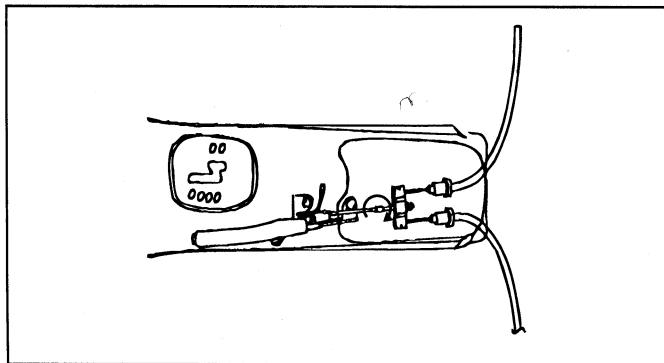
NOTE

Pull the brake lever with the force of 20kg.

ITEM	Spec.
Parking brake stroke	7 clicks

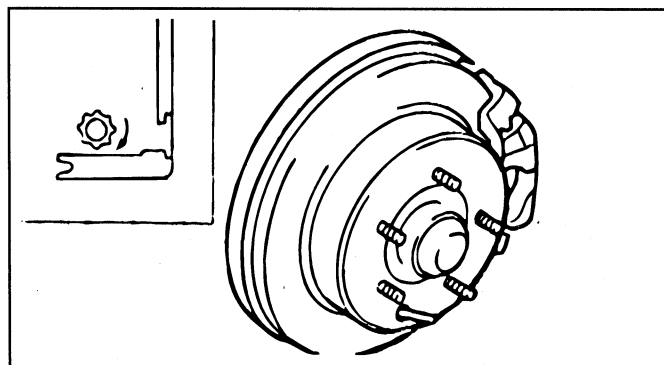
2. If the parking brake stroke is out of the standard value, adjust it as follows :

- 1) Remove the console.
- 2) Loosen the adjusting nut on the end of the cable rod.



EJJA040A

- 3) Remove the adjusting hole plug, and then turn the adjuster the direction of the arrow. To prevent the disc from rotating, use a screwdriver.
- 4) Turn the adjuster 5 notches in the opposite direction of arrow.



EJJA040B

- 5) Turn the adjuster nut to adjust the parking brake stroke to the specification.

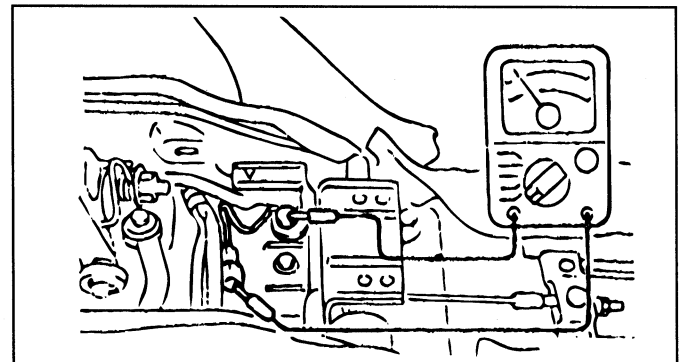
NOTE

If the number of parking brake notches is less than the specification, loosen the readjuster nut and readjust.

- 6) After adjusting, check that there is no gap between the adjusting nut and pin and that the adjusting nut is fixed in the nut holder precisely.
- 7) After adjusting the parking brake stroke, raise the rear of vehicle.
- 8) Check that the rear brakes do not drag by turning the rear wheel when the parking brake lever is released.

INSPECTION OF PARKING BRAKE SWITCH

1. Disconnect the parking brake switch connector, and then connect the tester to the parking brake switch and the bolt fixing the switch.
2. If there is continuity when the parking brake lever is pulled and there is non-continuity when it is released, the parking brake switch is good.

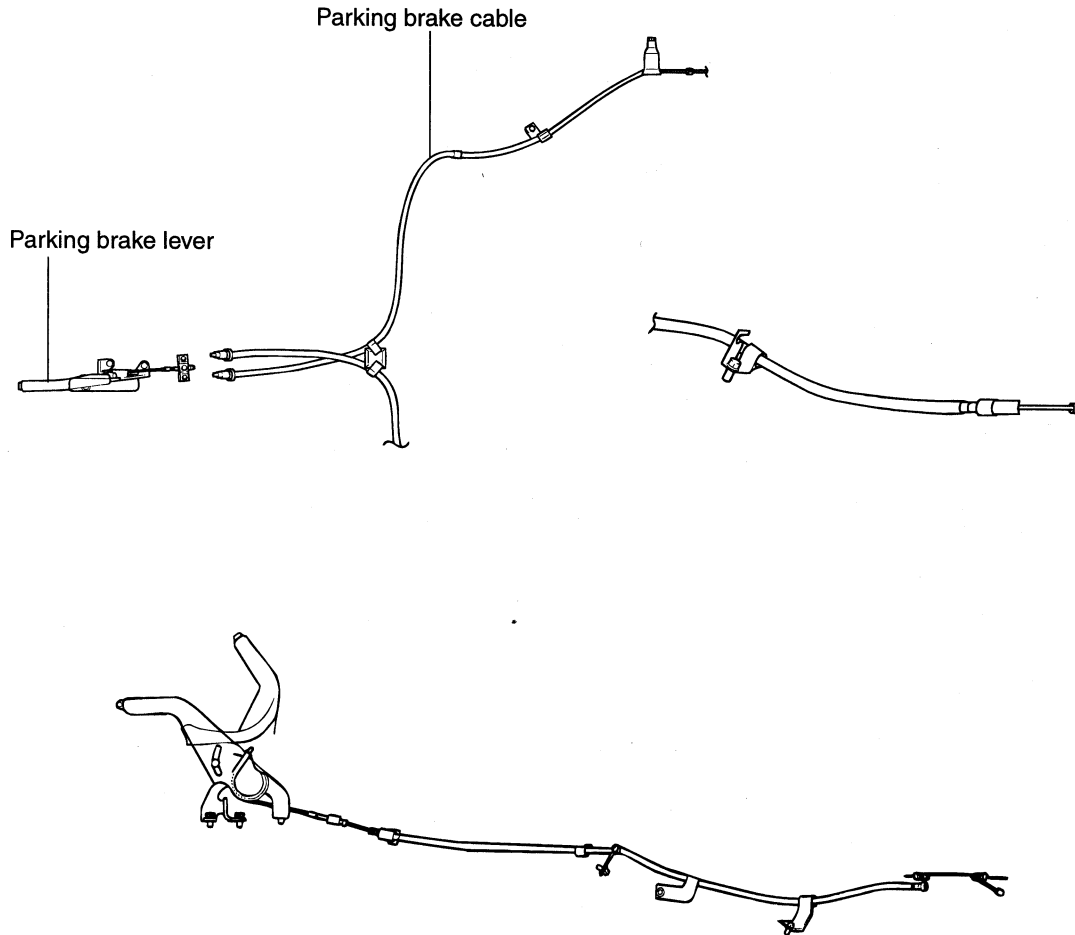


EJJA040C

PARKING BRAKE LEVER AND PARKING BRAKE CABLE

EJJB0430

COMPONENTS



Removal steps for the of lever

1. Remove the console
2. Loosen the lever adjusting nut
3. Detach the cable from the lever
4. Removal the lever mounting bolts
5. Disconnect the parking brake switch connector

Removal steps for the calbe

1. Remove the console
2. Loosen the lever adjusting nut
3. Detach the cable from lever
4. Remove the muffler protector
5. Remove the bolts mounting the cable (on the body)
6. Remove the cable clip from the rear drum
7. Remove the parking cable from the rear drum

ABS (ANTI-LOCK BRAKE SYSTEM)

EJJB2000

SPECIFICATION (ABS)

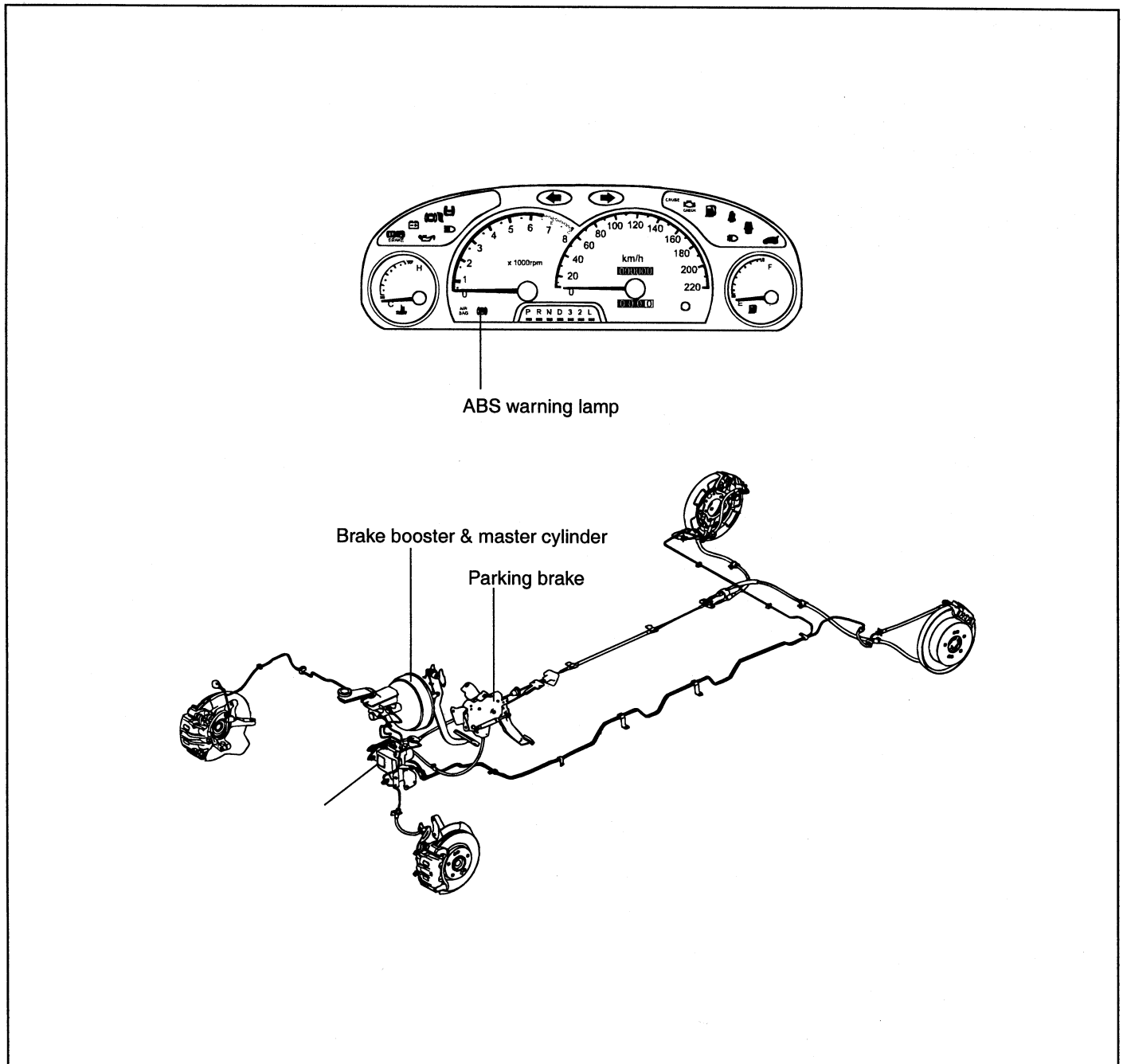
Part	Standard value	Remark
System		
Type	Solenoid/Solenoid	
Mode	ABS + EBD + BTCS	
ECU		
Operating voltage	10V - 16V	
Operating temperature	-40°C - 110°C	
Warning lamp		
ABS		
Operating current	12V	
EBD		
Consumption current	80mA	
Wheel speed sensor		Min. pin-to-pin voltage 130mV
Internal resistance		
Front	1100Ω ± 50Ω	
Rear	1100Ω ± 50Ω	
Insulation resistance	Min. 1000kΩ	
Air gap		
Front	0.3-0.9 mm	
Rear	0.2-0.7 mm	
Tone wheel	47 teeth	
HECU (Hydraulic and Electronic Control Unit)		
Pump capacity	2.45 cc/sec	o LPA : Low Pressure, Accumulator
Accumulator amount		o HPA : High Pressure, Accumulator
LPA	3.0cc	o NO : Normal Open
HPA	6.0cc	o NC : Normal Close
NO solenoid valve		
Front	Ø0.70mm	
Rear	Ø0.40mm	
NC solenoid valve		
Front	Ø0.56mm	
Rear	Ø0.40mm	
Pump orifice	Ø0.5mm	

TIGHTENING TORQUE (ABS)

EJHA2050

	Nm	kg.cm	lb.ft
Sensor mounting bolt on the brake plate			
Front	0.4-0.6	4-6	0.29-0.43
Rear	0.4-0.6	4-6	0.29-0.43
Hydraulic & electronic control unit mounting bolt	0.8-1.0	8-10	0.58-0.72
Hydraulic & electronic control unit mounting bracket bolt	1.7-2.6	17-26	1.23-1.88

SYSTEM COMPONENT EJHA2100



EJHA020B

The Anti-Lock Brake System (ABS) controls the hydraulic brake pressure of all four wheels during braking on hazardous road surfaces, preventing the wheels from locking up. ABS provides the following benefits :

1. Enables steering around obstacles with a greater degree of certainty, even during emergency braking.
2. Enables stopping during emergency braking while keeping stability and steerability even on curves.

If a malfunction occurs, a diagnosis function and fail-safe system are included for serviceability.

The hydraulic electronic control unit (HECU) receives signals about the vehicle's speed, direction and road conditions from sensors at the wheels.

Based on these signals, the control unit will determine the optimum amount of wheel spin.

EBD (ELECTRONIC BRAKE-FORCE DISTRIBUTION)

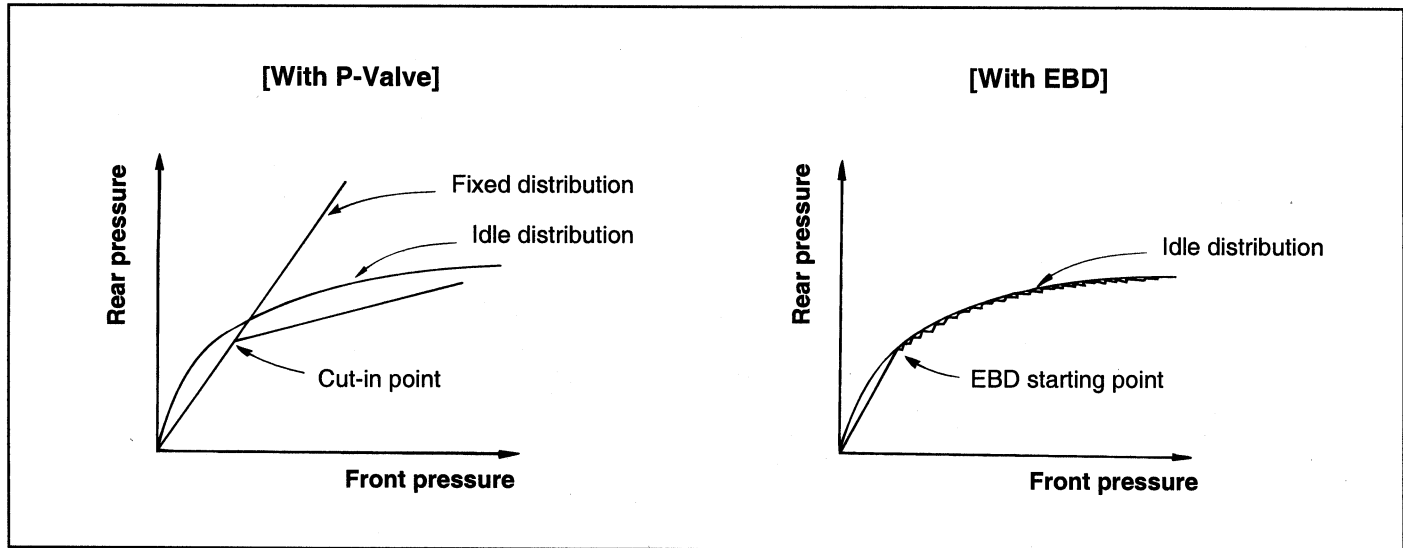
EJHA2150

EBD, instead of the proportioning valve, delivers ideal distribution of hydraulic pressure to the front and rear brakes. This prevents rear wheel lock up and provides higher brake efficiency within the range of brake application.

ADVANTAGES

- Functional improvement of the basic-brake system
- Compensation for different friction coefficients
- Elimination of the proportioning valve
- Failure notification by warning lamp

COMPARISON BETWEEN PROPORTIONING VALVE AND EBD

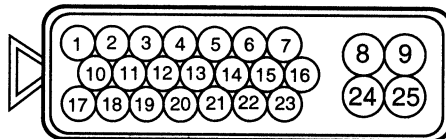


EJA0032A

INSPECTION AT HECU TERMINALS

EJJB2200

TERMINAL VOLTAGE CHART



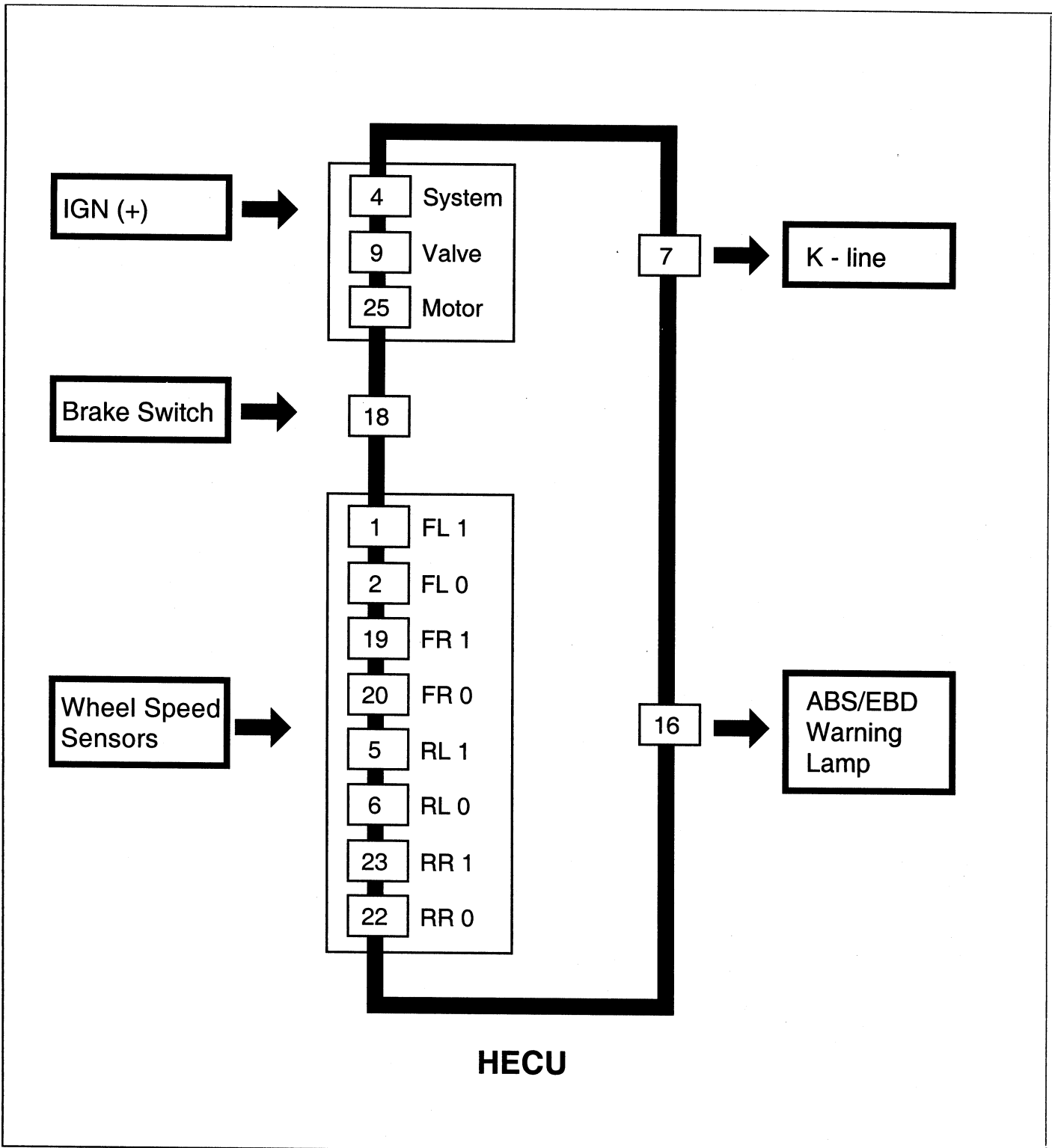
EJHA025A

Terminal No.	Description	Condition	Output
9	<ul style="list-style-type: none"> Battery power source 1 Solenoid valve power source 	Always	System voltage
8	Ground	Always - In ABS control	
7	Diagnosis interface terminal (K-Line)	Data to the Hi-Scan	
5 1 19 23	Wheel speed sensor (Left rear) Wheel speed sensor (Left front) Wheel speed sensor (Right front) Wheel speed sensor (Right rear)		Resistance $R=1.1k\Omega \pm 50\%$ Min. detectable voltage 130mV peak to peak voltage at 50Hz
6 2 20 22	Wheel speed sensor (Left rear) Wheel speed sensor (Left front) Wheel speed sensor (Right front) Wheel speed sensor (Right rear)		
4	Power input via ignition 2 switch	Ignition 2 condition	Over voltage detection : between $16.5V \pm 0.5V$ and $20V$ Suspend voltage detection : between $7.0V \pm 0.5$ and $9.5V \pm 0.5$ System off : below $5.5V \pm 0.5$
25	<ul style="list-style-type: none"> Battery power source 2 Motor power source 	Always	<ul style="list-style-type: none"> System voltage Max. current : below 100A (before 100msec.) Rated current : below 30A (after 100msec.)
24	Ground	G05	
16	ABS & EBD warning lamp	Energized ABS relay	Max. current : below 200mA Max. voltage 40V
18	Brake lamp switch input terminal		Input voltage threshold $1.00V - 2.75V$ $5.00V - 16.00V$
17	TCS warning lamp		Max. current : below 200mA

Terminal No.	Description	Condition	Output
13	TCS switch		Input voltage -1.0V - 16.0V
10	Wheel speed sensor output (Left front)		Max current : below 10mA External resistance : 10k Ω or more
3	Wheel speed sensor output (Right front)		
12	Wheel speed sensor output (Left rear)		
14	Wheel speed sensor output (Right front)		

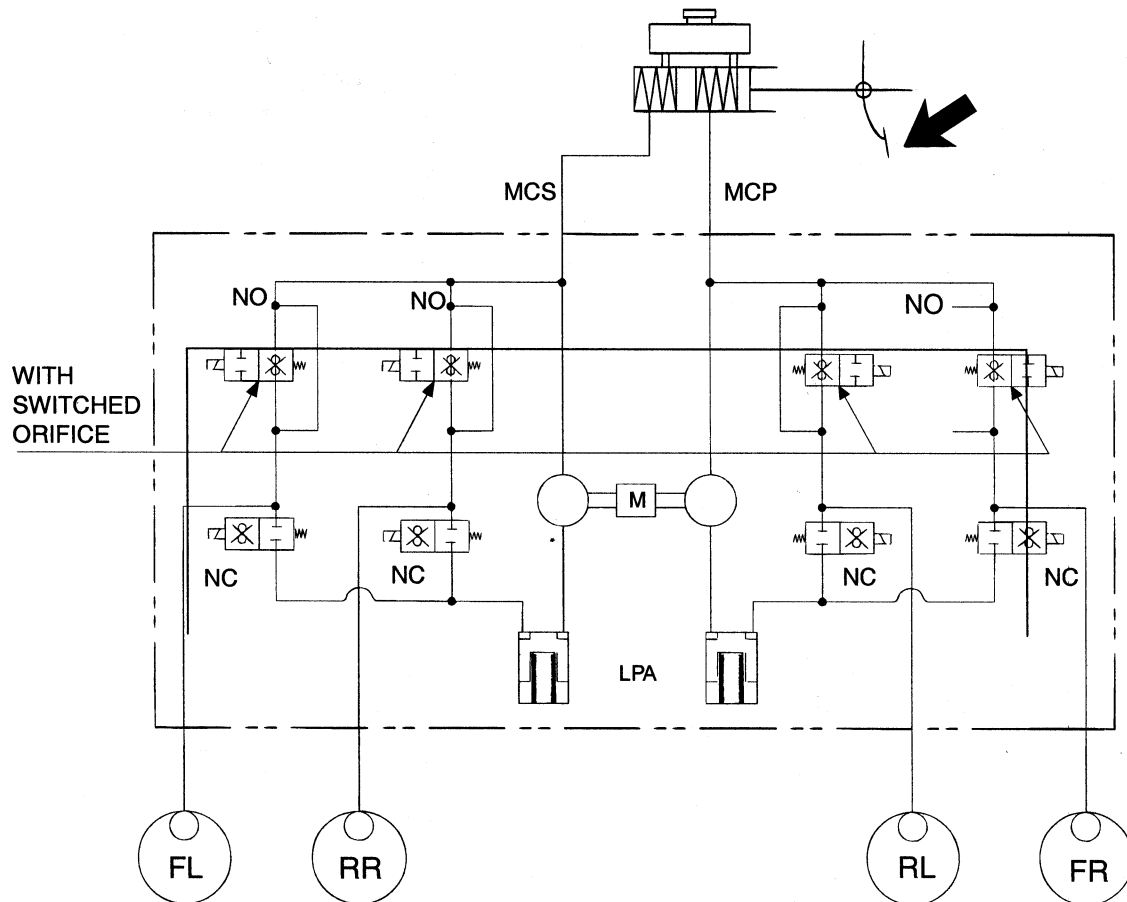
DIAGRAM OF INPUT/OUTPUT FOR
HECU

EJHA2250



SYSTEM DIAGRAM EJHA2300

[ABS]



MCS : Master Cylinder Secondary

MCP : Master Cylinder Primary

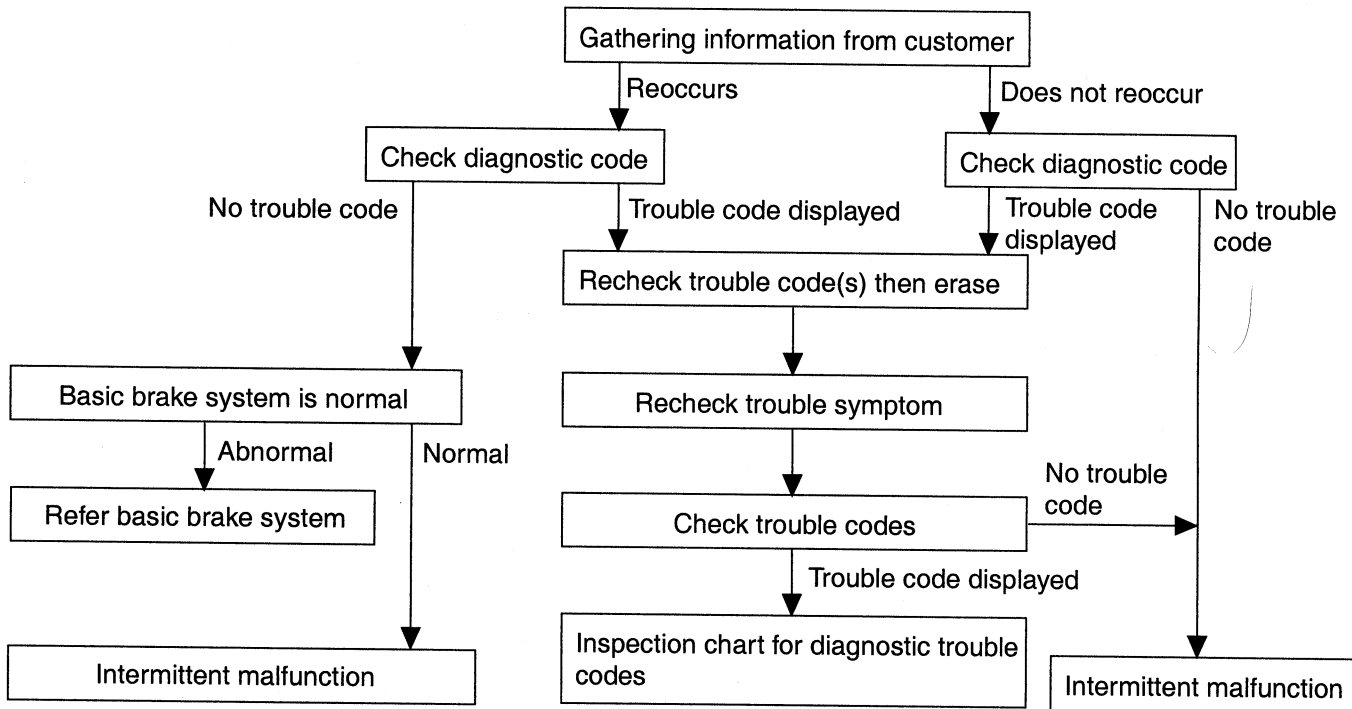
NO : Normal Open

NC : Normal Close

M : Motor & Pump

LPA : Low Pressure Accumulator

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING EJHA2400



EJDA015A

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

NOTES WITH REGARD TO DIAGNOSIS EJHA2450

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.
Pedal kickback	It's normal operation.
Diagnosis detection conditions can vary depending on the diagnosis code. When checking the trouble symptom after the diagnosis code has been erased, ensure that the requirements listed in "Comment" are met.	

ABS CHECK SHEET EJHA2500

ABS Check Sheet

 Inspector's
Name _____

Customer's Name		Registration No.	
		Registration Year	/ /
		VIN.	
Date Vehicle Brought In	/ /	Odometer	Km Miles

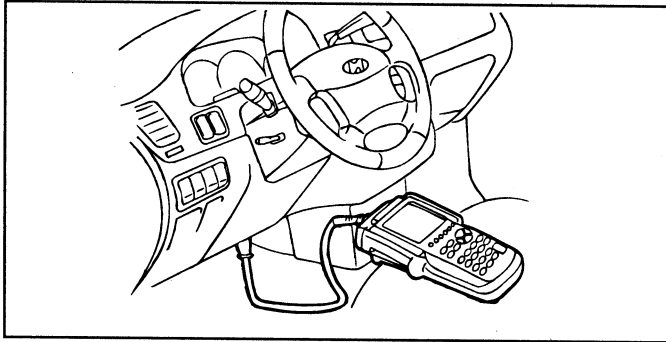
Date the Problem First Occurred	/ /
Frequency of Occurrence of Problem	<input type="checkbox"/> Continuous <input type="checkbox"/> Intermittent (times a day)

Symptoms	<input type="checkbox"/> ABS does not operate.	
	<input type="checkbox"/> ABS does not operate efficiently.	<input type="checkbox"/> Intermittent (times a day)
	ABS Warning Light Abnormal	<input type="checkbox"/> Remains ON <input type="checkbox"/> Does not light up

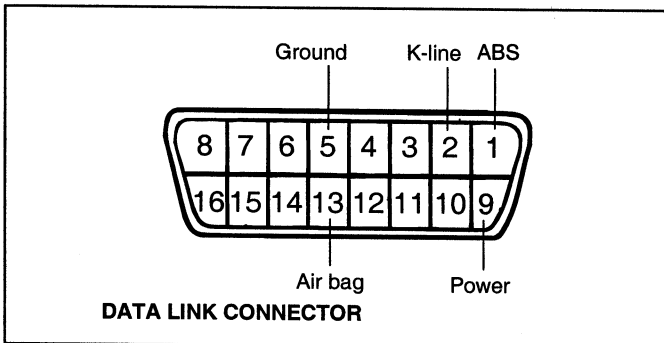
Diagnostic Trouble Code Check	1st Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code)
	2nd Time	<input type="checkbox"/> Normal Code	<input type="checkbox"/> Malfunction Code (Code)

HI-SCAN CHECK EJHA2550

1. Turn the ignition "OFF".
2. Connect the Hi-Scan or Hi-Scan Pro to the data link connector located underneath low crash pad panel.
3. Turn the ignition "ON".
4. Use the Hi-scan to check for diagnostic trouble codes.
5. After completion of the repair or correction of the problem, turn the ignition switch; then erase the stored faults codes using the clear key on the Hi-Scan.
6. Disconnect the Hi-Scan.



ERHA006A



EJHA100A

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

EJJB2600

Inspect according to the inspection chart that is appropriate for the malfunction code.

DTC on Hi-Scan	Description
C1101	Too high battery voltage (over 18V)
C1102	Too low battery voltage (below 9V)
C1200	FL wheel sensor : open or short to GND
C1201	-Range / Performance : exciter or speed jump error
C1202	- No signal : air-gap error
C1203	FR wheel sensor : open or short to GND
C1204	- Range / Performace : exciter or speed jump error
C1205	- No signal : air-gap error
C1206	RL wheel sensor : open or short to GND
C1207	- Range / Performanace : exciter or speed jump error
C1208	Battery voltage over volt (over 18V)
C1209	RR whel sensor : open or short to GND
C1210	- Range / Performance : exciter or speed jump error
C1211	Battery voltage over volt (over 18V)
C1604	Harware (including valve failures)
C2112	Valve relay (including fuse failure)
C2402	Electrical (Pump-Motor)

ACTUATOR DRIVING

No.	Description	Condition	Recognition	Time
01	Motor	KEY ON ENG. OFF	Motor pump relay operation (Click sounds)	2 seconds
02	Front left valve (In)		Front left solenoid valve operation (Click sounds)	
03	Front right valve (In)		Front right solenoid valve operation (Click sounds)	
04	Rear left valve (In)		Rear left solenoid valve operation (Click sounds)	
05	Rear right valve (In)		Rear right solenoid valve operation (Click sounds)	
06	Front left valve (Out)		Front left solenoid valve operation (Click sounds)	
07	Front right valve (Out)		Front right solenoid valve operation (Click sounds)	
08	Rear left valve (Out)		Rear left solenoid valve operation (Click sounds)	
09	Rear right valve (Out)		Rear right solenoid valve operation (Click sounds)	

CURRENT DATA

No.	Description	Recognition	Unit
1	Battery	Battery	Voltage
2	FL wheel speed SNSR	Front left wheel speed sensor	km/h
3	FR wheel speed SNSR	Front right wheel speed sensor	
4	RL wheel speed SNSR	Rear left wheel speed sensor	
5	RR wheel speed SNSR	Rear right wheel speed sensor	
6	ABS SRI status	Warning lamp	
7	Brake SW	Brake switch	
8	Motor pump relay	Motor relay	
9	Valve relay	Valve relay	
10	Motor pump status	Motor	
11	FL valve (In)	Front left valve (In)	
12	FR valve (In)	Front right valve (In)	
13	RL valve (In)	Rear left valve (In)	
14	RR valve (In)	Rear right valve (In)	
15	FL valve (Out)	Front left valve (Out)	
16	FR valve (Out)	Front right valve (Out)	
17	RL valve (Out)	Rear left valve (Out)	
18	RR valve (Out)	Rear right valve (Out)	

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
1	C1101	Power supply	Over voltage of Vign	When Vign>18V continue 224ms, ECU detects the failure.	All wheel inhibit	All wheel inhibit	All wheel inhibit	Vign < 17V	○	○	○	○	○	○	
	C1102		Voltage drop of Vign	When Vign<9V or VREF<9V continues 224ms, ECU detects the failure.	ABS inhibit (permit EBD control)	Continue EBD control	ABS inhibit	Vign>10V and VREF>10V continue 224ms. But in case of ABS control mode, all wheels inhibit until end of ABS control.	○	-	○	○	○	○	
2	C1604	Actuator	Voltage drop of Vign (EBD inhibit)	When Vign<7.5V or VREF<7.5V continues 70ms, ECU detects the failure.	All wheel inhibit	All wheel inhibit	All wheel inhibit	Vign>9V and VREF>9V continue 70ms	○	○	○	○	○	○	
															Interruption or short circuit of actuator
	C2112	Main relay	Interruption or short circuit of main relay												

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
3	C1604	Main relay	Interruption or short circuit of inhibit signal	With the initial check, the main CPU checks the functions of sub CPU inhibit signal and custom IC inhibit circuit.	-	-	Restart	O	O						
				1) IG-SW ECU checks VREF just after IGN-SW ON, and detects the failure. <table border="1" style="margin-left: 20px;"> <tr> <td>OFF</td> <td>voltage is below 2.5V, voltage is over 4.2V (short or leak)</td> <td>105ms</td> </tr> <tr> <td>ON</td> <td>voltage is below 6V (open)</td> <td>105ms</td> </tr> </table> If the ECU detects unusual Vign, failure isn't detected											OFF
OFF	voltage is below 2.5V, voltage is over 4.2V (short or leak)	105ms													
ON	voltage is below 6V (open)	105ms													
	C112			When voltage is below for 224ms, ECU detects the failure. But if the ECU detects a voltage drop or overvoltage, the failure is not detected.	System down	System down	Restart	O	O						
4	FL : C1200 FR : C1203 RL : C1206 RR : C1209	Wheel speed sensor	Interruption or short circuit of wheel speed sensor	The CPU detects the failure by checking voltage of the wheel speed sensor with a velocity of 0km/h.	Management A	Management B	Restart	O	O	*a					
				Sensor voltage is below 0.4V or over 2.7V Monitoring time=196ms											

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Detect timing						
					Out of control	EBD control mode	ABS control mode	ABS W/L	EBD W/L	A	B	C	D	E
4	FL : C1201 FR : C1204 RL : C1207 RR : C1210	Wheel speed sensor	Intermittent interruptions or short circuit of sensor. Defect of air gap, or sensor wheels, or clearance of bearing	After wheel velocity changes over 30km/h per 7ms (over 120G), if there is the difference between calibrated wheel velocity and monitoring velocity continuously beyond the constant, ECU detects the failure.	Management B	Management B	Management C							
					Management B	Management B	Management C							
					Management B	Management B	Management C							
	FL : C1202 FR : C1205 RL : C1208 RR : C1211	Missing sensor signal Too large air gap Sensor wheel is not installed	When starting the vehicle, ECU detects the following conditions. 1. $V_{MAX} \geq 40\text{km/h}$ and $V_{ref} \leq 0.6 \times V_{MAX}$ Monitoring time 120s. 2. Within the range of 7 to 20km/h, if the wheel speed sensor reports 6 km/h continuously, the ECU will report a failure for that wheel. 3. If the vehicle speed is over 20km/h for 120 seconds but the wheel speed sensor reports 6km/h continuously for 120 seconds, the ECU will report failure for that wheel.	Management B	Management B	Management C								
				Management B	Management B	Management C								
				Management B	Management B	Management C								
			Too large air gap Long term EMI	In ABS control, if the pressure decrease mode and hold mode continue, for 14sec., ECU detects the failure.	-	-	Management C							
	C1604		Defect of clearance of bearing EMI/IGN noise	When there are over 32 pulses from the wheel sensor within 7ms, ECU detects the failure.	System down	System down	System down							

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
6	C1604	ECU	CPU failure	<p>1. When ECU starts, main and sub CPU execute the following checks :</p> <p>a) ECU checks the value of the result of fixed multiplications, whether it becomes the value decided in advance or not.</p> <p>b) ECU executes read/write for RAM.</p> <p>c) ECU executes sum check of ROM.</p> <p>2. IGN After IGN ON, main and sub CPU communicate each other for synchronization. When one or the other CPU can't synchronize within 1sec., the main CPU shuts system down and sub CPU stops running.</p> <p>3. Main and sub CPU always execute the following checks. ECU checks whether the program is finished or not</p>	System down	System down	System down	Restart	0	0	0	0	0	0	0

No.	DTC	Failure Locations	Detect mode	Condition for Detection	Management			Conditions for Restoration	ABS W/L	EBD W/L	Detect timing				
					Out of control	EBD control mode	ABS control mode				A	B	C	D	E
6	C1604	ECU	CPU failure	<p>4. In every program cycle, the main CPU and sub CPU communicate with each other for synchronization. When one or the other can't synchronize within 300μsec, main CPU shuts the system down and sub CPU stops running.</p> <p>5. Sub CPU checks the following :</p> <p>a) Sub CPU always compares the result of analog sent by main CPU with the result of data calculated by sub CPU, in case that there is a difference above 7 bits for 112ms, ECU recognizes the failure.</p> <p>b) In case that wheel velocity of FL calculated by main CPU is different from that calculated by sub CPU above 10km/h for 504ms, ECU recognizes the failure.</p> <p>c) Sub CPU calculates the slip from Vref calculated by main CPU and wheel velocity of FL calculated by sub CPU. ECU recognizes a failure when the main CPU judges ABS phase as pressure decrease phase for 1sec. with no slip calculated by sub CPU break.</p> <p>d) When the main CPU does not judge ABS phase as pressure decrease phase, in that case the main CPU sets the valves as pressure decrease state for 1 sec., ECU recognizes the failure.</p> <p>e) When main CPU judges ABS phase as out of ABS control, in which case the valve driven information from main CPU is in a pressure hold state for 1 sec., ECU recognizes the failure.</p>	System down	System down	System down	Restart	0	0	0	0	0	0	0
					System down	System down	System down	Restart	0	0	0	0	0	0	

- *1 In case of main relay ON only
- *2 In case of motor initial check only, ECU detects the failure of motor relay output ON.
- *3 In case of motor initial check only
- *4 In case of over two wheels failure

Management A

Conditions	Management
$V_{max} > 5\text{km/h}$	Management B
$V_{max} < 5\text{km/h}$	One front wheel failure detected causes ABS inhibit
	One rear wheel or more than two wheels failure causes all wheels to inhibit ABS

Management B

Conditions	Management
Failure of one wheel	ABS inhibit (permit EBD control)
Failure of over two wheels	System down

Management C

Conditions Management	Management
Failure of one front wheel	ECU discontinues ABS control of defective wheel and continues ABS control of normal wheels. ABS inhibit after end of ABS control.
Failure of two front wheels	ECU discontinues ABS control of defective wheel and continues ABS control of normal wheels. System down after end of ABS control.
Failure of one rear wheel	ECU continues ABS control of rear wheels using information of normal rear wheel and front wheels. System down after end of ABS control.
Failure of two rear wheels	System down
Failure of one front wheel and one rear wheel	ECU discontinues ABS control of defective front wheel, and continues rear wheels using information of normal rear wheel. System down after end of ABS control.
Failure of over three wheels	System down

ADDITIONAL EXPLANATION OF FAILSAFE

1. Warning lamp initial lighting time
 - 1) Immediately after IG-SW ON, warning lamp is lit for 3 sec. This term is called ' warning lamp initial lighting time'.
 - 2) Within this term, in case that the ECM detects the failure, warning lamp is lighted continuously.

NOTE

1. System down

The system changes to normal braking with warning lamp ON after detecting the failure by its software. ECM restart is caused by IG-SW OFF → ON once.

After the failure is corrected, the ECM returns a to normal mode with warning lamp OFF.
2. All wheel inhibit

ECM discontinues ABS control of all wheels. (Equivalent to normal brake)

When the failure is corrected, it returns to normal mode with warning lamp OFF.

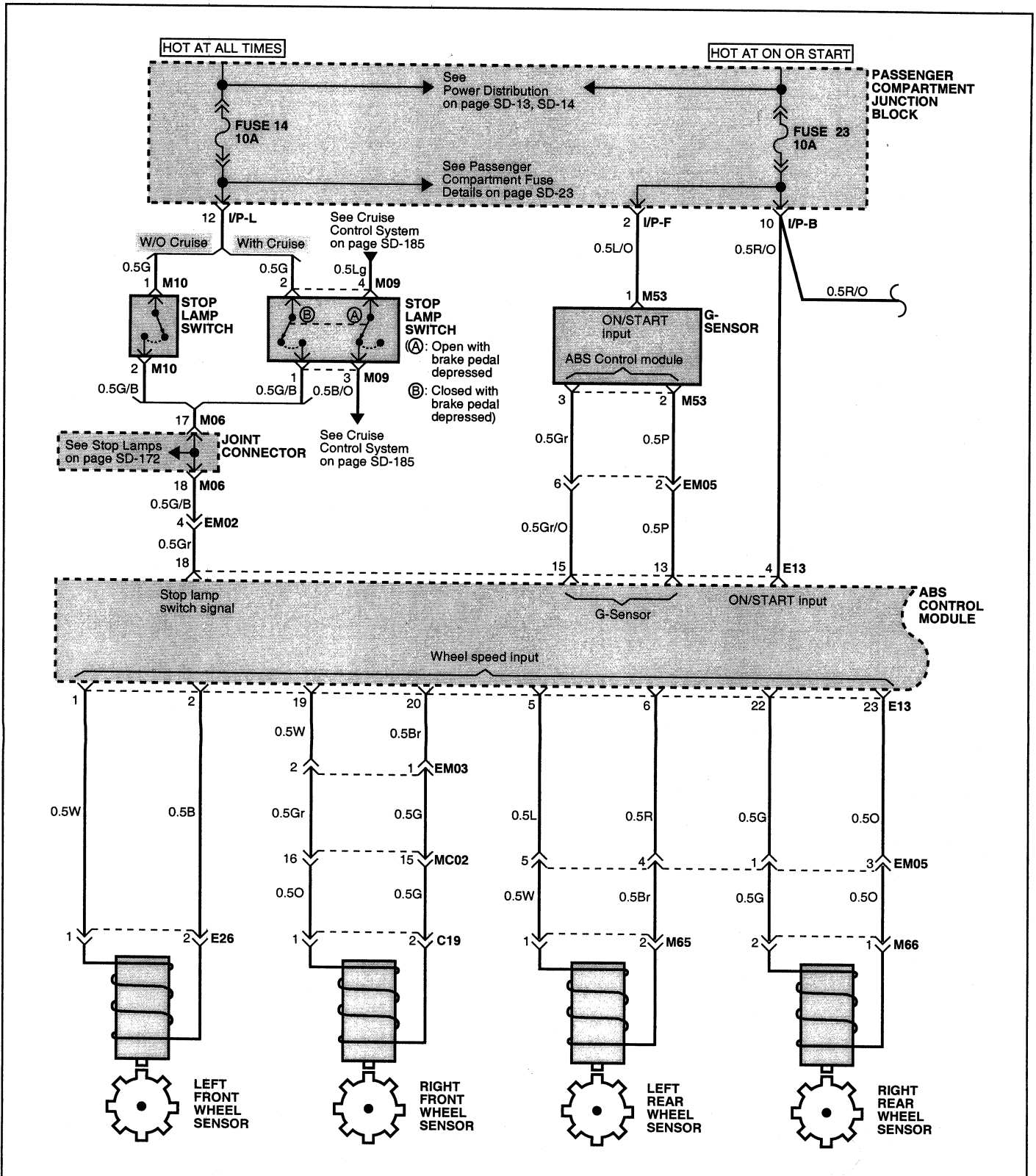
(But during ABS control, it does not return to a normal mode.)

TERM COMMENTARY

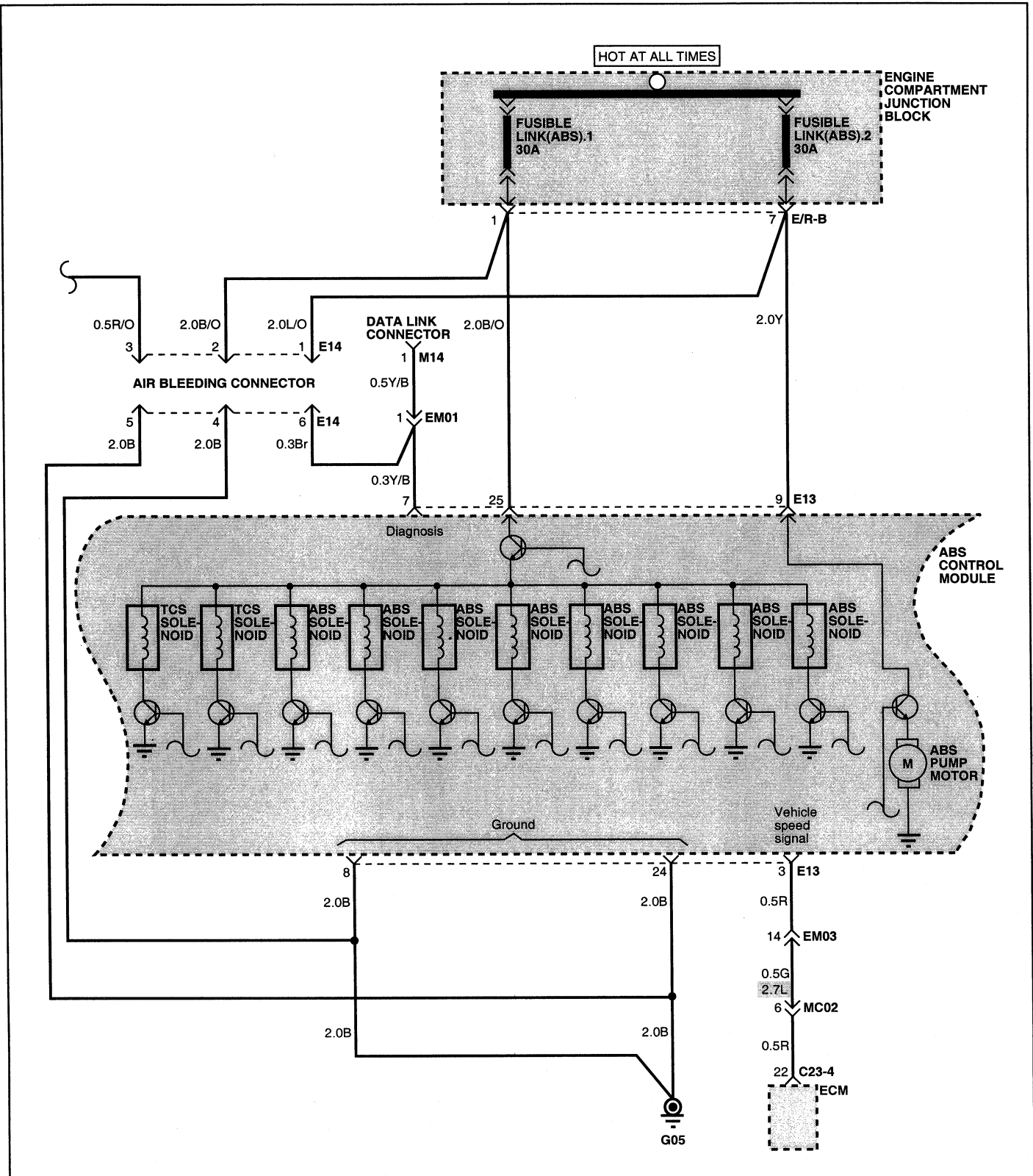
VIGN : Terminal voltage of IGN, VREF : Terminal voltage of REF
 VMAX : Maximum wheel velocity, Vref : estimated vehicle velocity

SCHEMATIC DIAGRAM EJB2650

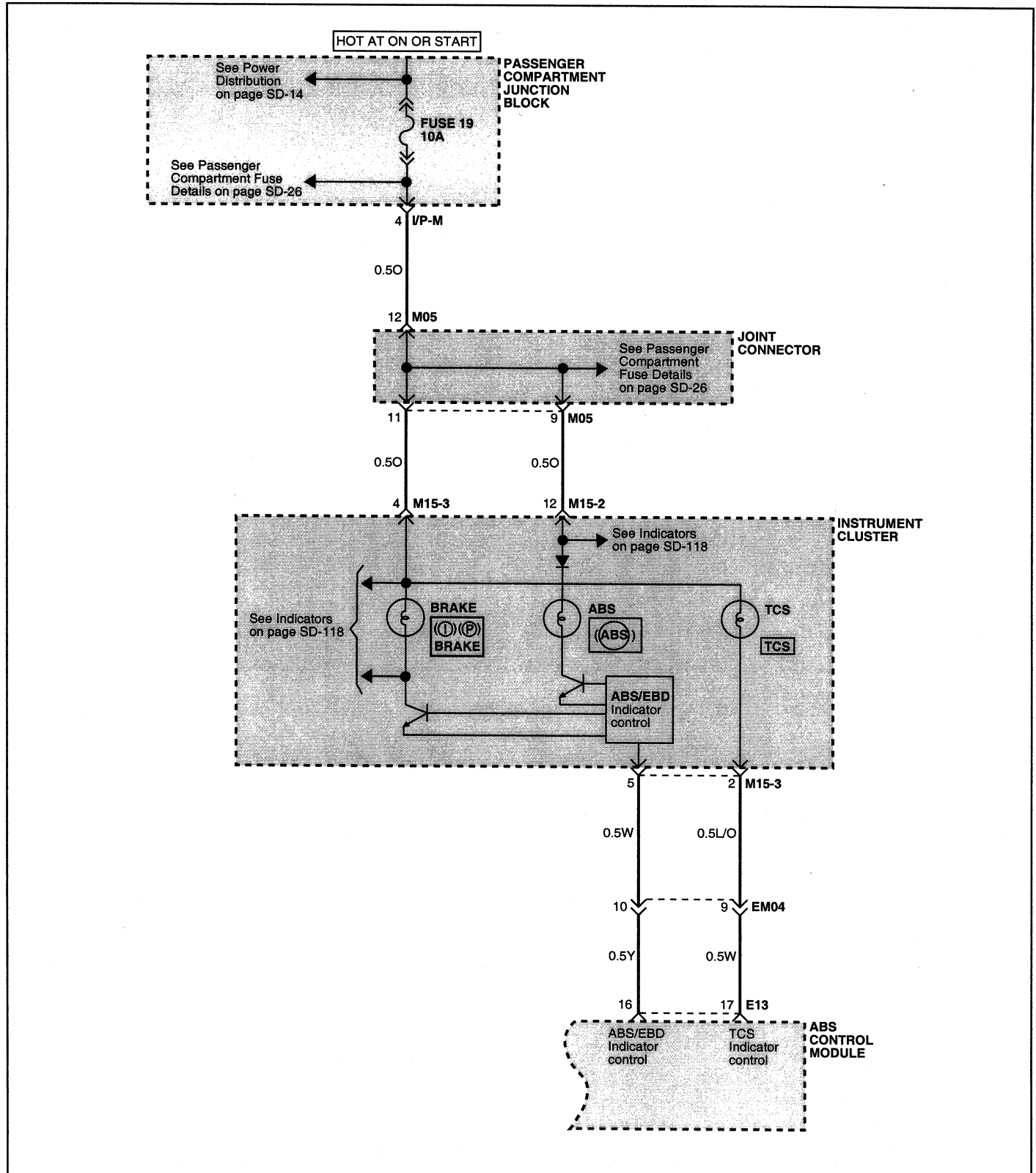
ABS CIRCUIT (1)



ABS CIRCUIT (2)



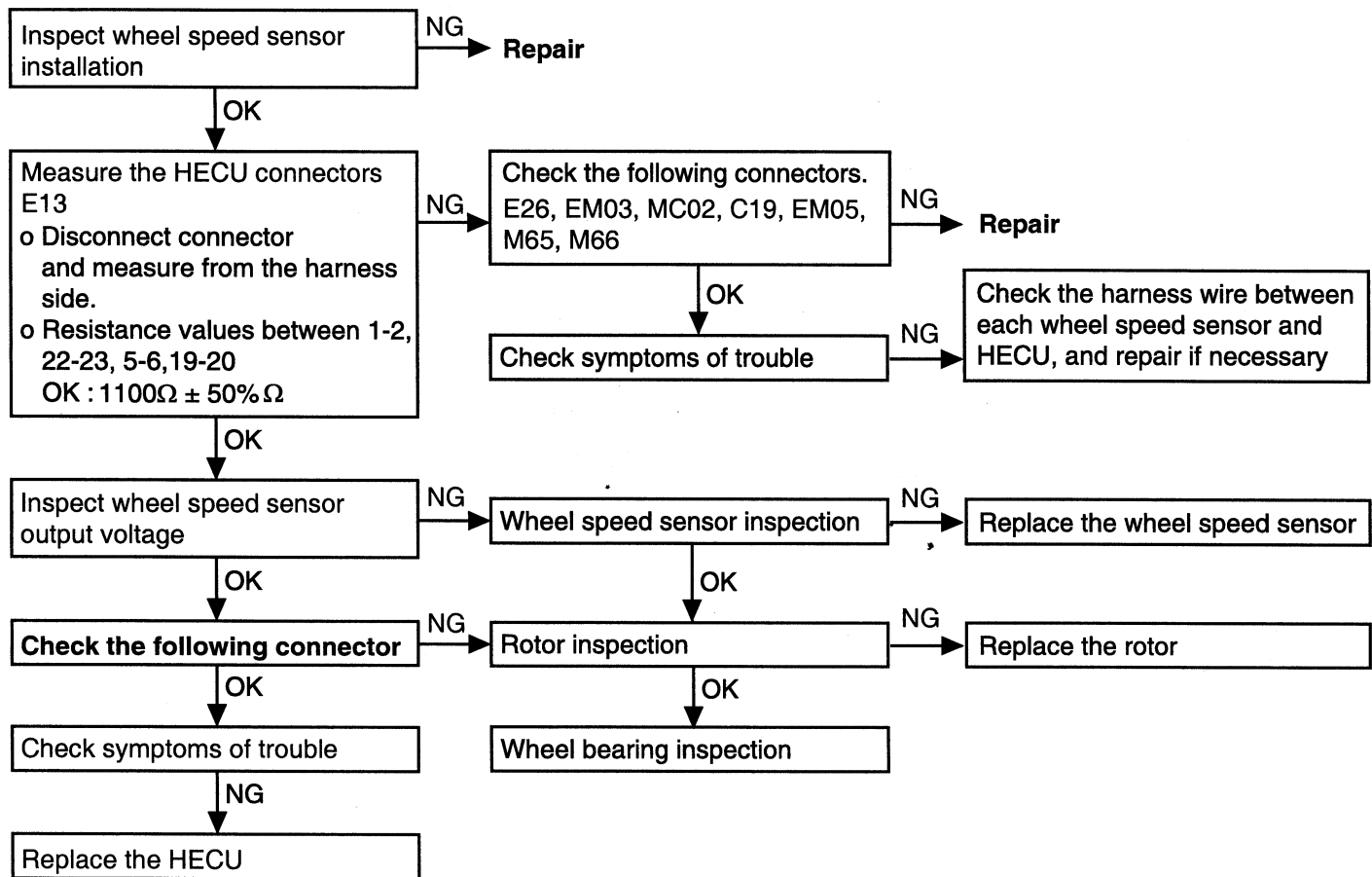
ABS CIRCUIT (3)



INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES

EJJB2700

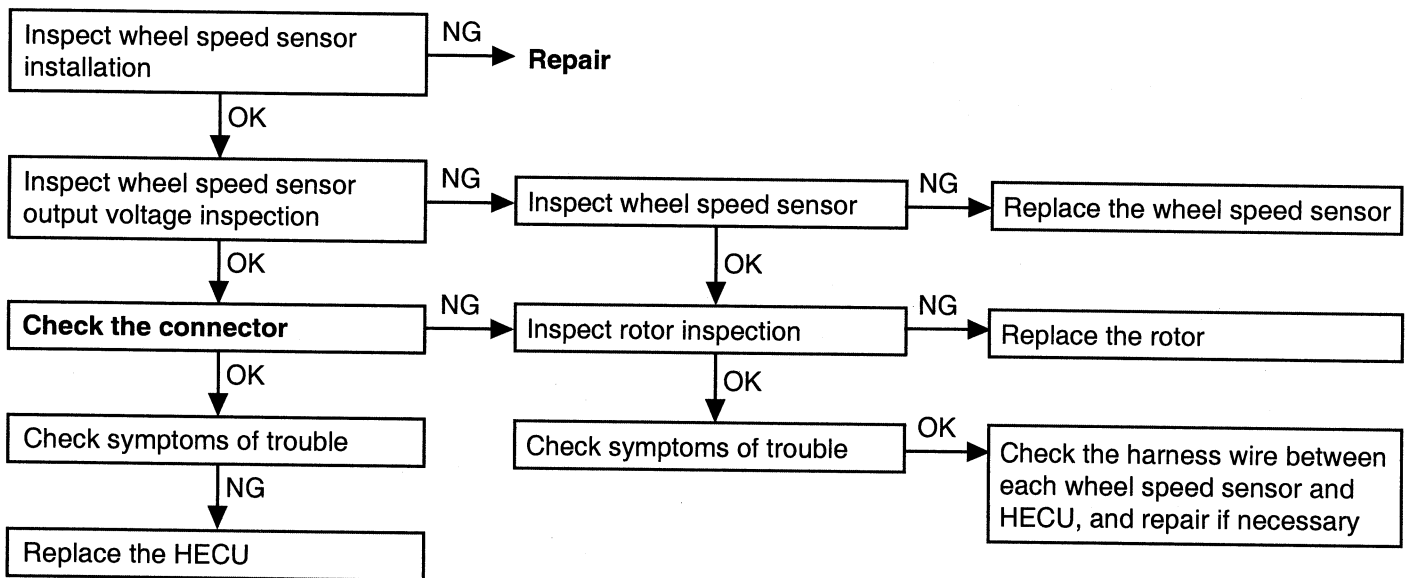
DTC No. C1200, C1203, C1206, C1209 Wheel speed sensor open or short to GND circuit	Probable cause
The HECU determines that an open or short circuit has occurred in more than one wire of the wheel speed sensors	<ul style="list-style-type: none"> • Malfunction of wheel speed sensor • Malfunction of wiring harness or connector • Malfunction of HECU



EJJB270A

EJHA2750

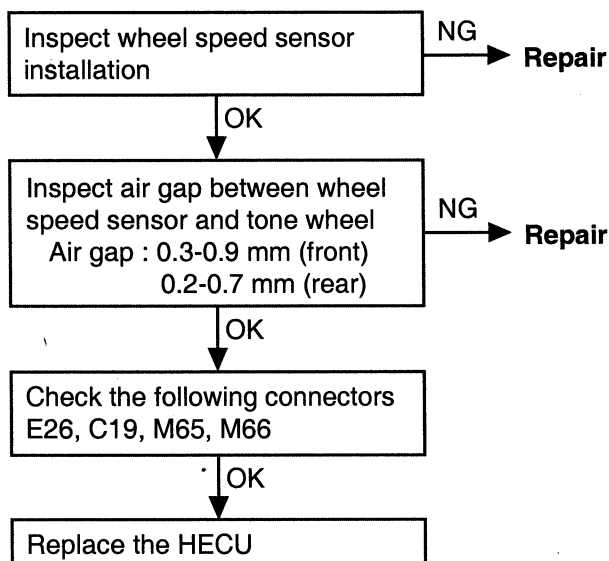
DTC No. C1201, C1204, C1207, C1210 (Speed jump or wrong exciter)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open short-circuit).	<ul style="list-style-type: none"> • Improper installation of wheel speed sensor • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of wiring harness or connector • Malfunction of HECU



EJHA115A

EHJA2800

DTC No. C1202, C1205, C1208, C1211 (Large air gap)	Probable cause
A wheel speed sensor outputs no signal	<ul style="list-style-type: none"> • Malfunction of wheel speed sensor • Improper installation of wheel speed sensor • Malfunction of rotor (excitor) • Malfunction of wiring harness or connector • Malfunction of HECU



EJB280A

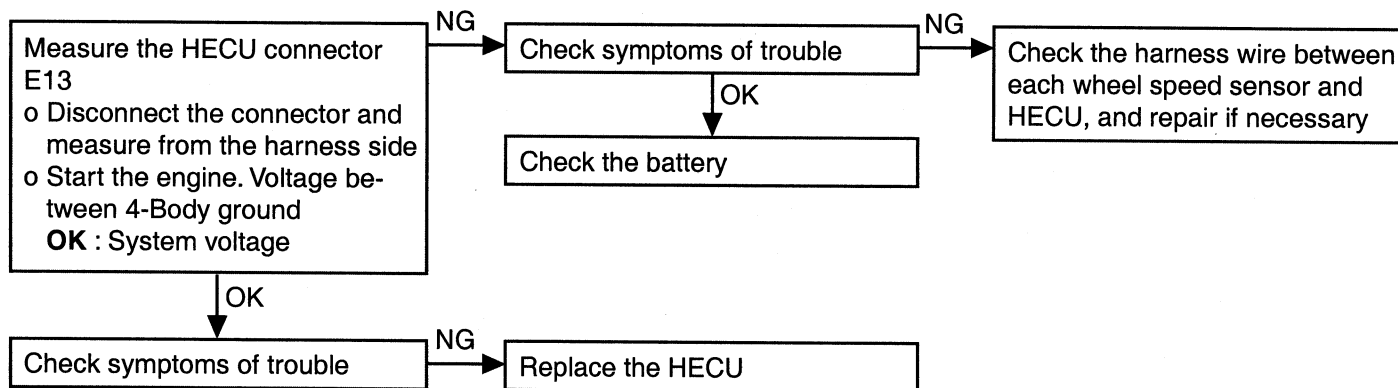
EJJB2850

DTC No. C1101, C1102 Voltage out of range (Low and over voltage)	Probable cause
The voltage of the HECU power supply drops lower than or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of HECU.

CAUTION

If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns

to the standard value, the code is no longer output. Before carrying out the following inspection, check the battery level and refill if necessary.



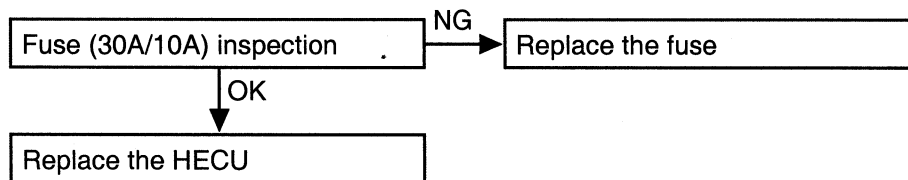
EJJB285A

EJHA2900

DTC No. C1604 ECU Hardware (EEPROM and ECU failure)	Probable cause
The HECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness even if no current flows in the solenoid or through the HECU.	<ul style="list-style-type: none"> • Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of HECU

EJHA2950

DTC No. C2112 Valve relay (Including fuse failure)	Probable cause
When the ignition switch is turned ON, the HECU switches the valve relay off and on during the initial check. In that way, the HECU compares the signals sent to the valve relay with the voltage in the valve power monitor line. That is how to check if the valve relay is operating normally. The HECU always checks if current flows in the valve power monitor line. It determines that there is an open circuit when no current flows. If no current flows in the valve power monitor line, this diagnosis code is output.	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of HECU

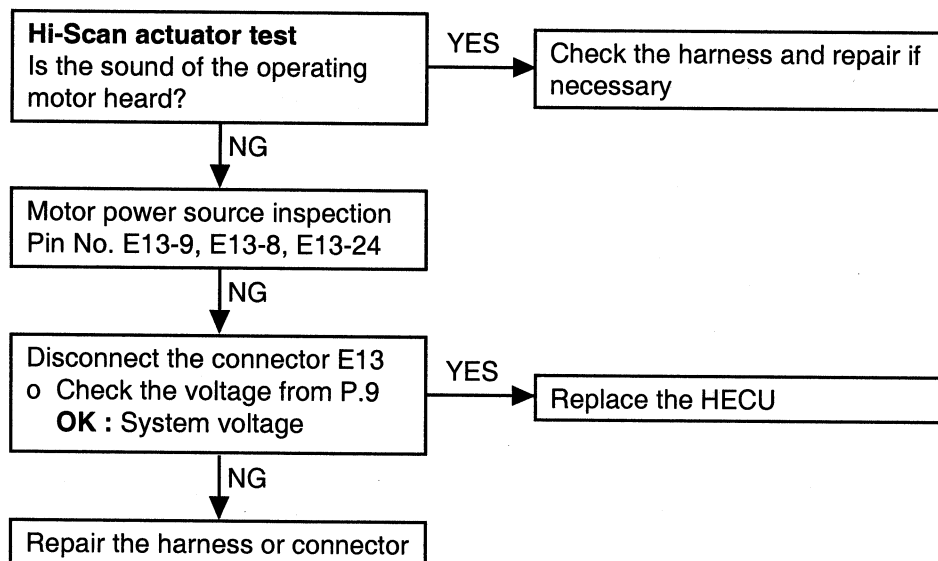


EJJB3000

DTC No. C2402 Electrical (Motor relay, motor)	Probable cause
When the motor power line is normal but no signal is input to the motor monitor line, it is abnormal.	<ul style="list-style-type: none"> • Malfunction of hydraulic unit • Malfunction of HECU

CAUTION

Because powering of the motor with the Hi-Scan or Hi-Scan Pro will discharge the battery, the engine should be run for a while after testing is completed.

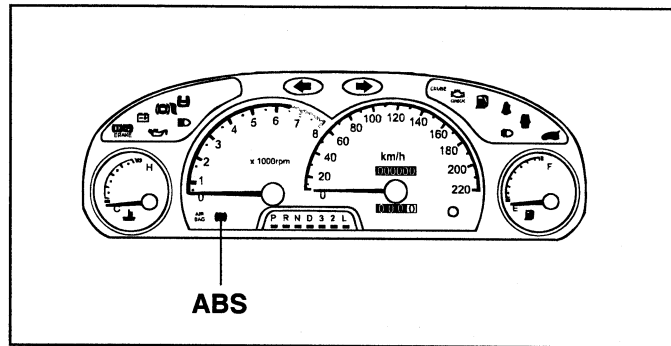


EJJB300A

ABS WARNING LAMP INSPECTION EJHA3050

Check that the ABS warning lamp illuminates as follows.

When the ignition key is turned "ON", the ABS warning lamp comes on for approximately 2 seconds and then goes out.



ERHA003A

INSPECTION CHART FOR TROUBLE SYMPTOMS EJHA3100

Find out the symptoms and check according to the inspection procedure chart.

Trouble system		Inspection procedure No.
Communication with Hi-Scan is not possible	Communication with any system is not possible.	1
	Communication with ABS only is not possible.	2
When the ignition key is turned "ON" (engine stopped), the ABS warning lamp does not illuminate.		3
After the engine starts, the lamp remains illuminated.		4
Faulty ABS operation	Unequal braking power on both sides	5
	Insufficient braking power	
	ABS operates under normal braking conditions	
	ABS operates before vehicle stops under normal braking conditions	
	Large brake pedal vibration (Caution 2.)	-

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.

INSPECTION PROCEDURE FOR TROUBLE

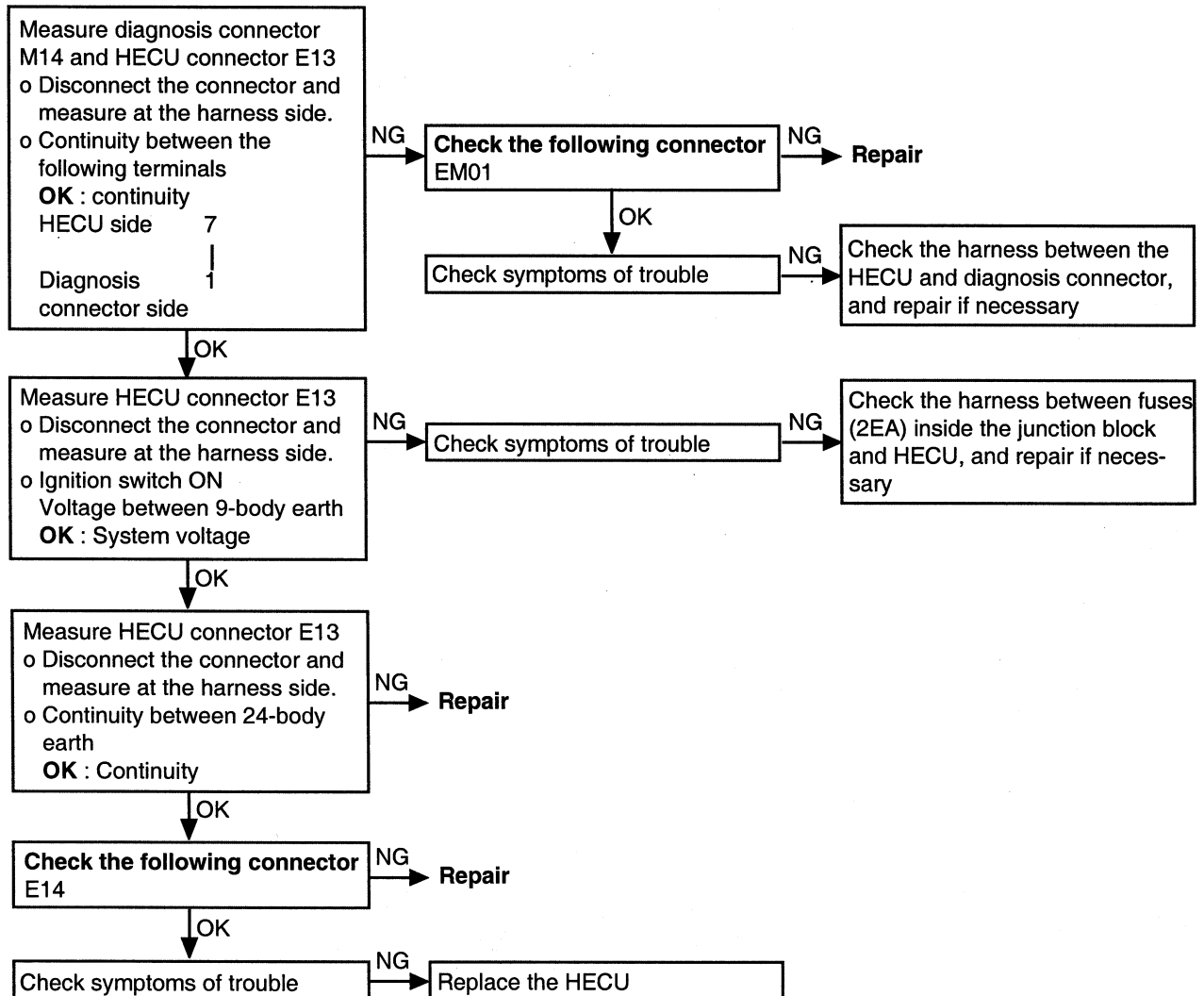
SYMPTOMS EJB3150

INSPECTION PROCEDURE 1

Communication with Hi-Scan is not possible. (Communication with all systems is not possible.)	Probable cause
The reason is probably a defect in the power supply system (including ground) for the diagnosis line.	<ul style="list-style-type: none"> • Malfunction of connector • Malfunction of wiring harness

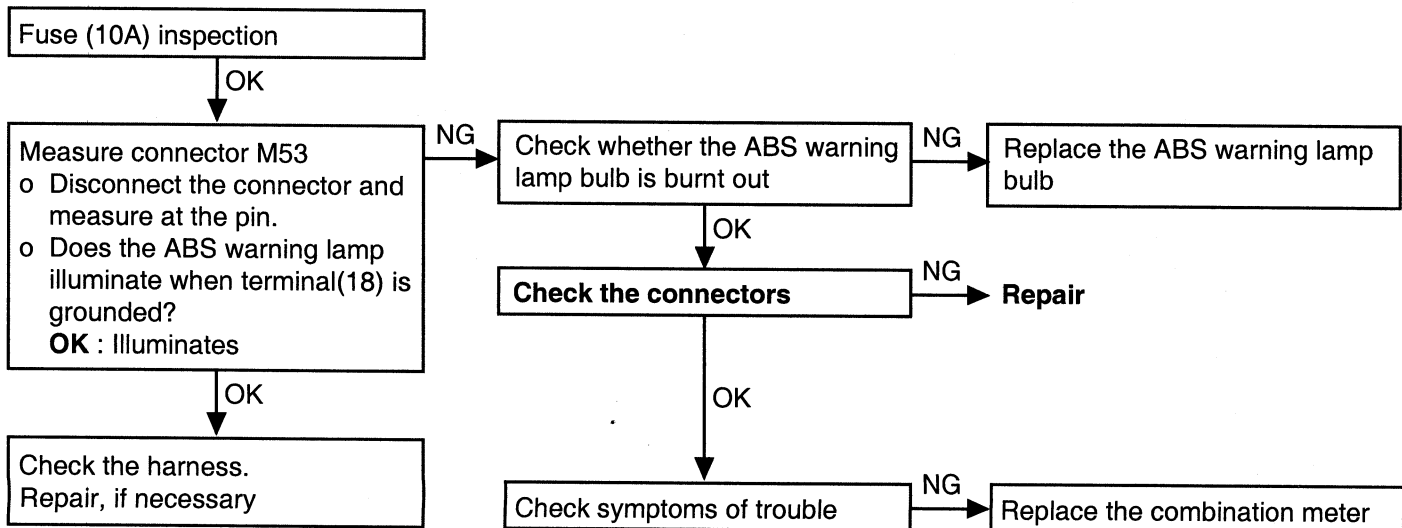
INSPECTION PROCEDURE 2

Communication with Hi-Scan is not possible. (Communication with ABS only is not possible.)	Probable cause
When communication with Hi-Scan is not possible, the cause is probably an open circuit in the HECU power circuit or an open circuit in the diagnosis output circuit.	<ul style="list-style-type: none"> • Blown fuse • Malfunction of wiring harness or connector • Malfunction of HECU



INSPECTION PROCEDURE 3

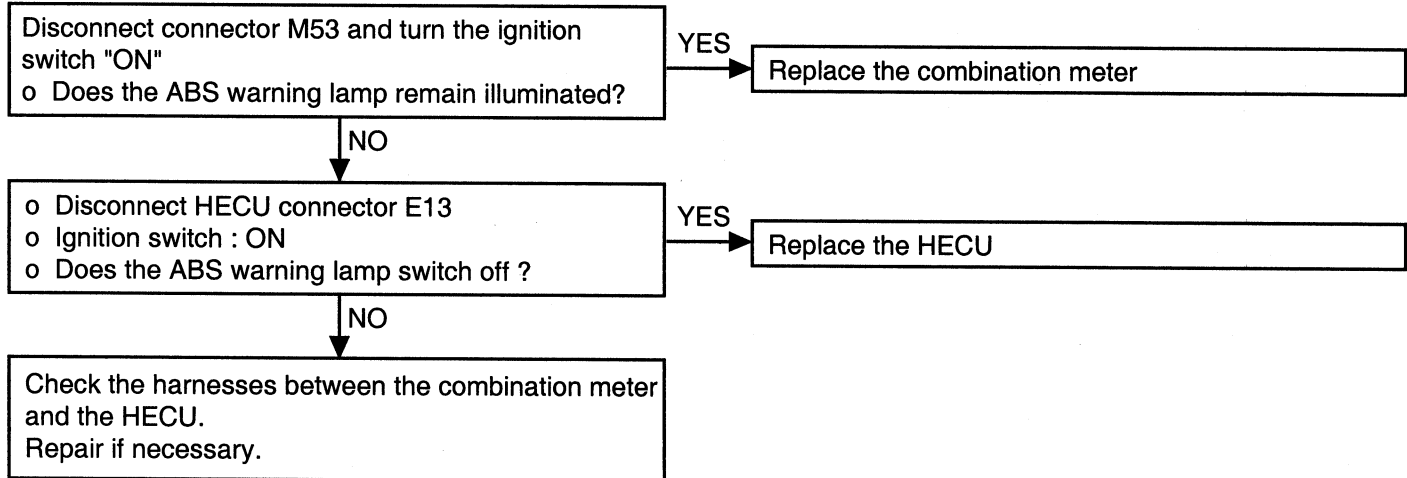
<p>When the ignition key is turned "ON" (engine stopped), ABS warning lamp does not illuminate</p>	<p>Probable cause</p>
<p>When current flows through the HECU, the ABS relay turns from on to off as the initial check. The ABS warning lamp will illuminate when the ABS relay is "Off" even if there is a problem with the circuit between the ABS warning lamp and the HECU.</p> <p>Therefore, if the lamp does not illuminate, the cause may be an open circuit in the lamp power supply circuit, a blown bulb, or an open circuit in both the circuits between the ABS warning lamp and the HECU and in the circuit between the ABS warning lamp and the ABS relay.</p>	<ul style="list-style-type: none"> • Blown fuse • Burnt out ABS warning lamp bulb • Malfunction of wiring harness or connector



INSPECTION PROCEDURE 4

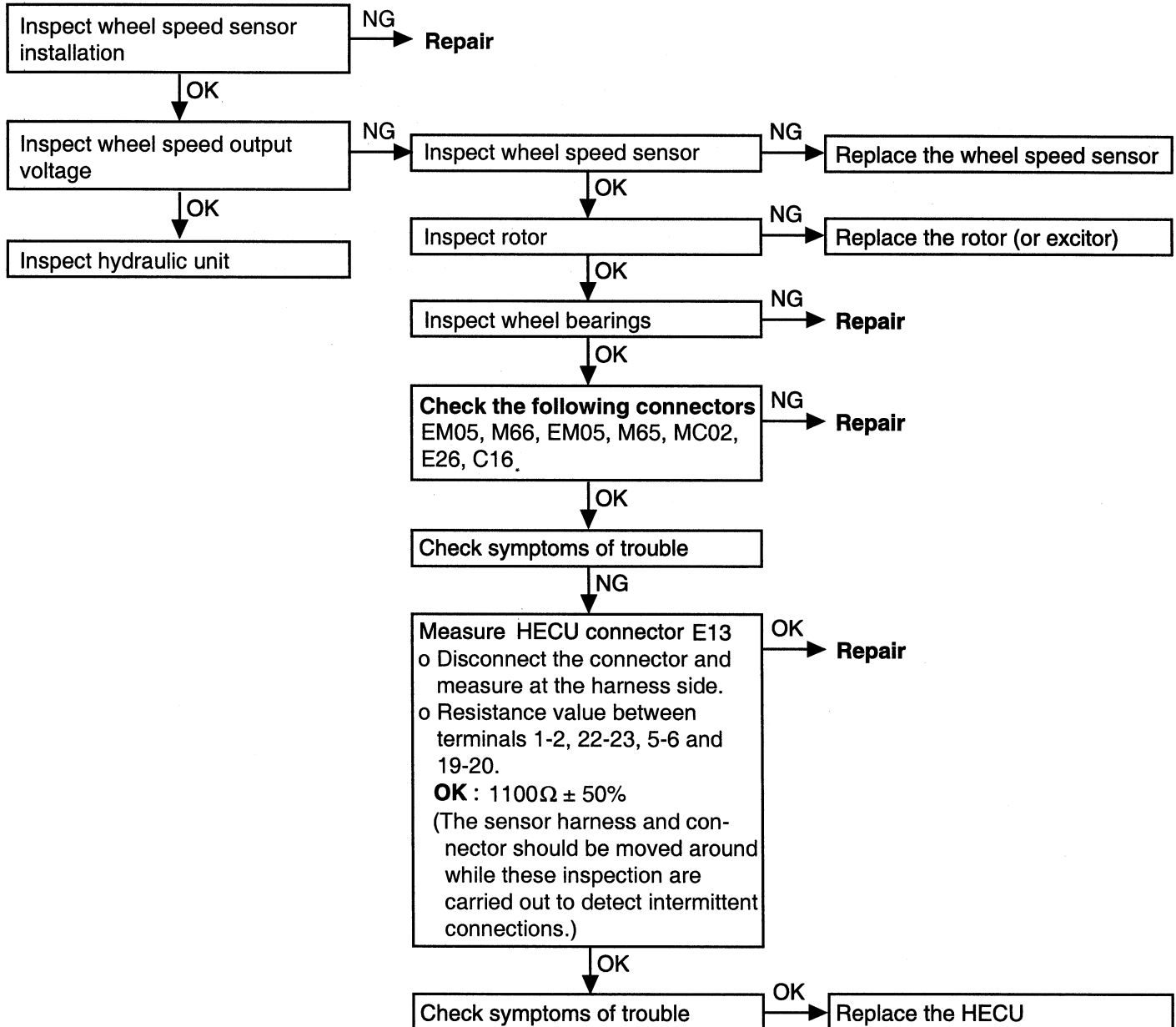
Even after the engine is started, the ABS warning lamp remains illuminated	Probable cause
The cause is probably a short-circuit in the ABS warning lamp illumination circuit	<ul style="list-style-type: none"> • Malfunction of combination meter • Malfunction of HECU • Malfunction of wiring harness

This trouble symptom is limited to cases where communication with the Hi-Scan is possible (HECU power supply is normal) and the diagnosis code is normal.



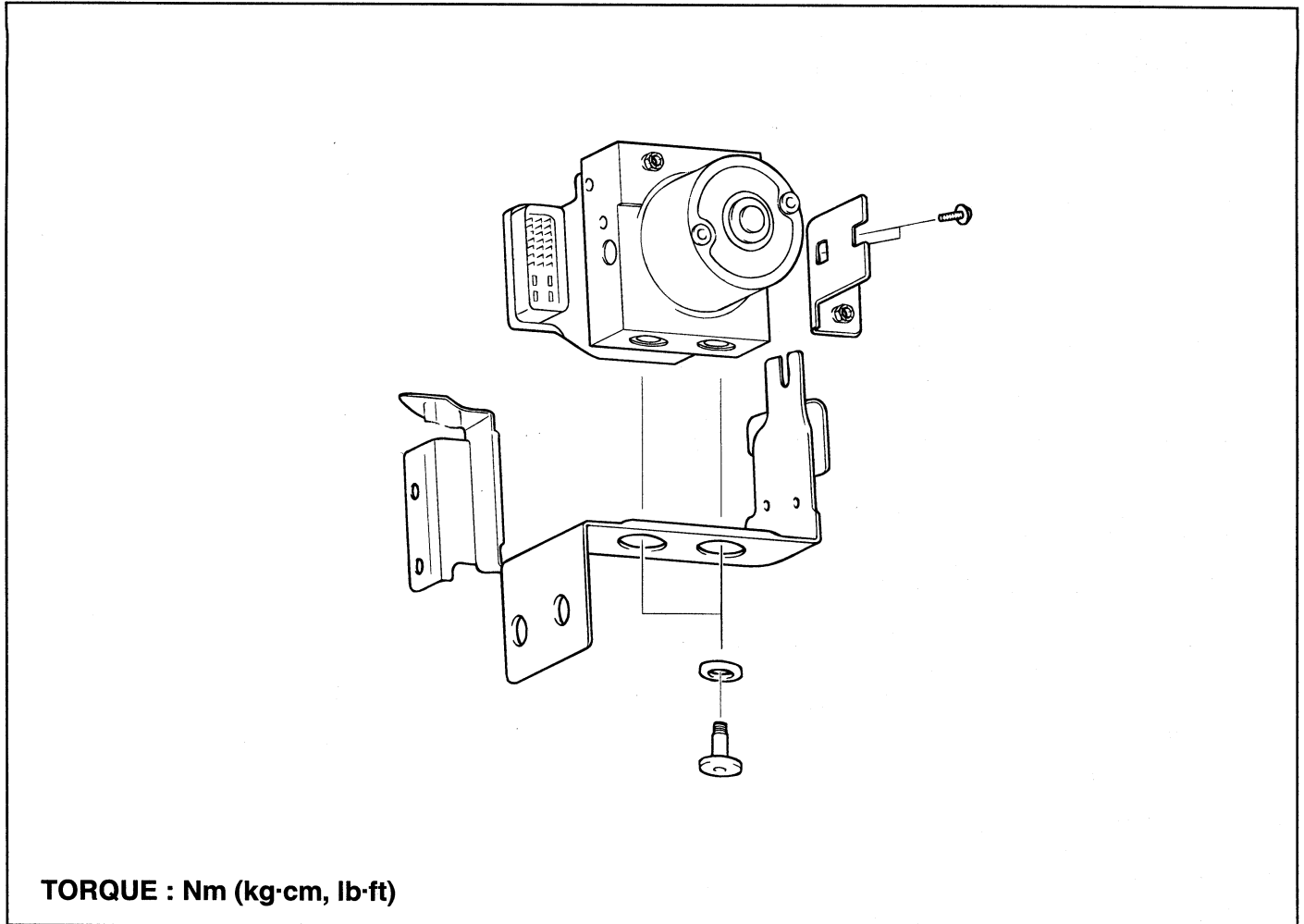
INSPECTION PROCEDURE 5

Brake operation is abnormal	Probable cause	
This varies depending on driving conditions and road surface conditions, so problem diagnosis is difficult. However, if a normal diagnosis code is displayed, carry out the following inspection.	<ul style="list-style-type: none"> • Improper installation of wheel speed sensor • Incorrect sensor harness contact • Foreign material adhering to wheel speed sensor 	<ul style="list-style-type: none"> • Malfunction of wheel speed sensor • Malfunction of rotor • Malfunction of wheel bearing • Malfunction of hydraulic unit • Malfunction of HECU



ANTI-LOCK BRAKING SYSTEM CONTROL
MODULE

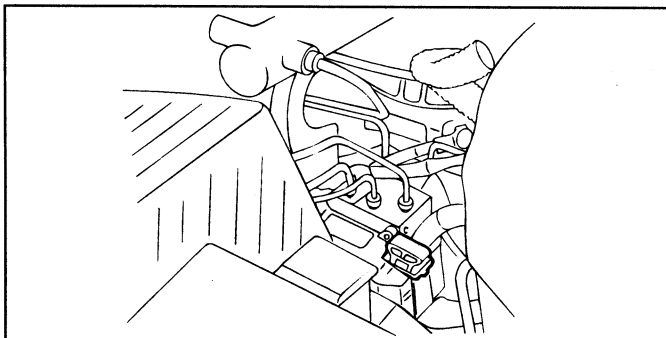
COMPONENTS EJHA3200



EJHA040A

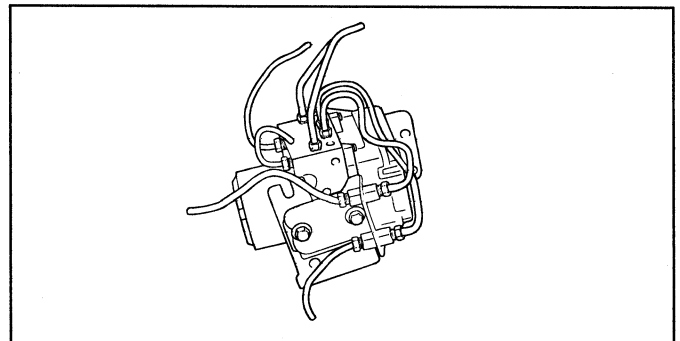
REMOVAL EJHA3250

1. Disconnect the HECU (Hydraulic and electronic Control Unit) and motor connector.



EJHA022A

2. Disconnect the brake lines from the HECU.

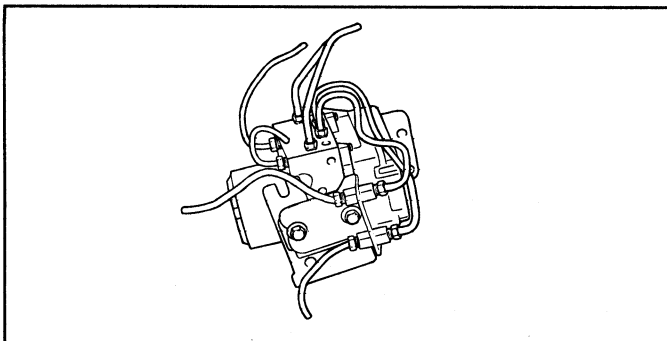


EJHA045A

3. Remove the HECU bracket mounting bolt and the HECU.

CAUTION

1. Never attempt to disassemble the HECU.
2. The HECU must be transported and stored in the upright position and with sealed ports. The HECU must not be drained.



EJHA045A

INSTALLATION

EJHA3300

1. Follow the reverse order for removal.
2. Tighten the modulator mounting bolts and brake tube nuts to the specified torque.

Tightening torque

HECU mounting bolt :

8-10 Nm (80-100 kg·cm, 5.6-6.9 lb·ft)

Brake tube nut :

13-17 Nm (130-170 kg·cm, 9-12 lb·ft)

**ANTI-LOCK BRAKING SYSTEM
MODULATOR****HYDRAULIC MODULE INSPECTION** EJHA3600**CAUTION**

Turn the ignition switch off before connecting or disconnecting the Hi-Scan.

1. Jack the vehicle up and support the vehicle with rigid racks at the specified jack-up points or replace the wheels which are checked on the rollers of the braking force tester.

CAUTION

1. The roller of the braking force tester and the tire should be dry during testing.
2. When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.
2. Release the parking brake and feel the drag force (drag torque) on each road wheel.

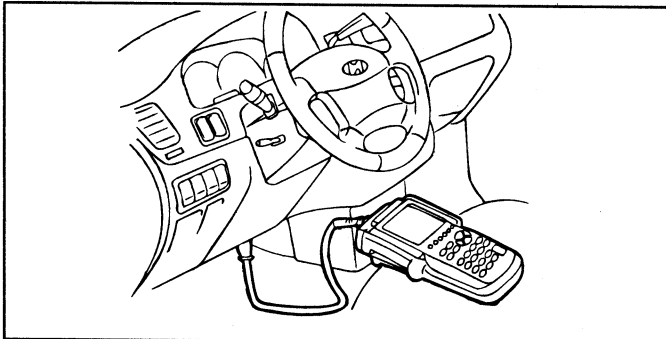
When using the braking force tester, take a reading of the brake drag force.

3. Turn the ignition key "OFF" and set the Hi-Scan or Hi-Scan Pro as shown in the diagram.
4. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.

NOTE

If the ABS is in fail-safe mode, the Hi-Scan actuator test cannot be used.

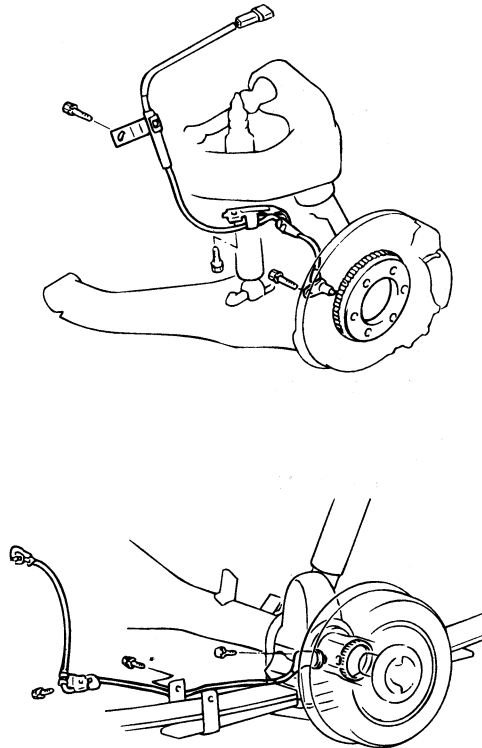
5. Use the Hi-Scan to force-drive the ABS actuator.



ERHA006A

ANTI-LOCK BRAKING SYSTEM WHEEL SPEED SENSOR

COMPONENTS EJHA3350



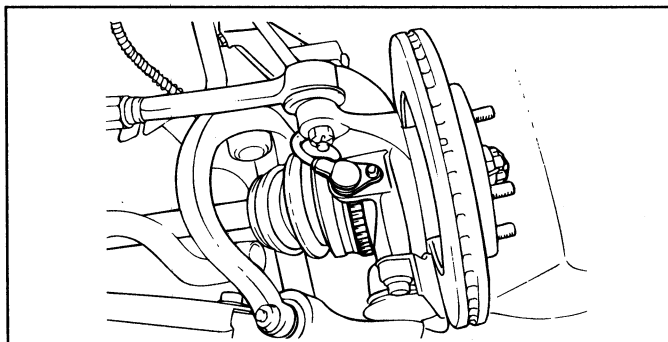
TORQUE : Nm (kg·cm, lb·ft)

EJHA055A

REMOVAL EJHA3400

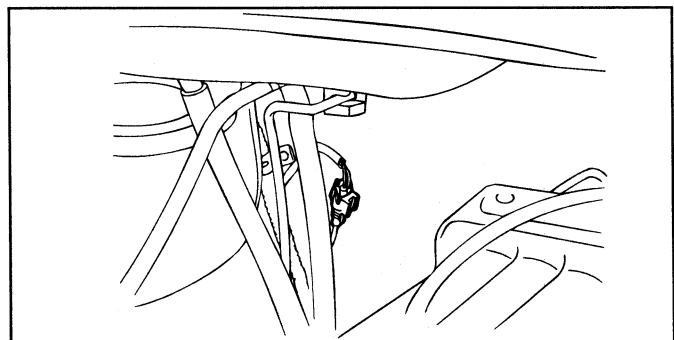
FRONT WHEEL SPEED SENSOR

1. Remove the front wheel speed sensor mounting bolt.



KFW8059A

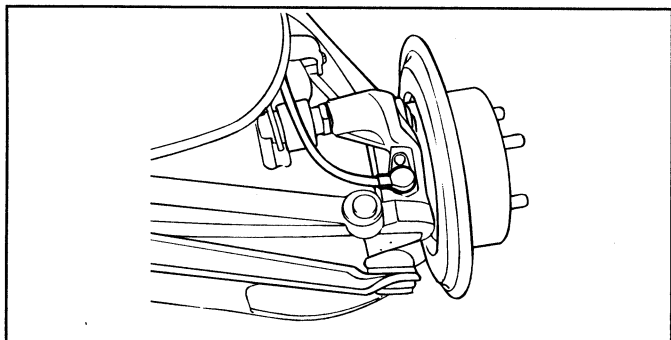
2. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector.



EJHA023B

REAR WHEEL SPEED SENSOR

Remove the rear wheel speed sensor after disconnecting the wheel speed sensor connector.



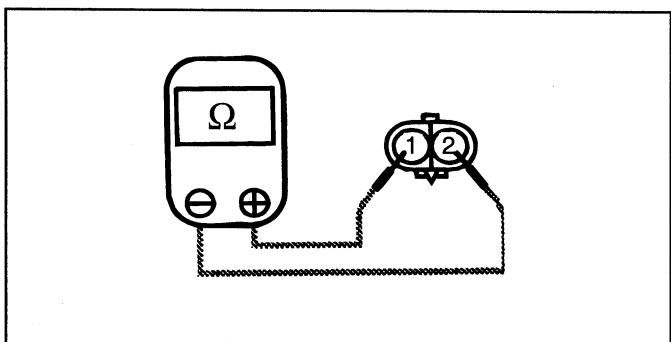
KFW8060A

INSPECTION EJHA3450

1. Connect an ohmmeter between the wheel speed sensor terminals and measure the resistance.

Service standard

Front : $1100\Omega \pm 50\%$
 Rear : $1100\Omega \pm 50\%$



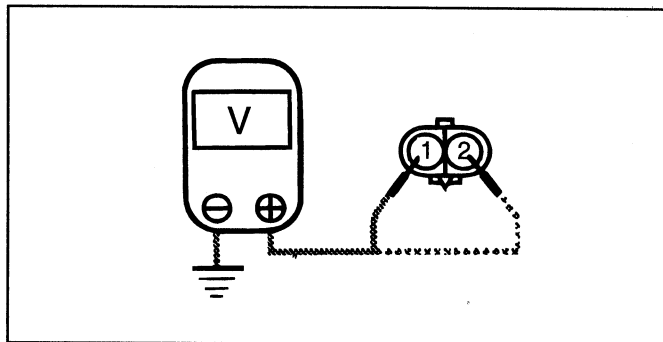
EJA9031E

2. Connect a voltmeter between the wheel speed sensor terminals and measure the voltage by turning the wheel.

NOTE

Set the voltmeter to measure AC voltage.

Service standard : AC voltage detected.



EJA9031F

ABS OPERATION CHECK EJHA3550

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift the vehicle up and release the parking brake.
2. Disconnect the HECU harness connector and measure from the harness side connector.

CAUTION

Be sure to remove the connector double lock and insert the probe into the harness side. Inserting it into the terminal side will result in a bad connection.

3. Rotate the wheel to be measured at approximately 1/2–1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	1	19	5	22
	2	20	6	23

Output voltage

When measuring with an oscilloscope : 130 mV peak-to-peak or more