Brake System

GENERAL	BR - 2
BRAKE SYSTEM	
LSPV (LOAD SENSING PROPORTIONING VALVE)	
PARKING BRAKE SYSTEM	BR -28
ABS (ANTI-LOCK BRAKE SYSTEM)	BR -30
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GENERAL

SPECIFICATIONS EJUC0010

Item	Specification
Master cylinder	
Туре	Tandem type
I.D. mm (In.)	25.4 (1.0)
Fluid level sensor	Provided
Brake booster	
Туре	Vacuum type with tandem booster
Boosting ratio	7.0 : 1
Front brake	
Туре	Disc type
Disc O.D.	254.5 mm (10.02 in.):2WD, 276.5 mm (10.89 in.):4WD
Disc thickness	24 mm (0.945 in.)
Pad thickness	10 mm (0.394 in.)
Cylinder I.D.	42.9 mm (1.69 in.) (X2)
Rear brake	
Туре	Leading trailing drum
Effective dia.	270 mm (1.63 in.)
Cylinder I.D.	22.23 mm (0.88 in.)
Clearance adjustment	Automatic
Parking brake actuation	Mechanical brake acting

O.D. = Outer diameter

I.D. = Inner diameter

SERVICE STANDARD EJUC0020

T = 0	Service limit	Standard value
Brake pedal height		170 mm (6.69 in.)
Clearance between stop lamp switch outer case and pedal stopper		0.5-1.0 mm (0.020-0.039 in.)
Brake pedal free play		3-8 mm (0.12-0.3 in.)
Clearance between brake pedal and floor board		70 mm (2.73 in.)
Parking brake lever stroke (when lever assembly is pulled with 196N (20kg, 44lb) force		7-9 clicks
Front disc brake pad thickness	2.0 mm (0.079 in.)	10 mm (0.394 in.)
Front disc thickness (minimum)	24 mm (0.88 in.)	24 mm (0.945 in.)
Front disc runout	0.05 mm (0.0012 in.)	
Front disc thickness variation	0.005 mm (0.0002 in.)	n an
Rear drum I.D.	272 mm (10.71 in.)	270mm (10.630 in.)
Rear brake lining thickness	1.5 mm (0.059 in.)	4.7mm (0.185 in.)

TIGHTENING TORQUE EJUC0030

	Nm	Kg∙cm	lb·ft
Master cylinder to booster mounting nut	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	910288 611-13 -5%
Front bleeder screw	7-9	70-90	5-6.6
Brake flare nut, brake hose and a second second second	13-17 · · ·	130-170	9-12
Rear bleeder screw	7-13	70-130	5-9.4
Caliper guide rod bolt a free sale	22-32	220-320	16-24
Caliper assembly to knuckle	80-100	800-1000	58-73
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
Wheel speed sensor mounting bolt (Front/Rear)	8.2-9.7	82-97	5.7-6.8
Hydraulic & electronic control unit mounting bolt	8.5-10	85-100	6-7
Hydraulic & electronic control unit mounting bracket bolt	8.5-10	85-100	6-7
Six brake tubes on the Hydraulic Unit	13-17	130-170	9-12

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

LUBRICANTS EJHA0150

Items	Recommended lubricant	Quantity
Brake fluid	DOT3 or DOT4	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		Pushing back of the front disc and rear disc brake piston
	EJDA043A	

TROUBLESHOOTING

Trouble symptom	Probable cause	Remedy
Noise or vibration when brakes are applied	Caliper improperly mounted	Correct
	Loose caliper mounting bolts	Retighten
and the second se	Unevenly worn or cracked brake drum or brake disc	Replace
	Foreign material in brake drum	Clean
	Seized pad or lining contact surface	Replace
10	Excessive clearance between pad assem- bly and caliper	Correct
	Uneven pad contact	Correct
	Lack of lubrication in sliding parts	Lubricate
	Loose suspension parts	Retighten
	Excessive disc runout	Replace disc
Vehicle pulls to one side	Difference in left and right tire inflation pressure	Adjust
when brakes are applied	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

BR -4

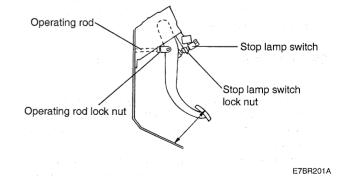
Trouble symptom	Probable cause	Remedy
Insufficient braking power	Low or deteriorated brake fluid	Refill or change
	Air in the brake system	Bleed the system
	Brake booster malfunction	Correct
	Inadequate contact of pad or lining	Correct
	Grease or oil on pad or lining surface	Replace
	Auto adjuster malfunction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

SERVICE ADJUSTMENT PROCEDURES EJUC0070

INSPECTION AND ADJUSTMENT

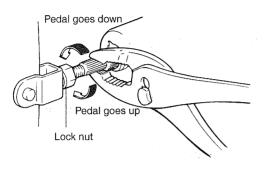
1. Measure the brake pedal height. If the height isn't within the standard value, adjust as follows.

Standard value :170 mm (6.69 in.)



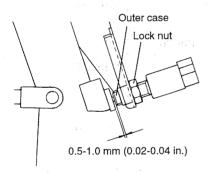
BRAKE SYSTEM

- Disconnect the stop lamp switch connector and loosen the stop lamp switch lock nut. Move it doesn't contact the brake pedal arm.
- Loosen the operating rod lock nut and adjust the brake pedal height by turning the operating rod with pliers until the connect brake pedal height is obtained.



H7BR202A

- 3) Turn the stop lamp switch until its tip just touches the tab on the brake pedal. Then turn it back 1/2 to 1 revolution and secure the lock nut.
- 4) Connect the stop lamp switch connector.
- 5) Check that the stop lamp doesn't illuminate when the brake pedal isn't depressed.



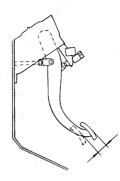
EJUC007A

2. With the engine stopped, depress the brake pedal two or three times to release the vacuum in the power brake booster. Then, press the pedal down by hand to verify that the amount of movement before any resistance (free play) is within specification.

Standard value :3-8 mm (0.12-0.32 in.)

If the free play is below the standard value, check that the clearance between the outer case of the stop lamp switch and the brake pedal is within the standard value.

If the free play is above the standard value, the clearance between the clevis pin and the brake pedal arm exceeds the standard value. If necessary, check and replace.



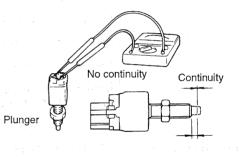
H7BR204A

 When the engine is started and the brake pedal is depressed with about of force, check for oil leak in the master cylinder, brake line and connections. If there is oil leak, repair.

STOP LAMP SWITCH INSPECTION

Connect a circuit tester to the stop lamp switch. When the switch plunger is pushed in, check that there is continuity.

If there is no continuity, the stop lamp switch is good.

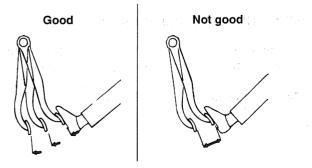


H7BR206A

BRAKE BOOSTER OPERATION TEST

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

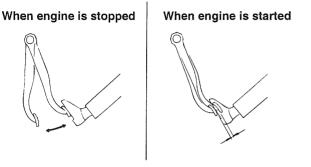
1. Run the engine for one or two minutes, and then shut it off. Depress the brake pedal several times at normal foot pressure. If there pedal goes down completely the first time, but rises gradually, the brake booster is functioning properly. If the height of the pedal doesn't change, the booster may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



EJA9002A

GENERAL

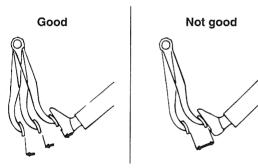
2. After checking that the height of the pedal changes when depressing the brake pedal several times with the engine stopped, start it keeping the brake pedal depressed. At this time, if it goes down slightly, the booster is good but if the height of it doesn't change, it is damaged.



EJA9002B

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.

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

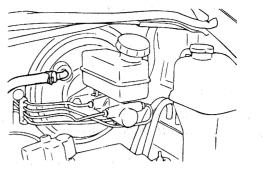
CHECK VALVE OPERATION CHECK

When checking the check valve, keep the check valve fit in the vacuum hose.

1. Remove the vacuum hose.



The check valve is press-fitted inside the vacuum hose at the position of the marking.

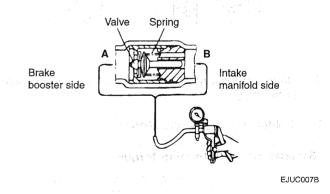


KJTB007H

2. Check the operation of the check valve by using a vacuum pump.

Vacuum pump connection	Accept/Reject criteria
Connection at the brake booster side (A)	A negative pressure (Vacuum) is created and held
Connection at the intake manifold side (B)	A negative pressure (Vacuum) is not created

If the check valve is defective, replace it if an assembly unit together with the vacuum hose.

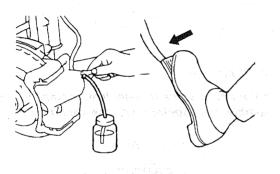


BLEEDING THE BRAKE SYSTEM EJUC0080

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

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

- 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.



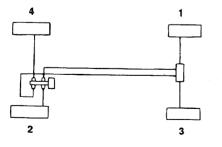
EAHA014B

- 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.

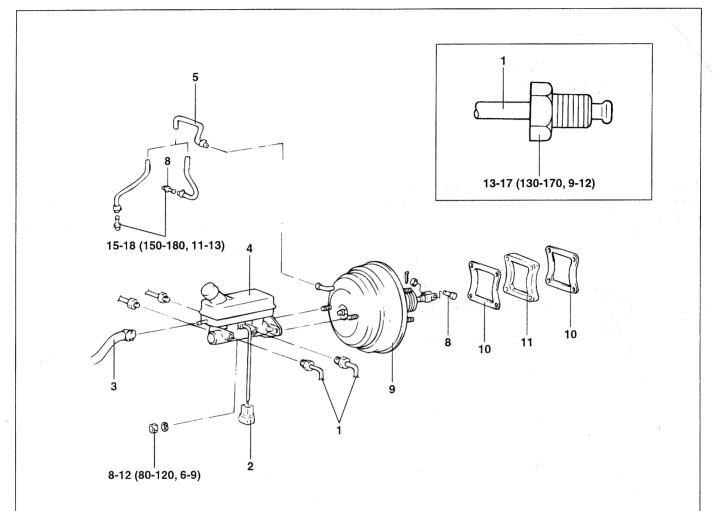


KJTB007J

BRAKE SYSTEM

BRAKE BOOSTER

COMPONENTS EJUC0110



Removal steps

- 1. Brake tube connection
- 2. Brake fluid level sensor connector
- 3. Clutch hose connection
- 4. Master cylinder assembly Adjustment of clearance between brake booster push rod and primary piston
- 5. Vacuum hose (With built-in check valve)

- 6. Split pin
 7. Washer
- 8. Clevis pin
- 9. Brake booster
- 10. Sealer
- 11. Spacer

- CATUION
- The check valve should not be removed from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.
- Don't disassemble the booster.

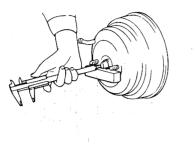
TORQUE : Nm (kg·cm, lb·ft)

EJUC011A

BOOSTER PUSH ROD EJUC0120

Adjust the clearance(A) the brake booster push rod.

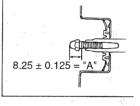
Standard value : 0.125-8.375 mm (0.005-0.33 in.)



H7BR233B

If the clearance is not within the standard value range, adjust by changing the push rod length by turning the screw of the push rod.

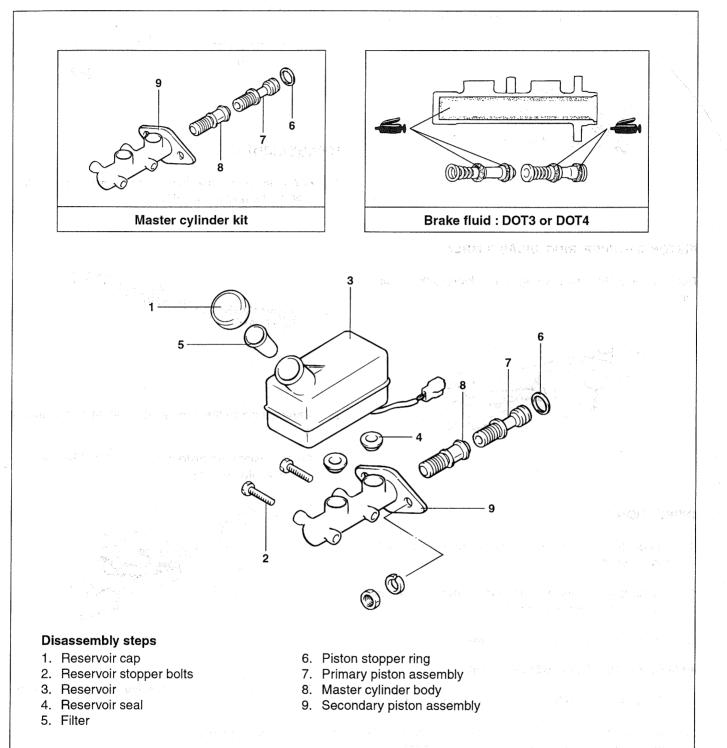




H7BR234A

MASTER CYLINDER

DISASSEMBLY AND REASSEMBLY EJUCO130



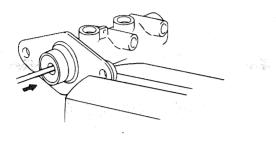
CAUTION Do not disassemble the primary and secondary piston assembly.

EJUC013A

DISASSEMBLY SERVICE POINTS EJUC0140

PISTON STOPPER PIN DISASSEMBLY

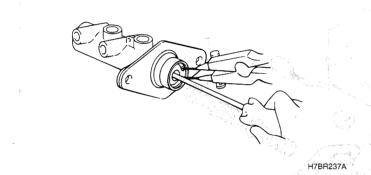
Remove the piston stopper pin, while depressing the piston.



H7BR236A

PISTON STOPPER RING DISASSEMBLY

Remove the piston stopper ring, while depressing the piston.

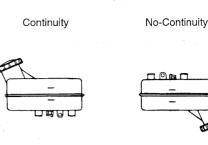


INSPECTION

- 1. Check the inner surface of master cylinder body for rust or pitting.
- 2. Check the primary and secondary pistons for rust, scoring wear, damage or wear.
- 3. Check the seal for damage and wear.

BRAKE FLUID LEVEL SENSOR CHECK

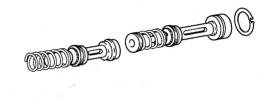
- 1. Connect circuit tester to brake fluid level sensor.
- 2. Sensor is in good condition if there is no circuit continuity when turning reservoir over and circuit continuity when returned to original position.



EJTB013A

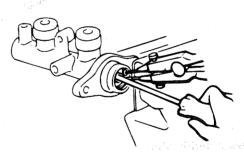
REASSEMBLY EJUC0150

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



KFW8016A

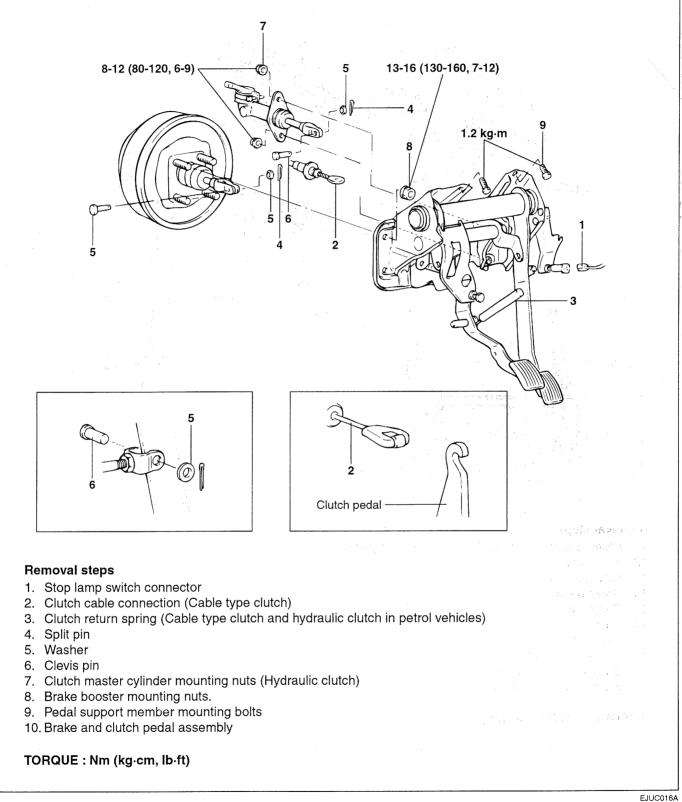
- 2. Carefully insert the springs and pistons in the proper direction.
- 3. Press against the pistons with a screwdriver and install the retainer ring.



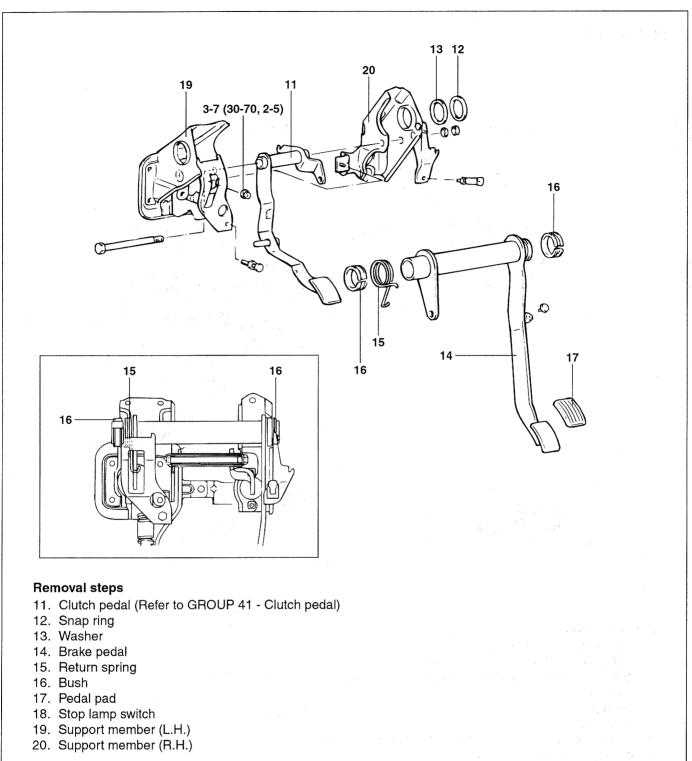
HE58-11

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

COMPONENTS EJUC0160





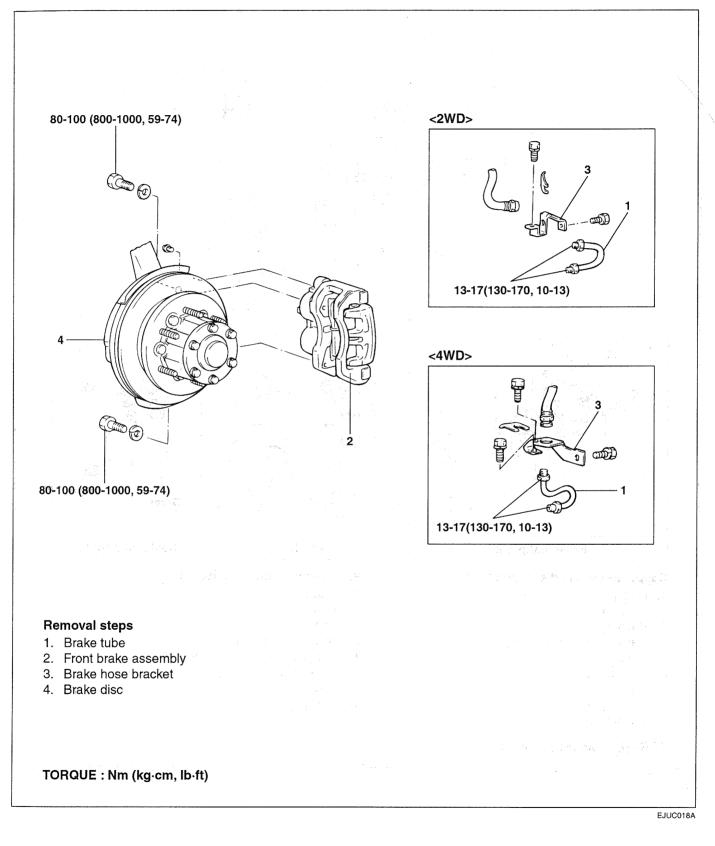


TORQUE : Nm (kg·cm, lb·ft)

EJUC017A

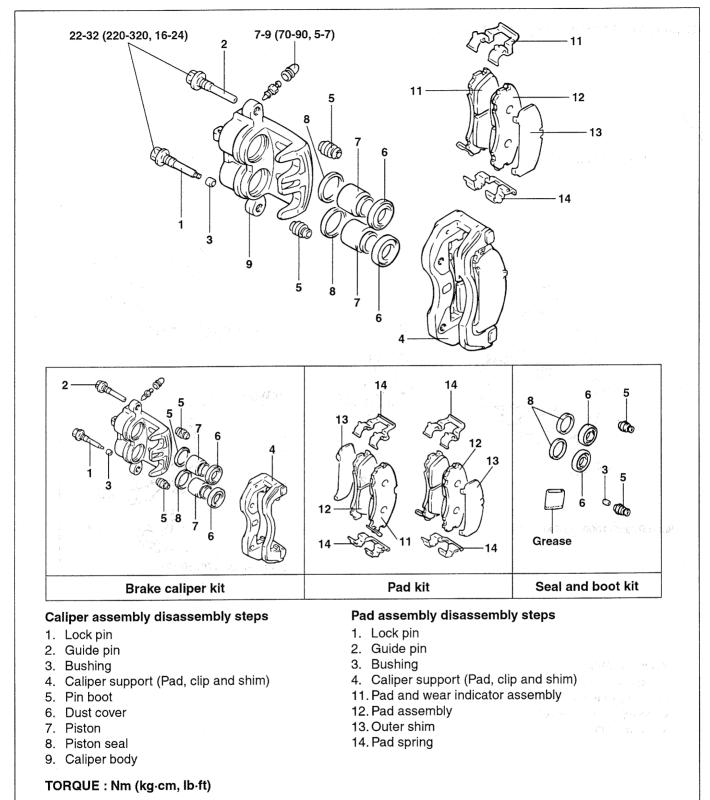
FRONT DISC BRAKE

REMOVAL AND INSTALLATION EJUC0180

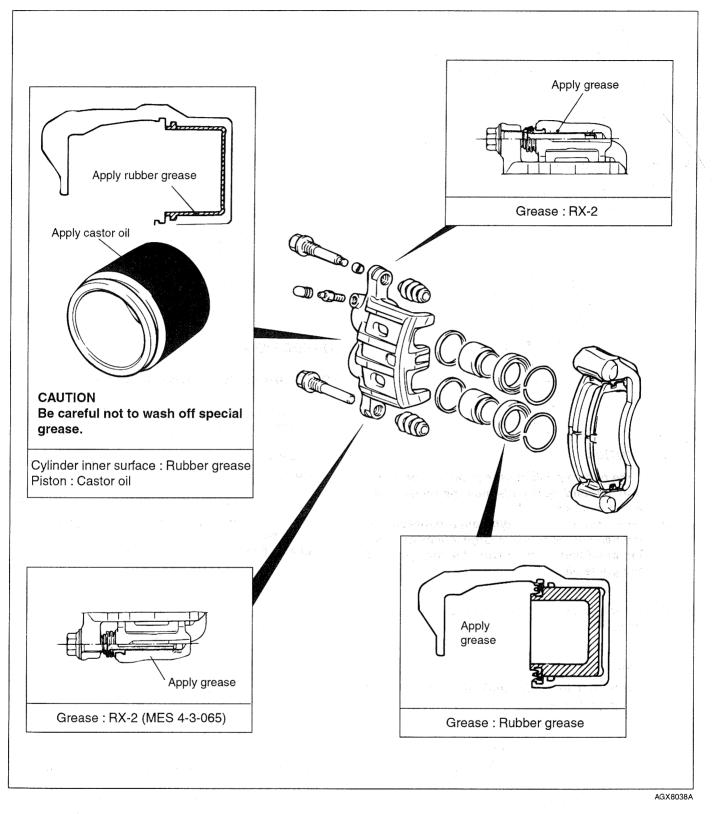


EJUC019A

DISASSEMBLY AND REASSEMBLY EJUC0190



DISASSEMBLY AND REASSEMBLY EJUC0200



INSPECTION AND REPLACEMENT EJUC0210

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The brake pads have wear indications that contact the brake disc when the brake pad thickness becomes 2mm, and emit a squealing sound to warn the driver.

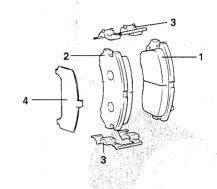
1. Check the brake pad thickness through the caliper body inspection hole.

Pad lining thickness mm (in.)

Standard value : 10mm (0.394 in.)

Service limit : 2.0 mm (0.079 in.)

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



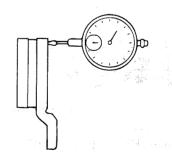
H7BR217A

INSPECTION EJUC0220

FRONT BRAKE DISC RUNOUT CHECK

- 1. Remove the caliper support, then raise the caliper assembly upward and suspend with a wire.
- 2. Check the surface of the disc for cracks and dust and clean it.
- 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: 0.06 mm (0.0024 in.) or less

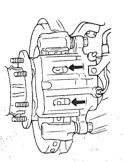
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H7BR221A

FRONT BRAKE DISC RUN OUT CORRECTION

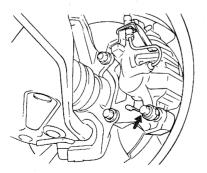
- 1. If the runout of the brake disc is equivalent to or exceeds the limit specification, replace the disc and hub, and then measure the runout again.
 - Before removing the brake disc, chalk both sides of the wheel stud on the side at which the runout is greatest.



- 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 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.

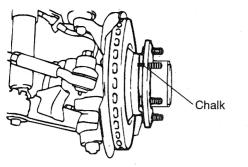
CAUTION

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



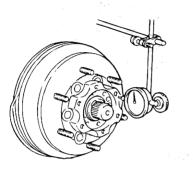
H7BR216A

H7882154



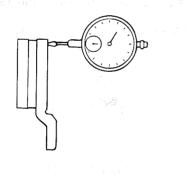
EJUC022A

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 runout.



KJTB021C

 If the 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.



H7BR221A

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

FRONT BRAKE DISC THICKNESS CHECK

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

Brake disc thickness

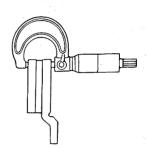
Standard value : 24 mm (0.945 in.)

Limit : 22.4 mm (0.882, in.)

Thickness variation (at least 8 positions)

The difference between any thickness measurements

Should not be more than 0.01 mm (0.0004 in.)



H7BR225A

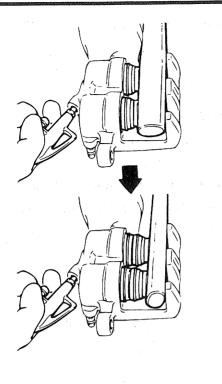
2. If the disc thickness is beyond the limit, replace with a new one.

DISASSEMBLY EJUC0230

Front disc brakes should be disassembled seperately. Don't 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 piston boot.

Remove the piston using a plastic hammer handle. Below 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.



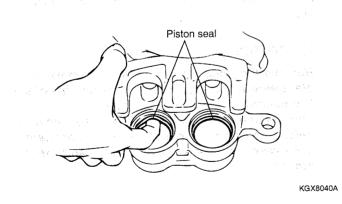
- 2. Remove the piston seal.
- 1) Remove the piston seal with your finger.

CAUTION

Don't use a screwdriver or another tool because it may damage the cylinder.

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

Brake fluid : DOT 3 or DOT 4



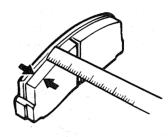
INSPECTION EJUC0240

- 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.

Pad thickness

Specification : 10.0 mm (0.39 in.) Service limit : 2.0 mm (0.08 in.)

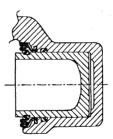


KGX8041A

REASSEMBLY EJJB0270

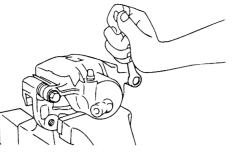
KGX8039A

- 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

5. Install the guide pin boots and guide pin.



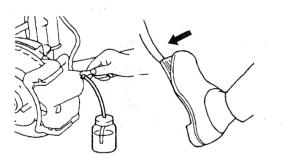
EJA9015J

INSTALLATION EJMB0280

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

Tightening torque Bleeder screw : 7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

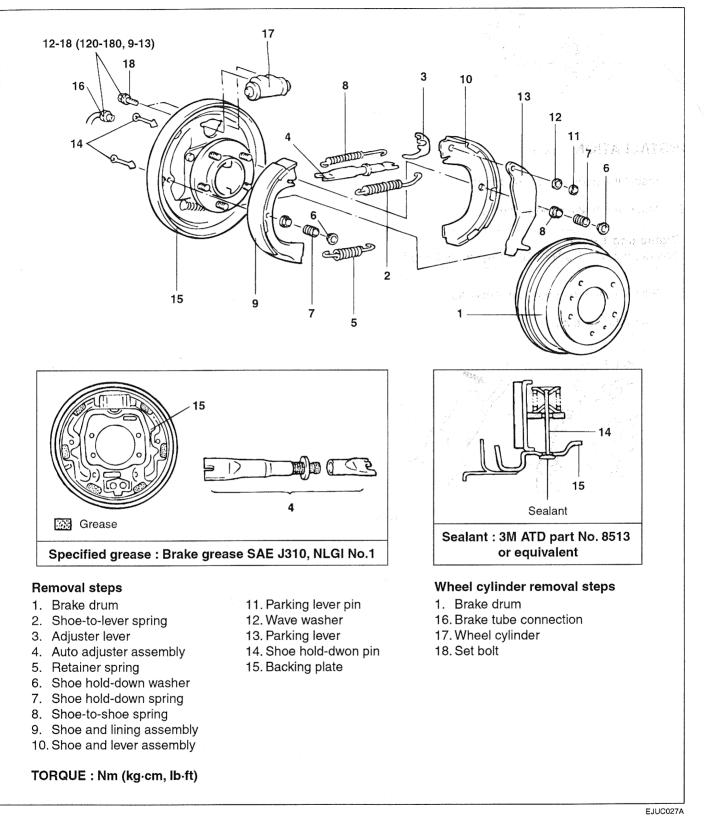
- 3. Fill the brake reservoir with brake fluid.
- 4. Bleed the system.



EAHA014B

REAR DRUM BRAKE

REMOVAL AND INSTALLATION EJUC0270



BRAKE SYSTEM

AHBR0720

INSPECTION EJUC0280

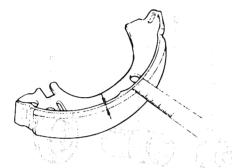
CHECKING THE BRAKE LINING FOR WEAR

Measure the thickness at the position where the brake lining is most worn.

Standard value : 4.7 mm (0.19 in.) Limit : 1.5 mm (0.06 in.)

If the lining is worn over the limit or severely, replace the shoe and lining assembly.

Remove the shoe and lining assembly as a complete set to prevent one-sided braking.

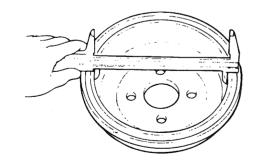


CHECKING THE BRAKE DRUM BORE

Measure the brake drum bore over two locations.

Standard value : 270 mm (10.63 in.) Limit : 272 mm (10.71 in.)

If the brake drum is worn over the limit or severely, replace the brake drum.



AHBR0710

AHBR0700

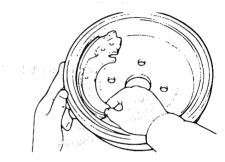
CHECKING CONTACT BETWEEN THE LINING AND BRAKE DRUM

Mark the inner surface of the brake drum with chalk and move the shoe and lining assembly along the brake drum to check for contact of them.

If the chalk is smeaed at the contact surface of them, the contact condition is good.

But if it isn't, replace the brake drum or shoe and lining assembly.

Wipe out the chalk after check.





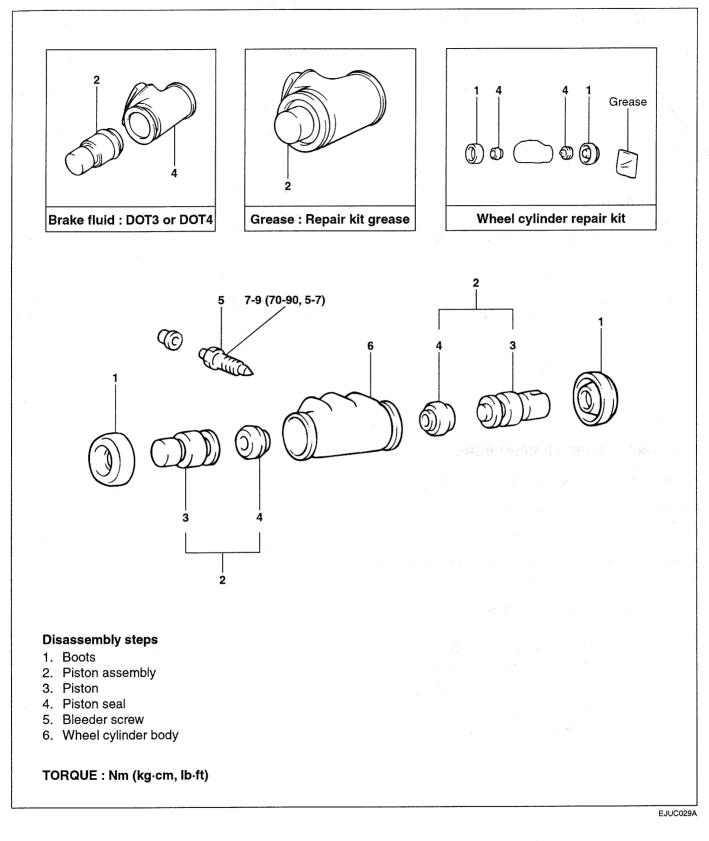
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DISASSEMBLY AND REASSEMBLY EJUC0290

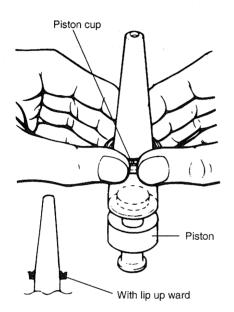


BRAKE SYSTEM

REASSEMBLY EJUC0300

PISTON CUP AND PISTON

- Clean piston with trichloroethylene, alcohol or specified brake fluid.
 Specified brake fluid : SAE J1703 (DOT 3 or DOT4)
- 2. Apply specified brake fluid on piston cup and outer surface of special tool.
- 3. Set specified tool on piston. Insert piston cup with lip upward in special tool.
- 4. Gently ease piston cup into piston groove.



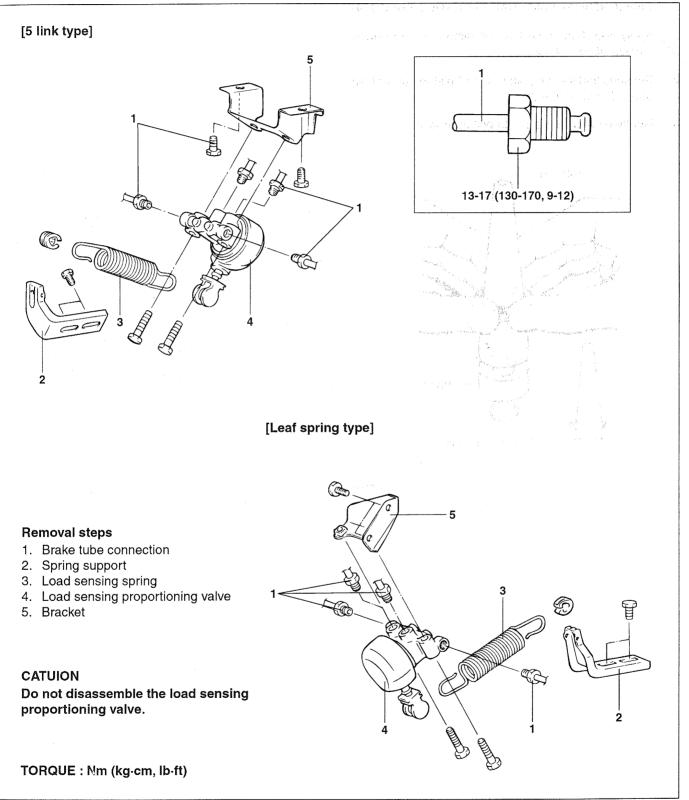
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AHBR0840

是一下,通过10日,小时建筑建筑

LSPV (LOAD SENSING PROPORTIONING VALVE)

COMPONENTS EJUC0090



EJUC009A

LOAD SENSING SPRING LENGTH CHECK

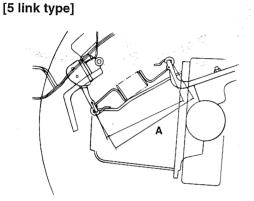
AND ADJUSTMENT EJUC0100

1. Park the vehicle on a level ground. The vehicle should be unloaded and supported only by wheels.

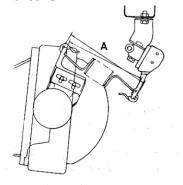
Never support the vehicle with jacks or other similar means.

2. With the lever pressed all the way to the load sensing proportioning valve side, check whether or not the length (shown in the figure) of the spring (the length between its ends) is the standard value.

Standard value (A) : 175 (+1, -0) mm (6.89 in.)



[Leaf spring type]



EJUC010A

3. If the spring length is not within the standard value, loosen the bolt attaching the support and adjust the distance by moving the support.

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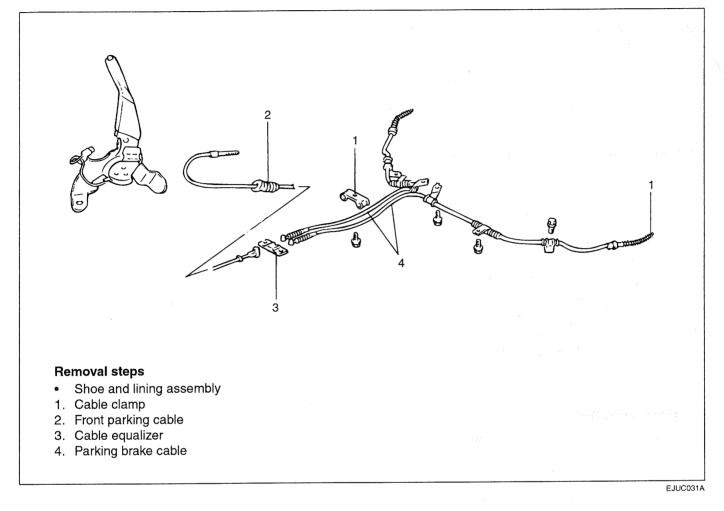
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PARKING BRAKE SYSTEM

PARKING BRAKE

COMPONENTS EJUC0310



SERVICE ADJUSTMENT PROCEDURES EJUC0320

PARKING BRAKE LEVER STROKE CHECK

1. Pull the parking brake lever with a force of approx. 196 N and count the number of notches.

The 196 N force of the parking brkae lever must be strictly observed.

Standard value : 7-9 notches

2. Lever Stroke Adjustment Tighten the adjusting nut as far as the end of the cable rod as shown in the illustration. Then release the parking brake cable to adjust the parking lever stroke by the following procedure.

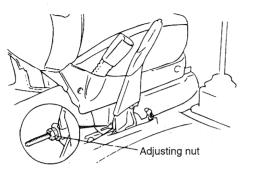
1) With the engine idling, forcefully depress the brake pedal five or six times and confirm that the pedal stoke stops changing.

🗊 ΝΟΤΕ

If the pedal stroke stops changing, the automatic adjustment mechanism is functioning normally, and the clearance between the shoe and drum is correct.

2) Turn the adjusting nut to adjust the parking brake lever stroke to within the standard value range.

If the number of brake lever notches engaged is less than the standard value, the cable has been pulled excessively. Be sure to adjust it to within the standard value.

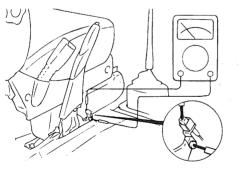


EJUC031B

- 3) After marking the adjustment, check to be sure that there is no play between the adjusting nut and the parking brake lever.
- 4) After adjusting the lever stroke, jack up the rear of the vehicle.
- 5) With the parking brake lever in the released position, turn the rear wheel to confirm that the rear brakes are not dragging.

PARKING BRAKE SWITCH CHECK

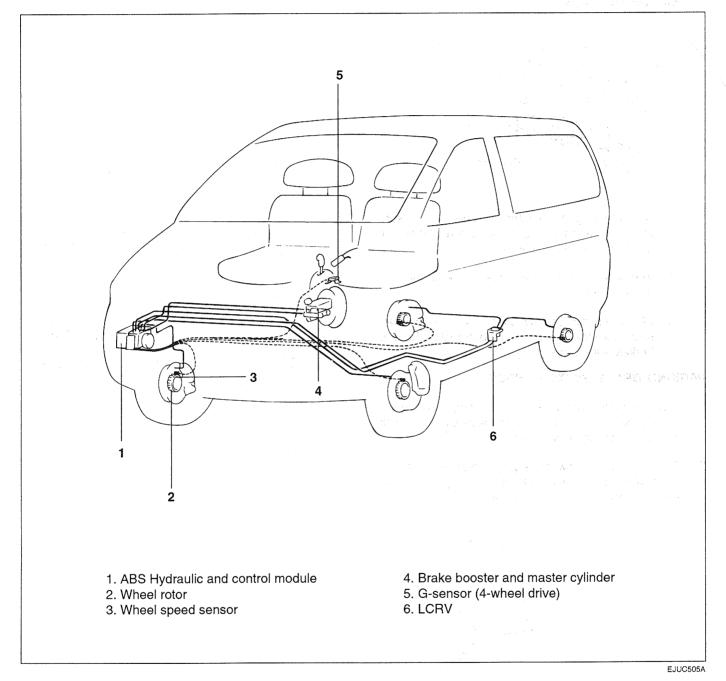
- 1. Disconnect the connector of the parking brake switch and connect an ohmmeter to the parking brake switch and the switch installation bolt.
- 2. The parking brake switch is good if there is continuity exists when the parking brake lever is pulled and there isn't continuity when it is returned.



H7BR253A

ABS (ANTI-LOCK BRAKE SYSTEM)

SYSTEM COMPONENT EJUC5050



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 :

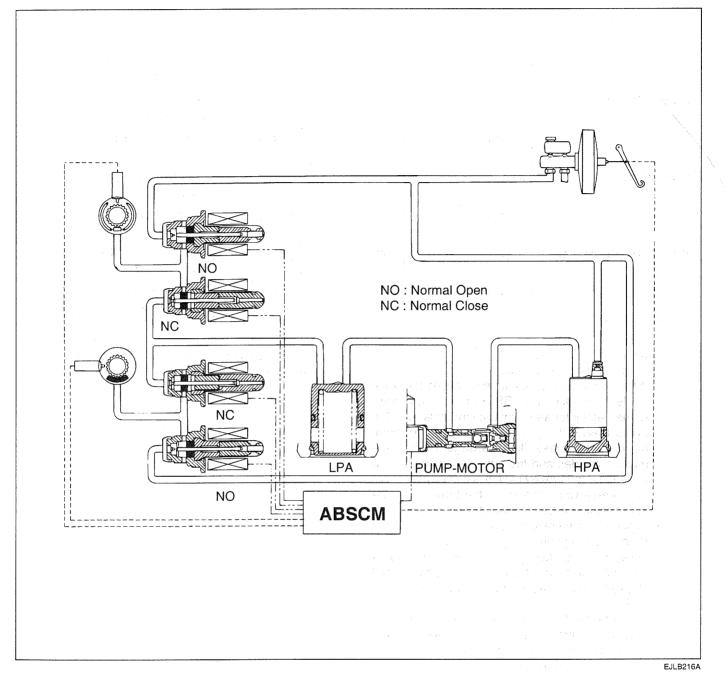
- 1. Enables steering around obstacles with a greater degree of certainty, even during emergency braking.
- 2. Enables stopping during emergency braking while keeping stability and steerability even on curves.

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

The hydraulic electronic control unit (HECU) recieves 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.

ABS OPERATION MODE EJLB2160



1. Non-ABS Range

The ABSCM controls the current flow of the inlet and outlet solenoid valves resulting the brake fluid passage open or close.

The inlet solenoid valve is normal open and the outlet solenoid valve is normal close.

In the range that the brake pedal is depressed and the ABS does not operate (the brake pressure increasing stage) the current to the each solenoid valve does not flows; i.e., the inlet solenoid valve is opened and the outlet solenoid valve is closed state by the force of spring.

ABS MODE	SOLENOID VALVE	CURRENT	STATE	PASSAGE
NORMAL BRAKE	INLET	OFF	OPEN	MASTER CYLINDER ⇔ WHEEL CYL.
	OUTLET	OFF	CLOSE	WHEEL CYLINDER ⇔ RESERVOIR
PRESSURE DECREAS- ING	INLET	ON	CLOSE	MASTER CYLINDER ⇔ WHEEL CYL.
	OUTLET	ON	OPEN	WHEEL CYLINDER ⇔ RESERVOIR
PRESSURE SUSTAIN	INLET	ON	CLOSE	MASTER CYLINDER ⇔ WHEEL CYL
	OUTLET	OFF	CLOSE	WHEEL CYLINDER ⇔ RESERVOIR
PRESSURE INCREASING	INLET	OFF	OPEN	MASTER CYLINDER ⇔ WHEEL CYL
	OUTLET	OFF	CLOSE	WHEEL CYLINDER ⇔ RESERVOIR

2. When the ABS operates

- Reducing the brake pressure
 - When the wheel speed sensor detects the tire's tendency to lock, the ABSCM flows the current to the each inlet and outlet solenoid valve. This mode makes the inlet solenoid valve to close blocking the brake fluid passage from brake master cylinder, and the outlet solenoid valve to open to let the brake fluid flows from wheel cylinder to reservoir. Therefore, the brake pressure in the system became reduced.
 - Sustaining the brake pressure When the brake pressure of wheel cylinder is reduced to the certain point, the ABSCM sends a signal of this mode to the solenoid valve so that the inlet valve to be ON and the outlet valve to be OFF.

It means that the hole passing the inlet and outlet solenoid are closed and the brake pressure within the wheel cylinder is sustained.

• Increasing the brake pressure

When the ABSCM determines that the vehicle has the tendency to speed up again and the wheel rotor (tone wheel) has no "lock" phenomenon then the inlet solenoid and outlet solenoid valve became OFF. And the brake pressure generated by the PUMP MOTOR reaches to the wheel cylinder passing through the inlet solenoid valve and it causes the pressure increasing.

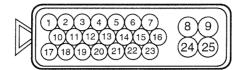
3. Fail-safe function

If a fail has occurred in the ABSCM turns to the failsafe mode and determines the trouble source and notifies it to the driver via ABS warning lamp or, if a scan tool (HI-SCAN) is available, displays it through the DTC connector. Also the DTC code can be read by the warning lamp flash pattern when the "L" terminal of DTC connector is grounded.

INSPECTION AT HECU TERMINALS EJUC5100

TERMINAL VOLTAGE CHART

[E50]



EJHA025A

Terminal No.	Description	Condition	Output
9	Battery power source 1 Solenoid valve power source	Always	System voltage
8	Ground	Always - In ABS control	
7	Diagnosis interface terminal	Data to the Hi-Scan	
6	Wheel speed sensor (Rear left)	· ·	Resistance
2	Wheel speed sensor (Front left)		R=1.1k $\Omega \pm 50\%$ V _{PP} (Peak to peak voltage)
19	Wheel speed sensor (Front right)		\leq 150mV/50Hz
22	Wheel speed sensor (Rear right)		
5	Wheel speed sensor (Rear left)		
1	Wheel speed sensor (Front left)		
20	Wheel speed sensor (Front right)		
23	Wheel speed sensor (Rear right)		
4	Power input via ignition 2 switch	Ignition 2 condition	Over voltage detection : between 16.5V and 20V System off : between 4.5V and 7.5V
25	Battery power source 2 Motor power source	Always	System voltage Max. current : below 100A (before 100msec.) Rated current : below 40A (after 100msec.)
24	Ground	Always - In ABS control (G07)	
16	ABS relay control	Energized ABS relay	Max. current : below 200mA Max. voltage : 40V
15	G-sensor ground	4WD only	Input voltage
13	G-sensor signal		: between 0.5V and 5.0V

BR -34

BRAKE SYSTEM

Terminal No.	Description	Condition	Output
14	Diagnosis interface terminal (L-line)		
18	Brake lamp switch input terminal		Input voltage detection V _{LOW} < 1.2V V _{High} > 4.0V

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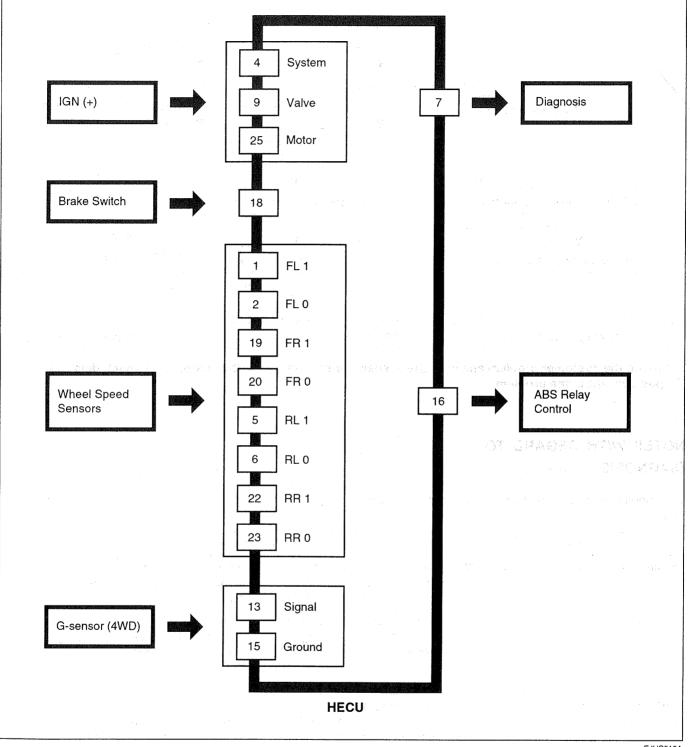
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DIAGRAM OF INPUT/OUTPUT FOR

HECU EJUC5150

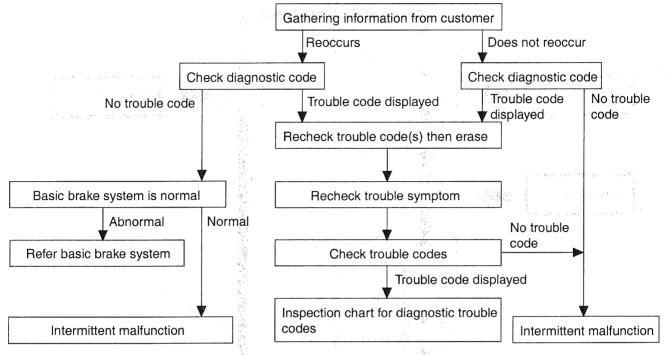


EJUC515A

EJDA015A

STANDARD FLOW OF DIAGNOSTIC

TROUBLESHOOTING EJHA2400



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

ALMAN,

NOTES WITH REGARD TO

DIAGNOSIS EJHA2450

The conditions listed in the following table are not abnormal.

conditions	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	 Sound of the motor inside the ABS hydraulic unit operation (whine). Sound is generated along with vibration of the brake pedal (scraping). 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.				

ABS (ANTI-LOCK BRAKE SYSTEM)

ABS CHECK SHEET EJHA2500

ABS Check Sheet

Inspector's Name

			Registration No.		
Customer's Name			Registration Year	1	1
			VIN.		
Date Vehicle Brought In	1	1	Odometer		Km Miles

Date the Problem First Occurred		1	1	
Frequency of Occurence of Problem	Continuous		 Intermittent (times a day)

	□ ABS does not o	operate.		
Symptoms	□ ABS does not operate efficiently.		□ Intermittent (times a day)
	ABS Warning Light Abnormal	Remains ON	Does not light up	81852879)

Diagnostic Trouble Code	1st Time	Normal Code	Malfunction Code (Code)
Check	2nd Time	Normal Code	Malfunction Code (Code)

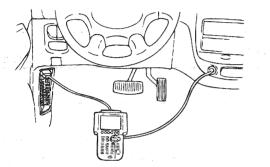
EJDA017A

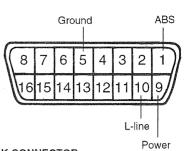
BR -38

BRAKE SYSTEM

HI-SCAN CHECK EJUC5200

- 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.





DATA LINK CONNECTOR

EJUC520A

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES EJUC5250

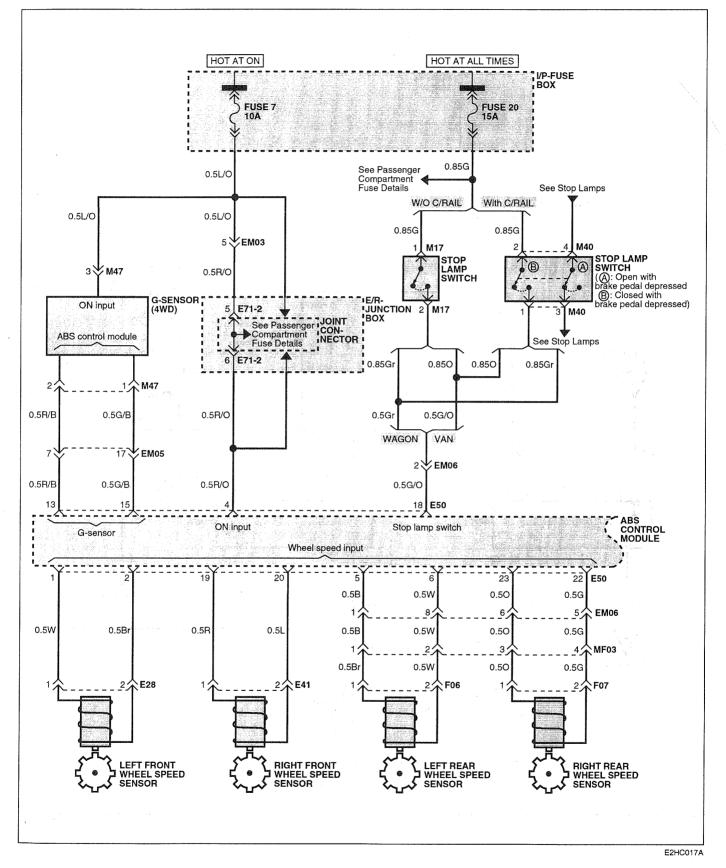
Inspect according to the inspection chart that is appropriate for the malfunction code.

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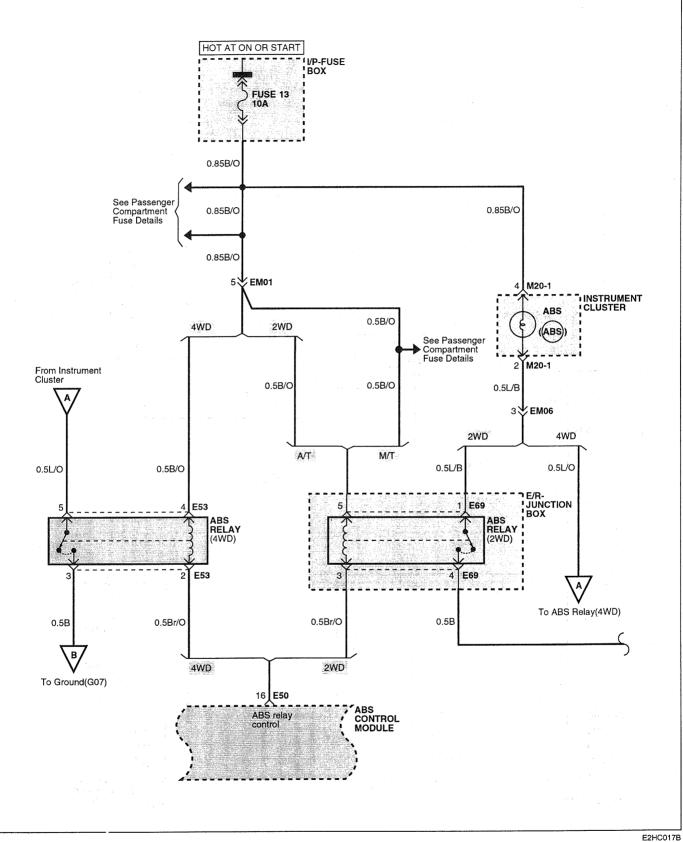
DTC on Hi-Scan	Description	
C1101	Too high battery voltage (over 16V)	
C1102	Too low battery voltage (below 8V)	
C1200	FL wheel sensor : open or short to ground	
C1201	-Range / Performance : exciter or speed jump error	
C1202	- No signal : air-gap error	
C1203	FR wheel sensor : open or short to ground	
C1204	- Range / Performance : exciter or speed jump error	
C1205	- No signal : air-gap error	
C1206	RL wheel sensor : open or short to ground	
C1207	- Range / Performance : exciter or speed jump error	
C1208	- No signal : air-gap error	
C1209	RR wheel sensor : open or short to ground	
C1210	- Range / Performance : exciter or speed jump error	
C1211	- No signal : air-gap error	
C1274	G-sensor signal is fail	
C1275	G-sensor range/performance : open or short to ground	
C1521	Mode select switch (2WD/4WD)	
C1604	Hardware (including valve failures)	
C2112	Valve relay (including fuse failure)	
C2402	Electrical (Pump-Motor)	

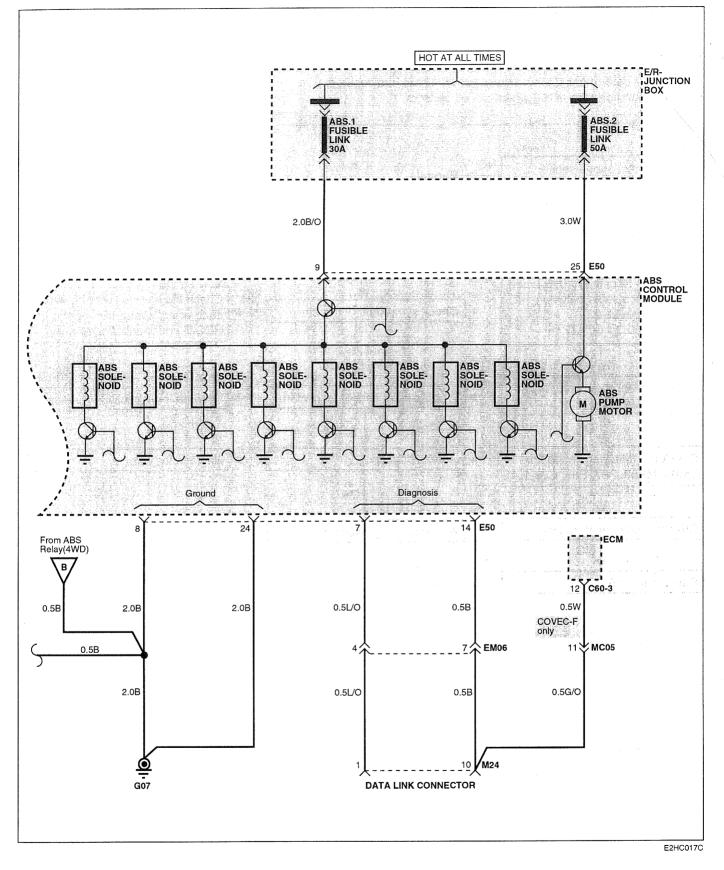
SCHEMATIC DIAGRAM EJUC5300

ABS CIRCUIT (1)



ABS CIRCUIT (2)

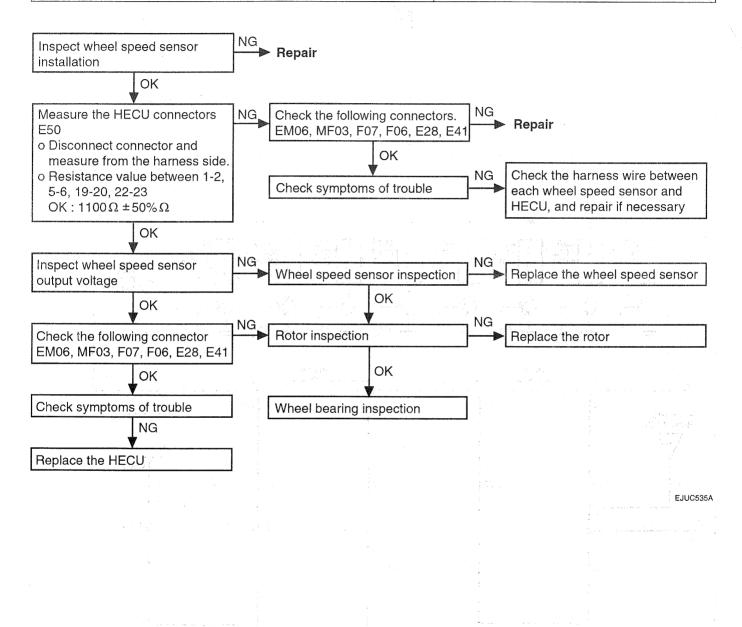




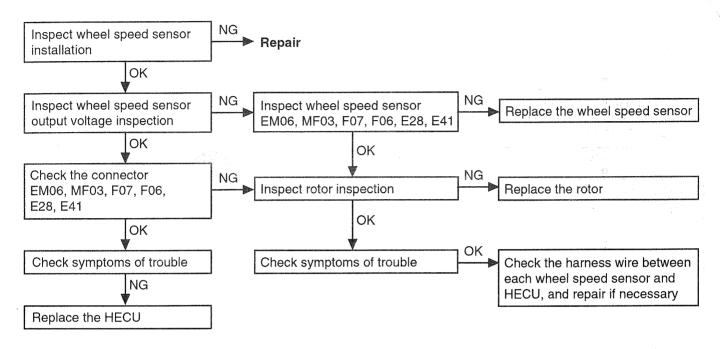
INSPECTION PROCEDURE FOR

DIAGNOSTIC TROUBLE CODES EJUC5350

DTC No. C1200, C1203, C1206, C1209 Wheel speed sensor open or short to ground circuit	Probable cause
The HECU determines that an open or short circuit has occured in more than one wire of the wheel speed sensors	 Malfunction of wheel speed sensor Malfunction of wiring harness or connector Malfunction of HECU



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).	 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

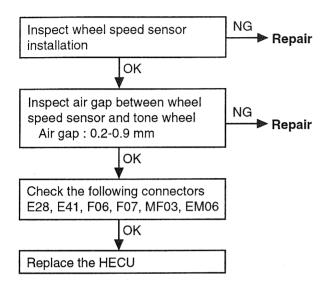


EJUC535B

BR -44

BRAKE SYSTEM

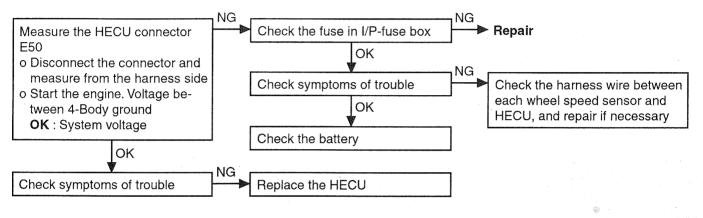
DTC No. C1202, C1205, C1208, C1211 (Large air gap)	Probable cause
A wheel speed sensor outputs no signal	 Malfunction of wheel speed sensor Improper installation of wheel speed sensor Malfunction of rotor (excitor) Malfunction of wiring harness or connector Malfunction of HECU



EJUC535C

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.	 Malfunction of wiring harness or connector Malfunction of HECU.

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.

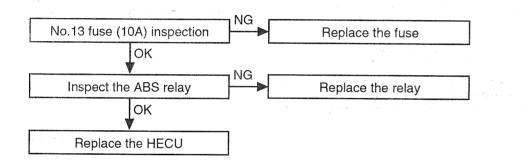


EJUC535D

BRAKE SYSTEM

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.	 Malfunction of wiring harness Malfunction of hydraulic unit Malfunction of HECU

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.	 Malfunction of wiring harness or connector Malfunction of HECU



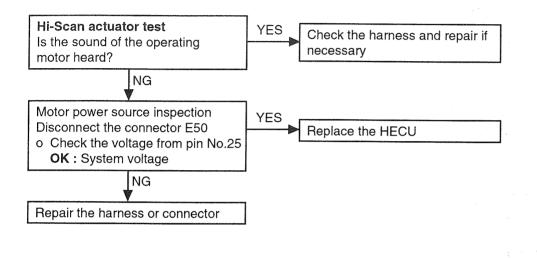
EJUC535E

ABS (ANTI-LOCK BRAKE SYSTEM)

DTC No. C2402 Valve relay (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.	 Malfunction of HECU Malfunction of wiring harness or connector 	

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.



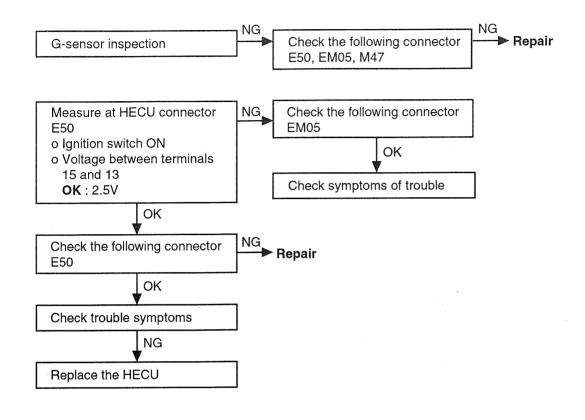
BR -47

EJUC535F

BR -48

BRAKE SYSTEM

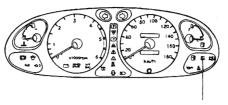
DTC No. C1274 G-sensor signal (Only 4WD)	Probable cause
This code is output at the following times : The output from G-sensor is between 0.5V and 5.0V. An open or short circuit is present in the G-sensor system.	 Malfunction of G-sensor Malfunction of wiring harness or connector Malfunction of HECU



EJUC535G

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 go out.



ABS warning lamp

EJUC540A

INSPECTION CHART FOR TROUBLE

SYMPTOMS EJHA3100

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

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

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

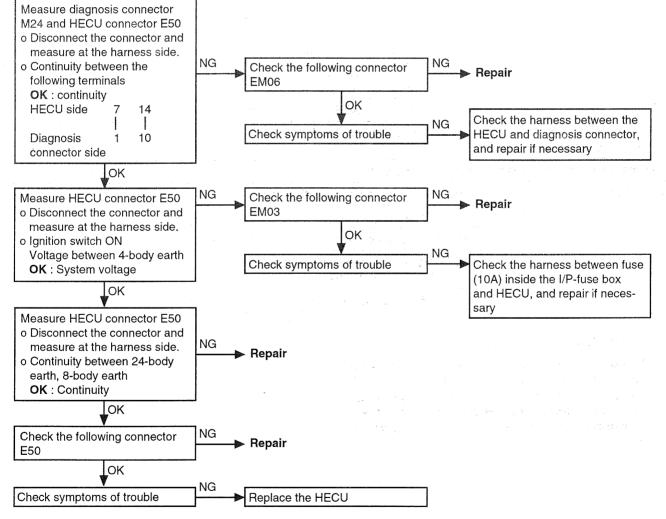
SYMPTOMS EJUC5450

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.	Malfunction of connectorMalfunction of wiring harness	

INSPECTION PROCEDURE 2

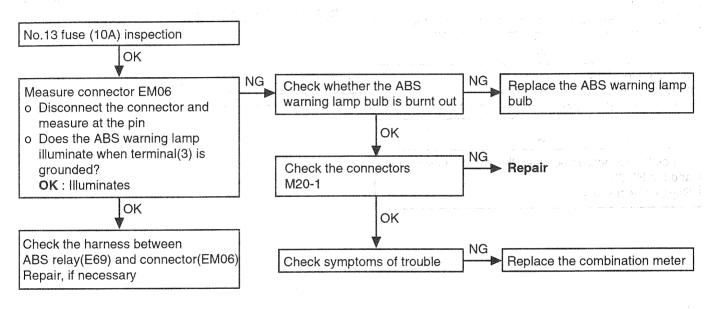
Communication with Hi-Scan is not possible. (Communication with ABS only is not possible.)	Probable cause	
When communication with Hi-Scan is not possible, the cause is probably an open circuit in the HECU power circuit or an open circuit in the diagnosis output circuit.	 Blown fuse Malfunction of wiring harness or connector Malfunction of HECU 	



EJUC545A

INSPECTION PROCEDURE 3

When the ignition key is turned "ON" (engine stopped), ABS warning lamp does not illuminate	Probable cause
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.	 Blown fuse Burnt out ABS warning lamp bulb Malfunction of wiring harness or connector
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.	

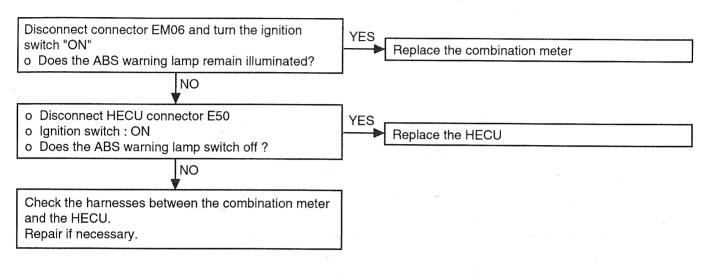


EJUC545B

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 warn- ing lamp illumination circuit	 Malfunction of combination meter Malfunction of HECU Malfunction of wiring harness 	

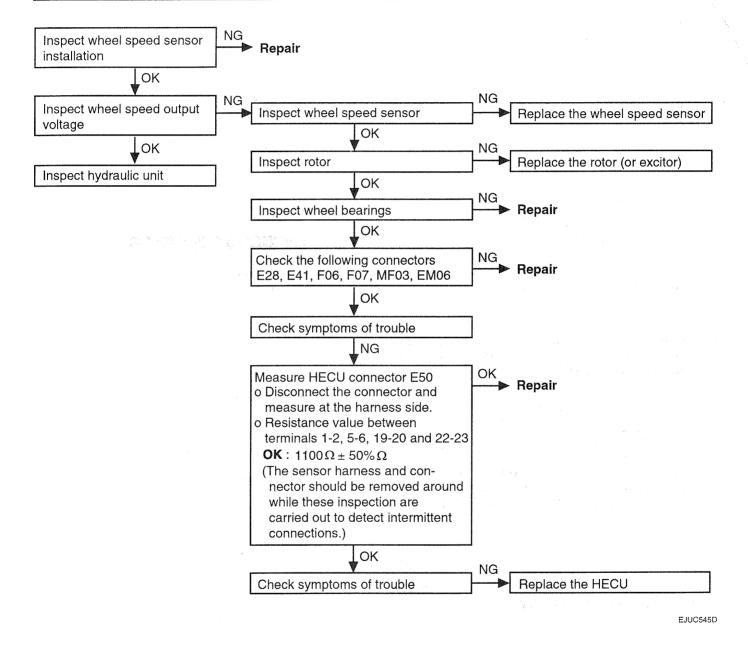
This trouble symptom is limited to cases where communication with the Hi-Scan is possible (HECU power supply is normal) and the diagnosis code is normal.



EJUC545C

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.	 Improper installation of wheel speed sensor Incorrect sensor harness contact Foreign material adhering to wheel speed sensor 	 Malfunction of wheel speed sensor Malfunction of rotor Malfunction of wheel bearing Malfunction of hydraulic unit Malfunction of HECU 	



BRAKE SYSTEM

BLEEDING OF BRAKE SYSTEM EJUC5500

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

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

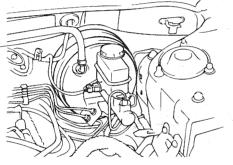
CAUTION

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

โป๊ NOTE

When pressure bleeding, do not depress the brake pedal.

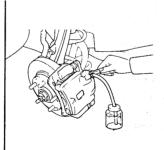
Recommended fluid DOT3 or DOT4



KFW8004A

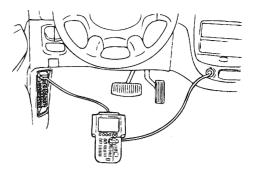
2. Connect a clear plastic tube to the wheel cylinder bleeder plug and insert the other end of the tube into a half filled clear plastic bottle.





KFW8006A

3. Connect the Hi-Scan (Pro) to the Data Link Connector located underneath the dash panel.



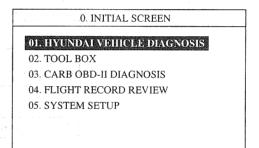
KJUC536A

4. Select and operate according to the instructions on the Hi-Scan (Pro) screen.

A CAUTION

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

1) Select hyundai vehicle diagnosis.



EJDA014C

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

1.6 AIR BLEEDING MODE ABS AIR BLEEDING STATUS

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

EJDA014F

BR -54

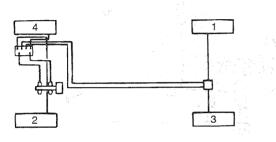
ABS (ANTI-LOCK BRAKE SYSTEM)

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

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

EJDA014G

- 5. Pump the brake pedal several times, and then loosen the bleeder screw until fluid starts to run out without bubbles. Then close the bleeder screw.
- 6. Repeat step 5 until there are no more bubbles in the fluid for each wheel.



KJUC536B

7. Tighten the bleeder screw.

Bleeder screw tightening torque :

7-9 Nm (70-90 kg·cm, 5-6.6 lb·ft)

10. **DA** ACE 80.



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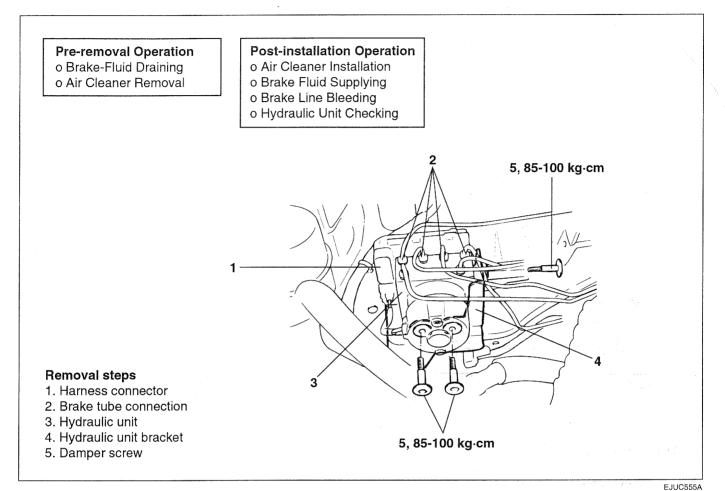
SAVEWSR



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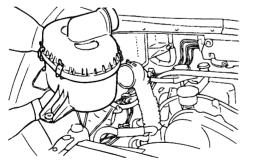
ANTI-LOCK BRAKING SYSTEM CONTROL MODULE

COMPONENTS EJUC5550



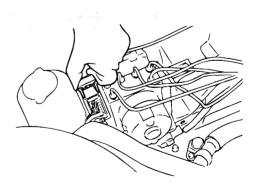
REMOVAL EJUC5600

1. Turn the ignition switch off and remove the air cleaner.



KJUC545A

2. Pull the HECU double lock connector upward.



KJUC545B

- 1. The hydraulic unit is heavy, and so care should taken when removing it.
- 2. The hydraulic unit is not to be disassembled; Its nuts and bolts should absolutely not be loosened.
- 3. The hydraulic unit must not be dropped or otherwise subjected to impact shocks.

4. The hydraulic unit must not be turned upside do or laid on its side.

HYDRAULIC MODULE INSPECTION EJUC5650

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 with specified jack-up points or replace the wheels which are checked on the rollers of the braking force tester.

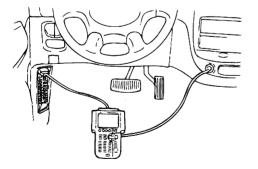
CAUTION

- 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.
- 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 as shown in the illustration.
- 4. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.

NOTE

When the ABS has been interrupted by the fail-safe function, the Hi-Scan actuator testing cannot be used.

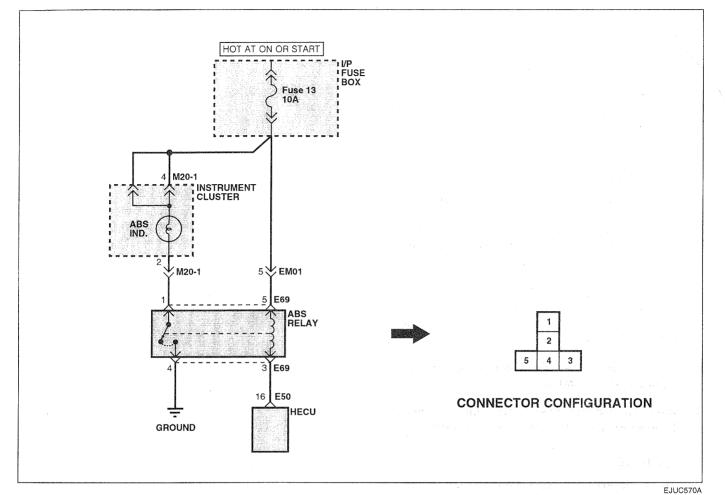
5. Use the Hi-Scan to force-drive the actuator.



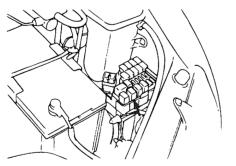
KJUC536A

ANTI-LOCK BRAKING SYSTEM RELAY

ABS RELAY INSPECTION EJUC5700

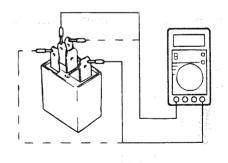


1. Turn the ignition switch OFF and disconnect the ABS relay from engine room relay box.



KJUC570B

2. Check for continuity between the terminals.



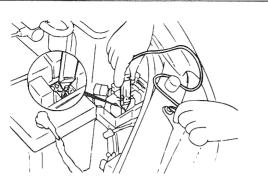
KJUC570C

Terminal	1	4	3	5
Battery voltage not supplied			0	-0
Battery voltage supplied	0	-0	Θ—	

EJUC570B

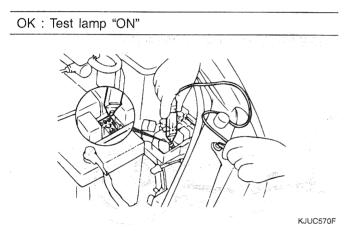
3. Insert a probe of test lamp to harness side connector terminal No.1 and ground the other probe.

OK : Test lamp "ON"



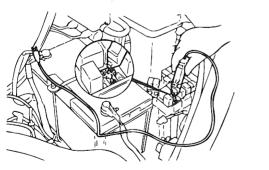
KJUC570E

4. Insert a probe of test lamp to harness side connector terminal No.5 and ground the other probe.



5. Apply the battery voltage to the terminal No.4

OK : Test lamp "ON"



KJUC570G

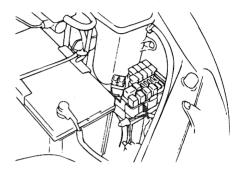
REMEDY FOR A FLAT BATTERY DISCHARGE

When booster cables are used to start the engine when the battery is completely discharged and then the vehicle is immediately driven without waiting for the battery to recharge itself to some extent, the engine may misfire, and driving might not be possible.

This happens because ABS consumes a great amount of current for its self-check function; the remedy is to either allow the battery to recharge sufficiently, or to remove the fusible link for ABS circuit, thus disabling the anti-skid brake system.

The ABS warning lamp will illuminate when the fusible link (for ABS) is removed.

After the battery has sufficiently charged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning lamp is not illuminated.



KJUC570B

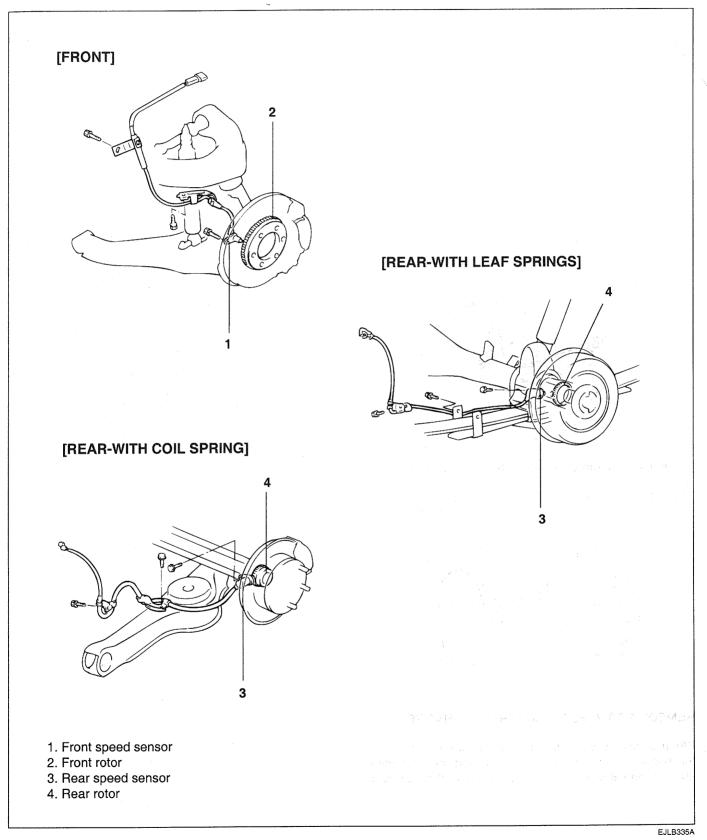




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ANTI-LOCK BRAKING SYSTEM WHEEL SPEED SENSOR

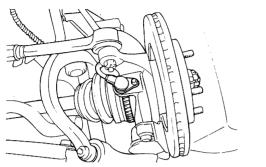
COMPONENTS EJLB3350



REMOVAL EJHA3400

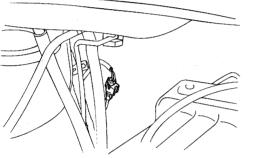
FRONT WHEEL SPEED SENSOR

1. Remove the front wheel speed sensor mounting bolt.



KFW8059A

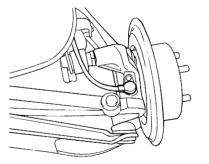
2. Remove the front wheel speed sensor after disconnecting the wheel speed sensor connector.



EJHA023B

REAR WHEEL SPEED SENSOR

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



KFW8060A

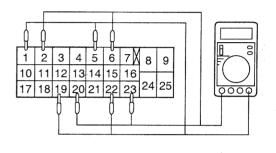
INSPECTION EJUC5750

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

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

A 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.



KGX8074A

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	. 1	19	5	22
No.	2	20	6	23

Output voltage

When measuring with an oscilloscope : $120mV_{P\mbox{-}P}$ or more

WHEEL SPEED SENSOR INSPECTION

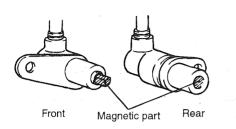
1. Check whether any metallic foreign material has adhered to the parts shown in the illustration at the speed sensor tip, and if so, remove it.

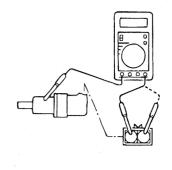
BRAKE SYSTEM

BR -62

NOTE

The section shown in the illustration can become magnetized because of the magnet built into the speed sensor, with the result that foreign metallic material easily adheres to it.





KJUC555C

Standard value : $100k\Omega$ or more

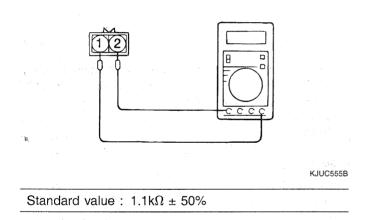
TOOTHED ROTOR

H7BR042A

Check whether rotor teeth are broken or deformed, and, if so, replace the rotor.

2. Measure the resistance between the speed sensor terminals.

If the internal resistance of the speed sensor is not within the standard value. Replace with a new speed sensor.



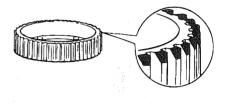
3. Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.



When checking for cable damage, remove the cable clamp part from the body and then bend and pull the cable near the clamp to check whether or not temporary disconnection occurs.

Check the connector connection and the terminal insertion.

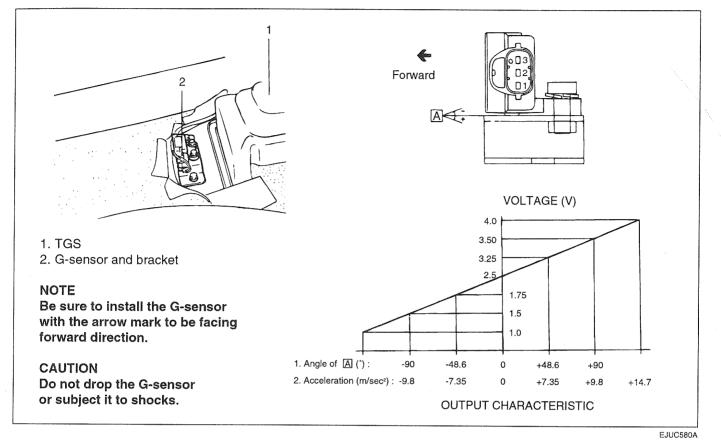
 Remove all connections from the speed sensor, and then measure the resistance between terminals(1) and (2) and the body of the speed sensor.



KJUC555D

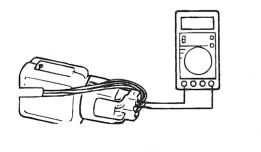
G-SENSOR

COMPONENTS EJUC5800



INSPECTION EJUC5850

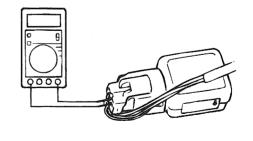
- 1. Insert the probes of voltmeter to the back of the harness side of G-sensor connector 2 and 3.
- 2. Turn the ignition switch to ON and check the output voltage of G-sensor.



KJUC565A

Standard value : 2.5V

3. Secure the G-sensor so that the arrow mark of the sensor mounting surface is facing straight down, and then check the output voltage between terminal 2 and 3.



KJUC565B

Standard value : 3.5V

4. In the case that the voltage is outside the standard value, and there is no abnormality in power supply and ground wires, replace the G-sensor.

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