

SERVICE BRAKES

CONTENTS

35109000487

BASIC BRAKE SYSTEM 35A

ANTI-SKID BRAKING SYSTEM (ABS) <4WD> 35B



BASIC BRAKE SYSTEM

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35109000494

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GENERAL INFORMATION

35100010304

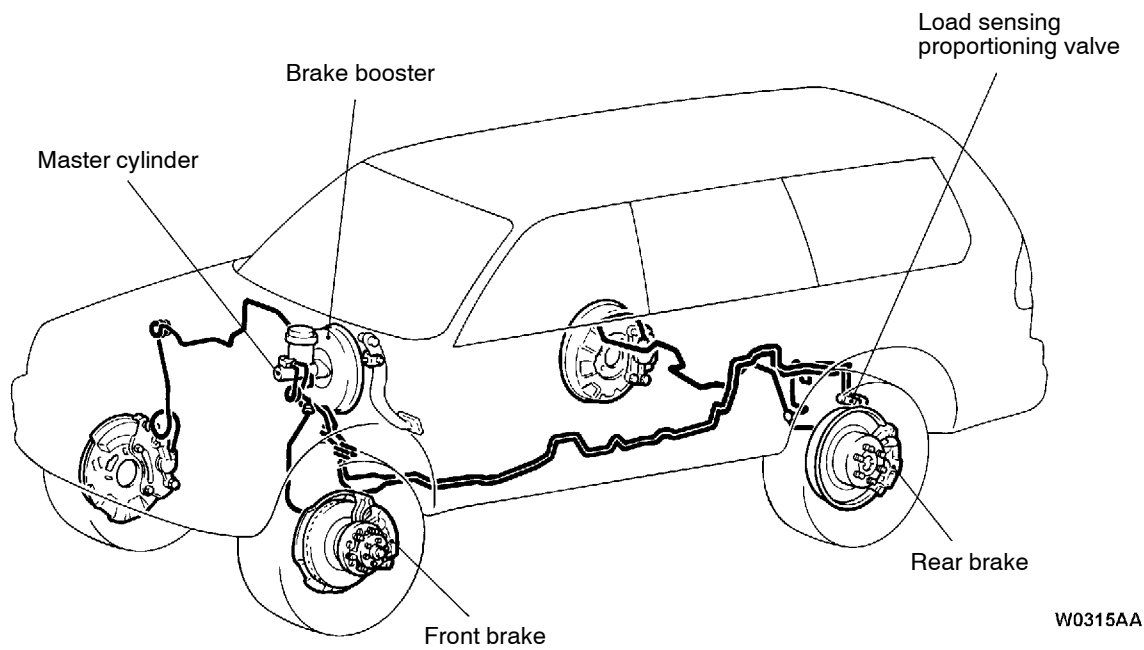
The brake system has high reliability and durability which maintains excellent braking performance and braking feeling. The main features are as follows.

- A dual type master cylinder is equipped in all models.
- A tandem type brake booster has been adopted.
- The following type of brake have been adopted.
 Front: Floating caliper, 2-piston, ventilated disc brakes (V5-W43, V6-W43)
 Rear: Floating caliper, 1-piston, solid disc brakes (S5-S43P)

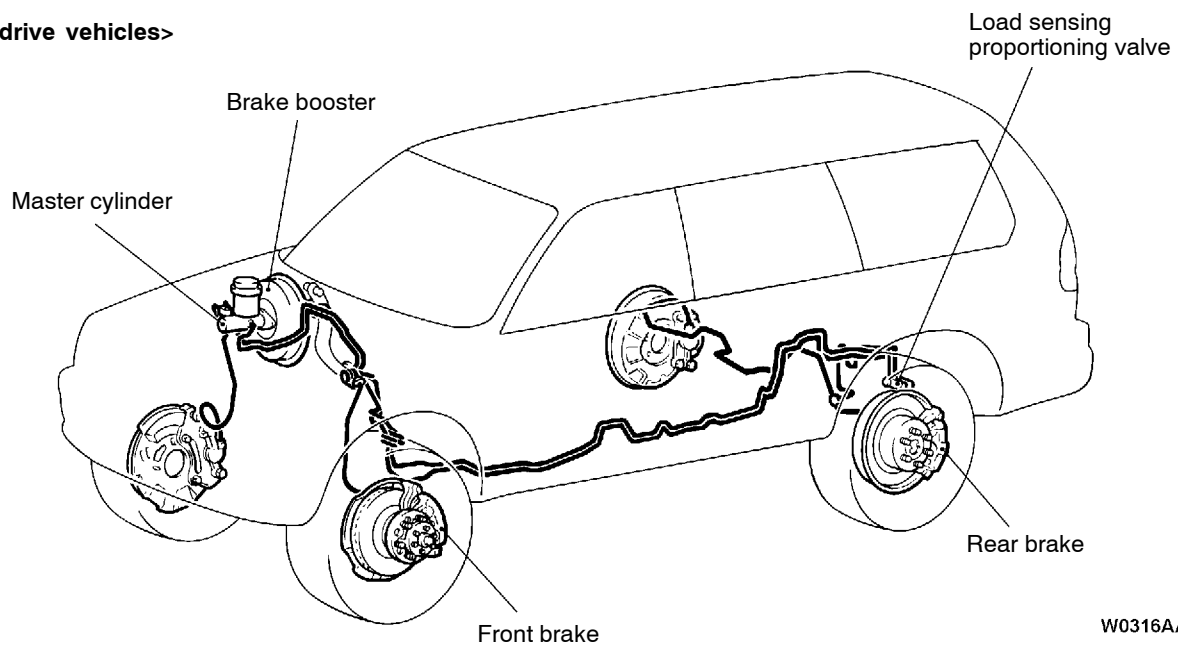
Items	6G7	4D5 <Vehicles without wide fender>	4D5 <Vehicles with wide fender>
Master cylinder I.D. mm	23.8		
Brake booster effective dia. of power cylinder mm	205 + 230	180 + 205	
Brake booster boosting ratio	5.0	6.0	5.0
Front brake disc effective dia. mm	265	227	265
Front brake wheel cylinder I.D. mm	42.86		
Rear brake disc effective dia. mm	272		
Rear brake wheel cylinder I.D. mm	42.85		

CONFIGURATION DIAGRAM

<L.H. drive vehicles>



<R.H. drive vehicles>



SERVICE SPECIFICATIONS

35100030386

Items		Standard value	Limit
Brake pedal height mm		176 – 181	–
Brake pedal free play mm		3 – 8	–
Brake pedal to floor board clearance mm		95 or more	–
Load sensing spring length mm		164 – 168	–
Load sensing proportioning valve output pressure kPa (Input pressure kPa)	When load sensing spring length is 144 mm (when unladen)	3,633 (5,884)	–
		5,610 (13,730)	–
	When load sensing spring length is 208 mm (when laden)	11,160 (13,730)	–
Disc brake pad thickness mm		10	2.0
Brake disc run-out mm	Front	–	0.06
	Rear	–	0.08
Front hub end play mm		0.05	–
Rear axle shaft end play mm		0 – 0.25	–
Brake disc thickness mm	Front	24	22.4
	Rear	18	16.4
Brake lining thickness mm		–	4.5
Brake drum inside diameter mm		197.0	198.0
Booster push rod to master cylinder piston clearance mm	Vehicle which brake booster of power cylinder is 180 mm and 205 mm in effective diameter	0.90 – 1.30	–
	Vehicle which brake booster of power cylinder is 205 mm and 230 mm in effective diameter	0.70 – 1.10	–
Disc brake drag force (tangential force of wheel mounting bolts) N	Front	106 or less	–
	Rear	56 or less	–

LUBRICANTS

35100040174

Items	Specified lubricant
Brake fluid	DOT3 or DOT4
Brake piston seal	Repair kit grease
Guide pin boot inner surface	
Lock pin boot inner surface	
Piston boot mounting grooves	
Sleeve inner surface	
Bushing inner surface	
Pin boot inner surface	

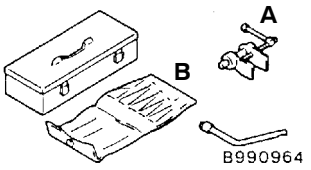
SEALANT

35100050214

Item	Specified sealant	Remark
Vacuum switch	3M ATD Part No.8661 or equivalent	Semi-drying sealant
Fitting		

SPECIAL TOOL

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Tool	Number	Name	Use
	MB990964 A: MB990520 B: MB990623	Brake tool set	Pushing-in of the disc brake piston Installation of drum brake wheel cylinder piston cup

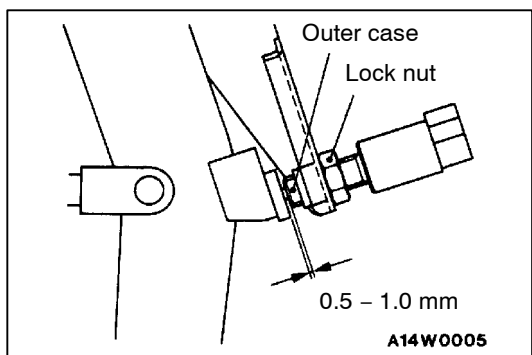
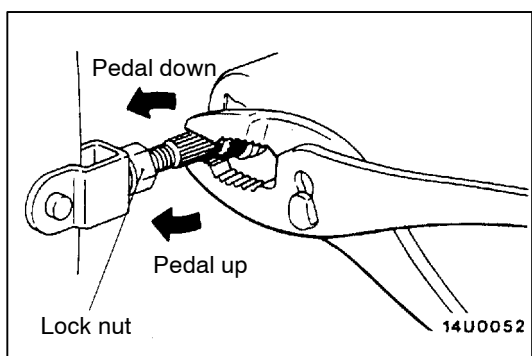
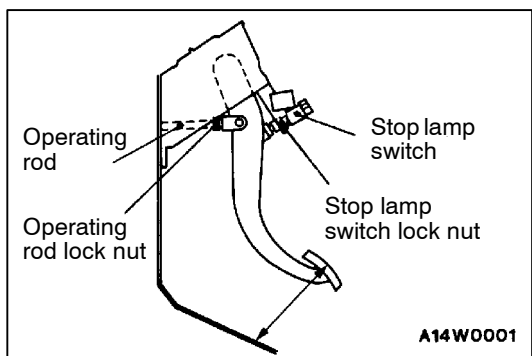
TROUBLESHOOTING

35100070128

Symptom	Probable cause	Remedy
Vehicle pulls to one side when brakes are applied	Grease or oil on pad or lining surface	Replace
	Inadequate contact of pad or lining	Correct
Insufficient braking power	Low or deteriorated brake fluid	Refill or change
	Air in brake system	Bleed air
	Overheated brake rotor due to dragging of pad or lining	Correct
	Inadequate contact of pad	
	Brake booster malfunction	
	Clogged brake line	
	Grease or oil on pad surface	Replace
	Load sensing proportioning valve malfunction	
Increased pedal stroke (Reduced pedal to floor board clearance)	Air in brake system	Bleed air
	Worn pad	Replace
	Broken vacuum hose	
	Faulty master cylinder	
	Brake fluid leaks	Correct
	Excessive push rod to master cylinder clearance	Adjust
Brake drag	Incomplete release of parking brake	Correct
	Clogged master cylinder return port	
	Incorrect parking brake adjustment	Adjust
	Improper push rod to master cylinder clearance	
	Faulty master cylinder piston return spring	Replace
	Worn brake pedal return spring	
	Lack of lubrication in sliding parts	Lubricate

Symptom	Probable cause	Remedy
Insufficient parking brake function	Worn brake lining or pad	Replace
	Grease or oil on lining or pad surface	
	Parking brake cable sticking	
	Stuck wheel cylinder or caliper piston	
	Excessive parking brake lever stroke	Adjust the parking brake lever stroke or check the parking brake cable routing
	Auto adjuster malfunction	Adjust
Scraping or grinding noise when brakes are applied	Worn brake pad	Replace
	Caliper to wheel interference	Correct or replace
	Dust cover to disc interference	
	Bent brake backing plate	
	Cracked brake disc	
Squealing, groaning or chattering noise when brakes are applied	Missing or damaged brake pad anti-squeak shim	Replace
	Brake discs and pads worn or scored	Correct or replace
	Burred or rusted calipers	Correct or deburr
	Dirty, greased, contaminated or glazed pad	Clean or replace
	Incorrect brake pedal or booster push rod	Adjust
Squealing noise when brakes are not applied	Bent or warped backing plate causing interference with drum	Replace
	Poor return of brake booster, master cylinder	
	Loose or extra parts in brakes	Retighten
	Improper positioning of pads in caliper	Correct
	Improper installation of support mounting to caliper body	
	Worn, damaged or insufficiently lubricated wheel bearings	Lubricate or replace
	Incorrect brake pedal or booster push rod	Adjust

Symptom	Probable cause	Remedy
Groaning, clicking or rattling noise when brakes are not applied	Loose wheel nuts	Retighten
	Loose installation bolts	
	Worn, damaged or dry wheel bearings	Lubricate or replace
	Failure of shim	Replace
	Wear on sleeve	
	Incorrect brake pedal or booster push rod	Adjust



ON-VEHICLE SERVICE

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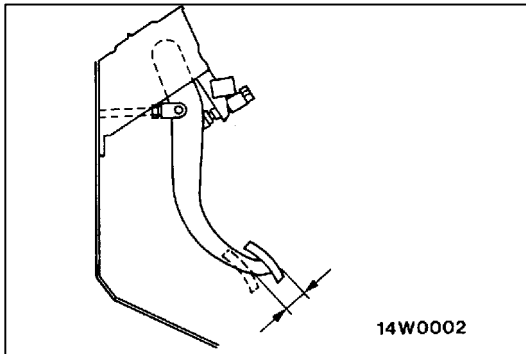
BRAKE PEDAL CHECK AND ADJUSTMENT

BRAKE PEDAL HEIGHT

1. Turn back the carpet etc. under the brake pedal.
2. Measure the brake pedal height as illustrated. If it is not within the standard value, adjust as follows.

Standard value: 176 – 181 mm (From the surface of melting seat to the face of pedal pad)

- (1) Disconnect the stop lamp switch connector, loosen the lock nut, and move the stop lamp switch to a position where it does not contact the brake pedal arm.
 - (2) Adjust the brake pedal height by turning the operating rod with pliers (with the operating rod lock nut loosened).
 - (3) Screw in the stop lamp switch until it contacts the brake pedal stopper (just before brake pedal is caused to move), return the stop lamp switch 1/2 to 1 turn and secure with the lock nut.
 - (4) Connect the connector of the stop lamp switch.
 - (5) Check to be sure that the stop lamp is not illuminated with the brake pedal released.
3. Return the carpet etc.



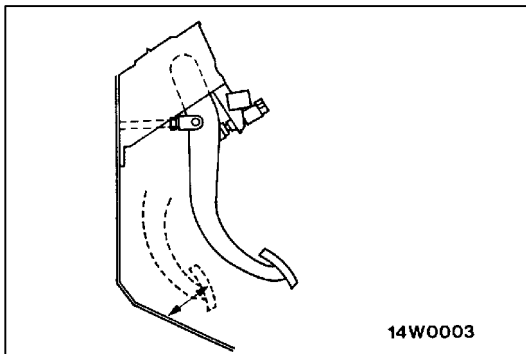
BRAKE PEDAL FREE PLAY

With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (free play) is within the standard value range.

Standard value: 3 – 8 mm

If the free play exceeds the standard value, it is probably due to excessive play between the clevis pin and brake pedal arm.

Check for excessive clearance and replace faulty parts as required.



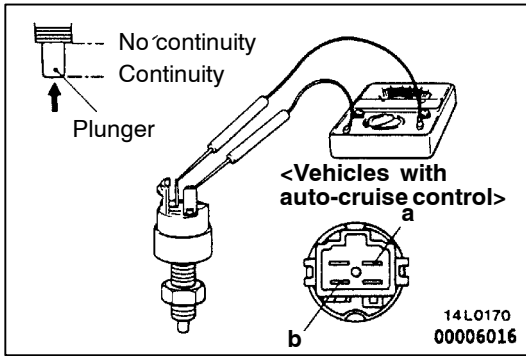
CREARANCE BETWEEN BRAKE PEDAL AND FLOOR BOARD

1. Turn back the carpet etc. under the brake pedal.
2. Start the engine, depress the brake pedal with approximately 490 N of force, and measure the clearance between the brake pedal and the floorboard.

Standard value:

95 mm or more (From the surface of melting seat to the face of pedal pad)

3. If the clearance is outside the standard value, check for air trapped in the brake line, clearance between the lining and the drum and dragging in the parking brake. Adjust and replace defective parts as required.
4. Return the carpet etc.



STOP LAMP SWITCH CHECK

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Connect a circuit tester to the stop lamp switch, and check whether or not there is continuity when the plunger of the stop lamp switch is pushed in and when it is released. The stop lamp switch is in good condition if there is no continuity when the plunger is pushed in to a depth of within 4 mm from the outer case edge surface, and if there is continuity when it is released.

For vehicles with auto-cruise control system, check the continuity between the terminals “a” and “b” of the stop lamp switch.

BRAKE BOOSTER OPERATING TEST

35100100162

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

1. Run the engine for one or two minutes, and then stop it.

If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.

2. With the engine stopped, step on the brake pedal several times.

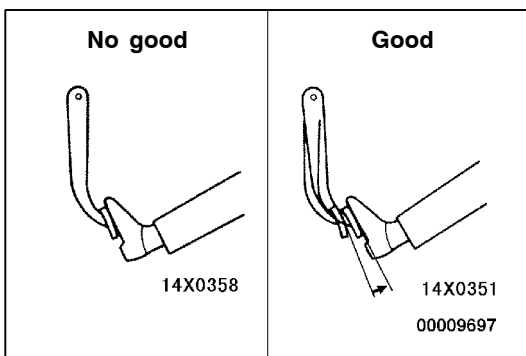
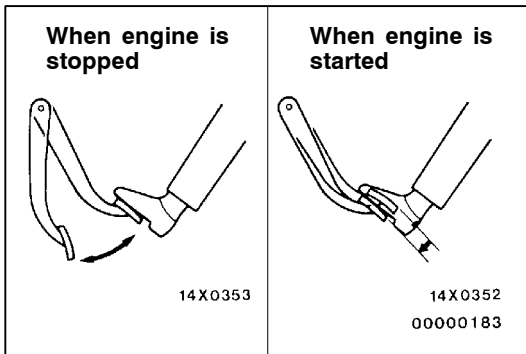
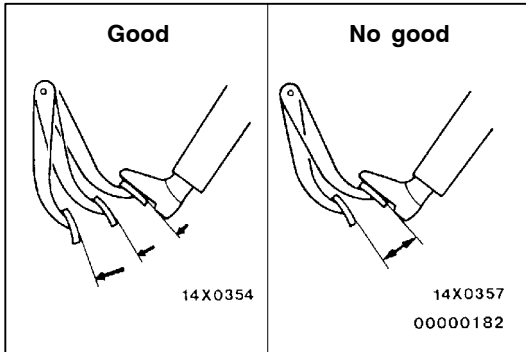
Then step on the brake pedal and start the engine. If the pedal moves downward slightly, the booster is in good condition. If there is no change, the booster is defective.

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

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

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

If one of the above three tests is not okay at last, the check valve, vacuum hose, or booster will be defective.



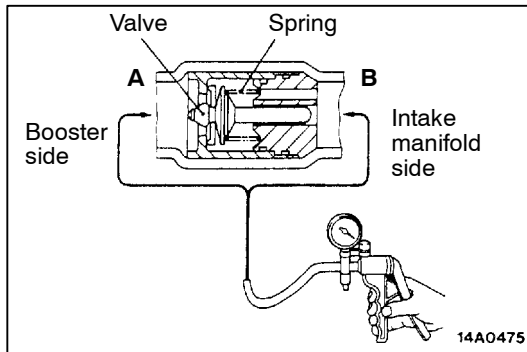
CHECK VALVE OPERATION CHECK

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1. Remove the vacuum hose. (Refer to P.35A-23.)

Caution

The check valve should not be removed from the vacuum hose.



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.

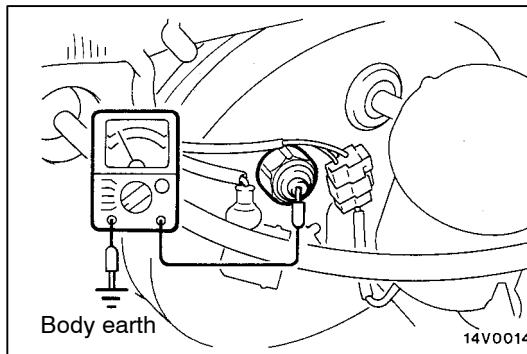
Caution

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

BRAKE BOOSTER VACUUM SWITCH CHECK**<4D5>**

35100920041

1. Connect an ohmmeter to the connector of the vacuum switch.
2. Start the engine and check for continuity when the vacuum hose is connected, and when it is disconnected. The vacuum switch is in good condition if there is no continuity when the vacuum hose is connected, and if there is continuity when it is disconnected.



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BLEEDING

Caution

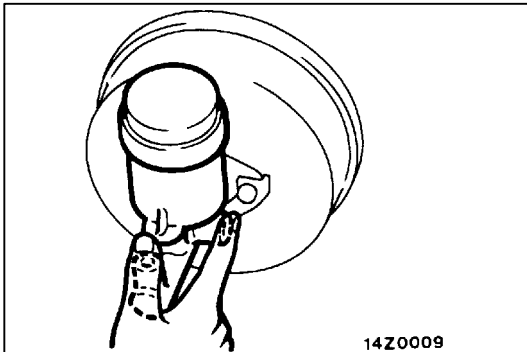
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

Specified brake fluid: DOT3 or DOT4

MASTER CYLINDER BLEEDING

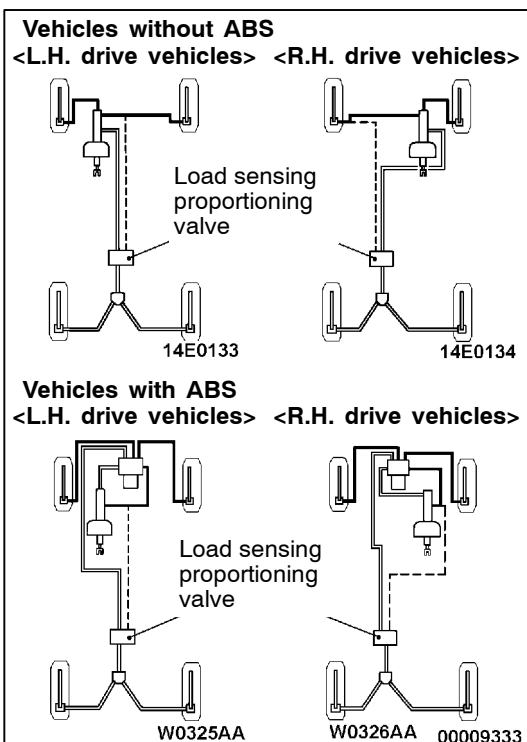
The master cylinder used has no check valve, so if bleeding is carried out by the following procedure, bleeding of air from the brake pipeline will become easier. (When brake fluid is not contained in the master cylinder.)

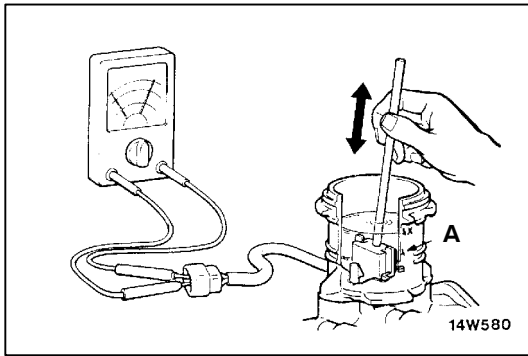
1. Fill the reserve tank with brake fluid.
2. Keep the brake pedal depressed.
3. Have another person cover the master cylinder outlet with a finger.
4. With the outlet still closed, release the brake pedal.
5. Repeat steps 2 – 4 three or four times to fill the inside of the master cylinder with brake fluid.



BRAKE PIPE LINE BLEEDING

Start the engine and bleed the air in the sequence shown in the figure.





BRAKE FLUID LEVEL SENSOR CHECK

35100910086

The brake fluid level sensor is in good condition if there is no continuity when the float surface is above “A” and if there is continuity when the float surface is below “A”.

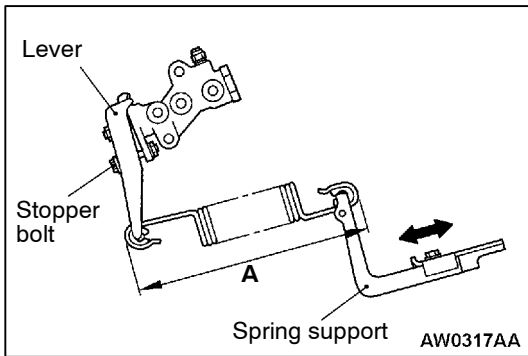
LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT

35100120045

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

Caution

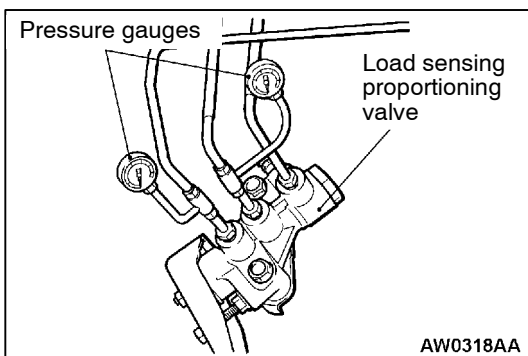
Never support the vehicle with jacks or other similar means.



2. While the lever of the load sensing proportioning valve is touching the stopper bolt, install the spring support so that the distance (A) is at the standard value.

Standard value (A): 164 – 168 mm

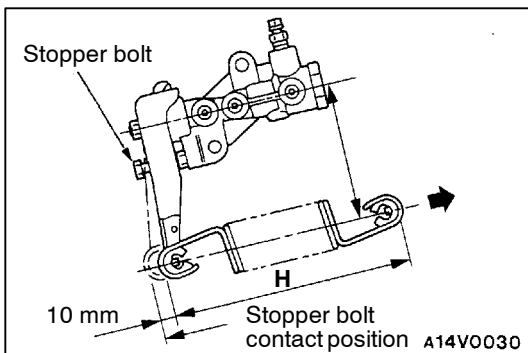
3. If the spring length is not within the standard value, loosen the bolt attaching the spring support and adjust the distance by moving the spring support.



LOAD SENSING PROPORTIONING VALVE FUNCTION TEST

35100130055

1. Connect pressure gauges to the input and output ports of the load sensing proportioning valve.
2. Bleed the system. (Refer to P.35-13.)



3. Disconnect the spring at the support side.
4. Place the spring so that it is in parallel with the load sensing proportioning valve, and pull in the direction indicated by the arrow so that its length H shown in the figure (the length between its ends) is as noted below.

NOTE

At this time the lever is pressed all the way to the load sensing proportioning valve.

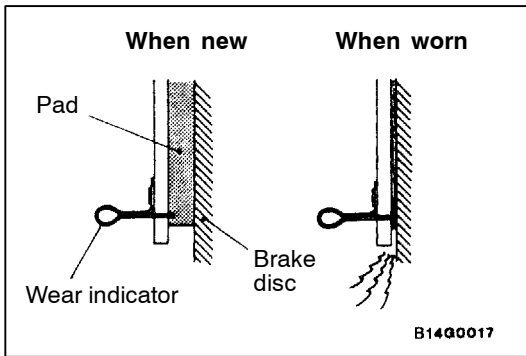
Standard value:

Spring length H mm	Input fluid pressure kPa	Output fluid pressure kPa
144* ¹	5,884	3,633
	13,730	5,610
208* ²	13,730	11,160

NOTE

*¹ and *² indicate the applicable lengths for unladen and laden vehicles respectively.

- After making the check, install the spring. Disconnect the pressure gauges from the load sensing proportioning valve and bleed the air. (Refer to P.35A-13.)

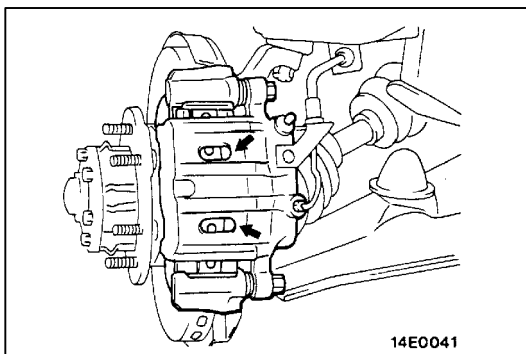


DISC BRAKE PAD CHECK AND REPLACEMENT

35100150242

NOTE

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



<Front>

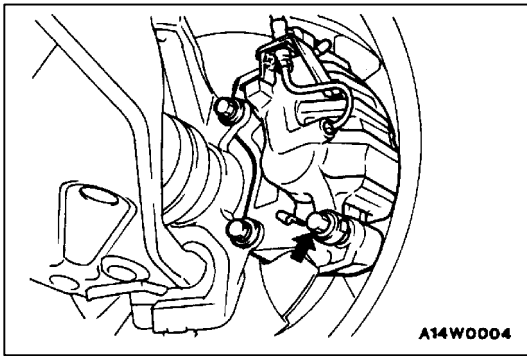
- Check the brake pad thickness through the caliper body check port.

Standard value: 10 mm

Limit: 2.0 mm

Caution

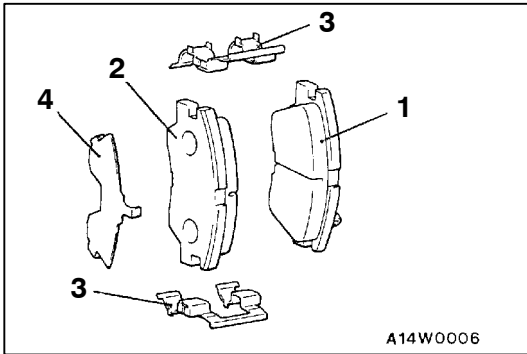
- When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.
- If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.



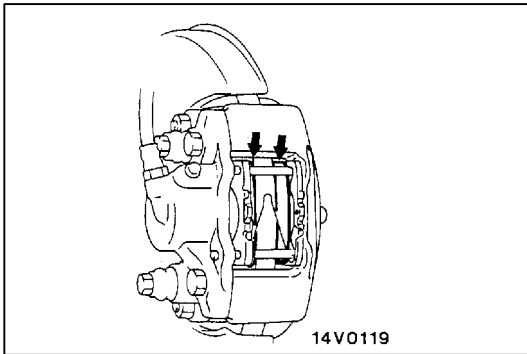
2. Remove the lock pin. Lift the caliper assembly and retain with wire.

Caution

**Do not wipe the special grease from the lock pin.
Do not contaminate the lock pin.**



3. Remove the following parts from caliper support.
 - (1) Pad and wear indicator assembly
 - (2) Pad assembly
 - (3) Clip
 - (4) Outer shim
4. Measure the hub torque with the pad removed to measure the brake drag force after pad installation. (Refer to P.35A-28.)
5. Install the pad and caliper assembly, and check the brake drag force. (Refer to P.35A-28.)



<Rear>

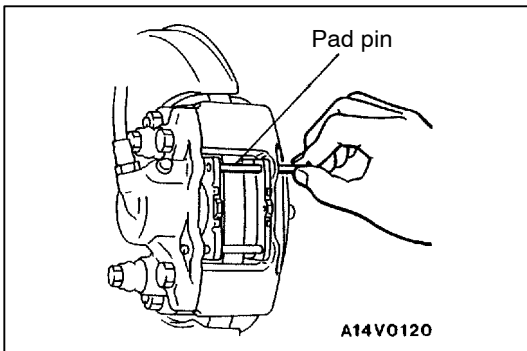
1. Check the brake pad thickness through the caliper body check port.

Standard Value: 10 mm

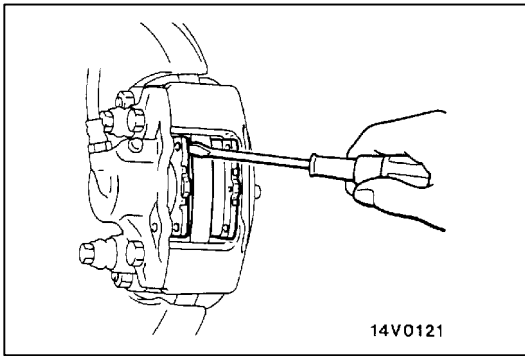
Limit: 2.0 mm

Caution

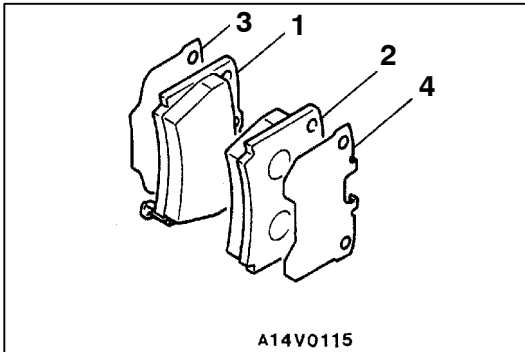
- (1) **When the limit is exceeded, replace the pads at both sides, and also the brake pads for the wheels on the opposite side at the same time.**
- (2) **If there is a significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston and pad pin.**



2. Remove the clip and pad pin.



3. Remove the pad and shim with a flat-tipped screwdriver.
 - (1) Pad and wear indicator assembly
 - (2) Pad assembly
 - (3) Inner shim
 - (4) Outer shim
4. Measure the hub torque with the pads removed to measure the brake drag force. (Refer to P.35A-33.)
5. Install the pad and caliper assembly, and check the brake drag force. (Refer to P.35A-33.)



DISC BRAKE ROTOR CHECK

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CAUTION

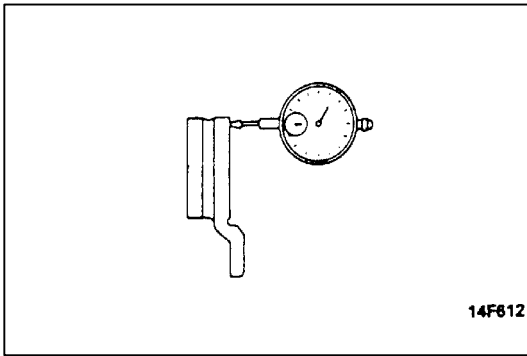
When servicing disc brakes, it is necessary to exercise caution to keep the disc brakes within the allowable service values in order to maintain normal brake operation.

Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	<ul style="list-style-type: none"> ● If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. ● If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.

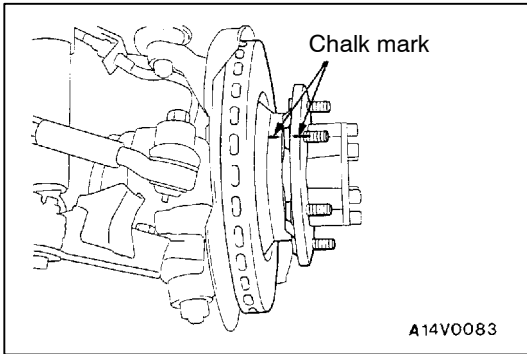
FRONT DISC BRAKE RUN-OUT CHECK AND CORRECTION

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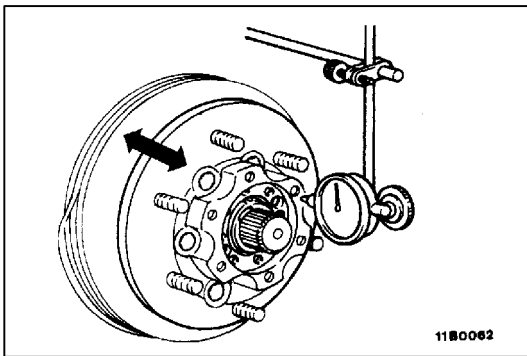


1. Remove the caliper support; then raise the caliper assembly upward and secure by using wire.
2. Inspect the disc surface for grooves, cracks and rust. Clean the disc thoroughly and remove all rust.
3. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

Limit: 0.06 mm



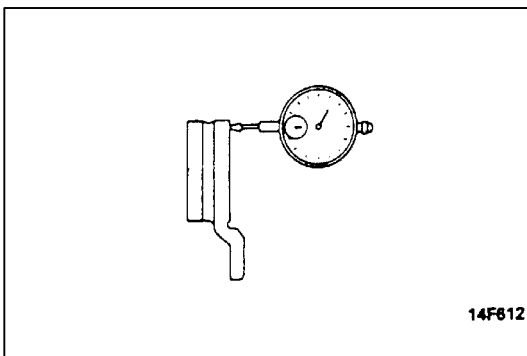
4. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.
 - (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.



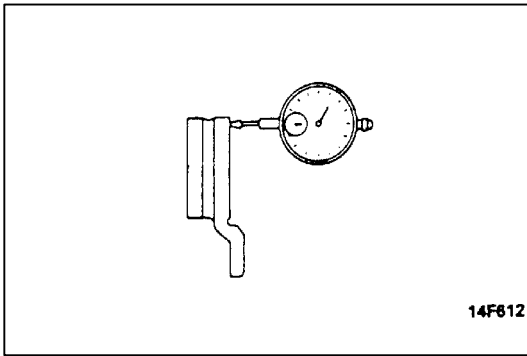
- (2) Place a dial gauge as show in the illustration, and then move the hub in the axial direction and measure the play.

Standard value: 0.05 mm

If the play is equal to or exceeds the standard value, adjust the wheel bearing preload. (Refer to GROUP 26 – Front Hub Assembly.)



- (3) If the play does not exceed the standard value specification, install the brake disc at a position 180° away from the chalk mark, and then check the run-out of the brake disc one again.
5. If the run-out cannot be corrected by changing the phase of the brake disc, replace the disc or turn rotor with on the car type brake lathe (“MAD, DL-8700PF” or equivalent).

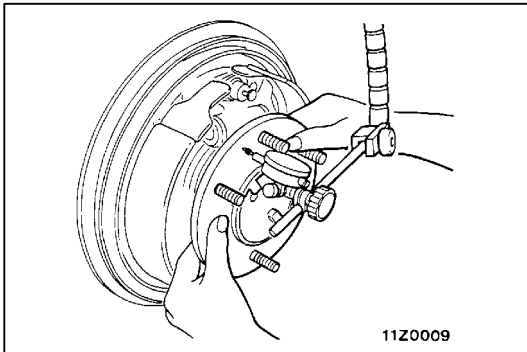


REAR DISC BRAKE RUN-OUT CHECK AND CORRECTION

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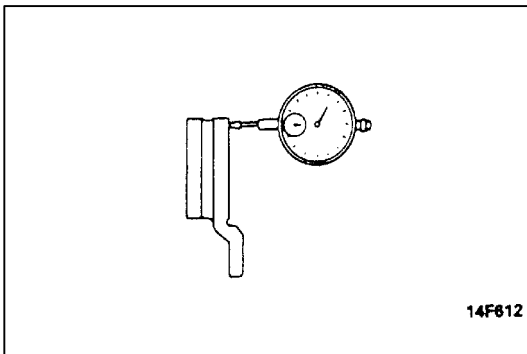
1. Remove the caliper support; then raise the caliper assembly upward and secure with a wire.
2. Check the disc surface for grooves, cracks and rust. Clean the disc thoroughly and remove all rust.
3. Place a dial gauge approximately 5 mm from the outer circumference of the brake disc, and measure the run-out of the disc.

Limit: 0.08 mm

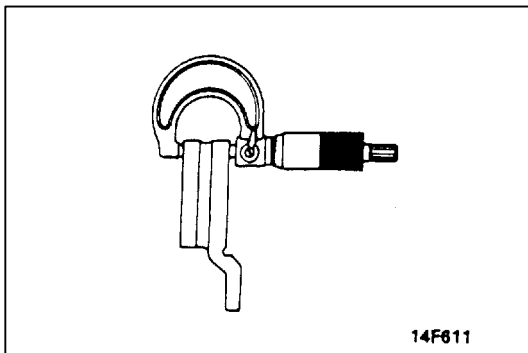


4. If the runout of the brake disc is the limit value or more, change the phase of the disc and hub, and then measure the run-out again.
 - (1) Before removing the brake disc, place a mating mark on both the wheel stud and disc with chalk on the point at which the run-out is greatest.
 - (2) Place a dial gauge as shown in the illustration, and then move the hub in the axial direction and measure the play.

Standard value: 0 – 0.25 mm



- (3) If the play does not exceed the standard value install the brake disc at a different phase, and then check the run-out of the brake disc again.
5. If the run-out cannot be corrected by changing the phase of the brake disc, replace the disc.

**THICKNESS CHECK**

35100160221

<Front>

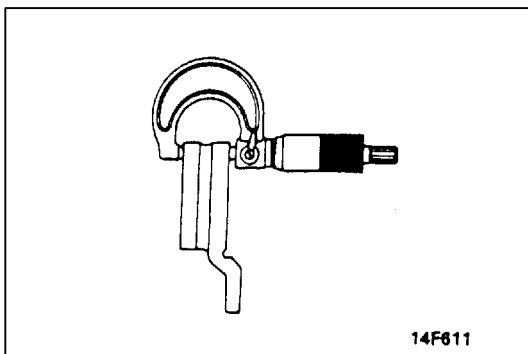
1. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm in from the outer edge of the disc.

Brake disc thickness**Standard value: 24 mm****Limit: 22.4 mm**

Thickness variation (at least 8 positions)

The difference between any thickness measurements should not be more than 0.015 mm.

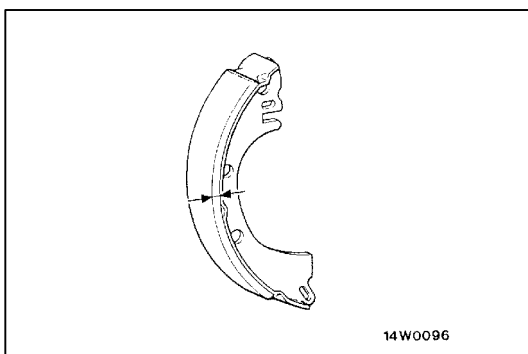
2. If the disc is beyond the limits for thickness, remove it and install a new one. If thickness variation exceeds the specification, replace the brake disc or turn rotor with on the car type brake lathe ("MAD, DL-8700PF" or equivalent).

**<Rear>**

1. Remove dirt and rust from the brake disc surface.
2. Measure the disc thickness at four locations or more.

Standard value: 18 mm**Limit: 16.4 mm**

Replace the discs and pad assembly for both left and right sides of the vehicle if they are worn beyond the specified limit.

**BRAKE LINING THICKNESS CHECK**

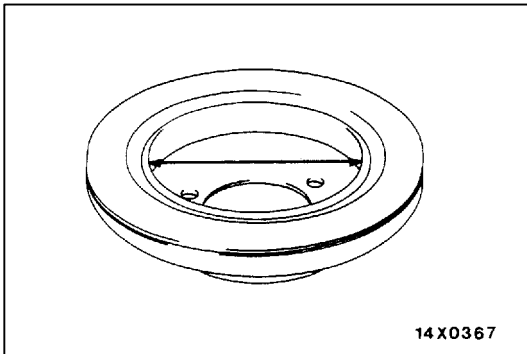
35100300272

1. Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wire, etc.
2. Remove the brake disc.
3. Measure the wear of the brake lining at the place worn the most.

Limit: 4.5 mm

4. Replace the shoe and lining assembly if brake lining thickness is less than the limit if it is not worn evenly.

Caution**Whenever the shoe and lining assembly is replaced, replace both R.H. and L.H. assemblies as a set to prevent car from pulling to one side when braking.**

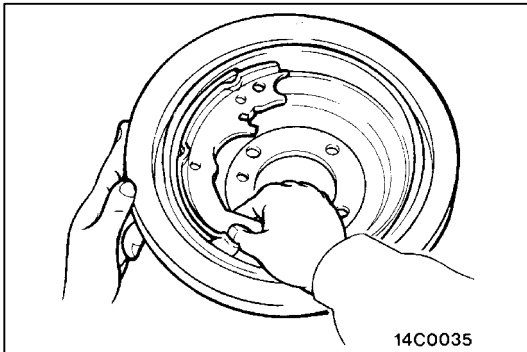
**BRAKE DISC INSIDE DIAMETER CHECK**

35100320216

1. Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wire, etc.
2. Remove the brake disc.
3. Measure the inside diameter of the brake disc at two or more locations.

Standard value: 197.0 mm**Limit: 198.0 mm**

Replace brake disc, shoe and lining assembly when wear exceeds the limit value or is badly imbalanced.

**BRAKE LINING AND BRAKE DISC CONNECTION CHECK**

35100310275

1. Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wire, etc.
2. Remove the brake disc.
3. Remove the shoe and lining assembly.
4. Chalk inner surface of brake disc and rub with shoe and lining assembly.
5. Replace shoe and lining assembly or brake disc if very irregular contact area.

NOTE

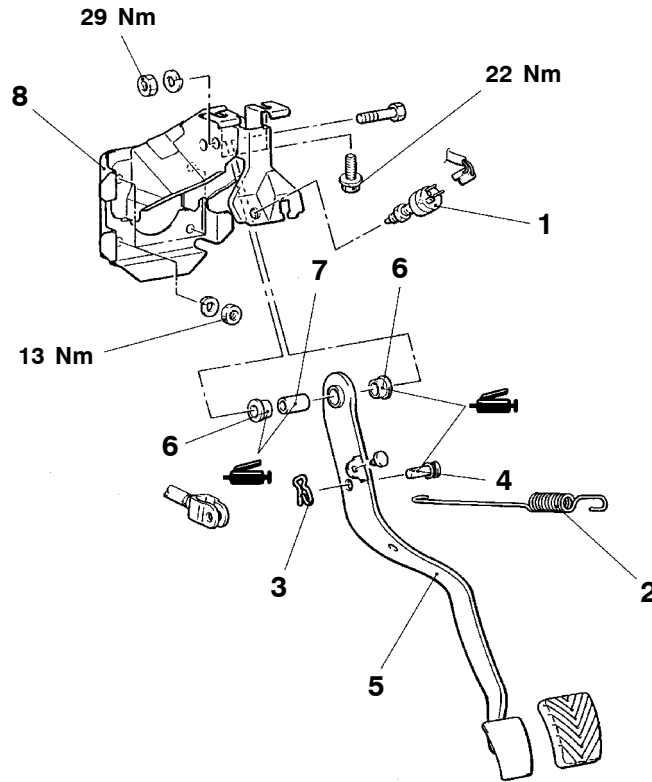
Clean off chalk after check.

BRAKE PEDAL

REMOVAL AND INSTALLATION

Post-installation Operation

- Brake Pedal Adjustment (Refer to P.35A-9.)



BT0108AA

Removal steps

- | | |
|--|--|
| <p>▶A◀</p> <ol style="list-style-type: none"> 1. Stop lamp switch 2. Brake pedal return spring 3. Snap pin 4. Pin assembly | <ol style="list-style-type: none"> 5. Brake pedal 6. Bushing 7. Spacer 8. Pedal support member |
|--|--|

INSTALLATION SERVICE POINT**▶A◀ BRAKE PEDAL RETURN SPRING INSTALLATION**

For L.H. drive vehicles, face the coil of brake pedal return spring toward the steering column side.

For R.H. drive vehicles, face it toward the brake pedal side.

MASTER CYLINDER AND BRAKE BOOSTER

35100370419

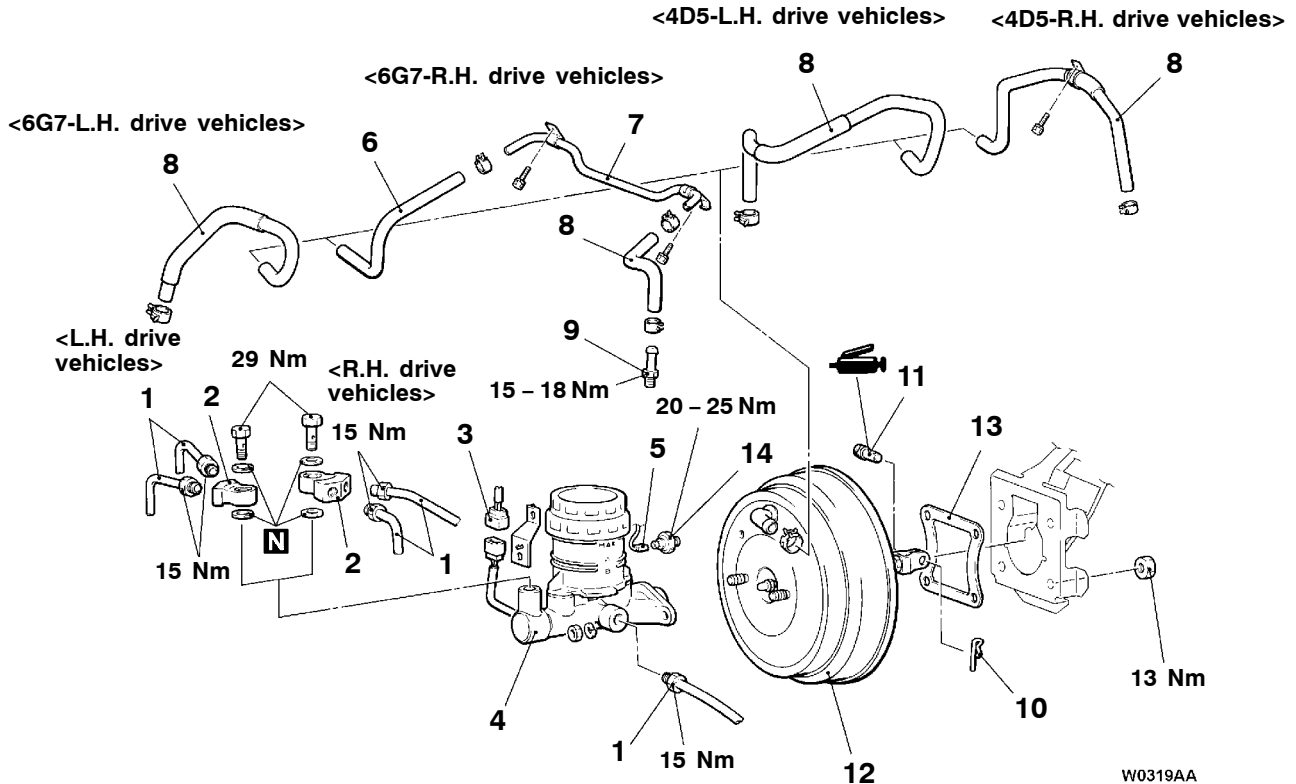
REMOVAL AND INSTALLATION

Pre-removal Operation

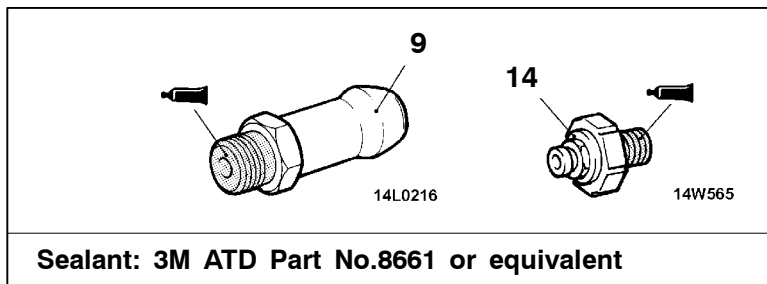
- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-13.)
- Brake Pedal Adjustment (Refer to P.35A-9.)



W0319AA
00009334



Sealant: 3M ATD Part No.8661 or equivalent

Removal steps

1. Brake tube connection
2. Connector
3. Brake fluid level sensor connector
4. Master cylinder assembly
 - Adjustment of clearance between brake booster push rod and primary piston
5. Vacuum switch connector <4D5>
6. Vacuum hose
7. Vacuum pipe
8. Vacuum hose (with built-in check valve)

9. Fitting
10. Snap pin
11. Pin assembly
12. Brake booster
13. Sealer
14. Vacuum switch <4D5>

Caution

Do not remove the check valve from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

INSTALLATION SERVICE POINTS

►A◄ VACUUM HOSE CONNECTION

Insert securely and completely until the vacuum hose at the engine side contacts the edge of the hexagonal part of the fitting, and then secure by using the hose clip.

►B◄ CLEARANCE ADJUSTMENT BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON

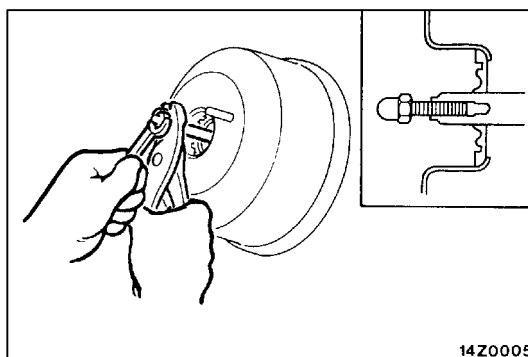
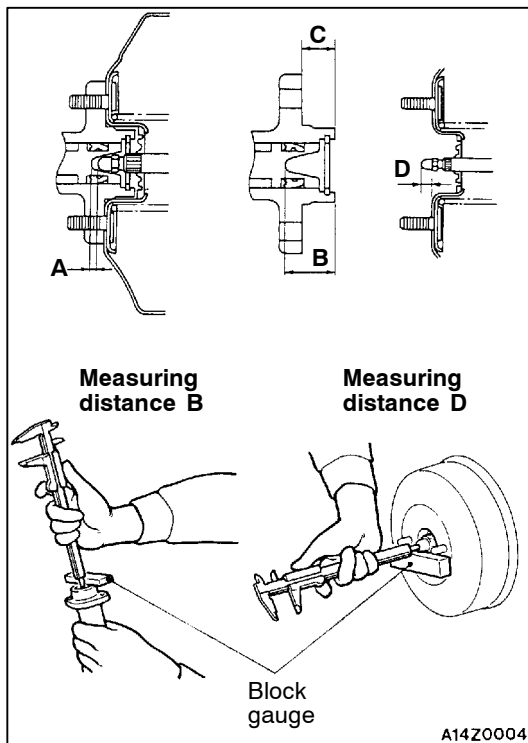
Calculate clearance A from the B, C and D measurements.
 $A = B - C - D$

Standard value:

Brake booster size	Clearance A standard valve mm
Vehicle which brake booster of power cylinder is 180 mm and 205 mm in effective diameter	0.90 – 1.30
Vehicle which brake booster of power cylinder is 205 mm and 230 mm in effective diameter	0.70 – 1.10

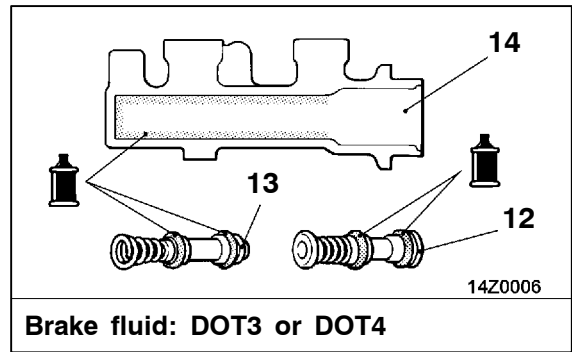
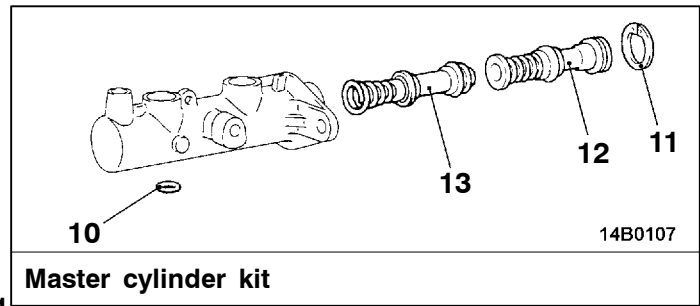
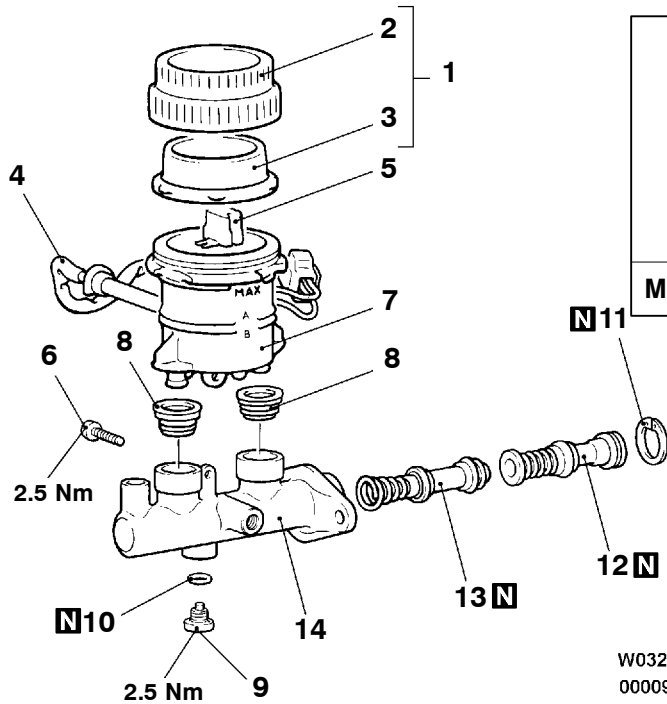
NOTE

When brake booster negative pressure (6G7: -66.7 kPa, 4D5: -93.3 kPa) is applied, clearance value will become 0.10 – 0.50 mm.



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.

**MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY**



W0320AA
00009335

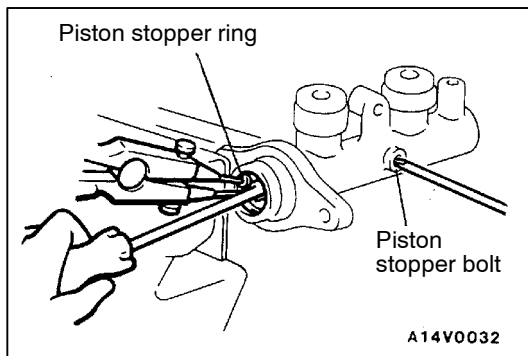
Disassembly steps

1. Reservoir cap assembly
2. Reservoir cap
3. Diaphragm
4. Brake fluid level sensor
5. Float
6. Reservoir stopper bolt
7. Reservoir tank
8. Reservoir seal
9. Piston stopper bolt

10. Gasket
11. Piston stopper ring
12. Primary piston assembly
13. Secondary piston assembly
14. Master cylinder body



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



DISASSEMBLY SERVICE POINT

▶ PISTON STOPPER BOLT/PISTON STOPPER RING DISASSEMBLY

Remove the piston stopper bolt and piston stopper ring while depressing the piston.

INSPECTION

- Check the inner surface of master cylinder body for rust or pitting.
- Check the primary and secondary pistons for rust, scoring, wear or damage.
- Check the diaphragm for cracks and wear.

LOAD SENSING PROPORTIONING VALVE

35100540032

REMOVAL AND INSTALLATION

Caution

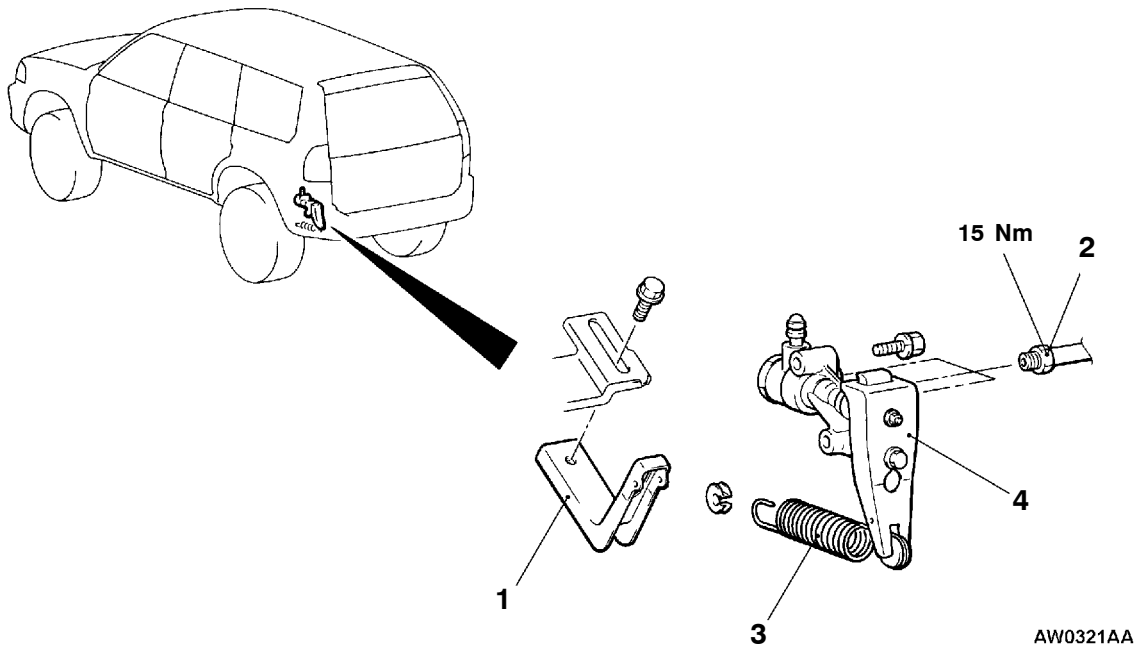
Do not disassemble the load sensing proportioning valve.

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

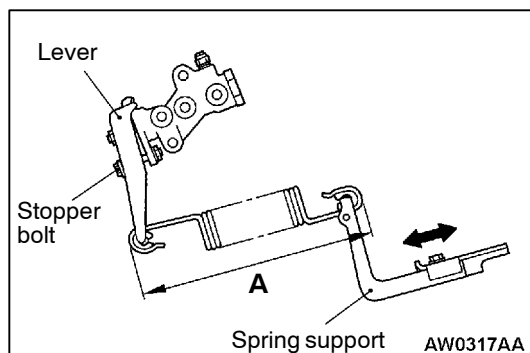
- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-12.)



Removal steps

- ▶◀ 1. Spring support
2. Brake tube connection

3. Load sensing spring
4. Load sensing proportioning valve



INSTALLATION SERVICE POINT

▶◀ SPRING SUPPORT INSTALLATION

While the lever of the load sensing proportioning valve is touching the stopper bolt, install the spring support so that the distance (A) is within the standard value.

Standard value (A): 164 – 168 mm

FRONT DISC BRAKE

35100600259

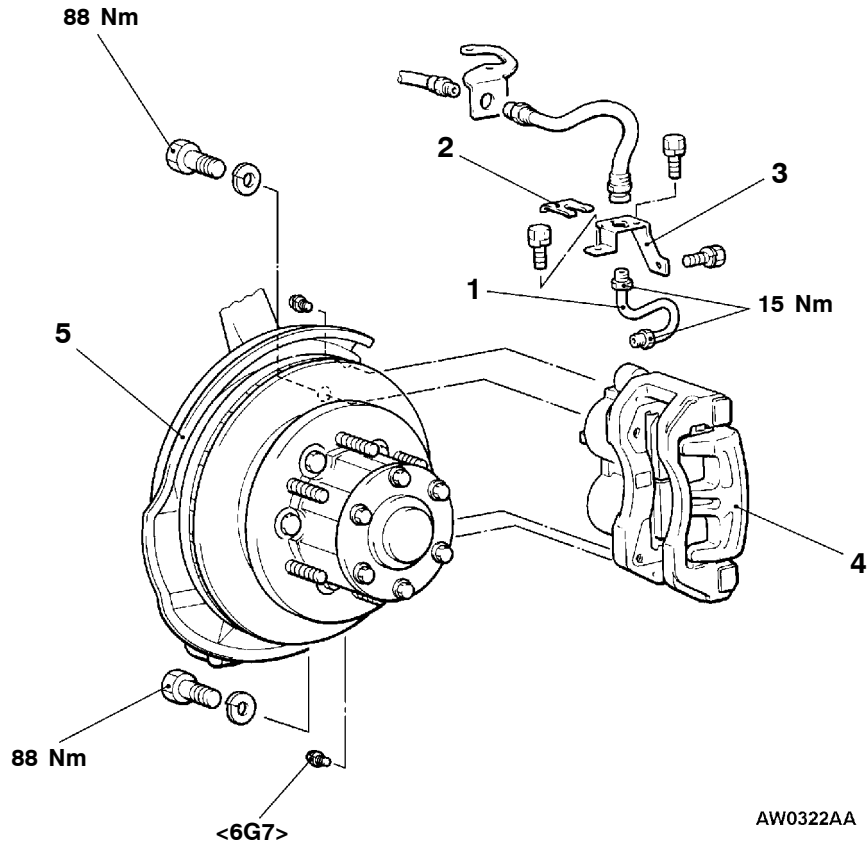
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-13.)



Removal steps

- ▶A◀
1. Brake tube
 2. Clip
 3. Brake hose bracket
 4. Front brake assembly
 5. Brake disc (Refer to GROUP 26 – Front Hub Assembly)

INSTALLATION SERVICE POINT

▶A◀ FRONT BRAKE ASSEMBLY INSTALLATION

1. Measure hub torque (A) with the pad removed to measure the brake drag force after pad installation.

Caution

Engage 2WD before measurement.

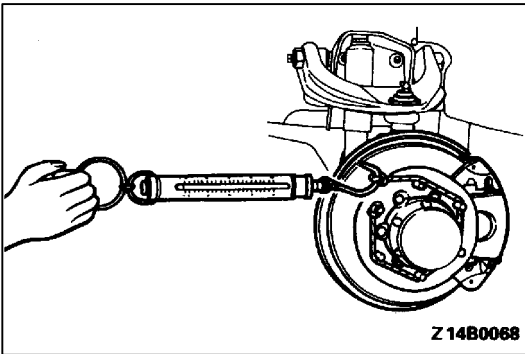
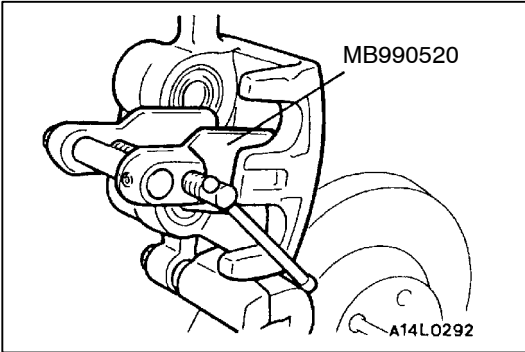
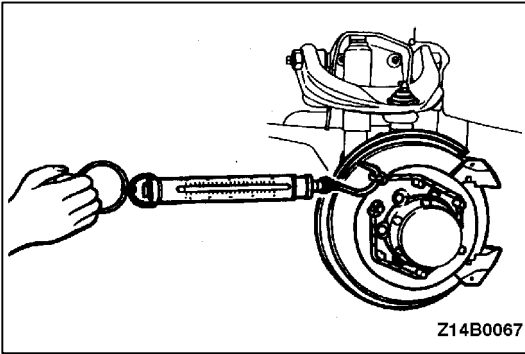
2. Securely attach the pad clip to the caliper support.

3. Clean the piston and insert into cylinder with special tool.
4. Be careful that the piston boot does not become caught, when lowering the caliper assembly and installing the lock pin.
5. Check the brake drag force as follows.
 - (1) Start the engine and hold the brake pedal down for 5 seconds. (Pedal depression force: approx. 196 N)
 - (2) Stop the engine.
 - (3) Turn the brake disc forward 10 times.

- (4) Check the hub torque (B) with a spring balance.
- (5) Calculate the drag force of the disc brake [difference between hub torque (B) and hub torque (A)].

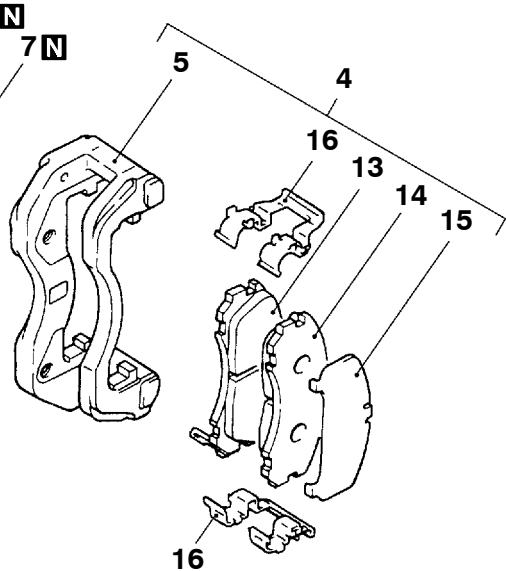
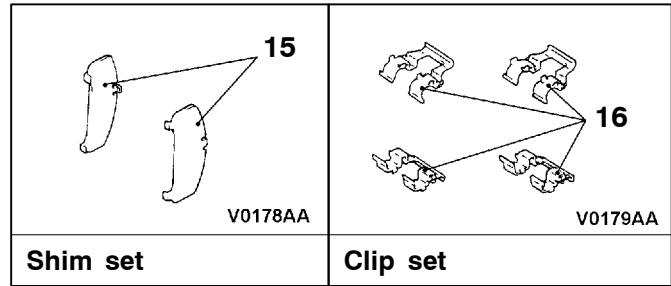
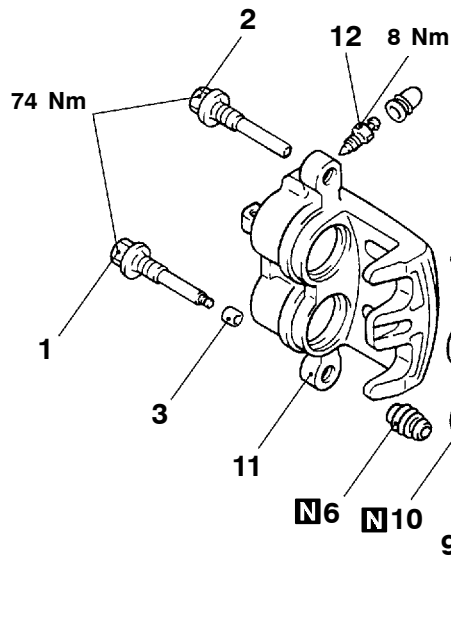
Standard value: 106 N or less

6. If the brake drag force exceeds the standard value, disassemble and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.

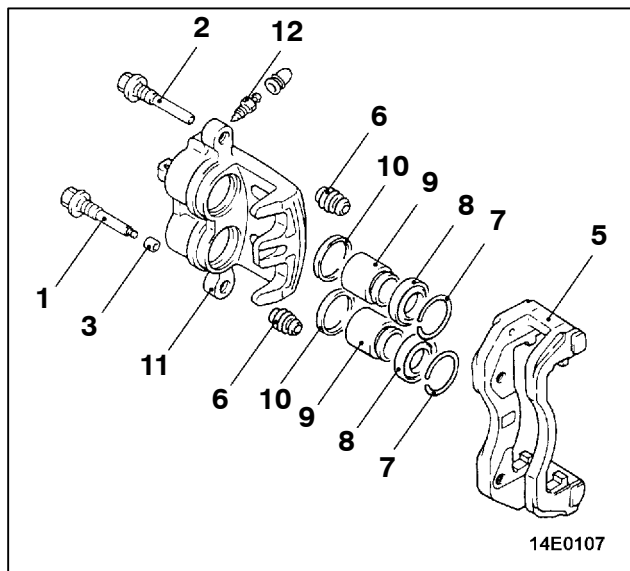


DISASSEMBLY AND REASSEMBLY

35100620293

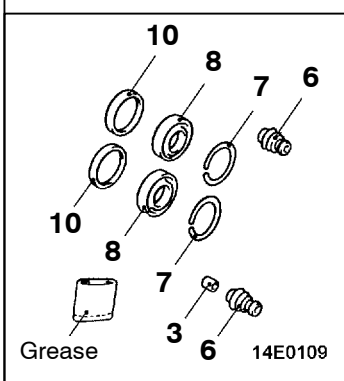


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00009336



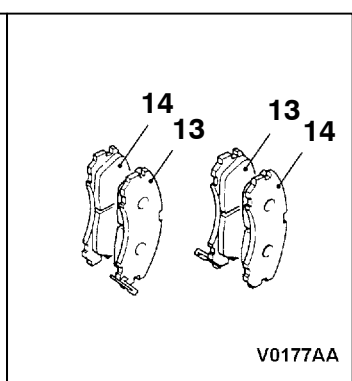
14E0107

Brake caliper kit



Grease 14E0109

Seal and boots kit



V0177AA

Pad set

Caliper assembly disassembly steps



1. Lock pin
2. Guide pin
3. Bushing
4. Caliper support, pad, clip and shim assembly
5. Caliper support
6. Pin boot
7. Boot ring
8. Piston boot
9. Piston
10. Piston seal
11. Caliper body
12. Bleeder screw

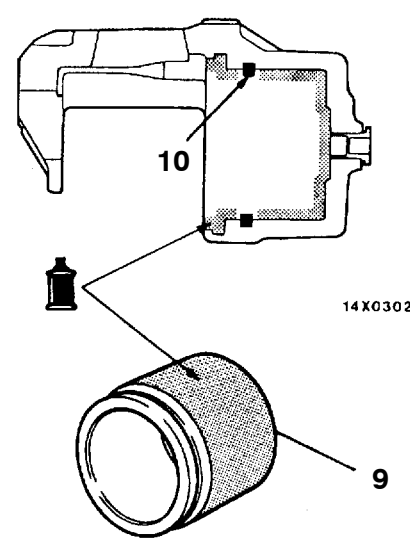
Pad assembly disassembly steps



1. Lock pin
2. Guide pin
3. Bushing
4. Caliper support, pad, clip and shim assembly
13. Pad and wear indicator assembly
14. Pad assembly
15. Outer shim
16. Clip



LUBRICATION POINTS



10

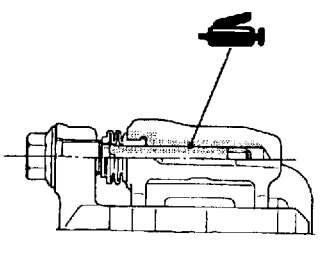
14X0302

9

14X0301

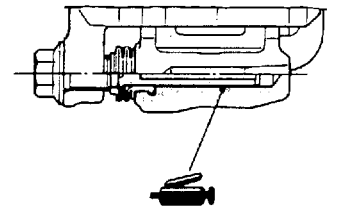
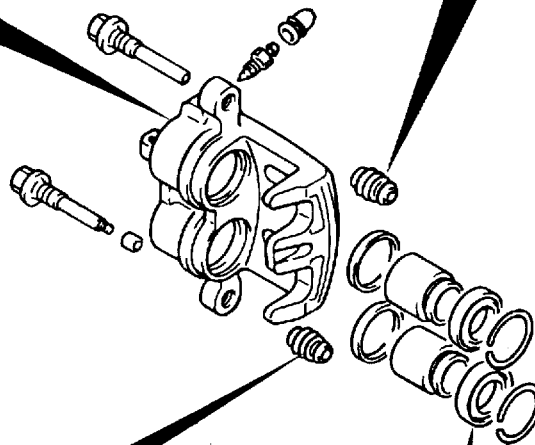
Caution
The piston seal inside the seal and boot kit is coated with a special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4



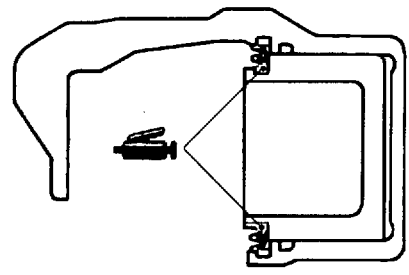
14W0046

Grease: Repair kit grease



14A0541

Grease: Repair kit grease

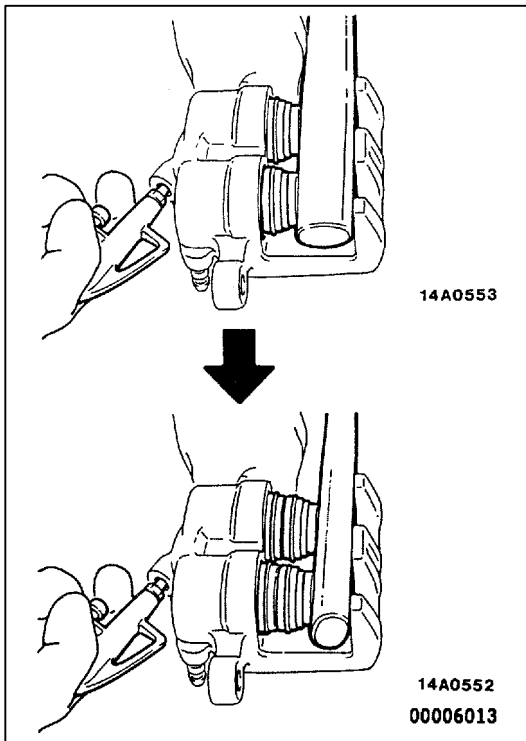


14L0128

Grease: Repair kit grease

DISASSEMBLY SERVICE POINTS

When disassembling the front disc brakes, disassemble both sides (left and right) as a set.



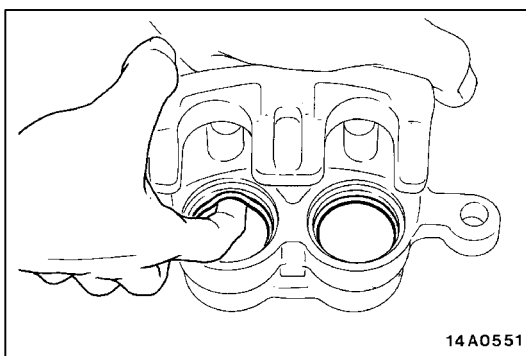
◀A▶ PISTON BOOT/PISTON REMOVAL

Protect caliper body with cloth. Blow compressed air through brake hose to remove piston boot and piston.

Caution

When removing the pistons, be sure to use the handle of a plastic hammer and adjust the height of the two pistons while pumping in air slowly so that the pistons protrude evenly.

Do not remove one piston completely before trying to remove the other piston, because it will become impossible to remove the second piston.



◀B▶ PISTON SEAL REMOVAL

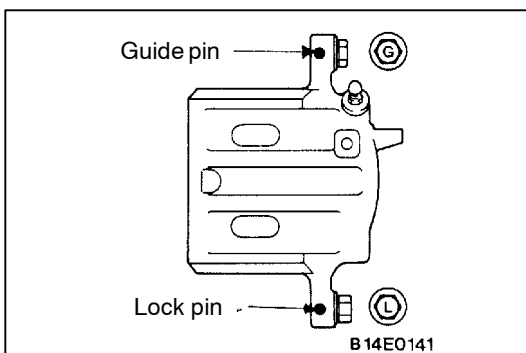
- (1) Remove piston seal with finger tip.

Caution

Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

- (2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

Specified brake fluid: DOT3 or DOT4



REASSEMBLY SERVICE POINT

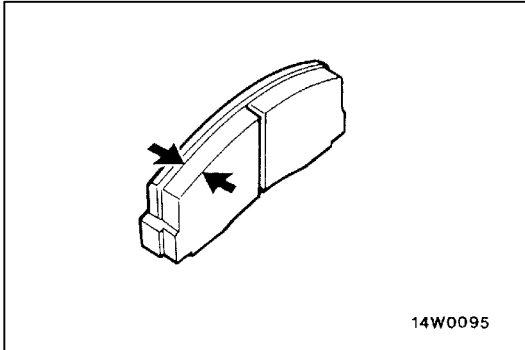
▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the lock pin and guide pin to the caliper body as shown in the illustration.

INSPECTION

35100630104

- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.

**PAD WEAR CHECK**

Measure the thickness at the thinnest and worn area of the pad.

Replace the pad assembly if pad thickness is less than the limit value.

Standard value: 10 mm

Limit: 2.0 mm

Caution

1. **Replace the pads always at both sides, and also the brake pads for the wheels on the opposite side at the same time.**
2. **If there is significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.**

REAR DISC BRAKE

35100700140

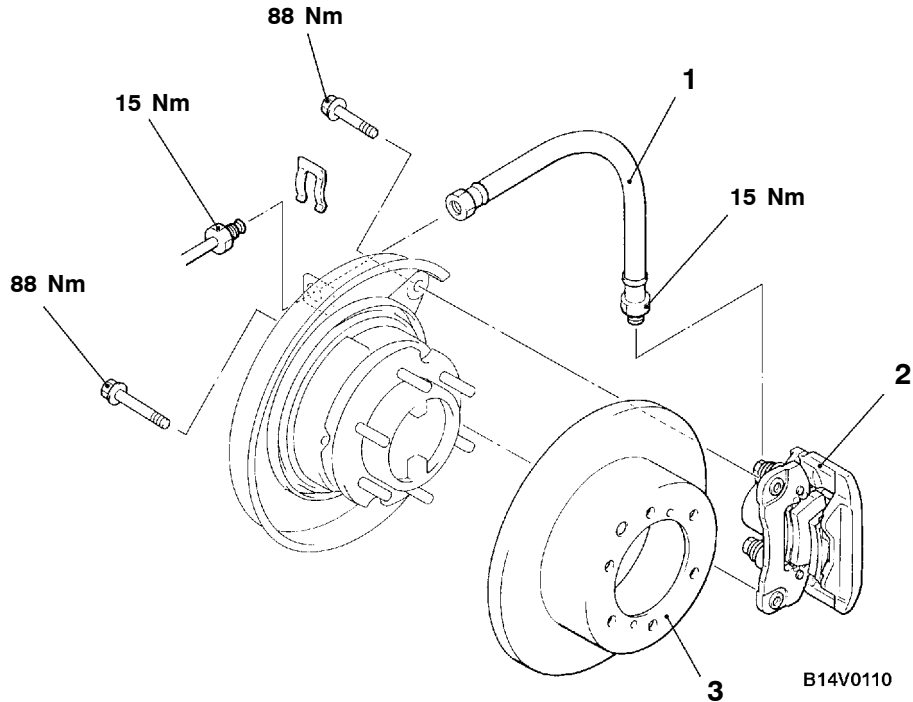
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

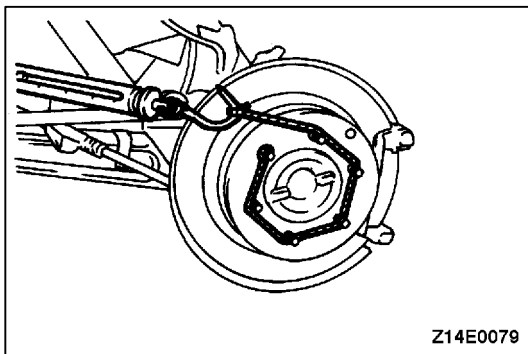
Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35A-13.)



Removal steps

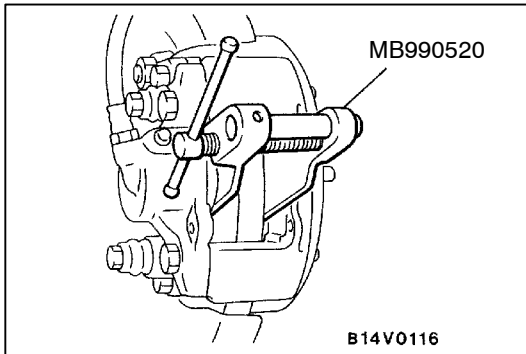
- ▶A◀
1. Brake hose connection
 2. Rear brake assembly
 3. Brake disc



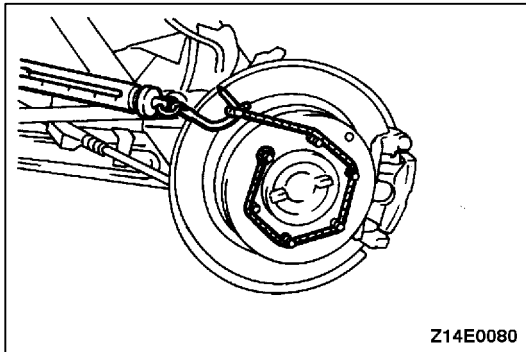
INSTALLATION SERVICE POINT

▶A◀ **REAR BRAKE ASSEMBLY INSTALLATION**

1. Measure hub torque (1) with the pad removed to measure the brake drag force after pad installation.



2. Clean the piston and insert into the cylinder with special tool.
3. Install the pad assembly to the caliper.
4. Start the engine. Depress the brake pedal fully a few times, and then stop the engine.
5. Turn the brake disc forward 10 times.



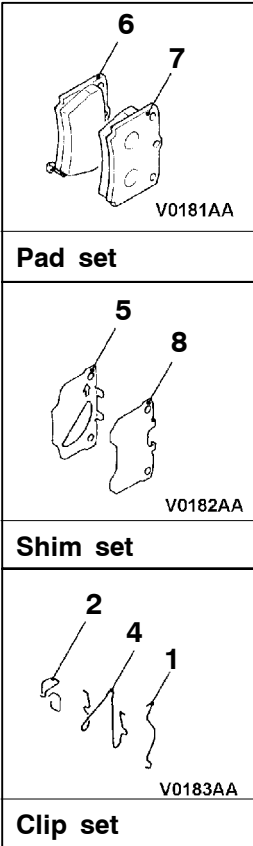
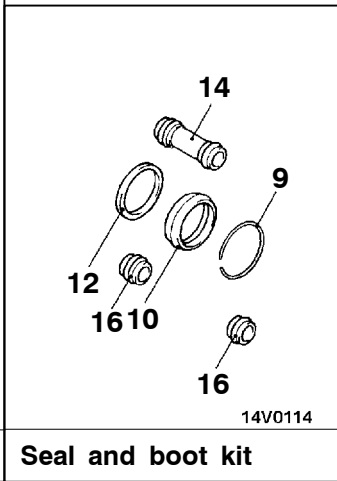
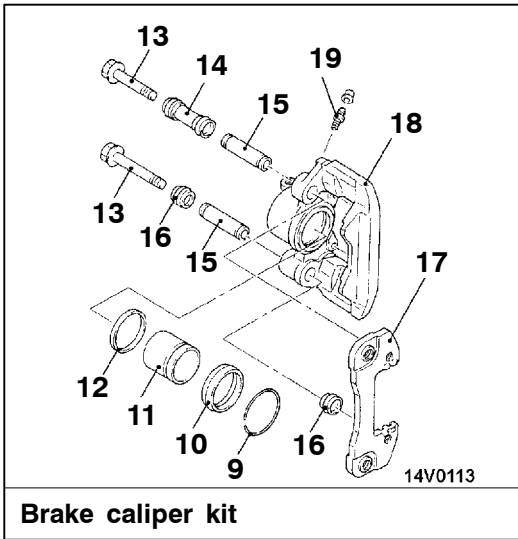
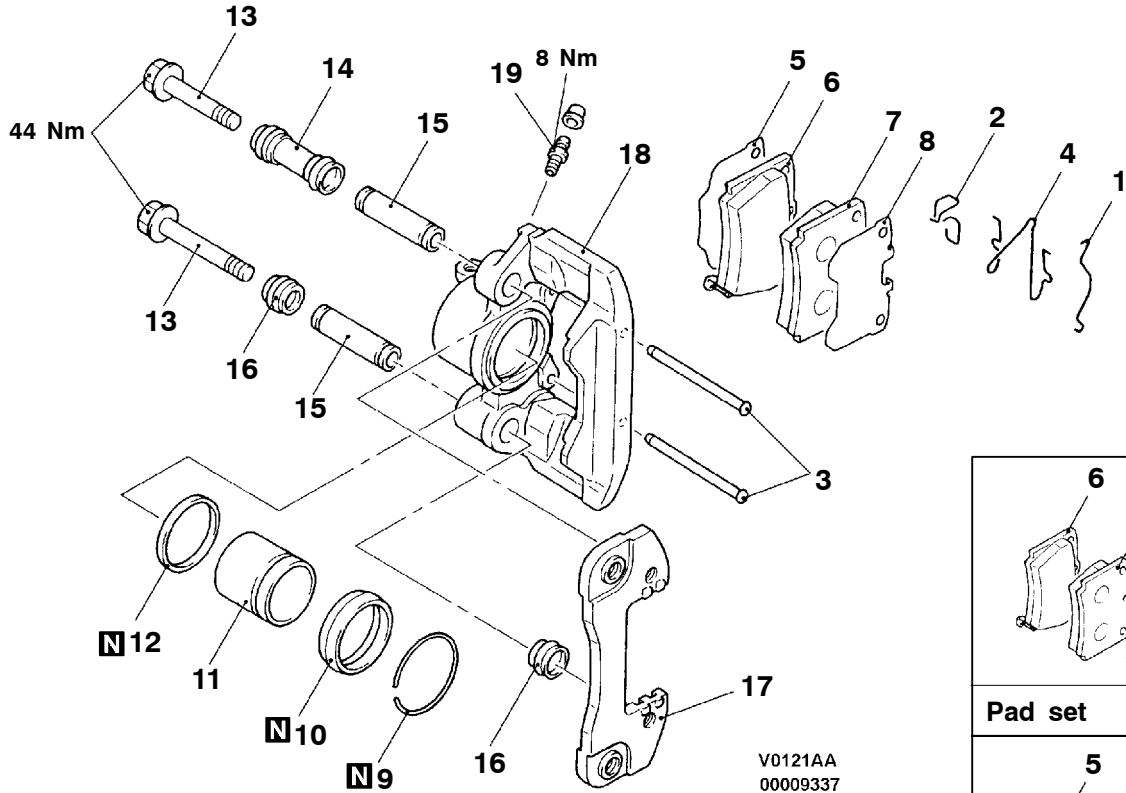
6. Check the hub torque (6) with a spring balance.
7. Calculate the drag force of the disc brake [difference between hub torque (1) and hub torque (6)].

Standard value: 56 N

8. If the brake drag torque exceeds the standard value, disassemble and clean the piston. Check for corrosion or worn piston seal, and check the sliding condition of the lock pin and guide pin.

DISASSEMBLY AND REASSEMBLY

35100720184



Caliper assembly disassembly steps

1. Clip
2. K-spring
3. Pad pin
4. Spring
5. Inner shim
6. Pad and wear indicator assembly
7. Pad assembly
8. Outer shim
9. Retaining ring
10. Piston boot
11. Piston
12. Piston seal
13. Sleeve bolt
14. Bushing
15. Sleeve

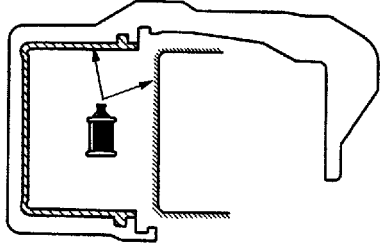
16. Pin boot
17. Inner caliper
18. Torque plate
19. Bleeder screw

Pad assembly disassembly steps

1. Clip
2. K-spring
3. Pad pin
4. Spring
5. Inner shim
6. Pad and wear indicator assembly
7. Pad assembly
8. Outer shim



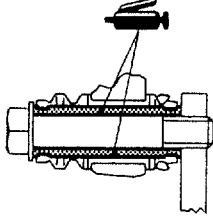
LUBRICATION POINTS



14V0132

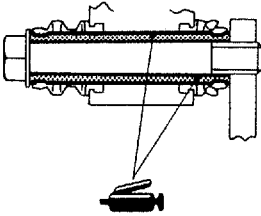
Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4



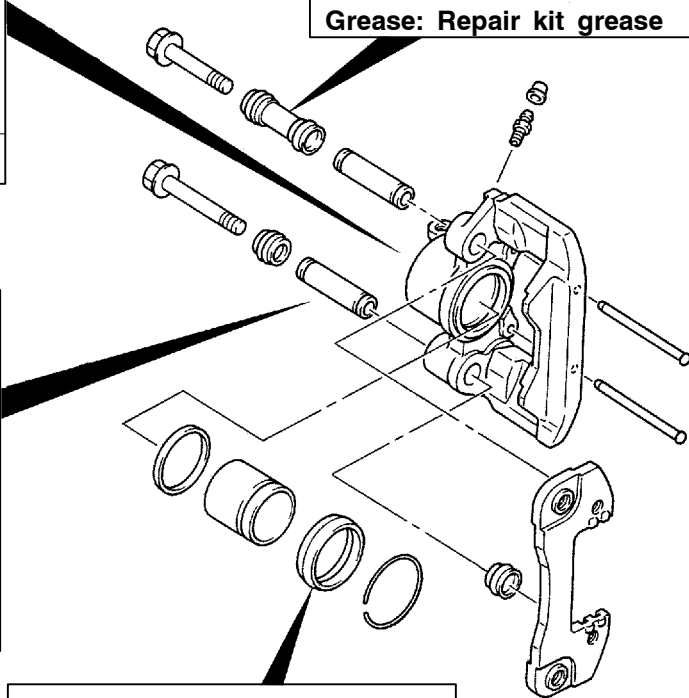
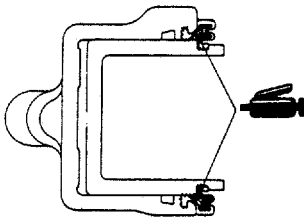
14V0122

Grease: Repair kit grease



14V0123

Grease: Repair kit grease

14M0083

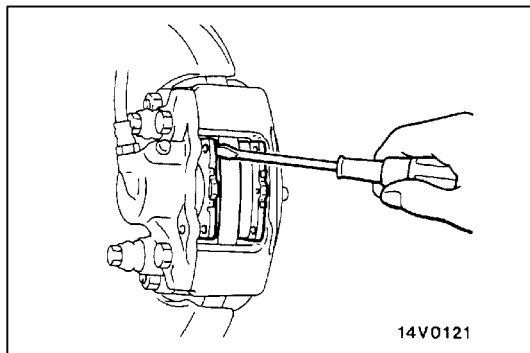
Grease: Repair kit grease

14V0113

00006015

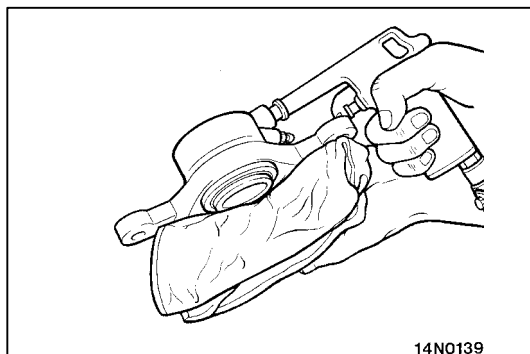
DISASSEMBLY SERVICE POINTS

When disassembling the rear disc brakes, disassemble both sides (left and right) as a set.



◀A▶ **PAD AND WEAR INDICATOR ASSEMBLY/PAD ASSEMBLY REMOVAL**

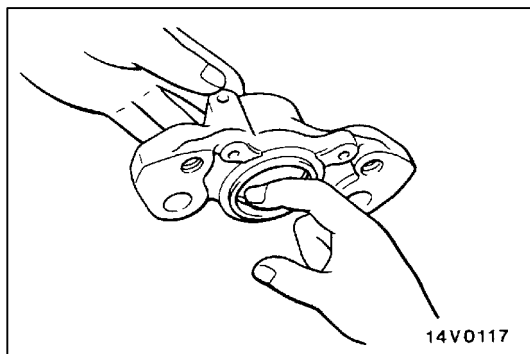
Use a flat-tipped screwdriver to remove the pad and wear indicator assembly and the pad assembly.



◀B▶ **PISTON BOOT/PISTON REMOVAL**

Protect the caliper body with a shop towel. Blow compressed air through the brake hose to remove the piston boot and piston.

Caution
Blow compressed air gently.



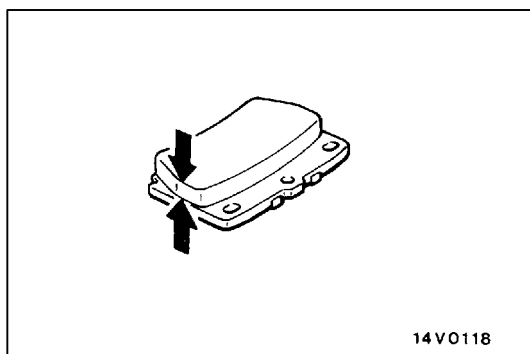
◀C▶ **PISTON SEAL REMOVAL**

1. Remove the piston seal with your finger tip.

Caution
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

2. Clean the piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

Specified break fluid: DOT3 or DOT4



INSPECTION

35100730118

PAD WEAR CHECK

Measure the thickness at the thinnest and worn area of the pad.

Replace the pad assembly if pad thickness is less than the limit value.

Standard value: 10 mm

Limit: 2.0 mm

Caution

1. Always replace both pads on each wheel as a set (both front wheels or both rear wheels). Failure to do so will result in un-even braking which may cause an unpredictable vehicle condition.
2. If there is significant difference in the thicknesses of the pads on the left and right sides, check the sliding condition of the piston, lock pin and guide pin.

NOTES

ANTI-SKID BRAKING SYSTEM (ABS) <4WD>

CONTENTS

35209000282

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Thickness Check	Refer to GROUP 35A		
Brake Lining Thickness Check Refer to GROUP 35A			

GENERAL INFORMATION

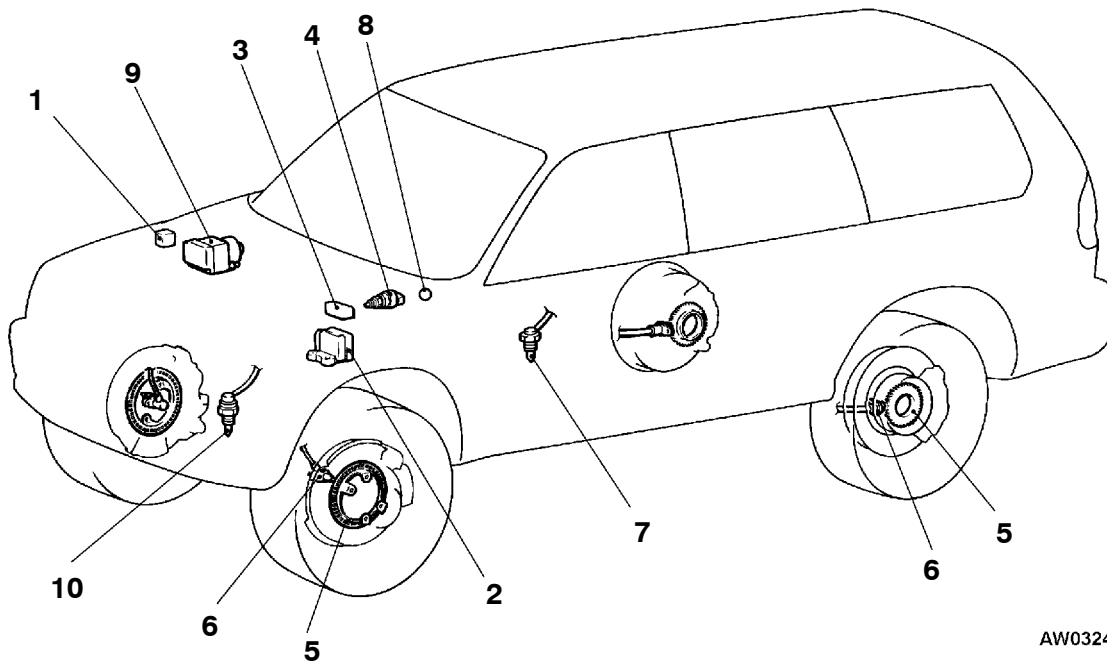
35200010307

The ABS consists of components such as the wheel speed sensors, stop lamp switch, hydraulic unit assembly (integrated in ABS-ECU) and the ABS warning lamp. If a problem occurs in the system, the malfunctioning components can be identified and the trouble symptoms will be memorized by the diagnosis function.

In addition, reading of diagnosis codes and service data and actuator testing are possible by using the MUT-II.

Items	Specifications
ABS type	4-sensor, 3-channel type
Speed sensor	Magnet coil type on 4-wheels
Front ABS rotor teeth	47
Rear ABS rotor teeth	47

CONSTRUCTION DIAGRAM



AW0324AA

1. ABS Warning lamp relay
2. Hydraulic unit assembly (integrated in ABS-ECU)
3. Diagnosis connector
4. Stop lamp switch
5. ABS rotor

6. Wheel speed sensor
7. 4WD detection switch
8. ABS warning lamp
9. G-Sensor
10. Freewheel engage switch

SERVICE SPECIFICATIONS

35200030327

Items		Standard value
Wheel speed sensor internal resistance k Ω		1.3 – 1.5
Wheel speed sensor insulation resistance k Ω		100 or more
G-sensor output voltage V	Stationary vehicle	2.4 – 2.6
	Arrow facing downward	3.4 – 3.6

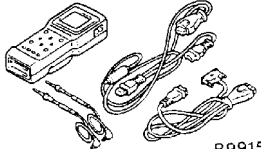
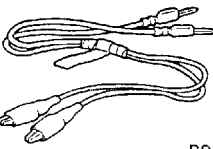
LUBRICANT

35200040061

Item	Specified lubricant
Brake fluid	DOT3 or DOT4

SPECIAL TOOLS

35200060296

Tool	Number	Name	Use
 B991502	MB991502	MUT-II sub assembly	For checking of ABS (Diagnosis code display when using the MUT-II)
 B991529	MB991529	Diagnosis code check harness	For checking of ABS (Diagnosis code display when using the ABS warning lamp)

TROUBLESHOOTING

35201110501

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING

Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

NOTES WITH REGARD TO DIAGNOSIS

The phenomena listed in the following table are not abnormal.

Phenomenon	Explanation of phenomenon
System check sound	When starting the engine, a thudding sound can sometimes be heard coming from inside the engine compartment, but this is because the system operation check is being performed, and is not an abnormality.
ABS operation sound	<ol style="list-style-type: none"> 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: tyres)
ABS operation (Long braking distance)	For road surfaces such as snow-covered roads 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 and not being too overconfident.

Diagnosis detection condition can vary depending on the diagnosis code.

Make sure that checking requirements listed in the “Comment” are satisfied when checking the trouble symptom again.

DIAGNOSIS FUNCTION

35201120351

DIAGNOSIS CODES CHECK

Read a diagnosis code by the MUT-II or ABS warning lamp.
(Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)

ERASING DIAGNOSIS CODES**With the MUT-II**

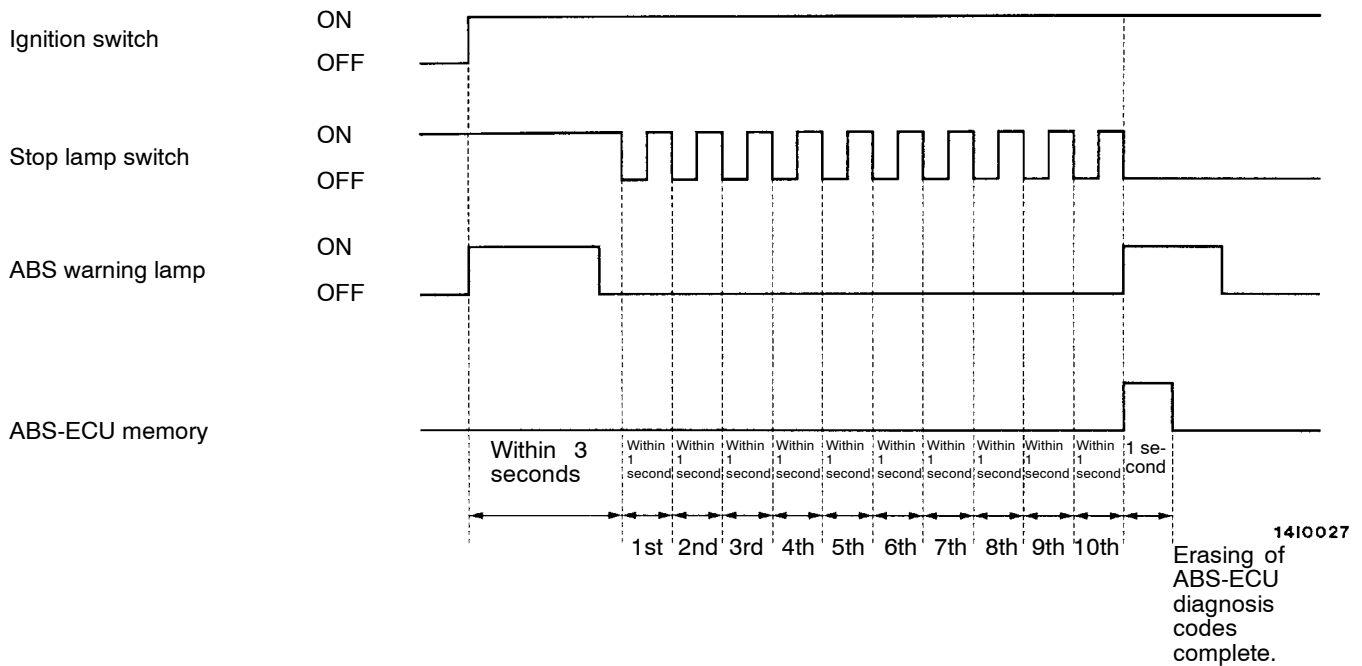
Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.

Without the MUT-II

1. Use the special tool to earth terminal (1) (diagnosis control terminal) of the diagnosis connector. (Refer to GROUP 00 – How to Use Troubleshooting/Inspection Service Points.)
2. Stop the engine.
3. Turn on the stop lamp switch. (Depress the brake.)
4. After carrying out steps 1. to 3., turn the ignition switch to ON. Within 3 seconds after turning the ignition switch to ON, turn off the stop lamp switch (release the brake). Then, turn the stop lamp switch on and off a total of 10 times.

NOTE

If the ABS-ECU function has been stopped because of fail-safe operation, it will not be possible to erase the diagnosis codes.



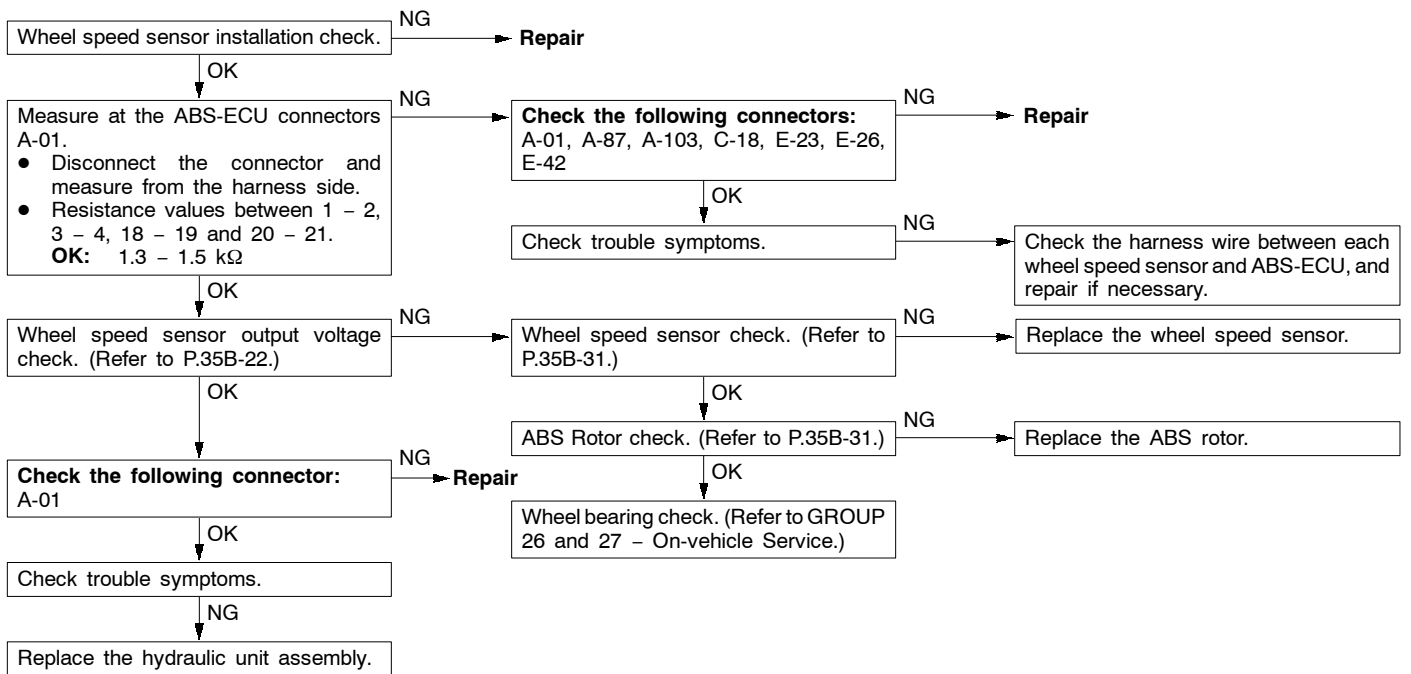
INSPECTION CHART FOR DIAGNOSIS CODES

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

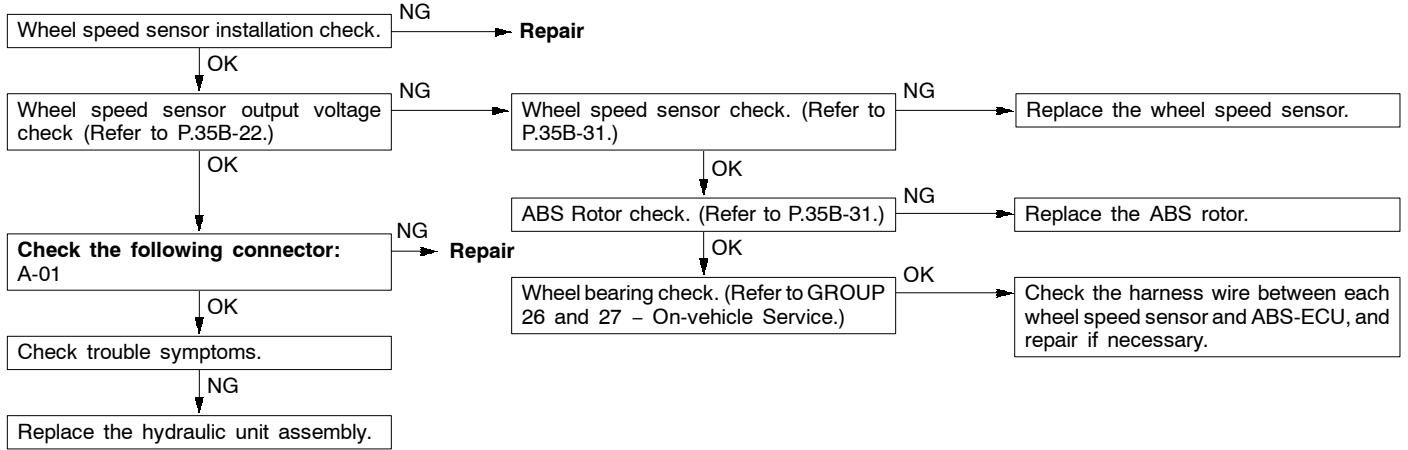
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front right wheel speed sensor	Open or short circuit	35B-7
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	35B-8
16	Power supply system		35B-8
21	Front right wheel speed sensor	Abnormal	35B-7
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
25	4WD position detection switch		35B-9
26	Freewheel engage switch		35B-10
32	G-sensor system		35B-11
33	Stop lamp switch system		35B-11
41	Front right solenoid valve		35B-12
42	Front left solenoid valve		
43	Rear solenoid valve		
51	Valve relay		
53	Motor relay, motor		
63	ABS-ECU		Refer to P. 35B-28 (Replace the hydraulic unit assembly)

INSPECTION PROCEDURE FOR DIAGNOSIS CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit or short circuit	Probable cause
Code No. 21, 22, 23, 24 Wheel speed sensor abnormal	
The ABS-ECU determines that an open circuit or short circuit occurs in more than one line of wheel speed sensors.	<ul style="list-style-type: none"> ● Malfunction of wheel speed sensor ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit assembly
These codes are output at the following times: <ul style="list-style-type: none"> ● When an open circuit cannot be found, but more than one wheel speed sensor does not output any signal during driving at 8 km/h or higher. ● When a chipped or plugged-up rotor tooth, etc. is detected. ● When the sensor output drops and anti-lock control is continuously carried out due to a defective sensor or a warped rotor. 	<ul style="list-style-type: none"> ● Malfunction of wheel speed sensor ● Malfunction of ABS rotor ● Malfunction of wheel bearing ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit assembly



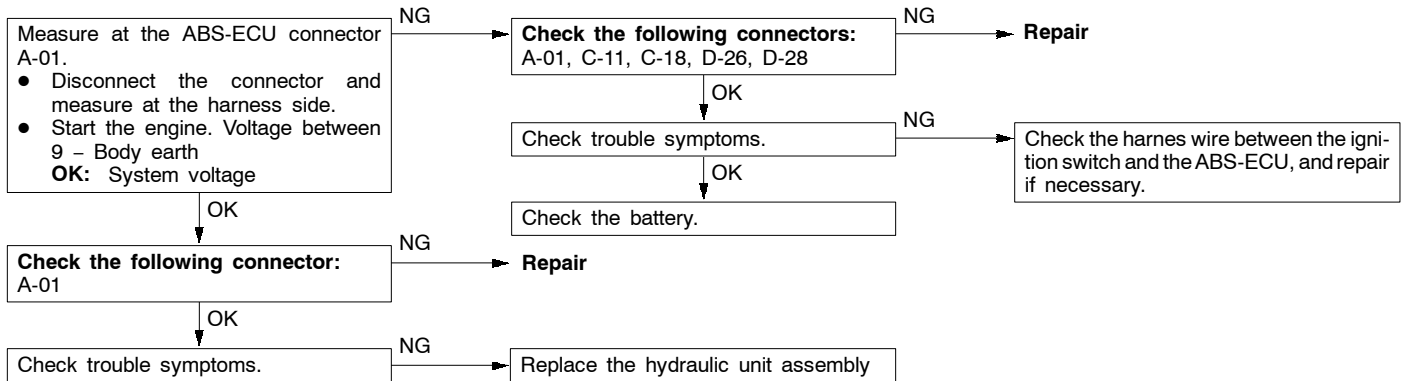
Code No. 15 Wheel speed sensor (Abnormal output signal)	Probable cause
A wheel speed sensor outputs an abnormal signal (other than an open or short-circuit).	<ul style="list-style-type: none"> ● Improper installation of wheel speed sensor ● Malfunction of wheel speed sensor ● Malfunction of ABS rotor ● Malfunction of wheel bearing ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit assembly



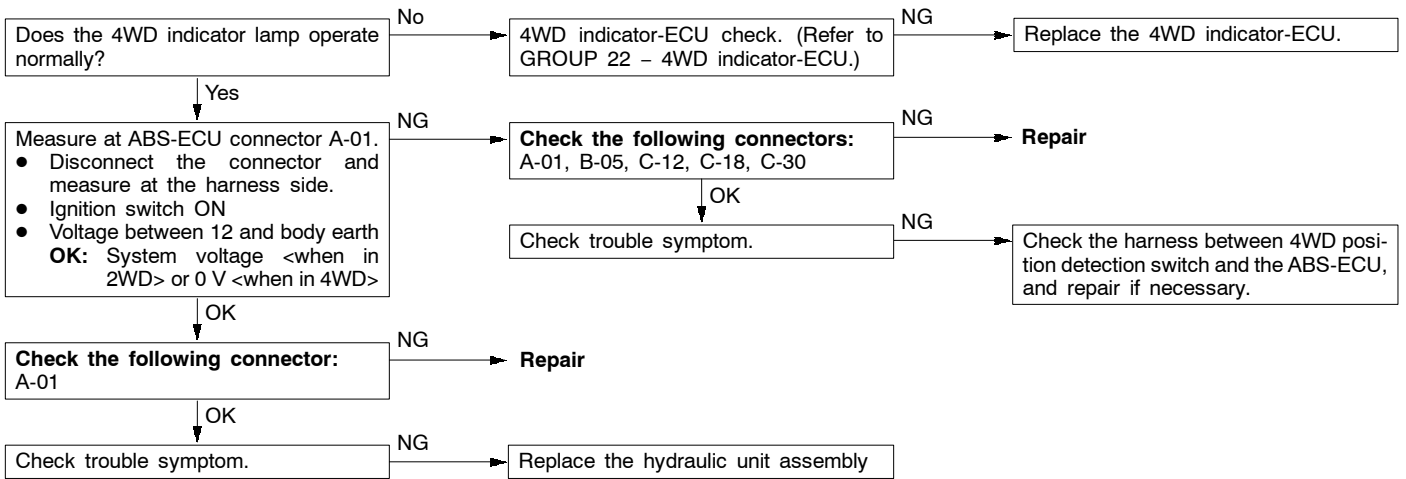
Code No. 16 Power supply system	Probable cause
The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.	<ul style="list-style-type: none"> ● Malfunction of wiring harness or connector. ● Malfunction of hydraulic unit assembly

Caution

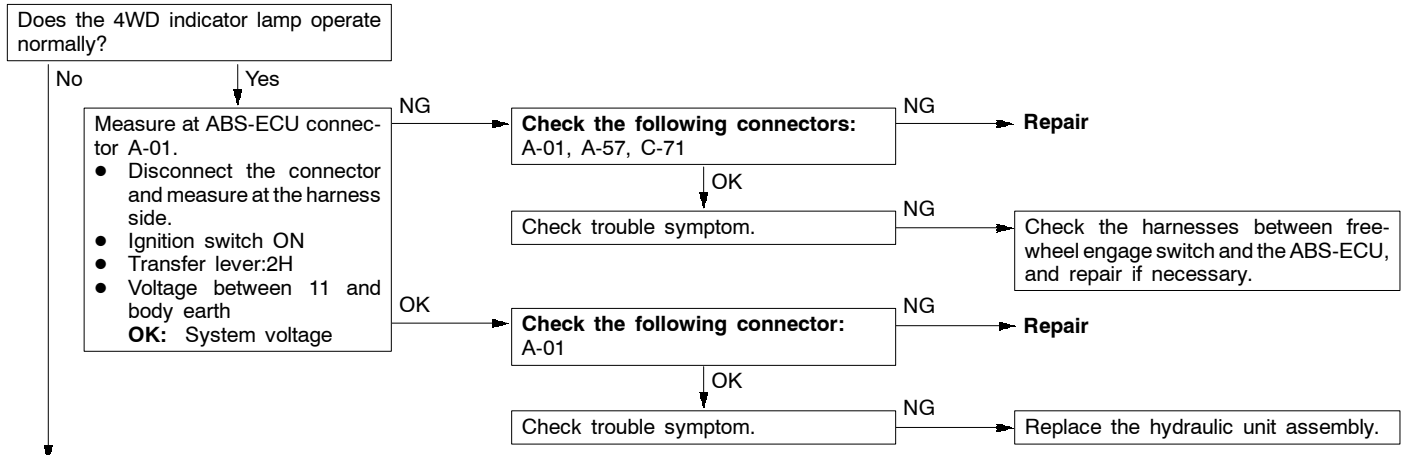
If battery voltage drops or rises during inspection, this code will be output as well. If the voltage returns to standard value, this code is no longer output. Before carrying out the following inspection, check the battery level, and refill distilled water if necessary.



Code No. 25 4WD position detection switch	Probable cause
ABS-ECU determines that an open circuit exists in the 4WD position detection switch system.	<ul style="list-style-type: none"> ● Malfunction of wiring harness or connector ● Malfunction of 4WD indicator-ECU ● Malfunction of 4WD position detection switch ● Malfunction of hydraulic unit assembly



Code No. 26 Freewheel engage switch	Probable cause
<p>This code is output at the following times:</p> <ul style="list-style-type: none"> • ABS-ECU determines that an open circuit exists in the freewheel engage switch system. • When the 4WD detection switch is off and the freewheel engage switch is on, the vehicle will continue running at 20 km/h or more for approximately 5 min. or more and then will continue running until a speed of 0 km/h is reached. (Code Nos. 25 and 26 are output.) 	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of freewheel engage switch • Malfunction of 4WD indicator-ECU • Malfunction of 4WD position detection switch • Malfunction of hydraulic unit assembly

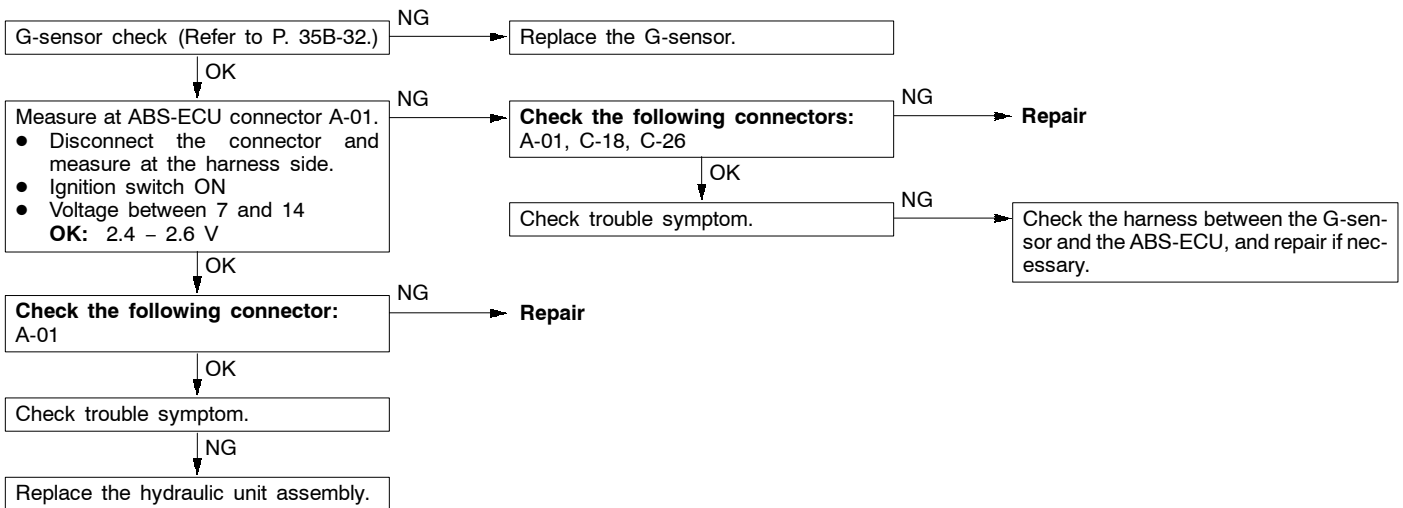


Trouble symptom	Main cause	Remedy
Even when the transfer shift lever is in the "4H" position, the 4WD indicator lamp does not illuminate.	Broken harness wire between the 4WD indicator-ECU and the freewheel engage switch, or broken earth wire from the freewheel engage switch	Repair the harness.
	Freewheel engage switch or 4WD position detection switch is defective.	Replace the switch.
	Broken harness wire between the 4WD indicator-ECU and the 4WD position detection switch	Repair the harness.
	Broken wire in the 4WD indicator-ECU circuit	4WD indicator-ECU inspection (Refer to GROUP 22 – 4WD indicator-ECU.)
4WD indicator lamp illuminates regardless of the position of the transfer shift lever.	Short in the harness wire in the 4WD position detection switch circuit	Repair the harness.
	4WD position detection switch is defective.	Replace the switch.
	Short in the ABS-ECU circuit	Replace the ABS-ECU.
	Short in the 4WD indicator-ECU circuit	4WD indicator-ECU inspection (Refer to GROUP 22 – 4WD indicator-ECU.)
No indicator is illuminated	Power circuit in the 4WD indicator-ECU is defective.	Repair the harness.
	4WD indicator-ECU is defective.	4WD indicator-ECU inspection (Refer to GROUP 22 – 4WD indicator-ECU.)

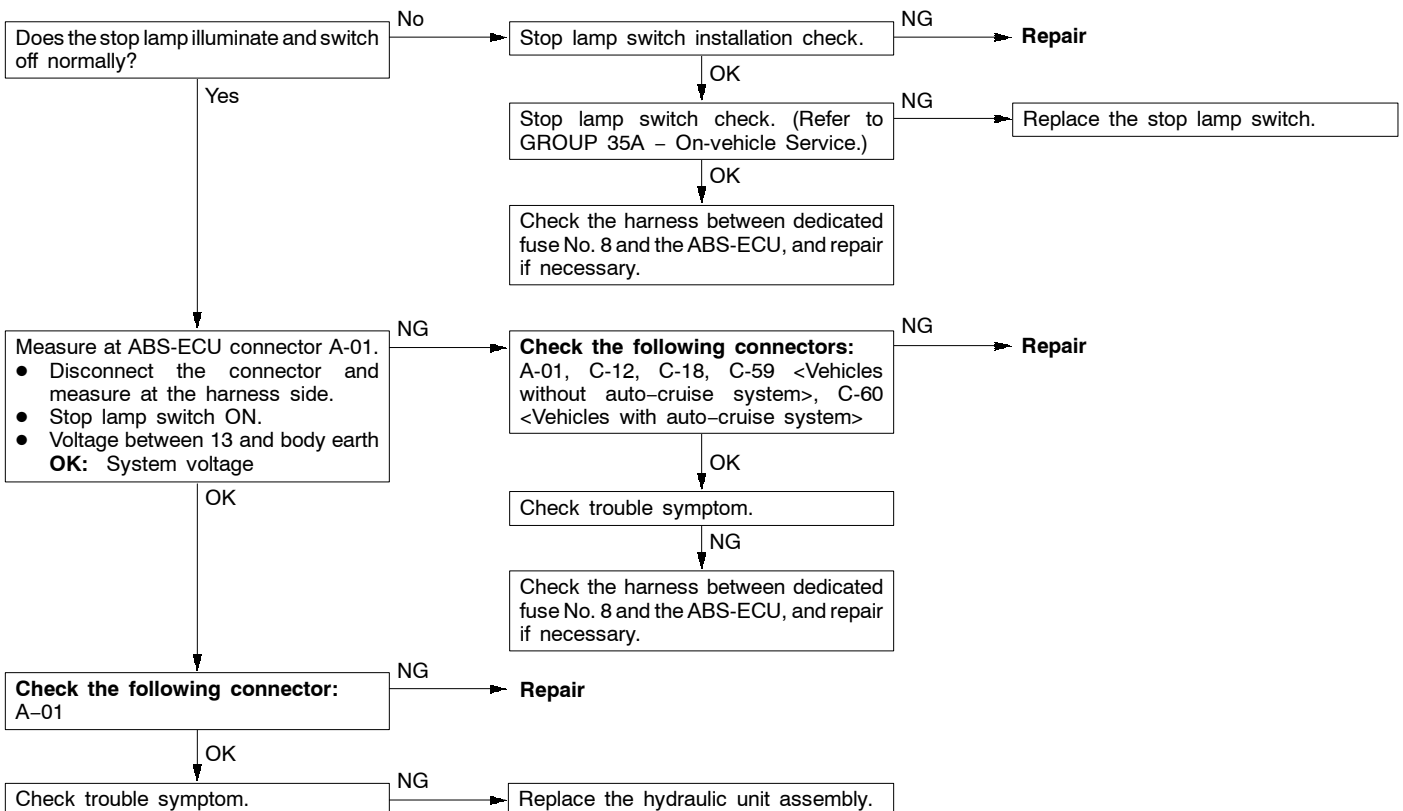
NOTE

When checking a short in the ABS-ECU circuit, remove the ABS-ECU connector and check if the 4WD indicator returns to normal. If it returns to normal, the ABS-ECU is defective. Furthermore, if the ABS-ECU is normal, then the 4WD indicator-ECU will be defective.

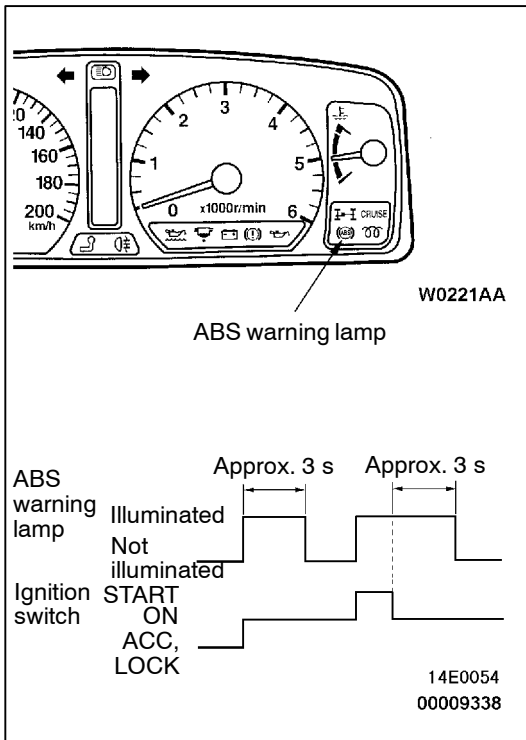
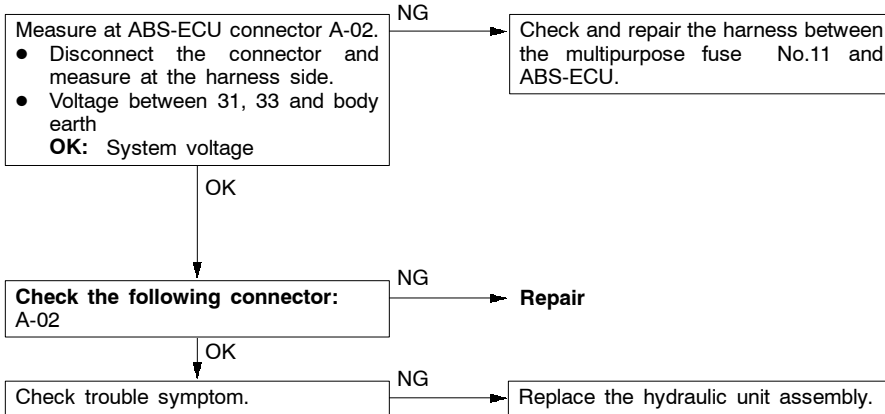
Code No. 32 G-sensor system	Probable cause
<p>This code is output at the following times:</p> <ul style="list-style-type: none"> • The G-sensor output is less than 0.5 V or more than 4.5 V. • An open or short circuit is present in the G-sensor system. 	<ul style="list-style-type: none"> • Malfunction of G-sensor • Malfunction of wiring harness or connector • Malfunction of hydraulic unit assembly



Code No. 33 Stop lamp switch system	Probable cause
<p>These codes are output at the following times:</p> <ul style="list-style-type: none"> • When the stop lamp switch is not be turned off (when the stop lamp switch stays on for 15 minutes or more although the ABS is not operating) • When the ABS-ECU determines that there is an open circuit in harness of the stop lamp switch system. 	<ul style="list-style-type: none"> • Malfunction of stop lamp switch • Malfunction of harness or connector • Malfunction of hydraulic unit assembly



Code No. 41, 42, 43 Solenoid valve system	Probable cause
Code No. 51 Valve relay system	
Code No. 53 Motor relay, Motor system	
These codes are output in the following cases: • If there is an open or short circuit in the ABS-ECU power circuit (solenoid valve, motor). • If there is a malfunction in the hydraulic unit inner circuit.	• Malfunction of harness or connector • Malfunction of hydraulic unit assembly



ABS WARNING LAMP INSPECTION

35201200161

Check that the ABS warning lamp illuminates as follows.

1. When the ignition key is turned to “ON”, the ABS warning lamp illuminates for approximately 3 seconds and then switches off.
2. When the ignition key is turned to “START”, the ABS warning lamp remains illuminated.
3. When the ignition key is turned from “START” back to “ON”, the ABS warning lamp illuminates for approximately 3 seconds and then switches off.

NOTE

The ABS warning lamp may remain on until the vehicle reaches a speed of several km/h. This is limited to cases where diagnosis code Nos.21 – 24 and 55 have been recorded because of a previous problem occurring. In this case, the ABS-ECU keeps the warning lamp illuminated until the problem corresponding to that diagnosis code can be detected.

4. If the illumination is other than the above, check the diagnosis codes.

INSPECTION CHART FOR TROUBLE SYMPTOMS

35201140555

Get an understanding of the trouble symptoms and check according to the inspection procedure chart.

Trouble symptoms		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	35B-14
	Communication with ABS only is not possible.	2	35B-14
When the ignition key is turned to “ON” (engine stopped), the ABS warning lamp does not illuminate.		3	35B-15
The ABS warning lamp remains illuminated after the engine is started.		4	35B-16
Faulty ABS operation	Unequal braking power on both sides	5	35B-17
	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

1. If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate even though sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem occurred while driving under such conditions as these.
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

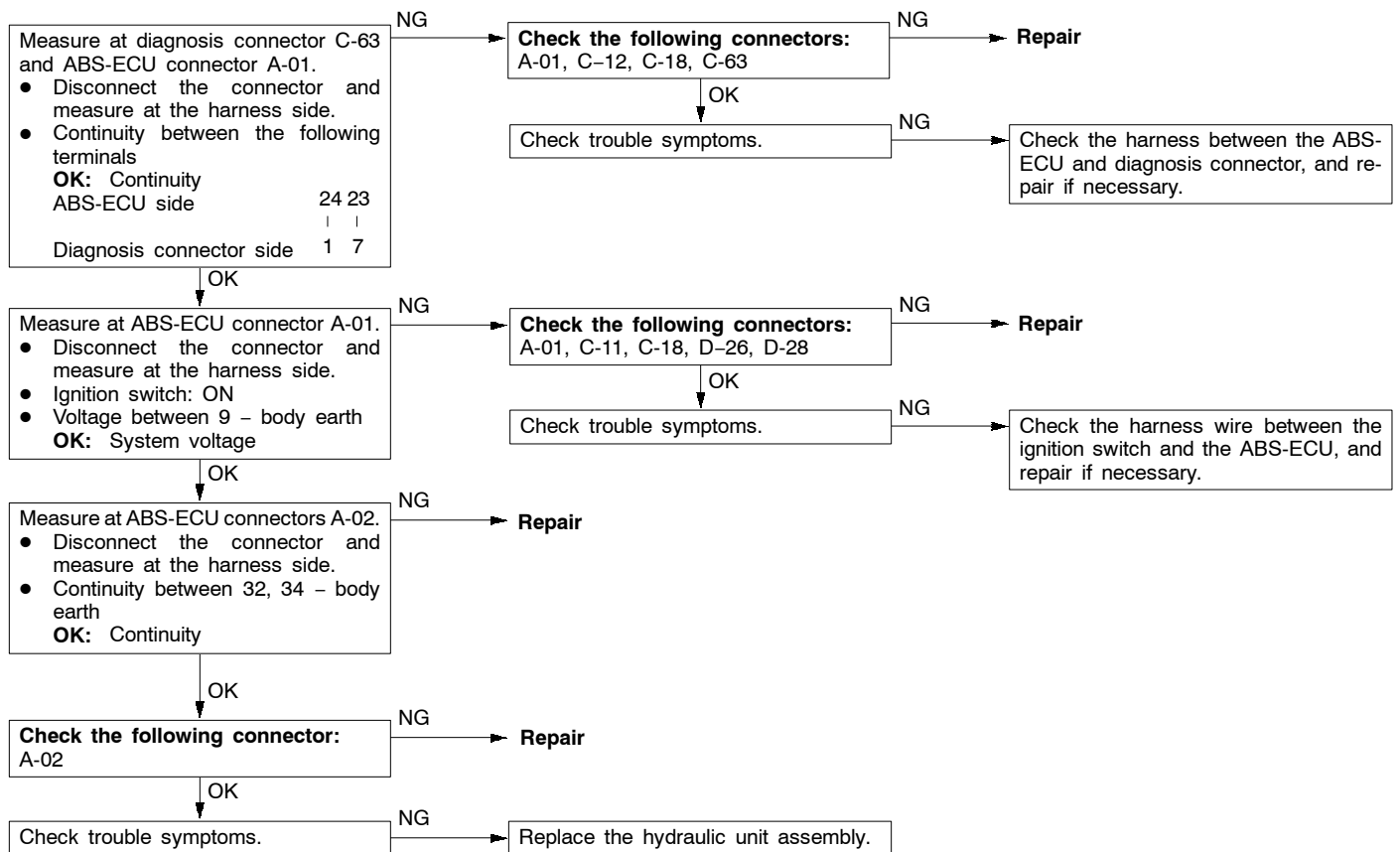
Inspection Procedure 1

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

Refer to GROUP 13A – Troubleshooting.

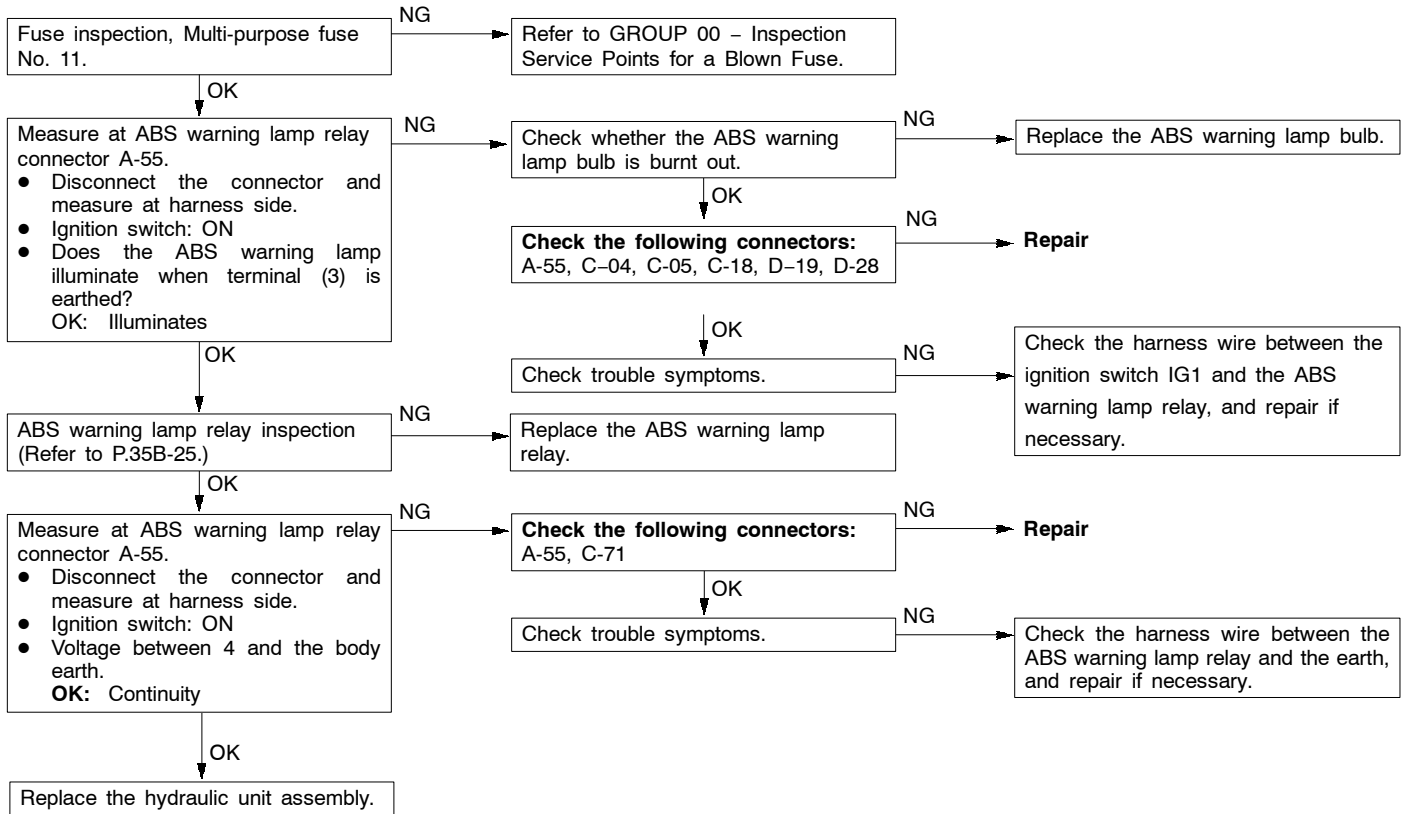
Inspection Procedure 2

Communication with MUT-II is not possible. (Communication with ABS only is not possible.)	Probable cause
When communication with the MUT-II is not possible, the cause is probably an open circuit in the ABS-ECU 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 hydraulic unit assembly



Inspection Procedure 3

When ignition key is turned to “ON” (engine stopped), ABS warning lamp does not illuminate.	Probable cause
Lamp power supply circuit disconnections, lamp bulb burnouts, ABS warning lamp relay faults, or circuit breaks between the ABS warning lamp and the ground are possible causes.	<ul style="list-style-type: none"> ● Blown fuse ● Burnt out ABS warning lamp bulb ● Malfunction of the ABS warning lamp relay ● Malfunction of wiring harness or connector ● Malfunction of hydraulic unit assembly

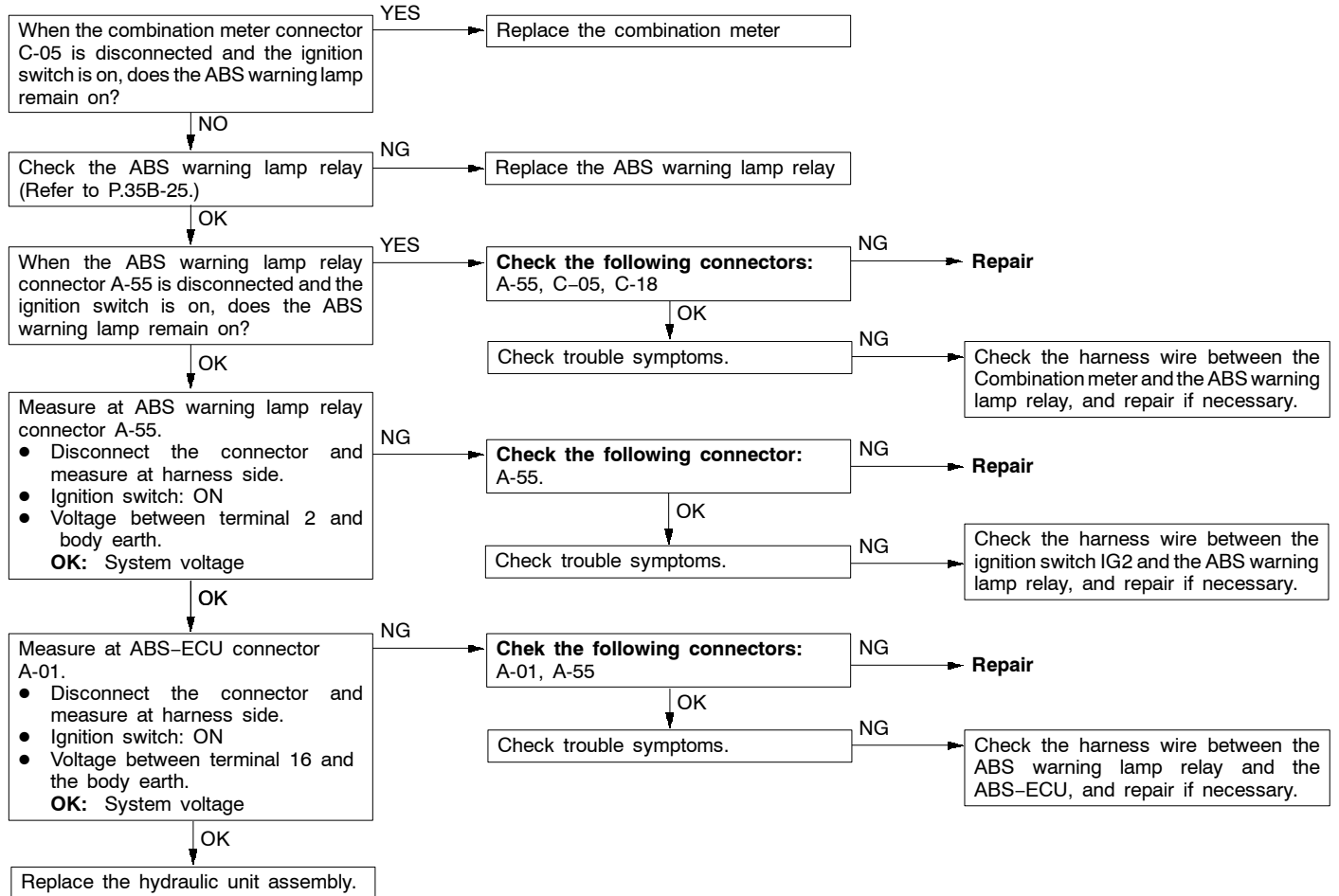


Inspection Procedure 4

The ABS warning lamp remains illuminated after the engine is started.	Probable cause
It is probably a short circuit in the ABS warning lamp circuit.	<ul style="list-style-type: none"> ● Defective combination meter ● Defective ABS warning lamp relay ● Malfunction of wiring or connector ● Defective hydraulic unit assembly

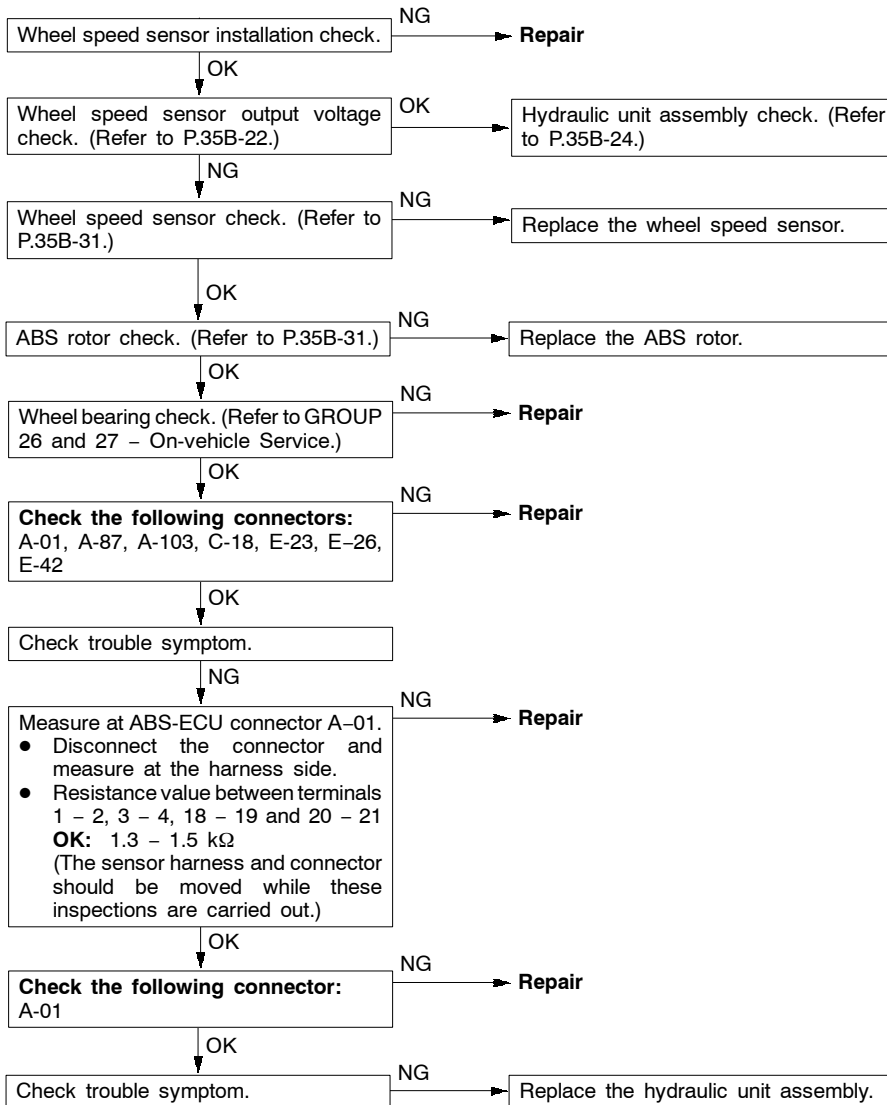
NOTE

This trouble symptom is limited to cases where communication with the MUT-II is possible (ABS-ECU power supply is normal) and the diagnosis code is a normal diagnosis code.



Inspection Procedure 5

Brake operation is abnormal.	Probable cause
This varies depending on the driving conditions and the 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 ● Malfunction of wheel speed sensor ● Malfunction of ABS rotor ● Malfunction of wheel bearing ● Malfunction of hydraulic unit assembly



DATA LIST REFERENCE TABLE

35201150299

The following items can be read by the MUT-II from the ABS-ECU input data.

1. When the system is normal

Item No.	Check item	Checking requirements	Normal value
11	Front-right wheel speed sensor	Perform a test run	Vehicle speeds displayed on the speedometer and MUT-II are identical.
12	Front-left wheel speed sensor		
13	Rear-right wheel speed sensor		
14	Rear-left wheel speed sensor		
16	ABS-ECU power supply voltage	Ignition switch power supply voltage and valve monitor voltage	9 – 16 V
25	4WD position detection switch	Place the transfer lever at 4H.	ON
		Place the transfer lever at 2H.	OFF
26	Free wheel engage switch	Engage 4WD	ON
		Engage 2WD	OFF
32	G-sensor output voltage	Stop the vehicle.	2.4 – 2.6 V
		Perform a test run.	Display value fluctuates with a mean value of 2.5 V.
33	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF

2. When the ABS-ECU shut off ABS operation.

When the diagnosis system stops the ABS-ECU, the MUT-II display data will be unreliable.

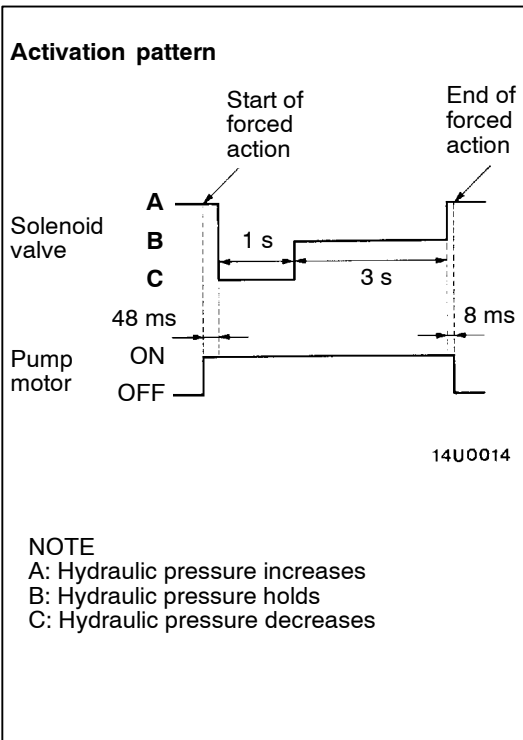
ACTUATOR TEST REFERENCE TABLE

35201160209

The MUT-II activates the following actuators for testing.

NOTE

1. If the ABS-ECU runs down, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h, forced actuation will be cancelled.
3. During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.



ACTUATOR TEST SPECIFICATIONS

No.	Item	
01	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-right wheel	
03	Solenoid valve for rear wheel	

CHECK AT ABS-ECU

35201180359

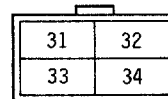
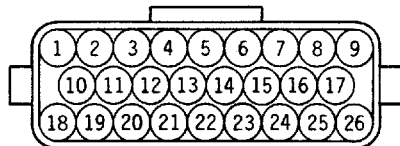
TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (32) and (34) (ground terminals) and each respective terminal.

NOTE

Do not measure terminal voltage for approximately three seconds after the ignition switch is turned on. The ABS-ECU performs the initial check during that period.

2. The terminal layouts are shown in the illustrations below.



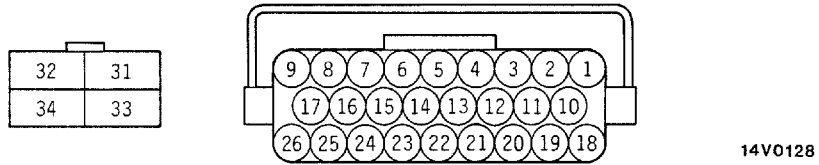
14V0127

Connector terminal No.	Signal	Checking requirement	Normal condition	
6	Engine control module	Ignition switch: "ON" (The motor is on approx.1 second after engine is started)	2 V or less	
7	G-sensor signal	Ignition switch: "ON"	2.38 – 2.62 V	
9	ABS-ECU power supply	Ignition switch: "ON"	System voltage	
		Ignition switch: "START"	0 V	
11	Input from freewheel engage switch	Ignition switch: "ON"	Transfer lever position: "2H"	System voltage
			Transfer lever position: "4H"	0 V

Connector terminal No.	Signal	Checking requirement		Normal condition
12	Input from 4WD detection switch	Ignition switch: ON	Transfer lever position: "2H"	System voltage
			Transfer lever position: "4H"	0 V
13	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch: "ON"	System voltage
			Stop lamp switch: "OFF"	0 V
14	G-sensor	Always		0V
16	Control output to ABS warning lamp relay.	Ignition switch: ON	The lamp is switch off.	2 V or less
			The lamp is illuminated.	System voltage
23	MUT-II	Connect the MUT-II		Serial communication with MUT-II
		Do not connect the MUT-II		1 V or less
24	Input from diagnosis indication selection	Connect the MUT-II		0 V
		Do not connect the MUT-II		Approximately 12 V
31	Solenoid valve power supply	Always		System voltage
33	Motor power supply			

RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

1. Turn the ignition switch off and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustration below.

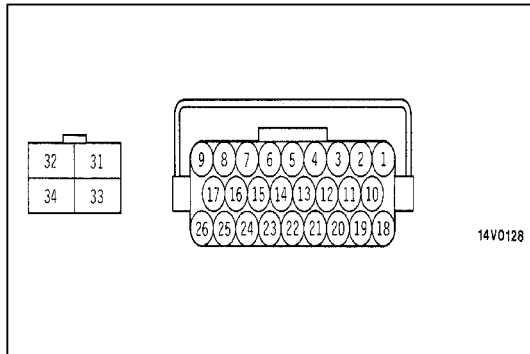


Connector terminal No.	Signal	Normal condition
20 – 21	Front-left wheel speed sensor	1.3 – 1.5 kΩ
1 – 2	Rear-right wheel speed sensor	1.3 – 1.5 kΩ
18 – 19	Front-right wheel speed sensor	1.3 – 1.5 kΩ
3 – 4	Rear-left wheel speed sensor	1.3 – 1.5 kΩ
32 – body earth	Solenoid valve earth	Continuity
34 – body earth	Motor earth	Continuity

ON-VEHICLE SERVICE

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ABS-ECU connector, and then use the special tool (inspection harness for connector pin contact pressure) to measure the output voltage at the harness-side connector.
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.	20	18	3	1
	21	19	4	2

Output voltage

**When measuring with a circuit tester:
70 mV or more**

**When measuring with an oscilloscope:
200 mV p-p or more**

4. If the output voltage is lower than the above values, the reason could be as follow:
 - Faulty wheel speed sensor.
 So replace the wheel speed sensor.

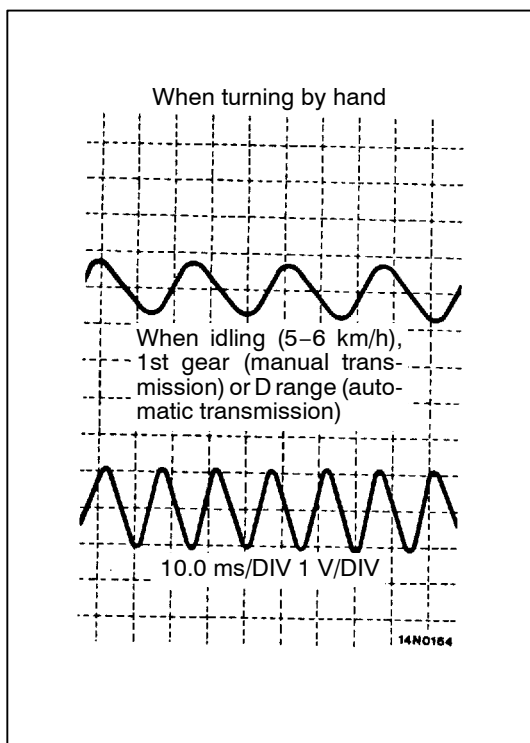
Inspecting Waveforms With An Oscilloscope

Use the following method to observe the output voltage waveform from each wheel sensor with an oscilloscope.

- Start the engine, and rotate the rear wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission). Turn the front wheels manually so that they rotate at a constant speed.

NOTE

1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The waveform measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.



Points In Waveform Measurement

Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (this is no problem if the minimum amplitude is 100 mV or more)	Axle hub eccentric or with large runout	Replace hub
Noisy or disturbed waveform	Open circuit in sensor	Replace sensor
	Open circuit in harness	Correct harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	ABS rotor with missing or damaged teeth	Replace ABS rotor

NOTE

The wheel speed sensor cable moves following motion of the front or rear suspension. Therefore, it is likely that it has an open circuit only when driving on rough roads and it functions normally on ordinary roads. It is, therefore, recommended to observe sensor output voltage waveform also under special conditions, such as rough road driving.

HYDRAULIC UNIT CHECK

35200170302

Caution

Turn the ignition switch off before connecting or disconnecting the MUT-II.

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

Caution

- (1) The roller of the braking force tester and the tyre 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.

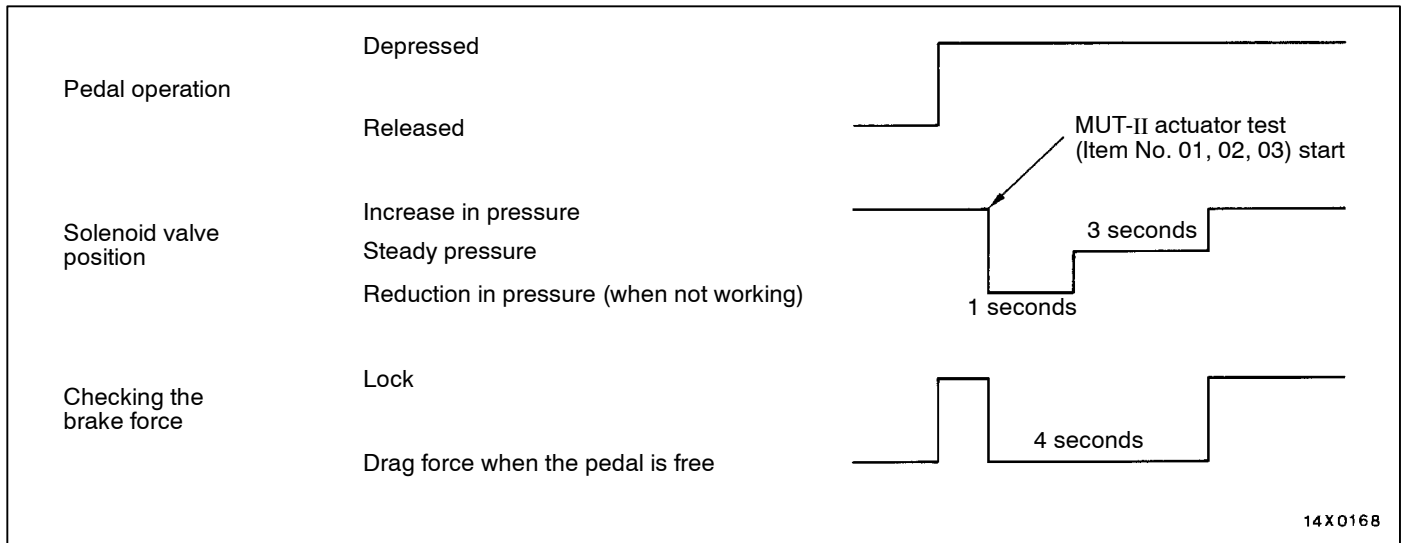
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.
3. Turn the ignition key to the OFF position and set the MUT-II.
4. After checking that the shift lever is in neutral, start the engine.
5. Use the MUT-II to force-drive the actuator.

NOTE

- (1) During the actuator test, the ABS warning lamp will illuminate and the anti-skid control will be cancelled.
 - (2) When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.
6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed. When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check that the braking force decreases when the actuator is force-driven.

Front wheel	785 – 981 N
Rear wheel	294 – 490 N

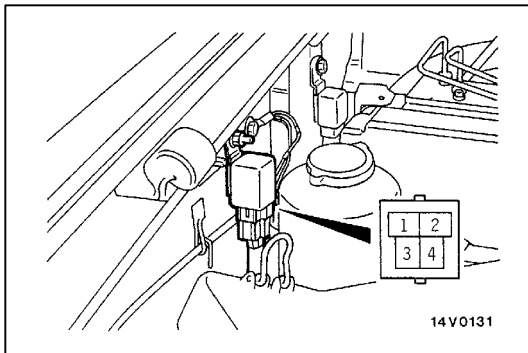
The result should be as shown in the following diagram.



7. If the result of inspection is abnormal, correct according to the “Diagnosis Table” (Refer to P.35B-25).
8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

Diagnosis Table

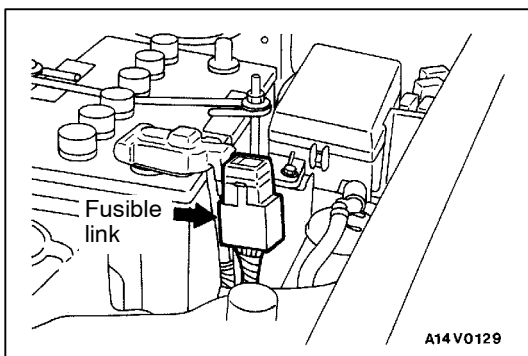
No.	Operation	Judgement – Normal	Judgement – Abnormal	Probable cause	Remedy
01	(1) Depress brake pedal to lock wheel. (2) Using the MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force.	Brake force released for 4 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than hydraulic unit	Check and clean brake line
02				Clogged hydraulic circuit in hydraulic unit	Replace hydraulic unit assembly
03			Brake force is not released	Incorrect hydraulic unit brake tube connection	Connect correctly
				Hydraulic unit solenoid valve not functioning correctly	Replace hydraulic unit assembly



ABS WARNING LAMP RELAY CONTINUITY CHECK

35201090263

Battery voltage	Terminal No.			
	1	2	3	4
Not applied			○	○
Applied	⊖	⊕		



REMEDY FOR A FLAT BATTERY

35200350232

When booster cables are used to start the engine when the battery is completely flat 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 recharged, install the fusible link (for ABS) and restart the engine; then check to be sure the ABS warning lamp is not illuminated.

MASTER CYLINDER AND BRAKE BOOSTER

Caution

Do not remove the check valve from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

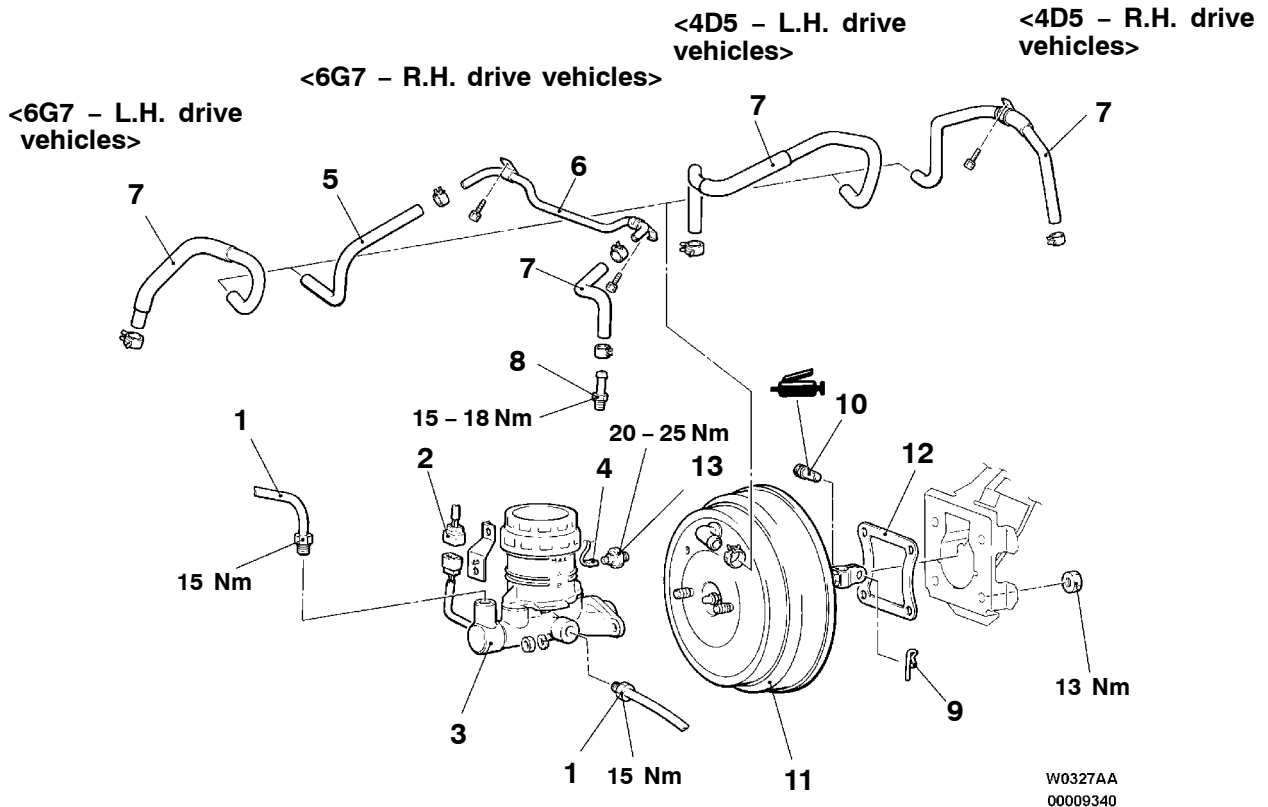
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to GROUP 35A – On-vehicle Service.)
- Brake Pedal Adjustment (Refer to GROUP 35A – On-vehicle Service.)



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00009340

Sealant: 3M ATD Part No. 8661 or equivalent

Removal steps

- | | |
|--|--|
| <p>1. Brake tube connection</p> <p>2. Brake fluid level sensor connector</p> <p>3. Master cylinder assembly</p> <p>►B◀ • Adjustment of clearance between brake booster push rod and primary piston</p> <p>4. Vacuum switch connector <4D5></p> <p>5. Vacuum hose</p> <p>6. Vacuum pipe</p> | <p>►A◀ 7. Vacuum hose (with built-in check valve)</p> <p>8. Fitting</p> <p>9. Snap pin</p> <p>10. Pin assembly</p> <p>11. Brake booster</p> <p>12. Sealer</p> <p>13. Vacuum switch <4D5></p> |
|--|--|

INSTALLATION SERVICE POINTS

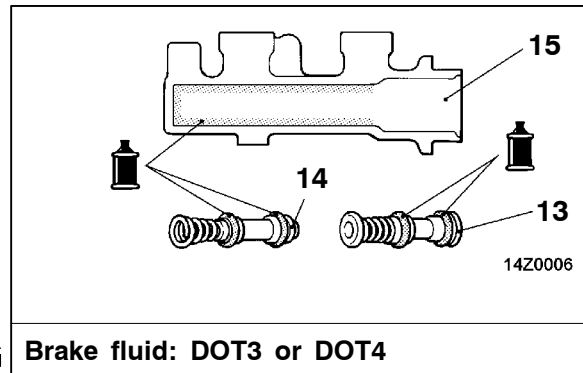
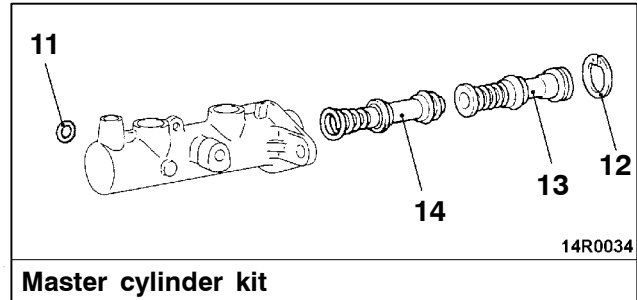
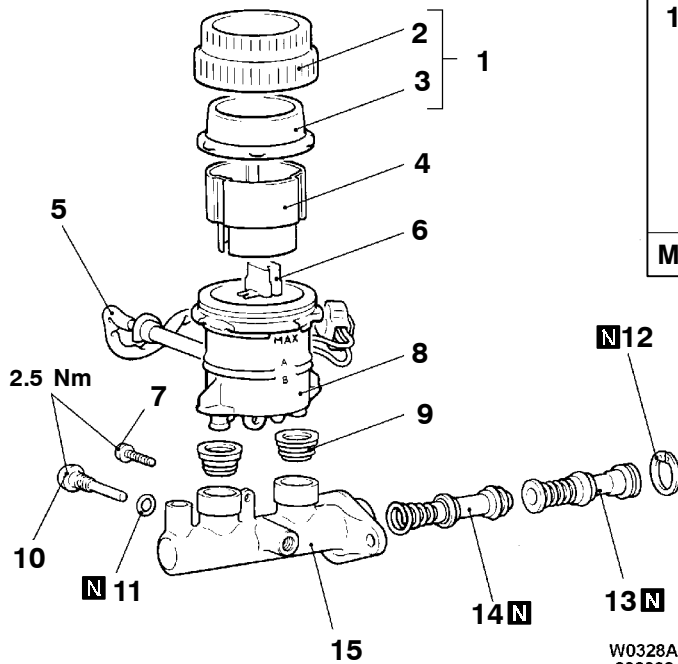
Refer to GROUP 35A – Master Cylinder and Brake Booster.

**MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY**

35200450178

Caution

Do not disassemble the primary piston and secondary piston assembly.



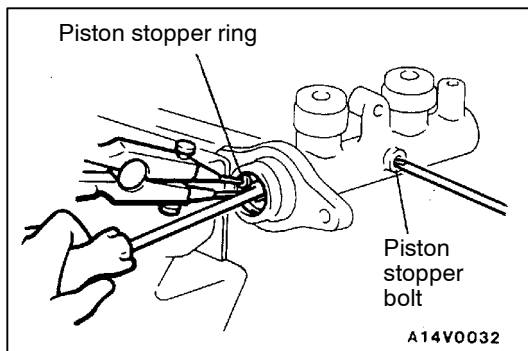
W0328AA
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Disassembly steps

1. Reservoir cap assembly
2. Reservoir cap
3. Diaphragm
4. Filter
5. Brake fluid level sensor
6. Float
7. Reservoir stopper bolt
8. Reservoir tank



9. Reservoir seal
10. Piston stopper bolt
11. Gasket
12. Piston stopper ring
13. Primary piston assembly
14. Secondary piston assembly
15. Master cylinder body



DISASSEMBLY SERVICE POINT

◀▶ PISTON STOPPER BOLT/PISTON STOPPER RING DISASSEMBLY

Remove the piston stopper bolt and piston stopper ring while depressing the piston.

INSPECTION

35200460027

- Check the inner surface of master cylinder body for rust or pitting.
- Check the primary and secondary pistons for rust, scoring, wear, damage or wear.
- Check the diaphragm for cracks and wear.

HYDRAULIC UNIT

35200860391

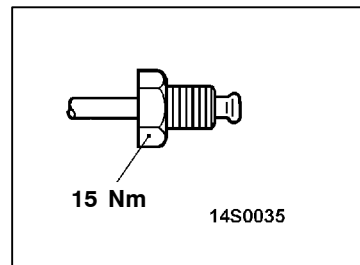
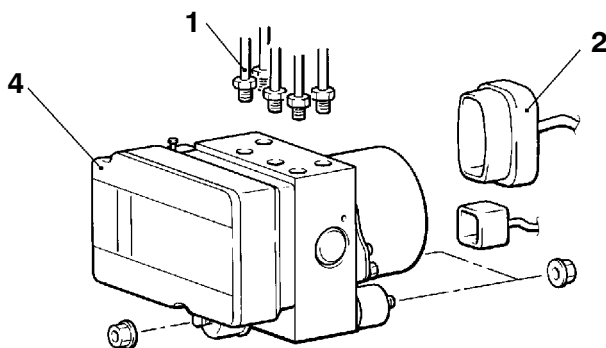
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

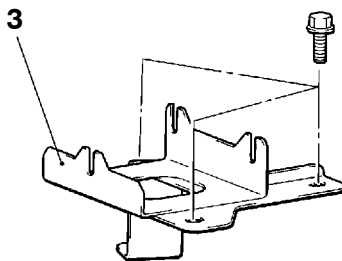
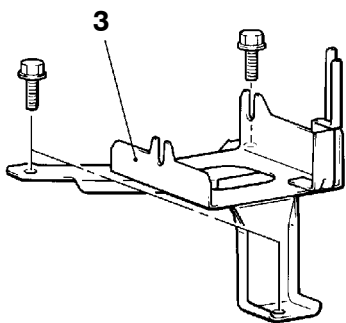
Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding (Refer to GROUP 35A – On-vehicle Service.)



<6G7, 4D5 – R.H. drive vehicles>

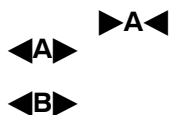
<4D5 – L.H. drive vehicles>



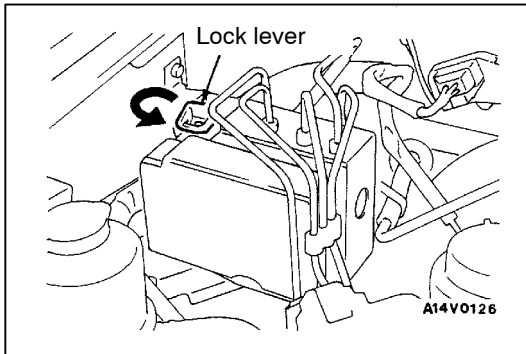
W0329AA

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Removal steps



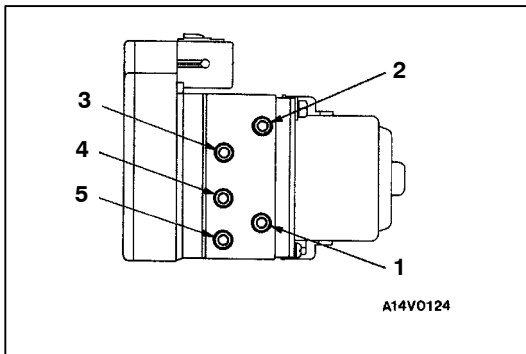
1. Brake tube
2. Harness connector
3. Bracket assembly
4. Hydraulic unit assembly

**REMOVAL SERVICE POINTS****◀A▶ HARNESS CONNECTOR REMOVAL**

Turn the lock lever in the direction shown in the illustration, and remove the harness.

◀B▶ HYDRAULIC UNIT REMOVAL**Caution**

1. The hydraulic unit assembly is heavy. Use care when removing it.
2. The hydraulic unit assembly cannot be disassembled. Never loosen its nuts or bolts.
3. Do not drop or shock the hydraulic unit assembly.
4. Do not turn the hydraulic unit assembly upside down or lay it on its side.

**INSTALLATION SERVICE POINT****▶A◀ BRAKE TUBE INSTALLATION**

Connect the tubes to the hydraulic unit assembly as shown in the illustration.

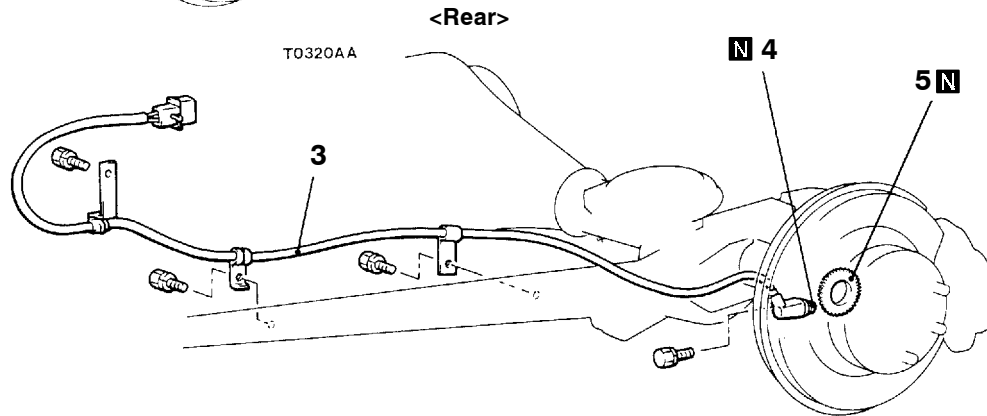
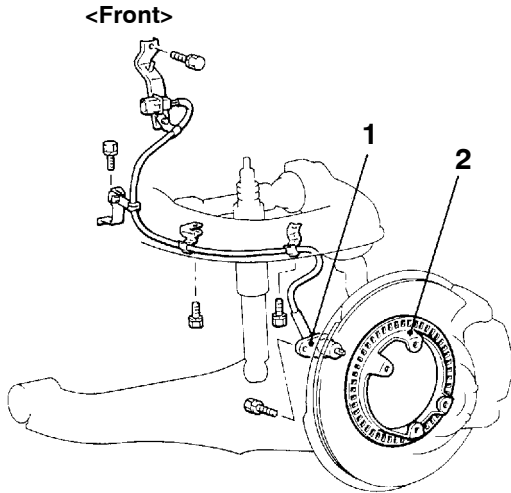
1. Master cylinder and load sensing proportioning valve <Front system>
2. Master cylinder <Rear system>
3. Load sensing proportioning valve <Rear system>
4. Front brake <R.H.>
5. Front brake <L.H.>

WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

Post-installation Operation

- Wheel Speed Sensor Output Voltage Measurement (Refer to P.35B-22.)



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00007720

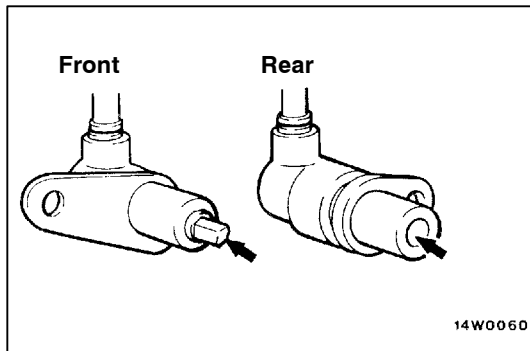
Rear speed sensor removal steps



1. Front speed sensor
2. Front ABS rotor (Refer to Group 26 - Front Hub Assembly.)
5. Rear ABS rotor (Refer to Group 27 - Axle Shaft.)



3. Rear speed sensor
4. O-ring



14W0060

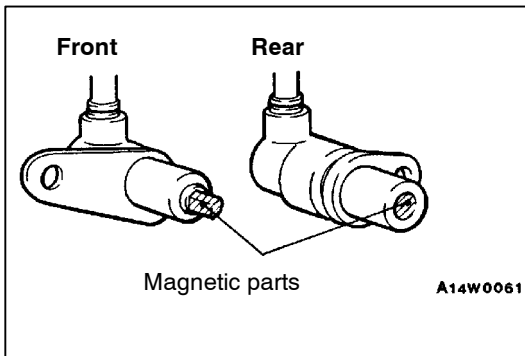
REMOVAL SERVICE POINT

FRONT SPEED SENSOR/REAR SPEED SENSOR REMOVAL

Caution

Be careful when handling the pole piece at the tip of the speed sensor and the toothed edge of the rotor so as not to damage them by contacting other parts.

35200840289

**INSPECTION****SPEED SENSOR CHECK**

1. Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip. Remove any foreign material.
Also check whether the pole piece is damaged. Replace it with a new one if it is damaged.

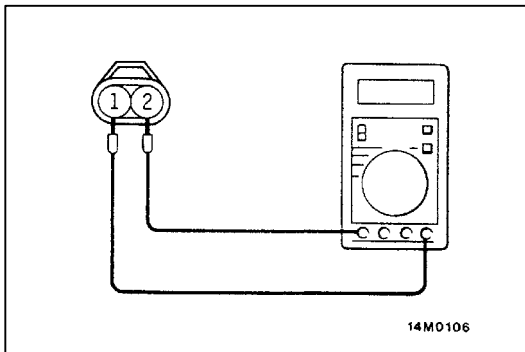
NOTE

The pole piece can become magnetized due to the magnet inside the speed sensor, causing foreign material to easily adhere to it. The pole piece may not be able to correctly sense the wheel rotation speed if foreign matter is on it or if it is damaged.

2. Measure the resistance between the speed sensor terminals.

Standard value: 1.3 – 1.5 k Ω

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



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

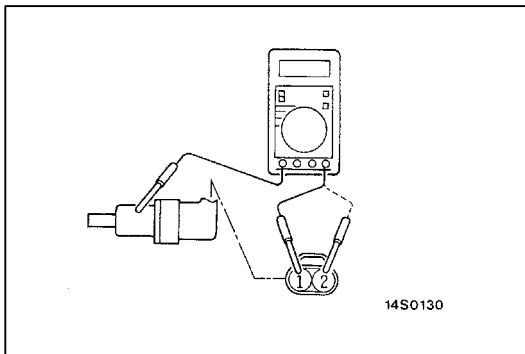
Standard value: 100 k Ω or more

If the speed sensor insulation resistance is not within the standard value range, replace with a new speed sensor.

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

NOTE

When checking for cable damage, remove the cable clamp part from the body and then gently bend and pull the cable near the clamp.

**TOOTHED ABS ROTOR CHECK**

Inspect to see if the ABS rotor is deformed or broken, and if faulty replace it with a new one.

G-SENSOR

35201010160

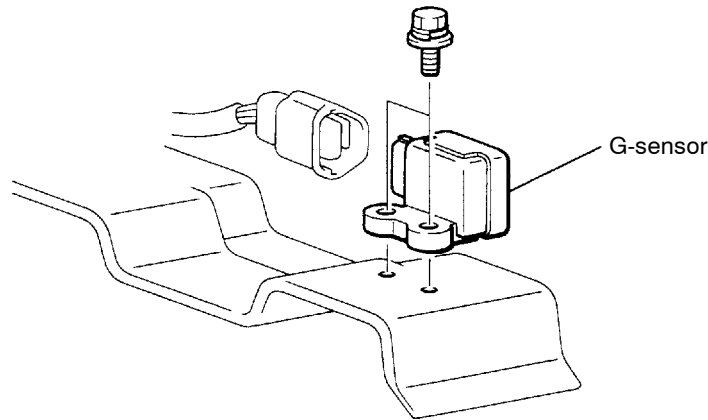
REMOVAL AND INSTALLATION

Caution

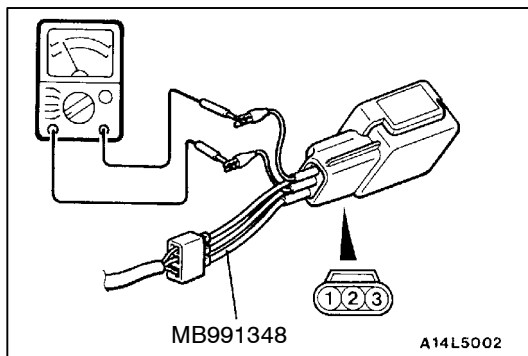
Do not drop or apply a shock on the G-sensor.

Pre-removal and Post-installation Operation

- Front and Rear Console Assembly Removal and Installation (Refer to GROUP 52A – Floor Console.)



A14V0100



INSPECTION

35201020149

G-SENSOR CHECK

1. Disconnect the G-sensor connector and connect special tool, between terminals of the disconnected connector.
2. With the ignition switch turned ON, read the voltage between terminals No. 2 and 3.

Standard value: 2.4 – 2.6 V

3. With special tool connected, rotate the sensor so that the arrow faces straight down. Read output voltage between terminals No. 2 and 3.

Standard value: 3.4 – 3.6 V

4. If the voltage deviates from the standard value, make sure that nothing is wrong with the power supply wire and ground wire and then replace the G-sensor.

