
SERVICE BRAKES

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120000044

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ANTI-SKID BRAKING SYSTEM (ABS) <2WD>	35B
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BASIC BRAKE SYSTEM

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GENERAL INFORMATION

120002235

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

- A dual type master cylinder is equipped in all models.
- Both a single type and a tandem type brake booster have been adopted.
- The following types of front brake have been adopted.

Floating caliper, double-piston, ventilated disc brakes (V4-W43, V5-W43) or floating caliper, single-piston, ventilated disc brakes (V4-S60, V5-S60).

- Both disc brakes and drum brakes have been adopted as the rear brakes.
Floating caliper, single-piston, solid disc brakes (S5-S38) or leading-trailing type drum brakes.

Items	2WD Wagon	2WD Panel van and window van <Standard wheelbase>	2WD Panel van and window van <Long wheelbase>	4WD Wagon	4WD Panel van and window van
Master cylinder I.D. mm	23.8	23.8	23.8	23.8	23.8
Brake booster effective dia. of power cylinder mm	205 + 230	230 or 205 + 230*2	205 + 230	205 + 230	205 + 230
Brake booster boosting ratio	6.5 <Petrol-powered vehicles> 7.0 <Diesel-powered vehicles>	4.5 or 6.5*2 <Petrol-powered vehicles> 5.5 or 7.0*2 <Diesel-powered vehicles>	6.5 <Petrol-powered vehicles> 7.0 <Diesel-powered vehicles>	6.5 <Petrol-powered vehicles> 7.0 <Diesel-powered vehicles>	6.5 <Petrol-powered vehicles> 7.0 <Diesel-powered vehicles>
Load sensing proportioning valve decompression ratio	0.15	0.15	0.15	0.15	0.15
Front brakes disc effective dia. mm	200	200	200	228	228
Front brakes wheel cylinder I.D. mm	60.3 or 42.9*1	60.3 or 42.9*1	42.9	42.9	42.9
Rear disc brakes disc effective dia. mm	—	—	—	272	—
Rear disc brakes wheel cylinder I.D. mm	—	—	—	38.1	—
Rear drum brakes drum I.D. mm	254	254	270	—	270
Rear drum brakes wheel cylinder I.D. mm	22.2	22.2	23.8	—	22.2
Rear drum brakes lining thickness mm	4.6	4.6	4.6	—	4.6

NOTE

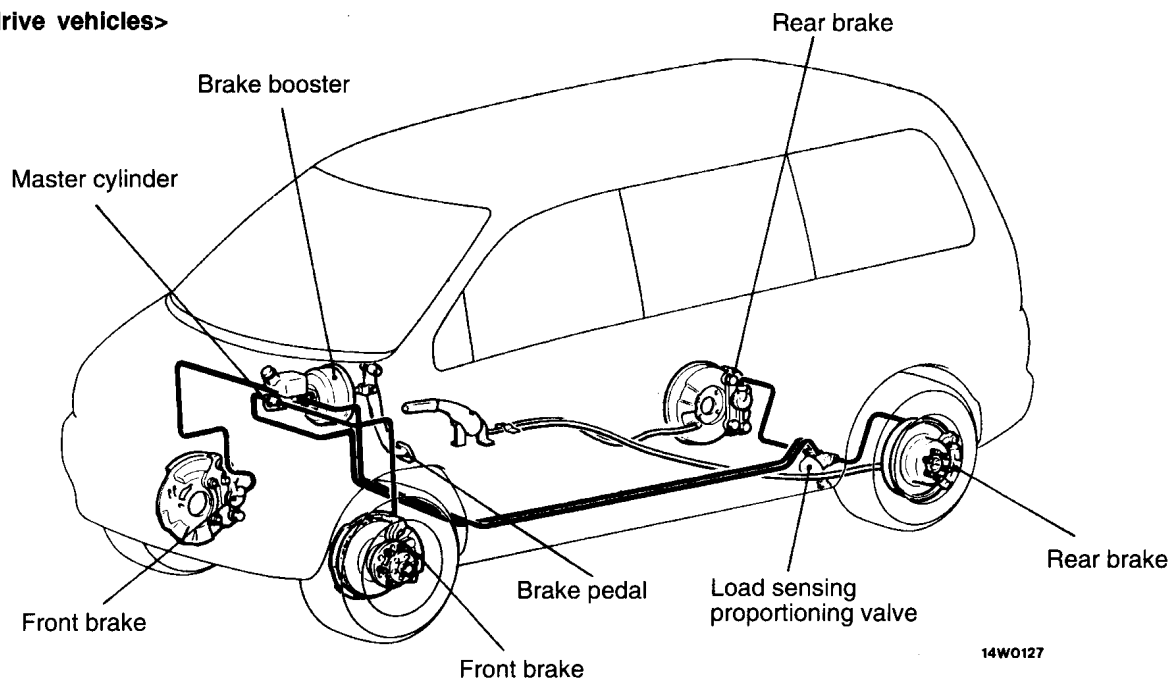
*1 : Vehicles with 4G64, 4D56 engines and ABS.

*2 : Vehicles with ABS.

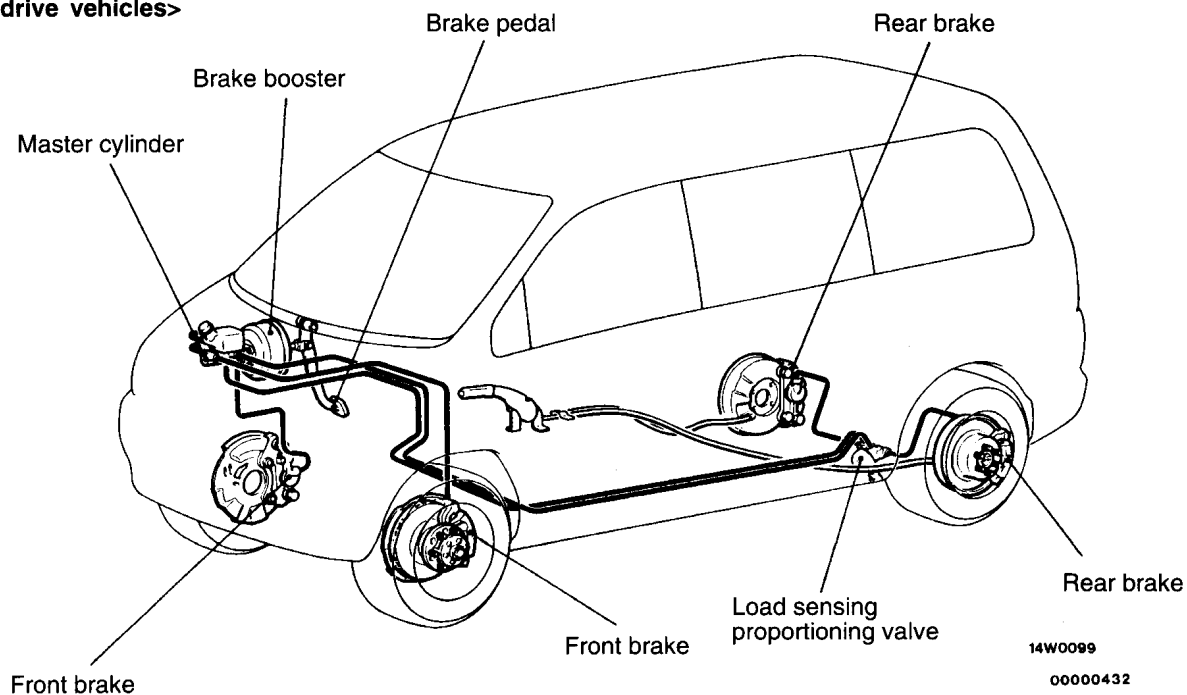
CONSTRUCTION DIAGRAM

120000047

<L.H. drive vehicles>



<R.H. drive vehicles>



SERVICE SPECIFICATIONS

120002236

Items			Standard value	Limit
Brake pedal height mm		L.H. drive vehicles	144–149	–
		R.H. drive vehicles	153–158	–
Brake pedal free play mm			3–8	–
Brake pedal to floor board clearance mm		2WD, 4WD Panel van and window van	85 or more	–
		4WD Wagon	75 or more	–
Load sensing proportioning valve output pressure kPa (Input pressure kPa)	2WD Panel van and window van	When load sensing spring length is 200.0 mm (when unladen)	2,626–3,410 (5,884)	–
			3,234–4,606 (11,760)	–
		When load sensing spring length is 235.5 mm (when laden)	8,526–10,080 (11,760)	–
	4WD Panel van and window van	When load sensing spring length is 200.0 mm (when unladen)	3,528–3,469 (5,884)	–
			3,234–4,606 (11,760)	–
		When load sensing spring length is 235.5 mm (when laden)	6,076–7,448 (11,760)	–
	Wagon	When load sensing spring length is 200.0 mm (when unladen)	3,528–4,508 (5,884)	–
			4,214–5,586 (11,760)	–
		When load sensing spring length is 218.0 mm (when laden)	7,840–9,408 (11,760)	–
Load sensing spring length <Distance between spring ends> mm			198–202	–
Booster push rod to master cylinder piston clearance mm		Diesel-powered vehicles	1.00–1.40	–
		Single brake booster <Petrol-powered vehicles>	0.65–1.05	–
		Tandem brake booster <Petrol-powered vehicles>	0.70–1.20	–
Front disc brake pad thickness mm			10	2.0
Front brake disc thickness mm			24	22.4
Front brake disc runout mm			–	0.07
Front disc brake drag force (tangential force of wheel mounting bolts) N			69 or less	–
Rear disc brake pad thickness mm			9.0	2.0
Rear brake disc thickness mm			18	16.4
Rear brake disc runout mm			–	0.08

Items	Standard value	Limit
Rear disc brake drag force (tangential force of wheel mounting bolts) N	69 or less	–
Rear drum brake lining thickness mm <Vehicles with drum brake>	4.7	1.0
Rear drum inside diameter mm <Vehicles with drum brake>	2WD Standard wheelbase	254.0
	2WD Long wheelbase, 4WD Panel van and window van	270.0
Rear drum brake lining thickness mm <Vehicles with disc brake>	6.5	4.5
Rear drum inside diameter mm <Vehicles with disc brake>	197.0	198.0
Front hub end play mm	0.05	–
Rear axle shaft axial play mm	–	0.25

LUBRICANTS

120000049

Items	Specified lubricant
Brake fluid	DOT3 or DOT4
Brake piston seal	Repair kit grease
Guide pin boot inner surfaces	
Lock pin boot inner surfaces	
Piston boot mounting grooves	
Brake piston boot inner surfaces	
Lock pin bush inner surfaces	
Piston cup surface	
Rear brake shoe and backing plate contact surfaces	Brake grease SAE J310, NLGI No. 1
Auto adjuster assembly	

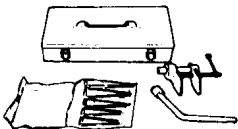
SEALANTS

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Items	Specified sealant	Remarks
Thread part fitting	3M ATD Part No. 8663 or equivalent	Semi-drying sealant
Vacuum switch		
Shoe hold-down pin	3M ATD Part No. 8513 or equivalent	Drying sealant

SPECIAL TOOLS

120000051

Tool	Number	Name	Use
	MB990964 MB990520 MB990621 MB990623	Brake tool set	Pushing-in of the disc brake piston Installation of drum brake wheel cylinder piston cup

TROUBLESHOOTING

120000052

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
	Auto adjuster malfunction	Adjust
	Drum eccentricity or uneven wear	Repair or replace as necessary
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 or lining	
	Brake booster malfunction	
	Clogged brake line	
	Grease or oil on pad or lining surface	Replace
	Load sensing proportioning valve malfunction	
	Auto adjuster malfunction	Adjust
Increased pedal stroke (Reduced pedal to floor board clearance)	Air in brake system	Bleed air
	Worn lining or pad	Replace
	Broken vacuum hose	
	Faulty master cylinder	
	Brake fluid leaks	Correct
	Auto adjuster malfunction	Adjust
	Excessive push rod to master cylinder clearance	
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	
	Broken rear drum brake shoe 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 lining or pad	Replace
	Caliper to wheel interference	Correct or replace
	Dust cover to disc interference	
	Bent brake backing plate	
	Cracked drums or brake disc	
Squealing, groaning or chattering noise when brakes are applied	Disc brakes—Missing or damaged brake pad anti-squeak shim	Replace
	Brake drums and linings, discs and pads worn or scored	Correct or replace
	Improper lining parts	
	Disc brake-burred or rusted calipers	Clean or deburr
	Dirty, greased, contaminated or glazed linings	Clean or replace
	Drum brakes—Weak, damaged or incorrect shoe hold-down springs, loose or damaged shoe hold-down pins and springs	Correct or replace
	Incorrect brake pedal or booster push rod	Adjust

Symptom	Probable cause	Remedy
Squealing, noise when brakes are not applied	Bent or warped backing plate causing interference with drum	Replace
	Drum brakes—Weak, damaged or incorrect shoe-to-shoe spring	
	Poor return of brake booster or master cylinder or wheel cylinder	
	Loose or extra parts in brakes	Retighten
	Improper positioning of pads in caliper	Correct
	Improper installation of support mounting to caliper body	
	Improper machining of drum causing interference with backing plate or shoe	Replace drum
	Disc brakes—Rusted, stuck	Lubricate or replace
	Worn, damaged or insufficiently lubricated wheel bearings	
	Incorrect brake pedal or booster push-rod	Adjust
Groaning clicking or rattling noise when brakes are not applied	Stones or foreign material trapped inside wheel covers	Remove stones, etc.
	Loose wheel nuts	Retighten
	Disc brakes—Loose installation bolt	
	Worn, damaged or dry wheel bearings	Lubricate or replace
	Disc brakes—Failure of shim	Replace
	Disc brakes—Wear on sleeve	
	Incorrect brake pedal or booster push-rod	Adjust

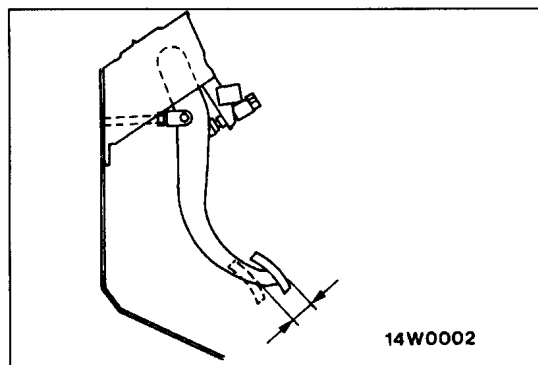
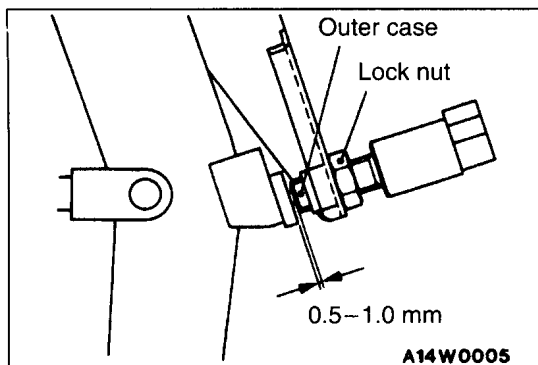
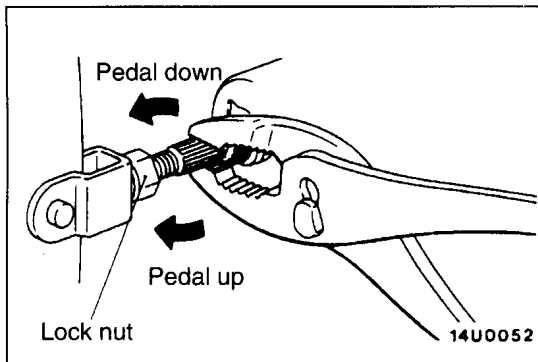
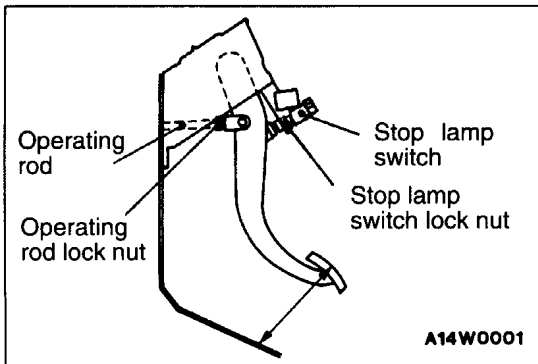
SERVICE ADJUSTMENT PROCEDURES

120002237

BRAKE PEDAL INSPECTION AND ADJUSTMENT

1. Measure the brake pedal height as illustrated. If the brake pedal height is not within the standard value, adjust as follows.

Standard value: <L.H. drive vehicles>144–149 mm
<R.H. drive vehicles>153–158 mm



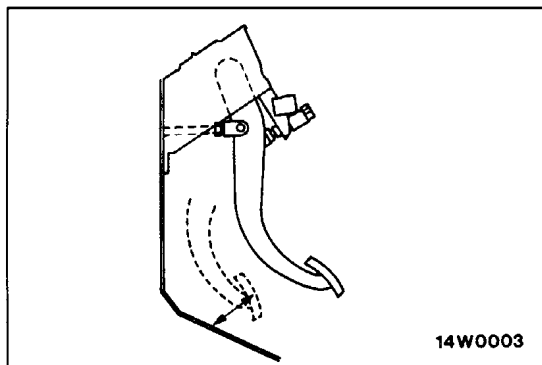
- (1) Disconnect the stop lamp switch connector, loosen the lock nut, and move the stop lamp switch to a position where it does not contact the brake pedal arm.
- (2) Adjust the brake pedal height by turning the operating rod with pliers (with the operating rod lock nut loosened), until the correct brake pedal height is obtained.
- (3) After screwing in the stop lamp switch until it contacts the brake pedal stopper (just before the brake pedal is caused to move), return the stop lamp switch 1/2 to 1 turn and secure by tightening 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 unpressed.

2. With the engine stopped, depress the brake pedal two or three times. After eliminating the vacuum in the power brake booster, press the pedal down by hand, and confirm that the amount of movement before resistance is met (the 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.

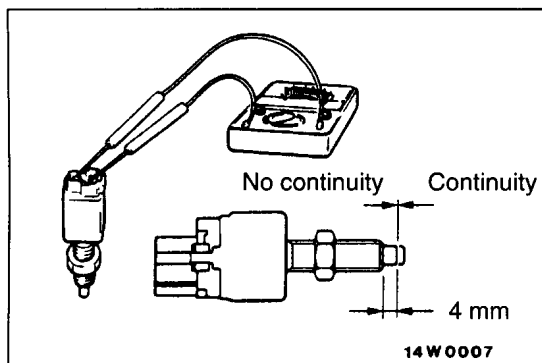
Check for excessive clearance and replace faulty parts as required.



3. 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: <2WD, 4WD Panel van and window van> 85 mm or more
<4WD Wagon> 75 mm or more

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.

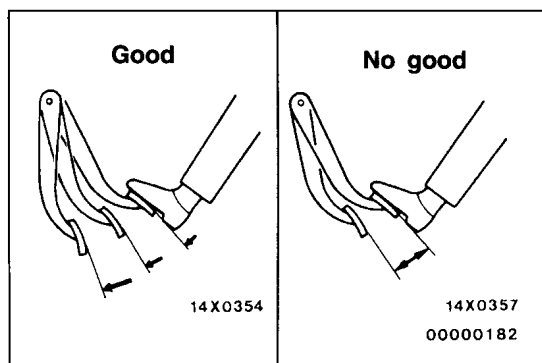


STOP LAMP SWITCH INSPECTION

120000054

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.



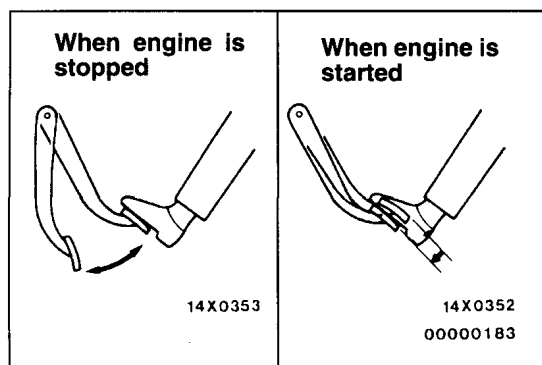
BRAKE BOOSTER OPERATING TEST

120000055

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

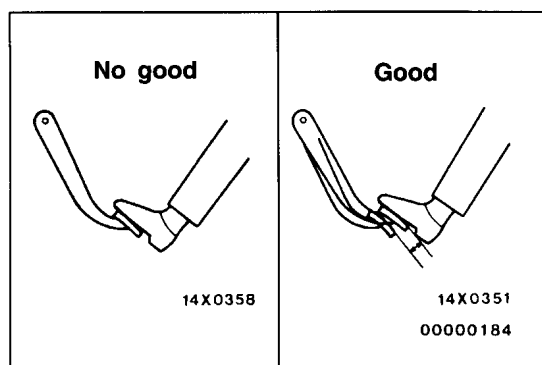
1. Run the engine for one or two minutes, and then stop it.

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.

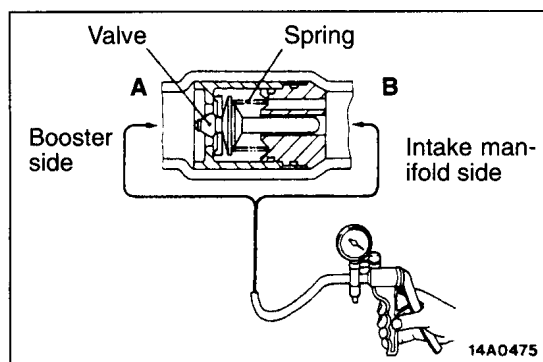
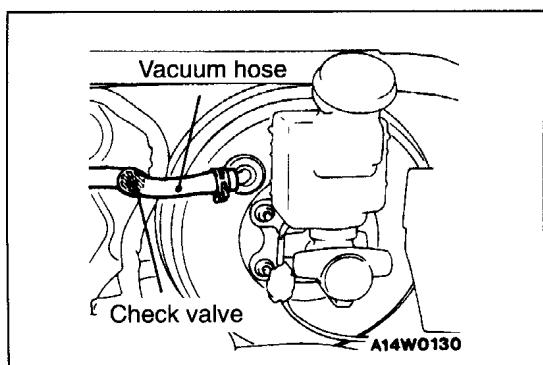


3. With the engine running, step on the brake pedal and then stop the engine.

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

120000056

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

1. Remove the vacuum hose.

NOTE

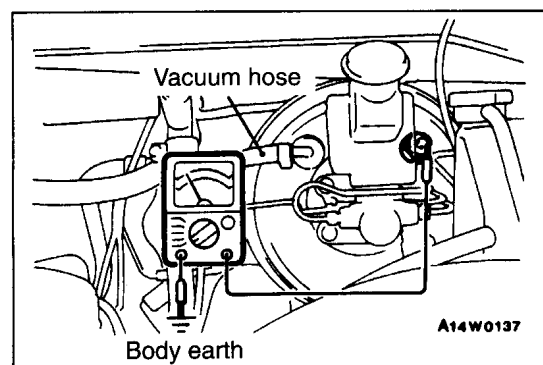
The check valve is press-fitted inside the vacuum hose at the position of the marking.

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 <DIESEL-POWERED VEHICLES>

120000057

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 not connected.

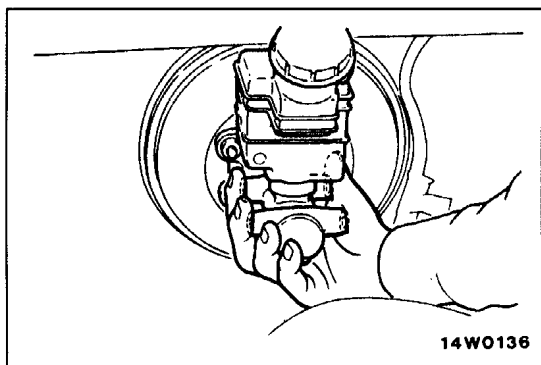
BLEEDING

120000058

Caution

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

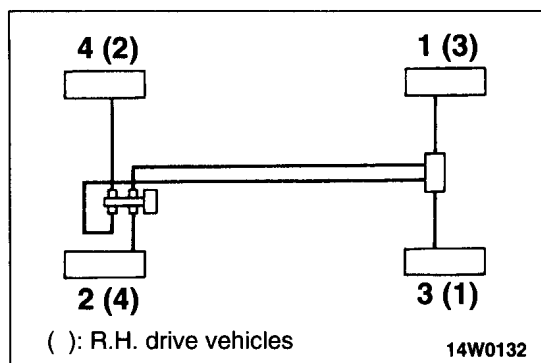
Specified brake fluid: DOT3 or DOT4



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 pipe line 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.

LOAD SENSING SPRING LENGTH CHECK AND ADJUSTMENT

120000059

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

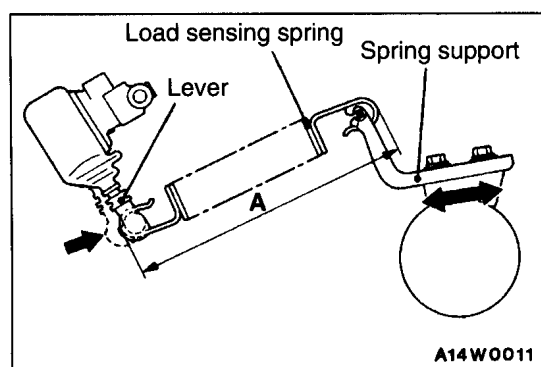
Caution

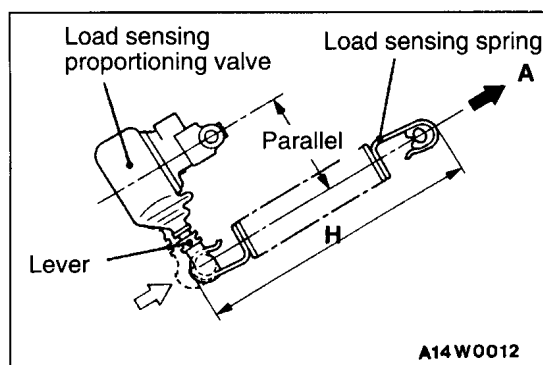
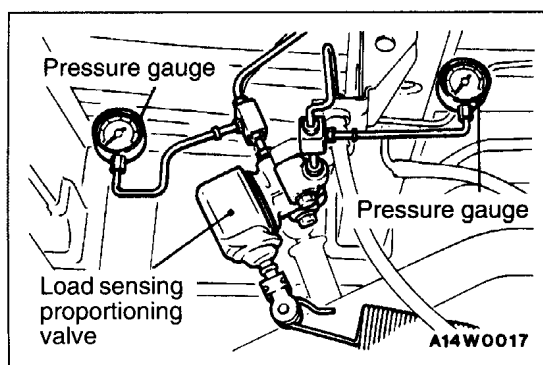
Never support the vehicle with jacks or other similar means.

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

Standard value (A): 198–202 mm

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





LOAD SENSING PROPORTIONING VALVE FUNCTION TEST

120002238

1. Connect pressure gauges to the input and output ports of the load sensing proportioning valve.
2. Bleed the system. (Refer to P.35A-11, GROUP 35B – Service Adjustment Procedures.)
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 then pull in the direction indicated by arrow A 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 side.

Check at this time whether or not the output fluid's pressure, relative to the load sensing proportioning valve's input fluid pressure, is within the standard value.

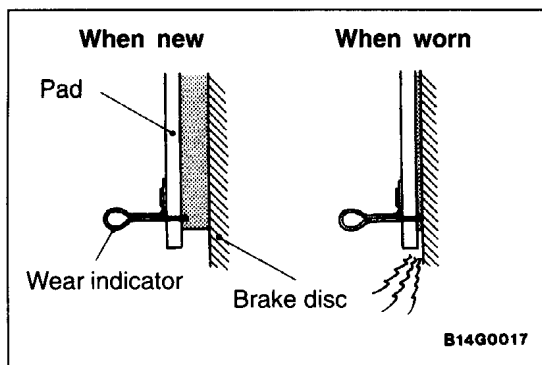
Standard value:

Items	Spring length H mm	Input fluid pressure kPa	Output fluid pressure kPa
2WD Panel van and window van	200.0* ¹	5,884	2,626–3,410
		11,760	3,234–4,606
	235.5* ²	11,760	8,526–10,080
4WD Panel van and window van	200.0* ¹	5,884	2,685–3,469
		11,760	3,234–4,606
	235.5* ²	11,760	6,076–7,448
Wagon	200.0* ¹	5,884	3,528–4,508
		11,760	4,214–5,586
	218.0* ²	11,760	7,840–9,408

NOTE

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

5. 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-11, GROUP 35B – Service Adjustment Procedures.)

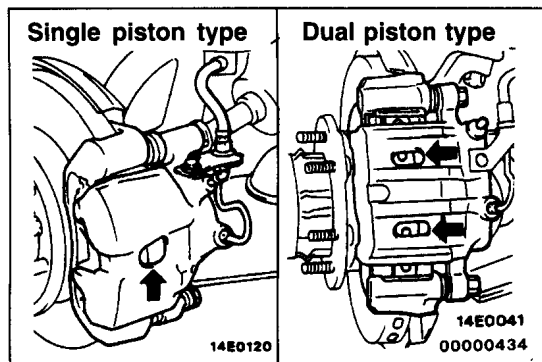


DISC BRAKE PAD CHECK AND REPLACEMENT

120000061

NOTE

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



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

Standard value: <Front> 10 mm
<Rear> 9.0 mm

Limit: 2.0 mm

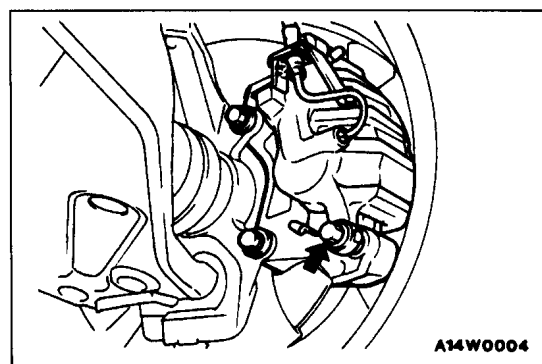
Caution

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, lock pin and guide pin.

2. Remove lock pin. Lift caliper assembly and retain with wires.

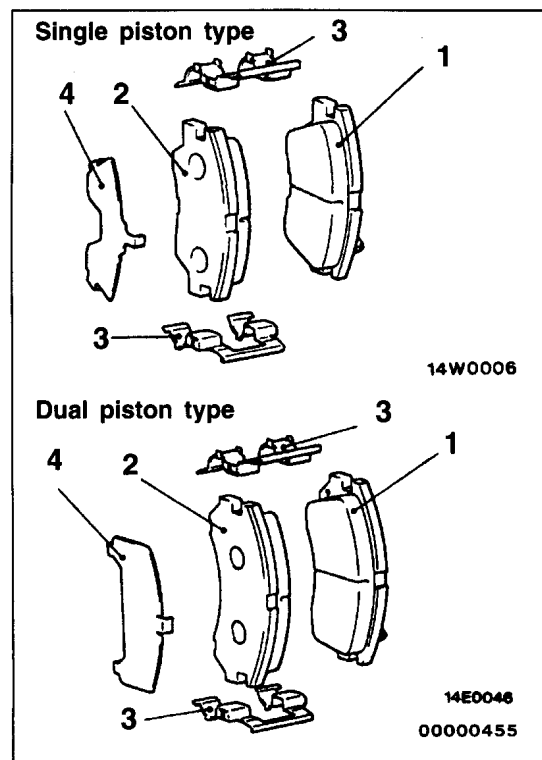
Caution

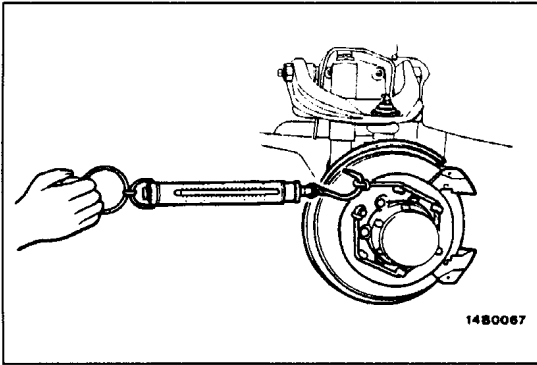
Do not wipe off the special grease that is on the lock pin or allow it to contaminate the lock pin.



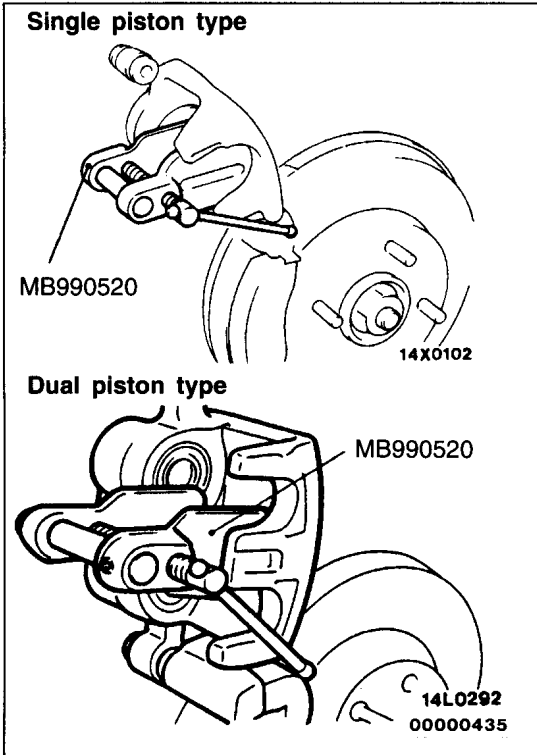
3. Remove the following parts from caliper support.

1. Pad & wear indicator assembly
2. Pad assembly
3. Clip
4. Outer shim

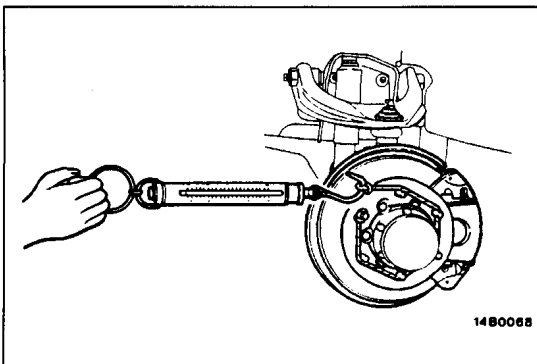




4. Measure hub torque (A) with pad removed to measure brake drag torque after pad installation. When measuring the brake drag torque for vehicles with LSD, remove the rear axle shaft. (Refer to GROUP 27 – Rear Axle.)
5. Securely attach the pad clip to the caliper support.



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



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

Standard value: 69 or less

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

FRONT DISC BRAKE ROTOR INSPECTION

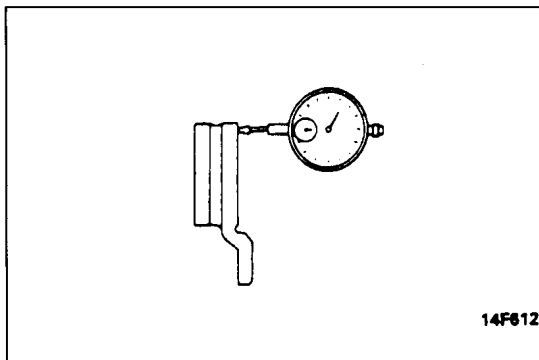
120000062

CAUTION

When servicing disc brakes, it is necessary to exercise caution to keep the disc brake 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.

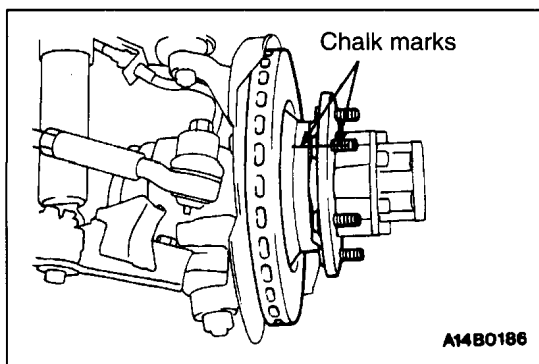
Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	<ul style="list-style-type: none"> If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. If grooves resulting from 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.

**RUN-OUT CHECK**

120000063

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: 0.07 mm

**RUN-OUT CORRECTION**

120000064

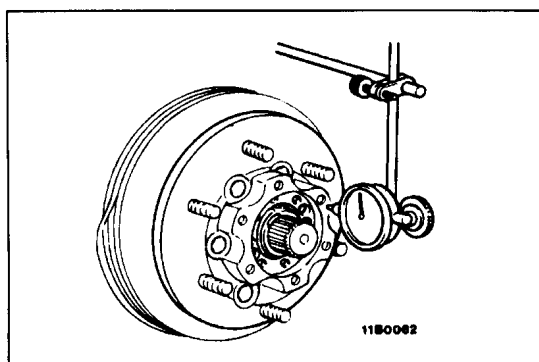
1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.

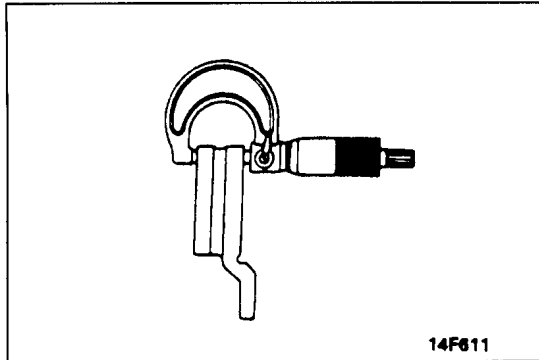
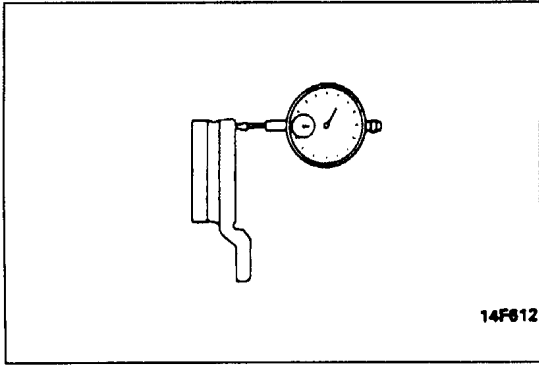
(1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.

- (2) For 4WD, place a dial gauge as shown in the illustration, and then move the hub in the axial direction and measure the play.

Standard value: 0.05 mm

If the play is equal to or exceeds the standard value, adjust the wheel bearing preload. (Refer to GROUP 26 – Front Hub Assembly <4WD>.)





- (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 once again.
2. If the run-out cannot be corrected by changing the phase of the brake disc, replace the brake disc or turn rotor with on the car type brake lathe ("MAD, DL-8700PF" or equivalent).

THICKNESS CHECK

120000065

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

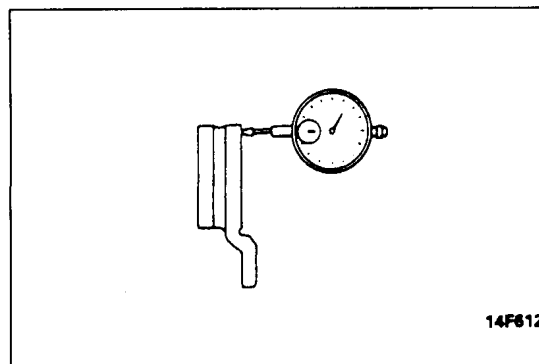
Standard value: 24 mm

Limit: 22.4 mm

Thickness variation (at least 8 position)

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 BRAKE DISC RUN-OUT CHECK

120000066

1. Remove the caliper support, raise the caliper assembly, and secure it by using a wire, etc.
2. 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

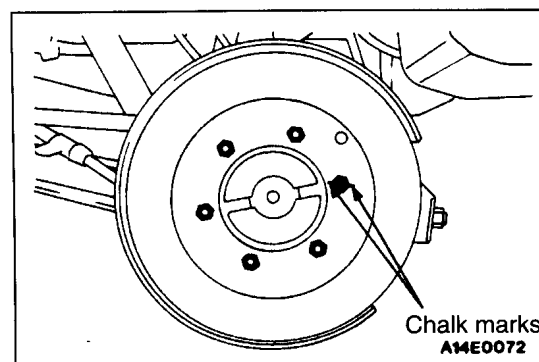
NOTE

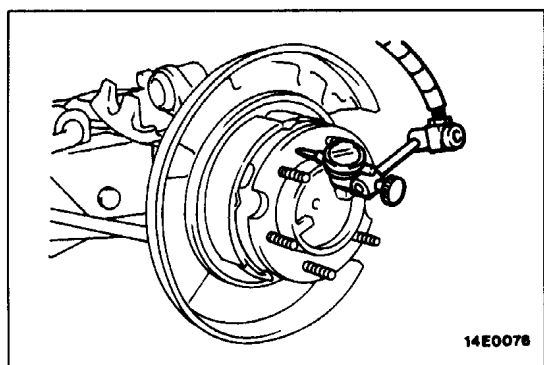
To secure the disc to the hub, tighten the nuts.

REAR BRAKE DISC RUN-OUT CORRECTION

120000067

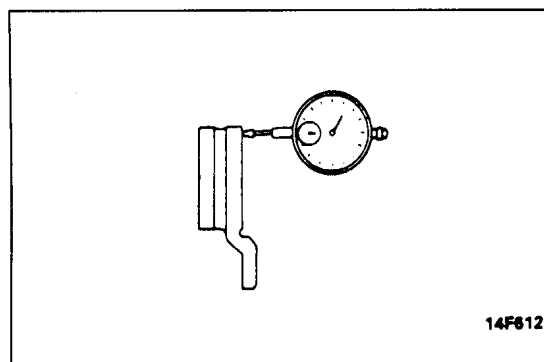
1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.
 - (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.



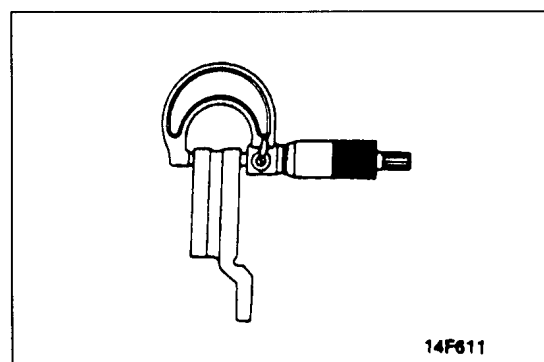


- (2) Remove the brake disc, and then place a dial gauge as shown in the illustration; then move the hub in the axial direction and measure the play.

Limit: 0.25 mm



- (3) If the play does not exceed the limit specification, install the brake disc at a position 180° away from the chalk mark, and then check the run-out of the brake disc once again.
2. If the problem cannot be corrected by changing the phase of the brake disc, replace the disc.



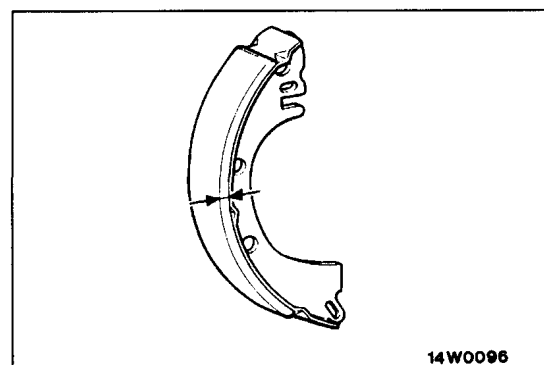
REAR BRAKE DISC THICKNESS CHECK 120000068

1. Remove dirt and rust from brake disc surface.
2. Measure disc thickness at 4 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 120000069

<VEHICLES WITH REAR DRUM BRAKE>

1. Remove the brake drum.
2. Measure the wear of the brake lining at the place worn the most.

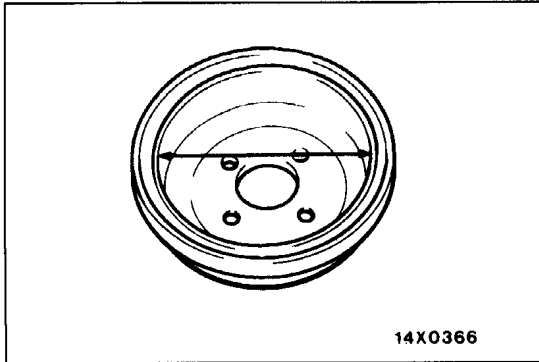
Standard value: 4.7 mm

Limit: 1.0 mm

Replace the shoe and lining assembly if brake lining thickness is less than the limit if it is not worn evenly. For information concerning the procedures for installation of the shoe and lining assembly, refer to P.35A-45.

Caution

1. Whenever the shoe and lining assembly is replaced, replace both RH and LH assemblies as a set to prevent car from pulling to one side when braking.
2. If there is a significant difference in the thicknesses of the shoe and lining assemblies on the left and right sides, check the sliding condition of the piston.

**BRAKE DRUM INSIDE DIAMETER CHECK**

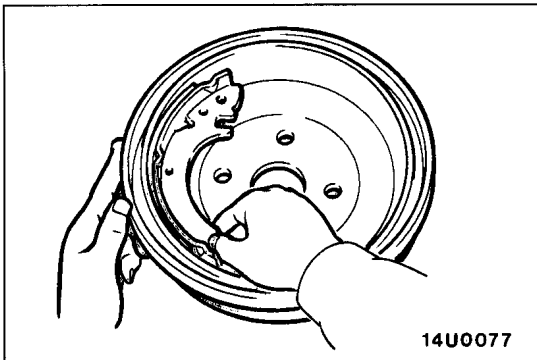
120002239

<VEHICLES WITH REAR DRUM BRAKE>

1. Remove the brake drum.
2. Measure the inside diameter of the brake drum at two or more locations.

Standard value: <2WD Standard wheelbase>**254.0 mm****<2WD Long wheelbase, 4WD Panel van and window van> 270.0 mm****Limit: <2WD Standard wheelbase> 256.0 mm****<2WD Long wheelbase, 4WD Panel van and window van> 272.0 mm**

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

**BRAKE LINING AND BRAKE DRUM CONNECTION CHECK**

120000071

<VEHICLES WITH REAR DRUM BRAKE>

1. Remove the brake drum.
2. Remove the shoe and lining assembly. (Refer to P.35A-45.)
3. Chalk inner surface of brake drum and rub with shoe and lining assembly.
4. Replace shoe and lining assembly or brake drums if there are any irregular contact area.

NOTE

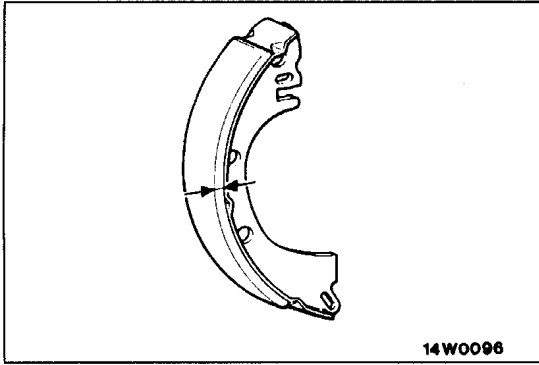
Clean off chalk after check.

BRAKE LINING THICKNESS CHECK

120000072

<VEHICLES WITH REAR DISC BRAKE>

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.

Standard value: 6.5 mm

Limit: 4.5 mm

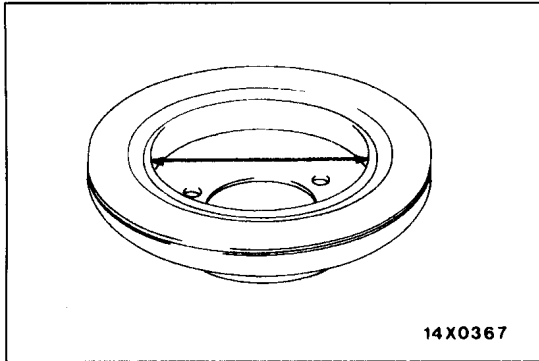
4. Replace the shoe and lining assembly if brake lining thickness is less than the limit or if it is not worn evenly.

Caution

Whenever the shoe and lining assembly is replaced, replace both RH and LH assemblies as a set to prevent car from pulling to one side when braking.

BRAKE DRUM INSIDE DIAMETER CHECK

120000073



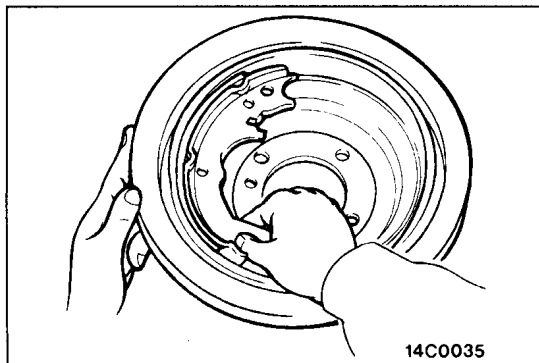
<VEHICLES WITH REAR DISC BRAKE>

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 DRUM CONNECTION CHECK

120000074

<VEHICLES WITH REAR DISC BRAKE>

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 there are any irregular contact area.

NOTE

Clean off chalk after check.

BRAKE PEDAL

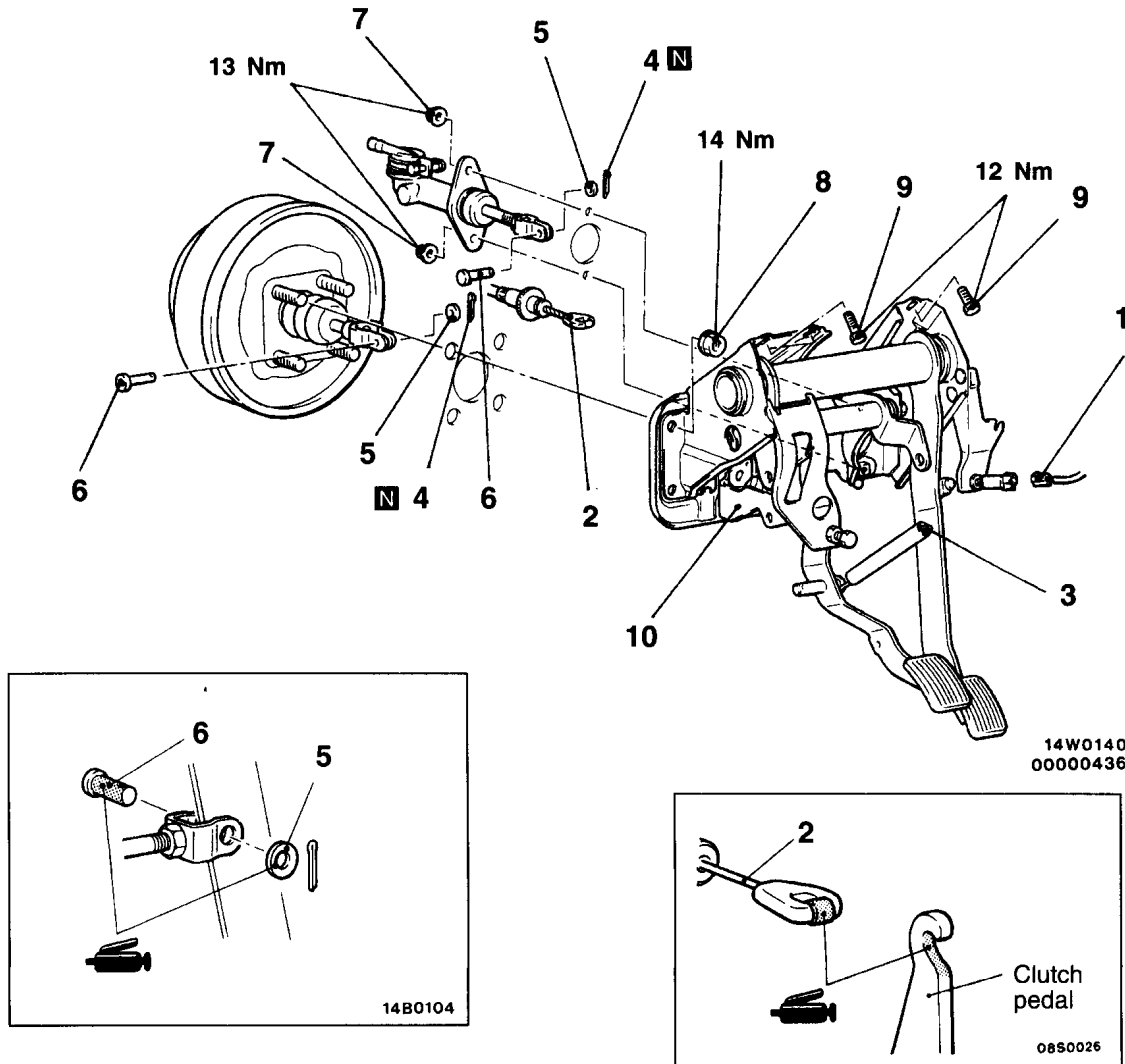
REMOVAL AND INSTALLATION <L.H. drive vehicles>

Pre-removal Operation

- Under Cover Removal (Refer to GROUP 52A – Instrument Panel.)
- Steering Column Assembly Removal (Refer to GROUP 37A – Steering Wheel and shaft.)
- Junction Block Removal

Post-installation Operation

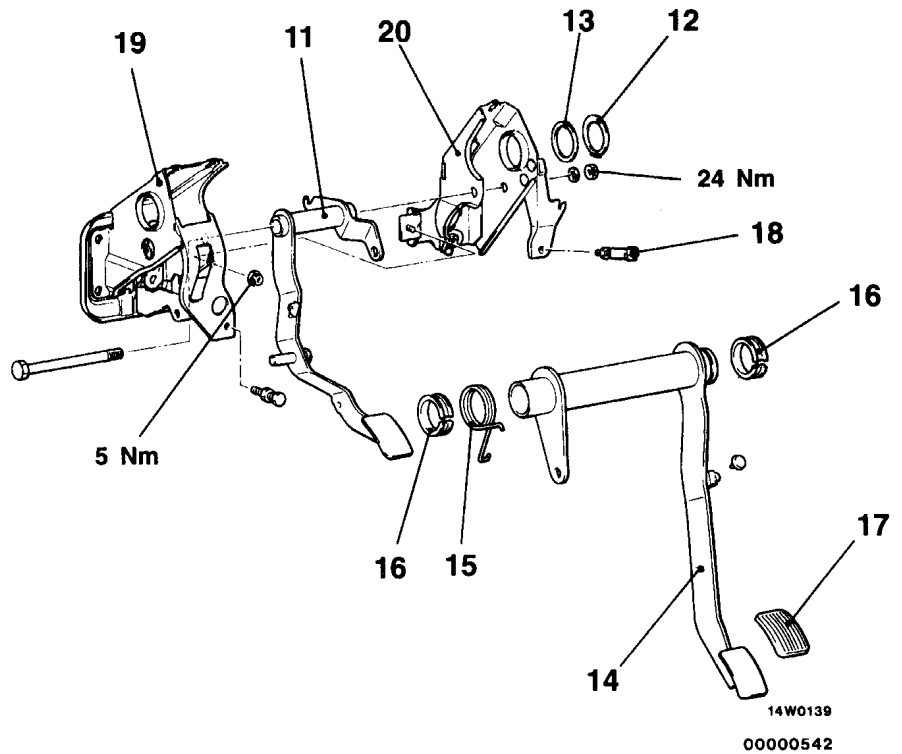
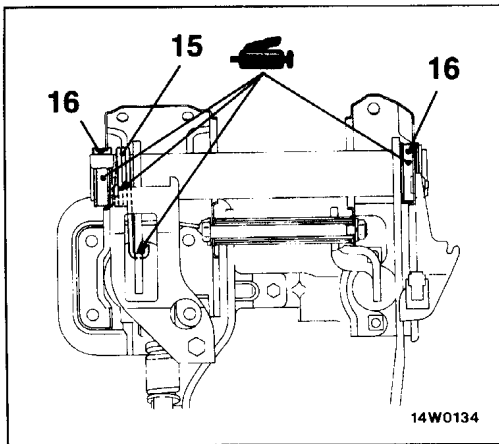
- Junction Block Installation
- Steering Column Assembly Installation (Refer to GROUP 37A – Steering Wheel and Shaft.)
- Under Cover Installation (Refer to GROUP 52A – Instrument Panel.)
- Brake Pedal Adjustment (Refer to P.35A-9.)

**Removal steps**

1. Stop lamp switch connector
2. Clutch cable connection <Cable type clutch>
3. Clutch return spring <Cable type clutch and hydraulic clutch for petrol vehicles>
4. Split pin
5. Washer
6. Clevis pin



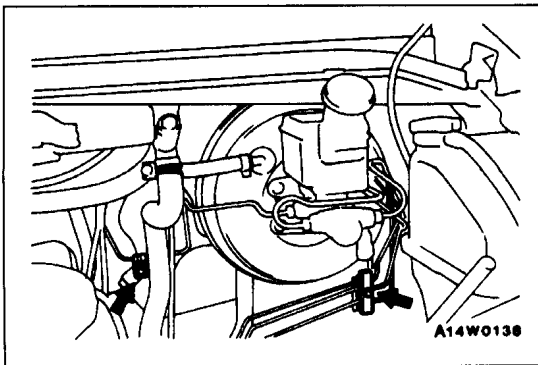
7. Clutch master cylinder mounting nuts <hydraulic clutch>
8. Brake booster mounting nuts
9. Pedal support member mounting bolts
10. Brake and clutch pedal assembly



Removal steps

11. Clutch pedal
(Refer to GROUP 21 – Clutch Pedal)
12. Snap ring
13. Washer
14. Brake pedal
15. Return spring

16. Bush
17. Pedal pad
18. Stop lamp switch
19. Support member (L.H.)
20. Support member (R.H.)



REMOVAL SERVICE POINT

◀A▶ BRAKE AND CLUTCH PEDAL ASSEMBLY REMOVAL

Remove the clamp bolt from the brake tube, push the master cylinder and brake booster slightly from the passenger's compartment towards the engine compartment. Then remove the brake and clutch pedal assembly.

Caution

Do not apply any excessive force to the brake tube.

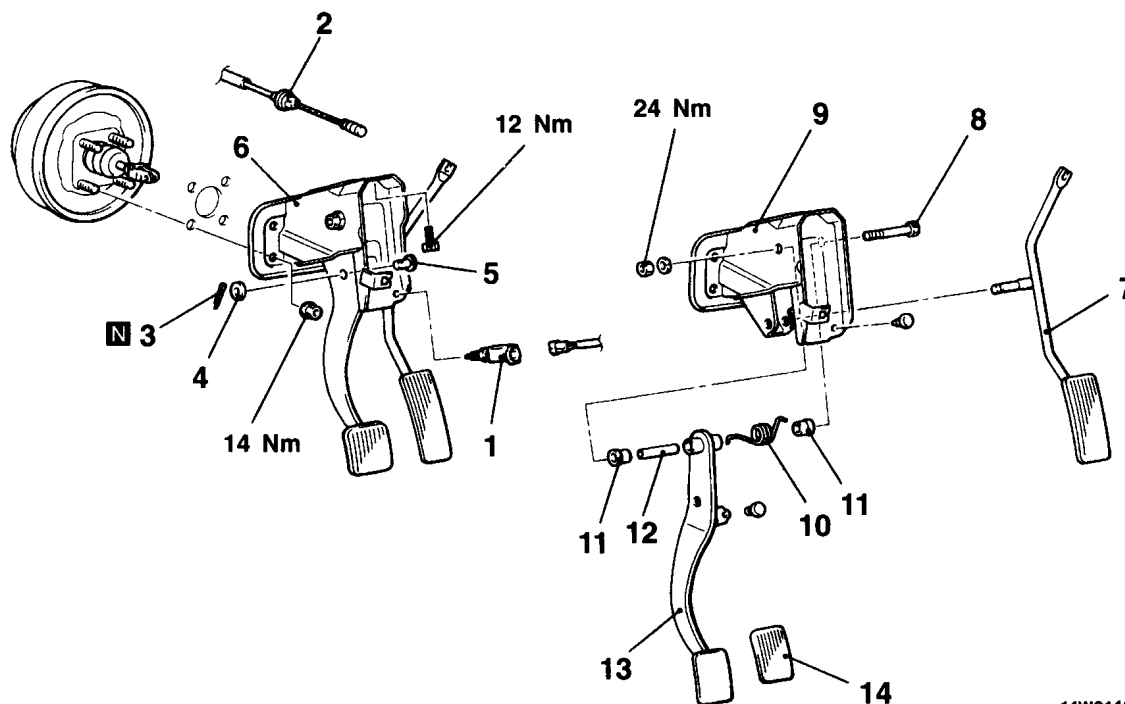
REMOVAL AND INSTALLATION <R.H. drive vehicles>

Pre-removal Operation

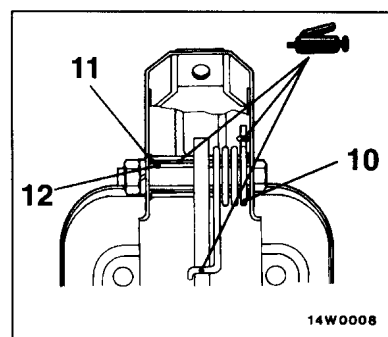
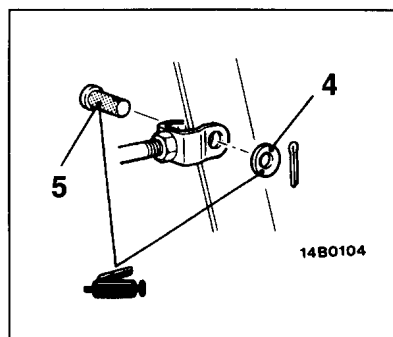
- Under Cover Removal
(Refer to GROUP 52A – Instrument Panel.)
- Junction Block Removal

Post-installation Operation

- Junction Block Installation
- Under Cover Installation
(Refer to GROUP 52A – Instrument Panel.)
- Brake Pedal Adjustment (Refer to P.35A-9.)



14W0146
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**Removal steps**

1. Stop lamp switch
2. Accelerator cable connection
3. Split pin
4. Washer
5. Clevis pin
6. Brake pedal assembly
7. Accelerator pedal (Refer to GROUP 13F – Accelerator Pedal.)
8. Brake pedal shaft bolt
9. Pedal support member
10. Brake pedal return spring
11. Bushing
12. Pipe
13. Brake pedal
14. Pedal pad

MASTER CYLINDER AND BRAKE BOOSTER

120002240

REMOVAL AND INSTALLATION

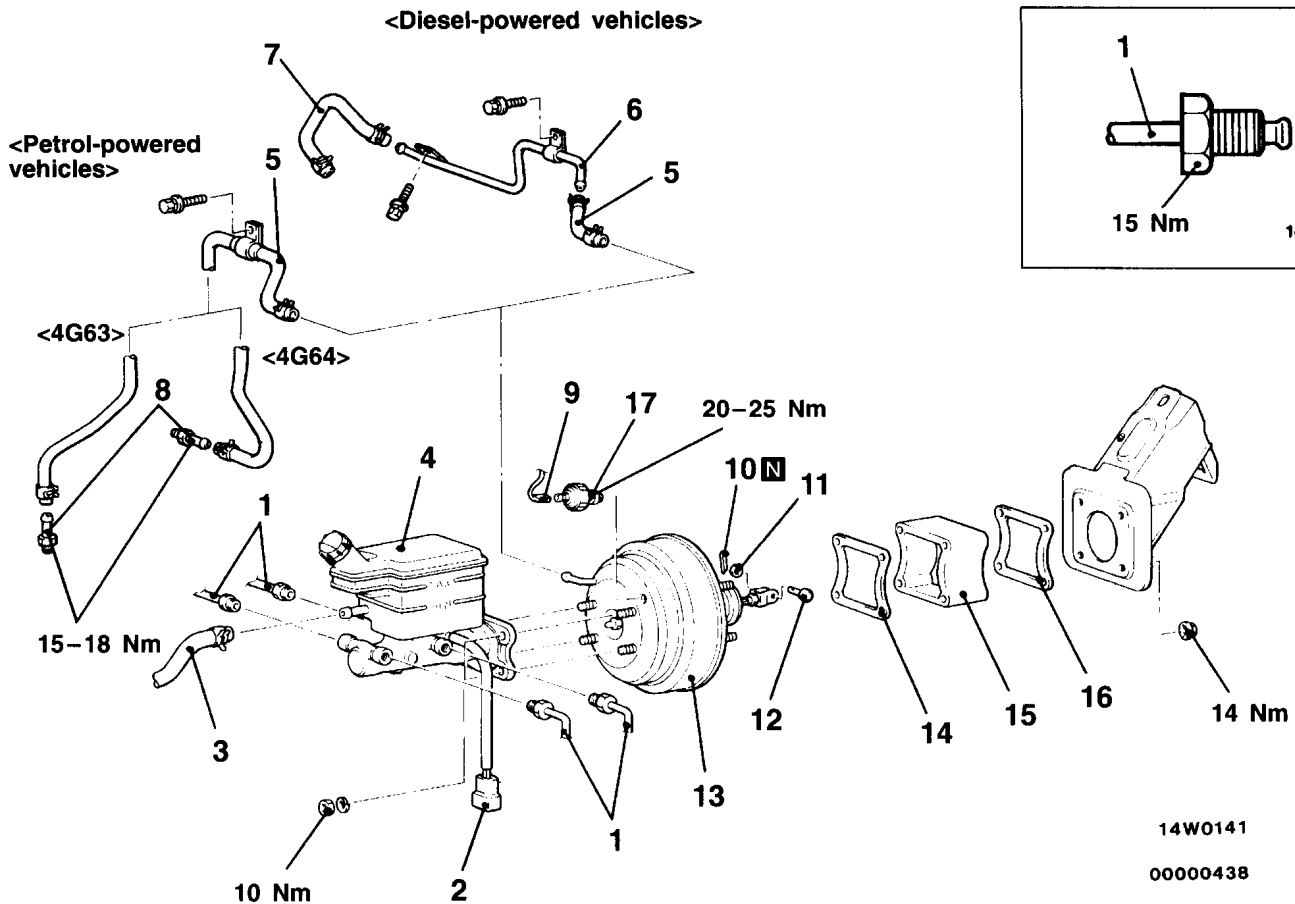
<L.H. drive vehicles>

Pre-removal Operation

- Battery Removal
- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-11.)
- Battery Installation
- Brake Pedal Adjustment (Refer to P.35A-9.)



Removal steps

1. Brake tube connection
2. Brake fluid level sensor connector
3. Clutch hose connection
4. Master cylinder assembly
- ▶B◀ • Adjustment of clearance between brake booster push rod and primary piston
- ▶A◀ 5. Vacuum hose (With built-in check valve)
6. Vacuum pipe <Diesel-powered vehicles>
7. Vacuum hose <Diesel-powered vehicles>
8. Fitting <Petrol-powered vehicles>

9. Vacuum switch connector <Diesel-powered vehicles>
10. Split pin
11. Washer
12. Clevis pin
13. Brake booster
14. Sealer
15. Spacer <Single brake booster>
16. Sealer <Single brake booster>
17. Vacuum switch <Diesel-powered vehicles>

Caution

The check valve should not be removed from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

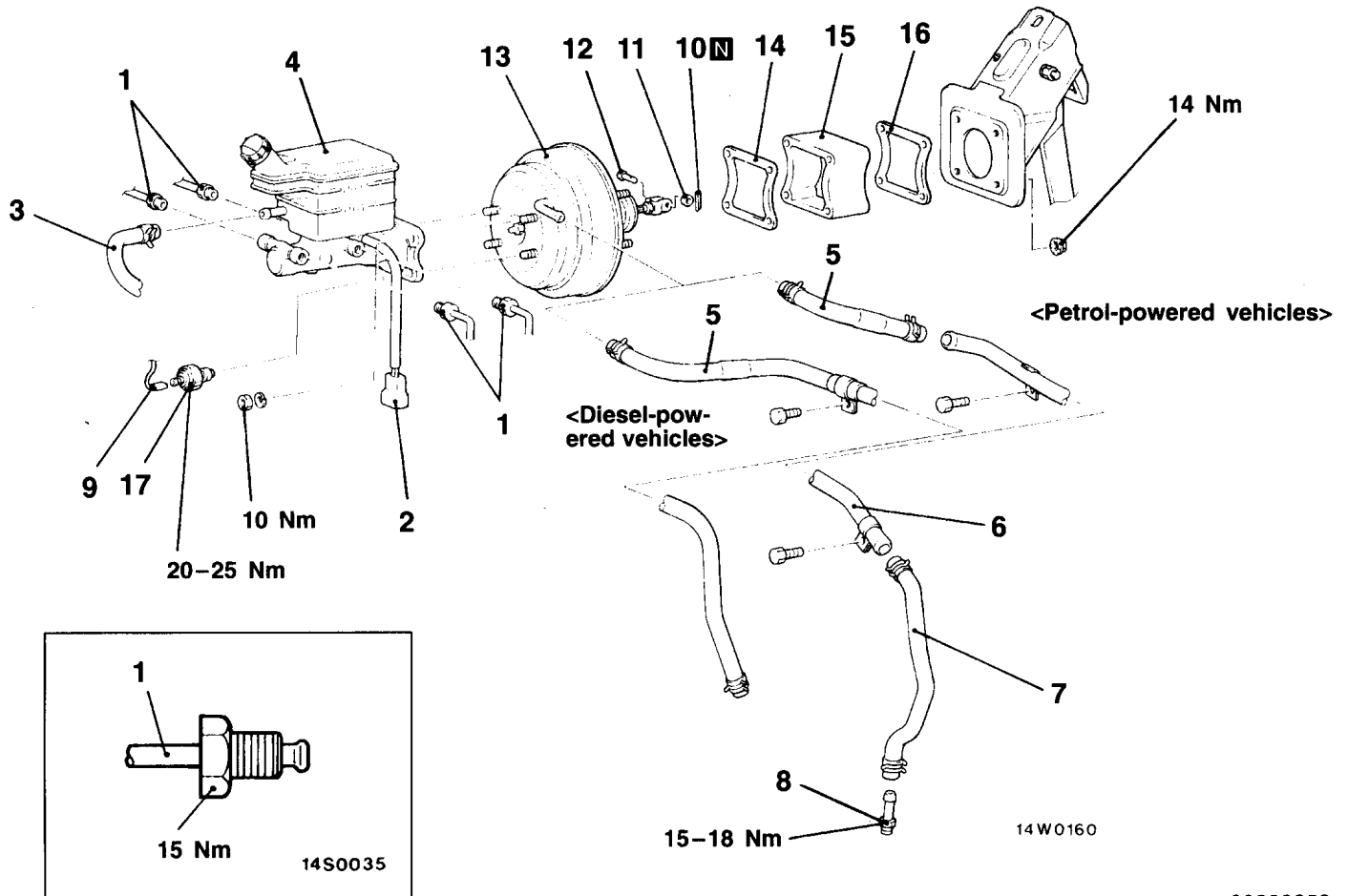
<R.H. drive vehicles>

Pre-removal Operation

- Battery Removal
- Brake Fluid Draining

Post-Installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-11.)
- Battery Installation
- Brake Pedal Adjustment (Refer to P.35A-9.)



00002853

Removal steps

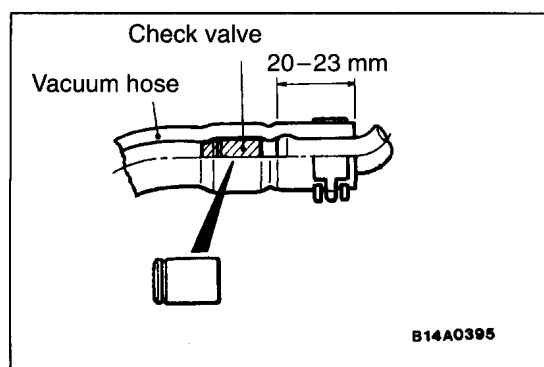
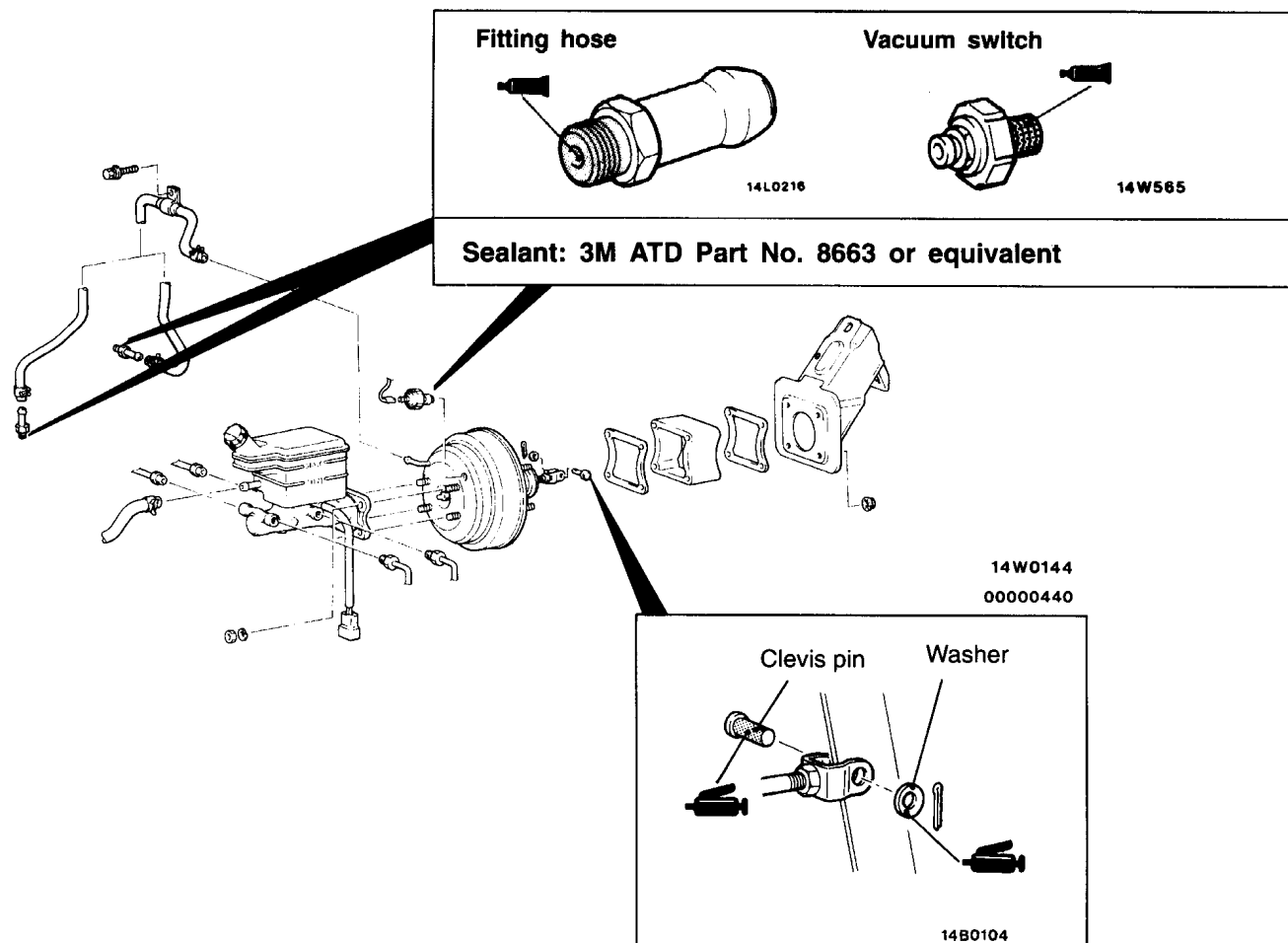
1. Brake tube connection
2. Brake fluid level sensor connector
3. Clutch hose connection
4. Master cylinder assembly
- ▶B◀ ● Clearance adjustment between brake booster push rod and primary piston
- ▶A◀ 5. Vacuum hose (With built-in check valve)
6. Vacuum pipe <Petrol-powered vehicles>
- ▶A◀ 7. Vacuum hose <Petrol-powered vehicles>
8. Fitting <Petrol-powered vehicles>
9. Vacuum switch connector <Diesel-powered vehicles>
10. Split pin
11. Washer
12. Clevis pin
13. Brake booster
14. Sealer
15. Spacer <Single brake booster>
16. Sealer <Single brake booster>
17. Vacuum switch <Diesel-powered vehicles>

Caution

The check valve should not be removed from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

35A-26 BASIC BRAKE SYSTEM – Master Cylinder and Brake Booster

Lubrication and sealing points



INSTALLATION SERVICE POINTS

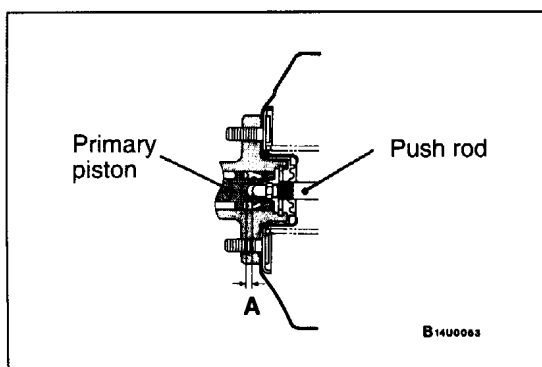
►A◄ VACUUM HOSE CONNECTION

- (1) Install to the pipe part of the brake booster so that the amount of insertion of the vacuum hose is as shown in the figure.

Caution

The check valve and the pipe part of the brake booster must not contact each other.

- (2) For petrol-powered vehicles, insert the hose until its engine side contacts the edge of the hexagonal part of the fitting, and then secure it by the hose clip.



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

Adjust the clearance (A) between the brake booster push rod and primary piston as follows:

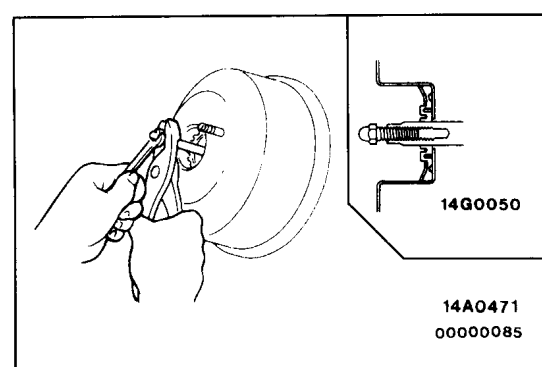
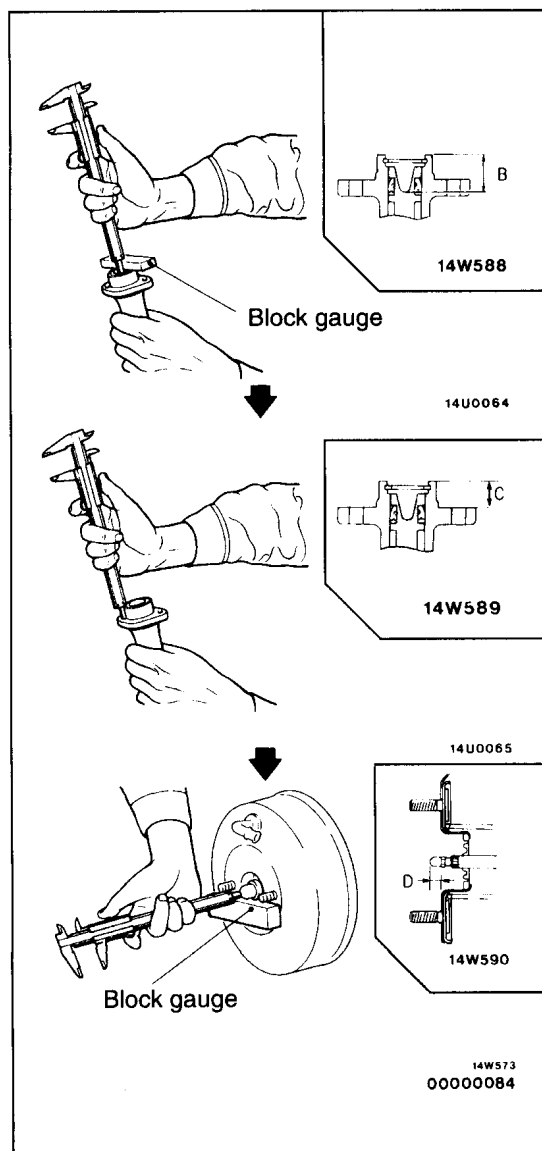
Calculate clearance A from the B, C and D measurements.
 $A = B - C - D$

Standard value:

Brake booster size		Clearance A standard value mm
Single brake booster	Petrol-powered vehicles	0.65–1.05
	Diesel-powered vehicles	1.00–1.40
Tandem brake booster	Petrol-powered vehicles	0.70–1.20
	Diesel-powered vehicles	1.00–1.40

NOTE

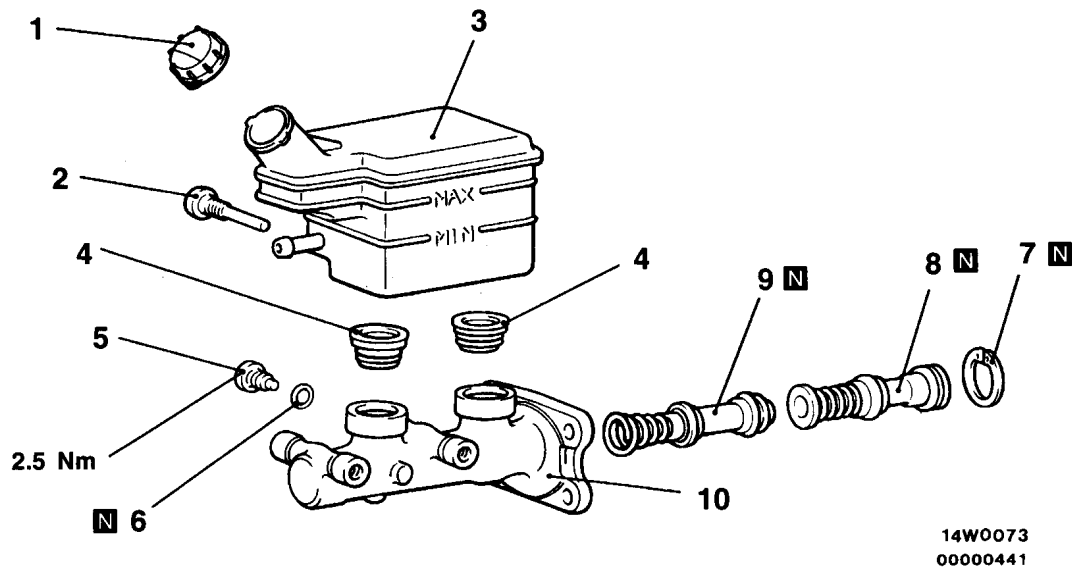
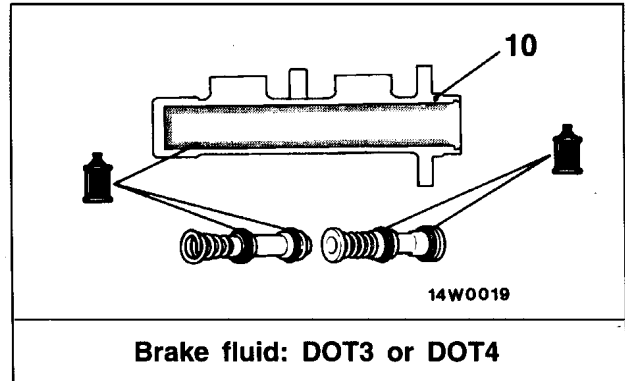
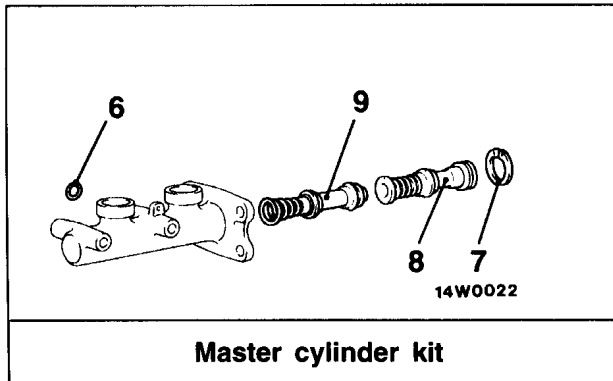
When brake booster negative pressure (petrol-powered vehicles: –66.7 kPa, diesel-powered vehicles: –93.3 kPa) is applied, clearance value will become 0.10–0.50 mm.



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

120000077



Disassembly steps

1. Reservoir cap
2. Reservoir stopper bolt
3. Reservoir
4. Reservoir seal
5. Piston stopper bolt



6. Gasket
7. Piston stopper ring
8. Primary piston assembly
9. Secondary piston assembly
10. Master cylinder body

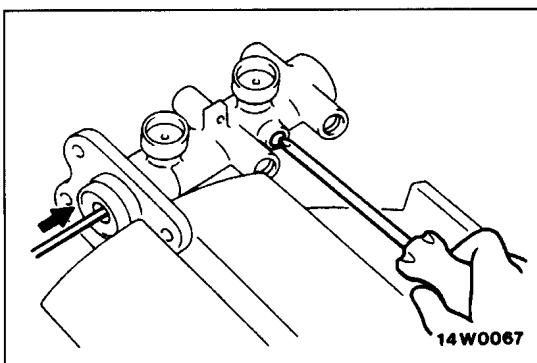
Caution

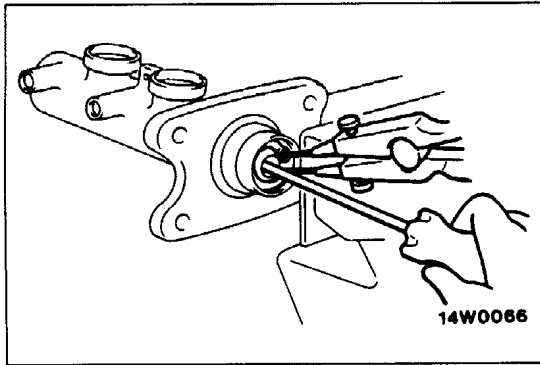
Do not disassemble the primary and secondary piston assembly.

DISASSEMBLY SERVICE POINTS

◀A▶ PISTON STOPPER BOLT DISASSEMBLY

Remove the piston stopper bolt, while depressing the piston.

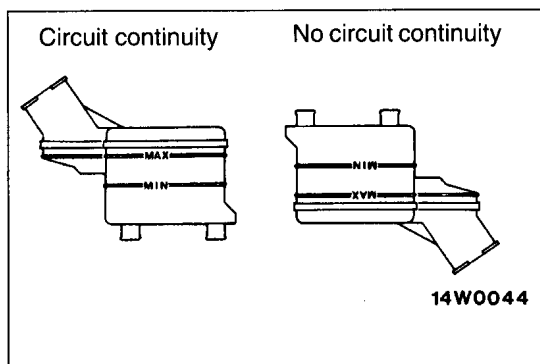


**◀B▶ PISTON STOPPER RING DISASSEMBLY**

Remove the 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, damage or wear.
- Check the diaphragm for cracks and wear.

**BRAKE FLUID LEVEL SENSOR CHECK**

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

LOAD SENSING PROPORTIONING VALVE

120002241

REMOVAL AND INSTALLATION

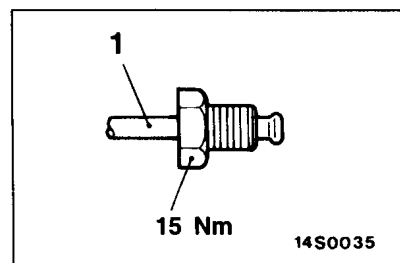
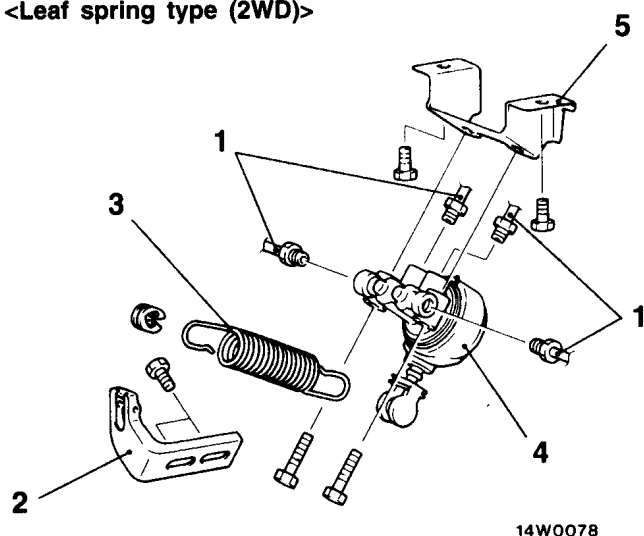
Pre-removal Operation

- Brake Fluid Draining

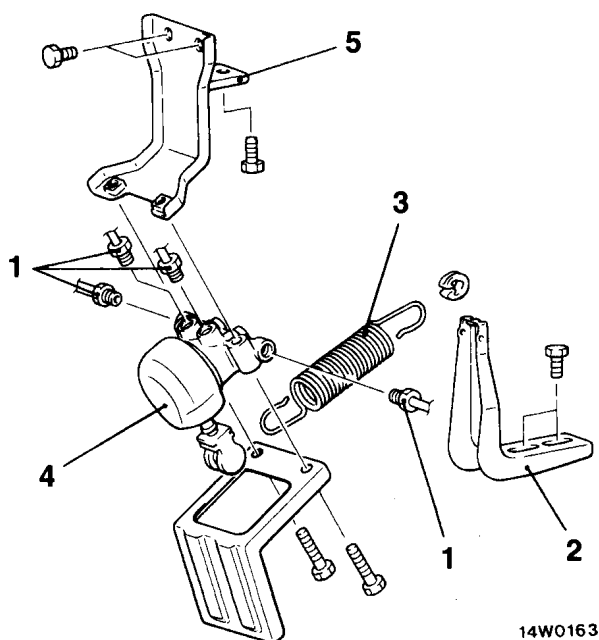
Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-11.)

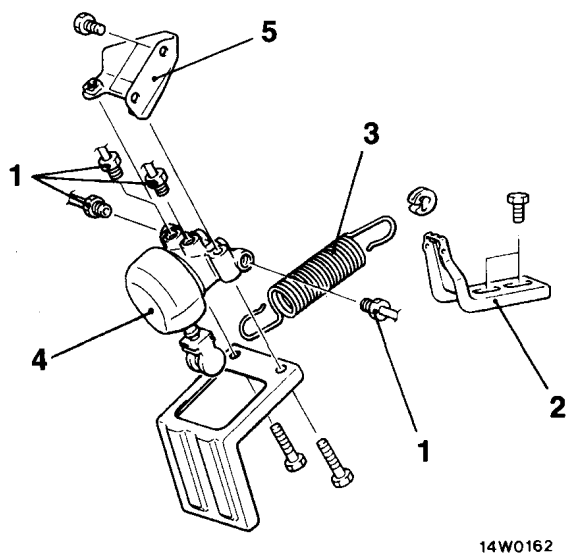
<Leaf spring type (2WD)>



<Leaf spring type (4WD)>



<Coil spring type>



Removal steps

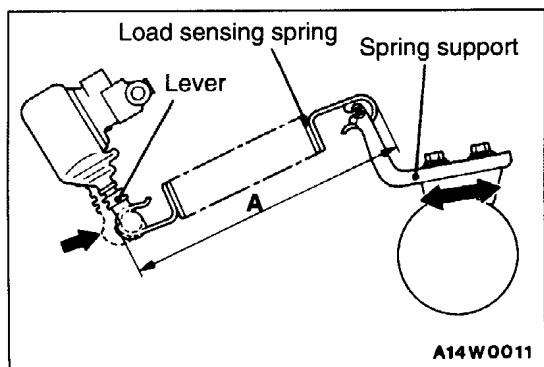


1. Brake tube connection
2. Spring support
3. Load sensing spring
4. Load sensing proportioning valve
5. Bracket

Caution

Do not disassemble the load sensing proportioning valve.

00002854

**INSTALLATION SERVICE POINT****►A◄ SPRING SUPPORT INSTALLATION**

- (1) Install the load sensing spring, and then tighten the spring support to the axle housing temporarily.
- (2) Insert the lever of the load sensing proportioning valve fully into the valve side and hold it. Then adjust the spring support so that the spring length (the distance between the two ends of the spring) is at the standard value.

Standard value (A): 198–202 mm

FRONT DISC BRAKE <SINGLE PISTON TYPE>

120000079

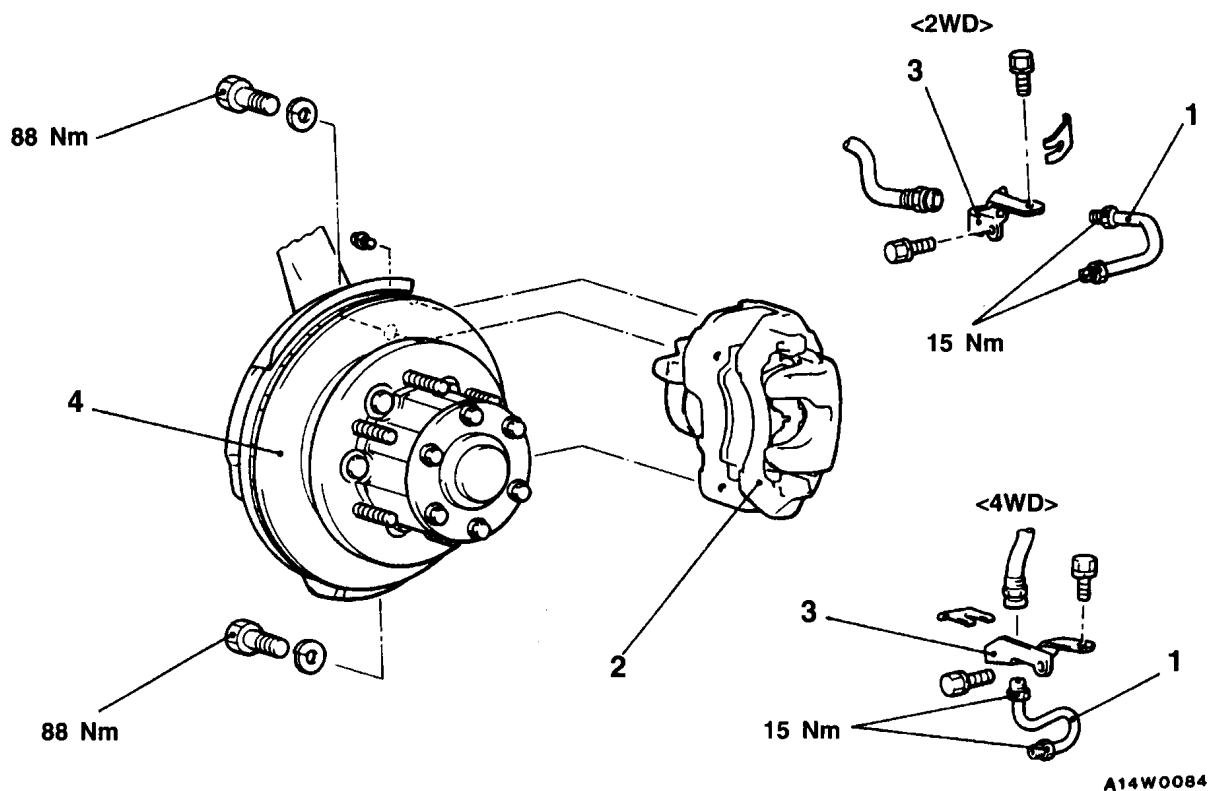
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-11.)



Removal steps



1. Brake tube
2. Front brake assembly
3. Brake hose bracket
4. Brake disc (Refer to GROUP 26 – Front Hub Assembly)

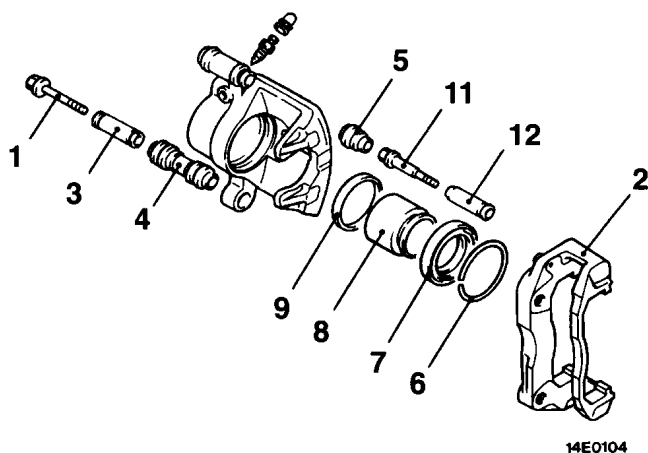
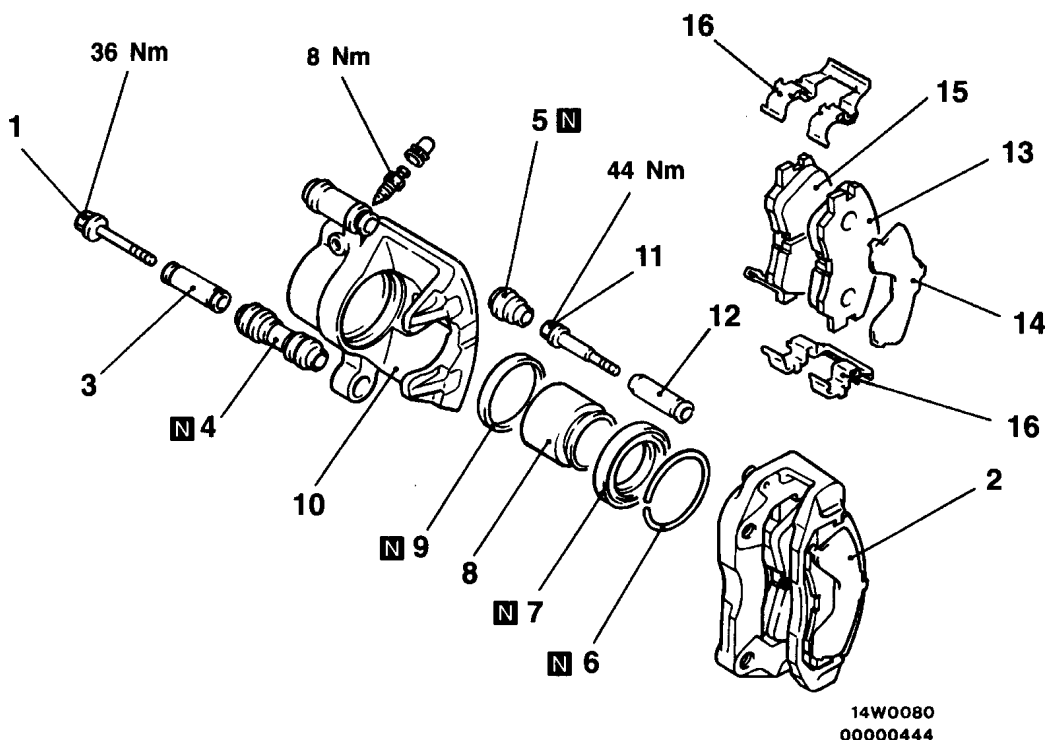
INSTALLATION SERVICE POINT

►A◄ FRONT BRAKE ASSEMBLY INSTALLATION

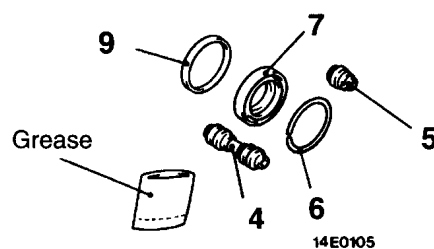
Install the front brake assembly and measure the disc brake drag torque. (Refer to P. 35A-14.)

DISASSEMBLY AND REASSEMBLY

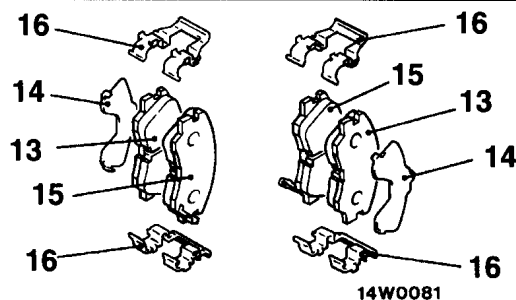
120000080



Brake caliper kit



Seal and boots repair kit



Pad repair kit

Caliper assembly disassembly steps

1. Lock pin
2. Caliper support (pad, clip, shim)
3. Lock pin sleeve
4. Lock pin boot
5. Guide pin boot
6. Boot ring
7. Piston boot
8. Piston
9. Piston seal
10. Caliper body
11. Guide pin
12. Guide pin sleeve

Pad assembly disassembly steps

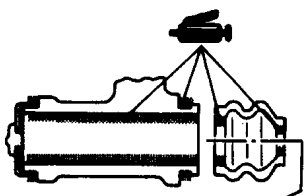
1. Lock pin
2. Caliper support (pad, clip, shim)
13. Pad assembly
14. Outer shim
15. Pad and wear indicator assembly
16. Clip



35A-34 BASIC BRAKE SYSTEM – Front Disc Brake <Single Piston Type>

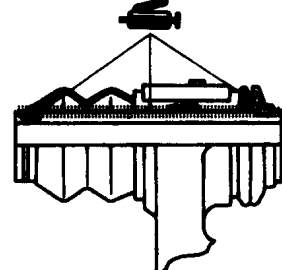
Lubrication points

Guide pin side



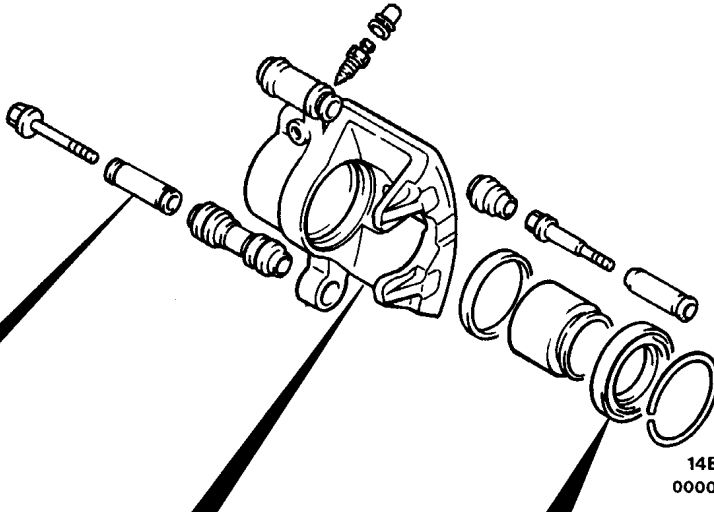
14K629

Lock pin side

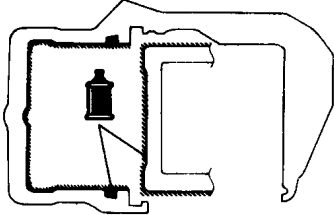


14K628

Grease: Repair kit grease



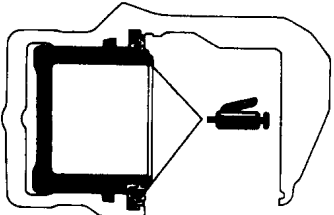
14E0102
00000445



14W644

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



14W643

Grease: Repair kit grease

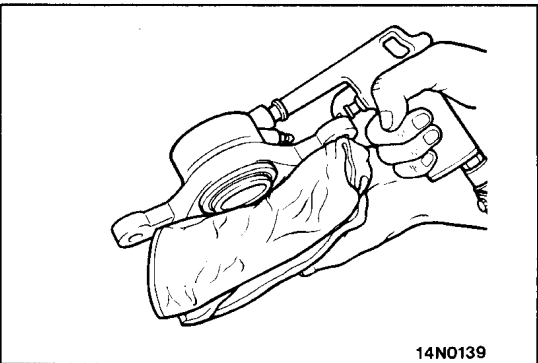
DISASSEMBLY SERVICE POINTS

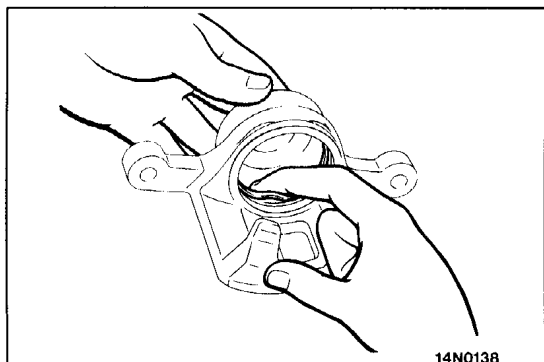
When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀▶ PISTON BOOT/PISTON REMOVAL

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

Caution
Blow compressed air gently.



**◀B▶ PISTON SEAL REMOVAL**

- (1) Remove piston seal with finger tip.

Caution

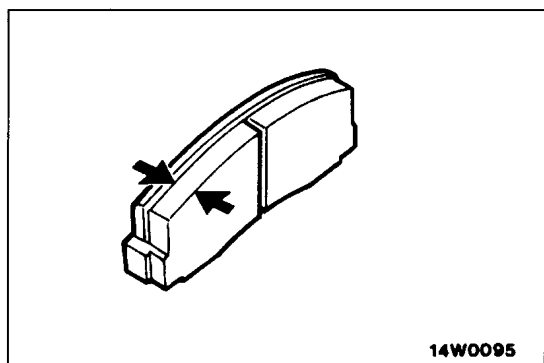
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

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

Specified brake fluid: DOT3 or DOT4

INSPECTION

- 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 thickness at the thinnest and worn area of the pad. Replace pad assembly if pad thickness is less than the limit value.

Standard value: 10 mm

Limit value: 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, lock pin and guide pin.

FRONT DISC BRAKE <DUAL PISTON TYPE>

120000081

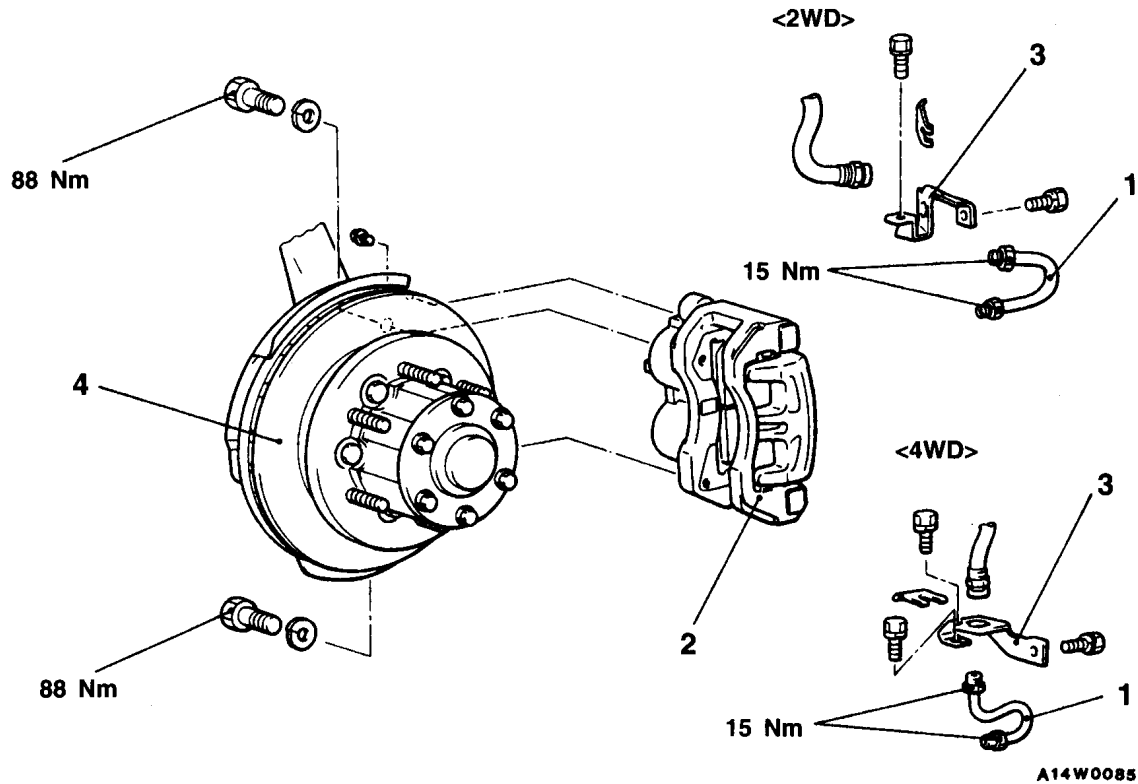
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-11.)



Removal steps



1. Brake tube
2. Front brake assembly
3. Brake hose bracket
4. Brake disc (Refer to GROUP 26 – Front Hub Assembly)

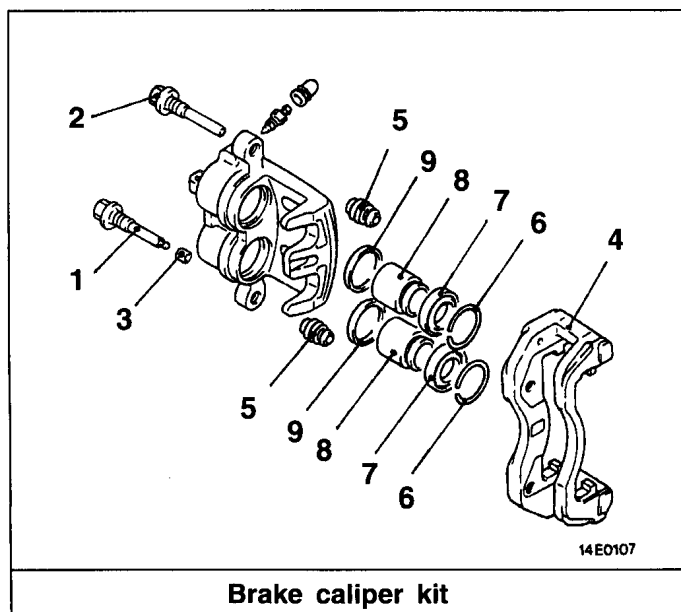
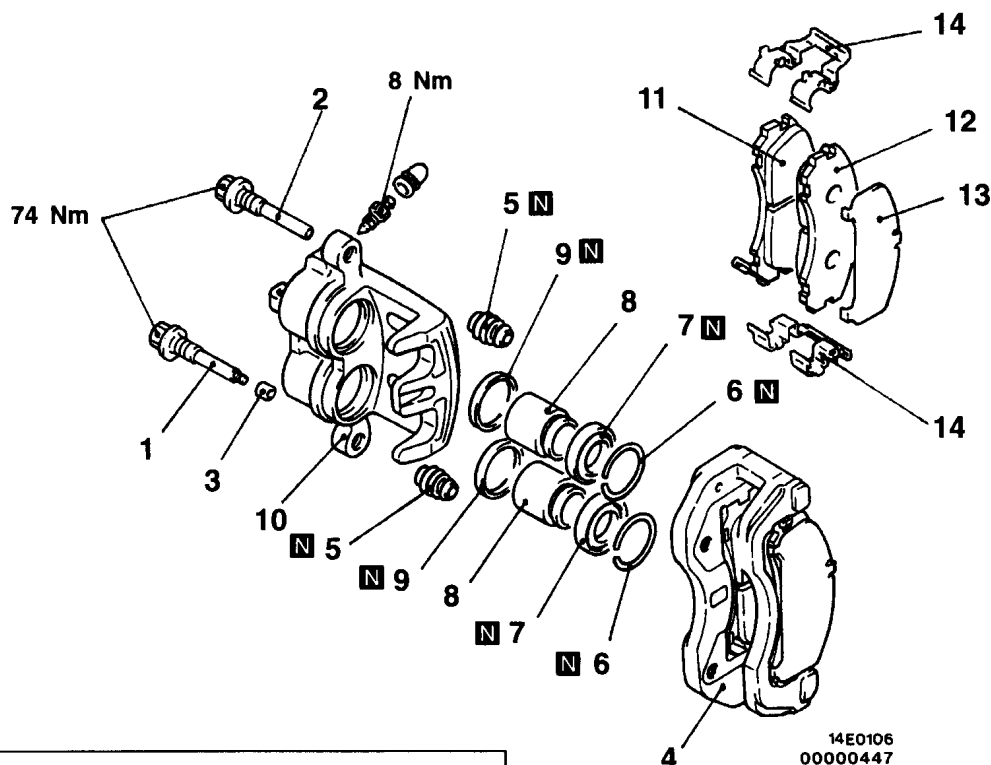
INSTALLATION SERVICE POINT

►A◄ FRONT BRAKE ASSEMBLY INSTALLATION

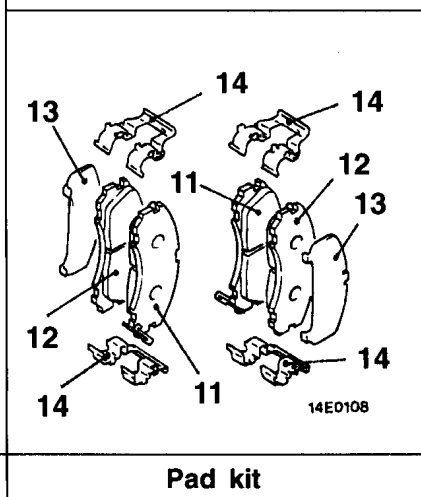
Install the front brake assembly and measure the disc brake drag torque. (Refer to P. 35A-14.)

DISASSEMBLY AND REASSEMBLY

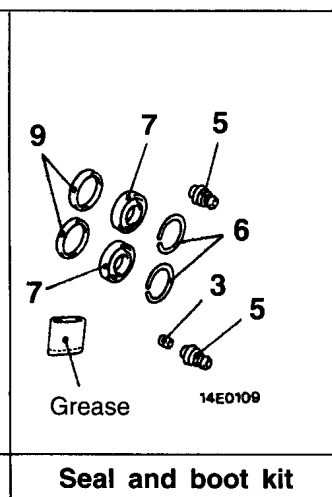
120000082



Brake caliper kit



Pad kit



Seal and boot kit

Caliper assembly disassembly steps



1. Lock pin
2. Guide pin
3. Bushing
4. Caliper support (Pad, clip and shim)
5. Pin boot
6. Boot ring
7. Piston boot
8. Piston
9. Piston seal
10. Caliper body



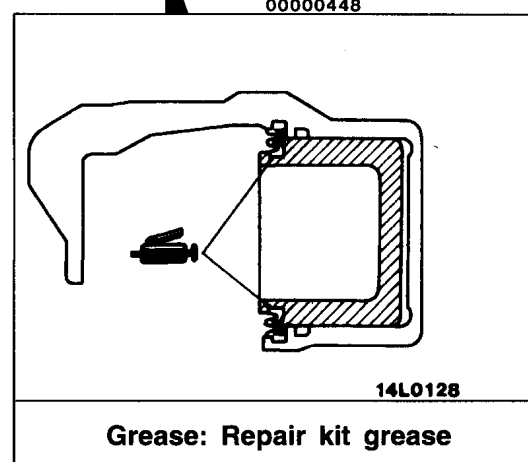
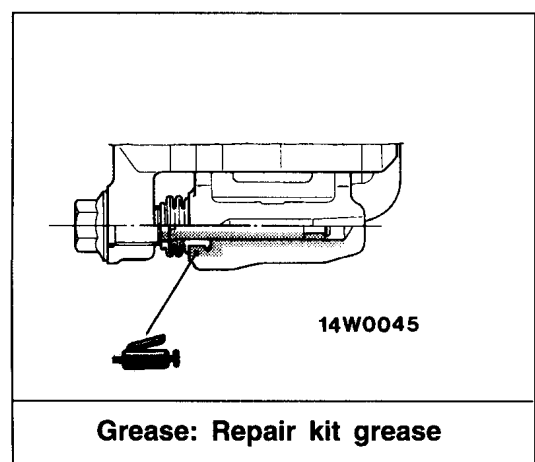
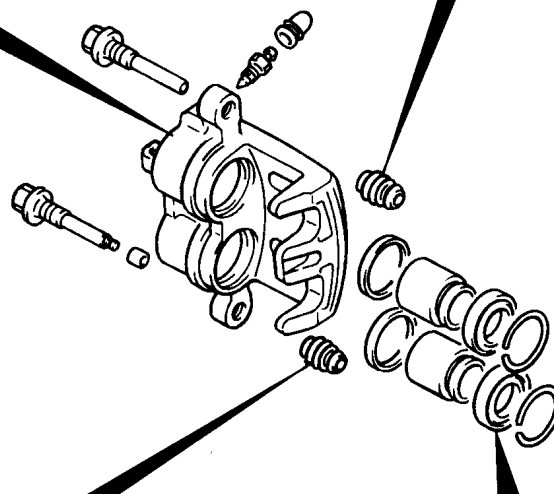
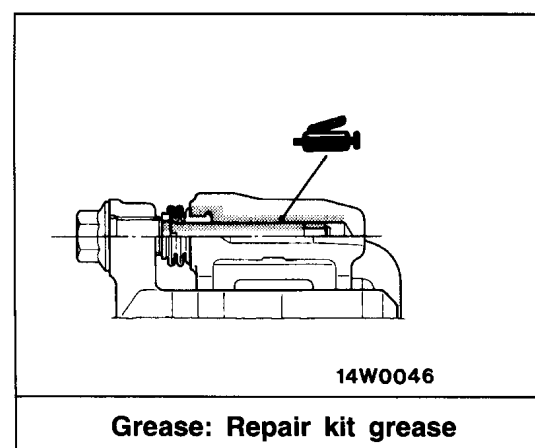
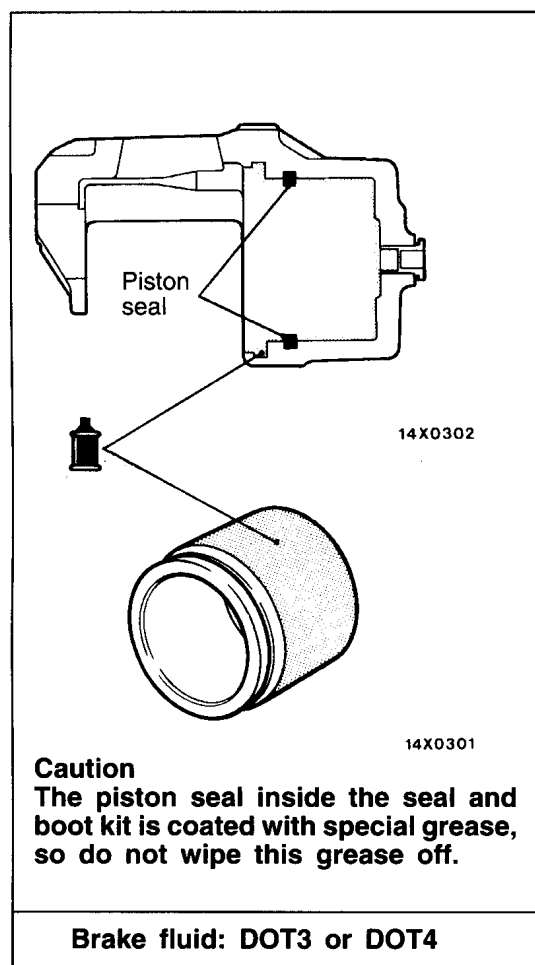
Pad assembly disassembly steps



1. Lock pin
2. Guide pin
3. Bushing
4. Caliper support (Pad, clip and shim)
11. Pad and wear indicator assembly
12. Pad assembly
13. Outer shim
14. Clip

35A-38 BASIC BRAKE SYSTEM – Front Disc Brake <Dual Piston Type>

Lubrication points



DISASSEMBLY SERVICE POINTS

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

◀A▶ PISTON BOOT/PISTON REMOVAL

Pump in compressed air through the brake hose installation hole and remove the pistons and piston boot.

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 in 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 screwdriver or other tool to prevent damage to inner cylinder.

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

Specified brake fluid: DOT3 or DOT4

INSPECTION

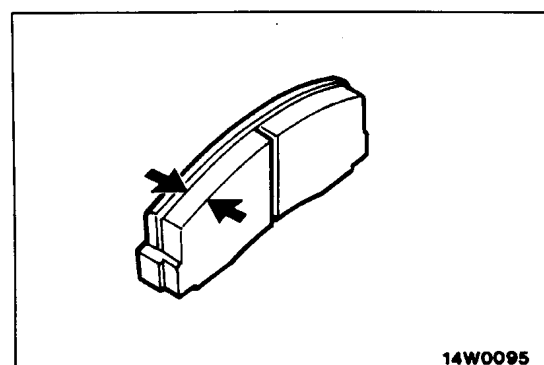
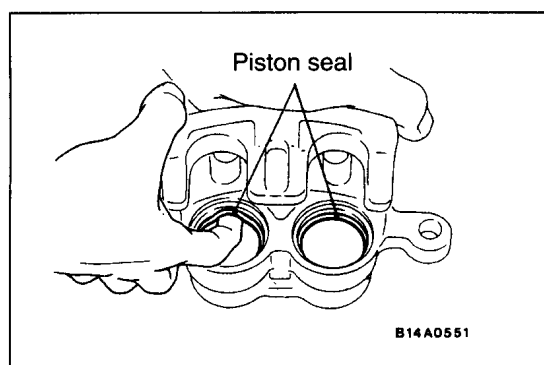
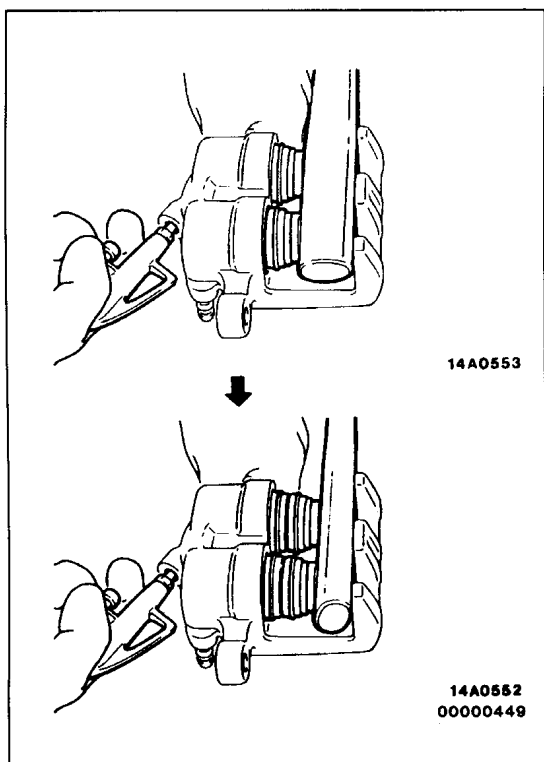
- Check cylinder for wear, damage or rust.
- Check piston surface for wear, damage or rust.
- Check caliper body or sleeve for wear.
- Check pad for damage or adhesion of grease, check backing metal for damage.

PAD WEAR CHECK

Measure thickness at the thinnest and worn area of the pad. Replace pad assembly if pad thickness is less than the limit value.

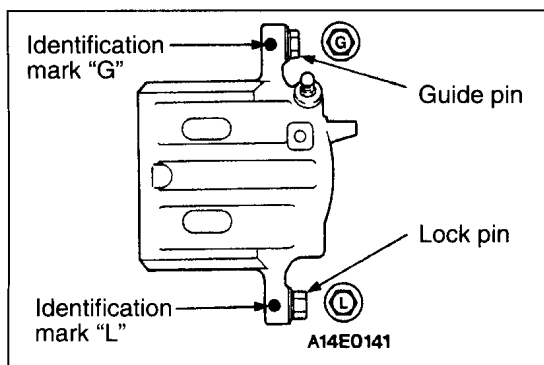
Standard value: 10 mm

Limit value: 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, lock pin and guide pin.



REASSEMBLY SERVICE POINT

►◄ LOCK PIN/GUIDE PIN INSTALLATION

Install the guide pin and lock pin as illustrated so that each head mark of the guide pin and the lock pin matches the identification mark ("G" or "L") located on the caliper body.

REAR DISC BRAKE

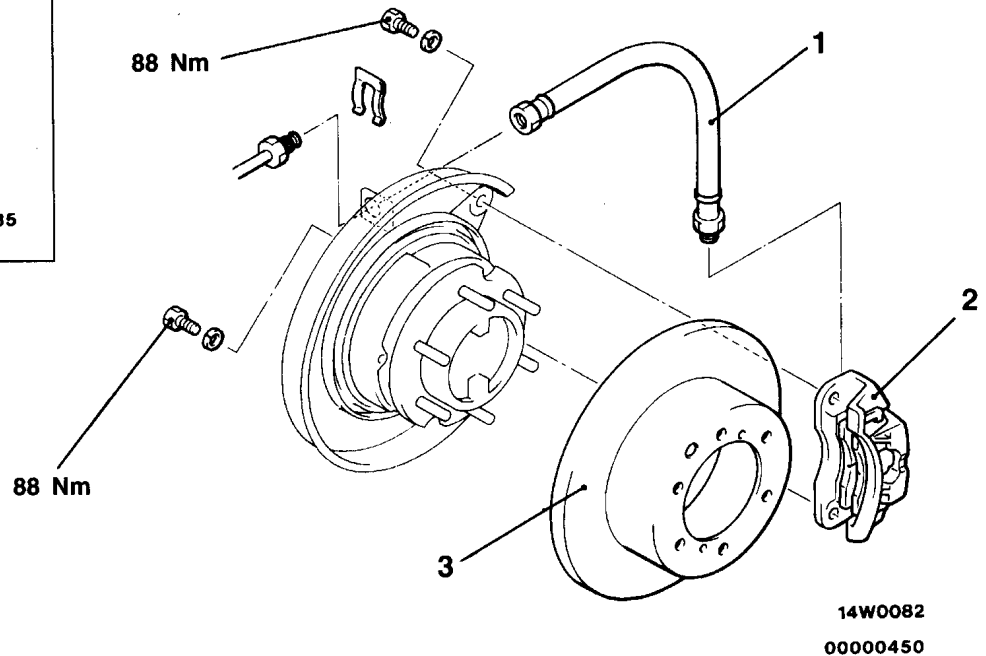
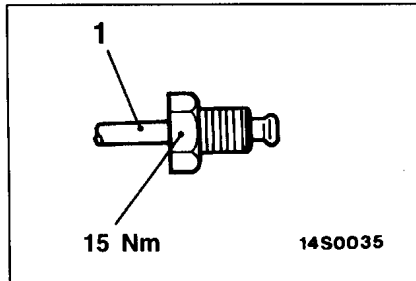
REMOVAL AND INSTALLATION

Pre-removal Operation

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P. 35A-11.)



Removal steps



1. Brake hose connection
2. Rear brake assembly
3. Brake disc

INSPECTION

- Check the brake disc for damage.
- Check the brake disc for thickness.
- Check the brake disc for run-out.

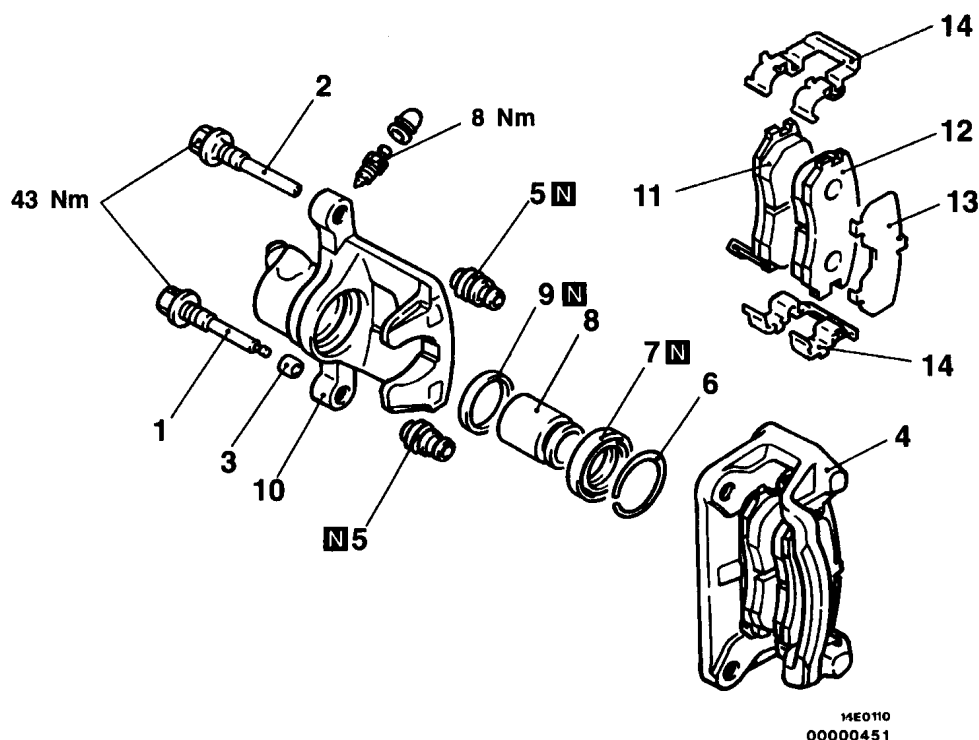
INSTALLATION SERVICE POINT

►A◄ REAR BRAKE ASSEMBLY INSTALLATION

Install the rear brake assembly and measure the disc brake drag torque. (Refer P. 35A-14.)

DISASSEMBLY AND REASSEMBLY

120000084



<p>14E0111</p>	<p>14E0112</p>	<p>14E0113</p>
Brake caliper kit	Pad kit	Seal and boot kit

Caliper assembly disassembly steps



1. Lock pin
2. Guide pin
3. Bushing
4. Caliper support (Pad, clip and shim)
5. Pin boot
6. Boot ring
7. Piston boot
8. Piston
9. Piston seal
10. Caliper body

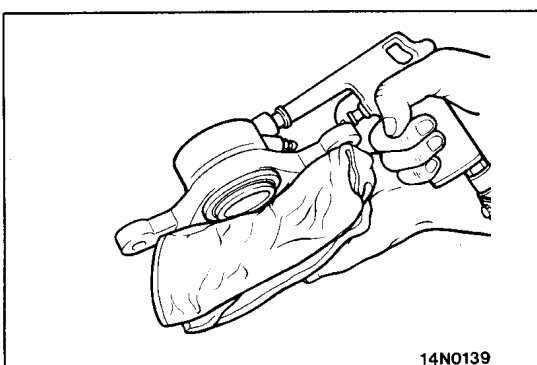
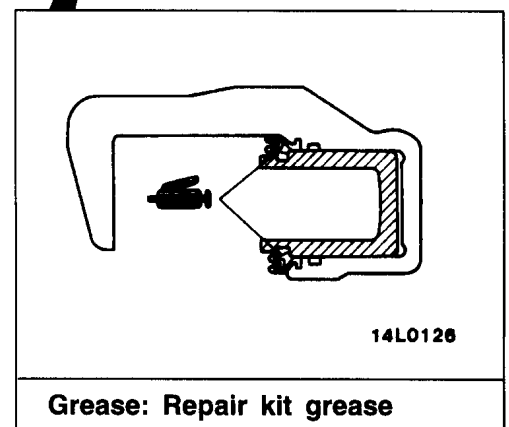
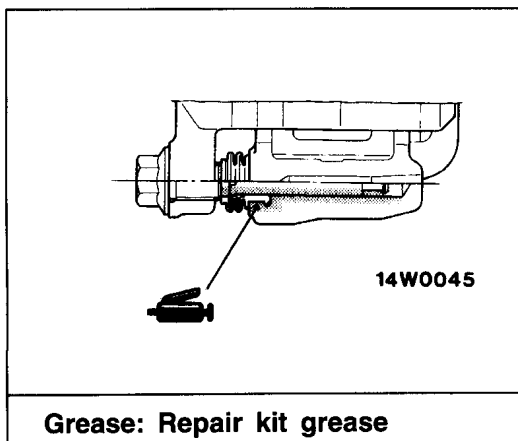
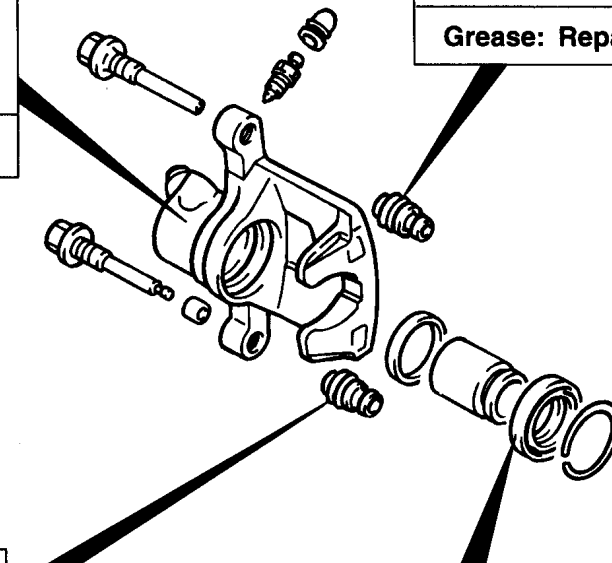
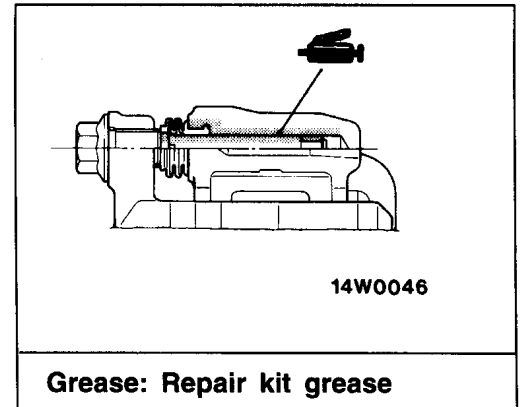
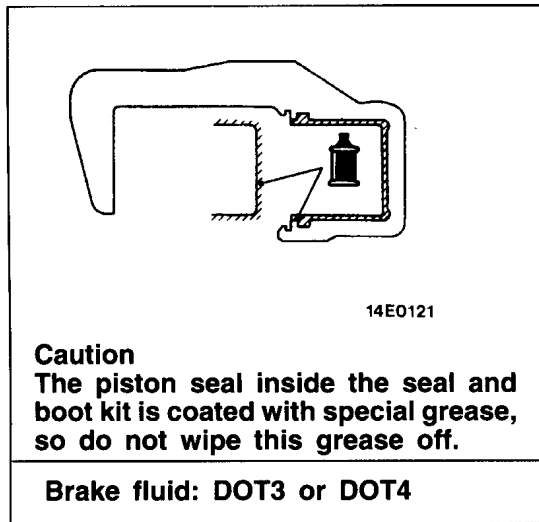


Pad assembly disassembly steps



1. Lock pin
2. Guide pin
3. Bushing
4. Caliper support (Pad, clip and shim)
11. Pad and wear indicator assembly
12. Pad assembly
13. Outer shim
14. Clip

Lubrication points



DISASSEMBLY SERVICE POINTS

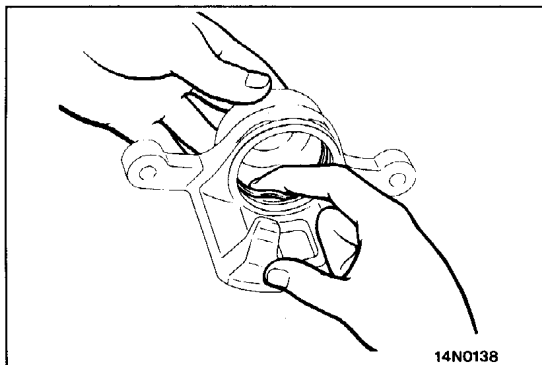
When disassembling the disc brakes, disassemble both sides (left and right) as a set.

◀A▶ PISTON BOOT/PISTON REMOVAL

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

Caution

Blow compressed air gently.



◀B▶ PISTON SEAL REMOVAL

- (1) Remove piston seal with finger tip.

Caution

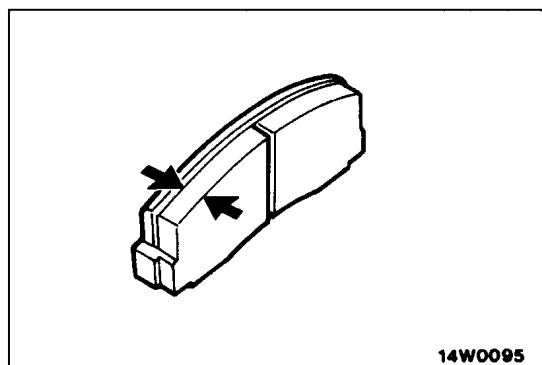
Do not use a flat-tipped screwdriver or other tool to prevent damage to inner cylinder.

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

Specified brake fluid: DOT3 or DOT4

INSPECTION

- 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 thickness at the thinnest and worn area of the pad. Replace pad assembly if pad thickness is less than the limit value.

Standard value: 9.0 mm

Limit value: 2.0 mm

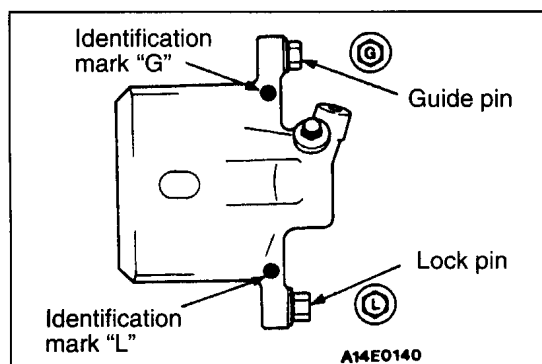
Caution

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, lock pin and guide pin.

REASSEMBLY SERVICE POINT

▶A◀ LOCK PIN/GUIDE PIN INSTALLATION

Install the guide pin and lock pin as illustrated so that each head mark of the guide pin and the lock pin matches the identification mark located on the caliper body.



REAR DRUM BRAKE <2WD>

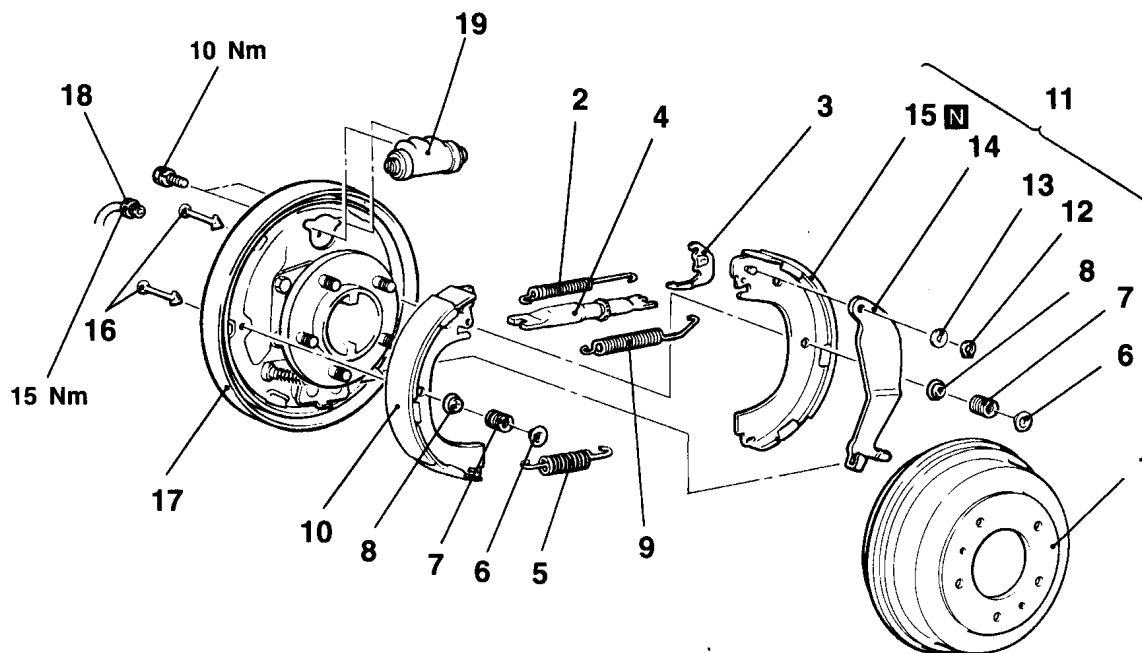
REMOVAL AND INSTALLATION

Pre-removal Operation

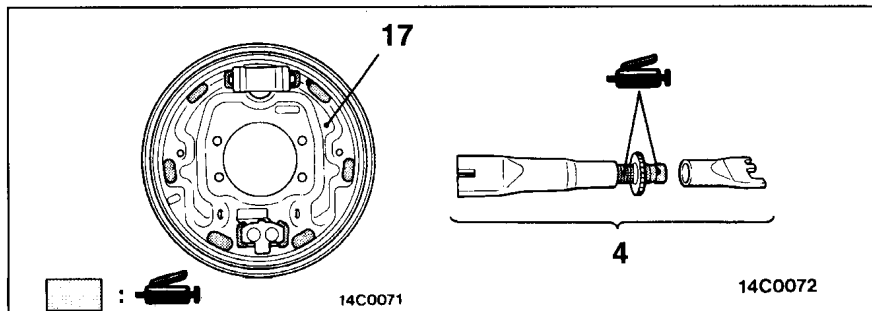
- Loosening the Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-Installation Operation

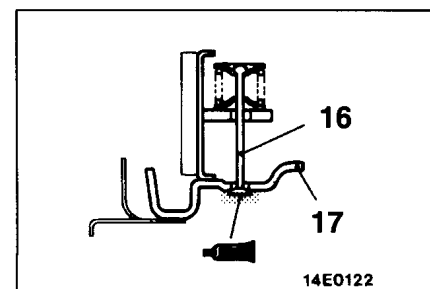
- Brake Fluid Filling and Air Bleeding (Refer to P. 35A-11 or GROUP 35B – Service Adjustment Procedures.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – Service Adjustment Procedures.)



14W0094
00000453



Specified grease: Brake grease SAE J310, NLGI No. 1



Sealant: 3M ATD Part
No. 8513 or equivalent

Rear drum brake removal steps

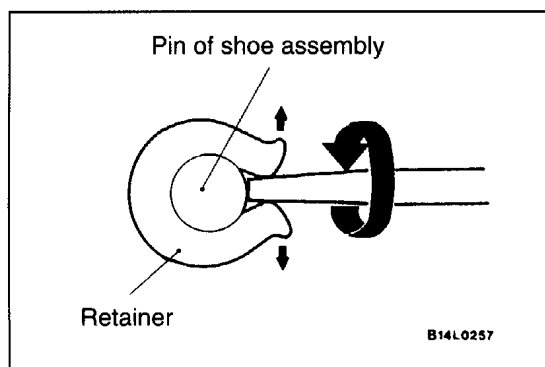
1. Brake drum
2. Shoe-to-lever spring
3. Adjuster lever
4. Auto adjuster assembly
5. Retainer spring
6. Shoe hold-down cup
7. Shoe hold-down spring
8. Shoe hold-down cup
9. Shoe-to-shoe spring
10. Shoe and lining assembly
11. Shoe and lever assembly



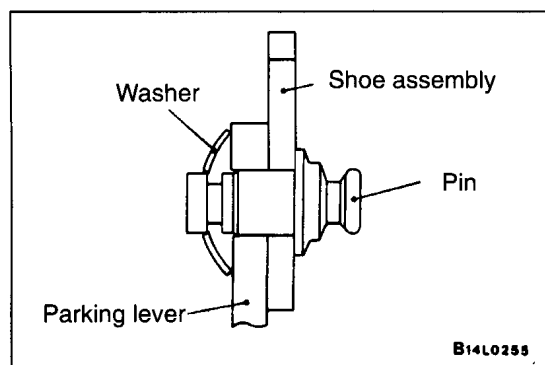
12. Retainer
13. Wave washer
14. Parking lever
15. Shoe and lining assembly
16. Shoe hold-down pin
17. Backing plate (Refer to GROUP 27 – Rear Axle Shaft)

Wheel cylinder removal steps

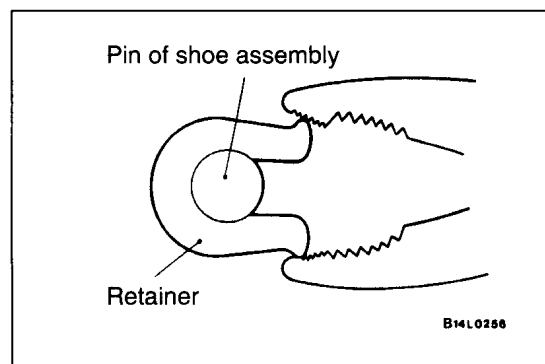
1. Brake drum
18. Brake tube connection
19. Wheel cylinder

**REMOVAL SERVICE POINT****◀▶ RETAINER REMOVAL**

Use a screwdriver or the like to open up the retainer joint, and remove the retainer.

**INSTALLATION SERVICE POINTS****▶A◀ WAVE WASHER INSTALLATION**

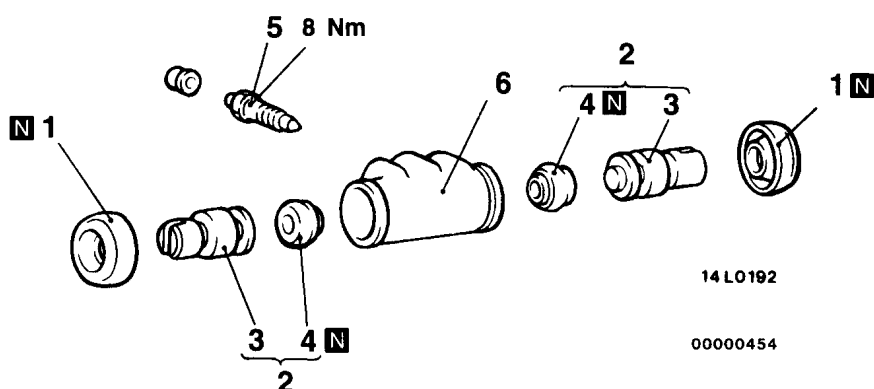
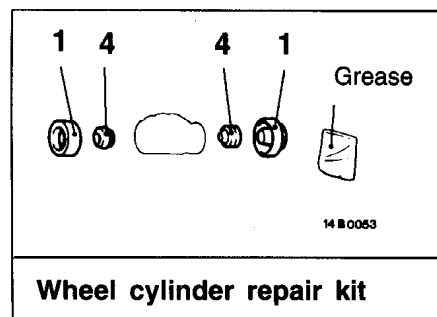
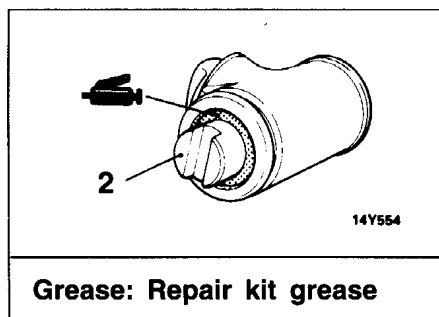
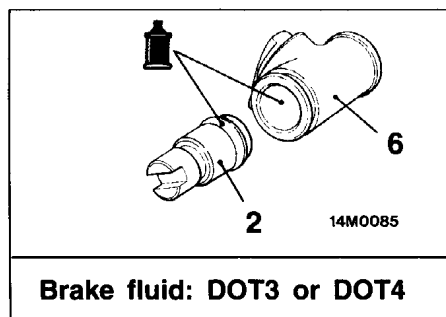
Install the washer in the direction shown in the illustration.

**▶B◀ RETAINER INSTALLATION**

Use pliers or the like to install the retainer or the pin positively.

120000086

WHEEL CYLINDER DISASSEMBLY AND REASSEMBLY



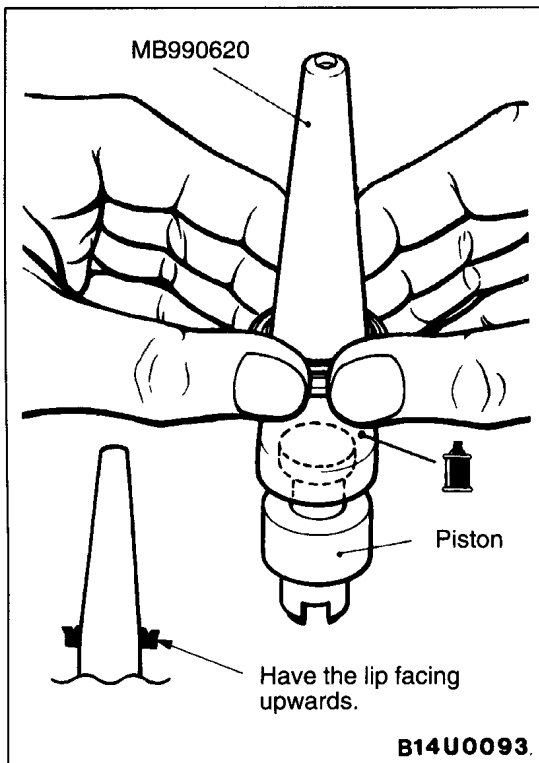
Disassembly steps



1. Boots
2. Piston assembly
3. Pistons
4. Piston cups
5. Bleeder screw
6. Wheel cylinder body

INSPECTION

Check the piston and wheel cylinder walls for rust or damage, and if there is any abnormality, replace the entire wheel cylinder assembly.



REASSEMBLY SERVICE POINT

►A◄ PISTON CUP/PISTON REASSEMBLY

- (1) Use alcohol or specified brake fluid to clean the wheel cylinder and the piston.
- (2) Apply the specified brake fluid to the piston cups and the special tool.

Specified brake fluid: DOT3 or DOT4

- (3) Set the piston cup on the special tool with the lip of the cup facing up, fit the cup onto the special tool, and then slide it down the outside of the tool into the piston groove.

Caution

In order to keep the piston cup from becoming twisted or slanted, slide the piston cup down the tool slowly and carefully, without stopping.

REAR DRUM BRAKE <4WD>

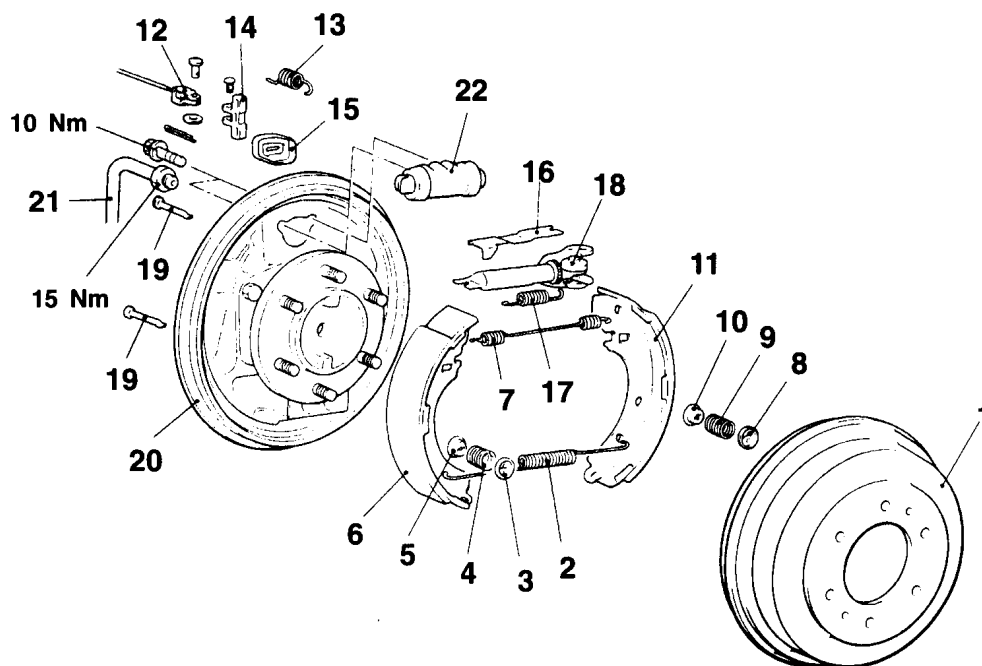
REMOVAL AND INSTALLATION

Pre-removal Operation

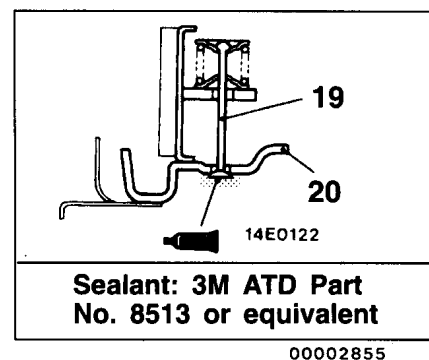
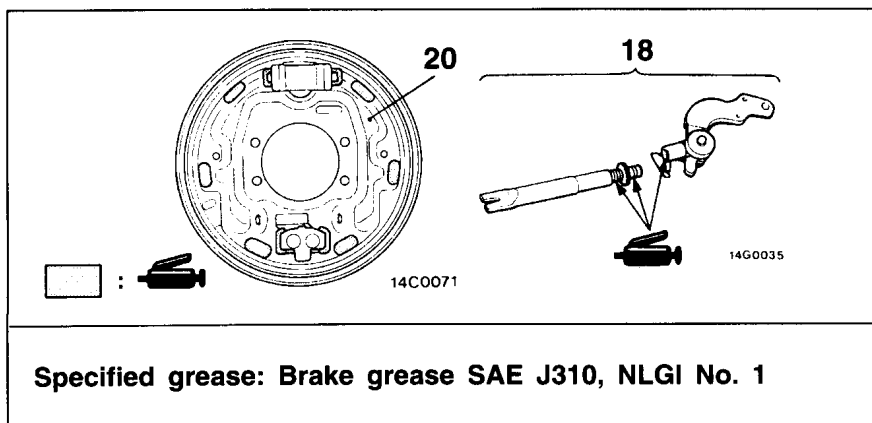
- Loosening the Parking Brake Cable Adjusting Nut.
- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Filling and Air Bleeding (Refer to P. 35A-11 or GROUP 35B – Service Adjustment Procedures.)
- Parking Brake Lever Stroke Adjustment (Refer to GROUP 36 – Service Adjustment Procedures.)



14W0104



00002855

Rear drum brake removal steps

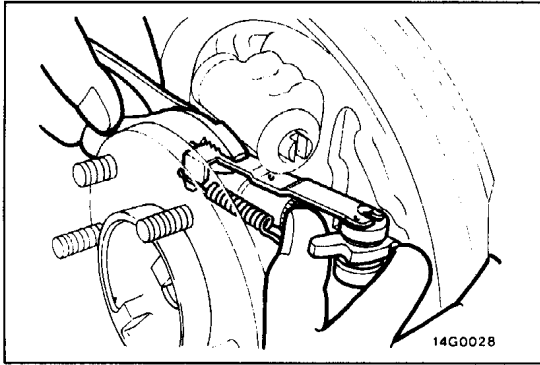
1. Brake drum
2. Lower shoe return spring
3. Shoe hold-down cup
4. Shoe hold-down spring
5. Shoe hold-down cup
6. Shoe and lining assembly
7. Upper shoe return spring
8. Shoe hold-down cup
9. Shoe hold-down spring
10. Shoe hold-down cup
11. Shoe and lining assembly
12. Parking brake cable connection
13. Lever return spring



14. Parking lever stopper
15. Lever boot
16. Lever return spring bracket
17. Spring
18. Adjuster lever assembly
19. Shoe hold-down pin
20. Backing plate (Refer to GROUP 27 – Rear Axle Shaft)

Wheel cylinder removal steps

1. Brake drum
21. Brake tube connection
22. Wheel cylinder

**REMOVAL SERVICE POINT****◀A▶ LEVER RETURN SPRING BRACKET/SPRING
REMOVAL**

Pull the lever return spring bracket with pliers and remove it and spring from the adjuster lever assembly.

WHEEL CYLINDER

120002244

DISASSEMBLY AND REASSEMBLY

Refer to P.35A-47.

ANTI-SKID BRAKING SYSTEM (ABS) <2WD>

CONTENTS

120002245

GENERAL INFORMATION	3	SERVICE ADJUSTMENT PROCEDURES	29
SERVICE SPECIFICATIONS	4	Brake Pedal Inspection and Adjustment Refer to GROUP 35A
LUBRICANTS	4	Stop Lamp Switch Inspection Refer to GROUP 35A
SEALANTS	4	Brake Booster Operating Test Refer to GROUP 35A
SPECIAL TOOLS	4	Brake Booster Vacuum Switch Check Refer to GROUP 35A
TROUBLESHOOTING	5		

CONTINUED ON NEXT PAGE

WARNINGS REGARDING SERVICING OF SUPPLEMENTAL RESTRAINT SYSTEM (SRS)EQUIPPED VEHICLES

WARNING!

- (1) Improper service or maintenance of any component of the SRS, or any SRS-related component, can lead to personal injury or death to service personnel (from inadvertent firing of the air bag) or to the driver and passenger (from rendering the SRS inoperative).
- (2) Service or maintenance of any SRS component or SRS-related component must be performed only at an authorized MITSUBISHI dealer.
- (3) MITSUBISHI dealer personnel must thoroughly review this manual, and especially its GROUP 52B – Supplemental Restraint System (SRS) before beginning any service or maintenance of any component of the SRS or any SRS-related component.

NOTE

The SRS includes the following components: impact sensors, SRS diagnosis unit, SRS warning lamp, air bag module, clock spring and interconnecting wiring. Other SRS-related components (that may have to be removed/installed in connection with SRS service or maintenance) are indicated in the table of contents by an asterisk(*)

Bleeding	29
Load Sensing Spring Length Check and Adjustment	Refer to GROUP 35A
Load Sensing Proportioning Valve Function Test	Refer to GROUP 35A
Disc Brake Pad Check and Replacement	Refer to GROUP 35A
Front Disc Brake Rotor Inspection	Refer to GROUP 35A
Rear Brake Disc Run-out Check	Refer to GROUP 35A
Rear Brake Disc Run-out Correction	Refer to GROUP 35A
Rear Brake Disc Thickness Check	Refer to GROUP 35A
Brake Lining Thickness Check	Refer to GROUP 35A
Brake Drum Inside Diameter Check	Refer to GROUP 35A
Brake Lining and Brake Drum Connection Check	Refer to GROUP 35A
ABS Operation Check	30

BRAKE PEDAL Refer to GROUP 35A

MASTER CYLINDER AND BRAKE BOOSTER 35

LOAD SENSING PROPORTIONING VALVE Refer to GROUP 35A

FRONT DISC BRAKE .. Refer to GROUP 35A

REAR DISC BRAKE Refer to GROUP 35A

REAR DRUM BRAKE .. Refer to GROUP 35A

HYDRAULIC UNIT 41

WHEEL SPEED SENSOR 43

STEERING WHEEL SENSOR* 45

ELECTRONIC CONTROL UNIT* 46

GENERAL INFORMATION

120000110

The ABS consists of wheel speed sensors, stop lamp switch hydraulic unit and the ABS-ECU. If a problem occurs in the system, the malfunctioning system can be identified by means of the diagnosis function, and the trouble symptom memory will not be erased even if the ignition switch is turned to

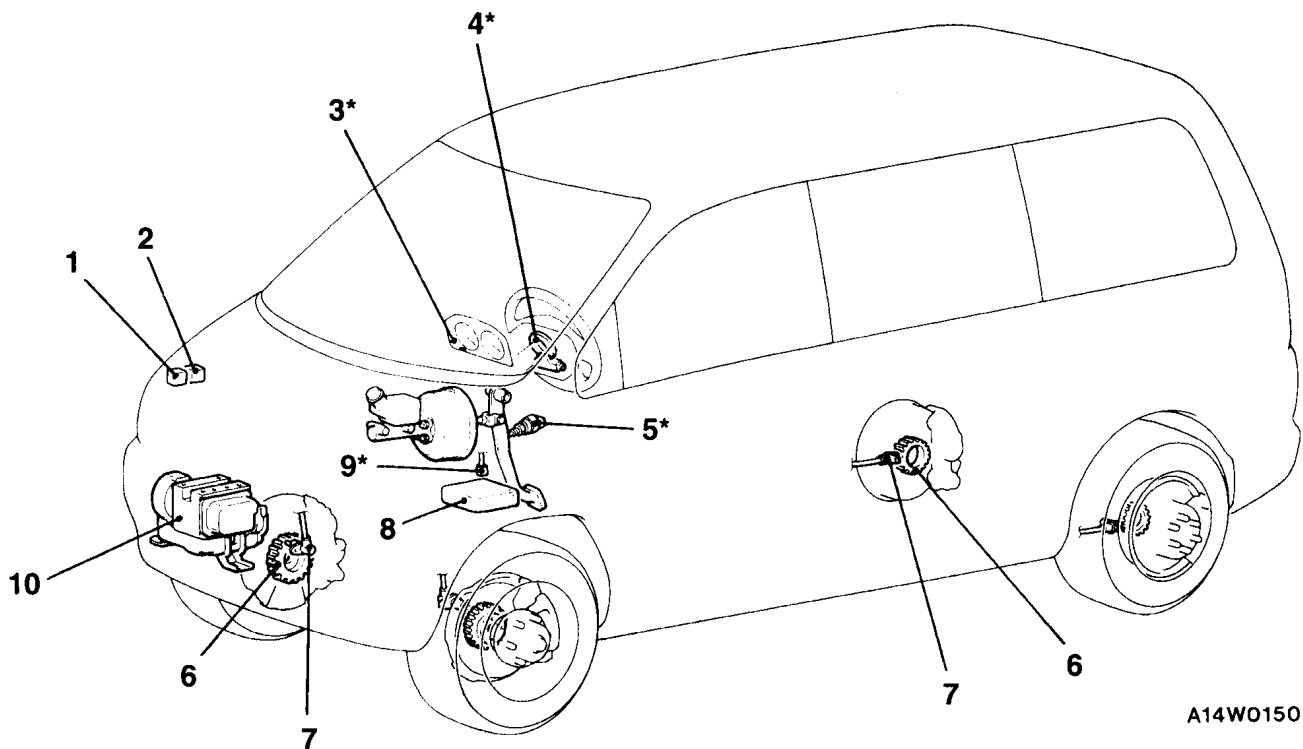
OFF. (However, it will be erased if the battery is disconnected.)

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

Items	Specifications
Speed sensor	Magnet coil type
Front rotor teeth	47
Rear rotor teeth	47

CONSTRUCTION DIAGRAM

120002438



A14W0150

NOTE

For R.H. drive vehicles, * indicates installaiton at the right side.

1. ABS valve relay
2. ABS motor relay
3. ABS warning lamp
4. Steering wheel sensor
5. Stop lamp switch
6. Rotor

7. Wheel speed sensor
8. ABS-ECU
9. Diagnosis connector
10. Hydraulic unit

SERVICE SPECIFICATIONS

120002440

Items		Standard value
Hydraulic unit solenoid valve internal resistance Ω	OUT	3.8
	IN	8.2
Speed sensor's internal resistance $k\Omega$	Front	0.9–1.1
	Rear	1.4–2.0
Speed sensor insulation resistance $k\Omega$		100 or more
Booster push rod to master cylinder piston clearance mm	Petrol-powered vehicles	0.70–1.20
	Diesel-powered vehicles	1.00–1.40

LUBRICANTS

120000113

Items	Specified lubricant
Brake fluid	DOT3 or DOT4

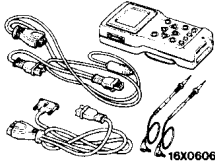

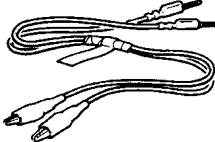
SEALANTS

120000114

Items	Specified sealant	Remarks
Thread part fitting	3M ATD Part No. 8663 or equivalent	Semi-drying sealant
Vacuum switch		

SPECIAL TOOLS

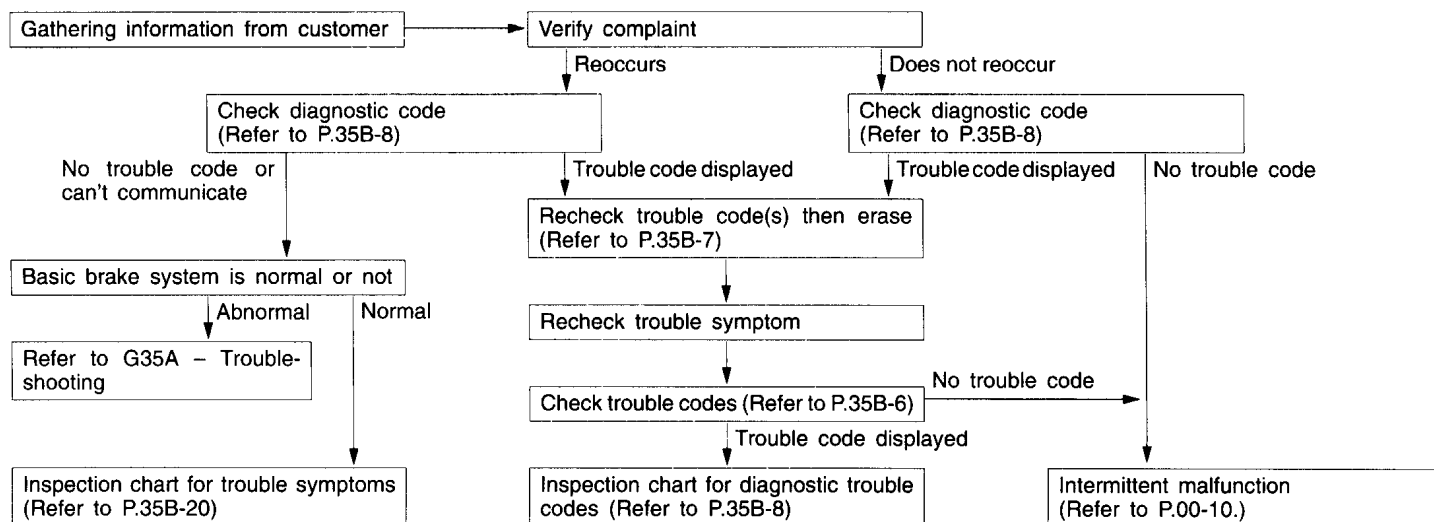
120000115

Tool	Number	Name	Use
	MB991502	MUT-II sub assembly	For checking of ABS (Diagnosis code display when using the MUT-II)
 16X0607	—	ROM pack	
	MB991529	Diagnosis code check harness	For checking of ABS (Diagnosis code display when using the ABS warning lamp)

TROUBLESHOOTING

120002441

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



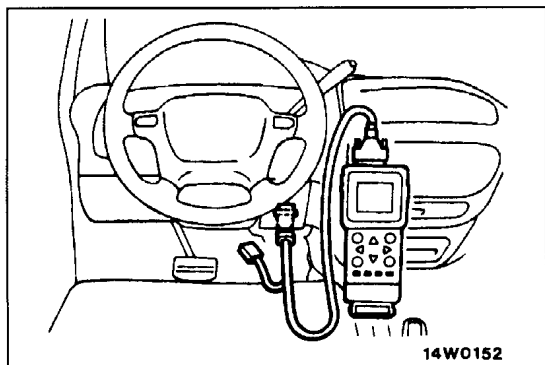
NOTES WITH REGARD TO DIAGNOSIS

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.



DIAGNOSTIC FUNCTION

DIAGNOSTIC CODES CHECK

With the MUT-II

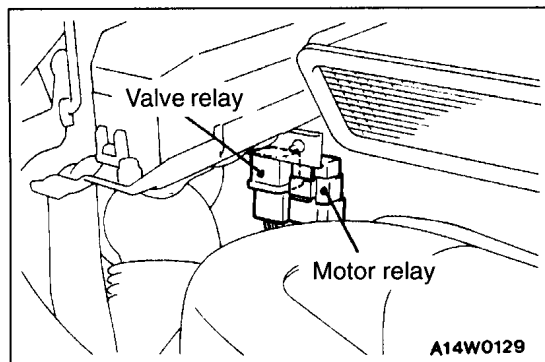
Connect the MUT-II to the diagnosis connector (16-pin), then check diagnostic codes.

Caution

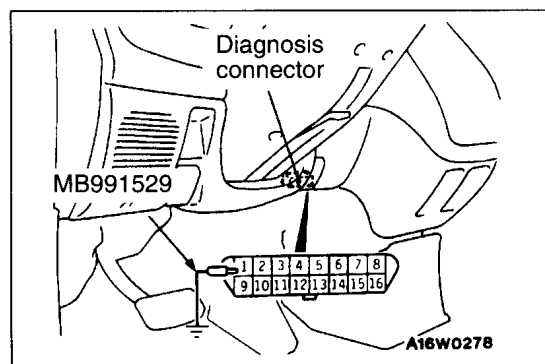
Turn the ignition switch off before connecting or disconnecting the MUT-II.

Without the MUT-II

1. Turn the ignition switch off and then disconnect the valve relay connector.



2. Use the special tool to earth diagnosis connector terminal No. 1.

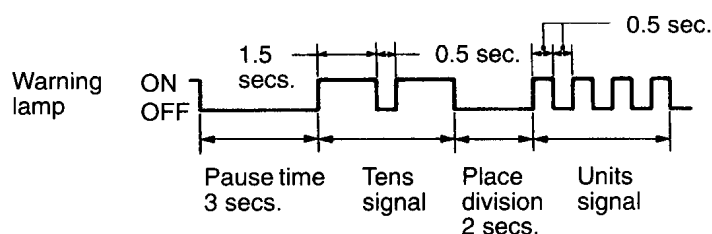


3. Turn the ignition switch to ON and then take a reading of the diagnosis codes from the flashing of the ABS warning lamp.

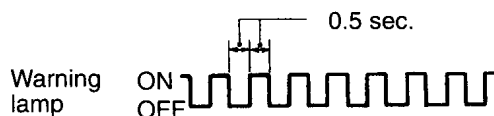
NOTE

Diagnosis code No. 51 (indicating an open or short circuit in the valve relay) will be always output, because the valve relay connector is disconnected.

When diagnosis code No. 24 is output



When no diagnosis code is output



4. Remedy the malfunctions indicated by the diagnosis codes, disconnect the diagnosis code check harness, and then reconnect the valve relay harness. Then turn the ignition switch to ON again to check the ABS warning lamp. (Refer to P.35B-19.) If the lamp indicates a malfunction, the valve relay system may be defective. (Refer to P.35B-17.)

ERASING DIAGNOSTIC CODES

With the MUT-II

Connect the MUT-II to the diagnosis connector (16-pin), then erase the diagnostic codes.

Without the MUT-II

Removing the battery cable from the battery (–) terminal for 10 seconds or more, then reconnect the cable.

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

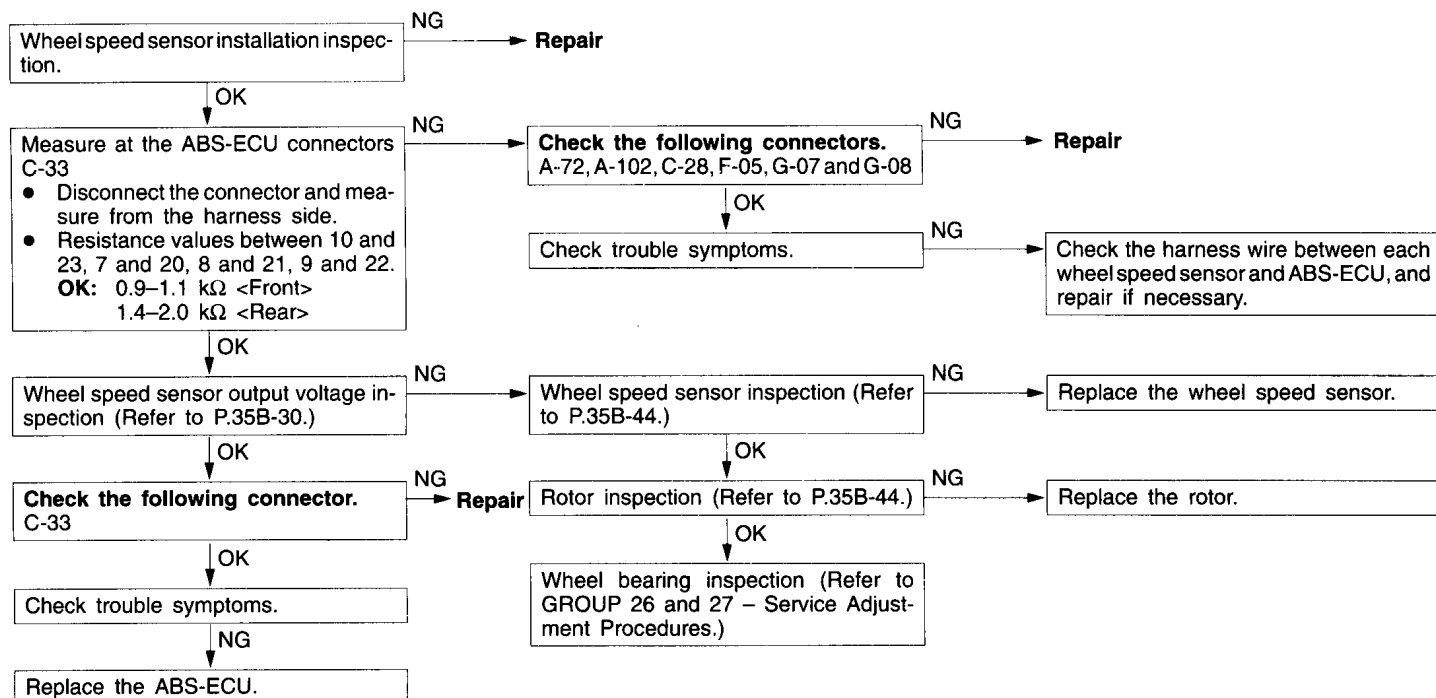
120002581

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

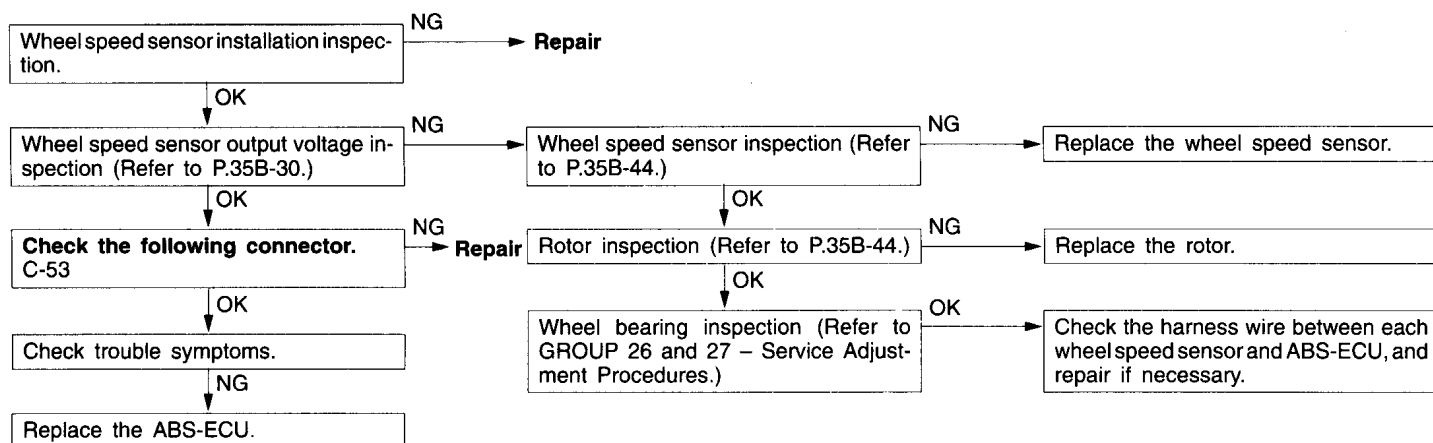
Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front-right wheel speed sensor	Open circuit	P.35B-9
12	Front-left wheel speed sensor		
13	Rear-right wheel speed sensor		
14	Rear-left wheel speed sensor		
15	Wheel speed sensor	Abnormal output signal	P.35B-10
16	Power supply system		P.35B-10
21	Front-right wheel speed sensor	Short circuit	P.35B-11
22	Front-left wheel speed sensor		
23	Rear-right wheel speed sensor		
24	Rear-left wheel speed sensor		
33	Stop lamp switch system		P.35B-12
34	Steering wheel sensor	Open circuit	P.35B-13
35	Steering wheel sensor (ST-N)	Neutral position improperly detected	P.35B-14
36	Steering wheel sensor (ST-1, ST-2)	Steering angle improperly detected	P.35B-15
41	Front-right solenoid valve		P.35B-16
42	Front-left solenoid valve		
43	Rear-right solenoid valve		
44	Rear-left solenoid valve		
51	Valve relay		P.35B-17
53	Motor relay, motor		P.35B-18
63	ABS-ECU		P.35B-46 (Replace the ABS-ECU.)

INSPECTION PROCEDURE FOR DIAGNOSTIC TROUBLE CODES

Code No. 11, 12, 13, 14 Wheel speed sensor open circuit	Probable cause
[Comment] The ABS-ECU determines that an open 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 ABS-ECU



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

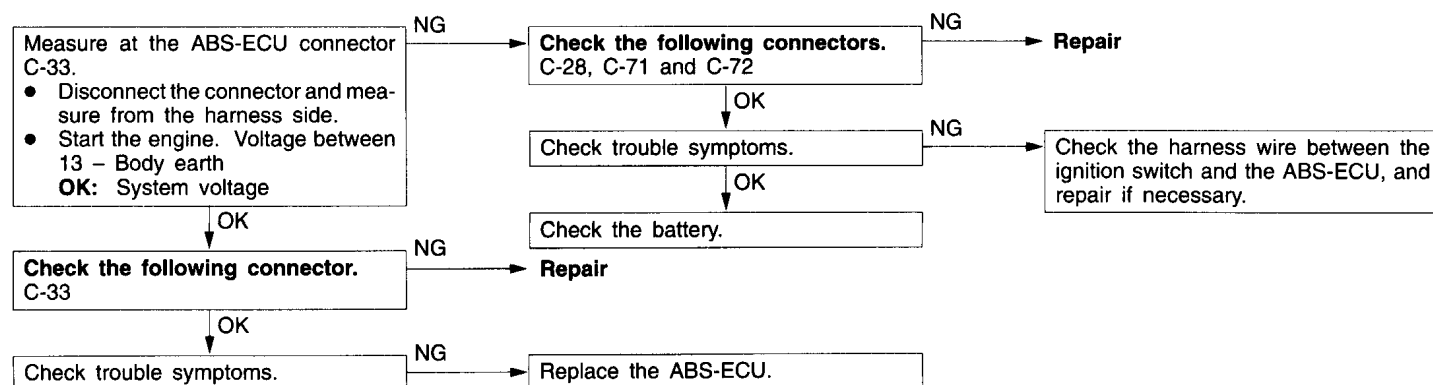


Code No. 16 Power supply system	Probable cause
<p>[Comment] The voltage of the ABS-ECU power supply drops lower or rises higher than the specified value. If the voltage returns to the specified value, this code is no longer output.</p>	<ul style="list-style-type: none"> • Malfunction of wiring harness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

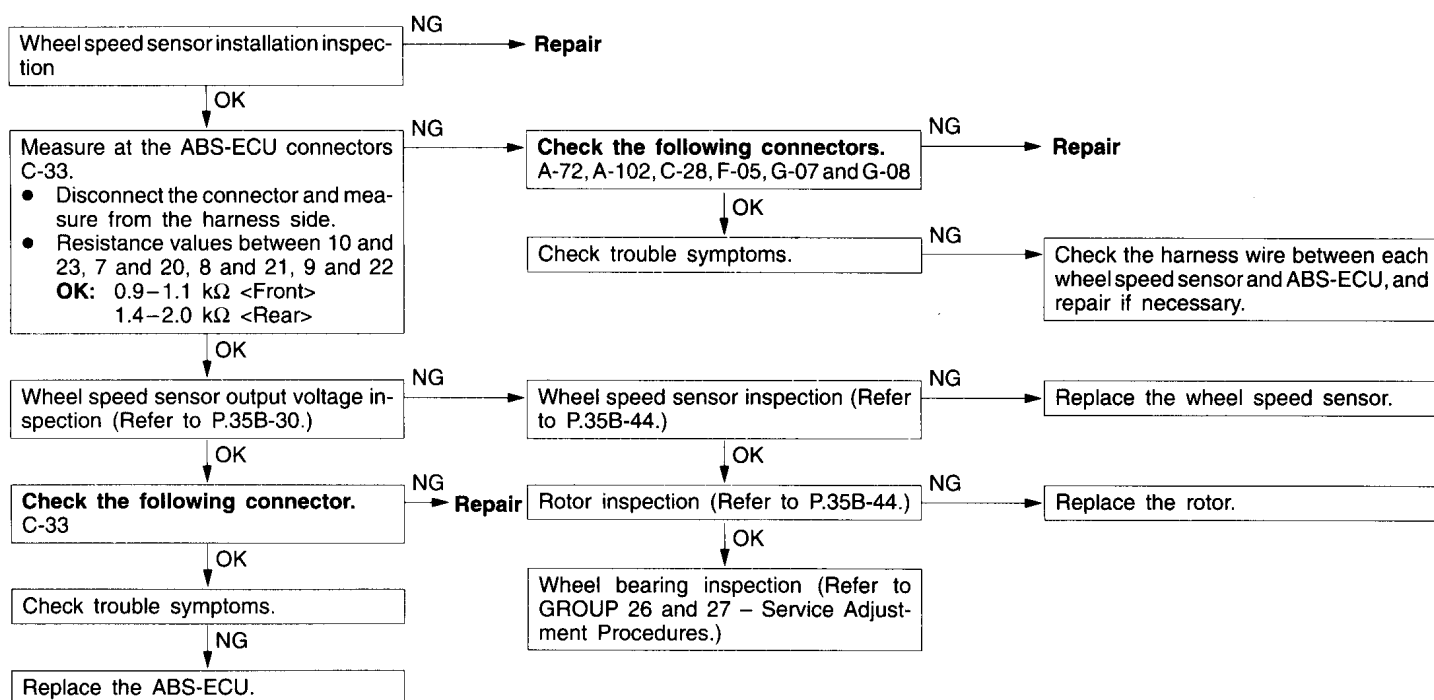
Caution

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.

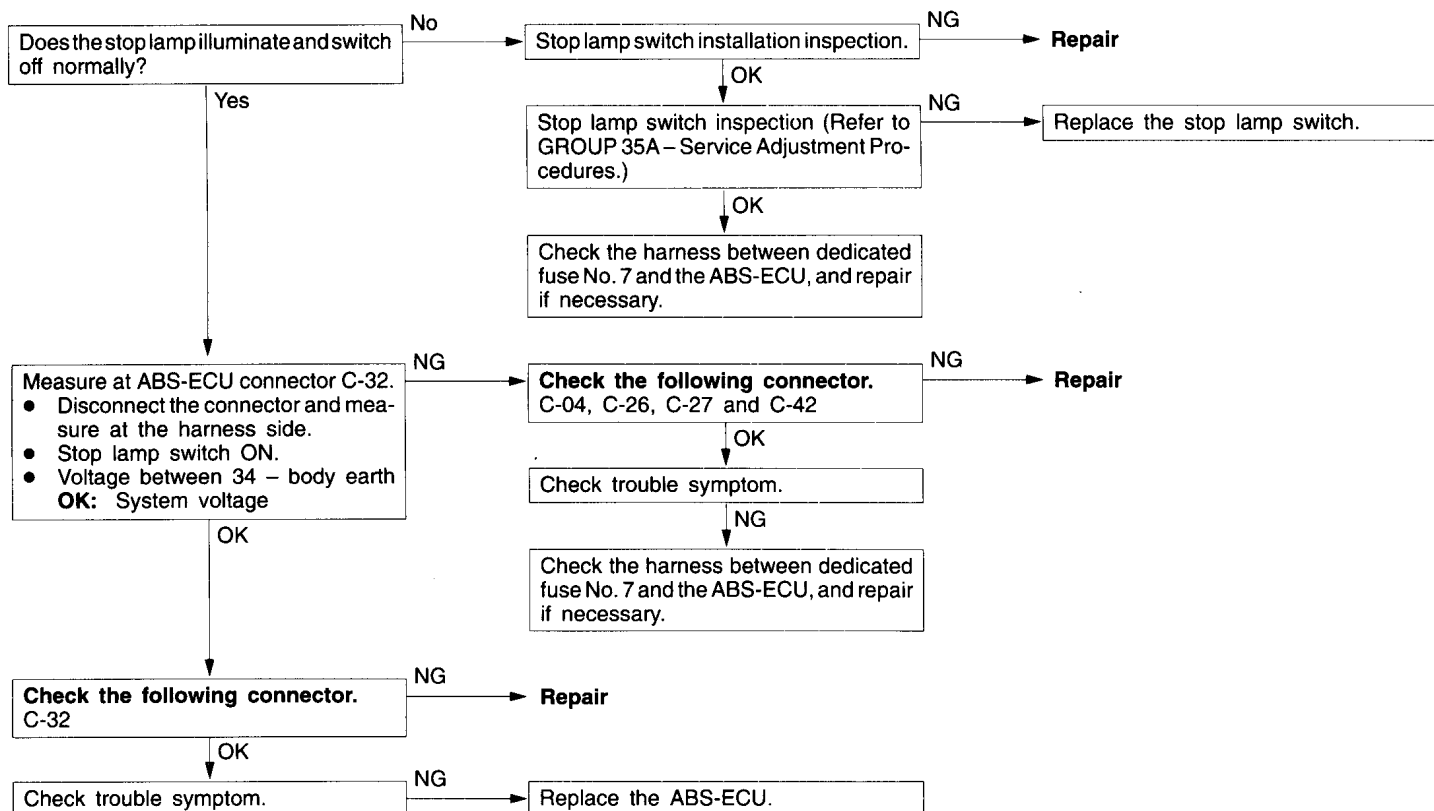
Before carrying out the following inspection, check the battery level, and refill distilled water if necessary.



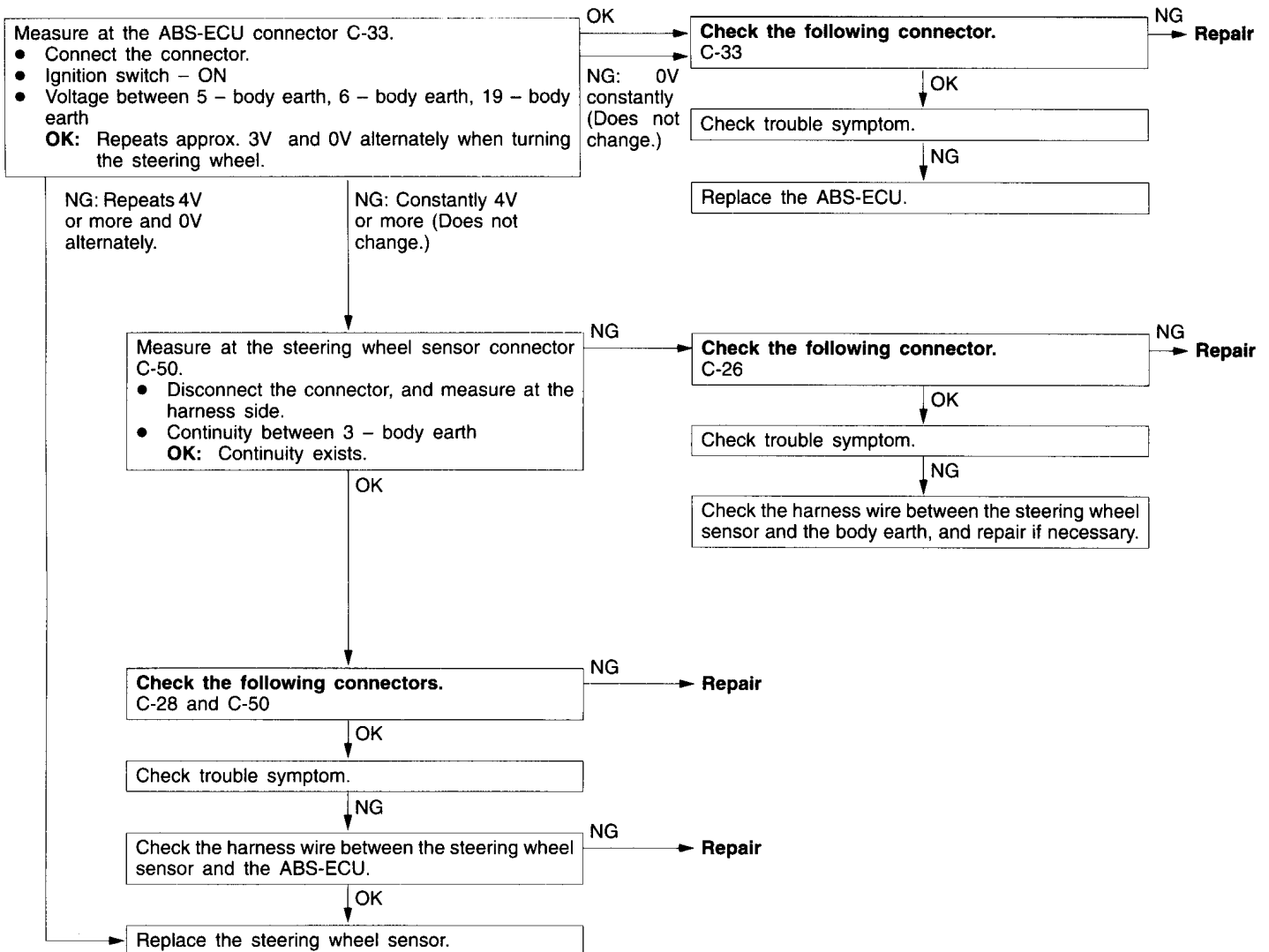
Code No. 21, 22, 23, 24 Wheel speed sensor short circuit	Probable cause
<p>[Comment]</p> <p>These codes are output at the following times:</p> <ul style="list-style-type: none"> When an open circuit cannot be found, but more than one wheel speed sensor does not output any signal during driving at 8 km/h 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 rotor Malfunction of wheel bearing Malfunction of wiring harness or connector Malfunction of ABS-ECU



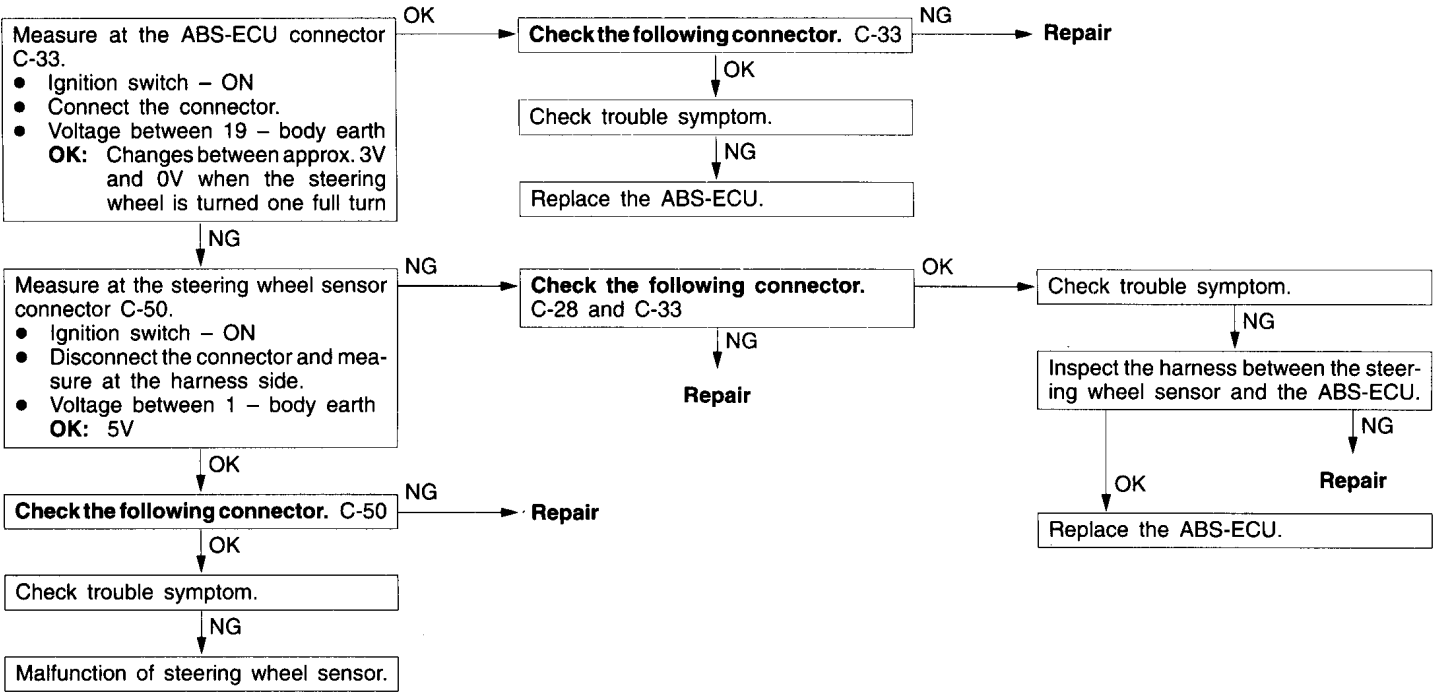
Code No. 33 Stop lamp switch system	Probable cause
<p>[Comment]</p> <p>These codes are output at the following times:</p> <ul style="list-style-type: none"> When the stop lamp switch is not be turned off (when the stop lamp switch stays on for 15 minutes or more although the ABS is not operating). When 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 ABS-ECU



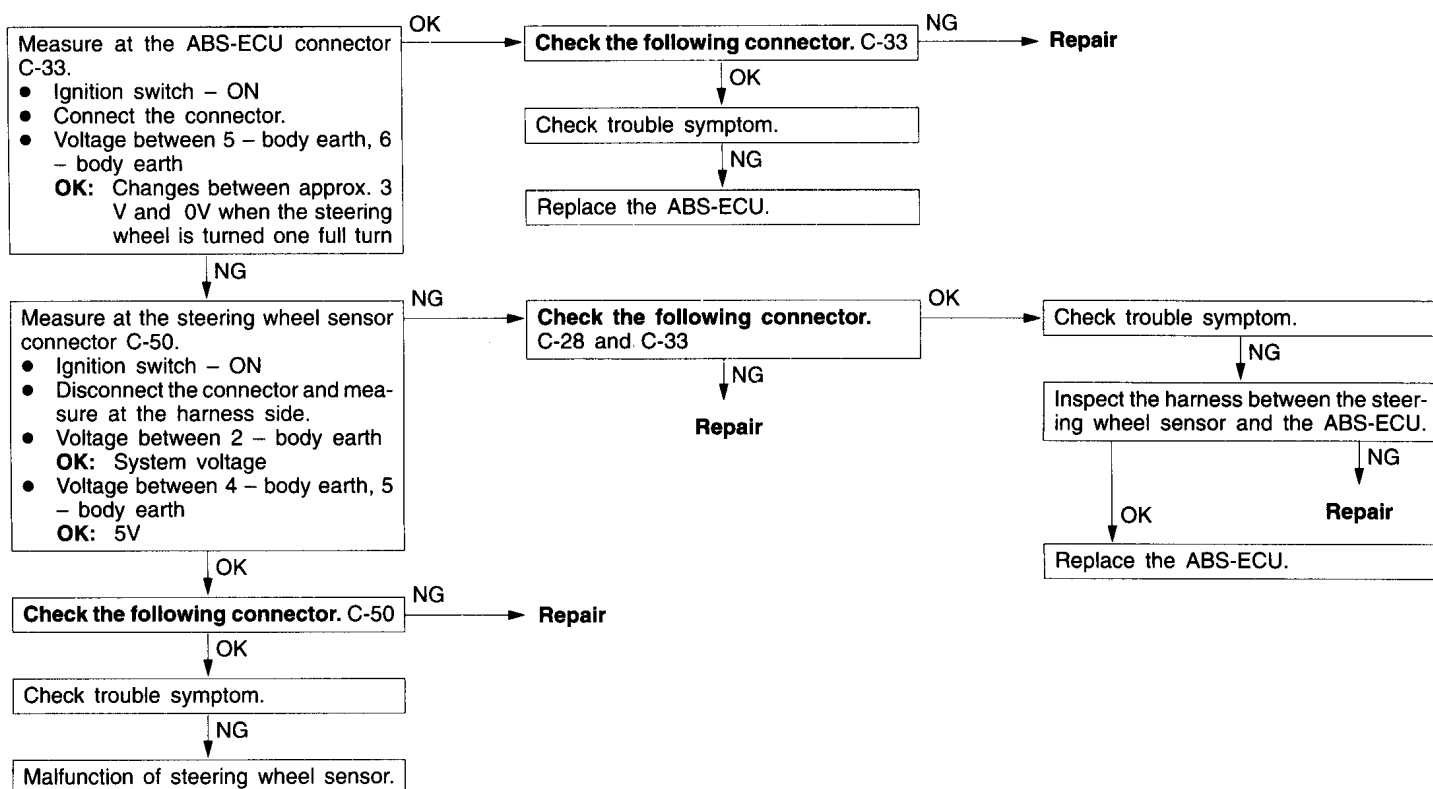
Code No. 34 Steering wheel sensor open circuit	Probable cause
<p>[Comment]</p> <p>There is an open circuit in a signal line (ST-1, ST-2, STN) or earth line of the sensor.</p>	<ul style="list-style-type: none"> • Malfunction of the steering wheel sensor • Malfunction of the connector or harness wire • Malfunction of the ABS-ECU



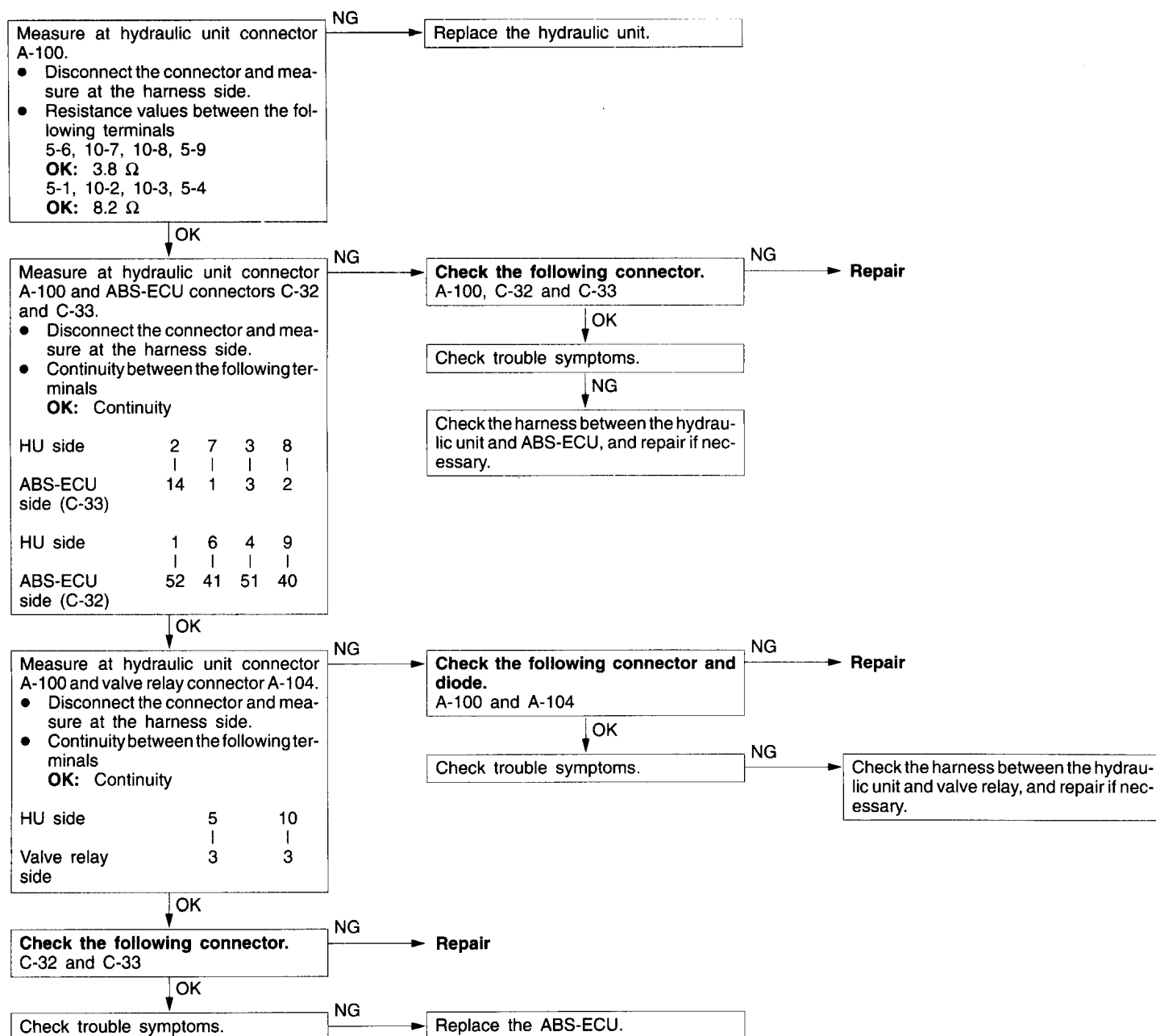
Code No. 35 Steering wheel sensor (ST-N) system (neutral position improperly detected)	Probable cause
<p>[Comment] The steering wheel neutral position continues to be detected even when the steering wheel has been turned 40° or more.</p>	<ul style="list-style-type: none">• Malfunction of the steering wheel sensor• Malfunction of the connector or harness wire• Malfunction of the ABS-ECU



Code No. 36 Steering wheel sensor (ST-1, ST-2) system (Steering angle improperly detected)	Probable cause
<p>[Comment] The steering angle signal does not change for five minutes or more during travelling at 10 km/h or higher.</p>	<ul style="list-style-type: none"> • Malfunction of the steering wheel sensor • Malfunction of the connector or harness wire • Malfunction of the ABS-ECU



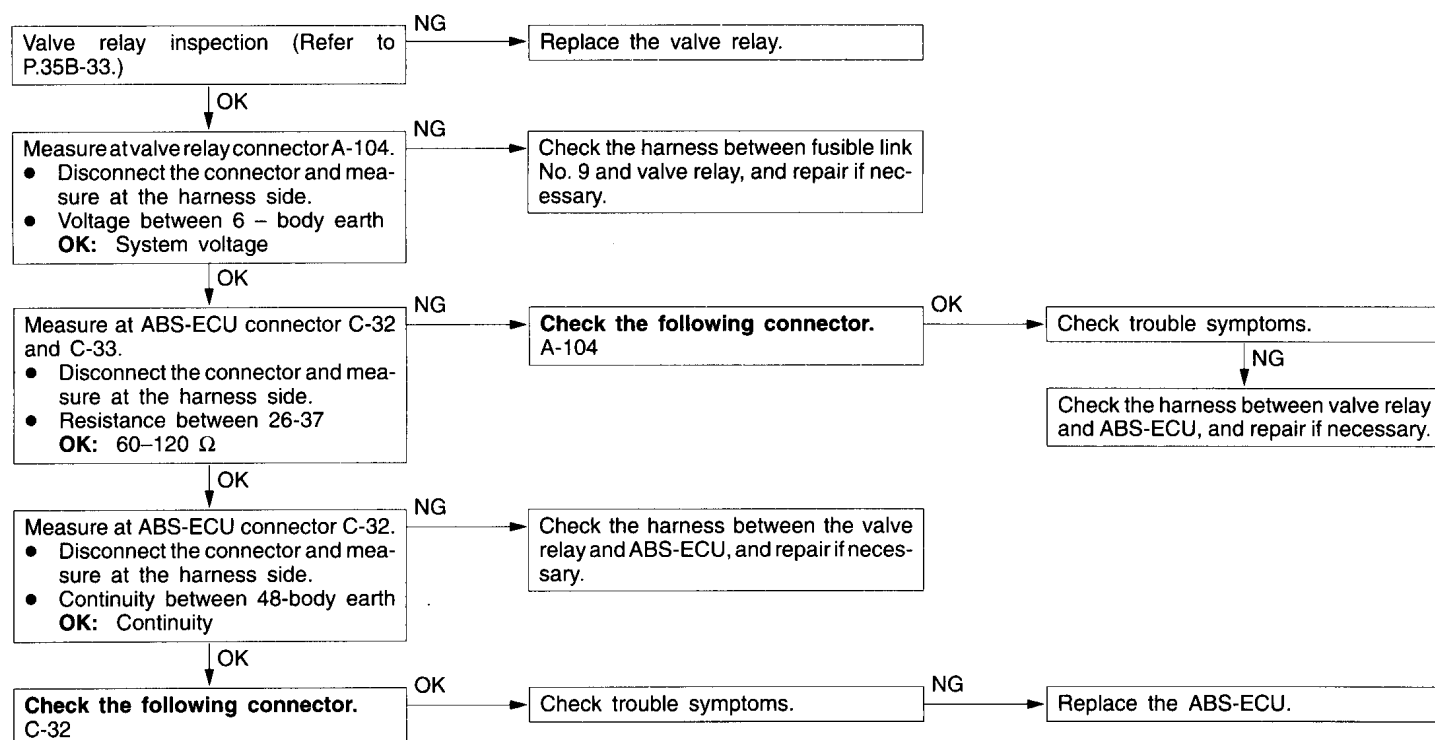
Code No. 41, 42, 43, 44 Solenoid valve	Probable cause
<p>[Comment] The ABS-ECU always monitors the solenoid valve drive circuit. It determines that there is an open or short-circuit in the solenoid coil or in a harness: When no current flows in the solenoid even though the ABS-ECU turns on it, and vice versa.</p>	<ul style="list-style-type: none"> • Malfunction of wiring harness • Malfunction of hydraulic unit • Malfunction of ABS-ECU



Code No. 51 Valve relay	Probable cause
<p>[Comment]</p> <p>When the ignition switch is turned to ON, the ABS-ECU switches the valve relay off and on during the initial check. In that way, the ABS-ECU compares the signals sent to the valve relay with the voltage in the valve power monitor line. That is how to check if the valve relay is operating normally. The ABS-ECU always checks if current flows in the valve power monitor line, too. It determines that there is an open circuit when no current flows. If no current flows in the valve power monitor line, this diagnosis code is output.</p>	<ul style="list-style-type: none"> • Malfunction of valve relay • Malfunction of wiring harness or connector • Malfunction of ABS-ECU • Malfunction of hydraulic unit

NOTE

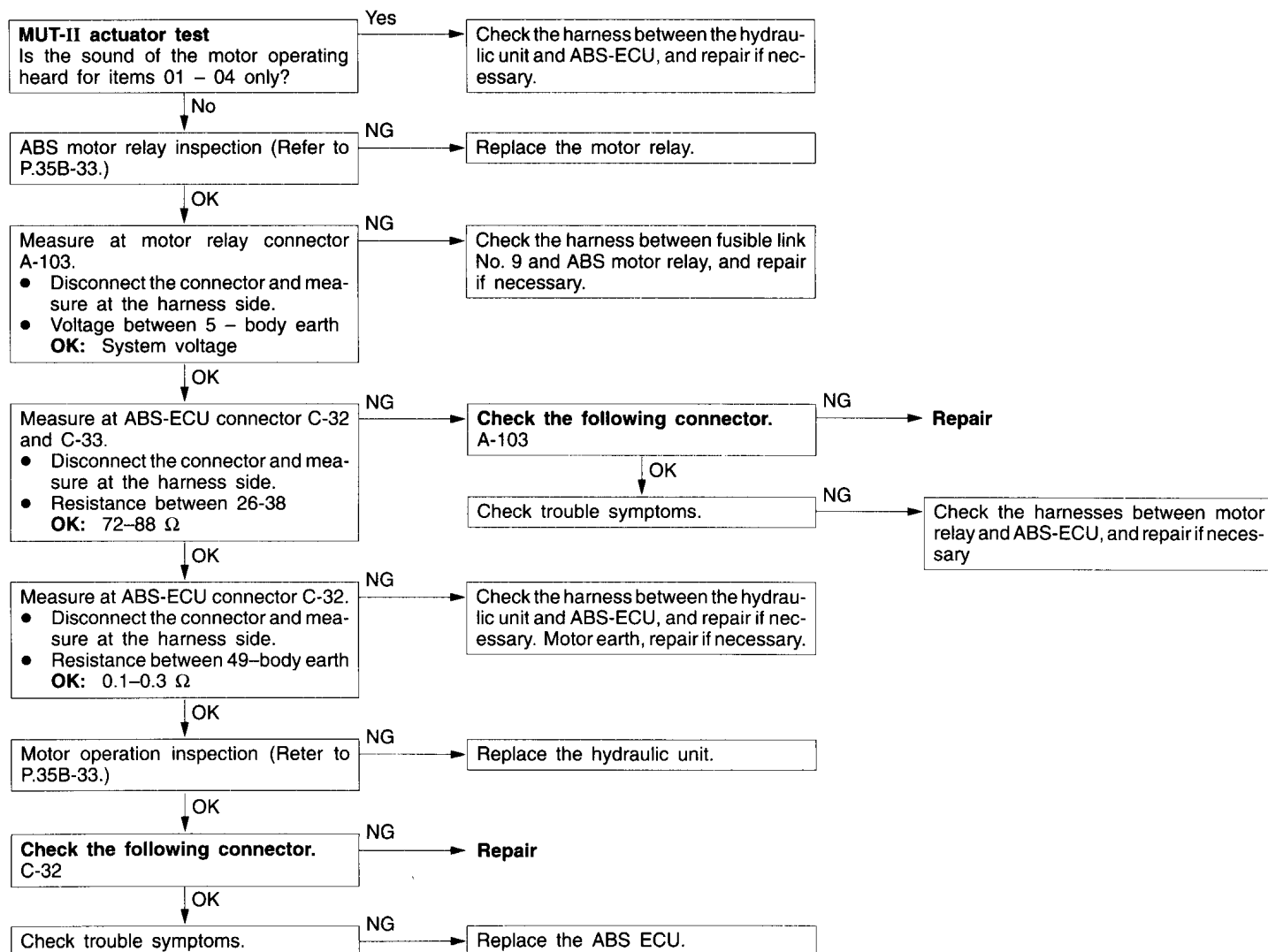
Whenever reading the diagnosis codes using the ABS warning lamp (P.35B-6), this diagnosis code will be output. That is not a malfunction but because the valve relay connector is disconnected. After repairing all other malfunctions, connect the valve relay connector again to check the valve relay. Then check that the ABS warning lamp does not illuminate. If it illuminates, the valve relay may be defective. So carry out the following procedure.



Code No. 53 Motor relay, motor	Probable cause
<p>[Comment]</p> <p>These codes are output at the following times:</p> <p>When the motor relay is on but no signal is input to the motor monitor line (motor is not operating, etc.)</p> <p>When the motor relay is off but a signal is input to the motor monitor line for 5 seconds or more (motor continues operating, etc.)</p> <p>When the motor relay does not operate</p>	<ul style="list-style-type: none"> • Malfunction of motor relay • Malfunction of wiring harness or connector • Malfunction of hydraulic unit • Malfunction of ABS-ECU

Caution

Because force-driving of the motor by means of the actuator test will drain the battery, the engine should be started and left to run for a while after testing is completed.

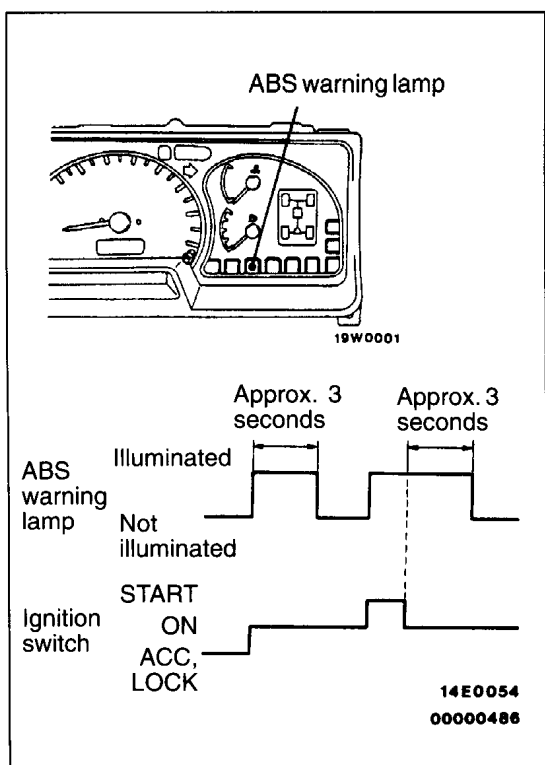


ABS WARNING LAMP INSPECTION

120002443

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



INSPECTION CHART FOR TROUBLE SYMPTOMS

120002582

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

Trouble symptom		Inspection procedure No.	Reference page
Communication with MUT-II is not possible.	Communication with all systems is not possible.	1	P.35B-21
	Communication with ABS only is not possible.	2	P.35B-21
When the ignition key is turned to "ON" (engine stopped), the ABS warning lamp does not illuminate.		3	P.35B-22
After the engine starts, the lamp remains illuminated.		4	P.35B-22
When the ignition key is turned to "START", the ABS warning lamp does not illuminate.		5	P.35B-23
After the ignition key is turned to "ON", the ABS warning lamp blinks twice, and when turned to "START", it illuminates. When returned to "ON", the lamp flashes once, and then switches off.		6	P.35B-23
Faulty ABS operation	Unequal braking power on both sides	7	P.35B-24
	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

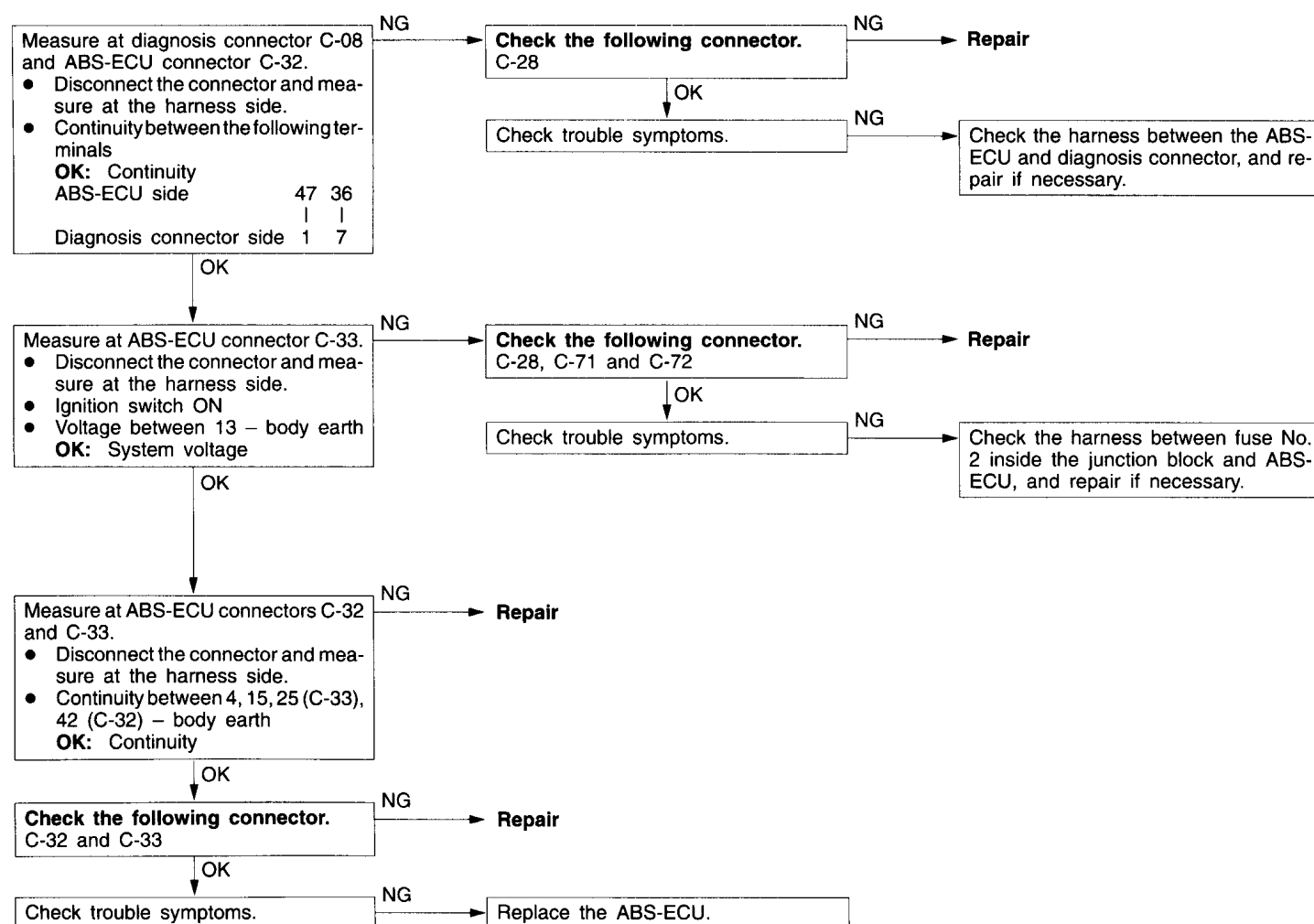
Inspection Procedure 1

Communication with MUT-II is not possible. (Communication with all systems is not possible.)	Probable cause
[Comment] 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

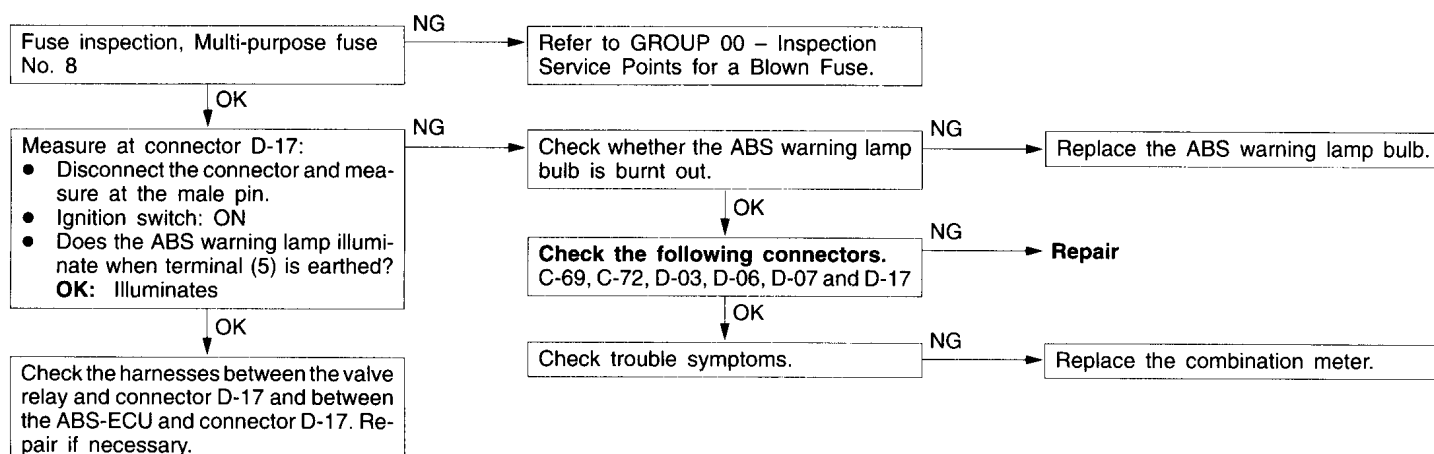
Inspection Procedure 2

Communication with MUT-II is not possible. (Communication with ABS only is not possible.)	Probable cause
[Comment] 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 ABS-ECU



Inspection Procedure 3

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

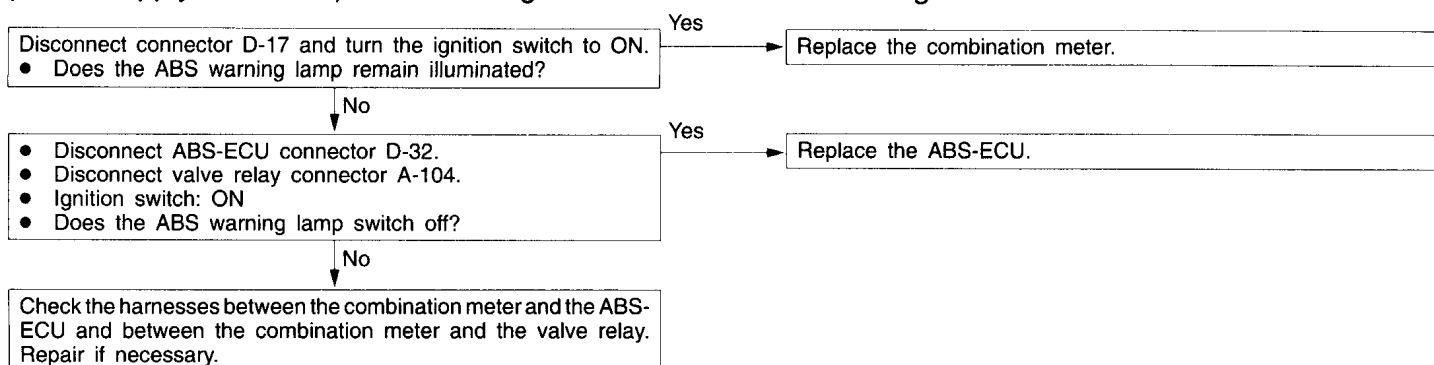


Inspection Procedure 4

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

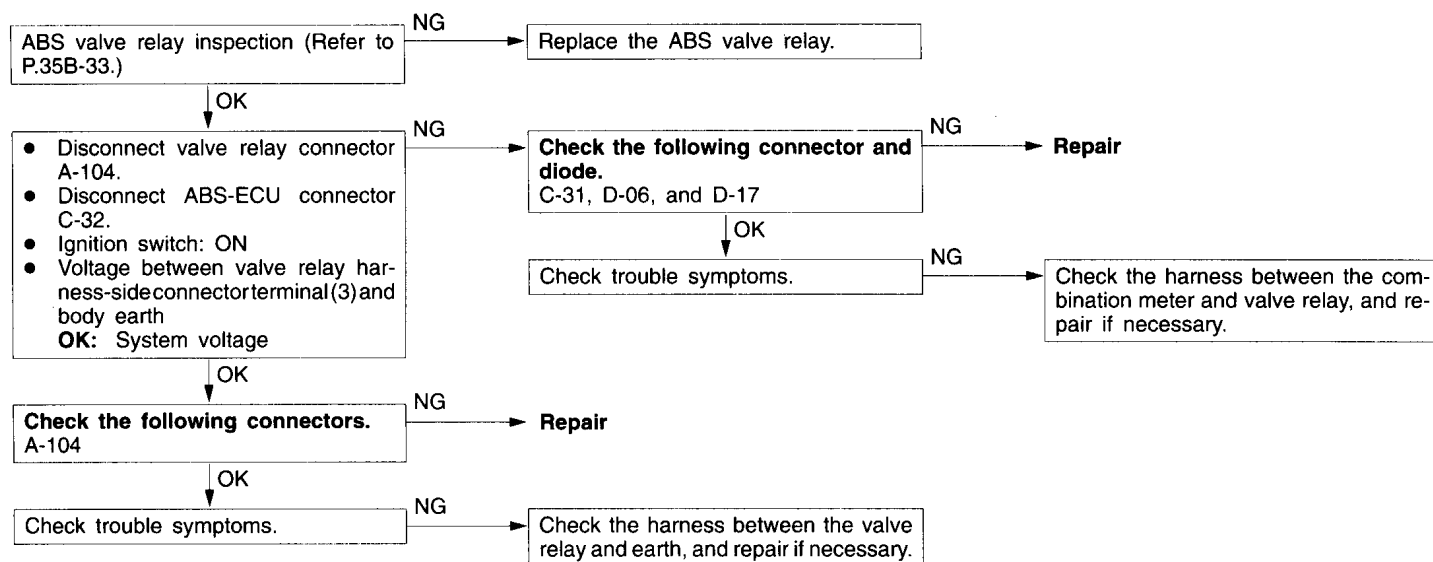
NOTE

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.



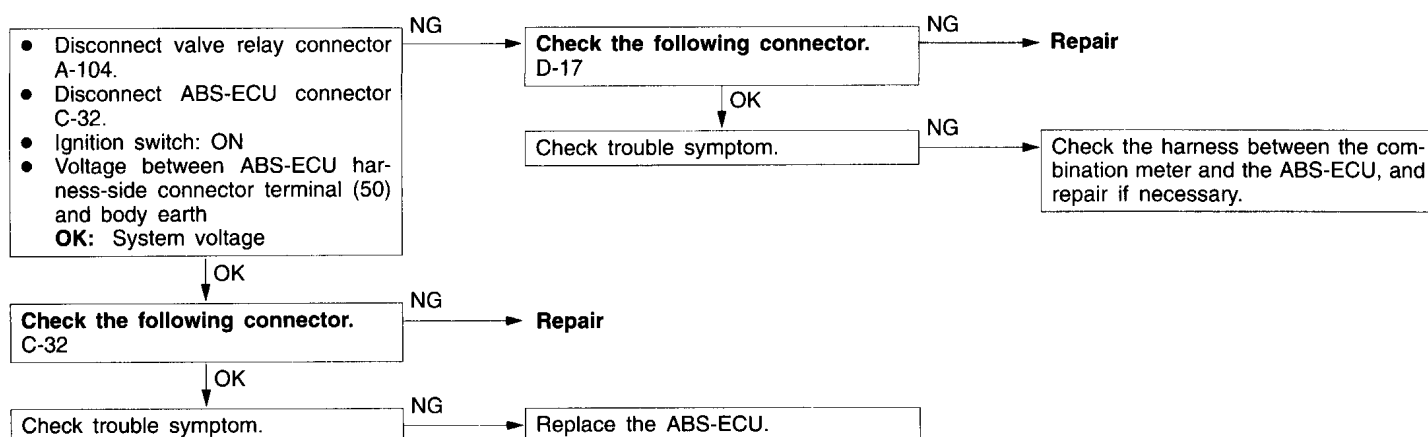
Inspection Procedure 5

When ignition key is turned to "START", ABS warning lamp does not illuminate.	Probable cause
<p>[Comment] Current does not flow in the ABS-ECU when the ignition switch is turned to START. Current flows in the ABS warning lamp even when the ignition switch is turned to START. Therefore, the valve relay, which current is supplied through the ABS-ECU, turns off when the ignition switch is at START. However, the warning lamp circuit of the valve relay must turn on in turn. So the cause must be a defective circuit on valve relay side.</p>	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



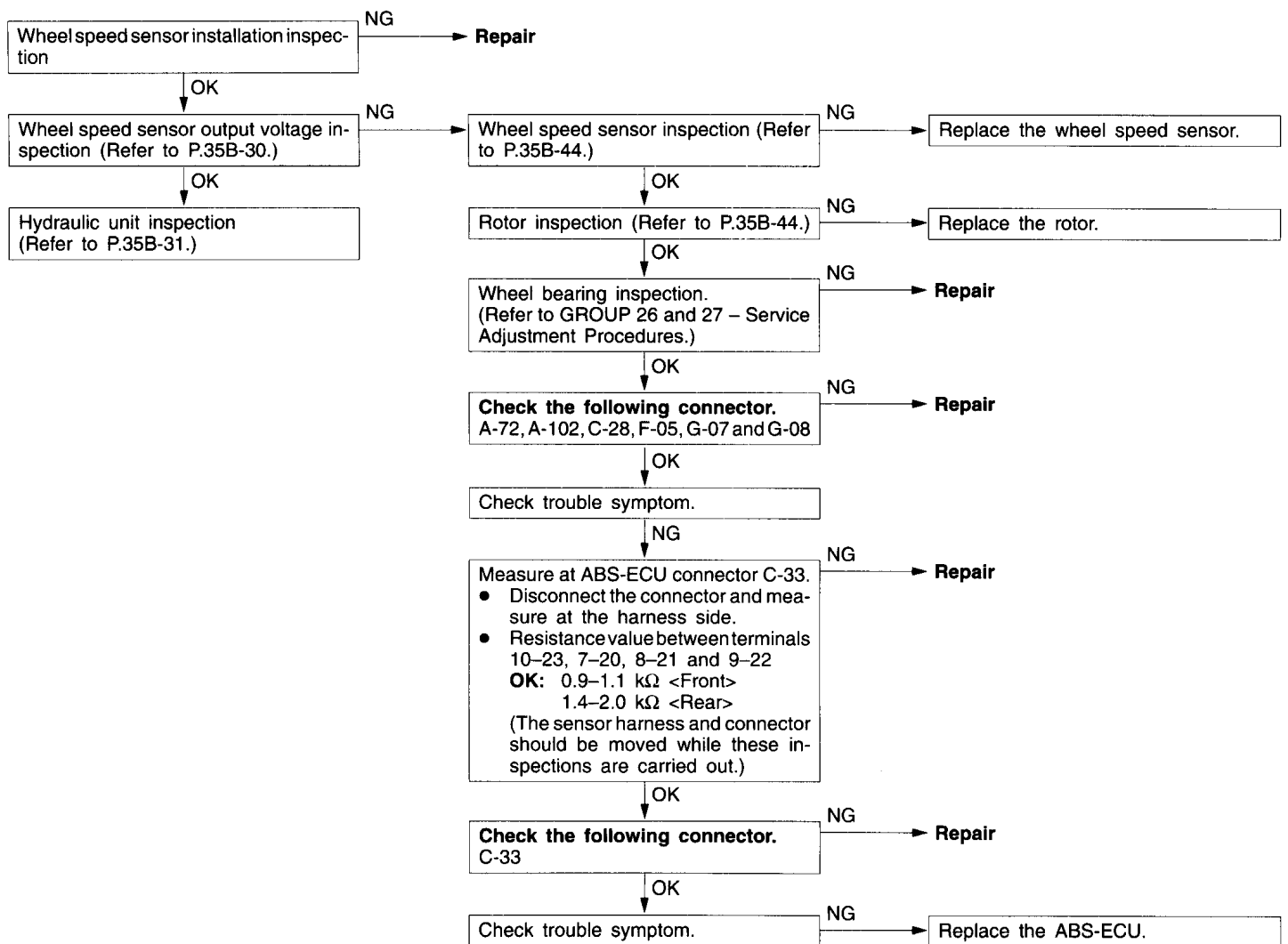
Inspection Procedure 6

The ABS warning lamp flashes twice after the ignition key is turned to "ON". The lamp illuminates when the ignition key is turned to "START", and when the key is returned to "ON", it flashes once.	Probable cause
<p>[Comment] The ABS-ECU causes the ABS warning lamp to illuminate during the initial check (approx. 3 seconds). During the initial check, the valve relay turns from off to on, off and back to on again. If there is an open circuit in the harness between the ABS-ECU and the ABS warning lamp, the lamp will illuminate only when the valve relay is OFF during valve relay test, etc.</p>	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of ABS-ECU



Inspection Procedure 7

Brake operation is abnormal.	Probable cause
<p>[Comment]</p> <p>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.</p>	<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 rotor • Malfunction of wheel bearing • Malfunction of hydraulic unit • Malfunction of ABS-ECU



SERVICE DATA REFERENCE TABLE

120000121

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	9–16V
33	Stop lamp switch	Depress the brake pedal.	ON
		Release the brake pedal.	OFF
34	Steering wheel sensor (Steering angle)	Turn the steering wheel after neutral position is learnt.	MUT-II displays 0° immediately after battery is connected and 5° intervals after neutral position is learnt.
35	Steering wheel sensor (Neutral position detection)	Turn the steering wheel within $\pm 5^\circ$ from neutral position.	ON
		Other than the above	OFF
37	Steering wheel sensor (Neutral position learning)	Drive straight-forward at 10 km/h or more	ON
		Other than the above	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.

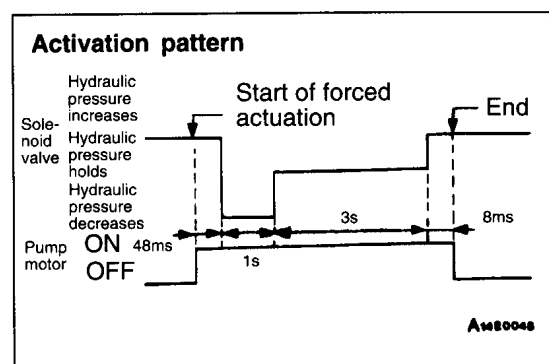
ACTUATOR TEST REFERENCE TABLE

120000122

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 canceled.



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-left wheel	
04	Solenoid valve for rear-right wheel	

CHECK AT ABS-ECU

120000123

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (15), (25) and (42) (earth terminals) and each respective terminal.
2. The terminal layouts are shown in the illustrations below.

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26

31	32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	51	52

14W0043

Con- nector terminal No.	Signal	Checking requirements		Normal condition
1	Output to front-left hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
2	Output to rear-right hydraulic unit solenoid valve (OUT side)			
3	Output to rear-right hydraulic unit solenoid valve (IN side)			
5	Seering wheel sensor (ST-1) input	Ignition switch: ON Turn steering wheel slowly.		0 and approx. 3 V alternates.
6	Seering wheel sensor (ST-2) input	Ignition switch: ON Turn steering wheel slowly.		0 and approx. 3 V alternates.
13	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
14	Output to front-left hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
19	Steering wheel sensor (ST-N) input	Let the engine run at idle and position the steering wheel in the neutral.		0.5 V or less
		Let the engine run at idle and turn the steering wheel 90° from the neutral.		2.5–3.5 V
26	Output to relay power supply	Ignition switch: ON		System voltage
32	Memory power supply	Always		System voltage
34	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch: ON	System voltage
			Stop lamp switch: OFF	1 V or less

Con- nector terminal No.	Signal	Checking requirements		Normal condition
36	MUT-II	Connect the MUT-II.		Serial commu- nication with MUT-II
		Do not connect the MUT-II.		1 V or less
37	Output to valve relay	Ignition switch: ON	Approximately 1 second after engine is started, the relay is on.	2 V or less
			The system runs down. The relay is off.	System voltage
38	Output to motor relay	Ignition switch: ON Approximately 1 second after en- gine is started	Motor is on.	2 V or less
			Motor is off.	System voltage
39	Idle-up solenoid valve (–)	Ignition switch: ON (The motor is on approximately 1 second after engine is started.)		2 V or less
40	Output to rear-left hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started.)		System voltage
41	Output to front-right hydraulic unit solenoid valve (OUT side)			
43	Idle-up solenoid valve (+)	Ignition switch: ON (The motor is on approximately 1 second after engine is started.)		System voltage
46	Ignition switch	Ignition switch: ON		System voltage
		Ignition switch: START		0 V
47	Input from diagnosis indication selection	Connect the MUT-II.		0 V
		Do not connect the MUT-II.		Approx. 12 V
48	Input from valve relay monitor	Ignition switch: ON		System voltage
49	Motor monitor	Ignition switch: ON Approximately 1 second after engine is started	Motor is on.	System voltage
			Motor is off.	0.5 V or less
50	Output to ABS warning lamp	Ignition switch: ON	The lamp is switched off.	System voltage
			The lamp is illuminated.	0–2 V
51	Output to rear-left hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started.)		System voltage
52	Output to front-right hydraulic unit solenoid valve (IN side)			

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 them between the terminals indicated in the table below.
3. The terminal layouts are shown in the illustrations below.

41	40	39	38	37	36	35	34	33	32	31
52	51	50	49	48	47	46	45	44	43	42

13	12	11	10	9	8	7	6	5	4	3	2	1
26	25	24	23	22	21	20	19	18	17	16	15	14

14W0042

Connector terminal No.	Signal	Normal condition
1 – Body earth	Front-left solenoid valve (OUT side)	3.8 Ω
2 – Body earth	Rear-right solenoid valve (OUT side)	3.8 Ω
3 – Body earth	Rear-right solenoid valve (IN side)	8.2 Ω
7–20	Front-left wheel speed sensor (+ wire)	0.9–1.1 kΩ
8–21	Rear-right wheel speed sensor (+ wire)	1.4–2.0 kΩ
9–22	Rear-left wheel speed sensor (+ wire)	1.4–2.0 kΩ
10–23	Front-right wheel speed sensor (+ wire)	0.9–1.1 kΩ
14 – Body earth	Front-left solenoid valve (IN side)	8.2 Ω
15 – Body earth	ABS-ECU earth	Continuity
25 – Body earth		
39–43	Idle-up solenoid valve	33–39 Ω
40 – Body earth	Rear-left solenoid valve (OUT side)	3.8 Ω
41 – Body earth	Front-right solenoid valve (OUT side)	3.8 Ω
42 – Body earth	ABS-ECU earth	Continuity
48 – Body earth	Valve relay monitor input	Continuity
49 – Body earth	Motor monitor	Continuity
51 – Body earth	Rear-left solenoid valve (IN side)	8.2 Ω
52 – Body earth	Front-right solenoid valve (IN side)	8.2 Ω

SERVICE ADJUSTMENT PROCEDURES

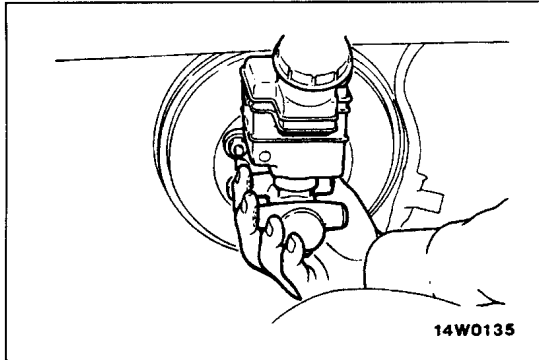
120000124

BLEEDING

Caution

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

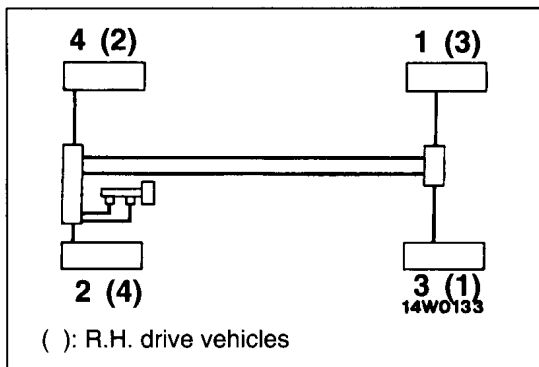
Specified brake fluid: DOT3 or DOT4



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 pipe line 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 to four times to fill the master cylinder with brake fluid.

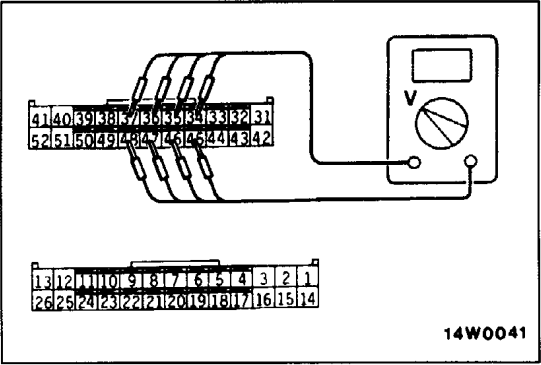


BRAKE PIPE LINE BLEEDING

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

Caution

Be sure to install a filter to the master cylinder reservoir tank when supplying brake fluid.



ABS OPERATION CHECK

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

1. Lift up the vehicle and release the parking brake.
 2. Disconnect the ECU harness connector and measure from the harness side connector.
- Caution**
Be sure to remove the connector’s double lock and insert the probe into the harness side. Inserting it into the terminal side will result in a bad connection.
3. Rotate the wheel to be measured at approximately 1/2–1 rotation per second, and check the output voltage using a circuit tester or an oscilloscope.

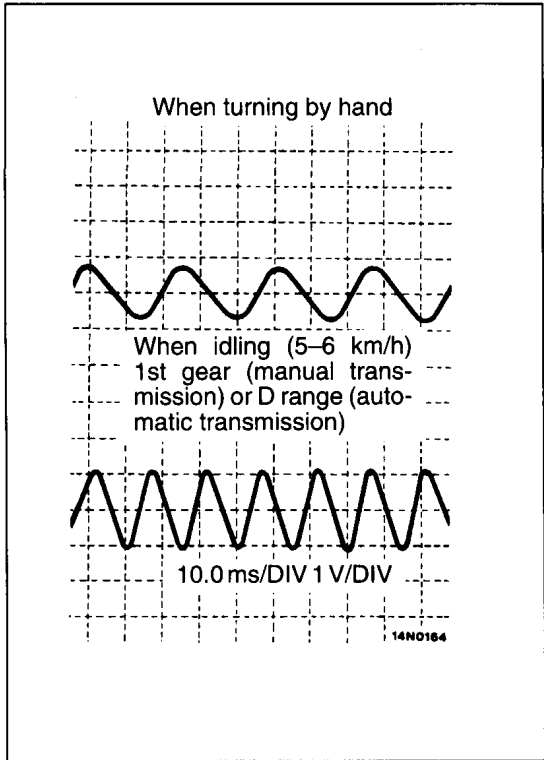
Wheel speed sensor	Front left	Front right	Rear left	Rear right
Terminal No.	7 20	10 23	9 22	8 21

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 Wave Forms With An Oscilloscope

Use the following method to observe the output voltage wave form 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

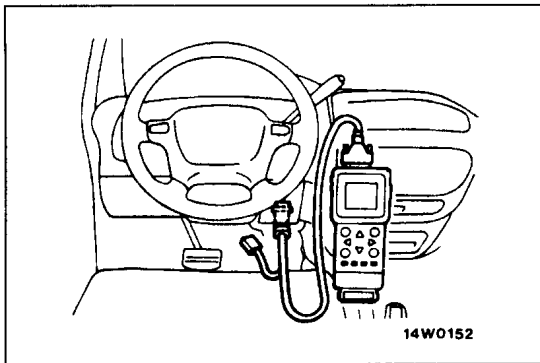
1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The waveform measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

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
	Rotor with missing or damaged teeth	Replace 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 (HU) INSPECTION

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

NOTE

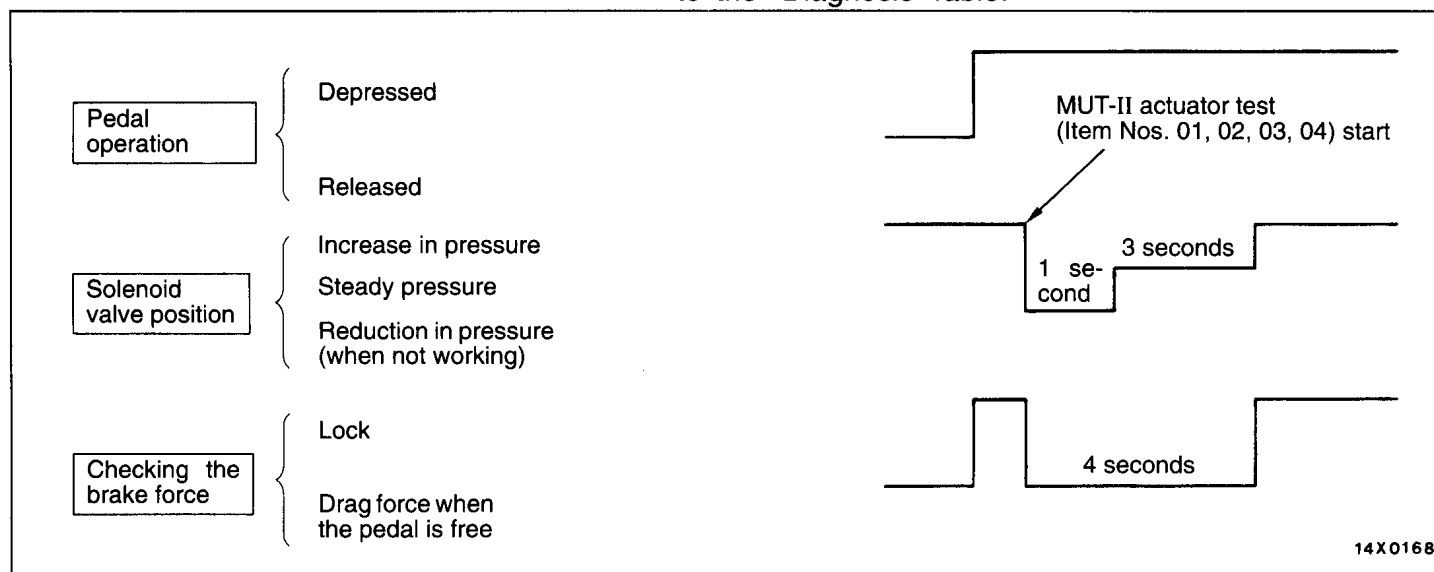
1. At this time, the ABS system will switch to the MUT-II mode and the ABS warning lamp will illuminate.
2. When the ABS has been interrupted by the fail-safe function, the MUT-II actuator testing cannot be used.
5. Use the MUT-II to force-drive the actuator.

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 to be sure that the braking force changes to the brake drag force inspected in step 2 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.

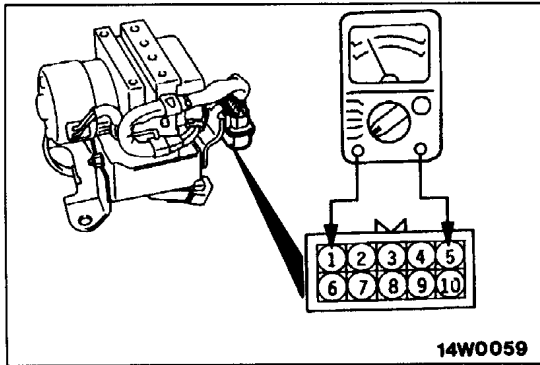
7. If the result of inspection is abnormal, correct according to the "Diagnosis Table."



Diagnosis Table

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

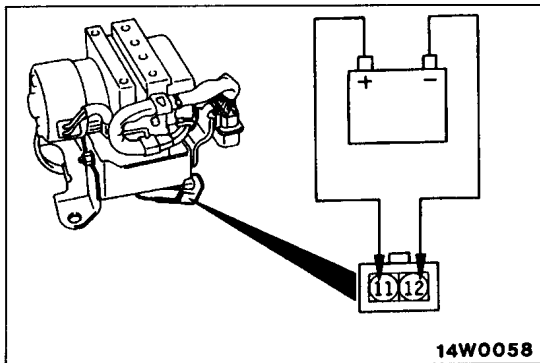
8. After inspection, disconnect the MUT-II immediately after turning the ignition switch to OFF.

**SOLENOID VALVE CHECK**

Measure the resistance between terminals.

Standard value:

Solenoid valve	Measurement terminals	Resistance between terminals
Front OUT (right side)	5–6	3.8 Ω
Front OUT (left side)	10–7	
Rear OUT (right side)	10–8	
Rear OUT (left side)	5–9	
Front IN (right side)	5–1	8.2 Ω
Front IN (left side)	10–2	
Rear IN (right side)	10–3	
Rear IN (left side)	5–4	

**MOTOR OPERATION CHECK**

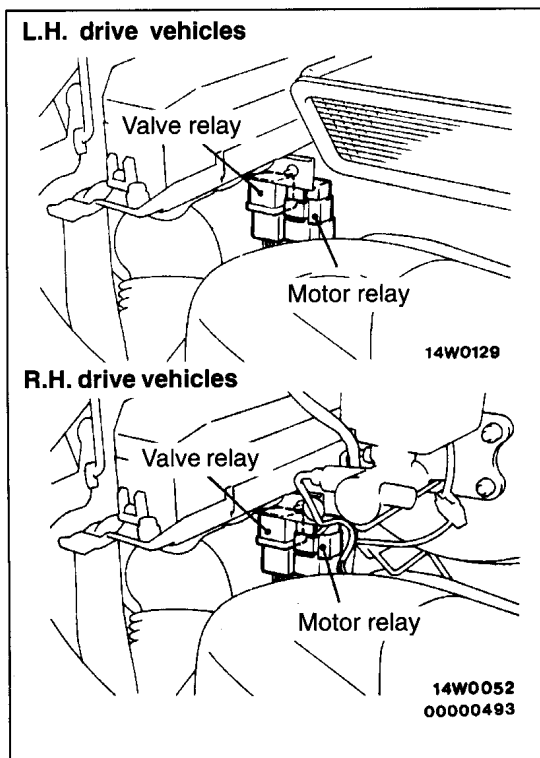
Connect the battery and check to be sure that the sound of the hydraulic unit motor operating can be heard.

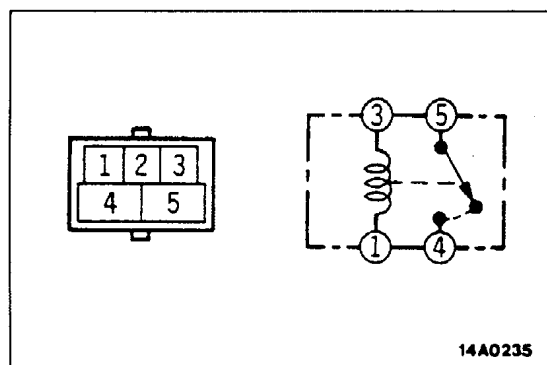
Caution

The battery power should not be applied for more than 1 second.

MOTOR RELAY AND VALVE RELAY INSPECTION

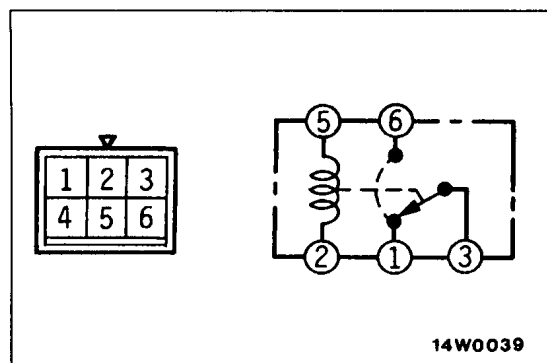
Check for continuity between the terminals of the relay with and without power as shown in the chart overleaf.





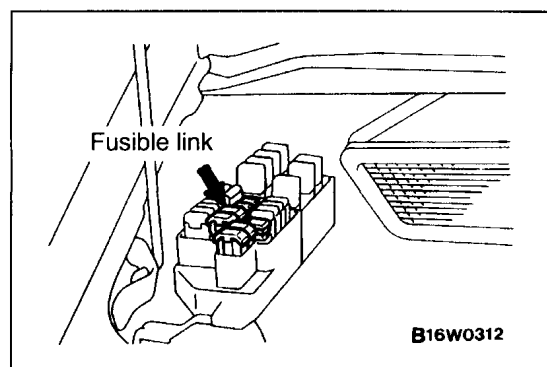
Motor relay <when energizing coil is at normal temperature ($20^{\circ}\pm 15^{\circ}\text{C}$)>

When there is no current	Between terminals 3 and 1	$74\pm 25\ \Omega$
	Between terminals 4 and 5	No continuity ($\infty\ \Omega$)
When there is current between terminals 3 and 1	Between terminals 4 and 5	Continuity (approx. $0\ \Omega$)



Valve relay <when energizing coil is at normal temperature ($20^{\circ}\pm 15^{\circ}\text{C}$)>

When there is no current	Between terminals 2 and 5	$80\pm 25\ \Omega$
	Between terminals 1 and 3	Continuity (approx. $0\ \Omega$)
	Between terminals 3 and 6	No continuity ($\infty\ \Omega$)
When there is current between terminals 2 and 5	Between terminals 1 and 3	No continuity ($\infty\ \Omega$)
	Between terminals 3 and 6	Continuity (approx. $0\ \Omega$)



REMEDY FOR A FLAT BATTERY

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

REMOVAL AND INSTALLATION

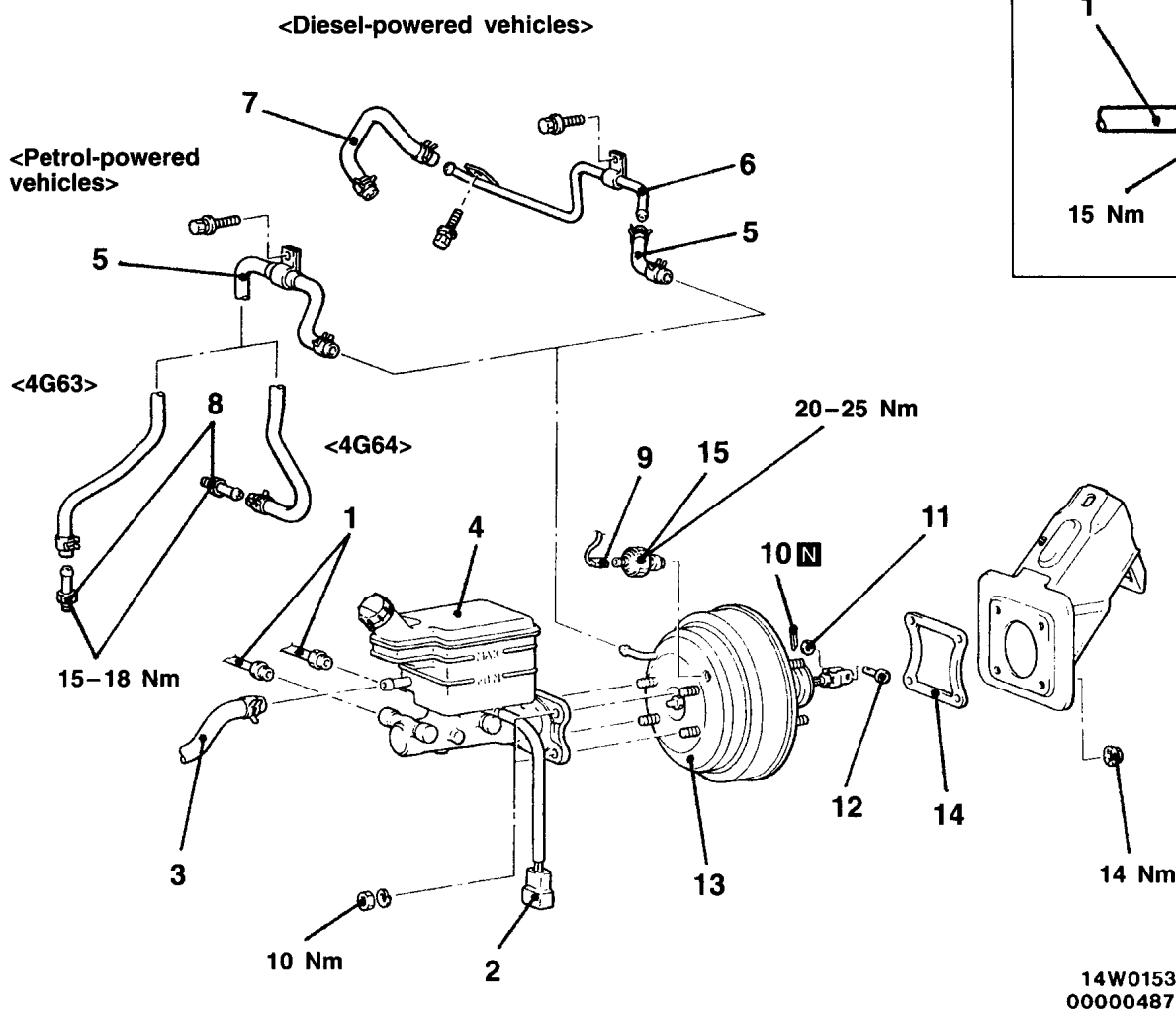
<L.H. drive vehicles>

Pre-removal Operation

- Battery Removal
- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35B-29.)
- Battery Installation
- Brake Pedal Adjustment (Refer to GROUP 35A – Service Adjustment Procedures.)



Removal steps

1. Brake tube connection
2. Brake fluid level sensor connector
3. Clutch hose connection
4. Master cylinder assembly
- ▶B◀ • Clearance adjustment between brake booster push rod and primary piston
- ▶A◀ 5. Vacuum hose (With built-in check valve)
6. Vacuum pipe <Diesel-powered vehicles>
7. Vacuum hose <Diesel-powered vehicles>
8. Fitting <Petrol-powered vehicles>

9. Vacuum switch connector <Diesel-powered vehicles>
10. Split pin
11. Washer
12. Clevis pin
13. Brake booster
14. Sealer
15. Vacuum switch <Diesel-powered vehicles>

Caution

The check valve should not be removed from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

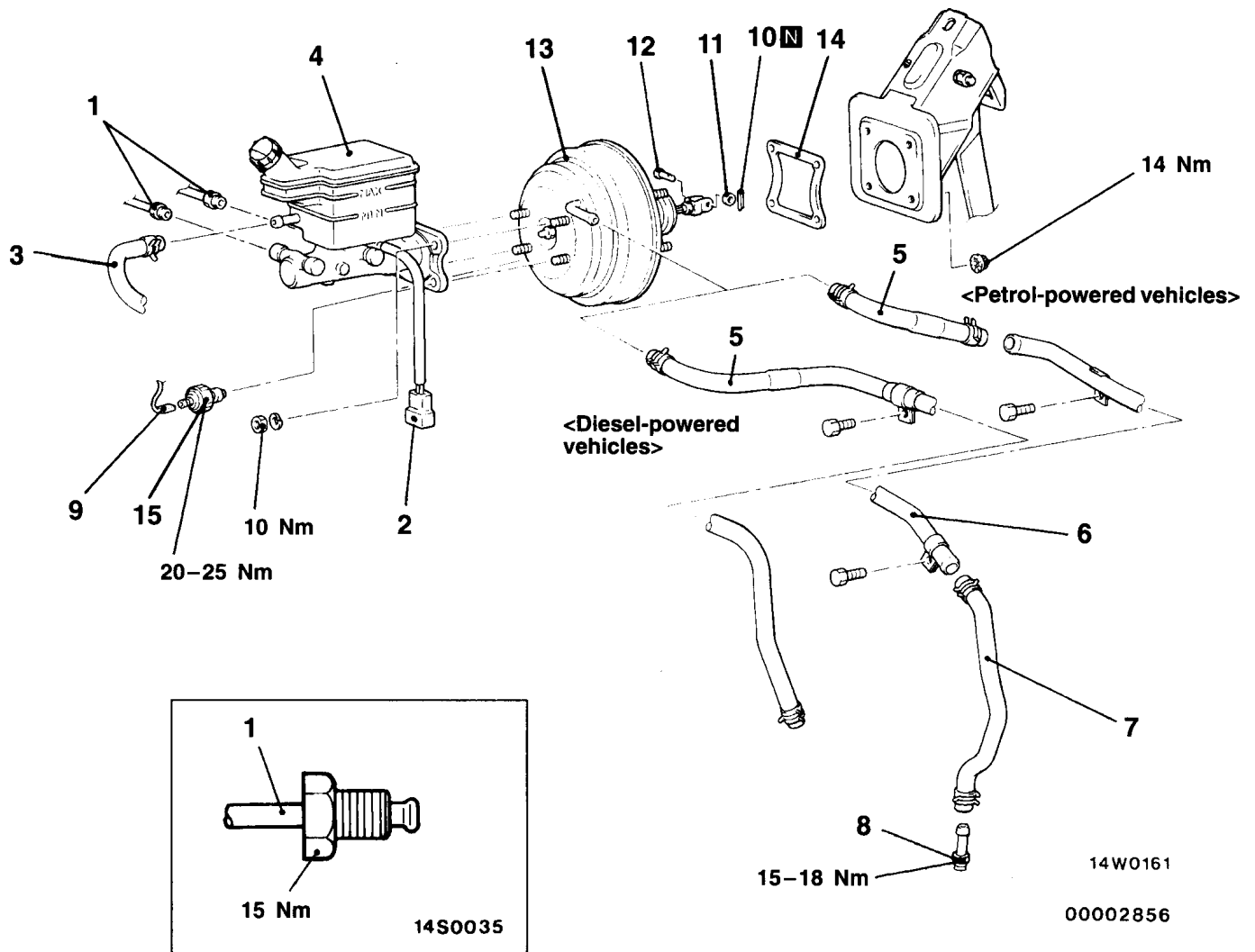
<R.H. drive vehicles>

Pre-removal Operation

- Battery Removal
- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Supplying
- Brake Line Bleeding (Refer to P.35B-29.)
- Battery Installation
- Brake Pedal Adjustment (Refer to GROUP 35A – Service Adjustment Procedures.)

**Removal steps**

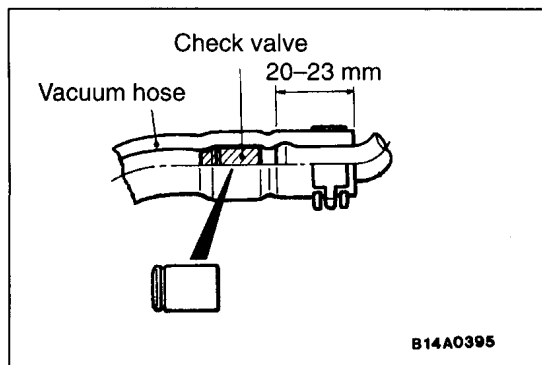
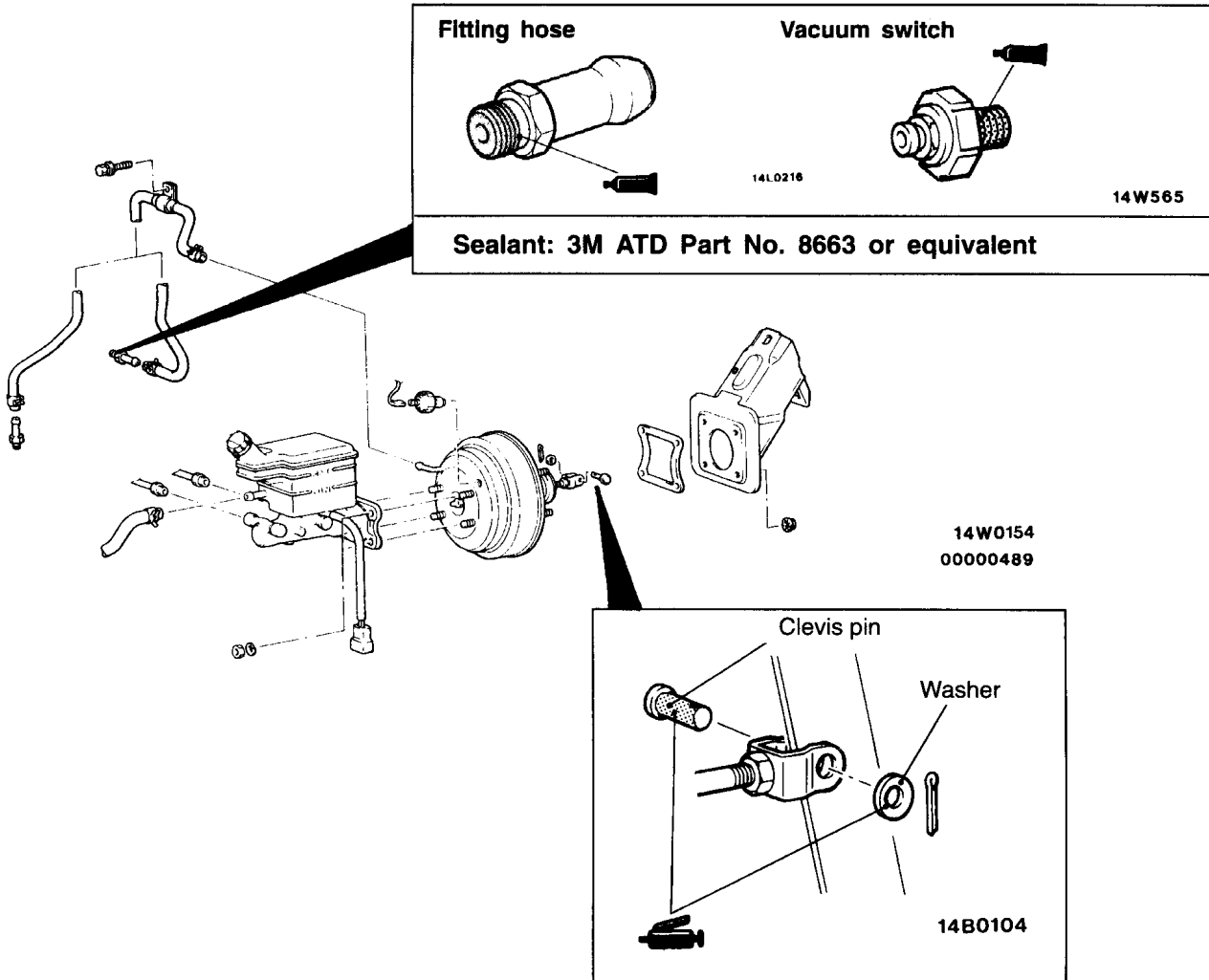
1. Brake tube connection
2. Brake fluid level sensor connector
3. Clutch hose connection
4. Master cylinder assembly
 - Clearance adjustment between brake booster push rod and primary piston
5. Vacuum hose (With built-in check valve)
6. Vacuum pipe
7. Vacuum hose
8. Fitting

9. Vacuum switch connector
10. Split pin
11. Washer
12. Clevis pin
13. Brake booster
14. Sealer
15. Vacuum switch

Caution

The check valve should not be removed from the vacuum hose. If the check valve is defective, replace it together with the vacuum hose.

Lubrication and Sealing points



INSTALLATION SERVICE POINTS

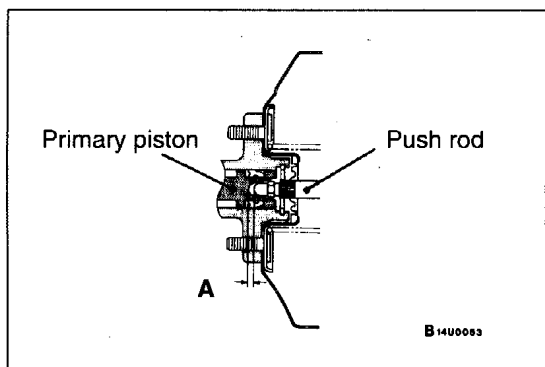
►A◄ VACUUM HOSE CONNECTION

- (1) Install to the pipe part of the brake booster so that the amount of insertion of the vacuum hose is as shown in the figure.

Caution

The check valve and the pipe part of the brake booster must not contact each other.

- (2) For petrol-powered vehicles, insert the hose until its engine-side contacts the edge of the hexagonal part of the fitting, and then secure it by the hose clip.



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

Adjust the clearance (A) between the brake booster push rod and primary piston as follows:

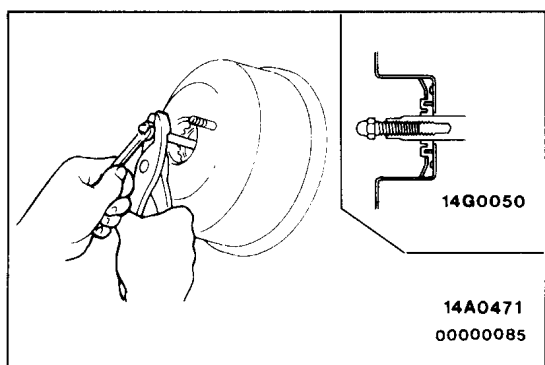
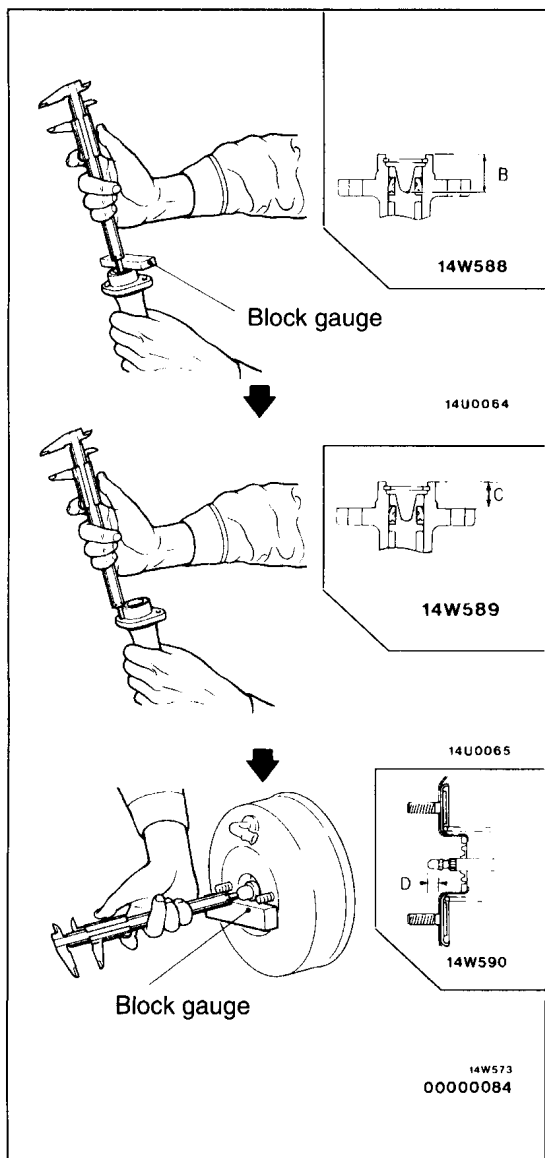
Calculate clearance A from the B, C and D measurements.
 $A = B - C - D$

Standard value:

Item	Clearance A standard value mm
Petrol-powered vehicles	0.70–1.20
Diesel-powered vehicles	1.00–1.40

NOTE

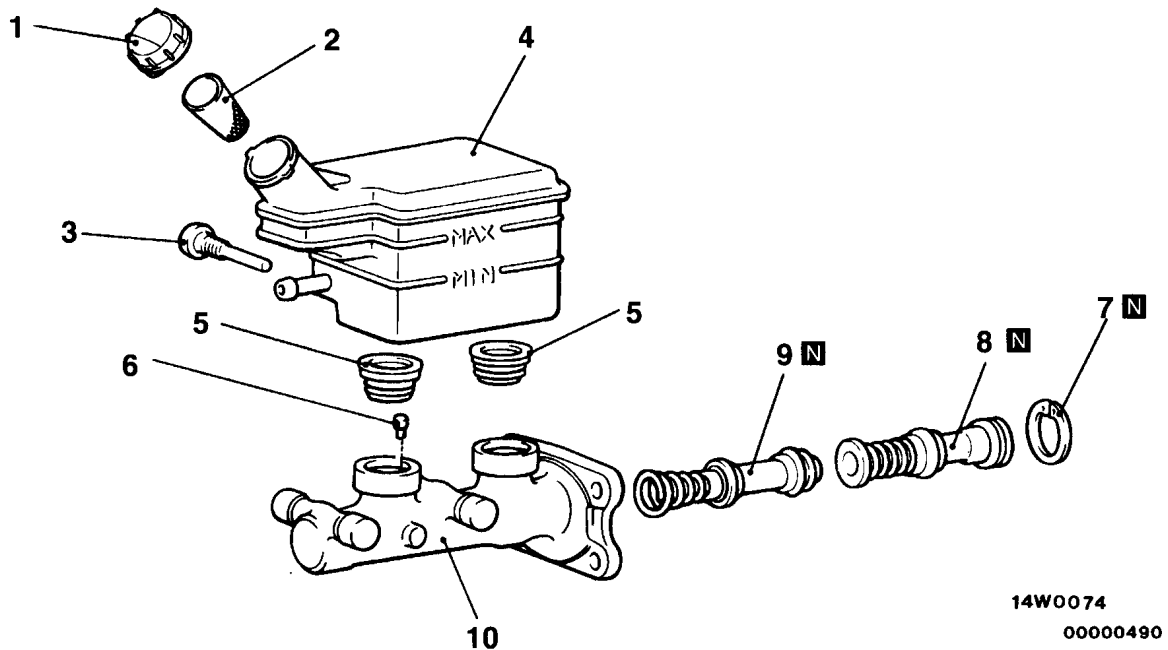
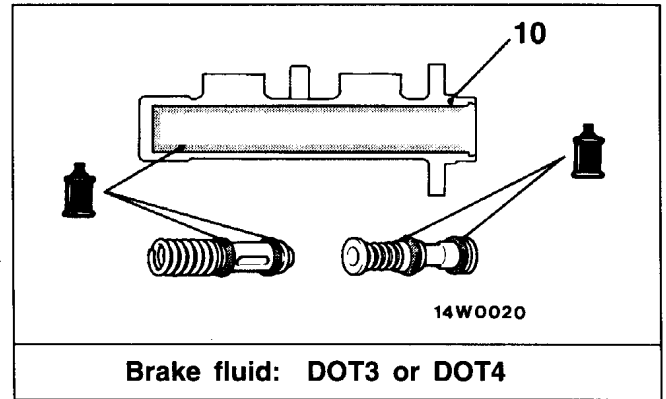
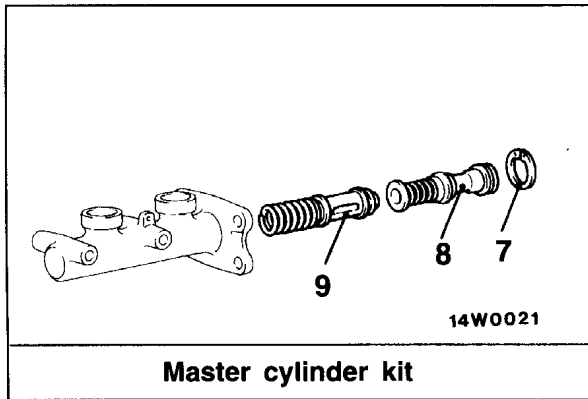
When brake booster negative pressure (petrol-powered vehicles: -66.7 kPa, diesel-powered vehicles: -93.3 kPa) is applied, clearance value will become 0.10–0.50 mm.



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.

120000127

MASTER CYLINDER DISASSEMBLY AND REASSEMBLY



Disassembly steps

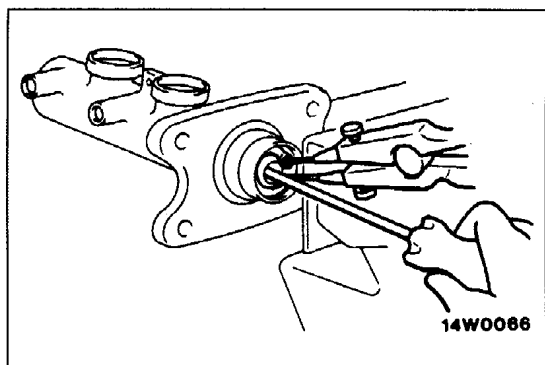
1. Reservoir cap
2. Filter
3. Reservoir stopper bolt
4. Reservoir
5. Reservoir seal



6. Piston stopper
7. Piston stopper ring
8. Primary piston assembly
9. Secondary piston assembly
10. Master cylinder body

Caution

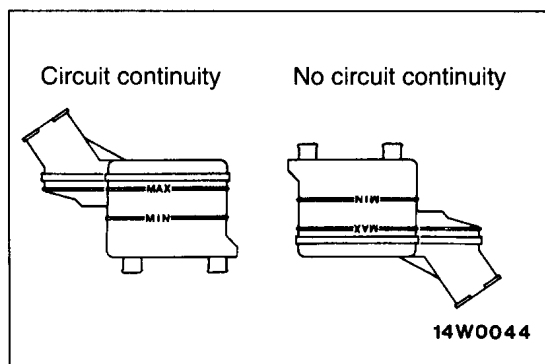
Do not disassemble the primary and secondary piston assemblies.

**DISASSEMBLY SERVICE POINT****◀▶ PISTON STOPPER RING DISASSEMBLY**

Remove the 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, damage or wear.
- Check the diaphragm for cracks and wear.

**BRAKE FLUID LEVEL SENSOR CHECK**

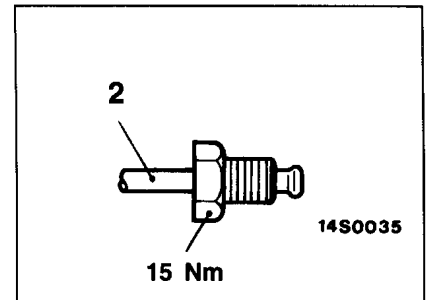
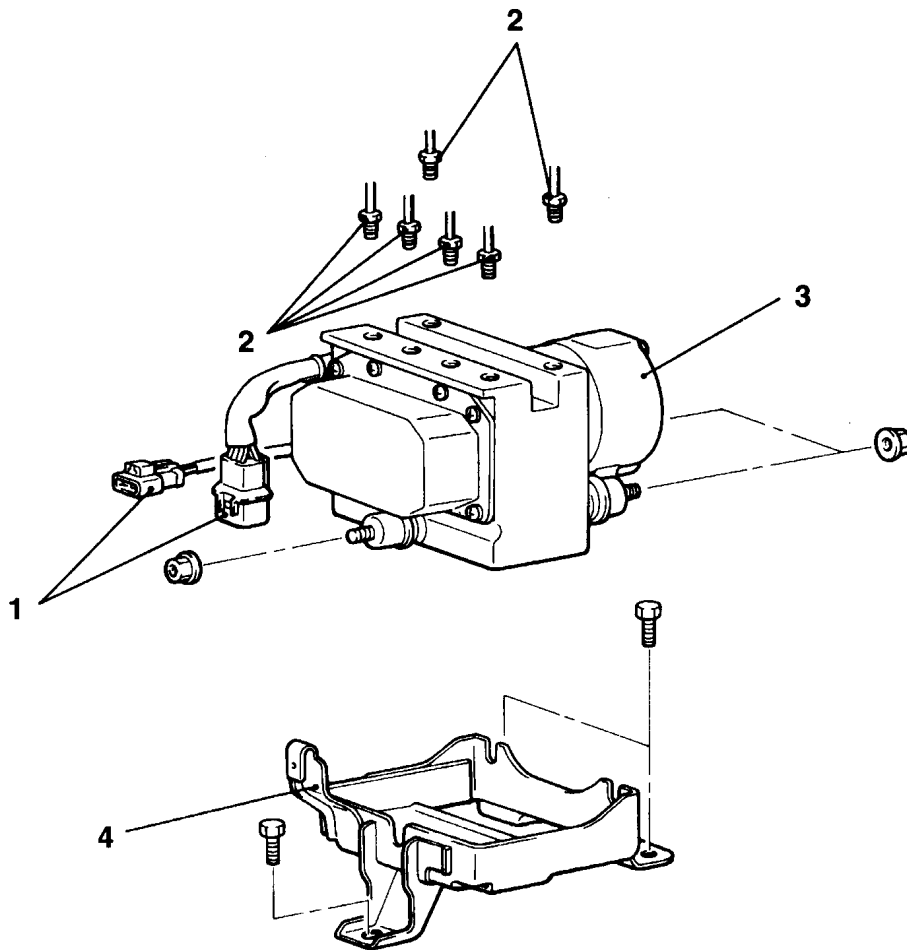
- (1) Connect circuit tester to brake fluid level sensor.
- (2) Sensor is in good condition if there is no circuit continuity when turning reservoir over and circuit continuity when returned to original position.

HYDRAULIC UNIT**REMOVAL AND INSTALLATION****Pre-removal Operation**

- Brake Fluid Draining
- Air Cleaner Removal (Refer to GROUP 15 – Air Cleaner.)

Post-installation Operation

- Air Cleaner Installation (Refer to GROUP 15 – Air Cleaner.)
- Brake Fluid Supplying
- Brake Lines Bleeding (Refer to P.35B-29.)
- Hydraulic Unit Checking (Refer to P.35B-31.)



03W0013

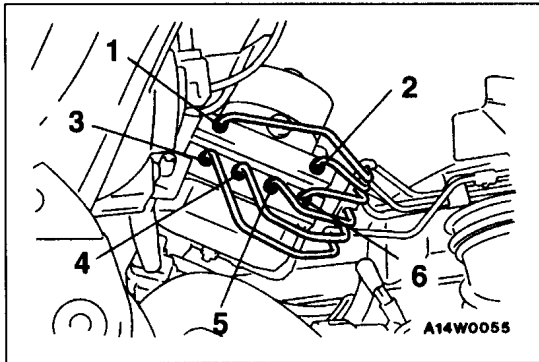
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Removal steps

- ◀A▶ ▶A▶
1. Harness connector
 2. Brake tube connection
 3. Hydraulic unit
 4. Hydraulic unit bracket

REMOVAL SERVICE POINT**◀A▶ HYDRAULIC UNIT REMOVAL****Caution**

1. The hydraulic unit is heavy, and so care should be taken when removing it.
2. The hydraulic unit is not to be disassembled; its nuts and bolts should absolutely not be loosened.
3. The hydraulic unit must not be dropped or otherwise subjected to impact shocks.
4. The hydraulic unit must not be turned upside down or laid on its side.

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

Connect the tube to the hydraulic unit as shown in the illustration.

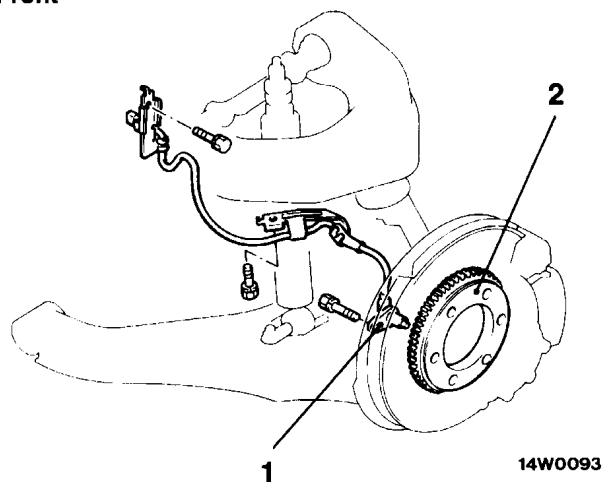
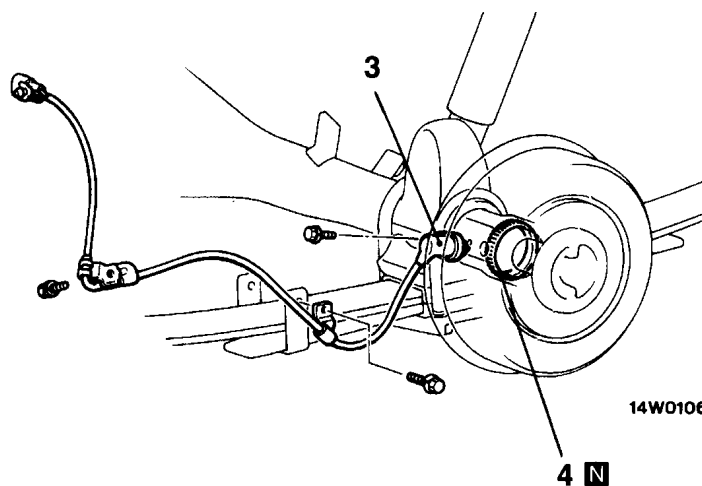
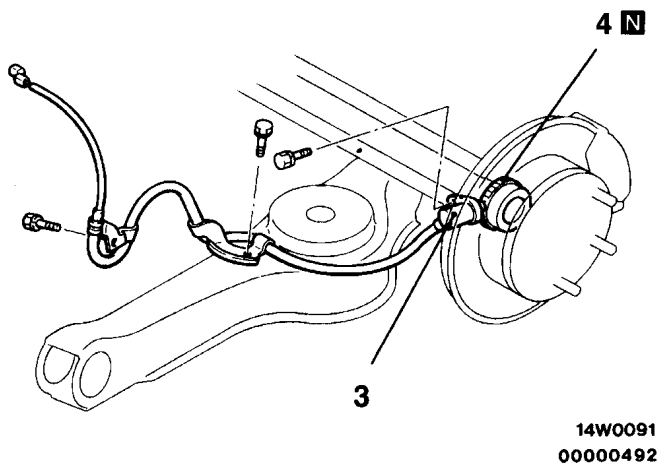
1. Master cylinder (for rear)
2. Master cylinder (for front)
3. Front brake (R.H.)
4. Rear brake (L.H.)
5. Rear brake (R.H.)
6. Front brake (L.H.)

WHEEL SPEED SENSOR

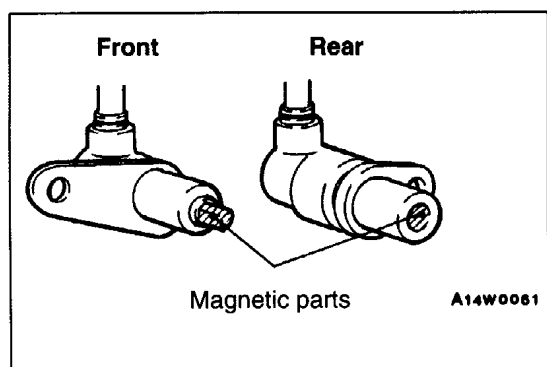
REMOVAL AND INSTALLATION

Post-Installation Operation

- Wheel Speed Sensor Output Voltage Checking
(Refer to P.35B-30.)

Front**Rear – Vehicles with leaf springs****Rear – Vehicles with coil springs**

1. Front speed sensor
2. Front rotor
(Refer to GROUP 26 – Front Hub.)
3. Rear speed sensor
4. Rear rotor (Refer to GROUP 27 –
Rear Axle Shaft.)



INSPECTION

SPEED SENSOR

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

NOTE

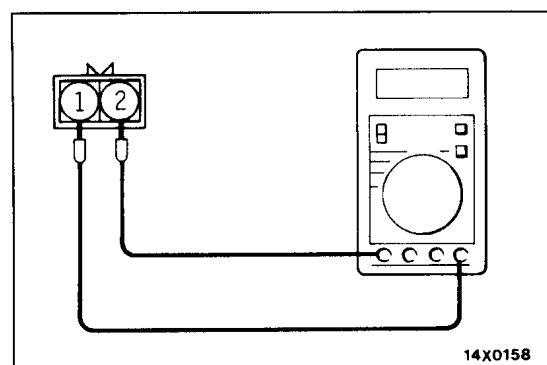
The section shown in the illustration can become magnetized because of the magnet built into the speed sensor, with the result that foreign metallic material easily adheres to it.

- (2) Measure the resistance between the speed sensor terminals.

Standard value: <Front> 0.9–1.1 k Ω

<Rear> 1.4–2.0 k Ω

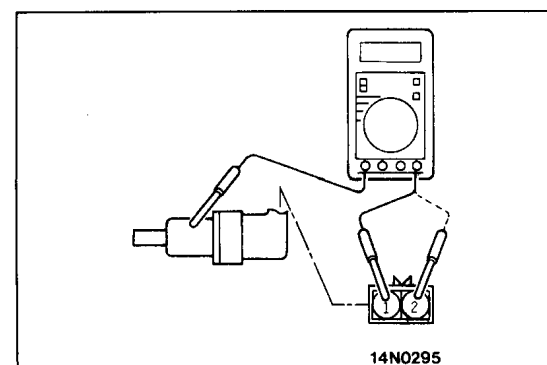
If the internal resistance of the speed sensor is not within the standard value, replace with a new speed sensor.



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

NOTE

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



SPEED SENSOR INSULATION INSPECTION

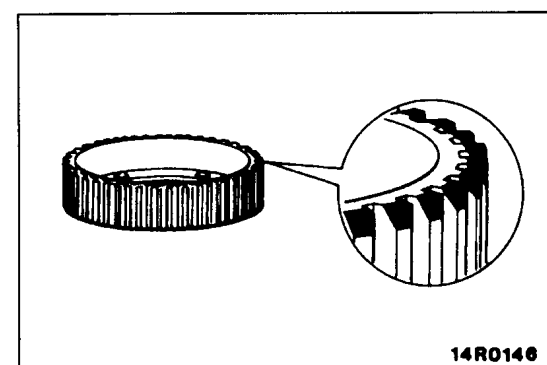
- (1) Remove all connections from the speed sensor, and then measure the resistance between terminals (1) and (2) and the body of the speed sensor.

Standard value: 100 k Ω or more

- (2) If the speed sensor insulation resistance is outside the standard value range, replace with a new speed sensor.

TOOTHED ROTOR

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

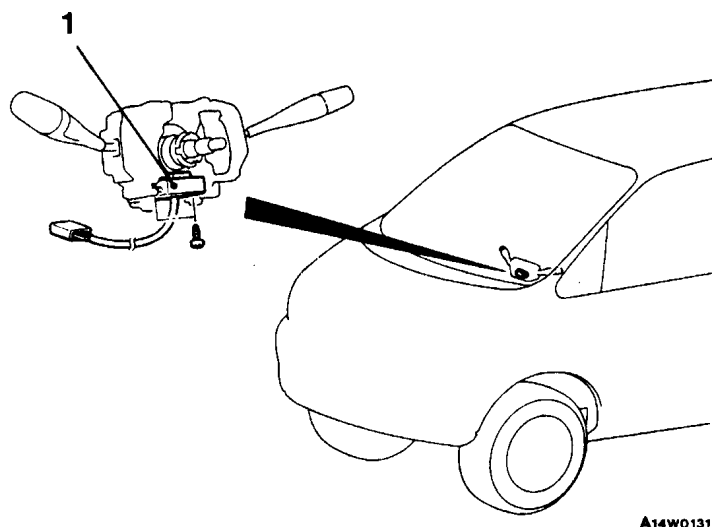


STEERING WHEEL SENSOR

REMOVAL AND INSTALLATION

Caution : SRS

When removing the air bag module and clock spring, refer to GROUP 52B – Service Precautions and GROUP 52B – Air Bag Module and Clock Spring before carrying out these operations.



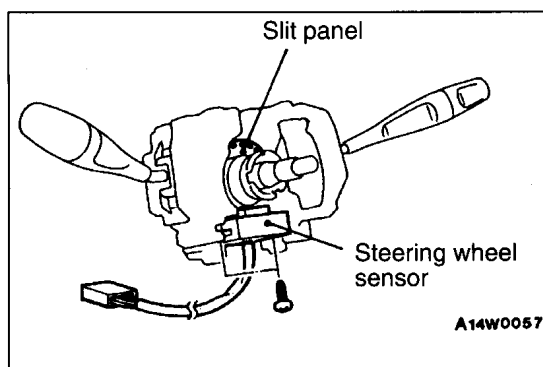
A14W0131

Removal steps

- Steering wheel and column cover removal (Refer to GROUP 37A – Steering wheel and Shaft.)
- Column switch removal (Refer to GROUP 51 – Windshield wiper and washer.)



1. Steering wheel sensor



A14W0057

REMOVAL SERVICE POINT**◀A▶ STEERING WHEEL SENSOR REMOVAL**

Remove the steering wheel sensor from the column switch.

Caution

1. The steering wheel sensor utilizes a photo coupler and care should be paid to ensure that no dust or grease are allowed to come into contact with it.
2. Be careful and ensure that the column switch side slit panel is not bent nor oil allowed to come into contact with it.

INSPECTION

Refer to P.35B-26.

ELECTRONIC CONTROL UNIT

120000131

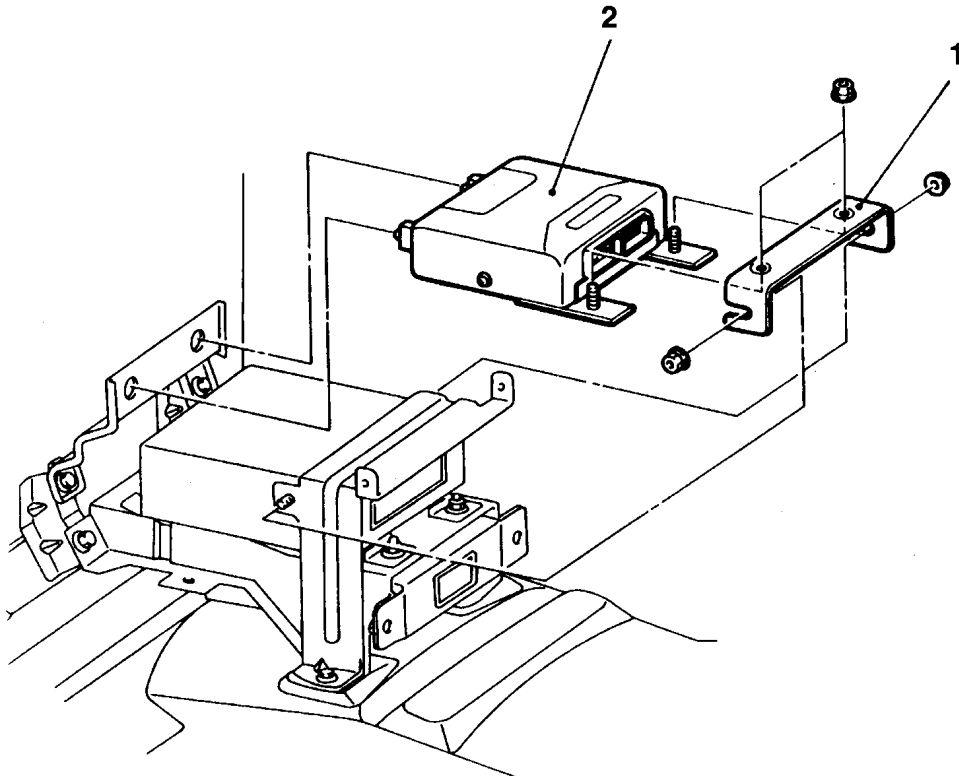
REMOVAL AND INSTALLATION

CAUTION: SRS

When removing and installing the ABS-ECU from vehicles equipped with SRS, do not let it bump against the SRS diagnostic unit or other components.

Pre-removal and Post-installation Operation

- Computer Cover Removal and Installation (Refer to GROUP 52A-Instrument Panel.)



A03W0014

Removal steps

1. ABS bracket
2. ABS-ECU

INSPECTION

Refer to P.35B-26.

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

CONTENTS

120000153

GENERAL INFORMATION	2	TROUBLESHOOTING	4
SERVICE SPECIFICATION	3	G-SENSOR	13
SPECIAL TOOLS	3		

**For the items below, refer to
GROUP 35A.**

LUBRICANTS

SEALANTS

SERVICE ADJUSTMENT PROCEDURES

- Brake Pedal Inspection and Adjustment
- Stop Lamp Switch Inspection
- Brake Booster Operating Test
- Brake Booster Vacuum Switch Check
- Load Sensing Spring Length Check and Adjustment
- Load Sensing Proportioning Valve Function Test
- Disc Brake Pad Check and Replacement
- Front Disc Brake Rotor Inspection
- Rear Brake Disc Run-out Check
- Rear Brake Disc Run-out Correction
- Rear Brake Disc Thickness Check
- Brake Lining Thickness Check
- Brake Drum Inside Diameter Check
- Brake Lining and Brake Drum Connection Check

BRAKE PEDAL

LOAD SENSING PROPORTIONING VALVE

FRONT DISC BRAKE

REAR DISC BRAKE

REAR DRUM BRAKE

**For the items below, refer to
GROUP 35B.**

SERVICE ADJUSTMENT PROCEDURES

- Bleeding
- ABS Operation Check

MASTER CYLINDER AND BRAKE BOOSTER

HYDRAULIC UNIT

WHEEL SPEED SENSOR

STEERING WHEEL SENSOR

ELECTRONIC CONTROL UNIT

GENERAL INFORMATION

120000154

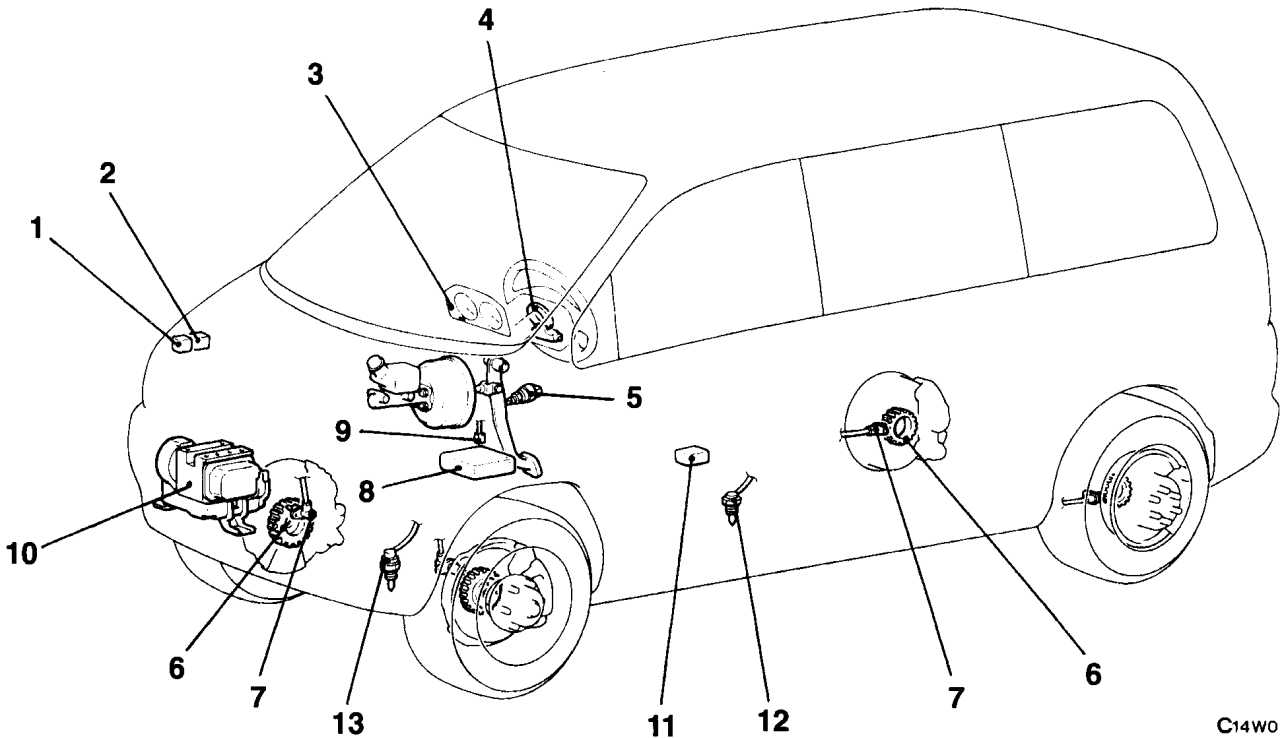
The ABS consists of wheel speed sensors, stop lamp switch hydraulic unit and the ABS-ECU. If a problem occurs in the system, the malfunctioning system can be identified by means of the diagnosis function, and the trouble symptom memory will not be erased even if the ignition switch is turned to

OFF. (However, it will be erased if the battery is disconnected.)
In addition, reading of diagnosis codes and service data and actuator testing are possible using the MUT-II.

Items	Specifications
Speed sensor	Magnet coil type
Front rotor teeth	47
Rear rotor teeth	47

CONSTRUCTION DIAGRAM

120002439



C14W0128

- 1. ABS valve relay
- 2. ABS motor relay
- 3. ABS warning lamp
- 4. Steering wheel sensor
- 5. Stop lamp switch
- 6. Rotor

- 7. Wheel speed sensor
- 8. ABS-ECU
- 9. Diagnosis connector
- 10. Hydraulic unit
- 11. G-sensor
- 12. 4WD position detection switch
- 13. Free wheel engage switch

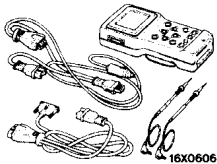

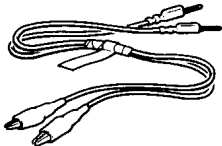
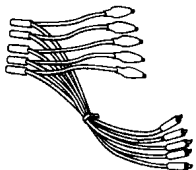
SERVICE SPECIFICATION

120000156

Items		Standard value
G-sensor output voltage V	When installed	2.3–2.7
	When removed with arrow mark facing down	3.3–3.7

SPECIAL TOOLS

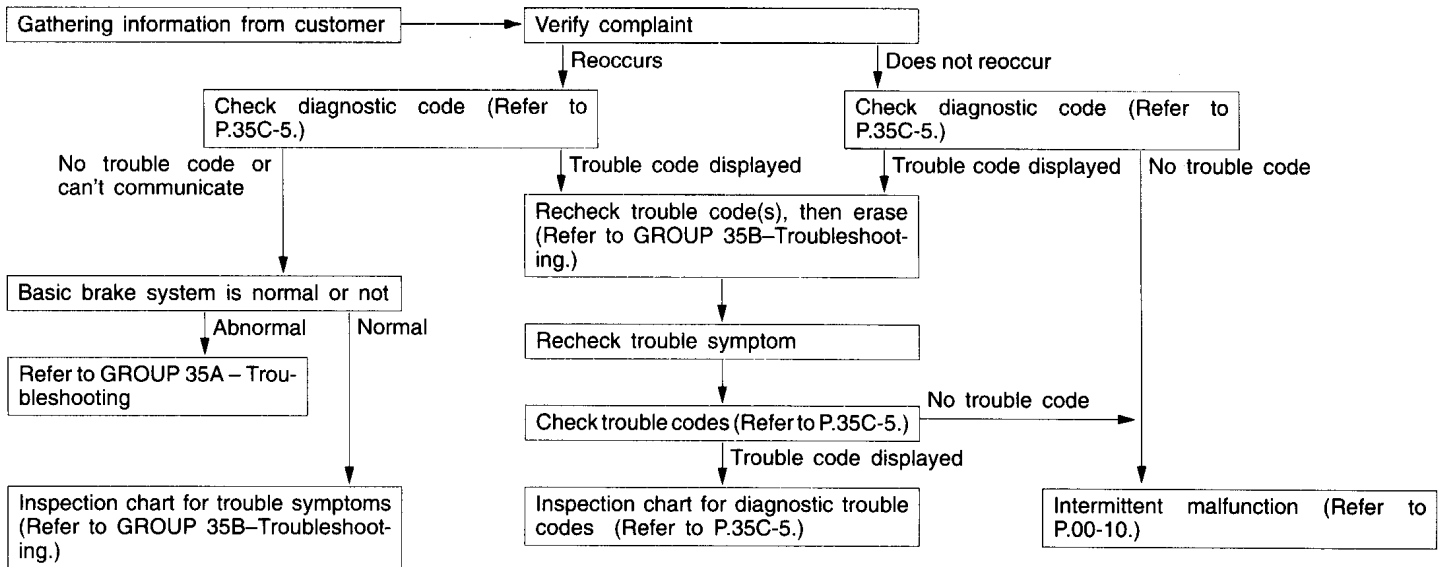
120000157

Tool	Number	Name	Use
 16X0606	MB991502	MUT-II sub assembly	For checking of ABS (Diagnosis code display when using the MUT-II)
 16X0607	—	ROM pack	
	MB991529	ABS check harness	For checking of ABS (Diagnosis code display when using the ABS warning lamp)
	MB991348	Test harness set	For checking of G-sensor

TROUBLESHOOTING

120000158

STANDARD FLOW OF DIAGNOSTIC TROUBLESHOOTING



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 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 operating (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.
To recheck trouble symptom, requirements listed in the "Comment" should be satisfied.

DIAGNOSTIC FUNCTION

120000159

Refer to GROUP 35B – Troubleshooting.

INSPECTION CHART FOR DIAGNOSTIC TROUBLE CODES

120002580

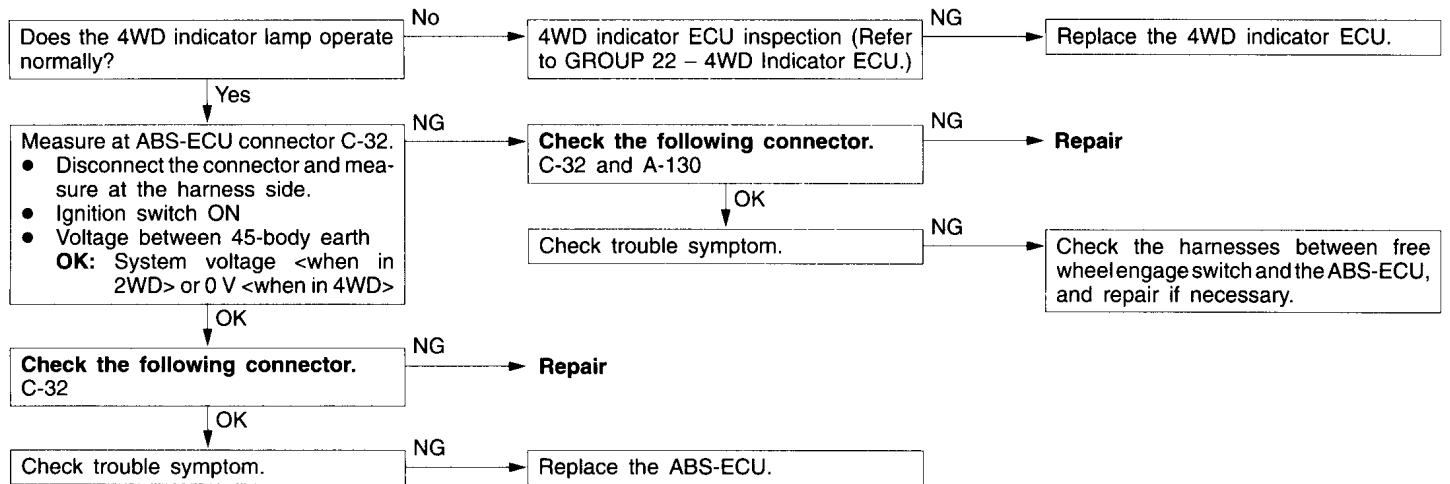
Inspect according to the inspection chart that is appropriate for the malfunction code.

Diagnosis code No.	Inspection item	Diagnosis content	Reference page
11	Front-right wheel speed sensor	Open circuit	Refer to GROUP 35B – Troubleshooting.
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	Refer to GROUP 35B – Troubleshooting.
16	Power supply system		Refer to GROUP 35B – Troubleshooting.
21	Front right wheel speed sensor	Short circuit	Refer to GROUP 35B – Troubleshooting.
22	Front left wheel speed sensor		
23	Rear right wheel speed sensor		
24	Rear left wheel speed sensor		
25	Free wheel engage switch		P.35C-6
26	4WD position detection switch		P.35C-7
32	G-sensor system		P.35C-8
33	Stop lamp switch system		Refer to GROUP 35B – Troubleshooting.
34	Steering wheel sensor	Open circuit	Refer to GROUP 35B – Troubleshooting.
35	Steering wheel sensor (ST-N)	Neutral position improperly detected	Refer to GROUP 35B – Troubleshooting.
36	Steering wheel sensor (ST-1, ST-2)	Steering angle improperly detected	Refer to GROUP 35B – Troubleshooting.
41	Front right solenoid valve		Refer to GROUP 35B – Troubleshooting.
42	Front left solenoid valve		
43	Rear right solenoid valve		
44	Rear left solenoid valve		
51	Valve relay		Refer to GROUP 35B – Troubleshooting.
53	Motor relay, motor		Refer to GROUP 35B – Troubleshooting.
63	ABS-ECU		Refer to GROUP 35B – Electronic Control Unit. (Replace the ABS-ECU.)

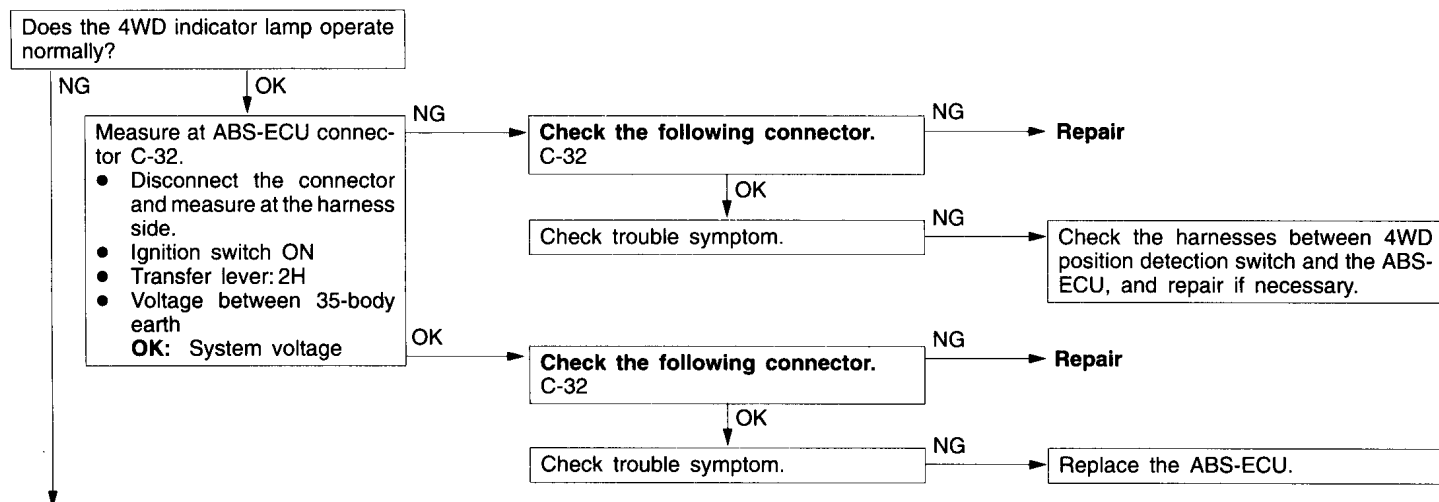
INSPECTION PROCEDURE CLASSIFIED BY DIAGNOSTIC TROUBLE

For diagnosis code numbers other than those listed below, refer to GROUP 35B – Troubleshooting.

Code No.25 Free wheel engage switch	Probable cause
<p>[Comment]</p> <p>ABS-ECU determines that an open circuit exists in the free wheel engage switch system.</p>	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of 4WD indicator ECU • Malfunction of ABS-ECU



Code No.26 4WD position detection switch	Probable cause
<p>[Comment]</p> <p>This code is output at the following times: ABS-ECU determines that an open circuit exists in the 4WD detection switch system. The free wheel engage switch is off and the 4WD detection switch is on at a vehicle speed of 15 km/h or more for 5 seconds or more.</p>	<ul style="list-style-type: none"> • Malfunction of wiring harness or connector • Malfunction of free wheel engage switch • Malfunction of 4WD indicator ECU • Malfunction of 4WD position detection switch • Malfunction of ABS-ECU

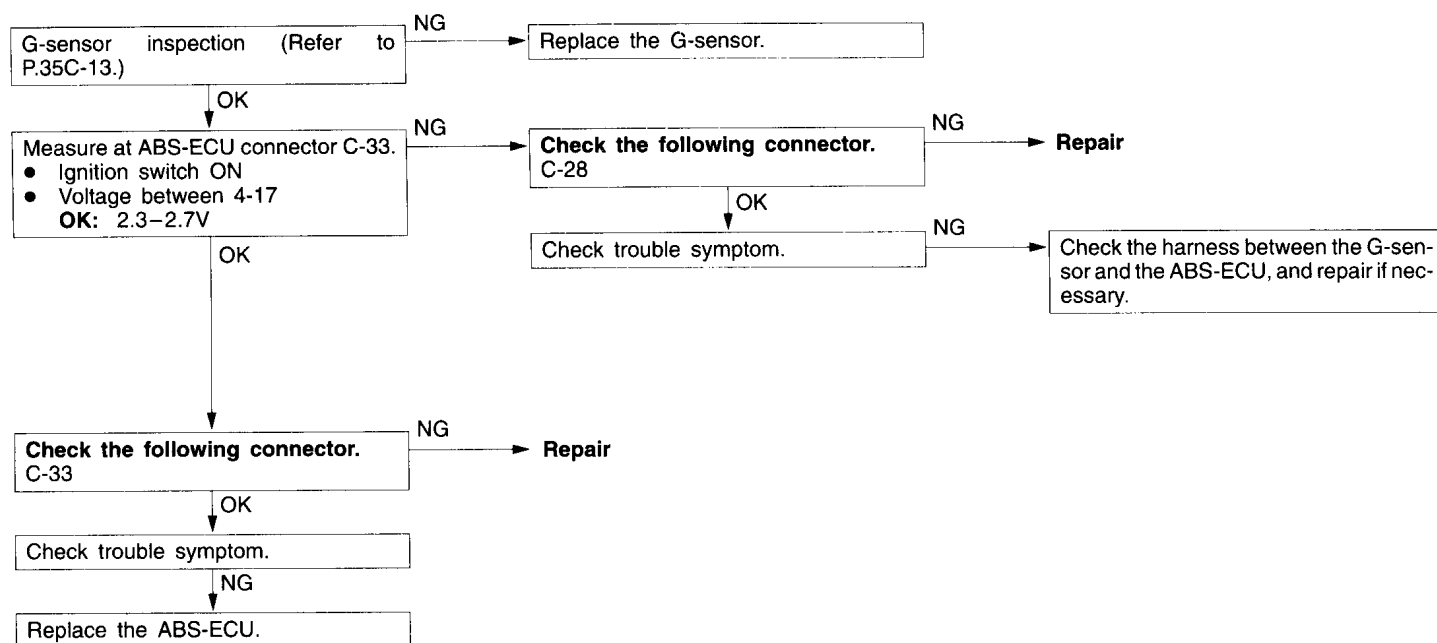


Trouble symptom	Main cause	Remedy
Even when the transfer shift lever is in the "4H" position, the 4WD front wheel indicator lamp does not illuminate.	Broken harness wire between the 4WD indicator ECU and the free-wheel engage switch, or broken earth wire from the free-wheel engage switch	Repair the harness.
	Free wheel engage switch is defective.	Replace the switch.
Even when the transfer shift lever is in the "4H" position, the free wheel differential indicator lamp does not illuminate.	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.)
Free wheel differential 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
[Comment] This code is output at the following times: 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 ABS-ECU



ABS WARNING LAMP INSPECTION

120000161

Refer to GROUP 35B – Troubleshooting.

INSPECTION CHART FOR TROUBLE SYMPTOMS

120000162

Refer to GROUP 35B – Troubleshooting.

DATA LIST REFERENCE TABLE

120000163

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	IG power supply voltage and valve monitor voltage	9–16V
25	Free wheel engage switch	Engage 4WD.	ON
		Engage 2WD.	OFF
26	4WD detection switch	Place the transfer lever at 4H.	ON
		Place the transfer lever at 2H.	OFF
32	G-sensor output voltage	Stop the vehicle.	2.3–2.7V
		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
34	Steering wheel sensor (Steering angle)	Turn the steering wheel after neutral position is learnt.	Displays 0° immediately after battery is connected and 5° intervals after neutral position is learnt.
35	Steering wheel sensor (Neutral position detection)	Turn the steering wheel within $\pm 5^\circ$ from the neutral.	ON
		Other than the above	OFF
37	Steering wheel sensor (Neutral position learning)	When driving straight-forward at 10 km/h or more	ON
		Other than the above	OFF

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

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

ACTUATOR TEST INSPECTION TABLE

120000164

Refer to GROUP 35B – Troubleshooting.

INSPECTION AT ABS-ECU TERMINALS

120000165

TERMINAL VOLTAGE CHART

1. Measure the voltages between terminals (15), (25) and (42) (earth terminals) and each respective terminal.
2. The terminal arrangements are shown in the illustrations below.

1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26

31	32	33	34	35	36	37	38	39	40	41
42	43	44	45	46	47	48	49	50	51	52

14W0043

Connector terminal No.	Signal	Checking requirements		Normal condition
1	Output to front-left hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
2	Output to rear-right hydraulic unit solenoid valve (OUT side)			
3	Output to rear-right hydraulic unit solenoid valve (IN side)			
4	G-sensor signal	Ignition switch: ON		2.3–2.7 V (Horizontal condition)
5	Steering wheel sensor input from steering wheel sensor (ST-1)	Ignition switch: ON Turn the steering wheel slowly.		Alternates between 0 and approx. 3 V
6	Steering wheel sensor input from steering wheel sensor (ST-2)	Ignition switch: ON Turn the steering wheel slowly.		Alternates between 0 and approx. 3 V
13	ABS-ECU power supply	Ignition switch: ON		System voltage
		Ignition switch: START		0V
14	Output to front-left hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
17	G-sensor earth	Always		0V
19	Steering wheel sensor input from steering wheel sensor (ST-N)	Let the engine run at idle and keep the steering wheel neutral.		0.5 V or less
		Let the engine run at idle and turn the steering wheel 90° from the neutral.		2.5–3.5V
26	Output to relay power supply	Ignition switch: ON		System voltage
31	Free wheel engage switch	Ignition switch: ON	2WD	System voltage
			4WD	1 V or less

Connector terminal No.	Signal	Checking requirements		Normal condition
32	Memory power supply	Always		System voltage
34	Input from stop lamp switch	Ignition switch: ON	Stop lamp switch ON	System voltage
			Stop lamp switch OFF	1 V or less
35	Input from 4WD detection switch	Ignition switch: ON	Transfer lever position: 2H	System voltage
			Transfer lever position: 4H	1 V or less
36	MUT-II	Connect the MUT-II.		Serial communication with MUT-II
		Do not connect the MUT-II.		1 V or less
37	Output to valve relay	Ignition switch: ON	Approximately 1 second after engine is started. The relay is on.	2 V or less
			The system runs down. The relay is off.	System voltage
38	Output to motor relay	Ignition switch: ON (Approximately 1 second after engine is started)	Motor is on	2 V or less
			Motor is off	System voltage
39	Idle-up solenoid valve (–)	Ignition switch: ON (When motor is on approximately 1 second after engine is started)		2 V or less
40	Output to rear-left hydraulic unit solenoid valve (OUT side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
41	Output to front-right hydraulic unit solenoid valve (OUT side)			
43	Idle-up solenoid valve (+)	Ignition switch: ON (When motor is on approximately 1 second after engine is started)		System voltage
45	Input from free wheel engage switch	Ignition switch: ON	Engage 2WD.	System voltage
			Engage 4WD.	1 V or less
46	Ignition switch	Ignition switch: ON		System voltage
		Ignition switch: START		0V
47	Input from diagnosis indication selection	Connect the MUT-II.		0V
		Do not connect the MUT-II.		Approx. 12 V
48	Input from valve relay monitor	Ignition switch: ON		System voltage
49	Motor monitor	Ignition switch: ON (Approximately 1 second after engine is started)	Motor is on	System voltage
			Motor is off	0.5 V or less
50	Output to ABS warning lamp	Ignition switch: ON	The lamp is switched off	System voltage
			The lamp illuminates	0–2V
51	Output to rear-left hydraulic unit solenoid valve (IN side)	Ignition switch: ON (When solenoid valve is off approximately 1 second after engine is started)		System voltage
52	Output to front-right hydraulic unit solenoid valve (IN side)			

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 them between the terminals indicated in the table below.
3. The terminal arrangements are shown in the illustrations below.

41	40	39	38	37	36	35	34	33	32	31
52	51	50	49	48	47	46	45	44	43	42

13	12	11	10	9	8	7	6	5	4	3	2	1
26	25	24	23	22	21	20	19	18	17	16	15	14

14W0042

Connector terminal No.	Signal	Normal condition
1–Body earth	Front-left solenoid valve (OUT side)	3.8Ω
2–Body earth	Rear-right solenoid valve (OUT side)	3.8Ω
3–Body earth	Rear-right solenoid valve (IN side)	8.2Ω
7–20	Front-left wheel speed sensor (+ wire)	0.9–1.1kΩ
8–21	Rear-right wheel speed sensor (+ wire)	1.4–2.0kΩ
9–22	Rear-left wheel speed sensor (+ wire)	1.4–2.0kΩ
10–23	Front-right wheel speed sensor (+ wire)	0.9–1.1kΩ
14–Body earth	Front-left solenoid valve (IN side)	8.2Ω
15–Body earth	ABS-ECU earth	Continuity
25–Body earth		
39–43	Idle-up solenoid valve	33–39Ω
40–Body earth	Rear-left solenoid valve (OUT side)	3.8Ω
41–Body earth	Front-right solenoid valve (OUT side)	3.8Ω
42–Body earth	ABS-ECU earth	Continuity
48–Body earth	Input from valve relay monitor	Continuity
49–Body earth	Motor monitor	Continuity
51–Body earth	Rear-left solenoid valve (IN side)	8.2Ω
52–Body earth	Front-right solenoid valve (IN side)	8.2Ω

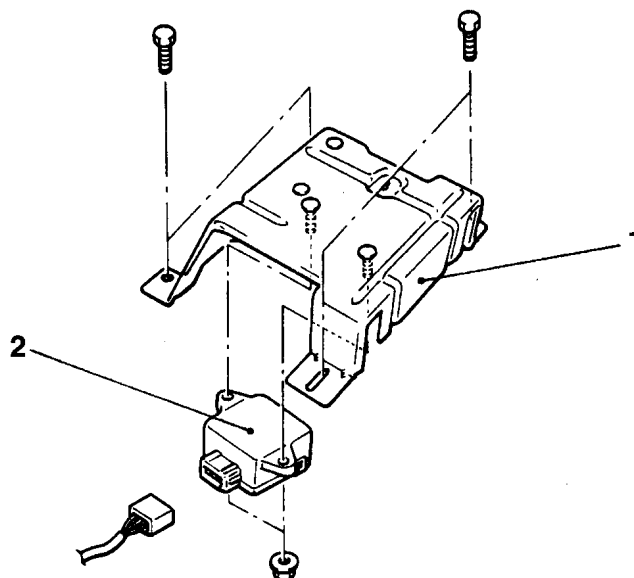
G-SENSOR

120000166

REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Driver's Side Front Seat Removal and Installation
(Refer to GROUP 52A – Seat.)



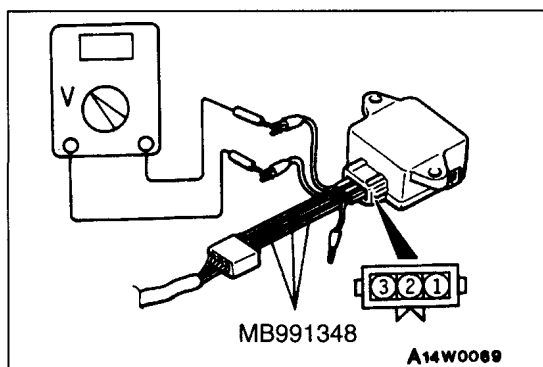
A14W0070

Removal steps

1. G-sensor bracket
2. G-sensor

Caution

Do not drop the G-sensor or subject it to shocks.

**INSPECTION**

- (1) Disconnect the G-sensor connector and connect the special tool between the terminals of the disconnected connector.
- (2) Turn the ignition switch to ON and take a reading of the following output voltage. Between terminals (2) and (3).

Standard value: 2.3–2.7V

- (3) With the special tool still connected, secure the G-sensor so that the FRONT mark on the sensor mounting surface faces straight down, and then take a reading of the following output voltage between terminals (2) and (3).

Standard value: 3.3–3.7V

- (4) If the voltage is outside the standard value, after checking to be sure that there is no abnormality in the power supply and earth wires, replace the G-sensor.

