

SERVICE BRAKES

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WARNING 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 (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: 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 (*).

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NOTES

SPECIFICATIONS

GENERAL SPECIFICATIONS

Items	Specifications
Master cylinder Type I.D. mm (in.) <Vehicles without A.B.S.> <Vehicles with A.B.S.>	Tandem type (with level sensor) 23.8 (15/16) 25.4 (1)
Brake booster Type Effective dia. of power cylinder mm (in.) 7+8 tandem 8+9 tandem Boosting ratio 7+8 tandem 8+9 tandem [Brake pedal depressing force] N (kg, lbs) 7+8 tandem 8+9 tandem	Vacuum type (tandem) 180+205 (7.0+8.0) 205+230 (8.0+9.0) 6.0 7.0 [240 (24, 53)] [261 (26.1, 58)]
Proportioning valve Type Split point MPa (kg/cm ² , psi) <SPACE RUNNER-2WD> <SPACE RUNNER-4WD> <SPACE WAGON-2WD> <SPACE WAGON-4WD> Decompression ratio	Dual type 2.5 (25, 356) 3.0 (30, 427) 3.0 (30, 427) 3.5 (35, 498) 0.25
Front brakes Type Disc O.D. mm (in.) Disc thickness mm (in.) Pad thickness mm (in.) Wheel cylinder I.D. mm (in.) Clearance adjustment	Floating caliper, single-piston, ventilated disc (M-R44V) 256 (10.1) 24 (0.94) 10 (0.39) 53.9 (2 1/8) Automatic

Items	Specifications
Rear drum brakes Type Drum I.D. mm (in.) 8-inch drum brake 9-inch drum brake Cylinder I.D. mm (in.) Clearance adjustment	8-inch leading-trailing or 9-inch leading-trailing 203 (8.0) 228.6 (9.0) 19.05 (3/4) Automatic
Rear disc brakes Type Disc O.D. mm (in.) Disc thickness mm (in.) Pad thickness mm (in.) Wheel cylinder I.D. mm (in.) Clearance adjustment	Floating caliper, single piston, ventilated disc (M-R45S) 262 (10.3) 10 (0.39) 10 (0.39) 34.9 (1 3/8) Automatic
ABS Rotor teeth Front wheel side Rear wheel side Speed sensor	 47 47 Magnet coil type

SERVICE SPECIFICATIONS

E35CB--

Items	Specifications
Standard value	
Brake pedal height	mm (in.) 195–200 (7.7–7.9)
Pedal stroke when stop lamp illuminates	mm (in.) 10–15 (0.39–0.59)
Brake pedal free play	mm (in.) 3–8 (0.12–0.31)
Brake pedal to floorboard clearance	mm (in.) 80 (3.15) or more
Output pressure of proportioning valve	
Split point	MPa (kg/cm ² , psi)
<2WD – Vehicles with A.B.S.>	2.25–2.75 (22.5–27.5, 320–391)
<except 2WD – Vehicles with A.B.S.>	2.75–3.25 (27.5–32.5, 391–462)
Output fluid pressure	
<2WD – Vehicles with A.B.S.>	3.75 (37.5, 533)
<except 2WD – Vehicles with A.B.S.>	4.25 (42.5, 604)
[input pressure MPa (kg/cm ² , psi)]	
<2WD – Vehicles with A.B.S.>	[6.5 (65, 925)]
<except 2WD – Vehicles with A.B.S.>	[7.0 (70, 996)]
Load sensing spring	mm (in.) 85.7–86.3 (3.37–3.40)
Output pressure at LSPV input pressure of 6.25 MPa (62.5 kg/cm ² , 889 psi) [when sensor spring is free]	MPa (kg/cm ² , psi) 3.2–3.7 (32–37, 455–526)
Output pressure at LSPV input pressure of 14 MPa (140 kg/cm ² , 1,991 psi) [when sensor spring is free]	MPa (kg/cm ² , psi) 5.38–6.18 (53.8–61.8, 765–879)
Output pressure at LSPV input pressure of 14 MPa (140 kg/cm ² , 1,991 psi) [when sensor spring length is 100.9 mm (3.97 in.)]	MPa (kg/cm ² , psi) 8.78–10.48 (87.8–104.8, 1,249–1,491)
Pad thickness	mm (in.) 10 (0.39)
Front brake disc thickness	mm (in.) 24 (0.94)
Rear brake disc thickness	mm (in.) 10 (0.39)
Booster push rod to master cylinder piston clearance	mm (in.)
<7+8 inch brake booster>	0.5–0.7 (0.020–0.028)
<8+9 inch brake booster>	0.6–0.8 (0.024–0.031)
Disc brake drag force (tangential force of wheel mounting bolts)	N (kg, lbs.) 70 (7.0, 15.4) or less
[Disc brake dragging torque	Nm (kgm, ft.lbs.)] 4 (0.4, 3) or less

Items	Specifications
Speed sensor's internal resistance	k Ω
<2WD-Front>	0.8–1.2
<2WD-Rear>	0.55–0.8
<4WD>	0.8–1.2
Speed sensor insulation resistance	k Ω
Clearance between the speed pole piece and the toothed rotor	mm (in.)
Front	0.3–0.9 (0.012–0.035)
Rear <2WD>	0.2–0.7 (0.008–0.028)
<4WD>	0.3–0.9 (0.012–0.035)
Limit	
Left/right proportioning valve output pressure difference	MPa (kg/cm ² , psi)
Line output pressure difference between right and left LSPVs	MPa (kg/cm ² , psi)
[when sensor spring is free]	0.4 (4, 57)
Line output pressure difference between right and left LSPVs	MPa (kg/cm ² , psi)
[when sensor spring length is 100.9 mm (3.97 in.)]	0.4 (4, 57)
Front disc runout	mm (in.)
Hub end play	mm (in.)
Pad thickness	mm (in.)
Front disc thickness	mm (in.)
Rear disc thickness	mm (in.)
Rear disc runout	mm (in.)
Rear lining thickness	mm (in.)
Rear drum linside diameter	mm (in.)
<Rear Drum Brake>	
8-inch drum brake	205 (8.1)
9-inch drum brake	230.6 (9.1)
<Drum in Disc Brake>	169 (6.7)

LUBRICANTS

E35CD--

Items	Specified lubricant
Brake fluid	DOT3 or DOT4
Brake piston seal Brake piston boot inner surfaces Lock pin boot inner surfaces Guide pin boot inner surfaces Lock pin sleeve Piston boot mounting grooves	Repair kit grease (orange)
Rear brake shoe and backing plate contact surfaces Shoe assembly and auto adjuster assembly contact surfaces Shoe and lever assembly and auto adjuster assembly contact surfaces	Brake grease SAE J310, NLGI No. 1

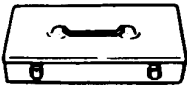



SEALANT AND ADHESIVES

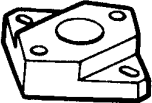
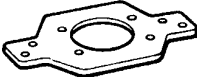
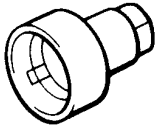
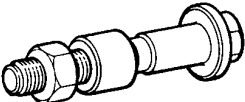
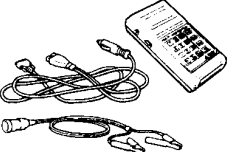




E35CE--

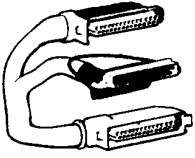
Items	Specified sealant	Remarks
Thread part fitting	3M ATD Part No. 8531 or No. 8646 or equivalent	Body sealant
Shoe hold-down pin	3M ATD Part No. 8513 or equivalent	Non-drying sealant

SPECIAL TOOLS

E35DA--

Tool	Number	Name	Use
	MB990964 MB990965	Brake tool set Brake tool box	Pushing-in of the front disc brake piston Installation of drum brake wheel cylinder piston cup.
	MB990520 (CT1092)	Piston expander	
	MB990806	Brake spring remover and installer	
	MB991008-(F)	Piston cup installer	

Tool	Number	Name	Use
	MB990750	Brake booster holder	Disassembly and reassembly of the brake booster
	MB990749	Lever attachment	Disassembly and reassembly of the brake booster
	MB991247	Wrench	Disassembly and reassembly of the 8+9 and 7+8 inch tandem brake booster
	MB990998	Front hub remover and installer	Measurement of brake dragging torque
	MB991341	Multi-use tester assembly (MUT)	Up to 1993 models For checking of A.B.S.
	MB991419	ROM pack	
	MB991377	Adapter harness	
	MB991502	MUT-II sub assembly	All models For checking of A.B.S.
		ROM pack	

Tools	Number	Name	Use
	MB991356	ABS check harness	For checking of A.B.S.

NOTES

ANTI-LOCK BRAKE SYSTEM TROUBLESHOOTING <2WD> E35EC-A

PARTICULAR PHENOMENA OF THE ANTI-LOCK BRAKE SYSTEM

Models equipped with the anti-lock brake system (A.B.S.) may exhibit one or more of the following phenomena from time to time, but none of these are abnormal.

- (1) A pulsing feeling in the brake pedal, or vibration of the body or the steering wheel, when the anti-lock brake system is activated by sudden braking or by braking on a slippery road surface. Actually, this phenomenon is an indication that the A.B.S. is functioning normally.
- (2) When the vehicle speed reaches approximately 8 km/h (5 mph) after the engine is started and the vehicle starts off (for the first time), a whining motor noise may be heard from the engine compartment if the vehicle is traveling in a quiet place, but this noise is simply the result of a self-check being made of the A.B.S. operation.

TROUBLESHOOTING METHODS

Problems related to the A.B.S. can be classified into two general categories: problems in the electrical system and those in the hydraulic system.

For problems in the electrical system the selfdiagnosis function is built into the electronic control unit (E.C.U.), causing the A.B.S. warning lamp to illuminate as a warning to the driver. In this instance, checks can be made by using the multi-use tester and oscilloscope.

Problems in the hydraulic system (poor braking, etc.) can be located in the same way as for ordinary brakes. There is, however, the necessity to check to determine whether the problem is related to ordinary brake components or to the components related to the A.B.S. To make this check, use the multi-use tester.

HOW TO USE THE TROUBLESHOOTING FLOW CHART

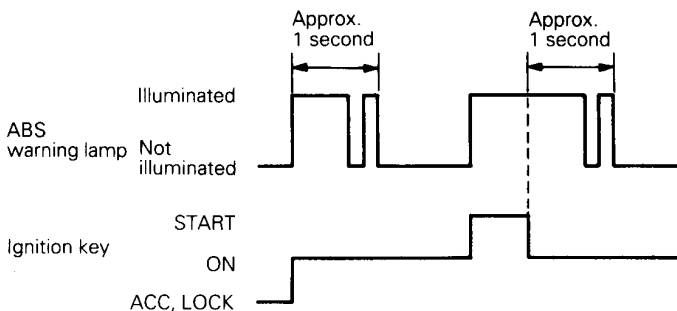
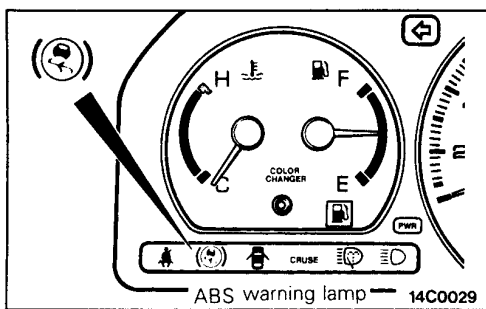
- (1) Following the flow chart, first refer to the illumination pattern of the ABS warning lamp, and next note the diagnosis code and inspect the brake operation.
- (2) Follow the inspection charts listed in the "Remedy" column to carry out an inspection. In each inspection chart, [Comment] and (Hint) are listed for troubleshooting reference.

NOTE

ECU: Electronic control unit

Check the trouble symptoms by the following procedure, and inspect according to the instructions.

- Before the engine starts, does the ABS warning lamp illuminate?
- (1) With the ignition key in the "ON" position, the ABS warning lamp flashes twice during a 1 second period (during this time, the valve relay self-check is carried out) and then the lamp switches off.
 - (2) With the ignition key in the "START" position, power to the ABS-ECU is cut, and because the valve relay turns OFF, the ABS warning lamp remains illuminated.
 - (3) When the ignition key is turned from the "START" position back to the "ON" position, the ABS warning lamp flashes 2 times (during this time, the valve relay self-check is carried out) and then the lamp stays switched off.



14A0589

Yes

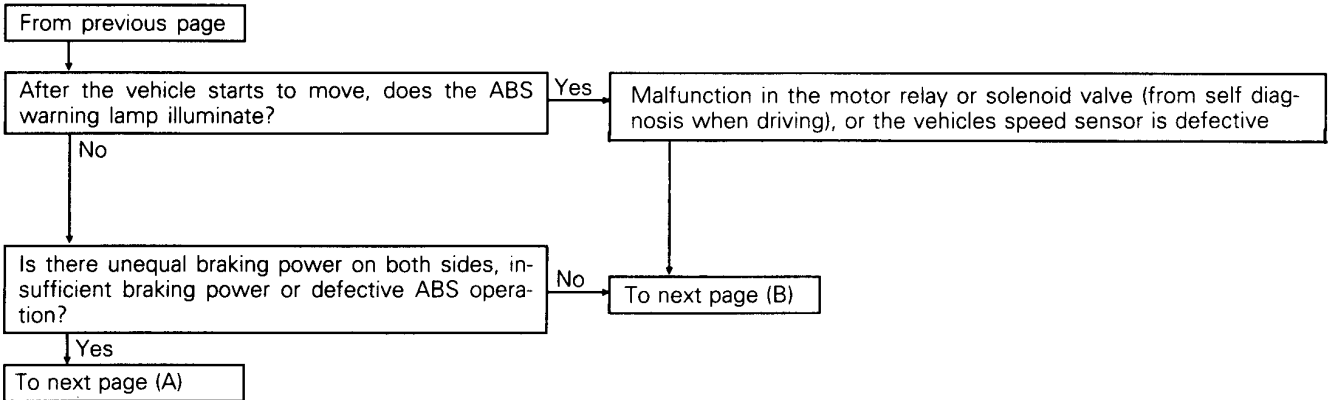
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No

No.	Trouble symptom	Main cause	Remedy
1	<p>The ABS warning lamp does not illuminate at all.</p> <p> ABS warning lamp: Illuminated (Not illuminated) Ignition key: START, ON, ACC, LOCK </p> <p>14A0590</p>	<ul style="list-style-type: none"> • ABS warning lamp bulb failure. • Broken wire in the ABS warning lamp power circuit (including blown fuse). 	<p>Inspect according to Flow Chart A (Refer to P.35-14).</p>
2	<p>When the ignition key is turned to "ON", the ABS warning lamp remains illuminated.</p> <p> ABS warning lamp: Illuminated (Not illuminated) Ignition key: START, ON, ACC, LOCK </p> <p>14A0591</p>	<ul style="list-style-type: none"> • Fail safe function is operated by the ABS-ECU self-diagnosis. • Short in the ABS-ECU warning lamp drive circuit • ABS-ECU is defective 	<p>Inspect according to Flow Chart B (Refer to P.35-17).</p>

35-10 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>

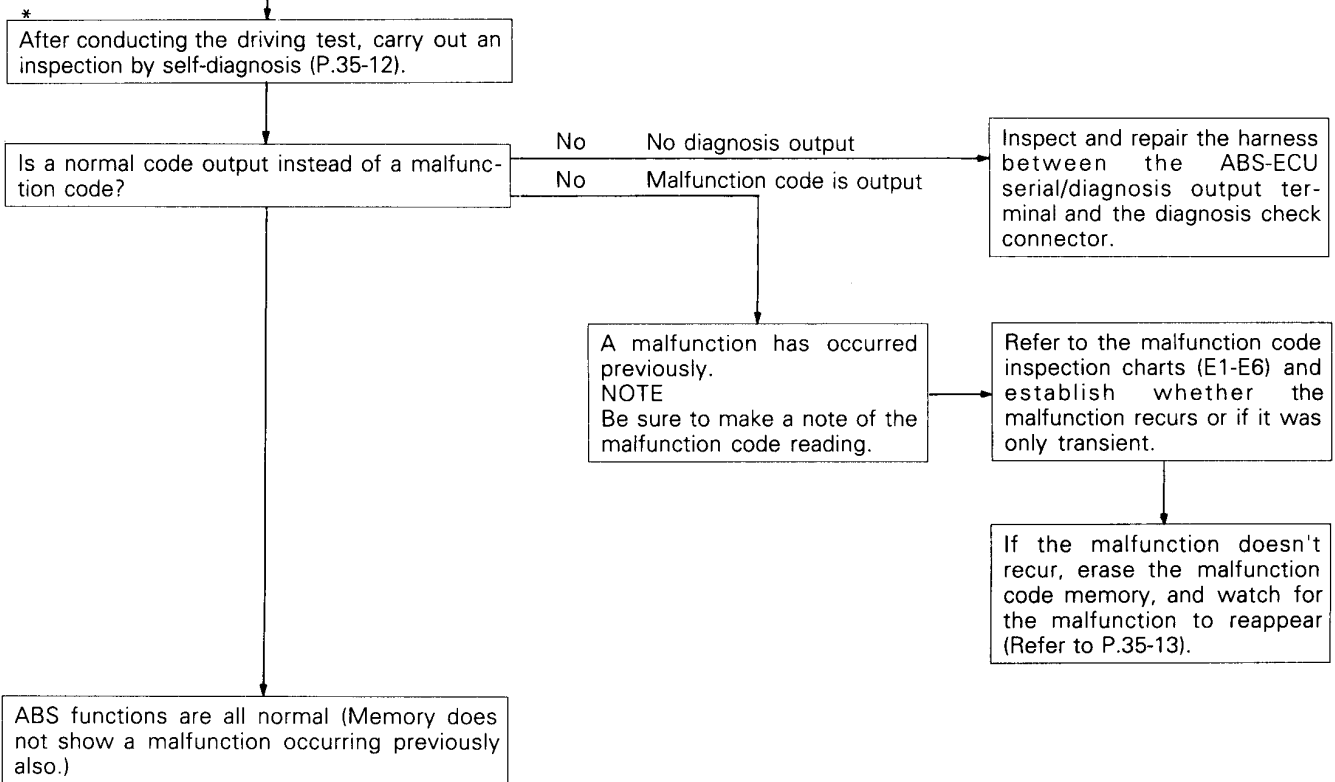
No.	Trouble symptom	Main cause	Remedy
3	<p>When the ignition key is turned to "START", the ABS warning lamp does not illuminate.</p> <p> ABS warning lamp Illuminated Not illuminated </p> <p>START</p> <p>Ignition key ON ACC, LOCK</p> <p style="text-align: right;">14A0592</p>	<ul style="list-style-type: none"> • Valve relay is defective • Broken harness wire between the ABS warning lamp and the hydraulic unit • Broken harness wire between the hydraulic unit and the earth 	Inspect according to Flow Chart C (Refer to P.35-19).
4	<p>After the ignition key is turned to "ON", the ABS warning lamp blinks once, and when turned to "START", it illuminates. When returned to "ON", the lamp flashes once, and then switches off. (The blinking when the key is turned to "ON" occurs simultaneously with the operation noise from the valve relay)</p> <p> ABS warning lamp Illuminated Not illuminated </p> <p>START</p> <p>Ignition key ON ACC, LOCK</p> <p style="text-align: right;">14A0593</p>	<ul style="list-style-type: none"> • Broken harness wire in the ABS-ECU warning lamp drive circuit • ABS-ECU is defective 	Inspect according to Flow Chart D (Refer to P.35-20).



(A) From previous page

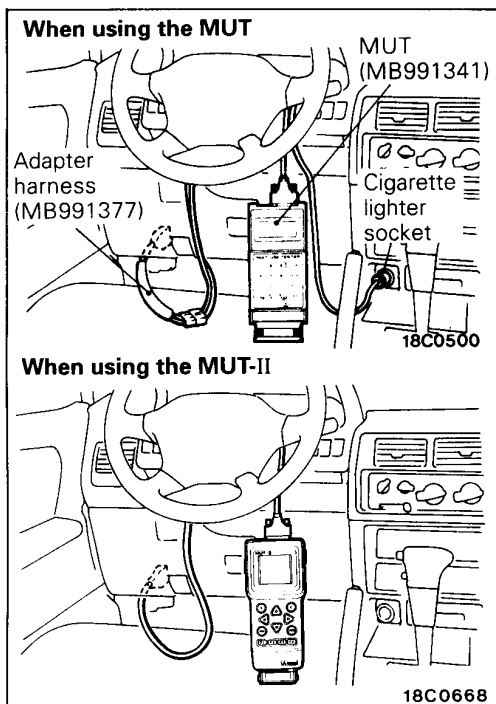
Trouble symptom	Main cause	Remedy
Unequal braking power Insufficient braking power	<ul style="list-style-type: none"> • Blocked pressure circuit inside the hydraulic unit. • Mechanical lock in the hydraulic unit solenoid valve. 	Follow the hydraulic unit operation inspection (refer to P.35-63) and replace the hydraulic unit if necessary. If the hydraulic unit is normal, inspect the components of the normal brake.
Decline in ABS function	<ul style="list-style-type: none"> • Blocked pressure circuit inside the hydraulic unit. • Operation of the hydraulic unit solenoid valve is defective. 	
ABS operates even when not carrying out sudden braking (ABS operating vibration starts to be felt).	<ul style="list-style-type: none"> • Insufficient wheel speed sensor output voltage (sensor is defective, excessive clearance between the sensor and rotor, or rotor is chipped). • ABS-ECU is defective 	Inspect the wheel speed sensor (refer to P.35-60), and replace the sensor or adjust the sensor clearance if necessary. If the problem occurs frequently even though the sensor is normal, then replace the ABS-ECU.

(B) From previous page



NOTE

* Drive for 30 seconds or more at vehicles speeds exceeding 30 km/h (19 mph).



CHECK USING SELF DIAGNOSIS FUNCTION

WHEN USING THE MULTI-USE TESTER (MUT) <Up to 1993 models> OR THE MUT-II <All models>

- (1) With the ignition switch OFF, connect the MUT or MUT-II through the adapter harness (MB991377) <Up to 1993 models> or the adapter harness included in the MUT-II sub assembly <All models>, turn the ignition ON and select the ABS system. (The ABS warning lamp lights up, it goes into the MUT or MUT-II mode. **In the MUT or MUT-II mode, ABS does not function.**)

If it does not go into the MUT or MUT-II mode, check the ECU power circuit and the harness between the ECU and diagnosis check terminals.

- (2) Read the diagnosis output codes from the ECU memory.
- (3) Clear the diagnosis codes once from memory. (Refer to P.35-13.)
If the memory cannot be cleared, the ECU is currently detecting the trouble and the ABS ECU is in fail safe. If it can be cleared, the trouble is either temporary or appears only when driving.
- (4) When the trouble codes cannot be cleared, or when the ABS ECU goes into fail safe during another test drive and trouble codes are output, check according to trouble code check charts (E-1–E-6).

DIAGNOSIS CODE CHART

Diagnosis code no.	Check chart name or remedy	Reference page	Diagnosis code no.	Check chart name or remedy	Reference page
11	E-1	P.35-21	41	E-4	P.35-25
12			42		
13			43		
14			51	E-5	P.35-26
15	E-2	P.35-21	52	E-6	P.35-27
22	E-3	P.35-24	55	ECU replacement	–

METHOD OF ERASING THE DIAGNOSIS CODE MEMORY

Caution

When repairs are completed, the diagnosis code memory should be erased. When the ABS-ECU function is stopped, the malfunction code memory cannot be erased, so the function should be continuing while inspection and repair is being carried out.

ACTUATOR TEST FUNCTION

The actuator can be force-driven using the MUT or MUT-II, enabling easy operation checking to be performed.

NOTE

1. When the ECU is cancelling the function, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. When force-driving the actuator, if the vehicle speed reaches 10 km/h (6 mph), forced-driving is cancelled.
3. The item Nos. in the table below indicate the numbers input to the MUT or MUT-II when actuator test execution is displayed.

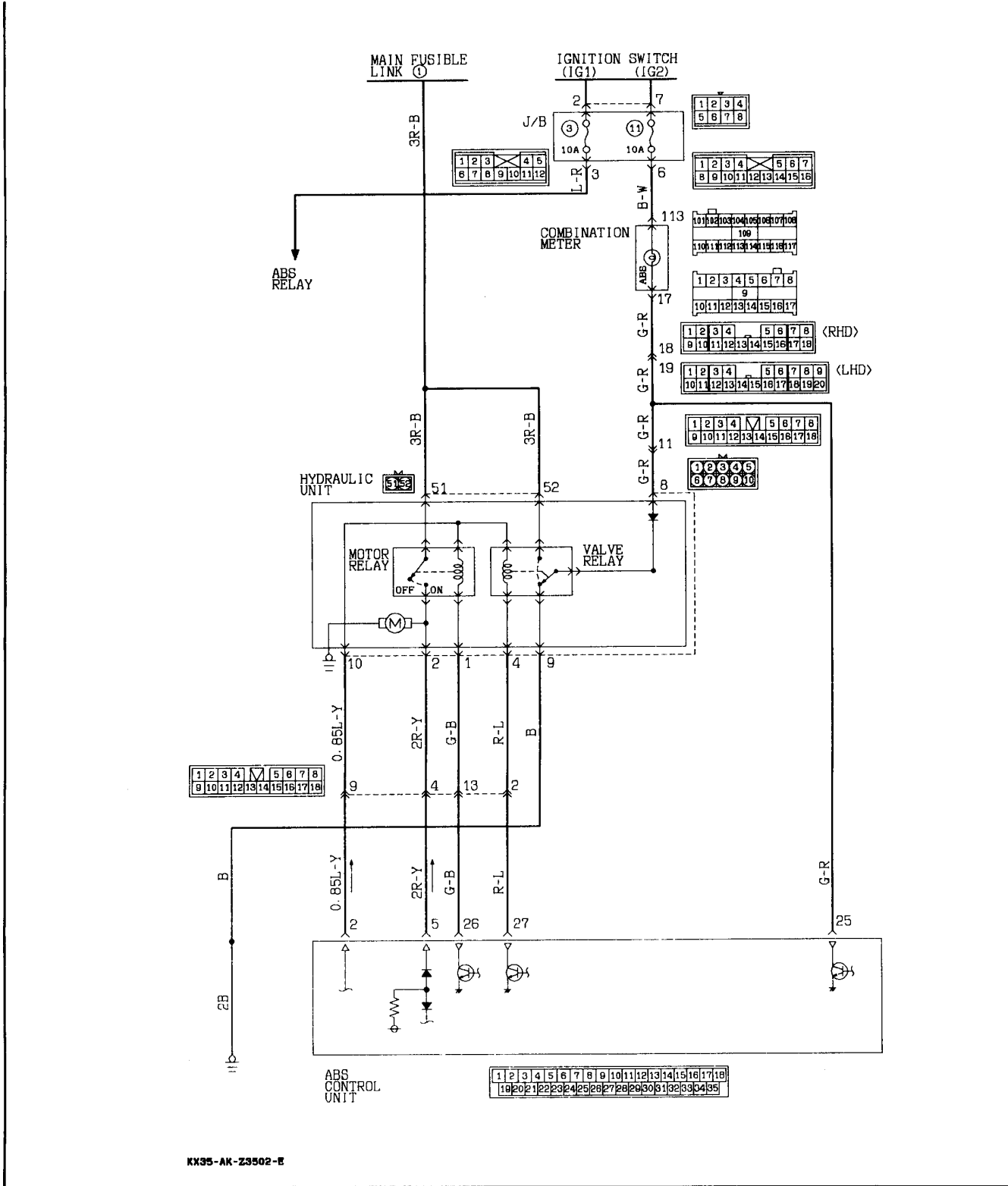
Item No	MUT or MUT-II display	Drive solenoid valve and motor	Drive pattern
01	FR valve automatic	Solenoid valve and pump motor for each HU corresponding channel. <Automatic pattern>	
02	FL valve automatic		
03	Rear valve automatic		
04	FR valve manual	Solenoid valve and pump motor for each HU corresponding channel. <Manual pattern>	
05	FL valve manual		
06	Rear valve manual		

35-14 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>

A ABS warning lamp does not illuminate at all

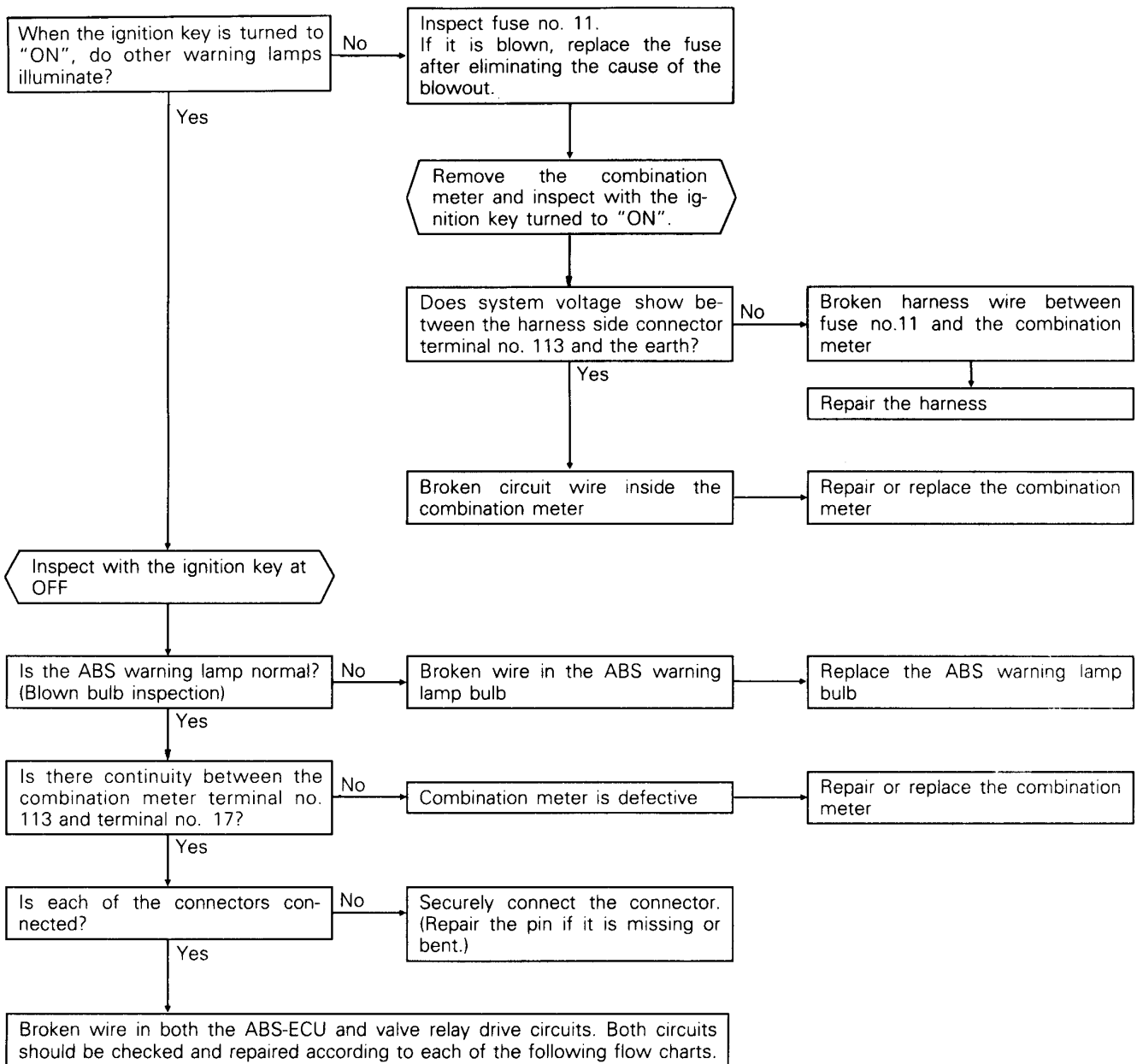
[Comment] When the lamp does not illuminate at all, there is a strong possibility that there is a malfunction of the ABS warning lamp or the power supply.

[Hint] If other warning lamps also do not illuminate, it is probably a blown fuse.

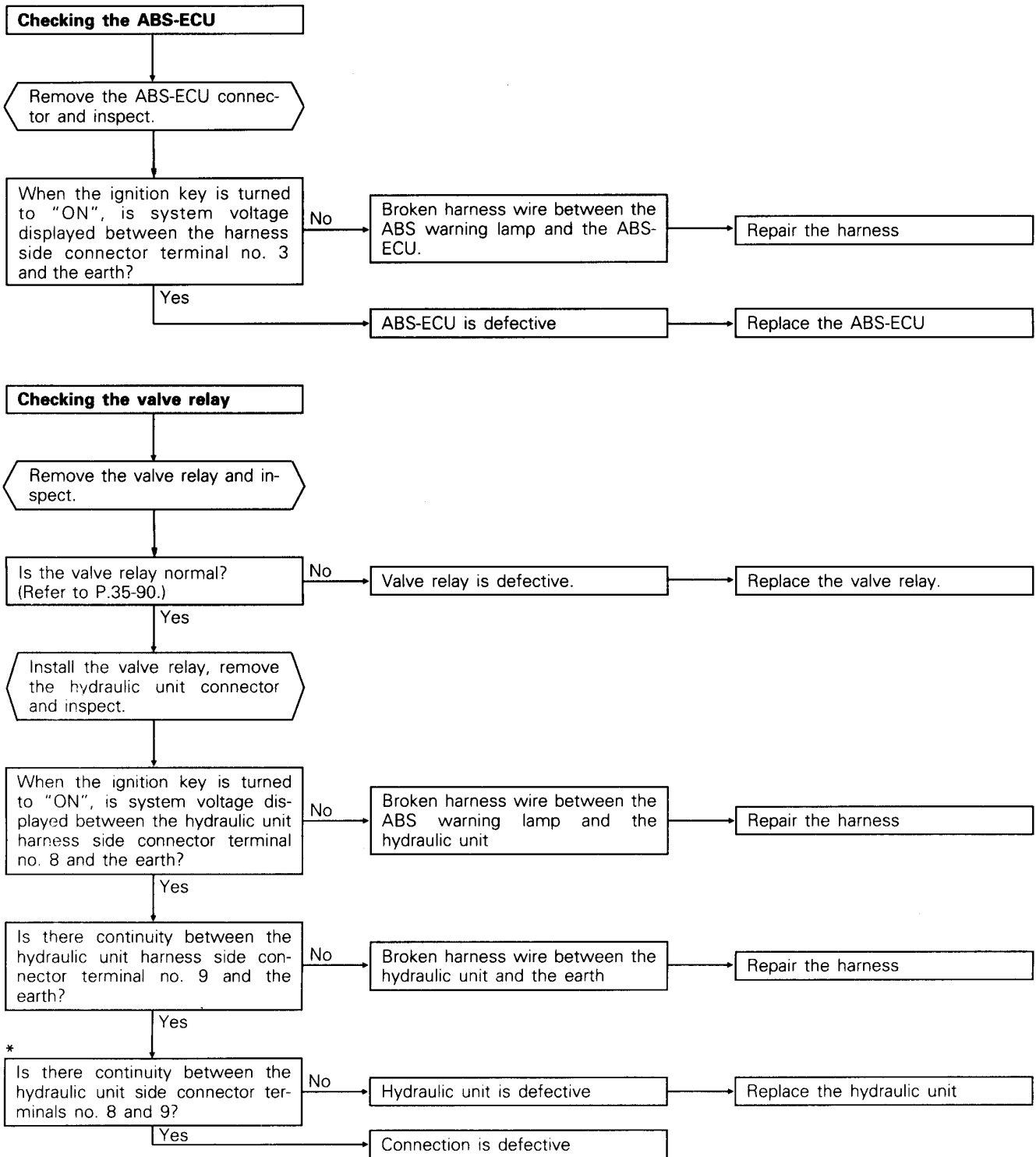


KX35-AK-23502-E

SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD> 35-15



35-16 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>



NOTE

For inspection sections marked by * pay attention to the polarity of the diodes. (Refer to the circuit diagram on P.35-14.)

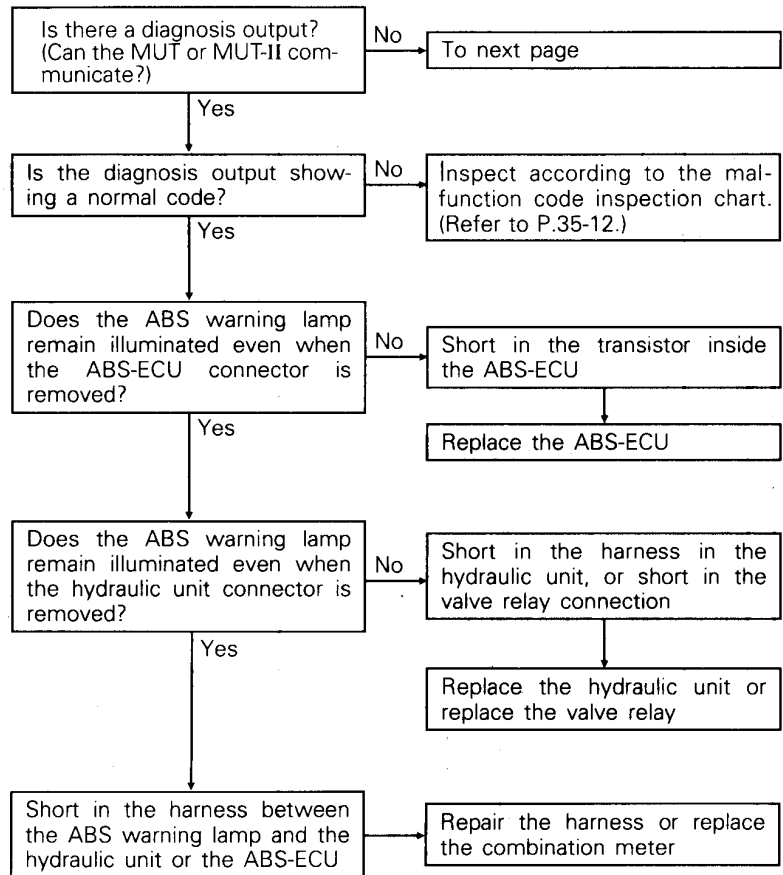
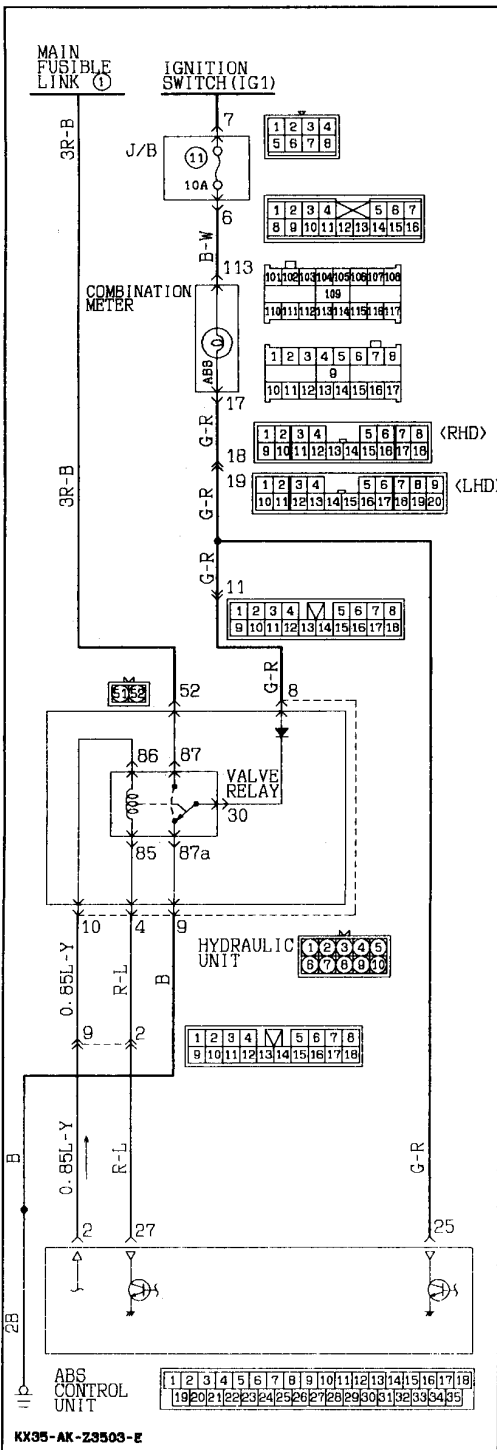
B When the ignition switch is turned to "ON", the ABS warning lamp remains illuminated

[Comment] This symptom occurs when the ABS-ECU is not functioning due to a broken wire, etc., in the ABS-ECU power circuit, when the fail-safe function is operating to isolate the system, or when there is a short in the warning lamp drive circuit.

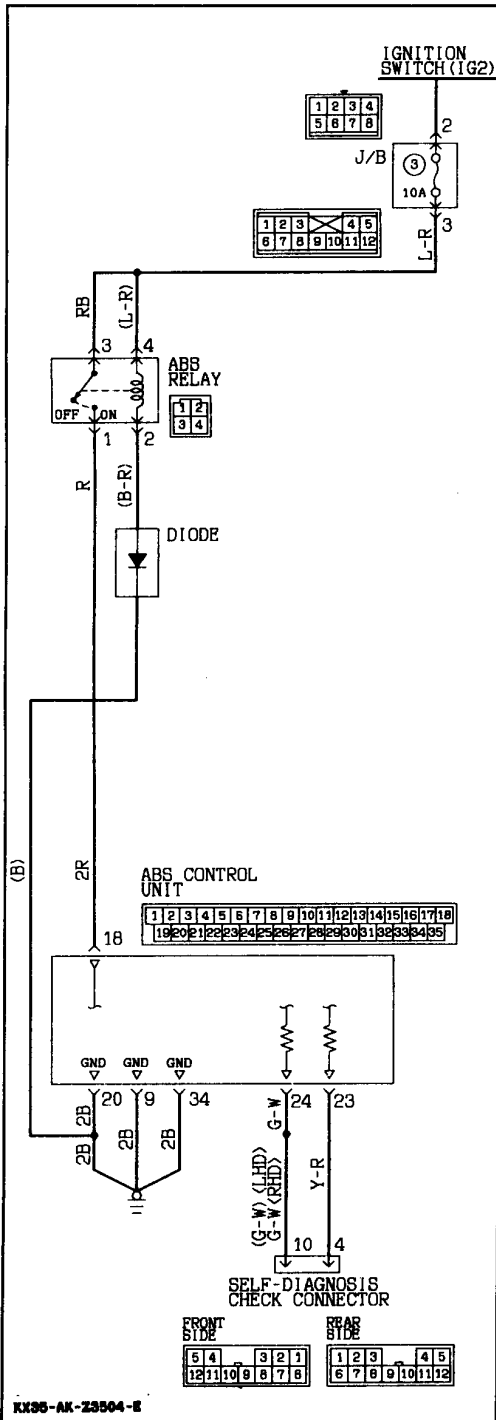
(Hint) Check the diagnosis output, and if there is no output voltage, or the multi-use tester and the ABS-ECU cannot communicate, then there is a high possibility that power is not being supplied to the ABS-ECU.

Caution

- If no malfunction code is output, there is a high possibility that the fail-safe function is operating. In this case, to check if there is a current problem, the memory should be temporarily erased, and a test run should be carried out.



35-18 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>



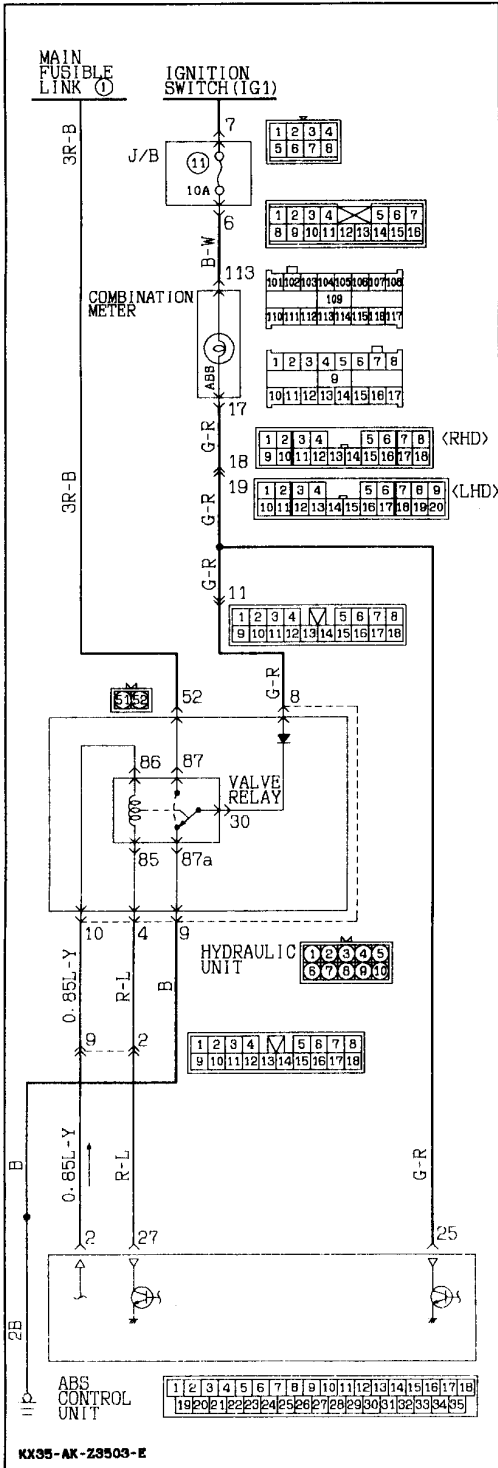
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    graph TD
      Start[From previous page] --> Q1{Is fuse no. 3 normal?}
      Q1 -- No --> A1[Replace the fuse after eliminating the cause of the blowout.]
      Q1 -- Yes --> Q2{Does the power relay operate normally (Refer to P.35-64.)}
      Q2 -- No --> A2[Power relay is defective]
      A2 --> A3[Replace the power relay]
      Q2 -- Yes --> Q3{Disconnect the ABS-ECU connector, and inspect the harness side connector.}
      Q3 --> Q4{When the ignition key is turned to "ON", does system voltage show between the harness side connector terminal no. 18 and the earth?}
      Q4 -- No --> A4[Broken harness wire between the power relay and the ABS-ECU.]
      A4 --> A5[Repair the harness]
      Q4 -- Yes --> Q5{Is there continuity between each of the harness-side connector terminal no. 9, 20 and 34 and the earth?}
      Q5 -- No --> A6[Broken wire in the ABS-ECU earth line]
      A6 --> A7[Repair the harness]
      Q5 -- Yes --> Q6{Is there continuity between the harness-side connector terminal no. 23 and 24 and the diagnosis check connector terminals no. 4 and 10?}
      Q6 -- No --> A8[Broken harness wire between the diagnosis check connector and the ABS-ECU.]
      A8 --> A9[Repair the harness]
      Q6 -- Yes --> A10[ABS-ECU is defective]
      A10 --> A11[Replace the ABS-ECU]
  
```

C When ignition key is turned to "START", ABS warning lamp switches off

[Comment] The ABS-ECU uses the power to the IG2 which is cut when the ignition switch is turned to "START". The ABS warning lamp uses IG1 power which is not cut even when the ignition switch is turned to "START". Accordingly, because the power to the

ABS-ECU is stopped in "START" position, the valve relay turns OFF. At this time, if the warning lamp does not illuminate, the cause is a problem in the lamp illumination circuit in the valve relay.



```

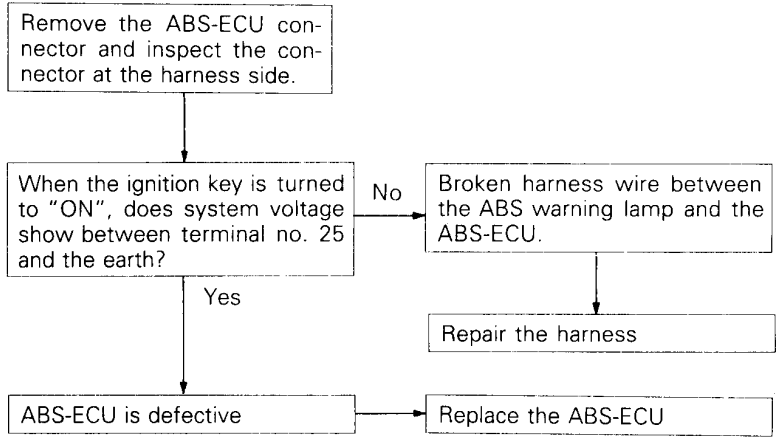
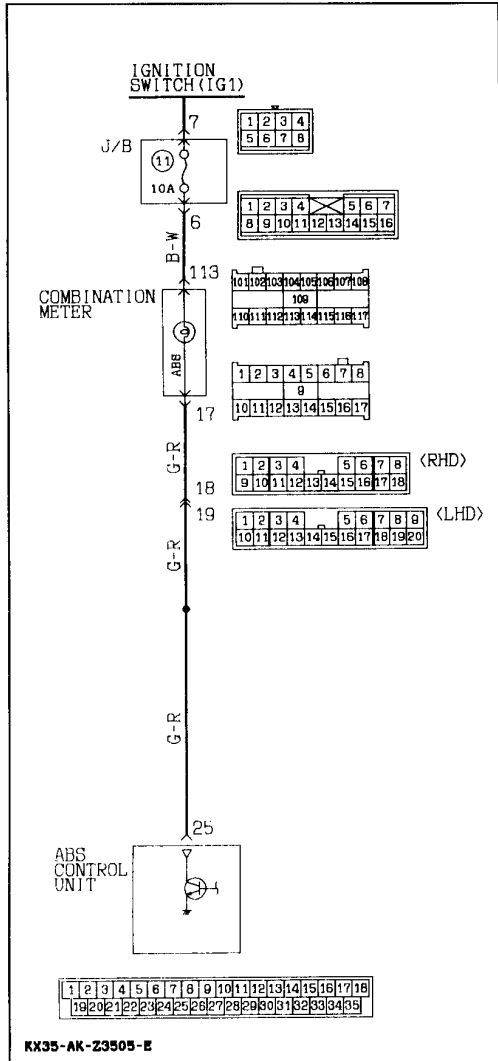
    graph TD
      Start([Remove the hydraulic unit connector and inspect.]) --> Q1{When the ignition key is turned to "ON", does system voltage show between the harness side connector terminal no. 8 and the earth?}
      Q1 -- No --> A1[Broken harness wire between the hydraulic unit and the ABS warning lamp]
      Q1 -- Yes --> Q2{Is there continuity between the harness side connector terminal no. 9 and the earth?}
      Q2 -- No --> A2[Broken wire between the hydraulic unit and the earth]
      Q2 -- Yes --> Q3{When the valve relay is removed, is there continuity between terminal no. 87a and terminal no. 30?}
      Q3 -- No --> A3[Valve relay is defective]
      Q3 -- Yes --> A4[Hydraulic unit harness is defective]
      A3 --> A5[Replace the valve relay]
      A4 --> A6[Replace the harness]
  
```

35-20 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>

D The ABS warning lamp flashes once 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.

[Comment] When power flows, the ABS ECU turns on the warning lamp for approximately 1 second while it performs a valve relay test. If there is

a break in the harness between the ECU and the warning lamp, the lamp illuminates only when the valve relay is off in the valve relay test, etc.



E-1	When the following diagnosis codes are displayed “11 FL SNSR. OPEN” “12 FR SNSR. OPEN” “13 RL SNSR. OPEN” “14 RR SNSR. OPEN”
------------	---

[Comment]

The ABS ECU detects breaks in the wheel speed sensor wire. This trouble code is output if the wheel speed sensor signal is not input (or short circuited) or if its output is low when starting to drive or while driving.

[Hint]

In addition to a broken wire/short circuit in the wheel speed sensor, also check whether the sensor gap is too large, sensor harness wire is broken, or sensor harness and body connector are not properly connected.

E-2	When diagnosis code “15 VEH. SPD. SNSR.” is displayed
------------	--

[Comment]

This trouble code is output when there is an abnormality (other than broken wire or short circuit) in any of the wheel speed sensor output signals while driving.

[Hint]

The following can be considered as the cause of the wheel speed sensor output abnormality.

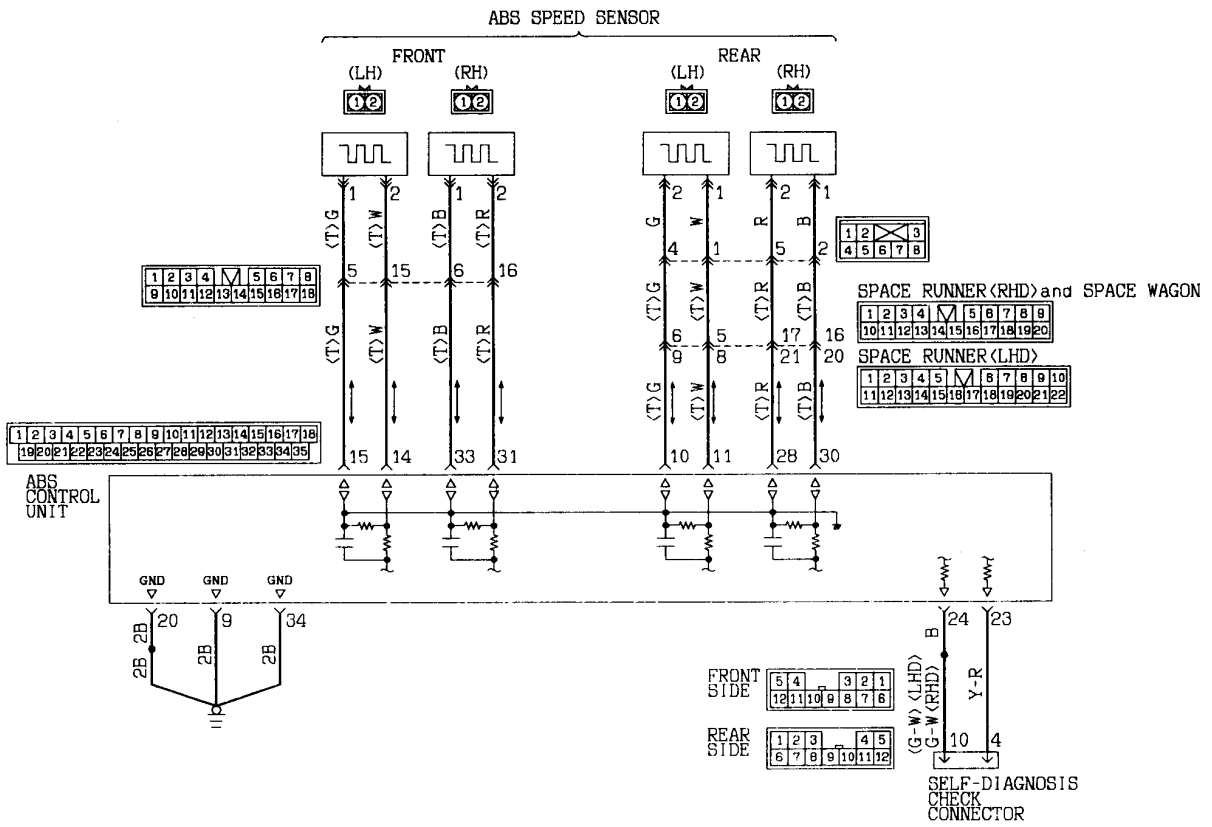
- Distortion of rotor, teeth missing
- Low frequency noise interference when sensor harness wire is broken
- Noise interference in sensor signal
- Sensor output signal is below the standard value or amplitude modulation is over the standard value. Using an oscilloscope to measure the wave shape of the wheel speed sensor output signal is very effective.

- Broken sensor harness
- Poor connection of connector

NOTE

- (1) If contact is poor, check the sensor cable by bending and lightly stretching it.
- (2) Except for the case where a fault condition exists in the system, but the inspection results are normal, if an abnormality cannot be found in the sensor circuit displayed as abnormal, erase the diagnosis code and turn the ignition switch to OFF once, and then test-drive again. If the same trouble code is output, replace the ABS ECU. If the trouble does not occur anymore, the problem is likely to be with the ABS ECU.
(If the trouble is in the speed sensor circuit, but is difficult to recreate, it will recur even after the ABS ECU has been replaced.)

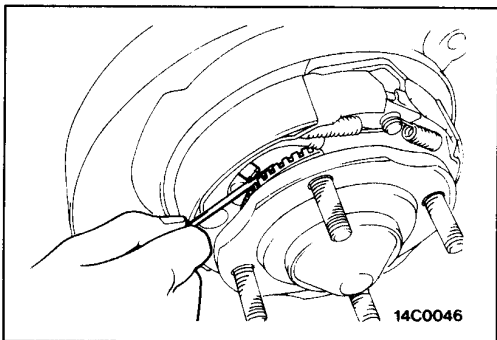
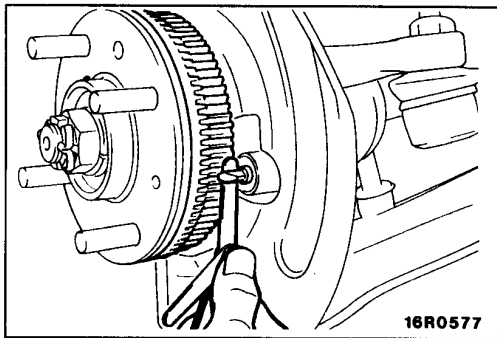
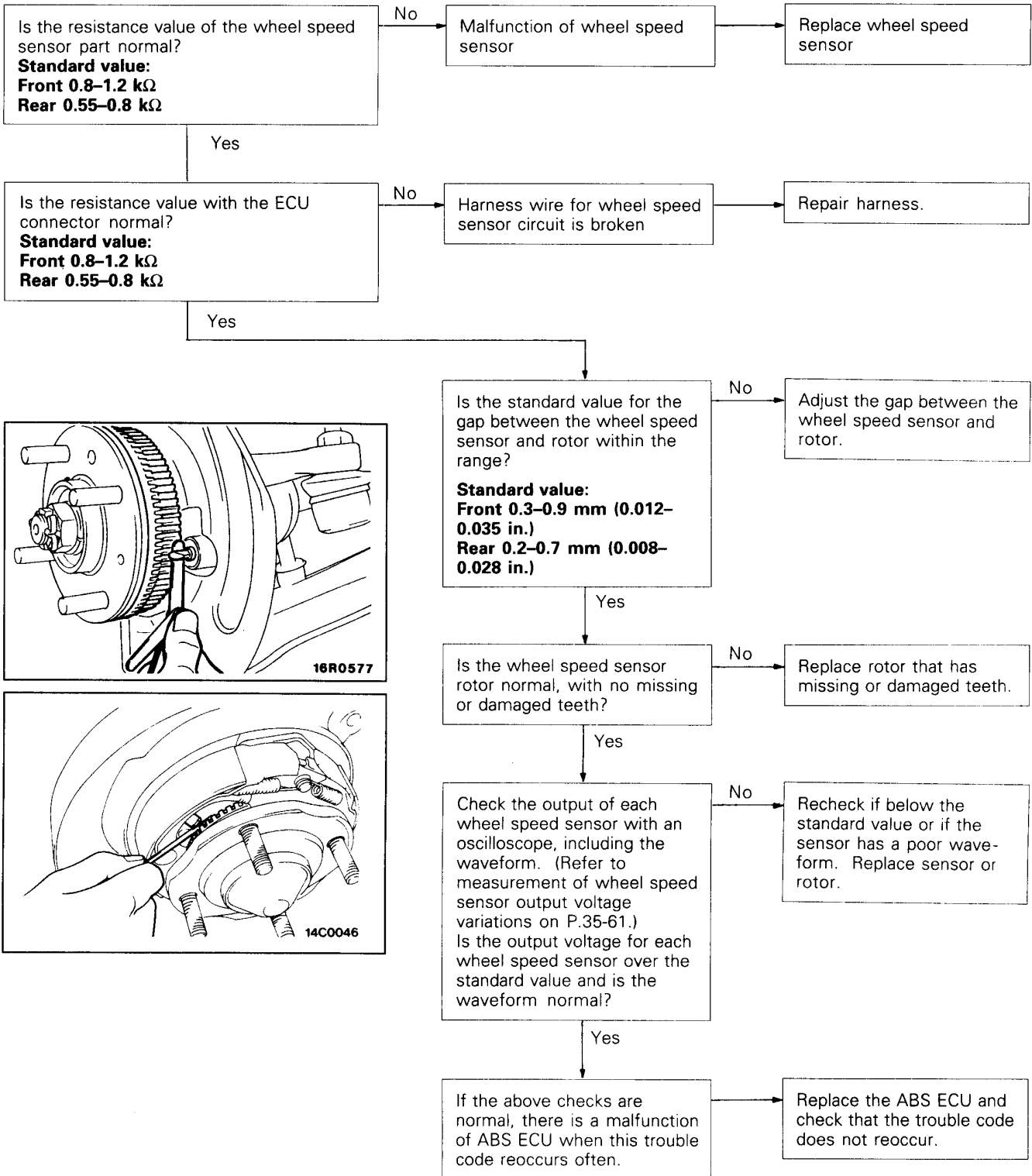
35-22 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>



KX35-AK-Z3506-E

Check flow connected with wheel speed sensor

NOTE
When checking with an oscilloscope, first measure voltage variations in the wheel speed sensor output. (Refer to P.35-61.)



35-24 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>

E-3 When diagnosis code "22 STOP LAMP SW" is displayed

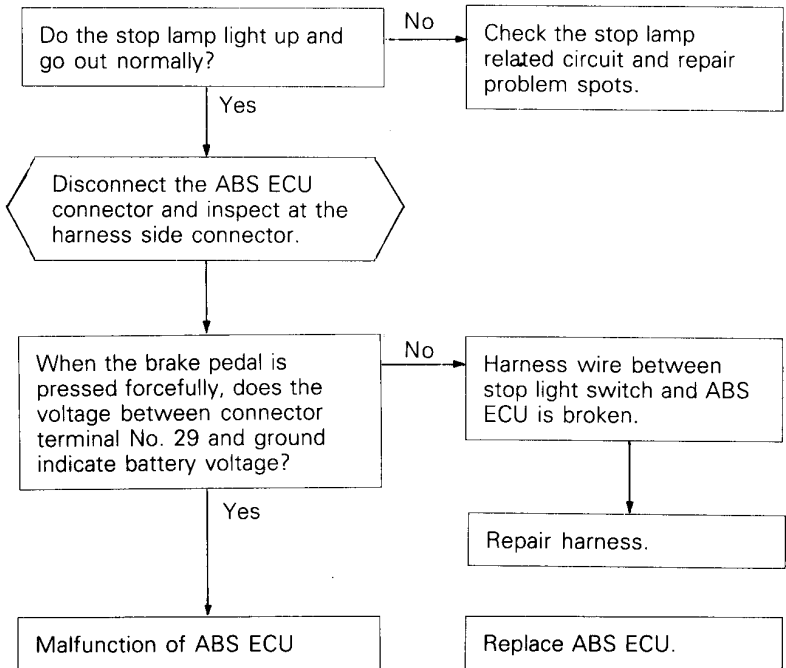
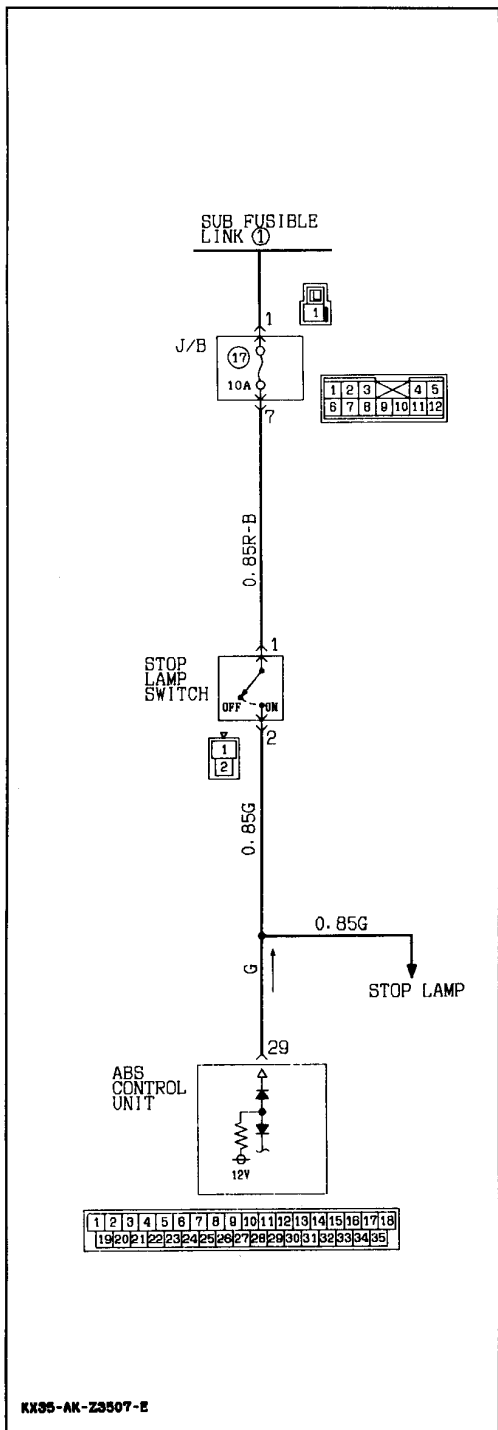
[Comment]

The ABS ECU outputs this trouble code in the following cases.

- Stop light switch may remain on for more than 15 minutes without ABS operation.
- The harness wire for the stop lamp switch may be open.

[Hint]

If the stop lamp operates normal, the harness for the stop lamp switch input circuit is broken or there is a malfunction in the ABS ECU.



KX35-AK-Z3507-E

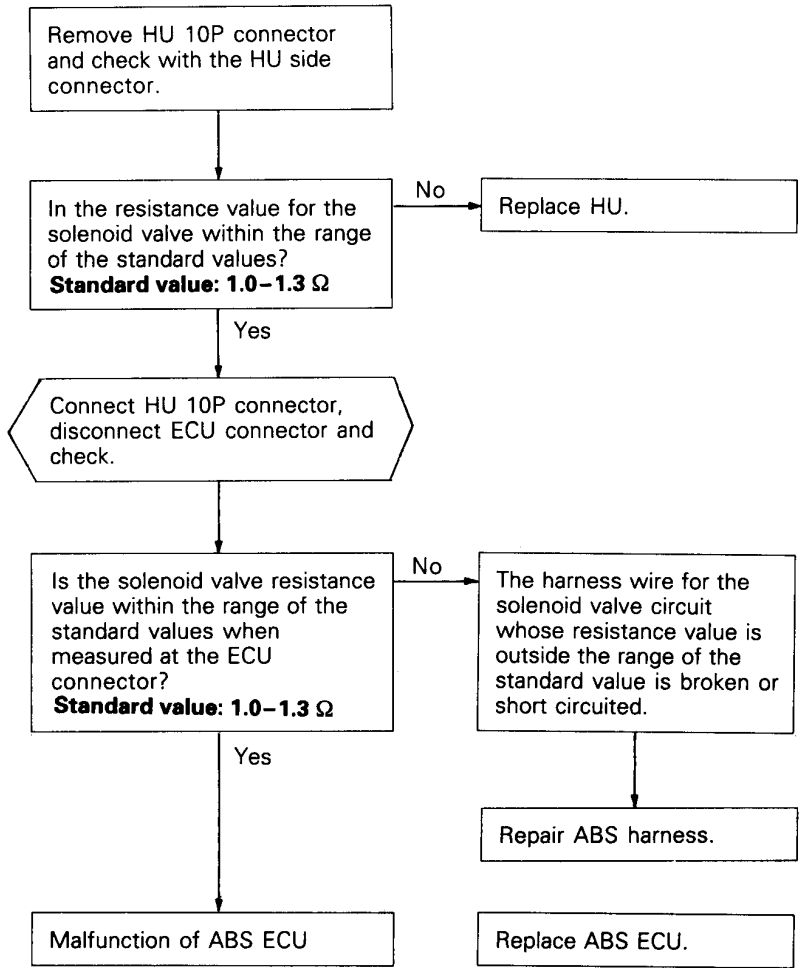
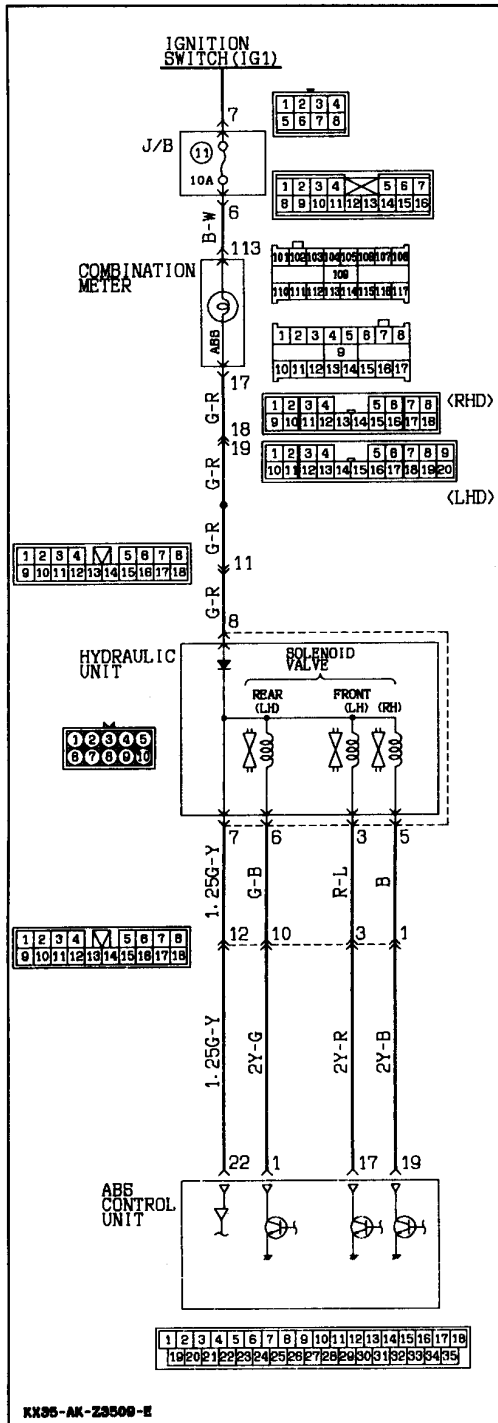
E-4 When diagnosis codes "41 FL SOL. VALVE", "42 FR. SOL. VALVE" or "43 REAR SOL. V" are displayed.

[Comment]

The ABS ECU normally monitors the solenoid valve drive circuit.

If no current flows in the solenoid even if the ECU turns the solenoid ON or if it continues to flow

even when turned OFF, the ECU determines the solenoid coil wire is broken/short-circuited or the harness is broken/short-circuited, and then these trouble codes are output.



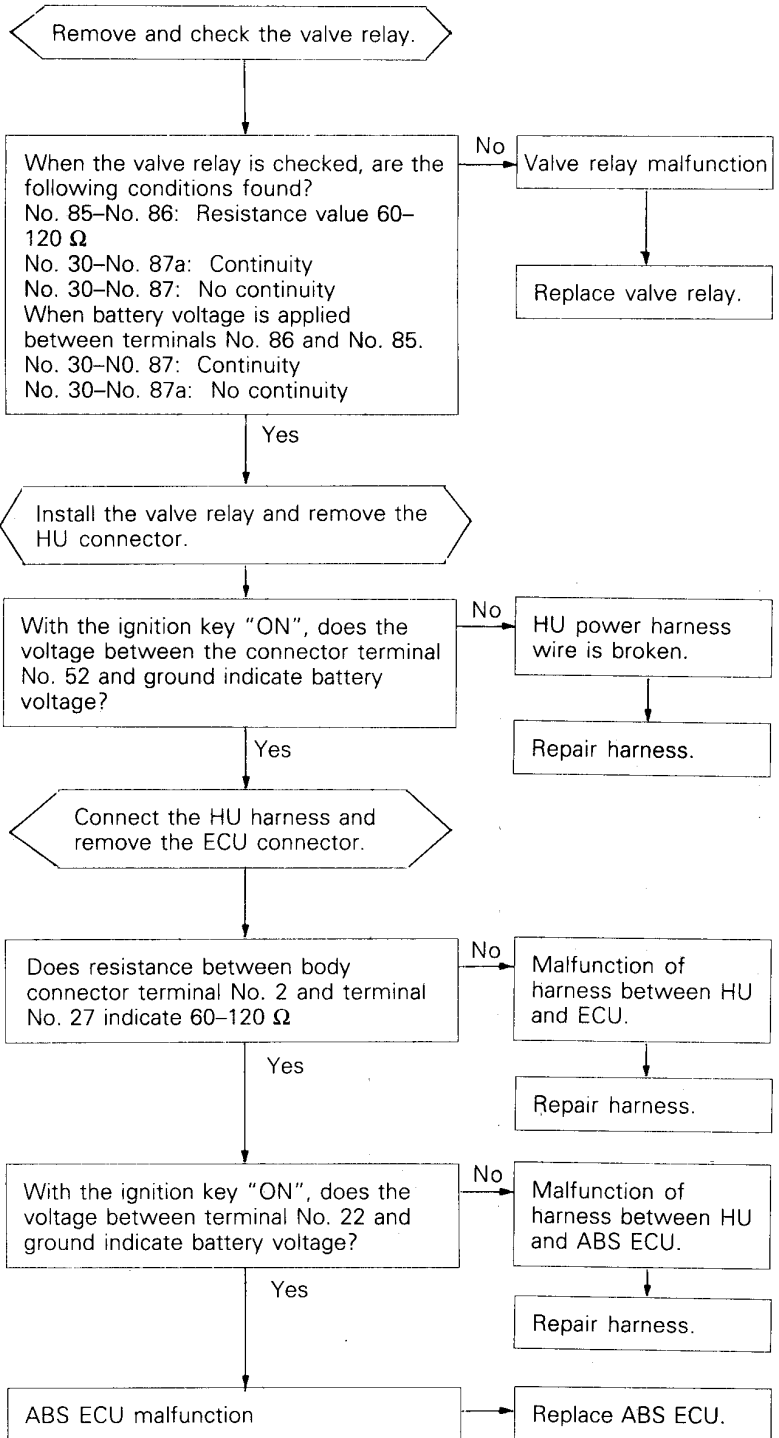
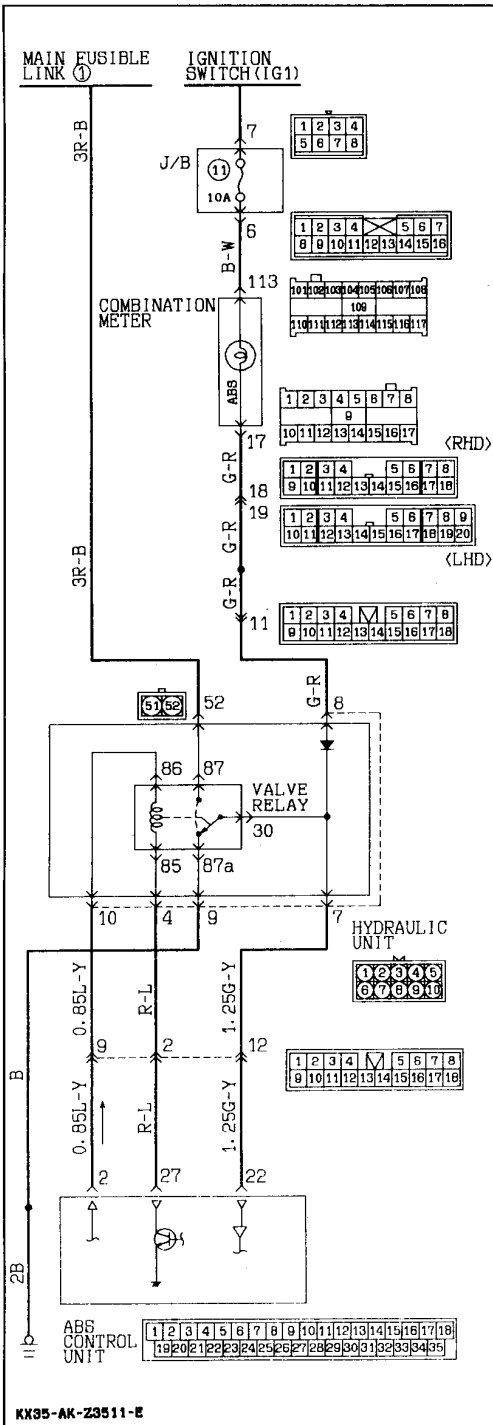
35-26 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <2WD>

E-5 When diagnosis code "51 VALVE RELAY" is displayed

[Comment]

When the ignition switch is turned ON, the ABS ECU switches the valve relay OFF and ON for an initial check, compares the voltage of the signal to the valve relay and valve power monitor line voltage to check whether the valve relay operation

is normal. In addition, normally it monitors whether or not there is power in the valve power monitor line since the valve relay is normally ON. Then, if the supply of power to the valve power monitor line is interrupted, this trouble code will be output.



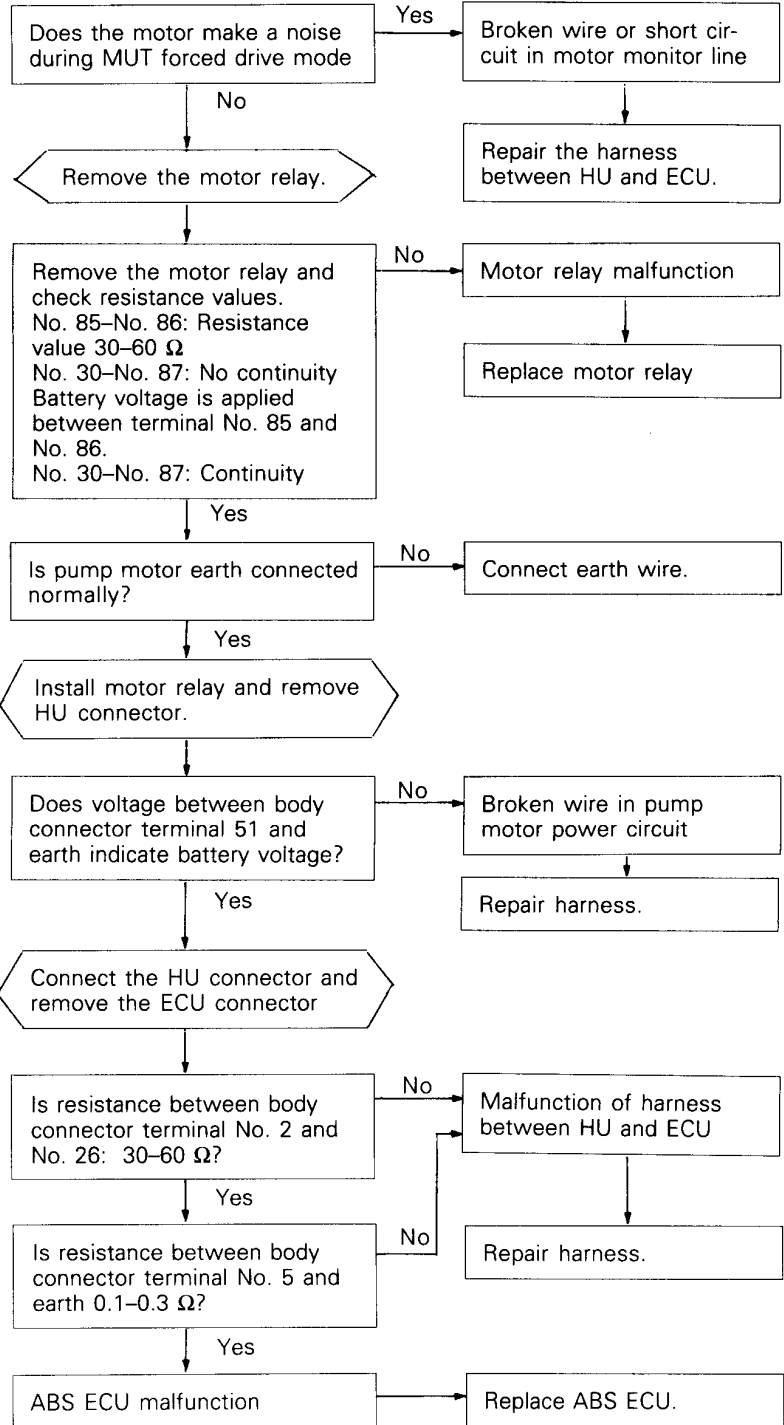
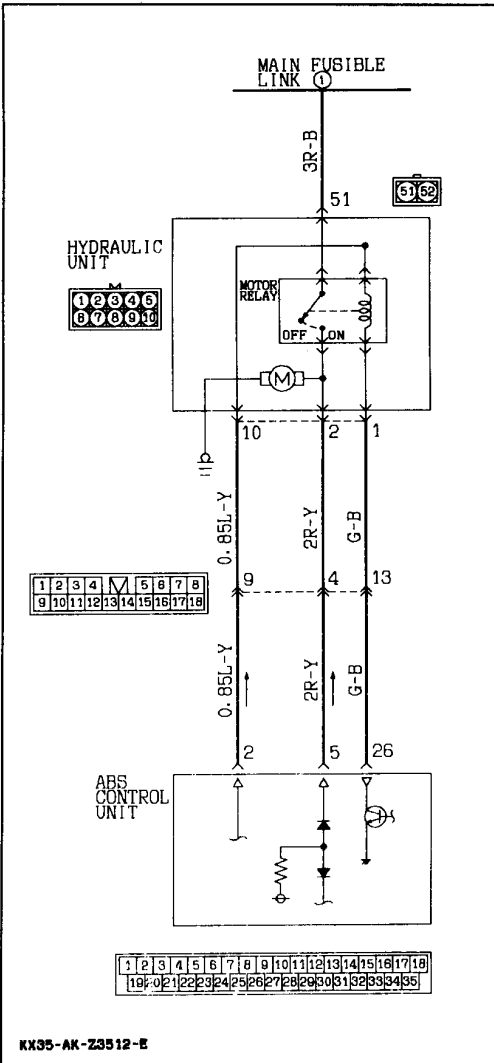
E-6 When diagnosis code "52 MOTOR RELAY" is displayed

[Comment]

The ABS-ECU outputs this malfunction code when the motor relay and motor are as follows.

- When the motor relay is ON and no signal is input to the motor monitor line. (When motor does not operate, etc.)

- When the motor relay is OFF and signals enter the motor monitor line for a period of 5 sec. or more. (When motor operates continuously, etc.)
- When motor does not operate.



ANTI-LOCK BRAKE SYSTEM TROUBLESHOOTING <4WD>

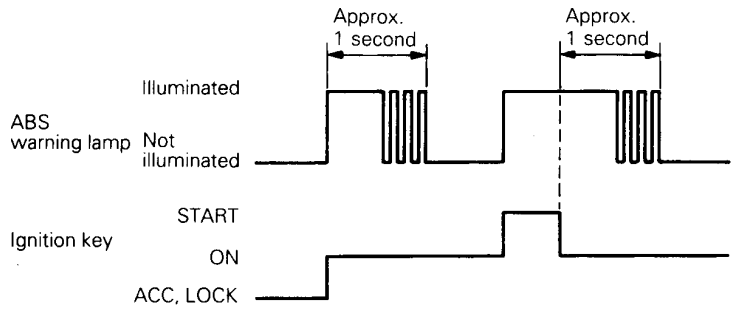
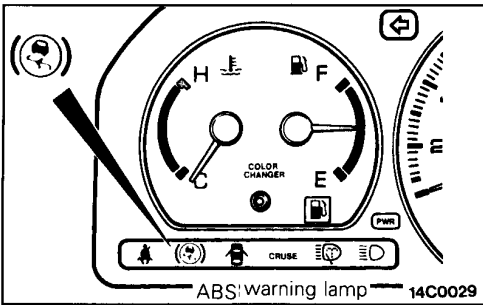
Check the trouble symptoms by the following procedure, and inspect according to the instructions.

Before the engine starts, does the ABS warning lamp illuminate?

(1) With the ignition key in the "ON" position, the ABS warning lamp flashes 4 times during a 1 second period (during this time, the valve relay self-check is carried out) and then the lamp switches off.

(2) With the ignition key in the "START" position, power to the ABS-ECU is cut, and because the valve relay turns OFF, the ABS warning lamp remains illuminated.

(3) When the ignition key is turned from the "START" position back to the "ON" position, the ABS warning lamp flashes 4 times (during this time, the valve relay self-check is carried out) and then the lamp stays switched off.



14A0594

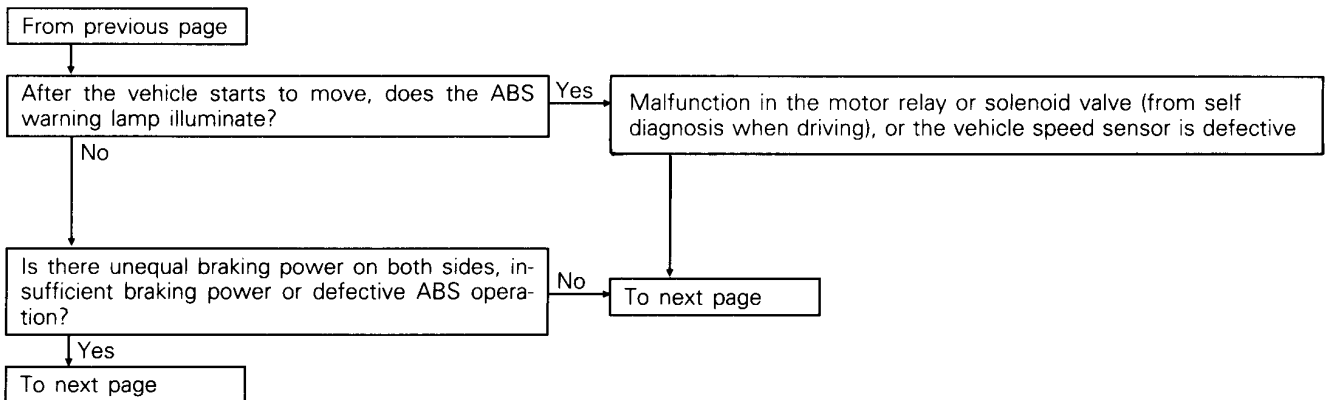
Yes → To next page

No ↓

No.	Trouble symptom	Main cause	Remedy
1	The ABS warning lamp does not illuminate at all. ABS warning lamp: Illuminated (Not illuminated) Ignition key: START, ON, ACC, LOCK	<ul style="list-style-type: none"> • ABS warning lamp bulb failure. • Broken wire in the ABS warning lamp power circuit (including blown fuse). 	Inspect according to Flow Chart A (Refer to P.35-33).
2	When the ignition key is turned to "ON", the ABS warning lamp remains illuminated. ABS warning lamp: Illuminated (Not illuminated) Ignition key: START, ON, ACC, LOCK	<ul style="list-style-type: none"> • Fail safe function is operated by the ABS-ECU self-diagnosis. • Short in the ABS-ECU warning lamp drive circuit • ABS-ECU is defective 	Inspect according to Flow Chart B (Refer to P.35-36).

SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD> 35-29

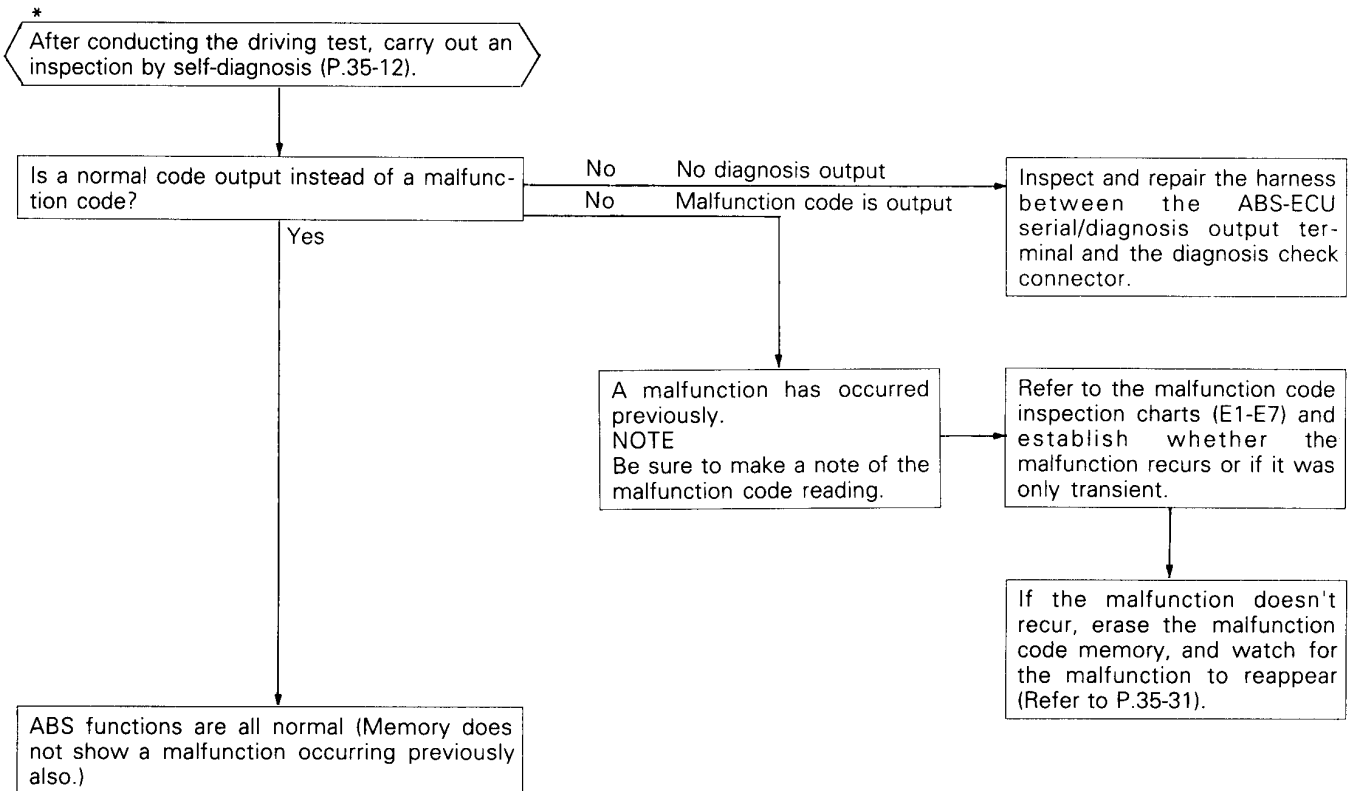
No.	Trouble symptom	Main cause	Remedy
3	<p>When the ignition key is turned to "START", the ABS warning lamp does not illuminate.</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>ABS warning lamp</p> <p style="margin-left: 20px;">Illuminated</p> <p style="margin-left: 20px;">Not illuminated</p> </div> </div> <p style="text-align: center; margin-top: 10px;">START</p> <p>Ignition key ON</p> <p style="margin-left: 20px;">ACC, LOCK</p> <p style="text-align: right; font-size: small;">14A0595</p>	<ul style="list-style-type: none"> Valve relay is defective Broken harness wire between the ABS warning lamp and the hydraulic unit Broken harness wire between the hydraulic unit and the earth 	<p>Inspect according to Flow Chart C (Refer to P.35-38).</p>
4	<p>After the ignition key is turned to "ON", the ABS warning lamp blinks once, and when turned to "START", it illuminates. When returned to "ON", the lamp flashes once, and then switches off. (The blinking when the key is turned to "ON" occurs simultaneously with the operation noise from the valve relay)</p> <div style="display: flex; align-items: center;"> <div style="margin-right: 10px;"> <p>ABS warning lamp</p> <p style="margin-left: 20px;">Illuminated</p> <p style="margin-left: 20px;">Not illuminated</p> </div> </div> <p style="text-align: center; margin-top: 10px;">START</p> <p>Ignition key ON</p> <p style="margin-left: 20px;">ACC, LOCK</p> <p style="text-align: right; font-size: small;">14A0593</p>	<ul style="list-style-type: none"> Broken harness wire in the ABS-ECU warning lamp drive circuit ABS-ECU is defective 	<p>Inspect according to Flow Chart D (Refer to P.35-39).</p>



35-30 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>

From previous page

Trouble symptom	Main cause	Remedy
Unequal braking power Insufficient braking power	<ul style="list-style-type: none"> Blocked pressure circuit inside the hydraulic unit. Mechanical lock in the hydraulic unit solenoid valve. 	Follow the hydraulic unit operation inspection (refer to P.35-63) and replace the hydraulic unit if necessary. If the hydraulic unit is normal, inspect the components of the normal brake.
Decline in ABS function	<ul style="list-style-type: none"> Blocked pressure circuit inside the hydraulic unit. Operation of the hydraulic unit solenoid valve is defective. 	
ABS operates even when not carrying out sudden braking (ABS operating vibration starts to be felt).	<ul style="list-style-type: none"> Insufficient wheel speed sensor output voltage (sensor is defective, excessive clearance between the sensor and rotor, or rotor is chipped). ABS-ECU is defective 	Inspect the wheel speed sensor (refer to P.35-60), and replace the sensor or adjust the sensor clearance if necessary. If the problem occurs frequently even though the sensor is normal, then replace the ABS-ECU.



NOTE

* Drive for 30 seconds or more at vehicles speeds exceeding 30 km/h (19 mph).

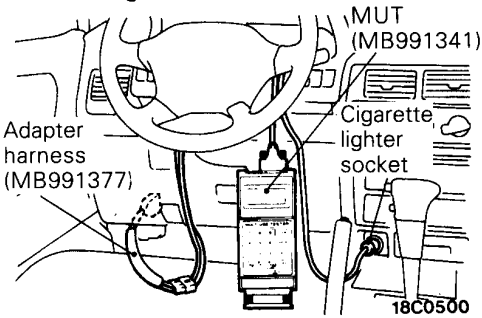
Connector terminal No. layout for troubleshooting

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	27	28	29	30	31	32	33	34	35	

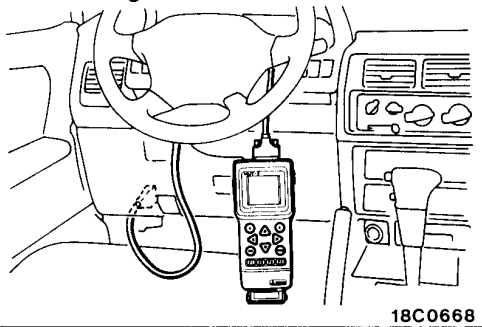
Terminal No. layout shown on the special tool connector

18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	

When using the MUT



When using the MUT-II



ABS-4WD

Caution

1. When carrying out inspection of the ABS-ECU terminal voltage and resistance, the special tool (MB991356) should be used.
2. Because the ABS-ECU connector terminal No. layout for troubleshooting is different from the terminal No. layout shown on the special tool connector, when using the special tool for inspecting, take the readings from the special tool terminal Nos.

Example

ABS-ECU connector terminal No. for troubleshooting	Terminal No. shown on the special tool connector
18	1

CHECK USING SELF DIAGNOSIS FUNCTION

WHEN USING THE MULTI-USE TESTER (MUT) <Up to 1993 models> OR THE MUT-II <All models>

- (1) With the ignition switch OFF, connect the MUT or MUT-II through the adapter harness (MB991377) <Up to 1993 models> or the adapter harness included in the MUT-II sub assembly <All models>, turn the ignition ON and select the ABS system. (The ABS warning lamp lights up, it goes into the MUT or MUT-II mode. **In the MUT or MUT-II mode, ABS does not function.**)
If it does not go into the MUT or MUT-II mode, check the ECU power circuit and the harness between the ECU and diagnosis check terminals.
- (2) Read the diagnosis output codes from the ECU memory.
- (3) Clear the diagnosis codes once from memory. (Refer to P.35-32.)
If the memory cannot be cleared, the ECU is currently detecting the trouble and the ABS ECU is in fail safe. If it can be cleared, the trouble is either temporary or appears only when driving.
- (4) When the trouble codes cannot be cleared, or when the ABS ECU goes into fail safe during another test drive and trouble codes are output, check according to trouble code check charts (E-1–E-7).

35-32 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>

DIAGNOSIS CODE CHART

Diagnosis code no.	Check chart name or remedy	Reference page	Diagnosis code no.	Check chart name or remedy	Reference page
11	E-1	P.35-40	41	E-5	P.35-45
12			42		
13			43		
14			51		
15	E-2	P.35-40	52	E-7	P.35-47
21	E-3	P.35-43	55	ECU replacement	-
22	E-4	P.35-44			

METHOD OF ERASING THE DIAGNOSIS CODE MEMORY

MEMORY

Refer to P.35-13.

ACTUATOR TEST FUNCTION

The actuator can be force-driven using the MUT or MUT-II, enabling easy operation checking to be performed.

NOTE

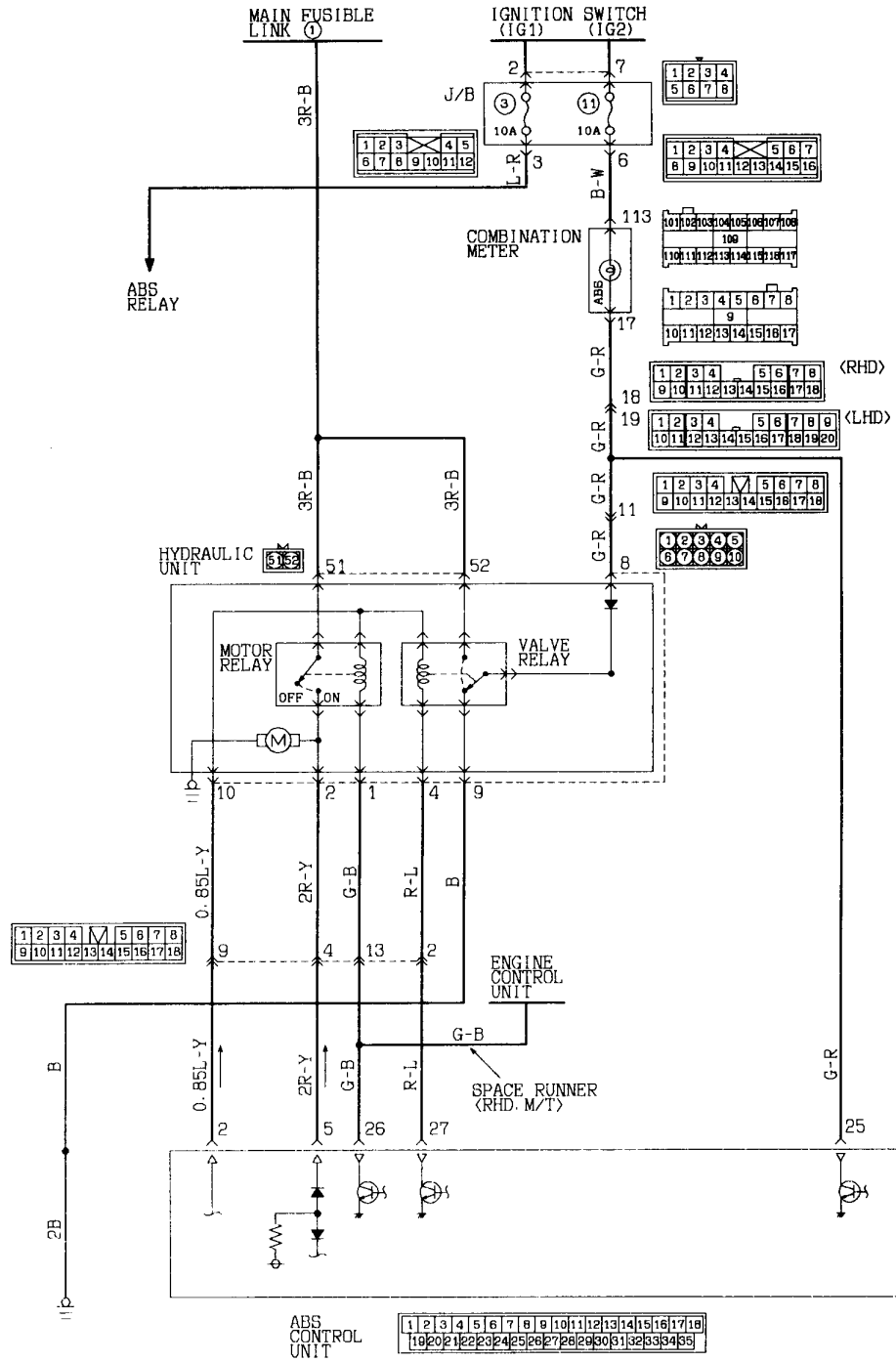
1. When the ECU is cancelling the function, actuator testing cannot be carried out.
2. Actuator testing is only possible when the vehicle is stationary. When force-driving the actuator, if the vehicle speed reaches 10 km/h (6 mph), forced-driving is cancelled.
3. The item Nos. in the table below indicate the numbers input to the MUT or MUT-II when actuator test execution is displayed.

Item No.	MUT or MUT-II display	Drive solenoid valve and motor	Drive pattern
01	FR valve automatic	Solenoid valve and pump motor for each HU corresponding channel. <Automatic pattern>	
02	FL valve automatic		
04	FR valve manual	Solenoid valve and pump motor for each HU corresponding channel. <Manual pattern>	
05	FL valve manual		

A ABS warning lamp does not illuminate at all

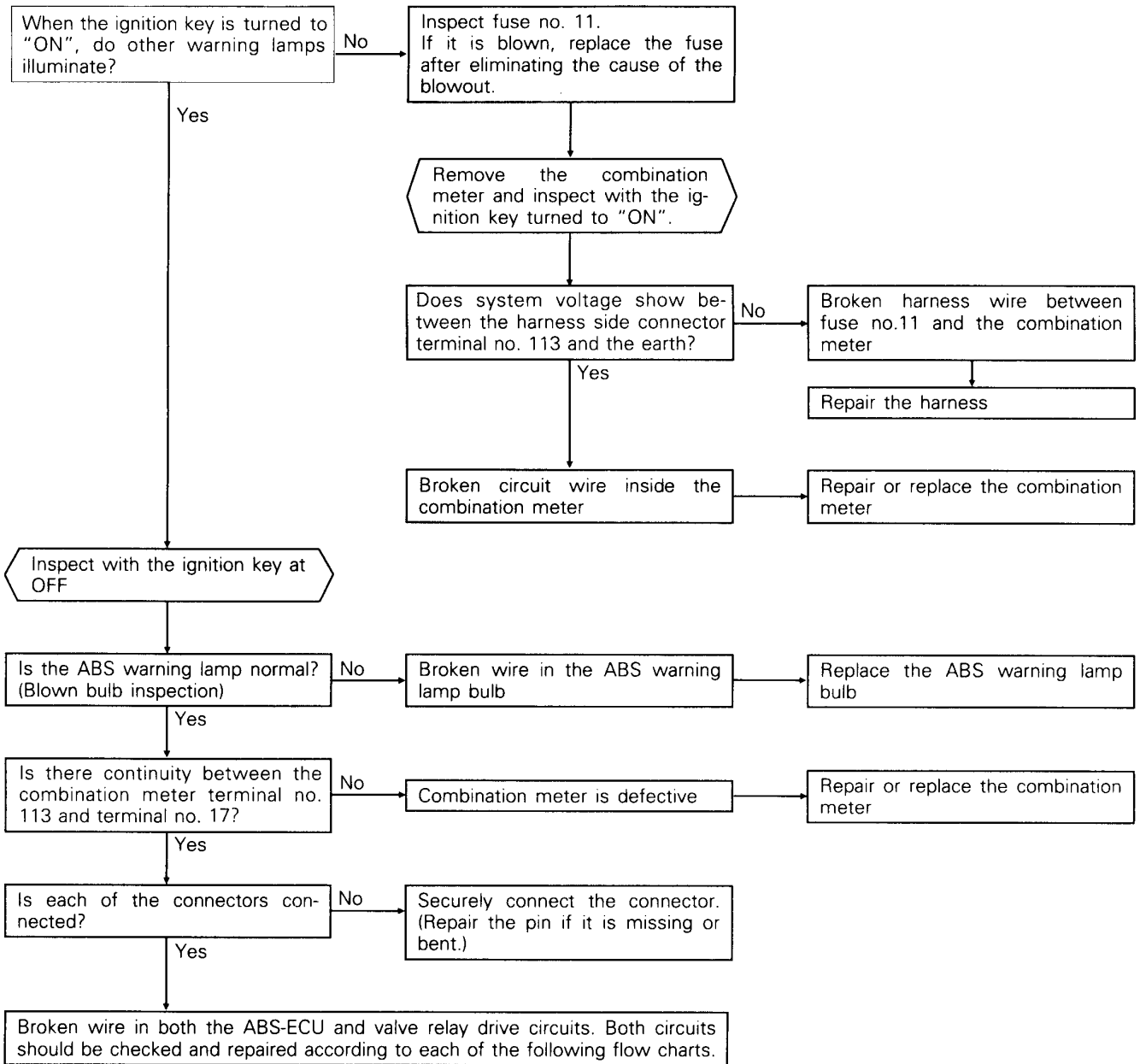
[Comment] When the lamp does not illuminate at all, there is a strong possibility that there is a malfunction of the ABS warning lamp or the power supply.

[Hint] If other warning lamps also do not illuminate, it is probably a blown fuse.

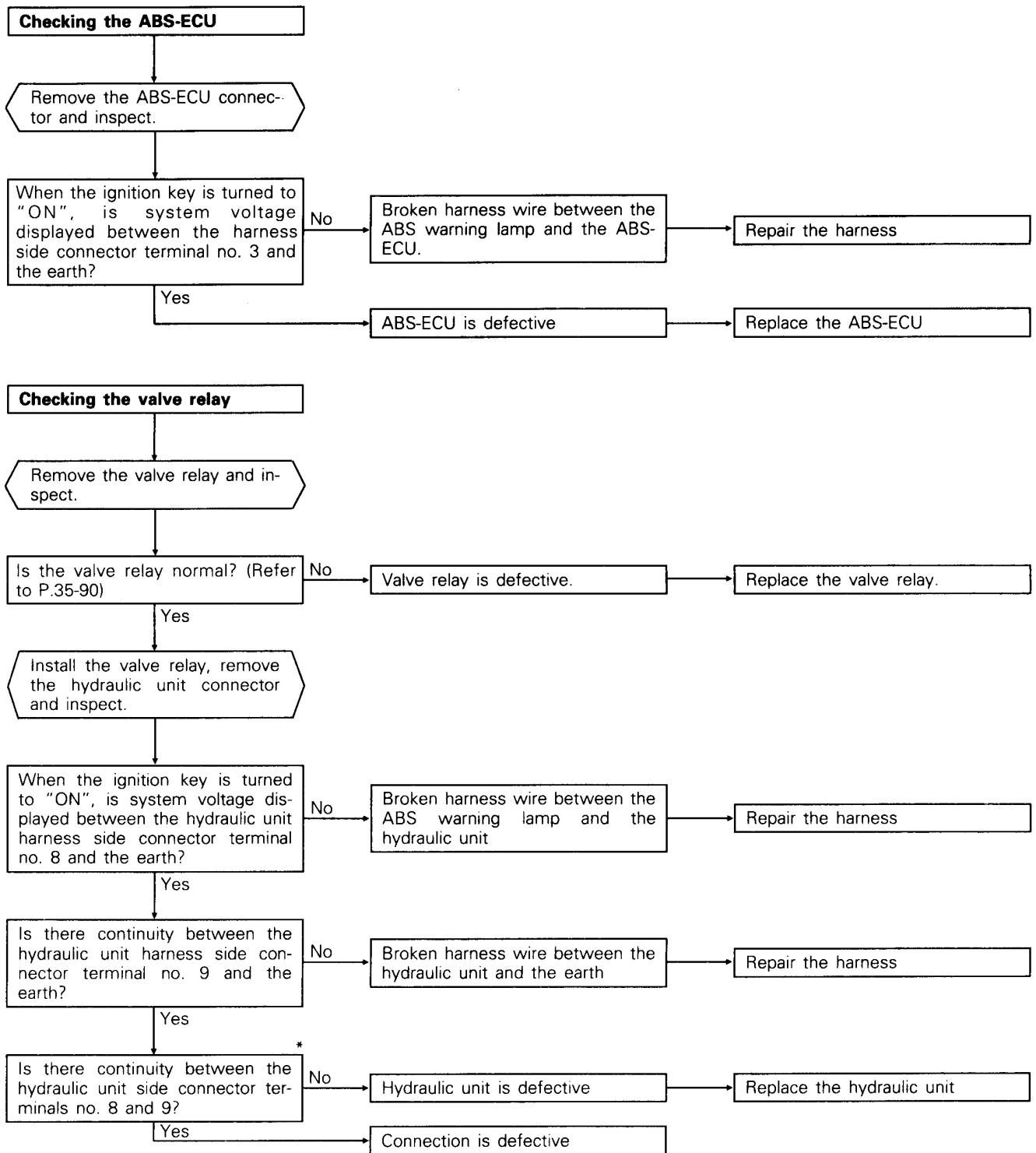


KX95-AR-Z3501-B

35-34 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>



SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD> 35-35



NOTE

For inspection sections marked by *, pay attention to the polarity of the diodes. (Refer to the circuit diagram on P.35-33.)

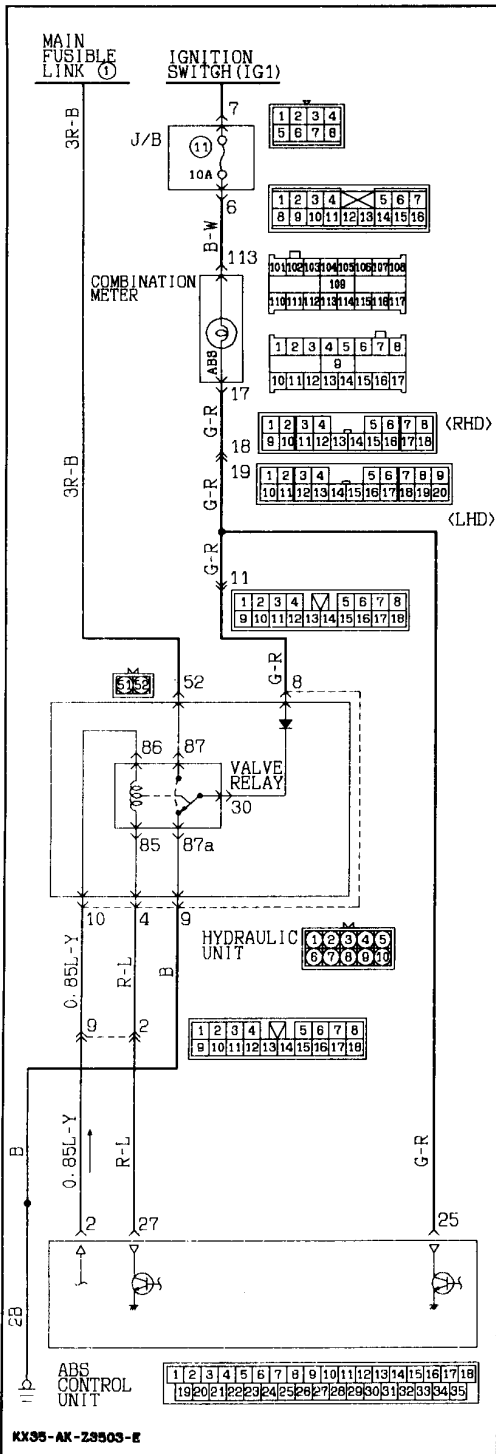
B When the ignition switch is turned to "ON", the ABS warning lamp remains illuminated

[Comment] This symptom occurs when the ABS-ECU is not functioning due to a broken wire, etc., in the ABS-ECU power circuit, when the fail-safe function is operating to isolate the system, or when there is a short in the warning lamp drive circuit.

(Hint) Check the diagnosis output, and if there is no output voltage, or the multi-use tester and the ABS-ECU cannot communicate, then there is a high possibility that power is not being supplied to the ABS-ECU.

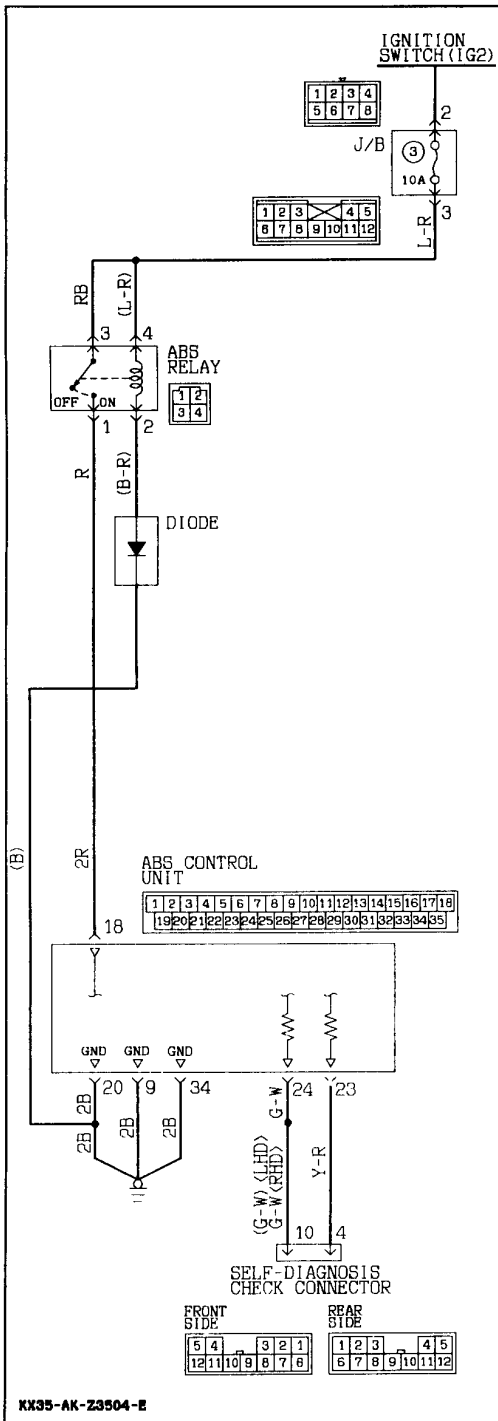
Caution

- If no malfunction code is output, there is a high possibility that the fail-safe function is operating. In this case, to check if there is a current problem, the memory should be temporarily erased, and a test run should be carried out.



```

    graph TD
        Q1[Is there a diagnosis output?  
(Can the multi-use tester communicate?)] -- No --> A1[To next page]
        Q1 -- Yes --> Q2[Is the diagnosis output showing  
a normal code?]
        Q2 -- No --> A2[Inspect according to the malfunction  
code inspection chart. (Refer to P.35-31.)]
        Q2 -- Yes --> Q3[Does the ABS warning lamp remain  
illuminated even when the ABS-ECU  
connector is removed?]
        Q3 -- No --> A3[Short in the transistor inside  
the ABS-ECU]
        A3 --> A4[Replace the ABS-ECU]
        Q3 -- Yes --> Q4[Does the ABS warning lamp remain  
illuminated even when the hydraulic  
unit connector is removed?]
        Q4 -- No --> A5[Short in the harness in the  
hydraulic unit, or short in the  
valve relay connection]
        A5 --> A6[Replace the hydraulic unit or  
replace the valve relay]
        Q4 -- Yes --> A7[Short in the harness between  
the ABS warning lamp and the  
hydraulic unit or the ABS-ECU]
        A7 --> A8[Repair the harness or replace  
the combination meter]
    
```

From previous page

Is fuse no. 3 normal?

No → Replace the fuse after eliminating the cause of the blowout.

Yes → Does the power relay operate normally? (Refer to P.35-64)

No → Power relay is defective → Replace the power relay

Yes → Disconnect the ABS-ECU connector, and inspect the harness side connector.

When the ignition key is turned to "ON", does system voltage show between the harness side connector terminal no. 18 and the earth?

No → Broken harness wire between the power relay and the ABS-ECU. → Repair the harness

Yes → Is there continuity between each of the harness side connector terminal nos. 9, 20 and 34 and the earth?

No → Broken wire in the ABS-ECU earth line → Repair the harness

Yes → Is there continuity between the harness-side connector terminal no. 23 and 24 and the diagnosis check connector terminals no. 4 and 10?

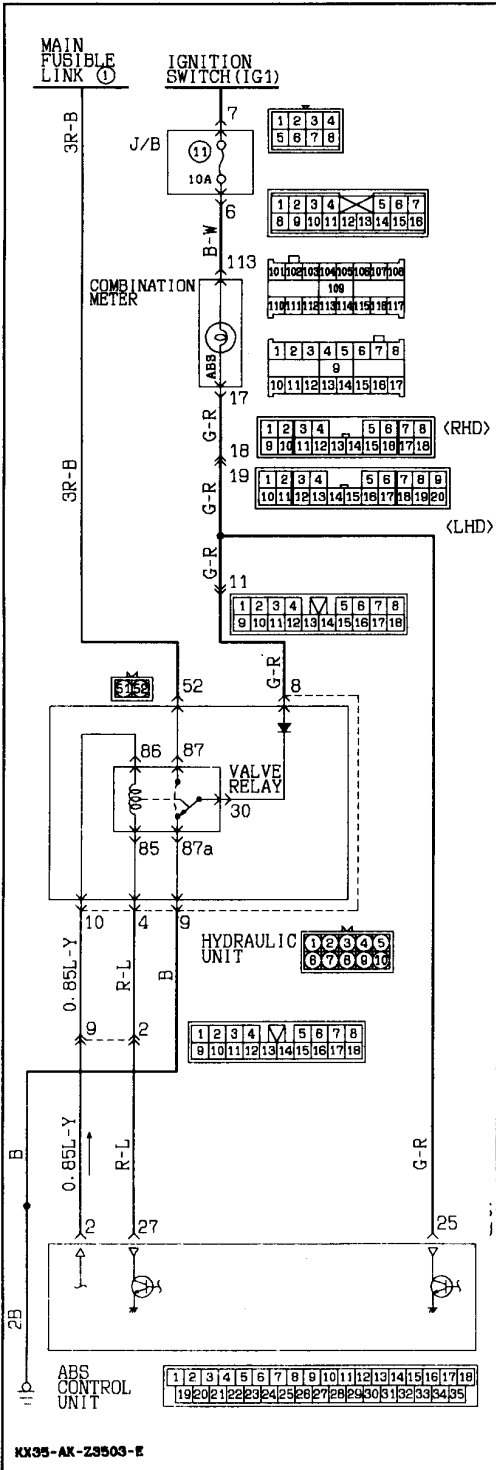
No → Broken harness wire between the diagnosis check connector and the ABS-ECU. → Repair the harness

Yes → ABS-ECU is defective → Replace the ABS-ECU

C When ignition key is turned to "START", ABS warning lamp switches off

[Comment] The ABS-ECU uses the power to the IG2 which is cut when the ignition switch is turned to "START". The ABS warning lamp uses IG1 power which is not cut even when the ignition switch is turned to "START". Accordingly, because the power to the

ABS-ECU is stopped in "START" position, the valve relay turns OFF. At this time, if the warning lamp does not illuminate, the cause is a problem in the lamp illumination circuit in the valve relay.



```

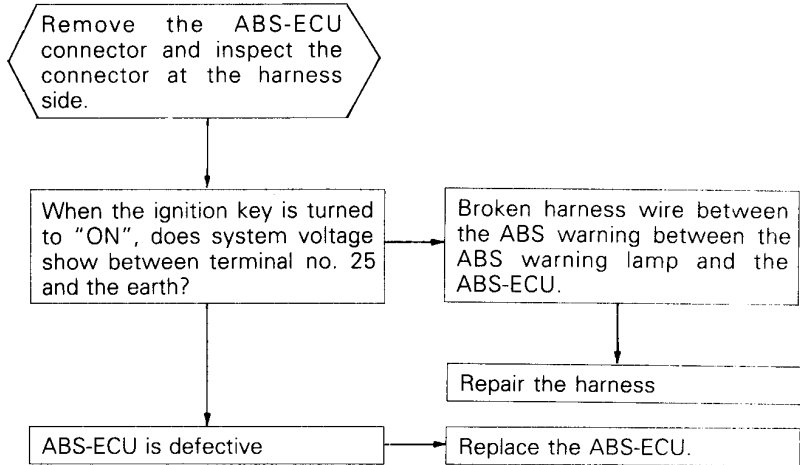
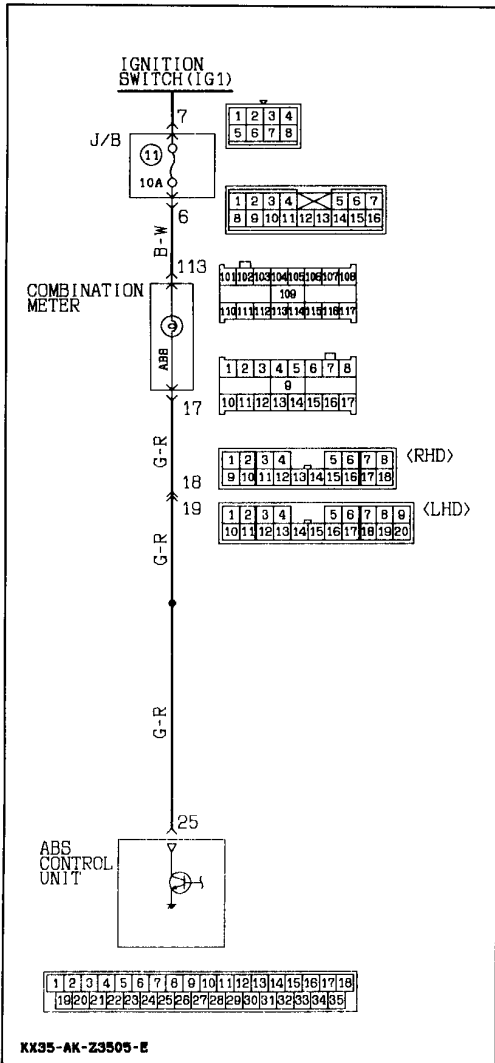
    graph TD
      Start([Remove the hydraulic unit connector and inspect.]) --> Q1{When the ignition key is turned to "ON", does system voltage show between the harness side connector terminal no. 8 and the earth?}
      Q1 -- No --> A1[Broken harness wire between the hydraulic unit and the ABS warning lamp]
      Q1 -- Yes --> Q2{Is there continuity between the harness side connector terminal no. 9 and the earth?}
      Q2 -- No --> A2[Broken wire between the hydraulic unit and the earth]
      Q2 -- Yes --> Q3{When the valve relay is removed, is there continuity between terminal no. 87a and terminal no. 30?}
      Q3 -- No --> A3[Valve relay is defective]
      Q3 -- Yes --> A4[Hydraulic unit harness is defective]
      A4 --> A5[Replace the harness]
      A3 --> A6[Replace the valve relay]
  
```

D The ABS warning lamp flashes once 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.

[Comment]

When power flows, the ABS ECU turns on the warning lamp for approximately 1 second while it performs a valve relay test. If there is a break in

the harness between the ECU and the warning lamp the lamp illuminates only when the valve relay is off in the valve relay test, etc.



35-40 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>

E-1	When the following diagnosis codes are displayed "11 FL SNSR. OPEN" "12 FR SNSR. OPEN" "13 RL SNSR. OPEN" "14 RR SNSR. OPEN"
------------	---

[Comment]

The ABS ECU detects breaks in the wheel speed sensor wire. This trouble code is output if the wheel speed sensor signal is not input (or short circuited) or if its output is low when starting to drive or while driving.

[Hint]

In addition to a broken wire/short circuit in the wheel speed sensor, also check whether the sensor gap is too large, sensor harness wire is broken, or sensor harness and body connector are not properly connected.

E-2	When diagnosis code "15 VEH. SPD. SNSR." is displayed
------------	--

[Comment]

This trouble code is output when there is an abnormality (other than broken wire or short circuit) in any of the wheel speed sensor output signals while driving.

[Hint]

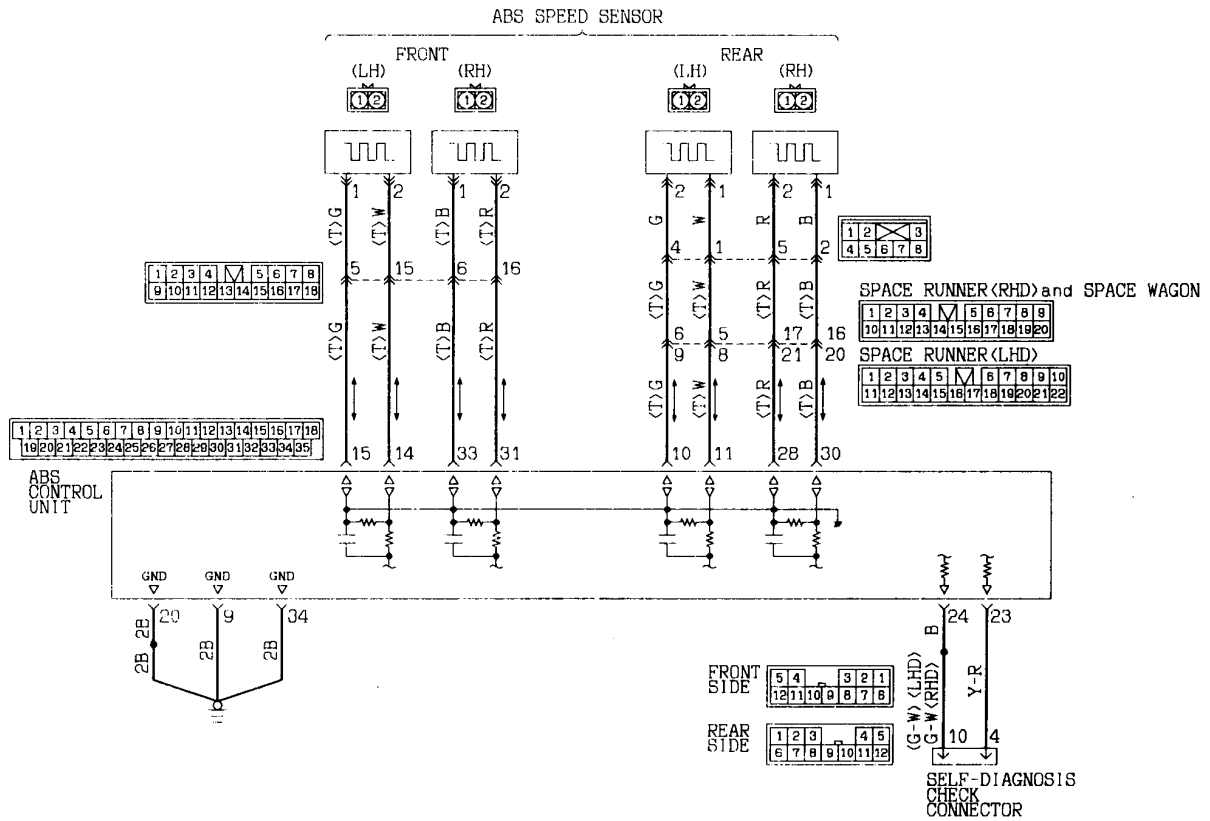
The following can be considered as the cause of the wheel speed sensor output abnormality.

- Distortion of rotor, teeth missing
- Low frequency noise interference when sensor harness wire is broken
- Noise interference in sensor signal
- Sensor output signal is below the standard value or amplitude modulation is over the standard value. Using an oscilloscope to measure the wave shape of the wheel speed sensor output signal is very effective.
- Broken sensor harness

- Poor connection of connector

NOTE

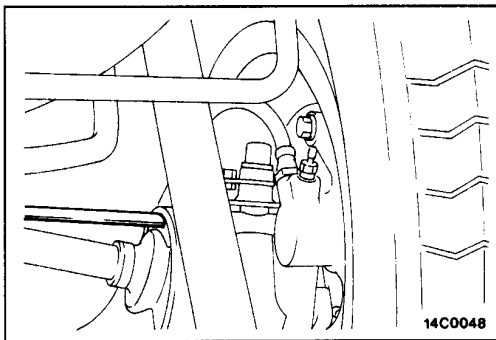
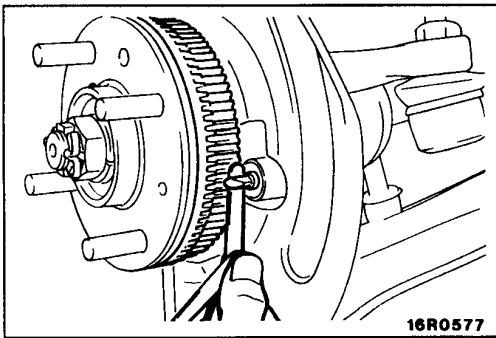
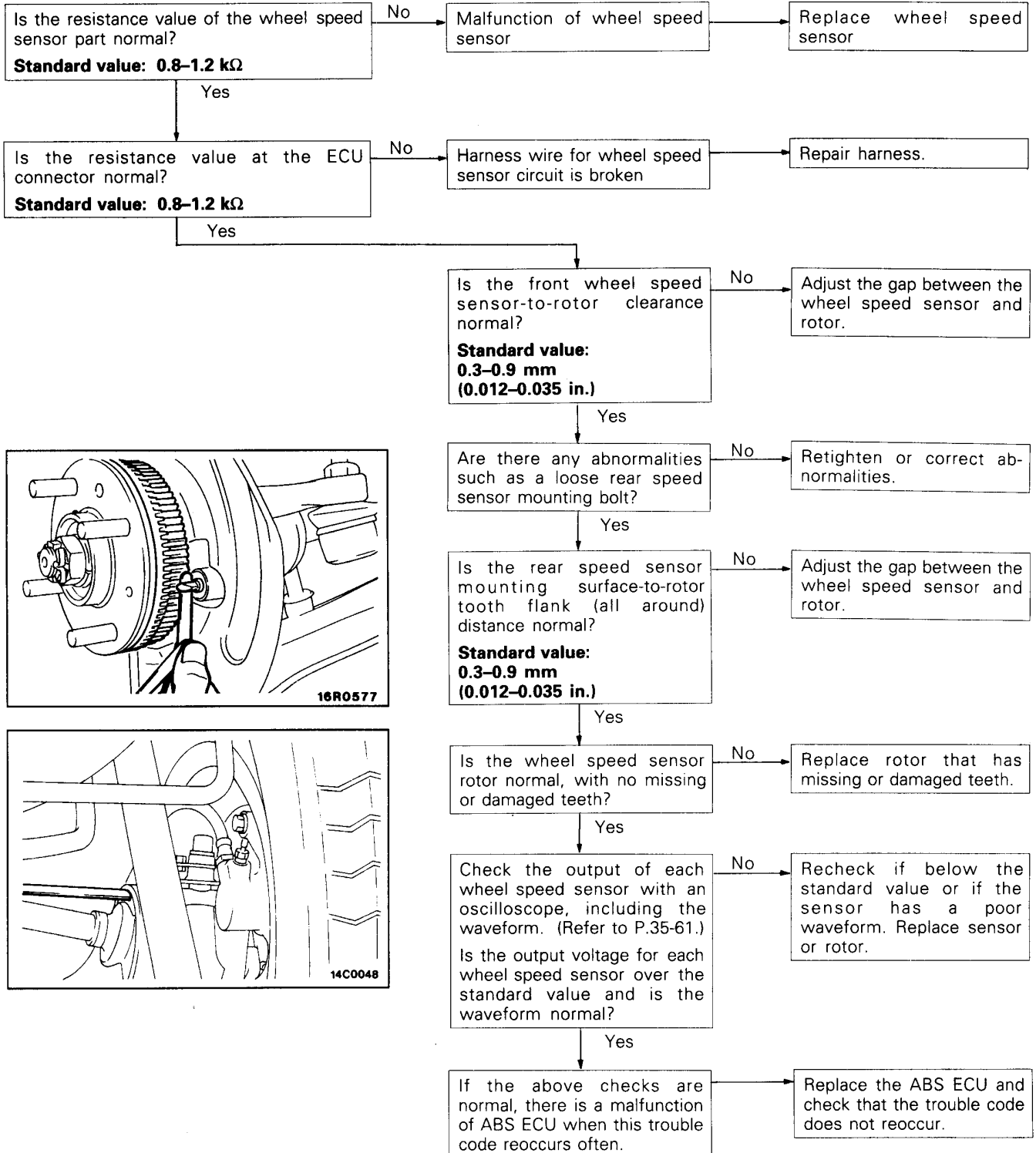
- (1) If contact is poor, check the sensor cable by bending and lightly stretching it.
- (2) Except for the case where a fault condition exists in the system, but the inspection results are normal, if an abnormality cannot be found in the sensor circuit displayed as abnormal, erase the diagnosis code and turn the ignition switch to OFF once, and then test-drive again. If the same trouble code is output, replace the ABS ECU. If the trouble does not occur anymore, the problem is likely to be with the ABS ECU.
(If the trouble is in the speed sensor circuit, but is difficult to recreate, it will recur even after the ABS ECU has been replaced.)



35-42 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>

Check flow connected with wheel speed sensor

NOTE
Check speed sensor harness and connector connection and then observe with oscilloscope. (Refer to P.35-61.)



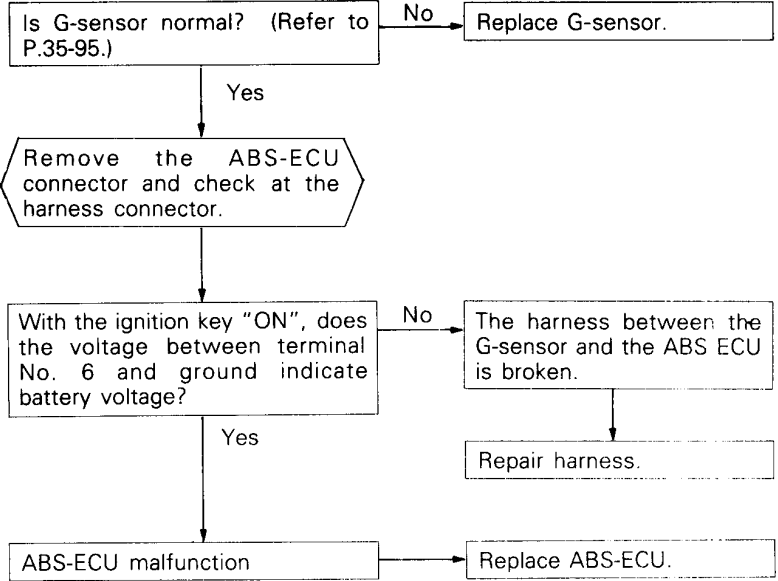
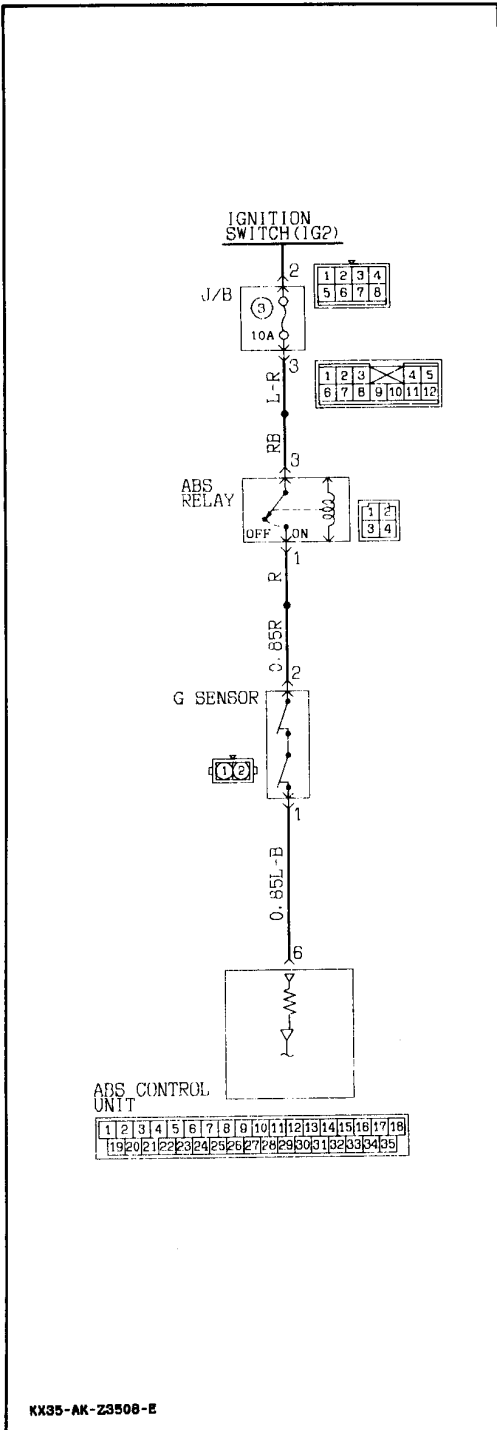
E-3 When diagnosis code "21 G SNSR" is displayed

[Comment]
The ABS-ECU outputs this trouble code in the following cases.

- G-sensor OFF trouble (It is judged that the G-sensor continues to be OFF for more than

approximately 13 seconds except when the vehicle is stopped or when there is stop lamp switch input.)

- When there is a broken wire or short circuit in the harness for the G-sensor system.



KX35-AK-Z3508-E

35-44 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>

E-4 When diagnosis code "22 STOP LAMP SW" is displayed

[Comment]

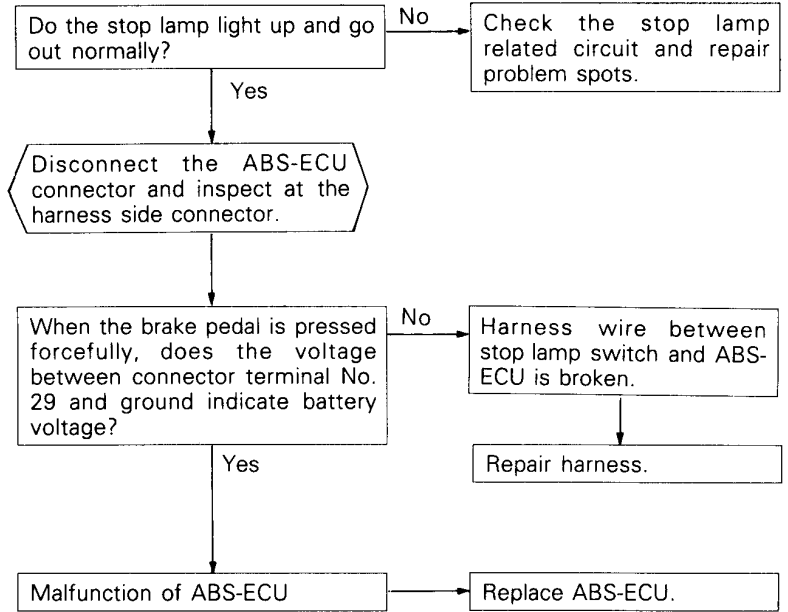
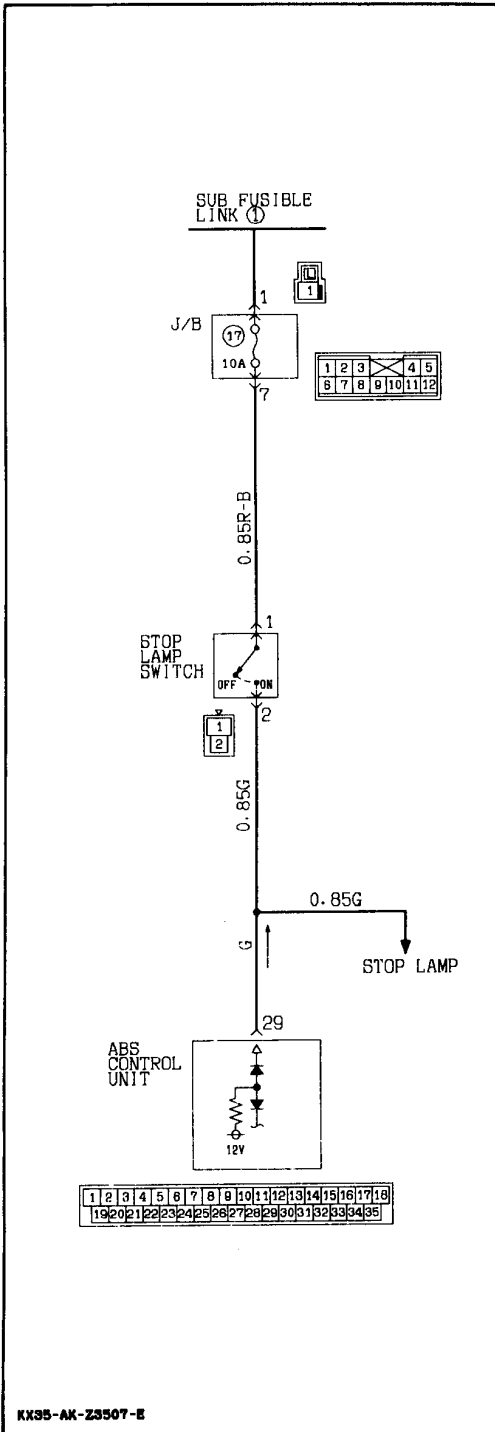
The ABS-ECU outputs this trouble code in the following cases.

- Stop light switch remains on for more than 15 minutes while the ABS is not functioning.

- The harness wire for the stop lamp switch may be open.

[Hint]

If the stop lamp operates normal, the harness for the stop lamp switch input circuit is broken or there is a malfunction in the ABS-ECU.



KX35-AK-Z3507-E

E-5 When diagnosis codes "41 FL SOL. VALVE", "42 FR SOL. VALVE" or "43 VALVE DRIFT" are displayed.

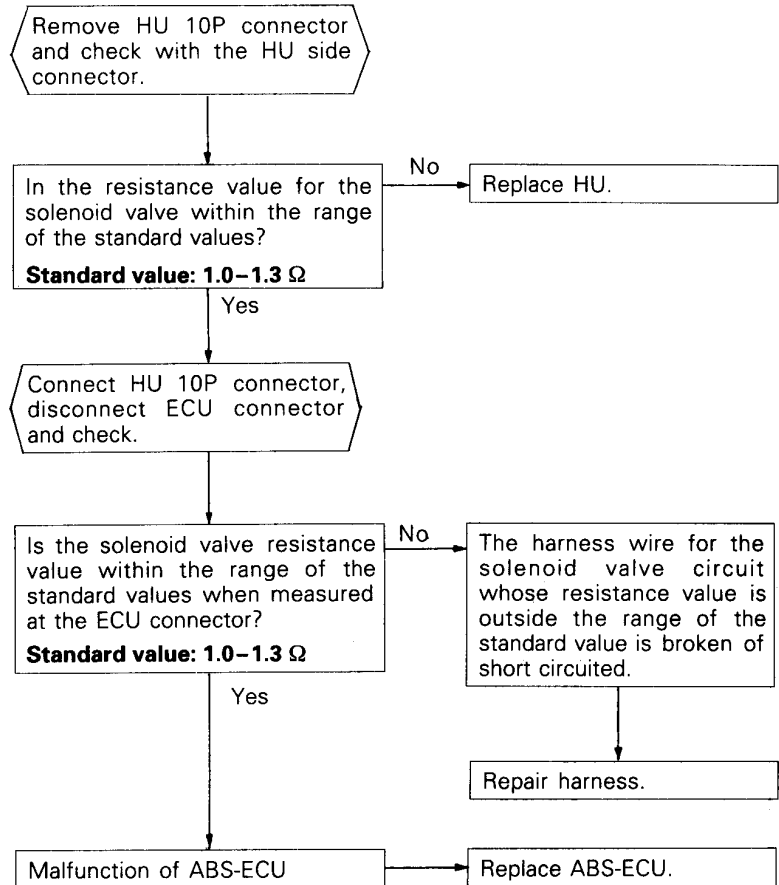
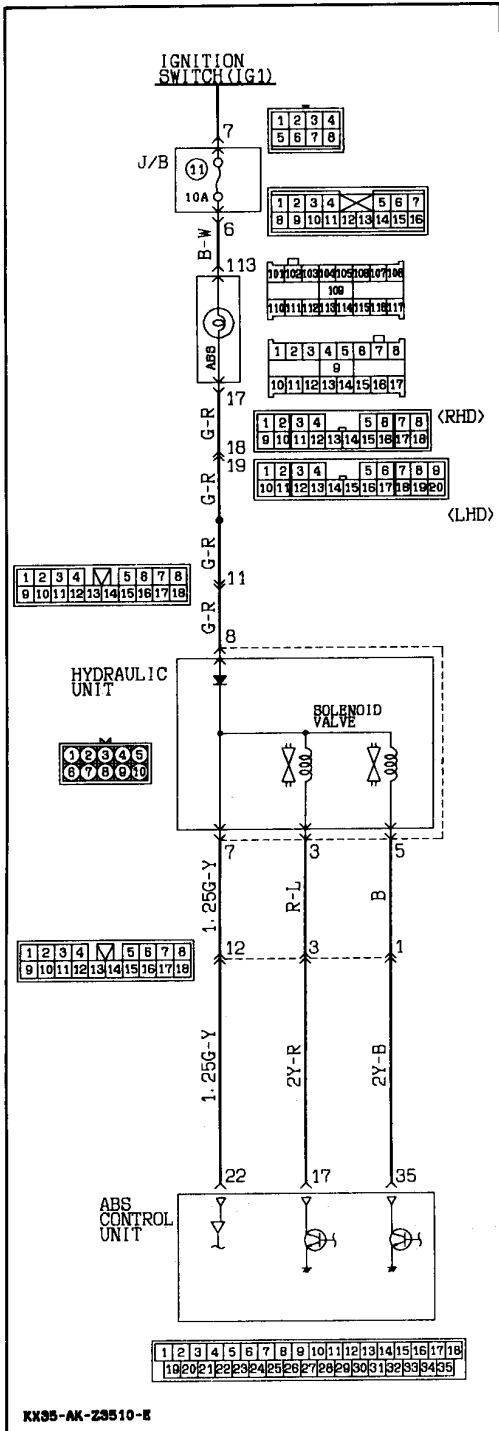
[Comment]

The ABS-ECU normally monitors the solenoid valve drive circuit.

If no current flows in the solenoid even if the ECU turns the solenoid ON or if it continues to flow even when turned OFF, the ECU determines the solenoid coil wire is broken/short-circuited or the

harness is broken/short-circuited, and then these trouble codes are output.

ABS-ECU controls the solenoid valve current and if the current value of the solenoid valves differs from each other in the same mode, solenoid valve drift error is produced and the ABS-ECU goes into the failsafe mode.

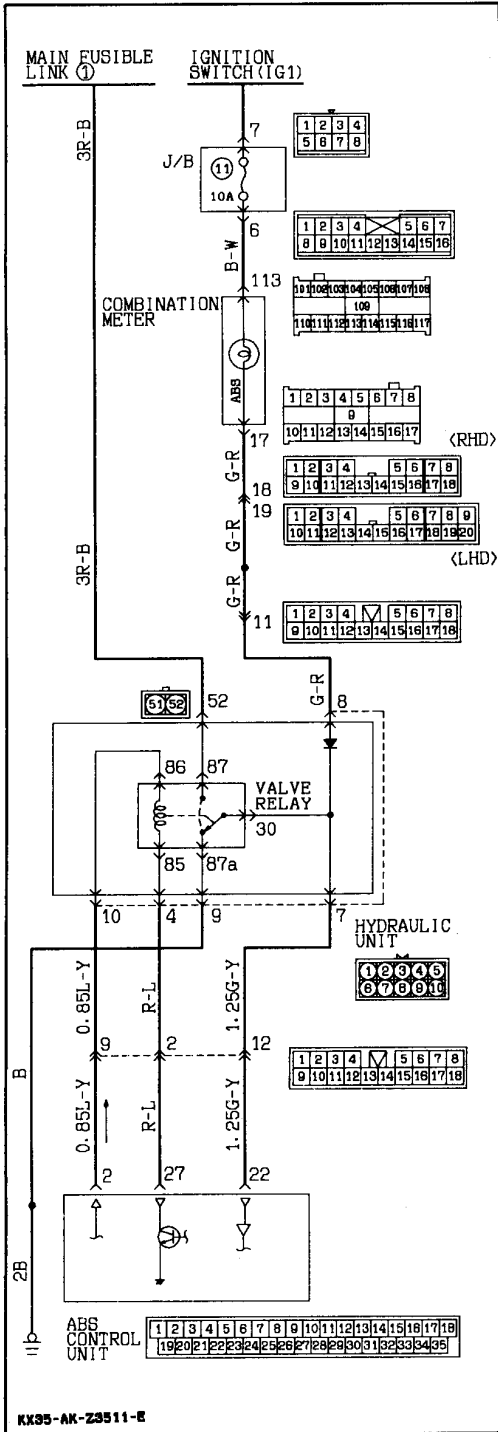


35-46 SERVICE BRAKES – Anti-lock Brake System Troubleshooting <4WD>

E-6 When diagnosis code "51 VALVE RELAY" is displayed

[Comment]
When the ignition switch is turned ON, the ABS-ECU switches the valve relay OFF and ON for an initial check, compares the voltage of the signal to the valve relay and valve power monitor line voltage to check whether the valve relay operation

is normal. In addition, normally it monitors whether or not there is power in the valve power monitor line since the valve relay is normally ON. If the supply of power to the valve power monitor line is interrupted, this trouble code will be output.



```

    graph TD
      Start([Remove and check the valve relay.]) --> Q1{When the valve relay is checked, are the following conditions found?  
No. 85-No. 86:  
Resistance value 60-120 Ω  
No. 30-No. 87a: Continuity  
No. 30-No. 87: No continuity  
When battery voltage is applied between terminals No. 86 and No. 85.  
No. 30-No. 87: Continuity  
No. 30-No. 87a: No continuity}
      Q1 -- No --> R1[Valve relay malfunction]
      R1 --> A1[Replace valve relay.]
      Q1 -- Yes --> P1[/Install the valve relay and remove the HU connector./]
      P1 --> Q2{With the ignition key "ON", does the voltage between the connector terminal No. 52 and ground indicate battery voltage?}
      Q2 -- No --> R2[HU power harness wire is broken.]
      R2 --> A2[Repair harness.]
      Q2 -- Yes --> P2[/Connect the HU harness and remove the ECU connector./]
      P2 --> Q3{Does resistance between body connector terminal No. 2 and terminal No. 27 indicate 60-120 Ω}
      Q3 -- No --> R3[Malfunction of harness between HU and ECU]
      R3 --> A3[Repair harness.]
      Q3 -- Yes --> Q4{With the ignition key "ON", does the voltage between the connector terminal No. 22 and ground indicate battery voltage?}
      Q4 -- No --> R4[Malfunction of harness between HU and ABS ECU]
      R4 --> A4[Repair harness.]
      Q4 -- Yes --> R5[ABS-ECU malfunction]
      R5 --> A5[Replace ABS-ECU.]
  
```

E-7 When diagnosis code "52 MOTOR RELAY" is displayed

[Comment]

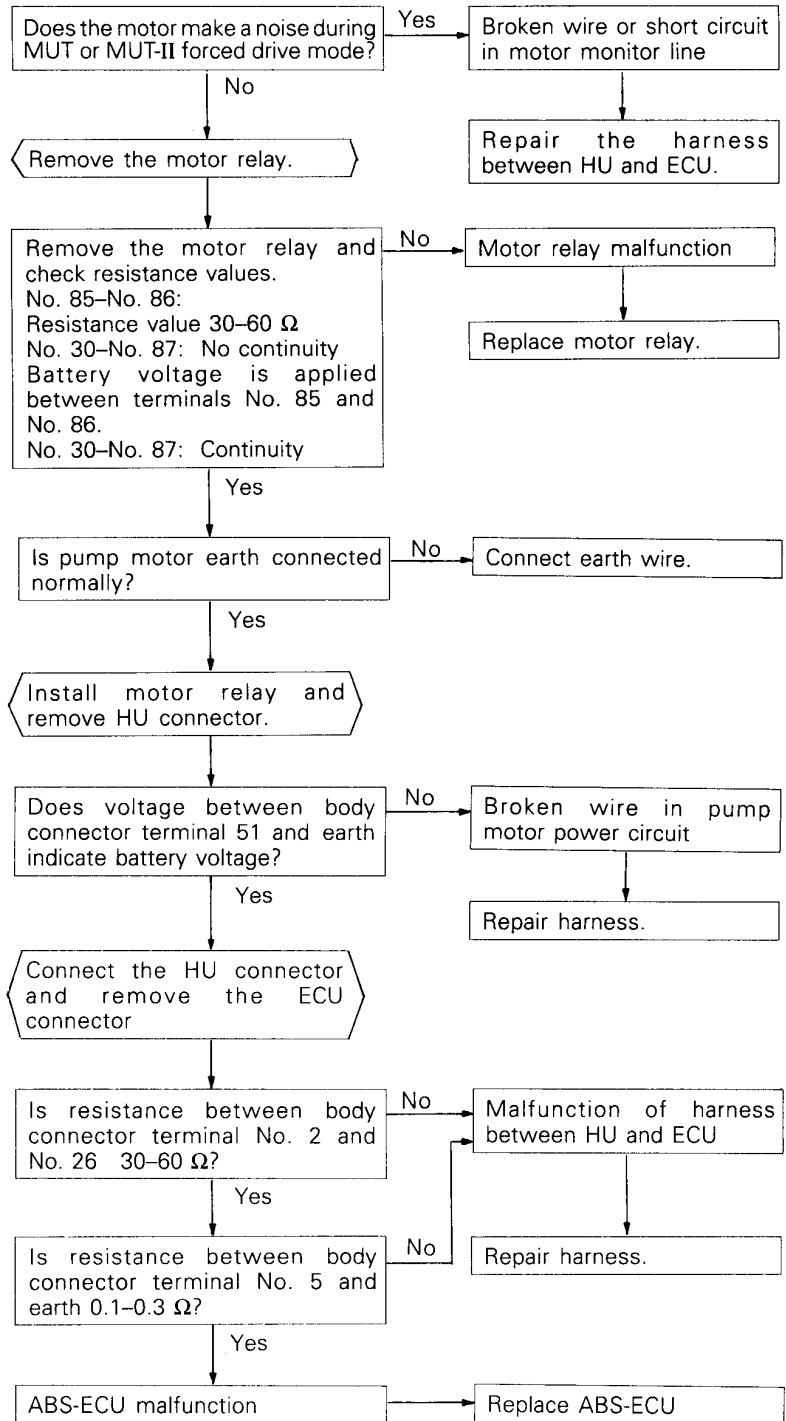
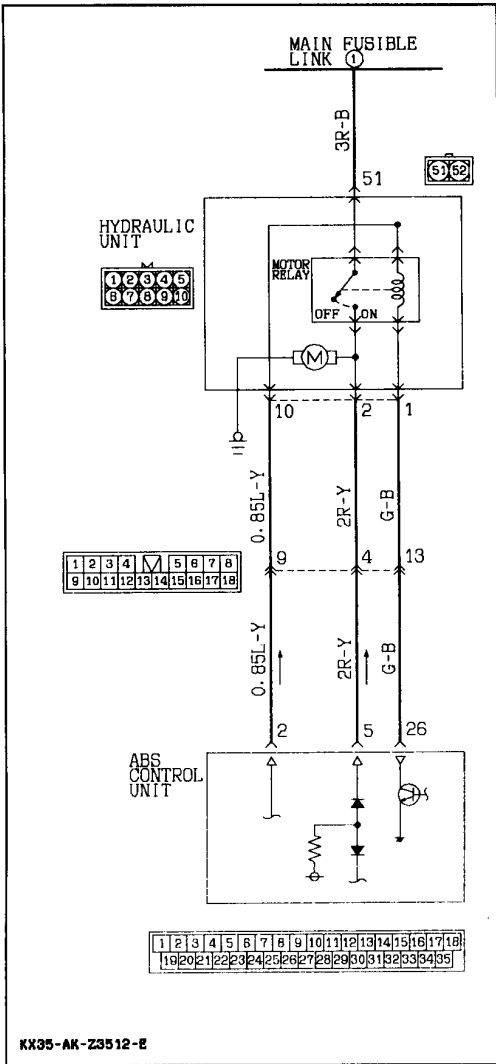
The ABS ECU outputs this trouble code for the motor relay and motor in the following cases.

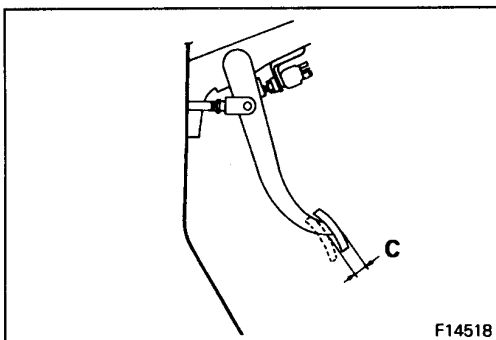
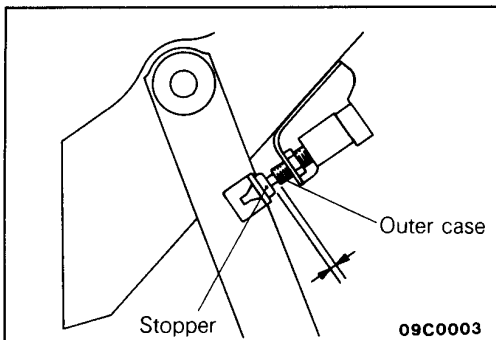
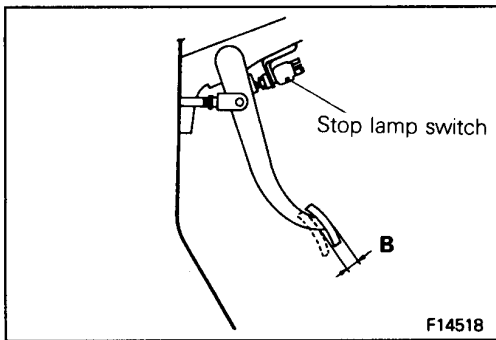
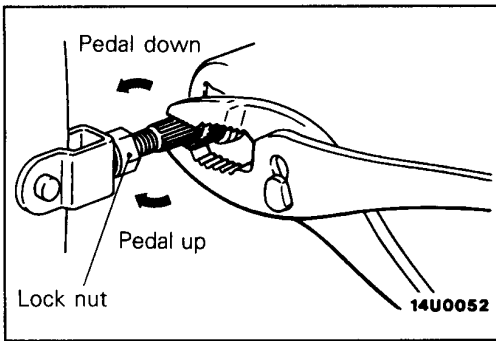
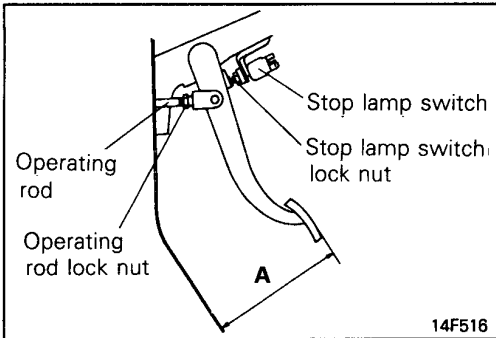
- When the motor relay does not function
- When there is trouble with the motor itself and it does not revolve

- When the motor ground is disconnected and the motor does not revolve
- When the motor continues to revolve

[Hint]

If there is motor operation noise during MUT or MUT-II forced drive mode, there is a broken or short circuited motor monitor wire.





SERVICE ADJUSTMENT PROCEDURES

BRAKE PEDAL INSPECTION AND ADJUSTMENT

E35FAAL

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

Standard value (A): 195–200 mm (7.7–7.9 in.)

- (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) Install the stop lamp switch so that the stop lamp illuminates with the pedal stroke being the standard value.

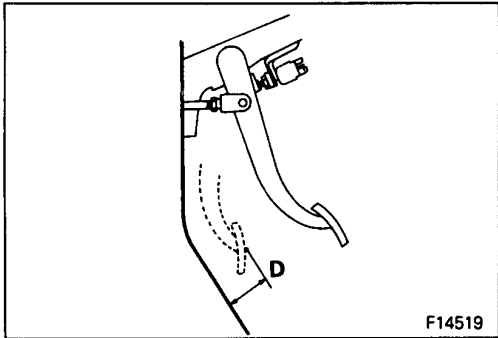
Standard value (B): 10–15 mm (0.39–0.59 in.)

- (4) Check to be sure that there is clearance between the stop lamp switch outer case and the stopper.

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 (C): 3–8 mm (0.12–0.31 in.)

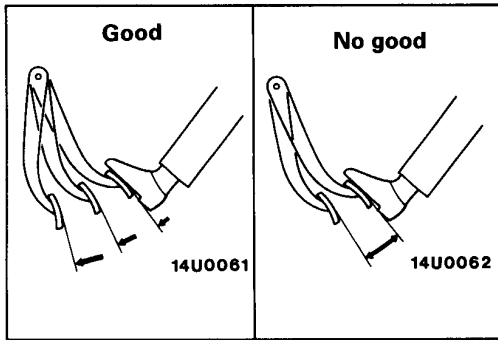
If the free play exceeds the standard value, it is probably due to excessive play between the clevis pin and brake pedal arm. Check for excessive clearance and replace faulty parts as required.



3. Start the engine, depress the brake pedal with approximately 500 N (50 kg, 110 lbs.) of force, and measure the clearance between the brake pedal and the floorboard.

Standard value (D): 80 mm (3.1 in.) 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.

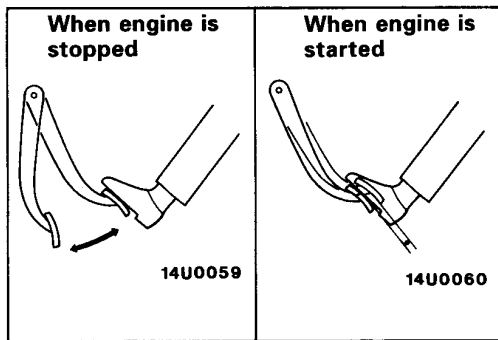


BRAKE BOOSTER OPERATING TEST

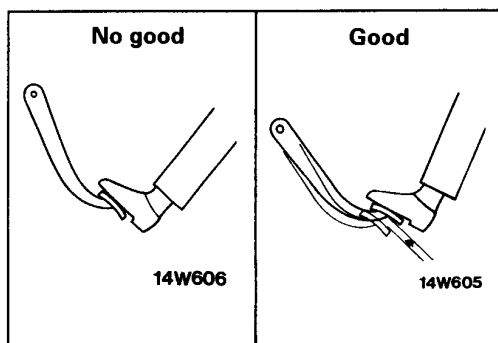
E35FCAA

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

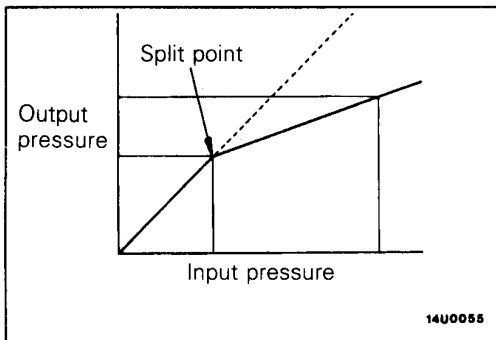
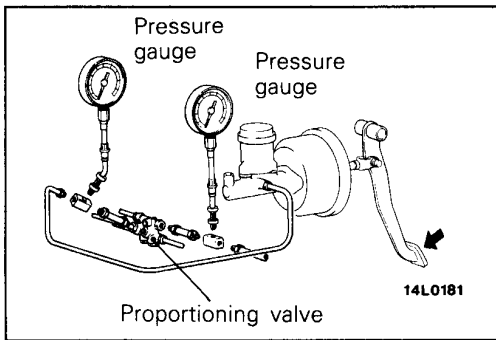
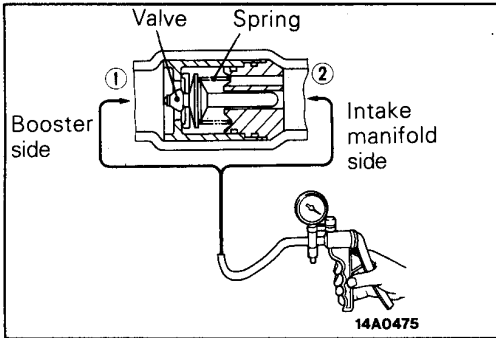
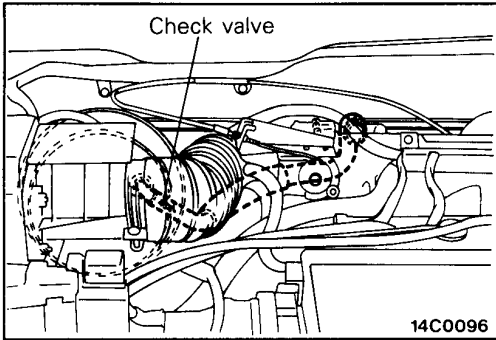
1. Run the engine for one or two minutes, and then stop it. If the pedal depresses fully the first time but gradually becomes higher when depressed succeeding times, the booster is operating properly, if the pedal height remains unchanged, the booster is defective.



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

E35FEA1

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-fit inside the vacuum hose.

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

Vacuum pump connection	Accept/reject criteria
Connection at the brake booster side ①	A negative pressure (vacuum) is created and held.
Connection at the intake manifold side ②	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.

PROPORTIONING VALVE FUNCTION TEST <SPACE RUNNER>

E35FKCJ

1. Connect two pressure gauges, one each to the input side and output side of the proportioning valve, as shown.
2. Air bleed the brake line and the pressure gauge.
3. While gradually depressing the brake pedal, make the following measurements and check to be sure that the measured values are within the allowable range.
 - (1) Output pressure begins to drop relative to input pressure (split point).

Standard value:

<2WD – Vehicles with A.B.S.>

2.25–2.75 MPa (22.5–27.5 kg/cm², 320–391 psi)

<except 2WD – Vehicles with A.B.S.>

2.75–3.25 MPa (27.5–32.5 kg/cm², 391–462 psi)

- (2) Output fluid pressure when input fluid pressure is 6.5 MPa (65 kg/cm², 925 psi) <2WD-Vehicles with A.B.S.>, 7.0 MPa (70 kg/cm², 996 psi) <except 2WD – Vehicles with A.B.S.>.

Standard value:

<2WD-Vehicles with A.B.S.>

3.75 MPa (37.5 kg/cm², 533 psi)

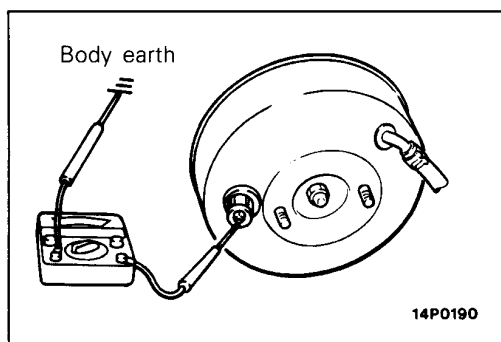
<except 2WD – Vehicles with A.B.S.>

4.25 MPa (42.5 kg/cm², 604 psi)

- (3) Output pressure difference between left and right brake lines

Limit: 0.4 MPa (4 kg/cm², 57 psi)

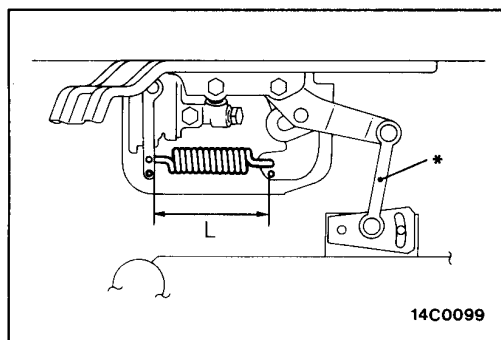
4. If the measured pressures are not within the permissible ranges, replace the proportioning valve.



**BRAKE BOOSTER VACUUM SWITCH CHECK
<DIESEL POWERD VEHICLES>**

E35FDABa

1. Disconnect the vacuum switch connector. Connect circuit tester to vacuum switch.
2. Start the engine. Vacuum switch is in good condition if it is not conductive when sufficient vacuum has built up in the booster, and conductive when the brake pedal is pumped several times after stopping the engine.

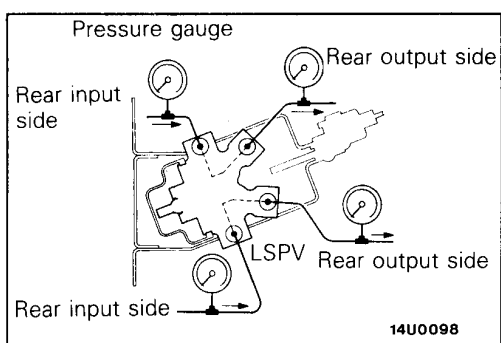


**LOAD SENSING PROPORTIONING VALVE
SPRING LENGTH ADJUSTMENT
<SPACE WAGON>**

E35FHAHa

1. Park the vehicle on a level surface.
- Caution**
Do not use a jack or similar device in order to keep the vehicle level.
2. Unload the vehicle and adjust the spring end position, utilizing the slot marked * so that the dimension "L" in the illustration will be as specified.

Standard value:
85.7–86.3 mm (3.37–3.40 in.)



**LOAD SENSING PROPORTIONING VALVE
FUNCTION TEST <SPACE WAGON>**

E35FKAHa

There should be no passengers or luggage in the vehicle during checking and adjustment of the fluid pressure.

1. Connect one pressure gauge each to the input side and the output side of the load sensing proportioning valve.

2. Back off the turnbuckle to loosen the link assembly. With the brake pedal depressed, make the following measurements and check to be sure that the measured values are within the allowable range.

- (1) Output pressure when input pressure is 6.25 MPa (62.5 kg/cm², 889 psi).

Standard value:

3.2–3.7 MPa (32–37 kg/cm², 455–526 psi)

- (2) Output pressure when input pressure is 14 MPa (140 kg/cm², 1991 psi).

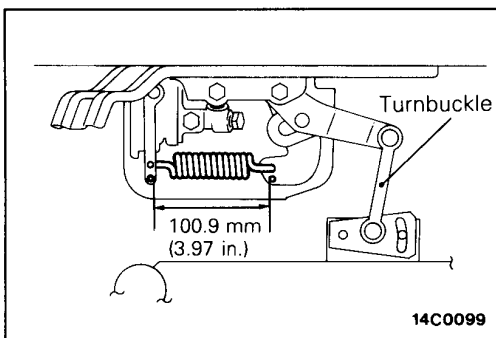
Standard value:

5.38–6.18 MPa

(53.8–61.8 kg/cm², 765–879 psi)

- (3) Output pressure between left and right brake lines.

Limit: 0.4 MPa (4 kg/cm², 57 psi)



3. If the measured pressures are not within the permissible ranges, replace the load sensing proportioning valve.

4. Turn the turnbuckle to adjust the length of the LSPV spring as shown in the illustration.

With the brake pedal depressed, make the following measurements and check to be sure that the measured values are within the allowable range.

- (1) Output pressure when input pressure is 14 MPa (140 kg/cm², 1,991 psi)

Standard value:

8.78–10.48 MPa

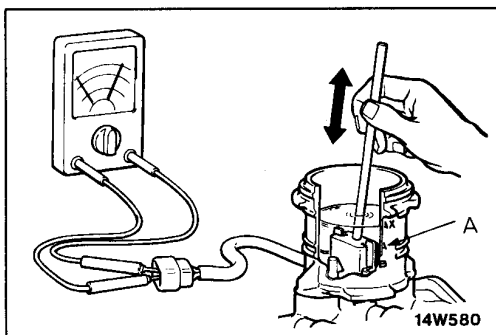
(87.8–104.8 kg/cm², 1,249–1,491 psi)

- (2) Output pressure difference between left and right brake lines.

Limit: 0.85 MPa (8.5 kg/cm², 121 psi)

5. If the measured pressures are not within the permissible ranges, replace the load sensing proportioning valve.

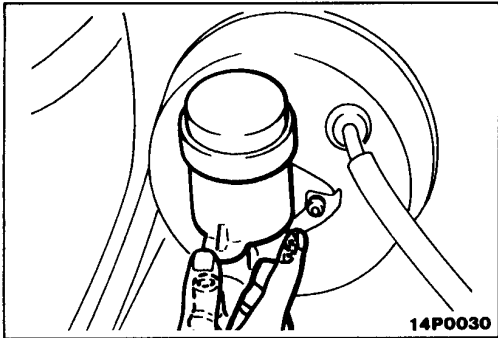
6. After the measurement, adjust the length of the sensor spring to the specified length.



BRAKE FLUID LEVEL SENSOR CHECK

E35FBAG

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



BLEEDING

E35FYAJ

Caution

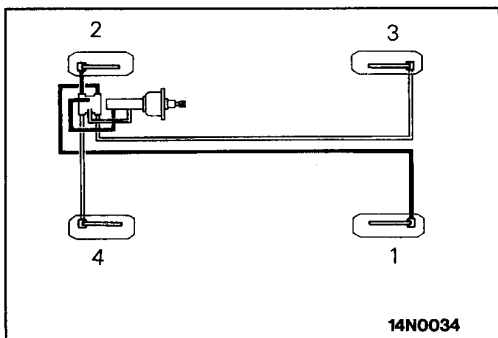
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

Specified brake fluid: DOT3 or DOT4

BLEEDING OF MASTER CYLINDER

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

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

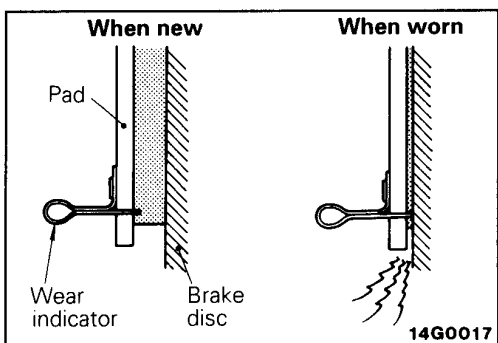


BLEEDING OF BRAKE PIPE LINE

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

Caution

For vehicles with ABS, be sure to install a filter to the master cylinder reservoir tank when supplying brake fluid.



FRONT DISC BRAKE PAD CHECK AND REPLACEMENT

E35FQAL

NOTE

The brake pads have wear indicators that contact the brake disc when the brake pad thickness becomes 2 mm (0.08 in.), and emit a squealing sound to warn the driver.

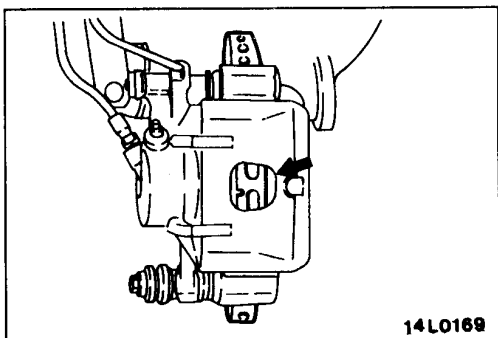
1. Check brake pad thickness through caliper body check port.

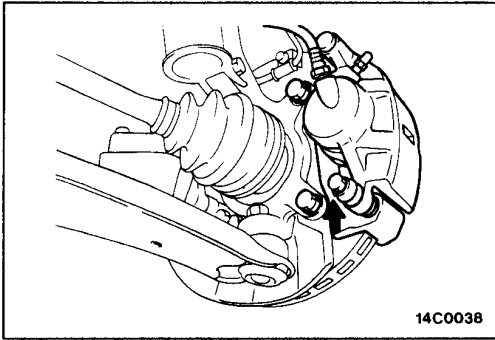
Standard value: 10.0 mm (0.39 in.)

Limit: 2.0 mm (0.08 in.)

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.

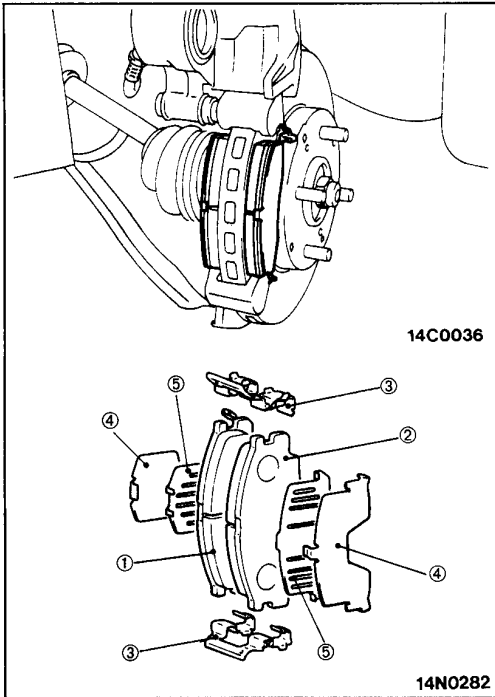




2. Remove guide pin. Lift caliper assembly and retain with wires.

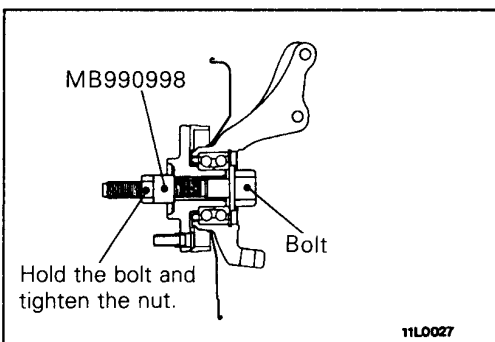
Caution

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

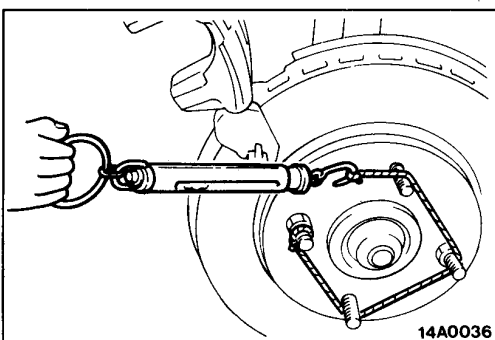


3. Remove the following parts from caliper support.

- ① Pad & wear indicator assembly
- ② Pad assembly
- ③ Clip
- ④ Outer shim
- ⑤ Inner shim



4. Take out the drive shaft.
(Refer to GROUP 26 – Drive Shaft.)
5. Set the special tool to the hub knuckle as shown in the illustration.

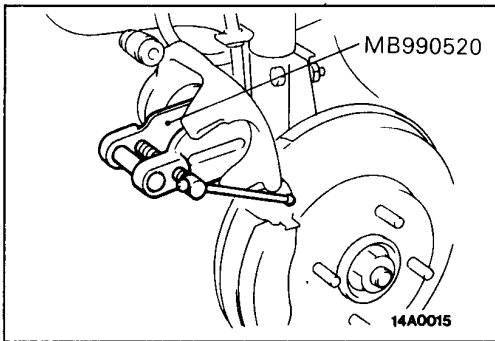


6. With the pad removed, use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.

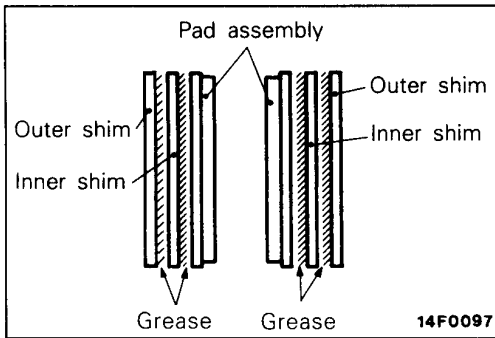
NOTE

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

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



8. Clean piston and insert into cylinder with special tool.
9. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the guide pin.



10. Apply repair kit grease to both sides of the inner shims.

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

Caution

1. **Make sure that the friction surfaces of pads and brake discs are free of grease and other contaminants.**
2. **The grease should never squeeze out from around the shim.**

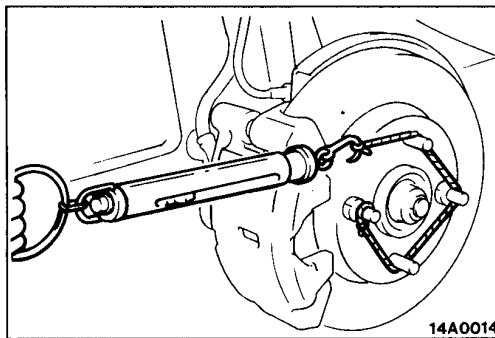
11. Check the disc brake drag force as follows.

- (1) Start the engine, and after depressing the brake pedal hard two or three times, stop the engine.
- (2) Turn brake disc forward 10 times.
- (3) Use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.

12. Calculate the disc brake drag torque (difference of values measured in Item 11 and Item 6).

Standard value: 70 N (7.0 kg, 15.4 lbs.) or less

13. If the brake drag torque exceeds the standard value, disassemble the piston and inspect the piston sliding part for dirt, rust, deterioration of the piston seal, and state of the lock pin and guide pin sliding states.



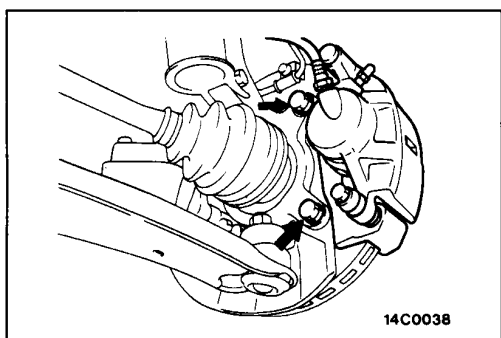
FRONT DISC BRAKE ROTOR INSPECTION

CAUTION

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

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

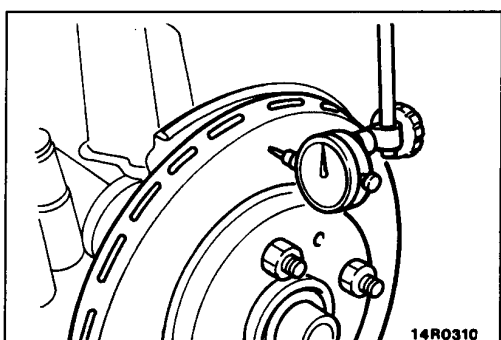
Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	<ul style="list-style-type: none"> • If the vehicle is not driven for a certain period, the sections of the discs that are not in contact with lining will become rusty, causing noise and shuddering. • If grooves resulting from excessive disc wear and scratches are not removed prior to installing a new pad assembly, there will momentarily be inappropriate contact between the disc and the lining (pad).
Run-out of 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

E35FSAE

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.

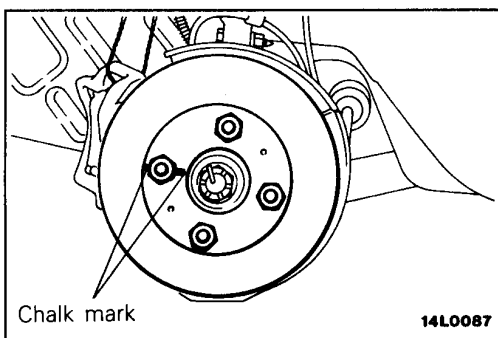


3. Place a dial gauge approximately 5 mm (0.2 in.) from the outer circumference of the brake disc, and measure the run-out of the disc.

Limit: 0.07 mm (0.0028 in.) or less

NOTE

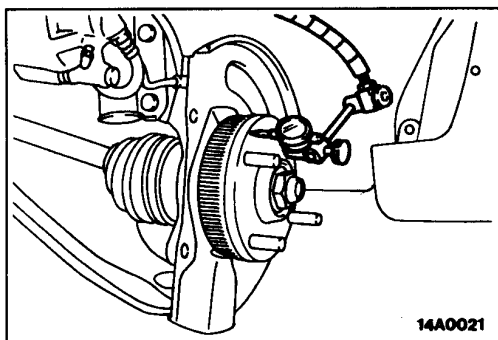
Tighten the nuts in order to secure the disc to the hub.



RUN-OUT CORRECTION

E35FTAA*

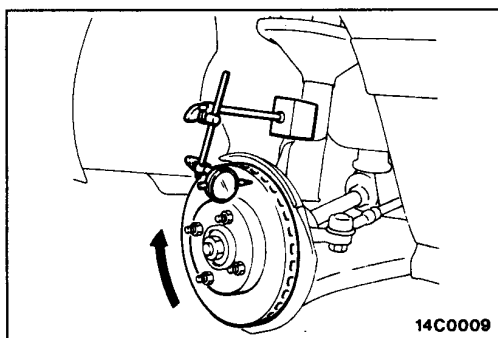
1. If the run-out of the brake disc is equivalent to or exceeds the limit specification, change the phase of the disc and hub, and then measure the run-out again.
 - (1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.



- (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.

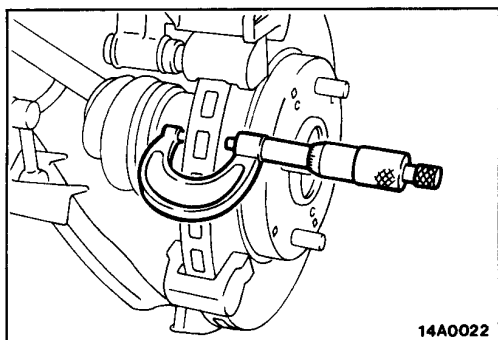
Limit: 0.05 mm (0.0020 in.)

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



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



THICKNESS CHECK

1. Using a micrometer, measure disc thickness at eight positions, approximately 45° apart and 10 mm (.39 in.) in from the outer edge of the disc.

Brake Disc Thickness

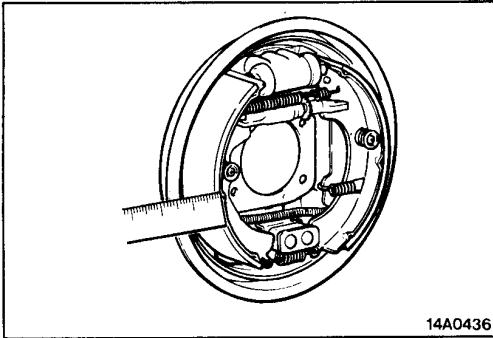
Standard value: 24 mm (0.94 in.)

Limit: 22.4 mm (0.88 in.)

Thickness Variation (At least 8 position)

The difference between any thickness measurements should not be more than 0.015 mm (0.0006 in.).

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 disc or turn rotor with on the car type brake lathe (MAD, DL-8700PF or equivalent).

**BRAKE LINING THICKNESS CHECK**

E35FFAA

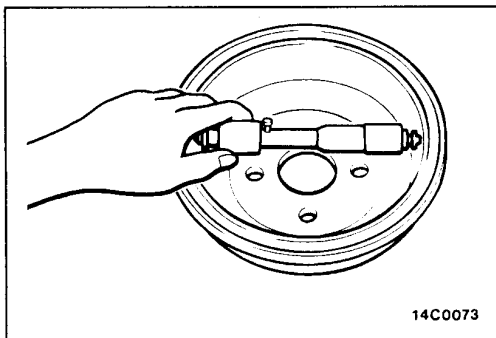
1. Remove the brake drum.
2. Measure the wear of the brake lining at the place worn the most.

Limit: 1.0 mm (0.04 in.)

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.35-80.

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.**

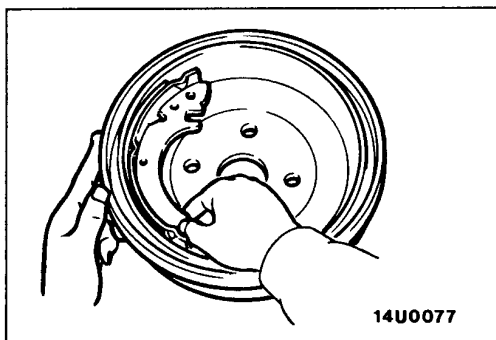
**BRAKE DRUM INSIDE DIAMETER CHECK**

E35FGAA

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

Limit: 8-inch drum brake 205 mm (8.1 in.)
9-inch drum brake 230.6 mm (9.1 in.)

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

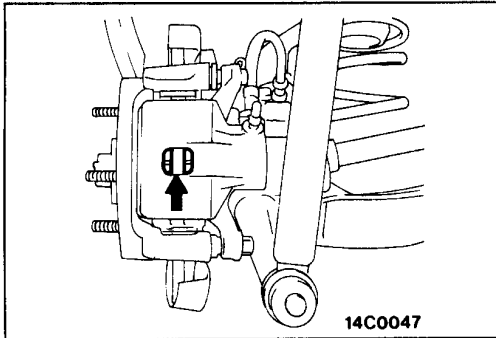
**BRAKE LINING AND BRAKE DRUM CONNECTION CHECK**

E35FIAD

1. Remove the brake drum.
2. Remove the shoe and lining assembly. (Refer to P.35-80.)
3. Chalk inner surface of brake drum and rub with shoe and lining assembly.
4. Replace shoe and lining assembly or brake drums if very irregular contact area.

NOTE

Clean of chalk after check.



REAR DISC BRAKE PAD CHECK AND REPLACEMENT

<VEHICLES WITH A.B.S.>

E35FUAG

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

Standard value: 10.0 mm (0.39 in.)

Limit: 2.0 mm (0.08 in.)

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 sleeve and guide pin sleeve.

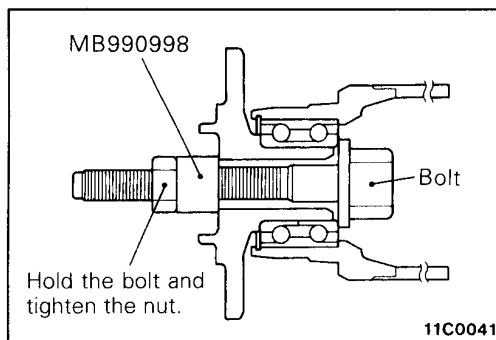
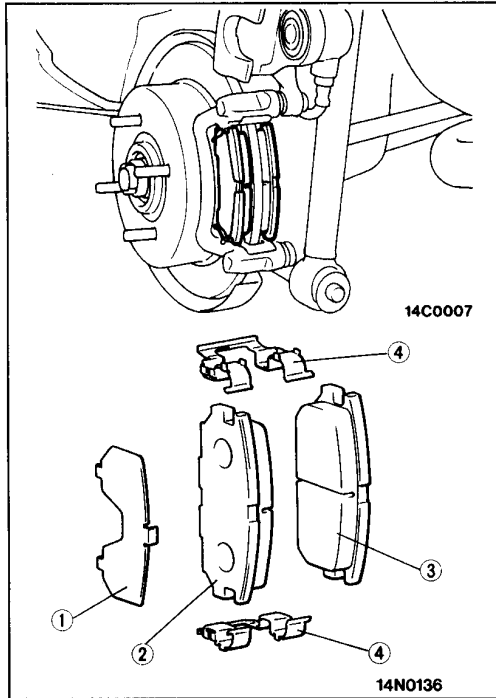
2. Remove guide pin. Lift caliper assembly and retain with wires.

Caution

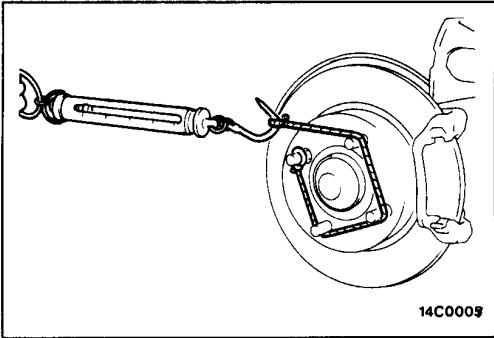
Do not wipe off the special grease that is on the guide pin or allow it to contaminate the guide pin.

3. Remove the following parts from caliper support.

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



4. For vehicles with 4WD, remove the drive shaft from the lower arm. (Refer to GROUP 27 – Drive Shaft.)
5. Set the special tool to the lower arm as shown in the illustration.



6. With the pad removed, use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.

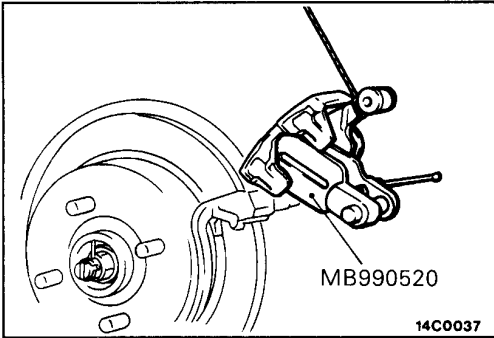
NOTE

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

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

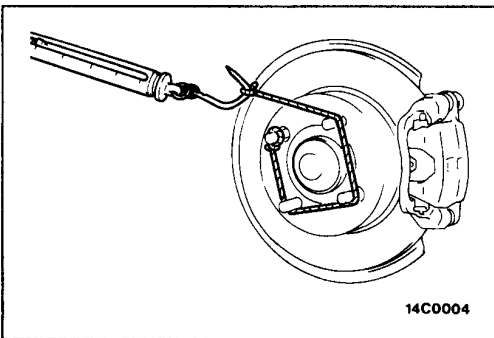
Caution

Do not deposit grease or other dirt on pad or brake disc friction surfaces.



8. Clean the piston; then use the special tool to thread the piston into the cylinder.

9. Be careful that the piston boot does not become caught, when lowering the caliper assembly and install the lock pin.



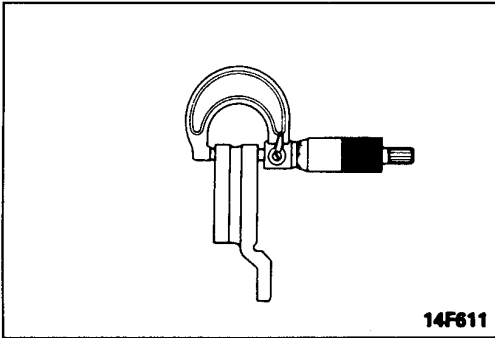
10. Check the disc brake drag force as follows.

- (1) Start the engine, and after depressing the brake pedal hard two or three times, stop the engine.
- (2) Turn brake disc forward 10 times.
- (3) Use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.

11. Calculate the drag torque of the disc brake (difference between measured values in 10 and 6).

Standard value: 70 N (7.0 kg, 15.4 lbs.) or less

12. If the disc brake drag force 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.



REAR BRAKE DISC THICKNESS CHECK
<VEHICLES WITH A.B.S.>

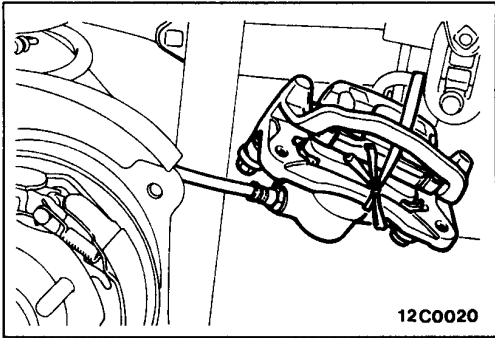
E35FVABa

1. Remove dirt and rust from brake disc surface.
2. Measure disc thickness at 4 locations or more.

Standard value: 10 mm (0.39 in.)

Limit: 8.4 mm (0.33 in.)

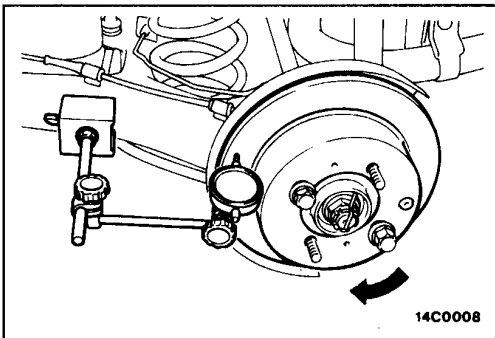
Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.



REAR BRAKE DISC RUN-OUT CHECK
<VEHICLES WITH A.B.S.>

E35FWABa

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 (0.2 in.) from the outer circumference of the brake disc, and measure the run-out of the disc.

Limit: 0.08 mm (0.0031 in.) or less

NOTE

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

REAR BRAKE DISC RUN-OUT CORRECTION <VEHICLES WITH A.B.S.>

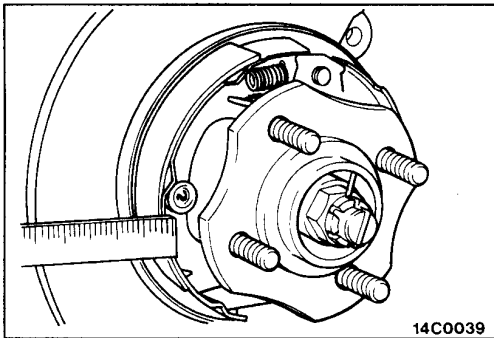
E35FLAC

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.

NOTE

The procedures for checking by changing the installation phase of the disc are the same as those for the front brake discs. (Refer to P.35-55-2.)

2. If the problem cannot be corrected by changing the phase of the brake disc, replace the disc.



14C0039

BRAKE LINING THICKNESS CHECK <VEHICLES WITH A.B.S.>

E35FFAC a

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

Limit: 1.0 mm (0.04 in.)

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

Caution

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

BRAKE DISC INSIDE DIAMETER CHECK <VEHICLES WITH A.B.S.>

E35FGAD

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

Limit: 169 mm (6.7 in.)

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

BRAKE LINING AND BRAKE DISC CONNECTION CHECK <VEHICLES WITH A.B.S.>

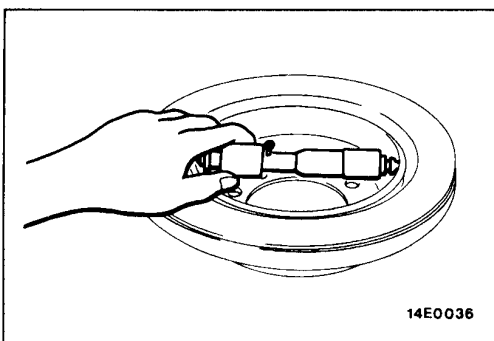
E35FLAE

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 hub with shoe and lining assembly.
5. Replace shoe and lining assembly or brake discs if very irregular contact area.

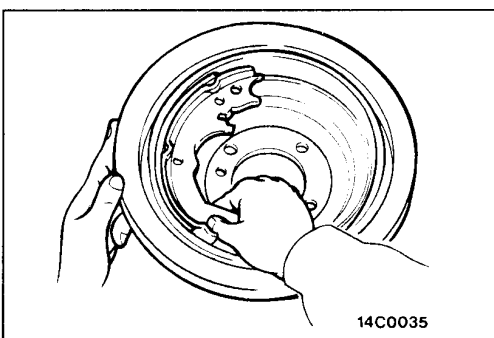
NOTE

Clean of chalk after check.

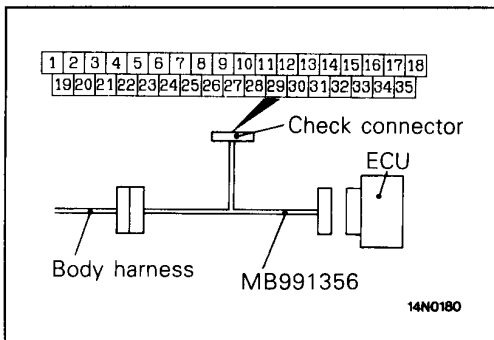
PWDE9104



14E0036



14C0035



CHECKING OPERATION OF THE ABS (ANTI-LOCK BRAKING SYSTEM)

WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

E35FPBA

1. Lift up the vehicle and release the parking brake.
2. Disconnect the ECU harness connector and measure with the adapter harness (MB991356) connected to the harness side connector.

Caution

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

NOTE

Do not connect the connector (Special Tool) marked with "*" except when recording the waveform on a driving test. In such a case, connect the connector to the ECU.

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

Terminal No.			
FL	RR	FR	RL
4	24	21	8
5	26	23	9

Output voltage

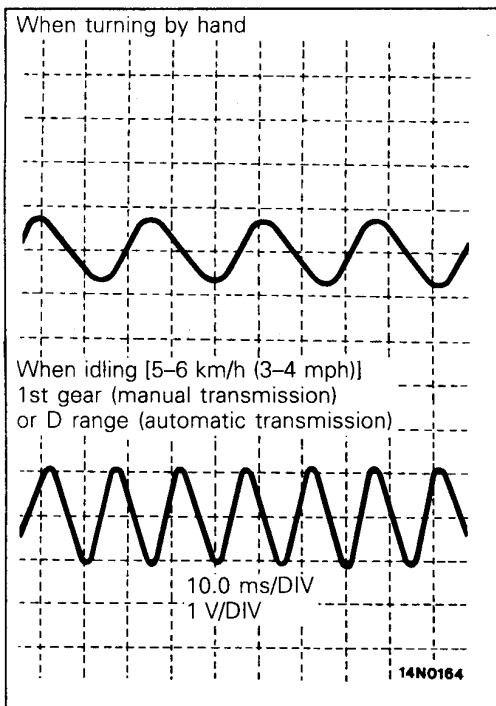
When measuring with a circuit tester:

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 follows:
 - Excessive clearance between the wheel speed sensor pole piece and the rotor.
 - Faulty wheel speed sensor.
 so adjust the wheel speed sensor or replace it.



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 front wheels by engaging 1st gear (vehicles with manual transmission) or D range (vehicles with automatic transmission).

NOTE

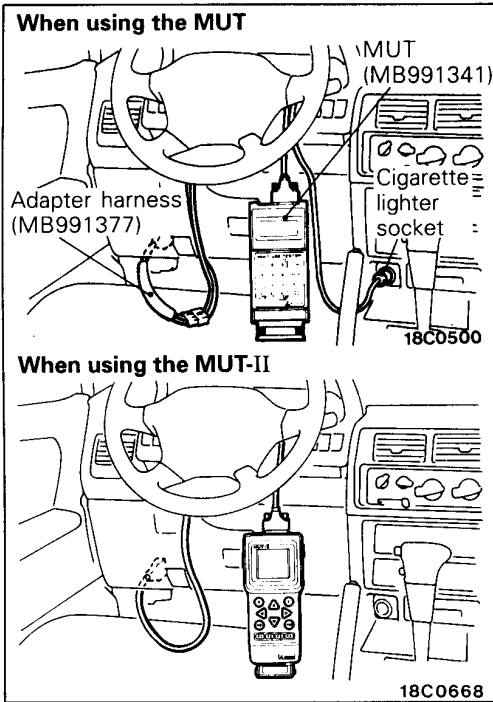
1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The wave form measurements can also be taken while the vehicle is actually moving.
3. The output voltage will be small when the wheel speed is low, and similarly it will be large when the wheel speed is high.

POINTS IN WAVEFORM MEASUREMENT

Symptom	Probable causes	Remedy
Too small or zero waveform amplitude	Faulty wheel speed sensor	Replace sensor
	Incorrect pole piece-to-rotor clearance	Adjust clearance
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.



INSPECTION OF HYDRAULIC UNIT

INSPECTION BY DEDUCTION

E35FPCA

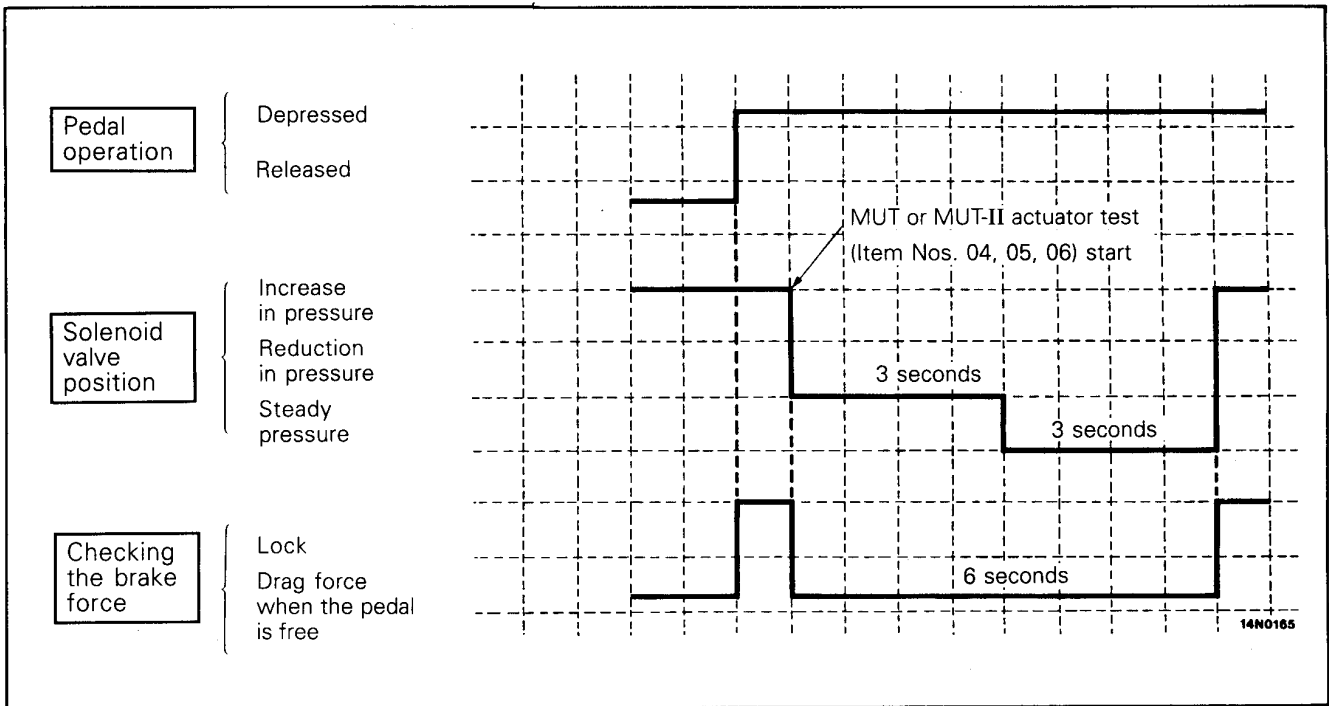
**WHEN USING THE MULTI-USE TESTER (MUT)
<Up to 1993 models> OR THE MUT-II <All models>**

1. Jack up the vehicle and support the vehicle with rigid racks placed at the specified jack-up points.
2. Release the parking brake and deduce the drag force (drag torque) of each wheel.
3. Set the MUT or MUT-II through the adapter harness (MB991377) <Up to 1993 models> or the adapter harness included in the MUT-II sub assembly <All models> as illustrated.
4. After confirming that the shift lever or selector lever is in the neutral position, start the engine.

NOTE

1. The ABS warning lamp lights up, it goes into the MUT or MUT-II mode.
2. While the ABS is in the fail safe mode, the MUT or MUT-II actuator test cannot be made.
5. Operate the MUT or MUT-II to force the actuator to operate.
6. Turning the wheel manually, check the change of the braking force when the brake pedal is depressed.

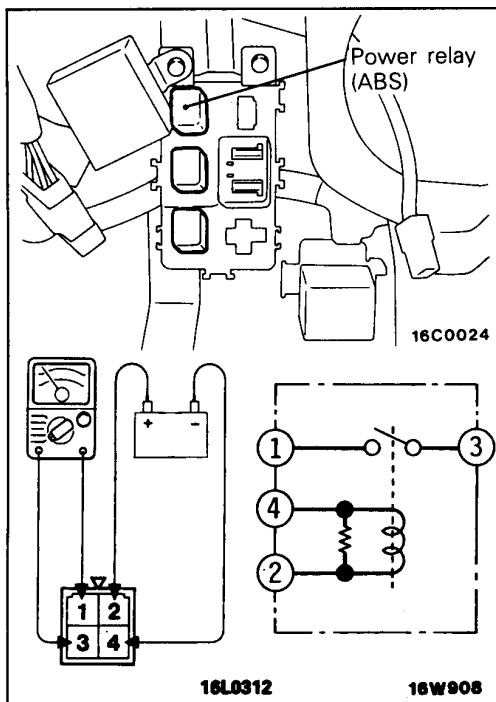
The change should be as shown in the following illustration.



7. If a different result is obtained when checking, correct it by following the procedure in the "diagnosis table".

No.	MUT or MUT-II display	Operation	Judgement		Probable cause	Remedy
			Normal	Abnormal		
04	FR VALVE M	(1) Depress brake pedal to lock wheel. (2) Using the MUT or MUT-II, select the wheel to be checked and force the actuator to operate. (3) Turn the selected wheel manually to check the change of brake force	Brake force released for 6 seconds after locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than HU	Check and clean brake line
05	FL VALVE M				Clogged hydraulic circuit in HU	Replace HU assembly
06*	Rear VALVE M*		Brake force is not released.		Incorrect HU brake tube connection	Connect correctly
		HU solenoid valve not functioning correctly			Replace HU assembly	

NOTE
*: 2WD



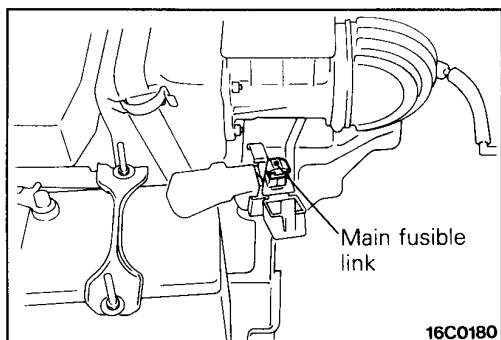
INSPECTION OF POWER RELAY

E35FPDA

Remove the instrument under cover and remove the power relay.

Terminal	1	2	3	4
Battery voltage				
Continuity no voltage		○		○
Continuity with voltage	○		○	⊕---⊖

NOTE
(1) ○—○ indicates that there is continuity between the terminals.
(2) ⊕---⊖ indicates connection of battery voltage.

**REMEDY FOR A FLAT BATTERY**

E35FPEA

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 A.B.S. 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 A.B.S. circuit, thus disabling the anti-skid brake system.

The A.B.S. warning lamp will illuminate when the fusible link (for A.B.S.) is removed.

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

BRAKE PEDAL <L.H. DRIVE VEHICLES>

REMOVAL AND INSTALLATION

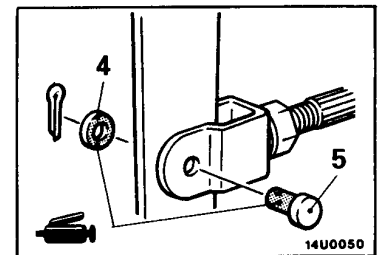
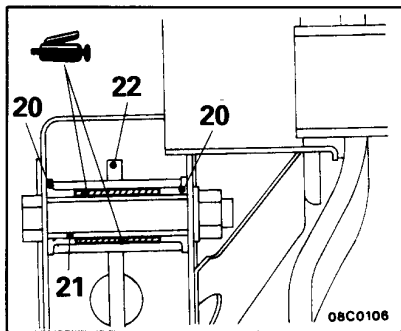
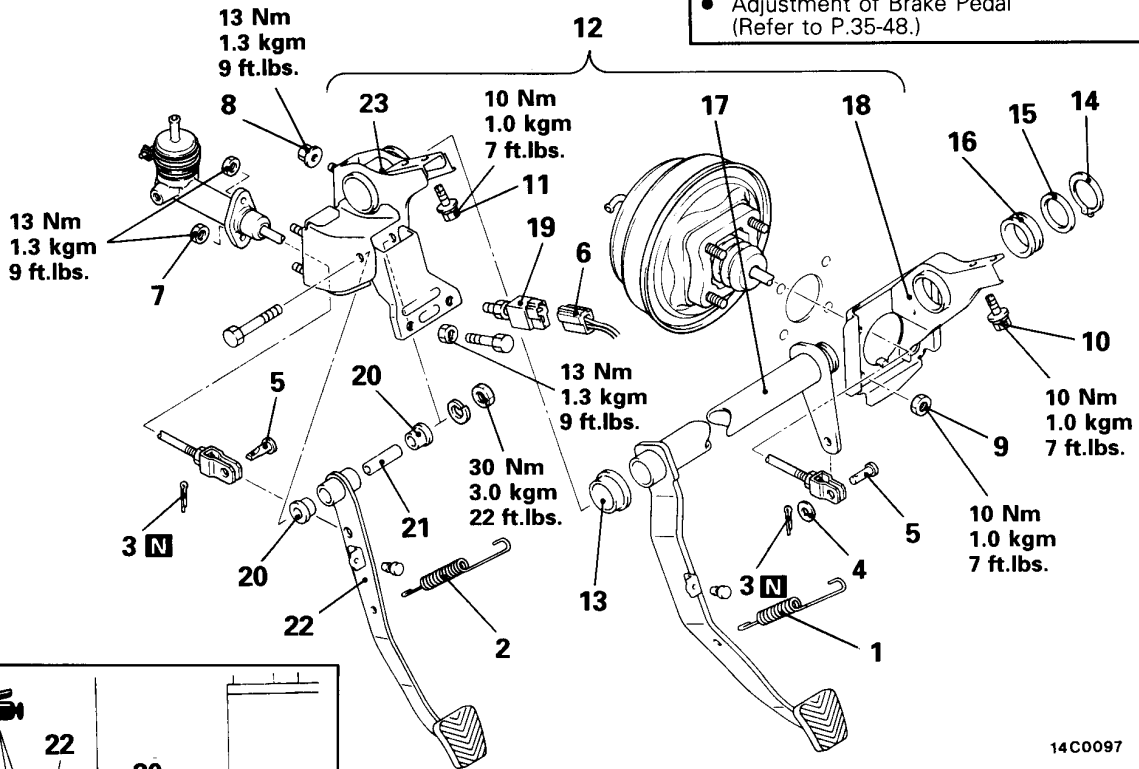
<M/T>

Pre-removal Operation

- Removal of Instrument Panel (Refer to GROUP 52A – Instrument Panel.)
- Removal of Heater Unit (Refer to GROUP 55 – Heater Unit.)
- Removal of Evaporator (Refer to GROUP 55 – Evaporator.)

Post-installation Operation

- Installation of Evaporator (Refer to GROUP 55 – Evaporator.)
- Installation of Heater Unit (Refer to GROUP 55 – Heater Unit.)
- Installation of Instrument Panel (Refer to GROUP 52A – Instrument Panel.)
- Adjustment of Clutch Pedal (Refer to GROUP 21 – Service Adjustment Procedures.)
- Adjustment of Brake Pedal (Refer to P.35-48.)



Removal steps

1. Brake pedal return spring
2. Clutch pedal return spring
3. Split pin
4. Washer
5. Clevis pin
6. Harness connector
7. Clutch master cylinder installation nuts
8. Bracket assembly installation nut
9. Brake booster installation nuts
10. Pedal support member installation bolts
11. Bracket assembly installation bolts
12. Pedal assembly
13. Bushing
14. Snap ring
15. Washer
16. Bushing
17. Brake pedal
18. Pedal support member
19. Stop lamp switch
20. Bushing
21. Spacer
22. Clutch pedal
23. Bracket assembly

<A/T>

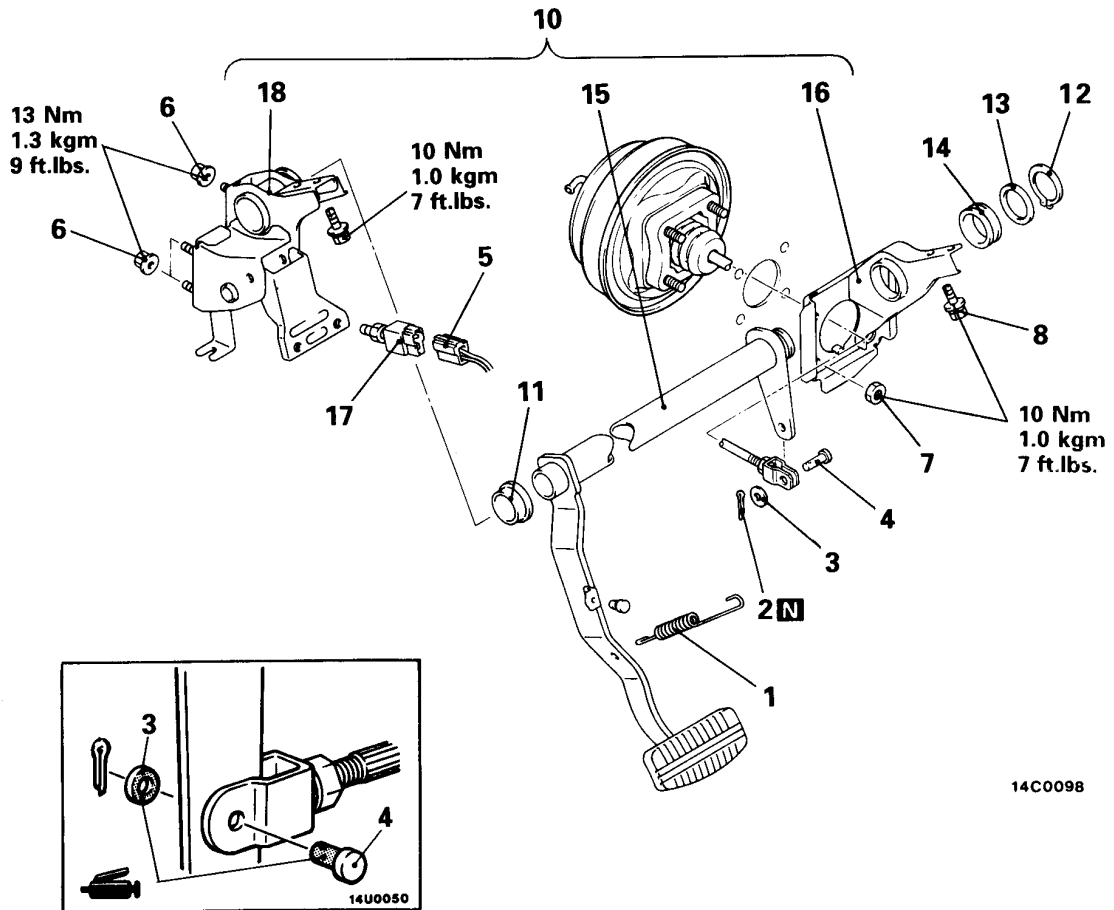
E35GA-B

Pre-removal Operation

- Removal of Instrument Panel
(Refer to GROUP 52A – Instrument Panel.)
- Removal of Heater Unit
(Refer to GROUP 55 – Heater Unit.)
- Removal of Evaporator
(Refer to GROUP 55 – Evaporator.)

Post-installation Operation

- Installation of Evaporator
(Refer to GROUP 55 – Evaporator.)
- Installation of Heater Unit
(Refer to GROUP 55 – Heater Unit.)
- Installation of Instrument Panel
(Refer to GROUP 52A – Instrument Panel.)
- Adjustment of Brake Pedal
(Refer to P.35-48.)



14C0098

Removal steps

- | | |
|---|--|
| <ol style="list-style-type: none"> 1. Brake pedal return spring 2. Split pin 3. Washer 4. Clevis pin 5. Harness connector 6. Bracket assembly installation nuts 7. Brake booster installation nuts 8. Pedal support member installation bolts 9. Bracket assembly installation bolts 10. Pedal assembly | <ol style="list-style-type: none"> 11. Bushing 12. Snap ring 13. Washer 14. Bushing 15. Brake pedal 16. Pedal support member 17. Stop lamp switch 18. Bracket assembly |
|---|--|

BRAKE PEDAL <R.H. DRIVE VEHICLES>

REMOVAL AND INSTALLATION

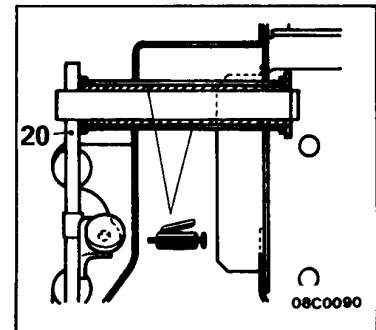
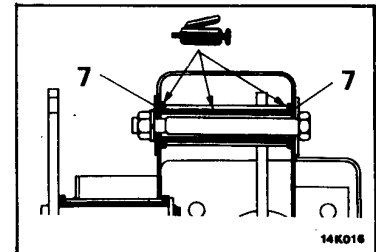
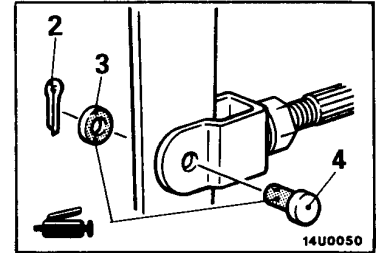
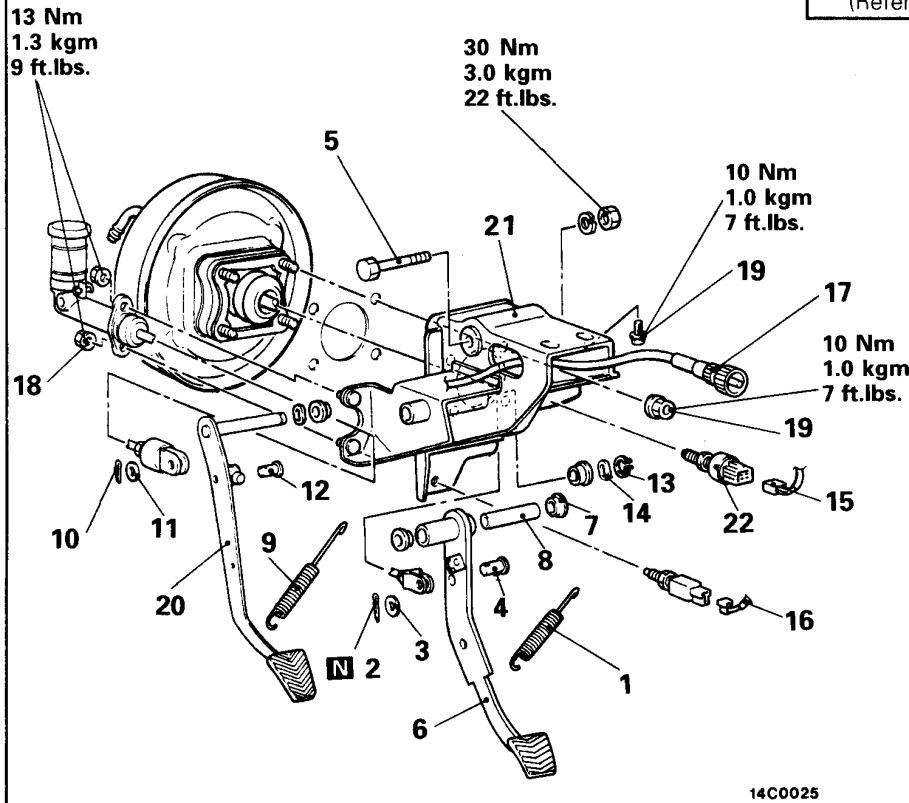
<M/T>

Pre-removal Operation

- Removal of Instrument Under Cover (Refer to GROUP 52A – Instrument Panel.)
- Removal of Combination Meter (Refer to GROUP 54 – Combination Meter.)

Post-installation Operation

- Installation of Combination Meter (Refer to GROUP 54 – Combination Meter.)
- Installation of Instrument Under Cover (Refer to GROUP 52A – Instrument Panel.)
- Clutch Pedal Adjustment (Refer to GROUP 21 – Service Adjustment Procedures.)
- Brake Pedal Adjustment (Refer to P.35-48.)



Pedal support member removal steps

1. Brake pedal return spring
2. Split pin
3. Washer
4. Clevis pin
5. Brake pedal shaft bolt
6. Brake pedal
9. Clutch pedal return spring
10. Split pin
11. Washer
12. Clevis pin
13. Snap ring
14. Washer
15. Harness connector
16. Harness connector
17. Speedometer cable
18. Clutch master cylinder installation nuts
19. Pedal support member installation bolt and nuts
20. Clutch pedal
21. Pedal support member
22. Stop lamp switch

Brake pedal removal steps

1. Brake pedal return spring
2. Split pin
3. Washer
4. Clevis pin
5. Brake pedal shaft bolt
6. Brake pedal
7. Bushings
8. Spacer

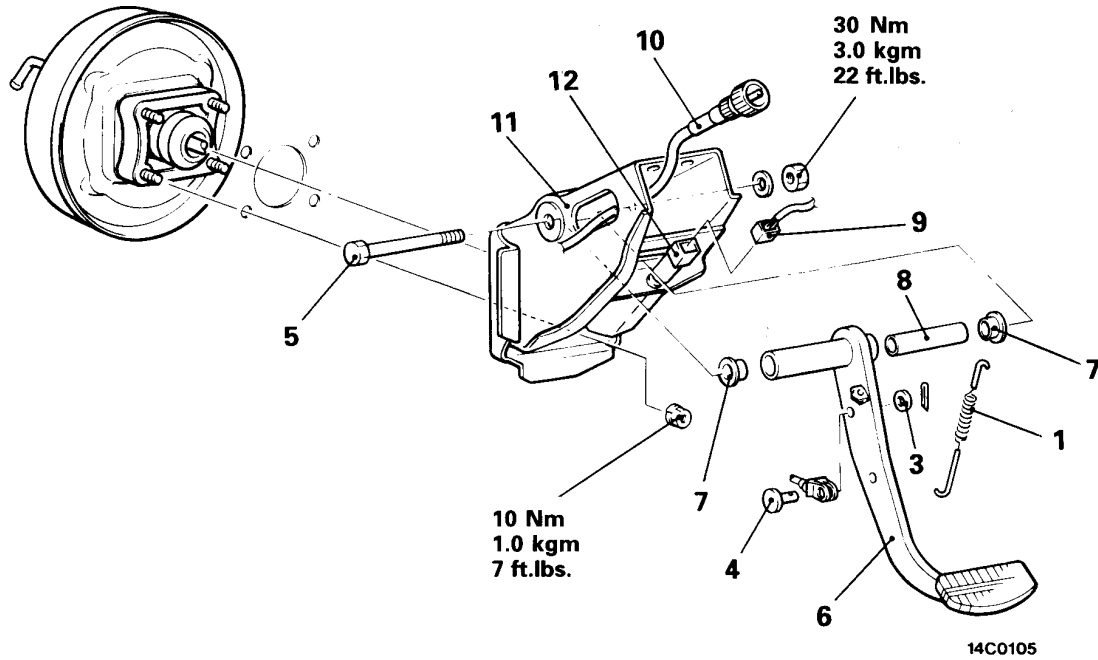
<A/T>

Pre-removal Operation

- Removal of Instrument Under Cover (Refer to GROUP 52A – Instrument Panel.)
- Removal of Combination Meter (Refer to GROUP 54 – Combination Meter.)

Post-installation Operation

- Installation of Combination Meter (Refer to GROUP 54 – Combination Meter.)
- Installation of Instrument Under Cover (Refer to GROUP 52A – Instrument Panel.)
- Brake Pedal Adjustment (Refer to P.35-48.)

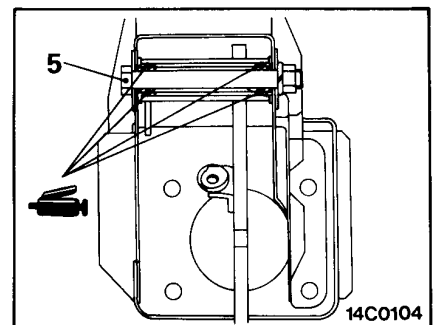
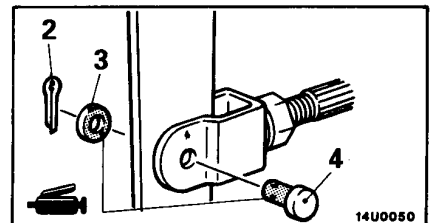


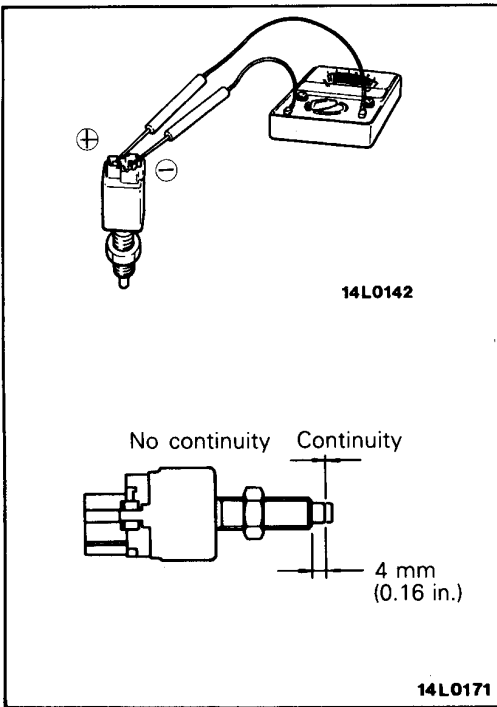
Pedal support member removal steps

1. Brake pedal return spring
2. Split pin
3. Washer
4. Clevis pin
5. Brake pedal shaft bolt
6. Brake pedal
9. Harness connector
10. Speedometer cable
11. Pedal support member
12. Stop lamp switch

Brake pedal removal steps

1. Brake pedal return spring
2. Split pin
3. Washer
4. Clevis pin
5. Brake pedal shaft bolt
6. Brake pedal
7. Bushings
8. Spacer





INSPECTION

- Check the bushing for wear.
- Check the brake pedal for bend or twisting.
- Check the brake pedal return spring for damage.

Stop lamp switch

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 (0.16 in.) from the outer case edge surface, and if there is continuity when it is released.

MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

Pre-removal Operation

- Draining of Brake Fluid
- Removal of Joint Duct or Evaporator <L.H. drive vehicles> (Refer to GROUP 55 – Heater Unit and Blower Assembly or Evaporator.)
- Removal of Instrument Under Cover <R.H. drive vehicles> (Refer to GROUP 52A – Instrument Panel.)

Post-installation Operation

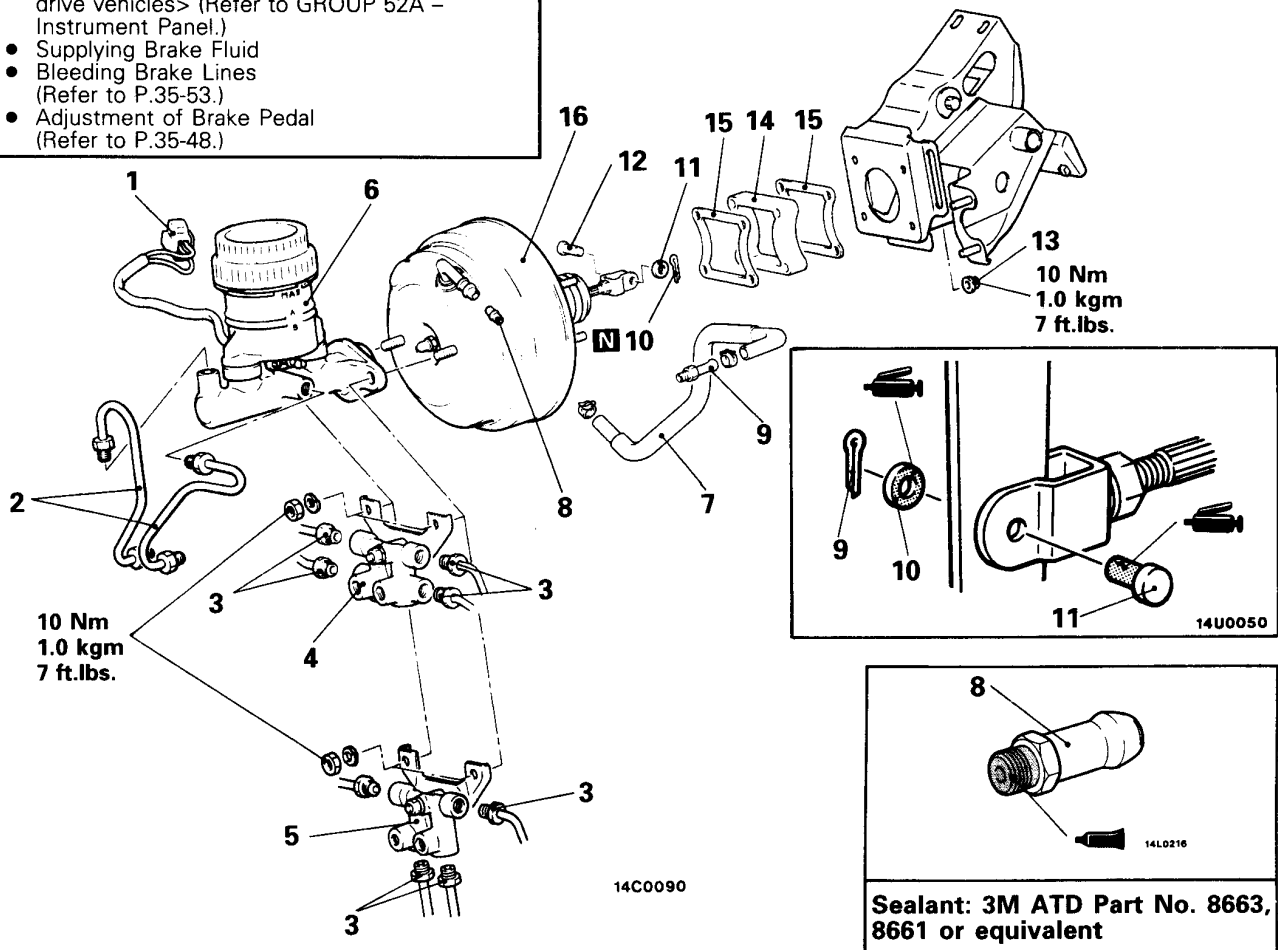
- Installation of Joint Duct or Evaporator <L.H. drive vehicles> (Refer to GROUP 55 – Heater Unit and Blower Assembly or Evaporator.)
- Installation of Instrument Under Cover <R.H. drive vehicles> (Refer to GROUP 52A – Instrument Panel.)
- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-53.)
- Adjustment of Brake Pedal (Refer to P.35-48.)

Flared brake line nuts

- 15 Nm
- 1.5 kgm
- 11 ft.lbs.



14F038



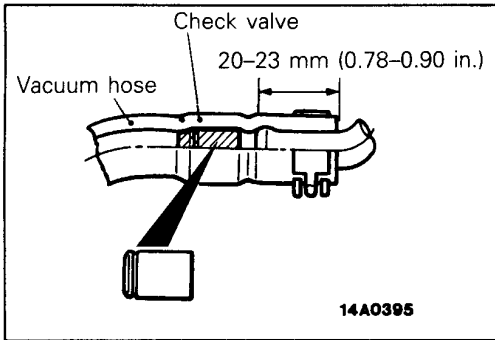
Master cylinder removal steps

1. Fluid level sensor connector
2. Brake tube
3. Brake tube
4. Proportioning valve } <Vehicles without A.B.S.>
5. 6-way connector <SPACE WAGON>
6. Master cylinder
 - Adjustment of clearance between brake booster push rod and primary piston

Brake booster removal steps

6. Master cylinder
 - Adjustment of clearance between brake booster push rod and primary piston

7. Vacuum hose
8. Check valve
9. Fitting
10. Split pin
11. Washer
12. Clevis pin
13. Brake booster installation nut
14. Spacer
15. Sealer
16. Brake booster



SERVICE POINTS OF INSTALLATION

6. CONNECTION OF THE VACUUM HOSE

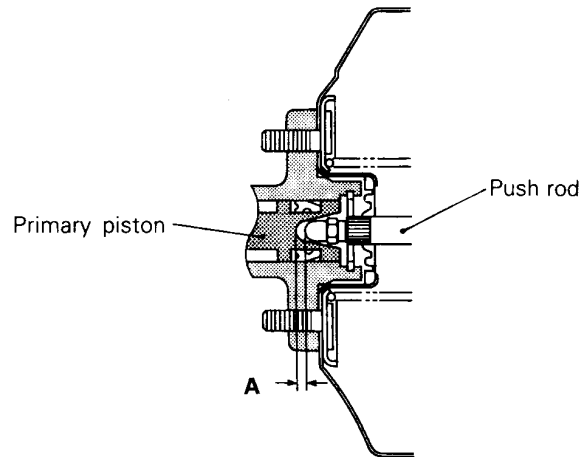
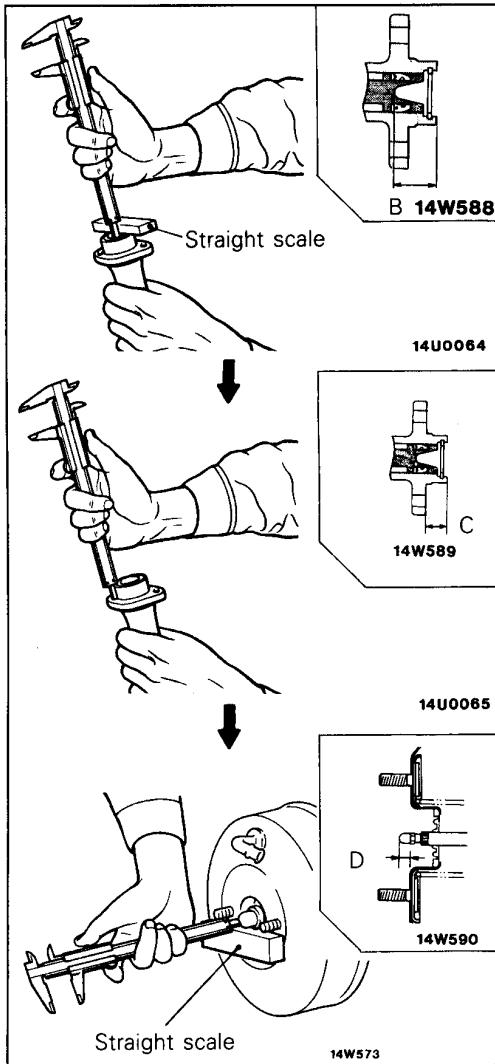
- (1) Install to the pipe part of the brake booster so that the amount of insertion of the vacuum hose is as shown in the figure.

Caution

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

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

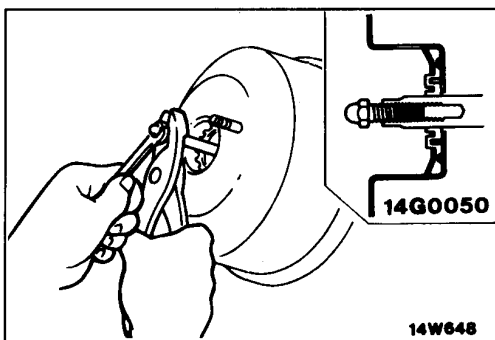
● **ADJUSTMENT OF CLEARANCE BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON**



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

$$A = B - C - D$$

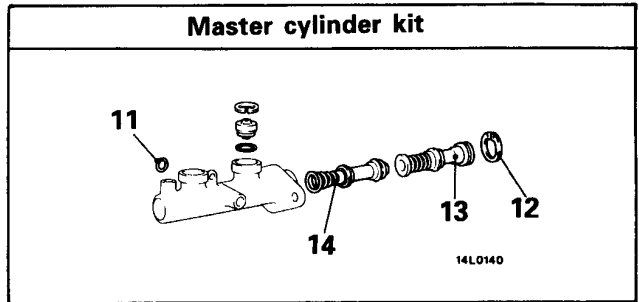
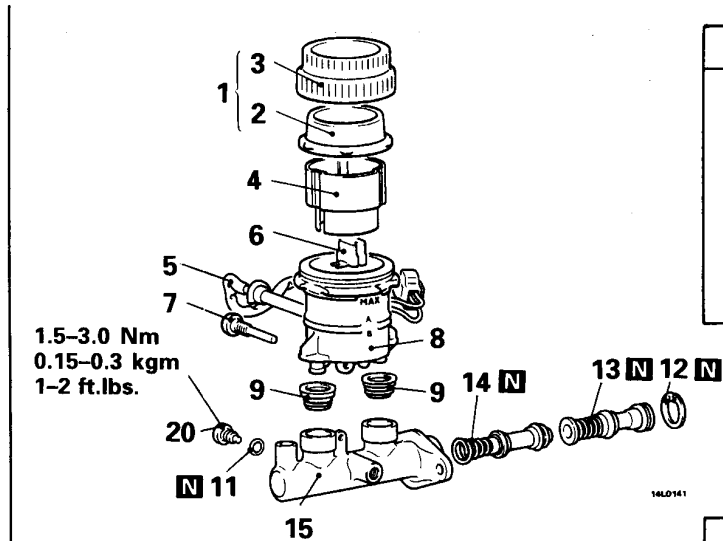
Standard value (A):
 7 + 8 inch brake booster
 0.5–0.7 mm (0.020–0.028 in.)
 8 + 9 inch brake booster
 0.6–0.8 mm (0.024–0.031 in.)



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.

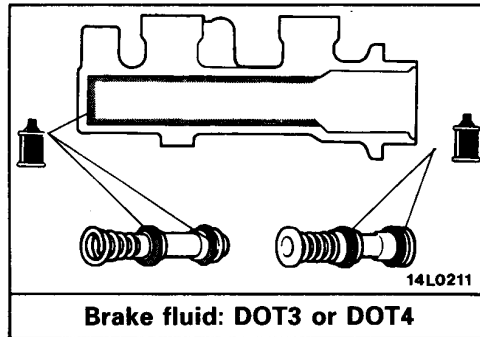
**MASTER CYLINDER
DISASSEMBLY AND REASSEMBLY**

E35IE--

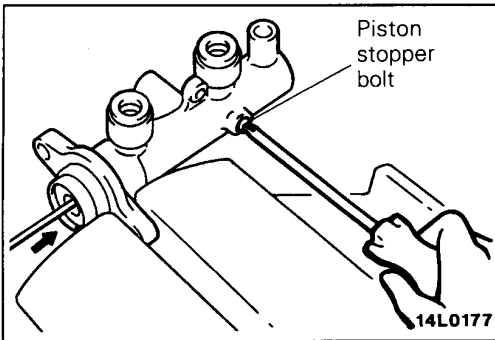


Disassembly steps

1. Reservoir cap assembly
2. Diaphragm
3. Reservoir cap
4. Filter <Vehicles with A.B.S.>
5. Brake fluid level sensor
6. Float
7. Reservoir stopper bolt
8. Reservoir tank
9. Reservoir seal
10. Piston stopper bolt
11. Gasket
12. Stopper ring
13. Primary piston assembly
14. Secondary piston assembly
15. Master cylinder body



Caution
Do not disassemble the primary and secondary piston assembly.

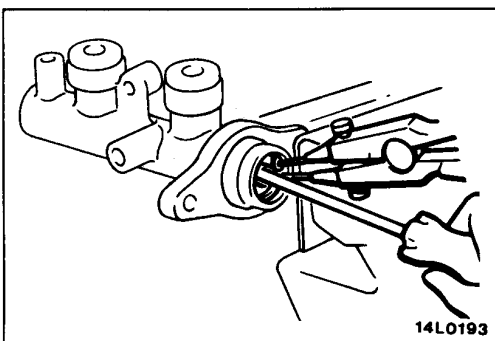


SERVICE POINTS OF DISASSEMBLY

E35IFAE

10. DISASSEMBLY OF PISTON STOPPER BOLT

Remove the piston stopper bolt, while depressing the piston.



12. DISASSEMBLY OF PISTON STOPPER RING

Remove the piston stopper ring, while depressing the piston.

INSPECTION

E35IGAF

- 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 LINE

REMOVAL AND INSTALLATION

Vehicles without ABS

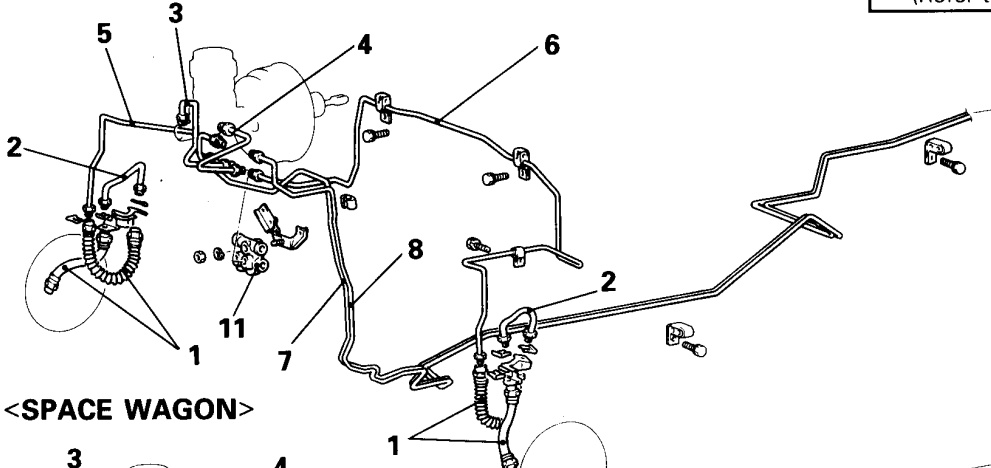
<SPACE RUNNER>

Pre-removal Operation

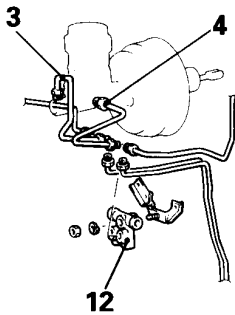
- Draining of Brake Fluid

Post-installation Operation

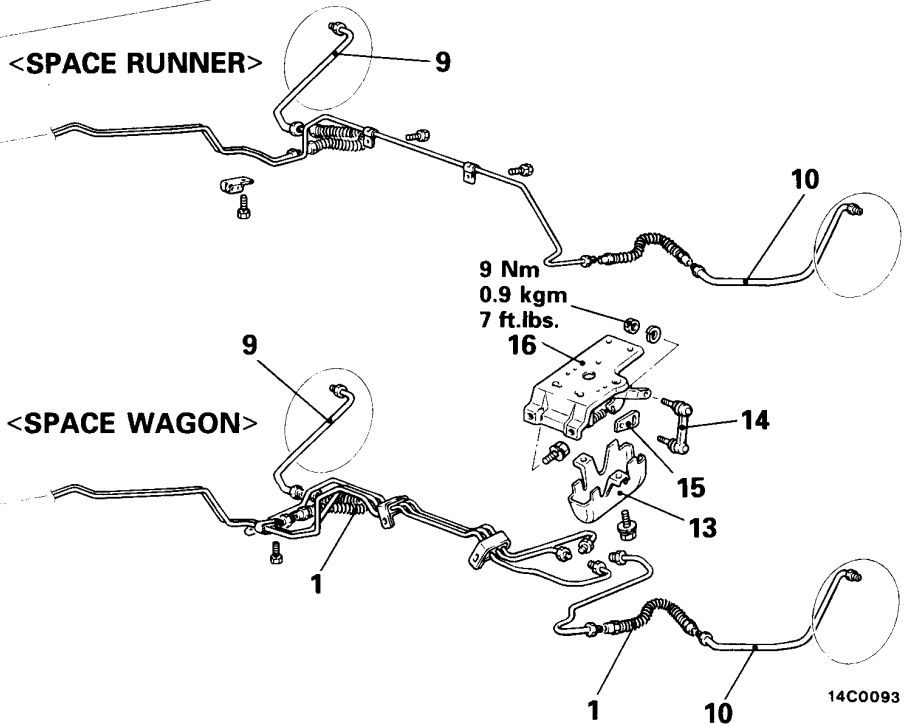
- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-53.)



<SPACE WAGON>



<SPACE RUNNER>



<SPACE WAGON>

- 1. Brake hose
- 2. Brake pipe (strut)
- 3. Brake pipe (B)
- 4. Brake pipe (A)
- 5. Brake pipe (front R.H.)
- 6. Brake pipe (front L.H.)
- 7. Brake pipe (main R.H.)
- 8. Brake pipe (main L.H.)
- 9. Brake pipe (rear R.H.)
- 10. Brake pipe (rear L.H.)
- 11. Proportioning valve
- 12. 6-way connector

- 13. Cover
- 14. Link assembly
- 15. Link bracket
- 16. Load-sensing proportioning valve assembly

Flared brake line nuts

- 15 Nm
- 1.5 kgm
- 11 ft.lbs.




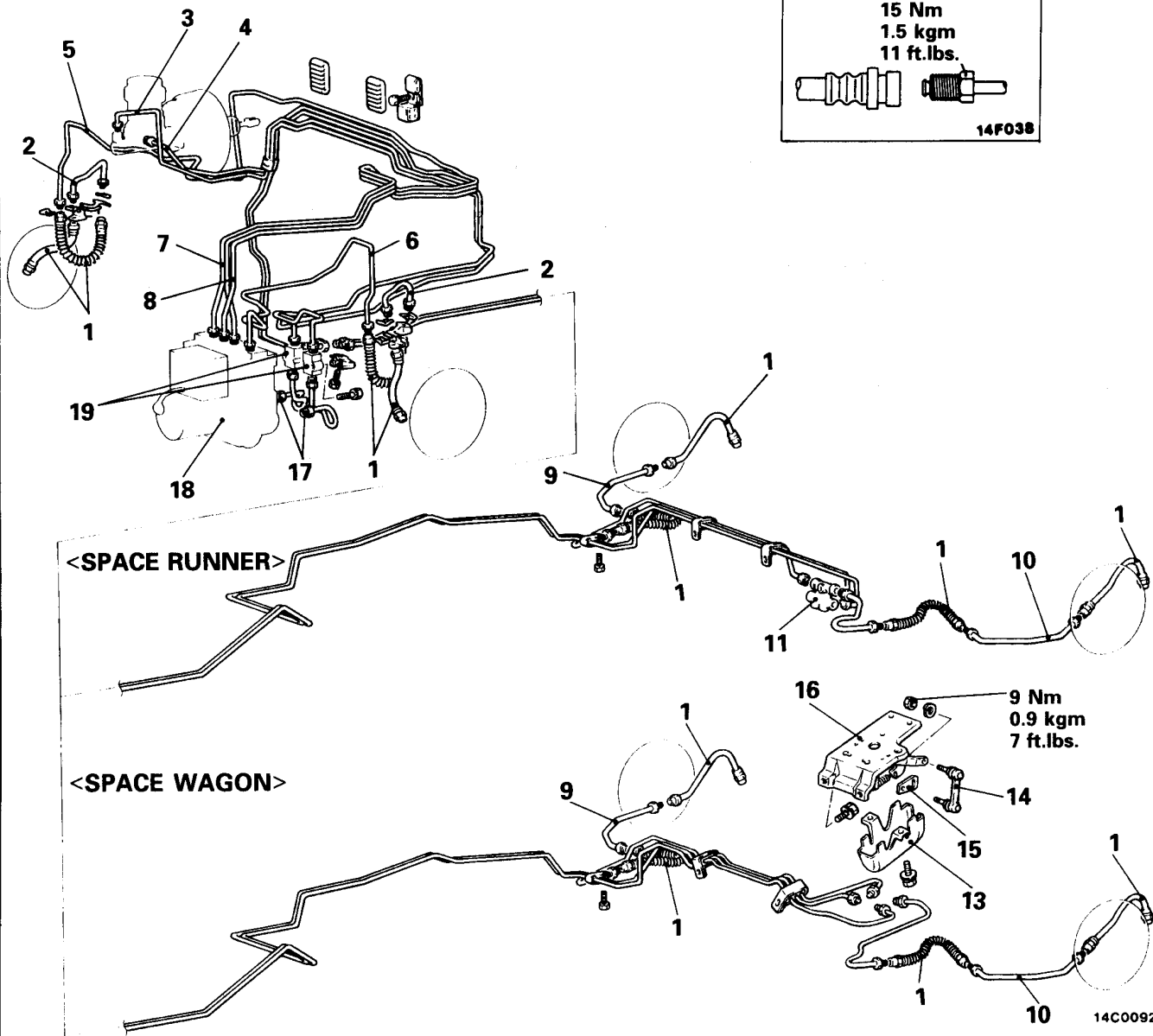
14F038

VEHICLES WITH ABS

Pre-removal Operation
 • Draining of Brake Fluid

Post-installation Operation
 • Supplying Brake Fluid
 • Bleeding Brake Lines
 (Refer to P.35-53.)

Flared brake line nuts
 15 Nm
 1.5 kgm
 11 ft.lbs.

 14F038

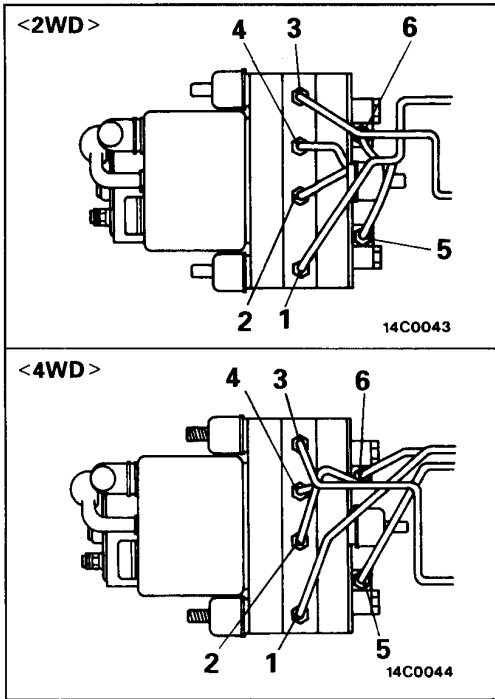


- | | |
|----------------------------|---|
| 1. Brake hose | 11. Proportioning valve |
| 2. Brake pipe (strut) | 13. Cover |
| 3. Brake pipe (B) | 14. Link assembly |
| 4. Brake pipe (A) | 15. Link bracket |
| 5. Brake pipe (front R.H.) | 16. Load-sensing proportioning valve assembly |
| 6. Brake pipe (front L.H.) | 17. Brake pipe |
| 7. Brake pipe (main R.H.) | ◆◆ 18. Hydraulic unit |
| 8. Brake pipe (main L.H.) | 19. 2-way connector |
| 9. Brake pipe (rear R.H.) | |
| 10. Brake pipe (rear L.H.) | |

INSPECTION

E35KCAA

- Check the brake pipes for cracks, crimps and corrosion.
- Check the brake hoses for cracks, damage and leakage.
- Check the flared brake line nuts for damage and leakage.



SERVICE POINTS OF INSTALLATION

E35KDAK a

18.CONNECTION OF THE PIPES TO THE HYDRAULIC UNIT

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

1. Hydraulic unit – front brake (L.H.)
2. Hydraulic unit – rear brake (R.H.)
3. Hydraulic unit – front brake (R.H.)
4. Hydraulic unit – rear brake (L.H.)
5. Hydraulic unit – master cylinder (for left front and right rear)
6. Hydraulic unit – master cylinder (for right front and left rear)

FRONT DISC BRAKE

E35LA--

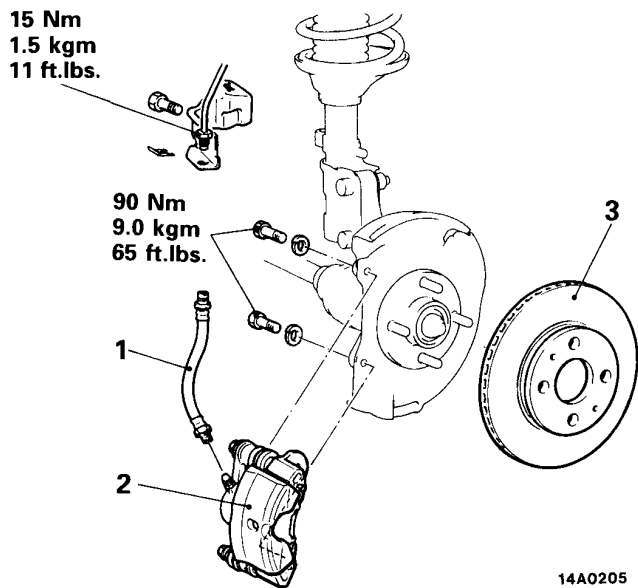
REMOVAL AND INSTALLATION

Pre-removal Operation

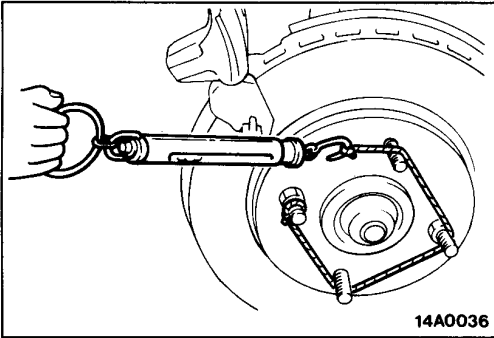
- Draining of Brake Fluid

Post-installation Operation

- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-53.)



1. Connection for the brake hose and the brake tube
- ◆◆ 2. Front brake assembly
3. Brake disc

**INSPECTION**

E35LCAC

- Check the brake disc for damage.

SERVICE POINTS OF INSTALLATION

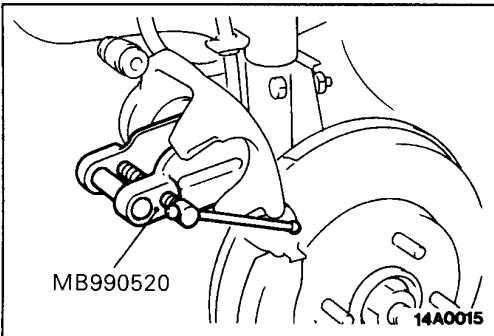
E35LDAF

2. INSTALLATION OF FRONT BRAKE ASSEMBLY

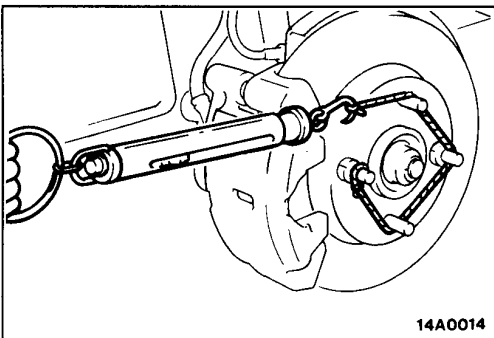
- (1) Measure hub torque with pad removed to measure brake drag torque after pad installation.

NOTE

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



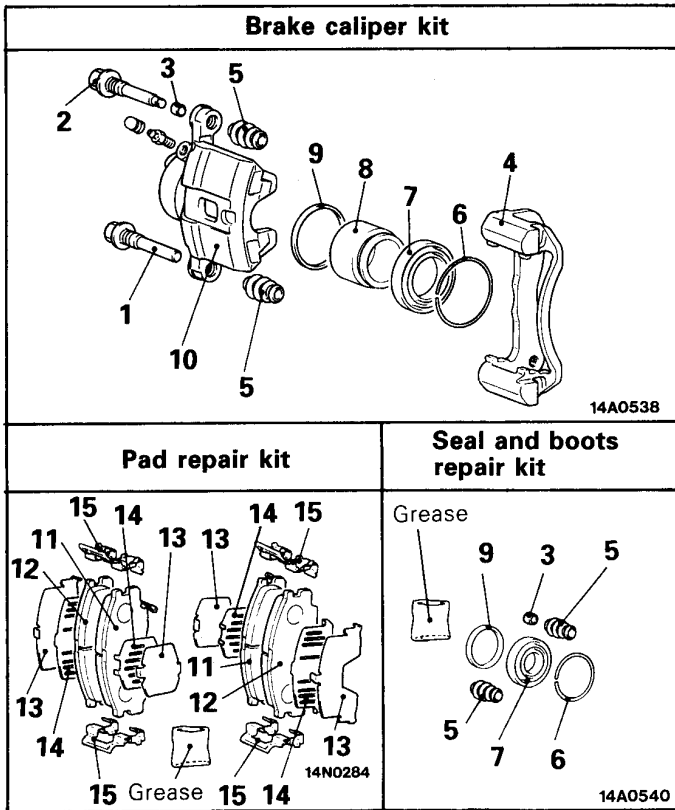
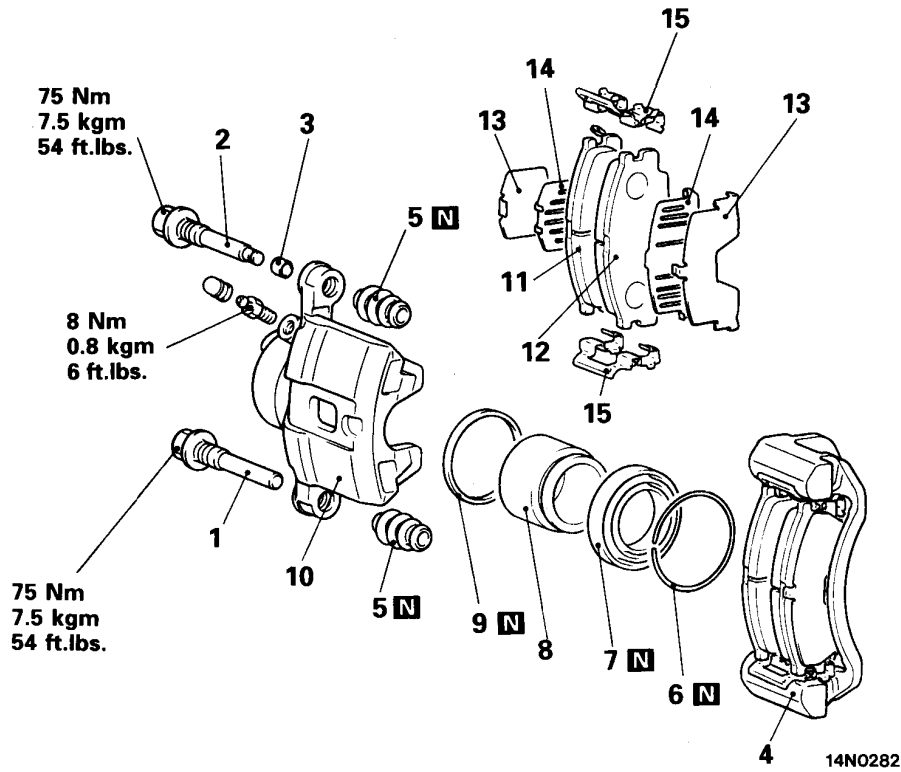
- (2) After installing the caliper support to the knuckle, use the special tool to expand the piston, and then install the caliper body.



- (3) Check brake drag torque as follows.
 - 1 Start engine and hold brake pedal down for 5 seconds. (Pedal depression force approx. 200 N [20 kg, 44 lbs.])
 - 2 Stop engine.
 - 3 Turn brake disc forward 10 times.
 - 4 Check brake drag torque with spring balance.
- (4) 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.

Standard value: 70 N (7.0 kg, 15.4 lbs.) or less [4 Nm (0.4 kgm, 3 ft.lbs.)] or less

DISASSEMBLY AND REASSEMBLY



Caliper assembly disassembly steps

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

Pad assembly disassembly steps

- ◆◆ 1. Guide pin
- ◆◆ 2. Lock pin
- ◆◆ 3. Bushing
- ◆◆ 4. Caliper support (pad, clip, shim)
- ◆◆ 11. Pad assembly (with wear indicator)
- ◆◆ 12. Pad assembly
- ◆◆ 13. Outer shim
- ◆◆ 14. Inner shim
- ◆◆ 15. Clip

LUBRICATION POINTS

14L0127

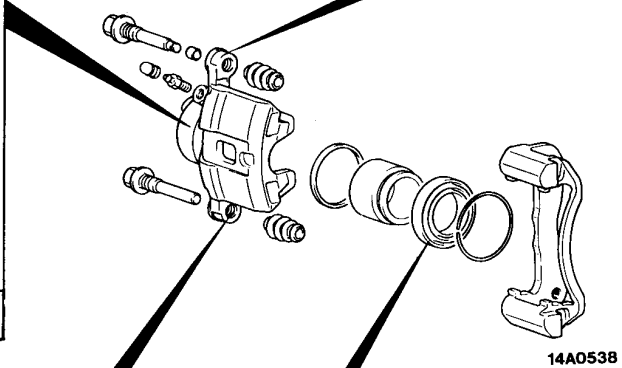
14Y184

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

14A0541

Grease: Repair kit grease (orange)



14A0541

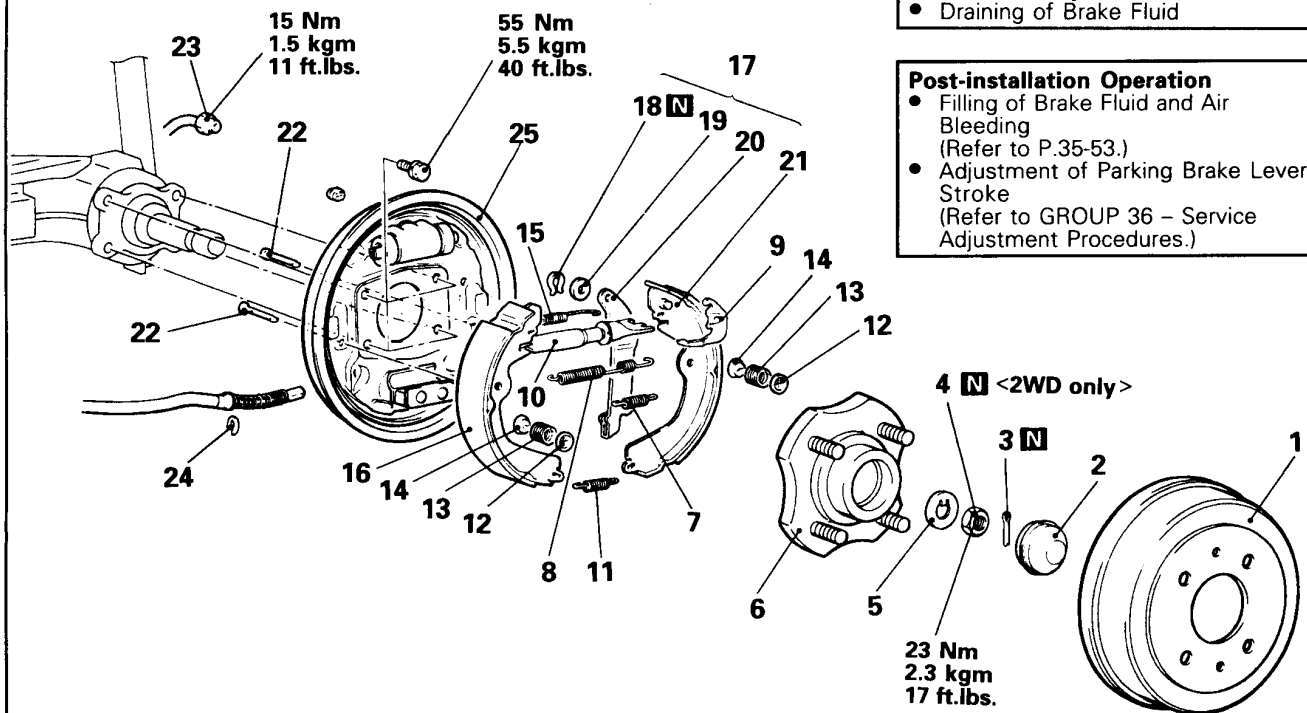
Grease: Repair kit grease (orange)

14L0128

Grease: Repair kit grease (orange)

REAR DRUM BRAKE

REMOVAL AND INSTALLATION



Pre-removal Operation

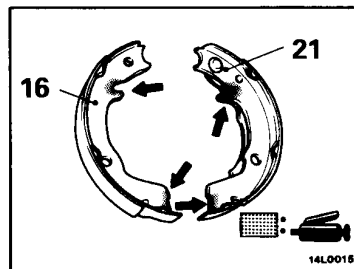
- Draining of Brake Fluid

Post-installation Operation

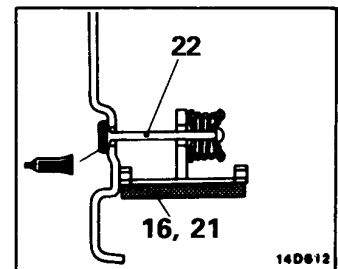
- Filling of Brake Fluid and Air Bleeding (Refer to P.35-53.)
- Adjustment of Parking Brake Lever Stroke (Refer to GROUP 36 – Service Adjustment Procedures.)

Removal steps

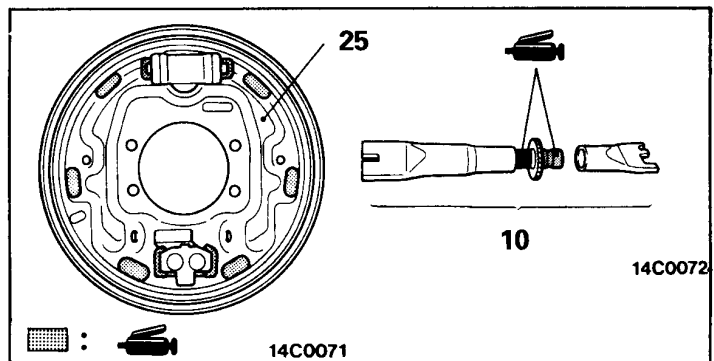
1. Brake drum
2. Hub cap <2WD>
3. Split pin <4WD>
4. Lock nut
5. Washer
6. Rear hub washer
7. Lever return spring
8. Shoe-to-lever spring
9. Adjuster lever
10. Auto adjuster assembly
11. Retainer
12. Shoe hold-down cup
13. Shoe hold-down spring
14. Shoe hold-down cup
15. Shoe-to-shoe spring
16. Shoe and lining assembly
17. Shoe and lever assembly
18. Retainer
19. Wave washer
20. Parking lever
21. Shoe and lining assembly
22. Shoe hold-down pin
23. Connection for the brake tube
24. Snap ring
25. Backing plate



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



Specified sealant:
 3M ATD Part No. 8513
 or equivalent



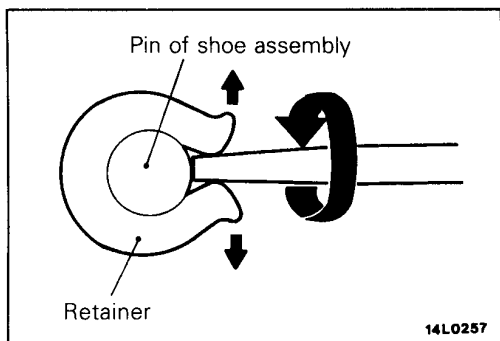
Specified grease: Brake grease SAE J310, NLGI No. 1

SERVICE POINTS OF REMOVAL

E35UBEA

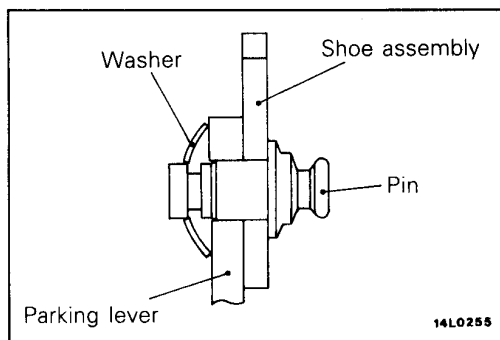
6. REMOVAL OF REAR HUB ASSEMBLY

- (1) For vehicles with 2WD, the rear hub unit bearing should not be disassembled.
- (2) For vehicles with 4WD, it is necessary to replace the wheel bearing when the hub assembly is removed. For the replacement procedure, refer to GROUP 27 – Rear Axle Hub.



18. REMOVAL OF RETAINER

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

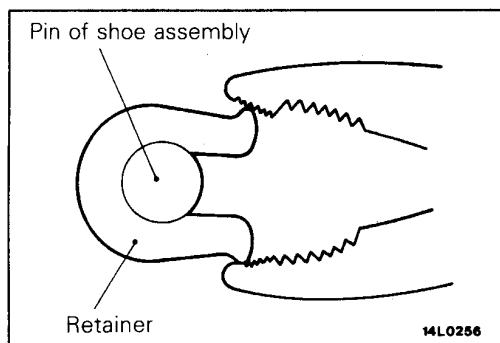


SERVICE POINTS OF INSTALLATION

E35UDEA

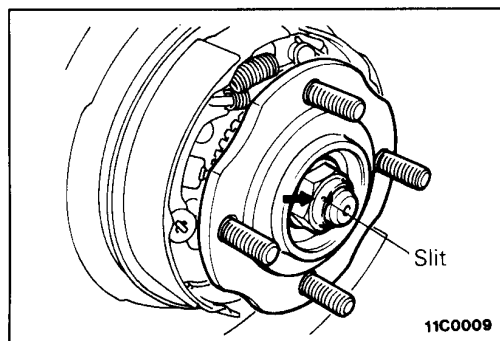
19. INSTALLATION OF WAVE WASHER

Install the washer in the direction shown in the illustration.



18. INSTALLATION OF RETAINER

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



4. INSTALLATION OF LOCK NUT <2WD>

After tightening the lock nut to the specified torque, crimp it at the slit position of the spindle.

REAR DRUM BRAKE WHEEL CYLINDER

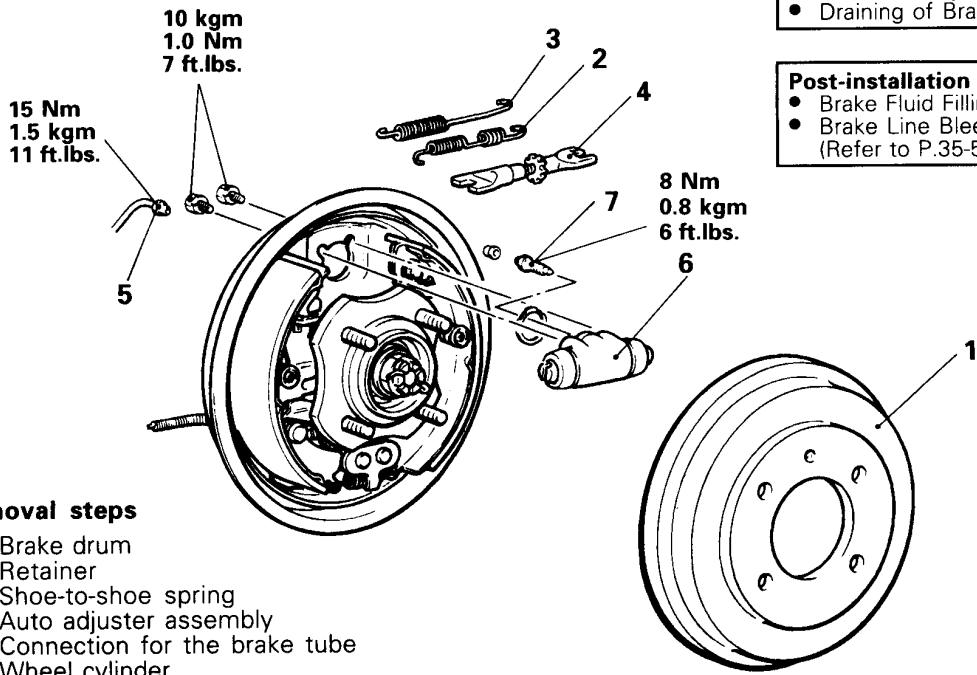
REMOVAL AND INSTALLATION

Pre-removal Operation

- Draining of Brake Fluid

Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding (Refer to P.35-53.)

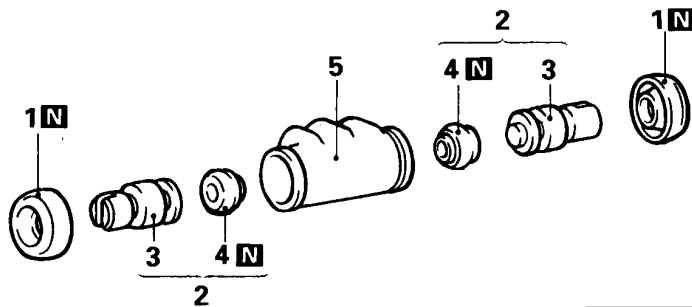
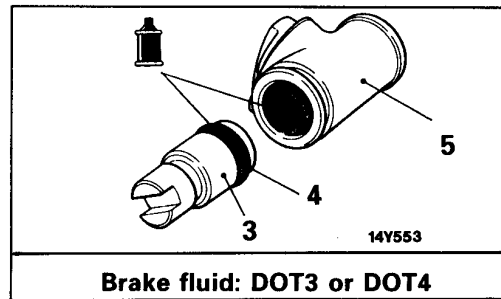
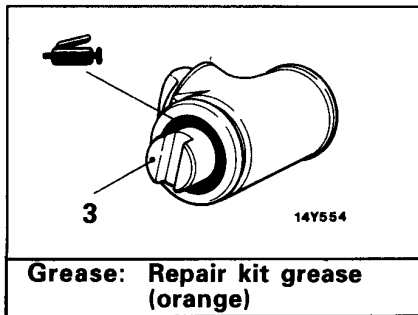


Removal steps

1. Brake drum
2. Retainer
3. Shoe-to-shoe spring
4. Auto adjuster assembly
5. Connection for the brake tube
6. Wheel cylinder
7. Bleeder screw

14C0079

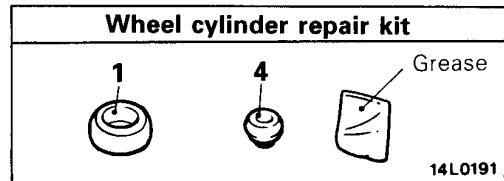
DISASSEMBLY AND REASSEMBLY

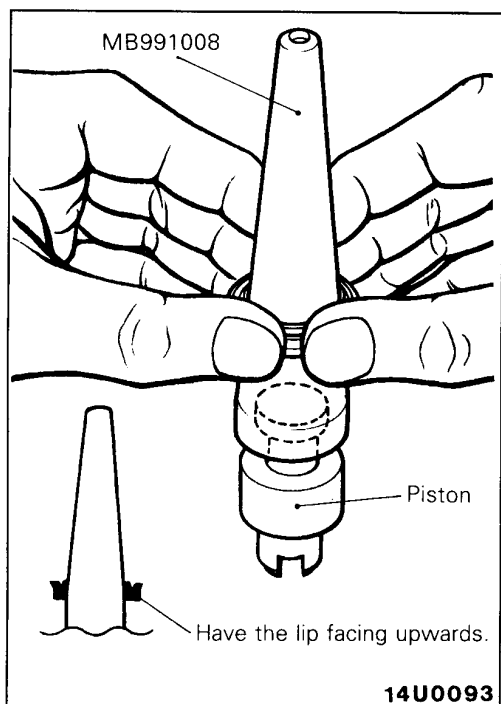


14L0192

Disassembly steps

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





INSPECTION

E35VGAB

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

SERVICE POINTS OF REASSEMBLY

E35VHAE

4. REASSEMBLY OF PISTON CUPS/3. PISTONS

- (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 DISC BRAKE <VEHICLES WITH A.B.S.>

REMOVAL AND INSTALLATION

Pre-removal Operation

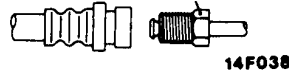
- Draining of Brake Fluid

Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding
(Refer to P.35-53.)

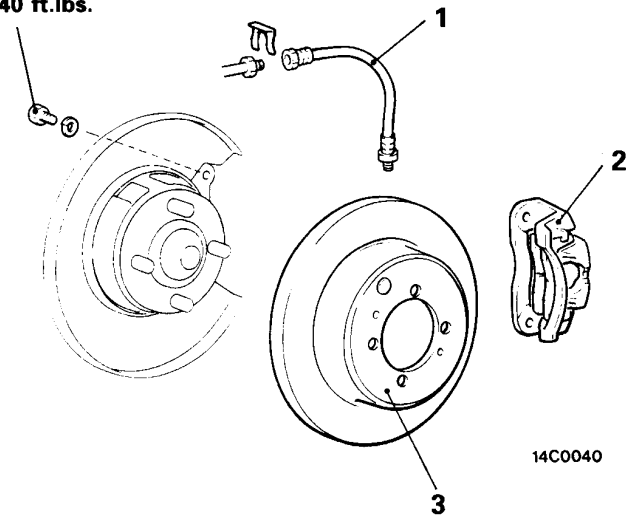
Flared brake line nuts

15 Nm
1.5 kgm
11 ft.lbs.



14F038

55 Nm
5.5 kgm
40 ft.lbs.

**Removal steps**

1. Connection for the brake hose
- ◆ 2. Rear brake assembly
3. Brake disc

INSPECTION

E35RCAD

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

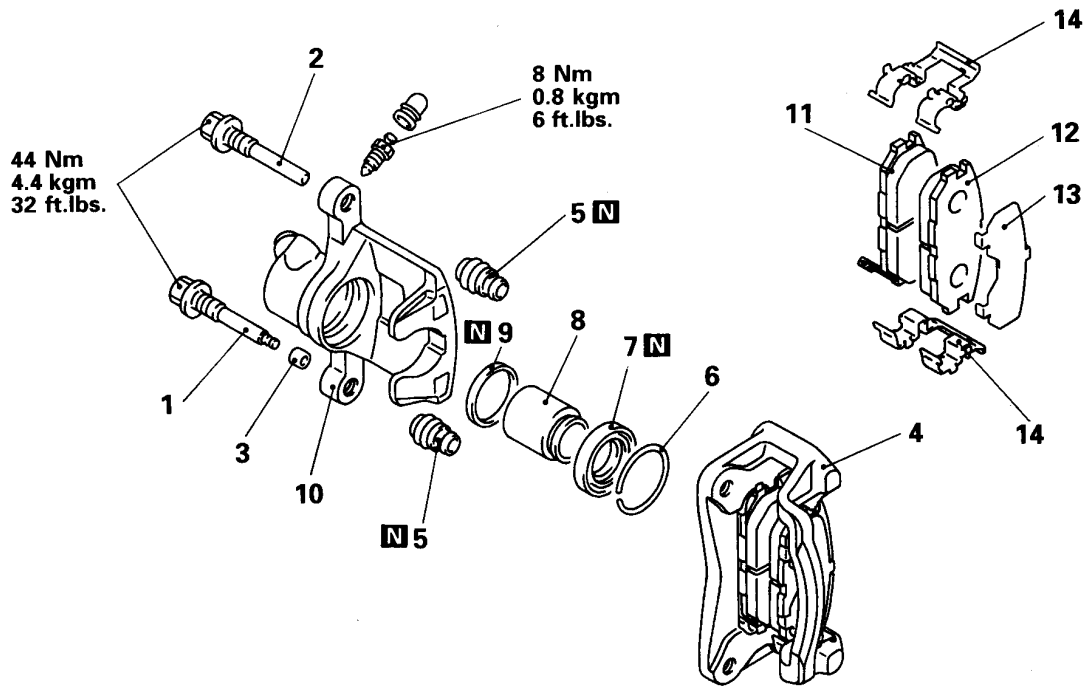
SERVICE POINTS OF INSTALLATION

E35RDAG

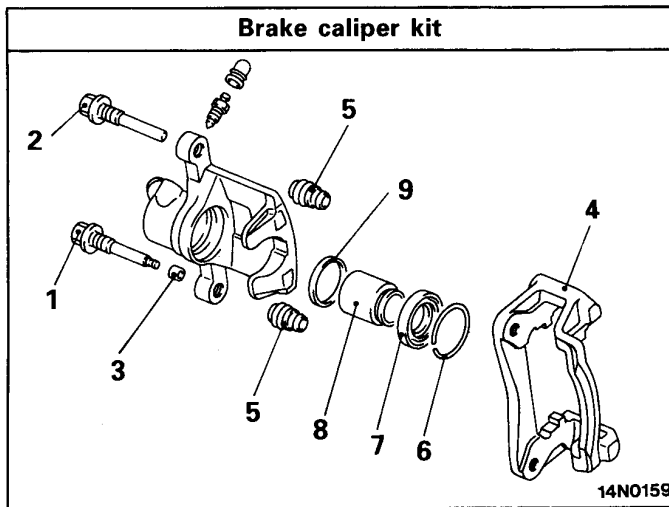
2. INSTALLATION OF REAR BRAKE ASSEMBLY

Install by the same procedure as for the front brake assembly. (Refer to P.35-77.)

DISASSEMBLY AND REASSEMBLY



14N0158



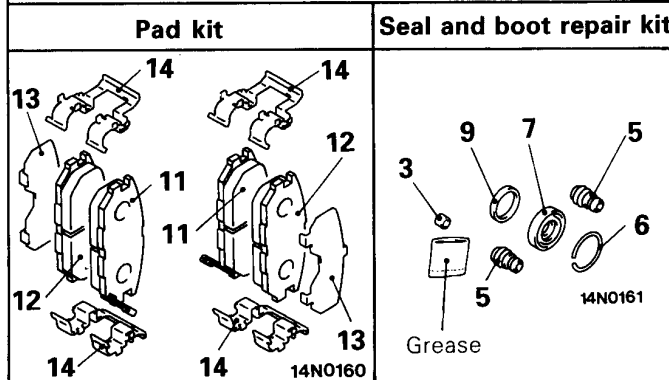
14N0159

Caliper assembly disassembly steps

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

Pad assembly disassembly steps

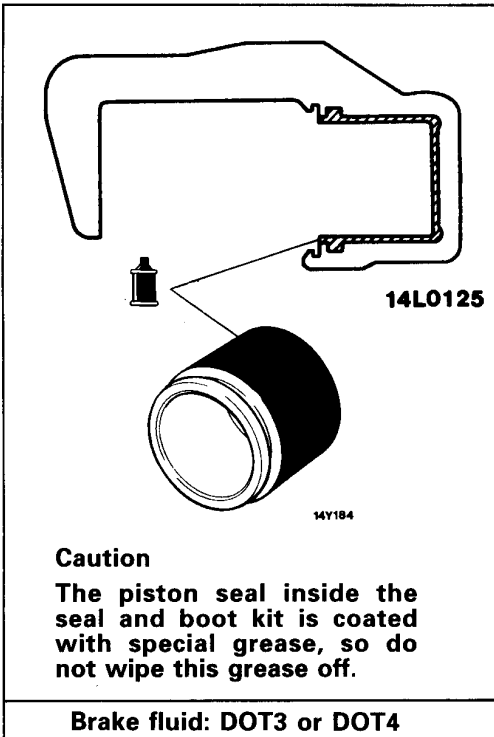
- ◆◆ 1. Guide pin
- ◆◆ 2. Lock pin
- ◆◆ 3. Bushing
- ◆◆ 4. Caliper support (pad, clip, shim)
- ◆◆ 11. Pad and wear indicator assembly
- ◆◆ 12. Pad assembly
- ◆◆ 13. Outer shim
- ◆◆ 14. Clip



14N0161

14N0160

LUBRICANT POINTS

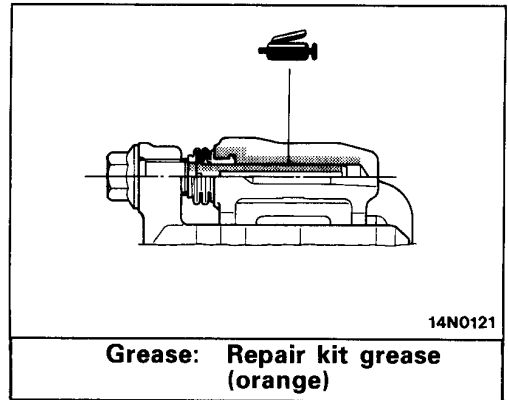


14L0125

14Y184

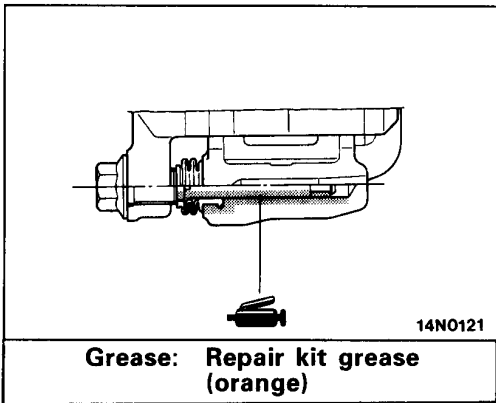
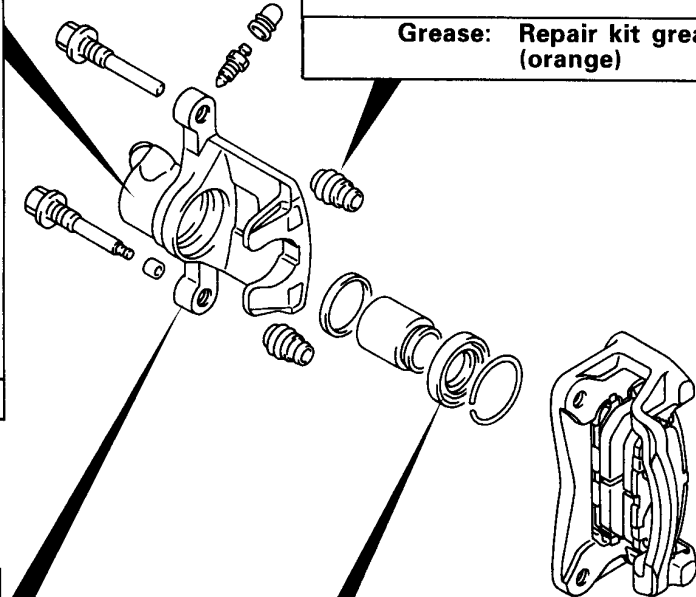
Caution
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4



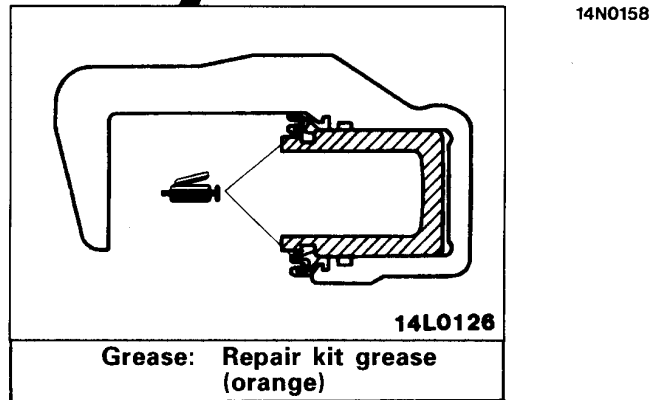
14N0121

Grease: Repair kit grease (orange)



14N0121

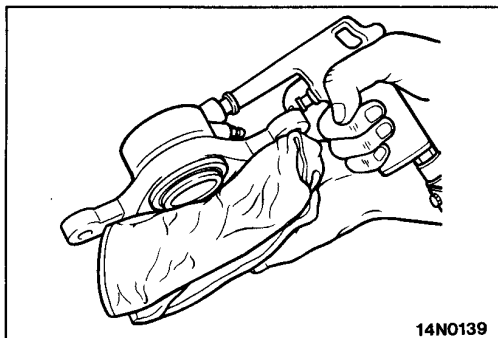
Grease: Repair kit grease (orange)



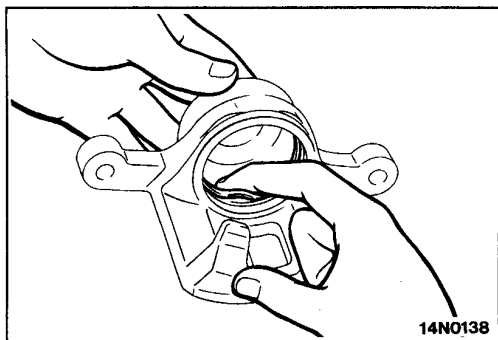
14L0126

Grease: Repair kit grease (orange)

14N0158



14N0139



14N0138

SERVICE POINTS OF DISASSEMBLY

E35RGAE

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

7. REMOVAL OF PISTON BOOT/8. PISTON

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

Caution

Blow compressed air gently.

9. REMOVAL OF PISTON SEAL

- (1) Remove piston seal with finger tip.

Caution

Do not use (-) screwdriver or other tool to prevent damage to inner cylinder.

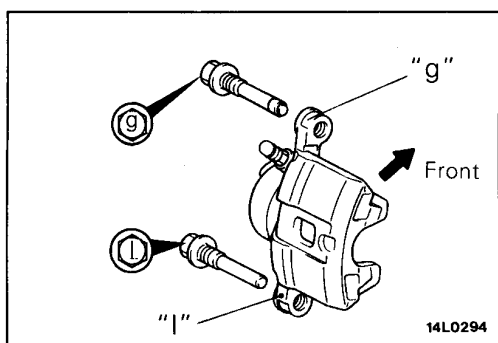
- (2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

Specified brake fluid: DOT3 or DOT4

INSPECTION

E35RHAE

- 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.



14L0294

SERVICE POINTS OF REASSEMBLY

E35RIAF

2. INSTALLATION OF LOCK PIN/1. GUIDE PIN

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

HYDRAULIC UNIT <VEHICLES WITH A.B.S.>

E35WA--

REMOVAL AND INSTALLATION

Pre-removal Operation

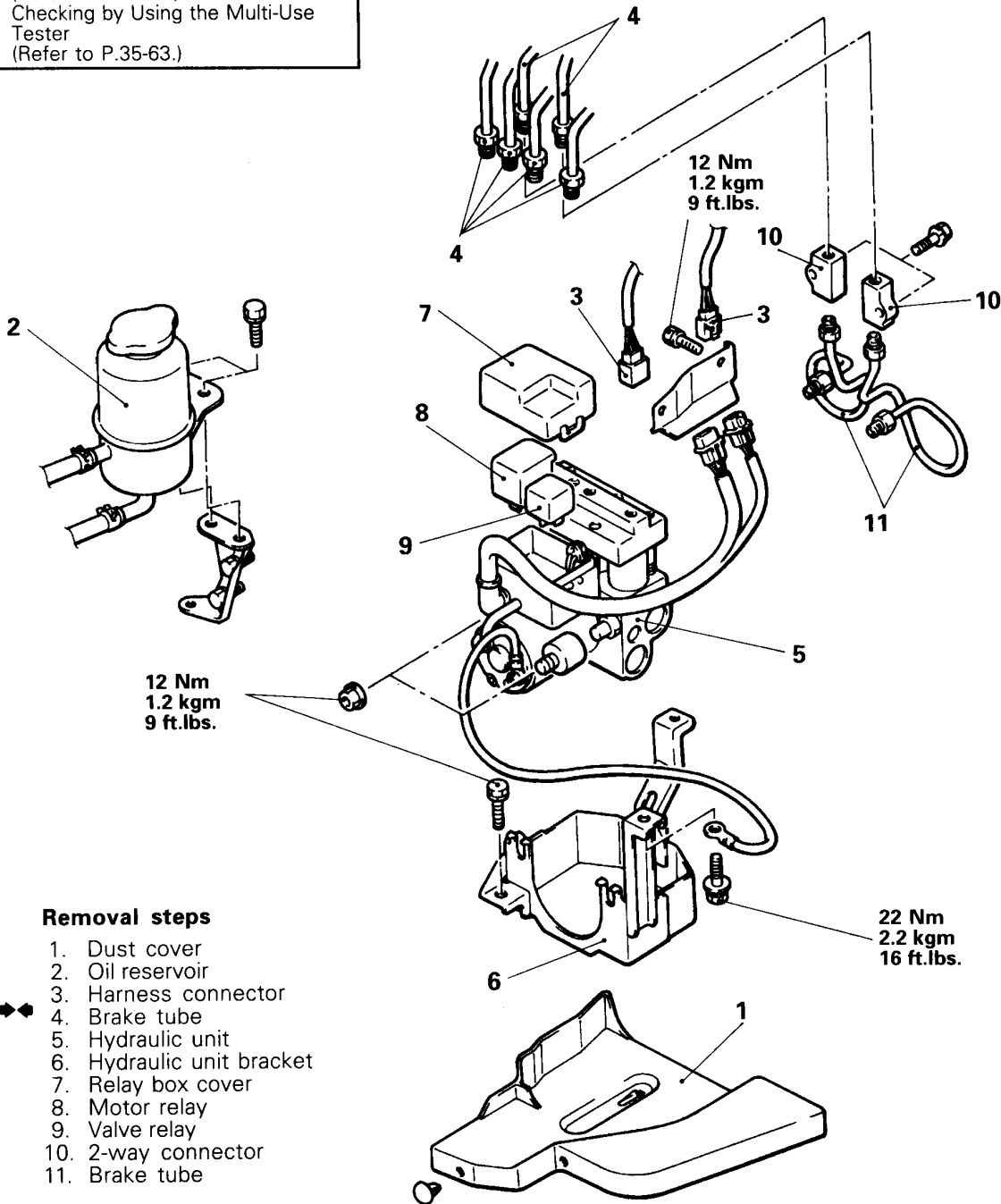
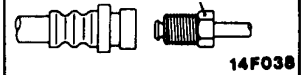
- Draining of Brake Fluid
- Removal of the Splash Shield

Post-installation Operation

- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-53.)
- Checking by Using the Multi-Use Tester (Refer to P.35-63.)

Flared brake line nuts

15 Nm
1.5 kgm
11 ft.lbs.



Removal steps

1. Dust cover
2. Oil reservoir
3. Harness connector
4. Brake tube
5. Hydraulic unit
6. Hydraulic unit bracket
7. Relay box cover
8. Motor relay
9. Valve relay
10. 2-way connector
11. Brake tube

14C0049

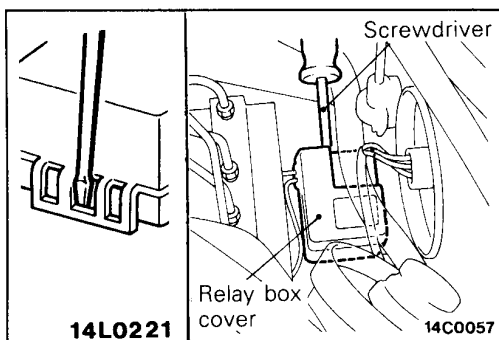
SERVICE POINTS OF REMOVAL

E35WBAH

5. REMOVAL OF THE HYDRAULIC UNIT

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.



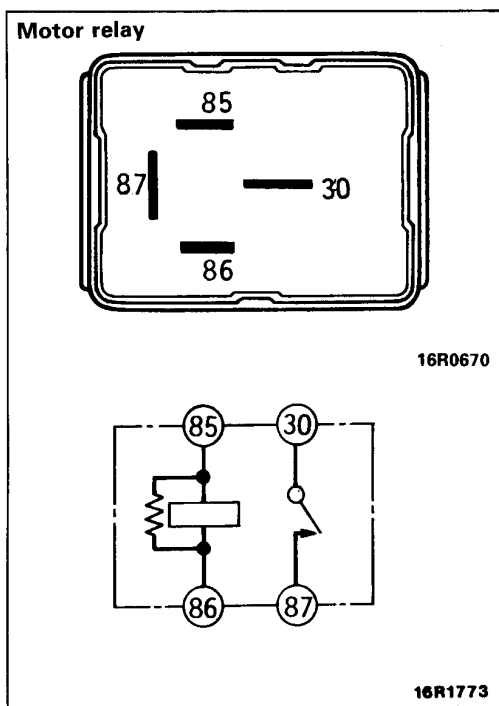
INSPECTION

E35WCAE

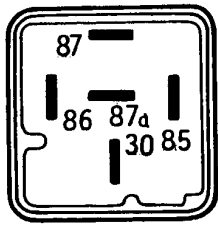
- (1) Insert the tip of a screwdriver into the space between the hydraulic unit and the relay box cover and use it to open the tab at one place, and then remove the cover.
- (2) Check whether there is continuity between terminals when there is no current flow at each relay and when there is current flow.

MOTOR RELAY

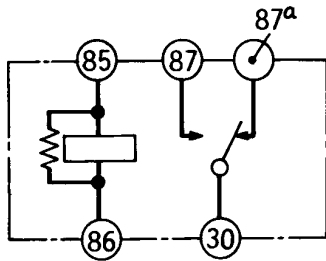
When no current flows	Between terminals 85 - 86	30 - 60 Ω
	Between terminals 30 - 87	No continuity (∞ Ω)
When current flows between terminal 85 - 86	Between terminals 30 - 87	Continuity (∞ Ω)



Valve relay



16R0670

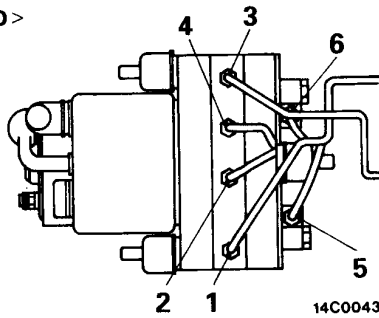


16R1772

VALVE RELAY

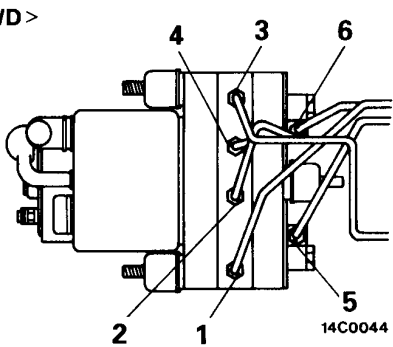
When no current flows	Between terminals 85 - 86	60 - 120 Ω
	Between terminals 30 - 87a	Continuity (approx. 0 Ω)
	Between terminals 30 - 87	No continuity (∞ Ω)
When current flows between terminal 85 - 86	Between terminals 30 - 87a	Continuity (∞ Ω)
	Between terminals 30 - 87	Continuity (approx. 0 Ω)

<2WD>



14C0043

<4WD>



14C0044

SERVICE POINTS OF INSTALLATION

E35KDAK a

4. CONNECTION OF THE BRAKE TUBE

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

1. Hydraulic unit – front brake (L.H.)
2. Hydraulic unit – rear brake (R.H.)
3. Hydraulic unit – front brake (R.H.)
4. Hydraulic unit – rear brake (L.H.)
5. Hydraulic unit – master cylinder (for left front and right rear)
6. Hydraulic unit – master cylinder (for right front and left rear)

WHEEL SPEED SENSOR <VEHICLES WITH A.B.S.>

E15YA--

REMOVAL AND INSTALLATION

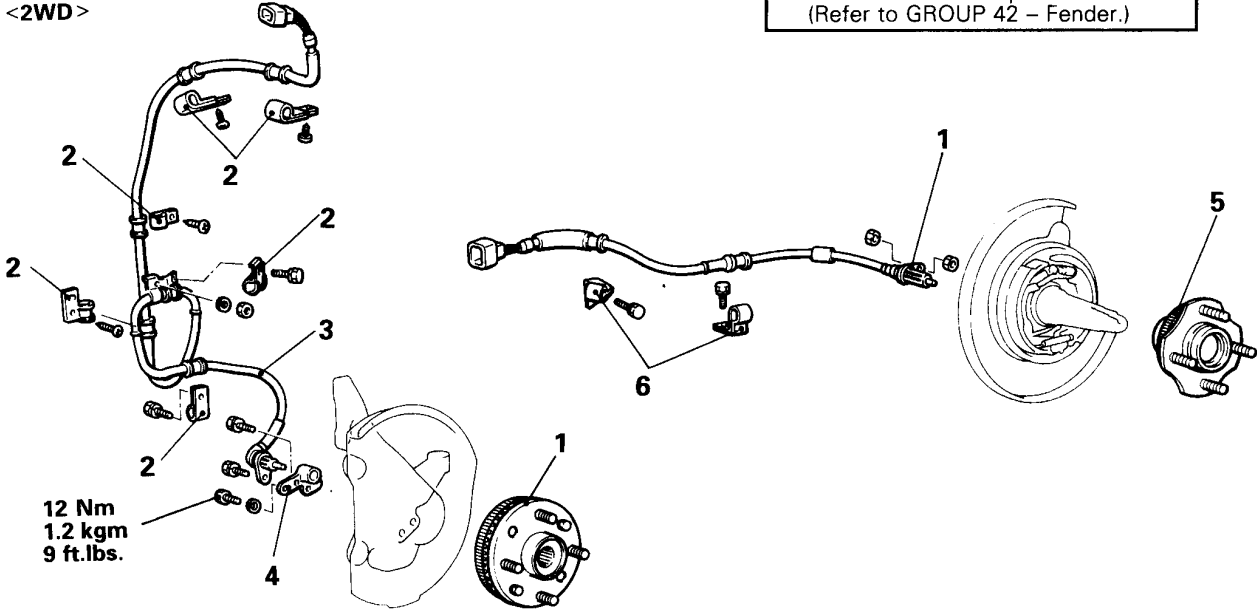
Pre-removal Operation

- Removal of the Splash Shield (Refer to GROUP 42 – Fender.)

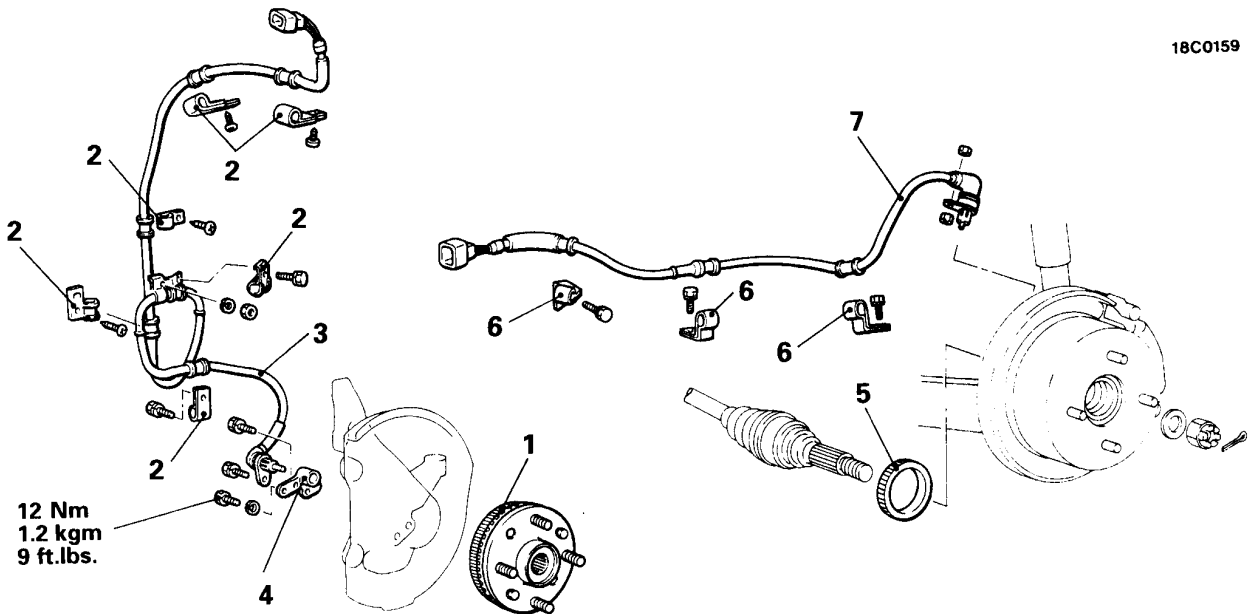
Post-installation Operation

- Checking of the Anti-lock Brake System (Refer to P.35-8, 28.)
- Installation of the Splash Shield (Refer to GROUP 42 – Fender.)

<2WD>



<4WD>



18C0159

18C0160

Front speed sensor removal steps

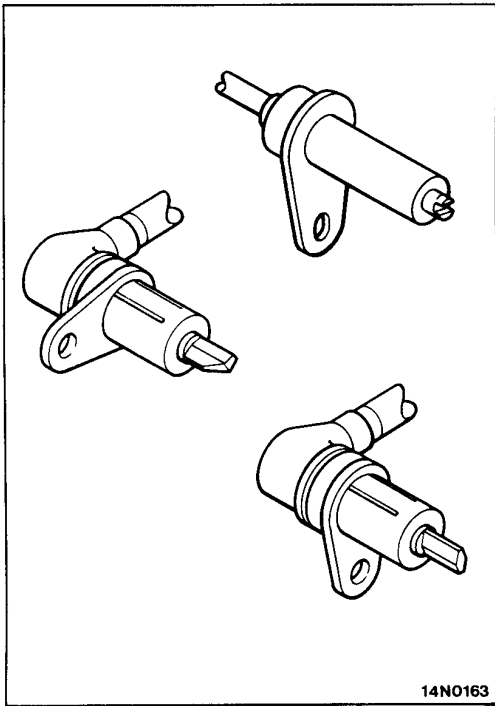
1. Front toothed rotor (Refer to GROUP 26 – Hub and Knuckle.)
2. Clip
3. Front speed sensor
4. Front speed sensor bracket



Rear speed sensor removal steps

5. Rear toothed rotor (Refer to GROUP 27 – Rear Axle Hub <2WD>, Drive Shaft <4WD>)
6. Clip
7. Rear speed sensor





SERVICE POINTS OF REMOVAL

E35YBAE a

3. REMOVAL OF THE FRONT SPEED SENSOR/7. REAR SPEED SENSOR

Caution

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

INSPECTION

E35YCAA a

SPEED SENSOR

- (1) Check whether any metallic foreign material has adhered to the pole piece at the speed sensor tip, and, if so, remove it. Also check whether the pole piece is damaged, and if so, replace it with a new one.

NOTE

The pole piece can become magnetized because of the magnet built into the speed sensor, with the result that metallic foreign material easily adheres to it. Moreover, the pole piece may not be able to function to correctly sense the wheel rotation speed if it is damaged.

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

Standard value:

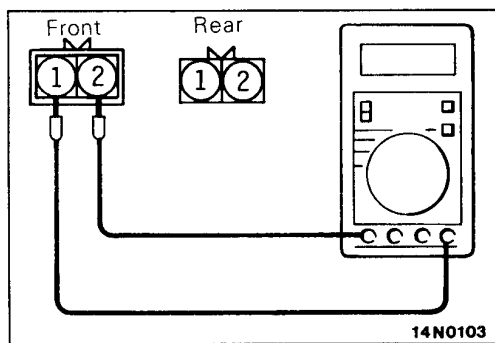
<2WD>	Front	0.8–1.2 kΩ
	Rear	0.55–0.8 kΩ
<4WD>		0.8–1.2 kΩ

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

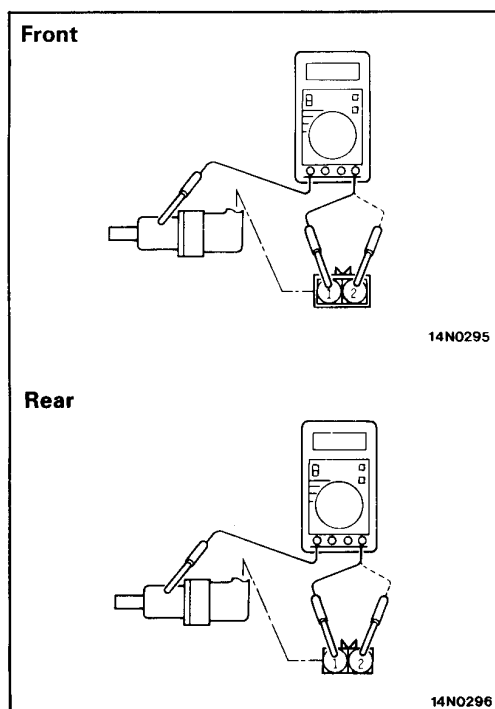


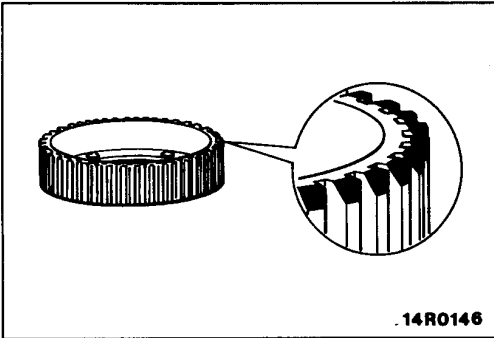
SPEED SENSOR INSULATION INSPECTION

- (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.

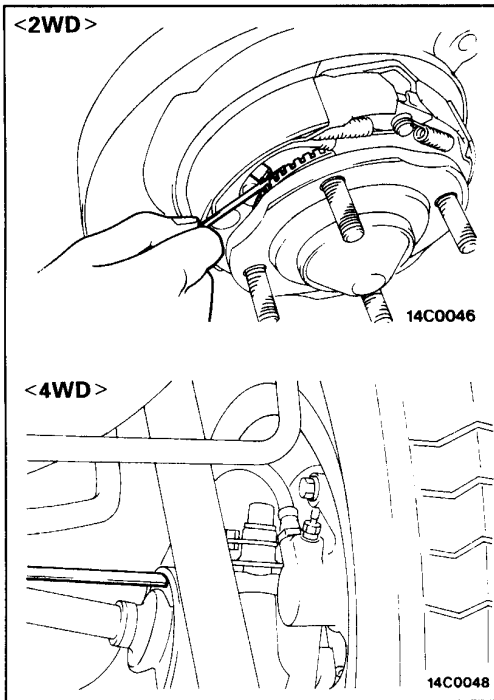
Standard value: 100 kΩ or more

- (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.

**SERVICE POINTS OF INSTALLATION**

E35YDAF

7. INSTALLATION OF REAR SPEED SENSOR

<2WD>

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface and then tighten the speed sensors at the position where the clearance is the standard value.

<4WD>

- (1) Remove the companion shaft and lower the drive shaft.
- (2) Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface and then tighten the speed sensors at the position where the clearance is the standard value.

Standard value:

<2WD>

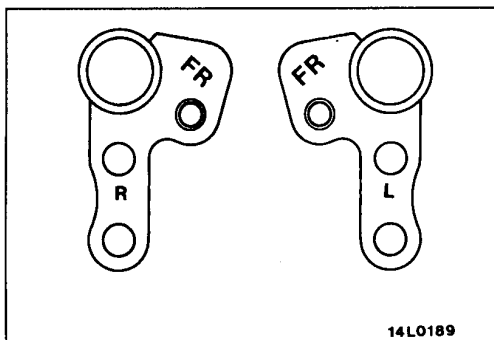
0.2–0.7 mm (0.008–0.028 in.)

<4WD>

0.3–0.9 mm (0.012–0.035 in.)**NOTE**

Check to be sure that there is no contact of the speed sensor's pole piece and the rotor's toothed surface when the rear hub assembly is slowly rotated one time.

If there is contact, it is probable that the rotor or the rear hub is installed incorrectly, recheck installation.

**4. INSTALLATION OF FRONT SPEED SENSOR BRACKET****NOTE**

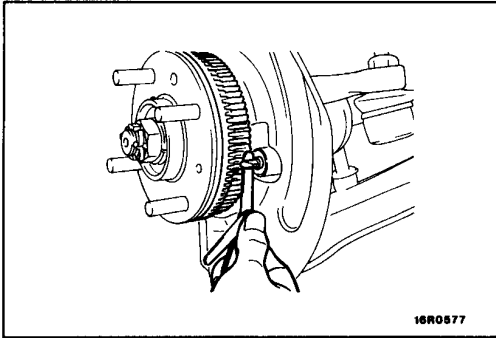
- (1) The shapes are different for the left and right speed sensor brackets. Each bracket has an identification symbol, so be sure to note these symbols and install correctly.

FR: Indicates that the bracket is for the front speed sensor.

R: Indicates that the bracket is for the right wheel.

L: Indicates that the bracket is for the left wheel.

- (2) Check to be sure, when installing the speed sensor to the bracket, that the letters 'FR' are visible.



3. INSTALLATION OF FRONT SPEED SENSOR

Insert a thickness gauge into the space between the speed sensor's pole piece and the rotor's toothed surface, and then tighten the speed sensor at the position where the clearance is the standard value all around.

Standard value: 0.3–0.9 mm (0.012–0.035 in.)

NOTE

If the clearance between the speed sensor's pole piece and the rotor's toothed surface is not within the standard value range, it is probable that the rotor is incorrectly installed, recheck installation.

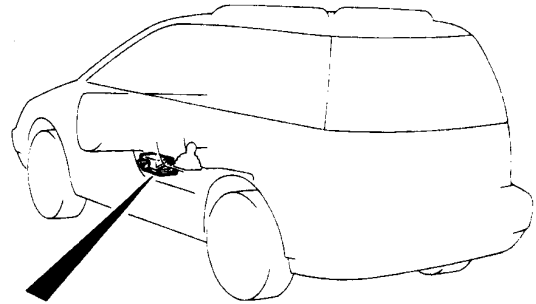
ELECTRONIC CONTROL UNIT <VEHICLES WITH A.B.S.>

E35ZA--

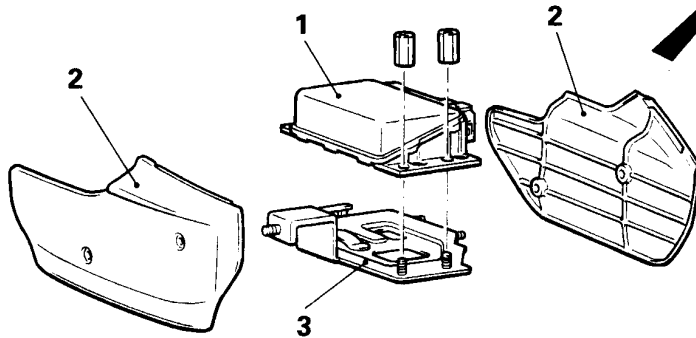
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

- Removal and Installation of Cup Holder Box (Refer to GROUP 52A – Floor Console.)

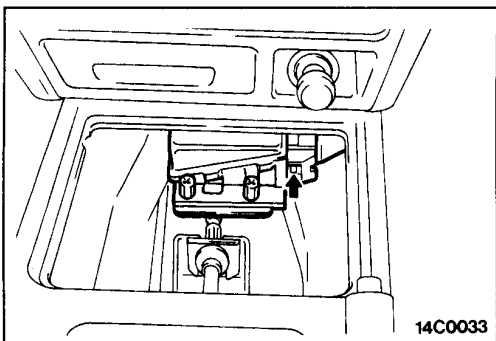


14C0070



Removal steps

- ↔
1. Electronic control unit
 2. Side cover
 3. Bracket



SERVICE POINTS OF REMOVAL

E35ZBAE

1. REMOVAL OF ELECTRONIC CONTROL UNIT

- (1) Remove the connector lock and take out the connector.
- (2) Tilt the electronic control unit sideways to remove it.

E35NA--

G-SENSOR <4WD – VEHICLES WITH A.B.S.>

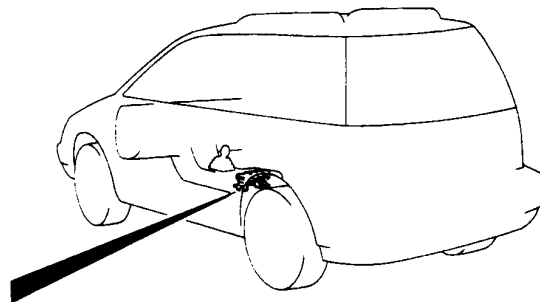
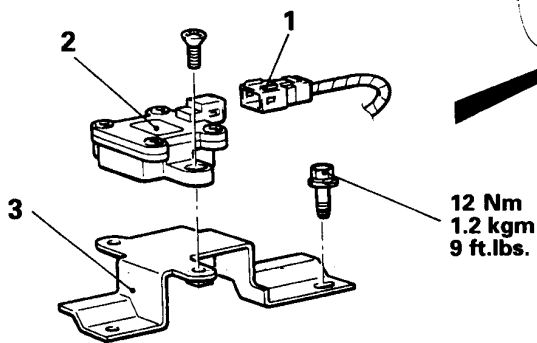
REMOVAL AND INSTALLATION

Pre-removal and Post-installation Operation

Removal and Installation of Floor Console Assembly (Refer to GROUP 52A – Floor Console)

CAUTION

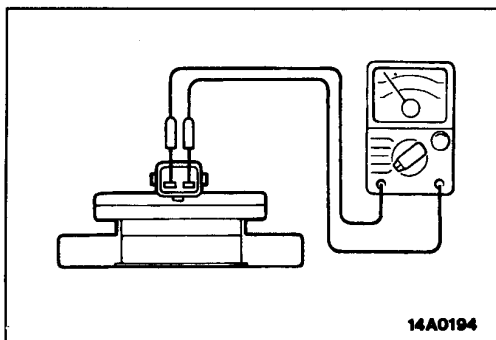
When installing or removing the floor console, don't allow any impact or shock to the SRS diagnosis unit.



14C0069

Removal steps

1. Wiring harness connector
2. G-sensor
3. G-sensor bracket

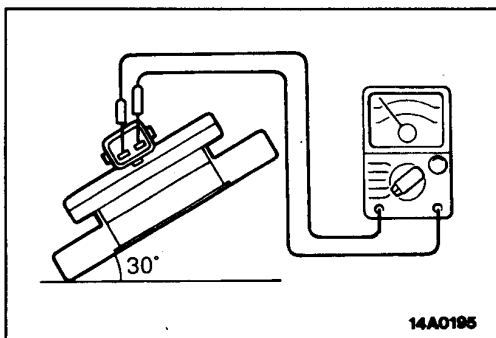


14A0194

INSPECTION

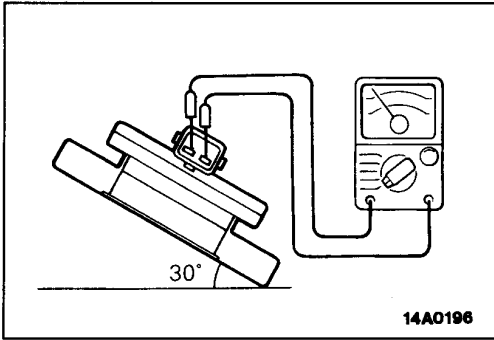
E35NCAA

- (1) Place the sensor on a level surface, then check that there is conductance between the terminals.



14A0195

- (2) Slowly inclining the G-sensor in the direction of forward vehicle travel, check that there is no conductance above a sensor angle of 30 degrees.



- (3) Slowly inclining the G-sensor in the direction of reverse vehicle travel, check that there is no conductance above a sensor angle of 30 degrees.