

# SERVICE BRAKES

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E35AA--

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## SPECIFICATIONS

## GENERAL SPECIFICATIONS

E35CA--

Items	Specifications
Master cylinder Type I.D. mm (in.)	Tandem type (with level sensor) 25.4 (1)
Brake booster Type Effective dia. of power cylinder mm (in.) Boosting ratio [Brake pedal depressing force]	Vacuum type (tandem) 203 + 230 (8.0 + 9.0) 6.0 [302 (30.2, 67)]
Proportioning valve Type Split point MPa (kg/cm <sup>2</sup> , psi) Decompression ratio	Dual type 4.0 (40, 569) 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, dual-piston, ventilated disc (M-R57W) 276 (10.9) 24 (0.94) 16.0 (0.63) 42.8 (1 11/16) × 2 Automatic
Rear 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-R45V) 266 (10.5) 18 (0.71) 15.5 (0.61) 34.9 (1 3/8) Automatic
ABS Rotor teeth Front wheel side Rear wheel side Speed sensor	98 49 Magnet coil type

SERVICE SPECIFICATIONS

E35CB--

Items	Specifications
Standard value	
Brake pedal height	mm (in.) 176–181 (6.9–7.1)
Brake pedal free play	mm (in.) 3–8 (0.12–0.31)
Brake pedal to floorboard clearance	mm (in.) 85 (3.35) or more
Output pressure of proportioning valve	
Split point	MPa (kg/cm <sup>2</sup> , psi) 3.75–4.25 (37.5–42.5, 533–604)
Output fluid pressure	4.75–5.25 (47.5–52.5, 676–747)
[input pressure	MPa (kg/cm <sup>2</sup> , psi)] [8.0 (80, 1.138)]
Pad thickness	mm (in.) 10 (0.39)
Front brake disc thickness	mm (in.) 24 (0.94)
Rear brake disc thickness	mm (in.) 18 (0.71)
Brake lining thickness	mm (in.) 2.8 (0.11)
Brake drum inside diameter	mm (in.) 168 (6.6)
Booster push rod to master cylinder piston clearance	mm (in.) 0.65–0.85 (0.026–0.033)
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
Speed sensor's internal resistance	kΩ
Front	1.4–2.2
Rear	1.3–2.1
Solenoid valve resistance (in the hydraulic unit)	Ω
Vehicles without TCL	2.8–3.4
Vehicles with TCL	3.0–3.2
Speed sensor insulation resistance	kΩ 100 or more
Clearance between the speed pole piece and the toothed rotor	mm (in.)
Front	0.2–0.7 (0.008–0.028)
Rear	0.3–0.9 (0.012–0.035)
Limit	
Left/right proportioning valve output pressure difference	MPa (kg/cm <sup>2</sup> , psi) 0.4 (4, 57)
Front disc runout	mm (in.) 0.08 (0.0031) or less*1, 0.03 (0.0012) or less*2
Hub end play	mm (in.) 0.05 (0.0020)
Pad thickness	mm (in.) 2.0 (0.08)
Front disc thickness	mm (in.) 22.4 (0.88)
Rear disc thickness	mm (in.) 16.4 (0.65)
Rear disc runout	mm (in.) 0.08 (0.0031) or less
Rear lining thickness	mm (in.) 1.0 (0.04)
Rear drum inside diameter	mm (in.) 169 (6.7)

NOTE

\*1 : <Vehicles built up to July, 1991>

\*2 : <Vehicles built from August, 1991>

## 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	Repair kit grease (orange)
Pad and outer shim contact surface and inner shim and inner shim contact surface and inner shim and pad	Brake grease SAE J310, NLGI No. 1

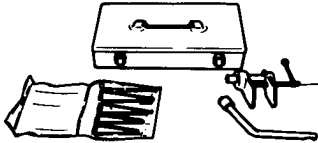
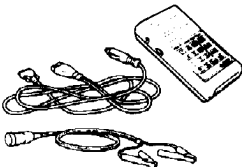

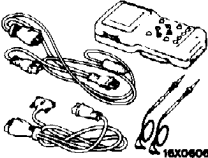

## SEALANTS AND ADHESIVES

E35CE--

Item	Specified sealant	Characteristic
Thread part of fitting	3M ATD Part No. 8661, 8663 or equivalent	Semi-drying sealant

## SPECIAL TOOLS

E35DA--

Tool	Number	Name	Use
	MB990964	Brake Tool set	Pushing-in of the disc brake piston MB990520
	MB991341	Multi-use tester assembly	Up to 1993 models For checking of ABS
		ROM pack  (For the number, refer to GROUP 00 - Precautions Before Service.)	
	MB991502	MUT-II	All models For checking of ABS
		ROM pack	

## ANTI-LOCK BRAKE SYSTEM TROUBLESHOOTING

E35EC--

### 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-skid 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 6 km/h (4 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

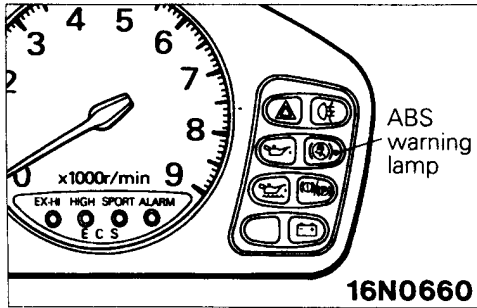
- (1) Following the flow chart, first refer to the illumination pattern of the ABS warning lamp, and next note the diagnosis code and inspect the brake operation.
- (2) Follow the inspection charts listed in the "Remedy" column. In each inspection chart, [Comment] and [Hint] are listed for troubleshooting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

#### NOTE

ECU: Electronic control unit

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

When the ignition key is turned to "ON", does the ABS warning lamp illuminate?



16N0660

ABS warning lamp	Illuminated	_____	_____
	Not illuminated	_____	_____
Ignition key	ON	_____	_____
	ACC, LOCK	_____	_____

14N0168

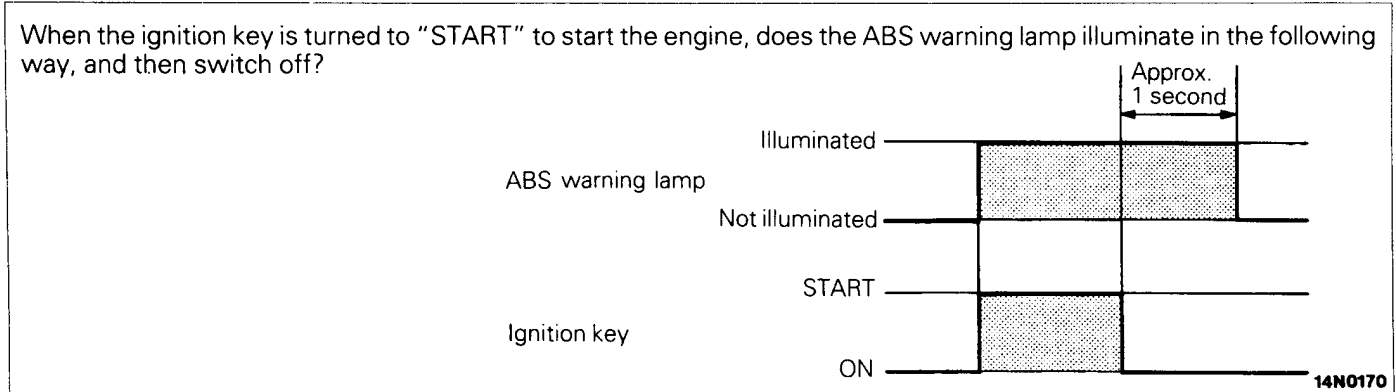
Yes

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 _____</p> <p>Ignition key: ON _____, ACC, LOCK _____</p> <p style="text-align: right;">14N0167</p>	<p>Broken wire in the warning lamp power circuit (including blown fuse).</p> <p>Warning lamp bulb failure.</p> <p>Broken wire in two warning lamp drive circuits (both bulb relay and ABS-ECU).</p>	<p>Inspect according to Inspection Chart A (P.35-15).</p>
2	<p>The ABS warning lamp switches off approximately 1 second after the ignition key is turned to "ON".</p> <p>ABS warning lamp: Illuminated _____, Not illuminated _____</p> <p>Ignition key: ON _____, ACC, LOCK _____</p> <p style="text-align: right;">14N0168</p>	<p>Broken harness wire between the alternator L terminal and the ABS-ECU.</p> <p>Interface inside the ABS-ECU is faulty.</p>	<p>Inspect according to Inspection Chart B (P.35-19).</p>
3	<p>The ABS warning lamp illuminates twice, but after that it remains switched off.</p> <p>ABS warning lamp: Illuminated _____, Not illuminated _____</p> <p>Ignition key: ON _____, ACC, LOCK _____</p> <p style="text-align: right;">14N0169</p>	<p>Broken harness wire between the ABS warning lamp and the ABS-ECU.</p> <p>Interface inside the ABS-ECU is faulty.</p>	<p>Inspect according to Inspection Chart C (P.35-20).</p>

To next page

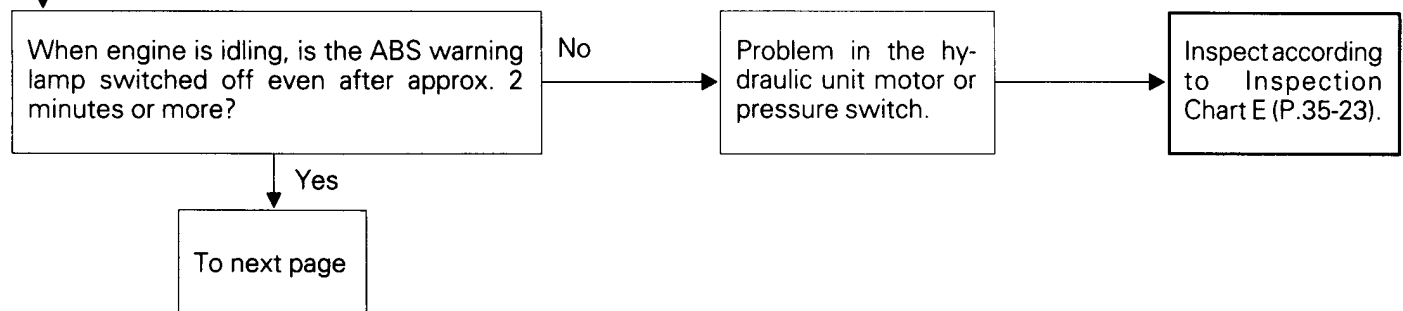
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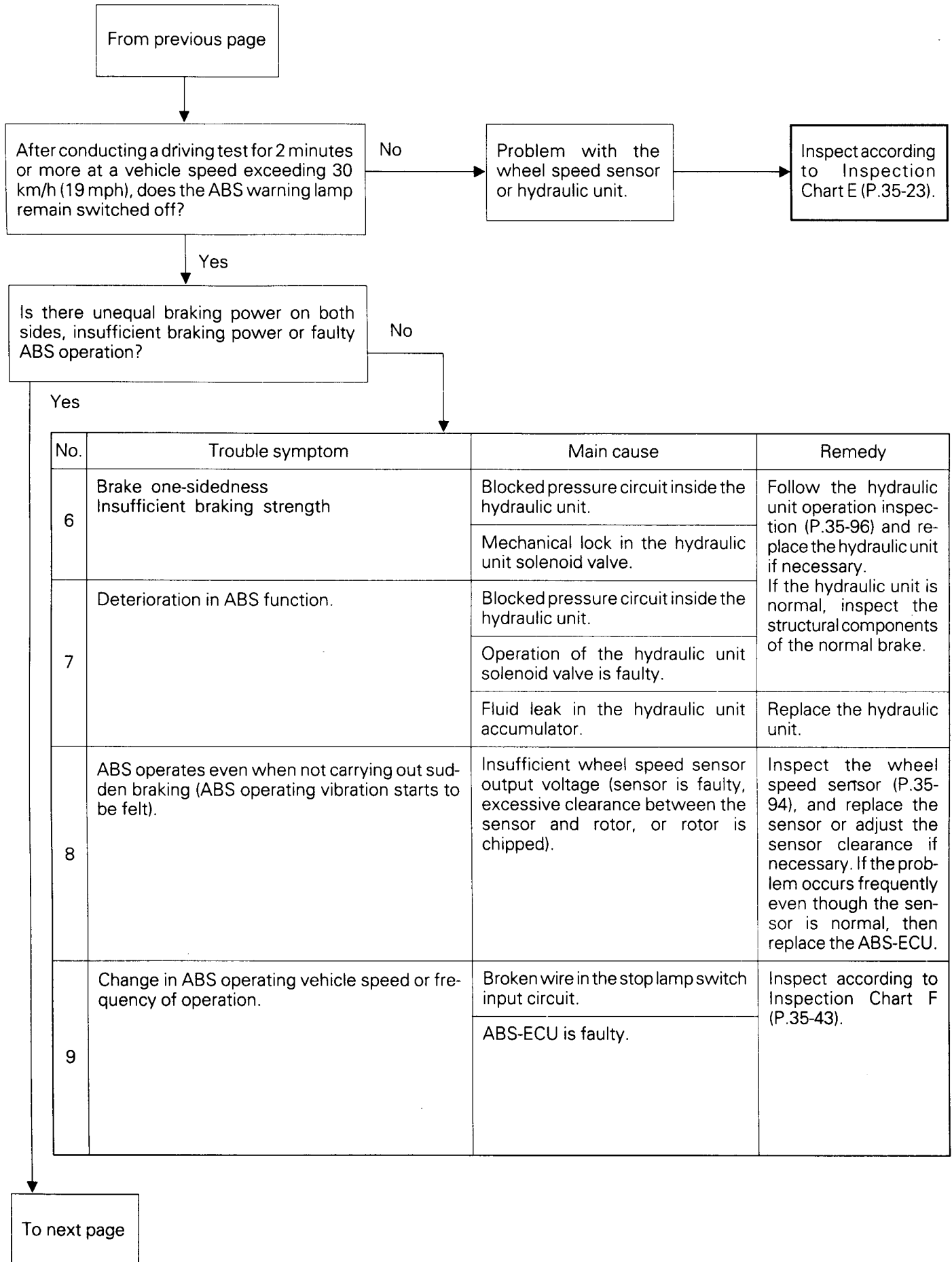


Yes

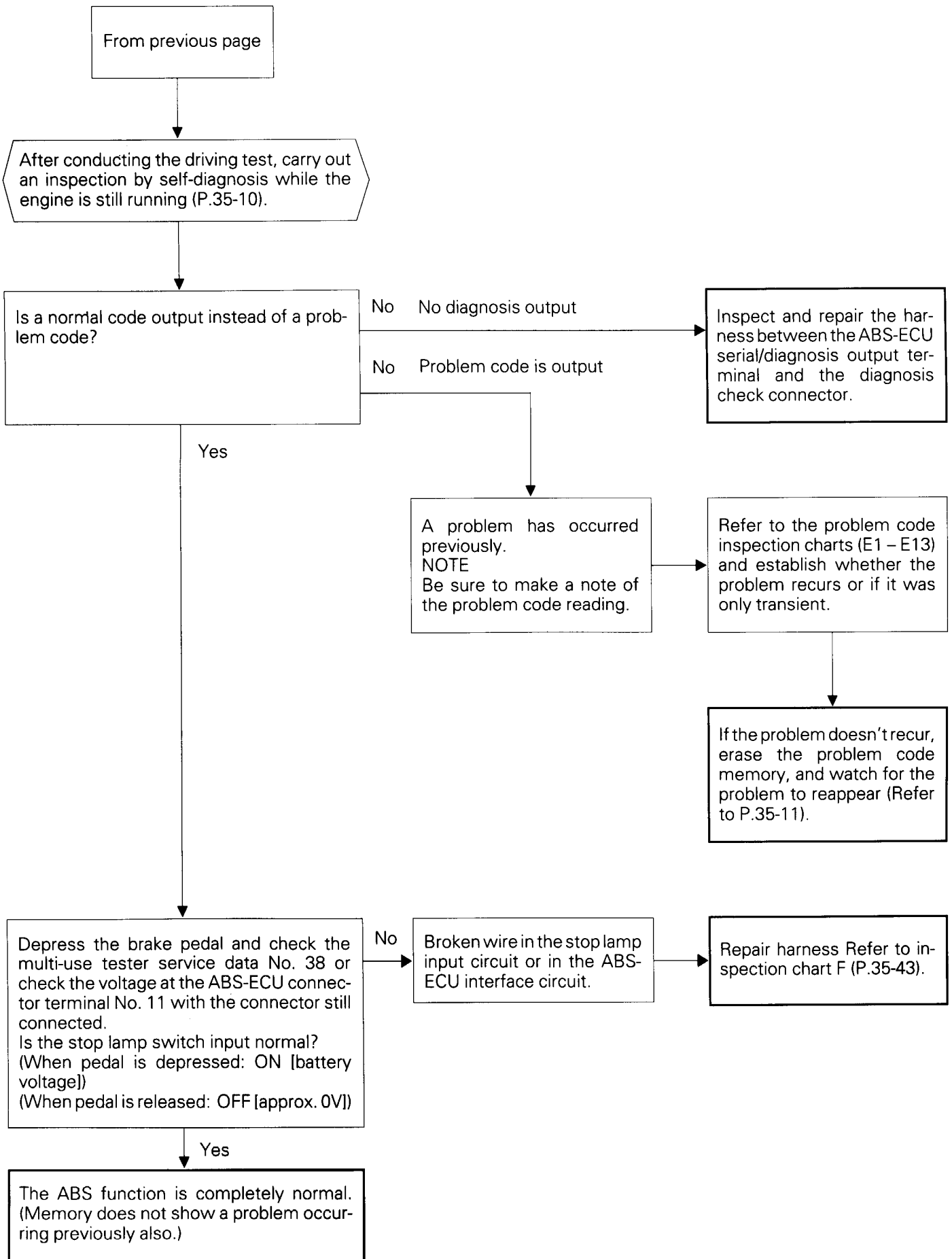
No

No.	Trouble symptom	Main cause	Remedy
4	When the ignition key is turned to "START", the ABS warning lamp switches off. (After the engine starts and the lamp remains illuminated, refer to the following item.)  <p>14N0171</p>	Broken wire in the ABS warning lamp drive circuit when the valve relay is OFF.	Inspect according to Inspection Chart D (P.35-21).
		Broken contact wire when the valve relay is OFF.	
		Broken diode wire.	
5	After the engine starts and the lamp remains illuminated.  <p>14N0172</p>	Broken wire in the ABS-ECU power circuit.	Inspect according to Inspection Chart E (P.35-23).
		Short in the ABS warning lamp drive circuit.	
		Fail-safe function is operating by the ABS-ECU self-diagnosis.	
		ABS-ECU is faulty.	









## INSPECTION BY SELF-DIAGNOSIS

- (1) Connect the multi-use tester <Up to 1993 models> or MUT-II <All models> to the diagnosis check connector.

**Caution**

**Connection and disconnection of the multi-use tester or MUT-II should always be made with the ignition switch in the OFF position.**

- (2) Start the engine, and select the ABS system on the multi-use tester or MUT-II. (ABS warning lamp will illuminate in tester mode.)

If it does not enter tester mode, check the harness between the ABS-ECU power circuit and the ABS-ECU diagnosis check connector.

- (3) Read and make a note of the diagnosis output codes.

**NOTE**

If the multi-use tester or MUT-II is disconnected after entering tester mode, momentarily stop and restart the engine before activating the multi-use tester or MUT-II.

- (4) Momentarily erase the diagnosis code memory. (Refer to P.35-11.)

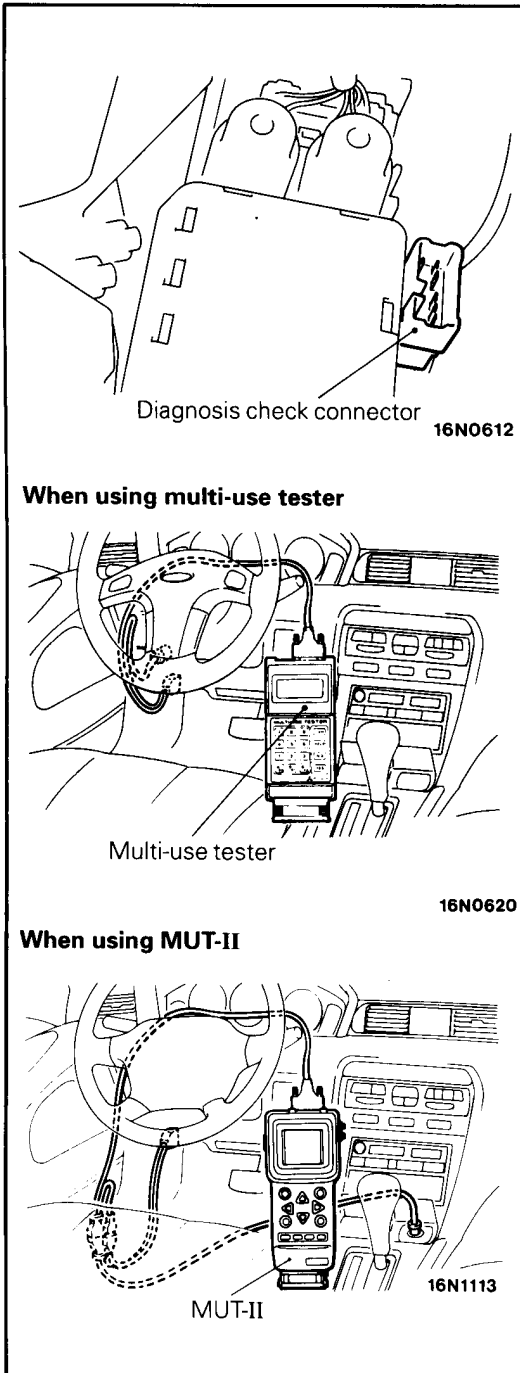
If the memory cannot be erased, the function is being stopped by a problem that is currently displaying a problem code. If the memory can be erased, then the problem was only temporary, or it is a problem that can only be detected while driving.

- (5) If the problem code is not erased, or if the ABS function is stopped by a repeated driving test and a problem code is output, inspect according to the problem code inspection charts (E-1 – E-13).

**NOTE**

The codes below are output as diagnosis codes according to the vehicle's condition, even when the ABS system is normal. These codes are output only for a current problem, and if the vehicle's condition returns to normal, then the codes will become normal.

Code No.	Vehicle Condition
16	Battery is dead
35	Engine is stopped
37	Low accumulator pressure



## METHOD OF ERASING THE DIAGNOSIS CODE MEMORY

### Caution

1. When repairs are completed, the diagnosis code memory should be erased.
2. When the ABS-ECU function is stopped, the problem code memory cannot be erased, so the inspection and repair should be continued.

### WHEN USING THE MULTI-USE TESTER

<Up to 1993 models> OR MUT-II <All models>

- (1) Erase the memory with the multi-use tester or MUT-II.

### NOTE

1. When using the multi-use tester or MUT-II, 4 codes can be erased, starting from the newest, each time the memory is erased.
2. After erasing the memory, a command cannot be received from the multi-use tester or MUT-II. When checking diagnosis codes, momentarily stop and restart the engine, and then reactivate the multi-use tester or MUT-II.

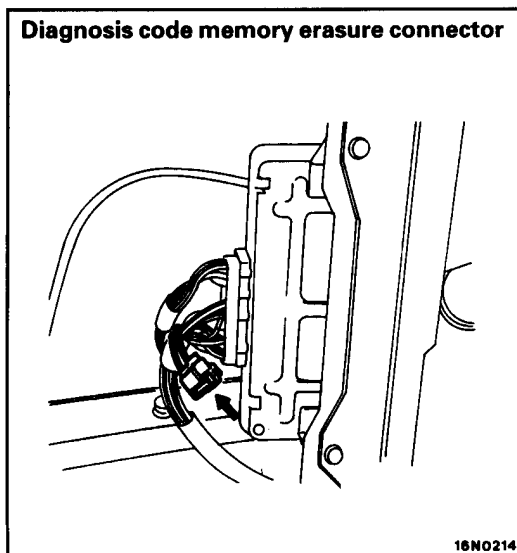
- (2) Check the diagnosis codes to check that the memory has been erased.

### WHEN USING THE CONNECTOR FOR DIAGNOSIS CODE MEMORY ERASURE

- (1) After connecting the two diagnosis code memory erasure connector terminals (left diagram), turn the ignition key to ON.  
At this time, the valve relay will turn OFF, and the ABS warning lamp will illuminate.
- (2) After approximately one second or more has passed, turn the ignition key to OFF.
- (3) Disconnect the two diagnosis code memory erasure connector terminals and turn the ignition key back to ON.  
At this point in time, the erasure of one problem code has been completed.

### NOTE

1. When erasing several codes, repeat steps (1) to (3).
2. Even if the ignition switch is continuously turned to ON and OFF with the two diagnosis code memory erasure connector terminals still connected, problem codes cannot be erased.



## DIAGNOSIS CODE TABLE

Diagnosis code No.	Name of inspection chart or remedy	Reference page	Diagnosis code No.	Name of inspection chart or remedy	Reference page
11	Inspection chart E-2	P. 35-27	41	Inspection chart E-9	P. 35-34
12			42		
13			43		
14			44		
15	Inspection chart E-1	P. 35-26	45		
16	Inspection chart E-6	P. 35-31	46		
21	Inspection chart E-3	P. 35-28	51	Inspection chart E-10	P. 35-35
22			52	Inspection chart E-11	P. 35-36
23			53		
24			54	Inspection chart E-12	P. 35-39
25	Inspection chart E-4	P. 35-28	61	Inspection chart E-13	P. 35-40
31	Inspection chart E-5	P. 35-28	62	Inspection chart E-14	P. 35-42
32			63	Replace the ABS-ECU	P. 35-133
35	Inspection chart E-7	P. 35-32	–	–	–
37	Inspection chart E-8	P. 35-33	–	–	–

## DIAGNOSIS CODE DISPLAY METHOD

The codes are displayed as follows depending on the system problem.

System problem		When using the multi-use tester or MUT-II	When using a voltage meter
No current problem	No previous problem	Normal code	Normal code "continuous 0.5 sec. ON/OFF".
	Previous problem	Four previous codes are displayed, starting from the most recent.	One previous code is displayed, starting from the most recent.
Current problem	No previous problem	One current problem code is displayed.	One current problem code is displayed.
	Previous problem	One current code and three previous codes are displayed, starting from the most recent.	

## NOTE

1. If diagnosis code No. 15 appears after a problem is detected in a wheel speed sensor that can specify the wheel position (nos. 11-14 or nos. 21-24), then it cannot be written into memory.
2. Diagnosis codes No. 16 and 35 (low voltage), No. 37 (LPWS ON), and No. 63 (ECU faulty) are only displayed when there is a current problem. (Past occurrences are not recorded in memory.)
3. Even if identical codes are output continuously, the code is only memorized when it is first displayed.

**SERVICE DATA INSPECTION TABLE**

The following items can be read by the multi-use tester <Up to 1993 models> or MUT-II <All models> from the ABS-ECU input data.

**WHEN THE SYSTEM IS NORMAL**

Service data item		Display units	Service data item		Display units
No.	Item		No.	Item	
11	Front right wheel speed	km/H	35	Alternator L terminal voltage	HIGH/LOW
12	Front left wheel speed	km/H	36	PCSW terminal voltage	HIGH/LOW
13	Rear right wheel speed	km/H	37	LPWS terminal voltage	HIGH/LOW
14	Rear left wheel speed	km/H	38	ON/OFF condition of stop lamp switch	ON/OFF
16	ECU power voltage	HIGH/LOW			

**WHEN SYSTEM IS ISOLATED BY THE ABS-ECU**

When the ABS-ECU function is being stopped by the self-diagnosis function, the above code nos. 11-14 for each wheel speed are not displayed.

By using this function, function checking of the hydraulic unit can be done without the need for special devices such as a hydraulic unit checker (MB991131).

**ACTUATOR TEST FUNCTION**

By using the multi-use tester <Up to 1993 models> or MUT-II <All models>, the following force-activation of the actuator can be performed.

**NOTE**

When the ABS-ECU function is stopped, actuator testing can not be carried out.

**ACTUATOR TEST SPECIFICATIONS**

No.	Drive conditions	Drive phenomena	Drive specifications
01	A and B	Solenoid valves of each corresponding hydraulic unit channel.	Voltage increase → Voltage decrease (48 msec) → Constant (3 sec) → Voltage increase (8 msec) → Constant (3 sec) → Carries out voltage increase operation.
02			
03			Voltage increase → Voltage reduction (3 sec) → Constant (3 sec) → Carries out voltage increase operation.
04			
05			
06			
07	A	Valve relay and ABS warning lamp	Relay OFF signal is output for 2 seconds. For a six second period including 2 seconds before and after this, the ABS-ECU outputs an ABS warning lamp OFF signal. This checks the operation by illuminating the warning lamp when the relay is OFF.
08	A	Motor relay	Motor ON signal is output for 2 seconds.
Drive conditions: <ul style="list-style-type: none"> <li>• Condition A: Highest wheel speed is less than 10 km/h (6 mph).</li> <li>• Condition B: Wheel speed of both front wheels or both rear wheels is 0 km/h (0 mph).</li> </ul>			

**Caution**

**The No. 08 motor relay drive should be checked only when the inspection is needed for the troubleshooting. There is a danger that the hydraulic**

**unit actuator pressure could become higher than necessary, which will have an adverse effect on the system.**

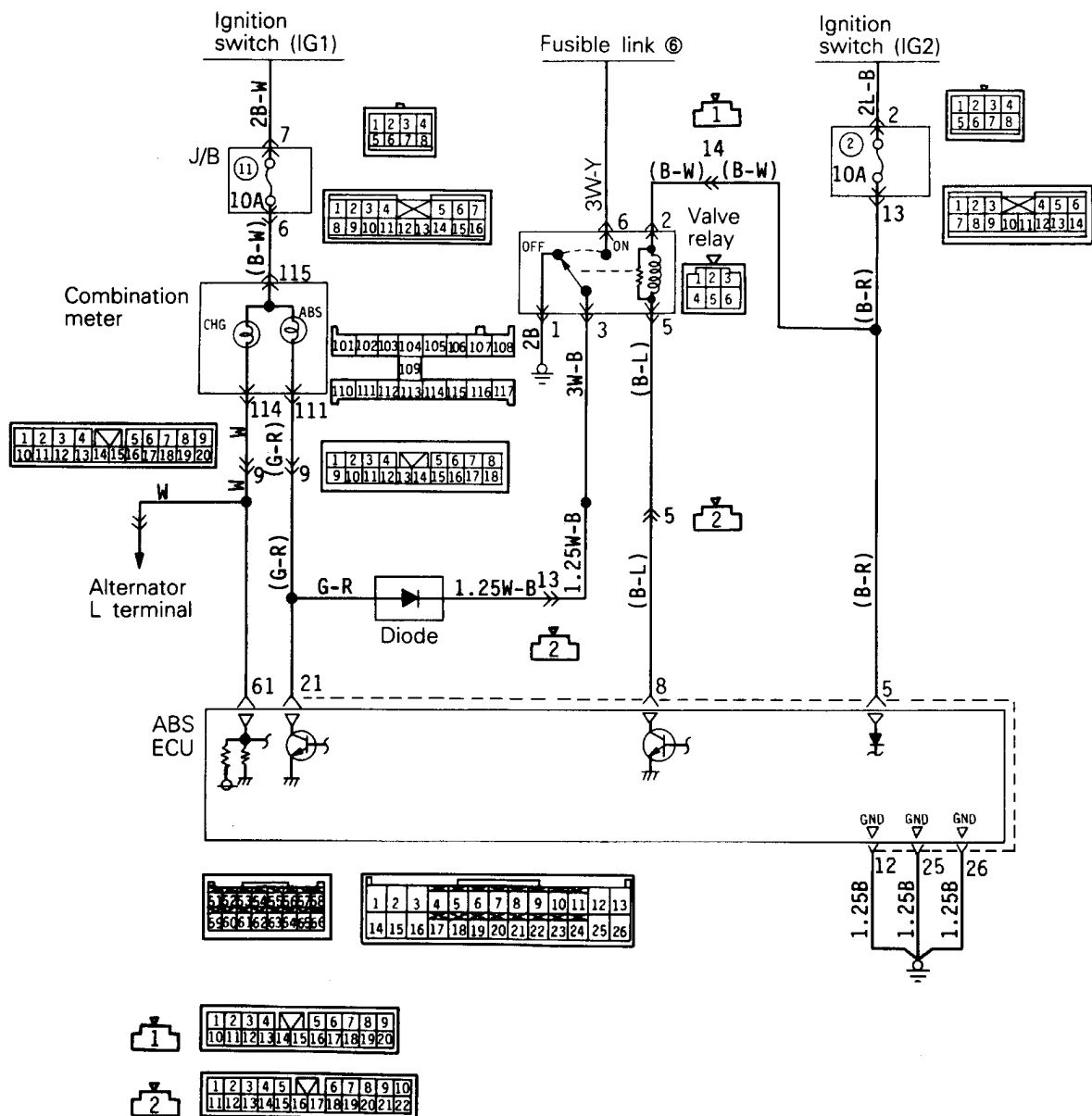
TROUBLE SYMPTOM INSPECTION CHART

**A** When ignition key is turned to "ON", ABS warning lamp does not illuminate

Comment: When power is supplied to the ABS-ECU, the valve relay changes from OFF to ON/OFF by the initial check, and thus even if there is a problem with the lamp illumination circuit that is driven by the ABS-ECU, the lamp will illuminate twice when the valve relay is OFF. Accordingly, there is a strong possibility that the problem is in the lamp bulb or in the power supply to the lamp.

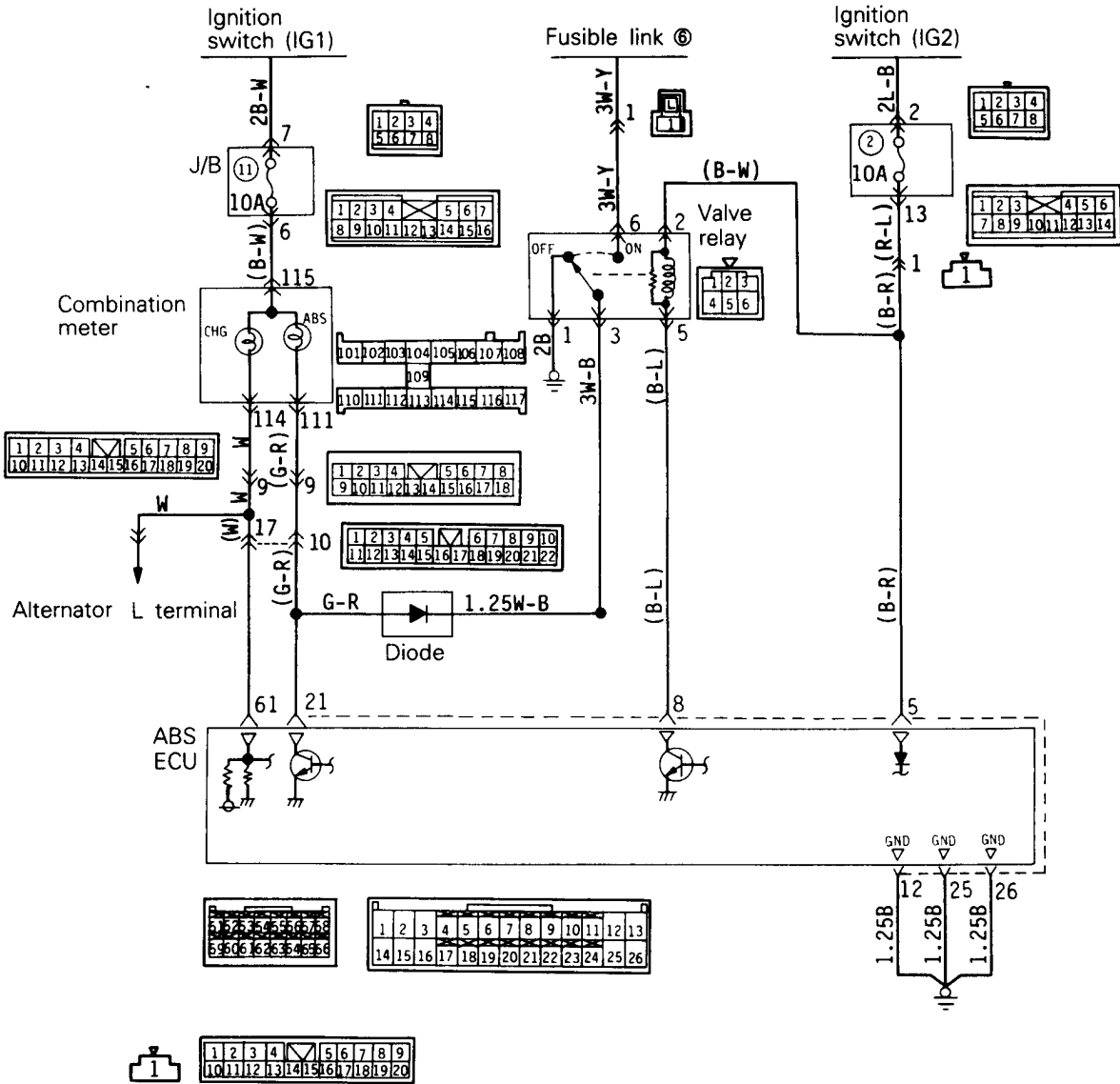
Hint: When other warning lamps also do not illuminate, the cause is probably a blown fuse.

LH drive vehicles

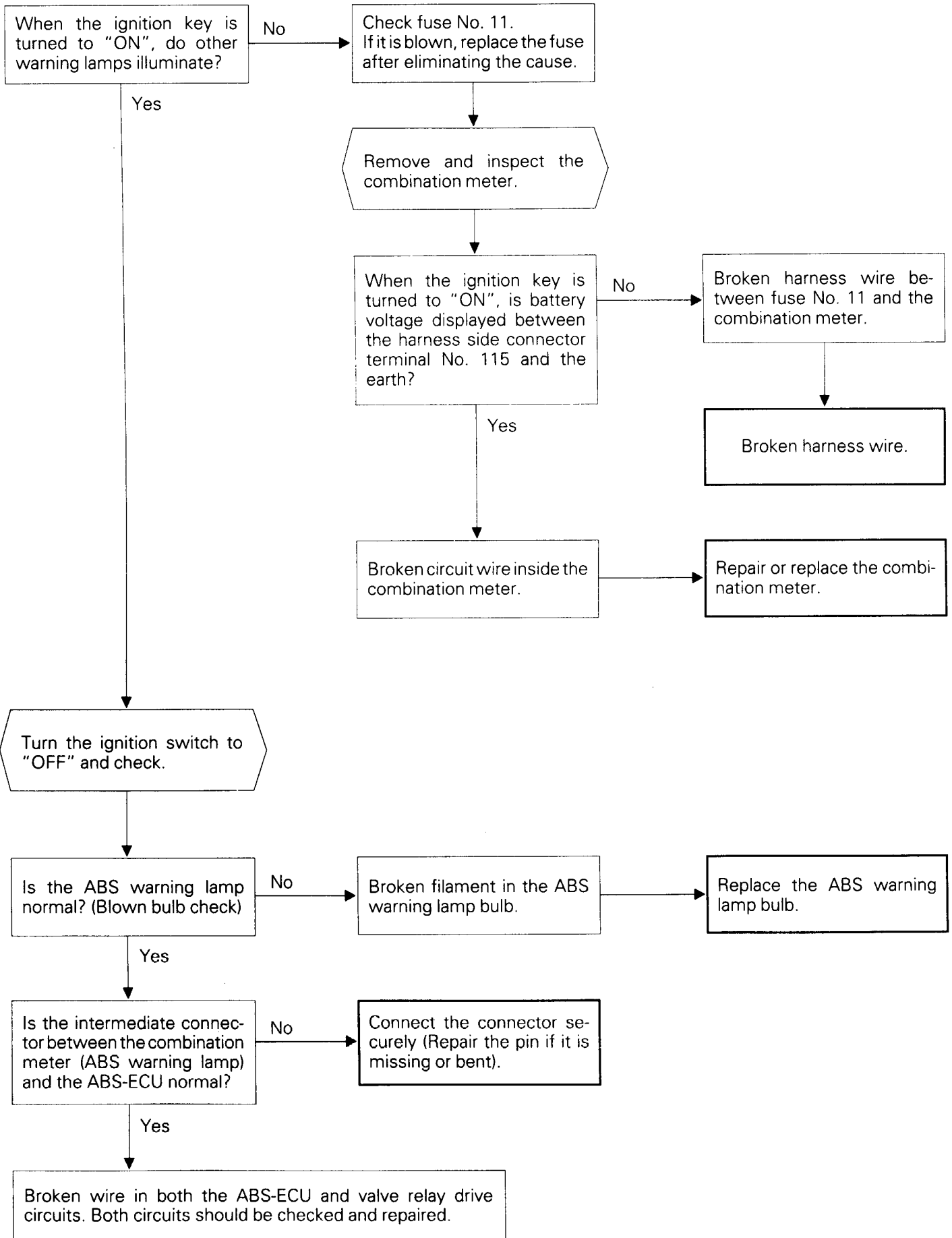


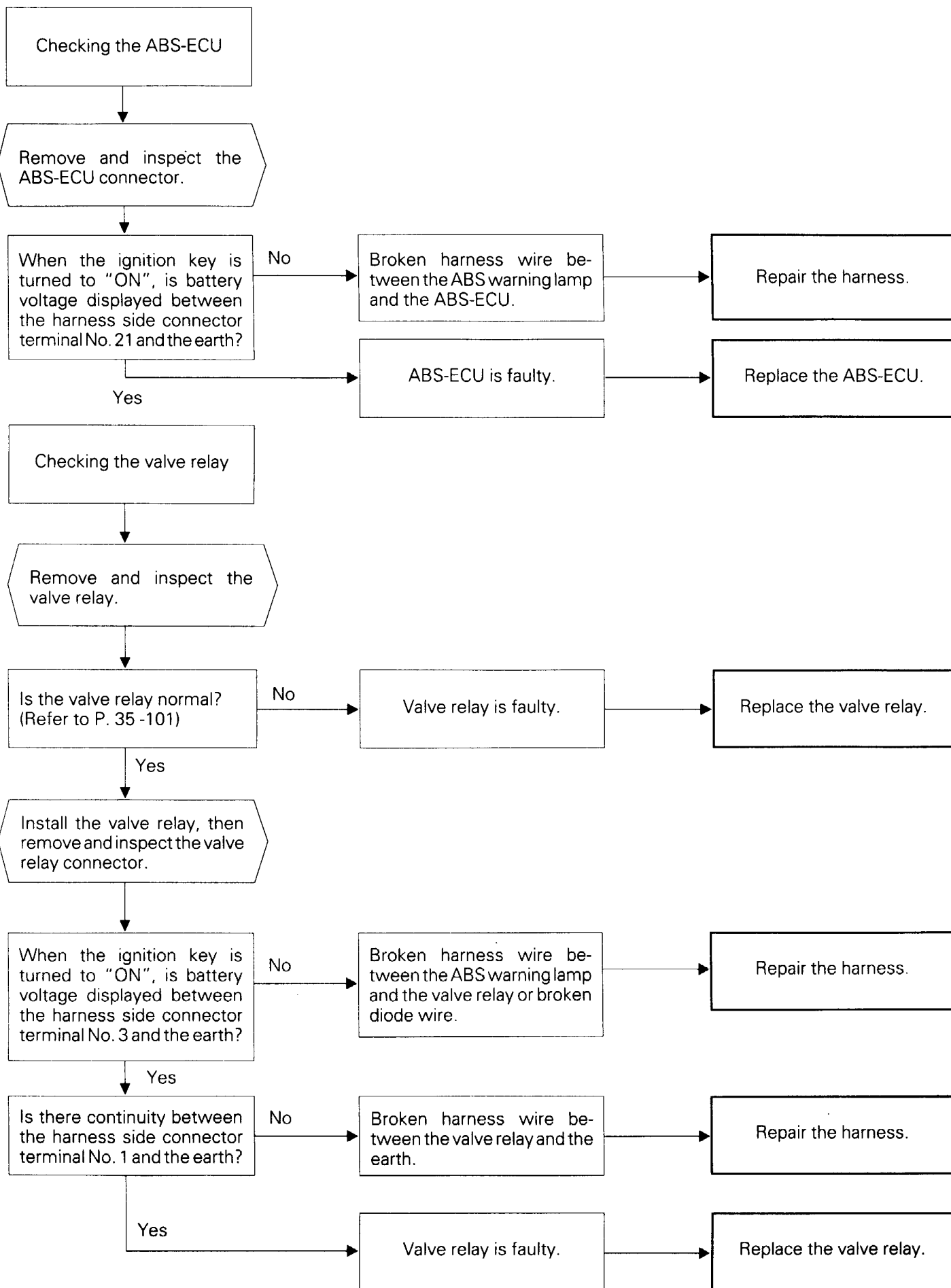
14N0219

RH drive vehicles





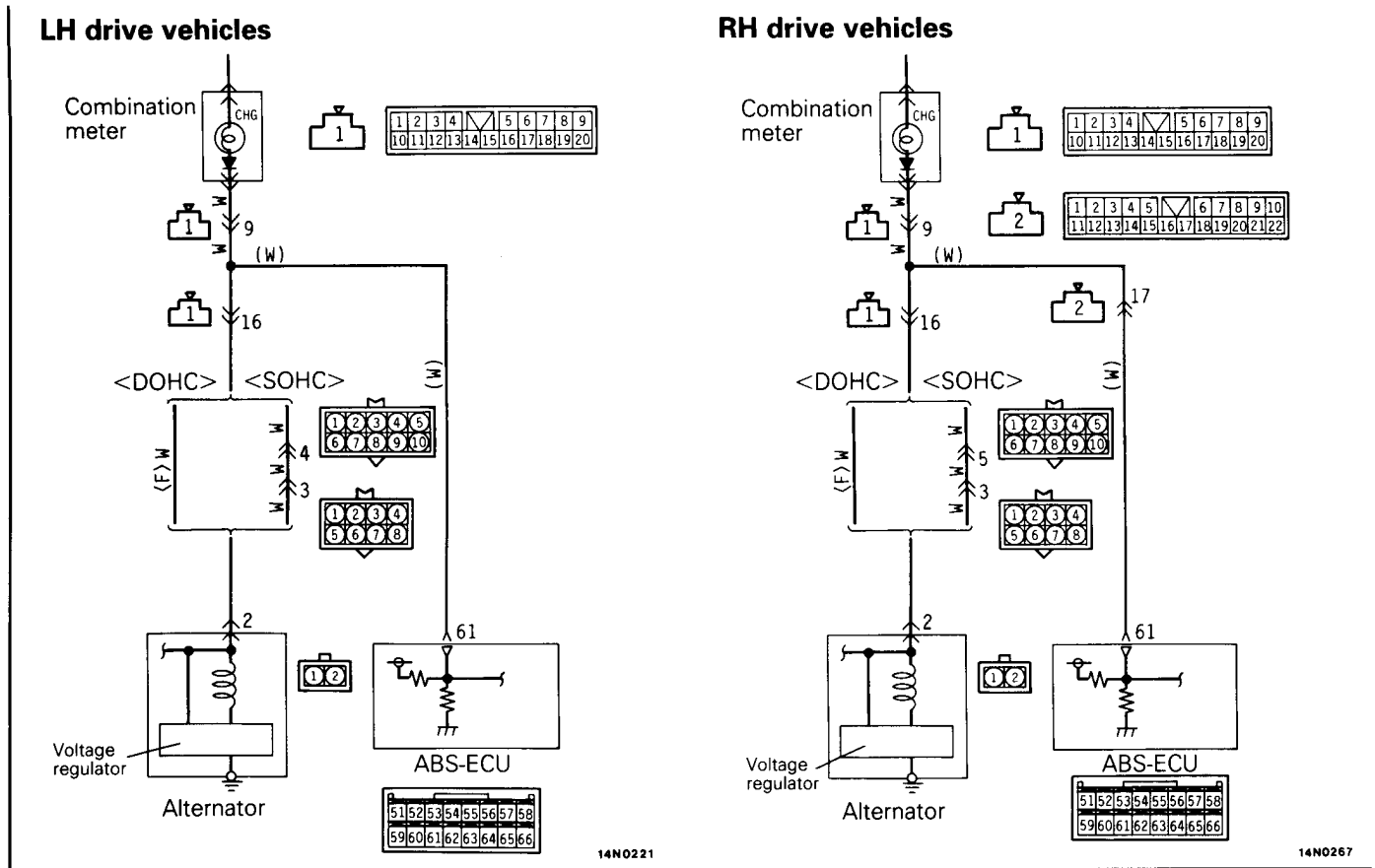




**B The ABS warning lamp switches OFF approximately 1 second after the ignition key is turned to "ON"**

Comment: The ABS-ECU monitors the voltage of the alternator L terminal, and when the engine is not running, the voltage of the L terminal is low, and thus the ABS warning lamp illuminates. Accordingly, when the ignition key is

turned to "ON", if the lamp turns off after the initial check (which takes about 1 second), there is a problem in the ABS warning lamp illumination function resulting from the alternator L terminal monitor.



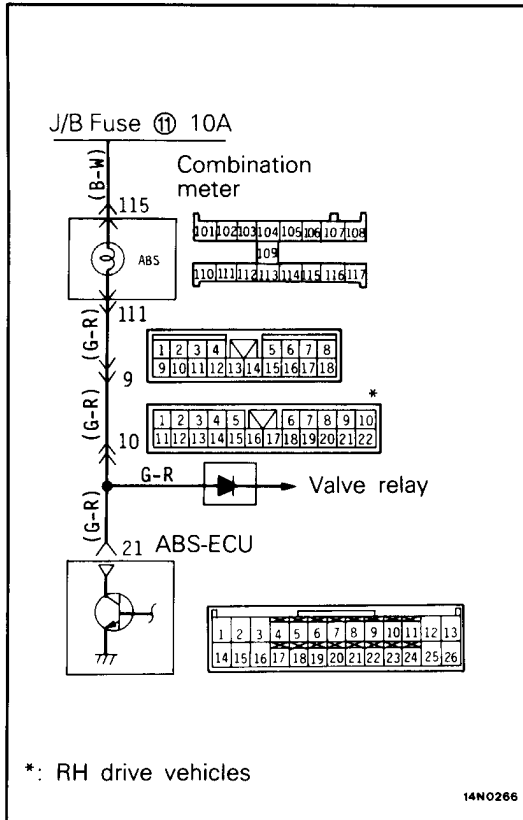
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    graph TD
        Start([Remove the ABS-ECU connector, and inspect the harness side connector.]) --> Question{When the ignition key is turned to "ON", does battery voltage show between No. 61 terminal and the earth?}
        Question -- No --> Fault1[Broken harness wire between the alternator L terminal and the ABS-ECU.]
        Question -- Yes --> Fault2[ABS-ECU is faulty.]
        Fault1 --> Repair1[Repair the harness.]
        Fault2 --> Repair2[Replace the ABS-ECU.]
    
```

**C The ABS warning lamp illuminates twice after the ignition key is turned to "ON", but after that it remains switched off**

Comment: The ABS-ECU causes the ABS warning lamp to illuminate during the initial check. The valve relay changes from OFF to ON→OFF→ON by the initial check, and if there is a broken wire in the lamp drive circuit from the ABS-ECU, the lamp will

illuminate when the valve relay is OFF. Accordingly, if the ignition key is "ON", and the lamp illuminates twice and then switches off, there is a problem in the ABS-ECU drive circuit.



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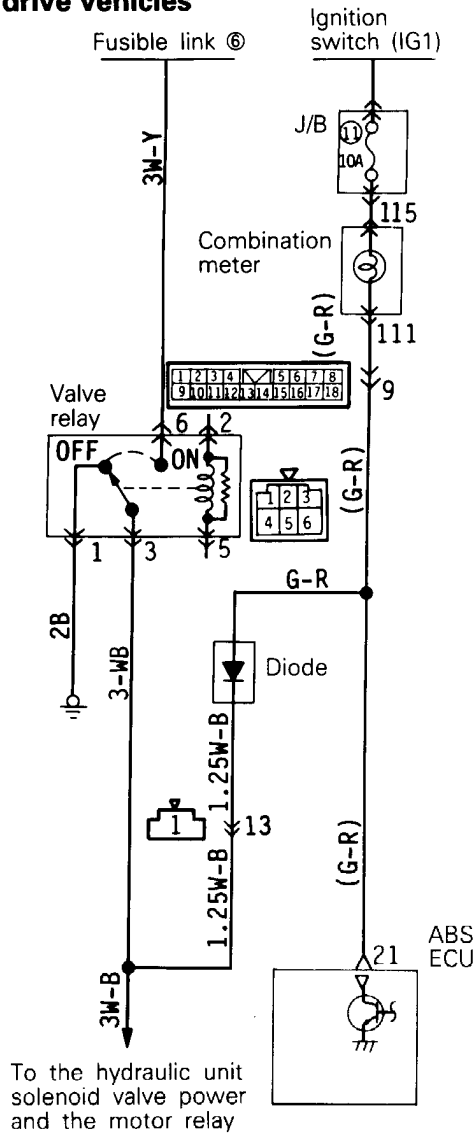
    graph TD
      A[Disconnect the valve relay connector and ABS-ECU connector, and inspect the ABS-ECU harness side connector.] --> B{When the ignition key is turned to "ON", does battery voltage show between terminal No. 21 and the earth?}
      B -- No --> C[Broken harness wire between the alternator L terminal and the ABS-ECU.]
      C --> D[Repair the harness]
      B -- Yes --> E[ABS-ECU is faulty.]
      E --> F[Replace the ABS-ECU]
    
```

**D 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, if the warning lamp switches off at this time, the cause is a

problem in the lamp illumination circuit in the valve relay.  
 Hint: After starting the engine, if the ABS warning lamp remains illuminated, a diagnosis code is detected. If the problem code No. 51 is output, there is a high possibility that there is a melted contact in the valve relay. (Refer to problem code chart E-10.)

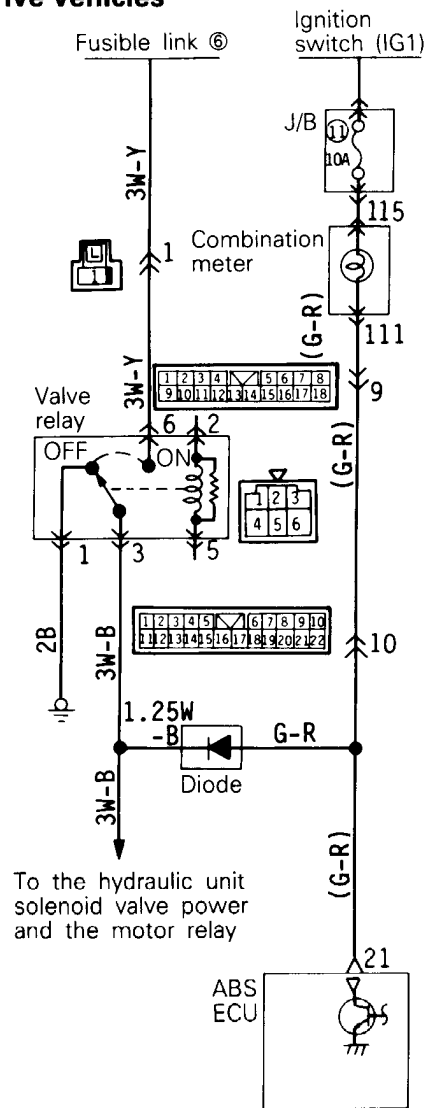
**LH drive vehicles**



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

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

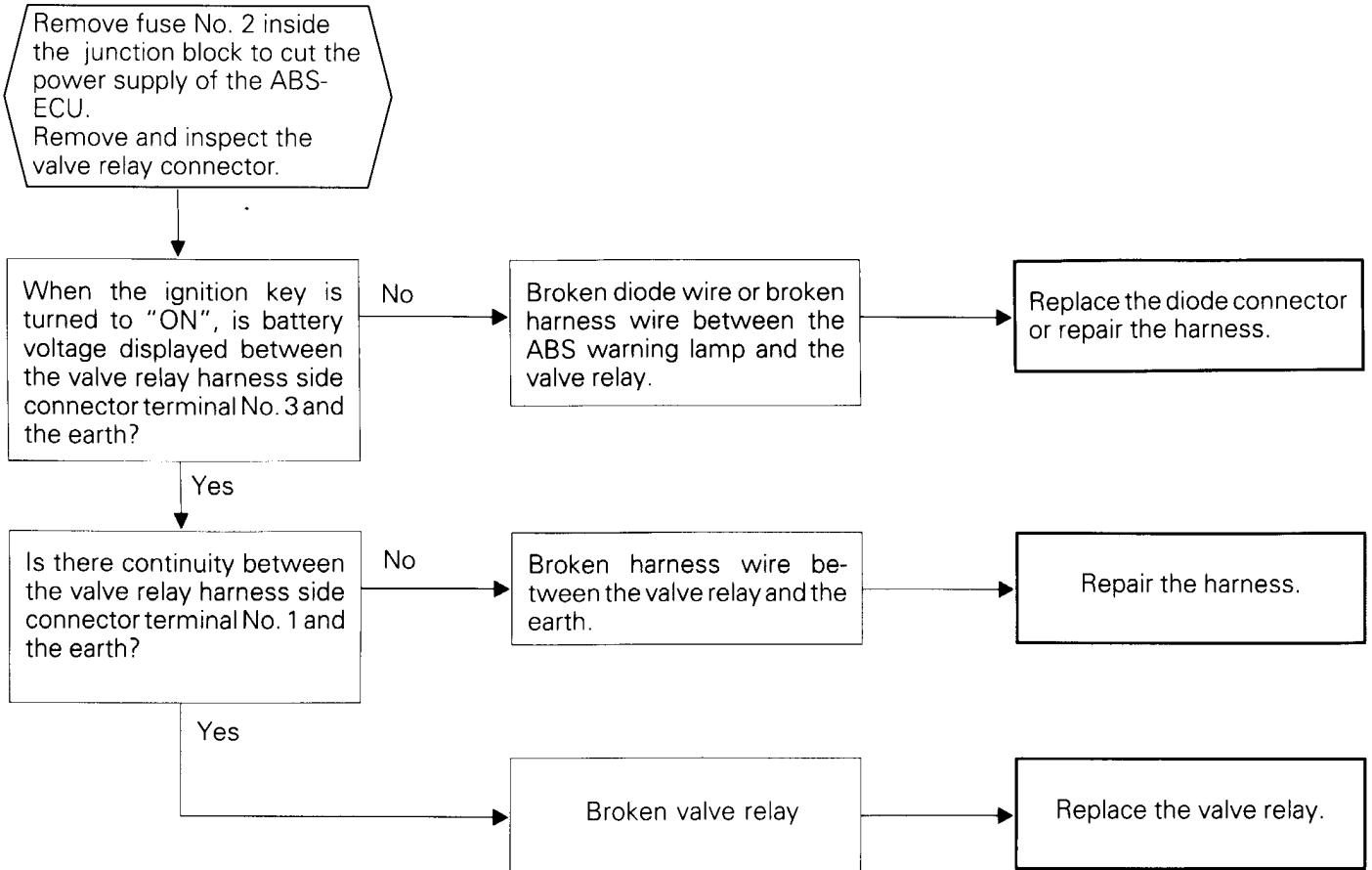
**RH drive vehicles**



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

14N0223

14N0222



**E Even after the engine is started, 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.

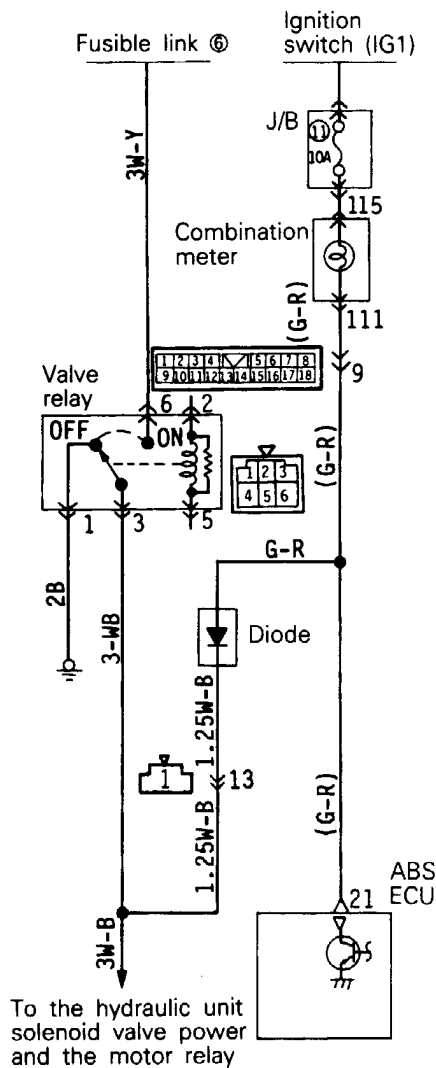
Hint: Check the diagnosis output, and if there is no output voltage, or the multi-use tester and the ABS-ECU cannot commu-

nicate, then there is a high possibility that power is not being supplied to the ABS-ECU.

**Caution**

**If a problem 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 the engine should be restarted.**

**LH drive vehicles**

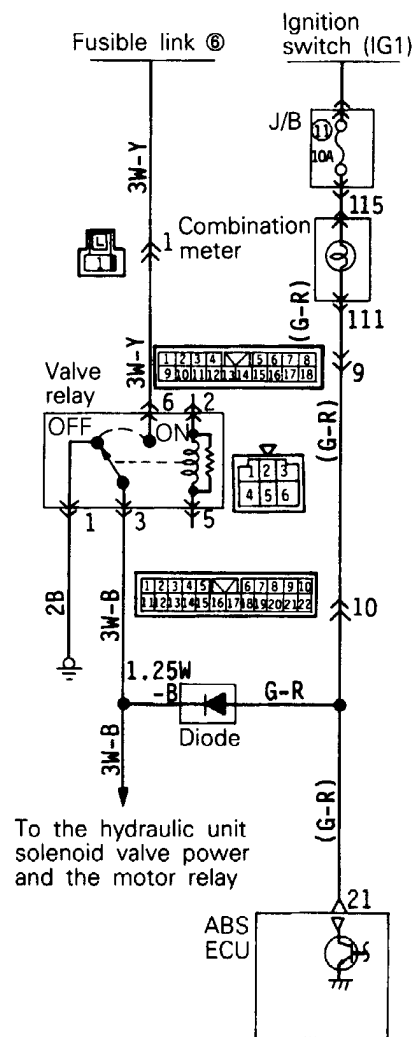


1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26

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

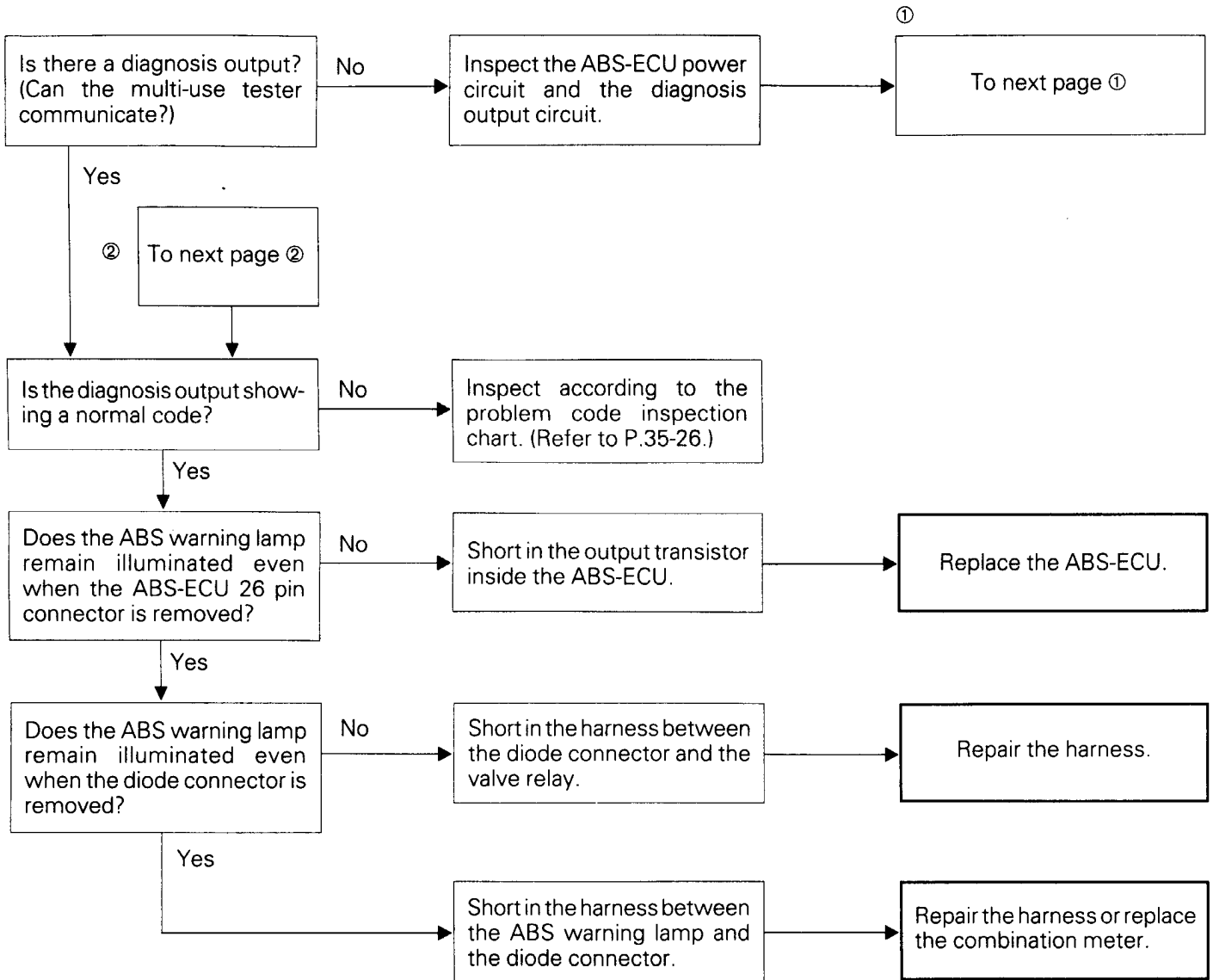
14N0223

**RH drive vehicles**

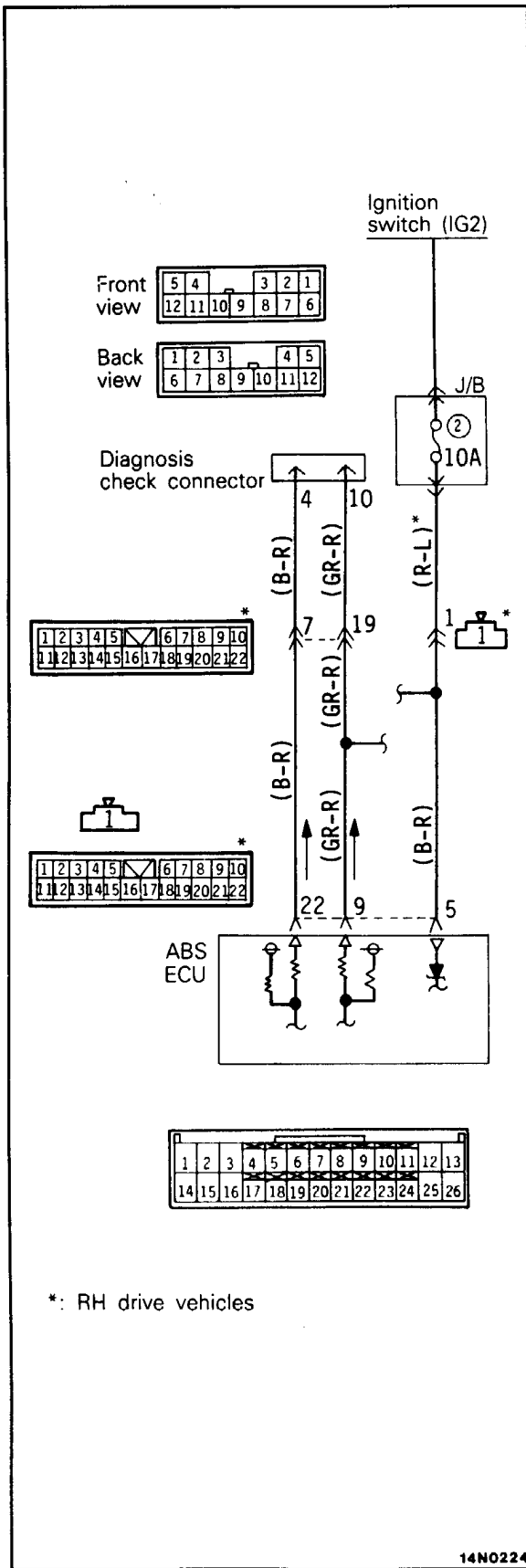


1	2	3	4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23	24	25	26

14N0222







```

    graph TD
        Start[From previous page ①] --> Q1{Can other electronic control systems communicate with the multi-use tester?}
        Q1 -- No --> A1[Malfunction in the multi-use tester. Repair or reinspect.]
        Q1 -- Yes --> Q2{Is fuse No. 2 normal?}
        A1 --> P2[To previous page ②]
        Q2 -- No --> A2[Replace the fuse after eliminating the cause.]
        Q2 -- Yes --> P3[/Disconnect the ABS-ECU connector, and inspect the harness side connector./]
        P3 --> Q3{When the ignition key is turned to "ON", does battery voltage show between the ABS-ECU connector terminal No. 5 and the earth?}
        Q3 -- No --> A3[Broken harness wire between fuse No. 2 and the ABS-ECU.]
        Q3 -- Yes --> Q4{Is there continuity between the ABS-ECU terminals No. 9 and No. 22 and the diagnosis check connector terminals No. 10 and No. 4?}
        A3 --> A4[Repair the harness.]
        Q4 -- No --> A5[Broken harness wire between the diagnosis check connector and the ABS-ECU.]
        Q4 -- Yes --> A6[ABS-ECU is faulty.]
        A5 --> A7[Repair the harness.]
        A6 --> A8[Replace the ABS-ECU.]
        A7 -- Yes --> P2
    
```

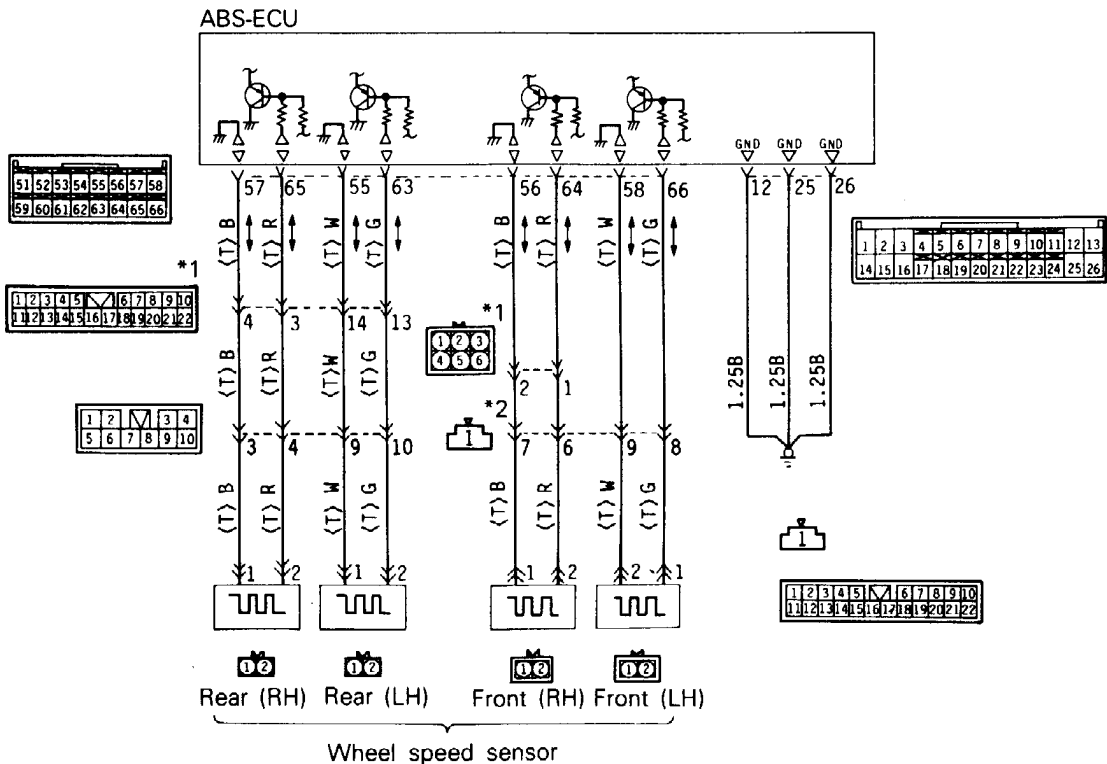
**E-1 When diagnosis code No. 15 is displayed**

**Comment:** There is a broken + wire or – wire in one or more of the four wheel speed sensors detected by a broken wire inspection by the ABS-ECU hardware circuit. In this instance, inspect all of the wheel speed sensors, as it cannot be determined which single wheel is abnormal.

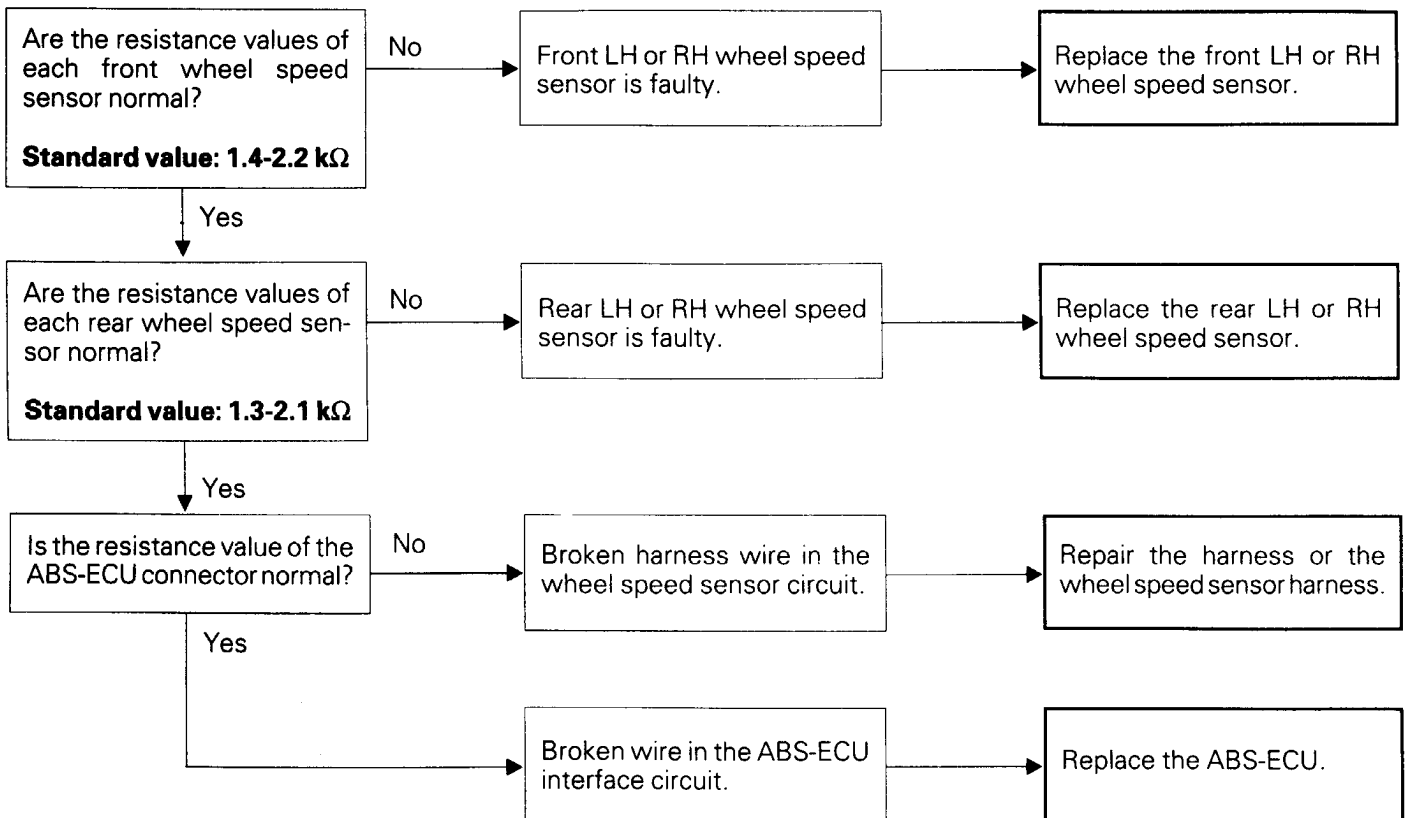
**Hint:** When using the multi-use tester, up to 4 codes are displayed. When this code (No. 15) appears, and a problem code for a specific wheel (nos. 11-14) is also displayed, it is likely that there is a broken wire in the wheel speed sensor indicated by these codes.

**NOTE**

1. When there is a faulty contact, inspect the sensor cable by lightly flexing and stretching it.
2. If there is no current problem, a normal value will result even if a problem is detected, so when the malfunction in the sensor circuit indicated cannot be discovered, momentarily turn the ignition switch to OFF, and carry out another driving test. At this time, replace the ABS-ECU only if the same problem code is output. After this, if the code does not reappear, there is a problem with the ABS-ECU interface. (For a problem that is difficult to reproduce, there is a possibility that the code will recur even when the ABS-ECU is replaced.)



\*1: RH drive vehicles  
 \*2: LH drive vehicles



**E-2 When diagnosis code No. 11, No. 12, No. 13 or No. 14 are displayed**

Comment: These codes are displayed when the sensor with the broken wire can be distinguished, and sensor output drops due to a faulty sensor or a bent rotor, etc., and anti-lock control is continuously operating.

Hint: If there is currently a broken wire in the sensor circuit, when the engine is restarted, the display switches to diagnosis

code No. 15. If the same code is displayed even after restarting the engine, the problem is not a broken circuit wire, but something such as an excessive sensor gap.

Remedy: Inspect according to "Wheel Speed Sensor Inspection Flow Chart " (P.35-29), while referring to the above.

**E-3 When diagnosis code No. 21, No. 22, No. 23 or No. 24 are displayed**

Comment: These problem codes are displayed when a broken wire cannot be verified, but when the vehicle speed reaches 10 km/h (6 mph) or more, no pulses are input.

Hint: The cause is likely to be either a short between the sensor harnesses, a short

in the sensor + wire with the body, or an excessive sensor gap.

Remedy: Inspect according to "Wheel Speed Sensor Inspection Flow Chart " (P.35-29), while referring to the above.

**E-4 When diagnosis code No. 25 is displayed**

Comment: A problem in both rear wheel sensors is diagnosed when the signal from either of the front wheel speed sensors is diagnosed as normal, and the wheel speed of both rear wheels is 0 km/h (0 mph) for a continuous 20 second period, even if the wheel speed of the front wheels is 11 km/h (7 mph) or more.

Hint: This code is displayed when there is a short in the sensor harnesses of both rear wheels, or if there is low output from both rear wheel sensors.

Remedy: Inspect according to "Wheel Speed Sensor Inspection Flow Chart " (P.35-29), while referring to the above.

**NOTE**

If the vehicle is raised up, or if the wheels are stuck and only the front wheels are moving, after approximately 20 seconds the ABS warning lamp will illuminate, and the system will be isolated.

Thus, this code can be output even when the system is normal, so it is only output during a current problem, and is not kept in memory from a previous problem. Accordingly, before turning the ignition switch to OFF, the problem code should be read and written down.

**E-5 When diagnosis code No. 31 or No. 32 are displayed**

Comment: These codes are displayed when a chipped rotor tooth or a jammed rotor (one tooth) is detected.

Also, they show that there is a request of brake fluid pressure control with the stop lamp switch OFF from when the vehicle is stationary until the vehicle speed exceeds approximately 15 km/h (9 mph). If the vehicle repeats start and stop and the condition above is detected five times, the ABS warning lamp will illuminate.

Hint: There is a strong chance that the wheel speed sensor output is low due to a bent rotor tooth or excessive sensor gap. Low sensor output could also be caused by a rare short in the sensor coil.

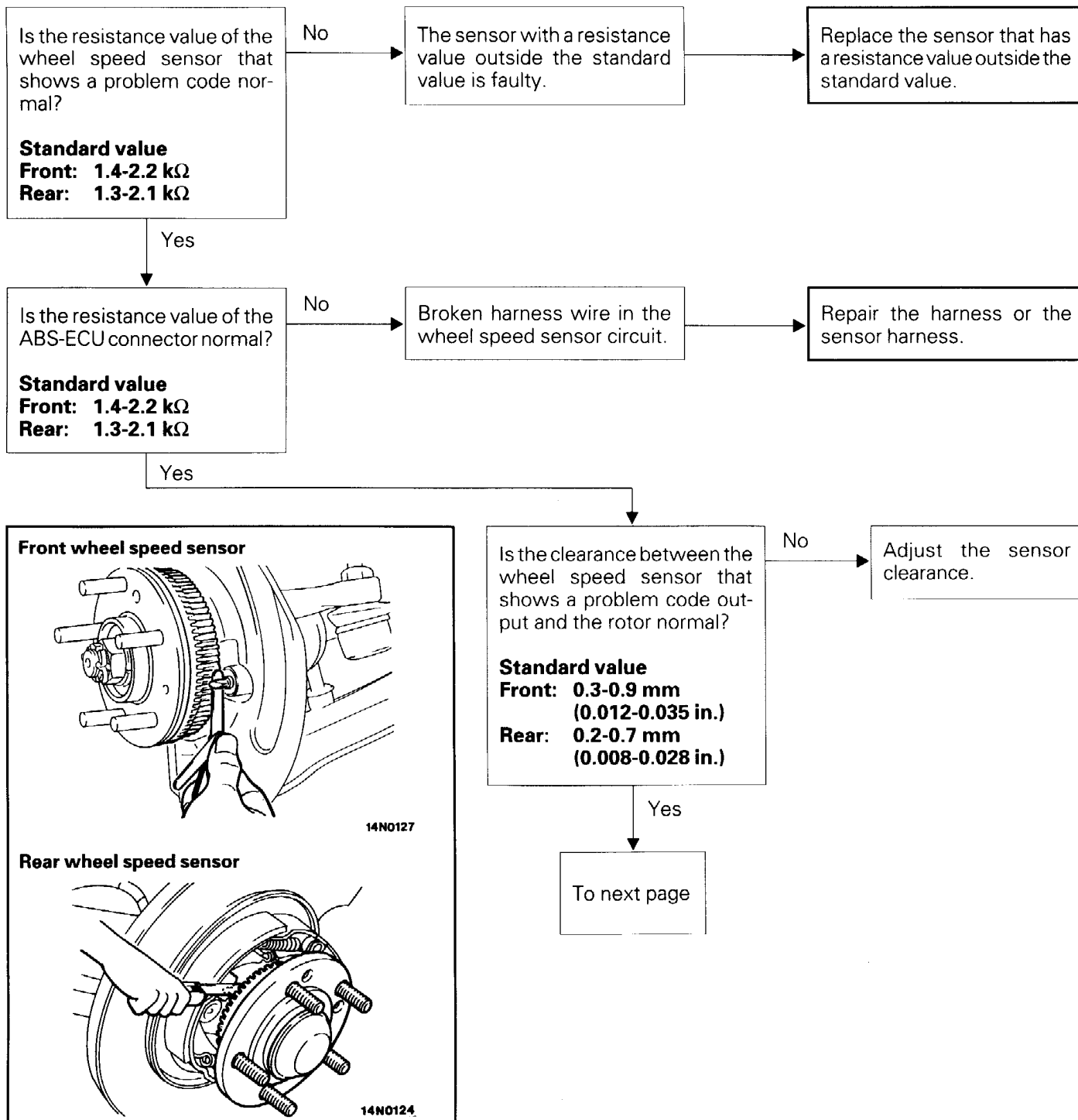
Remedy: Inspect according to "Wheel Speed Sensor Inspection Flow Chart " (P.35-29), while referring to the above.

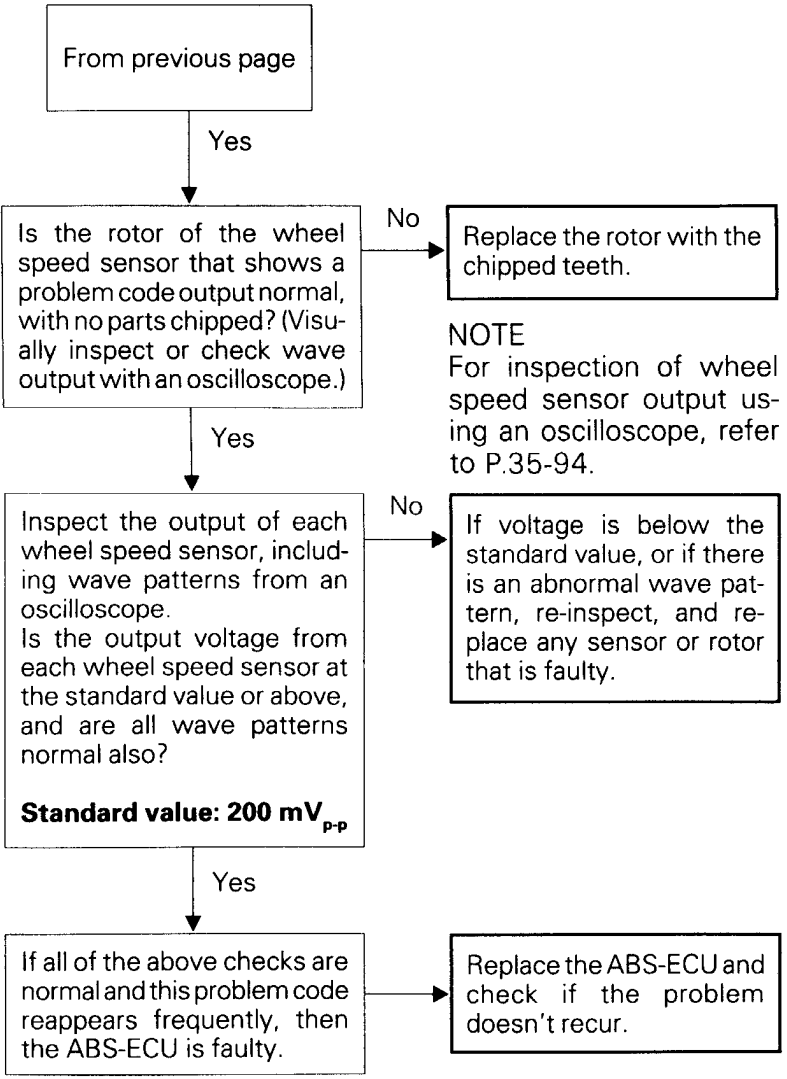
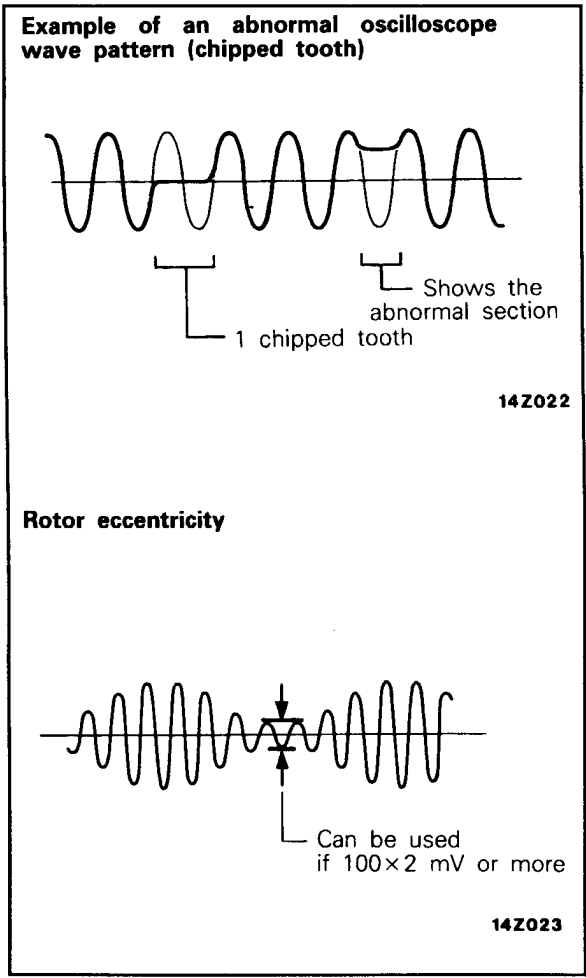
Wheel Speed Sensor Inspection Flow Chart

NOTE

1. When there is a faulty contact, inspect the sensor cable by lightly flexing and stretching it.
2. If there is no current problem, a normal value will result even if a problem is detected, so when the malfunction in the sensor circuit indicated cannot be discovered, momentarily turn the ignition switch to OFF, and carry out another driving test.

At this time, replace the ABS-ECU only if the same problem code is output. After this, if the code does not reappear, there is a problem with the ABS-ECU interface. (For a problem that is difficult to reproduce, there is a possibility that the code will recur even when the ABS-ECU is replaced.)

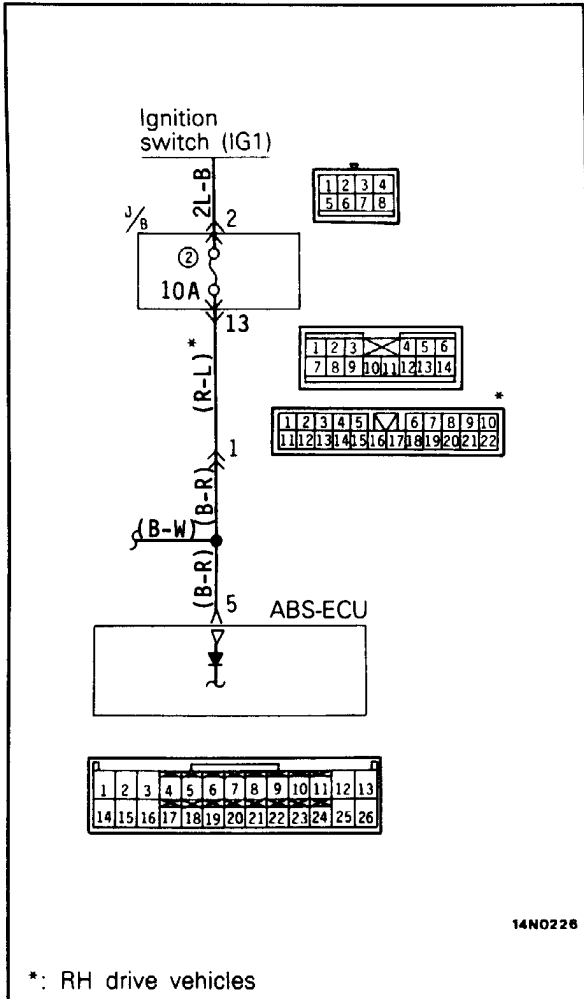




**E-6 When diagnosis code No. 16 is displayed**

Comment: This indicates that the ABS-ECU power voltage is lower than the standard value. If the voltage returns to standard voltage or above, this problem code will not be output.

**Caution**  
**If the battery voltage drops during inspection, this code will be output as a current problem, and correct diagnosis of the problem cannot be made. Before carrying out the following inspection, check the battery level, and refill it if necessary.**



```

    graph TD
      Q1[When the engine is running, does a voltage of 10V or more show between the ABS-ECU power terminal No. 5 and the earth?]
      A1[Yes] --> B1[Inside of ABS-ECU is faulty.]
      A1 -- No --> Q2[Are the fuse contacts normal? (Inspect visually or by using a voltage meter to measure the drop in voltage.)]
      B1 --> R1[Replace the ABS-ECU.]
      Q2 -- No --> R2[Repair the faulty contact.]
      Q2 -- Yes --> Q3[Is the connection of the ABS-ECU normal? (When the connector is disconnected, check if there are no bends in the pins, or that contact pressure is sufficient.)]
  
```

**E-7 When diagnosis code No. 35 is displayed**

Comment: This indicates that the output voltage of the alternator L terminal is low when the ignition key is turned to "ON" and the engine is stopped, or when the engine is running.

If the voltage returns to standard voltage or above, this problem code will not be output.

Hint: When the output voltage of the alternator L terminal is low, the charge warning lamp will illuminate. This code also ap-

pears when there is a short in the alternator L terminal monitor circuit, but not if there is a broken wire in that circuit.

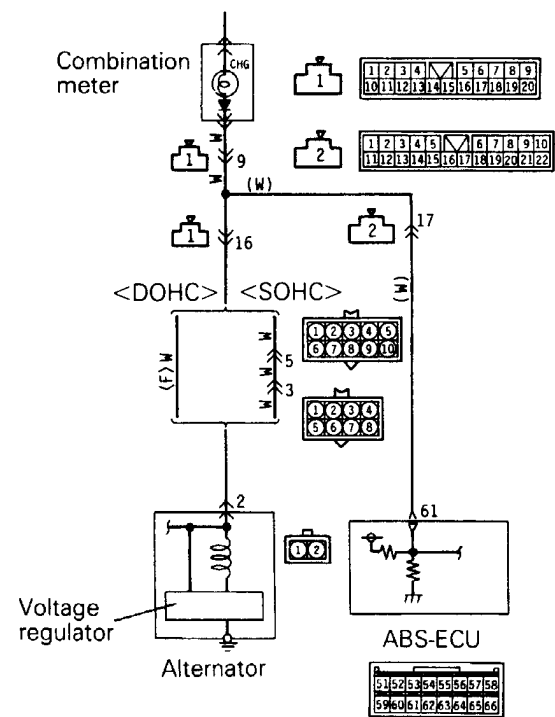
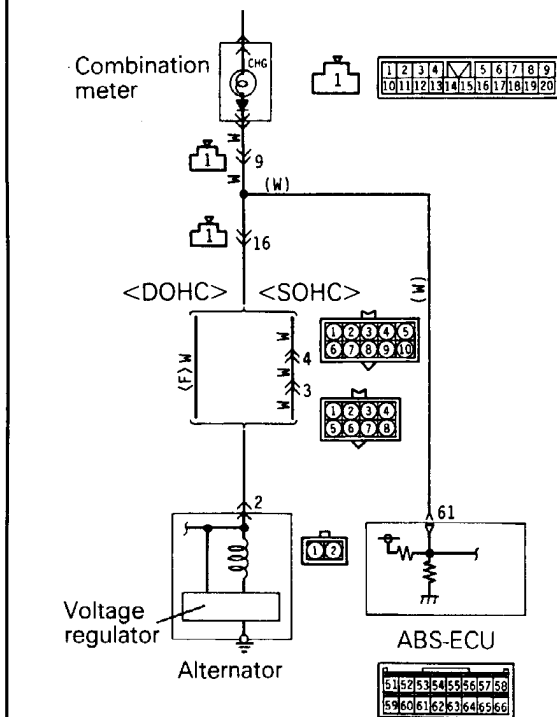
If the multi-use tester service data displays No. 35, this problem code is output.

**NOTE**

If the engine is stopped, this code will be output, even if the situation is normal, so the following inspection should only be carried out if the code is output while the engine is running.

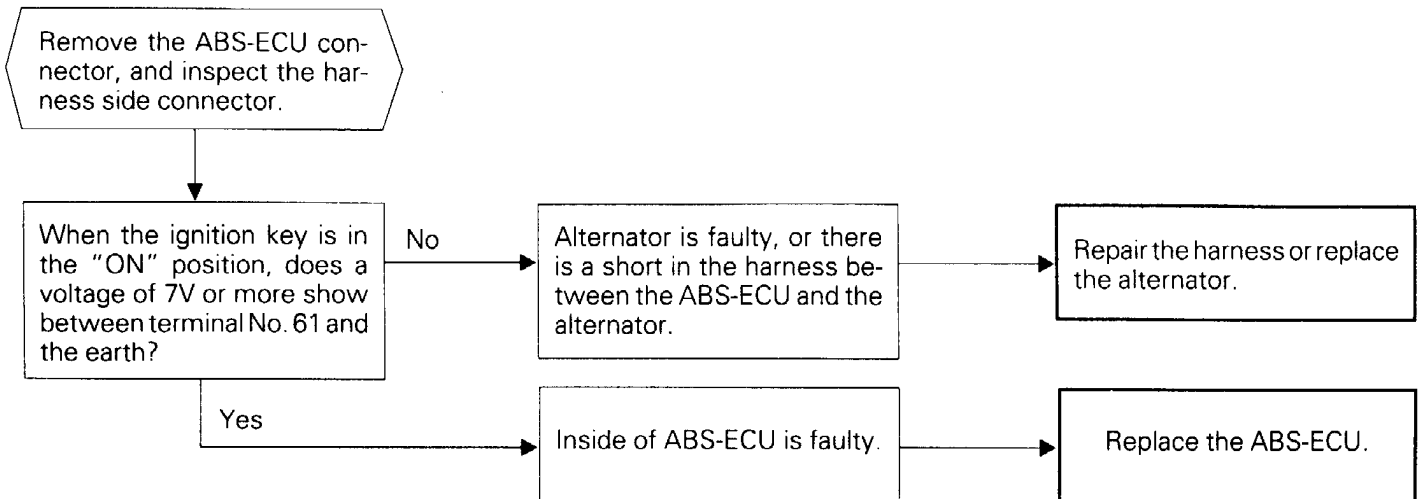
**LH drive vehicles**

**RH drive vehicles**



14N0221

14N0267





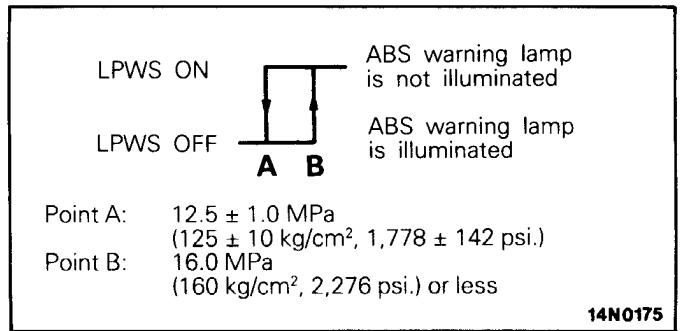
**E-8 When diagnosis code No. 37 is displayed**

Comment: This indicates that the power source pressure for the hydraulic unit is low. If the pressure returns to standard valve or above, this problem code will not be output.

Remedy: While the engine is idling, wait for the pressure to return (motor and pump drive). If the problem continues after approximately 35 seconds or more have passed, the problem code will change over to No. 61. (Inspect according to Inspection chart D-12.)

Hint: This problem code will be output even if there is a broken wire in the LPWS input harness. (ON problem [short] is not detected.)

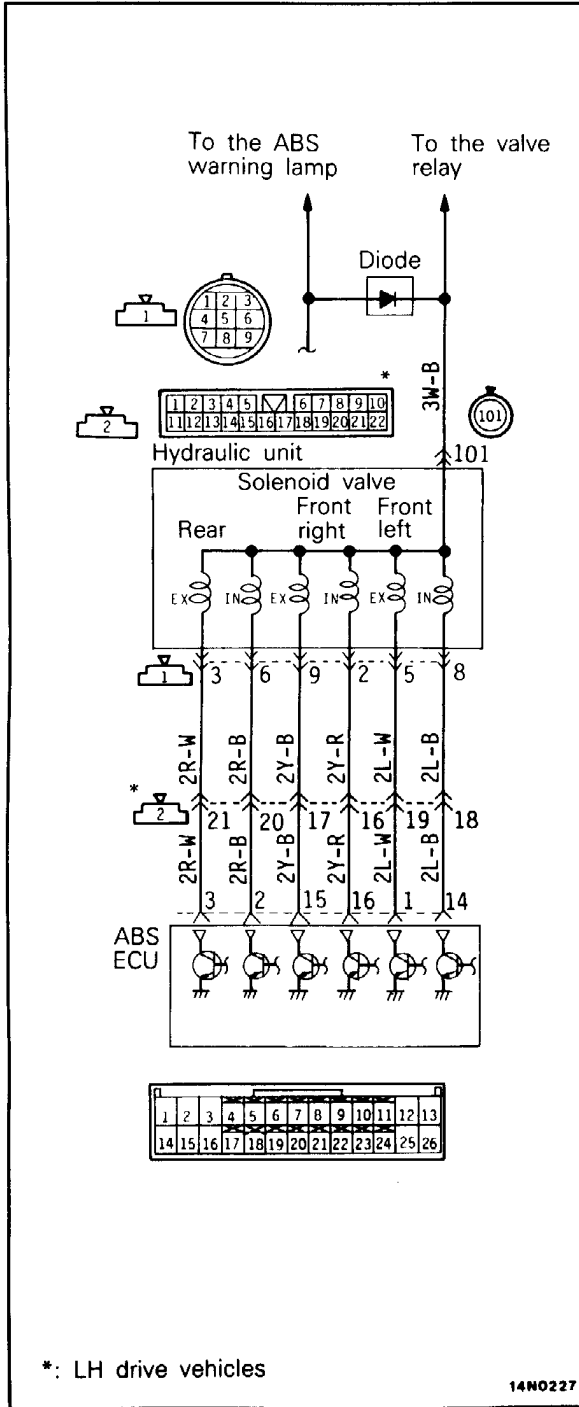
LPWS: Low pressure warning switch



**E-9 When diagnosis codes No. 41, No. 42, No. 43, No. 44, No. 45 or No. 46 are displayed**

Comment: The ABS-ECU normally monitors the solenoid valve drive circuit. If there is no current flowing to the solenoid even when the solenoid is ON, or the current continues to flow to the solenoid even when

the solenoid is OFF, the ABS-ECU diagnoses a broken wire or short in the solenoid coil or a broken wire or short in the harness, and this problem code is output.



```

    graph TD
      A[Remove the hydraulic unit 9 pin connector and the 1 pin connector, and inspect the hydraulic unit side connector.] --> B{Is the resistance value of the solenoid valve that shows a problem code within the standard range?}
      B -- No --> C[Replace the hydraulic unit.]
      B -- Yes --> D[Connect the hydraulic unit 9 pin connector and the 1 pin connector, and remove and inspect the ABS-ECU connector.]
      D --> E{If the resistance value of the solenoid valve that shows a problem code is measured between the ABS-ECU connector and the hydraulic unit 1 pin connector (No. 101) terminal, is the value within the standard range?}
      E -- No --> F[Broken harness wire or short in the solenoid valve that has a resistance value outside of the standard value range.]
      E -- Yes --> G[Broken harness wire or short in the ABS-ECU interface.]
      F --> H[Repair the harness.]
      G --> I[Replace the ABS-ECU.]
    
```

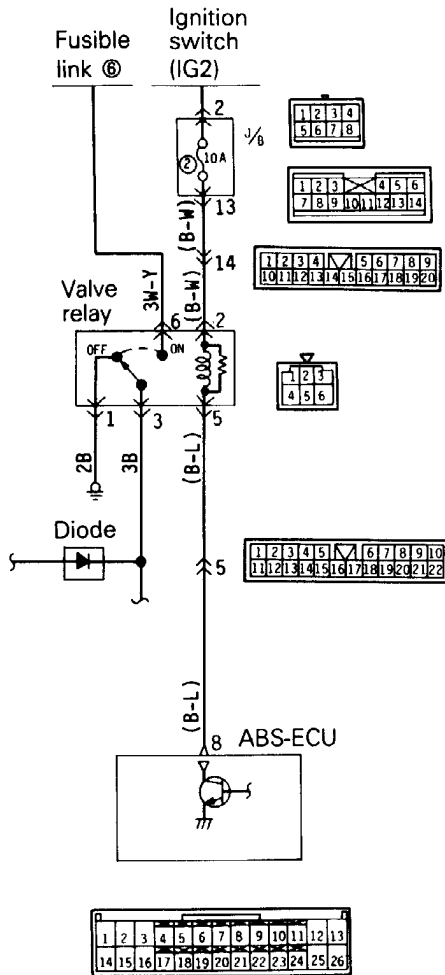
**Standard value:**  
 2.8–3.4 Ω (vehicles without TCL)  
 3.0–3.2 Ω (vehicles with TCL)

**E-10 When diagnosis code No. 51 is displayed**

Comment: During the initial check when the ignition switch is turned to "ON", if power is being supplied to the solenoid when the valve relay is OFF, the ABS-ECU diagno-

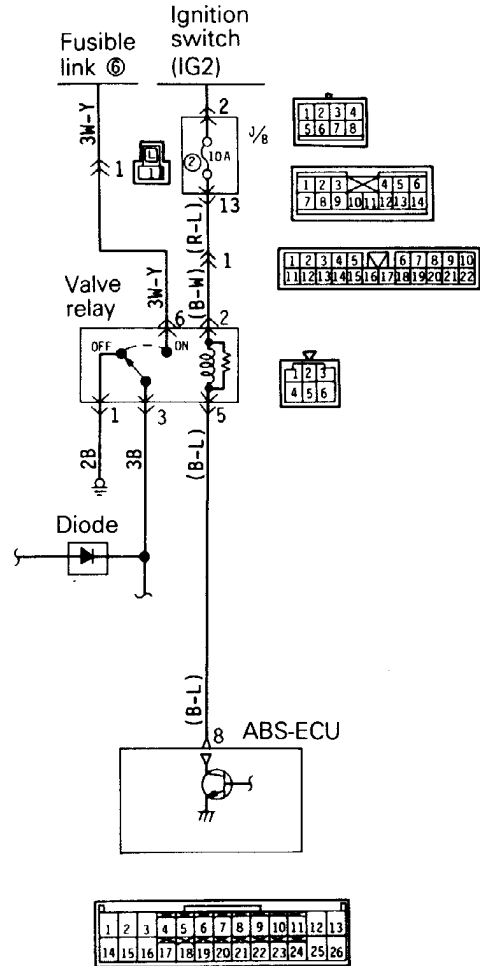
ses a melted relay contact or a short in the valve relay drive circuit, and the problem code No. 51 is output.

**LH drive vehicles**

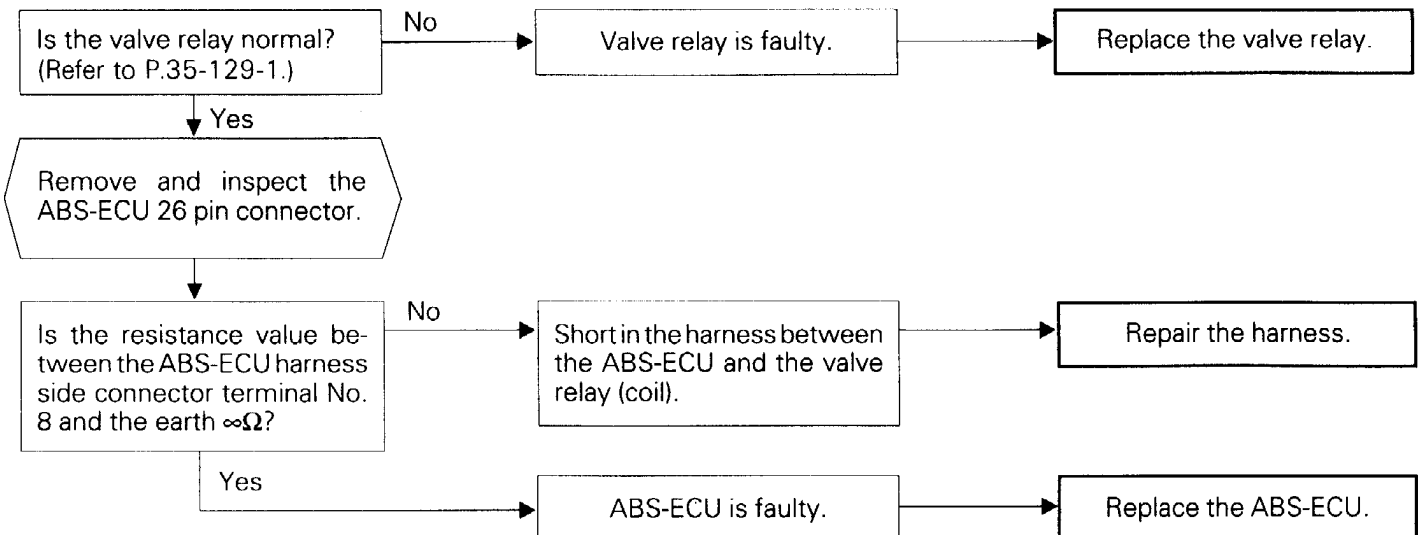


14N0229

**RH drive vehicles**



14N0269



**E-11 When diagnosis code No. 52 or No. 53 are displayed**

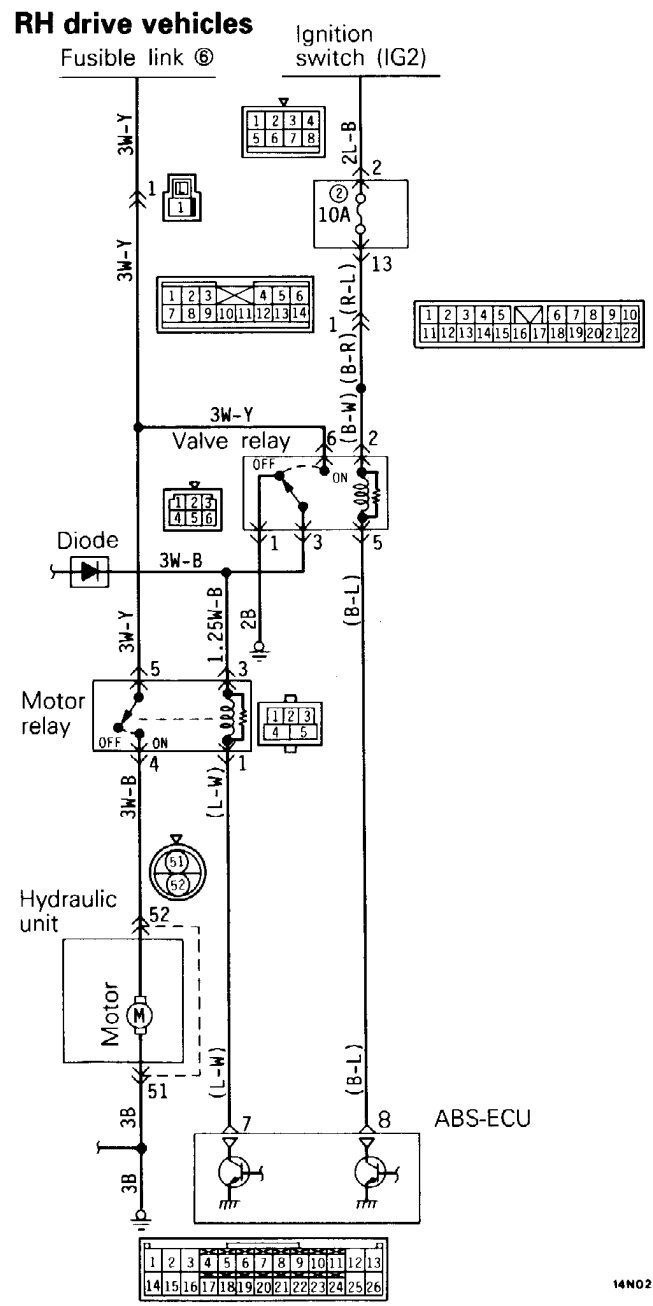
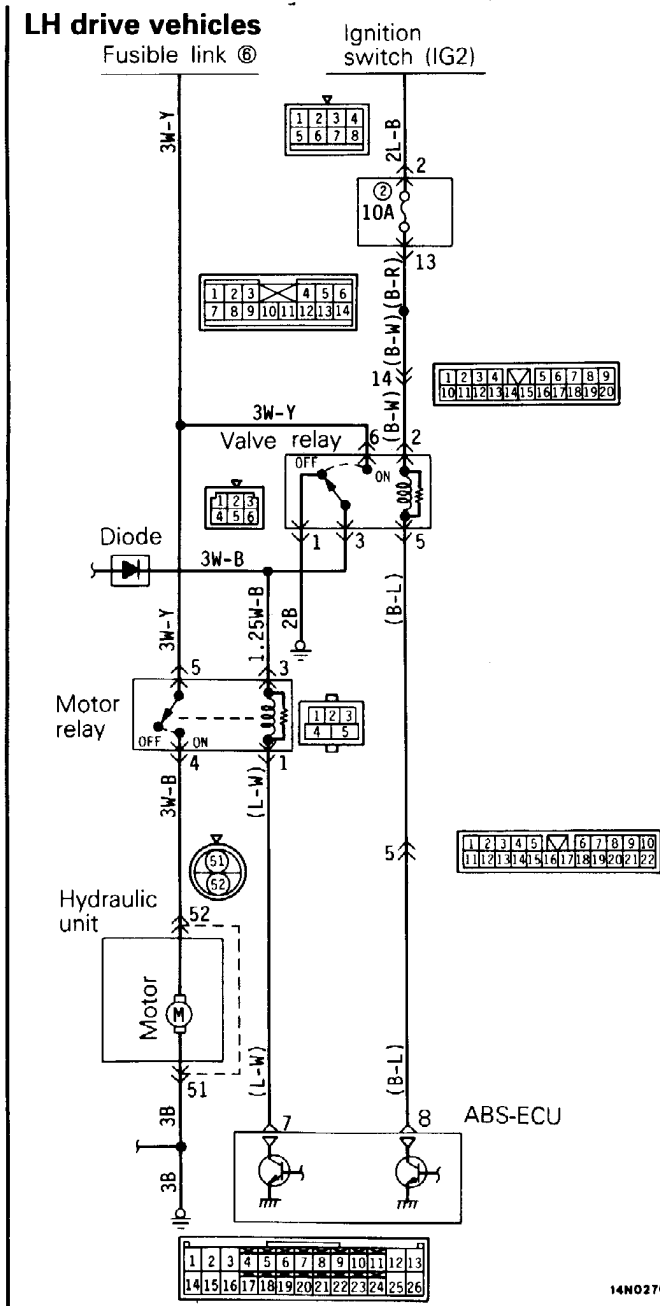
Comment: During the initial check when the ignition switch is turned to "ON", if power is not being supplied to the solenoid when the valve relay is ON, the ABS-ECU diagnoses an OFF problem in the valve relay (not turned ON), and outputs the problem code No. 52. Also, when the motor pump receives a signal to turn ON and voltage at the motor monitor is LOW, the ABS-ECU outputs the problem code No. 53.

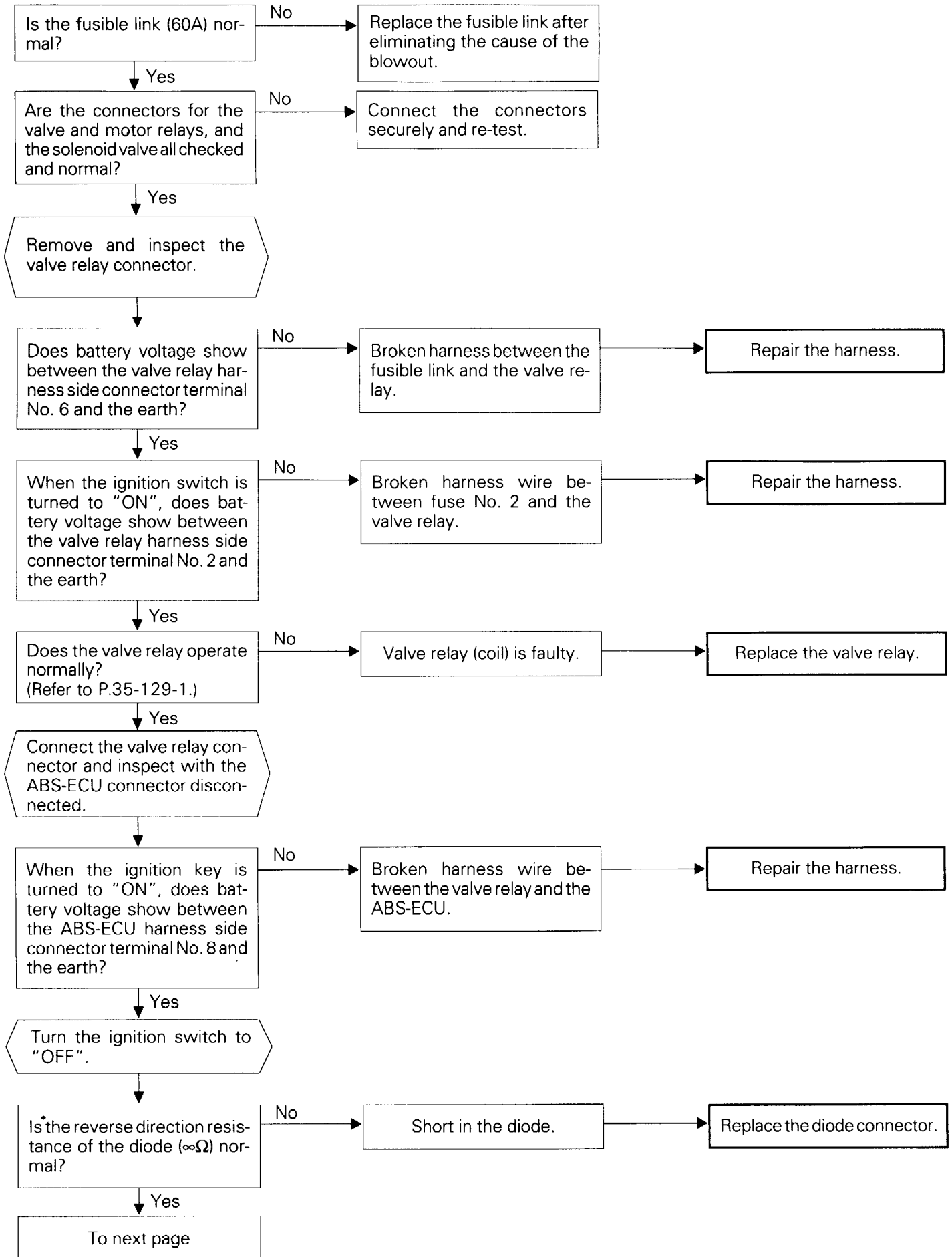
Hint: Because the same circuit is used as the power supply circuit for the valve relay and the motor relay, inspection of the circuit between the ABS fusible link (6) and the valve relay is necessary

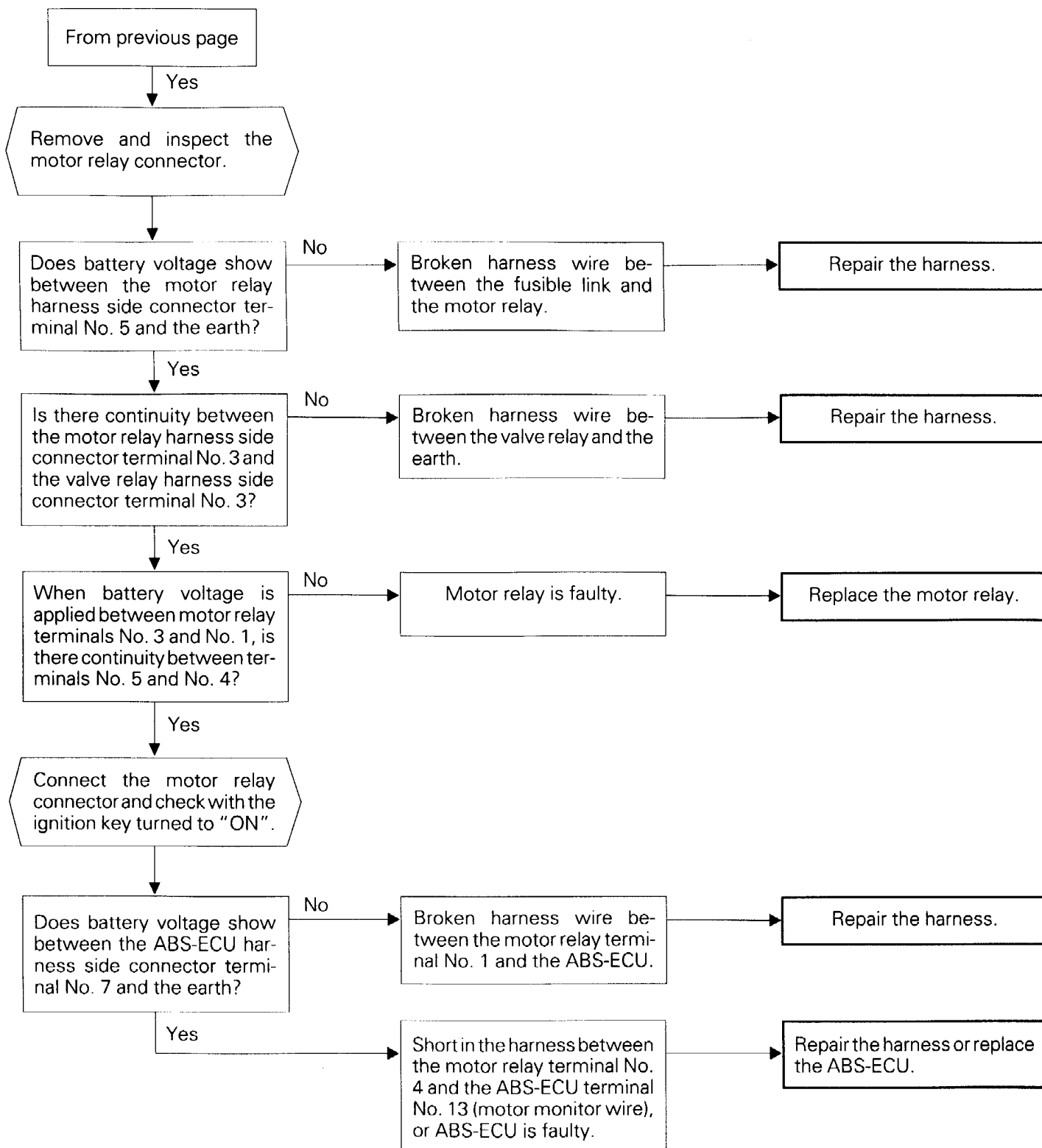
for both code Nos. 52 and 53. However, if the ABS system stops functioning after the sound of the motor is heard, or if it stops functioning when the motor relay is force-driven by the MUT actuator test (No. 08), the power supply and the valve relay system can be considered normal.

**Caution**

**As there is a problem that the accumulator pressure could become higher than necessary, resulting in a bad effect on the system, it is best not to carry out actuator test No. 8 if possible.**







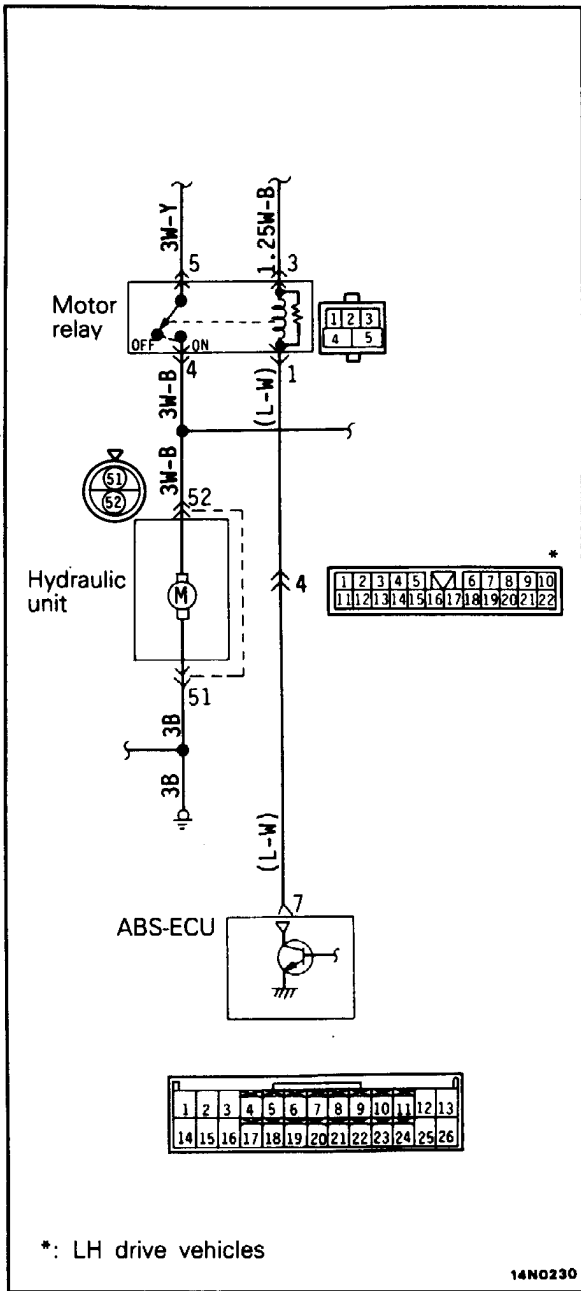
**E-12 When diagnosis code No. 54 is displayed**

**Comment:** When the pump motor receives a signal to turn OFF and the motor monitor is ON, if a melted contact, etc. is diagnosed in the motor relay, the ABS-ECU outputs the problem code No. 54.

**Hint:** Because the motor monitor wire is pulled up into the ABS-ECU by the IG power, this problem code is output if there is a broken wire in the harness, even if the motor relay and the motor are normal.

**Caution**

**If there is a melted contact in the motor relay, the motor will keep turning, even if the ignition witch is turned to OFF. In such a case, immediately remove the fusible link (60A) or disconnect the hydraulic unit 2 pin connector. Excessive running of the motor will cause a reduction in the efficiency of the hydraulic unit solenoid valve.**



```

    graph TD
        Start([Remove and inspect the motor relay connector.]) --> Q1{Is the resistance value between the motor relay harness side connector terminal No. 4 and the earth (motor resistance value) around the standard value?}
        Q1 -- No (approx. 0Ω) --> B1[Short in the harness between the motor relay and the motor or in the motor monitor circuit, or a short in the hydraulic unit motor coil.]
        Q1 -- No (approx. ∞Ω) --> B1
        Q1 -- Yes --> Q2{Does a resistance value of approximately 0Ω show between the ABS-ECU harness side connector terminal No. 7 and the earth?}
        B1 --> R1[Repair the harness or replace the hydraulic unit.]
        Q2 -- Yes --> R2[Short in the harness between the motor relay and the ABS-ECU.]
        Q2 -- No --> R3[ABS-ECU is faulty.]
        R1 --> R4[Repair the harness.]
        R2 --> R4
        R3 --> R5[Replace the ABS-ECU.]
    
```

**E-13 When diagnosis code No. 61 is displayed**

Comment: The ABS-ECU outputs this problem code No. 61 in the following cases if there is a fault inside the hydraulic unit.

- (1) Even when the pump motor operates for 34 seconds due to demand of the pressure control switch, and then alternately switches OFF for 8.5 seconds and ON for 8.5 seconds, repeating this intermittent operation 4 times (total approx. 1 minute 40 seconds), the accumulator does not recover pressure equal to the pressure control switch standard amount or higher.
- (2) When the low pressure warning switch outputs OFF (low pressure) for approximately 35 seconds after the engine is started.
- (3) When low pressure warning switch ON (high

pressure) is detected after the engine is started, and then the low pressure switch outputs OFF (low pressure) for 10 seconds or longer.

- (4) When the pressure control switch is ON (high pressure side) and the low pressure warning switch is OFF (low pressure side).

Hint: After starting the engine, if the ABS warning lamp illuminates after the motor has been operating intermittently as in (1) above, it is clear that this problem code is output under the conditions in (1) due to faulty pump pressure accumulation. After starting the engine, if the multi-use tester service data displays No. 37 (ON [high pressure side]), it is clear that this problem code is output under the conditions in (1).

**REMEDY FOR FAULTY PUMP PRESSURE ACCUMULATION**

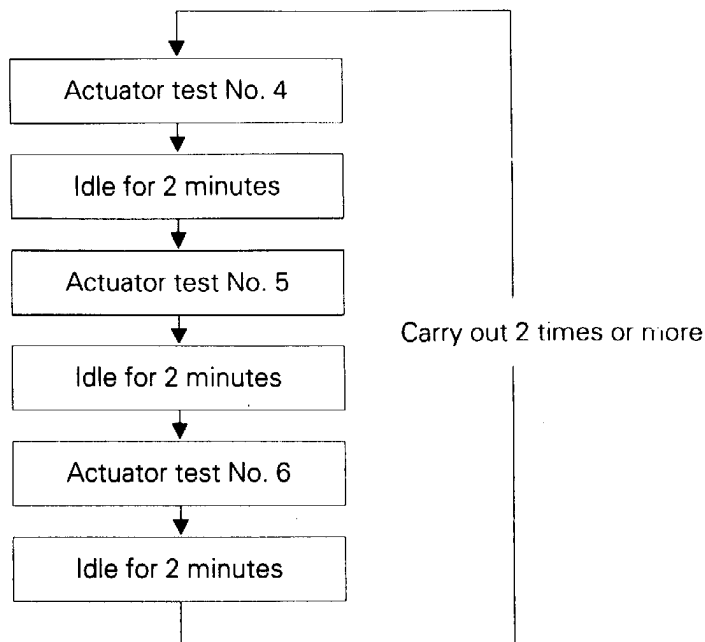
1. Operation to expel N<sub>2</sub> (nitrogen) gas  
For a vehicle that hasn't been used for a long period, the high pressure N<sub>2</sub> (nitrogen) gas that is stored inside the hydraulic unit accumulator passes through the rubber diaphragm and collects around the hydraulic unit pump, and this prevents oil pressure from building up even if the hydraulic unit pump is turning, so the following procedure should be carried out to expel the N<sub>2</sub> (nitrogen) that has collected around the pump.

**(1) When Using The Multi-use Tester**

With the brake pedal depressed, carry out multi-use tester actuator tests No. 04–06 in the following way. (The collected gas is leaked into the reservoir by means of the forced actuation of the solenoid valve.)

**NOTE**

For points on carrying out actuator tests, refer to P.35-96.





**(2) When Not Using The Multi-use Tester**

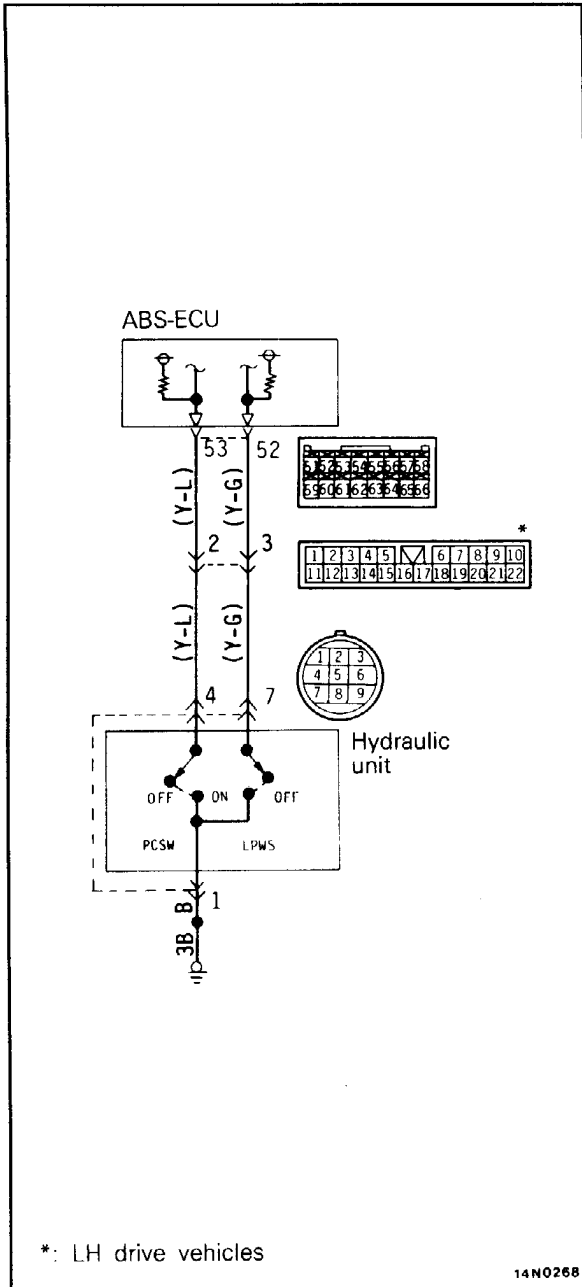
Start the engine, leave it idling for 2 minutes, and then stop the engine.

Repeat this 10 times or more.

(The collected gas is leaked into the reservoir in the same way as when using the multi-use tester, by the repeated short-term operation of the solenoid valve during the initial check.)

2. After carrying out the above, if it is normal [No abnormality is detected in the above cases (1) to (3)], carry out a normal bleeding of the brake lines.
3. After carrying out the above, if the motor operates intermittently and this problem code is output, the motor or pump operation is faulty, so replace the hydraulic unit.

**INSPECTION OF PRESSURE SWITCHES (WHEN THE MOTOR DOES NOT OPERATE AFTER THE ENGINE HAS BEEN TURNED ON)**



Remove and inspect the hydraulic unit 9 pin connector.

Check the continuity between the hydraulic unit harness side connector terminals No. 4 and No. 1 (PCSW) and between terminals No. 7 and No. 1 (LPWS). Are the operating conditions of both switches one of the following?

	I	II	III
PCSW:	ON	OFF	OFF
LPWS:	ON	ON	OFF

PCSW: Pressure control switch  
LPWS: Low pressure warning switch

ON: Continuity  
OFF: No continuity

**No** → A pressure switch inside the hydraulic unit is faulty. → Replace the hydraulic unit.

**Yes** → Connect the hydraulic unit connector, and remove and inspect the ABS-ECU connector.

Check for continuity between the ABS-ECU harness side connector terminals No. 53 (PCSW) and No. 52 (LPWS) and the earth. Are the operating conditions of both switches one of the following?

	I	II	III
PCSW:	ON	OFF	OFF
LPWS:	ON	ON	OFF

PCSW: Pressure control switch  
LPWS: Low pressure warning switch

ON: Continuity  
OFF: No continuity

**No** → Broken wire or short in the harness between the hydraulic unit and the ABS-ECU.

**Yes** → ABS-ECU is faulty. → Replace the ABS-ECU.

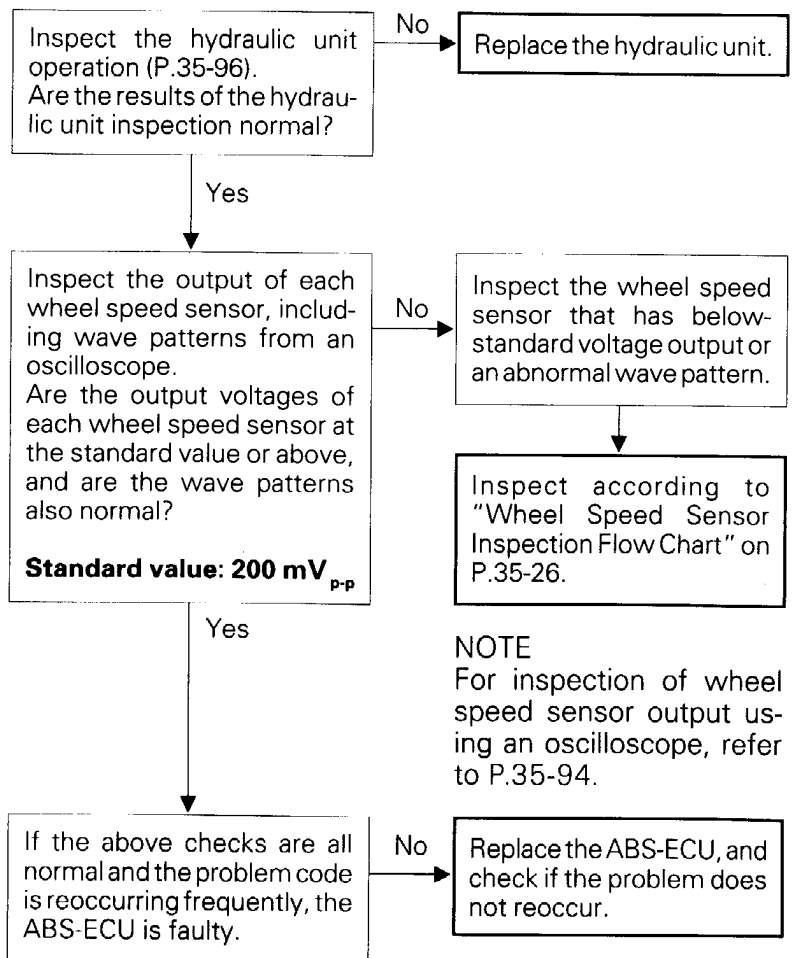
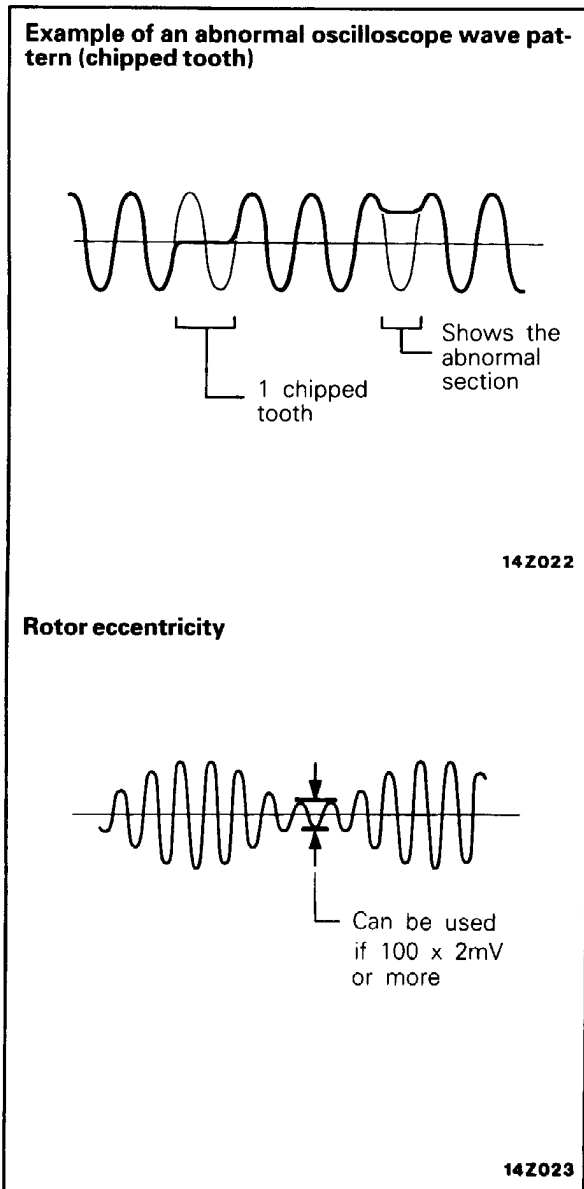
**E-14 When diagnosis code No. 62 is displayed**

Comment: Diagnosis code No. 62 is a problem code that is output when the ABS is unable to operate for a long period of time. However, it is possible that the problem could be caused not only by a faulty hydraulic unit, but also by a malfunctioning wheel speed sensor.

**Caution**

The problem code No. 62 is detected in the following cases, even if the ABS system is normal.

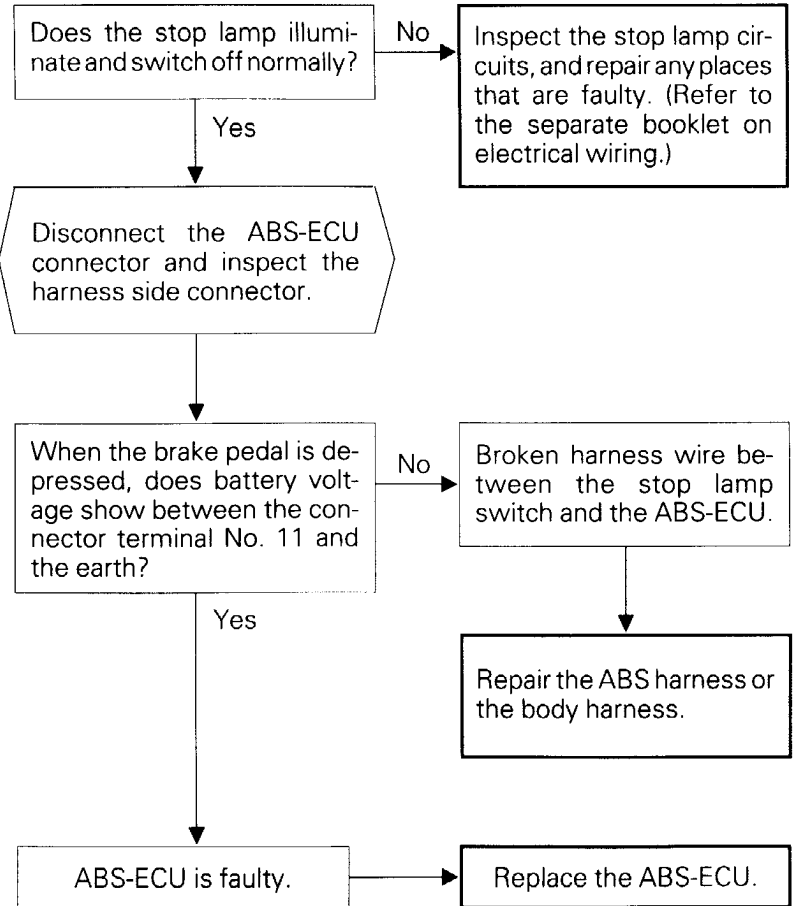
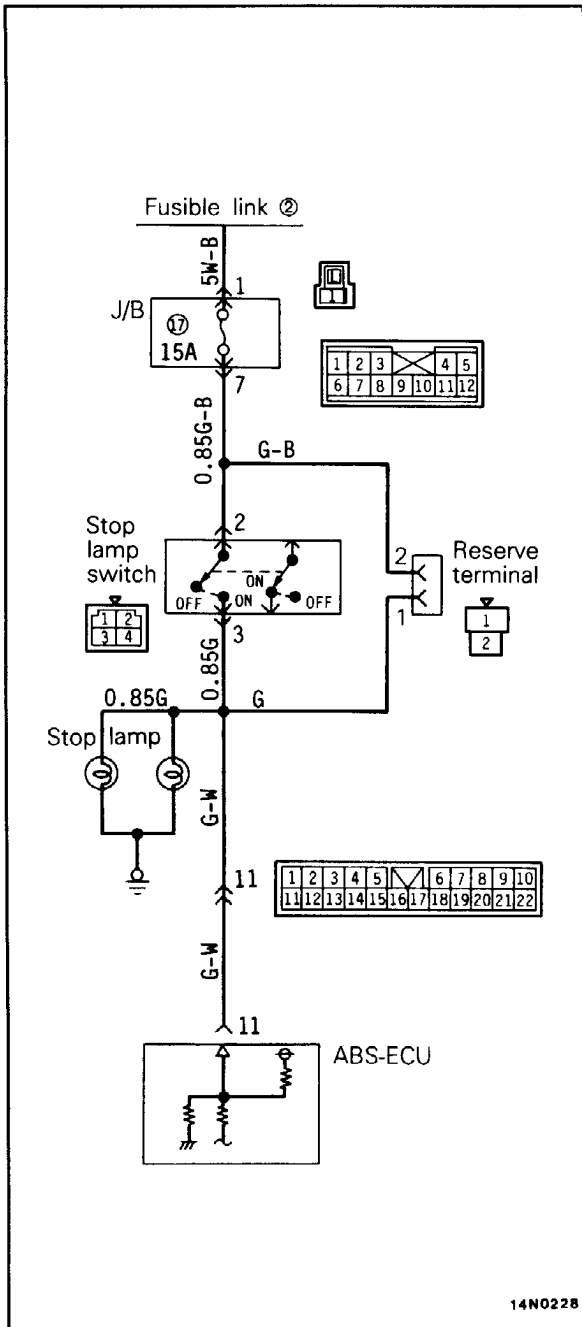
- If the parking brake is not fully released, or if the brakes are dragging while driving on snow or ice.
- When driving with left and right tyres of different sizes (difference in tyre diameter or uneven wear).
- When driving for a long period of time on roads with low friction coefficients, such as ice-covered roads.



**F Change in ABS operating vehicle speed or frequency of operation**

Comment: If the stop lamp switch ON signal is not input even once after the engine is started, the ABS control commences when the vehicle speed reaches 15 km/h (9 mph) or above. (Control is possible if the signal is input even once and the vehicle speed is approximately 6 km/h [4 mph] or above.) This symptom indicates a broken wire in the stop lamp switch.

Hint: When the stop lamp is illuminating normally, if the multi-use tester service data shows No. 38 even if the brake pedal is depressed, then there is a broken harness wire in the stop lamp switch input circuit, or the ABS-ECU interface circuit is faulty.



## TRACTION CONTROL (TCL) SYSTEM TROUBLESHOOTING

### 1. PARTICULAR PHENOMENA OF THE TCL SYSTEM

- (1) On slippery road surfaces, such as those covered by snow, sometimes a vibration is felt in the vehicle when traction control is operating normally. This is due to the braking action of the slip control, and is not unusual.
- (2) When the engine is started, a rattling sound can sometimes be heard inside the engine compartment and inside the vehicle. This is the sound of the ABS and TCL operation being checked, and is not unusual.
- (3) When climbing very steep slopes, or if the vehicle is stuck and there is continuous pressure on the accelerator pedal for 20 seconds or more, the TCL will continue to operate, and then the TCL OFF indicator will flash and the TCL system function will stop. In this case, momentarily stop the engine, and then after approximately 7 seconds (until the engine control relay switches OFF) restart the engine. After this, when the vehicle speed has reached 20 km/h (12 mph) or more, if the TCL OFF indicator switches off, then the TCL system will operate normally from then on.
- (4) If the vehicle is driven with extremely low tyre pressure, or with tyres that differ widely in diameter, the TCL system will operate even when the vehicle is moving straight, and the engine will give poor acceleration. This is because the wheel speed signal will be different from that of standard tyres. If standard tyres are fitted and the signal becomes normal, then there is no problem.

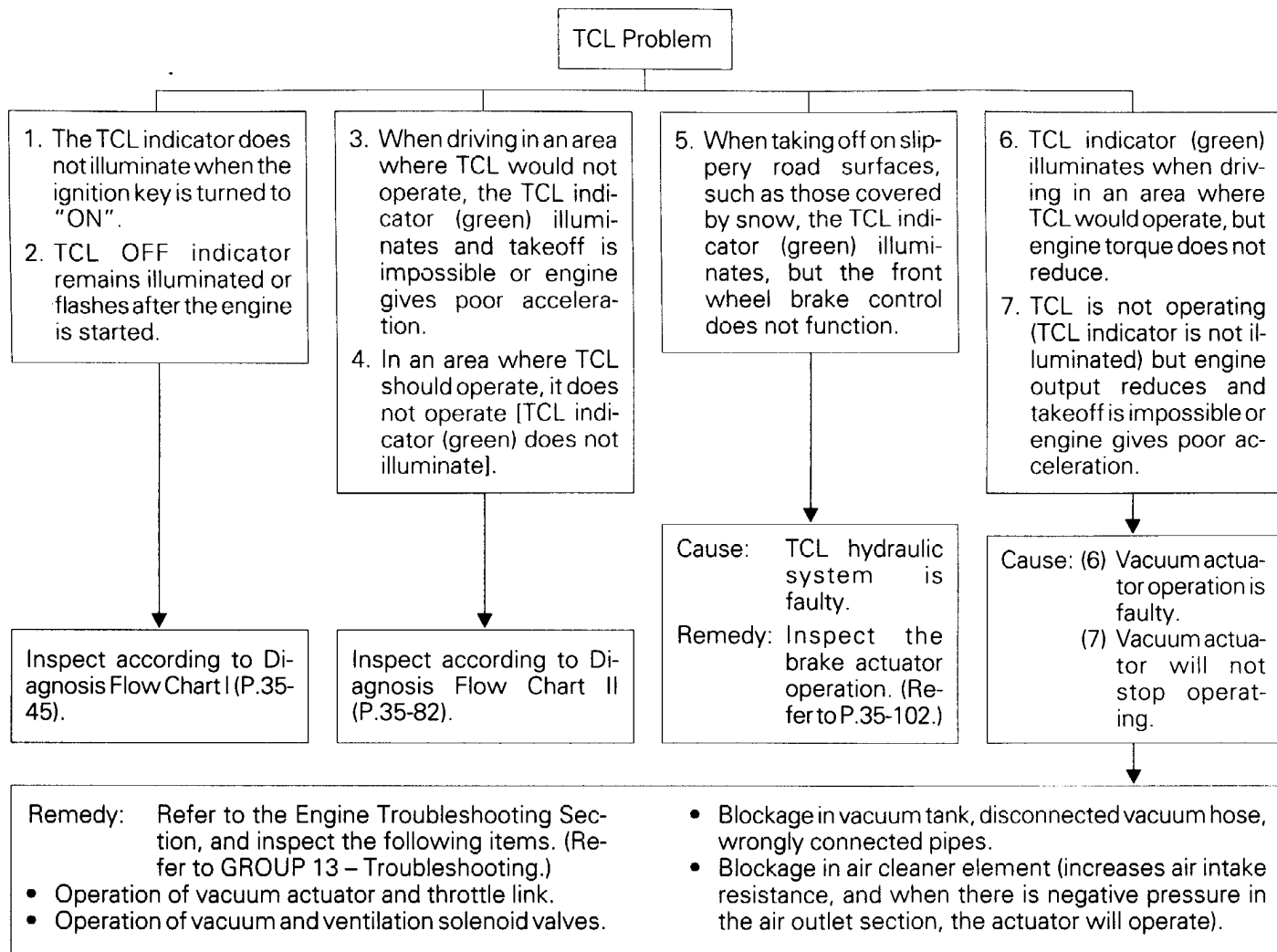
#### NOTE

When engine gives poor acceleration, it can be determined whether the cause is because of a problem connected to the TCL control or engine trouble by observing whether the TCL indicator (green) is illuminated or not.

## 2. DIAGNOSTIC PROCEDURES

Traction control system (TCL) problems have been divided into seven major sections as described below.

Each problem can be diagnosed according to the diagnosis flow chart or from the inspection summary.



## 3. DIAGNOSIS FLOW CHART I

1. When the ignition key is turned to "ON", the TCL indicator does not illuminate.
2. The TCL OFF indicator remains illuminated or flashes after the engine is started or while driving.

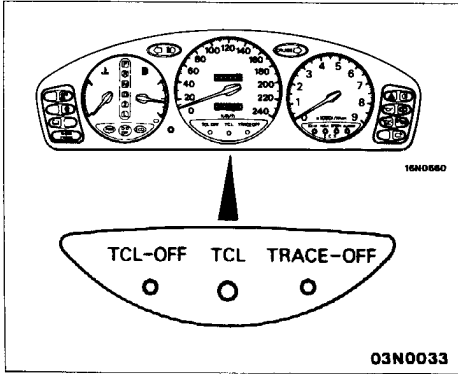
Comment: 1. is mainly caused by a broken wire in the indicator circuit, such as an indicator lamp blowout.

2. When lamp remains illuminated, a problem is detected by the self diagnosis function and a problem code is output, or it is probably a short in the indicator

circuit. If the lamp is flashing, a problem code is output, so this should be checked. When not actually driving the problem may not be detected, so it is necessary to retest to get an accurate perception of the problem.

Use the following procedures to recheck the problem.

When the ignition key has been turned to the "ON" position, do all of the TCL indicators illuminate?



TCL indicator lamps

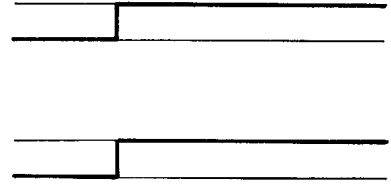
Illuminated

Not illuminated

Ignition key

ON

ACC, LOCK



Yes

No

No.	Problem	Main cause	Remedy
1	All TCL indicators are not illuminated.  TCL indicator lamps Illuminated _____ Not illuminated _____  Ignition key ON _____ ACC, LOCK _____	Broken wire in indicator lamp power circuit (including blown fuse).	Inspect according to Inspection Chart A (P.35-53).
		Control unit connector is disconnected.	
2	Either the TCL OFF, TCL or the TRACE OFF indicator is not illuminated. (At least one is illuminated.)	Blown lamp in the indicator that is not illuminated.	Inspect according to Inspection Chart B (P.35-54).
		Broken harness wire in the indicator drive circuit of the indicator that is not illuminated.	
		Broken wire in the ECU drive circuit of the indicator that is not illuminated.	

To next page

From previous page

When engine has been started, do all of the TCL indicators switch off?

Yes

No

No.	Problem	Main cause	Remedy
3	The TCL OFF indicator remains illuminated	Broken wire in the ECU power circuit	Inspect according to Inspection Chart C (P.35-56).
		Low ECU power voltage	
		ABS-related failure.	
		Engine-related failure.	
4	The TCL OFF indicator flashes	Fail-safe function is operating by TCL self-diagnosis.	Inspect according to Inspection Chart D (P.35-57).
5	The TCL indicator remains illuminated.	Short in the harness of the TCL indicator drive circuit.	Inspect according to Inspection Chart E (P.35-58).
		Short in the TCL indicator ECU drive circuit.	

When engine is idling, each time the TCL switch is pressed to "OFF", do the TRACE OFF indicator and the TCL OFF indicator alternate?

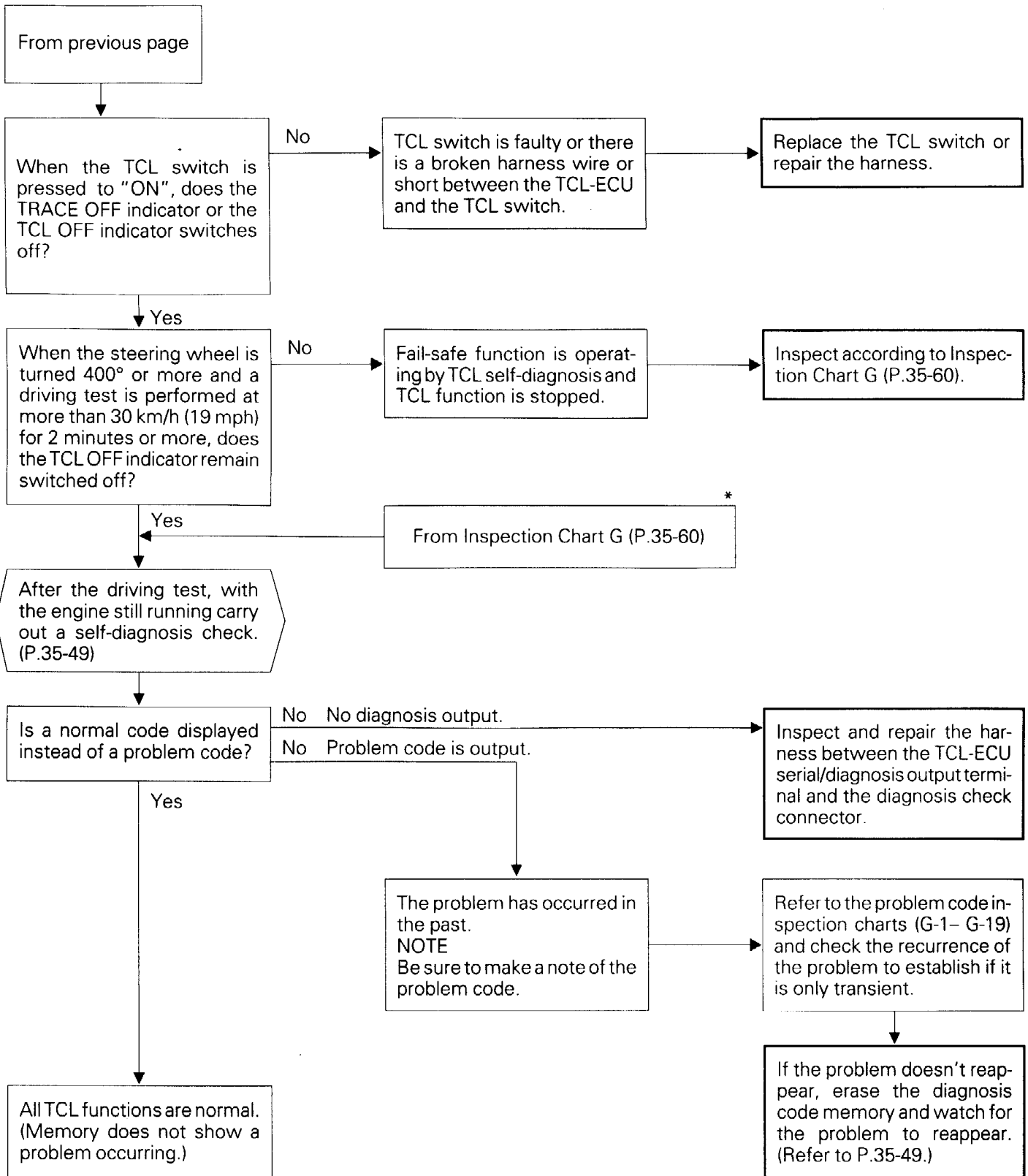
No

TCL switch or TCL-ECU is faulty.

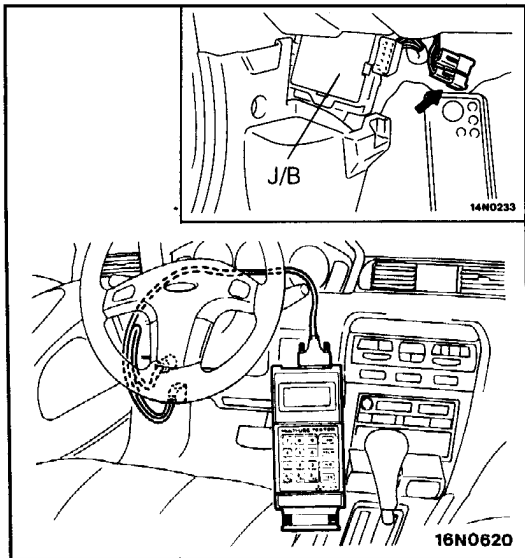
Inspect according to Inspection Chart F (P.35-59).

Yes

To next page







### 3-1. Inspection by self-diagnosis

[WHEN USING THE MULTI-USE TESTER]

**Caution**

**Connection and disconnection of the multi-use tester should always be made with the ignition switch in the OFF position.**

- (1) Take a reading of the diagnosis output code and make a note of it.  
If the multi-use tester will not activate, inspect the TCL-ECU power circuit or the harness between the TCL-ECU and the diagnosis check connector.
- (2) Momentarily erase the diagnosis code memory with the multi-use tester. Even when the memory is erased, and a problem signal is output, the problem signal currently being displayed will also cause the function to stop. If no signal is output, the problem was only transient, or it is a problem that is only detected while driving.
- (3) When a problem code is output again, or another code is output during a repeated driving test, inspect by following the diagnosis code table on the following page.

**NOTE**

The codes in the table below will be output as diagnosis codes for the vehicle's condition, even when the TCL system is normal.

These codes are output only when there is some problem, and when the vehicle condition returns to normal, the code will be normal.

Code No.	Vehicle condition
16	Battery is dead
62	ABS warning lamp is illuminated
63	ABS warning lamp is illuminated

## 3-2. Diagnosis code table

Diagnosis code No.	Probable cause	Inspection chart name or remedy	Reference page
11 <sup>*1</sup>	Abnormal APS output	G-1	P.35-61
12 <sup>*1</sup>	Broken signal wire in the shift control solenoid valve A	G-2	P.35-63
13 <sup>*1</sup>	Broken signal wire in the shift control solenoid valve B		
14 <sup>*1</sup>	Malfunction of the APS or TPS	G-3	P.35-64
15 <sup>*1</sup>	Malfunction of the TCL switch	G-4	P.35-64
16 <sup>*2</sup>	Drop in ECU power voltage	G-5	P.35-65
17 <sup>*2</sup>	Broken signal wire in IG2	G-6	P.35-66
21 <sup>*1</sup>	Broken wire in the front left wheel speed sensor	G-7	P.35-67
22 <sup>*1</sup>	Broken wire in the front right wheel speed sensor		
23 <sup>*1</sup>	Broken wire in the rear left wheel speed sensor		
24 <sup>*1</sup>	Broken wire in the rear right wheel speed sensor		
25 <sup>*4</sup>	Temporary simultaneous malfunction of the rear left and right wheel speed sensors	G-8	P.35-69
26 <sup>*1</sup>	Simultaneous malfunction in the rear left and right wheel speed sensors	G-9	P.35-69
33 <sup>*1</sup>	Broken wire in the steering wheel sensor	G-10	P.35-70
34 <sup>*1</sup>	Malfunction of the steering wheel sensor ST-1 or ST-2	G-11	P.35-72
35 <sup>*1</sup>	Malfunction of the steering wheel sensor ST-N	G-12	P.35-73
41 <sup>*1</sup>	Abnormal signal flow to the engine-ECU	G-13	P.35-75

Diagnosis code No.	Probable cause	Inspection chart name or remedy	Reference page
42* <sup>3</sup>	Malfunction of the engine-ECU throttle system	Inspect according to Engine Troubleshooting	—
43* <sup>3</sup>	CHECK ENGINE warning lamp is illuminated		
51* <sup>1</sup>	No drive signal response from the front right brake solenoid valve IN side	G-14	P.35-76
52* <sup>1</sup>	No drive signal response from the front right brake solenoid valve EX side		
53* <sup>1</sup>	No drive signal response from the front left brake solenoid valve IN side		
54* <sup>1</sup>	No drive signal response from the front left brake solenoid valve EX side		
55* <sup>1</sup>	Malfunction of the brake solenoid valve relay	G-15	P.35-78
56* <sup>3</sup>	Malfunction of the brake solenoid valve IN side	G-16	P.35-80
61* <sup>1</sup>	Broken wire in the ABS 0 (ABS operating) signal	G-17	P.35-80
62* <sup>2</sup>	Broken wire in the ABS 1 (ABS fail) signal, or malfunction of the ABS	G-18	P.35-81
63* <sup>2</sup>	Broken wire in the ABS 0 and the ABS 1 simultaneously, or malfunction in the ABS-ECU	G-19	P.35-81
—	Normal	—	—

**NOTE**

(1) When the above problem codes are output, the TCL OFF indicator gives the following displays from the TCL-ECU.

\*1: Causes the indicator to flash.

\*2: Causes the indicator to illuminate. However, if the system becomes normal, this problem code is automatically erased, and the TCL OFF indicator switches off.

\*3: Causes the indicator to illuminate.

\*4: This signal is judged to be only temporary, and the TCL OFF indicator is not illuminated or made to flash. (If the system becomes normal, the problem code is automatically erased.)

(2) When several problems are detected, they are all displayed, starting from the lowest code number.

## 35-52 SERVICE BRAKES – Traction Control System Troubleshooting

### 3-3. Table of service data inspection items

The following items from the ECU input data can be read using the multi-use tester.

Service data items		Display units	Service data items		Display units
No.	Item		No.	Item	
11	APS opening	mV	24	Wheel speed of rear right wheel	km/H
12	SCSV A drive	ON/OFF	27	Engine displacement	2.5L/3.0L
13	SCSV B drive	ON/OFF	28	Inhibitor switch input	2, L, D, R/N, P
14	TPS opening	mV			
15	Inhibitor switch R position input	ON/OFF	29	Slip control	ON/OFF
16	ECU power voltage	V	30	Trace control	ON/OFF
17	TCL OFF switch input	ON/OFF	31	Steering angle	deg
18	TCL ON switch input	ON/OFF	32	Steering neutral point	ON/OFF
19	Idle switch input	ON/OFF	33	Steering neutral point memory	ON/OFF
20	Ignition switch input	ON/OFF	34	Solenoid RH drive (Intake)	ON/OFF
21	Wheel speed of front left wheel	km/H	35	Solenoid RH drive (Exhaust)	ON/OFF
22	Wheel speed of front right wheel	km/H	36	Solenoid LH drive (Intake)	ON/OFF
23	Wheel speed of rear left wheel	km/H	37	Solenoid LH drive (Exhaust)	ON/OFF

#### NOTE

- For the steering angle (Item No. 31) 0° will be displayed for neutral position (before memory setting of the neutral position, the ignition key is turned to "ON"), L for left-hand side and R for right-hand side.
- For steering neutral point memory (Item No. 33), when the memory setting of the steering neutral position is completed, "ON" will be displayed.

3-4. Inspection chart for each problem

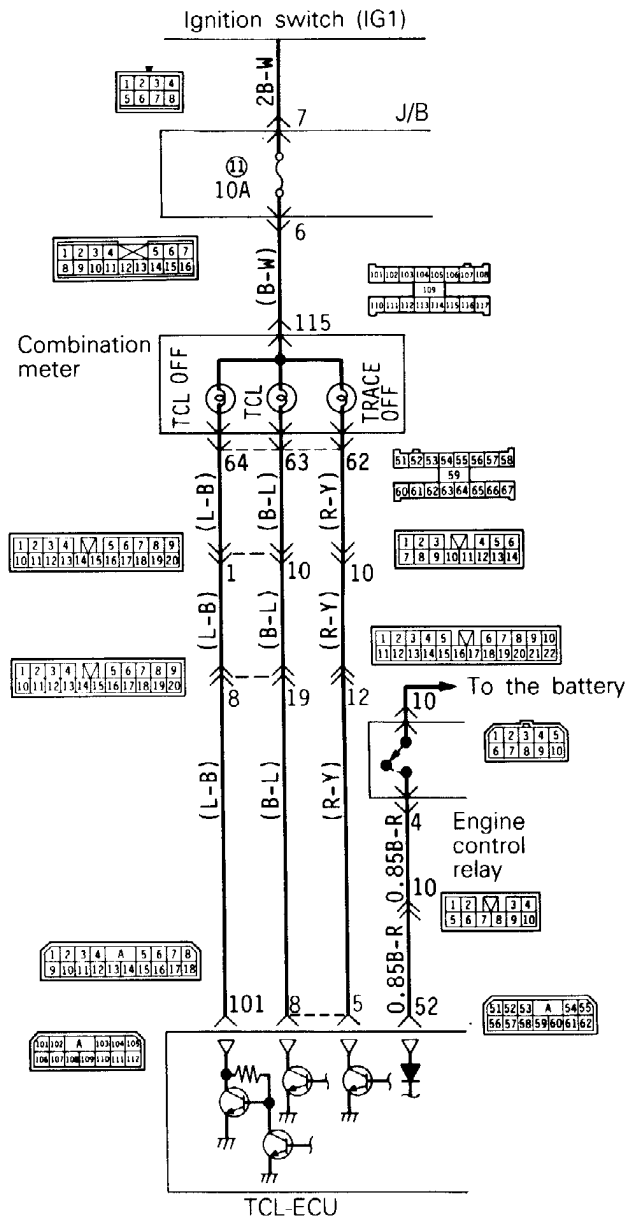
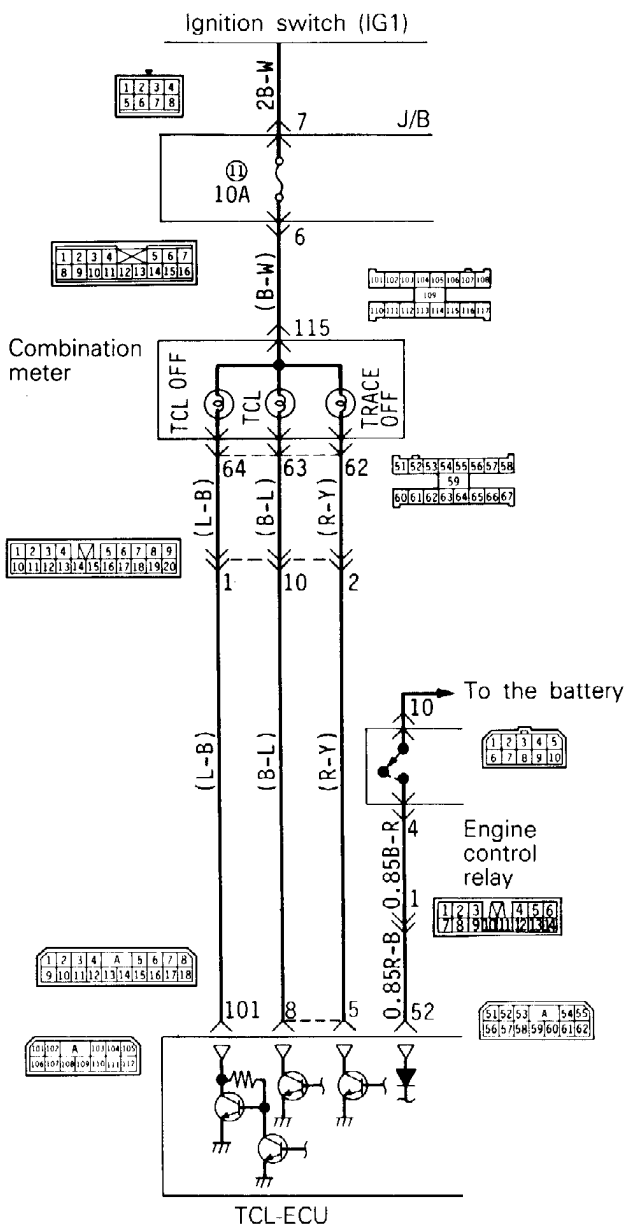
<b>A</b>	<b>After the ignition key has been turned to the "ON" position, all of the TCL indicators do not illuminate.</b>
----------	--

Comment: When the power has been connected, the TCL-ECU will make the TCL OFF, TCL and TRACE OFF indicators all illuminate until engine revolutions reach 450 rpm or higher, in order to check the indicator bulbs. However, the TCL OFF indicator will illuminate even when not started by

the ECU. Thus, when all the indicators do not illuminate, the cause could be either a broken wire in the indicator lamp power circuit or a loose ECU connector.  
Hint: If other warning lamps also do not illuminate, the problem is likely to be a blown fuse.

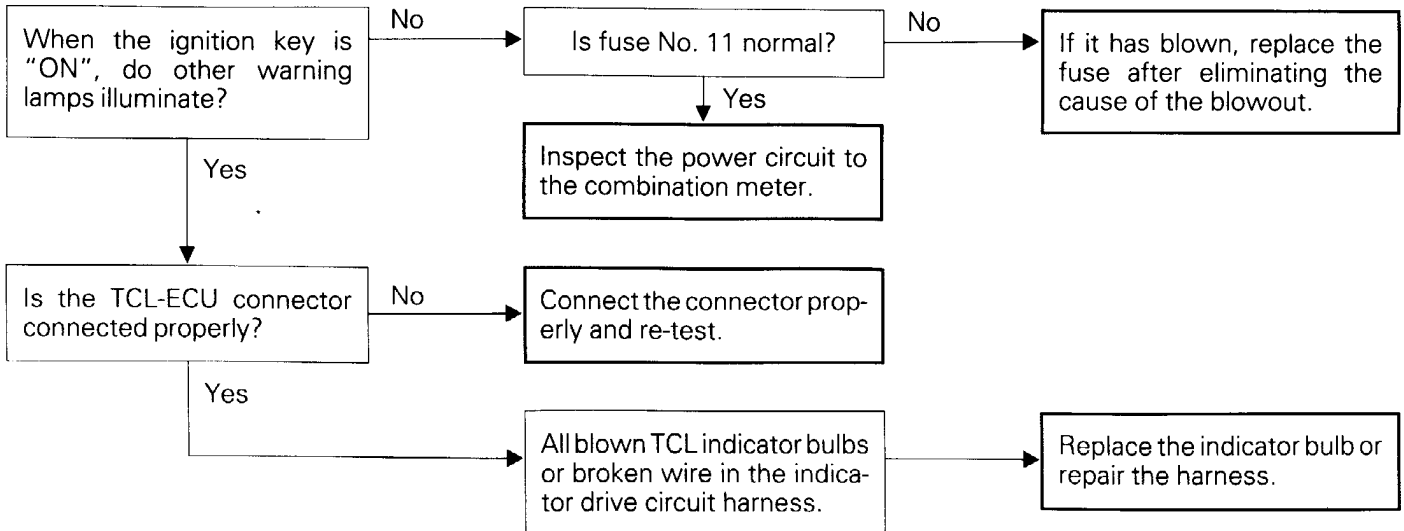
LH drive vehicles

RH drive vehicles



14A0255

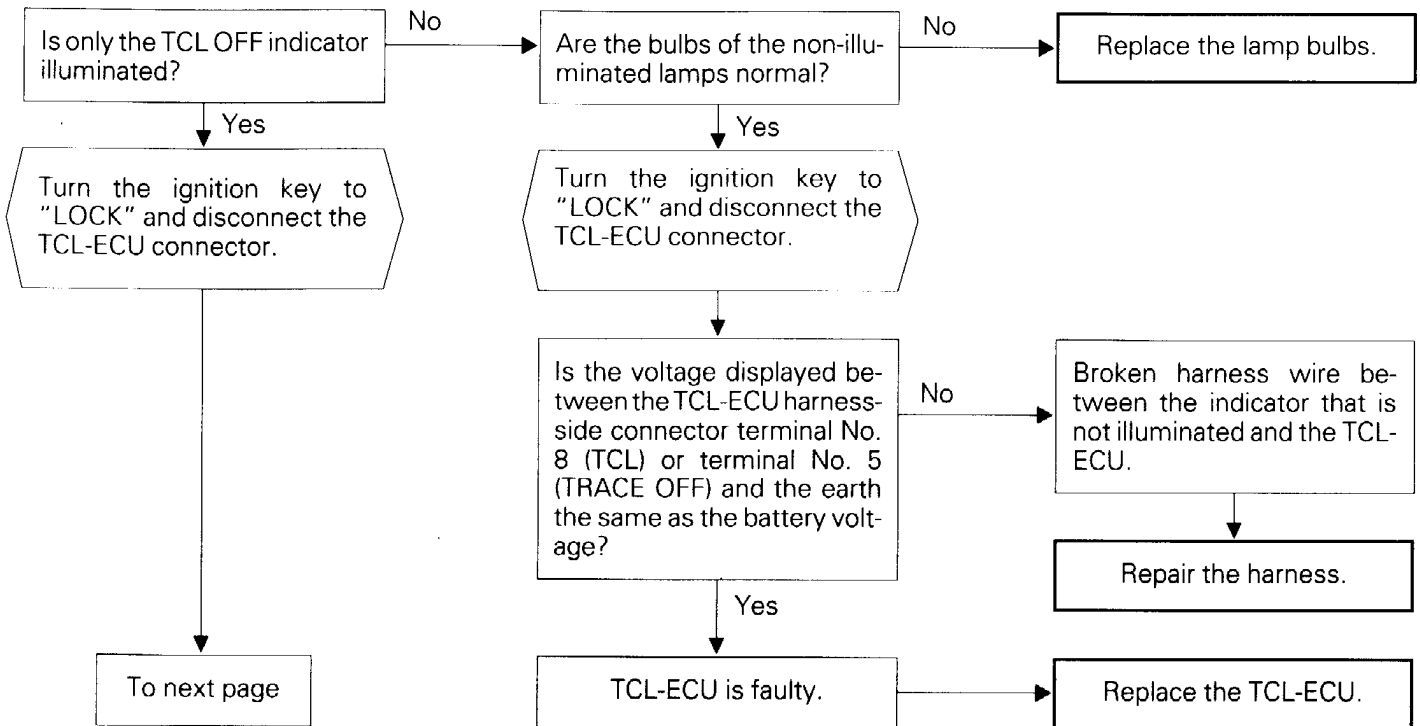
14A0254

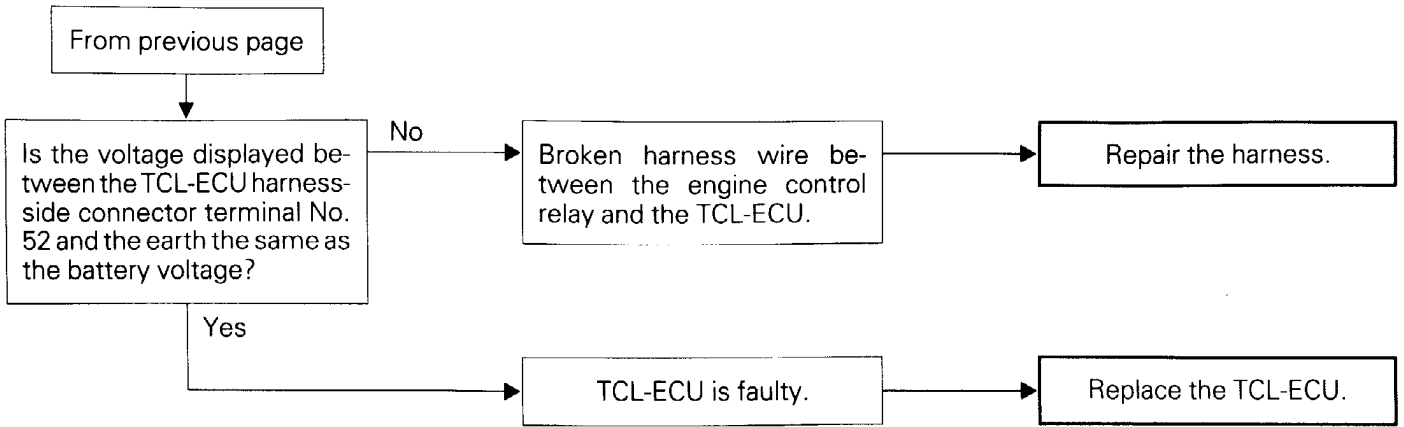


**B When the ignition key is "ON", either the TCL OFF, TCL or TRACE OFF indicator does not illuminate. (At least one of the indicators does illuminate.)**

Comment: The TCL indicators share a common power circuit, so when one or more of the indicators illuminates, the power circuit can be diagnosed as normal. Therefore, there is a strong possibility that the problem is a bulb failure or a broken harness wire.

Hint: The TCL OFF indicator can illuminate even when its circuit is not driven by the TCL-ECU. Therefore if the TCL OFF indicator is illuminated but other indicators are not illuminated, the reason is probably a faulty TCL-ECU (broken wire in the TCL-ECU power circuit).



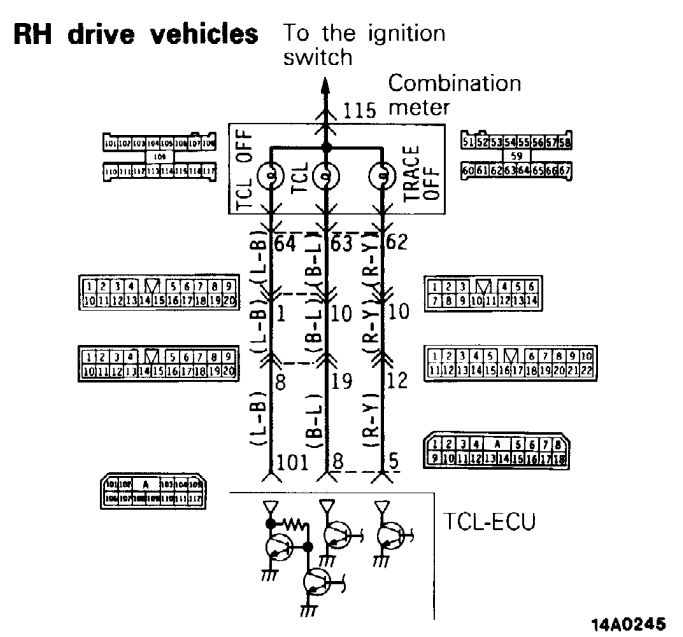
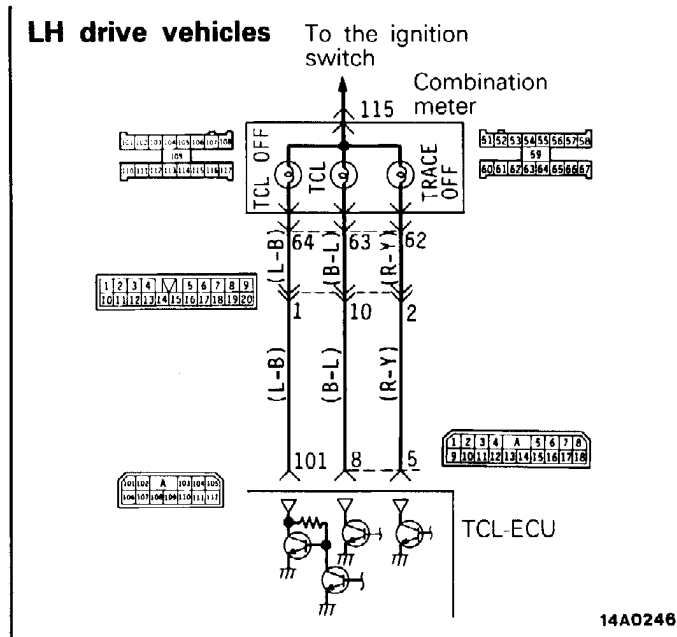
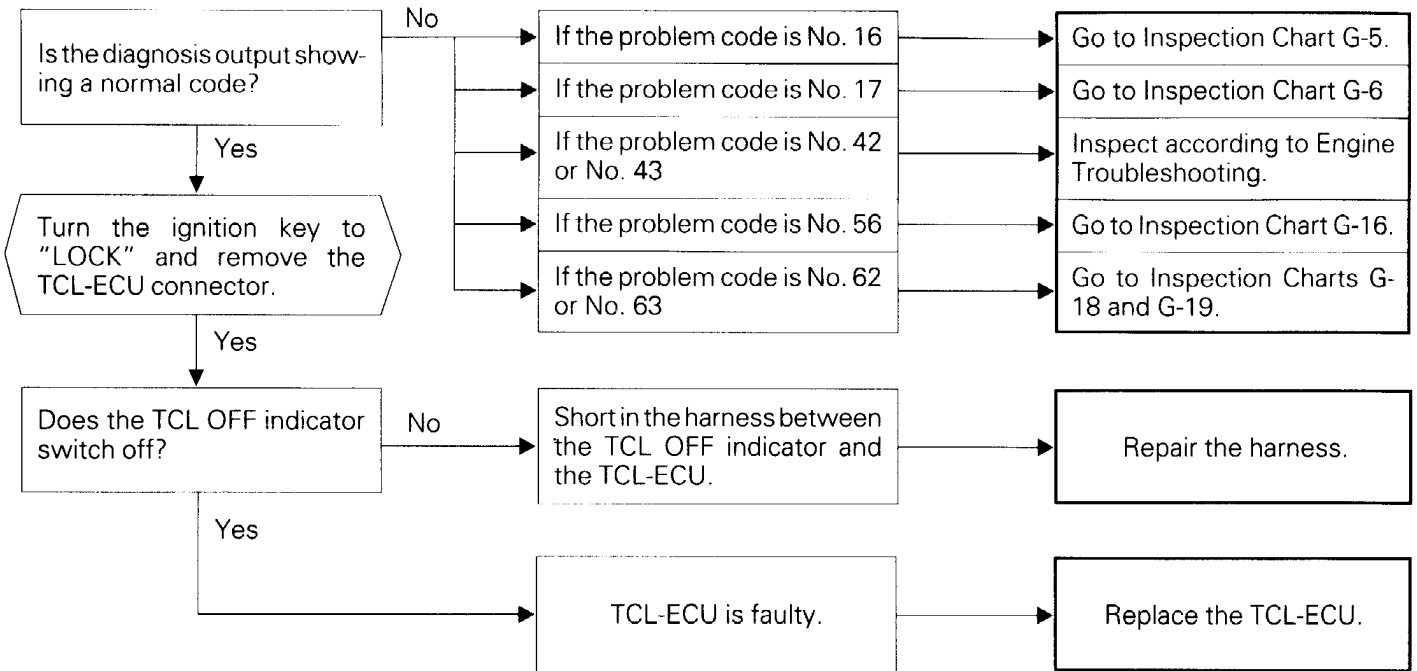


**C After the engine is started, the TCL OFF indicator only remains illuminated. (Other indicators switch off.)**

Comment: The TCL OFF indicator serves as a system warning indicator, and if the self-checking function detects a malfunction in the system immediately after starting the engine, this indicator will illuminate or flash.  
When the indicator illuminates, the cause is a problem in some other system connected with the TCL, or a drop in power voltage.

Hint: When the ABS warning lamp is illuminated, it is likely that there is a problem with the ABS, and when the CHECK ENGINE lamp is illuminated, there is a problem with the engine control system.

NOTE  
If there is no diagnosis output (communication cannot be made with the multi-use tester), inspect and repair the harness between the ECU serial/diagnosis output terminal and the diagnosis connector.



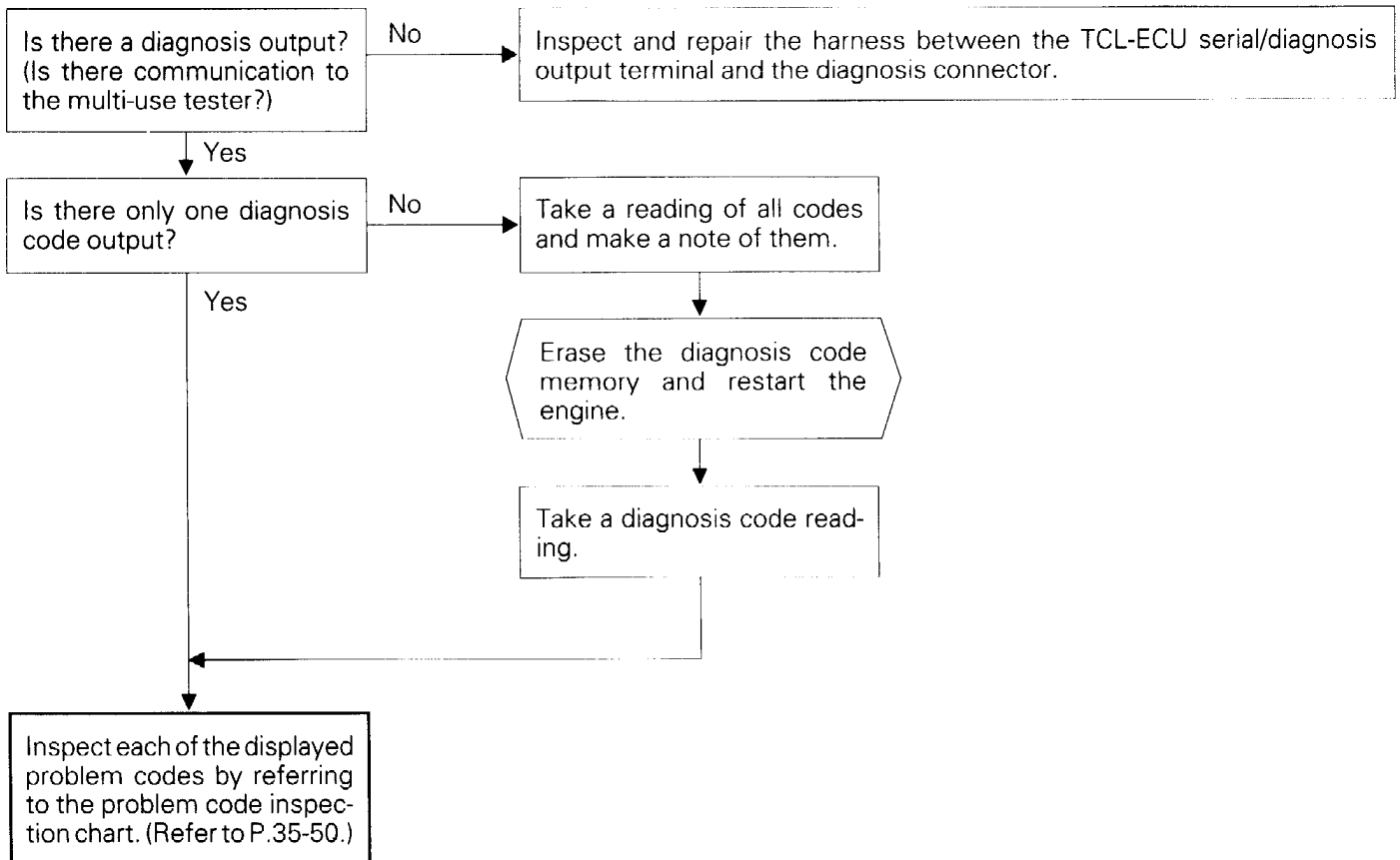


**D After the engine is started, the TCL OFF indicator flashes.**

Comment: The TCL OFF indicator serves as a system warning indicator, and if the self-checking function detects a malfunction in the system immediately after starting the engine, this indicator will illuminate or flash.  
 When the indicator flashes, it shows that a problem in the TCL-ECU has been detected, and the system functions have been stopped.

NOTE

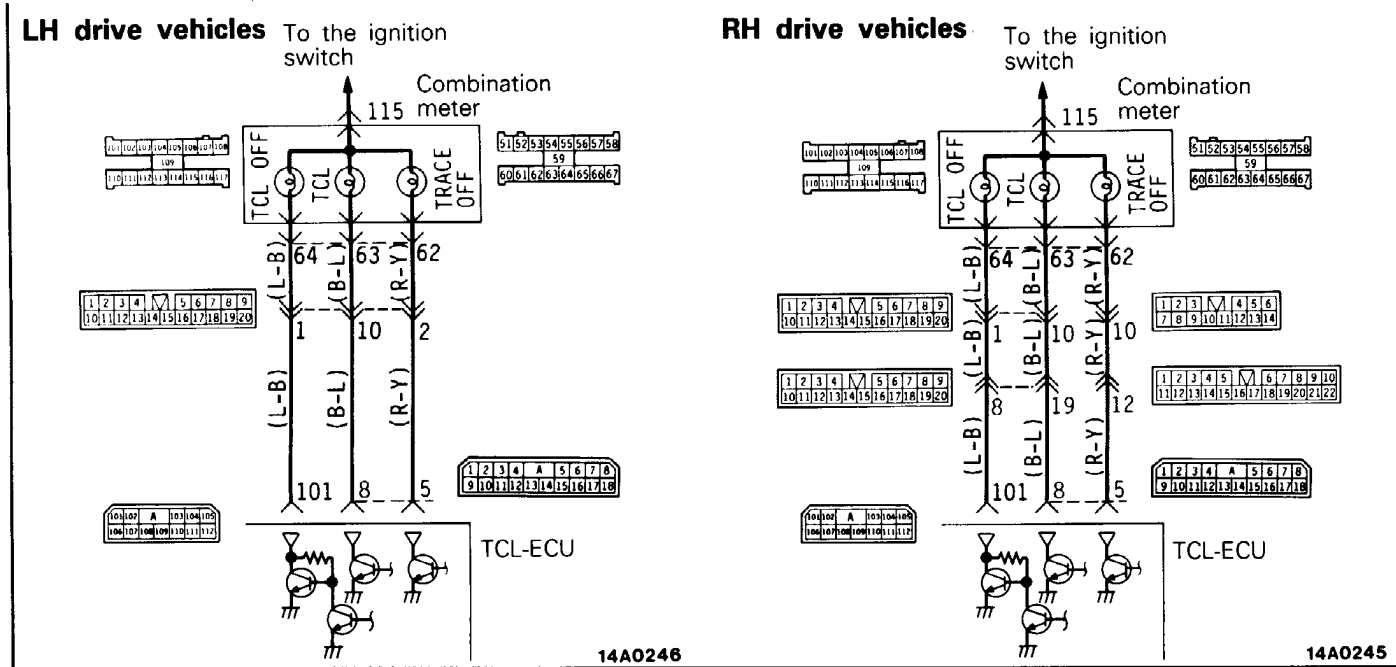
1. When several problem codes are displayed, it is impossible to tell which code is causing the indicator to flash immediately after the engine has been turned on. When there are problems, if the diagnosis code memory is momentarily erased and the engine is restarted, those problem codes will again be displayed.
2. Furthermore, there are some problems that cannot be detected immediately after starting the engine or during idling, but only when the vehicle is actually moving. Therefore, for non-recorded codes, the problems should be checked again during driving and if they recur, the problem code inspection chart should be referred to for inspection.



**E After the engine is started, the TCL indicator stays on.**

Comment: The TCL indicator illuminates when the engine is running only when the traction control is operating. If the light stays on

after the engine is started, the cause is a short in the TCL indicator drive circuit or a faulty TCL-ECU.



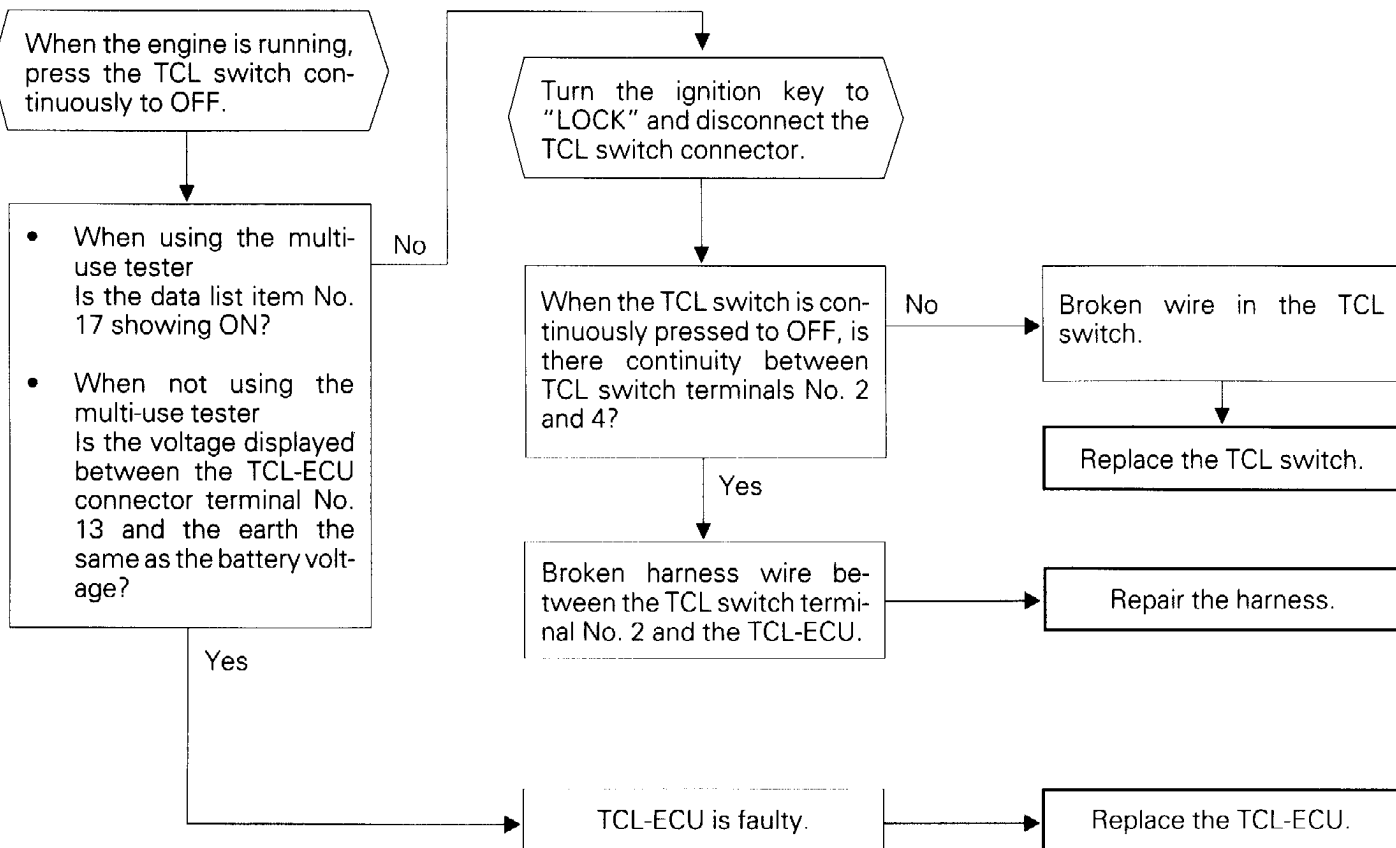
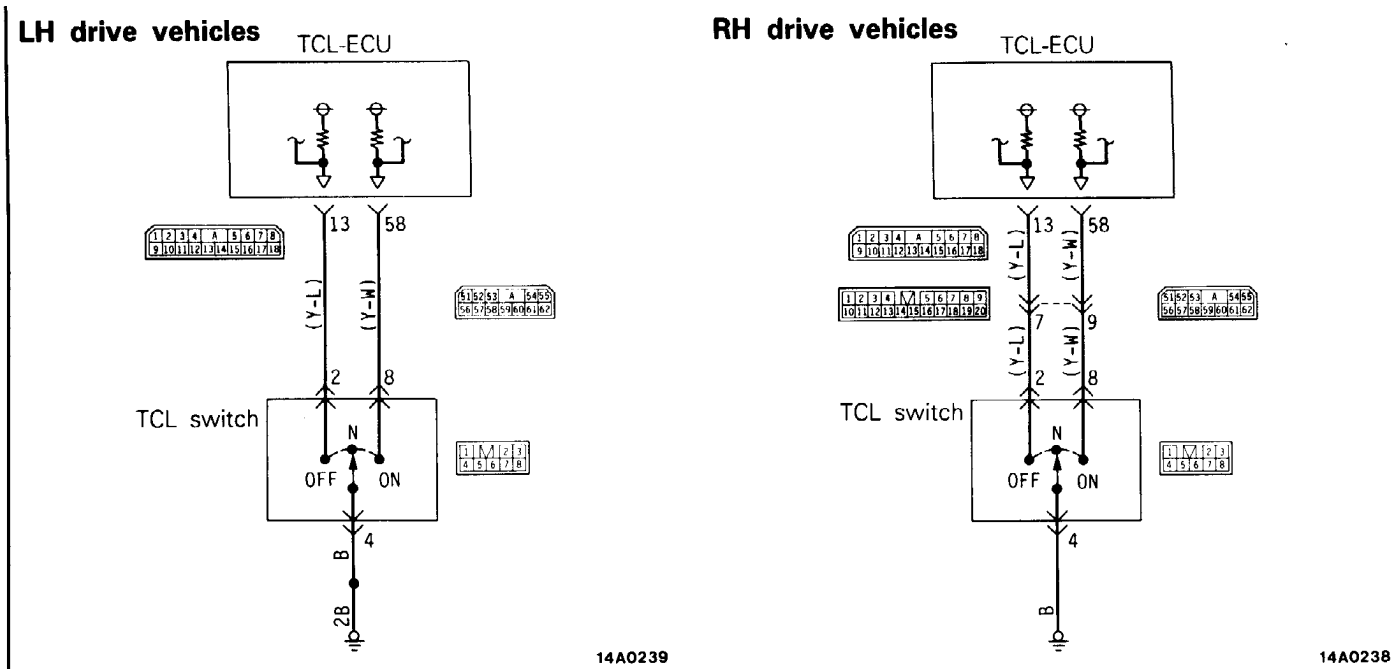
```

    graph TD
      Start([Turn the ignition key to "LOCK" and disconnect the TCL-ECU connector.]) --> Question{Does the TCL indicator remain illuminated when the ignition key is turned to "ON"?}
      Question -- No --> Faulty[TCL-ECU is faulty.]
      Faulty --> Replace[Replace the TCL-ECU.]
      Question -- Yes --> Short[Short in the harness between the TCL indicator and the TCL-ECU.]
      Short --> Repair[Repair the harness.]
    
```

**F** When the engine is idling, no matter how often the TCL switch is turned to the "OFF" position, the TRACE OFF indicator and the TCL OFF indicator do not alternate.

Comment: The TRACE OFF indicator and the TCL OFF indicator illuminate alternately each time the TCL switch is turned to OFF. When the indicators do not alternate

when the switch is operated, there is a problem with the switch or with the TCL-ECU.



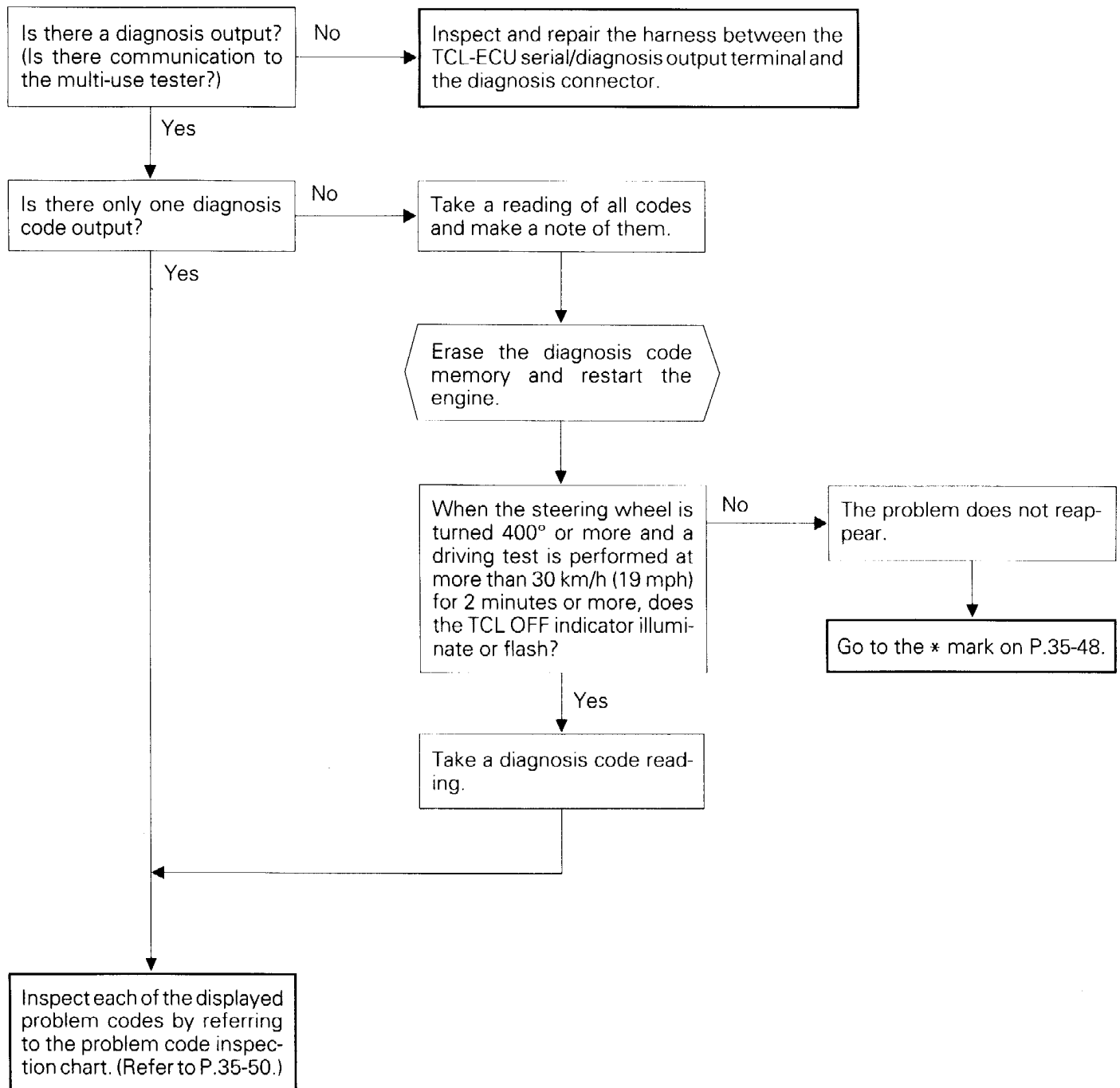
**G The TCL OFF indicator is normal when the engine is idling, but illuminates or flashes when the vehicle is moving.**

Comment: The TCL OFF indicator serves as a system warning indicator. Even if the self-checking function shows the system to be normal immediately after starting the engine, problems that can be detected only while the vehicle is actually moving can only be checked by a driving test.

**NOTE**

When several problem codes are displayed, it is impossible to tell which code is causing the indicator to flash when driving. When there are problems, if the diagnosis code memory is momentarily erased and the engine is restarted, those problem codes will again be displayed.

Furthermore, for non-recorded codes, the problems should be checked again and if they recur, the problem code inspection chart should be referred to for inspection.

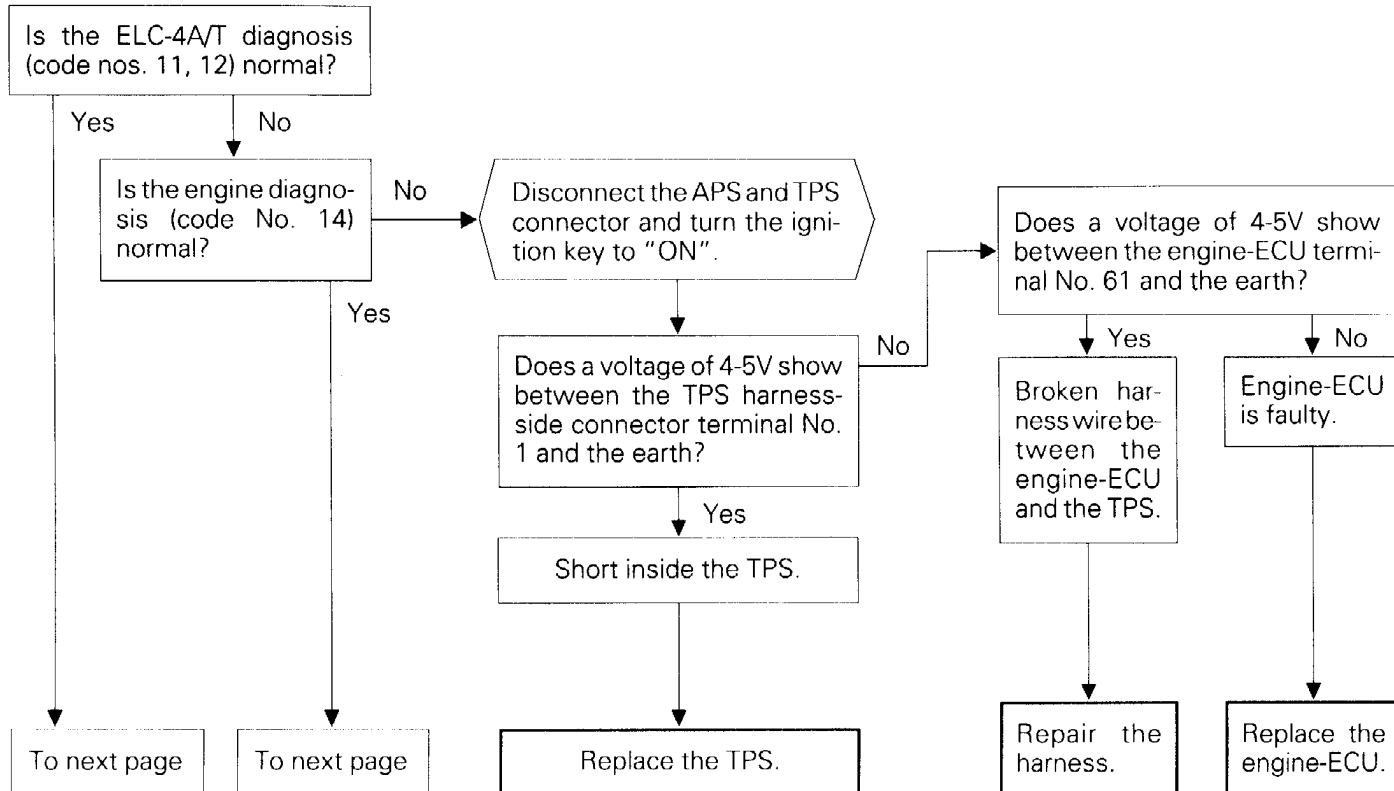
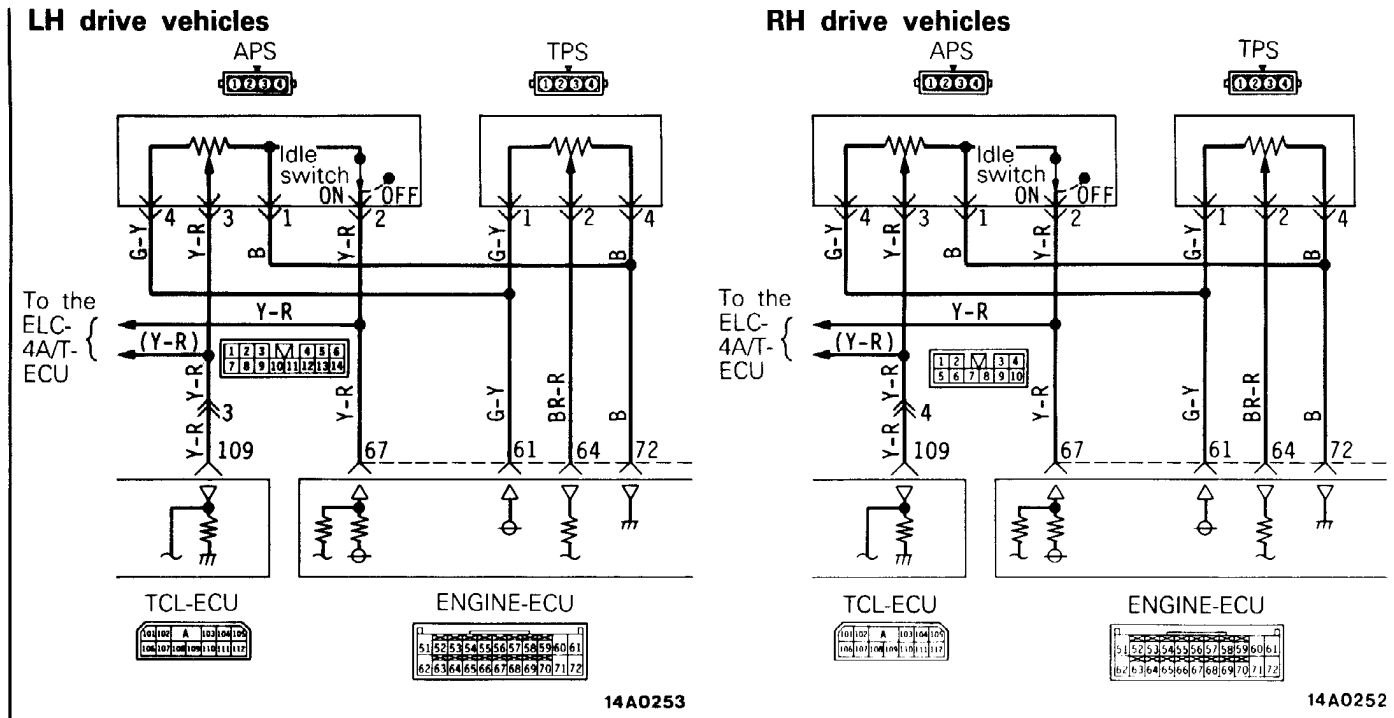


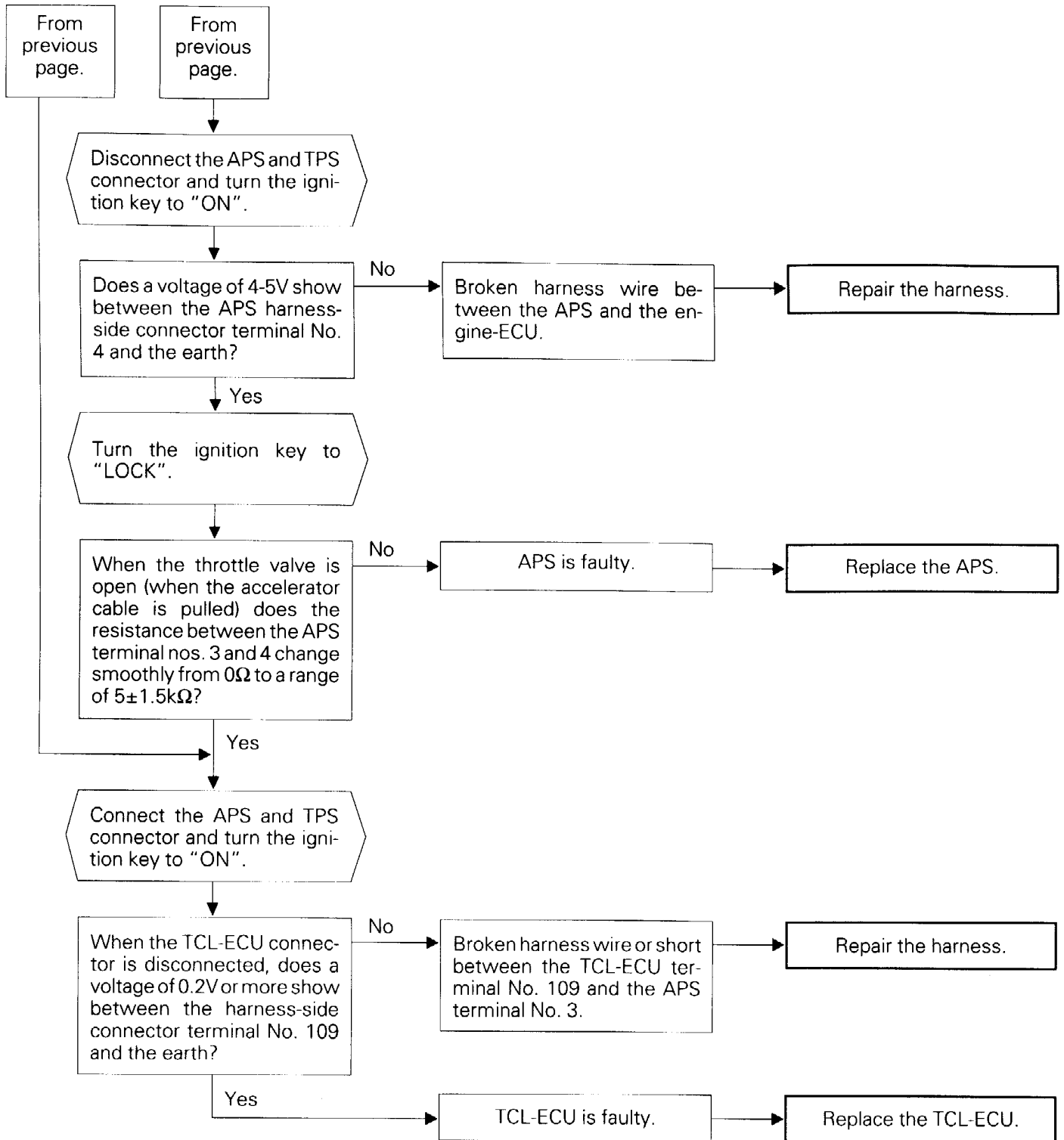
**G-1 When diagnosis code No. 11 is displayed**

Comment: This problem code is displayed when the APS output voltage becomes less than 0.2V due to a blown or shorted APS circuit.

Hint: APS power is supplied from the engine-ECU, and the output signal is shared by the ELC-4A/T and the ECS (electronic

controlled suspension) as well as the TCL. Therefore, if the ELC-4A/T diagnosis (APS diagnosis time is 4 seconds) is normal, then there is a broken harness wire between the APS and the TCL-ECU, or the TCL-ECU is faulty.



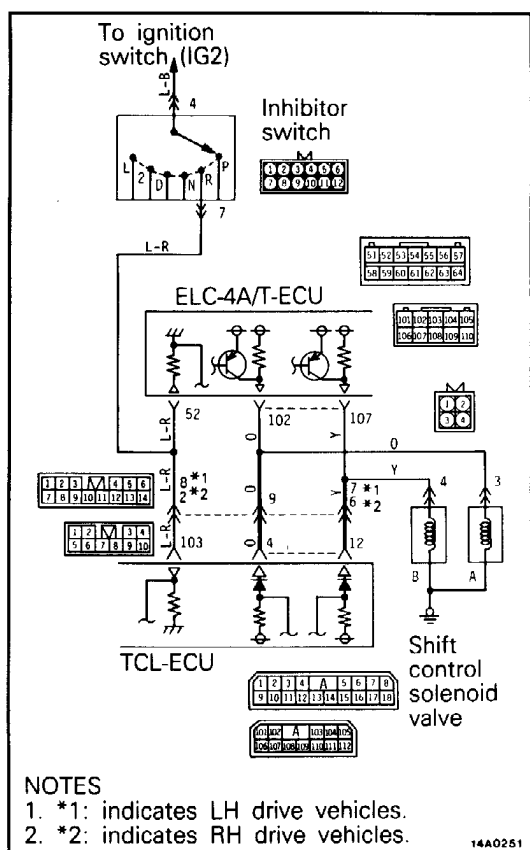


**G-2 When diagnosis code No. 12 or No. 13 is displayed**

**Comment:** These problem codes are displayed when a broken wire is detected between the TCL-ECU and the SCSV (Shift Control Solenoid Valve) A or B. The TCL-ECU circuit will turn ON when there is a broken wire in the SCSV A or B, so when the inhibitor switch is at R and the SCSV A is ON, or when the vehicle speed is 100 km/h (62 mph) or more and the SCSV B is ON, the diagnosis will be a broken wire.

**Hint:** A broken wire between the ELC-4A/T-ECU and the SCSV A or B is detected from the ELC-ECU side. Therefore, if there is no problem with the ELC-4A/T side, then there is a high possibility that the thick wire shown in the diagram below is broken.

**NOTE**  
Sometimes these codes will be output due to a short in the inhibitor switch "R" circuit, even when the SCSV A and B are normal.



- Disconnect the TCL-ECU connector.
- With the ignition key at "ON" turn the selector lever to "L" and check the circuit with a problem code displayed.

```

    graph TD
        Start([• Disconnect the TCL-ECU connector.  
• With the ignition key at "ON" turn the selector lever to "L" and check the circuit with a problem code displayed.]) --> Q1{Does battery voltage show between the TCL-ECU harness-side connector terminals (Nos. 4 or 12) and the earth?}
        Q1 -- Yes --> F1[TCL-ECU is faulty.]
        F1 --> R1[Replace the TCL-ECU.]
        Q1 -- No --> Q2{Does battery voltage show between the intermediate connector terminals (nos. 7 or 9 for LH drive vehicles, and nos. 6 or 9 for RH drive vehicles) and the earth?}
        Q2 -- No --> F2[Broken harness wire between the TCL-ECU and the intermediate connector.]
        F2 --> R2[Repair the harness.]
        Q2 -- Yes --> I1[With the selector lever still at "L", turn the ignition key to "ACC".]
        I1 --> Q3{When the intermediate connector terminals (nos. 7 or 9 for LH drive vehicles, and nos. 6 or 9 for RH drive vehicles) are earthed, is there continuity between the SCSV harness-side connectors (A or B) and the earth?}
        Q3 -- No --> F3[Broken harness wire between the ELC-4A/T-ECU from the intermediate connector and the SCSV junction.]
        F3 --> R3[Repair the harness.]
        Q3 -- Yes --> F4[Broken wire in the SCSV (A or B).]
        F4 --> R4[Replace the SCSV (A or B).]
    
```

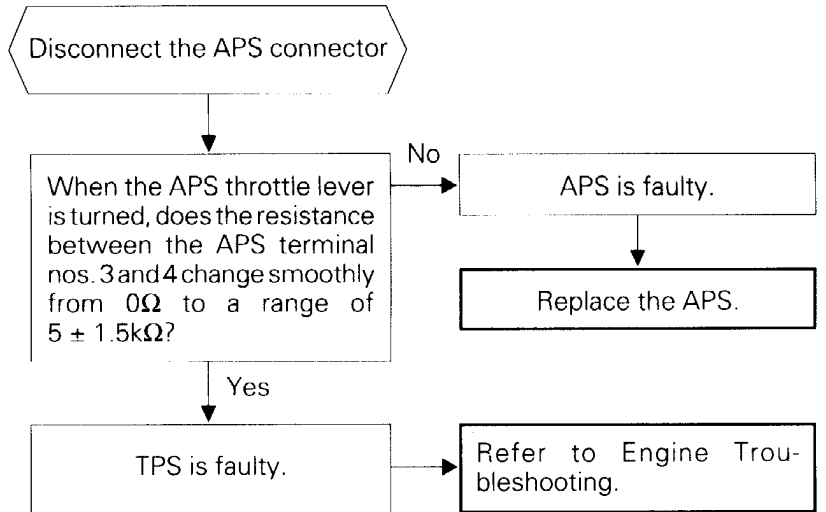
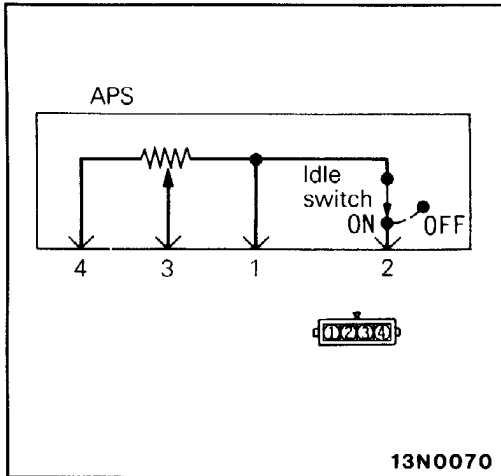
**G-3 When diagnosis code No. 14 is displayed.**

Comment: This problem code is displayed when the opening difference between the APS and TPS is 20° or greater due to a broken wire in the APS or TPS opening sensor circuit. If the APS has a broken wire, diagnosis code No. 11 is first displayed. Accordingly, when code No. 11 is not displayed,

Hint:

the APS power circuit is diagnosed to be normal.

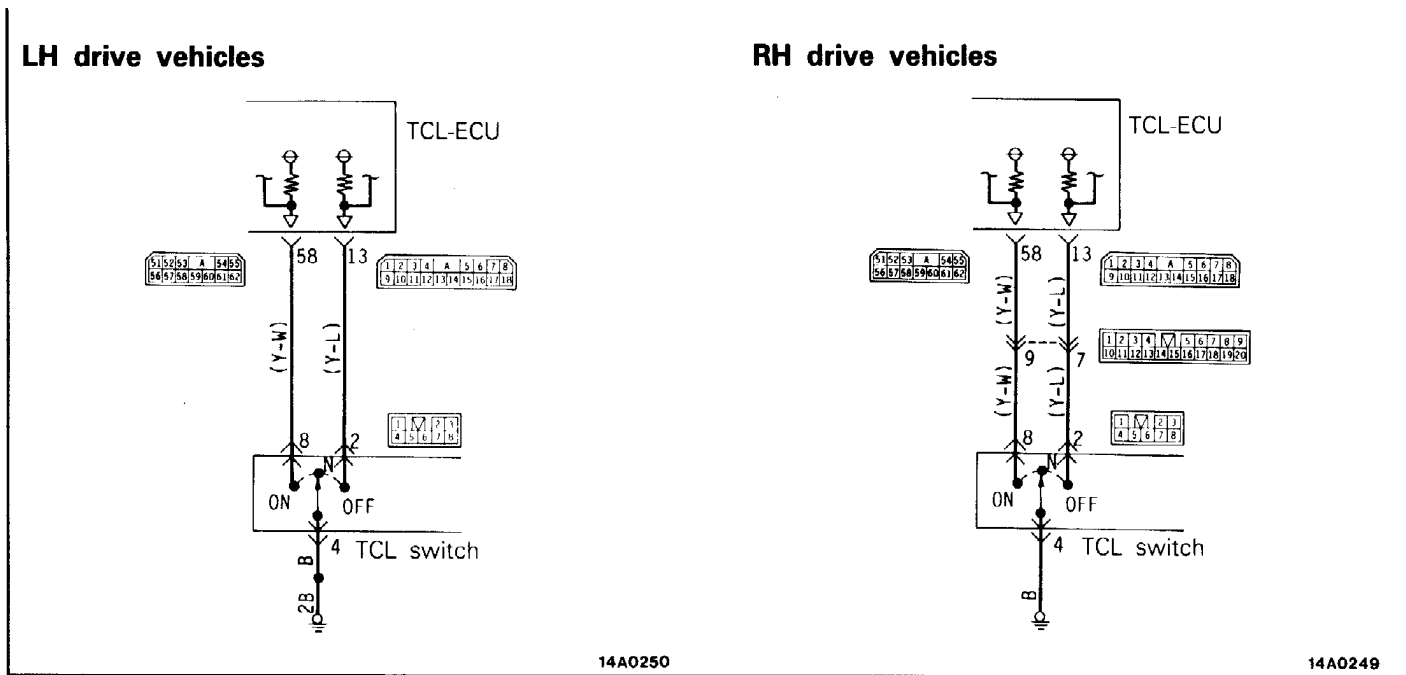
As the opening of both the APS and the TPS can be read using the multi-use tester, it is better to take a reading of the data for each one to check for an abnormality.



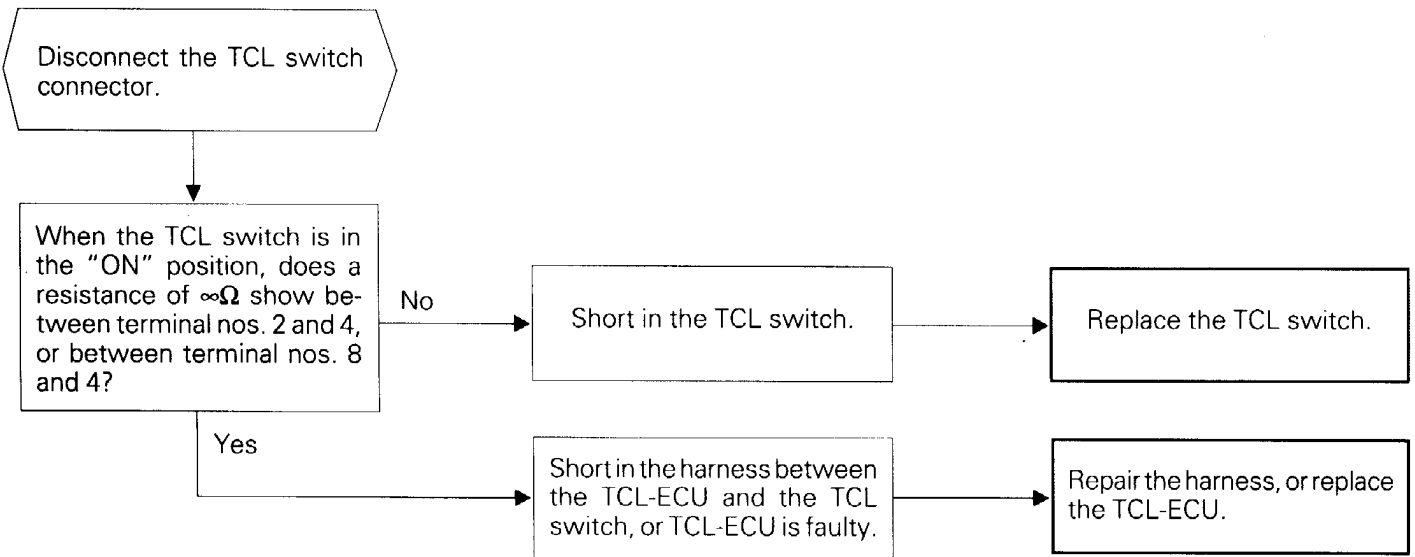
**G-4 When diagnosis code No. 15 is displayed.**

Comment: This problem code is displayed when an ON signal is input at the same time from both the TCL OFF and TRACE OFF posi-

tions because of a short, etc. in the TCL switch circuit.



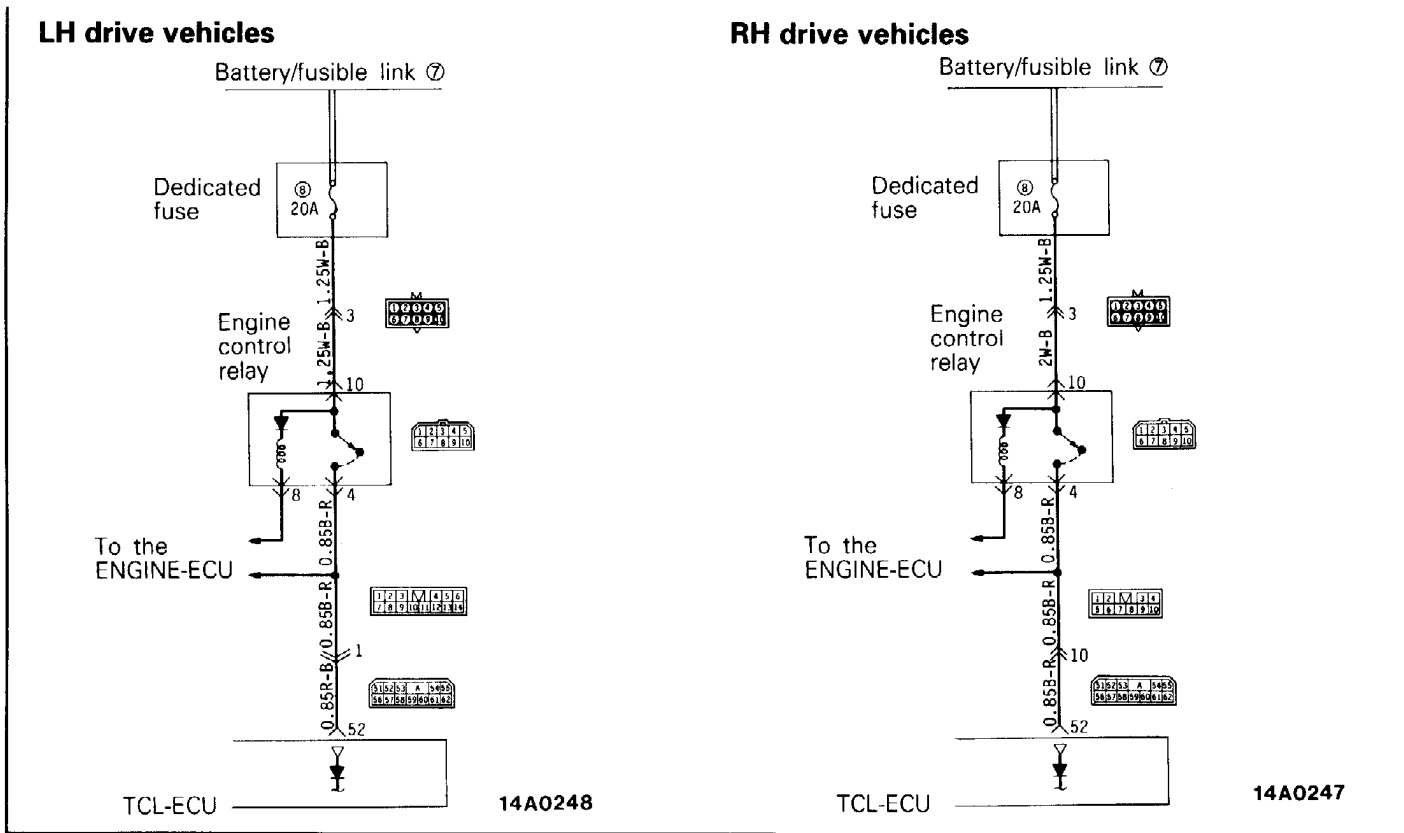


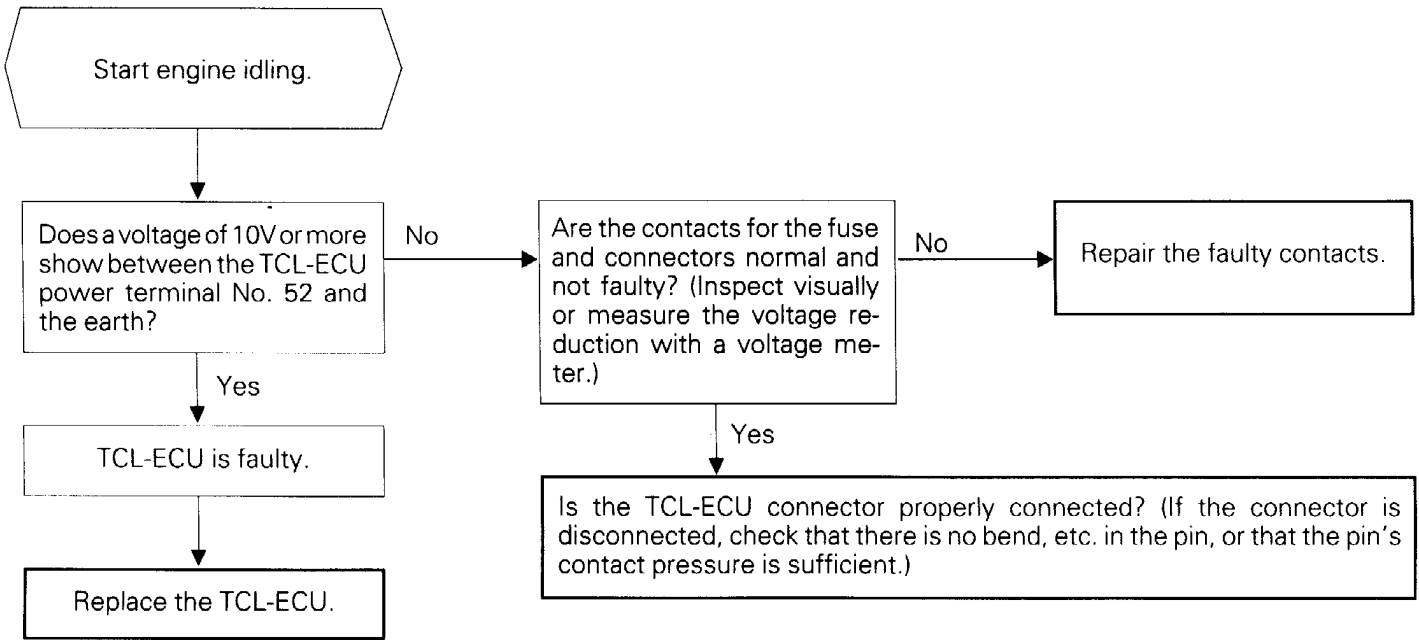


**G-5 When diagnosis code No. 16 is displayed.**

Comment: This problem code is displayed when the TCL-ECU power voltage is lower than the standard value. If the voltage returns to standard voltage or higher, this code will no longer be output.

**Caution**  
 If the battery voltage drops during inspection, this code will be output as a current problem, and correct problem diagnosis cannot be made. Before following the inspection below, check the battery condition, and recharge the battery if necessary.

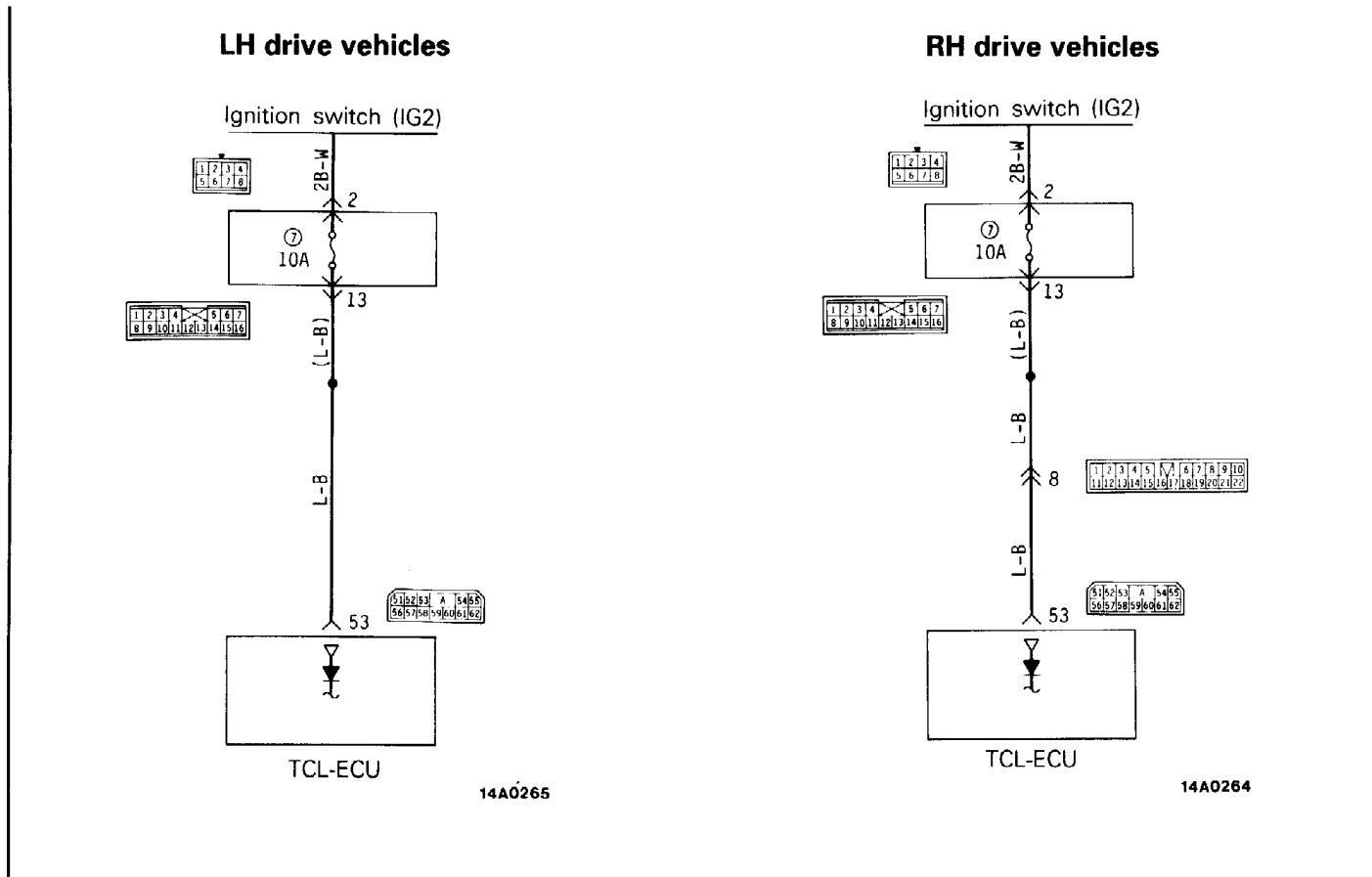


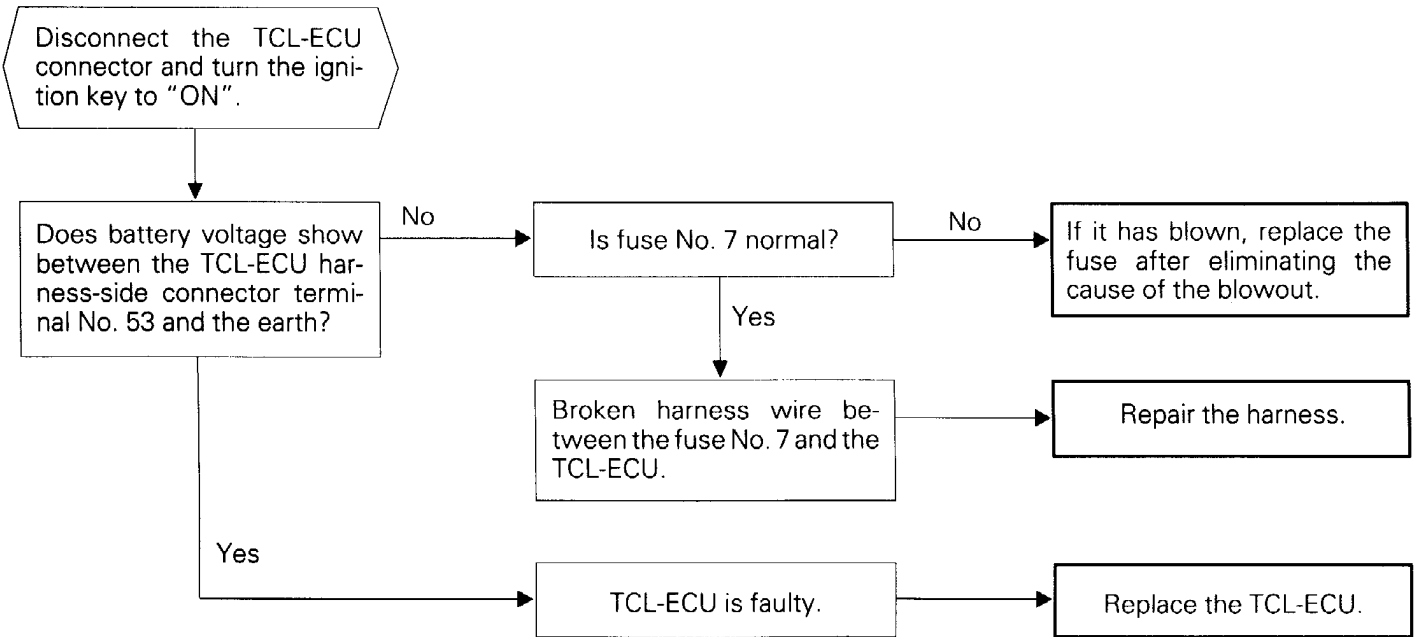


**G-6 When diagnosis code No. 17 is displayed.**

Comment: This problem code is displayed when engine revolutions is 450 rpm or higher and IG2 power is not supplied to the TCL-

ECU because of a broken wire or short in the IG2 power circuit.





**G-7 When diagnosis code No. 21, No. 22, No. 23 or No. 24 is displayed.**

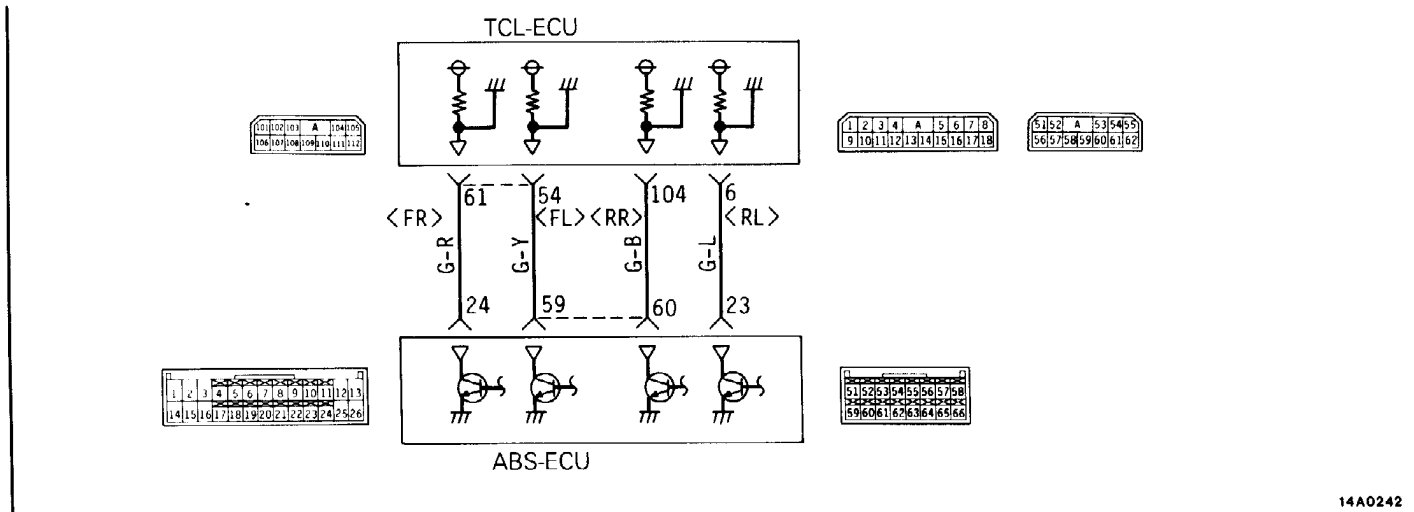
**Comment:** When diagnosis code No. 21 or 22 is displayed. These problem codes are displayed when a pulse is input by the sensor circuit due to a broken wire or short, or a faulty sensor, showing a wheel speed difference of 8 km/h (5 mph) or more in the front left and right wheels compared to the rear wheels.

When diagnosis code No. 23 or 24 is displayed.

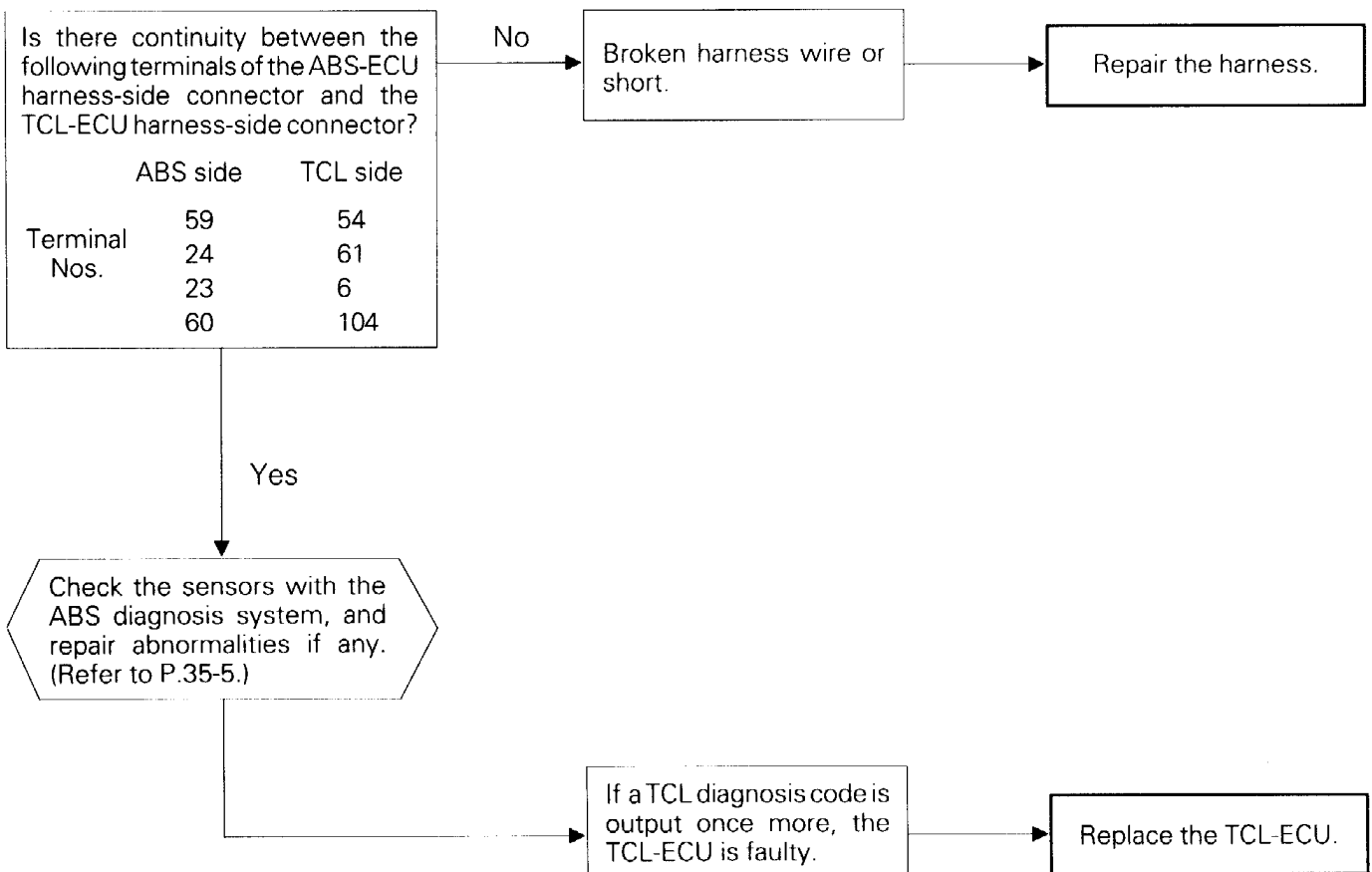
These problem codes are displayed when a pulse is input by the sensor circuit due to a broken wire or short, or a faulty sensor, showing a wheel speed difference of 8 km/h (5 mph) or more in the wheels on one side compared to the opposite side.

**Hint:** Problems between the ABS-ECU and the sensor are detected by the ABS-ECU. Therefore, if there is no problem with the ABS side, it is most likely due to a broken harness wire or a short between the ABS-ECU and the TCL-ECU.

**NOTE**  
When these problem codes are output, erase the problem code memory after fixing the cause of the problem, and carry out a driving test at a speed of 20 km/h (12 mph) or higher to check that the codes are not output again.



14A0242



**G-8 When diagnosis code No. 25 is displayed**

**Comment:** While driving at a speed of 20 km/h (12 mph) or over, this problem code is displayed when the pulse signal is stopped for an instant (0.015 sec.), due to a temporary disconnection in the sensor of both rear wheels. However, even when this code is displayed, the TCL OFF indicator will not illuminate or flash. Furthermore, the ABS warning lamp illuminates due to a broken sensor wire in the ABS hardware circuit, and TCL diagnosis code No. 62 will be displayed.

**Hint:** When diagnosis code No. 25 is displayed at the same time as code nos. 23 or 24, inspect according to the troubleshooting for code nos. 23 or 24.

When code No. 25 is displayed by itself, the problem is likely to be a faulty contact in the rear wheel sensor circuit.

**Remedy:** Inspect according to the same procedure for the ABS wheel speed sensor (rear) inspection. (Refer to P.35-94.)

**G-9 When diagnosis code No. 26 is displayed**

**Comment:** This problem code is displayed when an abnormality is diagnosed in the rear wheel sensor when the speed of both rear wheels is zero for 20 seconds while traction control is operating.

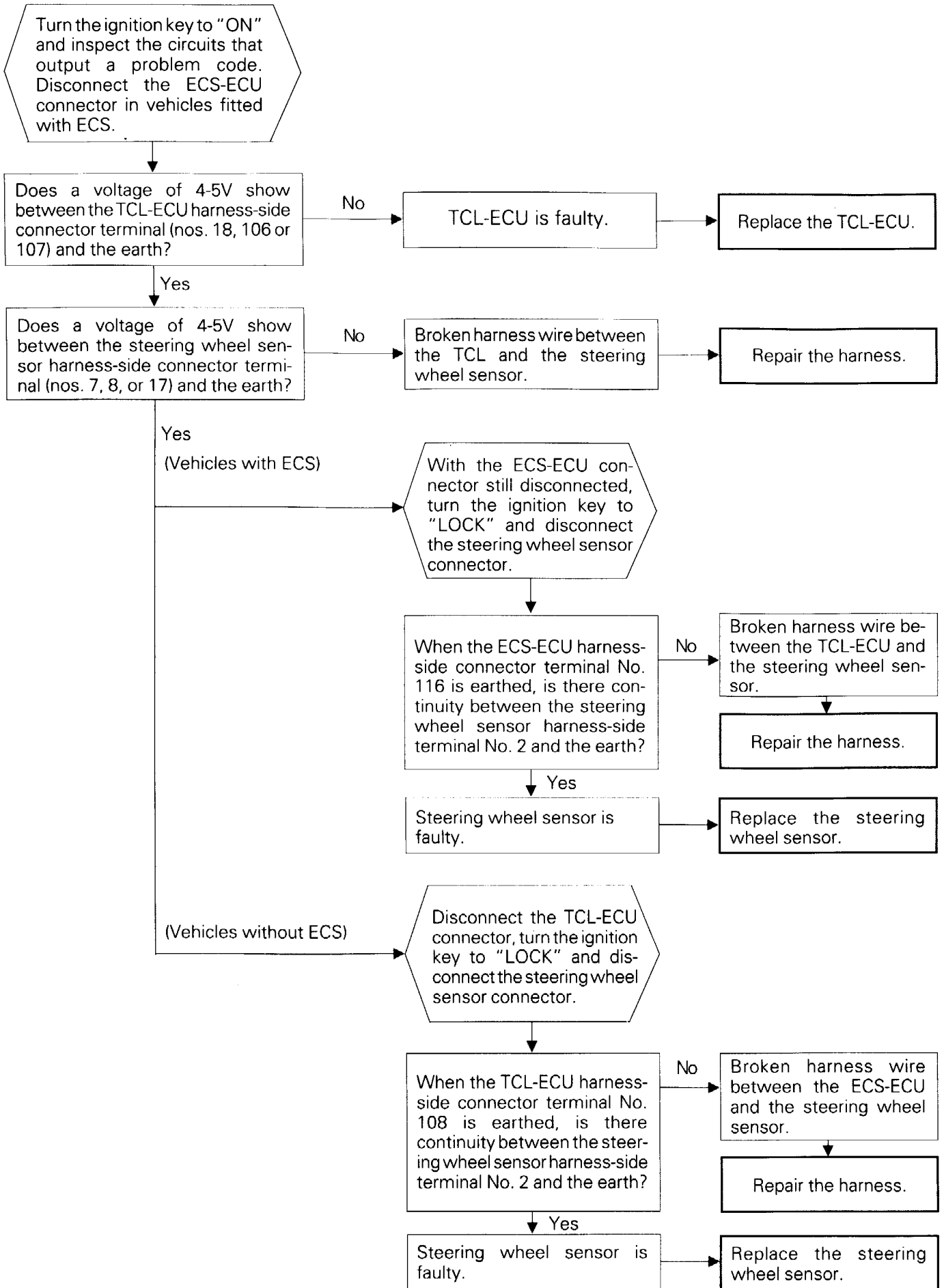
**Hint:** This problem occurs when there is a broken harness wire or short between the TCL-ECU and the ABS-ECU that leads to both rear wheels, or if the sensor harnesses for both rear wheel short at the same time.

**NOTE**

1. When the vehicle is stuck and only the front wheels are moving, or when the front wheels are jacked up and only the front wheels are moving, after 20 seconds the TCL indicator will begin to flash and the system will be isolated.
2. When this problem code is output, erase the problem code memory after fixing the cause of the problem, and carry out a driving test at a speed of 20 km/h (12 mph) or higher to check that the code is not output again.

**Remedy:** Inspect according to the inspection flowchart in Troubleshooting Chart G-7 for diagnosis code nos. 21, 22, 23 and 24.





**G-11 When diagnosis code No. 34 is displayed**

Comment: This problem code is displayed when an abnormality is diagnosed in the steering wheel sensor power circuit (thick wire section) when the steering angle is less than 10° (no steering signal is input at all) and conditions are as follows:

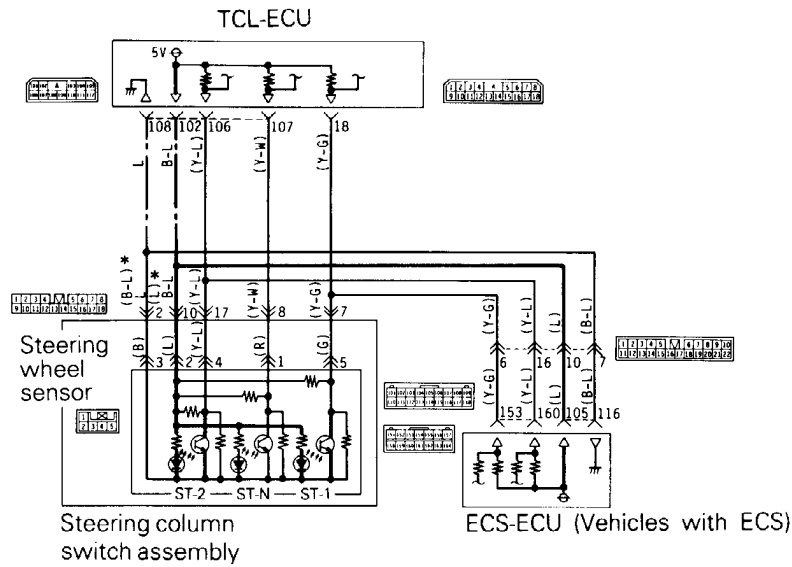
- Vehicle speed: 20 km/h – 60 km/h (12 mph – 37 mph)

- Rear wheel speed sensor: When difference between left and right exceeds 1.5 km/h (1 mph) (diagnosed while cornering)

**NOTE**

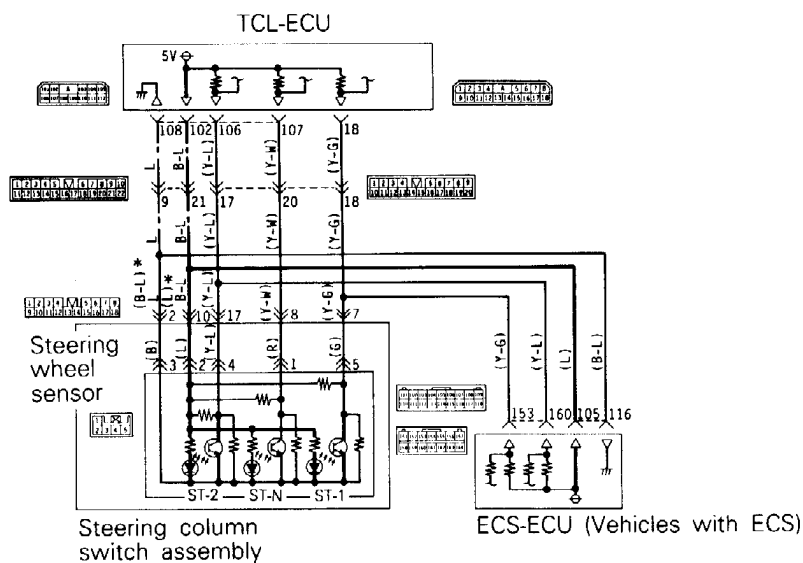
It should be noted that if the vehicle is fitted with left and right tyres of different diameters, this code will sometimes be output while driving, even when the steering wheel sensor is normal.

**LH drive vehicles**



14A0256

**RH drive vehicles**

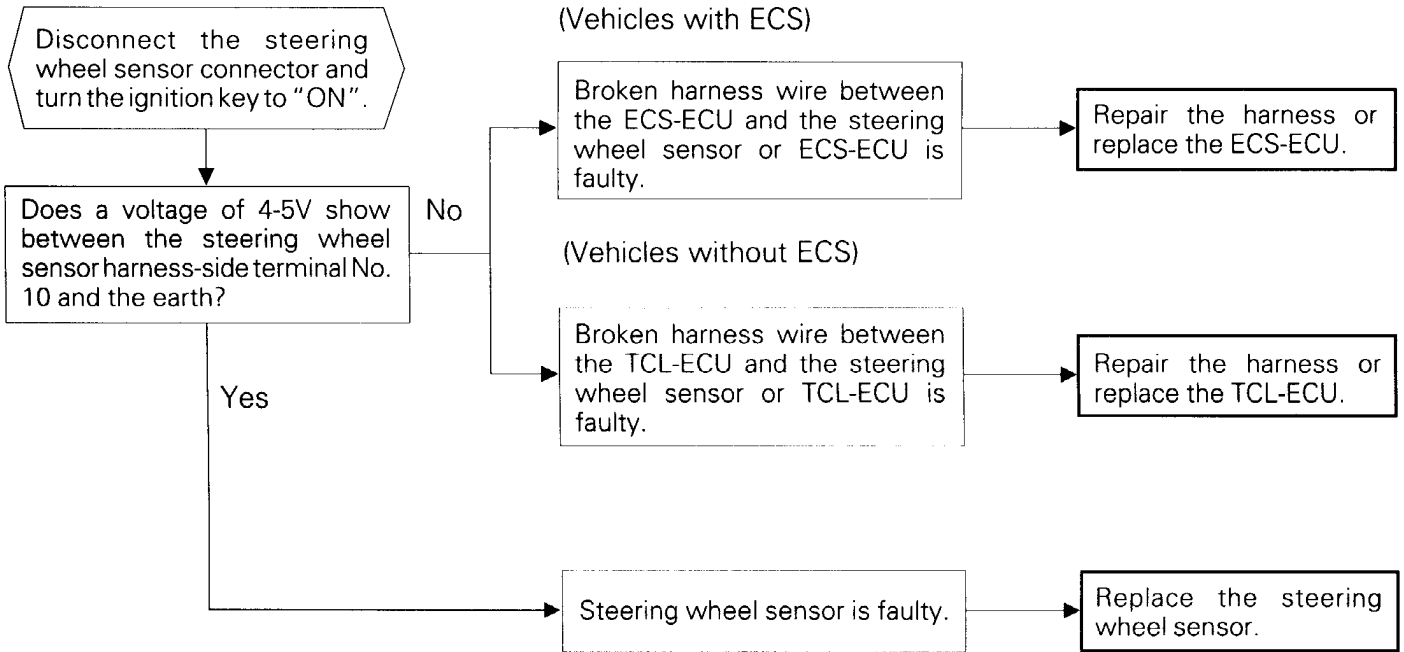


14A0257

**NOTES**

1. The diameter and color of wires marked with \* indicate vehicles with ECS.
2. The dotted lines indicate vehicles without ECS.



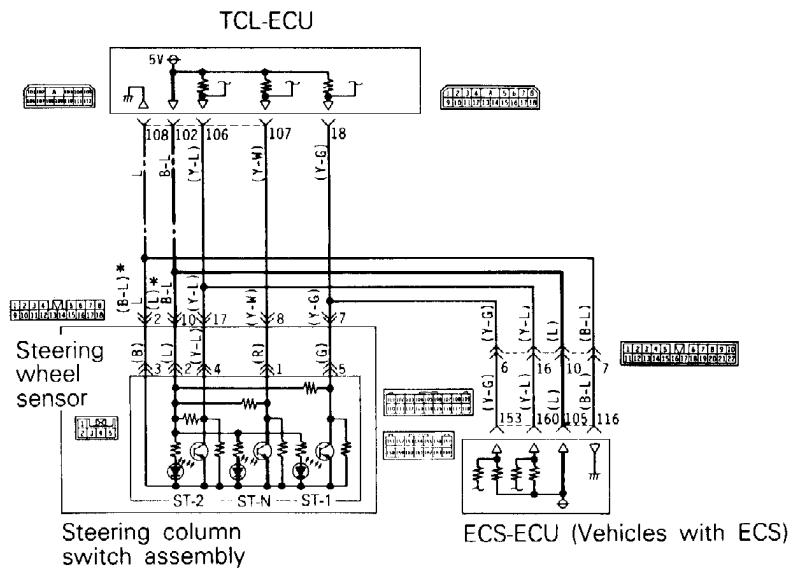


**G-12 When diagnosis code No. 35 is displayed**

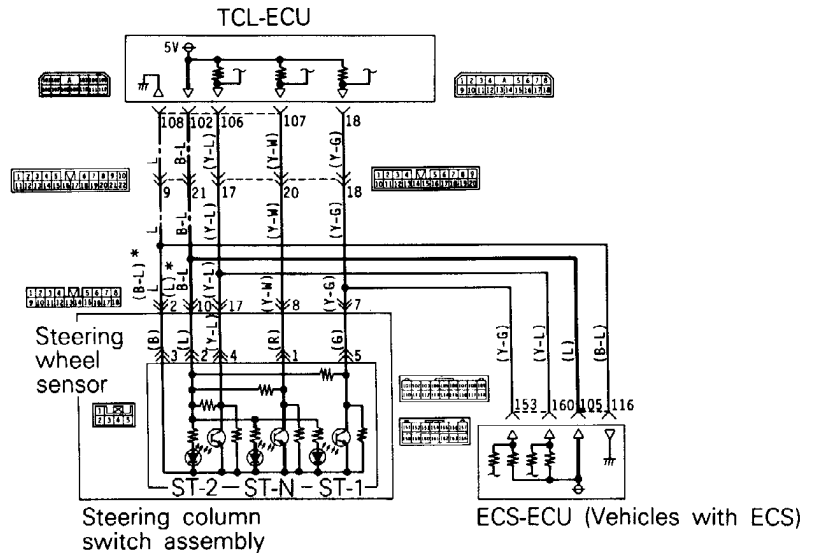
Comment: This problem code is displayed when the steering wheel sensor ST-N circuit (thick wire section) is diagnosed as faulty, when the steering wheel is turned 400° or more, but "ST-N" position is not registered.

NOTE  
Even if there is a problem, this code will not be displayed (detected) if the steering wheel is not turned.

**LH drive vehicles**



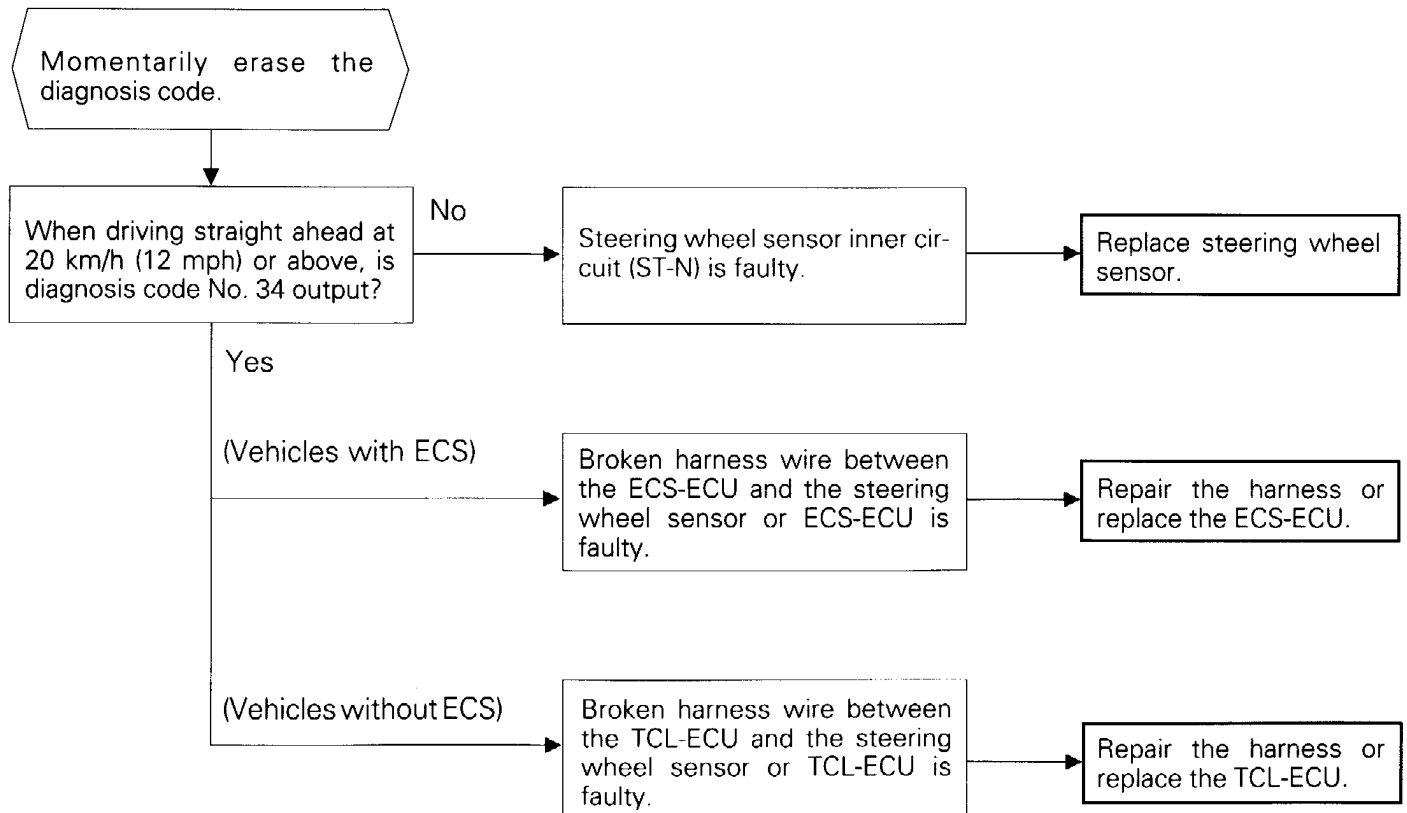
RH drive vehicles



NOTES

1. The diameter and color of wires marked with \* indicate vehicles with ECS:
2. The dotted lines indicate vehicles without ECS.

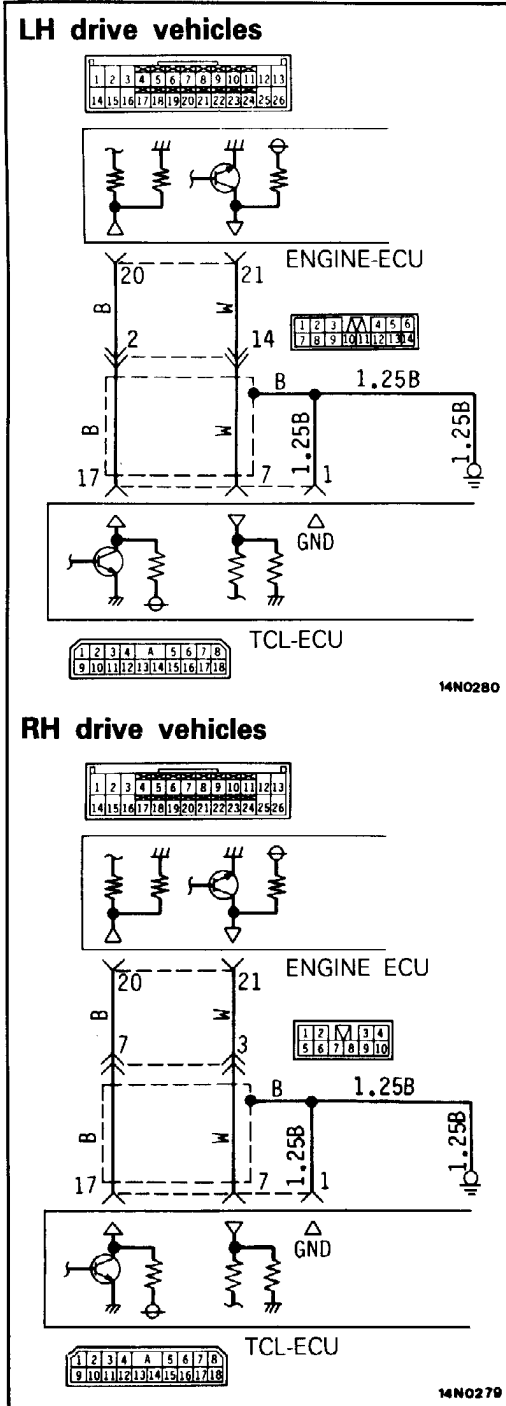
14A0261



**G-13 When diagnosis code No. 41 is displayed**

Comment: This code is displayed when there is a problem in the serial communication circuit between the TCL-ECU and the engine-ECU caused by a broken wire or

short, or if an error is detected in the communication due to a faulty ECU or shield wire.



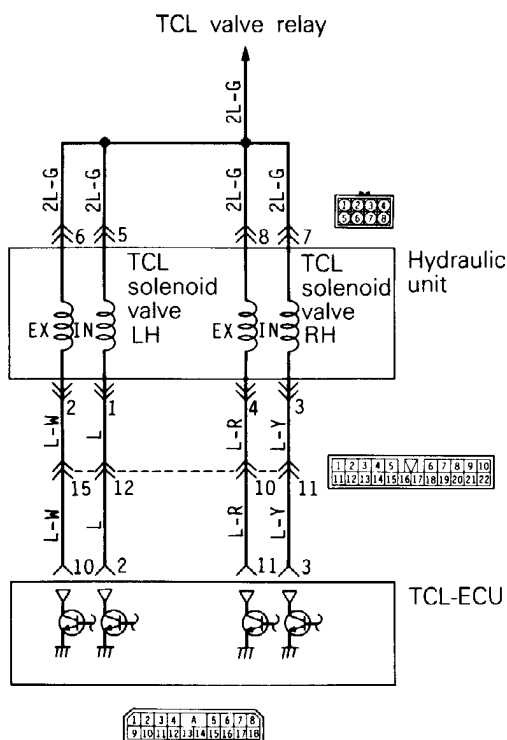
```

    graph TD
      Start[When the TCL-ECU harness-side connector terminal nos. 7 or 2 and 17 are earthed respectively, is there continuity between the following terminals and the earth?  
• between intermediate connector terminal No. 3, No. 14 and No. 7 and earth.  
• between engine-ECU connector terminal nos. 20 and 21 and earth.]
      Start -- No --> Broken[Broken wire in the harness with no continuity.]
      Broken --> Repair[Repair the harness.]
      Start -- Yes --> ReplaceEng[Replace the engine-ECU.]
      ReplaceEng --> CheckCode{Is a diagnosis code output by the TCL-ECU?}
      CheckCode -- No --> FaultyEng[Engine-ECU is faulty.]
      FaultyEng --> ReplaceEng2[Replace the engine-ECU.]
      CheckCode -- Yes --> FaultyTCL[TCL-ECU is faulty.]
      FaultyTCL --> ReplaceTCL[Replace the TCL-ECU.]
    
```

**G-14** When diagnosis code No. 51, no. 52, no. 53, or no. 54, is displayed

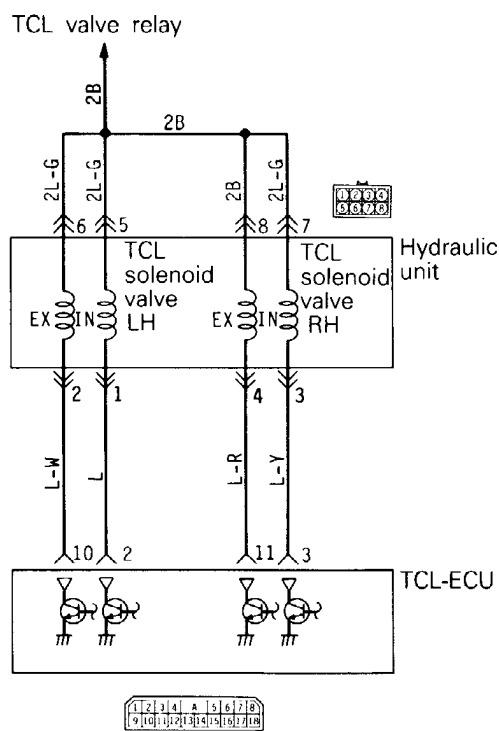
Comment: These codes are displayed when a broken coil wire or short is diagnosed in the solenoid valve or the in the harness when the ignition key is "ON" and the TCL-ECU initial check shows that the solenoid valve is ON but no current is flowing, or the solenoid valve is OFF but current is flowing.

**LH drive vehicles**

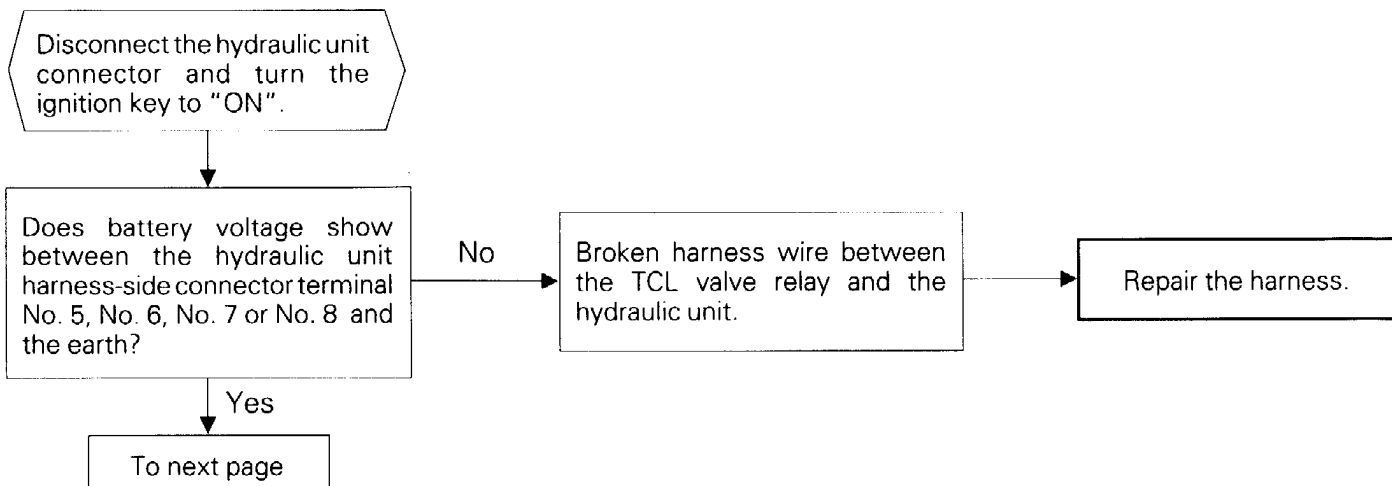


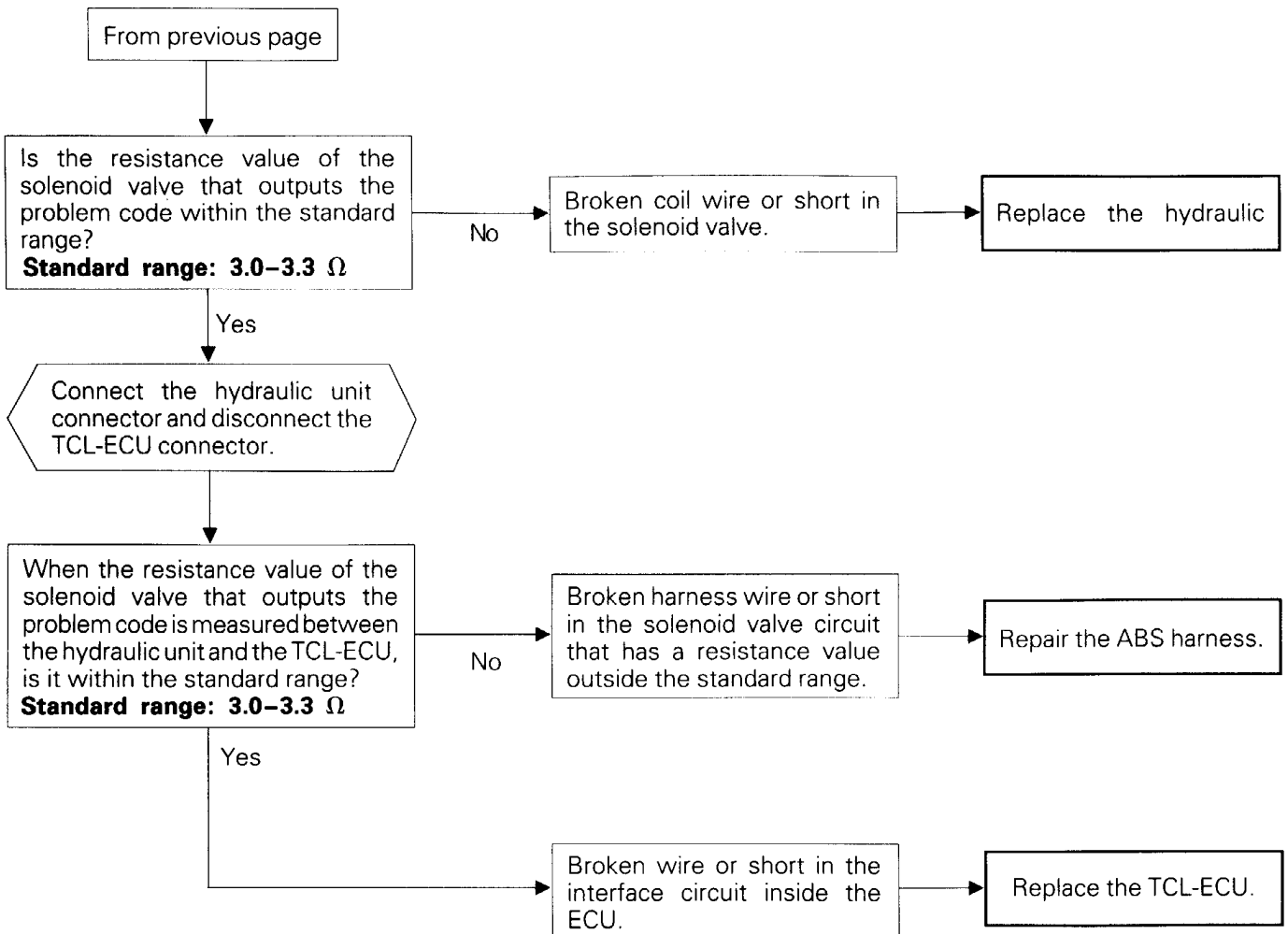
14A0243

**RH drive vehicles**



14A0244

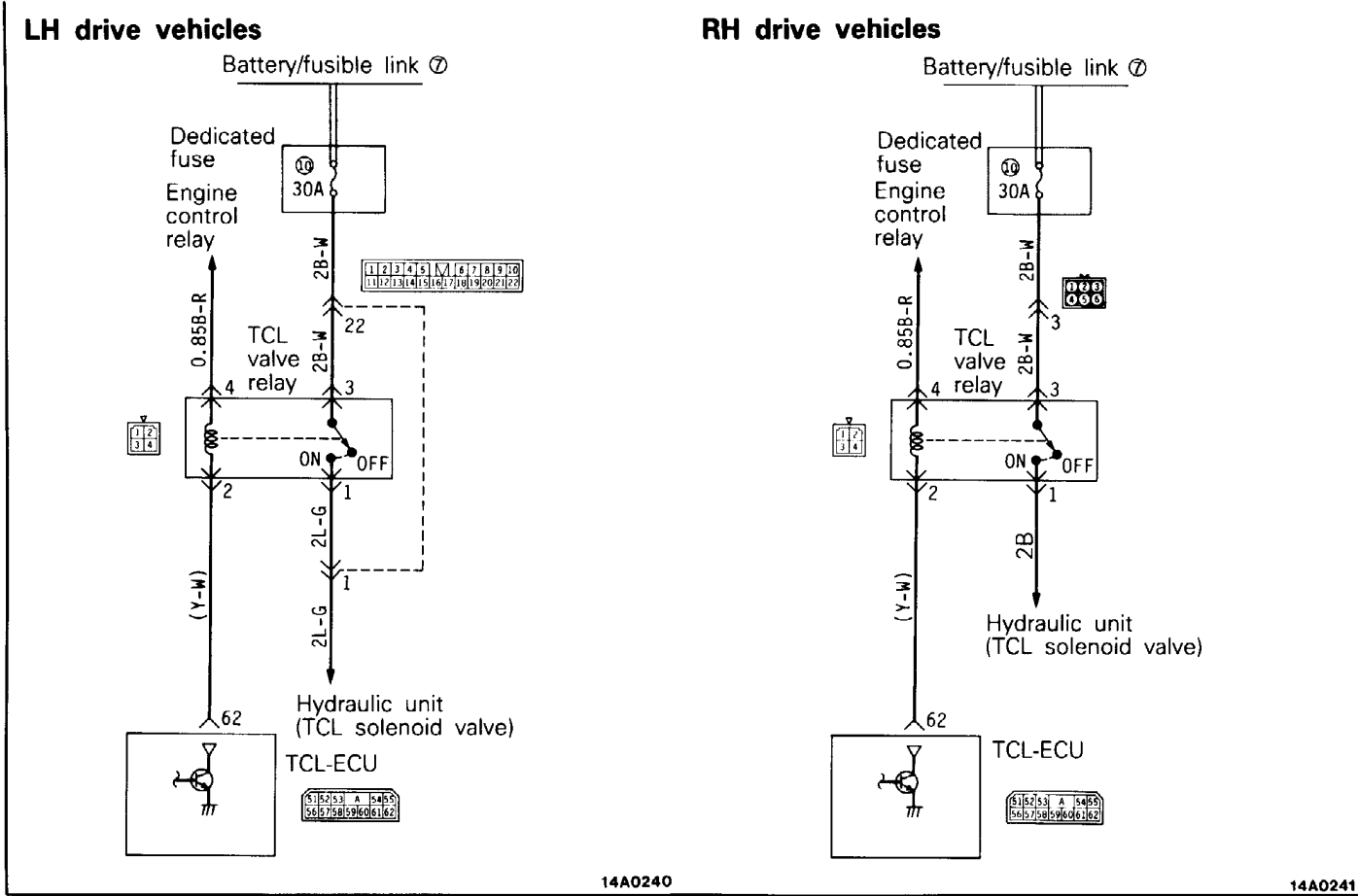




**G-15 When diagnosis code No. 55 is displayed**

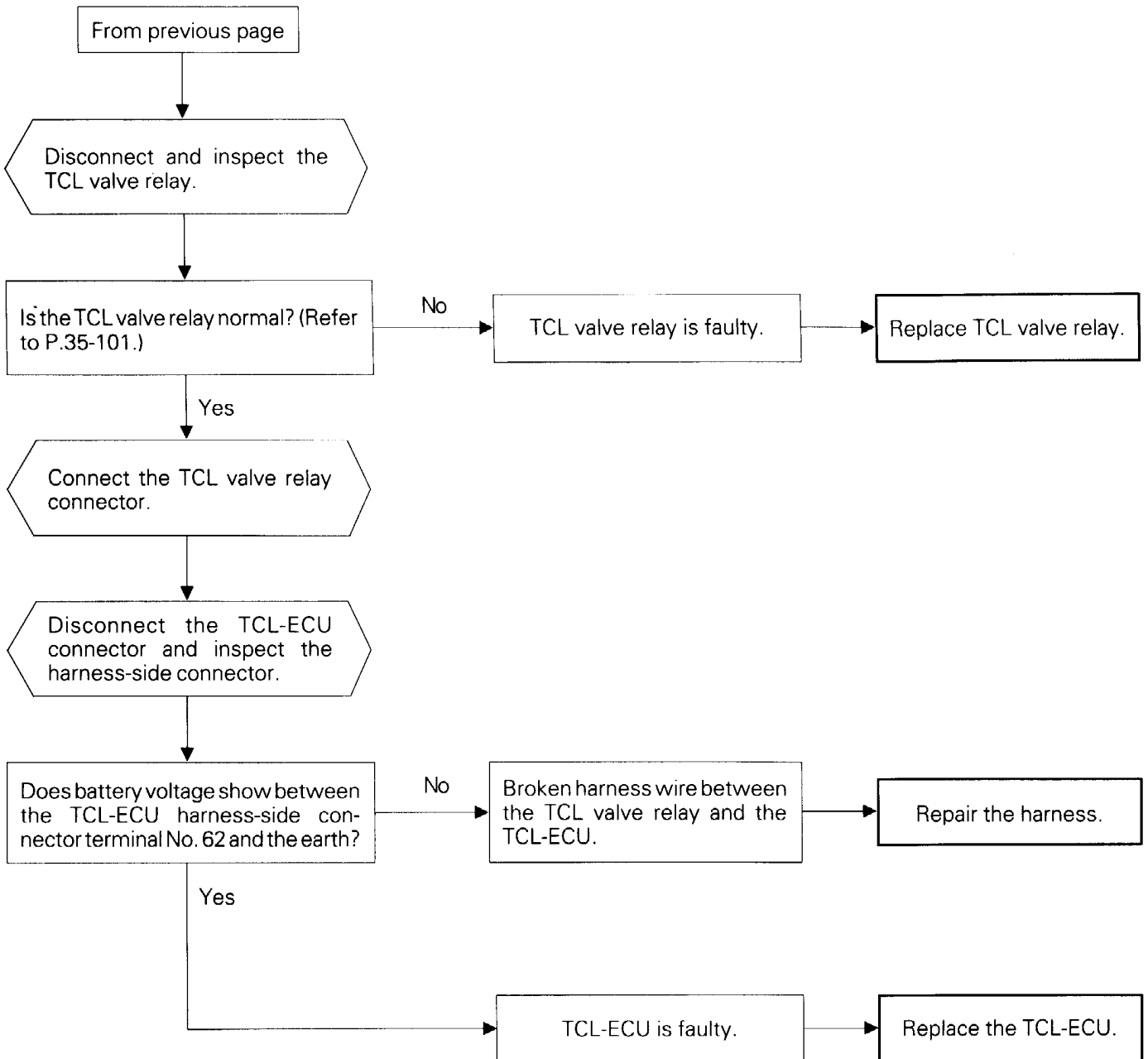
**Comment:** This problem code is displayed when the ignition key is "ON" and the TCL-ECU initial check shows that the TCL valve relay is ON but no power is supplied to the solenoid valve, or power is being supplied but none of the solenoid valves are operating.

**Hint:** When diagnosis code No. 51, No. 52, No. 53 or No. 54 are displayed, inspect according to the troubleshooting for code No. 51, No. 52, No. 53 and No. 54.



```

    graph TD
      A[Disconnect the TCL valve relay connector and turn the ignition key to "ON".] --> B{Does battery voltage show between the TCL valve relay harness-side connector terminal No. 3 and No. 4 and the earth?}
      B -- No --> C[Broken harness wire between the engine control relay or fuse No. 10 and the TCL valve relay.]
      B -- Yes --> D[To next page]
      C --> E[Repair the harness.]
    
```



**G-16 When diagnosis code No. 56 is displayed**

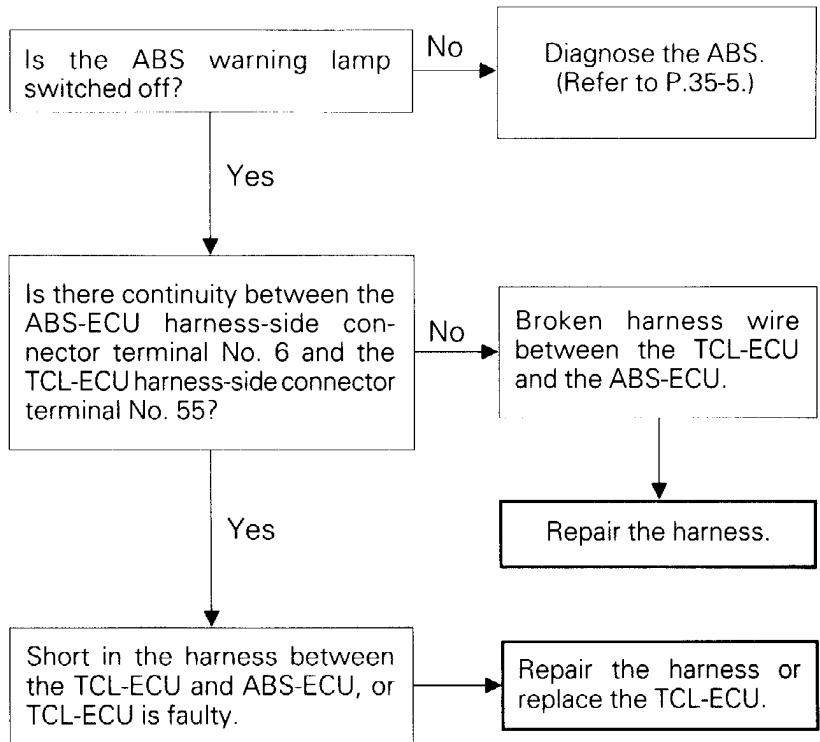
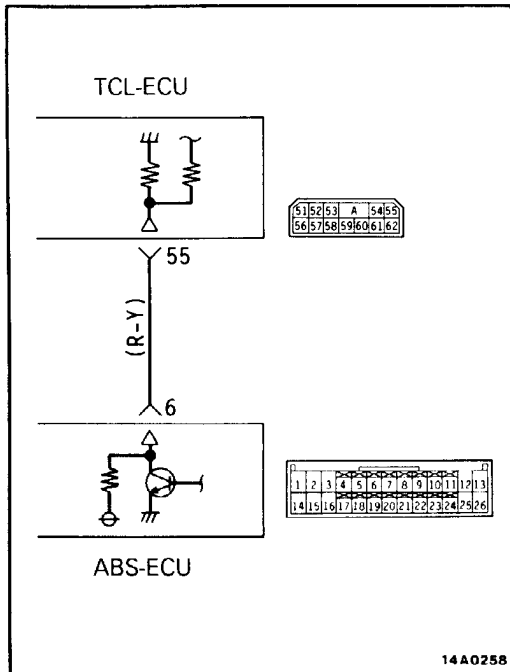
**Comment:** This problem code is displayed when the solenoid valve is ON (increase in pressure) for a longer than normal time when taking off on a slippery road surface, due to a faulty TCL-ECU interface circuit, etc.

**Remedy:** Inspect according to the troubleshooting for diagnosis code No. 51, No. 52, No. 53, No. 54 and No. 55, and if the TCL valve relay and solenoid valve are normal, the TCL-ECU is faulty and should be replaced.

**G-17 When diagnosis code No. 61 is displayed**

**Comment:** This problem code is displayed when the ABS signal during operation stays off for a long period of time (90 seconds or more), due to a broken harness wire or short between the TCL-ECU and the ABS-ECU, or if the ABS-ECU and TCL-ECU interface circuit is faulty.

**Hint:** If the ABS warning lamp remains off after the engine is started, it is probably caused by a broken harness wire or short between the ABS-ECU and the TCL-ECU.

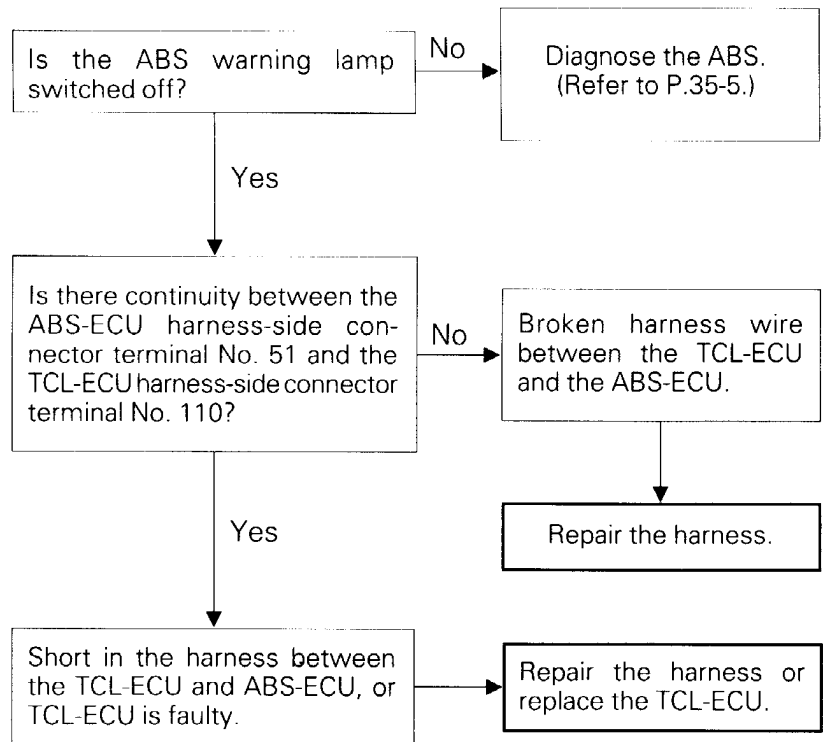
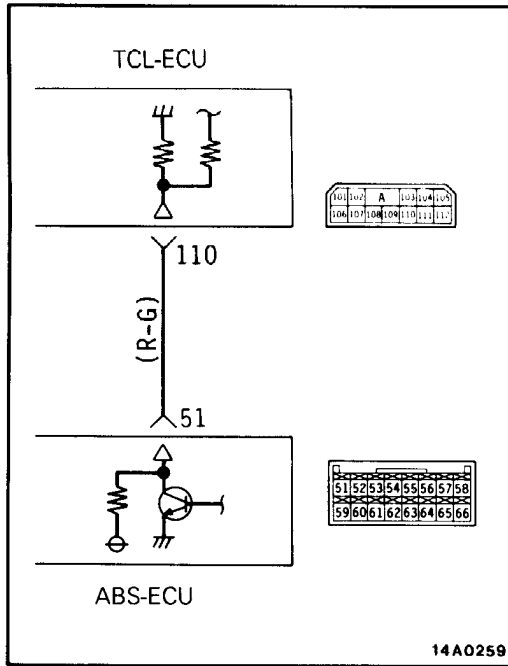




**G-18 When diagnosis code No. 62 is displayed**

**Comment:** This diagnosis code is displayed when the ignition key is "ON" and the TCL OFF indicator illuminates while the ABS-ECU is operating and the ABS warning lamp is illuminated.  
If the condition returns to normal, this problem code will not be output.

**Hint:** If the ABS warning lamp remains off after the engine is started, there is probably a broken harness wire or short between the ABS-ECU and the TCL-ECU.



**G-19 When diagnosis code No. 63 is displayed**

**Comment:** This problem code is displayed when the input signal for when ABS is operating (ABS 0 is the L signal), and the input signal for when ABS fails (ABS 1 is the L signal) are input by the TCL-ECU at the same time.  
If the condition returns to normal, this problem code will not be output.

**Remedy:** Inspect according to troubleshooting for diagnosis code nos. 61 and 62.

4. DIAGNOSIS FLOW CHART II

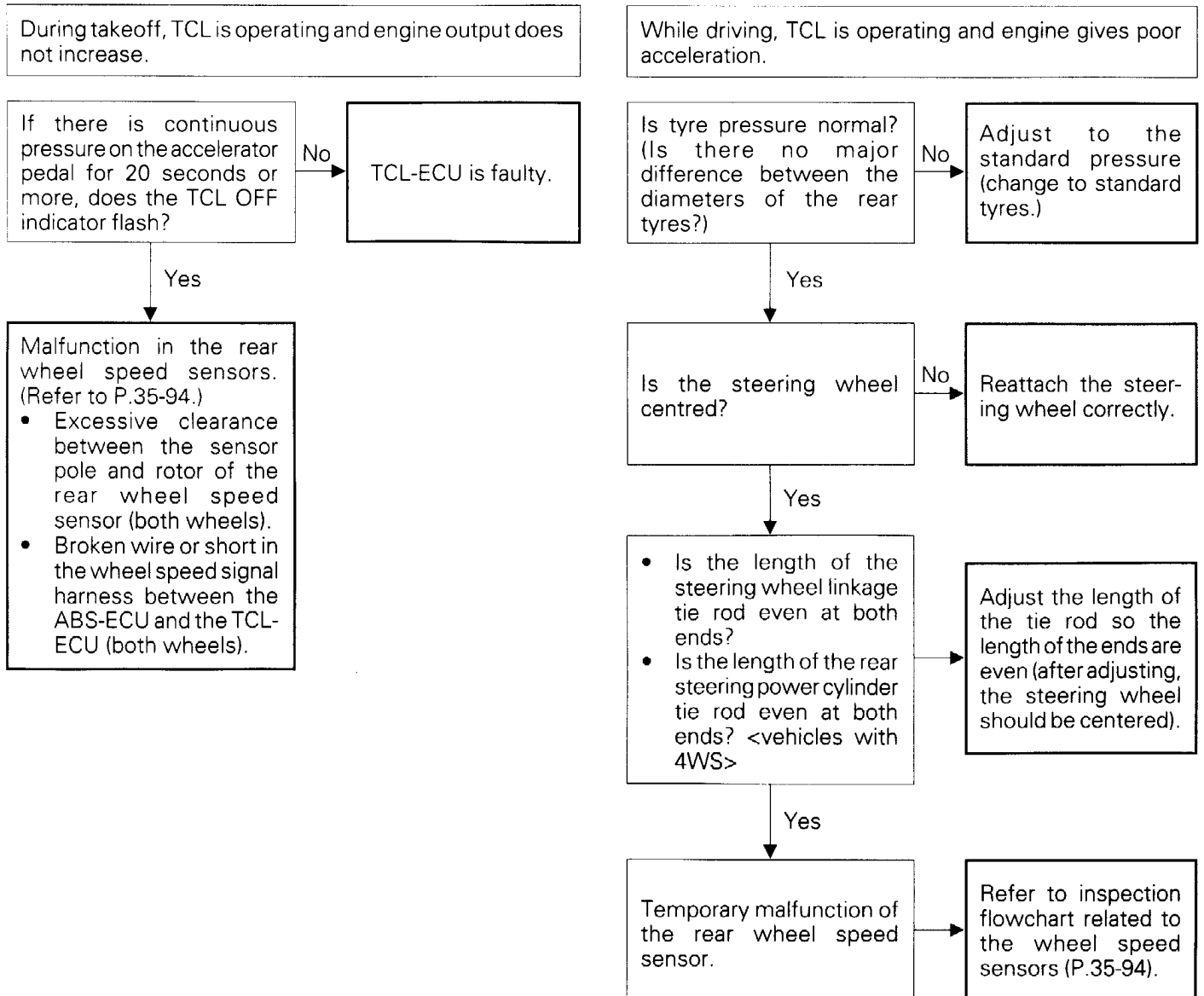
- 3. When driving in an area where TCL would not operate, the TCL indicator (green) illuminates and takeoff is impossible or engine gives poor acceleration.
- 4. In an area where TCL should operate, it does not operate [TCL indicator (green) does not illuminate].

Comment: The TCL control unit only detects the causes of nearly all of the above problems for a short time by its self diagnosis function, but the detection time for the following problems is long, so until the TCL OFF indicator starts flashing and a problem code is output, sometimes one

of the above problems can develop. Also, if there is a disagreement between the input value from the steering wheel sensor and the actual steering angle, the trace control will operate, even in areas where the TCL would not normally operate.

After checking if the problem reoccurs, inspect according to the following procedure.

3. When driving in an area where TCL would not operate, the TCL indicator (green) illuminates and takeoff is impossible or engine gives poor acceleration.

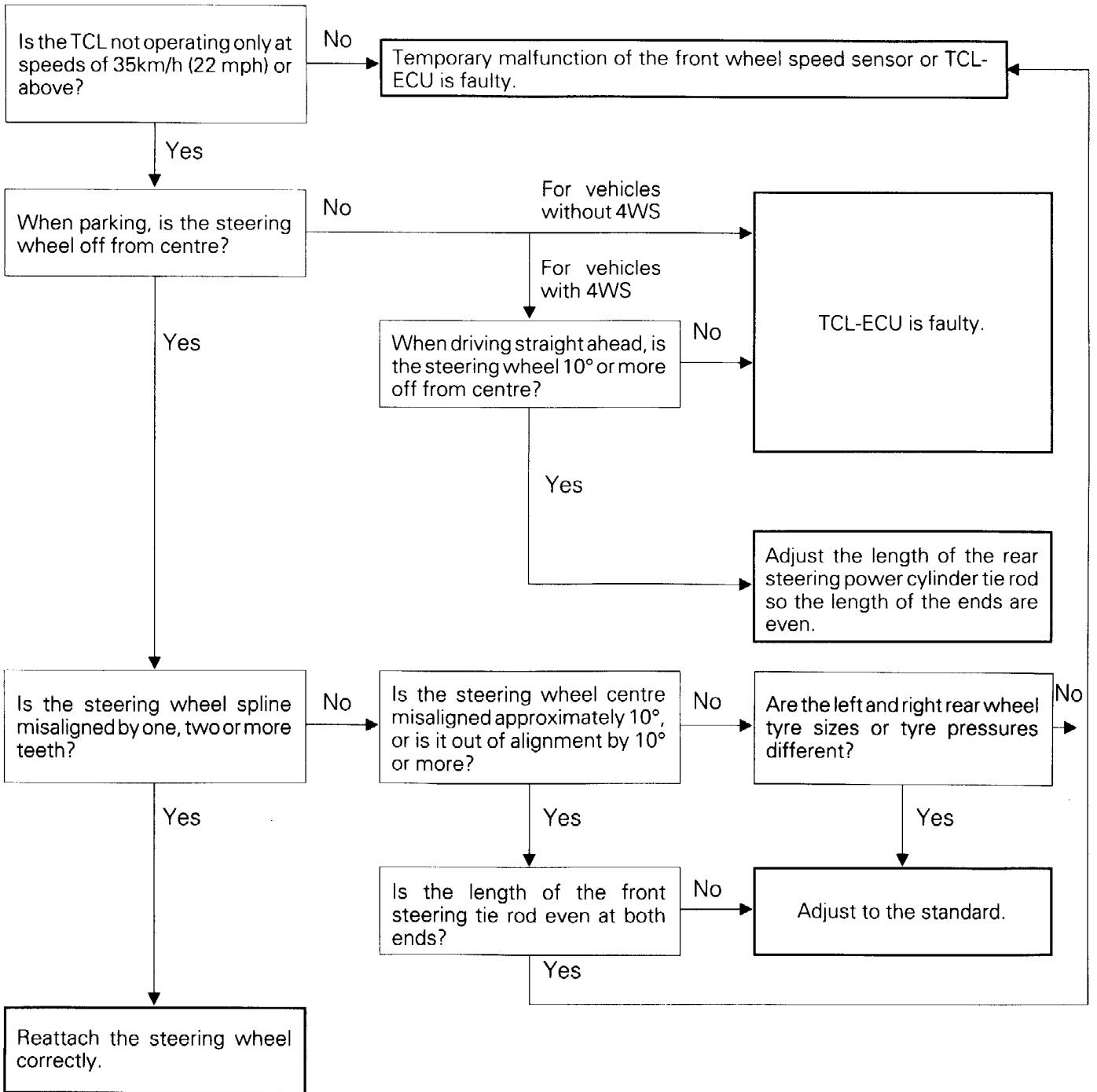


**4. In an area where TCL should operate, it does not operate [TCL indicator (green) does not illuminate].**

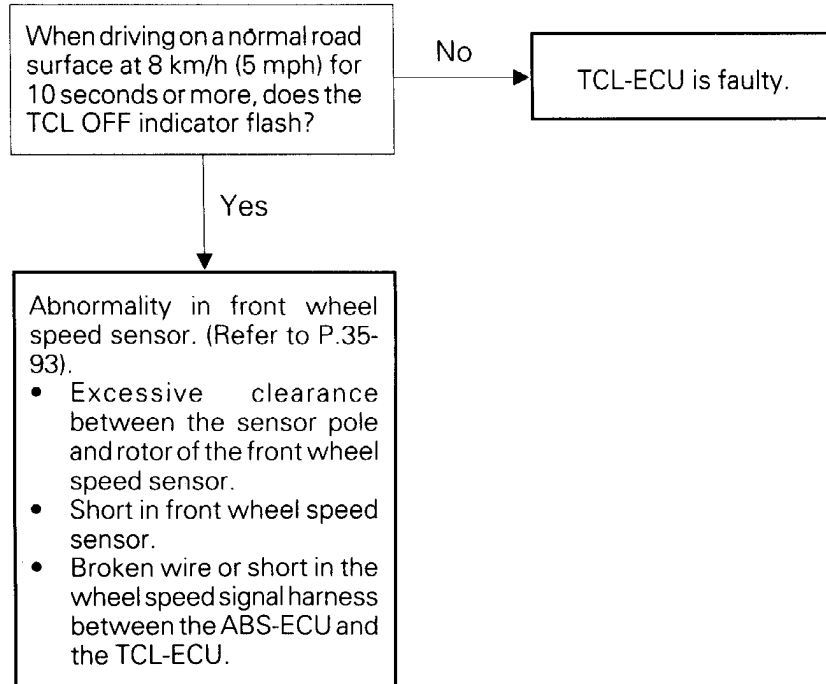
**NOTE**

This inspection flowchart is suitable for use if the ignition key is "ON" and the TCL OFF indicator illuminates, and then switches off after the engine is started.

When accelerating during turning on normal road surfaces and the TCL does not operate.



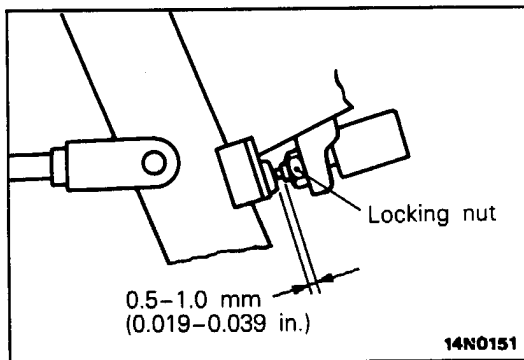
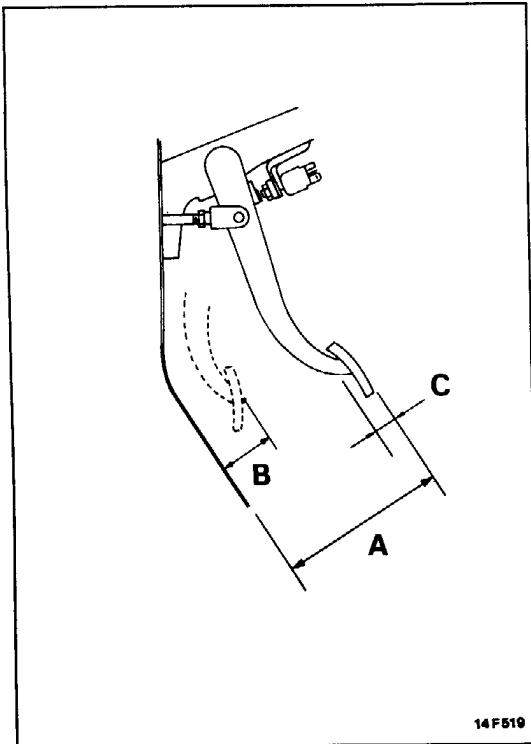
When taking off on a slippery road surface and TCL does not operate.



**SERVICE ADJUSTMENT PROCEDURES**  
E35FAAH

**BRAKE PEDAL INSPECTION AND ADJUSTMENT**

1. Measure the brake pedal height (A) as illustrated.  
**Standard value (A): 176–181 mm (6.9–7.1 in.)**
2. 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 (B): 85 mm (3.35 in.) or more**
3. While the engine is stopped, depress the brake pedal two or three times. After thus eliminating the vacuum in the brake booster, press the pedal down by hand, and confirm that the free play (C) is within the standard value range.  
**Standard value (C): 3–8 mm (0.12–0.31 in.)**



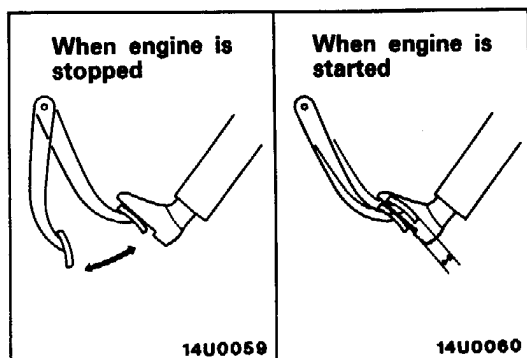
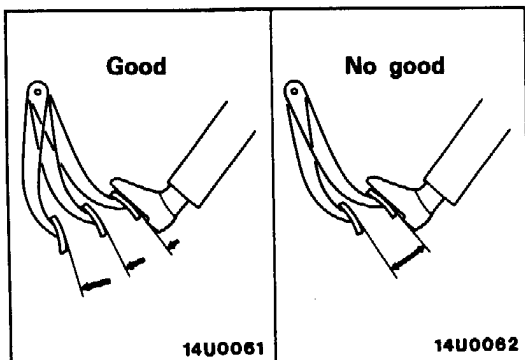
4. Adjust the brake pedal height
  - (1) Sufficiently loosen the stop lamp switch by loosening lock nut.
  - (2) Adjust the brake pedal height by turning the operating rod with pliers (with locking nut loosened).
  - (3) After turning the stop lamp switch until it contacts the pedal stop (until immediately before the brake pedal begins to move), turn the stop lamp switch back 1/2 to 1 revolution and secure with a lock nut.

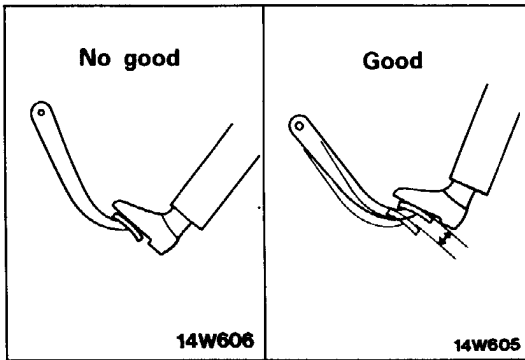
**BRAKE BOOSTER OPERATING TEST**

E35FCAAa

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.



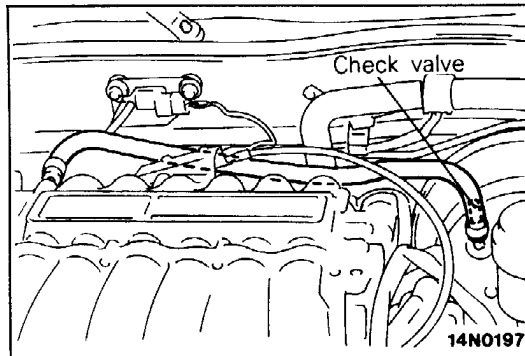


3. With the engine running, step on the brake pedal and then stop the engine.

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**

E35FEAI

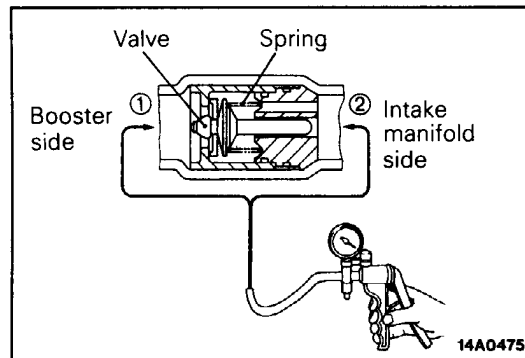
When checking the check valve, keep the check valve fit in the vacuum hose.

1. Remove the vacuum hose.

**NOTE**

The check valve is press-fit inside the vacuum hose.

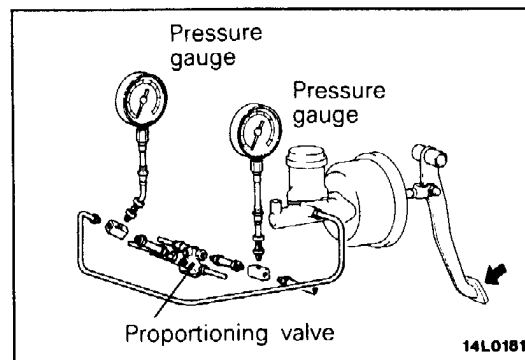
2. Check the operation of the check valve by using a vacuum pump.



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**

E35FKCI

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: 3.75–4.25 MPa (37.5–42.5 kg/cm<sup>2</sup>, 533–604 psi)**

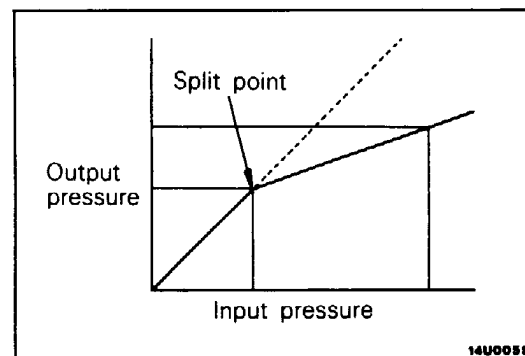
- (2) Output fluid pressure when input fluid pressure is 8.0 MPa (80 kg/cm<sup>2</sup>, 1,138 psi).

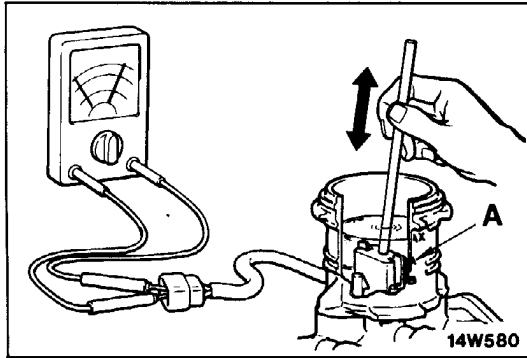
**Standard value: 4.75–5.25 MPa (47.5–52.5 kg/cm<sup>2</sup>, 676–747 psi)**

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

**Limit: 0.4 MPa (5 kg/cm<sup>2</sup>, 57 psi)**

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

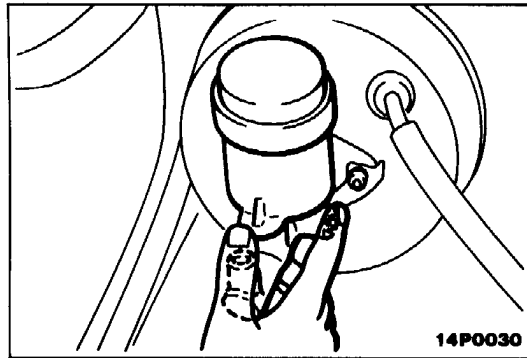




**BRAKE FLUID LEVEL SENSOR CHECK**

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**

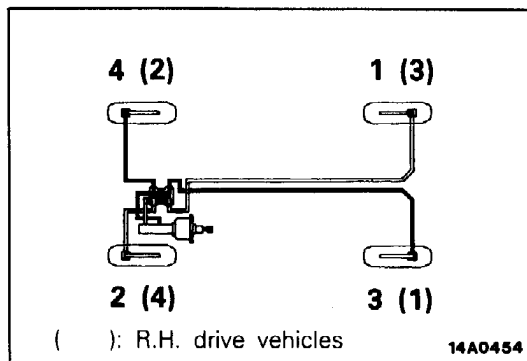
Use the specified brake fluid. Avoid using a mixture of the specified brake fluid and other fluid.

**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.

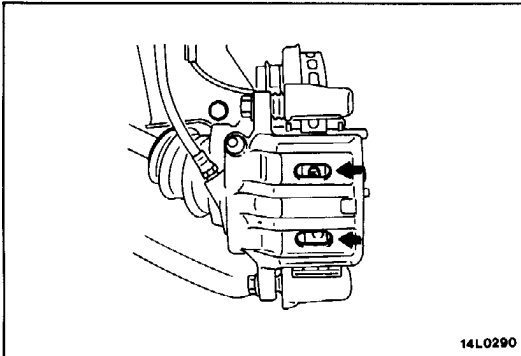


**BLEEDING OF BRAKE PIPE LINE**

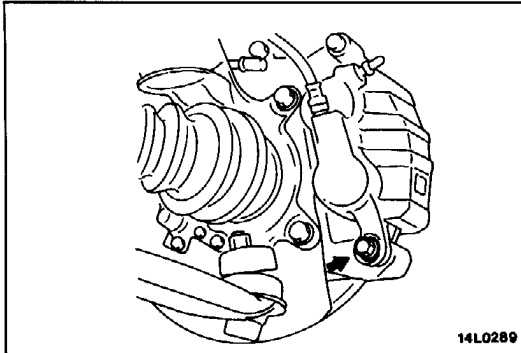
Start the engine and bleed the air in the sequence shown in the figure.

**Caution**

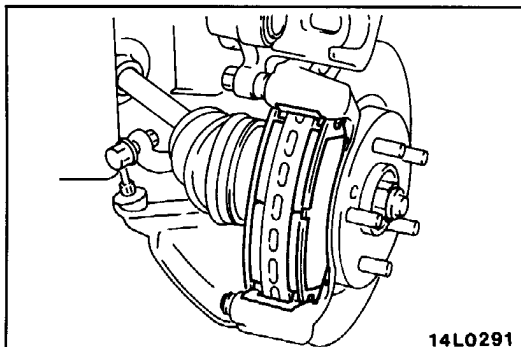
For vehicles with ABS, be sure to install a filter to the master cylinder reservoir tank when supplying brake fluid.



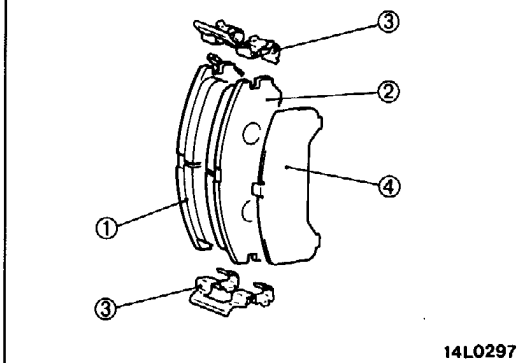
14L0290



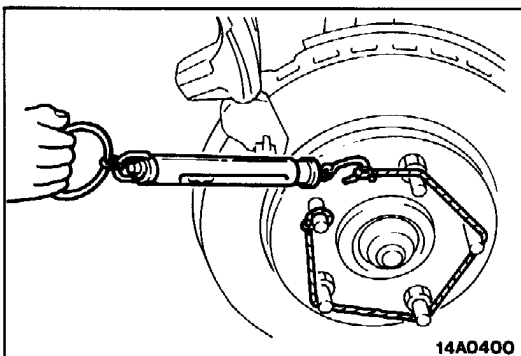
14L0289



14L0291



14L0297



14A0400

## FRONT DISC BRAKE PAD CHECK AND REPLACEMENT

E35FQAJa

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

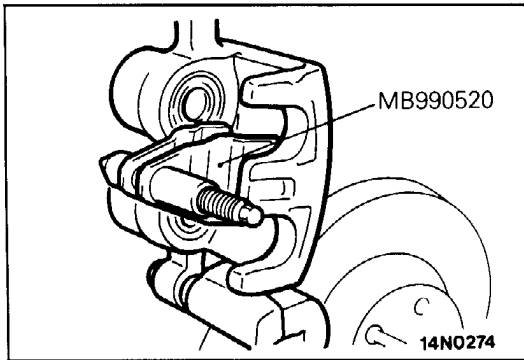
4. In order to measure the disc brake drag torque after pad installation, use a spring balance to measure the rotation sliding resistance of the hub in the forward direction with the pads removed.

### NOTE

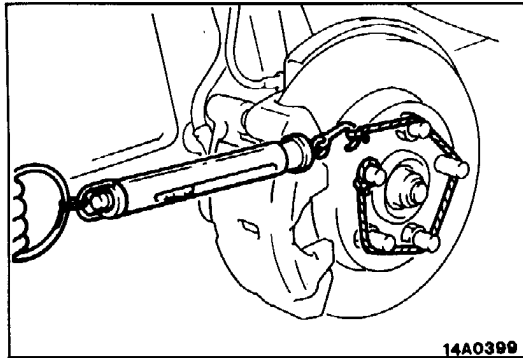
Tighten the nuts in order to secure the disc to the hub.

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





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



8. Start the engine, and after depressing the brake pedal hard two or three times, stop the engine.
9. Turn brake disc forward 10 times.
10. 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 4).

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

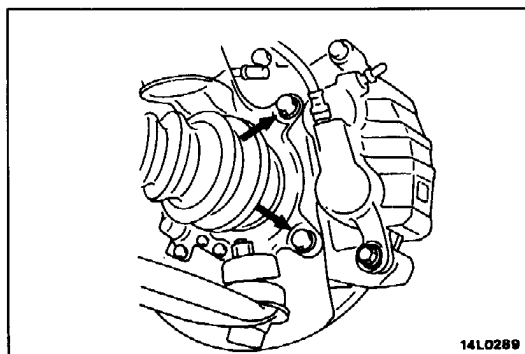
## FRONT DISC BRAKE ROTOR INSPECTION

**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.**

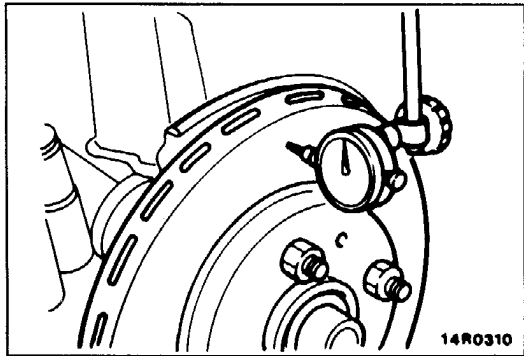
Before re-finishing or re-processing the brake disc surface, the following conditions should be checked.

Inspection items	Remarks
Scratches, rust, saturated lining materials and wear	<ul style="list-style-type: none"> <li>• 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.</li> <li>• 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).</li> </ul>
Run-out or drift	Excessive run-out or drift of the discs will increase the pedal depression resistance due to piston knock-back.
Change in thickness (parallelism)	If the thickness of the disc changes, this will cause pedal pulsation, shuddering and surging.
Inset or warping (flatness)	Overheating and improper handling while servicing will cause inset or warping.

**RUN-OUT CHECK**

E35FSAEa

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.



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

**Limit:**

<Vehicles built up to July, 1991>

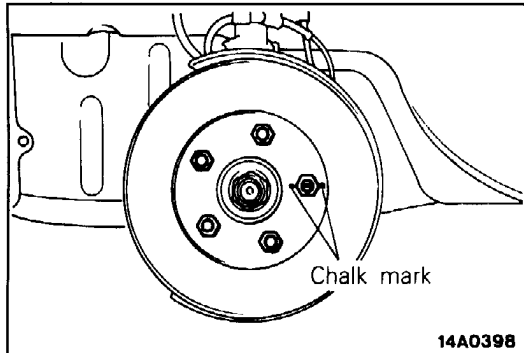
**0.08 mm (0.0031 in.) or less**

<Vehicles built from August, 1991>

**0.03 mm (0.0012 in.) or less**

**NOTE**

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

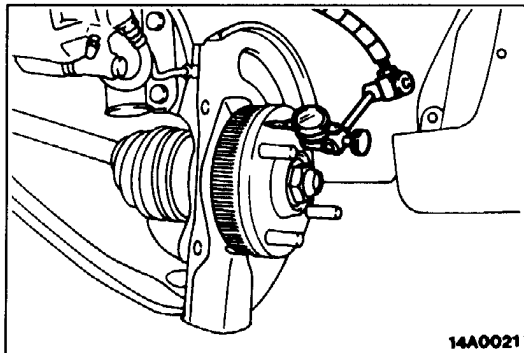


**RUN-OUT CORRECTION**

E35FTAAb

- If the run-out 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.

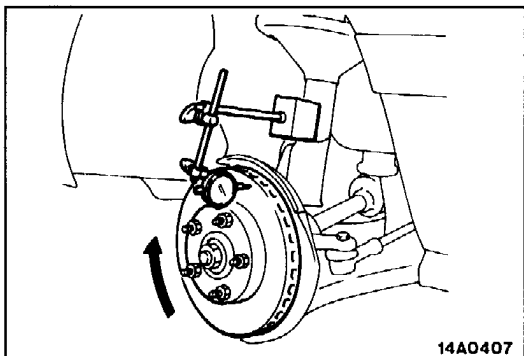
(1) Before removing the brake disc, chalk both sides of the wheel stud on the side at which run-out is greatest.



(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.

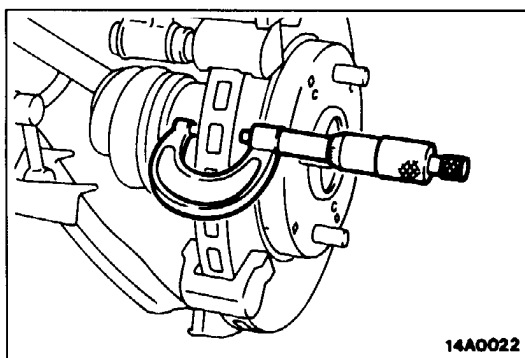
**Limit: 0.05 mm (0.0020 in.)**

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.

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



## THICKNESS CHECK

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

### Brake disc thickness

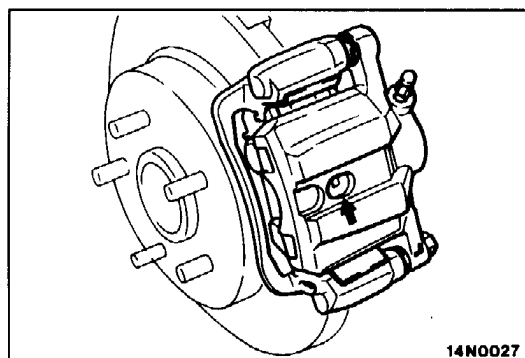
**Standard value: 24 mm (0.94 in.)**

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



## REAR DISC BRAKE PAD CHECK AND REPLACE- MENT

E35FUAE

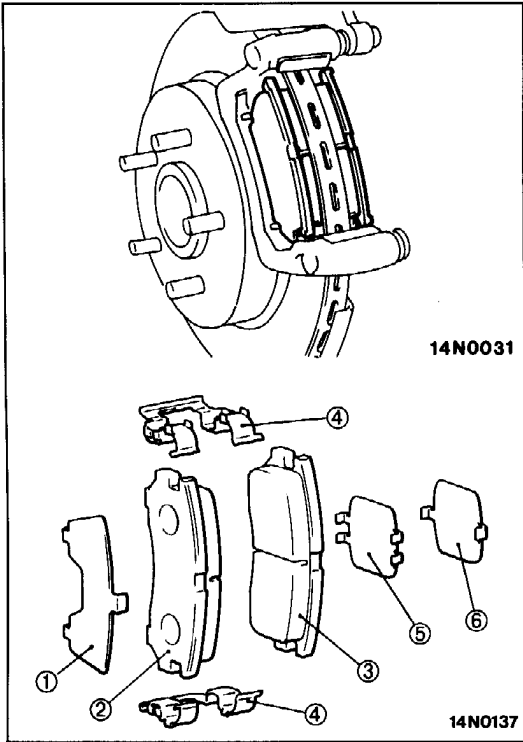
1. Check brake pad thickness through caliper body check port.

**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.



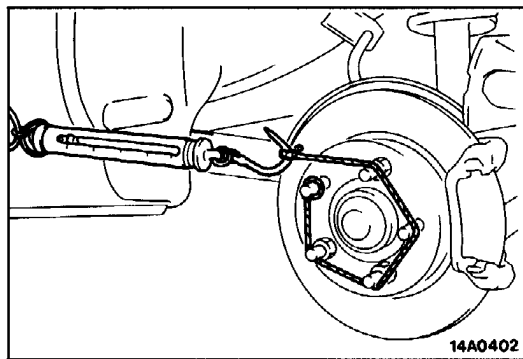
2. Remove guide pin. Lift caliper assembly and retain with wires.

**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
- ⑤ Inner shim A
- ⑥ Inner shim B



4. In order to measure the disc brake drag torque after pad installation, use a spring balance to measure the rotation sliding resistance of the hub in the forward direction with the pads removed.

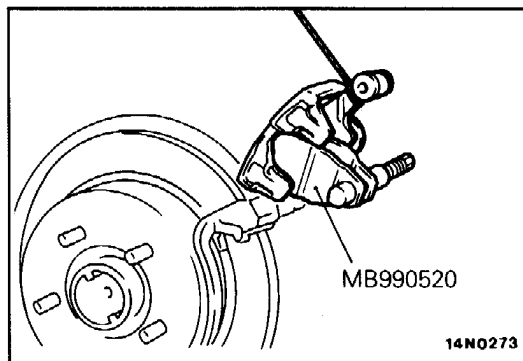
NOTE

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

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

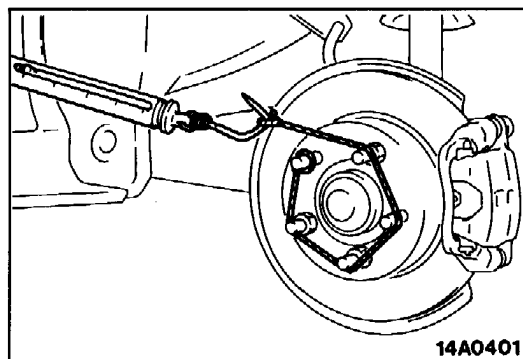
**Caution**

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



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

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



8. Start the engine, and after depressing the brake pedal hard two or three times, stop the engine.

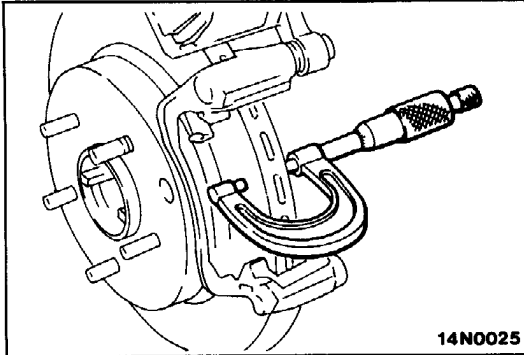
9. Turn brake disc forward 10 times.

10. 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 4).

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

12. If the disc brake drag force exceeds the standard value, disassemble piston and clean 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

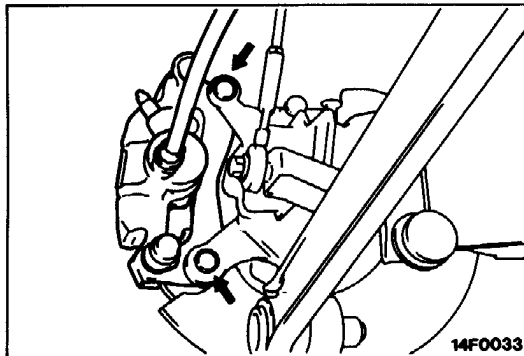
E35FVAB

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

**Standard value: 18.0 mm (0.71 in.)**

**Limit: 16.4 mm (0.65 in.)**

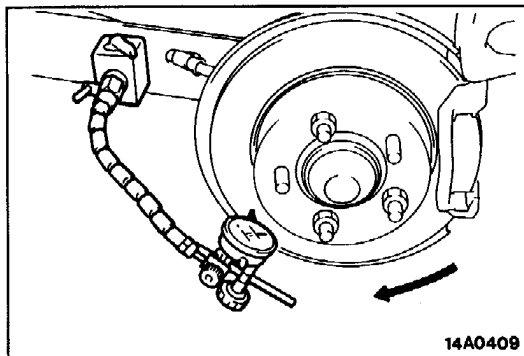
Replace the discs and pad assembly for both sides left and right of the vehicle if they are worn beyond the specified limit.



### REAR BRAKE DISC RUN-OUT CHECK

E35FWAB

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

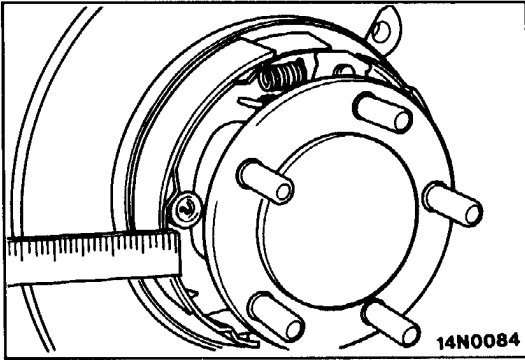
E35FLAAa

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.35-90.)

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

**BRAKE LINING THICKNESS CHECK**

E35FFAC

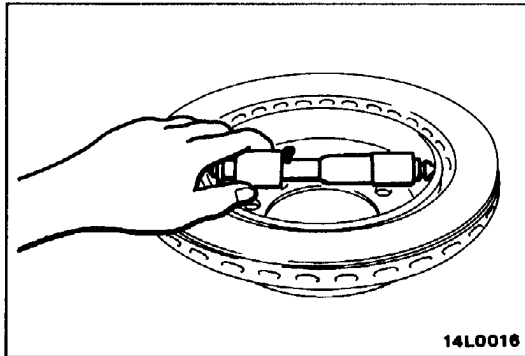
1. Remove the rear brake assembly, raise the rear brake assembly and secure it by using a wire, etc.
2. Remove the brake drum.
3. Measure the wear of the brake lining at the place worn the most.

**Standard value: 2.8 mm (0.11 in.)****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.**

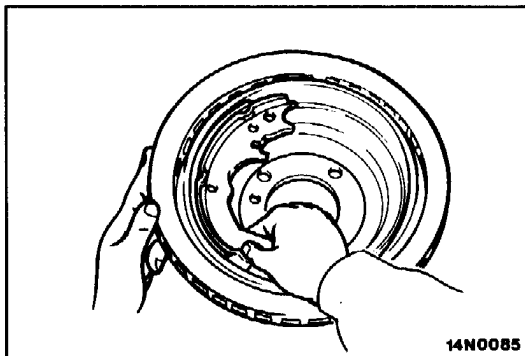
**BRAKE DRUM INSIDE DIAMETER CHECK**

E35FGAC

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.

**Standard value: 168 mm (6.6 in.)****Limit: 169 mm (6.7 in.)**

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

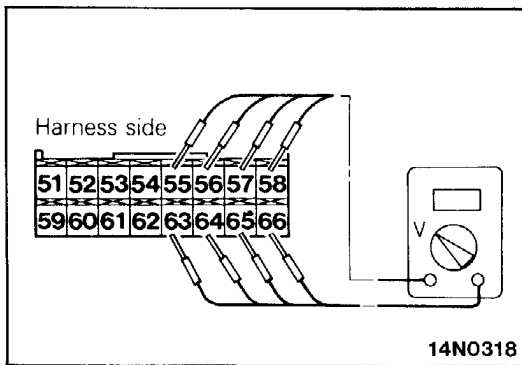
**BRAKE LINING AND BRAKE DRUM CONNECTION CHECK**

E35FLAC

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. Remove the shoe and lining assembly.
4. Chalk inner surface of brake drum and rub with shoe and lining assembly.
5. Replace shoe and lining assembly or brake drums if very irregular contact area.

**NOTE**

Clean of chalk after check.



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

### WHEEL SPEED SENSOR OUTPUT VOLTAGE CHECK

E35FPAM

1. Check that the clearance between the wheel speed sensor and the rotor are within the standard values.
2. Raise up the wheels and release the parking brake.
3. Remove the control unit harness connector and measure from the harness side connector.

#### Caution

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

4. 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.

Front		Rear	
LH	RH	LH	RH
58	56	55	57
66	64	63	65

#### Output voltage

**When measuring with a circuit tester:**

**70 mV or more**

**When measuring with an oscilloscope:**

**200 mV p-p or more**

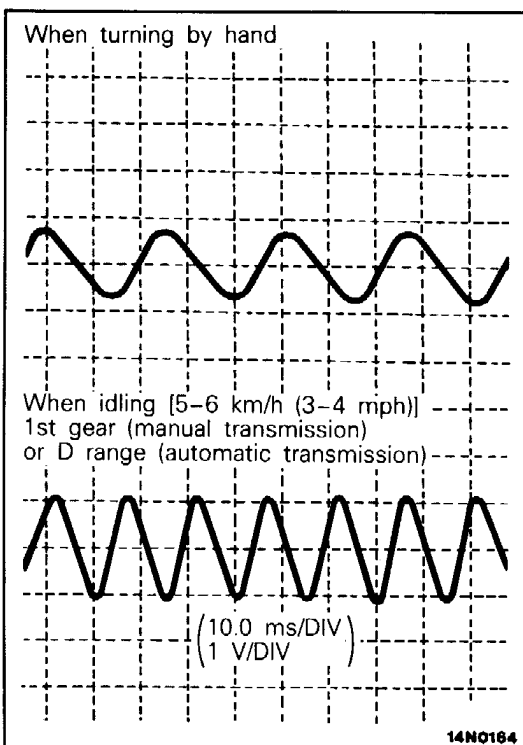
5. If the output voltage is lower than the above values, the reason could be as follows:
  - Excessive clearance between the wheel speed sensor pole piece and the rotor.
  - Faulty wheel speed sensor.
 so adjust the wheel speed sensor or replace it.

### 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). Turn the rear wheels manually so that they rotate at a constant speed.

#### NOTE

1. Check the connection of the sensor harness and connector before using the oscilloscope.
2. The 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.





**WAVE OBSERVATION POINTS**

Phenomenon	Cause	Suggested remedy
Wave amplitude is too small, or doesn't appear at all.	Wheel speed sensor is faulty.	Replace the sensor.
	Wrong clearance between the pole piece and rotor.	Adjust the clearance.
Excessive variation in the wave amplitude. (However, if the lowest amplitude occurs at 100mV or above, there is no problem.)	Excessive runout or eccentricity in the axle hub.	Replace the hub.
Noise or interference in the wave pattern.	Broken sensor wire.	Replace the sensor.
	Broken harness wire.	Repair the harness.
	Faulty wheel speed sensor attachment.	Repair the sensor attachment.
	Chipped or broken rotor teeth.	Replace the rotor.

**NOTE**

As the wheel speed sensor cable moves in conjunction with the movement of the front and rear suspension, the wires might break while driving on rough roads, but may have continuity while driving on normal roads. Accordingly, when measuring the wave pattern of the wheel speed sensor voltage, output, take a measurement while shaking the sensor harness to simulate the special conditions of a rough road.

**INSPECTION OF THE ABS HYDRAULIC SYSTEM**

E35FPAN

**INSPECTION USING THE BRAKING FORCE TESTER**

**NOTE**

1. The roller of the braking force tester and the tyre should be dry during testing.
2. When testing the front brakes, apply the parking brake, and when testing the rear brakes, stop the front wheels by chocking them.

1. Place the front wheel or the rear wheel on the rollers of the braking force tester.
2. Turn the ignition key to the OFF position and set the multi-use tester as shown in the diagram.

**Caution**

**Connection and disconnection of the multi-use tester should always be made with the ignition switch in the OFF position.**

3. After checking that the selector lever is in neutral, start the engine.

**Caution**

**At this time, check that the ABS warning lamp illuminates for a brief period before turning off. If it doesn't turn off, refer to the "Troubleshooting" section (P.35-5.)**

4. Operate the rollers of the braking force tester.
5. Keep depressing the brake pedal until the reading on the braking force tester reaches the value below, and maintain this braking force while testing.

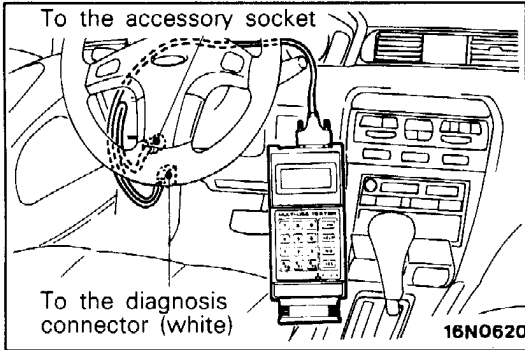
N (kg, lbs.)

Front wheel	1,800 (180, 397)
Rear wheel	650 (65, 143)

6. After the reading on the braking force tester has stabilized, operate the multi-use tester to carry out an actuator test (Item Nos. 01, 02, 03) and take a reading of the change in braking force. For diagnosis and remedy, refer to the following diagnosis table.

**NOTE**

1. When the multi-use tester is used and the ABS system is selected, the ABS system will switch to the multi-use tester mode and the ABS warning lamp will illuminate.
2. When the ABS has been interrupted by the fail-safe function, the multi-use tester actuator testing cannot be used.

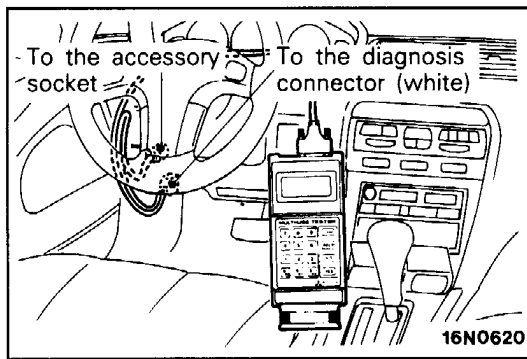


Diagnosis Table

No.	Operation	Diagnosis (braking force tester reading)		Cause	Remedy
		Normal	Problem		
01	After the reading on the braking force tester has stabilized, operate the multi-use tester to force-drive the actuator, and take a reading of the change in braking force.	1. When the actuator is force-driven by the multi-use tester, the brake force will change in the following way. Front wheel: N (kg, lbs.) 1,800 (180, 397) Step 1 600 ± 200 (60 ± 20, 132 ± 44) Step 2 (After approx. 6 seconds) 1,000 ± 200 (100 ± 20, 220 ± 44)	The Braking force at step 1 is very slight or hardly decreases at all.	Hydraulic unit brake pipes are incorrectly connected.	Connect correctly.
		Rear wheel: 650 (65, 143) Step 1 300 ± 15 (30 ± 15, 66 ± 33) Step 2 (After approx. 6 seconds) 650 ± 150 (65 ± 15, 143 ± 33)		The Braking force decreases at step 1, but the increase in braking force at step 2 is very slight or almost non-existent.	Blockage in the brake line outside the hydraulic unit.
02	After the reading on the braking force tester has stabilized, operate the multi-use tester to force-drive the actuator, and take a reading of the change in braking force.	2. Directly after checking the value at step 2 (within approx. 3 seconds), the braking force does not increase even when the brake pedal pressure is increased.	When the brake pedal pressure is increased, braking force increases.	Fluid leaking from the hydraulic unit (faulty seal).	Replace the hydraulic unit.
03					

NOTE

- For drive conditions, the wheel speed of both front wheels or both rear wheels should be 0 km/h (0 mph), and the maximum wheel speed of the wheel to be tested for braking force should be less than 10 km/h (6 mph).
- During testing, if the brake pedal pressure is not continuously maintained, an error could occur, resulting in a faulty diagnosis. When a diagnosis is faulty, the reason could be that pedal pressure was not constant, so the test should be repeated in the same way if necessary.
- The above reasons for problems are given, on the assumption that all brake components other than the hydraulic unit and brake lines are functioning normally.



### SIMPLE INSPECTION

1. Jack up the vehicle, and support it on axle stands.
2. Release the parking brake, and feel the drag force (drag torque) on each road wheel.
3. Turn the ignition key to the OFF position and set the multi-use tester as shown in the diagram.

#### Caution

**Connection and disconnection of the multi-use tester should always be made with the ignition switch in the OFF position.**

4. After checking that the selector lever is in neutral, start the engine.

#### Caution

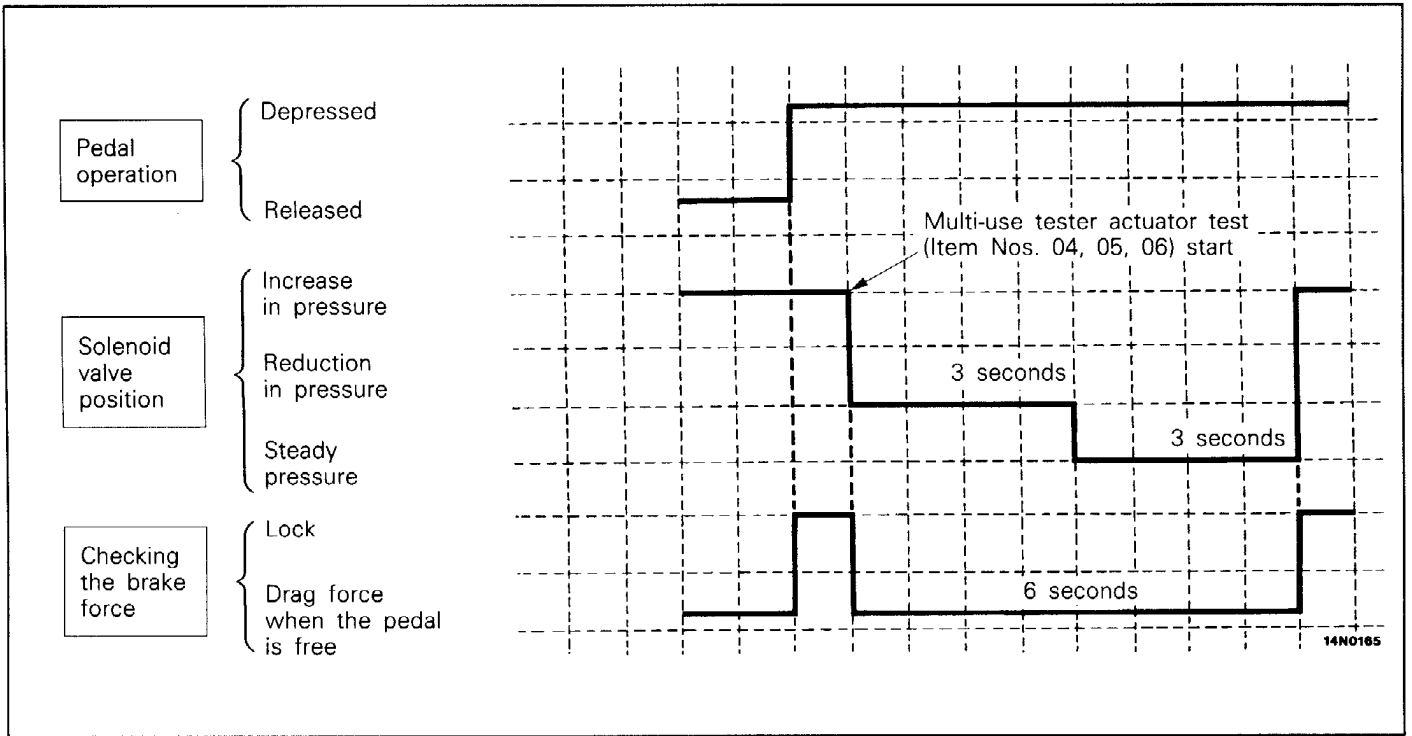
**At this time, check that the ABS warning lamp illuminates for a brief period before turning off. If it doesn't turn off, refer to the "Troubleshooting" section (P.35-5).**

5. Use the multi-use tester to force-drive the actuator.
6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed.

The result should be as shown in the following diagram.

#### NOTE

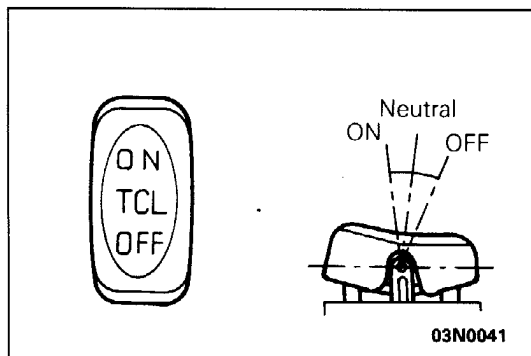
1. When the multi-use tester is used and the ABS system is selected, the ABS system will switch to multi-use tester mode, and the ABS warning lamp will illuminate.
2. When the ABS function has been interrupted by the fail-safe, the multi-use tester actuator testing cannot be used.



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

**Diagnosis Table**

No.	Operation	Diagnosis (braking force tester reading)		Cause	Remedy
		Normal	Problem		
04	(1) Depress the brake pedal to lock the wheels. (2) Choose the wheel to be checked with the multi-use tester, and force-drive the actuator. (3) Rotate the selected wheel manually to check the change in braking force.	After locking for a 6 second period, the braking force will release.	The wheel will not lock even when the brake pedal is depressed.	Blockage in the brake line outside the hydraulic unit.	Inspect the brake line and unblock.
05				Blockage in the oil pressure circuit in the hydraulic unit.	Replace the hydraulic unit.
06			Braking force does not decrease.	Hydraulic unit brake pipes are incorrectly connected.	Connect correctly.
				Hydraulic unit solenoid valve is faulty.	Replace the hydraulic unit.



## INSPECTING OPERATION OF THE TCL (TRACTION CONTROL) SYSTEM E35FPAO

### INSPECTING THE ILLUMINATION OF THE TCL SWITCH

When the headlamp is illuminated (tail lamp relay is operating), check if the TCL switch indicator is illuminated.

### INSPECTION OF THE TCL INDICATOR LAMPS

1. Check if each indicator lamp is illuminated when the TCL switch is pressed.

TCL switch mode	Inspection conditions	Indicator lamp		
		TCL OFF	TCL	TRACE OFF
Switch does not operate.	Turn the ignition key to the ON position.	○	○	○
	Start the engine.	×	×	×
TRACE OFF mode (press once to OFF)	Engine is idling	–	–	○
TCL OFF mode (press once more to OFF)		○	–	–
TCL ON mode	When the engine is idling, turn the steering wheel at least one and a half revolutions.	No illumination	–	–
	Drive the vehicle at 30 km/h (19 mph) for 2 minutes or more.	No illumination	–	–

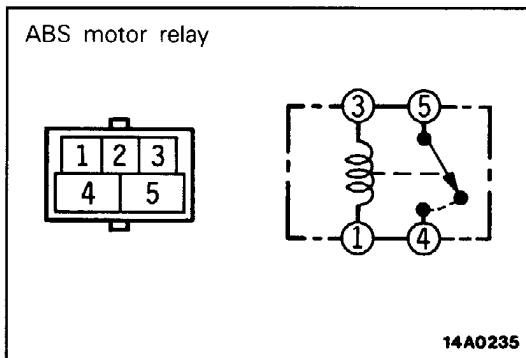
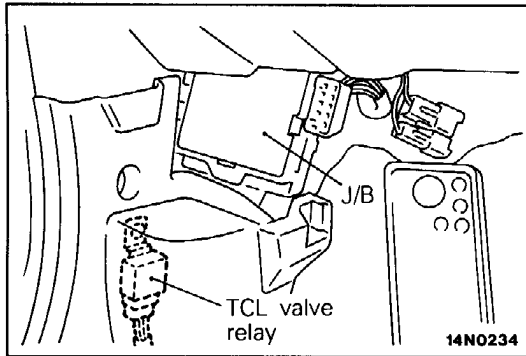
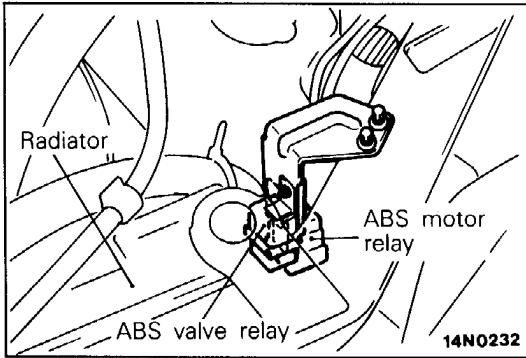
**NOTE**

○: illuminated, ×: extinguished, –: not relevant

**Caution**

**If a different result is obtained when checking, refer to the “Troubleshooting” section for remedy.**

2. When the headlamp is illuminated (tail lamp relay is operating), check if each indicator lamp is dimmed.



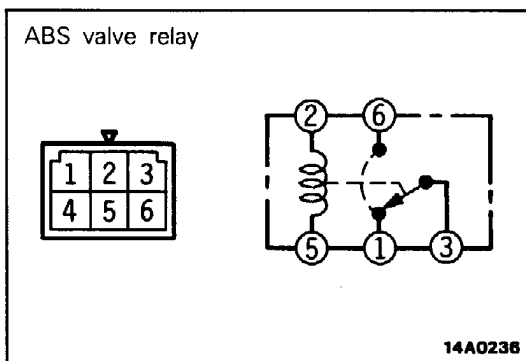
**INSPECTING THE MOTOR RELAY AND VALVE RELAY**

E35FPAP

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

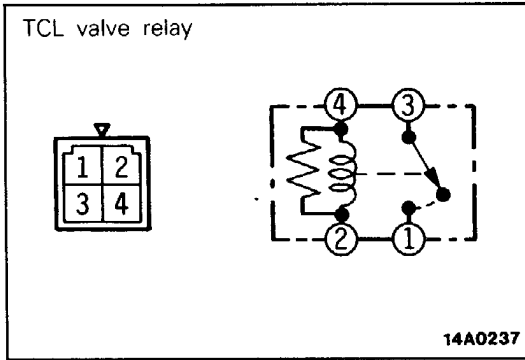
**ABS motor relay <when energizing coil is at normal temperature (20° ± 15°C [68° ± 27°F])>**

When there is no current	Between terminals ③ and ①	74 ± 25Ω
	Between terminals ④ and ⑤	No continuity (∞ Ω)
When there is current between terminals ③ and ①	Between terminals ④ and ⑤	Continuity (approx. 0Ω)



**ABS valve relay <when energizing coil is at normal temperature (20° ± 15°C [68° ± 27°F])>**

When there is no current	Between terminals ② and ⑤	80 ± 25Ω
	Between terminals ① and ③	Continuity (approx. 0Ω)
	Between terminals ③ and ⑥	No continuity (∞ Ω)
When there is current between terminals ② and ⑤	Between terminals ① and ③	No continuity (∞ Ω)
	Between terminals ③ and ⑥	Continuity (approx. 0Ω)



**TCL valve relay <when energizing coil is at normal temperature (20° ± 5°C [68° ± 9°F])>**

When there is no current	Between terminals ④ and ②	100 <sup>+25</sup> / <sub>-14</sub> Ω
	Between terminals ③ and ①	No continuity (∞ Ω)
When there is current between terminals ④ and ②	Between terminals ③ and ①	Continuity (approx. 0Ω)

**INSPECTING THE TCL HYDRAULIC SYSTEM  
INSPECTION USING THE BRAKING FORCE TESTER**

**NOTE**

1. The roller of the braking force tester and the tyre should be dry during testing.
2. The parking brake should be applied to lock the rear wheels.

1. Place the front wheel of the vehicle on the rollers of the braking force tester.
2. Turn the ignition key to the OFF position and set the multi-use tester as shown in the diagram.

**Caution**

**Connection and disconnection of the multi-use tester should always be made with the ignition switch in the OFF position.**

3. After checking that the selector lever is in neutral, start the engine.

**Caution**

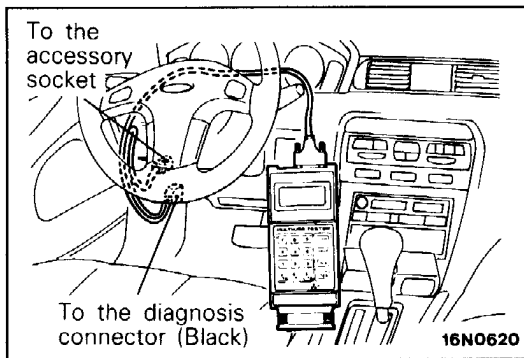
**At this time, check that the TCL-related indicator lamps momentarily illuminate before switching off. If they do not switch off, refer to the "Troubleshooting" section (P.35-44).**

4. Operate the rollers of the braking force tester and keep the steering wheel straight.
5. When the brake pedal is released, perform an actuator test with the multi-use tester (Item Nos. 01, 02) and take a reading of the change in braking force.

For diagnosis and remedy, refer to the following "diagnosis table".

**NOTE**

1. When the multi-use tester is operated and the TCL system is selected, the TCL system will switch to multi-use tester mode and the TCL indicator lamp will illuminate.
2. When the TCL has been interrupted by the fail-safe function, the multi-use tester actuator testing cannot be used.



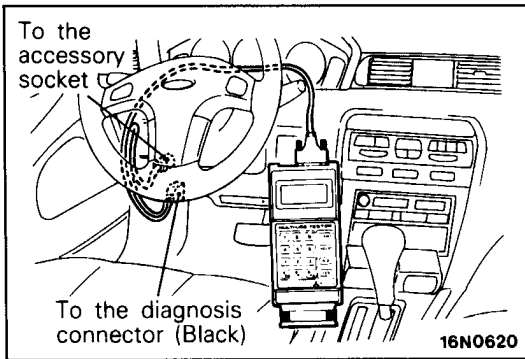


Diagnosis Table

No.	Operation	Diagnosis (braking force tester reading)		Cause	Remedy
		Normal	Problem		
01	Operate the multi-use tester to force-drive the actuator, and check the change in braking force.	When the actuator is force-driven by the multi-use tester the brake force will change in the following way. N (kg, lbs.) Approx. 200 (20, 44)	Braking force at step 1 is very slight or hardly increases at all.	Hydraulic unit brake pipes are incorrectly connected.	Connect correctly.
		Step 1 700–900 (70–90, 154–198)		Hydraulic unit is faulty.	Replace the hydraulic unit.
02		Step 2 (After approx. 3 seconds) 350–650 (35–65, 77–143)	Braking force increases at step 1, but the decrease in braking force at step 2 is very slight or almost non-existent.	Hydraulic unit is faulty.	Replace the hydraulic unit.
	Step 3 (After approx. 3 seconds) Approx. 200 (20, 44)				

NOTE

1. For drive conditions, the wheel speed of both front wheels should be 0 km/h (0 mph), and the maximum wheel speed of the wheel to be tested for braking force should be less than 10 km/h (6 mph).
2. The above reasons for problems are given on the assumption that all brake components other than the hydraulic unit are functioning normally.

**SIMPLE INSPECTION**

1. Jack up the front wheels, and support on axle stands.
2. After checking that the selector level is neutral, feel the drag force (drag torque) for each wheel brake.
3. Turn the ignition key to the ACC position and set the multi-use tester as shown in the diagram.

**Caution**

**Connection and disconnection of the multi-use tester should always be made with the ignition switch in the OFF position.**

4. Start the engine.

**Caution**

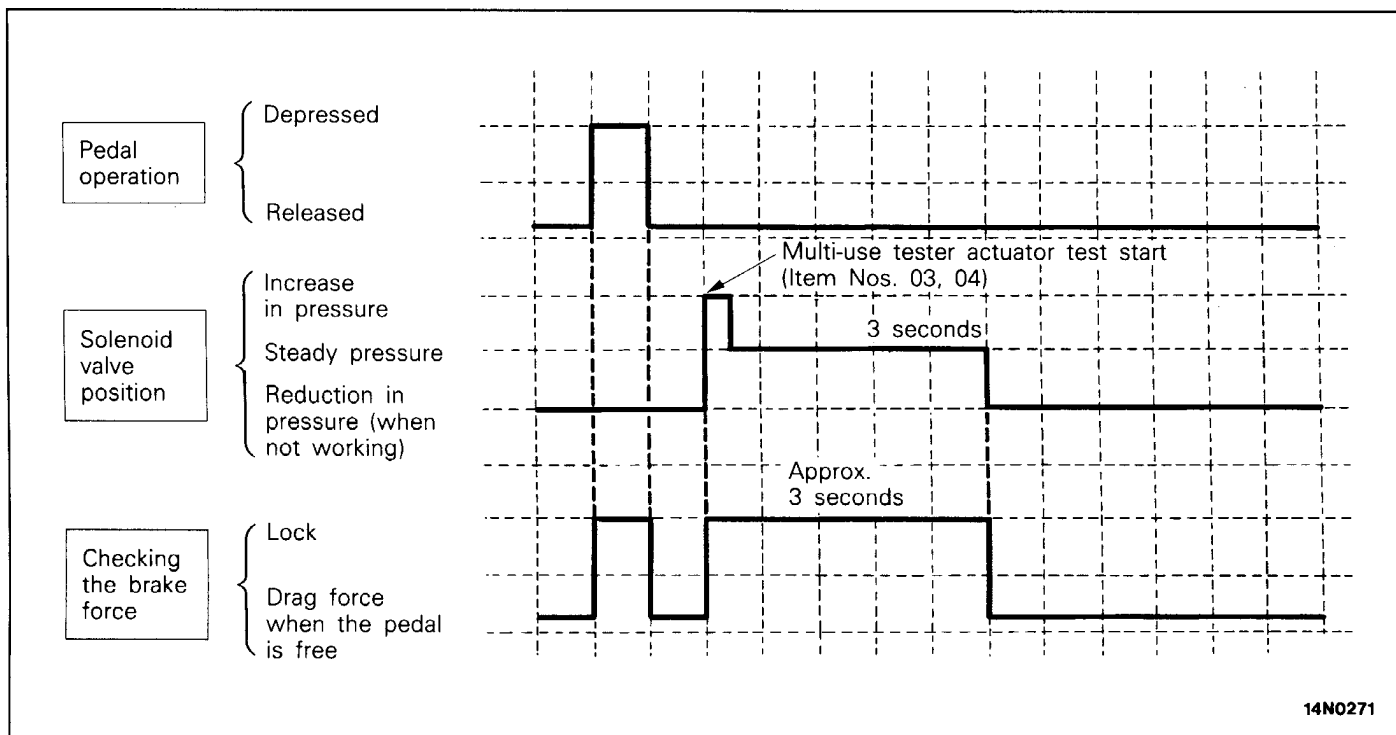
**At this time, check that the TCL-related indicator lamps momentarily illuminate before switching off. If they do not switch off, refer to the "Troubleshooting" section (P.35-44).**

5. Check that the wheels lock when the brake pedal is depressed, and that they become free when the pedal is released.
6. When the brake pedal is released, operate the multi-use tester to force-drive the actuator.
7. Rotate the wheel manually and check the change in braking force.

The result should be as shown in the following diagram.

**NOTE**

1. When the multi-use tester is operated and the TCL system is selected, the TCL system will switch to multi-use tester mode and the TCL OFF indicator lamp will illuminate.
2. When the TCL-ECU function has been interrupted by the fail-safe function, the multi-use tester actuator testing cannot be performed.



14N0271

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

**Diagnosis Table**

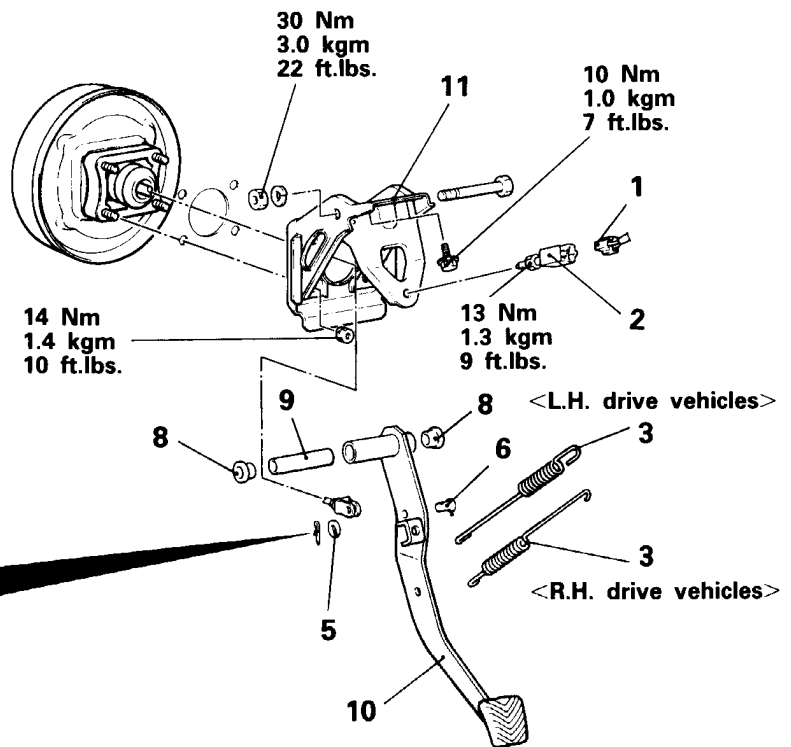
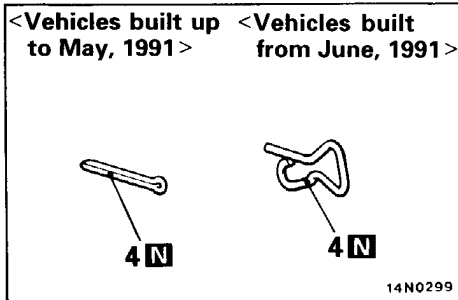
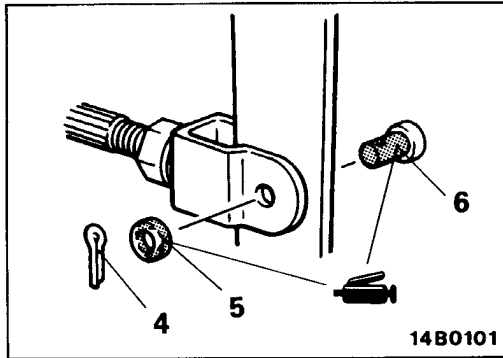
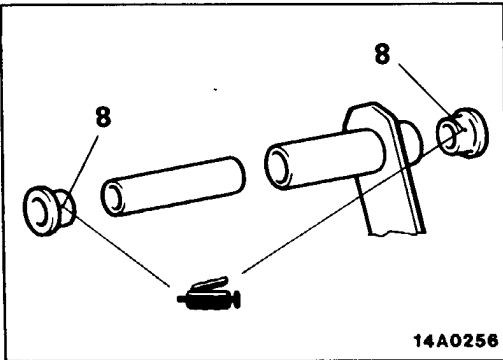
No.	Operation	Diagnosis (braking force tester reading)		Cause	Remedy
		Normal	Problem		
03	1. Rotate the wheel when the brake pedal is released. 2. Choose the wheel to be checked with the multi-use tester, and force-drive the actuator.	After continuous locking for a 3 second period, the braking force will decrease.	The wheel will not lock.	Hydraulic unit brake pipes are incorrectly connected.	Connect correctly.
04	3. Rotate the selected wheel manually to check the change in braking force.			Hydraulic unit is faulty.	Replace the hydraulic unit.

**BRAKE PEDAL**

**REMOVAL AND INSTALLATION**

**Post-installation Operation**

- Brake Pedal Adjustment  
(Refer to P.35-85.)



**Stop lamp switch removal steps**

1. Stop lamp switch connector
2. Stop lamp switch

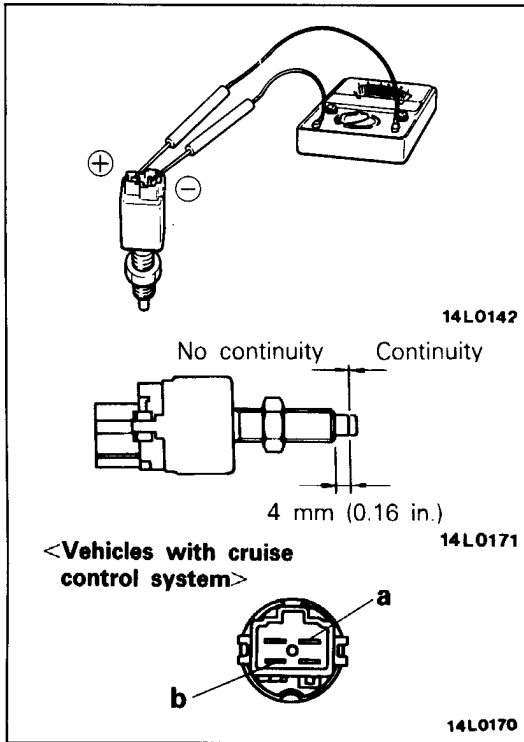
**Brake pedal removal steps**

1. Stop lamp switch connector
2. Stop lamp switch
3. Brake pedal return spring
4. Split pin\*1 or snap pin\*2
5. Washer
6. Clevis pin
7. Brake pedal assembly\*  
(parts from step 8 to step 11)
8. Bushing
9. Spacer
10. Brake pedal
11. Member assembly

**NOTE**

- (1)\*: M/T (L.H. drive vehicles)
- (2)\*1: <Vehicles built up to May, 1991>
- \*2: <Vehicles built from June, 1991>

E35GCAH



**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.

For vehicles with cruise control system, the check for continuity should be made at connectors "a" and "b" of the stop lamp switch.

# MASTER CYLINDER AND BRAKE BOOSTER

## REMOVAL AND INSTALLATION

### Pre-removal Operation

- Draining of Brake Fluid

### Post-installation Operation

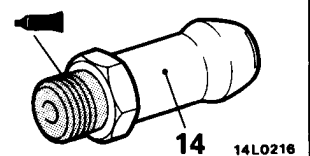
- Supplying Brake Fluid
- Bleeding (Refer to P.35-87.)
- Adjustment of Brake Pedal (Refer to P.35-85.)

### Brake tube flare nuts



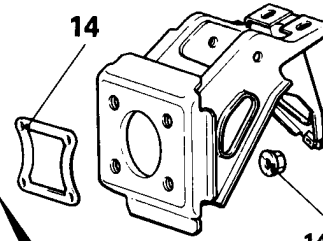
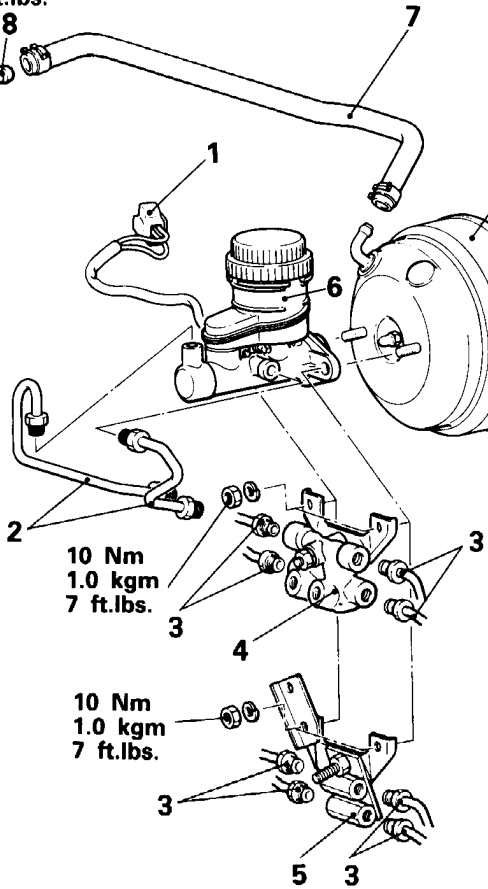
15 Nm  
1.5 kgm  
11 ft.lbs.

14F038



Sealant: 3M ATD Part No. 8663, 8661 or equivalent

15-18 Nm  
1.5-1.8 kgm  
11-13 ft.lbs.



14 Nm  
1.4 kgm  
10 ft.lbs.

14N0190

<Vehicles built up to May, 1991>    <Vehicles built from June, 1991>



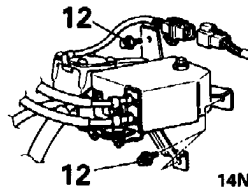
N9



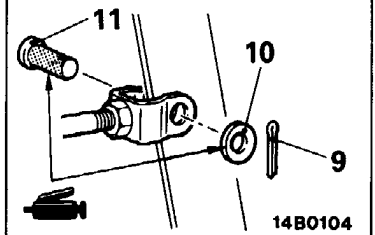
N9

14N0299

### R.H. drive vehicles



14N0037



14B0104

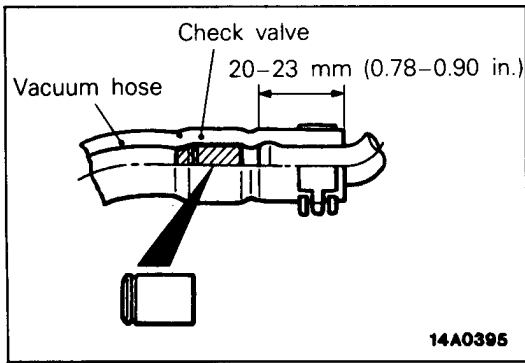
### Master cylinder removal steps

1. Brake fluid level sensor connector
  2. Brake pipe
  3. Brake pipe connection
  4. Proportioning valve
  5. Connector assembly  
<Vehicles with ABS or TCL>
  6. Master cylinder
- ◆◆ ● Adjustment of clearance between brake booster push rod and primary piston

### Brake booster removal steps

6. Master cylinder
7. Vacuum hose (with check valve)

8. Fitting
  9. Split pin\*1 or snap pin \*2
  10. Washer
  11. Clevis pin
  12. Actuator installation bolt  
<Vehicles with cruise control>
  13. Brake booster
  14. Sealer
- NOTE  
\*1 : <Vehicles built up to May, 1991>  
\*2 : <Vehicles built from June, 1991>



**SERVICE POINTS OF INSTALLATION**

E35IDAG

**7. CONNECTION OF THE VACUUM HOSE**

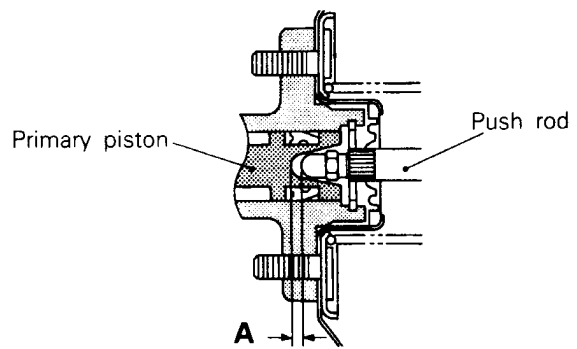
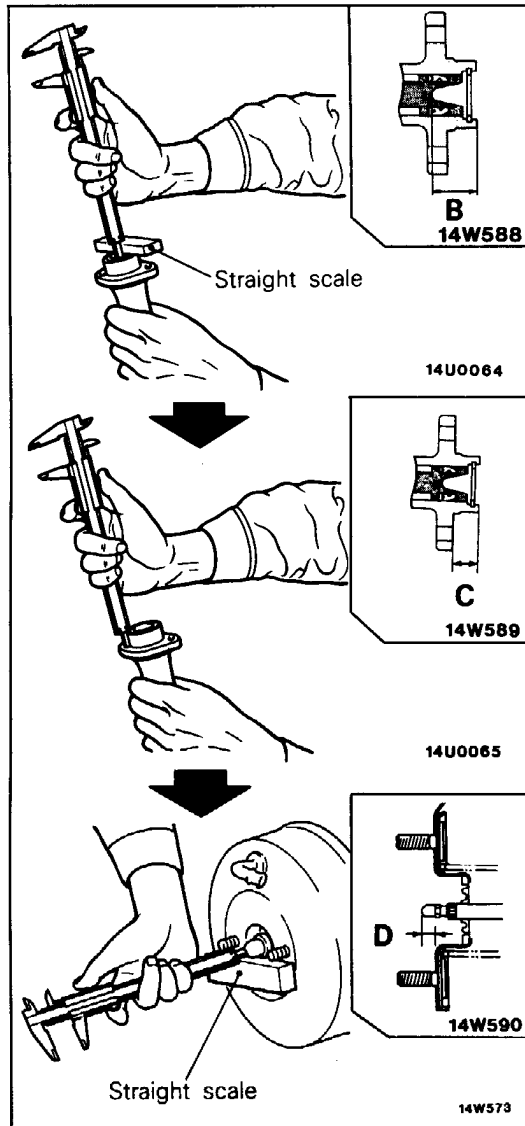
- (1) Install to the pipe part of the brake booster so that the amount of insertion of the vacuum hose is as shown in the figure.

**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.

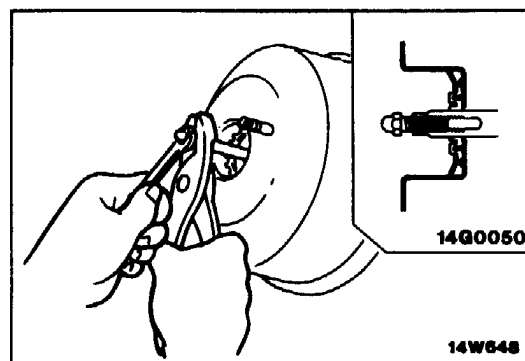
● **ADJUSTMENT OF CLEARANCE BETWEEN BRAKE BOOSTER PUSH ROD AND PRIMARY PISTON**



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

$$A = B - C - D$$

**Standard value (A): 0.65-0.85 mm (0.026-0.033 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.

DISASSEMBLY AND REASSEMBLY (MASTER CYLINDER)

E35IE--

**Master cylinder kit**  
14N0213

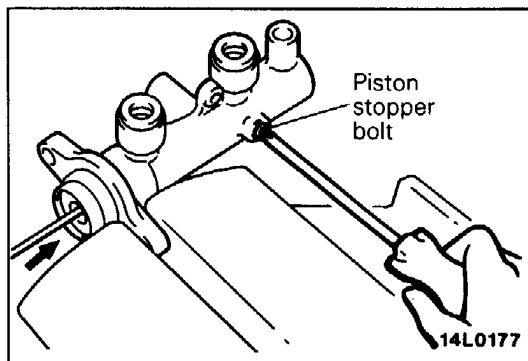
**Brake fluid: DOT3 or DOT4**  
14F0075

2.5 Nm  
0.25 kgm  
2 ft.lbs.

**Disassembly steps**

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

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

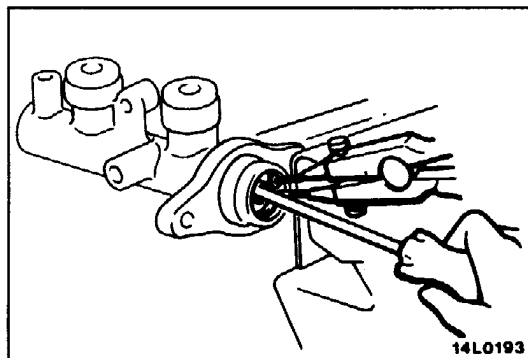


SERVICE POINTS OF DISASSEMBLY

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

#### Pre-removal Operation

- Draining of Brake Fluid

#### Post-installation Operation

- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-87.)

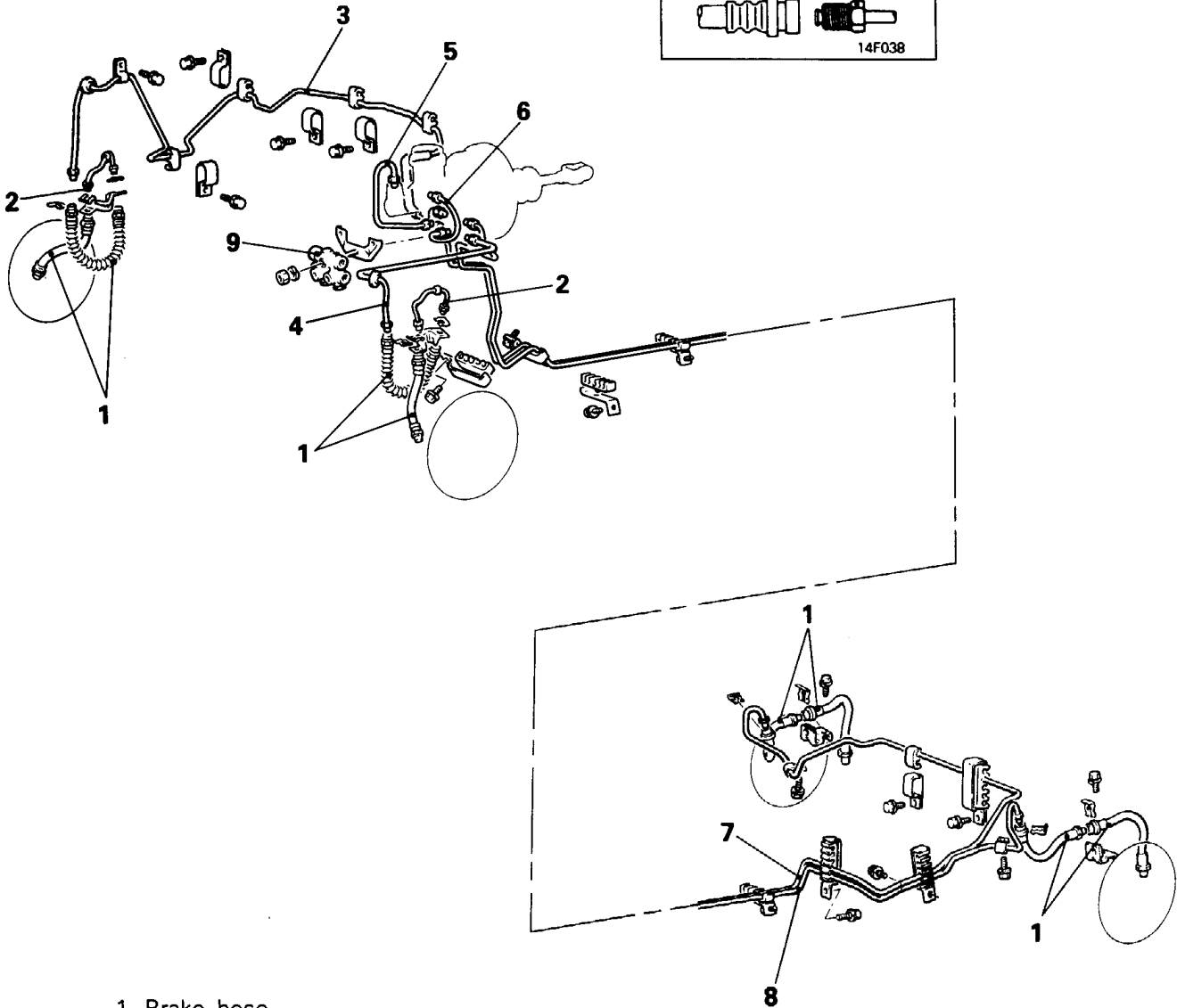
### L.H. drive vehicles

#### Flared brake line nuts

15 Nm  
1.5 kgm  
11 ft.lbs.



14F038



1. Brake hose
2. Brake pipe (strut)
3. Brake pipe (front RH)
4. Brake pipe (front LH)
5. Brake pipe (A)
6. Brake pipe (B)
7. Brake pipe (main LH)
8. Brake pipe (main RH)
9. Proportioning valve

14N0192

R.H. drive vehicles

**Pre-removal Operation**  
 ● Draining of Brake Fluid

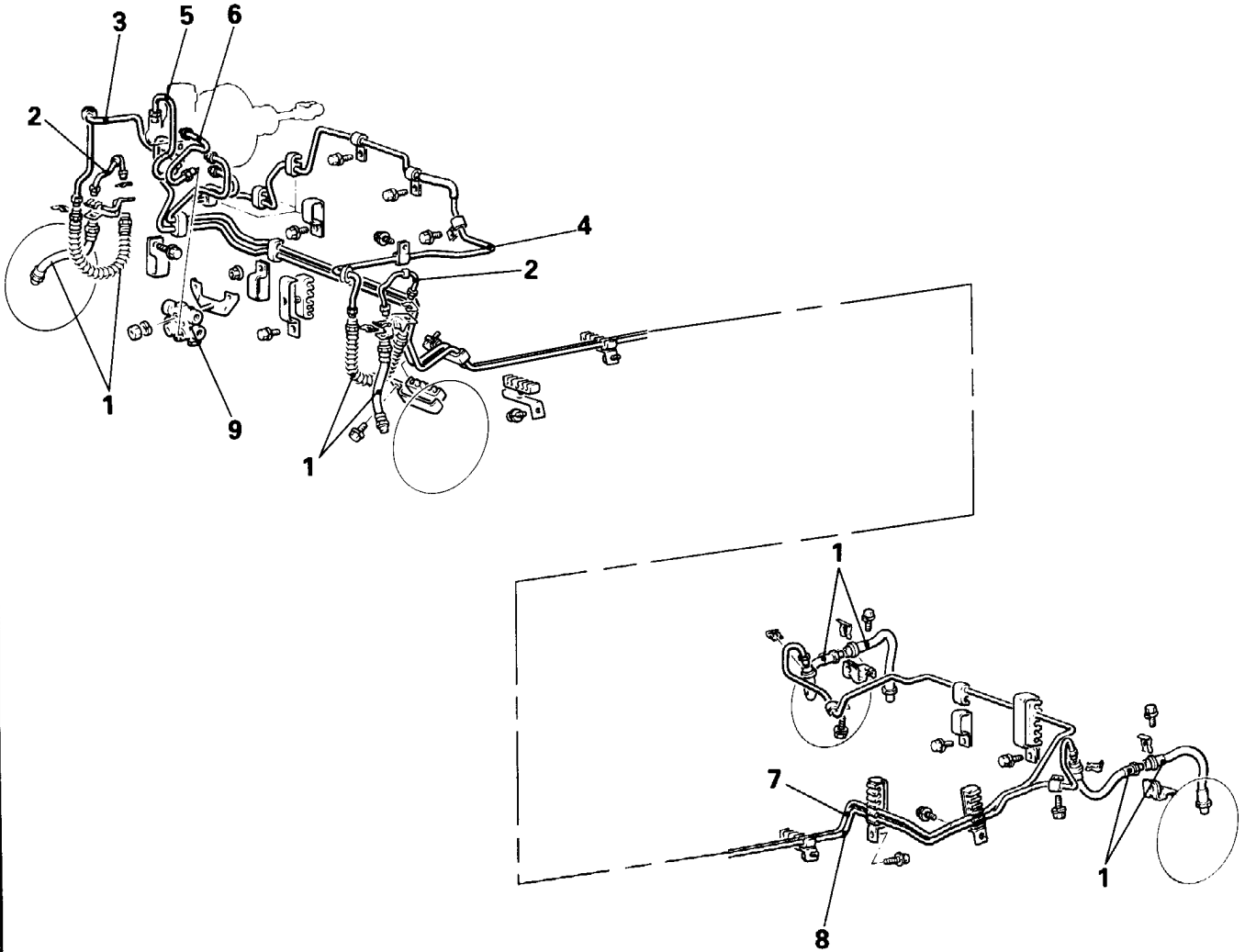
**Post-installation Operation**  
 ● Supplying Brake Fluid  
 ● Bleeding Brake Lines  
 (Refer to P.35-87.)

**Flared brake line nuts**

15 Nm  
 1.5 kgm  
 11 ft.lbs.



14F038



- 1. Brake hose
- 2. Brake pipe (strut)
- 3. Brake pipe (front RH)
- 4. Brake pipe (front LH)
- 5. Brake pipe (A)
- 6. Brake pipe (B)
- 7. Brake pipe (main LH)
- 8. Brake pipe (main RH)
- 9. Proportioning valve

14N0193

**Vehicles with ABS**

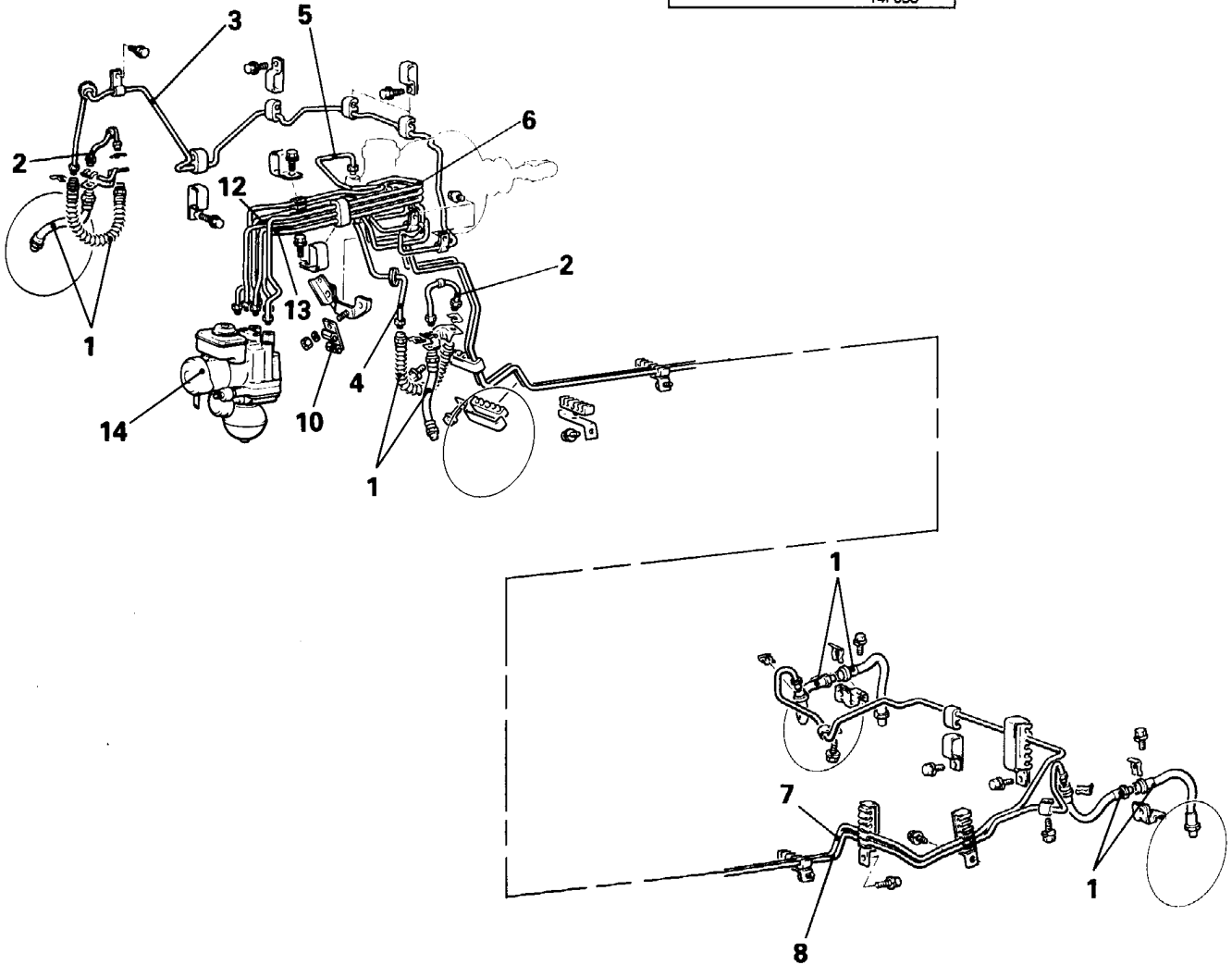
**L.H. drive vehicles**

**Pre-removal Operation**  
 ● Draining of Brake Fluid

**Post-installation Operation**  
 ● Supplying Brake Fluid  
 ● Bleeding Brake Lines  
 (Refer to P.35-87.)

**Flared brake line nuts**

15 Nm  
 1.5 kgm  
 11 ft.lbs.



- 1. Brake hose
- 2. Brake pipe (strut)
- 3. Brake pipe (front RH)
- 4. Brake pipe (front LH)
- 5. Brake pipe (A)
- 6. Brake pipe (B)
- 7. Brake pipe (main LH)
- 8. Brake pipe (main RH)
- 10. Connector assembly
- 12. Brake pipe (rear RH)
- 13. Brake pipe (rear LH)
- ◆◆ 14. Hydraulic unit

14N0195

R.H. drive vehicles

**Pre-removal Operation**  
 ● Draining of Brake Fluid

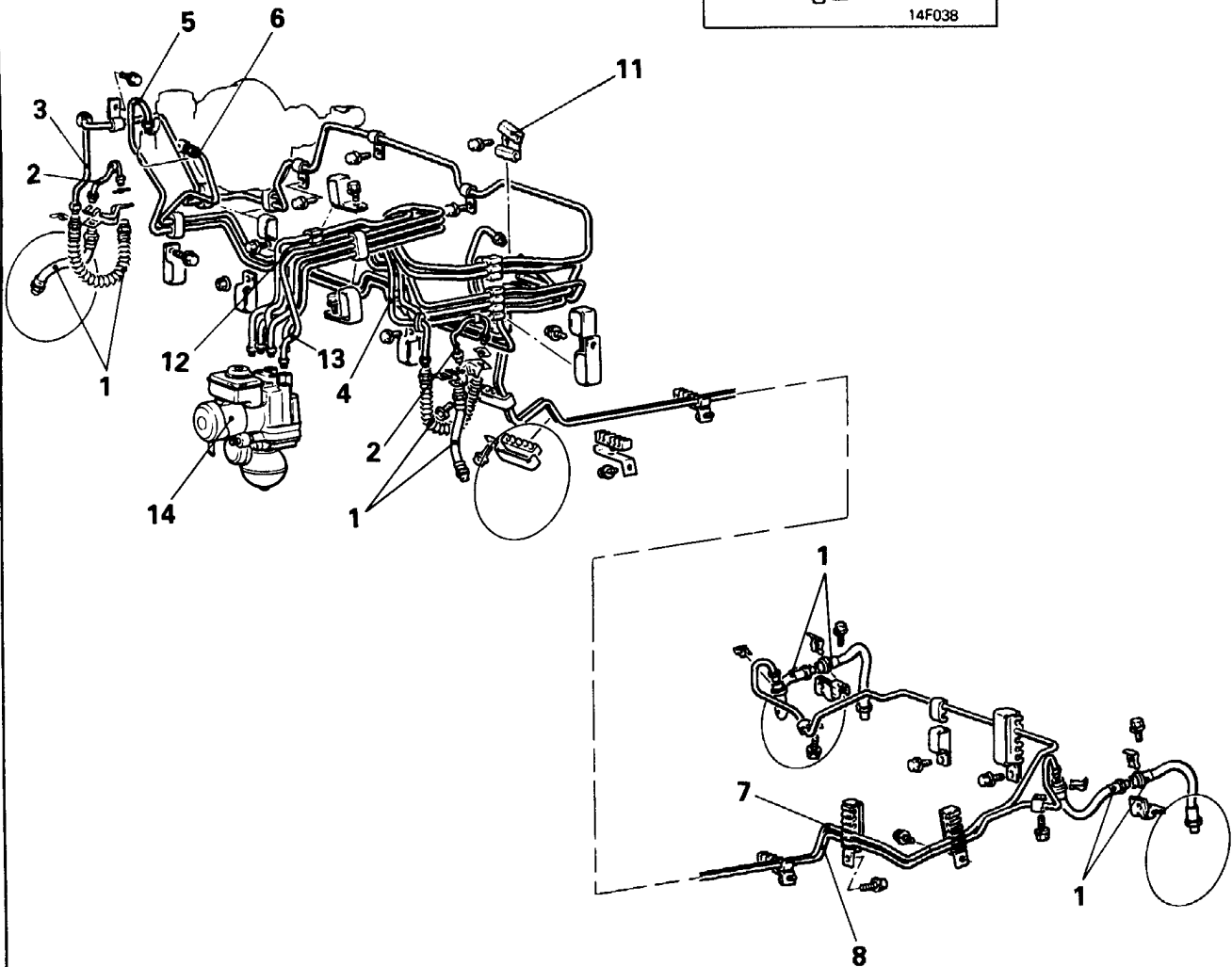
**Post-installation Operation**  
 ● Supplying Brake Fluid  
 ● Bleeding Brake Lines  
 (Refer to P.35-87.)

**Flared brake line nuts**

15 Nm  
 1.5 kgm  
 11 ft.lbs.



14F038



14N0114

- 1. Brake hose
- 2. Brake pipe (strut)
- 3. Brake pipe (front RH)
- 4. Brake pipe (front LH)
- 5. Brake pipe (A)
- 6. Brake pipe (B)
- 7. Brake pipe (main LH)
- 8. Brake pipe (main RH)
- 11. 2 way connector
- 12. Brake pipe (rear RH)
- 13. Brake pipe (rear LH)
- ◆◆ 14. Hydraulic unit

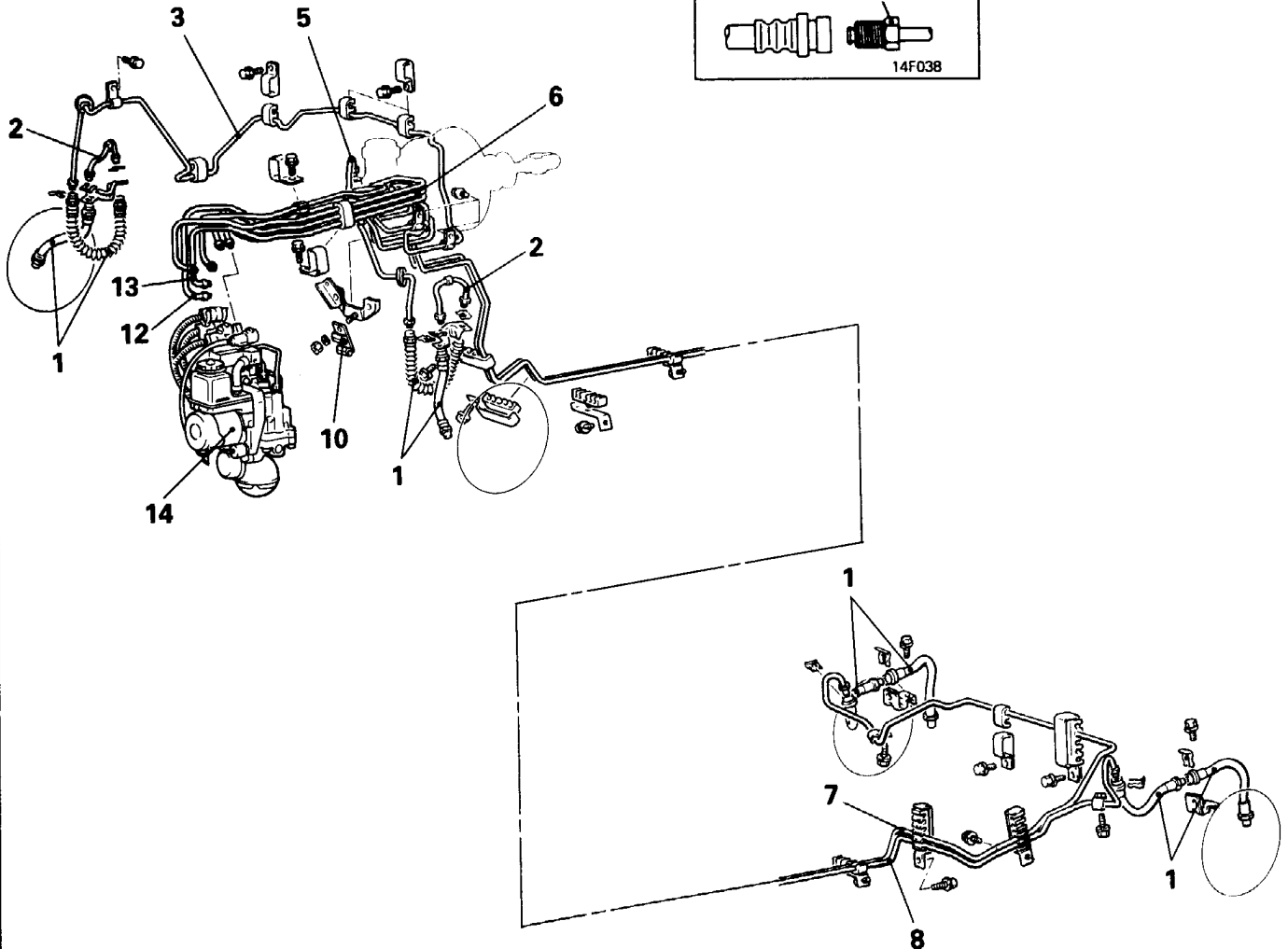
Vehicles with TCL  
L.H. drive vehicles

**Pre-removal Operation**  
● Draining of Brake Fluid

**Post-installation Operation**  
● Supplying Brake Fluid  
● Bleeding Brake Lines  
(Refer to P.35-87.)

Flared brake line nuts

15 Nm  
1.5 kgm  
11 ft.lbs.



- 1. Brake hose
- 2. Brake pipe (strut)
- 3. Brake pipe (front RH)
- 4. Brake pipe (front LH)
- 5. Brake pipe (A)
- 6. Brake pipe (B)
- 7. Brake pipe (main LH)
- 8. Brake pipe (main RH)
- 10. Connector assembly
- 12. Brake pipe (rear RH)
- 13. Brake pipe (rear LH)
- ◆◆ 14. Hydraulic unit

14N0196

R.H. drive vehicles

**Pre-removal Operation**  
 ● Draining of Brake Fluid

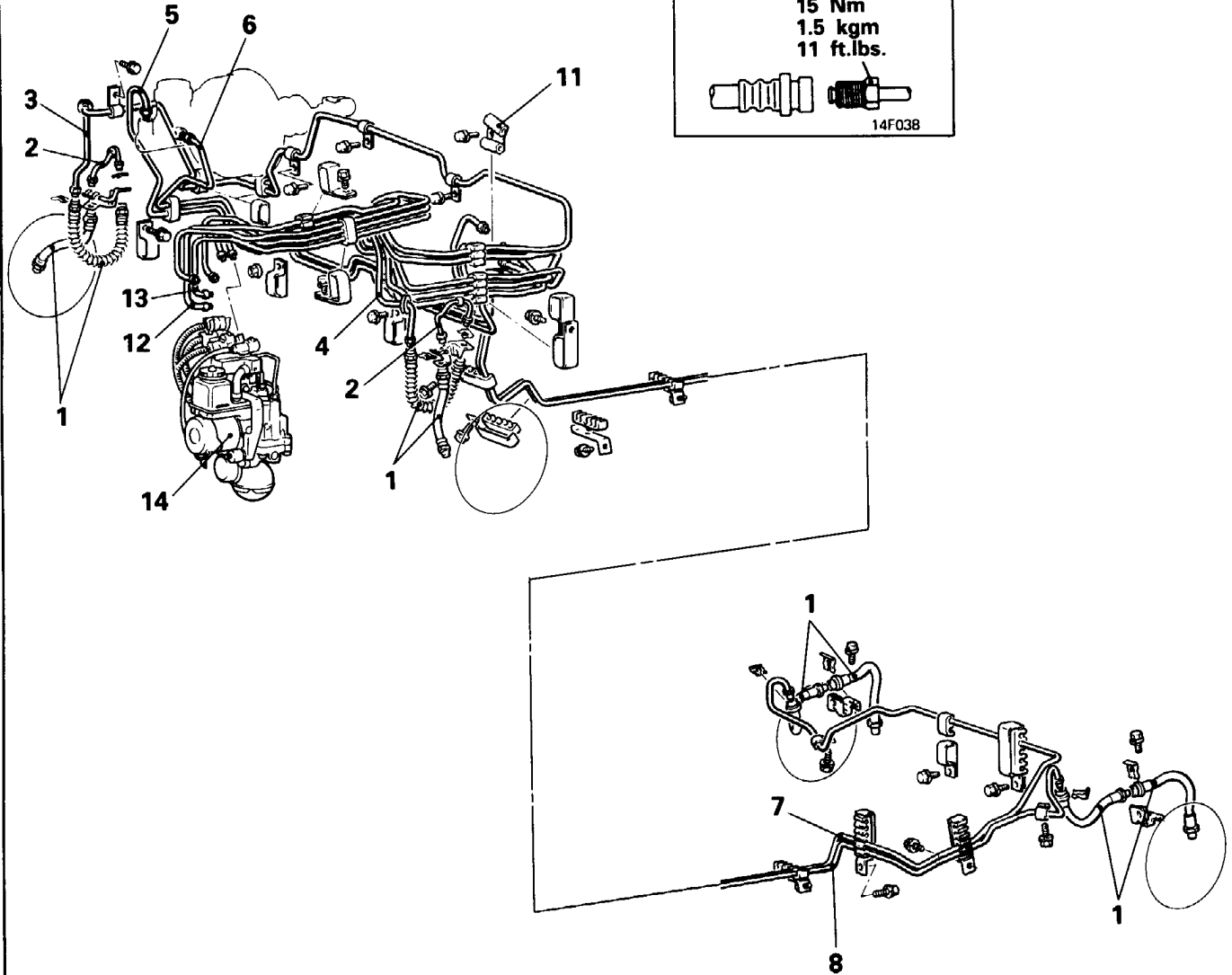
**Post-installation Operation**  
 ● Supplying Brake Fluid  
 ● Bleeding Brake Lines  
 (Refer to P.35-87.)

**Flared brake line nuts**

15 Nm  
 1.5 kgm  
 11 ft.lbs.



14F038



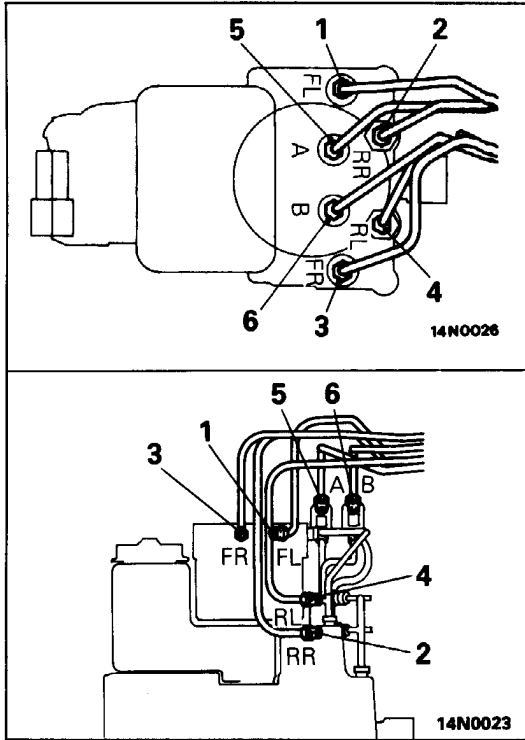
14N0113

- 1. Brake hose
- 2. Brake pipe (strut)
- 3. Brake pipe (front RH)
- 4. Brake pipe (front LH)
- 5. Brake pipe (A)
- 6. Brake pipe (B)
- 7. Brake pipe (main LH)
- 8. Brake pipe (main RH)
- 11. 2 way connector
- 12. Brake pipe (rear RH)
- 13. Brake pipe (rear LH)
- ◆◆ 14. Hydraulic unit

**INSPECTION**

E35KCAA

- Check the brake tubes 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

**14. 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**

**REMOVAL AND INSTALLATION**

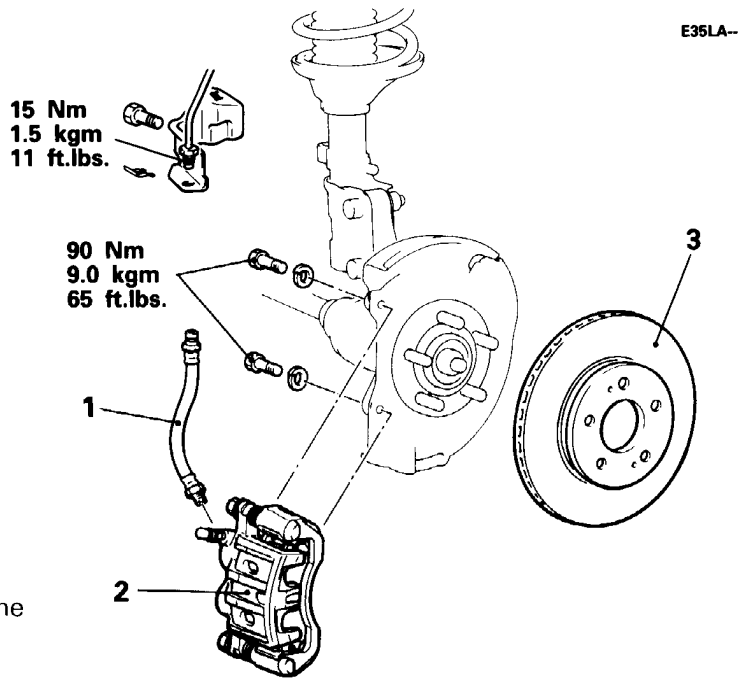
**Pre-removal Operation**

- Draining of Brake Fluid

**Post-installation Operation**

- Brake FLuid Filling
- Brake Line Bleeding (Refer to P.35-87.)

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



14N0140

**INSPECTION**

E35LCAC

- Check the brake disc for damage.

**SERVICE POINTS OF INSTALLATION**

E35LDAFa

**2. INSTALLATION OF FRONT BRAKE ASSEMBLY**

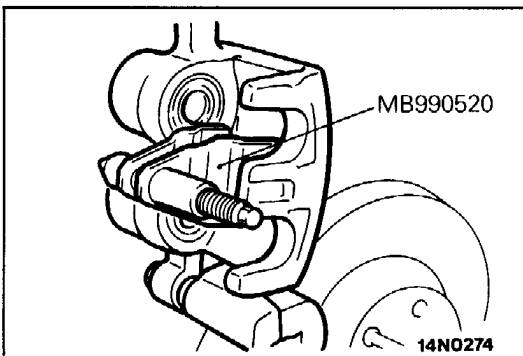
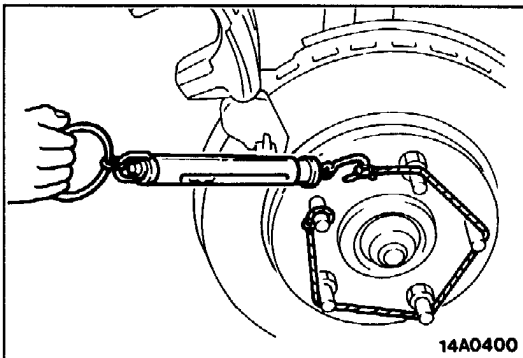
Measure the disc brake drag force after installation of the brake assembly by the following procedure.

- (1) With the brake assembly removed, use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.

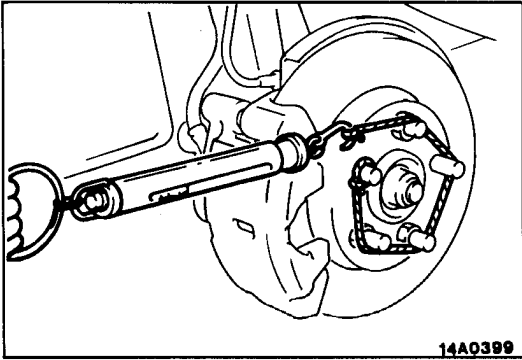
**NOTE**

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

- (2) After installing the caliper support to the knuckle, use the special tool to expand the piston, and then install the caliper body.
- (3) Start the engine, and after depressing the brake pedal hard two or three times, stop the engine.







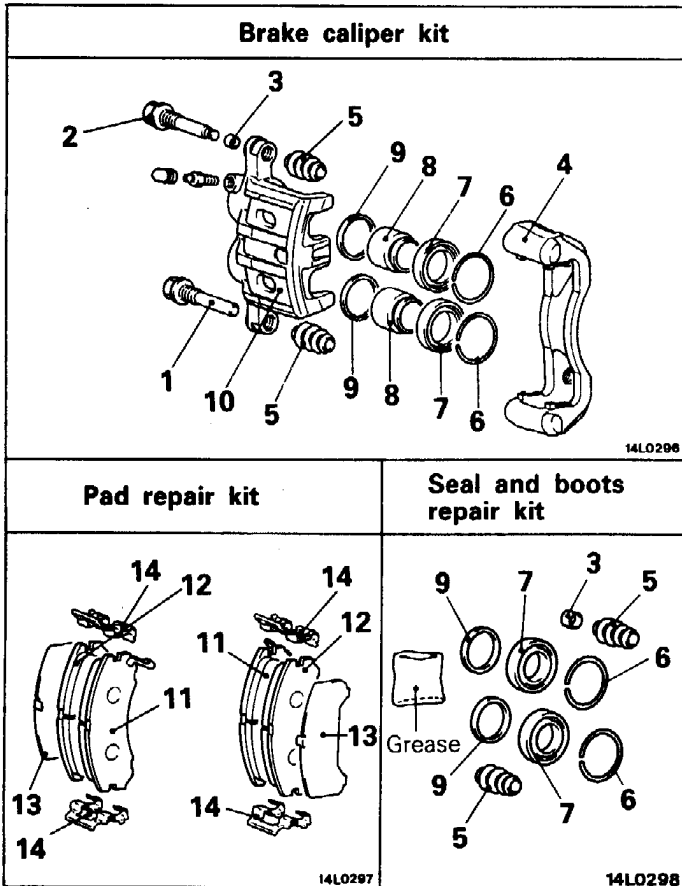
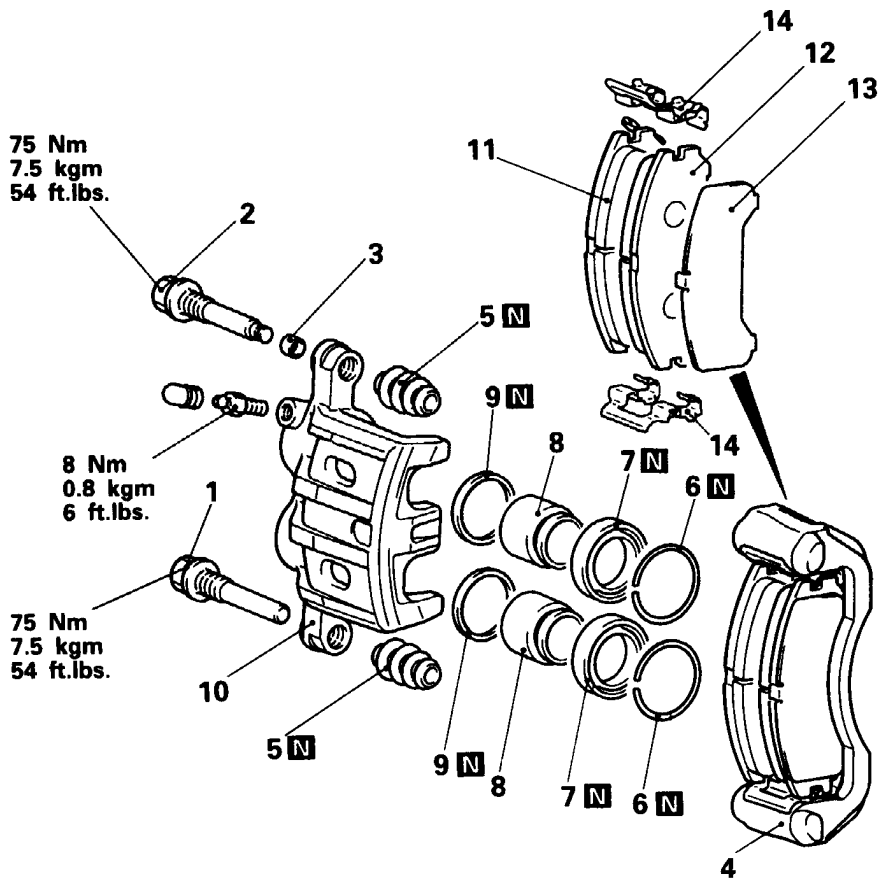
- (4) Turn brake disc forward 10 times.
- (5) Use a spring balance to measure the rotation sliding resistance of the hub in the forward direction.
- (6) Calculate the drag torque of the disc brake (difference between measured values in 5 and 1).

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

- (7) 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.

DISASSEMBLY AND REASSEMBLY

E35LF-



14L0295

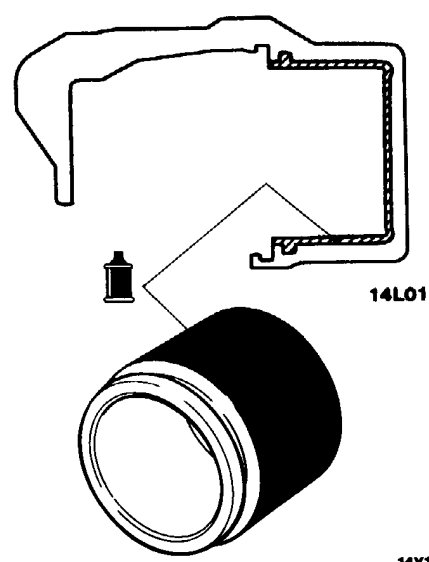
Caliper assembly disassembly steps

- ◆◆ 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. Clip

LUBRICATION POINTS

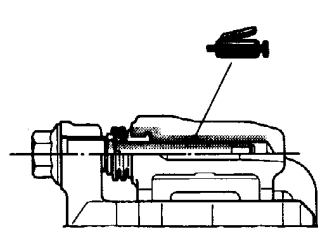


14L0127

14Y184

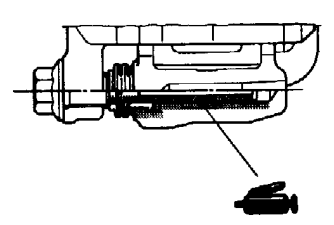
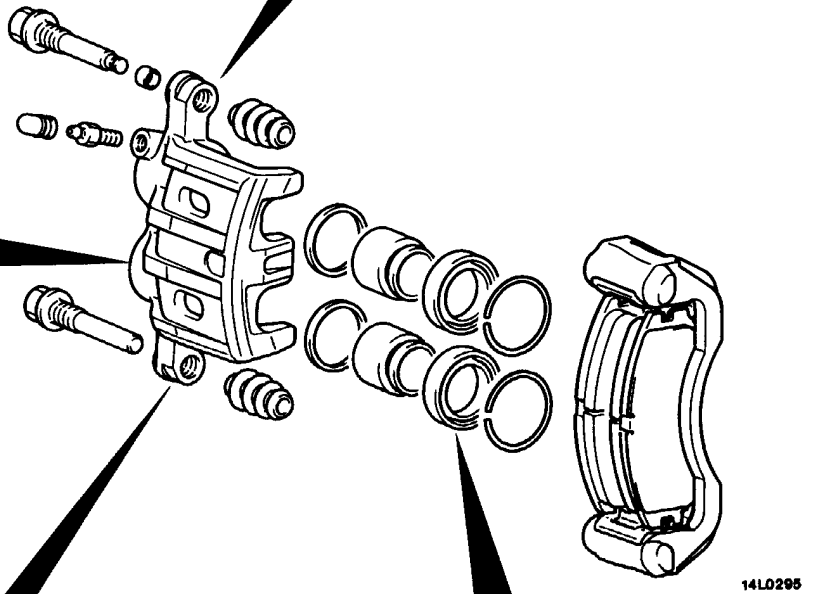
**Caution**  
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

**Brake fluid: DOT3 or DOT4**



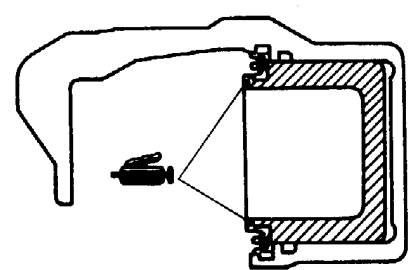
14A0541

**Grease: Repair kit grease (orange)**



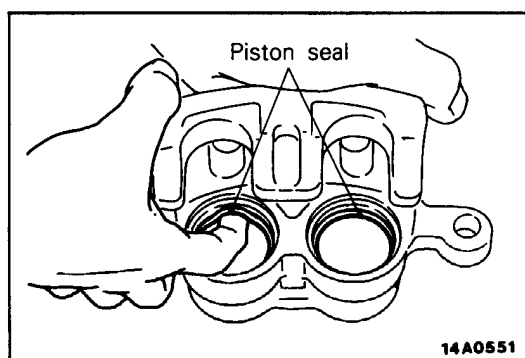
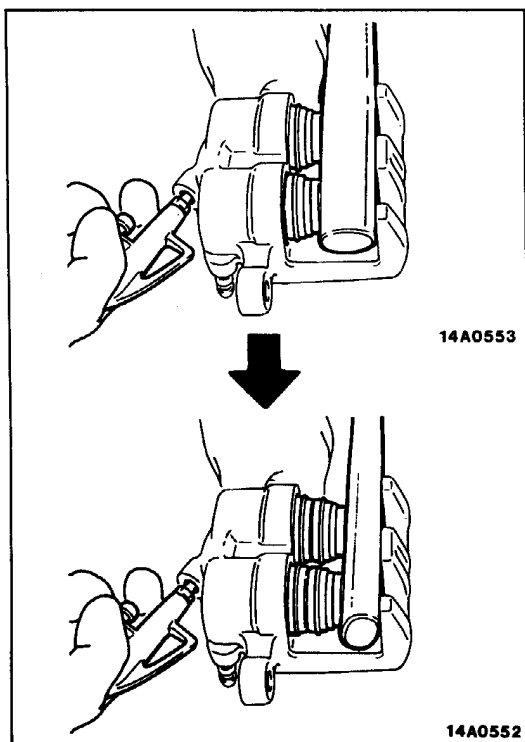
14A0541

**Grease: Repair kit grease (orange)**



14L0128

**Grease: Repair kit grease (orange)**



## SERVICE POINTS OF DISASSEMBLY

E35LGAG

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

### 7. REMOVAL OF PISTON BOOT/8. PISTON

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

#### Caution

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

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

### 9. REMOVAL OF PISTON SEAL

- (1) Remove piston seal with finger tip.

#### Caution

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

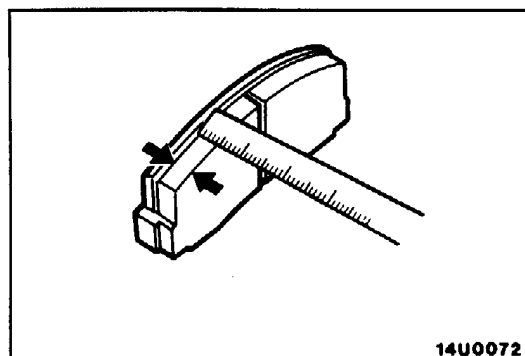
- (2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

**Specified brake fluid: DOT3 or DOT4**

## INSPECTION

E35LHAD

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

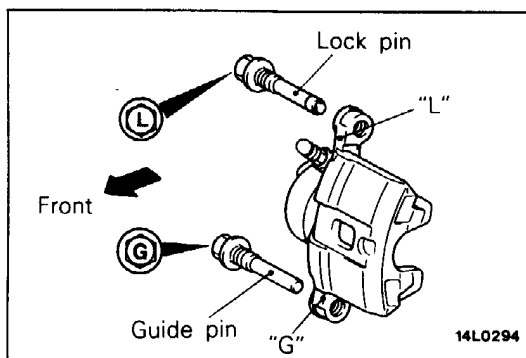
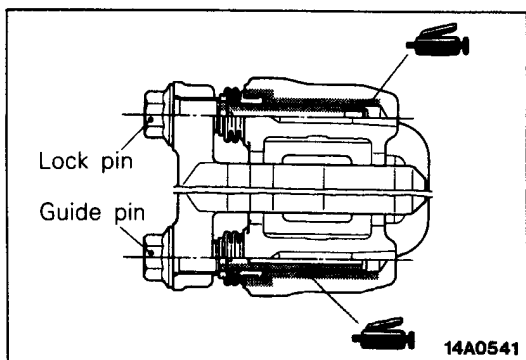


### PAD WEAR CHECK

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

**Standard value : 10 mm (0.39 in.)**

**Limit value : 2.0 mm (0.08 in.)**



## SERVICE POINTS OF REASSEMBLY

E35LIAH

### 5. INSTALLATION OF BOOT/3. BUSHING/2. LOCK PIN/1. GUIDE PIN

- (1) Grease parts as illustrated with specified grease.

**Specified grease: Repair kit grease (orange)**

- (2) 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.

**REAR DISC BRAKE**

E35RA--

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

- Draining of Brake Fluid

**Post-installation Operation**

- Brake Fluid Filling
- Brake Line Bleeding  
(Refer to P.35-87.)

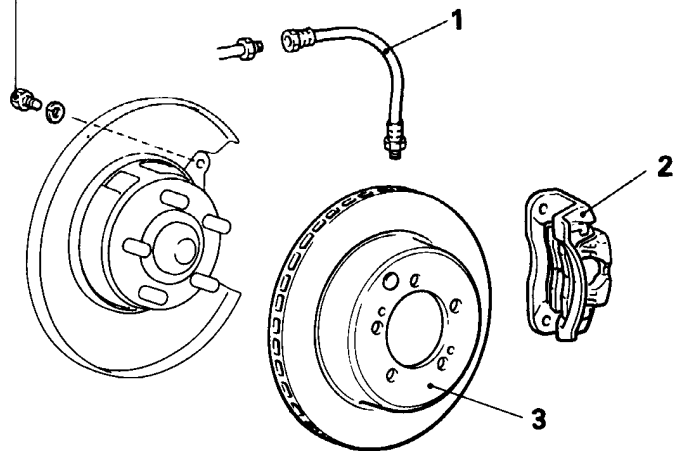
**Flared brake line nuts**

15 Nm  
1.5 kgm  
11 ft.lbs.



14F038

50-60 Nm  
5.0-6.0 kgm  
36-43 ft.lbs.



14N0035

**Removal steps**

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

**INSPECTION**

E3LCAC

- Check the brake disc for damage.

**SERVICE POINTS OF INSTALLATION**

E35RDAG

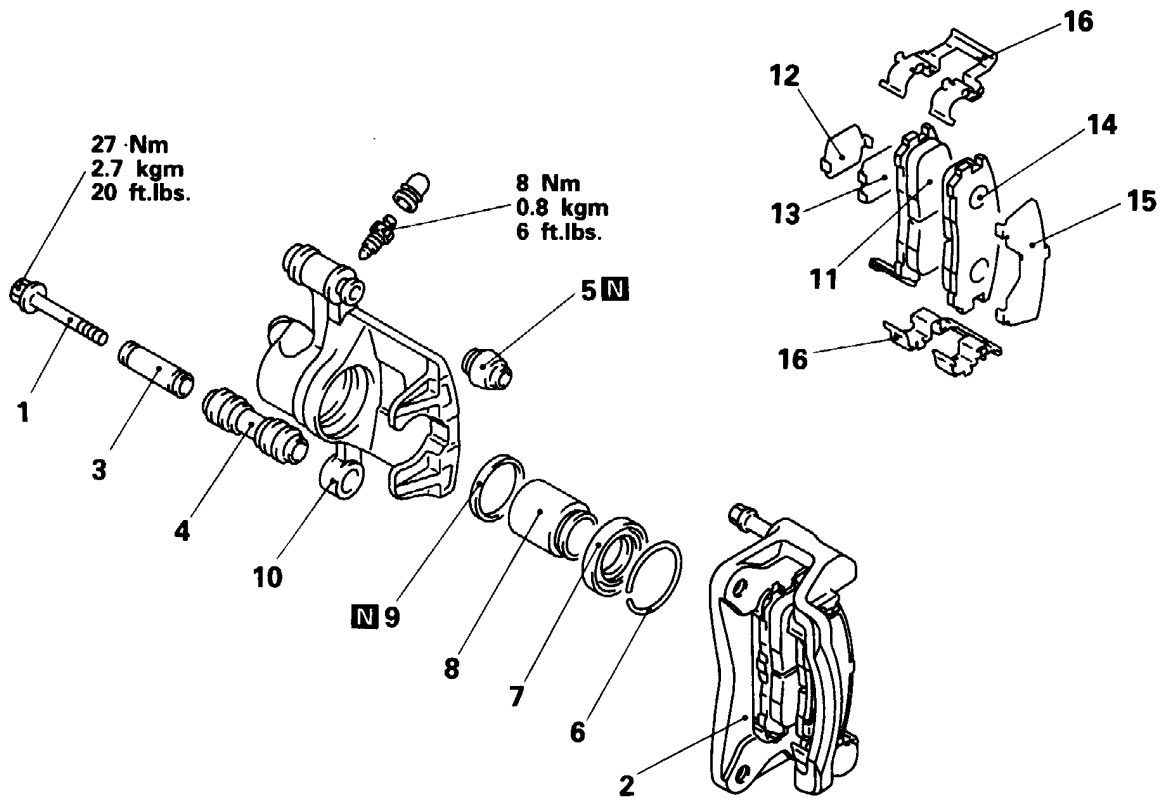
**2. INSTALLATION OF REAR BRAKE ASSEMBLY**

Install by the same procedure as for the front brake assembly.

(Refer to P.35-118.)

DISASSEMBLY AND REASSEMBLY

E35RF-



14N0154

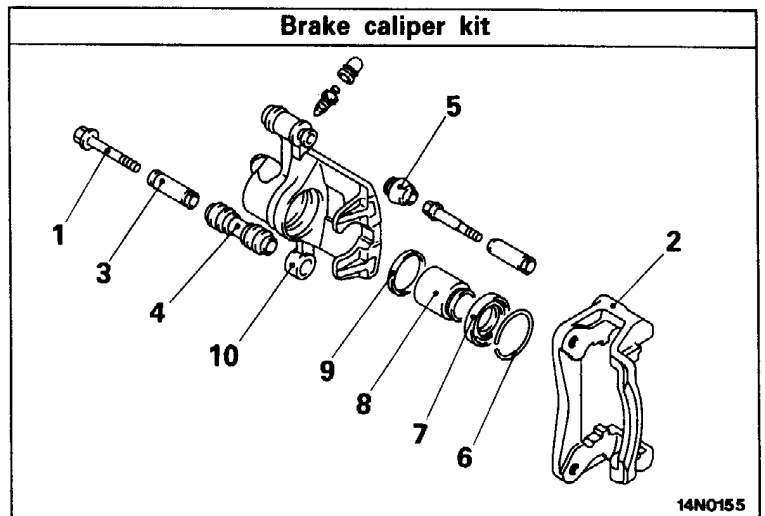
**Caliper assembly disassembly steps**

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

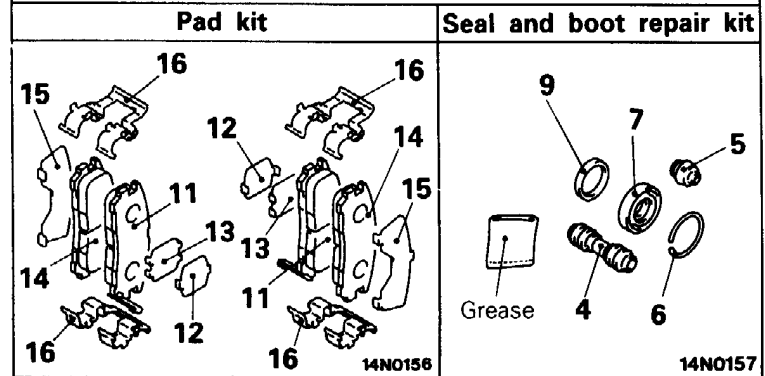


**Pad assembly disassembly steps**

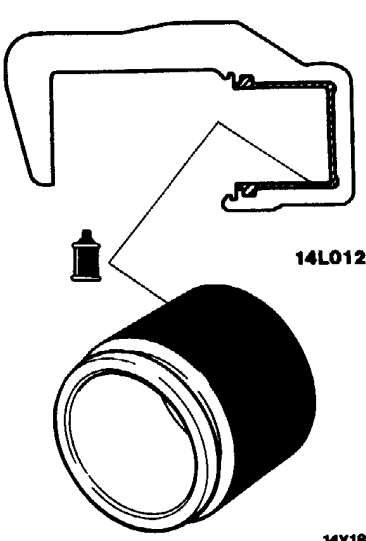
1. Lock pin
2. Caliper support (Pad, clip, shim)
11. Pad and wear indicator assembly
12. Inner shim B
13. Inner shim A
14. Pad assembly
15. Outer shim
16. Clip



14N0155



LUBRICANT POINTS

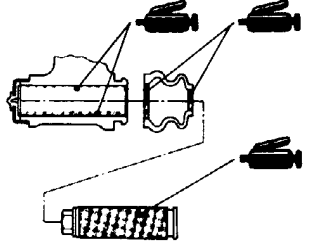


14L0125

14Y184

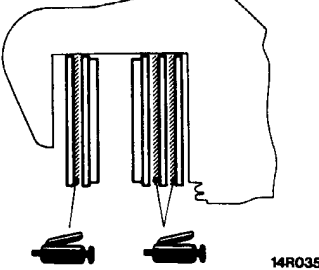
**Caution**  
The piston seal inside the seal and boot kit is coated with special grease, so do not wipe this grease off.

Brake fluid: DOT3 or DOT4



14L0124

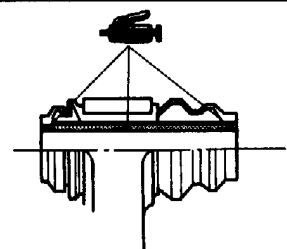
Grease: Repair kit grease (orange)



14R0357

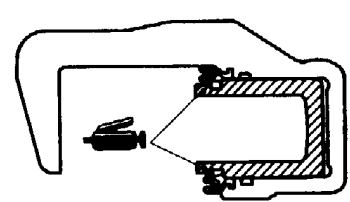
Grease: Brake grease SAE J310, NLGI No. 1

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



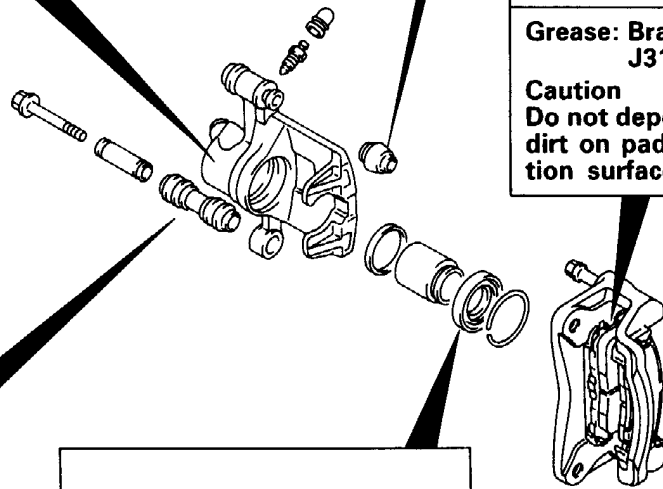
14L0121

Grease: Repair kit grease (orange)



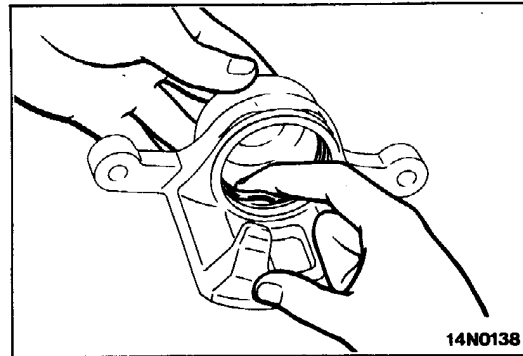
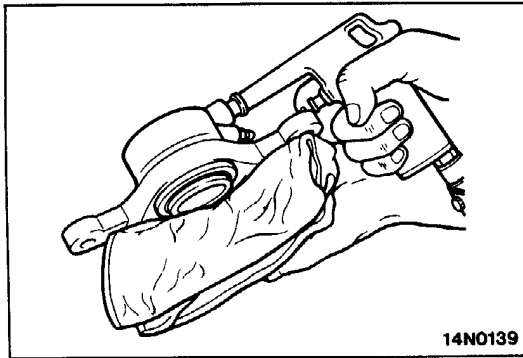
14L0126

Grease: Repair kit grease (orange)



14N0154





## 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.**

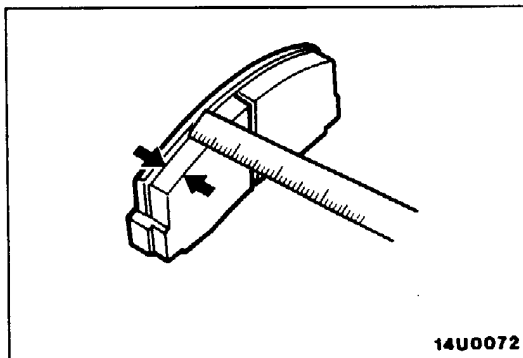
(2) Clean piston surface and inner cylinder with trichloroethylene, alcohol or specified brake fluid.

**Specified brake fluid: DOT3 or DOT4**

## INSPECTION

E35RHAD

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



### PAD WEAR CHECK

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

**Standard value : 10 mm (0.39 in.)**

**Limit value : 2.0 mm (0.08 in.)**

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

E35WA-

Caution

1. Do not dismantle the hydraulic unit, as the inside contains high pressure brake fluid. Also, the brake pipes marked with "\*" on vehicles fitted with TCL contain high pressure brake fluid, so these pipes should never be disconnected (refer to P.35-129).
2. Do not refill the hydraulic unit reserve tank, even if the fluid level drops. When the fluid level drops below the MIN line, the hydraulic unit should be replaced.
3. The accumulator contains high pressure nitrogen gas, so keep it away from flames.
4. Do not loosen or remove the safety plug in the lower section of the accumulator, except when disposing of the hydraulic unit.
5. Do not throw the accumulator into fire, drill holes, press, or weld without first releasing the gas.
6. When disposing of the hydraulic unit, first release the gas by turning the safety plug two or three times to loosen it, and wait about 3 minutes until the hissing sound can no longer be heard and all the gas has escaped. Remove the plug before disposal.

REMOVAL AND INSTALLATION <VEHICLES WITHOUT TCL>

Flared brake line nuts

15 Nm  
1.5 kgm  
11 ft.lbs



14F038

Pre-removal Operation

- Draining of Brake Fluid
- Removal of the Headlamp Washer Tank (Refer to GROUP 51 – Headlamp Washer.)

Post-installation Operation

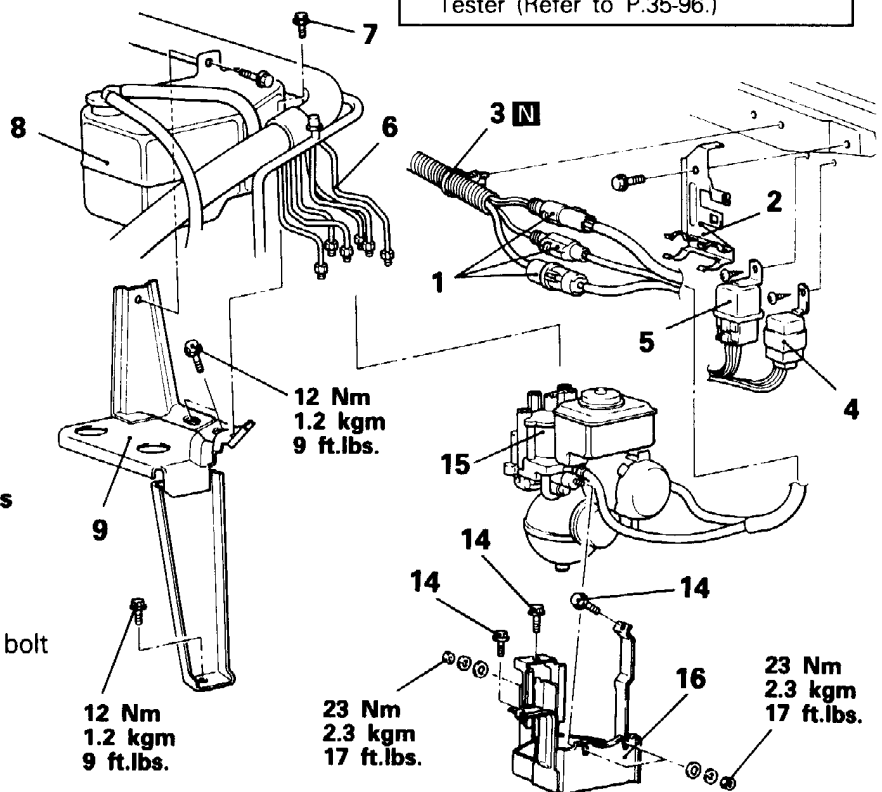
- Attaching the Headlamp Washer Tank (Refer to GROUP 51 – Headlamp Washer.)
- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-87.)
- Checking by Using the Multi-Use Tester (Refer to P.35-96.)

Relay removal steps

1. Hydraulic unit connector
2. Connector bracket
3. Clip
4. Motor relay
5. Valve relay

Hydraulic unit removal steps

1. Hydraulic unit connector
2. Connector bracket
3. Clip
6. Brake pipe
7. A/C pressure hose clamp bolt
8. Condense tank
9. Condense tank bracket
14. Bolt
15. Hydraulic unit
16. Hydraulic unit bracket



14W0207

REMOVAL AND INSTALLATION <VEHICLES WITH TCL>

Flared brake line nuts

15 Nm  
1.5 kgm  
11 ft.lbs.



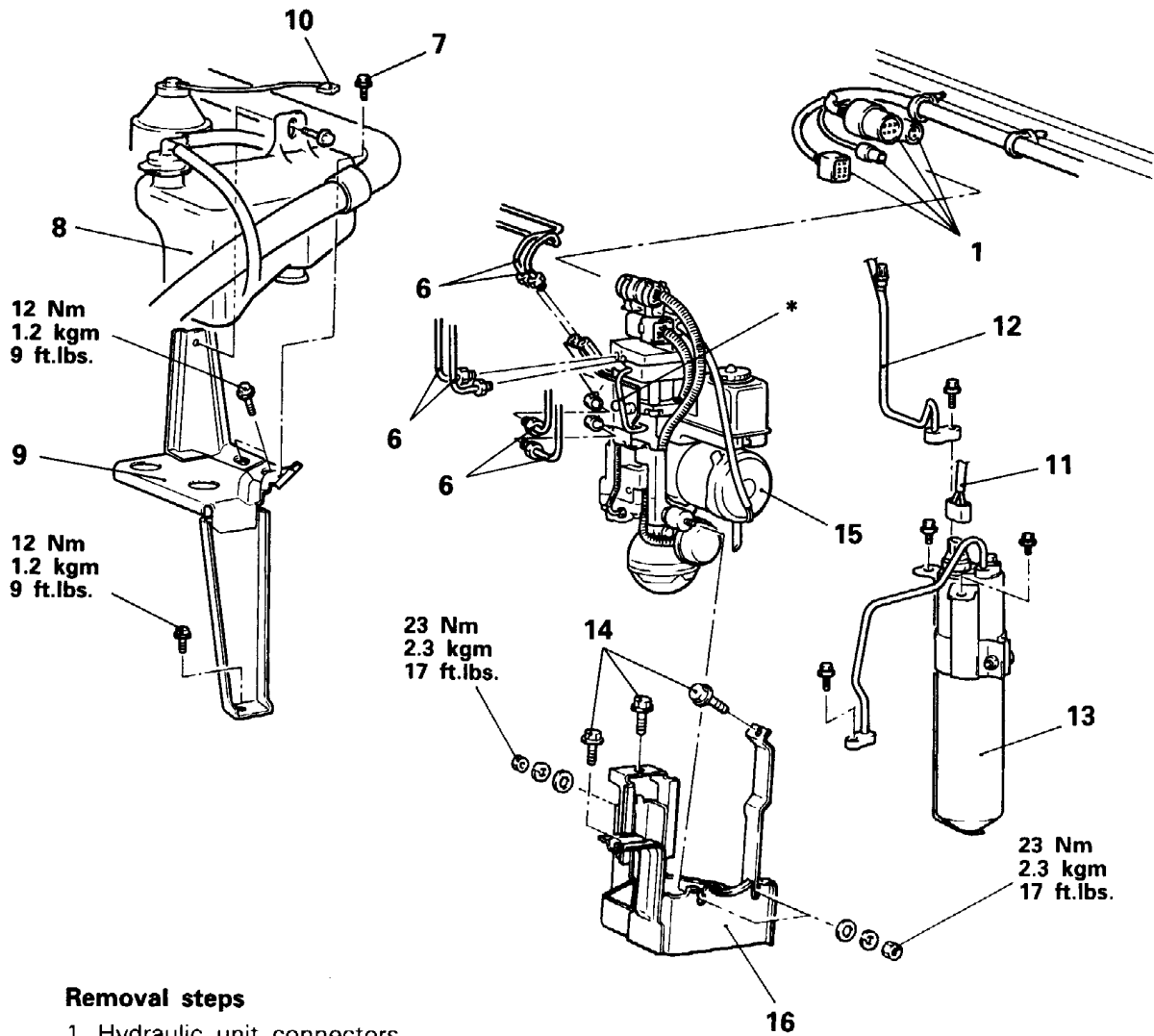
14F038

Pre-removal Operation

- Draining of Brake Fluid
- Removal of Refrigerant (Refer to GROUP 55 – Service Adjustment Procedures.)
- Removal of Headlamp Washer Tank (Refer to GROUP 51 – Headlamp Washer.)
- Removal of Master Cylinder (L.H. drive vehicles only) (Refer to P.35-108.)

Post-installation Operation

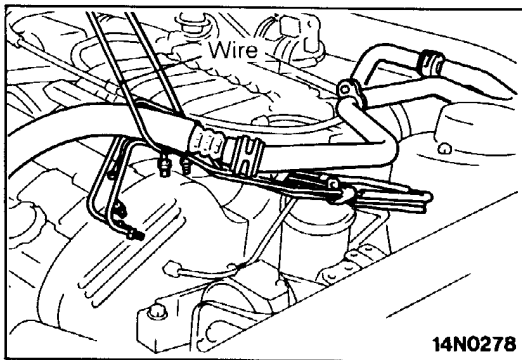
- Installation of Master Cylinder (L.H. drive vehicles only) (Refer to P.35-108.)
- Installation of Headlamp Washer Tank (Refer to GROUP 51 – Headlamp Washer.)
- Supply of Refrigerant (Refer to GROUP 55 – Service Adjustment Procedures.)
- Supplying Brake Fluid
- Bleeding Brake Lines (Refer to P.35-87.)
- Checking by Using the Multi-use Tester (Refer to P.35-49.)



Removal steps

- 1. Hydraulic unit connectors
- ↔ 6. Brake pipe
- ↔ 7. A/C pressure hose clamp bolts
- 8. Condensate tank
- 9. Condensate tank bracket
- 10. 4WS oil level connector
- 11. Dual-pressure switch connector
- 12. Liquid pipe B
- 13. High pressure pipe and receiver assembly
- 14. Bolts
- ↔ 15. Hydraulic unit
- 16. Hydraulic unit bracket

14N0209

**SERVICE POINTS OF REMOVAL**

E35WBAD

**6. REMOVAL OF BRAKE PIPE/7. A/C PRESSURE HOSE CLAMP BOLT**

- (1) After disconnecting the brake pipes from the hydraulic unit, remove the brake pipe mounting clamp bolt.
- (2) Lift up the brake pipes and the A/C pressure hose and secure them to the hood so that they do not interfere with the removal and installation of the hydraulic unit.

**Caution**

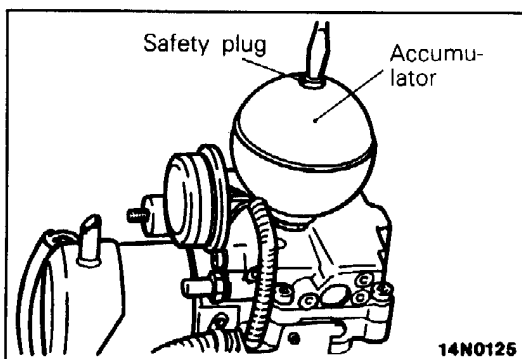
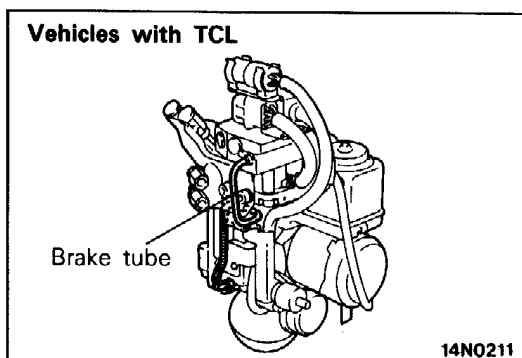
**Do not bend the brake pipes or A/C pressure hose by using excessive force.**

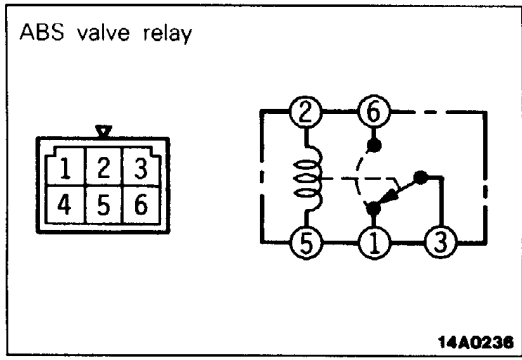
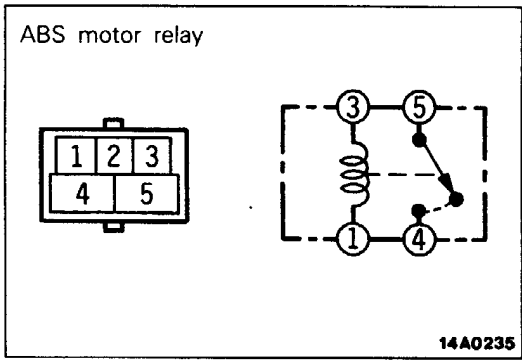
**15. REMOVAL OF HYDRAULIC UNIT**

Remove the hydraulic unit by pushing it backwards so that it doesn't touch the piping of the A/C receiver.

**Caution**

1. Be careful during removal of the hydraulic unit as the unit is heavy.
2. Do not dismantle the hydraulic unit, as the inside contains high pressure brake fluid. Also, the brake pipes shown contain high pressure brake fluid, so this pipe should never be disconnected.
3. Do not drop the hydraulic unit or subject it to shocks.
4. Do not turn the hydraulic unit upside down or put it on its side.
5. Do not refill the hydraulic unit reserve tank, even if the fluid level drops. When the fluid level drops below the MIN line, the hydraulic unit should be replaced.
6. The accumulator contains high pressure nitrogen gas, so keep it away from flames.
7. Do not loosen or remove the safety plug in the lower section of the accumulator, except when disposing of the hydraulic unit.
8. Do not throw the accumulator into fire, drill holes, press, or weld without first releasing the gas.
9. When disposing of the hydraulic unit, first release the gas by turning the safety plug two or three times to loosen it, and wait about 3 minutes until the hissing sound can no longer be heard and all the gas has escaped. Remove the plug before disposal.





**INSPECTION**

**MOTOR RELAY AND VALVE RELAY**

**Motor relay <when energizing coil is at normal temperature (20° ± 15°C [68° ± 27°F])>**

When there is no current	Between terminals ③ and ①	74 ± 25Ω
	Between terminals ④ and ⑤	No continuity (∞ Ω)
When there is current between terminals ③ and ①	Between terminals ④ and ⑤	Continuity (approx. 0Ω)

**Valve relay <when energizing coil is at normal temperature (20° ± 15°C [68° ± 27°F])>**

When there is no current	Between terminals ② and ⑤	80 ± 25Ω
	Between terminals ① and ③	Continuity (approx. 0Ω)
	Between terminals ③ and ⑥	No continuity (∞ Ω)
When there is current between terminals ② and ⑤	Between terminals ① and ③	No continuity (∞ Ω)
	Between terminals ③ and ⑥	Continuity (approx. 0Ω)

**NOTES**

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

E15YA--

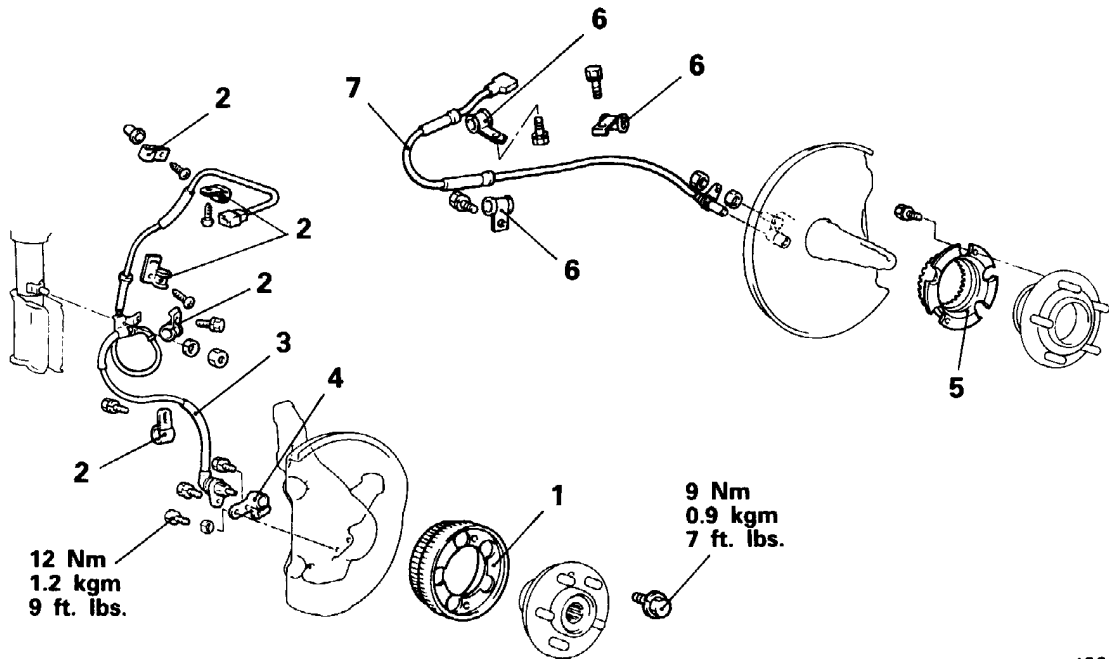
REMOVAL AND INSTALLATION

**Pre-removal Operation**

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

**Post-installation Operation**

- Checking of the Anti-skid Brake System  
(Refer to P.35-94.)
- Installation of the Splash Shield  
(Refer to Group 42 – Fender.)



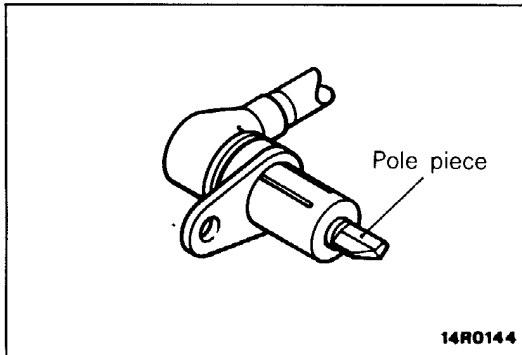
14N0106

**Front speed sensor removal steps**

- ◄◄ 1. Front toothed rotor
- ◄◄ 2. Clip
- ◄◄ ◄◄ 3. Front speed sensor
- ◄◄ ◄◄ 4. Front speed sensor bracket

**Rear speed sensor removal steps**

- ◄◄ 5. Rear toothed rotor
- ◄◄ 6. Clip
- ◄◄ ◄◄ 7. Rear speed sensor



## SERVICE POINTS OF REMOVAL

E35YBAD

### 1./5. REMOVAL OF TOOTHED ROTOR 3./7. SPEED SENSOR

#### Caution

1. 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, as they are easily chipped if knocked.
2. Care must be taken not to scratch or scar the rotor's toothed surface, and not to drop it.  
If the rotor's toothed surface is chipped or the rotor is deformed, it might not be able to accurately sense the wheel rotation speed and as a result the system might not perform normally.

## INSPECTION

### SPEED SENSOR CHECK

- (1) Check whether any metallic foreign material has adhered to the pole piece of the speed sensor tip, and, if so, it is removed.

Also check whether the pole piece is damaged, and, if so, replace it with a new one.

#### NOTE

The pole piece is 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: Front 1.4 – 2.2 kΩ**  
**Rear 1.3 – 2.1 kΩ**

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

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

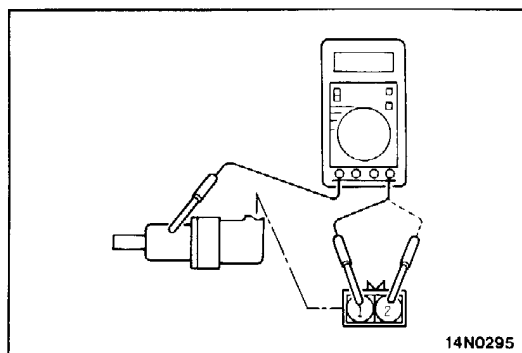
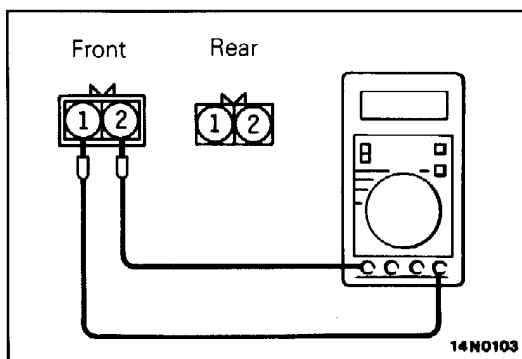
**Standard value: 100 kΩ or more**

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

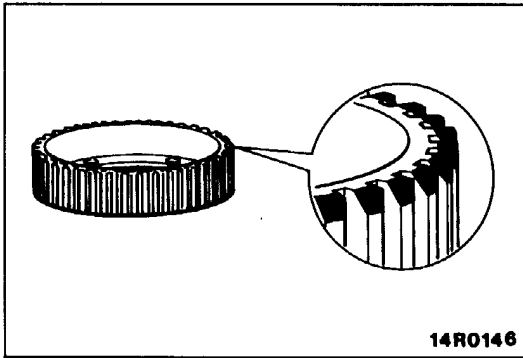
- (4) Check the speed sensor cable for breakage, damage or disconnection; replace with a new one if a problem is found.

#### NOTE

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

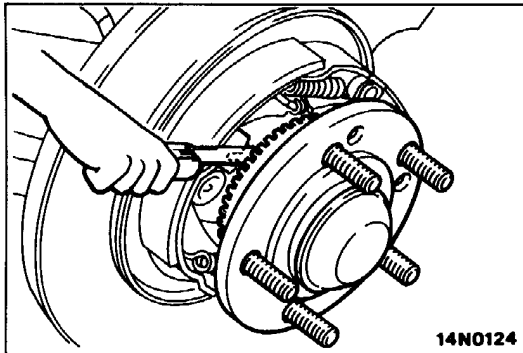






### TOOTHED ROTOR CHECK

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



## SERVICE POINTS OF INSTALLATION

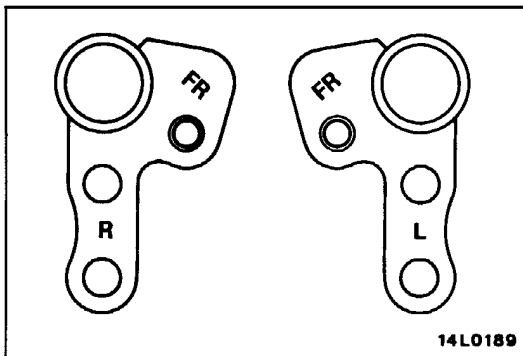
### 7. INSTALLATION OF REAR SPEED SENSOR

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 sensors at the position where the clearance is the standard value.

**Standard value: 0.2–0.7 mm (0.008–0.028 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 full turn. 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

Assemble the speed sensor and the speed sensor bracket.

#### NOTE

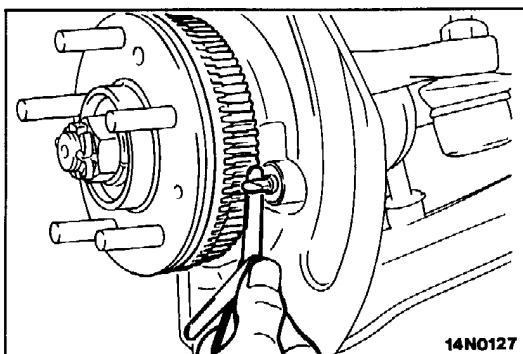
(1) The shapes are different for the left and right speed sensor brackets. Each bracket has an identification symbol, so be sure to note these symbols and install correctly.

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.>

E35EA-

## REMOVAL AND INSTALLATION

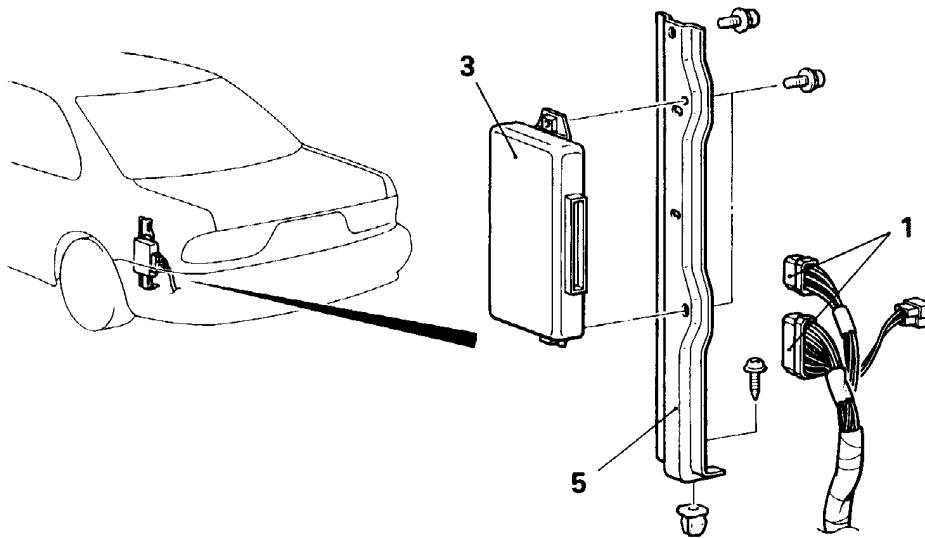
### Pre-removal Operation

- Removal of the Trunk Side Trim (L.H.) (Refer to GROUP 52 – Trim.)

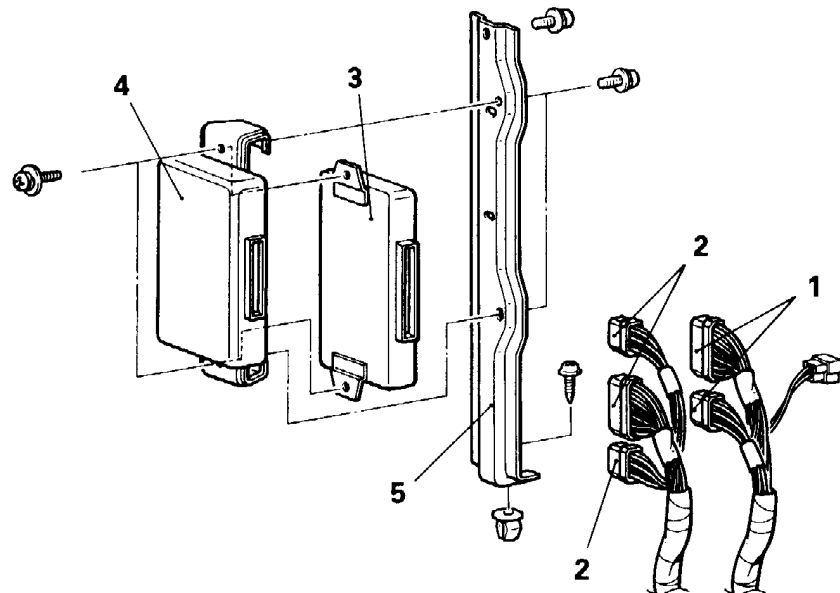
### Post-installation Operation

- Checking of the Anti-skid Brake System (Refer to p. 35-5.)
- Installation of the Trunk side Trim (L.H.) (Refer to GROUP 52 – Trim)

### <Vehicles without TCL>



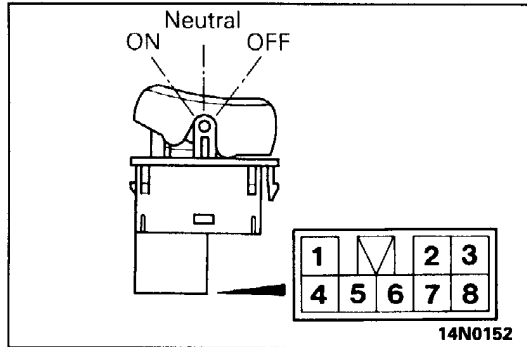
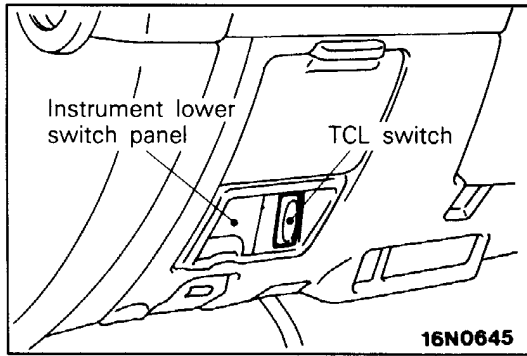
### <Vehicles with TCL>



### Removal steps

1. ABS-ECU connector
2. TCL-ECU connector
3. ABS-ECU
4. TCL-ECU
5. Bracket

14N0272



## TCL SWITCH

### INSPECTION

1. Remove the instrument lower switch panel.
2. Remove the TCL switch.

3. Operate the switch to check continuity between the terminals.

Connector terminal	1	2	3	4	7	8	5	6
Switch position								
ON				○	—	○		
Neutral							○	○
OFF		○	—	○				○

NOTE

○—○ shows that there is continuity between the terminals.