GROUP 35B

ANTI-LOCK BRAKING SYSTEM (ABS) <RWD>

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GENERAL DESCRIPTION

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

The system has the EBD (Electronic Brake-force Distribution) control system which provides the ideal braking force for the rear wheels.

In addition, reading of diagnostic trouble codes and data list and actuator testing are possible by using the Scan Tool.

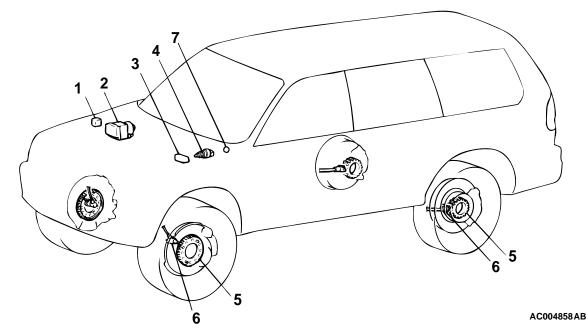
EBD CONTROL

In ABS, electronic control method is used whereby the rear wheel brake hydraulic pressure during braking is regulated by rear wheel control solenoid valves in accordance with the vehicle's rate of deceleration and the front and rear wheel slippage which are calculated from the signals received from the various wheel sensors. EBD control is a control system which provides a high level of control for both vehicle braking force and vehicle stability. The system has the following features:

- Because the system provides the optimum rear wheel braking force regardless of the vehicle laden condition and the condition of the road surface, the system reduces the required pedal depression force, particularly when the vehicle is heavily laden or driving on road surfaces with high frictional coefficients.
- Because the duty placed on the front brakes has been reduced, the increases in pad temperature can be controlled during front brakes applying to improve the wear resistance characteristics of the pad.
- Control valves such as the proportioning valve are no longer required.

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

CONSTRUCTION DIAGRAM



- 1. ABS RELAY
- 2. HYDRAULIC UNIT (INTEGRATED WITH ABS-ECU)
- DATA LINK CONNECTOR

- 4. STOPLIGHT SWITCH
- 5. ABS ROTOR
- 6. WHEEL SPEED SENSOR
- 7. ABS WARNING LIGHT

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ANTI-LOCK BRAKING SYSTEM (ABS) DIAGNOSIS

INTRODUCTION TO ANTI-LOCK BRAKING SYSTEM DIAGNOSIS

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The anti-lock braking system (ABS) operates differently from conventional brake systems. These differences include sounds, sensations, and vehicle performance that owners and service technicians who are not familiar with ABS may not be used to. Some operational characteristics may seem to be malfunctions, but they are simply signs of normal ABS operation. When diagnosing the ABS system, keep these operational characteristics in mind. Inform the owner of the kind of performance characteristics to expect from an ABS-equipped vehicle.

System Check Sound

When starting the engine, a thudding sound can sometimes be heard coming from the engine compartment. This is a normal sound during the ABS self-check.

ABS Operation Sounds and Sensations

During normal operation, the ABS makes several sounds that may seem unusual at first.

- A whining sound is caused by the ABS hydraulic unit motor.
- When pressure is applied to the brake pedal, the pulsation of the pedal causes a scraping sound.
- When the brakes are applied firmly, the ABS operates, rapidly applying and releasing the brakes many times per second. This repeated application and release of braking forces can cause the suspension to make a thumping sound and the tires to squeak.

TROUBLESHOOTING STRATEGY

Use these steps to plan your diagnostic strategy. If you follow them carefully, you will be sure that you have exhausted most of the possible ways to find an ABS fault.

- 1. Gather information about the problem from the customer.
- 2. Verify that the condition described by the customer exists.
- 3. Check the vehicle for any ABS DTC.

Long Stopping Distances on Loose Road Surfaces

When braking on loose surfaces like snow-covered or gravel roads, the stopping distance can be longer for an ABS-equipped vehicle than the stopping distance for a vehicle with a conventional brake system.

Shock at Starting Check

Shock may be felt when the brake pedal is lightly pressed while driving at a low speed. This is a normal characteristic because the ABS system operation check is carried out when vehicle speed is 8 km/ h (5 mph) or less.

ABS Diagnostic Trouble Code Detection Conditions

ABS diagnostic trouble codes (ABS DTCs) are set under different conditions, depending on the malfunction detected. Most ABS DTCs will only be set during vehicle operation. Some ABS DTCs will also be set during the ABS self-check immediately after the engine is started.

When you check if an ABS DTC will be displayed again after the DTC has been erased, you should recreate the ABS DTC set conditions. Depending on the detection timing and set conditions for the specific ABS DTC, you must either drive the vehicle or turn the engine off and restart it. To set the proper conditions for that DTC again, refer to "ABS DTC SET CONDITIONS" for each ABS DTC that you are trying to reset.

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- 4. If you cannot verify the condition and there are no ABS DTCs, the malfunction is intermittent. Refer to GROUP 00, How to use Troubleshooting/ Inspection Service Points – How to Cope with Intermittent Malfunctions P.00-6.
- 5. If you can verify the condition but there are no ABS DTCs, or the system cannot communicate with the scan tool, check that the basic brake system is operating properly.
- If the basic brake system is not operating properly, refer to the GROUP 35A, Basic Brake System Diagnosis P.35A-4.
- If the basic brake system is operating properly, refer to P.35B-32.

- 6. If there is an ABS DTC, record the number of the DTC, then erase the DTC from the memory using the scan tool.
- 7. Duplicate the ABS DTC set conditions to see if the same ABS DTC will set again.
- If the same ABS DTC sets again, perform the diagnostic procedures for the DTC. Refer to P.35B-7.
- If you cannot get the same ABS DTC to set again, the malfunction is intermittent. Refer to GROUP 00, How to use How to Cope with Intermittent Malfunctions P.00-6.

TROUBLE CODE DIAGNOSIS

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Retrieving ABS Diagnostic Trouble Codes

Using Scan Tool MB991502

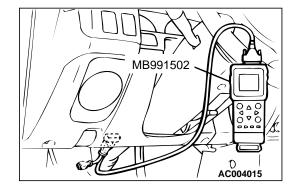
Required Special Tool:

MB991502: Scan Tool (MUT-II)

⚠ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

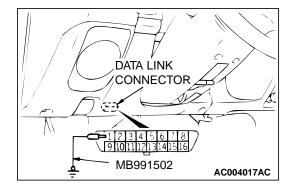
- 1. Connect scan tool MB991502 to the data link connector.
- 2. Turn the ignition switch to the "ON" position.
- 3. Use scan tool MB991502 to check for ABS diagnostic trouble codes.
- 4. Turn the ignition switch to the "LOCK" (OFF) position.
- 5. Disconnect scan tool MB991502.

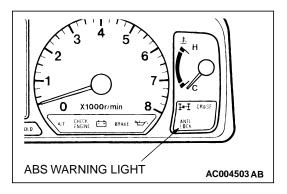


Using the ABS Warning Light and Special Tool MB991529

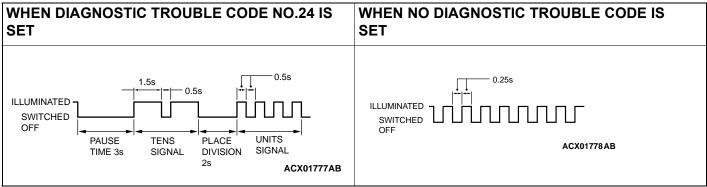
Required Special Tool:

- MB991529: Diagnostic Trouble Code Check Harness
- 1. Use special tool MB991529 to ground number 1 terminal of the data link connector.
- 2. Turn the ignition switch to the "ON" position.





3. Read out a diagnostic trouble code by observing how the warning light flashes.



- 4. Turn the ignition switch to the "LOCK" (OFF) position.
- 5. Disconnect special tool MB991529.

Erasing ABS Diagnostic Trouble Codes

Using Scan Tool MB991502

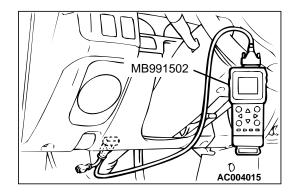
Required Special Tool:

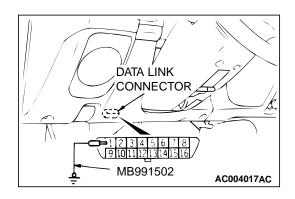
MB991502: Scan Tool (MUT-II)

⚠ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

- 1. Connect scan tool MB991502 to the data link connector.
- 2. Turn the ignition switch to the "ON" position.
- 3. Use scan tool MB991502 to erase ABS diagnostic trouble codes.
- 4. Turn the ignition switch to the "LOCK" (OFF) position.
- 5. Disconnect scan tool MB991502.

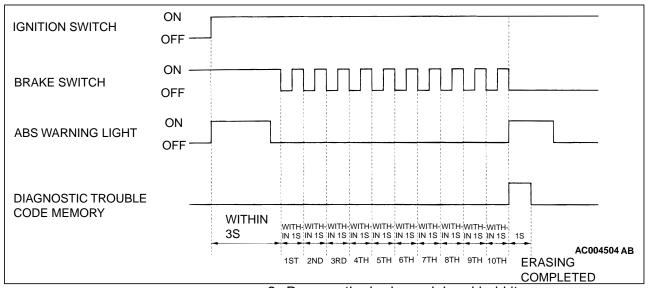




By Special Operation for the Brake Pedal

1. Use special tool MB991529 to ground number 1 terminal of the data link connector.

NOTE: If the ABS-ECU functions have stopped due to the fail-safe function, the diagnostic trouble code cannot be erased.



- 2. Depress the brake pedal and hold it.
- 3. Turn the ignition switch to the "ON" position.
- 4. After turning the ignition switch to the "ON" position, release the pedal within three seconds. Repeat this process of pressing and releasing the brake pedal 10 continuous times.
- 5. Turn the ignition switch to the "LOCK" (OFF) position.
- 6. Disconnect special tool MB991529.

DIAGNOSTIC TROUBLE CODE CHART

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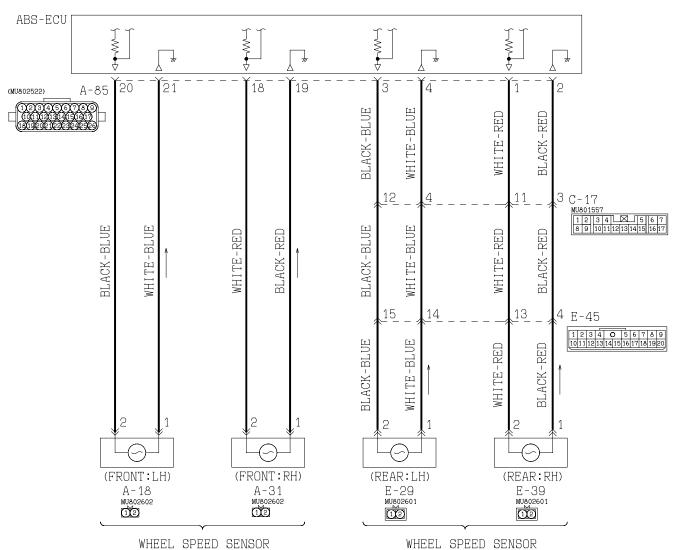
Follow the inspection chart that is appropriate for the diagnostic trouble code.

DIAGNOSTIC TROUBLE CODE NO.	INSPECTION ITEM	DIAGNOSTIC CONTENT	REFERENCE PAGE	
11	Front right wheel speed sensor	Open circuit or short circuit	P.35B-8	
12	Front left wheel speed sensor			
13	Rear right wheel speed sensor			
14	Rear left wheel speed sensor			
15	Wheel speed sensor	Abnormal output signal	P.35B-14	
16	Power supply system		P.35B-18	
21	Front right wheel speed sensor		P.35B-8	
22	Front left wheel speed sensor			
23	Rear right wheel speed sensor			
24	Rear left wheel speed sensor			
33	Stoplight switch system		P.35B-23	
41	Front right solenoid valve inside hydraulic unit		P.35B-30	
42	Front left solenoid valve inside hydraulic unit			
43	Rear solenoid valve inside hydraulic unit			
51	Hydraulic unit valve relay open or short circuit		P.35B-30	
53	Malfunction of hydraulic unit		P.35B-30	
63	ABS-ECU		Replace the ABS-ECU P.35B-63.	

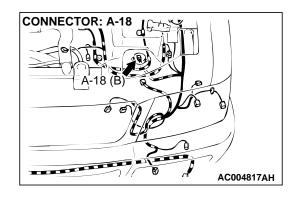
DIAGNOSTIC TROUBLE CODE PROCEDURES

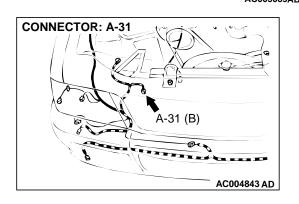
DTC 11, 12, 13, 14: Wheel Speed Sensor (Open Circuit or Short Circuit) DTC 21, 22, 23, 24: Wheel Speed Sensor

Wheel Speed Sensor Circuit

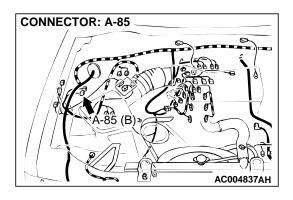


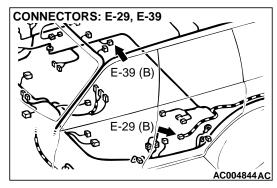
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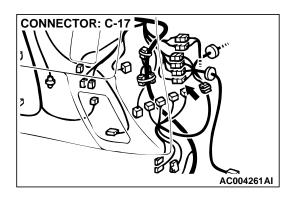
CIRCUIT OPERATION

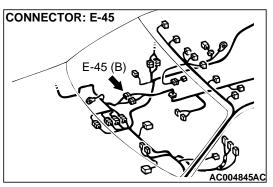
- A toothed ABS rotor generates a voltage pulse as it moves across the pickup field of each wheel speed sensor.
- The amount of voltage generated at each wheel is determined by the clearance between the ABS rotor teeth and the wheel speed sensor, and by the speed of rotation.
- The wheel speed sensors transmit the frequency of the voltage pulses and the amount of voltage generated by each pulse to the ABS-ECU.
- The ABS hydraulic unit modulates the amount of braking force individually applied to each wheel cylinder.

ABS DTC SET CONDITIONS

DTCs 11, 12, 13, 14 are set when signal is not input due to breakage of the (+) or (–) wire of one or more of the four wheel-speed sensors.

DTCs 21, 22, 23, 24 are set in the following cases:





- Open circuit is not found but no input is received by one or more of the four wheel-speed sensors at 10 km/h (6 mph) or more.
- Sensor output drops due to a malfunctioning sensor or warped ABS rotor.

TROUBLESHOOTING HINTS

The most likely causes for these DTCs to set are: DTC 11, 12, 13, 14

- · Malfunction of the wheel speed sensor
- Damaged wiring harness or connector
- Malfunction of the hydraulic unit (integrated with ABS-ECU)

DTC 21, 22, 23, 24

- Malfunction of the wheel speed sensor
- · Damaged wiring harness and connector
- Malfunction of the hydraulic unit (integrated with ABS-ECU)
- · Malfunction of the ABS rotor
- Malfunction of the wheel bearing
- Excessive clearance between the sensor and ABS rotor

DIAGNOSIS

Required Special Tools:

- MB991223: Harness Set
- MB991502: Scan tool (MUT-II)

STEP 1. Check the wheel speed sensor installation.

Q: Is the wheel speed sensor bolted securely in place at the front knuckle or the rear axle housing?

YES: Go to Step 2.

NO: Install it properly. Refer to P.35B-65. Then go to Step

9.

STEP 2. Measure the wheel speed sensor circuit resistance at ABS-ECU connector A-85.

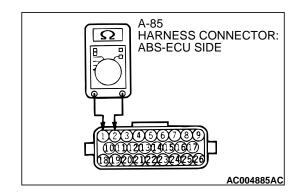
- (1) Disconnect connector A-85 and measure at the harness side
- (2) Measure the resistance between ABS-ECU connector terminals 1 and 2, 3 and 4, 18 and 19, 20 and 21.

Standard Value: 1.3 – 1.5 k Ω

Q: Is the resistance between terminals 1 and 2, 3 and 4, 18 and 19, 20 and 21 within 1.3 – 1.5 k Ω ?

YES: Go to Step 6.

NO: Go to Step 3, or Step 4, or Step 5

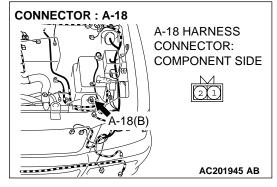


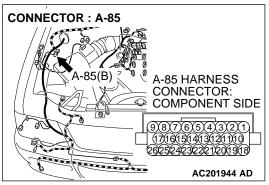
STEP 3. Check the harness wires between ABS-ECU connector A-85 (terminal No.20 and 21) and wheel speed sensor <front: LH> connector A-18 (terminal No.1 and 2).

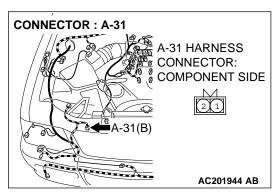
Q: Are any harness wires between ABS-ECU connector A-85 (terminal No.20 and 21) and wheel speed sensor <front: LH> connector A-18 (terminal No.1 and 2) damaged?

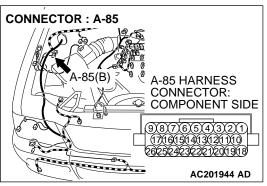
YES: Repair them and go to Step 9.

NO: Go to Step 7.







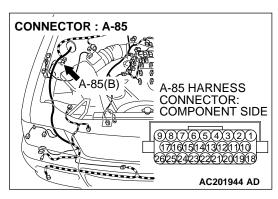


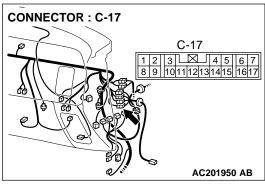
STEP 4. Check the harness wires between ABS-ECU connector A-85 (terminal No.18 and 19) and wheel speed sensor <front: RH> connector A-31 (terminal No.1 and 2). Q: Are any harness wires between ABS-ECU connector A-85 (terminal No.18 and 19) and wheel speed sensor <front: RH> connector A-31 (terminal No.1 and 2) damaged?

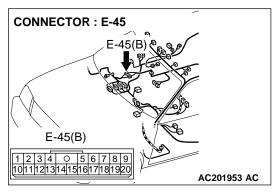
YES: Repair them and then go to Step 9.

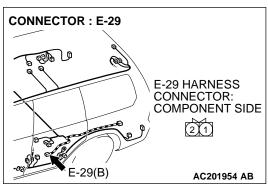
NO: Go to Step 7.

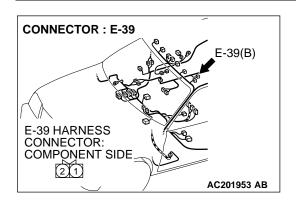
STEP 5. Check the harness wires between ABS-ECU connector A-85 (terminal No.1, 2, 3 and 4) and wheel speed sensor connector E-29 <rear: LH> (terminal No.1 and 2) or E-39 <rear RH> (terminal No 1 and 2).











NOTE: After inspecting intermediate connectors C-17 and E-45, inspect the wires. If intermediate connector C-17 or E-45 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 9.

Q: Are any harness wires between ABS-ECU connector A-85 (terminal No.1, 2, 3 and 4) and wheel speed sensor connector E-29 <rear: LH> (terminal No.1 and 2) or E-39 <rear RH> (terminal No.1 and 2) damaged?

YES: Repair them and then go to Step 9.

NO: Go to Step 7.

STEP 6. Measure the wheel speed sensor output voltage. Refer to P.35B-57.

Output Voltage:

- When measured with a voltmeter: 70 mV or more
- When measured with oscilloscope (maximum voltage): 200 mV or more

Q: Is the measured voltage within the specified range?

YES: Replace the hydraulic unit (integrated with ABS-ECU) and then go to Step 9.

NO: Go to Step 7.

STEP 7. Check the wheel speed sensor or ABS rotor.

Refer to P.35B-66. If there is damage in any of the check items below, replace the wheel speed sensor.

Check items:

Wheel speed sensor internal resistance

Standard value: $1.3 - 1.5 \text{ k}\Omega$

Wheel speed sensor insulation resistance

Standard value: 100 k Ω

Toothed ABS rotor check

Q: Is the wheel speed sensor or ABS rotor damaged?

YES: Replace it and then go to Step 9.

NO: Go to Step 8.

STEP 8. Check the wheel bearing.

Refer to GROUP 26, Front Hub Assembly P.26-13, and Refer to GROUP 27, Axle Shaft <Vehicles with drum brake> P.27-25, <Vehicles with disc brake> P.27-36.

Q: Is the wheel bearing damaged?

YES: Replace it and then go to Step 9.

NO: Go to Step 9.

STEP 9. Check ABS diagnostic trouble code.

Q: Do diagnostic trouble codes 11, 12, 13, 14, 21, 22, 23 and 24 reset?

YES: Go to Step 1.

NO: The procedure is complete.

DTC 15: Wheel Speed Sensor (Abnormal Output Signal)

WHEEL SPEED SENSOR CIRCUIT

Refer to P.35B-8.

CIRCUIT OPERATION

Refer to P.35C-8.

ABS DTC SET CONDITIONS

 DTC 15 is set when output signal produced by any of wheel-speed sensor is abnormal (excluding short and open-circuits).

TROUBLESHOOTING HINTS (The most likely causes for these DTC to set are:)

- Improper installation of the wheel speed sensor
- Malfunction of the wheel speed sensor
- Damaged wiring harness or connector
- · Malfunction of the ABS rotor
- · Malfunction of the wheel bearing
- Malfunction of the hydraulic unit (integrated with ABS-ECU)

DIAGNOSIS

Required Special Tools:

- MB991223: Harness Set
- MB991502: Scan tool (MUT-II)

STEP 1. Check the wheel speed sensor installation.

Q: Is the wheel speed sensor bolted securely in place at the front knuckle or the rear axle housing?

YES: Go to Step 2.

No: Install it properly. Refer to P.35B-65. Then go to Step

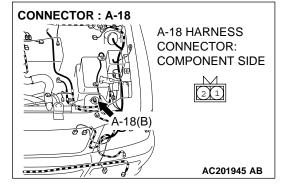
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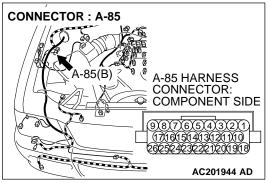
STEP 2. Check the harness wires between ABS-ECU connector A-85 (terminal No.20 and 21) and wheel speed sensor <front: LH> connector A-18 (terminal No.1 and 2).

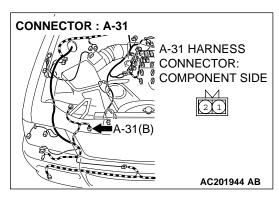
Q: Are any harness wires between ABS-ECU connector A-85 (terminal No.20 and 21) and wheel speed sensor <front: LH> connector A-18 (terminal No.1 and 2) damaged?

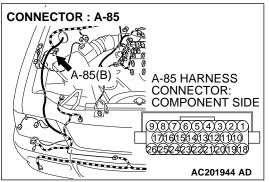
YES: Repair them and go to Step 8.

NO: Go to Step 3.







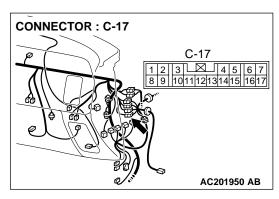


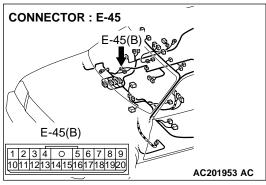
STEP 3. Check the harness wires between ABS-ECU connector A-85 (terminal No.18 and 19) and wheel speed sensor <front: RH> connector A-31 (terminal No.1 and 2). Q: Are any harness wires between ABS-ECU connector A-85 (terminal No.18 and 19) and wheel speed sensor <front: RH> connector A-31 (terminal No.1 and 2) damaged?

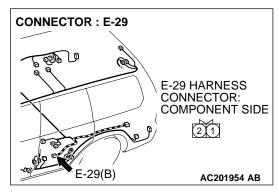
YES: Repair them and then go to Step 8.

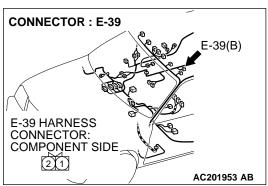
NO: Go to Step 4.

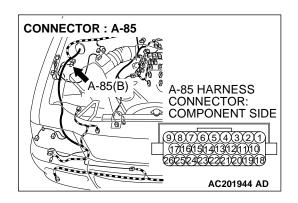
STEP 4. Check the harness wires between ABS-ECU connector A-85 (terminal No.1, 2, 3 and 4) and wheel speed sensor connector E-29 <rear: LH> (terminal No. 1 and 2) or E-39 <rear RH> (terminal No. 1 and 2).











NOTE: After inspecting intermediate connectors C-17 and E-45, inspect the wires. If intermediate connector C-17 or E-45 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 8.

Q: Are any harness wires between ABS-ECU connector A-85 (terminal No.1, 2, 3 and 4) and wheel speed sensor connector E-29 <rear: LH> (terminal No.1 and 2) or E-39 <rear RH> (terminal No.1 and 2) damaged?

YES: Repair them and then go to Step 8.

NO: Go to Step 5.

STEP 5. Measure the wheel speed sensor output voltage. Refer to P.35B-57.

Output Voltage:

- When measured with a voltmeter: 70 mV or more
- When measured with oscilloscope (maximum voltage): 200 mV or more

Q: Is the measured voltage within the specified range?

YES: Replace the hydraulic unit (integrated with ABS-ECU) and then go to Step 8.

NO: Go to Step 6.

STEP 6. Check the wheel speed sensor or ABS rotor.

Refer to P.35B-65. If there is damage in any of the check items, replace the wheel speed sensor.

Check items:

Wheel speed sensor internal resistance

Standard value: $1.3 - 1.5 \text{ k}\Omega$

Wheel speed sensor insulation resistance

Standard value: 100 k Ω

Toothed ABS rotor check

Q: Is the wheel speed sensor or ABS rotor damaged?

YES: Replace it and then go to Step 8.

NO: Go to Step 7.

STEP 7. Check the wheel bearing.

Refer to GROUP 26, Front Hub Assembly P.26-13, and Refer to GROUP 27, Axle Shaft <Vehicles with drum brake> P.27-25, <Vehicles with disc brake> P.27-36.

Q: Is the wheel bearing damaged?

YES: Replace it and then go to Step 8.

NO: Go to Step 8.

STEP 8. Check ABS diagnostic trouble code.

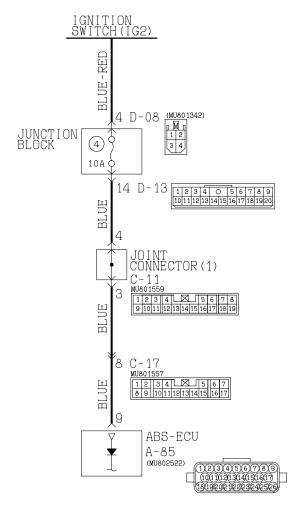
Q: Do the diagnostic trouble code 15 reset?

YES: Go to Step 1.

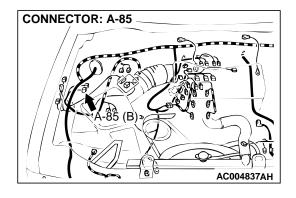
NO: The procedure is complete.

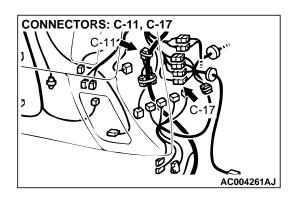
DTC 16: ABS-ECU Power Supply System

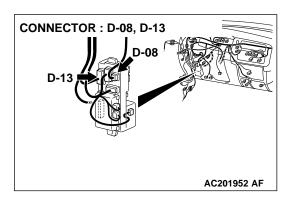
Power Supply Circuit



W3P02M15AA







CIRCUIT OPERATION

The ABS-ECU power is supplied to the ABS-ECU (terminal 9) from the ignition switch (IG2) through the fuse number 4 in the junction block and through the joint connector number 1.

ABS DTC SET CONDITIONS

Output is provided when ABS-ECU power supply voltage drops below or rises above the normal value. Output is not provided if power supply voltage returns to normal voltage.

TROUBLESHOOTING HINTS

The most likely causes for DTC is to set are:

- Damaged wiring harness and connector
- Malfunction of hydraulic unit (integrated with ABS-ECU)

DIAGNOSIS

Required Special Tool:

MB991502: Scan tool (MUT-II)

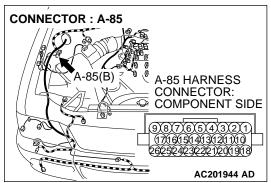
STEP 1. Check the battery.

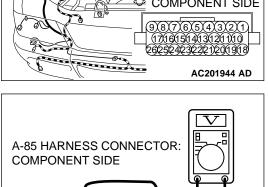
Refer to GROUP 54, Battery – On-vehicle Service – Battery Testing Procedure P.54-6.

Q: Is the battery damaged?

YES: Charge or replace the battery and then go to Step 4.

NO: Go to Step 2.





(9)(8)(7)(6)(5)(4)(3)(2)(1) (17)(6)(15)(4)(3)(2)(1)(10) 26)(25)(4)(3)(2)(2)(2)(9)(8)

AC202680 AB

STEP 2. Measure the power supply circuit voltage at ABS-ECU connector A-85.

(1) Disconnect connector A-85 and measure at the harness side.

(2) Measure the voltage between terminal 9 and ground.

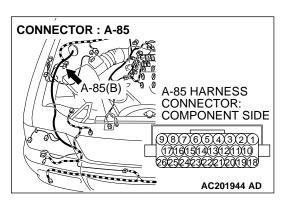
Q: Is battery positive voltage (approximately 12 volts) present?

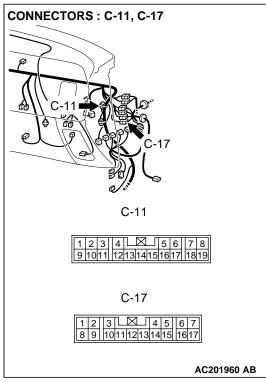
YES: Replace the hydraulic unit (integrated with ABS-ECU)

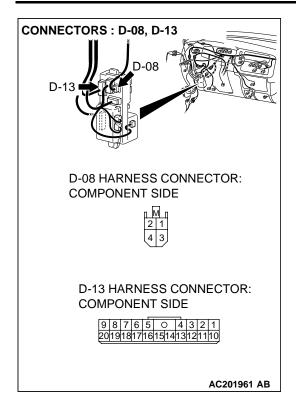
and then go to Step 4.

NO: Go to Step 3.

STEP 3. Check the harness wires between connector D-08 (terminal No.4) and ABS-ECU connector A-85 (terminal No.9).







NOTE: After inspecting intermediate connectors D-13, C-11, and C-17, inspect the wire. If intermediate connector D-13, C-11 or C-17 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 4.

Q: Are any harness wires between ABS-ECU connector D-08 (terminal No.4) and ABS-ECU connector A-85 (terminal No.9) damaged?

YES: Repair them and go to Step 4.

NO: Go to Step 4.

STEP 4. Check ABS diagnostic trouble code.

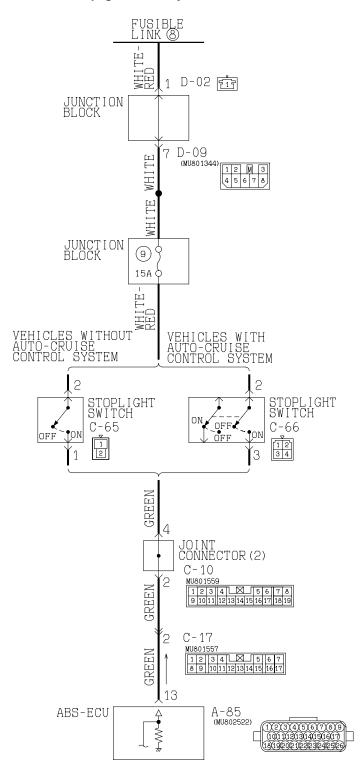
Q: Does diagnostic trouble code 16 reset?

YES: Start over at Step 1.

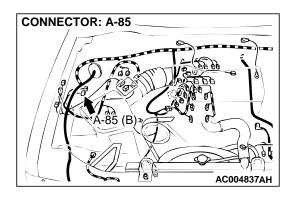
NO: The procedure is complete.

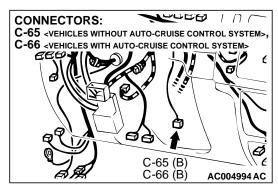
DTC 33: Stoplight Switch System

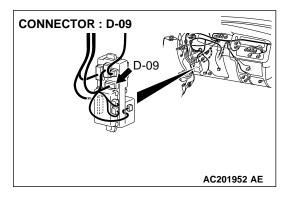
Stoplight Switch System

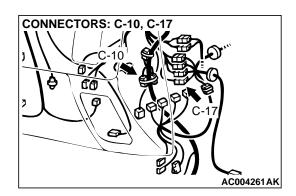


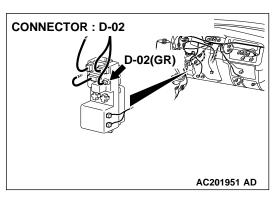
W3P02M16AA











CIRCUIT OPERATION

The "ON" signal when the brake pedal is pressed or the "OFF" signal when the brake pedal is released is input to the ABS-ECU (terminal 13).

ABS DTC SET CONDITION

DTC 33 is set in the following cases:

• Stoplight switch is not operating properly and remains in ON state for more than 15 minutes.

 Stoplight switch system harness is damaged and no signal is input to ABS-ECU.

TROUBLESHOOTING HINTS (The most likely causes for DTC 33 to set are:)

- Malfunction of the stoplight switch
- Damaged wiring harness and connector
- Malfunction of the hydraulic unit (integrated with ABS-ECU)

DIAGNOSIS

Required Special Tools:

- MB991223: Harness Set
- MB991502: Scan tool (MUT-II)

STEP 1. Check the stoplight operation.

Q: Does the stoplight come on and go out correctly?

YES: Go to Step 4. NO: Go to Step 2.

STEP 2. Check the stoplight switch installation condition.

Q: Is the stoplight switch installed properly?

YES: Go to Step 3.

NO: Repair it and then go to Step 8.

STEP 3. Check the stoplight switch continuity.

- (1) Remove the stoplight switch. (Refer to GROUP 35A, Brake Pedal P.35A-32.)
- (2) Connect an ohmmeter to stoplight switch, and check whether there is continuity when the plunger of the stoplight switch is pushed in and when it is released. For vehicles with auto-cruise control system, Check for continuity between the terminals "a" and "b" of the stoplight switch.
- (3) The stoplight 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 inch) from the outer case edge surface, and if there is continuity when it is released.

Q: Is the stoplight switch continuity incorrect?

YES: Replace it and then go to Step 8.

NO: Go to Step 4.

STEP 4. Using scan tool MB991502, check data list item 33: Stoplight switch.

↑ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

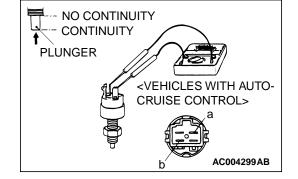
- (1) Connect scan tool MB991502 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991502 to data reading mode for item 33, Stoplight switch.
 - ON with brake pedal stepped down.
 - OFF with brake pedal released.

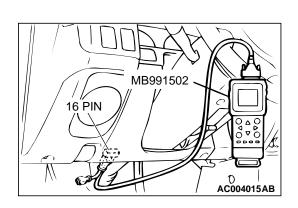
Q: Is the stoplight switch input normal?

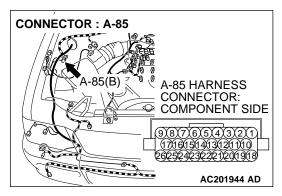
YES : This malfunction is intermittent. Refer to GROUP 00E, How to Use Troubleshooting/Inspection Service Points – How to Cope With Intermittent Malfunction

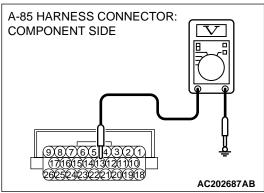
P.00E-2.

NO: Go to Step 5.









STEP 5. Measure the stoplight switch circuit voltage at ABS-ECU connector A-85.

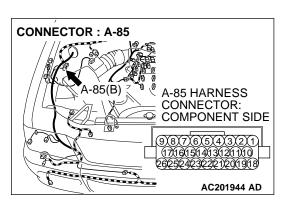
- (1) Disconnect connector A-85 and measure at the harness side.
- (2) Turn the stoplight switch ON.

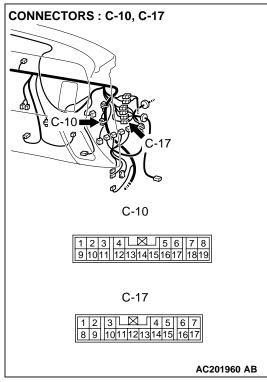
- (3) Measure the voltage between terminal 13 and ground. It should be approximately 12 volts (battery positive voltage).
- Q: Is the battery positive voltage (approximately 12 volts) present?

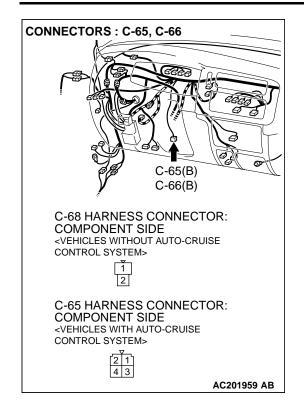
YES: Replace the ABS-ECU and then go to Step 7.

NO: Go to Step 6.

STEP 6. Check the harness wire between ABS-ECU connector A-85 (terminal No.13) and stoplight switch connector C-65 <Vehicles without auto-cruise control system> (terminal No.1) or C-66 <Vehicles with auto-cruise control system> (terminal No.3).





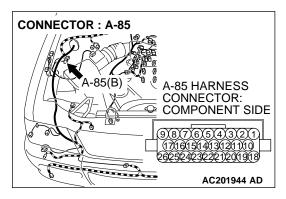


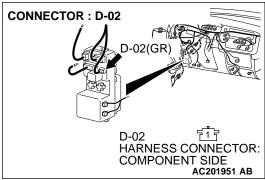
NOTE: After inspecting intermediate connectors C-17,C-10 and stoplight switch connector C-65 < Vehicles without autocruise control system> or C-66 < Vehicles with auto-cruise control system>, inspect the wire. If intermediate connector C-17, C-10, stoplight switch connector C-65 < Vehicles without autocruise control system>, or C-66 < Vehicles with auto-cruise control system> is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 7.

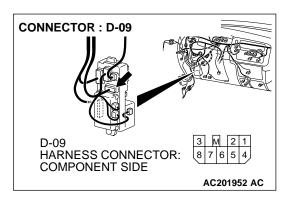
Q: Is the harness wire between ABS-ECU connector A-85 (terminal No.13) and stoplight switch connector C-65 <Vehicles without auto-cruise control system> (terminal No.1) or C-66 <Vehicles with auto-cruise control system> (terminal No.3) damaged?

YES: Repair it and then go to Step 7.

NO: Check the harness wire between ABS-ECU connector A-85 and stoplight connector C-65 < Vehicles without auto-cruise control system> or C-66 < Vehicles with auto-cruise control system>, and repair if necessary. Then go to Step 7.







STEP 7. Check the harness wire between fusible link No.8 and stoplight switch connector C-65 <Vehicles without auto-cruise control system> (terminal No.2) or C-66 <Vehicles with auto-cruise control system> (terminal No.2).

NOTE: After inspecting junction block connector D-02, D-09 and stoplight switch connector C-65 <Vehicles without autocruise control system> or C-66 <Vehicles with autocruise control system>, inspect the wire. If junction block connector D-02, D-09, stoplight switch connector C-65 <Vehicles without autocruise control system>, or C-66 <Vehicles with autocruise control system> is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 8.

Q: Is the harness wire between fusible link No.8 and stoplight switch connector C-65 <Vehicles without autocruise control system> (terminal No.2) or C-66 <Vehicles with auto-cruise control system> (terminal No.2) damaged?

YES: Repair it and then go to Step 8.

NO: Check the harness wire between ABS-ECU connector A-85 and stoplight connector C-65 <Vehicles without auto-cruise control system> or C-66 <Vehicles with auto-cruise control system>, and repair if necessary. Then go to Step 8.

STEP 8. Check ABS diagnostic trouble code.

Q: Does diagnostic trouble code 33 reset?

YES: Return to Step 1.

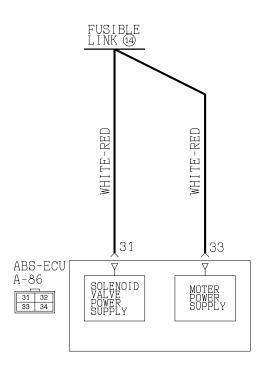
NO: The procedure is complete.

DTC 41, 42, 43 : Solenoid Valve inside Hydraulic Unit

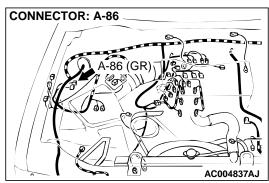
DTC 51: Hydraulic Unit Valve Relay Open or Short Circuit

DTC 53: Malfunction of Hydraulic Unit

Solenoid Valve and Motor Power supply Circuit



W3P02M17AA



CIRCUIT OPERATION

The ABS-ECU power is supplied to the ABS-ECU (terminal 31, 33) from the fusible link 14.

ABS DTC SET CONDITIONS

These codes are set in the following cases:

• If there is an open or short circuit in the ABS-ECU power circuit (solenoid valve, motor).

If there is a malfunction in hydraulic unit inner circuit.

TROUBLESHOOTING HINTS (The most likely causes for these DTCs to set are:)

- Damaged wiring harness or connector
- Malfunction of the hydraulic unit (integrated with ABS-ECU)

DIAGNOSIS

Required Special Tool:

• MB991223: Harness Set

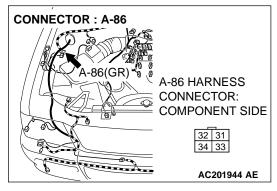
STEP 1. Measure the solenoid valve or motor power supply circuit at ABS-ECU connector A-86.

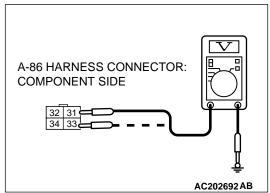
- (1) Disconnect connector A-86 and measure at the harness side.
- (2) Measure the voltage between terminal 31 and ground or 33 and ground.

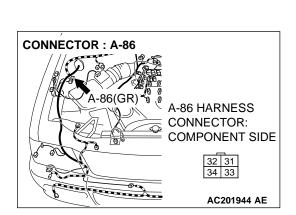
Q: Is battery positive voltage approximately 12 volts?

YES: Replace the hydraulic unit (integrated with ABS-ECU) and then go to Step 3.

NO: Go to Step 2.







STEP 2. Check the harness wire between fusible link number 14 and ABS-ECU connector A-86 (terminal No.31 and 33).

Q: Is any harness wire between fusible link number 14 and ABS-ECU connector A-86 (terminal No.31 and33) damaged?

YES: Repair it and then go to Step 3.

NO: Go to Step 3.

STEP 3. Check the diagnostic trouble code.

Q: Do diagnostic trouble codes 41, 42, 43, 51 and 53 reset?

YES: Go to Step 1.

NO: The procedure is complete.

SYMPTOM CHART

M1352011400341

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

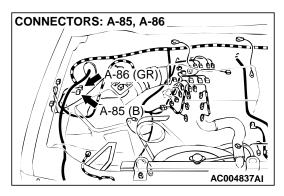
During ABS operation, the brake pedal may vibrate a little or may not be able to be pressed. Such conditions are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking. This is normal.

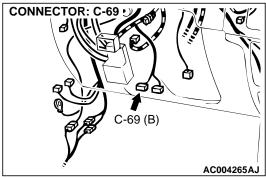
SYMPTOM		INSPECTION PROCEDURE NO.	REFERENCE PAGE
Communication with scan tool is not possible.			GROUP13A, Symptom Procedure P.13Ad-2
	Communication with ABS only is not possible.	1	P.35B-33
When the ignition switch is turned to the "ON" position (engine stopped or after start-up), the ABS warning light does not illuminate.		2	P.35B-40
The ABS warning light remains illuminated after the engine is started		3	P.35B-50
Faulty ABS operation		4	P.35B-52

SYMPTOM PROCEDURES

INSPECTION PROCEDURE 1: Communication with Scan Tool is not Possible. (Communication with ABS Only is not Possible.)

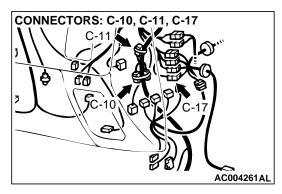
Data Link Connector Circuit 2 D-08 JUNCTION BLOCK 4 10A ¢ 14 D-13 1234 0 56789 1011121314151617181920 BL JOINT CONNECTOR (1) 3 BLUE (MU802522) H 9 A-85 ABS-ECU 23 A-86 32 34 24 YELLOW-VIOLET GREEN-RED 13 14 C-17 YELLOW-VIOLET BLACK BLACK JOINT CONNECTOR (2) 15 YELLOW-ORANGE GREEN-RED DATA LINK CONNECTOR C-69 FRONT SIDE 12345678 910111213141516 5 4 BLACK BLACK BLACK W3P02M18AA

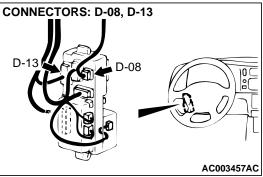




CIRCUIT OPERATION

- The diagnostic set is made from the ABS-ECU (terminal 23) to the diagnostic output terminal (terminal 7) of the data link connector.
- When the data link connector's diagnostic test mode control terminal (terminal 1) is grounded, the ABS-ECU (terminal 24) will go into diagnostic mode.





TECHNICAL DESCRIPTION (COMMENT)

When communication with the scan tool is not possible, the cause is probably an open circuit in the ABS-ECU power circuit or an open circuit in the diagnostic output circuit.

TROUBLESHOOTING HINTS (The most likely causes for this case:)

- Blown fuse
- Damaged wiring harness and connector
- Malfunction of the hydraulic unit (integrated with AS-ECU)

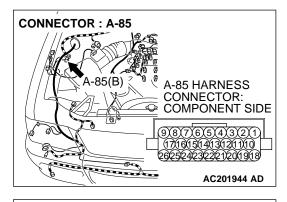
DIAGNOSIS

Required Special Tool:

• MB991223: Harness Set

STEP 1. Measure the power supply circuit at ABS-ECU connector A-85.

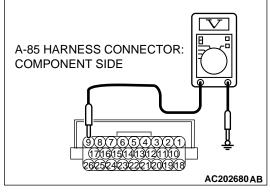
- (1) Disconnect connector A-85 and measure at the harness side.
- (2) Start the engine.



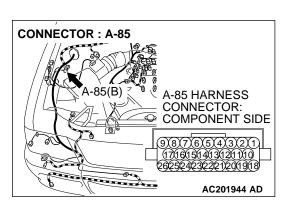
(3) Measure the voltage between terminal 9 and ground.

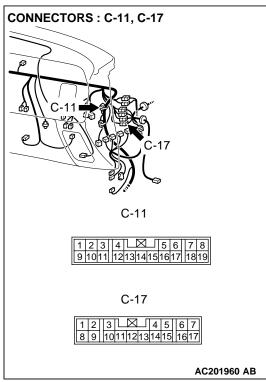
Q: Is battery positive voltage (approximately 12 volts) present?

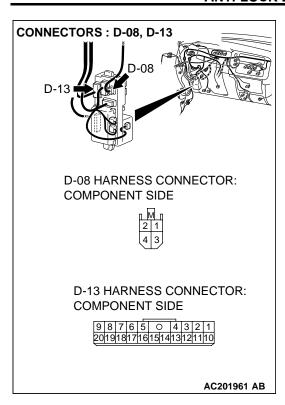
YES: Go to Step 3. **NO**: Go to Step 2.



STEP 2. Check the harness wire between ignition switch (IG2) and ABS-ECU connector A-85 (terminal No.9).





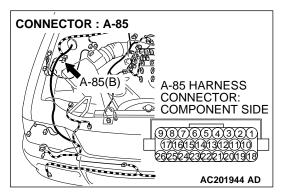


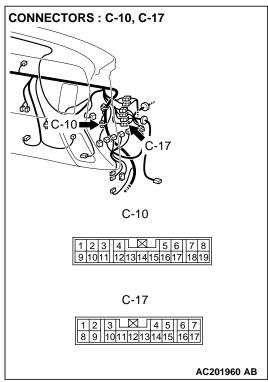
NOTE: After inspecting intermediate connectors C-17, C-11, D-08, and D-13, inspect the wire. If intermediate connector C-17, C-11, D-08, or D-13 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00-6. If the connector has been repaired or replaced, go to Step 3.

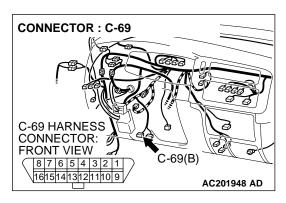
Q: Is any harness wire between ignition switch (IG2) and ABS-ECU connector A-85 (terminal No.9) damaged?

YES: Repair them and go to Step 5.

NO: Go to Step 3.







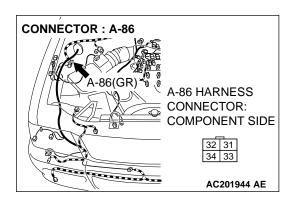
STEP 3. Check the harness wire between ABS-ECU connector A-85 (terminal No.23 and 24) and data link connector C-69 (terminal No.1 and 7).

NOTE: After inspecting intermediate connectors C-10 and C-17, inspect the wires. If intermediate connector C-10 or C-17 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 4.

Q: Is any harness wire between ABS-ECU connector A-85 (terminal No.23 and 24) and data link connector C-69 (terminal No.1 and 7) damaged?

YES: Repair them and go to Step 5.

NO: Go to Step 4.



STEP 4. Check the harness wires between ABS-ECU connector A-86 (terminal No.32 and 34) and ground.

Q: Are any harness wires between ABS-ECU connector A-86 (terminal No.32 and 34) and ground damaged?

YES: Repair them and then go to Step 5.

NO: Go to Step 5.

STEP 5. Retest the system.

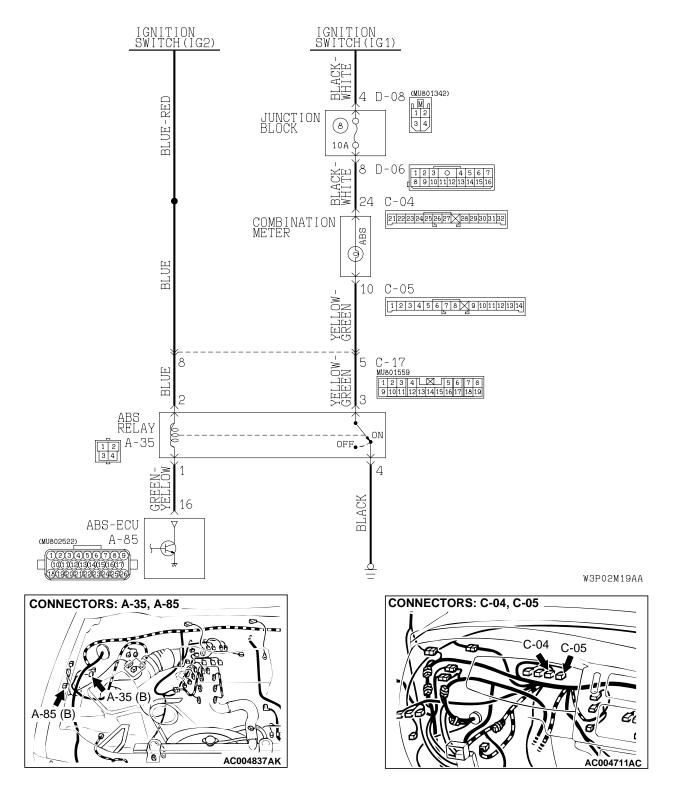
Q: Does the scan tool communicate with the ABS system?

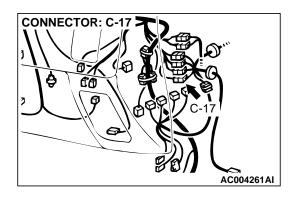
YES: The procedure is complete.

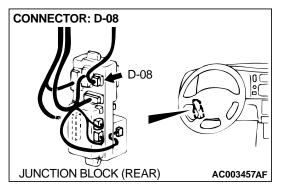
NO: Return to Step 1.

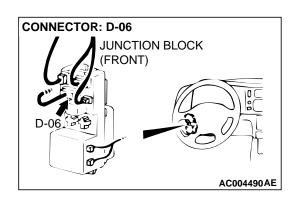
INSPECTION PROCEDURE 2: When the Ignition Switch is Turned to the "ON" Position (Engine Stopped or After Start-up), the ABS Warning Light does not Illuminate.

ABS Warning Light Circuit









CIRCUIT OPERATION

- The ABS warning light power is supplied from the ignition switch.
- The ABS-ECU controls the continuity to the ABS warning light by turning the power transistor in the unit "ON" and "OFF" to turn the ABS relay "ON" and "OFF".

TECHNICAL DESCRIPTION (COMMENT)

The cause may be: an open circuit in the light power apply circuit, a blown light bulb, an open circuit in both the circuit between the ABS warning light and the ABS-ECU.

TROUBLESHOOTING HINTS (The most likely causes for this case:)

- Blown fuse
- Damaged wiring harness and connector
- Burnt out ABS warning light bulb
- Malfunction of the ABS relay
- Malfunction of the hydraulic unit (integrated with ABS-ECU)

DIAGNOSIS

Required Special Tool:

MB991223: Harness Set

STEP 1. Check the ABS warning light circuit at ABS-ECU connector A-85.

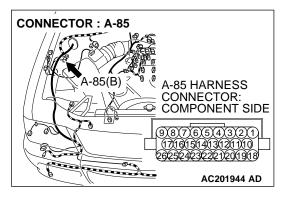
- (1) Disconnect ABS-ECU connector A-85.
- (2) Turn the ignition switch to the "ON" position.

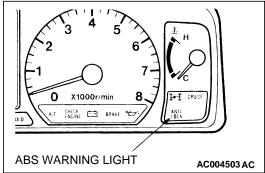
Q: Does the ABS warning light illuminate?

YES: Replace the hydraulic unit (integrated with ABS-ECU)

and then go to Step 16.

NO: Go to Step 2.





C-17 HARNESS CONNECTOR: MALE PIN CONNECTOR SIDE (1) DISC (2) Turn Q: Does term YES NO:

AC202696AB

STEP 2. Check the circuit at connector C-17.

- (1) Disconnect connector C-17.
- (2) Turn the ignition switch to the "ON" position.

Q: Does the ABS warning light illuminate when male pin terminal 5 is grounded?

YES: Go to Step 4. NO: Go to Step 3.

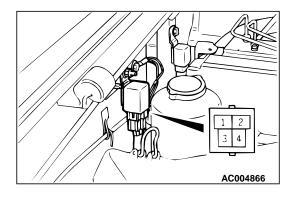
STEP 3. Check the ABS warning light bulb.

- (1) Remove the combination meter (Refer to GROUP 54A, Combination Meter P.54-110).
- (2) Check the ABS warning light bulb.

Q: Is the bulb burned out?

YES: Replace the bulb and then go to Step 16.

NO: Go to Step 4.



STEP 4. Check the ABS relay.

- (1) Remove the ABS relay.
- (2) Check for continuity between terminals 3 4 when battery voltage is applied between terminals 1 2.

BATTERY VOLTAGE	TESTER CONNECTION	SPECIFIED CONDITION
Not applied	3 – 4	Open circuit
 Connect terminal 2 to the positive battery terminal Connect terminal 1 to the negative battery terminal 	3 – 4	Less than 2 ohms

Q: Is the ABS warning light relay continuity?

YES: Go to Step 5.

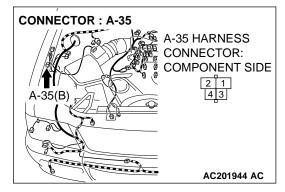
NO: Replace the ABS relay. Then go to Step 16.

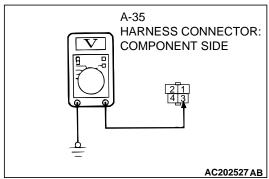
STEP 5. Measure the circuit at ABS relay.

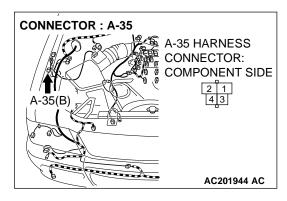
- (1) Disconnect ABS relay connector A-35 and measure at the ABS relay harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 3 and ground. voltage should measure approximately 12 volts (battery positive voltage.)

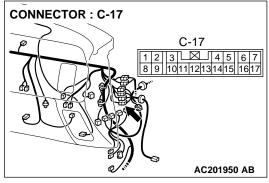
Q: Is battery positive voltage (approximately 12 volts) present?

YES: Go to Step 8. NO: Go to Step 6.







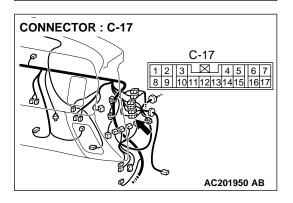


CONNECTOR: A-35

A-35 HARNESS
CONNECTOR:
COMPONENT SIDE

2 1
4 3

AC201944 AC



STEP 6. Check harness connectors A-35 and C-17 for loose, corroded or damaged terminals, or terminals pushed back in the connector.

Refer to GROUP 00E, Harness Connector Inspection P.00E-2.

Q: Are the connectors and terminals in good condition?

YES: Repair it and then go to Step 16.

NO: Go to Step 7.

STEP 7. Check the harness wire between ABS relay connector A-35 (terminal No. 2 and 3) and intermediate connector C-17 (terminal no.5 and 8).

Q: Is the harness wire between ABS relay connector A-35 (terminal No. 2 and 3) and intermediate connector C-17 (terminal No.5 and 8) damaged?

YES: Repair it and then go to Step 16.

NO: Go to Step 8.

A-35 HARNESS CONNECTOR:
COMPONENT SIDE

A-35(B)

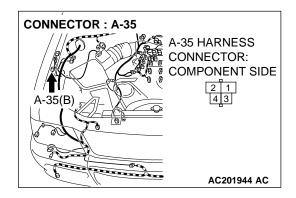
AC201944 AC

STEP 8. Check harness connector A-35 for loose, corroded or damaged terminals, or terminals pushed back in the connector.

Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Q: Are the connectors and terminals in good condition?

YES: Repair or replace it. Then go to Step 16.

NO: Go to Step 9.

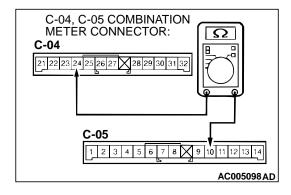


STEP 9. Check the harness wire between ABS relay connector A-35 (terminal No.4) and ground.

Q: Is the harness wire between ABS relay connector A-35 (terminal No.4) and ground damaged?

YES: Repair it and then go to Step 16.

NO: Go to Step 16.

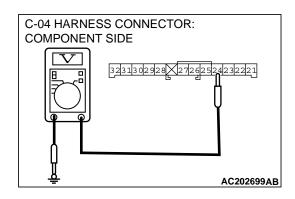


STEP 10. Measure the combination meter for continuity.

- (1) Remove the combination meter.
- (2) Remove the ABS warning light bulb. Then measure the resistance between the bulb terminals.
- (3) Install the ABS warning light bulb to the combination meter, and then measure the resistance between connector C-04 terminal 24 and connector C-05 terminal 10. The resistance reading at this time should be much the same as the resistance measured at step (2).
- Q: Are the two resistance values extremely different each other?

YES: Replace the combination meter (printed circuit board).

NO: Go to Step 11.

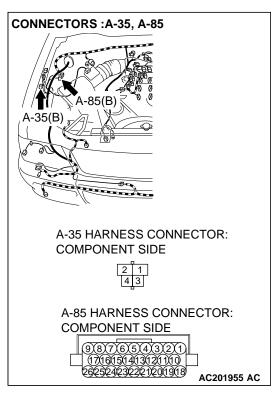


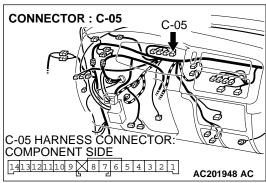
STEP 11. Measure the combination meter power supply circuit.

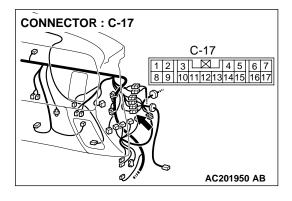
- (1) Disconnect connector C-04, and check at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 24 and ground. It should be approximately 12 volts (battery positive voltage.)

Q: Is battery positive voltage (approximately 12 volts) present?

YES: Go to Step 12.
NO: Go to Step 14.





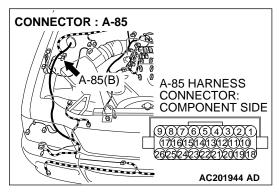


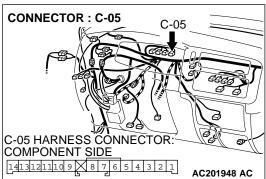
STEP 12. Check the combination meter connectors C-05, C-17, A-35 and A-85 for loose, corroded or damaged terminals, or terminals pushed back in the connector. Check connectors C-05, C-17, A-35 and A-85. (Refer to GROUP 00E, Harness Connector Inspection P.00E-2.)

Q: Are the connectors and terminals in good condition?

YES: Repair it and then go to Step 16.

NO: Go to Step 13.





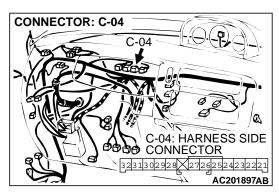
STEP 13. Check for continuity between combination meter connector C-05 (terminal No. 10) and the ABS-ECU connector (terminal No.16).

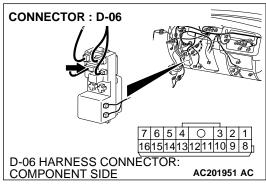
Check for continuity between combination meter connector C-05 and ABS-ECU connector A-85.

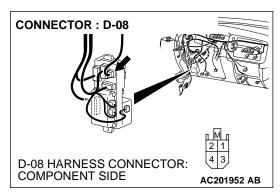
Q: Is there the continuity between combination meter connector C-05 (terminal No.10) and ABS-ECU connector A-85 (terminal No.16)?

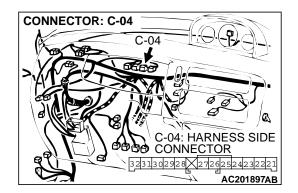
YES: Go to Step 16.

NO: Repair the harness wire and then go to Step 16.









STEP 14. Check connectors C-04, D-06 and D-08 for loose, corroded or damaged terminals, or terminals pushed back in the connector.

Check connectors C-04, D-06 and D-08. (Refer to GROUP 00E, Harness Connector Inspection P.00E-2.)

Q: Are the connectors and terminals in good condition?

YES: Repair it and then go to Step 16.

NO: Go to Step 15.

STEP 15. Check for continuity between the ignition switch (IG1) and the combination meter connector C-04 (terminal No. 24).

Q: Is there any continuity (less than 2 ohms) between the ignition switch (IG1) and combination meter connector C-04 (terminal No. 24)?

YES: Go to Step 16.

NO: Repair the harness wire and then go to Step 16.

STEP 16. Retest the system.

Q: Does the ABS warning light illuminate for 3 seconds when the ignition switch is turned to the "ON" position with engine stopped or upon start-up?

YES: The procedure is complete.

NO: Return to Step 1.

INSPECTION PROCEDURE 3: The ABS Warning Light Remains Illuminated after the Engine is Started.

NOTE: This diagnosis procedure is limited to cases where communication with the scan tool is possible (ABS-ECU power supply is normal) and no diagnostic trouble code outputs.

ABS Warning Light Circuit

Refer to P.35C-49.

CIRCUIT OPERATION

Refer to P.35C-49.

TECHNICAL DESCRIPTION (COMMENT)

The cause is probably the ABS-ECU, ABS relay and hydraulic unit malfunction.

TROUBLESHOOTING HINTS (The most likely causes for this condition:)

- Damaged wiring harness
- · Malfunction of hydraulic unit
- Malfunction of ABS relay

DIAGNOSIS

Required Special Tool:

MB991223: Harness Set

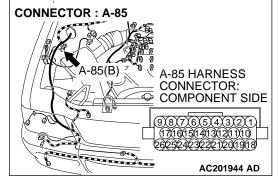
STEP 1. Check the ABS warning light circuit at ABS-ECU connector A-85.

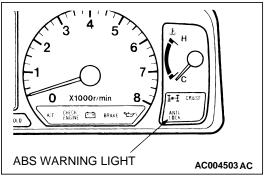
- (1) Disconnect ABS-ECU connector A-85.
- (2) Turn the ignition switch to the "ON" position.

Q: Is the ABS warning light illuminate?

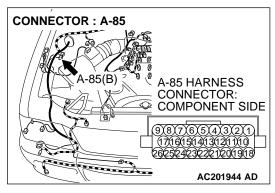
YES: Go to Step 2.

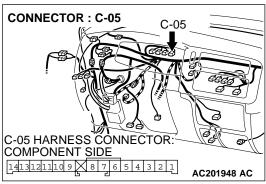
NO: Replace the ABS-ECU and then go to Step 3.

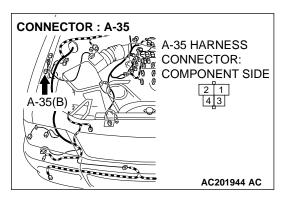


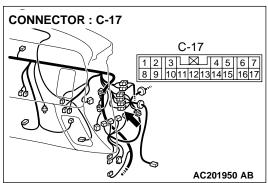


STEP 2. Check the harness wires between ABS-ECU connector A-85 (terminal No. 16) and ABS warning light connector C-05 (terminal No 10).









NOTE: After inspecting intermediate connector C-17 and ABC relay connector A-35, inspect the wire. If the intermediate connector C-17 and ABS relay connector A-35 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2.

Q: Are any harness wires between ABS-ECU connector A-85 (terminal No. 16) and ABS warning light connector C-05 (terminal No. 10) damaged?

YES: Repair them and then go to Step 3.

NO: Go to Step 3.

STEP 3. Retest the system.

Q: Does the ABS warning light turn off 3 seconds after start-up?

YES: The procedure is complete.

NO: Return to Step 1.

INSPECTION PROCEDURE 4: Brake Operation is Abnormal.

TECHNICAL DESCRIPTION (COMMENT)

The cause depends on driving and road surface conditions, so diagnosis may be difficult. However, if no diagnostic trouble code is displayed, carry out the following inspection.

TROUBLESHOOTING HINTS

The most likely cause for this condition:

Malfunction of the hydraulic unit

DIAGNOSIS

Check the hydraulic unit.

 Refer to P.35B-58. If the hydraulic unit is malfunctioning, replace it. Then check that the malfunction symptom is eliminated.

DATA LIST REFERENCE TABLE

M1352011500315

The following items can be read by the scan tool from the ABS-ECU input data.

1. When the system is normal

MUT-II SCAN TOOL DISPLAY	NO.	INSPECTION ITEM	INSPECTION REQUIREMENT	NORMAL VALUE
BATT. VOLTAGE	16	ABS-ECU power supply voltage	Ignition switch power supply voltage and valve monitor voltage	9 – 16 V
FL SNSR	12	Front left wheel speed sensor	Drive the vehicle	Vehicle speeds displayed on the
FR SNSR	11	Front right wheel speed sensor		speedometer and scan tool are identical.
RL SNSR	14	Rear left wheel speed sensor		
RR SNSR	13	Rear right wheel speed sensor		
STOPLIGHT	33	Stoplight switch	Depress the brake pedal.	ON
SW			Release the brake pedal.	OFF

^{2.} When the ABS-ECU shuts off the ABS operation.

When the diagnostic trouble system stops the ABS-ECU, the scan tool display data will be unreliable.

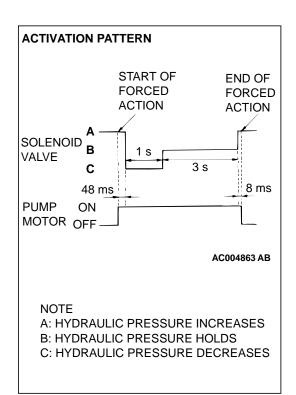
M1352011600282

ACTUATOR TEST REFERENCE

The scan tool activates the following actuators for testing.

NOTE: If the ABS-ECU is inoperative, actuator testing cannot be carried out.

NOTE: Actuator testing is only possible when the vehicle is stationary. If the vehicle speed during actuator testing exceeds 10 km/h (6 mph), forced actuation will be canceled.



ACTUATOR TEST SPECIFICATIONS

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

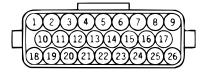
CHECK AT ABS-ECU

M1352011800316

TERMINAL VOLTAGE CHECK CHART

NOTE: Do not measure terminal voltage for approximately three seconds after the ignition switch is turned to the "ON" position. The ABS-ECU performs the initial check during that period.

- 1. Measure the voltages between terminals (32) or (34) (ground terminals) and each respective terminal.
- 2. The terminal layouts are shown in the illustrations.



_	$\overline{}$				
l	31	32			
l	33	34			
L					

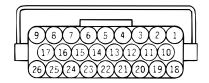
AC004864

CONNECTOR TERMINAL NO.	SIGNAL	INSPECTION REQUIREMENT		NORMAL CONDITION
9	ABS-ECU power supply	Ignition switch: "ON"		Battery positive voltage
		Ignition switch:	"START"	0 V
13	Input from stoplight switch	Stoplight switch: "ON" Stoplight switch: "OFF"		Battery positive voltage
				Battery positive voltage
16	Control output to ABS warning light relay	Ignition switch:	The light is switch off.	2 V or less
		"ON"	The light is illuminated.	Battery positive voltage
23	Scan tool	Connect the scan tool.		Serial communication with scan tool
		Do not connect the scan tool.		1 V or less
24	Input from diagnostic	Connect the sca	an tool.	0 V
	indication selection	Do not connect the scan tool.		Approximately 12 V
31	Solenoid valve power supply	Always		Battery positive voltage
33	Motor power supply	1		

RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS

- 1. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the ABS-ECU connectors before checking resistance and continuity.
- 2. Check between the terminals indicated in the table below.
- 3. The terminal layouts are shown in the illustration.





AC004865

CONNECTOR TERMINAL NO.	SIGNAL	NORMAL CONDITION
1 – 2	Rear-right wheel speed sensor	1.3 – 1.5 kΩ
3 – 4	Rear-left wheel speed sensor	1.3 – 1.5 kΩ
18 –19	Front-right wheel speed sensor	1.3 – 1.5 kΩ
20 – 21	Front-left wheel speed sensor	1.3 – 1.5 kΩ
32 – body ground	Solenoid valve ground	Continuity (Less than 2 ohms)
34 – body ground	Motor ground	Continuity (Less than 2 ohms)

SPECIAL TOOLS

M1352000600318

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
B991502	MB991502 Scan tool (MUT-II)	MB991496-OD	For checking of ABS [Diagnostic trouble code display when using the scan tool (MUT-II)]
MB991529	MB991529 Diagnostic trouble code check harness	Tool not necessary if scan tool (MUT-II) is available.	For checking of ABS (Diagnostic trouble code display when using the ABS warning light)
A B C C MB991223AB	MB991223 Harness set A: MB991219 Inspection harness	MB991223 MB991709-01	Wheel speed sensor output voltage measurement

ON-VEHICLE SERVICE

BLEEDING

M1352001500187

⚠ CAUTION

Use the specified brake fluid. Don't use a mixture of the specified brake fluid and another non-specified fluid.

Specified brake fluid: Conforming to DOT 3 or DOT 4

BLEEDING THE MASTER CYLINDER

Refer to GROUP 35A, On-vehicle Service P.35A-22.

BLEEDING THE BRAKE LINE

⚠ CAUTION

Be sure to filter/strain the brake fluid being added to the master cylinder reservoir tank. Debris may damage the hydraulic unit.

Refer to GROUP 35A, On-vehicle Service P.35A-22.

TSB Revision

WHEEL SPEED SENSOR OUTPUT VOLTAGE MEASUREMENT

M1352001600247



- MB991219: Inspection Harness
- 1. Lift up the vehicle and release the parking brake.
- Disconnect the ABS-ECU connector, and then use special tool MB991219 to measure the output voltage at the harness side connector.

TERMINAL NO.				
Front left	Front right	Rear left	Rear right	
20	18	3	1	
21	19	4	2	

Manually turning the wheel to be measured by 1/2 to 1 turn/ second, measure the output voltage with a voltmeter or oscilloscope.

Output voltage:

- When measured with voltmeter: 70 mV or more
- When measured with oscilloscope (maximum voltage): 200 mV or more

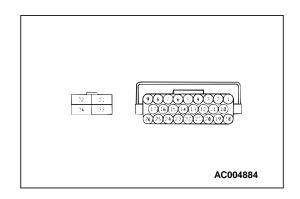
Probable causes of low output voltage

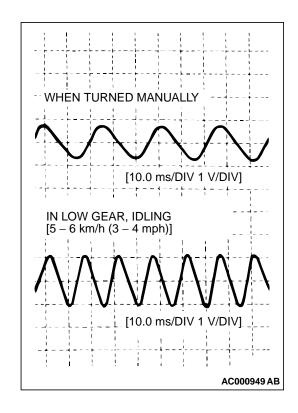
- Wheel speed sensor pole piece-to-ABS rotor clearance too large
- Faulty wheel speed sensor
- 4. To observe the waveform with an oscilloscope:
- Front Wheels:
 - Shift into low gear and drive the wheels.
- Rear Wheels:

Turn the wheels manually at a constant speed.

NOTE: Waveform may also be observed by driving the vehicles.

NOTE: The output waveform is low when the wheel speed is low. Similarly, it will be higher as the wheel speed increases. Waveform may also be observed by driving the vehicle.





POINTS IN WAVEFORM MEASUREMENT

SYMPTOM	PROBABLE CAUSES	REMEDY
Too small or zero waveform	Faulty wheel speed sensor	Replace sensor
amplitude	Incorrect pole piece-to-ABS rotor clearance	Adjust clearance
Waveform amplitude fluctuates excessively (This is no problem if the minimum amplitude is 100 mV or more).	Axle hub eccentric or with large runout	Replace hub
Noisy or disturbed waveform	Open circuit in wheel speed sensor	Replace sensor
	Open circuit in harness	Repair harness
	Incorrectly mounted wheel speed sensor	Mount correctly
	ABS rotor with missing or damaged teeth	Replace ABS rotor

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

HYDRAULIC UNIT CHECK

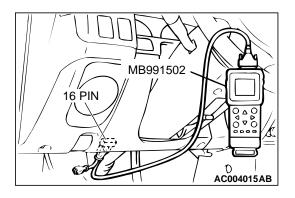
M1352001700255

Required Special Tool:

MB991502: Scan Tool (MUT-II)

⚠ CAUTION

- The roller of the braking force tester and the tire should be dry during testing.
- When testing the front brakes, apply the parking brake.
 When testing the rear brakes, stop the front wheels with chocks.
- 1. Jack up the vehicle. Then support the vehicle with rigid racks at the specified jack-up points or place the front or rear wheels on the rollers of the braking force tester.
- 2. Release the parking brake, and feel the drag force (drag torque) on each road wheel. When using the braking force tester, take a reading of the brake drag force.



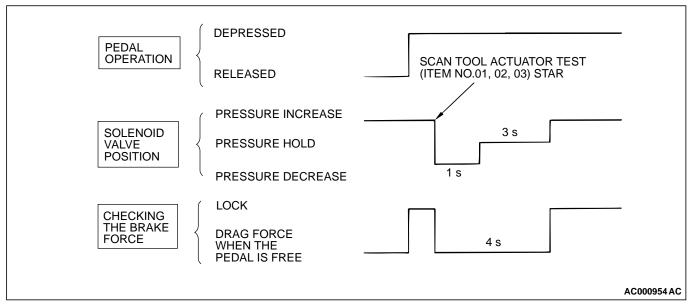
⚠ CAUTION

To prevent damage to scan tool MB991502, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991502.

- 3. Turn the ignition switch to the "LOCK" (OFF) position and set scan tool MB991502 as shown in the illustration.
- 4. After checking that the selector lever is in neutral, start the engine.
- 5. Use scan tool MB991502 to force-drive the actuator.

 NOTE: The ABS system will switch to the scan tool mode and the ABS warning light will illuminate.

NOTE: When the ABS has been interrupted by the fail-safe function, scan tool MB991502 actuator testing cannot be used.



6. Turn the wheel by hand and check the change in braking force when the brake pedal is depressed. When using the braking force tester, depress the brake pedal until the braking force is at the following values, and check that the braking force changes to the brake drag force in step 2 when the actuator is force-driven. The result should be as shown in the diagram above.

Front wheel	785 – 981 N (176 – 220 lb)
Rear wheel	294 – 490 N (66 – 110 lb)

7. If the result of inspection is abnormal, repair according to the Diagnosis Table below.

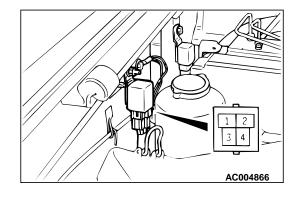
Diagnosis Table

SCAN TOOL DISPLAY	NO.	OPERATION	NORMAL CONDITION	ABNORMAL CONDITION	PROBABLE CAUSE	REMEDY
FR VALVE M	01	Depress brake pedal to lock wheel.	Brake force releases for four seconds	Wheel does not lock when brake pedal is	Clogged brake line other than hydraulic unit	Check and clean brake line.
FL VALVE M	02	2. Using scan tool MB991502, select the wheel to be checked and force the actuator to operate. 3. Turn the selected wheel manually to	after locking.	depressed.	Clogged hydraulic circuit in hydraulic unit	Replace hydraulic unit assembly.
RR VALVE M	03		the actuator to operate. 3. Turn the selected		Brake force is not released.	Incorrect hydraulic unit brake tube connection
		check the change of brake force.			Hydraulic unit solenoid valve not functioning correctly	Replace hydraulic unit assembly.

8. After inspection, disconnect the scan tool immediately after turning the ignition switch to the "LOCK" (OFF) position.

ABS POWER RELAY CHECK

M1352011000086



BATTERY VOLTAGE	TESTER CONNECTION	SPECIFIED CONDITION
Not applied	3 – 4	Open circuit
 Connect terminal 2 to the positive battery terminal Connect terminal 1 to the negative battery terminal 	3 – 4	Less than 2 ohms

DISCHARGED BATTERY

M1352003500279

⚠ WARNING

If the ABS is not operating, the vehicle posture will be unstable during braking, do not drive the vehicle with the ABS-ECU connector disconnected or with the ABS not operating for any other reason.

If the engine is started using a booster cable when the battery is completely flat, and the vehicle is then driven without waiting for the battery to be recharged, the engine may misfire and it may not be possible to drive the vehicle. This is because the ABS consumes a large amount of current when carrying out its initial checks. If this happens, recharge the battery fully.

TSB Revision

MASTER CYLINDER AND BRAKE BOOSTER

REMOVAL AND INSTALLATION

Refer to GROUP 35A, Master Cylinder and Brake Booster P.35A-33.

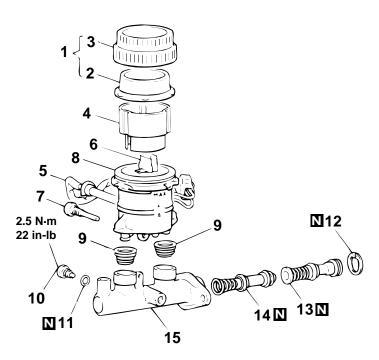
M1352004000169

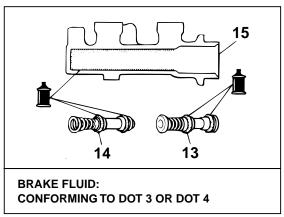
MASTER CYLINDER ASSEMBLY DISASSEMBLY AND ASSEMBLY

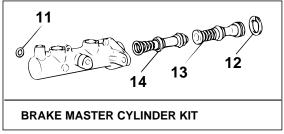
M1352004500164

⚠ CAUTION

Do not disassemble the primary and secondary and secondary piston assemblies







AC004911AB

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

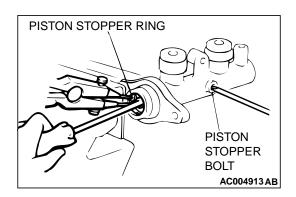
DISASSEMBLY STEPS

- 9. RESERVOIR SEAL
- 10. PISTON STOPPER BOLT
- 11. GASKET

<<A>>>

<<A>>>

- 12. PISTON STOPPER RING
- 13. PRIMARY PISTON ASSEMBLY
- 14. SECONDARY PISTON ASSEMBLY
- 15. MASTER CYLINDER BODY



DISASSEMBLY SERVICE POINT

<<A>> PISTON STOPPER BOLT/PISTON STOPPER RING DISASSEMBLY

While depressing the piston, remove the piston stopper bolt and piston stopper ring.

INSPECTION

M1352004100058

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

HYDRAULIC UNIT

REMOVAL AND INSTALLATION

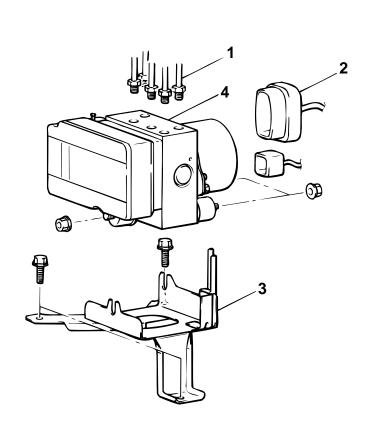
M1352008600237

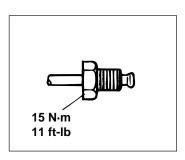
NOTE: The ABS-ECU is integrated with the hydraulic unit.

Ρı	re-removal Operation
•	Brake Fluid Draining

Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding (Refer to P.35A-22.)





AC004912 AB

REMOVAL STEPS

>>**A**<< 1. BRAKE TUBE

<<A>>>

2. HARNESS CONNECTOR

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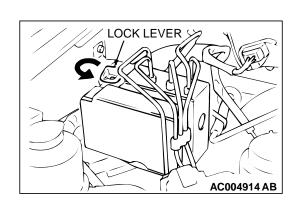
REMOVAL STEPS (Continued)

- 3. BRACKET ASSEMBLY
- 4. HYDRAULIC UNIT

REMOVAL SERVICE POINTS

<<A>> HARNESS CONNECTOR REMOVAL

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



<> HYDRAULIC UNIT REMOVAL

⚠ WARNING

The hydraulic unit is heavy. Use care when removing it.

⚠ CAUTION

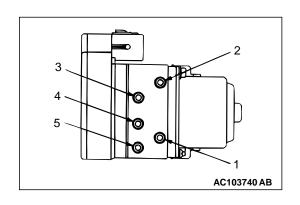
- The hydraulic unit cannot be disassembled. Never loosen its nuts or bolts.
- Do not drop or shock the hydraulic unit.
- Do not turn the hydraulic unit upside down or lay it on its side.

INSTALLATION SERVICE POINT

>>A<< BRAKE TUBE INSTALLATION

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

- 1. Master cylinder <Front system>
- 2. Master cylinder <Rear system>
- 3. Rear brake
- 4. Front brake <RH>
- 5. Front brake <LH>



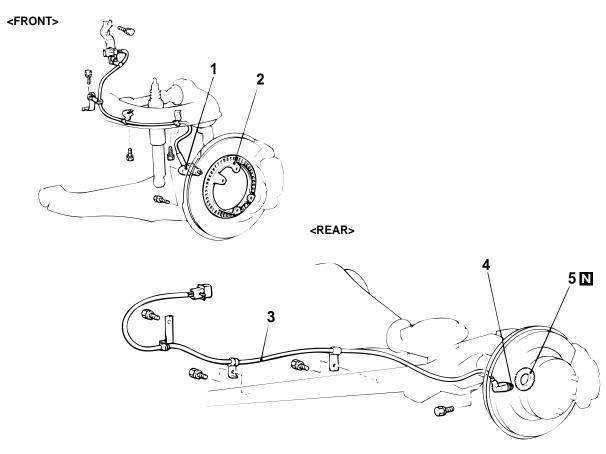
WHEEL SPEED SENSOR

REMOVAL AND INSTALLATION

M1352008300269

Post-installation Operation

• Wheel Speed Sensor Output Voltage Measurement (Refer to P.35B-57.).



AC004908AB

FRONT WHEEL SENSOR REMOVAL STEPS

- 1. FRONT SPEED SENSOR
- 2. FRONT ABS ROTOR (REFER TO **GROUP 26, FRONT HUB** ASSEMBLY P.26-13.)

<<A>>>

REMOVAL STEPS

REAR WHEEL SENSOR

- 3. **REAR SPEED SENSOR**
- 4. O-RING
- REAR ABS ROTOR (REFER TO **GROUP 27, AXLE SHAFT** <Vehicles with drum brake>P.27-25 , <Vehicles with disc brake>P.27-36 .)

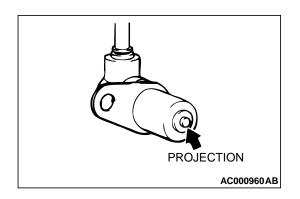
<<A>>>

REMOVAL SERVICE POINTS

<<A>> FRONT SPEED SENSOR/REAR SPEED SENSOR REMOVAL

⚠ CAUTION

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



INSPECTION

M1352008400244

SPEED SENSOR CHECK

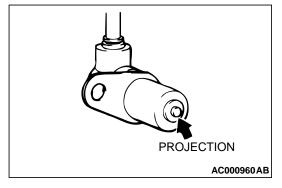
 Check whether any metallic foreign material has adhered to the projection at the speed sensor tip. Remove any foreign material. Also check whether the pole piece is damaged. Replace it with a new one if it is damaged.

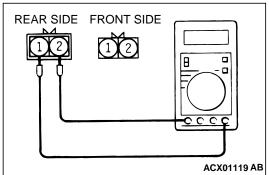
NOTE: The projection can become magnetized due to the magnet inside the speed sensor, causing foreign material to easily adhere to it. The projection may not be able to correctly sense the wheel rotation speed if foreign matter is on it or if it is damaged.

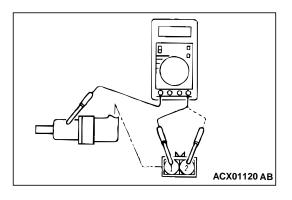
2. Measure the resistance between the speed sensor terminals.

Standard value: $1.0 - 1.5 \text{ k}\Omega$

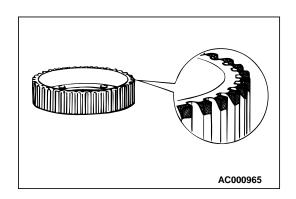
3. If the internal resistance of the speed sensor is not within the standard value, replace it with a new speed sensor.







- 4. Remove all connections from the speed sensor. The circuit should be open between terminals (1) and (2) and the body of the speed sensor. If the circuit is not open, replace with a new speed sensor.
- 5. Check the speed sensor cable for breakage, damage or disconnection. Replace with a new one if a problem is found. NOTE: When checking for cable damage, remove the cable clamp part from the body and then gently bend and pull the cable near the clamp.



TOOTHED ABS ROTOR CHECK

Check whether the ABS rotor teeth are broken or deformed. Replace the driveshaft BJ assembly for the front side or the driveshaft BJ assembly for the rear side, respectively, if the teeth are damaged or deformed.

SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1352012400225

ITEM	SPECIFICATION		
Hydraulic unit			
Brake tube flare nut	15 N·m (11 ft-lb)		
Master cylinder and brake booster			
Piston stopper bolt	2.5 N·m (22 in-lb)		

SERVICE SPECIFICATIONS

M1352000300317

ITEM	STANDARD VALUE
Wheel speed sensor internal resistance $k\Omega$	1.3 – 1.5
Wheel speed sensor insulation resistance $k\Omega$	100

NOTES