
GROUP 35B

ANTI-LOCK BRAKING SYSTEM (ABS)

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GENERAL DESCRIPTION

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ABS has been adopted as optional equipment in vehicles to maintain directional stability and steering performance during sudden braking.

The ABS control method used is a 4-sensor, 4-channel method which provides independent control for all wheels. The system has the following features.

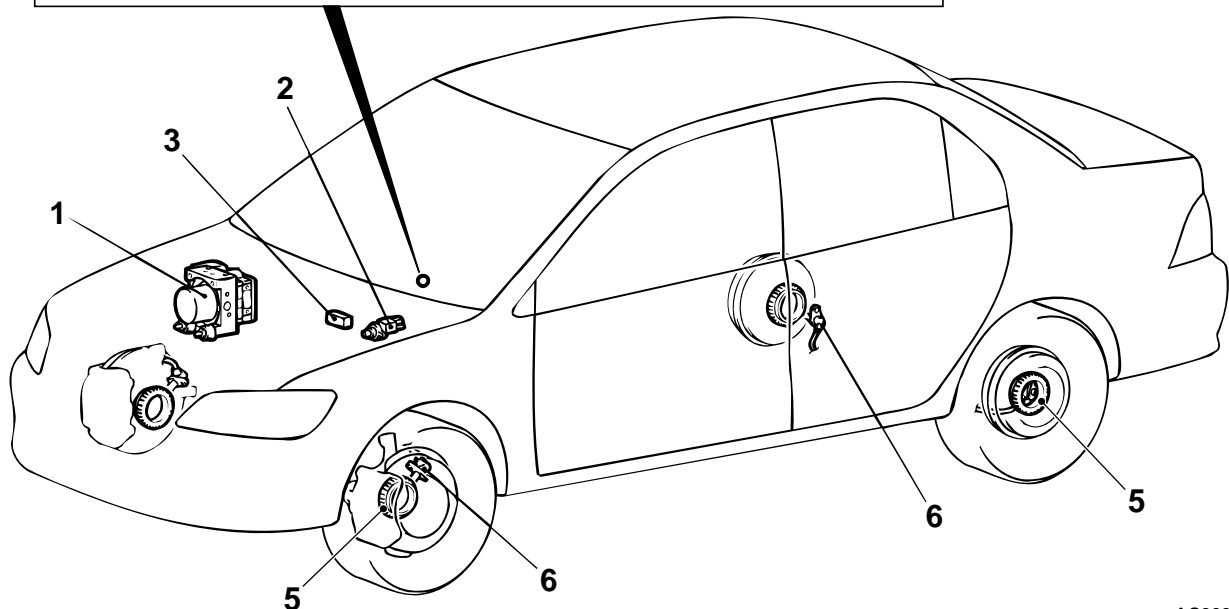
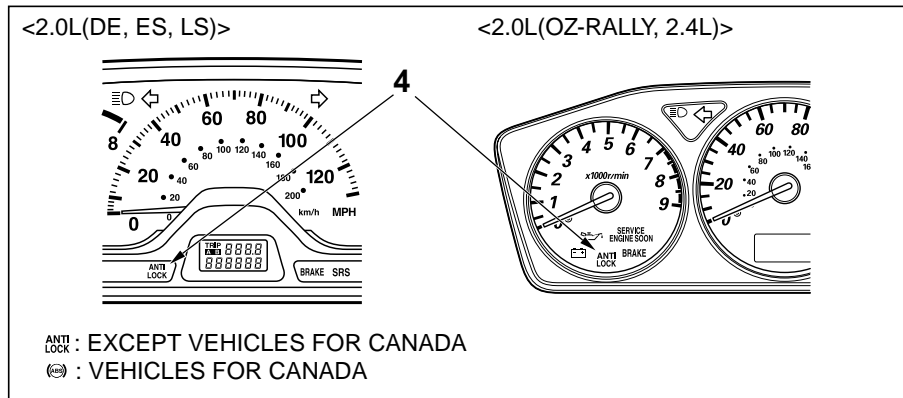
EBD CONTROL

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:

- EBD (Electronic Brake-force Distribution system) control has been added to provide the ideal braking force for the rear wheels.
- Fail-safe function which ensures that safety is maintained
- Diagnosis function which provides improved serviceability
- 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, 4-channel type
Speed sensor	Magnet coil type on 4-wheels
Front ABS rotor teeth	43
Rear ABS rotor teeth	43

CONSTRUCTION DIAGRAM



AC309194 AB

1. HYDRAULIC UNIT ASSEMBLY
(INTEGRATED WITH ABS-ECU)
2. STOP LIGHT SWITCH
3. DATA LINK CONNECTOR

4. ABS WARNING LIGHT
5. ABS ROTOR
6. WHEEL SPEED SENSOR

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.

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.

ANTI-LOCK BRAKING SYSTEM (ABS) DIAGNOSIS

INTRODUCTION TO ANTI-LOCK BRAKING SYSTEM DIAGNOSIS

M1352012500299

The anti-lock brake 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.

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.

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.

When you check if an ABS DTC will be displayed again after the DTC has been erased, you should duplicate 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.

ABS DIAGNOSTIC TROUBLESHOOTING STRATEGY

M1352011100384

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.
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-36](#).
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. Recreate 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-11](#).
 - If you cannot get the same ABS DTC to set again, the malfunction is intermittent. Refer to GROUP 00, How to use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunctions [P.00-6](#).

DIAGNOSIS FUNCTION

M1352011200712

HOW TO CONNECT THE SCAN TOOL

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)

⚠ CAUTION

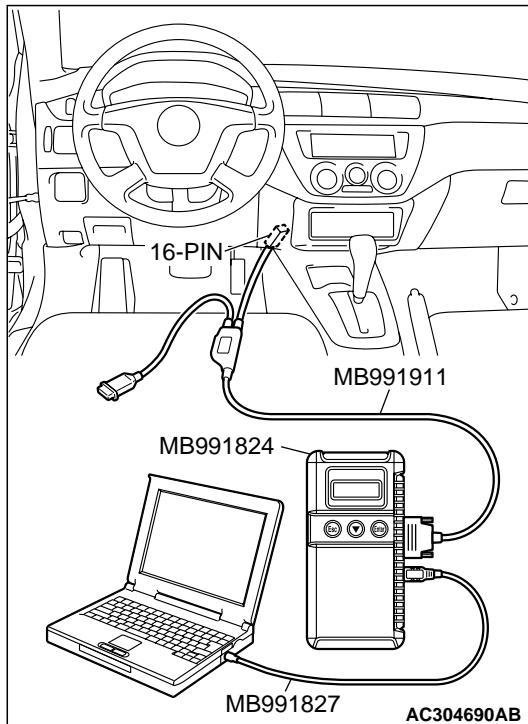
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

1. Ensure that the ignition switch is at the "LOCK" (OFF) position.
2. Start up the personal computer.
3. Connect special tool MB991827 to special tool MB991824 and the personal computer.
4. Connect special tool MB991911 to special tool MB991824.
5. Connect special tool MB991911 to the data link connector.
6. Turn the power switch of special tool MB991824 to the "ON" position.

NOTE: When special tool MB991824 is energized, special tool MB991824 indicator light will be illuminated in a green color.

7. Start the MUT-III system on the personal computer.

NOTE: Disconnecting scan tool MB991958 is the reverse of the connecting sequence, making sure that the ignition switch is at the "LOCK" (OFF) position.

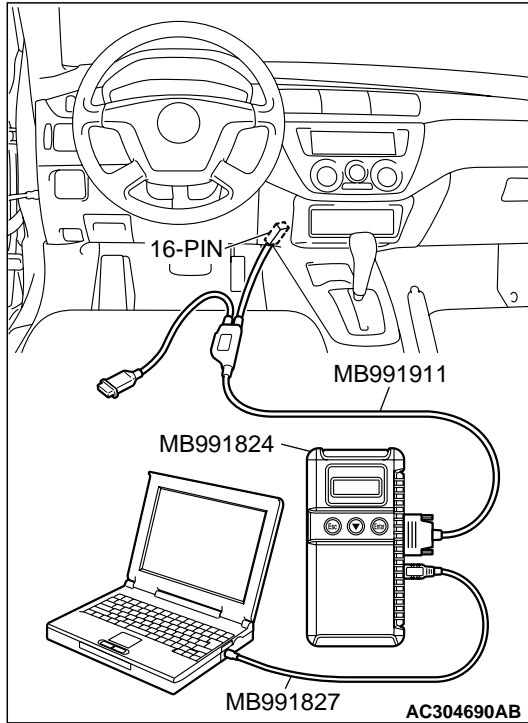


READING DIAGNOSTIC TROUBLE CODES

WHEN USING SCAN TOOL MB991958

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)



⚠ CAUTION

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

NOTE: If the battery voltage is low, diagnostic trouble codes will not be set. Check the battery if scan tool MB991958 does not display.

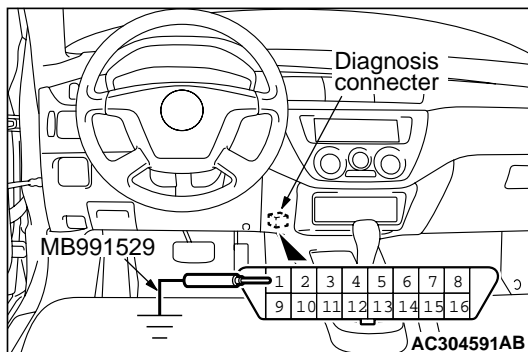
1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "ABS" from the "CHASSIS" tab.
6. Select "MITSUBISHI."
7. Select "Diagnostic Trouble Code."
8. If a DTC is set, it is shown.

WHEN USING THE ABS WARNING LIGHT

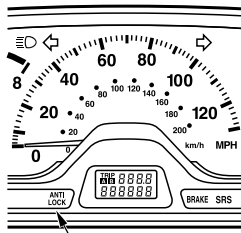
Required Special Tool:

- MB991529: Diagnostic Trouble Code Check Harness

1. Turn the ignition switch to the "LOCK" (OFF) position.
2. Use special tool MB991529 to earth terminal number 1 (diagnostic control terminal) of the data link connector.
3. Turn the ignition switch to the "ON" position.

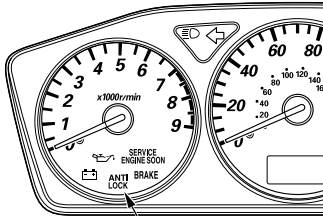


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ABS WARNING LIGHT

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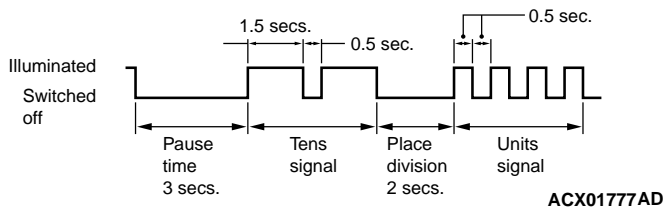
ABS WARNING LIGHT

ANTI LOCK : EXCEPT VEHICLES FOR CANADA
 (CANADA) : VEHICLES FOR CANADA

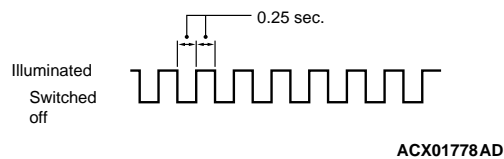
AC309195AB

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

When the diagnostic trouble code No.24 is set



When no diagnostic trouble code is set



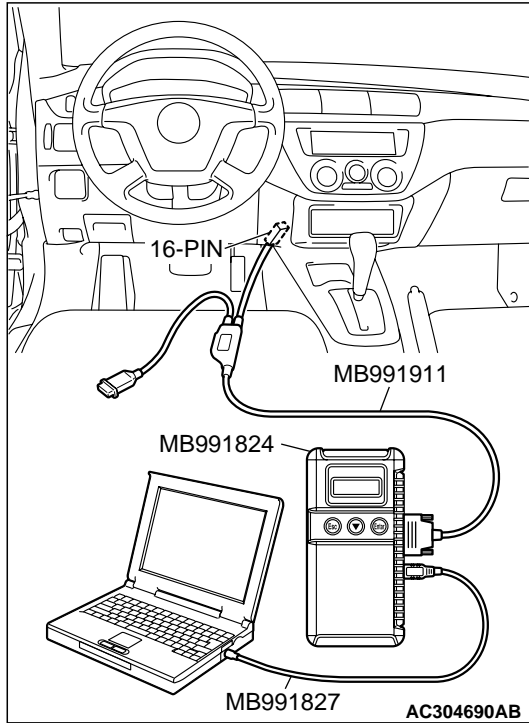
5. Turn the ignition switch to the "LOCK" (OFF) position.
6. Disconnect special tool MB991529.

ERASING DIAGNOSTIC TROUBLE CODES

WHEN USING SCAN TOOL MB991958

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)

**⚠ CAUTION**

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

NOTE: If the battery voltage is low, diagnostic trouble codes will not be set. Check the battery if scan tool MB991958 does not display.

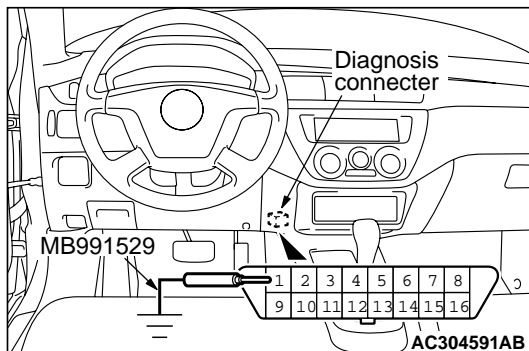
1. Connect scan tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System select."
5. Choose "ABS" from the "CHASSIS" tab.
6. Select "MITSUBISHI."
7. Select "Diagnostic Trouble Code."
8. If a DTC is set, it is shown.
9. Choose "DTC erase" to erase the DTC.

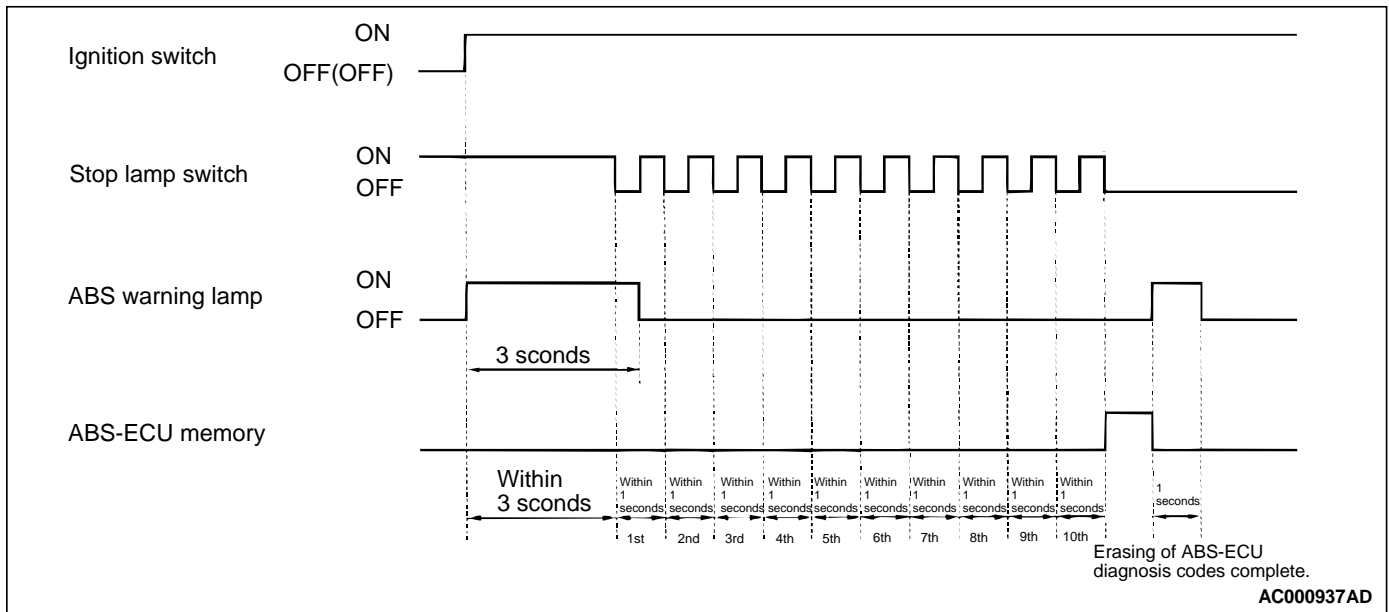
WHEN NOT USING SCAN TOOL MB991958**Required Special Tool:**

- MB991529: Diagnostic Trouble Code Check Harness

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

1. Turn the ignition switch to the "LOCK" (OFF) position.
2. Use special tool MB991529 to earth terminal number 1 of the data link connector.





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

DIAGNOSTIC TROUBLE CODE CHART

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

DTC	INSPECTION ITEM	DIAGNOSTIC CONTENT	REFERENCE PAGE
11	Front right wheel speed sensor	Open circuit or short circuit	P.35B-11
12	Front left wheel speed sensor		
13	Rear right wheel speed sensor		
14	Rear left wheel speed sensor		
16	Power supply system	ABS-ECU power supply voltage below or above the standard value. Not displayed if the voltage recovers.	P.35B-23
21	Front right wheel speed sensor		P.35B-11
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	ABS front right solenoid valve		P.35B-33
42	ABS front left solenoid valve		
43	ABS rear right solenoid valve		
44	ABS rear left solenoid valve		
51	Valve relay problem (stays on)		Replace the hydraulic unit (Integrated with ABS-ECU). (Refer to P.35B-70.)
52	Valve relay problem (stays off) or ABS-ECU power supply system problem		P.35B-33
53	Motor relay problem (stays off) or ABS-ECU power supply system problem		
54	Motor relay problem (stays on)		Replace the hydraulic unit (Integrated with ABS-ECU). (Refer to P.35B-70.)
55	Motor system (seized pump motor) or ABS-ECU power supply system problem		P.35B-33
63	ABS-ECU		Replace the hydraulic unit (Integrated with ABS-ECU). (Refer to P.35B-70.)

NOTE:

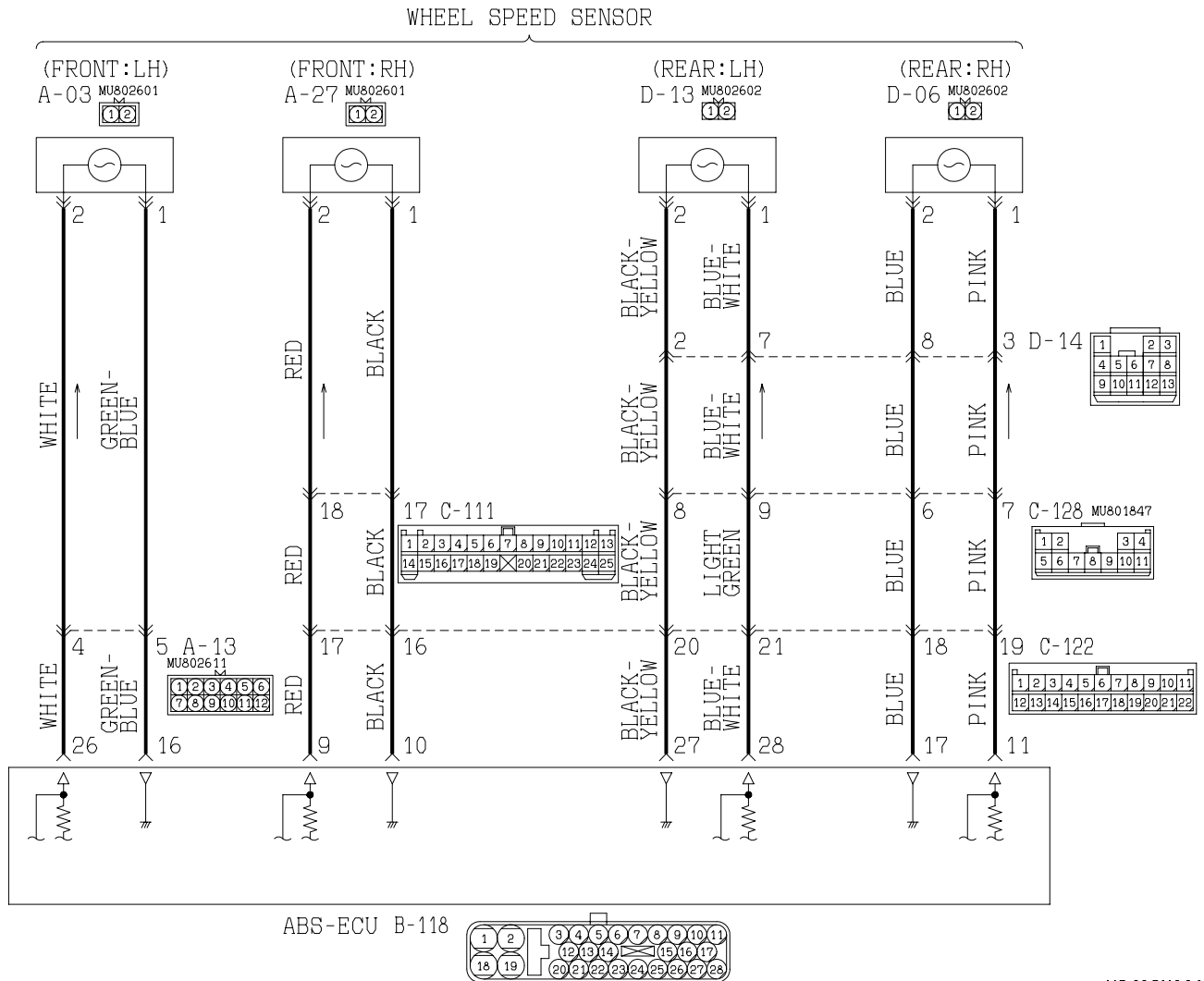
- Code No. 16 is cleared from the memory by turning the ignition switch to ACC position. When the system is properly reset, this code is also cleared from the memory.
- Code No. 52 and 63 are cleared from the memory by turning the ignition switch to ACC position.

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

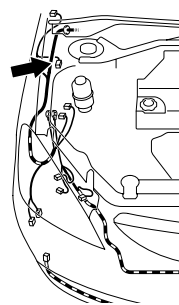
Wheel Speed Sensor Circuit



W2J02M00AA
AC100511AB

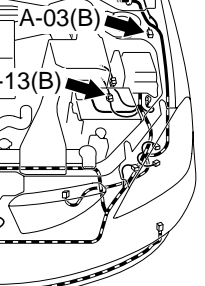
CONNECTOR : A-27

A-27(GR)

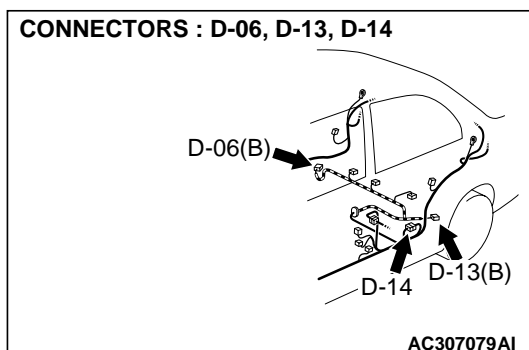
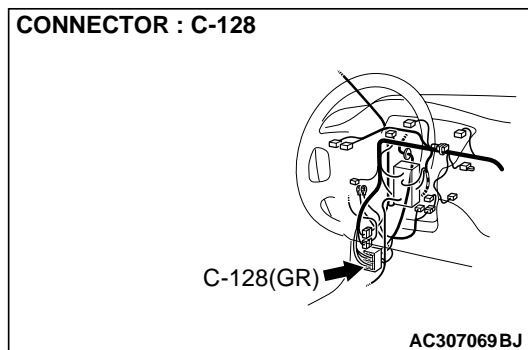
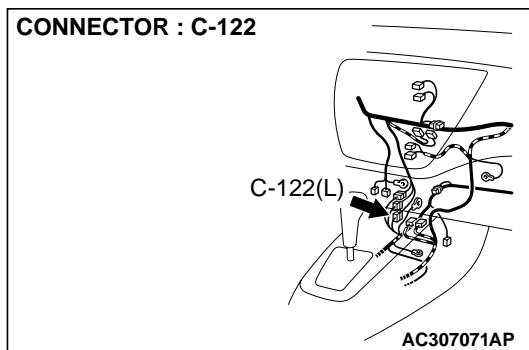
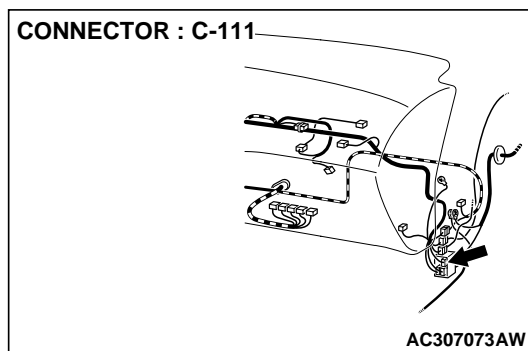
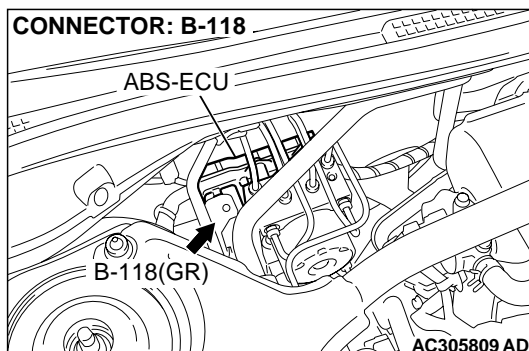


AC307064AQ

CONNECTORS : A-03, A-13



AC307066AU



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 electronic control unit (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 output when signal is not input due to breakage of the wires of one or more of the four wheel-speed sensors. DTCs 21, 22, 23, 24 are output 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 are 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 or 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
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)
- MB991529: Diagnostic Trouble Code Check Harness

STEP 1. Using scan tool MB991958, check data list.

⚠ CAUTION

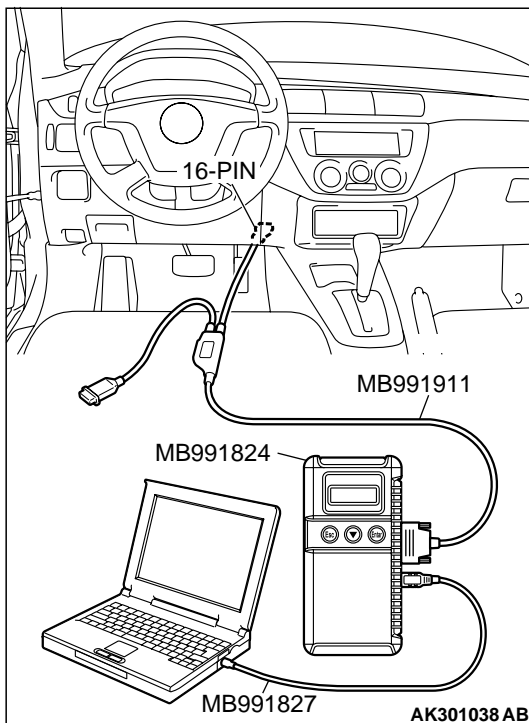
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine.
- (3) Set scan tool MB991958 to the data reading mode, and check the data list items by driving the vehicle.
 - Item 11 (DTC 11 is set): Front right ABS sensor
 - Item 12 (DTC 12 is set): Front left ABS sensor
 - Item 13 (DTC 13 is set): Rear right ABS sensor
 - Item 14 (DTC 14 is set): Rear left ABS sensor
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

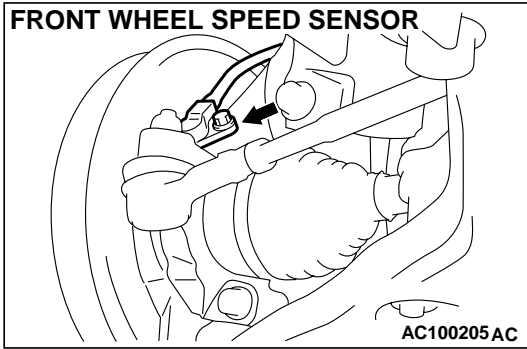
Q: Is the wheel speed sensor input normal?

YES : This malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope With Intermittent Malfunction P.00-6.

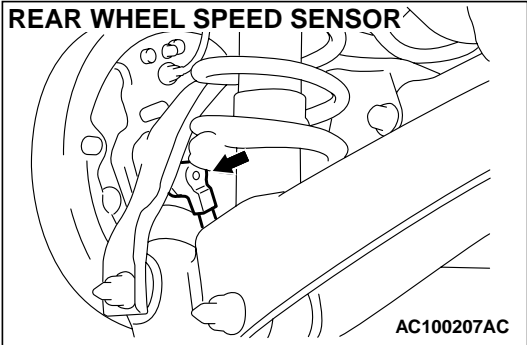
NO : Go to Step 2.



FRONT WHEEL SPEED SENSOR



REAR WHEEL SPEED SENSOR



STEP 2. Check the wheel speed sensor installation.

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

YES : Go to Step 3.

NO : Install it properly (Refer to [P.35B-72.](#)) and then go to Step 11.

STEP 3. Inspect the wheel speed sensor or ABS rotor.

Refer to [P.35B-73.](#)

Check items:

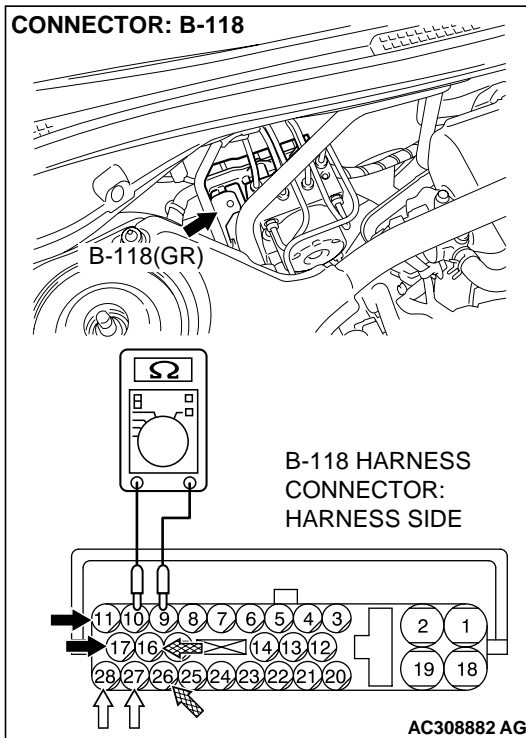
- Wheel speed sensor internal resistance: 1.24 – 1.64 k Ω
- Insulation between the wheel speed sensor body and the connector terminals
- Toothed ABS rotor check

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

YES : Replace it and then go to Step 11.

NO : Go to Step 4.

CONNECTOR: B-118



STEP 4. Check wheel speed sensor circuit at the ABS-ECU connector B-118.

- (1) Disconnect the connector B-118 and measure at the harness side.
- (2) Measure the resistance between the ABS-ECU connector terminals 16 and 26, 9 and 10, 27 and 28, or 11 and 17.

Standard Value: 1.24 – 1.64 k Ω

Q: Is the resistance between terminals 16 and 26, 9 and 10, 27 and 28, or 11 and 17 within the standard value?

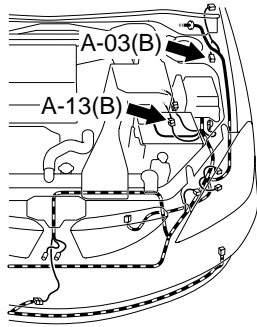
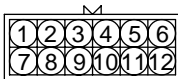
When resistances between all terminals are within the standard value. : Go to Step 9.

When resistance between terminals 16 and 26 is not within the standard value. : Go to Step 5.

When resistance between terminals 9 and 10 is not within the standard value. : Go to Step 6.

When resistance between terminals 27 and 28 is not within the standard value. : Go to Step 7.

When resistance between terminals 11 and 17 is not within the standard value. : Go to Step 8.

CONNECTORS: A-03, A-13A-03 HARNESS CONNECTOR:
HARNESS SIDE

A-13

AC307068AC

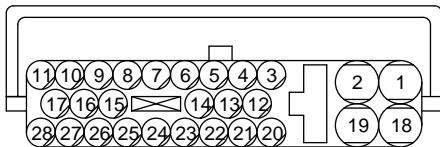
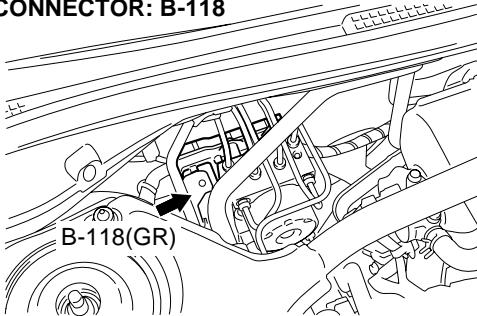
STEP 5. Check the harness wires between ABS-ECU connector B-118 terminal 16 and wheel speed sensor <front: LH> connector A-03 terminal 1 or ABS-ECU connector B-118 terminal 26 and wheel speed sensor <front: LH> connector A-03 terminal 2.

NOTE: After inspecting ABS-ECU connector B-118, intermediate connector A-13 and wheel speed sensor <front: LH> connector A-03, inspect the wire. If ABS-ECU connector B-118, intermediate connector A-13 and wheel speed sensor <front: LH> connector A-03 are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

Q: Is the harness wire between ABS-ECU connector B-118 terminal 16 and wheel speed sensor <front: LH> connector A-03 terminal 1 or ABS-ECU connector B-118 terminal 26 and wheel speed sensor <front: LH> connector A-03 terminal 2 damaged?

YES : Repair it and go to Step 11.

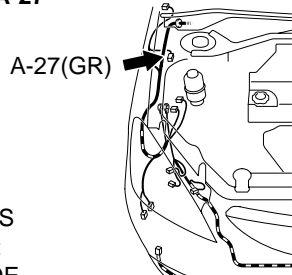
NO : Go to Step 11.

CONNECTOR: B-118B-118 HARNESS CONNECTOR:
HARNESS SIDE

AC308882 AH

STEP 6. Check the harness wires between ABS-ECU connector B-118 terminal 10 and wheel speed sensor <front: RH> connector A-27 terminal 1 or ABS-ECU connector B-118 terminal 9 and wheel speed sensor <front: RH> connector A-27 terminal 2.

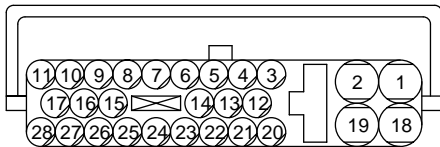
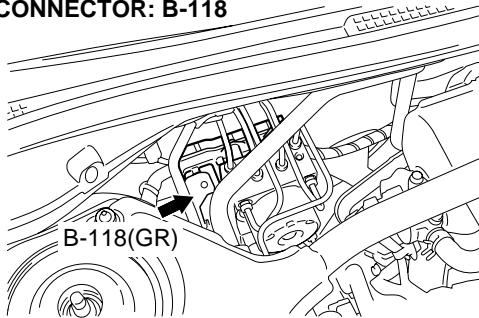
CONNECTOR : A-27



A-27 HARNESS
CONNECTOR:
HARNESS SIDE

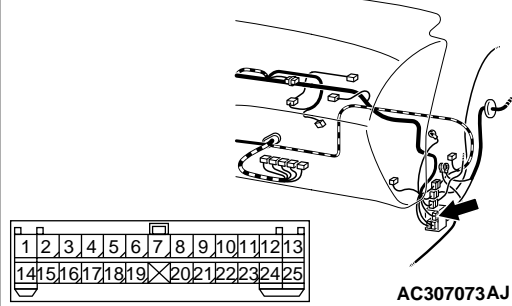
AC307064AQ

CONNECTOR: B-118



B-118 HARNESS CONNECTOR:
HARNESS SIDE

AC308882 AH

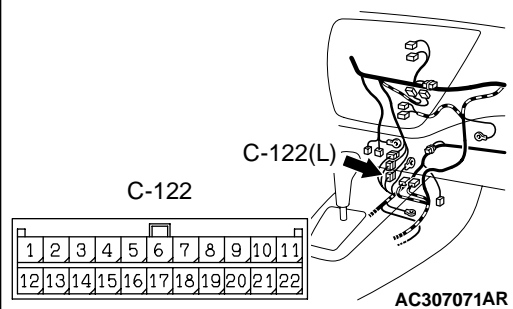
CONNECTOR : C-111

NOTE: After inspecting ABS-ECU connector B-118, intermediate connector C-111, C-122 and wheel speed sensor <front: RH> connector A-27, inspect the wire. If ABS-ECU connector B-118, intermediate connector C-111, C-122 and wheel speed sensor <front: RH> connector A-27 are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

Q: Is the harness wire between ABS-ECU connector B-118 terminal 10 and wheel speed sensor <front: RH> connector A-27 terminal 1 or ABS-ECU connector B-118 terminal 9 and wheel speed sensor <front: RH> connector A-27 terminal 2 damaged?

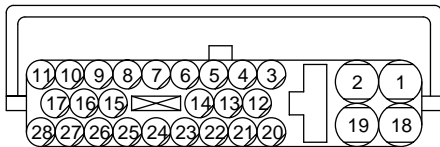
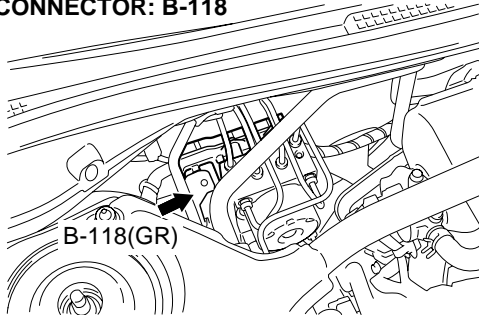
YES : Repair it and go to Step 11.

NO : Go to Step 11.

CONNECTOR : C-122

STEP 7. Check the harness wires between ABS-ECU connector B-118 terminal 28 and wheel speed sensor <rear: LH> connector D-13 terminal 1 or ABS-ECU connector B-118 terminal 27 and wheel speed sensor <rear: LH> connector D-13 terminal 2.

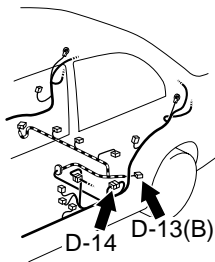
CONNECTOR: B-118



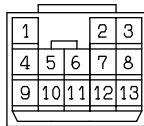
**B-118 HARNESS CONNECTOR:
HARNESS SIDE**

AC308882 AH

CONNECTORS : D-13, D-14



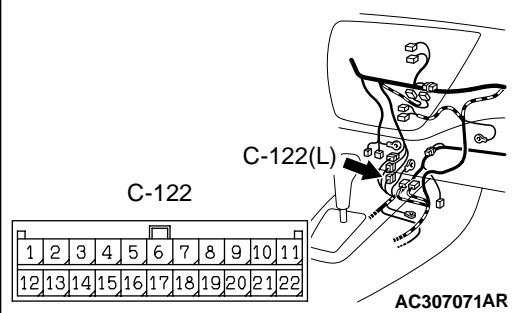
**D-13 HARNESS CONNECTOR:
HARNESS SIDE**



D-14

AC307080 AB

CONNECTOR : C-122



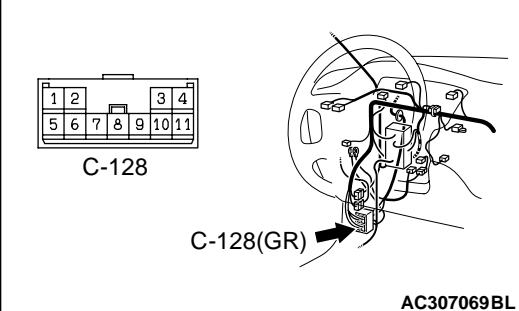
NOTE: After inspecting ABS-ECU connector B-118, intermediate connector C-122, C-128, D-14 and wheel speed sensor <rear: LH> connector D-13, inspect the wire. If ABS-ECU connector B-118, intermediate connector C-122, C-128, D-14 and wheel speed sensor <rear: LH> connector D-13 are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

Q: Is the harness wire between ABS-ECU connector B-118 terminal 28 and wheel speed sensor <rear: LH> connector D-13 terminal 1 or ABS-ECU connector B-118 terminal 27 and wheel speed sensor <rear: LH> connector D-13 terminal 2 damaged?

YES : Repair it and then go to Step 11.

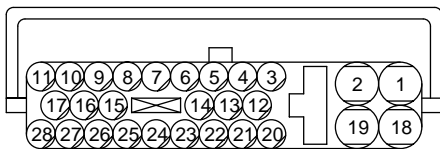
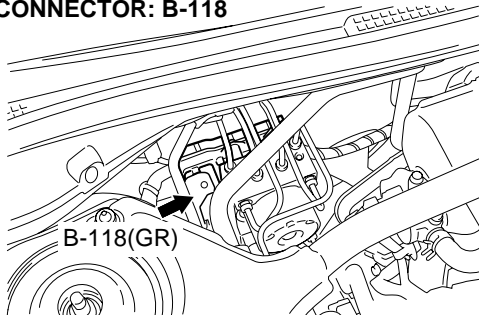
NO : Go to Step 11.

CONNECTOR : C-128



STEP 8. Check the harness wires between ABS-ECU connector B-118 terminal 11 and wheel speed sensor <rear: RH> connector D-06 terminal 1 or ABS-ECU connector B-118 terminal 17 and wheel speed sensor <rear: RH> connector D-06 terminal 2.

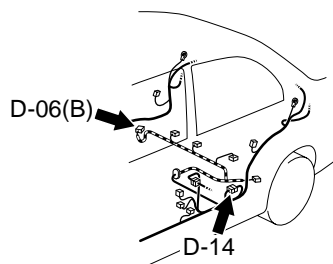
CONNECTOR: B-118



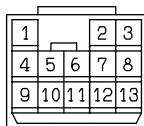
B-118 HARNESS CONNECTOR:
HARNESS SIDE

AC308882 AH

CONNECTORS : D-06,D-14

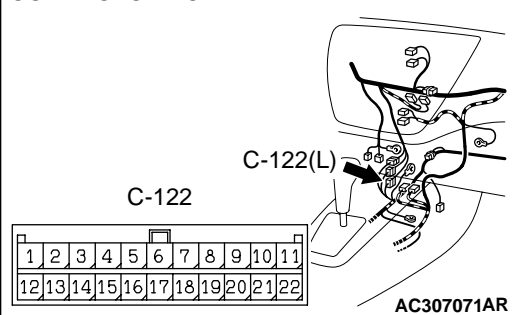


D-06 HARNESS CONNECTOR:
HARNESS SIDE



D-14

AC307080 AC

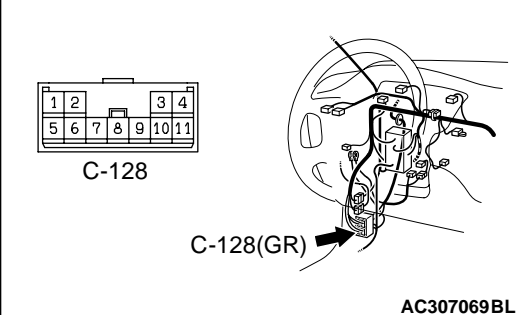
CONNECTOR : C-122

NOTE: After inspecting ABS-ECU connector B-118, intermediate connector C-122, C-128, D-14 and wheel speed sensor <rear: RH> connector D-06, inspect the wire. If ABS-ECU connector B-118, intermediate connector C-122, C-128, D-14 and wheel speed sensor <rear: RH> connector D-06 are damaged, repair or replace them. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 11.

Q: Is the harness wire between ABS-ECU connector B-118 terminal 11 and wheel speed sensor <rear: RH> connector D-06 terminal 1 or ABS-ECU connector B-118 terminal 17 and wheel speed sensor <rear: RH> connector D-06 terminal 2 damaged?

YES : Repair it and then go to Step 11.

NO : Go to Step 11.

CONNECTOR : C-128

STEP 9. Measure the wheel speed sensor output voltage.
Refer to P.35B-64.

Output Voltage:

- When measured with a voltmeter: 42 mV or more
- When measured with an oscilloscope (maximum voltage): 200 mV or more

Q: Does the voltage meet the specification?

YES : Replace the hydraulic unit (integrated with ABS-ECU) and then go to Step 11.

NO : Go to Step 10.

STEP 10. Check the wheel bearing.

Refer to GROUP 26, On-vehicle Service–Wheel Bearing Play Check <Front>P.26-8, GROUP 27, On-vehicle Service–Wheel Bearing Play Check <Rear–Drum Brake>P.27-5 or P.27-5<Rear–Disc Brake>. If play on the wheel bearing is not within the standard value, replace the wheel bearing.

Limit Value: 0.05 mm (0.002 inch)

Q: Is play on the wheel bearing within the standard value?

YES : Go to Step 11.

NO : Replace it and then go to Step 11.

STEP 11. Recheck for diagnostic trouble code.

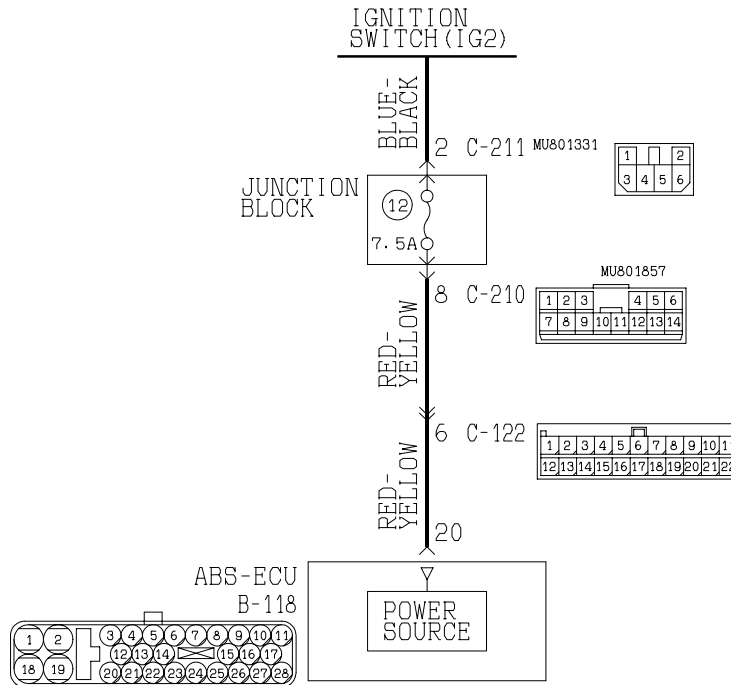
Q: Do the diagnostic trouble codes 11, 12, 13, 14, 21, 22, 23 or 24 reset?

YES : Go to Step 1.

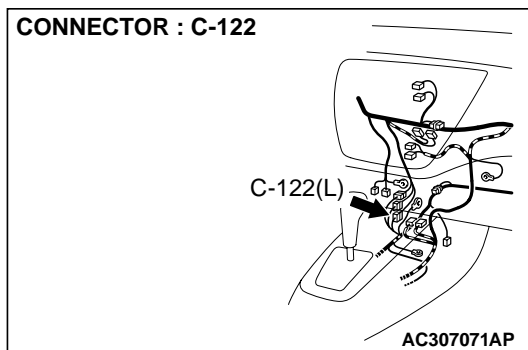
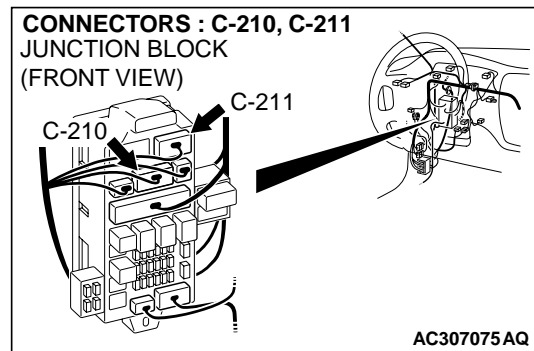
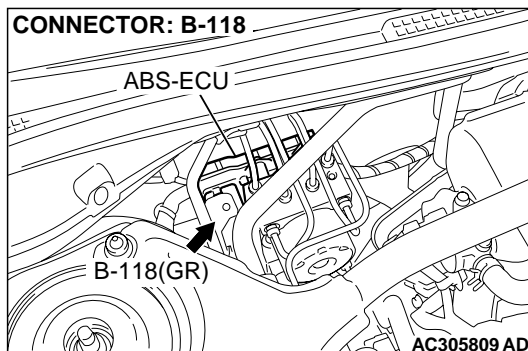
NO : The procedure is complete.

DTC 16: ABS-ECU Power Supply System (ABS-ECU Power Supply Voltage or Valve Relay Power Supply Voltage below or above the Specified Value)

Power Supply Circuit



W2J02M01AA
AC100512 AB



CIRCUIT OPERATION

The ABS-ECU power is supplied to the ABS-ECU (terminal 20) from the ignition switch (IG2) through the multi-purpose fuse number 12 in the junction block.

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:

- Malfunction of battery
- Damaged wiring harness and connector
- Malfunction of hydraulic unit and ABS-ECU

DIAGNOSIS**Required Special Tools:**

- MB991223: Harness Set
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)
- MB991529: Diagnostic Trouble Code Check Harness

STEP 1. Check the battery.

Refer to GROUP 54A, Battery – On-vehicle Service – Battery Testing Procedure [P.54A-6](#).

Q: Is the battery damaged?

YES : Charge or replace the battery and then go to Step 4.
NO : Go to Step 2.

STEP 2. Check the charging system.

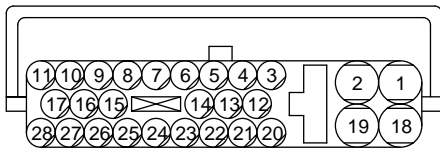
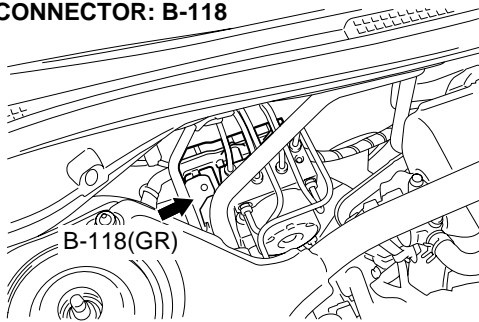
Refer to GROUP 16, Charging System – Diagnosis [P.16-4](#).

Q: Is the charging system damaged?

YES : Repair the Charging System and then go to Step 4.
NO : Go to Step 3.

STEP 3. Check the harness wires between junction block connector C-211 terminal 2 and ABS-ECU connector B-118 terminal 20.

CONNECTOR: B-118

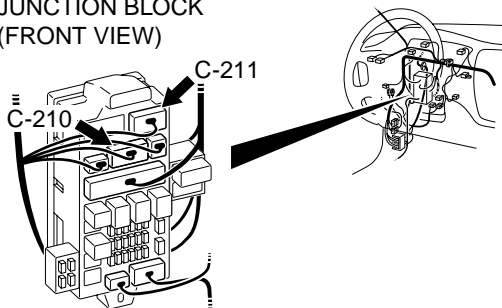


B-118 HARNESS CONNECTOR:
HARNESS SIDE

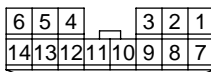
AC308882 AH

CONNECTORS : C-210, C-211

JUNCTION BLOCK
(FRONT VIEW)



C-210 HARNESS CONNECTOR:
HARNESS SIDE

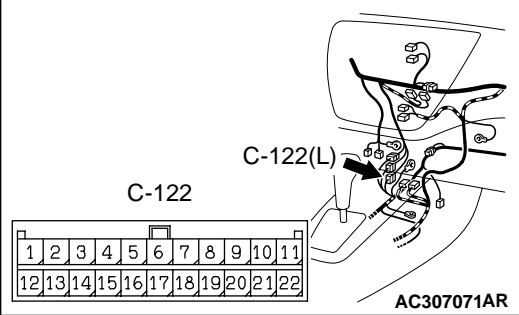


C-211 HARNESS CONNECTOR:
HARNESS SIDE



AC307076 AM

CONNECTOR : C-122



NOTE: After inspecting intermediate connector C-210 and C-122, inspect the wire. If intermediate connector C-210 and C-122 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 the harness wire between junction block connector C-211 terminal 2 and ABS-ECU connector B-118 terminal 20 damaged?

YES : Repair it and go to Step 4.

NO : Repair the hydraulic unit (integrated with ABS-ECU) and then go to Step 4.

STEP 4. Recheck for diagnostic trouble code.

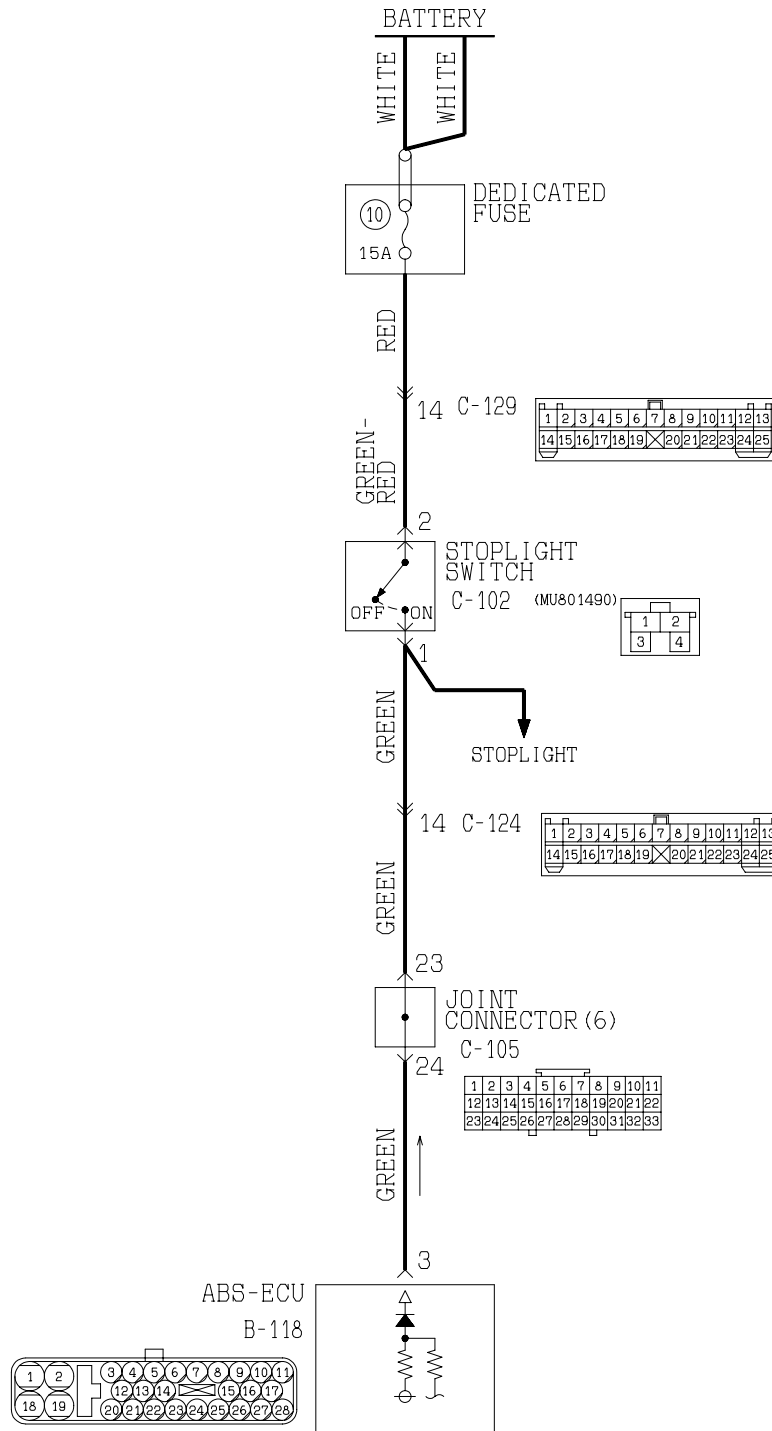
Q: Does DTC 16 reset?

YES : Start over at Step 1.

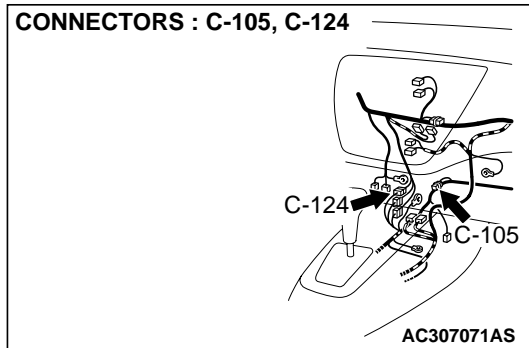
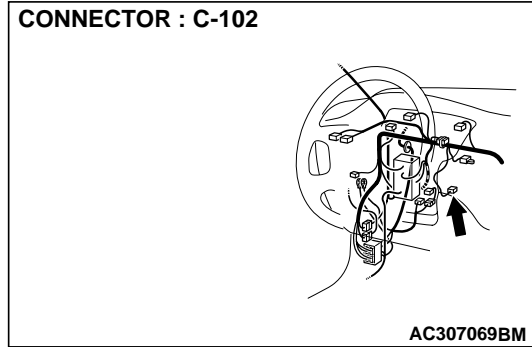
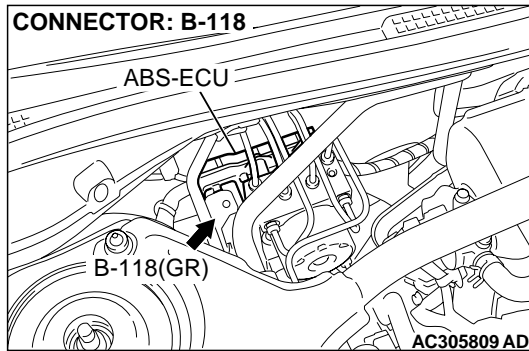
NO : The procedure is complete.

DTC 33 : Stoplight Switch System

Stoplight Switch Circuit



W2J02M02AA
AC202504 AB



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 3).

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 ABS-ECU

DIAGNOSIS

Required Special Tools:

- MB991223: Harness Set
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)
- MB991529: Diagnostic Trouble Code Check Harness

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 7.

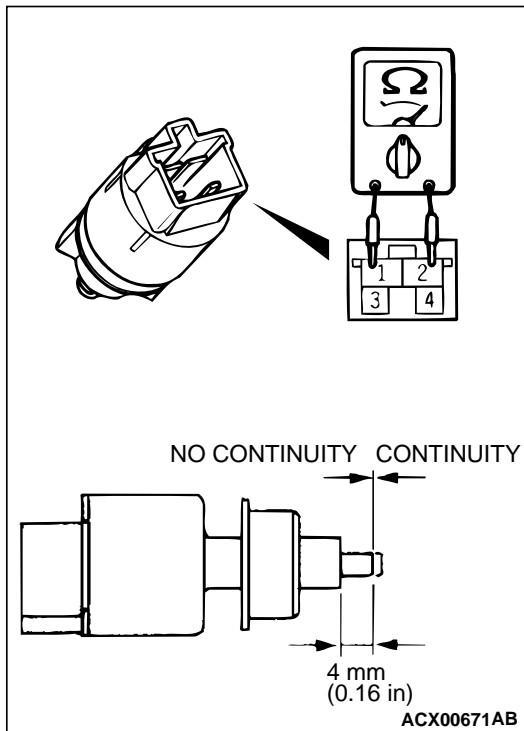
STEP 3. Check the stoplight switch continuity.

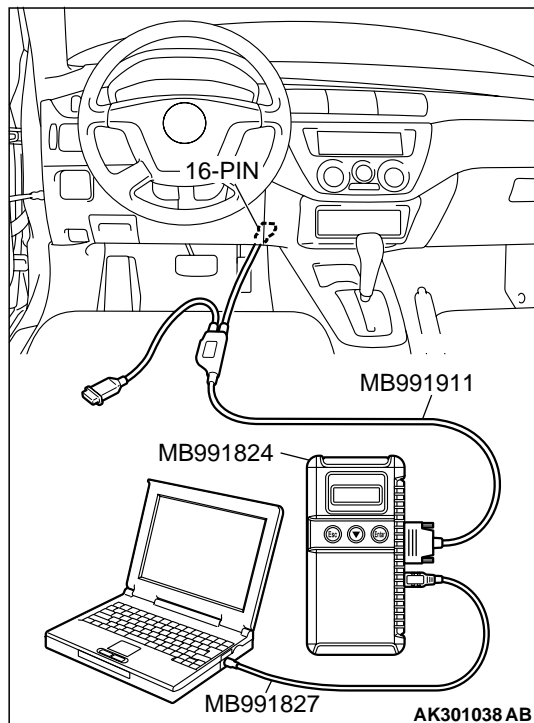
- (1) Remove the stoplight switch. (Refer to GROUP 35A, Brake Pedal [P.35A-34.](#))
- (2) Connect an ohmmeter to stoplight switch terminals 1 and 2, and check whether there is continuity when the plunger of the stoplight switch is pushed in and when it is released.
- (3) The stoplight switch is in good 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 7.

NO : Check the stoplight circuit and repair and then go to Step 7.





STEP 4. Using scan tool MB991958, check data list.

⚠ CAUTION

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

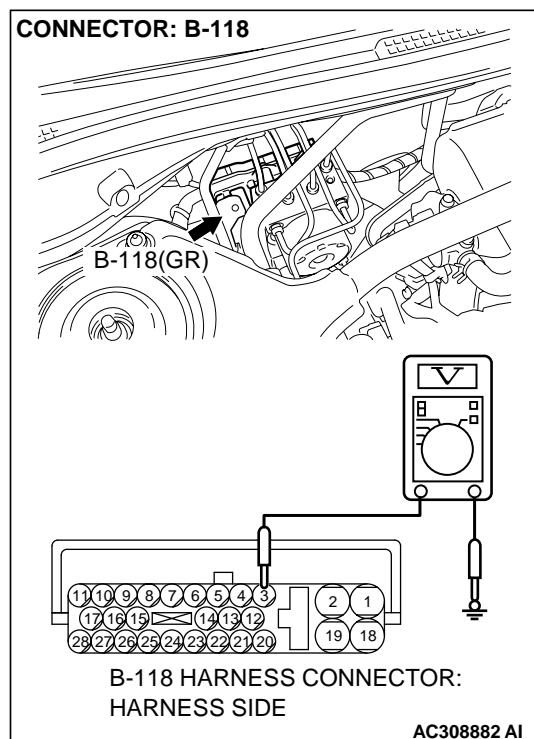
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to data reading mode.

- 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. Check the stoplight switch circuit at ABS-ECU connector B-118.

- (1) Disconnect connector B-118 and measure at the harness side.
- (2) Turn the stoplight switch ON.
- (3) Measure the voltage between terminal 3 and ground. It should be approximately 12 volts (battery positive voltage).

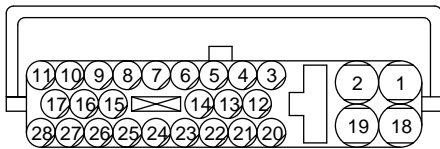
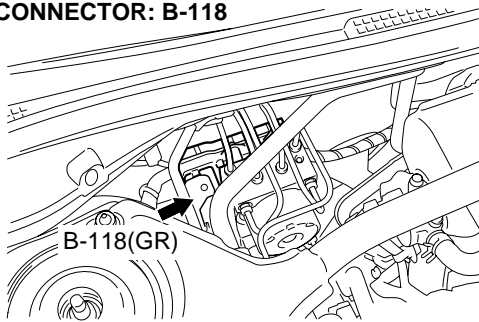
Q: Is battery positive voltage (approximately 12 volts) present?

YES : Replace the hydraulic unit (integrated with ABS-ECU) and then go to Step 7.

NO : Go to Step 6.

STEP 6. Check the harness wire between ABS-ECU connector B-118 terminal 3 and stoplight switch connector C-102 terminal 1.

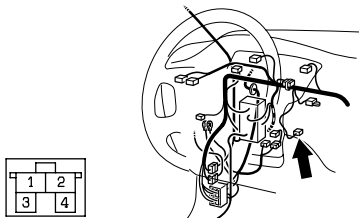
CONNECTOR: B-118



B-118 HARNESS CONNECTOR:
HARNESS SIDE

AC308882 AH

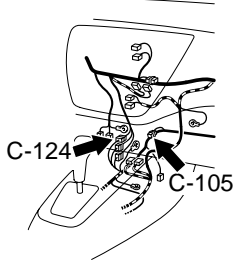
CONNECTOR : C-102



C-102 HARNESS CONNECTOR:
HARNESS SIDE

AC307069BN

CONNECTORS : C-105, C-124



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

C-105

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

C-124

AC307072 AS

NOTE: After inspecting intermediate connectors C-105, C-124 and stoplight switch connector C-102, inspect the wire. If intermediate connectors C-105, C-124 and stoplight switch connector C-102 are damaged, repair or replace them. 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 B-118 terminal 3 and stoplight switch connector C-102 terminal 1 damaged?

YES : Repair it and then go to Step 7.

NO : Go to Step 7.

STEP 7. Recheck for diagnostic trouble code.

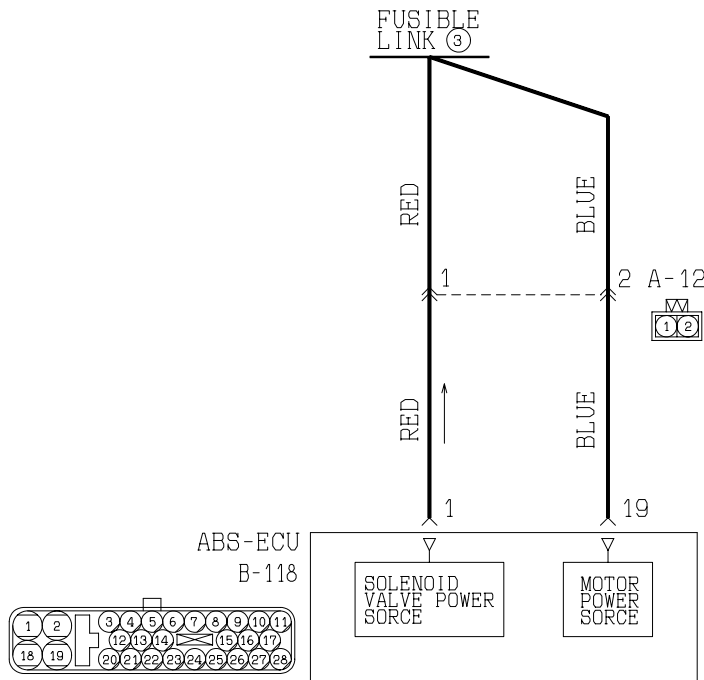
Q: Does DTC 33 reset?

YES : Return to Step 1.

NO : The procedure is complete.

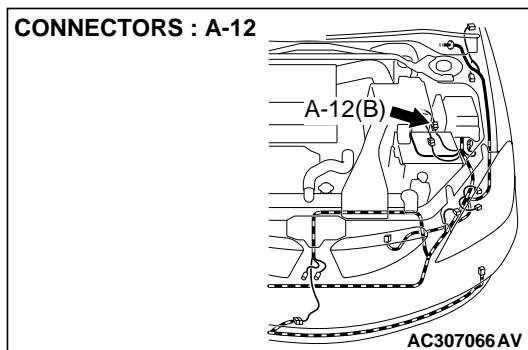
DTC 41, 42, 43, and 44: ABS Solenoid Valve inside Hydraulic Unit (Open Circuit or Short Circuit)
DTC 52: Valve Relay Problem (Stays off)
DTC 53: Motor Relay Problem (Stays off)
DTC 55: Motor System (Seized Pump Motor)

Solenoid Valve and Motor Power Supply Circuit

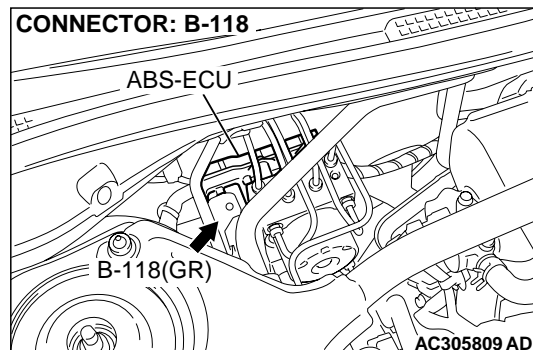


W2J02M03AA
AC100514 AB

CONNECTORS : A-12



CONNECTOR: B-118



CIRCUIT OPERATION

Power is continuously supplied to the ABS-ECU through fusible link number 3 to operate the solenoid valve and motor.

ABS DTC SET CONDITIONS

These codes are displayed if the power supply circuit of solenoid valve or motor is open or shorted.

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

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

DIAGNOSIS

Required Special Tools:

- MB991223: Harness Set
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)
- MB991529: Diagnostic Trouble Code Check Harness

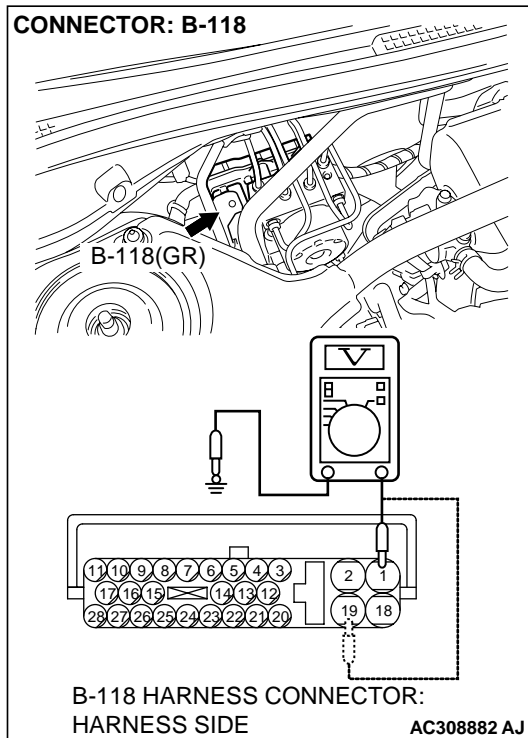
STEP 1. Check the solenoid valve or motor power supply circuit at ABS-ECU connector B-118.

- (1) Disconnect ABS-ECU connector B-118 and measure at the harness side.
- (2) Measure the voltage between terminal 1 and ground, and 19 and ground.

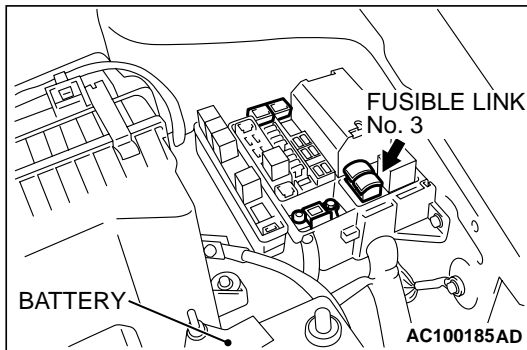
Q: Is battery positive voltage (approximately 12 volts) present?

YES : Replace the hydraulic unit (integrated with ABS-ECU). (Refer to [P.35B-70.](#)) Then go to Step 3.

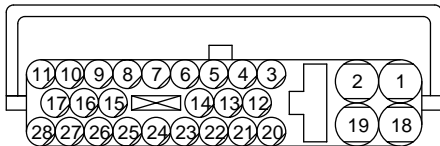
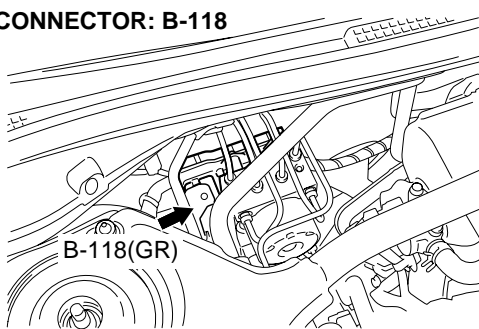
NO : Go to Step 2.



STEP 2. Check the harness wires between fusible link number 3 and ABS-ECU connector B-118 terminal 1 and 19.



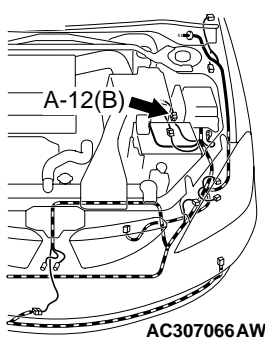
CONNECTOR: B-118



B-118 HARNESS CONNECTOR:
HARNESS SIDE

AC308882 AH

CONNECTORS : A-12



NOTE: After inspecting intermediate connector A-12, inspect the wire. If intermediate connector A-12 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 3.

Q: Is any of the harness wires between fusible link number 3 and ABS-ECU connector B-118 terminal 1 and 19 damaged?

YES : Repair it and then go to Step 3.

NO : Go to Step 3.

STEP 3. Recheck for diagnostic trouble code.

Q: Do diagnostic trouble codes 41, 42, 43, 44, 52, 53 or 55 reset?

YES : Go to Step 1.

NO : The procedure is complete.

SYMPTOM CHART

M1352011400631

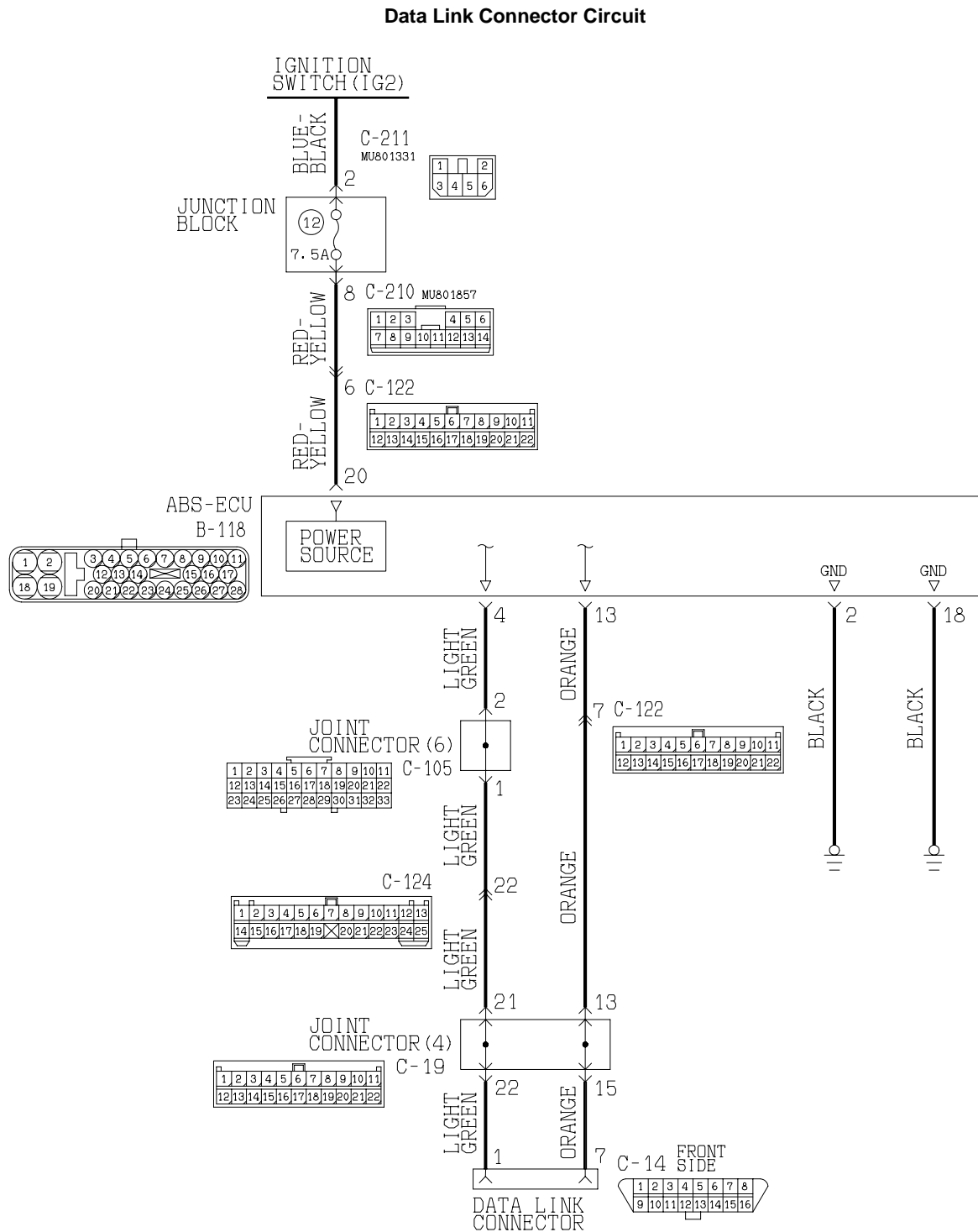
NOTE: If steering movements are made when driving at high speed, or when driving on road surfaces with low frictional resistance, or when passing over bumps, the ABS may operate although sudden braking is not being applied. Because of this, when getting information from the customer, check if the problem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

NOTE: 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.

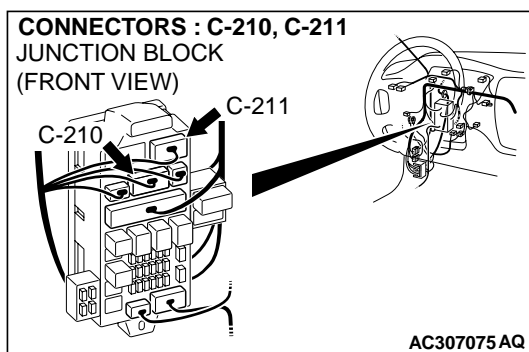
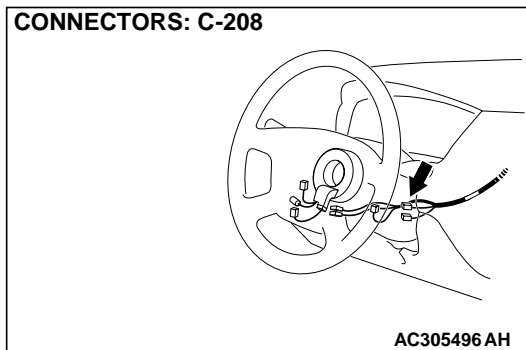
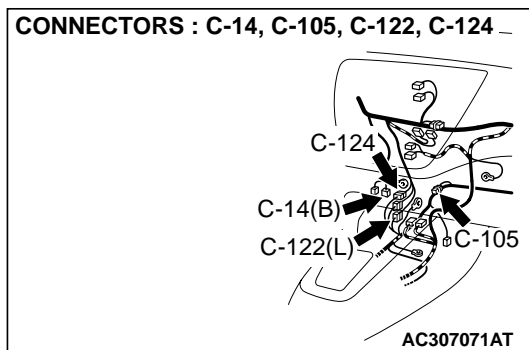
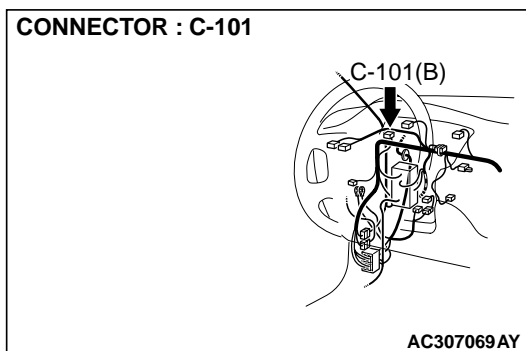
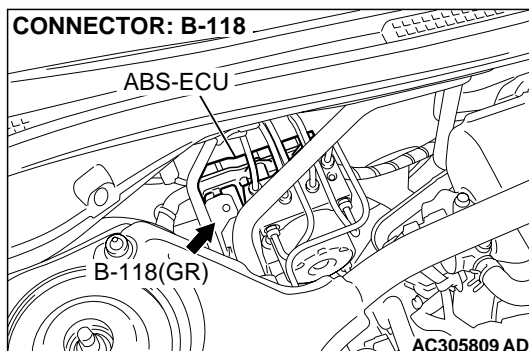
SYMPTOM	INSPECTION PROCEDURE NO.	REFERENCE PAGE
Communication between the scan tool and the whole system is not possible.	–	GROUP 13A, Diagnosis P.13A-714 <2.0L ENGINE>. GROUP 13B, Diagnosis P.13B-727 <2.4L ENGINE>.
Communication between the scan tool and the ABS-ECU is not possible.	1	P.35B-37 .
When the ignition key is turned to "ON" (Engine stopped), the ABS warning light does not illuminate.	2	P.35B-44 .
The ABS warning light remains illuminated after the engine is started.	3	P.35B-53 .
Faulty ABS operation	4	P.35B-59 .

SYMPTOM PROCEDURES

INSPECTION PROCEDURE 1: Communication between Scan Tool and the ABS-ECU is not possible.



W4J02M01AA



CIRCUIT OPERATION

- The DTC is set by the ABS-ECU (terminal 13) 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 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 or connector
- Malfunction of the hydraulic unit (Integrated with ABS-ECU)

DIAGNOSIS

Required Special Tool:

- MB991223: Harness Set

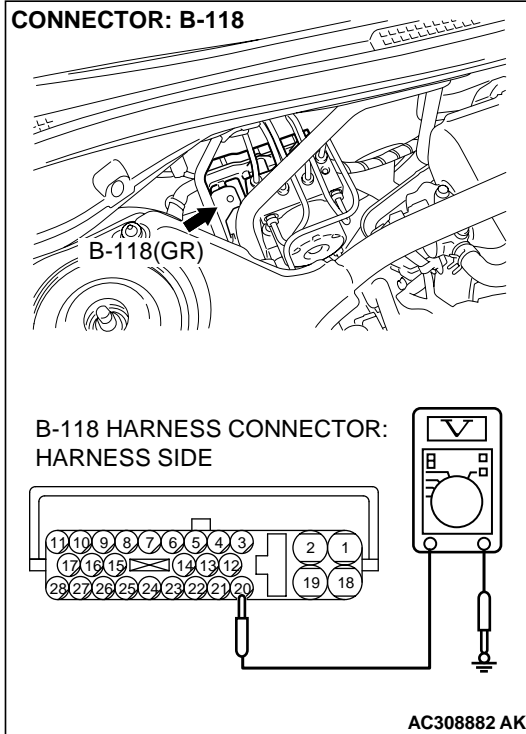
STEP 1. Check the power supply circuit at ABS-ECU connector B-118.

- (1) Disconnect ABS-ECU connector B-118 and measure at the harness side.
- (2) Start the engine.
- (3) Measure the voltage between terminal 20 and ground.

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

YES : Go to Step 3.

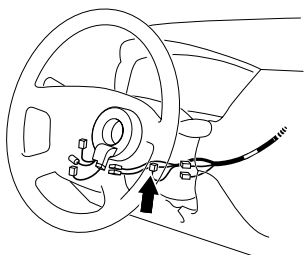
NO : Go to Step 2.



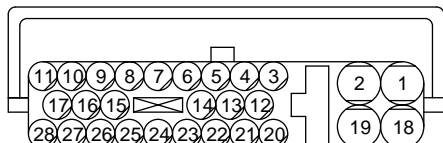
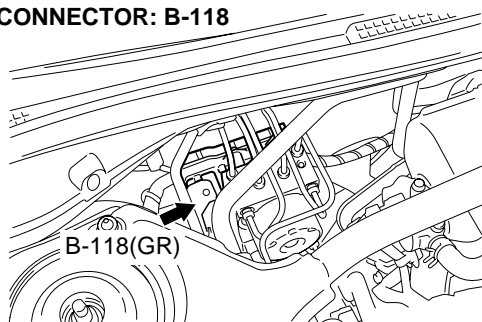
STEP 2. Check the harness wire between the ignition switch (IG2) connector C-208 terminal 4 and ABS-ECU connector B-118 terminal 20.

CONNECTORS: C-208

C-208 HARNESS
CONNECTOR:
HARNESS SIDE



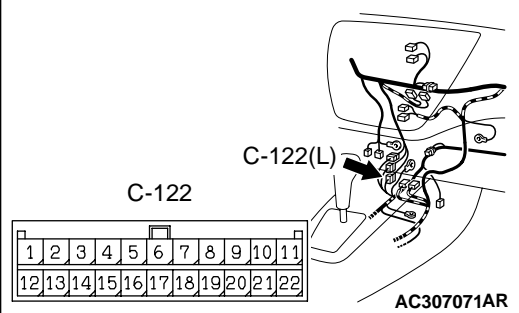
AC305496 AI

CONNECTOR: B-118

B-118 HARNESS CONNECTOR:
HARNESS SIDE

AC308882 AH

CONNECTOR : C-122



NOTE: After inspecting the intermediate connector C-122, C-210, and C-211, inspect the wire. If the intermediate connector C-122, C-210 or C-211 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 3.

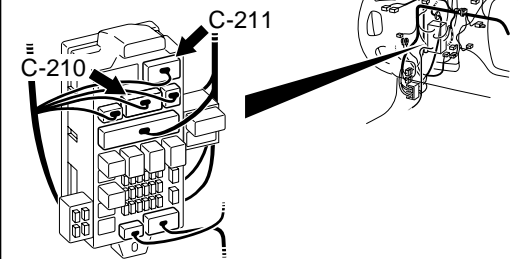
Q: Is the harness wire between the ignition switch (IG2) connector C-208 terminal 4 and ABS-ECU connector B-118 terminal 20 damaged?

YES : Repair it and go to Step 5.

NO : Go to Step 3.

CONNECTORS : C-210, C-211

JUNCTION BLOCK
(FRONT VIEW)



C-210 HARNESS CONNECTOR:
HARNESS SIDE

6	5	4		3	2	1
14	13	12	11	10	9	8
						7

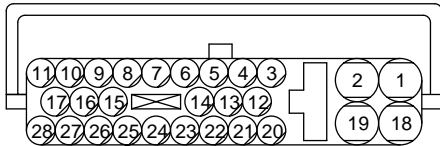
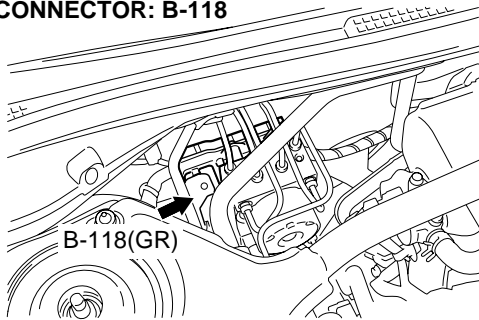
C-211 HARNESS CONNECTOR:
HARNESS SIDE

2		1
6	5	4
		3

AC307076 AM

STEP 3. Check the harness wires between ABS-ECU connector B-118 terminal 13 and data link connector C-14 terminal 7 or ABS-ECU connector B-118 terminal 4 and data link connector C-14 terminal 1.

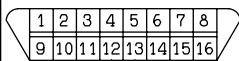
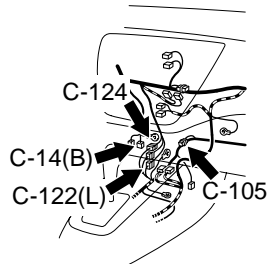
CONNECTOR: B-118



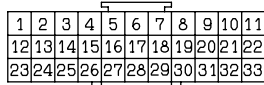
**B-118 HARNESS CONNECTOR:
HARNESS SIDE**

AC308882 AH

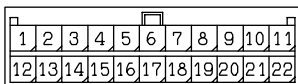
CONNECTORS : C-14, C-105, C-122, C-124



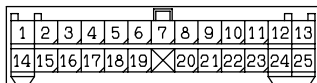
**C-14
FRONT SIDE**



C-105



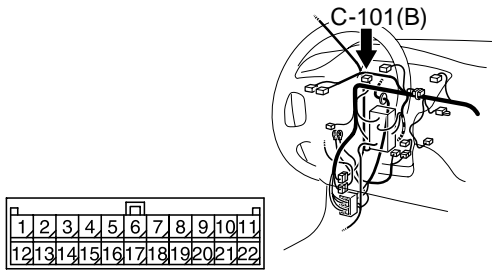
C-122



C-124

AC307072 AC

CONNECTOR : C-101



AC307069BO

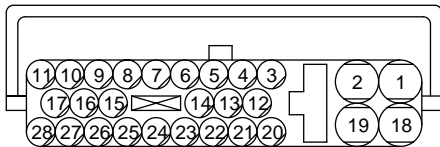
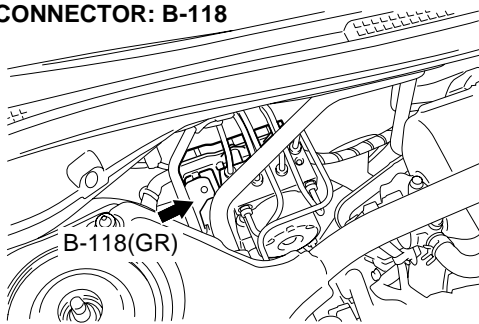
NOTE: After inspecting intermediate connectors C-101, C-105, C-122 and C-124, inspect the wires. If the intermediate connector C-101, C-105, C-122 or C-124 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. If the connector has been repaired or replaced, go to Step 5.

Q: Is any of the harness wires between ABS-ECU connector B-118 terminal 13 and data link connector C-14 terminal 7 or ABS-ECU connector B-118 terminal 4 and data link connector C-14 terminal 1 damaged?

YES : Repair it and go to Step 5.

NO : Go to Step 4.

CONNECTOR: B-118



**B-118 HARNESS CONNECTOR:
HARNESS SIDE**

AC308882 AH

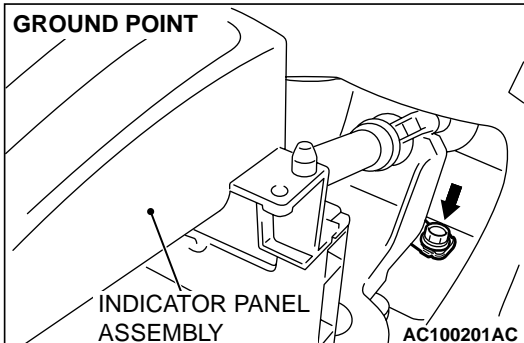
STEP 4. Check the harness wires between ABS-ECU connector B-118 terminal 2 and ground or ABS-ECU connector B-118 terminal 18 and ground.

Q: Is any of the harness wires between ABS-ECU connector B-118 terminal 2 and ground or ABS-ECU connector B-118 terminal 18 and ground damaged?

YES : Repair it and then go to Step 5.

NO : Retest the system. If the malfunction persists, replace the hydraulic unit (integrated with ABS-ECU). Then go to Step 5. If the malfunction is not reproduced, then a transient malfunction is suspected. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-6.

GROUND POINT



AC100201AC

STEP 5. Retest the system.

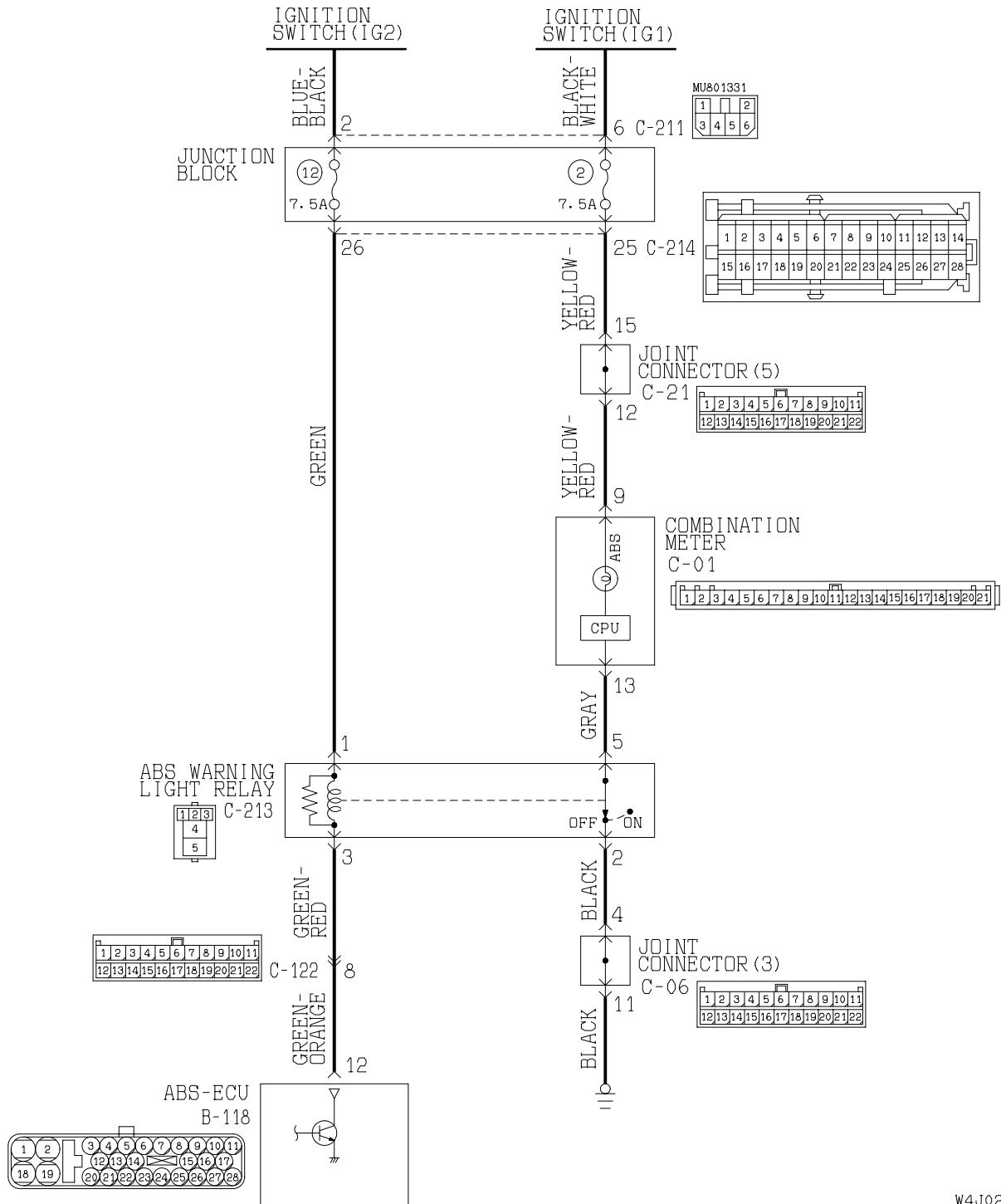
Q: Does the scan tool communicate with the ABS system?

YES : The procedure is complete.

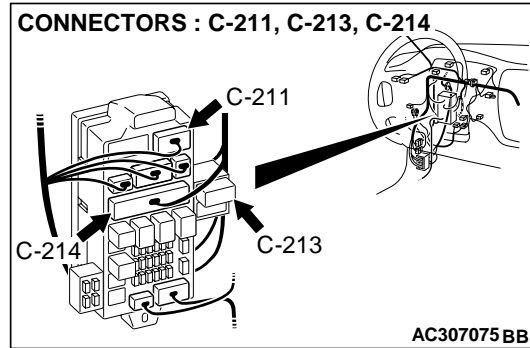
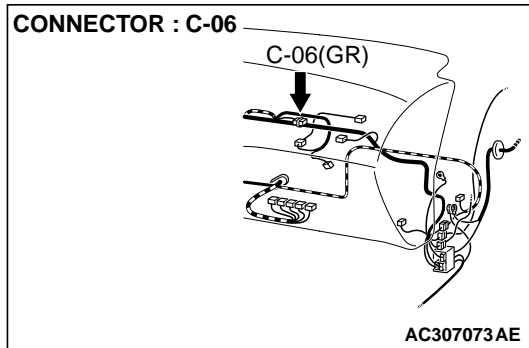
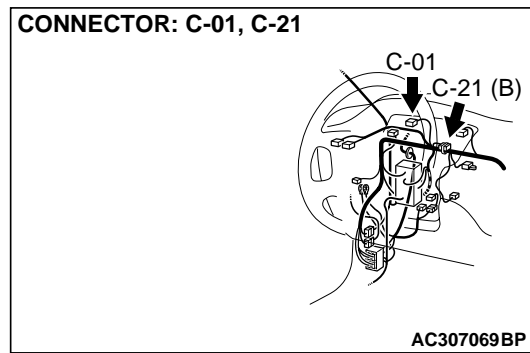
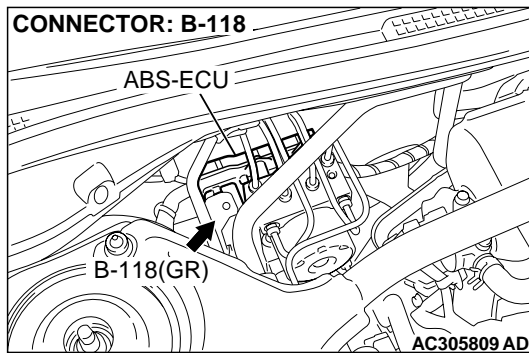
NO : Return to Step 1.

INSPECTION PROCEDURE 2: When the Ignition Key is Turned to "ON" (Engine Stopped), the ABS Warning Light does not Illuminate.

ABS Warning Light Circuit



W4J02M00AA



CIRCUIT OPERATION

- The ABS warning light power is supplied from the ignition switch. The ABS-ECU grounds the circuit to illuminate the light.
- The ABS-ECU illuminates the ABS warning light for 3 seconds while running self-check. This light can be illuminated for 3 seconds upon start-up or when the ignition switch is turned to the "ON" position with engine stopped.
- When the ABS-ECU connector is disconnected, the circuit is grounded to illuminate the light by the ABS warning light relay ON operation.
- The ABS-ECU controls the continuity to the ABS warning light by turning the power transistor in the unit "OFF" and "ON" to turn the ABS warning light relay "ON" and "OFF", respectively.

TECHNICAL DESCRIPTION (COMMENT)

The cause may be: an open circuit in the ABS warning light power supply circuit, a blown ABS warning light bulb, or a short circuit to ground between the ABS warning light and the ABS-ECU.

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

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

DIAGNOSIS**Required Special Tool:**

- MB991223: Harness Set

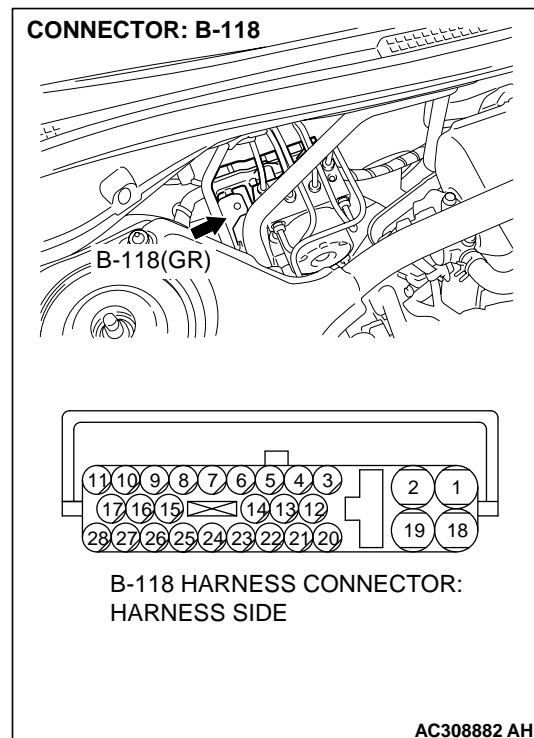
STEP 1. Check the ABS warning light relay circuit at ABS-ECU connector B-118.

- (1) Disconnect ABS-ECU connector B-118.
- (2) Turn the ignition switch to the "ON" position.

Q: Does the ABS warning light illuminate?

YES : Retest the system. If the malfunction persists, replace the hydraulic unit (integrated with ABS-ECU). Then go to Step 9. If the malfunction is not reproduced, an intermittent malfunction is suspected. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-6](#).

NO : Go to Step 2.

**STEP 2. Check the ABS warning light relay.**

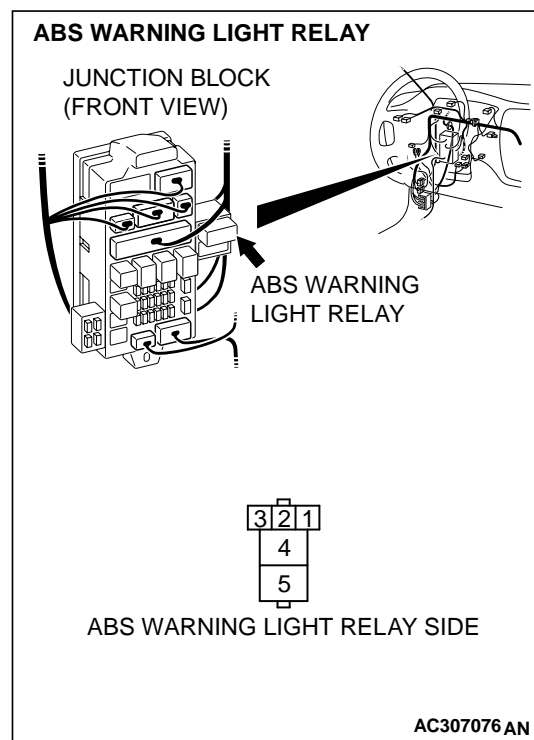
- (1) Remove the ABS warning light relay.
- (2) Check for continuity between terminals 2 – 5 when battery positive voltage (approximately 12 volts) is applied between terminals 1 – 3.

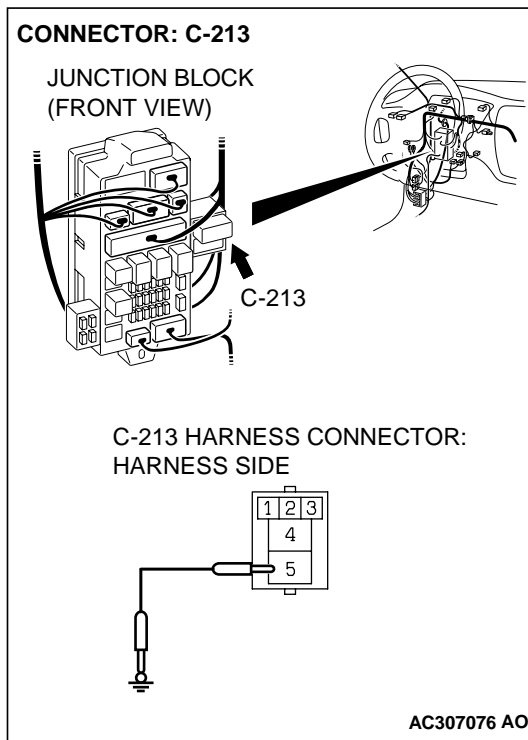
BATTERY VOLTAGE	TESTER CONNECTION	SPECIFIED CONDITION
No applied	2 – 5	Less than 2 ohms
<ul style="list-style-type: none"> • Connect terminal 1 to the positive battery terminal • Connect terminal 3 to the negative battery terminal 	2 – 5	Open circuit

Q: Is the ABS warning light relay normal?

YES : Go to Step 3.

NO : Replace it and then go to Step 9.





STEP 3. Check the ABS warning light circuit at ABS warning light relay connector C-213.

- (1) Disconnect ABS warning light relay connector C-213 and measure at the harness side.
- (2) Ground terminal 5.
- (3) Turn the ignition switch to the "ON" position, and then ABS warning light should turn on.

Q: Does the warning light turn on?

YES : Go to Step 8.

NO : Go to Step 4.

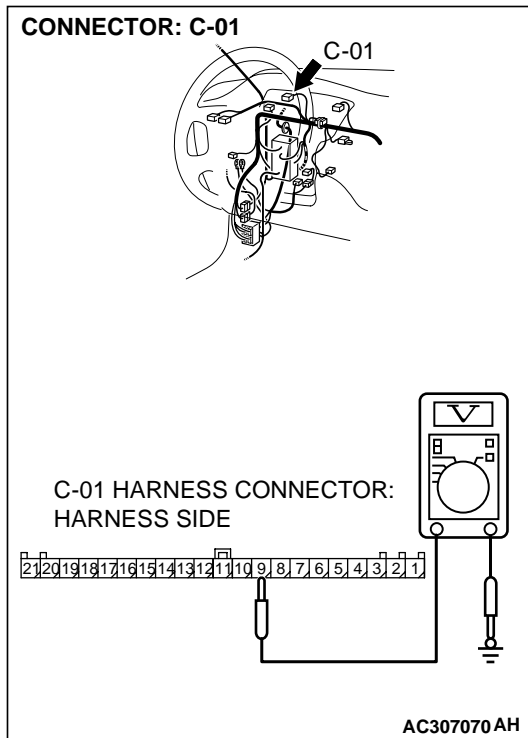
STEP 4 Check the ABS warning light bulb.

- (1) Remove the combination meter (Refer to GROUP 54A, Combination Meter [P.54A-46.](#))
- (2) Check the ABS warning light bulb.

Q: Is the bulb burned out?

YES : Replace the bulb and then go to Step 9.

NO : Go to Step 5.

**STEP 5. Check the combination meter power supply circuit.**

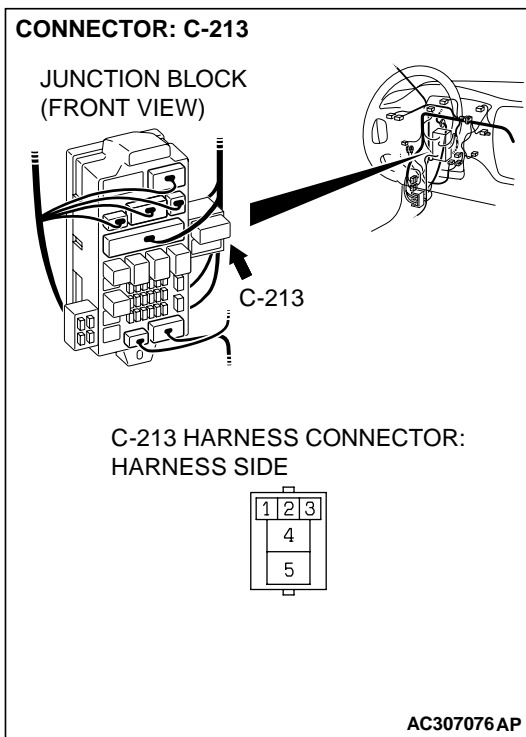
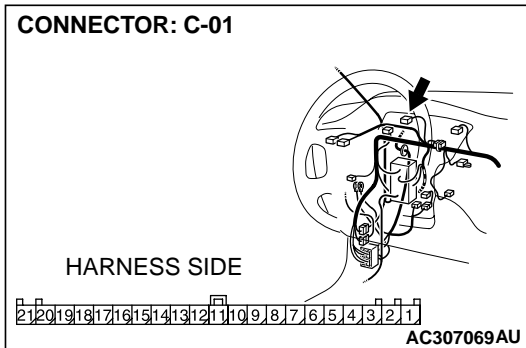
- (1) Disconnect connector C-01, and check at the harness side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 9 and ground. It should be battery positive voltage (approximately 12 volts).

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

YES : Go to Step 6.

NO : Go to Step 7.

STEP 6. Check the harness wire between the combination meter connector C-01 terminal 13 and the ABS warning light relay connector C-213 terminal 5.



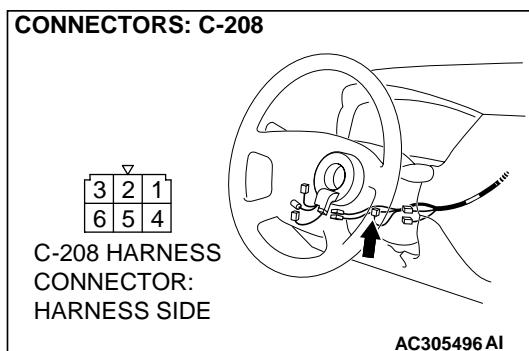
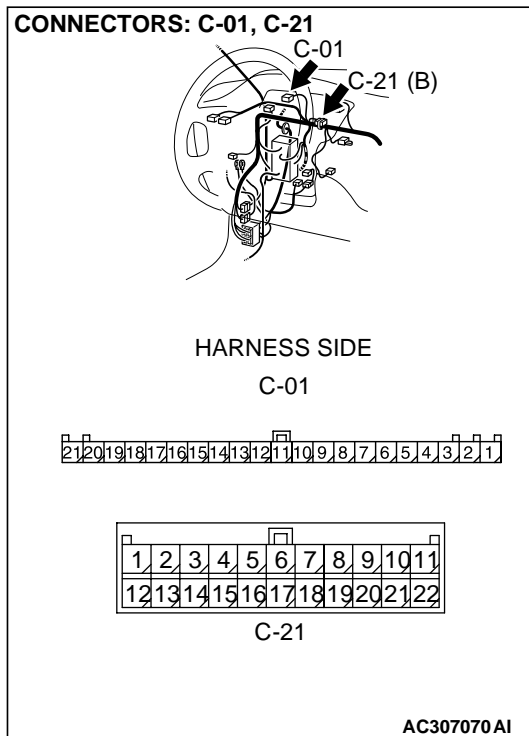
NOTE: After inspecting combination meter connector C-01 and ABS warning light relay connector C-213, inspect the wire. If the combination meter connector C-01 and ABS warning light relay connector C-213 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If the connector has been repaired or replaced, go to Step 9.

Q: Is the harness wire between the combination meter connector C-01 terminal 13 and the ABS warning light relay connector C-213 terminal 5 damaged?

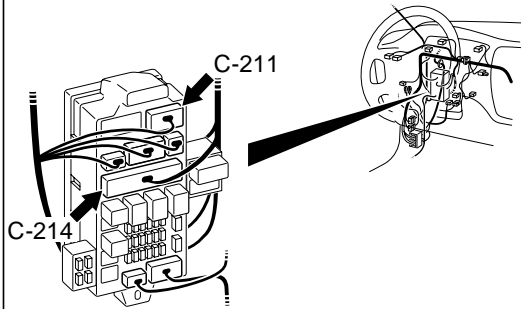
YES : Repair the harness wire and then go to Step 9.

NO : Replace the combination meter (printed circuit board) and then go to Step 9.

STEP 7. Check the harness wire between the ignition switch (IG1) connector C-208 terminal 2 and the combination meter connector C-01 terminal 9.



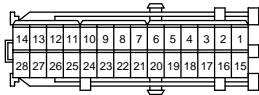
CONNECTORS : C-211, C-214



C-211 HARNESS CONNECTOR
(FRONT VIEW)



C-214 HARNESS CONNECTOR
(FRONT VIEW)



AC307076 AL

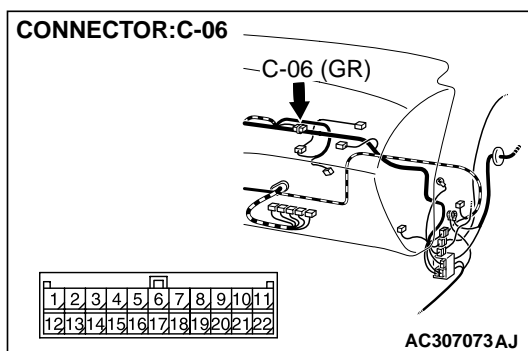
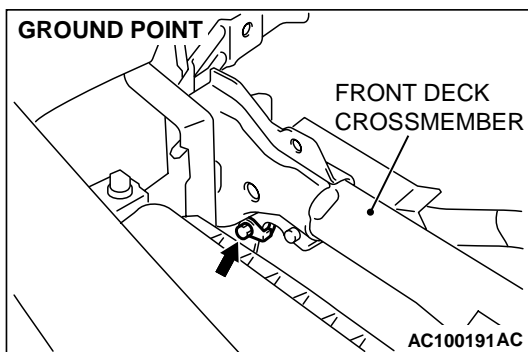
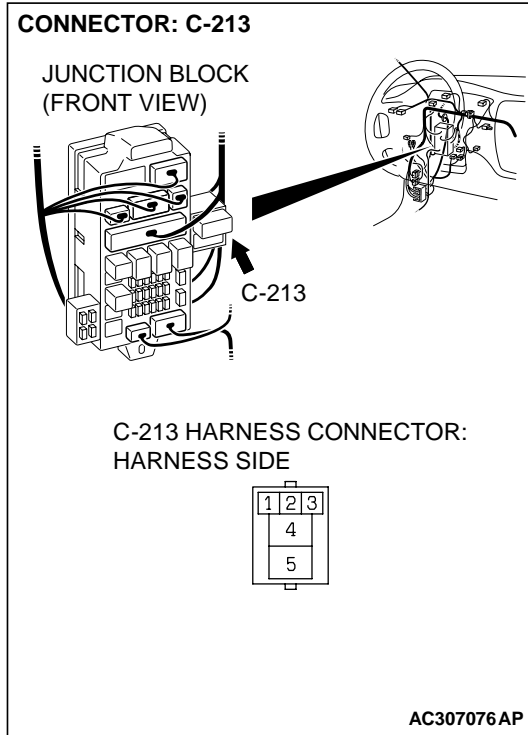
NOTE: After inspecting intermediate connectors C-21, C-211 and C-214, inspect the wire. If the intermediate connector C-21, C-211 or C-214 is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If the connector has been repaired or replaced, go to Step 9.

Q: Is the harness wire between the ignition switch (IG1) connector C-208 terminal 2 and the combination meter connector C-01 terminal 9 damaged?

YES : Repair the harness wire and then go to Step 9.

NO : Go to Step 9.

STEP 8. Check the harness wire between the ABS warning light relay connector C-213 terminal 2 and ground.



NOTE: After inspecting intermediate connector C-06, inspect the wire. If intermediate connector C-06 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: Is the harness wire between the ABS warning light relay connector C-213 terminal 2 and ground?

YES : Repair the harness wire and then go to Step 9.

NO : Go to Step 9.

STEP 9. 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.35B-44](#).

CIRCUIT OPERATION

Refer to [P.35B-44](#).

TECHNICAL DESCRIPTION (COMMENT)

The cause is probably the ABS-ECU malfunction.

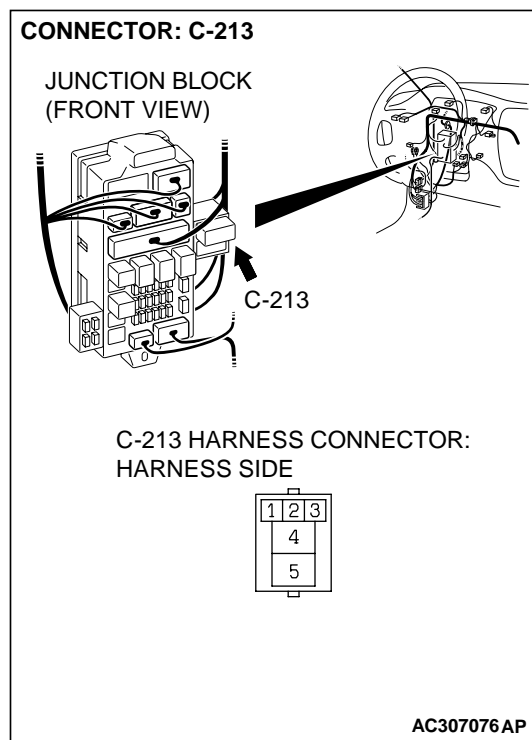
TROUBLESHOOTING HINTS (The most likely causes for this condition:)

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

DIAGNOSIS

Required Special Tool:

- MB991223: Harness Set

**STEP 1. Check the wiring harness between the ABS warning light relay and the ABS warning light.**

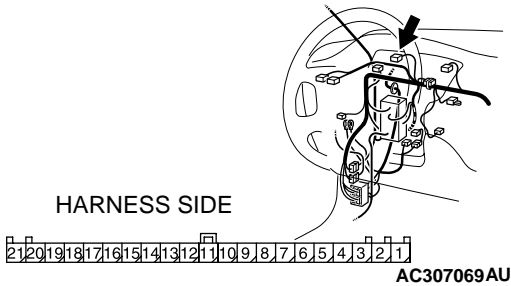
- (1) Disconnect ABS warning light relay connector C-213.
- (2) Turn the ignition switch to the "ON" position.

Q: Does the ABS warning light illuminate?

YES : Go to Step 2.

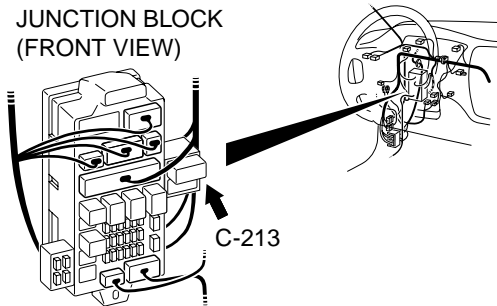
NO : Go to Step 3.

CONNECTOR: C-01

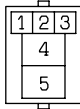


CONNECTOR: C-213

JUNCTION BLOCK
(FRONT VIEW)



C-213 HARNESS CONNECTOR:
HARNESS SIDE



AC307076AP

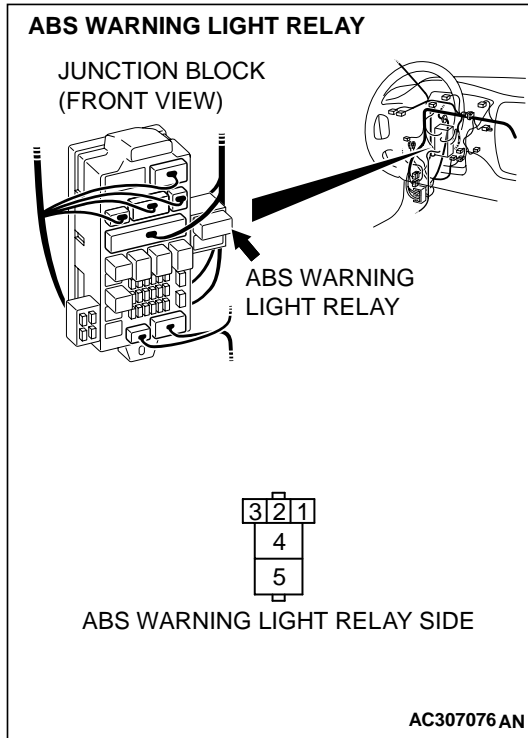
STEP 2. Check the harness wire between the combination meter connector C-01 terminal 13 and the ABS warning light relay connector C-213 terminal 5.

NOTE: After inspecting combination meter connector C-01 and ABS warning light relay connector C-213, inspect the wire. If combination meter connector C-01 or ABS warning light relay connector C-213 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 combination meter connector C-01 and ABS warning light relay connector C-213 damaged?

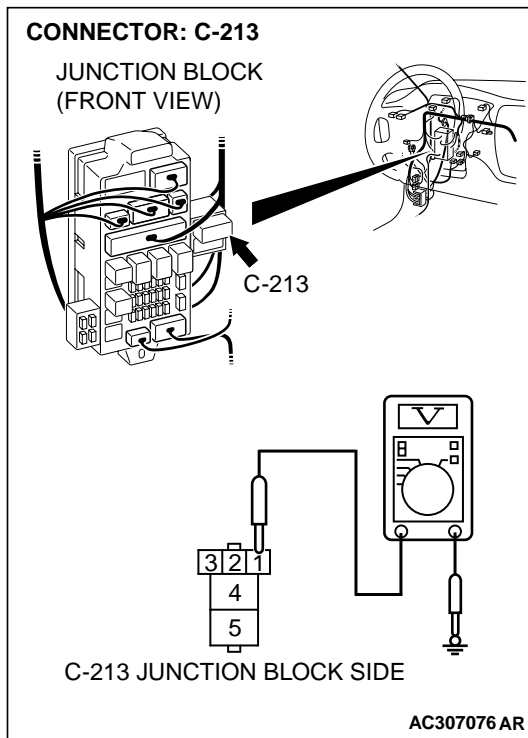
YES : Repair the harness wire and then go to Step 8.

NO : Replace the combination meter (printed circuit board) and then go to Step 8.

**STEP 3. Check the ABS warning light relay.**

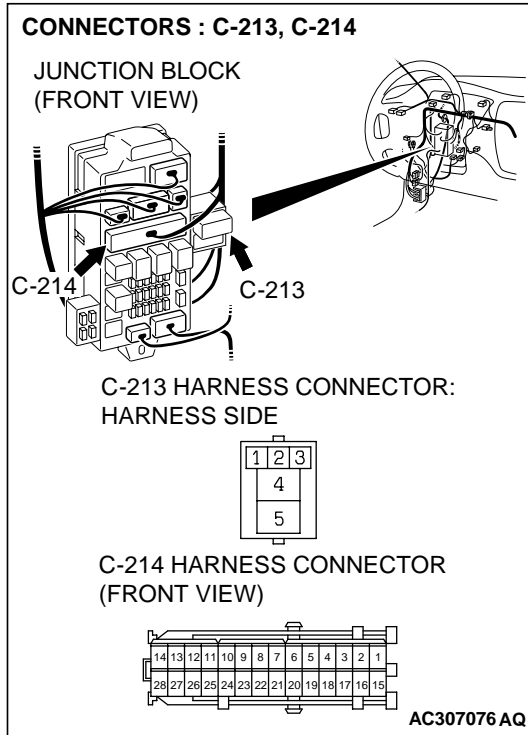
- (1) Remove the ABS warning light relay.
- (2) Check for continuity between terminals 2 – 5.

BATTERY VOLTAGE	TESTER CONNECTION	SPECIFIED CONDITION
No applied	2 – 5	Less than 2 ohms
<ul style="list-style-type: none"> Connect terminal 1 to the positive battery terminal Connect terminal 3 to the negative battery terminal 	2 – 5	Open circuit

Q: Is the ABS warning light relay continuity?**YES :** Go to Step 4.**NO :** Replace it and then go to Step 8.**STEP 4. Check the ABS warning light relay power supply circuit.**

- (1) Disconnect ABS warning light relay connector C-213 and measure at the junction block side.
- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 1 and ground. It should be approximately 12 volts (battery positive voltage).

Q: Is battery positive voltage (approximately 12 volts) present?**YES :** Go to Step 6.**NO :** Go to Step 5.



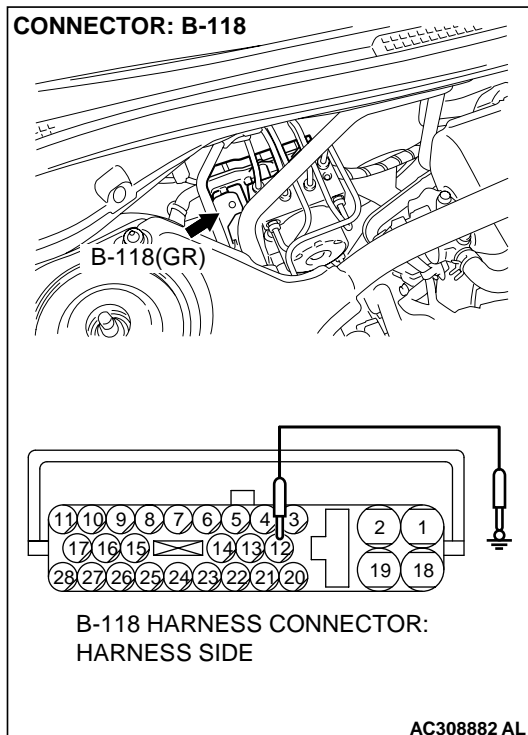
STEP 5. Check the harness wire between connector C-214 terminal 26 and the ABS warning light relay connector C-213 terminal 1.

NOTE: After inspecting connector C-214 and ABS warning light relay connector C-213, inspect the wire. If connector C-214 or ABS warning light relay connector C-213 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 connector C-214 terminal 26 and the ABS warning light relay connector C-213 terminal 1 damaged?

YES : Repair the harness wire and then go to Step 8.

NO : Go to Step 8.



STEP 6. Check the ABS warning light circuit at ABS-ECU connector B-118.

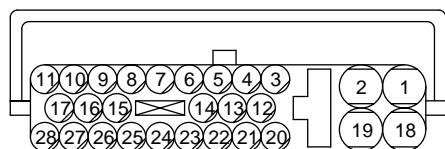
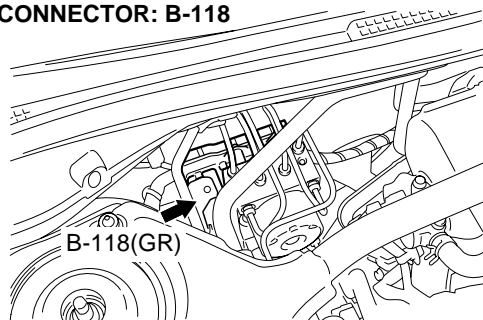
- (1) Disconnect ABS-ECU connector B-118 and measure at the harness side.
- (2) Connect ABS-ECU connector B-118 terminal 12 to ground.
- (3) Turn the ignition switch to the "ON" position.

Q: Does the ABS warning light go off?

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

NO : Go to Step 7.

STEP 7. Check the harness wire between ABS-ECU connector B-118 terminal 12 and ABS warning light relay connector C-213 terminal 3.

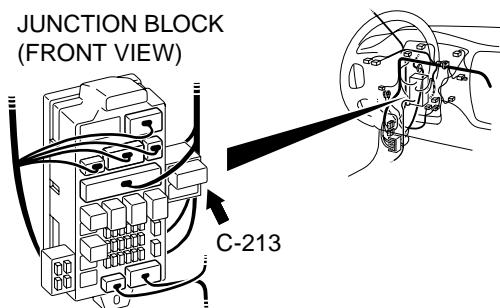
CONNECTOR: B-118

B-118 HARNESS CONNECTOR:
HARNESS SIDE

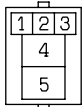
AC308882 AH

CONNECTOR: C-213

JUNCTION BLOCK
(FRONT VIEW)

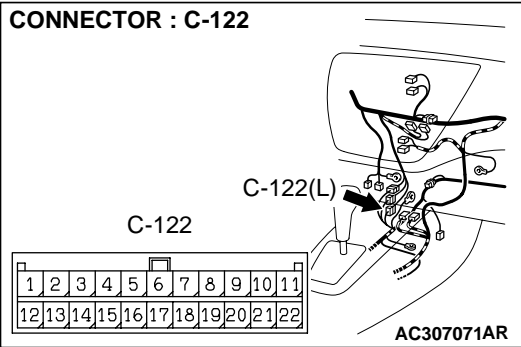


C-213 HARNESS CONNECTOR:
HARNESS SIDE



AC307076 AP

CONNECTOR : C-122



NOTE: After inspecting connector C-122, inspect the wire. If connector C-122 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 ABS-ECU connector B-118 terminal 12 and ABS warning light relay connector C-213 terminal 3 damaged?

YES : Repair it and then go to Step 8.

NO : Go to Step 8.

STEP 8. Retest the system.

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

YES : The procedure is complete.

NO : Return to Step 1.

INSPECTION PROCEDURE 4: Faulty ABS Operation

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 causes for this case:)

- Malfunction of the hydraulic unit

DIAGNOSIS

Check the hydraulic unit. (Refer to [P.35B-66](#).) If the hydraulic unit (integrated with ABS-ECU) is malfunctioning, replace it. Then check that the malfunction symptom is eliminated.

DATA LIST REFERENCE TABLE

M1352011500382

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

MUT-II SCAN TOOL DISPLAY	ITEM NO.	CHECK ITEM	CHECKING REQUIREMENT	NORMAL VALUE
FR SNSR	11	Front-right wheel speed sensor	Drive the vehicle	Vehicle speeds displayed on the speedometer and scan tool are identical.
FL SNSR	12	Front-left wheel speed sensor		
RR SNSR	13	Rear-right wheel speed sensor		
RL SNSR	14	Rear-left wheel speed sensor		
BATT. VOLTAGE	21	ABS-ECU power supply voltage	Ignition switch power supply voltage and valve monitor voltage	10 – 16 V
STOPLIGHT SW	36	Stoplight switch	Depress the brake pedal.	ON
			Release the brake pedal.	OFF

ACTUATOR TEST REFERENCE TABLE

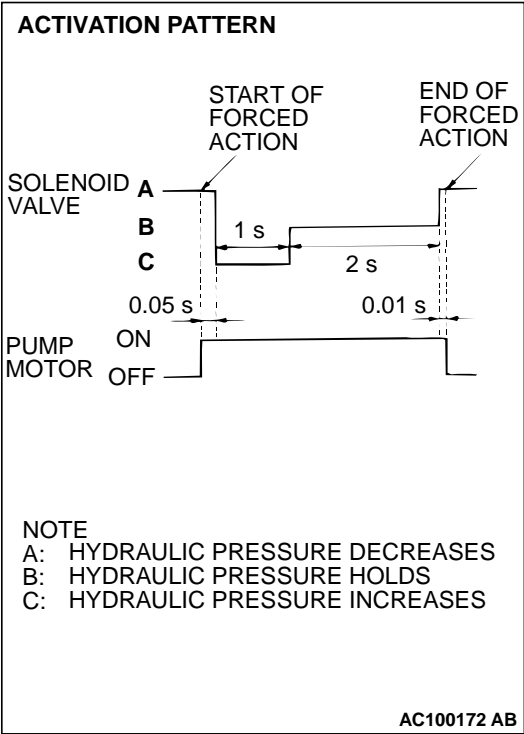
M1352011600646

The scan tool activates the following actuators for testing.

NOTE: Actuator testing is only possible when the vehicle is stationary.

NOTE: If the ABS-ECU runs down, actuator testing cannot be carried out.

ACTUATOR TEST SPECIFICATIONS



NO.	ITEM	PARTS TO BE ACTIVATED
01	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	Solenoid valve for front-right wheel	
03	Solenoid valve for rear-left wheel	
04	Solenoid valve for rear-right wheel	

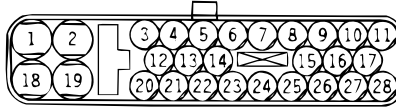
CHECK AT ABS-ECU

M1352011800394

TERMINAL VOLTAGE CHECK CHART

1. Measure the voltages between terminals (2) and (18) (ground terminals) and each respective terminal.
2. The terminal layouts are shown in the illustrations below.

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

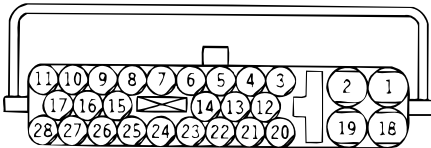


AC100946 AB

CONNECTOR TERMINAL NO	SIGNAL	CHECKING REQUIREMENT		NORMAL CONDITION
1	Solenoid valve power supply	Always		Battery positive voltage
3	Stop light switch input	Ignition switch: "ON"	Stop light switch: "ON"	Battery positive voltage
			Stop light switch: "OFF"	Approximately 0 V
4	Diagnosis changeover input	When the scan tool is connected		Approximately 0 V
		When the scan tool is not connected		Battery positive voltage
12	ABS-ECU warning lamp transistor output	Ignition switch: "ON"	When the light is switched off	Approximately 0 V
			When the light is illuminated	Battery positive voltage
13	Scan tool	When the scan tool is connected		Serial communication with Scan tool
		When the scan tool is not connected		Approximately 0 V
19	Motor power supply	Always		Battery positive voltage
20	ABS-ECU power supply	Ignition switch: "ON"		Battery positive voltage
		Ignition switch: "START"		Approximately 0 V

RESISTANCE AND CONTINUITY BETWEEN
HARNESS-SIDE CONNECTOR TERMINALS

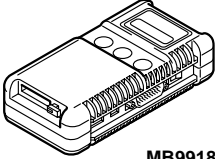
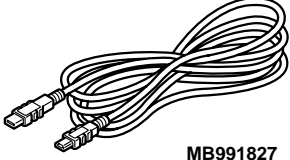
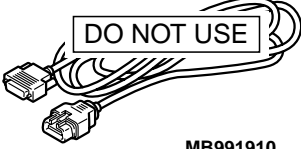
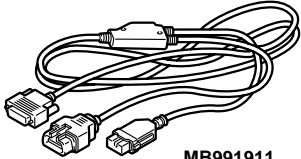
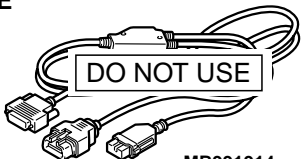
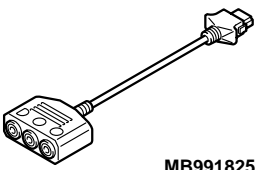
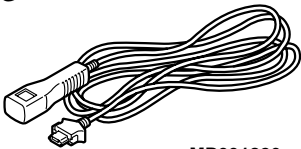
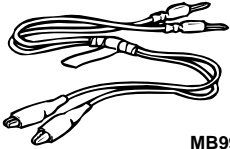
1. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Check the resistance and continuity between the terminals indicated in the table below.
3. The terminal layout is shown in the illustration.

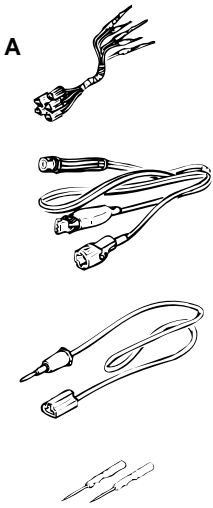


AC100947AB

CONNECTOR TERMINAL NO.	SIGNAL	NORMAL CONDITION
9 – 10	Front-right wheel speed sensor	1.24 – 1.64 kΩ
11 – 17	Rear-right wheel speed sensor	1.24 – 1.64 kΩ
16 – 26	Front-left wheel speed sensor	1.24 – 1.64 kΩ
27 – 28	Rear-left wheel speed sensor	1.24 – 1.64 kΩ
2 – body ground	Ground	Less than 2 ohms
18 – body ground	Ground	Less than 2 ohms

SPECIAL TOOLS

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
<p>A</p>  <p>MB991824</p> <p>B</p>  <p>MB991827</p> <p>C</p>  <p>MB991910</p> <p>D</p>  <p>MB991911</p> <p>E</p>  <p>MB991914</p> <p>F</p>  <p>MB991825</p> <p>G</p>  <p>MB991826 MB991958</p>	<p>MB991958 A: MB991824 B: MB991827 C: MB991910 D: MB991911 E: MB991914 F: MB991825 G: MB991826 MUT-III sub assembly A: Vehicle communication interface (V.C.I.) B: MUT-III USB cable C: MUT-III main harness A (Vehicles with CAN communication system) D: MUT-III main harness B (Vehicles without CAN communication system) E: MUT-III main harness C (for Daimler Chrysler models only) F: MUT-III measurement adapter G: MUT-III trigger harness</p>	<p>MB991824-KIT <i>NOTE: G: MB991826 MUT-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.</i></p>	<p>SWS communication line check (ECU check and service data)</p> <p>CAUTION MUT-III main harness B (MB991911) should be used. MUT-III main harness A and C should not be used for this vehicle.</p>
 <p>MB991529</p>	<p>MB991529 Diagnostic trouble code check harness</p>	<p>Tool not necessary if scan tool (MUT-III) is available.</p>	<p>For checking of ABS (Diagnostic trouble code display when using the ABS warning light)</p>

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
 <p>A</p> <p>MB991223AH</p>	MB991223 Harness set A: MB991219 Inspection harness	MB991223 MB991709-01	Wheel speed sensor output voltage measurement

ON-VEHICLE SERVICE

BLEEDING

M1352001500217

CAUTION

Use only brake fluid DOT3 or DOT4. Avoid using a mixture of the specified brake fluid and other fluid.

MASTER CYLINDER BLEEDING

Refer to GROUP 35A, On-vehicle Service – Bleeding
[P.35A-24](#).

BRAKE LINE BLEEDING

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 – Bleeding
[P.35A-24](#).

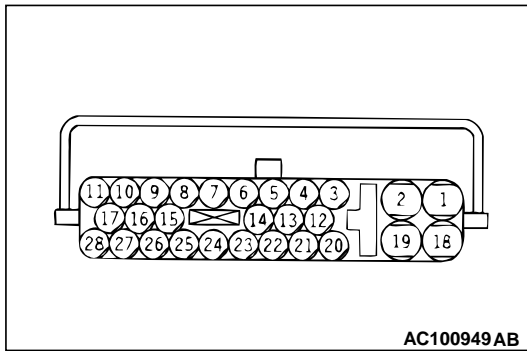
WHEEL SPEED SENSOR OUTPUT VOLTAGE MEASUREMENT

M1352001600311

Required Special Tool:

MB991219: Inspection Harness

1. Lift up the vehicle and release the parking brake.



2. 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
16	9	27	11
26	10	28	17

3. Manually turn the wheel to be measured 1/2 to 1 turn/second. Measure the output voltage with a voltmeter or oscilloscope.

Output voltage:

- Minimal voltmeter reading: 42 mV
- Maximum voltmeter reading: 300 mV
- Minimal oscilloscope reading: 120 mV
- Maximum oscilloscope reading: 600 mV

Probable causes of low output voltage

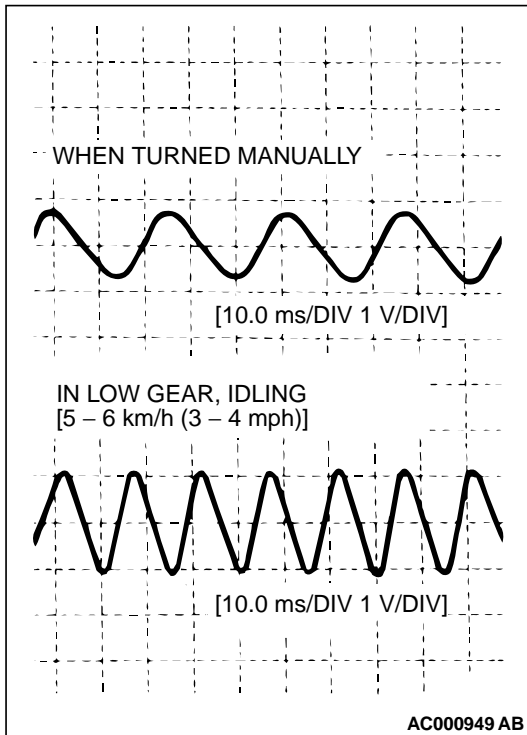
- Wheel speed sensor pole piece-to-ABS rotor clearance too large
- Faulty wheel speed sensor

NOTE: Check the connection of the sensor harness and connector before using the oscilloscope.

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: 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 amplitude	Faulty wheel speed sensor	Replace sensor
Waveform amplitude fluctuates excessively (This is no problem if the minimum amplitude is 100 mV or more)	Axle hub eccentric or with large runout	Replace hub
	Faulty ABS-ECU ground	Repair harness
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

M1352001700590

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: Vehicle Communication Interface (V.C.I.)
 - MB991827: MUT-III USB Cable
 - MB991911: MUT-III Main Harness B (Vehicles without CAN communication system)

⚠ 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.

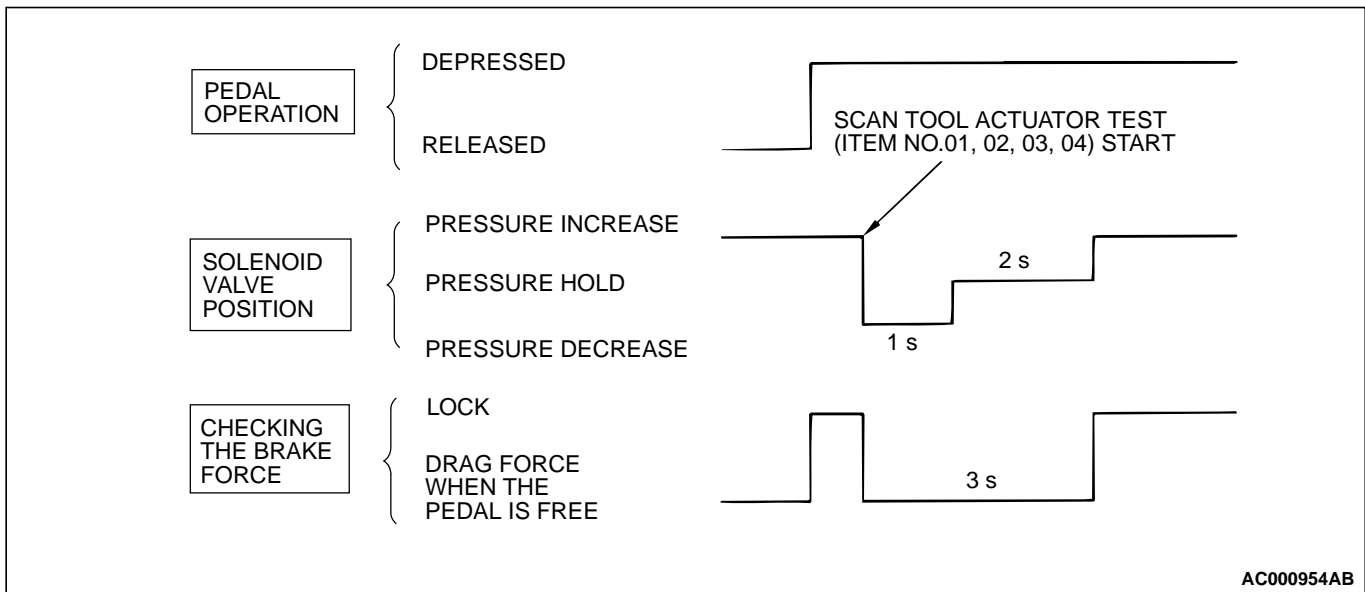
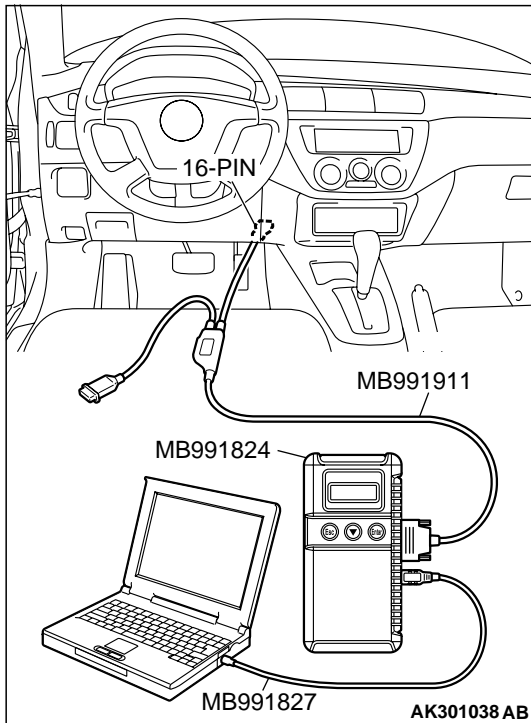
CAUTION

To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

3. Turn the ignition switch to the "LOCK" (OFF) position and set scan tool MB991958 as shown in the illustration.
4. After checking that the shift lever <M/T> or the selector lever <A/T> is in neutral, start the engine.
5. Use scan tool MB991958 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 MB991958 actuator testing cannot be used.



AC000954AB

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 inspected 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	588 – 784 N (132 – 176 lb.)

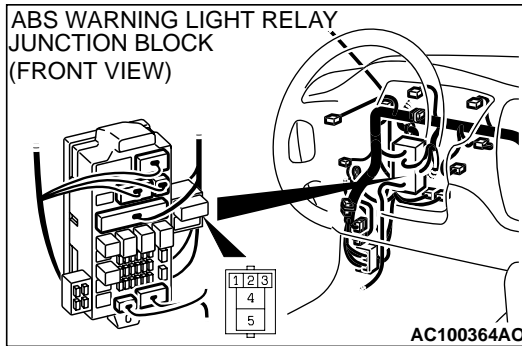
7. If the result of inspection is abnormal, repair according to the Diagnosis Table below.

DIAGNOSIS TABLE					
NO.	OPERATION	NORMAL CONDITION	ABNORMAL CONDITION	PROBABLE CAUSE	REMEDY
01	1. Depress brake pedal to lock wheel. 2. Using scan tool MB991502, select the wheel to be checked and force the actuator to operate. 3. Turn the selected wheel manually to check the change of brake force.	Brake force released for three locking.	Wheel does not lock when brake pedal is depressed.	Clogged brake line other than hydraulic unit	Check and clean brake line
02				Clogged hydraulic circuit in hydraulic unit	Replace hydraulic unit assembly
03			Brake force is not released	Incorrect hydraulic unit brake tube connection	Connect correctly
04				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 WARNING LIGHT RELAY CHECK

M1352011000097



BATTERY VOLTAGE	TESTER CONNECTION	SPECIFIED CONDITION
No applied	2 – 5	Less than 2 ohms
<ul style="list-style-type: none"> Connect terminal 1 to the positive battery terminal Connect terminal 3 to the negative battery terminal 	2 – 5	Open circuit

IN THE EVENT OF A DISCHARGED BATTERY

M1352003500354

⚠ 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.

HYDRAULIC UNIT

REMOVAL AND INSTALLATION

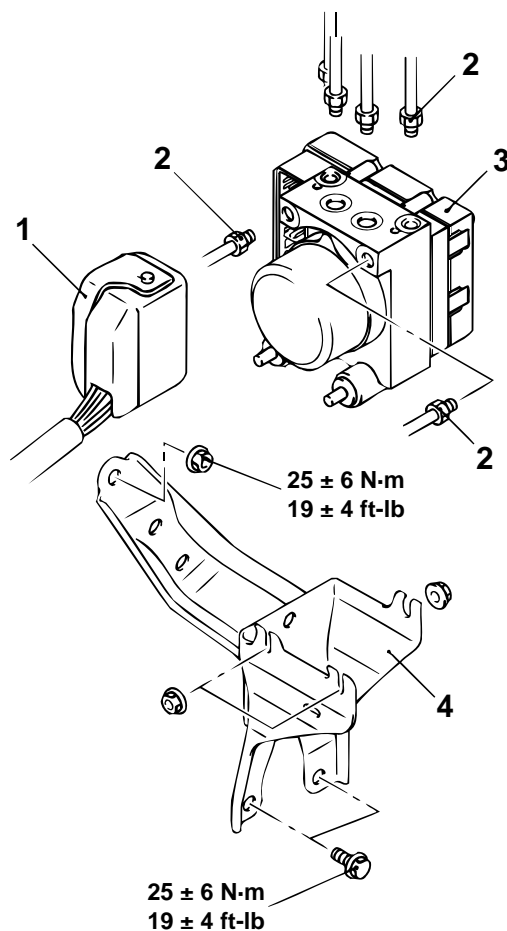
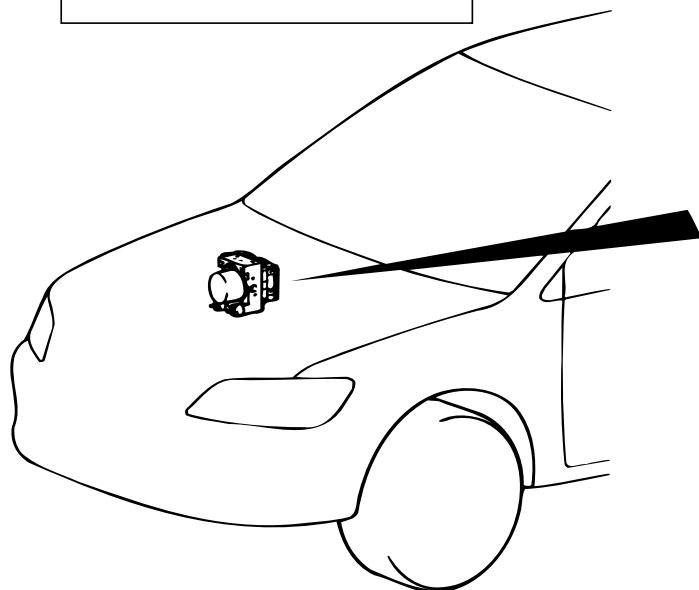
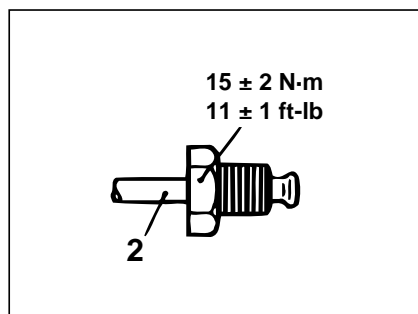
M1352008600312

*NOTE: The ABS-ECU is integrated in the hydraulic unit.***Pre-removal Operation**

- Brake Fluid Draining

Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding (Refer to [P.35B-64.](#))
- Hydraulic Unit Check (Refer to [P.35B-66.](#))



AC100173 AB

<<A>>

REMOVAL STEPS

1. HARNESS CONNECTOR
2. BRAKE PIPE CONNECTION

<>

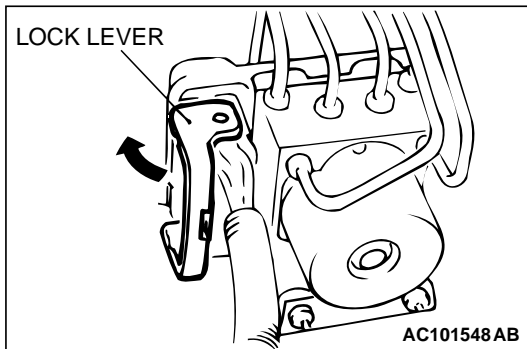
REMOVAL STEPS (Continued)

3. HYDRAULIC UNIT AND ABS-ECU
4. HYDRAULIC UNIT BRACKET ASSEMBLY

REMOVAL SERVICE POINTS

<<A>> HARNESS CONNECTOR DISCONNECTION

Move the lock lever of the ABS-ECU connector as shown in the illustration, and then disconnect the harness connector.



<> HYDRAULIC UNIT AND ABS-ECU REMOVAL

WARNING

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

CAUTION

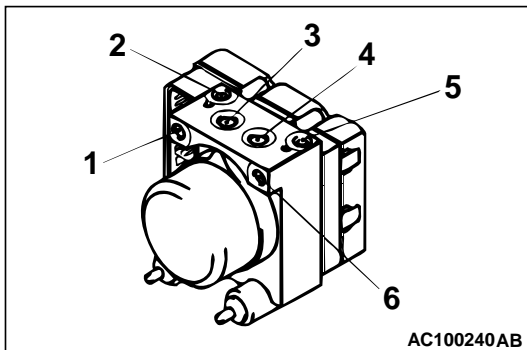
- The hydraulic unit cannot be disassembled. Never loosen its nuts or bolts.
- Do not drop or shock the hydraulic unit.
- Do not turn the hydraulic unit upside down or lay it on its side.

INSTALLATION SERVICE POINT

>>A<< BRAKE PIPE CONNECTION

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

1. From the master cylinder (secondary)
2. To the front brake (LH)
3. To the rear brake (RH)
4. To the rear brake (LH)
5. To the front brake (RH)
6. From the master cylinder (primary)



WHEEL SPEED SENSOR

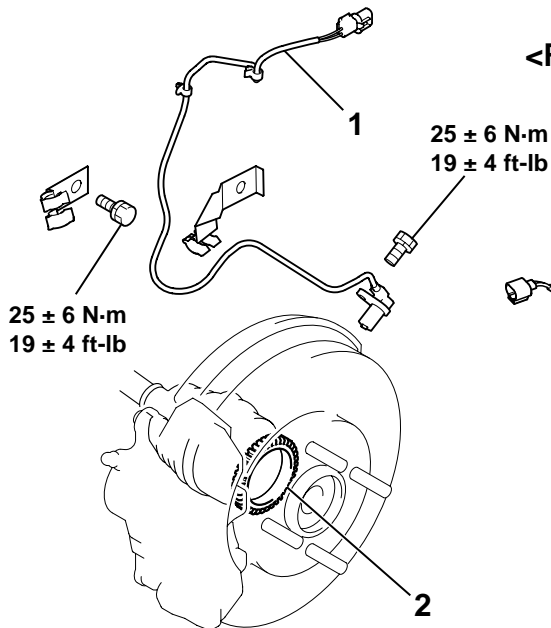
REMOVAL AND INSTALLATION

M1352008300560

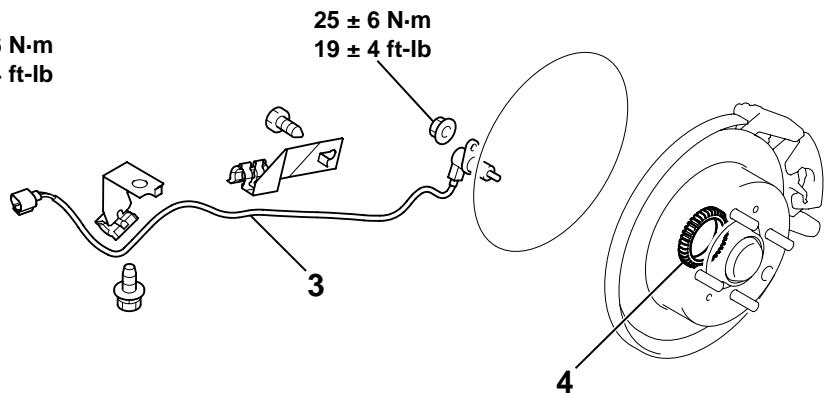
Post-installation Operation

- Wheel Speed Sensor Output Voltage Measurement (Refer to [P.35B-64](#)).

<FRONT>



<REAR>



AC304419 AE

FRONT WHEEL SPEED SENSOR
REMOVAL STEPS

<<A>>

1. FRONT SPEED SENSOR
2. FRONT ABS ROTOR (REFER TO GROUP 26, DRIVESHAFT [P.26-22](#)).

REAR WHEEL SPEED SENSOR
REMOVAL STEPS

<<A>>

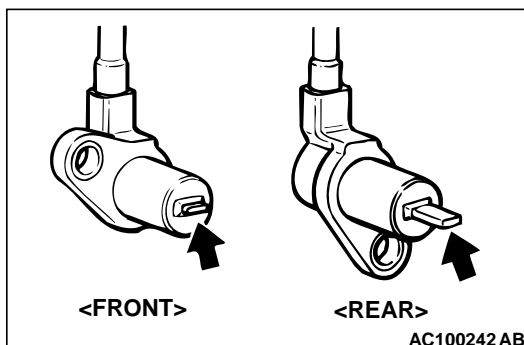
3. REAR WHEEL SPEED SENSOR
4. REAR ABS ROTOR (REFER TO GROUP 27, REAR HUB ASSEMBLY [P.27-9](#))

REMOVAL SERVICE POINT

<<A>> FRONT WHEEL SPEED SENSOR/REAR WHEEL
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.



AC100242 AB

INSPECTION

CHECK OF RESISTANCE BETWEEN WHEEL SPEED SENSOR TERMINALS

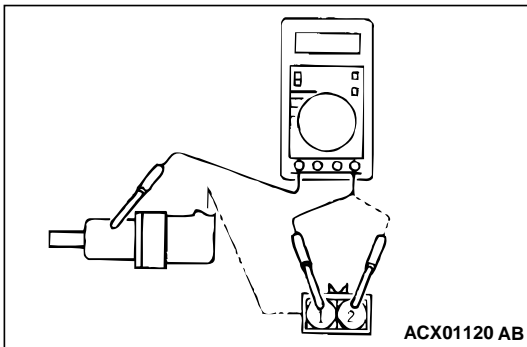
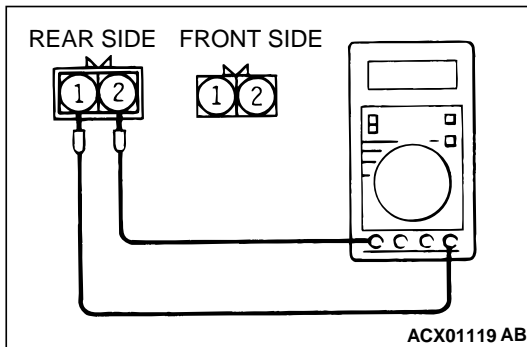
1. Check whether any metallic foreign material has adhered to the projection at the speed sensor tip. Remove any foreign material. Also check whether the pole piece is damaged. Replace it with a new one if it is damaged.

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: 1.24 – 1.64 kΩ

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

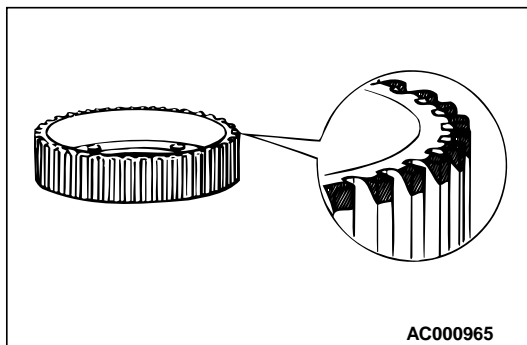


4. Remove all connections from the speed sensor. The circuit should be open between terminals (1) and (2) and the body of the speed sensor. If the circuit is not open, replace with a new speed sensor.
5. Check the speed sensor cable for breakage, damage or disconnection. Replace with a new one if a problem 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 assembly for the front side, or the ABS rotor for the rear side, respectively, if the teeth are damaged or deformed.



SPECIFICATIONS

FASTENER TIGHTENING SPECIFICATIONS

M1352012400269

ITEM	SPECIFICATION
Brake tube flare nut	15 ± 2 N·m (11 ± 1 ft-lb)
Front wheel speed sensor bolt	25 ± 6 N·m (19 ± 4 ft-lb)
Front wheel speed sensor bracket bolt	25 ± 6 N·m (19 ± 4 ft-lb)
Hydraulic unit bracket bolt and nut	25 ± 6 N·m (19 ± 4 ft-lb)
Rear wheel speed sensor nut	25 ± 6 N·m (19 ± 4 ft-lb)

SERVICE SPECIFICATIONS

M1352000300395

ITEM	STANDARD VALUE
Wheel speed sensor internal resistance kΩ	1.24 – 1.64