

## GROUP 35B

# ANTI-LOCK BRAKING SYSTEM (ABS)

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## GENERAL DESCRIPTION

M1352000100454

### FEATURES

The ABS 8 ensures directional stability and control during hard braking.

This ABS uses a 4-sensor 4-channel system that controls all four wheels independently of each other.

- EBD (Electronic Brake-force Distribution system) control provides the ideal braking force for the rear wheels.
- Active wheel speed sensors have been installed, that produce changes of current flow through the wheel speed sensor circuit which is influenced by the reluctor ring fitted to the wheel hub.
- Active wheel speed sensors have a constant incoming power supply on one wire and return a signal on the other wire
- The advantage of the active wheel speed sensor is that there is always a signal until the wheel has stopped. As the wheel speeds up or slows down, the frequency will change where the amplitude of the signal will remain constant.
- A Hall switch and magnet assembly is contained within the sensor.

### EBD CONTROL

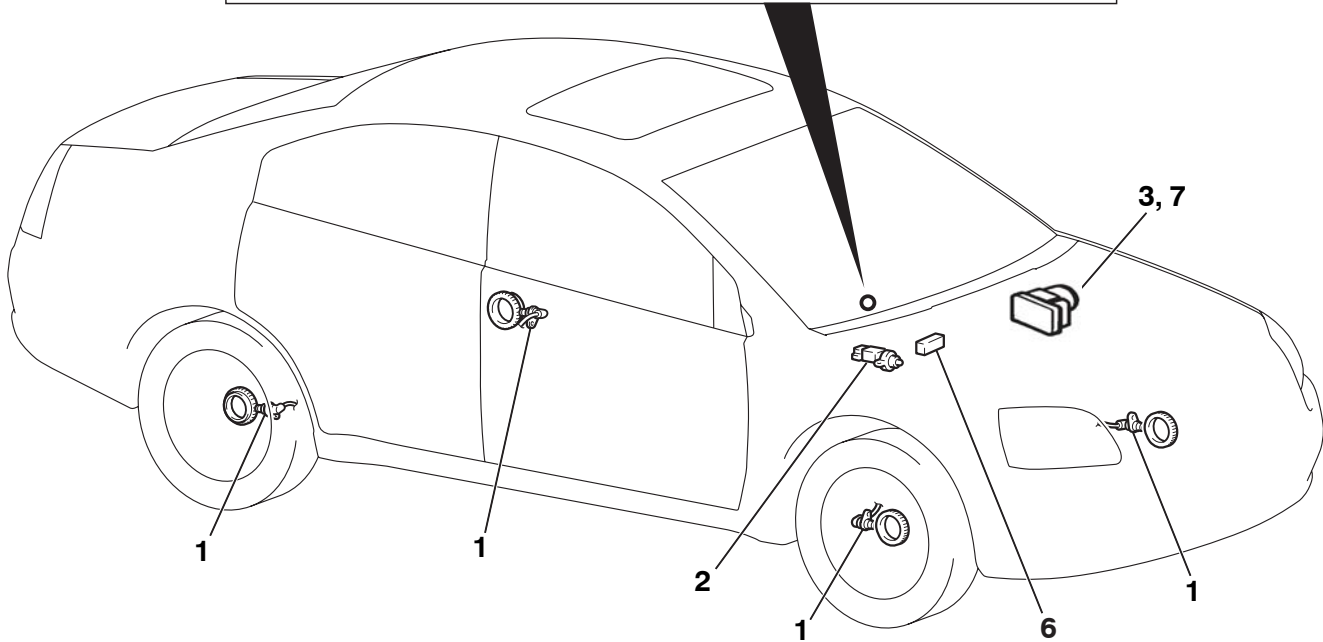
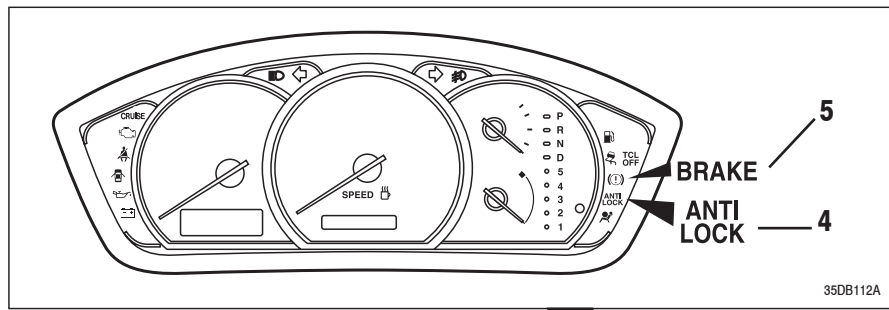
In ABS, electronic control is used so the rear wheel brake hydraulic pressure during braking is regulated by rear wheel control solenoid valves in accordance with the vehicle's rate of deceleration. The front and rear wheel slippage are calculated from the signals received from the various wheel sensors.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

- As the tooth on the reluctor approaches the sensor, the magnetic circuit is completed therefore turning on the Hall switch. As the tooth departs the sensor, the Hall switch will turn off.
- The output waveform displayed on the oscilloscope will be a square wave, (between signal wire and ground).
- To shorten the harness wires and enhance data transmission reliability, communication with other ECU is performed over a CAN (Controller Area Network).
- *NOTE: For further details on CAN communication, refer to GROUP 54C, CAN.*
- Fail-safe function ensures that safety is maintained.
- Diagnostic function provides improved serviceability.

***NOTE: If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be cycled to the "OFF" position then to the "ON" position again.***

- Because the system provides the optimum rear wheel braking force regardless of vehicle load and the condition of the road surface, the system reduces the required pedal depression force, particularly when the vehicle is heavily loaded.
- Because the duty placed on the front brakes is reduced, the increases in pad temperature can be controlled during front brake application to improve pad wear.
- Control valves such as the proportioning valve are not required.

**CONSTRUCTION DIAGRAM**



35DR031A

NAME OF PART		NUMBER	OUTLINE OF FUNCTION
Sensor	Active wheel speed sensor	1	Sends alternating voltage signals at frequencies which are independant to the rotation speeds of each wheel to the ABS-ECU.
	Stoplight switch	2	Sends a signal to the ABS-ECU to indicate whether the brake pedal is depressed or not.
Actuator	Hydraulic unit	3	Drives the solenoid valves according to signals from the ABS-ECU in order to control the brake hydraulic pressure for each wheel.
	ABS warning light	4	Illuminates in response to signals from the ABS-ECU when a problem develops in the ABS system.
	Brake warning light	5	Illuminates in response to signals from the ABS-ECU when a problem develops in the EBD system.
Data link connector		6	Outputs the diagnostic trouble codes and allows communication with the diagnostic tool.
ABS-ECU		7	Controls actuators (described above) based on the signals coming from each sensor.
			Controls the self-diagnosis and fail-safe functions.
			Controls the diagnostic function (diagnostic tool compatible).

## SYSTEM CHECK SOUND

When the vehicle speed reaches 10 km/h after ignition switch ON, 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 tyres 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

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

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## ABS Diagnostic Trouble Code Detection Conditions

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

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

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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.00-14](#).

5. If you can verify the condition but there are no ABS DTCs, or the system cannot communicate with the diagnostic 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-3](#).
  - If the basic brake system is operating properly, refer to [P.35B-71](#).
6. If there is an ABS DTC, record the number of the DTC, then erase the DTC from the memory using the diagnostic tool.

*NOTE: Any DTCs stored in the ABS-ECU cannot be erased if there is a malfunction.*

7. Duplicate the ABS DTC set conditions to see if the same ABS DTC will set again.
  - If the same ABS DTC sets again or the ABS DTC cannot be erased, perform the diagnostic procedures for the DTC. Refer to [P.35B-9](#).
  - 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.00-14](#).

## DIAGNOSTIC FUNCTION

### ON-BOARD DIAGNOSTICS (OBD)

If the ABS-ECU detects any problem in the CAN communication line or the ECUs, which the ABS-ECU is communicating with, it stores a diagnostic trouble code. The DTCs have 9 items. The DTCs can be confirmed by connecting diagnostic tool

M1352011200596

MB991958 (MUT-III sub assembly.) The stored DTCs are not erased even after the ignition switch has been turned to the LOCK (OFF) position, or the battery has been disconnected. The DTCs can be erased by operating diagnostic tool MB991958 (MUT-III sub assembly.)

## HOW TO CONNECT THE DIAGNOSTIC TOOL (MUT-III)

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

### **⚠ CAUTION**

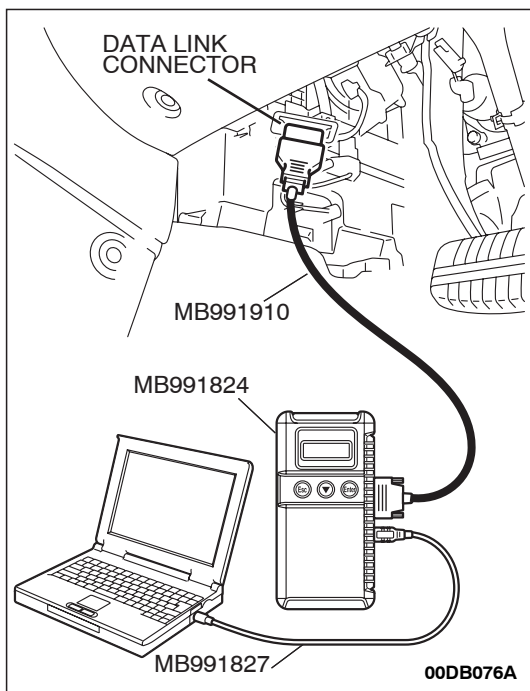
**To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.**

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 MB991910 to the special tool MB991824.
5. Connect special tool MB991910 to the data link connector.
6. Turn the power switch special tool MB991824 to the "ON" position.

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

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

*NOTE: Disconnect the diagnostic tool MB991958 in the reverse order of the connecting sequence, making sure that the ignition switch is at the "LOCK" (OFF) position.*



## HOW TO READ AND ERASE DIAGNOSTIC TROUBLE CODES

### Required Special Tools:

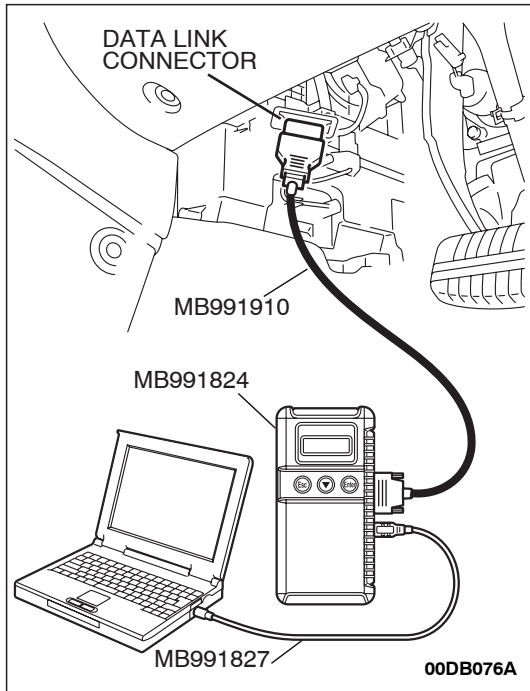
- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

### **⚠ CAUTION**

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

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

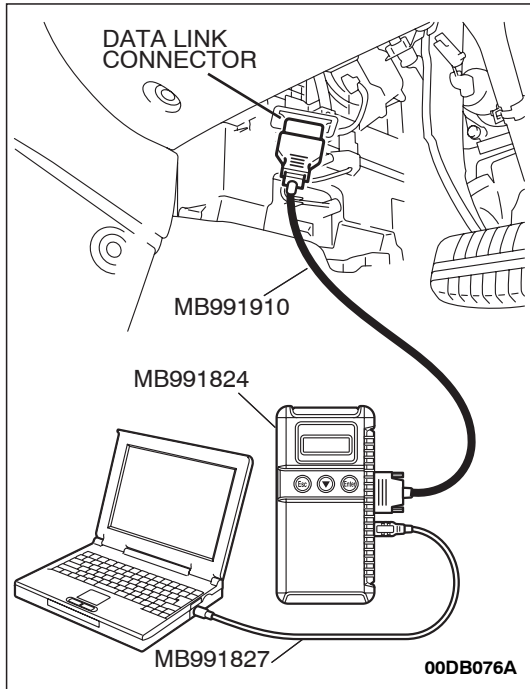
1. Connect diagnostic tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "Interactive Diagnosis" from the start-up screen.
4. Select "System Select."
5. Choose "ABS" .
6. Select "Diagnostic Trouble Code."
7. If a DTC is set, it is shown.
8. Choose "DTC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



## HOW TO READ DATA LIST

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A



**CAUTION**

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

1. Connect diagnostic 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" .
6. Select "Data List."
7. Choose an appropriate item and select the "OK" button.

## HOW TO PERFORM ACTUATOR TEST

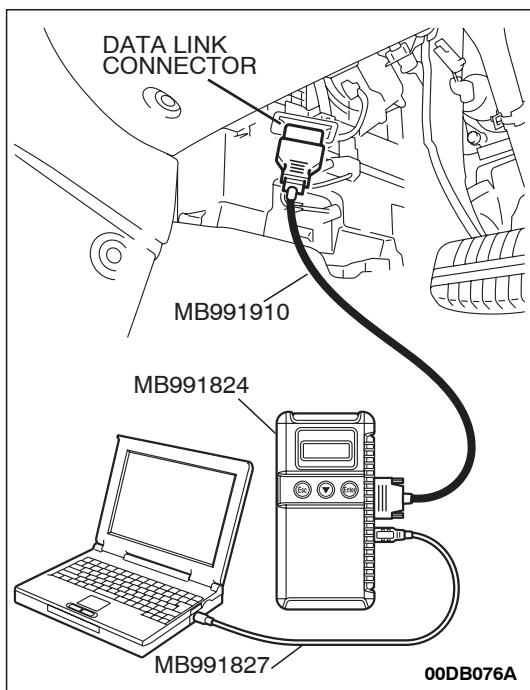
### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

**CAUTION**

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

1. Connect diagnostic 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" .
6. Choose "Actuator Test" from "ABS" screen.
7. Choose an appropriate item and select the "OK" button.





## HOW TO DIAGNOSE THE CAN BUS LINE

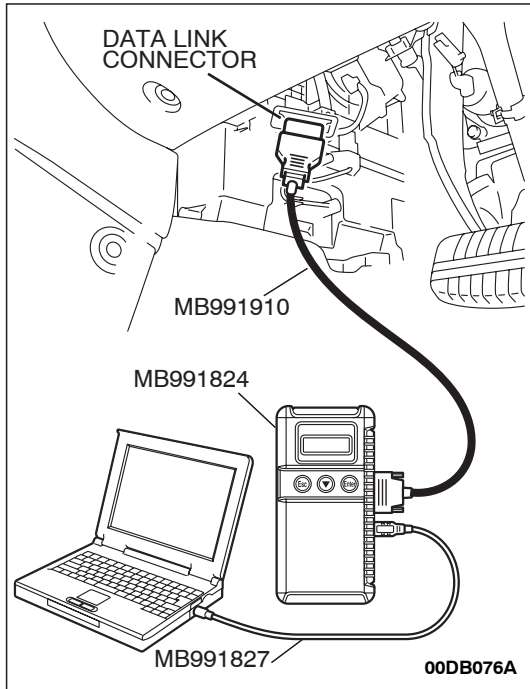
### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

### **⚠ CAUTION**

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

1. Connect diagnostic tool MB991958 to the data link connector.
2. Turn the ignition switch to the "ON" position.
3. Select "CAN bus diagnosis" from the start-up screen.
4. When the vehicle information is displayed, confirm that it matches the vehicle whose CAN bus lines will be diagnosed.
  - If they match, go to step 8.
  - If not, go to step 5.
5. Select "view vehicle information" button.
6. When the vehicle information is displayed, confirm again that it matches the vehicle which is being diagnosed.
  - If they match, go to step 8.
  - If not, go to step 5.
7. Press the "OK" button.
8. When the options are displayed, choose the options (mark the check) and then select "OK".





## DIAGNOSTIC TROUBLE CODE CHART

M1352011300601

### **CAUTION**

During diagnosis, a DTC code associated with another system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for DTCs. If DTC code(s) are set, erase them all.

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

DTC	INSPECTION ITEM	DIAGNOSTIC CONTENT	REFERENCE PAGE
C1200	Front right wheel speed sensor	Open circuit or short circuit	P.35B-10
C1201	Front right wheel speed sensor	Abnormal output signal	P.35B-26
C1205	Front left wheel speed sensor	Open circuit or short circuit	P.35B-10
C1206	Front left wheel speed sensor	Abnormal output signal	P.35B-26
C1210	Rear right wheel speed sensor	Open circuit or short circuit	P.35B-10
C1211	Rear right wheel speed sensor	Abnormal output signal	P.35B-26
C1215	Rear left wheel speed sensor	Open circuit or short circuit	P.35B-10
C1216	Rear left wheel speed sensor	Abnormal output signal	P.35B-26
C1225	Deviation between wheel speeds		P.35B-40 or refer to the above appropriate abnormal output sensor signal P.35B-26
C1226	ABS front right (FR) inlet solenoid valve		P.35B-41
C1231	ABS front right (FR) outlet solenoid valve		P.35B-41
C1236	ABS front left (FL) inlet solenoid valve		P.35B-41
C1241	ABS front left (FL) outlet solenoid valve		P.35B-41
C1246	ABS rear right (RR) inlet solenoid valve		P.35B-41
C1251	ABS rear right (RR) outlet solenoid valve		P.35B-41
C1256	ABS rear left (RL) inlet solenoid valve		P.35B-41
C1261	ABS rear left (RL) outlet solenoid valve		P.35B-41
C1266	Motor pump system (seizure)		P.35B-48
C1273	Motor relay (drive circuit) problem (stays off)		P.35B-48
C1274	Motor relay (drive circuit) problem (stays on)		P.35B-48
C1276	Valve relay malfunction		P.35B-56
C1278	Valve relay problem (stays off)		P.35B-56
C1279	Valve relay problem (stays on)		P.35B-56
C1607	ABS-ECU malfunction		P.35B-62
C1860	Power supply system	Abnormal rise in voltage	P.35B-63
C1861	Power supply system	Abnormal drop in voltage	P.35B-63
U1073	CAN-Bus off		P.35B-69

DTC	INSPECTION ITEM	DIAGNOSTIC CONTENT	REFERENCE PAGE
U1100*	CAN communications system time out error engine related data		GROUP 13D, Diagnostic Trouble Code Procedures <a href="#">13A-527</a>
U1101*	CAN communications system time out error A/T related data		GROUP 54C, Diagnostic Trouble Code Procedures
U1400*	CAN invalid signal Accelerator Position (Dynamic range error APS)		GROUP 13D, Diagnostic Trouble Code Procedures <a href="#">13A-515</a>
U1415	CAN invalid signal Gear Position		GROUP 23A Diagnostic Trouble Code Chart <a href="#">P.23A-34</a>

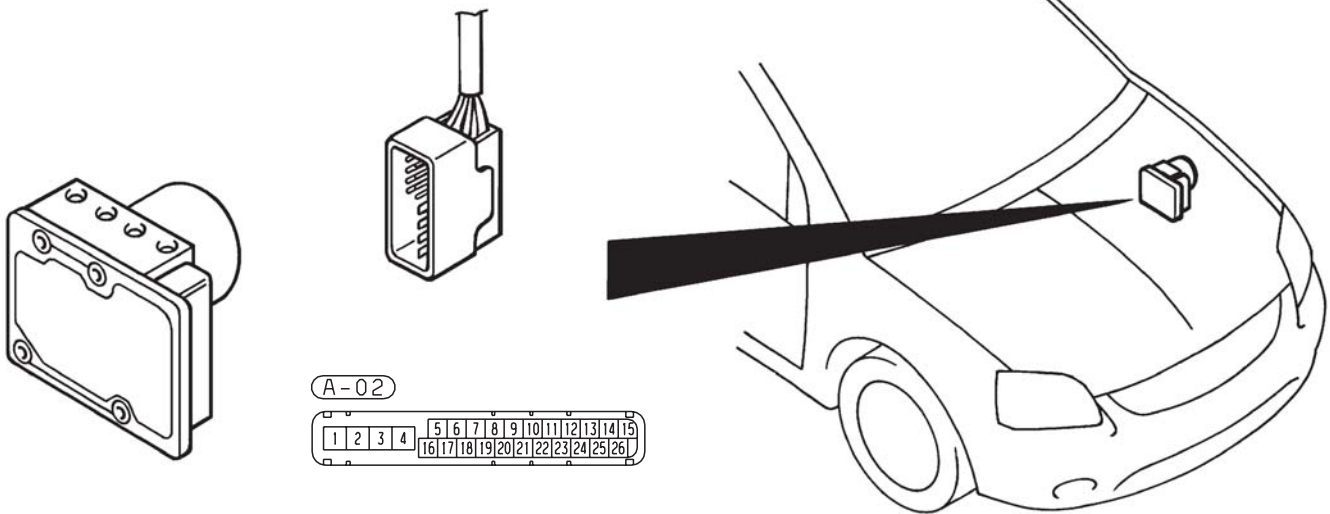
*NOTE: Since the ABS system is controlled with the same ABS/TCL-ECU used to control the TCL system, the codes (with a \*) used only for the ABS system also appear.*

*The inspection contents for the codes (with a \*) used only for the TCL system do not described in this group.*

## DIAGNOSTIC TROUBLE CODE PROCEDURES

### DTC C1200/C1205/C1210/1215 Wheel Speed Sensor (Open circuit or short circuit)

**A**



35DB090A

#### **⚠ CAUTION**

- Wheel speed sensor wires/ wiring are not to be interchanged, as this could destroy the sensor.
- Never apply external voltage (e.g. battery voltage) to sensors. Excessively high voltages or current can lead to failures.

**NOTE: If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is**

**an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.**

**⚠ CAUTION**

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Diagnose the CAN bus lines before the DTC (Refer to GROUP 54C, Trouble code diagnosis **P.54C-13**).

**CIRCUIT OPERATION**

- Active wheel speed sensors have been installed, that produce changes of current flow through the wheel speed sensor circuit which is influenced by the reluctor ring fitted to the wheel hub.
- Active wheel speed sensors have a constant incoming power supply on one wire and return a signal on the other wire
- The advantage of the active wheel speed sensor is that there is always a signal until the wheel has stopped. As the wheel speeds up or slows down, the frequency will change where the amplitude of the signal will remain constant.
- A Hall switch and magnet assembly is contained within the sensor.

- As the tooth on the reluctor approaches the sensor, the magnetic circuit is completed therefore turning on the Hall switch. As the tooth departs the sensor, the Hall switch will turn off.
- The output waveform displayed on the oscilloscope will be a square wave, (between signal wire and ground).
- The ABS hydraulic unit modulates the amount of braking force individually applied to each wheel cylinder.

**ABS DTC SET CONDITIONS**

The ABS-ECU monitors voltage fluctuation in each wheel speed sensor circuit. If the ECU detects a short or open circuit in the circuit, it will set a diagnostic trouble code.

**WHEEL SPEED SENSOR AIR GAP:**

- Sensor air gap: (0.2mm - 0.85mm).

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

### Current trouble

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

### Past trouble

- Carry out diagnosis with particular emphasis on connector(s) or wiring harness in wheel speed sensor circuit. For diagnosis procedures, refer to "How to cope with past trouble" (Refer to GROUP 00, How to use Troubleshooting/Inspection Service Points [P.00-16](#)).

### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

## DIAGNOSIS

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
  - MB991222: Back-probing probe
  - MB991219: Inspection test harness

### STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.

#### CAUTION

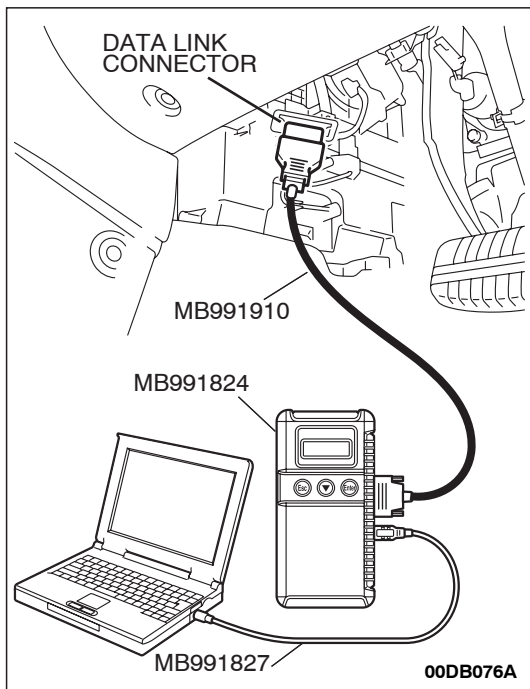
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

### Q: Is the CAN bus line found to be normal?

**YES :** Go to Step 3

**NO :** Repair the CAN bus line (Refer to GROUP 54C, Diagnosis [P.54C-15](#)). Then go to Step 2.



**STEP 2. Recheck for diagnostic trouble code.**

**⚠ CAUTION**

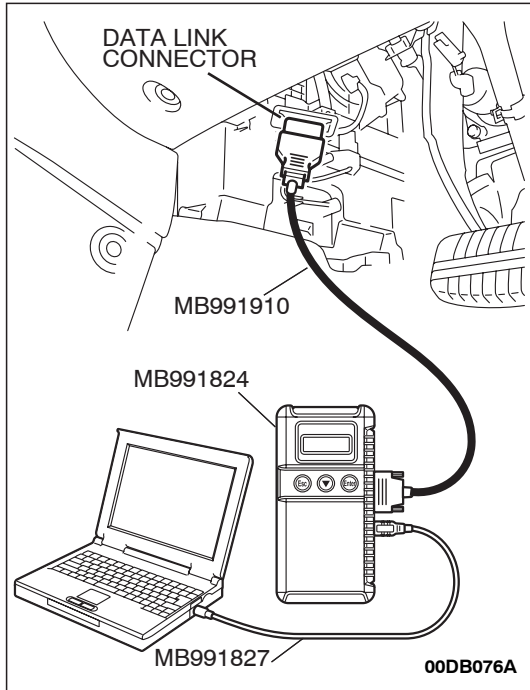
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1200, C1205, C1210 or C1215 set?**

**YES :** Go to Step 3

**NO :** The procedure is complete.



**STEP 3. Using diagnostic tool MB991958, check data list.**

**⚠ CAUTION**

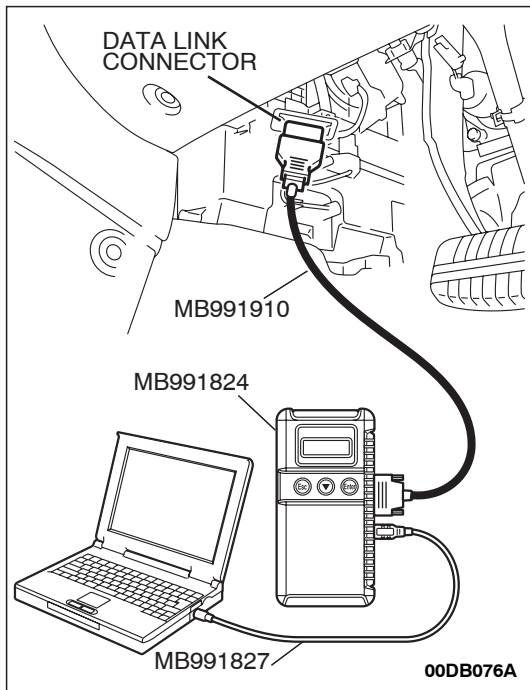
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Start the engine.
- (3) Set diagnostic tool MB991958 to the data reading mode, and check the data list items by driving the vehicle.
  - Item 01 (DTC C1205 is set): Front left wheel speed sensor
  - Item 02 (DTC C1200 is set): Front right wheel speed sensor
  - Item 03 (DTC C1215 is set): Rear left wheel speed sensor
  - Item 04 (DTC C1210 is set): Rear right wheel speed sensor
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Does the speedometer indication match the diagnostic tool indication?**

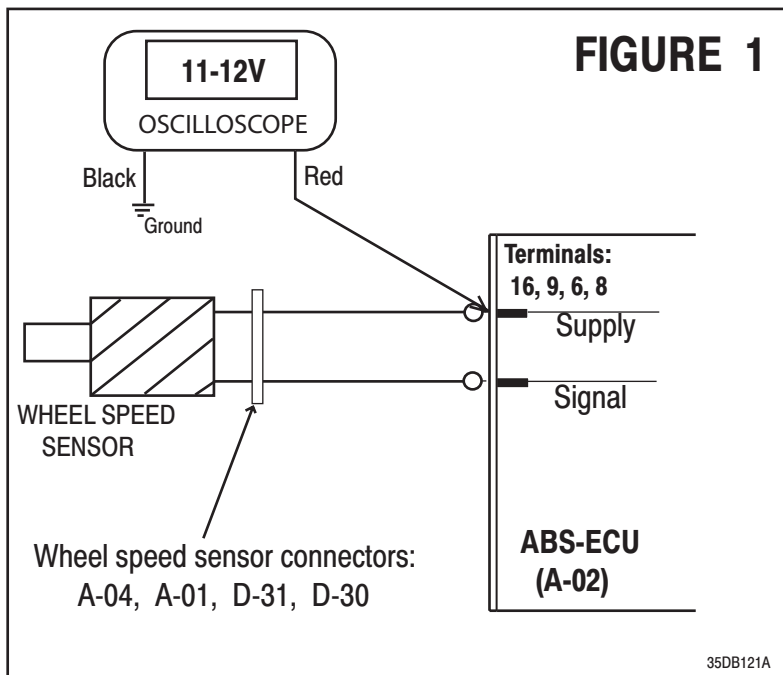
**YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).

**NO :** Go to Step 4.



**STEP 4. Measure supply voltage for wheel speed sensor using an oscilloscope.**

- (1) ABS-ECU must remain connected.
- (2) Remove ABS connector protection cap to access terminal location from the rear of connector for back-probing.
- (3) Using probe (MB991222) , backprobe the wheel speed sensor voltage supply circuit terminals (16, 9, 6 and 8) at the ABS-ECU connector (A-02) individually.
- (4) Connect oscilloscope (as per figure 1) shows, to the appropriate terminal positions and check supply voltage individually with scope.



- If Item 01 (DTC C1205 is set): Connect oscilloscope to FL sensor signal terminal (16) at ABS-ECU (A-02)
  - If Item 02 (DTC C1200 is set): Connect oscilloscope to FR sensor signal terminal (9) at ABS-ECU (A-02)
  - If Item 03 (DTC C1215 is set): Connect oscilloscope to RL sensor signal terminal (6) at ABS-ECU (A-02)
  - If Item 04 (DTC C1210 is set): Connect oscilloscope to RR sensor signal terminal (8) at ABS-ECU (A-02)
- (5) Turn the ignition switch to the "ON" position.

**(6) The recommended Supply Voltage at terminals 16, 9, 6, and 8 are:**

- Set value: 10.0Volts - 14.5Volts

**Q: Is the supply voltage within the set value?**

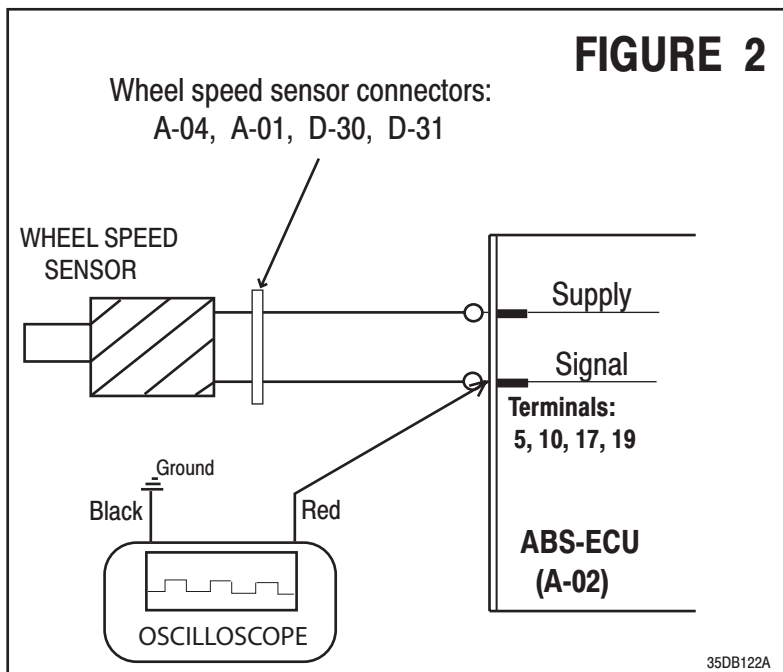
**YES :** Go to Step 5

- NO :**
- Refer to Power supply system [P.35B-63](#)
  - Refer to Motor supply system [P.35B-48](#)
  - Refer to Valve relay system [P.35B-56](#)

**STEP 5. Measure wheel speed sensor signals using an oscilloscope.**

*NOTE: To check connections of the wheel speed sensors, remove the rear seat to access the rear wheel speed sensor connectors, and remove inner front guard (splash shield) to access the front wheel speed sensors.*

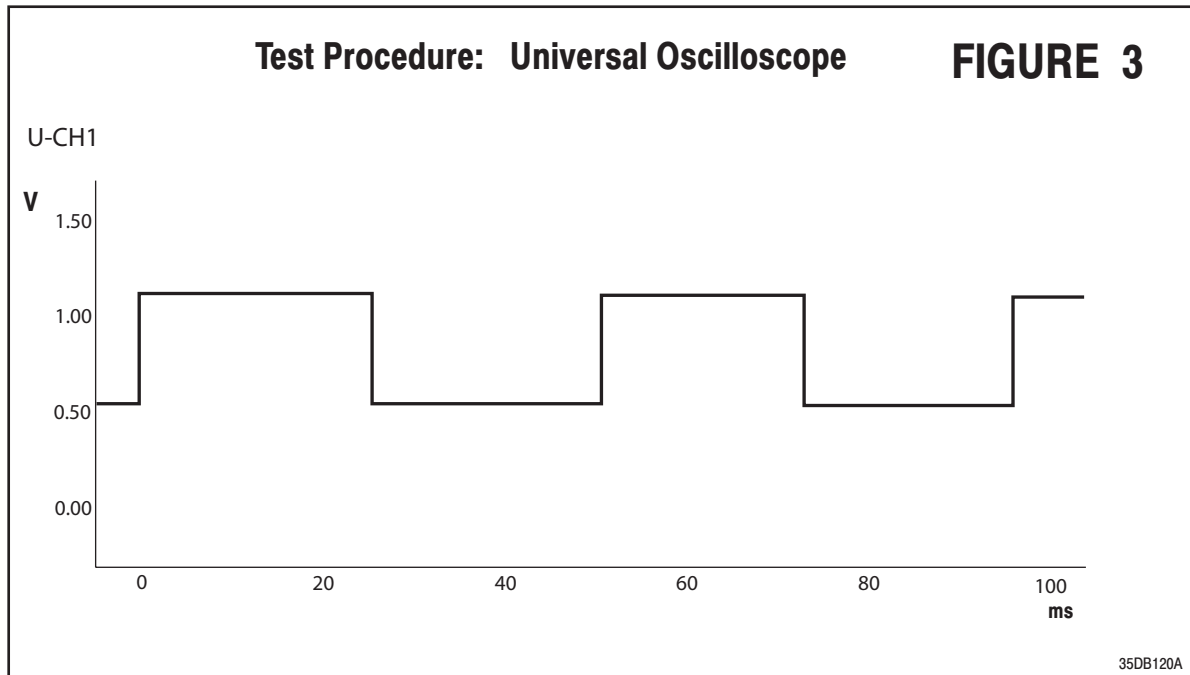
- (1) Wheel speed sensor must remain connected to measure active sensor.
- (2) ABS-ECU must remain connected.
- (3) Remove ABS connector protection cap to access terminal location from the rear of connector for back-probing.
- (4) Using probe (MB991222), backprobe the wheel speed sensor signal circuit terminals (5, 10, 17, 19), and check individually at the ABS-ECU connector A-02
- (5) The wheel to be tested must be free to turn by hand or be driven by brake dynamometer
- (6) Connect oscilloscope (as per figure 2) shows, to the appropriate terminal positions and check sensor operation individually with scope.



- If Item 01 (DTC C1205 is set): Connect oscilloscope to FL sensor signal terminal (5) at ABS-ECU (A-02)
  - If Item 02 (DTC C1200 is set): Connect oscilloscope to FR sensor signal terminal (10) at ABS-ECU (A-02)
  - If Item 03 (DTC C1215 is set): Connect oscilloscope to RL sensor signal terminal (17) at ABS-ECU (A-02)
  - If Item 04 (DTC C1210 is set): Connect oscilloscope to RR sensor signal terminal (19) at ABS-ECU (A-02)
- (7) Recommended Oscilloscope setting:
- Y-axis: 2Volts
  - X-axis: 100ms
- (8) Turn the ignition switch to the "ON" position.
- (9) Turn wheel by hand at approximately 1 revolution per second (r/sec) or drive on brake dynamometer at 5km/h.



Q: Does the oscilloscope measurement signal shape correspond to the figure 3 below?

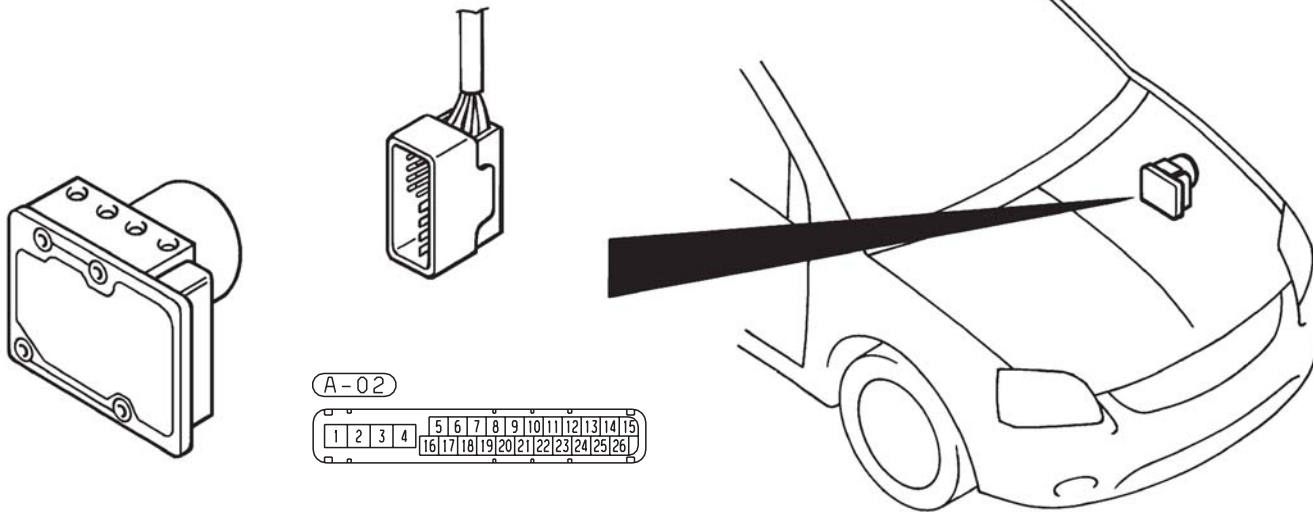


*NOTE: If the oscilloscope signal shape is correct and wheel sensor air gap is within specification, but the voltage values are either higher or lower as shown in the table below, the wheel speed sensor must be changed.*

- YES :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).
- NO :**
- FR sensor malfunction. Go to Step 6
  - FL sensor malfunction. Go to Step 8
  - RR sensor malfunction. Go to Step 10
  - RL sensor malfunction. Go to Step 12

**STEP 6.** Check ABS-ECU connector A-02 and wheel speed sensor <front: RH> connector A-01 for loose, corroded or damaged terminals, or terminals pushed back in the connector.

**A**



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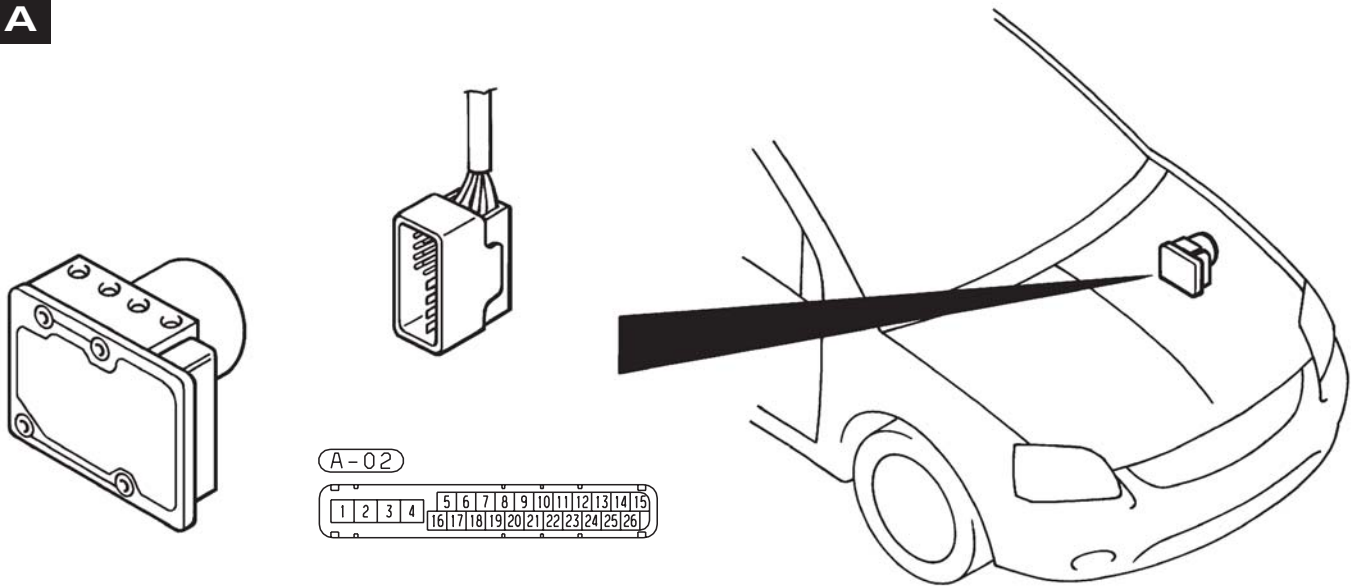
**Q: Are ABS-ECU connector A-02 and wheel speed sensor <front: RH> connector A-01 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 16.

**NO :** Go to Step 7.

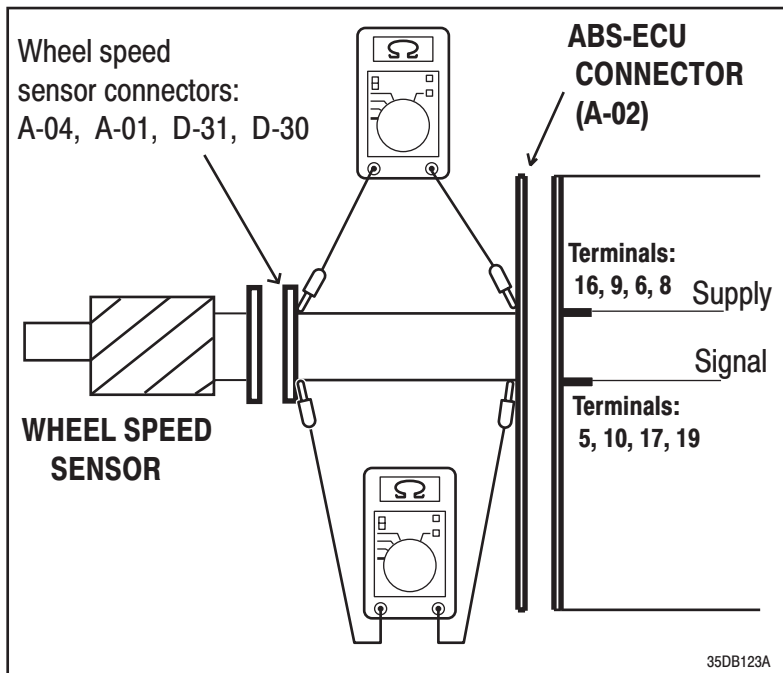
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**STEP 7. Check the harness wires and continuity resistance between ABS-ECU connector A-02 (terminal 9, 10) and wheel speed sensor <front: RH> connector A-01 (terminal 2, 1). (see figure and table below)**

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*



35DB123A

SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	Less than 2 ohms
	19	2	Less than 2 ohms
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms

**Q: Is the harness wire between ABS-ECU connector A-02 (terminal 9, 10) and wheel speed sensor <front: RH> connector A-01 (terminal 2, 1) damaged?**

**YES :** Repair the wiring harness. Then go to Step 16.

**NO :** Go to Step 14.

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**STEP 8. Check ABS-ECU connector A-02 and wheel speed sensor <front: LH> connector A-04 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

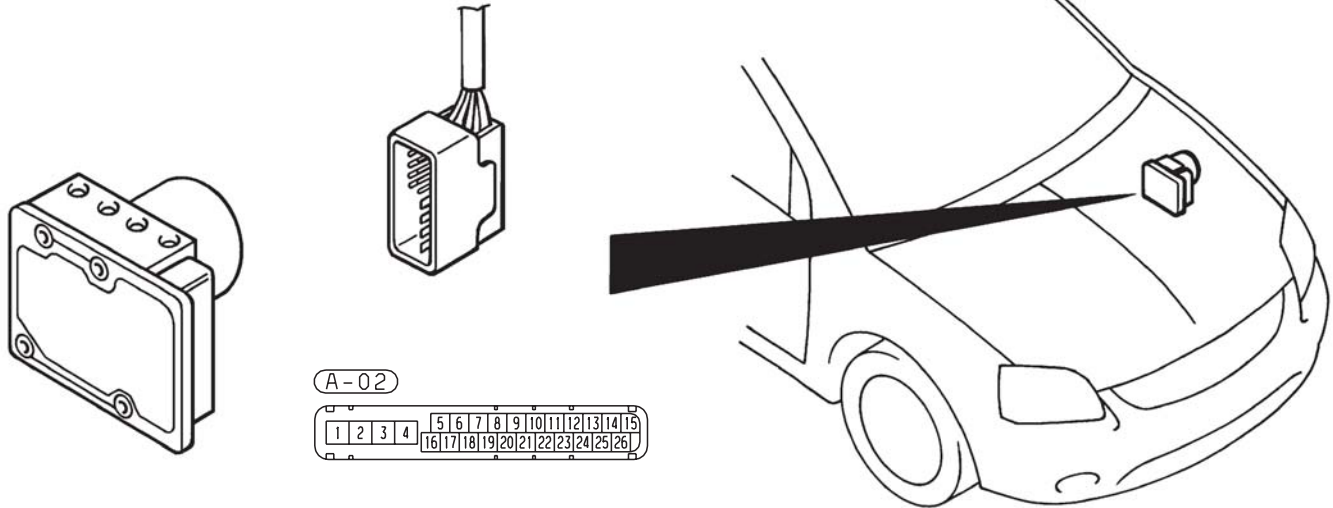
**Q: Are ABS-ECU connector A-02 and wheel speed sensor <front: LH> connector A-04 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 16.

**NO :** Go to Step 9.

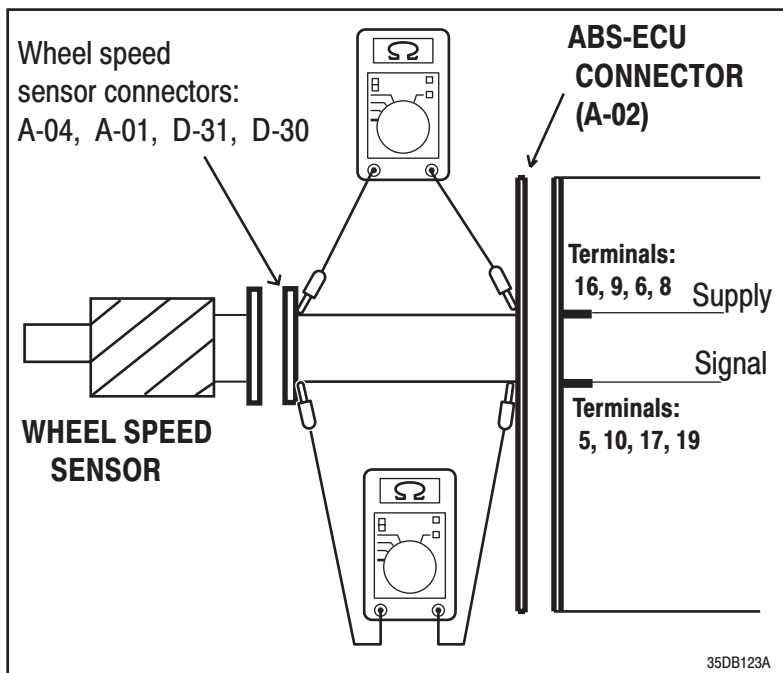
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**STEP 9. Check the harness wires and continuity resistance between ABS-ECU connector A-02 (terminal 5, 16) and wheel speed sensor <front: LH> connector A-04 (terminal 1, 2). (see figure and table below).**

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*



35DB123A

SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	Less than 2 ohms
	19	2	Less than 2 ohms
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms

**Q: Is the harness wire between ABS-ECU connector A-02 (terminal 5, 16) and wheel speed sensor <front: LH> connector A-04 (terminal 1, 2) damaged?**

**YES :** Repair the wiring harness. Then go to Step 16.

**NO :** Go to Step 14.

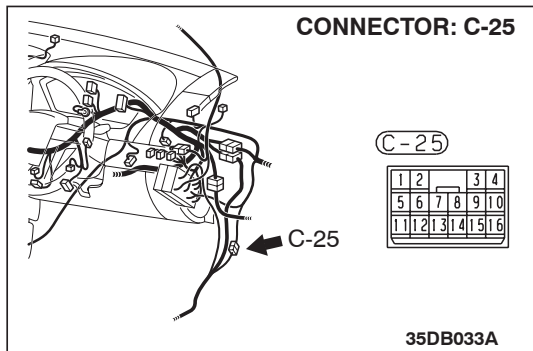
**STEP 10. Check ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <rear: RH> connector D-30 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

**Q: Are ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <rear: RH> connector D-30 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

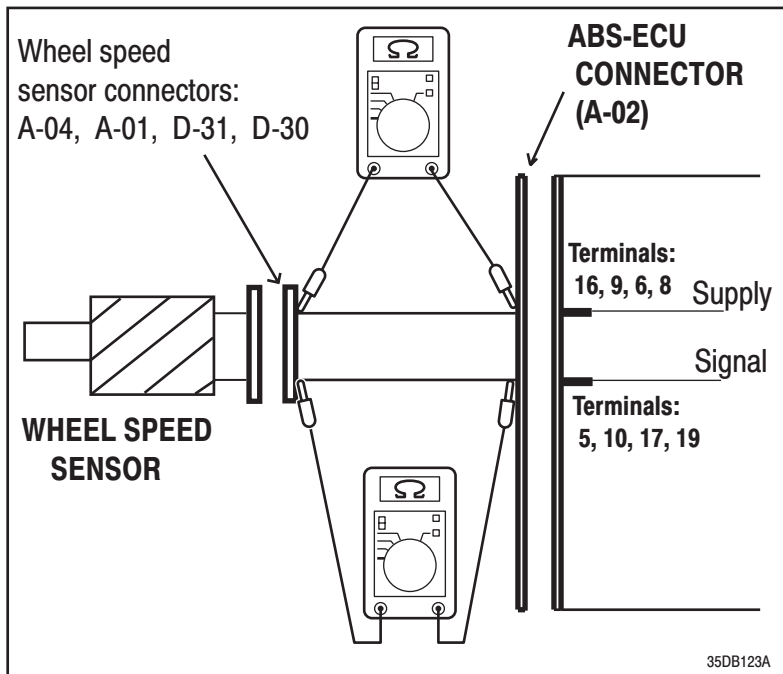
**P.00E-2.** Then go to Step 16.

**NO :** Go to Step 11.



**STEP 11. Check the harness wires and continuity resistance between ABS-ECU connector A-02 (terminal 8, 19) and wheel speed sensor <rear: RH> connector D-30 (terminal 1, 2). (see figure and table below).**

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*



SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	<b>Less than 2 ohms</b>
	19	2	<b>Less than 2 ohms</b>
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms

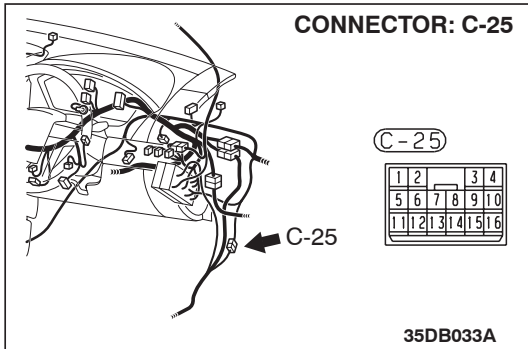
**Q: Is the harness wire between ABS-ECU connector A-02 (terminal 8, 19) and wheel speed sensor <rear: RH> connector D-30 (terminal 1, 2) damaged?**

**YES :** Repair the wiring harness. Then go to Step 16.

**NO :** Go to Step 14.



**STEP 12. Check ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <rear: LH> connector D-31 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**



**Q: Are ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <rear: LH> connector D-31 damaged?**

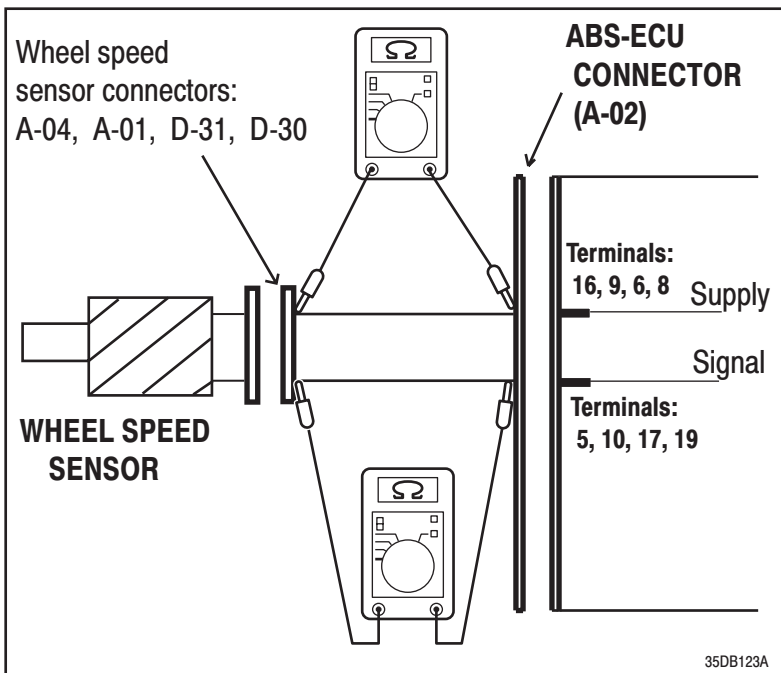
**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 16.

**NO :** Go to Step 13..

**STEP 13. Check the harness wires and continuity resistance between ABS-ECU connector A-02 (terminal 6, 17) and wheel speed sensor <rear: LH> connector D-31 (terminal 1, 2). (see figure and table below).**

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*



SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	Less than 2 ohms
	19	2	Less than 2 ohms
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms

**Q: Is the harness wire between ABS-ECU connector A-02 (terminal 6, 17) and wheel speed sensor <rear: LH> connector D-31 (terminal 1, 2) damaged?**

**YES :** Repair the wiring harness. Then go to Step 16.

**NO :** Go to Step 14.

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**STEP 14. Inspect the wheel speed sensor.**

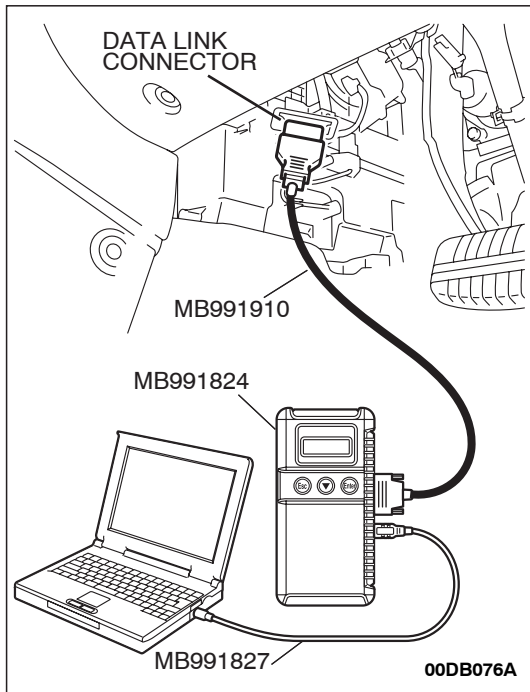
Check the wheel speed sensor relevant to the DTC code. For the applicable inspection procedure, refer to [P.35B-96](#).

- When DTC code C1200 is set: Front right wheel speed sensor
- When DTC code C1205 is set: Front left wheel speed sensor
- When DTC code C1210 is set: Rear right wheel speed sensor
- When DTC code C1215 is set: Rear left wheel speed sensor

**Q: Is the wheel speed sensor damaged?**

**YES :** Replace the wheel speed sensor. Then go to Step 16.

**NO :** Still replace the wheel speed sensor. Then go to Step 15



**STEP 15. Recheck for diagnostic trouble code.**

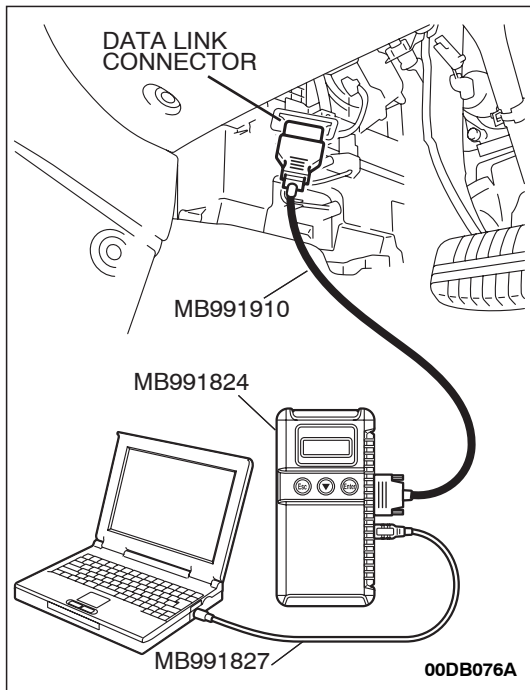
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is reset.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1200, C1205, C1210 or C1215 set?**

**YES :** Replace the hydraulic unit (integrated with ABS-ECU). Then go to Step 16.

**NO :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).



**STEP 16. Recheck for diagnostic trouble code.**

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

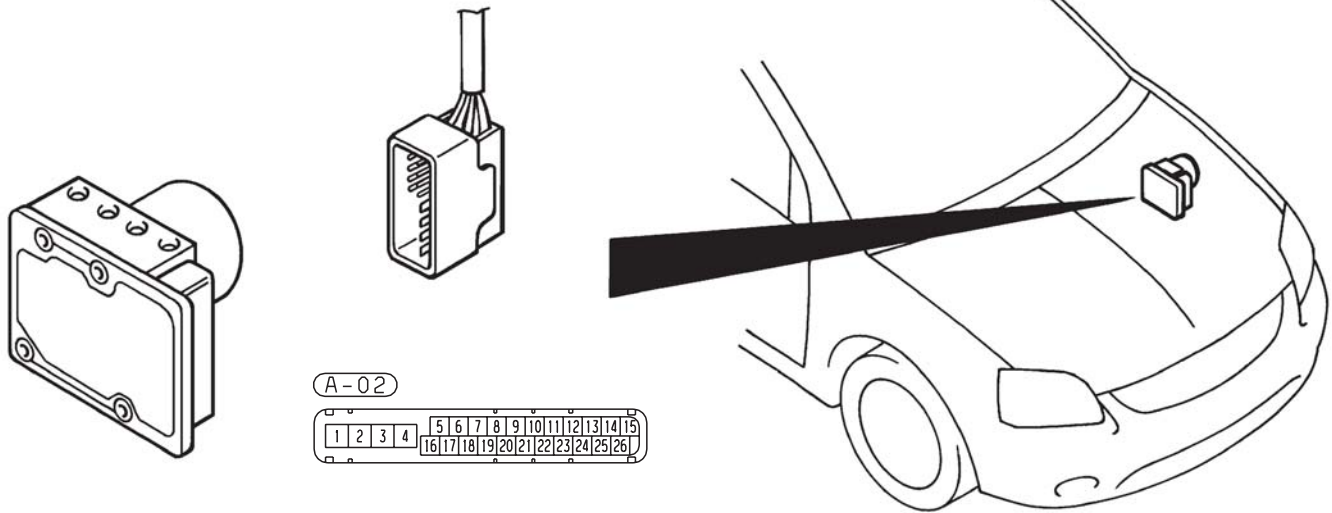
**Q: Is DTC C1200, C1205, C1210 or C1215 set?**

**YES :** Repeat the troubleshooting from Step 1.

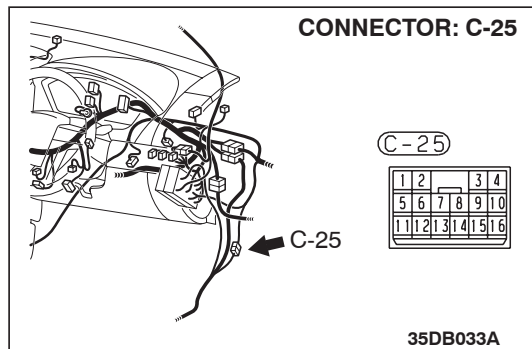
**NO :** The procedure is complete.

DTC C1201/C1206/C1211/1216 Wheel Speed Sensor (Abnormal Output Signal). (C1225) Deviation in wheel speed. This code may also be set, together with other codes.

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### CAUTION

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Prior to this diagnosis, diagnose the CAN bus lines.

**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.

### CIRCUIT OPERATION

- Active wheel speed sensors have been installed, that produce changes of current flow through the wheel speed sensor circuit which is influenced by the reluctor ring fitted to the wheel hub.

- Active wheel speed sensors have a constant incoming power supply on one wire and return a signal on the other wire
- The advantage of the active wheel speed sensor is that there is always a signal until the wheel has stopped. As the wheel speeds up or slows down, the frequency will change where the amplitude of the signal will remain constant.
- A Hall switch and magnet assembly is contained within the sensor.
- As the tooth on the reluctor approaches the sensor, the magnetic circuit is completed therefore turning on the Hall switch. As the tooth departs the sensor, the Hall switch will turn off.
- The output waveform displayed on the oscilloscope will be a square wave, (between signal wire and ground).
- The ABS hydraulic unit modulates the amount of braking force individually applied to each wheel cylinder.

## ABS DTC SET CONDITIONS

The ABS-ECU monitors the signals from each wheel speed sensor while the vehicle is being driven. If any fault below is found in these sensor signals, the ECU will set the relevant diagnostic trouble code.

- Missing sensor signal
- Sensor signal, which will not be created under normal operation
- Significant difference among the wheel speed sensor signals

**NOTE: DTC C1225** may also be set with the abnormal wheel speed sensor codes as it too looks for a variation in wheel speeds that does not meet criteria. It is possible for DTC C1125 to be logged by itself, "during an extended wheel spin" and only be stored as a history code and no action is required.

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

### Current trouble

- Malfunction of the wheel speed sensor or wheel speed rotor

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

### Past trouble

- Carry out diagnosis with particular emphasis on connector(s) or wiring harness in wheel speed sensor circuit. For diagnosis procedures, refer to "How to cope with past trouble" (Refer to GROUP 00, How to use Troubleshooting/Inspection Service Points [P.00-16](#)).

### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

### Past trouble

For diagnosis procedures, refer to "How to cope with past trouble" (Refer to GROUP 00, How to Use Troubleshooting [P.00-16](#)).

## DIAGNOSIS

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
  - MB991219: Inspection Test Harness

**STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.**

**⚠ CAUTION**

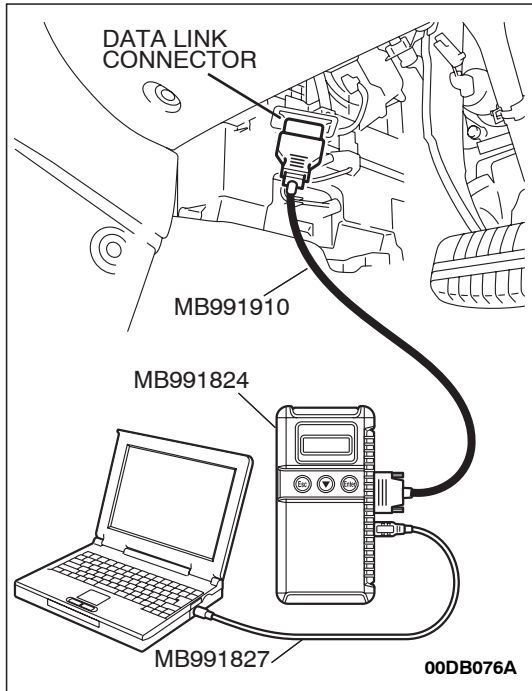
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the CAN bus line found to be normal?**

**YES :** Go to Step 3

**NO :** Repair the CAN bus line (Refer to GROUP 54C, Diagnosis [P.54C-15](#)). Then go to Step 2.



**STEP 2. Recheck for diagnostic trouble code.**

**⚠ CAUTION**

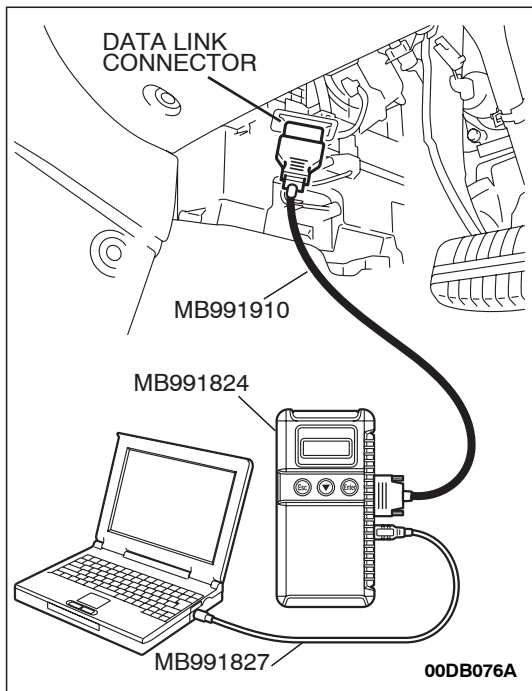
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

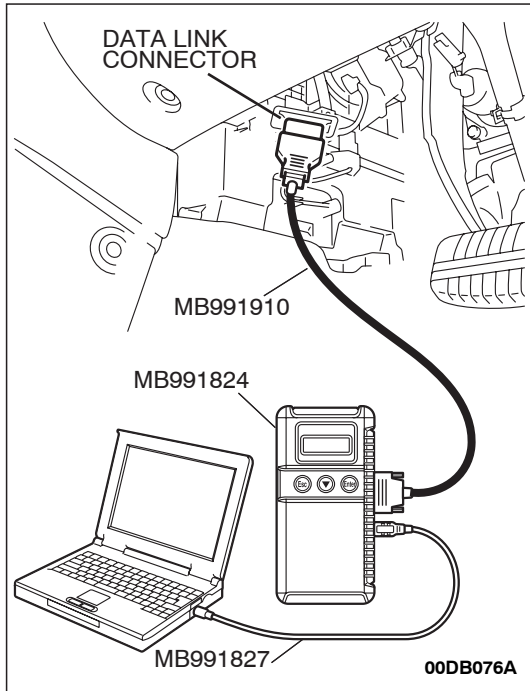
- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1201, C1206, C1211 or C1216 set?**

**YES :** Go to Step 3

**NO :** The procedure is complete.





**STEP 3. Using diagnostic tool MB991958, read the diagnostic trouble code.**

**⚠ CAUTION**

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

Use diagnostic tool MB991958 to check whether DTC codes C1200, C1205, C1210 and C1215 have been set simultaneously.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Check whether DTC C1200, C1205, C1210 or C1215 have been set.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1200, C1205, C1210 or C1215 set?**

**YES :** Carry out diagnosis relevant to DTC C1200, C1205, C1210 or C1215 (Refer to [P.35B-10](#)).

**NO :** Go to Step 4.

**STEP 4. Check the installation condition of the wheel speed sensors.**

For the wheel speed sensor, which the DTC code indicates, check whether the sensor or its mounting bolts are loosened.

- DTC C1201 is set: Front right wheel speed sensor
- DTC C1206 is set: Front left wheel speed sensor
- DTC C1211 is set: Rear right wheel speed sensor
- DTC C1216 is set: Rear left wheel speed sensor

**Q: Is the wheel speed sensor installed correctly?**

**YES :** Go to Step 5.

**NO :** Reinstall the wheel speed sensor correctly. Then go to Step 16.

**STEP 5. Check the wheel speed sensor after it is removed from the vehicle.**

Check the wheel speed sensor which the DTC code indicates (Refer to [P.35B-96](#)).

- DTC C1201 is set: Front right wheel speed sensor
- DTC C1206 is set: Front left wheel speed sensor
- DTC C1211 is set: Rear right wheel speed sensor
- DTC C1216 is set: Rear left wheel speed sensor

**Q: Is the wheel speed sensor in good condition?**

**YES :** Go to Step 6.

**NO :** Replace the wheel speed sensor (Refer to [P.35B-95](#)). Then go to Step 16.



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**STEP 6. Check the wheel bearing for looseness.**

*NOTE: If the wheel bearing is loose, the gap between the wheel speed sensor and rotor may become excessive. Check the wheel bearing, which DTC code indicates, for looseness.*

- DTC C1201 is set: Check the front right wheel bearing (Refer to GROUP 26, On-vehicle service – Wheel bearing end play check [P.26-8](#)).
- DTC C1206 is set: Check the front left wheel bearing (Refer to GROUP 26, On-vehicle service – Wheel bearing end play check [P.26-8](#)).
- DTC C1211 is set: Check the rear right wheel bearing (Refer to GROUP 27, On-vehicle service – Wheel bearing end play check [P.27-4](#)).
- DTC C1216 is set: Check the rear left wheel bearing (Refer to GROUP 27, On-vehicle service – Wheel bearing end play check [P.27-4](#)).

**Q: Is the wheel bearing end play within the standard value?**

**YES :** Go to Step 7.

**NO (front bearing end play is not within the standard value) :** Replace the front hub assembly (Refer to GROUP 26, Front axle hub assembly [P.26-9](#)).

**NO (rear bearing end play is not within the standard value) :** Replace the rear hub assembly (Refer to GROUP 27, Rear axle hub assembly [P.27-4](#)).

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**STEP 7. Check the wheel speed rotor.**

Check the wheel speed rotor, which DTC code indicates, for foreign material or deformation.

- DTC C1201 is set: Front right wheel speed sensor
- DTC C1206 is set: Front left wheel speed sensor
- DTC C1211 is set: Rear right wheel speed sensor
- DTC C1216 is set: Rear left wheel speed sensor

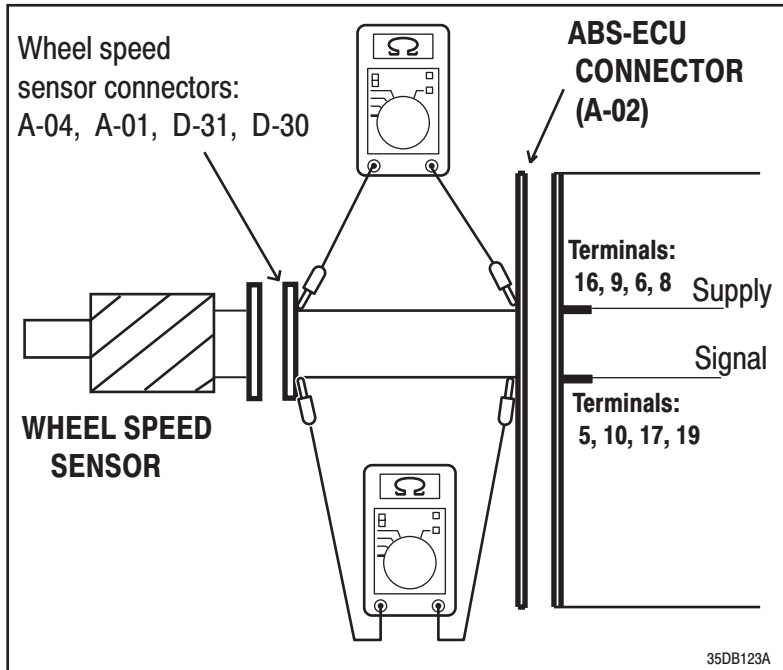
**Q: Is the wheel speed rotor in good condition?**

**YES :** Go to Step 8.

**NO (front bearing end play is not within the standard value) :** If the wheel speed rotor is contaminated with foreign material, clean it. If the driveshaft is deformed, replace it (Refer to GROUP 26, Drive shaft assembly [P.26-13](#)).

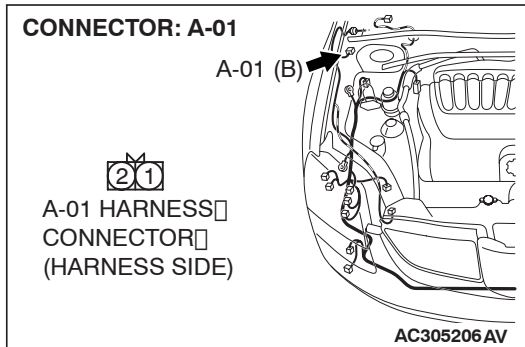
**NO (rear bearing end play is not within the standard value) :** If the wheel speed rotor is contaminated with foreign material, clean it. If the wheel speed rotor is deformed, replace it (Refer to GROUP 27, Rear axle hub assembly [P.27-6](#)).

**STEP 8. Check ABS-ECU connector A-02 and wheel speed sensor <front: RH> connector A-01 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**



*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	Less than 2 ohms
	19	2	Less than 2 ohms
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms



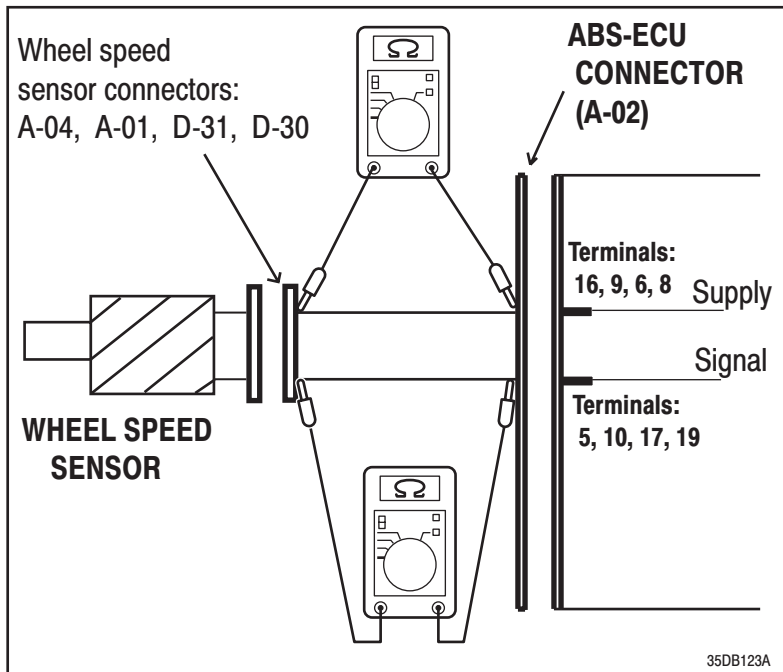
**Q:** Are ABS-ECU connector A-02 and wheel speed sensor <front: RH> connector A-01 damaged?

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 13.

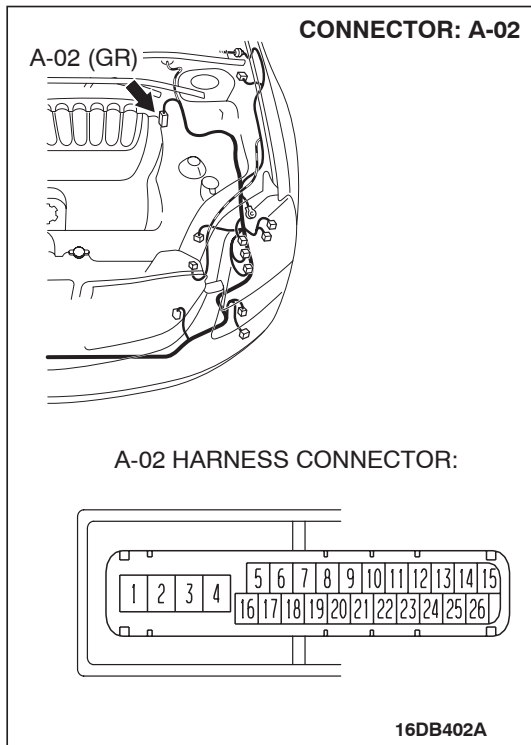
**NO :** Open or short circuit may be present in the front right wheel speed sensor circuit. Repair the wiring harness between ABS-ECU connector A-02 (terminals 9 and 10) and front right wheel speed sensor A-01 (terminals 2 and 1). Then go to Step 13.

**STEP 9.** Check ABS-ECU connector A-02 and wheel speed sensor <front: LH> connector A-04 for loose, corroded or damaged terminals, or terminals pushed back in the connector.



*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	Less than 2 ohms
	19	2	Less than 2 ohms
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms



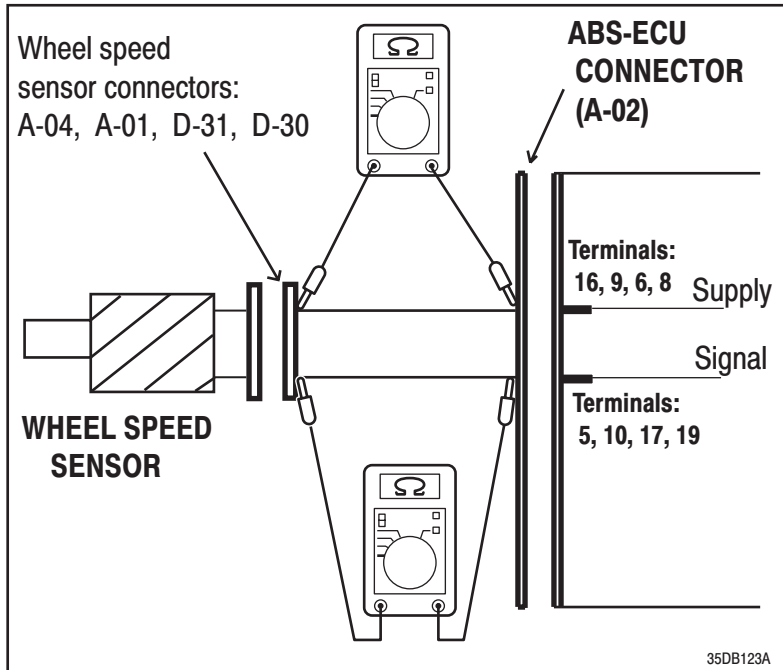
**Q: Are ABS-ECU connector A-02 and wheel speed sensor <front: LH> connector A-04 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

**P.00E-2.** Then go to Step 13.

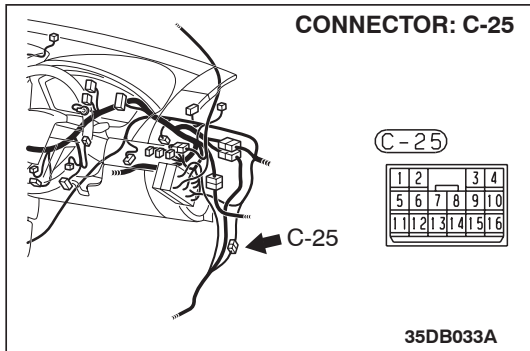
**NO :** Open or short circuit may be present in the front left wheel speed sensor circuit. Repair the wiring harness between ABS-ECU connector A-02 (terminals 5 and 16) and front left wheel speed sensor A-04 (terminals 1 and 2). Then go to Step 13.

**STEP 10.** Check ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <Rear: RH> connector D-30 for loose, corroded or damaged terminals, or terminals pushed back in the connector.



*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	<b>Less than 2 ohms</b>
	19	2	<b>Less than 2 ohms</b>
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms



**Q:** Are ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <Rear: RH> connector D-30 damaged?

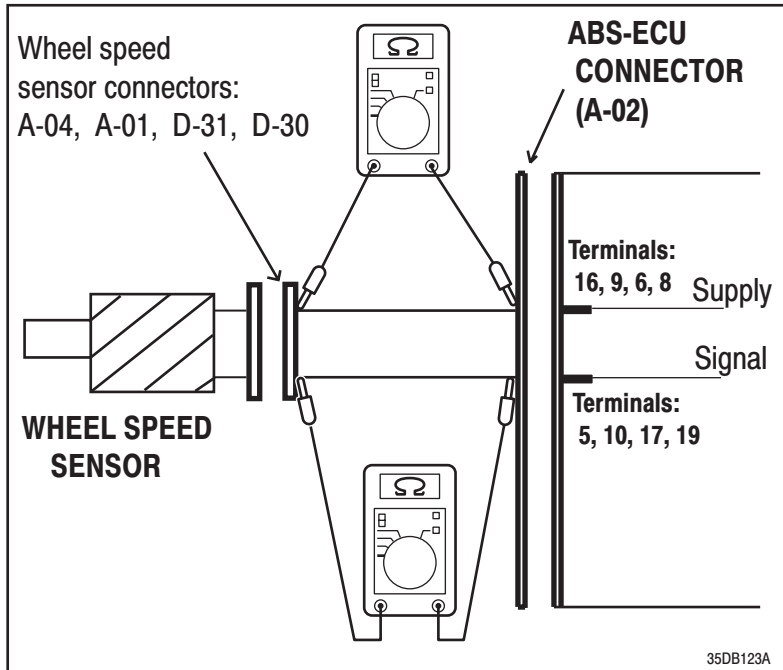
**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 13.

**NO :** Open or short circuit may be present in the rear right wheel speed sensor circuit. Repair the wiring harness between ABS-ECU connector A-02 (terminals 8 and 19) and rear right wheel speed sensor D-30 (terminals 1 and 2). Then go to Step 13.

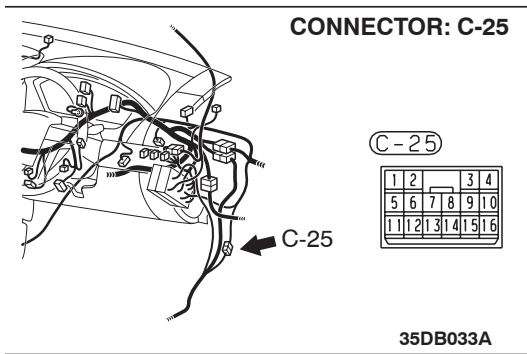


**STEP 11. Check ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <rear: LH> connector D-31 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**



*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

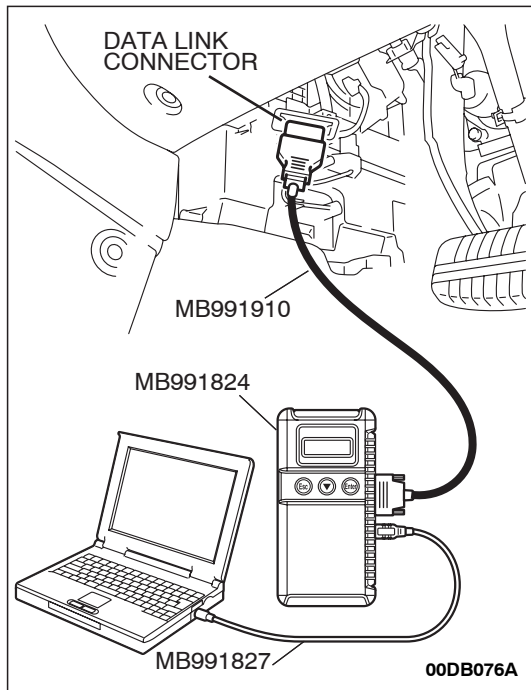
SIGNAL	TERMINAL NO.		NORMAL CONDITION
	ABS (A-02)	SENSOR	
FR wheel speed sensor (A-01)	9	2	Less than 2 ohms
	10	1	Less than 2 ohms
RR wheel speed sensor (D-30)	8	1	Less than 2 ohms
	19	2	Less than 2 ohms
FL wheel speed sensor (A-04)	16	2	Less than 2 ohms
	5	1	Less than 2 ohms
RL wheel speed sensor (D-31)	6	1	Less than 2 ohms
	17	2	Less than 2 ohms



**Q: Are ABS-ECU connector A-02, intermediate connector C-25 and wheel speed sensor <rear: LH> connector D-31 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.

**NO :** Open or short circuit may be present in the rear left wheel speed sensor circuit. Repair the wiring harness between ABS-ECU connector A-02 (terminals 17 and 6) and rear left wheel speed sensor D-31 (terminals 2 and 1). Then go to Step 13.



**STEP 12. Recheck for diagnostic trouble code.**

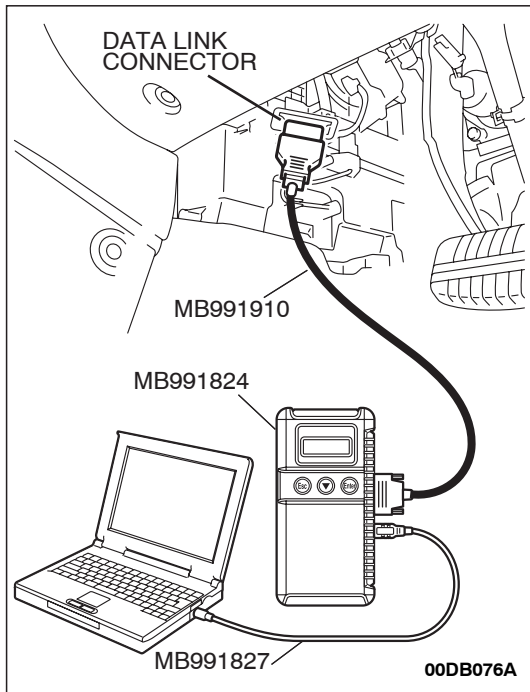
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1201, C1206, C1211 or C1216 set?**

**YES :** Replace the hydraulic unit (integrated with ABS-ECU). Then go to Step 13.

**NO :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).



**STEP 13. Recheck for diagnostic trouble code.**

Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1201, C1206, C1211 or C1216 set?**

**YES :** Go to Step 1.

**NO :** The procedure is complete.

---

**DTC C1225: Deviation between wheel speeds.**

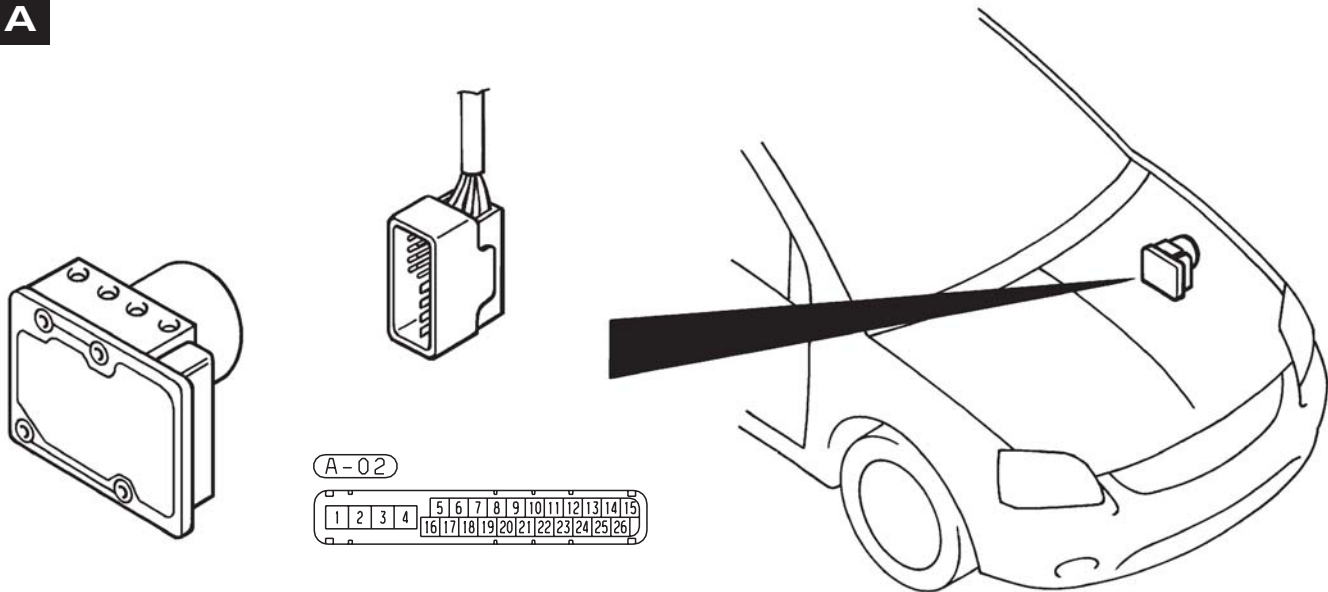
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*NOTE: If DTC C1225 is set, it is more likely to be set together with other codes [P.35B-26](#) and it too will look for a variation in wheel speeds which do not meet required specification. It will, in most cases be set whenever a "plausibility" or an abnormal wheel speed output signal is created. Refer to [P.35B-26](#).*

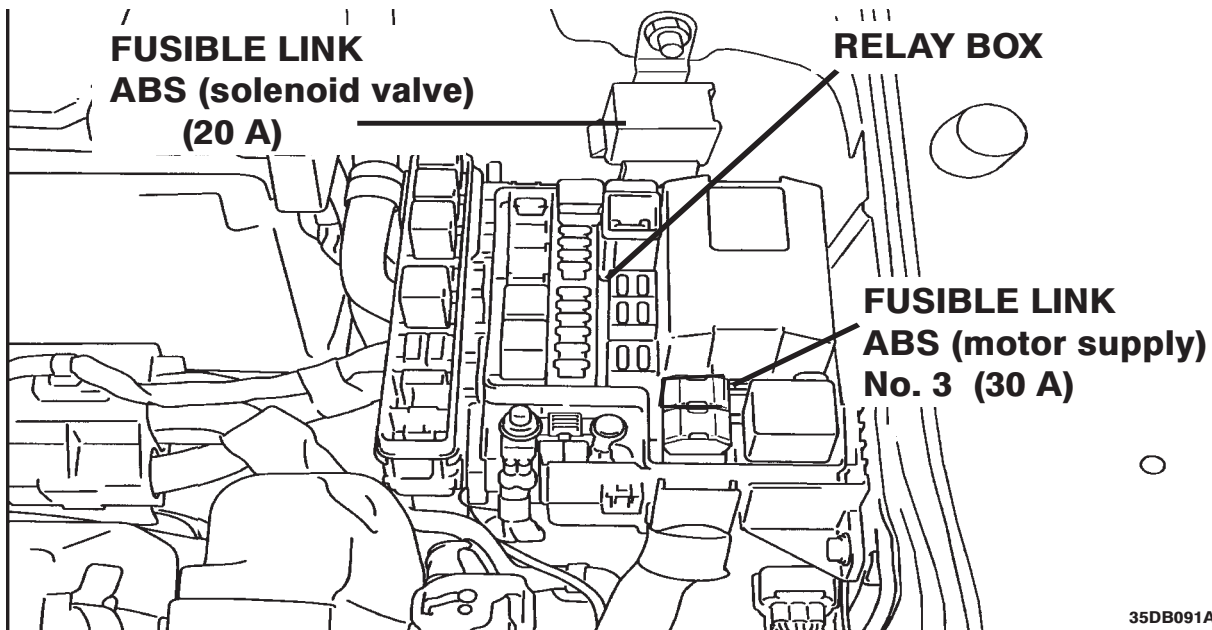
*NOTE: It is possible for DTC 1225 to be logged by itself, for example "during extended wheel spin". If this were the case, it would only be a history code and no action is necessary.*

DTC C1226/C1231/C1236/C1241/C1246/C1251/C1256/C1261: ABS Solenoid Valve

A



35DB090A



35DB091A

**CAUTION**

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Prior to this diagnosis, diagnose the CAN bus lines.

**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.

tion then to the "ON" position again.

**CIRCUIT OPERATION**

- The ABS-ECU contains the power supply circuit (terminal 3) for the solenoid valve. The solenoid valve is energized by a MOSFET driver, which is integrated in the ABS-ECU.
- A MOSFET driver, which is integrated in the ABS-ECU, is always energizing the solenoid valve unless the initial check is in progress when the ignition switch is turned on.
- The ABS-ECU activates the solenoid valve by turning on its driving transistor.

## ABS DTC SET CONDITIONS

These diagnostic trouble codes will be set under the cases below.

- The solenoid valve is not energized even after the ABS-ECU has turned on the driving transistor (Open circuit is present in the power supply circuit to the ABS-ECU solenoid valve, or the valve relay has failed).
- The solenoid valve is not energized even after the ABS-ECU has turned on the driving transistor (Open circuit is present in the solenoid valve circuit inside the ABS-ECU, or the valve relay has failed).
- After the ABS-ECU has turned off the driving transistor, the solenoid valve still remains energized (short in the solenoid valve circuit).
- When a solenoid valve failure is detected

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

### Current trouble

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

### Past trouble

- Carry out diagnosis with particular emphasis on connector(s) or wiring harness between the power supply circuit (terminal 3) to the ABS-ECU solenoid valve or ground circuit (terminal 1) . For diagnosis procedures, refer to "How to cope with past trouble" (Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-16](#)).

### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

## DIAGNOSIS

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
  - MB991219: Inspection Test Harness

**STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.**

**⚠ CAUTION**

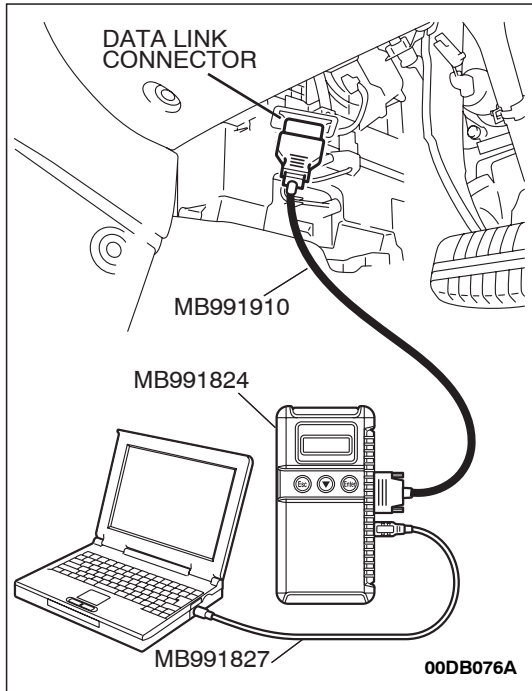
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the CAN bus line found to be normal?**

**YES :** Go to Step 3.

**NO :** Repair the CAN bus line (Refer to GROUP 54C, Diagnosis [P.54C-15](#)). Then go to Step 2.



**STEP 2. Recheck for diagnostic trouble code.**

**⚠ CAUTION**

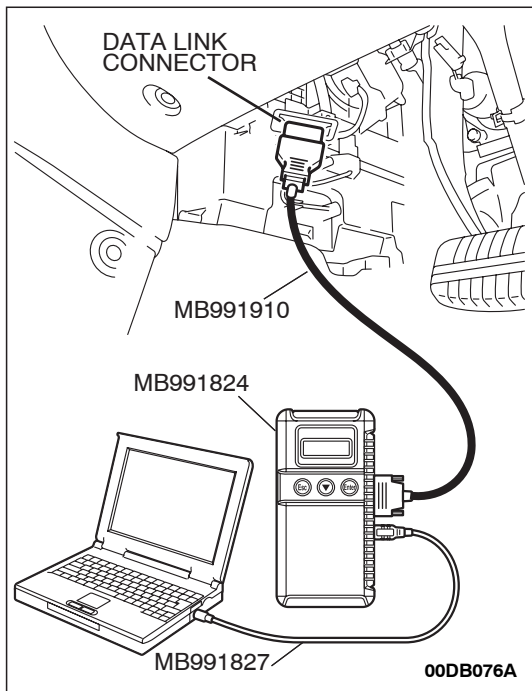
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Erase the DTC.
- (2) Turn the ignition switch to the "ON" position.
- (3) Check if the DTC is set.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

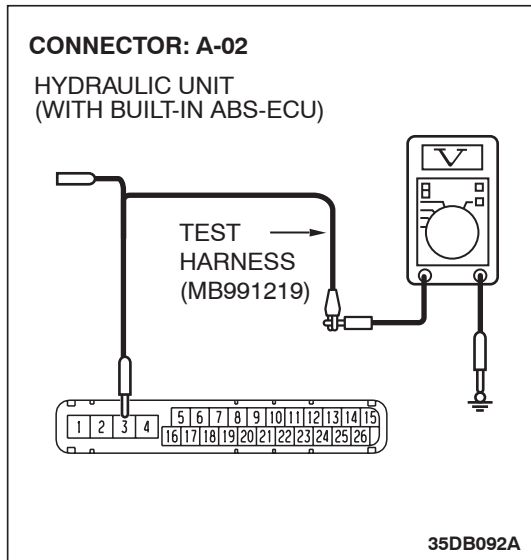
**Q: Is DTC C1226, C1231, C1236, C1241, C1246, C1251, C1256 or C1261 set?**

**YES :** Go to Step 3.

**NO :** The procedure is complete.







**STEP 3. Measure the voltage at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

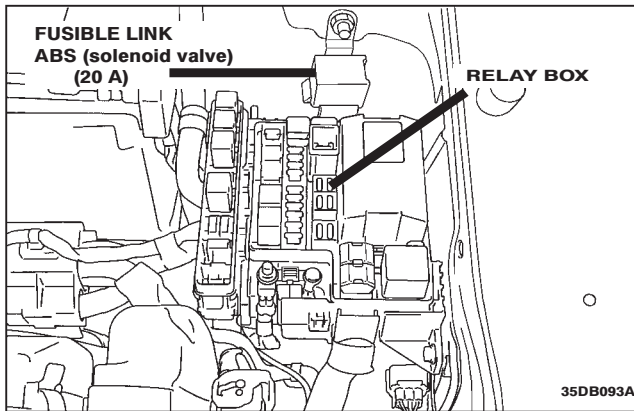
*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 3 and ground. It should be approximately 12 volts (battery positive voltage).

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

**YES :** Go to Step 5.

**NO :** Go to Step 4.



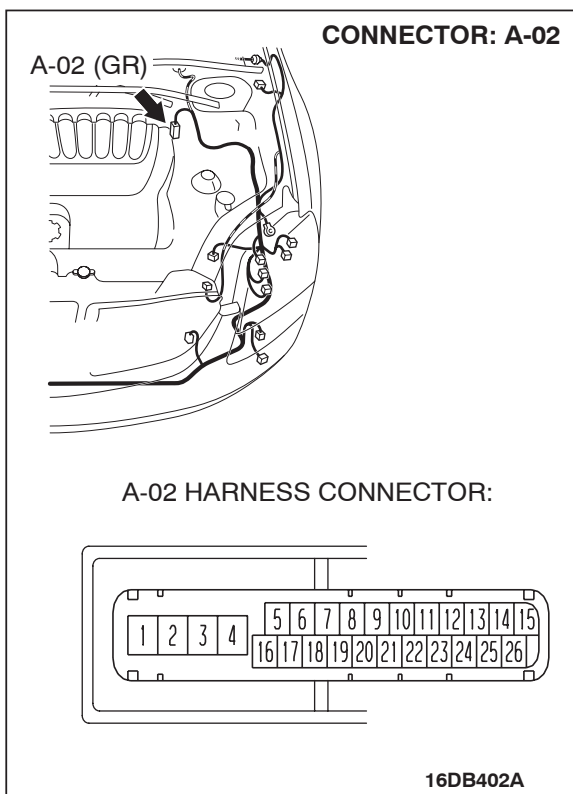
**STEP 4. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

**P.00E-2.** Then go to Step 8.

**NO :** An open or short circuit may be present in the solenoid valve power supply circuit. Repair the wiring harness between ABS-ECU connector A-02 terminal 3 and external (20A) fusible link. Then go to Step 8.



**STEP 5. Measure the resistance at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

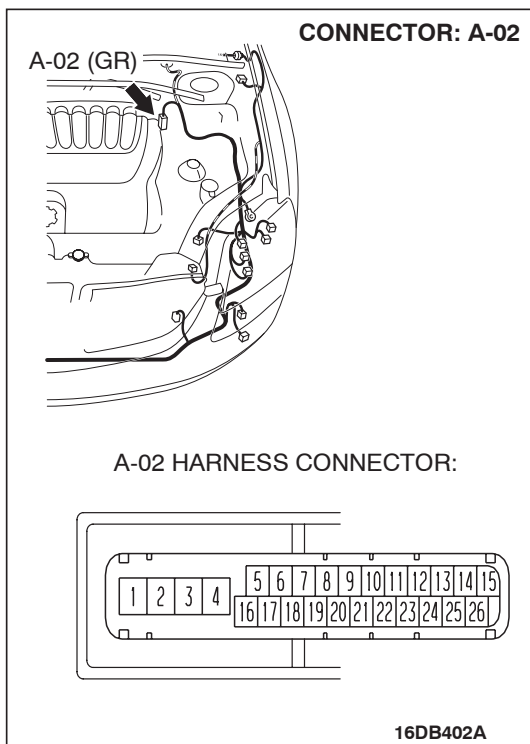
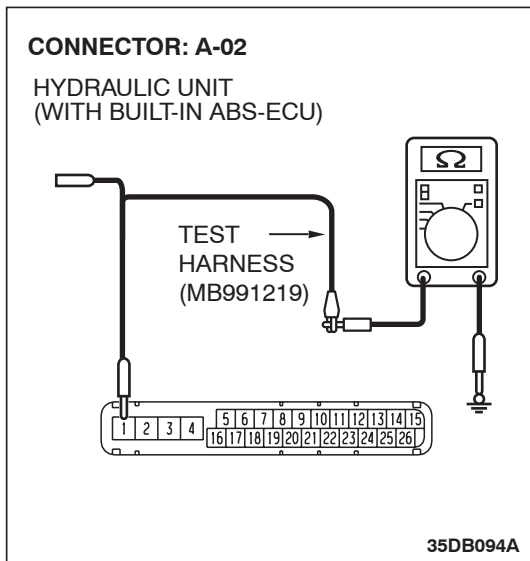
*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

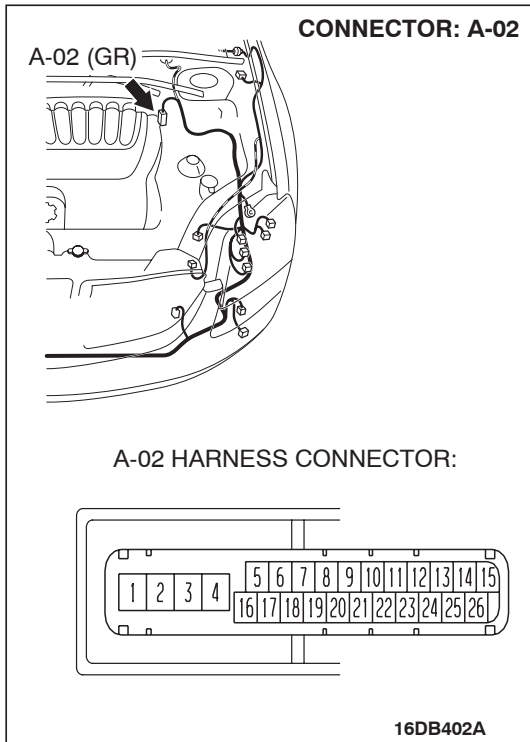
- (2) Measure the resistance between terminal 1 and ground. It should be 2 ohms or less.

**Q: Is the measured resistance 2 ohms or less?**

**YES :** Go to Step 7.

**NO :** Go to Step 6.





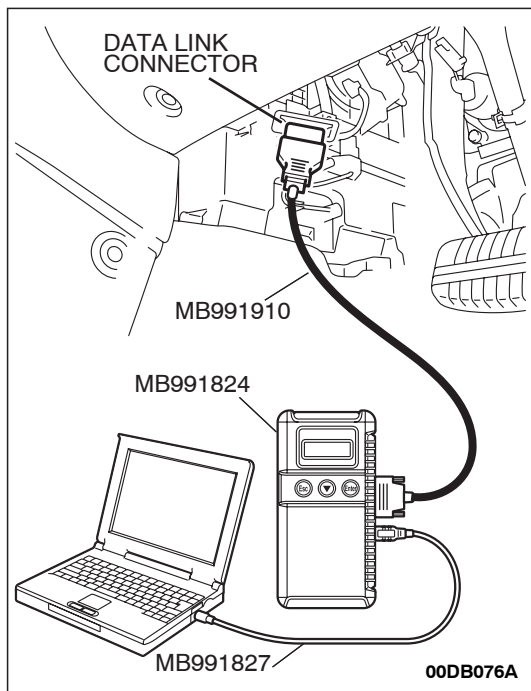
**STEP 6. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 8.

**NO :** An open circuit may be present in the ground circuit. Repair the wiring harness between ABS-ECU connector A-02 terminal 1 and the body ground. Then go to Step 8.



**STEP 7. Recheck for diagnostic trouble code.**

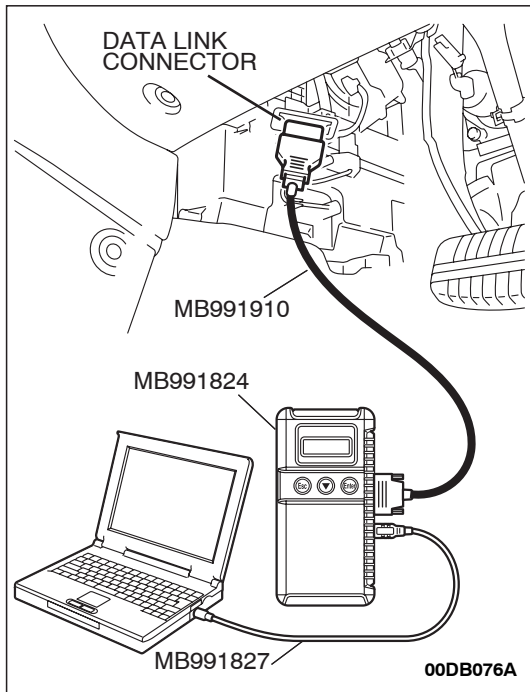
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1226, C1231, C1236, C1241, C1246, C1251, C1256 or C1261 set?**

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

**NO :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).



**STEP 8. Recheck for diagnostic trouble code.**

Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

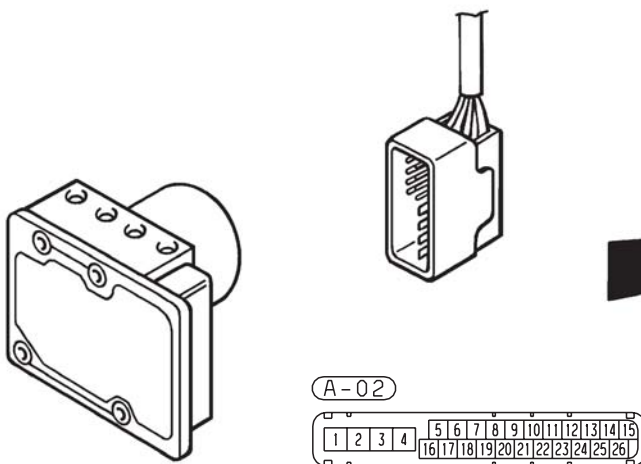
**Q: Is DTC C1226, C1231, C1236, C1241, C1246, C1251, C1256 or C1261 set?**

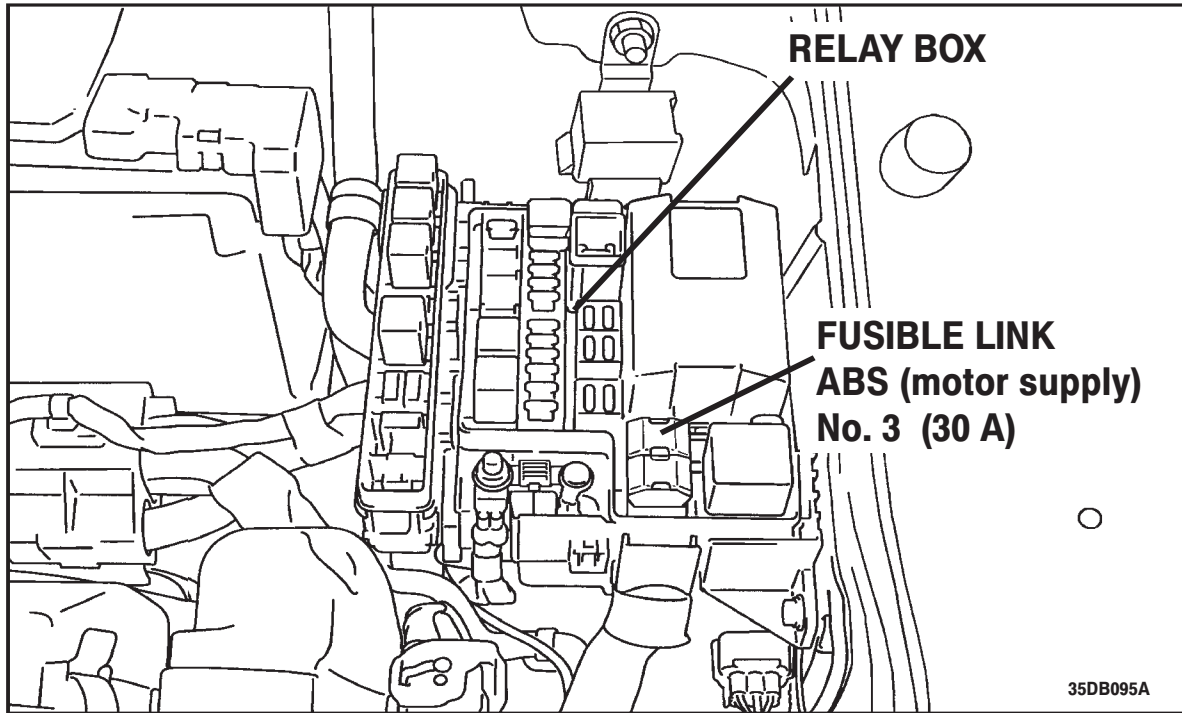
**YES :** Go to Step 1.

**NO :** The procedure is complete.

**DTC C1266/C1273/C1274: Motor system**

**A**





**⚠ CAUTION**

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Prior to this diagnosis, diagnose the CAN bus lines.

**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.

**CIRCUIT OPERATION**

- The ABS-ECU contains the power supply circuit (terminal 2) for the pump motor. The pump motor is energized by a MOSFET driver, which is integrated in the ABS-ECU.
- A MOSFET driver, which is integrated in the ABS-ECU, is always off unless the motor solenoid valve check is activated when the vehicle is started.
- The ABS-ECU activates the pump motor by turning on the ECU built-in MOSFET driver when the ABS is working.

**ABS DTC SET CONDITIONS**

These diagnostic trouble codes will be set under the cases below.

**DTC C1266: Motor system (seizure)**

- This DTC is set when the ECU determines the pump motor is not running smoothly (i.e. motor seizure) by the motor relay ON/OFF.

**DTC C1273: Motor relay problem (stuck off)**

- If the ABS-ECU determines that the motor is not running after the MOSFET driver is turned on, the ECU determines that the motor relay is stuck off, and sets this DTC.

**DTC C1274: Motor relay problem (stuck on)**

- If the ABS-ECU determines that the motor is running after the MOSFET driver is turned off, the ECU determines that the motor relay is stuck on, and sets this DTC.

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

**Current trouble**

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

## Past trouble

- Carry out diagnosis with particular emphasis on connector(s) or wiring harness between the power supply circuit (terminal 2) to the ABS-ECU motor or ground circuit (terminal 4). For diagnosis procedures, refer to "How to cope with past trouble" (Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-16](#)).

## Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

## DIAGNOSIS

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
- MB991219: Inspection Test Harness

### STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.

#### CAUTION

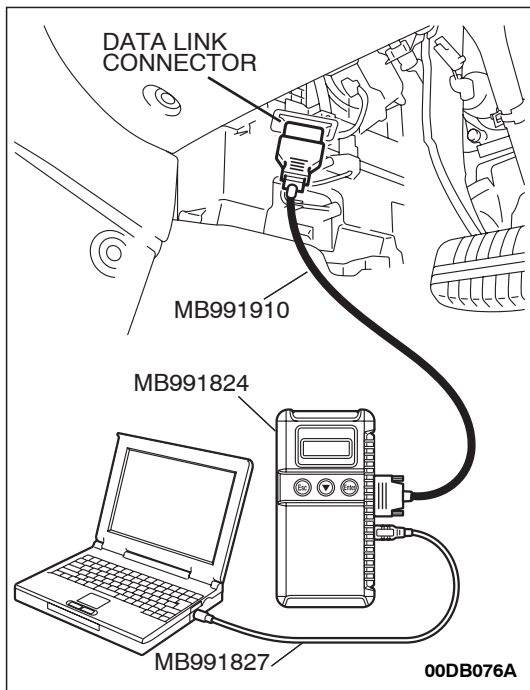
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

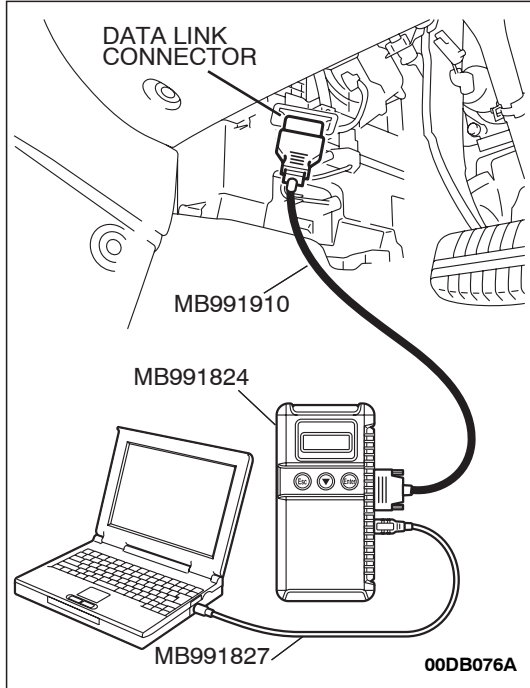
### Q: Is the CAN bus line found to be normal?

**YES** : Go to Step 3.

**NO** : Repair the CAN bus line (Refer to GROUP 54C, Diagnosis [P.54C-15](#)). Then go to Step 2.







**STEP 2. Recheck for diagnostic trouble code.**

**⚠ CAUTION**

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

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

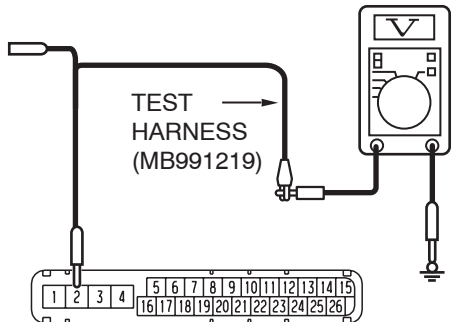
**Q: Is DTC C1266, C1273 or C1274 set?**

**YES :** Go to Step 3.

**NO :** The procedure is complete.

**CONNECTOR: A-02**

HYDRAULIC UNIT  
(WITH BUILT-IN ABS-ECU)



**STEP 3. Measure the voltage at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 2 and ground. It should be approximately 12 volts (battery positive voltage).

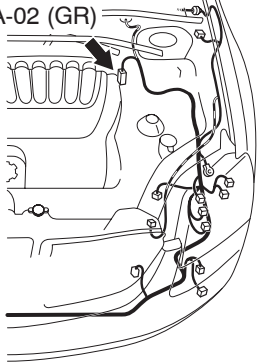
**Q: Is the voltage approximately 12 volts (battery positive voltage)?**

**YES :** Go to Step 5.

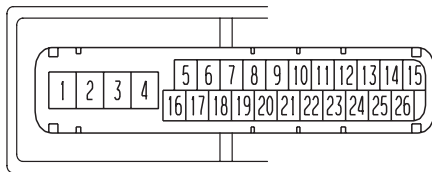
**NO :** Go to Step 4.

**CONNECTOR: A-02**

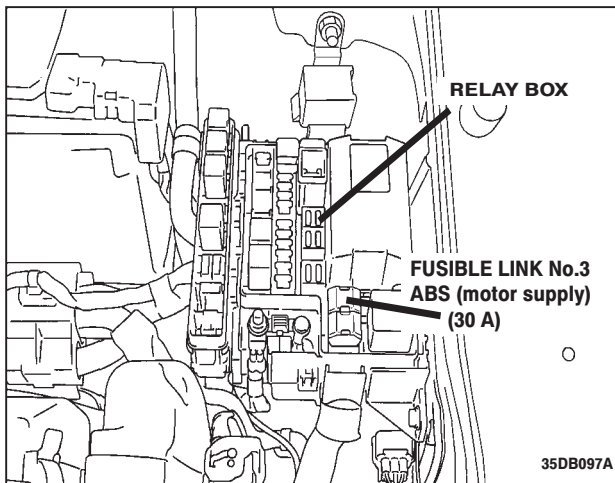
A-02 (GR)



A-02 HARNESS CONNECTOR:



16DB402A

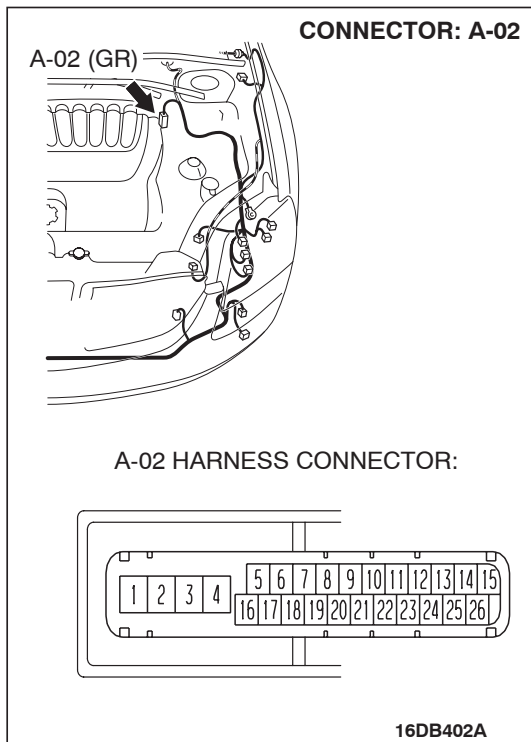


**STEP 4. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

**NO :** An open or short circuit may be present in the solenoid valve power supply circuit. Repair the wiring harness between ABS-ECU connector A-02 terminal 2 and fusible link No.3. Then go to Step 8.



**STEP 5. Measure the resistance at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

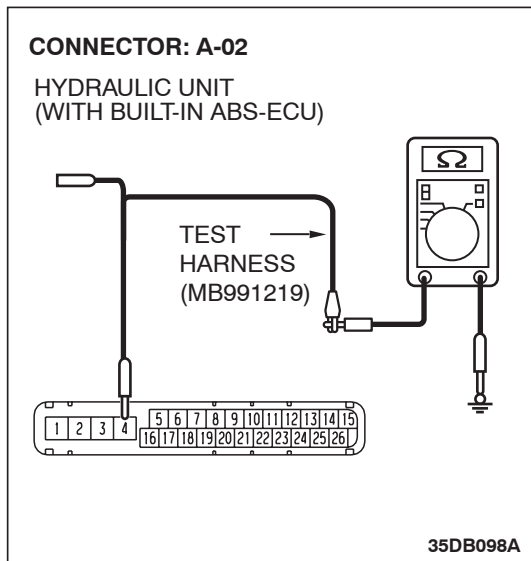
*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Measure the resistance between terminal 4 and ground. It should be 2 ohms or less.

**Q: Is the measured resistance 2 ohms or less?**

**YES :** Go to Step 7.

**NO :** Go to Step 6.



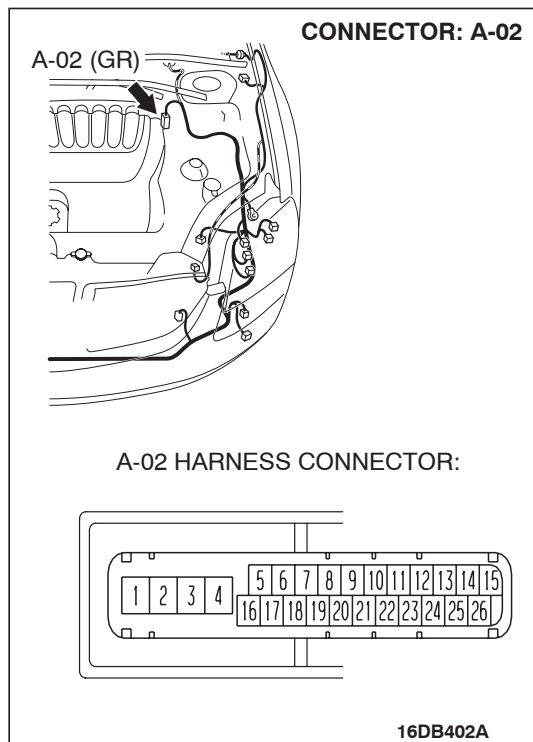
**STEP 6. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

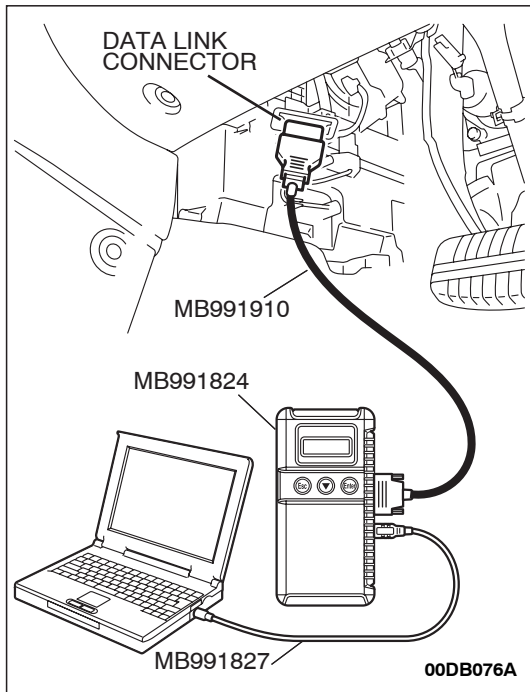
**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

**P.00E-2.** Then go to Step 8.

**NO :** An open circuit may be present in the ground circuit. Repair the wiring harness between ABS-ECU connector A-02 terminal 4 and the body ground. Then go to Step 8.





**STEP 7. Recheck for diagnostic trouble code.**

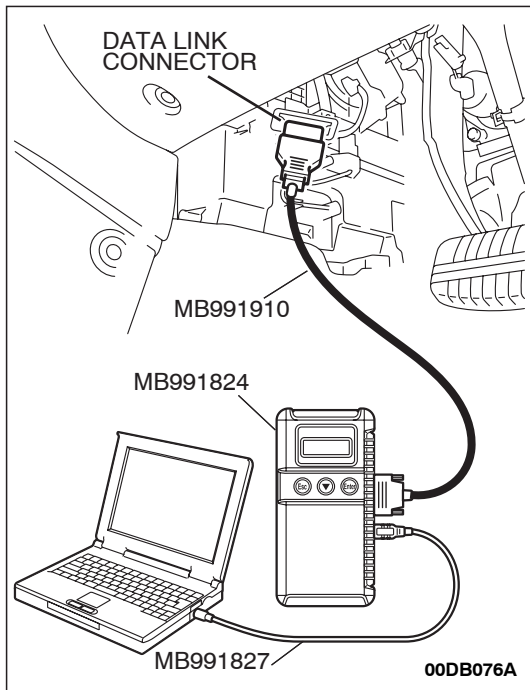
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1266, C1273 or C1274 set?**

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

**NO :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).



**STEP 8. Recheck for diagnostic trouble code.**

Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

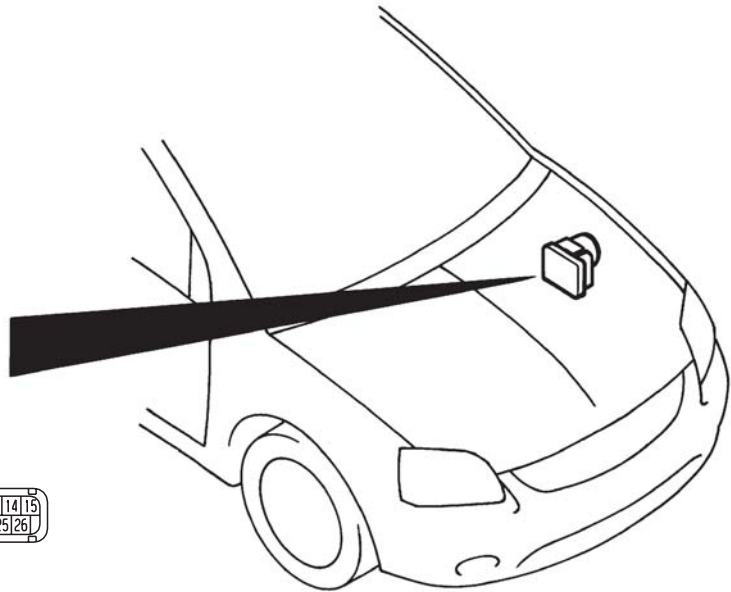
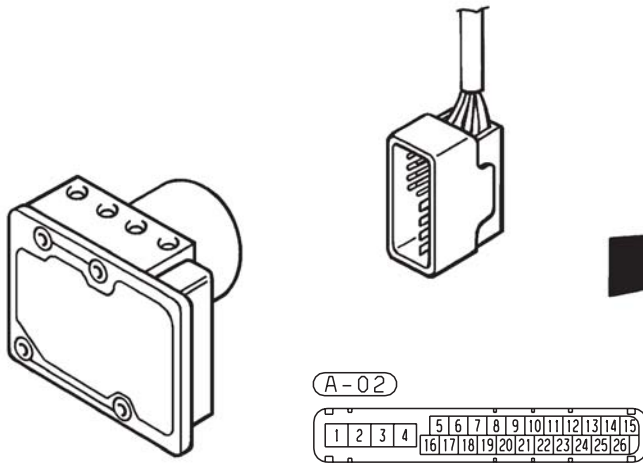
**Q: Is DTC C1266, C1273 or C1274 set?**

**YES :** Go to Step 1.

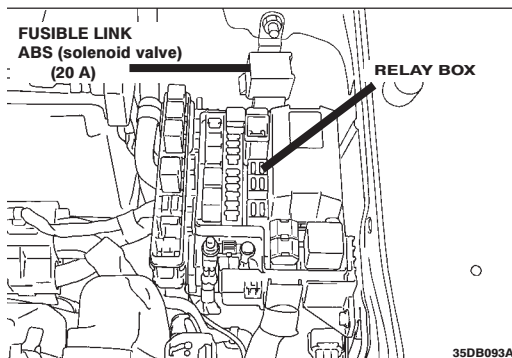
**NO :** The procedure is complete.

DTC C1276/ C1278/ C1279 Valve Relay System

A



35DB090A



35DB093A

**CAUTION**

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Prior to this diagnosis, diagnose the CAN bus lines.

**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.

**CIRCUIT OPERATION**

- The ABS-ECU contains the power supply circuit (terminal 3) for the solenoid valve. The solenoid valve is energized by a MOSFET driver, which is integrated in the ABS-ECU.

- A MOSFET driver, which is integrated in the ABS-ECU, is always energizing the solenoid valve unless the initial check is in progress when the ignition switch is turned on.

**ABS DTC SET CONDITIONS**

These diagnostic trouble codes will be set under the cases below.

**DTC C1278 (Valve relay OFF failure)**

- After the ABS-ECU turned on the MOSFET driver, the solenoid valve is not energized (valve relay OFF failure).

**DTC C1278 (Valve relay ON failure)**

- After the ABS-ECU turned off the MOSFET driver, the solenoid valve still remains energized (valve relay ON failure).

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

### Circuit drawings

- Refer to circuit diagrams GROUP-90
- Refer to configuration diagrams GROUP-80

### Current trouble

- Damaged wiring harness or connector

- Malfunction of the hydraulic unit (integrated with ABS-ECU)

### Past trouble

Carry out diagnosis with particular emphasis on connector(s) or wiring harness between the power supply circuit (terminal 3) to the ABS-ECU solenoid valve or ground circuit (terminal 1) . For diagnosis procedures, refer to "How to cope with past trouble" (Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points P.00-16).

## DIAGNOSIS

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
- MB991219: Inspection Test Harness

### STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.

#### CAUTION

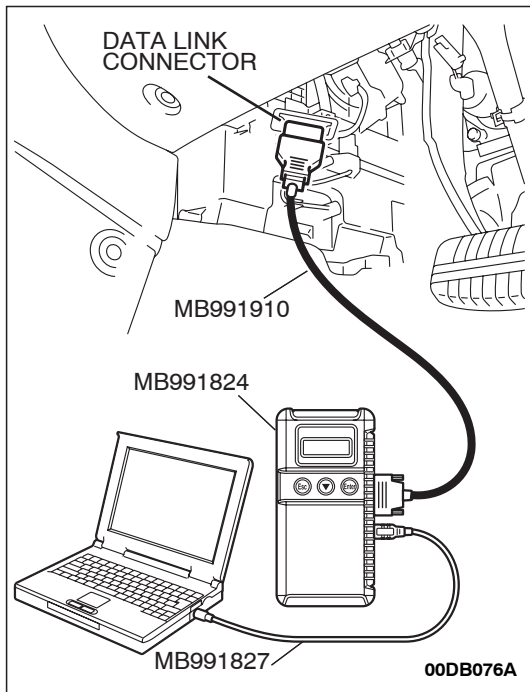
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

### Q: Is the CAN bus line found to be normal?

**YES** : Go to Step 3.

**NO** : Repair the CAN bus line (Refer to GROUP 54C, Diagnosis P.54C-15). Then go to Step 2.





**STEP 2. Recheck for diagnostic trouble code.**

**⚠ CAUTION**

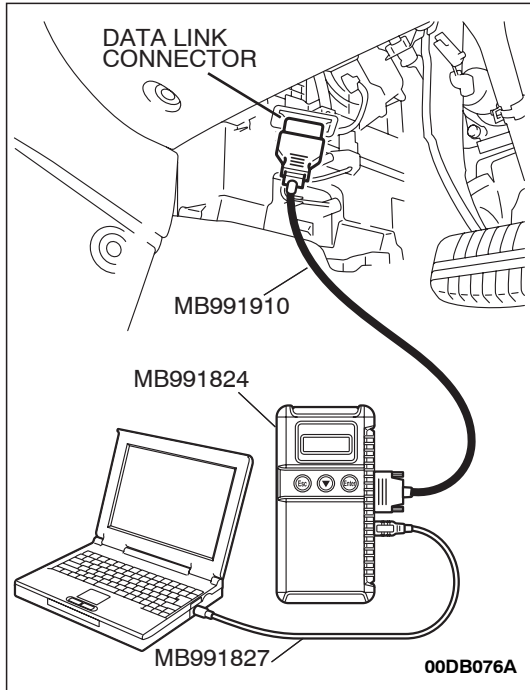
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1278 or C1279 set?**

**YES :** Go to Step 3.

**NO :** The procedure is complete.



**STEP 3. Measure the voltage at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

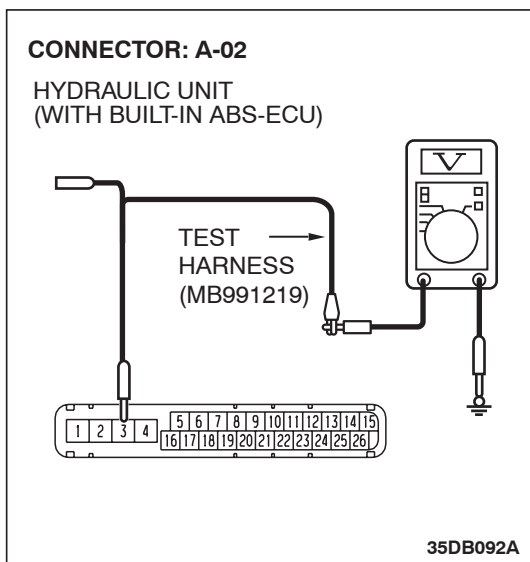
*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 3 and ground. It should be approximately 12 volts (battery positive voltage).

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

**YES :** Go to Step 5.

**NO :** Go to Step 4.



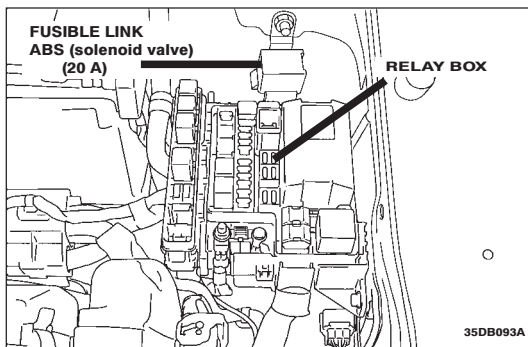
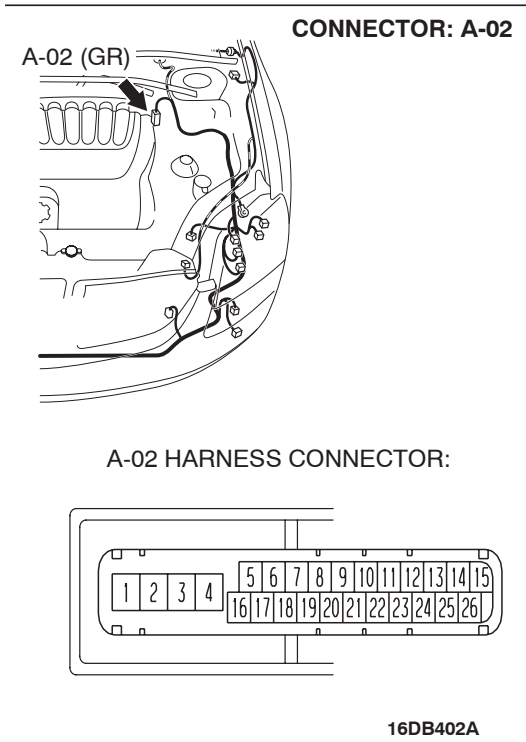
**STEP 4. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

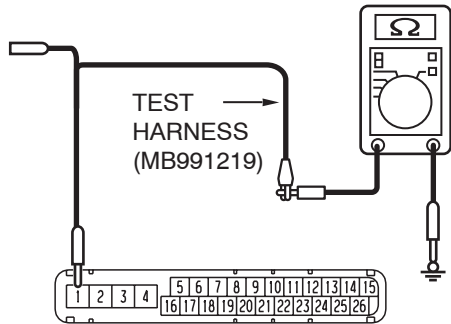
[P.00E-2](#). Then go to Step 8.

**NO :** An open or short circuit may be present in the solenoid valve power supply circuit. Repair the wiring harness between ABS-ECU connector A-02 terminal 3 and external (20 amp) fusible link. Then go to Step 8.



**CONNECTOR: A-02**

HYDRAULIC UNIT  
(WITH BUILT-IN ABS-ECU)



**STEP 5. Measure the resistance at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Measure the resistance between terminal 1 and ground. It should be 2 ohms or less.

**Q: Is the measured resistance 2 ohms or less?**

**YES :** Go to Step 7.

**NO :** Go to Step 6.

**STEP 6. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

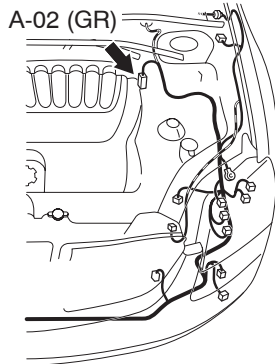
**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

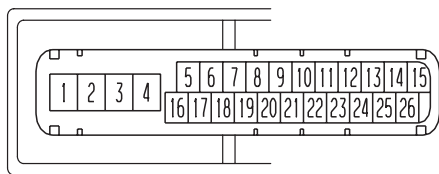
**P.00E-2.** Then go to Step 8.

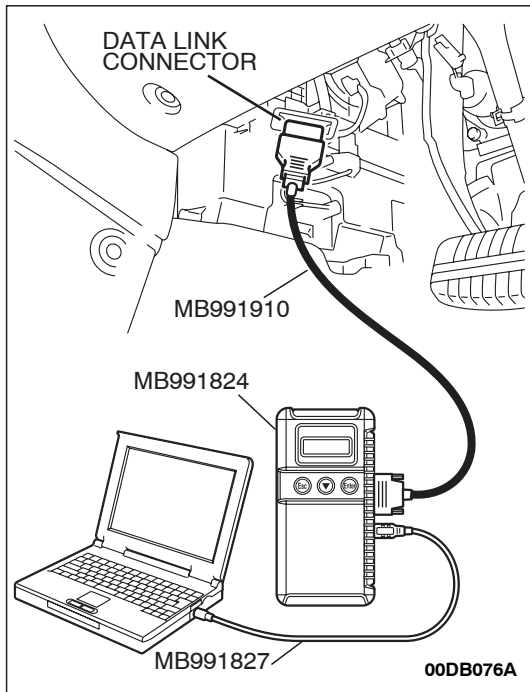
**NO :** An open circuit may be present in the ground circuit. Repair the wiring harness between ABS-ECU connector A-02 terminal 1 and the body ground. Then go to Step 8.

**CONNECTOR: A-02**



A-02 HARNESS CONNECTOR:





**STEP 7. Recheck for diagnostic trouble code.**

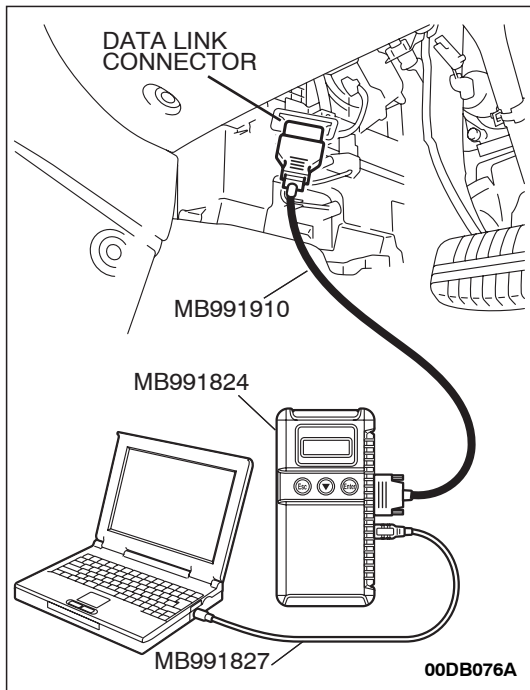
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1278 or C1279 set?**

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

**NO :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).



**STEP 8. Recheck for diagnostic trouble code.**

Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1278 or C1279 set?**

**YES :** Go to Step 1.

**NO :** The procedure is complete.

**DTC C1607: ABS-ECU malfunction**

**⚠ CAUTION**

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Prior to this diagnosis, diagnose the CAN bus lines.

**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.

**⚠ CAUTION**

Whenever the ECU is replaced, ensure that the CAN bus lines are normal.

**ABS DTC SET CONDITIONS**

The ABS-ECU always monitors itself while the system is working. If the ECU detects any faults, it will set this DTC.

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

- Malfunction of the hydraulic unit (integrated with ABS-ECU)

**Circuit drawings**

- Refer to circuit diagrams GROUP-90
- Refer to configuration diagrams GROUP-80

**DIAGNOSIS**

**Required Special Tools:**

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

**STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.**

**⚠ CAUTION**

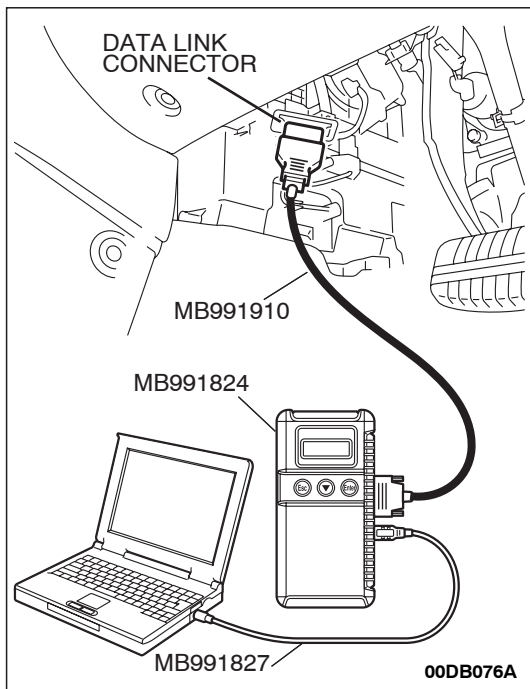
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the CAN bus line found to be normal?**

**YES :** Go to Step 2.

**NO :** Repair the CAN bus line (Refer to GROUP 54C, Diagnosis P.54C-15). Then go to Step 2.



STEP 2. Recheck for diagnostic trouble code.

**⚠ CAUTION**

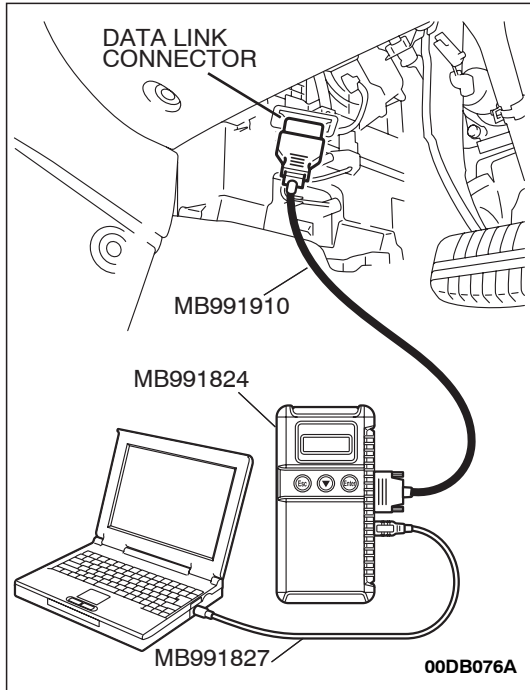
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1607 set?**

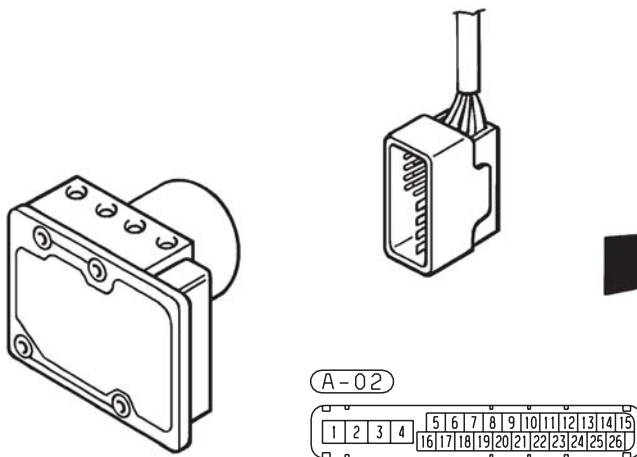
**YES** : Replace the hydraulic unit (integrated with ABS-ECU).

**NO** : The procedure is complete.



**DTC C1860/C1861: Power supply system (abnormal decrease or increase in voltage)**

**A**



**⚠ CAUTION**

If there is any problem in the CAN bus lines, an incorrect diagnostic trouble code may be set. Prior to this diagnosis, diagnose the CAN bus lines.

**NOTE:** *If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.*

### CIRCUIT OPERATION

The ABS-ECU is energized by the ignition switch (IG1) through multi-purpose fuse 23 and the ABS-ECU terminal 18.

### ABS DTC SET CONDITIONS

DTC C1861 will be set when the power supply voltage to the ABS-ECU has decreased to a predetermined value or lower. C1860 will be set when the power supply voltage to the ABS-ECU has increased to a predetermined value or higher.

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

#### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

#### Current trouble

- Excessive electrical load
- Defective battery
- Damaged wiring harness or connector
- Malfunction of the hydraulic unit (integrated with ABS-ECU)
- Charging system failed

#### Past trouble

Carry out diagnosis with particular emphasis on connector(s) or wiring harness in the power supply circuit (terminal 18) to the ABS-ECU. For diagnosis procedures, refer to "How to cope with past trouble" (Refer to [GROUP 00](#), How to Use Troubleshooting/Inspection Service Points [P.00-16](#)).

## DIAGNOSIS

#### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
- MB991219: Inspection Test Harness



**STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.**

**⚠ CAUTION**

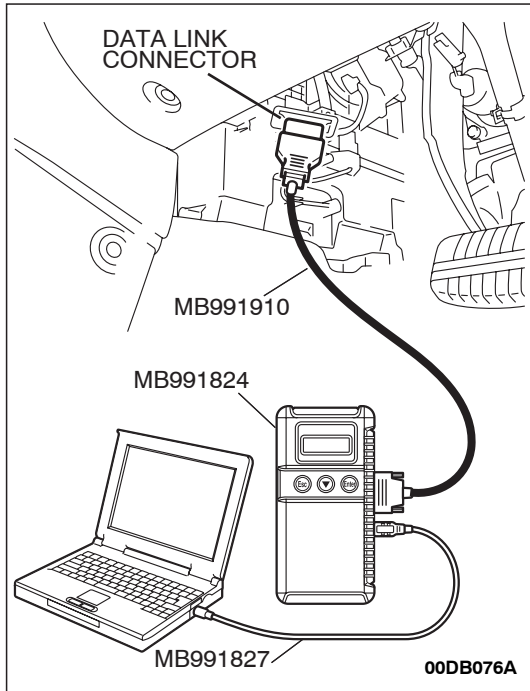
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the CAN bus line found to be normal?**

**YES :** Go to Step 3.

**NO :** Repair the CAN bus line (Refer to GROUP 54C, Diagnosis [P.54C-15](#)). Then go to Step 2.



**STEP 2. Recheck for diagnostic trouble code.**

**⚠ CAUTION**

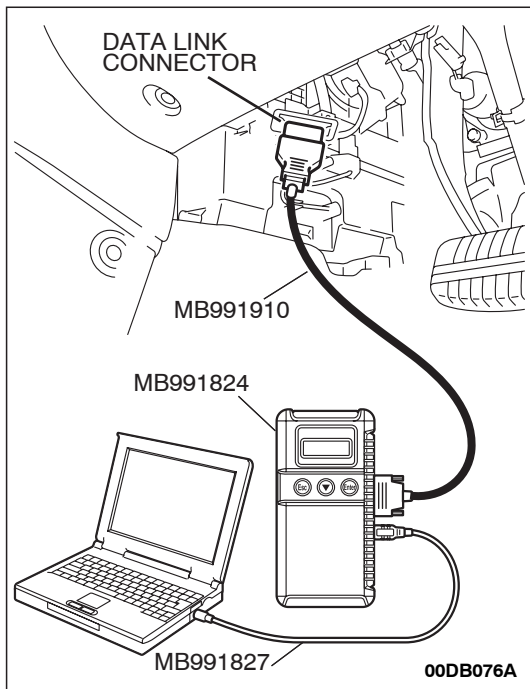
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1860 or C1861 set?**

**YES :** Go to Step 3.

**NO :** The procedure is complete.





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**STEP 3. Check the battery.**

Check the battery (Refer to GROUP 54A, Battery test [P.54A-6](#)).

**Q: Is the battery in good condition?**

**YES :** Go to Step 4.

**NO :** Charge or replace the battery. Then go to Step 8.

---

**STEP 4. Check the charging system.**

Check the charging system (Refer to GROUP 16, Charging system diagnosis [P.16-3](#)).

**Q: Is the charging system in good condition?**

**YES :** Go to Step 5.

**NO :** Repair or replace the charging system component(s).  
Then go to Step 8.

---

**STEP 5. Measure the voltage at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

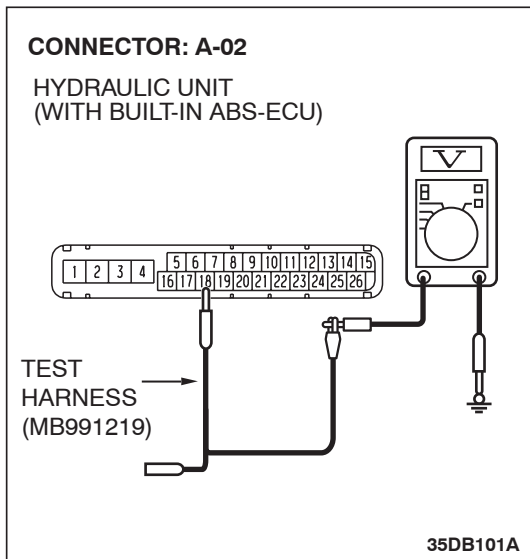
*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Turn the ignition switch to the "ON" position.  
(3) Measure the voltage between terminal 18 and ground. It should be approximately 12 volts (battery positive voltage).

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

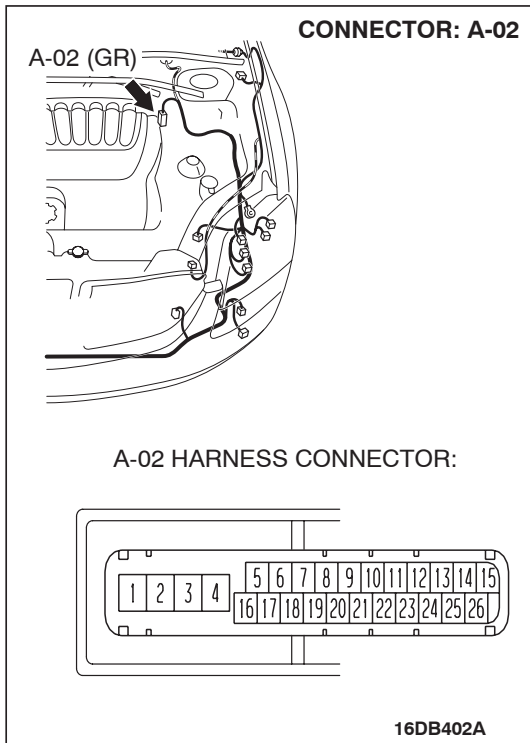
**YES :** Go to Step 7.

**NO :** Go to Step 6.

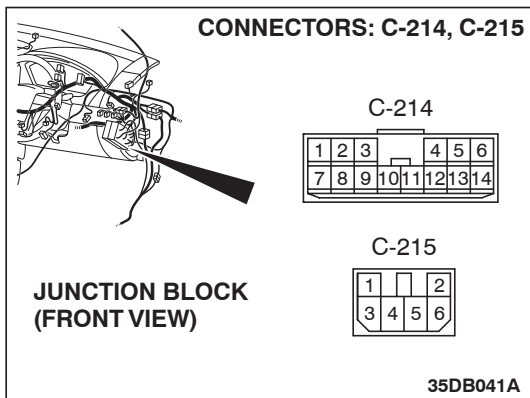


**STEP 6. Check ABS-ECU connector A-02, junction block connectors C-214, C-215 and ignition switch connector C-308 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

- ABS-ECU connector A-02



- Junction block connectors C-214 and C-215



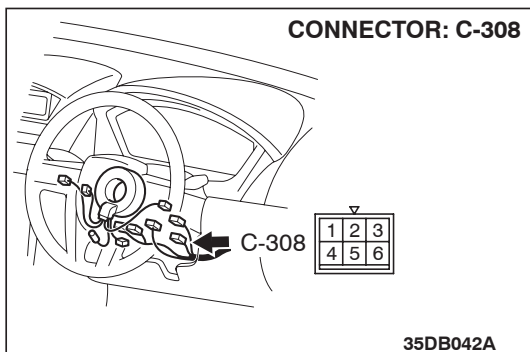
- Ignition switch connector C-308

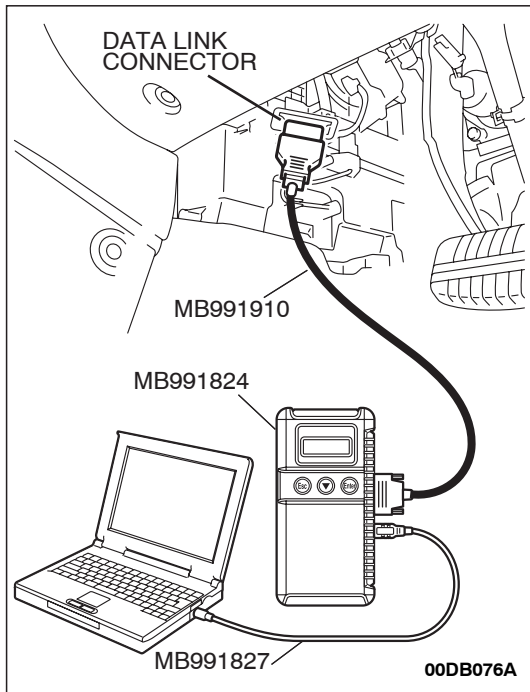
**Q: Are the connectors and terminals in good condition?**

**YES :** An open or short circuit may be present in the power supply line to the ABS-ECU. Repair the wiring harness between ABS-ECU connector A-02 terminal 18 and ignition switch connector C-308 terminal 4. Go to Step 8.

**NO :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection

[P.00E-2](#). Then go to Step 8.





**STEP 7. Recheck for diagnostic trouble code.**

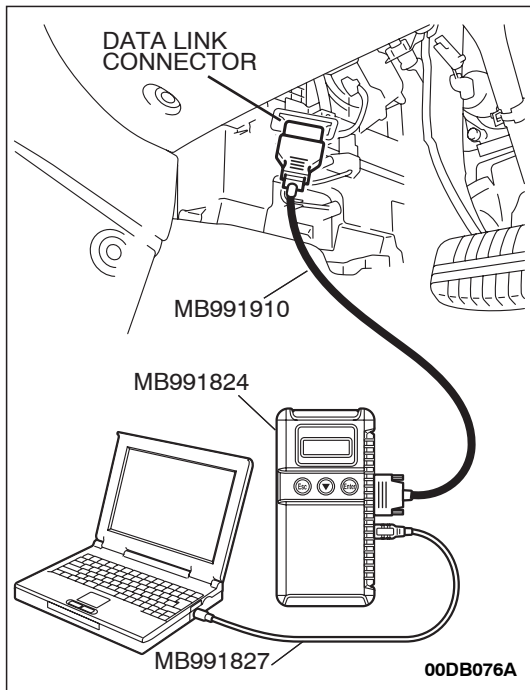
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1860 or C1861 set?**

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

**NO :** It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).



**STEP 8. Recheck for diagnostic trouble code.**

Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC C1860 or C1861 set?**

**YES :** Go to Step 1.

**NO :** The procedure is complete.

DTC U1073: CAN-Bus off

**CAUTION**

- If DTC U1073 is set in the ABS-ECU, always diagnose the CAN main bus line. If there is any fault in the CAN bus lines, an incorrect DTC may be set.
- Whenever the ECU is replaced, ensure that the communication circuit is normal.

**TROUBLE JUDGMENT**

This code is stored when the ABS-ECU has ceased the CAN communication (bus off). Then, if a penalty mode is entered after approximately five minutes, the regular data transmission from the ABS-ECU will be cancelled.

**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)

**Circuit drawings**

- Refer to circuit diagrams GROUP-90
- Refer to configuration diagrams GROUP-80

**DIAGNOSIS**

**Required Special Tools:**

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

**STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.**

**CAUTION**

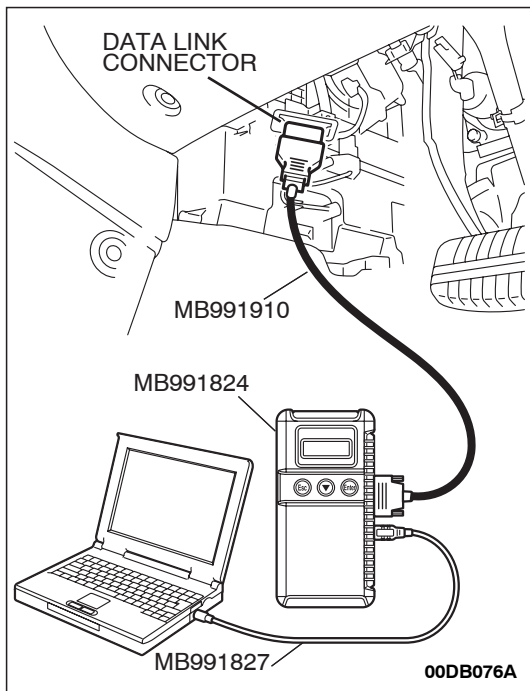
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

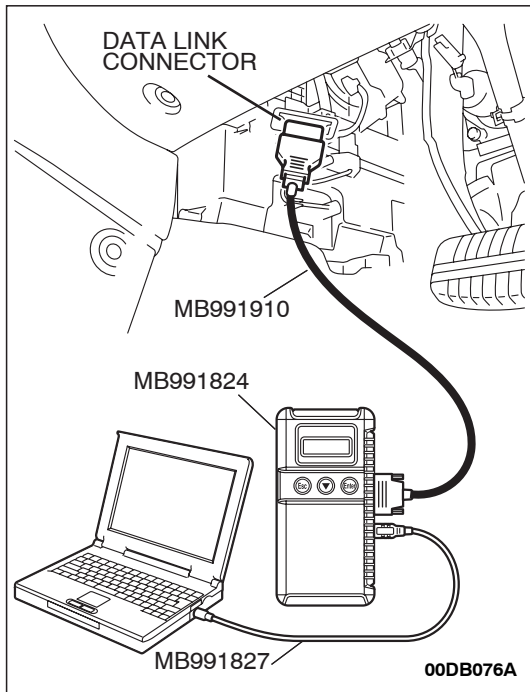
- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the CAN bus line found to be normal?**

**YES :** Go to Step 2.

**NO :** Repair the CAN bus line (Refer to GROUP 54C, Diagnosis P.54C-15). Then go to Step 2.





**STEP 2. Recheck for diagnostic trouble code.**

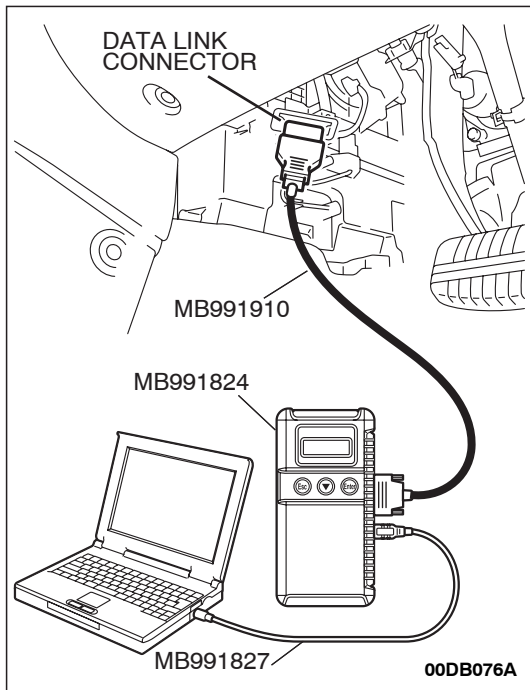
Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC U1073 set?**

**YES :** Replace the ABS-ECU. Then go to Step 3.

**NO :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use  
Troubleshooting/Inspection Service Points – How to  
Cope with Intermittent Malfunction [P.00-14](#).



**STEP 3. Recheck for diagnostic trouble code.**

Check again if the DTC is set.

- (1) Turn the ignition switch to the "ON" position.
- (2) Erase the DTC.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.
- (4) Turn the ignition switch to the "ON" position.
- (5) Check if the DTC is set.
- (6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is DTC U1073 set?**

**YES :** Go to Step 1.

**NO :** The procedure is complete.

## SYMPTOM CHART

M1352011400619

### CAUTION

During diagnosis, a DTC code associated with another system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for DTC code(s). If DTC code(s) are set, erase them all.

**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.

**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.

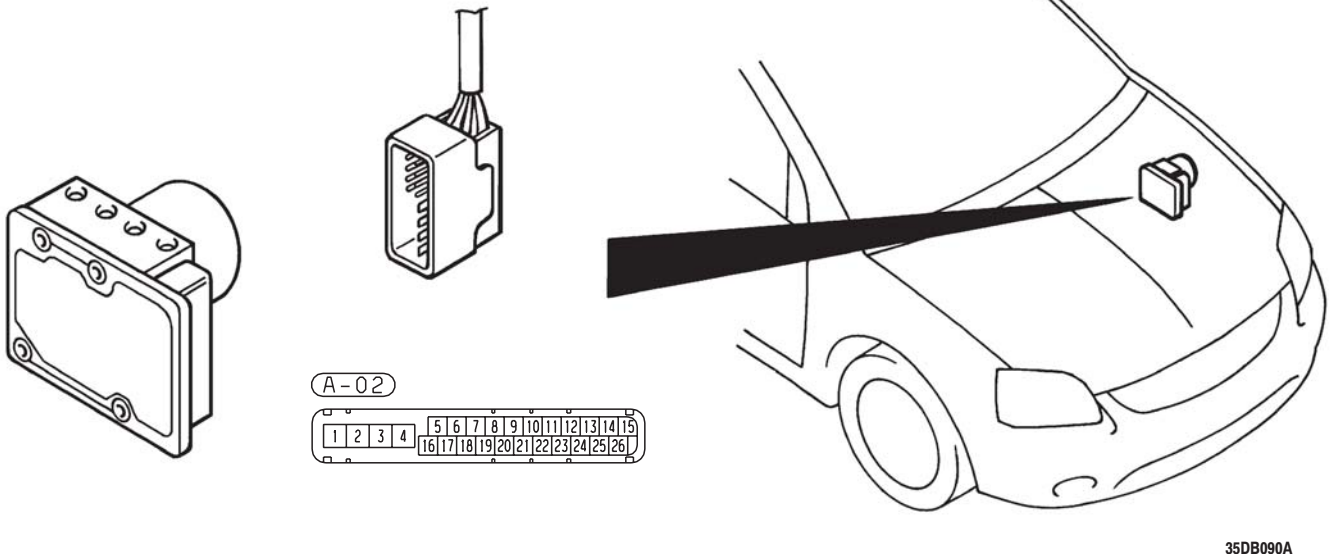
**NOTE:** During ABS operation, the brake pedal may vibrate a little or may not be able to be pressed. Such conditions are due to intermittent changes in hydraulic pressure inside the brake line to prevent the wheels from locking. This is normal.

SYMPTOMS	INSPECTION PROCEDURE NO.	REFERENCE PAGE
Communication between the diagnostic tool and the ABS-ECU is not possible.	1	P.35B-72
Power supply circuit system	2	P.35B-74
When the ignition key is turned to "ON" (Engine stopped), the ABS warning light does not illuminate.	3	P.35B-79
The ABS warning light remains illuminated after the engine is started.	4	P.35B-79
Faulty ABS operation	5	P.35B-81

## SYMPTOM PROCEDURES

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

**A**



35DB090A

### TECHNICAL DESCRIPTION (COMMENT)

If the diagnostic tool (MUT-III Sub Assembly) cannot communicate with the ABS system, the CAN bus lines may be defective. If the ABS system does not work, the ABS-ECU or its power supply circuit may be defective.

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

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

#### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)
- Refer to component locations [GROUP-70](#)

## DIAGNOSIS

### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A



**STEP 1.** Using diagnostic tool MB991958, diagnose the CAN bus line.

**⚠ CAUTION**

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

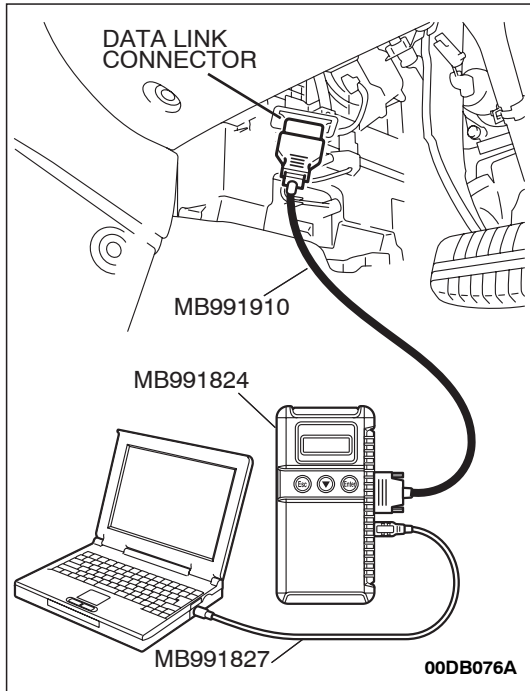
Use diagnostic tool MB991958 to diagnose the CAN bus lines.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.

**Q: Is the check result satisfactory?**

**YES :** Check and repair the power supply circuit system (Refer to [P.35B-74](#)).

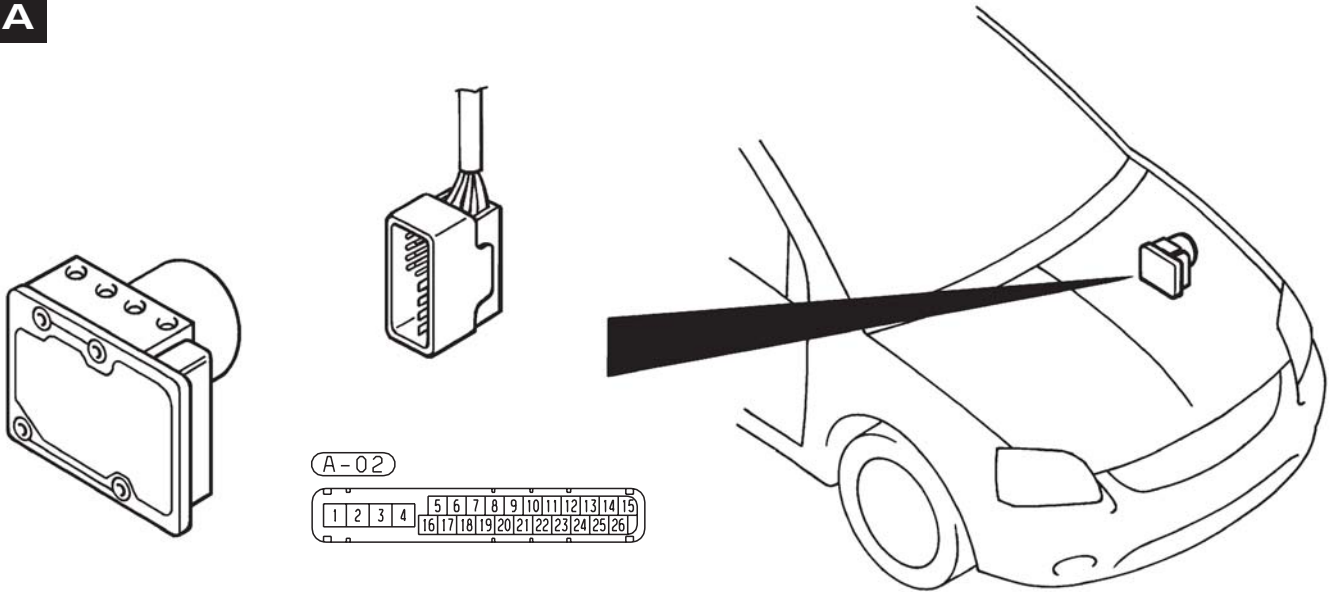
**NO :** Repair the CAN bus lines (Refer to GROUP 54C, Diagnosis-CAN Bus Diagnostic Chart [P.54C-15](#)).





## INSPECTION PROCEDURE 2: Power Supply Circuit System

A



35DB090A

### CIRCUIT OPERATION

- The ABS-ECU is energized by the ignition switch (IG1) through multi-purpose fuse 19 and the ABS-ECU terminal 18.
- If the power supply to the ABS-ECU has failed, diagnostic tool (MUT-III Sub Assembly) will not be able to communicate with it.

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

- Damaged wiring harness or connector
- Defective battery
- Charging system failed
- Malfunction of the hydraulic unit (integrated with ABS-ECU)

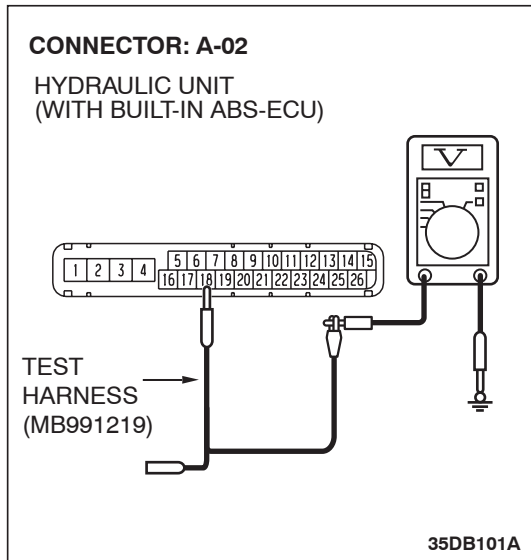
#### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

### DIAGNOSIS

#### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A
- MB991219: Inspection Test Harness



**STEP 1. Measure the voltage at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Turn the ignition switch to the "ON" position.
- (3) Measure the voltage between terminal 18 and ground. It should measure approximately 12 volts (battery positive voltage).

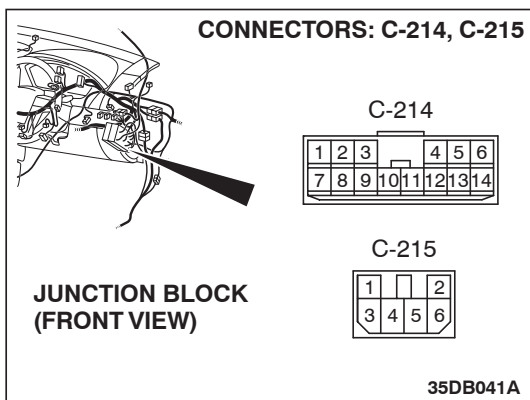
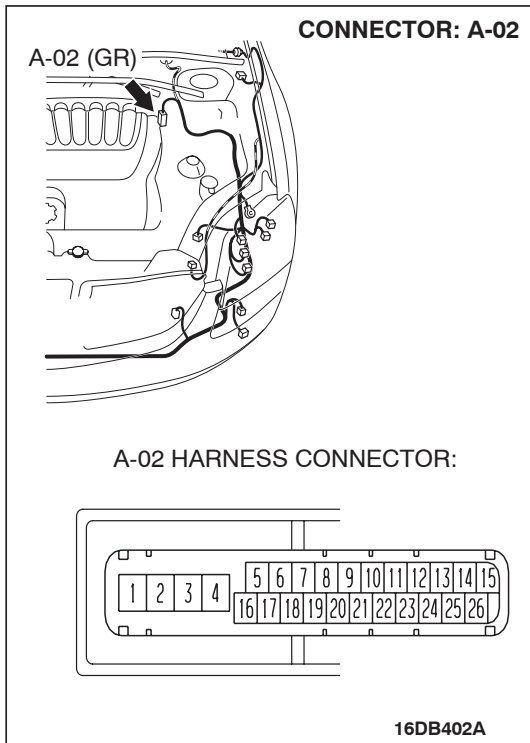
**Q: Is battery positive voltage (approximately 12 volts) present?**

**YES :** Go to Step 3.

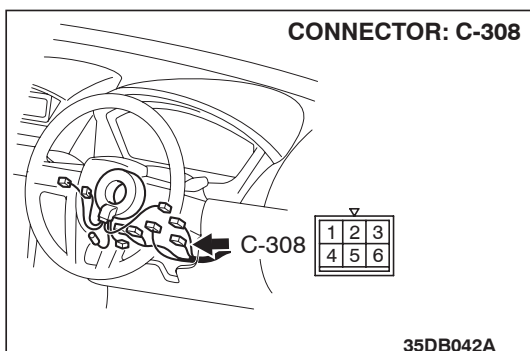
**NO :** Go to Step 2.

**STEP 2. Check ABS-ECU connector A-02, junction block connectors C-214, C-215 and ignition switch connector C-308 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

- ABS-ECU connector A-02



- Junction block connectors C-214 and C-215



- Ignition switch connector C-308

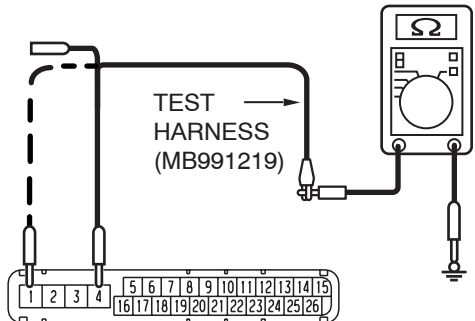
**Q: Are the connectors and terminals in good condition?**

**YES :** An open or short circuit may be present in the power supply line to the ABS-ECU. Repair the wiring harness between ABS-ECU connector A-02 terminal 18 and ignition switch connector C-308 terminal 4. Then go to Step 8.

**NO :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

**CONNECTOR: A-02**

HYDRAULIC UNIT  
(WITH BUILT-IN ABS-ECU)



35DB098A

**STEP 3. Measure the resistance at ABS-ECU connector A-02.**

- (1) Disconnect the connector A-02, and use special tool Inspection Check Harness (MB991219) to probe the wiring harness-side connector.

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

- (2) Measure the resistance between terminal 1, 4 and ground. It should be 2 ohms or less.

**Q: Is the measured resistance 2 ohms or less?**

**YES :** Go to Step 5.

**NO :** Go to Step 4.

**STEP 4. Check ABS-ECU connector A-02 for loose, corroded or damaged terminals, or terminals pushed back in the connector.**

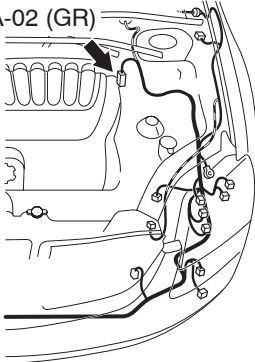
**Q: Is ABS-ECU connector A-02 damaged?**

**YES :** Repair or replace the damaged component(s). Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 8.

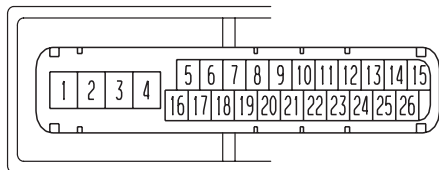
**NO :** An open circuit may be present in the ground circuit. Repair the wiring harness between ABS-ECU connector A-02 terminals 1, 4 and the body ground. Then go to Step 8.

**CONNECTOR: A-02**

A-02 (GR)



A-02 HARNESS CONNECTOR:



16DB402A

**STEP 5. Check the battery.**

Check the battery (Refer to GROUP 54A, Battery test [P.54A-6](#)).

**Q: Is the battery in good condition?**

**YES :** Go to Step 6.

**NO :** Charge or replace the battery. Then go to Step 8.

---

**STEP 6. Check the charging system.**

Check the charging system (Refer to GROUP 16, Charging system diagnosis [P.16-3](#)).

**Q: Is the charging system in good condition?**

**YES :** Go to Step 7.

**NO :** Repair or replace the charging system component(s). Then go to Step 8.

---

**STEP 7. Retest the system.**

**Q: Can the ABS-ECU communicate with the diagnostic tool (MUT-III Sub Assembly)?**

**YES :** It can be assumed that this malfunction is intermittent.  
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction [P.00-14](#).

**NO :** Replace the ABS-ECU. Then go to Step 8.

---

**STEP 8. Retest the system.**

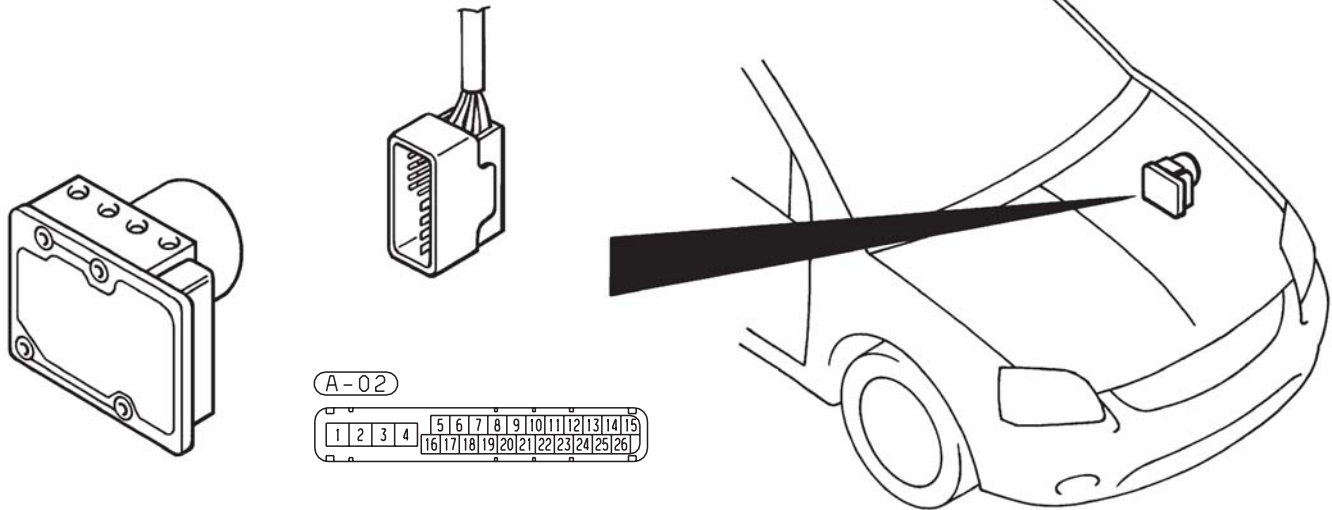
**Q: Can the ABS-ECU communicate with the diagnostic tool (MUT-III Sub Assembly)?**

**YES :** The procedure is complete.

**NO :** Go to Step 1.

**INSPECTION PROCEDURE 3:** When the Ignition Key is Turned to "ON" (Engine Stopped), the BRAKE/ABS Warning Light does not illuminate. **INSPECTION PROCEDURE 4:** The BRAKE/ABS Warning Light Remains Illuminated after the Engine is Started.

**A**



35DB090A

### TECHNICAL DESCRIPTION (COMMENT)

- The ABS-ECU sends the ABS warning light and the brake warning light signals to the combination meter via the CAN communication.
- This may be caused by faults in the CAN bus line, the combination meter, or the ABS-ECU.

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

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

#### Circuit drawings

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

## DIAGNOSIS

#### Required Special Tools:

- MB991958: Diagnostic Tool (MUT-III Sub Assembly)
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A

**STEP 1. Using diagnostic tool MB991958, diagnose the CAN bus line.**

**⚠ CAUTION**

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

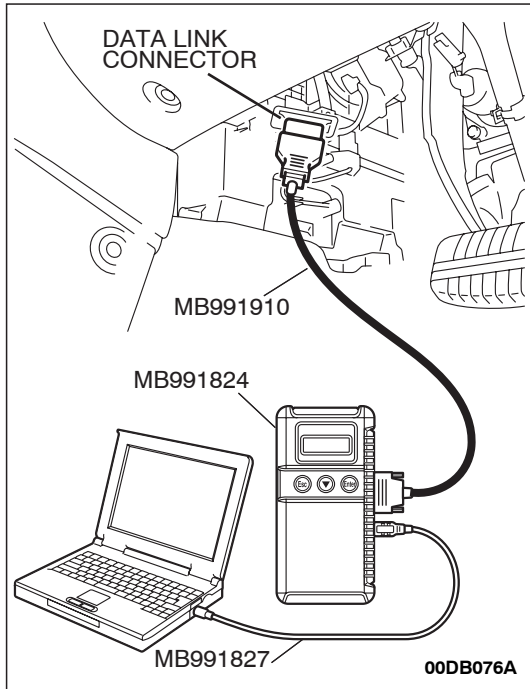
Use diagnostic tool MB991958 to diagnose the CAN bus lines.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Diagnose the CAN bus line.

**Q: Is the check result satisfactory?**

**YES :** Go to Step 2.

**NO :** Repair the CAN bus lines (Refer to GROUP 54C, Diagnosis-CAN Bus Diagnostic Chart [P.54C-15](#)).  
Repair the CAN bus lines, and then go to Step 2.



**STEP 2. Using diagnostic tool MB991958, read the combination meter diagnostic trouble code.**

**⚠ CAUTION**

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

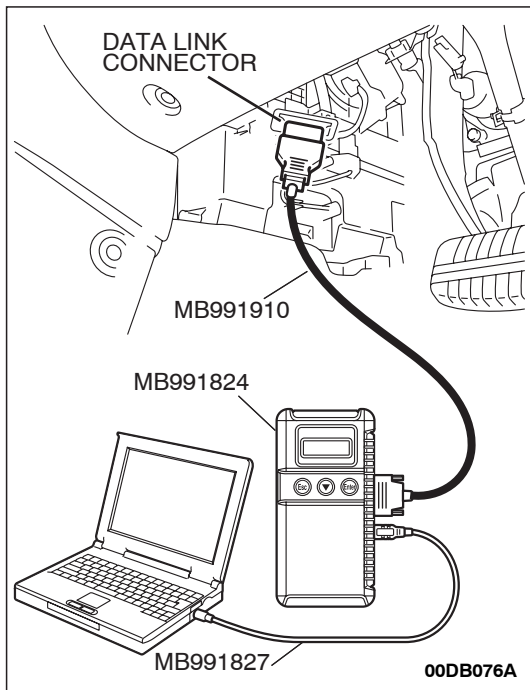
Use diagnostic tool MB991958 to check whether combination meter DTC U1102 has been set.

- (1) Connect diagnostic tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Check whether combination meter DTC U1102 has been set.

**Q: Is combination meter DTC U1102 set?**

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

**NO :** Replace the combination meter.



---

**INSPECTION PROCEDURE 5: 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

**Circuit drawings**

- Refer to circuit diagrams [GROUP-90](#)
- Refer to configuration diagrams [GROUP-80](#)

**DIAGNOSIS**

---

**STEP 1. Hydraulic unit check**

Refer to [P.35B-90](#).

**Q: Is the hydraulic unit normal?**

**YES** : Go to Step 2.

**NO** : Connect the brake pipes correctly, repair the external brake lines, or replace the hydraulic unit.

---

**STEP 2. Verify that the condition described by the customer exists.**

**Q: Can any faults be found with the brake operation?**

**YES** : Check the brake system related components except the ABS system.

**NO** : The procedure is complete.



## DATA LIST REFERENCE TABLE

M1352011500780

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

MUT-III DIAGNOSTIC TOOL DISPLAY	DATA LIST ITEM NO.	CHECK ITEM	CHECKING REQUIREMENTS	NORMAL VALUE
FL wheel speed sensor	01	Front-left wheel speed sensor	Drive the vehicle	Vehicle speeds displayed on the speedometer and diagnostic tool are identical.
FR wheel speed sensor	02	Front-right wheel speed sensor		
RL wheel speed sensor	03	Rear-left wheel speed sensor		
RR wheel speed sensor	04	Rear-right wheel speed sensor		
Power supply voltage	05	ABS-ECU power supply voltage	Ignition switch power supply voltage and valve monitor voltage	Battery positive voltage
Stop lamp switch (input)	06	Stoplamp switch	Depress the brake pedal.	ON
			Release the brake pedal.	OFF
Stop lamp switch	13	Stoplamp switch	Depress the brake pedal.	ON
			Release the brake pedal.	OFF
Pump motor	21	Pump motor	When the ABS outputs the operation permission signal during driving	ON
			When the ABS outputs the operation permission signal during driving	OFF
Valve relay	30	Valve relay	When the ABS outputs the operation permission signal during driving	ON
			When the ABS outputs the operation permission signal during driving	OFF
TCL mode	35	TCL operation	When the TCL outputs the operation permission signal during driving	ON
			When the TCL outputs the operation inhibition signal during driving	OFF

## ACTUATOR TEST REFERENCE TABLE

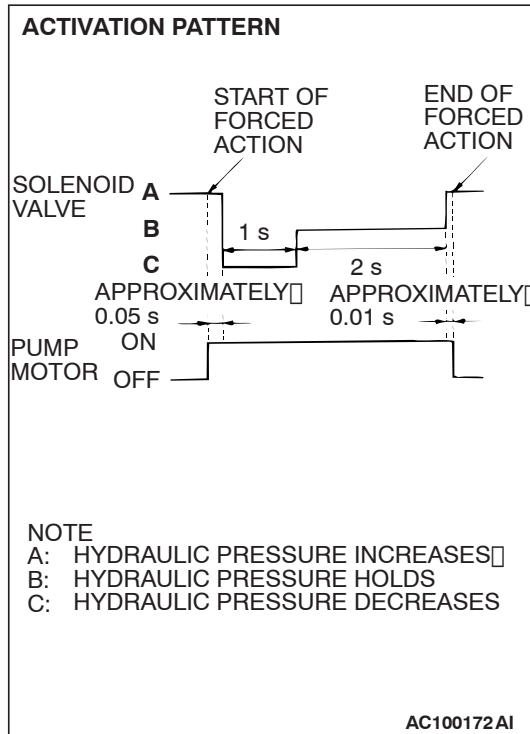
The diagnostic tool activates the following actuators for testing.

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

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

M1352011600765

## ACTUATOR TEST SPECIFICATIONS



NO.	ITEM	PARTS TO BE ACTIVATED
01	FL wheel speed sensor	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
02	FR wheel speed sensor	
03	RL wheel speed sensor	
04	RR wheel speed sensor	
09	Engine TCL Drive	Outputs the engine torque control signal (engine torque = 0) to Engine ECU for three seconds.

## CHECK AT ABS-ECU

M1352011800769

### TERMINAL VOLTAGE CHECK CHART

**Required Special Tool:**

MB991219: Inspection Test Harness

1. Disconnect the ABS-ECU connector A-02, and use special tool Inspection Test Harness (MB991219) to probe the wiring harness-side connector.
2. Measure the voltages between ground and each terminal listed below in the table. Also measure voltages between ground and each terminal listed below in the table.

*NOTE: The special tool (Inspection test harness) MB991219 for connector pin contact pressure should be used. The test probe should never be forcibly inserted, as it may cause a defective contact.*

3. The terminal layouts are shown in the illustrations below.

CONNECTOR TERMINAL NO	SIGNAL	CHECKING REQUIREMENT		NORMAL CONDITION
3	Solenoid valve power supply	Always		Battery positive voltage
20	Stop light switch input	Ignition switch: "ON"	Stop light switch: "ON"	Battery positive voltage
			Stop light switch: "OFF"	Approximately 0 V
2	Motor power supply	Always		Battery positive voltage
18	ABS-ECU power supply	Ignition switch: "ON"		Battery positive voltage
		Ignition switch: "START"		Approximately 0 V

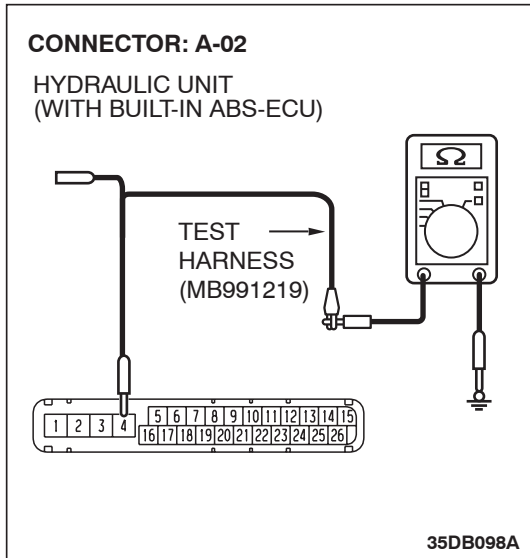
## GROUND RESISTANCE AND CONTINUITY BETWEEN HARNESS-SIDE CONNECTOR TERMINALS AND BODY GROUND

### Required Special Tool:

MB991219: Inspection Test Harness

1. Turn the ignition switch to the "LOCK" (OFF) position and disconnect the ABS-ECU connectors before checking resistance and continuity.
2. Using the Inspection Test Harness (MB991219) to probe the wiring harness-side connector, check the resistance and continuity between the terminals indicated in the table below.
3. The terminal layout is shown in the illustration.

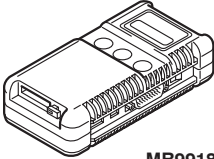
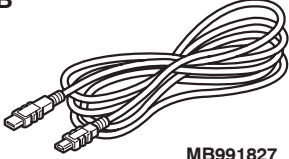
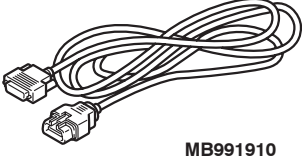
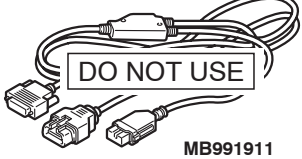

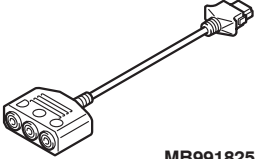
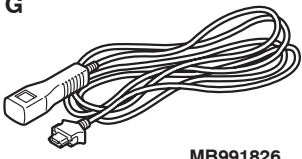
**NOTE:** If the ABS-8 ECU or the active wheel speed sensor are disconnected, or if the wiring is an open/ short circuit, the ABS 8 ECU will shut off power supply to the respective wheel speed sensor. All other wheel speed sensors will operate normally. To restore the power supply, the ignition switch must be turned to the "OFF" position then to the "ON" position again.


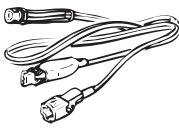
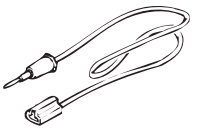



CONNECTOR TERMINAL NO.	SIGNAL	NORMAL CONDITION
1 – body ground	Ground	Less than 2 ohms
4 – body ground	Ground	Less than 2 ohms

# SPECIAL TOOLS

M1352000600653

TOOL	TOOL NUMBER AND NAME	SUPERSESION	APPLICATION
<p><b>A</b></p>  <p>MB991824</p> <p><b>B</b></p>  <p>MB991827</p> <p><b>C</b></p>  <p>MB991910</p> <p><b>D</b></p>  <p>MB991911</p> <p><b>E</b></p>  <p>MB991914</p> <p><b>F</b></p>  <p>MB991825</p> <p><b>G</b></p>  <p>MB991826</p> <p>MB991958</p>	<p>MB991958</p> <p>A: MB991824</p> <p>B: MB991827</p> <p>C: MB991910</p> <p>D: MB991911</p> <p>E: MB991914</p> <p>F: MB991825</p> <p>G: MB991826</p> <p>MUT-III Sub Assembly</p> <p>A: Vehicle Communication Interface (V.C.I.)</p> <p>B: MUT-III USB Cable</p> <p>C: MUT-III Main Harness A (Vehicles with CAN communication system)</p> <p>D: MUT-III Main Harness B (Vehicles without CAN communication system)</p> <p>E: MUT-III Main Harness C (for Daimler Chrysler models only)</p> <p>F: MUT-III Adapter Harness</p> <p>G: MUT-III Trigger Harness</p>	<p>MB991824–KIT</p> <p><i>NOTE: G: MB991826 MUT-III Trigger Harness is not necessary when pushing V.C.I. ENTER key.</i></p>	<p>Checking diagnostic trouble codes</p> <p><b>CAUTION</b></p> <p>For vehicles with CAN communication, use MUT-III main harness A to send simulated vehicle speed. If you connect MUT-III main harness B instead, the CAN communication does not function correctly.</p>

TOOL	TOOL NUMBER AND NAME	SUPERSESSION	APPLICATION
<p><b>A</b></p>    <p><b>B</b></p>  <p align="right"><b>MB991222</b></p>	<p>MB991223 Harness set (A): MB991219 Inspection harness (B): MB991222 Back probing tool</p>	<p>General service tools</p>	<p>(A): Resistance measurement between ABS-ECU and wheel speed sensors ABS-ECU terminal voltage measurement ABS-ECU terminal (ground) resistance measurement (B): ABS-ECU wheel speed sensor signal voltage measurement ABS-ECU wheel speed sensor signal measurement</p>

## ON-VEHICLE SERVICE

### WHEEL SPEED SENSOR SIGNAL MEASUREMENT

M1352001600667

#### Required Special Tool:

MB991222: Back probing tool

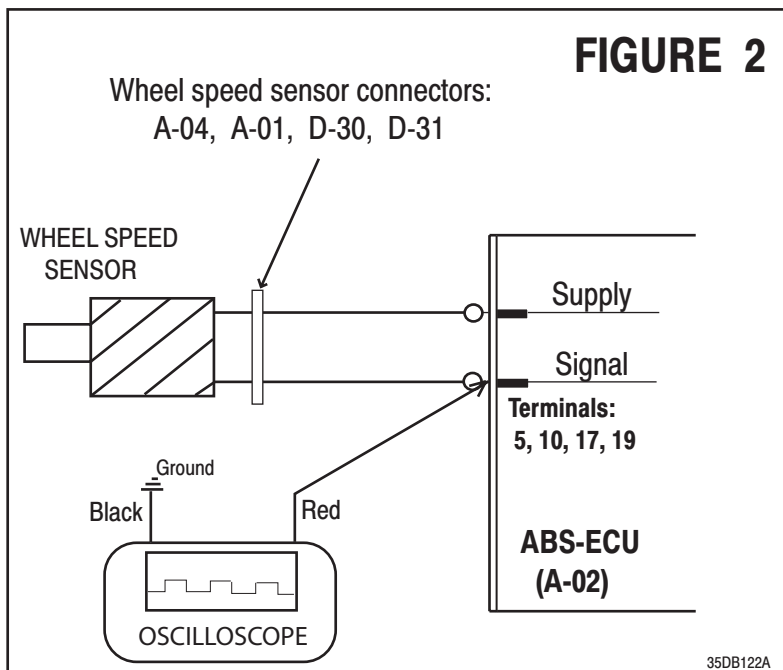
1. ABS connector (A-02) must remain connected to hydraulic unit when checking signal measurements.
2. Remove ABS connector protection cap to access terminal location from rear of connector for backprobing.
3. Release the parking brake and lift up the vehicle.
4. Use probe tool MB991222 to measure the output signal at the ABS connector A-02 by back probing the terminal positions shown in the table below.

TERMINAL NO.			
Front left	Front right	Rear left	Rear right
5	10	17	19

*NOTE: To check wheel speed sensor connectors, remove the rear seat to access the rear wheel speed sensor connections and remove inner guard (splash shield) to access front wheel speed sensors, to confirm the connection of the sensor harness and connector before using the oscilloscope.*

5. Connect oscilloscope (as per figure 2) shows, to the appropriate terminal positions by back probing (using probe MB991222) and check sensor operation individually with scope.

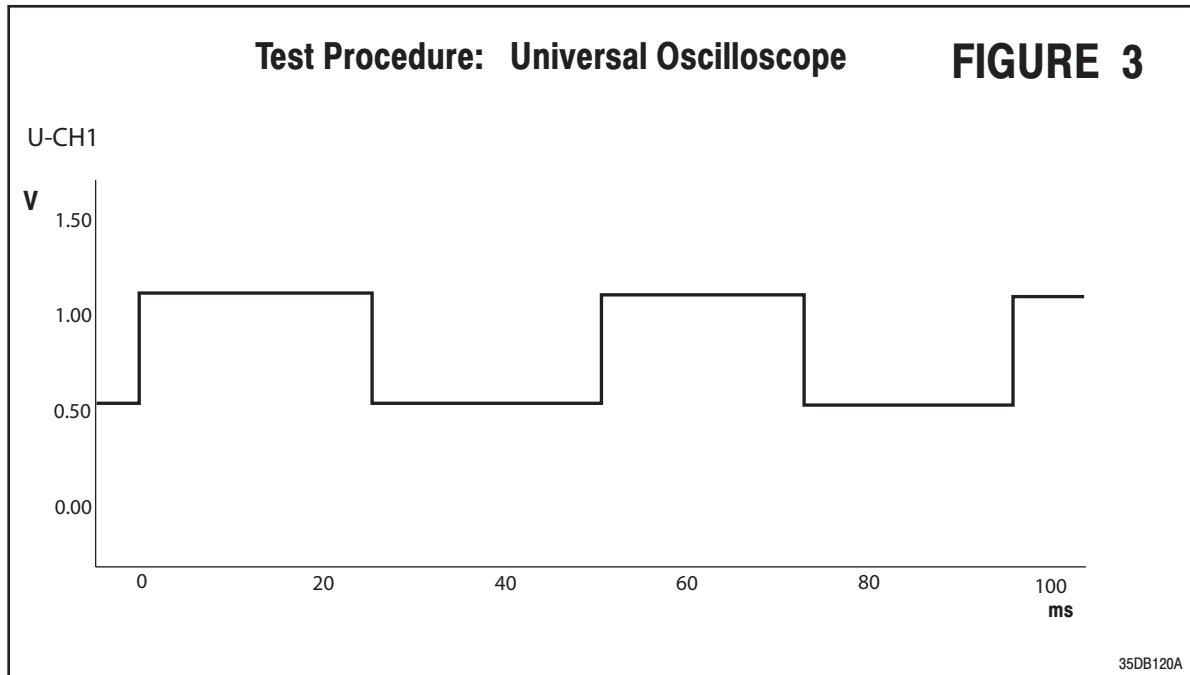
Turn the ignition switch to the "ON" position.



6. Turn wheel by hand at approximately 1 revolution per second (r/sec) or drive on brake dynamometer at 5km/h.

Recommended Oscilloscope setting:

- Y-axis: 2Volts
- X-axis: 100ms



*NOTE: If the oscilloscope signal shape is correct and wheel sensor air gap is within specification, but the voltage values are either higher or lower as shown in the table below, the wheel speed sensor must be changed.*

Wheel speed sensor	Standard	Value
	High	0.9V - 1.5V
	Low	0.3V - 0.8V

**Probable causes of low output voltage**

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

7. To observe the waveform with an oscilloscope:

- Front and Rear Wheels: Turn the wheels manually at a constant speed

*NOTE: The output voltage will remain same regardless of vehicle speed.*

*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 signal waveform also under special conditions, such as driving on a rough road.*



## HYDRAULIC UNIT CHECK

### Required Special Tools:

- MB991958: MUT-III Sub Assembly
  - MB991824: Vehicle Communication Interface (V.C.I.)
  - MB991827: MUT-III USB Cable
  - MB991910: MUT-III Main Harness A (Vehicles with CAN communication system)

### CAUTION

- The roller of the braking force tester and the tyre 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.

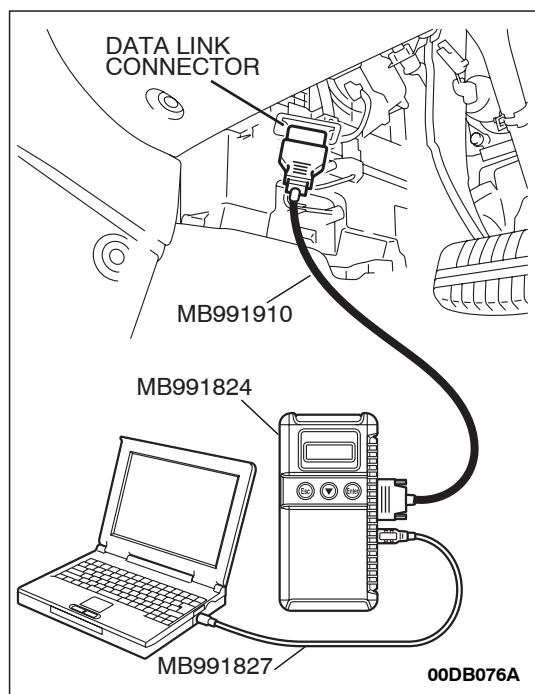
### CAUTION

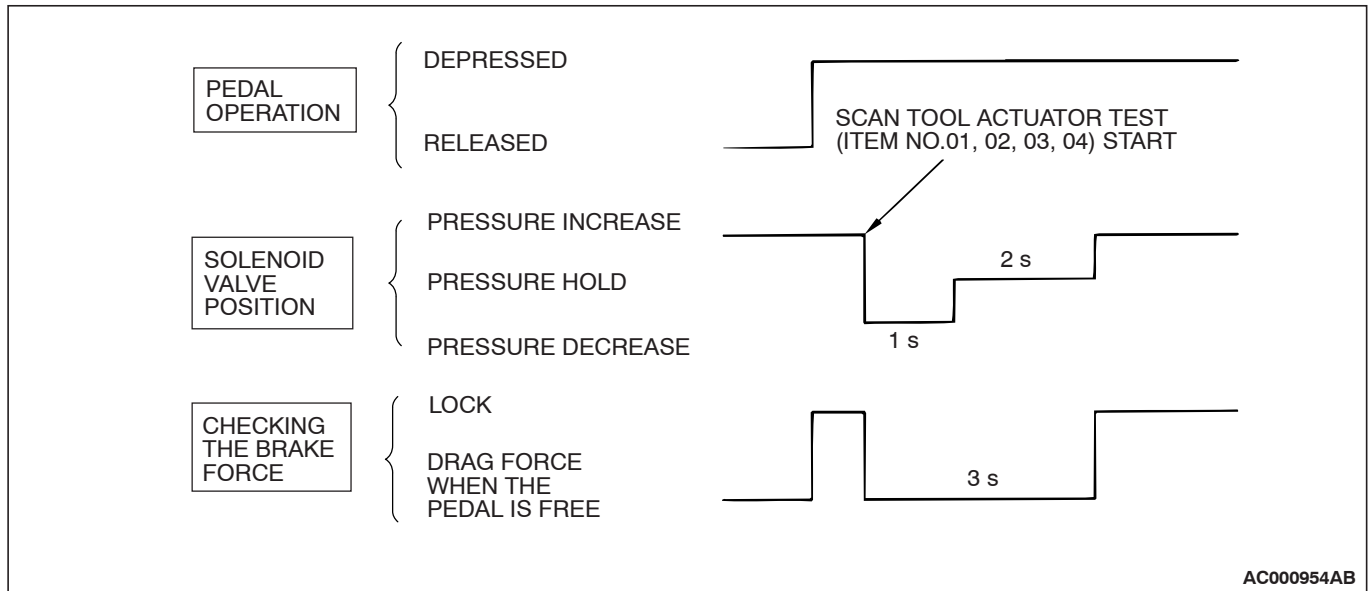
To prevent damage to diagnostic tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting diagnostic tool MB991958.

3. Connect diagnostic tool MB991958 to the data link connector.
4. After checking that the selector lever is in "P" range, start the engine.
5. Select "Interactive Diagnosis" from the start-up screen.
6. Select "System Select."
7. Choose "ABS" .
8. Select "Actuator Test" from "ABS" screen
9. Choose an appropriate item for hydraulic unit check.

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

*NOTE: When the ABS has been interrupted by the fail-safe function, diagnostic tool MB991958 actuator testing cannot be used.*





10. 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 reading taken 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.)

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

<b>DIAGNOSIS TABLE</b>					
<b>MUT-III DISPLAY</b>	<b>OPERATION</b>	<b>INSPECTION RESULT</b>	<b>JUDGMENT</b>	<b>PROBABLE CAUSE</b>	<b>REMEDY</b>
01 FL VALVE 02 FR VALVE 03 RL VALVE 04 RR VALVE	<ul style="list-style-type: none"> <li>Depress brake pedal to lock wheel.</li> <li>Using diagnostic tool MB991958, select the wheel to be checked and force the actuator to operate.</li> <li>Turn the selected wheel manually to check the change of brake force.</li> </ul>	Brake force is released for three seconds after wheels have been locked.	Normal	—	—
		Wheel does not lock when brake pedal is depressed.	Abnormal	Clogged brake line other than hydraulic unit	Check and clean brake line
				Clogged hydraulic circuit in hydraulic unit	Replace hydraulic unit assembly
		Brake force is not released	Abnormal	Incorrect hydraulic unit brake tube connection	Connect correctly
				Hydraulic unit solenoid valve not functioning correctly	Replace hydraulic unit assembly

12. After inspection, disconnect diagnostic tool MB991958 immediately after turning the ignition switch to the "LOCK" (OFF) position.

### IN THE EVENT OF A DISCHARGED BATTERY

M1352003500547

#### **WARNING**

***If the ABS is not operating, the vehicle will be unstable during braking. Do not drive the vehicle with the ABS-ECU connector disconnected or with the ABS not operating.***

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

M1352008600464

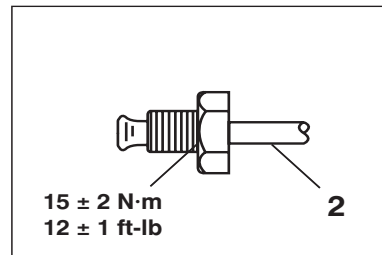
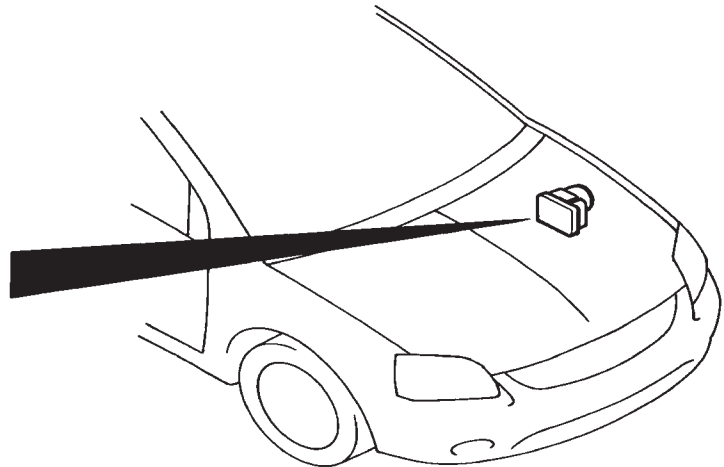
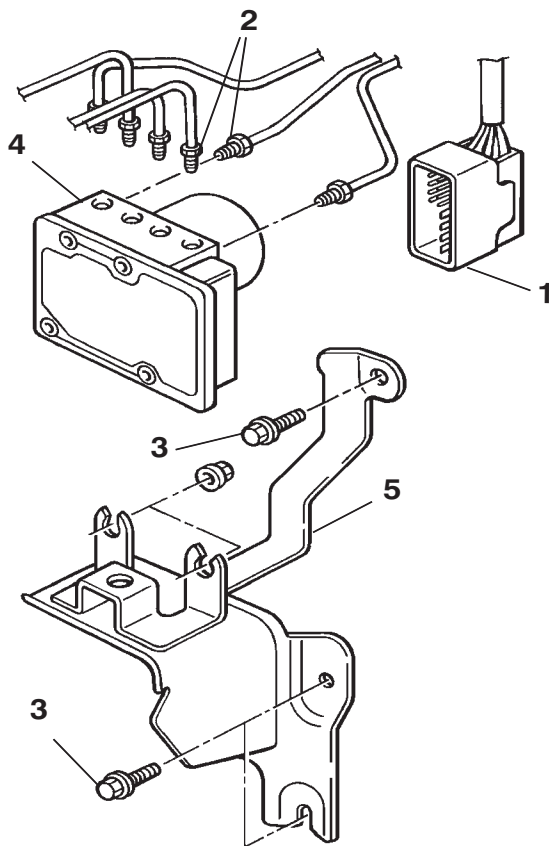
**NOTE:** The ABS-ECU is integrated in the hydraulic unit.

#### Pre-removal Operation

- Strut Tower Bar Removal (Refer to GROUP 42, Strut Tower Bar P.42-12).
- Brake Fluid Draining

#### Post-installation Operation

- Brake Fluid Filling
- Brake Line Bleeding (Refer to GROUP 35A, On-vehicle Service – Bleeding P.35A-16).
- Hydraulic Unit Check (Refer to P.35B-90).
- Strut Tower Bar Installation (Refer to GROUP 42, Strut Tower Bar P.42-12).



35DB104A

#### REMOVAL STEPS

- BATTERY AND BATTERY TRAY
  - HARNESS CONNECTORS AROUND THE ABS-ECU
  - HARNESS CLAMPS AROUND THE ABS-ECU
  - CONNECTOR BRACKETS AROUND THE ABS-ECU <3.8L ENGINE>
1. ABS-ECU HARNESS CONNECTOR

<<A>>

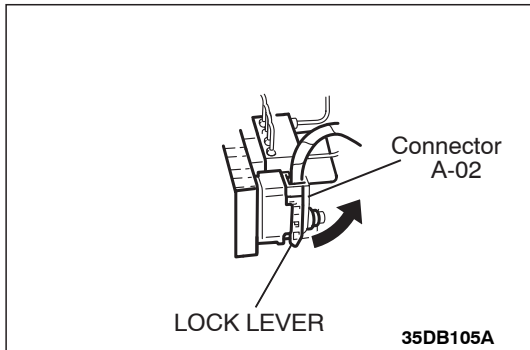
#### REMOVAL STEPS (Continued)

- >>A<<
2. BRAKE TUBE CONNECTION
  3. ABS EQUIPMENT BOLT AND NUTS
  4. BRAKE MODULATOR HYDRAULIC UNIT (HYDRAULIC UNIT AND ABS-ECU)
  5. BRAKE HYDRAULIC UNIT BRACKET
- <<B>>

## REMOVAL SERVICE POINTS

### <<A>> ABS-ECU HARNESS CONNECTOR DIS-CONNECTION

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



### <<B>> BRAKE MODULATOR HYDRAULIC UNIT (HYDRAULIC UNIT AND ABS-ECU) REMOVAL

#### **WARNING**

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

#### **CAUTION**

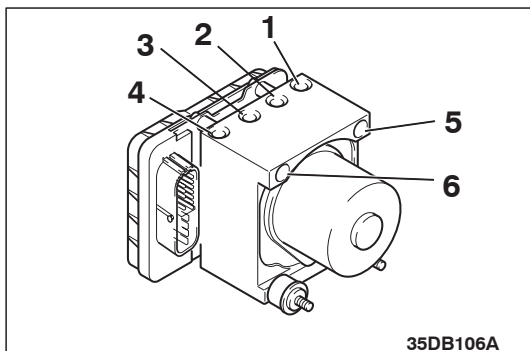
- The hydraulic unit cannot be disassembled. Never loosen its nuts or bolts.
- Do not drop or shock the hydraulic unit.
- Do not turn the hydraulic unit upside down or lay it on its side.

## INSTALLATION SERVICE POINT

### >>A<< BRAKE TUBE CONNECTION

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

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



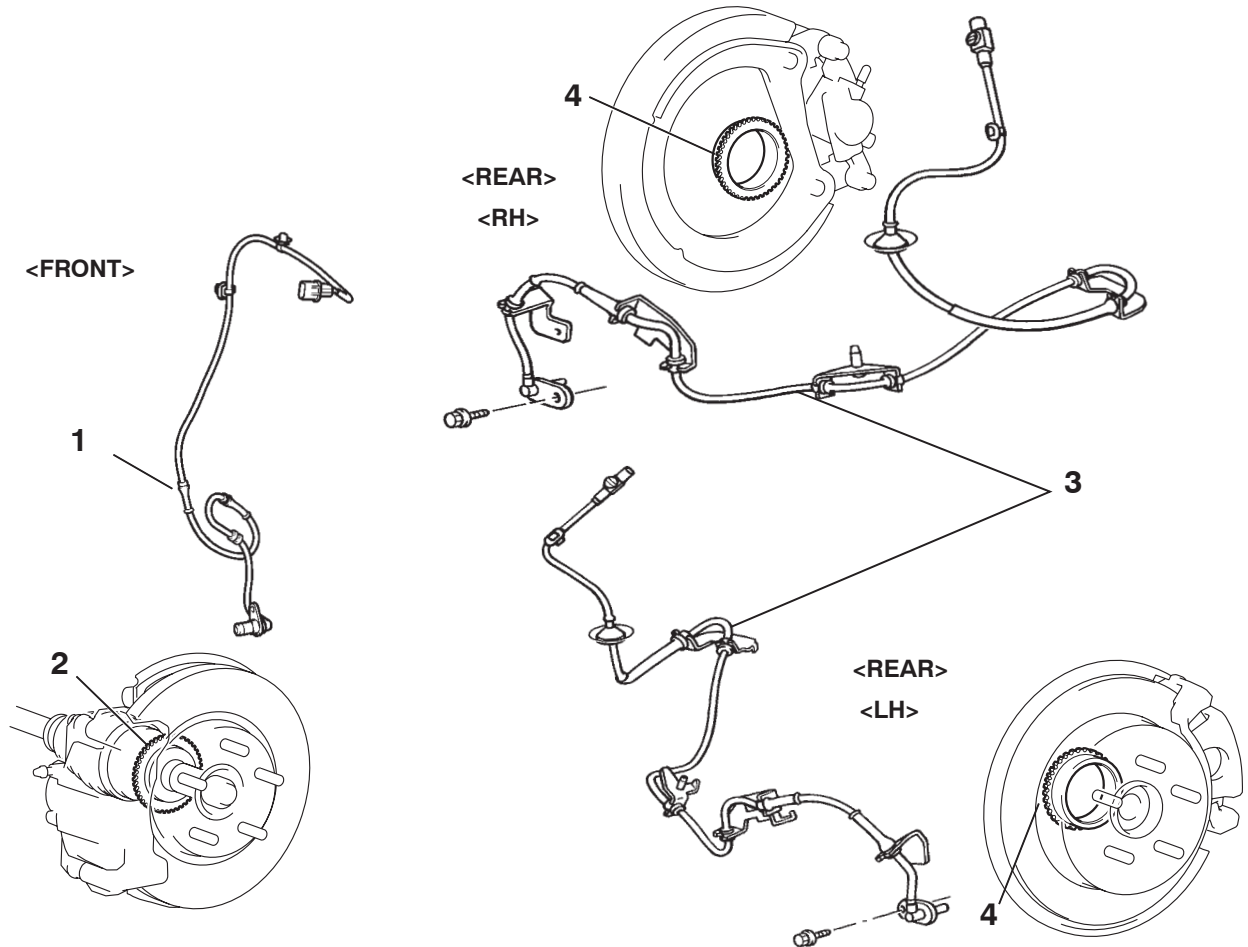
# WHEEL SPEED SENSOR

## REMOVAL AND INSTALLATION

M1352008300548

### Post-installation Operation

- Wheel Speed Sensor Output Signal Voltage Measurement (Refer to [P.35B-88](#)).



### FRONT WHEEL SPEED SENSOR REMOVAL STEPS

- SPLASH SHIELD (REFER TO GROUP 42, FENDER [P.42-10](#)).
1. FRONT WHEEL SPEED SENSOR
  2. FRONT WHEEL SPEED ROTOR (REFER TO GROUP 26, DRIVESHAFT ASSEMBLY [P.26-13](#)).

### REAR WHEEL SPEED SENSOR REMOVAL STEPS

3. REAR WHEEL SPEED SENSOR
4. REAR WHEEL SPEED ROTOR (REFER TO GROUP 27, REAR AXLE HUB ASSEMBLY [P.27-6](#)).

<<A>>

*NOTE: Front wheel speed rotors are integrated with the BJ assembly of the drive shaft and cannot be disassembled.*

*NOTE: Rear wheel speed rotors are integrated with the rear hub assembly and cannot be disassembled.*

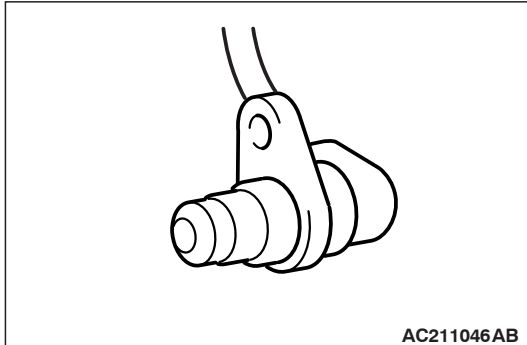
<<A>>

## 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 wheel speed sensor and the toothed edge of the wheel speed rotor so as not to damage them by contacting other parts.



## INSPECTION

M1352008400459

### WHEEL SPEED SENSOR CHECK

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.

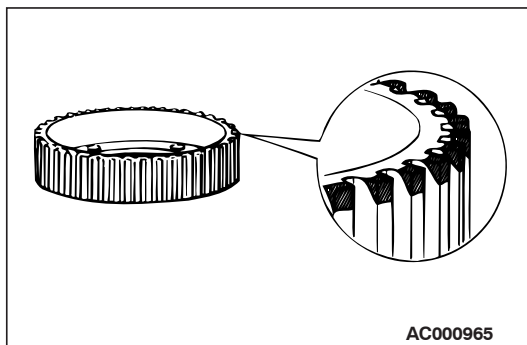
*NOTE: The projection can become magnetized due to the magnet inside the wheel speed sensor, and may cause foreign material to adhere to it. The projection may not be able to correctly sense the wheel rotation speed if foreign matter is on it or if it is damaged.*

2. Check the wheel 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 WHEEL SPEED ROTOR CHECK

Check whether the wheel speed rotor teeth are broken or deformed. Replace the BJ assembly of the drive shaft, or the rear hub assembly, respectively, if the teeth are damaged or deformed.



## SPECIFICATIONS

### FASTENER TIGHTENING SPECIFICATION

M1352012400377

ITEM	SPECIFICATION
Brake tube flare nut	$15 \pm 2$ N·m ( $12 \pm 1$ ft-lb)

### GENERAL SPECIFICATIONS

M1352000200075

ITEM		SPECIFICATION
ABS control method		4-sensor, 4-channel
Numbers of wheel speed rotor teeth	Front	43
	Rear	43
Wheel speed sensor	Type	Active Wheel Speed Sensor
	Gap between sensor and rotor (mm)	0.2mm – 0.85mm <Non-adjustable type>



