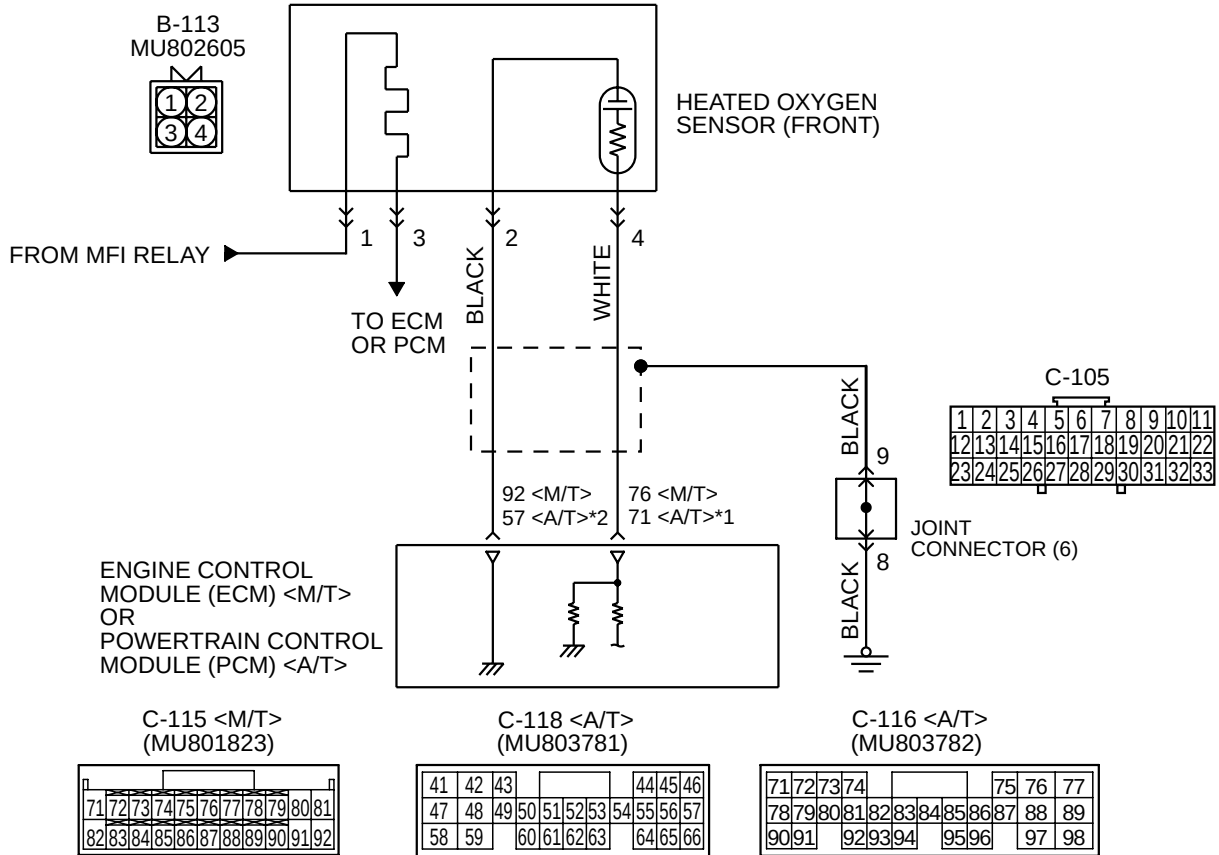


DTC P0130: Heated Oxygen Sensor Circuit (sensor 1)

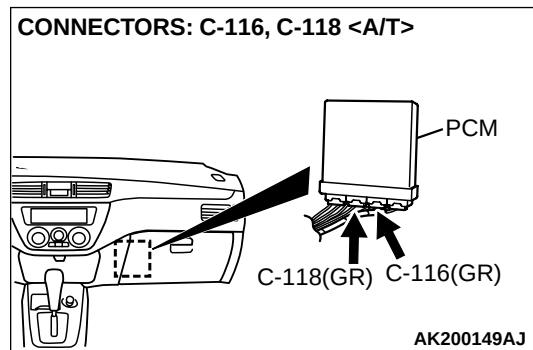
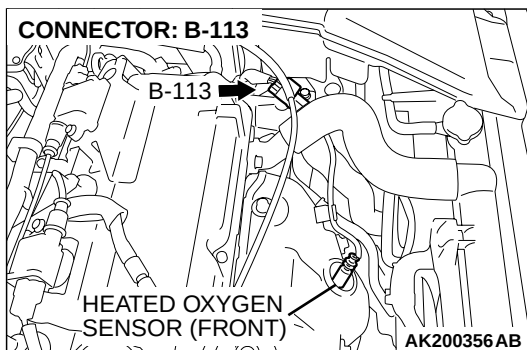
Heated Oxygen Sensor (front) Circuit

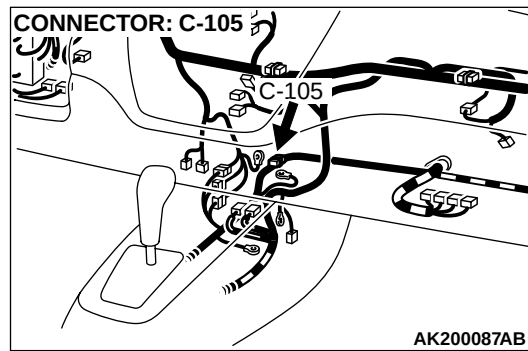
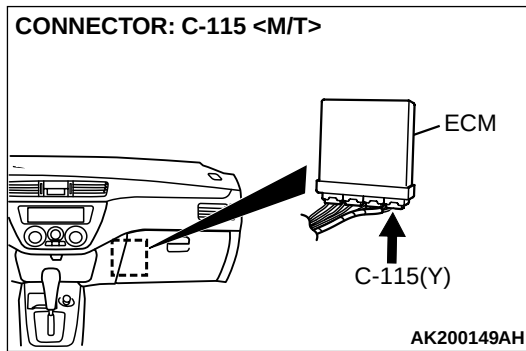


NOTE

- *1: PCM connector C-116 <A/T>
*2: PCM connector C-118 <A/T>

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CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) <M/T> or PCM (terminal No. 71) <A/T> from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM <M/T> or PCM <A/T>.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM <M/T> or PCM <A/T> forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM <M/T> or PCM <A/T> also checks for an open circuit in the heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

- While the heated oxygen sensor (front) output is low, 5 volts are applied to the input circuit of the heated oxygen sensor (front). An open circuit is detected while monitoring the sensor output with 5 volts applied.

MONITOR EXECUTION

- Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

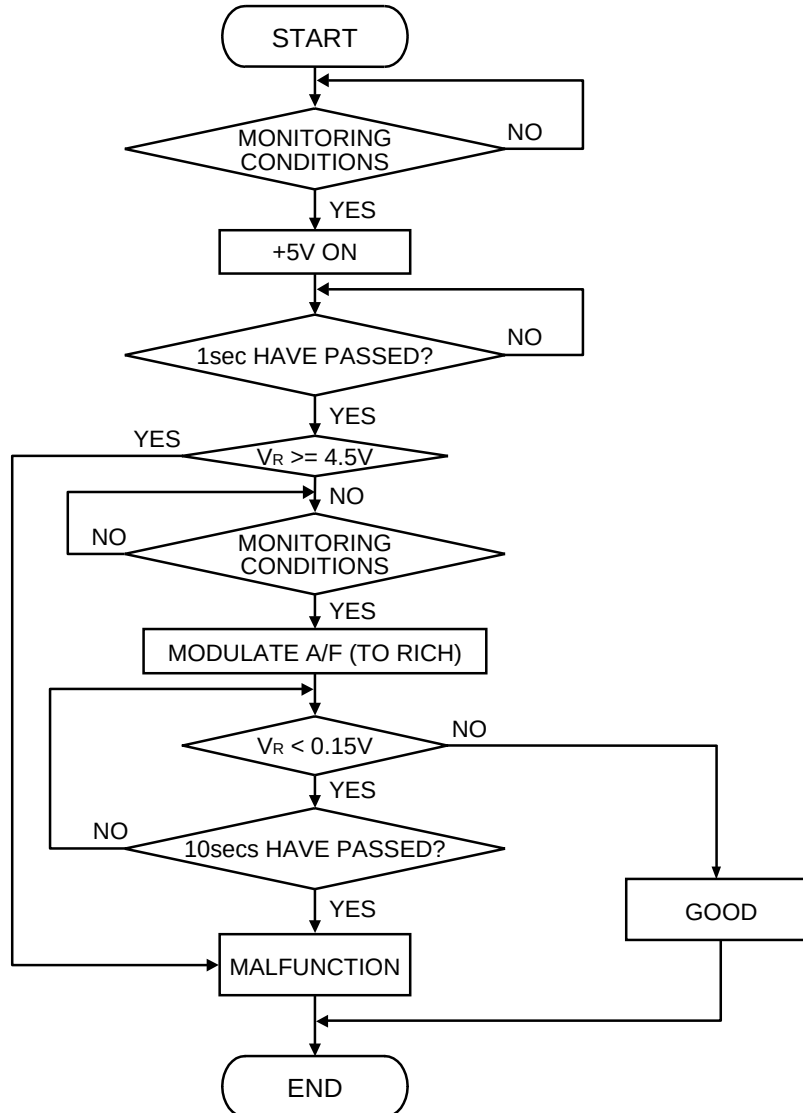
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302304

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (front) signal voltage has continued to be 0.2 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.

- Monitoring time: 7 seconds.

Judgment Criteria

- Input voltage supplied to the ECM <M/T> or PCM <A/T> interface circuit is higher than 4.5 volts when 5 volts is applied to the heated oxygen sensor (front) output line via a resistor.
- The ECM <M/T> or PCM <A/T> monitors for this condition once during the drive cycle.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (front) deteriorated.

- Open circuit in heated oxygen sensor (front) output line.
- Open circuit in heated oxygen sensor (front) ground line.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MD998464: Test Harness

STEP 1. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor (front).**⚠ CAUTION**

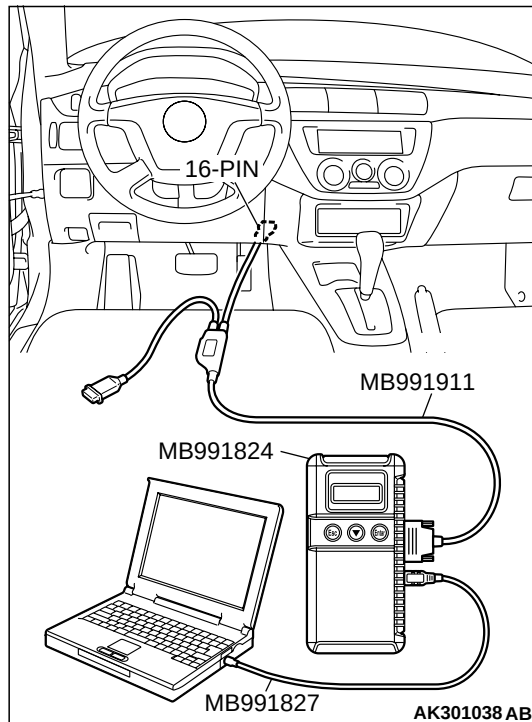
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

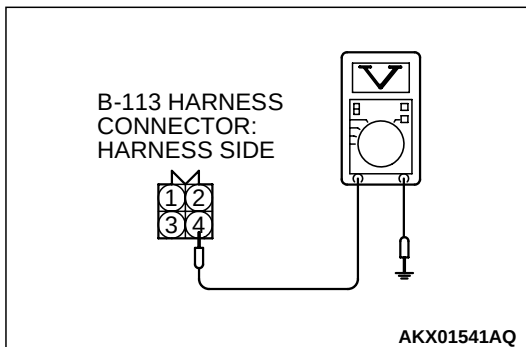
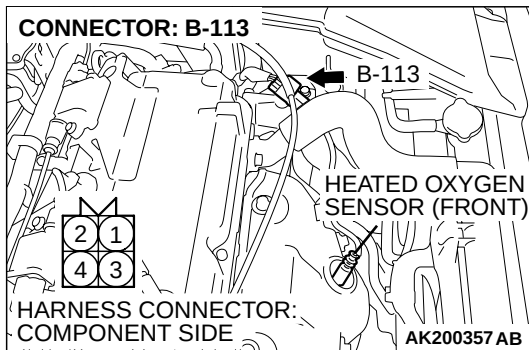
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
 - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
 - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.





STEP 2. Measure the sensor output voltage at heated oxygen sensor (front) connector B-113 by backprobing.

- (1) Do not disconnect connector B-113.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 4 and ground by backprobing.

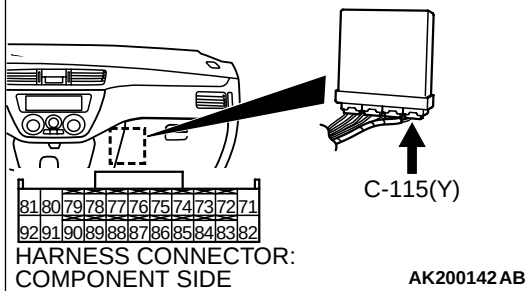
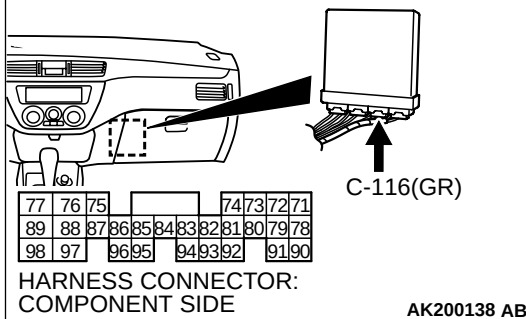
- Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

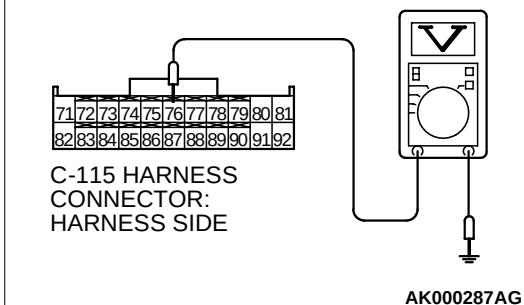
Q: Is the measured voltage within the specified range?

YES : Go to Step 3.

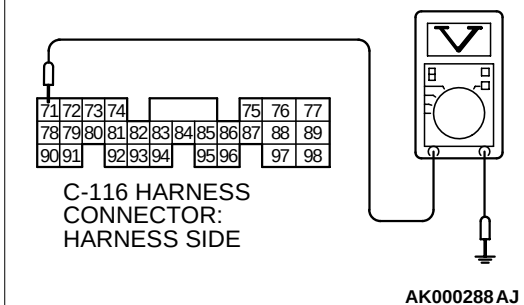
NO : Go to Step 7.

CONNECTOR: C-115 <M/T>**CONNECTOR: C-116 <A/T>**

<M/T>



<A/T>



STEP 3. Measure the sensor output voltage at ECM connector C-115 <M/T> or PCM connector C-116 <A/T> by backprobing.

- (1) Do not disconnect connector C-115 <M/T> or C-116 <A/T>.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 76 <M/T> or No. 71 <A/T> and ground by backprobing.
 - Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 to 0.8 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

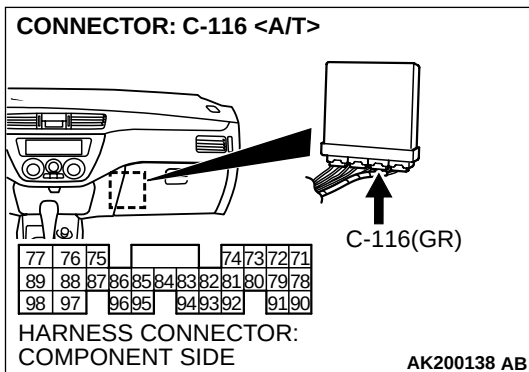
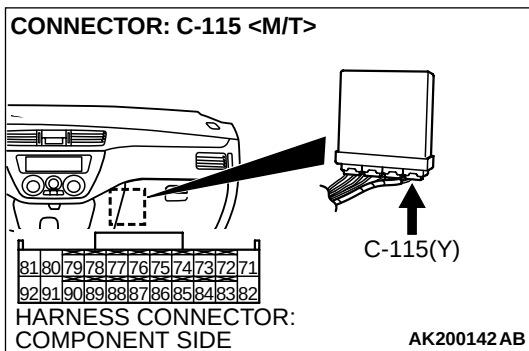
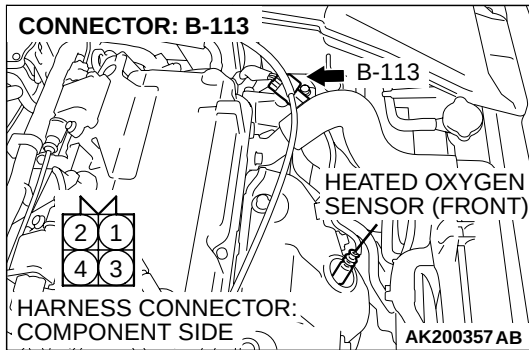
YES : Go to Step 4.

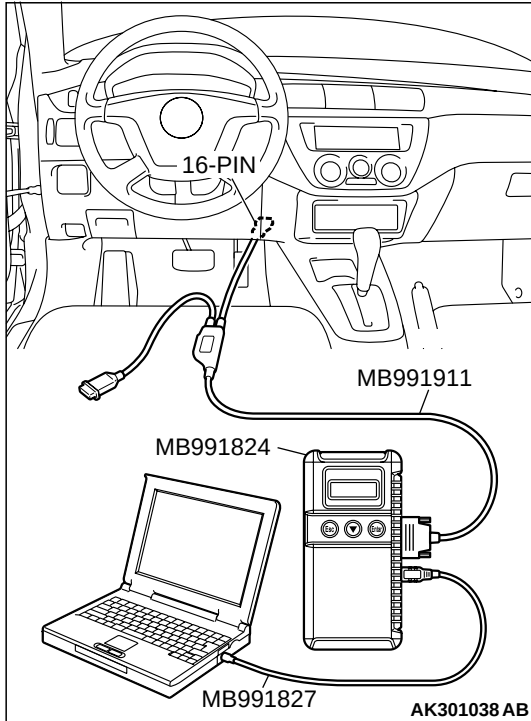
NO : Go to Step 6.

STEP 4. Check harness connector B-113 at heated oxygen sensor (front) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 15.





STEP 5. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor (front).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
 - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
 - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

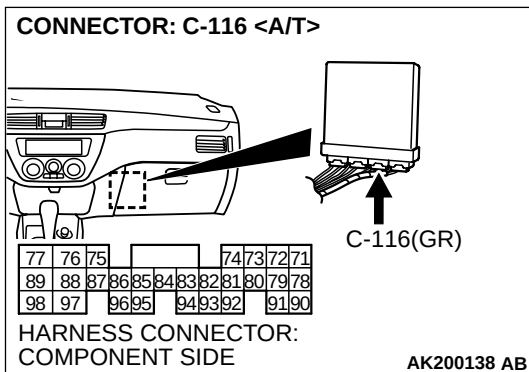
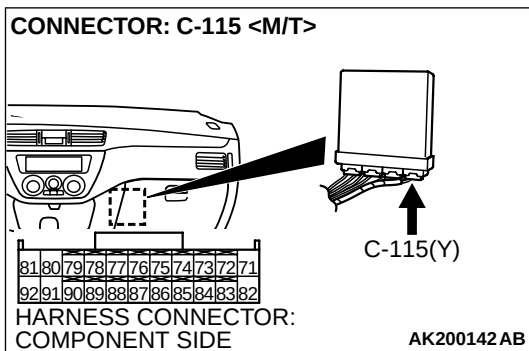
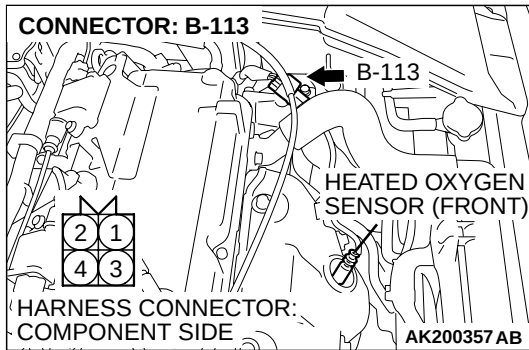
Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Replace the ECM or PCM. Then go to Step 15.

STEP 6. Check harness connector B-113 at heated oxygen sensor (front) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

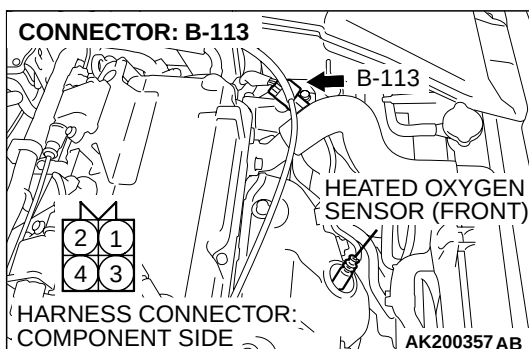
- YES :** Repair harness wire between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76) <M/T> or PCM connector C-116 (terminal No. 71) <A/T> because of open circuit or harness damage. Then go to Step 15.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 15.

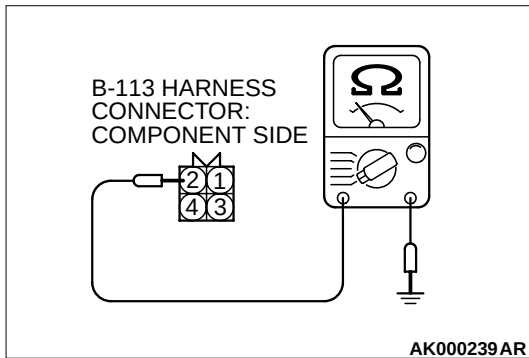
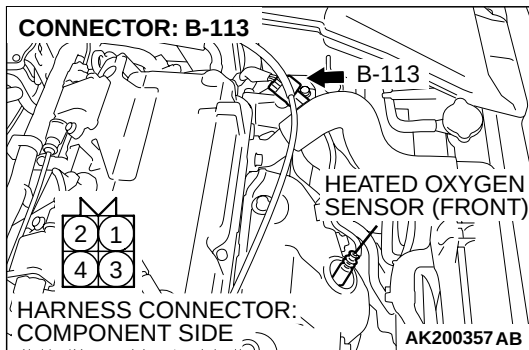


STEP 7. Check harness connector B-113 at heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

- YES :** Go to Step 8.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 15.





STEP 8. Check for continuity at heated oxygen sensor (front) harness side connector B-113.

(1) Disconnect connector B-113 and measure at the harness side.

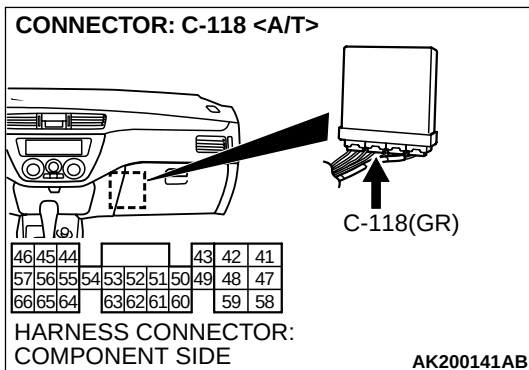
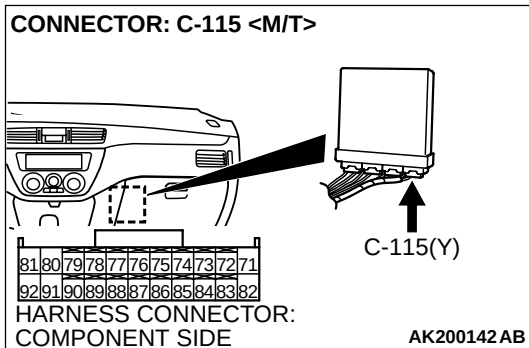
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.



STEP 9. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

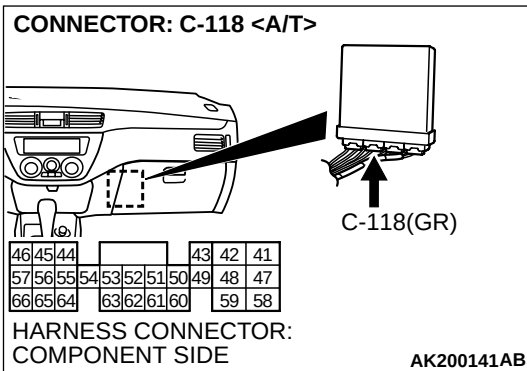
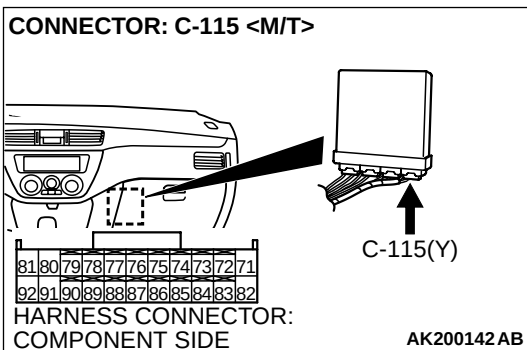
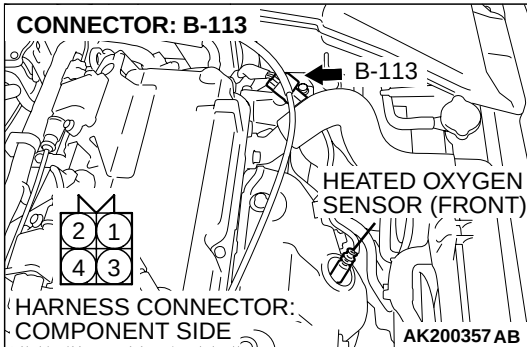
YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 15.

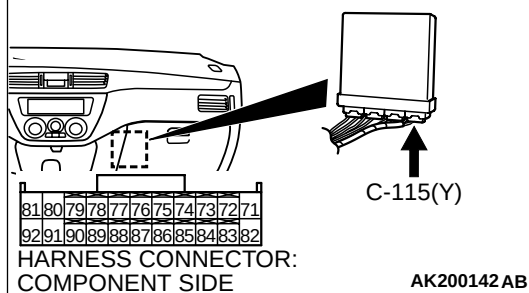
STEP 10. Check for open circuit and harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 2) and ECM connector C-115 (terminal No. 92) <M/T> or PCM connector C-118 (terminal No. 57) <A/T>.
Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 15.

NO : Repair it. Then go to Step 15.



CONNECTOR: C-115 <M/T>



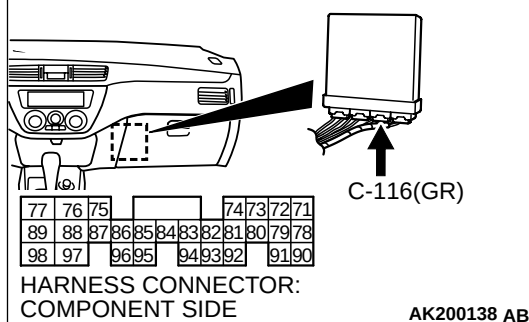
STEP 11. Check harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 15.

CONNECTOR: C-116 <A/T>

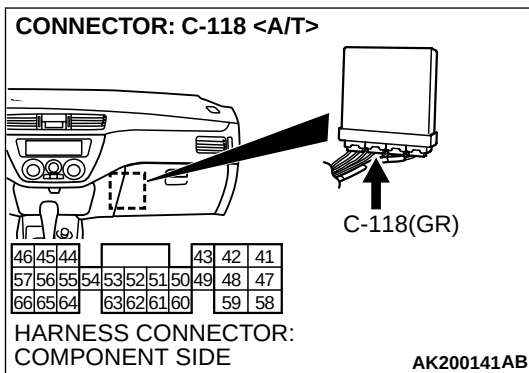
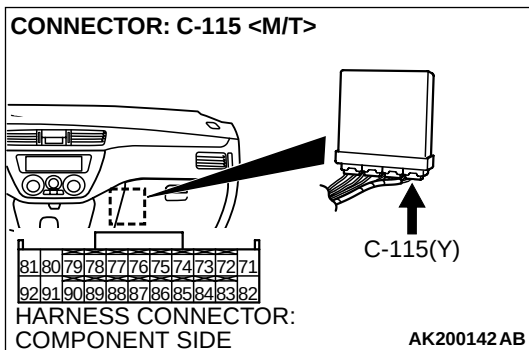
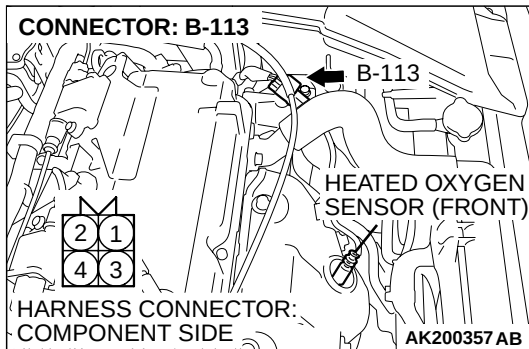


STEP 12. Check for harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 2) and ECM connector C-115 (terminal No. 92) <M/T> or PCM connector C-118 (terminal No. 57) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 15.

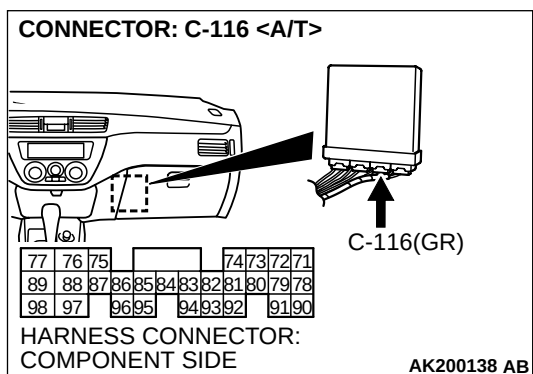
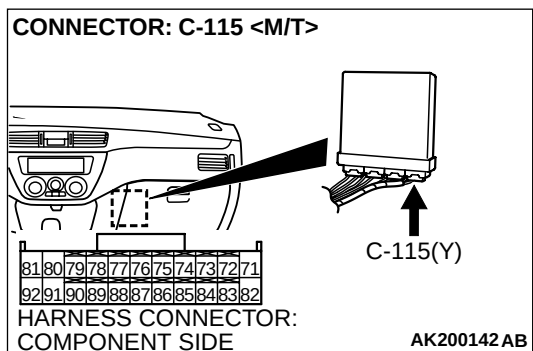
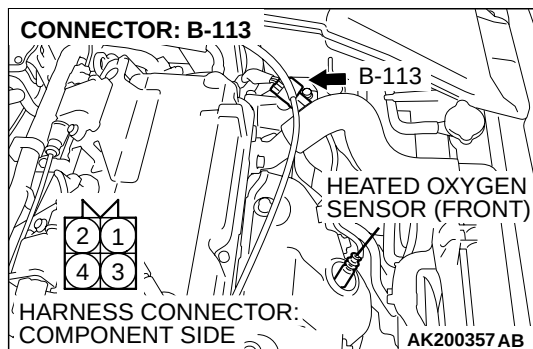


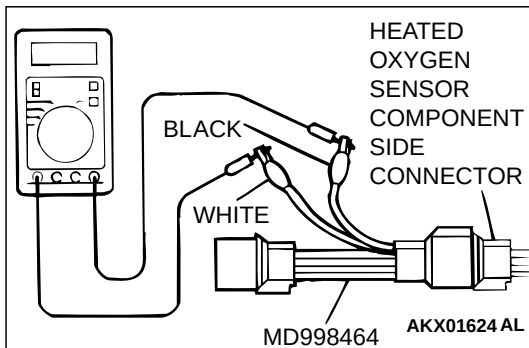
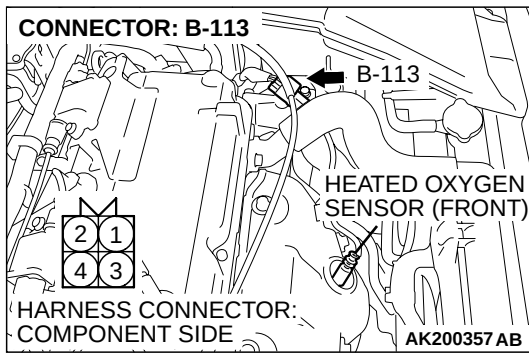
STEP 13. Check for short circuit to ground and harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76) <M/T> or PCM connector C-116 (terminal No. 71) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 14.

NO : Repair it. Then go to Step 15.





STEP 14. Check the heated oxygen sensor (front).

- (1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor (front) heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (front) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (red clip) and the terminal No.3 (blue clip) of the heated oxygen sensor (front) with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the measured voltage between 0.6 and 1.0 volt?

YES : Replace the ECM or PCM. Then go to Step 15.

NO : Replace the heated oxygen sensor (front). Then go to Step 15.

STEP 15. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

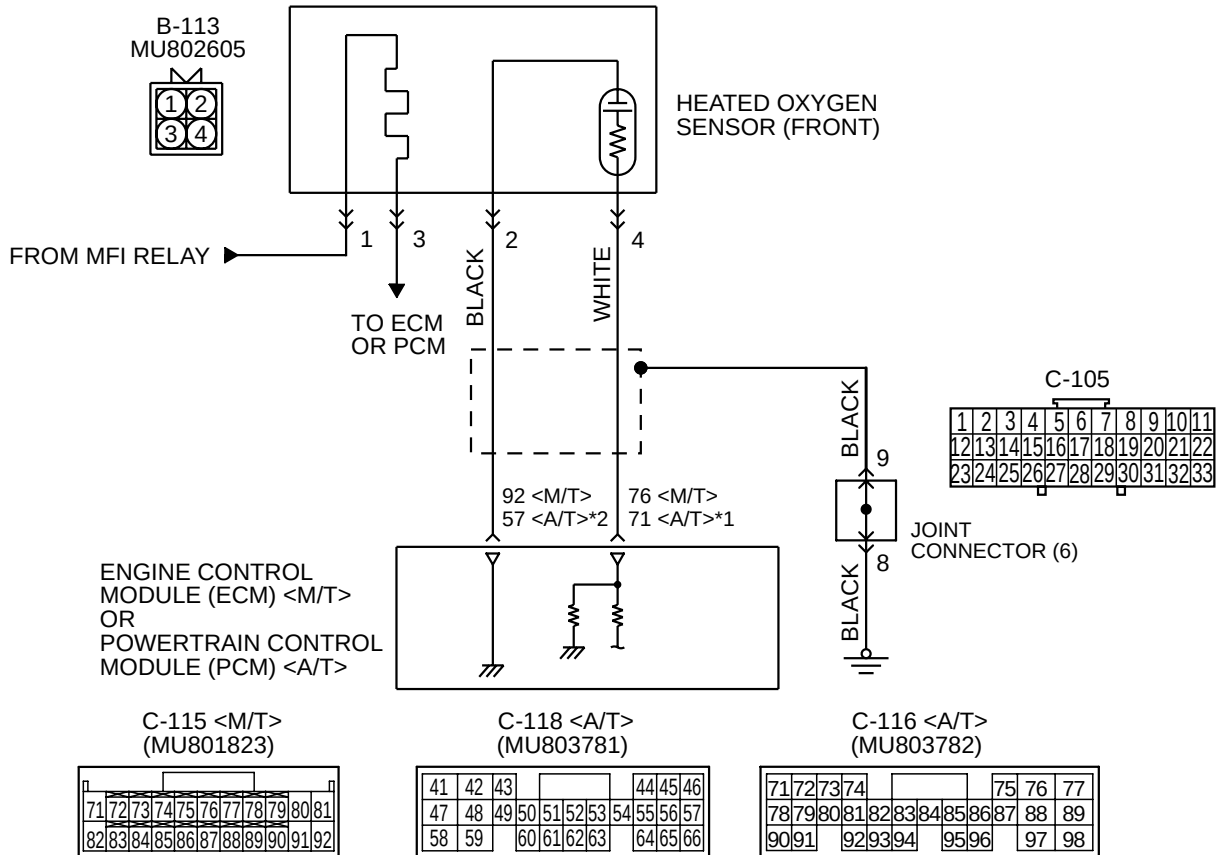
Q: Is DTC P0130 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0131: Heated Oxygen Sensor Circuit Low Voltage (sensor 1)

Heated Oxygen Sensor (front) Circuit

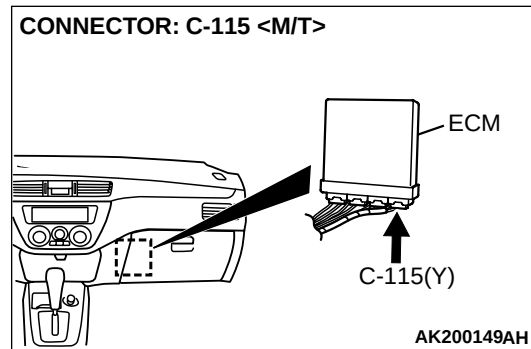
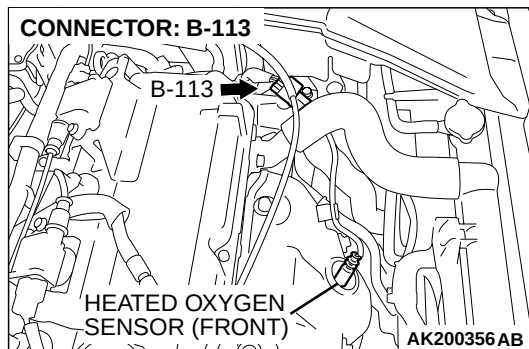


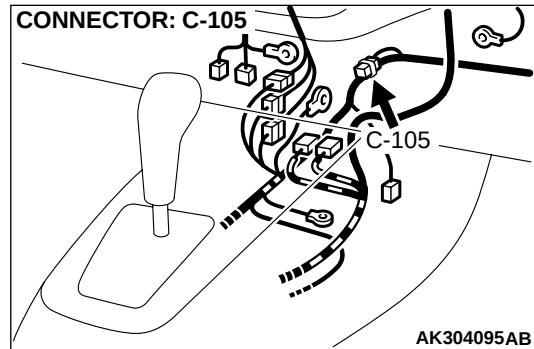
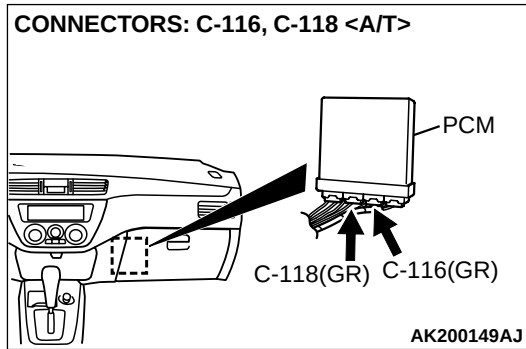
NOTE

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

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CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) <M/T> or PCM (terminal No. 71) <A/T> from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM <M/T> or PCM <A/T>.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM <M/T> or PCM <A/T> forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM <M/T> or PCM <A/T> also checks for an open circuit in the heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

- When the output of the heated oxygen sensor (front) is low, the air-fuel ratio is forcefully made richer. And this time, also the output of the heated oxygen sensor (front) is monitored. If the output is lower than the standard value, a short circuit (short circuit to ground) is determined to have occurred.

MONITOR EXECUTION

- Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

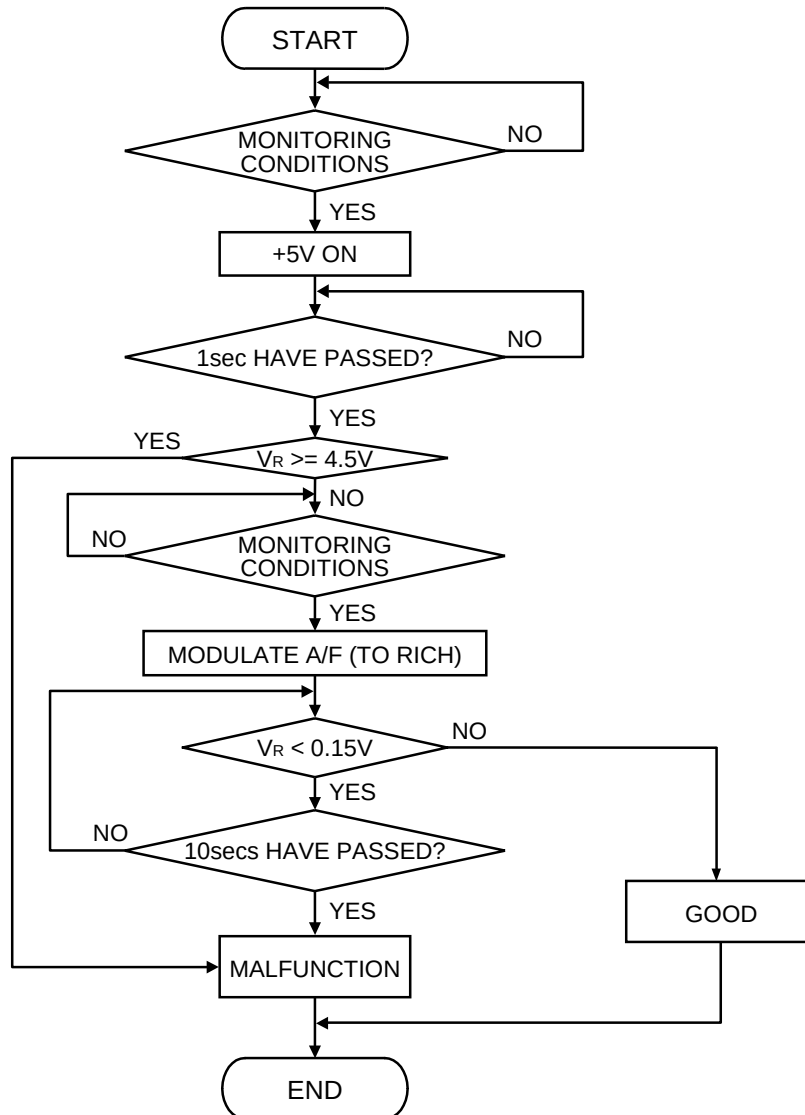
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302305

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (front) signal voltage has continued to be 0.2 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Volume airflow sensor output frequency is 81 Hz or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- After the ignition switch is turned ON, the changes in the output voltage of the heated oxygen sensor (front) is lower than 0.078 volt.
- Monitoring time: 10 seconds.

Judgement Criteria

- Making the air/fuel ratio 15 percent for 10 seconds richer does not result in raising the heated oxygen sensor (front) output voltage beyond 0.2 volt.
- The ECM<M/T> or PCM<A/T> monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (front) deteriorated.
- Short circuit in heated oxygen sensor (front) output line.
- ECM failed. <M/T>
- PCM failed. <A/T>

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Procedure 6 – Other Monitor [P.13A-6](#).

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MD998464: Test Harness

STEP 1. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor (front).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
 - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
 - Warm up the engine. When the engine is idling, the output voltage should repeat 0.4 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

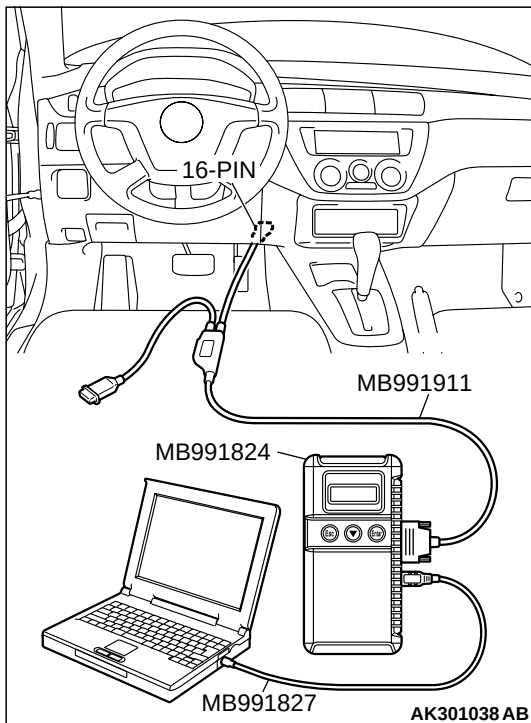
Q: Is the sensor operating properly?

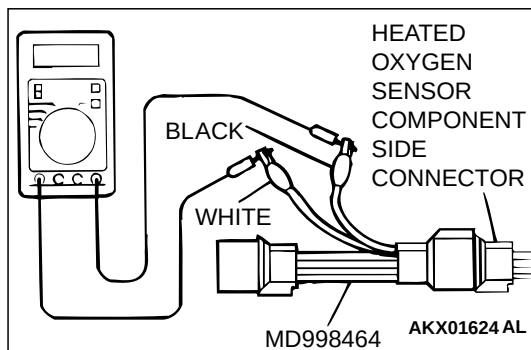
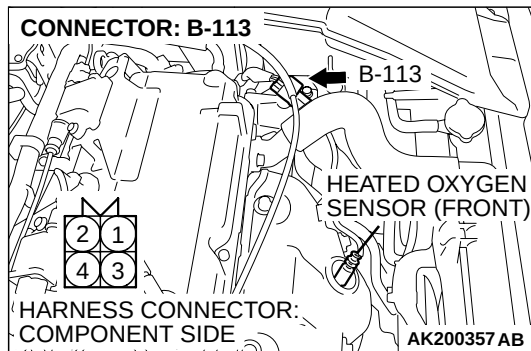
YES : It can be assumed that this malfunction is intermittent.

Refer to GROUP 00, How to Use

Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.



**STEP 2. Check the heated oxygen sensor (front).**

- (1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor (front) heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (front) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (red clip) and the terminal No.3 (blue clip) of the heated oxygen sensor (front) with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the measured voltage between 0.6 and 1.0 volt?

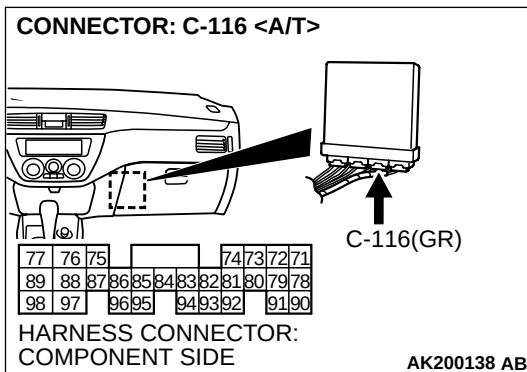
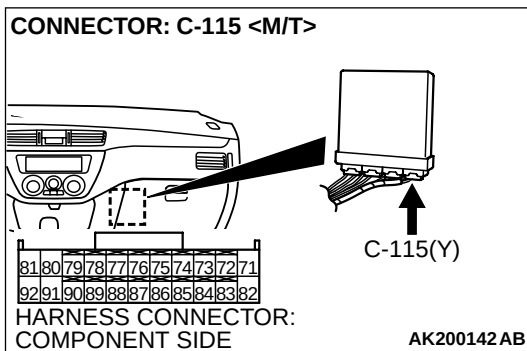
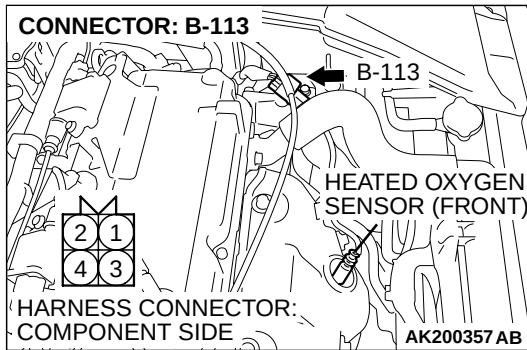
YES : Go to Step 3.

NO : Replace the heated oxygen sensor (front). Then go to Step 5.

STEP 3. Check harness connector B-113 at heated oxygen sensor (front) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

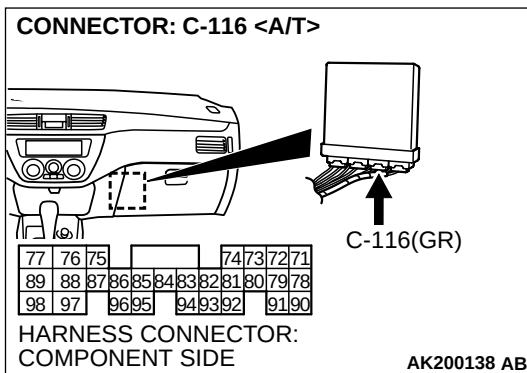
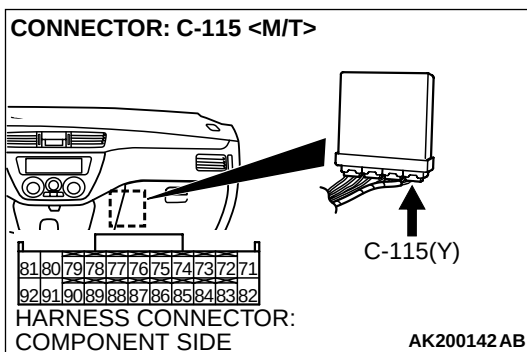
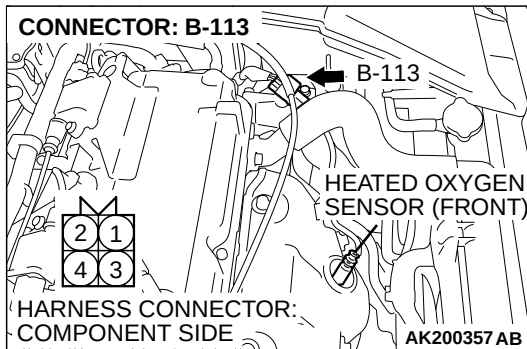


STEP 4. Check for short circuit to ground between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76) <M/T> or PCM connector C-116 (terminal No. 71) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 5.

NO : Repair it. Then go to Step 5.



STEP 5. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

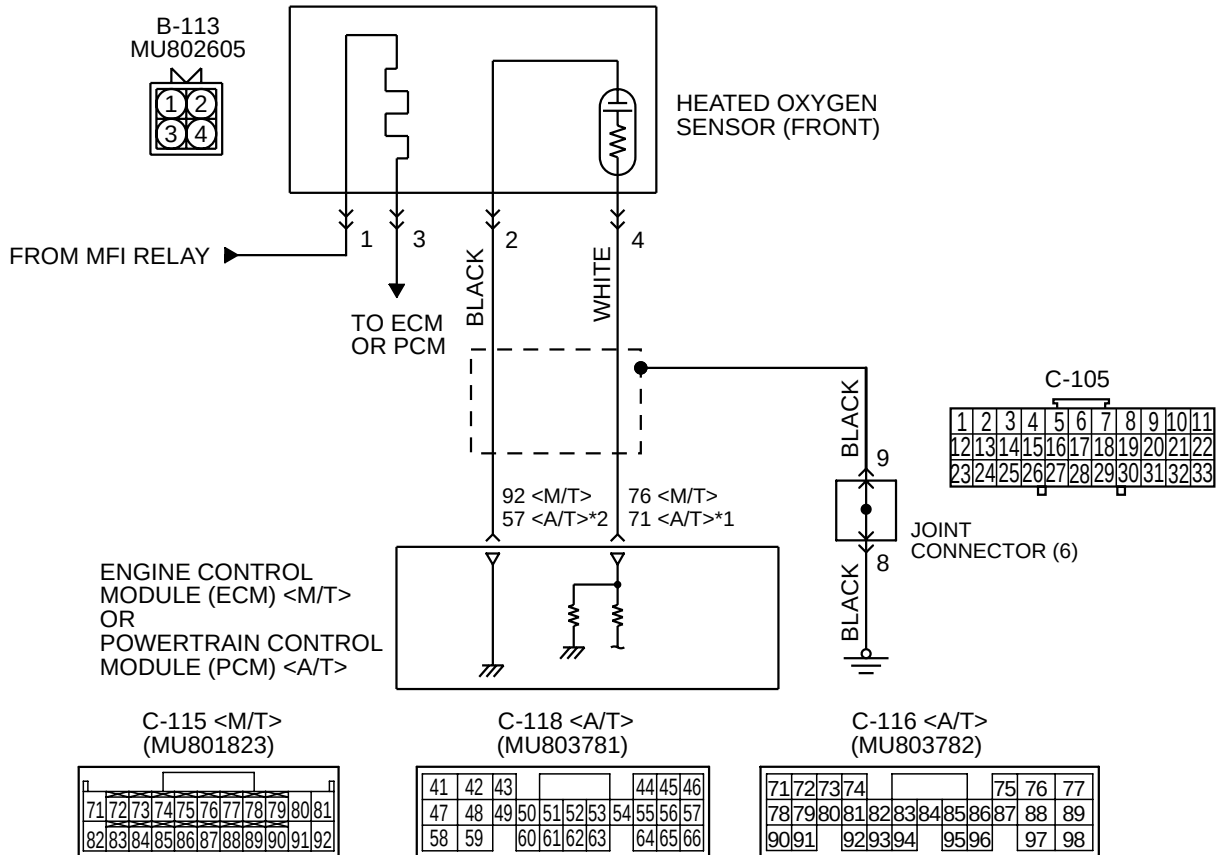
Q: Is DTC P0131 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0132: Heated Oxygen Sensor Circuit High Voltage (sensor 1)

Heated Oxygen Sensor (front) Circuit

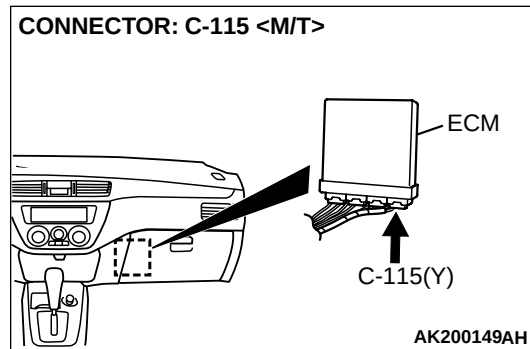
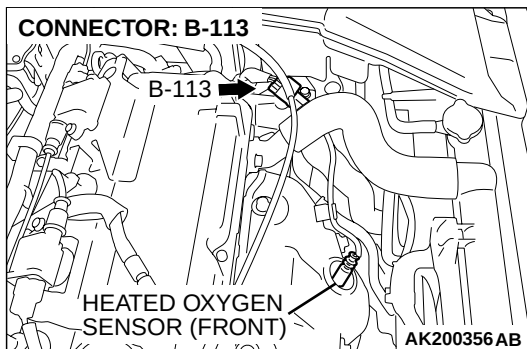


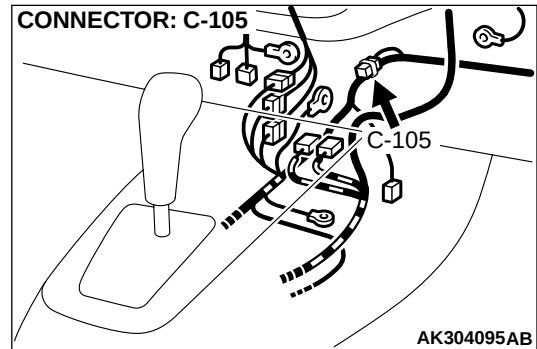
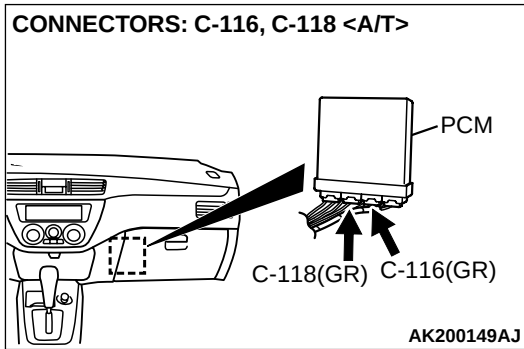
NOTE

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

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CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) <M/T> or PCM (terminal No. 71) <A/T> from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM <M/T> or PCM <A/T>.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM <M/T> or PCM <A/T> forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM <M/T> or PCM <A/T> also checks for an open circuit in the heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

- If the heated oxygen sensor (front) output is higher than the standard value while monitoring the heated oxygen sensor (front) output, a short circuit (short circuit to power supply) is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

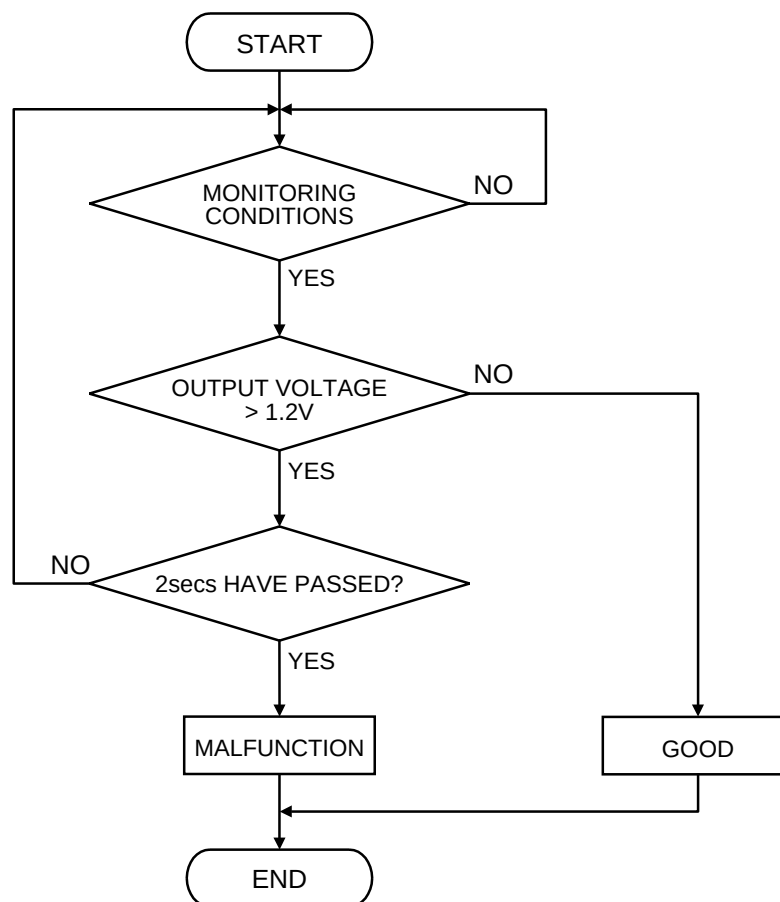
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302306

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgment Criteria

- Heated oxygen sensor (front) output voltage has continued to be 1.2 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (front) deteriorated.
- Short circuit in heated oxygen sensor (front) output line.
- ECM failed. <M/T>
- PCM failed. <A/T>

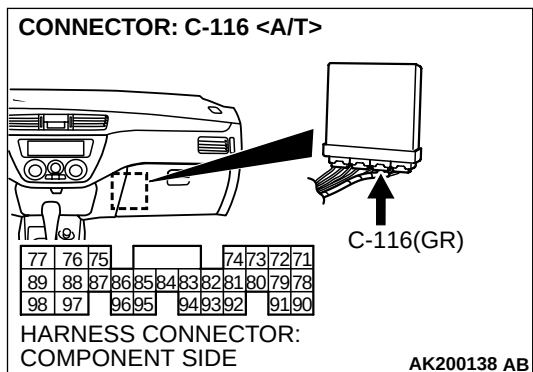
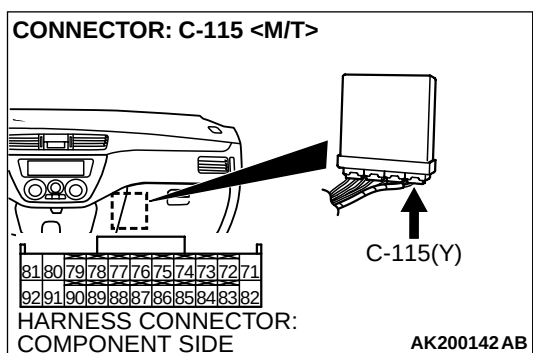
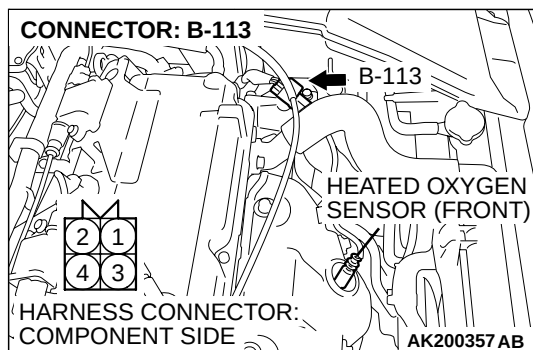
DIAGNOSIS

STEP 1. Check harness connector B-113 at heated oxygen sensor (front) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.

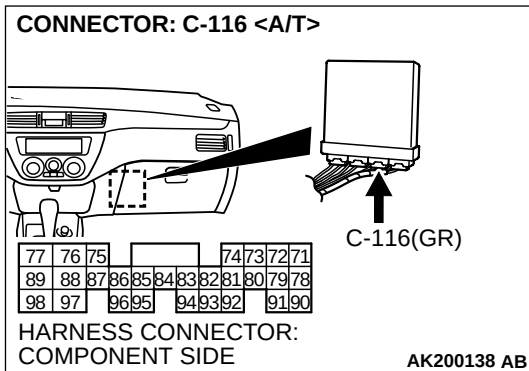
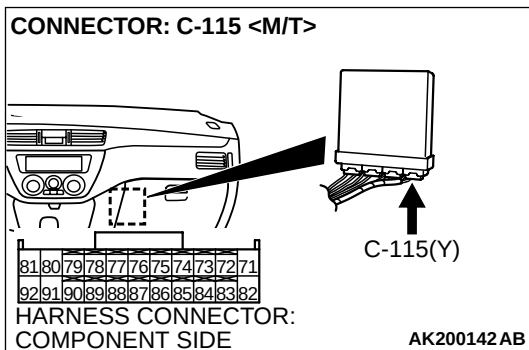
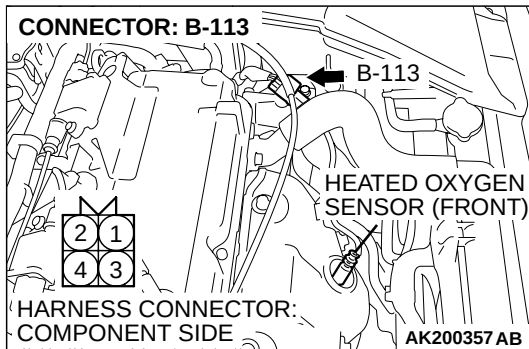


STEP 2. Check for short circuit to power supply between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76) <M/T> or PCM connector C-116 (terminal No. 71) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 3.

NO : Repair it. Then go to Step 3.



STEP 3. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

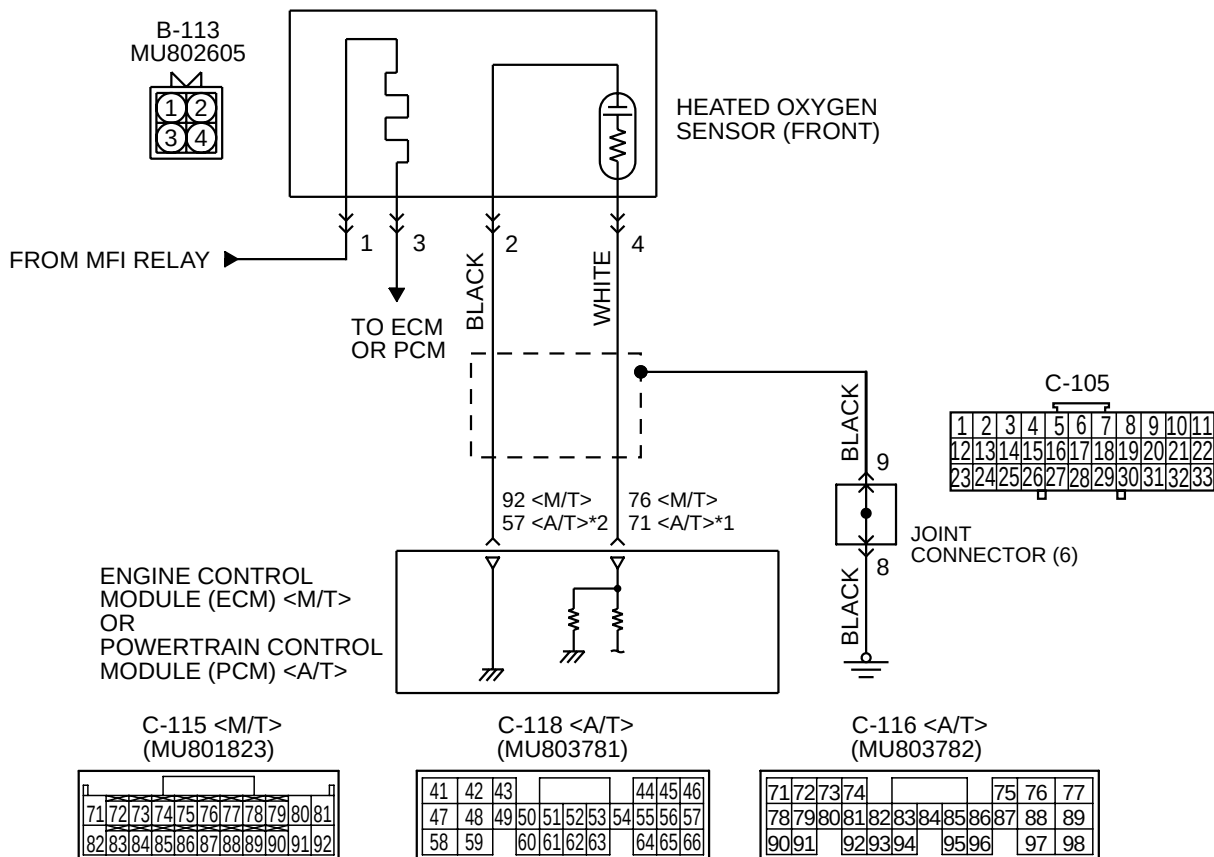
Q: Is DTC P0132 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0133: Heated Oxygen Sensor Circuit Slow Response (sensor 1)

Heated Oxygen Sensor (front) Circuit

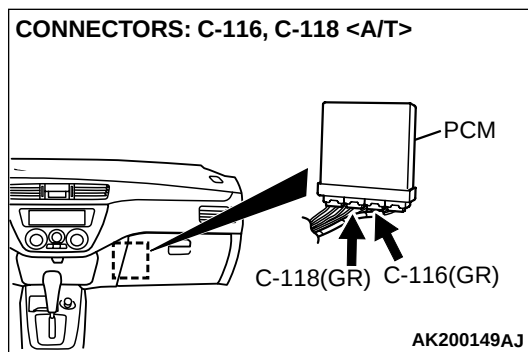
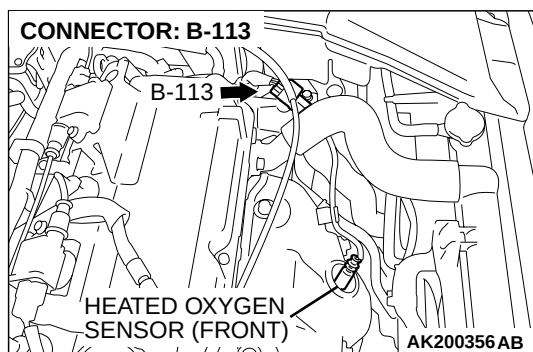


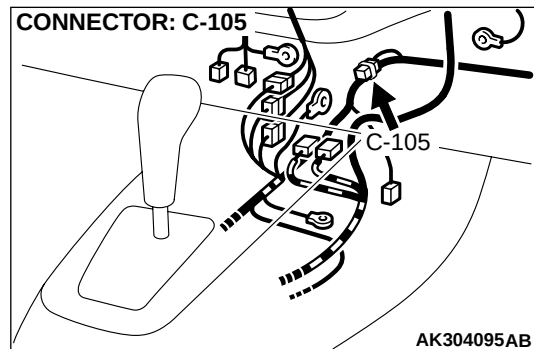
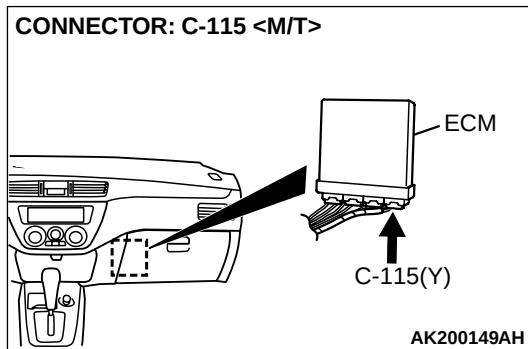
NOTE

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

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CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 76) <M/T> or PCM (terminal No. 71) <A/T> from the output terminal (terminal No. 4) of the heated oxygen sensor (front).
- Terminal No. 2 of the heated oxygen sensor (front) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The heated oxygen sensor (front) detects the concentration of oxygen in the exhaust gas; it converts those data to voltage, and inputs the resulting signals to the ECM <M/T> or PCM <A/T>.
- When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor signal response becomes poor.
- The ECM <M/T> or PCM <A/T> forcibly varies the air/fuel mixture to make it leaner and richer, and checks the response speed of the heated oxygen sensor (front). In addition, the ECM <M/T> or PCM <A/T> also checks for an open circuit in the heated oxygen sensor (front) output line.

DESCRIPTIONS OF MONITOR METHODS

- If the inversion frequency is low while monitoring the lean/rich inversion frequency of the heated oxygen sensor (front), the heated oxygen sensor (front) is determined to have deteriorated.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

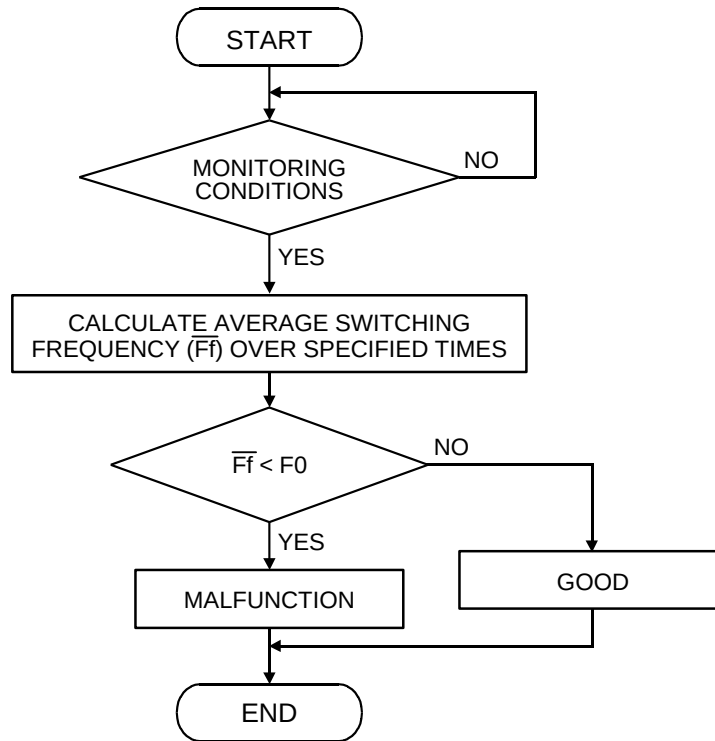
- Heated oxygen sensor (front) heater monitor
- Misfire monitor
- Fuel system monitor

Sensor (The sensor below is determined to be normal)

- Manifold absolute pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



F0: THRESHOLD VALUE FOR AVERAGE SWITCHING FREQUENCY

AK302307

Check Conditions

- Engine coolant temperature is higher than 50°C (122°F).
- Engine speed is at between 1,200 and 3,000 r/min.
- Volumetric efficiency is at between 20 and 60 percent.
- Under the closed loop air/fuel control.
- Short-term fuel trim is at between -25 percent and +25 percent.
- The throttle valve is open.
- More than 2 seconds have elapsed after the above mentioned conditions have been met.
- The ECM <M/T> or PCM <A/T> monitors for this condition for 5 cycles of 10 seconds each during the drive cycle.

Judgment Criteria

- The heated oxygen sensor (front) sends "lean" and "rich" signals alternately 10 times or less for 10 seconds.

NOTE: If the sensor switching frequency is lower than the Judgment Criteria due to the MUT-III OBD-II test Mode – H02S Test Results, it is assumed that the heated oxygen sensor has deteriorated. If it is higher, it is assumed that the harness is damaged or has a short circuit.

If the heated oxygen sensor signal voltage has not changed even once (lean/rich) after the DTC was erased, the sensor switch time will display as 0 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (front) deteriorated.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor (front).

⚠ CAUTION

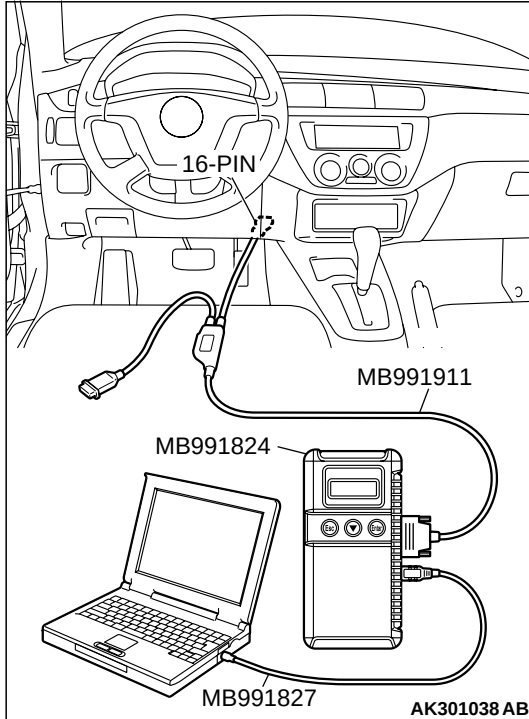
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool or MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
- (4) Warm up the engine, 2,500 r/min.
 - Output voltage repeats 0.4 volt or less and 0.6 – 1.0 volt 10 times or more within 10 seconds.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Replace the heated oxygen sensor (front). Then go to Step 2.



STEP 2. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0133 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0134: Heated Oxygen Sensor Circuit No Activity Detected (sensor 1)

**Heated Oxygen Sensor Circuit No Activity
Detected (sensor 1) Circuit**

- Refer to, DTC P0130 Heated Oxygen Sensor (front) Circuit [P.13A-201](#).
- Refer to, DTC P0201, P0202, P0203, P0204 – Injector Circuit [P.13A-342](#).

CIRCUIT OPERATION

- Refer to, DTC P0130 Heated Oxygen Sensor (front) Circuit [P.13A-201](#).
- Refer to, DTC P0201, P0202, P0203, P0204 – Injector Circuit [P.13A-342](#).

TECHNICAL DESCRIPTION

- The ECM <M/T> or PCM <A/T> effects air/fuel ratio feedback control in accordance with the signals from the heater oxygen sensor (front).
- If the heated oxygen sensor (front) has deteriorated, corrections will be made by the heated oxygen sensor (rear).
- DTC P0134 becomes stored in memory if a failure is detected in the above air/fuel ratio feedback control system.

DESCRIPTIONS OF MONITOR METHODS

- If the heated oxygen sensor (front) output does not cross 0.5 volts while monitoring the heated oxygen sensor (front) output, a malfunction is determined to have occurred.

MONITOR EXECUTION

- Continuous

**MONITOR EXECUTION CONDITIONS (Other
monitor and Sensor)**

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

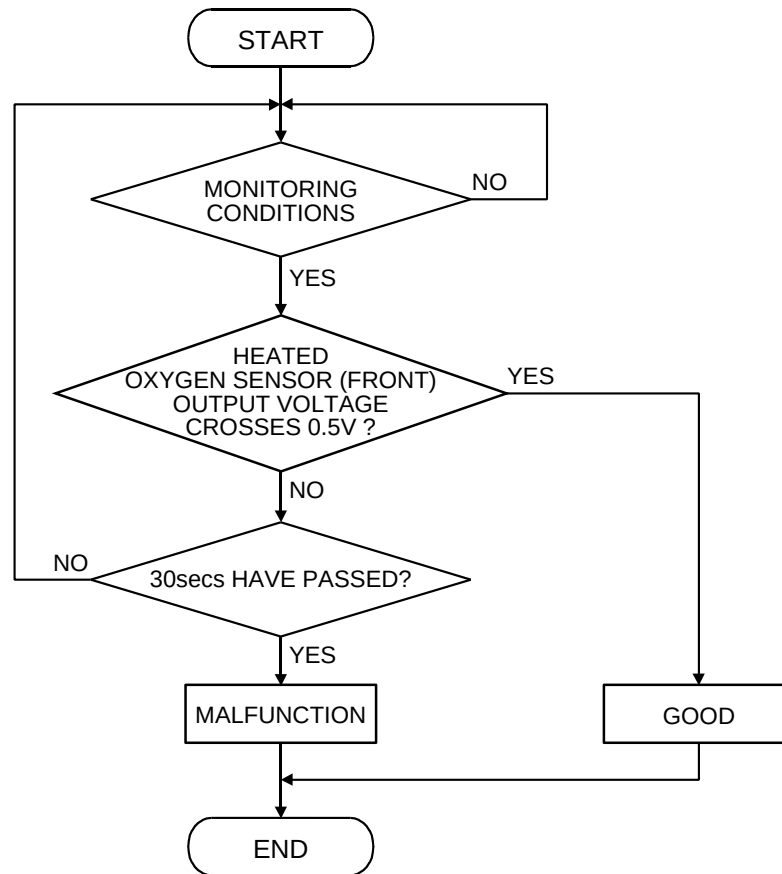
- Misfire monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302308

Check Conditions

- 20 seconds or more have passed since the starting sequence was completed.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is at between 30 and 100 percent.
- Throttle position sensor output voltage is lower than 3.6 volts.

- Except while fuel is being shut off.
- Monitoring time: 30 seconds.

Judgment Criteria

- Heated oxygen sensor (front) output voltage does not get across 0.5 volt within about 30 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (front) deteriorated.
- Open circuit in heated oxygen sensor (front) output line.
- Open circuit in heated oxygen sensor (front) ground line.
- Heated oxygen sensor (rear) deteriorated.

NOTE: When the heated oxygen sensor (front) begins to deteriorate, the heated oxygen sensor output voltage will deviate from the voltage when the sensor was new (normally 0.5 volt at stoichiometric ratio). This deviation will be corrected by the heated oxygen sensor (rear).

If the heated oxygen sensor (rear) responds poorly because it has deteriorated, it will improperly correct the heated oxygen sensor (front). Thus, even when closed loop control is being effected, the fluctuation of the heated oxygen sensor (front) output voltage decreases, without intersecting with 0.5 volt. As a result, there is a possibility of DTC P0134 becoming registered.

- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MD998464: Test Harness

STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).**⚠ CAUTION**

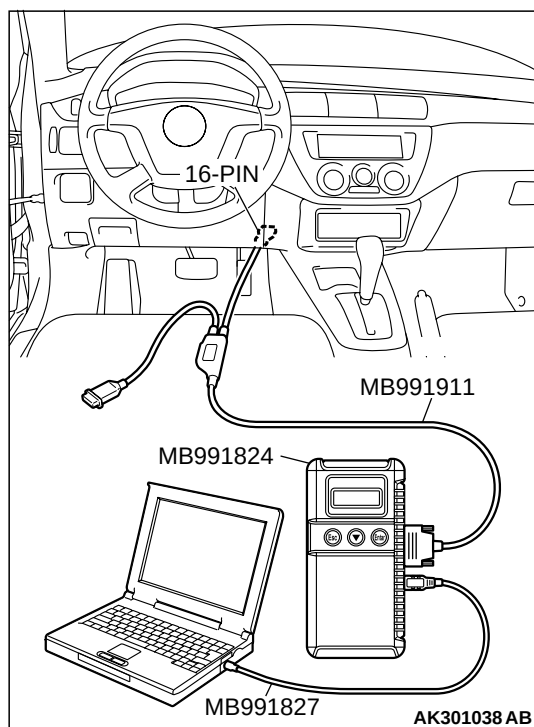
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
 - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.

NO : Refer to, DTC P0136 – Heated Oxygen Sensor Circuit (Sensor 2) [P.13A-252](#), DTC P0137 – Heated Oxygen Sensor Circuit Low Voltage (sensor 2) [P.13A-268](#), DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (sensor 2) [P.13A-275](#), DTC P0139 – Heated Oxygen Sensor Circuit Slow Response (sensor 2) [P.13A-280](#).



STEP 2. Check for exhaust leaks.

Q: Are there any abnormalities?

YES : Repair it. Then go to Step 12.

NO : Go to Step 3.

STEP 3. Check for intake system vacuum leaks.

Q: Are there any abnormalities?

YES : Repair it. Then go to Step 12.

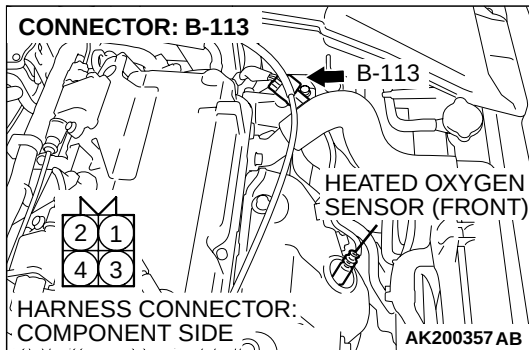
NO : Go to Step 4.

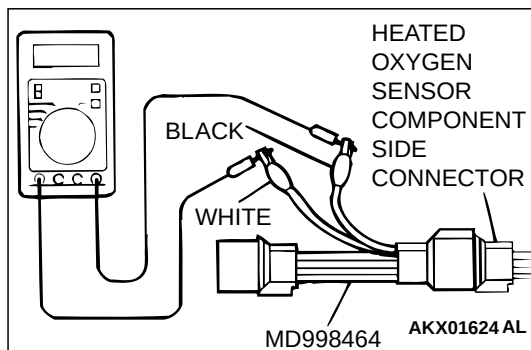
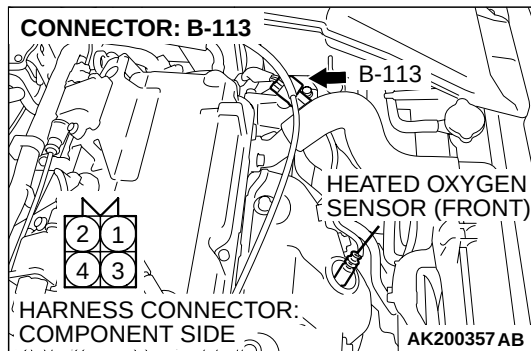
STEP 4. Check harness connector B-113 at the heated oxygen sensor (front) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



**STEP 5. Check the heated oxygen sensor (front).**

- (1) Disconnect the heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464 to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 2 (black clip) and terminal No. 4 (white clip).
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

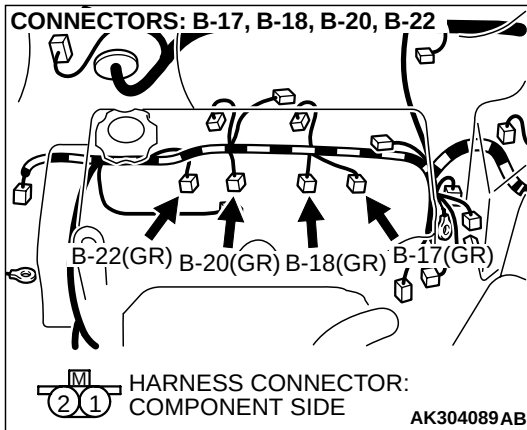
- Be very careful when connecting the jumper wires; incorrect connection can damage the heated oxygen sensor (front).
- Be careful the heater is broken when voltage of beyond 8 volts is applied to the heated oxygen sensor (front) heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (front) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.1 (red clip) and the terminal No.3 (blue clip) of the heated oxygen sensor (front) with the positive terminal and the negative terminal of 8 volts power supply respectively, then check again.

Q: Is the measured voltage between 0.6 and 1.0 volt?

YES : Go to Step 6.

NO : Replace the heated oxygen sensor (front). Then go to Step 12.

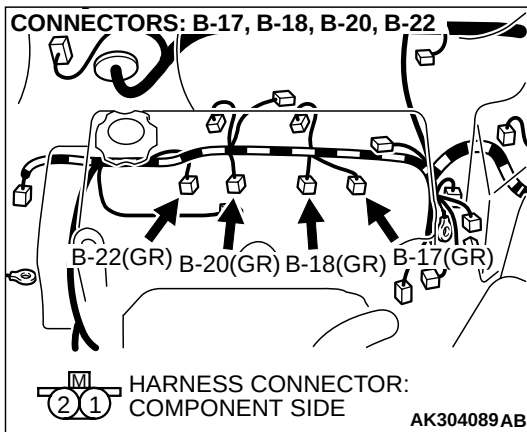


STEP 6. Check harness connectors B-17, B-18, B-20, B-22 at injector for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 7. Check the injector.

(1) Disconnect each injector connector.

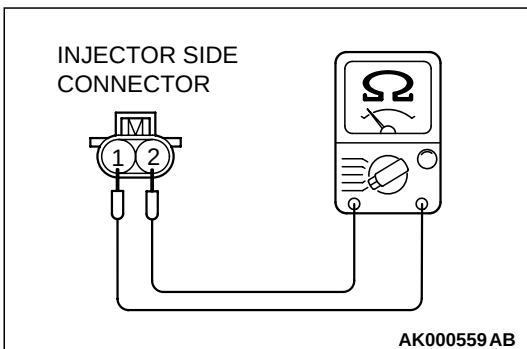
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 8.

NO : Replace the injector. Then go to Step 12.



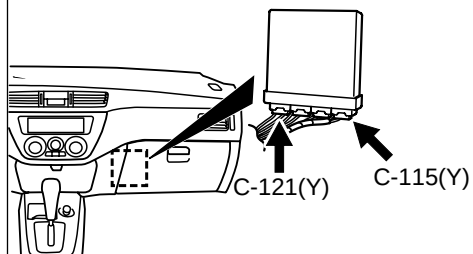
STEP 8. Check harness connectors C-115, C-121 at ECM <M/T> or harness connectors C-116, C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 9.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

CONNECTORS: C-115, C-121 <M/T>



81	80	79	78	77	76	75	74	73	72	71
92	91	90	89	88	87	86	85	84	83	82

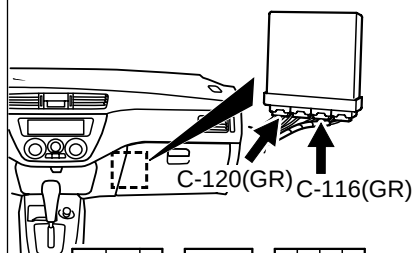
**C-115 HARNESS CONNECTOR:
COMPONENT SIDE**

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

**C-121 HARNESS CONNECTOR:
COMPONENT SIDE**

AK200355AB

CONNECTORS: C-116, C-120 <A/T>



77	76	75					74	73	72	71	
89	88	87	86	85	84	83	82	81	80	79	78
98	97		96	95		94	93	92		91	90

**C-116 HARNESS CONNECTOR:
COMPONENT SIDE**

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

**C-120 HARNESS CONNECTOR:
COMPONENT SIDE**

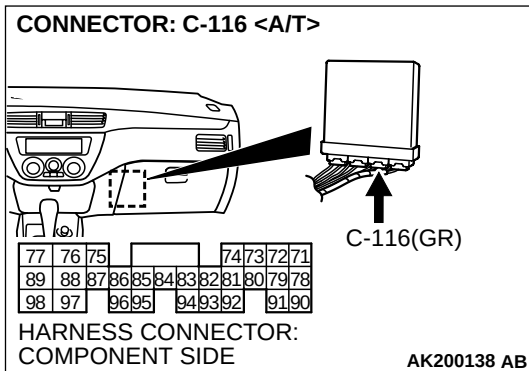
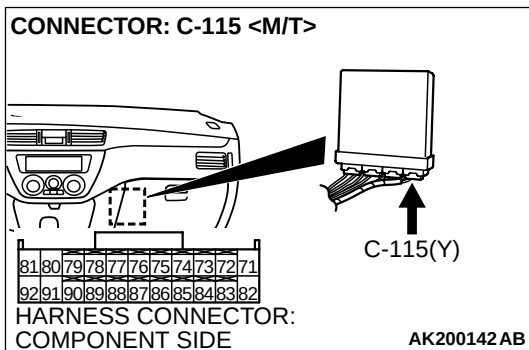
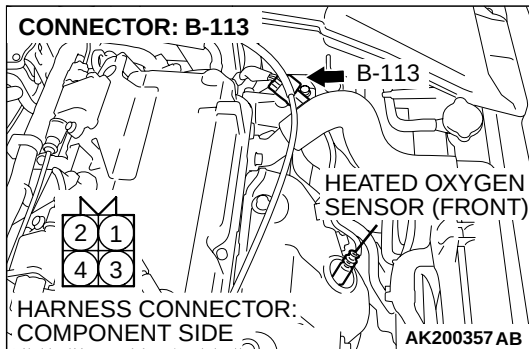
AK200135AB

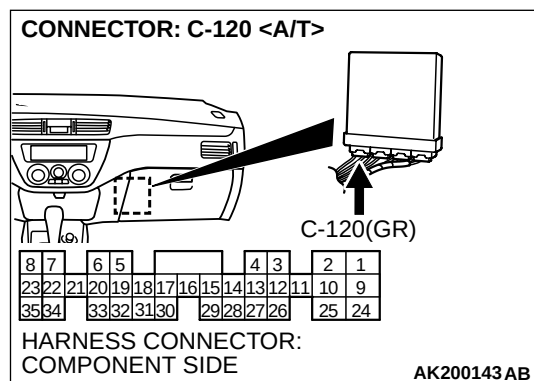
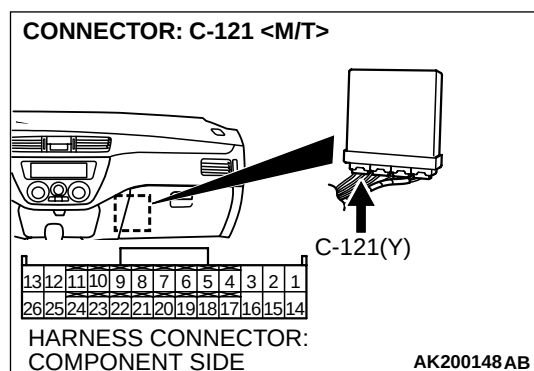
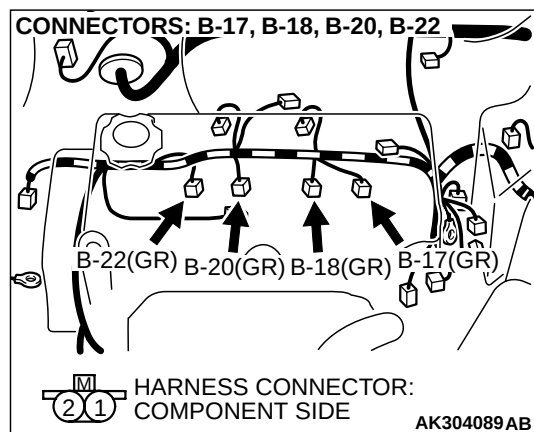
STEP 9. Check for harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 4) and ECM connector C-115 (terminal No. 76) <M/T> or PCM connector C-116 (terminal No. 71) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.





STEP 10. Check for harness damage between injector connectors B-17, B-18, B-20, B-22 and ECM connector C-121 <M/T> or PCM connector C-120 <A/T>.

- Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) <M/T> or PCM connector C-120 (terminal No. 1) <A/T> at No. 1 cylinder.
- Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) <M/T> or PCM connector C-120 (terminal No. 9) <A/T> at No. 2 cylinder.
- Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) <M/T> or PCM connector C-120 (terminal No. 24) <A/T> at No. 3 cylinder.
- Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) <M/T> or PCM connector C-120 (terminal No. 2) <A/T> at No. 4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

STEP 11. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-905](#).

Q: Is the fuel pressure normal?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

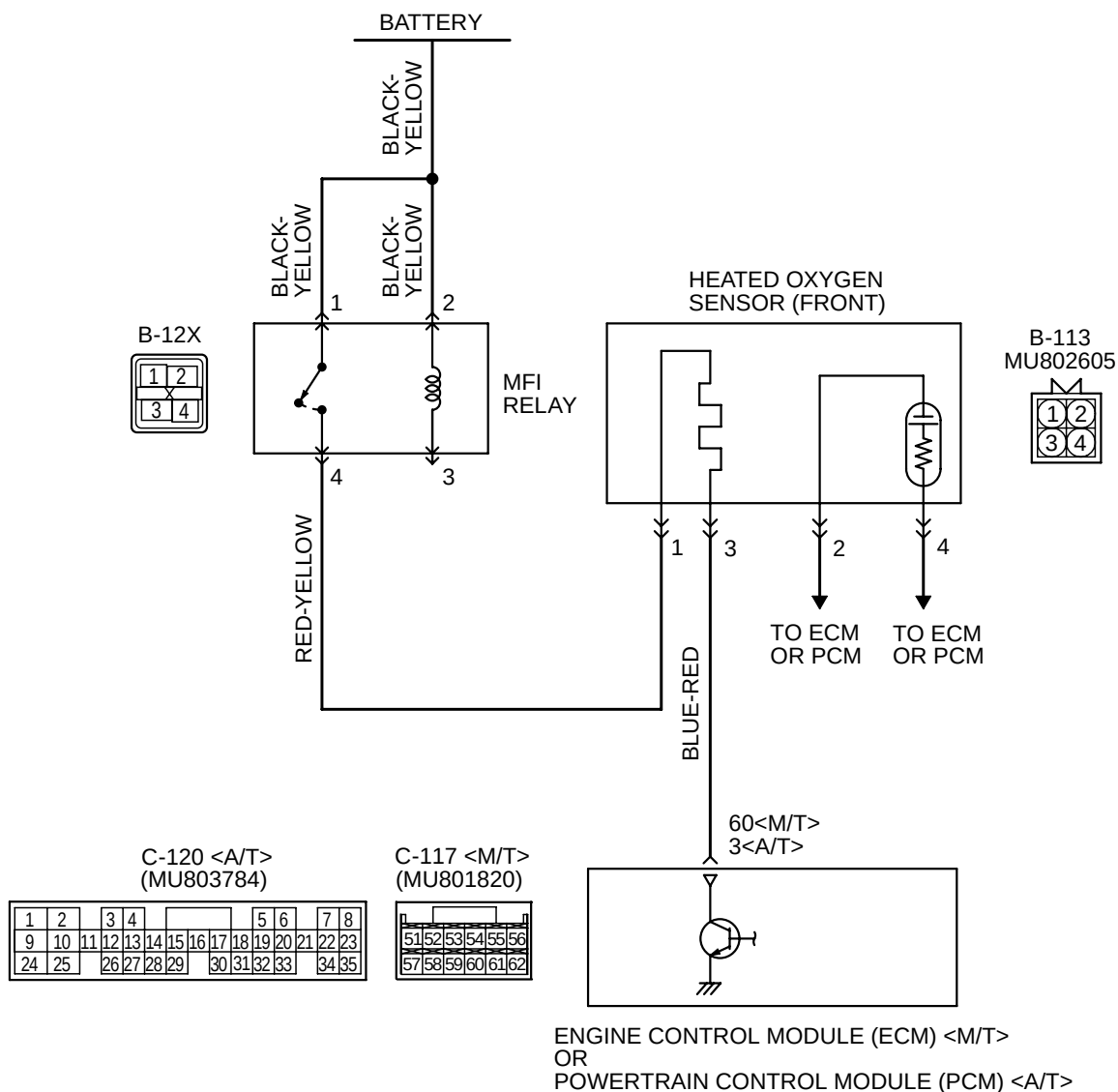
Q: Is DTC P0134 set?

YES : Retry the troubleshooting.

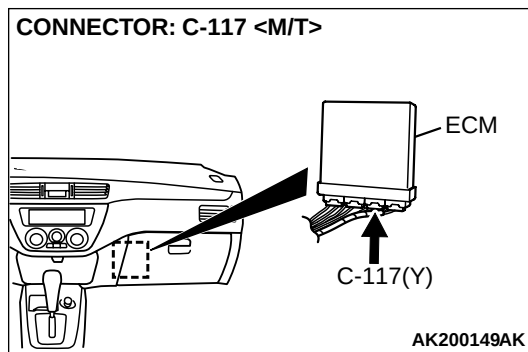
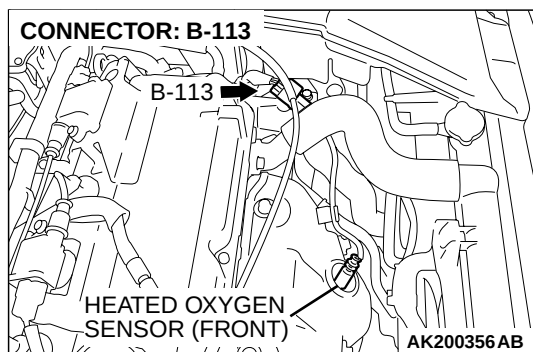
NO : The inspection is complete.

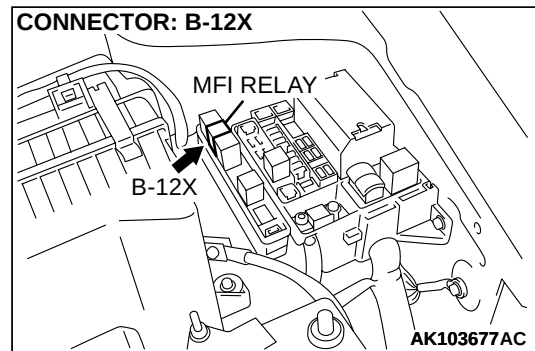
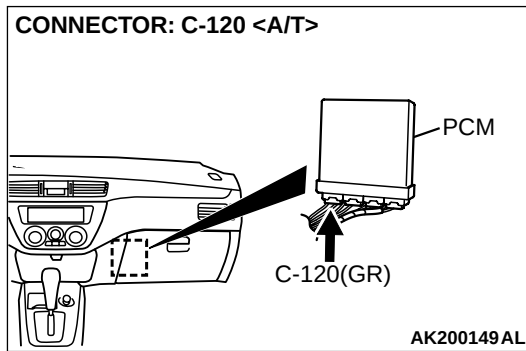
DTC P0135: Heated Oxygen Sensor Heater Circuit (sensor 1)

Heated Oxygen Sensor (front) Heater Circuit



AK000867





CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the heated oxygen sensor (front) heater.
- The ECM (terminal No. 60) <M/T> or PCM (terminal No. 3) <A/T> controls continuity to the heated oxygen sensor (front) heater by turning the power transistor in the ECM <M/T> or PCM <A/T> "ON" and "OFF".

TECHNICAL DESCRIPTION

- The ECM <M/T> or PCM <A/T> checks whether the heater current is within a specified range when the heater is energized.

DESCRIPTIONS OF MONITOR METHODS

- An open or short circuit is detected while monitoring the amperage that flows to the heated oxygen sensor (front) at the engine coolant temperature of 20°C (68°F) or above.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

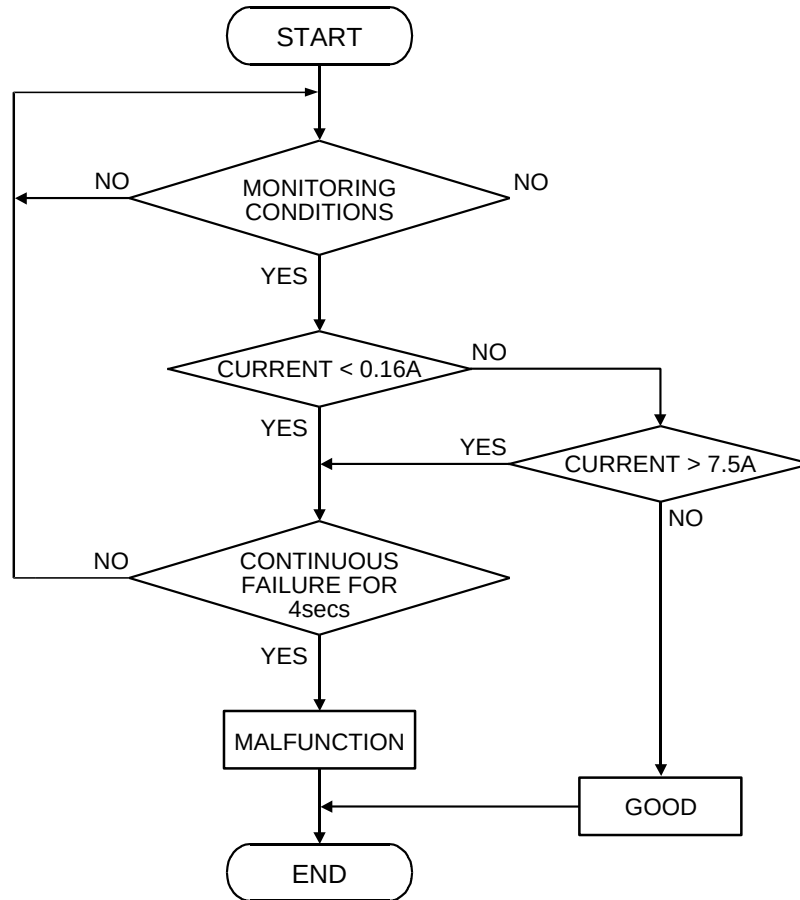
- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302309

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the heated oxygen sensor (front) heater is on.
- Battery positive voltage is at between 11 and 16.5 volts.

Judgment Criteria

- Heater current of the heated oxygen sensor (front) heater has continued to be lower than 0.16 ampere or higher than 7.5 ampere for 4 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted heated oxygen sensor (front) heater circuit.
- Open circuit in heated oxygen sensor (front) heater.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tool:

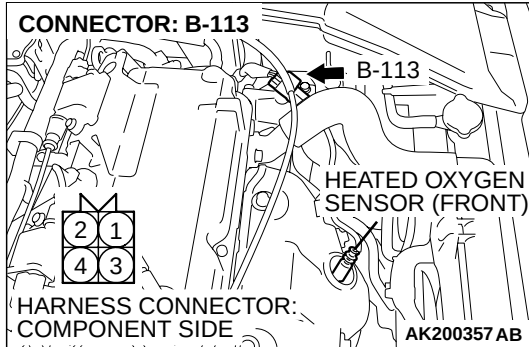
- MD998464: Test Harness

STEP 1. Check connector B-113 at the heated oxygen sensor (front) for damage.

Q: Is the connector in good condition?

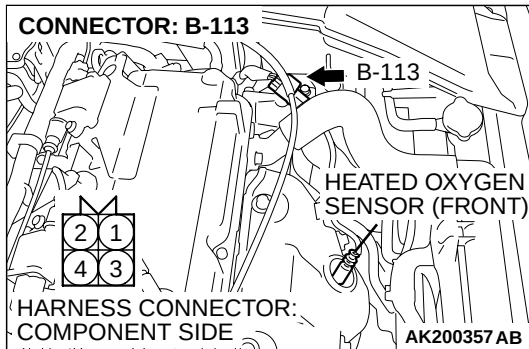
YES : Go to Step 2.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 2. Check the heated oxygen sensor (front).

(1) Disconnect heated oxygen sensor (front) connector B-113 and connect test harness special tool, MD998464, to the connector on the heated oxygen (front) sensor side.



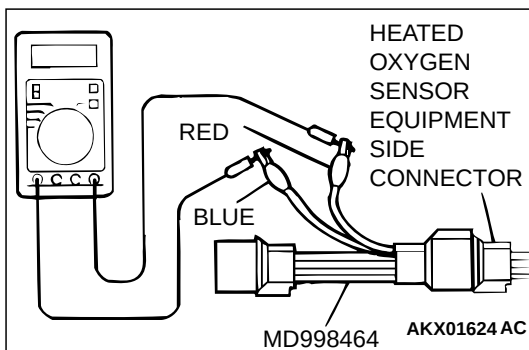
(2) Measure the resistance between heated oxygen sensor connector terminal No. 1 (red clip) and terminal No. 3 (blue clip).

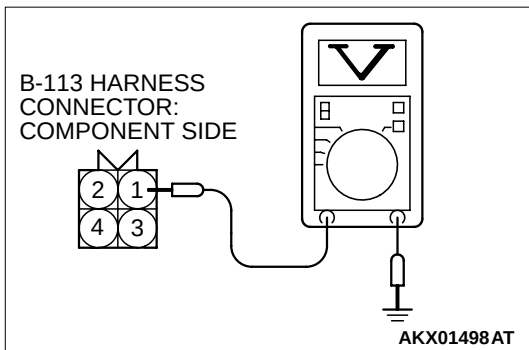
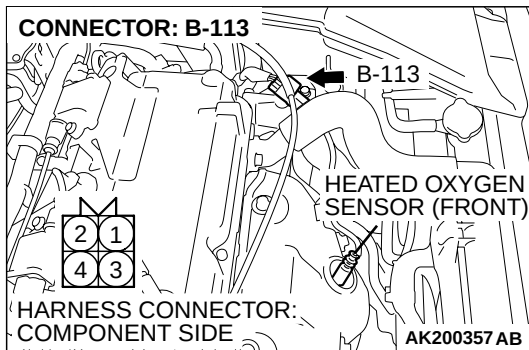
Standard value: 4.5 – 8.0 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 4.5 and 8.0 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the heated oxygen sensor (front). Then go to Step 12.





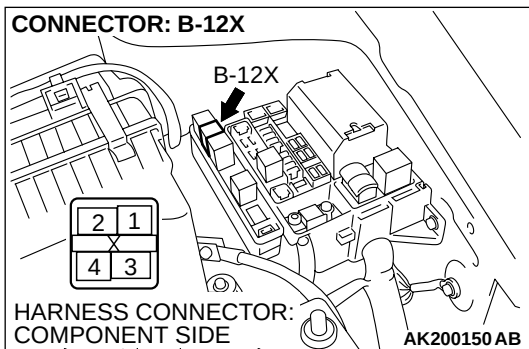
STEP 3. Measure the power supply voltage at heated oxygen sensor (front) harness side connector B-113.

- (1) Disconnect connector B-113 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

- YES :** Go to Step 5.
NO : Go to Step 4.



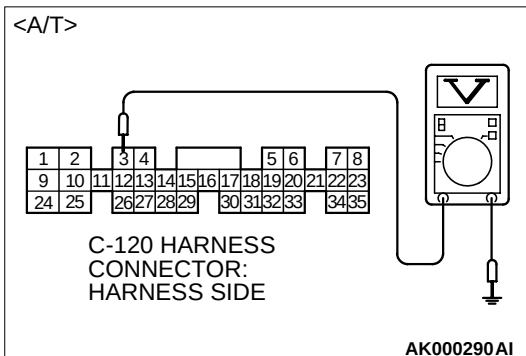
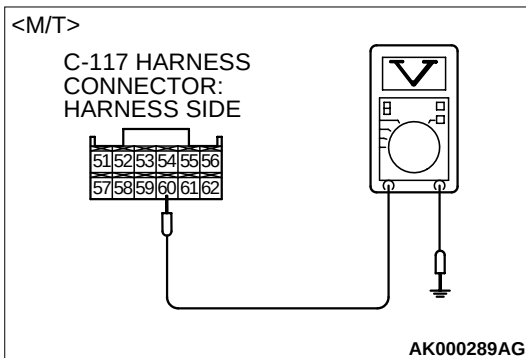
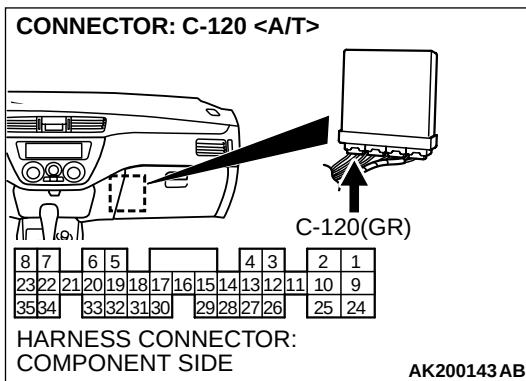
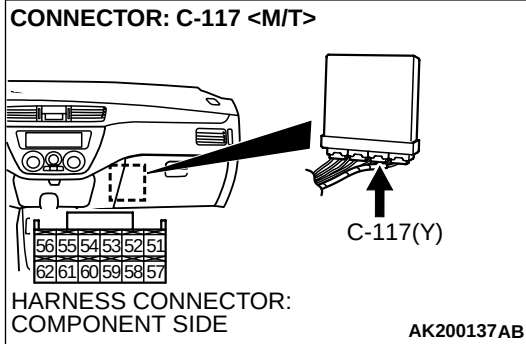
STEP 4. Check harness connector B-12X at the MFI relay for damage.

Q: Is the harness connector in good condition?

- YES :** Repair harness wire between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (front) connector B-113 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 5. Measure the power supply voltage at ECM connector C-117 <M/T> or PCM connector C-120 <A/T> by backprobing.

- (1) Do not disconnect connector C-117 <M/T> or C-120 <A/T>.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 60 <M/T> or No. 3 <A/T> and ground by backprobing.

- Voltage should be battery positive voltage.

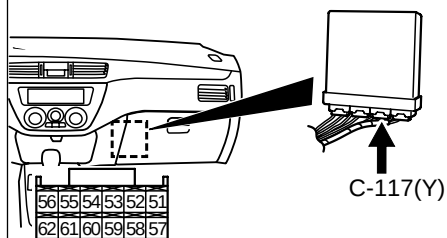
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 8.

NO : Go to Step 6.

CONNECTOR: C-117 <M/T>

HARNESS CONNECTOR:
COMPONENT SIDE

AK200137AB

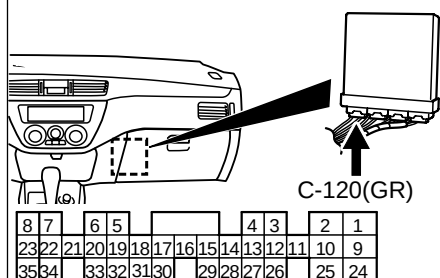
STEP 6. Check harness connector C-117 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 7.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

CONNECTOR: C-120 <A/T>

HARNESS CONNECTOR:
COMPONENT SIDE

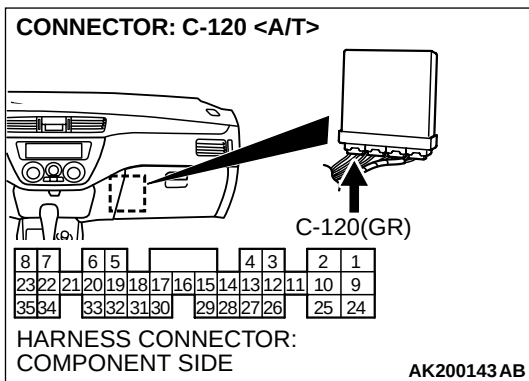
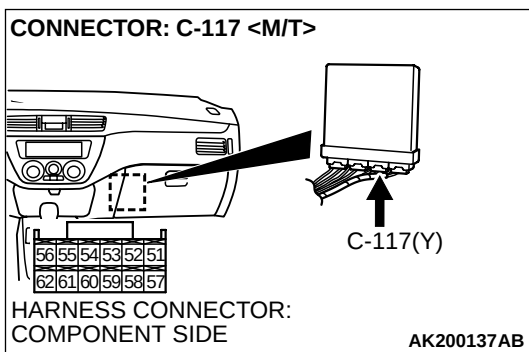
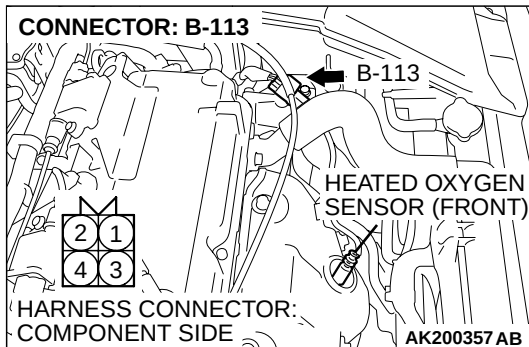
AK200143AB

STEP 7. Check for open circuit and short circuit to ground between heated oxygen sensor (front) connector B-113 (terminal No. 3) and ECM connector C-117 (terminal No. 60) <M/T> or PCM connector C-120 (terminal No. 3) <A/T>.

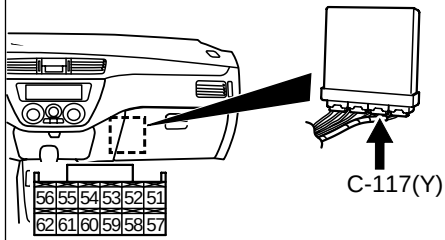
Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.

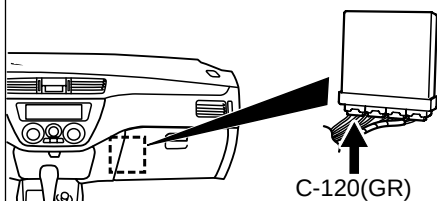


CONNECTOR: C-117 <M/T>

HARNESS CONNECTOR:
COMPONENT SIDE

AK200137 AB

CONNECTOR: C-120 <A/T>

HARNESS CONNECTOR:
COMPONENT SIDE

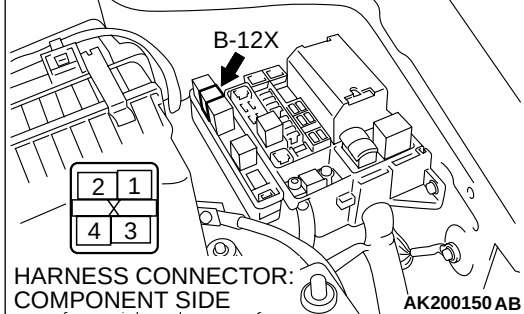
AK200143 AB

STEP 8. Check harness connector C-117 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 9.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

CONNECTOR: B-12X

HARNESS CONNECTOR:
COMPONENT SIDE

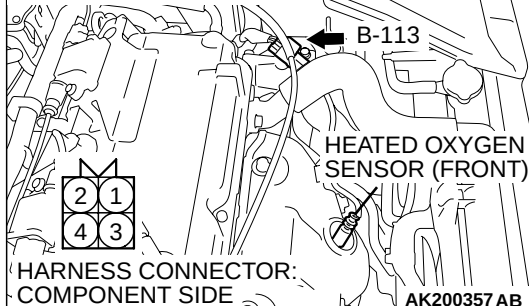
AK200150 AB

STEP 9. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (front) connector B-113 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 10.

NO : Repair it. Then go to Step 12.

CONNECTOR: B-113

HARNESS CONNECTOR:
COMPONENT SIDE

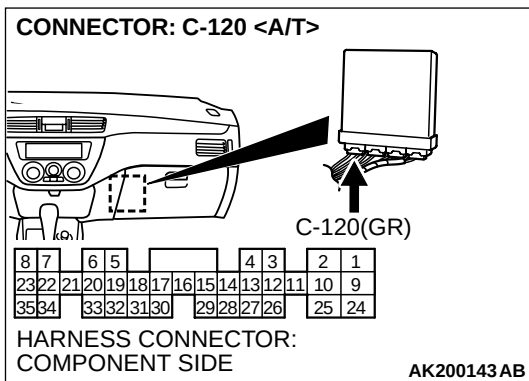
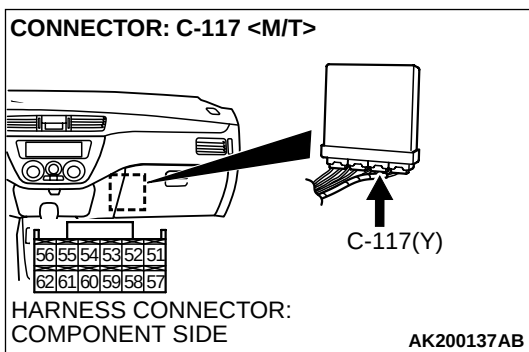
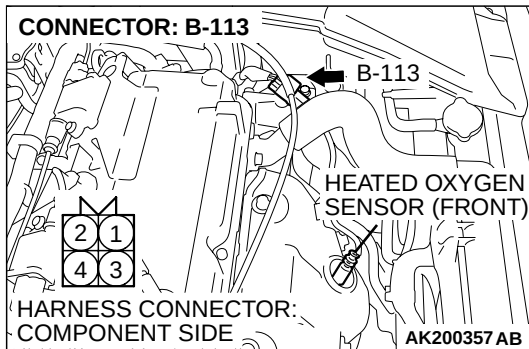
AK200357 AB

STEP 10. Check for harness damage between heated oxygen sensor (front) connector B-113 (terminal No. 3) and ECM connector C-117 (terminal No. 60) <M/T> or PCM connector C-120 (terminal No. 3) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



STEP 11. Check the trouble symptoms.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

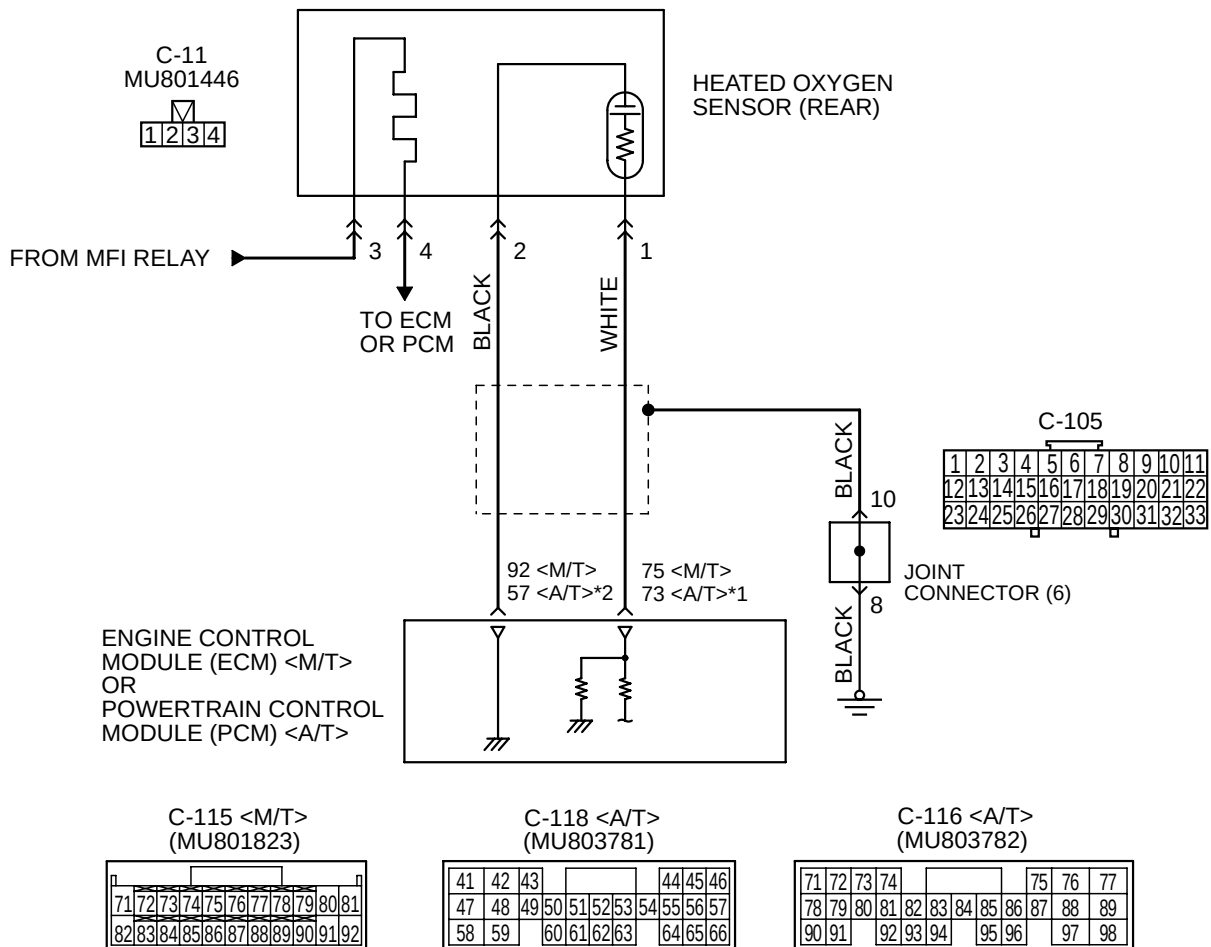
Q: Is DTC P0135 set?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

STEP 12. Test the OBD-II drive cycle.

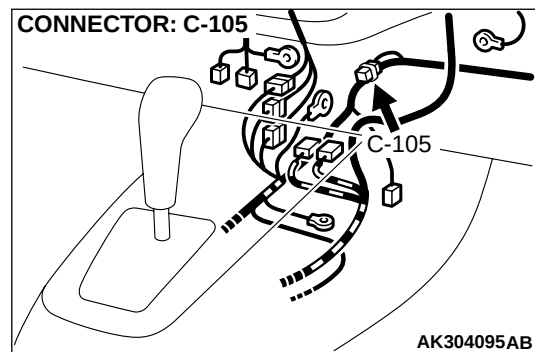
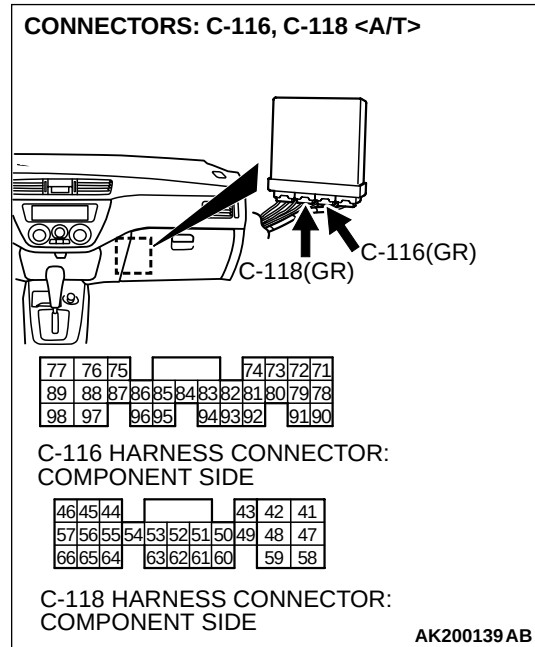
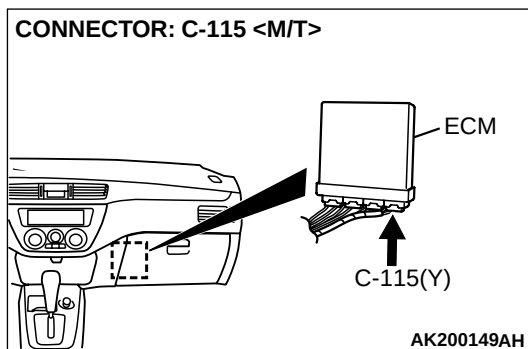
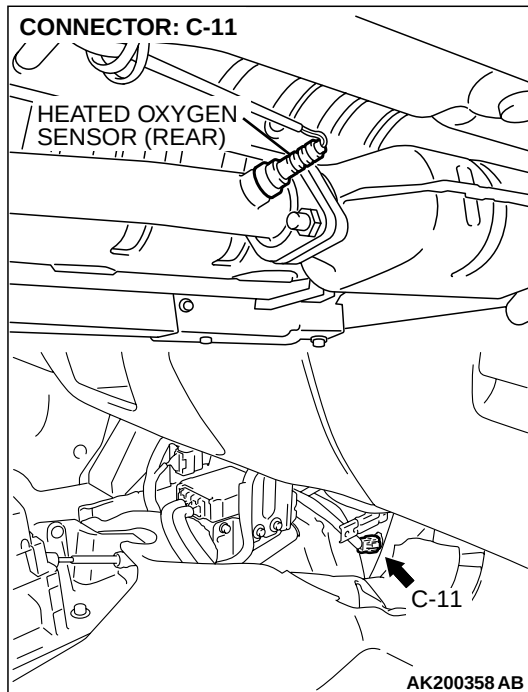
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0135 set?**YES :** Retry the troubleshooting.**NO :** The inspection is complete.**DTC P0136: Heated Oxygen Sensor Circuit High Voltage (sensor 2)****Heated Oxygen Sensor (rear) Circuit****NOTE**

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

AK000868



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) <M/T> or PCM (terminal No. 73) <A/T> from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

DESCRIPTIONS OF MONITOR METHODS

- While the heated oxygen sensor (rear) output is low, 5 volts are applied to the input circuit of the heated oxygen sensor (rear). An open circuit is detected while monitoring the sensor output with 5 volts applied.

MONITOR EXECUTION

- Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

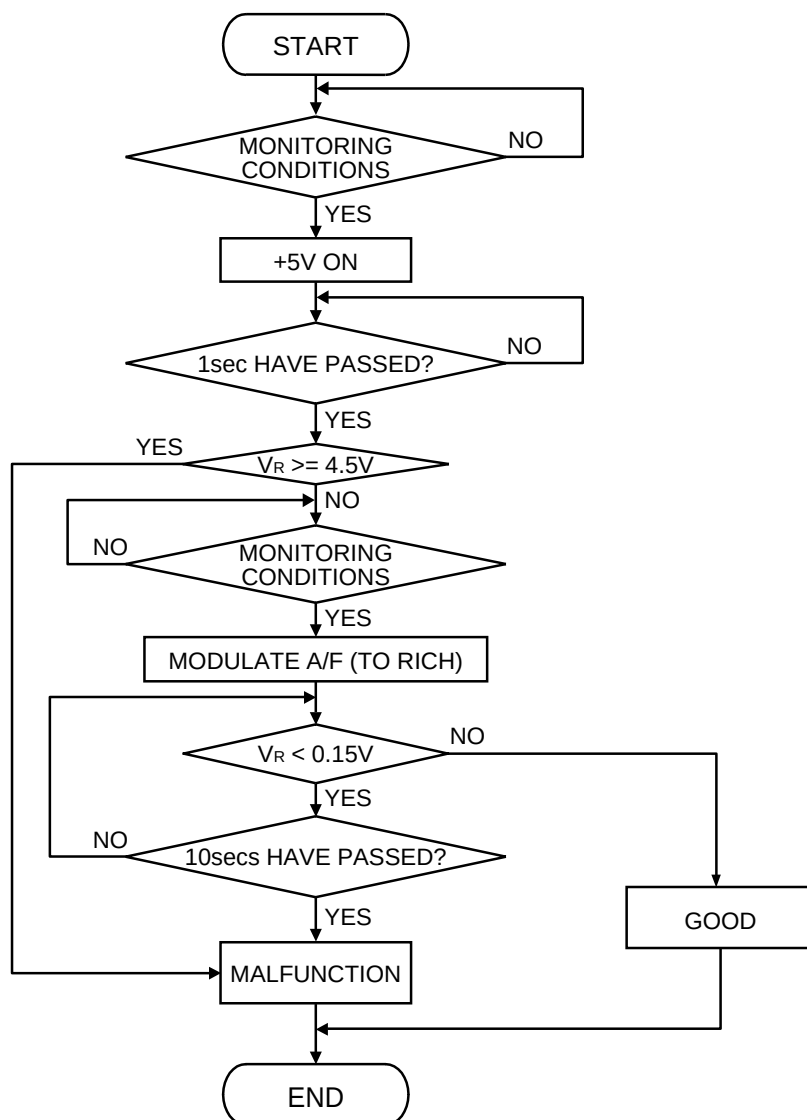
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302310

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (rear) signal voltage has continued to be 0.15 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.

- Monitoring time: 7 seconds.

Judgment Criteria

- Input voltage supplied to the ECM <M/T> or PCM <A/T> interface circuit is higher than 4.5 volts when 5 volts is applied to the heated oxygen sensor (rear) output line via a resistor.
- The ECM <M/T> or PCM <A/T> monitors for this condition once during the drive cycle.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (rear) failed.

- Open circuit in heated oxygen sensor (rear) output line.
- Open circuit in heated oxygen sensor (rear) ground line.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991658: Test Harness Set

STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

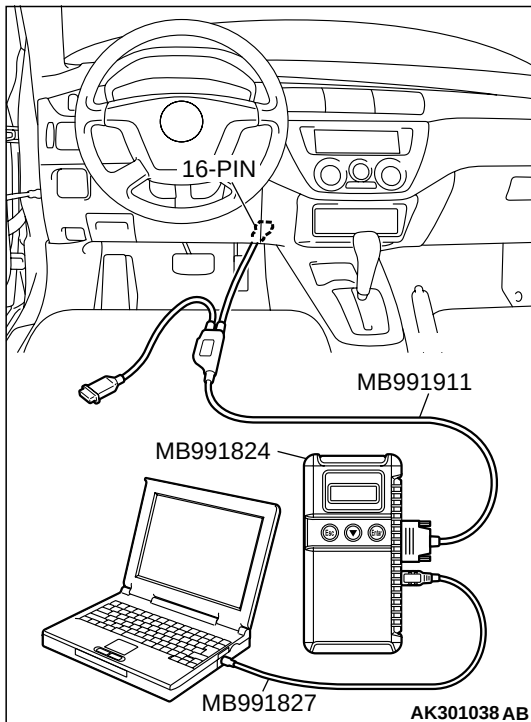
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

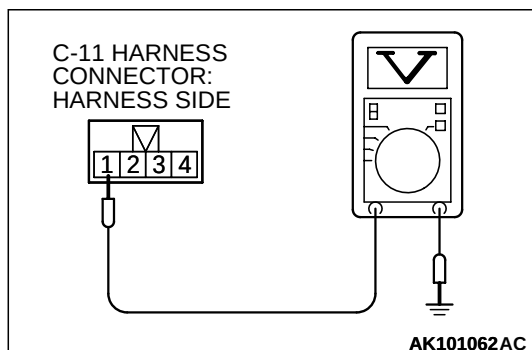
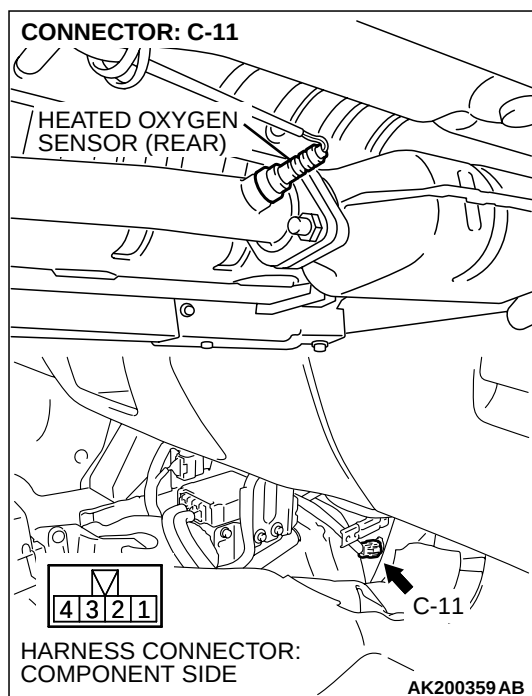
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
 - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.



**STEP 2. Measure the sensor output voltage at heated oxygen sensor (rear) connector C-11 by backprobing.**

- (1) Do not disconnect connector C-11.
- (2) Start the engine and run at idle.

- (3) Measure the voltage between terminal No. 1 and ground by backprobing.

- Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

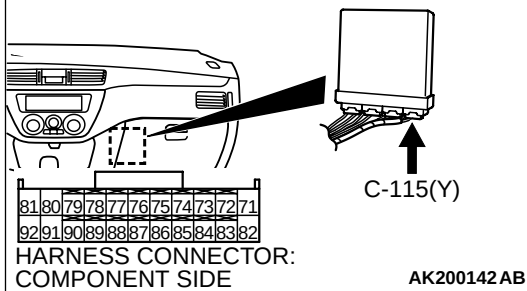
YES : Go to Step 3.

NO : Go to Step 7.

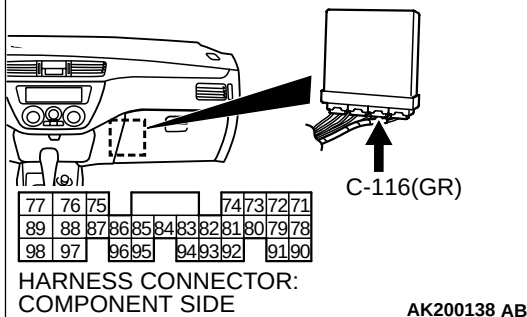
STEP 3. Measure the sensor output voltage at ECM connector C-115 <M/T> or PCM connector C-116 <A/T> by backprobing.

- (1) Do not disconnect connector C-115 <M/T> or C-116 <A/T>.
- (2) Start the engine and run at idle.

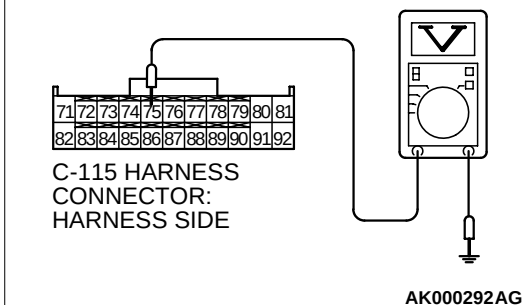
CONNECTOR: C-115 <M/T>



CONNECTOR: C-116 <A/T>



<M/T>



- (3) Measure the voltage between terminal No. 75 <M/T> or No. 73 <A/T> and ground by backprobing.

- Warm up the engine. When the engine is 2,500 r/min, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.

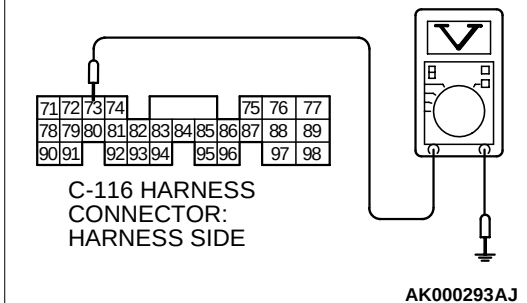
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

YES : Go to Step 4.

NO : Go to Step 6.

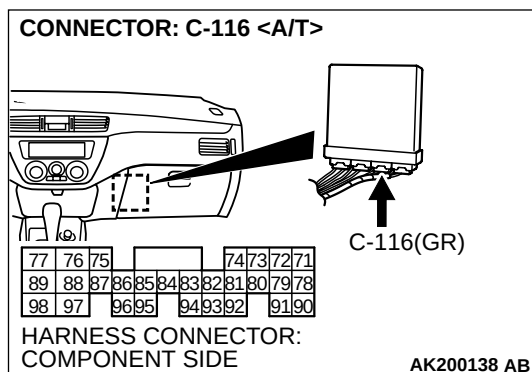
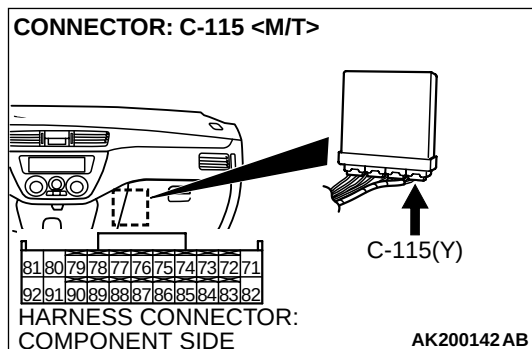
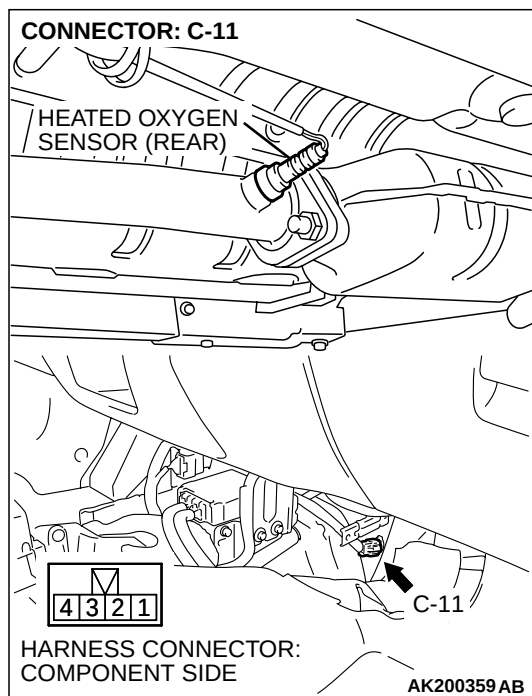
<A/T>

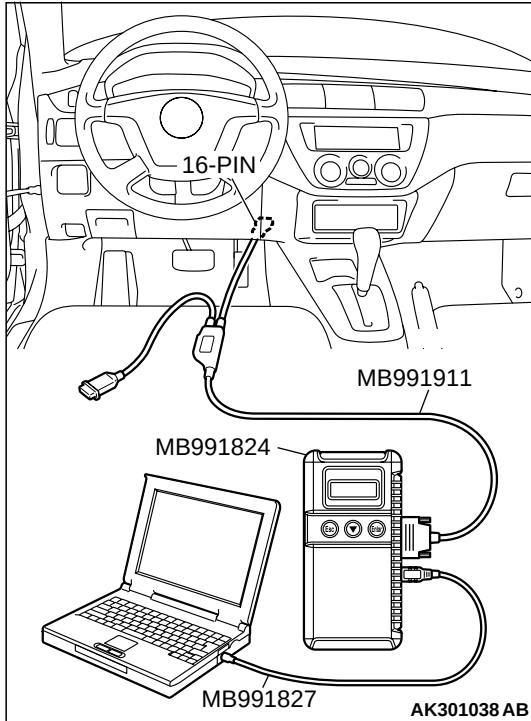


STEP 4. Check harness connector C-11 at heated oxygen sensor (rear) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.





STEP 5. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
 - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

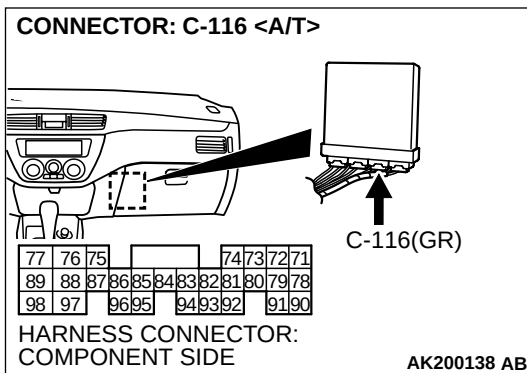
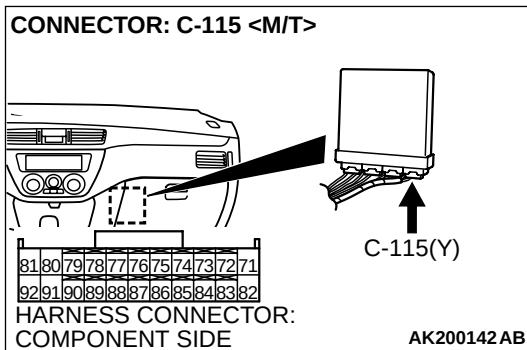
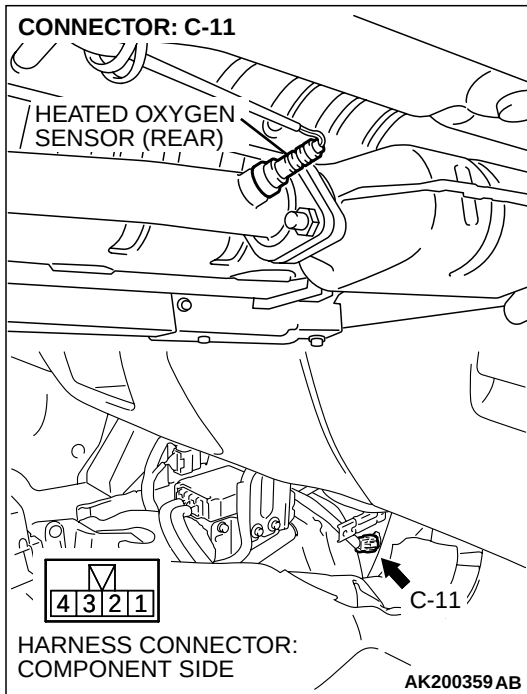
YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use

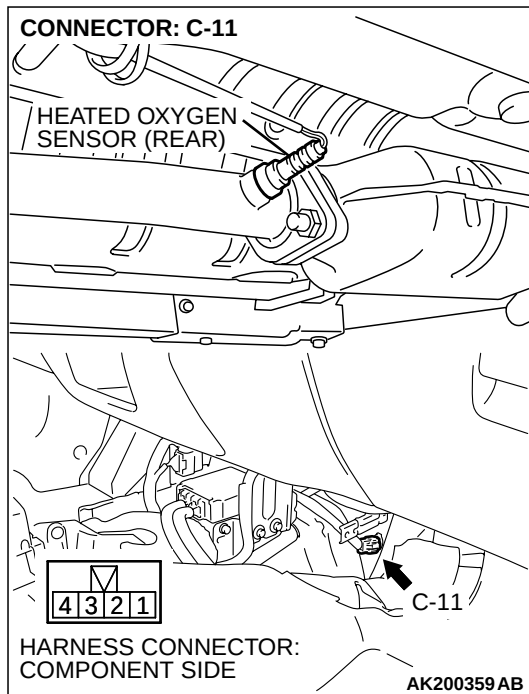
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Replace the ECM or PCM. Then go to Step 14.

STEP 6. Check harness connector C-11 at heated oxygen sensor (rear) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

- YES :** Repair harness wire between heated oxygen sensor (rear) connector C-11 (terminal No. 1) and ECM connector C-115 (terminal No. 75) <M/T> or PCM connector C-116 (terminal No. 73) <A/T> because of open circuit or harness damage. Then go to Step 14.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.



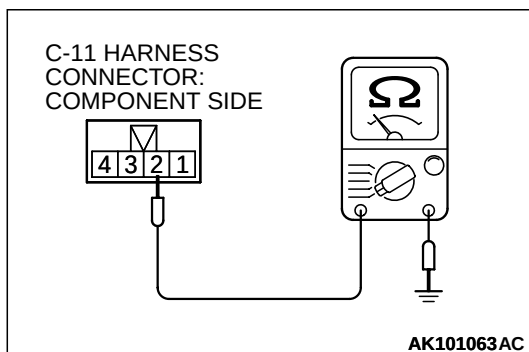
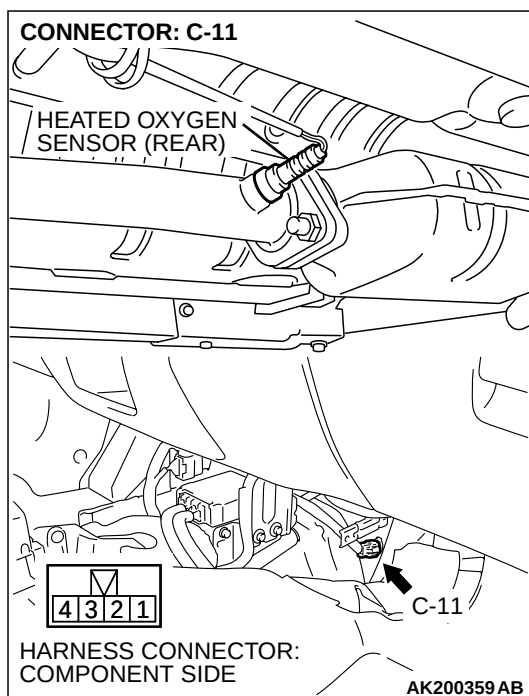


STEP 7. Check harness connector C-11 at heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

**STEP 8. Check for continuity at heated oxygen sensor (rear) harness side connector C-11.**

(1) Disconnect connector C-11 and measure at the harness side.

(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 11.

NO : Go to Step 9.

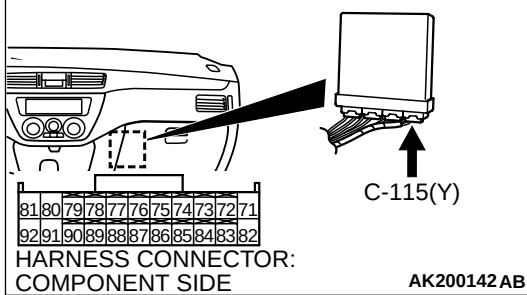
STEP 9. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

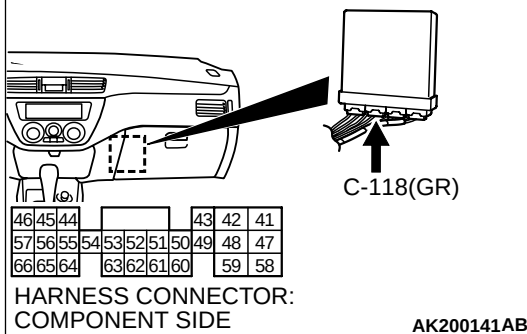
YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

CONNECTOR: C-115 <M/T>



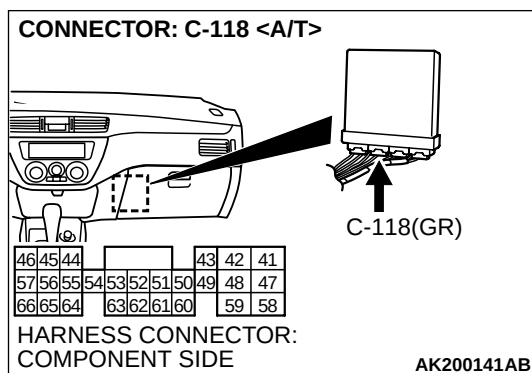
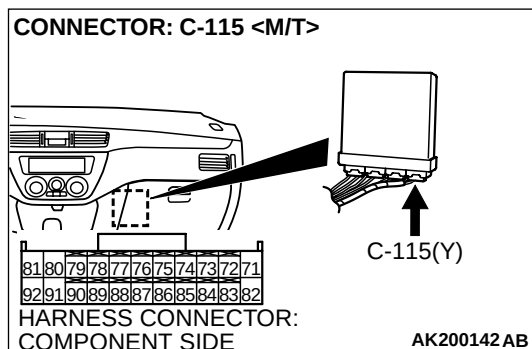
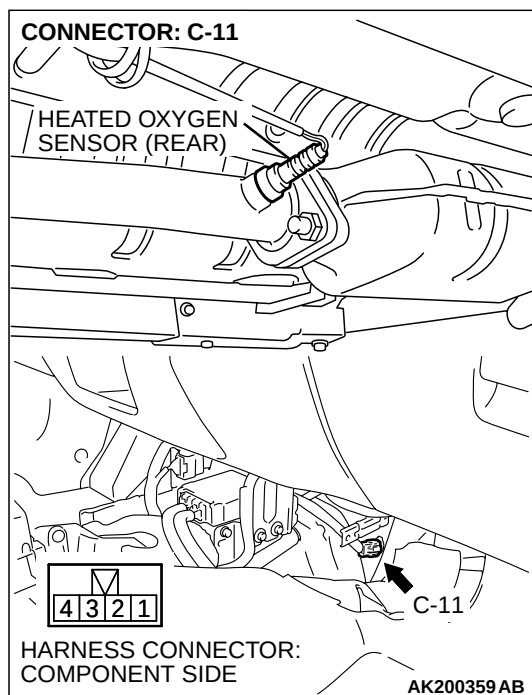
CONNECTOR: C-118 <A/T>



STEP 10. Check for open circuit and harness damage between heated oxygen sensor (rear) connector C-11 (terminal No. 2) and ECM connector C-115 (terminal No. 92) <M/T> or PCM connector C-118 (terminal No. 57) <A/T>.
Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 14.

NO : Repair it. Then go to Step 14.



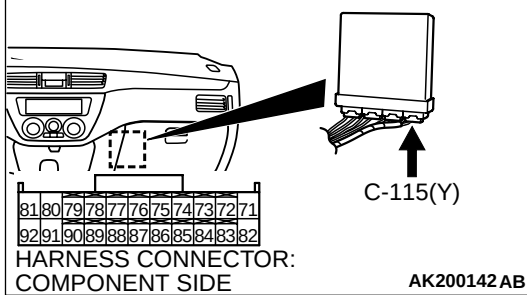
STEP 11. Check harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

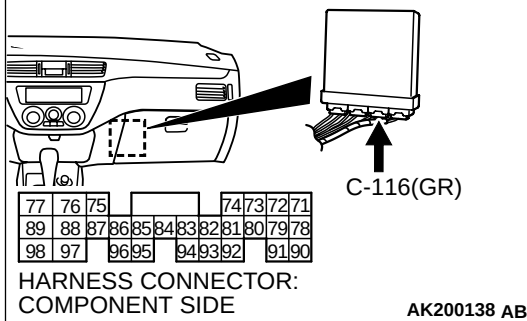
YES : Go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.

CONNECTOR: C-115 <M/T>



CONNECTOR: C-116 <A/T>

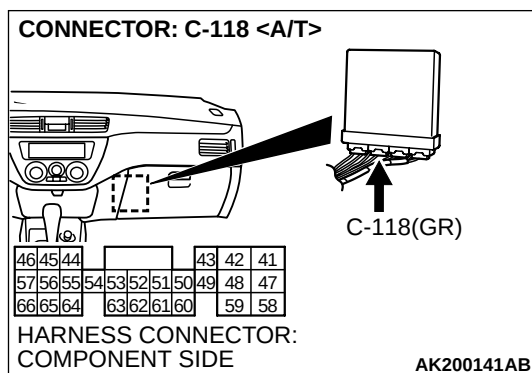
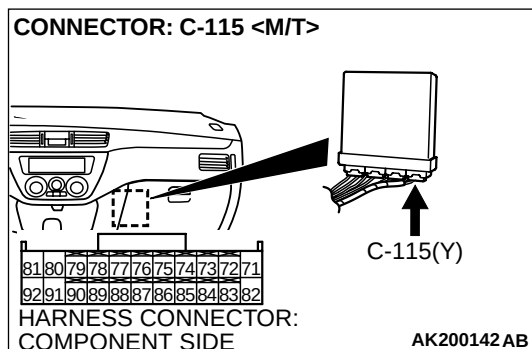
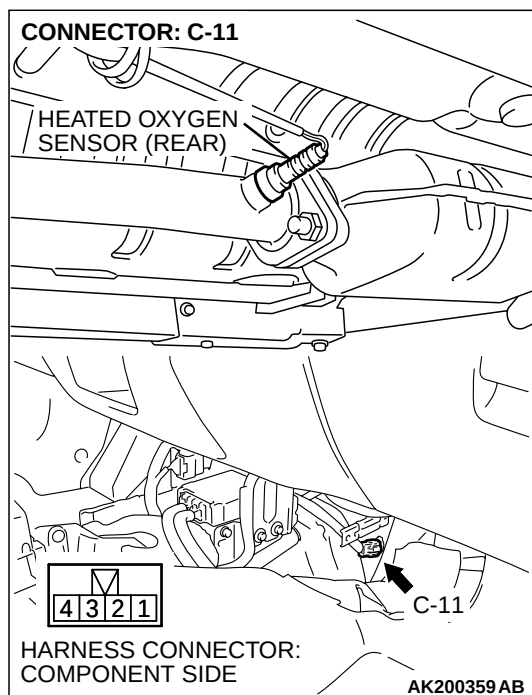


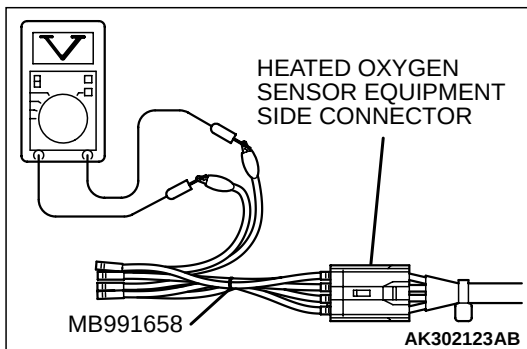
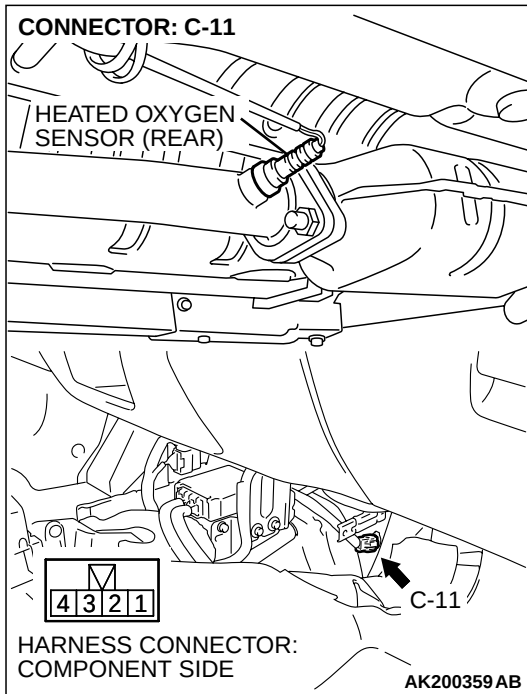
STEP 12. Check for harness damage between heated oxygen sensor (rear) connector C-11 (terminal No. 2) and ECM connector C-115 (terminal No. 92) <M/T> or PCM connector C-118 (terminal No. 57) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 13.

NO : Repair it. Then go to Step 14.





STEP 13. Check the heated oxygen sensor (rear).

- (1) Disconnect the heated oxygen sensor (rear) connector C-11 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 1 and terminal No. 2.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wire; incorrect connection can damage the heated oxygen sensor (rear).
- Be careful the heater is broken when voltage of beyond 12 volts is applied to the heated oxygen sensor (rear) heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (rear) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.3 and the terminal No.4 of the heated oxygen sensor (rear) with the positive terminal and the negative terminal of 12 volts power supply respectively, then check again.

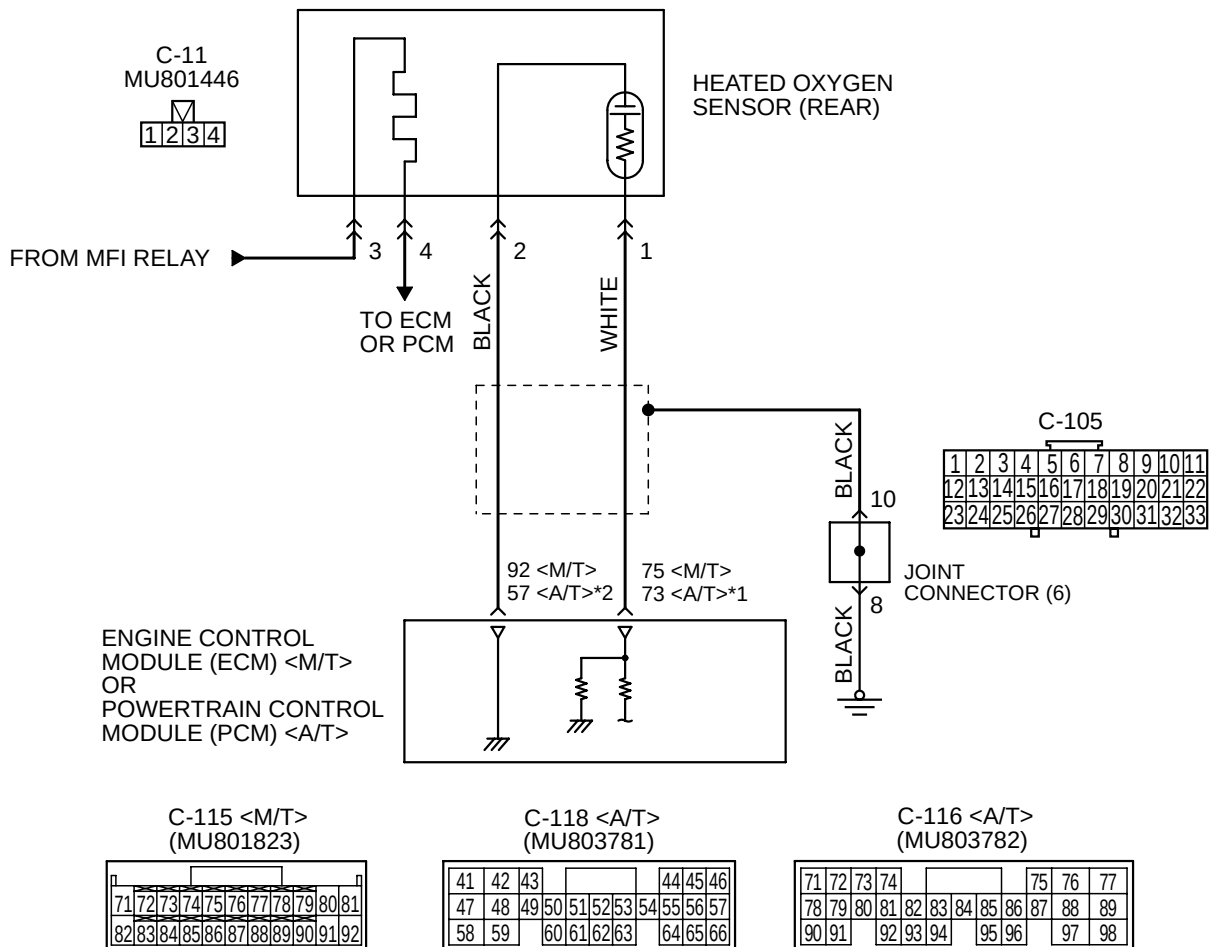
Q: Is the measured voltage between 0.6 and 1.0 volt?

YES : Replace the ECM or PCM. Then go to Step 14.

NO : Replace the heated oxygen sensor (rear). Then go to Step 14.

STEP 14. Test the OBD-II drive cycle.

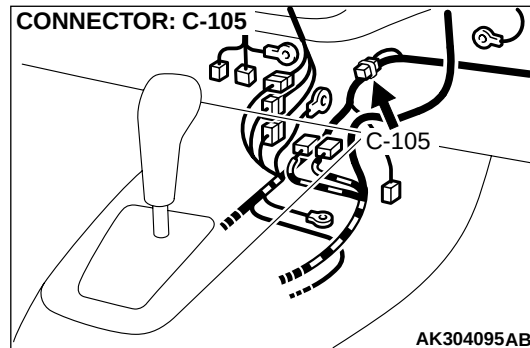
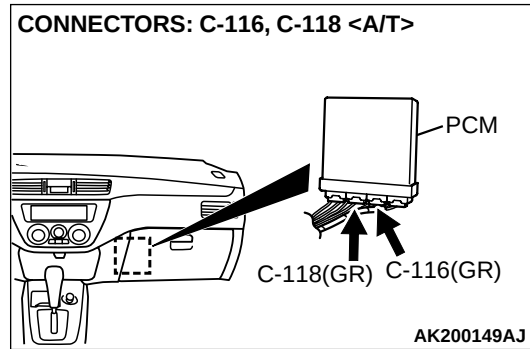
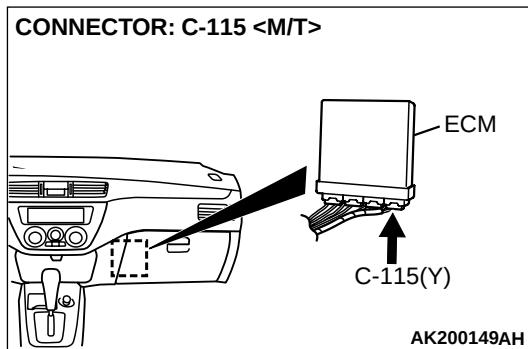
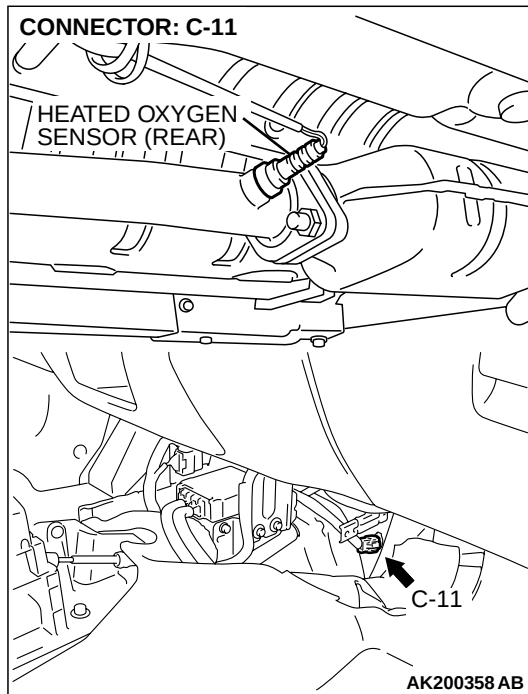
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0136 set?**YES :** Retry the troubleshooting.**NO :** The inspection is complete.**DTC P0137: Heated Oxygen Sensor Circuit Low Voltage (sensor 2)****Heated Oxygen Sensor (rear) Circuit****NOTE**

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

AK000868



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) <M/T> or PCM (terminal No. 73) <A/T> from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

DESCRIPTIONS OF MONITOR METHODS

- The output of the heated oxygen sensor (rear) is monitored when the air-fuel mixture is forcefully made richer, and if the sensor output remains low and unchanged, a malfunction is determined to have occurred.

MONITOR EXECUTION

- Once per driving cycle

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

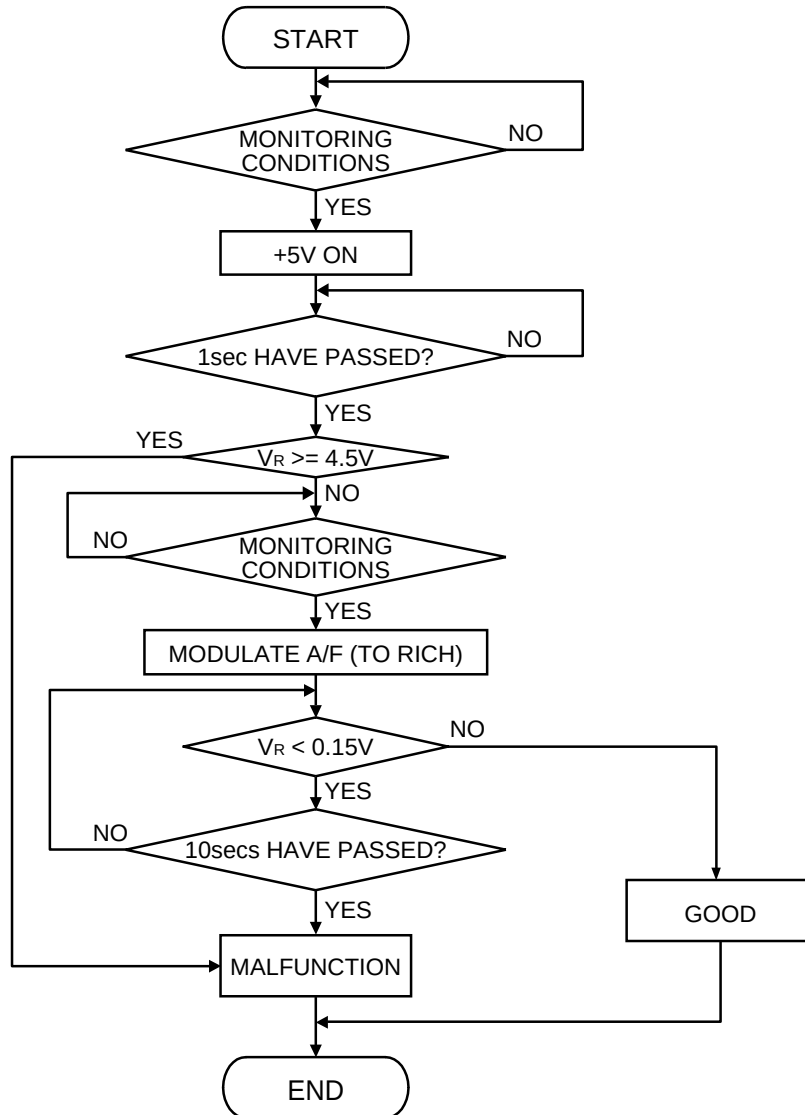
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302311

Check Conditions

- 3 minutes or more have passed since the starting sequence was completed.
- Heated oxygen sensor (rear) signal voltage has continued to be 0.15 volt or lower.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is higher than 1,200 r/min.
- Volumetric efficiency is higher than 25 percent.
- Volume airflow sensor output frequency is 81 Hz or more.
- At least 20 seconds have passed since fuel shut off control was canceled.
- The heated oxygen sensor (front) outputs 0.5 volt or more.
- After the ignition switch is turned ON, the changes in the output voltage of the heated oxygen sensor (rear) is lower than 0.078 volt.
- Monitoring time: 10 seconds.

Judgement Criteria

- Making the air/fuel ratio 15 percent for 10 seconds richer does not result in raising the heated oxygen sensor (rear) output voltage beyond 0.15 volt.
- The ECM <M/T> or PCM <A/T> monitors for this condition once during the drive cycle.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (rear) failed.
- Short circuit in heated oxygen sensor (rear) output line.
- ECM failed. <M/T>
- PCM failed. <A/T>

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Procedure 6 – Other Monitor [P.13A-6](#).

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991658: Test Harness Set

STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).

CAUTION

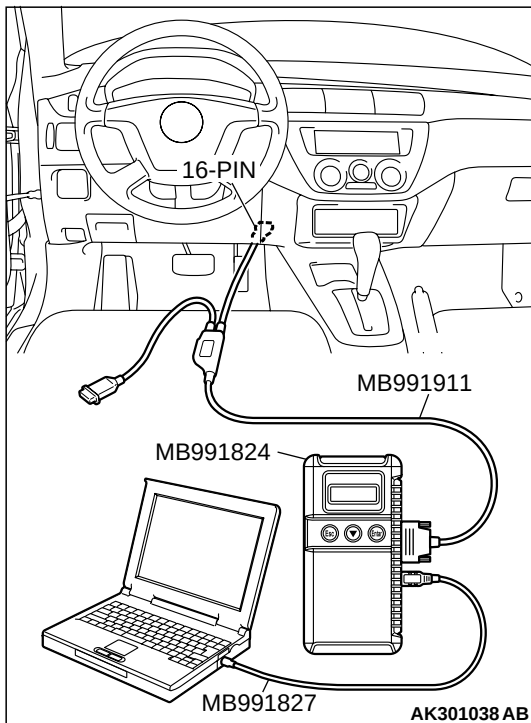
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

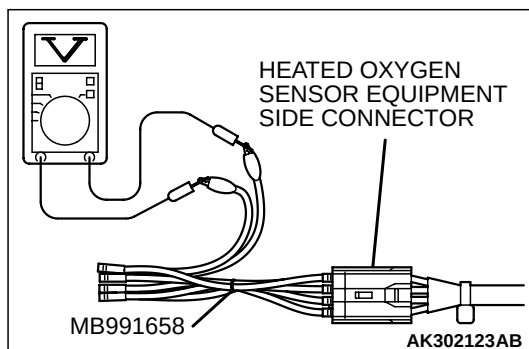
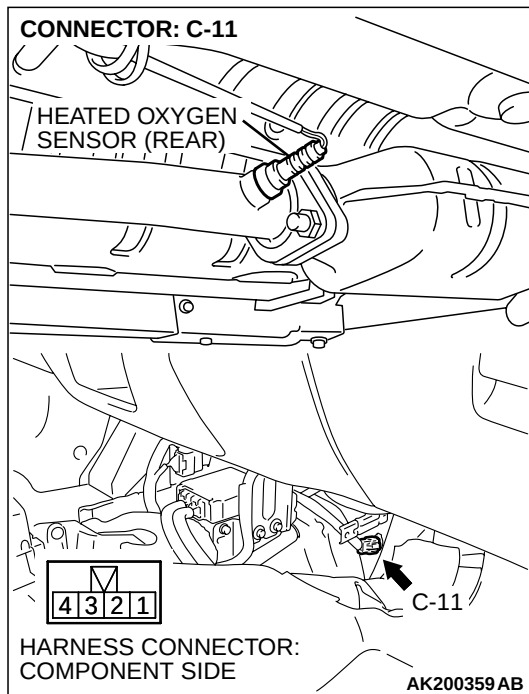
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
 - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.



**STEP 2. Check the heated oxygen sensor (rear).**

- (1) Disconnect the heated oxygen sensor (rear) connector C-11 and connect test harness special tool, MB991658, to the connector on the heated oxygen sensor (front) side.
- (2) Warm up the engine until engine coolant 80°C (176°F) or higher.
- (3) Perform a racing for 5 minutes or more with the engine speed of 4,500 r/min.

- (4) Connect a digital voltage meter between terminal No. 1 and terminal No. 2.
- (5) While repeatedly revving the engine, measure the heated oxygen sensor (front) output voltage.

Standard value: 0.6 – 1.0 volt

CAUTION

- Be very careful when connecting the jumper wire; incorrect connection can damage the heated oxygen sensor (rear).
- Be careful the heater is broken when voltage of beyond 12 volts is applied to the heated oxygen sensor (rear) heater.

NOTE: If the sufficiently high temperature [of approximate 400°C (752°F) or more] is not reached although the heated oxygen sensor (rear) is normal, the output voltage would be possibly low although the rich air/fuel ratio. Therefore, if the output voltage is low, use a jumper wire to connect the terminal No.3 and the terminal No.4 of the heated oxygen sensor (rear) with the positive terminal and the negative terminal of 12 volts power supply respectively, then check again.

Q: Is the measured voltage between 0.6 and 1.0 volt?

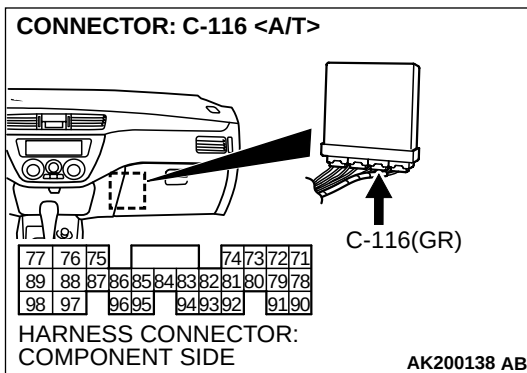
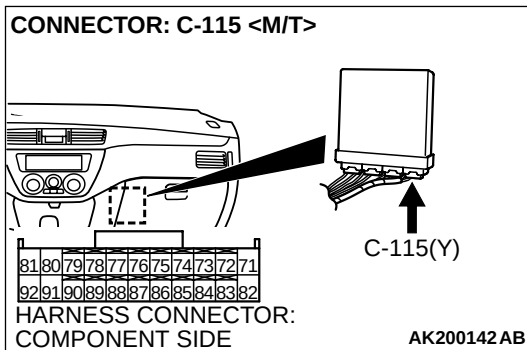
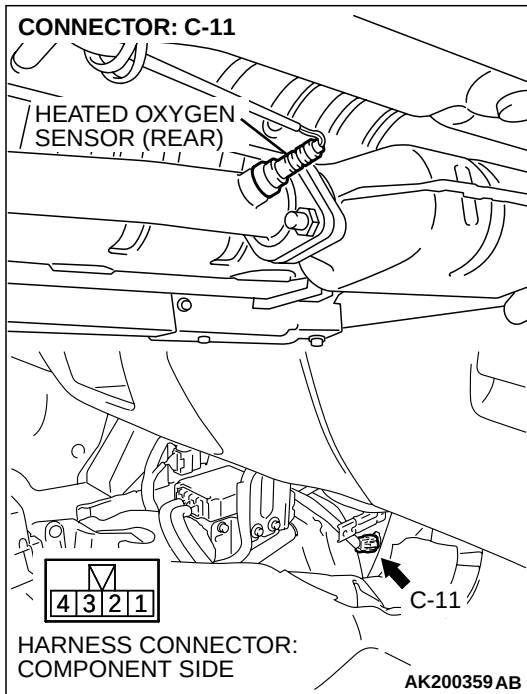
YES : Go to Step 3.

NO : Replace the heated oxygen sensor (rear). Then go to Step 5.

STEP 3. Check harness connector C-11 at heated oxygen sensor (rear) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

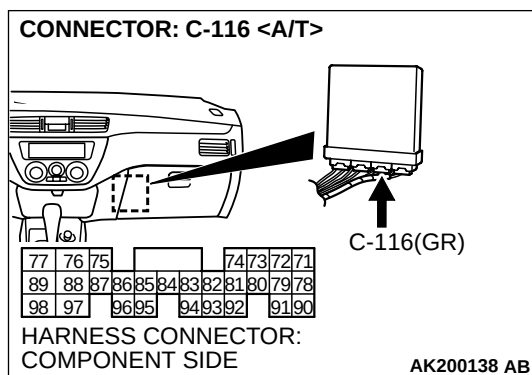
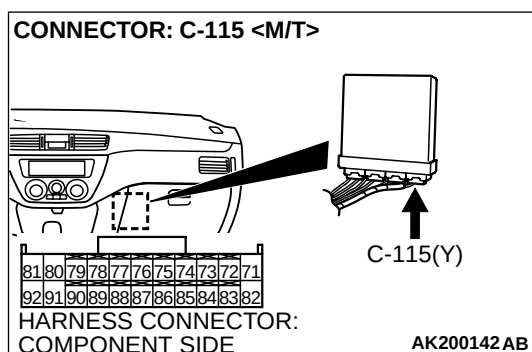
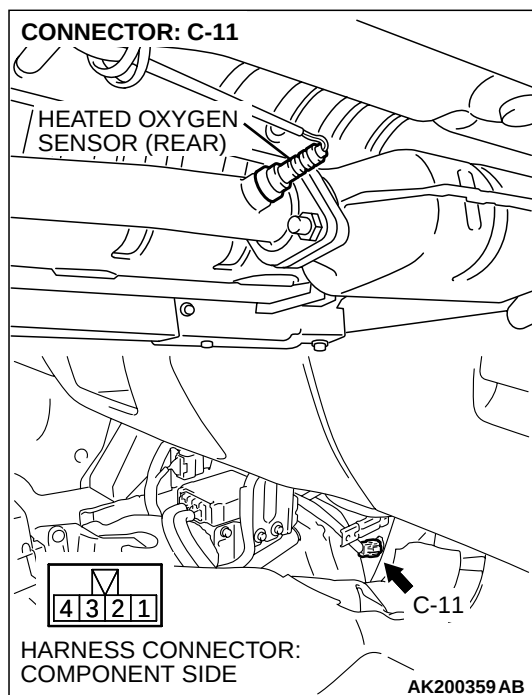


STEP 4. Check for short circuit to ground between heated oxygen sensor (rear) connector C-11 (terminal No. 1) and ECM connector C-115 (terminal No. 75) <M/T> or PCM connector C-116 (terminal No. 73) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 5.

NO : Repair it. Then go to Step 5.



STEP 5. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

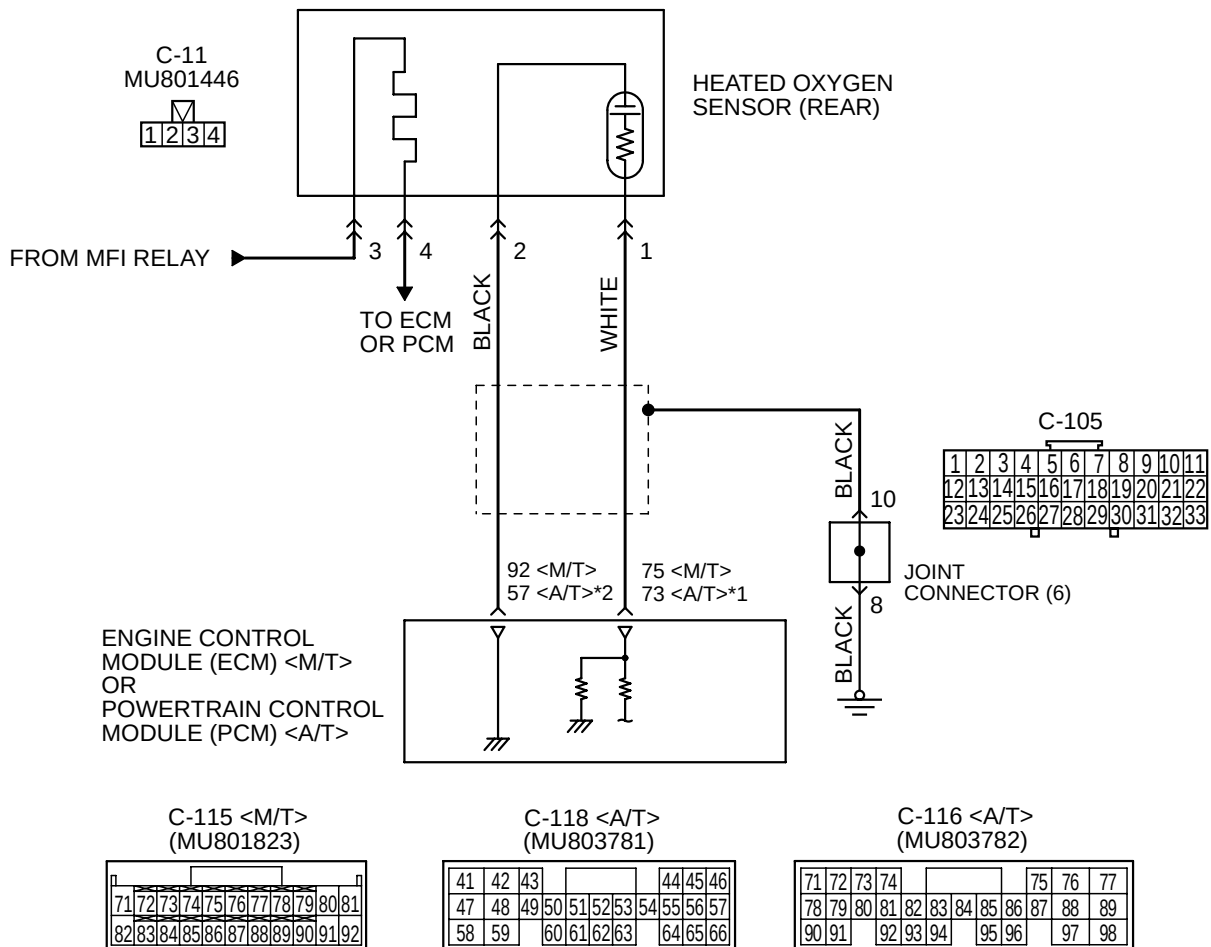
Q: Is DTC P0137 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0138: Heated Oxygen Sensor Circuit High Voltage (sensor 2)

Heated Oxygen Sensor (rear) Circuit

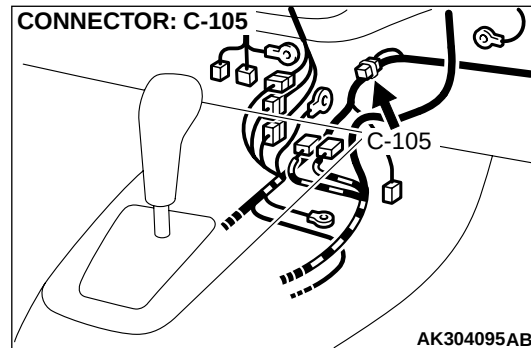
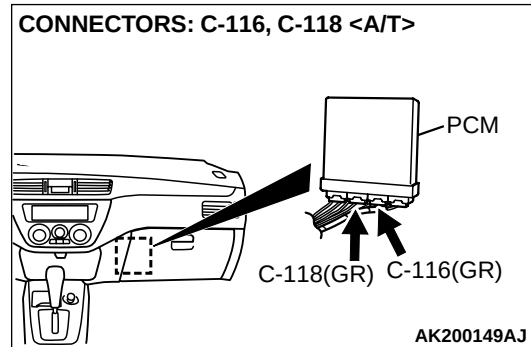
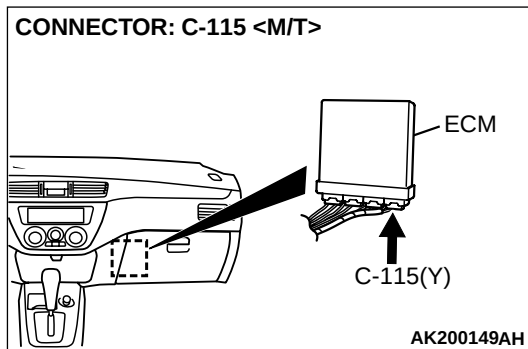
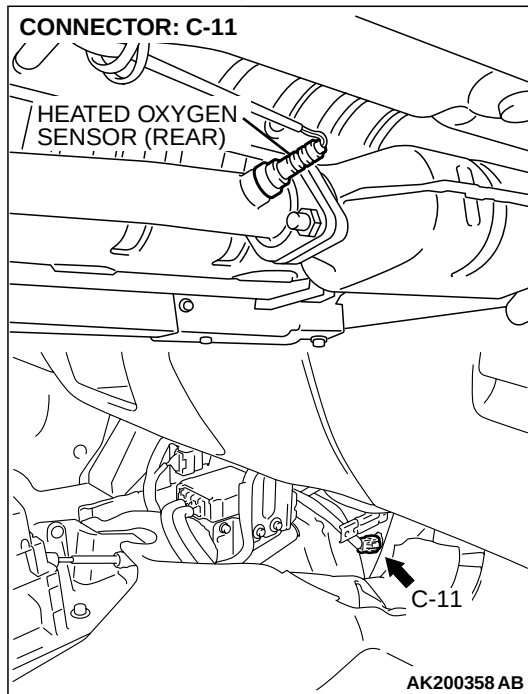


NOTE

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

AK000868



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) <M/T> or PCM (terminal No. 73) <A/T> from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).
- The ECM <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

DESCRIPTIONS OF MONITOR METHODS

- If the heated oxygen sensor (rear) output is higher than the standard value while monitoring the heated oxygen sensor (rear) output, a short circuit (short circuit to power supply) is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

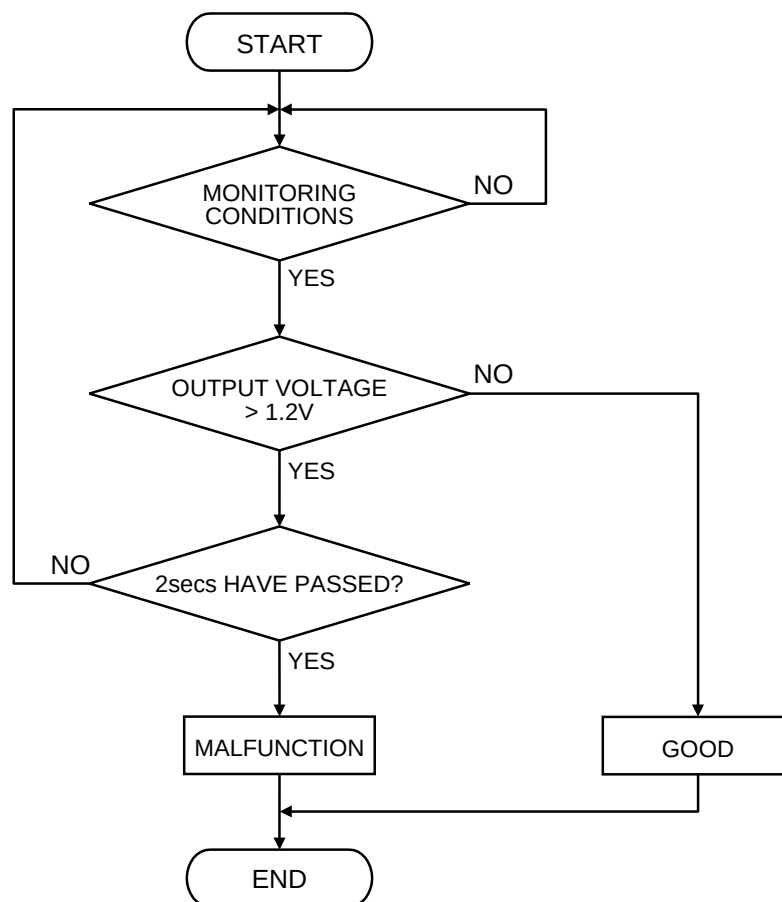
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302312

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgment Criteria

- Heated oxygen sensor (rear) output voltage has continued to be 1.2 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (rear) failed.
- Short circuit in heated oxygen sensor (rear) output line.
- ECM failed. <M/T>
- PCM failed. <A/T>

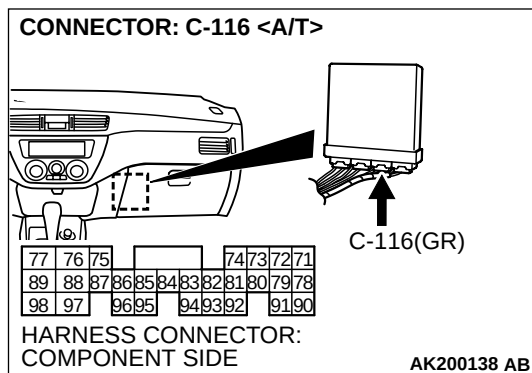
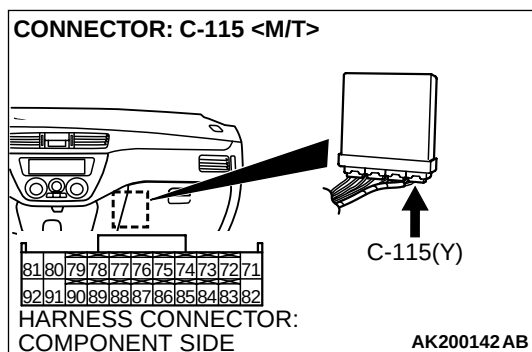
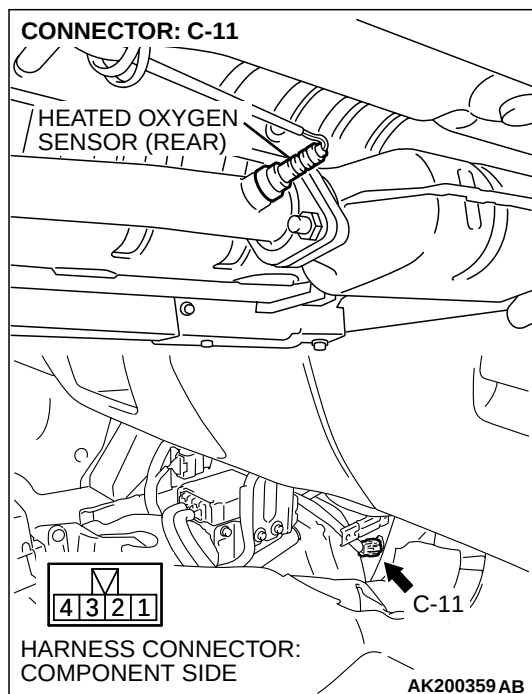
DIAGNOSIS

STEP 1. Check harness connector C-11 at heated oxygen sensor (rear) and harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 3.

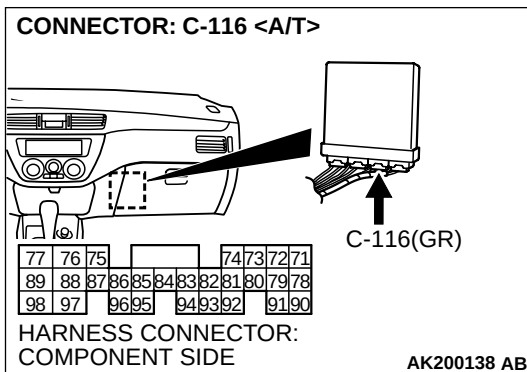
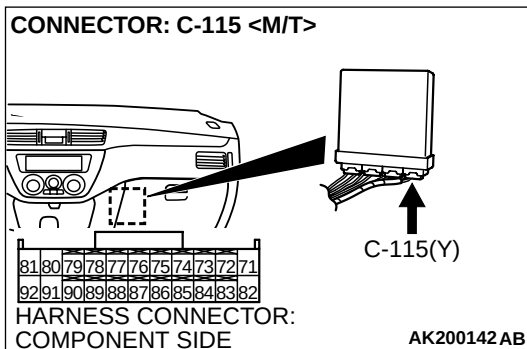
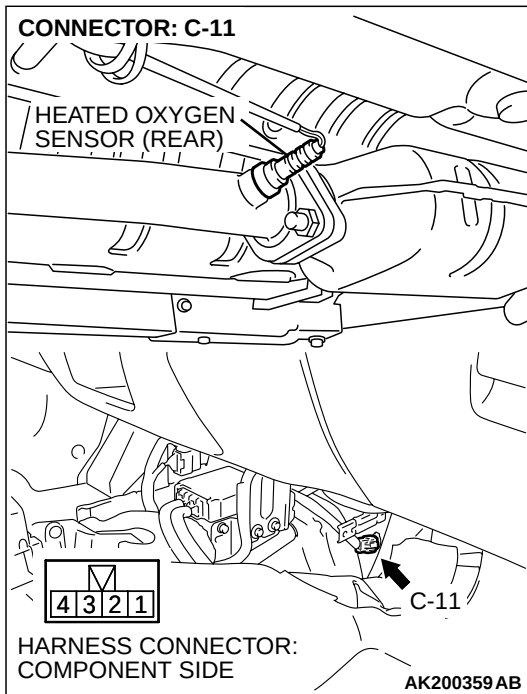


STEP 2. Check for short circuit to power supply between heated oxygen sensor (rear) connector C-11 (terminal No. 1) and ECM connector C-115 (terminal No. 75) <M/T> or PCM connector C-116 (terminal No. 73) <A/T>.

Q: Is the harness wire in good condition?

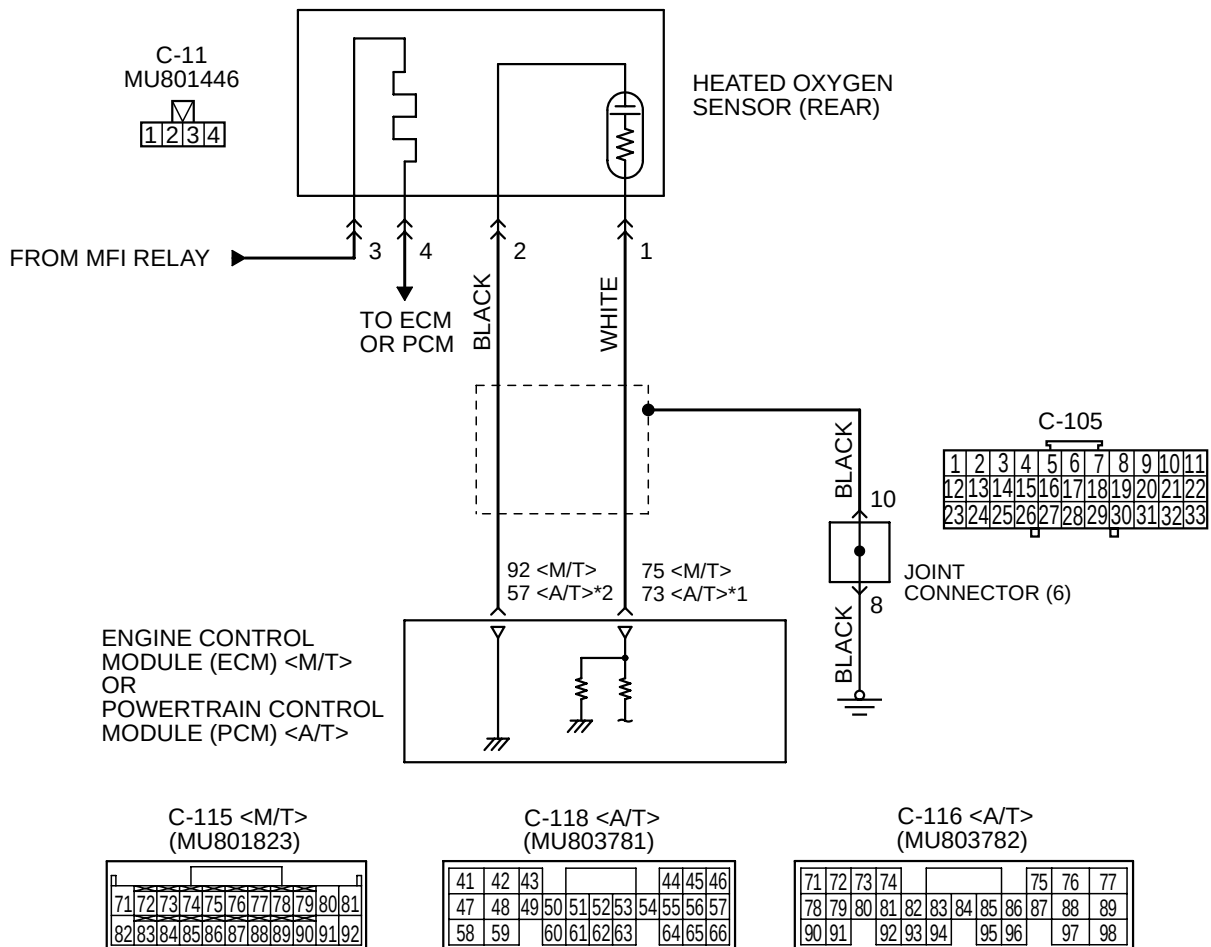
YES : Replace the ECM or PCM. Then go to Step 3.

NO : Repair it. Then go to Step 3.



STEP 3. Test the OBD-II drive cycle.

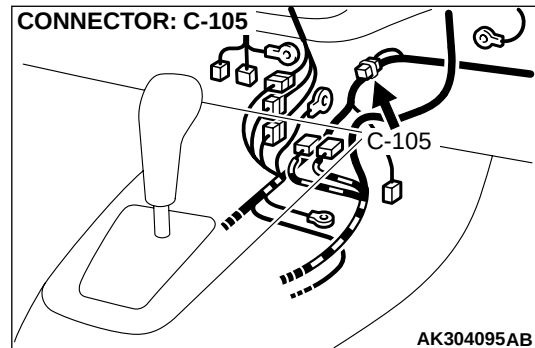
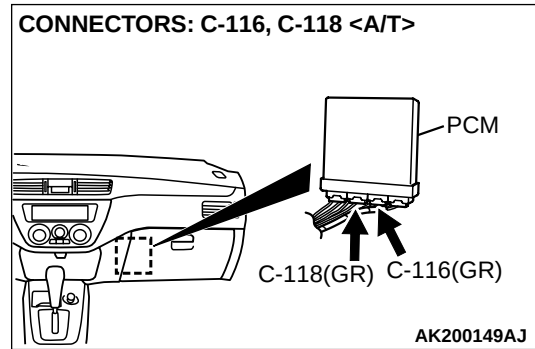
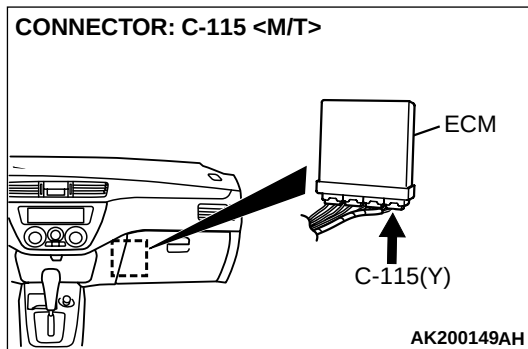
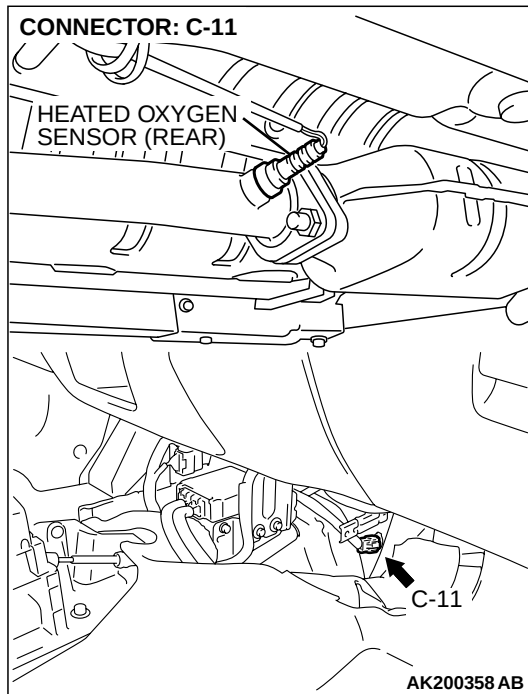
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0138 set?**YES :** Retry the troubleshooting.**NO :** The inspection is complete.**DTC P0139: Heated Oxygen Sensor Circuit Slow Response (sensor 2)****Heated Oxygen Sensor (rear) Circuit****NOTE**

*1: PCM connector C-116 <A/T>

*2: PCM connector C-118 <A/T>

AK000868



CIRCUIT OPERATION

- A voltage corresponding to the oxygen concentration in the exhaust gas is sent to the ECM (terminal No. 75) <M/T> or PCM (terminal No. 73) <A/T> from the output terminal (terminal No. 1) of the heated oxygen sensor (rear).
- Terminal No. 2 of the heated oxygen sensor (rear) is grounded with ECM (terminal No. 92) <M/T> or PCM (terminal No. 57) <A/T>.

TECHNICAL DESCRIPTION

- The output signal of the heated oxygen sensor (front) is compensated by the output signal of the heated oxygen sensor (rear).

- The ECM <M/T> or PCM <A/T> checks for an open circuit in the heated oxygen sensor (rear) output line.

DESCRIPTIONS OF MONITOR METHODS

- If the heated oxygen sensor (rear) output does not change in spite of repeating the prescribed (stop-and-go) driving pattern that includes a fuel shut-off, the heated oxygen sensor (rear) is determined to be stuck with faulty output.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

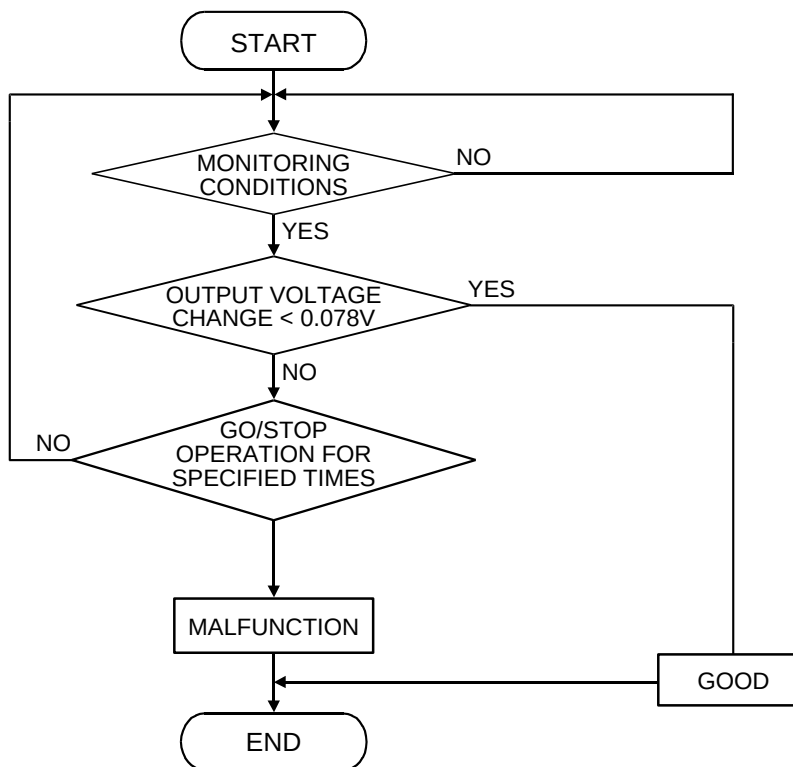
- Heated oxygen sensor (front) heater monitor
- Heated oxygen sensor (rear) heater monitor
- Air fuel ratio feedback system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor

DTC SET CONDITIONS**Logic Flow Chart**

F1: COUNTER OF A DRIVING STATE.
F2: COUNTER OF A STOP STATE.
(THE COUNTER F2 IS NOT RESET AFTER EACH DRIVE CYCLE.)



AK302313

Check Conditions

- Engine coolant temperature is higher than 76°C (169°F).
- The heated oxygen sensor (front) is active.
- The cumulative volume airflow sensor output frequency is higher than 4,000 Hz.
- Repeat 3 or more times: drive^{*1}, stop^{*2}.

Drive^{*1}:

- Engine speed is higher than 1,500 r/min.
- Volumetric efficiency is higher than 40 per cent.
- Vehicle speed is higher than 30 km/h (18.7 mph).
- A total of more than 10 seconds have elapsed with the above mentioned conditions, and more than 2 seconds have elapsed with the fuel shut off.

Stop^{*2}:

- Vehicle speed is lower than 1.5 km/h (0.9 mph).

Judgement Criteria

- Change in the output voltage of the heated oxygen sensor (rear) is lower than 0.313 volt.

NOTE: Monitoring stops after fuel has been shut off for more than 38 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 4 – Heated Oxygen Sensor Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Heated oxygen sensor (rear) failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

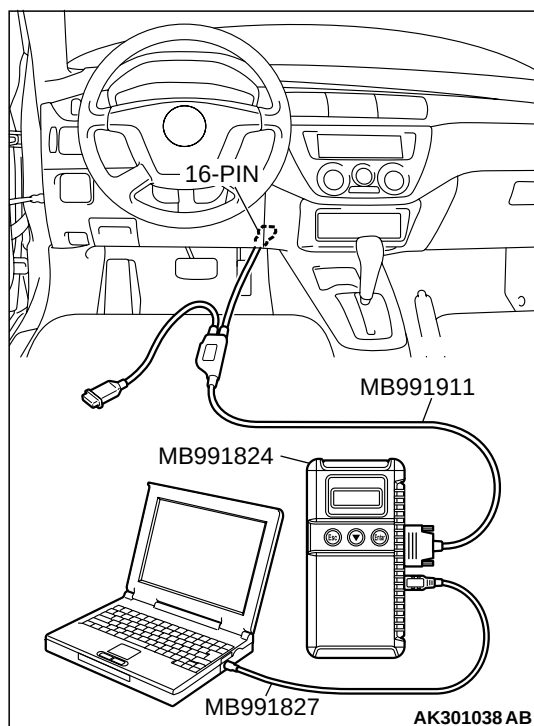
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
- (4) Warm up the engine.
 - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

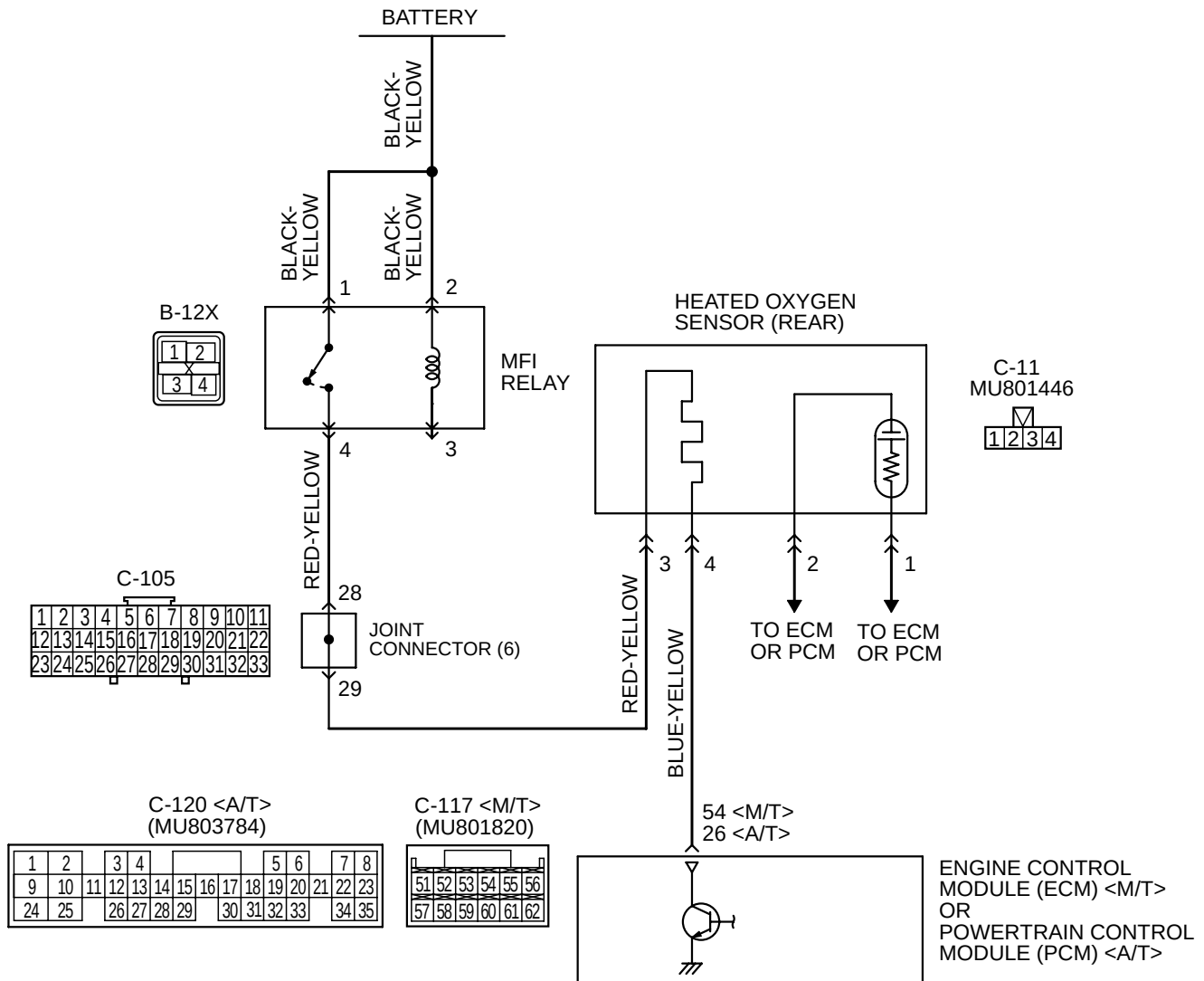
YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Replace the heated oxygen sensor (rear). Then go to Step 2.

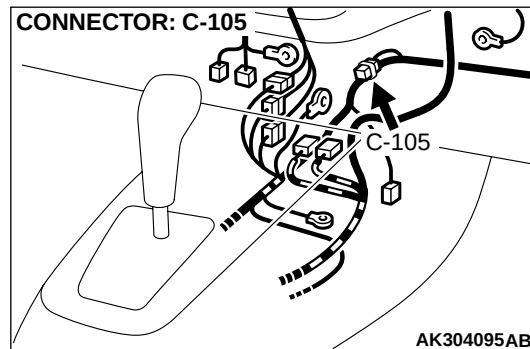
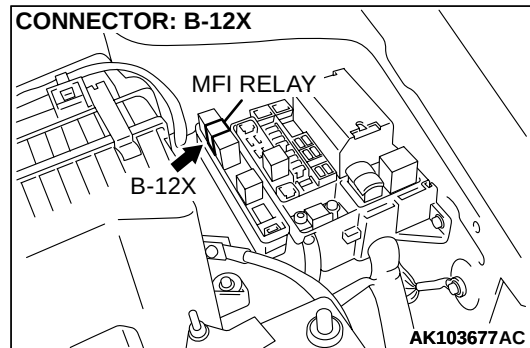
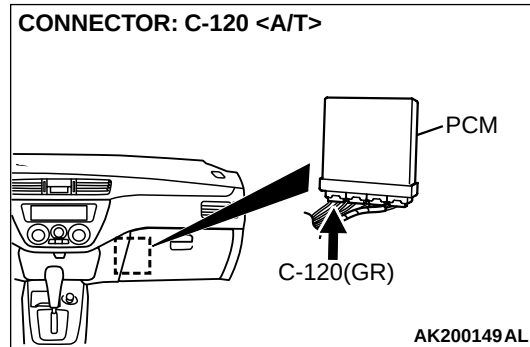
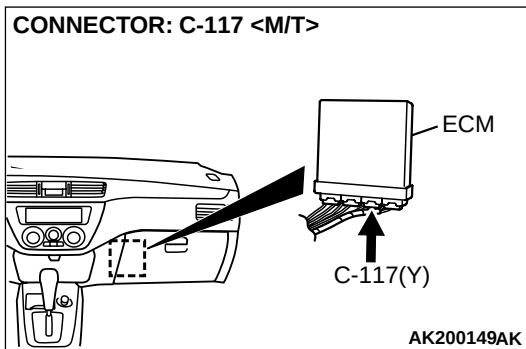
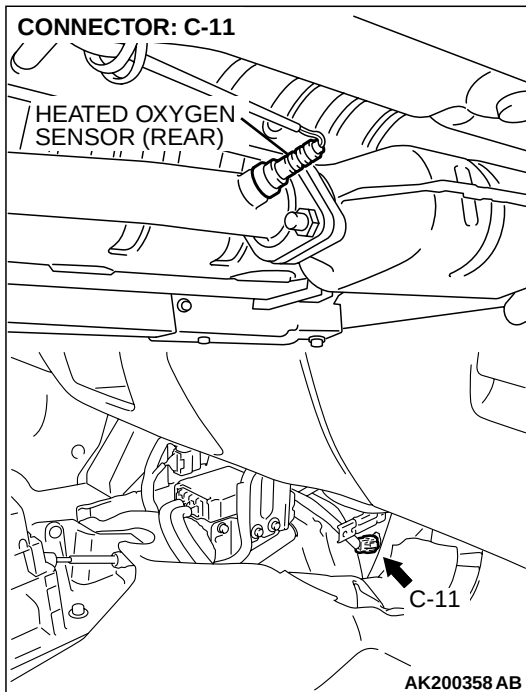


STEP 2. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 4 – Heated Oxygen Sensor Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0139 set?**YES :** Retry the troubleshooting.**NO :** The inspection is complete.**DTC P0141: Heated Oxygen Sensor Heater Circuit (sensor 2)****Heated Oxygen Sensor (rear) Heater Circuit**

AK000869



CIRCUIT OPERATION

- Power is supplied from the MFI relay (terminal No. 4) to the heated oxygen sensor (rear) heater.
- The ECM (terminal No. 54) <M/T> or PCM (terminal No. 26) <A/T> controls continuity to the heated oxygen sensor (rear) heater by turning the power transistor in the ECM <M/T> or PCM <A/T> "ON" and "OFF".

BACKGROUND

- The ECM <M/T> or PCM <A/T> checks whether the heater current is within a specified range when the heater is energized.

DESCRIPTIONS OF MONITOR METHODS

- An open or short circuit is detected while monitoring the amperage that flows to the heated oxygen sensor (rear) heater at the engine coolant temperature of 20°C (68°F) or above.

MONITOR EXECUTION

- Continuous

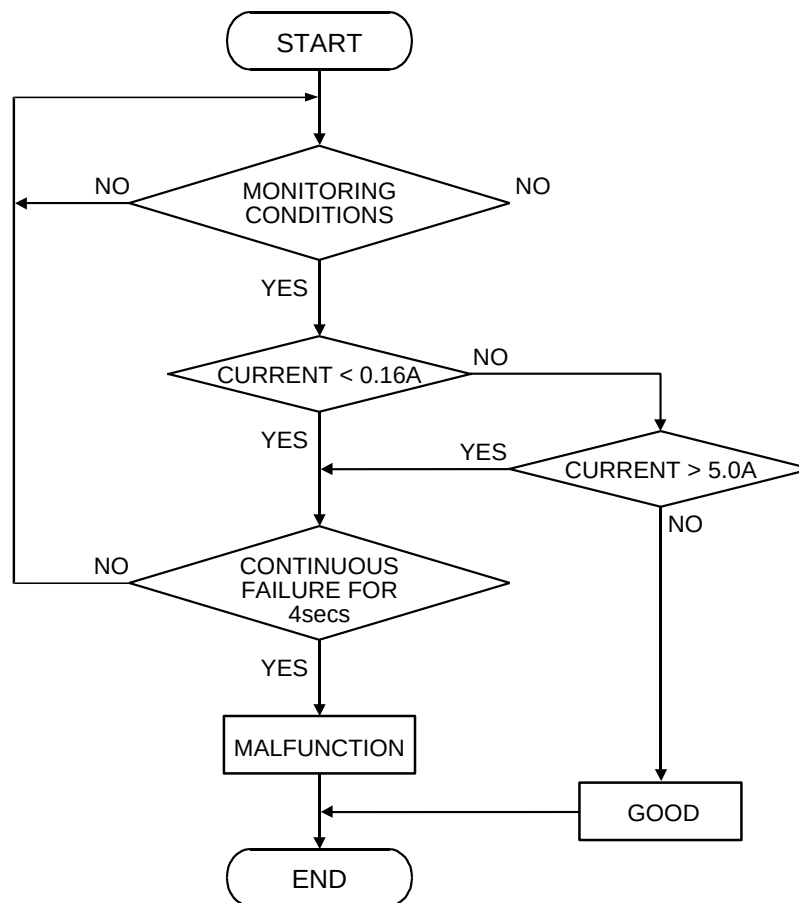
MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Not applicable

Sensor (The sensor below is determined to be normal)

- Engine coolant temperature sensor

DTC SET CONDITIONS**Logic Flow Chart**

AK302314

Check Conditions

- 60 seconds have elapsed from the start of the previous monitoring.
- Engine coolant temperature is higher than 20°C (68°F).
- While the heated oxygen sensor (rear) heater is on.
- Battery positive voltage is at between 11 and 16.5 volts.

Judgment Criteria

- Heater current of the heated oxygen sensor (rear) heater has continued to be lower than 0.16 ampere or higher than 5.0 ampere for 4 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Open or shorted heated oxygen sensor (rear) heater circuit.

- Open circuit in heated oxygen sensor (rear) heater.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tool:

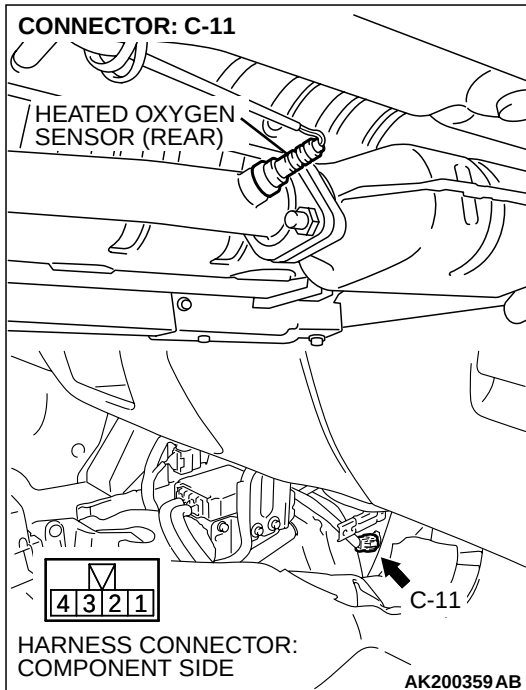
- MB991658: Test Harness Set

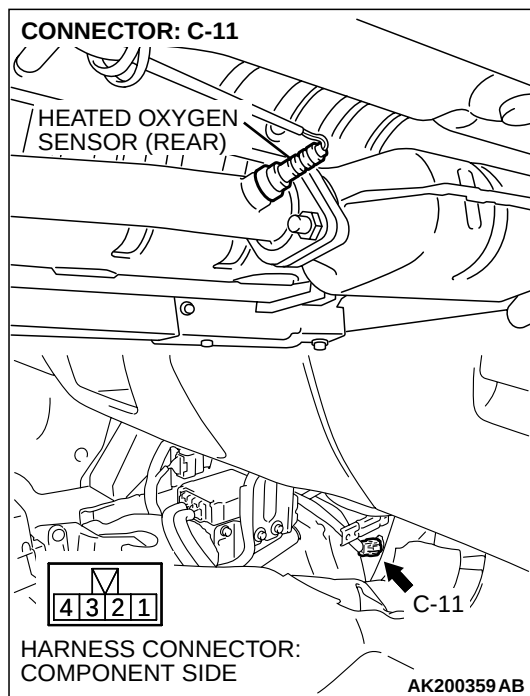
STEP 1. Check harness connector C-11 at the heated oxygen sensor (rear) for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 2.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



**STEP 2. Check the heated oxygen sensor (rear).**

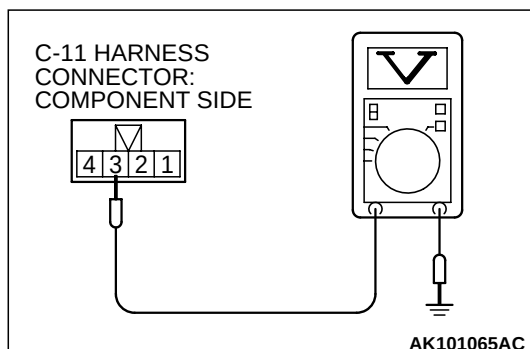
- (1) Disconnect heated oxygen sensor (rear) connector C-11 and connect test harness special tool, MB991658, to the connector on the heated oxygen (rear) sensor side.
- (2) Measure the resistance between heated oxygen sensor connector terminal No. 3 and terminal No. 4.

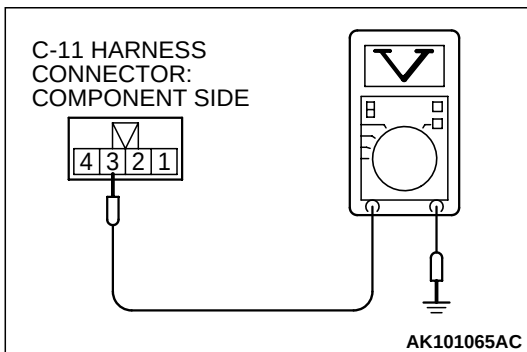
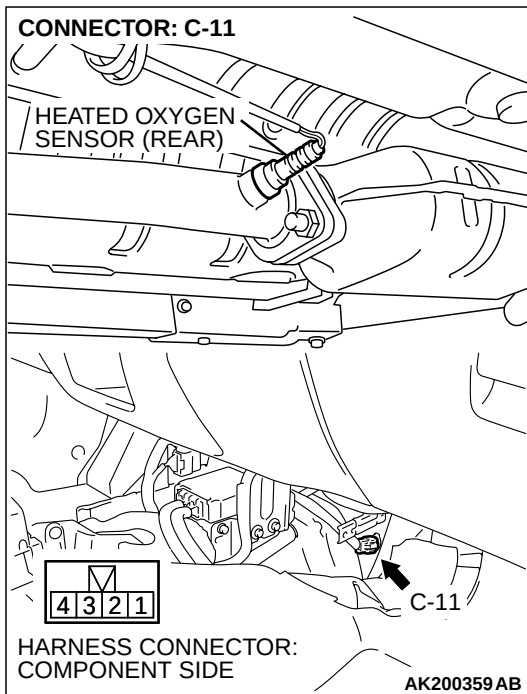
Standard value: 11 – 18 ohms [at 20°C (68°F)]

Q: Is the measured resistance between 11 and 18 ohms [at 20°C (68°F)]?

YES : Go to Step 3.

NO : Replace the heated oxygen sensor (rear). Then go to Step 12.





STEP 3. Measure the power supply voltage at heated oxygen sensor (rear) harness side connector C-11.

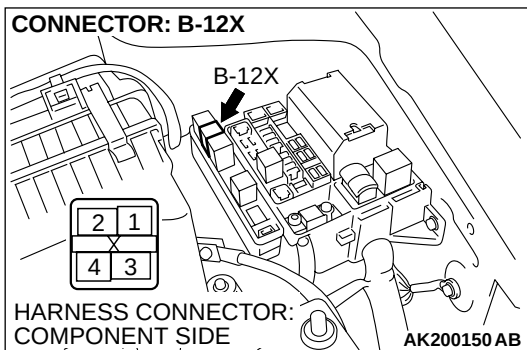
- (1) Disconnect connector C-11 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 3 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 5.

NO : Go to Step 4.



STEP 4. Check harness connector B-12X at the MFI relay for damage.

Q: Is the harness connector in good condition?

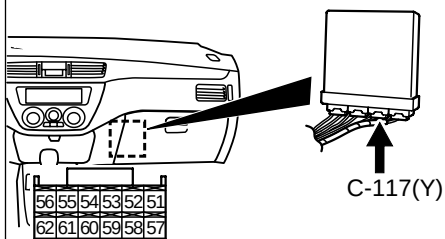
YES : Check connector C-105 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (rear) connector C-11 (terminal No. 3) because of open circuit or short circuit to ground. Then go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 5. Measure the power supply voltage at ECM connector C-117 <M/T> or PCM connector C-120 <A/T> by backprobing.

- (1) Do not disconnect connector C-117 <M/T> or C-120 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

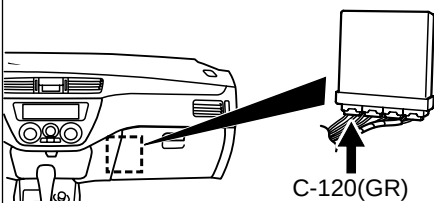
CONNECTOR: C-117 <M/T>



HARNESS CONNECTOR:
COMPONENT SIDE

AK200137AB

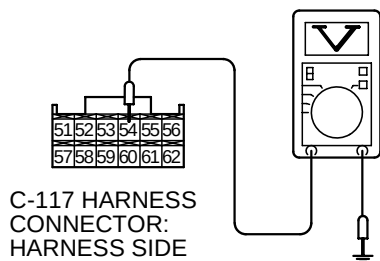
CONNECTOR: C-120 <A/T>



HARNESS CONNECTOR:
COMPONENT SIDE

AK200143AB

<M/T>



C-117 HARNESS
CONNECTOR:
HARNESS SIDE

AK000294AG

- (3) Measure the voltage between terminal No. 54 <M/T> or No. 26 <A/T> and ground by backprobing.

- Voltage should be battery positive voltage.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

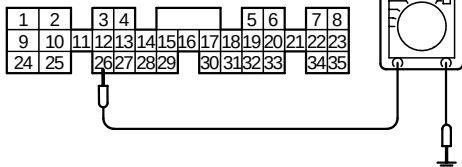
Q: Is battery positive voltage (approximately 12 volts) present?

YES : Go to Step 8.

NO : Go to Step 6.

<A/T>

C-120 HARNESS
CONNECTOR:
HARNESS SIDE



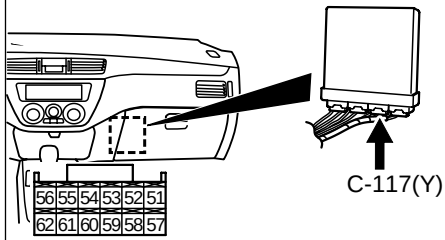
AK000295AI

STEP 6. Check harness connector C-117 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 7.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

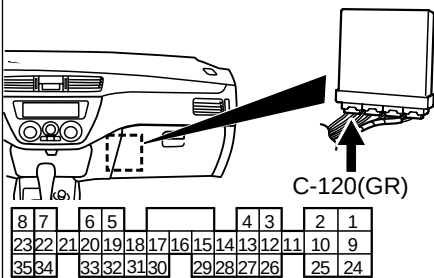
CONNECTOR: C-117 <M/T>



HARNESS CONNECTOR:
COMPONENT SIDE

AK200137 AB

CONNECTOR: C-120 <A/T>



HARNESS CONNECTOR:
COMPONENT SIDE

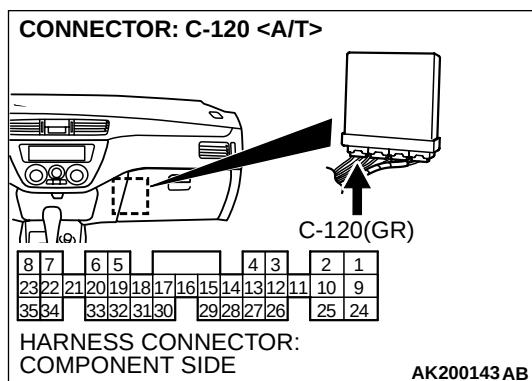
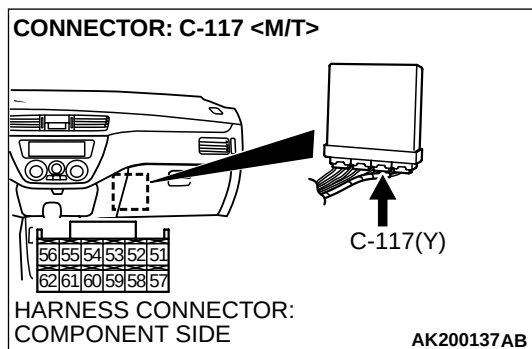
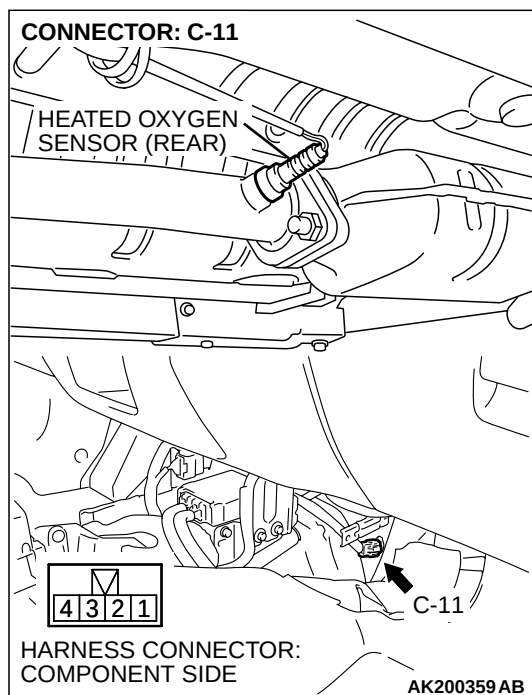
AK200143 AB

STEP 7. Check for open circuit and short circuit to ground between heated oxygen sensor (rear) connector C-11 (terminal No. 4) and ECM connector C-117 (terminal No. 54) <M/T> or PCM connector C-120 (terminal No. 26) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.

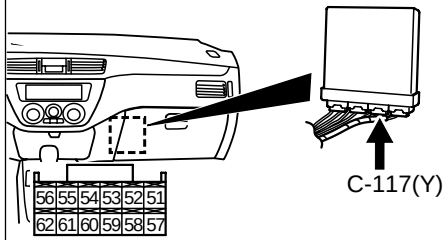


STEP 8. Check harness connector C-117 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 9.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

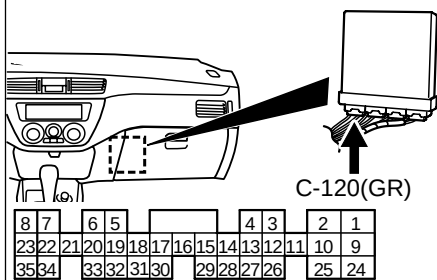
CONNECTOR: C-117 <M/T>



HARNESS CONNECTOR:
COMPONENT SIDE

AK200137 AB

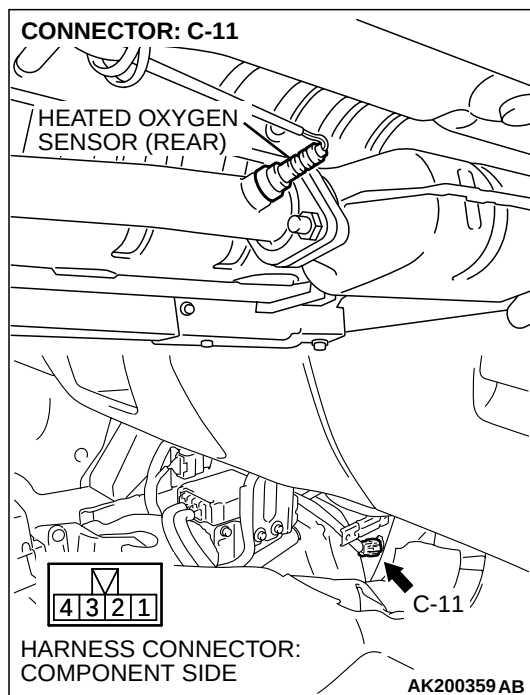
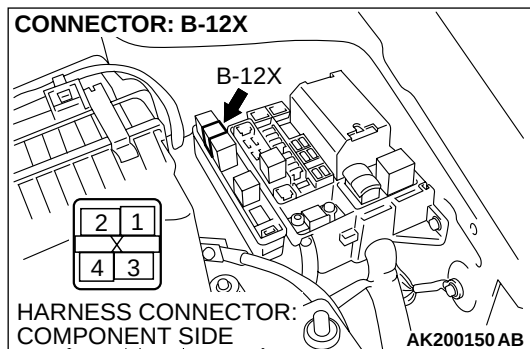
CONNECTOR: C-120 <A/T>



HARNESS CONNECTOR:
COMPONENT SIDE

AK200143 AB

STEP 9. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and heated oxygen sensor (rear) connector C-11 (terminal No. 3).



NOTE: Check harness after checking intermediate connector C-105. If intermediate connectors is damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Go to Step 10.

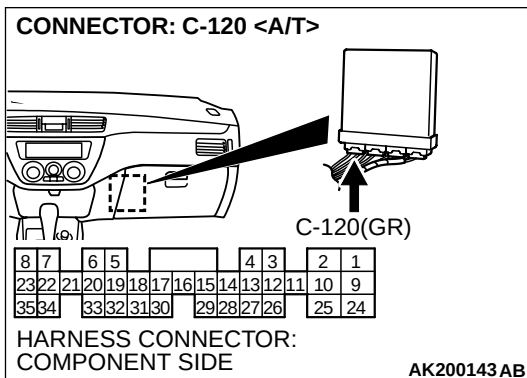
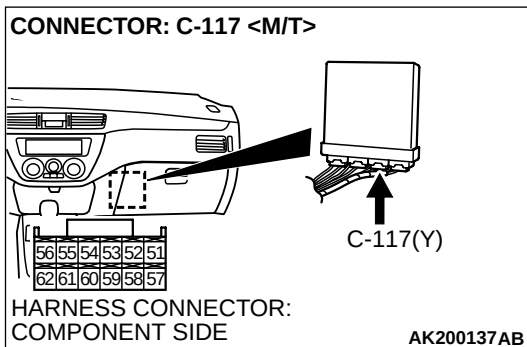
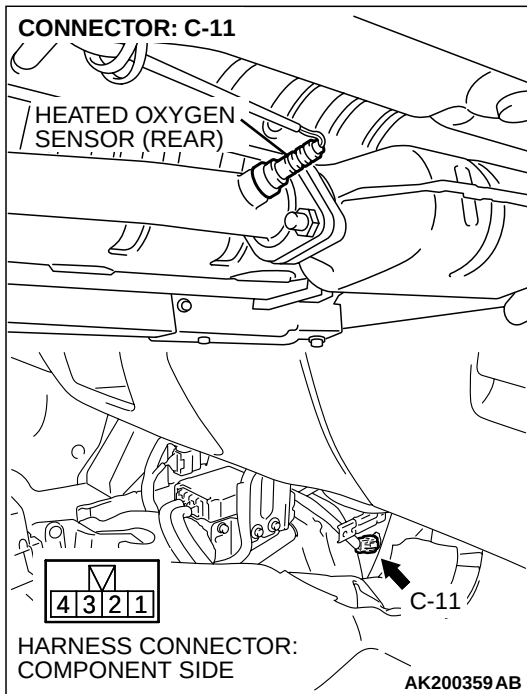
NO : Repair it. Then go to Step 12.

STEP 10. Check for harness damage between heated oxygen sensor (rear) connector C-11 (terminal No. 4) and ECM connector C-117 (terminal No. 54) <M/T> or PCM connector C-120 (terminal No. 26) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.



STEP 11. Check the trouble symptoms.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0141 set?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0141 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0171: System too Lean

System too Lean Circuit

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction. [P.13A-342](#)

CIRCUIT OPERATION

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction. [P.13A-342](#)

TECHNICAL DESCRIPTION

- If a malfunction occurs in the fuel system, the fuel trim value becomes too large.
- The ECM <M/T> or PCM <A/T> checks whether the fuel trim value is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

- If an excessively lean state of air-fuel ratio is detected from the learned air-fuel ratio (long-term fuel trim) and the feedback air-fuel ratio (short-term fuel trim), a malfunction is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

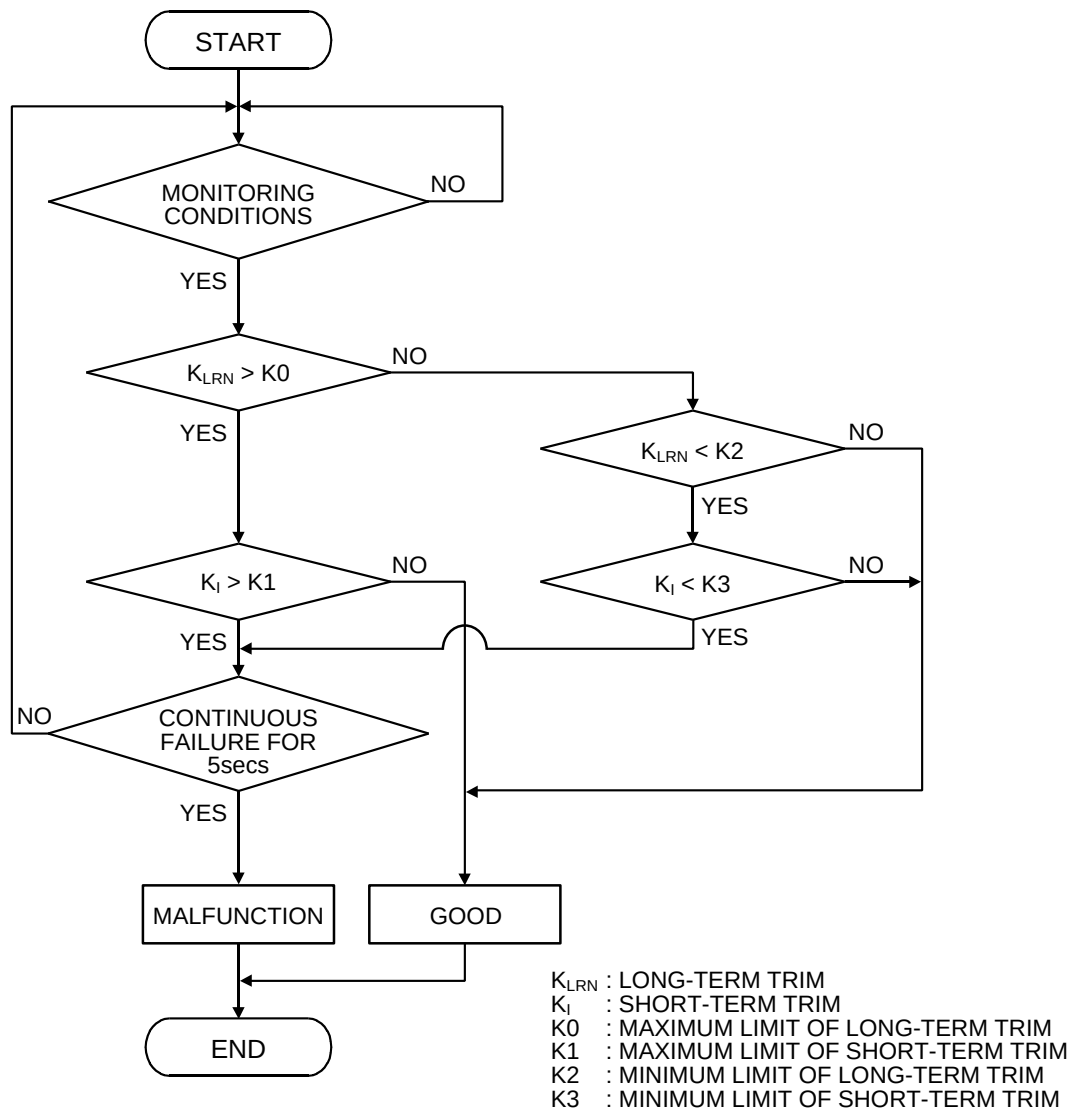
- Misfire monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302315

DTC SET CONDITIONS

Check Conditions

- Engine coolant temperature is lower than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is lower than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.

- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 81 Hz or more.

Judgment Criteria

- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.
- or
- Short-term fuel trim has continued to be higher than +10.0 percent for 5 seconds.

Check Conditions

- Engine coolant temperature is lower than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is lower than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 81 Hz or less.

Judgment Criteria

- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be higher than +15 percent for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is higher than 60°C (140°F) when the engine is started.
- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 81 Hz or more.

Judgment Criteria

- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be higher than +20.0 percent for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than approximately 100°C (212°F) when the engine is started.
- Intake air temperature is higher than 60°C (140°F) when the engine is started.

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 81 Hz or less.

Judgment Criteria

- Long-term fuel trim has continued to be higher than +12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be higher than +25.0 percent for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 77°C (171°F).
- Under the closed loop air/fuel ratio control.

Judgment Criteria

- Long-term fuel trim has continued to be +12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be +25.0 percent for 5 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Volume airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Air drawn in from gaps in gasket, seals, etc.
- Heated oxygen sensor failed.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Use of incorrect or contaminated fuel.
- ECM failed. <M/T>
- PCM failed. <A/T>

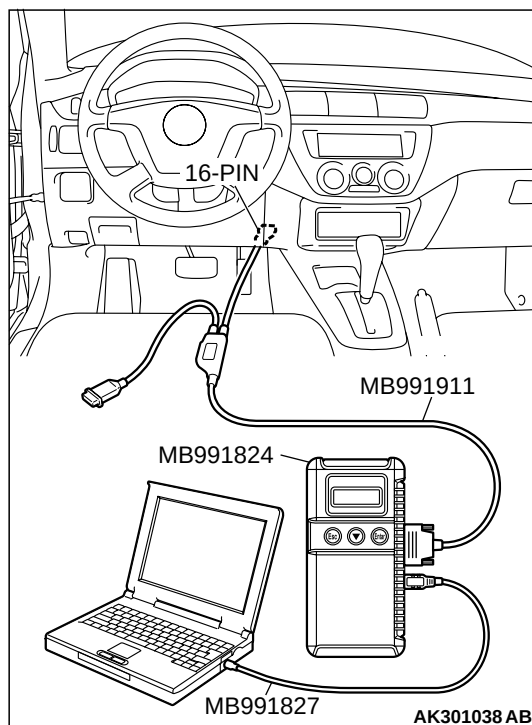
DIAGNOSIS**Required Special Tools:**

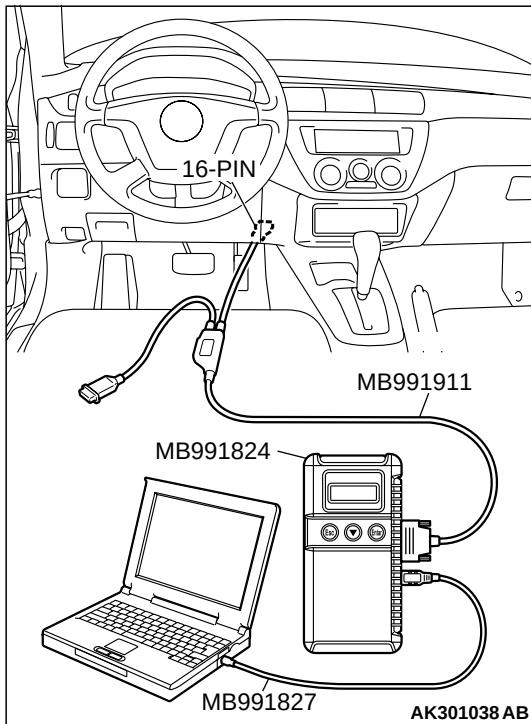
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Check for exhaust leaks.**Q: Are there any abnormalities?****YES** : Go to Step 2.**NO** : Repair it. Then go to Step 14.**STEP 2. Check for intake system vacuum leaks.****Q: Are there any abnormalities?****YES** : Go to Step 3.**NO** : Repair it. Then go to Step 14.**STEP 3. Using scan tool MB991958, check data list item 12: Volume Airflow Sensor.****⚠ CAUTION**

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

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 12, Volume Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - When idling, between 20 and 46 Hz (between 1.3 and 3.3 gm/s).
 - When 2,500 r/min, between 70 and 110 Hz (between 6.6 and 10.2 gm/s).
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?**YES** : Go to Step 4.**NO** : Refer to, DTC P0101 – Volume Airflow Circuit Range/Performance Problem [P.13A-35](#), DTC P0102 – Volume Airflow Circuit Low Input [P.13A-47](#).



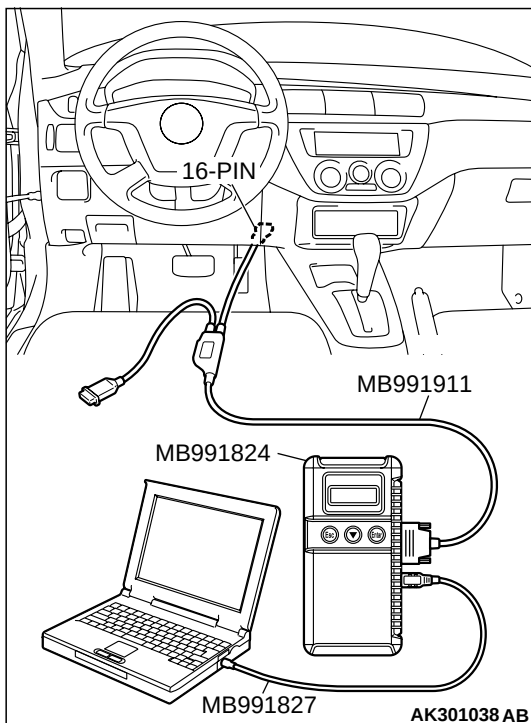
STEP 4. Using scan tool MB991958, check data list item 13: Intake Air Temperature Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
 - The intake air temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 5.

NO : Refer to, DTC P0111 – Intake Air Temperature Circuit Range/Performance Problem [P.13A-102](#), DTC P0112 – Intake Air Temperature Circuit Low Input [P.13A-111](#), DTC P0113 – Intake Air Temperature Circuit High Input [P.13A-118](#).



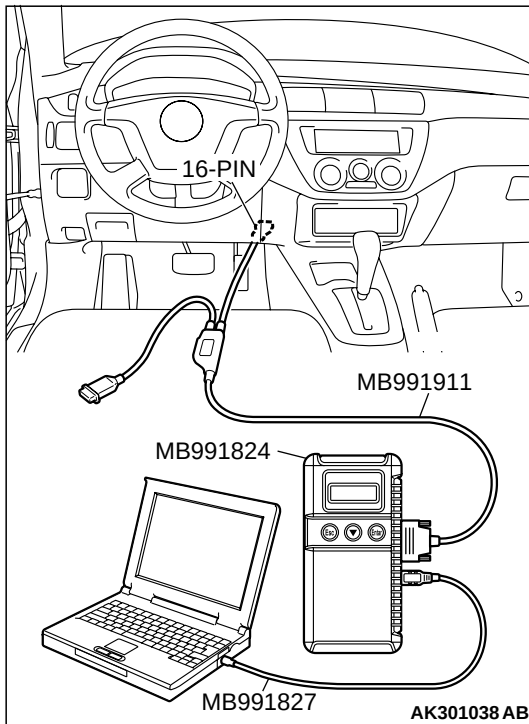
STEP 5. Using scan tool MB991958, check data list item 21: Engine Coolant Temperature Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 6.

NO : Refer to, DTC P0116 – Engine Coolant Temperature Circuit Range/Performance Problem [P.13A-127](#), DTC P0117 – Engine Coolant Temperature Circuit Low Input [P.13A-139](#), DTC P0118 – Engine Coolant Temperature Circuit High Input [P.13A-146](#).



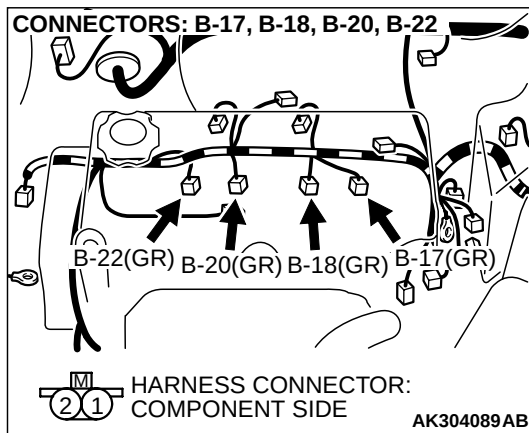
STEP 6. Using scan tool MB991958, check data list item 25: Barometric Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 25, Barometric Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 7.

NO : Refer to, DTC P2227 – Barometric Pressure Circuit Range/Performance Problem [P.13A-676](#), DTC P2228 – Barometric Pressure Circuit Low Input [P.13A-684](#), DTC P2229 – Barometric Pressure Circuit High Input [P.13A-703](#).

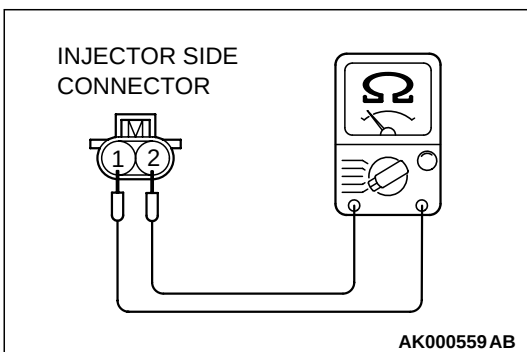
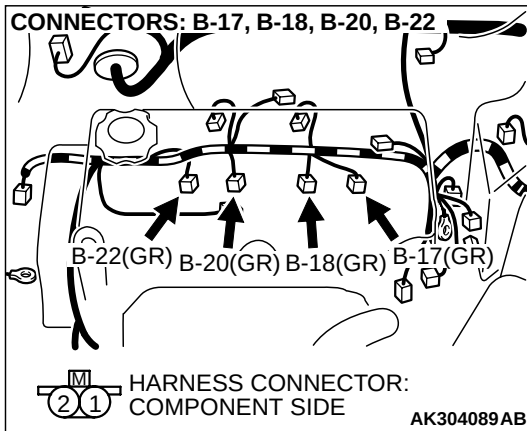


STEP 7. Check harness connectors B-17, B-18, B-20, B-22 at injector for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.



STEP 8. Check the injector.

(1) Disconnect each injector connector.

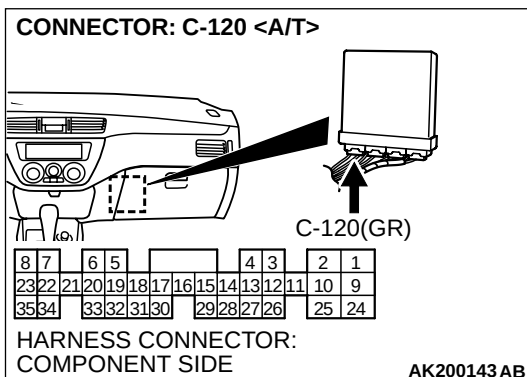
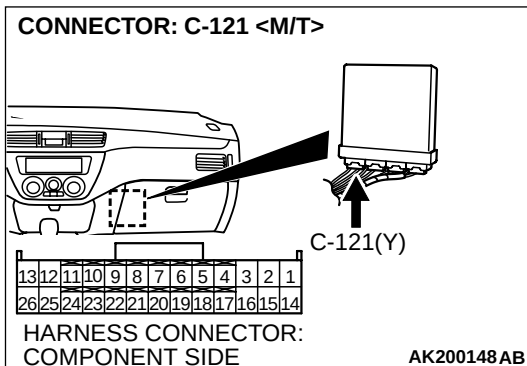
(2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 9.

NO : Replace the injector. Then go to Step 14.

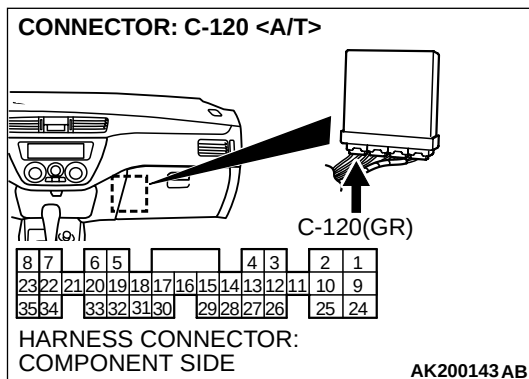
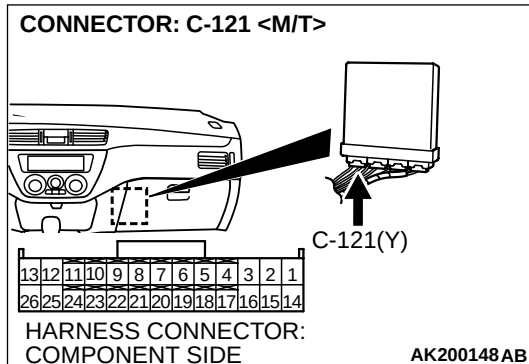
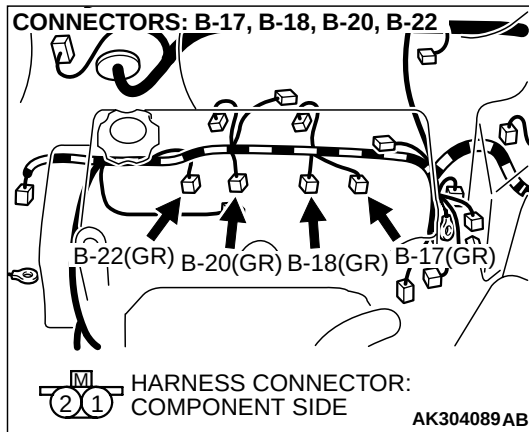


STEP 9. Check harness connector C-121 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 14.



STEP 10. Check for harness damage between injector connector and ECM connector <M/T> or PCM connector <A/T>.

- Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) <M/T> or PCM connector C-120 (terminal No. 1) <A/T> harness No. 1 cylinder.
- Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) <M/T> or PCM connector C-120 (terminal No. 9) <A/T> harness No. 2 cylinder.
- Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) <M/T> or PCM connector C-120 (terminal No. 24) <A/T> harness No. 3 cylinder.
- Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) <M/T> or PCM connector C-120 (terminal No. 2) <A/T> harness No. 4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 14.

STEP 11. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-905](#).

Q: Is the fuel pressure normal?

YES : Go to Step 12.

NO : Repair or replace it. Then go to Step 14.

STEP 12. Check for entry of foreign matter (water, kerosene, etc.) into fuel.

Q: Are there any abnormalities?

YES : Go to Step 13.

NO : Replace the fuel. Then go to Step 14.

STEP 13. Replace the injector.

(1) Replace the injector.

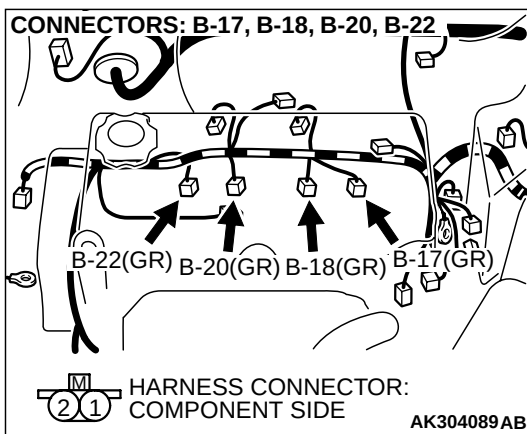
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor [P.13A-6](#).

(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0171 set?

YES : Replace the ECM or PCM. Then go to Step 14.

NO : The procedure is complete.



STEP 14. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0171 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0172: System too Rich

System too Rich Circuit

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction [P.13A-342](#).

CIRCUIT OPERATION

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction [P.13A-342](#).

TECHNICAL DESCRIPTION

- If a malfunction occurs in the fuel system, the fuel trim value becomes too small.
- The ECM <M/T> or PCM <A/T> checks whether the fuel trim value is within a specified range.

DESCRIPTIONS OF MONITOR METHODS

- If an excessively rich state of air-fuel ratio is detected from the learned air-fuel ratio (long-term fuel trim) and the feedback air-fuel ratio (short-term fuel trim), a malfunction is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

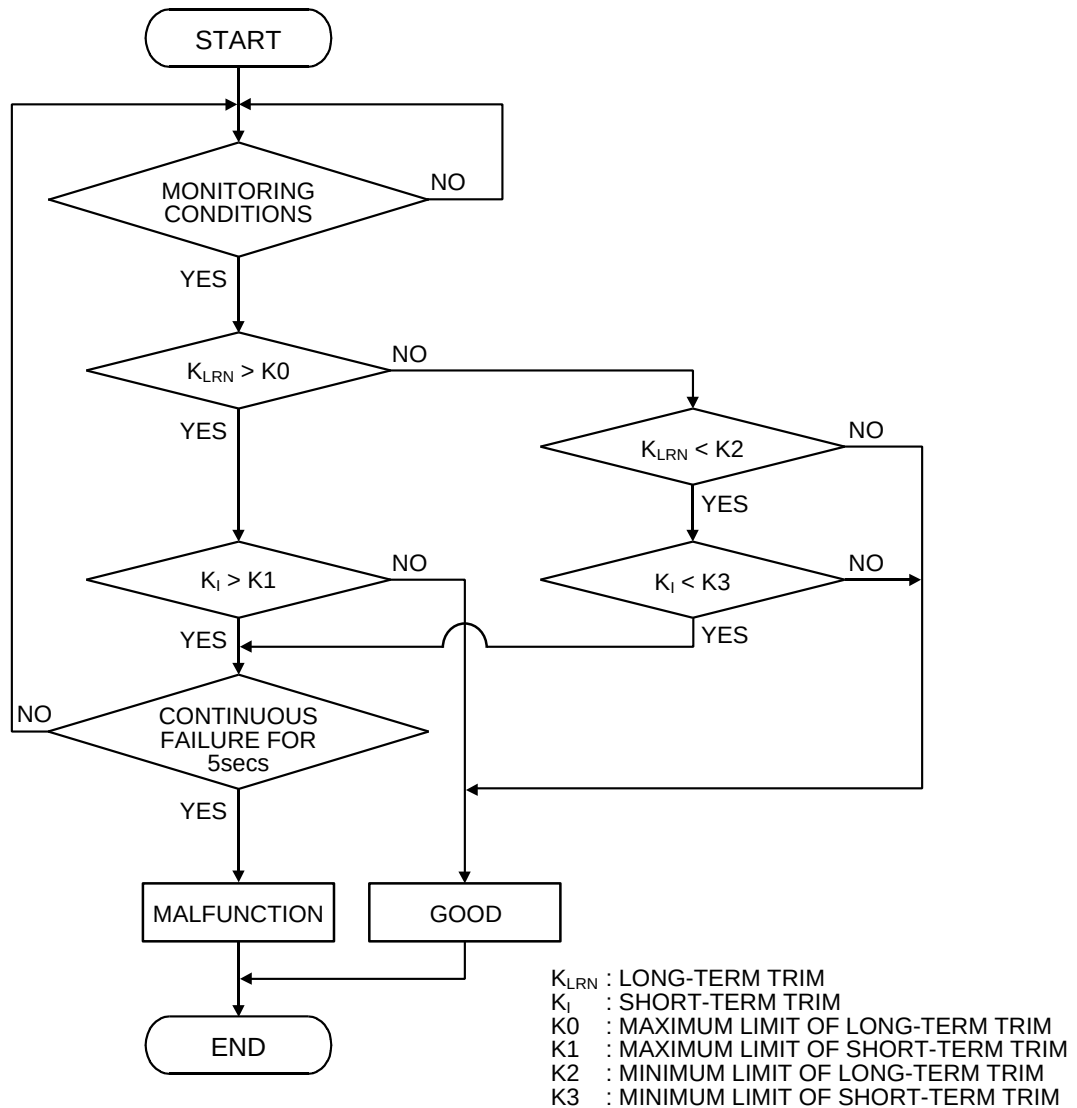
- Misfire monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302315

Check Conditions

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 81 Hz or more.

Judgment Criteria

- Long-term fuel trim has continued to be lower than -12.5 percent for 5 seconds.
- or
- Short-term fuel trim has continued to be lower than -6.0 percent for 5 seconds.

Check Conditions

- Under the closed loop air/fuel ratio control.
- Engine coolant temperature is higher than 77°C (171°F).
- Volume airflow sensor output frequency is 81 Hz or less.

Judgment Criteria

- Long-term fuel trim has continued to be lower than -12.5 percent for 5 seconds.
- or
- Short-term fuel trim has continued to be lower than -11.0 percent for 5 seconds.

Check Conditions

- Engine coolant temperature is higher than 77°C (171°F).
- Under the closed loop air/fuel ratio control.

Judgment Criteria

- Long-term fuel trim has continued to be -12.5 percent for 5 seconds.

or

- Short-term fuel trim has continued to be -25.0 percent for 5 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Volume airflow sensor failed.
- Injector failed.
- Incorrect fuel pressure.
- Heated oxygen sensor failed.
- Engine coolant temperature sensor failed.
- Intake air temperature sensor failed.
- Barometric pressure sensor failed.
- Exhaust leak.
- Use of incorrect or contaminated fuel.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check data list item 12: Volume Airflow Sensor.**⚠ CAUTION**

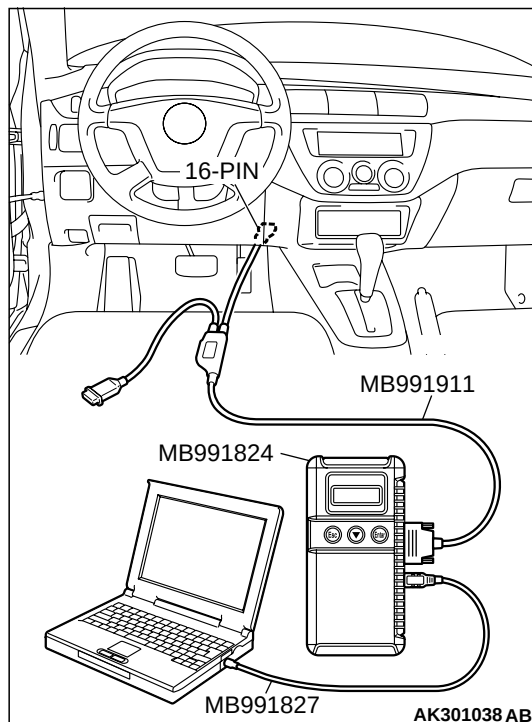
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

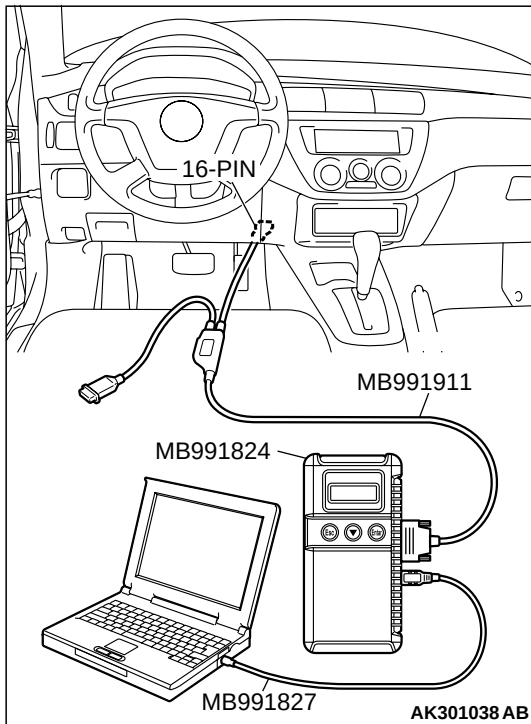
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 12, Volume Airflow Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 96°C (176°F to 205°F).
 - When idling, between 20 and 46 Hz (between 1.3 and 3.3 gm/s).
 - When 2,500 r/min, between 70 and 110 Hz (between 6.6 and 10.2 gm/s).
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.

NO : Refer to, DTC P0101 – Volume Airflow Circuit Range/Performance Problem [P.13A-35](#), DTC P0102 – Volume Airflow Circuit Low Input [P.13A-47](#).





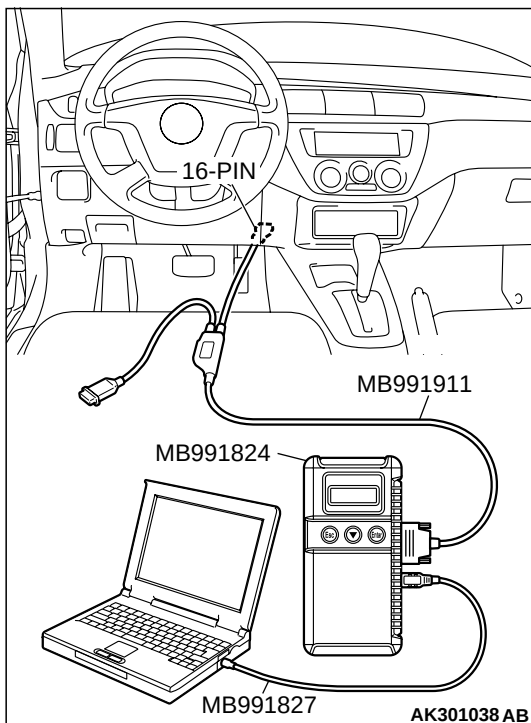
STEP 2. Using scan tool MB991958, check data list item 13: Intake Air Temperature Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 13, Intake Air Temperature Sensor.
 - The intake air temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 3.

NO : Refer to, DTC P0111 – Intake Air Temperature Circuit Range/Performance Problem [P.13A-102](#), DTC P0112 – Intake Air Temperature Circuit Low Input [P.13A-111](#), DTC P0113 – Intake Air Temperature Circuit High Input [P.13A-118](#).



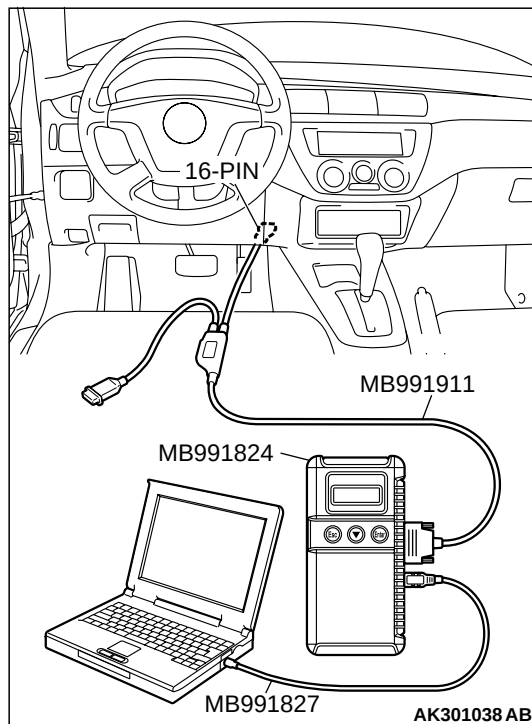
STEP 3. Using scan tool MB991958, check data list item 21: Engine Coolant Temperature Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 21, Engine Coolant Temperature Sensor.
 - The engine coolant temperature and temperature shown with the scan tool should approximately match.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 4.

NO : Refer to, DTC P0116 – Engine Coolant Temperature Circuit Range/Performance Problem [P.13A-127](#), DTC P0117 – Engine Coolant Temperature Circuit Low Input [P.13A-139](#), DTC P0118 – Engine Coolant Temperature Circuit High Input [P.13A-146](#).



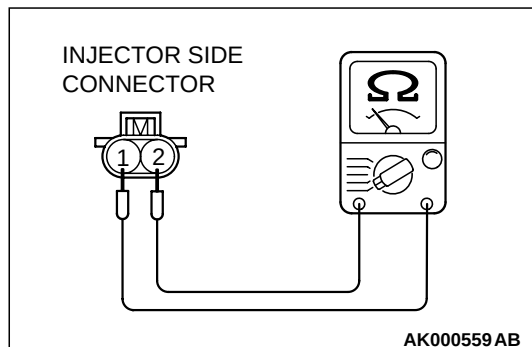
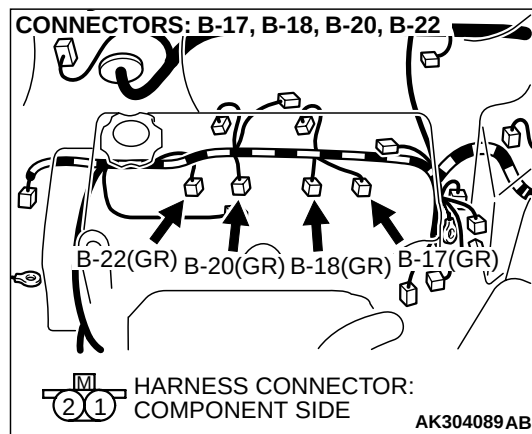
STEP 4. Using scan tool MB991958, check data list item 25: Barometric Pressure Sensor.

- (1) Turn the ignition switch to the "ON" position.
- (2) Set scan tool MB991958 to the data reading mode for item 25, Barometric Pressure Sensor.
 - When altitude is 0 m (0 foot), 101 kPa (29.8 in.Hg).
 - When altitude is 600 m (1,969 feet), 95 kPa (28.1 in.Hg).
 - When altitude is 1,200 m (3,937 feet), 88 kPa (26.0 in.Hg).
 - When altitude is 1,800 m (5,906 feet), 81 kPa (23.9 in.Hg).
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 5.

NO : Refer to, DTC P2227 – Barometric Pressure Circuit Range/Performance Problem [P.13A-676](#), DTC P2228 – Barometric Pressure Circuit Low Input [P.13A-684](#), DTC P2229 – Barometric Pressure Circuit High Input [P.13A-703](#).



STEP 5. Check the injector.

- (1) Disconnect each injector connector.

- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 6.

NO : Replace the injector. Then go to Step 8.

STEP 6. Check the fuel pressure.

Refer to On-vehicle Service – Fuel Pressure Test [P.13A-905](#).

Q: Is the fuel pressure normal?

YES : Go to Step 7.

NO : Repair or replace it. Then go to Step 8.

STEP 7. Replace the injector.

(1) Replace the injector.

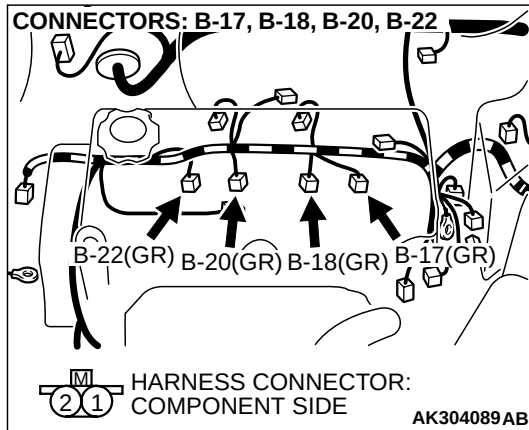
(2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor [P.13A-6](#).

(3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0172 set?

YES : Replace the ECM or PCM. Then go to Step 8.

NO : The procedure is complete.



STEP 8. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 2 – Fuel Trim Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

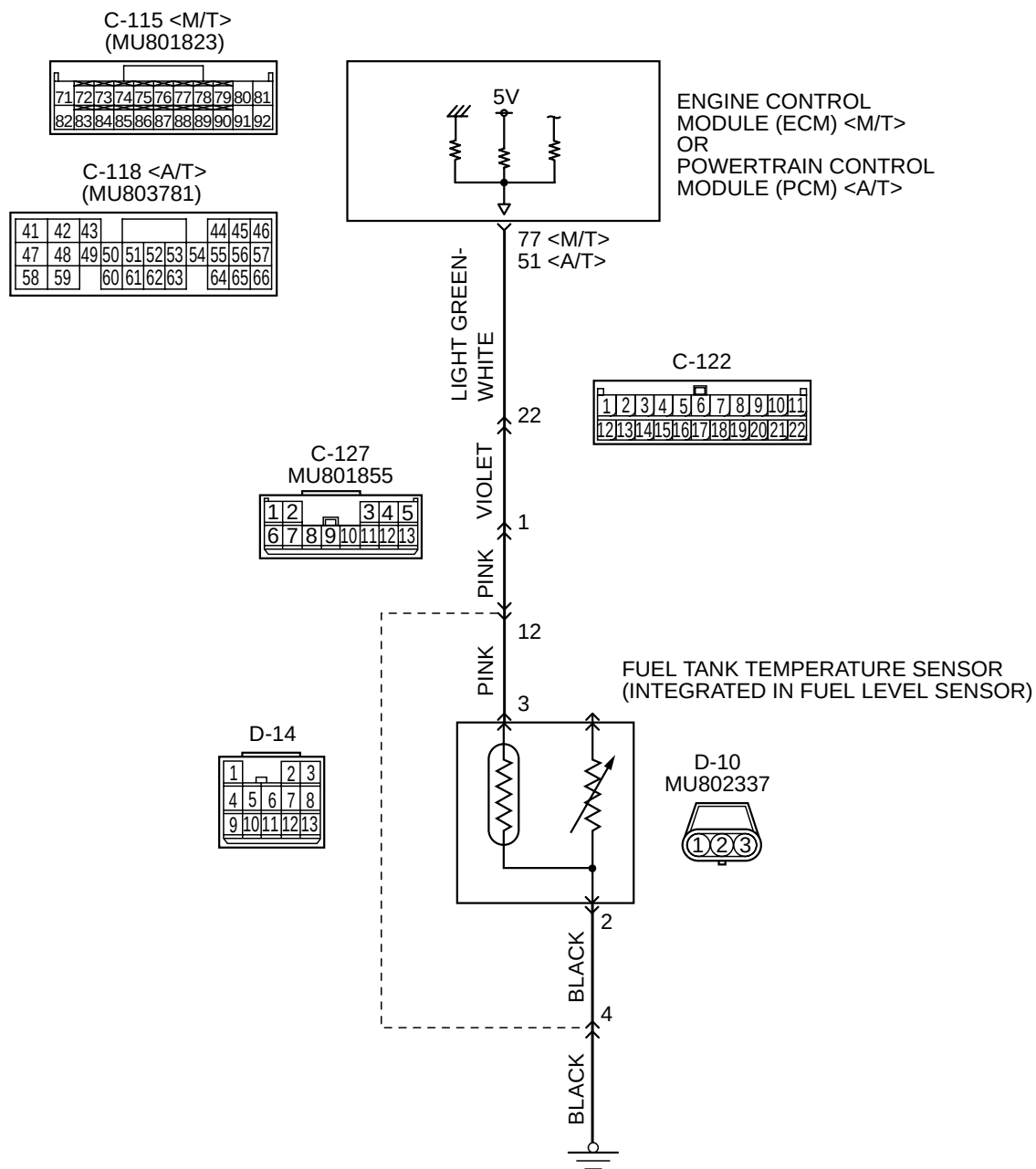
Q: Is DTC P0172 set?

YES : Retry the troubleshooting.

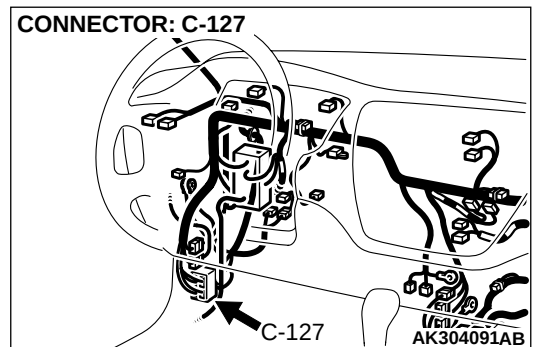
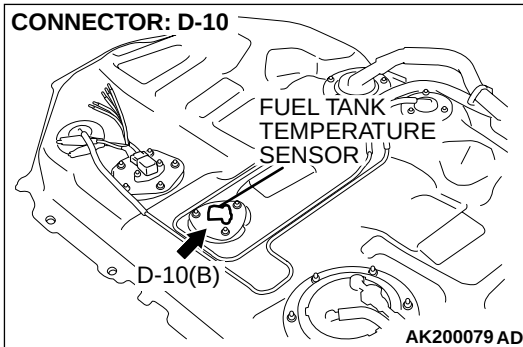
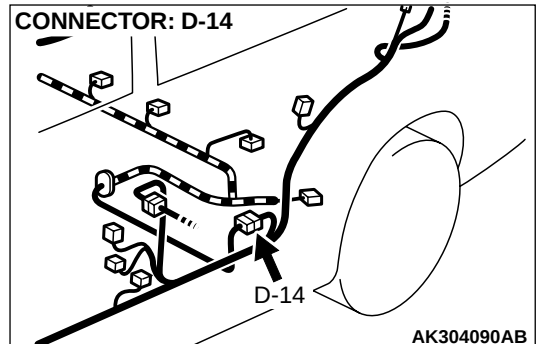
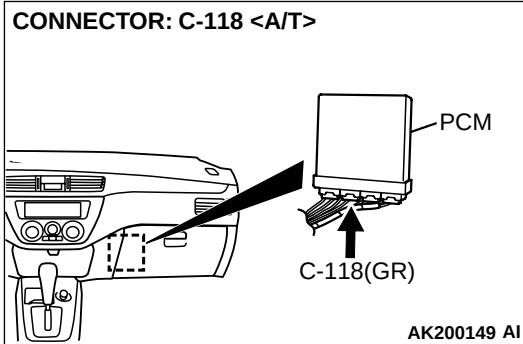
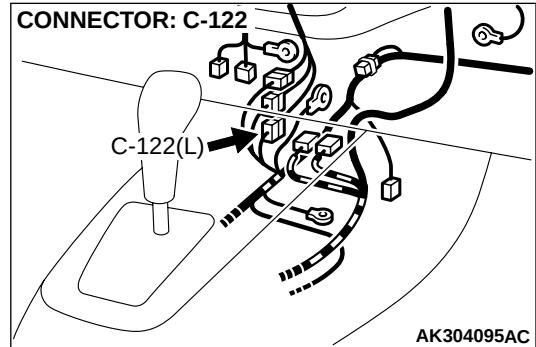
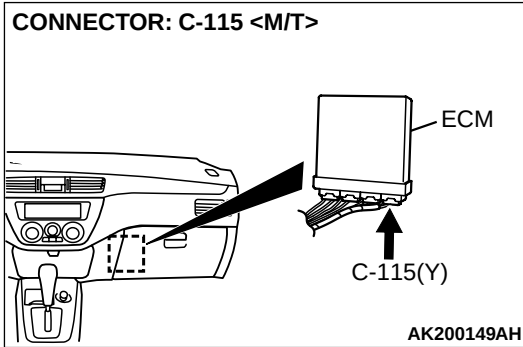
NO : The inspection is complete.

DTC P0181: Fuel Tank Temperature Sensor Circuit Range/Performance

Fuel Tank Temperature Sensor Circuit



AK302343



CIRCUIT OPERATION

- 5-volt voltage is applied to the fuel tank temperature sensor output terminal (terminal No. 3) from the ECM (terminal No. 77) <M/T> or PCM (terminal No. 51) <A/T> via the resistor in the ECM <M/T> or PCM <A/T>.
- The fuel tank temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases. The ground terminal (terminal No. 2) is grounded to the vehicle body.

TECHNICAL DESCRIPTION

- The fuel tank temperature sensor converts the fuel tank temperature to a voltage.

- The ECM <M/T> or PCM<A/T> detects the fuel tank temperature in the fuel tank with this output voltage.

DESCRIPTIONS OF MONITOR METHODS

- If the fuel tank temperature is found to be higher than the engine coolant temperature by a prescribed value, through a comparison between the engine coolant temperature and the fuel tank temperature when the engine is started cold, a malfunction is determined to have occurred.

MONITOR EXECUTION

- Once per driving cycle

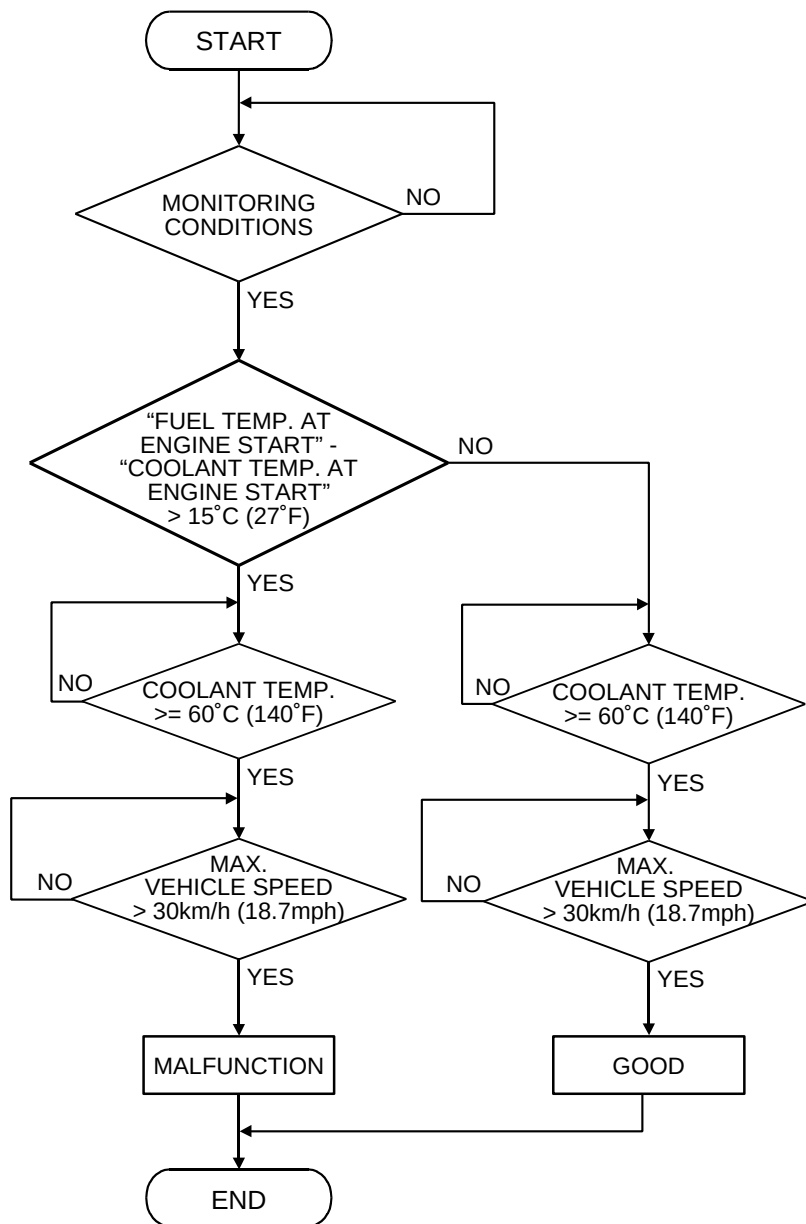
MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

- Not applicable

Sensor (The sensor below is determined to be normal)

- Intake air temperature sensor
- Engine coolant temperature sensor

DTC SET CONDITIONS**Logic Flow Chart**

Check Conditions

- The engine coolant temperature – intake air temperature is 5°C (9°F) or less when the engine is started.
- The engine coolant temperature is between –10°C (14°F) and 36°C (96.8°F) when the engine is started.
- Engine coolant temperature is higher than 60°C (140°F).
- Maximum vehicle speed is higher than 30 km/h (18.7 mph) after the starting sequence has been completed.

Judgement Criteria

- The fuel tank temperature – engine coolant temperature is 15° C (27° F) or more when the engine is started.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Fuel tank temperature sensor failed.
- Open or shorted fuel tank temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

NOTE: A diagnostic trouble code (DTC) could be output if the engine coolant is changed as indicated below. Because this is not a failure, the DTC must be erased.

Make sure to test drive the vehicle in accordance with the drive cycle pattern in order to verify that a DTC will not be output.

- *The engine and the radiator have been flushed repeatedly when the engine coolant temperature was high (or the fuel tank temperature was high).*

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check data list item 4A: Fuel Tank Temperature Sensor.

⚠ CAUTION

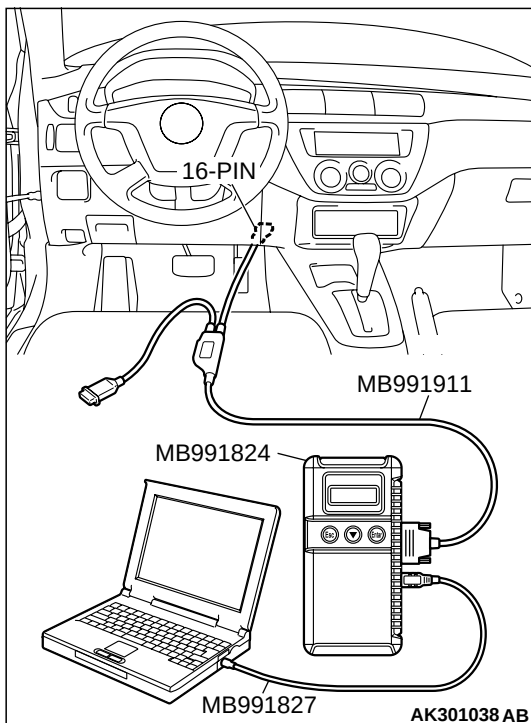
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

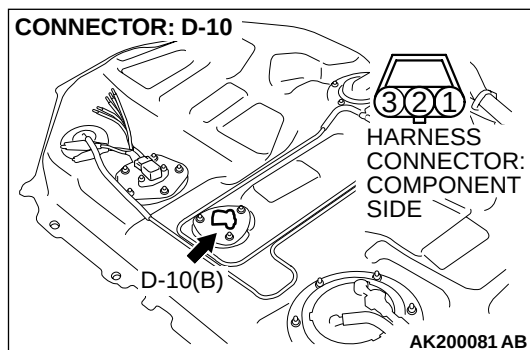
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 4A, Fuel Tank Temperature Sensor.
 - With the engine cool, the fuel tank temperature should be approximately the same as ambient air temperature.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.



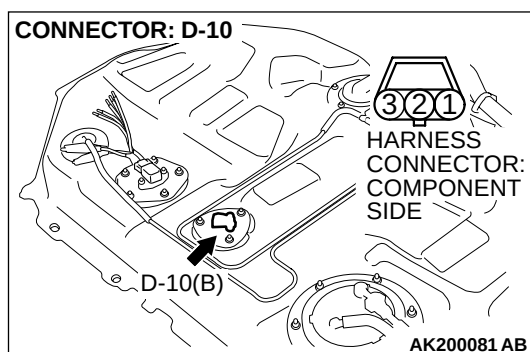


STEP 2. Check connector D-10 at the fuel tank temperature sensor for damage.

Q: Is the connector in good condition?

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 3. Check the fuel tank temperature sensor.

(1) Disconnect the fuel tank temperature sensor connector D-10.

(2) Measure the resistance between terminal No. 2 and No. 3 of the fuel tank temperature sensor.

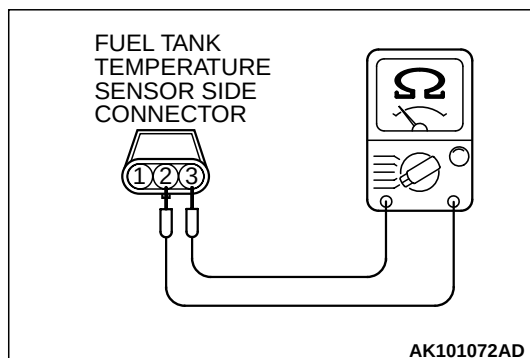
Standard value:

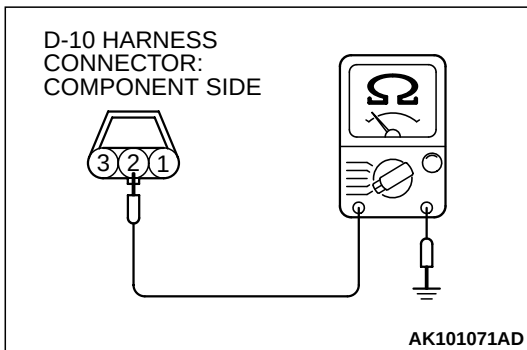
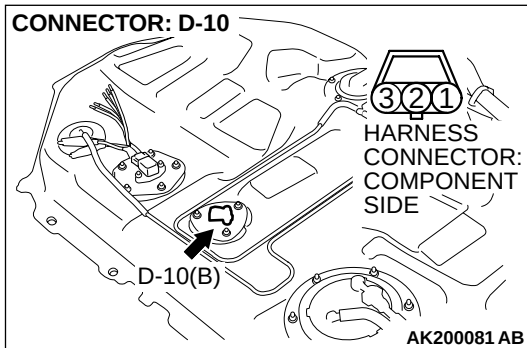
0.5 – 12.0 k Ω

Q: Is the resistance between 0.5 and 12.0 k Ω ?

YES : Go to Step 4.

NO : Replace the tank fuel tank temperature sensor. Then go to Step 12.





STEP 4. Check for continuity at fuel tank temperature sensor harness side connector D-10.

(1) Disconnect connector D-10 and measure at the harness side.

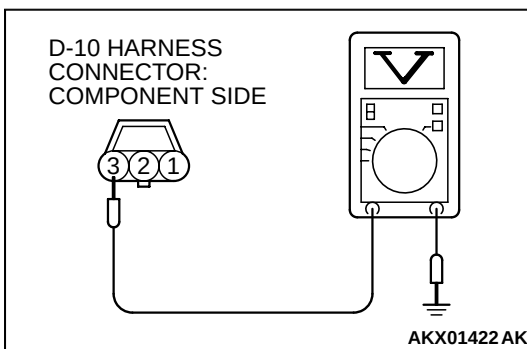
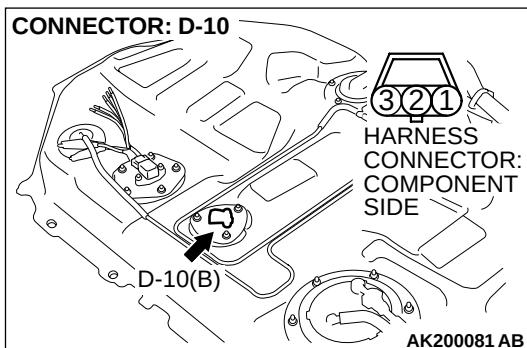
(2) Check for the continuity between terminal No. 2 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 5.

NO : Check connector D-14 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between fuel tank temperature sensor connector D-10 (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 12.



STEP 5. Measure the sensor supply voltage at fuel tank temperature sensor harness side connector D-10.

(1) Disconnect connector D-10 and measure at the harness side.

(2) Turn the ignition switch to the "ON" position.

(3) Measure the voltage between terminal No. 3 and ground.

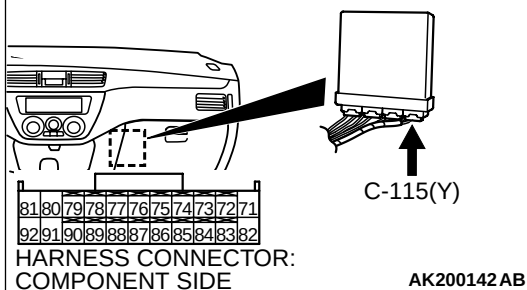
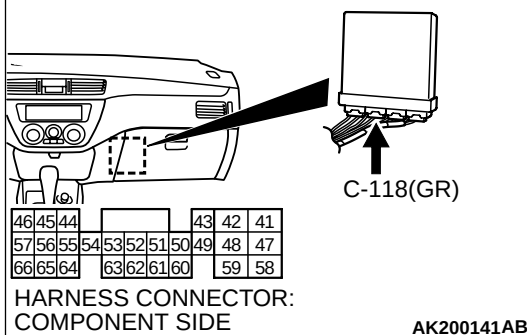
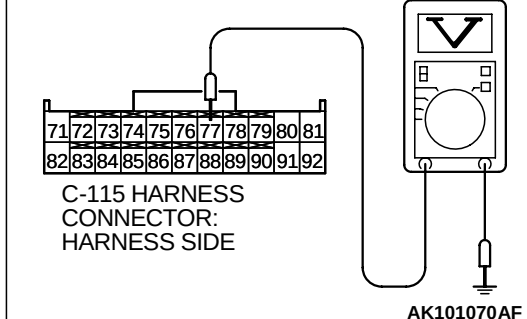
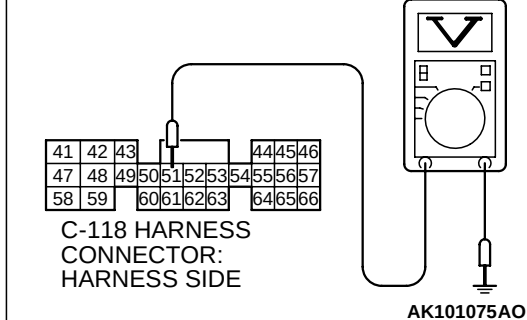
- Voltage should be between 4.5 and 4.9 volts.

(4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

YES : Go to Step 6.

NO : Go to Step 10.

CONNECTOR: C-115 <M/T>**CONNECTOR: C-118 <A/T>****<M/T>****<A/T>****STEP 6. Measure the sensor supply voltage at ECM connector C-115 <M/T> or PCM connector C-118 <A/T> by backprobing.**

- (1) Do not disconnect the ECM connector C-115 <M/T> or PCM connector C-118 <A/T>.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 77 <M/T> or terminal No. 51 <A/T> and ground by backprobing.
 - When fuel tank temperature is 0°C (32°F), voltage should be 2.7 and 3.1 volts.
 - When fuel tank temperature is 20°C (68°F), voltage should be 2.1 and 2.5 volts.
 - When fuel tank temperature is 40°C (104°F), voltage should be 1.6 and 2.0 volts.
 - When fuel tank temperature is 80°C (176°F), voltage should be 0.8 and 1.2 volts.

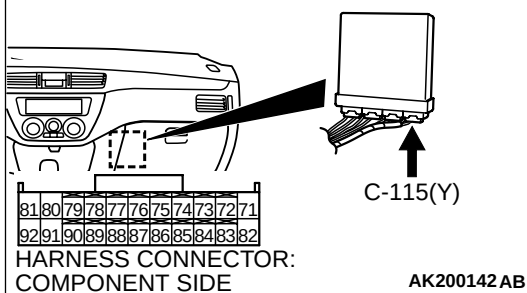
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage within the specified range?

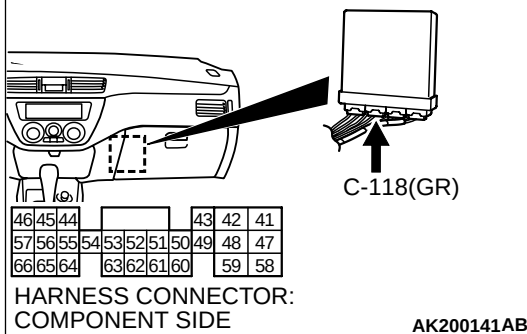
YES : Go to Step 7.

NO : Go to Step 8.

CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>

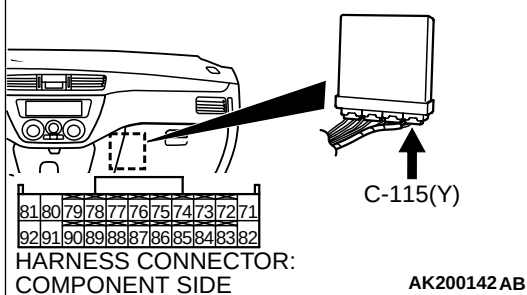


STEP 7. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

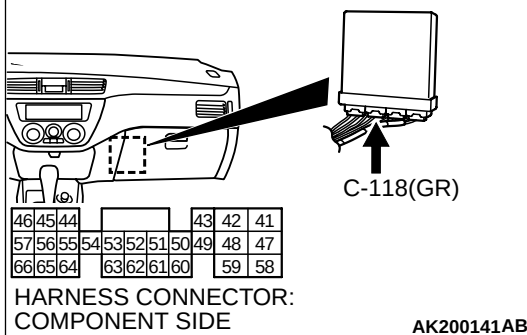
YES : Check connector C-122, C-127 and D-14 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector are in good condition, repair harness wire between fuel tank temperature sensor connector D-10 (terminal No. 3) and ECM connector C-115 (terminal No. 77) <M/T> or PCM connector C-118 (terminal No. 51) <A/T> because of open circuit. Then go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>



STEP 8. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 9.

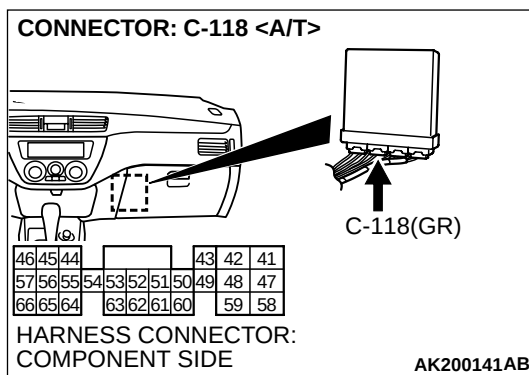
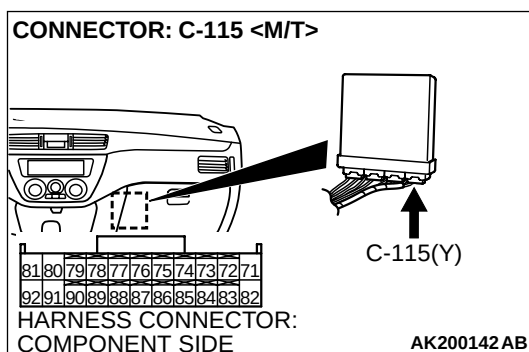
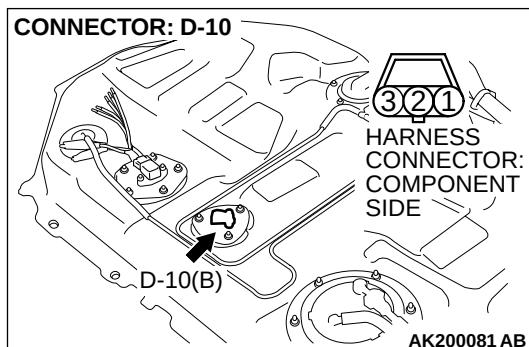
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 9. Check for short circuit to ground between fuel tank temperature sensor connector D-10 (terminal No. 3) and ECM connector C-115 (terminal No. 77) <M/T> or PCM connector C-118 (terminal No. 51) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.

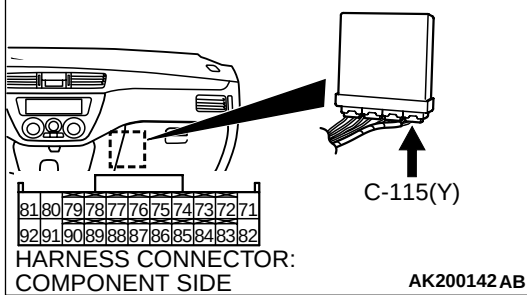


STEP 10. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

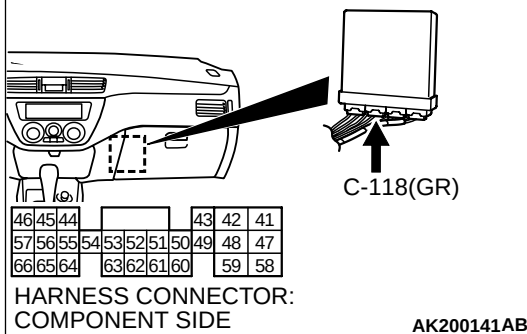
YES : Go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

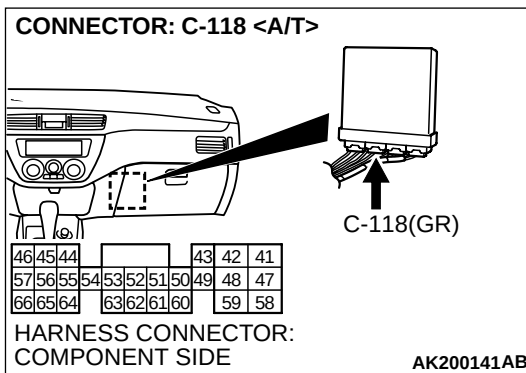
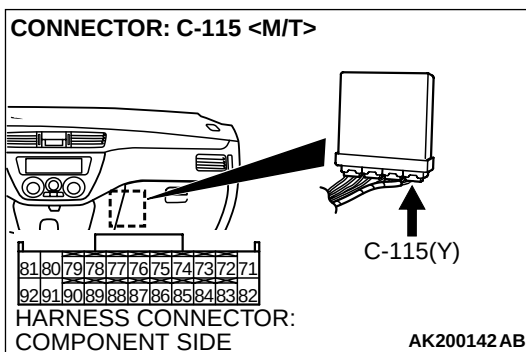
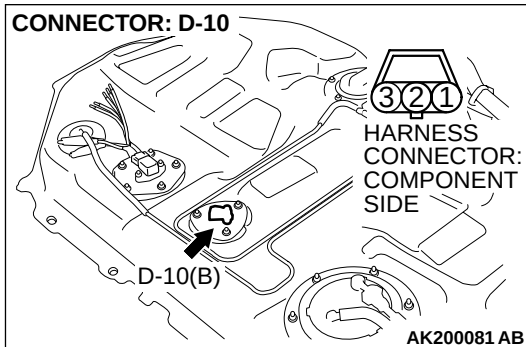
CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>



STEP 11. Check for harness damage between fuel tank temperature sensor connector D-10 (terminal No. 3) and ECM connector C-115 (terminal No. 77) <M/T> or PCM connector C-118 (terminal No. 51) <A/T>.



NOTE: Check harness after checking intermediate connector C-122, C-127 and D-14. If intermediate connector are damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 12.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.

STEP 12. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

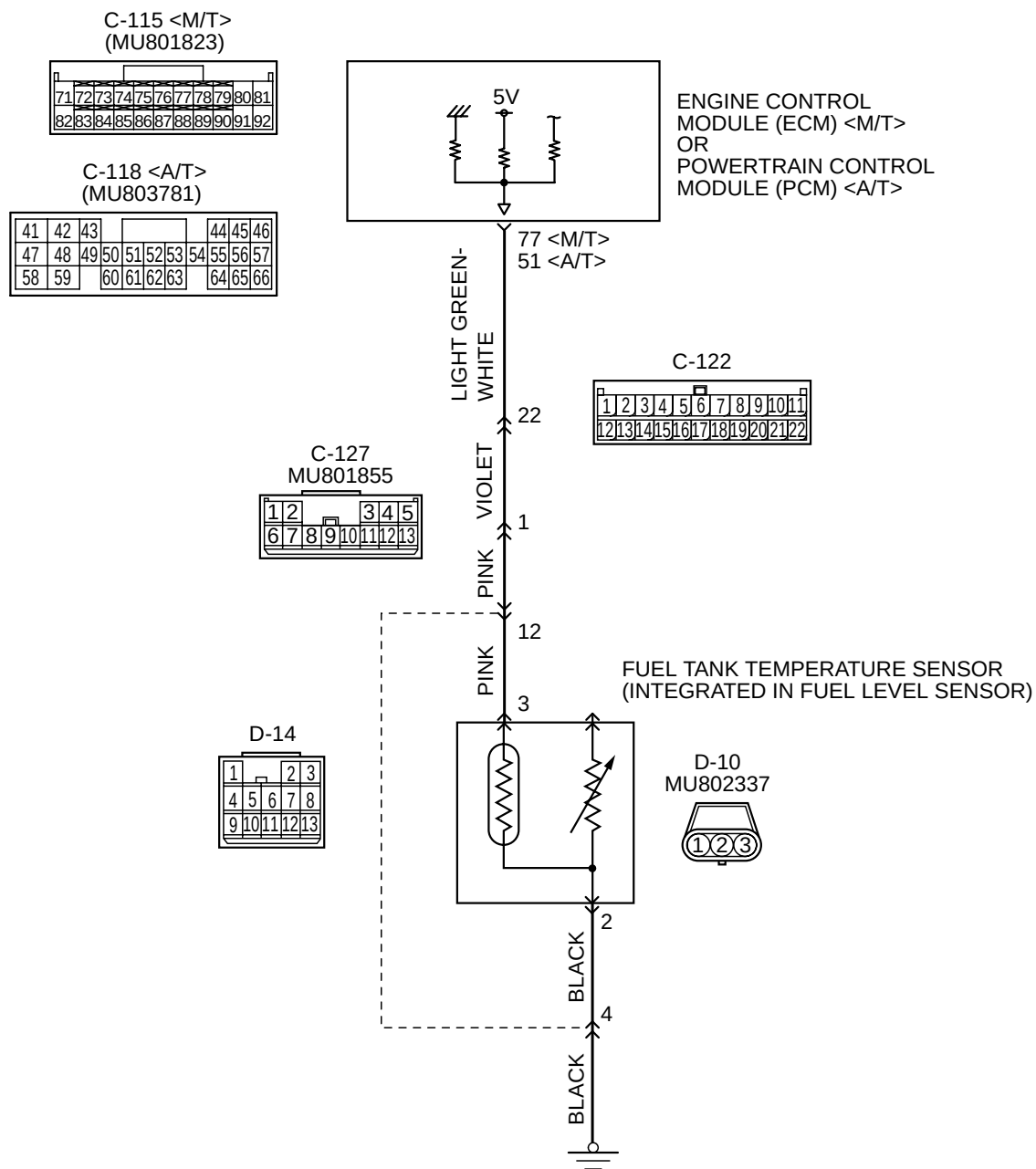
Q: Is DTC P0181 set?

YES : Retry the troubleshooting.

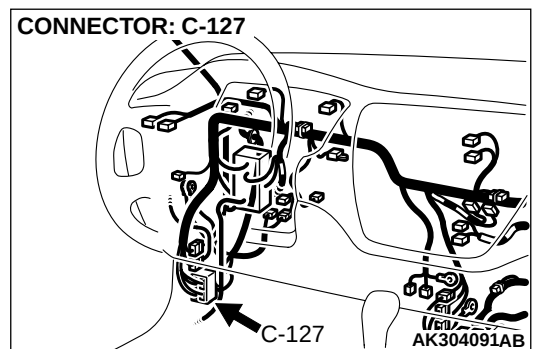
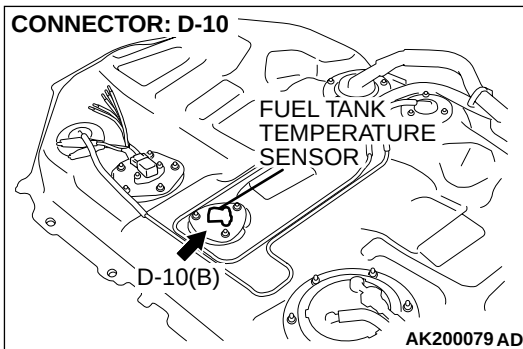
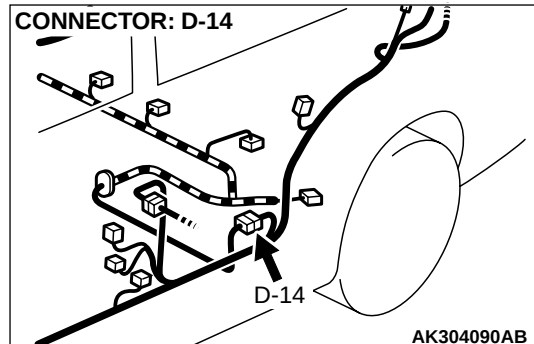
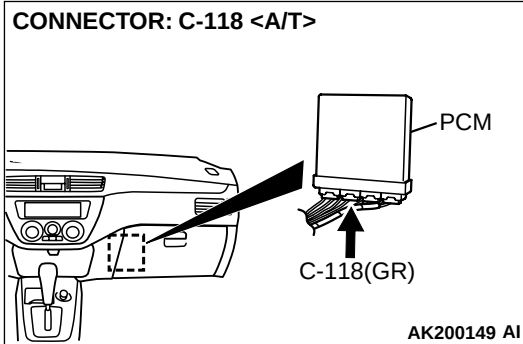
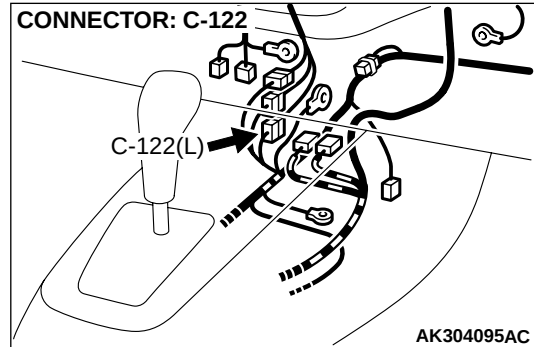
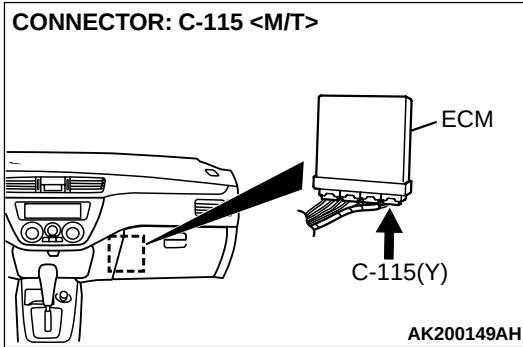
NO : The inspection is complete.

DTC P0182: Fuel Tank Temperature Sensor Circuit Low Input

Fuel Tank Temperature Sensor Circuit



AK302343



CIRCUIT OPERATION

- 5-volt voltage is applied to the fuel tank temperature sensor output terminal (terminal No. 3) from the ECM (terminal No. 77) <M/T> or PCM (terminal No. 51) <A/T> via the resistor in the ECM <M/T> or PCM <A/T>.
- The fuel tank temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases. The ground terminal (terminal No. 2) is grounded to the vehicle body.

TECHNICAL DESCRIPTION

- The fuel tank temperature sensor converts the fuel tank temperature to a voltage.
- The ECM <M/T> or PCM <A/T> detects the fuel tank temperature in the fuel tank with this output voltage.

DESCRIPTIONS OF MONITOR METHODS

- A short circuit is detected while monitoring the fuel tank temperature sensor output.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

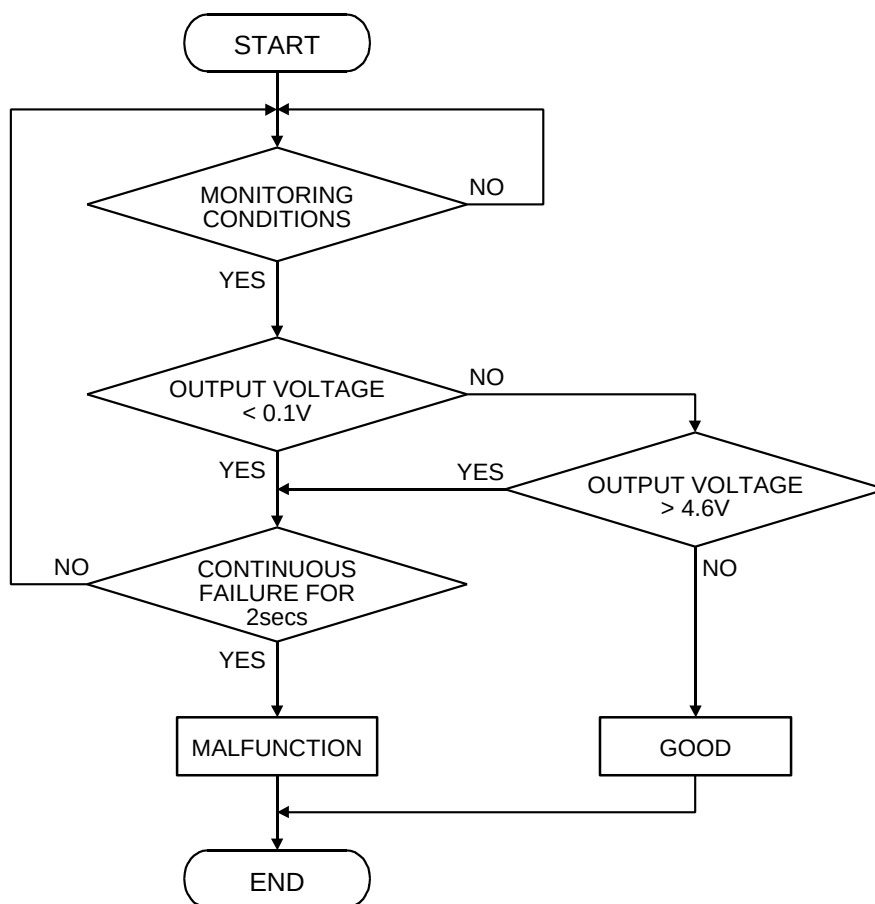
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302317

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgement Criteria

- Fuel tank temperature sensor output voltage has continued to be 0.1 volt or lower for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Fuel tank temperature sensor failed.
- Open or shorted fuel tank temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check data list item 4A: Fuel Tank Temperature Sensor.

⚠ CAUTION

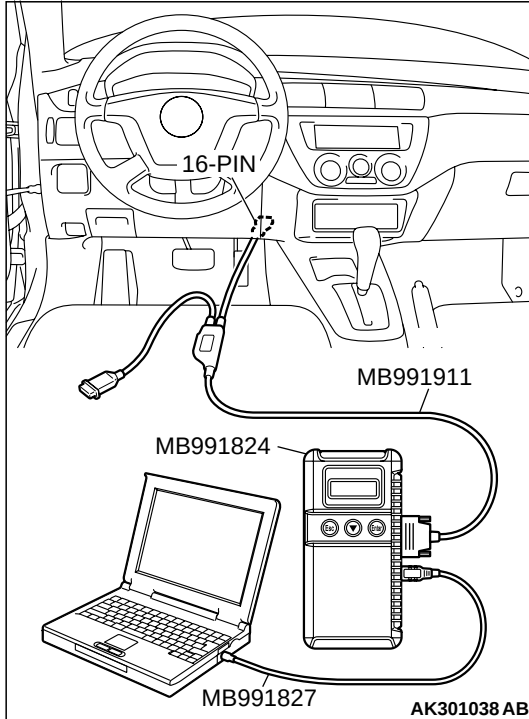
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

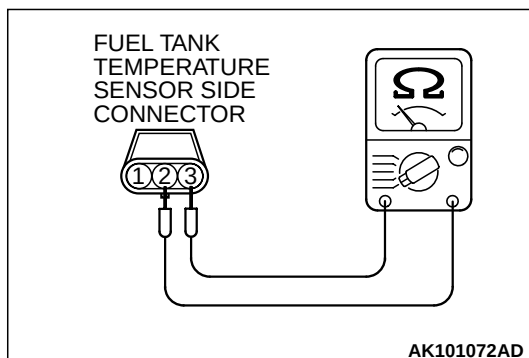
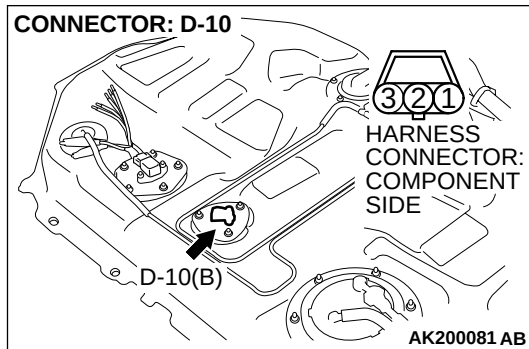
- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 4A, Fuel Tank Temperature Sensor.
 - With the engine cool, the fuel tank temperature should be approximately the same as ambient air temperature.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.



**STEP 2. Check the fuel tank temperature sensor.**

(1) Disconnect the fuel tank temperature sensor connector D-10.

(2) Measure the resistance between terminal No. 2 and No. 3 of the fuel tank temperature sensor.

Standard value:

0.5 – 12.0 k Ω

Q: Is the resistance between 0.5 and 12.0 k Ω ?

YES : Go to Step 3.

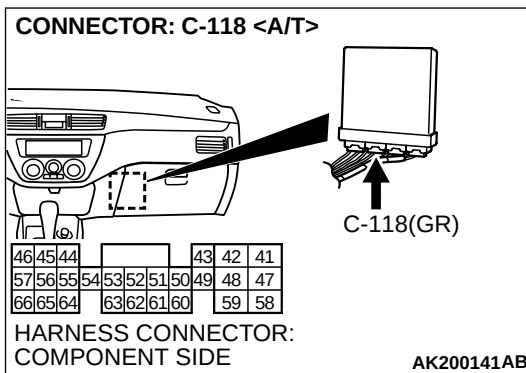
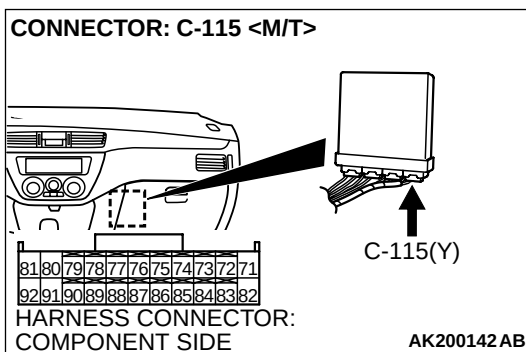
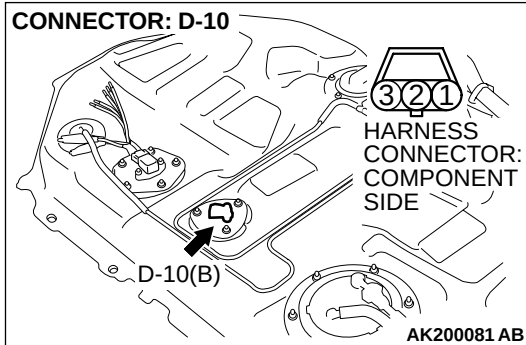
NO : Replace the fuel tank temperature sensor. Then go to Step 5.

STEP 3. Check harness connector D-10 at the fuel tank temperature sensor and harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.

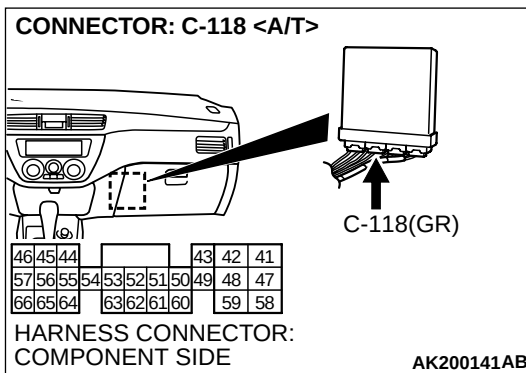
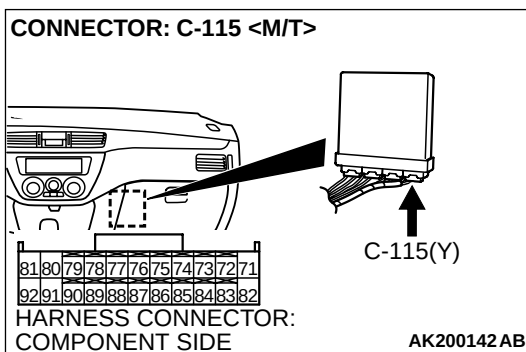
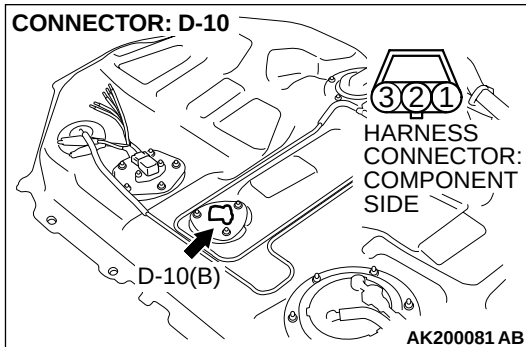
Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.



STEP 4. Check for short circuit to ground between fuel tank temperature sensor connector D-10 (terminal No. 3) and ECM connector C-115 (terminal No. 77) <M/T> or PCM connector C-118 (terminal No. 51) <A/T>.



NOTE: Check harness after checking intermediate connectors C-122, C-127 and D-14. If intermediate connector are damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 5.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 5.

NO : Repair it. Then go to Step 5.

STEP 5. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

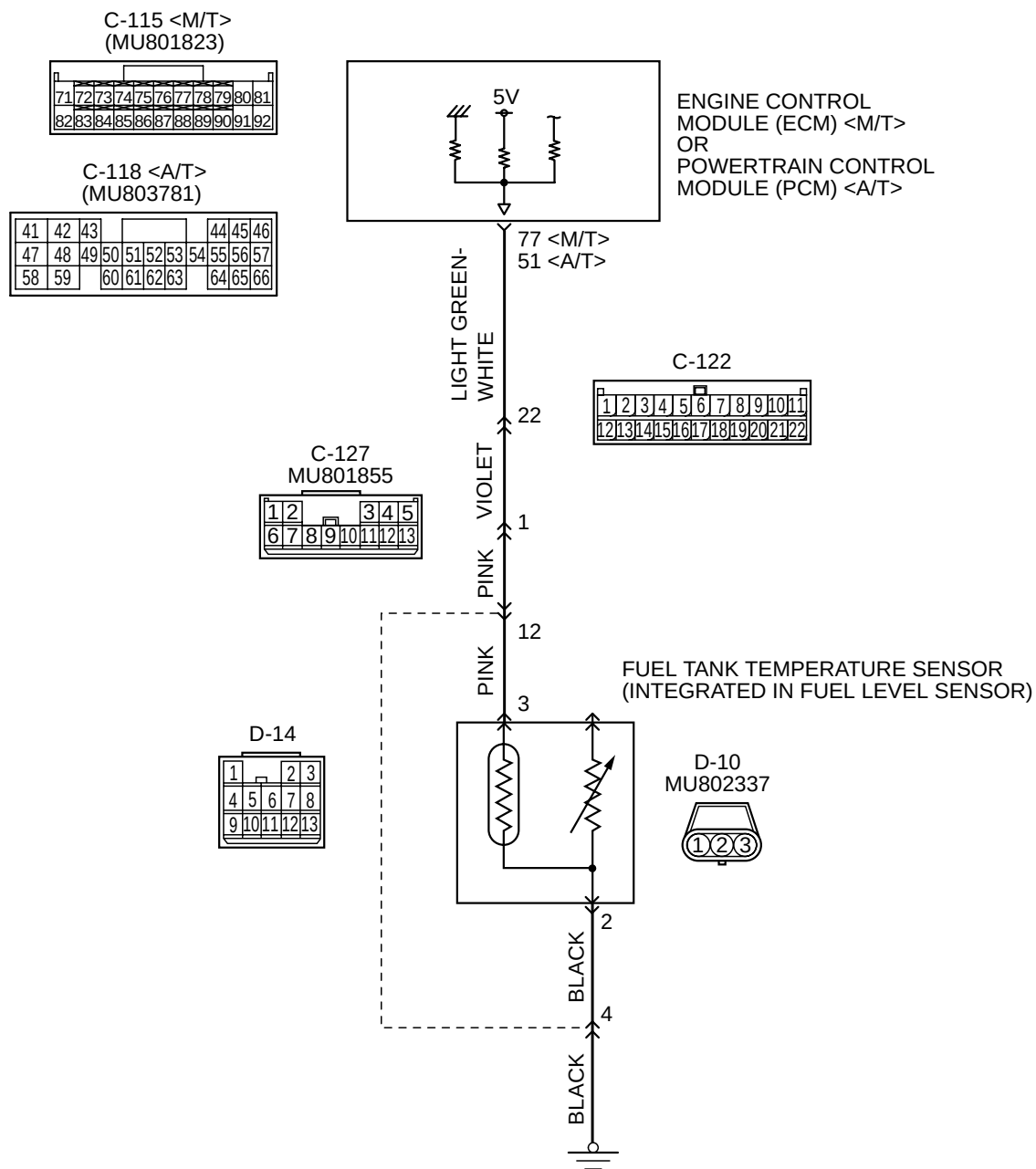
Q: Is DTC P0182 set?

YES : Retry the troubleshooting.

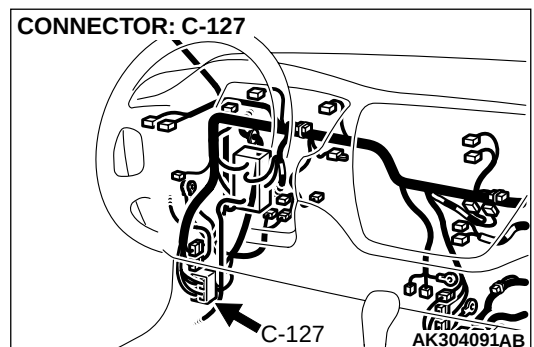
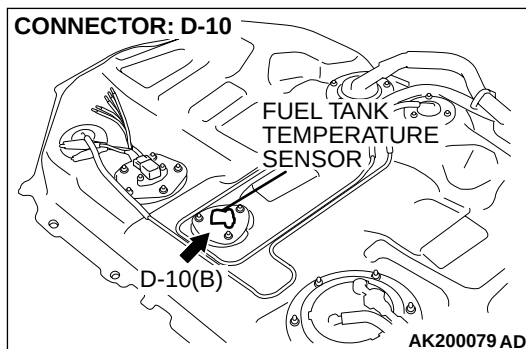
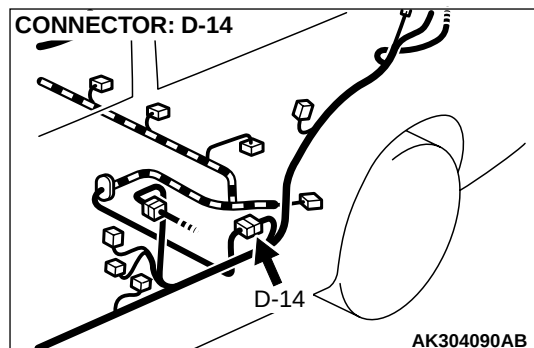
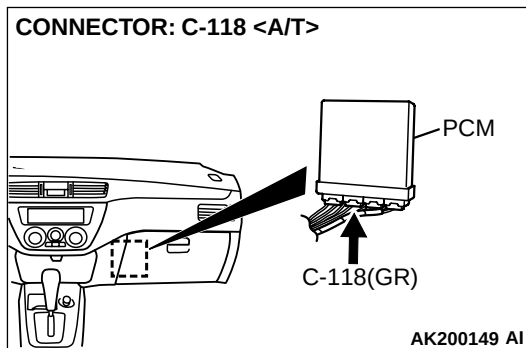
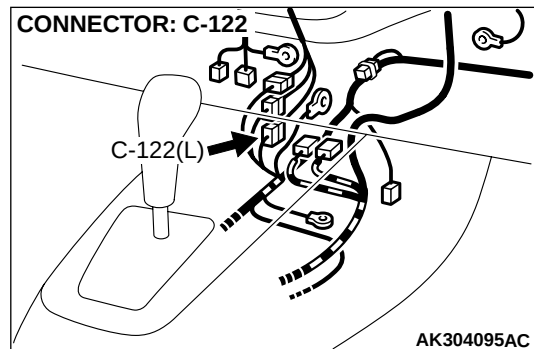
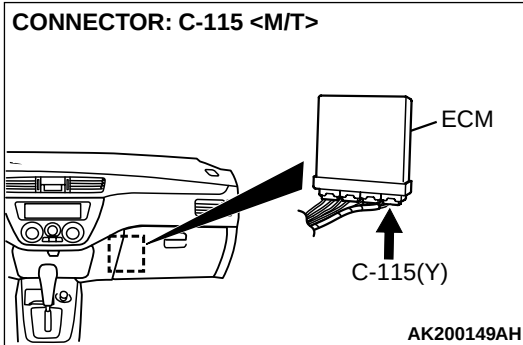
NO : The inspection is complete.

DTC P0183: Fuel Tank Temperature Sensor Circuit High Input

Fuel Tank Temperature Sensor Circuit



AK302343



CIRCUIT OPERATION

- 5-volt voltage is applied to the fuel tank temperature sensor output terminal (terminal No. 3) from the ECM (terminal No. 77) <M/T> or PCM (terminal No. 51) <A/T> via the resistor in the ECM <M/T> or PCM <A/T>.
- The fuel tank temperature sensor output voltage increases when the resistance increases and decreases when the resistance decreases. The ground terminal (terminal No. 2) is grounded to the vehicle body.

TECHNICAL DESCRIPTION

- The fuel tank temperature sensor converts the fuel tank temperature to a voltage.
- The ECM <M/T> or PCM <A/T> detects the fuel tank temperature in the fuel tank with this output voltage.

DESCRIPTIONS OF MONITOR METHODS

- An open circuit is detected while monitoring the fuel tank temperature sensor output.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

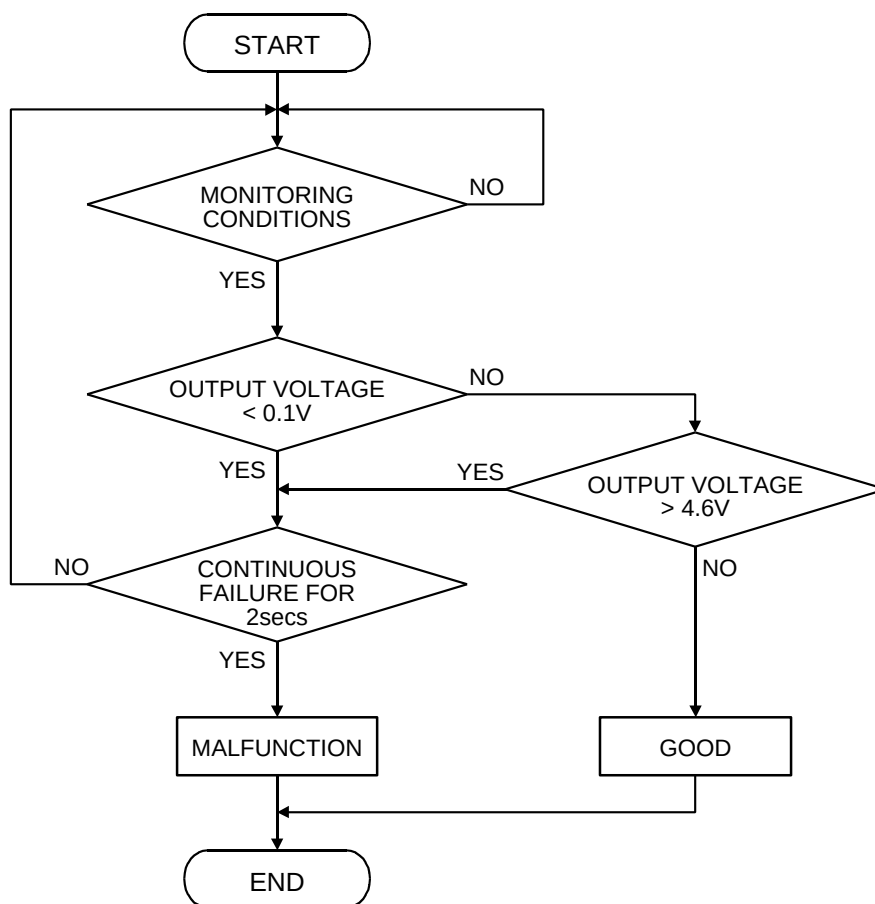
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302317

Check Conditions

- 2 seconds or more have passed since the starting sequence was completed.

Judgement Criteria

- Fuel tank temperature sensor output voltage has continued to be 4.6 volts or higher for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Fuel tank temperature sensor failed.
- Open or shorted fuel tank temperature sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check data list item 4A: Fuel Tank Temperature Sensor.

⚠ CAUTION

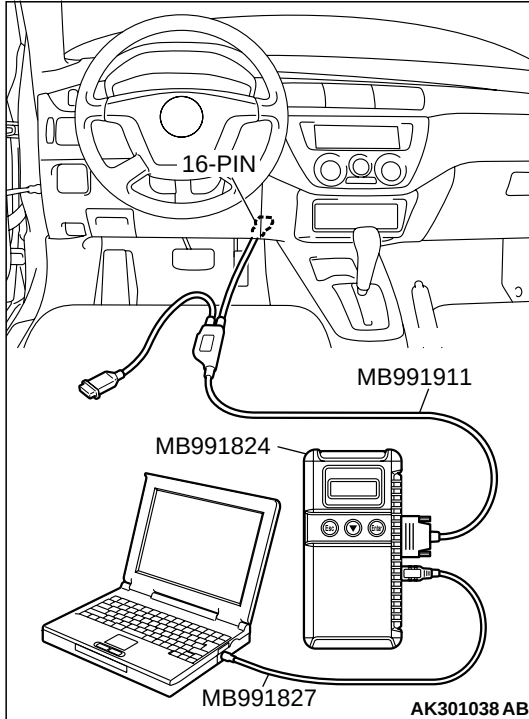
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 4A, Fuel Tank Temperature Sensor.
 - With the engine cool, the fuel tank temperature should be approximately the same as ambient air temperature.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.

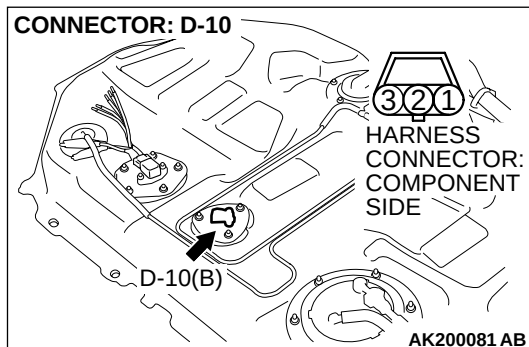


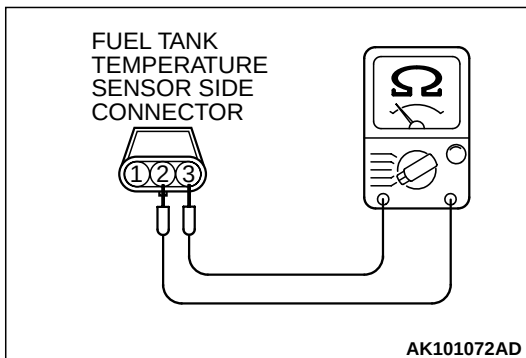
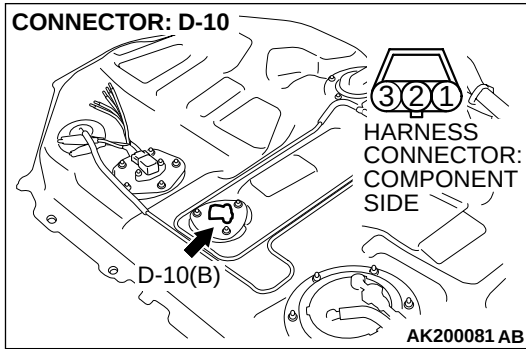
STEP 2. Check harness connector D-10 at the fuel tank temperature sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness
Connector Inspection [P.00E-2](#). Then go to Step 11.



**STEP 3. Check the fuel tank temperature sensor.**

- (1) Disconnect the fuel tank temperature sensor connector D-10.

- (2) Measure the resistance between terminal No. 2 and No. 3 of the fuel tank temperature sensor.

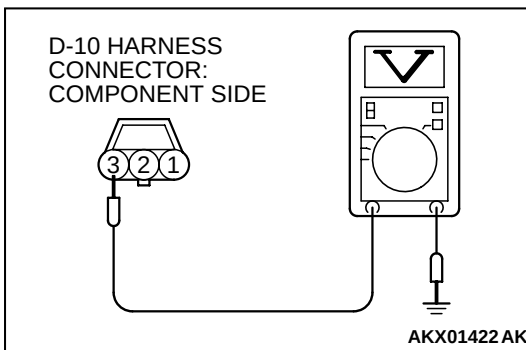
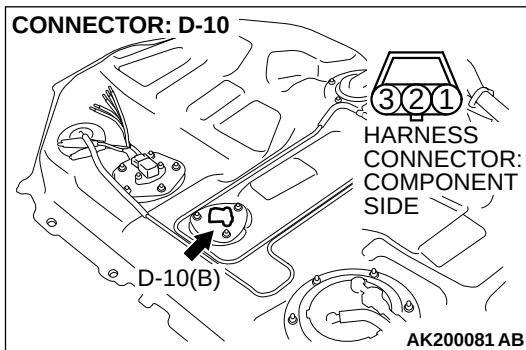
Standard value:

0.5 – 12.0 kΩ

Q: Is the resistance between 0.5 and 12.0 kΩ?

YES : Go to Step 4.

NO : Replace the fuel tank temperature sensor. Then go to Step 11.

**STEP 4. Measure the sensor supply voltage at fuel tank temperature sensor harness side connector D-10.**

- (1) Disconnect connector D-10 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 3 and ground.
- Voltage should be between 4.5 and 4.9 volts
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

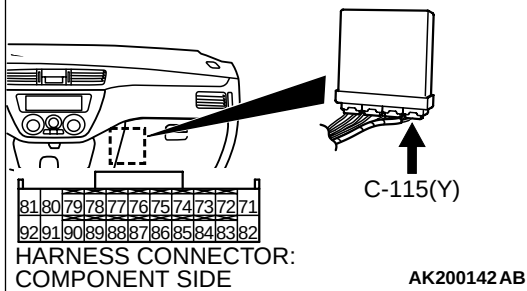
YES : Go to Step 8.

NO : Go to Step 5.

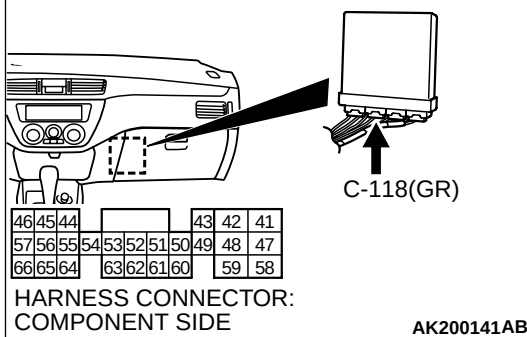
STEP 5. Measure the sensor supply voltage at ECM connector C-115 <M/T> or PCM connector C-118 <A/T> by backprobing.

- (1) Do not disconnect the ECM connector C-115 <M/T> or PCM connector C-118 <A/T>.
- (2) Disconnect the fuel tank temperature sensor connector D-10.
- (3) Turn the ignition switch to the "ON" position.

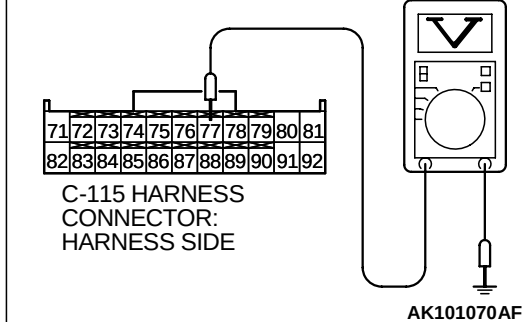
CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>



<M/T>



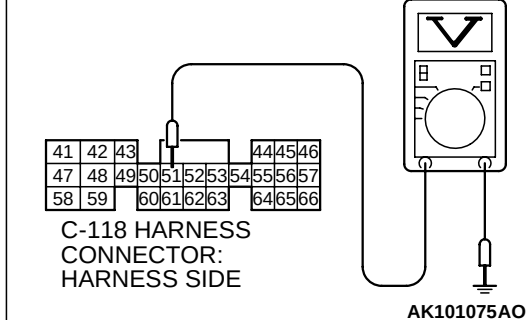
- (4) Measure the voltage between terminal No. 77 <M/T> or No. 51 <A/T> and ground by backprobing.
 - Voltage should be between 4.5 and 4.9 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.5 and 4.9 volts?

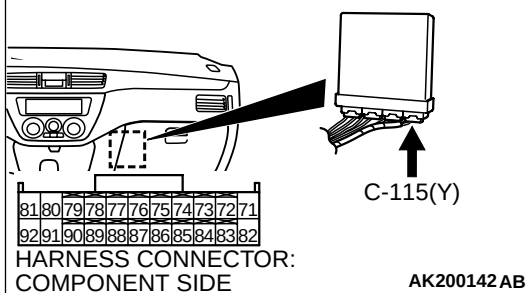
YES : Go to Step 6.

NO : Go to Step 7.

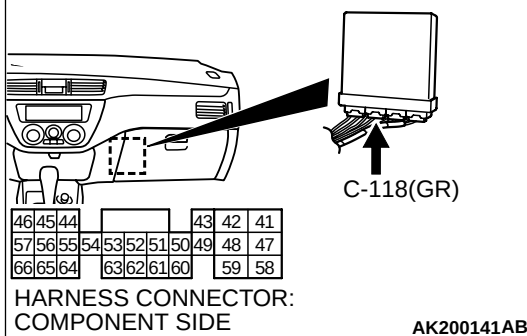
<A/T>



CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>

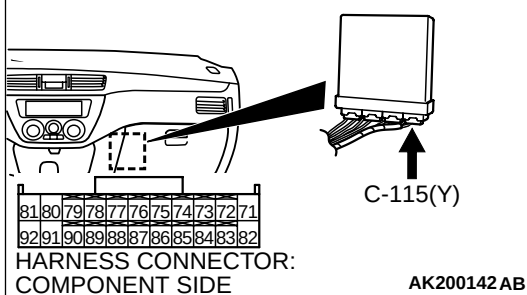


STEP 6. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

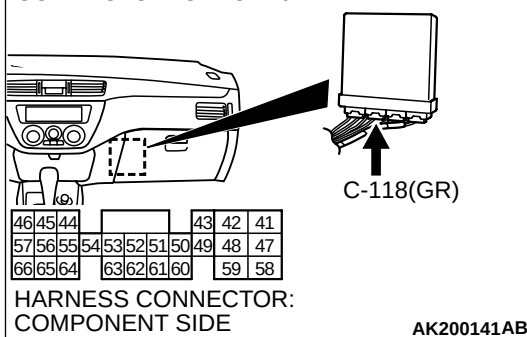
YES : Check connector C-122, C-127 and D-14 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector are in good condition, repair harness wire between fuel tank temperature sensor connector D-10 (terminal No. 3) and ECM connector C-115 (terminal No. 77) <M/T> or PCM connector C-118 (terminal No. 51) <A/T> because of open circuit. Then go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

CONNECTOR: C-115 <M/T>



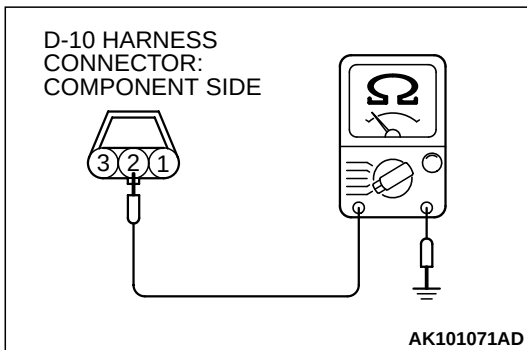
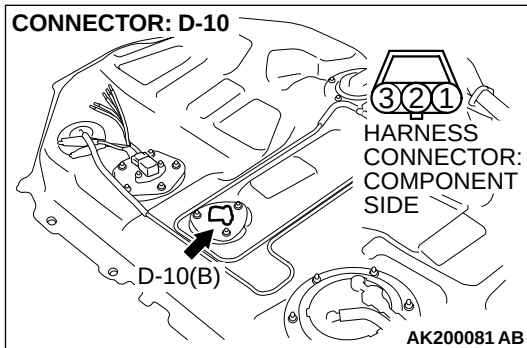
CONNECTOR: C-118 <A/T>



STEP 7. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Replace the ECM or PCM. Then go to Step 11.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.



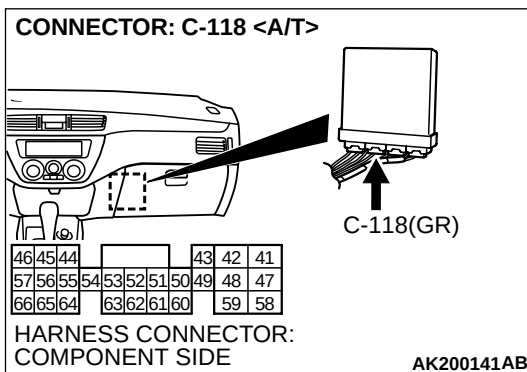
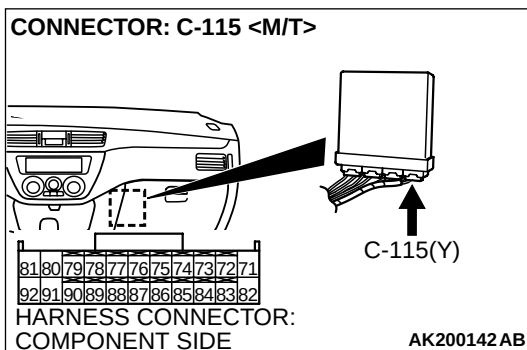
STEP 8. Check for continuity at fuel tank temperature sensor harness side connector D-10.

- (1) Disconnect connector D-10 and measure at the harness side.
- (2) Check for the continuity between terminal No. 2 and ground.
 - Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 9.

NO : Check connector D-14 at intermediate connector for damage, and repair or replace as required. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). If intermediate connector is in good condition, repair harness wire between fuel tank temperature sensor connector D-10 (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 11.



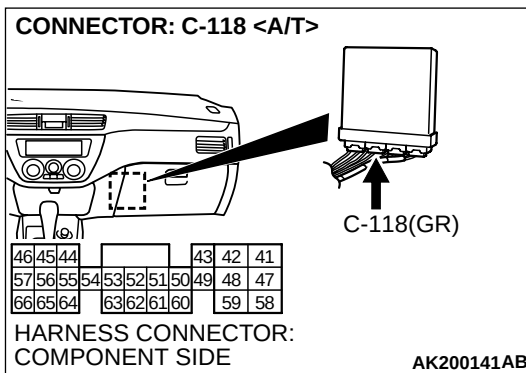
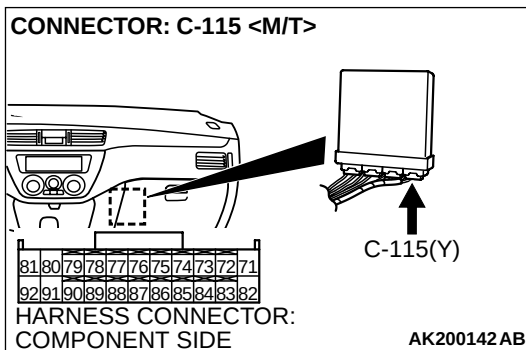
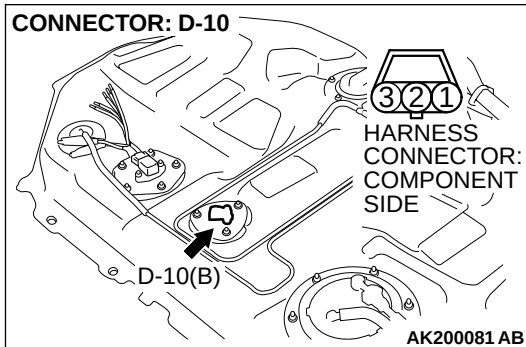
STEP 9. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

STEP 10. Check for open circuit and harness damage between fuel tank temperature sensor connector D-10 (terminal No. 3) and ECM connector C-115 (terminal No. 77) <M/T> or PCM connector C-118 (terminal No. 51) <A/T> .



NOTE: Check harness after checking intermediate connectors C-122, C-127 and D-14. If intermediate connector are damaged, repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 11.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 11.

NO : Repair it. Then go to Step 11.

STEP 11. Test the OBD-II drive cycle.

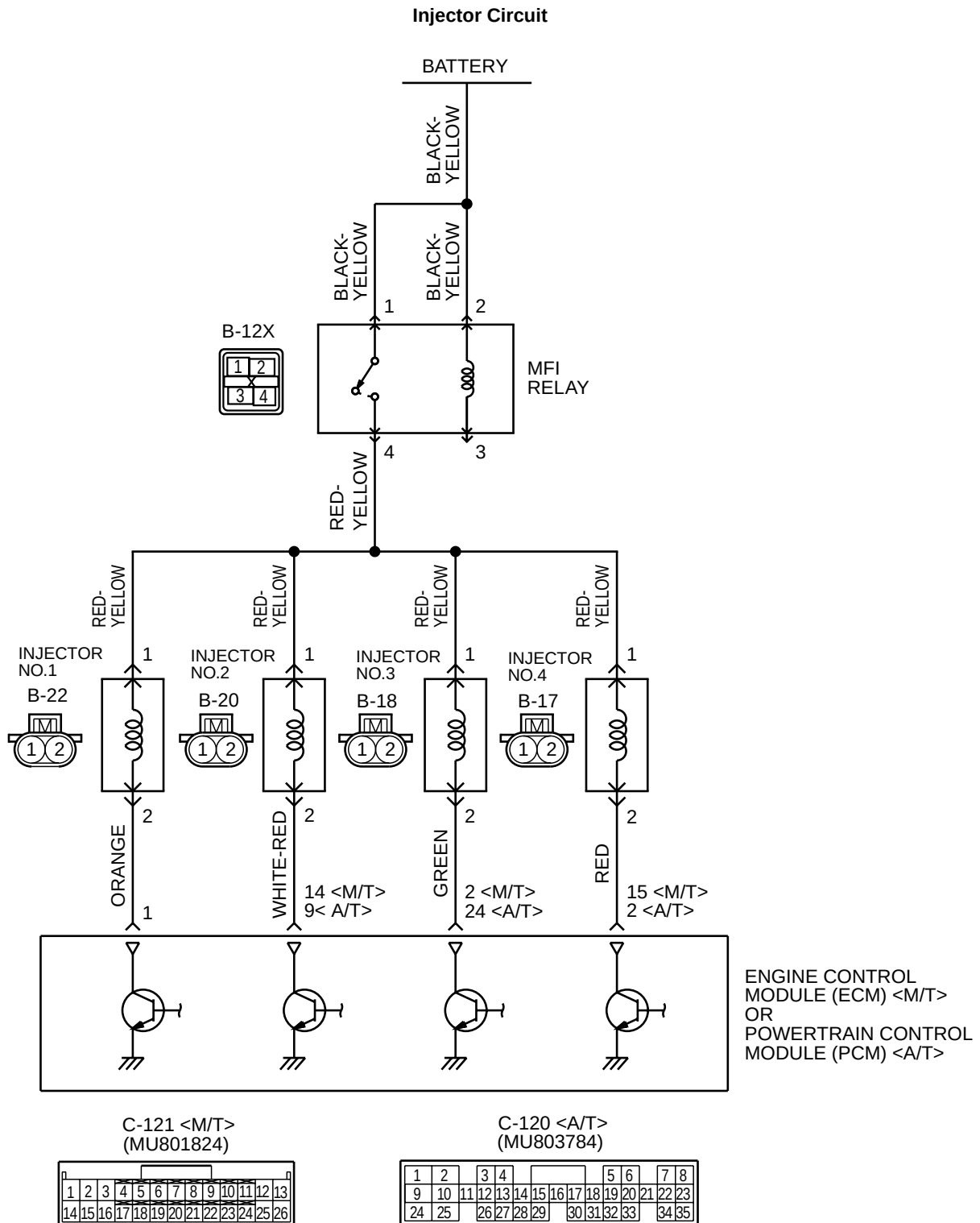
- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle –Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

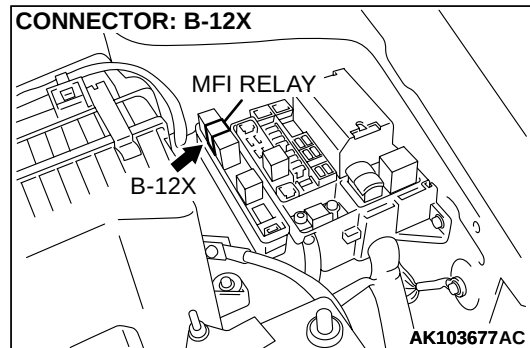
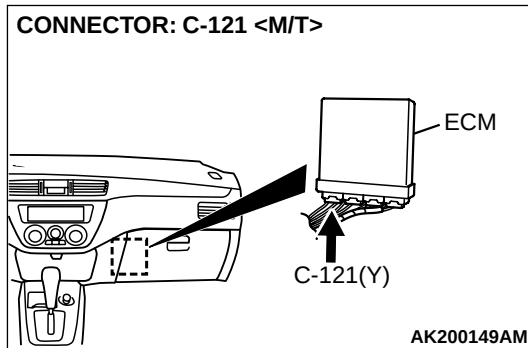
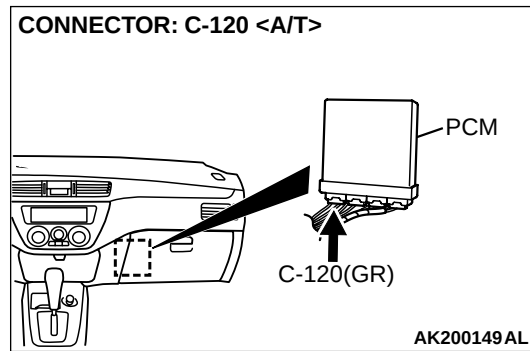
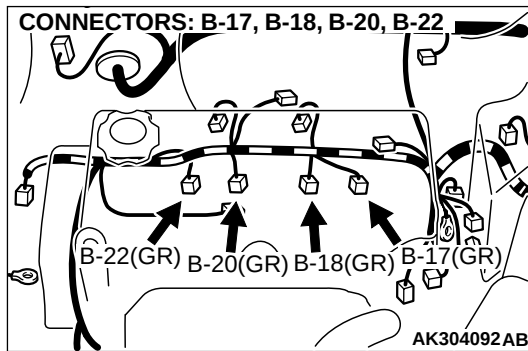
Q: Is DTC P0183 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0201: Injector Circuit – Cylinder 1, DTC P0202: Injector Circuit – Cylinder 2, DTC P0203: Injector Circuit – Cylinder 3, DTC P0204: Injector Circuit – Cylinder 4





CIRCUIT OPERATION

- The injector power is supplied from the MFI relay (terminal No. 4).
- The ECM <M/T> or PCM <A/T> controls the injector by turning the power transistor in the ECM <M/T> or PCM <A/T> "ON" and "OFF".

TECHNICAL DESCRIPTION

- The amount of fuel injected by the injector is controlled by the amount of continuity time the coil is grounded by the ECM <M/T> or PCM <A/T>.
- A surge voltage is generated when the injectors are driven and the current flowing to the injector coil is shut off.
- The ECM <M/T> or PCM <A/T> checks this surge voltage.

DESCRIPTIONS OF MONITOR METHODS

- If a surge current is not generated in the coil after the injector has been actuated, an open or short circuit is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

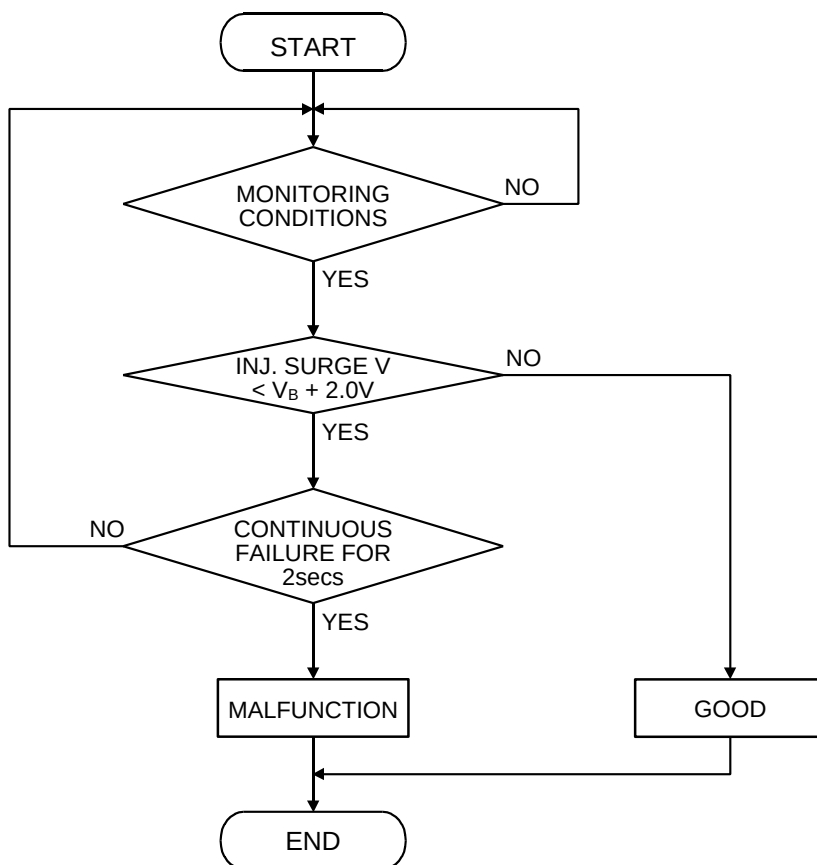
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302318

Check Conditions

- Engine speed is lower than 1,000 r/min.
- Throttle position sensor output voltage is lower than 1.16 volts.

Judgment Criteria

- Injector coil surge voltage (battery positive voltage +2 volts) has not been detected for two seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Injector failed.
- Open or shorted injector circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991348: Test Harness Set

STEP 1. Using scan tool MB991958, check actuator test item 01, 02, 03, 04: Injectors.

⚠ CAUTION

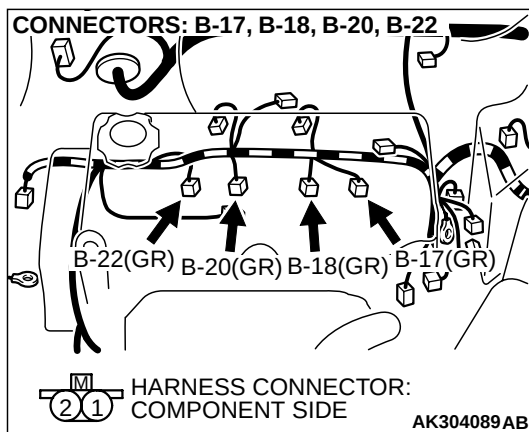
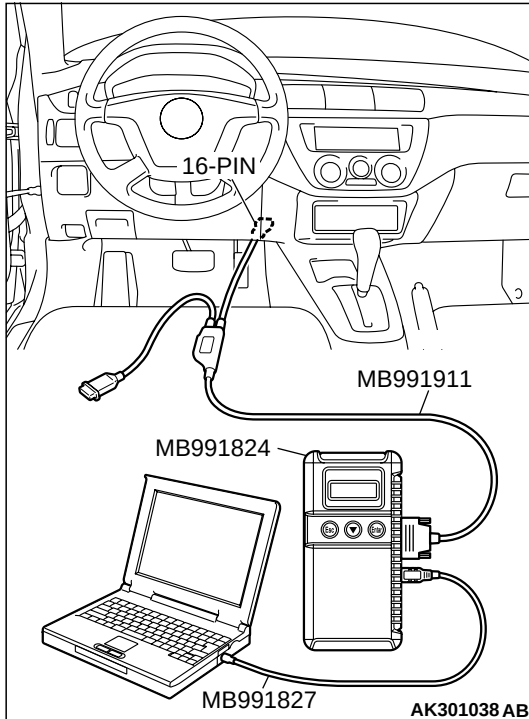
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the actuator testing mode for item 01, 02, 03, 04 Injectors.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - Does the idle state worsen when the injector is cut off.
(Does idling become unstable or does the engine stall.)
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the actuator operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.



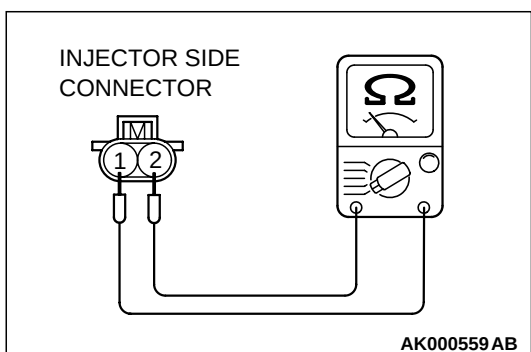
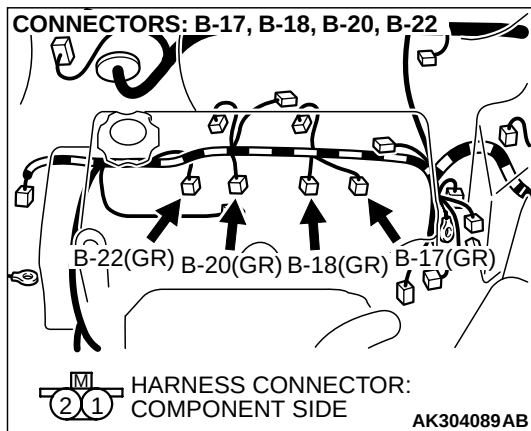
STEP 2. Check the connector at injector for damage.

- a. Check connector B-22 at No. 1 cylinder.
- b. Check connector B-20 at No. 2 cylinder.
- c. Check connector B-18 at No. 3 cylinder.
- d. Check connector B-17 at No. 4 cylinder.

Q: Is the connector in good condition?

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness
Connector Inspection [P.00E-2](#). Then go to Step 10.

**STEP 3. Check the injector.**

- (1) Disconnect the injector connector B-22 <No. 1 cylinder> or B-20 <No. 2 cylinder> or B-18 <No.3 cylinder> or B-17 <No.4 cylinder>.

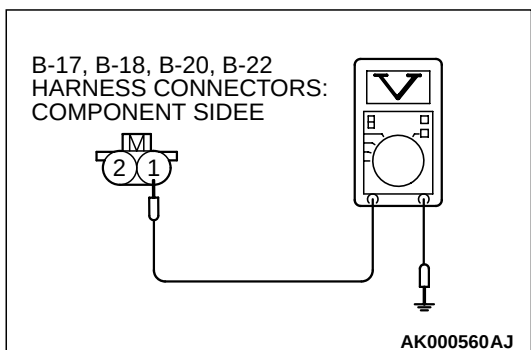
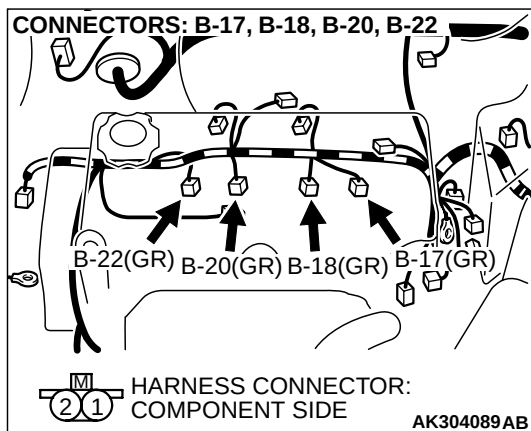
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 4.

NO : Replace the injector. Then go to Step 10.

**STEP 4. Measure the power supply voltage at injector connector.**

- (1) Disconnect connector B-22 <No. 1 cylinder> or B-20 <No. 2 cylinder> or B-18 <No. 3 cylinder> or B-17 <No. 4 cylinder> and measure at the harness side.

- (2) Turn the ignition switch to the "ON" position.

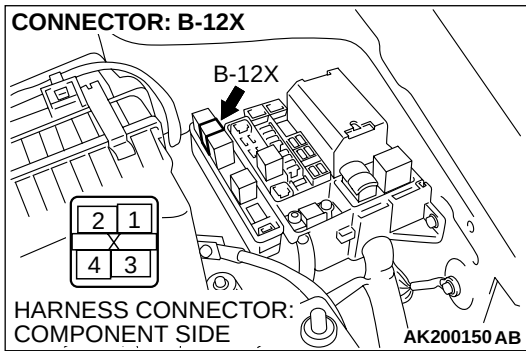
- (3) Measure the voltage between terminal No. 1 and ground.
 - Voltage should be battery positive voltage.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 6.

NO : Go to Step 5.



STEP 5. Check connector B-12X at MFI relay for damage.

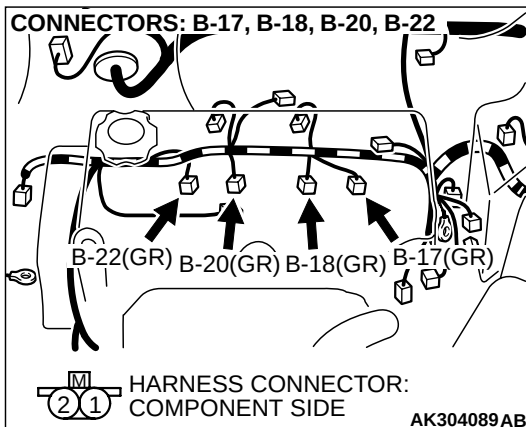
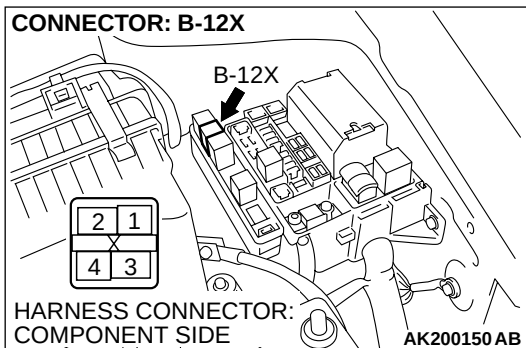
Q: Is the connector in good condition?

YES : Repair harness wire between MFI relay connector and injector connector because of open circuit or short circuit to ground.

- Repair harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-22 (terminal No. 1) at No. 1 cylinder.
- Repair harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-20 (terminal No. 1) at No. 2 cylinder.
- Repair harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-18 (terminal No. 1) at No. 3 cylinder.
- Repair harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-17 (terminal No. 1) at No. 4 cylinder.

Then go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.



STEP 6. Check for harness damage between MFI relay connector and injector connector.

- Check the harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-22 (terminal No. 1) at No.1 cylinder.
- Check the harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-20 (terminal No. 1) at No.2 cylinder.
- Check the harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-18 (terminal No. 1) at No.3 cylinder.
- Check the harness wire between MFI relay connector B-12X (terminal No. 4) and injector connector B-17 (terminal No. 1) at No.4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 7.

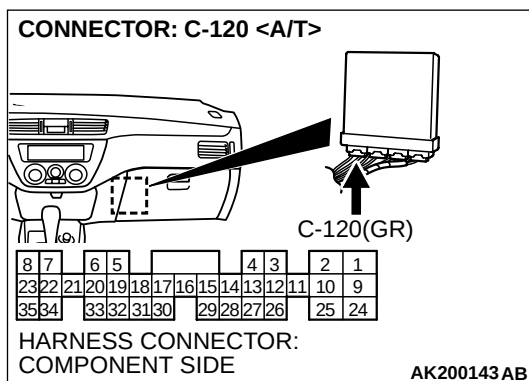
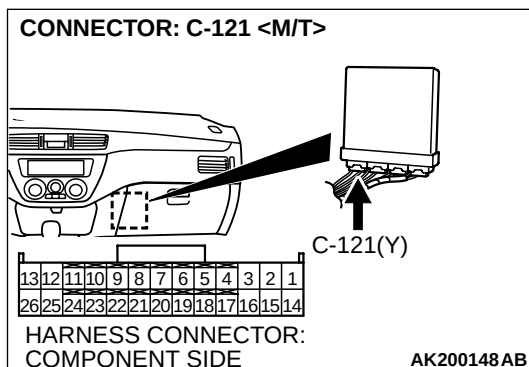
NO : Repair it. Then go to Step 10.

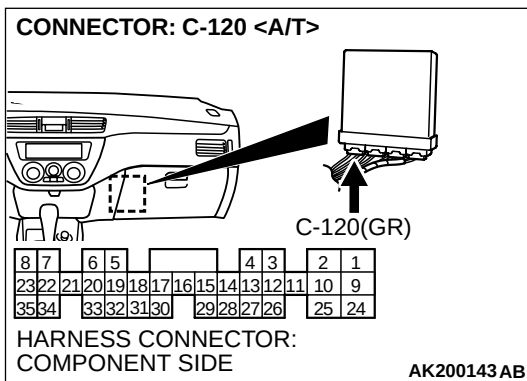
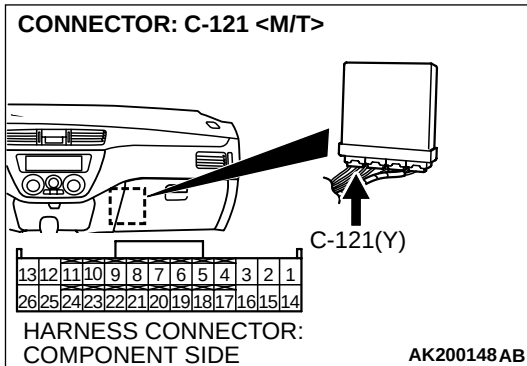
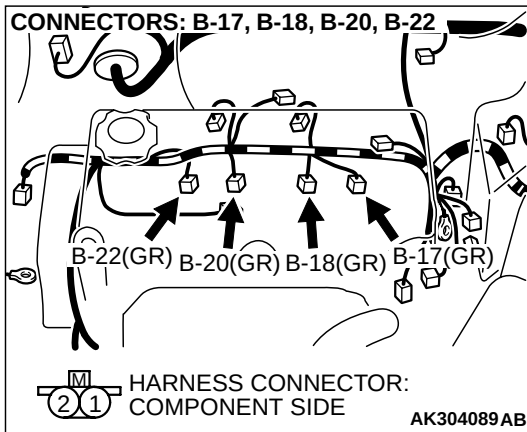
STEP 7. Check harness connector C-121 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 10.





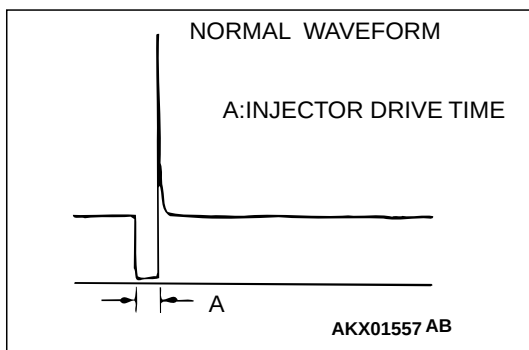
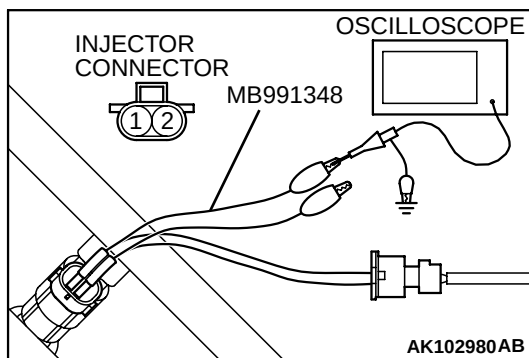
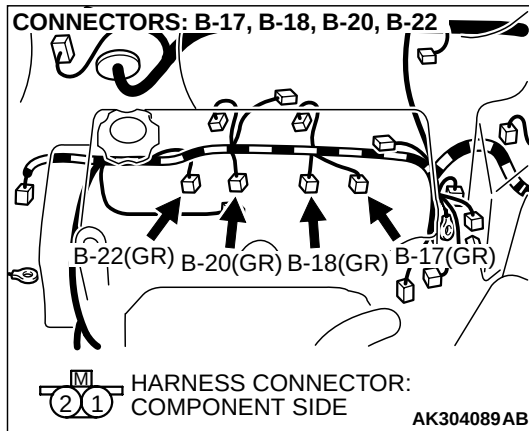
STEP 8. Check for open circuit and short circuit to ground and harness damage between injector connector and ECM connector <M/T> or PCM connector <A/T>.

- Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) <M/T> or PCM connector C-120 (terminal No. 1) <A/T> at No.1 cylinder.
- Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) <M/T> or PCM connector C-120 (terminal No. 9) <A/T> at No.2 cylinder.
- Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) <M/T> or PCM connector C-120 (terminal No. 24) <A/T> at No.3 cylinder.
- Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) <M/T> or PCM connector C-120 (terminal No. 2) <A/T> at No.4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 9.

NO : Repair it. Then go to Step 10.

**STEP 9. Using the oscilloscope, check the injector.**

(1) Disconnect the injector connector B-22 <No. 1 cylinder> or B-20 <No. 2 cylinder> or B-18 <No. 3 cylinder> or B-17 <No. 4 cylinder> and connect the test harness special tool (MB991348) in between. (All terminals should be connected.)

(2) Connect the oscilloscope probe to the injector side connector terminal No. 2.

NOTE: When measuring with the ECM or PCM side connector, connect an oscilloscope probe to the each of the following terminals.

- ECM terminal No. 1 or PCM terminal No. 1 at No. 1 cylinder.
- ECM terminal No. 14 or PCM terminal No. 9 at No. 2 cylinder.
- ECM terminal No. 2 or PCM terminal No. 24 at No. 3 cylinder.
- ECM terminal No. 15 or PCM terminal No. 2 at No. 4 cylinder.

(3) Start the engine and run at idle.

(4) Measure the waveform.

- The waveform should show a normal pattern similar to the illustration.

(5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the waveform normal?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Replace the ECM or PCM. Then go to Step 10.

STEP 10. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

Q: Are DTC P0201, P0202, P0203 and P0204 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0300: Random/Multiple Cylinder Misfire Detected

Random Misfire Circuit

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction [P.13A-342](#).

CIRCUIT OPERATION

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction [P.13A-342](#).

TECHNICAL DESCRIPTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM <M/T> or PCM <A/T> checks for such changes in engine speed.

DTC SET CONDITIONS

Check Conditions

- Engine speed is between 500 and 6,000 r/min.
- Engine coolant temperature is higher than –10°C (14°F).
- Intake air temperature is higher than –10°C (14°F).
- Barometric pressure is higher than 76 kPa (11 psi).
- Adaptive learning is complete for the vane which generates a crankshaft position signal.

- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is –0.059 volt/10 ms to +0.059 volt/10 ms.

Judgement Criteria (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is higher than 950°C (1742°F)].

or

- Misfire has occurred in 20 or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

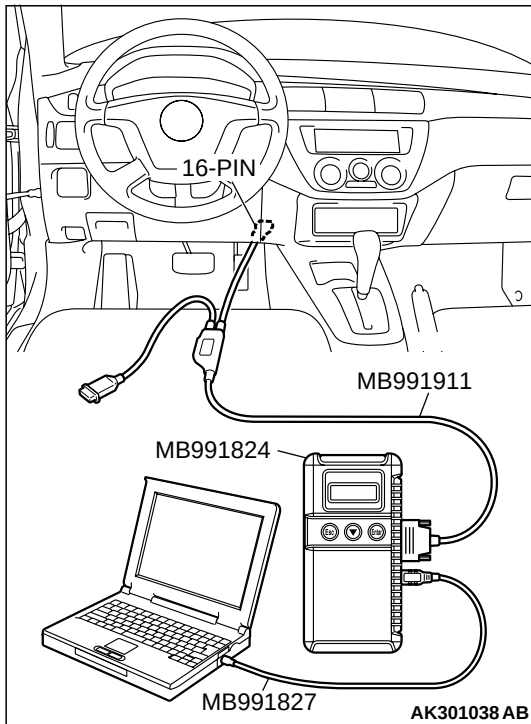
TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Ignition system related part(s) failed.
- Poor crankshaft position sensor.
- Incorrect air/fuel ratio.
- Low compression pressure.
- Skipping of timing belt teeth.
- EGR system and EGR valve failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B



STEP 1. Using scan tool MB991958, check data list item 22: Crankshaft Position Sensor.

⚠ CAUTION

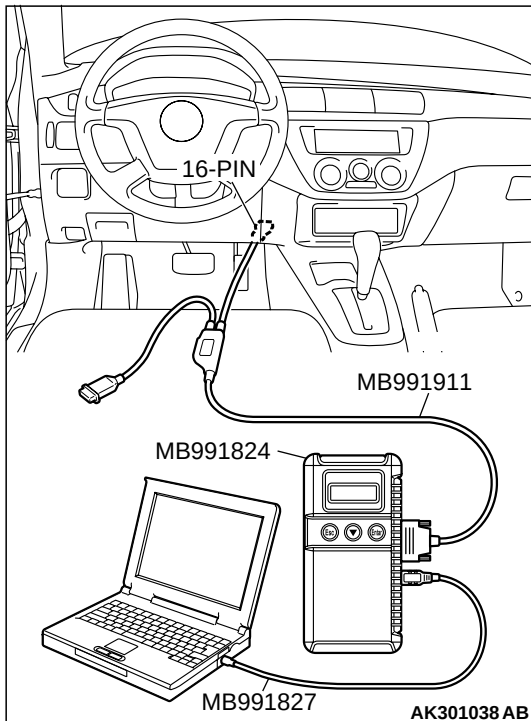
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 22, Crankshaft Position Sensor.
- (4) Check the waveform of the crankshaft position sensor while keeping the engine speed constant.
 - The pulse width should be constant.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 2.

NO : Refer to, DTC P0335 – Crankshaft Position Sensor Circuit Malfunction [P.13A-371](#).



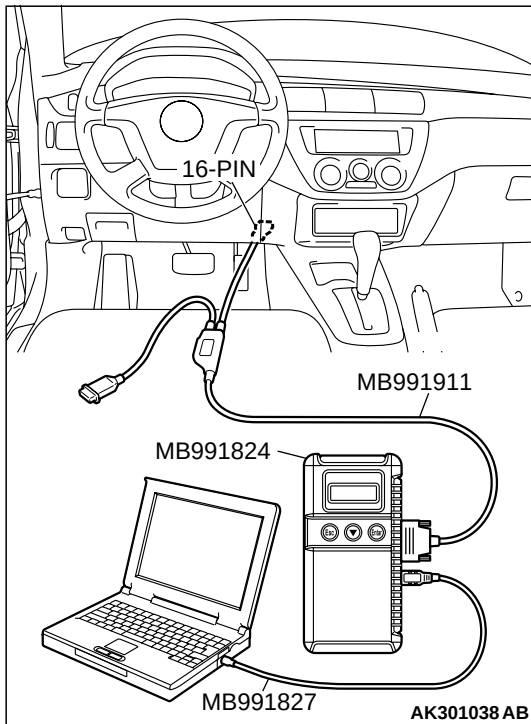
STEP 2. Using scan tool MB991958, check data list item 81: Long-Term Fuel Trim (trim).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 81, Long-Term Fuel Trim (trim).
 - The fuel trim should be between -12.5 and +12.5 when the load is 2,500 r/min (during closed loop) after the engine is warmed.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the specification normal?

YES : Go to Step 3.

NO : Refer to, DTC P0171 – System too Lean [P.13A-297](#), DTC P0172 – System too Rich [P.13A-306](#).



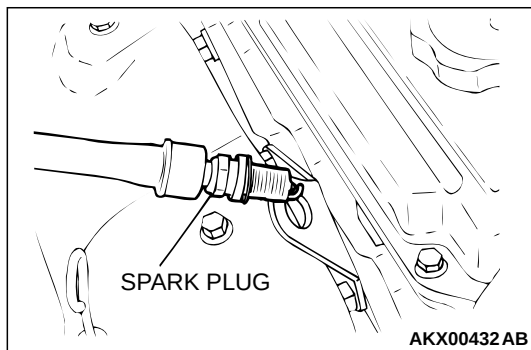
STEP 3. Using scan tool MB991958, check data list item 82: Short-Term Fuel Trim (trim).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 82, Short-Term Fuel Trim (trim).
 - The fuel trim should be between -25 and +25 when the load is 2,500 r/min (during closed loop) after the engine is warmed.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the specification normal?

YES : Go to Step 4.

NO : Refer to, DTC P0171 – System too Lean [P.13A-297](#),
DTC P0172 – System too Rich [P.13A-306](#).



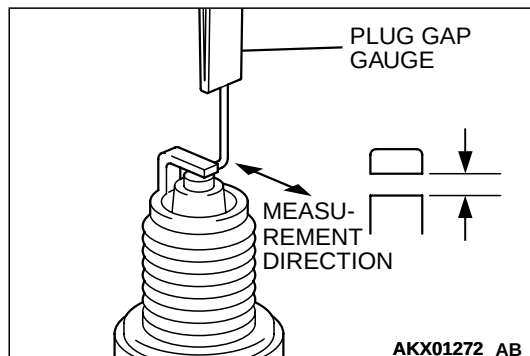
STEP 4. Check the ignition coil spark.

- (1) Check each ignition coil spark.
- (2) Remove the intake manifold.
- (3) Remove the spark plug and connect to the spark plug cable.
- (4) Ground the spark plug side electrode securely.
 - When the engine is cranked, the spark plug should spark.

Q: Did it spark?

YES : Go to Step 7.

NO : Go to Step 5.

**STEP 5. Check the spark plugs.**

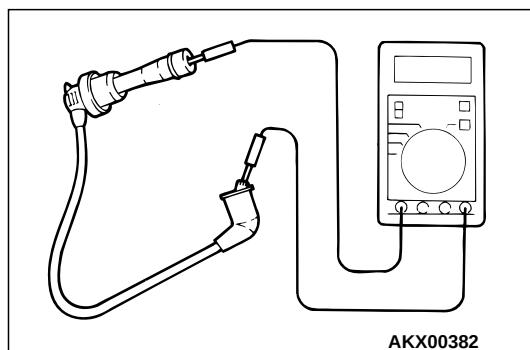
- (1) Check that the plug is not burned, that the insulator plug is not damaged, and that the seizure state is good.
- (2) If cleaning is required due to carbon deposits, etc., clean using a plug cleaner or wire brush, etc.
- (3) Check the plug gap using a plug gap gauge, and adjust if not within the standard value.

Standard value: 1.0 – 1.1 mm (0.039 – 0.043 inch)

Q: Is the spark plug in good condition?

YES : Go to Step 6.

NO : Replace the faulty spark plug. Then go to Step 13.

**STEP 6. Check the spark plug cable.**

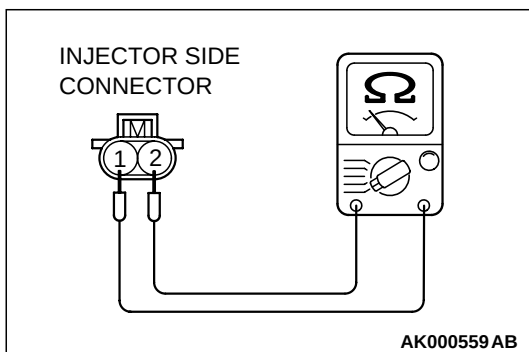
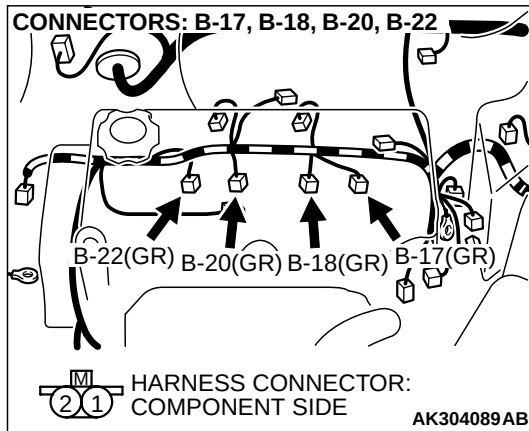
- (1) Check the cap and coating for cracks.
- (2) Measure the resistance.

Limit: maximum 19 k Ω

Q: Is the measured resistance less than 19 k Ω ?

YES : Refer to INSPECTION PROCEDURE 33 – Ignition Circuit System [P.13A-846](#).

NO : Replace the faulty spark plug cable. Then go to Step 13.



STEP 7. Check the injector.

(1) Disconnect the injector connector.

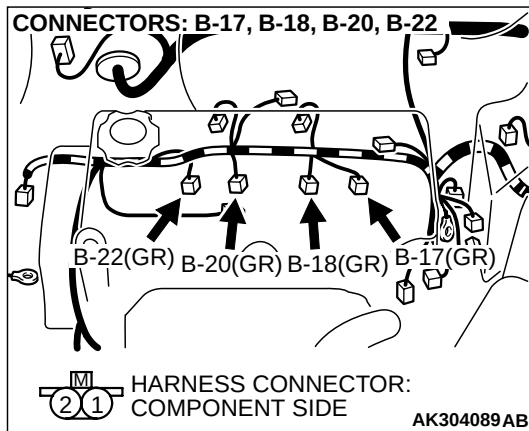
(2) Measure the resistance between each injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

Q: Is the resistance between 13 and 16 ohms [at 20°C (68°F)]?

YES : Go to Step 8.

NO : Replace the faulty injector. Then go to Step 13.



STEP 8. Check connectors B-17, B-18, B-20, B-22 at injector for damage.

Q: Is the connector in good condition?

YES : Go to Step 9.

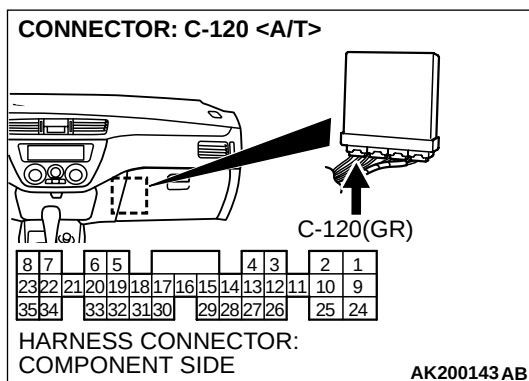
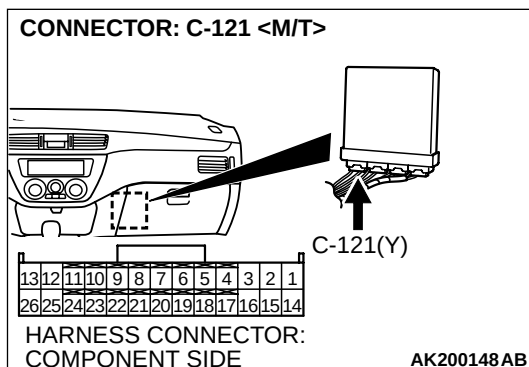
NO : Repair or replace the faulty injector. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.

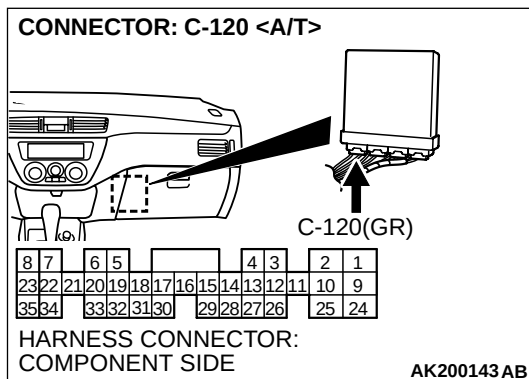
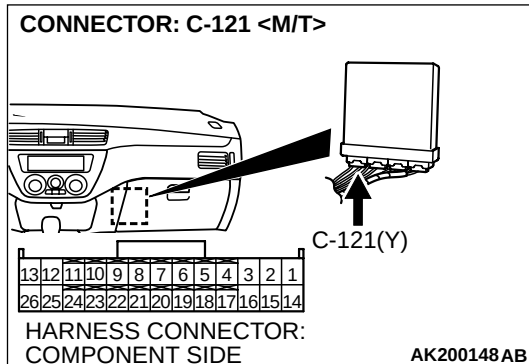
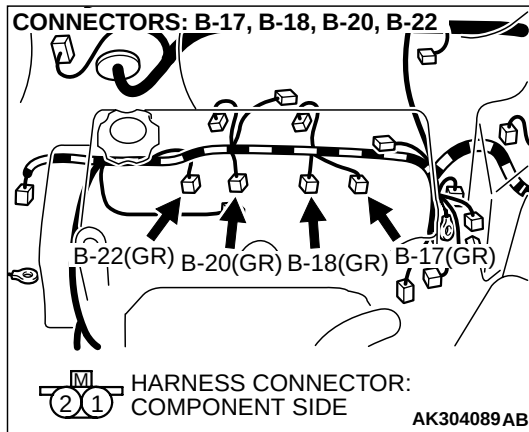
STEP 9. Check connector C-121 at ECM <M/T> or connector C-120 at PCM <A/T> for damage.

Q: Is the connector in good condition?

YES : Go to Step 10.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 13.





STEP 10. Check for harness damage between injector connector and ECM connector <M/T> or PCM connector <A/T>.

- Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) <M/T> or PCM connector C-120 (terminal No. 1) <A/T> when checking No.1 cylinder.
- Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) <M/T> or PCM connector C-120 (terminal No. 9) <A/T> when checking No.2 cylinder.
- Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) <M/T> or PCM connector C-120 (terminal No. 24) <A/T> when checking No.3 cylinder.
- Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) <M/T> or PCM connector C-120 (terminal No. 2) <A/T> when checking No.4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 13.

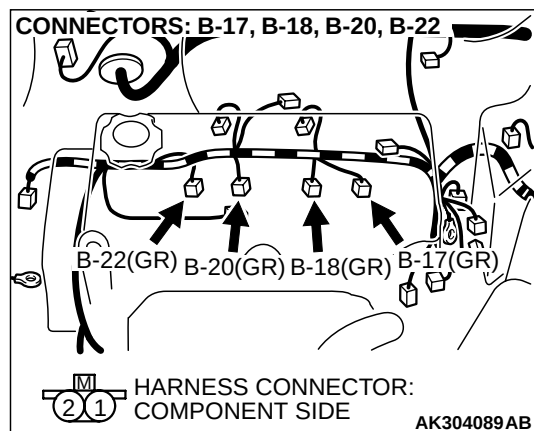
STEP 11. Check the following items.

- Check the following items, and repair or replace the defective component.
 - Check for skipped timing belt teeth.
 - Check compression.
 - EGR valve failed.

Q: Are there any abnormalities?

YES : Go to Step 12.

NO : Repair or replace it. Then go to Step 13.

**STEP 12. Replace the injector.**

- (1) Replace the injector.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Is DTC P0300 set?

YES : Replace the ECM or PCM. Then go to Step 13.

NO : The procedure is complete.

STEP 13. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0300 set?

YES : Repeat the troubleshooting.

NO : The procedure is complete.

DTC P0301: Cylinder 1 Misfire Detected, DTC P0302: Cylinder 2 Misfire Detected, DTC P0303: Cylinder 3 Misfire Detected, DTC P0304: Cylinder 4 Misfire Detected

Misfire Detected Circuit

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction [P.13A-342](#).

CIRCUIT OPERATION

- Refer to, DTC P0201 – P0204 Injector Circuit Malfunction [P.13A-342](#).

TECHNICAL DESCRIPTION

- If a misfire occurs while the engine is running, the engine speed changes for an instant.
- The ECM <M/T> or PCM <A/T> checks for such changes in engine speed.

DESCRIPTIONS OF MONITOR METHODS

- If the amount of negative change in the angular acceleration is excessive while monitoring the angular acceleration of the crankshaft, a misfire is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

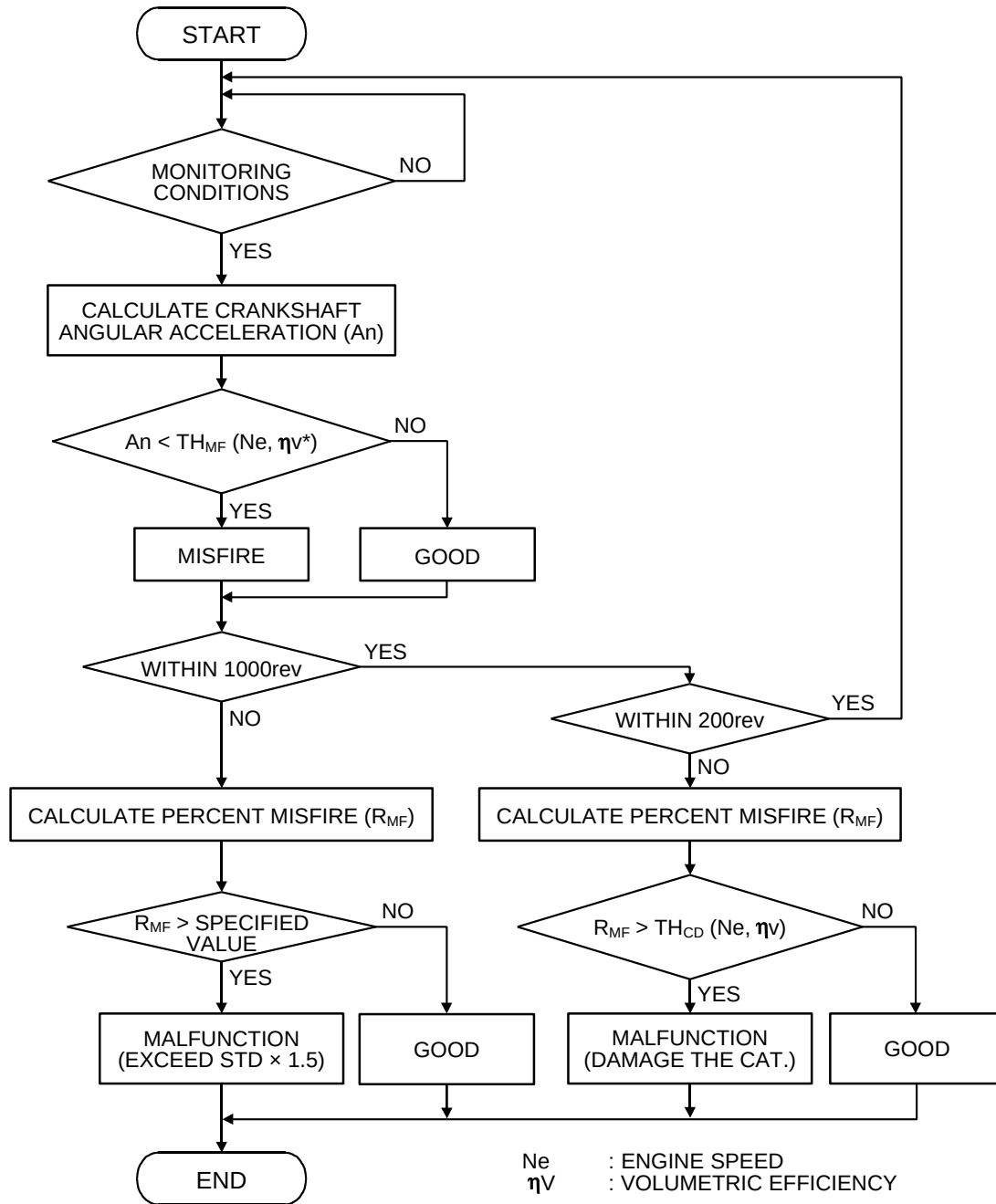
- Not applicable

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Crankshaft position sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302320

Check Conditions

- Engine speed is between 500 and 6,000 r/min.
- Engine coolant temperature is higher than -10°C (14°F).
- Intake air temperature is higher than -10°C (14°F).
- Barometric pressure is at between 76 kPa (22.4 in.Hg) and 106 kPa (31 in.Hg).
- Volumetric efficiency is at between 30 and 55 percent.
- Adaptive learning is complete for the vane which generates a crankshaft position signal.
- While the engine is running, excluding gear shifting, deceleration, sudden acceleration/deceleration and A/C compressor switching.
- The throttle deviation is -0.059 volt/10ms to $+0.059$ volt/10ms.

Judgement Criteria (change in the angular acceleration of the crankshaft is used for misfire detection).

- Misfire has occurred more frequently than allowed during the last 200 revolutions [when the catalyst temperature is higher than 950°C ($1,742^{\circ}\text{F}$)].
- or
- Misfire has occurred in 20 or more of the last 1,000 revolutions (corresponding to 1.5 times the limit of emission standard).

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Ignition system related part(s) failed.
- Low compression pressure.
- Injector failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**STEP 1. Check the spark plugs.**

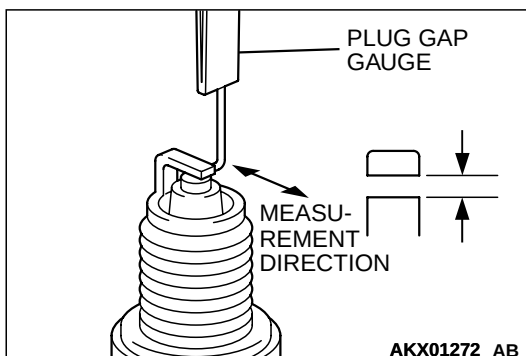
- (1) Check that the plug is not burned, that the insulator plug is not damaged, and that the seizure state is good.
- (2) If cleaning is required due to carbon deposits, etc., clean using a plug cleaner or wire brush, etc.
- (3) Check the plug gap using a plug gap gauge, and adjust if not within the standard value.

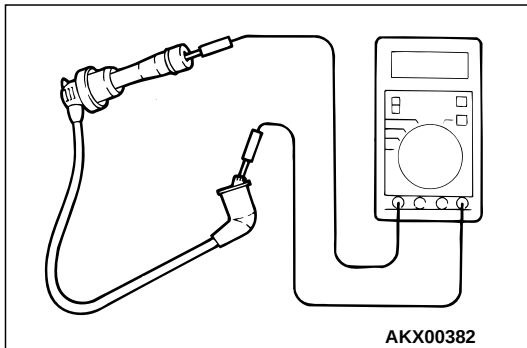
Standard value: 1.0 – 1.1 mm (0.039 – 0.043 inch)

Q: Is the spark plug in good condition?

YES : Go to Step 2.

NO : Replace the spark plug. Then go to Step 9.





STEP 2. Check the spark plug cable.

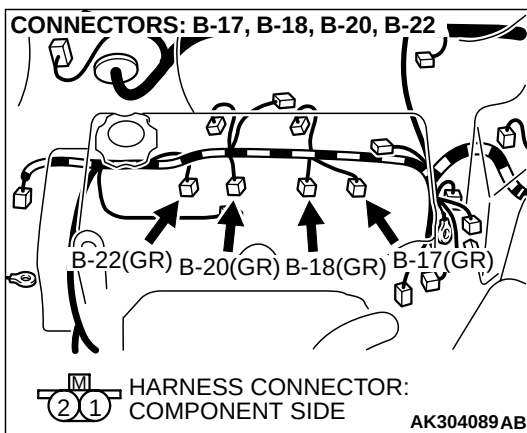
- (1) Check the cap and coating for cracks.
- (2) Measure the resistance.

Limit: maximum 19 k Ω

Q: Is the measured resistance less than 19 k Ω ?

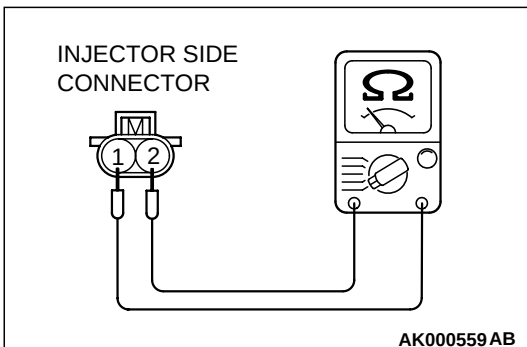
YES : Go to Step 3.

NO : Replace the spark plug cable. Then go to Step 9.



STEP 3. Check the injector.

- (1) Disconnect the injector connector B-22 <No. 1 cylinder>, B-20 <No. 2 cylinder>, B-18 <No. 3 cylinder>, B-17 <No. 4 cylinder>.



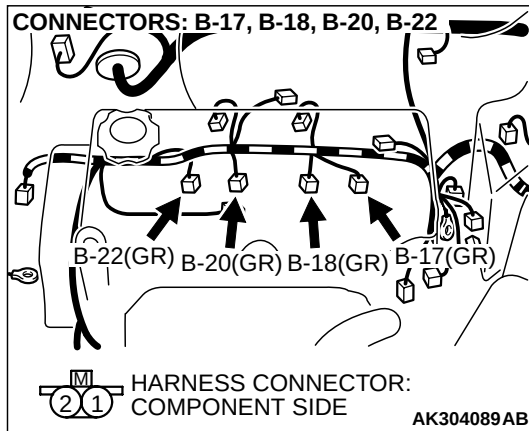
- (2) Measure the resistance between injector side connector terminal No. 1 and No. 2.

Standard value: 13 – 16 ohms [at 20°C (68°F)]

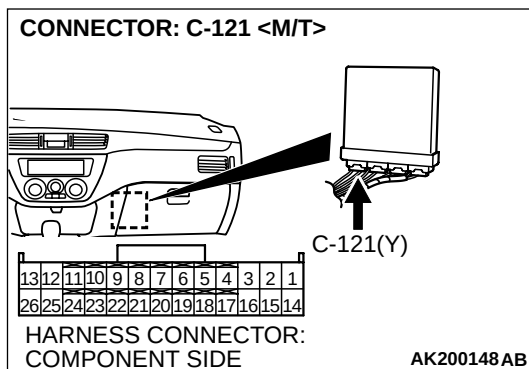
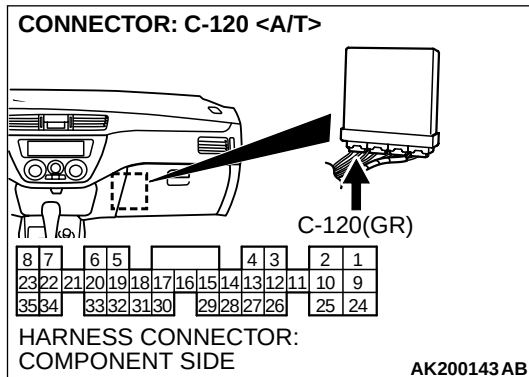
Q: Is the resistance between 13 and 16 ohms [at 20°C (68°F)]?

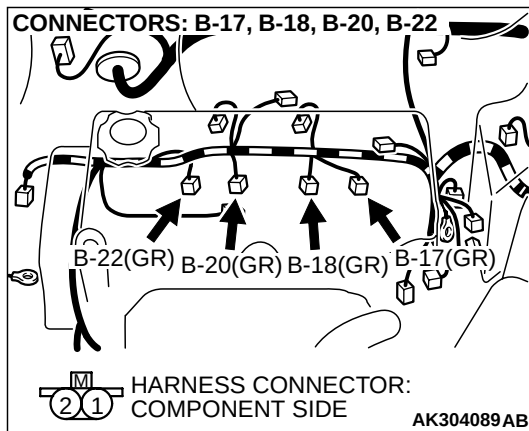
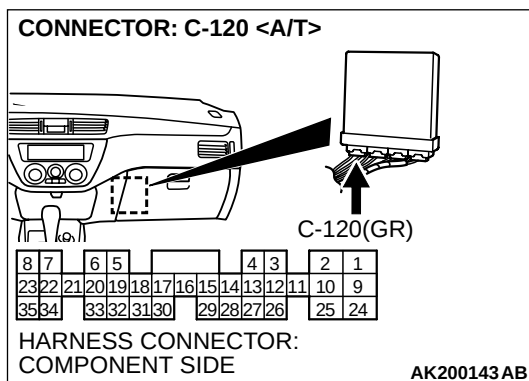
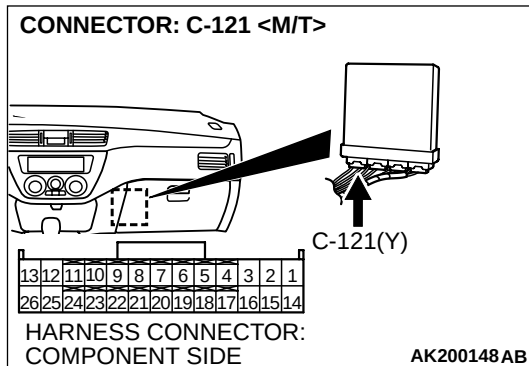
YES : Go to Step 4.

NO : Replace the injector. Then go to Step 9.

**STEP 4. Check connector at injector for damage.**

- Check connector B-22 at No. 1 cylinder.
- Check connector B-20 at No. 2 cylinder.
- Check connector B-18 at No. 3 cylinder.
- Check connector B-17 at No. 4 cylinder.

Q: Is the connector in good condition?**YES :** Go to Step 5.**NO :** Repair or replace the injector. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.**STEP 5. Check harness connector C-121 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.****Q: Is the harness connector in good condition?****YES :** Go to Step 6.**NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 9.



STEP 6. Check for harness damage between injector connector and ECM connector <M/T> or PCM connector <A/T>.

- Check the harness wire between injector connector B-22 (terminal No. 2) and ECM connector C-121 (terminal No. 1) <M/T> or PCM connector C-120 (terminal No. 1) <A/T> at No.1 cylinder.
- Check the harness wire between injector connector B-20 (terminal No. 2) and ECM connector C-121 (terminal No. 14) <M/T> or PCM connector C-120 (terminal No. 9) <A/T> at No.2 cylinder.
- Check the harness wire between injector connector B-18 (terminal No. 2) and ECM connector C-121 (terminal No. 2) <M/T> or PCM connector C-120 (terminal No. 24) <A/T> at No.3 cylinder.
- Check the harness wire between injector connector B-17 (terminal No. 2) and ECM connector C-121 (terminal No. 15) <M/T> or PCM connector C-120 (terminal No. 2) <A/T> at No.4 cylinder.

Q: Is the harness wire in good condition?

YES : Go to Step 7.

NO : Repair it. Then go to Step 9.

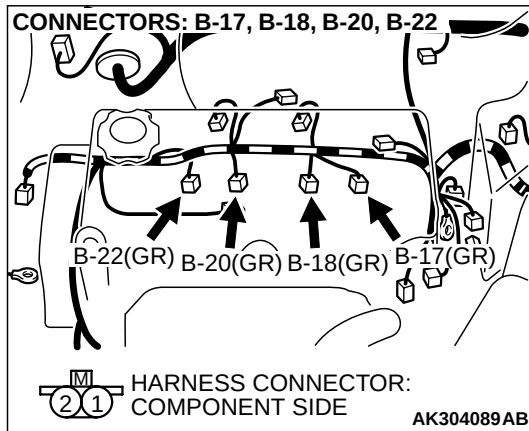
STEP 7. Check the compression.

Refer to GROUP 11A, On-Vehicle Service – Compression Pressure Check [P.11A-15](#).

Q: Are there any abnormalities?

YES : Go to Step 8.

NO : Repair or replace it. Then go to Step 9.

**STEP 8. Replace the injector.**

- (1) Replace the injector.
- (2) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (3) Check the diagnostic trouble code (DTC).

Q: Are DTC P0301, P0302, P0303 and P0304 sets?

YES : Replace the ECM or PCM. Then go to Step 9.

NO : The procedure is complete.

STEP 9. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

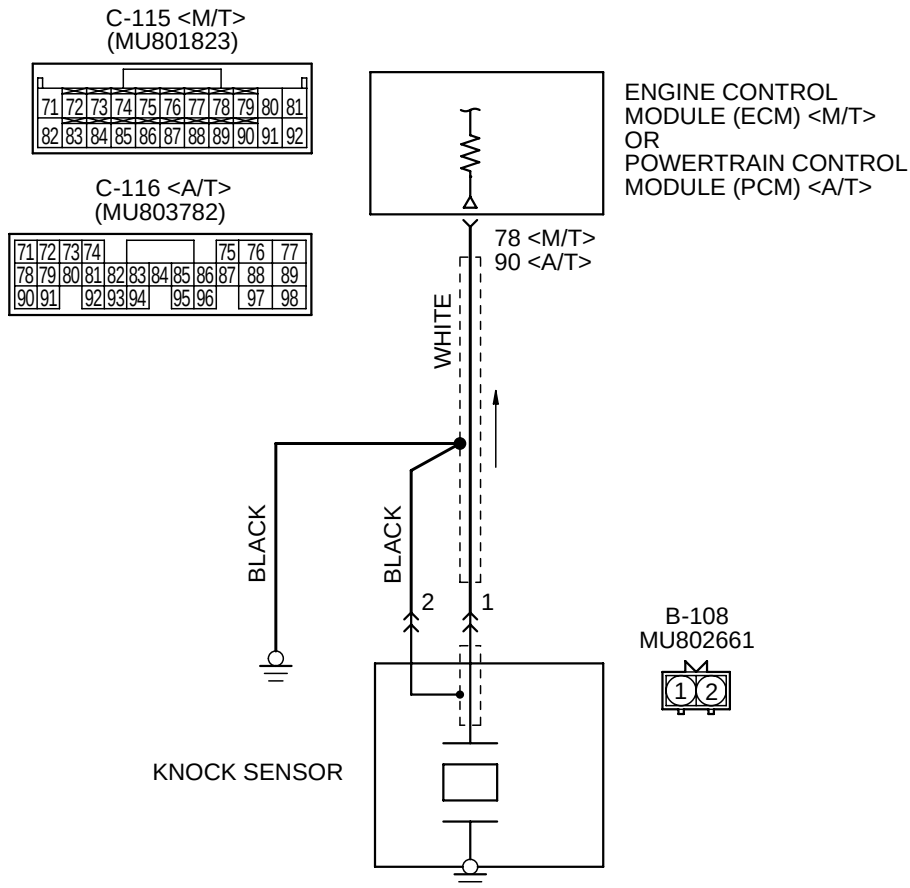
Q: Are DTC P0301, P0302, P0303 and P0304 set?

YES : Retry the troubleshooting.

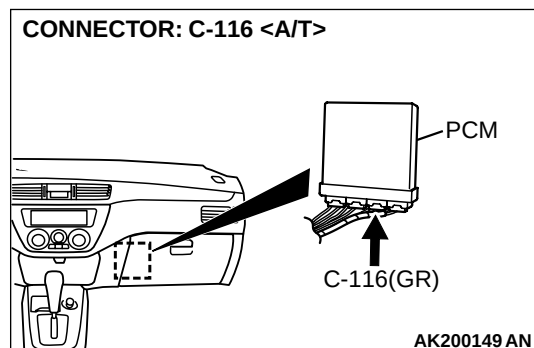
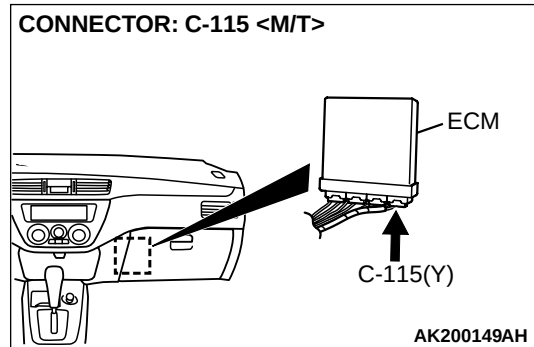
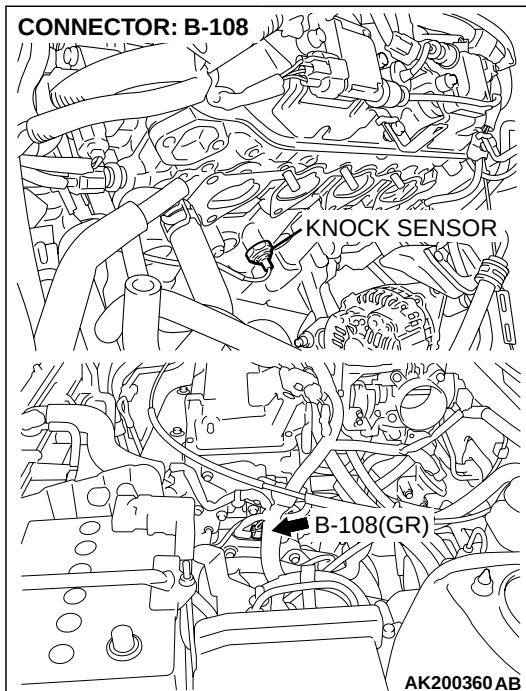
NO : The inspection is complete.

DTC P0325: Knock Sensor Circuit

Knock Sensor Circuit



AK100027



CIRCUIT OPERATION

- The knock sensor sends a signal voltage to the ECM (terminal No. 78) <M/T> or PCM (terminal No. 90) <A/T>.

TECHNICAL DESCRIPTION

- The knock sensor converts the vibration of the cylinder block into a voltage and outputs it. If there is a malfunction of the knock sensor, the voltage output will not change.
- The ECM <M/T> or PCM <A/T> checks whether the voltage output changes.

DTC SET CONDITIONS**Check Conditions**

- Two seconds or more have passed since the starting sequence was completed.

- Engine speed is higher than 2,500 r/min.

Judgment Criteria

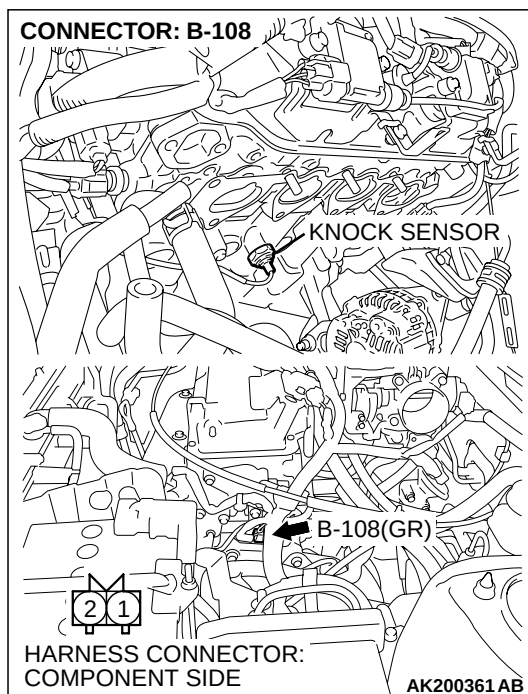
- Knock sensor output voltage (knock sensor peak voltage in each 1/2 turn of the crankshaft) has not changed more than 0.06 volt in the last consecutive 200 periods.

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Knock sensor failed.
- Open or shorted knock sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

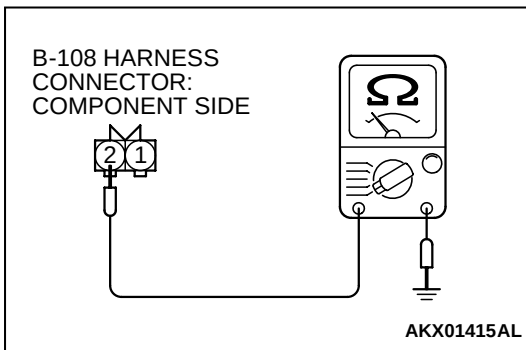
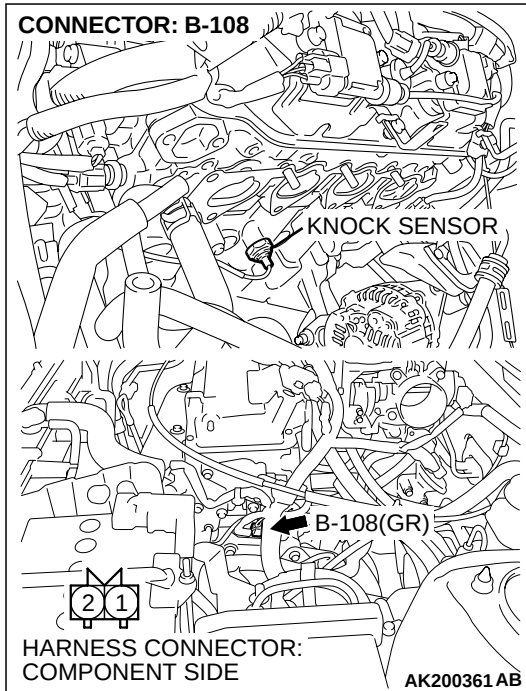
DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Check harness connector B-108 at the knock sensor for damage.**Q: Is the harness connector in good condition?****YES** : Go to Step 2.**NO** : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 6.

STEP 2. Check for continuity at knock sensor harness side connector B-108.

(1) Disconnect connector B-108 and measure at the harness side.



(2) Check for the continuity between terminal No. 2 and ground.

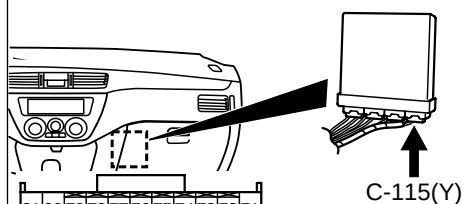
- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 3.

NO : Repair harness wire between knock sensor connector B-108 (terminal No. 2) and ground because of open circuit or harness damage. Then go to Step 6.

CONNECTOR: C-115 <M/T>

HARNESS CONNECTOR:
COMPONENT SIDE

AK200142 AB

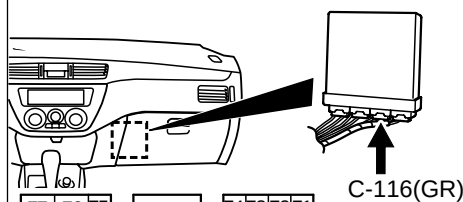
STEP 3. Check harness connector C-115 at ECM <M/T> or harness connector C-116 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 6.

CONNECTOR: C-116 <A/T>

HARNESS CONNECTOR:
COMPONENT SIDE

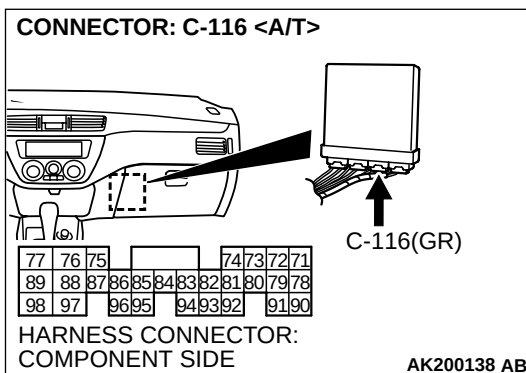
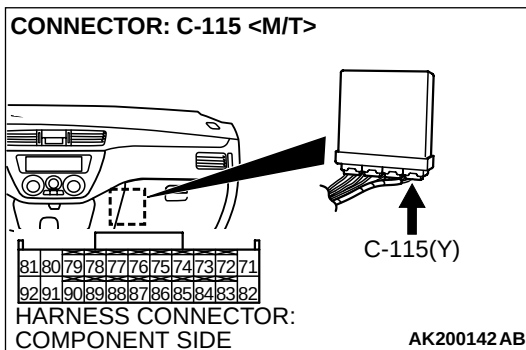
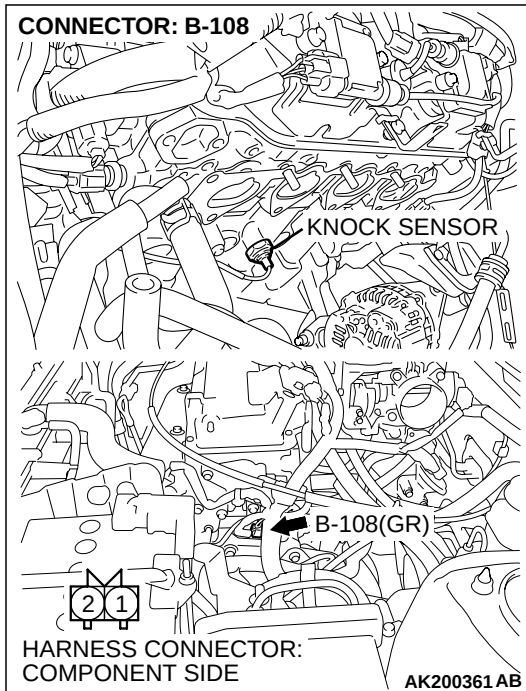
AK200138 AB

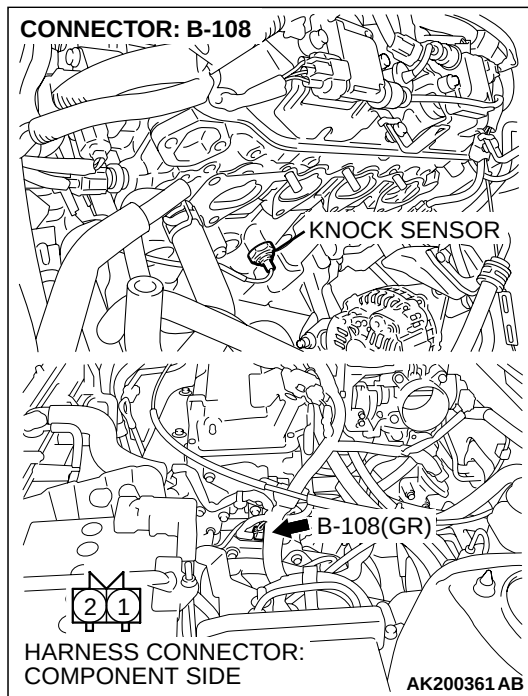
STEP 4. Check for open circuit and short circuit to ground and harness damage between knock sensor connector B-108 (terminal No. 1) and ECM connector C-115 (terminal No. 78) <M/T> or PCM connector C-116 (terminal No. 90) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 5.

NO : Repair it. Then go to Step 6.





STEP 5. Check the knock sensor.

- (1) Disconnect the knock sensor connector B-108.
- (2) Start the engine and run at idle.
- (3) Measure the voltage between knock sensor side connector terminal No. 1 (output) and No. 2 (ground).
- (4) Gradually increase the engine speed.
 - The voltage increases with the increase in the engine speed.
- (5) Turn the ignition switch to the "LOCK"(OFF) position.

Q: Is the sensor operating properly?

YES : Replace the ECM or PCM. Then go to Step 6.

NO : Replace the knock sensor. Then go to Step 6.

STEP 6. Using scan tool MB991958, read the diagnostic trouble code (DTC).

CAUTION

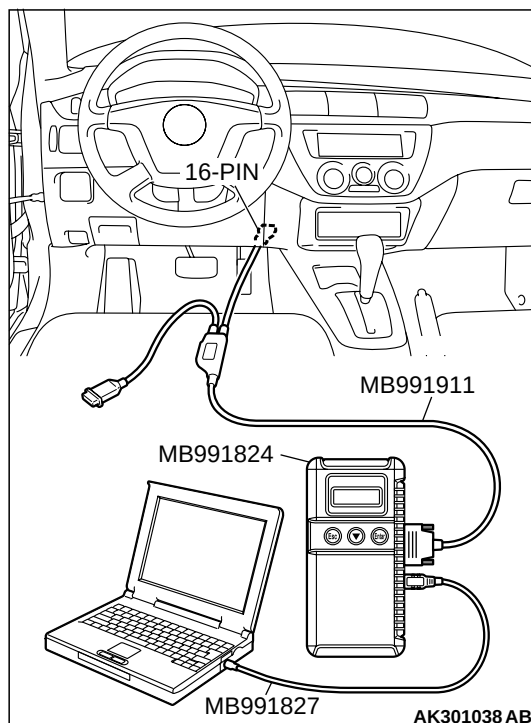
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Erase the DTC.
- (4) Test drive under the following conditions:
 - Engine speed: 3,000 – 5,000r/min
 - Engine load: 40 % or more
 - Drive a minimum of 3 seconds after the above conditions have been met.
- (5) After completing the test drive, read the DTC. Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is DTC P0325 set?

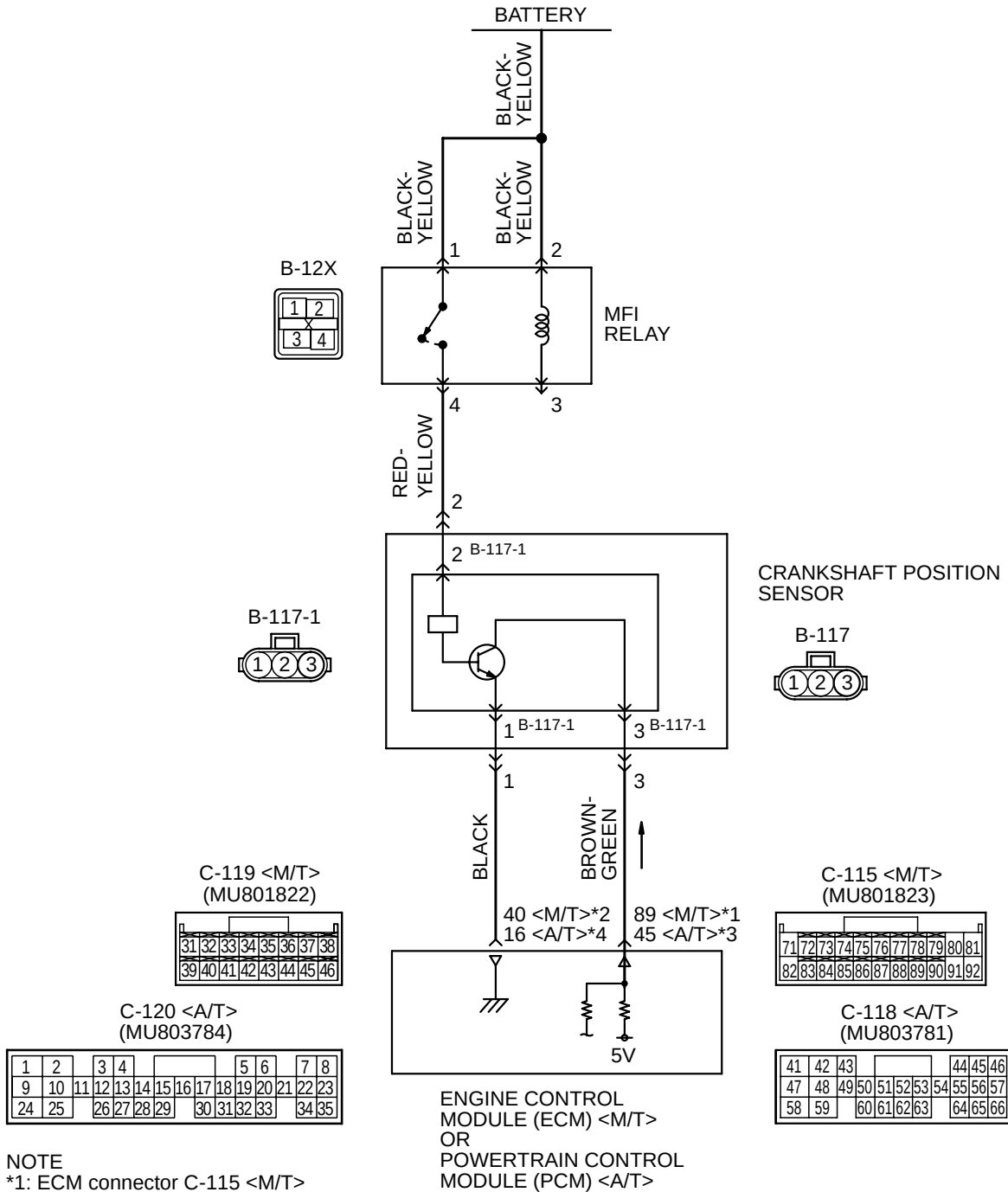
YES : The procedure is complete.

NO : Repeat the troubleshooting.



DTC P0335: Crankshaft Position Sensor Circuit

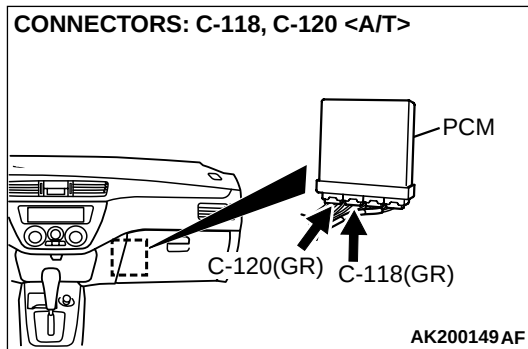
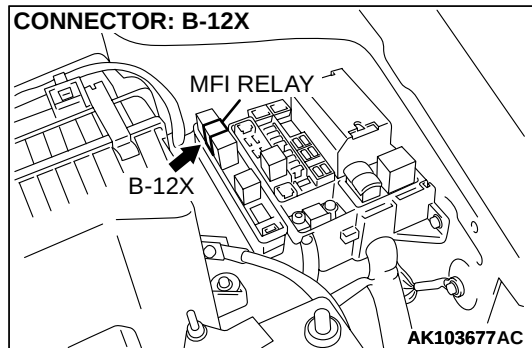
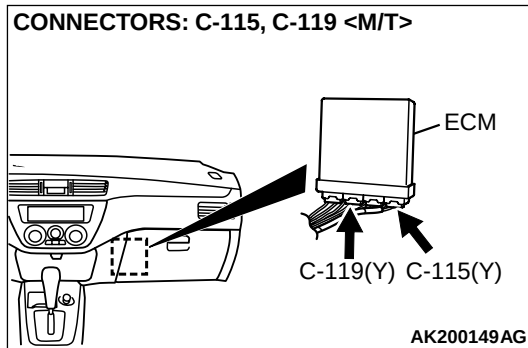
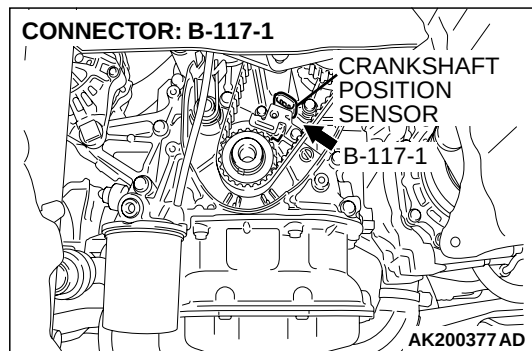
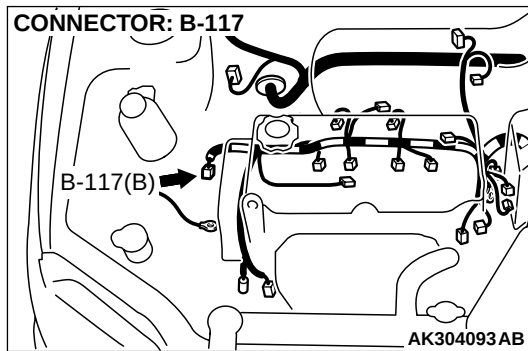
Crankshaft Position Sensor Circuit



NOTE

- *1: ECM connector C-115 <M/T>
- *2: ECM connector C-119 <M/T>
- *3: PCM connector C-118 <A/T>
- *4: PCM connector C-120 <A/T>

AK100028



CIRCUIT OPERATION

- The crankshaft position sensor power is supplied from the MFI relay (terminal No. 4).
- Terminal No. 1 of the crankshaft position sensor is grounded with ECM (terminal No. 40) <M/T> or PCM (terminal No. 16) <A/T>.
- A 5-volt voltage is applied on the crankshaft position sensor output terminal (terminal No. 3) from the ECM (terminal No. 89) <M/T> or PCM (terminal No. 45) <A/T>. The crankshaft position sensor generates a pulse signal when the output terminal is opened and grounded.

TECHNICAL DESCRIPTION

- The crankshaft position sensor detects the crank angle (position) of each cylinder, and converts that data to pulse signals, which are then input to the ECM <M/T> or PCM <A/T>.
- When the engine is running, the crankshaft position sensor outputs a pulse signal.

- The ECM <M/T> or PCM <A/T> checks whether pulse signal is input while the engine is cranking.

DESCRIPTIONS OF MONITOR METHODS

- An open, short circuit, or faulty output pattern is detected while monitoring the crankshaft position sensor output.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

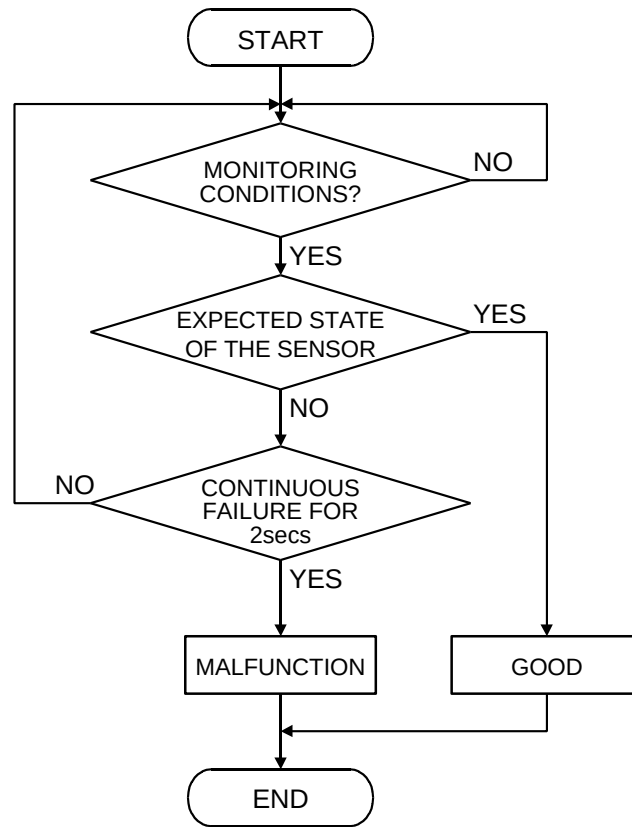
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS <Range/Performance problem-alignment>

Logic Flow Chart



AK302321

Check Conditions

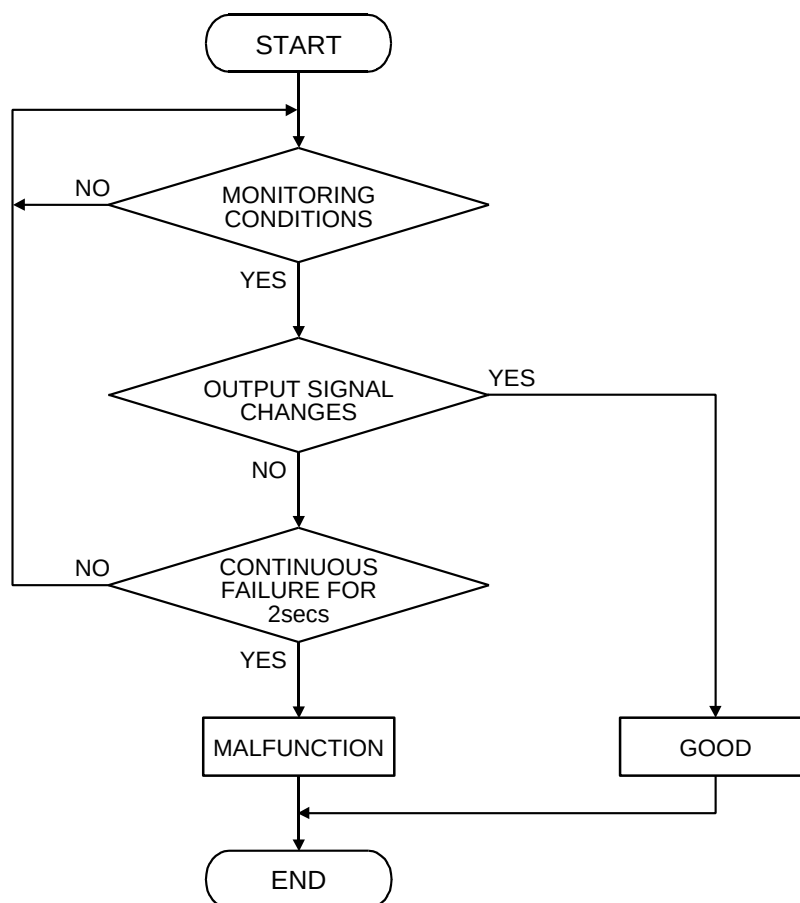
- Engine is being cranked.

Judgment Criteria

- Crankshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

DTC SET CONDITIONS <Circuit continuity>

Logic Flow Chart



AK302322

Check Conditions, Judgment Criteria

- Normal signal pattern has not been input for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle –
Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Crankshaft position sensor failed.
- Open or shorted crankshaft position sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B
- MB991658: Test Harness Set

STEP 1. Using scan tool MB991958, check data list item 22: Crankshaft Position Sensor.

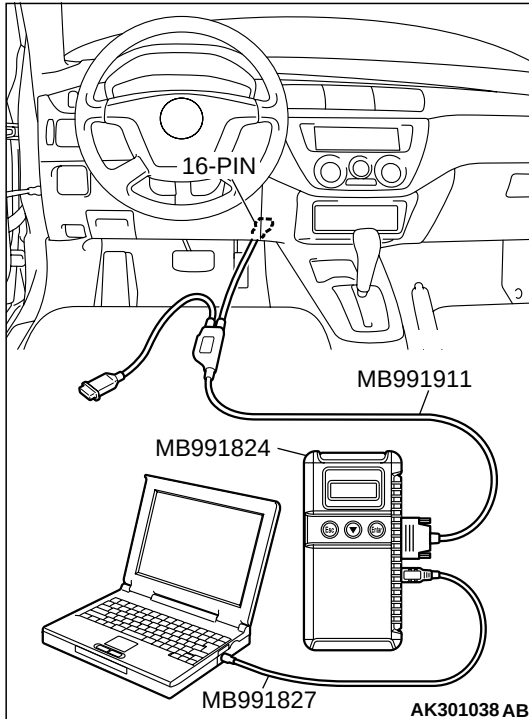
⚠ CAUTION

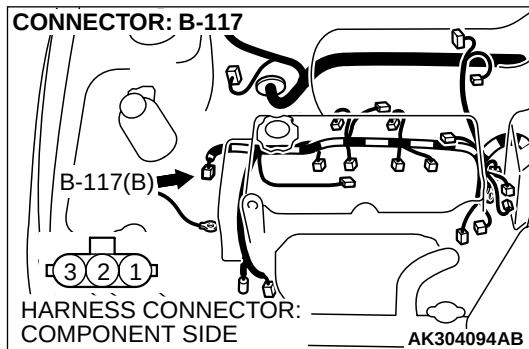
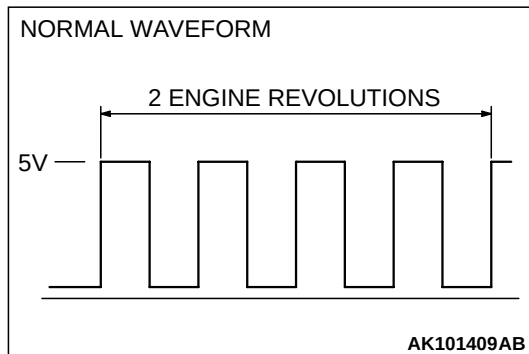
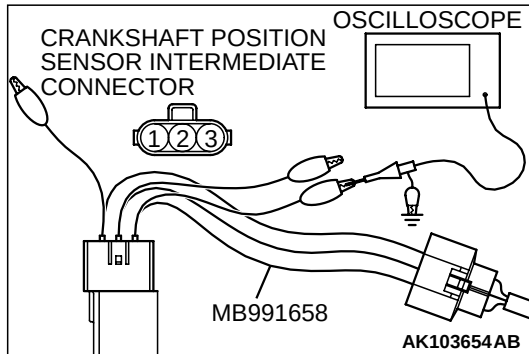
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 22, Crankshaft Position Sensor.
 - The tachometer and engine speed indicated on the scan tool should much.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

- YES :** It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).
- NO :** Go to Step 2.





STEP 2. Using the oscilloscope, check the crankshaft position sensor.

- (1) Disconnect the crankshaft position sensor intermediate connector B-117, and connect test harness special tool (MB991658) in between. (All terminals should be connected.)
- (2) Connect the oscilloscope probe to the crankshaft position sensor side connector terminal No. 3.
NOTE: Connect the oscilloscope probe to terminal No. 89 <M/T> or terminal No. 45 <A/T> by backprobing when measuring with the ECM or PCM connector.
- (3) Start the engine and run at idle.

- (4) Check the waveform.
 - The waveform should show a pattern similar to the illustration.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the waveform normal?

YES : Go to Step 3.

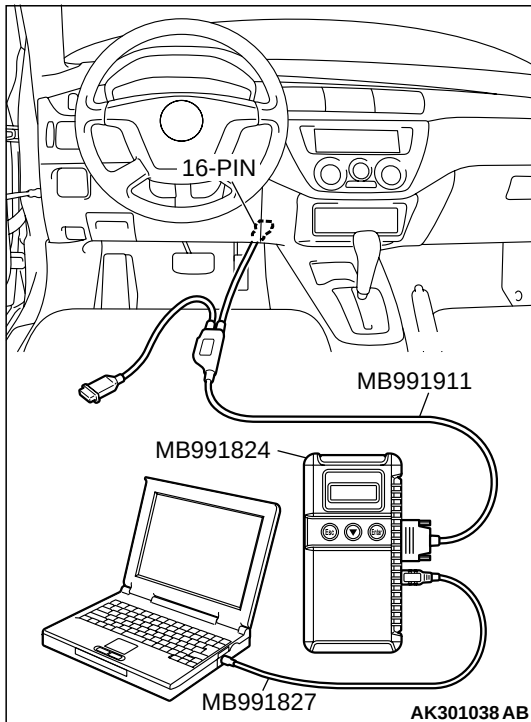
NO : Go to Step 5.

STEP 3. Check harness connector B-117 at the crankshaft position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 4.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.



STEP 4. Using scan tool MB991958, check data list item 22: Crankshaft Position Sensor.

⚠ CAUTION

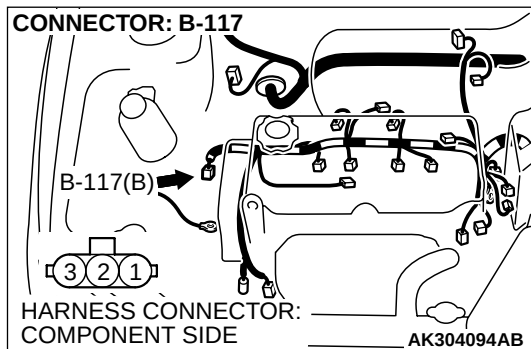
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the data reading mode for item 22, Crankshaft Position Sensor.
 - The tachometer and engine speed indicated on the scan tool should much.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Replace the ECM or PCM. Then go to Step 23.

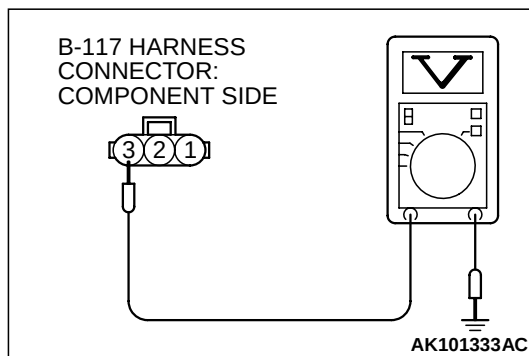
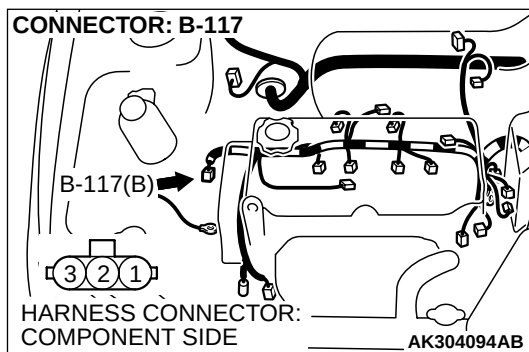


STEP 5. Check harness connector B-117 at the crankshaft position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 6.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.

**STEP 6. Measure the sensor supply voltage at crankshaft position sensor harness side connector B-117.**

- (1) Disconnect connector B-117 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 3 and ground.
 - Voltage should be between 4.8 and 5.2 volts.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

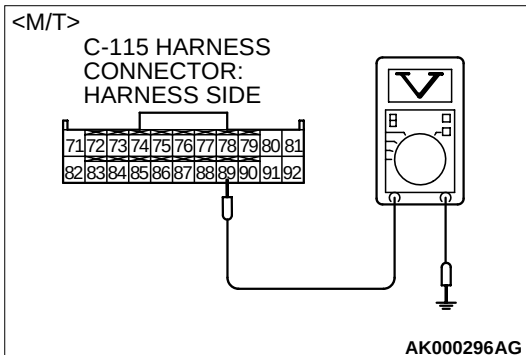
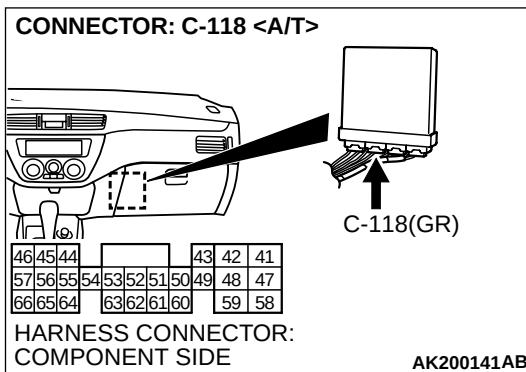
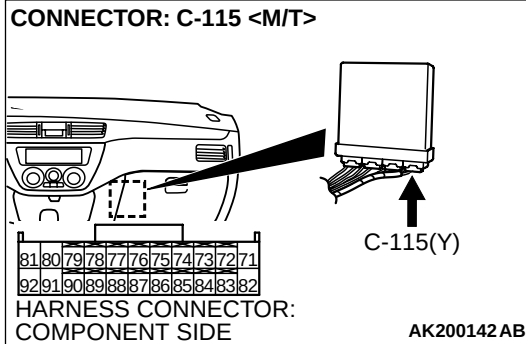
Q: Is the measured voltage between 4.8 and 5.2 volts?

YES : Go to Step 11.

NO : Go to Step 7.

STEP 7. Measure the sensor supply voltage at ECM connector C-115 <M/T> or PCM connector C-118 <A/T> by backprobing.

- (1) Do not disconnect the ECM connector C-115 <M/T> or PCM connector C-118 <A/T>.
- (2) Disconnect the crankshaft position sensor connector B-117.
- (3) Turn the ignition switch to the "ON" position.

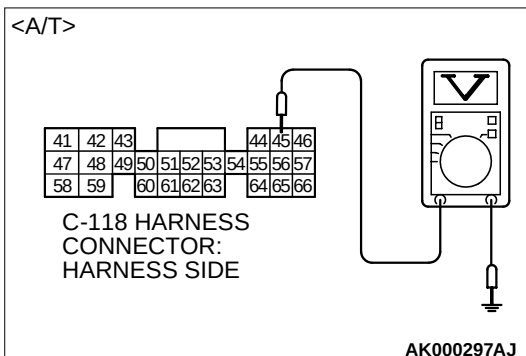


- (4) Measure the voltage between terminal No. 89 <M/T> or No. 45 <A/T> and ground by backprobing.
 - Voltage should be between 4.8 and 5.2 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

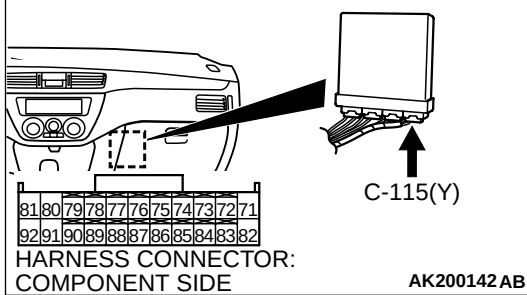
Q: Is the measured voltage between 4.8 and 5.2 volts?

YES : Go to Step 8.

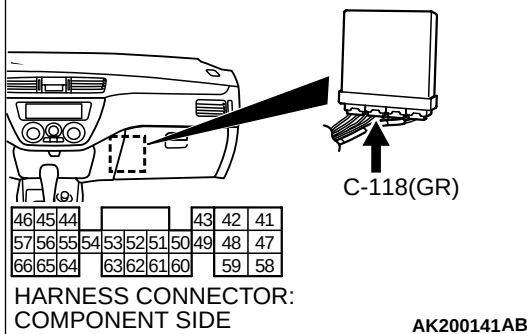
NO : Go to Step 9.



CONNECTOR: C-115 <M/T>



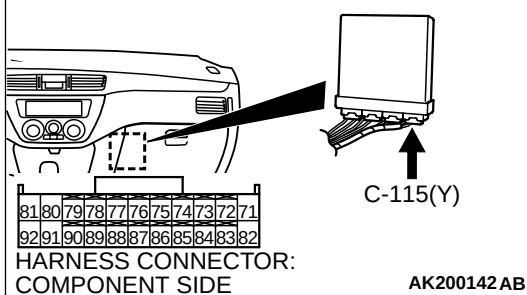
CONNECTOR: C-118 <A/T>



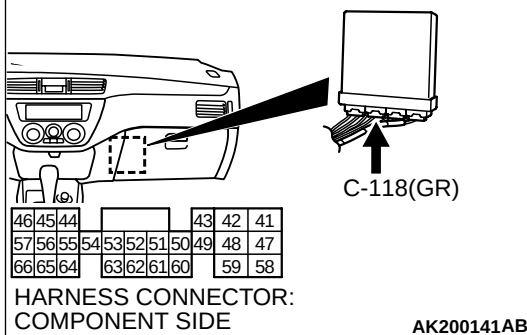
STEP 8. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

- YES :** Repair it because of open circuit between crankshaft position sensor connector B-117 (terminal No. 3) and ECM connector C-115 (terminal No. 89) <M/T> or PCM connector C-118 (terminal No. 45) <A/T>. Then go to Step 23.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.

CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>



STEP 9. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

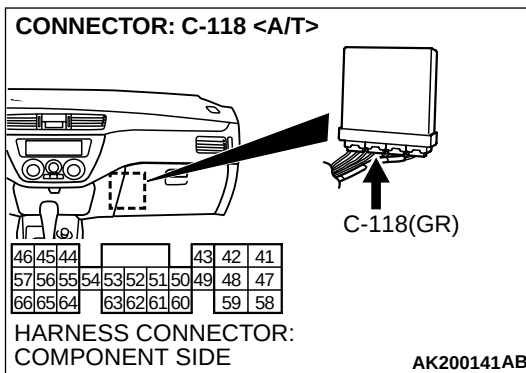
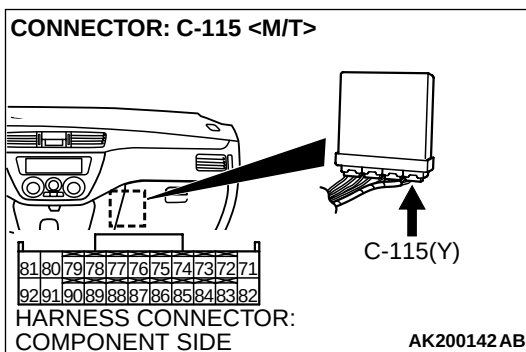
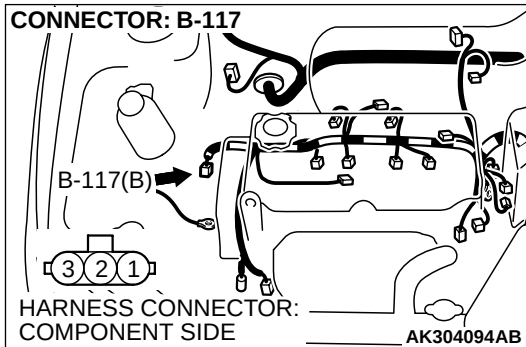
- YES :** Go to Step 10.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.

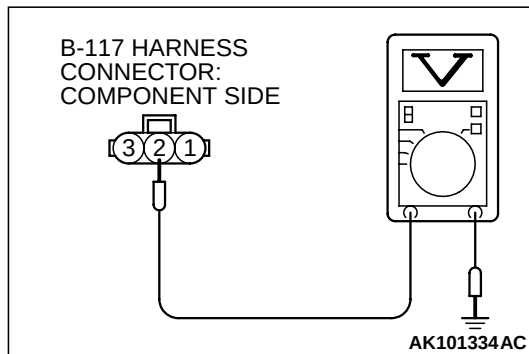
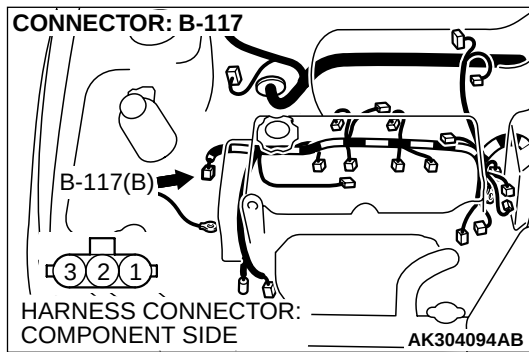
STEP 10. Check for short circuit to ground between crankshaft position sensor connector B-117 (terminal No. 3) and ECM connector C-115 (terminal No. 89) <M/T> or PCM connector C-118 (terminal No. 45) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 23.

NO : Repair it. Then go to Step 23.



**STEP 11. Measure the power supply voltage at crankshaft position sensor harness side connector B-117.**

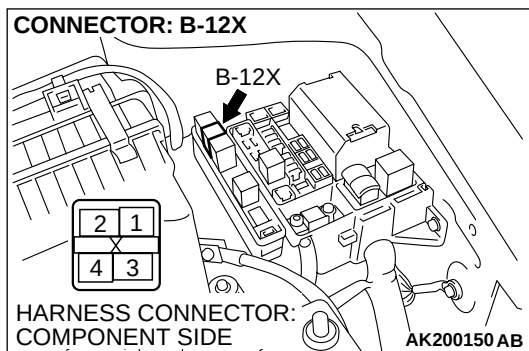
- (1) Disconnect connector B-117 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 2 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 13.

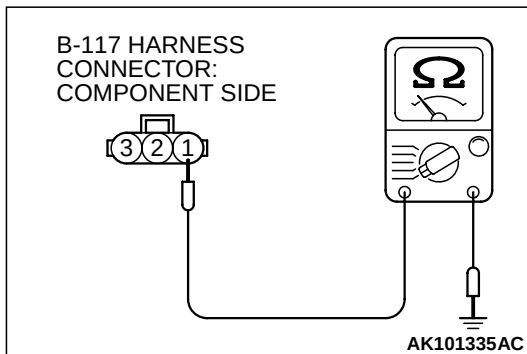
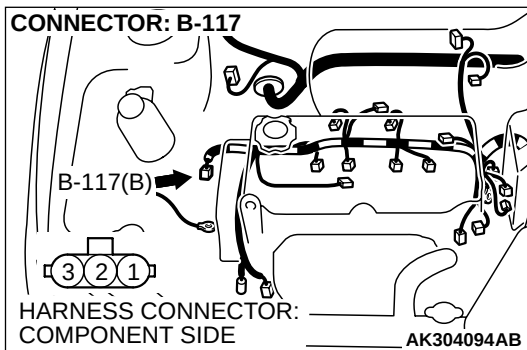
NO : Go to Step 12.

**STEP 12. Check harness connector B-12X at MFI relay for damage.**

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-12X (terminal No. 4) and crankshaft position sensor connector B-117 (terminal No. 2) because of open circuit or short circuit to ground. Then go to Step 23.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.



STEP 13. Check for continuity at crankshaft position sensor harness side connector B-117.

(1) Disconnect connector B-117 and measure at the harness side.

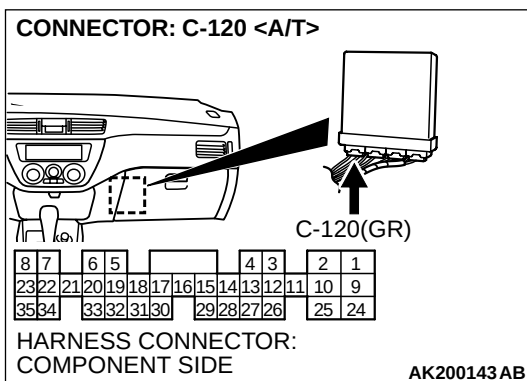
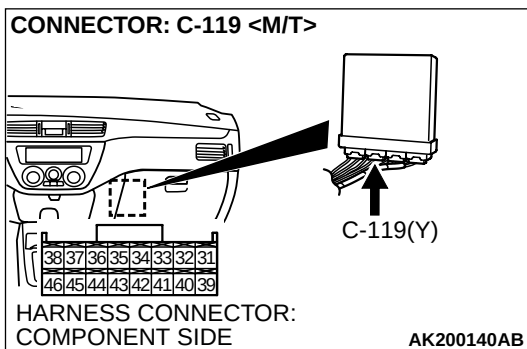
(2) Check for the continuity between terminal No. 1 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 16.

NO : Go to Step 14.



STEP 14. Check harness connector C-119 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

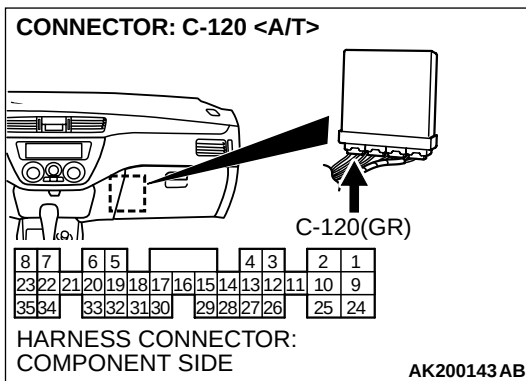
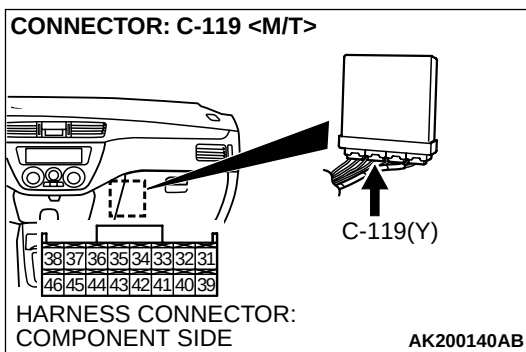
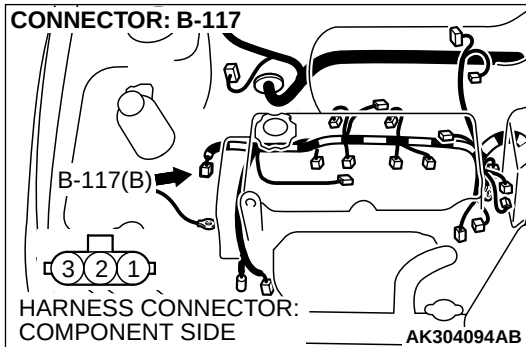
YES : Go to Step 15.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.

STEP 15. Check for open circuit and harness damage between crankshaft position sensor connector B-117 (terminal No. 1) and ECM connector C-119 (terminal No. 40) <M/T> or PCM connector C-120 (terminal No. 16) <A/T>.
Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 23.

NO : Repair it. Then go to Step 23.

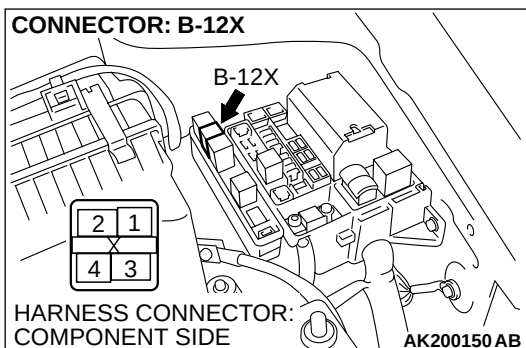


STEP 16. Check harness connector B-12X at the MFI relay for damage.

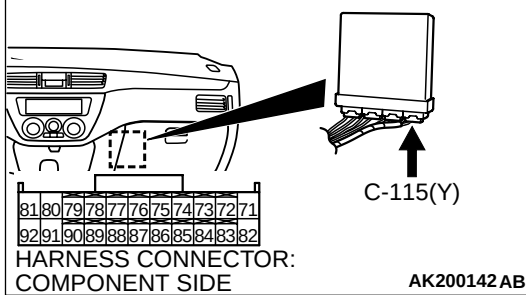
Q: Is the harness connector in good condition?

YES : Go to Step 17.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 23.



CONNECTOR: C-115 <M/T>

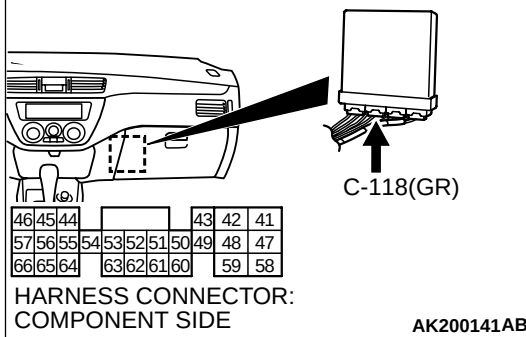


STEP 17. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 18.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.

CONNECTOR: C-118 <A/T>

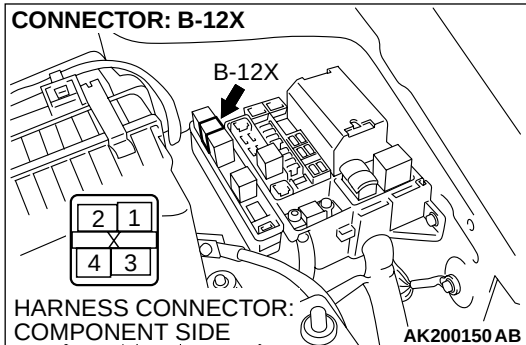


STEP 18. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and crankshaft position sensor connector B-117 (terminal No. 2).
Q: Is the harness wire in good condition?

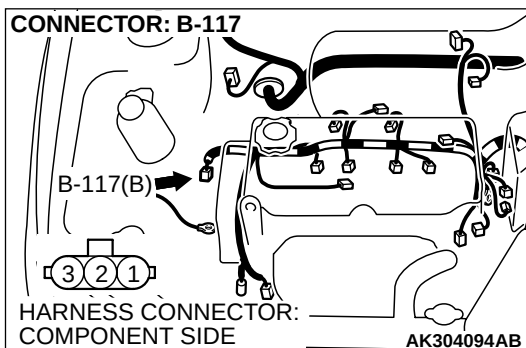
YES : Go to Step 19.

NO : Repair it. Then go to Step 23.

CONNECTOR: B-12X



CONNECTOR: B-117

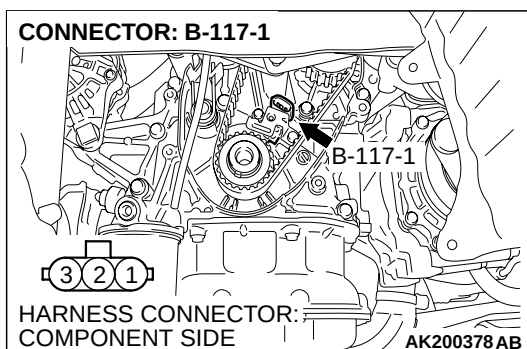
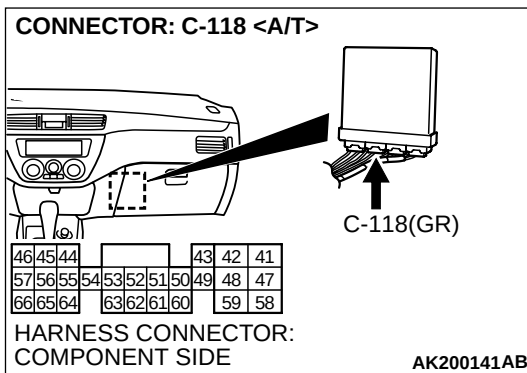
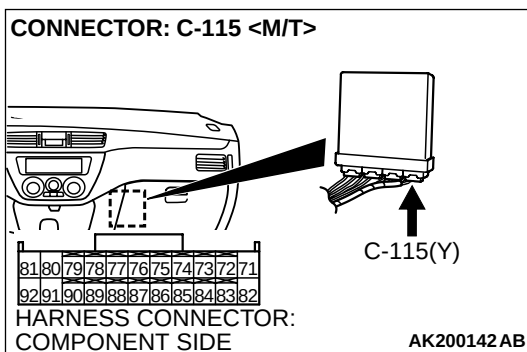
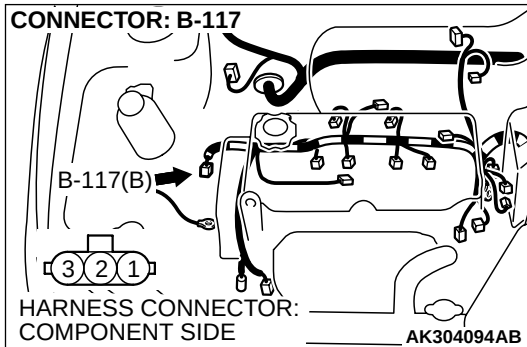


STEP 19. Check for harness damage between crankshaft position sensor connector B-117 (terminal No. 3) and ECM connector C-115 (terminal No. 89) <M/T> or PCM connector C-118 (terminal No. 45) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 20.

NO : Repair it. Then go to Step 23.

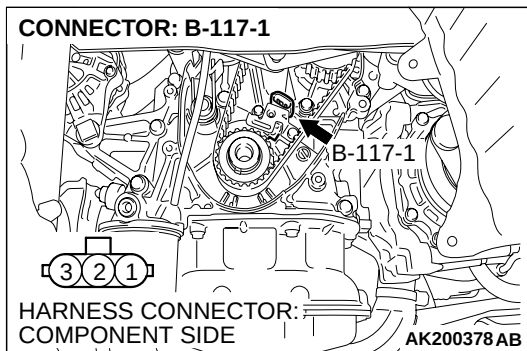
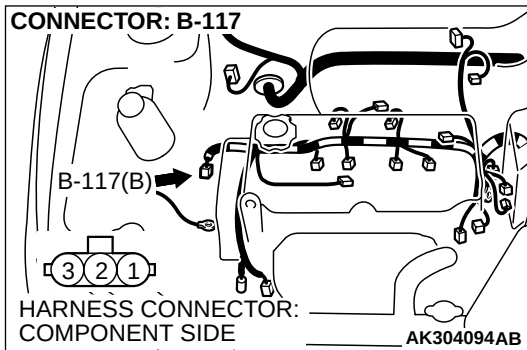


STEP 20. Check harness connector B-117-1 for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 21.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 23.



STEP 21. Check for open circuit and short circuit to ground and harness damage between connector B-117 and connector B-117-1.

Q: Is the harness wire in good condition?

YES : Go to Step 22.

NO : Replace the timing belt cover (lower). Then go to Step 23.

STEP 22. Check the crankshaft sensing blade.

Q: Is the crankshaft sensing blade in a good condition?

YES : Replace the crankshaft position sensor. Then go to Step 23.

NO : Repair it. Then go to Step 23.

STEP 23. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

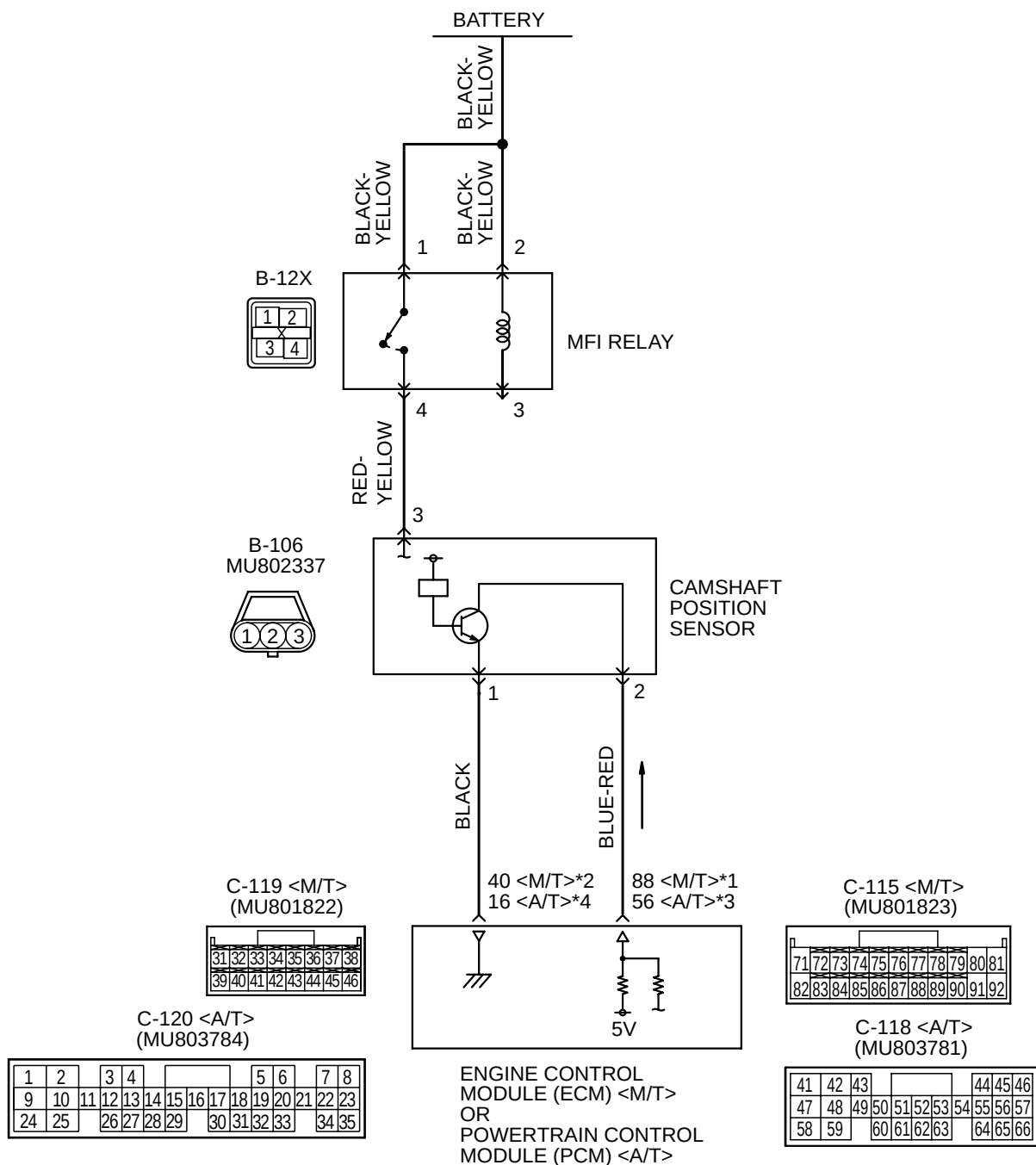
Q: Is DTC P0335 set?

YES : Retry the troubleshooting.

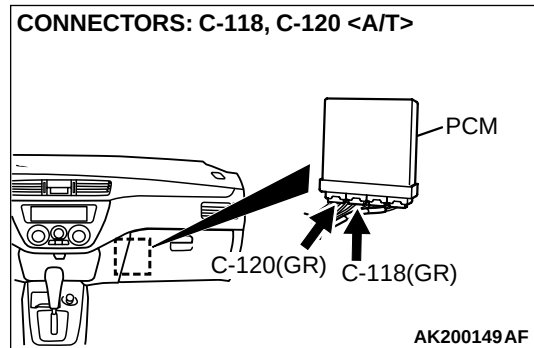
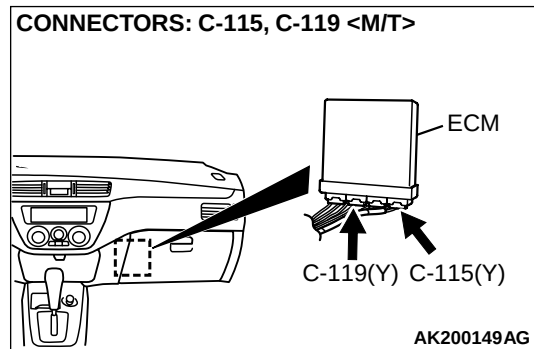
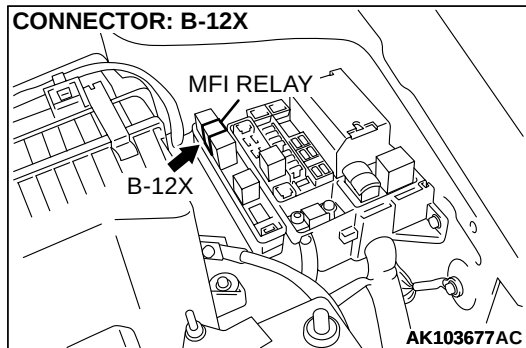
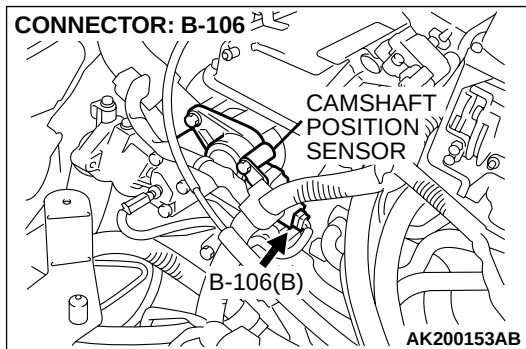
NO : The inspection is complete.

DTC P0340: Camshaft Position Sensor Circuit

Camshaft Position Sensor Circuit



AK100029



CIRCUIT OPERATION

- The camshaft position sensor power is supplied from the MFI relay (terminal No. 4).
- Terminal No. 1 of the camshaft position sensor is grounded with ECM (terminal No. 40) <M/T> or PCM (terminal No. 16) <A/T>.
- A 5-volt voltage is applied on the camshaft position sensor output terminal (terminal No. 2) from the ECM (terminal No. 88) <M/T> or PCM (terminal No. 56) <A/T>. The camshaft position sensor generates a pulse signal when the output terminal is opened and grounded.

TECHNICAL DESCRIPTION

- The camshaft position sensor functions to detect the top dead center position of the number 1 cylinder and to convert that data to pulse signals that are input to the ECM <M/T> or PCM <A/T>.
- When the engine is running, the camshaft position sensor outputs a pulse signal.

- The ECM <M/T> or PCM <A/T> checks whether pulse signal is input while the engine is cranking.

DESCRIPTIONS OF MONITOR METHODS

- An open, short circuit, or faulty output pattern is detected while monitoring the camshaft position sensor output.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

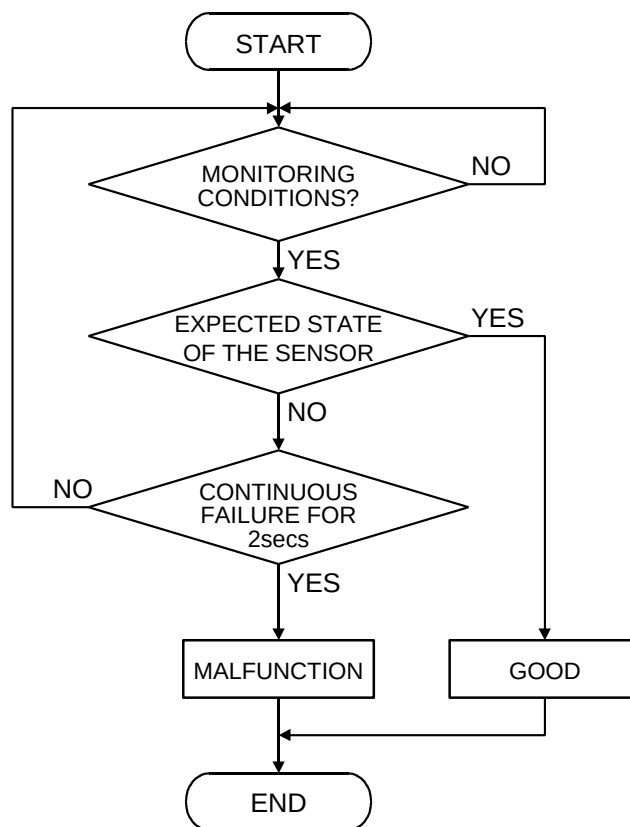
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS <Range/Performance problem-alignment>

Logic Flow Chart



AK302321

Check Conditions

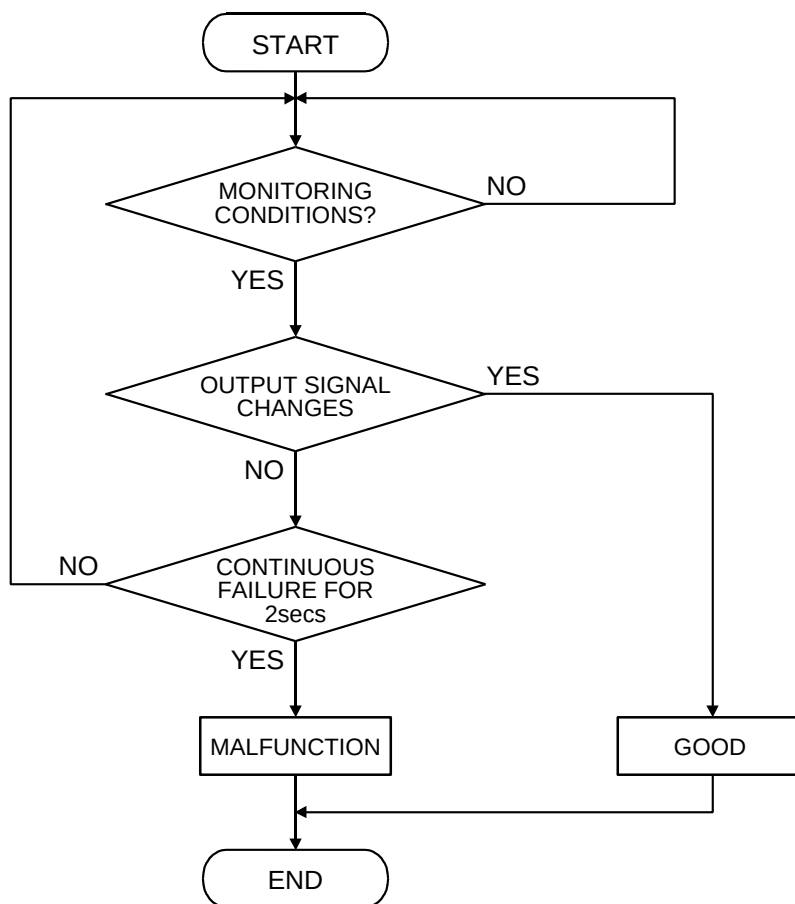
- Engine speed is higher than 50 r/min.

Judgment Criteria

- Camshaft position sensor output voltage has not changed (no pulse signal is input) for 2 seconds.

DTC SET CONDITIONS <Circuit continuity>

Logic Flow Chart



AK302323

Check Conditions

- Engine speed is higher than 50 r/min.

Judgment Criteria

- Normal signal pattern has not been input for cylinder identification from the crankshaft position sensor signal and camshaft position sensor signal for 2 seconds.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

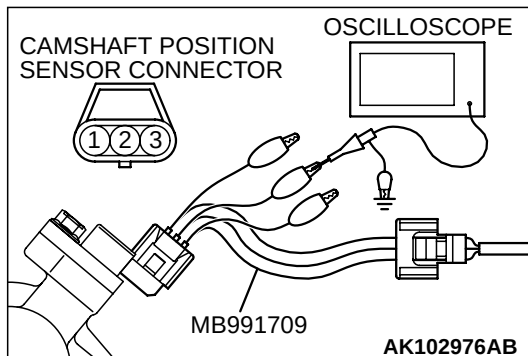
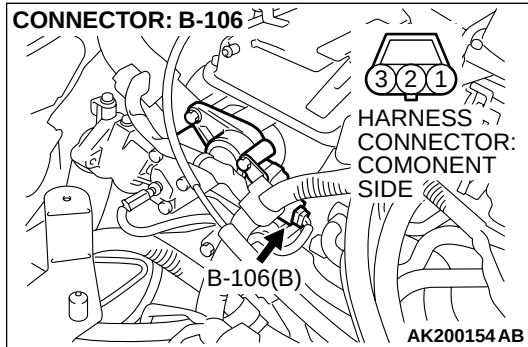
- Camshaft position sensor failed.
- Open or shorted camshaft position sensor circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**Required Special Tool:**

- MB991709: Test Harness Set

STEP 1. Using the oscilloscope, check the camshaft position sensor.

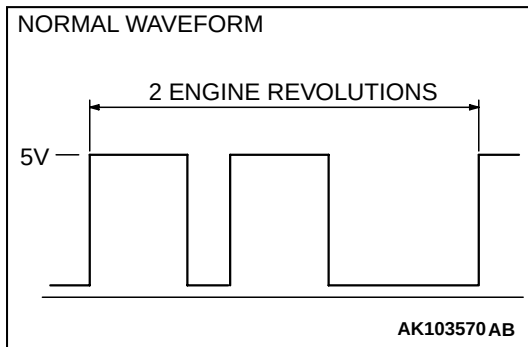
- (1) Disconnect the camshaft position sensor connector B-106, and connect test harness special tool (MB991709) in between. (All terminals should be connected.)



- (2) Connect the oscilloscope probe to the camshaft position sensor side connector terminal No. 2.

NOTE: When measuring with the ECM or PCM side connector, connect an oscilloscope probe to terminal No. 88 <M/T> or terminal No. 56 <A/T>.

- (3) Start the engine and run at idle.



- (4) Check the waveform.

- The waveform should show a pattern similar to the illustration.

- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the waveform normal?

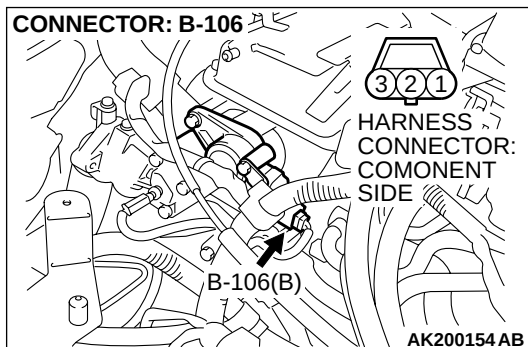
YES : Go to Step 2.

NO : Go to Step 4.

STEP 2. Check connector B-106 at camshaft position sensor for damage.**Q: Is the connector in good condition?**

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.



STEP 3. Retest the system.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0340 set?

YES : Replace the ECM or PCM. Then go to Step 20.

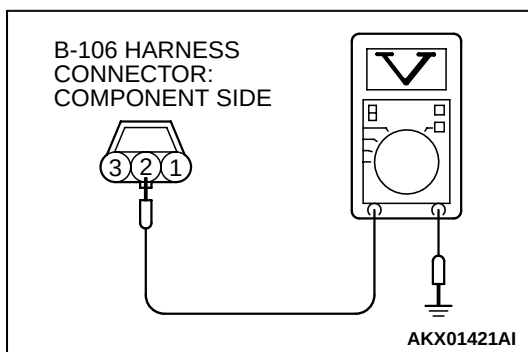
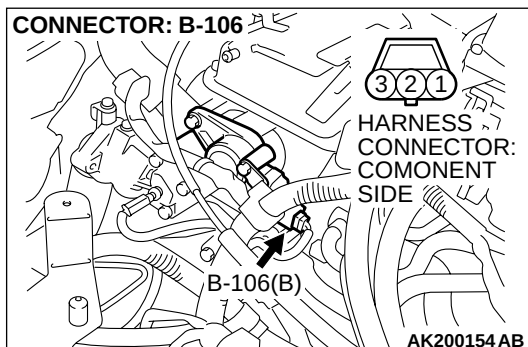
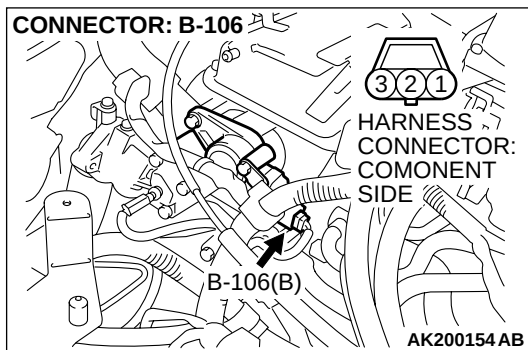
NO : It can be assumed that this malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points [P.00-6](#).

STEP 4. Check harness connector B-106 at camshaft position sensor for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 5.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.



STEP 5. Measure the sensor supply voltage at camshaft position sensor connector B-106.

- (1) Disconnect connector B-106 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

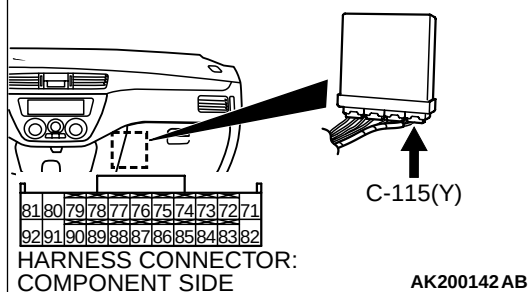
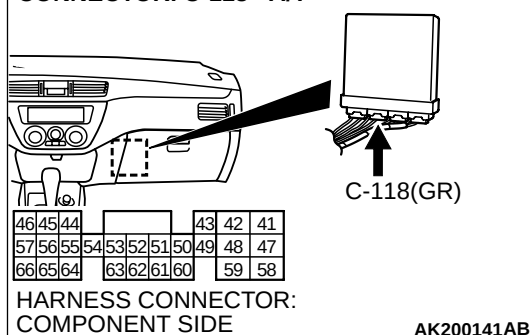
- (3) Measure the voltage between terminal No. 2 and ground.
 - Voltage should be between 4.8 and 5.2 volts.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.8 and 5.2 volts?

YES : Go to Step 10.

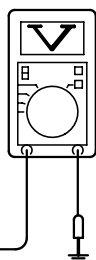
NO : Go to Step 6.

CONNECTOR: C-115 <M/T>**CONNECTOR: C-118 <A/T>**

<M/T>

C-115 HARNESS
CONNECTOR:
HARNESS SIDE

71	72	73	74	75	76	77	78	79	80	81
82	83	84	85	86	87	88	89	90	91	92



AK000317AG

STEP 6. Measure the sensor supply voltage at ECM connector C-115 <M/T> or PCM connector C-118 <A/T> by backprobing.

- (1) Do not disconnect the ECM connector C-115 <M/T> or PCM connector C-118 <A/T>.
- (2) Disconnect the camshaft position sensor connector B-106.
- (3) Turn the ignition switch to the "ON" position.

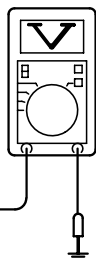
- (4) Measure the voltage between terminal No. 88 <M/T> or No. 56 <A/T> and ground by backprobing.
 - Voltage should be between 4.8 and 5.2 volts.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the measured voltage between 4.8 and 5.2 volts?**YES :** Go to Step 7.**NO :** Go to Step 8.

<A/T>

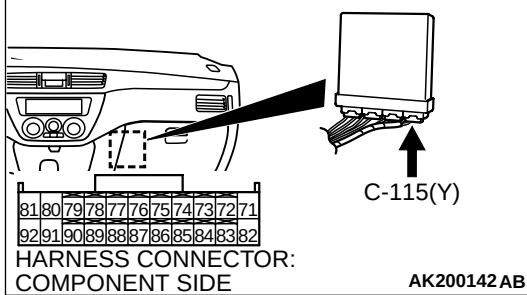
C-118 HARNESS
CONNECTOR:
HARNESS SIDE

41	42	43		44	45	46
47	48	49	50	51	52	53
54	55	56	57	58	59	60
61	62	63	64	65	66	

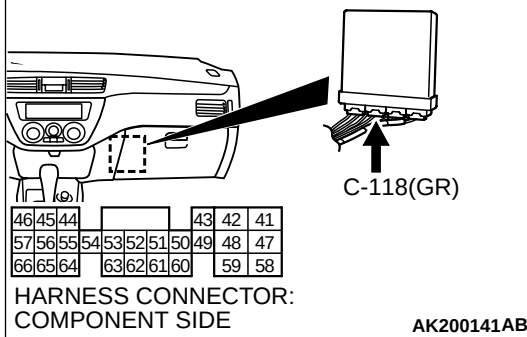


AK000318AJ

CONNECTOR: C-115 <M/T>



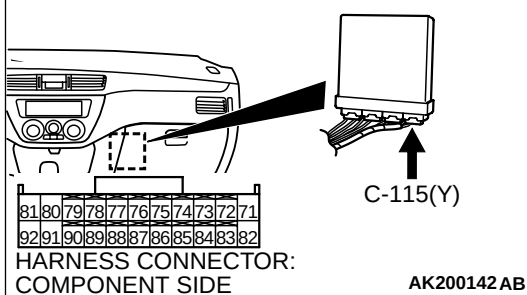
CONNECTOR: C-118 <A/T>



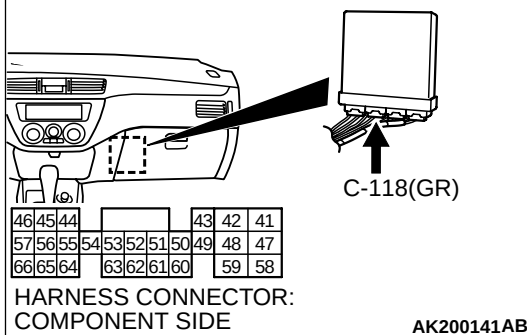
STEP 7. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

- YES :** Repair harness wire between camshaft position sensor connector B-106 (terminal No. 2) and ECM connector C-115 (terminal No. 88) <M/T> or PCM connector C-118 (terminal No. 56) <A/T> because of open circuit. Then go to Step 20.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

CONNECTOR: C-115 <M/T>



CONNECTOR: C-118 <A/T>



STEP 8. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

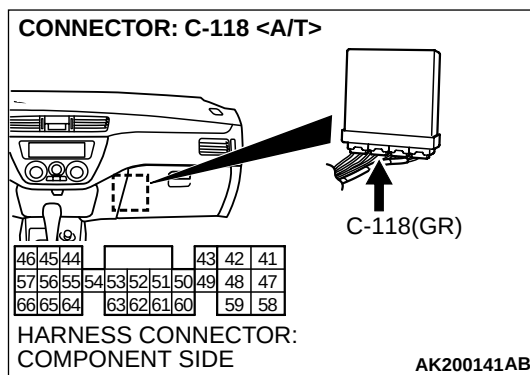
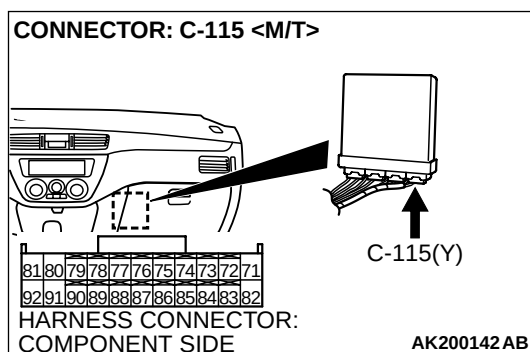
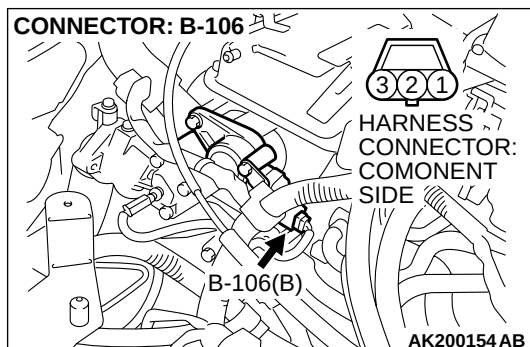
- YES :** Go to Step 9.
- NO :** Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

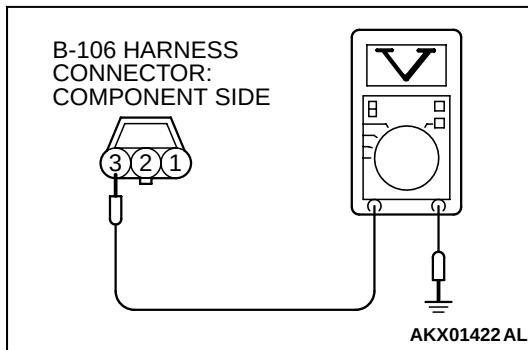
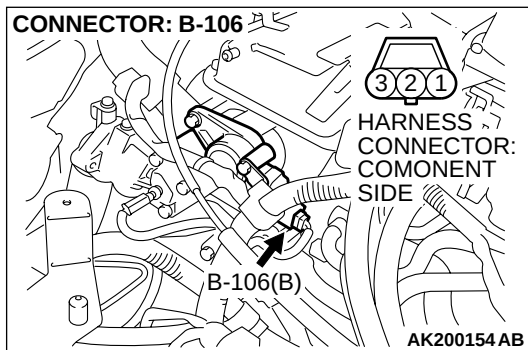
STEP 9. Check for short circuit to ground between camshaft position sensor connector B-106 (terminal No. 2) and ECM connector C-115 (terminal No. 88) <M/T> or PCM connector C-118 (terminal No. 56) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 20.

NO : Repair it. Then go to Step 20.





STEP 10. Measure the power supply voltage at camshaft position sensor connector B-106.

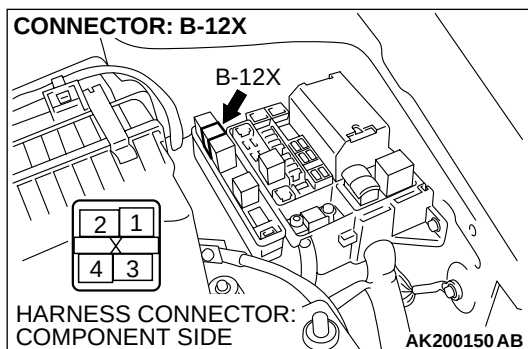
- (1) Disconnect connector B-106 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

- (3) Measure the voltage between terminal No. 3 and ground.
 - Voltage should be battery positive voltage.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 12.

NO : Go to Step 11.

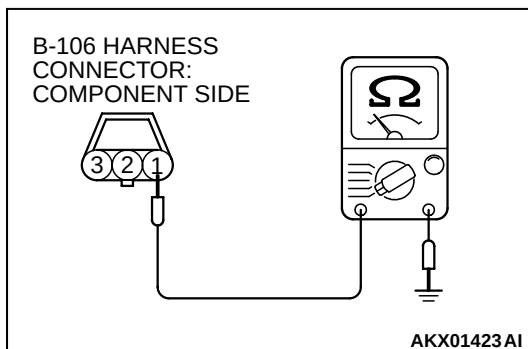
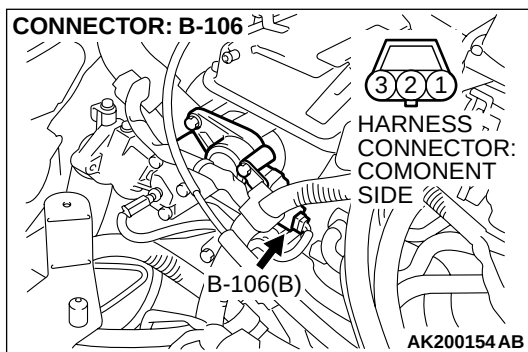


STEP 11. Check harness connector B-12X at MFI relay for damage.

Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-12X (terminal No. 4) and camshaft position sensor connector B-106 (terminal No. 3) because of open circuit or short circuit to ground. Then go to Step 20.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.



STEP 12. Check for continuity at camshaft position sensor connector B-106.

(1) Disconnect connector B-106 and measure at the harness side.

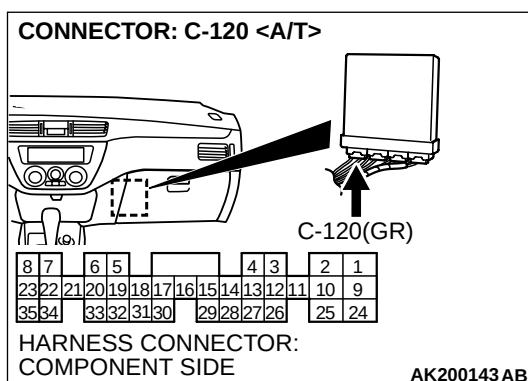
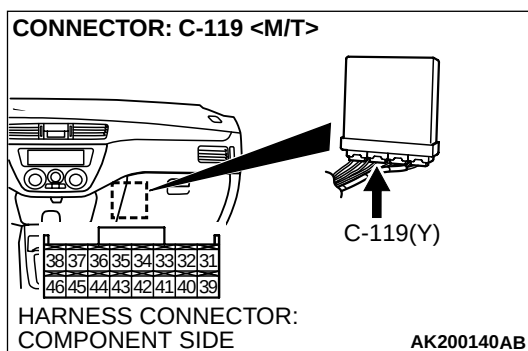
(2) Check for the continuity between terminal No. 1 and ground.

- Should be less than 2 ohms.

Q: Does continuity exist?

YES : Go to Step 15.

NO : Go to Step 13.



STEP 13. Check harness connector C-119 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

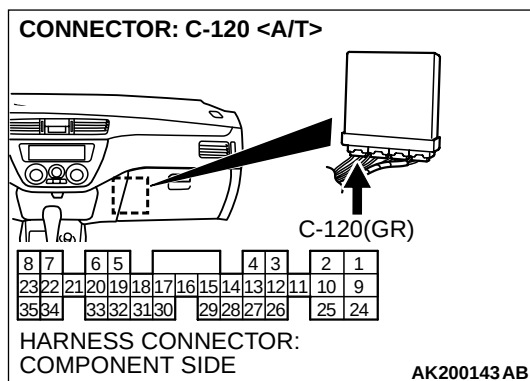
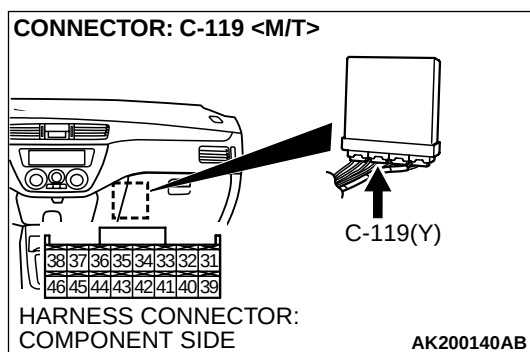
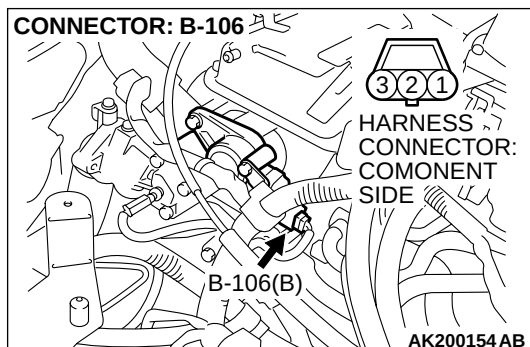
YES : Go to Step 14.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

STEP 14. Check for open circuit and harness damage between camshaft position sensor connector B-106 (terminal No. 1) and ECM connector C-119 (terminal No. 40) <M/T> or PCM connector C-120 (terminal No. 16) <A/T>.
Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 20.

NO : Repair it. Then go to Step 20.

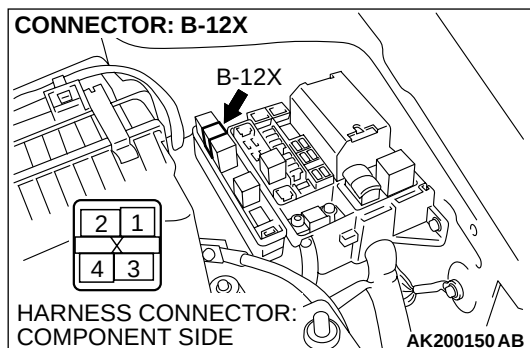


STEP 15. Check harness connector B-12X at the MFI relay for damage.

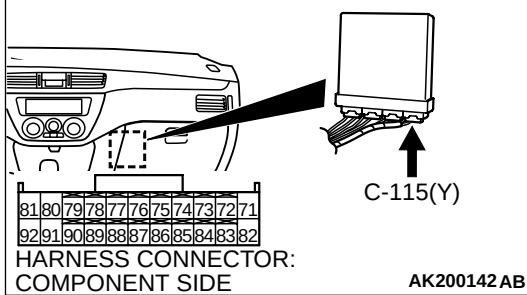
Q: Is the harness connector in good condition?

YES : Go to Step 16.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection P.00E-2. Then go to Step 20.



CONNECTOR: C-115 <M/T>

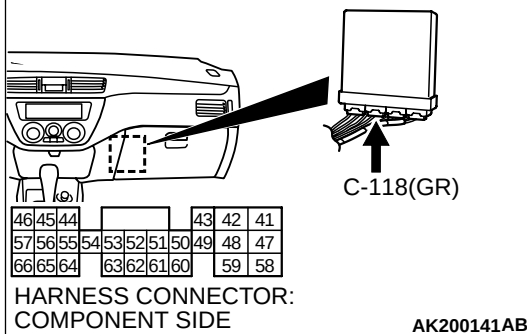


STEP 16. Check harness connector C-115 at ECM <M/T> or harness connector C-118 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 17.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 20.

CONNECTOR: C-118 <A/T>

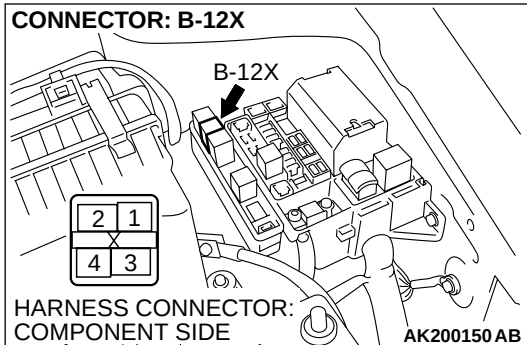


STEP 17. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and camshaft position sensor connector B-106 (terminal No. 3).
Q: Is the harness wire in good condition?

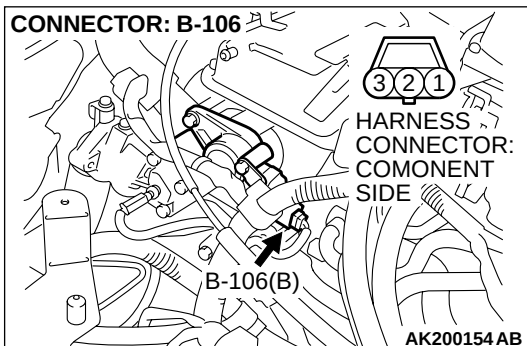
YES : Go to Step 18.

NO : Repair it. Then go to Step 20.

CONNECTOR: B-12X



CONNECTOR: B-106

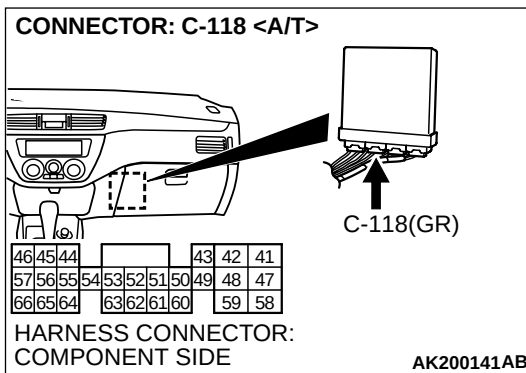
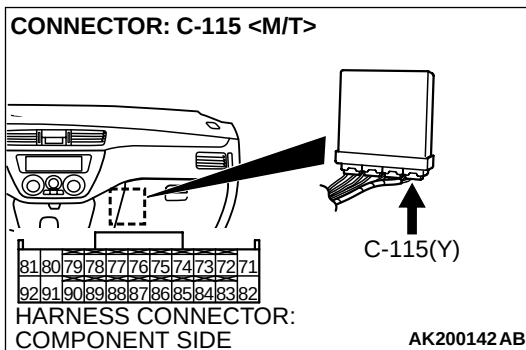
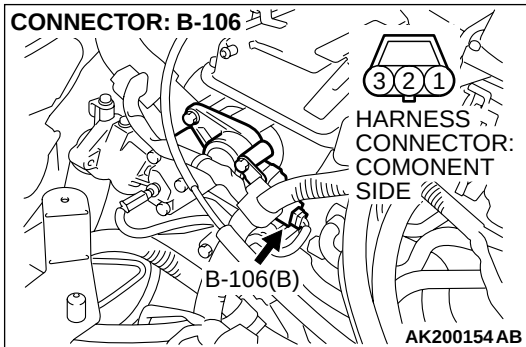


STEP 18. Check for harness damage between camshaft position sensor connector B-106 (terminal No. 2) and ECM connector C-115 (terminal No. 88) <M/T> or PCM connector C-118 (terminal No. 56) <A/T>.

Q: Is the harness wire in good condition?

YES : Go to Step 19.

NO : Repair it. Then go to Step 20.



STEP 19. Check the camshaft position sensing cylinder.

Q: Is the camshaft position sensing cylinder in a good condition?

YES : Replace the camshaft position sensor. Then go to Step 20.

NO : Repair it. Then go to Step 20.

STEP 20. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0340 set?**YES :** Retry the troubleshooting.**NO :** The inspection is complete.

DTC P0401: Exhaust Gas Recirculation Flow Insufficient Detected

TECHNICAL DESCRIPTION

- When the EGR vacuum regulator solenoid valve switches from "OFF" to "ON" while the engine is running, EGR gas flows.
- The ECM <M/T> or PCM <A/T> checks how the EGR gas flow signal changes.

DESCRIPTIONS OF MONITOR METHODS

- The changes in the intake manifold pressure is monitored while the EGR valve opens and closes, and if the changes are small, the EGR flow rate is determined to be insufficient.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)**Other Monitor (There is no temporary DTC stored in memory for the item monitored below)**

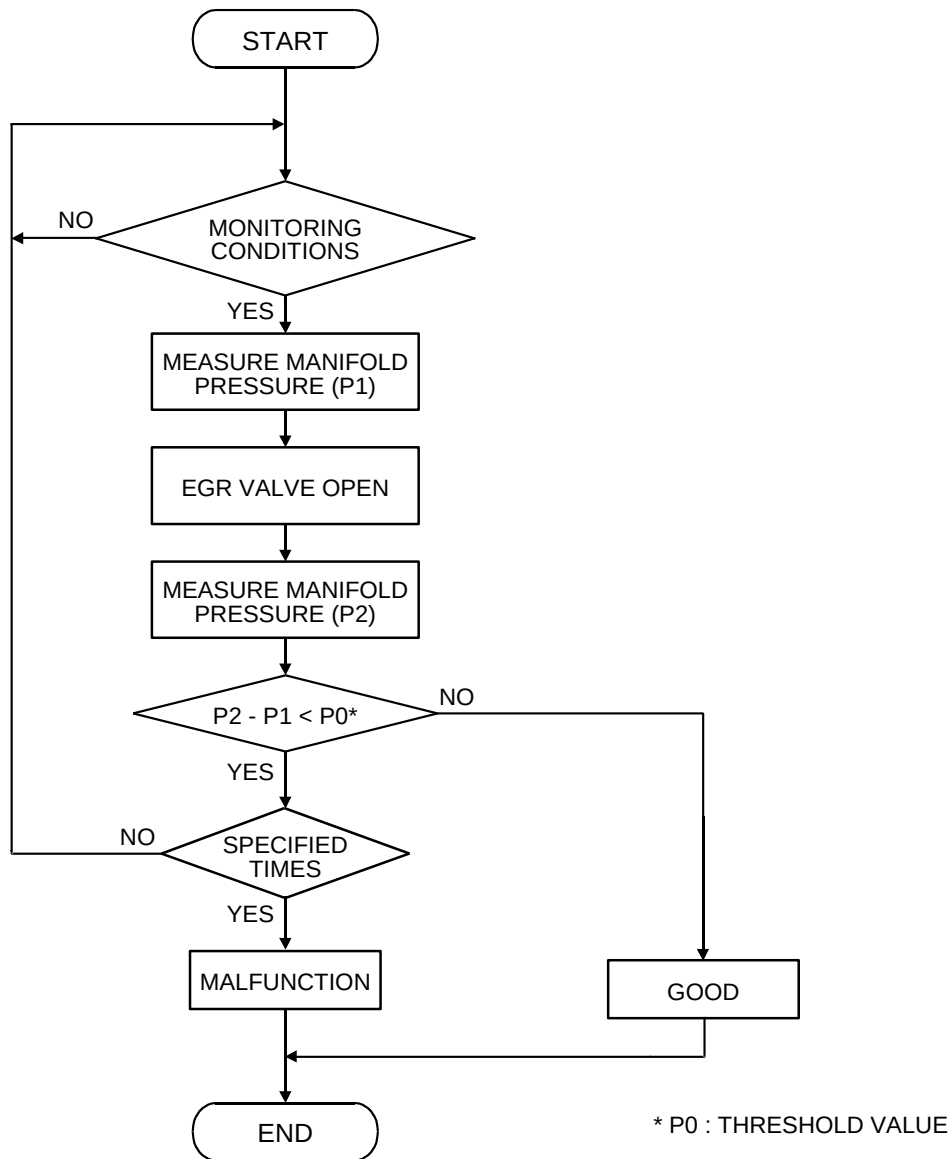
- EGR vacuum regulator solenoid valve monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor
- Manifold differential pressure sensor

DTC SET CONDITIONS

Logic Flow Chart



AK302325

Check Conditions

- At least 20 seconds have passed since the last monitor was complete.
- Engine coolant temperature is higher than 76°C (169°F).
- Engine speed is at between 1,000 and 1,800 <M/T> or 880 and 1,800 <A/T> r/min.
- Intake air temperature is higher than -10°C (14°F).
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).
- Vehicle speed is 1.5 km/h (0.9 mph) <M/T> or 30 km/h (18.7 mph) <A/T> or more.
- At least 90 seconds have passed since manifold absolute pressure sensor output voltage fluctuated 1.5 volts or more.
- The throttle valve is closed.
- Volumetric efficiency is lower than 15 <M/T> or 25 <A/T> percent.
- While fuel is being shut off. <M/T>
- 20 seconds have elapsed from the start of the previous monitoring.
- The ECM <M/T> or PCM <A/T> monitors for this condition for 3 cycles of 2 seconds each during the drive cycle.

Judgement Criteria

- The intake manifold pressure fluctuation width is lower than 3.5 kPa (0.50 psi). When the EGR vacuum regulator solenoid valve is turned ON.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 5 – Exhaust Gas Recirculation (EGR) System Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- EGR valve does not open.
- EGR control vacuum is too low.
- EGR vacuum regulator solenoid valve failed.
- Open or shorted EGR vacuum regulator solenoid valve circuit, or connector damage.
- Manifold differential pressure sensor failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Check the EGR system.

Refer to GROUP 17, Emission Control System – Exhaust Gas Recirculation (EGR) System – EGR System Check [P.17-223](#).

Q: Are there any abnormalities?

YES : Go to Step 2.

NO : Repair it. Then go to Step 3.

STEP 2. Using scan tool MB991958, check data list item 95: Manifold Absolute Pressure Sensor.**⚠ CAUTION**

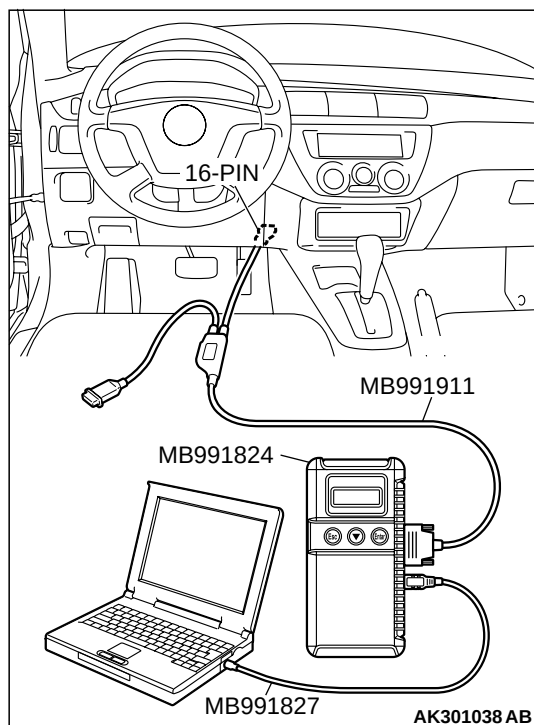
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 95, Manifold Absolute Pressure Sensor.
- (4) Warm up the engine to normal operating temperature: 80°C to 95°C (176°F to 203°F).
 - Should be between 64 – 78 kPa (18.9 – 23.0 in.Hg) at engine idling.
- (5) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Clean the EGR valve and EGR passage. Then go to Step 3.

NO : Refer to DTC P0106 – Manifold Absolute Pressure Sensor Circuit Range/Performance Problem [P.13A-57](#), DTC P0107 – Manifold Absolute Pressure Sensor Circuit Low Input [P.13A-71](#), DTC P0108 – Manifold Absolute Pressure Sensor Circuit High Input [P.13A-90](#).



STEP 3. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 5 – Exhaust Gas Recirculation (EGR) System Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

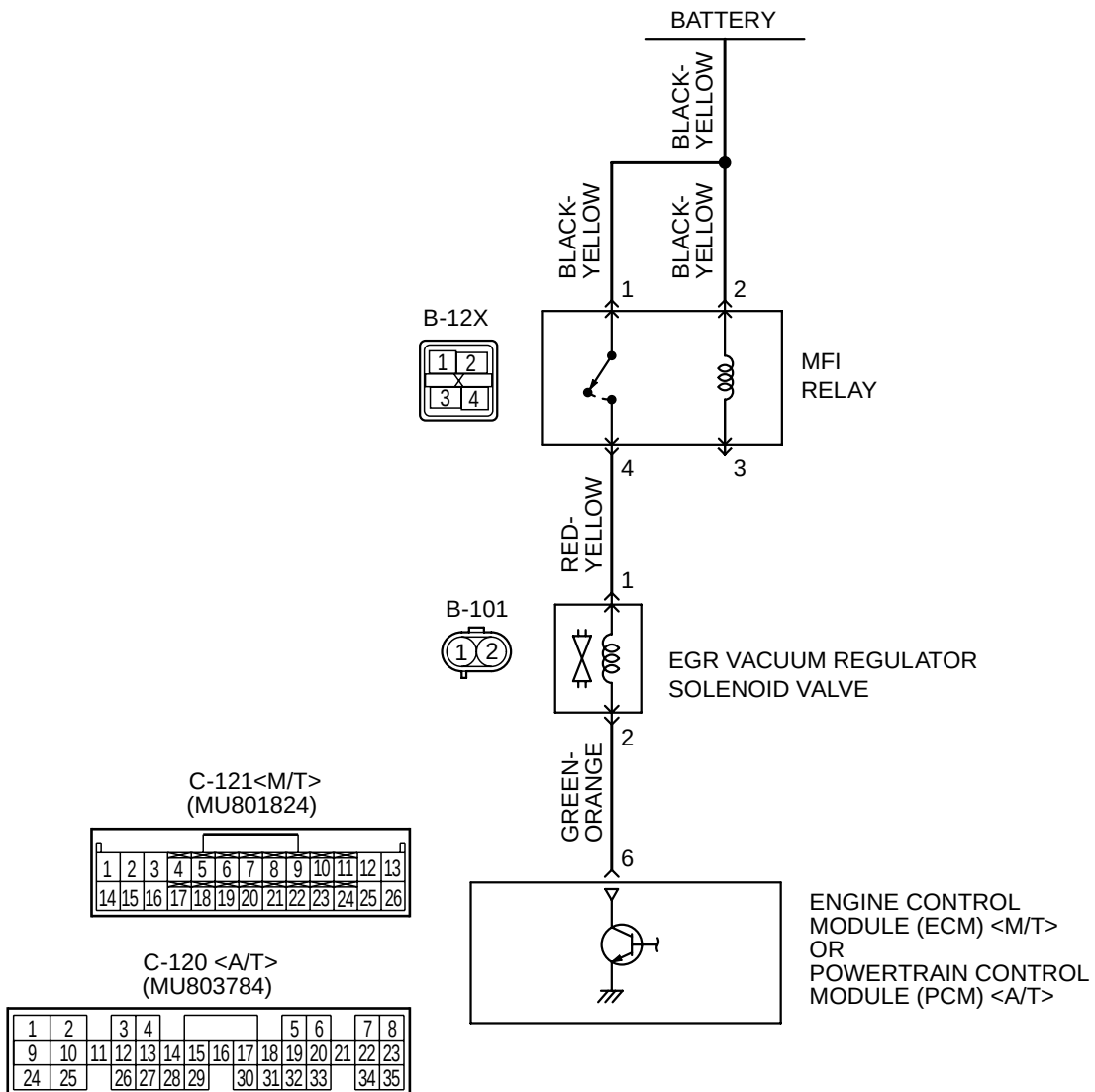
Q: Is DTC P0401 set?

YES : Retry the troubleshooting.

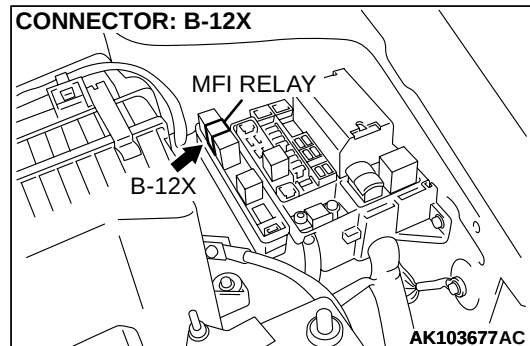
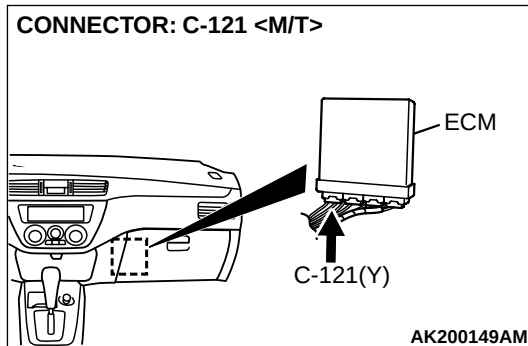
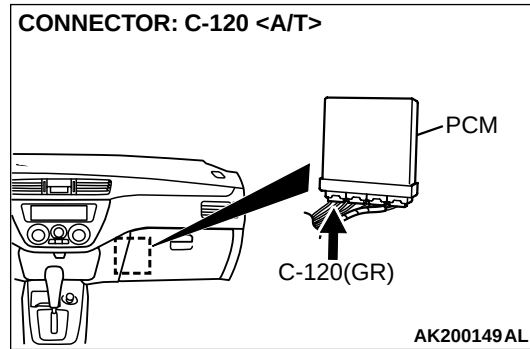
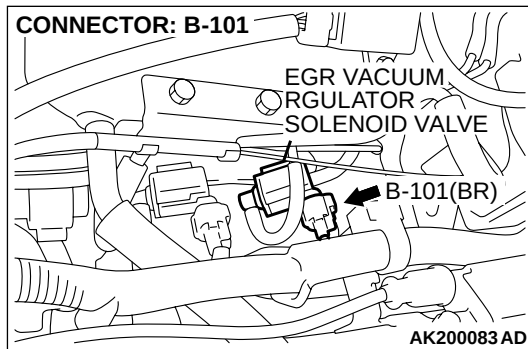
NO : The inspection is complete.

DTC P0403: Exhaust Gas Recirculation Control circuit

EGR Vacuum Regulator Solenoid Valve Circuit



AK3042100



CIRCUIT OPERATION

- The EGR vacuum regulator solenoid valve power is supplied from the MFI relay (terminal No. 4).
- The ECM <M/T> or PCM <A/T> controls the EGR vacuum regulator solenoid valve ground by turning the power transistor in the ECM <M/T> or PCM <A/T> "ON" and "OFF".

TECHNICAL DESCRIPTION

- To judge if there is open circuit in the EGR vacuum regulator solenoid valve drive circuit, ECM <M/T> or PCM <A/T> measures the surge voltage of the EGR vacuum regulator solenoid valve coil.
- The ECM <M/T> or PCM <A/T> drives the EGR vacuum regulator solenoid valve. After the solenoid is turned off, the ECM <M/T> or PCM <A/T> will check if the solenoid coil produces a surge voltage of 2 volts or more.

DESCRIPTIONS OF MONITOR METHODS

- If a surge current is not generated in the coil after the EGR vacuum regulator solenoid valve has been actuated, an open circuit is determined to have occurred.

MONITOR EXECUTION

- Continuous

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

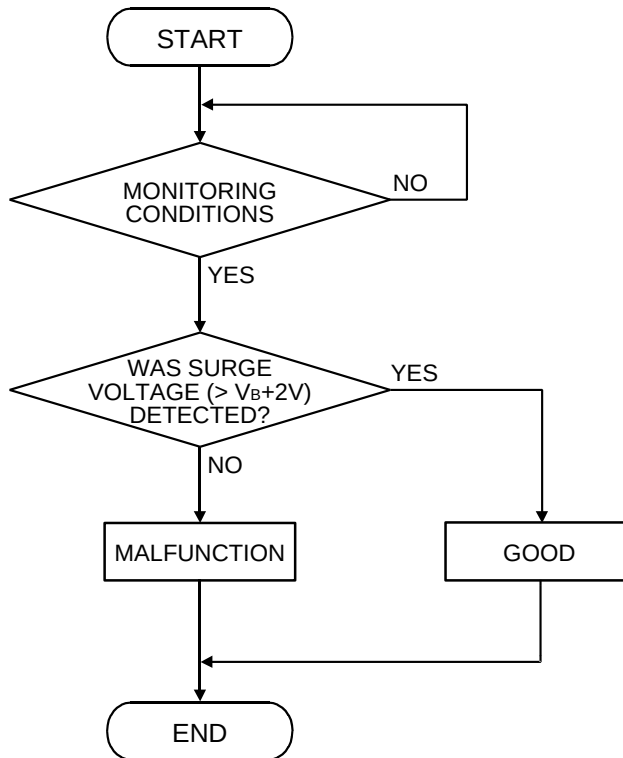
- Not applicable

Sensor (The sensor below is determined to be normal)

- Not applicable

DTC SET CONDITIONS

Logic Flow Chart



AK302326

Check Conditions

- Engine is being cranked.
- Battery positive voltage is at between 10 and 16.5 volts.

Judgment Criteria

- The EGR vacuum regulator solenoid valve coil surge voltage (battery positive voltage + 2 volts) is not detected for 0.2 second.
- The ECM <M/T> or PCM <A/T> monitors for this condition once during the drive cycle.

Check Conditions

- Battery positive voltage is at between 10 and 16.5 volts.
- ON duty cycle of the EGR vacuum regulator solenoid valve is between 10 and 90 percent.
- ON duty cycle of the evaporative emission purge solenoid is 0 percent.
- Evaporative emission ventilation solenoid is OFF.

- More than 1 second has elapsed after the above mentioned conditions have been met.

Judgment Criteria

- The EGR vacuum regulator solenoid valve coil surge voltage (battery positive voltage + 2 volts) is not detected for 1 second. When the EGR vacuum regulator solenoid valve is turned OFF.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- EGR vacuum regulator solenoid valve failed.
- Open or shorted EGR vacuum regulator solenoid valve circuit, or connector damage.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS**Required Special Tools:**

- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Using scan tool MB991958, check actuator test item 10: EGR vacuum regulator solenoid valve.

⚠ CAUTION

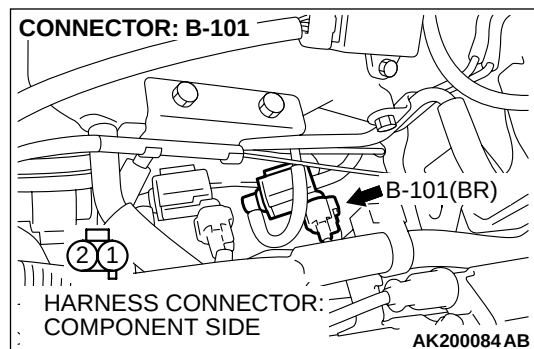
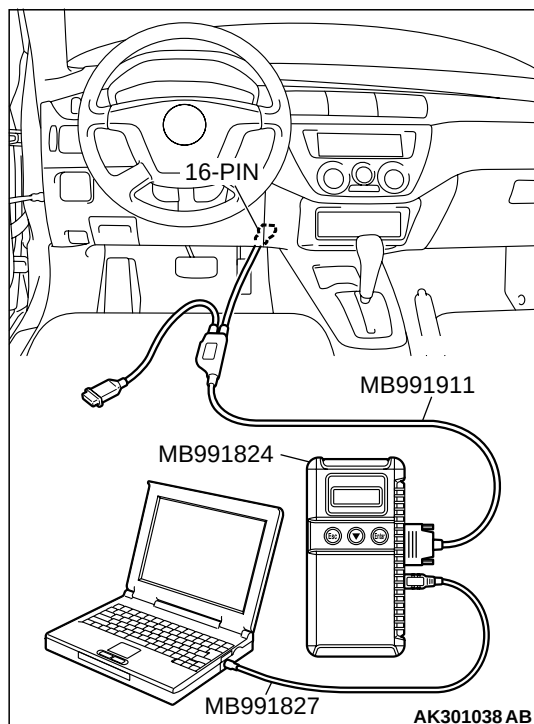
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Turn the ignition switch to the "ON" position.
- (3) Set scan tool MB991958 to the actuator test mode for item 10, EGR vacuum regulator solenoid valve.
 - An operation sound should be heard and vibration should be felt when the EGR vacuum regulator solenoid valve is operated.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the solenoid operating properly?

YES : It can be assumed that this malfunction is intermittent.
Refer to GROUP 00, How to Use
Troubleshooting/Inspection Service Points [P.00-6](#).

NO : Go to Step 2.

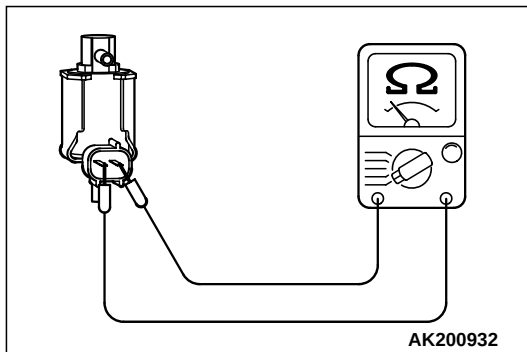
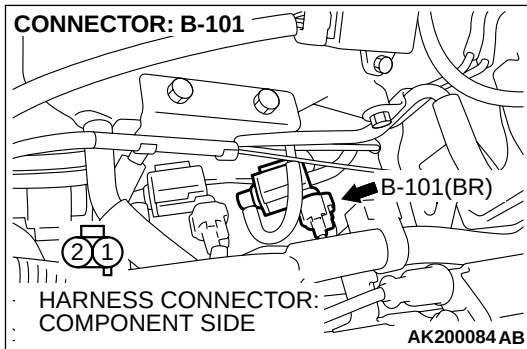


STEP 2. Check harness connector B-101 at the EGR vacuum regulator solenoid valve for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 3.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 3 Check the EGR vacuum regulator solenoid valve.

- (1) Disconnect the EGR vacuum regulator solenoid valve connector B-101.

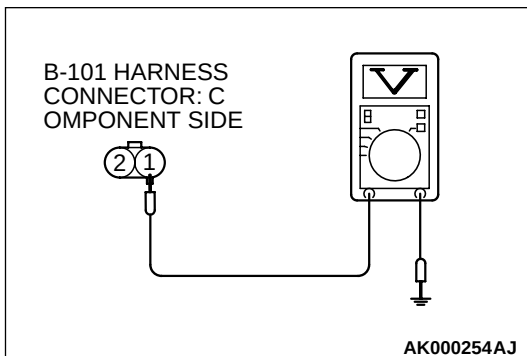
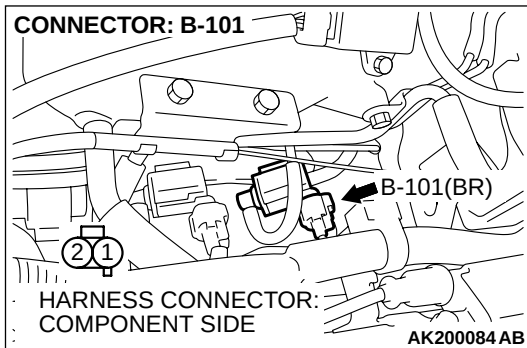
- (2) Measure the resistance between EGR vacuum regulator solenoid valve side connector terminal No. 1 and No. 2.

Standard value: 29 – 35 ohms [at 20°C (68°F)]

Q: Is the resistance between 29 and 35 ohms [at 20°C (68°F)]?

YES : Go to Step 4.

NO : Replace the EGR vacuum regulator solenoid valve.
Then go to Step 12.



STEP 4. Measure the power supply voltage at EGR vacuum regulator solenoid valve harness side connector B-101.

- (1) Disconnect connector B-101 and measure at the harness side.
- (2) Turn the ignition switch to the "ON" position.

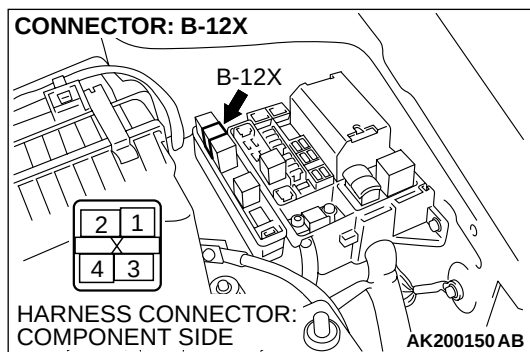
- (3) Measure the voltage between terminal No. 1 and ground.
- Voltage should be battery positive voltage.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 6.

NO : Go to Step 5.



STEP 5. Check harness connector B-12X at MFI relay for damage.

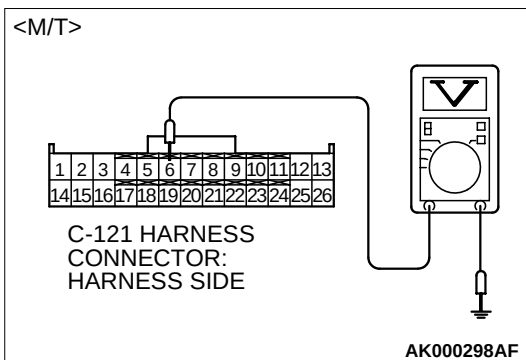
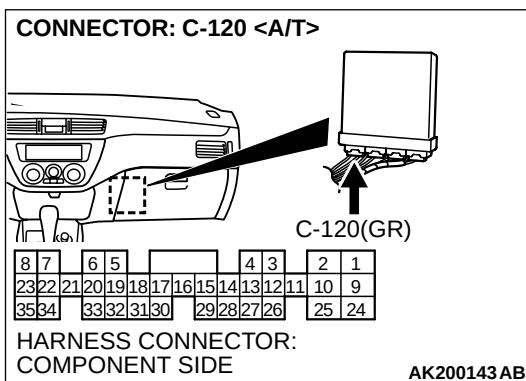
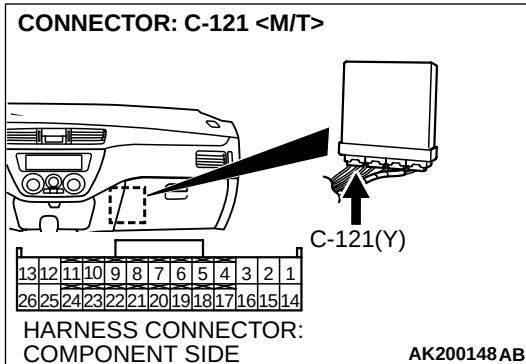
Q: Is the harness connector in good condition?

YES : Repair harness wire between MFI relay connector B-12X (terminal No. 4) and EGR vacuum regulator solenoid valve connector B-101 (terminal No. 1) because of open circuit or short circuit to ground. Then go to Step 12.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

STEP 6. Measure the power supply voltage at ECM connector C-121 <M/T> or PCM connector C-120 <A/T> by backprobing.

- (1) Do not disconnect connector C-121 <M/T> or C-120 <A/T>.
- (2) Turn the ignition switch to the "ON" position.



- (3) Measure the voltage between terminal No. 6 and ground by backprobing.

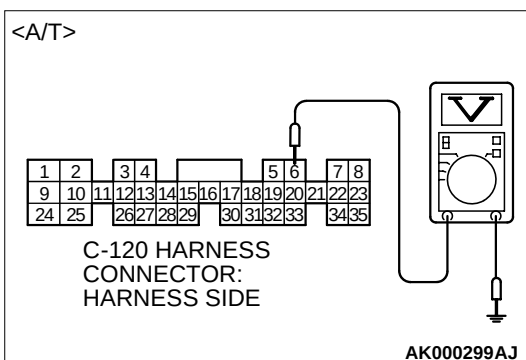
- Voltage should be battery positive voltage.

- (4) Turn the ignition switch to the "LOCK" (OFF) position.

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

YES : Go to Step 9.

NO : Go to Step 7.

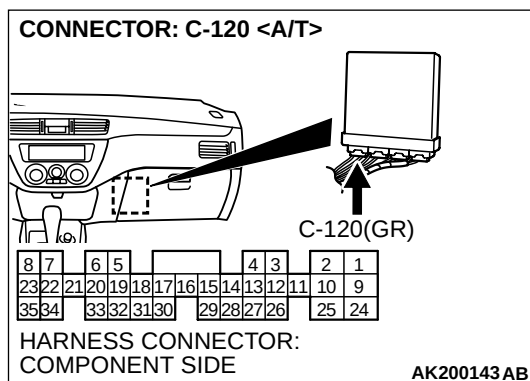
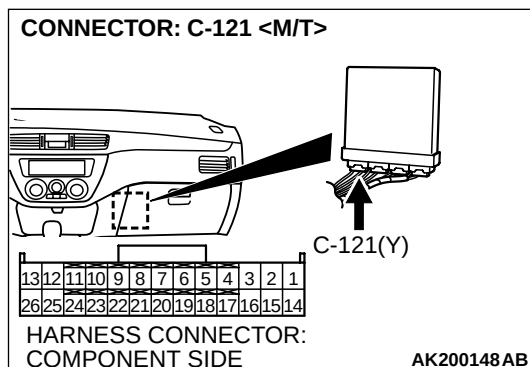


STEP 7. Check harness connector C-121 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.

Q: Is the harness connector in good condition?

YES : Go to Step 8.

NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.

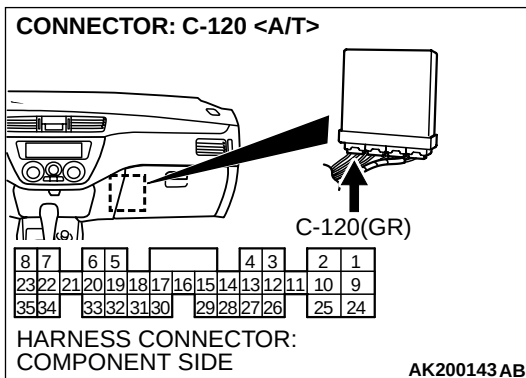
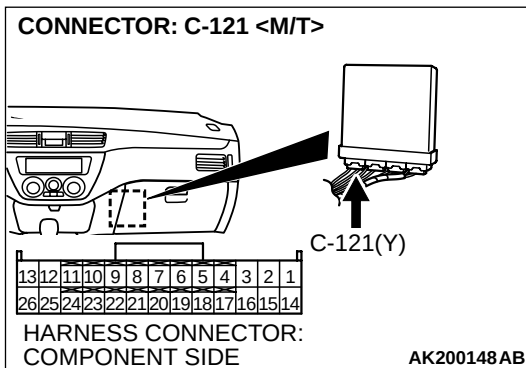
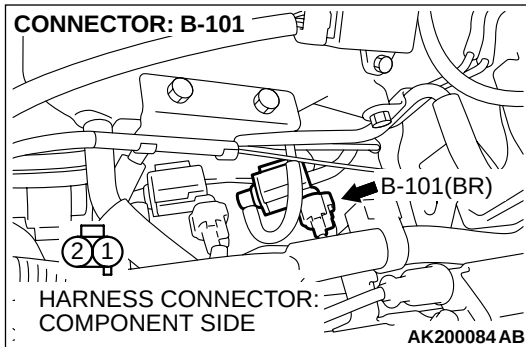


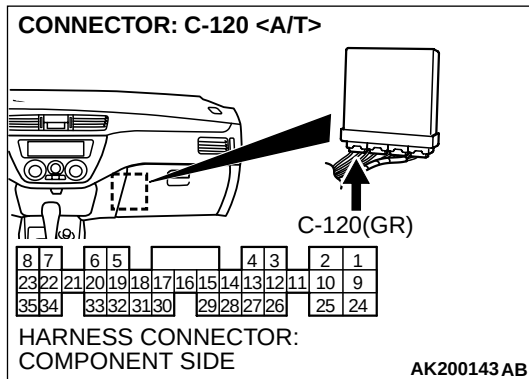
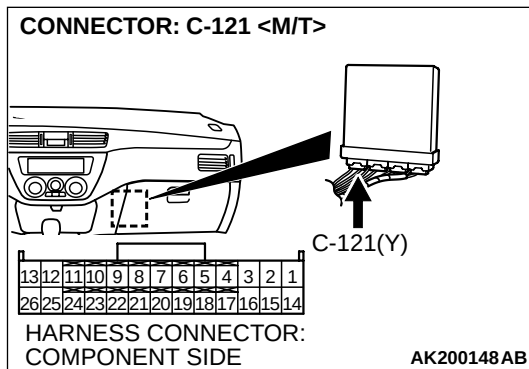
STEP 8. Check for open circuit and short circuit to ground between EGR vacuum regulator solenoid valve connector B-101 (terminal No. 2) and ECM connector C-121 (terminal No. 6) <M/T> or PCM connector C-120 (terminal No. 6) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.

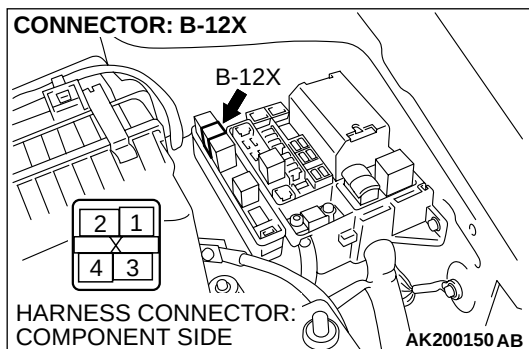




STEP 9. Check harness connector C-121 at ECM <M/T> or harness connector C-120 at PCM <A/T> for damage.
Q: Is the harness connector in good condition?

YES : Go to Step 10.

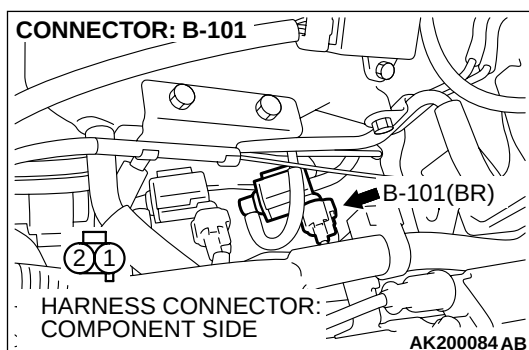
NO : Repair or replace it. Refer to GROUP 00E, Harness Connector Inspection [P.00E-2](#). Then go to Step 12.



STEP 10. Check for harness damage between MFI relay connector B-12X (terminal No. 4) and EGR vacuum regulator solenoid valve connector B-101 (terminal No. 1).
Q: Is the harness wire in good condition?

YES : Go to Step 11.

NO : Repair it. Then go to Step 12.

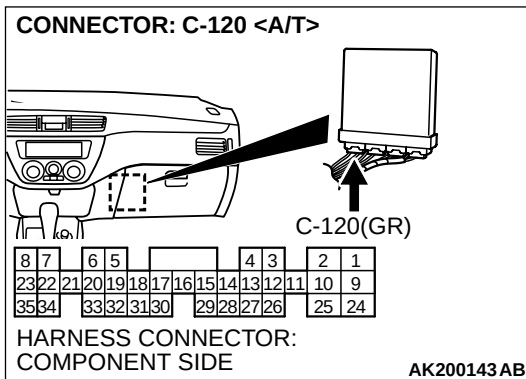
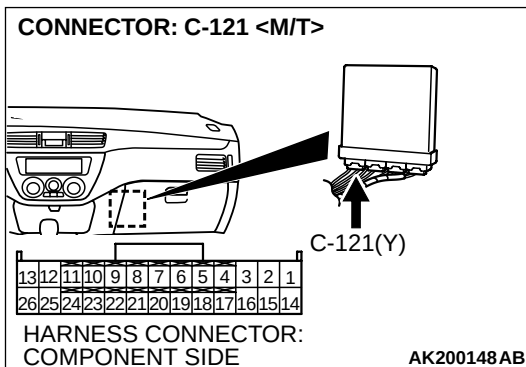
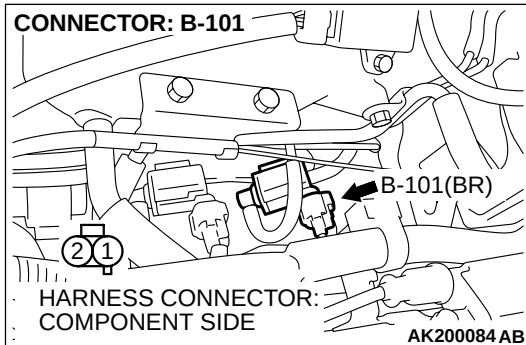


STEP 11. Check for harness damage between EGR vacuum regulator solenoid valve connector B-101 (terminal No. 2) and ECM connector C-121 (terminal No. 6) <M/T> or PCM connector C-120 (terminal No. 6) <A/T>.

Q: Is the harness wire in good condition?

YES : Replace the ECM or PCM. Then go to Step 12.

NO : Repair it. Then go to Step 12.



STEP 12. Test the OBD-II drive cycle.

(1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 6 – Other Monitor [P.13A-6](#).

(2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0403 set?

YES : Retry the troubleshooting.

NO : The inspection is complete.

DTC P0421: Warm Up Catalyst Efficiency Below Threshold**TECHNICAL DESCRIPTION**

- The signal from the rear heated oxygen sensor differs from the front heated oxygen sensor. That is because the catalytic converter purifies exhaust gas. When the catalytic converter has deteriorated, the signal from the front heated oxygen sensor becomes similar to the rear heated oxygen sensor.
- The ECM <M/T> or PCM <A/T> compares the output of the front and rear heated oxygen sensor signals.

DESCRIPTIONS OF MONITOR METHODS

- If the inversion frequency is found to be equal through a comparison of the lean/rich inversion frequency of the heated oxygen sensor (front), the catalyst is determined to have deteriorated.

MONITOR EXECUTION CONDITIONS (Other monitor and Sensor)

Other Monitor (There is no temporary DTC stored in memory for the item monitored below)

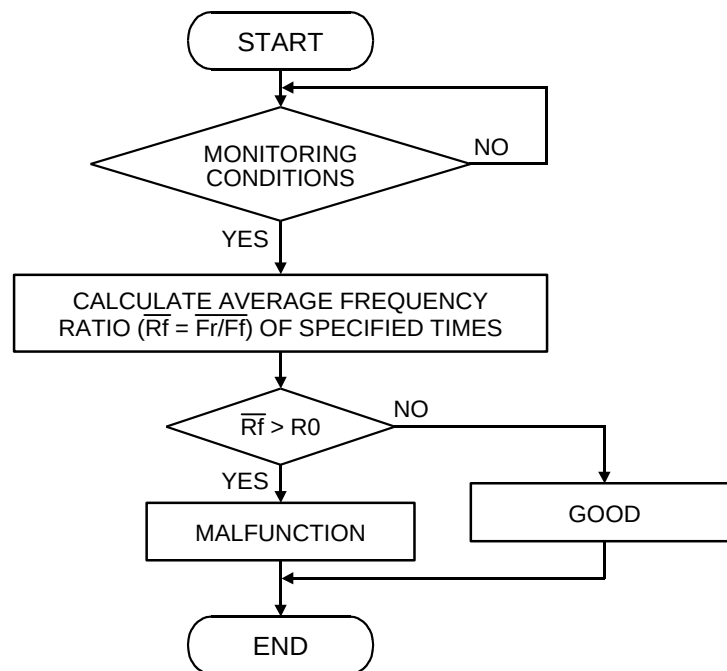
- Heated oxygen sensor (front) monitor
- Heated oxygen sensor (rear) monitor
- Misfire monitor
- Fuel system monitor
- Air fuel ratio feedback system monitor

Sensor (The sensor below is determined to be normal)

- Volume airflow sensor
- Barometric pressure sensor
- Intake air temperature sensor
- Engine coolant temperature sensor
- Throttle position sensor

MONITOR EXECUTION

- Continuous

DTC SET CONDITIONS**Logic Flow Chart**

AK302327

Check Conditions

- Engine speed is lower than 3,000 r/min.
- Volume airflow sensor output frequency is at between 94 and 168 Hz.
- The throttle valve is open.
- More than 3 seconds has elapsed after the three above-mentioned conditions have been met.
- Intake air temperature is higher than -10°C (14°F).
- Barometric pressure is higher than 76 kPa (22.4 in.Hg).
- Under the closed loop air/fuel ratio control.
- Vehicle speed is 1.5 km/h (0.93 mph) or more.
- The ECM <M/T> or PCM <A/T> monitors for this condition for 7 cycles of 10 seconds each during the drive cycle.
- Short-term fuel trim is at between -25 and +25 percent.

- The cumulative volume airflow sensor output frequency is higher than 4,000 Hz.

Judgment Criteria

- The heated oxygen sensor (rear) signal frequency divided by heated oxygen sensor (front) signal frequency = 0.6 or more.

OBD-II DRIVE CYCLE PATTERN

Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 3 – Catalytic Converter Monitor
[P.13A-6](#).

TROUBLESHOOTING HINTS (The most likely causes for this code to be set are:)

- Catalytic converter deteriorated.
- Heated oxygen sensor failed.
- ECM failed. <M/T>
- PCM failed. <A/T>

DIAGNOSIS

Required Special Tools:

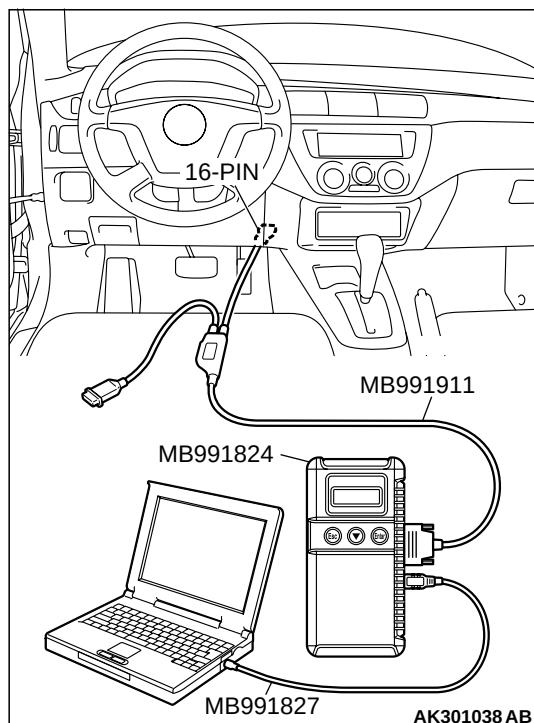
- MB991958: Scan Tool (MUT-III Sub Assembly)
 - MB991824: V.C.I.
 - MB991827: USB Cable
 - MB991911: Main Harness B

STEP 1. Check for exhaust leaks.

Q: Are there any abnormalities?

YES : Go to Step 2.

NO : Repair it. Then go to Step 7.



STEP 2. Using scan tool MB991958, check data list item 59: Heated Oxygen Sensor (rear).

⚠ CAUTION

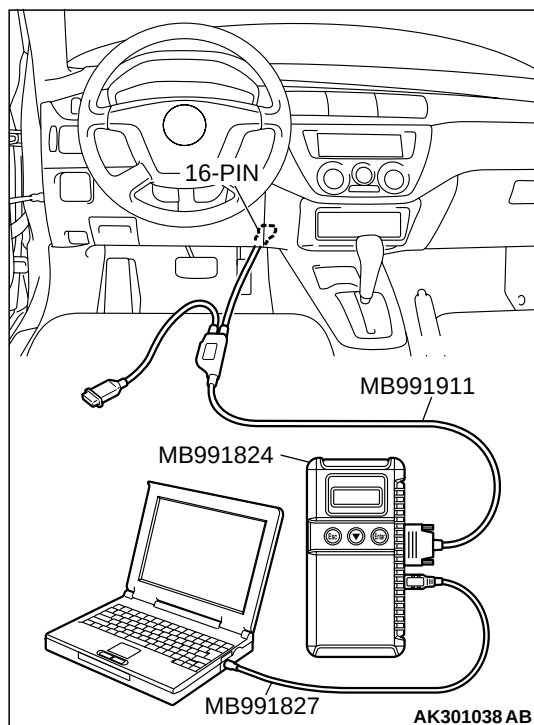
To prevent damage to scan tool MB991958, always turn the ignition switch to the "LOCK" (OFF) position before connecting or disconnecting scan tool MB991958.

- (1) Connect scan tool MB991958 to the data link connector.
- (2) Start the engine and run at idle.
- (3) Set scan tool MB991958 to the data reading mode for item 59, Heated Oxygen Sensor (rear).
 - Warm up the engine. When the engine is revved, the output voltage should repeat 0 volt and 0.6 to 1.0 volt alternately.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 3.

NO : Refer to, DTC P0136 – Heated Oxygen Sensor Circuit (sensor 2) [P.13A-252](#), DTC P0137 – Heated Oxygen Sensor Circuit Low Voltage (sensor 2) [P.13A-268](#), DTC P0138 – Heated Oxygen Sensor Circuit High Voltage (sensor 2) [P.13A-275](#), DTC P0139 – Heated Oxygen Sensor Circuit Slow Response (sensor 2) [P.13A-280](#).



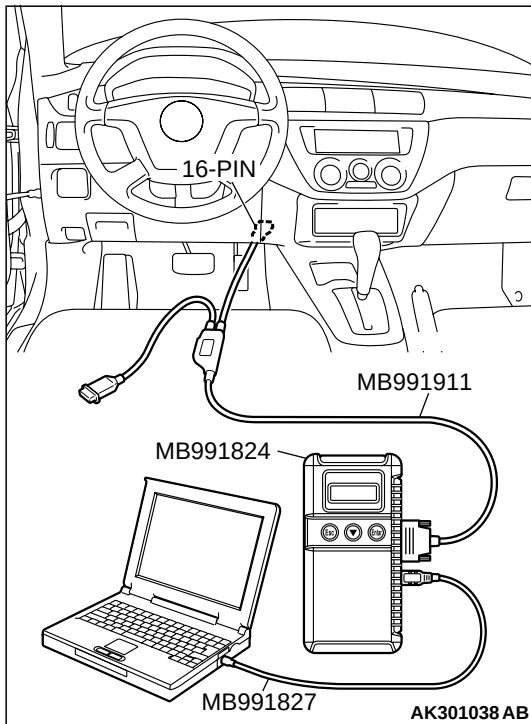
STEP 3. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor (front).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
 - Warm up the engine. When the engine is revved, the output voltage should measure 0.6 to 1.0 volt.
- (3) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 4.

NO : Refer to, DTC P0130 – Heated Oxygen Sensor Circuit (sensor 1) [P.13A-201](#), DTC P0131 – Heated Oxygen Sensor Low Voltage (sensor 1) [P.13A-216](#), DTC P0132 – Heated Oxygen Sensor Circuit High Voltage (sensor 1) [P.13A-223](#), DTC P0133 – Heated Oxygen Sensor Circuit Slow Response (sensor 1) [P.13A-228](#), DTC P0134 – Heated Oxygen Sensor Circuit No Activity Detected (sensor 1) [P.13A-232](#).



STEP 4. Using scan tool MB991958, check data list item 11: Heated Oxygen Sensor (front).

- (1) Start the engine and run at idle.
- (2) Set scan tool MB991958 to the data reading mode for item 11, Heated Oxygen Sensor (front).
- (3) Keep the engine speed at 2,000 r/min.
 - 0 – 0.4 and 0.6 – 1.0 volt should alternate 15 times or more within 10 seconds.
- (4) Turn the ignition switch to the "LOCK" (OFF) position.

Q: Is the sensor operating properly?

YES : Go to Step 5.

NO : Replace the heated oxygen sensor (front). Then go to Step 7.

STEP 5. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 3 – Catalytic Converter Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0421 set?

YES : Replace the catalytic converter. Then go to Step 6.

NO : The inspection is complete.

STEP 6. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 3 – Catalytic Converter Monitor and Procedure 6 – Other Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0421 set?

YES : Replace the ECM or PCM. Then go to Step 7.

NO : The inspection is complete.

STEP 7. Test the OBD-II drive cycle.

- (1) Carry out a test drive with the drive cycle pattern. Refer to Diagnostic Function – OBD-II Drive Cycle – Procedure 3 – Catalytic Converter Monitor [P.13A-6](#).
- (2) Check the diagnostic trouble code (DTC).

Q: Is DTC P0421 set?**Continue****YES** : Retry the troubleshooting.**NO** : The inspection is complete.