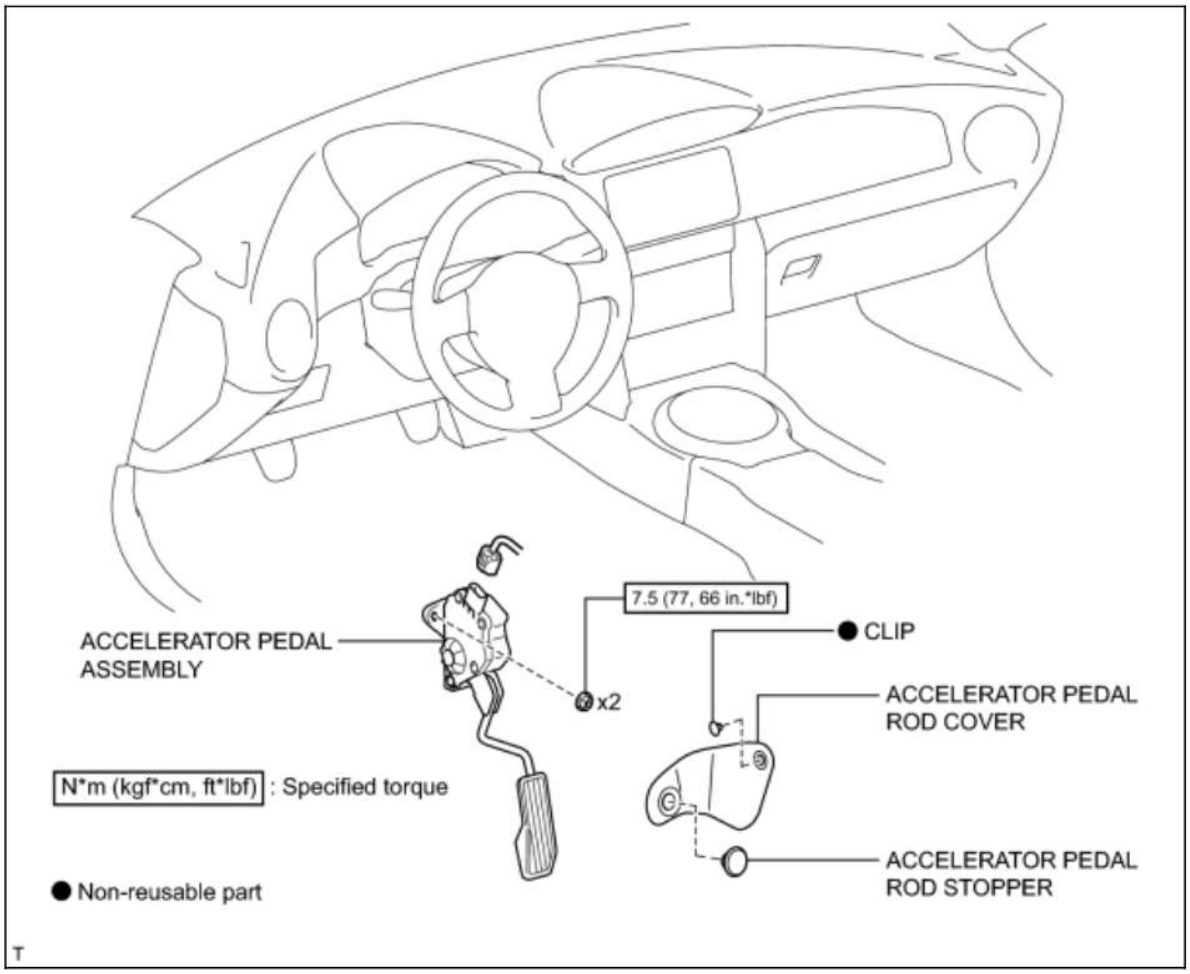
Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002QU600LX
Title: FA20 ENGINE CONTROL: ACCELERATOR PEDAL: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION



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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002QU500LX
Title: FA20 ENGINE CONTROL: ACCELERATOR PEDAL: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL ACCELERATOR PEDAL ASSEMBLY

NOTICE:

- Avoid excessive force to the accelerator pedal assembly.
- Do not disassemble the accelerator pedal assembly.

(a) Install the accelerator pedal assembly with the 2 nuts.

Torque: 7.5 N·m (77 kgf·cm, 66in·lbf)

(b) Connect the accelerator pedal assembly connector.

2. INSTALL ACCELERATOR PEDAL ROD COVER

(a) Engage the new clip, and install the accelerator pedal rod cover.

3. INSTALL ACCELERATOR PEDAL ROD STOPPER

(a) Install the accelerator pedal rod stopper.

4. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHM006X
Title: FA20 ENGINE CONTROL: ACCELERATOR PEDAL: ON-VEHICLE INSPECTION (2013 FR-S)		

ON-VEHICLE INSPECTION

1. INSPECT ACCELERATOR PEDAL ASSEMBLY

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Data List / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

(e) Read the value displayed on the Techstream.

Standard Voltage:

ACCELERATOR PEDAL OPERATION	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2
Released	0.5 to 0.8 V	0.5 to 0.8 V
Depressed	2.4 to 3.5 V	2.4 to 3.5 V

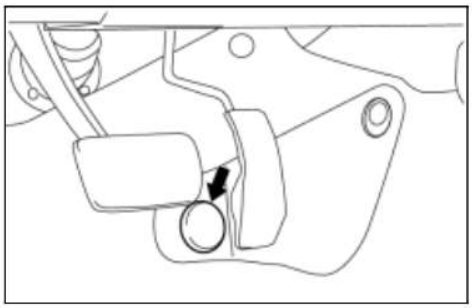
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002QU700LX
Title: FA20 ENGINE CONTROL: ACCELERATOR PEDAL: REMOVAL (2013 FR-S)		

REMOVAL

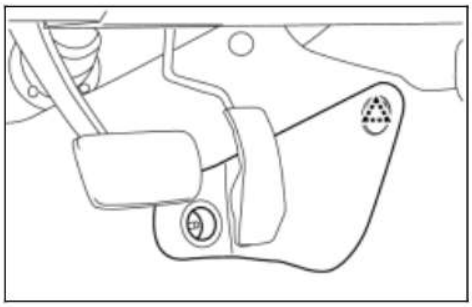
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE ACCELERATOR PEDAL ROD STOPPER

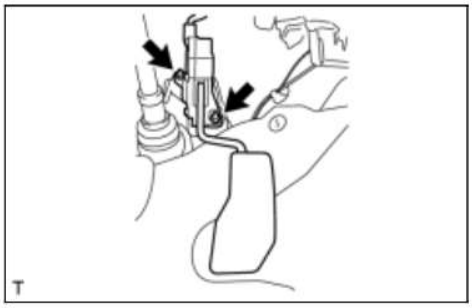


(a) Remove the accelerator pedal rod stopper.

3. REMOVE ACCELERATOR PEDAL ROD COVER



(a) Disengage the clip, and remove the accelerator pedal rod cover.



4. REMOVE ACCELERATOR PEDAL ASSEMBLY

(a) Disconnect the accelerator pedal assembly connector.

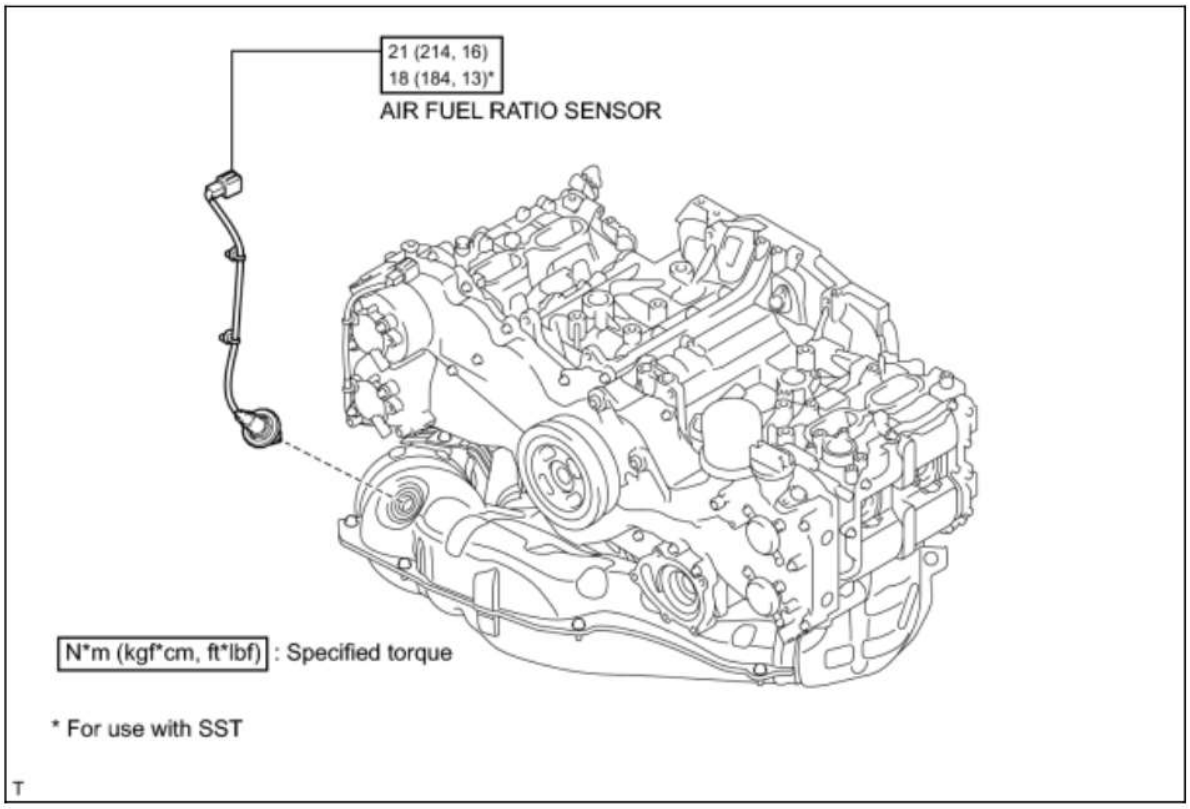
(b) Remove the 2 nuts and the accelerator pedal assembly.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BOE00FX
Title: FA20 ENGINE CONTROL: AIR FUEL RATIO SENSOR: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION



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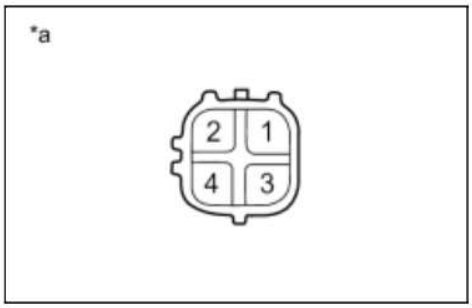
Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MUG00UX
Title: FA20 ENGINE CONTROL: AIR FUEL RATIO SENSOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT AIR FUEL RATIO SENSOR

(a) Measure the resistance according to the value(s) the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	1.98 to 2.64 Ω
1 - 4	Always	10 kΩ or higher

Text in Illustration

*a	Component without harness connected (Air Fuel Ratio Sensor)

If the result is not as specified, replace the air fuel ratio sensor.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MUF00WX
Title: FA20 ENGINE CONTROL: AIR FUEL RATIO SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

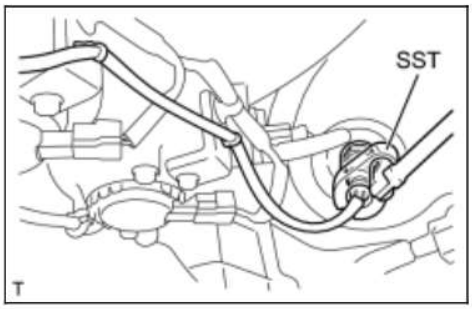
1. INSTALL AIR FUEL RATIO SENSOR

(a) Using SST, install the air fuel ratio sensor onto the exhaust manifold.

SST: 09224-00010

Without SST - Torque: 21 N·m (214 kgf·cm, 16ft·lbf)

With SST - Torque: 18 N·m (184 kgf·cm, 13ft·lbf)



NOTICE:

If a component has been dropped or subjected to a strong impact, replace it.

HINT:

- This torque value is effective when SST is parallel to the torque wrench.
- The "with SST" torque value is effective when using SST with a fulcrum length of 30 mm (1.18 in.).
- The "with SST" torque value is effective when using a torque wrench with a fulcrum length of 180 mm (7.087 in.).
- If using a torque wrench with a different length, or connecting the torque wrench and SST at an angle, refer to the alternate torque values INFO .

(b) Engage the 2 clamps.

(c) Connect the air fuel ratio sensor connector.

2. CONNECT BATTERY NEGATIVE TERMINAL INFO

3. INSPECT FOR EXHAUST GAS LEAK INFO

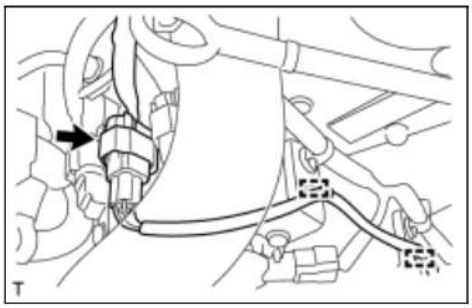
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MUI00YX
Title: FA20 ENGINE CONTROL: AIR FUEL RATIO SENSOR: REMOVAL (2013 FR-S)		

REMOVAL

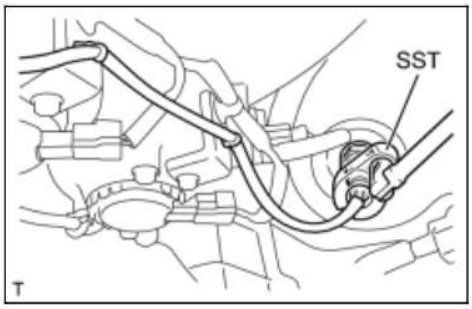
1. DISCONNECT BATTERY NEGATIVE TERMINAL INFO

2. REMOVE AIR FUEL RATIO SENSOR



(a) Disconnect the air fuel ratio sensor connector.

(b) Disengage the 2 clamps.



(c) Using SST, remove the air fuel ratio sensor from the exhaust manifold.

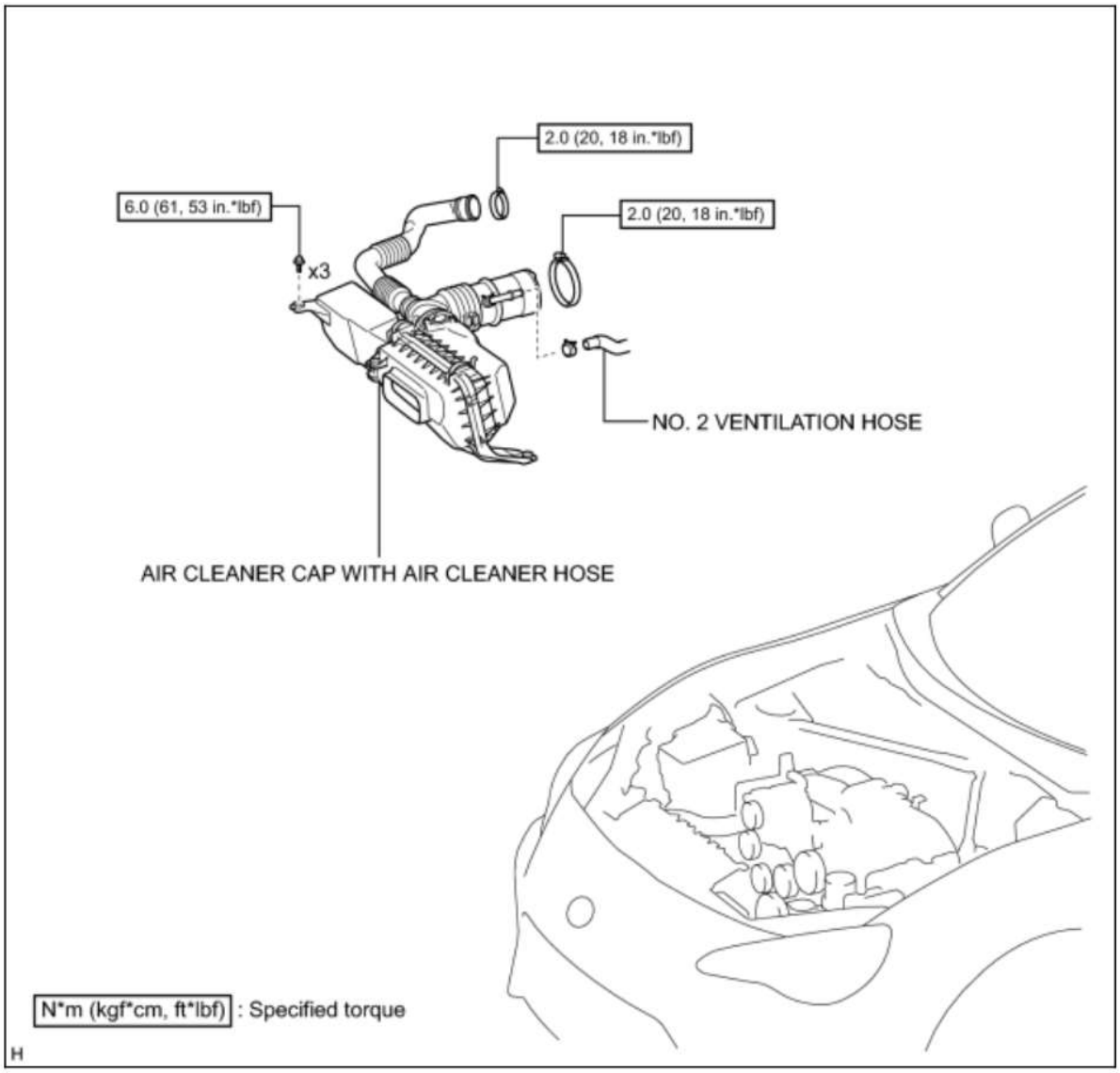
SST: 09224-00010

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BO600QX
Title: FA20 ENGINE CONTROL: CAMSHAFT OIL CONTROL VALVE: COMPONENTS (2013 FR-S)		

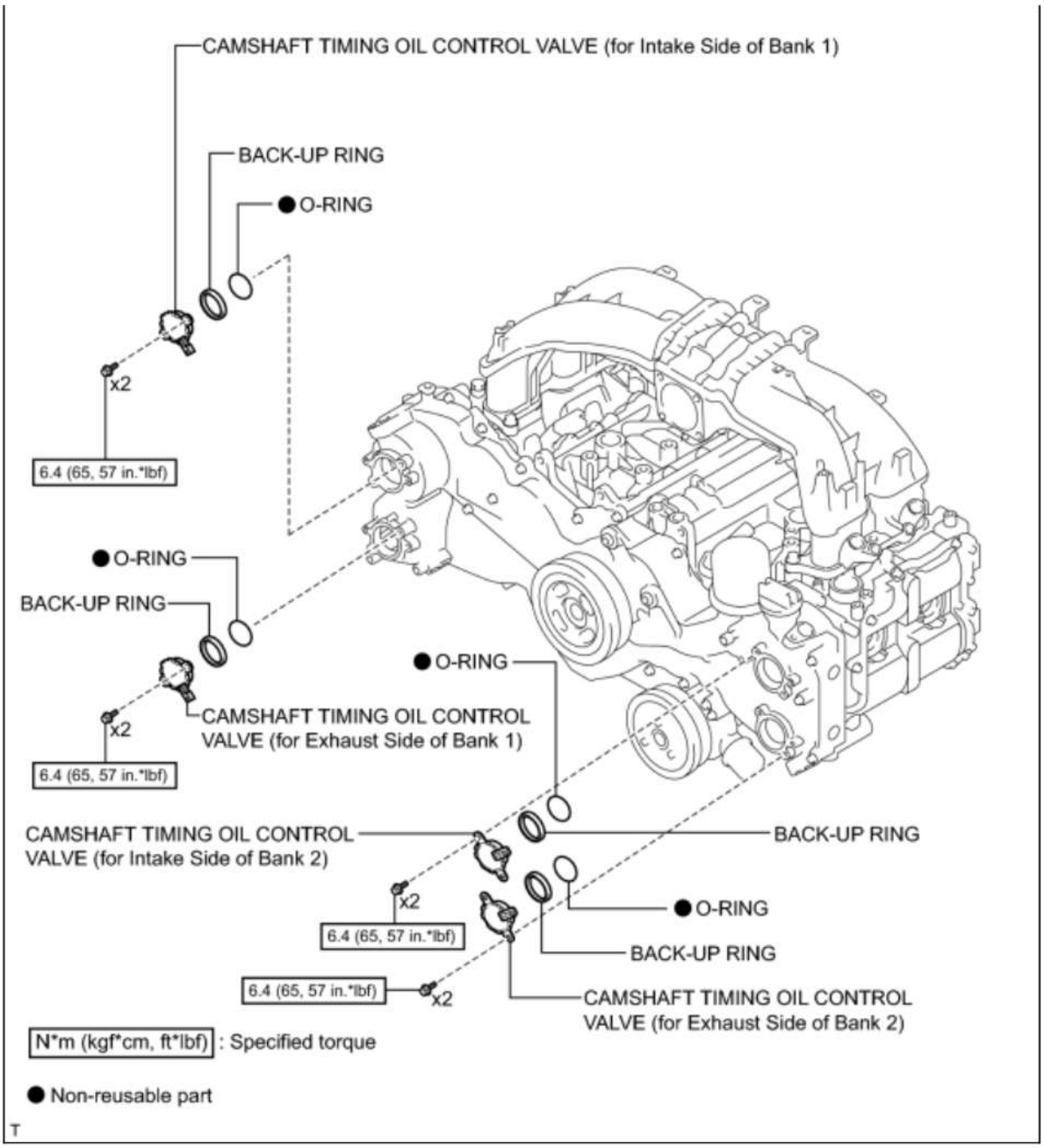
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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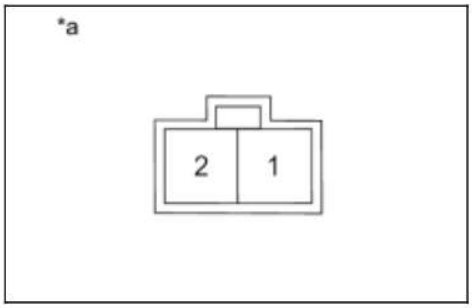
Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHH008X
Title: FA20 ENGINE CONTROL: CAMSHAFT OIL CONTROL VALVE: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	6.85 to 7.65 Ω

Text in Illustration

*a	Component without harness connected (Camshaft Timing Oil Control Valve)

If the result is not as specified, replace the camshaft timing oil control valve.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BO500PX
Title: FA20 ENGINE CONTROL: CAMSHAFT OIL CONTROL VALVE: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE (for Exhaust Side of Bank 2)

(a) Install the back-up ring to the camshaft timing oil control valve.

(b) Apply a light coat of engine oil to a new O-ring and install it to the camshaft timing oil control valve.

(c) Install the camshaft timing oil control valve with the 2 bolts.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

NOTICE:

- If a component has been dropped or subjected to a strong impact, replace it.
- Make sure that the O-ring is not damaged or does not jump out of position during installation.

(d) Connect the camshaft timing oil control valve connector.

2. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE (for Intake Side of Bank 2)

(a) Install the back-up ring to the camshaft timing oil control valve.

(b) Apply a light coat of engine oil to a new O-ring and install it to the camshaft timing oil control valve.

(c) Install the camshaft timing oil control valve with the 2 bolts.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

NOTICE:

- If a component has been dropped or subjected to a strong impact, replace it.
- Make sure that the O-ring is not damaged or does not jump out of position during installation.

(d) Connect the camshaft timing oil control valve connector.

3. INSTALL AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

4. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE (for Exhaust Side of Bank 1)

(a) Install the back-up ring to the camshaft timing oil control valve.

(b) Apply a light coat of engine oil to a new O-ring and install it to the camshaft timing oil control valve.

(c) Install the camshaft timing oil control valve with the 2 bolts.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

NOTICE:

- If a component has been dropped or subjected to a strong impact, replace it.
- Make sure that the O-ring is not damaged or does not jump out of position during installation.

(d) Connect the camshaft timing oil control valve connector.

5. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE (for Intake Side of Bank 1)

(a) Install the back-up ring to the camshaft timing oil control valve.

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(b) Apply a light coat of engine oil to a new O-ring and install it to the camshaft timing oil control valve.

(c) Install the camshaft timing oil control valve with the 2 bolts.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

NOTICE:

- If a component has been dropped or subjected to a strong impact, replace it.
- Make sure that the O-ring is not damaged or does not jump out of position during installation.

(d) Connect the camshaft timing oil control valve connector.

6. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO



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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHI00AX
Title: FA20 ENGINE CONTROL: CAMSHAFT OIL CONTROL VALVE: ON-VEHICLE INSPECTION (2013 FR-S)		

ON-VEHICLE INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Turn the A/C switch on.

(e) Inspect the camshaft timing oil control valve (for intake side).

(1) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank 1).

(2) Check the engine speed while operating the camshaft timing oil control valve assembly (for intake side) using the Techstream.

OK:

TESTER OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
36 deg (CA)	Engine idles roughly or stalls

If the operation is not as specified, check the camshaft timing oil control valve, wire harness and ECM.

(3) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank 2).

(4) Check the engine speed while operating the camshaft timing oil control valve assembly (for intake side) using the Techstream.

OK:

TESTER OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
36 deg (CA)	Engine idles roughly or stalls

If the operation is not as specified, check the camshaft timing oil control valve, wire harness and ECM.

(f) Inspect the camshaft timing oil control valve (for exhaust side).

(1) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Exhaust Linear (Bank 1).

(2) Check the engine speed while operating the camshaft timing oil control valve assembly (for exhaust side) using the Techstream.

OK:

TESTER OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed

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51 deg (CA)	Engine idles roughly or stalls

If the operation is not as specified, check the camshaft timing oil control valve, wire harness and ECM.

(3) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Exhaust Linear (Bank 2).

(4) Check the engine speed while operating the camshaft timing oil control valve assembly (for exhaust side) using the Techstream.

OK:

TESTER OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
51 deg (CA)	Engine idles roughly or stalls

If the operation is not as specified, check the camshaft timing oil control valve, wire harness and ECM.



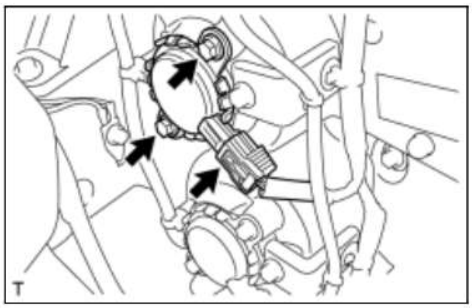
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BO700QX
Title: FA20 ENGINE CONTROL: CAMSHAFT OIL CONTROL VALVE: REMOVAL (2013 FR-S)		

REMOVAL

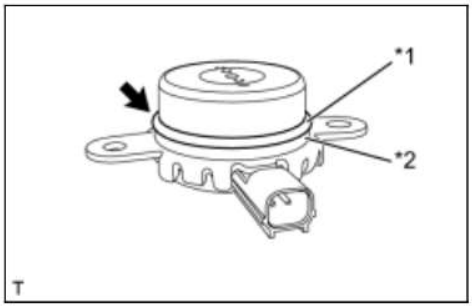
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE (for Intake Side of Bank 1)



(a) Disconnect the camshaft timing oil control valve connector.

(b) Remove the 2 bolts and the camshaft timing oil control valve.



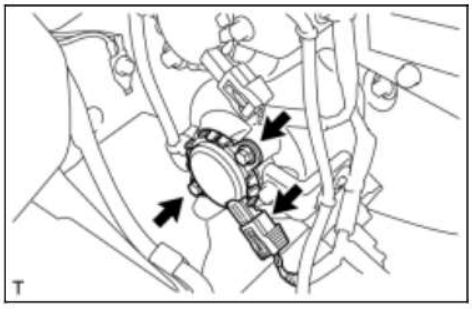
(c) Remove the O-ring from the camshaft timing oil control valve.

Text in Illustration

*1	O-ring
*2	Back-up Ring

(d) Remove the back-up ring from the camshaft timing oil control valve.

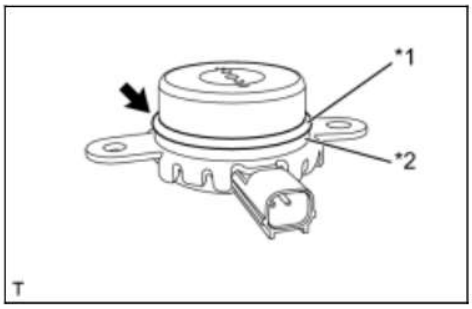
3. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE (for Exhaust Side of Bank 1)



(a) Disconnect the camshaft timing oil control valve connector.

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(b) Remove the 2 bolts and the camshaft timing oil control valve.



(c) Remove the O-ring from the camshaft timing oil control valve.

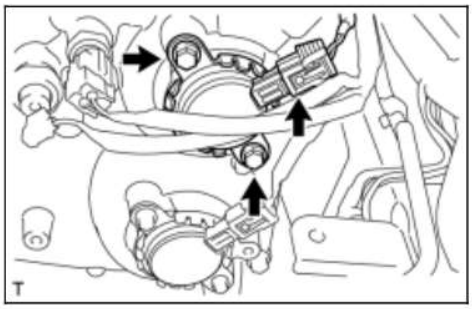
Text in Illustration

*1	O-ring
*2	Back-up Ring

(d) Remove the back-up ring from the camshaft timing oil control valve.

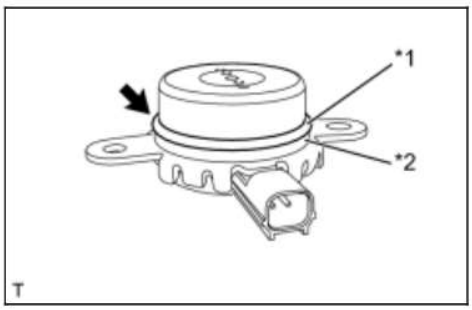
4. REMOVE AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

5. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE (for Intake Side of Bank 2)



(a) Disconnect the camshaft timing oil control valve connector.

(b) Remove the 2 bolts and the camshaft timing oil control valve.



(c) Remove the O-ring from the camshaft timing oil control valve.

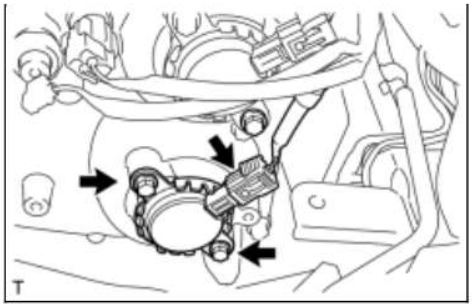
Text in Illustration

*1	O-ring
*2	Back-up Ring

(d) Remove the back-up ring from the camshaft timing oil control valve.

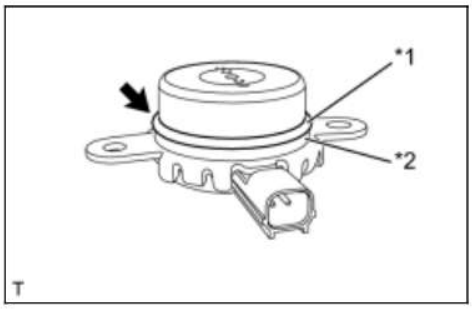
6. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE (for Exhaust Side of Bank 2)

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(a) Disconnect the camshaft timing oil control valve connector.

(b) Remove the 2 bolts and the camshaft timing oil control valve.



(c) Remove the O-ring from the camshaft timing oil control valve.

Text in Illustration

*1	O-ring
*2	Back-up Ring

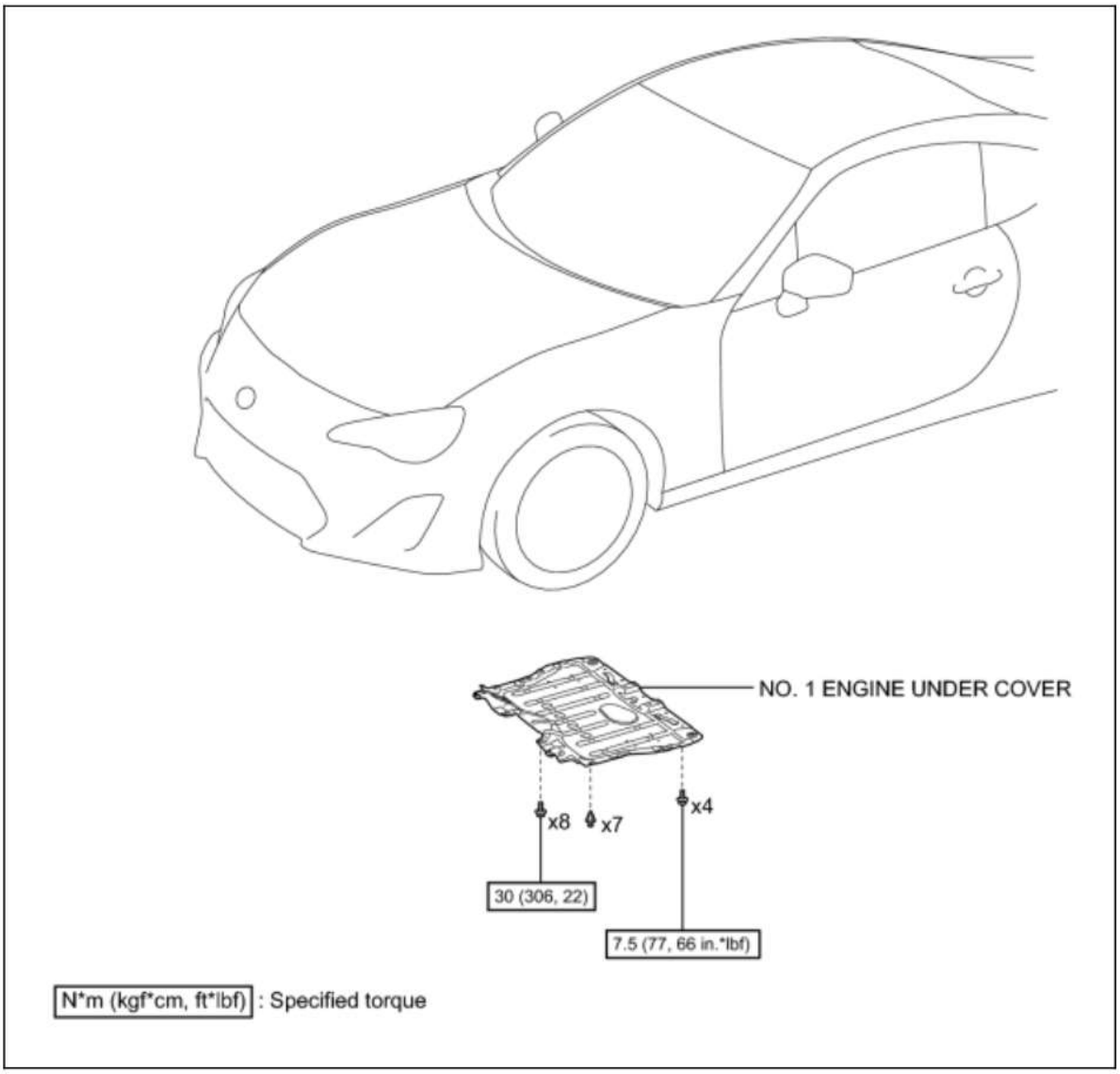
(d) Remove the back-up ring from the camshaft timing oil control valve.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002Q9U00HX
Title: FA20 ENGINE CONTROL: CAMSHAFT POSITION SENSOR: COMPONENTS (2013 FR-S)		

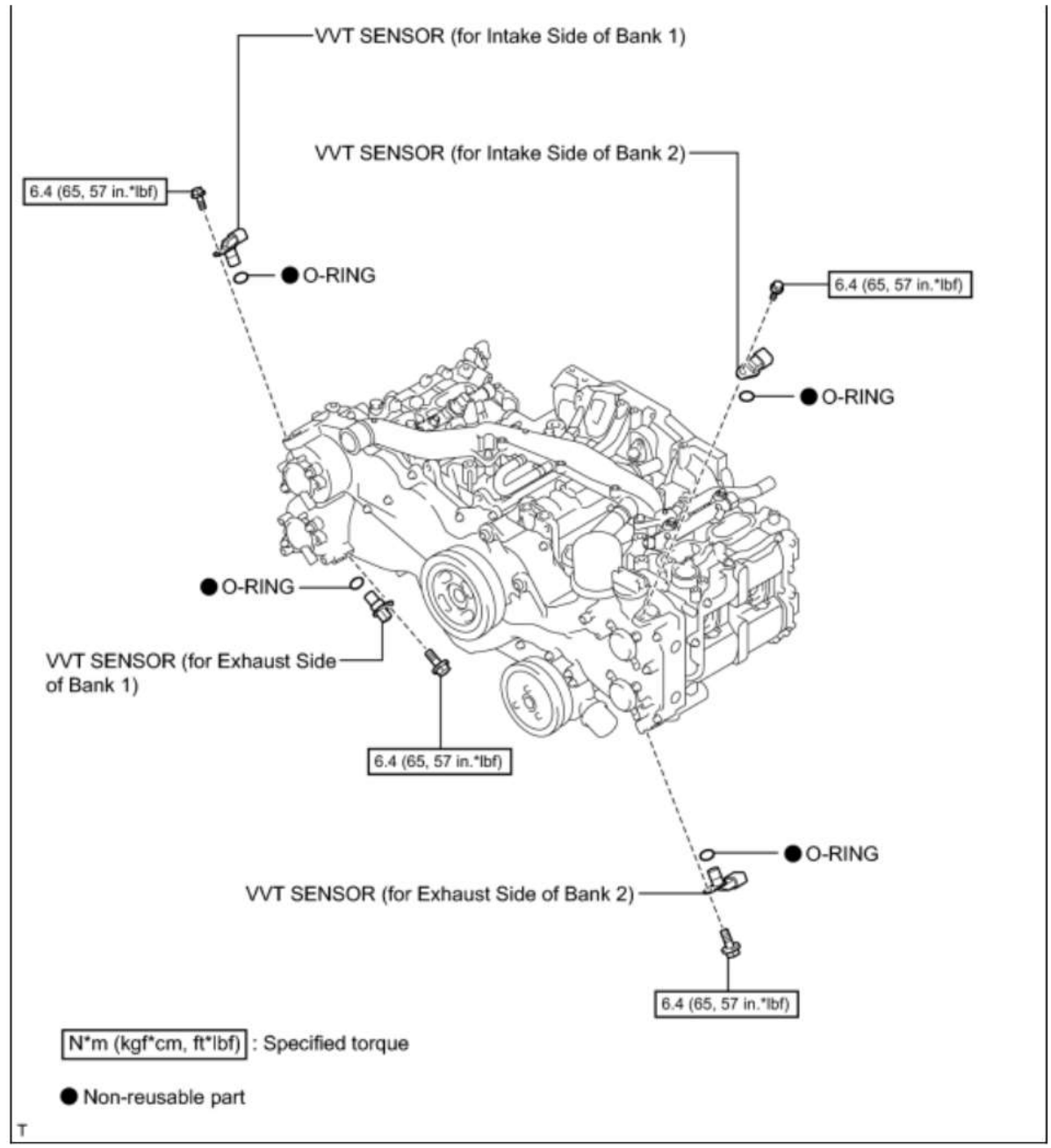
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002Q9T00JX
Title: FA20 ENGINE CONTROL: CAMSHAFT POSITION SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL VVT SENSOR (for Exhaust Side of Bank 2)

(a) Apply a light coat of engine oil to the new O-ring of the VVT sensor.

(b) Install the VVT sensor with the bolt.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

(c) Connect the VVT sensor connector.

2. INSTALL NO. 1 ENGINE UNDER COVER INFO

3. INSTALL VVT SENSOR (for Intake Side of Bank 2)

(a) Apply a light coat of engine oil to the new O-ring of the VVT sensor.

(b) Install the VVT sensor with the bolt.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

(c) Connect the VVT sensor connector

4. INSTALL VVT SENSOR (for Exhaust Side of Bank 1)

(a) Apply a light coat of engine oil to the new O-ring of the VVT sensor.

(b) Install the VVT sensor with the bolt.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

(c) Connect the VVT sensor connector.

5. INSTALL VVT SENSOR (for Intake Side of Bank 1)

(a) Apply a light coat of engine oil to the new O-ring of the VVT sensor.

(b) Install the VVT sensor with the bolt.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

(c) Connect the VVT sensor connector.

6. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

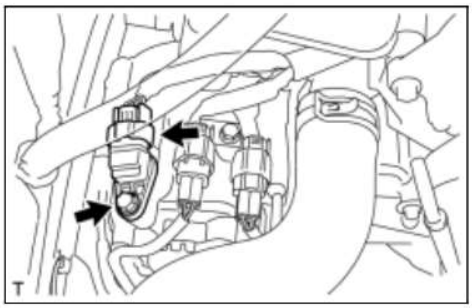
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002Q9V00JX
Title: FA20 ENGINE CONTROL: CAMSHAFT POSITION SENSOR: REMOVAL (2013 FR-S)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE VVT SENSOR (for Intake Side of Bank 1)

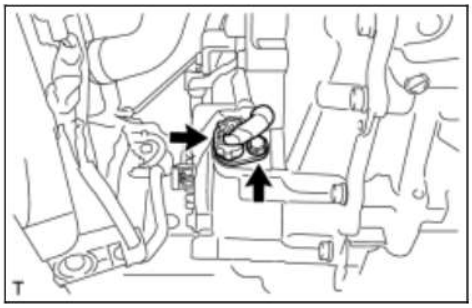


(a) Disconnect the VVT sensor connector.

(b) Remove the bolt and VVT sensor.

(c) Remove the O-ring from the VVT sensor.

3. REMOVE VVT SENSOR (for Exhaust Side of Bank 1)



(a) Disconnect the VVT sensor connector.

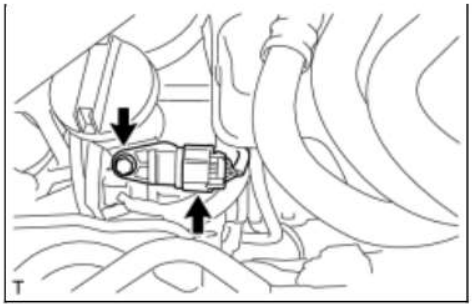
(b) Remove the bolt and VVT sensor.

(c) Remove the O-ring from the VVT sensor.

4. REMOVE VVT SENSOR (for Intake Side of Bank 2)

(a) Disconnect the VVT sensor connector.

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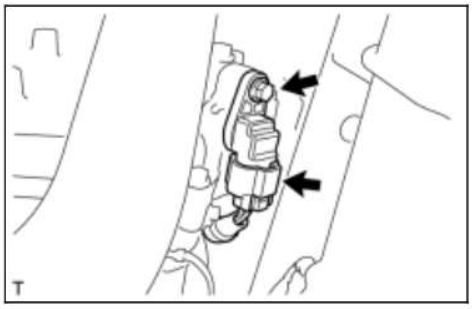


(b) Remove the bolt and VVT sensor.

(c) Remove the O-ring from the VVT sensor.

5. REMOVE NO. 1 ENGINE UNDER COVER INFO

6. REMOVE VVT SENSOR (for Exhaust Side of Bank 2)



(a) Disconnect the VVT sensor connector.

(b) Remove the bolt and VVT sensor.

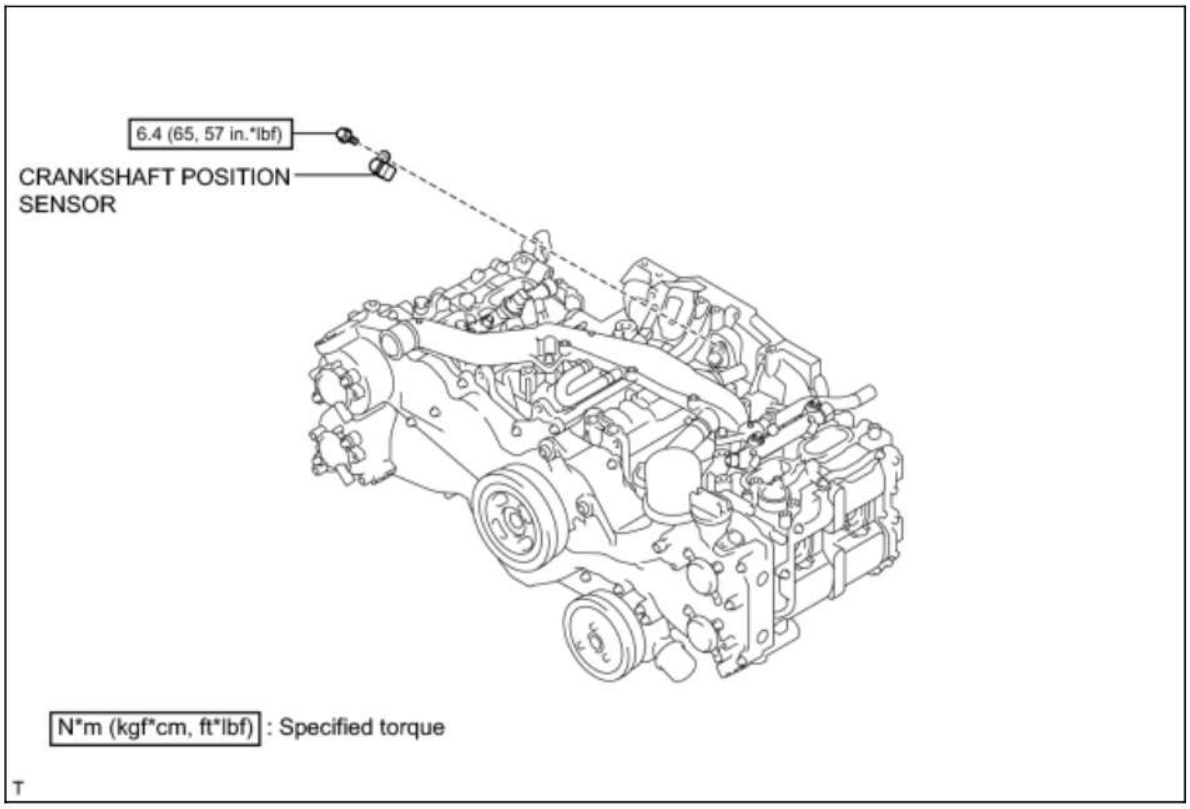
(c) Remove the O-ring from the VVT sensor.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002Q9Y00JX
Title: FA20 ENGINE CONTROL: CRANKSHAFT POSITION SENSOR: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION



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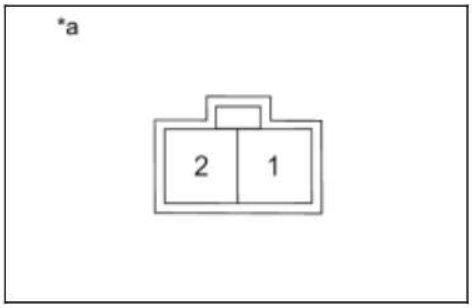
Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002QA000KX
Title: FA20 ENGINE CONTROL: CRANKSHAFT POSITION SENSOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT CRANKSHAFT POSITION SENSOR

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	Always	1836 to 2244 Ω

Text in Illustration

*a	Component without harness connected: (Crankshaft Position Sensor)

If the resistance is not as specified, replace the crankshaft position sensor.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002Q9X00JX
Title: FA20 ENGINE CONTROL: CRANKSHAFT POSITION SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL CRANKSHAFT POSITION SENSOR

(a) Install the crankshaft position sensor with the bolt.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

(b) Connect the crankshaft position sensor connector.

2. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

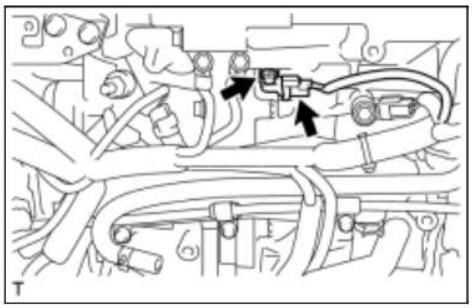
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002Q9Z00JX
Title: FA20 ENGINE CONTROL: CRANKSHAFT POSITION SENSOR: REMOVAL (2013 FR-S)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE CRANKSHAFT POSITION SENSOR



(a) Disconnect the crankshaft position sensor connector.

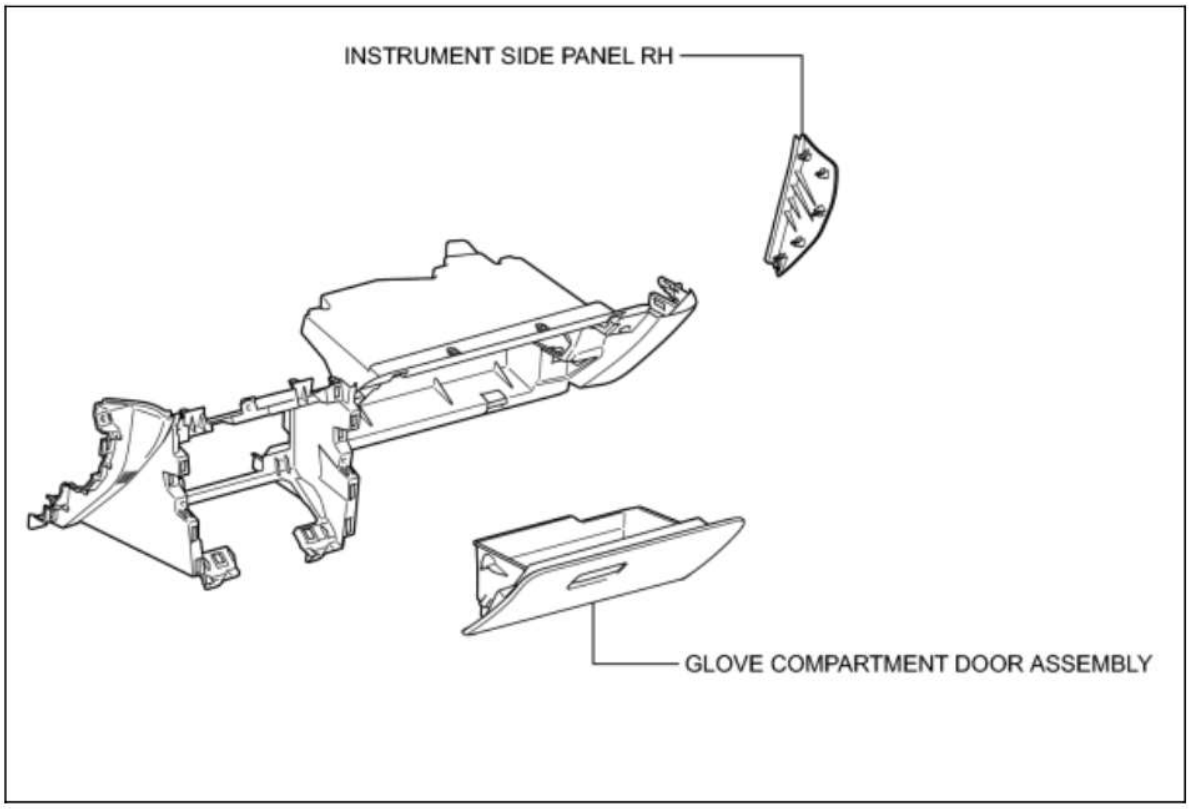
(b) Remove the bolt and crankshaft position sensor.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000047VL005X
Title: FA20 ENGINE CONTROL: ECM: COMPONENTS (2013 FR-S)		

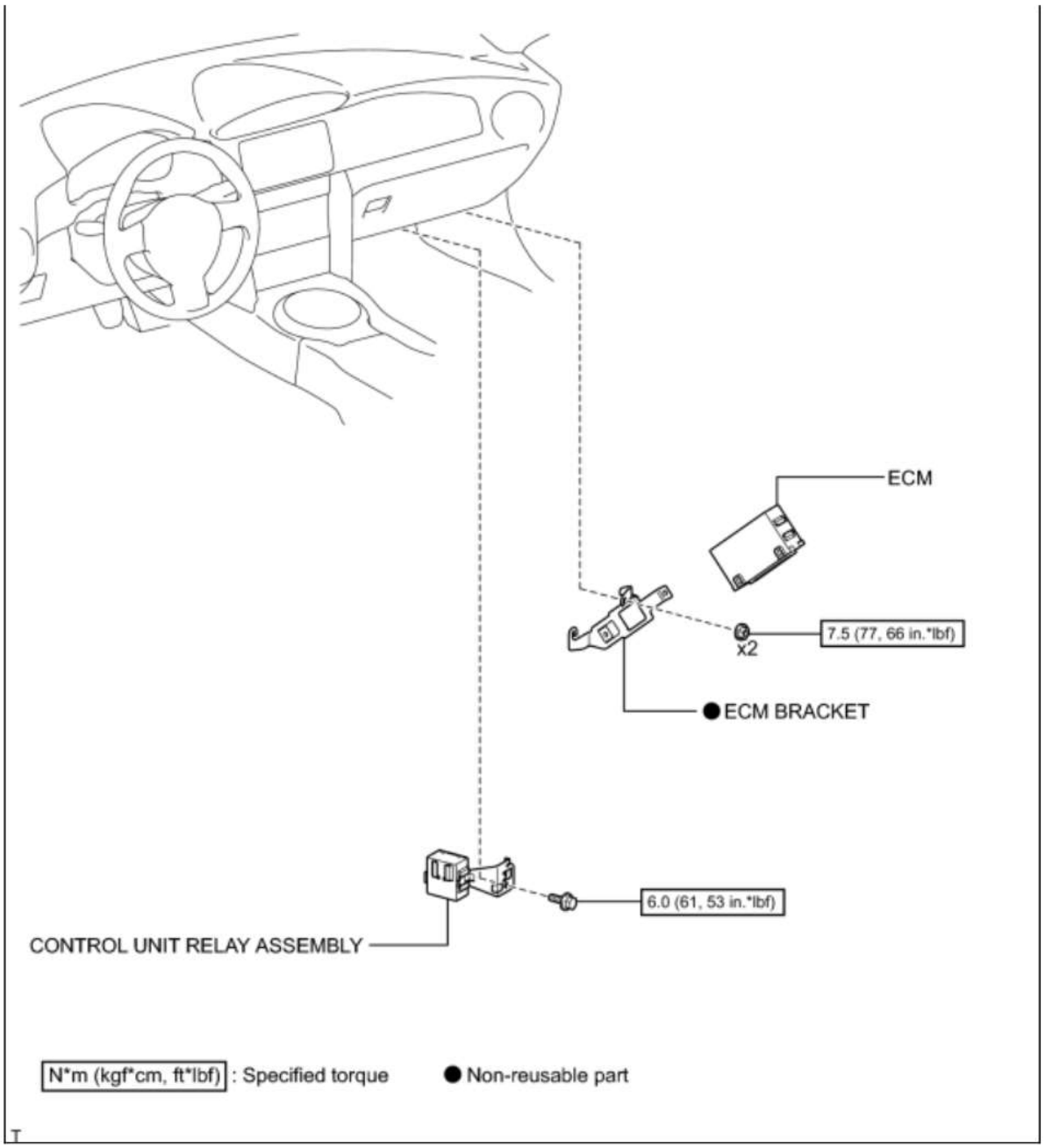
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000047NH009X
Title: FA20 ENGINE CONTROL: ECM: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL ECM BRACKET

(a) Engage the 2 claws, and install the new ECM bracket to the ECM.

NOTICE:

- After attaching the ECM bracket to the ECM, do not remove the ECM bracket.
- If the ECM bracket is attached to the ECM the wrong way around, replace ECM bracket with new items.

2. INSTALL ECM

NOTICE:

When replacing the ECM, do not use ECM with different specifications.

(a) Install the ECM with the 2 nuts.

Torque: 7.5 N·m (77 kgf·cm, 66in·lbf)

(b) Connect the 4 connectors to the ECM.

NOTICE:

Be sure to securely connect the connectors.

3. INSTALL CONTROL UNIT RELAY ASSEMBLY INFO

4. INSTALL GLOVE COMPARTMENT DOOR ASSEMBLY INFO

5. INSTALL INSTRUMENT SIDE PANEL RH INFO

6. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

7. PERFORM INITIALIZATION INFO

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000047NJ009X
Title: FA20 ENGINE CONTROL: ECM: REMOVAL (2013 FR-S)		

REMOVAL

NOTICE:

If the ECM or ECM bracket have replaced, use the new ECM and new ECM bracket.

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

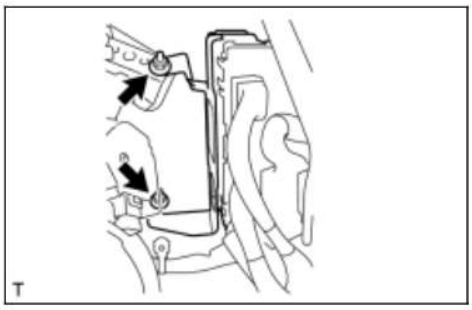
2. REMOVE INSTRUMENT SIDE PANEL RH INFO

3. REMOVE GLOVE COMPARTMENT DOOR ASSEMBLY INFO

4. REMOVE CONTROL UNIT RELAY ASSEMBLY INFO

5. REMOVE ECM

(a) Disconnect the 4 connectors from the ECM.

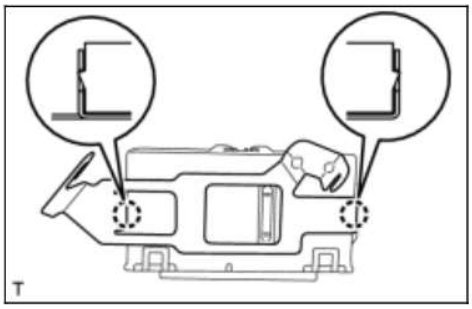


(b) Remove the 2 nuts and the ECM.

NOTICE:

If a component has been dropped or subjected to a strong impact, replace it.

6. REMOVE ECM BRACKET



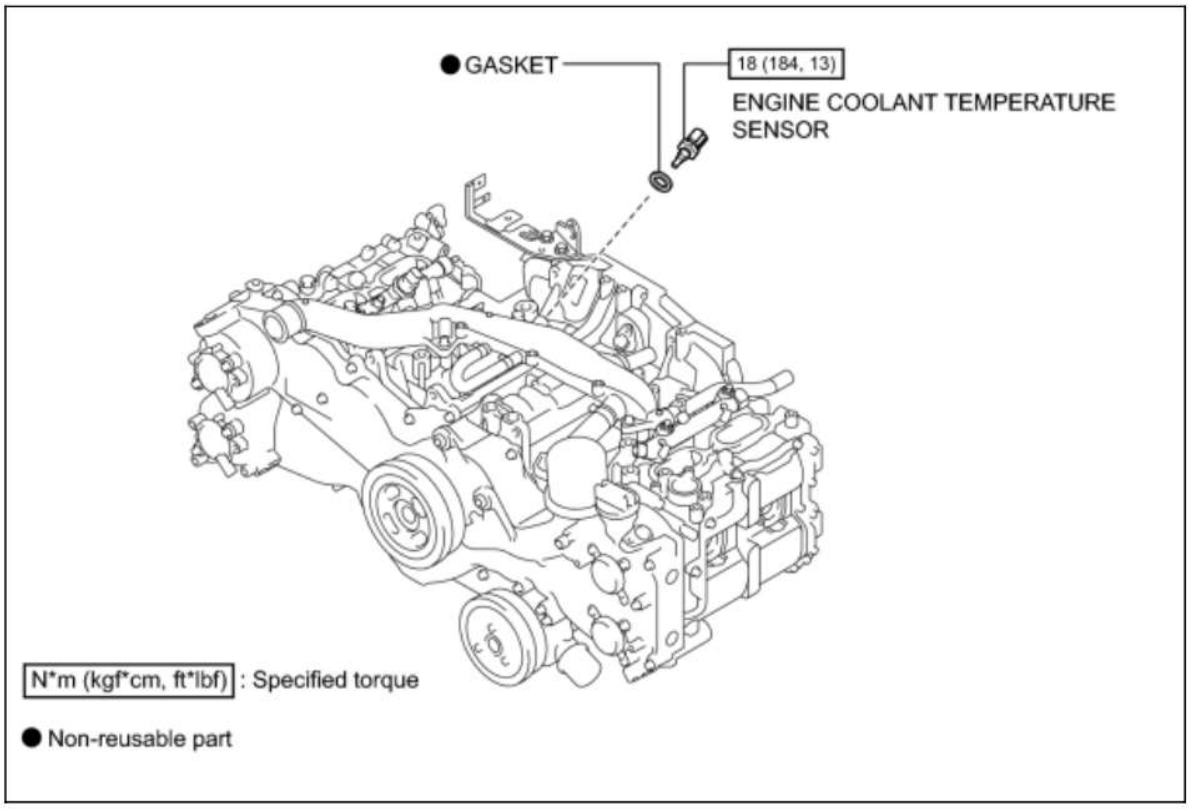
(a) Disengage the 2 claws, and remove ECM bracket.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003II1008X
Title: FA20 ENGINE CONTROL: ENGINE COOLANT TEMPERATURE SENSOR: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION

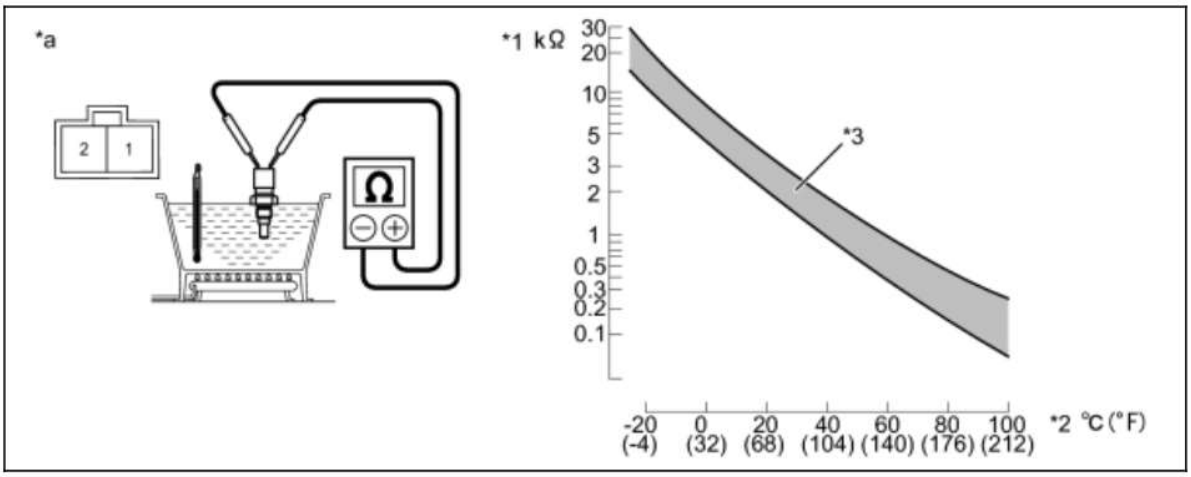


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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MTM00NX
Title: FA20 ENGINE CONTROL: ENGINE COOLANT TEMPERATURE SENSOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT ENGINE COOLANT TEMPERATURE SENSOR



Text in Illustration

*1	Resistance	*2	Temperature
*3	Acceptable	-	-
*a	Component without harness connected (Engine Coolant Temperature Sensor)	-	-

(a) Partially soak the sensor in the water and warm up the water.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	Approximately. 20°C (68°F)	2.35 to 2.65 kΩ
	Approximately. 80°C (176°F)	0.305 to 0.331 kΩ

NOTICE:

When checking the engine coolant temperature sensor in water, keep the terminals dry. After the check, wipe the engine coolant temperature sensor dry.

If the result is not as specified, replace the engine coolant temperature sensor.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003II0008X
Title: FA20 ENGINE CONTROL: ENGINE COOLANT TEMPERATURE SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL ENGINE COOLANT TEMPERATURE SENSOR

(a) Install a new gasket to the engine coolant temperature sensor.

(b) Using a 19 mm union nut wrench, install the engine coolant temperature sensor to the cylinder head sub-assembly.

Torque: 18 N·m (184 kgf·cm, 13ft·lbf)

NOTICE:

- If a component has been dropped or subjected a strong impact, replace it.
- Use the torque value compensation formula to calculate the torque value for use when a torque wrench is combined with a tool such as a ball joint lock nut wrench INFO .

(c) Connect the engine coolant temperature sensor connector.

2. INSTALL INTAKE MANIFOLD

INFO

3. FILL ENGINE COOLANT INFO

4. INSPECT COOLANT LEAK INFO

5. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL (for High Pressure) INFO

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003II2008X
Title: FA20 ENGINE CONTROL: ENGINE COOLANT TEMPERATURE SENSOR: REMOVAL (2013 FR-S)		

REMOVAL

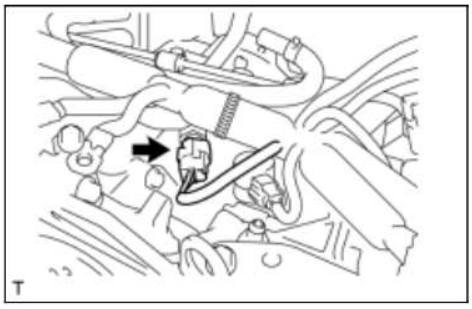
1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. DRAIN ENGINE COOLANT INFO

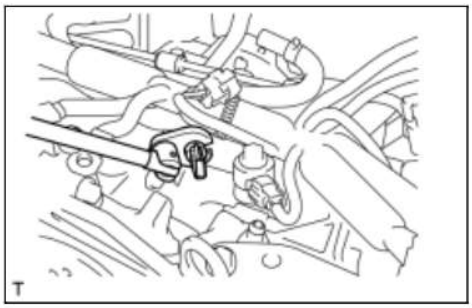
3. REMOVE INTAKE MANIFOLD

INFO

4. REMOVE ENGINE COOLANT TEMPERATURE SENSOR



(a) Disconnect the engine coolant temperature sensor connector.



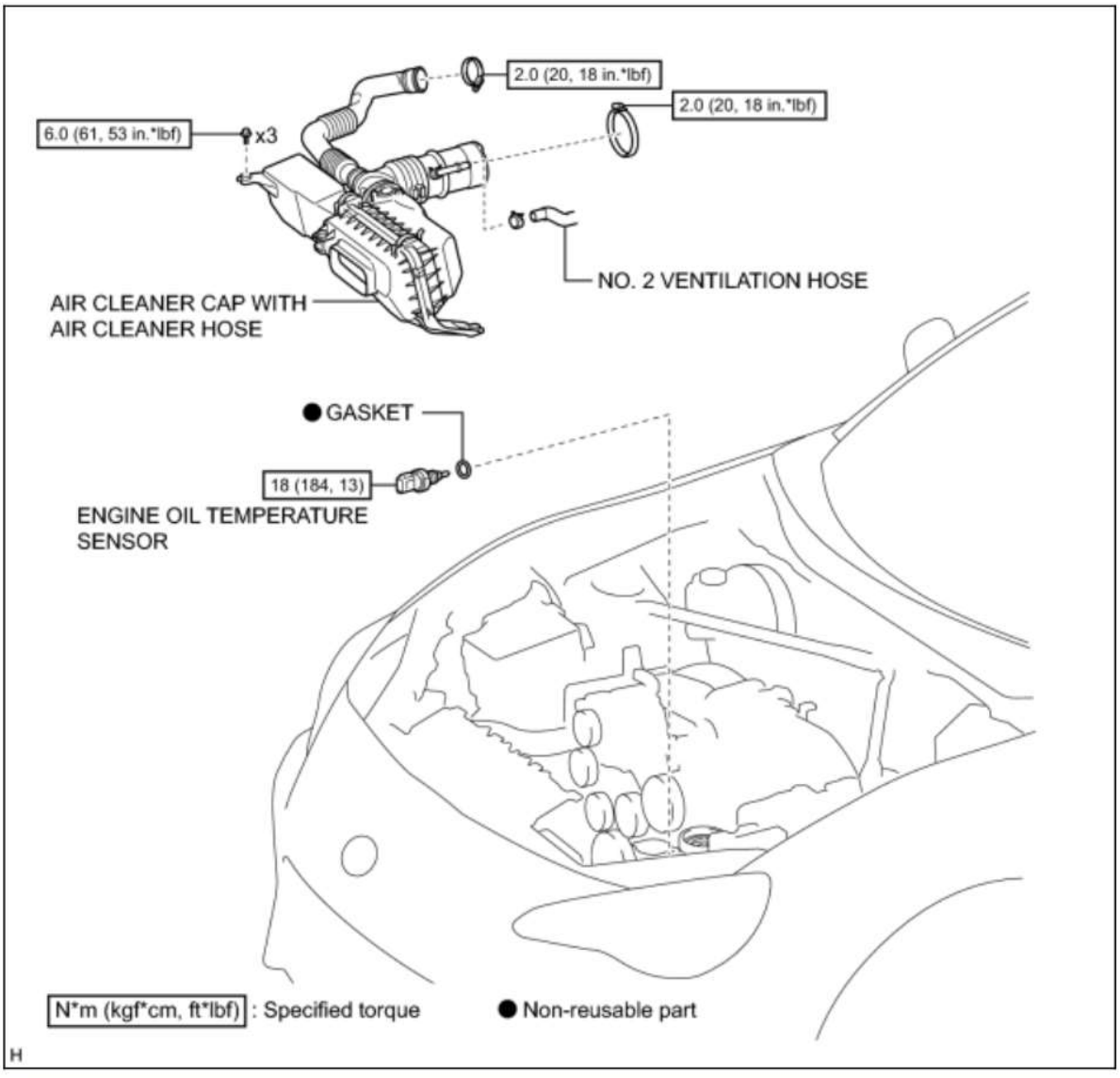
(b) Using a 19 mm union nut wrench, remove the engine coolant temperature sensor.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003II1009X
Title: FA20 ENGINE CONTROL: ENGINE OIL TEMPERATURE SENSOR: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION

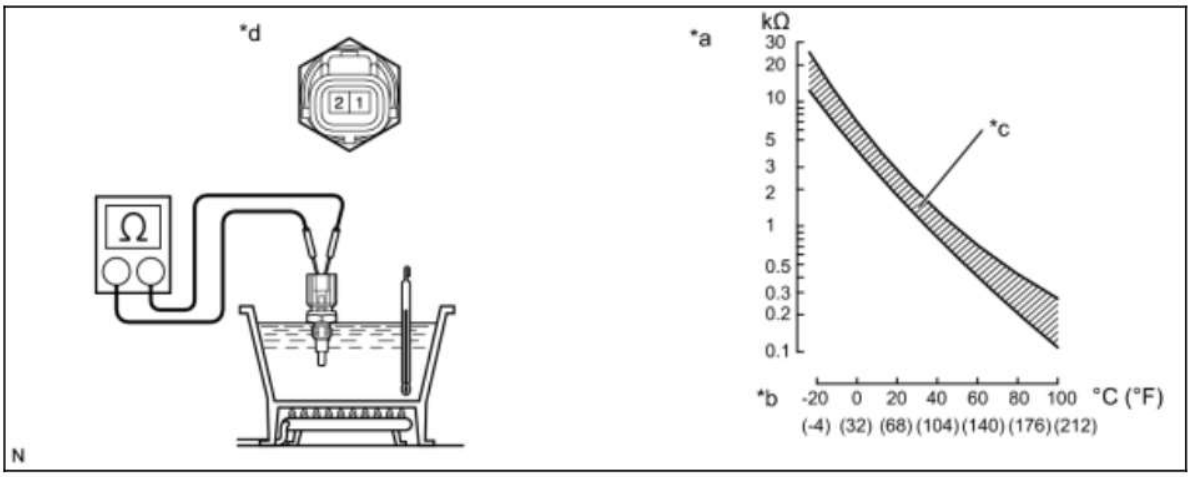


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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MTM00PX
Title: FA20 ENGINE CONTROL: ENGINE OIL TEMPERATURE SENSOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT ENGINE OIL TEMPERATURE SENSOR



Text in Illustration

*a	Resistance	*b	Temperature
*c	Acceptable	*d	Component without harness connected (Engine oil Temperature Sensor)

(a) Partially soak the sensor in the water and warm up the water.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	Approximately 20°C (68°F)	2.25 to 2.65 kΩ
	Approximately 80°C (176°F)	0.305 to 0.331 kΩ

NOTICE:

When checking the engine oil temperature sensor in water, keep the terminals dry. After the check, wipe the engine oil temperature sensor dry.

If the result is not as specified, replace the engine oil temperature sensor.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003II0009X
Title: FA20 ENGINE CONTROL: ENGINE OIL TEMPERATURE SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL ENGINE OIL TEMPERATURE SENSOR

(a) Install a new gasket to the engine oil temperature sensor.

(b) Using a 19 mm deep socket wrench, install the engine oil temperature sensor to the cylinder head sub-assembly.

Torque: 18 N·m (184 kgf·cm, 13ft·lbf)

(c) Connect the engine oil temperature sensor connector.

2. INSTALL AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003II2009X
Title: FA20 ENGINE CONTROL: ENGINE OIL TEMPERATURE SENSOR: REMOVAL (2013 FR-S)		

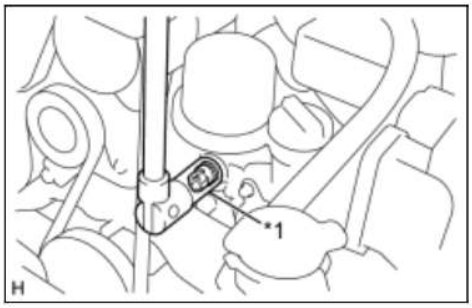
REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

3. REMOVE ENGINE OIL TEMPERATURE SENSOR

(a) Disconnect the engine oil temperature sensor connector.



(b) Using a 19 mm deep socket wrench, remove the engine oil temperature sensor.

Text in Illustration

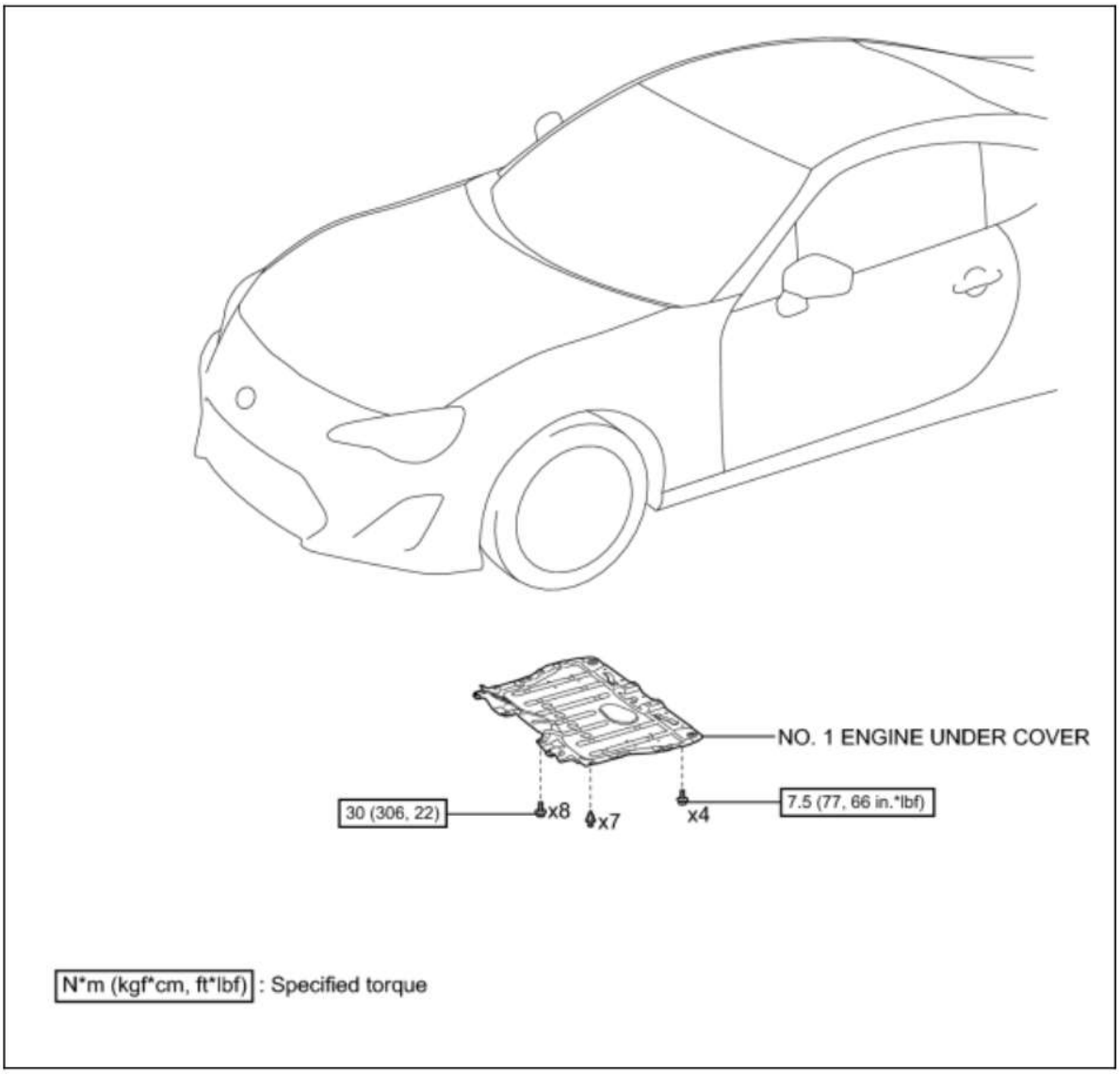
*1	19 mm Deep Socket Wrench

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BOD00FX
Title: FA20 ENGINE CONTROL: HEATED OXYGEN SENSOR: COMPONENTS (2013 FR-S)		

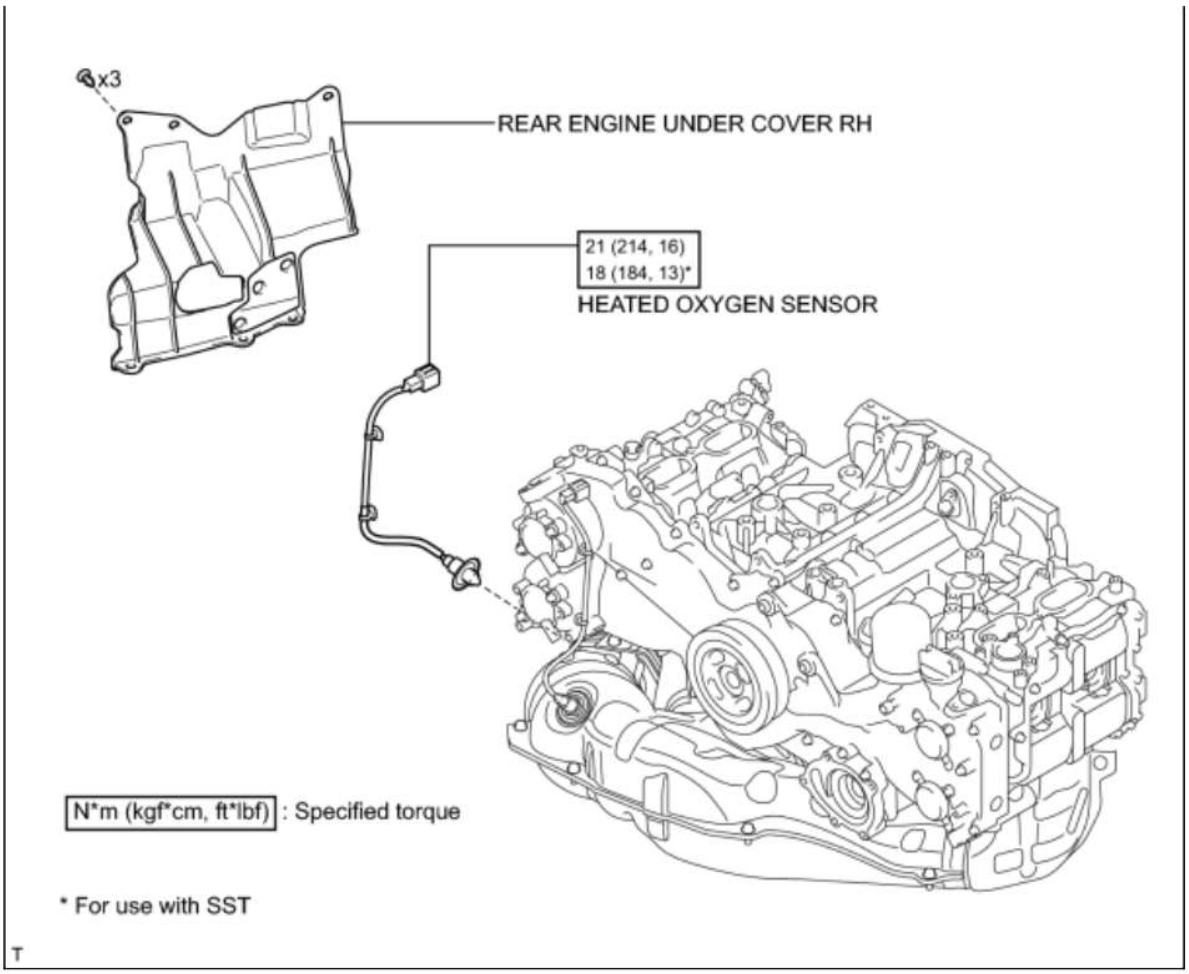
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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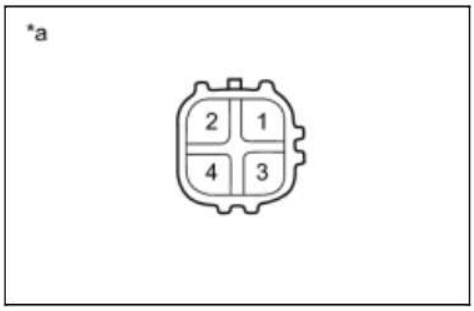
Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MUK00UX
Title: FA20 ENGINE CONTROL: HEATED OXYGEN SENSOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT HEATED OXYGEN SENSOR

(a) Measure the resistance according to the value(s) the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68 °F)	5.0 to 6.4 Ω
1 - 4	Always	10 kΩ or higher

Text in Illustration

*a	Component without harness connected (Heated Oxygen Sensor)

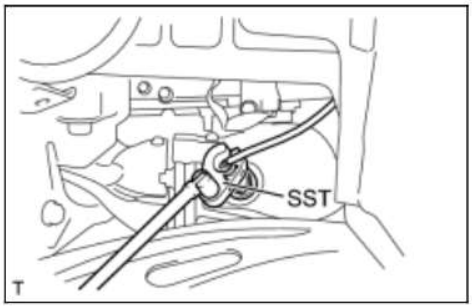
If the result is not as specified, replace the heated oxygen sensor.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MUJ00VX
Title: FA20 ENGINE CONTROL: HEATED OXYGEN SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL HEATED OXYGEN SENSOR



(a) Using SST, install the heated oxygen sensor onto the exhaust manifold assembly.

SST: 09224-00010
without SST - Torque: 21 N·m (214 kgf·cm, 16ft·lbf)
with SST - Torque: 18 N·m (184 kgf·cm, 13ft·lbf)

HINT:

- This torque value is effective when SST is parallel to the torque wrench.
- The "with SST" torque value is effective when using SST with a fulcrum length of 30 mm (1.18 in.).
- The "with SST" torque value is effective when using a torque wrench with a fulcrum length of 180 mm (7.087 in.).
- If using a torque wrench with a different length, or connecting the torque wrench and SST at an angle, refer to the alternate torque values INFO

(b) Engage the 2 clamps.

(c) Connect the oxygen sensor connector.

2. INSPECT FOR EXHAUST GAS LEAK INFO

3. INSTALL REAR ENGINE UNDER COVER RH

(a) Instal the 3 clips, and connect the engine under cover rear RH.

4. INSTALL NO. 1 ENGINE UNDER COVER INFO

5. INSTALL FRONT TIRE

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MUM00VX
Title: FA20 ENGINE CONTROL: HEATED OXYGEN SENSOR: REMOVAL (2013 FR-S)		

REMOVAL

1. REMOVE FRONT TIRE RH

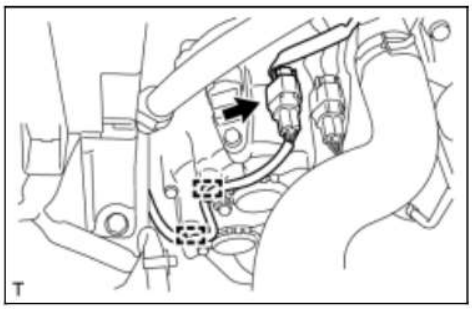
2. REMOVE NO. 1 ENGINE UNDER COVER INFO

3. DISCONNECT REAR ENGINE UNDER COVER RH



(a) Remove the 3 clips, and disconnect the rear engine under cover RH.

4. REMOVE HEATED OXYGEN SENSOR



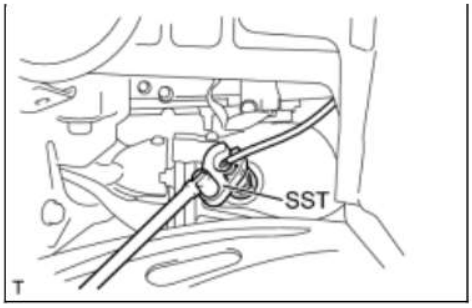
(a) Disconnect the oxygen sensor connector.

(b) Disengage the 2 clamps.

(c) Using SST, remove the oxygen sensor from the exhaust manifold assembly.

SST: 09224-00010

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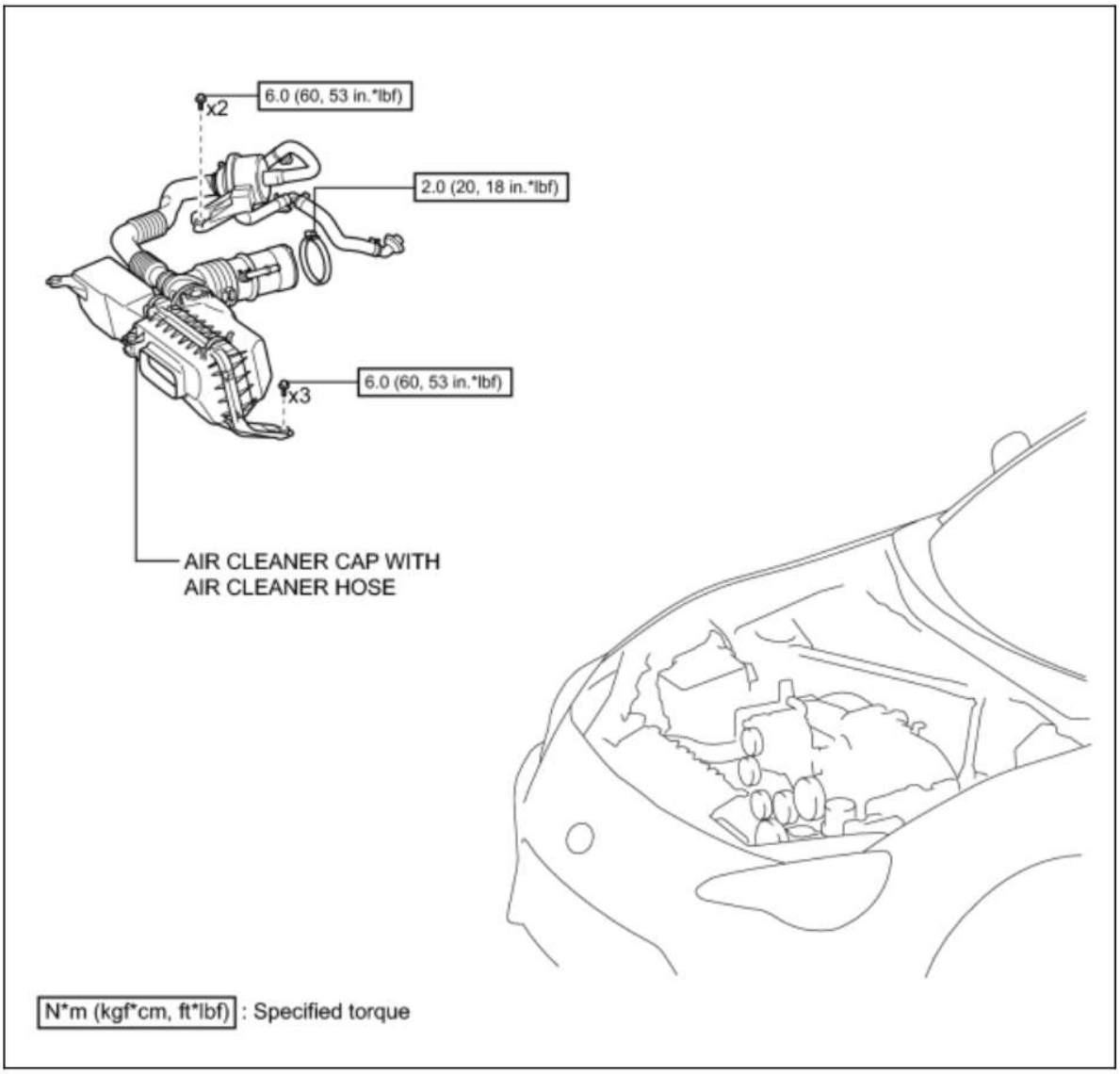


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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002QV300OX
Title: FA20 ENGINE CONTROL: IGNITION COIL AND SPARK PLUG: COMPONENTS (2013 FR-S)		

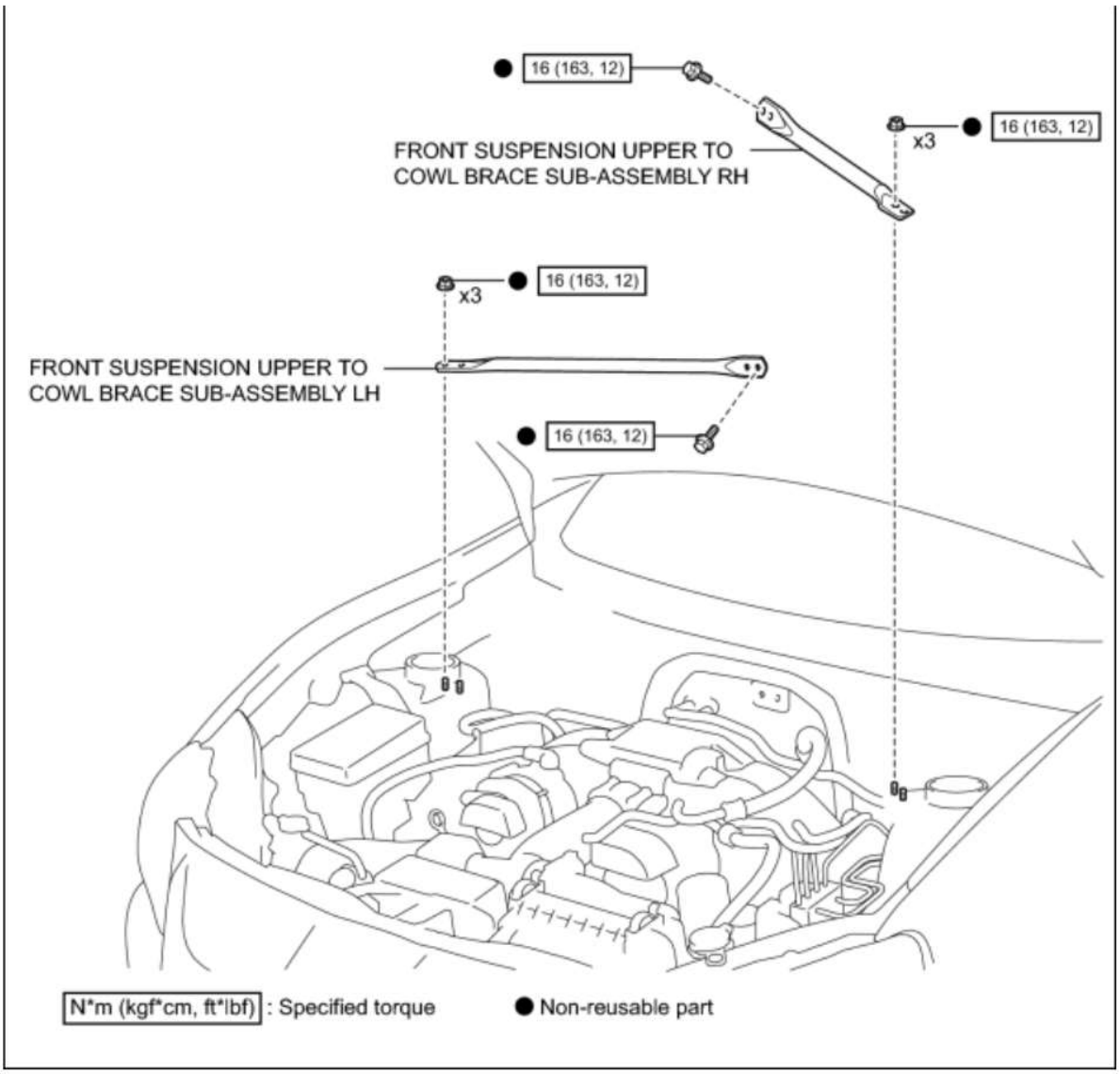
COMPONENTS

ILLUSTRATION



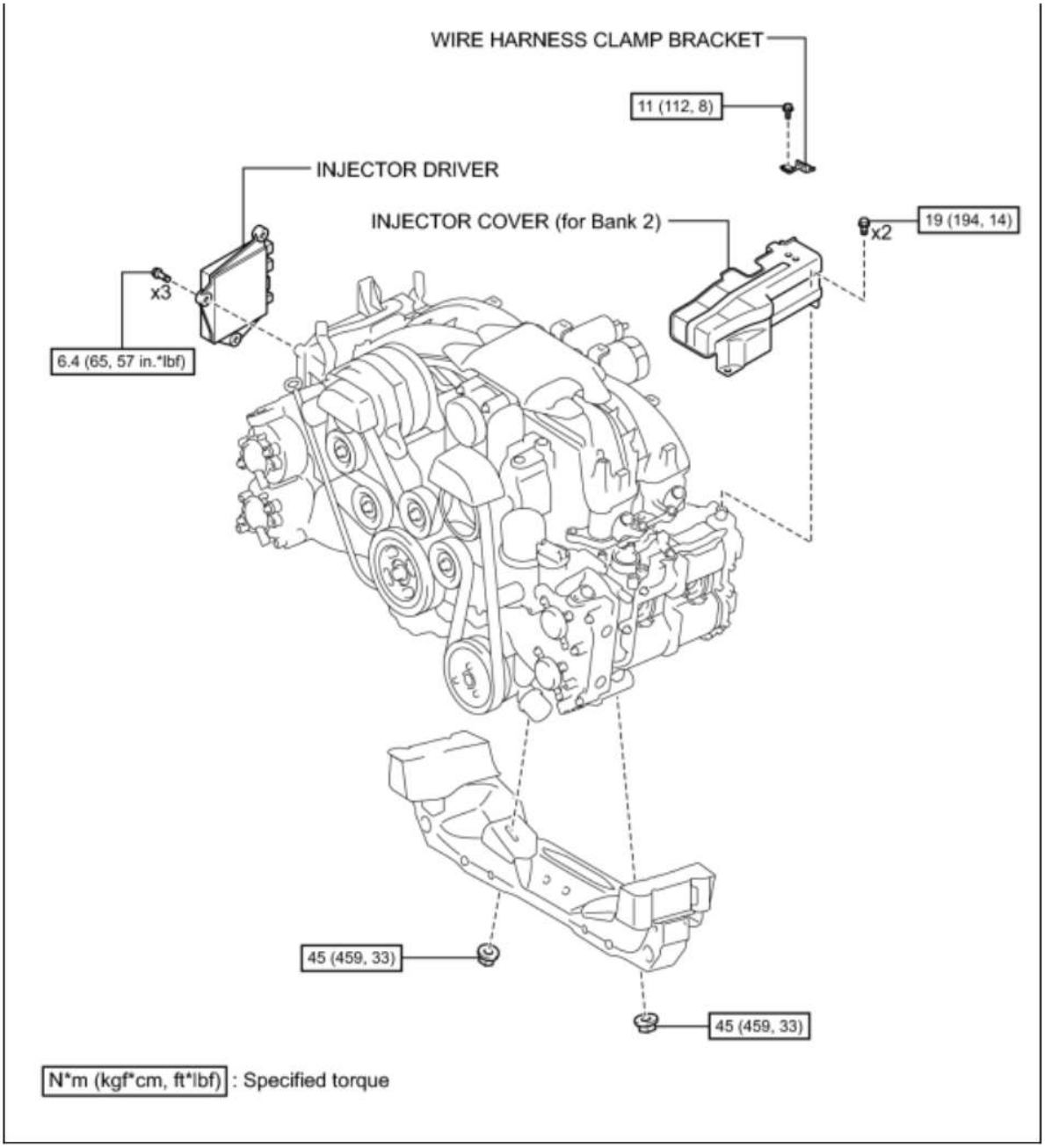
ILLUSTRATION

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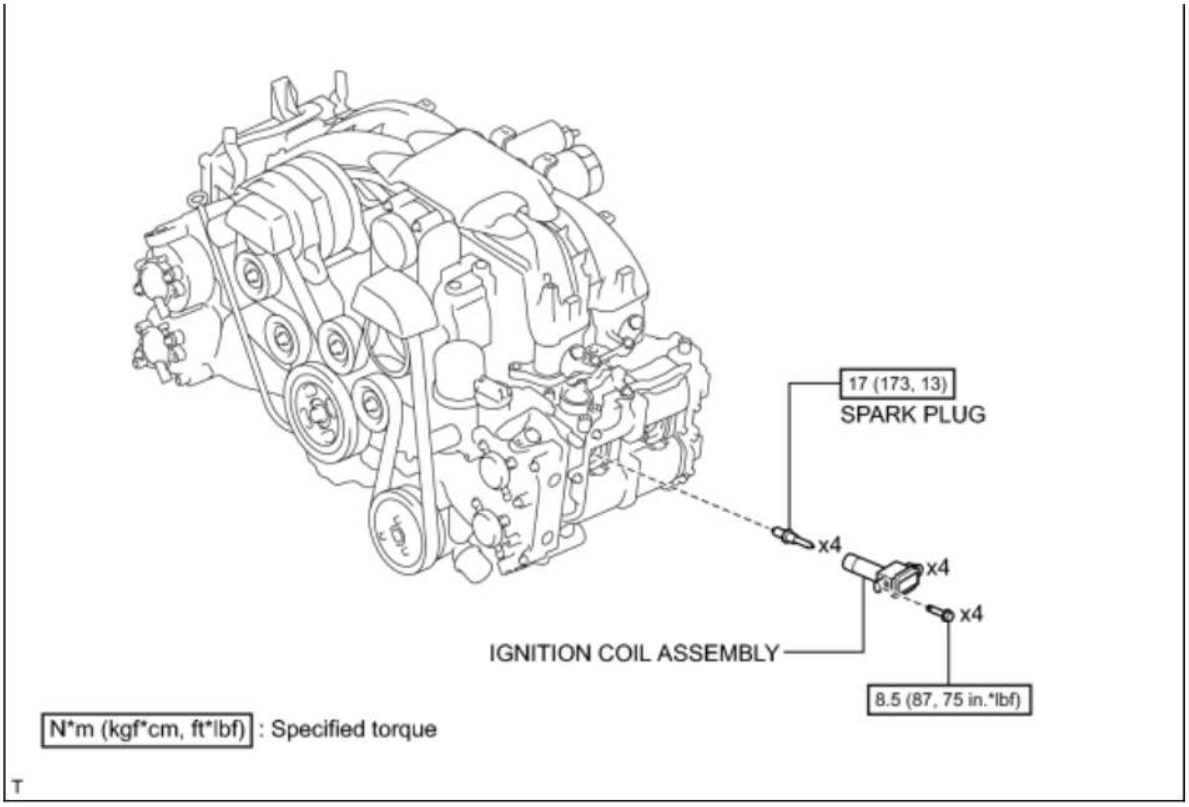
ILLUSTRATION

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ILLUSTRATION

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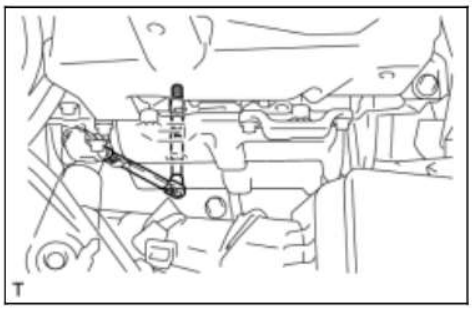


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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000053AP003X
Title: FA20 ENGINE CONTROL: IGNITION COIL AND SPARK PLUG: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL SPARK PLUG (for Bank 1)



(a) Using the spark plug wrench 14 mm, tilt extension bar 35 mm and universal joint 54 mm, and install the 2 spark plugs onto the cylinder head sub-assembly.

Torque: 17 N·m (173 kgf·cm, 13ft·lbf)

NOTICE:

If a component has been dropped or subjected a strong impact, replace it.

2. INSTALL IGNITION COIL ASSEMBLY (for Bank 1)

(a) Install the 2 ignition coils onto the cylinder head cover sub-assembly with the 2 bolts.

Torque: 8.5 N·m (87 kgf·cm, 75in·lbf)

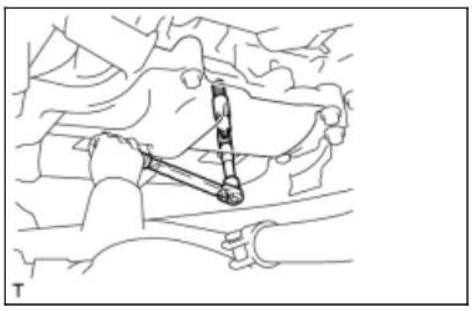
NOTICE:

If a component has been dropped or subjected a strong impact, replace it.

(b) Connect the 2 ignition coil connectors to the ignition coil.

3. INSTALL INJECTOR DRIVER INFO

4. INSTALL SPARK PLUG (for Bank 2)



(a) Using the spark plug wrench 14 mm, tilt extension bar 35 mm and universal joint 54 mm, and install the 2 spark plugs onto the cylinder head sub-assembly.

Torque: 17 N·m (173 kgf·cm, 13ft·lbf)

NOTICE:

If a component has been dropped or subjected a strong impact, replace it.

5. INSTALL IGNITION COIL ASSEMBLY (for Bank 2)

(a) Install the 2 ignition coils onto the cylinder head cover sub-assembly with the 2 bolts.

Torque: 8.5 N·m (87 kgf·cm, 75in·lbf)

NOTICE:

If a component has been dropped or subjected a strong impact, replace it.

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(b) Connect the 2 ignition coil connectors to the ignition coil.

6. INSTALL INJECTOR COVER (for Bank 2)

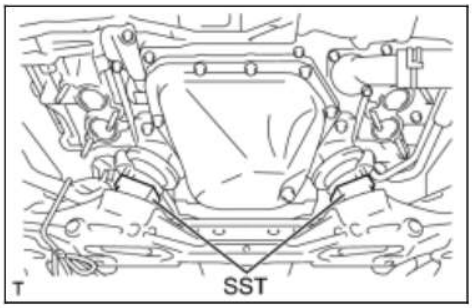
(a) Install the injector cover with the 2 bolts.

Torque: 19 N·m (194 kgf·cm, 14ft·lbf)

(b) Engage the clamp, and install the fuel hoses.

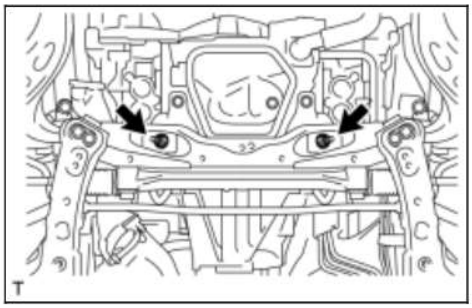
7. REMOVE SST

(a) Hoist the engine assembly up with an engine sling device and a mini crane.



(b) Remove the SST.

SST: 09250-53010



(c) Install the 2 nuts.

(d) Remove the rope that is tying the front exhaust pipe sub-assembly to the front suspension cross member sub-assembly.

8. REMOVE ENGINE HANGER INFO

9. INSTALL EXHAUST MANIFOLD

INFO

10. CONNECT ENGINE WIRE

(a) Connect the engine wire with the wire harness clamp bracket mount bolt and 3 clamps.

Torque: 11 N·m (112 kgf·cm, 8ft·lbf)

(b) Connect the engine wire with the 4 clamps.

11. INSTALL AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

12. INSTALL FRONT SUSPENSION UPPER TO COWL BRACE SUB-ASSEMBLY LH INFO

13. INSTALL FRONT SUSPENSION UPPER TO COWL BRACE SUB-ASSEMBLY RH INFO

14. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002QV400RX
Title: FA20 ENGINE CONTROL: IGNITION COIL AND SPARK PLUG: REMOVAL (2013 FR-S)		

REMOVAL

1. SET HOOD SUB-ASSEMBLY INFO

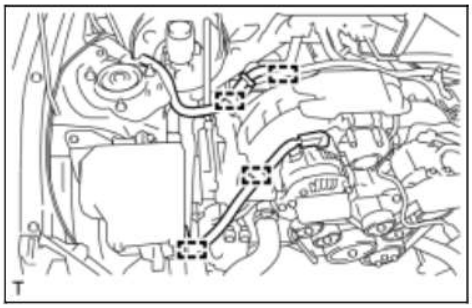
2. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

3. REMOVE FRONT SUSPENSION UPPER TO COWL BRACE SUB-ASSEMBLY LH INFO

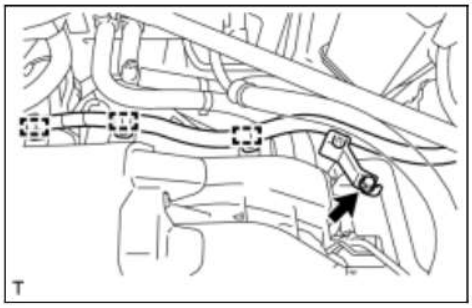
4. REMOVE FRONT SUSPENSION UPPER TO COWL BRACE SUB-ASSEMBLY RH INFO

5. REMOVE AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

6. DISCONNECT ENGINE WIRE



(a) Disengage the 4 clamps, and disconnect the engine wire.



(b) Disengage the 3 clamps and wire harness clamp bracket mount bolt, and disconnect the engine wire.

7. REMOVE EXHAUST MANIFOLD

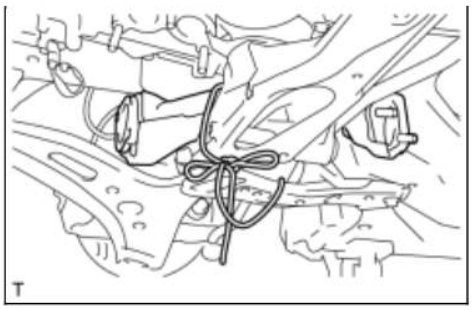
INFO

8. INSTALL ENGINE HANGER INFO

9. SET SST

(a) Tie the front exhaust pipe sub-assembly onto the front

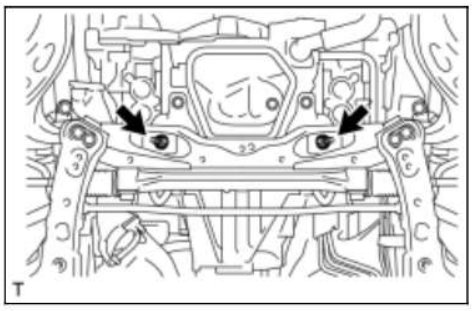
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suspension cross member sub-assembly using rope.

HINT:

This operation is necessary in order to prevent the front exhaust pipe sub-assembly from falling off.

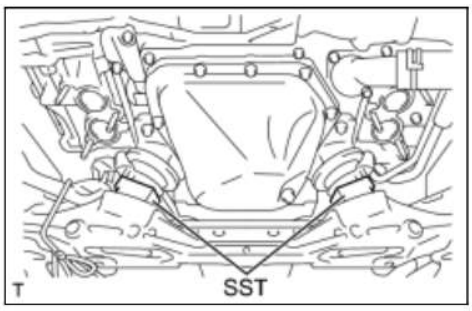


(b) Remove the 2 nuts.

(c) Install the engine hanger with the bolt. INFO

Torque: 33 N·m (337 kgf·cm, 24ft·lbf)

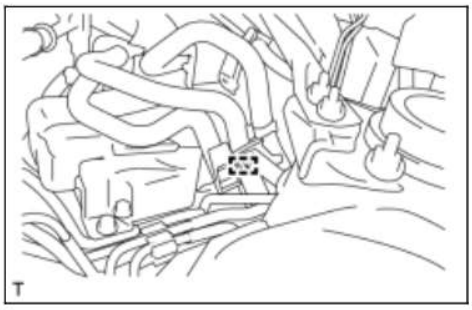
(d) Hoist the engine assembly up with an engine sling device and a mini crane.



(e) Install the SST to between the engine mount and front.

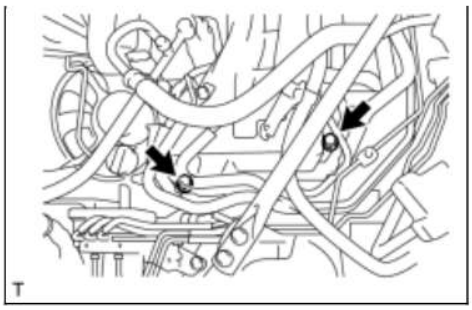
SST: 09250-53010

10. REMOVE INJECTOR COVER (for Bank 2)



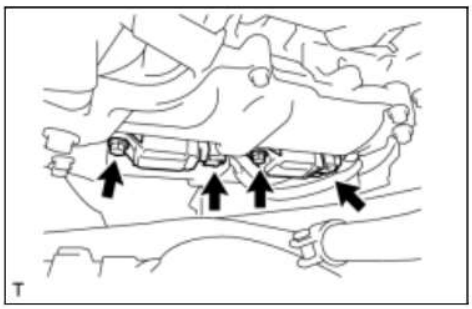
(a) Disengage the clamp, and disconnect the fuel hoses.

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(b) Remove the 2 bolts and injector cover.

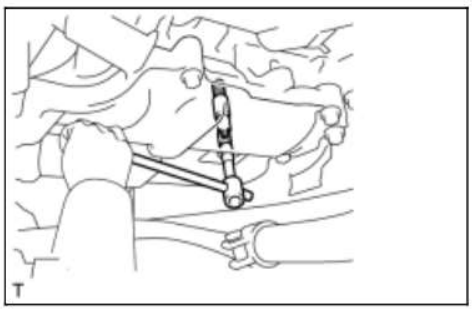
11. REMOVE IGNITION COIL ASSEMBLY (for Bank 2)



(a) Disconnect the 2 ignition coil connectors from the ignition coil assembly.

(b) Remove the 2 bolts and remove the 2 ignition coils.

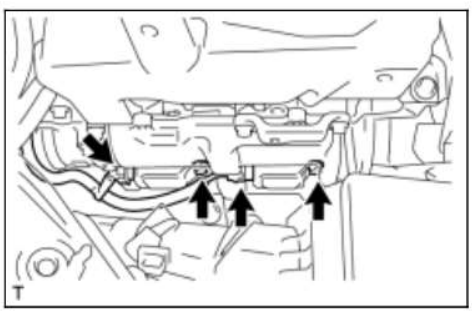
12. REMOVE SPARK PLUG (for Bank 2)



(a) Using the spark plug wrench 14 mm, tilt extension bar 35 mm and universal joint 54 mm, and remove the 2 spark plugs.

13. REMOVE INJECTOR DRIVER INFO

14. REMOVE IGNITION COIL ASSEMBLY (for Bank 1)

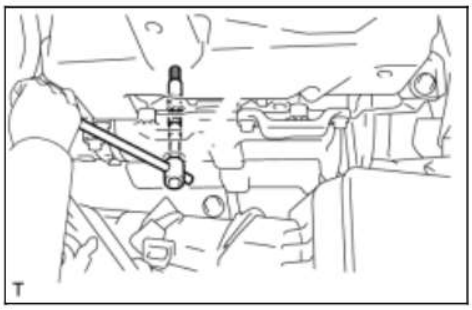


(a) Disconnect the 2 ignition coil connectors from the ignition coil assembly.

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(b) Remove the 2 bolts and remove the 2 ignition coils.

15. REMOVE SPARK PLUG (for Bank 1)



(a) Using the spark plug wrench 14 mm, tilt extension bar 35 mm and universal joint 54 mm, and remove the 2 spark plugs.

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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IGF006X
Title: FA20 ENGINE CONTROL: IGNITION SYSTEM: ON-VEHICLE INSPECTION (2013 FR-S)		

ON-VEHICLE INSPECTION

1. PERFORM SPARK TEST

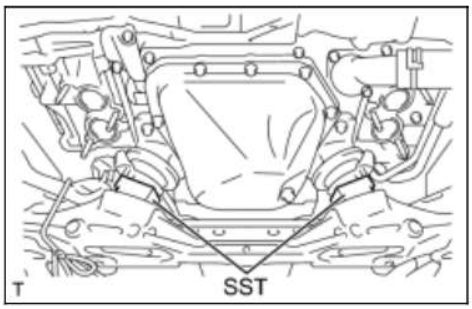
(a) Check for DTCs INFO .

NOTICE:

If any DTC is present, perform troubleshooting in accordance with the procedure for that DTC.

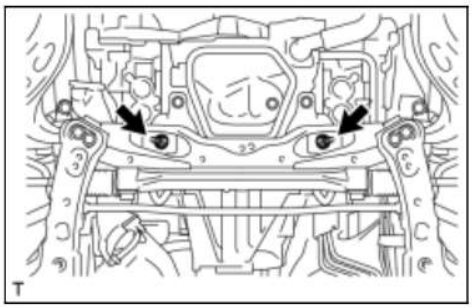
(b) Remove the 4 ignition coils and 4 spark plugs INFO .

(c) Hoist the engine assembly up with an engine sling device and a mini crane.



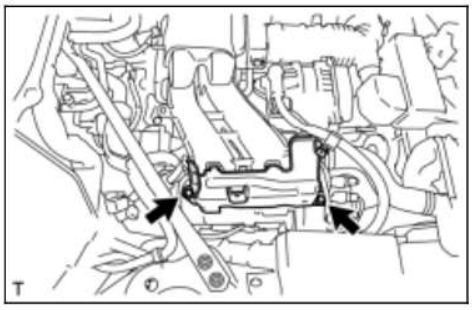
(d) Remove the SST.

SST: 09250-53010



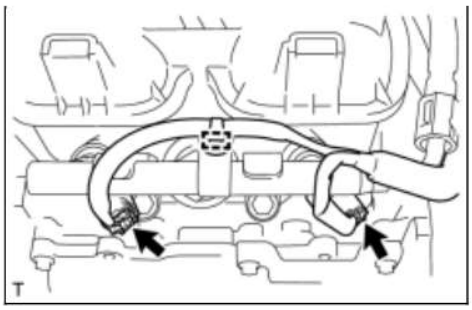
(e) Install the 2 nuts.

Torque: 45 N·m (459 kgf·cm, 33ft·lbf)



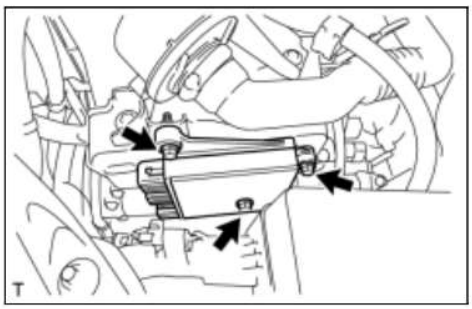
(f) Remove the 2 bolts and injector cover (bank 1).

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(g) Disconnect the 2 fuel injector connectors.

(h) Install the injector cover (bank 1).

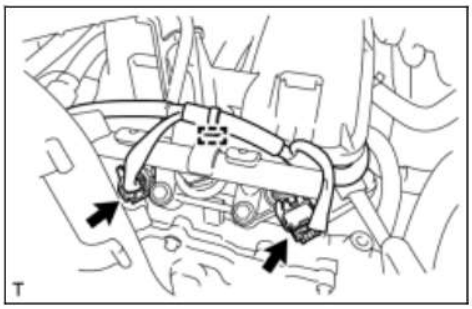


(i) Install the injector driver with the 3 bolts.

Torque: 6.4 N·m (65 kgf·cm, 57in·lbf)

HINT:

Do not connect the upper side 2 connectors.



(j) Disconnect the 2 fuel injector connectors.

(k) Connect the cable to the negative battery terminal.

(l) Install the air cleaner case sub-assembly with the hose.

(m) Install a spark plug to each ignition coil and connect the ignition coil connector.

(n) Ground the spark plug.

(o) Check that spark occurs while the engine is being cranked.

(p) Check whether sparks occur.

NOTICE:

- Ground the spark plugs when checking them.
- Do not crank the engine for more than 2 seconds.
- Do not use an ignition coil and spark plug that has been dropped or subjected to a strong impact.

(q) If spark does not occur, perform the following procedure.

2. INSPECT IGNITION COIL AND SPARK PLUG

(a) Perform the spark test in accordance with the following procedure.

(1) Check that the wire harness side connector of the ignition coil assembly is securely connected.

Result:

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RESULT	PROCEED TO
NG	Connect securely
OK	Go to next step

(2) Perform a spark test on each ignition coil assembly.

1. If there is a cylinder where sparks do not occur, replace its ignition coil with the ignition coil of a cylinder where sparks occur normally.
2. Crank the engine and visually check that sparks occur at the cylinder with the normally operating ignition coil.

Result:

RESULT	PROCEED TO
OK	Replace ignition coil assembly
NG	Go to next step

(3) Perform a spark test on each spark plug.

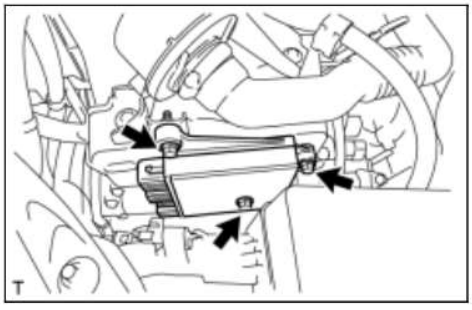
1. If there is a cylinder where sparks do not occur, replace its spark plug with the spark plug of a cylinder where sparks occur normally.
2. Crank the engine and visually check that sparks occur at the cylinder with the normally operating spark plug.

Result:

RESULT	PROCEED TO
OK	Replace spark plug
NG	Inspect the ignition system INFO

(b) Disconnect the cable from the negative battery terminal.

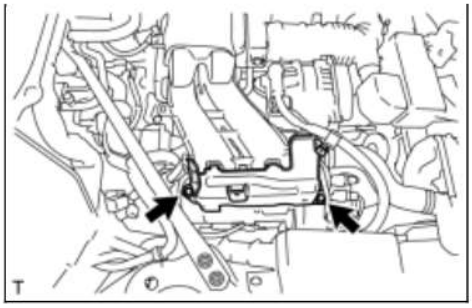
(c) Remove the air cleaner case sub-assembly with hose.

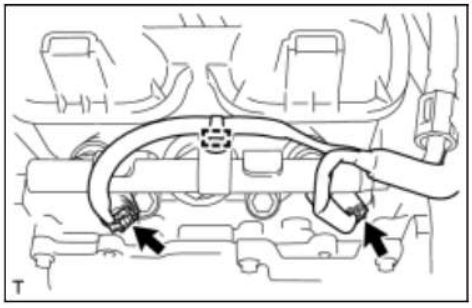


(d) Remove the 3 bolts and the injector driver.

(e) Remove the 2 bolts and the injector cover (bank 1).

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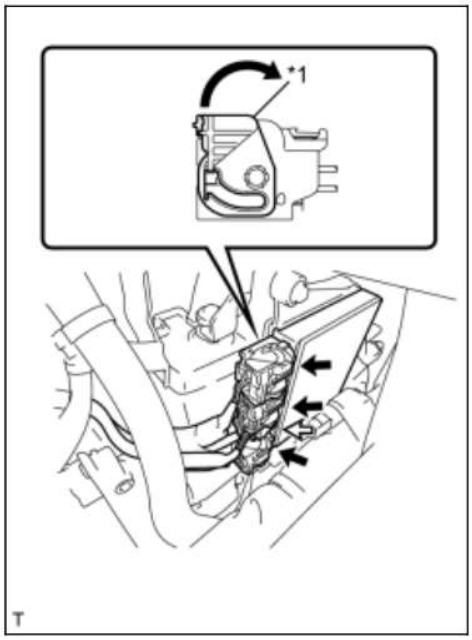


(f) Connect the 2 fuel injector connectors.

(g) Install the 2 bolts and the injector cover.

(h) Install the 3 bolts and the injector driver.

(i) Connect the 4 connectors to the injector driver. Move the lock levers in the direction indicated by the arrow to lock the 3 connectors.

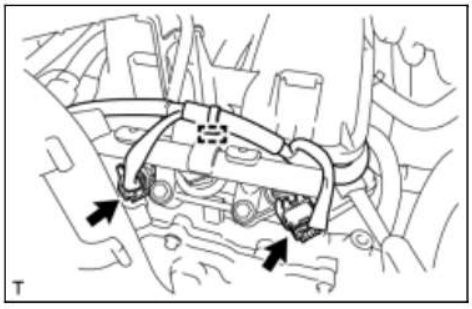


Text in Illustration

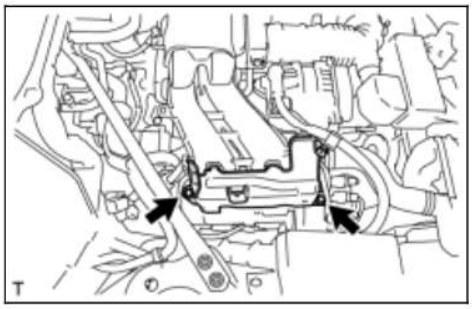
*1	Lock Lever
➡	Connector with Lock Lever

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⇨	Connector without Lock Lever

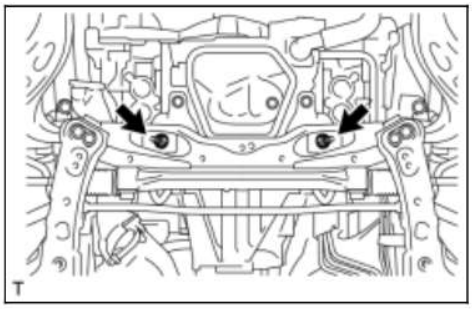


(j) Connect the 2 fuel injector connectors.



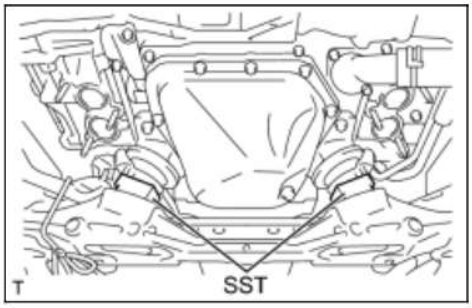
(k) Install the injector cover (bank 1) with the 2 bolts.

Torque: 19 N·m (194 kgf·cm, 14ft·lbf)



(l) Remove the 2 nuts.

(m) Hoist the engine assembly up with an engine sling device and a mini crane.



(n) Install the SST.

SST: 09250-53010

(o) Install the ignition coil assembly and spark plug INFO .

(p) Clear the DTCs INFO .

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(q) Check for DTCs INFO .

HINT:

Reinstall the sensors, connectors, etc. and restore the previous vehicle conditions before rechecking for DTCs.

3. INSPECT SPARK PLUG

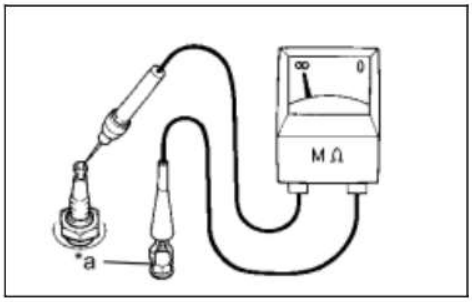
NOTICE:

- When replacing a spark plug, make sure to use the designated spark plug because an ion current type misfire detection system is used for the spark plug.
- Do not damage the platinum tip. If the spark plug has been dropped, make sure to replace it with a designated new spark plug.
- Do not use a wire brush for cleaning.
- Do not attempt to adjust the electrode gap of a used spark plug.
- Make sure to use SST to check gaps, preventing the platinum tip from being damaged.
- If damaged, replace it with a designated new spark plug.

(a) Check the electrode using a megohmmeter:

Text in Illustration

*a	Ground



(1) Measure the resistance according to the value(s) in the table below.

Standard Insulation Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
Spark plug (terminal part) - Body ground	Always	10 MΩ or higher

HINT:

- If the result is not as specified, clean the spark plug with a spark plug cleaner and measure the resistance again.
- If a megohmmeter is not available, perform the following simple inspection instead.

(b) Alternative inspection method:

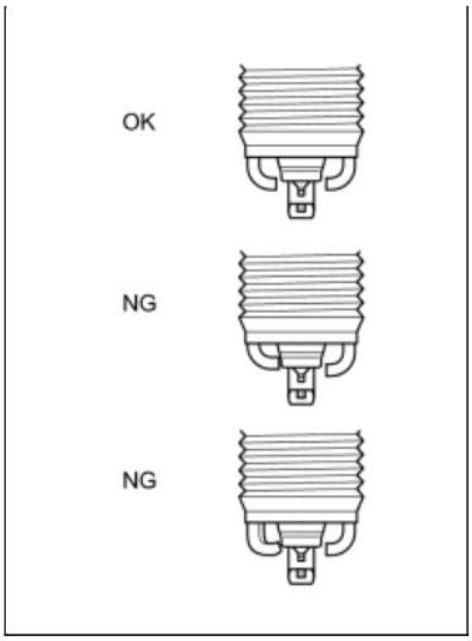
(1) Quickly accelerate the engine to 4000 rpm 5 times.

(2) Remove the spark plug INFO .

(3) Visually check the spark plug.

If the electrode is dry, the spark plug is functioning

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properly. If the electrode is damp, proceed to the next step.

HINT:

If a megohmmeter is not available, perform the following simple inspection instead.

(4) Install the spark plug INFO .

(c) Check the spark plug for any damage to its threads and insulator.

HINT:

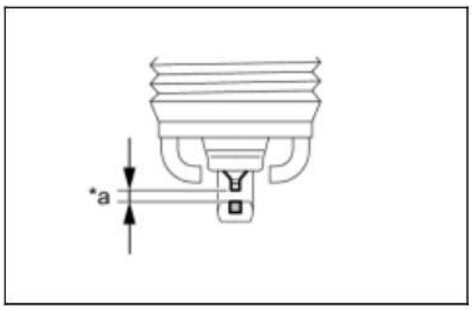
If there is any damage, replace the spark plug.

Recommended Spark Plug:

MANUFACTURER	PRODUCT
DENSO made	ZXE27HBR8

(d) Reference:

(1) Using SST, check the spark plug electrode gap.



Text in Illustration

*a	Spark Plug Electrode Gap

SST: 09240-00020

Maximum electrode gap for a used spark plug:
1.0 mm (0.0394 in.)
If the gap exceeds the maximum, replace the spark plug.

NOTICE:

Never attempt to adjust the gap of a used plug.

Electrode gap for a new spark plug:
0.7 to 0.8 mm (0.0276 to 0.0315 in.)

(e) Clean the spark plugs.

If the electrode has traces of wet carbon, clean the electrode with a spark plug cleaner and then dry it.

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Standard air pressure:

588 kPa (6.0 kgf/cm ^{2} , 85 psi)

Standard duration:

20 seconds or less

HINT:

Only use a spark plug cleaner when the electrode is free of oil. If the electrode has traces of oil, use gasoline to clean off the oil before using the spark plug cleaner.

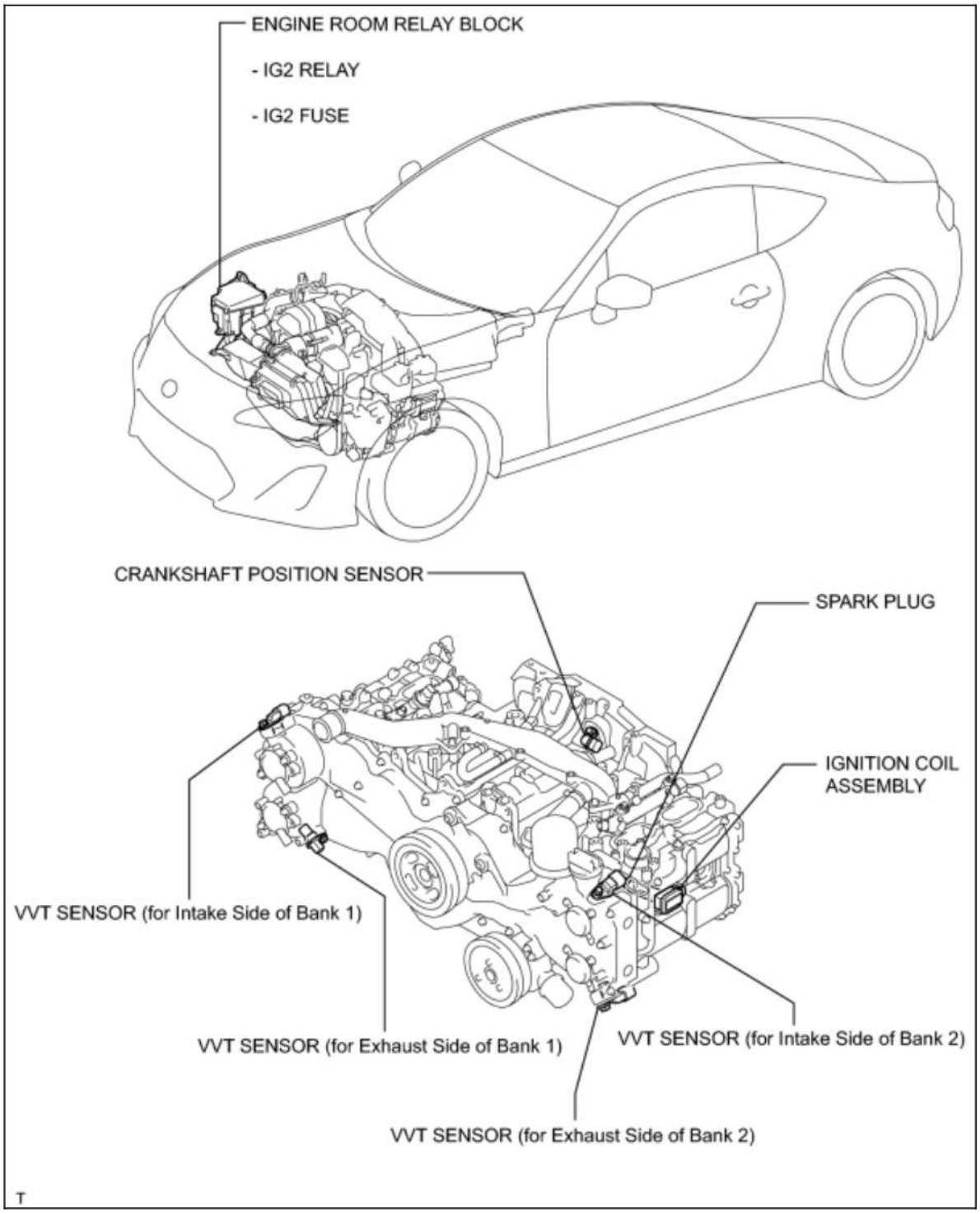


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Last Modified: 3-27-2012	6.4 R	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BOZ00FX
Title: FA20 ENGINE CONTROL: IGNITION SYSTEM: PARTS LOCATION (2013 FR-S)		

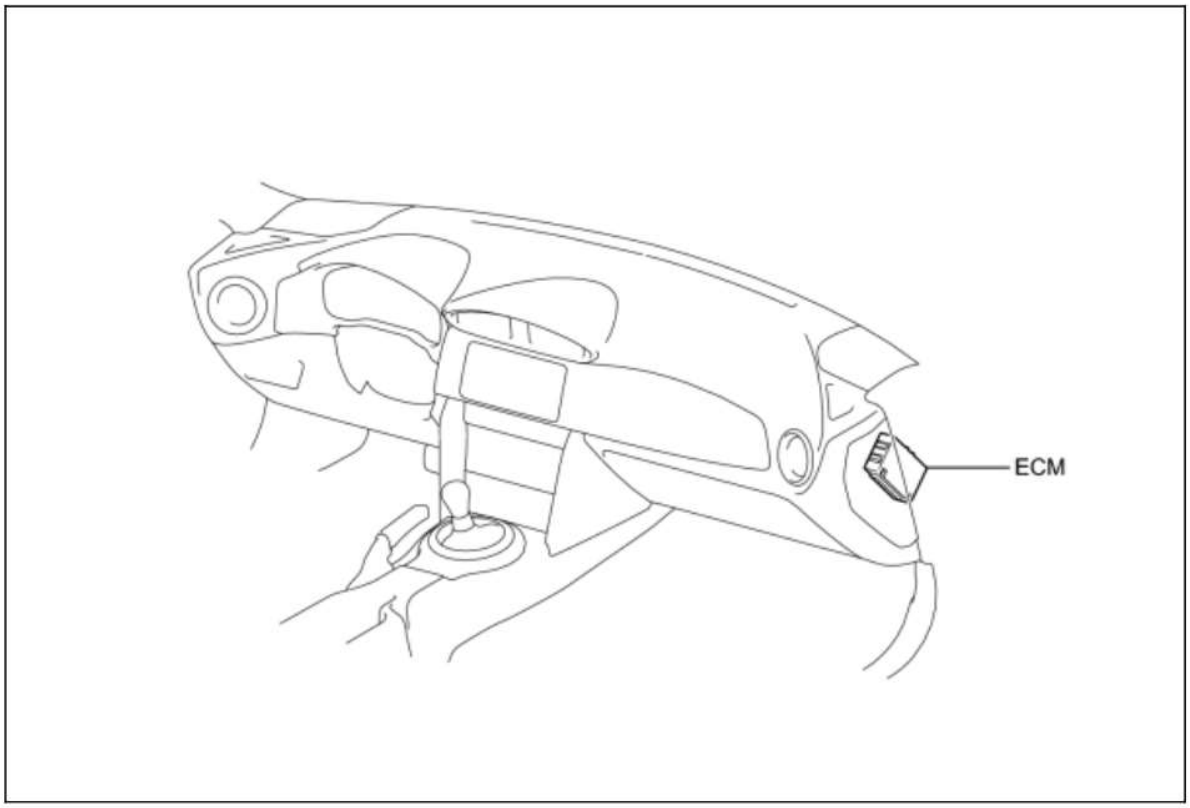
PARTS LOCATION

ILLUSTRATION



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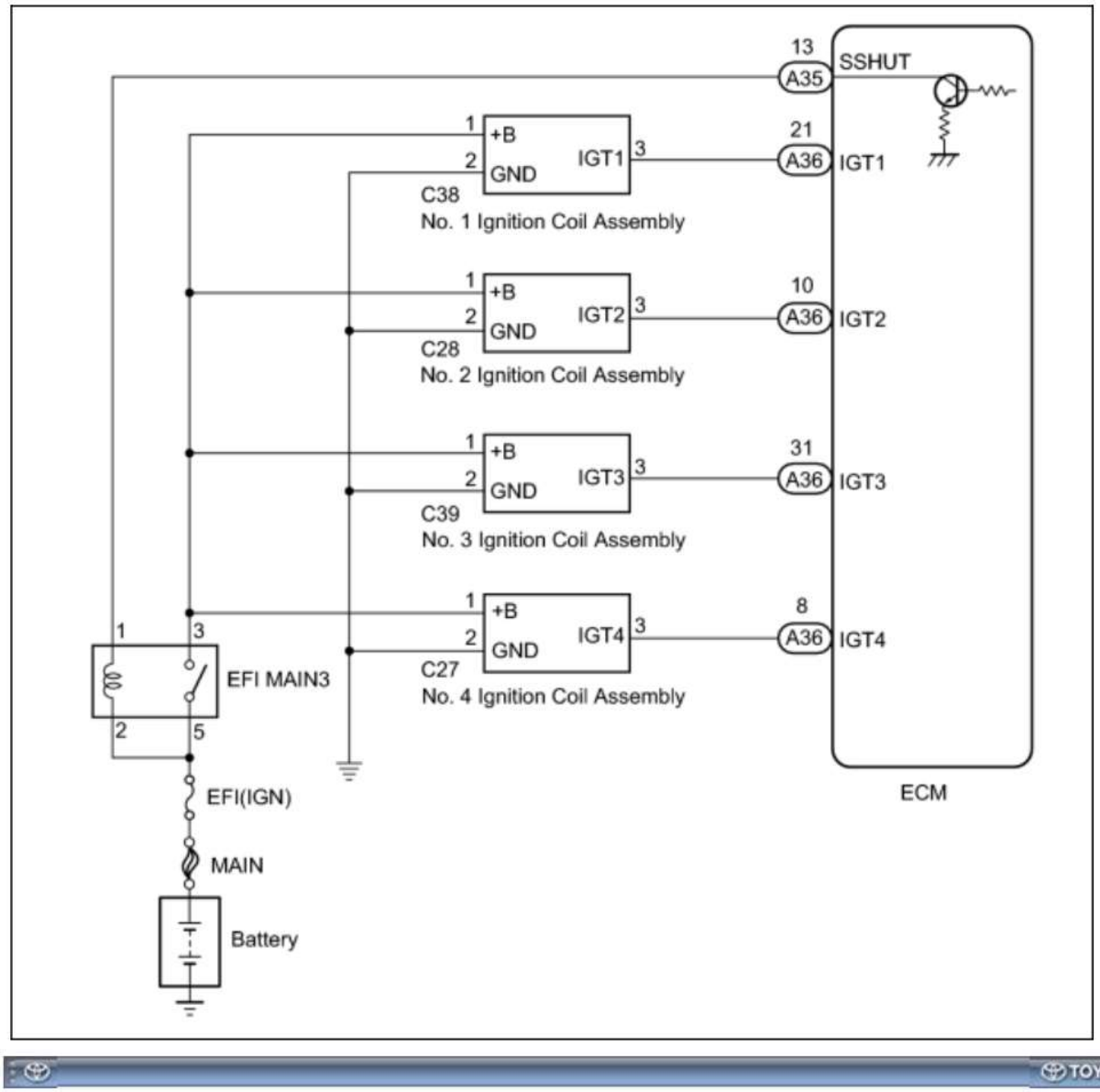
ILLUSTRATION



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Last Modified: 3-27-2012	6.4 U	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IGE006X
Title: FA20 ENGINE CONTROL: IGNITION SYSTEM: SYSTEM DIAGRAM (2013 FR-S)		

SYSTEM DIAGRAM

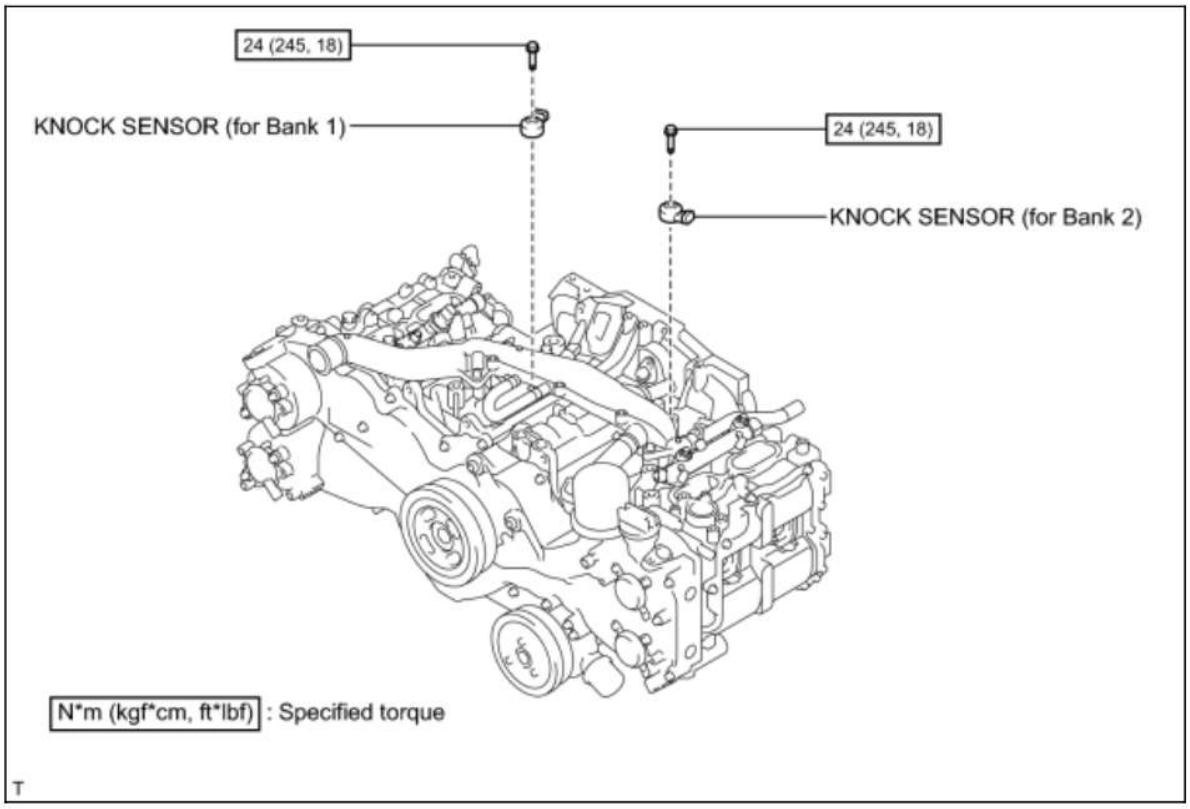


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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BO400JX
Title: FA20 ENGINE CONTROL: KNOCK SENSOR: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION

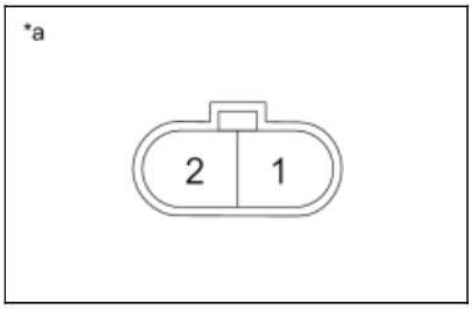


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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MTF00WX
Title: FA20 ENGINE CONTROL: KNOCK SENSOR: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT KNOCK SENSOR



(a) Measure the resistance according to the value(s) the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	532 to 588 kΩ

Text in Illustration

*a	Component without harness connected (Knock Sensor)

If the result is not as specified, replace the knock sensor.

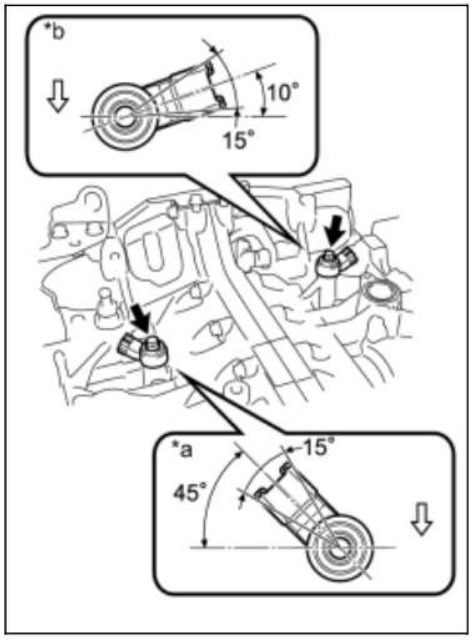
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MTE00WX
Title: FA20 ENGINE CONTROL: KNOCK SENSOR: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL KNOCK SENSOR

(a) Install the 2 knock sensors onto the cylinder block with the 2 bolts as shown in the illustration.



Torque: 24 N·m (245 kgf·cm, 18ft·lbf)

Text in Illustration

*a	Bank 1
*b	Bank 2
⇨	Engine Front Side

(b) Connect the 2 knock sensors connectors.

2. INSTALL INTAKE MANIFOLD

INFO

3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MTH00WX
Title: FA20 ENGINE CONTROL: KNOCK SENSOR: REMOVAL (2013 FR-S)		

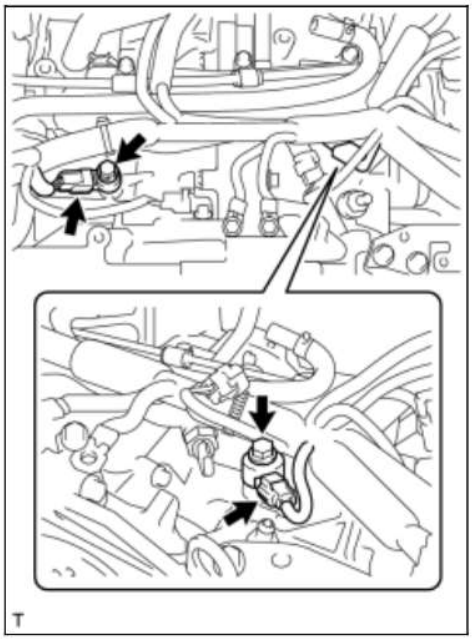
REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE INTAKE MANIFOLD

INFO

3. REMOVE KNOCK SENSOR



(a) Disconnect the 2 knock sensor connectors.

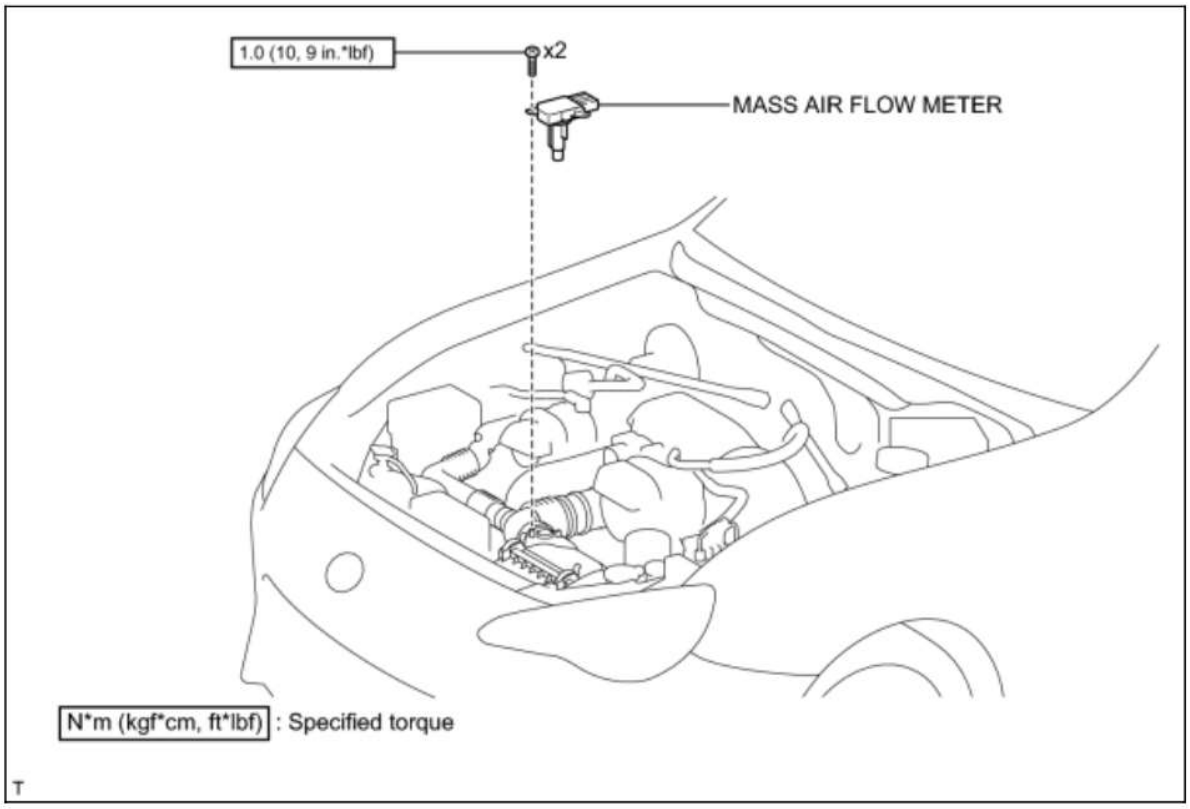
(b) Remove the 2 bolts and the 2 knock sensor.

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Last Modified: 3-27-2012	6.4 K	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHS006X
Title: FA20 ENGINE CONTROL: MASS AIR FLOW METER: COMPONENTS (2013 FR-S)		

COMPONENTS

ILLUSTRATION

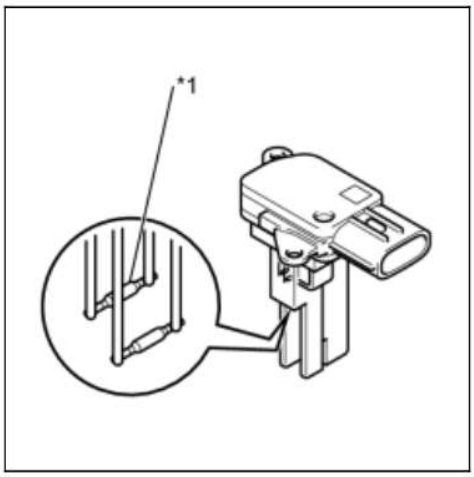


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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000MTL00MX
Title: FA20 ENGINE CONTROL: MASS AIR FLOW METER: INSPECTION (2013 FR-S)		

INSPECTION

1. INSPECT MASS AIR FLOW METER



(a) Perform a visual check for any foreign matter on the platinum hot wire (heater) of the mass air flow meter shown in the illustration.

Text in Illustration

*1	Platinum Hot Wire (Heater)

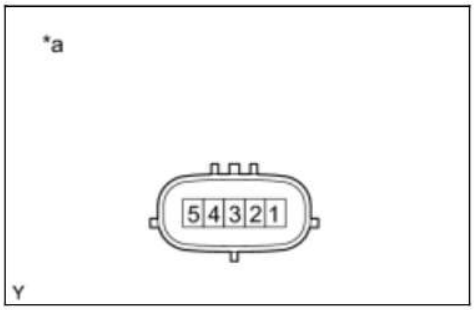
OK:

There is no foreign matter.

If the result is not as specified, replace the mass air flow meter.

(b) Measure the resistance according to the value(s) in the table below.

Text in Illustration



*a	Component without harness connected (Mass Air Flow Meter)

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	-20°C (-4°F)	13.6 to 18.4 kΩ
	20°C (68°F)	2.21 to 2.69 kΩ
	60°C (140°F)	0.49 to 0.67 kΩ

If the resistance is not as specified, replace the mass air flow meter.

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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHR006X
Title: FA20 ENGINE CONTROL: MASS AIR FLOW METER: INSTALLATION (2013 FR-S)		

INSTALLATION

1. INSTALL MASS AIR FLOW METER

(a) Install the mass air flow meter with the 2 screws.

Torque: 1.0 N·m (10 kgf·cm, 9in·lbf)

(b) Connect the mass air flow meter.

2. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHU006X
Title: FA20 ENGINE CONTROL: MASS AIR FLOW METER: ON-VEHICLE INSPECTION (2013 FR-S)		

ON-VEHICLE INSPECTION

NOTICE:

- Perform the mass air flow meter inspection according to the procedures below.
- Only replace the mass air flow meter when the mass air flow value in the Data List is not within the normal operating range (with the engine stopped) or there is foreign matter on the mass air flow meter platinum hot wire (heater).

1. INSPECT MASS AIR FLOW METER

(a) Read the value using the Techstream.

NOTICE:

- Perform the inspection with the vehicle indoors and on a level surface.
- Perform the inspection of the mass air flow meter while it is installed to the air cleaner case (installed to the vehicle).
- During the test, do not use the exhaust air duct to perform suction on the exhaust pipe.

(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON.

(3) Turn the Techstream on.

(4) Enter the following menus: Data List / MAF.

(5) Wait for 30 seconds, and read the values on the Techstream.

Standard:

TESTER DISPLAY	CONDITION	STANDARD CONDITION
MAF	• Engine not running • 30 seconds after turning ignition switch to ON	0.47 gm/sec or less

- If the result is not as specified, replace the mass air flow meter.
- If the result is within the specified range, inspect the mass air flow meter INFO .

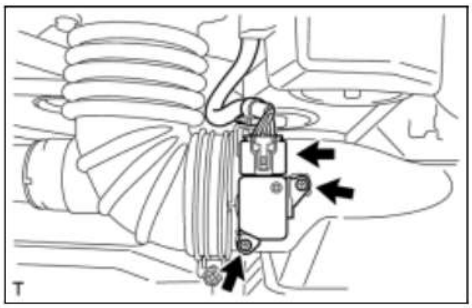
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Last Modified: 3-27-2012	6.4 A	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000003IHT006X
Title: FA20 ENGINE CONTROL: MASS AIR FLOW METER: REMOVAL (2013 FR-S)		

REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

2. REMOVE MASS AIR FLOW METER



(a) Disconnect the mass air flow meter connector.

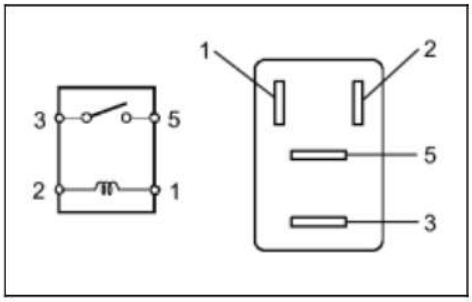
(b) Remove the 2 screws and the mass air flow meter.

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Last Modified: 3-27-2012	6.4 G	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM00000480H005X
Title: FA20 ENGINE CONTROL: RELAY: ON-VEHICLE INSPECTION (2013 FR-S)		

ON-VEHICLE INSPECTION

1. INSPECT EFI MAIN 1 RELAY



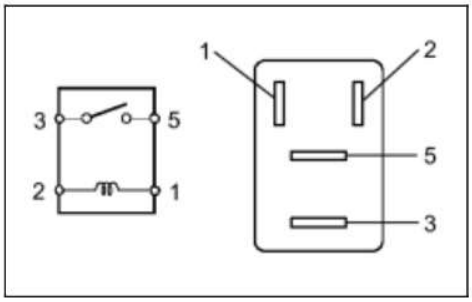
(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

If the result is not as specified, replace the EFI main 1 relay.

2. INSPECT EFI MAIN 2 RELAY



(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

If the result is not as specified, replace the EFI main 2 relay.

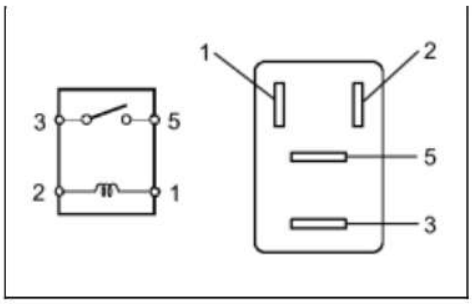
3. INSPECT EFI MAIN 3 RELAY

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

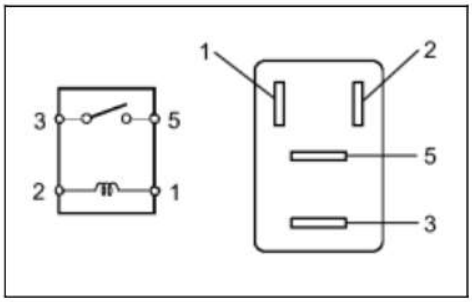
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3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

If the result is not as specified, replace the EFI main 3 relay.

4. INSPECT IG2 RELAY



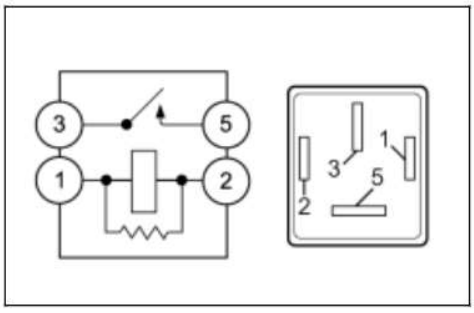
(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

If the result is not as specified, replace the IG2 relay.

5. INSPECT INJ RELAY



(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

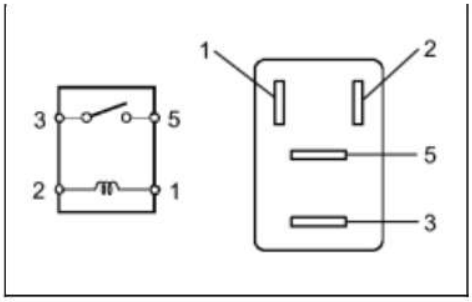
If the result is not as specified, replace the INJ relay.

6. INSPECT ETCS RELAY

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

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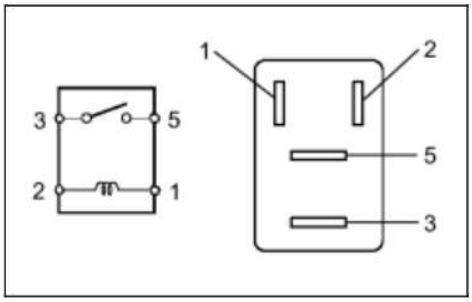
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

If the result is not as specified, replace the ETCS relay.

7. INSPECT C/OPEN RELAY

(a) Measure the resistance according to the value(s) in the table below.

Standard Resistance:



TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 - 5	Battery voltage not applied to 1 and 2 terminals	10 kΩ or higher
	Battery voltage applied to 1 and 2 terminals	Below 1 Ω

If the result is not as specified, replace the C/OPEN relay.

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDM0MBX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: BASIC INSPECTION (2013 FR-S)		

BASIC INSPECTION

When a malfunction is not confirmed by the DTC check, troubleshooting should be carried out for all circuits considered to be possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following procedure, the location of the problem can be found quickly and efficiently. Therefore, using this check is essential when engine troubleshooting.

1.	**CHECK BATTERY VOLTAGE**

NOTICE:

Carry out this check with the engine stopped and the ignition switch off.

Result

RESULT	PROCEED TO
11 V or higher	OK
Below 11 V	NG

NG ▶ **CHARGE OR REPLACE BATTERY**

OK ▼

2.	**CHECK WHETHER ENGINE CRANKS**

NG ▶ **PROCEED TO PROBLEM SYMPTOMS TABLE**

OK ▼

3.	**CHECK WHETHER ENGINE STARTS**

NG ▶ **GO TO STEP 6**

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OK

4.	**CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

(a) Visually check that the air cleaner filter element sub-assembly is not excessively contaminated with dirt or oil.

NG ▶ **REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY**

OK

5.	**CHECK IDLING SPEED**

(a) Check the engine idling speed INFO .

NG ▶ **TROUBLESHOOT IDLING SPEED AND PROCEED TO NEXT STEP**

OK

6.	**CHECK FUEL PRESSURE**

(a) Check the fuel pressure INFO .

NG ▶ **TROUBLESHOOT FUEL PRESSURE AND PROCEED TO NEXT STEP**

OK

7.	**CHECK FOR SPARK**

(a) Perform a spark test INFO .

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NG	TROUBLESHOOT SPARK AND PROCEED TO NEXT STEP
OK	PROCEED TO PROBLEM SYMPTOMS TABLE



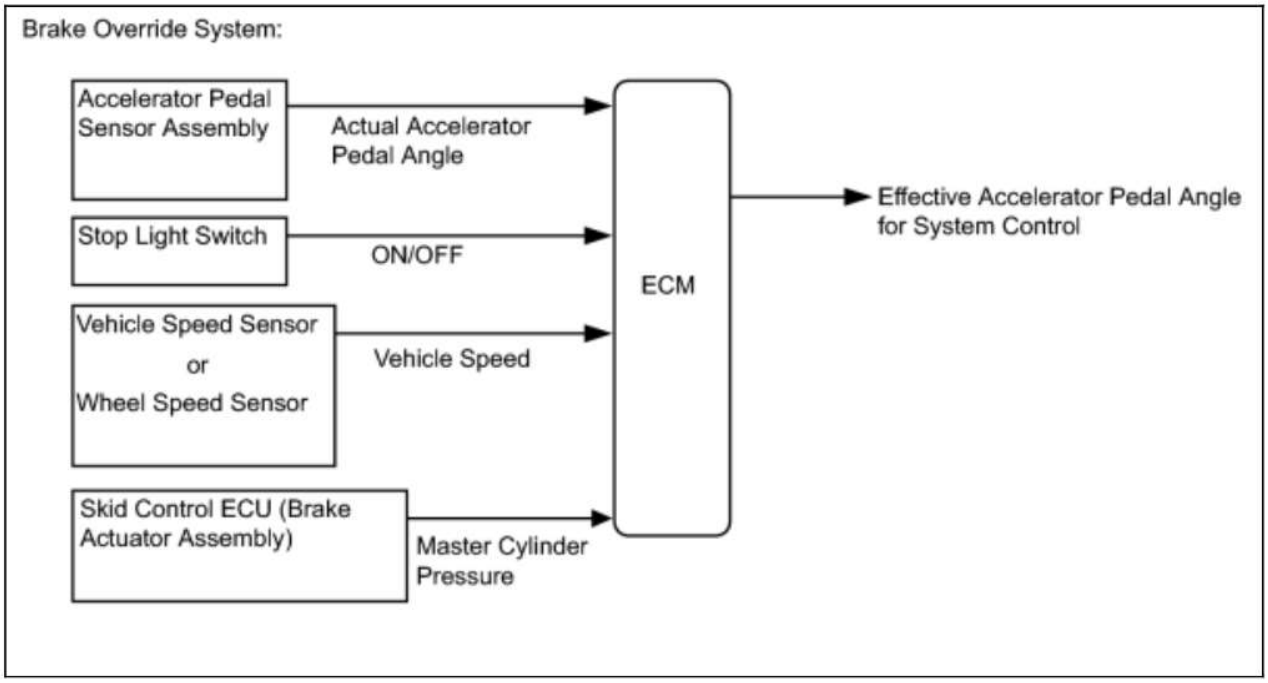
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Last Modified: 4-14-2014	6.6 J	Doc ID: RM000004G8F0CEX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: Brake Override System; 2013 MY FR-S [03/2012 -]		

Brake Override System

DESCRIPTION

When the vehicle is being driven with the accelerator pedal depressed, depressing the brake pedal without releasing the accelerator pedal will activate the brake override system to restrict driving torque. The conditions for activating the brake override system as well as the items that are controlled are explained below.



Activation Conditions:

- Vehicle is running at or above the specified speed.
- The accelerator pedal is depressed, and then the brake pedal is depressed.

NOTICE:

The vehicle may not enter the brake override system control due to the relation of the accelerator pedal angle and the vehicle's speed.

Items Controlled:

- Driving torque is restricted.

HINT:

During brake override system control, the value for the accelerator pedal angle (which is used for engine control) is forcibly reduced to a specified value. For this reason, the Data List value for Accelerator Position will be replaced with a specified value regardless of the actual accelerator

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pedal angle (Accel Sens. No. 1 Volt %, Accel Sens. No. 2 Volt %)

Deactivation Conditions:

- When the Stop Light Switch turns OFF or the actual accelerator pedal angle increases or decreases beyond the specified range.

INSPECTION PROCEDURE

Inspection Method

Drive at 10 km/h (6.25 mph), depress the accelerator pedal by 1/2 to 3/4 and keep it in that position. Under these conditions, if the brake pedal is depressed, then the brake override system has been activated.

CAUTION:

When carrying out the inspection, use a place where you are able to carry it out safely and also pay close attention to your surroundings.

Also, when driving make absolutely sure that all road traffic laws, such as speed limits, are observed.

HINT:

- Under normal conditions, the Accelerator Position value changes in response to the Accel Sens. No. 1 Volt % value. For more information on the numerical values, refer to the Data List INFO .
- If the Data List values of Accelerator Position and Accel Sens. No. 1 Volt % do not match, and the value of Accelerator Position changes but the value of Accel Sens. No. 1 Volt % is constant, this confirms that brake override system has activated. (Data can be captured relatively easily by using the snapshot function in the Data List. Confirm the data after performing the drive test.)

NOTICE:

The brake override system restricts driving torque if the brake pedal is depressed when driving with the accelerator pedal depressed. If a customer reports experiencing loss of torque after the accelerator and brake pedals have both been intentionally depressed, explain to the customer that this is not a malfunction, and that the customer should avoid depressing both the accelerator and brake pedals at the same time.

Example: While operating the accelerator pedal, the customer uses their left foot to operate the brake pedal.

PROCEDURE

1.	CHECK DTC OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: System Select / Health Check.

(d) Check DTCs.

Result

RESULT	PROCEED TO

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DTC is not output	A
DTCs are output	B

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (STOP LIGHT SWITCH AND and ST1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Data List / Stop Light Switch and ST1.

(d) Check the Data List indication when the brake pedal is depressed and released.

OK:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Stop Light Switch	Brake pedal released	OFF
	Brake pedal depressed	ON
ST1	Brake pedal released	OFF
	Brake pedal depressed	ON

NG ▶ INSPECT STOP LIGHT SWITCH ASSEMBLY

OK ▼

3.	INSPECT BRAKE PEDAL

(a) Inspect and adjust the brake pedal (for Manual Transmission) INFO .

(b) Inspect and adjust the brake pedal (for Automatic Transmission) INFO .

HINT:

If the stop light switch turns ON too late, the start of brake override system control may be delayed; if it turns ON too soon, brake override system control may begin too early, so conduct

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inspection of the brake pedal and stop light switch assembly.

RESULT	PROCEED TO
OK	A
NG (for Manual Transmission)	B
NG (for Automatic Transmission)	C

B ▶ REPAIR OR REPLACE BRAKE PEDAL

C ▶ REPAIR OR REPLACE BRAKE PEDAL

A ▼

4.	READ VALUE USING TECHSTREAM (ACCELERATOR PEDAL SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Data List / Accel Sens. No. 1 Volt % and Accel Sens. No. 2 Volt %.

(d) Read the value displayed on the Techstream.

OK:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Accel Sens. No. 1 Volt %	Accelerator Pedal Released → Depressed → Released	Values smoothly change following accelerator pedal operation
Accel Sens. No. 2 Volt %		

HINT:

For numerical values of Accel Sens. No. 1 Volt % and Accel Sens. No. 2 Volt %, refer to the Data List INFO .

NG ▶ REPLACE ACCELERATOR PEDAL SENSOR ASSEMBLY

OK

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5.	READ VALUE USING TECHSTREAM (VEHICLE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Start the engine.

(d) Enter the following menus: Powertrain / Engine / Data List / Vehicle Speed.

(e) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Vehicle Speed	Vehicle stopped, engine running	0 km/h (0 mph)
	Vehicle running at constant speed between 16.1 to 64.4 km/h (10 to 40 mph)	No large fluctuations when driving at a constant speed

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Data can be captured relatively easily by using the snapshot function in the Data List. Confirm the data after performing the drive test.

NG ▶ GO TO METER / GAUGE SYSTEM

OK

6.	READ VALUE USING TECHSTREAM (FR, FL, RR, RL WHEEL SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Start the engine.

(d) Enter the following menus: Chassis / ABS/VSC/TRAC / Data List / FR Wheel Speed, FL Wheel Speed, RR Wheel Speed and RL Wheel Speed.

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(e) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
FR Wheel Speed FL Wheel Speed RR Wheel Speed RL Wheel Speed	Vehicle stopped, engine running	0 km/h (0 mph)
	Vehicle running at constant speed between 16.1 to 64.4 km/h (10 to 40 mph)	No large fluctuations when driving at a constant speed

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

Data can be captured relatively easily by using the snapshot function in the Data List. Confirm the data after performing the drive test.

NG ▶ INSPECT FRONT OR REAR SPEED SENSOR

OK ▶ END

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDQ0U4X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: CHECK FOR INTERMITTENT PROBLEMS (2013 FR-S)		

CHECK FOR INTERMITTENT PROBLEMS

HINT:

Inspect the vehicle ECM using check mode. Intermittent problems are easier to detect with the Techstream when the ECM is in check mode. In check mode, the ECM uses 1 trip detection logic, which is more sensitive to malfunctions than normal mode (default), which uses 2 trip detection logic.

1. Clear DTCs INFO .
2. Switch the ECM from normal mode to check mode using the Techstream INFO .
3. Perform a simulation test.
4. Check and wiggle the harness(es), connector(s) and terminal(s).

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDL0OBX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: CHECK MODE PROCEDURE (2013 FR-S)		

CHECK MODE PROCEDURE

HINT:

Compared to normal mode, check mode is more sensitive to malfunctions. Therefore, check mode can detect malfunctions that cannot be detected in normal mode.

NOTICE:

All the stored DTCs and freeze frame data are cleared if: 1) the ECM is changed from normal mode to check mode or vice versa; or 2) the ignition switch is turned from ON to ACC or off while in check mode. Before changing modes, always check and note any DTCs and freeze frame data.

1. CHECK MODE PROCEDURE

(a) Check and ensure the following conditions:

(1) Battery voltage is 11 V or higher.

(2) Throttle valve is fully closed.

(3) Shift lever is in P, N or neutral.

(4) A/C switch is off.

(b) Turn the ignition switch off.

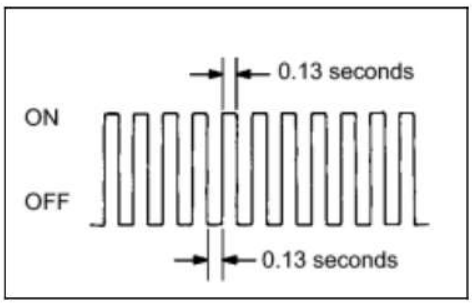
(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine / Utility / Check Mode.

(g) Switch the ECM from normal mode to check mode.



(h) Check that the MIL flashes as shown in the illustration.

(i) Start the engine.

(j) Check that the MIL turns off.

(k) Simulate the conditions of the malfunction described by the customer.

(l) Check DTCs and freeze frame data using the Techstream.

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDR0C4X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: CHECKING MONITOR STATUS (2013 FR-S)		

CHECKING MONITOR STATUS

The purpose of the monitor result (mode 06) is to allow access to the results of on-board diagnostic monitoring tests of specific components/systems that are not continuously monitored. Examples are catalysts and evaporative emissions (EVAP) systems.

The monitor result allows the OBD II scan tool to display the monitor status, test value, minimum test limit and maximum test limit. These data are displayed after the vehicle has been driven to run the monitor.

When the test value is not between the minimum and maximum test limits, the ECM (PCM) interprets this as a malfunction. If the test value is on the borderline of the test limits, the component is likely to malfunction in the near future.

Perform the following procedures to view the monitor status. Although these procedures refer to the Lexus/Toyota Techstream, the monitor status can be checked using a generic OBD II scan tool. Refer to your scan tool operator's manual for specific procedural information.

1. PERFORM MONITOR DRIVE PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Clear DTCs INFO .

(d) Operate the vehicle in accordance with the applicable drive pattern described in Readiness Monitor Drive Pattern INFO . Do not turn the ignition switch off.

NOTICE:

The test results will be lost if the ignition switch is turned off.

2. ACCESS MONITOR RESULT

(a) Enter the following menus: Powertrain / Engine / Monitor / Current Monitor / Result.

(b) Confirm the monitor status for each component.

HINT:

The monitor status for each component is displayed in the Result column.

- Pass: The component is functioning normally.
- Fail: The component is malfunctioning.

(c) Display the test results and test values for a monitor by selecting the icon in the Details column for that monitor.

3. CHECK COMPONENT STATUS

(a) Compare the test value with the minimum test limit (Min Limit) and maximum test limit (Max Limit).

(b) If the test value is between the minimum and maximum test limits, the component is functioning normally. If not, the component is malfunctioning. The test value is usually not near the test limits. If the test value is on the borderline of the test limits, the component is likely to malfunction in the near future.

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HINT:

The monitor result might on rare occasions be Pass even if the Malfunction Indicator Lamp (MIL) is illuminated. This indicates the system malfunctioned on a previous driving cycle. This might be caused by an intermittent problem.

4. MONITOR RESULT INFORMATION

When using a generic scan tool, multiply the test value by the scaling value.

Refer to "Monitor Result" in each DTC related to the monitor INFO .

Advance / Retarded Intake Side (for Bank 1):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$35	$8B	Multiply by 0.5	°CA	VVT slow response (Advance)
$35	$8C	Multiply by 0.5	°CA	VVT slow response (Retarded)

Advance / Retarded Intake Side (for Bank 2):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$36	$8B	Multiply by 0.5	°CA	VVT slow response (Advance)
$36	$8C	Multiply by 0.5	°CA	VVT slow response (Retarded)

Advance / Retarded Exhaust Side (for Bank 1):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$35	$8D	Multiply by 0.5	°CA	VVT slow response (Advance)
$35	$8E	Multiply by 0.5	°CA	VVT slow response (Retarded)

Advance / Retarded Exhaust Side (for Bank 2):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$36	$8D	Multiply by 0.5	°CA	VVT slow response (Advance)
$36	$8E	Multiply by 0.5	°CA	VVT slow response (Retarded)

A/F Sensor Bank 1 Sensor 1:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$01	$84	Multiply by 0.004	No dimension	A/F sensor minimum value
$01	$85	Multiply by 0.004	No dimension	A/F sensor maximum value
$01	$86	Multiply by 0.004	No dimension	A/F sensor response
$01	$8F	Multiply by 0.004	No dimension	A/F sensor fluctuation (Width)
$01	$90	Multiply by 0.004	No dimension	A/F sensor fluctuation (Time)
$01	$91	Multiply by 0.004	No dimension	Rich to lean delay level
$01	$92	Multiply by 0.001	Second	Rich / lean time ratio
$01	$A3	Multiply by 0.004	No dimension	Lean to rich delay level

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$01	$A4	Multiply by 0.001	Second	Lean / rich time ratio
$01	$AC	Multiply by 0.001	Second	Waiting time for rich side
$01	$AD	Multiply by 0.001	Second	Rich / lean time difference
$01	$AE	Multiply by 0.001	Second	Waiting time for lean side
$01	$AF	Multiply by 0.001	Second	Lean / rich time difference

HO2 Sensor Bank 1 Sensor 2:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$02	$05	Multiply by 0.004	Second	Rich to lean sensor threshold time (calculated)
$02	$06	Multiply by 0.004	Second	Lean to rich sensor threshold time (calculated)
$02	$07	Multiply by 0.005	V	Minimum sensor voltage for test cycle (calculation)
$02	$08	Multiply by 0.005	V	Maximum sensor voltage for test cycle (calculation)

Catalyst:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$21	$89	Multiply by 0.004	No dimension	Oxygen storage capacity of catalyst

EVAP Monitor (Cap Off):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$39	$93	Multiply by 0.00025	kPa	Mode B test result

EVAP Monitor (0.040"):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$3B	$94	Multiply by 0.00025	kPa	Mode C test result
$3B	$95	Multiply by 0.00025	kPa	Mode D test result

EVAP Monitor (0.020"):

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$3C	$96	Multiply by 0.00025	kPa	Mode D test result
$3C	$97	Multiply by 0.00025	kPa	Mode E test result
$3C	$C1	Multiply by 0.00025	kPa	Mode 4-1 test result
$3C	$C2	Multiply by 0.00025	kPa	Mode 4-2 test result
$3C	$C3	Multiply by 0.00025	kPa	Mode 5 test result
$3C	$C4	Multiply by 0.00025	kPa	Mode 7 test result
$3C	$C5	Multiply by 0.00025	kPa	Mode 8 test result
$3C	$C6	Multiply by 0.01	Second	Mode 9 test result
$3C	$C7	Multiply by 0.00025	kPa	Mode 13 test result

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$3C	$C8	Multiply by 0.00025	kPa	Mode 15-1 test result
$3C	$C9	Multiply by 0.00025	kPa	Mode 15-2 test result
$3C	$CA	Multiply by 0.00025	kPa	Mode 16 test result

Purge Flow Monitor:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$3D	$98	Multiply by 0.00025	kPa	0.04" mode Z test result
$3D	$CB	Multiply by 0.01	Second	Test 1 result
$3D	$CC	Multiply by 0.00025	kPa	Test 2 result

A/F Sensor Heater Bank 1 Sensor 1:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$41	$9B	Multiply by 1	Time	Oxygen sensor heater test result

Oxygen Sensor Heater Bank 1 Sensor 2:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$42	$A2	Multiply by 1	Ω	A/F sensor heater impedance

Misfire:

MONITOR ID	TEST ID	SCALING	UNIT	DESCRIPTION
$A1	$0B	Multiply by 1	Time	Total EWMA misfire count of all cylinders in last ten driving cycles
$A1	$0C	Multiply by 1	Time	• When ignition switch ON, total misfire count of all cylinders in last driving cycle is displayed. • While engine is running, total misfire count of all cylinders in current driving cycle is displayed.
$A2	$0B	Multiply by 1	Time	Total EWMA* misfire count of cylinder 1 in last ten driving cycles
$A2	$0C	Multiply by 1	Time	• When ignition switch ON, total misfire count of cylinder 1 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 1 in current driving cycle is displayed.
$A3	$0B	Multiply by 1	Time	Total EWMA* misfire count of cylinder 2 in last ten driving cycles
$A3	$0C	Multiply by 1	Time	• When ignition switch ON, total misfire count of cylinder 2 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 2 in current driving cycle is displayed.

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$A4	$0B	Multiply by 1	Time	Total EWMA* misfire count of cylinder 3 in last ten driving cycles
$A4	$0C	Multiply by 1	Time	• When ignition switch ON, total misfire count of cylinder 3 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 3 in current driving cycle is displayed.
$A5	$0B	Multiply by 1	Time	Total EWMA* misfire count of cylinder 4 in last ten driving cycles
$A5	$0C	Multiply by 1	Time	• When ignition switch ON, total misfire count of cylinder 4 in last driving cycle is displayed. • While engine is running, total misfire count of cylinder 4 in current driving cycle is displayed.

HINT:

***: EWMA (Exponential Weighted Moving Average) misfire counts for last 10 driving cycles (calculated)**
Calculation: 0.1 x (current counts) + 0.9 x (previous average) Initial value for (previous average) = 0



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Last Modified: 3-27-2012	6.4 U	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000SXS076X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: DATA LIST / ACTIVE TEST (2013 FR-S)		

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the Techstream to read the Data List allows the values or states of switches, sensors, actuators and other items to be read without removing any parts. This non-intrusive inspection can be very useful because intermittent conditions or signals may be discovered before parts or wiring is disturbed. Reading the Data List information early in troubleshooting is one way to save diagnostic time.

NOTICE:

- In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.
- The actual values may differ from the values listed in the chart under "Results of real-vehicle check" due to climate, weather conditions, etc.

HINT:

Normal Condition: If no conditions are specifically stated for "idling", the shift lever should be in P, N or neutral, the A/C switch should be off and all accessory switches should be off.

(a) Warm up the engine.

(b) Turn the A/C switch off.

(c) Turn the ignition switch off.

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON.

(f) Turn the Techstream on.

(g) Enter the following menus: Powertrain / Engine / Data List.

HINT:

- To display the list box, press the pull down menu button next to Primary. Then select a measurement group.
- When you select a measurement group, the ECU data belonging to that group is displayed.
- Measurement Group List / Description
    - All Data / All data
    - Primary / -
    - Engine Control / Engine control system related data
    - Gas General / -
    - Gas AF Control / Air fuel ratio control system related data
    - Gas AF O2 Sensor / Air fuel ratio sensor and heated oxygen sensor related data
    - Gas Throttle / Gasoline throttle system related data
    - Gas Intake Control / Intake control system related data
    - Gas Valve Control / Valve control system related data
    - Gas Misfire / "Misfire" related data
    - Gas Starting / "Difficult to start" related data
    - Gas Rough Idle / "Rough idle" related data

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Gas Evaporative / Evaporative system related data
- Gas CAT Converter / Catalyst converter related data
- Check Mode / Check mode related data
- Monitor Status / Monitor status related data
- Ignition / Ignition system related data
- Charging Control / Charging control system related data
- Compression / Data used during "Check the Cylinder Compression" Active Test
- AT / Continuously variable transaxle system related data
- Vehicle Information / Vehicle information

(h) According to the display on the Techstream, read the Data List.

HINT:

- The title used for each group of Data List items in this repair manual does not appear on the Techstream. However, the name in parentheses after the title, which is a Measurement Group, does appear on the Techstream. When the name shown in parentheses is selected on the Techstream, all the Data List items listed for that group will be displayed.
- "Result of real-vehicle check" is the assessment of one vehicle. Use it only for reference.

2. Various Vehicle Conditions 1 (All Data)

Vehicle Speed

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vehicle Speed	Vehicle speed/ Min.: 0 km/h (0 mph), Max.: 255 km/h (158 mph)	Actual vehicle speed	Yes
	Diagnostic Note: • This is the current vehicle speed • The vehicle speed is detected using the wheel speed sensors. ◦ Vehicle speed data is delayed when it is displayed. Therefore, even if the vehicle speed listed in the freeze frame data is 0 km/h (0 mph), this does not always mean that the malfunction occurred when the vehicle was stopped. ◦ To accurately confirm whether the vehicle was stopped or not, use "SPD (SP2)" which is the transmission output speed.		

Engine Speed

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Speed	Engine speed/ Min.: 0 rpm, Max.: 16383 rpm	650 to 800 rpm: Idling	Yes
	Diagnostic Note: When the crankshaft position sensor is malfunctioning, "Engine Speed" is approximately 0 or varies greatly from the actual engine speed.		

Calculate Load

TESTER	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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DISPLAY			
Calculate Load	Load calculated by ECM/ Min.: 0%, Max.: 100%	15 to 40%: Idling	Yes
	Diagnostic Note: This is the engine load calculated based on the estimated intake manifold pressure. Calculate Load = Estimated intake manifold pressure / maximum intake manifold pressure x 100 (%) (For example, when the estimated intake manifold pressure is the same as atmospheric pressure, Calculate Load is 100%.)		

Vehicle Load

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vehicle Load	Vehicle load/ Min.: 0%, Max.: 25700%	-	Yes
	Diagnostic Note: This is the engine intake air charging efficiency. Vehicle Load = Current intake airflow (g/rev.) / maximum intake airflow Maximum intake airflow = Displacement (L) / 2 x 1.2 (g/rev.) **HINT:** **Due to individual engine differences, intake air temperature, etc., the value may exceed 100%.** Intake airflow (g/rev.) = Intake airflow (gm/sec) x 60 / Engine speed (rpm) (Intake airflow (gm/sec) is MAF)		

MAF

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MAF	Airflow rate from Mass Air Flow (MAF) meter/ Min.: 0 gm/sec, Max.: 655.35 gm/sec	1.0 to 3.0 gm/sec: Idling 8 to 13 gm/sec: 3000 rpm (without load)	Yes
	Diagnostic Note: This is the intake air amount from the mass air flow meter.		

Atmosphere Pressure

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Atmosphere	Atmospheric pressure/ Min.: 0 kPa (0 mmHg), Max.: 255 kPa (1912 mmHg)	Equivalent to atmospheric pressure (absolute pressure): Ignition switch ON	Yes

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Pressure	Diagnostic Note: • This value is calculated from the intake air amount. • Standard atmospheric pressure: 101 kPa (757 mmHg) • For every 100 m increase in altitude, pressure drops by 1 kPa. This varies by weather.

MAP

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MAP	intake manifold pressure/ Min.: 0 kPa (0 mmHg), Max.: 255 kPa (1912 mmHg)	80 to 110 kPa: Ignition switch ON 20 to 48 kPa: Idling (A/C off)	Yes
	Diagnostic Note: Intake manifold pressure is calculated by manifold absolute pressure sensor.		

Engine Oil Temperature Sensor

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Oil Temperature Sensor	Engine oil temperature/ Min.: -40°C, Max.: 215°C	More than 85°C (185°F): After warming up	Yes
	Diagnostic Note: Engine oil temperature is calculated by engine oil temperature sensor.		

Coolant Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Coolant Temp	Coolant temperature/ Min.: -40°C, Max.: 215°C	75 to 100°C (167 to 212°F): After warming up	Yes
	Diagnostic Note: This is the engine coolant temperature. **HINT:** • After warming up the engine, the engine coolant temperature is 75 to 100°C. • After a long soak, the engine coolant temperature, intake air temperature and ambient air temperature are approximately equal. • If the value is -40°C (-40°F) or higher than 215°C (419°F), the sensor circuit may be open or shorted.		

Intake Air

TESTER	MEASUREMENT	NORMAL CONDITION	STORED AS FREEZE

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DISPLAY	ITEM/RANGE		FRAME DATA
Intake Air	Intake air temperature/ Min.: -40°C, Max.: 215°C	Equivalent to temperature at location of mass air flow meter: Ignition switch ON	Yes
	Diagnostic Note: This is the intake air temperature. **HINT:** • After a long soak, the engine coolant temperature, intake air temperature and ambient air temperature are approximately equal. • If the value is -40°C (-40°F) or higher than 215°C (419°F), the sensor circuit is open or shorted.		

Ambient Temperature

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Ambient Temperature	Ambient temperature/ Min.: -40°C, Max.: 215°C	Equivalent to ambient air temperature: Ignition switch ON	Yes
	Diagnostic Note: This is the ambient temperature. **HINT:** • After a long soak, the engine coolant temperature, intake air temperature and ambient air temperature are approximately equal.		

Engine Run Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Run Time	Engine run time/ Min.: 0 s, Max.: 65535 s	Time after engine start	Yes
	Diagnostic Note: This is the time elapsed since the engine started. **HINT:** **The time is counted only while the engine is running.**		

Initial Engine Coolant Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Initial engine coolant temperature/	-	Yes

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Initial Engine Coolant Temp	Min.: -40°C, Max.: 119.3°C		
	Diagnostic Note: This is the coolant temperature stored when the ignition switch is turned to ON.		

Initial Intake Air Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Initial Intake Air Temp	Initial intake air temperature/ Min.: -40°C, Max.: 119.3°C	-	Yes
	Diagnostic Note: This is the intake air temperature stored when the ignition switch is turned to ON.		

Battery Voltage

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Battery Voltage	Battery voltage/ Min.: 0 V, Max.: 65.535 V	11 to 14 V: Idling	Yes
	Diagnostic Note: If 11 V or less, characteristics of some electrical components may change.		

3. Throttle Control 1 (Gas Throttle)

Accelerator Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accelerator Position	Accelerator pedal position/ Min.: 0%, Max.: 399.9%	Actual accelerator pedal position	No
	Diagnostic Note: This is the accelerator pedal position defined using the learned fully released position (sensor output) of accelerator pedal position sensor as 0% and the fully depressed position as 100%.		

Accel Sens. No.1 Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sens. No.1 Volt %	Absolute Accelerator Pedal Position (APP) No. 1/ Min.: 0%, Max.: 100%	10 to 20%: Accelerator pedal released 50 to 70%: Accelerator pedal fully depressed	Yes
	Diagnostic Note: The accelerator pedal position sensor No. 1 output is converted using 5 V = 100%. **HINT:** **If there are no accelerator pedal position sensor DTCs stored, it is possible to conclude**		

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	that the accelerator pedal position sensor system is normal.

Accel Sens. No.2 Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sens. No.2 Volt %	Absolute APP No. 2/ Min.: 0%, Max.: 100%	10 to 20%: Accelerator pedal released 50 to 70%: Accelerator pedal fully depressed	Yes
	Diagnostic Note: The accelerator pedal position sensor No. 2 output is converted using 5 V = 100%.		

Accel Sensor Out No.1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sensor Out No.1	APP sensor No. 1 voltage/ Min.: 0 V, Max.: 4.980 V	0.5 to 0.8 V: Accelerator pedal released 2.4 to 3.5 V: Accelerator pedal fully depressed	No
	Diagnostic Note: This is the raw voltage from the accelerator pedal position sensor No. 1.		

Accel Sensor Out No.2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Sensor Out No.2	APP sensor No. 2 voltage/ Min.: 0 V, Max.: 4.980 V	0.5 to 0.8 V: Accelerator pedal released 2.4 to 3.5 V: Accelerator pedal fully depressed	No
	Diagnostic Note: This is the raw voltage from the accelerator pedal position sensor No. 2. Accelerator pedal position sensor No. 2 is used to monitor accelerator pedal position sensor No. 1. When there is a malfunction in sensor No. 1, the ECM uses sensor No. 2 to control the engine.		

Accelerator Idle Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accelerator Idle Position	Whether or not accelerator pedal position sensor detecting released accelerator pedal/ ON or OFF	ON: Accelerator pedal released	No
	Diagnostic Note: This is a parameter calculated by the ECM which indicates whether the accelerator pedal		

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	is in the learned idle position.

Accel Fully Close Learn #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Fully Close Learn #1	Accelerator fully released learned value No. 1/ Min.: 0 deg, Max.: 124.5 deg	2.5 to 6.5 deg: Ignition switch ON	No
	Diagnostic Note: This is the value of accelerator pedal position sensor No. 1 learned when the accelerator pedal is released.		

Accel Fully Close Learn #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Accel Fully Close Learn #2	Accelerator fully released learned value No. 2/ Min.: 0 deg, Max.: 124.5 deg	2.5 to 6.5 deg: Ignition switch ON	No
	Diagnostic Note: This is the value of accelerator pedal position sensor No. 2 learned when the accelerator pedal is released.		

Throttle Sensor Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sensor Volt %	Absolute throttle position sensor/ Min.: 0%, Max.: 100%	• 10 to 22%: Throttle fully closed • 80 to 90%: Throttle fully open	Yes
	Diagnostic Note: The throttle position sensor No. 1 output is converted using 5 V = 100%.		

Throttl Sensor #2 Volt %

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttl Sensor #2 Volt %	Throttle sensor position #2/ Min.: 0%, Max.: 100%	• 35 to 45%: Throttle fully closed • 80 to 90%: Throttle fully open	Yes
	Diagnostic Note: The throttle position sensor No. 2 output is converted using 5 V = 100%.		

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ST1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ST1	Brake pedal signal/ ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	No
	Diagnostic Note: This is the stop light switch signal.		

Throttle Idle Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Idle Position	Whether or not throttle position sensor detecting idle/ ON or OFF	ON: Accelerator pedal released	No
	Diagnostic Note: This is a parameter calculated by the ECM. The value is ON when the throttle is at the idle position and OFF when the throttle is open.		

Throttle Require Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Require Position	Required throttle position/ Min.: 0 V, Max.: 4.980 V	0.5 to 1.1 V: Idling at P, N or neutral (A/C off)	No
	Diagnostic Note: This is a value calculated by the ECM showing the voltage for the target throttle valve position.		

Throttle Sensor Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sensor Position	Throttle sensor position/ Min.: 0%, Max.: 100%	• 3 to 5%: Throttle fully closed • 65 to 75%: Throttle fully open	Yes
	Diagnostic Note: This is the throttle valve opening amount used for engine control. This value has no meaning when the ignition switch is ON and the engine is stopped.		

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Throttle Position No. 1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position No. 1	Throttle position sensor No. 1 output voltage/ Min.: 0 V, Max.: 4.980 V	• 0.5 to 1.1 V: Throttle fully closed • 3.2 to 4.8 V: Throttle fully open • 0.6 to 1.4 V: Fail-safe operating	No
	Diagnostic Note: This is the throttle position sensor No. 1 output voltage.		

Throttle Position No. 2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position No. 2	Throttle position sensor No. 2 output voltage/ Min.: 0 V, Max.: 4.980 V	• 1.5 to 2.2 V: Throttle fully closed • 4.0 to 4.5 V: Throttle fully open • 1.9 to 2.6 V: Fail-safe operating	No
	Diagnostic Note: This is the throttle position sensor No. 2 output voltage.		

Throttle Position Command

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Position Command	Throttle position command value/ Min.: 0 V, Max.: 4.980 V	-	No
	Diagnostic Note: Throttle Position Command is the same value as Throttle Require Position.		

Throttle Sens Open Pos #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sens Open Pos #1	Throttle position sensor No. 1/ Min.: 0 V, Max.: 4.980 V	0.7 to 1.1 V: Ignition switch ON	No
	Diagnostic Note: This is the throttle position sensor No. 1 output voltage when there is no current supplied to the electronic throttle actuator. The accelerator pedal is released but the throttle valve is kept open by the throttle valve opener with the ignition switch ON.		

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Throttle Sens Open Pos #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Sens Open Pos #2	Throttle position sensor No. 2/ Min.: 0 V, Max.: 4.980 V	0.7 to 1.1 V: Ignition switch ON	No
	Diagnostic Note: This is the throttle position sensor No. 2 output voltage when there is no current supplied to the electronic throttle actuator. The accelerator pedal is released but the throttle valve is kept open by the throttle valve opener with the ignition switch ON.		

Throttle Motor Power Supply Relay

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor Power Supply Relay	Throttle motor power supply relay/ ON or OFF	ON: Ignition switch ON	Yes

Throttle Motor DUTY

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor DUTY	Throttle actuator/ Min.: 0%, Max.: 100%	2 to 5%: Idling at P, N or neutral (A/C off)	Yes
	Diagnostic Note: This is the output duty ratio of the throttle actuator drive circuit.		

Throttle Motor Duty (Open)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Motor Duty (Open)	Throttle actuator duty ratio (open)/ Min.: 0%, Max.: 255%	0 to 40%: Idling at P, N or neutral (A/C off)	No
	Diagnostic Note: This is the duty ratio used to drive the throttle actuator and open the throttle valve. It is an ECM command signal.		

Throttle Motor Duty (Close)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Throttle actuator duty ratio (close)/ Min.: 0%, Max.: 255%	0 to 40%: Idling at P, N or neutral (A/C off)	No

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Throttle Motor Duty (Close)	Diagnostic Note: This is the duty ratio used to drive the throttle actuator and close the throttle valve. It is an ECM command signal. **HINT:** **During idling, the throttle valve opening angle is usually controlled using a duty ratio drive signal which closes the throttle valve. However, when carbon deposits build up, it may be necessary to open the throttle valve more than the throttle valve opener does. In that case, the opening angle is controlled using a "Throttle Motor Duty (Open)" signal which opens the throttle valve.**

Throttle Fully Close Learn

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Throttle Fully Close Learn	Throttle valve fully closed (learned value)/ Min.: 0 V, Max.: 4.980 V	0.35 to 0.85 V: Ignition switch ON	No
	Diagnostic Note: • The ECM uses this learned value to determine the fully closed (and fully open) position of the throttle valve. • Learning is performed immediately after the ignition switch is turned to ON.		

+BM Voltage

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
+BM Voltage	+BM voltage/ Min.: 0 V, Max.: 79.998 V	11 to 14 V: Ignition switch ON	No
	Diagnostic Note: This is the power supply for the electronic throttle actuator.		

Actuator Power Supply

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Actuator Power Supply	Actuator power supply/ ON or OFF	ON: Ignition switch ON	No
	Diagnostic Note: If +BM power is lost, this item changes to OFF.		

Throttle Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Throttle valve opening angle/		

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Throttle Position	Min.: 0 deg, Max.: 499.99 deg	-	Yes
	Diagnostic Note: This value has no meaning when the ignition switch is ON and the engine is stopped.		

4. Idle Speed Control (Gas Rough Idle)

ISC Flow

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Flow	Flow rate calculated using information from each sensor/ Min.: 0 g/s, Max.: 299.99 g/s	-	Yes
	Diagnostic Note: This is the total ISC airflow amount (the amount of intake air necessary to maintain idling). **HINT:** **ISC Flow (total ISC airflow amount) = ISC Learning Value + ISC Feedback Value + each compensation amount**		

ISC Position

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Position	Requested throttle opening amount calculated using ISC control/ Min.: 0 deg, Max.: 499.99 deg	-	Yes
	Diagnostic Note: This is the throttle valve opening amount while the engine is idling (the throttle valve opening amount necessary to maintain ISC air flow).		

ISC Feedback Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Feedback Value	ISC feedback amount/ Min.: -150 g/s, Max.: 149.99 g/s	-	Yes
	Diagnostic Note: This is the feedback amount necessary to adjust the airflow amount to maintain the target idling speed. **HINT:** **When the idling speed differs from the target, the feedback amount is adjusted. If the feedback amount becomes more than a certain value, this will be reflected in the ISC learned airflow value.**		

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ISC Learning Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ISC Learning Value	ISC learned airflow value/ Min.: -150 g/s, Max.: 149.99 g/s	-	Yes
	Diagnostic Note: This is the learned value of the airflow amount necessary for engine idling. **HINT:** • If ISC Feedback Value becomes more than a certain value, this will be reflected in ISC Learning Value. • ISC Flow (total ISC airflow amount) = ISC Learning Value + ISC Feedback Value + each compensation amount		

Electric Load Feedback Val

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Electric Load Feedback Val	Compensation flow rate according to electrical load/ Min.: -150 g/s, Max.: 149.99 g/s	-	Yes
	Diagnostic Note: This is the ISC compensation amount determined according to the electrical load.		

Air Conditioner FB Val

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Air Conditioner FB Val	Compensation flow rate according to air conditioner load/ Min.: -150 g/s, Max.: 149.99 g/s	-	Yes
	Diagnostic Note: This is the ISC compensation amount determined according to the air conditioner load.		

Deposit Loss Flow

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Deposit	Flow loss due to deposits/ Min.: -150 g/s, Max.: 149.99 g/s	-	Yes
	Diagnostic Note: • This value indicates the amount of compensation for a decrease in flow passage area due to the buildup of deposits on the throttle valve. • Check this value for reference when the engine stalls, is difficult to start, or idles roughly.		

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Loss Flow	When the ISC learned value is initialized by disconnecting the battery negative terminal or removing the EFI(+B) fuse , performing the following procedures in order to quickly relearn the Deposit Loss Flow value. After the Deposit Loss Flow has been relearned, gradual fine adjustments will continue automatically. ◦ Start the engine cold and allow the engine to idle. ◦ After the engine is warmed up (engine coolant temperature is above 80°C [176°F]), allow the engine to idle for an additional 5 minutes. ◦ Turn the ignition switch off and wait for 30 seconds. ◦ Start the engine again, and allow the engine to idle for 5 minutes.

5. Fuel System (Gas General)

Fuel Press

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Press	Fuel pressure/ Min.: 0 kPa (0 kgf/cm ^{2} , 0 psi), Max.: 655350 kPa (6683 kgf/cm ^{2} , 95050 psi)	3000 to 5000 kPa (30.6 to 51.0 kgf/cm ^{2} , 435 to 725 psi): Idling at P, N or neutral after warming up (A/C off)	Yes
	Diagnostic Note: This item indicates the fuel pressure on the high-pressure side.		

Fuel Pump Duty

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Pump Duty	Fuel pump duty/ Min.: 0%, Max.: 399.9%	20 to 70%: Idling	Yes

Fuel Level Sensor Impedance

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Level Sensor Impedance	Fuel Level Sensor Impedance/ Min.: 0 Ohm, Max.: 511.5 Ohm	About 100 Ohm: Fuel receiver gauge is F position	No

Injector (Port)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injector (Port)	Injection period of the No. 1 cylinder/ Min.: 0 µs, Max.: 65535 µs	1000 to 2000 µs Idling after warming up	Yes
	Diagnostic Note: This is the injection period of the No. 1 cylinder (the command value from the ECM).		

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Injection Volum (Cylinder 1)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injection Volum (Cylinder 1)	Injection volume (cylinder 1)/ Min.: 0 ml, Max.: 2.047 ml	0 to 0.15 ml: Idling after warming up	Yes
	Diagnostic Note: This is the fuel injection volume for 10 injections.		

Fuel Pressure Target Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Pressure Target Value	Target fuel pressure/ Min.: 0 MPa, Max.: 65.535 MPa	• 3 to 5 MPa (31 to 51 kgf/cm ^{2} , 435 to 725 psi): Idling after warming up • 7 to 9 MPa (72 to 91 kgf/cm ^{2} , 1024 to 8924 psi): 2500 rpm (without load)	Yes
	Diagnostic Note: This item indicates the target fuel pressure for the high-pressure fuel pump.		

HP FP Discharge Rate

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
HP FP Discharge Rate	Fuel volume required by the high pressure fuel pump/ Min.: 0 ml, Max.: 2.047 ml	0.04 to 0.08 ml: Idling at P, N or neutral after warming up (A/C off)	Yes
	Diagnostic Note: This item indicates the high-pressure fuel pump discharge amount.		

Injection Way

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injection Way	Injection mode/ Port / Direct / Either	-	Yes
	Diagnostic Note: This item indicates the injection mode.		

Injection Switching Status

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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Injection Switching Status	Prohibition of changing the D-4S injection method/ OK or NG	-	Yes
	Diagnostic Note: This item indicates whether the Control the Injection Way Active Test is prohibited.		

Injection Timing (D4)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injection Timing (D4)	Injection timing/ Min.: -3277 deg(CA), Max.: 3276.7 deg(CA)	320 to 340 deg(CA): Idling at P, N or neutral after warming up (A/C off)	Yes
	Diagnostic Note: This item indicates the injection timing of the main injector.		

Injection Time (D4)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Injection Time (D4)	Injection time/ Min.: 0 µs, Max.: 65535 µs	0 to 2000 µs: Idling at P, N or neutral after warming up (A/C off)	Yes
	Diagnostic Note: This item indicates the last injection time of the injector for the number 1 cylinder.		

6. EVAP System 1 (All Data)

Vacuum Pump

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Vacuum Pump	Key-off EVAP system pump status/ ON or OFF	-	Yes
	Diagnostic Note: This item changes to ON during the key-off EVAP monitor which is performed approximately 5 hours after the ignition switch is turned off INFO .		

7. EVAP System 2 (Gas Evaporative)

EVAP (Purge) VSV

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Purge valve control duty/ Min.: 0%, Max.: 100%	-	Yes
	Diagnostic Note: • This is the command signal from the ECM.		

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EVAP (Purge) VSV	• This is the purge valve control duty ratio. When EVAP (Purge) VSV is any value except 0%, EVAP purge* is being performed. *: Gasoline vapor from the fuel tank is being introduced into the intake system via the purge VSV. • When the engine is cold or immediately after the engine is started, EVAP (Purge) VSV is 0%.

Evap Purge Flow

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Evap Purge Flow	Purge flow/ Min.: 0%, Max.: 399.9%	-	Yes
	Diagnostic Note: This is the percentage of total engine airflow contributed by EVAP purge operation. (Evap Purge Flow = Purge flow / Engine airflow x 100 (%))		

Purge Density Learn Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Purge Density Learn Value	Purge density learned value/ Min.: -200%, Max.: 199.993%	-	Yes
	Diagnostic Note: Purge Density Learn Value is the proportion of the decrease in injection volume (based on the change in the air fuel ratio feedback compensation value) related to a 1% purge flow rate. When Purge Density Learn Value is a large negative value, the purge effect is large. The purge density is determined from the change in the air fuel ratio feedback compensation value when purge flow is introduced. Purge density learning is performed so that the feedback compensation value is 0 +/-2%. **HINT:** • Usually, the value is approximately +/-1%. • 1%: The concentration of HC in the purge gas is relatively low. • 0%: The concentration of HC in the purge gas is approximately equal to the stoichiometric air fuel ratio. • Large negative values indicate that the concentration of HC in the purge gas is relatively high.		

Vapor Pressure Pump

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	Vapor pressure/ Min.: 0 kPa (0 mmHg), Max.: 1441.77 kPa (10814.17 mmHg)	Approximately 100 kPa (750 mmHg): Ignition switch ON	No
	Diagnostic Note: This is the EVAP system pressure monitored by the canister pressure sensor.		

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Vapor Pressure Pump	**HINT:** • Except for when the monitor is running, this value should be approximately the same as atmospheric pressure. • As Vapor Pressure Pump is almost the same as Atmosphere Pressure when the engine is stopped, these items can be used to help determine if the canister pressure sensor characteristics are abnormal, if there is noise, or if the sensor output is stuck at a certain value.

EVAP System Vent Valve

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
EVAP System Vent Valve	Key-off EVAP system vent valve status/ ON or OFF	OFF: Vent ON: Close	Yes

EVAP Purge VSV

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
EVAP Purge VSV	VSV status for EVAP control/ ON or OFF	-	Yes
	Diagnostic Note: This parameter displays ON when EVAP (Purge) VSV is 30% or more, and displays OFF when the VSV duty ratio is less than 30%.		

Purge Cut VSV Duty

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Purge Cut VSV Duty	Purge valve duty/ Min.: 0%, Max.: 399.9%	-	Yes
	Results of real-vehicle check: • Idling (warm up the engine): 0.0% • Running without load (3000 rpm): 33.3%		

8. Air Fuel Ratio Control 1 (All Data)

Target Air-Fuel Ratio

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Target Air-Fuel	Target air fuel ratio/ Min.: 0, Max.: 1.99	0.8 to 1.2: During idling	Yes
	Diagnostic Note: This is the target air fuel ratio used by the ECM.		

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Ratio	1.0 is the stoichiometric air fuel ratio. Values that are more than 1 indicate the system attempting to make the air fuel ratio leaner. Values that are less than 1 indicate the system attempting to make the air fuel ratio richer. Target Air-Fuel Ratio and AF Lambda B1S1 are related.

9. Air Fuel Ratio Control 2 (Gas AF O2 Sensor)

AF Lambda B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AF Lambda B1S1	Output air fuel ratio associated/ Min.: 0, Max.: 1.999	• Value less than 1 (0.000 to 0.999) = Rich • 1 = Stoichiometric air fuel ratio • Value more than 1 (1.001 to 1.999) = Lean	Yes
	Diagnostic Note: This is the actual air fuel ratio calculated based on the air fuel ratio sensor output. Performing the "Control the Injection Volume" or "Control the Injection Volume for A/F Sensor" function of the Active Test enables the technician to check the voltage output of the sensor.		

AFS Voltage B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AFS Voltage B1S1	Air fuel ratio sensor output voltage/ Min.: 0 V, Max.: 7.999 V	About 2.2 V: Idling (warming up the engine)	Yes
	Diagnostic Note: • This is the voltage output of the air fuel ratio sensor (the voltage cannot be measured at the terminals of the sensor). This value is calculated by the ECM based on the current output of the air fuel ratio sensor (refer to AFS Current B1S1 below for the actual sensor output). • Performing the "Control the Injection Volume" or "Control the Injection Volume for A/F Sensor" function of the Active Test enables the technician to check the voltage output of the sensor.		

AFS Current B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
AFS Current B1S1	Air fuel ratio sensor output current / Min.: -128 mA, Max.: 127.99 mA	-0.5 to 0.5 mA: Idling	Yes
	Diagnostic Note: • With a stoichiometric air fuel ratio (for example, during idling after the engine is		

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	warmed up), the air fuel ratio sensor current output is approximately -0.5 to 0.5 mA. • When the value is outside the range of 0.7 to 2.2 mA when the fuel-cut is being performed, there is a malfunction in the air fuel ratio sensor or sensor circuit.

A/F Sensor Impedance B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Sensor Impedance B1S1	Air fuel ratio sensor impedance/ Min.: 0 Ohm, Max.: 6553.5 Ohm	About 32 Ohm: Idling after warming up	Yes

A/F Heater Duty #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Heater Duty #1	Air fuel ratio sensor heater duty ratio/ Min.: 0%, Max.: 399.9%	0 to 100%	Yes
	Diagnostic Note: When the value is any value except 0%, current is being supplied to the heater.		

O2S B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2S B1S2	Heated oxygen sensor output voltage / Min.: 0 V, Max.: 1.275 V	0 to 0.9 V: Vehicle driven at constant speed of 70 km/h (44mph)	Yes
	Diagnostic Note: This is the output voltage of the heated oxygen sensor. Values close to 0 V indicate an air fuel ratio leaner than the stoichiometric ratio. Values close to 1 V indicate an air fuel ratio richer than the stoichiometric ratio. During air fuel ratio feedback control, the value moves back and forth in the range of 0 to 1 V. Performing the "Control the Injection Volume" or "Control the Injection Volume for A/F Sensor" function of the Active Test enables the technician to check voltage output of the sensor.		

O2 Heater B1S2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2 Heater B1S2	Heated oxygen sensor heater/ Not Act or Active	-	Yes

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O2 Sensor Heater Duty

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
O2 Sensor Heater Duty	Oxygen sensor heater duty ratio/ Min.: 0%, Max.: 400%	0 to 100%	Yes
	Diagnostic Note: When the vehicle is any valve except 0%, current is being supplied to the heater.		

Short FT #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Short FT #1	Short-term fuel trim / Min.: -100%, Max.: 99.2%	-15 to +15%	Yes
	Diagnostic Note: This item is the "short-term fuel injection volume compensation ratio" used to maintain the air fuel ratio at the stoichiometric ratio using the air fuel ratio sensor for feedback.		

Long FT #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Long FT #1	Long-term fuel trim / Min.: -100%, Max.: 99.2%	-15 to +15%	Yes
	Diagnostic Note: The ECM will learn the Long FT values based on Short FT. The goal is to keep Short FT at 0% to keep the A/F mixture at the stoichiometric ratio. This value is used to determine whether the system related to air fuel ratio control is malfunctioning. The condition of the system is determined based on the sum of Short FT and Long FT (excluding times when the system is in transition). • +15% or more: There may be a lean air fuel ratio. • -15 to +15%: The air fuel ratio can be determined to be normal. • -15% or less: There may be a rich air fuel ratio. • The learned value is cleared when the battery cable is disconnected. • Air fuel ratio feedback leaning is divided up according to the engine operating range (engine speed * load), and separate value are stored for each operating range. "Long FT #1" indicates the learned value for the current operating range. [A/F Learn Value Idle #1], [A/F Learn Value Low #1], [A/F Learn Value Mid1 #1], [A/F Learn Value Mid2 #1] and [A/F Learn Value High #1] indicate the leaned values for the different operating ranges. The learned value that is the same as "Long FT #1" indicates the current engine operating range.		

Fuel System Status #1

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel System Status #1	Fuel system status/ ON or OFF	-	Yes

10. Ignition System (Ignition)

IGN Advance

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
IGN Advance	Ignition timing advance for No. 1 cylinder/ Min.: -64 deg., Max.: 63.5 deg.	BTDC -5 to 10 deg.: Idling at N position	Yes

Knock Feedback Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Knock Feedback Value	Knocking feedback value/ Min.: -1024 deg(CA), Max.: 1023.9 deg(CA)	-	Yes

Diagnostic Note:
This is the ignition timing retard compensation amount determined by the presence or absence of knocking.
Ignition timing = Most retarded timing value*1 + Knock Correct Learn Value*2 + Knock Feedback Value*3
Example: 21 deg(CA) = 10° + 14° - 3°
*1: The most retarded timing value is a constant determined by the engine speed and engine load.
*2: The knock correction learned value is calculated as shown below in order to keep Knock Feedback Value as close to -3 deg(CA) as possible.
When Knock Feedback Value is less than -4 deg(CA), Knock Correct Learn Value is slowly decreased.
When Knock Feedback Value is more than -2 deg(CA), Knock Correct Learn Value is slowly increased.
*3: The base value is -3 deg(CA) and is adjusted based on the presence or absence of knocking. When there is no knocking, the value is increased, and when knocking is present, the value is decreased.

HINT:

If Knock Feedback Value does not change around the time when knocking occurs even though knocking continues (for example, stays at -3 deg(CA)), it can be determined that knocking is not being detected.

Possible Causes:

- There is a problem with the knock sensor sensitivity.
- The knock sensor is improperly installed.
- There is a problem with a wire harness.

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Knock Correct Learn Value

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Knock Correct Learn Value	Knocking correction learned value/ Min.: -1024 deg(CA), Max.: 1023.9 deg(CA)	-	Yes
	Diagnostic Note: Refer to "Knock Feedback Value". When there is knocking or a lack of power, compare the following values to another vehicle of the same model. • Engine speed • Calculate Load • IGN Advance • Knock Feedback Value • Knock Correct Learn Value Knock Correct Learn Value is large: There is no knocking and the ignition timing is advanced. Knock Correct Learn Value is small: Knocking is present and the ignition timing is being retarded. **HINT:** **When knocking continues even though Knock Correct Learn Value is less than that of the vehicle being used for comparison (in other words, the ignition timing is being retarded but the knocking is not stopping), there may be a buildup of deposits or other such problems due to deterioration over time (oil entering the cylinders, poor quality fuel, etc.).**		

Idle Spark Advn Ctrl #1 to #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Idle Spark Advn Ctrl #1 Idle Spark Advn Ctrl #2 Idle Spark Advn Ctrl #3 Idle Spark Advn Ctrl #4	Individual cylinder timing advance compensation amount (No. 1 to No. 4)/ Min.: -16 deg(CA), Max.: 15.875 deg(CA)	-	Yes
	Diagnostic Note: • This is the ignition timing advance compensation amount used to stabilize idling (each cylinder has a separate value). When the speed for a certain cylinder drops, the system advances the timing for that particular cylinder in an attempt to restore the speed and stabilize idling. • It may be possible to use this item to help determine specific cylinders which are not operating normally.		

11. VVT Control 1 (All Data)

VVT Aim Angle #1, #2

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Aim Angle #1, #2	VVT hold duty learned value for bank 1 (bank 2)/ Min.: 0%, Max.: 399.9%	-	Yes
	Diagnostic Note: This value represents the duty ratio necessary to operate the camshaft timing oil control valve in order to block the camshaft timing oil control valve path and maintain the advanced state of the VVT controller. This is only available during the Active Test.		

VVT Change Angle #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Change Angle #1, #2	VVT displacement angle for bank 1 (bank2)/ Min.: -320 DegFR, Max.: 320 DegFR	-	Yes
	Diagnostic Note: This is the VVT displacement angle during forced operation. This is only available during the Active Test. By checking the VVT Change Angle during the Active Test, it is also possible to determine whether or not the camshaft position sensor signal is being output.		

VVT OCV Duty #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT OCV Duty #1, #2	VVT camshaft timing oil control valve operation duty for bank 1 (bank2)/ Min.: 0%, Max.: 399.9%	-	Yes
	Diagnostic Note: This is the requested duty value for forced operation. This is only available during the Active Test.		

VVT Ex Hold Lrn Val #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex Hold Lrn Val #1, #2	VVT exhaust hold duty ratio learned value for bank 1 (bank2)/ Min.: 0%, Max.: 399.9%	-	Yes
	Diagnostic Note: This value represents the duty ratio necessary to operate the camshaft timing oil control valve in order to block the camshaft timing oil control valve path and maintain the advanced state of the VVT controller. This is only available during the Active Test.		

VVT Ex Chg Angle #1, #2

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex Chg Angle #1, #2	VVT exhaust displacement angle for bank 1 (bank2)/ Min.: 0 DegFR, Max.: 639.9 DegFR	-	Yes
	Diagnostic Note: This is the displacement angle during forced operation. This is only available during the Active Test.		

VVT Ex OCV Duty #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex OCV Duty #1, #2	VVT exhaust camshaft timing oil control valve duty for bank 1 (bank2)/ Min.: 0%, Max.: 399.9%	-	No
	Diagnostic Note: This is the requested duty value for forced operation. This is only available during the Active Test.		

Target VVT Angle #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Target VVT Angle #1, #2	Target VVT angle for bank 1 (bank2)/ Min.: -320 DegFR, Max.: 320 DegFR	-	Yes
	Diagnostic Note: This is only available during the Active Test.		

Target VVT Ex Angle #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Target VVT Ex Angle #1, #2	Target VVT exhaust angle for bank 1 (bank2)/ Min.: 0 DegFR, Max.: 640 DegFR	-	Yes
	Diagnostic Note: This is only available during the Active Test.		

VVT OCV Current #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
	VVT camshaft timing oil control valve	0.55 to 0.85 A: Idling	

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VVT OCV Current #1, #2	output current for bank 1 (bank2)/ Min.: 0 A, Max.: 1.99 A	after warming up	Yes
	Diagnostic Note: This is only available during the Active Test.		

VVT Ex OCV Current #1, #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VVT Ex OCV Current #1, #2	VVT exhaust camshaft timing oil control valve output current for bank 1 (bank2)/ Min.: 0 A, Max.: 1.99 A	0.55 to 0.85 A: Idling after warming up	Yes
	Diagnostic Note: This is only available during the Active Test.		

12. VN Turbo (All Data)

VN Turbo Type

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
VN Turbo Type	Turbo type/ Not/Commo/Vacuum/CAN	Not	No
	Diagnostic Note: This is the type of the turbo charger.		

13. Catalyst (Gas CAT Converter)

Catalyst Temp B1S1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Catalyst Temp B1S1	Catalyst temperature/ Min.: -40°C, Max.: 6513.5°C	-	Yes
	Diagnostic Note: This is the temperature of the front catalyst estimated by the ECM.		

14. Various Vehicle Conditions 2 (All Data)

Starter Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Starter Signal	Starter signal/ ON or OFF	ON: Starter operating OFF: Starter not operating	Yes

Starter Control

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Starter Control	Starter signal/ ON or OFF	ON: Starter operating OFF: Starter not operating	Yes

Starter Cut Relay

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Starter Cut Relay	Starter cut relay/ ON or OFF	-	Yes

ACC Relay

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ACC Relay	ACC relay/ ON or OFF	-	Yes

Neutral Position SW Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Neutral Position SW Signal	PNP switch status/ ON or OFF	ON: Shift lever in P, N or neutral	Yes

Clutch Switch

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Clutch Switch	Clutch switch status/ ON or OFF	ON: Clutch pedal depressed OFF: Clutch pedal released	Yes

Stop Light Switch

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Stop Light Switch	Stop light switch status/ ON or OFF	ON: Brake pedal depressed OFF: Brake pedal released	Yes

A/C Signal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/C Signal	A/C switch status/ ON or OFF	ON: A/C on	Yes

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A/C Pressure Normal SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/C Pressure Normal SW	Air conditioning pressure sensor status/ ON or OFF	ON: Air conditioning pressure sensor on	Yes

Closed Throttle Position SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Closed Throttle Position SW	Closed throttle position switch/ ON or OFF	• ON: Throttle fully closed • OFF: Throttle open	Yes

Rear Defogger SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Rear Defogger SW	Rear defogger switch/ ON or OFF	ON: Rear defogger switch ON	No

Blower Fan SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Blower Fan SW	Blower fan switch/ ON or OFF	ON: Blower fan switch ON	No

Head Light Switch

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Head Light Switch	Head light switch/ ON or OFF	ON: light control switch tail on	No

Front Wiper Switch

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Front Wiper Switch	Front wiper switch/ ON or OFF	ON: Front wiper switch ON	No

Ignition Status

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Ignition Status	Ignition switch/ ON or OFF	ON: Ignition switch ON	Yes

Fuel Cut Condition

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Cut Condition	Fuel cut condition/ ON or OFF	ON: Fuel cut operating	Yes

15. Check Mode (Check Mode)

Check Mode

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Check Mode	Check mode/ ON or OFF	ON: Check mode on	No

16. Test Result (Monitor Status)

Monitor Information 1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
NSW Test Result	N position monitor/ Compl or Incmpl	-	*1	No
OXS1 Test Result	Check mode result for heated oxygen sensor / Compl or Incmpl	-	*1	No
A/F Test Results #1	Check mode result for air fuel ratio sensor/ Compl or Incmpl	-	*1	No
Starter SW Test Result	Check mode result for starter switch/ Compl or Incmpl	-	*1	No
Complete Parts Monitor	Comprehensive component monitor/ Not Avl or Avail	-	*1	No
Fuel System Monitor	Fuel system monitor/ Not Avl or Avail	-	*1	No
Misfire Test Result	Check mode result for misfire monitor/ Not Avl or Avail	-	*1	No
EGR/VVT Monitor	EGR/VVT monitor/ Not Avl or Avail	-	*1	No
EGR/VVT Monitor	EGR/VVT monitor/	-	*1	No

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	Compl or Incmpl			
O2S(A/FS) Heater Monitor	O2S (A/FS) heater monitor/ Not Avl or Avail	-	*1	No
O2S(A/FS) Heater Monitor	O2S (A/FS) heater monitor/ Compl or Incmpl	-	*1	No
O2S(A/FS) Monitor	O2S (A/FS) monitor/ Not Avl or Avail	-	*1	No
O2S(A/FS) Monitor	O2S (A/FS) monitor/ Compl or Incmpl	-	*1	No
A/C Monitor	A/C monitor/ Not Avl or Avail	-	*1	No
A/C Monitor	A/C monitor/ Compl or Incmpl	-	*1	No
2nd Air Monitor	2nd air monitor/ Not Avl or Avail	-	*1	No
2nd Air Monitor	2nd air monitor/ Compl or Incmpl	-	*1	No
EVAP Monitor	EVAP monitor/ Not Avl or Avail	-	*1	No
EVAP Monitor	EVAP monitor/ Compl or Incmpl	-	*1	No
Heated Catalyst Monitor	Heated catalyst monitor/ Not Avl or Avail	-	*1	No
Heated Catalyst Monitor	Heated catalyst monitor/ Compl or Incmpl	-	*1	No
Catalyst Monitor	Catalyst monitor/ Not Avl or Avail	-	*1	No
Catalyst Monitor	Catalyst monitor/ Compl or Incmpl	-	*1	No

*1:
Avail: The monitor is available on the vehicle.
Not Avl: The monitor is not available on the vehicle.
Incmpl / Compl: The item changes from Incmpl to Compl if the monitor was completed at least once at some time in the past. This item does not change when the ignition switch is turned off. However, the item changes back to Incmpl when DTCs are cleared or the battery cable is disconnected.
Monitor result (mode 06): The last judgment result is output. This is not cleared when the ignition switch is turned off, but is cleared when DTCs are cleared.

Monitor Information 2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	DIAGNOSTIC NOTE	STORED AS FREEZE FRAME DATA
Component Monitor ENA	Comprehensive component monitor/ Unable or Enable	-	*2	No

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Component Monitor CMPL	Comprehensive component monitor/ Compl or Incmpl	-	*2	No
Fuel System Monitor ENA	Fuel system monitor/ Unable or Enable	-	*2	No
Fuel System Monitor CMPL	Fuel system monitor/ Compl or Incmpl	-	*2	No
Misfire Monitor ENA	Misfire monitor/ Unable or Enable	-	*2	No
Misfire Monitor CMPL	Misfire monitor/ Compl or Incmpl	-	*2	No
EGR/VVT Monitor ENA	EGR monitor/ Unable or Enable	-	*2	No
EGR/VVT Monitor CMPL	EGR monitor/ Compl or Incmpl	-	*2	No
Heater Monitor ENA	O2S (A/FS) heater monitor/ Unable or Enable	-	*2	No
Heater Monitor CMPL	O2S (A/FS) heater monitor/ Compl or Incmpl	-	*2	No
O2S(A/FS) Monitor ENA	O2S (A/FS) monitor/ Unable or Enable	-	*2	No
O2S(A/FS) Monitor CMPL	O2S (A/FS) monitor/ Compl or Incmpl	-	*2	No
A/C Monitor ENA	A/C monitor/ Unable or Enable	-	*2	No
A/C Monitor CMPL	A/C monitor/ Compl or Incmpl	-	*2	No
2nd Air Monitor ENA	2nd air monitor/ Unable or Enable	-	*2	No
2nd Air Monitor CMPL	2nd air monitor/ Compl or Incmpl	-	*2	No
EVAP Monitor ENA	EVAP monitor/ Unable or Enable	-	*2	No
EVAP Monitor CMPL	EVAP monitor/ Compl or Incmpl	-	*2	No
Heated Cat Monitor ENA	Heated catalyst monitor/ Unable or Enable	-	*2	No
Heated Cat Monitor CMPL	Heated catalyst monitor/ Compl or Incmpl	-	*2	No
Catalyst Monitor ENA	Catalyst monitor/ Unable or Enable	-	*2	No
Catalyst Monitor	Catalyst monitor/			

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CMPL	Compl or Incmpl	-	*2	No

*2:
Enable: The monitor is available on the vehicle.
Unable: The monitor is not available on the vehicle.
Incmpl / Compl: The item changes from Incmpl to Compl if the monitor was completed during the current trip. The item changes back to Incmpl when the ignition switch is turned off.
Monitor result (mode 06): The last judgment result is output. This is not cleared when the ignition switch is turned off, but is cleared when DTCs are cleared. Therefore, only when DTCs are cleared at the beginning of a trip do the system monitor (Monitor Information 2) and monitor result (mode 06) match.

17. Various Vehicle Conditions 3 (All Data)

TC Terminal

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
TC Terminal	TC terminal status/ ON or OFF	-	No

Codes (Include History)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
# Codes (Include History)	Number of codes/ Min.: 0, Max.: 255	0	No

MIL

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MIL	MIL status/ ON or OFF	-	No

MIL ON Run Distance

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
MIL ON Run Distance	Distance driven with MIL on/ Min.: 0 km, Max.: 65535 km	-	No
	Diagnostic Note: This is the distance driven after a DTC is stored.		

Running Time from MIL ON

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Running Time from MIL ON	Running time from MIL ON/ Min.: 0 min, Max.: 65535	-	No

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	min		

Time after DTC Cleared

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Time after DTC Cleared	Time after DTCs cleared/ Min.: 0 min, Max.: 65535 min	Time after DTCs cleared	Yes
	Diagnostic Note: This is the time elapsed after DTCs were cleared. Time elapsed after the ignition switch is turned off is not counted.		

Distance from DTC Cleared

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Distance from DTC Cleared	Distance driven after DTCs cleared/ Min.: 0 km, Max.: 65535 km	Distance driven after DTCs cleared	Yes
	Diagnostic Note: This is the distance driven after DTCs were cleared.		

Warmup Cycle Cleared DTC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Warmup Cycle Cleared DTC	Warmup cycles after DTCs cleared/ Min.: 0, Max.: 255	-	Yes
	Diagnostic Note: This is the number of warmup cycles after the DTCs were cleared. This is the number of times the engine was warmed up* after DTCs were cleared (or after the vehicle left the factory). *: An engine warmup is defined as the engine coolant temperature rising 20°C (104°F) or more and reaching a temperature of 70°C (158°F) or higher after the engine is started.		

Dist Batt Cable Disconnect

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Dist Batt Cable Disconnect	Distance driven after battery cable disconnected/ Min.: 0 km, Max.: 65535 km	Total distance vehicle driven after battery cable disconnected	Yes

IG OFF Elapsed Time

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TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
IG OFF Elapsed Time	Time after ignition switch off/ Min.: 0 min, Max.: 655350 min	-	Yes

OBD Requirements

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
OBD Requirements	OBD requirement	OBD II (California ARB)	No

Number of Emission DTC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Number of Emission DTC	Emissions-related DTCs	-	No
	Diagnostic Note: This is the number of emissions-related DTCs.		

TC and TE1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
TC and TE1	TC and CG (TE1) terminals of DLC3/ ON or OFF	-	Yes

18. Misfire (Gas Misfire)

Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Cylinder #1 Misfire Count Cylinder #2 Misfire Count Cylinder #3 Misfire Count Cylinder #4 Misfire Count	Misfire count of cylinders 1 to 4/ Min.: 0, Max.: 255	0 to 16	Yes
	Diagnostic Note: This is the misfire count for each individual cylinder. This counter is incremented by one for each misfire and is cleared every 200 revolutions. Check this item to help determine the malfunctioning cylinder.		

19. Various Vehicle Conditions 4 (All Data)

Engine Speed (Starter Off)

TESTER DISPLAY	MEASUREMENT	NORMAL	STORED AS FREEZE FRAME

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	ITEM/RANGE	CONDITION	DATA
Engine Speed (Starter Off)	Engine speed when starter off/ Min.: 0 rpm, Max.: 51199 rpm	-	Yes
	Diagnostic Note: This is the engine speed immediately after starting the engine.		

Starter Count

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Starter Count	Number of times starter turned on after ignition switch turned to ON/ Min.: 0, Max.: 255	-	Yes
	Diagnostic Note: This is the number of times the starter turned on during the current trip.		

Run Dist of Previous Trip

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Run Dist of Previous Trip	Distance driven during previous trip/ Min.: 0 km, Max.: 655.35 km	-	Yes
	Diagnostic Note: Before 5 seconds elapse after starting the engine, which is DTC P1604 (Startability Malfunction) detection duration, this parameter indicates the distance driven during the previous trip. After 5 seconds elapse after starting the engine, this parameter indicates the distance driven during the current trip calculated from the vehicle speed signal. **HINT:** **Run Dist of Previous Trip in freeze frame data which were present when the startability malfunction occurred (DTC P1604 detected) indicates the distance driven during the previous trip, but in all other cases, such as for the snapshot data of Data List (real-time measurements), or for freeze frame data which were present when the DTCs other than P1604 were detected, the value indicates the distance driven during the current trip.**		

Engine Starting Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Starting Time	Time elapsed before engine starts/ Min.: 0 ms, Max.: 655350 ms	-	Yes
	Diagnostic Note: This is the time elapsed after the starter turns on until the engine speed reaches 400 rpm.		

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	This value is cleared 5 seconds after the engine is started and the value is displayed as 0 ms.

Previous Trip Coolant Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Coolant Temp	Engine coolant temperature during previous trip/ Min.: -40°C, Max.: 215°C	-	Yes
	Diagnostic Note: Before 120 seconds elapse after starting the engine, this parameter indicates the engine coolant temperature at the end of the previous trip. After 120 seconds elapse after starting the engine, this parameter indicates the engine coolant temperature during the current trip.		

Previous Trip Intake Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Intake Temp	Intake air temperature during previous trip/ Min.: -40°C, Max.: 215°C	-	Yes
	Diagnostic Note: Before 120 seconds elapse after starting the engine, this parameter indicates the intake air temperature at the end of the previous trip. After 120 seconds elapse after starting the engine, this parameter indicates the intake air temperature during the current trip.		

Engine Oil Temperature

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Oil Temperature	Engine oil temperature (estimated temperature)/ Min.: -40°C, Max.: 215°C	-	Yes

Previous Trip Eng Oil Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Eng Oil Temp	Engine oil temperature during previous trip/ Min.: -40°C, Max.: 215°C	-	Yes

Ambient Temp for A/C

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA

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Ambient Temp for A/C	Ambient temperature for A/C/ Min.: -40°C, Max.: 215°C	-	Yes

Previous Trip Ambient Temp

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Previous Trip Ambient Temp	Ambient temperature during previous trip/ Min.: -40°C, Max.: 215°C	-	Yes

Engine Start Hesitation

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Start Hesitation	History of hesitation during engine start/ ON or OFF	-	Yes
	Diagnostic Note: This value changes to ON when the engine speed does not reach 500 rpm during cranking.		

Low Rev for Eng Start

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Low Rev for Eng Start	History of low engine speed after engine start/ ON or OFF	-	Yes
	Diagnostic Note: This flag changes to ON when the engine speed drops to 200 rpm or less within approximately 2 seconds of starting the engine.		

Fuel Cut Elps Time

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Cut Elps Time	Time elapsed before engine starts/ Time elapsed after fuel cut/ Min.: 0 sec, Max.: 67107 sec	-	Yes

Engine Oil Temp for Eng Start

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Oil Temp for	History of engine oil temperature		

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Eng Start	during engine start/ Min.: -40 deg, Max.: 215 deg	-	Yes

A/F Learn Value Idle #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Idle #1	Air fuel ratio learn value of idle area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when idling with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher).		

A/F Learn Value Idle #1 (Dual)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Idle #1 (Dual)	Air fuel ratio learn value of idle area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when idling with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher).		

A/F Learn Value Low #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Low #1	Air fuel ratio learn value of low load area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the low load range (when the range of engine loads is divided into four parts).		

A/F Learn Value Mid1 #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Mid1 #1	Air fuel ratio learn value of middle1 load area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the mid-size load range closer to the low load range (when the range of engine loads is divided into four parts).		

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A/F Learn Value High #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value High #1	Air fuel ratio learn value of high load area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the high load range (when the range of engine loads is divided into four parts).		

A/F Learn Value Low #1 (Dual)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Low #1	Air fuel ratio learn value of low load area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the low load range (when the range of engine loads is divided into four parts).		

A/F Learn Value Mid1 #1 (Dual)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value Mid1 #1	Air fuel ratio learn value of middle1 load area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the mid-size load range closer to the low load range (when the range of engine loads is divided into four parts).		

A/F Learn Value High #1 (Dual)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/F Learn Value High #1	Air fuel ratio learn value of high load area/ Min.: -50%, Max.: 49.6%	-15 to +15%	Yes
	Diagnostic Note: Learning is performed when driving with the engine warmed up (engine coolant temperature is 80°C [176°F] or higher) and operating in the high load range (when the range of engine loads is divided into four parts).		

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A/C Magnetic Clutch Relay

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
A/C Magnetic Clutch Relay	A/C magnetic clutch relay/ ON or OFF	ON: A/C on	Yes

Electrical Fan Motor

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Electrical Fan Motor	Electric fan motors operation status/ ON or OFF	-	Yes

Electric Cooling Fan Relay #1

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Electric Cooling Fan Relay #1	Electric cooling fan relay No. 1/ ON or OFF	ON: Cooling fan relay No. 1 ON	Yes

Electric Cooling Fan Relay #2

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Electric Cooling Fan Relay #2	Electric cooling fan relay No. 2/ ON or OFF	ON: Cooling fan relay No. 2 ON	Yes

Brake Override System

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Brake Override System	Brake override system operation/ ON or OFF	ON: Brake override system ON	Yes

Idle Fuel Cut

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Idle Fuel Cut	Fuel cut at idle/ ON or OFF	ON: Fuel cut operating	Yes
	Diagnostic Note: Idle Fuel Cut = "ON" when the throttle valve is fully closed and the engine speed is		

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	high.

FC TAU

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
FC TAU	Fuel cut TAU (fuel cut during very light load)/ ON or OFF	ON: Fuel cut operating	Yes
	Diagnostic Note: This is the fuel cut performed under a very light load to prevent the engine combustion from becoming incomplete.		

Immobiliser Fuel Cut

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Immobiliser Fuel Cut	Status of immobiliser fuel cut/ ON or OFF	-	Yes

Immobiliser Fuel Cut History

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Immobiliser Fuel Cut History	Status of the immobiliser fuel cut history/ ON or OFF	-	Yes

Fuel Dilution Estimate

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Dilution Estimate	Fuel dilution estimate/ Min.: 0 ml, Max.: 1279.9 ml	-	No

20. Compression (Compression)

Engine Speed of Cyl #1 to #4

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Engine Speed of Cyl #1 Engine Speed of Cyl	Engine speed for cylinder No. 1 to No. 4/ Min.: 0 rpm, Max.: 51199 rpm	-	Yes
	Diagnostic Note: This is output only when Check the Cylinder Compression is performed using the Active Test.		

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#2 Engine Speed of Cyl #3 Engine Speed of Cyl #4	This is the engine speed for each cylinder measured during the engine cranking. When there is compression loss, the engine speed for that cylinder increases. **HINT:** **When multiple cylinders have compression loss, the engine speeds for multiple cylinders increase and it is not possible to determine which cylinders have compression loss. At this time, it is necessary to actually perform a compression measurement.**

Av Engine Speed of All Cyl

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Av Engine Speed of All Cyl	Average engine speed for all cylinders/ Min.: 0 rpm, Max.: 51199 rpm	-	No
	Diagnostic Note: This is output only when Check the Cylinder Compression is performed using the Active Test.		

21. Automatic Transmission (All Data)

Refer to Automatic Transmission System INFO .

Received MIL from ECT

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Received MIL from ECT	MIL status/ ON or OFF	-	Yes

Shift Position Sig from ECT

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Shift Position Sig from ECT	Received Shift Position Signal from ECT/ 1st, 2nd, 3rd, 4th, 5th, 6th, 7th or 8th	Same as actual gear ratio	Yes

SPD (NT)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
SPD (NT)	Input turbine speed (speed sensor NT)/ Min.: 0 rpm, Max.:	• Lock-up ON (After warming up engine): Input turbine speed (NT) equal to engine speed • Lock-up OFF (Idling at P or N position):	Yes

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	12750 rpm	Input turbine speed (NT) nearly equal to engine speed	

ECT Lock Up

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
ECT Lock Up	ECT lock up status/ ON or OFF	-	Yes

Shift SW Status (P Range)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Shift SW Status (P Range)	Park/neutral position switch status/ ON or OFF	ON: Shift lever in P OFF: Shift lever not in P	Yes

Shift SW Status (R Range)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Shift SW Status (R Range)	Park/neutral position switch status/ ON or OFF	ON: Shift lever in R OFF: Shift lever not in R	Yes

Shift SW Status (N Range)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Shift SW Status (N Range)	Park/neutral position switch status/ ON or OFF	ON: Shift lever in N OFF: Shift lever not in N	Yes

Sports Mode Selection SW

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Sports Mode Selection SW	Sport mode select switch status/ ON or OFF	ON: Shift lever in M, "+" or "-" OFF: Shift lever not in M, "+" or "-"	Yes

Shift SW Status (D Range)

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Shift SW Status (D Range)	Park/neutral position switch status/	ON: Shift lever in D OFF: Shift lever not	Yes

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	ON or OFF	in D	

Spark Timing Retard Request from ECT

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Spark Timing Retard Request from ECT	Status of the spark timing retard request from ECT/ ON or OFF	-	Yes

Fuel Cut Request from ECT

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Fuel Cut Request from ECT	Status of the fuel cut request from ECT/ ON or OFF	-	Yes

Torque Down Prohibit Request to ECT

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Torque Down Prohibit Request to ECT	Status of the torque down prohibit request to ECT/ ON or OFF	-	Yes

Torque Down Request from VSC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Torque Down Request from VSC	Status of the torque down request from VSC/ ON or OFF	-	Yes

Torque Up Request from VSC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Torque Up Request from VSC	Status of the torque up request from VSC/ ON or OFF	-	Yes

Torque Down Prohibit Request to VSC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Torque Down Prohibit Request to VSC	Status of the torque down prohibit request to VSC/ ON or OFF	-	Yes

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Torque Up Prohibit Request to VSC

TESTER DISPLAY	MEASUREMENT ITEM/RANGE	NORMAL CONDITION	STORED AS FREEZE FRAME DATA
Torque Up Prohibit Request to VSC	Status of the torque up prohibit request to VSC/ ON or OFF	-	Yes

22. ACTIVE TEST

HINT:

Using the Techstream to perform Active Tests allows relays, VSVs, actuators and other items to be operated without removing any parts. This non-intrusive functional inspection can be very useful because intermittent operation may be discovered before parts or wiring is disturbed. Performing Active Tests early in troubleshooting is one way to save diagnostic time. Data List information can be displayed while performing Active Tests.

(a) Warm up the engine.

(b) Turn the ignition switch off.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine / Active Test.

(g) According to the display on the Techstream, perform the Active Test.

TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTE
Control the Injection Volume	Change injection volume	Between -12.5% and 24.8%	• All injectors are tested at the same time. • This test is possible when the following conditions are met: ◦ Engine speed is 3000 rpm or less. ◦ Engine coolant temperature is 80°C (80°F) or more. • Injection volume can be changed in fine gradations within control range. • Control the Injection Volume enables the checking and graphing of the air fuel ratio sensor and the heated oxygen sensor voltage outputs. • To conduct the test, enter the following menus: Active Test / Control the Injection Volume /

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			AFS Voltage B1S1 and O2S B1S2. • During the Active Test, air fuel ratio feedback control and feedback learning are stopped.
Control the Injection Volume for A/F Sensor	Change injection volume	-12%/0%/12%	• All injectors are tested at the same time. • This test is possible when the following conditions are met: ◦ Engine speed is 3000 rpm or less. ◦ Engine coolant temperature is 80°C (80°F) or more. • Control the Injection Volume for A/F Sensor enables the checking and graphing of the air fuel ratio sensor and the heated oxygen sensor voltage outputs. • To conduct the test, enter the following menus: Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2. • During the Active Test, air fuel ratio feedback control and feedback learning are stopped.
Activate the VSV for Evap Control	Activate purge VSV control	ON/OFF	• Engine is stopped.
Control the A/C Magnet Clutch	A/C magnet clutch control	ON/OFF	Perform this test when the following conditions are met: • Ignition switch is ON. • Engine is stopped. • Shift lever is in P, N or neutral.
Control the Fuel Pump / Speed	Activate fuel pump	ON/OFF	Perform this test when the following conditions are met: • Ignition switch is ON. • Engine is stopped. • Shift lever is in P, N or neutral.
			Perform this test when the following

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Control the Fuel Pump Duty	Fuel pump control	25%/80%	conditions are met: • Ignition switch is ON. • Engine is stopped. • Shift lever is in P, N or neutral.
Connect the TC and TE1	Turn on and off TC and TE1 connection	ON/OFF	• ON: TC and TE1 are connected. • OFF: TC and TE1 are disconnected. • Perform this test when the following conditions are met: ◦ Ignition switch is ON. ◦ Engine is stopped. ◦ Shift lever is in P, N or neutral.
Control the Electric Cooling Fan	Control electric cooling fan	ON/OFF	Perform this test when the ignition switch is ON.
Activate the ACC Cut Relay	Activate ACC cut relay	ON/OFF	Perform this test when the following conditions are met: • Ignition switch is ON. • Engine is stopped. • Shift lever is in P, N or neutral.
Control the ETCS Open/Close Slow Speed	Throttle actuator	Close/Open	This test is possible when the following conditions are met: • Ignition switch is ON. • Engine is stopped. • Accelerator pedal is fully depressed. • Shift lever is in P, N or neutral.
Control the ETCS Open/Close Fast Speed	Throttle actuator	Close/Open	• Same as above.
Control the Injection Timing #1	Control injection timing #1	Between -16 deg(CA) and 15.87 deg(CA)	Test possible during vehicle stopping and engine idling.
Control the Injection Timing #2	Control injection timing #2	Between -16 deg(CA) and 15.87 deg(CA)	Test possible during vehicle stopping and engine idling.
Control the Injection Timing #3	Control injection timing #3	Between -16 deg(CA) and 15.87 deg(CA)	Test possible during vehicle stopping and engine idling.

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Control the Injection Timing #4	Control injection timing #4	Between -16 deg(CA) and 15.87 deg(CA)	Test possible during vehicle stopping and engine idling.
Control the Target Fuel Pressure	Control the target fuel pressure	-12.5 to 24.8%	Perform the test at below 3000 rpm.
Control the Voltage of Alternator	Control the voltage of alternator	12.8 to 14.3 V	Perform this test when the following conditions are met: • Engine is idling. • Shift lever is in P, N or neutral.
Control the Injection Way	Perform 3 pattern in order to operate fuel injection	Either/Port/Direct	This test is possible when the following conditions are met: • Engine speed is 3000 rpm or less • Engine coolant temperature is 80°C (176°F) or more. • Shift lever is in P, N or neutral. Perform the port mode within 3 minutes.
D-4S (A/F Control)	Perform 3 pattern in order to operate air fuel ratio control	• Either/Port/Direct • -12.5 to 24.8%	This test is possible when the following conditions are met: • Engine speed is 3000 rpm or less • Engine coolant temperature is 80°C (176°F) or more. • Shift lever is in P, N or neutral. Perform the port mode within 3 minutes.
D-4S (Fuel Cut)	Perform 3 pattern in order to operate fuel cut	• Either/Port/Direct • Selected cylinder (cylinder #1 to #4)	This test is possible when the following conditions are met: • Engine speed is 3000 rpm or less • Engine coolant temperature is 80°C (176°F) or more. • Shift lever is in P, N or neutral. Perform the port mode within 3 minutes.
D-4S (Injection Volume)	Perform 3 pattern in order to operate injection volume	• Either/Port/Direct • -12.5 to 24.8%	This test is possible when the following conditions are met: • Engine speed is 3000 rpm or less • Engine coolant temperature is 80°C (176°F) or more. • Shift lever is in P, N or neutral.

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			Perform the port mode within 3 minutes.
Control the Select Cylinder Fuel Cut	Selected cylinder (cylinder #1 to #4) injector fuel cut	#1/#2/#3/#4 ON/OFF	This test is possible when the following conditions are met • Vehicle is stopped. • Engine is idling. • Shift lever is in P, N or neutral. • Speed sensor is normal. *1
Control the All Cylinders Fuel Cut	All cylinder fuel cut	ON/OFF	This test is possible when the following conditions are met • Vehicle is stopped. • Engine is idling. • Shift lever is in P, N or neutral. • Speed sensor is normal. *1
Check the Cylinder Compression	Check the cylinder compression pressure	ON/OFF	This test is possible when the following conditions are met • Vehicle is stopped. • Engine is idling. • Shift lever is in P, N or neutral. • Speed sensor is normal. *1 Fuel injection and ignition stop in all cylinders. *2
Activate the Starter Cut Relay	Activate starter cut relay	ON/OFF	Perform this test when the following conditions are met: • Ignition switch is ON. • Engine is stopped. • Shift lever is in P, N or neutral.
Control the Target Engine Speed	Control the target engine speed	500 to 2000 rpm	Test possible during vehicle stopping and engine idling.
Control the VVT Linear (Bank 1)	Control VVT (for intake side of bank 1)	-27 to 36 deg (CA)	• Engine stalls or idles roughly when the VVT actuator is operated. • Perform this test when the following conditions are met: ◦ Engine is idling. ◦ Shift lever is in P, N or neutral.

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			• DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction.
Control the VVT Linear (Bank 2)	Control VVT (for intake side of bank 2)	-27 to 36 deg (CA)	• Engine stalls or idles roughly when the VVT actuator is operated. • Perform this test when the following conditions are met: ◦ Engine is idling. ◦ Shift lever is in P, N or neutral. • DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction.
Control the VVT Exhaust Linear (Bank 1)	Control VVT (for exhaust side of bank 1)	0 to 51 deg (CA)	• Engine stalls or idles roughly when the VVT actuator is operated. • Perform this test when the following conditions are met: ◦ Engine is idling. ◦ Shift lever is in P, N or neutral. • DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction.
Control the VVT Exhaust Linear (Bank 2)	Control VVT (for exhaust side of bank 2)	0 to 51 deg (CA)	• Engine stalls or idles roughly when the VVT actuator is operated. • Perform this test when the following conditions are met: ◦ Engine is idling. ◦ Shift lever is in P, N or neutral. • DTCs related to the VVT system may be stored due to Active Test operation, but this does not indicate a malfunction.

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NOTICE:

***1:**

- If the display of the Data List item Catalyst OT MF F/C item is Not Avl, perform this Active Test with the vehicle stopped and the engine idling.
- If the display of the Data List item Catalyst OT MF F/C item is Avail, perform this Active Test as described below.

a. Stop the engine, turn the ignition switch to ON.
b. Enter the Control the Select Cylinder Fuel Cut.
c. Select the cylinder for fuel cut (cylinder #1 to #4) and turn the Active Test ON (press the RIGHT or LEFT button).
d. Start the engine.

HINT:

***2: When cranking the engine, each cylinder measures the engine speed. In this Active Test, the fuel and ignition of all cylinders is cut. The engine must then be cranked for approximately 10 seconds. At this time, the speed of each cylinder is measured. If the speed of one cylinder is more than the other cylinders, it can be determined that the compression pressure of that cylinder is lower than the other cylinders.**

1. Warm up the engine.
2. Turn the ignition switch off.
3. Connect the Techstream to the DLC3.
4. Turn the ignition switch to ON.
5. Turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Active Test / Check the Cylinder Compression.

   HINT:

   To display the entire Data List, press the pull down menu button next to Primary. Then select Compression.

7. Push the snapshot button to turn the snapshot function on.

   HINT:

   Using the snapshot function, data can be recorded during the Active Test.

8. While the engine is not running, press the RIGHT or LEFT button to change Check the Cylinder Compression to ON.

   HINT:

   After performing the above procedure, Check the Cylinder Compression will start. Fuel injection for all cylinders is prohibited and each cylinder engine speed measurement enters standby mode.

9. Crank the engine for about 10 seconds.

   HINT:

   Continue to crank the engine until the values change from the default value (51199 rpm).

10. Monitor the engine speed (Engine Speed of Cyl #1 to #4) displayed on the Techstream.

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HINT:

At first, the Techstream displays extremely high cylinder engine speed values. After approximately 10 seconds of engine cranking, each cylinder engine speed measurement will change to the actual engine speed.

NOTICE:

- Do not crank the engine continuously for 20 seconds or more.
- If it is necessary to crank the engine again after Check the Cylinder Compression has been changed to ON and the engine has been cranked once, press Exit to return to the Active Test menu screen. Then change Check the Cylinder Compression to ON and crank the engine.
- Use a fully-charged battery.

23. SYSTEM CHECK

HINT:

Performing a System Check enables the system, which consists of multiple actuators, to be operated without removing any parts. In addition, it can show whether or not any DTCs are stored, and can detect potential malfunctions in the system. The System Check can be performed with the Techstream.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Utility.

(e) Perform the System Check by referring to the table below.

TESTER DISPLAY	TEST PART	CONTROL RANGE	DIAGNOSTIC NOTE
Evaporative System Check (Automatic Mode)	Perform 5 steps in order to operate EVAP key-off monitor automatically	35°C (95°F) or less	• If no pending DTCs are output after performing this test, the system is functioning normally. • Refer to EVAP Inspection Procedure INFO .
Evaporative System Check (Manual Mode)	Perform 5 steps in order to operate EVAP key-off monitor manually	35°C (95°F) or less	• Used to detect malfunctioning parts. • Refer to EVAP Inspection Procedure INFO .

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDC0GNX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: DEFINITION OF TERMS (2013 FR-S)		

DEFINITION OF TERMS

TERM	DEFINITION
Monitor Description	Description of what ECM monitors and how it detects malfunctions (monitoring purpose and details).
Related DTCs	Group of diagnostic trouble codes that are output by ECM based on same malfunction detection logic.
Typical Enabling Condition	Preconditions that allow ECM to detect malfunctions. With all preconditions satisfied, ECM stores DTC when monitored value(s) exceeds malfunction threshold(s).
Sequence of Operation	Order of monitor priority, applied if multiple sensors and components are involved in single malfunction detection process. Each sensor and component is monitored in turn, when previous detection operation is completed.
Required Sensor/Components	Sensors and components used by ECM to detect each malfunction.
Frequency of Operation	Number of times ECM checks for each malfunction during each driving cycle. "Once per driving cycle" means ECM only performs checks for that malfunction once during single driving cycle. "Continuous" means ECM performs checks for that malfunction whenever enabling conditions are met.
Duration	Minimum time for which ECM must detect continuous deviation in monitored value(s) in order to store DTC. Timing begins when Typical Enabling Conditions are met.
Malfunction Thresholds	Value beyond which ECM determines malfunctions exist and stores DTCs.
MIL Operation	Timing of MIL illumination after malfunction is detected. "Immediate" means ECM illuminates MIL as soon as malfunction is detected. "2 driving cycles" means ECM illuminates MIL if same malfunction is detected second time during next sequential driving cycle.

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDJ0VLX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: DIAGNOSIS SYSTEM (2013 FR-S)		

DIAGNOSIS SYSTEM

1. DESCRIPTION

When troubleshooting OBD II (On-Board Diagnostics) vehicles, the Techstream (complying with SAE J1987) must be connected to the DLC3 (Data Link Connector 3) of the vehicle. Various data in the vehicle's ECM (Engine Control Module) can be then read.

OBD II regulations require that the vehicle's on-board computer illuminates the MIL (Malfunction Indicator Lamp) on the instrument panel when the computer detects a malfunction in:



a. The emission control system and components.
b. The powertrain control components (which affect vehicle emissions).
c. The computer itself.

In addition, the applicable DTCs prescribed by SAE J2012 are stored in the ECM memory. If the malfunction does not recur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain stored in the ECM memory.

To check the DTCs, connect the Techstream to the DLC3. The Techstream displays output DTCs, freeze frame data, and a variety of engine data. The DTCs and freeze frame data can be cleared with the Techstream. In order to enhance OBD function on vehicles and develop the Off-Board diagnosis system, Controller Area Network (CAN) communication is used in this system. CAN is a network which uses a pair of data transmission lines spanning multiple computers and sensors. It allows for high speed communications between the systems and simplification of the wire harness connections.

2. NORMAL MODE AND CHECK MODE

The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic is used to ensure accurate detection of malfunctions. Check mode is also available as an option for technicians. In check mode, 1 trip detection logic is used for duplicating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (Techstream only).

3. 2 TRIP DETECTION LOGIC

When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the same malfunction is detected during the next subsequent drive cycle, the MIL is illuminated (2nd trip).

4. DLC3 (Data Link Connector 3)

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(a) Check the DLC3 INFO .

5. FREEZE FRAME DATA

The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data stored at the time of a malfunction.

6. BATTERY VOLTAGE

Standard voltage:
11 to 14 V

If voltage is below 11 V, replace or recharge the battery.

7. MIL (Malfunction Indicator Lamp)

(a) The MIL is illuminated when the ignition switch is first turned to ON (the engine is not running).

(b) The MIL turns off when the engine is started. If the MIL remains illuminated, the diagnosis system has detected a malfunction or abnormality in the system.

HINT:

If the MIL is not illuminated when the ignition switch is first turned to ON, check the MIL circuit INFO .

8. ALL READINESS

HINT:

- With "All Readiness", you can check whether or not the DTC judgment has been completed by using the Techstream.
- You should check "All Readiness" after simulating malfunction symptoms or for validation after finishing repairs.

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Perform the DTC judgment driving pattern to run the DTC judgment.

(h) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(i) Input the DTCs to be confirmed.

(j) Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed

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	System abnormal
INCOMPLETE	• DTC judgment not completed • Perform the driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit



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Last Modified: 3-27-2012	6.4 S	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDF0FSX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: DIAGNOSTIC TROUBLE CODE CHART (2013 FR-S)		

DIAGNOSTIC TROUBLE CODE CHART

HINT:

Factors such as instrument type may cause readings to differ slightly from stated values. If any DTCs are output during a check mode DTC check, check the circuit for the DTCs listed in the table below. For details of each DTC, refer to the "See page" below.

***: The MIL flashes when a catalyst damaging misfire is detected.**

DTC CODE	DETECTION ITEM	MIL	MEMORY	SEE PAGE
P000A	Camshaft Position "A" - Timing Slow Response Bank 1	Comes on	DTC stored	INFO
P000B	Camshaft Position "B" - Timing Slow Response Bank 1	Comes on	DTC stored	INFO
P000C	Camshaft Position "A" - Timing Slow Response Bank 2	Comes on	DTC stored	INFO
P000D	Camshaft Position "B" - Timing Slow Response Bank 2	Comes on	DTC stored	INFO
P0010	Camshaft Position "A" Actuator Circuit (Bank 1)	Comes on	DTC stored	INFO
P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)	Comes on	DTC stored	INFO
P0013	Camshaft Position "B" Actuator Circuit / Open (Bank 1)	Comes on	DTC stored	INFO
P0014	Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 1)	Comes on	DTC stored	INFO
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)	Comes on	DTC stored	INFO
P0017	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor B)	Comes on	DTC stored	INFO
P0018	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor A)	Comes on	DTC stored	INFO
P0019	Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor B)	Comes on	DTC stored	INFO
P0020	Camshaft Position "A" Actuator Circuit (Bank 2)	Comes on	DTC stored	INFO
P0021	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 2)	Comes on	DTC stored	INFO
P0023	Camshaft Position "B" Actuator Circuit / Open (Bank 2)	Comes on	DTC stored	INFO

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P0024	Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 2)	Comes on	DTC stored	INFO
P0030	A/F Sensor Heater Control Circuit (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0031	Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0032	Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0068	MAP / MAF - Throttle Position Correlation	Comes on	DTC stored	INFO
P0087	Fuel Rail / System Pressure - Too Low	Comes on	DTC stored	INFO
P0088	Fuel Rail / System Pressure - Too High	Comes on	DTC stored	INFO
P0101	Mass Air Flow Circuit Range / Performance Problem	Comes on	DTC stored	INFO
P0102	Mass or Volume Air Flow Circuit Low Input	Comes on	DTC stored	INFO
P0103	Mass or Volume Air Flow Circuit High Input	Comes on	DTC stored	INFO
P0107	Manifold Absolute Pressure / Barometric Pressure Circuit Low Input	Comes on	DTC stored	INFO
P0108	Manifold Absolute Pressure / Barometric Pressure Circuit High Input	Comes on	DTC stored	INFO
P0111	Intake Air Temperature Sensor Gradient Too High	Comes on	DTC stored	INFO
P0112	Intake Air Temperature Circuit Low Input	Comes on	DTC stored	INFO
P0113	Intake Air Temperature Circuit High Input	Comes on	DTC stored	INFO
P0116	Engine Coolant Temperature Circuit Range / Performance Problem	Comes on	DTC stored	INFO
P0117	Engine Coolant Temperature Circuit Low Input	Comes on	DTC stored	INFO
P0118	Engine Coolant Temperature Circuit High Input	Comes on	DTC stored	INFO
P0122	Throttle Position Sensor Circuit Low Input	Comes on	DTC stored	INFO
P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input	Comes on	DTC stored	INFO

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P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	Comes on	DTC stored	INFO
P0128	Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)	Comes on	DTC stored	INFO
P0131	Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0132	Oxygen Sensor Circuit High Voltage Bank1 Sensor1	Comes on	DTC stored	INFO
P0134	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P0137	Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0138	Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P013A	Oxygen Sensor Slow Response - Rich to Lean Bank 1 Sensor 2	Comes on	DTC stored	INFO
P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0140	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P0141	Oxygen Sensor Heater Circuit (Bank 1 Sensor 2)	Comes on	DTC stored	INFO
P014C	A/F Sensor Slow Response - Rich to Lean Bank 1 Sensor 1	Comes on	DTC stored	INFO
P014D	A/F Sensor Slow Response - Lean to Rich Bank 1 Sensor 1	Comes on	DTC stored	INFO
P015A	A/F Sensor Delayed Response - Rich to Lean Bank 1 Sensor 1	Comes on	DTC stored	INFO
P015B	A/F Sensor Delayed Response - Lean to Rich Bank 1 Sensor 1	Comes on	DTC stored	INFO
P0171	System Too Lean (Bank 1)	Comes on	DTC stored	INFO
P0172	System Too Rich (Bank 1)	Comes on	DTC stored	INFO
P0191	Fuel Rail Pressure Sensor Circuit Range / Performance	Comes on	DTC stored	INFO
P0192	Fuel Rail Pressure Sensor Circuit Low Input	Comes on	DTC stored	INFO
P0193	Fuel Rail Pressure Sensor Circuit High Input	Comes on	DTC stored	INFO

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P0196	Engine Oil Temperature Sensor (Range/Performance)	Comes on	DTC stored	INFO
P0197	Engine Oil Temperature Sensor Low	Comes on	DTC stored	INFO
P0198	Engine Oil Temperature Sensor High	Comes on	DTC stored	INFO
P0201	Injector Circuit / Open - (Cylinder 1)	Comes on	DTC stored	INFO
P0202	Injector Circuit / Open - (Cylinder 2)	Comes on	DTC stored	INFO
P0203	Injector Circuit / Open - (Cylinder 3)	Comes on	DTC stored	INFO
P0204	Injector Circuit / Open - (Cylinder 4)	Comes on	DTC stored	INFO
P0222	Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input	Comes on	DTC stored	INFO
P0223	Throttle / Pedal Position Sensor / Switch "B" Circuit High Input	Comes on	DTC stored	INFO
P0230	Fuel Pump Primary Circuit	Comes on	DTC stored	INFO
P0300	Random / Multiple Cylinder Misfire Detected	Comes on/Blinks*	DTC stored	INFO
P0301	Cylinder 1 Misfire Detected	Comes on/Blinks*	DTC stored	INFO
P0302	Cylinder 2 Misfire Detected	Comes on/Blinks*	DTC stored	INFO
P0303	Cylinder 3 Misfire Detected	Comes on/Blinks*	DTC stored	INFO
P0304	Cylinder 4 Misfire Detected	Comes on/Blinks*	DTC stored	INFO
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0332	Knock Sensor 2 Circuit Low Input (Bank 2)	Comes on	DTC stored	INFO
P0333	Knock Sensor 2 Circuit High Input (Bank 2)	Comes on	DTC stored	INFO
P0335	Crankshaft Position Sensor "A" Circuit	Comes on	DTC stored	INFO
P0336	Crankshaft Position Sensor Range / Performance	Comes on	DTC stored	INFO
P0340	Camshaft Position Sensor Circuit Malfunction	Comes on	DTC stored	INFO

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P0341	Camshaft Position Sensor "A" Circuit Range / Performance (Bank 1 or Single Sensor)	Comes on	DTC stored	INFO
P0345	Camshaft Position Sensor "A" Circuit (Bank 2)	Comes on	DTC stored	INFO
P0346	Camshaft Position Sensor "A" Circuit Range / Performance (Bank 2)	Comes on	DTC stored	INFO
P0351	Ignition Coil "A" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0352	Ignition Coil "B" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0353	Ignition Coil "C" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0354	Ignition Coil "D" Primary / Secondary Circuit	Comes on	DTC stored	INFO
P0365	Camshaft Position Sensor "B" Circuit (Bank 1)	Comes on	DTC stored	INFO
P0366	Camshaft Position Sensor "B" Circuit Range / Performance (Bank 1)	Comes on	DTC stored	INFO
P0390	Camshaft Position Sensor "B" Circuit (Bank 2)	Comes on	DTC stored	INFO
P0391	Camshaft Position Sensor "B" Circuit Range / Performance (Bank 2)	Comes on	DTC stored	INFO
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	Comes on	DTC stored	INFO
P0441	Evaporative Emission Control System Incorrect Purge Flow	Comes on	DTC stored	INFO
P0451	Evaporative Emission Control System Pressure Sensor Range / Performance	Comes on	DTC stored	INFO
P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input	Comes on	DTC stored	INFO
P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input	Comes on	DTC stored	INFO
P0455	Evaporative Emission Control System Leak Detected (Gross Leak)	Comes on	DTC stored	INFO
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	Comes on	DTC stored	INFO
P0458	Evaporative Emission System Purge Control Valve Circuit Low	Comes on	DTC stored	INFO
P0459	Evaporative Emission System Purge Control Valve Circuit High	Comes on	DTC stored	INFO
P0461	Fuel Level Sensor "A" Circuit Range / Performance	Comes on	DTC stored	INFO
P0462	Fuel Level Sensor "A" Circuit Low	Comes on	DTC stored	INFO

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P0463	Fuel Level Sensor "A" Circuit High	Comes on	DTC stored	INFO
P0500	Vehicle Speed Sensor "A"	Comes on	DTC stored	INFO
P0506	Idle Air Control System RPM Lower than Expected	Comes on	DTC stored	INFO
P0507	Idle Air Control System RPM Higher than Expected	Comes on	DTC stored	INFO
P050A	Cold Start Idle Air Control System Performance	Comes on	DTC stored	INFO
P050B	Cold Start Ignition Timing Performance	Comes on	DTC stored	INFO
P0560	System Voltage	Comes on	DTC stored	INFO
P0604	Internal Control Module Random Access Memory (RAM) Error	Comes on	DTC stored	INFO
P0605	Internal Control Module Read Only Memory (ROM) Error	Comes on	DTC stored	INFO
P0606	ECM / PCM Processor	Comes on	DTC stored	INFO
P060A	Internal Control Module Monitoring Processor Performance	Comes on	DTC stored	INFO
P060B	Internal Control Module A/D Processing Performance	Comes on	DTC stored	INFO
P0616	Starter Relay Circuit Low	Comes on	DTC stored	INFO
P0617	Starter Relay Circuit High	Comes on	DTC stored	INFO
P062D	No. 1 Fuel Injector Driver Circuit Performance	Comes on	DTC stored	INFO
P062F	Internal Control Module EEPROM Error	Comes on	DTC stored	INFO
P0700	Transmission Control System (MIL Request)	Comes on	DTC stored	INFO
P0851	Park / Neutral Switch Input Circuit Low	Comes on	DTC stored	INFO
P0852	Park / Neutral Switch Input Circuit High	Comes on	DTC stored	INFO
P1109	Throttle Deposit Malfunction	Does not come on	DTC stored	INFO
P1160	Throttle Valve Return Spring Malfunction	Comes on	DTC stored	INFO
P1170	Port Injector Fuel Performance	Does not come on	DTC stored	INFO

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P117B	Direct Injector Fuel Performance	Does not come on	DTC stored	INFO
P1235	High Pressure Fuel Pump Circuit	Comes on	DTC stored	INFO
P1261	DI Injector Circuit / Open - (Cylinder 1)	Comes on	DTC stored	INFO
P1262	DI Injector Circuit / Open - (Cylinder 2)	Comes on	DTC stored	INFO
P1263	DI Injector Circuit / Open - (Cylinder 3)	Comes on	DTC stored	INFO
P1264	DI Injector Circuit / Open - (Cylinder 4)	Comes on	DTC stored	INFO
P1449	Evaporative Emission System Lid Open Switch Stuck ON	Comes on	DTC stored	INFO
P1451	Fuel Tank Pressure Sensor Range/Performance	Comes on	DTC stored	INFO
P1603	Engine Stall History	Does not come on	DTC stored	INFO
P1604	Startability Malfunction	Does not come on	DTC stored	INFO
P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)	Comes on	DTC stored	INFO
P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)	Comes on	DTC stored	INFO
P2101	Throttle Actuator Control Motor Circuit Range/Performance	Comes on	DTC stored	INFO
P2102	Throttle Actuator Control Motor Circuit Low	Comes on	DTC stored	INFO
P2103	Throttle Actuator Control Motor Circuit High	Comes on	DTC stored	INFO
P2109	Throttle / Pedal Position Sensor "A" Minimum Stop Performance	Does not come on	DTC stored	INFO
P2119	Throttle Actuator Control Throttle Body Range / Performance	Comes on	DTC stored	INFO
P2122	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input	Comes on	DTC stored	INFO
P2123	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input	Comes on	DTC stored	INFO
P2127	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input	Comes on	DTC stored	INFO
P2128	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input	Comes on	DTC stored	INFO
P2135	Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation	Comes on	DTC stored	INFO

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P2138	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation	Comes on	DTC stored	INFO
P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)	Comes on	DTC stored	INFO
P219A	Bank 1 Air-Fuel Ratio Imbalance	Comes on	DTC stored	INFO
P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low	Comes on	DTC stored	INFO
P2402	Evaporative Emission Leak Detection Pump Stuck ON	Comes on	DTC stored	INFO
P2404	Evaporative Emission System Leak Detection Pump Sense Circuit Range / Performance	Comes on	DTC stored	INFO
P2419	Evaporative Emission System Switching Valve Control Circuit Low	Comes on	DTC stored	INFO
P2420	Evaporative Emission Pressure Switching Valve Stuck OFF	Comes on	DTC stored	INFO
P2610	ECM / PCM Internal Engine Off Timer Performance	Comes on	DTC stored	INFO
U0073	Control Module Communication Bus "A" Off	Comes on	DTC stored	INFO
U0101	Lost Communication with TCM	Comes on	DTC stored	INFO
U0122	Lost Communication with Vehicle Dynamics Control Module	Comes on	DTC stored	INFO
U0140	Lost Communication with Body Control Module	Comes on	DTC stored	INFO
U0155	Lost Communication with Instrument Panel Cluster (IPC) Control Module	Comes on	DTC stored	INFO
U0402	Invalid Data Received from TCM	Comes on	DTC stored	INFO
U0416	Invalid Data Received from Vehicle Dynamics Control Module	Comes on	DTC stored	INFO
U0423	Invalid Data Received from Instrument Panel Cluster Control Module	Comes on	DTC stored	INFO



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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDK0XMX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: DTC CHECK / CLEAR (2013 FR-S)		

DTC CHECK / CLEAR

NOTICE:

When the diagnosis system is changed from normal mode to check mode or vice versa, all DTCs and freeze frame data recorded in normal mode are cleared. Before changing modes, always check and make a note of DTCs and freeze frame data.

HINT:

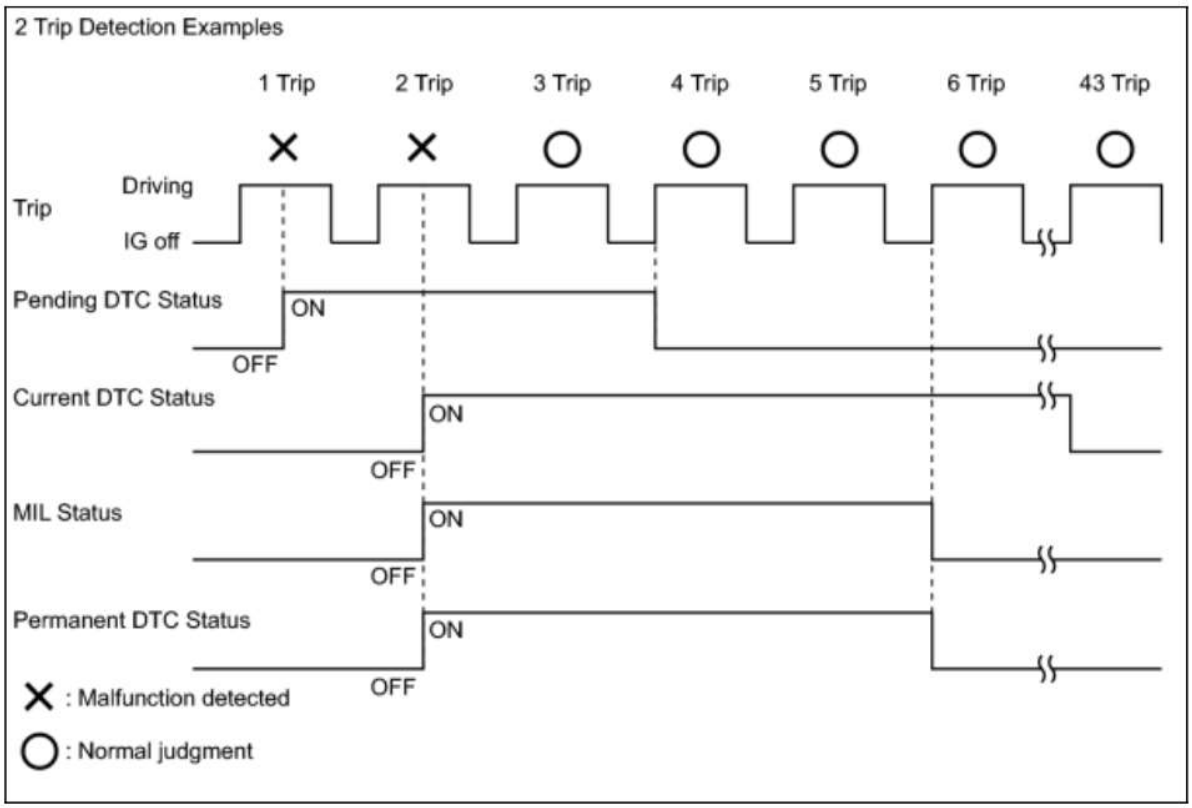
- DTCs which are stored in the ECM can be displayed on the Techstream. The Techstream can display the current, pending and permanent DTCs.
- If a malfunction is detected during the current driving cycle, current and permanent DTCs are stored.
- Some DTCs are not stored if the ECM does not detect the same malfunction again during a second consecutive driving cycle. However, such malfunctions, detected on only one occasion, are stored as pending DTCs.
- Current and pending DTCs can be cleared by using the Techstream or by disconnecting the cable from the negative (-) battery terminal. However, permanent DTCs cannot be cleared using either of these two methods.
- After clearing current DTCs using the Techstream (or by disconnecting the cable from the negative battery terminal), permanent DTCs can be cleared when the system is determined to be normal for the relevant DTCs and then the universal trip is performed. The driving pattern to obtain a normal judgment is described under the "Confirmation Driving Pattern" for the respective DTC.

2 Trip Detection Examples

Pending DTC	Store condition	Malfunction detected
	Clear condition	System determined to be normal or DTCs cleared using Techstream or Cable disconnected from negative (-) battery terminal
Current DTC	Store condition	Malfunction detected (2nd trip)
	Clear condition	No malfunctions in 40 driving cycles or DTCs cleared using Techstream or Cable disconnected from negative (-) battery terminal
Permanent DTC	Store condition	Malfunction detected (2nd trip)
	Clear condition	Ignition switch turned to ON after normal judgment obtained in 3 consecutive driving cycles or After DTCs cleared using Techstream or cable disconnected from negative (-) battery terminal, normal judgment obtained and universal trip performed (not for misfire and fuel system DTCs)

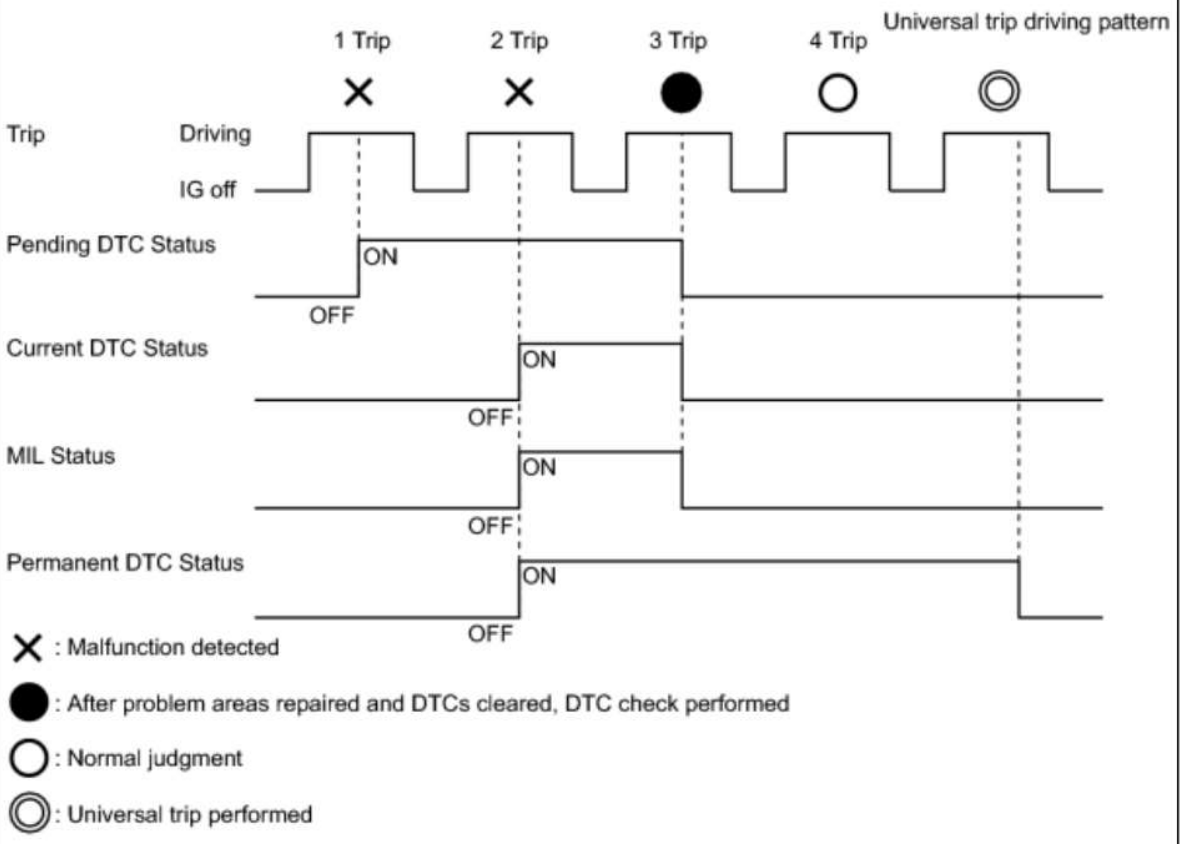
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		or After DTCs cleared using Techstream or cable disconnected from negative (-) battery terminal, malfunction not detected when universal trip driving performed (misfire and fuel system DTCs)
MIL	ON	Malfunction detected (2nd trip)
	OFF	Ignition switch turned to ON after normal judgment obtained in 3 consecutive driving cycles or DTCs cleared using Techstream or Cable disconnected from negative (-) battery terminal



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2 Trip Detection Examples (Instance when DTCs were cleared midway through by using the Techstream or by disconnecting the cable from the negative battery terminal)



HINT:

- Obtaining a normal judgment and performing a universal trip driving pattern can be done in the same driving cycle or in different driving cycles.
- It is unnecessary to obtain a normal judgment if the DTCs are misfire or fuel system DTCs.

1. CHECK DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Check DTCs and freeze frame data, and then write them down.

(f) Check the details of the DTCs INFO .

2. CLEAR DTC (Pending and Current DTC)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Clear DTCs.

3. CLEAR DTC (Pending and Current DTC without using Techstream)

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(a) Perform either of the following operations:

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

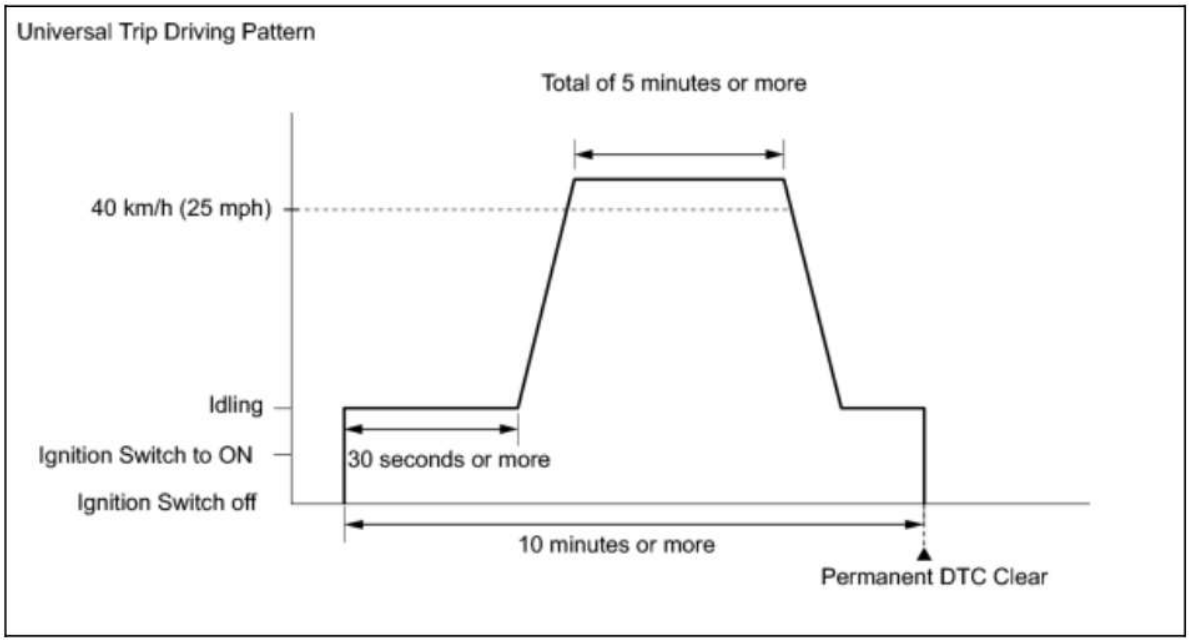
(1) Disconnect the cable from the negative (-) battery terminal for more than 1 minute.

(2) Remove the EFI (+B) fuse from the engine room relay block assembly located inside the engine compartment for more than 1 minute.

4. CLEAR PERMANENT DTC

HINT:

Even if the following procedure is not performed, permanent DTCs are cleared by obtaining a normal judgment during 3 consecutive driving cycles.



(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Check if permanent DTCs are stored.

HINT:

If permanent DTCs are not output, it is not necessary to continue this procedure.

(f) Clear DTCs.

(g) Perform the respective confirmation driving patterns in order to obtain a normal judgment for the output DTCs.

HINT:

- Confirmation driving patterns do not need to be performed for misfire and fuel system DTCs.
- For the confirmation driving pattern, refer to the procedures for the relevant DTC INFO .

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(h) Perform the universal trip.

HINT:

The driving pattern to obtain a normal judgment and the universal trip driving can be performed consecutively in the same driving cycle.

1. Idle the engine for 30 seconds or more.
2. Drive the vehicle at 40 km/h (25 mph) or more for a total of 5 minutes or more.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

HINT:

It is possible to complete the drive pattern even if the vehicle decelerates to less than 40 km/h (25 mph) during the driving cycle provided that the vehicle is driven at 40 km/h (25 mph) or more for a total of 5 minutes.

3. Allow 10 minutes or more to elapse from the time the engine is started.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Check that the permanent DTCs have been cleared.

HINT:

The permanent DTCs are cleared when the universal trip is completed.



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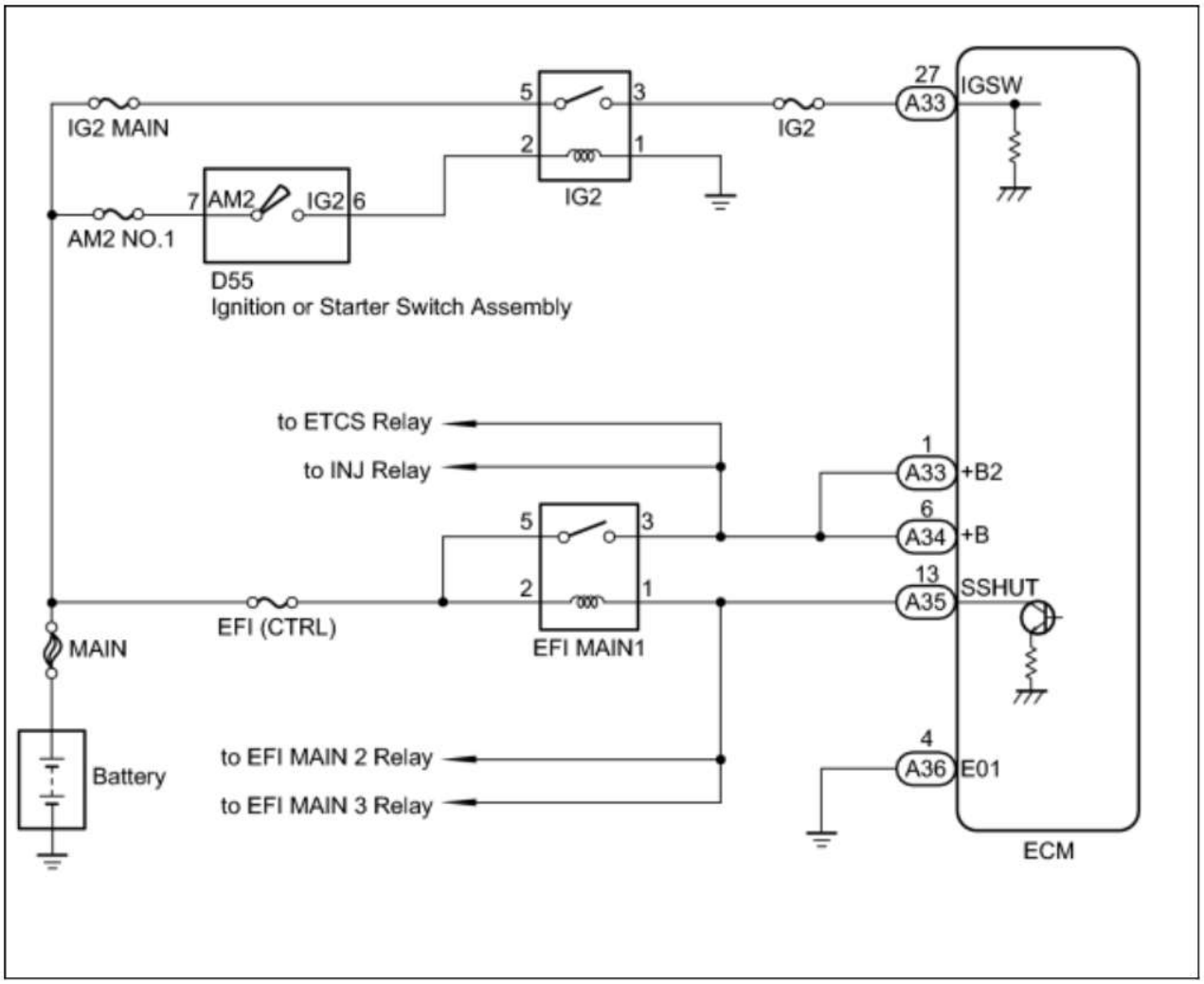
Last Modified: 4-14-2014	6.6 J	Doc ID: RM000001F7102QX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: ECM Power Source Circuit; 2013 MY FR-S [03/2012 - 05/2013]		

ECM Power Source Circuit

DESCRIPTION

When the ignition switch is turned to ON, the IGSW signal is input into the ECM. This turns the internal transistor ON, causing the current to flow to the EFI MAIN1 relay coil, which closes the relay, supplying power to the ECM +B and +B2 terminals.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

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Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

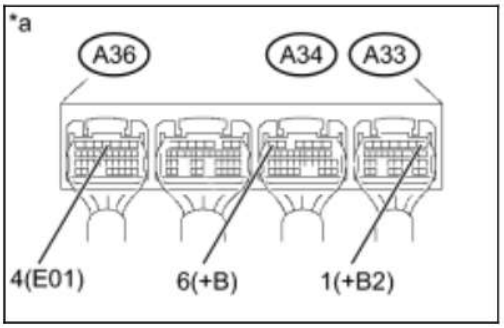
1.	INSPECT ECM (POWER SOURCE VOLTAGE)

(a) Turn the ignition switch to ON.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-6 (+B) - A36-4 (E01)	Ignition switch ON	12 to 14 V
A33-1 (+B2) - A36-4 (E01)	Ignition switch ON	12 to 14 V



Text in Illustration

*a	Component with harness connected (ECM)

NG ▶ GO TO STEP 4

OK ▼

2.	CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)

(a) Disconnect the ECM connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-4 (E01) - Body ground	Always	Below 1 Ω

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

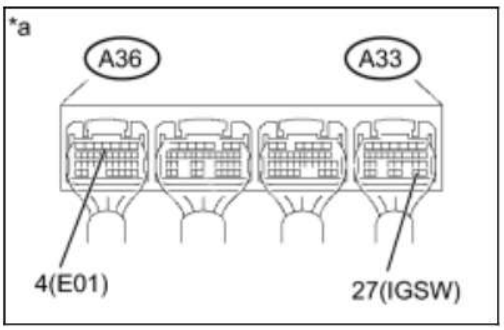
3.	INSPECT ECM (IGSW TERMINAL VOLTAGE)

(a) Turn the ignition switch to ON.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-27 (IGSW) - A36-4 (E01)	Ignition switch ON	10 to 13 V



Text in Illustration

*a	Component without harness connected (ECM)

NG ▶ GO TO STEP 8

OK ▶ REPLACE ECM

4.	INSPECT ECM (SSHUT TERMINAL VOLTAGE)

(a) Turn the ignition switch to ON.

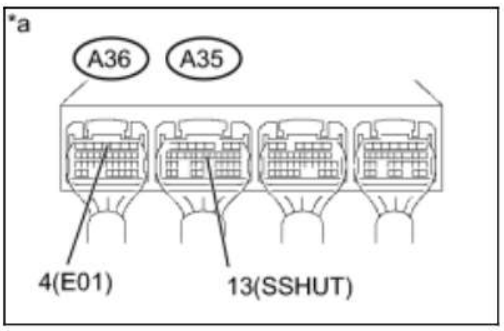
(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION

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A35-13 (SSHUT) - A36-4 (E01)	Ignition switch ON	approximately 0 V



Text in Illustration

*a	Component without harness connected (ECM)

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

5.	INSPECT RELAY (EFI MAIN1)

(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ REPLACE RELAY (EFI MAIN1)

OK ▼

6.	CHECK HARNESS AND CONNECTOR (EFI MAIN1 RELAY - ECM)

(a) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 1 - A35-13 (SSHUT)	Always	Below 1 Ω
EFI MAIN1 relay terminal 3 - A34-6 (+B)	Always	Below 1 Ω
EFI MAIN1 relay terminal 3 - A33-1 (+B2)	Always	Below 1 Ω

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Standard Resistance (Check for short):

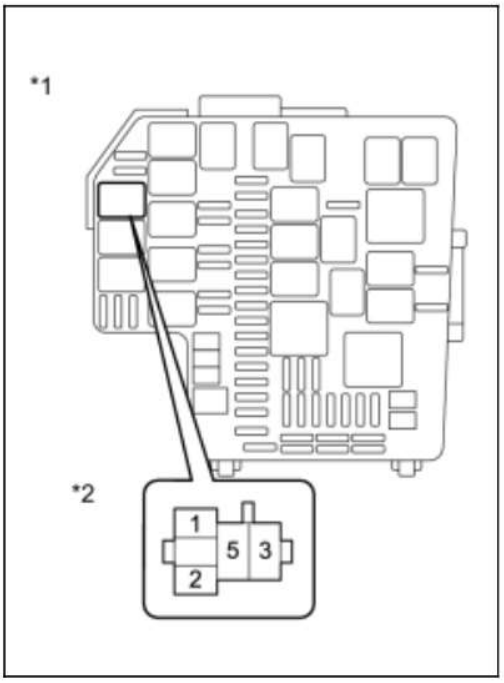
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 1 or A35-13 (SSHUT) - Body ground	Always	10 kΩ or higher
EFI MAIN1 relay terminal 3, A34-6 (+B) or A33-1 (+B2) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

7.	INSPECT TERMINAL VOLTAGE (EFI MAIN1 RELAY)

(a) Remove the EFI MAIN1 relay from the engine room relay block assembly.



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 2 - Body ground	Always	11 to 14 V
EFI MAIN1 relay terminal 5 - Body ground	Always	11 to 14 V

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Text in Illustration

*1	Engine Room Relay Block Assembly
*2	EFI MAIN1 Relay Terminal

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

8.	CHECK HARNESS AND CONNECTOR (IG2 RELAY - ECM)

(a) Remove the IG2 relay from the engine room relay block assembly.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 relay terminal 3 - A33-27 (IGSW)	Always	Below 1 Ω
IG2 relay terminal 1 - Body ground	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 relay terminal 3 or A33-27 (IGSW) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

9.	INSPECT RELAY (IG2)

(a) Inspect the IG2 relay INFO .

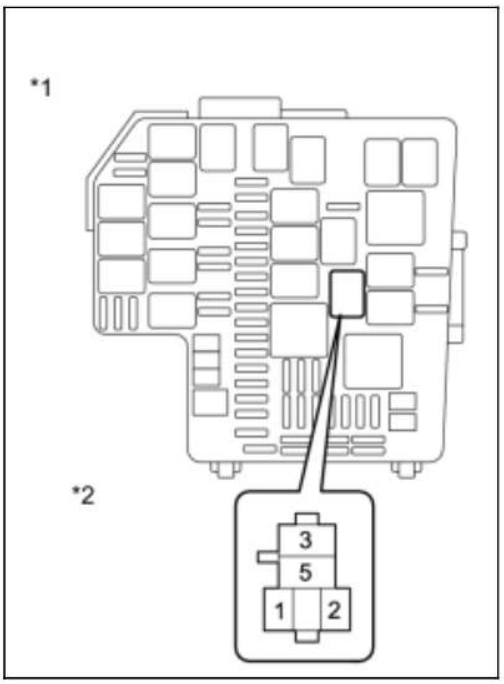
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NG ▶ REPLACE RELAY (IG2)

OK ▼

10.	INSPECT TERMINAL VOLTAGE (IG2 RELAY)

(a) Remove the IG2 relay from the engine room relay block assembly.



(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 relay terminal 5 - Body ground	Always	11 to 14 V

Text in Illustration

*1	Engine Room Relay Block Assembly
*2	IG2 Relay Terminal

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

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11.	CHECK HARNESS AND CONNECTOR (IG2 RELAY - IGNITION OR STARTER SWITCH ASSEMBLY)

(a) Remove the IG2 relay from the engine room relay block assembly.

(b) Disconnect the ignition or starter switch assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 relay terminal 2 - D55-6 (IG2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
IG2 relay terminal 2 or D55-6 (IG2) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

12.	INSPECT IGNITION OR STARTER SWITCH ASSEMBLY

(a) Inspect the ignition or starter switch assembly INFO .

NG ▶ REPLACE IGNITION OR STARTER SWITCH ASSEMBLY

OK ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

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Last Modified: 4-14-2014	6.6 J	Doc ID: RM0000011IO036X
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: EVAP System; 2013 MY FR-S [03/2012 -]		

EVAP System

RELATED DTCS

DTC NO.	MONITORING ITEM	SEE PAGE
P0441	Purge flow	INFO
P0451	Difference between canister pressure sensor (built into canister pump module) output value and manifold absolute pressure sensor output value	INFO
P0452	Canister pressure sensor (built into canister pump module) voltage low	
P0453	Canister pressure sensor (built into canister pump module) voltage high	
P0455	EVAP gross leak	INFO
P0456	EVAP small leak	
P0458	Purge valve voltage low	INFO
P0459	Purge valve voltage high	
P1449	Air filter clogged (built into canister pump module)	INFO
P1451	Pipe clogged	INFO
P2404	• Reference orifice high-flow (built into canister pump module) • Reference orifice low-flow (built into canister pump module)	
P2401	Leak detection pump stuck OFF (built into canister pump module)	INFO
P2402	Leak detection pump stuck ON (built into canister pump module)	
P2419	Vent valve stuck closed (built into canister pump module)	
P2420	Vent valve stuck open (vent) (built into canister pump module)	
P2610	Soak timer (built into ECM)	INFO

If any EVAP system DTCs are stored, the malfunctioning area can be determined using the table below.

Malfunctioning Areas \ DTCs	P0441	P0451	P0452	P0453	P0455	P0456	P0458	P0459

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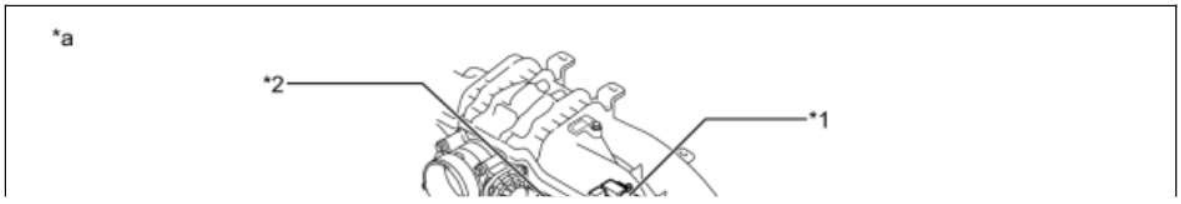
Purge valve stuck open	●				●			
Purge valve stuck closed	●							
Purge valve low output							●	
Purge valve high output								●
Canister pressure sensor signal fixed		●						
Canister pressure sensor low output			●					
Canister pressure sensor high output				●				
Gross leak	●				●			
Small leak						●		

Malfunctioning Areas \ DTCs	P1449	P1451	P2401	P2402	P2404	P2419	P2420
Reference orifice low-flow					●		
Reference orifice high-flow					●		
Leak detection pump stuck OFF			●		●		
Leak detection pump stuck ON				●	●		
Vent valve stuck closed					●	●	
Vent valve stuck open					●		●
Canister filter clogged		●					
Pipe clogged	●						

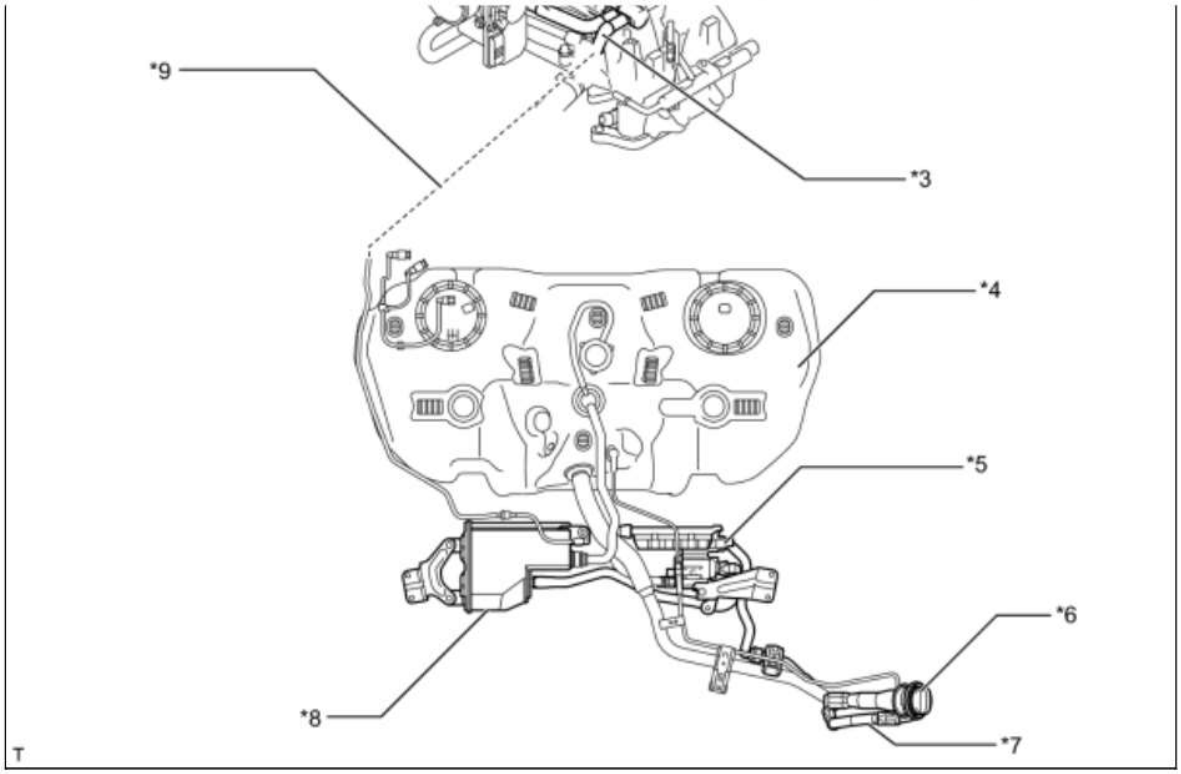
NOTICE:

If the reference pressure difference between the first and second checks is more than the specification, all the DTCs relating to the reference pressure (P0455, P0456, P1451, P2404) will all be stored.

DESCRIPTION



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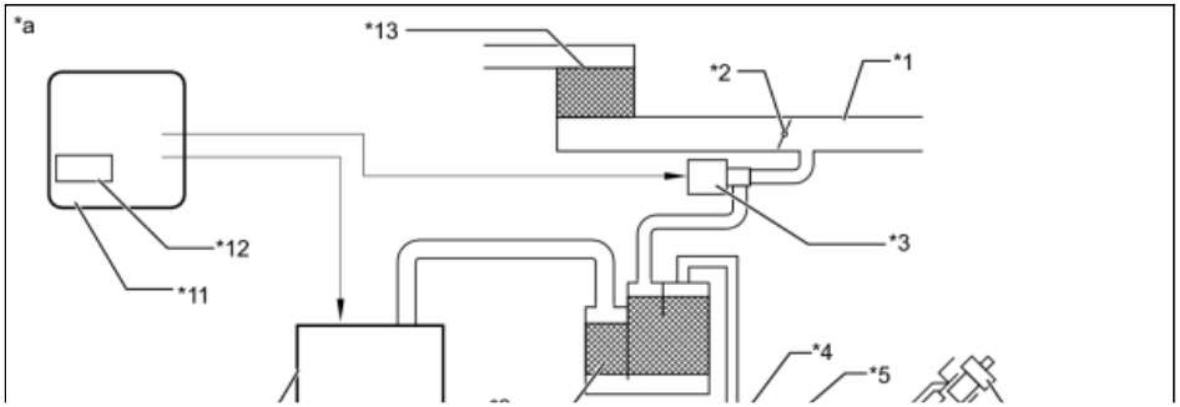


Text in Illustration

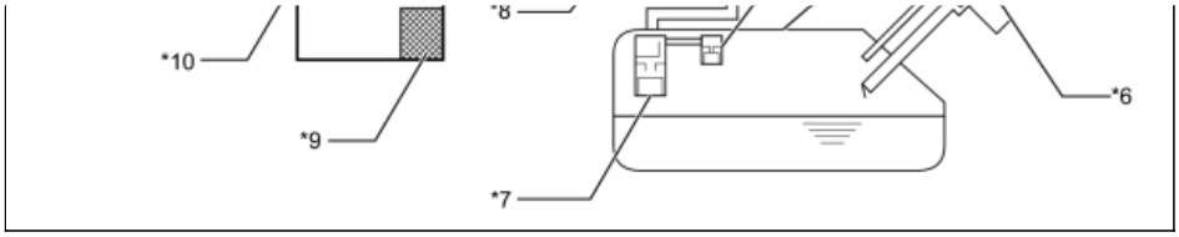
*1	Purge Valve	*2	EVAP Hose (to Intake Manifold)
*3	EVAP Hose (from Charcoal Canister Assembly)	*4	Fuel Tank
*5	Canister Pump Module - Canister Pressure Sensor - Leak Detection Pump - Vent Valve - Canister filter	*6	Fuel Tank Cap Assembly
*7	Air Inlet Port	*8	Charcoal Canister Assembly
*9	Purge Line	-	-
*a	Location of EVAP (Evaporative Emission) System	-	-

HINT:

The canister pressure sensor, the canister filter, the leak detection pump and the vent valve are built into the canister pump module.



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Text in Illustration

*1	Intake Manifold	*2	Throttle Valve
*3	Purge Valve	*4	Cut-off Valve
*5	Fuel Tank	*6	Fuel Tank Cap Assembly
*7	Fuel Tank Vent Valve	*8	Charcoal Canister Assembly (Charcoal Filter)
*9	Canister Filter	*10	Canister Pump Module
*11	ECM	*12	Soak Timer
*13	Air Cleaner	-	-
*a	EVAP System Circuit	-	-

NOTICE:

In the EVAP system of this vehicle, turning ON the vent valve does not seal off the EVAP system. To check for leaks in the EVAP system, disconnect the air inlet drain hose and apply pressure from atmospheric side of the charcoal canister assembly.

While the engine is running, if a predetermined condition (closed-loop, etc.) is met, the purge valve is opened by the ECM and fuel vapors stored in the charcoal canister assembly are purged to the intake manifold. The ECM changes the duty cycle ratio of the purge valve to control purge flow volume.

The purge flow volume is also determined by the intake manifold pressure. Atmospheric pressure is allowed into the charcoal canister assembly through the vent valve to ensure that the purge flow is maintained when negative pressure (vacuum) is applied to the charcoal canister assembly.

The following two monitors run to confirm appropriate EVAP system operation.

1. Purge flow monitor

The purge flow monitor consists of the 2 monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

- The 1st monitor

  While the engine is running and the purge valve (Vacuum Switching Valve) is on (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If the variation in the pressure is less than threshold, the ECM begins the 2nd monitor.

- The 2nd monitor

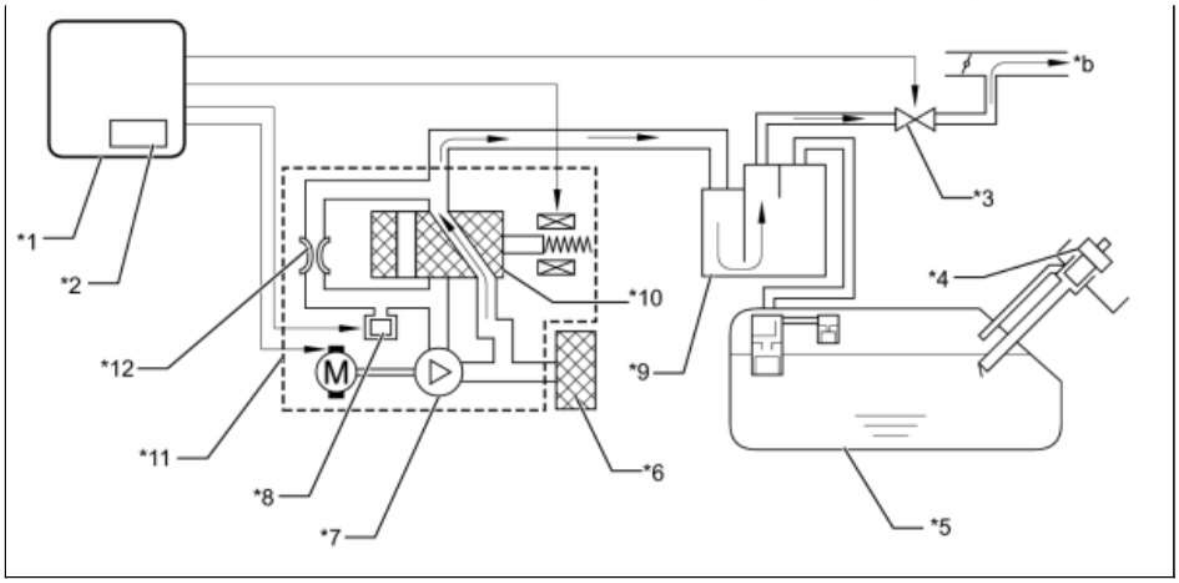
  The vent valve is turned ON (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than threshold, the ECM interprets this as the purge valve being stuck closed, and illuminates the MIL and stores DTC P0441 (2 trip detection logic).

Atmospheric pressure check:

In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after of the purge flow monitor, is measured by the ECM.



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Text in Illustration

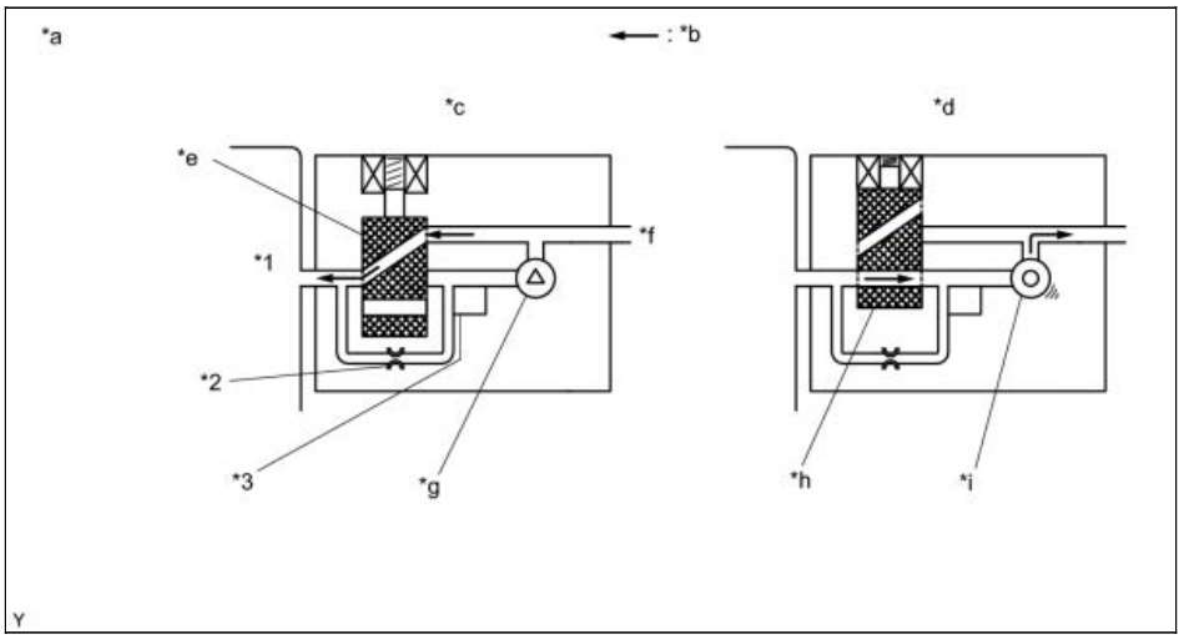
*1	ECM	*2	Soak Timer
*3	Purge Valve (on)	*4	Fuel Tank Cap Assembly
*5	Fuel Tank	*6	Canister Filter
*7	Leak Detection Pump (off)	*8	Canister Pressure Sensor
*9	Charcoal Canister Assembly	*10	Vent Valve (off)
*11	Canister Pump Module	*12	Reference Orifice (0.02 inch)
*a	EVAP Purge Flow	*b	to Intake Manifold

COMPONENT	OPERATION
Charcoal Canister Assembly	Contains activated charcoal to absorb EVAP (Evaporative Emissions) generated in fuel tank.
Cut-off valve	Located in fuel tank. Valve closes by its own weight when vehicle overturns to prevent fuel from spilling out.
Purge valve (Vacuum Switching Valve)	Opens or closes line between charcoal canister assembly and intake manifold. ECM uses purge valve to control EVAP purge flow. In order to discharge EVAP absorbed by charcoal canister assembly to intake manifold, ECM opens purge valve. EVAP discharge volume to intake manifold controlled by purge valve duty cycle (current-carrying time). (Open: on, Close: off)
Fuel tank vent valve	Located in the fuel tank. Passes evaporative emissions occurring during fueling to the charcoal canister assembly. Additionally, this mechanism also detects when the fuel tank is full.
Soak timer	Built into ECM. To ensure accurate EVAP monitor, measures 5 hours (+/-15 min) after ignition switch is turned off. This allows fuel to cool down, stabilizing EVAP pressure. When approximately 5 hours elapsed, ECM activates (refer to fig. 3).
Canister pump module	Consists of (a) to (d) below. Canister pump module cannot be disassembled.
(a) Vent valve	Vents and closes EVAP system. When ECM turns valve on, EVAP system is closed. When ECM turns valve off, EVAP system is vented. Negative pressure (vacuum) is created in EVAP system to check for EVAP leaks by closing purge valve, turning on vent valve (closing it) and operating leak detection

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	pump (refer to fig. 1).
(b) Canister pressure sensor	Indicates pressure as voltages. ECM supplies regulated 5 V to pressure sensor, and uses feedback from sensor to monitor EVAP system pressure (refer to fig. 2).
(c) Leak detection pump	Creates negative pressure (vacuum) in EVAP system for leak check.
(d) Reference orifice	Has opening with 0.02 inch diameter. Vacuum is produced through orifice by closing purge valve, turning off vent valve and operating leak detection pump, to monitor reference pressure. Reference pressure indicates a small leak of EVAP.

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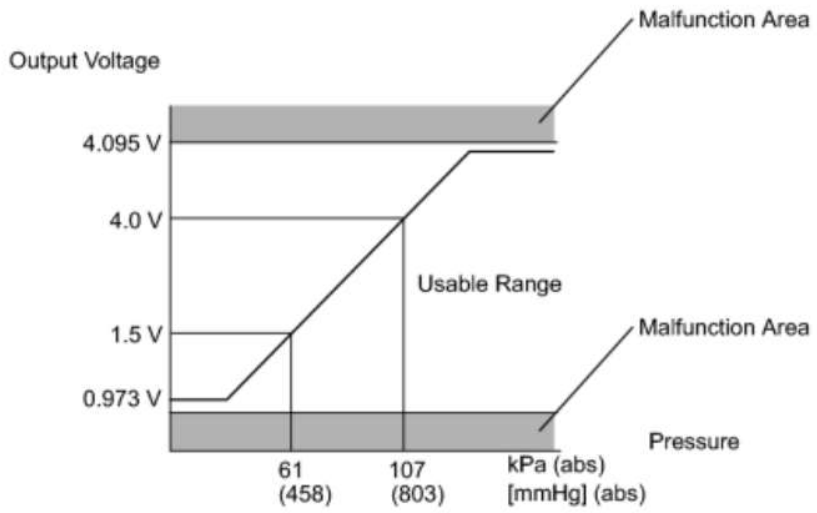


Text in Illustration

*1	Canister	*2	Reference Orifice (0.02 Inch)
*3	Canister Pressure Sensor	-	-

*a	Canister Pump Module (fig. 1)	*b	Airflow
*c	Condition: Purge Flow	*d	Condition: Leak Check
*e	Vent Valve: off (vent)	*f	to Canister Filter (Atmosphere)
*g	Leak Detection Pump: off	*h	Vent Valve: on (closed)
*i	Leak Detection Pump: on	-	-

Canister Pressure Sensor Specification (fig.2)



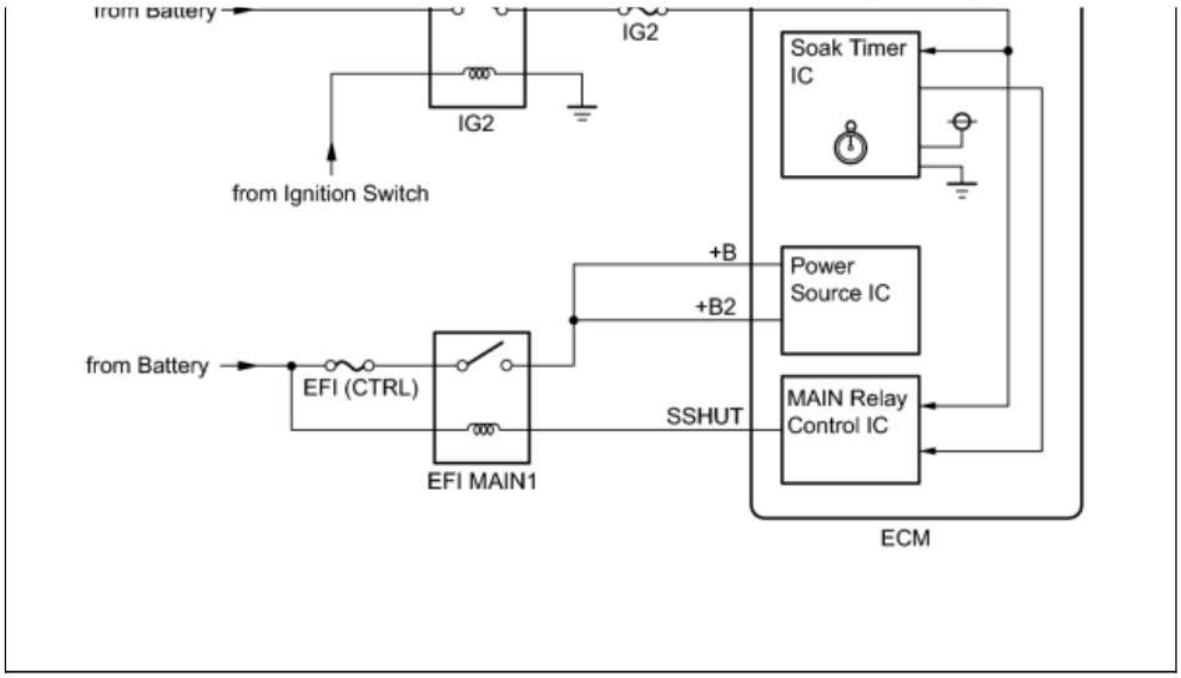
HINT:

Standard atmospheric pressure is 101.3 kPa (abs) [760 mmHg (abs)]

fig. 3



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WIRING DIAGRAM

Refer to DTC P0451 INFO .

INSPECTION PROCEDURE

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following inspection procedure.
- The Techstream is required to conduct the following diagnostic troubleshooting procedure.

HINT:

- Using the Techstream monitor results enables the EVAP (Evaporative Emission) system to be confirmed.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	CONFIRM DTC

(a) Turn the ignition switch off and wait for 10 seconds.

(b) Turn the ignition switch to ON.

(c) Turn the ignition switch off and wait for 10 seconds.

(d) Connect the Techstream to the DLC3.

(e) Turn the ignition switch to ON and turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine / Trouble Codes.

(g) Confirm DTCs and freeze frame data.

If any EVAP system DTCs are stored, the malfunctioning area can be determined using the table below.

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DTCs / Malfunctioning Areas	P0441	P0451	P0452	P0453	P0455	P0456	P0458	P0459
Purge valve stuck open	●				●			
Purge valve stuck closed	●							
Purge valve low output							●	
Purge valve high output								●
Canister pressure sensor signal fixed		●						
Canister pressure sensor low output			●					
Canister pressure sensor high output				●				
Gross leak	●				●			
Small leak						●		

DTCs / Malfunctioning Areas	P1449	P1451	P2401	P2402	P2404	P2419	P2420
Reference orifice low-flow					●		
Reference orifice high-flow					●		
Leak detection pump stuck OFF			●		●		
Leak detection pump stuck ON							

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Leak detection pump stuck ON				●	●		
Vent valve stuck closed					●	●	
Vent valve stuck open					●		●
Canister filter clogged		●					
Pipe clogged	●						

NOTICE:

If the reference pressure difference between the first and second checks is more than the specification, all the DTCs relating to the reference pressure (P0455, P0456, P1451, P2404) will all be stored.

NEXT

2.	PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F) and the coolant temperature below 45°C (113°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

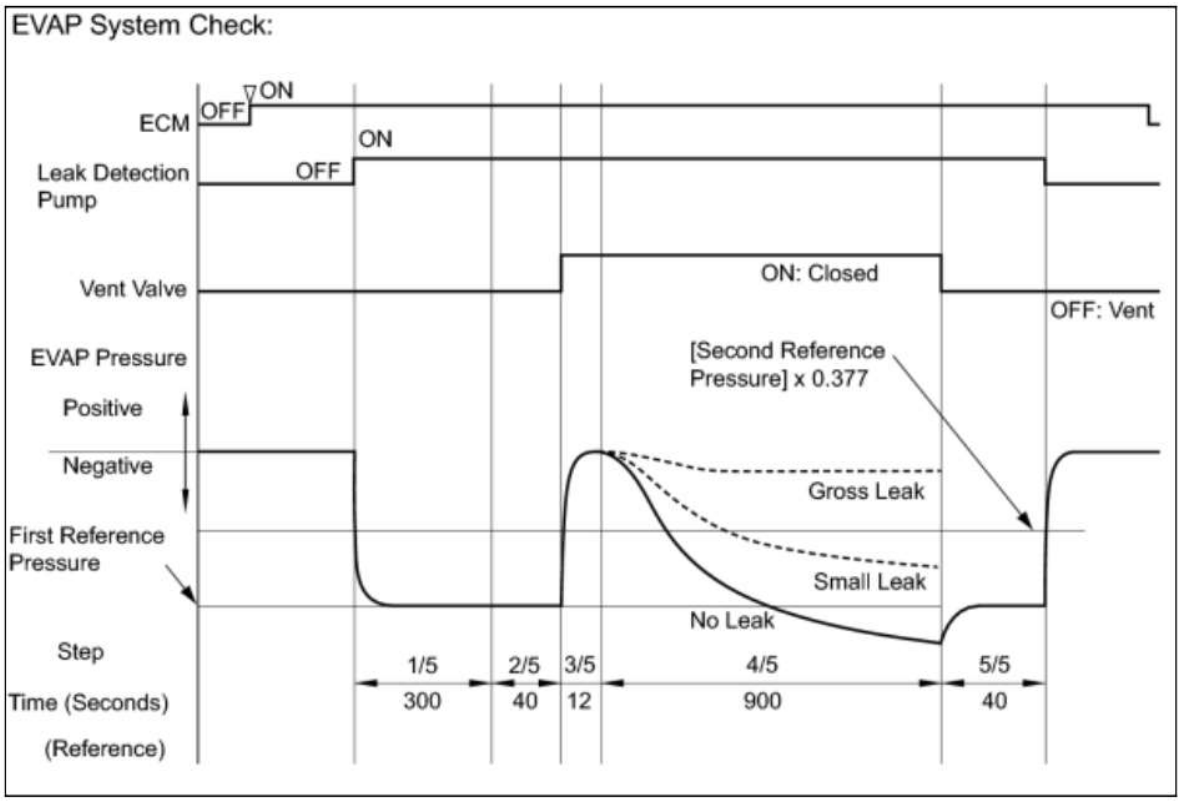
(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.

(f) After the EVAP SYSTEM CHECK is completed, check for pending DTCs by entering the following menus: Powertrain / Engine / Trouble Codes.

NEXT

3.	PERFORM EVAP SYSTEM CHECK (MANUAL MODE)

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NOTICE:

- In the Evaporative System Check (Manual Mode), the series of 5 Evaporative System Check steps are performed manually using the Techstream.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F) and the coolant temperature below 45°C (113°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

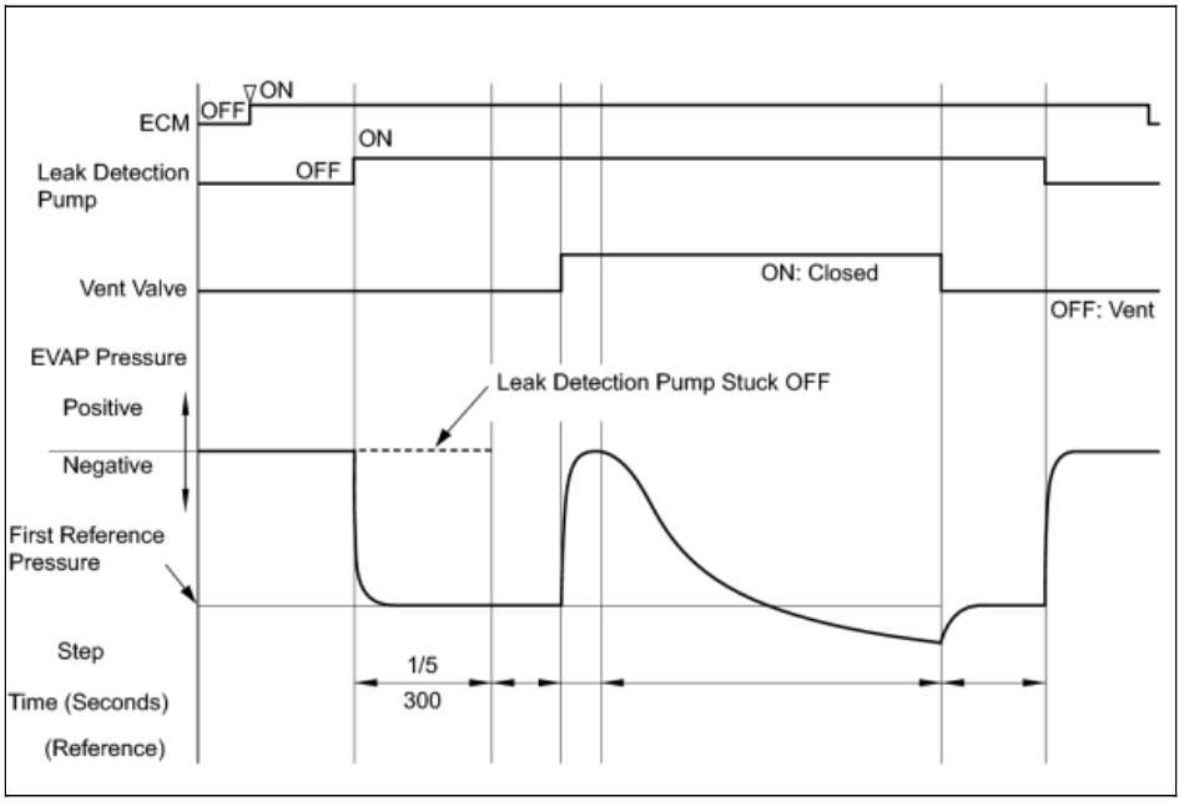
(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Manual Mode.

NEXT

NEXT

4.	PERFORM EVAP SYSTEM CHECK (STEP 1/ 5)



(a) Check the EVAP pressure in step 1/5.

Result

DTC *	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	Virtually no variation in EVAP pressure	Not yet determined	A
P2404	EVAP pressure is less than -0.224 kPa(gauge) [2 mmHg(gauge)]	Leak detection pump stuck OFF	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

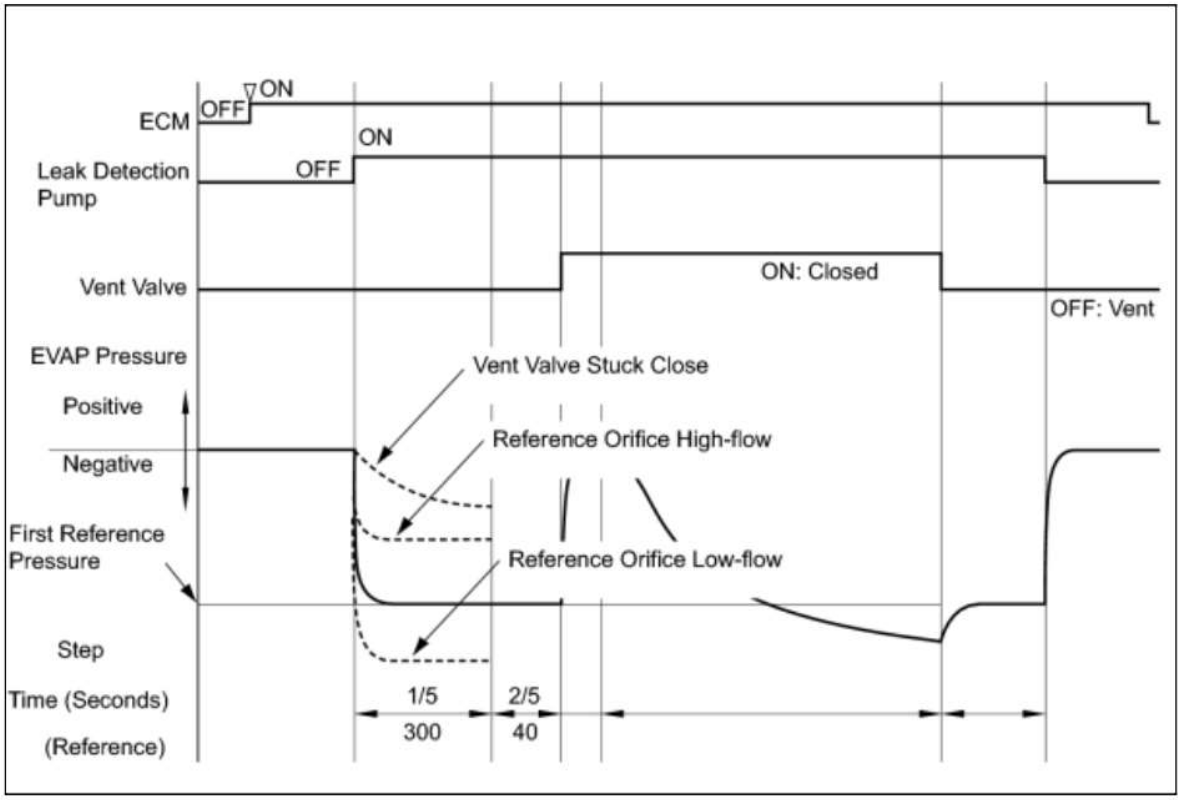
B GO TO STEP 9

A

5	PERFORM EVAP SYSTEM CHECK (STEP 2/ 5)

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5.	PERFORM EVAP SYSTEM CHECK (STEP 2/ 5)



(a) Check the EVAP pressure in steps 2/5.

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	Virtually no variation in EVAP pressure	Not yet determined	A
P2404	EVAP pressure fluctuates by more than +/- 0.3 kPa (gauge) [2 mmHg (gauge)]	• Vent valve stuck close • Reference orifice high-flow • Reference orifice low-flow	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

HINT:

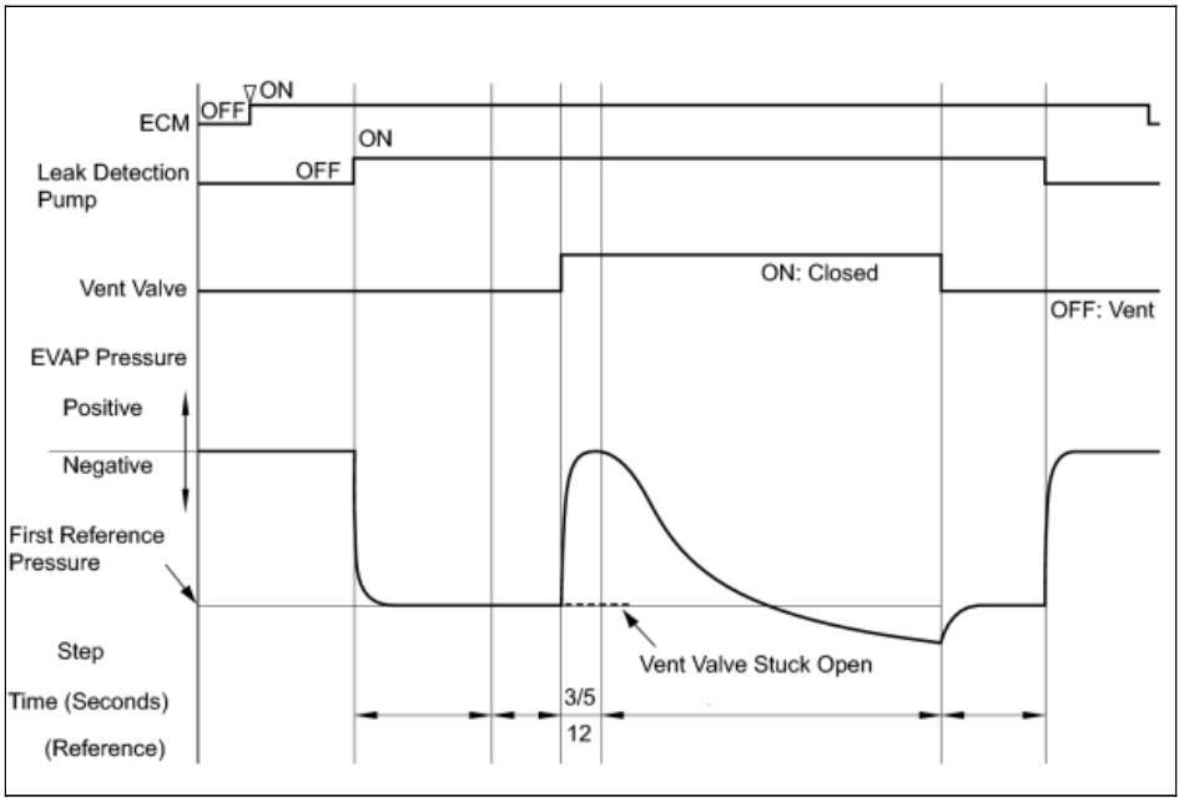
The first reference pressure is the value determined in step 2/5.

B ▶ GO TO STEP 12

A

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6.	PERFORM EVAP SYSTEM CHECK (STEP 3/ 5)



(a) Check the EVAP pressure in step 3/5.

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure increases by 0.2 kPa (gauge) [2 mmHg (gauge)] or more within 12 seconds.	Not yet determined	A
P2404	• EVAP pressure increases by less than 0.2 kPa (gauge) [2 mmHg (gauge)] within 12 seconds. • Virtually no variation in EVAP pressure	Vent valve stuck open	B

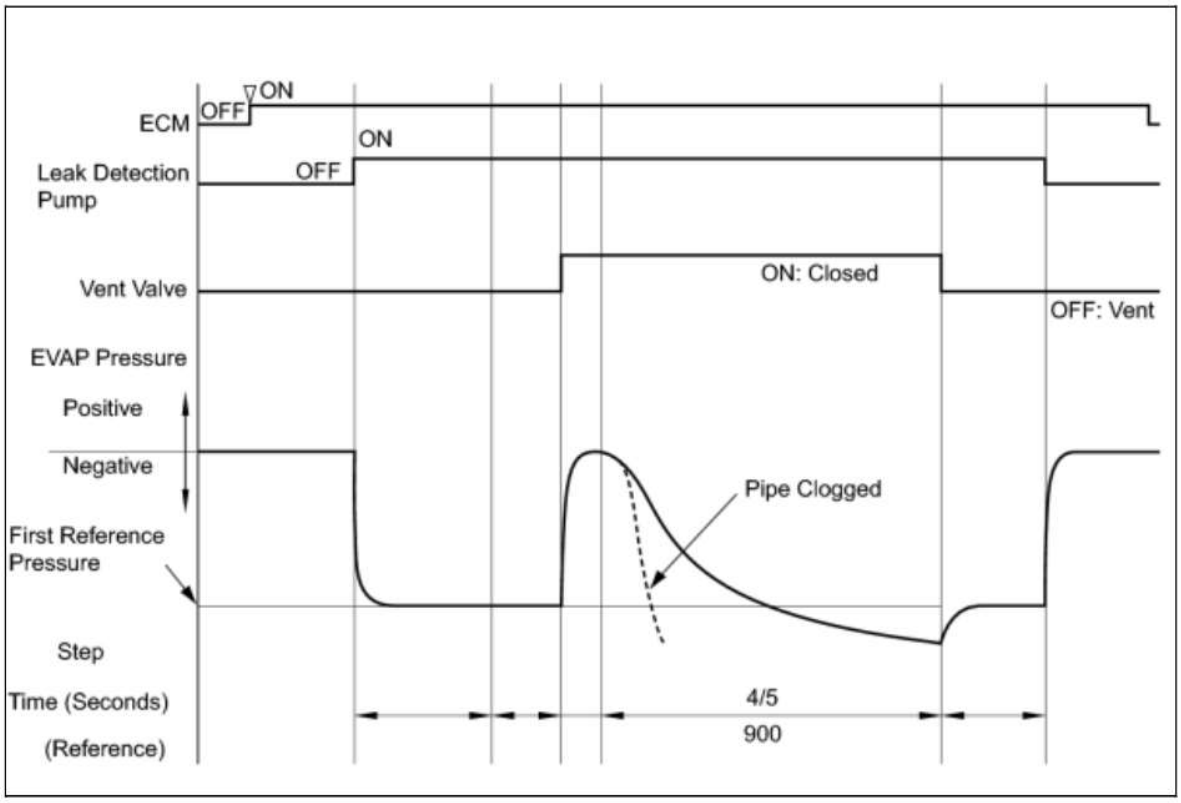
*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

B GO TO STEP 14

A

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7.	PERFORM EVAP SYSTEM CHECK (STEP 4/ 5)



(a) Check the EVAP pressure in step 4/5.

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure is more than -5 kPa (gauge) [-38 mmHg (gauge)] within 900 seconds	Not yet determined	A
P1451	EVAP pressure is reference pressure -0.9 kPa [- 7 mmHg] less then -5 kPa (gauge) [-38 mmHg (gauge)] within 27 seconds	Pipe clogged	B

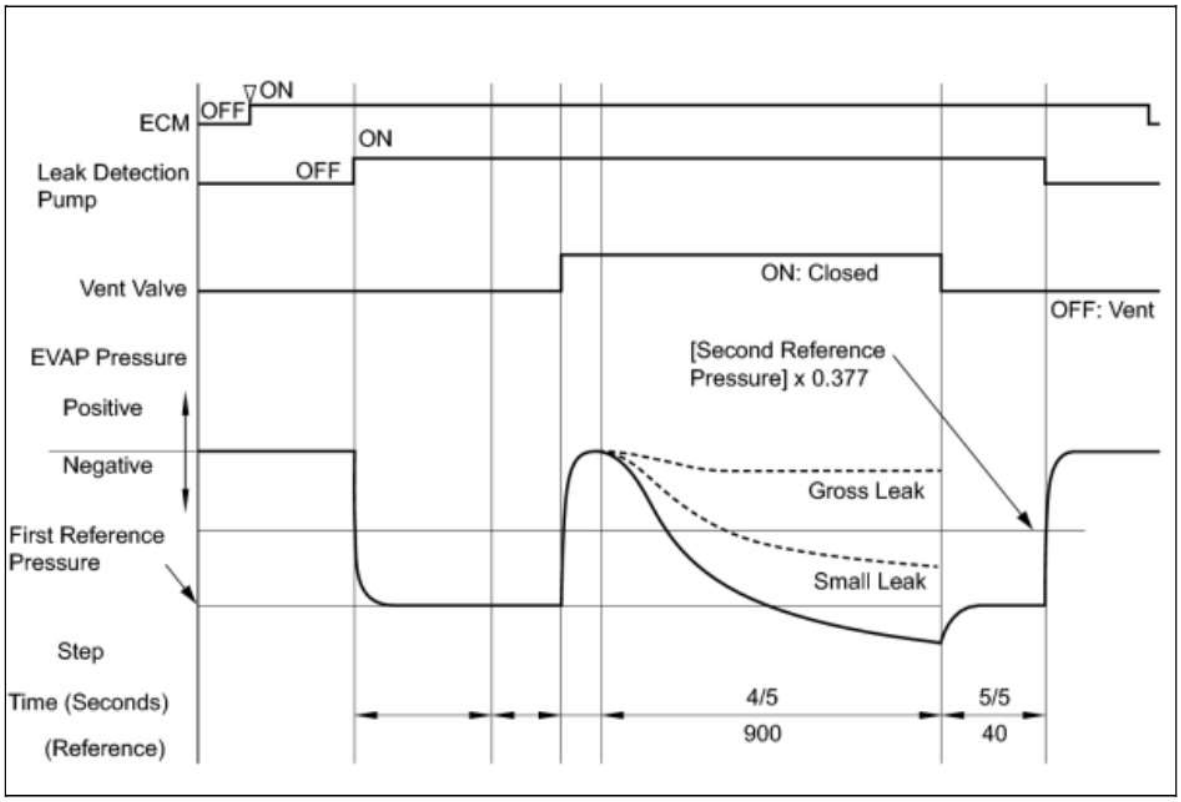
*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

B ▶ GO TO STEP 18

A ▼

8.	PERFORM EVAP SYSTEM CHECK (STEP 5/ 5)

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(a) Check the EVAP pressure in step 5/5.

(b) Compare the EVAP pressure in step 4/5 and the reference pressure (step 5/5).

Result

DTC*	RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
-	EVAP pressure increases by 0.3 kPa (gauge) [2 mmHg (gauge)] or less within 40 seconds.	Not yet determined (no leakage from EVAP system)	A
P2404	EVAP pressure increases by more than 0.3 kPa (gauge) [2 mmHg (gauge)] within 40 seconds of proceeding from step 4/5 to 5/5	EVAP gross leak	B
P0455	EVAP pressure from step 4/5 higher than [reference pressure (step 4/5) x 0.377]	EVAP gross leak	B
P0456	EVAP pressure from step 4/5 higher than reference pressure (step D)	EVAP small leak	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in the "Confirm DTC" procedure above.

A ▶ GO TO STEP 27

B ▶ GO TO STEP 20

9.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE VACUUM PUMP)

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(a) Enter the following menus: Powertrain / Engine / Active Test / Activate the Vacuum Pump.

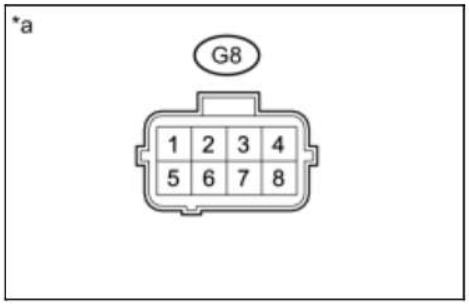
(b) Measure the voltage according to the value(s) in the table below.

Text in Illustration

*a	Front view of wire harness connector (to Canister Pump Module)

Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
G8-4 - Body ground	Leak detection pump on and off (Active Test ON and OFF)	Approximately 0 V when OFF and ON	Power source wire harness of leak detection pump	A
		10 to 13 V when OFF and ON	• Wire harness or connector between leak detection pump and ECM • ECM	B
		10 to 13 V when OFF Approximately 0 V when ON	Leak detection pump	C



B ▶ GO TO STEP 11

C ▶ GO TO STEP 28

A ▼

10.	INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR LEAK DETECTION PUMP)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

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Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
G8-3 - Body ground	Ignition switch ON	11 to 14 V	Canister pump module	A
		Below 1 V	Wire harness or connector between canister pump module and battery	B

A ▶ GO TO STEP 28

B ▶ GO TO STEP 25

11.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-8 (MPMP) - G8-4	Always	Below 1 Ω
A35-8 (MPMP) or G8-4 - Body ground	Always	10 kΩ or higher

Result

RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
OK	ECM	A
NG	Wire harness or connector between ECM and canister pump module	B

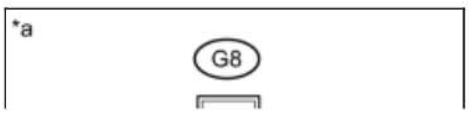
A ▶ GO TO STEP 30

B ▶ GO TO STEP 25

12.	INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.



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Text in Illustration

*a	Component without harness connected (Canister Pump Module)



(c) Apply the battery voltage to terminals G8-5 and G8-1 of the canister pump module.

(d) Touch the canister pump module to confirm the vent valve operation.

Result

CONDITION	TESTER RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Apply battery voltage to terminals G8-5 and G8-1	Operating	• Wire harness or connector between vent valve and ECM • Leak detection pump performance deteriorates • Leak detection pump circuit malfunctioning (large resistance exists in the circuit) • ECM	A
	Not operating	Vent valve	B

B ▶ GO TO STEP 28

A ▼

13.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for Open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-1 (VPMP) - G8-1	Always	Below 1 Ω

Standard Resistance (Check for Short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-1 (VPMP) or G8-1 - Body ground	Always	10 kΩ or higher

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Result

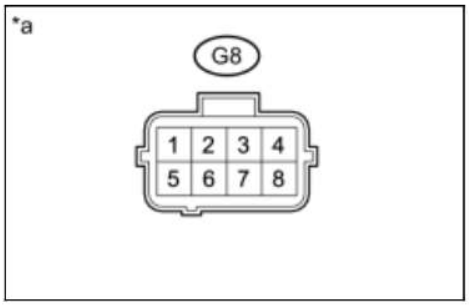
RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
OK	ECM	A
NG	Wire harness or connector between ECM and canister pump module	B

A ▶ GO TO STEP 30

B ▶ GO TO STEP 25

14.	INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR VENT VALVE)

(a) Turn the ignition switch off.



Text in Illustration

*a	Front view of wire harness connector (to Canister Pump Module)

(b) Disconnect the canister pump module connector.

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

Result

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
G8-5 - Body ground	Ignition switch ON	11 to 14 V	• Wire harness or connector between vent valve and ECM • Vent valve • Charcoal canister assembly (charcoal filter inside canister) clogged • ECM	A
		Below 1 V	Power source wire harness of vent valve	B

B ▶ GO TO STEP 25

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A

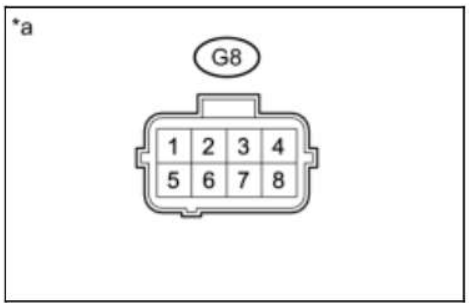
15.	INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

Text in Illustration

*a	Component without harness connected (Canister Pump Module)



(c) Apply the battery voltage to terminals G8-5 and G8-1 of the pump module.

(d) Touch the canister pump module to confirm the vent valve operation.

Result

CONDITION	TESTER RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Apply battery voltage to terminals G8-5 and G8-1	Operating	• Wire harness or connector between vent valve and ECM • Leak detection pump performance deteriorates • Leak detection pump circuit malfunctioning (large resistance exists in the circuit) • ECM	A
	Not operating	• Vent valve	B

B ▶ GO TO STEP 28

A

16.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Disconnect the ECM connector.

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(d) Measure the resistance according to the value(s) in the table below.

Result

TESTER CONNECTION	CONDITION	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
A35-1 (VPMP) - G8-1	Always	Below 1 Ω	• Charcoal canister assembly (charcoal filter inside canister) clogged • ECM	A
		10 kΩ or higher	Wire harness or connector between ECM and charcoal canister assembly pump module	B

B ▶ GO TO STEP 25

A ▼

17.	INSPECT CANISTER PUMP MODULE (CHARCOAL FILTER INSIDE CANISTER)

(a) Check for filter blockage in the charcoal canister assembly INFO .

OK:

No blockages in the charcoal canister assembly.

OK ▶ GO TO STEP 30

NG ▶ GO TO STEP 24

18.	INSPECT EVAP HOSE (CHARCOAL CANISTER ASSEMBLY - CANISTER PUMP MODULE)

(a) Check for blockages in the EVAP purge line between the charcoal canister assembly and canister pump module.

OK:

No blockages in the EVAP purge line between the charcoal canister assembly and canister pump module.

NG ▶ GO TO STEP 26

OK ▼

19.	INSPECT EVAP HOSE (CHARCOAL CANISTER ASSEMBLY - FUEL TANK)

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(a) Check for blockages in the EVAP purge line between the charcoal canister assembly and fuel tank.

OK:

No blockages in the EVAP purge line between the charcoal canister assembly and fuel tank.

OK ▶ GO TO STEP 24

NG ▶ GO TO STEP 26

20.	CHECK FUEL TANK CAP ASSEMBLY

(a) Check that the fuel tank cap assembly is correctly installed and confirm that the fuel tank cap assembly meets OEM specifications.

(b) Tighten the fuel tank cap assembly firmly (only one click sound could be heard).

Result

TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
fuel tank cap assembly correctly installed	-	A
fuel tank cap assembly loose	• fuel tank cap assembly improperly installed • Defective fuel tank cap assembly • fuel tank cap assembly does not meet OEM specifications	B
Defective fuel tank cap assembly	-	B
No fuel tank cap assembly	-	C

B ▶ GO TO STEP 22

C ▶ GO TO STEP 23

A ▼

21.	LOCATE EVAP LEAK PART

(a) Check for leakage from EVAP system (hose, disconnection, cracks, etc.).

(b) Repair or replace the leak point.

NEXT ▶ GO TO STEP 29

22.	CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP ASSEMBLY

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HINT:

- When reinstalling the fuel tank cap assembly, tighten it firmly (only one click sound could be head).
- When replacing the fuel tank cap assembly, use a fuel tank cap assembly that meets OEM specifications, and install it firmly.

NEXT GO TO STEP 29

23.	REPLACE FUEL TANK CAP ASSEMBLY

HINT:

When installing the fuel tank cap assembly, tighten it firmly (only one click sound could be head).

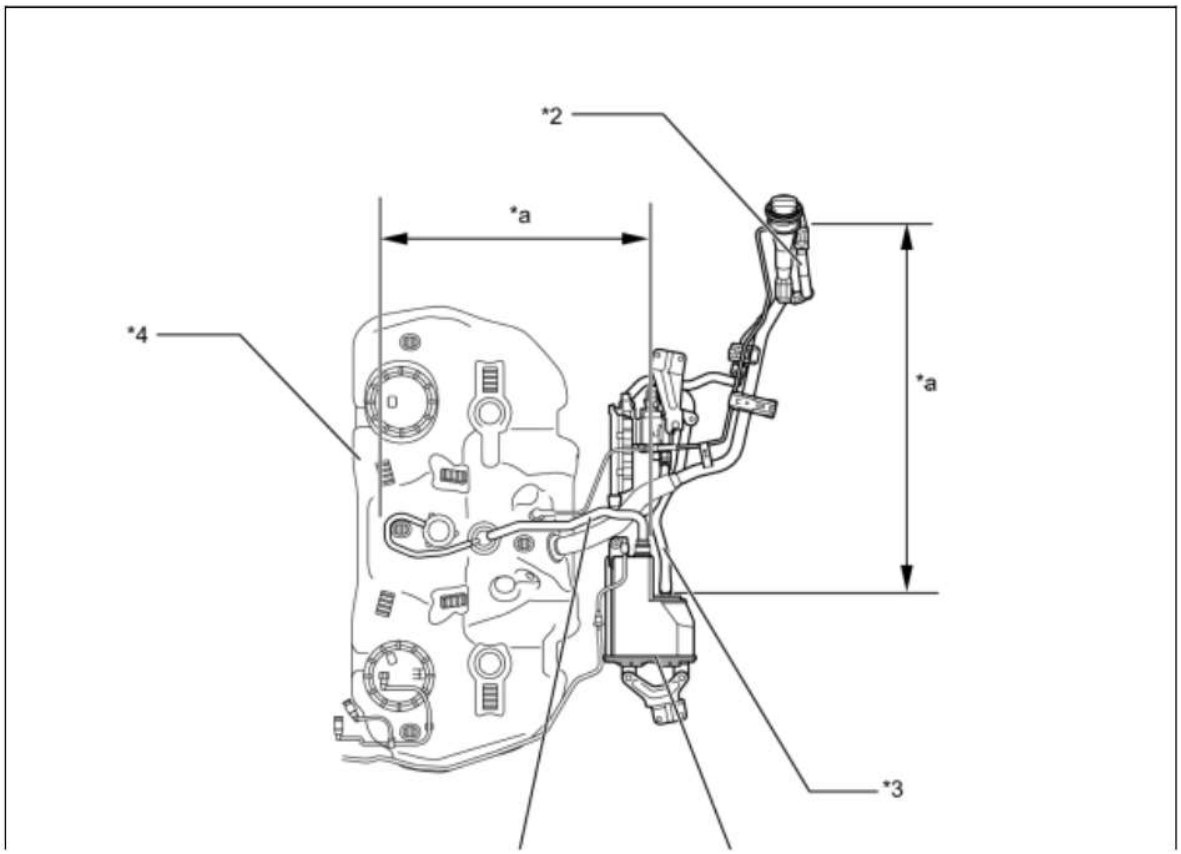
NEXT GO TO STEP 29

24.	REPLACE CHARCOAL CANISTER ASSEMBLY

(a) Replace the charcoal canister assembly INFO .

NOTICE:

- When replacing the charcoal canister assembly, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.
- Check for filter blockage in the canister filter. If the canister filter has blockages, replace the canister pump module.



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Text in Illustration

*1	Fuel Tank Vent Hose	*2	Air Inlet Port
*3	Drain Hose	*4	Fuel Tank
*5	Charcoal Canister Assembly	-	-
*a	Inspection Area (check for disconnection and/or cracks)	-	-

NEXT GO TO STEP 29

25.	REPAIR OR REPLACE HARNESS OR CONNECTOR

NEXT GO TO STEP 29

26.	REPAIR OR REPLACE EVAP PURGE LINE (PURGE VALVE - CANISTER)

NEXT GO TO STEP 29

27.	REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS

(a) Repair the malfunctioning areas indicated by the DTCs that had been confirmed when the vehicle was brought in.

NEXT GO TO STEP 29

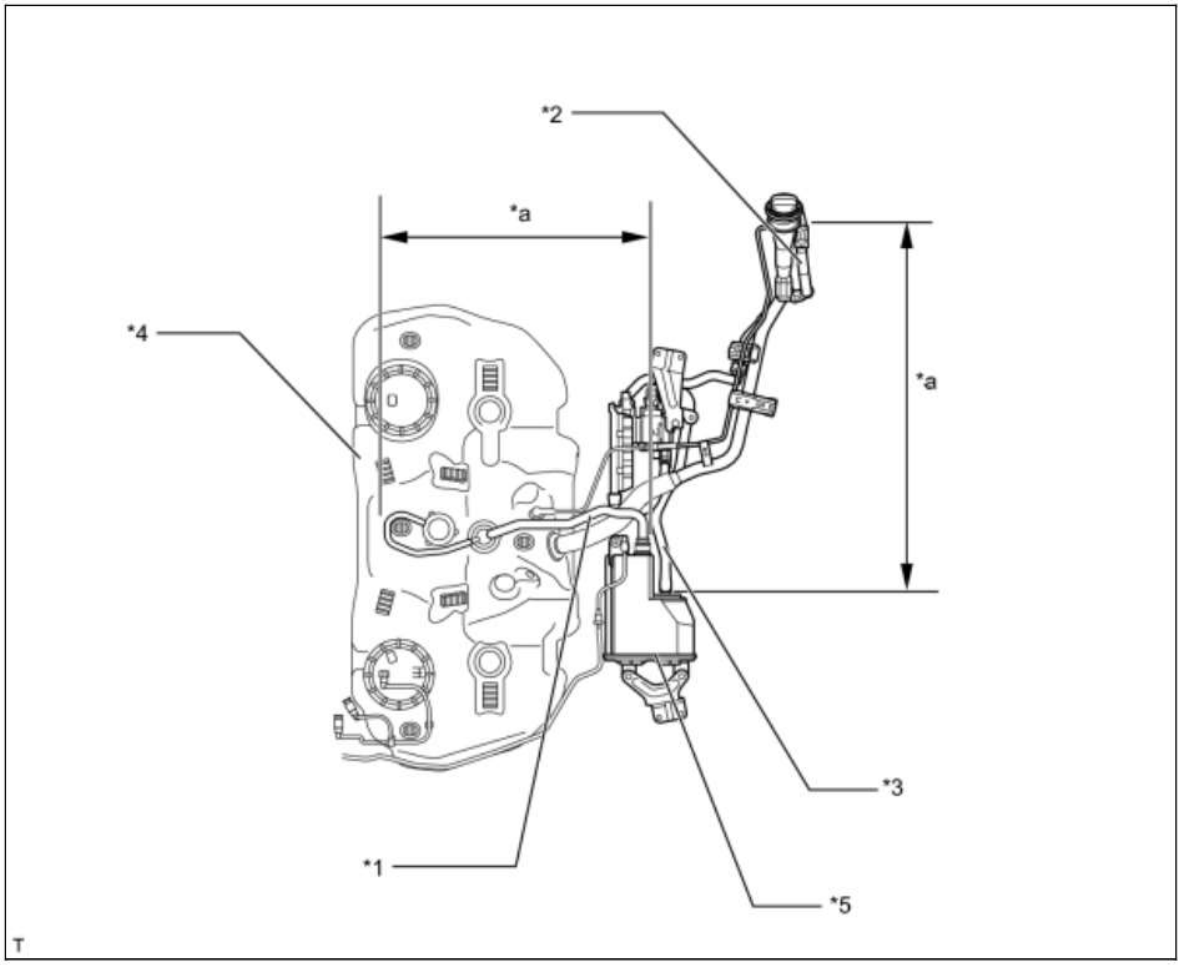
28.	REPLACE CHARCOAL CANISTER ASSEMBLY

(a) Replace the canister pump module INFO .

NOTICE:

- When replacing the charcoal canister assembly, check the canister pump module interior and related pipes for water, fuel and other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.
- Check for filter blockage in the canister filter. If the canister filter has blockages, replace the canister filter.

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Text in Illustration

*1	Fuel Tank Vent Hose	*2	Air Inlet Port
*3	Vent Hose	*4	Fuel Tank
*5	Charcoal Canister Assembly	-	-
*a	Inspection Area (check for disconnection and/or cracks)	-	-

NEXT

29.	PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off

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- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F) and the coolant temperature below 45°C (113°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine / Trouble Codes.

Result

RESULT	PROCEED TO
EVAP system DTCs are output	A
No DTCs output (No pending DTCs output)	B

B ▶ END

A ▼

30.	REPLACE ECM

(a) Replace the ECM INFO .

NEXT ▼

31.	PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below

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35°C (95°F) and the coolant temperature below 45°C (113°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine / Trouble Codes.

HINT:

If no pending DTCs are found, the repair has been successfully completed.

NEXT END

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Last Modified: 3-27-2012	6.4 U	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDO0IEX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: FAIL-SAFE CHART (2013 FR-S)		

FAIL-SAFE CHART

If any of the following DTCs are stored, the ECM enters fail-safe mode to allow the vehicle to be driven temporarily or stops fuel injection.

DTC CODE	FAIL-SAFE OPERATION	FAIL-SAFE DEACTIVATION CONDITION
P000A P000C P0010 P0011 P0016 P0018 P0020 P0021 P0341 P0345 P0346	Fix intake VVT control at intermediate position	After recovery in normal status, turn the ignition switch to ON again
P000B P000D P0013 P0014 P0017 P0019 P0023 P0024 P0365 P0366 P0390 P0391	Fix exhaust VVT control at maximum retard angle	After recovery in normal status, turn the ignition switch to ON again
P0031 P0032 P0037 P0131 P0132 P0134 P0137 P0138 P013A P013B P013E P013F P0140 P0141	Stop air fuel ratio feedback control	After recovery in normal status, turn the ignition switch to ON again
P0087		

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P0088 P0191 P0192 P0193 P1235	• Stop fuel pump assembly drive (high pressure side) • Fix fuel pressure at 0.4 MPa (4.07 kgf/cm ^{2} , 57.9 psi). • Cut fuel at 1500 rpm or more	After recovery in normal status, turn the ignition switch to ON again
P0101 P0102 P0103	Make the engine load the manifold absolute pressure converted estimated value	Return to normal status
P0068 P0107 P0108	Make the manifold absolute pressure value the mass air flow meter converted estimated value	Return to normal status
P0111 P0112 P0113	Fix inlet air temperature at 20°C (68°F)	Return to normal status
P0116 P0117 P0118 P0125	• Fix coolant temperature at 70°C (158°F) • Stop intake and exhaust VVT	Return to normal status
P0172	Stop purge control	Return to normal status
P0196 P0197 P0198	Fix engine oil temperature at 70°C (158°F)	Return to normal status
P062D P1261 P1262 P1263 P1264	• Cut fuel at 1500 rpm or more • Cut fuel to abnormal cylinders	After recovery in normal status, turn the ignition switch to ON again
P0201 P0202 P0203 P0204	Cut fuel to abnormal cylinders	After recovery in normal status, turn the ignition switch to ON again
P062F P0122 P0123 P0222 P0223 P0604 P0605 P0606 P060A P060B P1160 P2101 P2102 P2103 P2109 P2119	Stop electronic throttle control, and fix the throttle valve opening angle (5 degrees)	After recovery in normal status, turn the ignition switch to ON again

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P2135		
P0327 P0328 P0332 P0333	Maximum retard angle	Return to normal status
P0451	Stop leak detection pump control	Return to normal status
P0500	Fix ECU recognized vehicle speed at 10 km/h (6.2 mph)	Return to normal status
P0851 P0852	Turn off the gear position display within the combination meter	Return to normal status
P1451 P2404	Fix atmospheric pressure at 101.3 kPa (760 mmHg)	Return to normal status
P2122 P2123 P2127 P2128	Accelerator pedal sensor assembly has 2 sensor circuits: Main and Sub If either circuit malfunctions, substitute the normal accelerator position sensor until the prescribed angle. If both circuits malfunction, fix accelerator position at prescribed angle (12%).	After recovery in normal status, turn the ignition switch to ON again
P2138	• Fix accelerator pedal angle • Stop electronic throttle control, and fix the throttle valve opening angle	After recovery in normal status, turn the ignition switch to ON again

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDS0SJX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: FREEZE FRAME DATA (2013 FR-S)		

FREEZE FRAME DATA

1. DESCRIPTION

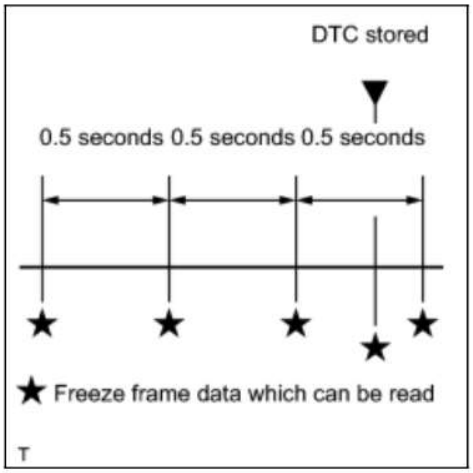
The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

Freeze frame data records the engine conditions (fuel system information, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected.

HINT:

If it is impossible to duplicate the problem even though a DTC is output, check the freeze frame data.

The ECM records engine conditions in the form of freeze frame data every 0.5 seconds. Using the Techstream, 5 separate sets of freeze frame data can be checked.



- 3 data sets from before the DTC was stored
- 1 data set from when the DTC was stored
- 1 data set from after the DTC was stored

These data sets can be used to simulate the condition of the vehicle from around the time of the occurrence of the malfunction. The data may assist in identifying the cause of the malfunction, and in judging whether it was temporary or not.

2. LIST OF FREEZE FRAME DATA

Refer to "Data List / Active Test" INFO .

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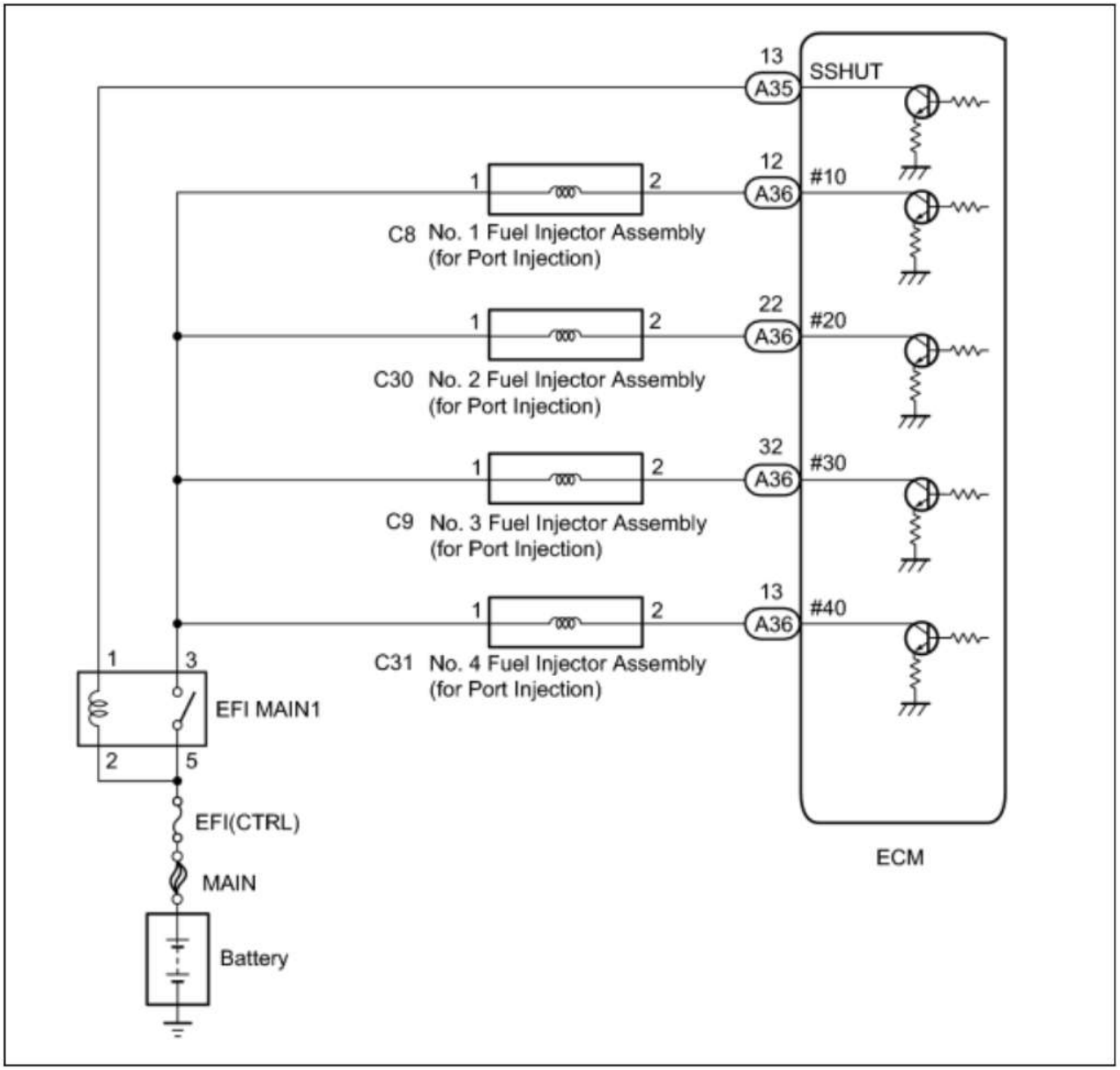
Last Modified: 4-14-2014	6.6 J	Doc ID: RM000000ZRM0EXX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: Fuel Injector Circuit; 2013 MY FR-S [03/2012 - 05/2013]		

Fuel Injector Circuit

DESCRIPTION

The fuel injectors (for port injection) are attached to the intake manifold, and inject fuel into the intake manifold based on the ECM signals.

WIRING DIAGRAM



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INSPECTION PROCEDURE

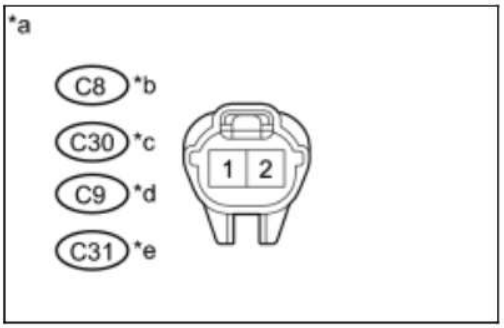
NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	INSPECT FUEL INJECTOR ASSEMBLY (POWER SOURCE)

(a) Disconnect the fuel injector assembly connectors.



(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C8-1 - Body ground	Ignition switch ON	11 to 14 V
C30-1 - Body ground	Ignition switch ON	11 to 14 V
C9-1 - Body ground	Ignition switch ON	11 to 14 V
C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

NG ▶ GO TO STEP 4

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OK

2.	INSPECT FUEL INJECTOR ASSEMBLY (INJECTION AND VOLUME)

(a) Check the fuel injector injection and volume INFO .

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY

OK

3.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

(a) Disconnect the fuel injector assembly connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-2 - A36-12 (#10)	Always	Below 1 Ω
C30-2 - A36-22 (#20)	Always	Below 1 Ω
C9-2 - A36-32 (#30)	Always	Below 1 Ω
C31-2 - A36-13 (#40)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C1-2 or A36-12 (#10) - Body ground	Always	10 kΩ or higher
C2-2 or A36-22 (#20) - Body ground	Always	10 kΩ or higher
C3-2 or A36-32 (#30) - Body ground	Always	10 kΩ or higher
C8-2 or A36-13 (#40) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

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OK ▶ REPLACE ECM

4.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY - EFI MAIN1 RELAY)

(a) Disconnect the fuel injector assembly connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω
C30-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω
C9-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω
C31-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
C30-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
C9-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
C31-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ CHECK ECM POWER SOURCE CIRCUIT

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Last Modified: 4-14-2014	6.6 J	Doc ID: RM000001F70022X
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: Fuel Pump Control Circuit; 2013 MY FR-S [03/2012 -]		

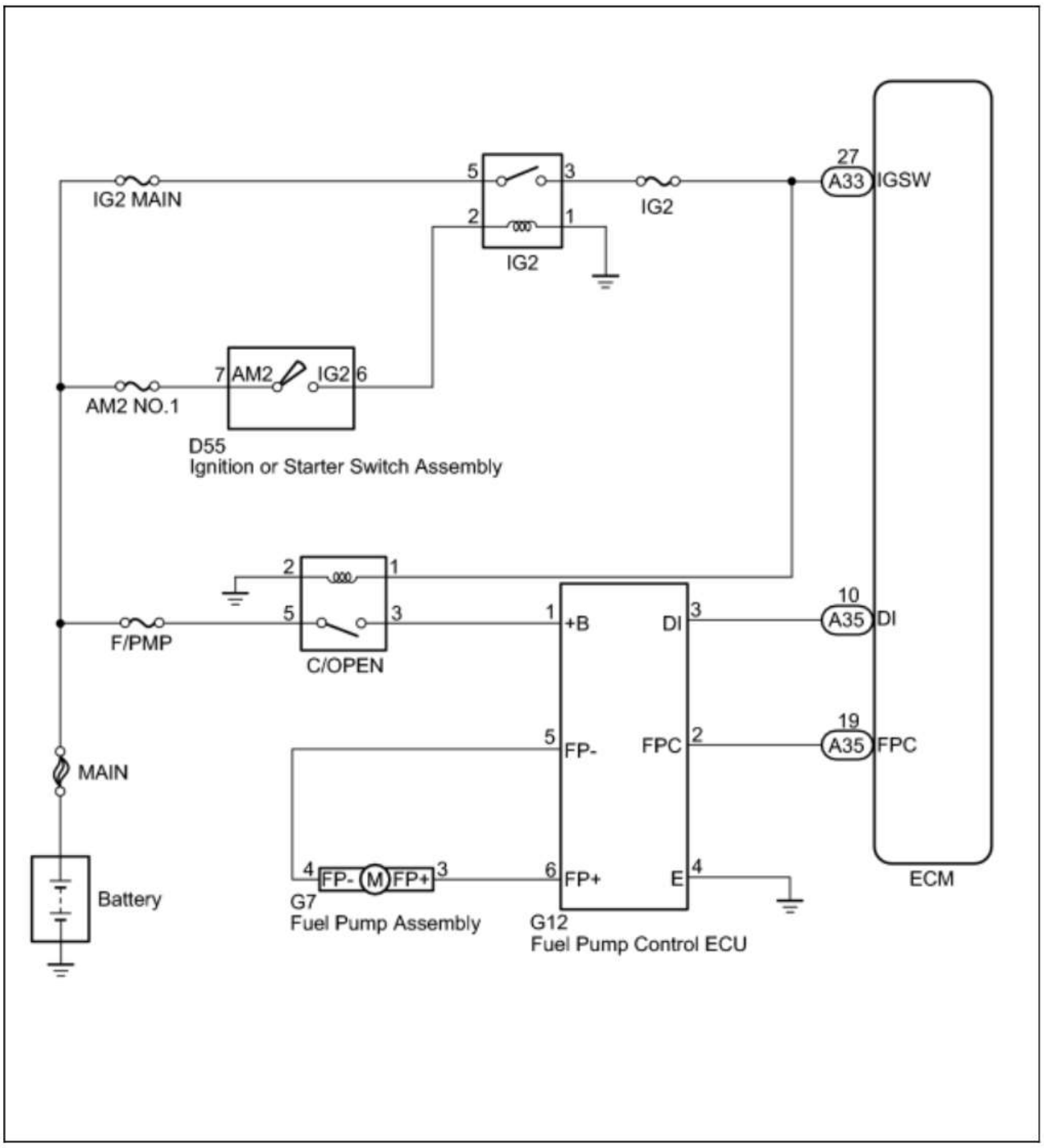
Fuel Pump Control Circuit

DESCRIPTION

The fuel pump circuit (low pressure side) is comprised of the ECM, fuel pump assembly (low pressure side), and fuel pump control ECU assembly (which operates the fuel pump [low pressure side]). The ECM judges the speed of the fuel pump assembly (low pressure side) based on the engine output. This speed is converted into a loading signal, which is sent to the fuel pump control ECU assembly. The fuel pump control ECU assembly adjusts the fuel pump operating speed (low pressure side), based on the signal sent from the ECM.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP/ SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump/Speed.

(e) Check whether the fuel pump operating sound occurs when performing the Active Test on the Techstream.

Result

RESULT	PROCEED TO
Fuel pump operating sound does not occur	A
Fuel pump operating sound occurs	B

B ▶ GO TO STEP 8

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test /Control the Fuel Pump Duty.

(e) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

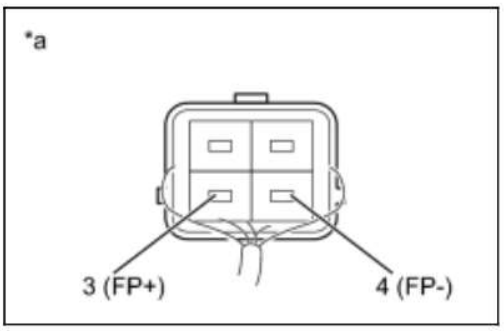
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (FP+) - 4 (FP-)	FPC Duty: 25%	3.2 to 4.05 V
3 (FP+) - 4 (FP-)	FPC Duty: 80%	8.8 to 12.5 V

Text in Illustration

*a	Component without harness connected

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	(Fuel Pump Assembly)



(f) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump/Speed.

(g) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
3 (FP+) - 4 (FP-)	ON (FPC Duty: 25%)	9.0 to 14.0 V

HINT:

- Be sure to measure the voltage with all the connectors connected.
- Before performing this inspection, check that the battery voltage is between 11 and 14 V (not depleted).

NG ▶ GO TO STEP 6

OK ▼

3.	CHECK HARNESS AND CONNECTOR (ECM - FUEL PUMP CONTROL ECU ASSEMBLY)

(a) Disconnect the ECM connector.

(b) Disconnect the fuel pump control ECU assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-19 (FPC) - G12-2 (FPC)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

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A35-19 (FPC) or G12-2 (FPC) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

4.	REPLACE FUEL PUMP ASSEMBLY

(a) Replace the fuel pump assembly INFO .

NEXT ▼

5.	CHECK CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Check the fuel pump operation INFO .

OK:
Malfunction has been repaired successfully.

NG ▶ REPLACE ECM

OK ▶ END

6.	REPLACE FUEL PUMP CONTROL ECU ASSEMBLY

(a) Replace the fuel pump control ECU assembly INFO .

NEXT ▼

7.	CHECK CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Check the fuel pump operation INFO .

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OK:

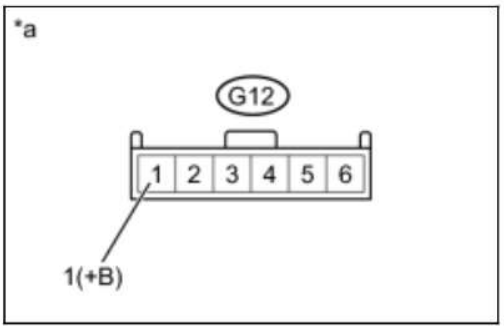
Malfunction has been repaired successfully.

NG ▶ REPLACE ECM

OK ▶ END

8.	INSPECT FUEL PUMP CONTROL ECU ASSEMBLY (POWER SOURCE VOLTAGE)

(a) Disconnect the fuel pump control ECU assembly connector.



(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G12-1 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector: (to Fuel Pump Control ECU Assembly)

NG ▶ GO TO STEP 14

OK ▼

9.	CHECK HARNESS AND CONNECTOR (FUEL PUMP - FUEL PUMP CONTROL ECU ASSEMBLY)

(a) Disconnect the fuel pump connector.

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(b) Disconnect the fuel pump control ECU assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G7-4 (FP-) - G12-5 (FP-)	Always	Below 1 Ω
G7-3 (FP+) - G12-6 (FP+)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G7-4 (FP-) or G12-5 (FP-) - Body ground	Always	10 kΩ or higher
G7-3 (FP+) or G12-6 (FP+) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

10.	INSPECT FUEL PUMP ASSEMBLY

(a) Inspect fuel pump assembly INFO .

NG ▶ REPLACE FUEL PUMP ASSEMBLY

OK ▼

11.	CHECK HARNESS AND CONNECTOR (FUEL PUMP CONTROL ECU ASSEMBLY - ECM)

(a) Disconnect the ECM connector.

(b) Disconnect the fuel pump control ECU assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-19 (FPC) - G12-2 (FPC)	Always	Below 1 Ω
G12-4 (E)- Body ground	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-19 (FPC) or G12-2 (FPC) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

12.	REPLACE FUEL PUMP CONTROL ECU ASSEMBLY

(a) Replace the fuel pump control ECU assembly INFO .

NEXT ▼

13.	CHECK CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Check the fuel pump operation INFO .

OK:
Malfunction has been repaired successfully.

NG ▶ REPLACE ECM

OK ▶ END

14.	CHECK HARNESS AND CONNECTOR (C/ OPEN RELAY - FUEL PUMP CONTROL ECU ASSEMBLY)

(a) Remove the C/OPEN relay from the engine room relay block assembly.

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(b) Disconnect the fuel pump control ECU assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 3 - G12-1 (+B)	Always	Below 1 Ω
C/OPEN relay terminal 1 - Body ground	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 3 or G12-1 (+B) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

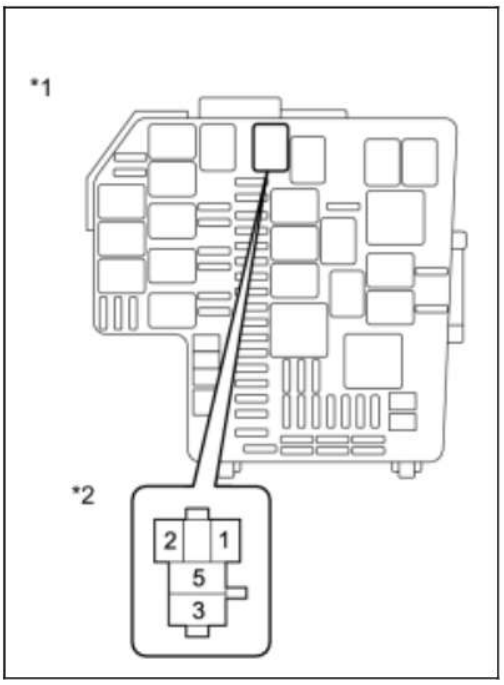
15.	INSPECT TERMINAL VOLTAGE (C/ OPEN RELAY)

(a) Remove the C/OPEN relay from the engine room relay block assembly.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 5 - Body ground	IG ON	11 to 14 V



Text in Illustration

*1	Engine Room Relay Block Assembly
*2	C/OPEN Relay Terminal

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NG ▶ GO TO ECU POWER SOURCE CIRCUIT

OK ▼

16.	CHECK HARNESS AND CONNECTOR (C/ OPEN RELAY - ECM - IG2 RELAY)

(a) Disconnect the ECM connector.

(b) Remove the C/OPEN relay and IG2 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 2 - A33-27 (IGSW)	Always	Below 1 Ω
C/OPEN relay terminal 2 - IG2 relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 2, A33-27 (IGSW) or IG2 relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ REPLACE ECM

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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PD90TLX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: HOW TO PROCEED WITH TROUBLESHOOTING (2013 FR-S)		

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:

***: Use the Techstream.**

1.	**VEHICLE BROUGHT TO WORKSHOP**

NEXT

2.	**CUSTOMER PROBLEM ANALYSIS**

NEXT

3.	**CONNECT TECHSTREAM TO DLC3***

HINT:

If the display indicates a communication fault in the Techstream, inspect the DLC3.

When any CAN communication system DTCs are output, perform troubleshooting on the CAN communication system first.

NEXT

4.	**CHECK DTC AND FREEZE FRAME DATA***

(a) Check for DTCs INFO and freeze frame data INFO .

HINT:

Record or print DTCs and freeze frame data if necessary.

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NEXT

5.	**CLEAR DTC AND FREEZE FRAME DATA***

(a) Clear DTCs and freeze frame data INFO .

NEXT

6.	**CONDUCT VISUAL INSPECTION**

NEXT

7.	**SELECT CHECK MODE DIAGNOSIS***

(a) Switch the ECM from normal mode to check mode.

HINT:

Refer to Check Mode Procedure INFO .

NEXT

8.	**CONFIRM PROBLEM SYMPTOMS**

(a) Confirm problem symptoms.

HINT:

If the engine does not start, first perform the "Check DTC" procedure and "Conduct Basic Inspection" procedure below.

Result

RESULT	PROCEED TO
Malfunction does not occur	A
Malfunction occurs	B

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B ▶ GO TO STEP 10

A ▼

9.	SIMULATE SYMPTOMS

HINT:

Refer to Symptom Simulation INFO .

NEXT ▼

10.	CHECK DTC*

(a) Check for DTCs.

HINT:

Refer to DTC Check / Clear INFO .

Result

RESULT	PROCEED TO
Trouble code output	A
No trouble code output	B

B ▶ GO TO STEP 12

A ▼

11.	REFER TO DTC CHART

(a) Refer to Diagnostic Trouble Code Chart INFO .

NEXT

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12.	CONDUCT BASIC INSPECTION

(a) Conduct basic inspection INFO .

Result

RESULT	PROCEED TO
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B ▶ **GO TO STEP 17**

A

13.	REFER TO PROBLEM SYMPTOMS TABLE

(a) Refer to Problem Symptoms Table INFO .

Result

RESULT	PROCEED TO
Malfunctioning circuit confirmed	A
Malfunctioning parts confirmed	B

B ▶ **GO TO STEP 17**

A

14.	CHECK ECM POWER SOURCE CIRCUIT

(a) Check the ECM power source circuit.

HINT:

Refer to ECM Power Source Circuit INFO .

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NEXT

15.	**CONDUCT CIRCUIT INSPECTION**

Result

RESULT	PROCEED TO
Malfunction not confirmed	A
Malfunction confirmed	B

B ▶ **GO TO STEP 18**

A

16.	**CHECK FOR INTERMITTENT PROBLEMS**

(a) Check for intermittent problems.

HINT:

Refer to Check for Intermittent Problems INFO .

NEXT

17.	**CONDUCT PARTS INSPECTION**

NEXT

18.	**IDENTIFY PROBLEM**

NEXT

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19.	ADJUST AND/OR REPAIR

NEXT

20.	CONDUCT CONFIRMATION TEST

NEXT END

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Last Modified: 4-14-2014	6.6 J	Doc ID: RM000000WZ10ULX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: MIL Circuit; 2013 MY FR-S [03/2012 -]		

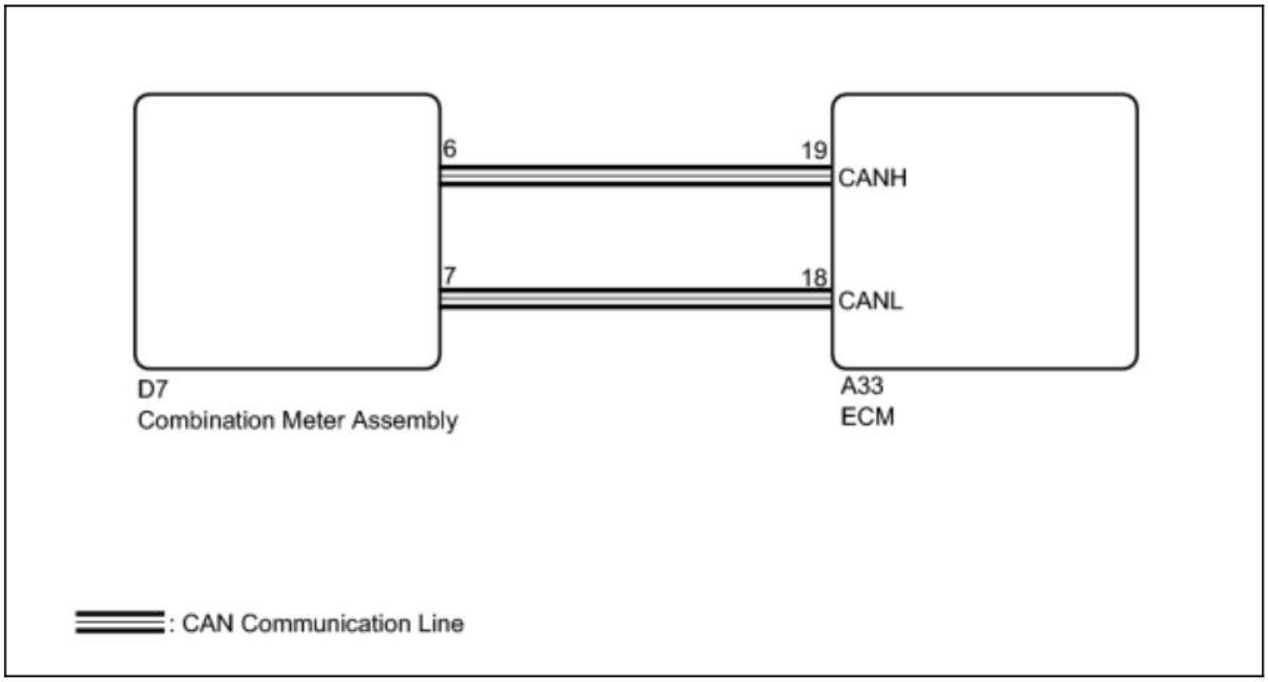
MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate vehicle malfunctions detected by the ECM. When the ignition switch is turned to ON, power is supplied to the MIL circuit, which illuminates the MIL.

The MIL operation can be checked visually: When the ignition switch is turned to ON, the MIL should be illuminated and should turn off after engine is started. If the MIL remains illuminated or is not illuminated, conduct the following troubleshooting procedure using the Techstream.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	CHECK THAT MIL IS ILLUMINATED

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(a) Perform troubleshooting in accordance with the table below.

Result

RESULT	PROCEED TO
MIL remains ON	A
MIL does not illuminate	B
MIL illuminates for several seconds, but turns off after engine is started	C

B ▶ GO TO STEP 3

C ▶ CHECK FOR INTERMITTENT PROBLEMS

A ▼

2.	CHECK WHETHER MIL TURNS OFF

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Check if any DTCs have been detected. Note down any DTCs.

Result

RESULT	PROCEED TO
No DTC detected	A
Any DTCs detected	B

HINT:

Check for detected DTCs output from other ECUs which relate to the MIL.

B ▶ REPAIR CIRCUITS INDICATED BY OUTPUT DTCS

A ▶ GO TO METER / GAUGE SYSTEM

3.	CHECK THAT ENGINE STARTS

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(a) Turn the ignition switch to ON.

(b) Start the engine.

Result

RESULT	PROCEED TO
Engine starts	A
Engine does not start*	B

HINT:

*: The Techstream cannot communicate with the ECM.

B ▶ GO TO VC OUTPUT CIRCUIT

A ▶ REPLACE COMBINATION METER

TOYOTA

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDU0OMX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P000A,P000C,P0011,P0021: Camshaft Position "A" - Timing Slow Response Bank 1 (2013 FR-S)		

DTC	**P000A**	**Camshaft Position "A" - Timing Slow Response Bank 1**

DTC	**P000C**	**Camshaft Position "A" - Timing Slow Response Bank 2**

DTC	**P0011**	**Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)**

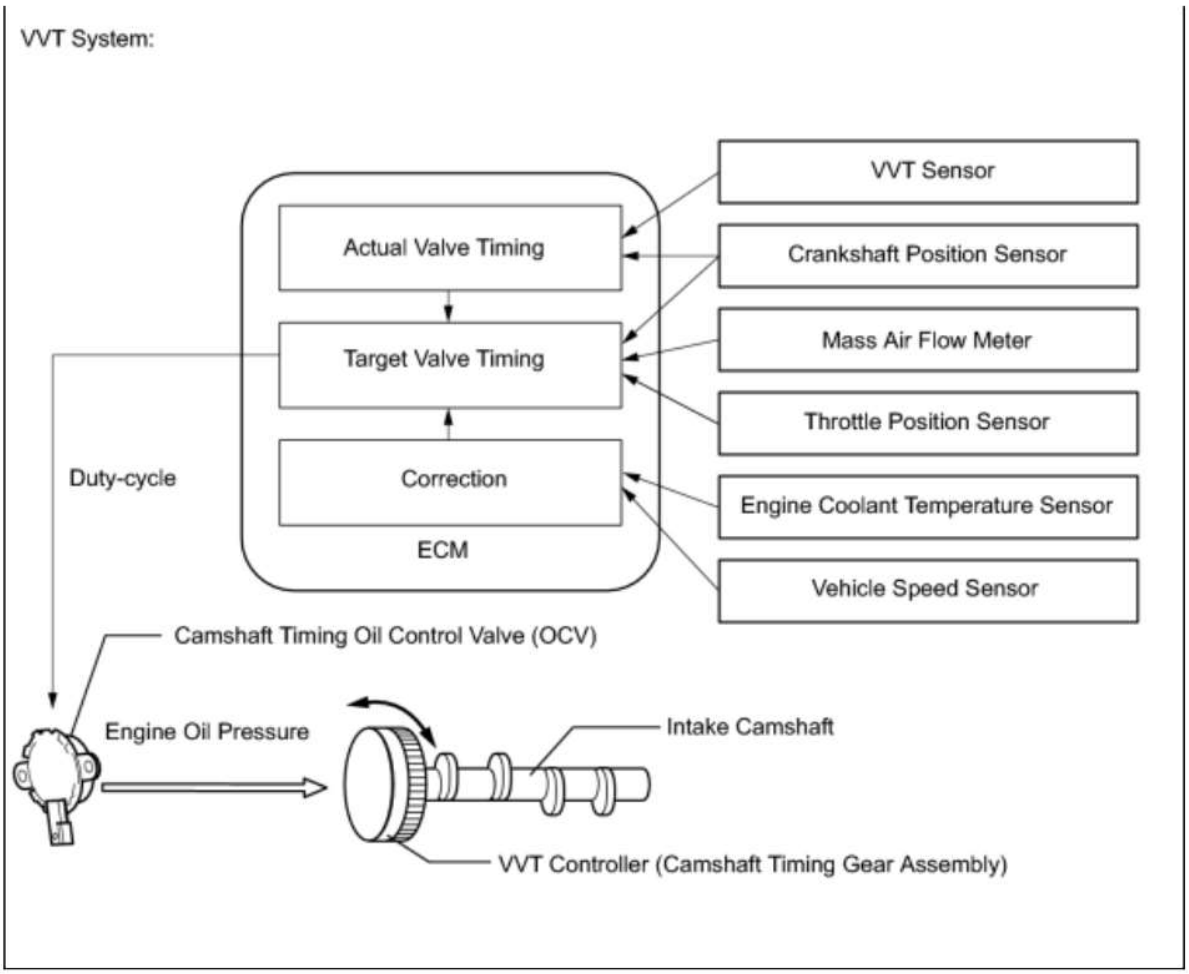
DTC	**P0021**	**Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 2)**

DESCRIPTION

The Variable Valve Timing (VVT) system adjusts the intake valve timing to improve driveability. The engine oil pressure turns the VVT controller to adjust the valve timing.

The camshaft timing oil control valve is a solenoid valve and switches the engine oil line. The valve moves when the ECM applies 12 V to the solenoid. The ECM changes the energizing time to the solenoid (duty-cycle) in accordance with the camshaft position, crankshaft position, throttle position, etc.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P000A	Integrated deviations in target intake valve timing and actual intake valve timing per specified time exceed thresholds for 15 seconds (bank 1). (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve (for intake side of bank 1) • Oil control valve filter • Camshaft timing gear assembly (for intake side of bank 1) • ECM
P0011	Deviation in target intake valve timing and actual intake valve timing exceeds thresholds (bank 1). (2 trip detection logic)	
P000C	Integrated deviations in target intake valve timing and actual intake valve timing per specified time exceed thresholds for 15 seconds (bank 2). (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve (for intake side of bank 2) • Oil control valve filter • Camshaft timing
	Deviation in target intake valve timing and actual intake valve	

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P0021	timing exceeds thresholds (bank 2). (2 trip detection logic)	gear assembly (for intake side of bank 2) • ECM

MONITOR DESCRIPTION

The ECM optimizes the intake valve timing using the Variable Valve Timing (VVT) system to control the intake camshaft. The VVT system includes the ECM, the camshaft timing oil control valve and the VVT controller (camshaft timing gear assembly). The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.
If the difference between the target and actual intake valve timings is large, and changes in the actual intake valve timing are small, the ECM interprets this as the VVT controller stuck malfunction and stores a DTC.
These DTCs indicate that the VVT controller cannot operate properly due to camshaft timing oil control valve malfunctions or the presence of foreign objects in the camshaft timing oil control valve.

MONITOR STRATEGY

Related DTCs	P000A: VVT intake method with mid-position start functional check (Bank 1) P000C: VVT intake method with mid-position start functional check (Bank 2) P0011: VVT intake method with mid-position start functional check (Bank 1) P0021: VVT intake method with mid-position start functional check (Bank 2)
Required Sensors/Components (Main)	Camshaft timing oil control valve Camshaft timing gear assembly
Required Sensors/Components (Related)	Crankshaft position sensor VVT sensor Engine coolant temperature sensor
Frequency of Operation	Continuous
Duration	15 seconds: P000A, P000C 7 seconds: P0011, P0021 (Target error) 1 second: P0011, P0021 (Mid lock position)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	P0340, P0345 (Camshaft position sensor - intake with variable valve timing (VVT))
Battery voltage	10.9 V or more

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Engine speed	500 rpm or higher
Engine oil temperature	0°C (32°F) or higher

P000A, P000C

VVT feedback control	Active
Change of VVT target angle during 64 msec	Less than 3.84°CA
VVT target position	0°CA or more

P0011, P0021 (Target error)

VVT feedback control	Active

P0011, P0021 (Mid lock position)

VVT command	Mid lock position
Elapsed time after engine start	0.5 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P000A, P000C

Sigma (VVT target position - VVT actual position)	More than 4000°CA or less than -4000°CA

P0011, P0021 (Target error)

VVT target position - VVT actual position	More than 7°CA or less than -7°CA

P0011, P0021 (Mid lock position)

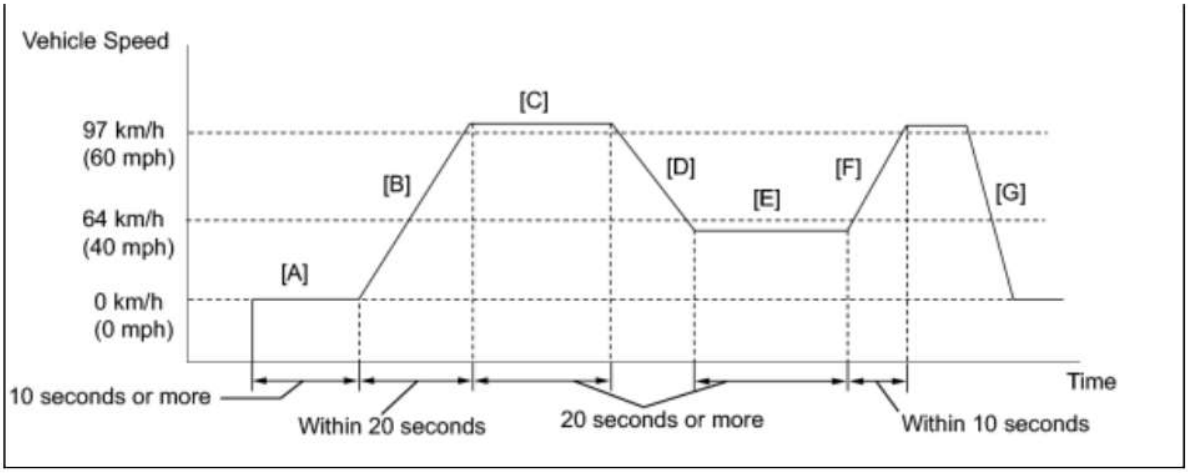
VVT target position - VVT actual position	More than 10°CA or less than -10°CA

MONITOR RESULT

Refer to detailed information in Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Accelerate the vehicle to 97 km/h (60 mph) or more within 20 seconds [B].
c. Drive the vehicle at 97 km/h (60 mph) or more for 20 seconds or more [C].
d. Release the accelerator pedal to Decelerate until the vehicle speed decreases to less than 64 km/h (40 mph) [D].

HINT:

Release the accelerator pedal fully to perform the fuel-cut.

e. Drive the vehicle at 60 km/h (40 mph) or less for 20 seconds or more [E].
f. Accelerate the vehicle to 97 km/h (60 mph) or more within 10 seconds [F].
g. Release the accelerator pedal and stop the vehicle [G].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P000A, P000C, P0011 or P0021.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0010 INFO .

INSPECTION PROCEDURE

HINT:

- If DTC P000A or P0011 is displayed, check the intake camshaft circuit for the right bank VVT system (bank 1).
- If DTC P000C or P0021 is displayed, check the intake camshaft circuit for the left bank VVT system (bank 2).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P000A, P000C, P0011 OR P0021)**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P000A, P000C, P0011 or P0021 is output	A
DTC P000A, P000C, P0011 or P0021 and other DTCs are output	B

HINT:

If any DTCs other than DTC P000A, P000C, P0011 or P0021 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Turn the A/C switch on.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank 1), Control the VVT Linear (Bank 2).

(f) Check the engine speed while operating the camshaft timing oil control valve (for intake camshaft) using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
36 deg (CA)	Engine idles roughly or stalls

HINT:

Refer to "Data List / Active Test" [VVT OCV Duty #1, VVT OCV Duty #2 and VVT Change Angle #1, VVT Change Angle #2] INFO **.**

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NG ▶ CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH)

OK ▼

3.	CHECK WHETHER DTC OUTPUT RECURS (DTC P000A, P000C, P0011 OR P0021)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P000A, P000C, P0011 or P0021 is output	B

HINT:

DTC P000A, P000C, P0011 or P0021 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH)

A ▶ CHECK FOR INTERMITTENT PROBLEMS

4.	CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH)

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(a) Check the valve timing INFO .

NG ▶ ADJUST VALVE TIMING

OK ▼

5.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE CAMSHAFT)

(a) Inspect the camshaft timing oil control valve (for intake camshaft) INFO .

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE CAMSHAFT)

OK ▼

6.	INSPECT CAMSHAFT TIMING GEAR ASSEMBLY

(a) Inspect the camshaft timing gear assembly INFO .

HINT:

DTC P000A, P000C, P0011 or P0021 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

NG ▶ REPLACE CAMSHAFT TIMING GEAR ASSEMBLY (FOR INTAKE CAMSHAFT)

OK ▼

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P000A, P000C, P0011 OR P0021)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P000A, P000C, P0011 or P0021 is output	B

HINT:

DTC P000A, P000C, P0011 or P0021 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XH80G0X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P000B,P000D,P0014,P0024: Camshaft Position "B" - Timing Slow Response Bank 1 (2013 FR-S)		

DTC	**P000B**	**Camshaft Position "B" - Timing Slow Response Bank 1**

DTC	**P000D**	**Camshaft Position "B" - Timing Slow Response Bank 2**

DTC	**P0014**	**Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 1)**

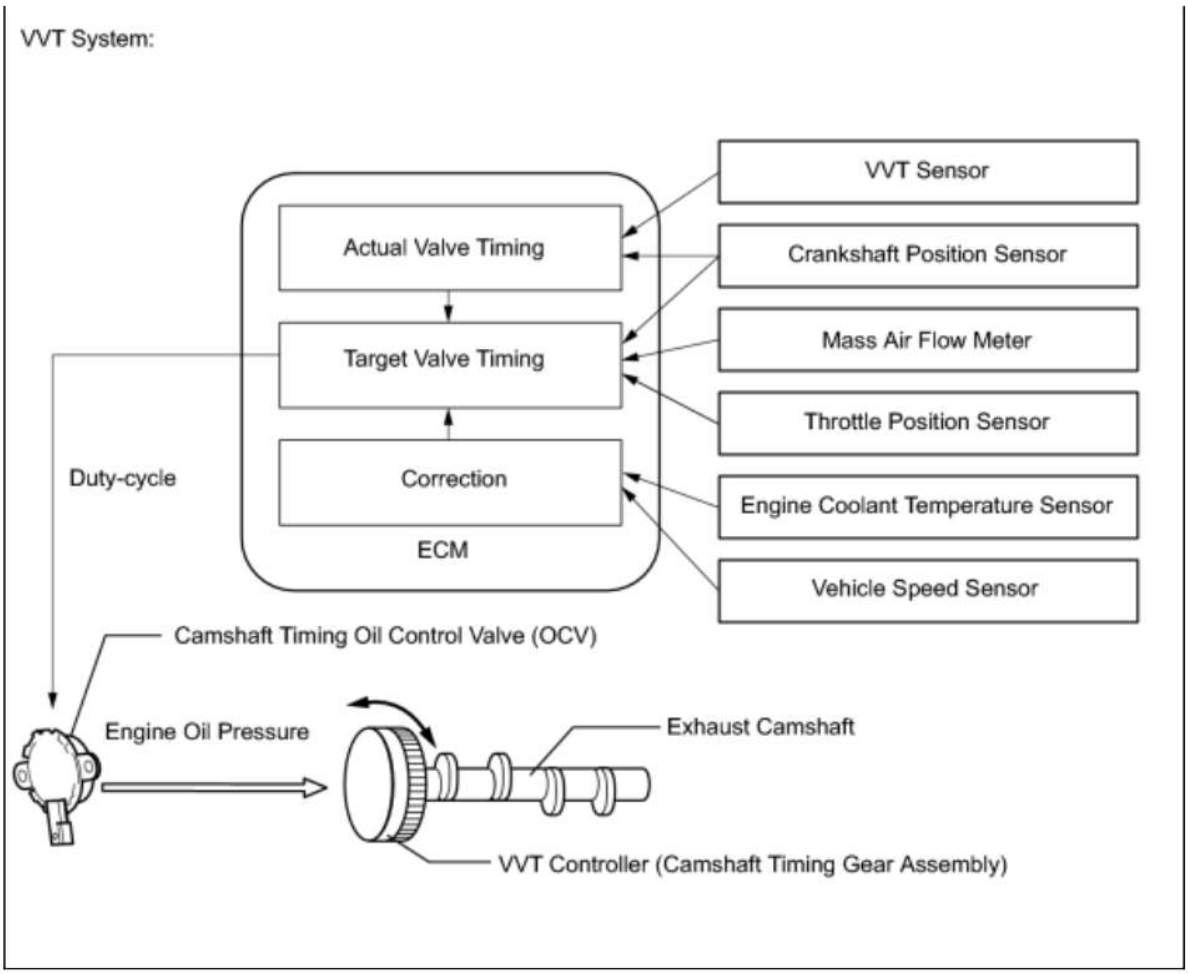
DTC	**P0024**	**Camshaft Position "B" - Timing Over-Advanced or System Performance (Bank 2)**

DESCRIPTION

The Variable Valve Timing (VVT) system adjusts the exhaust valve timing to improve driveability. The engine oil pressure turns the VVT controller to adjust the valve timing.

The camshaft timing oil control valve is a solenoid valve and switches the engine oil line. The valve moves when the ECM applies 12 V to the solenoid. The ECM changes the energizing time to the solenoid (duty-cycle) in accordance with the camshaft position, crankshaft position, throttle position, etc.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P000B	Integrated deviations in target exhaust valve timing and actual exhaust valve timing per specified time exceed threshold for 25 seconds (bank 1). (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve (for exhaust side of bank 1) • Camshaft oil control valve filter (bank 1) • Camshaft timing gear assembly (for exhaust side of bank 1) • ECM
P0014	Deviation in target exhaust valve timing and actual exhaust valve timing exceeds threshold for 8 seconds (bank 1). (2 trip detection logic)	
P000D	Integrated deviations in target exhaust valve timing and actual exhaust valve timing per specified time exceed threshold for 25 seconds (bank 2). (2 trip detection logic)	• Valve timing • Camshaft timing oil control valve (for exhaust side of bank 2) • Camshaft oil control valve filter (bank 2) • Camshaft timing
	Deviation in target exhaust valve timing and actual exhaust	

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P0024	valve timing exceeds threshold for 8 seconds (bank 2). (2 trip detection logic)	gear assembly (for exhaust side of bank 2) • ECM

MONITOR DESCRIPTION

The ECM optimizes the exhaust valve timing using the Variable Valve Timing (VVT) system to control the exhaust camshaft. The VVT system includes the ECM, the camshaft timing oil control valve and the VVT controller (camshaft timing exhaust gear assembly). The ECM sends a target duty-cycle control signal to the camshaft timing oil control valve. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the exhaust camshaft.

If the difference between the target and actual exhaust valve timing is large, and changes in the actual exhaust valve timing are small, the ECM interprets this as a VVT controller stuck malfunction and stores a DTC.

MONITOR STRATEGY

Related DTCs	P000B: VVT exhaust method without mid-position start (Bank 1) P000D: VVT exhaust method without mid-position start (Bank 2) P0014: VVT exhaust method without mid-position start (Bank 1) P0024: VVT exhaust method without mid-position start (Bank 2)
Required Sensors/Components (Main)	Camshaft timing oil control valve Camshaft timing exhaust gear assembly
Required Sensors/Components (Related)	Crankshaft position sensor VVT sensor Engine coolant temperature sensor
Frequency of Operation	Continuous
Duration	25 seconds: P000B, P000D 8 seconds: P0014, P0024
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	P0365, P0390 (Camshaft position sensor - exhaust with variable valve timing (VVT))
Battery voltage	10.9 V or more
Engine speed	500 rpm or higher
Engine oil temperature	0°C (32°F) or higher
VVT feedback control	Active

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P000B, P000D

Change of VVT target angle during 64 msec	Less than 3.84°CA
VVT target position	0°CA or more

TYPICAL MALFUNCTION THRESHOLDS

P000B, P000D

Sigma (VVT target position - VVT actual position)	More than 4000°CA or less than -4000°CA

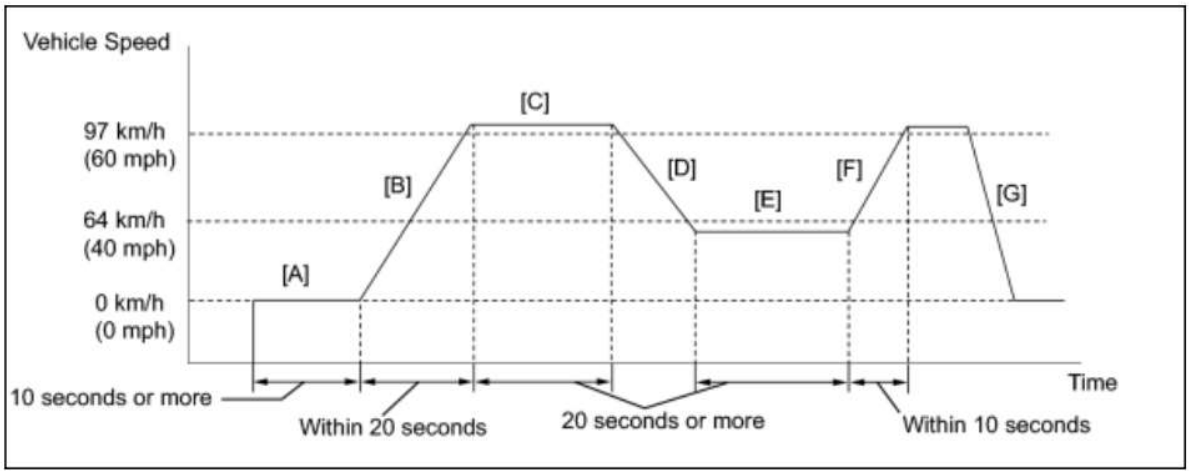
P0014, P0024

VVT target position - VVT actual position	More than 15°CA or less than -15°CA

MONITOR RESULT

Refer to detailed information in Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Accelerate the vehicle to 97 km/h (60 mph) or more within 20 seconds [B].
c. Drive the vehicle at 97 km/h (60 mph) or more for 20 seconds or more [C].
d. Release the accelerator pedal to Decelerate until the vehicle speed decreases to less

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than 64 km/h (40 mph) [D].

HINT:

Release the accelerator pedal fully to perform the fuel-cut.

e. Drive the vehicle at 60 km/h (40 mph) or less for 20 seconds or more [E].
f. Accelerate the vehicle to 97 km/h (60 mph) or more within 10 seconds [F].
g. Release the accelerator pedal and stop the vehicle [G].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P000B, P000D, P0014 or P0024.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0013 INFO .

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INSPECTION PROCEDURE

HINT:

- If DTC P000B or P0014 is displayed, check the exhaust camshaft circuit for the right bank VVT system (bank 1).
- If DTC P000D or P0024 is displayed, check the exhaust camshaft circuit for the left bank VVT system (bank 2).
- DTC P0014 or P0024 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. Those foreign objects may then be captured by the oil filter.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P000B, P000D, P0014 OR P0024)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P000B, P000D, P0014 or P0024 is output	A
DTC P000B, P000D, P0014 or P0024 and other DTCs are output	B

HINT:

If any DTCs other than P000B, P000D, P0014 or P0024 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE)**

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(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Turn the A/C switch on.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Exhaust Linear (Bank 1), Control the VVT Exhaust Linear (Bank 2).

(f) Check the engine speed while operating the camshaft timing oil control valve (for exhaust camshaft) using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
51 deg (CA)	Engine idles roughly or stalls

HINT:

Refer to "Data List / Active Test" [VVT Ex OCV Duty #1, VVT Ex OCV Duty #2 and VVT Ex Chg Angle #1, VVT Ex Chg Angle #2] INFO .

NG ▶ **CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH)**

OK ▼

3.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P000B, P000D, P0014 OR P0024)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

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(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC P000B, P000D, P0014 or P0024 is output	A
DTC is not output	B

HINT:

DTC P000B, P000D, P0014 or P0024 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A ▼

4.	CHECK VALVE TIMING (CHECK FOR LOOSE TIMING CHAIN AND JUMPED TEETH)

(a) Check the valve timing INFO .

NG ▶ ADJUST VALVE TIMING

OK ▼

5.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE (FOR EXHAUST CAMSHAFT)

(a) Inspect the camshaft timing oil control valve (for exhaust camshaft) INFO .

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR EXHAUST CAMSHAFT)

OK ▼

6.	INSPECT CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY

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(a) Inspect the camshaft timing exhaust gear assembly INFO .

HINT:

DTC P000B, P000D, P0014 or P0024 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

NG ▶ **REPLACE CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY**

OK ▼

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P000B, P000D, P0014 OR P0024)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P000B, P000D, P0014 or P0024 is output	B

HINT:

DTC P000B, P000D, P0014 or P0024 may be stored when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain stored even if the system returns to normal after a short time. These foreign objects may then be captured by the oil filter.

B ▶ **REPLACE ECM**

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A END

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDW0MSX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0010,P0020: Camshaft Position "A" Actuator Circuit (Bank 1) (2013 FR-S)		

DTC	**P0010**	**Camshaft Position "A" Actuator Circuit (Bank 1)**

DTC	**P0020**	**Camshaft Position "A" Actuator Circuit (Bank 2)**

DESCRIPTION

Refer to P000A INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0010	Oil control valve current is less than 0.306 A for intake camshaft circuit for 2 seconds or more (bank 1). (1 trip detection logic)	• Open or short in camshaft timing oil control valve circuit (for intake side of bank 1) • Camshaft timing oil control valve (for intake side of bank 1) • ECM
P0020	Oil control valve current is less than 0.306 A for intake camshaft circuit for 2 seconds or more (bank 2). (1 trip detection logic)	• Open or short in camshaft timing oil control valve circuit (for intake side of bank 2) • Camshaft timing oil control valve (for intake side of bank 2) • ECM

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MONITOR DESCRIPTION

This DTC is designed to detect open or short in the camshaft timing oil control valve (for intake camshaft) circuit. If the camshaft timing oil control valve's duty-cycle is excessively high or low while the engine is running, the ECM will illuminate the MIL and store the DTC.

MONITOR STRATEGY

Related DTCs	P0010: Oil control valve for intake-VVT circuit continuity (Bank 1) P0020: Oil control valve for intake-VVT circuit continuity (Bank 2)
Required Sensors/Components (Main)	camshaft timing oil control valve
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous

Duration	2 second
MIL Operation	Immediate
Sequence of Operation	None

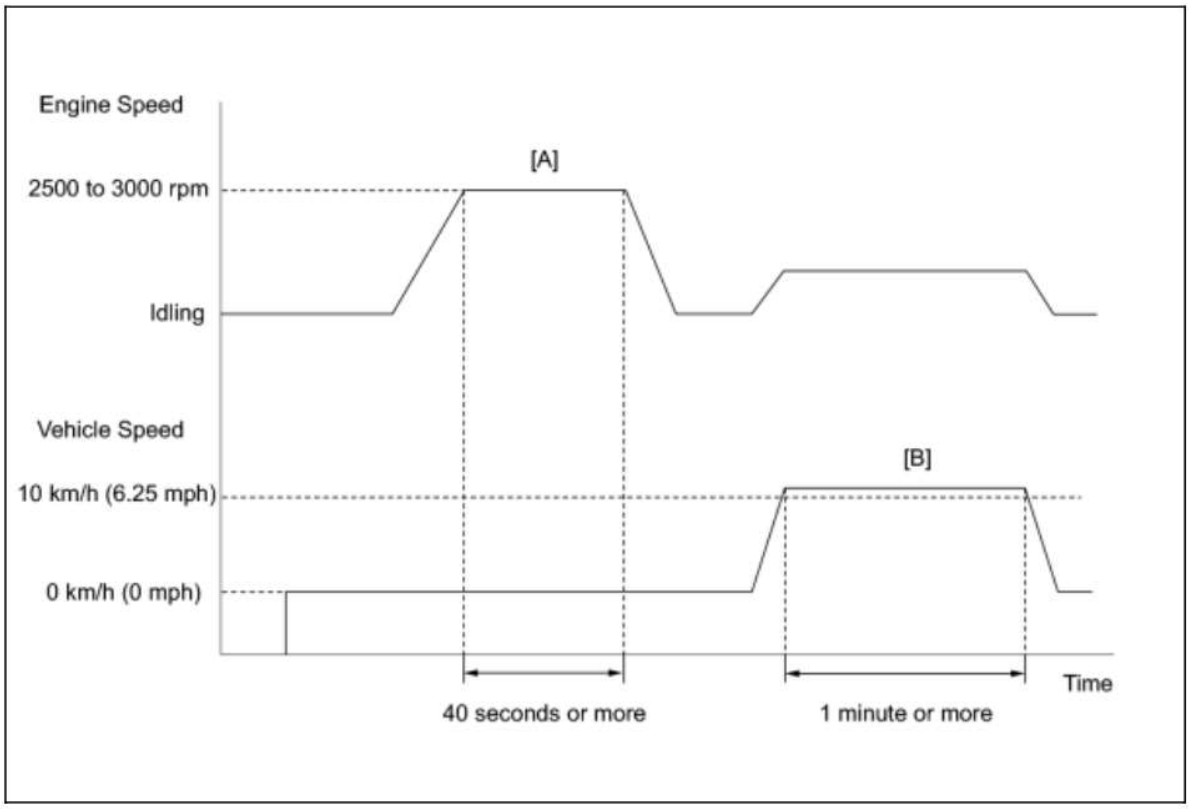
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Battery voltage	10.9 V or more
Camshaft timing oil control valve control duty	99.61% or more

TYPICAL MALFUNCTION THRESHOLDS

Camshaft timing oil control valve control actual current	Less than 0.306 A

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0010 or P0020.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

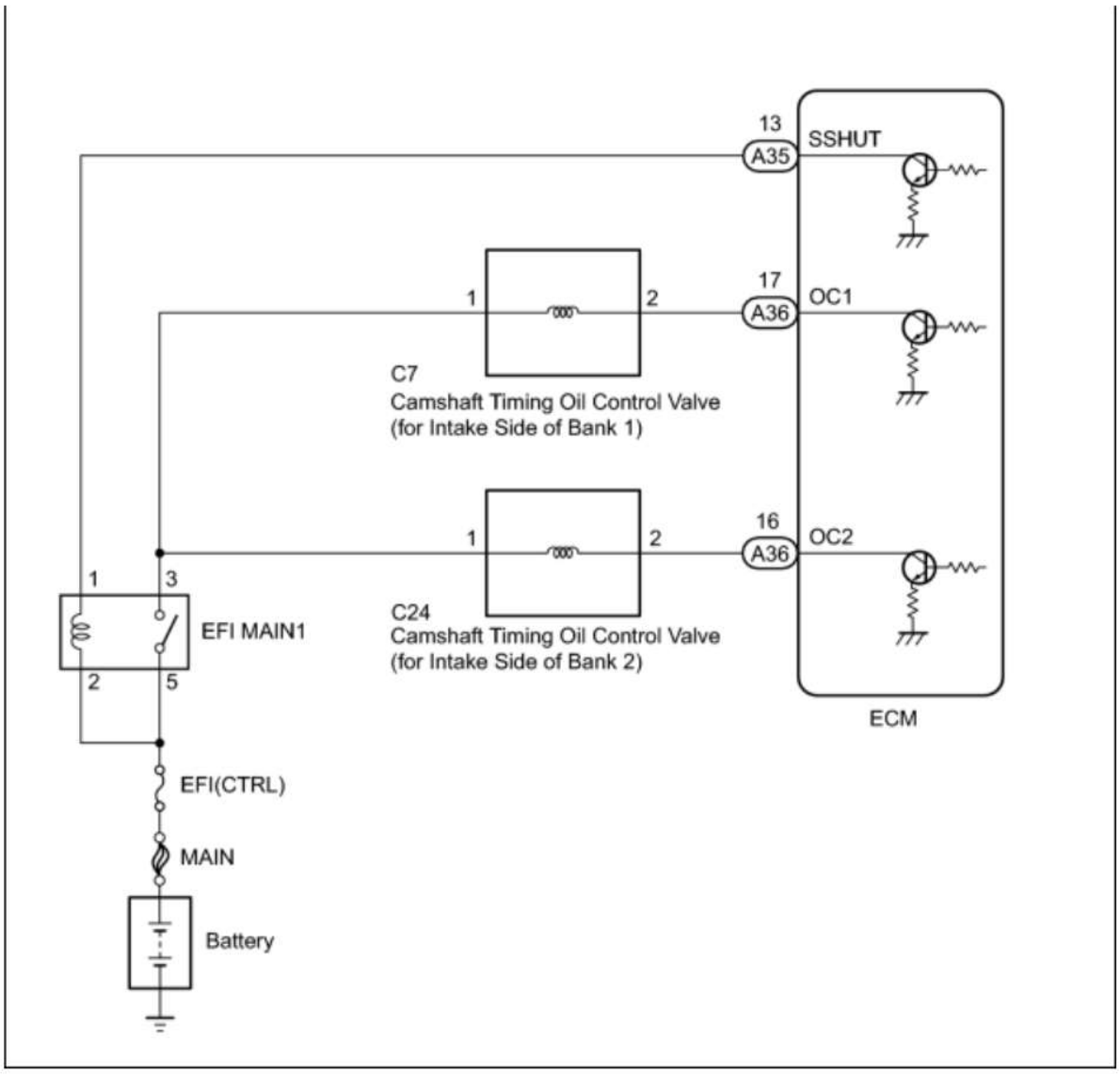
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- If DTC P0010 is displayed, check the intake camshaft circuit for the right bank VVT system (bank 1).
- If DTC P0020 is displayed, check the intake camshaft circuit for the left bank VVT system (bank 2).
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Clear the DTC after recording the freeze frame data and DTC.

(e) Turn the ignition switch off.

(f) Start the engine and allow the engine to idle.

(g) Enter the following menus: Powertrain / Engine / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0010 or P0020 is output	A
DTC is not output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE CAMSHAFT)**

(a) Inspect the camshaft timing oil control valve (for intake camshaft) INFO .

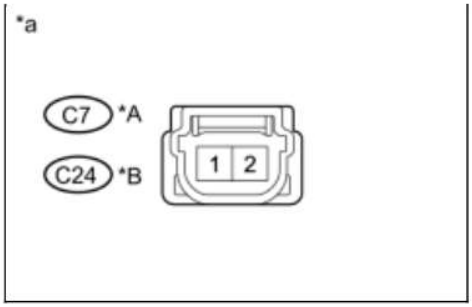
NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE CAMSHAFT)**

OK ▼

3.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF CAMSHAFT TIMING OIL CONTROL VALVE)**

(a) Disconnect the camshaft timing oil control valve (for intake camshaft connector).

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(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C7-1 - Body ground	Ignition switch ON	11 to 14 V
C24-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to Camshaft Timing Oil Control Valve)

NG ▶ **INSPECT RELAY (EFI MAIN1)**

OK
▼

4.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE - ECM)**

(a) Disconnect the camshaft timing oil control valve (for intake camshaft connector).

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-17 (OC1) - C7-2	Always	Below 1 Ω
A36-16 (OC2) - C24-2	Always	Below 1 Ω

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Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-17 (OC1) or C7-2 - Body ground	Always	10 kΩ or higher
A36-16 (OC2) or C24-2 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

5.	**INSPECT RELAY (EFI MAIN1)**

(a) Inspect EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK ▼

6.	**CHECK WIRE HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE - EFI MAIN1 RELAY)**

(a) Disconnect the ECM connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 - C7-1	Always	Below 1 Ω
EFI MAIN1 relay terminal 3 - C24-1	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 or C7-1 - Body ground	Always	10 kΩ or higher
EFI MAIN1 relay terminal 3 or C24-1 - Body ground	Always	10 kΩ or higher

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ CHECK ECM POWER SOURCE CIRCUIT



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XH70FAX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0013,P0023: Camshaft Position "B" Actuator Circuit / Open (Bank 1) (2013 FR-S)		

DTC	**P0013**	**Camshaft Position "B" Actuator Circuit / Open (Bank 1)**

DTC	**P0023**	**Camshaft Position "B" Actuator Circuit / Open (Bank 2)**

DESCRIPTION

Refer to P000B INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0013	Oil control valve current is less than 0.306 A for exhaust camshaft circuit for 2 seconds or more (bank 1). (1 trip detection logic)	• Open or short in camshaft timing oil control valve circuit (for exhaust side of bank 1) • Camshaft timing oil control valve (for exhaust side of bank 1) • ECM
P0023	Oil control valve current is less than 0.306 A for exhaust camshaft circuit for 2 seconds or more (bank 2). (1 trip detection logic)	• Open or short in camshaft timing oil control valve circuit (for exhaust side of bank 2) • Camshaft timing oil control valve (for exhaust side of bank 2) • ECM

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MONITOR DESCRIPTION

This DTC is designed to detect open or short in the camshaft timing oil control valve (for exhaust camshaft) circuit. If the camshaft timing oil control valve's duty-cycle is excessively high or low while the engine is running, the ECM will illuminate the MIL and store the DTC.

MONITOR STRATEGY

Related DTCs	P0013: Oil control valve for exhaust-VVT circuit continuity (Bank 1) P0023: Oil control valve for exhaust-VVT circuit continuity (Bank 2)
Required Sensors/Components (Main)	Exhaust camshaft timing oil control valve
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous

Duration	2 seconds
MIL Operation	Immediately
Sequence of Operation	None

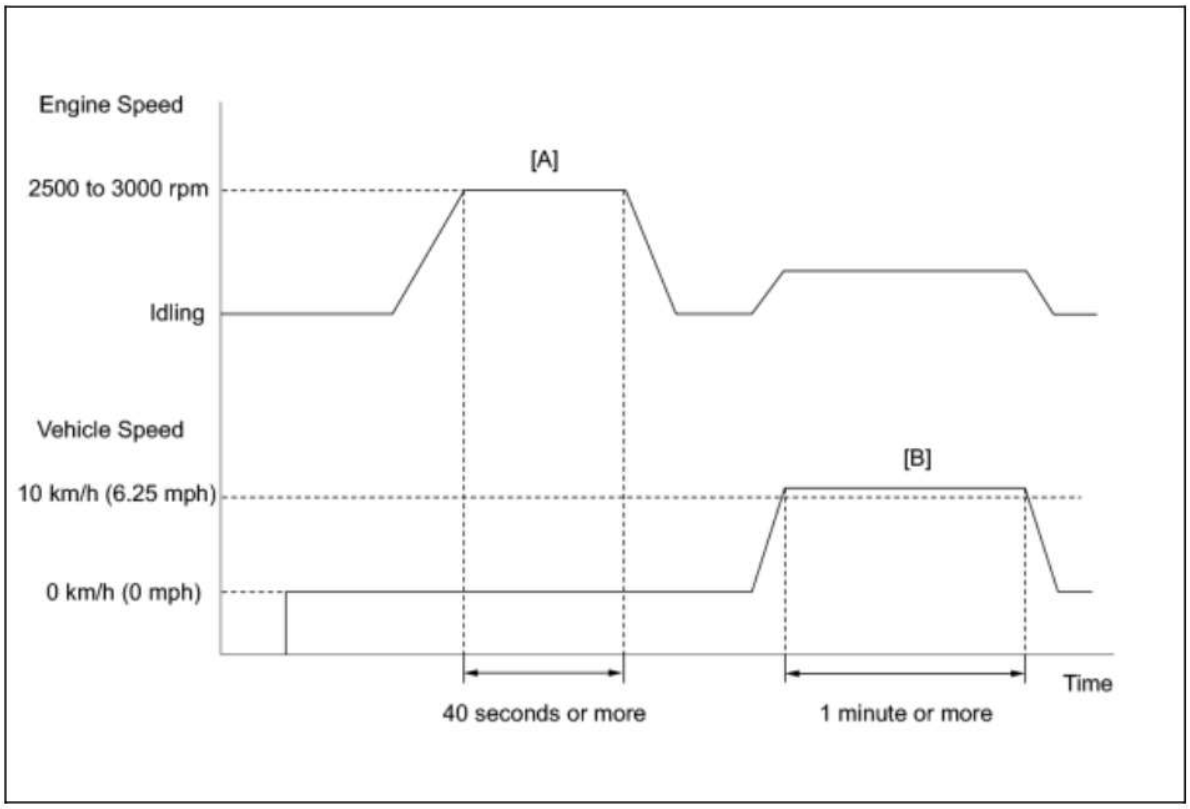
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Battery voltage	10.9 V or more
Camshaft timing oil control valve control duty	99.61% or more

TYPICAL MALFUNCTION THRESHOLDS

Camshaft timing oil control valve control actual current	Less than 0.306 A

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0013 or P0023.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

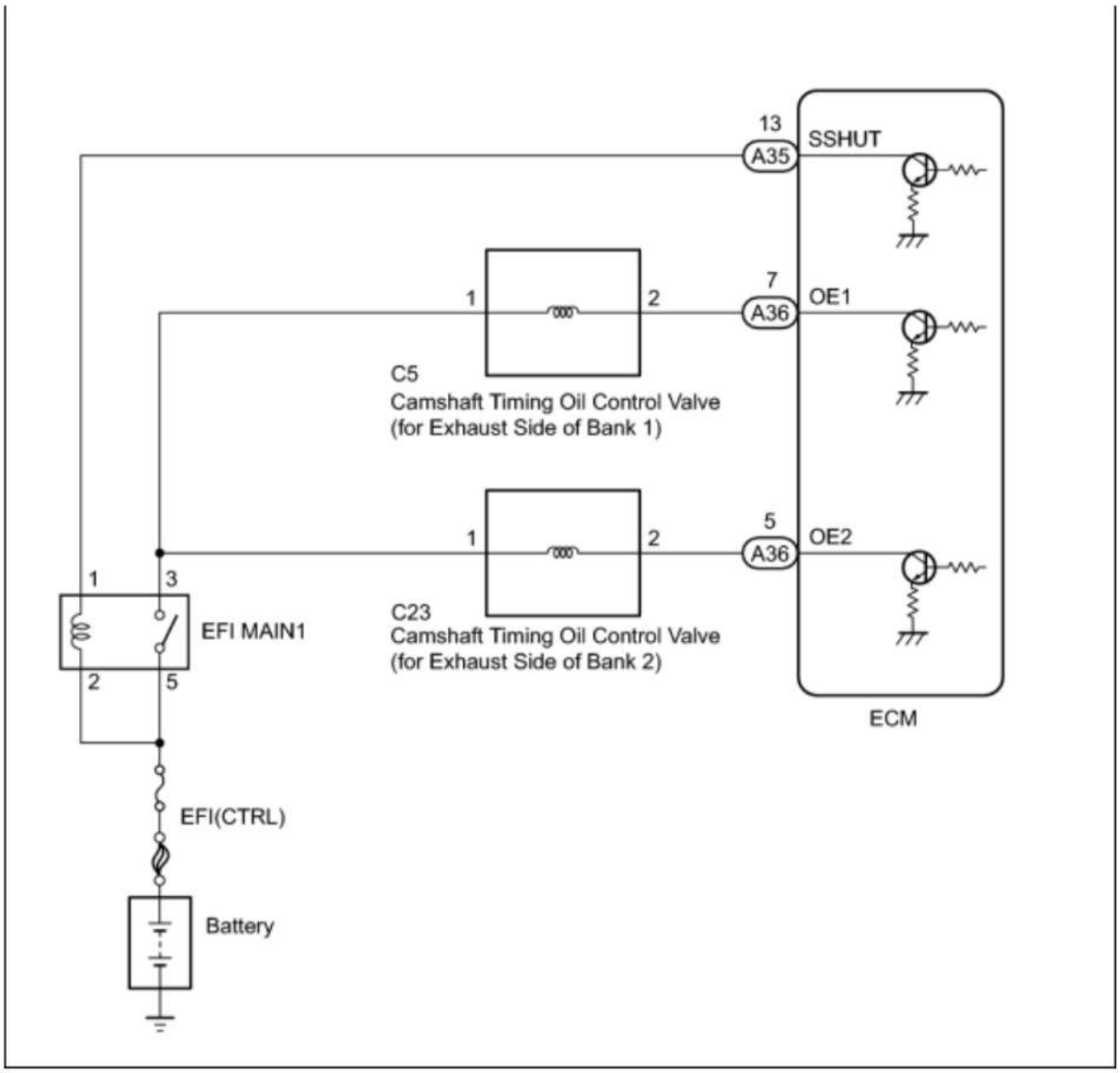
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- If DTC P0013 is displayed, check the exhaust camshaft circuit for the right bank VVT system (bank 1).
- If DTC P0023 is displayed, check the exhaust camshaft circuit for the left bank VVT system (bank 2).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC after recording the freeze frame data and DTC.

(e) Turn the ignition switch off.

(f) Start the engine and allow the engine to idle.

(g) Enter the following menus: Powertrain / Engine / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0013 or P0023 is output	A
DTC is not output	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**INSPECT CAMSHAFT TIMING OIL CONTROL VALVE (FOR EXHAUST CAMSHAFT)**

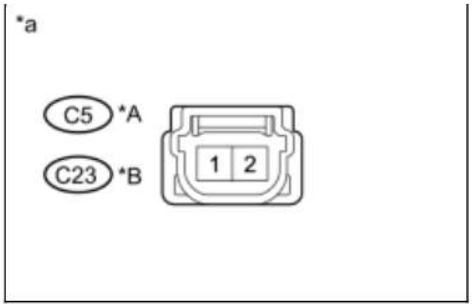
(a) Inspect the camshaft timing oil control valve (for exhaust camshaft) INFO .

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR EXHAUST CAMSHAFT)**

OK ▼

3.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF CAMSHAFT TIMING OIL CONTROL VALVE)**

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(a) Disconnect the camshaft timing oil control valve (for exhaust camshaft connector).

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C5-1 - Body ground	Ignition switch ON	11 to 14 V
C23-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to Camshaft Timing Oil Control Valve)

NG ▶ **INSPECT RELAY (EFI MAIN1)**

OK
▼

4.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE - ECM)**

(a) Disconnect the camshaft timing oil control valve (for exhaust camshaft) connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-7 (OE1) - C5-2	Always	Below 1 Ω
A36-5 (OE2) - C23-2	Always	Below 1 Ω

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Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-7 (OE1) or C5-2 - Body ground	Always	10 kΩ or higher
A36-5 (OE2) or C23-2 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

5.	**INSPECT RELAY (EFI MAIN1)**

(a) Inspect EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK ▼

6.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE - EFI MAIN1 RELAY)**

(a) Disconnect the ECM connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 - C5-1	Always	Below 1 Ω
EFI MAIN1 relay terminal 3 - C23-1	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 or C5-1 - Body ground	Always	10 kΩ or higher
EFI MAIN1 relay terminal 3 or C23-1 - Body ground	Always	10 kΩ or higher

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ CHECK ECM POWER SOURCE CIRCUIT



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000WC20GWX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P014C,P014D,P015A,P015B: A/F Sensor Slow Response - Rich to Lean Bank 1 Sensor 1 (2013 FR-S)		

DTC	**P014C**	**A/F Sensor Slow Response - Rich to Lean Bank 1 Sensor 1**

DTC	**P014D**	**A/F Sensor Slow Response - Lean to Rich Bank 1 Sensor 1**

DTC	**P015A**	**A/F Sensor Delayed Response - Rich to Lean Bank 1 Sensor 1**

DTC	**P015B**	**A/F Sensor Delayed Response - Lean to Rich Bank 1 Sensor 1**

DESCRIPTION

Refer to DTC P2195 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P014C	The "Rich to Lean response rate deterioration level*" value is standard or less for 70 seconds. (2 trip detection logic)	• Air fuel ratio sensor • Air fuel ratio sensor heater • ECM
P014D	The "Lean to Rich response rate deterioration level*" value is standard or more for 70 seconds. (2 trip detection logic)	
P015A	The "Rich to Lean delay level*" value is standard or more. (2 trip detection logic)	
P015B	The "Lean to Rich delay level*" value is standard or more. (2 trip detection logic)	

*: Calculated by ECM based on the air fuel ratio sensor output.

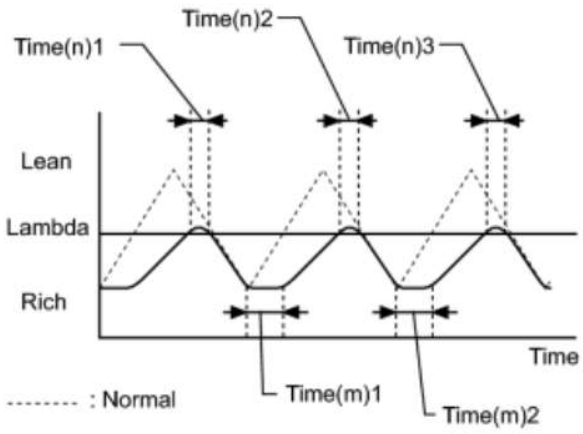
MONITOR DESCRIPTION

P014C, P014D (Asymmetric slow response)

The ECM monitors the time that the air fuel ratio sensor output waveform is at its maximum and minimum as time(m) and Time(n) respectively.

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P014C:



n: Local Maximum

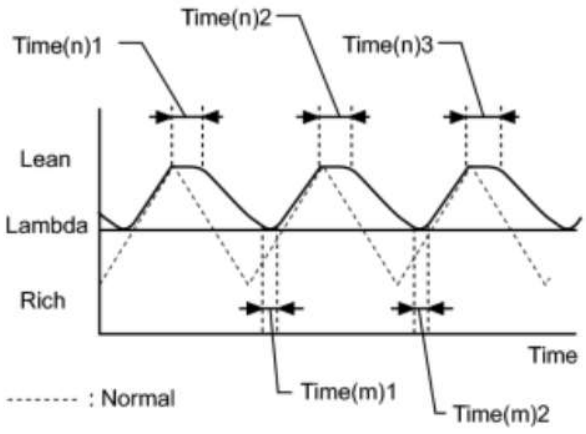
m: Local Minimum

Average of Time(n) = (Time(n)1 + Time(n)2 + ···· / Number of Peaks

Average of Time(m) = (Time(m)1 + Time(m)2 + ···· / Number of Peaks

Malfunction: Average of Time(m) - Average of Time(n) = 0.08 seconds or more

P014D:



n: Local Maximum

m: Local Minimum

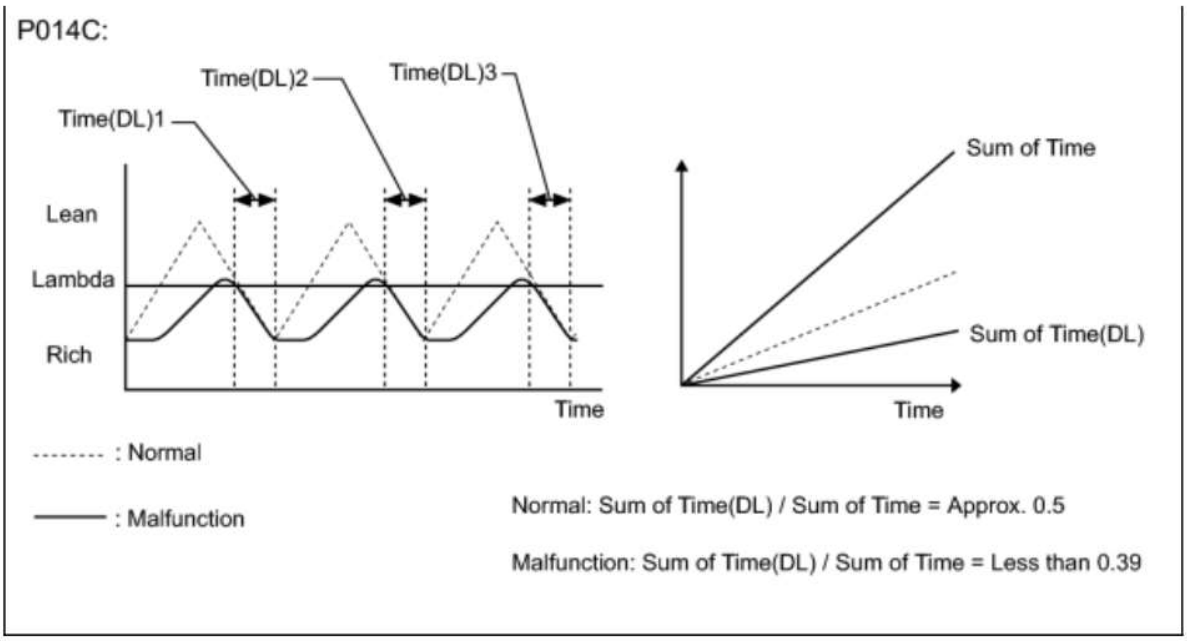
Average of Time(n) = (Time(n)1 + Time(n)2 + ···· / Number of Peaks

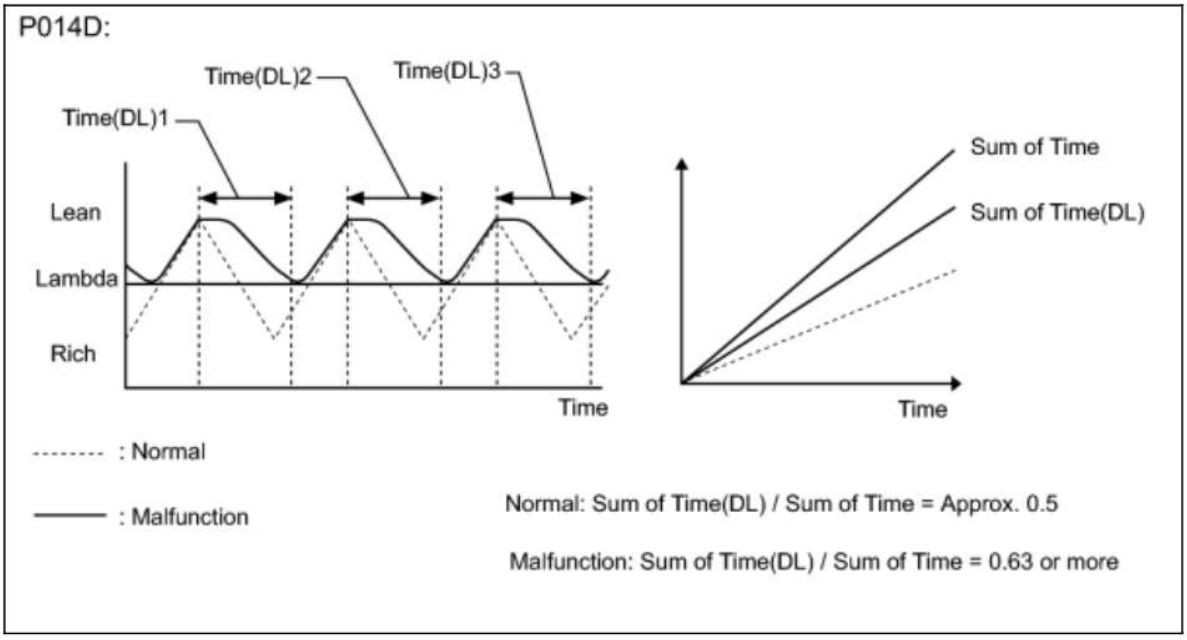
Average of Time(m) = (Time(m)1 + Time(m)2 + ···· / Number of Peaks

Malfunction: Average of Time(n) - Average of Time(m) = 0.1 seconds or more

If the difference between the average time(m) and the average time(n) is the specified value or more, and the air fuel ratio sensor output waveform time of decreasing lambda is less than the air fuel ratio sensor output cumulative time, then P014C is stored, and if this is more, P014D is stored.

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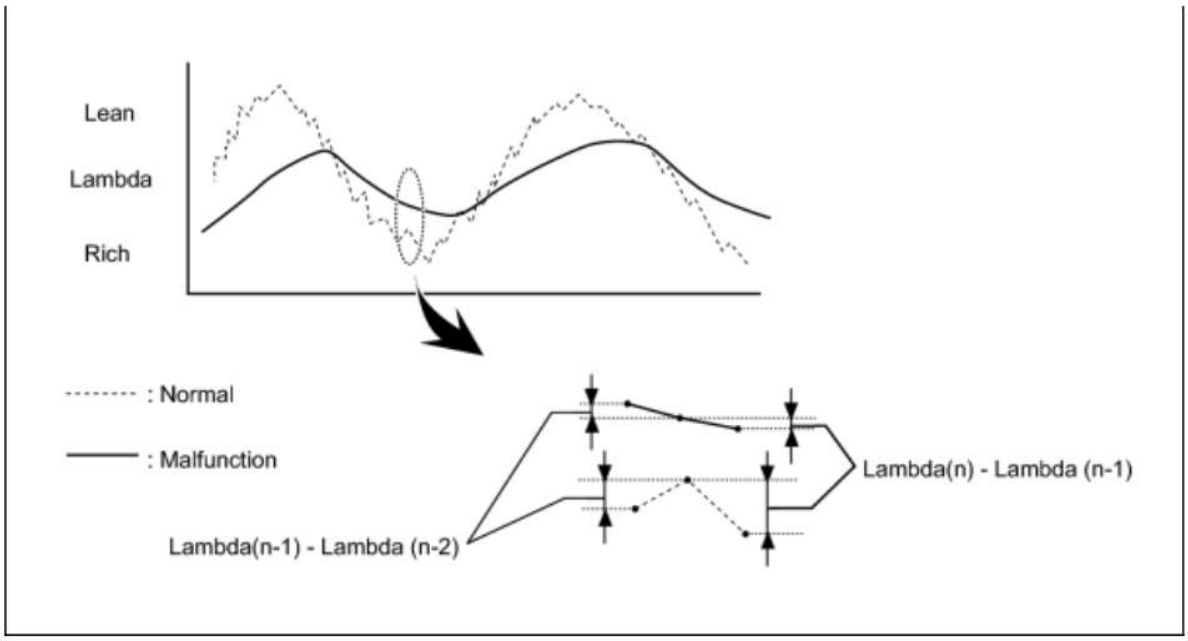




P014C, P014D (Symmetric slow response)

The ECM monitors the amount of change from the air fuel ratio sensor for each specified period, and when the total variation exceeds a specified value, P014C or P014D is stored.

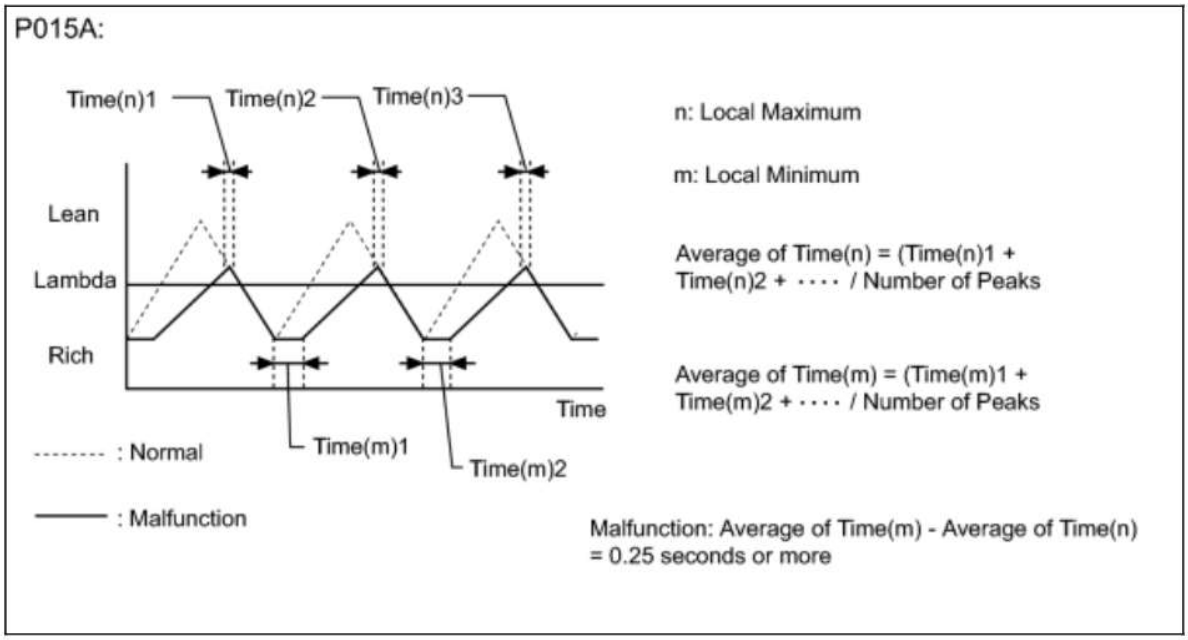
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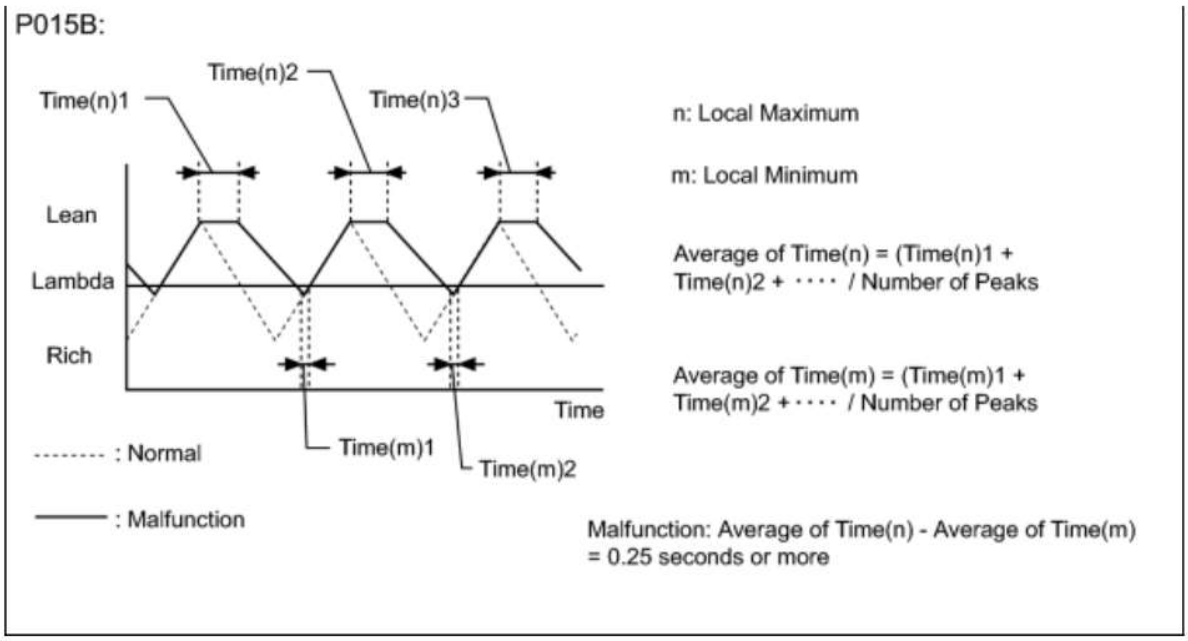
P015A, P015B (Asymmetric delayed start)

The ECM monitors the time that the air fuel ratio sensor output waveform is at its maximum and minimum as time(m) and time(n) respectively.

If the difference between the average time(m) and the average time(n) is the specified value or more, and time(m) is the specified value or more, then P015A is stored, and if time(n) is the specified value or more, then P015B is stored.

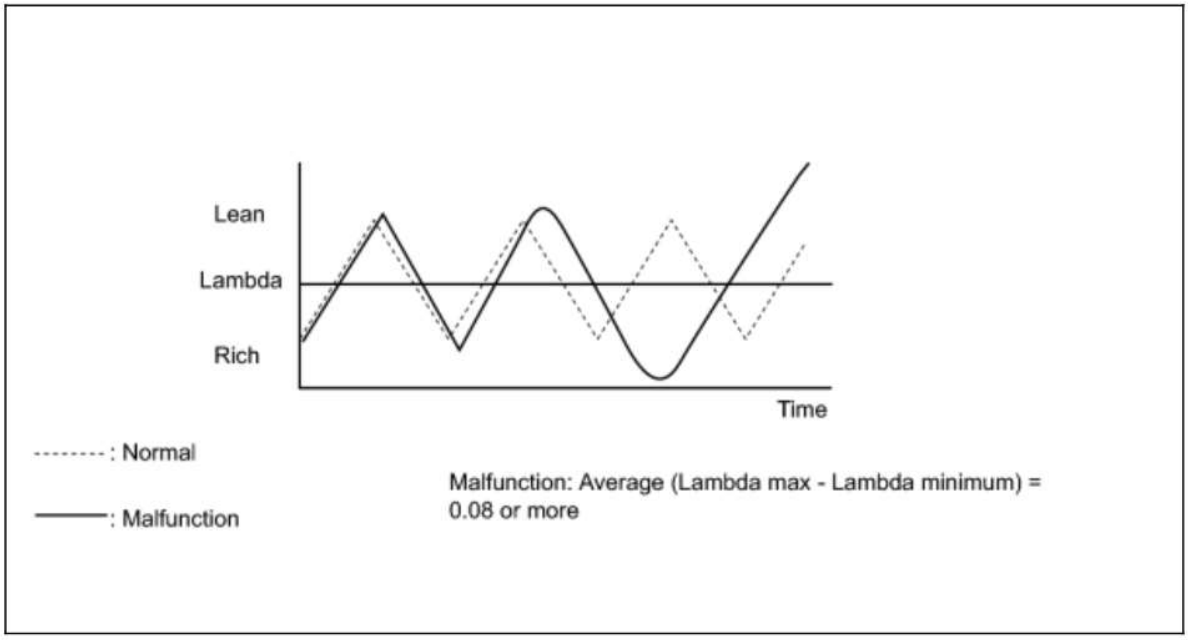


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P015A, P015B (Symmetric delayed start)

If the average value for the Lambda maximum value and minimum value is the specified value or more, then P015A and P015B are stored.



MONITOR STRATEGY

Related DTCs	P014C: Primary oxygen sensor response (Asymmetric slow response Rich to Lean) P014D: Primary oxygen sensor response (Asymmetric slow response Lean to Rich) P014C and P014D: Primary oxygen sensor response (Symmetric slow response) P015A: Primary oxygen sensor response (Asymmetric delayed start

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	Rich to Lean) P015B: Primary oxygen sensor response (Asymmetric delayed start Lean to Rich) P015A and P015B: Primary oxygen sensor response (Symmetric delayed start)
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Speed sensor Crankshaft position sensor
Frequency of Operation	Once per driving cycle
Duration	70 seconds: P014C, P014D 30 seconds: P015A, P015B (Asymmetric delayed start) 90 seconds: P015A, P015B (Symmetric delayed start)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or higher
Fuel system	Closed loop
Impedance of air fuel ratio sensor	0 to 65 Ω
Elapsed time after engine start	40 seconds or more
Engine coolant temperature	0°C or higher
Engine speed	1000 rpm or higher
Intake air mass per second	10 g/sec or more
Elapsed time for fuel cut not active	3 seconds or more
Engine	Not idling

P015A, P015B (Symmetric delayed start)

Learning value of EVAP density during purge	Less than 0.2
Total time of canister purge	20 seconds or more
Change of intake air mass during 1/2 engine revolution	Less than 0.02 g/rev

TYPICAL MALFUNCTION THRESHOLDS

P014C (Asymmetric slow response)

Sum of DL (time of decreasing lambda) / Sum of total time	Less than 0.39
Average of time(m) (local minimum) - Average of time(n) (local maximum)	0.08 seconds or more

P014D (Asymmetric slow response)

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Sum of DL (time of decreasing lambda) / Sum of total time	0.63 or more
Average of time(n) (local maximum) - Average of time(m) (local minimum)	0.1 seconds or more

P014C, P014D (Symmetric slow response)

Sum of lambda ({(lambda(n) - lambda(n-1)} - {(lambda(n-1) - lambda(n-2)})	Less than 7 (varies with accumulated value of lambda variation)

P015A (Asymmetric delayed start)

Average of time(m) (local minimum)	0.35 seconds or more
Average of time(m) (local minimum) - Average of time(n) (local maximum)	0.25 seconds or more

P015B (Asymmetric delayed start)

Average of time(n) (local minimum)	0.35 seconds or more
Average of time(n) (local maximum) - Average of time(m) (local minimum)	0.25 seconds or more

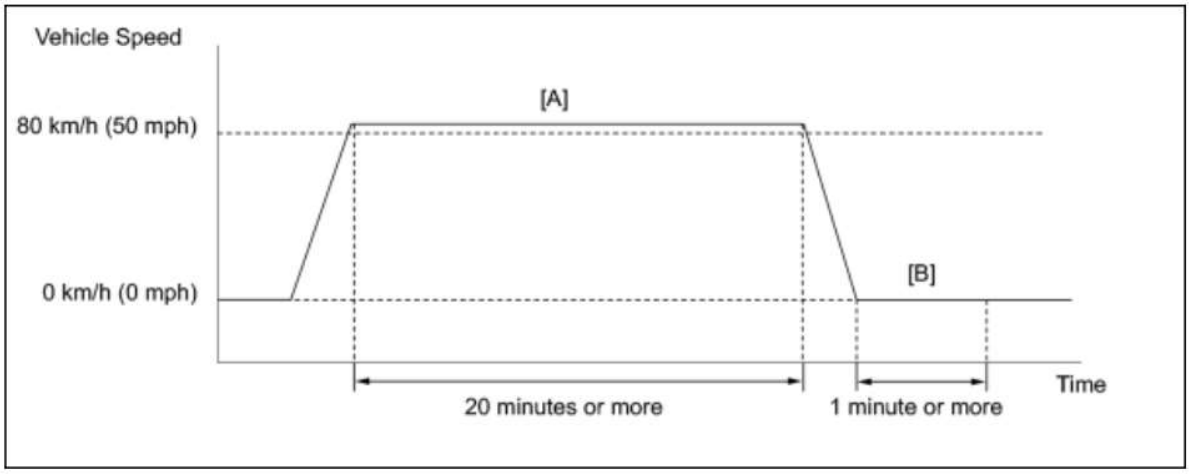
P015A, P015B (Symmetric delayed start)

Average of (maximum lambda - minimum lambda)	0.08 or more

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

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HINT:

Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P014C, P014D, P015A or P015B.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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WIRING DIAGRAM

Refer to DTC P0030 INFO .

INSPECTION PROCEDURE

HINT:

- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P014C, P014D, P015A OR P015B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P014C, P014D, P015A or P015B is output	A
DTC P014C, P014D, P015A or P015B and other DTCs are output	B

HINT:

If any DTCs other than DTC P014C, P014D, P015A or P015B are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

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▼

2.	**INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

(a) Inspect the air fuel ratio sensor INFO .

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

OK
▼

3.	**CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)** INFO

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

OK
▼

4.	**CHECK AIR FUEL RATIO SENSOR**

(a) Check that the proper air fuel ratio sensor is installed to the vehicle.

NG ▶ **SECURELY REINSTALL AIR FUEL RATIO SENSOR**

OK
▼

5.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Drive the vehicle according to the Confirmation Driving Pattern.

NEXT

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6.	CHECK WHETHER DTC OUTPUT RECURS (DTC P014C, P014D, P015A OR P015B)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P014C, P014D, P015A or P015B is output	A
DTC is not output	B

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A

7.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

NEXT

8.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Drive the vehicle according to the Confirmation Driving Pattern.

NEXT

	CHECK WHETHER DTC OUTPUT RECURS (DTC P014C, P014D, P014E, P014F,

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9.	**P015A, P015B, P015C OR P015D)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC P014C, P014D, P015A or P015B is output	B

B ▶ **CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO**

A ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDV0M3X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0016-P0019: Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A) (2013 FR-S)		

DTC	**P0016**	**Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)**

DTC	**P0017**	**Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor B)**

DTC	**P0018**	**Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor A)**

DTC	**P0019**	**Crankshaft Position - Camshaft Position Correlation (Bank 2 Sensor B)**

DESCRIPTION

In the VVT (Variable Valve Timing) system, the appropriate intake and exhaust valve open and close timing is controlled by the ECM. The ECM performs intake and exhaust valve control by performing the following: 1) controlling the camshaft and camshaft timing oil control valve, and operating the camshaft timing gear: and 2) changing the relative positions of the camshaft and crankshaft.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0016	One of the following conditions is met (2 trip detection logic): • Slip intake valve timing for 1 second (bank 1). • Intake camshaft position has slipped from the central lock position for 1 second (bank 1).	• Valve timing • Camshaft timing oil control valve (for intake side of bank 1) • Oil control valve filter (bank 1) • Camshaft timing gear assembly (for intake side of bank 1) • ECM
P0017	One of the following conditions is met (2 trip detection logic): • Slip exhaust valve timing for 5 seconds (bank 1). • Exhaust camshaft position has slipped from the central lock position for 5 seconds (bank 1).	• Valve timing • Camshaft timing oil control valve (for exhaust of bank 1) • Oil control valve filter (bank 1) • Camshaft timing gear assembly (for exhaust side of bank 1) • ECM
		• Valve timing

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P0018	One of the following conditions is met (2 trip detection logic): • Slip intake valve timing for 1 second (bank 2). • Intake camshaft position has slipped from the central lock position for 1 second (bank 2).	• Camshaft timing oil control valve (for intake side of bank 2) • Oil control valve filter (bank 2) • Camshaft timing gear assembly (for intake side of bank 2) • ECM
P0019	One of the following conditions is met (2 trip detection logic): • Slip exhaust valve timing for 5 seconds (bank 2). • Exhaust camshaft position has slipped from the central lock position for 5 seconds (bank 2).	• Valve timing • Camshaft timing oil control valve (for exhaust side of bank 2) • Oil control valve filter (bank 2) • Camshaft timing gear assembly (for exhaust side of bank 2) • ECM

MONITOR DESCRIPTION

To monitor the correlation of the intake camshaft position and crankshaft position, the ECM checks the VVT learned value while the engine is idling. The VVT learned value is calibrated based on the camshaft position and crankshaft position. The intake valve timing is set to the most retarded angle while the engine is idling. If the VVT learned value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and stores DTC P0016 (bank 1) or P0018 (bank 2).

To monitor the correlation of the exhaust camshaft position and crankshaft position, the ECM checks the VVT learned value while the engine is idling. The VVT learned value is calibrated based on the camshaft position and crankshaft position. The exhaust valve timing is set to the most advanced angle while the engine is idling. If the VVT learned value is out of the specified range in consecutive driving cycles, the ECM illuminates the MIL and stores DTC P0017 (bank 1) or P0019 (bank 2).

MONITOR STRATEGY

Related DTCs	P0016: Crankshaft / Camshaft correlation (intake) functional check (Bank 1) P0017: Crankshaft / Camshaft correlation (exhaust) functional check (Bank 1) P0018: Crankshaft / Camshaft correlation (intake) functional check (Bank 2) P0019: Crankshaft / Camshaft correlation (exhaust) functional check (Bank 2)
Required Sensors/Components (Main)	Camshaft timing gear assembly Camshaft timing exhaust gear assembly
Required Sensors/Components (Related)	VVT sensor Crankshaft position sensor
Frequency of Operation	Continuous
	1 second: P0016, P0018

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Duration	5 second: P0017, P0019
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or more
Elapsed time after engine start	60 seconds or more
Engine coolant temperature	50°C (122°F) or higher
VVT feedback control	Not active
VVT target position	Less than 0.01°CA
Learning experienced flag	Set
Duration of no power steering switch change	3 seconds or more
Duration of no neutral switch change	3 seconds or more

P0016, P0018

Engine speed	1400 to 3000 rpm

P0017, P0019

Engine speed	500 to 1700 rpm

TYPICAL MALFUNCTION THRESHOLDS

P0016, P0018 (One tooth misalignment)

Actual angle of camshaft - Learning value of the base position	10°CA or more

P0016, P0018 (Two teeth misalignment)

Actual angle of camshaft	Less than 28°CA or more than 87°CA

P0017, P0019 (One tooth misalignment)

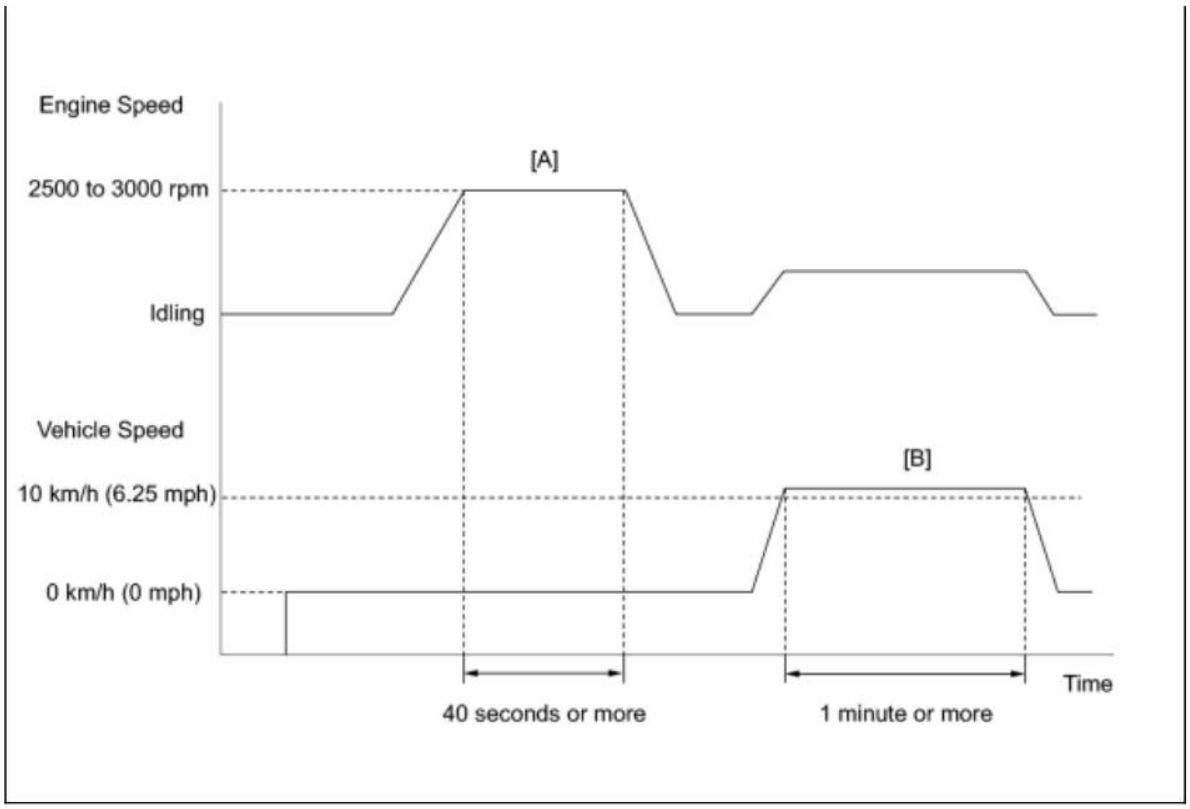
Actual angle of camshaft - Learning value of the base position	10°CA or more

P0017, P0019 (Two teeth misalignment)

Actual angle of camshaft	Less than 58°CA or more than 117°CA

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0016, P0017, P0018 or P0019.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0010 for the camshaft timing oil control valve (for intake camshaft) circuit INFO .

Refer to DTC P0013 for the camshaft timing oil control valve (for exhaust camshaft) circuit INFO .

INSPECTION PROCEDURE

HINT:

- If DTC P0016 or P0017 is displayed, check the intake camshaft circuit for the right bank VVT system (bank 1).
- If DTC P0018 or P0019 is displayed, check the intake camshaft circuit for the left bank VVT system (bank 2).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0016, P0017, P0018 OR P0019)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0016, P0017, P0018 or P0019 is output	A
DTC P0016, P0017, P0018 or P0019 and other DTCs are output	B

HINT:

If any DTCs other than P0016, P0017, P0018 or P0019 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE)**

HINT:

If the VVT system can be operated through the Active Test, it can be assumed that the VVT system is operating normally.

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the A/C on.

(d) Turn the Techstream on.

(e) Warm up the engine.

(f) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank 1) or Control the VVT Exhaust Linear (Bank 1) / VVT Change Angle #1, VVT Ex Chg Angle #1, VVT Change Angle #2, VVT Ex Chg Angle #2.

(g) Perform the Active Test. Check that the displacement angle varies.

OK:
Displacement angle varies.

INSPECT CAMSHAFT TIMING OIL CONTROL

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NG ▶ VALVE (FOR INTAKE OR EXHAUST CAMSHAFT)

OK ▼

3.	CHECK VALVE TIMING

(a) Check the valve timing INFO .

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P0016, P0017, P0018 OR P0019)

A ▶ ADJUST VALVE TIMING

4.	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE OR EXHAUST CAMSHAFT)

(a) Inspect the camshaft timing oil control valve (for intake or exhaust camshaft) INFO .

NG ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE OR EXHAUST CAMSHAFT)

OK ▼

5.	INSPECT OIL CONTROL VALVE FILTER AND OIL PIPE

(a) Check that the oil control valve filter and oil pipe are not clogged.

OK:
The oil control valve filter and oil pipe are not clogged.

NG ▶ CLEAN OR REPLACE OIL CONTROL VALVE FILTER AND OIL PIPE

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OK

6.	**INSPECT CAMSHAFT TIMING GEAR ASSEMBLY (FOR INTAKE OR EXHAUST CAMSHAFT)**

(a) Inspect the camshaft timing gear assembly (for intake camshaft or exhaust camshaft) INFO .

NG ▶ **REPLACE CAMSHAFT TIMING GEAR ASSEMBLY (INTAKE OR EXHAUST CAMSHAFT)**

OK

7.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0016, P0017, P0018 OR P0019)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(k) Read pending DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0016, P0017, P0018 or P0019 is output	B

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B ▶ REPLACE ECM

A ▶ END



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000WC10PBX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0030-P0032: A/F Sensor Heater Control Circuit (Bank 1 Sensor 1) (2013 FR-S)		

DTC	**P0030**	**A/F Sensor Heater Control Circuit (Bank 1 Sensor 1)**

DTC	**P0031**	**Oxygen (A/F) Sensor Heater Control Circuit Low (Bank 1 Sensor 1)**

DTC	**P0032**	**Oxygen (A/F) Sensor Heater Control Circuit High (Bank 1 Sensor 1)**

DESCRIPTION

Refer to DTC P2195 INFO .

HINT:

- When any of these DTCs is stored, the ECM enters fail-safe mode. The ECM turns off the air fuel ratio sensor heater in fail-safe mode. Fail-safe mode continues until the ignition switch is turned off.
- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.
- The ECM provides a pulse width modulated control circuit to adjust the current through the heater. The air fuel ratio sensor heater circuit uses a relay on the +B side of the circuit.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0030	Air fuel ratio sensor impedance is greater than 65 Ω for 10 seconds or more. (2 trip detection logic)	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM
P0031	Air fuel ratio sensor heater voltage is less than 1.2 V for 1 second or more. (1 trip detection logic)	
P0032	Air fuel ratio sensor heater voltage is 1.2 V or more for 2 seconds or more. (1 trip detection logic)	

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

MONITOR DESCRIPTION

The ECM uses information from the air fuel ratio sensor to regulate the air fuel ratio and keep it close to the stoichiometric level. This maximizes the ability of the three-way catalytic converter to purify the exhaust gases.

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The air fuel ratio sensor detects oxygen levels in the exhaust gas and transmits the information to the ECM. The inner surface of the sensor element is exposed to the outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of platinum-coated zirconia and includes an integrated heating element.

The zirconia element generates a small voltage when there is a large difference in the oxygen concentrations between the exhaust gas and outside air. The platinum coating amplifies this voltage generation.

The air fuel ratio sensor is more efficient when heated. When the exhaust gas temperature is low, the sensor cannot generate useful voltage signals without supplementary heating. The ECM regulates the supplementary heating using a duty-cycle approach to adjust the average current in the sensor heater element. If the heater current is outside the normal range, the signal transmitted by the air fuel ratio sensor becomes inaccurate. As a result, the ECM is unable to regulate the air fuel ratio properly.

When the current in the air fuel ratio sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0030: Primary oxygen sensor - Heater functional check P0031: Primary oxygen sensor - Heater circuit continuity P0032: Primary oxygen sensor - Heater circuit continuity
Required Sensors/Components (Main)	Air fuel ratio sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	10 seconds: P0030 1 second: P0031 2 seconds: P0032
MIL Operation	2 driving cycles: P0030 Immediate: P0031, P0032
Sequence of Operation	None

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TYPICAL ENABLING CONDITIONS

P0030

Monitor runs whenever following DTCs not stored	P0122, P0123, P0222, P0223 (Throttle position sensor) P0300, P0301, P0302, P0303, P0304 (Misfire) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Battery voltage	10.9 V or more

Heater energize continuously	Active
Elapsed time after fuel cut.	20 seconds or more

P0031

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or more
Air fuel ratio sensor heater control duty	Less than 87.5%

P0032

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or more
Air fuel ratio sensor heater control duty	12.5% or more

TYPICAL MALFUNCTION THRESHOLDS

P0030

Impedance of air fuel ratio sensor	65 Ω or higher

P0031

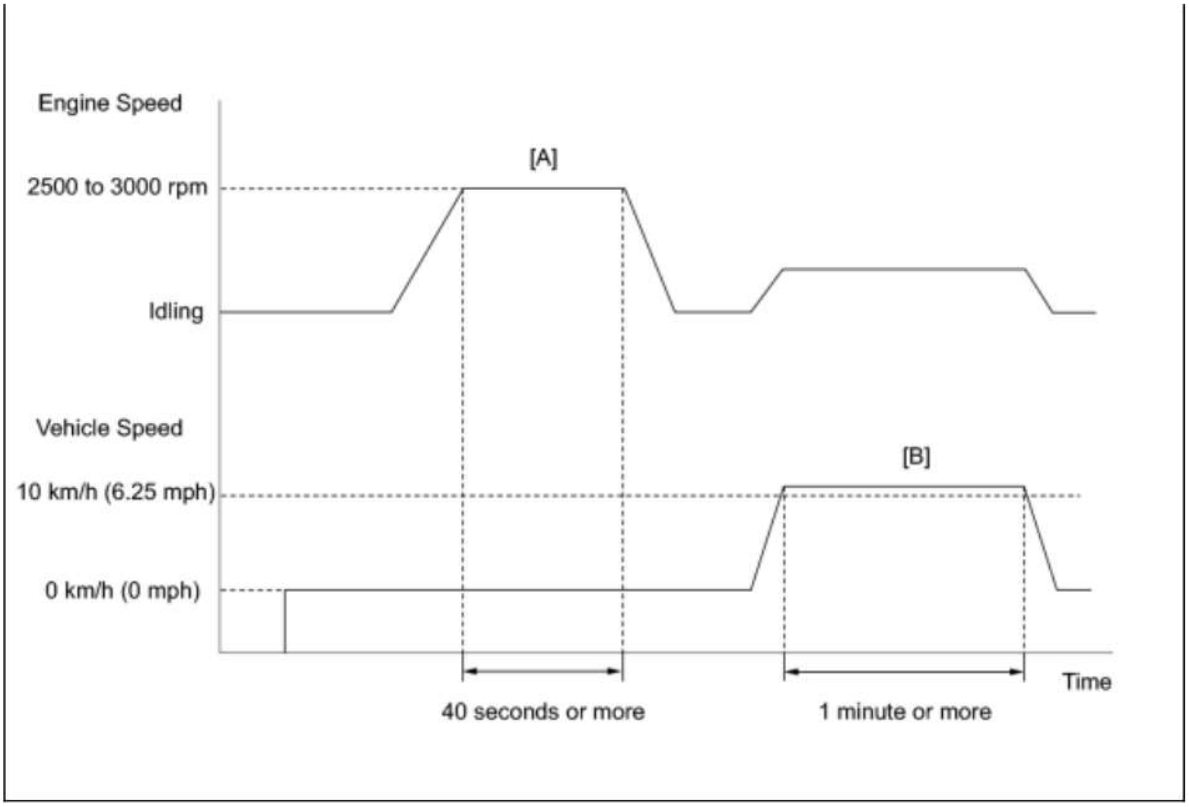
Air fuel ratio sensor heater ON voltage	Less than 1.2 V

P0032

Air fuel ratio sensor heater ON voltage	1.2 V or higher

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0030, P0031 or P0032.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

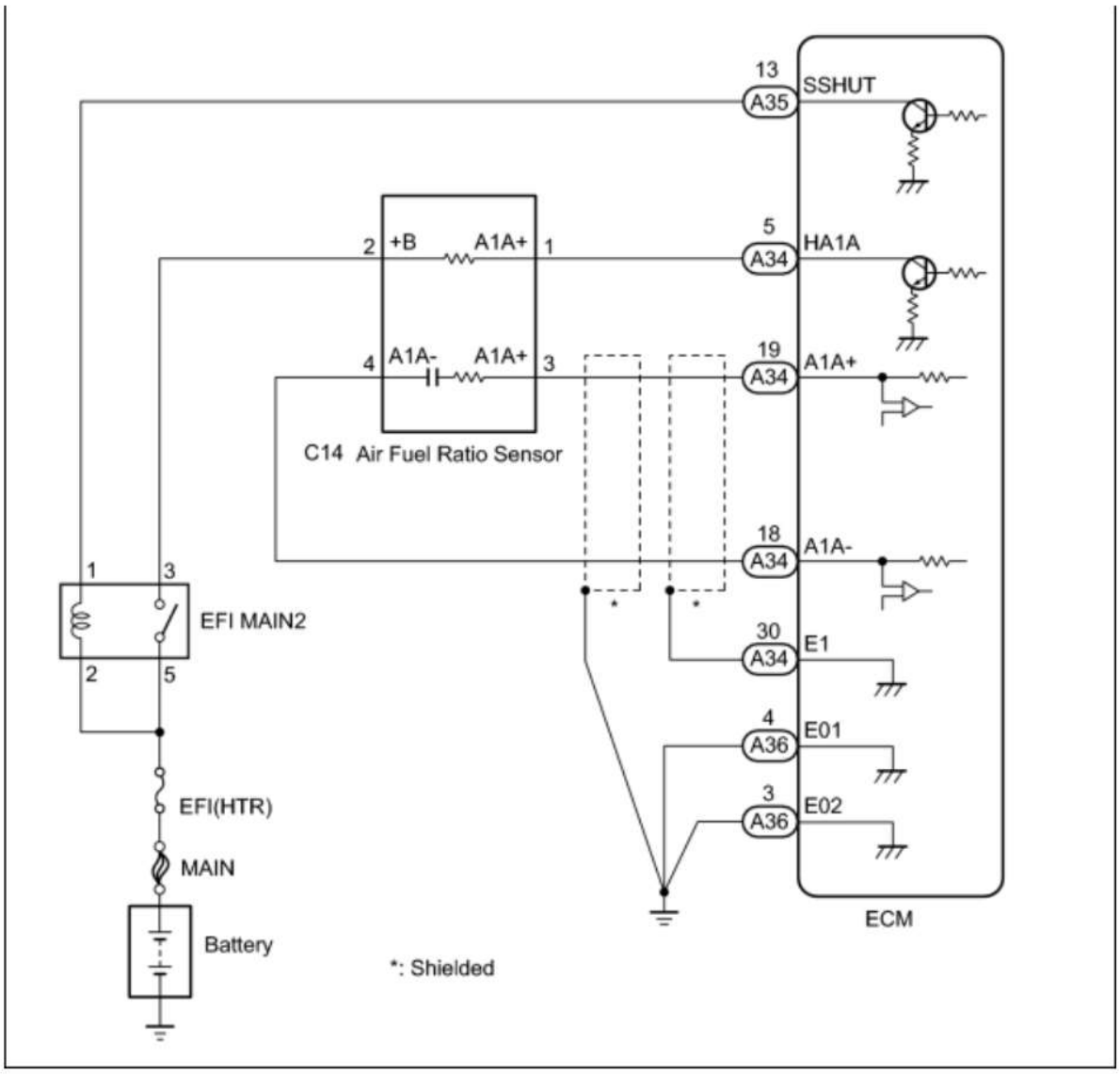
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Refer to "Data List / Active Test" [A/F Heater Duty #1] INFO .
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Change the fuel injection volume using the Control the Injection Volume function provided in the Active Test and monitor the air fuel ratio sensor output voltage INFO . If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

PROCEDURE

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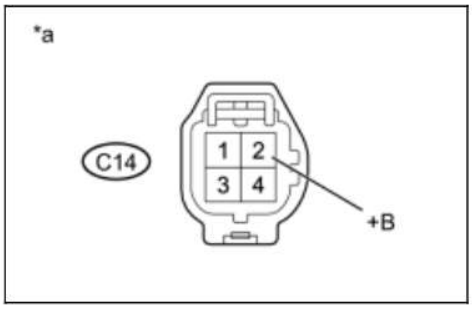
1.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

(a) Inspect the air fuel ratio sensor INFO .

NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▼

2.	INSPECT TERMINAL VOLTAGE (POWER SOURCE OF AIR FUEL RATIO SENSOR)



(a) Disconnect the air fuel ratio sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C14-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Air Fuel Ratio Sensor)

NG ▶ INSPECT RELAY (EFI MAIN2)

OK ▼

3.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

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(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-5 (HA1A) - C14-1(HA1A)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-5 (HA1A) or C14-1 (HA1A) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	CHECK WHETHER DTC OUTPUT RECURS (P0030, P0031 OR P0032)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes.

(k) Read DTCs.

Result

RESULT	PROCEED TO

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DTC is not output	A
DTC P0030, P0031or P0032 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

5.	**INSPECT RELAY (EFI MAIN2)**

(a) Check the EFI MAIN2 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN2)**

OK ▼

6.	**CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - EFI MAIN2 RELAY)**

(a) Disconnect the air fuel ratio sensor connector.

(b) Remove the EFI MAIN2 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN2 relay terminal 3 - C14-2 (+B)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN2 relay terminal 3 or C14-2 (+B) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PFA0P5X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0037,P0038,P0141: Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2) (2013 FR-S)		

DTC	**P0037**	**Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)**

DTC	**P0038**	**Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)**

DTC	**P0141**	**Oxygen Sensor Heater Circuit (Bank 1 Sensor 2)**

DESCRIPTION

Refer to DTC P0137 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0037	Heated oxygen sensor heater voltage is less than battery voltage X 0.3 V for 10 seconds or more. (2 trip detection logic)	• Open or short in heated oxygen sensor heater circuit • Heated oxygen sensor • ECM
P0038	Heated oxygen sensor heater voltage is battery voltage X 0.2 V or more for 10 seconds or more. (2 trip detection logic)	
P0141	Heated oxygen sensor heater voltage is less than battery voltage X 0.88 V for 10 seconds or more. (2 trip detection logic)	

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MONITOR DESCRIPTION

The sensing portion of the heated oxygen sensor has a zirconia element which is used to detect the oxygen concentration in the exhaust gas. If the zirconia element is at the appropriate temperature, and the difference between the oxygen concentrations surrounding the inside and outside surfaces of the sensor is large, the zirconia element generates voltage signals. In order to increase the oxygen concentration detecting capacity of the zirconia element, the ECM supplements the heat from the exhaust with heat from a heating element inside the sensor.

The ECM monitors the current applied to the heated oxygen sensor heater to check the heater for malfunctions.

If the heater current is outside the normal range, the signal transmitted by the heated oxygen sensor becomes inaccurate. When the current in the heated oxygen sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and stores a DTC.

MONITOR STRATEGY

	P0037: Secondary oxygen sensor - Heater circuit continuity

Related DTCs	P0038: Secondary oxygen sensor - Heater circuit continuity P0141: Secondary oxygen sensor - Heater functional check
Required Sensors/Components (Main)	Heated oxygen sensor heater
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	10 seconds (8 msec. X 1250 count): P0037 2.56 seconds (8 msec. X 320 count): P0038 10 seconds (4 msec X 1250 count): P0141
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0037

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or higher
Elapsed time after engine start	1 second or more
Heated oxygen sensor heater control duty	Less than 75%

P0038

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or higher
Elapsed time after engine start	1 second or more
Heated oxygen sensor heater control duty	20% or more

P0141

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or higher
Elapsed time after engine start	1 second or more
Engine coolant temperature	60°C (140 °F) or higher
Impedance of air fuel ratio sensor	Less than 65 Ω
Heated oxygen sensor heater control duty	Less than 70%
Air fuel ratio sensor heater control duty	Less than 75%

TYPICAL MALFUNCTION THRESHOLDS

P0037

Output voltage	Battery voltage X 0.2 or more

P0038

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Output voltage	Battery voltage X 0.3 or more

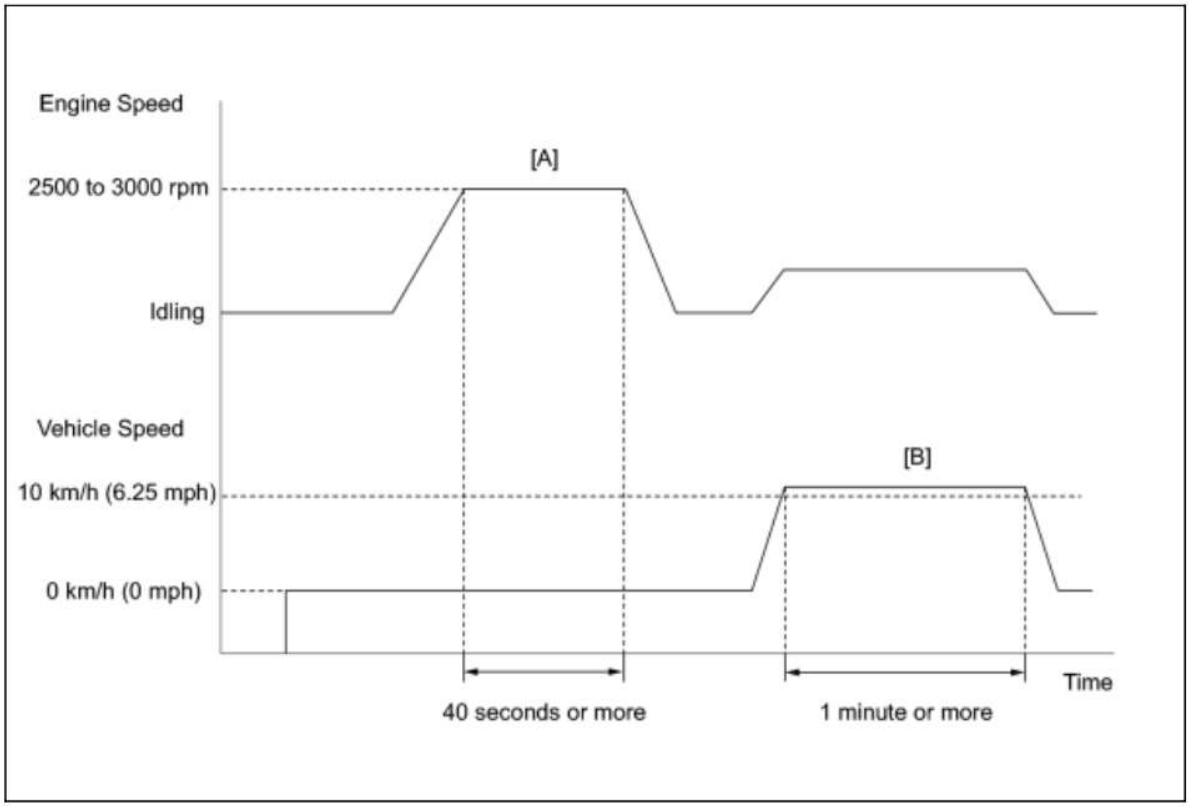
P0141

Judgement voltage	Less than Battery voltage X 0.88

MONITOR RESULT

Refer to detailed information in Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

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HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0037, P0038 or P0141.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

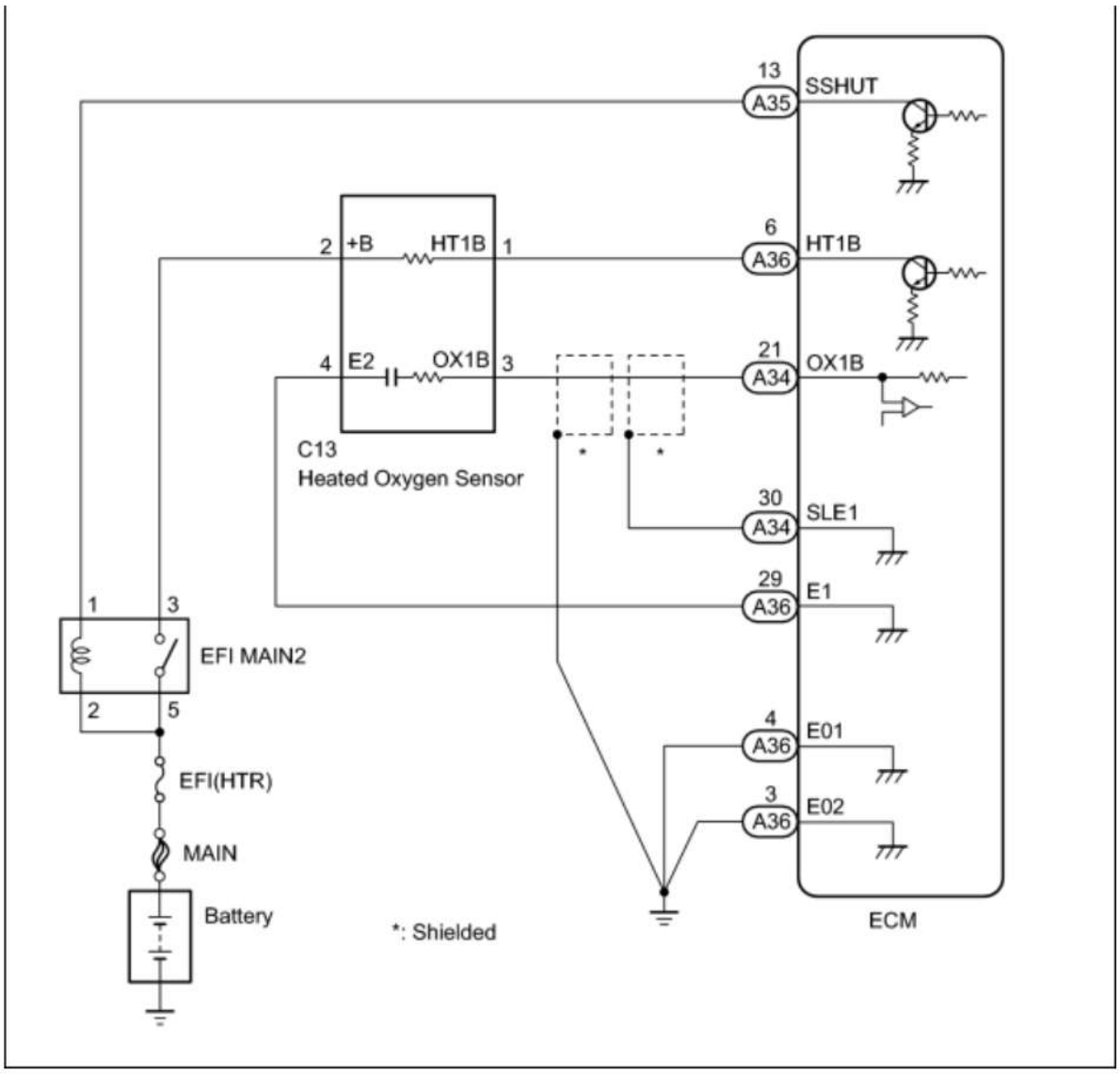
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Refer to "Data List / Active Test" [O2 Heater B1S2 and O2 Heater Curr Val B1S2] INFO .
- When the values for the Data List item O2 Heater Curr Val B1S2 is not 0 A, the heater is on.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Change the fuel injection volume using the Control the Injection Volume function provided in the Active Test and monitor the heated oxygen sensor output voltage INFO . If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

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PROCEDURE

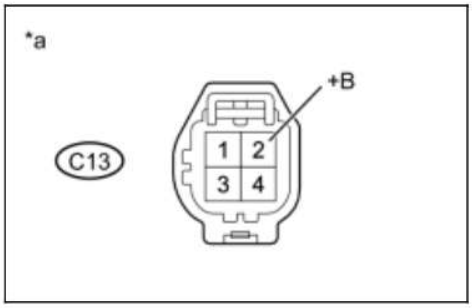
1.	INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)

(a) Inspect the heated oxygen sensor INFO .

NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

2.	INSPECT TERMINAL VOLTAGE (POWER SOURCE OF HEATED OXYGEN SENSOR)



(a) Disconnect the heated oxygen sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C13-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Heated Oxygen Sensor)

NG ▶ INSPECT RELAY (EFI MAIN2)

OK ▼

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3.	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

(a) Disconnect the heated oxygen sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-6 (HT1B) - C13-1 (HT1B)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-6 (HT1B) or C13-1 (HT1B)- Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0037 OR P0038)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes.

(k) Read pending DTCs.

Result

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RESULT	PROCEED TO
DTC is not output	A
DTC P0037, P0038 or P0141 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

5.	**INSPECT RELAY (EFI MAIN2)**

(a) Check the EFI MAIN2 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN2)**

OK ▼

6.	**CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - EFI MAIN2 RELAY)**

(a) Disconnect the heated oxygen sensor connector.

(b) Remove the EFI MAIN2 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN2 relay terminal 3 - C13-2 (+B)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN2 relay terminal 3 or C13-2 (+B) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001BFY08MX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P050A,P050B: Cold Start Idle Air Control System Performance (2013 FR-S)		

DTC	**P050A**	**Cold Start Idle Air Control System Performance**

DTC	**P050B**	**Cold Start Ignition Timing Performance**

DESCRIPTION

Cold start emission reduction strategy (CSERS) is employed to shorten the time to catalyst light-off from cold start. CSERS consists of retarded ignition timing and increased engine idle speed for a calibrated period of time. This monitor detects malfunctions of the estimated exhaust gas temperature, ECM commanded ignition timing and engine idle speed not reaching the target values.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P050A	The engine speed does not achieve the target engine speed for 7 seconds with engine cooled down. (2 trip detection logic)	• Throttle with motor body assembly • Mass air flow meter • PCV system • Air cleaner filter element • Intake system • VVT system • Wire harness or connector • ECM
P050B	The ignition timing is not retarded for 7 seconds, despite rapid warming control of the catalyst (to retard the ignition timing). (2 trip detection logic)	

MONITOR STRATEGY

Related DTCs	P050A: Cold start emission reduction strategy functional check P050B: Cold start emission reduction strategy functional check
Required Sensors/Components (Main)	Throttle with motor body assembly
Required Sensors/Components (Related)	Mass air flow meter Vacuum sensor assembly Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	14 seconds: P050A (Case 1) 7 seconds: P050A (Case 2) 10 seconds: P050B

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MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None
Atmospheric pressure	75.06 kPa(abs) [563 mmHg(abs)] or higher
Battery voltage	10.9 V or more
Vehicle speed	Less than 2 km/h (1.2 mph)
Throttle position	Less than 0.296%
Elapsed time after gear position change N ⟷ D	3 seconds or more

P050A (Case 1)

Idle speed control	Active
Commanded ignition timing with CSERS	Less than 3°CA

P050A (Case 2)

Engine coolant temperature	Less than 80°C (176°F)
Integrated amount of intake air	Less than 800 g (varies with engine coolant temperature at engine start)
Elapsed time after engine start	2 seconds or more

P050B

Engine coolant temperature	Less than 80°C (176°F)
Integrated amount of intake air	Less than 800 g (varies with engine coolant temperature at engine start)
Commanded ignition timing with CSERS	Less than 3°CA

TYPICAL MALFUNCTION THRESHOLDS

P050A (Case 1)

Estimated exhaust gas temperature* *: (Manifold absolute pressure X Coefficient 1) + {(Actual engine speed - Target engine speed) X Coefficient 2}	Less than 298°C (568.4°F)

P050A (Case 2)

Actual engine speed - Target engine speed	Less than -300 rpm

P050B

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Final commanded ignition timing - Commanded ignition timing with CSERS	More than 7°CA

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Data List / Coolant Temp, Intake Air.
7. Check that "Coolant Temp - Intake Air" is less than 5°C (9°F).

HINT:

If the conditions are not met, then turn the ignition switch off, and wait until the conditions are met.

8. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P050A or P50B.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and

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check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0102 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P050A OR P050B)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P050A or P050B is output	A
DTC P050A or P050B and other DTCs are output	B

HINT:

If any DTCs other than P050A or P050B are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

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2.	READ VALUE USING TECHSTREAM (FUEL TRIM)

HINT:

Calculate the total fuel trim values to check the characteristic deviation of the mass air flow meter.

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Short FT #1 and Long FT #1.

(e) Read the values displayed on the Techstream at engine idle.

(f) Add together the Short FT #1 and Long FT #1 values to obtain the total fuel trim.

Standard:
Total of Short FT #1 and Long FT #1 values is between -20% and 20%.

NG ▶ **CHECK PCV SYSTEM**

OK ▼

3.	INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (THROTTLE VALVE)

(a) Check that there are no deposits around the throttle valve and throttle valve condition.

OK:
No deposits around the throttle valve and throttle valve moves smoothly.

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ **CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)**

A ▼

4.	REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY

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(a) Replace the throttle with motor body assembly INFO .

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)

5.	CHECK PCV SYSTEM

(a) Check the PCV hose connections INFO .

OK:
PCV valve and hose are connected correctly and are not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

6.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks from the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

7.	CHECK AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Visually check that the air cleaner filter element is not excessively contaminated with dirt or oil.

OK:
The air cleaner filter element is not excessively contaminated with dirt or oil.

NG ▶ REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

OK ▼

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8.	**PERFORM ACTIVE TEST USING TECHSTREAM (OPERATE CAMSHAFT TIMING OIL CONTROL VALVE)**

(a) Operate the VVT system through the Active test, and check if the VVT system is operating normally.

(1) Perform the Active Test, referring to DTC P000A inspection procedure (VVT system for intake camshaft) INFO .

(2) Perform the Active Test, referring to DTC P000B inspection procedure (VVT system for exhaust camshaft) INFO .

NG ▶ **CHECK AND REPAIR VVT SYSTEM**

OK ▼

9.	**READ VALUE USING TECHSTREAM (MAF)** INFO

OK ▶ **CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)**

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

10.	**REPAIR OR REPLACE PCV HOSE**

(a) Repair or replace the PCV valve or hose.

NEXT ▶ **CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)**

11.	**REPAIR OR REPLACE INTAKE SYSTEM**

(a) Repair or replace the intake system.

NEXT ▶ **CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)**

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12.	REPLACE AIR CLEANER FILTER ELEMENT SUB-ASSEMBLY

(a) Replace the air cleaner filter element sub-assembly INFO .

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)

13.	CHECK AND REPAIR VVT SYSTEM

(a) Check and repair the VVT system.

HINT:

- Refer to DTC P000A Inspection Procedure (VVT system for intake camshaft) INFO .
- Refer to DTC P000B Inspection Procedure (VVT system for exhaust camshaft) INFO .

NEXT ▼

14.	CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(h) Input the DTC: P050A or P050B.

(i) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P050A or P050B is output)	B

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B ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

A ▶ CHECK FOR INTERMITTENT PROBLEMS

15.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

16.	CHECK WHETHER DTC OUTPUT RECURS (DTC P050A OR P050B)

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(h) Input the DTC: P050A or P050B.

(i) Check the DTC judgment result.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P050A or P050B is output)	A
NORMAL (DTC is not output)	B

END

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B

A

17.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM) INFO

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

18.	REPLACE MASS AIR FLOW METER

(a) Replace the mass air flow meter INFO .

HINT:

If the results of the inspections performed in step 9 indicated no problem, proceed to the next step without replacing the mass air flow meter.

NEXT

19.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

NOTICE:

In this operation, the engine must be cold (approximately the same as the engine coolant temperature recorded in the freeze frame data).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving

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Pattern.

(g) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(h) Input the DTC: P050A or P50B.

(i) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P050A or P050B is output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XH6022X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P062D,P1261-P1264: No. 1 Fuel Injector Driver Circuit Performance (2013 FR-S)		

DTC	**P062D**	**No. 1 Fuel Injector Driver Circuit Performance**

DTC	**P1261**	**DI Injector Circuit / Open - (Cylinder 1)**

DTC	**P1262**	**DI Injector Circuit / Open - (Cylinder 2)**

DTC	**P1263**	**DI Injector Circuit / Open - (Cylinder 3)**

DTC	**P1264**	**DI Injector Circuit / Open - (Cylinder 4)**

DESCRIPTION

The D-4S system has two fuel injection methods. One is the in-cylinder direct injection method that directly injects pressurized fuel into the combustion chamber. The other is the intake port injection method. The ECM determines which fuel injection method to use in accordance with the engine conditions. For the in-cylinder direction injection method, the injector driver (EDU) in the engine room operates the fuel injectors (for direction injection) at high speeds. The EDU receives fuel injection request signals from the ECM and converts the signals to high voltage / high current injector operation signals to operate the fuel injectors (for direction injection).

The fuel injection sequence occurs in numerical order from No. 1 to No. 4.

The ECM monitors the EDU at all times. If drivers or fuel injectors are malfunctioning, the EDU sends fuel injector operation condition signals (fail signals IJF1 to IJF2) to the ECM. When the ECM receives the signals, the ECM stops the fuel injection control of the appropriate cylinders, cuts voltage to the appropriate injector relay, and illuminates the MIL.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P062D	When injection is finished in all cylinders, the diagnostic signal from the EDU does not change (open or short in the injector or EDU circuit). (1 trip detection logic)	• Open or short in injector driver (EDU) circuit • Injector driver (EDU) • ECM
		• Open or short in fuel injector (for direct injection) circuit (No.

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P1261	When the injection of No. 1 cylinder is finished, the diagnostic signal from injector driver (EDU) does not change (open or short in No. 1 cylinder injector circuit). (1 trip detection logic)	1 cylinder) • Injector driver (EDU) • Fuel injector assembly (for direct injection) (No. 1 cylinder) • ECM
P1262	When the injection of No. 2 cylinder is finished, the diagnostic signal from injector driver (EDU) does not change (open or short in No. 2 cylinder injector circuit). (1 trip detection logic)	• Open or short in fuel injector (for direct injection) circuit (No. 2 cylinder) • Injector driver (EDU) • Fuel injector assembly (for direct injection) (No. 2 cylinder) • ECM
P1263	When the injection of No. 3 cylinder is finished, the diagnostic signal from injector driver (EDU) does not change (open or short in No. 3 cylinder injector circuit). (1 trip detection logic)	• Open or short in fuel injector (for direct injection) circuit (No. 3 cylinder) • Injector driver (EDU) • Fuel injector assembly (for direct injection) (No. 3 cylinder) • ECM
P1264	When the injection of No. 4 cylinder is finished, the diagnostic signal from injector driver (EDU) does not change (open or short in No. 4 cylinder injector circuit). (1 trip detection logic)	• Open or short in fuel injector (for direct injection) circuit (No. 4 cylinder) • Injector driver (EDU) • Fuel injector assembly (for direct injection) (No. 4 cylinder) • ECM

MONITOR STRATEGY

Related DTCs	P062D: Fuel injector driver circuit functional check P1261: Direct fuel injector functional check (Cylinder 1) P1262: Direct fuel injector functional check (Cylinder 2) P1263: Direct fuel injector functional check (Cylinder 3) P1264: Direct fuel injector functional check (Cylinder 4)
Required Sensors/Components (Main)	Fuel injector assembly (for direct injection) Injector driver (EDU)

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Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.225 seconds or more (varies with engine speed): P062D 20 counts [0.33 seconds or more (varies with engine speed)]: P1261, P1262, P1263, P1264
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	8.7 V or more
Engine speed	Less than 7450 rpm
Injection time	0.7 msec or more

TYPICAL MALFUNCTION THRESHOLDS

P062D

Falling edge for all injectors	Not detected

P1261, P1262, P1263, P1264

Falling edge of injector output signal from injector driver (EDU)	Not detected

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Record the Freeze Frame Data.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Based on engine speed, engine load and other freeze frame data stored in the ECM, reproduce the conditions present when the DTC was stored.
8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read the DTC.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P062D, P1261, P1262, P1263 or P1264.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION

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NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shown ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

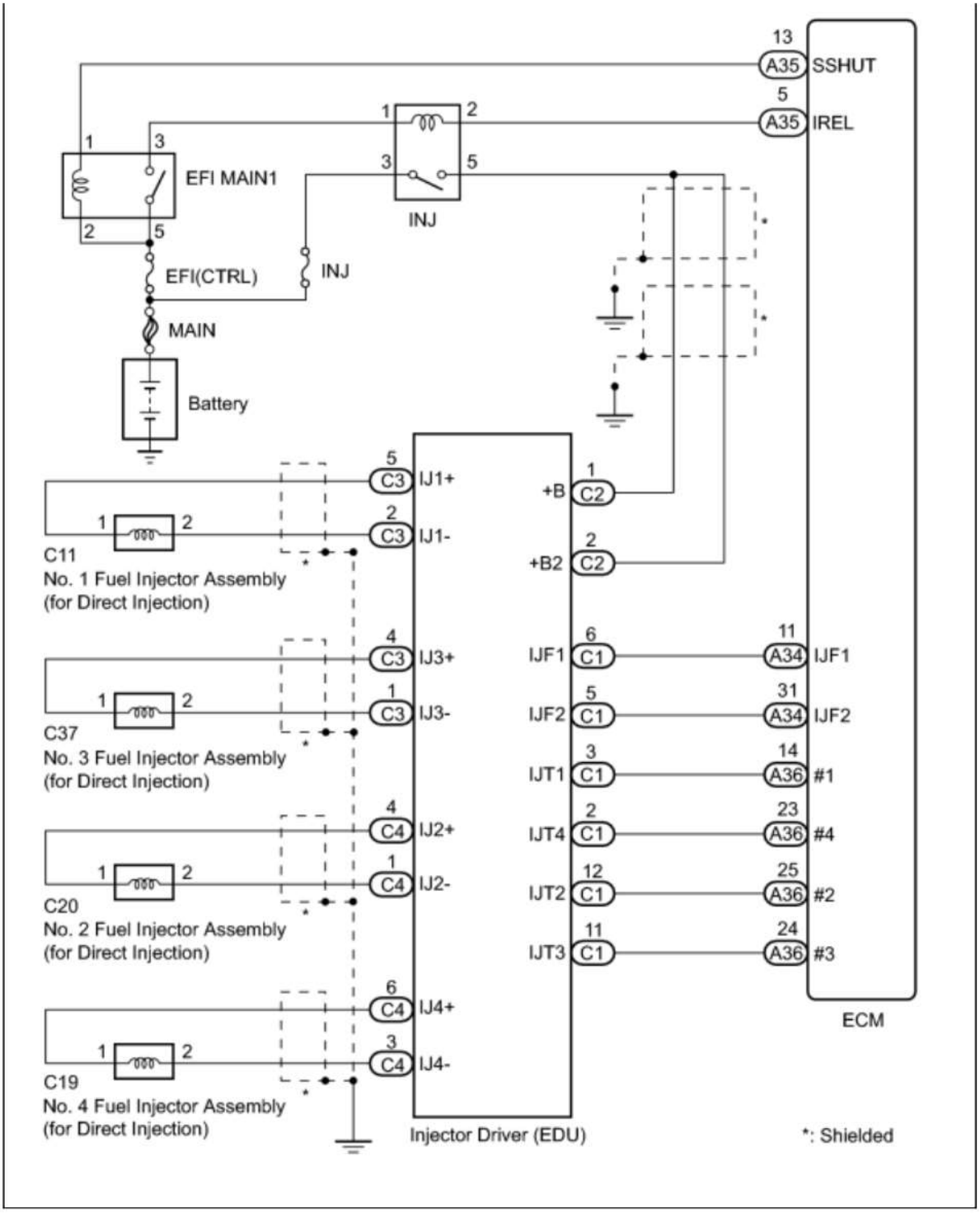
13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- If DTC P1261 is output, check the No. 1 fuel injector (for direct injection) (No. 1 cylinder) circuit.
- If DTC P1262 is output, check the No. 2 fuel injector (for direct injection) (No. 2 cylinder) circuit.
- If DTC P1263 is output, check the No. 3 fuel injector (for direct injection) (No. 3 cylinder) circuit.
- If DTC P1264 is output, check the No. 4 fuel injector (for direct injection) (No. 4 cylinder) circuit.
- If the current from the INJ relay is cut because DTC P062D is stored, DTC P1235 will be stored even if the fuel pump assembly (for high pressure) is normal.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition

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information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
P1261, P1262, P1263 and/or P1264 are output	A
DTC P062D is output	B

B ▶ **CHECK HARNESS OR CONNECTOR (ECM - INJECTOR DRIVER (EDU))**

A ▼

2.	**CHECK HARNESS AND CONNECTOR**

(a) Disconnect the injector driver (EDU) connectors.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C3-2 (IJ1-) - C3-5 (IJ1+)	20°C (68°F)	1.74 to 2.04 Ω
C4-1 (IJ2-) - C4-4 (IJ2+)	20°C (68°F)	1.74 to 2.04 Ω
C3-1 (IJ3-) - C3-4 (IJ3+)	20°C (68°F)	1.74 to 2.04 Ω
C4-3 (IJ4-) - C4-6 (IJ4+)	20°C (68°F)	1.74 to 2.04 Ω

HINT:

The standard values shown are fuel injector assembly resistance values.

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Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C3-2 (IJ1-) or C3-5 (IJ1+) - Body ground	20°C (68°F)	1 MΩ or higher
C4-1 (IJ2-) or C4-4 (IJ2+) - Body ground	20°C (68°F)	1 MΩ or higher
C3-1 (IJ3-) or C3-4 (IJ3+) - Body ground	20°C (68°F)	1 MΩ or higher
C4-3 (IJ4-) or C4-6 (IJ4+) - Body ground	20°C (68°F)	1 MΩ or higher

NG ▶ **INSPECT FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

OK ▼

3.	CHECK HARNESS AND CONNECTOR (ECM - INJECTOR DRIVER (EDU))

(a) Disconnect the ECM connectors.

(b) Disconnect the injector driver (EDU) connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-14 (#1) - C1-3 (IJT1)	Always	Below 1 Ω
A36-25 (#2) - C1-12 (IJT2)	Always	Below 1 Ω
A36-24 (#3) - C1-11 (IJT3)	Always	Below 1 Ω
A36-23 (#4) - C1-2 (IJT4)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-14 (#1) or C1-3 (IJT1) - Body ground	Always	10 kΩ or higher
A36-25 (#2) or C1-12 (IJT2) - Body ground	Always	10 kΩ or higher
A36-24 (#3) or C1-11 (IJT3) - Body ground	Always	10 kΩ or higher
A36-23 (#4) or C1-2 (IJT4) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK

4.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

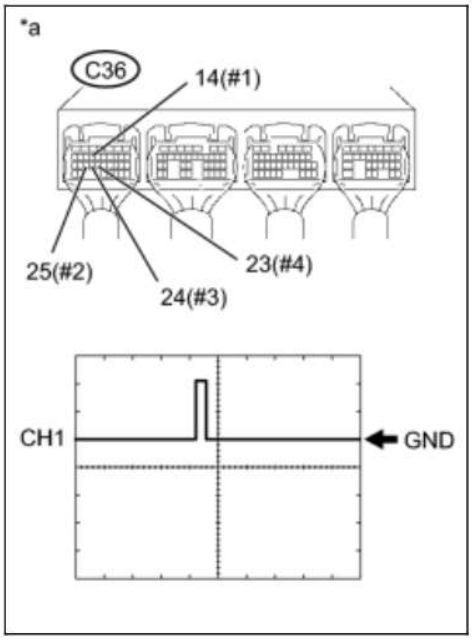
(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

NEXT

5.	CHECK ECM (ECM OUTPUT VOLTAGE)

(a) Disconnect the injector driver (EDU) connector.



(b) Inspect the ECM using an oscilloscope.

(1) While cranking the engine, check waveform the terminals of the ECM connector.

Standard:

Signal waveform appears as shown in the illustration.

ECM Terminal Name	A36-14 (#1) or A36-23 (#4) - Body ground A36-25 (#2) or A36-24 (#3) - Body ground
Tester Range	2 V/DIV., 4 ms./DIV.
Condition	Cranking

Text in Illustration

*a	Component with harness connected (ECM)

NG ▶ **REPLACE ECM**

OK ▶ **REPLACE INJECTOR DRIVER (EDU)**

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6.	CHECK HARNESS OR CONNECTOR (ECM - INJECTOR DRIVER (EDU))

(a) Disconnect the ECM connector.

(b) Disconnect the injector driver (EDU) connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-11 (IJF1) - C1-6 (IJF1)	Always	Below 1 Ω
A34-31 (IJF2) - C1-5 (IJF2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-11 (IJF1) or C1-6 (IJF1) - Body ground	Always	10 kΩ or higher
A34-31 (IJF2) or C1-5 (IJF2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

7.	CHECK TERMINAL VOLTAGE (ECM OUTPUT VOLTAGE)

(a) Disconnect the injector driver (EDU) connector.

(b) Inspect the ECM using an oscilloscope.

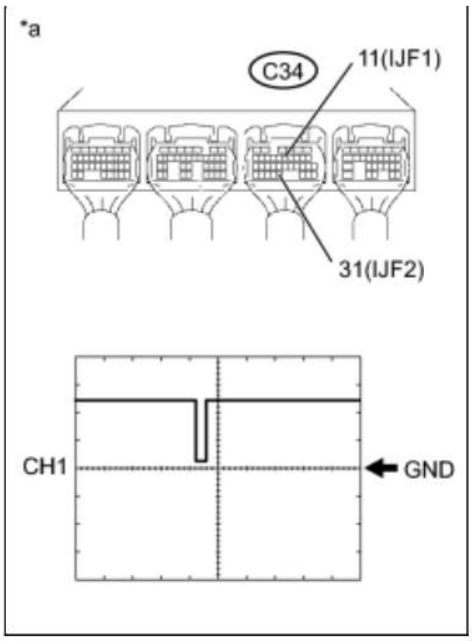
(1) While start the engine, check waveform the terminals of the ECM connector.

Standard:

Signal waveform appears as shown in the illustration.

ECM Terminal Name	A34-11 (IJF1) - Body ground A34-31 (IJF2) - Body ground
Tester Range	2 V/DIV., 4 ms./DIV.
Condition	Idling

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Text in Illustration

*a	Component with harness connected (ECM)

NG ▶ **REPLACE ECM**

OK ▶ **REPLACE INJECTOR DRIVER (EDU)**

8.	INSPECT FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)

(a) Inspect the resistance of the fuel injector (for direct injection) INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000U5B0MLX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0068: MAP / MAF - Throttle Position Correlation (2013 FR-S)		

DTC	**P0068**	**MAP / MAF - Throttle Position Correlation**

DESCRIPTION

Refer to DTC P0107 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0068	One of the following conditions is met (2 trip detection logic): • Manifold absolute pressure sensor voltage is less than 1.25 V for 5 seconds or more when throttle position is 16° or more with driving. • Manifold absolute pressure sensor voltage is more than 3.3 V for 10 seconds or more when throttle position is 5.13° or less with driving.	• Open or short in manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • ECM

MONITOR DESCRIPTION

The manifold absolute pressure sensor is affixed to the intake manifold.

If the manifold absolute pressure is low in spite of driving conditions that would suggest this would be high, or if this is high in spite of driving conditions that would suggest this would be low, then this DTC is detected.

MONITOR STRATEGY

Related DTCs	P0068: Manifold absolute pressure sensor rationality check
Required Sensors/Components (Main)	Manifold absolute pressure sensor
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	5 seconds: Low side monitor 10 seconds: High side monitor
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

	P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor)

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Monitor runs whenever following DTCs not stored	P0117, P0118 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)

Low Side Monitor

Engine coolant temperature	60°C (140°F) or more
Engine speed	Less than 2800 rpm
Intake air	0.36 g/rev or more
Throttle position	8% or more

High Side Monitor

Engine coolant temperature	60°C (140°F) or more
Engine speed	550 to 880 rpm
Intake air	Less than 0.35 g/rev
Throttle position	Less than 3.04%

TYPICAL MALFUNCTION THRESHOLDS

Low Side Monitor

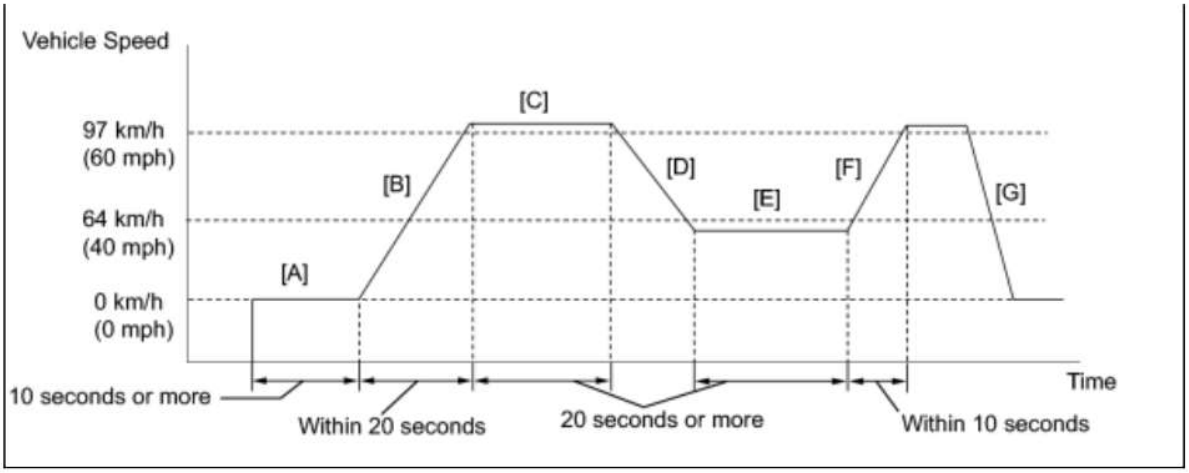
Manifold absolute pressure sensor voltage [Manifold absolute pressure]	Less than 1.25 V [21.66 kPa (162 mmHg)]

High Side Monitor

Manifold absolute pressure sensor voltage [Manifold absolute pressure]	More than 3.3 V [21.66 kPa (162 mmHg)]

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Accelerate the vehicle to 97 km/h (60 mph) or more within 20 seconds [B].
c. Drive the vehicle at 97 km/h (60 mph) or more for 20 seconds or more [C].
d. Release the accelerator pedal to Decelerate until the vehicle speed decreases to less than 64 km/h (40 mph) [D].

HINT:

Release the accelerator pedal fully to perform the fuel-cut.

e. Drive the vehicle at 60 km/h (40 mph) or less for 20 seconds or more [E].
f. Accelerate the vehicle to 97 km/h (60 mph) or more within 10 seconds [F].
g. Release the accelerator pedal and stop the vehicle [G].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0068.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to P0107 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0068)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

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(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0068 is output	A
DTC P0068 and other DTCs are output	B

B ▶ **GO TO DTC CHART**

A
▼

2.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks INFO .

OK:
PCV valve and hose are connected correctly and are not damaged.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK
▼

3.	**CHECK PCV HOSE CONNECTIONS**

(a) Check the PCV hose connections INFO .

OK:
No leaks from intake system.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK
▼

4.	**REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR**

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(a) Replace the manifold absolute pressure sensor INFO .

NEXT

5.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P0068.

(l) Check the DTC judgment.

Result:

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

END

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NEXT



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PG603AX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0087: Fuel Rail / System Pressure - Too Low (2013 FR-S)		

DTC	**P0087**	**Fuel Rail / System Pressure - Too Low**

DESCRIPTION

The high-pressure fuel system consists of the spill control valve, pump plunger and fuel pressure sensor. The spill control valve opens and closes the low-pressure fuel line (from the fuel tank), the pump plunger (operated by the camshaft) pressurizes fuel and the fuel pressure sensor located on the fuel delivery pipe monitors fuel pressure.

The fuel pump assembly (for high pressure) is installed to the cylinder head cover (bank 2) and is driven by the cam located at the intake camshaft.

The plunger moves up and down by the camshaft rotations, and produces a vacuum to suck fuel and pressurizes the fuel. This fuel flows into the fuel delivery pipe. The ECM opens and closes the spill control valve to regulate the fuel pressure to the target fuel pressure. In order to obtain and maintain the target pressure, the ECM monitors the fuel pressure using the fuel pressure sensor and performs the feedback control.

HINT:

The spill control valve, pump plunger are built into the fuel pump assembly (for high pressure).

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0087	Fuel pressure is lower than the target value. (1 trip detection logic)	• Leak of fuel • Fuel pipe (Fuel tank - Fuel pump assembly (for high pressure) [bank 1 or bank 2]) • Fuel pipe (Fuel pump assembly (for high pressure) - Fuel injector assembly [for direct injection]) • Fuel injector assembly (for direct injection) • Fuel pump assembly (for high pressure) • Injector driver (EDU) • Fuel pump assembly • ECM

MONITOR DESCRIPTION

If the fuel pressure decreases even after the ECM commands the high-pressure fuel pump to close the spill control valve, a DTC is output.

MONITOR STRATEGY

Related DTCs	P0087: High pressure fuel system monitor functional check (Pressure too low)
Required sensors/Components (Main)	Fuel pressure sensor

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Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	10 seconds
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTC not stored	None
Elapsed time after engine start	10 seconds
Elapsed time after fuel cut	2 seconds or more
Target fuel pressure change during 64 msec	Less than 2.4 MPa (24.4 kgf/cm ^{2} , 348 psi)
Direct injection ratio	0% or more

TYPICAL MALFUNCTION THRESHOLDS

Actual fuel pressure - Target fuel pressure	Less than -3.5 MPa (-35.7 kgf/cm ^{2} , -508 psi)

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Record the Freeze Frame Data.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Based on engine speed, engine load and other freeze frame data stored in the ECM, reproduce the conditions present when the DTC was stored.
8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read the DTC.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0087.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed

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	◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shown ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK FUEL LEAK (HIGH PRESSURE SIDE)**

(a) Check around and beneath the car for fuel leaks, fumes, etc.

OK:
No fuel leaks present.

NG ▶ **REPAIR OR REPLACE FUEL LEAK POINT**

OK ▼

2.	**CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0087)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Trouble Codes.

(d) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0087 is output	A
DTC P0087 and other DTCs are output	B

HINT:

If any DTCs other than P0087 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

3.	**CHECK IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

(a) Has the vehicle run out of fuel in the past?

NO ▶ **DTC CAUSED BY RUNNING OUT OF FUEL**

YES

▼

4.	**READ VALUE USING TECHSTREAM (FUEL PRESS)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Start the engine.

(d) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(e) Read Fuel Press when racing the engine.

Result:

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RESULT	PROCEED TO
Fuel Press value varies.	A
Fuel Press value does not increase.	B
Fuel Press value does not vary.	C

B ▶ **CHECK FUEL LEAK (HIGH PRESSURE SIDE)**

C ▶ **REPLACE FUEL PRESSURE SENSOR**

A
▼

5.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Start the engine.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(e) When performing the Active Test, check for an operating sound from the fuel pump.

NG ▶ **CHECK FUEL PUMP OPERATION**

OK
▼

6.	**CHECK FUEL PRESSURE (LOW PRESSURE SIDE)**

(a) Check the fuel pressure (low pressure side) INFO .

NG ▶ **REPLACE FUEL PRESSURE REGULATOR**

OK
▼

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7.	CHECK FUEL LEAK (HIGH PRESSURE SIDE)

(a) Connect the Techstream to the DLC3.

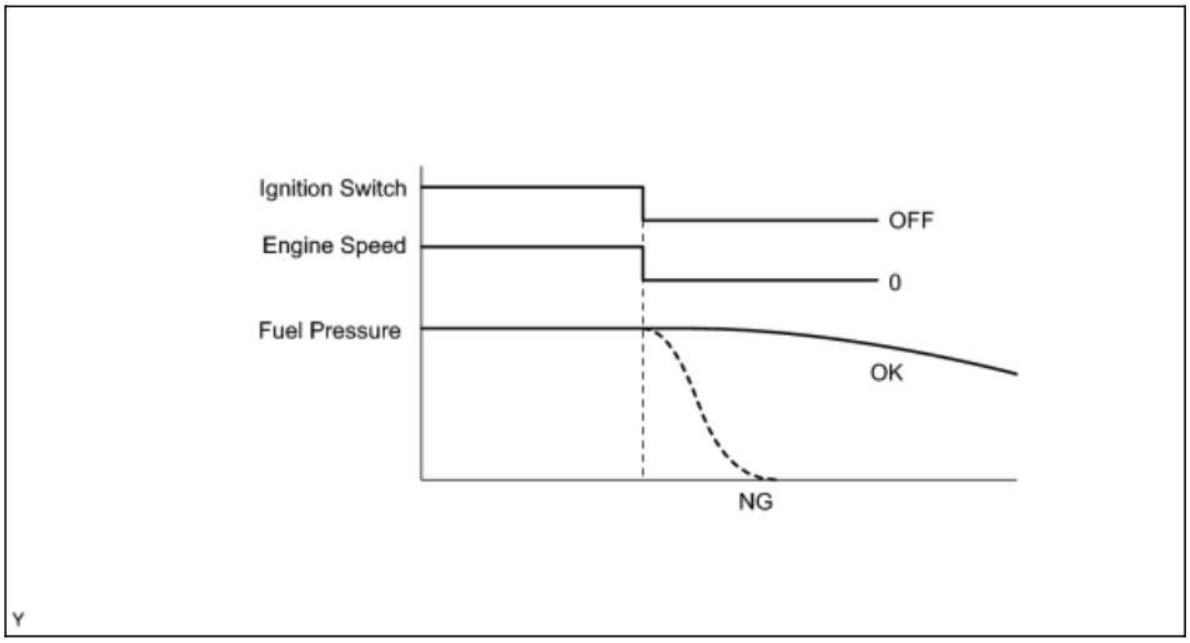
(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(d) Check changes in the fuel pressure when the engine is stopped.

HINT:

Turn the ignition switch to ON immediately after turning the ignition switch off.



Result

RESULT	PROCEED TO
The fuel pressure drops immediately after turning the ignition switch off.	A
The fuel pressure is nearly maintained, or with moderate variations.	B

B ▶ **REPLACE INJECTOR DRIVER (EDU)**

A ▼

8.	INSPECT FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)

(a) Inspect the fuel pump assembly (for high pressure) INFO .

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NG ▶ **REPLACE FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)**

OK
▼

9.	**REPLACE INJECTOR DRIVER (EDU)**

(a) Replace the fuel injector driver (EDU) INFO .

NEXT
▼

10.	**PERFORM CONFIRMATION DRIVING PATTERN**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Start the engine and warm it up.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read the DTC.

Result:

RESULT	PROCEED TO
DTC P0087 is output	A
DTC is not output	B

B ▶ **END**

A

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11.	REPLACE FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)

(a) Replace the fuel pump assembly (high pressure side) INFO .

HINT:

If the fuel pump assembly (for high pressure) has been replaced in step 8, then proceed to step 13 without replacing the fuel pump assembly (for high pressure).

NEXT

12.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Start the engine and warm it up.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read the DTC.

Result:

RESULT	PROCEED TO
DTC P0087 is output	A
DTC is not output	B

B **END**

A

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13.	CHECK FUEL LEAK (HIGH PRESSURE SIDE)

(a) Connect the Techstream to the DLC3.

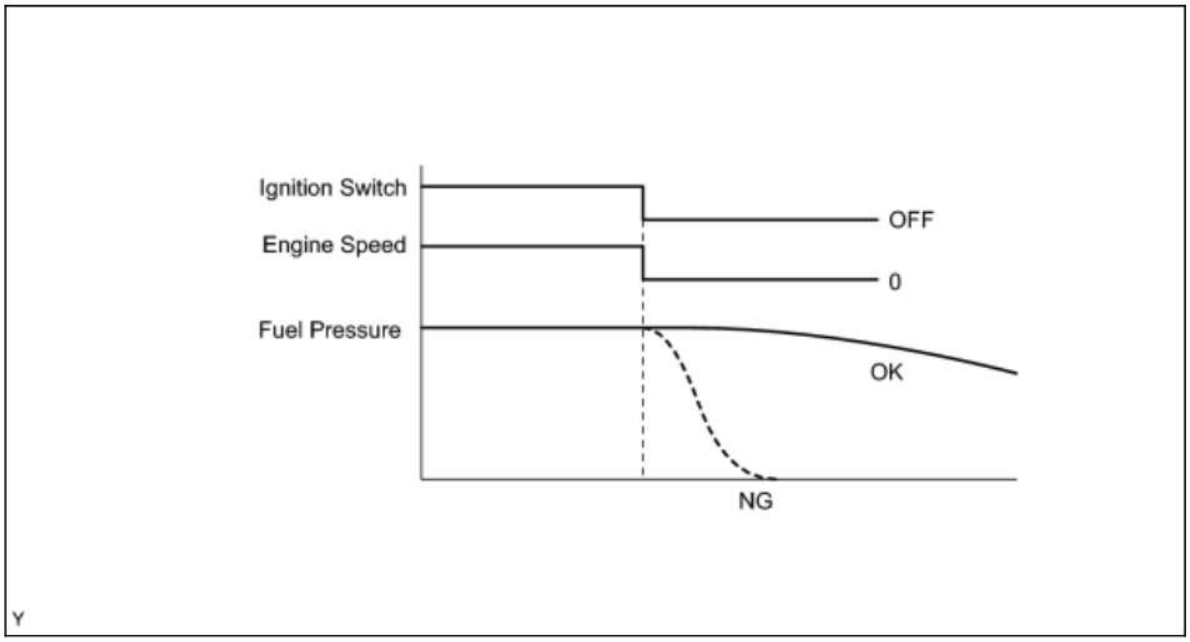
(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(d) Check changes in the fuel pressure when the engine is stopped.

HINT:

Turn the ignition switch to ON immediately after turning the ignition switch off.



Result

RESULT	PROCEED TO
The fuel pressure drops immediately after turning the ignition off.	A
The fuel pressure is nearly maintained, or with moderate variations.	B

B ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

A ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PG7039X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0088: Fuel Rail / System Pressure - Too High (2013 FR-S)		

DTC	**P0088**	**Fuel Rail / System Pressure - Too High**

DESCRIPTION

Refer to DTC P0087 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0088	Fuel pressure is higher than the target value for 10 seconds or more. (1 trip detection logic)	• Fuel pump assembly (for high pressure) • ECM

MONITOR DESCRIPTION

If the fuel pressure does not decrease even after the ECM commands the high-pressure fuel pump to open the spill control valve, a DTC is output.

If there is minimal difference between the fuel pressure before and after the fuel relief valve operates, a DTC is output.

MONITOR STRATEGY

Related DTCs	P0088: High pressure fuel system monitor functional check (Pressure too high)
Required sensors/Components (Main)	Fuel pressure sensor
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	10 seconds
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTC not stored	None
Elapsed time after engine start	10 seconds
Elapsed time after fuel cut	2 seconds or more
Target fuel pressure change during 64 msec	Less than 2.4 MPa (24.4 kgf/cm ^{2} , 348 psi)
Direct injection ratio	0% or more

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TYPICAL MALFUNCTION THRESHOLDS

Actual fuel pressure - Target fuel pressure	More than 6 MPa (61.2 kgf/cm ^{2} , 871 psi)

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Record the Freeze Frame Data.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Based on engine speed, engine load and other freeze frame data stored in the ECM, reproduce the conditions present when the DTC was stored.
8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read the DTC.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0088.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

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- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

PROCEDURE

1.	**CHECK OTHER DTCS OUTPUT (IN ADDITION TO DTC P0088)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Trouble Codes.

(d) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0088 is output	A
DTC P0088 and other DTCs are output	B

HINT:

If any DTCs other than P0088 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM**

(a) Connect the Techstream to the DLC3.

(b) Start the engine and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Target Fuel Pressure / Fuel Press.

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(d) Check that the fuel pressure fluctuates when the target fuel pressure changes.

HINT:

The Active Test operation lowers the target fuel pressure by 12.5% or increase the target fuel pressure by 24.8%.

OK:
Fuel pressure fluctuates.

NG ▶ **REPLACE FUEL PRESSURE SENSOR**

OK ▼

3.	**REPLACE FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)**

(a) Replace the fuel pump assembly (for high pressure) INFO .

NEXT ▼

4.	**CHECK IF DTC OUTPUT RECURS (SEE IF DTC P0088 IS OUTPUT AGAIN)**

(a) Connect the Techstream to the DLC3.

(b) Turn the Techstream on.

(c) Clear the DTCs INFO .

(d) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(e) Enter the following menus: Powertrain / Engine / Trouble Codes.

(f) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0088 is output	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PF40ACX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0101: Mass Air Flow Circuit Range / Performance Problem (2013 FR-S)		

DTC	**P0101**	**Mass Air Flow Circuit Range / Performance Problem**

DESCRIPTION

Refer to DTC P0102 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0101	One of the following conditions is met (2 trip detection logic): • Mass air flow meter voltage is less than 1.13 V for 5 seconds or more when throttle position is 16° or more with driving. • Mass air flow meter voltage is more than 1.88 V for 10 seconds or more when throttle position is 5.13° or less with driving.	• Mass air flow meter • Intake system • PCV hose connections

MONITOR DESCRIPTION

The mass air flow meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide an appropriate air fuel ratio. Inside the mass air flow meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a specific temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to the mass air flow meter. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The ECM monitors the average engine load value ratio to check the mass air flow meter for malfunctions. The average engine load value ratio is obtained by comparing the average engine load calculated from the MAF meter output to the average engine load estimated from the driving conditions, such as the engine speed and the throttle opening angle. If the average engine load value ratio is below the threshold value, the ECM determines that the intake air volume is low, and if the average engine load value ratio is above the threshold value, the ECM determines that the intake air volume is high.

If this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is stored.

MONITOR STRATEGY

Related DTCs	P0101: Mass air flow meter rationality check
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Crankshaft position sensor VVT sensor Engine coolant temperature sensor Throttle position sensor

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Frequency of Operation	Continuous
Duration	5 seconds: Low side monitor 10 seconds: High side monitor
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0102, P0103 (Mass air flow (MAF) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0335, P0336 (Crankshaft position sensor) P0340, P0345 (Camshaft position sensor - Intake with variable valve timing (VVT)) P0506, P0507 (Idle speed control (ISC)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)

Low Side Monitor

Engine speed	1500 rpm or higher
Throttle position	8% or more
Engine coolant temperature	60°C (140°F) or higher
Intake manifold pressure	53.32 kPa [400 mmHg] or higher

High Side Monitor

Engine speed	550 to 880 rpm
Throttle position	Less than 3.04%
Engine coolant temperature	60°C (140°F) or higher
Intake manifold pressure	Less than 53.32 kPa [400 mmHg]

TYPICAL MALFUNCTION THRESHOLDS

Low Side Monitor

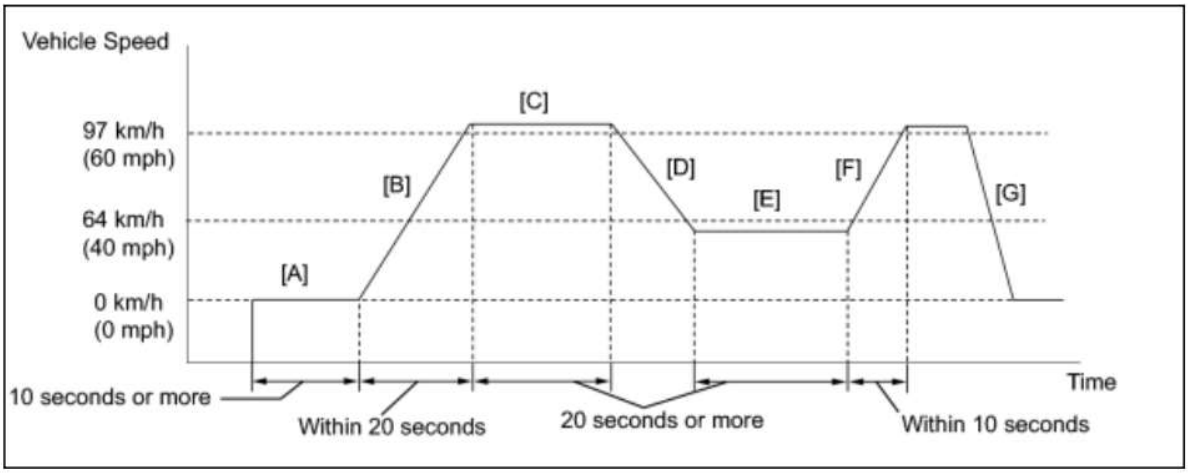
Mass air flow meter voltage [Mass air flow]	Less than 1.13 V [1.87 g/sec]

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High Side Monitor

Mass air flow meter voltage (fuel system in rich) [Mass air flow]	More than 1.88 V [10.6 g/sec]

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Accelerate the vehicle to 97 km/h (60 mph) or more within 20 seconds [B].
c. Drive the vehicle at 97 km/h (60 mph) or more for 20 seconds or more [C].
d. Release the accelerator pedal to Decelerate until the vehicle speed decreases to less than 64 km/h (40 mph) [D].

HINT:

Release the accelerator pedal fully to perform the fuel-cut.

e. Drive the vehicle at 60 km/h (40 mph) or less for 20 seconds or more [E].
f. Accelerate the vehicle to 97 km/h (60 mph) or more within 10 seconds [F].
g. Release the accelerator pedal and stop the vehicle [G].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.

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11. Input the DTC: P0101.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0102 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0101)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0101 is output	A
DTC P0101 and other DTCs are output	B

HINT:

If any DTCs other than P0101 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A
▼

2.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks from intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK
▼

3.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose connections INFO .

OK:
PCV valve and hose are connected correctly and are not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

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OK

4.	**REPLACE MASS AIR FLOW METER**

(a) Replace the mass air flow meter INFO .

NEXT

5.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P0101.

(l) Check the DTC judgment.

Result

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal

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INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

NEXT END

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000U5B0MNX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0102,P0103: Mass or Volume Air Flow Circuit Low Input (2013 FR-S)		

DTC	**P0102**	**Mass or Volume Air Flow Circuit Low Input**

DTC	**P0103**	**Mass or Volume Air Flow Circuit High Input**

DESCRIPTION

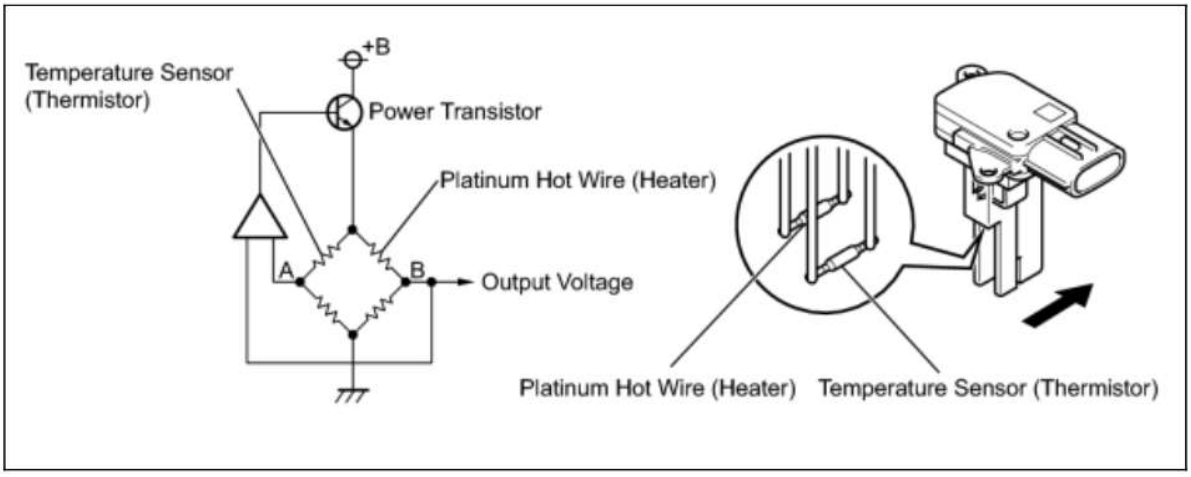
The mass air flow meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide the appropriate air fuel ratio.

Inside the mass air flow meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a given temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to the wire and internal thermistor. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The circuit is constructed so that the platinum hot wire and the temperature sensor create a bridge circuit, and the power transistor is controlled so that the potentials of A and B remain equal to maintain the predetermined temperature.

HINT:

When any of these DTCs is stored, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is calculated by the ECM, according to the engine speed and throttle valve position. Fail-safe mode continues until a pass condition is detected.



DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA

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P0102	Mass air flow meter voltage is 0.127 V or less for 0.5 seconds or more. (1 trip detection logic)	• Open or short in mass air flow meter circuit • Mass air flow meter • ECM
P0103	Mass air flow meter voltage is 4.723 V or more for 0.5 seconds or more. (1 trip detection logic)	

HINT:

When any of these DTCs are output, check the air-flow rate using the Techstream. Enter the following menus: Powertrain / Engine / Data List / MAF.

MASS AIR FLOW RATE (GM/SEC)	MALFUNCTION
Approximately 0.0	• Open in mass air flow meter power source circuit • Open or short in VG circuit
160.0 or more	• Open in E2G circuit

MONITOR DESCRIPTION

If there is a defect in the mass air flow meter or an open or short circuit, the voltage level deviates from the normal operating range. The ECM interprets this deviation as a malfunction in the mass air flow meter circuit and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0102: Mass air flow meter circuit continuity (Low voltage) P0103: Mass air flow meter circuit continuity (High voltage)
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0102

Mass air flow meter voltage [Mass air flow]	Less than 0.127 V [0.0 g/sec]

P0103

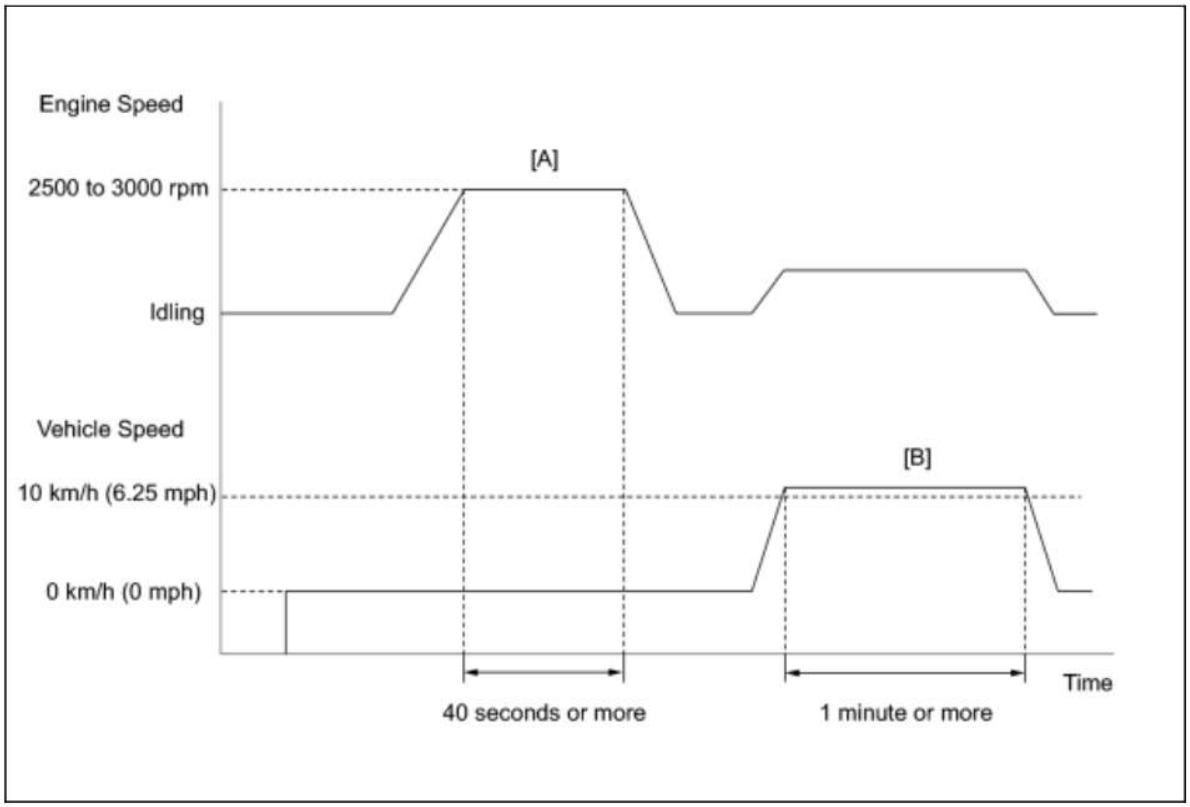
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Mass air flow meter voltage [Mass air flow]	More than 4.723 V [248.1 g/sec]

COMPONENT OPERATING RANGE

Mass air flow meter voltage [Mass air flow]	0.127 to 4.651 V [0.01 to 235.37 g/sec]

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

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11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0102 or P0103.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

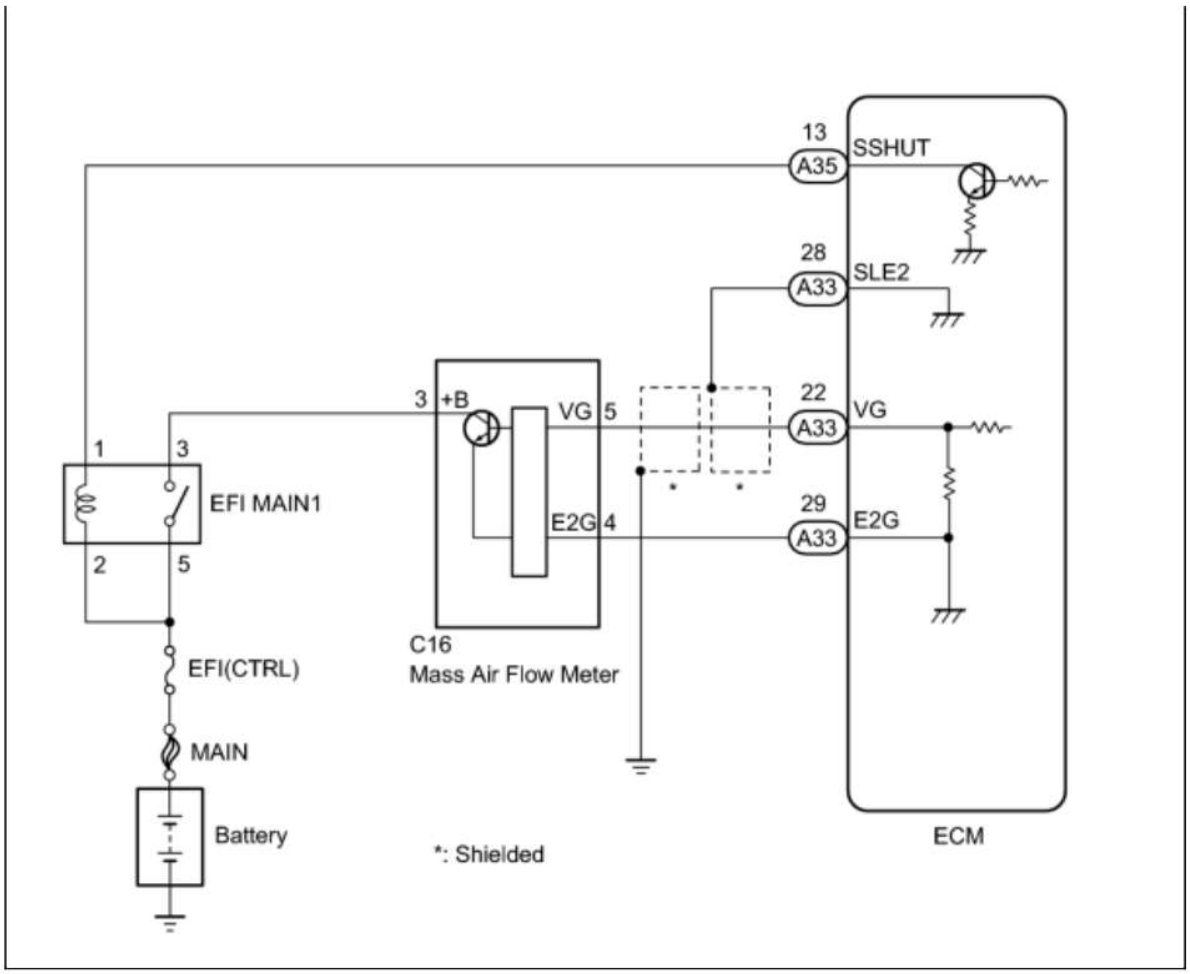
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ DTC OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

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Result

RESULT	PROCEED TO
DTC P0102 is output	A
DTC P0103 is output	B

B ▶ **CHECK HARNESS AND CONNECTOR (SENSOR GROUND)**

A

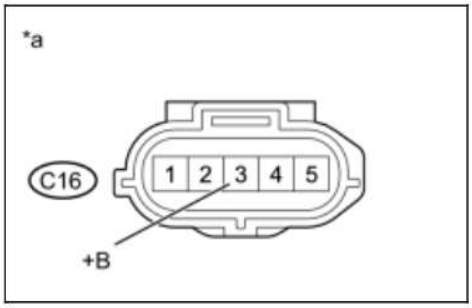
2.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF MASS AIR FLOW METER)

(a) Disconnect the mass air flow meter connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:



TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C16-3 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Mass Air Flow Meter)

NG ▶ **CHECK RELAY (EFI MAIN1)**

OK

3.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

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(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
C33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
C33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**INSPECT MASS AIR FLOW METER**

(a) Inspect the mass air flow meter, referring to the On-vehicle Inspection for Mass Air Flow Meter INFO .

(b) Inspect the mass air flow meter, referring to the Inspection for Mass Air Flow Meter INFO .

(c) Inspect the function of the mass air flow meter.

(1) Connect the Techstream to the DLC3.

(2) Turn the ignition switch to ON.

(3) Turn the Techstream on.

(4) Enter the following menus: Powertrain / Engine / Data List / MAF.

(5) Start the engine.

(6) Check that the MAF value changes when the engine is raced.

OK:
The reading changes.

NG ▶ **REPLACE MASS AIR FLOW METER**

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OK ▶ REPLACE ECM

5.	CHECK HARNESS AND CONNECTOR (SENSOR GROUND)

(a) Disconnect the mass air flow meter connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C16-4 (E2G)- Body ground	Always	Below 1 Ω

NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

OK ▶ REPLACE MASS AIR FLOW METER

6.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-29 (E2G) or C16-4 (E2G) - Body-ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ REPLACE ECM

7.	CHECK RELAY (EFI MAIN1)

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(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK ▼

8.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - EFI MAIN1 RELAY)

(a) Disconnect the mass air flow meter connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 - C16-3 (+B)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 or C16-3 (+B) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000U5B0MMX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0107,P0108: Manifold Absolute Pressure / Barometric Pressure Circuit Low Input (2013 FR-S)		

DTC	**P0107**	**Manifold Absolute Pressure / Barometric Pressure Circuit Low Input**

DTC	**P0108**	**Manifold Absolute Pressure / Barometric Pressure Circuit High Input**

DESCRIPTION

Manifold absolute pressure sensor uses a built-in sensor to detect the intake manifold pressure as a voltage. Additionally, because this measures the absolute pressure as the pressure within the intake manifold without detecting the atmospheric pressure as a standard value, this enables measurements without being influenced by changes in atmospheric pressure from altitude or other causes.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0107	Manifold absolute pressure sensor voltage is 0.61 V or less for 0.5 seconds or more. (1 trip detection logic)	• Open or short in manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • ECM
P0108	Manifold absolute pressure sensor voltage is 3.906 V or more for 0.5 seconds or more. (1 trip detection logic)	

HINT:

When any of these DTCs are output, check the manifold absolute pressure using the Techstream. Enter the following menus: Powertrain / Engine / Data List / MAP.

MANIFOLD ABSOLUTE PRESSURE (KPA [MMHG])	MALFUNCTION
Approximately 0 [0]	Short in MAP circuit
141 [1058] or more	• Short in VC circuit • Open in PIM circuit • Open in E1 circuit

MONITOR DESCRIPTION

The ECM calculates the manifold absolute pressure based upon the manifold absolute pressure sensor output voltage. If the manifold absolute pressure output voltage is outside the normal range, there may be an abnormality with the manifold absolute pressure, or an open or short in the circuit. In these cases, the ECM will light the check engine warning light, and store the DTC.

MONITOR STRATEGY

	P0107: Manifold absolute pressure sensor range check (Low

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Related DTCs	voltage) P0108: Manifold absolute pressure sensor range check (High voltage)
Required Sensors/Components (Main)	Manifold absolute pressure sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0107

Manifold absolute pressure sensor voltage [Manifold absolute pressure]	Less than 0.61 V [0.35 kPa (3 mmHg)]

P0108

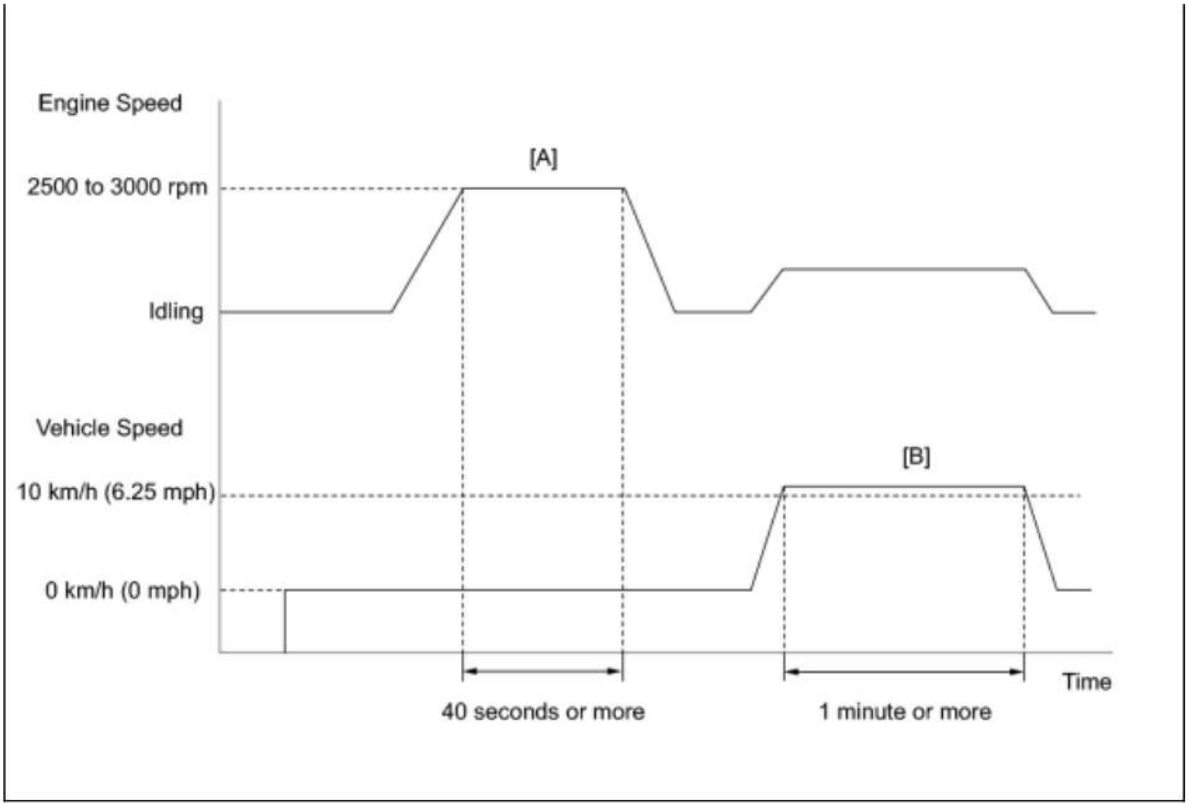
Manifold absolute pressure sensor voltage [Manifold absolute pressure]	More than 3.906 V [110.22 kPa (827 mmHg)]

COMPONENT OPERATING RANGE

Manifold absolute pressure sensor voltage [Manifold absolute pressure]	0.647 to 3.897 V [1.56 to 109.9 kPa (12 to 824 mmHg)]

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0107 or P0108.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	∘ DTC judgment completed ∘ System abnormal
INCOMPLETE	∘ DTC judgment not completed ∘ Perform driving pattern after confirming DTC enabling conditions
N/A	∘ Unable to perform DTC judgment ∘ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

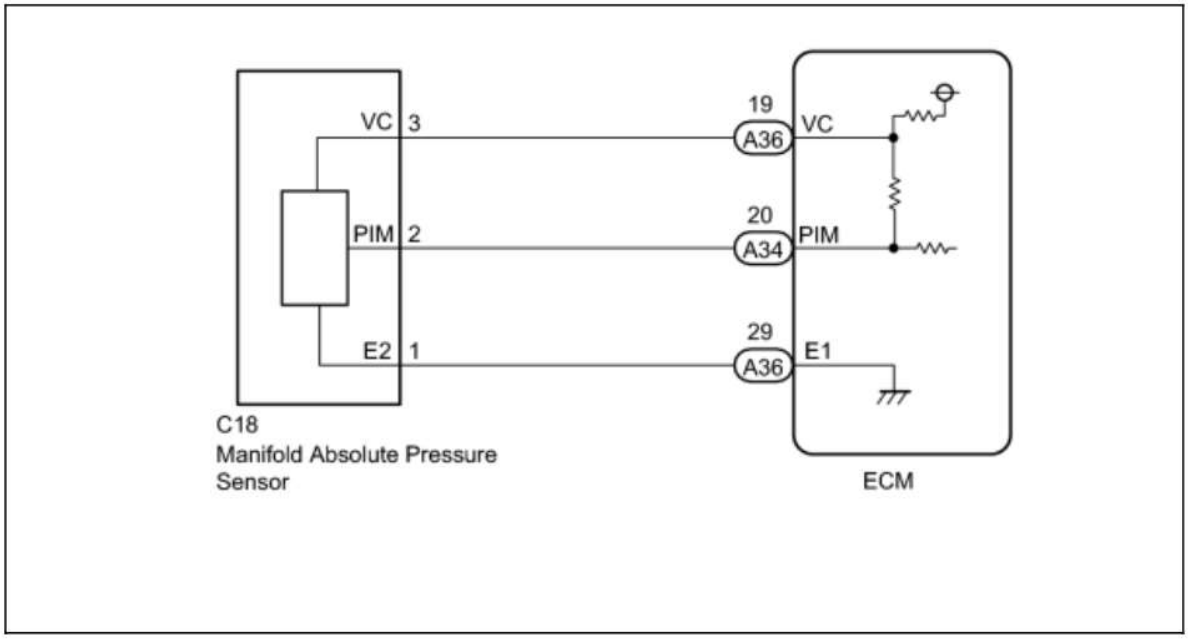
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

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Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (MAP)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / MAP.

(e) Read the value displayed on the Techstream.

Standard:

Nearly equal to atmosphere pressure

Reference Value

CONDITION	MAP
Ignition switch ON	80 to 110 kPa

HINT:

Standard atmospheric pressure is 101 kPa (758 mmHg). For every 100 m (328 ft) increase in altitude, pressure drops by 1 kPa. This varies by weather.

NG ▶ **CHECK TERMINAL VOLTAGE (POWER SOURCE OF MANIFOLD ABSOLUTE PRESSURE SENSOR)**

OK ▶ **CHECK INTERMITTENT PROBLEMS**

2.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF MANIFOLD ABSOLUTE PRESSURE SENSOR)**

(a) Disconnect the manifold absolute pressure sensor connector.

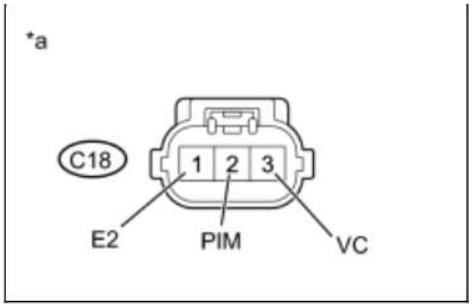
(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH	SPECIFIED

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	CONDITION	CONDITION
C18-3 (VC) - C18-1 (E2)	Ignition switch ON	4.5 to 5.5 V
C18-2 (PIM) - C18-1 (E2)	Ignition switch ON	4.0 to 5.0 V

Text in Illustration

*a	Front view of wire harness connector (to Manifold Absolute Pressure Sensor)

NG ▶ **CHECK HARNESS AND CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)**

OK ▼

3.	REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor INFO .

NEXT ▼

4.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Start the engine and warm it up.

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(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read the DTC.

Result:

RESULT	PROCEED TO
DTC P0107 or P0108 is output	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

5.	**CHECK HARNESS AND CONNECTOR (MANIFOLD ABSOLUTE PRESSURE SENSOR - ECM)**

(a) Disconnect the manifold absolute pressure sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19 (VC) - C18-3 (VC)	Always	Below 1 Ω
A34-20 (PIM) - C18-2 (PIM)	Always	Below 1 Ω
A36-29 (E1) - C18-1(E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19 (VC) or C18-3 (VC) - Body ground	Always	10 kΩ or higher
A34-20 (PIM) or C18-2 (PIM) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C18-1 (E2) or Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001WPH06PX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0111: Intake Air Temperature Sensor Gradient Too High (2013 FR-S)		

DTC	**P0111**	**Intake Air Temperature Sensor Gradient Too High**

DESCRIPTION

The intake air temperature sensor, mounted on the mass air flow meter, monitors the intake air temperature. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature is low, the resistance of the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes.

The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R.

Resistor R and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0111	The difference between maximum and minimum values for inlet air temperature sensor voltage is less than 0.02 V for 1 second or more. (2 trip detection logic)	Mass air flow meter

MONITOR DESCRIPTION

The ECM performs OBD II monitoring based on the values from the intake air temperature sensor. If there is no change of the sensor value within the normal range, the ECM will not be able to perform OBD II monitoring or will misdiagnose that there is a malfunction in the sensor. The ECM detects when the intake air temperature sensor value is stuck by performing monitoring after the ignition switch is turned off or the engine is started (short soak or long soak).

MONITOR STRATEGY

Related DTCs	P0111: Intake air temperature sensor rationality check
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	Immediately
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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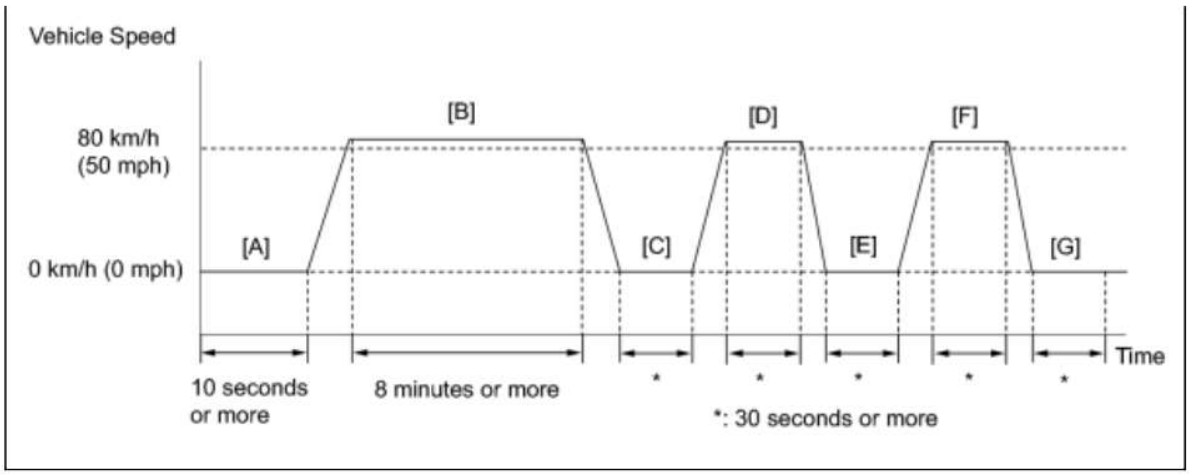
Monitor runs whenever following DTCs not stored	P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0500 (Vehicle speed sensor (VSS)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Battery voltage	10.9 V or more
Engine coolant temperature	60°C (140°F) or higher
Integrated amount of intake air	6500 g or more
Either of the following condition is met:	A or B
A. All of the following conditions are met:	(a), (b) and (c)
(a) Time period	10 seconds
(b) Vehicle speed	4 km/h (2.5 mph) or higher
(c) Intake air mass per second	10 g/sec or more
B. All of the following conditions are met:	(a) and (b)
(a) Time period	10 seconds
(b) Vehicle speed	Less than 40 km/h (24.9 mph)

TYPICAL MALFUNCTION THRESHOLDS

Intake air temperature sensor maximum voltage - Intake air temperature sensor minimum voltage	Less than 0.02 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Check that engine coolant temperature is 30°C (86°F) or less.
7. Start the engine.
8. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Drive the vehicle at 80 km/h (50 mph) or more for 8 minutes or more [B].
c. Stop the vehicle and idle the engine for 30 seconds or more [C].
d. Drive the vehicle at 80 km/h (50 mph) or more for 30 seconds or more [D].
e. Stop the vehicle and idle the engine for 30 seconds or more [E].
f. Drive the vehicle at 80 km/h (50 mph) or more for 30 seconds or more [F].
g. Stop the vehicle and idle the engine for 30 seconds or more [G].

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0111.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal

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INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to P0112 INFO .

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0111)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0111 and other DTCs are output	A
DTC P0111 is output	B

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HINT:

If any DTCs other than P0111 are output, troubleshoot those DTCs first.

B ▶ **REPLACE MASS AIR FLOW METER**

A ▶ **GO TO DTC CHART**



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PF30NNX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0112,P0113: Intake Air Temperature Circuit Low Input (2013 FR-S)		

DTC	**P0112**	**Intake Air Temperature Circuit Low Input**

DTC	**P0113**	**Intake Air Temperature Circuit High Input**

DESCRIPTION

The intake air temperature sensor, mounted on the mass air flow meter, monitors the intake air temperature. The intake air temperature sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the intake air temperature is low, the resistance of the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes.

The intake air temperature sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor.

Resistor and the intake air temperature sensor are connected in series. When the resistance value of the intake air temperature sensor changes, according to changes in the intake air temperature, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

HINT:

When DTC P0112 or P0113 is stored, the ECM enters fail-safe mode. During fail-safe mode, the intake air temperature is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0112	Intake air temperature sensor voltage is less than 0.4 V for 0.5 seconds or more. (1 trip detection logic)	• Open or short in intake air temperature sensor circuit • Intake air temperature sensor (built into mass air flow meter) • ECM
P0113	Intake air temperature sensor voltage is 4.707 V or more for 0.5 seconds or more. (1 trip detection logic)	

HINT:

When any of these DTCs are output, check the intake air temperature using the Techstream. Enter the following menus: Powertrain / Engine / Data List / Intake Air.

TEMPERATURE DISPLAYED	MALFUNCTION
-40°C (-40°F)	Open circuit
215°C (419°F)	Short circuit

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MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the intake air temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a malfunction in the intake air temperature sensor circuit and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0112: Intake air temperature sensor range check (Low voltage) P0113: Intake air temperature sensor range check (High voltage)
Required Sensors/Components (Main)	Intake air temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0112

Intake air temperature sensor voltage [Intake air temperature]	Less than 0.4 V [Higher than 132.8°C (271°F)]

P0113

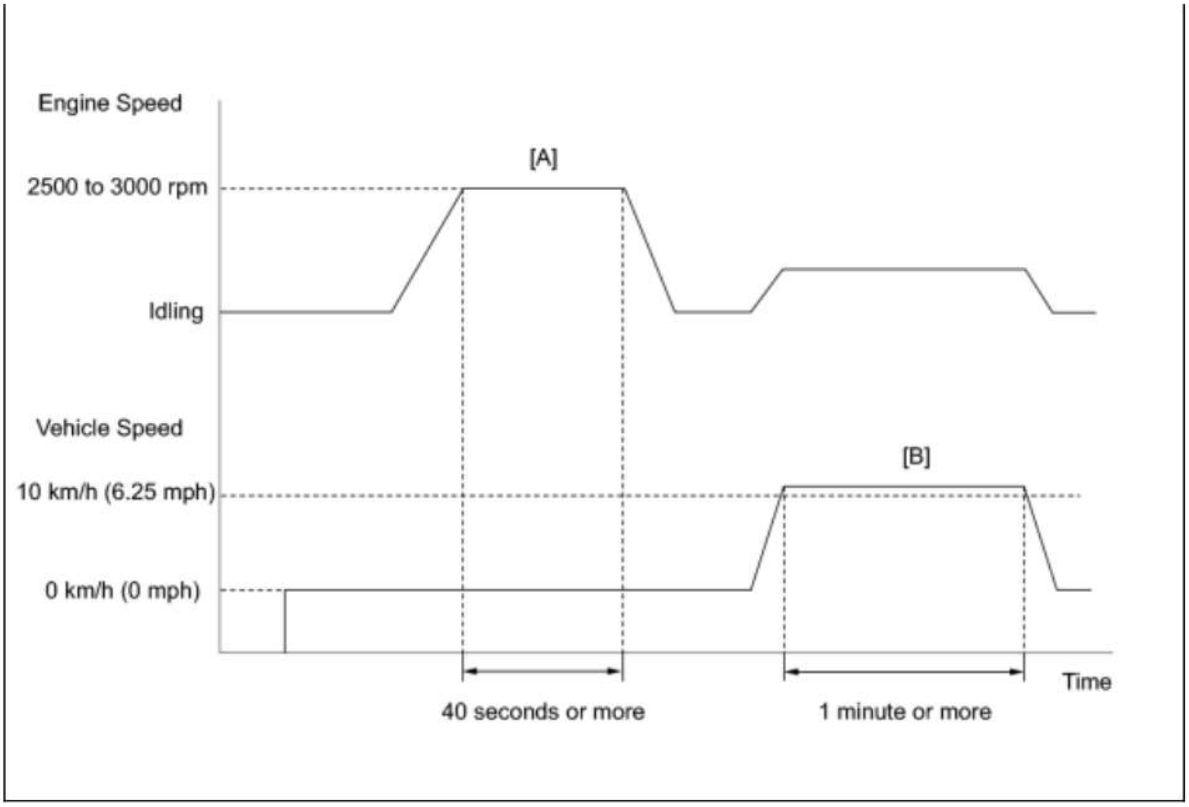
Intake air temperature sensor voltage [Intake air temperature]	More than 4.91 V [Below -46.9°C (-52.4°F)]

COMPONENT OPERATING RANGE

Intake air temperature sensor voltage [Intake air temperature]	0.435 to 4.698 V [-44.6 to 128.53°C (-48.3 to 263.4°F)]

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0112 or P0113.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

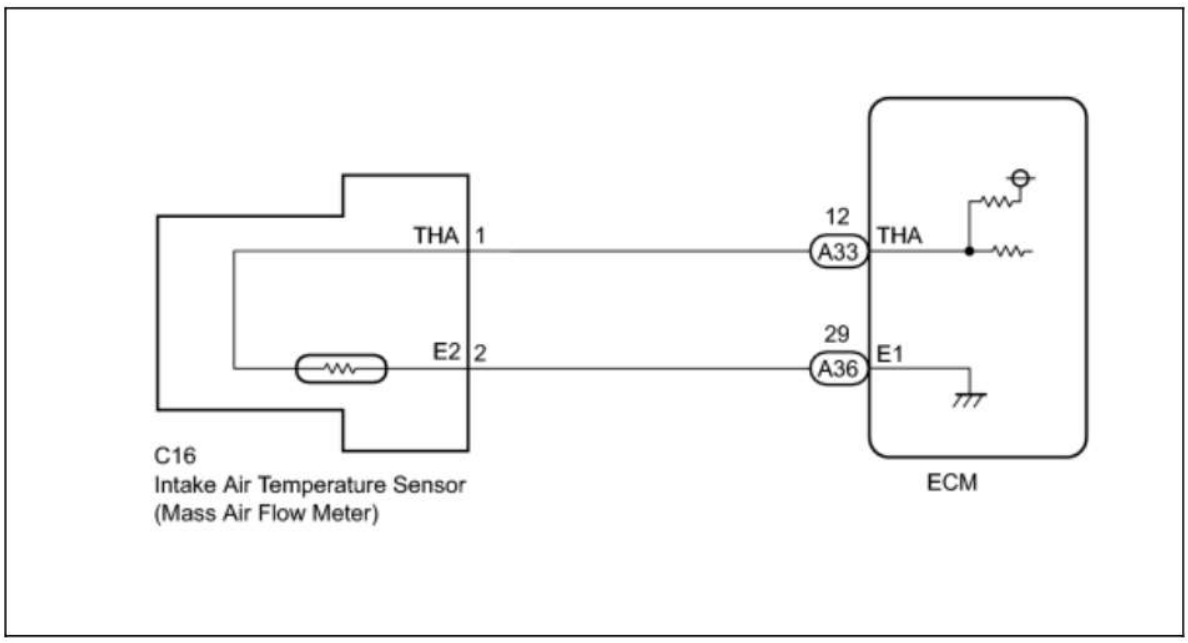
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the

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air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (INTAKE AIR TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Intake Air.

(e) Read the value displayed on the Techstream.

OK:

Same as actual intake air temperature.

Result

RESULT	PROCEED TO
-40°C (-40°F)	A
215°C (419°F)	B
Same as actual intake air temperature	C

HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates 215°C (419°F).

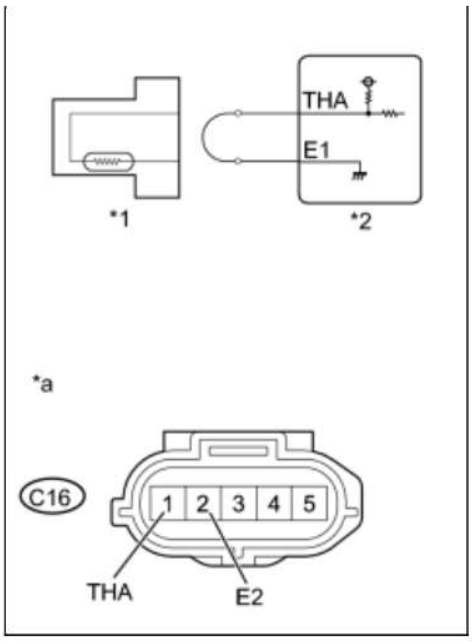
B ▶ **READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)**

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)**

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(a) Disconnect the mass air flow meter connector.

(b) Connect terminals 1 and 2 of the mass air flow meter connector on the wire harness side.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine / Data List / Intake Air.

(g) Read the value displayed on the Techstream.

Standard value:
215°C (419°F)

Text in Illustration

*1	Mass Air Flow Meter
*2	ECM
*a	Front view of wire harness connector (to Mass Air Flow Meter)

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

OK ▶ **REPLACE MASS AIR FLOW METER**

3.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

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(c) Measure the resistance according to the value(s) in the table below.

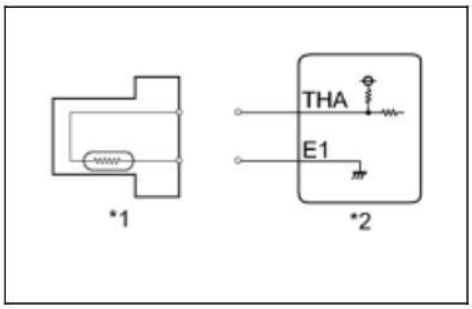
Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-12 (THA) - C16-1 (THA)	Always	Below 1 Ω
A36-29 (E1) - C16-2 (E2)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the mass air flow meter connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Data List / Intake Air.

(f) Read the value displayed on the Techstream.

Standard value:
-40°C (-40°F)

Text in Illustration

*1	Mass Air Flow Meter
*2	ECM

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

OK ▶ **REPLACE MASS AIR FLOW METER**

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5.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-12 (THA) or C16-1(THA) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C16-2 (E2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PFB0PSX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0116: Engine Coolant Temperature Circuit Range / Performance Problem (2013 FR-S)		

DTC	**P0116**	**Engine Coolant Temperature Circuit Range / Performance Problem**

DESCRIPTION

Refer to DTC P0117 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0116	The engine coolant temperature has not dropped completely 6 hours after ignition switch turned off. (2 trip detection logic)	• Thermostat • Engine coolant temperature sensor

MONITOR DESCRIPTION

If the engine coolant temperature sensor value does not change after the warmed up engine is stopped and then the next cold engine start is performed, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the MIL is illuminated and the DTC is stored.

MONITOR STRATEGY

Related DTCs	P0116: Engine coolant temperature sensor stuck rationality check
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	Intake air temperature sensor
Frequency of Operation	Once per driving cycle
Duration	0.512 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118 (Engine coolant temperature (ECT) sensor) P0462, P0463 (Fuel level sensor (FL))
Battery voltage	10.9 V or higher
Soak time	6 hours or more
Elapsed time after electric circuit turned	

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on (ignition switch ON)	Less than 60 seconds
Engine coolant temperature at the end of the previous driving cycle	70.2°C (158.2°F) or higher (varies with estimated ambient temperature at previous ignition switch off)

TYPICAL MALFUNCTION THRESHOLDS

Engine coolant temperature	45°C (113°F) or higher
Engine coolant temperature - Intake air temperature	15°C (59°F) or higher

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.
4. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Start the engine and warm it up until the engine coolant temperature reaches 80°C (176°F) or higher.
8. Turn the ignition switch off and leave the vehicle for 6 hours or more.
9. Turn the ignition switch to ON and turn the Techstream on.
10. Enter the following menus: Powertrain / Engine / Trouble Codes.
11. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
13. Input the DTC: P0116.
14. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

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- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

1. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0117, P0118 or P0125 are output simultaneously with DTC P0116, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- When the DTC is output, check the engine coolant temperature using the Techstream. Enter the following menus: Powertrain / Engine / Data List / Coolant Temp. If the Coolant Temp value is lower than the actual engine coolant temperature, the engine coolant temperature sensor circuit may be malfunctioning. In this case, check the wire harnesses and connectors (and those connections) between the ECM and the engine coolant temperature sensor first.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0116)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0116 is output	A
DTC P0116 and other DTCs are output	B

HINT:

If any DTCs and other than P0116 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

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A

2.	**INSPECT THERMOSTAT**

(a) Inspect the thermostat (thermostat opening temperature) INFO .

NG ▶ **REPLACE THERMOSTAT**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PF50PIX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0117,P0118: Engine Coolant Temperature Circuit Low Input (2013 FR-S)		

DTC	**P0117**	**Engine Coolant Temperature Circuit Low Input**

DTC	**P0118**	**Engine Coolant Temperature Circuit High Input**

DESCRIPTION

A thermistor, whose resistance value varies according to the engine coolant temperature, is built into the engine coolant temperature sensor. The structure of the sensor and its connection to the ECM are the same as those of the intake air temperature sensor.

HINT:

When any of DTCs P0117 and P0118 is stored, the ECM enters fail-safe mode. During fail-safe mode, the engine coolant temperature is estimated to be 70°C (158°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0117	Engine coolant temperature sensor voltage is less than 0.47 V for 0.5 seconds or more. (1 trip detection logic)	• Short in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM
P0118	Engine coolant temperature sensor voltage is more than 4.698 V for 0.5 seconds or more. (1 trip detection logic)	• Open in engine coolant temperature sensor circuit • Engine coolant temperature sensor • ECM

HINT:

When any of these DTCs are output, check the engine coolant temperature using the Techstream. Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

TEMPERATURE DISPLAYED	MALFUNCTION
-40°C (-40°F)	Open circuit
215°C (419°F)	Short circuit

MONITOR DESCRIPTION

The engine coolant temperature sensor is used to monitor the engine coolant temperature. The engine

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coolant temperature sensor has a thermistor with a resistance that varies according to the temperature of the engine coolant. When the coolant temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are reflected in the output voltage from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the engine coolant temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the engine coolant temperature sensor circuit and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0117: Engine coolant temperature sensor range check (Low voltage) P0118: Engine coolant temperature sensor range check (High voltage)
Required Sensors/Components (Main)	Engine coolant temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0117

Engine coolant temperature sensor voltage [Engine coolant temperature]	Less than 0.47 V [Higher than 122.8°C (253°F)]

P0118

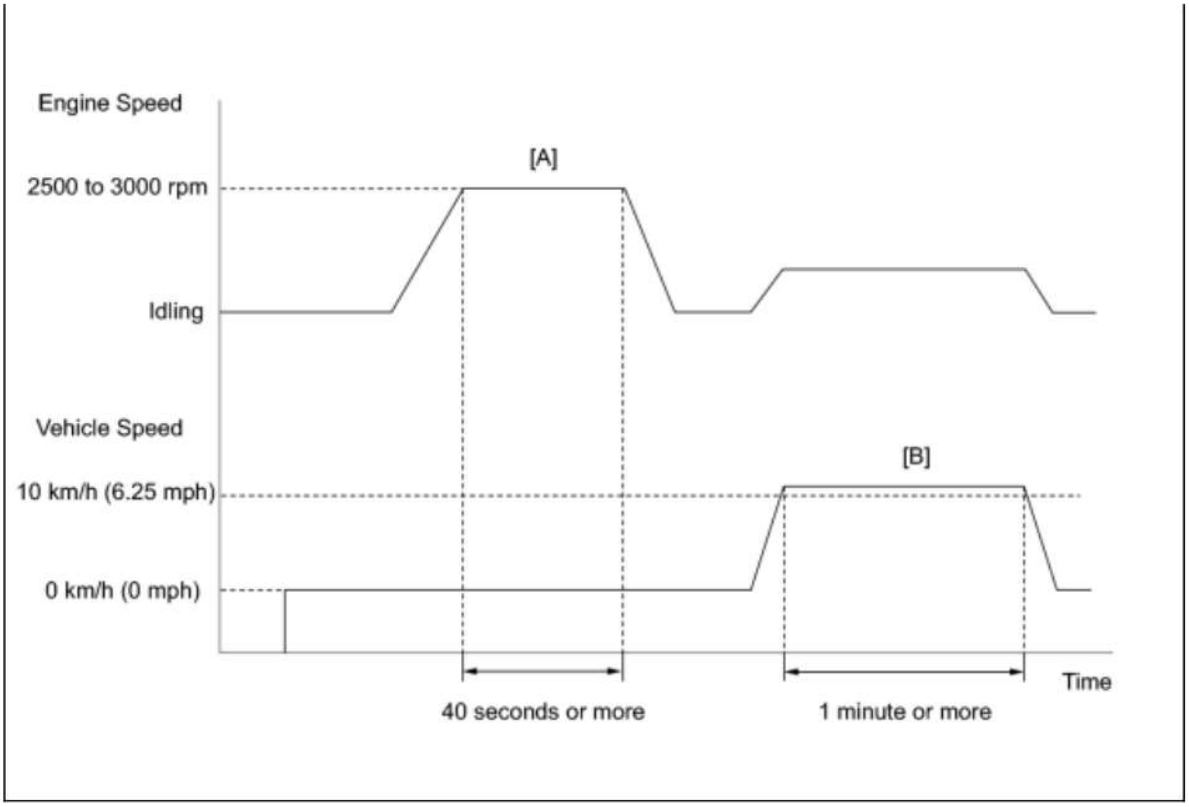
Engine coolant temperature sensor voltage [Engine coolant temperature]	More than 4.698 V [Below -46.2°C (-51.2°F)]

COMPONENT OPERATING RANGE

Engine coolant temperature sensor voltage [Engine coolant temperature]	0.479 to 4.688 V [-43.85 to 121.85°C (-46.9 to 251.3°F)]

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0117 or P0118.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

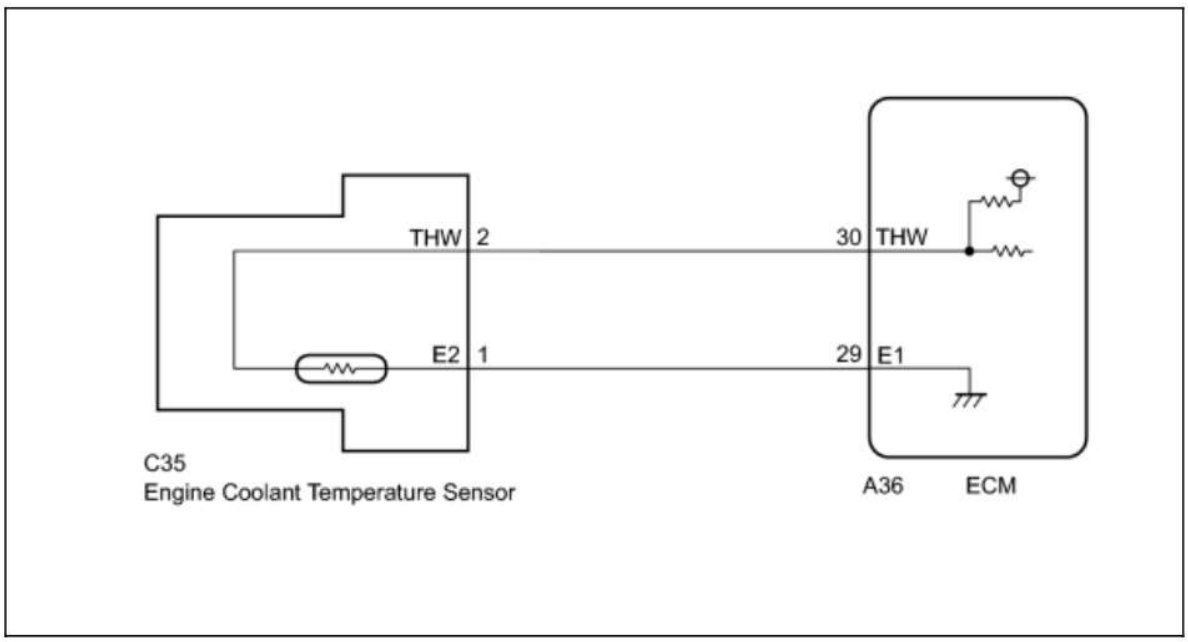
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or

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not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

- If DTC P0117 is stored, check that the engine does not overheat (the DTC P0117 may be stored due to engine overheating).

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ENGINE COOLANT TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

(e) Read the value displayed on the Techstream.

Standard value:
Between 75 and 100°C (167 and 212°F) with warm engine.

Result

RESULT	PROCEED TO
-40°C (-40°F)	A
215°C (419°F)	B
Between 75 and 100°C (167 and 212°F)	C

HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates higher than 215°C (419°F).

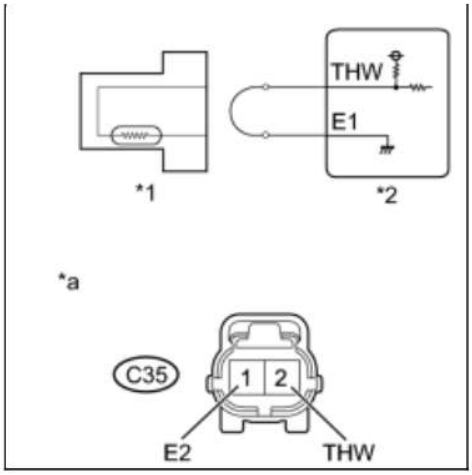
B ▶ **READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)**

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

2.	**READ VALUE USING TECHSTREAM (CHECK FOR OPEN IN WIRE HARNESS)**

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(a) Disconnect the engine coolant temperature sensor connector.

(b) Connect terminals 1 and 2 of the engine coolant temperature sensor connector on the wire harness side.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

(g) Read the value displayed on the Techstream.

Standard value:
Higher than 215°C (419°F)

Text in Illustration

*1	Engine Coolant Temperature Sensor
*2	ECM
*a	Front view of wire harness connector (to Engine Coolant Temperature Sensor)

NG ▶ **CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

3.	**CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

(a) Disconnect the engine coolant temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

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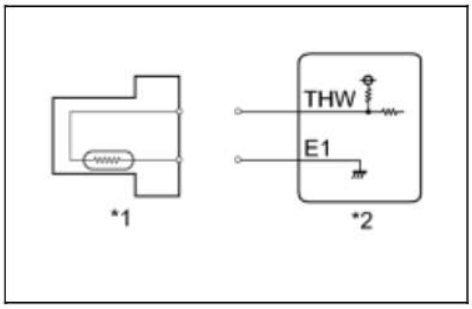
Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) - C35-2 (THW)	Always	Below 1 Ω
A36-29 (E1) - C35-1 (E2)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

4.	READ VALUE USING TECHSTREAM (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the engine coolant temperature sensor connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

(f) Read the value displayed on the Techstream.

Standard value:
-40°C (-40°F)

Text in Illustration

*1	Engine Coolant Temperature Sensor
*2	ECM

NG ▶ **CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

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5.	**CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)**

(a) Disconnect the engine coolant temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) or C35-2 (THW) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C35-1 (E2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 4-14-2014	6.6 C	Doc ID: RM000004GKG01MX
Model Year: 2013	Model: FR-S	Prod Date Range: [05/2013 -]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P119E,P119F,P219A; Bank 1 Air-Fuel Ratio Imbalance for Port Injection; 2013 MY FR-S [05/2013 -]		

DTC	P119E	Bank 1 Air-Fuel Ratio Imbalance for Port Injection

DTC	P119F	Bank 1 Air-Fuel Ratio Imbalance for Direct Injection

DTC	P219A	Bank 1 Air-Fuel Ratio Imbalance

DESCRIPTION

Refer to DTC P0300 INFO .

Refer to DTC P2195 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P119E	Crankshaft position sensor signal fluctuates in port injection air fuel ratio feedback control.	• Fuel injector assembly (for port injection) • Fuel injector assembly (for direct injection) • Intake system • Gas leaks from exhaust system • Ignition system • Compression pressure • Air fuel ratio sensor • ECM
P119F	Crankshaft position sensor signal fluctuates in direct injection air fuel ratio feedback control.	
P219A	One of the following conditions is met (2 trip detection logic): • Air fuel ratio sensor signal fluctuates in air fuel ratio feedback control. • Crankshaft position sensor signal fluctuates in air fuel ratio feedback control.	

MONITOR DESCRIPTION

Fuel System Air Fuel Ratio Cylinder Imbalance Monitor

The ECM uses the air fuel ratio sensor and crankshaft position sensor to monitor the difference in air fuel ratios between the cylinders caused by differences in injection volumes between the cylinders, leakage in the intake or exhaust system, etc.

When the air fuel ratios of the cylinders are lean or rich with respect to each other, the ECM determines that a problem is present and stores a DTC.

Air Fuel Ratio Sensor Monitoring Method

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When the system detects a difference in air fuel ratios between the cylinders due to fluctuation in the air fuel ratio sensor output over 1 engine cycle (2 crankshaft revolutions), the system determines that there is a problem.

Crankshaft Position Sensor Monitoring Method

The system monitors the engine speed variation and when the variation becomes large, the system determines that there is a difference in air fuel ratios between the cylinders, which it determines to be a problem.

MONITOR STRATEGY

Related DTCs	P119E: Fuel system air fuel ratio cylinder imbalance functional check (for port fuel injection) P119F: Fuel system air fuel ratio cylinder imbalance functional check (for direct injection) P219A: Fuel system air fuel ratio cylinder imbalance functional check
Required Sensors/Components (Main)	Air fuel ratio sensor Crankshaft position sensor
Required Sensors/Components (Related)	Mass air flow meter Engine coolant temperature sensor Speed sensor
Frequency of Operation	Once per driving cycle
Duration	200 revolutions: Air fuel ratio sensor monitoring method 400 revolutions: Crankshaft position sensor monitoring method
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever the following DTCs are not stored	None

P119E, P119F and P219A (Crankshaft Position Sensor Monitoring Method)

Accelerator pedal position	0%
Engine speed	500 rpm or higher
Estimated time after engine start	30 seconds or more
Engine coolant temperature	Higher than 60°C (140°F)
Fuel system status (Air fuel ratio sensor)	Closed loop

P219A (Air Fuel Ratio Sensor Monitoring Method)

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Estimated time after engine start	30 seconds or more
Engine speed	1600 to 3200 rpm
Engine coolant temperature	Higher than 60°C (140°F)
Fuel system status (Air fuel ratio sensor)	Closed loop
Intake air mass per revolution	0.55 to 0.8 g/rev (varies with engine speed)
Change of intake air mass during 1/2 engine revolution	Less than 0.005 g/rev

TYPICAL MALFUNCTION THRESHOLDS

P119E and P219A (Crankshaft Position Sensor Monitoring Method)

The average of the crankshaft speed fluctuation at port fuel injection	Higher than 30.7 rpm (for Automatic Transmission) (varies with engine speed) Higher than 18.3 rpm (for Manual Transmission) (varies with engine speed)

P119F and P219A (Crankshaft Position Sensor Monitoring Method)

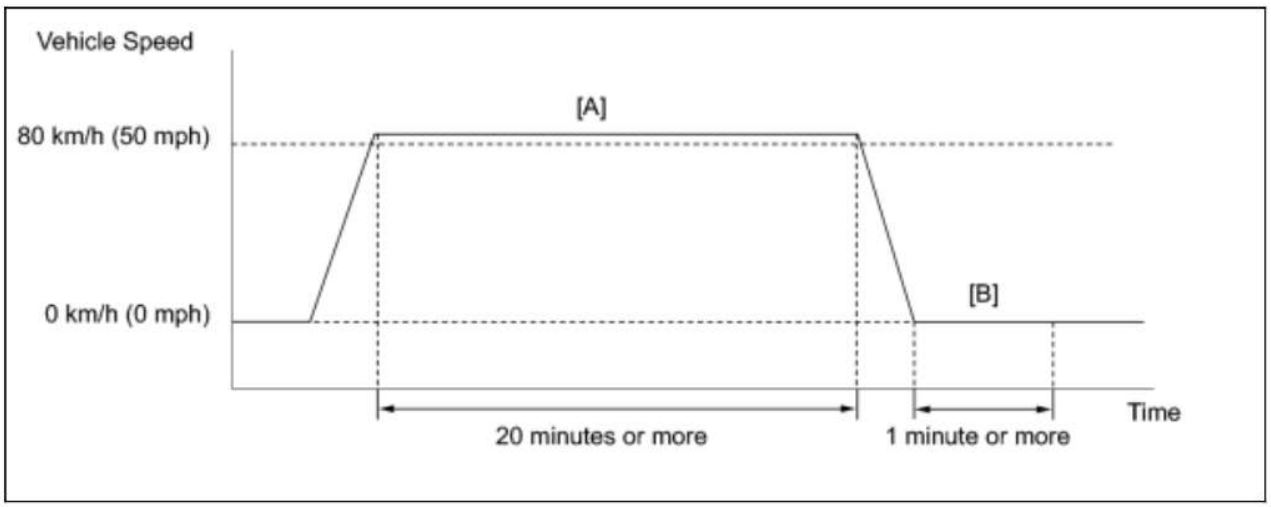
The average of the crankshaft speed fluctuation at direct fuel injection	Higher than 25.5 rpm (for Automatic Transmission) (varies with engine speed) Higher than 16.5 rpm (for Manual Transmission) (varies with engine speed)

P219A (Air Fuel Ratio Sensor Monitoring Method)

Either following condition is met	A or B
A. The average of the positive gradient of air fuel ratio sensor output	More than 0.001125 (varies with engine speed and intake air mass per revolution)
B. The average of the negative gradient of air fuel ratio sensor output	Less than 0.000975 (varies with engine speed and intake air mass per revolution)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

HINT:

Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P119E, P119F or P219A.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal

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INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to P0030 INFO .

Refer to P0335 INFO .

INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from the transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P219A)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

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(e) Read the DTCs.

Result

RESULT	PROCEED TO
DTC P119E, P119F or P219A is output	A
DTC P119E, P119F, P219A and other DTCs are output	B

HINT:

If any DTCs other than P219A are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	READ VALUE USING TECHSTREAM (FREEZE FRAME DATA)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Freeze Frame Data Items for DTC P119E, P119F and P219A

- Vehicle Speed
- Engine Speed
- Calculate Load
- Accelerator Idle Position
- Short FT #1
- Long FT #1
- Cylinder #1 Misfire Count to Cylinder #4 Misfire Count

HINT:

When the sum of Short FT and Long FT is positive, the engine is running lean, and when the sum is negative, the engine is running rich.

DTC stored during idling	It is possible to conclude that the problem was detected due to a "lean imbalance" (detected using crankshaft speed variation).
DTC stored while vehicle being driven	It is possible to conclude that the problem was detected due to a "rich imbalance" (detected using the air fuel ratio sensor).

NEXT

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3.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

HINT:

The A/C switch and all accessory switches should be off and the shift lever should be in P, N or neutral position.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume / Cylinder #1 to #4 Misfire Count.

HINT:

When the "Control the Injection Volume" Active Test is selected (injection volume is 0%), if a misfire count increases, proceed to step 6 (Check Intake System).

(f) Perform the Control the Injection Volume operation with the engine idling.

(g) Check the misfire counts ("Cylinder #1 Misfire Count" to "Cylinder #4 Misfire Count") while decreasing the injection volume in 5% increments.

NOTICE:

Do not decrease the injection volume by higher than 20%.

The cylinder whose misfire count has not increased can be assumed to be running rich. Therefore, perform inspections while focusing on that cylinder.

NEXT

4.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST SYSTEM

OK

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5.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK

6.	INSPECT SPARK PLUG

(a) Inspect the spark plug of the cylinder causing the imbalance INFO .

NG ▶ REPLACE SPARK PLUG

OK

7.	CHECK FOR SPARK (SPARK TEST)

(a) Perform a spark test INFO .

HINT:
If the result of the spark test is normal, proceed to the next step.

NEXT

8.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO .

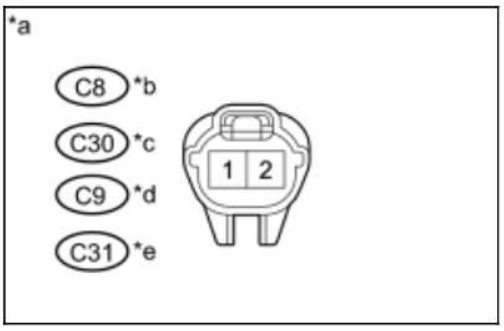
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NG ▶ CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK ▼

9.	CHECK HARNESS AND CONNECTOR (POWER SOURCE VOLTAGE)

(a) Disconnect the fuel injector assembly (for port injection) connector.



(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1 - Body ground	Ignition switch ON	11 to 14 V
C30-1 - Body ground	Ignition switch ON	11 to 14 V
C9-1 - Body ground	Ignition switch ON	11 to 14 V
C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

NG ▶ GO TO FUEL INJECTOR CIRCUIT

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OK

10.	CHECK HARNESS AND CONNECTOR (FUEL INJECTOR ASSEMBLY - ECM)

(a) Check the harness and connector of fuel injector assembly (for port injection) INFO .

(b) Check the harness and connector of fuel injector assembly (for direct injection) INFO .

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

11.	CHECK FUEL INJECTOR ASSEMBLY OF CYLINDER CAUSING IMBALANCE

(a) Check the fuel injector assembly (for port injection) [whether fuel volume is high or low, and whether injection pattern is poor] INFO .

(b) Check the fuel injector assembly (for direct injection) [whether fuel volume is high or low, and whether injection pattern is poor] INFO .

Result

RESULT	PROCEED TO
OK	A
Fuel injector assembly (for port injection) is NG.	B
Fuel injector assembly (for direct injection) is NG.	C

B ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

C ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)

A

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12.	CHECK FOR CAUSE OF FAILURE

(a) If the cause of the problem has not been found even after performing the troubleshooting procedure, perform the inspection below.

(b) Check the intake valve for deposits.

HINT:

As the DTC may have been stored due to deposits on the intake valve, remove the cylinder head and check the intake valve.

NEXT

13.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Check for DTCs.

P219A is not output.

NEXT END

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PF60PBX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0122,P0123,P0222,P0223,P2135: Throttle Position Sensor Circuit Low Input (2013 FR-S)		

DTC	**P0122**	**Throttle Position Sensor Circuit Low Input**

DTC	**P0123**	**Throttle / Pedal Position Sensor / Switch "A" Circuit High Input**

DTC	**P0222**	**Throttle / Pedal Position Sensor / Switch "B" Circuit Low Input**

DTC	**P0223**	**Throttle / Pedal Position Sensor / Switch "B" Circuit High Input**

DTC	**P2135**	**Throttle / Pedal Position Sensor / Switch "A" / "B" Voltage Correlation**

DESCRIPTION

HINT:

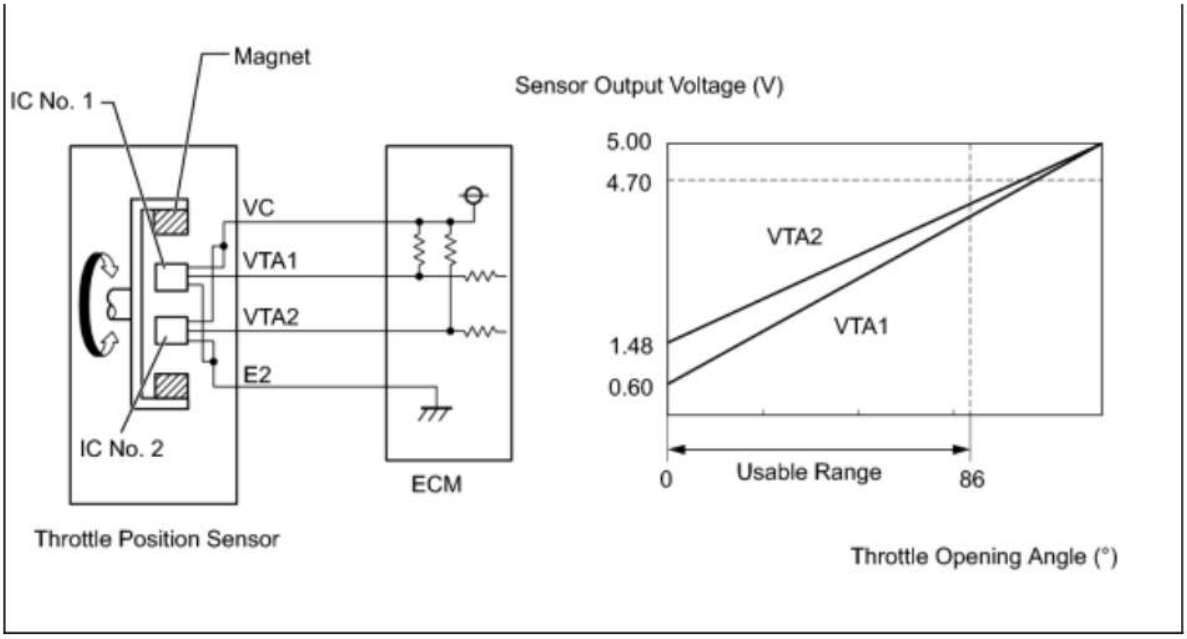
These DTCs relate to the throttle position sensor.

The throttle position sensor is mounted on the throttle with motor body assembly, and detects the opening angle of the throttle valve. This sensor is a non-contact type sensor. It uses Hall-effect elements in order to yield accurate signals even in extreme driving conditions, such as at high speeds as well as very low speeds.

The throttle position sensor has 2 sensor circuits, each of which transmits a signal, VTA1 and VTA2. VTA1 is used to detect the throttle valve angle and VTA2 is used to detect malfunctions in VTA2. The sensor signal voltages vary between 0 V and 5 V in proportion to the throttle valve opening angle, and are transmitted to the VTA1 and VTA2 terminals of the ECM.

As the valve closes, the sensor output voltage decreases and as the valve opens, the sensor output voltage increases. The ECM calculates the throttle valve opening angle according to these signals and controls the throttle actuator in response to driver inputs. These signals are also used in calculations such as air fuel ratio correction, power increase correction and fuel-cut control.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0122	The voltage of VTA1 is 0.273 V or less for 0.024 seconds or more. (1 trip detection logic)	• Throttle position sensor (built into throttle with motor body assembly) • Short in VTA1 circuit • Open in VC circuit • ECM
P0123	The voltage of VTA1 is more than 4.736 V for 0.024 seconds or more. (1 trip detection logic)	• Throttle position sensor (built into throttle with motor body assembly) • Open in VTA1 circuit • Open in E1 circuit • Short between VC and VTA1 circuits • ECM
P0222	The voltage of VTA2 is 1.153 V or less for 0.024 seconds or more. (1 trip detection logic)	• Throttle position sensor (built into throttle with motor body assembly) • Short in VTA2 circuit • Open in VC circuit • ECM
P0223	The voltage of VTA2 is 4.772 V or more for 0.024 seconds or more. (1 trip detection logic)	• Throttle position sensor (built into throttle with motor body assembly) • Open in VTA2 circuit • Open in E1 circuit • Short between VC and VTA2 circuits • ECM
P2135	Deviation in voltages of VTA1 and VTA2 exceed thresholds for 0.212 seconds or more.	• Short between VTA1 and VTA2 circuits • Throttle position sensor (built into

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	(1 trip detection logic)	throttle with motor body assembly) • ECM

HINT:

- When any of these DTCs are output, check the throttle valve opening angle using the Techstream. Enter the following menus: Powertrain / Engine / Data List / Throttle Position No. 1 and Throttle Position No. 2.
- Throttle Position No. 1 is the VTA1 signal, and Throttle Position No. 2 is the VTA2 signal.

Reference (Normal Condition):

TECHSTREAM DISPLAY	ACCELERATOR PEDAL FULLY RELEASED	ACCELERATOR PEDAL FULLY DEPRESSED
Throttle Position No. 1	0.5 to 1.1 V	3.2 to 4.8 V
Throttle Position No. 2	1.5 to 2.2 V	4.0 to 4.5 V

MONITOR DESCRIPTION

The ECM uses the throttle position sensor to monitor the throttle valve opening angle. There are several checks that the ECM performs to confirm the proper operation of the throttle position sensor.

- A specific voltage difference is expected between the sensor terminals, VTA1 and VTA2, for each throttle valve opening angle. If the difference between VTA1 and VTA2 is incorrect, the ECM interprets this as a malfunction in the sensor circuit, and stores a DTC.
- VTA1 and VTA2 each have a specific voltage range. If VTA1 or VTA2 is outside the normal operating range, the ECM interprets this as a malfunction in the sensor circuit, and stores a DTC.
- VTA1 and VTA2 should never be close to the same voltage level. If VTA1 is within 0.02 V of VTA2, the ECM determines that there is a short circuit in the sensor circuit, and stores a DTC.

If the malfunction is not repaired successfully, a DTC is stored 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0122: Throttle position sensor circuit continuity (Low Voltage) (Sensor 1) P0123: Throttle position sensor circuit continuity (High Voltage) (Sensor 1) P0222: Throttle position sensor circuit continuity (Low Voltage) (Sensor 2) P0223: Throttle position sensor circuit continuity (High Voltage) (Sensor 2) P2135: Throttle position sensor rationality check
Required Sensors/Components (Main)	Throttle position sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
	0.024 seconds: P0122, P0123, P0222, P0223

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Duration	0.212 seconds: P2135
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None
Battery voltage	6 V or more

TYPICAL MALFUNCTION THRESHOLDS

P0122

VTA1 voltage (Throttle position)	Less than 0.273 V (5.46%)

P0123

VTA1 voltage (Throttle position)	More than 4.736 V (94.73%)

P0222

VTA2 voltage (Throttle position)	Less than 1.153 V (3.82%)

P0223

VTA2 voltage (Throttle position)	More than 4.772 V (94.30%)

P2135

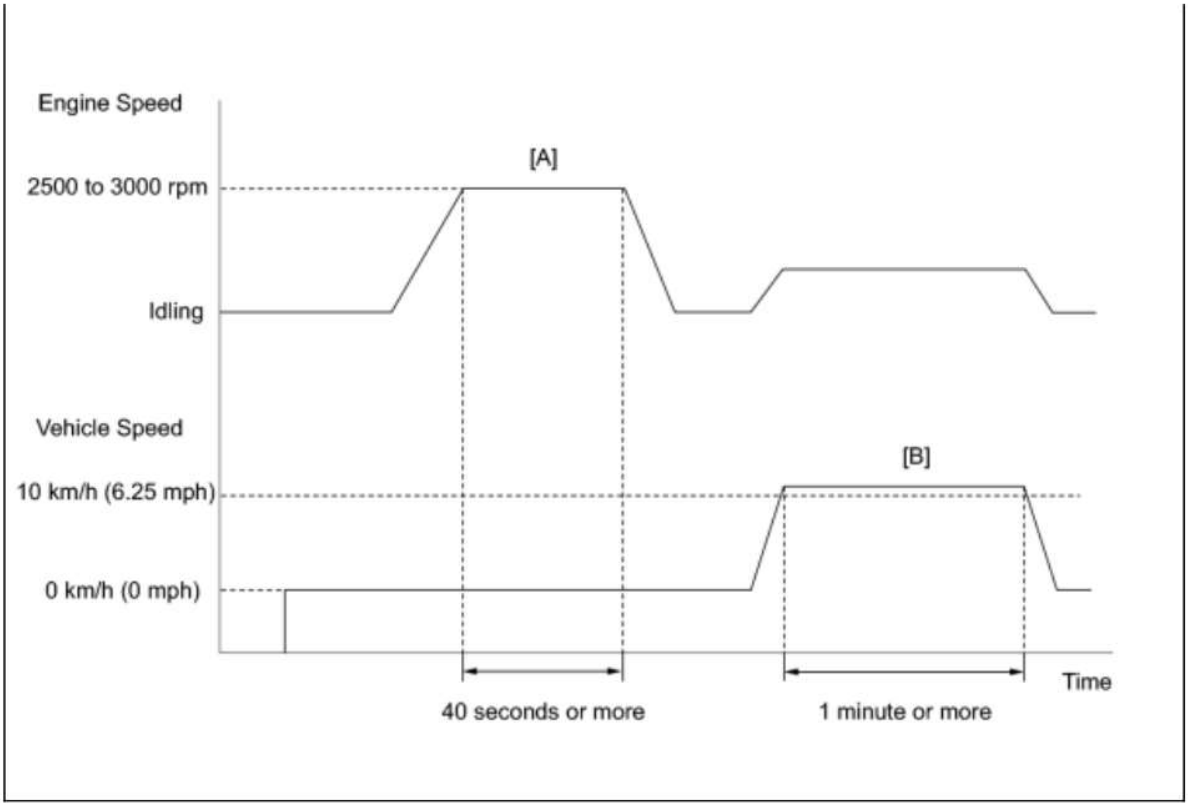
VTA2 - VTA1	Less than 3.79% (varies with VTA1)

COMPONENT OPERATING RANGE

VTA1 voltage (Throttle position)	0.382 to 4.504 V (7.64 to 90.09%)
VTA2 voltage (Throttle position)	1.262 to 4.696 V (6.54 to 92.41%)

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0122, P0123, P0222, P0223 or P2135.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

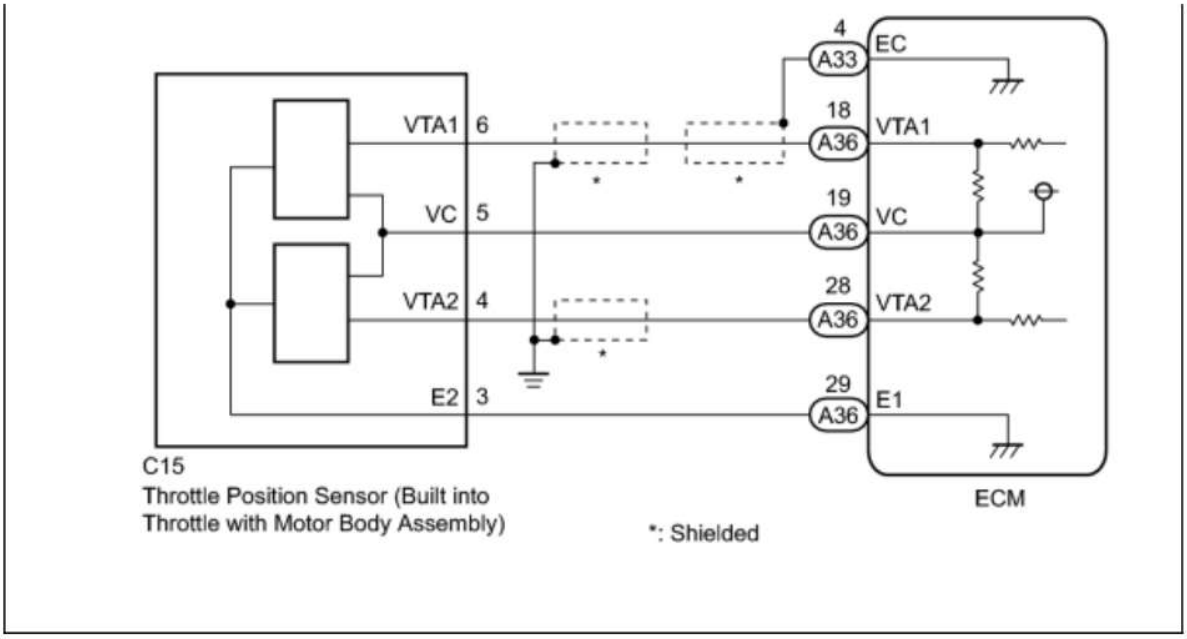
FAIL-SAFE

When any of these DTCs or other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a specified throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal angle, to allow the vehicle to continue at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION SENSOR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Throttle Position No. 1 and Throttle Position No. 2.

(e) Read the values displayed on the Techstream.

Result

WHEN ACCELERATOR PEDAL RELEASED		WHEN ACCELERATOR PEDAL DEPRESSED		TROUBLE AREA	PROCEED TO
THROTTLE POSITION NO. 1 (VTA1)	THROTTLE POSITION NO. 2 (VTA2)	THROTTLE POSITION NO. 1 (VTA1)	THROTTLE POSITION NO. 2 (VTA2)		
0 to 0.2 V	0 to 1.75 V	0 to 0.2 V	0 to 1.75 V	VC circuit open	
4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	4.5 to 5.0 V	E2 circuit open	

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0 to 0.2 V, or 4.5 to 5.0 V	1.9 V to 2.6 V (Fail-safe)	0 to 0.2 V, or 4.5 to 5.0 V	1.9 V to 2.6 V (Fail-safe)	VTA1 circuit open or ground short	A
0.6 V to 1.4 V (Fail-safe)	0 to 1.75V, or 4.8 to 5.0 V	0.6 V to 1.4 V (Fail-safe)	0 to 1.75 V, or 4.8 to 5.0 V	VTA2 circuit open or ground short	
0.5 to 1.1 V	1.5 to 2.2 V	3.2 to 4.8 V (Not fail-safe)	4.0 to 4.5 V (Not fail-safe)	Throttle position sensor circuit normal	B

B ▶ **CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)**

A ▼

2.	**CHECK HARNESS AND CONNECTOR (THROTTLE POSITION SENSOR - ECM)**

(a) Disconnect the throttle with motor body assembly connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19 (VC) - C15-5 (VC)	Always	Below 1 Ω
A36-18 (VTA1) - C15-6 (VTA1)	Always	Below 1 Ω
A36-28 (VTA2) - C15-4 (VTA2)	Always	Below 1 Ω
A36-29 (E1) - C15-3 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

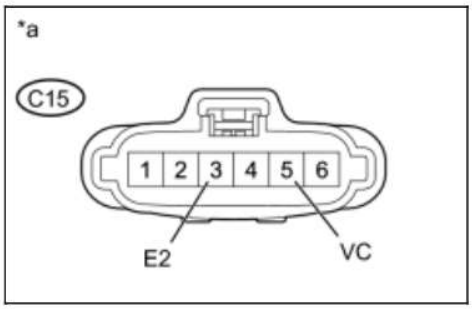
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19(VC) or C15-5 (VC) - Body ground	Always	10 kΩ or higher
A36-18 (VTA1) or C15-6 (VTA1) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C15-3 (E2) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C15-4 (VTA2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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3.	**INSPECT ECM (VC VOLTAGE)**



(a) Disconnect the throttle with motor body assembly connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C15-5 (VC) - C15-3 (E2)	Ignition switch ON	4.5 to 5.5 V

Text in Illustration

*a	Front view of wire harness connector (to Throttle with Motor Body Assembly)

NG ▶ **REPLACE ECM**

OK

4.	**REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

(a) Replace the throttle with motor body assembly INFO .

NEXT

5.	**CHECK WHETHER DTC OUTPUT RECURS (THROTTLE POSITION SENSOR DTCS)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Start the engine.

(f) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(g) Enter the following menus: Powertrain / Engine / Trouble Codes.

(h) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0122, P0123, P0222, P0223 and/or P2135 are output	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000T9P0BWX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0125: Insufficient Coolant Temperature for Closed Loop Fuel Control (2013 FR-S)		

DTC	**P0125**	**Insufficient Coolant Temperature for Closed Loop Fuel Control**

DESCRIPTION

Refer to DTC P0117 INFO .

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0125	Despite estimated engine coolant temperature is 20°C (68 °F) or more, engine coolant temperature sensor value is less than 20°C (68 °F) for 300 seconds or more. (2 trip detection logic)	• Cooling system • Engine coolant temperature sensor • Thermostat

MONITOR DESCRIPTION

The diagnostic system monitors for a functional check of the engine coolant temperature sensor. If the engine coolant temperature does not reach the temperature to enable the closed loop air/fuel ratio control within a predetermined time after engine start, the diagnostic system determines a malfunction of engine coolant temperature sensor and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0125: Engine coolant temperature sensor range check
Required Sensors/Components (Main)	Engine coolant temperature sensor Thermostat Cooling system
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	120 seconds: Closed loop temperature -10°C (14°F) 300 seconds: Closed loop temperature -10 to 20 °C (14 to 68°F)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

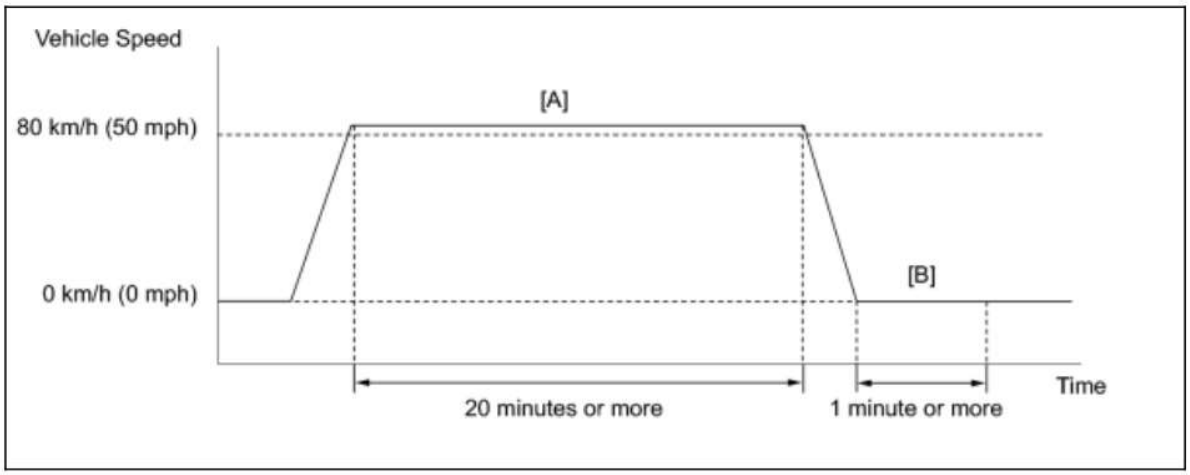
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Monitor runs whenever following DTCs are not present	P0117, P0118 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0300, P0301, P0302, P0303, P0304 (Misfire) P0500 (Vehicle speed sensor (VSS)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Battery voltage	10.9 V or more
Engine speed	500 rpm or higher
Diagnostic value(n)	[Diagnostic value(n-1) + 64 + 7.9 (varies with vehicle speed and lowest engine coolant temperature)] or more

TYPICAL MALFUNCTION THRESHOLDS

Engine coolant temperature	Less than 20°C (68°F)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

   HINT:

   Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0125.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0117 INFO .

INSPECTION PROCEDURE

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HINT:

- If any of DTCs P0116, P0117 or P0118 are set simultaneously with DTC P0125, the engine coolant temperature sensor may have an open or a short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0125)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0125 is output	A
DTC P0125 and other DTCs are output	B

HINT:

If any DTCs other than P0125 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A
▼

2.	**INSPECT THERMOSTAT**

(a) Inspect the thermostat INFO .

NG ▶ **REPLACE THERMOSTAT**

OK
▼

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3.	**CHECK COOLING SYSTEM**

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG ▶ **REPAIR OR REPLACE COOLING SYSTEM**

OK ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000TB3096X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0128: Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature) (2013 FR-S)		

DTC	**P0128**	**Coolant Thermostat (Coolant Temperature Below Thermostat Regulating Temperature)**

DESCRIPTION

At the same time as using the engine coolant temperature sensor to determine the engine coolant temperature, the ECM estimates the engine coolant temperature. If the difference between the estimated and actual engine coolant temperatures exceeds a predetermined value, then the DTC is stored, notifying of a malfunction in the functioning of the thermostat.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0128	Abnormal (open) thermostat functioning detected. (2 trip detection logic)	• Thermostat • Cooling system • Engine coolant temperature sensor • ECM

MONITOR DESCRIPTION

The ECM estimates the engine coolant temperature based on the starting temperature, engine loads, and engine speeds. The ECM then compares the estimated temperature with the actual engine coolant temperature. If the difference between the estimated engine coolant temperature and the actual engine coolant temperature exceeds the specified value, the ECM interprets this as a malfunction in the thermostat or the engine cooling system and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0128: Thermostat functional check
Required Sensors/Components (Main)	Thermostat Engine coolant temperature sensor
Required Sensors/Components (Related)	Intake air temperature sensor Speed sensor
Frequency of Operation	Once per driving cycle
Duration	Immediately
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

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Monitor runs whenever following DTCs not stored	P0101, P0102, P0103 (Mass air flow (MAF) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0300, P0301, P0302, P0303, P0304 (Misfire) P0335, P0336 (Crankshaft position sensor) P0340, P0345 (Camshaft position sensor - Intake with variable valve timing (VVT)) P0500 (Vehicle speed sensor (VSS)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Battery voltage	10.9 V or higher
Ambient temperature	-7°C (19.4°F) or higher
Vehicle speed	30 km/h (18.6 mph) or higher

Case 1

Modeled engine coolant temperature	60°C (140°F) or higher

Case 2

Modeled engine coolant temperature	70.2°C (158.4°F) or higher (varies with ambient temperature at engine start)

Case 3

Modeled engine coolant temperature	47.1°C (116.8°F) or higher (varies with ambient temperature at engine start)

TYPICAL MALFUNCTION THRESHOLDS

Case 1

Actual engine coolant temperature	Less than 60°C (140°F)
Sigma (Modeled engine coolant temperature - Actual engine coolant temperature)	1731.6°C (3148.9°F) or higher (varies with engine coolant temperature at engine start)

Case 2

Actual engine coolant temperature	Less than 77.8°C (172°F) (varies with ambient temperature at engine start)

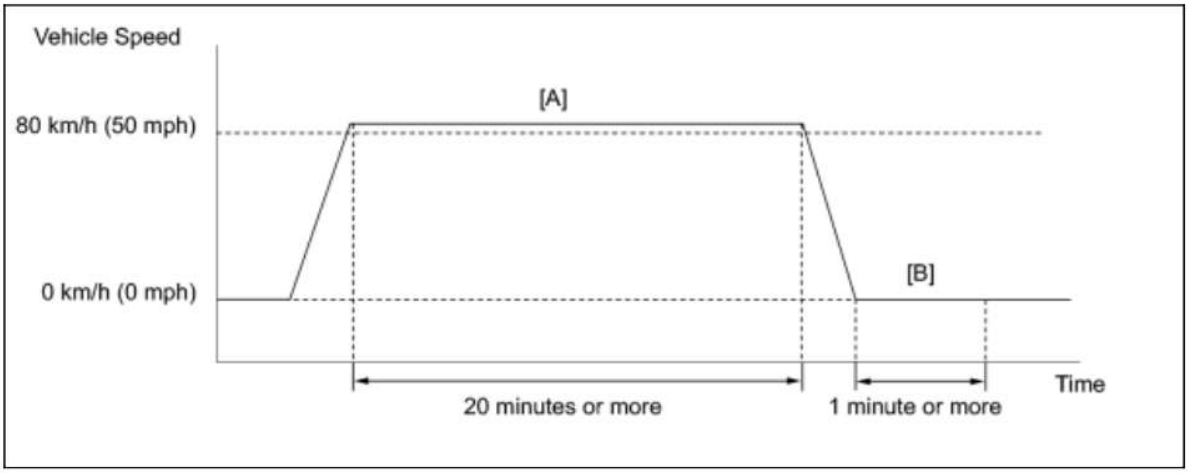
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Sigma (Modeled engine coolant temperature - Actual engine coolant temperature)	1731.6°C (3148.9°F) or higher (varies with engine coolant temperature at engine start)

Case 3

Modeled engine coolant temperature - Actual engine coolant temperature	11.1 °C (52°F) or higher
Sigma (Modeled engine coolant temperature - Actual engine coolant temperature)	1731.6°C (3148.9°F) or higher (varies with engine coolant temperature at engine start)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0128.
12. Check the DTC judgment result.

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TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- When the DTC is output, check the engine coolant temperature using the Techstream. Enter the following menus: Powertrain / Engine / Data List / Coolant Temp. If the Coolant Temp value is lower than the actual engine coolant temperature, the engine coolant temperature sensor circuit may be malfunctioning. In this case, check the wire harnesses and connectors (and those connections) between the ECM and the engine coolant temperature sensor first.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0128)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0128 is output	A
DTC P0128 and other DTCs are output	B

HINT:

If any DTCs other than P0128 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▼

2.	**CHECK COOLING SYSTEM**

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal cooling fan operation or any modifications.

NG ▶ **REPAIR OR REPLACE COOLING SYSTEM**

OK ▼

3.	**INSPECT THERMOSTAT**

(a) Inspect the thermostat (thermostat opening temperature) INFO .

NG ▶ **REPLACE THERMOSTAT**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000028K60CZX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0131,P0132,P0134: Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 1) (2013 FR-S)		

DTC	**P0131**	**Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 1)**

DTC	**P0132**	**Oxygen Sensor Circuit High Voltage Bank1 Sensor1**

DTC	**P0134**	**Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)**

DESCRIPTION

Refer to DTC P2195 INFO .

HINT:

- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0131	One of the following conditions is met for 1 second or more (1 trip detection logic): • The voltage of A1A+ is less than 0.4 V. • The voltage of A1A- is less than 0.4 V. • The difference between voltage of A1A+ and voltage of A1A- is less than 0.1 V and the voltage of A1A- is more than 3.8 V and less than 4.7 V.	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM
P0132	One of the following conditions is met for 1 second or more (1 trip detection logic): • The voltage of A1A+ is more than 4.7 V. • The voltage of A1A- is more than 4.7 V.	
P0134	Air fuel ratio sensor impedance is 450 Ω or more for 5 seconds or more. (1 trip detection logic)	

MONITOR DESCRIPTION

These DTCs are output when there is an open or short in the air fuel ratio sensor circuit, or if the air fuel ratio sensor output drops. To detect these problems, the voltage of the air fuel ratio sensor is monitored when turning the ignition switch to ON, and the admittance (admittance is an electrical term that indicates the ease of flow of current) is checked while driving. If the voltage of the air fuel ratio sensor is between

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0.6 V and 4.5 V, it is considered normal. If the voltage is out of the specified range, or the admittance is less than the standard value, the ECM determines that there is a malfunction in the air fuel ratio sensor. If the same malfunction is detected in next driving cycle, the MIL is illuminated and a DTC is stored.

MONITOR STRATEGY

Related DTCs	P0131: Primary oxygen sensor - ECM input voltage circuit continuity P0132: Primary oxygen sensor - ECM input voltage circuit continuity P0134: Primary oxygen sensor - Output voltage circuit continuity
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Sub)	-
Frequency of Operation	Continuous
Duration	1 second: P0131, P0132 5 seconds: P0134
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None

P0131, P0132

Battery voltage	10.9 V or higher

P0134

Battery voltage	10.9 V or higher
Accumulated variation of front lambda sensor heater control duty per 0.128 sec.	70% or higher for 36 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0131

Either of following conditions is met:	A, B, C or D
A. A1A+ terminal voltage	Less than 0.4 V
B. A1A- terminal voltage	Less than 0.4 V
C. Difference of A1A+ terminal voltage and A1A- terminal voltage	Less than 0.1 V
D. A1A- terminal voltage	Less than 4.7 V and higher than 3.8 V

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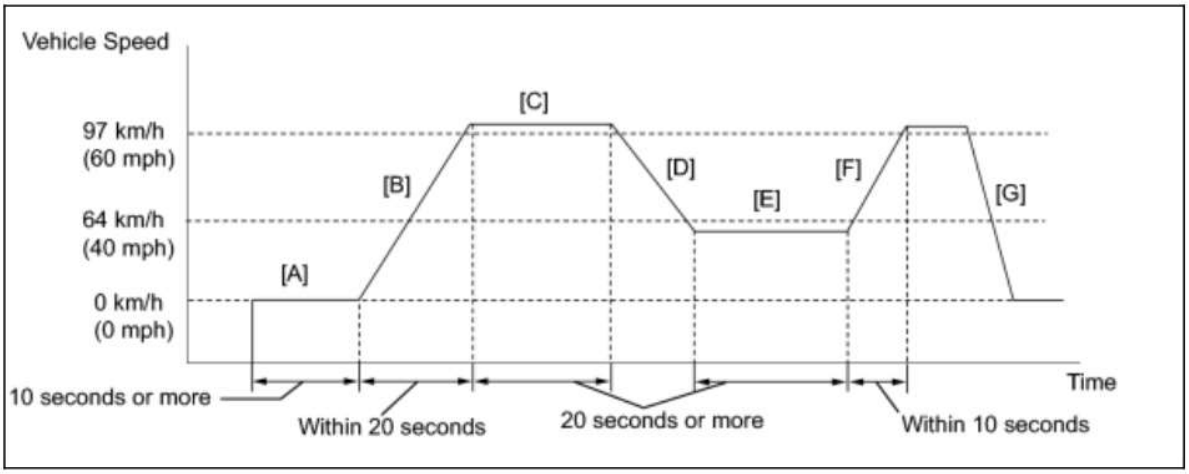
P0132

Either of following conditions is met:	A or B
A. A1A+ terminal voltage	4.7 V or higher
B. A1A- terminal voltage	4.7 V or higher

P0134

Impedance of air fuel ratio sensor	450 Ω or higher

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Accelerate the vehicle to 97 km/h (60 mph) or more within 20 seconds [B].
c. Drive the vehicle at 97 km/h (60 mph) or more for 20 seconds or more [C].
d. Release the accelerator pedal to Decelerate until the vehicle speed decreases to less than 64 km/h (40 mph) [D].

HINT:

Release the accelerator pedal fully to perform the fuel-cut.

e. Drive the vehicle at 60 km/h (40 mph) or less for 20 seconds or more [E].
f. Accelerate the vehicle to 97 km/h (60 mph) or more within 10 seconds [F].
g. Release the accelerator pedal and stop the vehicle [G].

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8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0131, P0132 or P0134.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0030 INFO .

INSPECTION PROCEDURE

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or

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not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

- Refer to "Data List / Active Test" [AFS Voltage B1S1] INFO .

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)**

(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-19 (A1A+) - C14-3 (A1A+)	Always	Below 1 Ω
A34-18 (A1A-) - C14-4 (A1A-)	Always	Below 1 Ω
A34-5 (HA1A) - C14-1 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-19 (A1A+) or C14-3 (A1A+) - Body ground	Always	10 kΩ or higher
A34-18 (A1A-) or C14-4 (A1A-) - Body ground	Always	10 kΩ or higher
A34-5 (HA1A) or C14-1 (HA1A) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK
▼

2.	**REPLACE AIR FUEL RATIO SENSOR**

(a) Replace the air fuel ratio sensor INFO .

NEXT
▼

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3.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0131, P0132 OR P0134)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(j) Input the DTC: P0131, P0132 or P0134.

(k) Check the DTC judgment.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P0131, P0132 or P0134 is output)	B

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000WBY0GEX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0137,P0138,P013A,P013B,P013E,P013F,P0140: Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2) (2013 FR-S)		

DTC	P0137	Oxygen Sensor Circuit Low Voltage (Bank 1 Sensor 2)

DTC	P0138	Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)

DTC	P013A	Oxygen Sensor Slow Response - Rich to Lean Bank 1 Sensor 2

DTC	P013B	O2 Sensor Slow Response - Lean to Rich (Bank 1 Sensor 2)

DTC	P013E	O2 Sensor Delayed Response - Rich to Lean (Bank 1 Sensor 2)

DTC	P013F	O2 Sensor Delayed Response - Lean to Rich (Bank 1 Sensor 2)

DTC	P0140	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 2)

DESCRIPTION

In order to obtain a high purification rate of the carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxide (NOx) components in the exhaust gas, a TWC (Three-Way Catalytic Converter) is used. For the most efficient use of the TWC, the air fuel ratio must be precisely controlled so that it is always close to the stoichiometric air fuel level. For the purpose of helping the ECM to deliver accurate air fuel ratio control, a Heated Oxygen (HO2) sensor is used.

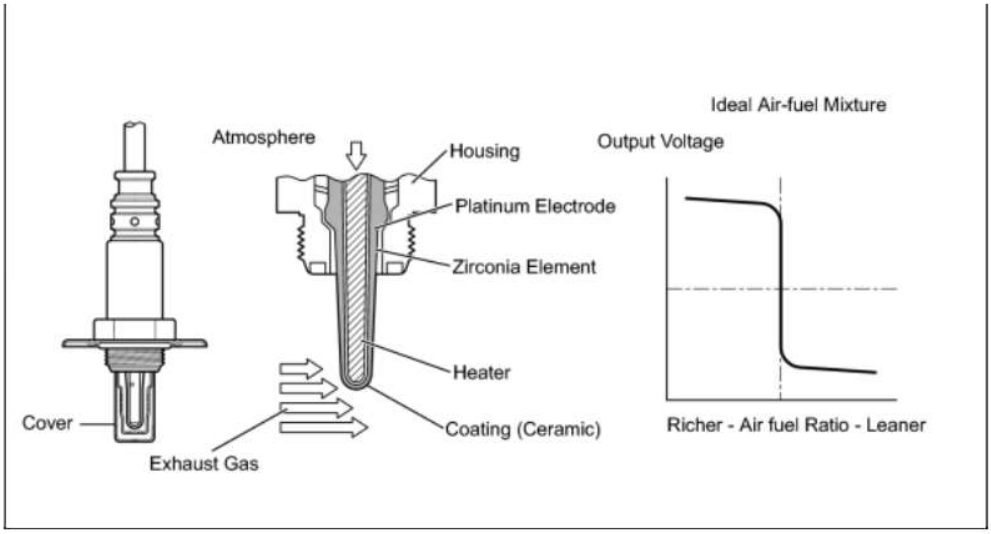
The HO2 sensor is located behind the TWC, and detects the oxygen concentration in the exhaust gas. Since the sensor is integrated with the heater that heats the sensing portion, it is possible to detect the oxygen concentration even when the intake air volume is low (the exhaust gas temperature is low).

When the air fuel ratio becomes lean, the oxygen concentration in the exhaust gas is rich. The HO2 sensor informs the ECM that the post-TWC air fuel ratio is lean (low voltage, i.e. less than 0.45 V).

Conversely, when the air fuel ratio is richer than the stoichiometric air fuel level, the oxygen concentration in the exhaust gas becomes lean. The HO2 sensor informs the ECM that the post-TWC air fuel ratio is rich (high voltage, i.e. more than 0.45 V). The HO2 sensor has the property of changing its output voltage drastically when the air fuel ratio is close to the stoichiometric level.

The ECM uses the supplementary information from the HO2 sensor to determine whether the air fuel ratio after the TWC is rich or lean, and adjusts the fuel injection time accordingly. Thus, if the HO2 sensor is working improperly due to internal malfunctions, the ECM is unable to compensate for deviations in the primary air fuel ratio control.

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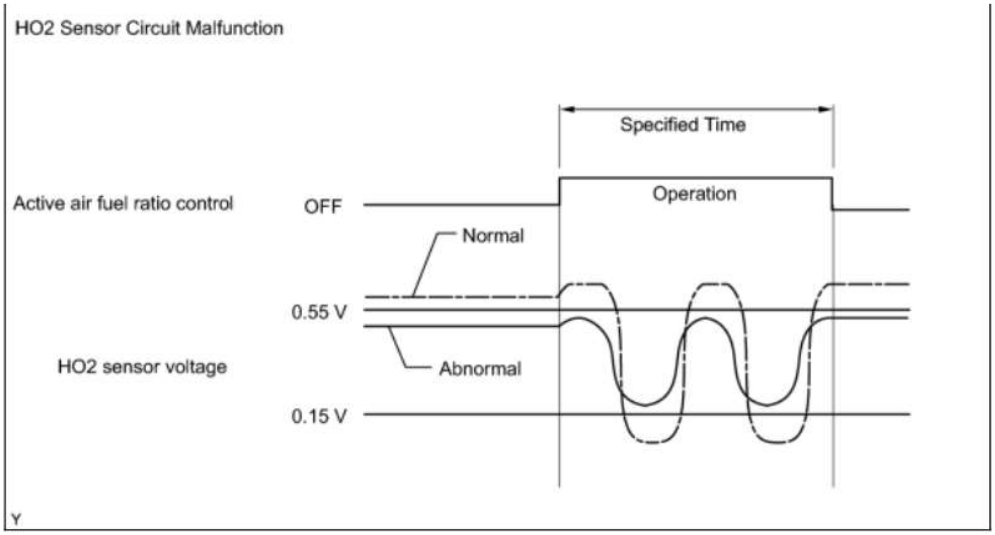
DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0137	Heated Oxygen (HO2) sensor voltage is less than 0.03 V. (2 trip detection logic)	• Heated oxygen sensor circuit • Heated oxygen sensor • Gas leak from exhaust system
P0138	Heated Oxygen (HO2) sensor voltage is 1.2 V or more for 2.5 seconds or more. (2 trip detection logic)	
P013A	The response rate for heated oxygen sensor voltage to change from 0.5 V (rich) to 0.2 V (lean) is slow for 2 seconds or more. (2 trip detection logic)	
P013B	The response rate for heated oxygen sensor voltage to change from 300 mV (lean) to 500 mV (rich) is slow for 4 seconds or more. (2 trip detection logic)	
P013E	Heated oxygen sensor voltage is slow in dropping to 0.5 V or less for 4 seconds or more. (2 trip detection logic)	
P013F	Heated oxygen sensor voltage is slow in increasing to 0.3V or more for 120 seconds. (2 trip detection logic)	
P0140	One of the following conditions is met for 180 seconds or more (2 trip detection logic): • The minimum voltage of heated oxygen sensor does not drop below 0.15 V. • The maximum voltage of heated oxygen sensor does not exceed 0.55 V.	

MONITOR DESCRIPTION

1. Abnormal Voltage Output of Heated Oxygen (HO2) Sensor (DTC P013B, P013F or P0140)

If the sensor is not functioning properly, the voltage output variation is small. For example, when the HO2 sensor voltage does not decrease to less than 0.15 V and does not increase to more than 0.55 V, the ECM determines that the sensor voltage output is abnormal and stores DTC P013B, P013F or P0140.

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2. Open in Heated Oxygen (HO2) Sensor Circuit (DTC P0137)

During active air fuel ratio control, the ECM calculates the Oxygen Storage Capacity (OSC)* of the Three-Way Catalytic Converter (TWC) by forcibly regulating the air fuel ratio to become rich or lean.

If the HO2 sensor has an open or short, or the voltage output of the sensor noticeably decreases, the OSC indicates an extraordinarily high value. Even if the ECM attempts to continue regulating the air fuel ratio to become rich or lean, the HO2 sensor output does not change.

While performing active air fuel ratio control, when the target air fuel ratio is rich and the HO2 sensor voltage output is 0.03 V or less (lean), the ECM interprets this as an abnormally low sensor output voltage and stores DTC P0137.

HINT:

***: The TWC has the capability to store oxygen. The OSC and the emission purification capacity of the TWC are mutually related. The ECM determines whether the catalyst has deteriorated, based on the calculated OSC value** INFO **.**

3. Extremely High Output Voltage of Heated Oxygen (HO2) Sensor (DTC P0138)

The ECM continuously monitors the HO2 sensor output voltage while the engine is running.

DTC P0138 is stored if the HO2 sensor voltage output is more than 1.2 V.

4. Abnormal Voltage Output of Heated Oxygen (HO2) Sensor During Fuel-cut (DTC P013A or P013E)

The sensor output voltage drops to below 0.2 V (extremely lean status) immediately when the vehicle decelerates and fuel cut is operating. If the voltage does not drop to below 0.5 V for 4 seconds or more, or voltage does not drop from 0.5 V to 0.2 V, the ECM determines that the sensor response has deteriorated, illuminates the MIL and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0137: Secondary oxygen sensor - A lack of circuit continuity output range check P0138: Secondary oxygen sensor - A lack of circuit continuity output range check P013A: Secondary oxygen sensor - Response rate functional check P013B: Secondary oxygen sensor - Response rate functional check P013E: Secondary oxygen sensor - Response rate functional check P013F: Secondary oxygen sensor - Response rate functional check P0140: Secondary oxygen sensor - Output voltage rationality check
Required Sensors/Components (Main)	Heated oxygen sensor
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Mass air flow meter Throttle position sensor Air fuel ratio sensor
	Once per driving cycle: Active air fuel ratio control detection, heated oxygen sensor abnormal

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Frequency of Operation	voltage during fuel cut. Continuous: Other
Duration	20 seconds: P0137 (Case 1) 40 seconds: P0137 (Case 2 and 3) 2.5 seconds: P0138 2 seconds: P013A 4 seconds: P013B, P013E 120 seconds: P013F 180 seconds: P0140
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0137 (Case 1)

Monitor runs whenever following DTC not stored	None
Fuel system	Closed loop
Short term fuel trim	0.7 to 1.35
Battery voltage	10.9 V or more
Intake air mass per second	10 g/sec

P0137 (Case 2)

Monitor runs whenever following DTC not stored	None
Fuel system	Closed loop
Short term fuel trim	0.7 to 1.35
Battery voltage	10.9 V or more
Intake air mass per second	10 g/sec
Continuous time of secondary oxygen sensor heating	30 seconds or more
Fuel shut-off	Not experienced

P0137 (Case 3)

Monitor runs whenever following DTC not stored	None
Fuel system	Closed loop
Short term fuel trim	0.7 to 1.35
Battery voltage	10.9 V or more
Intake air mass per second	10 g/sec
Continuous time of secondary oxygen sensor heating	30 seconds or more
Fuel shut-off	Experienced

P0138

Monitor runs whenever following DTC not stored	None
Fuel system	Closed loop
Short term fuel trim	0.7 to 1.35
Battery voltage	10.9 V or more

P013A

Monitor runs whenever following DTC not stored	None
Battery voltage	10.9 V or more

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Fuel system	Closed loop
Integrated time of heated oxygen sensor heater operation	180 seconds or more
Engine speed when deceleration fuel cut starts	1000 rpm or higher
Heated oxygen sensor output voltage when fuel cut starts	0.55 V or more
Elapsed time for fuel cut	5 seconds or more
Engine coolant temperature when fuel cut starts	60°C (140°F) or higher
Estimated temperature of heated oxygen sensor element when fuel cut	500°C (932°F) or higher

P013B

Monitor runs whenever following DTC not stored	None
Battery voltage	10.9 V or more
Fuel system	Closed loop
Elapsed time for fuel cut	5 seconds or more
Fuel cut	Not active

P013E

Monitor runs whenever following DTC not stored	None
Battery voltage	10.9 V or more
Fuel system	Closed loop
Engine speed when deceleration fuel cut starts	1000 rpm or higher
Heated oxygen sensor output voltage when fuel cut starts	0.55 V or more
Elapsed time for fuel cut	5 seconds or more
Engine coolant temperature when fuel cut starts	60°C (140°F) or higher
Estimated temperature of heated oxygen sensor element when fuel cut	500°C (932°F) or higher
Air fuel ratio enrichment compensation	Not active

P013F

Monitor runs whenever following DTC not stored	None
Battery voltage	10.9 V or more
Fuel system	Closed loop
Engine speed when deceleration fuel cut finish	500 rpm or higher
Heated oxygen sensor output voltage when fuel cut finish	Less than 0.15 V
Elapsed time for fuel cut	5 seconds or more
Engine coolant temperature when fuel cut starts	60°C (140°F) or higher
Estimated temperature of heated oxygen sensor element when fuel cut	500°C (932°F) or higher
Fuel cut	Not active

P0140

Monitor runs whenever following DTCs not present	P0030 (Air fuel ratio sensor - heater) P0037, P0038 (Heated oxygen sensor - heater) P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0101, P0102, P0103 (Mass air flow (MAF) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0300, P0301, P0302, P0303, P0304 (Misfire) P0604, P0605 (ROM in ECM)

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	P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2195, P2196 (Air fuel ratio sensor - output voltage) P2138 (Accelerator pedal position sensor (APPS) correlation)
Engine coolant temperature	60°C (140°F) or higher
Target commanded output voltage of heated oxygen sensor	0.6 V or more
Intake air mass per second	10 g/sec or higher
Battery voltage	10.9 V or more
Fuel system status	Closed loop
All of the following conditions are experienced.	A, B and C
A. Time of fuel cut in deceleration	5 seconds or more
B. Engine speed	1000 rpm or higher
C. Short term fuel trim	0.7 to 1.35

TYPICAL MALFUNCTION THRESHOLDS

P0137

Minimum output voltage caused by a lack of circuit continuity	Less than 0.03 V

P0138

Maximum output voltage caused by a lack of circuit continuity	1.2 V or more

P013A

Response time from rich (0.5 V) to lean (0.2 V) if output voltage decrease from 0.55 V to 0.15 V	0.491 seconds or more

P013B

Response time from lean (0.3 V) to rich (0.5 V) if output voltage increase from 0.25 V to 0.55 V	4 seconds or more

P013E

Response time from fuel cut start to heated oxygen sensor output reaching 0.5 V	4 seconds or more

P013F

Response time from fuel cut start to heated oxygen sensor output reaching 0.3 V	120 seconds or more (32 msec. X 3750 count)

P0140

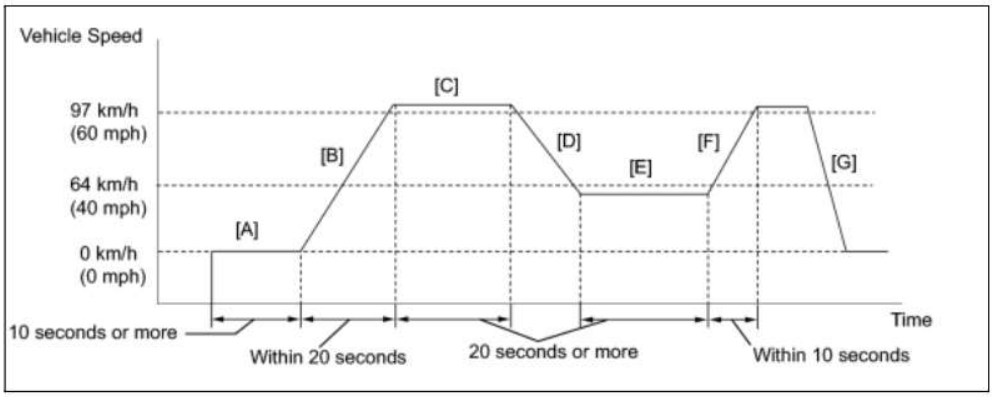
Either of the following condition is met:	A or B
A. Maximum output voltage	Less than 0.55 V
B. Minimum output voltage	0.15 V or more

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Idle the engine for 10 seconds or more [A].
b. Accelerate the vehicle to 97 km/h (60 mph) or more within 20 seconds [B].
c. Drive the vehicle at 97 km/h (60 mph) or more for 20 seconds or more [C].
d. Release the accelerator pedal to Decelerate until the vehicle speed decreases to less than 64 km/h (40 mph) [D].

HINT:

Release the accelerator pedal fully to perform the fuel-cut.

e. Drive the vehicle at 60 km/h (40 mph) or less for 20 seconds or more [E].
f. Accelerate the vehicle to 97 km/h (60 mph) or more within 10 seconds [F].
g. Release the accelerator pedal and stop the vehicle [G].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0137, P0138 P13A, P013B, P013E, P013F or P0140.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory

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	limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0037 INFO .

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume function provided in the Active Test. The Control the Injection Volume function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume.
6. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12.5% to +12.5%. The injection volume can be changed in fine gradations.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	+12.5%	Rich	Below 2.0 V
	-12.5%	Lean	Higher than 2.4 V
O2S B1S2 (Heated oxygen)	+12.5%	Rich	Higher than 0.55 V
	-12.5%	Lean	Below 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR OUTPUT VOLTAGE	HEATED OXYGEN SENSOR OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-

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	Output Voltage: Higher than 2.4 V / Below 2.0 V — OK	Output Voltage: Higher than 0.55 V / Below 0.4 V — OK	
2	Injection Volume: +12.5% / -12.5% Output Voltage: Almost no reaction — NG	Injection Volume: +12.5% / -12.5% Output Voltage: Higher than 0.55 V / Below 0.4 V — OK	• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3	Injection Volume: +12.5% / -12.5% Output Voltage: Higher than 2.4 V / Below 2.0 V — OK	Injection Volume: +12.5% / -12.5% Output Voltage: Almost no reaction — NG	• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit
4	Injection Volume: +12.5% / -12.5% Output Voltage: Almost no reaction — NG	Injection Volume: +12.5% / -12.5% Output Voltage: Almost no reaction — NG	• Fuel injector assembly • Fuel pressure • Gas leak from exhaust system (air fuel ratio extremely rich or lean)

- Following the Control the Injection Volume procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume / AFS Voltage B1S1 and O2S B1S2; and then press the graph button on the Data List view.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

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1.	READ OUTPUT DTC (DTC P0137, P0138, P013A, P013B, P013E, P013F AND P0140)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
P0137, P0138, P013A, P013B, P013E, P013F or P0140 is output	A
P0137, P0138, P013A, P013B, P013E, P013F or P0140 and other DTCs are output	B

HINT:

If any DTCs other than P0136, P0137, P0138 or P0139 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume.

(f) Change the fuel injection volume using the Techstream, and monitoring the voltage output of heated oxygen sensors displayed on the Techstream.

(g) Read the heated oxygen (HO2) sensor output voltage while idling.

HINT:

- Change the fuel injection volume within the range of - 12.5% and +12.5%.
- The heated oxygen sensor is displayed as O2S B1S2, on the Techstream.
- The heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

Standard:

The heated oxygen (HO2) sensor output voltage alternates between more than 0.55 V and less than 0.4 V.

NG ▶ CHECK FOR EXHAUST GAS LEAK

OK ▼

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3.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME)

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume.

(f) Change the fuel injection volume using the Techstream and monitor the voltage output of the air fuel ratio and heated oxygen sensors displayed on the Techstream.

HINT:

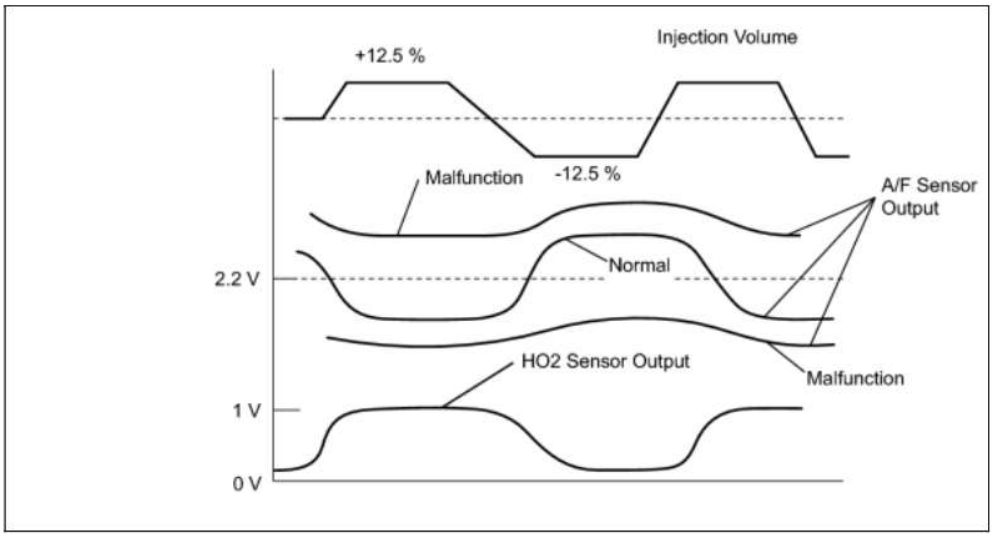
- Change the fuel injection volume within the range of -12% and +12%. The injection volume can be changed in fine gradations within the range.
- The air fuel ratio sensor is displayed as AFS Voltage B1S1, and the heated oxygen sensor is displayed as O2S B1S2, on the Techstream.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

Result

TECHSTREAM DISPLAY (SENSOR)	VOLTAGE VARIATION	PROCEED TO
AFS Voltage B1S1 (A/F)	Alternates between more and less than 2.2 V	OK
	Remains at more than 2.2 V	NG
	Remains at less than 2.2 V	NG

HINT:

A normal heated oxygen sensor voltage (O2S B1S2) reacts in accordance with increases and decreases in fuel injection volumes. When the air fuel ratio sensor voltage remains at either less or more than 2.2 V despite the heated oxygen sensor indicating a normal reaction, the air fuel ratio sensor is malfunctioning.



NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▶ CHECK ENGINE TO DETERMINE CAUSE OF EXTREMELY RICH OR LEAN ACTUAL AIR FUEL RATIO (FUEL INJECTOR, FUEL SYSTEM, INTAKE SYSTEM, ETC.)

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4.	CHECK FOR EXHAUST GAS LEAK

(a) Inspect for exhaust gas leaks from the exhaust manifold sub-assembly and exhaust pipes.

OK:
No gas leakage.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▼

5.	INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)

(a) Inspect the heated oxygen sensor INFO .

NG ▶ REPLACE HEATED OXYGEN SENSOR

OK ▼

6.	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

(a) Disconnect the heated oxygen sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-6 (HT1B) - C13-1 (HT1B)	Always	Below 1 Ω
A34-21 (OX1B) - C13-3 (OX1B)	Always	Below 1 Ω
A36-29 (E1) - C13-4 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-6 (HT1B) or C13-1 (HT1B) - Body ground	Always	10 kΩ or higher
A34-21 (OX1B) or C13-3 (OX1B) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C13-4 (E2) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

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7.	REPLACE HEATED OXYGEN SENSOR

(a) Replace the heated oxygen sensor INFO .

NEXT

8.	CHECK WHETHER DTC OUTPUT RECURS (P0137, P0138, P013A, P013B, P013E, P013F OR P0140)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P0137, P0138, P013A, P013B, P013E, P013F or P0140.

(l) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P0137, P0138, P013A, P013B, P013E, P013F or P0140 is output)	B

B ▶ REPLACE AIR FUEL RATIO SENSOR

A ▶ END

9.	REPLACE HEATED OXYGEN SENSOR

(a) Replace the heated oxygen sensor INFO .

NEXT

10.	CHECK WHETHER DTC OUTPUT RECURS (P0137, P0138, P013A, P013B, P013E, P013F OR P0140)

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P0137, P0138, P013A, P013B, P013E, P013F or P0140.

(l) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P0137, P0138, P013A, P013B, P013E, P013F or P0140 is output)	B

B ▶ **REPLACE HEATED OXYGEN SENSOR**

A ▶ **END**

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Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000WC30M6X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0171,P0172,P1170,P117B: System Too Lean (Bank 1) (2013 FR-S)		

DTC	P0171	System Too Lean (Bank 1)

DTC	P0172	System Too Rich (Bank 1)

DTC	P1170	Port Injector Fuel Performance

DTC	P117B	Direct Injector Fuel Performance

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim consists of both the short-term and the long-term fuel trim.

The short-term fuel trim is fuel compensation that is used to constantly maintain the air fuel ratio at stoichiometric levels. The signal from the air fuel ratio sensor indicates whether the air fuel ratio is rich or lean compared to the stoichiometric ratio. This triggers a reduction in the fuel injection volume if the air fuel ratio is rich and an increase in the fuel injection volume if it is lean.

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the ideal theoretical value. The long-term fuel trim controls overall fuel compensation. The long-term fuel trim compensates for long term deviations of the fuel trim from the ideal theoretical value. These long term deviations result from the corrections made by the short-term fuel trim.

If both the short-term fuel and long-term fuel trim are lean or rich beyond predetermined values, it is interpreted as a malfunction, the ECM illuminates the MIL and sets a DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0171	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to lean side. (2 trip detection logic)	• Intake system • Fuel injector assembly (for port injection) • Fuel injector assembly (for direct injection) • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leaks from exhaust system • Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • PCV valve and hose • PCV hose connections • ECM • Wire harness or connector
		• Mass air flow meter • Engine coolant temperature sensor • Fuel injector assembly (for port injection)

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P0172	With warm engine and stable air fuel ratio feedback, fuel trim considerably in error to rich side. (2 trip detection logic)	• Fuel injector assembly (for direct injection) • Ignition system • Fuel pressure • Gas leaks from exhaust system • Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • ECM • Wire harness or connector
P1170	Although a DTC is stored for a rich or lean condition, the amount of fuel trim during direct injection is normal for 9 seconds. (1 trip detection logic)	• Fuel injector assembly (for port injection) • Fuel pressure • ECM
P117B	Although a DTC is stored for a rich or lean condition, the amount of fuel trim during port injection is normal for 9 seconds. (1 trip detection logic)	• Fuel injector assembly (for direct injection) • Fuel pressure • ECM

HINT:

- When DTC P0171 is set, the actual air-fuel ratio is on the lean side. When DTC P0172 is set, the actual air-fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P0171 may be set. The MIL is then illuminated.
- When DTC P1170 or P117B is output , it may not be possible to precisely determine whether the port injection or the direct injection is malfunctioning, depending on the conditions. In this case, perform an Active Test (control the injection way) to determine which injection system is malfunctioning.

MONITOR DESCRIPTION

Under closed loop fuel control, fuel injection volumes that deviate from those estimated by the ECM cause changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim values. Deviations from the ECM's estimated fuel injection volumes also affect the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air fuel ratio). If the average fuel trim learning value exceeds the malfunction threshold, the ECM interprets this as a malfunction in the fuel system and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0171: Fuel system main feedback control functional check (System too lean) P0172: Fuel system main feedback control functional check (System too rich) P1170: Fuel system main feedback control functional check (Direct injection fail) P117B: Fuel system main feedback control functional check (Port injection fail)
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	Air fuel ratio sensor Mass air flow meter Crankshaft position sensor
Frequency of Operation	Continuous
Duration	9 seconds X 3 times: P0171 and P0172 9 seconds: P1170 and P117B
MIL Operation	2 driving cycles: P0171 and P0172 Immediately: P1170 and P117B
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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All

Monitor runs whenever following DTCs not present	P0030 (Air fuel ratio sensor - heater) P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0102, P0103 (Mass air flow (MAF) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0300, P0301, P0302, P0303, P0304 (Misfire) P0458, P0459 (Solenoid valve for purge control) P0461, P0462, P0463 (Fuel level sensor (FL)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation) P2195, P2196 (Air fuel ratio sensor - output voltage)

P0171

Fuel system status	Closed loop
Engine coolant temperature	40°C (104°F) or higher
Intake air mass per revolution	More than 0.12 g/rev (varies with engine speed)
Change of intake air mass during 1/2 engine rev.	0.02 g/rev or less
Oil attenuation	Not determined

P0172

Fuel system status	Closed loop
Engine coolant temperature	40°C (104°F) or higher
Intake air mass per revolution	More than 0.12 g/rev (varies with engine speed)
Change of intake air mass during 1/2 engine rev.	0.02 g/rev or less
Oil attenuation	Not determined
Learning value of EVAP density during purge	Less than 0.2
Integrated time of canister purge after engine start	20 seconds or more

P1170

Enable condition to detect malfunction in P0171 or P0172	Satisfied
P0171 or P0172 malfunction	Detected
Direct injection ratio	100%

P117B

Enable condition to detect malfunction in P0171 or P0172	Satisfied
P0171 or P0172 malfunction	Detected
Port injection ratio	100%

TYPICAL MALFUNCTION THRESHOLDS

P0171

Diagnostic value [Air fuel ratio sensor short term fuel trim + air fuel ratio sensor long term	30% or higher (varies with intake

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fuel trim + (measured lambda - target lambda)]	air mass per second)

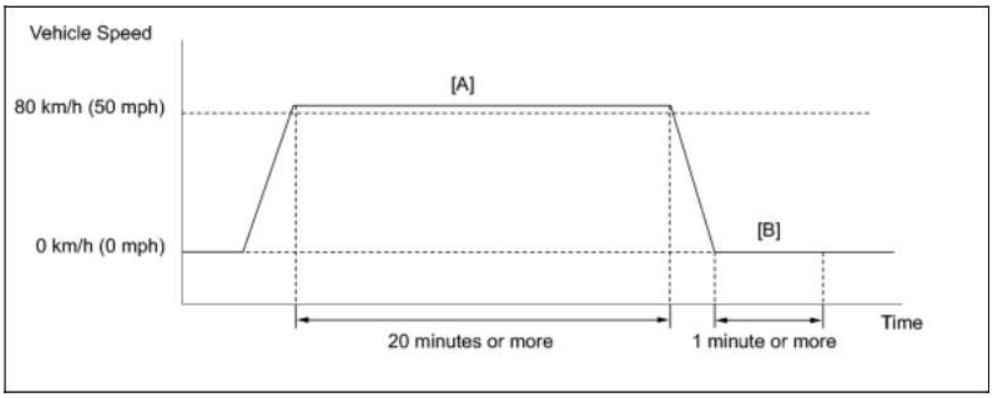
P0172

Diagnostic value [Air fuel ratio sensor short term fuel trim + air fuel ratio sensor long term fuel trim + (measured lambda - target lambda)]	Less than -30% (varies with intake air mass per second)

P1170, P117B

Diagnostic value [Air fuel ratio sensor short term fuel trim + air fuel ratio sensor long term fuel trim + (measured lambda - target lambda)]	Less than 15% or higher than -15%

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

   HINT:

   Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

   CAUTION:

   When performing the confirmation driving pattern, obey all speed limits and traffic laws.

   a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
   b. Stop the vehicle.
   c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0171, P0172, P1170 or P117B.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal

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ABNORMAL	∘ DTC judgment completed ∘ System abnormal
INCOMPLETE	∘ DTC judgment not completed ∘ Perform driving pattern after confirming DTC enabling conditions
N/A	∘ Unable to perform DTC judgment ∘ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor function provided in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor / Gas AF Control / AFS Voltage B1S1 and O2S B1S2.
6. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12.5% to +12.5%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	+12.5%	Rich	Below 2.0 V
	-12.5%	Lean	Higher than 2.4 V
O2S B1S2 (Heated oxygen)	+12.5%	Rich	Higher than 0.55 V
	-12.5%	Lean	Below 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA

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1	Injection Volume +12.5% -12.5% Output Voltage Higher than 2.4 V / Below 2.0 V OK	Injection Volume +12.5% -12.5% Output Voltage Higher than 0.55 V / Below 0.4 V OK	-
2	Injection Volume +12.5% -12.5% Output Voltage Almost no reaction NG	Injection Volume +12.5% -12.5% Output Voltage Higher than 0.55 V / Below 0.4 V OK	• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
3	Injection Volume +12.5% -12.5% Output Voltage Higher than 2.4 V / Below 2.0 V OK	Injection Volume +12.5% -12.5% Output Voltage Almost no reaction NG	• Heated oxygen sensor • Heated oxygen sensor heater • Heated oxygen sensor circuit
4	Injection Volume +12.5% -12.5% Output Voltage Almost no reaction NG	Injection Volume +12.5% -12.5% Output Voltage Almost no reaction NG	• Fuel injector assembly • Fuel pressure • Gas leak from exhaust system (Air fuel ratio extremely rich or lean)

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor / Gas AF Control / AFS Voltage B1S1 and O2S B1S2; and then press the graph button on the Data List view.

HINT:

- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame

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data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.

- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0171, P0172, P1170 AND/OR P117B)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
P0171, P0172, P1170 or P117B	A
P0171, P0172, P1170 and/or P117B and other DTCs	B

HINT:

If any DTCs other than P0171, P0172, P1170 or P117B are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn Techstream on.

(d) Warm up the engine and run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2.

(f) Perform the Control the Injection Volume for A/F Sensor operation with the engine in an idling.

(g) Monitor the output voltages of the A/F and HO2 sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12.5% to 12.5%.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

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TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (A/F)	12.5%	Rich	Less than 2.0 V
	-12.5%	Lean	More than 2.4 V
O2S B1S2 (HO2)	12.5%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

Result:

STATUS AFS VOLTAGE B1S1	STATUS O2S B1S2	A/F CONDITION AND A/F SENSOR CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	A
Lean	Lean	Actual air-fuel ratio lean	• Ventilation valve and hose • Ventilation hose connections • Injector for port injection • Gas leakage from exhaust system • Air induction system • Fuel pressure • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor	A
Rich	Rich	Actual air-fuel ratio rich	• Gas leakage from exhaust system • Ignition system • Fuel pressure • Mass air flow (MAF) meter • Engine coolant temperature (ECT) sensor	A
Lean	Lean/Rich	A/F sensor malfunction	• Air fuel ratio sensor	B
Rich	Lean/Rich	A/F sensor malfunction	• Air fuel ratio sensor	B

Lean: During the Control the Injection Volume for A/F Sensor Active Test, the air fuel ratio sensor output voltage (AFS Voltage) is consistently higher than 2.4 V, and the heated oxygen sensor output voltage (O2S) is consistently below 0.4 V.

Rich: During the Control the Injection Volume for A/F Sensor Active Test, the AFS Voltage is consistently below 2.0 V, and the O2S is consistently higher than 0.55 V.

Lean/Rich: During the Control the Injection Volume for A/F Sensor Active Test, the output voltage of the heated oxygen sensor alternates correctly.

HINT:

Refer to "Data List / Active Test" [AFS Voltage B1S1 and O2S B1S2] INFO .

B ▶ **INSPECT AIR FUEL RATIO SENSOR**

A ▼

3.	**CHECK FREEZE FRAME DATA**

(a) Check freeze frame data, and understand the status of vehicles when abnormalities occur.

HINT:

- The 5 separate sets of freeze frame data can be used to check the engine status before and after storing of the DTC.

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- Use freeze frame data to check if the engine was idling or running.

FREEZE FRAME DATA

Engine Speed	Fuel System Status #1	O2S B1S2
Calculate Load	Short FT #1	Evap Purge Flow
Vehicle Speed	Long FT #1	Shift Position Sig from ECT
MAF	AFS Voltage B1S1	Coolant Temp

NEXT

4.	**CHECK VEHICLE CONDITION**

HINT:

When checking trouble during abnormal status, use the following procedure.

(a) Remove the EFI (+B) fuse, wait 60 seconds or more, and connect the fuse.

HINT:

- Clear the ECM feedback learning value.
- After clearing the DTC, initial diagnosis of the electronically controlled throttle is performed. Accordingly, engine start after clearing DTC takes place 10 seconds or more after turning the ignition switch ON.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn Techstream on.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume.

(f) Increase or decrease injection quantities by 1 step.

HINT:

This operation stops feedback compensation and feedback learning, enabling checking of trouble.

(g) Start the engine.

(h) Refer to the running state freeze frame data, reproduce the conditions in which the abnormality occurred, and check the trouble.

Result:

RESULT	PROCEED TO
Trouble can be confirmed.	A
Trouble cannot be confirmed.	B

B ▶ **READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)**

A

5.	**CHECK VEHICLE CONDITION**

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(a) Specify the location of the trouble from the following, then conduct inspections and replacements.

NOTICE:

If only the check light is lit, and it is not possible to specify the location of the trouble, then go to step 3.

TROUBLE AREA	SYMPTOM	CAUSE	TROUBLESHOOTING	DIAGNOSTIC NOTE
Mass air flow meter	• Rough idling • Pausing at start-up • MIL lights up only.	Deviation in characteristic of the mass air flow meter	Refer to INFO .	-
Fuel injector assembly (for port injection or direct injection)	MIL lights up only.	Fuel injector assembly blockage	• Refer to INFO for port injection. • Refer to INFO for direct injection.	• Very long unattended idle time • Long running distance • Long-term usage of regular gasoline From the vehicle usage conditions above, there may be a blockage in the fuel injector assembly. During driving, the MIL lights up often.
	• Engine stalls when the vehicle stops (restart is possible). • MIL lights up only.	Problem with oil-tightness in fuel injector assembly	• Refer to INFO for port injection. • Refer to INFO for direct injection.	• Problem with oil-tightness results in a rich side abnormality • If a high concentration of HC within the intake manifold after the engine stopped, this results in a rich side abnormality. • From scorching on the spark plug, there may be a fuel system abnormality. • DTC P0088 may have been stored.
Fuel pump assembly	• Engine stall • Poor acceleration	• Fuel pump assembly malfunction • Low pressure side fuel pressure abnormality • Low pressure side fuel system blockage	• Refer to INFO for fuel pump control circuit (low pressure side). • Refer to INFO for fuel pressure (low pressure side).	-
		Air sucked in from the intake manifold	Check intake manifold gasket	-

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		gasket.	inspection.	
Intake system	• Rough idling • MIL lights up only.	• Damage to intake system hoses • Continuous the purge VSV stuck on	Start the engine, and in idle condition block off individual hoses connected to the intake manifold, and check that the fuel compensation quantity (total of feedback compensated value and feedback learning value) decreases.	If air is being drawn into the hose, the fuel compensation quantity (total of feedback compensated value and feedback learning value) is large, and this drops with a racing condition.
Air fuel ratio sensor	Rough idling	Air fuel ratio sensor malfunction	Refer to INFO .	Air fuel ratio sensor system DTC may be stored.

(b) After the trouble area is repaired, Check that the trouble symptom is resolved.

Result

RESULT	PROCEED TO
Trouble symptom resolved	A
Trouble symptom not resolved	B

B ▶ READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

A ▼

6.	**CLEAR DTC**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

NEXT ▼

7.	**READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Short #1, Long FT #1.

(f) Read the value Short #1 and Long FT #1.

Result:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION

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Short FT #1 + Long FT #1	Vehicle condition when the malfunction occurs (Idling or driving)	-20% to +20%

HINT:

If the trouble occurs during high speed driving, it is possible to take measurements at medium or low speeds by matching the intake air volume to that at the time of the trouble by shifting down.

NG ▶ **READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)**

OK ▼

8.	**CHECK VEHICLE CONDITION**

(a) Check the diagnostic table and freeze frame data again, and if there is no abnormality, finish operations.

HINT:

- In the event of running out of gas, the fuel compensation quantity will increase by +35% or more, and if this continues for 2 trips, this is a lean abnormality, and P0171 may be stored.
- Repeated short trips (a short time between the ignition switch ON and turning it off or short distance driving) result in gasoline vaporizing at subsequent engine warm-up, and P0172 as a result of increased blow-by gas may be stored.

NEXT ▶ **END**

9.	**READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Port.

(e) Read the value Short FT #1 and Long FT #1.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Short FT #1 + Long FT #1	Idling	-20% to +20%

(f) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

(g) Read the value Short FT #1 and Long FT #1.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Short FT #1 + Long FT #1	Idling	-20% to +20%

Result:

CONTROL THE INJECTION WAY		PROCEED TO
PORT	DIRECT	
OK	OK	A
OK	NG	B

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NG	OK	C
NG	NG	D

B ▶ READ VALUE USING TECHSTREAM (FUEL PRESS)

C ▶ INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

D ▶ CHECK EMISSION CONTROL SYSTEM

A ▼

10.	CHECK VEHICLE CONDITION

(a) Check the diagnostic table and freeze frame data again, and if there is no abnormality, finish operations.

HINT:

- In the event of running out of gas, the fuel compensation quantity will increase by +35% or more, and if this continues for 2 trips, this is a lean abnormality, and P0171 may be stored.
- Repeated short trips (a short time between turning the ignition switch ON and turning it off or short distance driving) result in gasoline vaporizing at subsequent engine warm-up, and P0172 as a result of increased blow-by gas may be stored.

NEXT ▶ END

11.	CHECK EMISSION CONTROL SYSTEM

(a) Check emission control system INFO .

NG ▶ REPAIR OR REPLACE EMISSION CONTROL SYSTEM

OK ▼

12.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

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13.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO .

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

14.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / MAF.

(f) Read MAF with the engine speed at 3000 rpm.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
MAF	Engine speed at 3000 rpm	8 to 13 g/s

NG ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

OK ▼

15.	CHECK IGNITION SYSTEM

(a) Check the ignition system INFO .

NG ▶ REPAIR OR REPLACE IGNITION SYSTEM

OK ▼

16.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

Result:

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RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

A ▶ REPAIR OR REPLACE EXHAUST SYSTEM

17.	INSPECT AIR FUEL RATIO SENSOR

(a) Inspect the air fuel ratio sensor INFO .

NG ▶ REPLACE AIR FUEL RATIO SENSOR

OK ▼

18.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-19 (A1A+) - C14-3 (A1A+)	Always	Below 1 Ω
A34-18 (A1A-) - C14-4 (A1A-)	Always	Below 1 Ω
A34-5 (HA1A) - C14-1 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-19 (A1A+) or C14-3 (A1A+) - Body ground	Always	10 kΩ or higher
A34-18 (A1A-) or C14-4 (A1A-) - Body ground	Always	10 kΩ or higher
A34-5 (HA1A) or C14-1 (HA1A) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

19.	REPLACE AIR FUEL RATIO SENSOR

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(a) Replace the air fuel ratio sensor INFO .

NEXT

20.	READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Short FT #1, Long FT #1.

(f) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Short FT #1 + Long FT #1	Idling or racing	-20% to +20%

HINT:

If the trouble occurs during high speed driving, it is possible to take measurements at medium or low speeds by matching the intake air volume to that at the time of the trouble by shifting down.

NG ▶ CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

OK ▶ END

21.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

(a) Check the fuel pressure (low pressure side) INFO .

B ▶ CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

A ▶ REPAIR OR REPLACE FUEL SYSTEM (LOW PRESSURE SIDE)

22.	READ VALUE USING TECHSTREAM (FUEL PRESS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(f) Read the value displayed on the Techstream.

Standard:

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TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Fuel Press	Idling	3000 to 5000 kPa (30.6 to 50.9 kgf/cm ^{2} , 436 to 725 psi)

HINT:

- The A/C switch and all accessory switches should be off, and the shift lever should be in the N, P or neutral position, and the engine should be fully warmed up.
- If the result is other than the standard value, there may be a fuel system (high pressure side) abnormality.

NG ▶ **REPAIR OR REPLACE FUEL SYSTEM (HIGH PRESSURE SIDE)**

OK ▼

23.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION WAY)

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

(e) Read the value Fuel Press Target Value, Short FT #1 and Long FT #1.

Standard:

TECHSTREAM DISPLAY		CONDITION	PROCEED TO
FUEL PRESSURE TARGET VALUE	SHORT FT #1 + LONG FT #1		
3 to 5 MPa (30.6 to 50.9 kgf/cm ^{2} , 436 to 725 psi)	-	Idling	A
5 MPa (50.9 kgf/cm ^{2} , 725 psi) or more	+20% or more		B
5 MPa (50.9 kgf/cm ^{2} , 725 psi) or more	-20% or less		C
3 MPa (30.6 kgf/cm ^{2} , 436 psi) or less	+20% or more		C
3 MPa (30.6 kgf/cm ^{2} , 436 psi) or less	-20% or less		D

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the N, P or neutral position, and the engine should be fully warmed up.

B ▶ **READ VALUE USING TECHSTREAM (FUEL PRESS)**

C ▶ **REPLACE FUEL PRESSURE SENSOR**

D ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

A ▼

24.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION WAY)

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(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

(e) Read the value Fuel Press Target Value, Short FT #1 and Long FT #1.

Standard:

TECHSTREAM DISPLAY		CONDITION	PROCEED TO
FUEL PRESSURE TARGET VALUE	SHORT FT #1 + LONG FT #1		
3 to 5 MPa (30.6 to 50.9 kgf/cm ^{2} , 436 to 725 psi)	-25% or less	Idling	A
3 to 5 MPa (30.6 to 50.9 kgf/cm ^{2} , 436 to 725 psi)	+30% or more		
5 MPa (50.9 kgf/cm ^{2} , 725 psi) or more	-25% to 25%		B

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the N, P or neutral position, and the engine should be fully warmed up.

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE ECM**

25.	READ VALUE USING TECHSTREAM (FUEL PRESS)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(f) Read the value displayed on the Techstream.

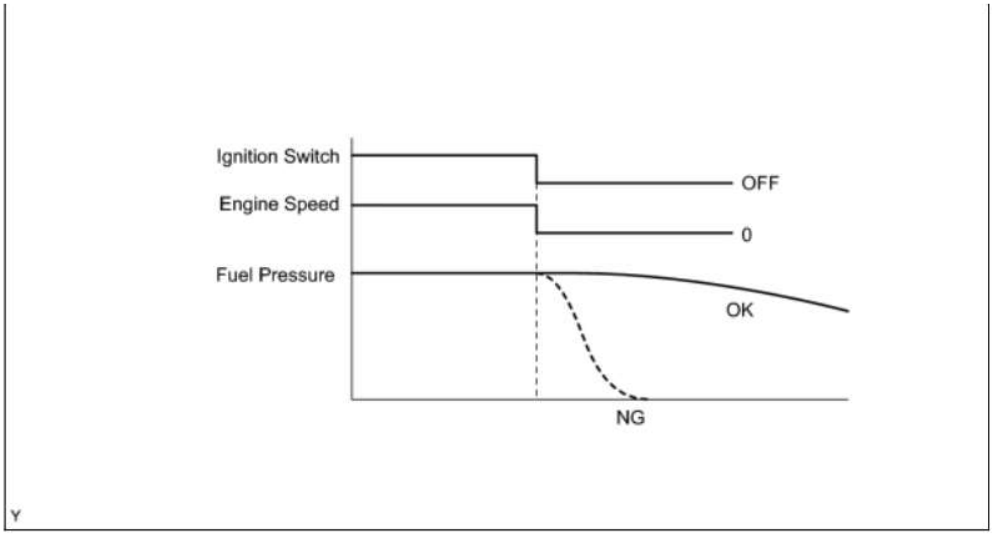
Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Fuel Press	Engine running → Ignition switch OFF → Ignition switch ON	Fuel Press value decrease moderately.

HINT:

- Turn the ignition switch to ON immediately after turning the ignition switch off.
- After approximately 10 minutes, fuel pressure reaches 0 kPa.
- Depending on the vehicle condition, after turning the ignition switch to ON, fuel pressure may rise moderately.

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Result:

RESULT	PROCEED TO
Fuel pressure rises or drops moderately.	A
Fuel pressure drops immediately after turning the ignition switch off.	B

B ▶ **REPLACE FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)**

A ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

26.	INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Inspect the fuel injector assembly (for port injection) INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

OK ▶ **REPLACE ECM**

27.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

(a) Check the connection and terminal contact pressure of connectors and wire harness between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

28.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

NEXT

29.	READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Short FT #1, Long FT #1

(f) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Short FT #1 + Long FT #1	Vehicle condition when the malfunction occurs (Idling or driving)	-20% to +20%

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)**

OK ▶ **END**

30.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
A33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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31.	REPLACE MASS AIR FLOW METER

(a) Replace the mass air flow meter INFO .

HINT:

If the result of the inspection performed in step 8 indicated no problem, proceed to the next step without replacing the mass air flow meter.

NEXT

32.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

NEXT

33.	READ VALUE USING TECHSTREAM (SHORT FT #1 AND LONG FT #1)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Short FT #1, Long FT #1.

(f) Read the value displayed on the Techstream.

Standard:

TECHSTREAM DISPLAY	CONDITION	SPECIFIED CONDITION
Short FT #1 + Long FT #1	Idling or racing	-20% to +20%

HINT:

If the trouble occurs during high speed driving, it is possible to take measurements at medium or low speeds by matching the intake air volume to that at the time of the trouble by shifting down.

NG ▶ REPLACE ECM

OK ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XH502XX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0191-P0193: Fuel Rail Pressure Sensor Circuit Range / Performance (2013 FR-S)		

DTC	**P0191**	**Fuel Rail Pressure Sensor Circuit Range / Performance**

DTC	**P0192**	**Fuel Rail Pressure Sensor Circuit Low Input**

DTC	**P0193**	**Fuel Rail Pressure Sensor Circuit High Input**

DESCRIPTION

The fuel pressure sensor is installed on the delivery pipe. The sensor changes fuel pressure to an electrical signal and sends the signal to the ECM. Then the ECM controls the pump discharge using this feedback to maintain the fuel's target pressure. If the sensor output stops, the ECM will stop the high pressure side fuel pump and supply fuel using the low pressure side fuel pump.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0191	One of the following conditions is met (2 trip detection logic): • Fuel pressure is 1.9 MPa or more 5 hours after ignition switch turned off. • Fuel pressure is 1.84 MPa or less for 10 seconds or more with engine running when 5 hours or more elapsed after ignition switch turned off.	• Open or short in fuel pressure sensor circuit • Fuel pressure sensor • ECM
P0192	Fuel pressure sensor voltage is too low for 2.5 seconds or more. (1 trip detection logic)	• Short in fuel pressure sensor circuit • Fuel pressure sensor • ECM
P0193	Fuel pressure sensor voltage is too high for 2.5 seconds or more. (1 trip detection logic)	• Open in fuel pressure sensor circuit • Fuel pressure sensor • ECM

HINT:

After confirming DTC P0192 or P0193, use the Techstream to confirm the fuel pressure in the delivery

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pipe by entering the following menus: Powertrain / Engine / Data List / Fuel Press.

FUEL PRESSURE (KPA)	MALFUNCTION
Approximately 0	• PR, E1 circuit short
Approximately 26000	• PR, VC circuit short

MONITOR DESCRIPTION

These DTCs are set if the fuel pressure sensor output voltage is out of the standard range. The DTCs stand for an open or short malfunction of the sensor circuit.

If these DTCs are set, the ECM enters fail-safe mode and limits the engine power. Fail-safe mode continues until the ignition switch is turned off.

MONITOR STRATEGY

Related DTCs	P0191: Fuel pressure sensor rationality check P0192: Fuel pressure sensor output range check (Low voltage) P0193: Fuel pressure sensor output range check (High voltage)
Required Sensors/Components (Main)	Fuel Pressure Sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle: P0191 Continuous: P0192, P0193
Duration	0.1 seconds: P0191 (Stuck high monitor) 10 seconds: P0191 (Stuck low monitor) 2.5 seconds: P0192, P0193
MIL Operation	2 driving cycles: P0191 Immediately: P0192, P0193
Sequence of Operation	None

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TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0191 (Stuck High Monitor)

Battery voltage	10.9 V or more
Soak time	5 hours or more
Elapsed time after ignition switch ON	0.1 seconds or more
High pressure fuel pump	Off

P0191 (Stuck Low Monitor)

Battery voltage	10.9 V or more
Soak time	5 hours or more
Target fuel pressure	4 MPa (40.8 kgf/cm ^{2} , 581 psi) or higher
Engine speed	600 rpm or higher
Vehicle speed	30 km/h (18.6 mph) or more
Direct injection	Active
High pressure fuel pump	Off

TYPICAL MALFUNCTION THRESHOLDS

P0191 (Stuck High Monitor)

Fuel pressure sensor value	Higher than 1.9 MPa (19.4 kgf/cm ^{2} , 276 psi)

P0191 (Stuck Low Monitor)

Fuel pressure sensor value	Less than 1.84 MPa (18.7 kgf/cm ^{2} , 267 psi)

P0192

Fuel rail pressure sensor voltage [Fuel pressure]	Less than 0.208 V [0 MPa (0 kgf/cm ^{2} , 0 psi)]

P0193

Fuel rail pressure sensor voltage [Fuel pressure]	More than 4.78 V [26.75 MPa (273 kgf/cm ^{2} , 3880 psi)]

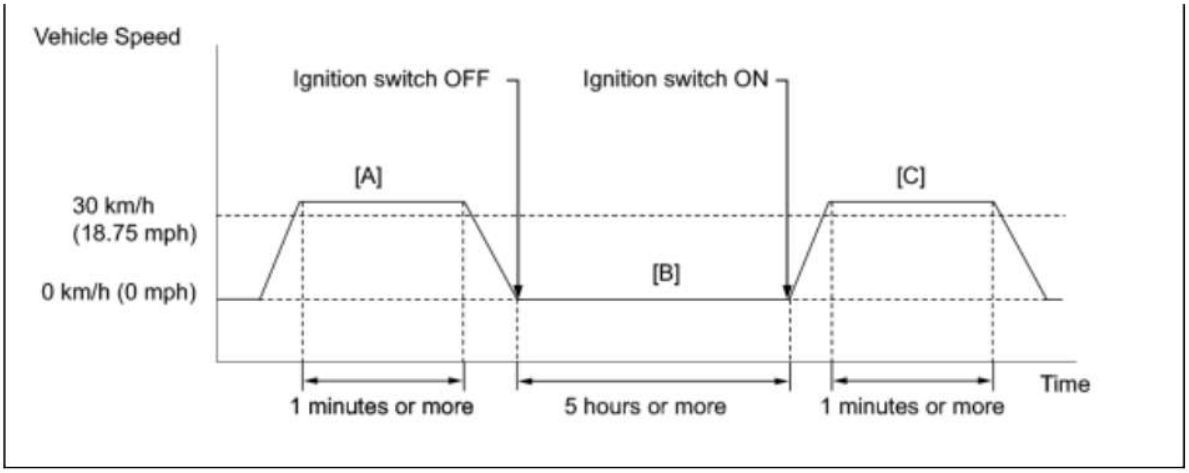
COMPONENT OPERATING RANGE

Fuel rail pressure sensor voltage [Fuel pressure]	0.306 to 4.639 V [0.00 to 25.87 MPa (0 to 263.8 kgf/cm ^{2} , 0 to 3752 psi)]

CONFIRMATION DRIVING PATTERN

P0191

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more.
8. Drive the vehicle at 30 km/h (18.75 mph) or more for 1 minute or more [A].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Turn the ignition switch off and leave vehicle for 5 hours or more [B].
10. Turn the ignition switch to ON and turn the Techstream on.
11. Enter the following menus: Powertrain / Engine / Trouble Codes.
12. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
13. Drive the vehicle at 30 km/h (18.75 mph) or more for 1 minute or more [C].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

14. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

15. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
16. Input the DTC: P0191.
17. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	∘ DTC judgment completed ∘ System abnormal
INCOMPLETE	∘ DTC judgment not completed ∘ Perform driving pattern after confirming DTC enabling conditions
N/A	∘ Unable to perform DTC judgment ∘ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

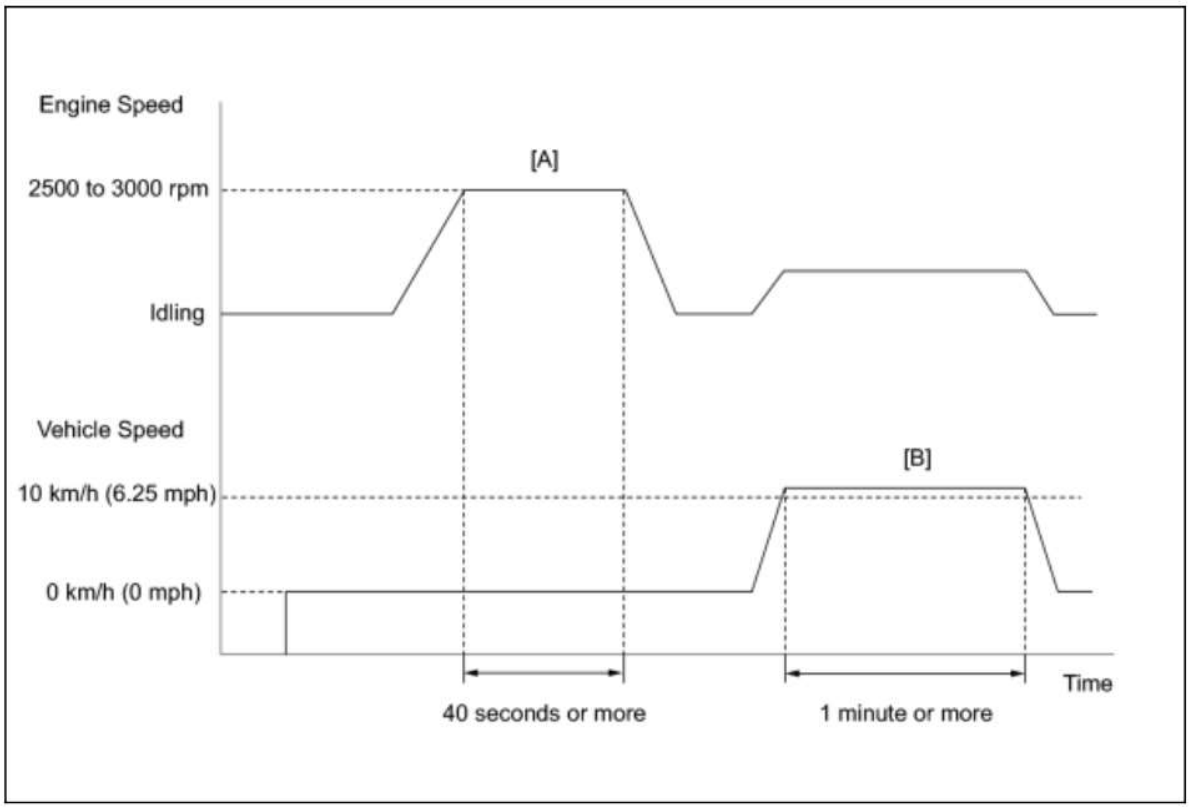
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

18. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

P0192, P0193



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .

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4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0192 or P0193.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

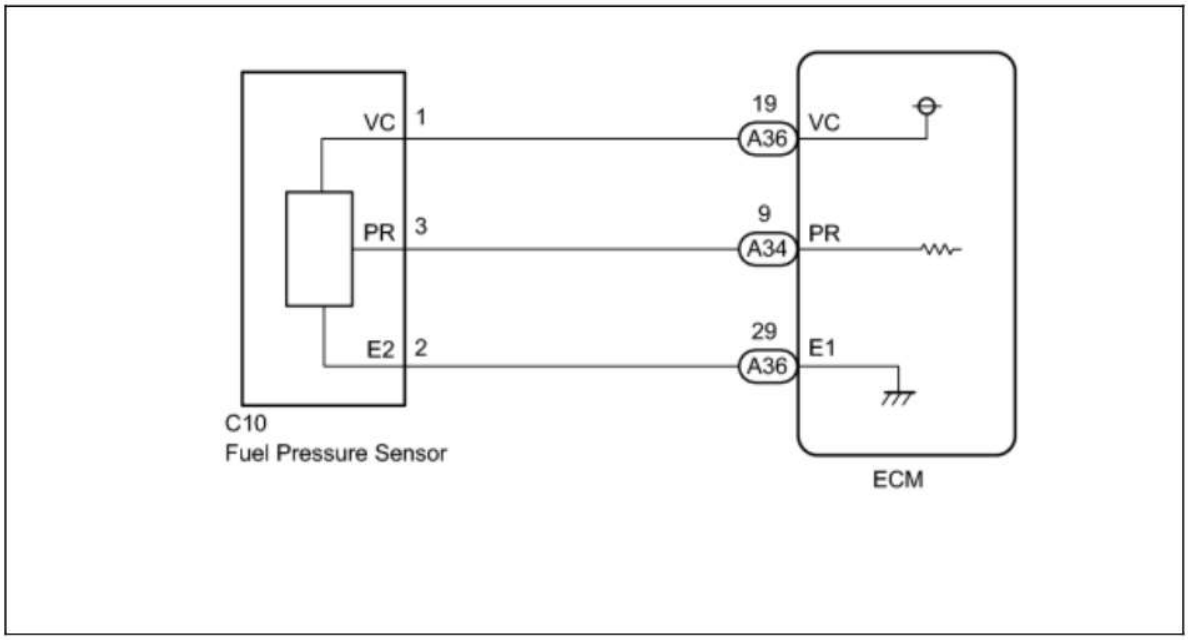
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (FUEL PRESS)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(e) Read the values.

Result:

FUEL PRESSURE (KPA)	PROCEED TO
26000 or more	A
Approximately 0	
3000 to 5000*	B

HINT:

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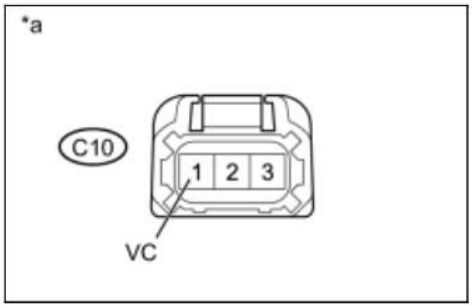
***: The value must change when the engine is moving or stationary.**

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

▼

2.	INSPECT FUEL PRESSURE SENSOR (FUEL PRESSURE SENSOR POWER SOURCE)



(a) Disconnect the fuel pressure sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C10-1 (VC) - Body ground	Ignition switch ON	4.5 to 5.5 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Pressure Sensor)

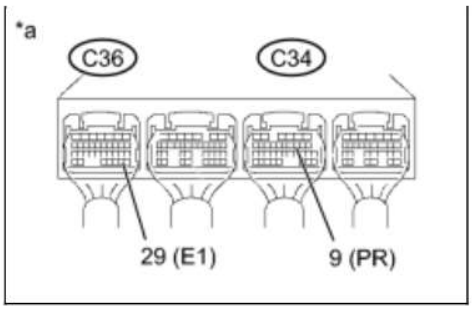
NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - FUEL PRESSURE SENSOR)**

OK

▼

3.	INSPECT ECM (PR VOLTAGE)

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(a) Start the engine.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-9 (PR) - A36-29 (E1)	Idling with warm engine	1.0 to 1.7 V

Text in Illustration

*a	Component with harness connected (ECM)

HINT:

The fuel pressure in the delivery pipe is 3 to 5 MPa.

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - FUEL PRESSURE SENSOR)**

OK ▶ **REPLACE ECM**

4.	**CHECK HARNESS AND CONNECTOR (ECM - FUEL PRESSURE SENSOR)**

(a) Disconnect the ECM connectors.

(b) Disconnect the fuel pressure sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-9 (PR) - C10-3 (PR)	Always	Below 1 Ω
A36-29 (E1) - C10-2 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-9 (PR) or C10-3 (PR) - body ground	Always	10 kΩ or higher
A34-29 (E1) or C10-2 (E2) - body ground	Always	10 kΩ or higher

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NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - FUEL PRESSURE SENSOR)**

OK ▶ **REPLACE FUEL PRESSURE SENSOR**

5.	CHECK HARNESS AND CONNECTOR (ECM - FUEL PRESSURE SENSOR)

(a) Disconnect the fuel pressure sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19 (VC) - C10-1 (VC)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19 (VC) or C10-1 (VC) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - FUEL PRESSURE SENSOR)**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PFB0PRX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0196-P0198: Engine Oil Temperature Sensor (Range/Performance) (2013 FR-S)		

DTC	**P0196**	**Engine Oil Temperature Sensor (Range/Performance)**

DTC	**P0197**	**Engine Oil Temperature Sensor Low**

DTC	**P0198**	**Engine Oil Temperature Sensor High**

DESCRIPTION

The resistance of the thermistor within the oil temperature sensor changes in accordance with variations in the oil temperature. The method for connecting the oil temperature sensor and the ECM is the same as for the intake air temperature sensor.

HINT:

If any DTC is stored, the ECM enters fail-safe mode. During operation of fail-safe mode, the ECM sets the engine oil temperature determined value at 70°C (158°F). Operation of fail-safe mode continues until the ECM restores normal operation.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0196	Despite estimated engine oil temperature is higher than 45°C (113°F), engine oil temperature sensor value is lower than 45°C (113°F). (2 trip detection logic)	• Engine oil temperature sensor • ECM
P0197	Engine oil temperature sensor voltage is less than 0.203 V for 0.5 seconds or more. (1 trip detection logic)	
P0198	Engine oil temperature sensor voltage is more than 4.698 V for 0.5 seconds or more. (1 trip detection logic)	

MONITOR DESCRIPTION

P0196

When a cold engine start is performed and then the engine is warmed up, if the Engine oil temperature sensor value is less than specified value, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the ECM interprets this as a malfunction in the engine oil temperature sensor and stores a DTC.

P0197, P0198

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The ECM monitors the sensor voltage and uses this value to calculate the engine oil temperature. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a malfunction in the engine oil temperature sensor circuit and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0196: Engine oil temperature sensor functional check P0197: Engine oil temperature sensor functional check (Low voltage) P0198: Engine oil temperature sensor functional check (High voltage)
Required Sensors/Components (Main)	Engine oil temperature sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle: P0196 Continuous: P0197, P0198
Duration	250 to 550 seconds: P0196 0.5 seconds: P0197, P0198
MIL Operation	Immediately: P0196 2 driving cycles: P0197, P0198
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0196

Monitor runs whenever following DTCs not stored	P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0197, P0198 (Engine oil temperature (EOT) sensor) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Battery voltage	10.9 V or more

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Engine speed	500 rpm or higher
Diagnostic value (n) [Diagnostic value (n-1) + 64 + 3.0 (varies with lowest engine oil temperature and vehicle speed)]	1732125 - (39285 X Lowest engine oil coolant after engine start)

P0197, P0198

Monitor runs whenever following DTCs not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0196

Actual engine oil temperature	Less than 45°C (113°F)

P0197

Engine oil temperature sensor voltage [Engine oil temperature]	Less than 0.203 V [165.54°C (330°F)]

P0198

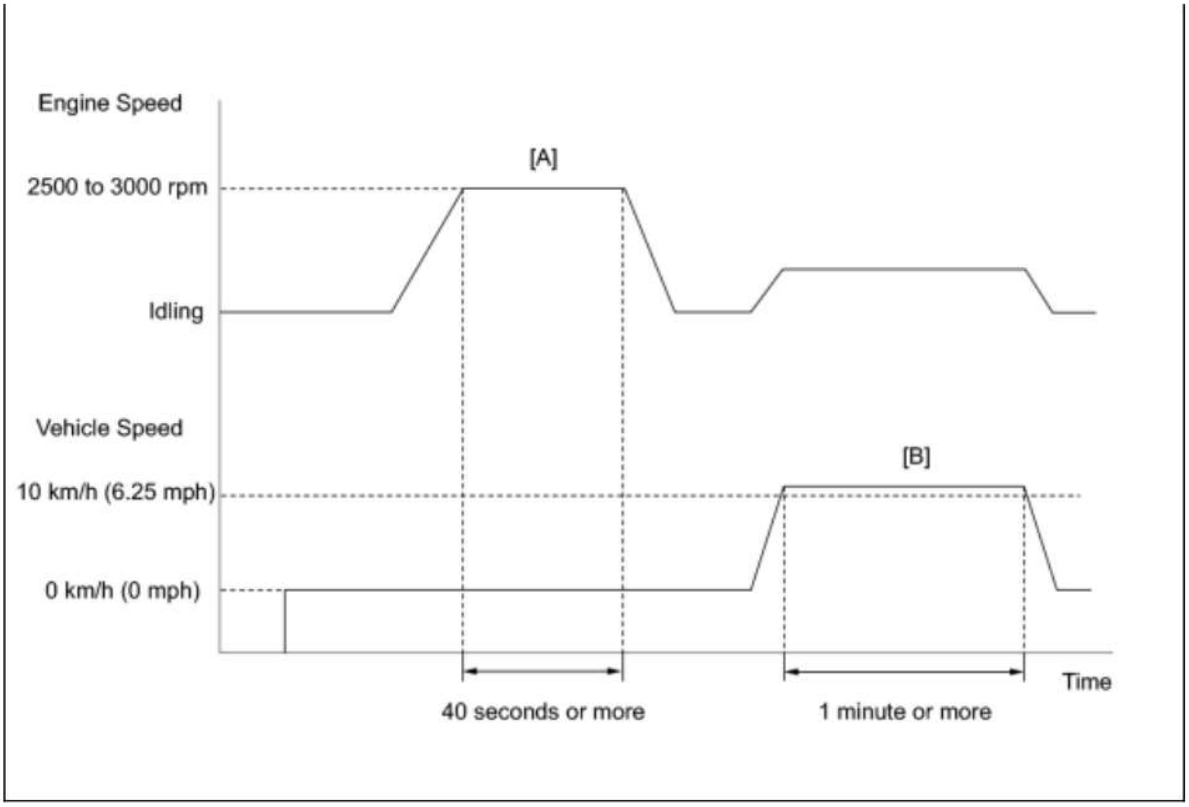
Engine oil temperature sensor voltage [Engine oil temperature]	More than 4.698 V [-46.24°C (-51.2°F)]

COMPONENT OPERATING RANGE

Engine oil temperature sensor voltage [Engine oil temperature]	0.210 to 4.688 V [163.70 to -43.85 °C (326.7 to -46.9°F)]

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine oil temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0196, P0197 or P0198.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

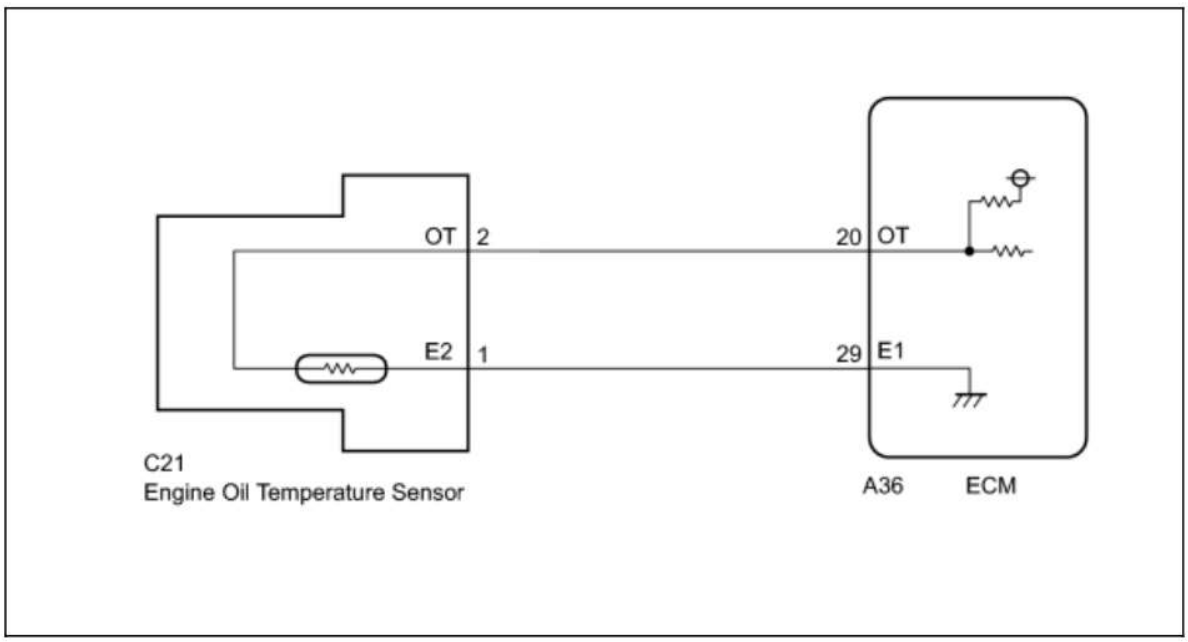
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or

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not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

- When the DTC is output, check the engine oil temperature using the Techstream. Enter the following menus: Powertrain / Engine / Data List / Engine Oil Temperature. If the Engine Oil Temperature value is lower than the actual engine oil temperature, the engine oil temperature sensor circuit may be malfunctioning. In this case, check the wire harnesses and connectors (and those connections) between the ECM and the engine oil temperature sensor first.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ENGINE OIL TEMPERATURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Engine Oil Temperature.

(e) Read the value displayed on the Techstream.

Result

RESULT	PROCEED TO
-40°C (-40°F)	A
215°C (419°F)	B
Between 75 and 100°C (167 and 212°F)	C

HINT:

- If there is an open circuit, the Techstream indicates -40°C (-40°F).
- If there is a short circuit, the Techstream indicates higher than 215°C (419°F).

B ▶ **READ VALUE USING TECHSTREAM (ENGINE OIL TEMPERATURE)**

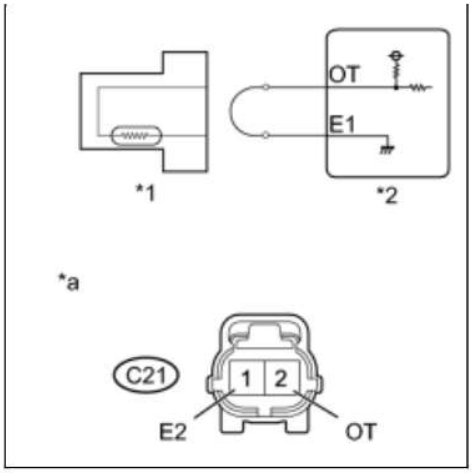
C ▶ **CHECK INTERMITTENT PROBLEMS**

A

▼

2.	**READ VALUE USING TECHSTREAM (ENGINE OIL TEMPERATURE)**

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(a) Disconnect the Engine oil temperature sensor connector.

(b) Connect terminals 1 and 2 of the Engine oil temperature sensor connector on the wire harness side.

(c) Connect the Techstream to the DLC3.

(d) Turn the ignition switch to ON.

(e) Turn the Techstream on.

(f) Enter the following menus: Powertrain / Engine / Data List / Engine Oil Temperature.

(g) Read the value displayed on the Techstream.

Standard value:
215°C (419°F)

Text in Illustration

*1	Engine oil temperature sensor
*2	ECM
*a	Front view of wire harness connector (to Engine oil temperature sensor)

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - ENGINE OIL TEMPERATURE SENSOR)**

OK ▶ **REPLACE ENGINE OIL TEMPERATURE SENSOR**

3.	**CHECK HARNESS AND CONNECTOR (ECM - ENGINE OIL TEMPERATURE SENSOR)**

(a) Disconnect the engine oil temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

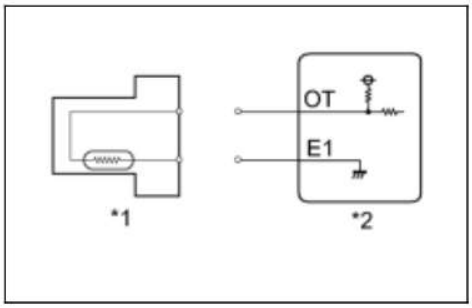
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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-20 (OT) - C21-2 (OT)	Always	Below 1 Ω
A36-29 (E1) - C21-1 (E2)	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK ▶ **REPLACE ECM**

4.	READ VALUE USING TECHSTREAM (ENGINE OIL TEMPERATURE)



(a) Disconnect the Engine oil temperature sensor connector.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Data List / Engine Oil Temperature.

(f) Read the value displayed on the Techstream.

Standard Value:
-40°C (-40°F)

Text in Illustration

*1	Engine oil temperature sensor
*2	ECM

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - ENGINE OIL TEMPERATURE SENSOR)**

OK ▶ **REPLACE ENGINE OIL TEMPERATURE SENSOR**

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5.	CHECK HARNESS AND CONNECTOR (ECM - ENGINE OIL TEMPERATURE SENSOR)

(a) Disconnect the engine oil temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-20 (OT) or C21-2 (OT) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS AND CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000001O9K02AX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0201-P0204: Injector Circuit / Open - (Cylinder 1) (2013 FR-S)		

DTC	**P0201**	**Injector Circuit / Open - (Cylinder 1)**

DTC	**P0202**	**Injector Circuit / Open - (Cylinder 2)**

DTC	**P0203**	**Injector Circuit / Open - (Cylinder 3)**

DTC	**P0204**	**Injector Circuit / Open - (Cylinder 4)**

DESCRIPTION

The D-4S system has two injection systems. One is the in-cylinder direct injection system that directly injects pressurized fuel into the combustion chamber. The other is the intake port injection system. The ECM determines the percentage of in-cylinder direct injection to the intake port injection systems in accordance with the engine speed and load.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0201	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the fuel injector IC continuously 10 times or more (No. 1 cylinder). (1 trip detection logic)	• Open or short in fuel injector (for port injection) circuit (No. 1 cylinder) • INJ fuse • Fuel injector assembly (for port injection) (No. 1 cylinder) • ECM
P0202	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the fuel injector IC continuously 10 times or more (No. 2 cylinder). (1 trip detection logic)	• Open or short in fuel injector (for port injection) circuit (No. 2 cylinder) • INJ fuse • Fuel injector assembly (for port injection) (No. 2 cylinder) • ECM

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P0203	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the fuel injector IC continuously 10 times or more (No. 3 cylinder). (1 trip detection logic)	• Open or short in fuel injector (for port injection) circuit (No. 3 cylinder) • INJ fuse • Fuel injector assembly (for port injection) (No. 3 cylinder) • ECM
P0204	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the fuel injector IC continuously 10 times or more (No. 4 cylinder). (1 trip detection logic)	• Open or short in fuel injector (for port injection) circuit (No. 4 cylinder) • INJ fuse • Fuel injector assembly (for port injection) (No. 4 cylinder) • ECM

MONITOR DESCRIPTION

The ECM monitors the injection control of the port injector. If a malfunction is detected in the port injector circuit, the ECM cancels the injection control for the corresponding cylinder and turns on the MIL.

MONITOR STRATEGY

Related DTCs	P0201: Fuel injector circuit continuity (Cylinder 1) P0202: Fuel injector circuit continuity (Cylinder 2) P0203: Fuel injector circuit continuity (Cylinder 3) P0204: Fuel injector circuit continuity (Cylinder 4)
Required sensors/Components (Main)	Fuel injector assembly (for port injection) (cylinder 1 to 4)
Required sensors/Components (Sub)	None
Frequency of operation	Continuous
Duration	2.5 seconds
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.9 V or more
Elapsed time after engine start	1 second or more
Engine speed	500 rpm or higher
Injection time	0.001 seconds or more

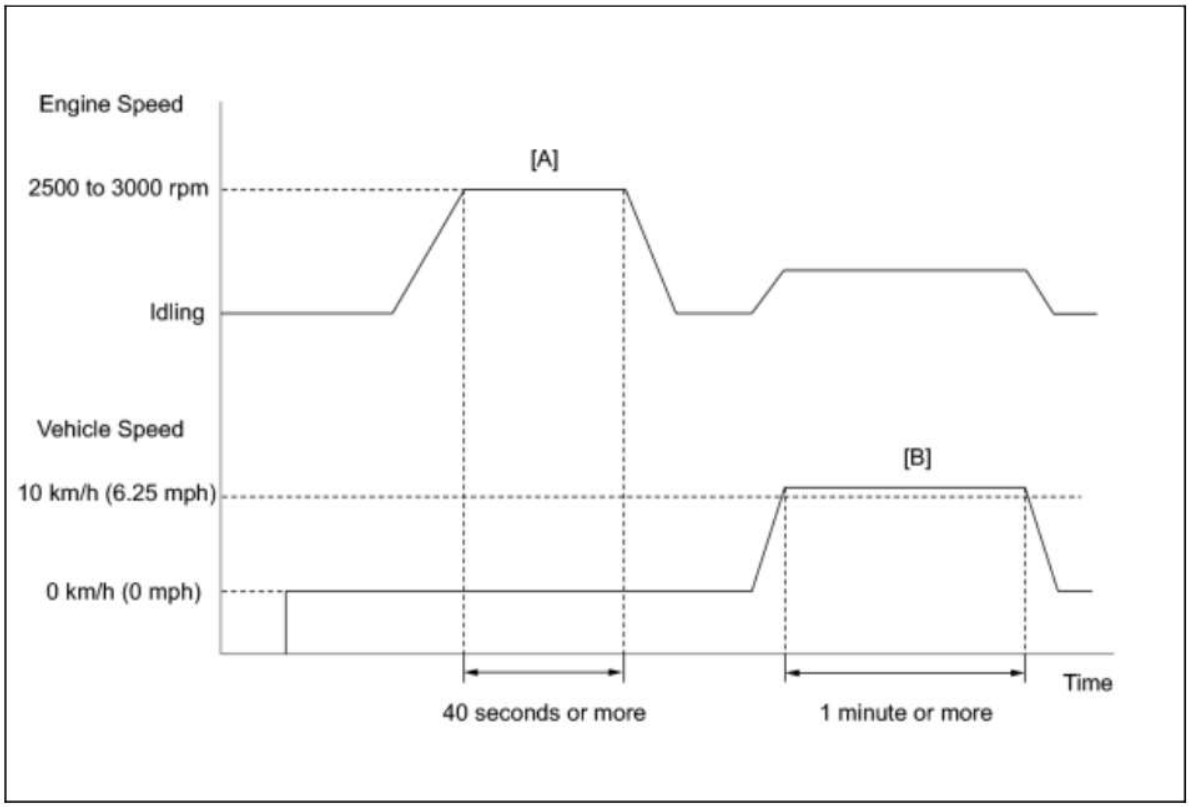
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Fuel cut	Not active

TYPICAL MALFUNCTION THRESHOLDS

Signal of malfunction from fuel injector IC	On

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

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11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0201, P0202, P0203 or P0204.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

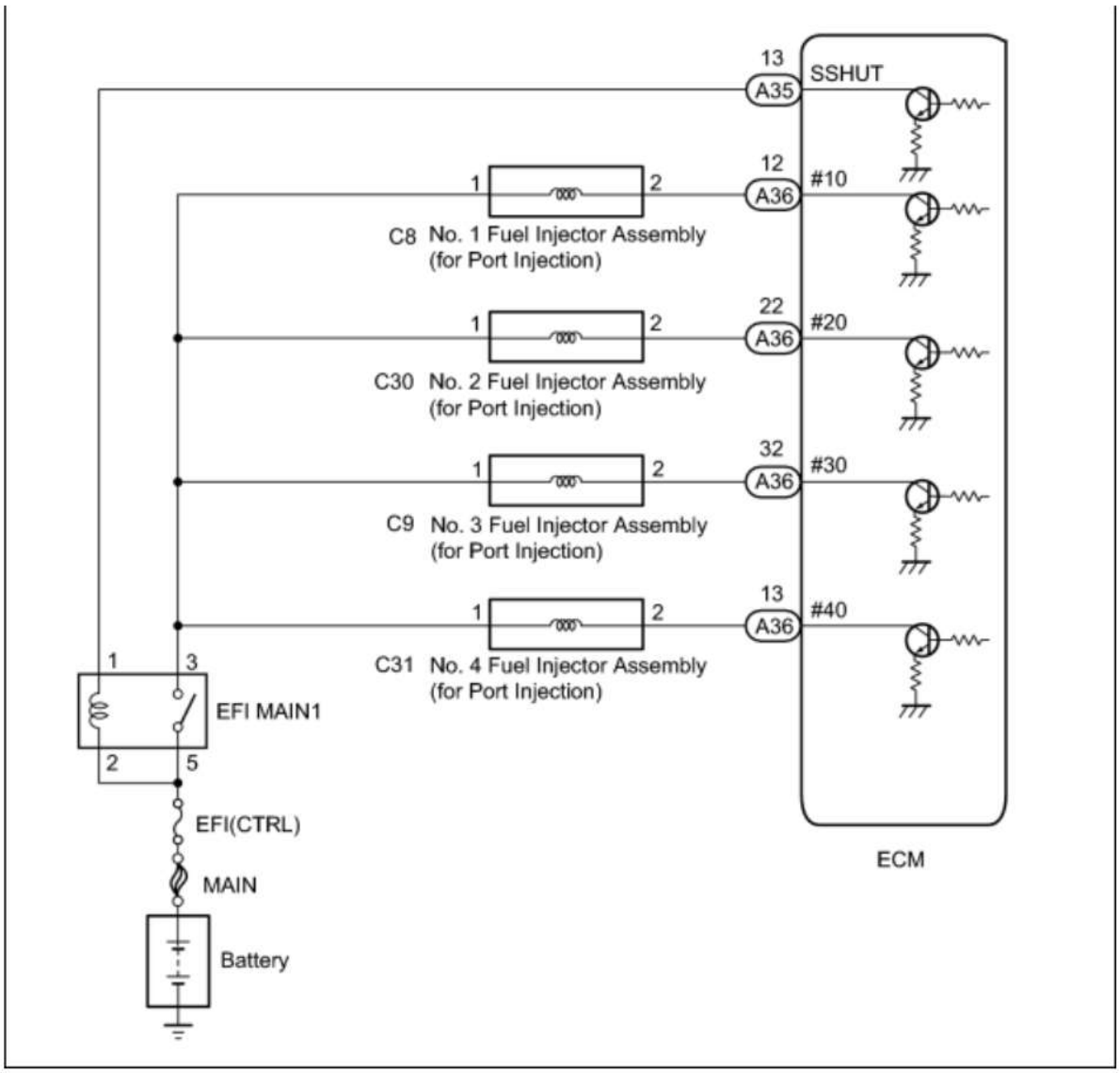
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- If DTC P0201 is output, check the No. 1 fuel injector assembly (for port injection) (No. 1 cylinder) circuit.
- If DTC P0202 is output, check the No. 2 fuel injector assembly (for port injection) (No. 2 cylinder) circuit.
- If DTC P0203 is output, check the No. 3 fuel injector assembly (for port injection) (No. 3 cylinder) circuit.
- If DTC P0204 is output, check the No. 4 fuel injector assembly (for port injection) (No. 4 cylinder) circuit.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

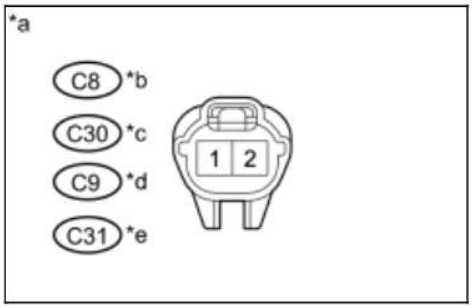
RESULT	PROCEED TO
P0201, P0202, P0203 and P0204 are output	A
P0201, P0202, P0203 or P0204 is output	B
P0201, P0202, P0203 or P0204 and other DTCs are output	C

B ▶ **INSPECT RELAY (EFI MAIN1)**

C ▶ **GO TO DTC CHART**

A ▼

2.	CHECK FUEL INJECTOR ASSEMBLY (POWER SOURCE VOLTAGE)



(a) Disconnect the fuel injector assembly (for port injection) connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1 - Body ground	Ignition switch ON	11 to 14 V

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C30-1 - Body ground	Ignition switch ON	11 to 14 V
C9-1 - Body ground	Ignition switch ON	11 to 14 V
C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

NG ▶ **INSPECT RELAY (EFI MAIN1)**

OK
▼

3.	**CHECK HARNESS AND CONNECTOR (ECM - FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION))**

(a) Disconnect the ECM connector.

(b) Disconnect the fuel injector assembly (for port injection) connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-12 (#10) - C8-2	Always	Below 1 Ω
A36-22 (#20) - C30-2	Always	Below 1 Ω
A36-32 (#30) - C9-2	Always	Below 1 Ω
A36-13 (#40) - C31-2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-12 (#10) or C8-2 - Body ground	Always	10 kΩ or higher
A36-22 (#20) or C30-2 - Body ground	Always	10 kΩ or higher
A36-32 (#30) or C9-2 - Body ground	Always	10 kΩ or higher
A36-13 (#40) or C31-2 - Body ground	Always	10 kΩ or higher

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NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

(a) Inspect the fuel injector assembly (for port injection) INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

OK ▶ **REPLACE ECM**

5.	**INSPECT RELAY (EFI MAIN1)**

(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK ▼

6.	**CHECK HARNESS AND CONNECTOR (EFI MAIN1 RELAY - FUEL INJECTOR ASSEMBLY)**

(a) Disconnect the fuel injector assembly (for port injection) connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω
C30-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω
C9-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω

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C31-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C8-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
C30-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
C9-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
C31-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **GO TO ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000T8X0C9X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0230: Fuel Pump Primary Circuit (2013 FR-S)		

DTC	**P0230**	**Fuel Pump Primary Circuit**

DESCRIPTION

When a malfunction in the fuel pump control circuit (low pressure side) is detected, DTC P0230 is stored.

The fuel pump control circuit (low pressure side) consists of the ECM, fuel pump assembly and fuel pump control ECU (which operates the fuel pump assembly). Based on the engine output, the ECM determines the fuel pump speed. The speed is then converted to a duty signal and sent to the fuel pump control ECU. Based on the signal sent from the ECM, the fuel pump control ECU adjusts the fuel pump assembly operation speed among 3 settings. The fuel pump control ECU also has a self-diagnosis function. Based on the fuel pump control circuit (low pressure side) condition, the fuel pump control ECU outputs a diagnostic signal to the ECM, and the ECM determines if there is a malfunction in the fuel pump control circuit (low pressure side).

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0230	Open or short in fuel pump circuit for 2.5 seconds or more. (1 trip detection logic)	• Open or short in fuel pump control circuit (low pressure side) • C/OPEN relay • Fuel pump assembly • Fuel pump control ECU • ECM

MONITOR DESCRIPTION

To monitor the fuel pump control circuit (low pressure side), the ECM checks the fuel pump control signal (FPC) and diagnostic signal (DI). The FPC voltage varies between approximately 0 V and approximately 12 V (duty signal). Based on the condition of the fuel pump control ECU malfunction, the DI voltage varies between approximately 0 V and approximately 12 V. The ECM then compares the variation of the FPC voltage and DI voltage, and determines if the fuel pump control circuit (low pressure side) is malfunctioning. When the ECM determines that the fuel pump control circuit (low pressure side) is malfunctioning, a DTC is stored immediately.

MONITOR STRATEGY

Related DTCs	P0230: Fuel pump control circuit continuity
Required sensors/Components (Main)	Fuel pump control ECU
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	2.5 seconds
MIL operation	2 driving cycles

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Sequence of operation	None

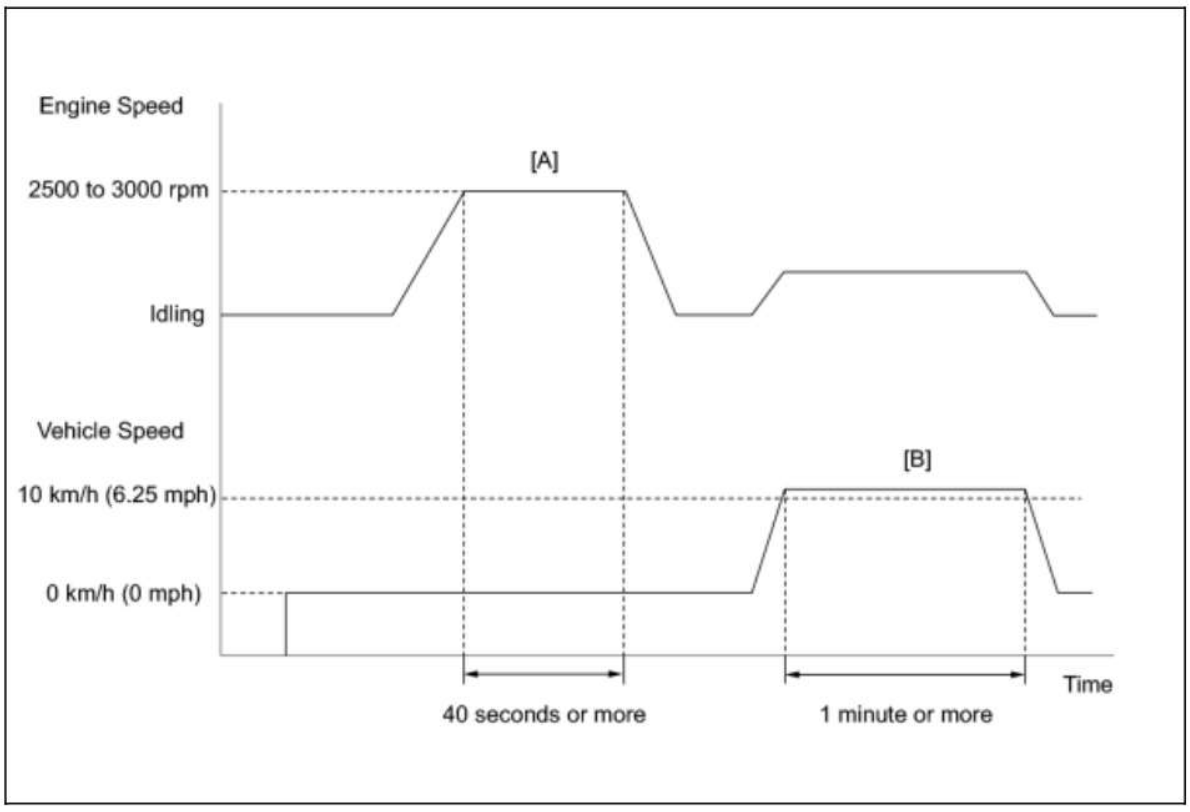
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None
Battery voltage	8 V or more
Fuel level	15% or more
After engine starting	180 seconds or more
Fuel pump control	On

TYPICAL MALFUNCTION THRESHOLDS

Fuel control ECU output diagnostic signal	Low

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0230.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to Fuel Pump Control Circuit INFO .

INSPECTION PROCEDURE

This troubleshooting procedure is based on the premise that the engine is started. If the engine is not started, proceed to Problem Symptoms Table INFO .

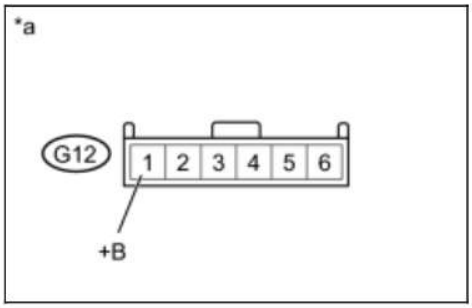
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NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**INSPECT TERMINAL VOLTAGE (+B OF FUEL PUMP CONTROL ECU)**



(a) Disconnect the fuel pump control ECU connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
G12-1 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Pump Control ECU)

NG ▶ **INSPECT RELAY (C/OPEN)**

OK ▼

2.	**CHECK HARNESS AND CONNECTOR (FUEL PUMP CONTROL ECU - BODY GROUND)**

(a) Disconnect the fuel pump control ECU connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G12-4 (E) - Body ground	Always	Below 1 Ω

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NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

3.	CHECK HARNESS AND CONNECTOR (ECM - FUEL PUMP CONTROL ECU)

(a) Disconnect the ECM connector.

(b) Disconnect the fuel pump control ECU connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-10 (DI) - G12-3 (DI)	Always	Below 1 Ω
A35-19 (FPC) - G12-2 (FPC)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-10 (DI) or G12-3 (DI) - Body ground	Always	10 kΩ or higher
A35-19 (FPC) or G12-2 (FPC) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	INSPECT FUEL PUMP ASSEMBLY

(a) Inspect the fuel pump assembly INFO .

NG ▶ **CHECK HARNESS AND CONNECTOR (FUEL PUMP CONTROL ECU - FUEL PUMP ASSEMBLY)**

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OK

5.	**REPLACE FUEL PUMP CONTROL ECU**

(a) Replace the fuel pump control ECU INFO .

NEXT

6.	**CONFIRM WHETHER DTC OUTPUT RECURS**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Clear the DTCs INFO .

(d) Crank the engine for 15 seconds.

(e) Idle the engine for 1 minute.

(f) Enter the following menus: Powertrain / Engine / DTC.

(g) Read the DTCs.

Result

RESULT	PROCEED TO
No DTC output	A
DTC P0230 output	B

B ▶ **REPLACE ECM**

A ▶ **END**

7.	**CHECK HARNESS AND CONNECTOR (FUEL PUMP CONTROL ECU - FUEL PUMP ASSEMBLY)**

(a) Disconnect the fuel pump control ECU connector.

(b) Disconnect the fuel pump assembly connectors.

(c) Measure the resistance according to the value(s) in the table below.

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Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G12-5 (FP-) - G7-4 (FP-)	Always	Below 1 Ω
G12-6 (FP+) - G7-3 (FP+)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G12-5 (FP-) or G7-4 (FP-) - Body ground	Always	10 kΩ or higher
G12-6 (FP+) or G7-3 (FP+) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE FUEL PUMP ASSEMBLY**

8.	INSPECT RELAY (C/OPEN)

(a) Inspect the C/OPEN relay INFO .

NG ▶ **REPLACE RELAY (C/OPEN)**

OK ▼

9.	INSPECT RELAY (C/OPEN RELAY OPERATION)

(a) Check the relay operation sound when the ignition switch is turned to ON.

Result:

ITEM	CONDITION	STANDARD
C/OPEN RELAY	Ignition switch OFF → Ignition switch ON	Operation sound is heard.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK

10.	CHECK HARNESS AND CONNECTOR (C/OPEN RELAY - FUEL PUMP CONTROL ECU)

(a) Remove the C/OPEN relay from the engine room relay block assembly.

(b) Disconnect the fuel pump control ECU connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 3 - G12-1	Always	Below 1 Ω
C/OPEN relay terminal 1 - Body ground	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C/OPEN relay terminal 3 or G12-1 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **GO TO ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XH30QQX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0300-P0304: Random / Multiple Cylinder Misfire Detected (2013 FR-S)		

DTC	**P0300**	**Random / Multiple Cylinder Misfire Detected**

DTC	**P0301**	**Cylinder 1 Misfire Detected**

DTC	**P0302**	**Cylinder 2 Misfire Detected**

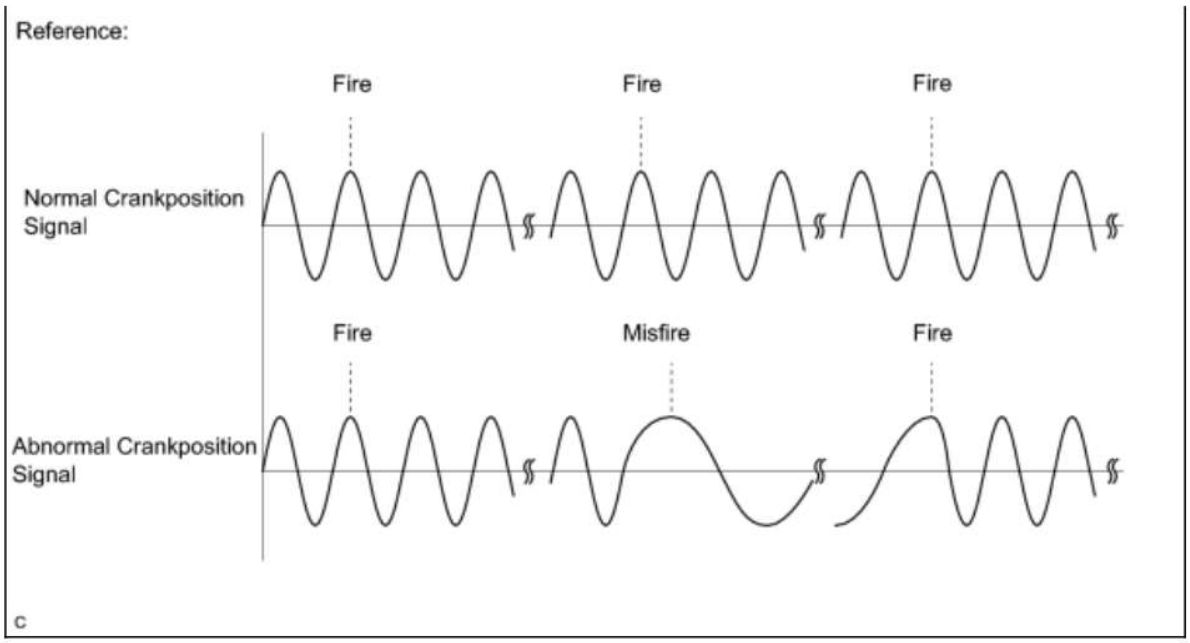
DTC	**P0303**	**Cylinder 3 Misfire Detected**

DTC	**P0304**	**Cylinder 4 Misfire Detected**

DESCRIPTION

When the engine misfires, high concentrations of hydrocarbons (HC) enter the exhaust gas. Extremely high hydrocarbon concentration levels can cause an increase in exhaust emission levels. Extremely high concentrations of hydrocarbons can also cause increases in the three-way catalytic converter temperature, which may cause damage to the three-way catalytic converter. To prevent this increase in emissions and to limit the possibility of thermal damage, the ECM monitors the misfire count. When the temperature of the three-way catalytic converter reaches the point of thermal degradation, the ECM blinks the MIL. To monitor misfires, the ECM uses both the VVT sensor and the crankshaft position sensor. The VVT sensor is used to identify any misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. Misfires are counted when the crankshaft rotation speed variations exceed predetermined thresholds. If the misfire count exceeds the threshold levels, and could cause emission control system performance deterioration, the ECM illuminates the MIL and stores a DTC.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0300	Simultaneous misfiring of several cylinders occurs and one of the following conditions is met (2 trip detection logic): • A misfire occurs that may damage the three-way catalytic converter (MIL blinks). • An emission deterioration misfire occurs (MIL illuminates).	• Open or short in engine wire harness • Connector connection • Vacuum hose connections • Ignition system • Fuel injector assembly (for port injection) • Fuel injector assembly (for direct injection) • Fuel pressure (low pressure side) • Fuel pressure (high pressure side) • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve timing • PCV valve and hose • PCV hose connections • Intake system
P0301	Misfiring of the No. 1 cylinder occurs and one of the following conditions is met (2 trip detection logic): • A misfire occurs that may damage the three-way catalytic converter (MIL blinks). • An emission deterioration misfire occurs (MIL illuminates).	
P0302	Misfiring of the No. 2 cylinder occurs and one of the following conditions is met (2 trip detection logic): • A misfire occurs that may damage the three-way catalytic converter (MIL blinks). • An emission deterioration misfire occurs (MIL illuminates).	
P0303	Misfiring of the No. 3 cylinder occurs and one of the following conditions is met (2 trip detection logic): • A misfire occurs that may damage the three-way catalytic converter (MIL blinks). • An emission deterioration misfire occurs (MIL illuminates).	
	Misfiring of the No. 4 cylinder occurs and one of the following conditions is met (2 trip detection logic):	

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P0304	• A misfire occurs that may damage the three-way catalytic converter (MIL blinks). • An emission deterioration misfire occurs (MIL illuminates).	• ECM

When DTCs for misfiring cylinders are randomly stored, but DTC P0300 is not stored, it indicates that misfires have been detected in different cylinders at different times. DTC P0300 is only stored when several misfiring cylinders are detected at the same time.

MONITOR DESCRIPTION

The ECM illuminates the MIL and stores a DTC when either one of the following conditions, which could cause emission deterioration, is detected (2 trip detection logic).

- Within the first 1000 crankshaft revolutions after the engine starts, an excessive number of misfires (approximately 20 to 50 misfires per 1000 crankshaft revolutions) occurs once.
- An excessive number of misfires (approximately 20 to 50 misfires per 1000 crankshaft revolutions) occurs a total of 4 times.

The ECM flashes the MIL and stores a DTC when either one of the following conditions, which could cause damage to the three-way catalytic converter, is detected (2 trip detection logic).

- At a high engine speed, a sufficient amount of misfires to damage the catalyst occurring within 200 crankshaft revolutions is detected once.
- At a normal engine speed, a sufficient amount of misfires to damage the catalyst occurring within 200 crankshaft revolutions is detected 3 times.

MONITOR STRATEGY

Related DTCs	P0300: Multiple cylinder misfire P0301: Cylinder 1 misfire (crankshaft speed fluctuation) P0302: Cylinder 2 misfire (crankshaft speed fluctuation) P0303: Cylinder 3 misfire (crankshaft speed fluctuation) P0304: Cylinder 4 misfire (crankshaft speed fluctuation)
Required Sensors/Components (Main)	Crankshaft position sensor VVT sensor
Required Sensors/Components (Related)	Engine coolant temperature sensor Intake air temperature sensor Mass air flow meter
Frequency of Operation	Continuous
Duration	1000 crankshaft revolutions (Emissions-related misfire) 200 crankshaft revolutions (Catalyst-damaging misfire)
MIL Operation	2 driving cycles: Emission-related misfire MIL flashes immediately: Catalyst-damaging misfire
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

	P0011, P0021 (VVT intake method (A) with mid-position start)

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Monitor runs whenever following DTCs not stored	P0030, P0031, P0032 (Air fuel ratio sensor - heater) P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0101, P0102, P0103 (Mass air flow (MAF) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0131, P0132 (Air fuel ratio sensor - ECM input voltage) P0134, P2195, P2196 (Air fuel ratio sensor - output voltage) P0171, P0172 (Fuel system main feedback control) P0335, P0336 (Crankshaft position sensor) P0340, P0345 (Camshaft position sensor - intake with VVT) P0365, P0390 (Camshaft position sensor - exhaust with VVT) P0458, P0459 (Solenoid valve for purge control) P0461, P0462, P0463 (Fuel level sensor (FL)) P0604, P0605 (ROM in ECM) P0851, P0852 (Neutral position switch) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Change of manifold absolute pressure (MAP) during 1/2 engine rev.	Less than 13.3 kPa (100 mmHg)
Throttle position change during 16 ms	Less than 16.8%
Fuel cut	Not active
VSC or A/T torque control	Not active
EVAP system monitoring	Not active
Battery voltage	8 V or higher
Engine speed	500 to 7450 rpm
Fuel level	15% or more
MAP	21.7 kPa (163 mmHg) or more (A/T) (varies with engine speed) 20.9 kPa (157 mmHg) or more (M/T) (varies with engine speed)

TYPICAL MALFUNCTION THRESHOLDS

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Monitor Period of Emission-related Misfire

Misfire percentage in 1000 rev.	1.9% or more

Monitor Period of Catalyst-damaging Misfire (MIL Blinks)

Misfire percentage in 200 rev.	5% or more (varies with engine speed)

MONITOR RESULT

Refer to detailed information in Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON.
3. Turn the Techstream on.
4. Record the DTC(s) and freeze frame data.
5. Clear DTCs (even if no DTCs are stored, perform the Clear DTC procedure) INFO .
6. Using the Techstream, switch the ECM from normal mode to check mode INFO .
7. Read the misfire counts of each cylinder, Cylinder #1 Misfire Count to Cylinder #4 Misfire Count, with the engine idling. If any misfire count is displayed, skip the following confirmation driving pattern.
8. Drive the vehicle so that the vehicle conditions displayed in Engine Speed and Calculate Load of the Data List are the same as the freeze frame data. Perform this step several times.

   HINT:

   In order to store misfire DTCs, it is necessary to operate the vehicle for the period of time shown in the table below, confirm the Misfire RPM and Misfire Load in the Data List.

ENGINE SPEED	DURATION
Idling	8.0 minutes or more
1000	4.5 minutes or more
2000	2.5 minutes or more
3000	1.5 minutes or more

9. Check whether misfires have occurred by checking DTCs and freeze frame data.

   HINT:

   Do not turn the ignition switch off until the output DTC(s) and freeze frame data have been recorded. When the ECM returns to normal mode (default), the stored DTC(s), freeze frame data and other data are cleared.

10. Record the DTC(s), freeze frame data and misfire counts.
11. Turn the ignition switch off and wait for at least 30 seconds.
12. Clear DTCs (even if no DTCs are stored, perform the Clear DTC procedure) INFO .

INSPECTION PROCEDURE

HINT:

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- If any DTCs other than misfire DTCs are output, troubleshoot those DTCs first.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If the misfire does not recur when the vehicle is brought to the workshop, reproduce the conditions stored in the ECM as freeze frame data.
- If the misfire still cannot be reproduced even though the conditions stored in the ECM as freeze frame data have been reproduced, one of the following factors is considered to be a possible cause of the problem:
    a. There was insufficient fuel in the tank.
    b. Improper fuel was used.
    c. The spark plugs have been contaminated.
    d. The problem requires further diagnosis.
- After finishing repairs, check the misfire counts of the cylinders (Cylinder #1 Misfire Count to Cylinder #4 Misfire Count).
- Be sure to confirm that no misfiring cylinder DTCs are stored again by conducting the confirmation driving pattern after finishing repairs.
- When one of Short FT #1 or Long FT #1 in the freeze frame data is outside the range of +/-15%, the air fuel ratio may be rich (-15% or less) or lean (+15% or more).
- When Coolant Temp in the freeze frame data is below 75°C (167°F), the misfires have occurred only while warming up the engine.
- An extremely imbalanced drive wheel which causes body vibration may cause misfire DTCs to be stored.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO MISFIRE DTCS)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0300, P0301, P0302, P0303 and/or P0304 are output	A
DTC P0300, P0301, P0302, P0303 and/or P0304 and other DTCs are output	B

HINT:

If any DTCs other than P0300, P0301, P0302, P0303 and P0304 are output, troubleshoot those DTCs first.

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B ▶ GO TO DTC CHART

A ▼

2.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose connections INFO .

OK:

PCV valve and hose are correctly connected and are not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

3.	READ VALUE USING TECHSTREAM (PORT INJECTION)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Port.

(e) Start the engine and allow the engine to idle.

(f) Read the Cylinder #1 Misfire Count to Cylinder #4 Misfire Count or DTCs displayed on the Techstream.

Result

MISFIRE COUNT	PROCEED TO
Most misfires occur in only 1 or 2 cylinders	A
3 cylinders or more have equal misfire counts	A
There are no misfire counts	B

B ▶ READ VALUE USING TECHSTREAM (CYLINDER MISFIRE COUNT)

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A

4.	READ VALUE USING TECHSTREAM (DIRECT INJECTION)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

(e) Start the engine and allow the engine to idle.

(f) Read the Cylinder #1 Misfire Count to Cylinder #4 Misfire Count or DTCs displayed on the Techstream.

Result

MISFIRE COUNT		PROCEED TO
PORT	DIRECT	
Most misfires occur in only 1 or 2 cylinders	Most misfires occur in only 1 or 2 cylinders	A
3 cylinders or more have equal misfire counts	3 cylinders or more have equal misfire counts	B
Most misfires occur in only 1 or 2 cylinders	There are no misfire counts	C
3 cylinders or more have equal misfire counts	There are no misfire counts	D

B ▶ **CHECK INTAKE SYSTEM**

C ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

D ▶ **CHECK FUEL PRESSURE (LOW PRESSURE SIDE)**

A

5.	INSPECT SPARK PLUG

(a) Inspect the spark plug of the misfiring cylinder INFO .

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NG ▶ REPLACE SPARK PLUG

OK ▼

6.	CHECK FOR SPARK (SPARK TEST)

(a) Perform a spark test INFO .

HINT:

If the result of the spark test is normal, proceed to the next step.

NEXT ▼

7.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO .

NG ▶ CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK ▶ REPLACE ECM

8.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks from intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

9.	READ VALUE USING TECHSTREAM (COOLANT TEMP)

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

(e) Read the Coolant Temp twice, when the engine is both cold and warmed up.

Standard:

With cold engine

Same as ambient air temperature.

With warm engine

Between 75 and 100°C (167 and 212°F)

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK ▼

10.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / MAF, Coolant Temp and Engine Speed.

(f) Allow the engine to idle until Coolant Temp reaches 75°C (167°F) or higher.

(g) Read MAF with the engine speed at 3000 rpm.

Standard:

Between 13.0 gm/sec and 14.0 gm/sec (shift lever: N, A/C: Off).

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

OK ▼

11.	CHECK VALVE TIMING

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(a) Check the valve timing INFO .

Result

RESULT	PROCEED TO
ABNORMAL	A
NORMAL	B

B ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

A ▶ **ADJUST VALVE TIMING**

12.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

(a) Check the fuel pressure (low pressure side) INFO .

NG ▶ **INSPECT FUEL PUMP ASSEMBLY**

OK ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

13.	INSPECT FUEL PUMP ASSEMBLY

(a) Inspect the fuel pump assembly INFO .

NG ▶ **REPLACE FUEL PUMP ASSEMBLY**

OK ▶ **GO TO FUEL INJECTOR CIRCUIT**

14.	READ VALUE USING TECHSTREAM (CYLINDER MISFIRE COUNT)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

(e) Start the engine and allow the engine to idle.

(f) Read the Cylinder #1 Misfire Count to Cylinder #4 Misfire Count or DTCs displayed on the

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Techstream.

Result

MISFIRE COUNT		PROCEED TO
PORT	DIRECT	
There are no misfire counts	There are misfire counts	A
There are no misfire counts	There are no misfire counts	B

B ▶ READ VALUE USING TECHSTREAM (CYLINDER MISFIRE COUNT)

A ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)

15.	READ VALUE USING TECHSTREAM (CYLINDER MISFIRE COUNT)

(a) Connect the Techstream to the DLC3.

(b) Start the engine and turn the Techstream on.

(c) Clear DTCs (INFO).

(d) Enter the following menus: Powertrain / Engine / Data List / Misfire RPM, Misfire Load, Cylinder #1 to #4 Misfire Count and Injection Way.

(e) Monitor all of the misfire count values or DTCs and Injection Way displayed on the Techstream.

Result

MISFIRE COUNTS	INJECTION WAY	PROCEED TO
There are no misfire counts	-	A
Most misfires occur in only 1 or 2 cylinders	Either	B
3 cylinders or more have equal misfire counts	Either	C
There are misfire counts	Direct	D

B ▶ INSPECT SPARK PLUG

C ▶ CHECK INTAKE SYSTEM

D ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)

A ▶ CHECK FOR INTERMITTENT PROBLEMS

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16.	INSPECT SPARK PLUG

(a) Inspect the spark plug of the misfiring cylinder INFO .

NG ▶ REPLACE SPARK PLUG

OK
▼

17.	CHECK FOR SPARK (SPARK TEST)

(a) Perform a spark test INFO .

HINT:

If the result of the spark test is normal, proceed to the next step.

NEXT
▼

18.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Measure the cylinder compression pressure of the misfiring cylinder INFO .

NG ▶ CHECK ENGINE TO DETERMINE CAUSE OF LOW COMPRESSION

OK ▶ REPLACE ECM

19.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks from intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK
▼

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20.	READ VALUE USING TECHSTREAM (COOLANT TEMP)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

(e) Read the Coolant Temp twice, when the engine is both cold and warmed up.

Standard:

With cold engine

Same as ambient air temperature.

With warm engine

Between 75 and 100°C (167 and 212°F)

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

▼

21.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / MAF, Coolant Temp and Engine Speed.

(f) Allow the engine to idle until Coolant Temp reaches 75°C (167°F) or higher.

(g) Read MAF with the engine speed at 3000 rpm.

Standard:

Between 13.0 gm/sec and 14.0 gm/sec (shift lever: N, A/C: Off).

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

OK

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22.	CHECK VALVE TIMING

(a) Check the valve timing INFO .

NG ▶ ADJUST VALVE TIMING

OK

23.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

24.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

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(k) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(l) Input the DTC: P0300, P0301, P0302, P0303 or P0304.

(m) Check the DTC judgment result.

Result

RESULT	PROCEED TO
ABNORMAL (P0300, P0301, P0302, P0303 or P0304 output)	A
NORMAL (No DTC output)	B

B ▶ **END**

A ▼

25.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-12 (THA) - C16-1 (THA)	Always	Below 1 Ω
A36-29 (E1) - C16-2 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-12 (THA) or C16-1 (THA) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C16-2 (E2) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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26.	REPLACE MASS AIR FLOW METER

(a) Replace the mass air flow meter INFO .

HINT:

If the results of the inspections performed in steps 15 and 20 indicated no problem, proceed to the next step without replacing the mass air flow meter.

NEXT

27.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(k) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(l) Input the DTC: P0300, P0301, P0302, P0303 or P0304.

(m) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (No DTC output)	A
ABNORMAL (P0300, P0301, P0302, P0303 or P0304 output)	B

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B ▶ REPLACE ECM

A ▶ END



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000SVT0NQX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0327,P0328,P0332,P0333: Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor) (2013 FR-S)		

DTC	**P0327**	**Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)**

DTC	**P0328**	**Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)**

DTC	**P0332**	**Knock Sensor 2 Circuit Low Input (Bank 2)**

DTC	**P0333**	**Knock Sensor 2 Circuit High Input (Bank 2)**

DESCRIPTION

A flat-type knock sensor (non-resonant type) has a structure that can detect vibrations between approximately 5 kHz and 15 kHz.

Knock sensor is fitted onto the engine block to detect engine knocking.

The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed.

The voltage is generated when the engine block vibrates due to knocking. Any occurrence of engine knocking can be suppressed by delaying the ignition timing.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0327	Knock sensor voltage is less than 0.154 V for 1 second or more (bank 1). (1 trip detection logic)	• Open or short in knock sensor circuit (bank 1) • Knock sensor (bank 1) • ECM
P0328	Knock sensor voltage is more than 4.838 V for 1 second or more (bank 1). (1 trip detection logic)	
P0332	Knock sensor voltage is less than 0.154 V for 1 second or more (bank 2). (1 trip detection logic)	• Open or short in knock sensor circuit (bank 2) • Knock sensor (bank 2) • ECM
P0333	Knock sensor voltage is more than 4.838 V for 1 second or more (bank 2). (1 trip detection logic)	

HINT:

When DTC P0327, P0328, P332 or P0333 is stored, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is delayed to its maximum retardation. Fail-safe mode continues until the ignition switch is turned off.

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MONITOR DESCRIPTION

If the output voltage transmitted by the knock sensor remains low or high for more than 1 second, the ECM interprets this as a malfunction in the sensor circuit and the ECM illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0327: Knock sensor range check (Low voltage) (Bank 1) P0328: Knock sensor range check (High voltage) (Bank 1) P0332: Knock sensor range check (Low voltage) (Bank 2) P0333: Knock sensor range check (High voltage) (Bank 2)
Required Sensors/Components (Main)	Knock sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None

TYPICAL MALFUNCTION THRESHOLDS

P0327, P0332

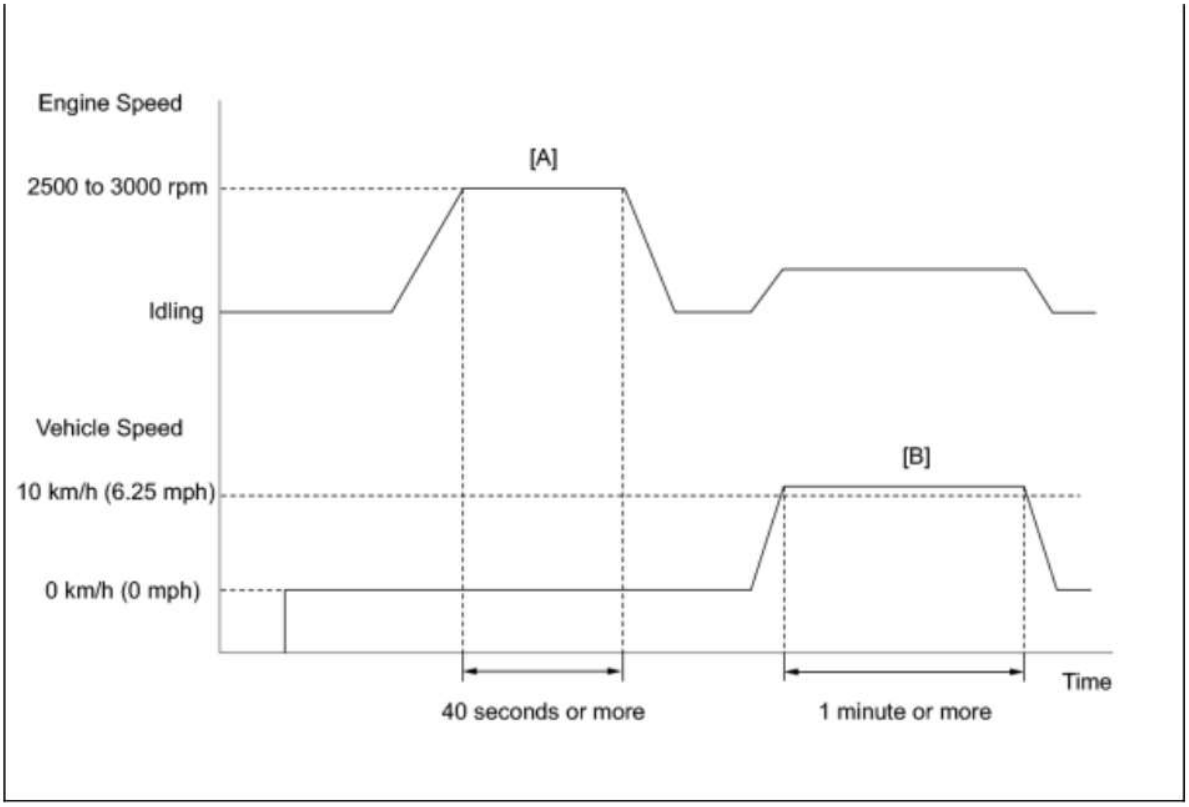
Knock sensor voltage	Less than 0.154 V

P0328, P0333

Knock sensor voltage	More than 4.838 V

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0327, P0328, P0332 or P0333.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	∘ DTC judgment completed ∘ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

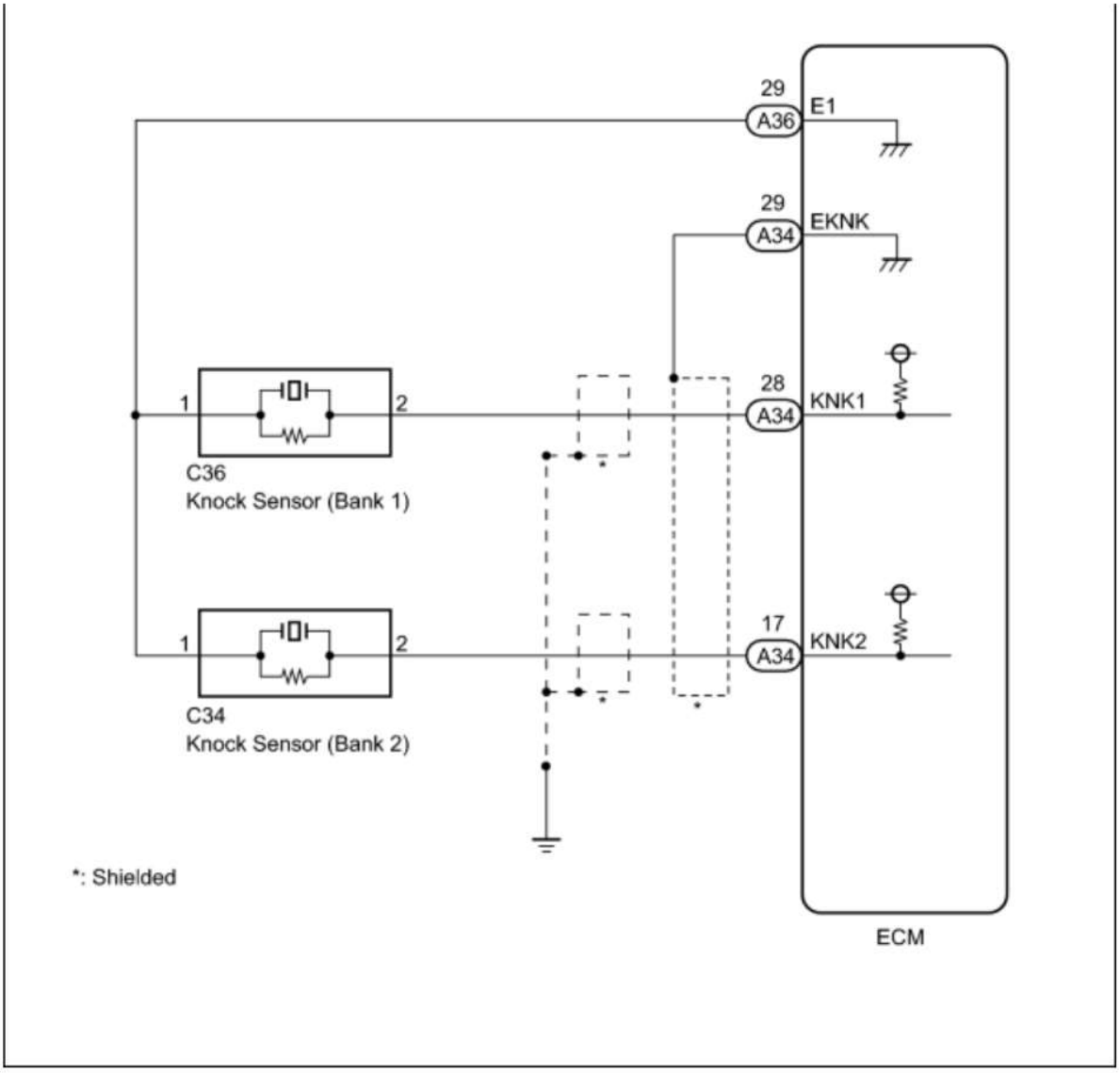
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

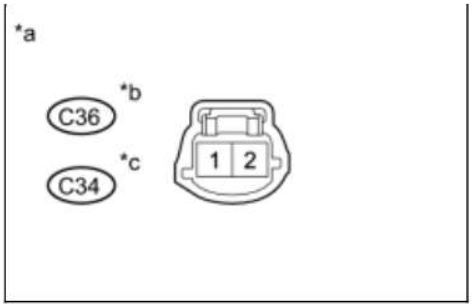
HINT:

- If DTC P0327 or P0332 is displayed, check the knock sensor circuit for the right bank (bank 1).
- If DTC P0328 or P0333 is displayed, check the knock sensor circuit for the left bank (bank 2).
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK TERMINAL VOLTAGE (+B OF KNOCK SENSOR)**

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(a) Disconnect the knock sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C36-1 - C36-2	Ignition switch ON	2.4 to 2.6 V
C34-1 - C34-2	Ignition switch ON	2.4 to 2.6 V

Text in Illustration

*a	Front view of wire harness connector (to Knock Sensor)
*b	Bank 1
*c	Bank 2

NG ▶ **CHECK HARNESS AND CONNECTOR (ECM - KNOCK SENSOR)**

OK ▼

2.	**INSPECT KNOCK SENSOR**

(a) Inspect the knock sensor INFO .

NG ▶ **REPLACE KNOCK SENSOR**

OK ▼

3.	**CHECK WHETHER DTC OUTPUT RECURS**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(k) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(l) Input the DTC: P0327, P0328, P0332, or P0333.

(m) Check the DTC judgment result.

Result

RESULT	PROCEED TO
NORMAL (No DTC output)	A
ABNORMAL (P0327, P0328, P0332, or P0333 output)	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

4.	CHECK HARNESS AND CONNECTOR (ECM - KNOCK SENSOR)

(a) Disconnect the knock sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-28 (KNK1) - C36-2	Always	Below 1 Ω
A34-17 (KNK2) - C34-2	Always	Below 1 Ω

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A36-29 (E1) - C36-1	Always	Below 1 Ω
A36-29 (E1) - C34-1	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-28 (KNK1) or C36-2 - Body ground	Always	10 kΩ or higher
A34-17 (KNK2) or C34-2 - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C36-1 - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C34-1 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

5.	**CHECK WHETHER DTC OUTPUT RECURS**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine.

(i) Warm up the engine.

(j) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(k) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(l) Input the DTC: P0327, P0328, P0332 or P0333.

(m) Check the DTC judgment result.

Result

RESULT	PROCEED TO

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NORMAL (No DTC output)	A
ABNORMAL (P0327, P0328, P0332, or P0333 output)	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000TCW0R7X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0335,P0336: Crankshaft Position Sensor "A" Circuit (2013 FR-S)		

DTC	**P0335**	**Crankshaft Position Sensor "A" Circuit**

DTC	**P0336**	**Crankshaft Position Sensor Range / Performance**

DESCRIPTION

The crankshaft position sensor system consists of a No. 1 crankshaft position sensor plate and Magnetoresistive Element (MRE) type sensor. The crankshaft angle sensor plate is installed on the crankshaft. The crankshaft position sensor generates 30 signals per crankshaft revolution. The ECM uses the camshaft position signal to distinguish between the cylinders, and uses the crankshaft position signal to detect the crankshaft position and engine speed.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0335	No crankshaft position sensor signal is sent to the ECM while cranking for 3 seconds or more. (1 trip detection logic)	• Open or short in crankshaft position sensor circuit • Crankshaft position sensor • Crankshaft angle sensor plate (crankshaft sub-assembly) • ECM
P0336	Crankshaft position sensor signal is not 30 counts per 1 revolution of crankshaft. (2 trip detection logic)	• Crankshaft position sensor • Crankshaft angle sensor plate (crankshaft sub-assembly) • ECM

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MONITOR DESCRIPTION

If there is no signal from the crankshaft position sensor despite the crankshaft revolving, the ECM interprets this as a malfunction of the sensor and the ECM illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0335: Crankshaft position sensor circuit continuity P0336: Crankshaft position sensor rationality check
Required sensors/Components (Main)	Crankshaft position sensor
Required sensors/Components (Related)	VVT sensor
Frequency of operation	Continuous
Duration	3 seconds: P0335 10 revolutions: P0336

MIL operation	Immediately: P335 2 driving cycles: P336
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

P0335

Monitor runs whenever following DTCs not present	None
Battery voltage	8 V or more
Starter switch	On

P0336

Monitor runs whenever following DTCs not present	P0122, P0123, P0222, P0223 (Throttle position sensor) P0335 (Crankshaft position sensor) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Engine speed	Less than 4000 rpm
Battery voltage	8 V or more

TYPICAL MALFUNCTION THRESHOLDS

P0335

Crankshaft position sensor signal	No signal

P0336

Crankshaft position sensor signal during 1 revolution	Not 30

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine.

HINT:

If the engine could not be started, crank engine for 10 seconds.

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7. Idle the engine for 20 seconds or more.
8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0335 or P0336.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

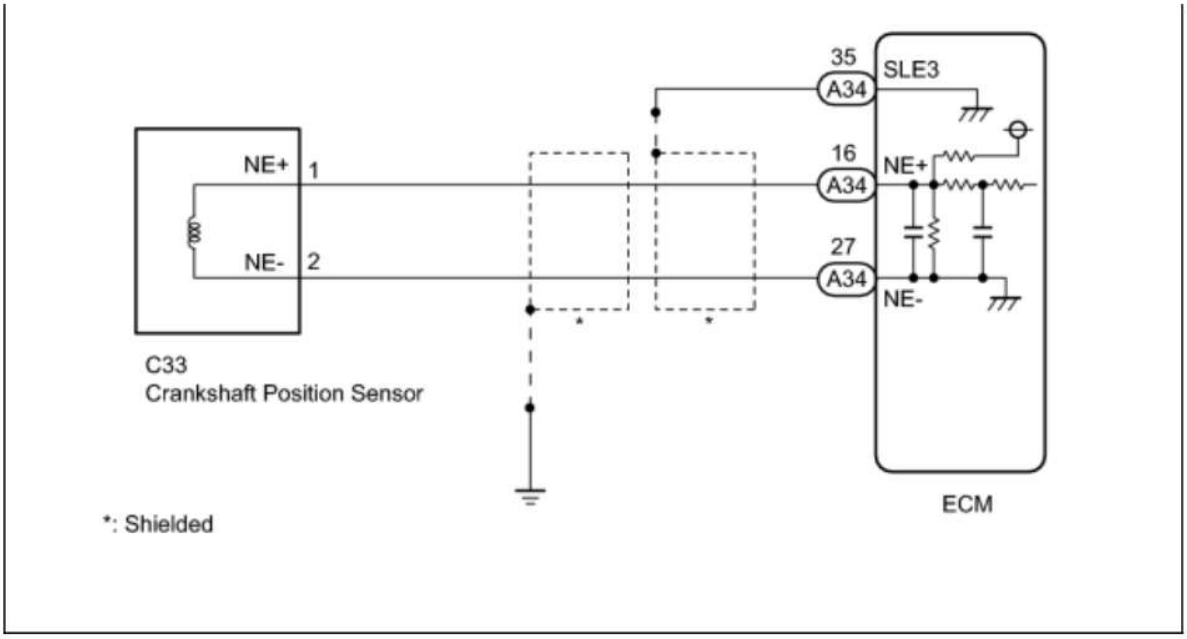
13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- If no problem is found by this diagnostic troubleshooting procedure, check for problems by referring to the engine mechanical section.
- The engine speed can be checked by using the Techstream. To perform the check, follow the procedures below:

  a. Connect the Techstream to the DLC3.
  b. Start the engine.
  c. Turn the Techstream on.
  d. Enter the following menus: Powertrain / Engine / Data List / Engine Speed.

  The engine speed may be indicated as zero despite the engine running normally. This is caused by a lack of NE signals from the crankshaft position sensor. Alternatively, the engine speed may be indicated as lower than the actual engine speed if the crankshaft position sensor output voltage is insufficient.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (ENGINE SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Engine Speed.

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(e) Start the engine.

(f) Read the values displayed on the Techstream while the engine is running.

OK:

Correct values are displayed.

Result

RESULT	PROCEED TO
NG	A
OK	B

HINT:

- To check the engine speed change, display the graph on the Techstream.
- If the engine does not start, check the engine speed while cranking.
- If the engine speed indicated on the Techstream remains zero (0), there may be an open or short in the Crankshaft Position sensor circuit.

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

▼

2.	**INSPECT CRANKSHAFT POSITION SENSOR**

(a) Inspect the crankshaft position sensor INFO .

NG ▶ **REPLACE CRANKSHAFT POSITION SENSOR**

OK

▼

3.	**CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)**

(a) Disconnect the ECM connector.

(b) Disconnect the crankshaft position sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C34-16 (NE+) - C33-1 (NE+)	Always	Below 1 Ω

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C34-27 (NE-) - C33-2 (NE-)	Always	Below 1 Ω

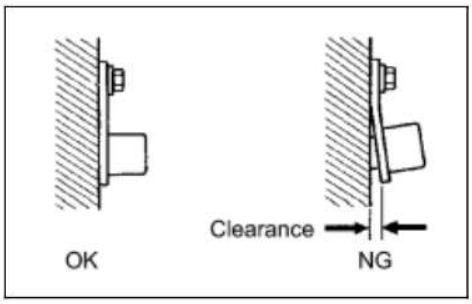
Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C34-16 (NE+) or C33-1 (NE+) - Body ground	Always	10 kΩ or higher
C34-27 (NE-) or C33-2 (NE-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**CHECK SENSOR INSTALLATION (CRANKSHAFT POSITION SENSOR)**



(a) Check the crankshaft position sensor installation.

OK:

Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL SENSOR**

OK ▼

5.	**INSPECT CRANKSHAFT (TEETH OF SENSOR PLATE)**

(a) Check the teeth of the No. 1 crankshaft position sensor plate.

OK:

Sensor plate does not have any cracks or deformation.

NG ▶ **REPLACE NO. 1 CRANKSHAFT POSITION SENSOR PLATE**

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OK

6.	REPLACE CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

NEXT

7.	CHECK WHETHER DTC OUTPUT RECURS (DTC P0335 OR P0336)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the tester on.

(g) Start the engine.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
No DTC is output	A
P0335 or P0336 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

A ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000WBZ0JFX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0340,P0341,P0345,P0346: Camshaft Position Sensor Circuit Malfunction (2013 FR-S)		

DTC	**P0340**	**Camshaft Position Sensor Circuit Malfunction**

DTC	**P0341**	**Camshaft Position Sensor "A" Circuit Range / Performance (Bank 1 or Single Sensor)**

DTC	**P0345**	**Camshaft Position Sensor "A" Circuit (Bank 2)**

DTC	**P0346**	**Camshaft Position Sensor "A" Circuit Range / Performance (Bank 2)**

DESCRIPTION

The intake camshaft VVT sensors consist of a magnet and MRE (Magnetic Resistive Element).

The VVT camshaft drive gear has a sensor plate with 3 teeth on its outer circumference. When the gear rotates, changes occur in the air gaps between the sensor plate and MRE, which affects the magnetic field. As a result, the resistance of the MRE material fluctuates. The VVT sensor converts the gear rotation data to pulse signals, uses the pulse signals to determine the camshaft angle, and sends it to the ECM.

The crank angle sensor generates 30 signals for each engine rotation. Based on combination of the VVT sensor signals and crankshaft position sensor signals, the ECM detects the crankshaft angle. Then the ECM uses this data to control fuel injection time and injection timing. Also, based on the crankshaft position sensor signal, the ECM detects the engine speed.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0340	One of the following conditions is met (1 trip detection logic): • No VVT sensor for intake side signal input during crankshaft 1.5 rotations (bank 1). • No VVT sensor for intake side signal is sent to the ECM while cranking for 3 seconds or more (bank 1).	• Open or short in VVT sensor circuit (for intake side of bank 1) • VVT sensor (for intake side of bank 1) • Camshaft timing gear assembly (bank 1) • Jumped tooth of timing chain for intake camshaft (bank 1) • ECM
P0341	VVT sensor for intake side signal is not 3 during crankshaft 2 rotations (bank 1). (1 trip detection logic)	
	One of the following conditions is met (1 trip detection logic): • No VVT sensor for intake side signal input	• Open or short in VVT sensor circuit (for intake side of bank 2)

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P0345	during crankshaft 1.5 rotations (bank 2). • No VVT sensor for intake side signal is sent to the ECM while cranking for 3 seconds or more (bank 2).	• VVT sensor (for intake side of bank 2) • Camshaft timing gear assembly (bank 2) • Jumped tooth of timing chain for intake camshaft (bank 2) • ECM
P0346	VVT sensor for intake side signal is not 3 during crankshaft 2 rotations (bank 2). (1 trip detection logic)	

MONITOR DESCRIPTION

If no signal is transmitted by the VVT sensor despite the engine running, or the rotations of the camshaft and the crankshaft are not synchronized, the ECM interprets this as a malfunction of the sensor.

MONITOR STRATEGY

Related DTCs	P0340: Camshaft position sensor - Intake with VVT circuit continuity (Bank 1) P0341: Camshaft position sensor - Intake with VVT rationality check (Bank 1) P0345: Camshaft position sensor - Intake with VVT circuit continuity (Bank 2) P0346: Camshaft position sensor - Intake with VVT rationality check (Bank 2)
Required Sensors/Components (Main)	VVT sensor (Bank 1 and 2)
Required Sensors/Components (Sub)	Crankshaft position sensor
Frequency of Operation	Once per driving cycle: P340, P0345 (First monitor) Continuous: P340, P0345 (Second monitor) Continuous: P341, P0346
Duration	3 seconds: P340, P0345 (First monitor) 7 revolutions: P340, P0345 (Second monitor) 2 revolutions: P341, P0346
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None
Battery voltage	8 V or more

P0340, P0345 (First monitor)

Starter	On
Elapsed time after engine start	0.2 seconds or more

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P0341, P0346

Elapsed time after engine start	0.2 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0340, P0345 (First monitor)

Intake VVT sensor signal	No signal

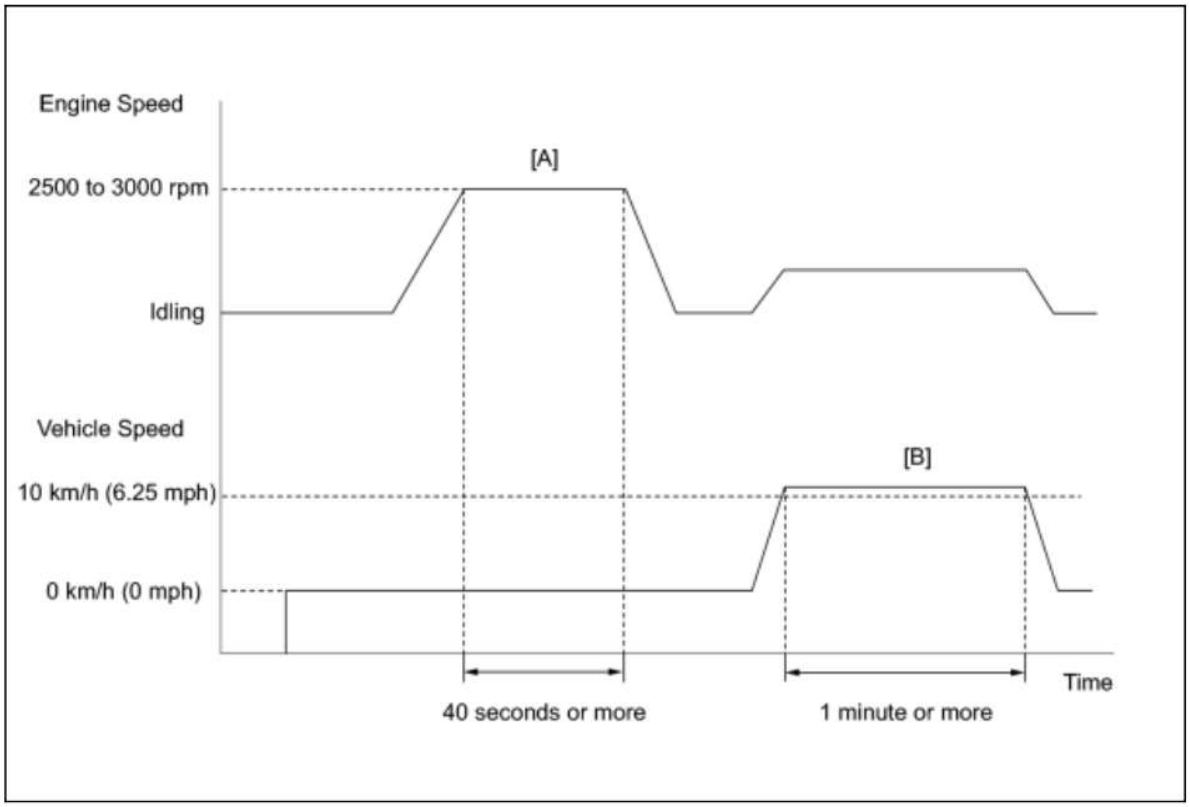
P0340, P0345 (Second monitor)

Intake VVT sensor signal during 1.5 revolutions	No signal

P0341, P0346

Intake VVT sensor signal during 2 revolutions	Not 3

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of

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between 2500 and 3000 rpm for 40 seconds or more [A].

8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0340, P0341, P0345 or P0346.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

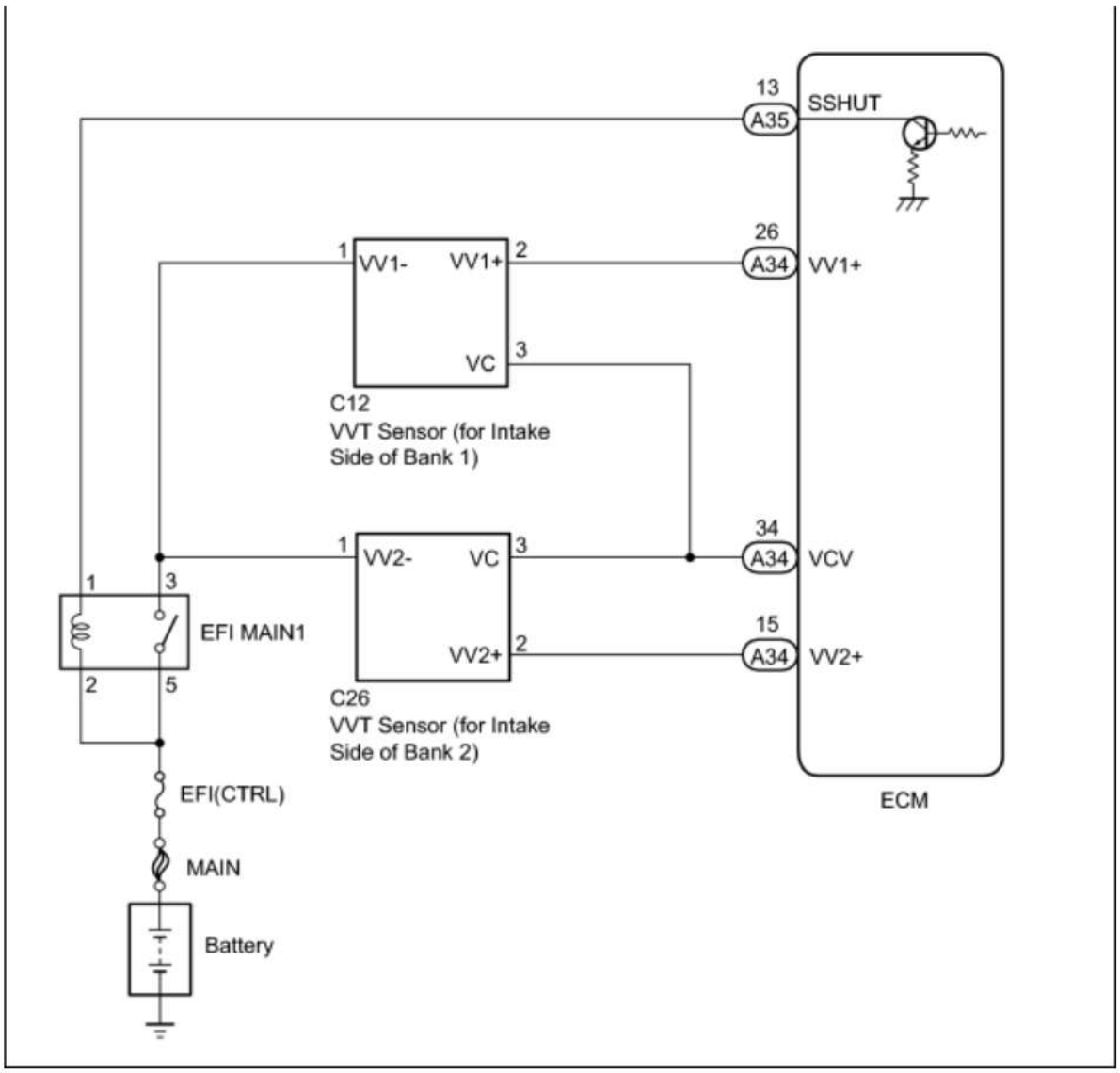
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- If DTC P0340 or P0341 is displayed, check the VVT sensor for intake side circuit for the right bank (bank 1).
- If DTC P0345 or P0346 is displayed, check the VVT sensor for intake side circuit for the left bank (bank 2).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If no problem is found by this diagnostic troubleshooting procedure, troubleshoot the engine mechanical system.

PROCEDURE

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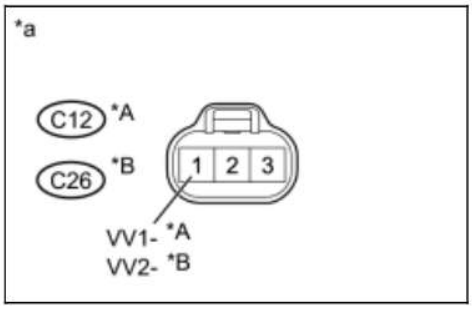
1.	CHECK VVT SENSOR FOR INTAKE SIDE (SENSOR POWER SOURCE)

(a) Disconnect the VVT sensor connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:



TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C12-1 (VV1-) - Body ground	Ignition switch ON	11 to 14 V
C26-1 (VV2-) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to VVT Sensor for Intake Side)

NG ▶ **INSPECT RELAY (EFI MAIN1)**

OK ▼

2.	CHECK HARNESS AND CONNECTOR (VVT SENSOR FOR INTAKE SIDE - ECM)

(a) Disconnect the ECM connector.

(b) Disconnect the VVT sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-26 (VV1+) - C12-2 (VV1+)	Always	Below 1 Ω
A34-15 (VV2+) - C26-2 (VV2+)	Always	Below 1 Ω
A34-34 (VCV) - C12-3 (VC)	Always	Below 1 Ω
A34-34 (VCV) - C26-3 (VC)	Always	Below 1 Ω

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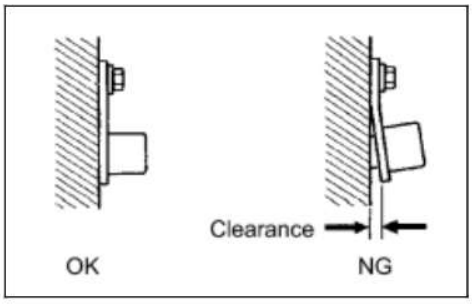
Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-26 (VV1+) or C12-2 (VV1+) - Body ground	Always	10 kΩ or higher
A34-15 (VV2+) or C26-2 (VV2+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C12-3 (VC) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C26-3 (VC) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (VVT SENSOR FOR INTAKE SIDE - ECM)**

OK ▼

3.	**CHECK SENSOR INSTALLATION (VVT SENSOR FOR INTAKE SIDE)**



(a) Check the VVT sensor installation.

OK:

Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL VVT SENSOR FOR INTAKE SIDE**

OK ▼

4.	**CHECK CAMSHAFT TIMING GEAR ASSEMBLY (TEETH OF PLATE)**

(a) Check the teeth of the sensor plate.

OK:

Sensor plate teeth do not have any cracks or deformation.

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NG ▶ **REPLACE CAMSHAFT TIMING GEAR ASSEMBLY**

OK
▼

5.	**CHECK VALVE TIMING**

(a) Check the valve timing INFO .

NG ▶ **ADJUST VALVE TIMING**

OK
▼

6.	**REPLACE VVT SENSOR FOR INTAKE SIDE**

(a) Replace the VVT sensor INFO .

NEXT
▼

7.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0340, P0341, P0345 AND/OR P0346)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Start the engine.

(g) Turn the Techstream on

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

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(j) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC P0340, P0341, P0345 or P0346 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

A ▶ **END**

8.	**INSPECT RELAY (EFI MAIN1)**

(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK ▼

9.	**CHECK HARNESS AND CONNECTOR (VVT SENSOR FOR INTAKE SIDE - EFI MAIN1 RELAY)**

(a) Disconnect the VVT sensor for intake side connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 - C12-1 (VV1-)	Always	Below 1 Ω
EFI MAIN1 relay terminal 3 - C26-1 (VV2-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 or C12-1 (VV1-) - Body ground	Always	10 kΩ or higher

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EFI MAIN1 relay terminal 3 or C26-1 (VV2-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (VVT SENSOR FOR INTAKE SIDE - ECM)**

OK ▶ **GO TO ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XH40PUX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0351-P0354: Ignition Coil "A" Primary / Secondary Circuit (2013 FR-S)		

DTC	**P0351**	**Ignition Coil "A" Primary / Secondary Circuit**

DTC	**P0352**	**Ignition Coil "B" Primary / Secondary Circuit**

DTC	**P0353**	**Ignition Coil "C" Primary / Secondary Circuit**

DTC	**P0354**	**Ignition Coil "D" Primary / Secondary Circuit**

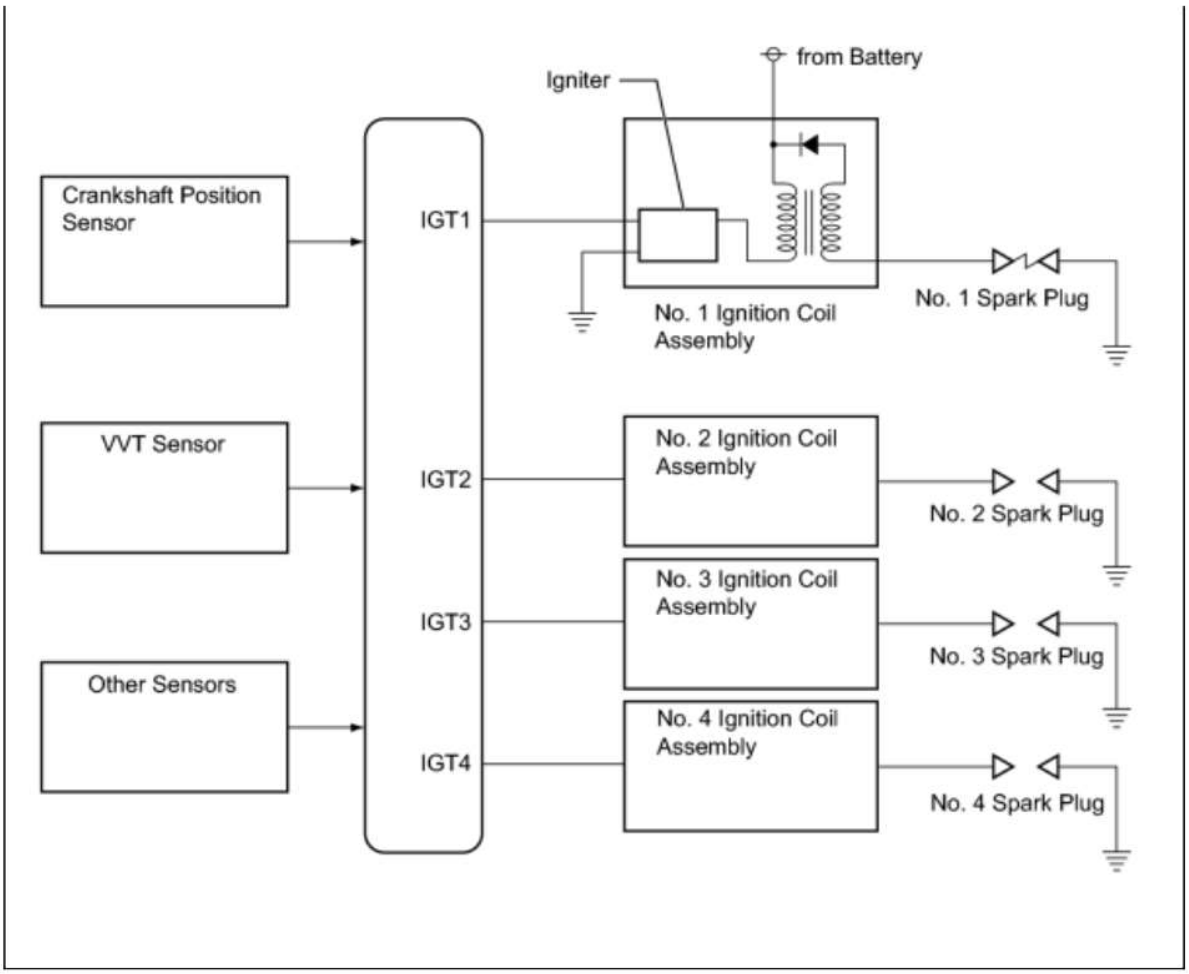
DESCRIPTION

A Direct Ignition System (DIS) is used on this vehicle.

The DIS is a 1-cylinder ignition system in which each cylinder is ignited by one ignition coil and one spark plug is connected to the end of each secondary wiring. A powerful voltage, generated in the secondary wiring, is applied directly to each spark plug. The spark current of the spark plugs passes from the ground electrodes to the center electrode.

The ECM determines the ignition timing and transmits the ignition (IGT) signals to each cylinder. Using the IGT signal, the ECM turns the power transistor inside the igniter on and off. The power transistor, in turn, switches on and off the current to the primary coil. When the current to the primary coil is cut off, a powerful voltage is generated in the secondary coil. This voltage is applied to the spark plugs, causing them to spark inside the cylinders.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0351	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the ignition coil driver IC for No. 1 ignition coil assembly continuously 10 times or more. (1 trip detection logic)	• Ignition system • Open or short in IGT circuit (1 to 4) between ignition coil and ECM • Ignition coil (No. 1 to No. 4 cylinder) • ECM
P0352	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the ignition coil driver IC for No. 2 ignition coil assembly continuously 10 times or more. (1 trip detection logic)	
P0353	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the ignition coil driver IC for No. 3 ignition coil assembly continuously 10 times or more. (1 trip detection logic)	
P0354	Received diagnostic information (open circuit detected / GND short / +B short or overheating) from the ignition coil driver IC for No. 4 ignition coil assembly continuously 10 times or more. (1 trip detection logic)	

MONITOR DESCRIPTION

If the ECM receives the malfunction signal from the ignition coil driver IC, it interprets this as a fault in the

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igniter and stores a DTC.

MONITOR STRATEGY

Related DTCs	P0351: Ignition Coil "A" Primary / Secondary Circuit P0352: Ignition Coil "B" Primary / Secondary Circuit P0353: Ignition Coil "C" Primary / Secondary Circuit P0354: Ignition Coil "D" Primary / Secondary Circuit
Required Sensors/Components (Main)	Igniter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	2.5 seconds (256 msec. X 10 counts)
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

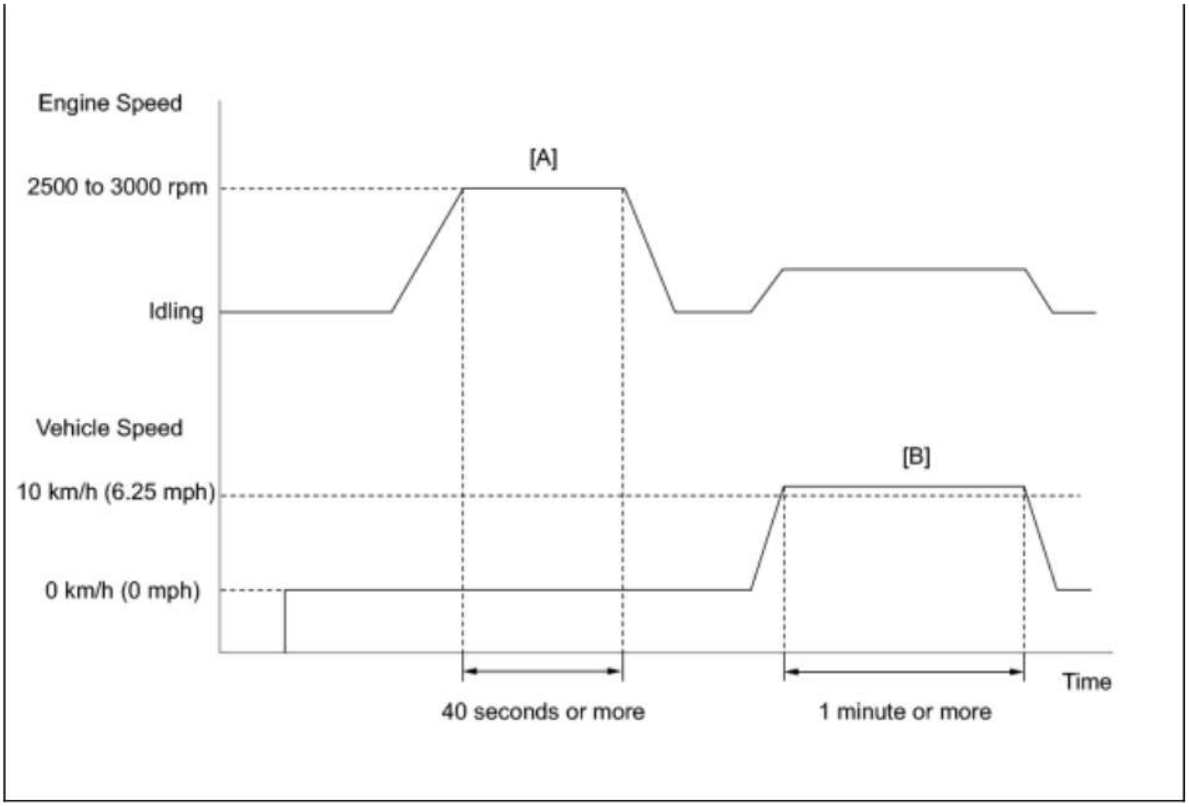
Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or more
Elapsed time after engine start	1 second or more
Engine speed	500 rpm or higher
Ignition dwell time	0.002 seconds or more
Ignition cut	Not active

TYPICAL MALFUNCTION THRESHOLDS

Signal of malfunction from ignition coil driver IC	On

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0351, P0352, P0353 or P0354.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

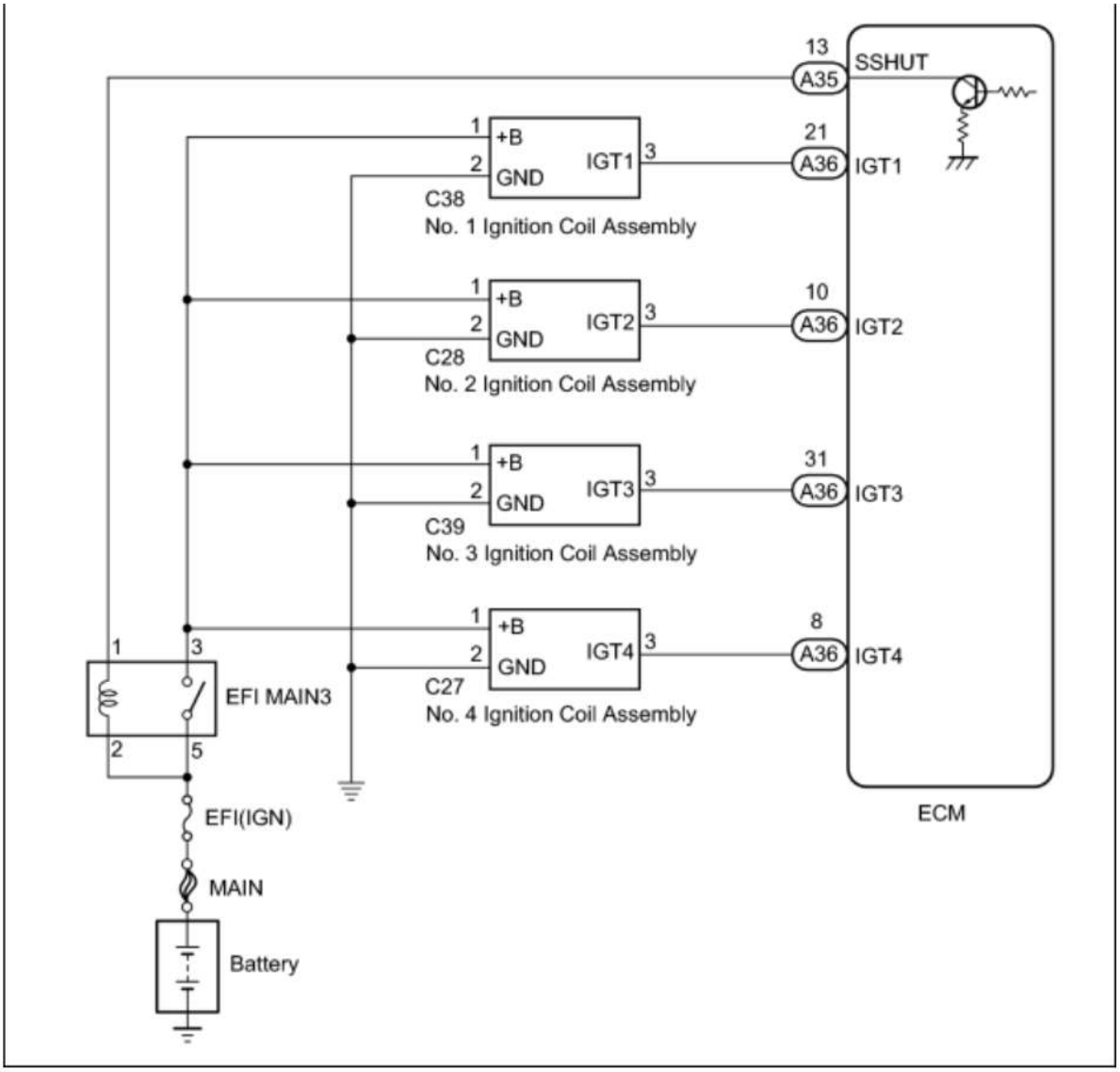
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- These DTCs indicate malfunctions relating to the primary circuit.
- If DTC P0351 is output, check the No. 1 ignition coil (No. 1 cylinder) circuit.
- If DTC P0352 is output, check the No. 2 ignition coil (No. 2 cylinder) circuit.
- If DTC P0353 is output, check the No. 3 ignition coil (No. 3 cylinder) circuit.
- If DTC P0354 is output, check the No. 4 ignition coil (No. 4 cylinder) circuit.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK WHETHER DTC OUTPUT RECURS**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Shuffle the arrangement of the ignition coils (among No. 1 to No. 4 cylinders).

NOTICE:

Do not change the location of the connectors.

(g) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine / Trouble Codes.

(i) Read DTCs.

Result

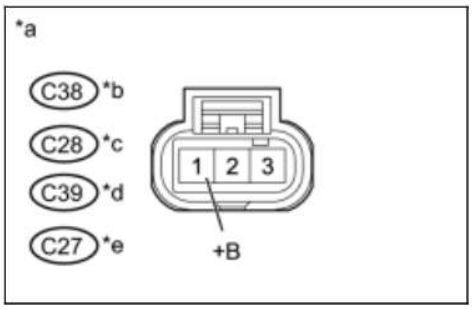
RESULT	PROCEED TO
Same DTC output	A
Different ignition coil DTC output	B

B ▶ **REPLACE IGNITION COIL**

A

▼

2.	**INSPECT TERMINAL VOLTAGE (POWER SOURCE OF IGNITION COIL)**



(a) Disconnect the ignition coil connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

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Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C38-1 (+B) - Body ground	Ignition switch ON	11 to 14 V
C28-1 (+B) - Body ground	Ignition switch ON	11 to 14 V
C39-1 (+B) - Body ground	Ignition switch ON	11 to 14 V
C27-1 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Ignition Coil)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (IGNITION COIL - BODY GROUND)**

(a) Disconnect the ignition coil connectors.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C38-2 (GND) - Body ground	Always	Below 1 Ω
C28-2 (GND) - Body ground	Always	Below 1 Ω
C39-2 (GND) - Body ground	Always	Below 1 Ω
C27-2 (GND) - Body ground	Always	Below 1 Ω

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

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OK

4.	CHECK HARNESS AND CONNECTOR (IGNITION COIL - ECM)

(a) Disconnect the ECM connector.

(b) Disconnect the ignition coil connectors.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-21 (IGT1) - C38-3 (IGT1)	Always	Below 1 Ω
A36-10 (IGT2) - C28-3 (IGT2)	Always	Below 1 Ω
A36-31 (IGT3) - C39-3 (IGT3)	Always	Below 1 Ω
A36-8 (IGT4) - C27-3 (IGT4)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-21 (IGT1) or C38-3 (IGT1) - Body ground	Always	10 kΩ or higher
A36-10 (IGT2) or C28-3 (IGT2) - Body ground	Always	10 kΩ or higher
A36-31 (IGT3) or C39-3 (IGT3) - Body ground	Always	10 kΩ or higher
A36-8 (IGT4) or- C27-3 (IGT4) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000YTB0FIX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0365,P0366,P0390,P0391: Camshaft Position Sensor "B" Circuit (Bank 1) (2013 FR-S)		

DTC	**P0365**	**Camshaft Position Sensor "B" Circuit (Bank 1)**

DTC	**P0366**	**Camshaft Position Sensor "B" Circuit Range / Performance (Bank 1)**

DTC	**P0390**	**Camshaft Position Sensor "B" Circuit (Bank 2)**

DTC	**P0391**	**Camshaft Position Sensor "B" Circuit Range / Performance (Bank 2)**

DESCRIPTION

The exhaust camshaft VVT sensors consist of a magnet and MRE (Magnetic Resistive Element).

The exhaust camshaft has a sensor plate with 2 teeth on its outer circumference.

When the exhaust camshaft rotates, changes occur in the air gaps between the 2 teeth and MRE, which affects the magnet. As a result, the resistance of the MRE material fluctuates. The VVT sensor converts the exhaust camshaft rotation data to pulse signals, uses the pulse signals to determine the camshaft angle, and sends it to the ECM.

The crank angle sensor generates 30 signals for each engine rotation. Based on combination of the VVT signals and NE signal, the ECM detects the crankshaft angle. Then the ECM uses this data to control fuel injection time and injection timing. Also, based on the NE signal, the ECM detects the engine speed.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0365	No VVT sensor for exhaust side signal input during crankshaft 7.5 rotations (bank 1). (1 trip detection logic)	• Open or short in VVT sensor circuit (for exhaust side of bank 1) • VVT sensor (for exhaust side of bank 1) • Exhaust camshaft (bank 1) • Jumped tooth of timing chain • ECM
P0366	2 VVT sensor for exhaust side signals are not output during crankshaft 2 rotations (bank 1). (1 trip detection logic)	
P0390	No VVT sensor for exhaust side signal input during crankshaft 7.5 rotations (bank 2). (1 trip detection logic)	• Open or short in VVT sensor circuit (for exhaust side of bank 2) • VVT sensor (for exhaust side of bank 2) • Exhaust camshaft (bank 2)
P0391	2 VVT sensor for exhaust side signals are not output during crankshaft 2 rotations (bank 2).	

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	(1 trip detection logic)	• Jumped tooth of timing chain • ECM

MONITOR DESCRIPTION

If no signal is transmitted by the VVT sensor despite the engine running, or the rotations of the camshaft and the crankshaft are not synchronized, the ECM interprets this as a malfunction of the sensor and the ECM illuminates the MIL and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0365: Camshaft Position Sensor "B" Circuit (Bank 1) P0366: Camshaft Position Sensor "B" Circuit Range / Performance (Bank 1) P0390: Camshaft Position Sensor "B" Circuit (Bank 2) P0391: Camshaft Position Sensor "B" Circuit Range / Performance (Bank 2)
Required sensors/Components (Main)	VVT sensor for exhaust side (bank 1 and 2)
Required sensors/Components (Related)	Crankshaft position sensor
Frequency of operation	Continuous
Duration	7.5 revolutions: P0365, P0390 2 revolutions: P0366, P0391
MIL operation	Immediately
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	None
Battery voltage	10.9 V or more
Elapsed time after engine start	0.2 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0365, P0390

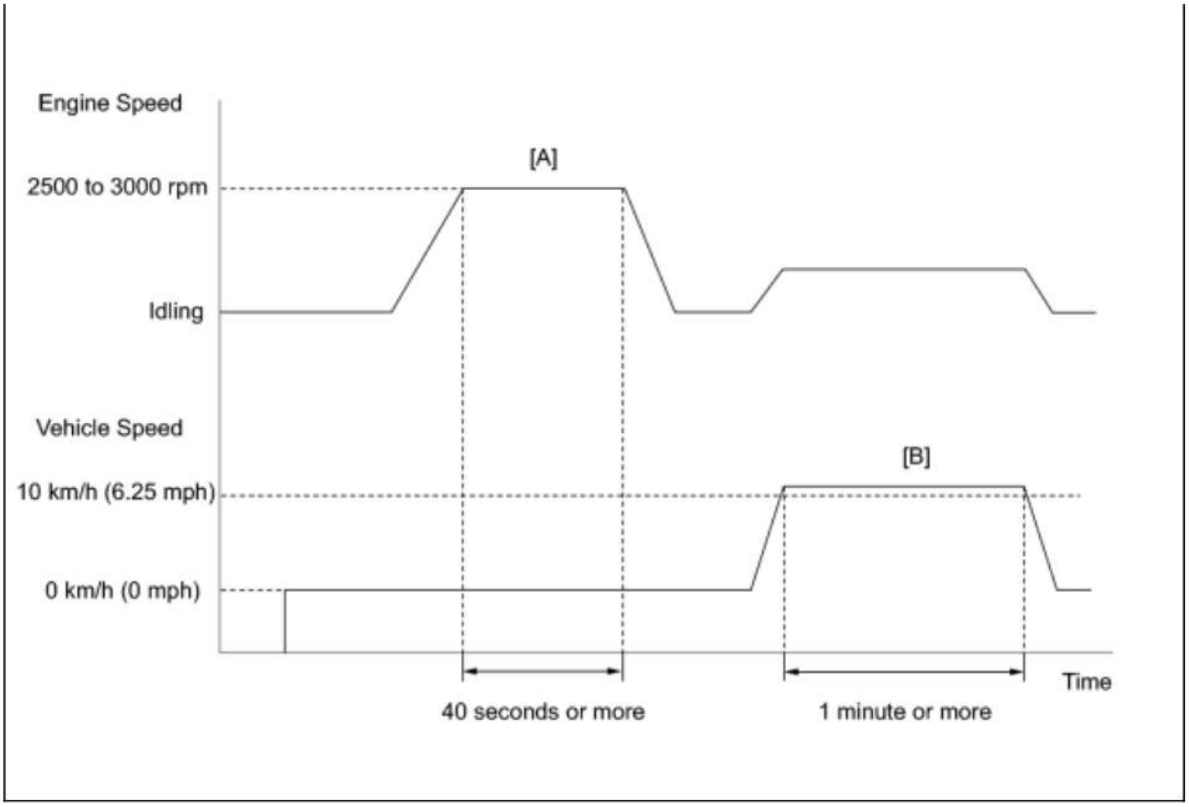
Exhaust VVT sensor signal	No signal

P0366, P0391

Exhaust VVT sensor signal during 2 revolutions	Not 2

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0365, P0366, P0390 or P0391.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal

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ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

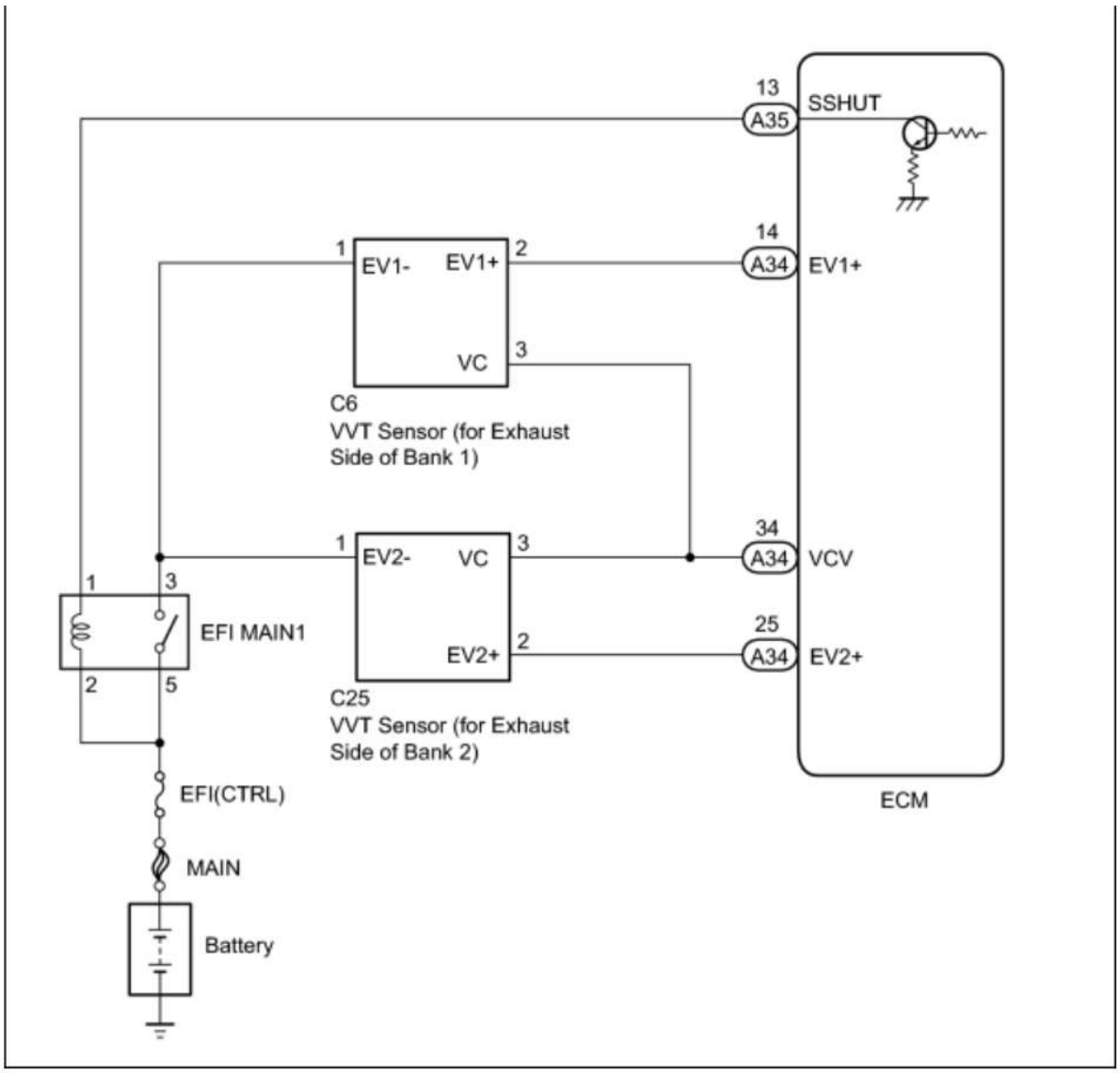
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

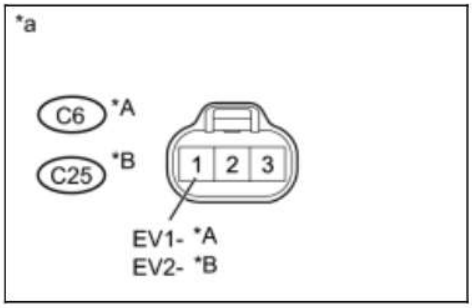
- If DTC P0365 or P0366 is displayed, check the VVT sensor circuit for the right bank (bank 1).
- If DTC P0390 or P0391 is displayed, check the VVT sensor circuit for the left bank (bank 2).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If no problem is found by this diagnostic troubleshooting procedure, troubleshoot the engine mechanical system.

PROCEDURE

1.	**CHECK VVT SENSOR FOR EXHAUST SIDE (SENSOR POWER SOURCE)**

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(a) Disconnect the VVT sensor for exhaust side connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C6-1 (EV1-) - Body ground	Ignition switch ON	11 to 14 V
C25-1 (EV2-) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to VVT Sensor for Exhaust Side)

NG ▶ **INSPECT RELAY (EFI MAIN1)**

OK
▼

2.	**CHECK HARNESS AND CONNECTOR (VVT SENSOR FOR EXHAUST SIDE - ECM)**

(a) Disconnect the ECM connector.

(b) Disconnect the VVT sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-14 (EV1+) - C6-2 (EV1+)	Always	Below 1 Ω
A34-25 (EV2+) - C25-2 (EV2+)	Always	Below 1 Ω

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A34-34 (VCV) - C6-3 (VC)	Always	Below 1 Ω
A34-34 (VCV) - C25-3 (VC)	Always	Below 1 Ω

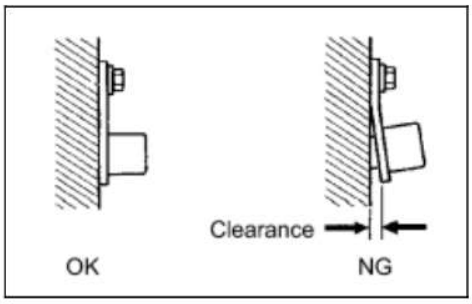
Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-14 (EV1+) or C6-2 (EV1+) - Body ground	Always	10 kΩ or higher
A34-25 (EV2+) or C25-2 (EV2+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C6-3 (VC) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C25-3 (VC) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (VVT SENSOR FOR EXHAUST SIDE - ECM)**

OK ▼

3.	**CHECK SENSOR INSTALLATION (VVT SENSOR FOR EXHAUST SIDE)**



(a) Check the VVT sensor installation.

OK:

Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL VVT SENSOR FOR EXHAUST SIDE**

OK ▼

4.	**CHECK CAMSHAFT TIMING GEAR ASSEMBLY (TEETH OF PLATE)**

(a) Check the teeth of the sensor plate.

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OK:

Sensor plate teeth do not have any cracks or deformation.

NG ▶ **REPLACE CAMSHAFT TIMING GEAR ASSEMBLY**

OK

▼

5.	**CHECK VALVE TIMING**

(a) Check the valve timing INFO .

NG ▶ **ADJUST VALVE TIMING**

OK

▼

6.	**REPLACE VVT SENSOR FOR EXHAUST SIDE**

(a) Replace the VVT sensor for exhaust side INFO .

NEXT

▼

7.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P0365, P0366, P0390 OR P0391)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Start the engine.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

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(i) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(j) Read the DTC.

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC P0365, P0366, P0390 or P0391 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

A ▶ **END**

8.	**INSPECT RELAY (EFI MAIN1)**

(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK ▼

9.	**CHECK HARNESS AND CONNECTOR (VVT SENSOR FOR EXHAUST SIDE - EFI MAIN1 RELAY)**

(a) Disconnect the VVT sensor for exhaust side connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 - C6-1 (EV1-)	Always	Below 1 Ω
EFI MAIN1 relay terminal 3 - C25-1 (EV2-)	Always	Below 1 Ω

Standard Resistance (Check for short):

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 or C6-1 (EV1-) - Body ground	Always	10 kΩ or higher
EFI MAIN1 relay terminal 3 or C25-1 (EV2-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (VVT SENSOR FOR EXHAUST SIDE - ECM)**

OK ▶ **GO TO ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM00000220S035X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0420: Catalyst System Efficiency Below Threshold (Bank 1) (2013 FR-S)		

DTC	**P0420**	**Catalyst System Efficiency Below Threshold (Bank 1)**

DESCRIPTION

The ECM uses sensors mounted in front of and behind the Three-Way Catalytic Converter (TWC) to monitor its efficiency.

The first sensor, the air fuel ratio sensor, sends pre-catalyst information to the ECM. The second sensor, the heated oxygen sensor, sends post-catalyst information to the ECM.

In order to detect any deterioration in the three-way catalytic converter, the ECM calculates the oxygen storage capacity of the three-way catalytic converter. This calculation is based on the voltage output of the heated oxygen sensor while performing active air fuel ratio control.

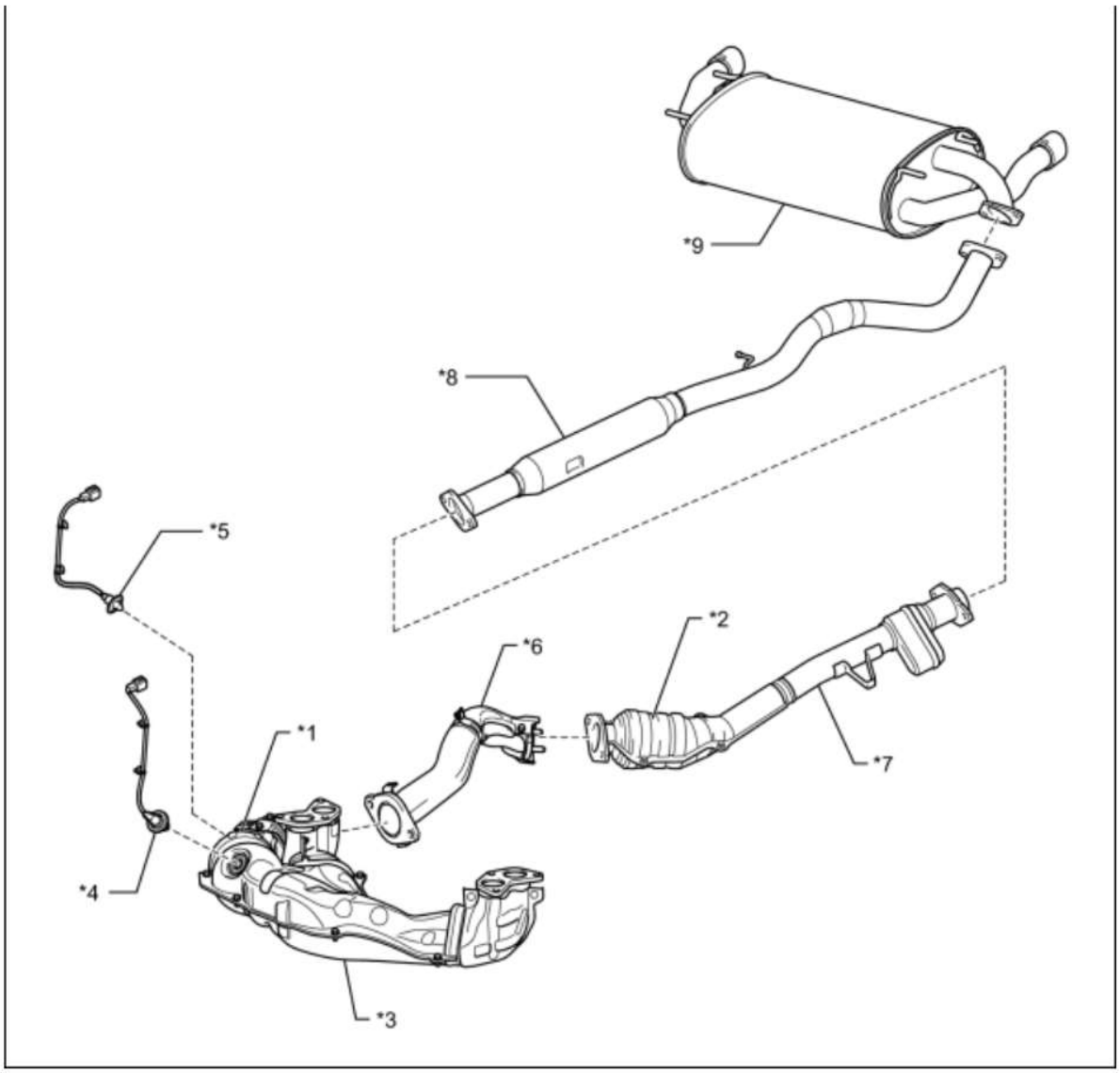
The ECM uses the oxygen storage capacity value to determine the state of the three-way catalytic converter. If any deterioration has occurred, the ECM illuminates the MIL and stores the DTC.

This system determines the deterioration of the entire catalyst system (including the front and rear catalysts), by using the oxygen storage capacity value of the front catalyst, that is more sensitive than the rear catalyst, as the representative value. Therefore, be sure to replace the front and rear catalysts together when catalyst replacement is necessary.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0420	Diagnostic value is more than the standard value under active air-fuel ratio control. (2 trip detection logic)	• Gas leakage from exhaust system • Air fuel ratio sensor • Heated oxygen sensor • Front exhaust manifold assembly (TWC: Front catalyst) and front exhaust pipe assembly (TWC: Rear catalyst)

CATALYST LOCATION

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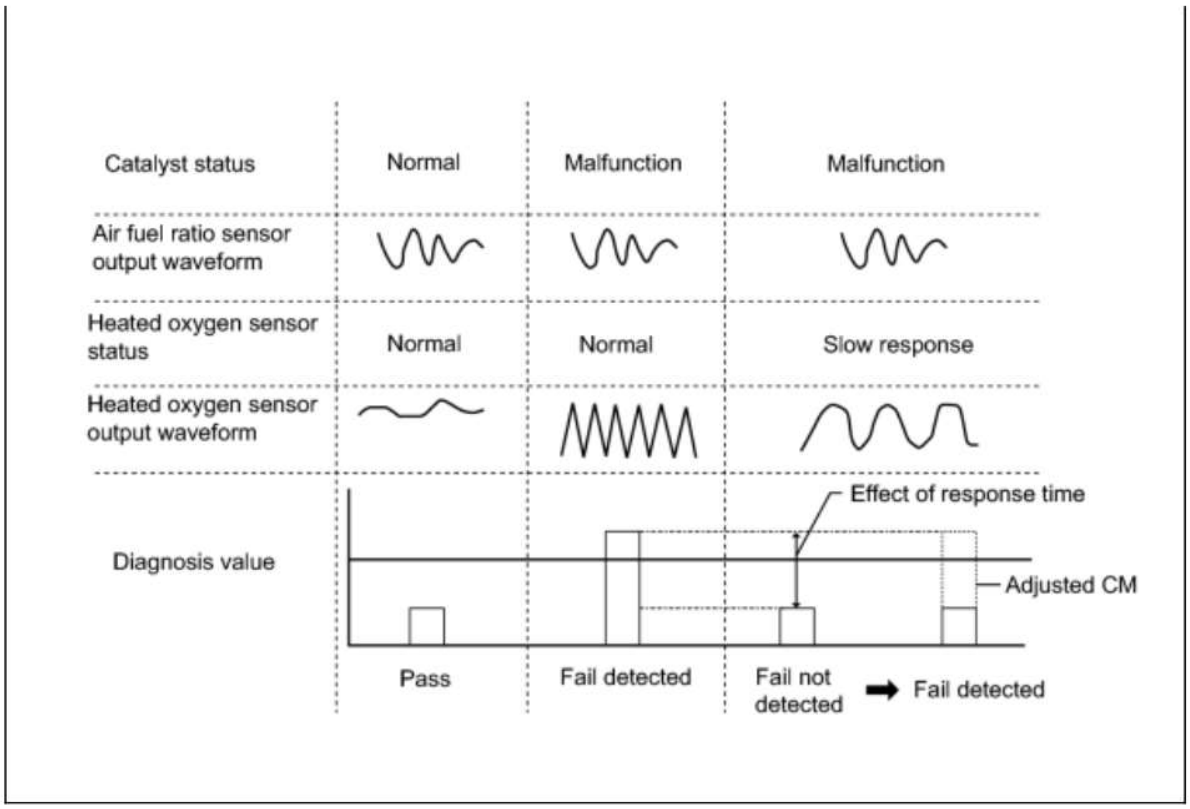
Text in Illustration

*1	TWC: Front Catalyst	*2	TWC: Rear Catalyst
*3	Exhaust Manifold	*4	Air Fuel Ratio Sensor
*5	Heated Oxygen Sensor	*6	Front Exhaust Pipe Sub-Assembly
*7	Front Exhaust Pipe Assembly	*8	Center Exhaust Pipe Assembly
*9	Tail Exhaust pipe Assembly	-	-

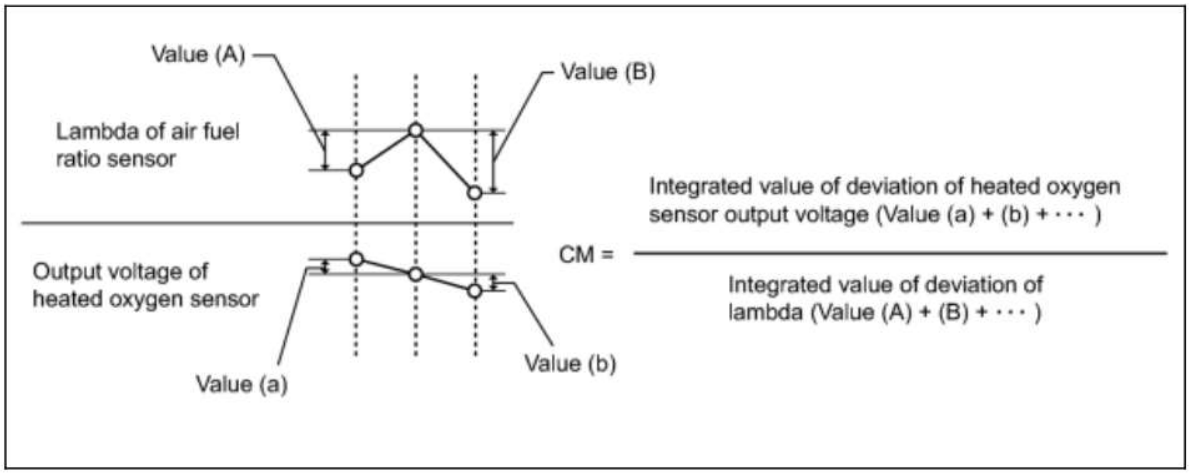
MONITOR DESCRIPTION

The ECM uses diagnostic values to determine deterioration of the catalyst. If the diagnostic value exceeds a specified value, the catalyst is considered deteriorated, and the DTC is stored.

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The diagnostic values are based upon the catalyst monitor value (CM) calculated by changes in the air fuel ratio sensor lambda and changes in the heated oxygen sensor output voltage, and in the response rate calculated from the heated oxygen sensor response time.



*: Diagnostic Value = CM X (1 + Response rate)

MONITOR STRATEGY

Related DTCs	P0420: Catalyst monitor with sufficient sensor performance for other monitors functional check
Required Sensors/Components (Main)	Air fuel ratio sensor Heated oxygen sensor
	Intake air temperature sensor

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Required Sensors/Components (Related)	Mass air flow meter Manifold absolute pressure sensor Crankshaft position sensor Engine coolant temperature sensor
Frequency of Operation	Once per driving cycle
Duration	30 to 55 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs are not present	P0030, P0031, P0032 (Air fuel ratio sensor - heater) P0037, P0038 (Heated oxygen sensor - heater) P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0101, P0102, P0103 (Mass air flow (MAF) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0131, P0132 (Air fuel ratio sensor - ECM input voltage) P0134, P2195, P2196 (Air fuel ratio sensor - output voltage) P0137, P0138 (Heated oxygen sensor - a lack of circuit continuity) P0140 (Heated oxygen sensor - output voltage) P0461, P0462, P0463 (Fuel level sensor (FL)) P0500 (Vehicle speed sensor (VSS)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2096, P2097 (Post catalyst fuel trim system) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Engine coolant temperature	60°C (140°F) or more
Battery voltage	10.9 V or more
Fuel system status	Closed loop
Intake air mass per second	5 g/sec or more, and less than 30 g/sec
Estimated exhaust gas temperature in a catalyst	440°C (824°F) or more
Elapsed time	

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(difference between actual and target lambda < 0.15)	1 second
Vehicle speed	70 km (43.4 mph) or higher
Change of intake air mass during 1/2 engine rev.	Less than 0.02 g/rev
Heated oxygen sensor output change, lean to rich after fuel cut	Experienced
Evaporative system monitor	Not active
Integrated time of canister purge after engine start	35 seconds or more
Learning value of EVAP density during purge	Less than 0.2
Estimated temperature of secondary oxygen sensor element	500°C or higher
Integrated amount of intake air per second	4800 g or more (varies with estimated ambient temperature)
Atmospheric pressure	75.06 kPa [563 mmHg] or more

TYPICAL MALFUNCTION THRESHOLDS

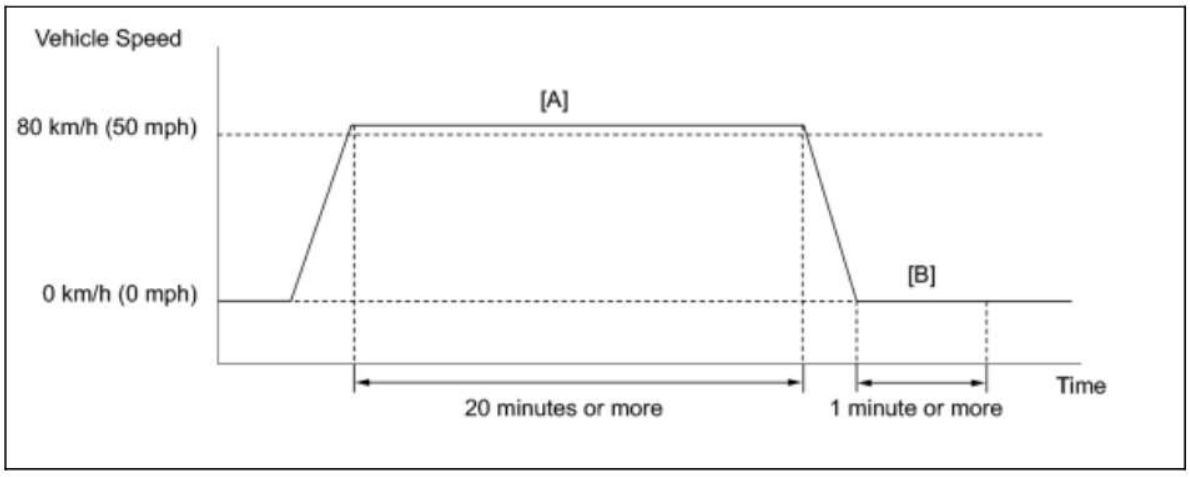
Diagnostic value*	10 or more

*: Refer to Monitor Description

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.

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6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

HINT:

Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0420.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

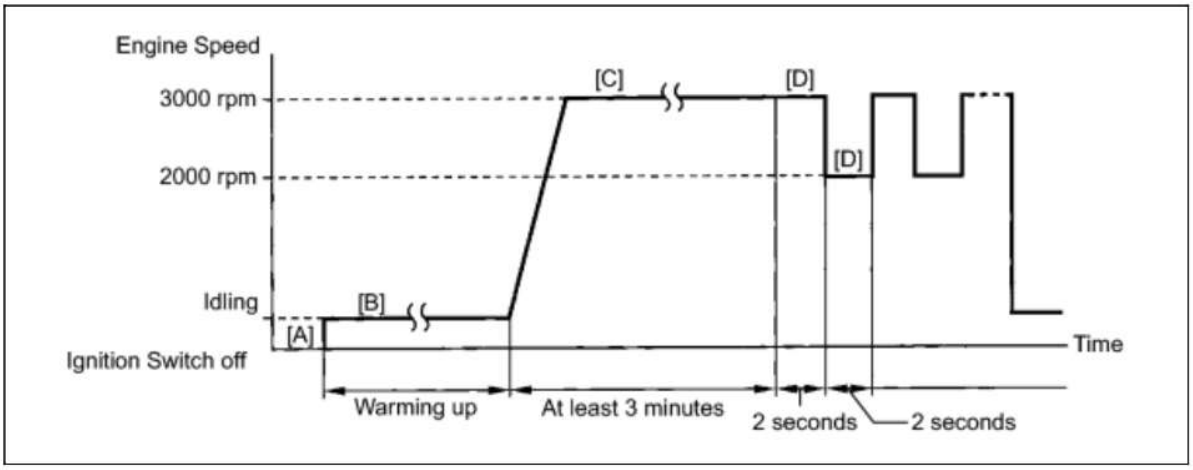
HINT:

- If a permanent DTC is output, the system is malfunctioning.

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If no permanent DTC is output, the system is normal.

CONDITIONING FOR SENSOR TESTING

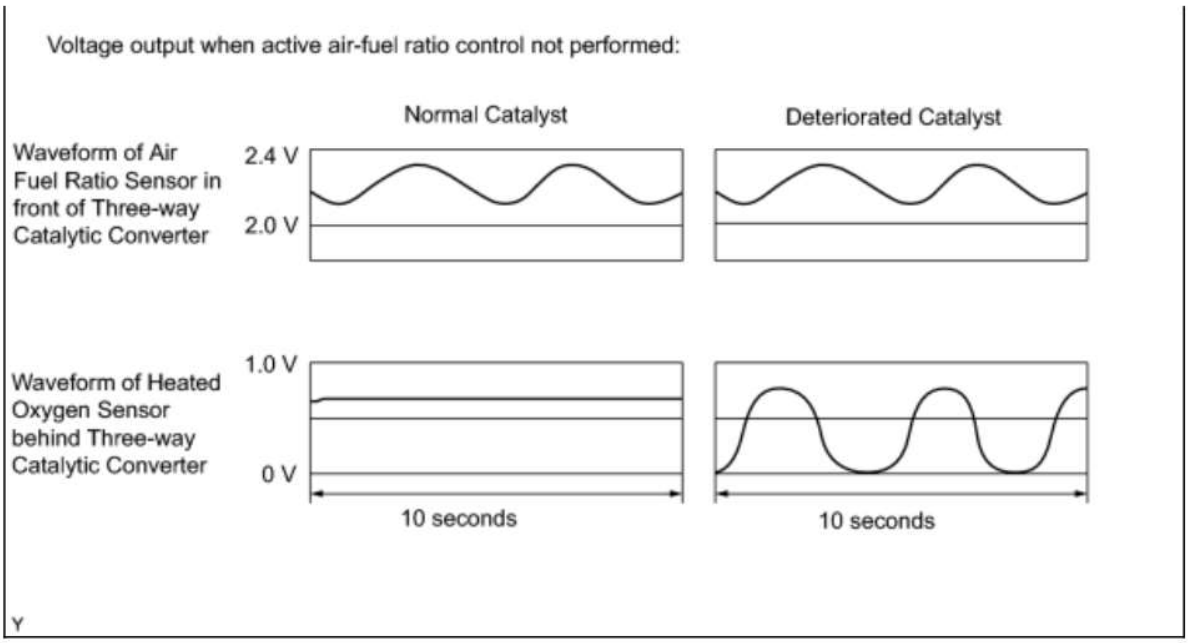


1. Connect the Techstream to the DLC3 [A].
2. Start the engine and warm it up with all the accessories switched off, until the engine coolant temperature stabilizes [B].
3. Run the engine at an engine speed of between 2500 rpm and 3000 rpm for at least 3 minutes [C].
4. While running the engine at 3000 rpm and 2000 rpm for 2 seconds, check the waveforms of the air fuel ratio and heated oxygen sensors using the Techstream [D].

HINT:

- If either of the voltage outputs of either the air fuel ratio or heated oxygen sensor does not fluctuate, or either of the sensors makes a noise, the sensor may be malfunctioning.
- If the voltage outputs of both the sensors remain lean or rich, the air fuel ratio may be extremely lean or rich. In such cases, enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor.
- If the three-way catalytic converter has deteriorated, the heated oxygen sensor (located behind the three-way catalytic converter) voltage output fluctuates up and down frequently, even under normal driving conditions (active air fuel ratio control is not performed).

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INSPECTION PROCEDURE

HINT:

- If a malfunction cannot be found when troubleshooting DTC P0420, a lean or rich abnormality may be the cause. Perform troubleshooting by following the inspection procedure for P0171 (System Too Lean) and P0172 (System Too Rich).
- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO

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DTC P0420 is output	A
DTC P0420 and other DTCs are output	B

HINT:

If any DTCs other than P0420 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**PERFORM ACTIVE TEST USING TECHSTREAM (Control the Injection Volume)**

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up.

(c) Turn the Techstream on.

(d) Run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume

(f) Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).

(g) Monitor the voltage outputs of the air fuel ratio sensor and heated oxygen sensor (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of - 12.5% to +12.5%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

Standard:

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	+12.5%	Rich	Below 2.0 V
	-12.5%	Lean	Higher than 2.4 V
O2S B1S2 (Heated oxygen)	+12.5%	Rich	Higher than 0.55 V
	-12.5%	Lean	Below 0.4 V

Result:

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STATUS AFS VOLTAGE B1S1	STATUS O2S B1S2	A/F CONDITION AND A/F AND HO2 SENSOR CONDITIONS	MISFIRE	MAIN SUSPECTED TROUBLE AREAS	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	• Three-Way Catalytic Converter (TWC) • Gas leakage from exhaust system	A
Lean	Lean/Rich	Air fuel ratio sensor malfunction	-	• Air fuel ratio sensor	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	-	• Air fuel ratio sensor	
Lean/Rich	Lean	Heated oxygen sensor malfunction	-	• Heated oxygen sensor • Gas leakage from exhaust system	C
Lean/Rich	Rich	Heated oxygen sensor malfunction	-	• Heated oxygen sensor • Gas leakage from exhaust system	
Lean	Lean	Actual air-fuel ratio lean	May occur	• Extremely rich or lean actual air-fuel ratio • Gas leakage from exhaust system	D
Rich	Rich	Actual air-fuel ratio lean	-	• Extremely rich or lean actual air-fuel ratio • Gas leakage from exhaust system	

Lean: During Control the Injection Volume for A/F Sensor, the air fuel ratio sensor output voltage (AFS Voltage B1S1) is consistently higher than 2.4 V, and the heated oxygen sensor output voltage (O2S B1S2) is consistently below 0.4 V.

Rich: During Control the Injection Volume for A/F Sensor, the AFS Voltage B1S1 is consistently below 2.0 V, and the O2S B1S2 is consistently higher than 0.55 V.

Lean/Rich: During Control the Injection Volume for A/F Sensor of the Active Test, the output voltage of the air fuel ratio sensor and heated oxygen sensor alternate correctly.

B ▶ **REPLACE AIR FUEL RATIO SENSOR**

C ▶ **CHECK FOR EXHAUST GAS LEAK**

D ▶ **CHECK FOR EXHAUST GAS LEAK**

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A

3.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK

4.	REPLACE EXHAUST MANIFOLD (TWC: FRONT CATALYST)

(a) Replace the exhaust manifold (TWC: front catalyst) INFO .

NEXT ▶ REPLACE FRONT EXHAUST PIPE ASSEMBLY (TWC: REAR CATALYST)

5.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▶ REPLACE HEATED OXYGEN SENSOR

6.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

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NG ▶ REPAIR OR REPLACE EXHAUST GAS LEAK POINT

OK ▶ CHECK CAUSE OF EXTREMELY RICH OR LEARN ACTUAL AIR FUEL RATIO



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000SWF0AFX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0441: Evaporative Emission Control System Incorrect Purge Flow (2013 FR-S)		

DTC	**P0441**	**Evaporative Emission Control System Incorrect Purge Flow**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0441	Purge flow	While engine running, following conditions successively met: • The pressure difference between non-purge and purge is less than 0.075 kPa (gauge) [1 mmHg (gauge)]. • Regardless of forced vent valve on (close) and purge being carried out, the pressure difference between non-purge and purge is less than 0.075 kPa (gauge) [1 mmHg (gauge)].	• Purge valve • Purge line • Connector/wire harness (Purge valve - ECM) • ECM • Leak from EVAP system	While engine running	2 trip

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DESCRIPTION

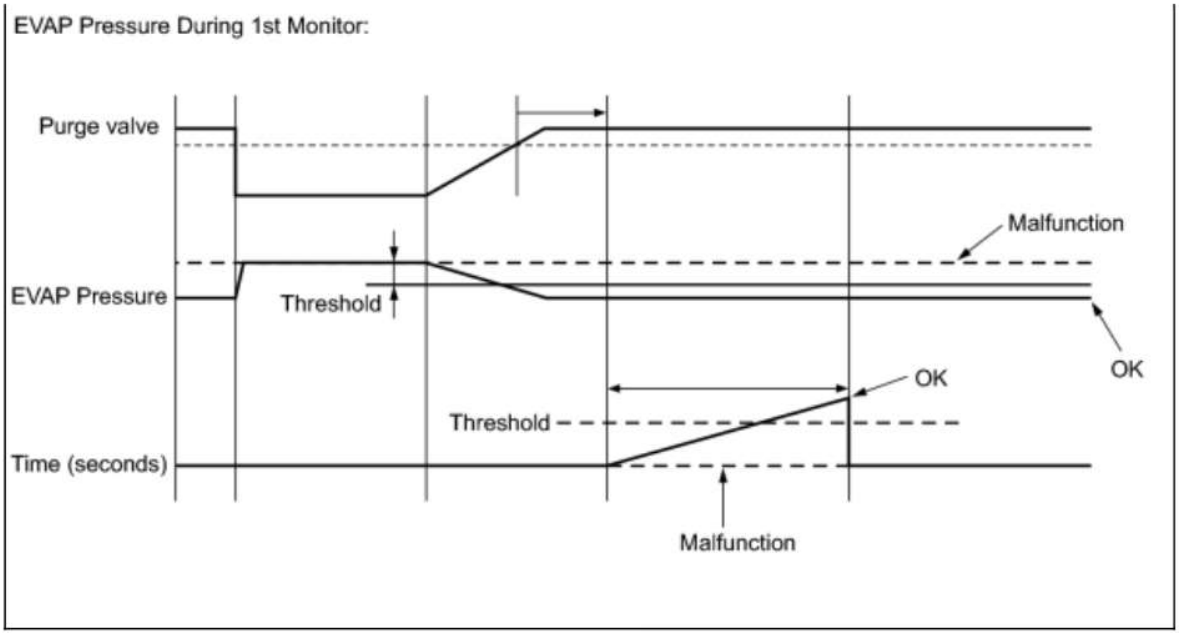
The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

The purge flow monitor runs while the engine is running. The purge flow monitor consists of 2 monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

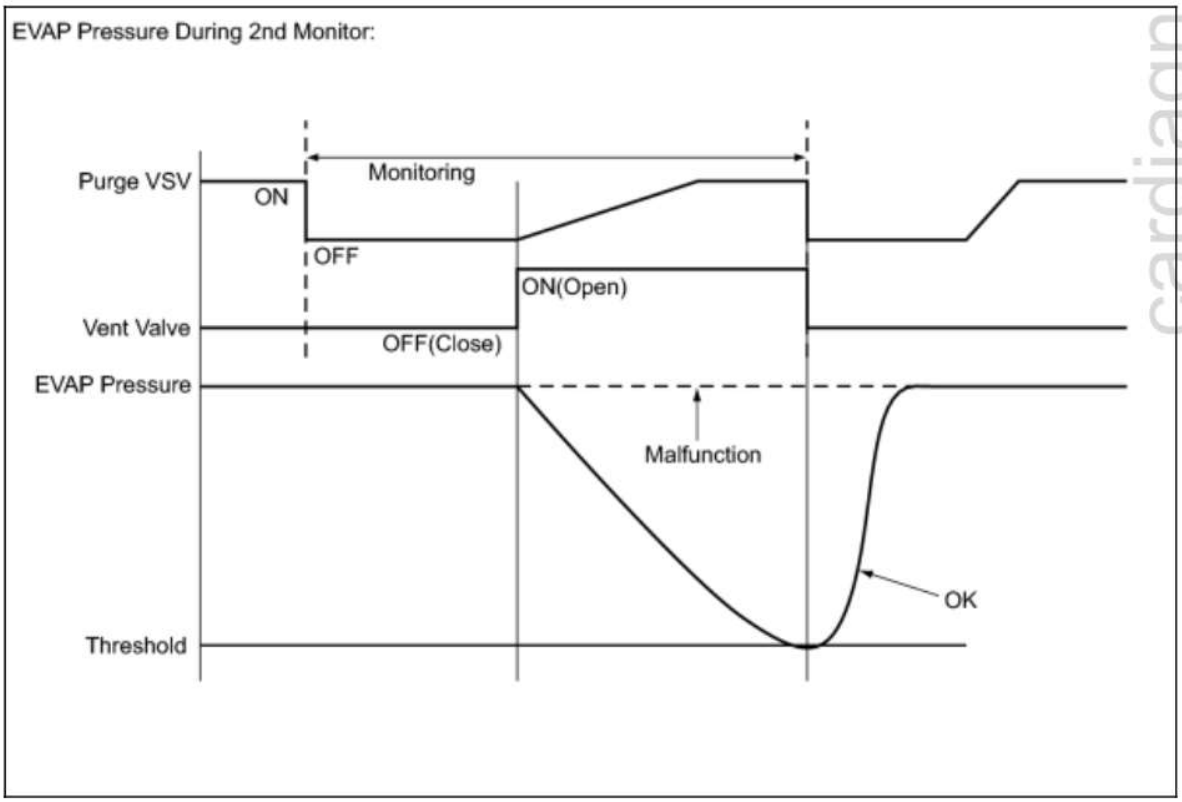
- The 1st monitor

  While the engine is running and the purge valve is on (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If the variation in the pressure is more than threshold, the ECM begins the 2nd monitor.



- The 2nd monitor

  The vent valve is turned on (closed) and the EVAP pressure is then measured. If the variation in the pressure is more than threshold, the ECM interprets this as the purge valve being stuck closed, and illuminates the MIL and stores DTC P0441 (2 trip detection logic).



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MONITOR STRATEGY

Related DTC	P0441: Incorrect purge flow in ELCM functional check

Required Sensors/Components (Main)	Purge valve Canister pump module
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	26 seconds: 1st stage 21 seconds: 2nd stage
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

1st Stage

Battery voltage	10.9 V or higher
Atmospheric pressure	75.06 kPa(abs) [563 mmHg(abs)] or higher
Learning value of EVAP density during purge	Less than 0.2
Integrated time of canister purge after engine start	120 seconds or more

2nd Stage

Battery voltage	10.9 V or higher
Atmospheric pressure	75.06 kPa(abs) [563 mmHg(abs)] or higher
Engine speed	1050 rpm or higher
Vehicle speed	30 km/h (18.6 mph) or higher
Integrated time of canister purge after engine start	120 seconds or more
Learning value of EVAP density during purge	Less than 0.2
Fuel system status	Closed loop
Lambda	0.76 to 1.25
Ambient temperature	-25.0°C (-13°F) or higher
Short-term fuel trim	0.9 or higher

TYPICAL MALFUNCTION THRESHOLDS

1st Stage

Pressure without purge - Pressure with purge	Less than 0.075 kPa(gauge) [1 mmHg(gauge)]

2nd Stage

Pressure without purge - Pressure with purge	Less than 0.666 kPa(gauge) [5 mmHg(gauge)]

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MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and wait 15 minutes or more.
7. Enter the following menus: Powertrain / Engine / Trouble Codes.
8. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine / Utility / All readiness.
10. Input the DTC: P0441.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ You should perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.
- If the judgment result shows INCOMPLETE or N/A, perform the following procedure.

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms

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and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

12. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
13. Turn the ignition switch off and wait for at least 30 seconds.
14. Turn the ignition switch to ON and turn the Techstream on.
15. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.
16. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All Readiness.
17. Input the DTC: P0441.
18. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

19. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	**PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE VSV FOR EVAP CONTROL)**

(a) Connect a Techstream to the DLC3.

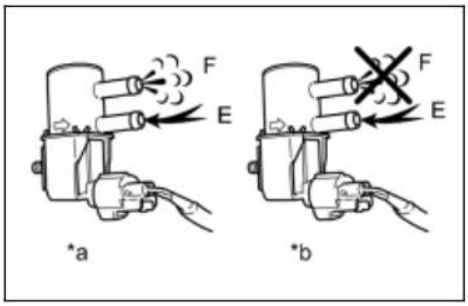
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(b) Disconnect the vacuum hose (canister side) from the purge valve.

(c) Start the engine.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Active Test / Activate the VSV for EVAP Control.



(f) When the purge valve is operated using the Techstream, check whether the port of the purge valve applies suction to your finger.

OK:

TESTER OPERATION	TESTER OPERATION
VSV ON	Purge valve port applies suction to finger
VSV OFF	Purge valve port applies no suction to finger

Text in Illustration

*a	Purge valve ON
*b	Purge valve OFF

NG ▶ **REPLACE PURGE VALVE**

OK ▼

2.	**INSPECT EVAP LEAK PART**

(a) Check for leakage from EVAP system (hose, disconnection, cracks, etc.).

OK:

No leakages in the EVAP purge line

NG ▶ **REPAIR OR REPLACE EVAP PURGE LINE**

OK ▼

3.	**REPLACE PURGE VALVE**

(a) Replace the purge valve INFO .

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NEXT ▶ PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)

4.	REPAIR OR REPLACE EVAP PURGE LINE

NEXT ▼

5.	PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine / Trouble Codes.

Result

RESULT	PROCEED TO
EVAP system DTCs are output	A
No DTCs output (No pending DTCs output)	B

B ▶ END

A ▼

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6.	**REPLACE ECM**

(a) Replace the ECM INFO .

NEXT

7.	**PERFORM EVAP SYSTEM CHECK (AUTOMATIC MODE)**

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine / Trouble Codes.

HINT:

If no pending DTCs are found, the repair has been successfully completed.

NEXT **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000012MC083X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0451-P0453: Evaporative Emission Control System Pressure Sensor Range / Performance (2013 FR-S)		

DTC	**P0451**	**Evaporative Emission Control System Pressure Sensor Range / Performance**

DTC	**P0452**	**Evaporative Emission Control System Pressure Sensor / Switch Low Input**

DTC	**P0453**	**Evaporative Emission Control System Pressure Sensor / Switch High Input**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0451	Difference between canister pressure sensor output value and manifold absolute pressure sensor output value	The difference between the canister pressure sensor output value and the manifold absolute pressure sensor output value with the ignition switch ON is large.	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch off) • Engine running	2 trip
P0452	Canister pressure sensor low input	EVAP pressure sensor less than 0.973 V for 1 second.		• Ignition switch ON • EVAP monitoring (ignition switch off)	1 trip
P0453	Canister pressure sensor high input	EVAP pressure sensor more than 4.095 V for 1 second.		• Ignition switch ON • EVAP monitoring (ignition switch off)	1 trip

HINT:

The canister pressure sensor is built into the canister pump module.

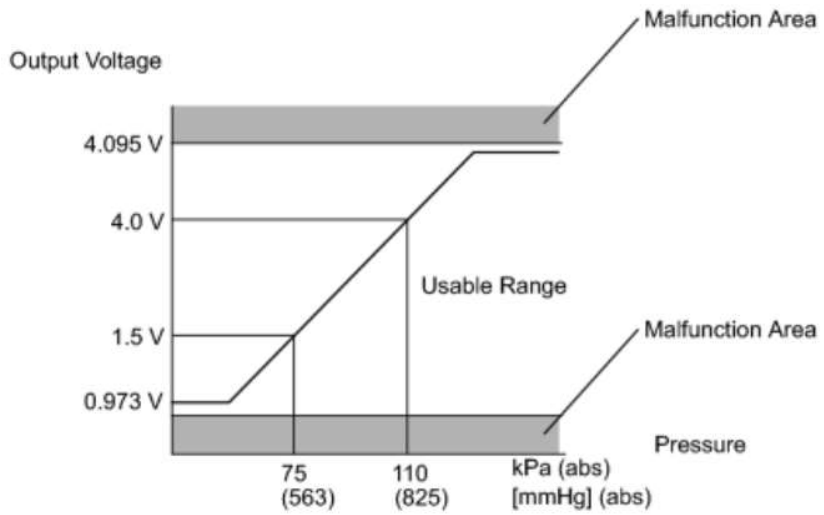
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DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

Canister Pressure Sensor Specification (fig. 2)



HINT:

Standard atmospheric pressure is 101.3 kPa (abs) [760 mmHg (abs)]

1. DTC P0451: Difference between canister pressure sensor output value and manifold absolute pressure sensor output value

   If the difference between the atmospheric pressure calculated using the canister pressure sensor and that calculated using the MAP sensor exceeds the specified value, then the ECM determines there is a canister pressure sensor abnormality. The ECM then illuminates the MIL and stores the DTC (2 trip detection logic).
2. DTC P0452: Canister pressure sensor voltage low

   If the canister pressure sensor voltage output (pressure) is below 0.973 V: 51.71 kPa(abs) [388 mmHg(abs)], the ECM interprets this as an open or short circuit in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and stores the DTC (1 trip detection logic).
3. DTC P0453: Canister pressure sensor voltage high

   If the canister pressure sensor voltage output (pressure) is 4.095 V: 108.99 kPa(abs) [818 mmHg(abs)] or more, the ECM interprets this as an open or short circuit in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and stores the DTC (1 trip detection logic).

MONITOR STRATEGY

	P0451: ELCM pressure sensor rationality

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Related DTC	P0452: ELCM pressure sensor range check (Low voltage) P0453: ELCM pressure sensor range check (High voltage)
Required Sensors/Components (Main)	Canister pump module
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle: P0451 Continuous: P0452, P0453
Duration	0.328 seconds: P0451 1 second: P0452, P0453
MIL Operation	2 driving cycles: P0451 Immediately: P0452, P0453
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None

P0451

Ignition switch	On
Elapsed time after ignition switch ON	0.5 to 60 seconds
Soak time	60 seconds or more
ELCM vacuum pump	Not active
ELCM switching valve	Off (Open)
Purge control	Not active

P0452, P0453

Battery voltage	10.9 V or more
Either of the following conditions is met:	A or B
A. Ignition switch	On
B. Activated by soak timer	Satisfied

TYPICAL MALFUNCTION THRESHOLDS

P0451

ELCM pressure at ignition switch ON - MAP at ignition switch ON	Higher than 4.7329 KPa (36 mmHg)

P0452

ELCM pressure sensor output voltage [ELCM pressure]	Less than 0.973 V [51.71 KPa (388 mmHg)]

P0453

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ELCM pressure sensor output voltage [ELCM pressure]	More than 4.095 V [108.99 KPa (818 mmHg)]

COMPONENT OPERATING RANGE

ELCM pressure sensor output voltage [ELCM pressure]	1.016 to 4.087 V [52.49 to 108.85 KPa (394 to 817 mmHg)]

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Enter the following menus: Powertrain / Engine / Data List / Intake Air.
4. Check that the intake air temperature is between 4.4 and 35°C (40 and 95°F).
5. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
6. Turn the ignition switch off and wait for at least 30 seconds.
7. Turn the ignition switch to ON and turn the Techstream on.
8. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.
9. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All readiness.
10. Input the DTC: P0451, P0452 or P0453.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has

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	reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

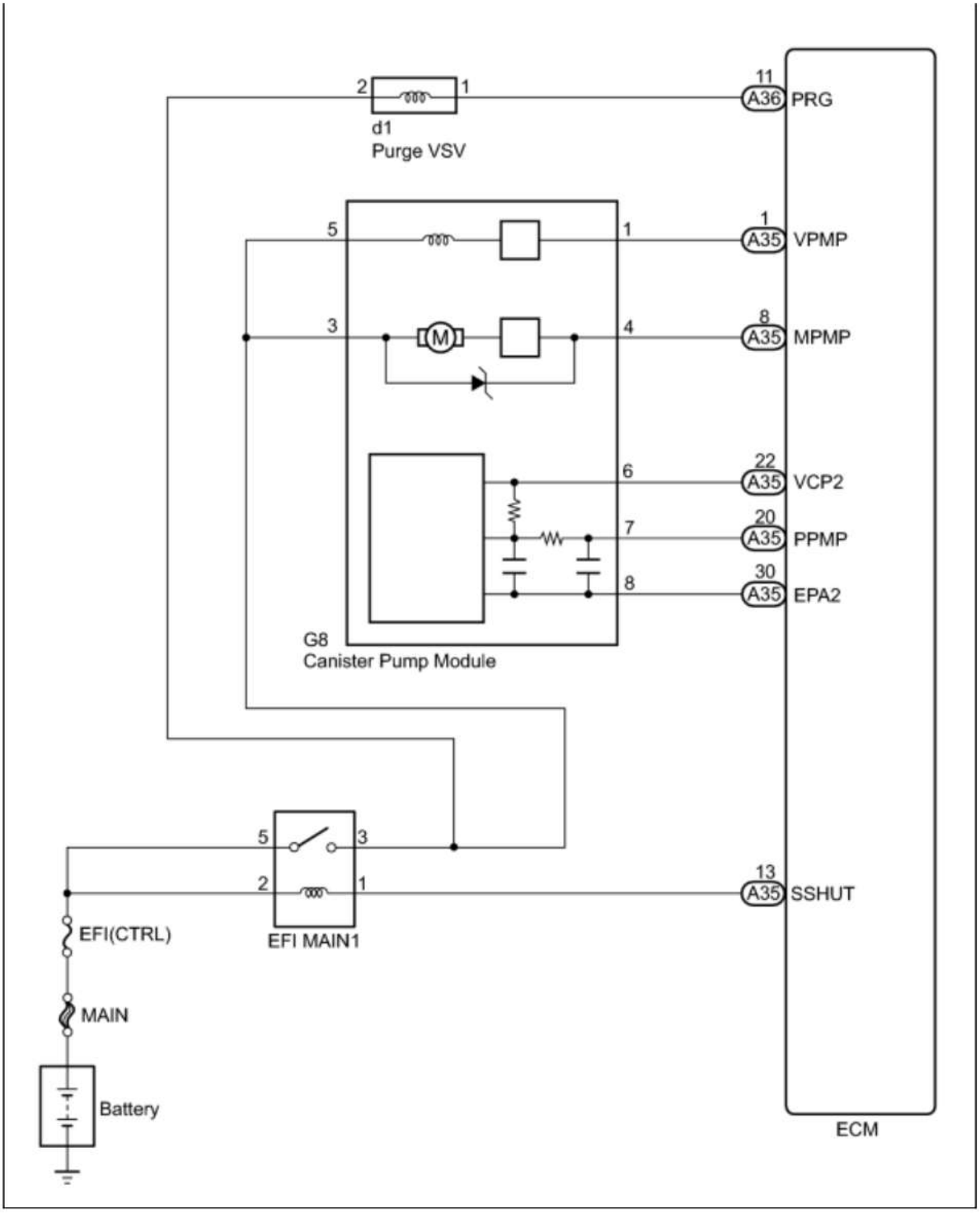
12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

- When a vehicle is brought into the workshop, leave it as it is. Do not change the vehicle condition. For example, do not tighten the fuel cap.
- Do not disassemble the canister pump module.
- The Techstream is required to conduct the following diagnostic troubleshooting procedure.
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	**CONFIRM DTC AND EVAP PRESSURE**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON (do not start the engine).

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

(f) Enter the following menus: Powertrain / Engine / Data List / Vapor Pressure Pump.

(g) Read the EVAP (Evaporative Emission) pressure displayed on the Techstream.

Result

DISPLAY (DTC OUTPUT)	TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
P0451	-	• Canister pressure sensor • Manifold absolute pressure sensor	C
P0452	Below 75 kPa(abs) [563 mmHg(abs)]	• Wire harness/connector (ECM - Canister pressure sensor) • Canister pressure sensor • Short in ECM circuit	A
P0453	Higher than 110 kPa(abs) [825 mmHg(abs)]	• Wire harness/connector (ECM - Canister pressure sensor) • Canister pressure sensor • Open in ECM circuit	B

B ▶ **CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)**

C ▶ **READ VALUE USING TECHSTREAM (ATMOSPHERE PRESSURE)**

A ▼

2.	**CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)**

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(a) Turn the ignition switch off.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Result

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
A35-20 (PPMP) - Body ground	Always	Below 10 Ω	• Wire harness/connector (ECM - Canister pressure sensor) • Short in canister pressure sensor circuit	A
		10 kΩ or higher	• Wire harness/connector (ECM - Canister pressure sensor) • Short in ECM circuit	B

B ▶ **READ VALUE USING TECHSTREAM (ATMOSPHERE PRESSURE)**

A ▼

3.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Disconnect the canister pump module connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Result

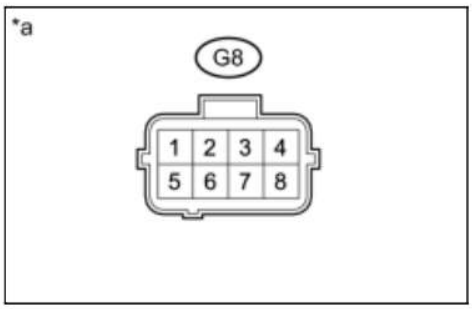
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
A35-20 (PPMP) - Body ground	Always	10 kΩ or higher	Short in canister pressure sensor circuit	A
		Below 10 Ω	Short in wire harness/connector (ECM - Canister pressure sensor)	B

A ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)**

B ▶ **REPLACE ECM**

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4.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)



(a) Disconnect the canister pump module connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G8-8 - Body ground	Always	100 Ω or less

(c) Turn the ignition switch to ON.

(d) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
G8-6 - Body ground	Ignition switch ON	4.5 to 5.5 V
G8-7 - Body ground	Ignition switch ON	4.5 to 5.5 V

Result

TEST RESULT	SUSPECTED TROUBLE AREA	PROCEED TO
Voltage and resistance within standard ranges	Open in canister pressure sensor circuit	A
Voltage and/or resistance outside standard ranges	Open in wire harness/connector (ECM - Canister pressure sensor)	B

Text in Illustration

*a	Front view of wire harness connector (to Canister Pump Module)

B ▶ REPLACE ECM

A

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5.	**REPLACE CANISTER PUMP MODULE**

(a) Replace the canister pump module INFO .

NEXT ▶ **CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)**

6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR (CANISTER PUMP MODULE - ECM)**

NEXT ▶ **CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)**

7.	**REPLACE ECM**

(a) Replace the ECM INFO .

NEXT ▶ **CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)**

8.	**READ VALUE USING TECHSTREAM (ATMOSPHERE PRESSURE)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Atmosphere Pressure.

(e) Compares Atmosphere Pressure displayed with the Techstream to the actual atmosphere pressure.

Result

RESULT	PROCEED TO
Difference with the actual atmosphere pressure is less than 27 kPa (abs) [203 mmHg (abs)].	A
Difference with the actual atmosphere pressure is 27 kPa (abs) [203 mmHg (abs)] or more.	B

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B ▶ REPLACE CANISTER PUMP MODULE

A ▼

9.	READ VALUE USING TECHSTREAM (MAP)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / MAP.

(e) Compares the MAP displayed with the Techstream to the actual atmosphere pressure.

Result

RESULT	PROCEED TO
Difference with the actual atmosphere pressure is less than 27 kPa (abs) [203 mmHg (abs)].	A
Difference with the actual atmosphere pressure is 27 kPa (abs) [203 mmHg (abs)] or more.	B

B ▶ REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

A ▶ CHECK INTERMITTENT PROBLEMS

10.	REPLACE CANISTER PUMP MODULE

(a) Replace the canister pump module INFO .

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

11.	REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor INFO .

NEXT ▶ CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

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12.	CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Perform the Evaporative System Check using the Techstream, referring to the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(j) Input the DTC: P0451, P0452 or P0453.

(k) Check the DTC judgment result.

Result

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

NEXT END

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000SWH09OX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0455,P0456,P1451,P2404: Evaporative Emission Control System Leak Detected (Gross Leak) (2013 FR-S)		

DTC	**P0455**	**Evaporative Emission Control System Leak Detected (Gross Leak)**

DTC	**P0456**	**Evaporative Emission Control System Leak Detected (Very Small Leak)**

DTC	**P1451**	**Fuel Tank Pressure Sensor Range/Performance**

DTC	**P2404**	**Evaporative Emission System Leak Detection Pump Sense Circuit Range / Performance**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P0455	EVAP gross leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. Reference pressure is measured at start and end of leak check. If stabilized pressure is higher than [second reference pressure x 0.377], ECM determines that EVAP system has a large leak.	• Fuel cap (loose) • Leakage from EVAP line (canister - fuel tank) • Leakage from EVAP line (purge valve - canister) • Leakage from canister pump module • Leakage from fuel tank • Leakage from	While ignition switch off	2 trip
P0456	EVAP small leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure is measured. Reference pressure measured at start and end of leak check. If stabilized pressure is higher than second reference pressure, ECM determines that EVAP system has a small leak.		While ignition switch on	2 trip

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			canister		
P1451	EVAP clogged	A blockage in the EVAP system pipe is detected.	• Blockage in EVAP line (canister - fuel tank) • Blockage in EVAP line (purge valve - canister) • Blockage in canister pump module	While ignition switch on	2 trip
P2404	EVAP malfunction	Leak detection pump ending pressure is more than the threshold. The difference between the leak detection pump highest pressure and lowest pressure is the threshold value or more. The vent valve abnormality is detected.	• Leak detection pump	While ignition switch on	2 trip

DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

5 hours*1 after the ignition switch is turned off, the leak detection pump creates negative pressure (vacuum) in the EVAP (Evaporative Emission) system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:

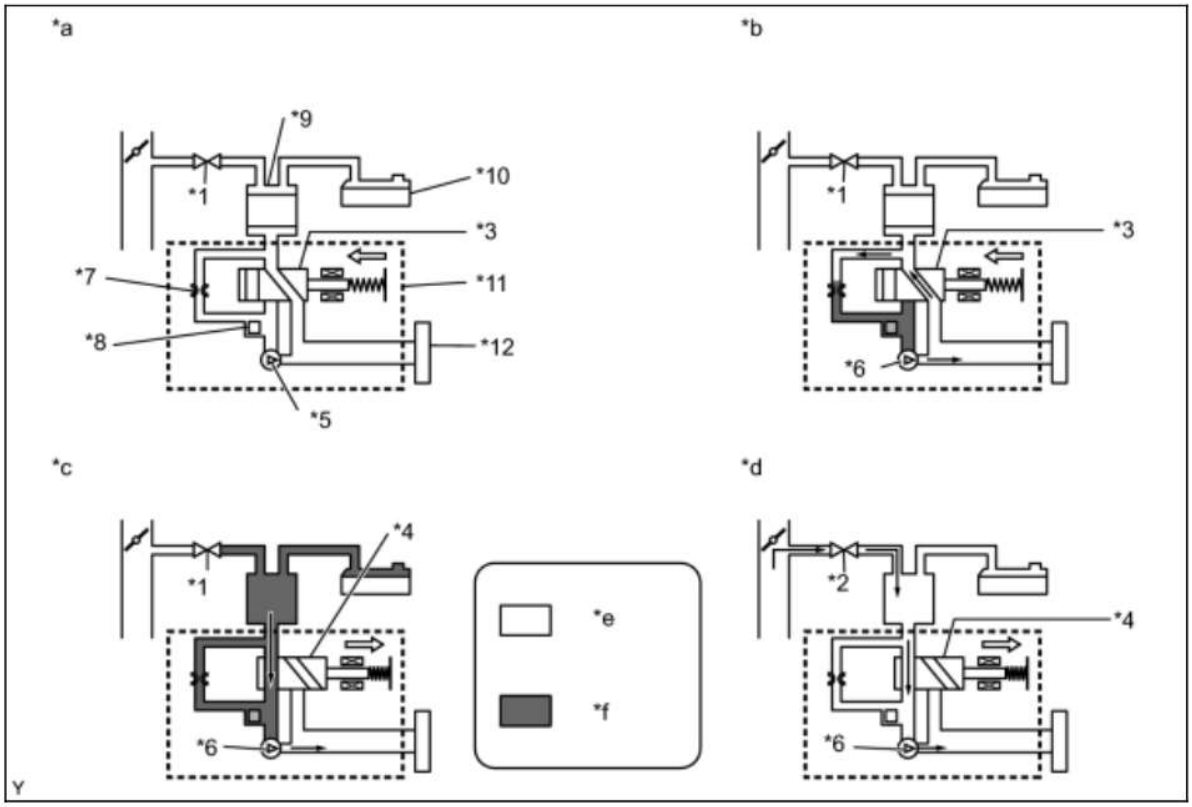
***: If the enable conditions are not satisfied 5 hours after the ignition switch is turned off, the monitor check starts 2 hours later. If the enable conditions are still not satisfied 7 hours after the ignition switch is turned off, the monitor check starts 2.5 hours later.**

SEQUENCE	OPERATION	DURATION
A	Leak detection pump monitor	300 seconds
B	First reference pressure measurement	40 seconds
C	Vent valve monitor	12 seconds
D	Pipe clogging monitor	900 seconds

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E	Second reference pressure measurement	40 seconds

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.



Text in Illustration

*1	Purge valve: OFF (closed)	*2	Purge valve: ON (open)
*3	Vent Valve: OFF (vent)	*4	Vent Valve: ON (closed)
*5	Leak Detection Pump: OFF	*6	Leak Detection Pump: ON
*7	Reference Orifice (0.02 inch)	*8	Canister Pressure Sensor
*9	Canister	*10	Fuel Tank
*11	Canister Pump Module	*12	Canister Filter
*a	Operation A: Atmospheric Pressure Measurement	*b	Operation B, E: Reference Pressure Measurement
*c	Operation C: EVAP System Pressure Measurement	*d	Operation D: Purge valve Monitor
*e	Atmospheric Pressure	*f	Negative Pressure

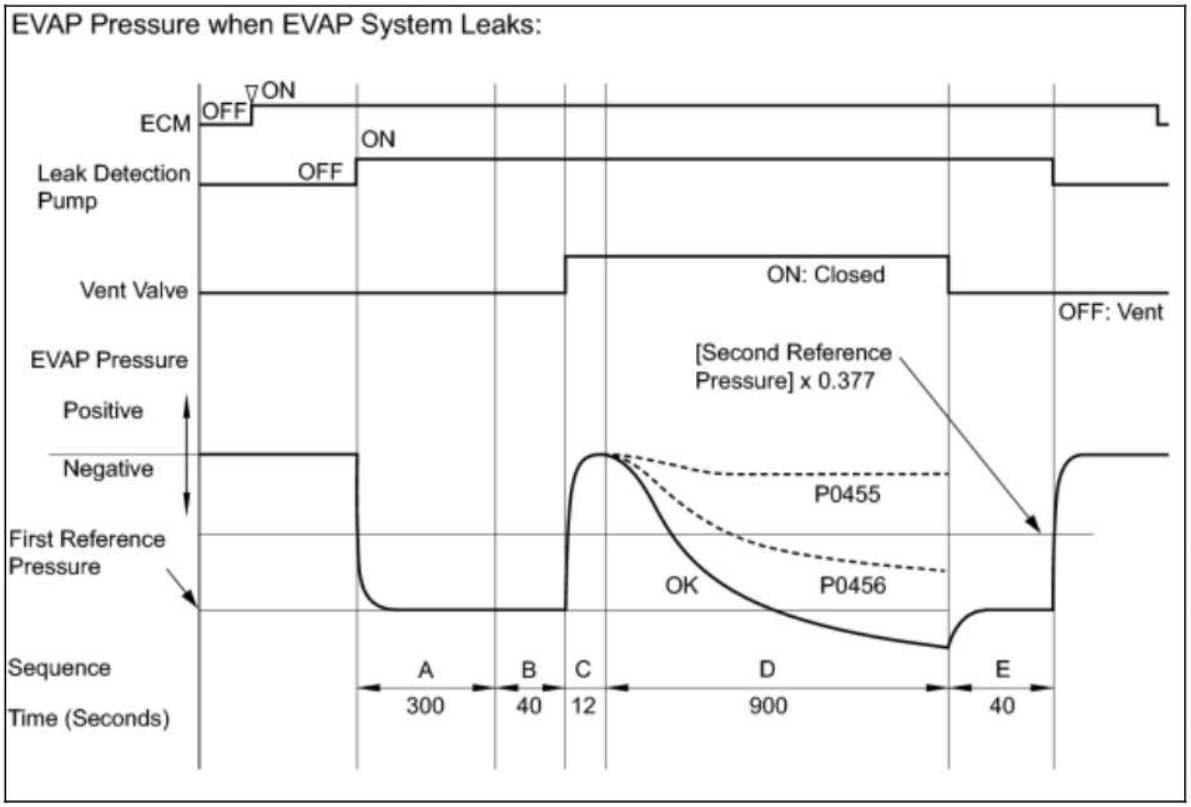
(a) P0455: EVAP (Evaporative Emission) gross leak

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than [second reference pressure x 0.377] (near atmospheric pressure), the ECM determines that the EVAP system has a large leak, illuminates the MIL and stores the DTC (2 trip detection logic).

(b) P0456: EVAP very small leak

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In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than second reference pressure, the ECM determines that the EVAP system has a small leak, illuminates the MIL and stores the DTC (2 trip detection logic).



MONITOR STRATEGY

Related DTC	P0455: Evaporative system functional check (0.040 inch leak) P0456: Evaporative system functional check (0.020 inch leak) P1451: Evaporative system functional check (Pipe clogging) P2404: Evaporative system functional check (ELCM performance)
Required Sensors/Components (Main)	Purge valve Canister pump module
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle: P0455, P0456, P1451 and P2404
Duration	23 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

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Monitor runs whenever following DTCs not stored	None

P0455, P0456, P1451, P2404

Soak time	5, 7 or 9.5 hours
Battery voltage	10.9 V or higher
Engine coolant temperature	4.4 to 45°C (39.9 to 113°F)
Intake air temperature	4.4°C (39.9°F) or higher
Atmospheric pressure	75.06 to 110 kPa(abs) [563 to 825 mmHg(abs)]
EVAP density learning during previous driving cycle	Completed
Learning value of EVAP density during purge in previous driving cycle	Less than 0.2
Integrated value of purge airflow during previous driving cycle	3000 or higher (varies with engine coolant temperature)
EVAP leak check diagnostic	Not completed

TYPICAL MALFUNCTION THRESHOLDS

P0455

Tank pressure	Higher than [reference pressure x 0.377 - (-45.5)]

P0456

Tank pressure	Less than (reference pressure x 0.377 - (-45.5))

P1451

Time it takes to become [reference pressure for functional check - 0.941 kPa or 4.9726 kPa [7 mmHg or 37 mmHg]]	Less than 27 seconds

P2404

Either of following conditions met	A, B, C or D
A: Operation A ending pressure	-0.224 kPa [-2 mmHg] or higher
B. Maximum pressure - minimum pressure at operation B and E	0.314 kPa [2 mmHg] or higher
C. Ending pressure at operation B and E	Less than -3.9717 kPa [-30 mmHg] or higher than -0.9419 kPa [-7 mmHg] (varies with atmospheric pressure)
D. Operation C ending pressure - reference pressure for functional check	Less than 0.224 kPa [2 mmHg]

MONITOR RESULT

Refer to Checking Monitor Status INFO .

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CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.
7. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P0455, P0456, P1451 or P2404.
9. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

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INSPECTION PROCEDURE

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0455, P0456, P1451 or P2404 is output	A
DTC P0455, P0456, P1451 or P2404 and other DTCs are output	B

B ▶ **GO TO DTC CHART**

A ▶ **GO TO EVAP SYSTEM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000VSO0FWX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0458,P0459: Evaporative Emission System Purge Control Valve Circuit Low (2013 FR-S)		

DTC	**P0458**	**Evaporative Emission System Purge Control Valve Circuit Low**

DTC	**P0459**	**Evaporative Emission System Purge Control Valve Circuit High**

DESCRIPTION

To reduce hydrocarbon emissions, evaporated fuel from the fuel tank is routed through a charcoal canister to the intake manifold for combustion in the cylinders.

The ECM changes the duty signals to the purge valve (Vacuum Switching Valve for Purge Control) so that the intake amount of hydrocarbon emissions is appropriate for the driving conditions (engine load, engine speed, vehicle speed, etc.) after the engine is warmed up.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0458	The voltage of purge valve circuit is low for 2.5 seconds or more. (2 trip detection logic)	• Open or short in purge valve circuit • purge valve • ECM
P0459	The voltage of purge valve circuit is high for 2.5 seconds or more. (2 trip detection logic)	

MONITOR DESCRIPTION

The ECM monitors the output terminal voltage when the vacuum switching valve assembly is actuated. By turning the FET in the ECM on and off, the purge valve assembly is subject to duty control. If the ECM control value (drive signal) and the output terminal voltage duty cycle continue to not match, then the ECM interprets this as a malfunction in the vacuum switching valve circuit, illuminates the MIL, and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0458: Solenoid valve for purge control functional check P0459: Solenoid valve for purge control functional check
Required sensors/Components (Main)	Purge valve
Required sensors/Components (Related)	-
Frequency of operation	Continuous
Duration	2.5 seconds
MIL operation	2 driving cycles
Sequence of operation	None

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TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None

P0458

Battery voltage	10.9 V or more
After engine starting	1 second or more
Purge valve control duty ratio	Less than 75%

P0459

Battery voltage	10.9 V or more
After engine starting	1 second or more
Purge valve control duty ratio	More than 25%

TYPICAL MALFUNCTION THRESHOLDS

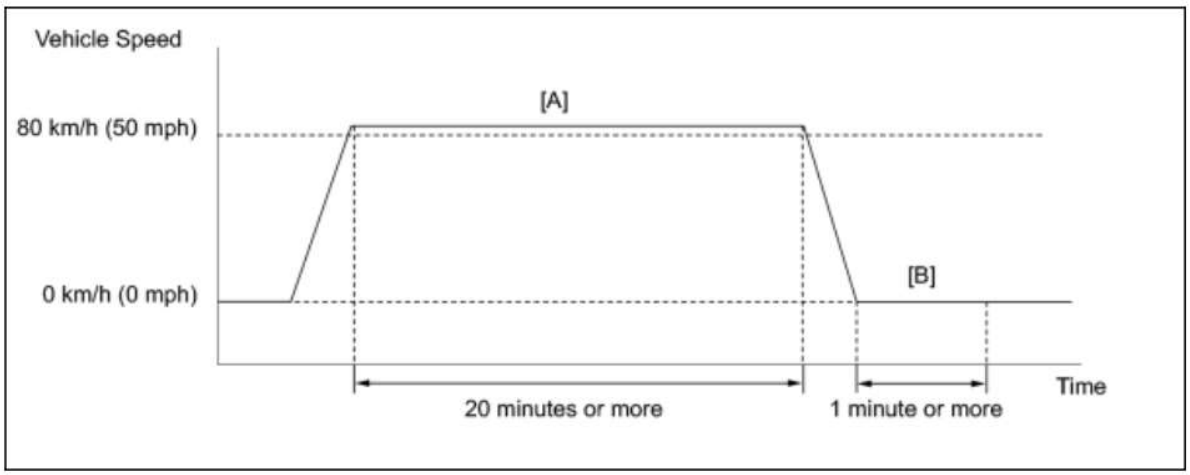
P0458

Drain voltage of FET for purge valve	Less than battery voltage X 0.38

P0459

Current of FET for purge valve	More than 3.5 A

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.

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6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

HINT:

Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0458 or P0459.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

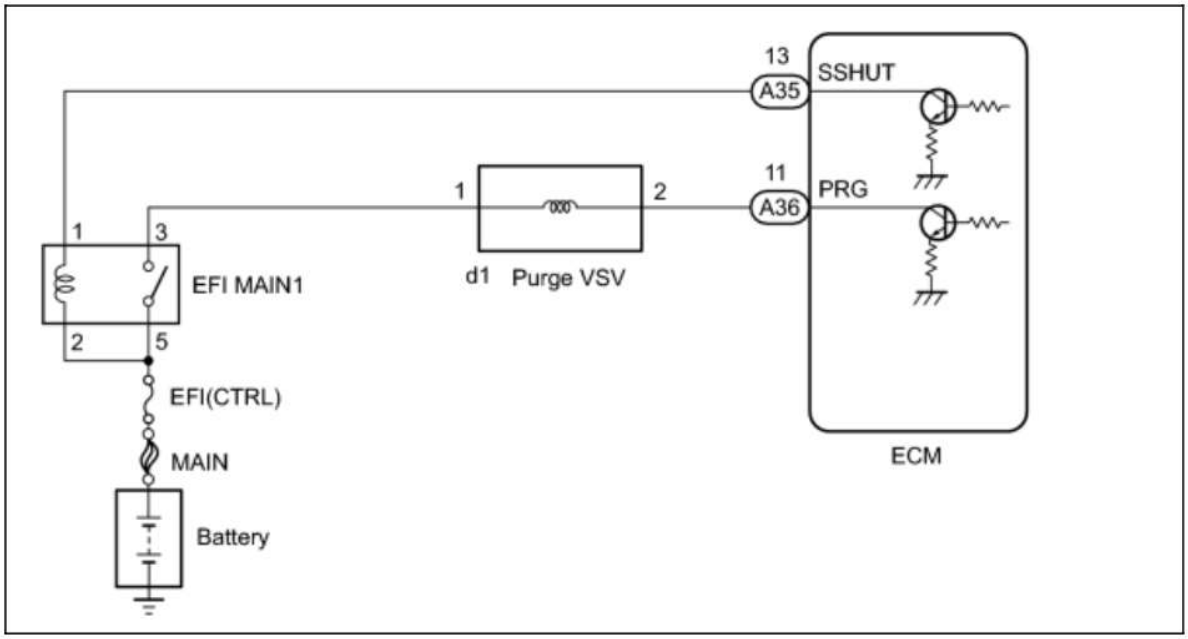
HINT:

- If a permanent DTC is output, the system is malfunctioning.

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- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

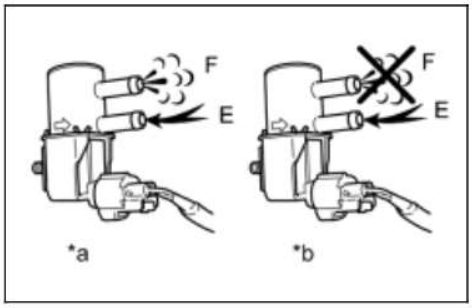
Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

Read freeze frame data using the Techstream. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE VSV FOR EVAP CONTROL)**



(a) Connect a Techstream to the DLC3.

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(b) Disconnect the vacuum hose (canister side) from the purge valve.

(c) Start the engine.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Active Test / Activate the VSV for EVAP Control.

(f) When the purge valve is operated using the Techstream, check whether the port of the purge valve applies suction to your finger.

OK:

TESTER OPERATION	SPECIFIED CONDITION
VSV ON	Purge valve port applies suction to finger
VSV OFF	Purge valve port applies no suction to finger

Text in Illustration

*a	Purge valve ON
*b	Purge valve OFF

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ **CHECK HARNESS AND CONNECTOR (PURGE VALVE - EFI MAIN1 RELAY)**

A ▼

2.	**INSPECT PURGE VALVE**

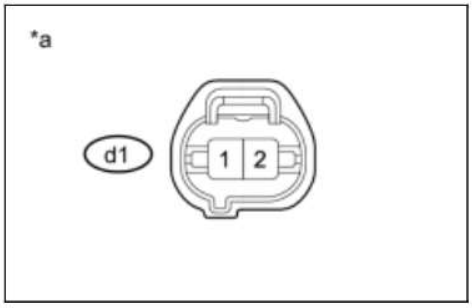
(a) Inspect the purge valve INFO .

NG ▶ **REPLACE PURGE VALVE**

OK ▼

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3.	INSPECT PURGE VALVE (POWER SOURCE)



(a) Disconnect the purge valve connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
d1-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Purge valve)

NG ▶ **INSPECT RELAY (EFI MAIN1)**

OK ▼

4.	CHECK HARNESS AND CONNECTOR (PURGE VALVE - ECM)

(a) Disconnect the ECM connector.

(b) Disconnect the purge valve connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-11 (PRG) - d1-2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

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A36-11 (PRG) or d1-2 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

5.	**CHECK WHETHER DTC OUTPUT RECURS**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the tester on.

(g) Start the engine.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
No DTC is output	A
P0458 or P0459 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

6.	**INSPECT RELAY (EFI MAIN1)**

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(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ **REPLACE RELAY (EFI MAIN1)**

OK
▼

7.	CHECK HARNESS AND CONNECTOR (PURGE VALVE - EFI MAIN1 RELAY)

(a) Disconnect the purge valve connector.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
d1-1 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
d1-1 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **GO TO ECM POWER SOURCE CIRCUIT**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PF60PCX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0461-P0463: Fuel Level Sensor "A" Circuit Range / Performance (2013 FR-S)		

DTC	**P0461**	**Fuel Level Sensor "A" Circuit Range / Performance**

DTC	**P0462**	**Fuel Level Sensor "A" Circuit Low**

DTC	**P0463**	**Fuel Level Sensor "A" Circuit High**

DESCRIPTION

The signal output from the sender gauge assembly installed in the fuel tank is converted to a CAN communication signal using the combination meter assembly, and this signal is input into the ECM as a remaining fuel signal.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0461	Compared with the estimated fuel consumption, the actual variation in the fuel sender gauge assembly signal is small. (2 trip detection logic)	• Fuel sender gauge assembly • Fuel sender gauge assembly No. 2 • Combination meter assembly • ECM
P0462	Fuel sender gauge assembly voltage is less than 0.35 V for 2.5 seconds or more. (2 trip detection logic)	
P0463	Fuel sender gauge assembly voltage is higher than 7.183 V for 1 second or more. (2 trip detection logic)	

MONITOR DESCRIPTION

The ECM uses the fuel sender gauge to monitor the amount of furl. There are several checks that the ECM performs to confirm the proper operation of the fuel sender gauge.

P0461

If the fuel sender gauge variation is lower than the estimated fuel consumption calculated from the fuel injection quantity and the engine speed, the ECM interprets this as a malfunction in the fuel sender gauge, and stores the DTC.

P0462, P0463

If an open or short in the fuel sender gauge signal line is detected, the ECM interprets this as a malfunction in the fuel sender gauge, and stores the DTC.

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MONITOR STRATEGY

Related DTCs	P0461: Fuel level sensor rationality check P0462: Fuel level sensor range check (Low voltage) P0463: Fuel level sensor range check (High voltage)
Required Sensors/Components (Main)	Fuel sender gauge assembly Fuel sender gauge assembly No. 2
Required Sensors/Components (Related)	Combination meter assembly
Frequency of Operation	Continuous
Duration	Immediately: P0461 2.5 seconds: P0462 1 second: P0463
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0461

Monitor runs whenever following DTCs not stored	P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0462, P0463 (Fuel level sensor (FL)) P0500 (Vehicle speed sensor (VSS)) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation) U0073, U0155, U0423 (CAN system)
Elapsed time after engine start	5 seconds or more
Battery voltage	10.9 V or more
Fuel cut	Not active
Integrated amount of intake air mass	165375 g or more

P0462, P0463

Monitor runs whenever following DTCs not stored	U0073, U0155, U0423 (CAN system)
Battery voltage	10.9 V or more
Elapsed time after engine start	3 seconds or more

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TYPICAL MALFUNCTION THRESHOLDS

P0461

Maximum fuel level - Minimum fuel level	Less than 5.2%

P0462

Fuel sender gauge voltage (Resistance)	Less than 0.35 V (10.5 Ω)

P0463

Fuel sender gauge voltage (Resistance)	More than 7.183 V (432 Ω)

COMPONENT OPERATING RANGE

Fuel sender gauge voltage (Resistance)	0.398 to 7.051 V (12 to 416 Ω)

CONFIRMATION DRIVING PATTERN

P0461

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Drive the vehicle and consume more than 30 liters (31.7 US qts) of the fuel.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0461.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed

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	◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

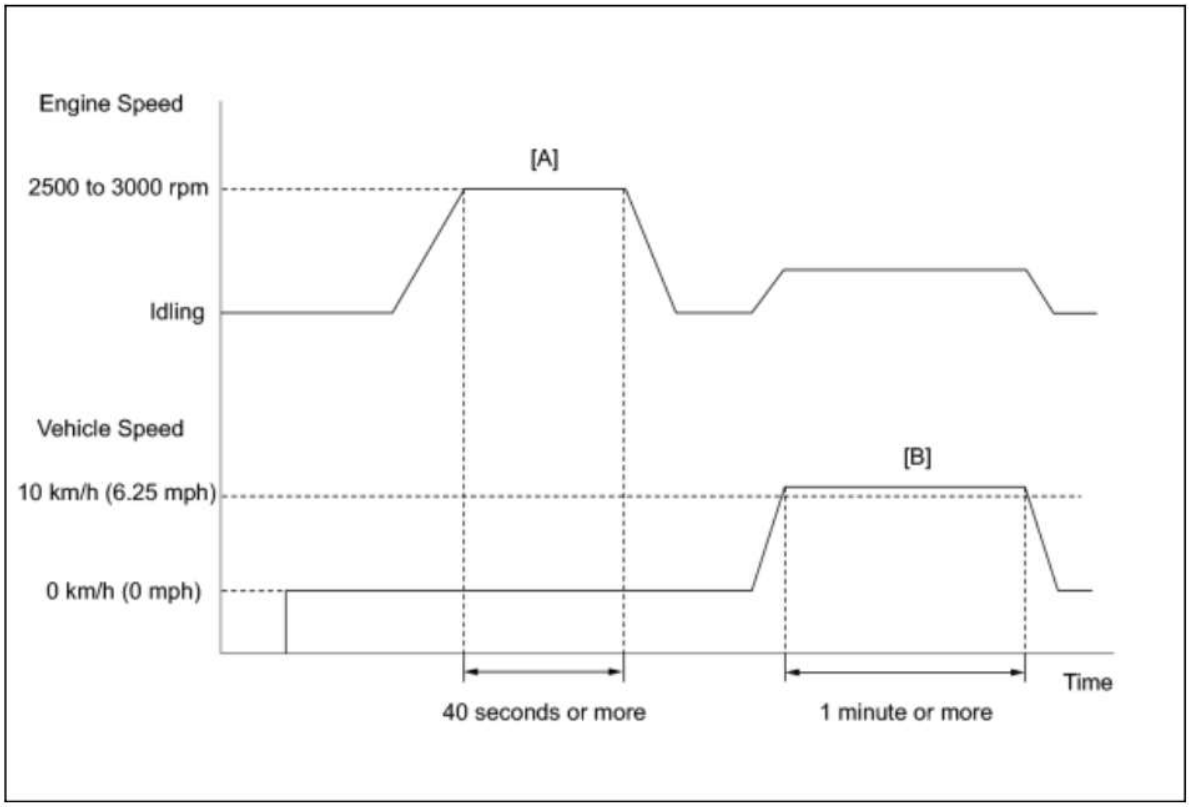
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

P0462, P0463



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.

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5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher .
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P462 or P0463.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

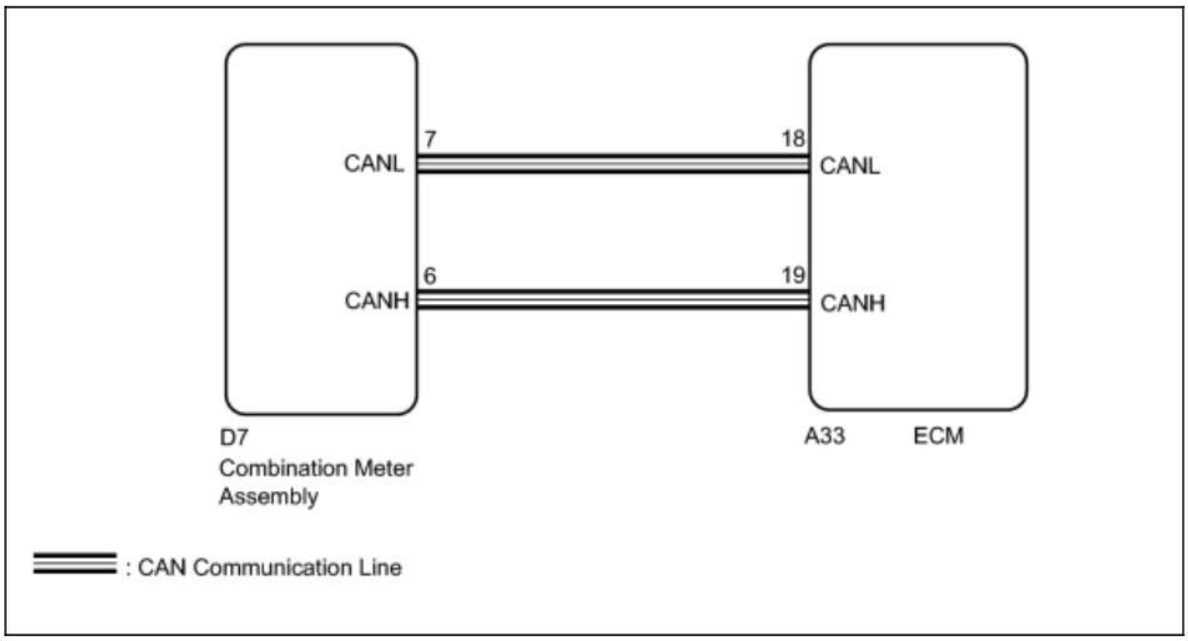
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC P0461, P0462 or P0463 is output	A
DTC P0461, P0462 or P0463 and other DTCs are output	B

B ▶ GO TO DTC CHART

A ▶ GO TO FUEL GAUGE MALFUNCTION

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000012ME0EVX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0500: Vehicle Speed Sensor "A" (2013 FR-S)		

DTC	**P0500**	**Vehicle Speed Sensor "A"**

DESCRIPTION

Vehicles, which are equipped with ABS (Anti-lock Brake System), detect the vehicle speed using the skid control ECU (brake actuator assembly) and wheel speed sensor. The wheel speed sensor monitors the wheel rotation speed and sends a signal to the skid control ECU. The skid control ECU converts the wheel speed signal into a 4-pulse signal and transmits it to the ECM. The ECM determines the vehicle speed based on the frequency of the pulse signal.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0500	The vehicle speed signal from the driving wheels is 300 km/h or more for 2.5 seconds or more. (1 trip detection logic)	• Open or short in wheel speed signal circuit • Skid control ECU (Brake actuator assembly) • Speed sensor

MONITOR DESCRIPTION

If the driving wheel speed signal input from the skid control ECU indicates speed of 300 km/h (186.42 mph) or more, the ECM interprets this as a malfunction in the speed signal circuit. The ECM then illuminates the MIL and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0500: Vehicle speed sensor (VSS) range check
Required Sensors/Components (Main)	Speed sensor Combination meter Skid control ECU
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	U0073, U0122, U0416 (CAN system)
Battery voltage	10.9 V or more

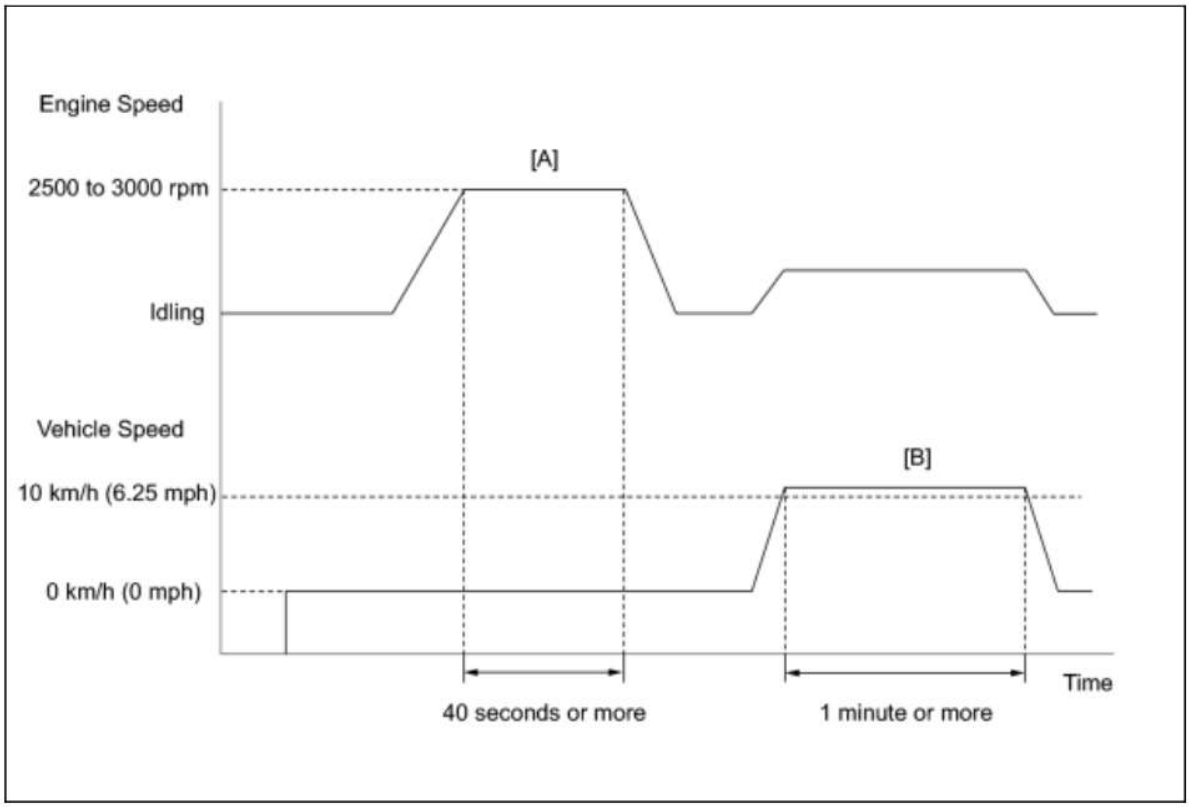
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Elapsed time after engine start	2 seconds

TYPICAL MALFUNCTION THRESHOLDS

Vehicle speed	More than 300 km/h (186.42 mph)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

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11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0500.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

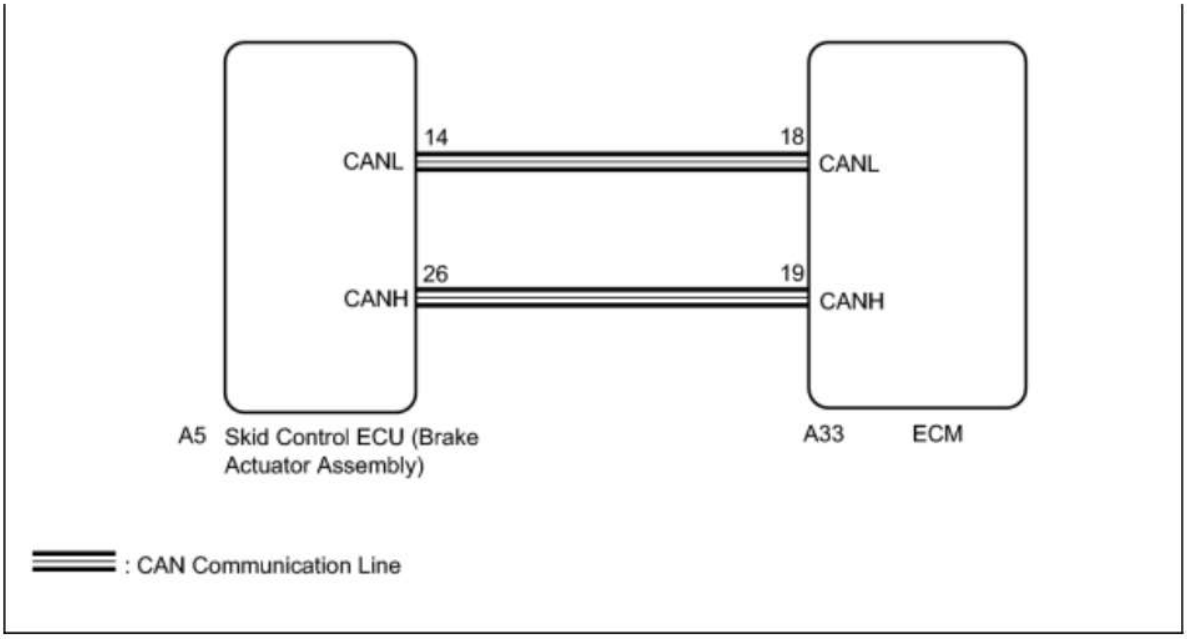
14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (VEHICLE SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Enter the following menus: Powertrain / Engine / Data List / Vehicle Speed.

(d) Drive the vehicle.

(e) Read the value displayed on the Techstream.

Result

RESULT	PROCEED TO
Values displayed on Techstream and speedometer display not equal	A
Values displayed on Techstream and speedometer display equal	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

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2.	CHECK DTC OUTPUT (VEHICLE STABILITY CONTROL SYSTEM)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Chassis / ABS/VSC/TRAC / Trouble Codes.

(e) Read DTCs INFO .

Result

RESULT	PROCEED TO
No DTC is output	A
No DTCs are output	B

B GO TO VEHICLE STABILITY CONTROL SYSTEM

A

3.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes.

Result:

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RESULT	PROCEED TO
DTC is not output	A
DTC P0500 is output	B

B ▶ **REPLACE ECM**

A ▶ **CHECK FOR INTERMITTENT PROBLEMS**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000T8M0MVX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0506,P0507: Idle Air Control System RPM Lower than Expected (2013 FR-S)		

DTC	**P0506**	**Idle Air Control System RPM Lower than Expected**

DTC	**P0507**	**Idle Air Control System RPM Higher than Expected**

DESCRIPTION

The idling speed is controlled by the ETCS (Electronic Throttle Control System). The ETCS is comprised of: 1) the one valve type throttle body; 2) the throttle actuator, which operates the throttle valve; 3) the throttle position sensor, which detects the opening angle of the throttle valve; 4) the accelerator pedal position sensor, which detects the accelerator pedal position; and 5) the ECM, which controls the ETCS. Based on the target idling speed, the ECM controls the throttle actuator to provide the proper throttle valve opening angle.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0506	The engine speed is not close to the target engine speed for 30 seconds or more (Actual engine speed - target engine speed) < -100 rpm). (2 trip detection logic)	• Electronic throttle control system • Intake system • PCV hose connections • ECM
P0507	The engine speed is not close to the target engine speed for 30 seconds or more (Actual engine speed - target engine speed) >= 200 rpm). (2 trip detection logic)	

MONITOR DESCRIPTION

The ECM monitors the idling speed and idling air flow volume to conduct Idle Speed Control (ISC). The ECM determines that the ISC system is malfunctioning if the difference between the target engine idling speed and actual engine idling speed exceeds the threshold for 30 seconds or more.

MONITOR STRATEGY

Related DTCs	P0506: Idle speed control (ISC) functional check P0507: Idle speed control (ISC) functional check
Required Sensors/Components (Main)	Electronic throttle control system
Required Sensors/Components (Related)	Crankshaft position sensor Engine coolant temperature sensor Speed sensor
Frequency of Operation	Continuous

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Duration	30 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	P0030, P0031, P0032 (Air fuel ratio sensor - heater) P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0117, P0118, P0125 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0131, P0132 (Air fuel ratio sensor - ECM input voltage) P0134, P2195, P2196 (Air fuel ratio sensor - output voltage) P0300, P0301, P0302, P0303, P0304 (Misfire) P0461, P0462, P0463 (Fuel level sensor (FL)) P0500 (Vehicle speed sensor (VSS)) P0604, P0605 (ROM in ECM) P0851, P0852 (Neutral position switch) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Fuel level	15% or more
Atmospheric pressure	75.06 kPa [563 mmHg] or more
Battery voltage	10.9 V or more
Engine coolant temperature	60°C (140°F) or higher
Elapsed time after engine start	10.49 seconds or more
Closed control in ISC	Active
Lambda	0.81 to 1.1
Elapsed time after A/C switch OFF ←→ ON	5.1 seconds or more
Elapsed time after changing intake manifold pressure =< 4 kPa (30 mmHg)	5.1 seconds or more
Vehicle speed	0 km/h (0 mph)
Elapsed time after neutral switch OFF ←→ ON	5.1 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

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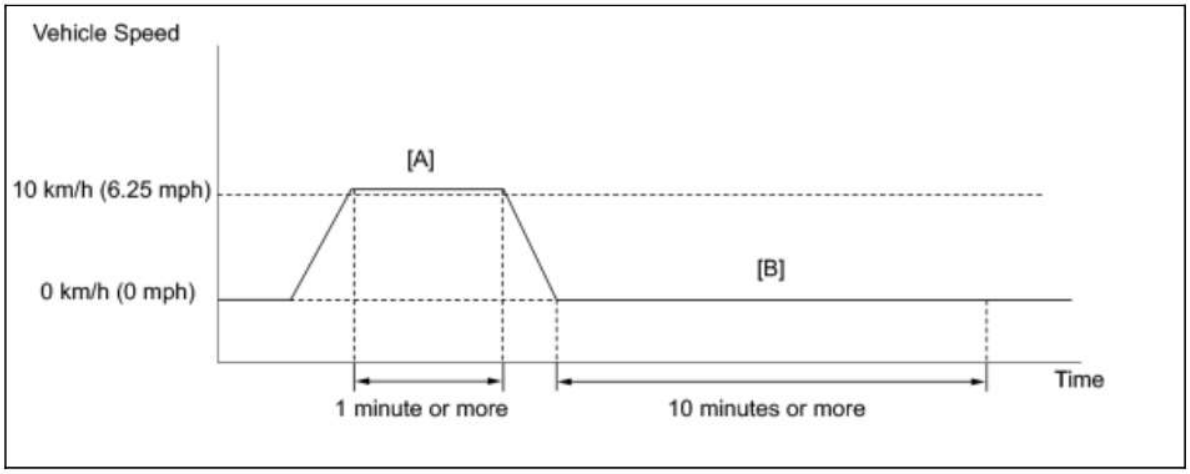
P0506

Actual engine speed - Target engine speed	Less than -100 rpm

P0507

Actual engine speed - Target engine speed	More than 200 rpm

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [A].
b. Stop the vehicle.
c. Idle the engine for 10 minutes or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P0506 or P0507.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION

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NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- The following conditions may also cause DTC DTC P0506 or P0507 to be stored:
  a. The floor carpet overlapping slightly onto the accelerator pedal, causing the accelerator pedal to be slightly depressed and therefore the throttle valve position to be slightly open.
  b. The accelerator pedal being not fully released.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Refer to "Data List / Active Test" [Engine Speed, ISC Feedback Value and ISC Learning Value] INFO .

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0506 AND P0507)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

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(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0506 or P0507 is output	A
DTC P0506 or P0507 and other DTCs are output	B

HINT:

If any DTCs other than P0506 or P0507 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A

▼

2.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose connections INFO .

OK:

PCV valve and hose are connected correctly and are not damaged.

NG ▶ **REPAIR OR REPLACE PCV HOSE**

OK

▼

3.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:

No leaks from the intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

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4.	INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (THROTTLE VALVE)

(a) Check the throttle with motor body assembly condition INFO .

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

NG ▶ REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY

OK

5.	CONFIRM WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P0506 or P0507 is output	A
No DTC is output	B

B ▶ END

A ▶ CHECK FOR INTERMITTENT PROBLEMS

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000T8P0ZQX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0560: System Voltage (2013 FR-S)		

DTC	**P0560**	**System Voltage**

MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the ignition switch is off. This power allows the ECM to store data such as DTC history, freeze frame data and fuel trim values. If the battery voltage falls below a minimum level, the memory is cleared and the ECM determines that there is a malfunction in the power supply circuit. When the engine is next started, the ECM illuminates the MIL and stores the DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0560	Back up power source terminal voltage is 3.5 V or less with the engine running for 2.5 seconds or more. (1 trip detection logic)	• Open in back up power source circuit • Battery • Battery terminals • ECM

HINT:

If DTC P0560 is stored, the ECM does not store other DTCs or the data stored in the ECM is partly cleared.

MONITOR STRATEGY

Related DTCs	P0560: Back-up power supply for memory of ECM functional check
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

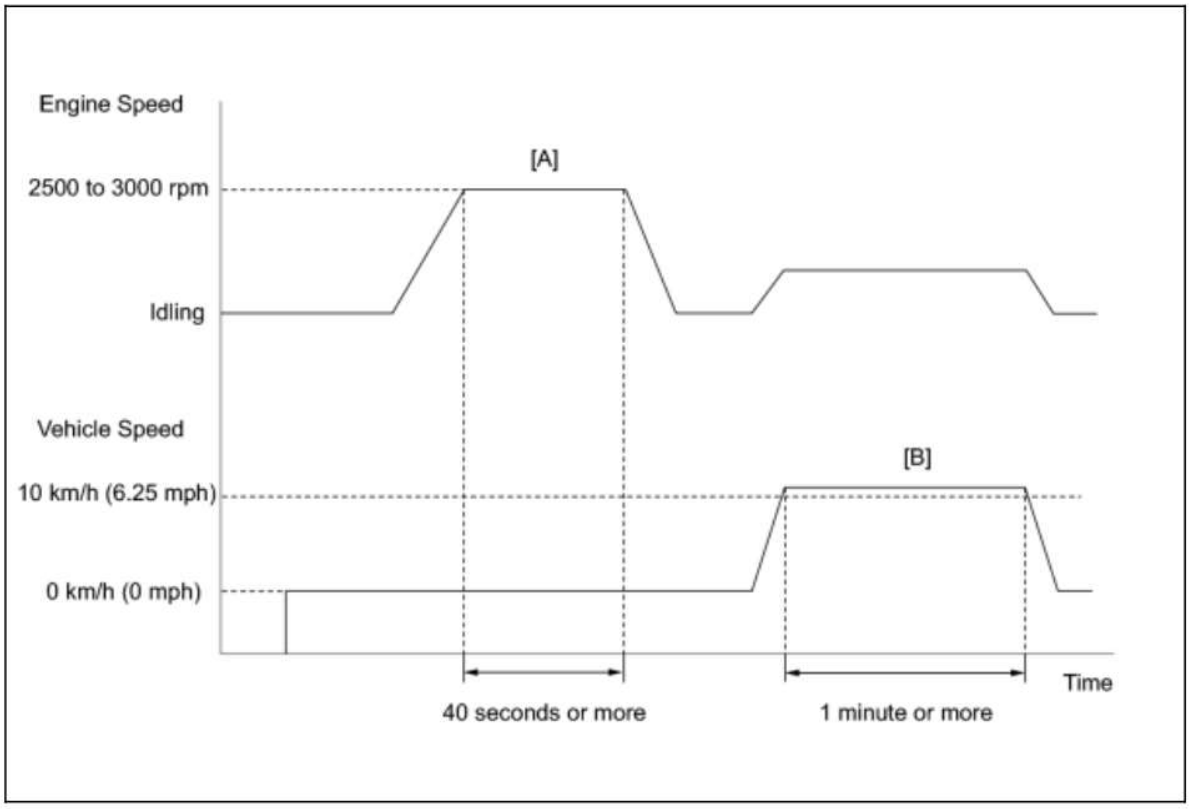
Monitor runs whenever following DTCs not stored	None
Engine speed	500 rpm or higher
Battery voltage	10.9 V or more

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TYPICAL MALFUNCTION THRESHOLDS

Voltage of back-up power	Less than 3.5 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. With the vehicle stationary, depress the accelerator pedal and maintain an engine speed of between 2500 and 3000 rpm for 40 seconds or more [A].
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0560.

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13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

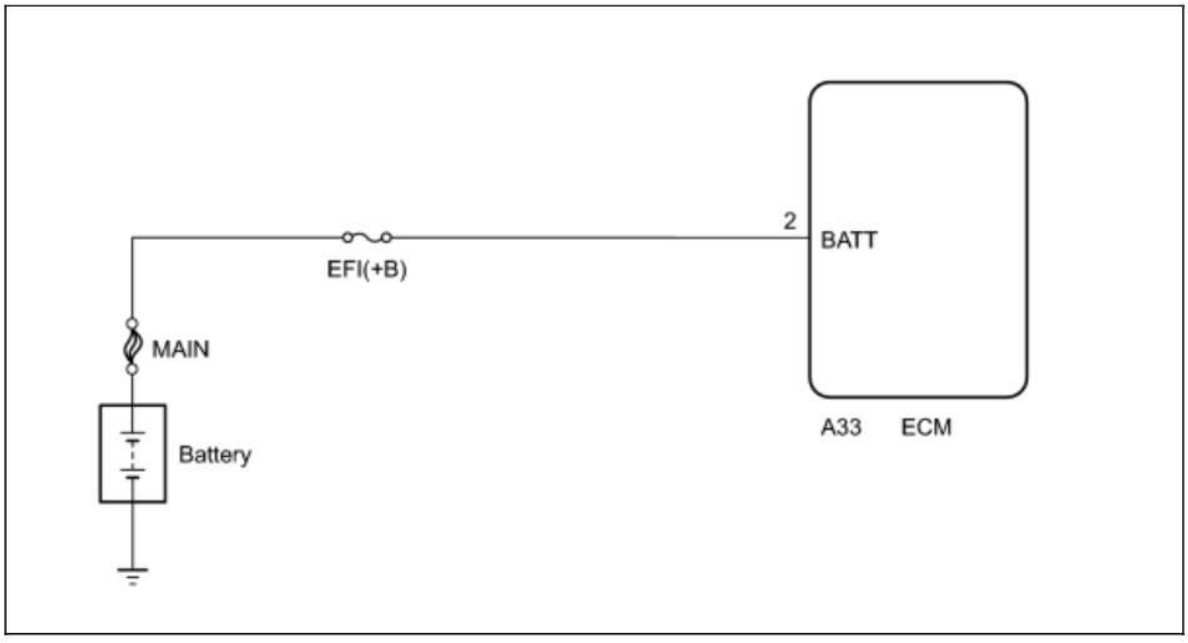
- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



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INSPECTION PROCEDURE

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following inspection procedure.
- After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK HARNESS AND CONNECTOR (ECM - BATTERY)**

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

(a) Disconnect the cable from the negative (-) battery terminal INFO .

(b) Disconnect the cable from the positive (+) battery terminal.

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-2 (BATT) - Battery positive (+) terminal	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-2 (BATT) or Battery positive (+) terminal - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

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2.	INSPECT CHARGING SYSTEM

(a) Inspect the charging system INFO .

NG ▶ REPAIR OR REPLACE MALFUNCTIONING PARTS

OK ▼

3.	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine / Trouble Codes.

(i) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0560 is output	B

B ▶ REPLACE ECM

A ▶ CHECK FOR INTERMITTENT PROBLEMS

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000W950HAX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0604-P0606,P060A,P060B,P062F: Internal Control Module Random Access Memory (RAM) Error (2013 FR-S)		

DTC	**P0604**	**Internal Control Module Random Access Memory (RAM) Error**

DTC	**P0605**	**Internal Control Module Read Only Memory (ROM) Error**

DTC	**P0606**	**ECM / PCM Processor**

DTC	**P060A**	**Internal Control Module Monitoring Processor Performance**

DTC	**P060B**	**Internal Control Module A/D Processing Performance**

DTC	**P062F**	**Internal Control Module EEPROM Error**

DESCRIPTION

P0604

The ECM continuously monitors its internal memory status. This self-check ensures that the ECM functioning properly. It is diagnosed by internal "mirroring" of the main CPU and sub CPU to detect the Random Access Memory (RAM) errors. If outputs from these CPUs are different and deviate from the standard, the ECM stores the DTC.

P0605

The ECM continuously monitors its internal memory status. This self-check ensures that the ECM functioning properly. It is diagnosed by internal "mirroring" of the main CPU and sub CPU to detect the Read Only Memory (ROM) errors. If outputs from these CPUs are different and deviate from the standard, the ECM stores the DTC.

P0606

The ECM continuously monitors its main and sub CPUs. This self-check ensures that the ECM is functioning properly. If outputs from the CPUs are different and deviate from the standard, the ECM stores the DTC.

P060A

The main CPU and sub CPU of the ECM perform data communication between each other. The main CPU monitors the communications and WDC pulses from the sub CPU. If the malfunction is detected, the ECM stores the DTC.

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P060B

If a communication error occurs in the ECM, the ECM stores the DTC.

P062F

The ECM monitors its internal operation. If the ECM detects an internal malfunction, the ECM stores the DTC.

DTC	DTC SETTING CONDITION	TROUBLE AREA
P0604	ECM internal error (RAM) (1 trip detection logic)	ECM
P0605	ECM internal error (ROM) (1 trip detection logic)	ECM
P0606	ECM internal error (Processor) (1 trip detection logic)	ECM
P060A	ECM internal error (Monitoring processor) (1 trip detection logic)	ECM
P060B	ECM internal error (A/D processor) (1 trip detection logic)	ECM
P062F	ECM internal error (EEPROM) (1 trip detection logic)	ECM

MONITOR STRATEGY

Related DTCs	P0604: RAM in ECM functional check P0605: ROM in ECM functional check P0606: Control module processor functional check P060A: Internal control module monitoring processor performance functional check P060B: Internal control A/D processing performance functional check P062F: Internal control EEPROM error functional check
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous: P0604, P0605, P0606, P060A, P060B Once per driving cycle: P062F
Duration	0.512 seconds: P0604, P0605 2 times: P0606 (Instruction check) (Case 1) 0.512 seconds: P0606 (Instruction check) (Case 2) 0.504 seconds: P0606 (Software flow check) 0.048 seconds: P0606 (Output driver communication check) 0.048 seconds: P0606 (CAN register check) 0.024 seconds: P060A (Disable function observation IC) 0.016 seconds: P060A (Malfunction of observation IC calculation) 0.2 seconds: P060A (Observation IC resister monitoring)

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	0.2 seconds: P060B 2 driving cycles: P062F
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

P0604, P0605

Ignition switch	OFF to ON

P0606 (Instruction Check) (Case 1)

Ignition switch	OFF to ON

P0606 (Instruction Check) (Case 2)

ETCS relay	On
Battery voltage	6.2 V or more

P0606 (Software Monitor Check)

ETCS relay	On
Battery voltage	6.2 V or more

P060A (Disable Function Observation IC)

Battery voltage	6 V or more
Main throttle sensor circuit continuity	No failure
Sub throttle sensor circuit continuity	No failure
Throttle sensor rationality check	No failure
Microcomputer disable	Off
Observation IC disable	On

P060A (Malfunction of Observation IC Calculation)

Battery voltage	6 V or more
Microcomputer disable	On

P060A (Observation IC Resister Monitoring)

Battery voltage	6 V or more

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P060B

Battery voltage	6 V or more

TYPICAL MALFUNCTION THRESHOLDS

P0604

Setting value can be written in all RAM area, and the values can be read correctly	Fail to read correctly

P0605

Comparing Check sum data on ROM with Calculated sum data	Not equal

P0606 (Instruction Check) (Case 1)

Instruction error	Detect

P0606 (Instruction Check) (Case 2)

Calculated data through CPU and FPU (Floating point number Processing Unit) are compared with expectation	Not equal

P0606 (Software Flow Check)

Software flow error	Detect

P0606 (Output Driver Communication Check)

Driver IC communication	Malfunction
Port voltage of driver IC check	Low

P0606 (CAN Resister Check)

Comparison of data written to CAN register with data read from the CAN register	Not equal

P060A (Disable Function Observation IC)

Throttle angle - Memory throttle angle when monitoring	More than 1.6%

P060A (Malfunction of Observation IC Calculation)

TAC disable request from observation IC	Not detected

P060A (Observation IC Resister Monitoring)

Comparison of data written to observation IC register with data read from the observation IC register	Not equal

P060B

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Either of the following conditions is met:	A or B
A. A/D voltages for monitoring - 0 at target A/D voltages 0 V	More than 0.01953 V
B. 5 - A/D voltages for monitoring at target A/D voltages 5 V	More than 4.97925 V

P062F (Observation IC Resister Monitoring)

Fail writing to EEPROM	Yes

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the Techstream off.
5. Turn the ignition switch off.
6. Disconnect the Techstream.
7. Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.
8. Connect the cable to the negative (-) battery terminal.
9. Connect the Techstream to the DLC3.
10. Turn the ignition switch to ON and turn the Techstream on.
11. Wait 16 seconds or more.
12. Enter the following menus: Powertrain / Engine / Trouble Codes.
13. Read the pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

14. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
15. Input the DTC: P0604, P0605, P0606, P060A, P060B or P062F.
16. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

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- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

17. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	READ DTC OUTPUT (DTC P0604, P0605, P0606, P060A, P060B AND/OR P062F)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off.

(f) Turn the Techstream off.

(g) Disconnect the Techstream.

(h) Disconnect the cable from the negative (-) battery terminal and wait for 1 minute.

(i) Connect the cable to the negative (-) battery terminal.

(j) Connect the Techstream to the DLC3.

(k) Turn the ignition switch to ON.

(l) Turn the Techstream on.

(m) Wait for 16 seconds or more.

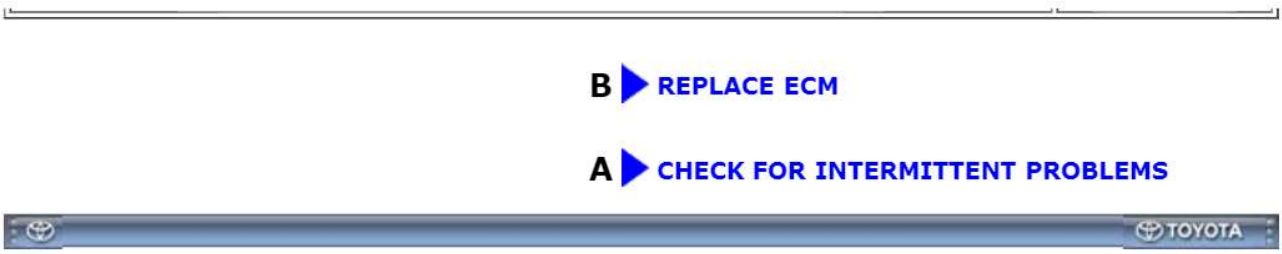
(n) Enter the following menus: Powertrain / Engine / Trouble Codes.

(o) Read the DTCs.

Result:

RESULT	PROCEED TO
DTC is not output	A
DTC DTC P0604, P0605, P0606, P060A, P060B or P062F is output	B

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000TA0123X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0616,P0617: Starter Relay Circuit Low (2013 FR-S)		

DTC	**P0616**	**Starter Relay Circuit Low**

DTC	**P0617**	**Starter Relay Circuit High**

MONITOR DESCRIPTION

While the engine is being cranked, battery voltage is applied to terminal STA of the ECM. If the ECM detects the starter control (STA) signal after the engine is started, it determines that there is a malfunction in the STA circuit. The ECM then illuminates the MIL and stores the DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0616	No starter signal is input when engine started. (1 trip detection logic)	• Starter system • ST relay circuit • ECM
P0617	Starter signal remains input after engine started. (1 trip detection logic)	• Starter system • ST relay circuit • ECM

MONITOR STRATEGY

Related DTCs	P0616: Starter switch circuit without push start system functional check P0617: Starter switch circuit without push start system functional check
Required Sensors/Components (Main)	ST relay Park/neutral position switch assembly Ignition or starter switch assembly
Required Sensors/Components (Related)	Speed sensor Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Immediately: P0616 60 seconds: P0617
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0616

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Monitor runs whenever following DTCs not stored	P0500 (Vehicle speed sensor (VSS))
Battery voltage	8 V or more
Engine condition	Stop to Run
Vehicle speed	Less than 1 km/h (0.6 mph)

P0617

Monitor runs whenever following DTCs not stored	P0500 (Vehicle speed sensor (VSS))
Battery voltage	8 V or more
Engine condition	Run

TYPICAL MALFUNCTION THRESHOLDS

P0616

Starter signal 1	Off

P0617

Starter signal 1	On

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Idle the engine for 1 second or more.
7. Enter the following menus: Powertrain / Engine / Trouble Codes.
8. Read pending DTCs.

   HINT:

   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

9. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
10. Input the DTC: P0616 or P0617.
11. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal

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INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

12. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to Starter Signal Circuit INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- The following troubleshooting flowchart is based on the premise that the engine can be cranked normally.

  If the engine does not crank, proceed to Problem Symptoms Table INFO .
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**READ VALUE USING TECHSTREAM (STARTER SIGNAL, STARTER SWITCH)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Starter Signal and Starter Switch.

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(e) Read the value displayed on the Techstream when the ignition switch is turned to ON and cranking.

OK:

TECHSTREAM DISPLAY	CONDITION	NORMAL CONDITION
Starter Signal	Ignition switch ON	OFF
	Cranking	ON
Starter Switch	Ignition switch ON	OFF
	Cranking	ON

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ **CHECK WHETHER DTC OUTPUT RECURS**

A ▼

2.	**INSPECT RELAY (ST)**

(a) Inspect the ST relay INFO .

NG ▶ **REPLACE RELAY (ST)**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (ST RELAY - ECM)**

(a) Remove the ST relay from the engine room relay block assembly.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

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ST relay terminal 3 - A33-17 (STSW2)	Always	Below 1 Ω
ST relay terminal 1 - A35-26 (STA)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
ST relay terminal 3 or A33-17 (STSW2) - Body ground	Always	10 kΩ or higher
ST relay terminal 1 or A35-26 (STA) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **CHECK STARTER SIGNAL CIRCUIT**

4.	**CHECK WHETHER DTC OUTPUT RECURS**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the tester on.

(g) Start the engine.

(h) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
No DTC is output	A
P0616 or P0617 is output	B

HINT:

If the engine does not start, replace the ECM.

B ▶ **REPLACE ECM**

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A ▶ CHECK FOR INTERMITTENT PROBLEMS



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000002KQO09CX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0700: Transmission Control System (MIL Request) (2013 FR-S)		

DTC	**P0700**	**Transmission Control System (MIL Request)**

DESCRIPTION

The ECM and TCM communicate with each other via the CAN communication line. If the TCM detects an automatic transmission malfunction, the ECM receives this signal.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0700	Automatic transmission system malfunction received from the TCM (1 trip detection logic)	• Automatic transmission system • ECM

MONITOR STRATEGY

Related DTCs	P0700: Transmission control system (MIL request) functional check
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

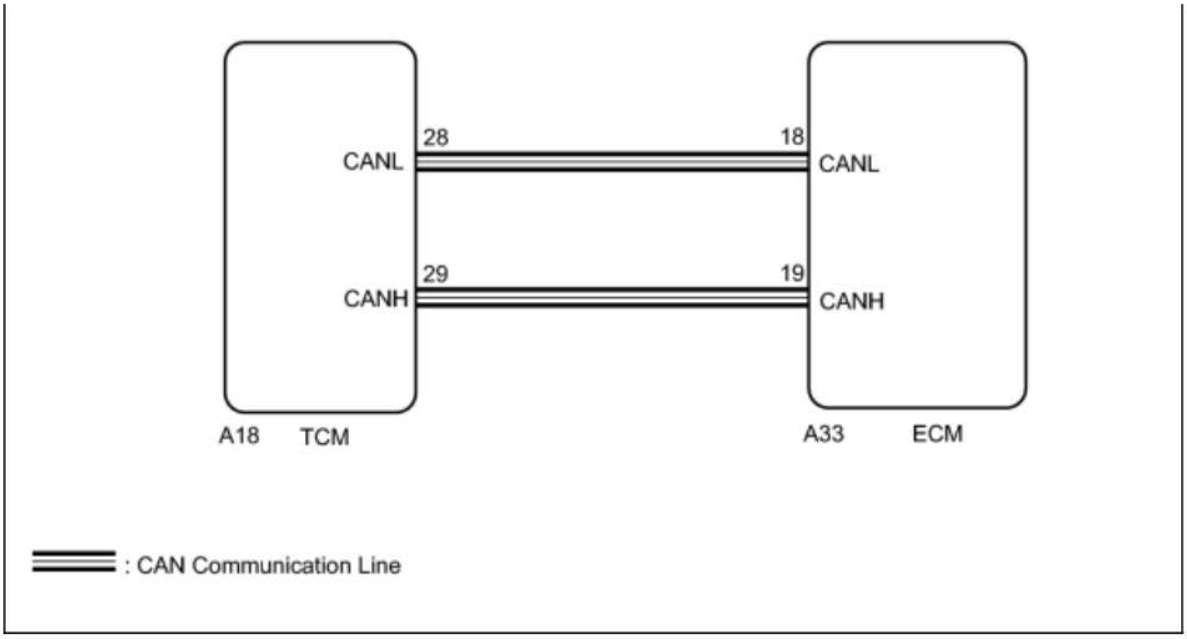
Monitor runs whenever following DTCs not stored	U0073, U0101, U0402 (CAN system)
Battery voltage	10.9 V or more

TYPICAL MALFUNCTION THRESHOLDS

MIL request flag from TCM	Set

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

After turning ignition switch off, waiting time may be required before disconnecting the cable from the negative (-) battery terminal. Therefore, make sure to read the disconnecting the cable from the negative (-) battery terminal notices before proceeding with work INFO .

HINT:

Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK DTC OUTPUT (AUTOMATIC TRANSMISSION SYSTEM)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / ECT / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC is output	B

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B ▶ GO TO AUTOMATIC TRANSMISSION SYSTEM

A ▼

2.	READ OUTPUT DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTC INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Enter the following menus: Powertrain / Engine / Trouble Codes.

(i) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P0700 is output	B

B ▶ REPLACE ECM

A ▶ CHECK FOR INTERMITTENT PROBLEMS

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XCT0QKX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P0851,P0852: Park / Neutral Switch Input Circuit Low (2013 FR-S)		

DTC	**P0851**	**Park / Neutral Switch Input Circuit Low**

DTC	**P0852**	**Park / Neutral Switch Input Circuit High**

DESCRIPTION

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P0851	**Manual Transmission** No non-neutral position detected in shift change running state (judged based on changes in the relationship between vehicle speed and engine speed) (2 trip detection logic) **Automatic Transmission** The CAN data received from the TCM is "P or N" position signal while the park/neutral position switch assembly is not in P or N position. (2 trip detection logic)	**Manual Transmission** • Open or short in neutral position switch signal circuit • Neutral position switch • ECM **Automatic Transmission** • Open or short in park/neutral position switch signal circuit • Park/neutral position switch assembly • ECM • TCM
	Manual Transmission No neutral position detected in shift change running state	**Manual Transmission** • Open or short in neutral position switch signal circuit • Neutral position switch

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P0852	(judged based on changes in the relationship between vehicle speed and engine speed) (2 trip detection logic) **Automatic Transmission** The CAN data received from the TCM is other than "P or N" position signal while the park/neutral position switch assembly is in P or N position. (2 trip detection logic)	• ECM **Automatic Transmission** • Open or short in park / neutral position switch signal circuit • Park/neutral position switch assembly • ECM • TCM

MONITOR DESCRIPTION

Manual Transmission

The ECM detects the shift change status from the neutral position switch signal, and detects the current selected gear from the engine speed and vehicle speed. If the neutral position switch signal and the shift change status cannot be coordinated, the ECM interprets this as a malfunction, illuminates the MIL, and stores the DTC.

Automatic Transmission

If the ECM cannot coordinate the N, P or neutral information from the park/neutral position switch signal with the shift information sent from the TCM through CAN communication, then the ECM interprets this as a malfunction, illuminates the MIL, and stores the DTC.

MONITOR STRATEGY

Related DTCs	P0851: Neutral position switch circuit continuity (Low voltage) P0852: Neutral position switch circuit continuity (High voltage)
Required Sensors/Components (Main)	Park/neutral position switch assembly Neutral position switch
Required Sensors/Components (Related)	-
Frequency of Operation	Once per driving cycle
Duration	3 counts: Manual transmission 6.4 seconds: Automatic transmission
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Manual Transmission

Monitor runs whenever following DTCs not present	P0500 (Vehicle speed sensor (VSS))
ST relay	Off

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Starter	Off
Battery voltage	10.9 V or more
Driving condition change from the following condition A to B:	-
A. All of the following conditions are met:	(a) and (b)
(a) Vehicle speed	Less than 0 km/h (0 mph)
(b) Engine speed	550 to 880 rpm
B. All of the following conditions are met:	(a) and (b)
(a) Vehicle speed	64 km/h (39.8 mph) or more
(b) Engine speed	1600 to 2600 rpm

Automatic Transmission

Monitor runs whenever following DTCs not present	U0073, U0101, U0402 (CAN system)
ST relay	Off
Starter	Off
Battery voltage	10.9 V or more
Range switch on automatic transmission (TCM)	ON
Engine speed	500 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

P0851 (Manual Transmission)

Switch signal for manual transmission	Less than battery voltage X 0.19

P0852 (Manual Transmission)

Switch signal for manual transmission	More than battery voltage X 0.6

P0851 (Automatic Transmission)

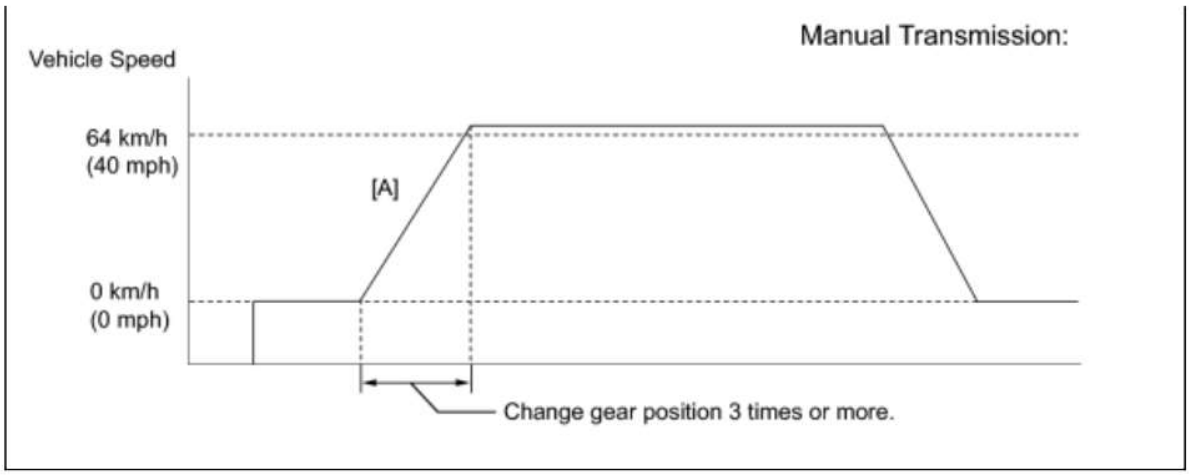
Park/neutral position switch signal	Less than battery voltage X 0.19
Park/neutral position from TCM	On

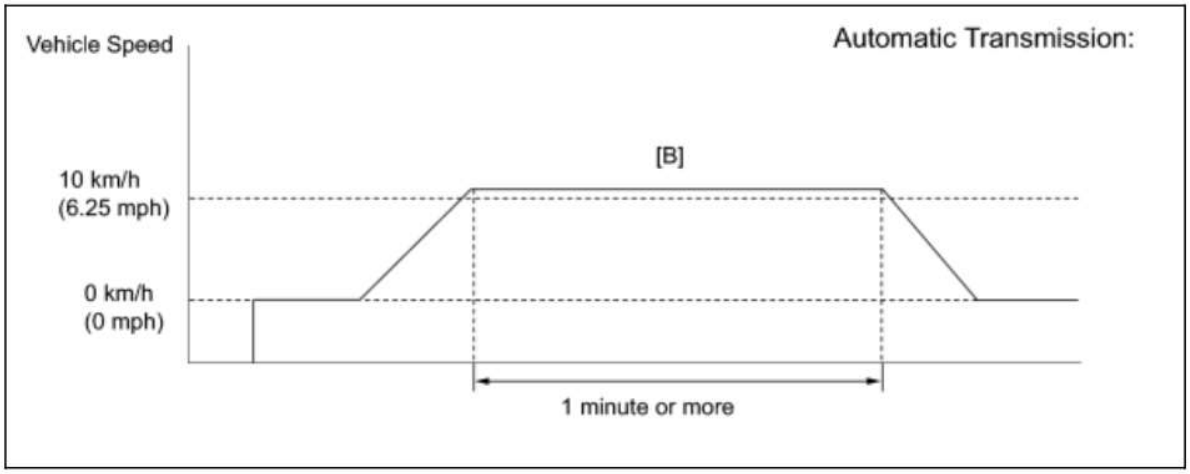
P0852 (Automatic Transmission)

Park/neutral position switch signal	More than battery voltage X 0.6
Park/neutral position from TCM	Off

CONFIRMATION DRIVING PATTERN

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1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Change gear position 3 times or more during Accelerating vehicle to 64 km/h (40 mph) [A]. (for Manual Transmission)

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [B]. (for Automatic Transmission)

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

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11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P0851 or P0852.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

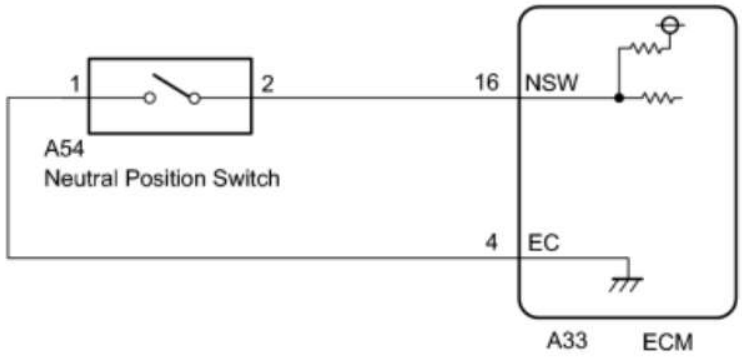
HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

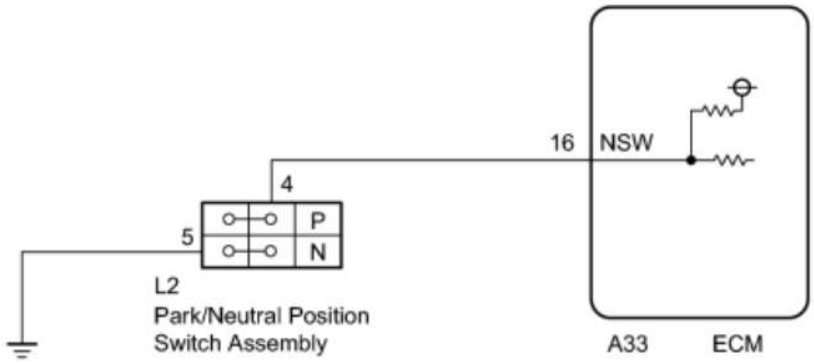
WIRING DIAGRAM

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for Manual Transmission:



for Automatic Transmission:



INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- Stop light switch assembly conditions can be checked using the Techstream.

a. Connect the Techstream to the DLC3.
b. Turn the ignition switch to ON.
c. Turn the Techstream on.

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d. Enter the following menus: Powertrain / Engine / Data List / Stop Light Switch and ST1.
e. Check the Data List indication when the brake pedal is depressed and released.

BRAKE PEDAL OPERATION	STOP LIGHT SWITCH	ST1
Depressed	ON	ON
Released	OFF	OFF

PROCEDURE

1.	**CHECK VEHICLE TYPE**

(a) Confirm the transmission.

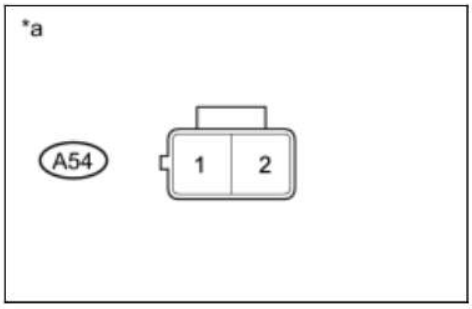
Result

RESULT	PROCEED TO
Manual Transmission	A
Automatic Transmission	B

B ▶ **INSPECT TERMINAL VOLTAGE (POWER SOURCE OF PARK/NEUTRAL POSITION SWITCH ASSEMBLY)**

A ▼

2.	**INSPECT TERMINAL VOLTAGE (POWER SOURCE OF NEUTRAL POSITION SWITCH)**



(a) Disconnect the neutral position switch connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A54-1 - A54-2	Ignition switch ON	11 to 14 V

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Text in Illustration

*a	Front view of wire harness connector (to Neutral Position Switch)

NG ▶ CHECK HARNESS AND CONNECTOR (NEUTRAL POSITION SWITCH - ECM)

OK ▼

3.	INSPECT NEUTRAL POSITION SWITCH

(a) Inspect the neutral position switch INFO .

NG ▶ REPLACE NEUTRAL POSITION SWITCH

OK ▶ CHECK FOR INTERMITTENT PROBLEMS

4.	CHECK HARNESS AND CONNECTOR (NEUTRAL POSITION SWITCH - ECM)

(a) Disconnect the ECM connector.

(b) Disconnect the neutral position switch connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-16 (NSW) - A54-2	Always	Below 1 Ω
A33-4 (EC) - A54-1	Always	Below 1 Ω

Standard Resistance (Check for short):

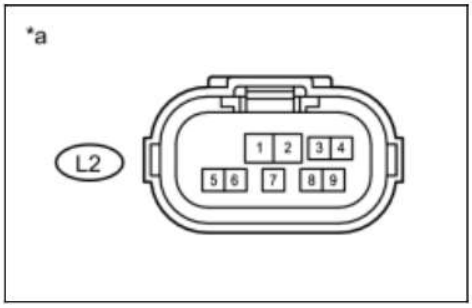
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-16 (NSW) or A54-2 - Body ground	Always	10 kΩ or higher
A33-4 (EC) or A54-1 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

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OK ▶ REPLACE ECM

5.	INSPECT TERMINAL VOLTAGE (POWER SOURCE OF PARK/NEUTRAL POSITION SWITCH ASSEMBLY)



(a) Disconnect the park/neutral position switch assembly connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
L2-4 - L2-5	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Park/Neutral Position Switch Assembly)

NG ▶ CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH ASSEMBLY - ECM - BODY GROUND)

OK ▼

6.	INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY

(a) Inspect the park/neutral position switch assembly INFO .

NG ▶ REPLACE PARK/NEUTRAL POSITION SWITCH ASSEMBLY

OK ▶ CHECK FOR INTERMITTENT PROBLEMS

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7.	**CHECK HARNESS AND CONNECTOR (PARK/NEUTRAL POSITION SWITCH ASSEMBLY - ECM - BODY GROUND)**

(a) Disconnect the ECM connector.

(b) Disconnect the park/neutral position switch assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-16 (NSW) - L2-4	Always	Below 1 Ω
L2-5 - Body ground	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-16 (NSW) or L2-4 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000043HM01EX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P1109,P2109: Throttle Deposit Malfunction (2013 FR-S)		

DTC	**P1109**	**Throttle Deposit Malfunction**

DTC	**P2109**	**Throttle / Pedal Position Sensor "A" Minimum Stop Performance**

DESCRIPTION

The idling speed is controlled by the Electronic Throttle Control System (ETCS). The ETCS is comprised of a throttle actuator, which operates the throttle valve, and a throttle position sensor, which detects the opening amount of the throttle valve. The ECM controls the throttle actuator to adjust the throttle valve opening amount so that the idling speed is maintained at the target idling speed.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1109	ISC learning value is 95% or more of the maximum learning ISC learning value, and 50% or more deposit is accumulated for 10 seconds continuously. (5 trip detection logic)	Throttle with motor body assembly
P2109	One of the following conditions is met (1 trip detection logic): • The throttle position sensor opening angle when learning the fully-closed position is less than 9.975°or more than 20.025°. • When the throttle actuator current is off, the difference between the actual throttle position and the fully-closed position is less than 1.162°.	Throttle with motor body assembly

HINT:

- The ISC learned value is the calculated intake air amount corresponding to the throttle opening amount necessary to maintain the idling speed.
- This malfunction is only detected once per trip. After it has been detected once, the system will not monitor for the malfunction for the rest of the trip.
- The system uses the throttle with motor body assembly and mass air flow meter assembly to detect this malfunction.

MONITOR DESCRIPTION

If there are deposits in the throttle valve, a decrease in the ISC flow rate may cause engine stall or unstable idling. Therefore, the necessary ISC flow rate for idling is maintained using the ISC learned value and feedback. The ECM stores this DTC if the ISC learned value approaches its limit.

MONITOR STRATEGY

Related DTCs	P2109: Throttle position sensor minimum stop rationality check
Required Sensors/Components (Main)	Throttle position sensor

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Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.008 seconds: Case 1 0.08 seconds: Case 2
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None
Battery voltage	6 V or more

TYPICAL MALFUNCTION THRESHOLDS

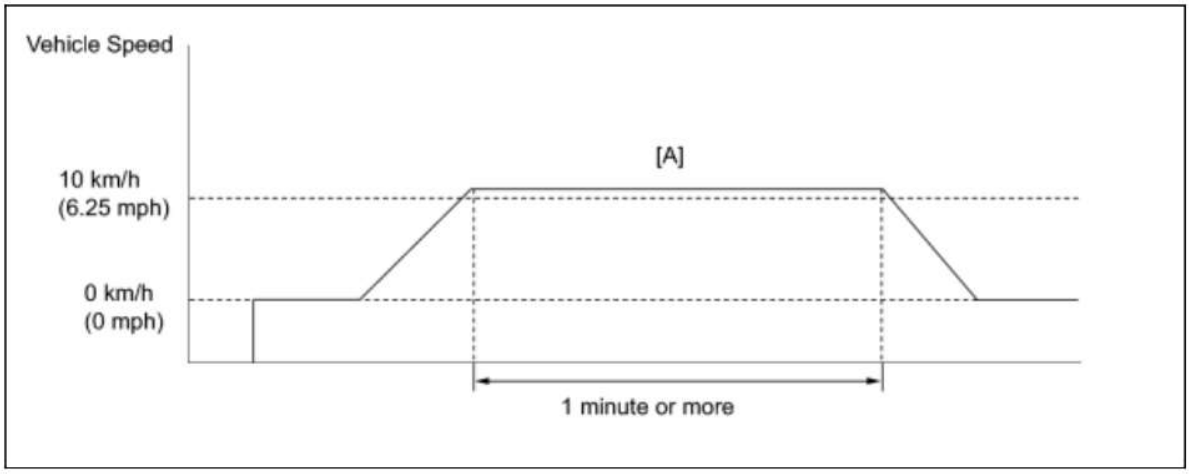
Case 1

Throttle minimum stop position	Less than -4.02% (0.399 V) or more than 4.02% (0.801 V)

Case 2

Throttle position at ignition switch OFF to ON - Throttle minimum stop position	Less than 0.71% (0.035 V)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Depress the accelerator pedal fully and release the accelerator pedal.
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [A].

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CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P1109 or P2109.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

NOTICE:

Never clean the throttle with motor body assembly.

HINT:

- Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
- Since a pending DTC is not stored for this DTC, it takes time to confirm whether the malfunction

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has been successfully repaired by checking for this DTC. When confirming whether the malfunction has been successfully repaired, compare "ISC Learning Value" recorded in the freeze frame data with "ISC Learning Value" in the Data List after repairs have been made to save time.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P2109)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P1109 or P2109 is output	A
DTC P1109 or P2109 and other DTCs are output	B

HINT:

If any DTCs other than P1109 or P2109 are output, troubleshoot those DTCs first.

B ▶ **GO TO DTC CHART**

A ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PFX0SWX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P1160,P2119: Throttle Valve Return Spring Malfunction (2013 FR-S)		

DTC	**P1160**	**Throttle Valve Return Spring Malfunction**

DTC	**P2119**	**Throttle Actuator Control Throttle Body Range / Performance**

DESCRIPTION

The electronic throttle control system is composed of the throttle actuator, throttle position sensor, accelerator pedal position sensor, and ECM. The ECM operates the throttle actuator to regulate the throttle valve in response to driver inputs. The throttle position sensor detects the opening angle of the throttle valve, and provides the ECM with feedback so that the throttle valve can be appropriately controlled by the ECM.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1160	After setting throttle valve opening angle at 40% in throttle actuator control, the change in opening angle is less than 2°after throttle actuator has been off. (1 trip detection logic)	Throttle with motor body assembly
P2119	The throttle valve opening angle continues to vary greatly from the target opening angle. (1 trip detection logic)	• Electronic throttle control system • Wire harness or connector • ECM

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MONITOR DESCRIPTION

P1160

When the ECM cuts the power supply to the throttle actuator, the throttle valve returns to the fully-closed position by the spring. If the throttle valve does not return with ETCS relay off, the ECM judges throttle valve is stuck and then the ECM illuminates the MIL and stores the DTC.

P2119

The ECM determines the actual opening angle of the throttle valve from the throttle position sensor signal. The actual opening angle is compared to the target opening angle commanded by the ECM. If the difference between these two values is outside the standard range, the ECM interprets this as a malfunction in the electronic throttle control system. The ECM then illuminates the MIL and stores the

DTC.

MONITOR STRATEGY

Related DTCs	P1160: Throttle return spring functional check P2119: Throttle actuator control functional check
Required Sensors/Components (Main)	Throttle actuator (throttle with motor body assembly)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	Immediately: P1160 5 seconds: P2119 (Case 1 and Case 5) 2 seconds: P2119 (Case 2) More than 248 msec (varies with throttle position): P2119 (Case 3) 1 second: P2119 (Case 4)
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None

P1160

Ignition switch	Off
Time after ignition switch off	3.392 seconds
Throttle position sensor 1 circuit DTC	Not detected
Throttle position sensor 2 circuit DTC	Not detected
Throttle position sensor rationality DTC	Not detected
Battery voltage	6 V or more

P2119 (Case 1)

Battery voltage	6.2 V or more
ETCS relay	On
Engine speed	Less than 500 rpm

P2119 (Case 2)

Battery voltage	6.2 V or more
ETCS relay	On
Engine speed	500 rpm or higher

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P2119 (Case 3)

ETCS relay	On
Engine speed	500 rpm or higher
Battery voltage	6.2 V or more
Throttle position sensor 1 value	More than target throttle position

P2119 (Case 4)

ETCS relay	On
Engine speed	500 rpm or higher
Battery voltage	6.2 V or more
Throttle position sensor 1 value	Less than target throttle position

P2119 (Case 5):

ETCS relay	On
Engine speed	Less than 300 rpm
Battery voltage	6.2 V or more

TYPICAL MALFUNCTION THRESHOLDS

P1160

Throttle position sensor 1 at diagnosis start - throttle position sensor 1	Less than 1.6%

P2119 (Case 1 and Case 2)

Throttle motor control duty	More than 95%

P2119 (Case 3, Case 4 and Case 5)

Target throttle position - throttle position sensor 1	More than 3.72% (varies with target throttle position)

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Depress the accelerator pedal fully and release the accelerator pedal.
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic

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laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P1160 or P2119.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

FAIL-SAFE

When this DTC or other DTCs relating to Electronic Throttle Control System (ETCS) malfunctions are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a fully closed throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue running at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

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WIRING DIAGRAM

Refer to DTC P2101 INFO .

INSPECTION PROCEDURE

NOTICE:

- Never clean the throttle with motor body assembly.
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Refer to "Data List / Active Test" [Throttle Position Commanded, Throttle Position No. 1, Throttle Motor Current, Throttle Motor Duty (Open) and Throttle Motor Duty (Close)] INFO .
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P1160 OR P2119)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P1160 and/or P2119 is output	A
DTC P1160 and/or P2119 and other DTCs are output	B

HINT:

If any DTCs other than P1160 and/or P2119 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A

▼

2.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION)**

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Enter the following menus: Powertrain / Engine / Data List / Throttle Position No. 1 and Throttle Position Command.

(h) Read the values displayed on the Techstream while fully depressing and releasing the accelerator pedal quickly.

Result

RESULT	PROCEED TO
Throttle Position No. 1 does not change	A
Throttle Position No. 1 changes even a little	B

HINT:

When a DTC is output, the system changes to fail-safe mode. Therefore, only use the data up until the time the DTC is stored for confirmation.

B ▶ **INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)**

A ▼

3.	**INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (RESISTANCE OF THROTTLE ACTUATOR)**

(a) Inspect the throttle with motor body assembly INFO .

NG ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

OK ▼

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4.	**INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)**

(a) Check for contamination between the throttle valve and housing. If necessary, clean the throttle with motor body assembly. Also, check that the throttle valve moves smoothly.

OK:

Throttle valve is not contaminated with foreign objects and moves smoothly.

NG ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

OK ▼

5.	**READ VALUE USING TECHSTREAM (THROTTLE POSITION)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Enter the following menus: Powertrain / Engine / Data List / Throttle Position No. 1, Throttle Position No. 2 and Throttle Position Command.

(h) Read the values displayed on the Techstream while wiggling the ECM wire harness.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
Value in Data List changes when wire harness is wiggled, or DTC is output	A
Other than above	B

B ▶ **CHECK WHETHER DTC OUTPUT RECURS**

A ▼

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6.	**REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - THROTTLE WITH MOTOR BODY ASSEMBLY)**

(a) As the DTC was stored due to a change in the contact resistance of the connector, repair or replace the wire harness or connector.

NEXT ▶ END

7.	**REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

(a) Replace the throttle with motor body assembly INFO .

NEXT ▼

8.	**CHECK WHETHER DTC OUTPUT RECURS**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes.

(j) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P1160 and/or P2119 is output	B

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B ▶ REPLACE ECM

A ▶ END

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000XCU02ZX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P1235: High Pressure Fuel Pump Circuit (2013 FR-S)		

DTC	**P1235**	**High Pressure Fuel Pump Circuit**

DESCRIPTION

The fuel pump assembly (for high pressure) is attached to the insulator, which is attached to the cylinder head cover. The pump activates according to the position of the cam on the intake side camshaft (bank 2).

The fuel pump assembly (for high pressure) increases the pressure of the fuel supplied from the fuel pump in the fuel tank to the specified fuel pressure according to the operating condition, and it feeds the fuel to the fuel delivery pipe.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1235	When fuel pump for high pressure is operating, the diagnostic signal from injector driver (EDU) does not change (open or short in the fuel pump (for high pressure) circuit). (1 trip detection logic)	• Open or short in fuel pump (for high pressure) • Fuel pump assembly (for high pressure) • ECM

MONITOR STRATEGY

Related DTCs	P1235: High pressure fuel pump functional check
Required Sensors/Components (Main)	Fuel pump assembly (for high pressure)
Required Sensors/Components (Related)	Injector driver (EDU)
Frequency of Operation	Continuous
Duration	20 counts [More than 0.1 seconds (varies with engine speed)]
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever these DTCs are not present	None
Battery voltage	10.5 V or more
Elapsed time after engine start	5 seconds or more

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Starter	Off
Active crank angle of high pressure fuel pump	More than 7°CA (varies with engine speed) and less than 148°CA

TYPICAL MALFUNCTION THRESHOLDS

High pressure fuel pump output signal	No falling edge detected

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Record the Freeze Frame Data.
4. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
5. Turn the ignition switch off and wait for at least 30 seconds.
6. Turn the ignition switch to ON and turn the Techstream on.
7. Based on engine speed, engine load and other freeze frame data stored in the ECM, reproduce the conditions present when the DTC was stored.
8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read the DTC.

HINT:

- If a DTC is output, the system is malfunctioning.
- If a DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P1235.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

- If the judgment result shown ABNORMAL, the system has a malfunction.
- If the judgment result shows NORMAL, the system is normal.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and

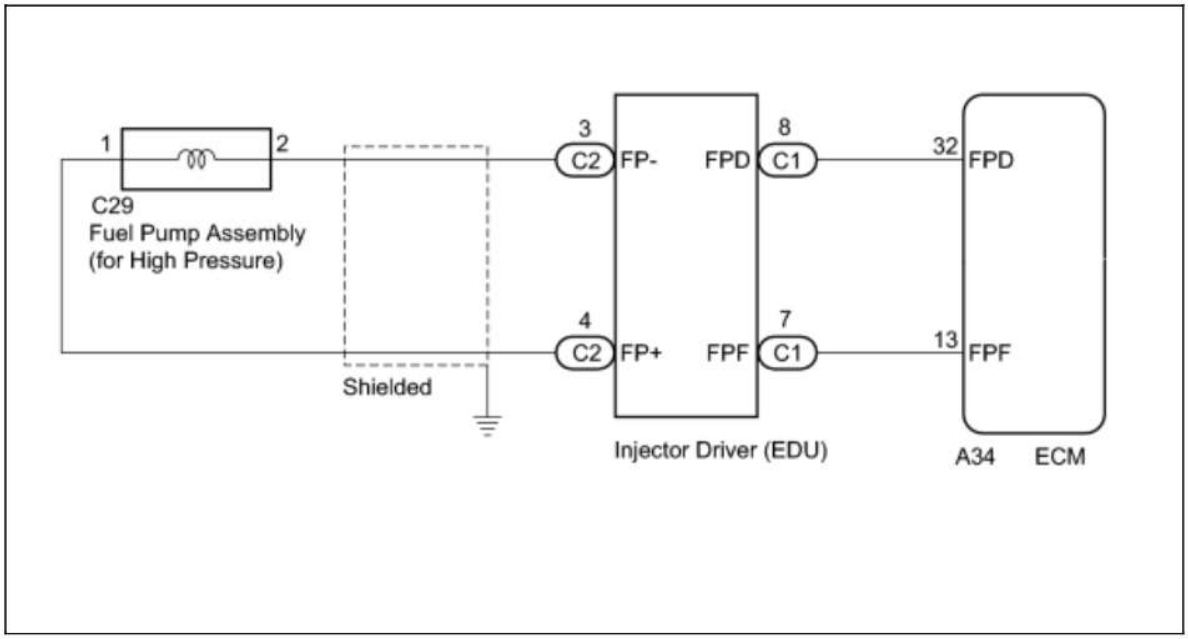
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check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If the current from the INJ relay is cut because DTC P062D is stored, DTC P1235 will be stored even if the fuel pump assembly (for high pressure) is normal.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	**INSPECT FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)**

(a) Inspect the fuel pump assembly (for high pressure) INFO .

NG ▶ **REPLACE FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)**

OK
▼

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2.	**CHECK HARNESS AND CONNECTOR (INJECTOR DRIVER (EDU) - FUEL PUMP ASSEMBLY)**

(a) Disconnect the injector driver (EDU) connector.

(b) Disconnect the fuel pump assembly (for high pressure) connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C2-3 (FP-) - C29-2	Always	Below 1 Ω
C2-4 (FP+) - C29-1	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C2-3 (FP-) or C29-2 - Body ground	Always	10 kΩ or higher
C2-4 (FP+) or C29-1 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (ECM - INJECTOR DRIVER (EDU))**

(a) Disconnect the ECM connector.

(b) Disconnect the injector driver (EDU) connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-32 (FPD) - C1-8 (FPD)	Always	Below 1 Ω
A34-13 (FPF) - C1-7 (FPF)	Always	Below 1 Ω

Standard Resistance (Check for short):

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-32 (FPD) or C1-8 (FPD) - Body ground	Always	10 kΩ or higher
A34-13 (FPF) or C1-7 (FPF) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

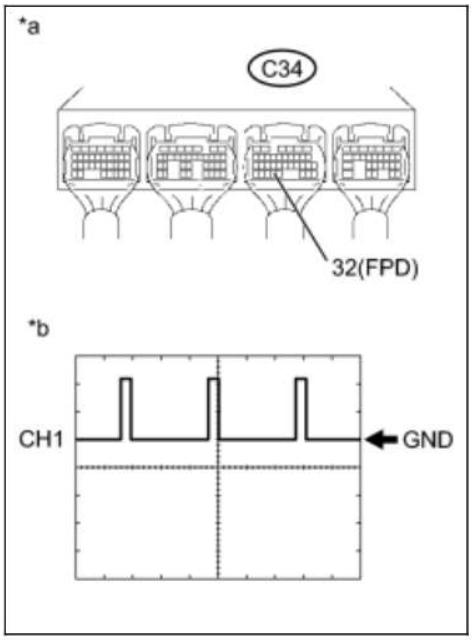
OK ▼

4.	**INSPECT ECM (FPD VOLTAGE)**

(a) Turn the ignition switch to ON.

(b) Inspect the ECM using an oscilloscope.

(1) While idling the engine, check the waveform the terminals of the ECM connector.



ECM Terminal Name	A34-32 (FPD) - Body ground
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling

Text in Illustration

*a	Component with harness connected (ECM)
*b	FPD Terminal Waveform Normal Waveform

Standard:
Signal waveform appears as shown in the illustration.

HINT:

The FPD terminal waveform is output only right after the engine starts. If this DTC is stored when the engine is started from ignition switch off, the system enters fail-safe mode and the waveform is not output.

NG ▶ **INSPECT ECM (FPD VOLTAGE)**

OK ▼

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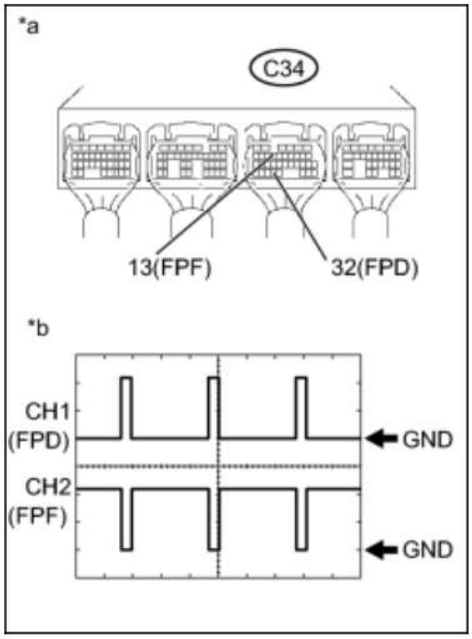
5.	INSPECT ECM (FPF VOLTAGE)

(a) Turn the ignition switch to ON.

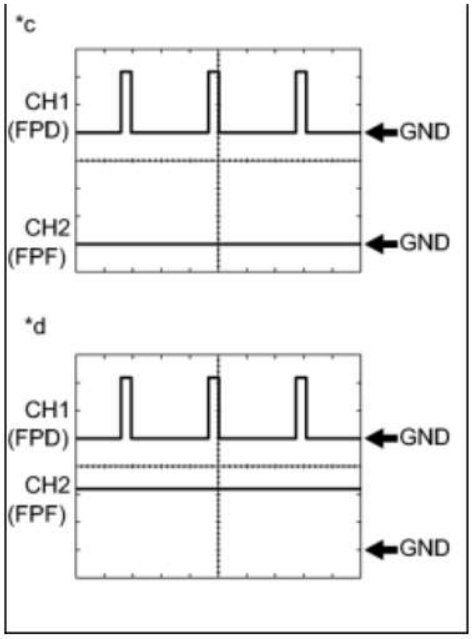
(b) Inspect the ECM using an oscilloscope.

(1) While idling the engine, check the waveform the terminals of the ECM connector.

ECM Terminal Name	CH1: A34-32 (FPD) - Body ground CH2: A34-13 (FPF) - Body ground
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling



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Text in Illustration

*a	Component with harness connected (ECM)
*b	FPD Terminal and FPF Terminal Waveform Normal Waveform
*c	FPF Terminal Waveform NG Waveform 1
*d	FPF Terminal Waveform NG Waveform 2

HINT:

***: If the FPF terminal waveform is similar to the FPF terminal waveform NG waveform 1, stop the engine and disconnect injector driver (EDU) connector. Then, while cranking the engine, check to see if there is a difference between the FPF terminal waveform and the previous one.**

Result:

FPD TERMINAL WAVEFORM	FPF TERMINAL WAVEFORM		PROCEED TO
OK	OK		A
OK	NG waveform 1*	Does not change from NG waveform 1 (FPF terminal waveform remains at GND even after disconnecting the injector driver (EDU) connector and cranking the engine)	A
		Changes to NG waveform 2 (FPF terminal waveform rises from GND after disconnecting the injector driver (EDU) connector and cranking the engine)	B
OK	NG waveform 2		B

B ▶ REPLACE INJECTOR DRIVER (EDU)

A ▶ REPLACE ECM

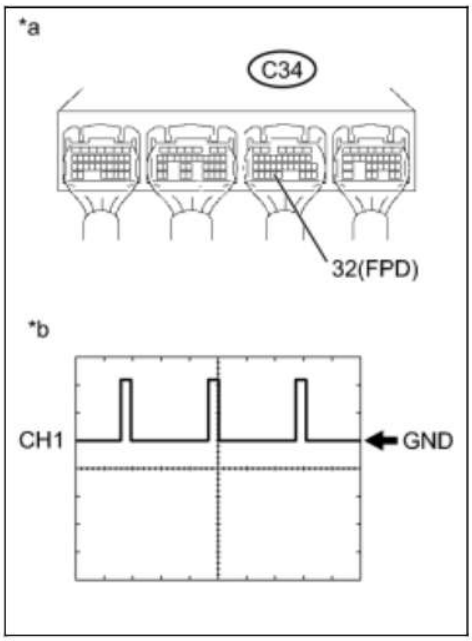
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6.	INSPECT ECM (FPD VOLTAGE)

(a) Turn the ignition switch to ON.

(b) Disconnect the injector driver (EDU) connector.

(c) Inspect the ECM using an oscilloscope.



(1) While cranking the engine, check the waveform the terminals of the ECM connector.

ECM Terminal Name	A34-32 (FPD) - Body ground
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Cranking

Text in Illustration

*a	Component with harness connected (ECM)
*b	FPD Terminal Waveform Normal Waveform

Standard:
Signal waveform appears as shown in the illustration.

NG ▶ **REPLACE ECM**

OK ▶ **REPLACE INJECTOR DRIVER (EDU)**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000005967000X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P1449: Evaporative Emission System Lid Open Switch Stuck ON (2013 FR-S)		

DTC	**P1449**	**Evaporative Emission System Lid Open Switch Stuck ON**

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P1449	Canister filter clogged	The canister pressure sensor output value has rapidly changed.	• Clogged on EVAP line (drain tube) • Clogged on EVAP line (canister pump module - drain separator) • Clogged on canister pump module (drain separator)	While ignition switch off	2 trip

DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

The ECM monitors for canister filter in the canister pump module. The pressure is checked every 5 seconds and if the pressure difference becomes more than threshold, stops the EVAP system monitor. The ECM then illuminates the MIL and stores the DTC (2 trip detection logic).

MONITOR STRATEGY

Related DTC	P1449: Evaporative Emission System Lid Open Switch Stuck ON
Required Sensors/Components (Main)	Purge valve Canister pump module
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	6 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

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Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or higher
Elapsed time after engine	20 seconds or more
ELCM vacuum pump	Not active
ELCM switching valve	Off (Open)
All of the following condition are met	A and B
A. Pressure difference in 0.064 seconds	Less than 0.66661 kPa [5 mmHg]
B. Period to satisfy above condition	18.12 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

Pressure difference in 5 seconds	1.21 kPa [9 mmHg] or more

MONITOR RESULT

Refer to Checking Monitor Status INFO .

CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or higher, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure).
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.
7. After the Evaporative System Check is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All Readiness.
8. Input the DTC: P1449.
9. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal

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INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

PROCEDURE

1.	**INSPECT EVAP HOSE (DRAIN TUBE)**

(a) Check for filter blockage in the drain tube.

OK:

OK: No blockages in the drain tube.

NG ▶ **REPLACE EVAP HOSE (DRAIN TUBE)**

OK ▼

2.	**INSPECT EVAP HOSE (CANISTER PUMP MODULE - DRAIN SEPARATOR)**

(a) Check for filter blockage in the EVAP purge line between the canister pump module and drain separator.

OK:

No blockages in the EVAP purge line between the canister pump module and drain separator.

NG ▶ **REPLACE EVAP HOSE (CANISTER PUMP MODULE - DRAIN SEPARATOR)**

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OK

3.	**INSPECT DRAIN SEPARATOR**

(a) Check for filter blockage in the drain separator.

OK:
No blockages in the drain separator.

NG ▶ **REPLACE DRAIN SEPARATOR**

OK

4.	**REPLACE CANISTER PUMP MODULE**

(a) Replace the canister pump module INFO .

NEXT ▶ **PERFORM EVAP SYSTEM**

5.	**REPLACE EVAP HOSE (DRAIN TUBE)**

NEXT ▶ **PERFORM EVAP SYSTEM**

6.	**REPLACE EVAP HOSE (CANISTER PUMP MODULE - DRAIN SEPARATOR)**

NEXT ▶ **PERFORM EVAP SYSTEM**

7.	**REPLACE DRAIN SEPARATOR**

(a) Replace the drain separator.

NEXT

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8.	PERFORM EVAP SYSTEM

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine in this step.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an Evaporative System Check, keep the fuel temperature below 35°C (95°F).

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.

(f) After the Evaporative System Check is completed, check for pending DTCs by entering the following menus: Powertrain / Engine / Trouble Codes.

HINT:

If no pending DTCs are found, the repair has been successfully completed.

NEXT ▶ END

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000021140ENX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P1603: Engine Stall History (2013 FR-S)		

DTC	**P1603**	**Engine Stall History**

DESCRIPTION

After starting the engine, this DTC is stored when the engine stops without the ignition switch being operated.

Using the Techstream, the conditions present when the DTC was stored can be confirmed by referring to the freeze frame data. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.

It is necessary to check if the vehicle has run out of fuel before performing troubleshooting, as this DTC is also stored when the engine stalls due to running out of fuel.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1603	After monitoring for startability problems (P1604) finishes and starting the engine, with the engine running, the engine stops (the engine speed drops to 300 rpm or less) without the ignition switch being operated. (1 trip detection logic)	• Air leak in intake system • Purge valve • Brake booster • Mass air flow meter • Engine coolant temperature sensor • Thermostat • Power supply circuit (purge valve, air fuel ratio sensor, fuel injector assembly, ignition coil assembly) • Fuel pump assembly) • Fuel pump control circuit (low pressure side) • Fuel line • PCV valve and hose • Camshaft timing oil control valve • Knock sensor • Ignition system • Air conditioning system • Power steering system • Electrical load signal system • Charging system • Automatic

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		transmission system • Park/neutral position switch assembly • ECM • Wire harness or connector • Engine immobiliser system

INSPECTION PROCEDURE

HINT:

- In contrast to normal malfunction diagnosis for components, circuits and systems, DTCs P1603 is used to determine the malfunctioning area from the problem symptoms and freeze frame data when the user mentions problems such as engine stall.

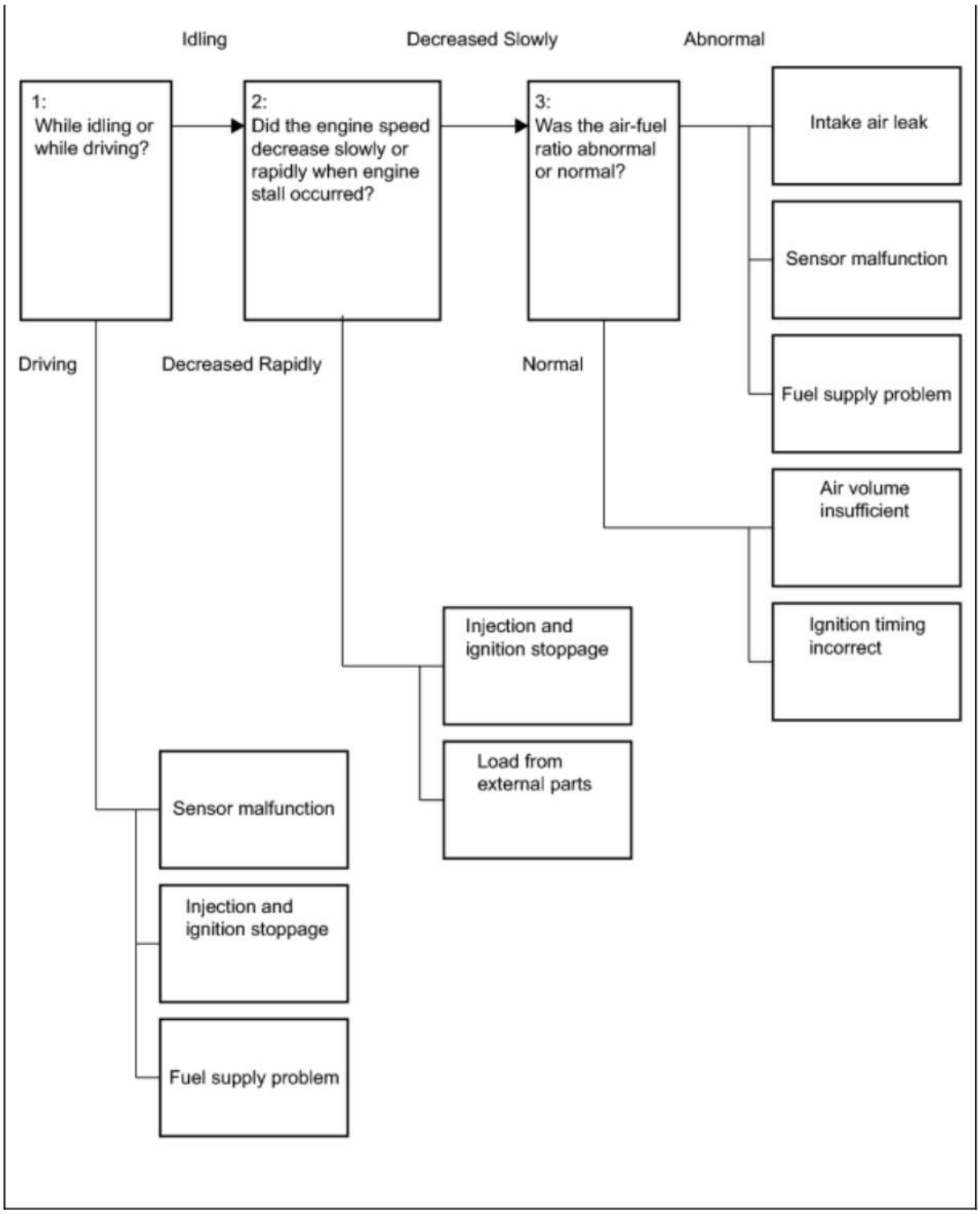
  As these DTCs can be stored as a result of certain user actions, even if these DTCs are output, if the customer makes no mention of problems, clear these DTCs without performing any troubleshooting and return the vehicle to the customer.
- If any other DTCs are output, perform troubleshooting for those DTCs first.
- Use any information from the customer problem analysis about the condition of the vehicle at the time when the problem occurred (how the engine stopped, conditions when the engine was restarted, etc.) as a reference.

SYMPTOM	SUSPECTED AREA
Engine vibration occurs and engine stops	Air-fuel ratio abnormal
Engine stops with no engine vibration	Ignition system, injection stoppage, high load from external parts
Engine can be started with accelerator pedal depressed	Insufficient air volume
Rough idling after engine started	Air-fuel ratio abnormal, abnormal combustion

- Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
- When confirming the freeze frame data, be sure to check all 5 sets of freeze frame data INFO .
- When confirming freeze frame data, if there are multiple items related to the cause of the malfunction, perform troubleshooting for all related items.
- Try to operate the vehicle under the conditions recorded in the freeze frame data which were present when the malfunction occurred. Confirm the data at this time and the data when the engine is idling (engine warmed up, no load, and shift lever in D, N or neutral) and compare these data with the freeze frame data.
- Inspections take into account the fact that the malfunction may not have reoccurred and place emphasis on checking the vehicle conditions present at the time when the malfunction occurred.
- When performing inspections, jiggle the relevant wire harnesses and connectors in an attempt to reproduce malfunctions that do not always occur.

Inspection flow:
Using freeze frame data, narrow down the parts to be inspected according to the vehicle conditions at the time when the malfunction occurred.

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1:

- If the engine stalled when the intake air volume was low (during idling or deceleration), there may be a decrease in torque due to an incorrect air-fuel ratio, etc.
- If the engine stalled when the intake air volume was high (during driving or acceleration), there may be a major malfunction such as continuous misfire due to ignition stoppage, fuel injection stoppage, etc. and the torque drops to zero.

2:

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- If the engine speed decreased slowly, there may have been a decrease in torque due to an air-fuel ratio that was incorrect (by approximately 20 to 30%), etc.
- If the engine speed decreased rapidly, there may have been a malfunction such as when the engine misfires almost continuously due to ignition stoppage, fuel injection stoppage, etc., or when the external load increases due to an external part malfunctioning.

3:

- If the air-fuel ratio is abnormal, there may have been an intake air leak, sensor malfunction, or fuel supply problem.
- If the vehicle was normal, the air volume may have been insufficient or the ignition timing may have been incorrect.

P1603 inspection flow: Narrow down the parts to be inspected according to the vehicle conditions at the time when the malfunction occurred (freeze frame data).

<table>
<tr><th>VEHICLE STATE</th><th>ENGINE SPEED</th><th colspan="2">SUSPECTED AREA</th><th>PRIMARY PARTS TO INSPECT</th><th>PROCEDURE</th></tr>
<tr><td rowspan="7">Idling or decelerating</td><td rowspan="7">Slowly decreases and engine stalls</td><td>Ignition system abnormal</td><td>Igniter abnormal</td><td>• Power supply circuit
• Ignition coil assemblies
• Spark plug</td><td>10, 38, 52</td></tr>
<tr><td rowspan="3">Air-fuel ratio abnormal</td><td>Air suction</td><td>• Intake system connections
• Purge valve system
• Brake booster</td><td>5 to 9</td></tr>
<tr><td>Sensor malfunction (value from sensor too lean)</td><td rowspan="2">• Mass air flow meter
• Engine coolant temperature sensor
• Air fuel ratio sensor system
• Thermostat</td><td>11 to 23</td></tr>
<tr><td>Sensor malfunction (value from sensor too rich)</td><td>39 to 51</td></tr>
<tr><td>Fuel supply problem</td><td>• Fuel pump control circuit
• Purge valve system
• Fuel line
• ECM</td><td>24 to 37</td></tr>
<tr><td>Intake air volume insufficient</td><td>Problem with air passage</td><td>• Intake system connections
• Mass air flow meter
• Brake booster
• PCV valve and hose
• Purge valve system</td><td>53 to 55</td></tr>
</table>

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			Excessive valve overlap	• Camshaft timing oil control valve	56 to 59
		Ignition timing incorrect	Does not operate as expected	• Knock sensor • Engine coolant temperature sensor • Mass air flow meter	60 to 64
	Rapidly decreases and engine stalls*	Ignition and injection stops (electrical system malfunction)	Power temporarily cut	• Power supply circuit (fuel injector assembly (for port injection), ignition coil assembly)	65, 66
		External part malfunctioning	Increase in load	• Air conditioning system • Electrical load signal system • Power steering system • Automatic transmission system • Park/neutral position switch assembly	67 to 69
Accelerating	-	Crankshaft position sensor or VVT sensor malfunction	Power temporarily cut	• Check DTCs	1
		Mass air flow meter	Foreign matter adhesion	• Mass air flow meter	70 to 73
		Ignition and injection stops (electrical system malfunction)	Power temporarily cut	• Power supply circuit (fuel injector assembly (for port injection), ignition coil assembly)	74, 75
		Fuel supply problem	Fuel leak, clog	• Fuel pump control circuit • Fuel line	76 to 80

*: If the engine stalls immediately after the injection method is switched from port injection to direct injection, the injector driver (EDU) may be malfunctioning.

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection

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procedure.

PROCEDURE

1.	CHECK FOR ANY OTHER DTCS OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Read the DTCs INFO .

Result

RESULT	PROCEED TO
Only DTC P1603 is output	A
DTCs other than P1603 are output	B

HINT:

If any DTCs other than P1603 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

OK:
Immobiliser Fuel Cut is OFF.

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ READ FREEZE FRAME DATA

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A

3.	CHECK ENGINE IMMOBILISER SYSTEM

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Idle the engine

(d) Enter the following menus: Powertrain / Engine / Data List / Immobiliser Communication and Immobiliser Fuel Cut.

(e) Check the Data List indication.

Result

DATA LIST ITEM	RESULT
Immobiliser Communication	ON
Immobiliser Fuel Cut	OFF

NG ▶ **CHECK ENGINE IMMOBILISER SYSTEM**

OK

4.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

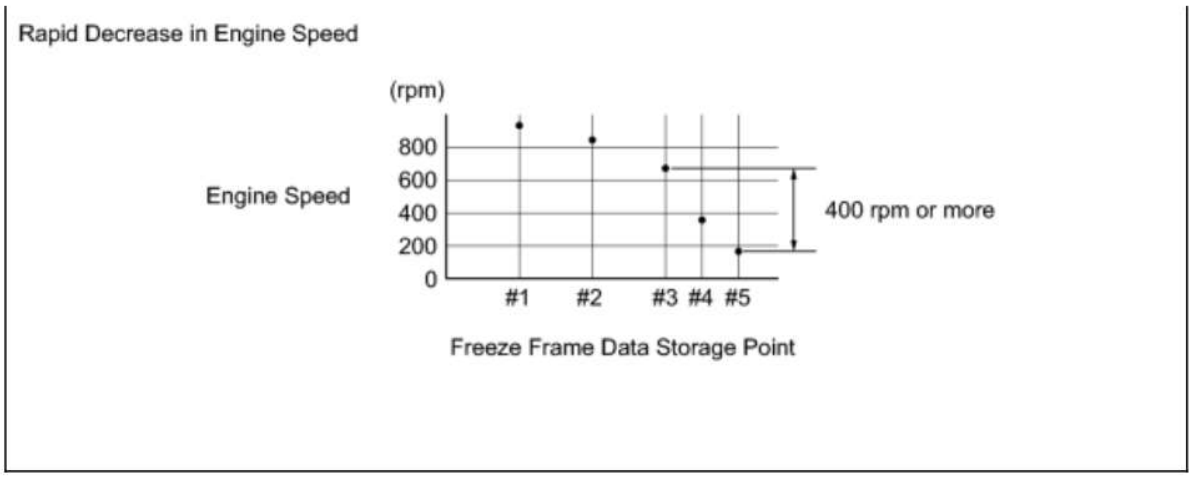
Result

PROBLEM SYMPTOM	FREEZE FRAME DATA ITEM			SUSPECTED AREA	PROCEED TO
	CLOSED THROTTLE POSITION SW	ENGINE SPEED	TOTAL OF SHORT FT AND LONG FT		
				• Air suction • Sensor	

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When idling or decelerating, engine speed slowly decreases and engine stalls	All 5 sets of freeze frame data are ON	Decreases slowly*1	All 5 sets of freeze frame data are +15% or more*2	malfunction (value from sensor too lean) • Fuel supply problem	A
			At least 1 of the 5 sets of freeze frame data is -15% or less*3	Sensor malfunction (value from sensor too rich)	B
			All 5 sets of freeze frame data are from -15% to +15%	• Intake air volume insufficient • Ignition timing incorrect	C
When idling or decelerating, engine speed rapidly decreases and engine stalls		Decreases rapidly*1	-	• Injection stoppage, ignition stoppage • Load from external parts	D
When accelerating or driving at constant speed, engine stalls	At least one is OFF	-	-	• Sensor malfunction • Injection stoppage, ignition stoppage • Fuel supply problem	E

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HINT:

- *1: A rapid decrease in engine speed may be caused by an electrical fault in the shared wiring of all or a number of cylinders, an increase in load from external parts, etc. The engine speed is considered to have decreased rapidly if either of the following conditions applies.

  Otherwise, the engine speed is considered to have decreased slowly.

  a. In the freeze frame data, the decrease in engine speed from #3 to #5 is 400 rpm or more.
  b. In the freeze frame data, the engine speed at #5 is 120 rpm or less.

- If the vehicle speed is 30 km/h or less and the difference between Engine Speed and SPD (NT) is 100 rpm or less, inspect the automatic transmission. (Depending on the rate of vehicle deceleration, the engine speed may have decreased due to the A/T lock-up release being late.)
- *2: When a DTC is stored, feedback compensation increases because the air-fuel ratio is determined to be lean.
- *3: When a DTC is stored, feedback compensation decreases because the air-fuel ratio is determined to be rich.

B ▶ **CHECK IGNITION SYSTEM**

C ▶ **CHECK IGNITION SYSTEM**

D ▶ **CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)**

E ▶ **CHECK FREEZE FRAME DATA**

A ▼

5.	**CHECK INTAKE SYSTEM**

(a) Check for air leakage in the intake system [vacuum hose disconnection, cracks, damaged

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gaskets, etc.] INFO .

HINT:

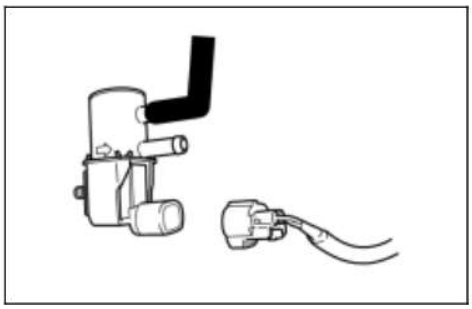
- If the accelerator pedal is released after racing the engine, the inspection is easier to perform because the vacuum inside the intake pipes increases and the air suction noise becomes louder.
- If Short FT and Long FT are largely different from the normal values when idling (the intake air volume is small) and almost the same as the normal values when racing the engine (the intake air volume is high), air leakage may be present.

OK:
There is no air leakage.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

6.	CHECK PURGE VALVE



(a) Disconnect the purge hose (on the canister side) of the purge valve.

(b) Start the engine.

(c) Idle the engine.

(d) Disconnect the connector of the purge valve.

(e) Check if air flows through the purge valve.

OK:
Air does not flow.

(f) Connect the connector of the purge valve.

(g) Connect the purge hose of the purge valve.

HINT:

When this inspection is performed, the MIL may illuminate. After finishing the inspection, check and clear DTCs INFO **.**

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NG ▶ REPLACE PURGE VALVE

OK ▼

7.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

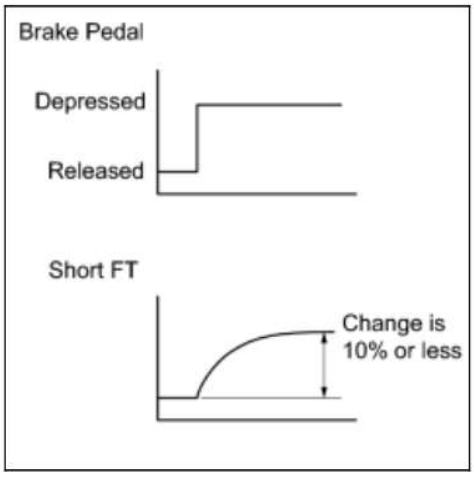
Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Stop Light Switch	At least 1 of the 5 sets of freeze frame data is ON	Air suction from brake booster	A
	All 5 sets of freeze frame data are OFF	-	B

B ▶ CHECK IGNITION SYSTEM

A ▼

8.	READ VALUE USING TECHSTREAM (SHORT FT)



(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

(d) Idle the engine.

(e) Using the Techstream, read the value of Short FT #1 in the Data List while depressing the brake pedal.

Standard:

Short FT #1 changes by +10% or less.

HINT:

When air leakage from the brake booster is present, the feedback compensation increases because the air-fuel ratio becomes lean.

NG ▶ **INSPECT BRAKE BOOSTER ASSEMBLY**

OK ▼

9.	**PERFORM DRIVE TEST**

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

(c) Idle the engine.

(d) Using the Techstream, read the value of Short FT #1 in the Data List.

Standard:

DATA LIST	CONDITION	SPECIFIED CONDITION
Short FT #1 + Long FT #1	The conditions of the vehicle are matched to those present when the problem occurs	-15 to +15%

NG ▶ **INSPECT BRAKE BOOSTER ASSEMBLY**

OK ▼

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10.	CHECK IGNITION SYSTEM

(a) Perform ignition system On-vehicle Inspection INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK
▼

11.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Calculate Load	Below 90% of the current value of the vehicle*1	Mass air flow meter	A
AFS Voltage B1S1	2.2 V or higher*2	• Air fuel ratio sensor • Wire harness or connector	B

HINT:

- *1: If the mass air flow meter is malfunctioning and incorrectly measures the pressure to be less than the actual intake manifold pressure, the freeze frame data will show a low engine load value.
- *2: If the air fuel ratio sensor is malfunctioning and constantly outputs a value indicating the air-fuel ratio is lean, the actual air-fuel ratio will become rich and the engine may stall.

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

A

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12.	CHECK MASS AIR FLOW METER

(a) Remove the mass air flow meter.

(b) Check for foreign matter in the airflow passage of the mass airflow meter.

Result

RESULT	PROCEED TO
Visible foreign matter is not present	A
Visible foreign matter is present	B

B ▶ REPLACE MASS AIR FLOW METER

A

13.	CHECK HARNESS AND CONNECTOR (ECM - MASS AIR FLOW METER)

(a) Disconnect the ECM.

(b) Disconnect the mass air flow meter connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
A33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

14.	PERFORM DRIVE TEST

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

(c) Idle the engine.

(d) Using the Techstream, read the value of Calculate Load in the Data List.

Standard:

DATA LIST	SPECIFIED CONDITION
Calculate Load	90 to 110% of the current value of the vehicle

Result

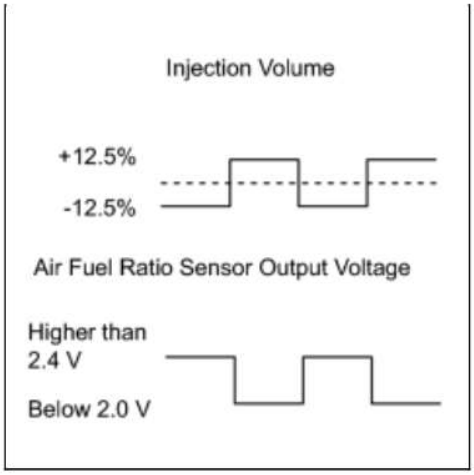
RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ READ FREEZE FRAME DATA

A ▶ REPLACE MASS AIR FLOW METER

15.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Start the engine, turn off all accessory switches and warm up the engine until the engine coolant temperature stabilizes.

(d) Idle the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor.

(f) Read the output voltage from the air fuel ratio sensor when increasing and decreasing the fuel injection volume.

Standard:

TECHSTREAM DISPLAY	SPECIFIED CONDITION
Control the Injection Volume for A/F Sensor (+12.5%)	Air fuel ratio sensor output voltage is below 2.0 V
Control the Injection Volume for A/F Sensor (-12.5%)	Air fuel ratio sensor output voltage is higher than 2.4 V

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

HINT:

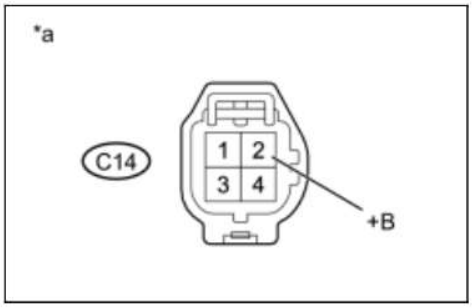
The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

B ▶ READ FREEZE FRAME DATA

A ▼

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16.	CHECK TERMINAL VOLTAGE (AIR FUEL RATIO SENSOR POWER SOURCE)



(a) Disconnect the air fuel ratio sensor connector.

(b) Turn ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C14-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Air Fuel Ratio Sensor)

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR AIR FUEL RATIO SENSOR POWER SOURCE CIRCUIT**

OK
▼

17.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the ECM.

(b) Disconnect the air fuel ratio sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

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Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-18 (A1A-) - C14-4 (A1A-)	Always	Below 1 Ω
A34-19 (A1A+) - C14-3 (A1A+)	Always	Below 1 Ω
A34-5 (HA1A) - C14-2 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-18 (A1A-) or C14-4 (A1A-) - Body ground	Always	10 kΩ or higher
A34-19 (A1A+) or C14-3 (A1A+) - Body ground	Always	10 kΩ or higher
A34-5 (HA1A) or C14-2 (HA1A) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

18.	**READ FREEZE FRAME DATA**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	PROCEED TO
Initial Engine Coolant Temp, Ambient Temp for A/C, Initial Intake Air Temp	Difference in temperature between each item is less than 10°C*1	A
	Difference in temperature between each item is 10°C or more*2	B

HINT:

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- *1: A long time had elapsed after stopping the engine.
- *2: A long time had not elapsed after stopping the engine.

B READ FREEZE FRAME DATA

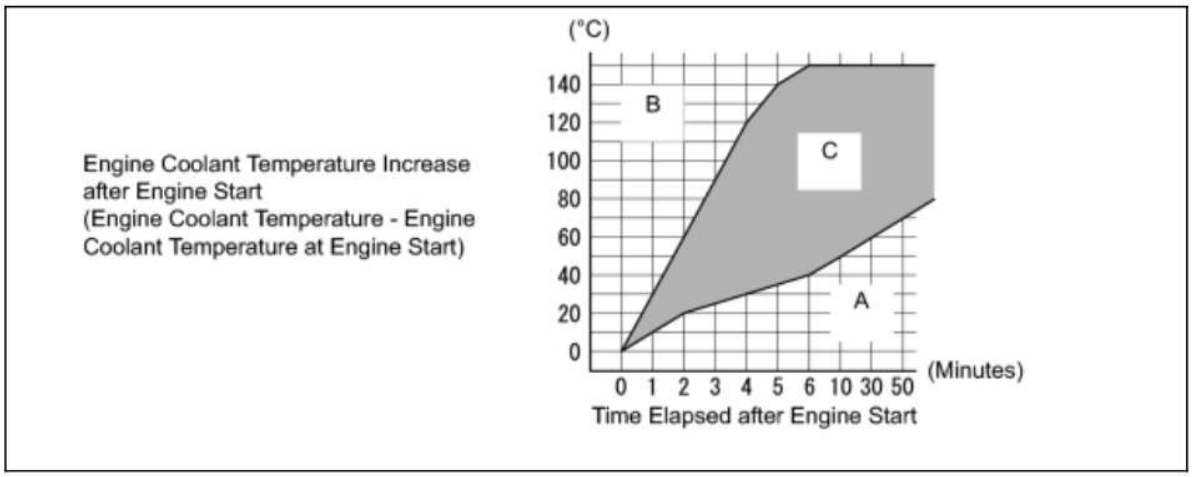
A

19.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .



Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Initial Engine Coolant Temp, Coolant Temp, Engine Run Time	Range A	• Engine coolant temperature sensor • Thermostat	A
	Range B	Engine coolant temperature sensor	B
	Range C	-	C

HINT:

This step is not directly related to engine stall.

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B ▶ **INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

C ▶ **READ FREEZE FRAME DATA**

A ▼

20.	INSPECT THERMOSTAT

HINT:

For the thermostat inspection, refer to the following procedures INFO .

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ **INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

A ▶ **REPLACE THERMOSTAT**

21.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Coolant Temp	120°C or higher	Engine coolant temperature sensor	A
Coolant Temp, Ambient Temp for A/C	Engine coolant temperature is lower than outside temperature by 15°C or more	Engine coolant temperature sensor	
Both freeze frame data items listed above	Values are other than above	-	B

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B ▶ READ FREEZE FRAME DATA

A ▼

22.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO .

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

23.	CHECK HARNESS AND CONNECTOR (ECM - ENGINE COOLANT TEMPERATURE SENSOR)

(a) Disconnect the ECM connector.

(b) Disconnect the engine coolant temperature sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) - C35-2 (THW)	Always	Below 1 Ω
A36-29 (E1) - C35-1 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) or C35-2 (THW) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C35-1 (E2) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

REPAIR OR REPLACE HARNESS OR

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NG ▶ CONNECTOR

OK ▼

24.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
EVAP (Purge) VSV	At least 1 of the 5 sets of freeze frame data is not 0%	Purge valve	A
	All 5 sets of freeze frame data are 0%	-	B

HINT:

If the purge valve is stuck closed, air-fuel ratio compensation by the purge valve is incorrectly adjusted, and then the air-fuel ratio becomes lean and the engine may stall.

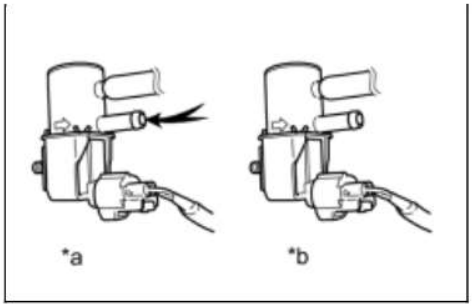
B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP DUTY)**

A ▼

25.	PERFORM ACTIVE TEST USING TECHSTREAM (ACTIVATE THE VSV FOR EVAP CONTROL)

(a) Disconnect the purge hose (on the canister side) of the purge valve.

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(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Activate the VSV for Evap Control.

(f) Operate the purge valve and check the airflow.

OK:

ACTIVATE THE VSV FOR EVAP CONTROL	SPECIFIED CONDITION
ON	Air flows
OFF	Air does not flow

Result

RESULT	PROCEED TO
NG	A
OK	B

Text in Illustration

*a	Purge valve ON (Air flows)
*b	Purge valve OFF (Air does not flow)

HINT:

Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP DUTY)**

A

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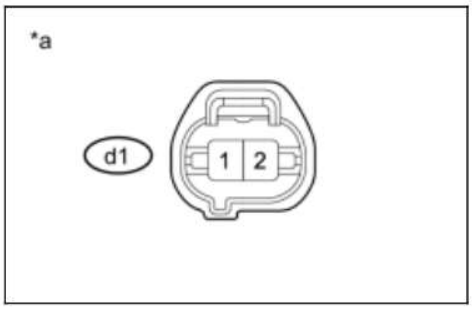
26.	INSPECT PURGE VALVE

(a) Inspect the purge valve INFO .

NG ▶ REPLACE PURGE VALVE

OK ▼

27.	CHECK TERMINAL VOLTAGE (PURGE VALVE POWER SOURCE)



(a) Disconnect the purge valve connector.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
d1-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Purge Valve)

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ REPAIR PURGE VALVE POWER SOURCE CIRCUIT

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OK

28.	CHECK HARNESS AND CONNECTOR (PURGE VALVE - ECM)

(a) Disconnect the purge valve connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-11 (PRG) - d1-2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-11 (PRG) or d1-2 - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

29.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

NEXT

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30.	READ VALUE USING TECHSTREAM (EVAP (Purge) VSV)

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

(c) Idle the engine for 15 minutes or more.

(d) Using the Techstream, read the value of EVAP (Purge) VSV in the Data List.

Standard:

DATA LIST	SPECIFIED CONDITION
EVAP (Purge) VSV	Value other than 0% is displayed

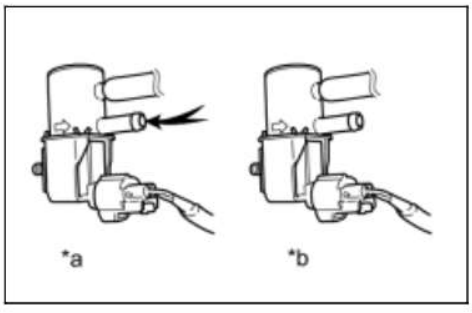
Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

31.	PERFORM ACTIVE TEST USING TECHSTREAM



(a) Disconnect the purge hose (on the canister side) of the purge valve.

(b) Connect the Techstream to the DLC3.

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(c) Turn the ignition switch to ON.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Activate the VSV for Evap Control.

(f) Operate the purge valve and check the airflow.

OK:

ACTIVATE THE VSV FOR EVAP CONTROL	SPECIFIED CONDITION
ON	Air flows
OFF	Air does not flow

Result

RESULT	PROCEED TO
NG	A
OK	B

Text in Illustration

*a	VSV ON (Air flows)
*b	VSV OFF (Air does not flow)

HINT:

Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

32.	CHECK CONNECTOR CONNECTION CONDITION (ECM)

(a) Check the ECM connector connection condition.

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **RECONNECT CONNECTOR CORRECTLY**

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OK ▶ REPLACE ECM

33.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP DUTY)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump Duty.

(e) When performing the Active Test, check for an operating sound from the fuel pump.

Standard:

CONTROL THE FUEL PUMP DUTY	SPECIFIED CONDITION
25 or 80%	Operating sound heard
OFF	Operating sound not heard

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- While performing the Active Test, make sure that there is no fuel leakage from the pipes, no signs that fuel has leaked, and no fuel smell.
- If the fuel pump operating noise is abnormal, proceed to step 34.

B ▶ CHECK FUEL SYSTEM

A ▼

34.	INSPECT FUEL PUMP ASSEMBLY

(a) Inspect the fuel pump assembly INFO .

NG ▶ REPLACE FUEL PUMP ASSEMBLY

CHECK FUEL PUMP CONTROL CIRCUIT (LOW

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OK ▶ PRESSURE SIDE)

35.	CHECK FUEL SYSTEM

(a) Check the fuel system.

- Check the fuel pump operation.
- Check the fuel leaks.
- Check the fuel pressure (low pressure side).
- Check the fuel pressure (high pressure side).
- Perform the Active Test [D-4S (Fuel Cut)].

HINT:

For the fuel system On-vehicle Inspection, refer to the following procedures INFO **.**

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A ▼

36.	CHECK FUEL SYSTEM

(a) Check for foreign matter such as iron particles around the fuel pump assembly (fuel pump, fuel pump filter and inside the fuel tank), and for signs that the fuel pump was stuck.

Result

RESULT	PROCEED TO
There is foreign matter or signs that fuel pump was stuck	A
There is no foreign matter and no signs that fuel pump was stuck	B

HINT:

If there is foreign matter such as iron particles on the fuel pump, fuel filter or fuel tank, remove the foreign matter.

B ▶ REPAIR OR REPLACE FUEL SYSTEM

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A

37.	CHECK FUEL SYSTEM

(a) Check the fuel system.

- Check the fuel pump operation.
- Check the fuel leaks.
- Check the fuel pressure (low pressure side).
- Check the fuel pressure (high pressure side).
- Perform the Active Test [D-4S (Fuel Cut)].

HINT:

For the fuel system On-vehicle Inspection, refer to the following procedures INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▶ **END**

38.	CHECK IGNITION SYSTEM

(a) Perform ignition system On-vehicle Inspection INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK

39.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

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Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Calculate Load	110% or more of the current value of the vehicle*1	Mass air flow meter	A
AFS Voltage B1S1	Below 2.4 V*2	• Air fuel ratio sensor • Harness and connector	B
Both freeze frame data items listed above	Values are other than above	-	C

HINT:

- *1: If the mass air flow meter is malfunctioning and incorrectly measures the intake air volume to be higher than the actual volume of air flowing through the intake manifold, the freeze frame data will show a high engine load value.
- *2: As the air fuel ratio sensor output is low before the sensor warms up, the value at that time cannot be used for diagnosis. If the air fuel ratio sensor is malfunctioning and constantly outputs a value indicating the air-fuel ratio is rich, the actual air-fuel ratio will become lean and the engine may stall.

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

C ▶ **READ FREEZE FRAME DATA**

A ▼

40.	CHECK MASS AIR FLOW METER

(a) Remove the mass airflow meter.

(b) Check for foreign matter in the airflow passage of the mass air flow meter.

Result

RESULT	PROCEED TO
Visible foreign matter is not present	A
Visible foreign matter is present	B

B ▶ **REPLACE MASS AIR FLOW METER**

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A

41.	CHECK HARNESS AND CONNECTOR (ECM - MASS AIR FLOW METER)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
A33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

42.	PERFORM DRIVE TEST

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

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(c) Idle the engine.

(d) Using the Techstream, read the value of Calculate Load in the Data List.

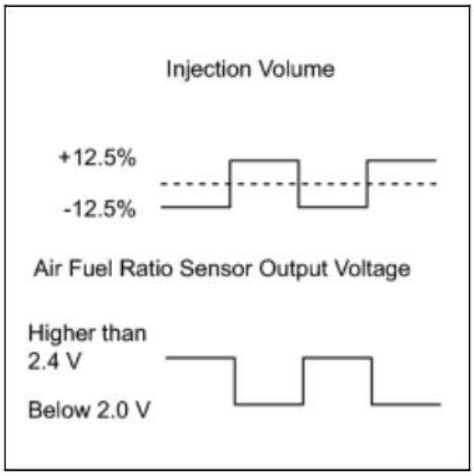
Standard:

DATA LIST	SPECIFIED CONDITION
Calculate Load	90 to 110% of the current value of the vehicle

NG ▶ **REPLACE MASS AIR FLOW METER**

OK ▼

43.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**



(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Start the engine, turn off all accessory switches and warm up the engine until the engine coolant temperature stabilizes.

(d) Idle the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor.

(f) Read the output voltage from the air fuel ratio sensor when increasing and decreasing the fuel injection volume.

Standard:

TECHSTREAM DISPLAY	SPECIFIED CONDITION
Control the Injection Volume for A/F Sensor	

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(+12.5%)	Air fuel ratio sensor output voltage is below 2.0 V
Control the Injection Volume for A/F Sensor (-12.5%)	Air fuel ratio sensor output voltage is higher than 2.4 V

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

HINT:

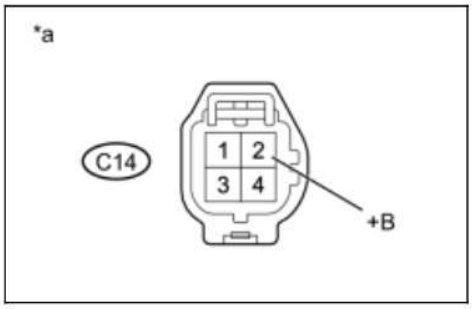
The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

B ▶ **READ FREEZE FRAME DATA**

A ▼

44.	CHECK TERMINAL VOLTAGE (AIR FUEL RATIO SENSOR POWER SOURCE)

(a) Disconnect the air fuel ratio sensor connector.



(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C14-2 (+B) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Air Fuel Ratio Sensor)

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HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR AIR FUEL RATIO SENSOR POWER SOURCE CIRCUIT**

OK
▼

45.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-18 (A1A-) - C14-4 (A1A-)	Always	Below 1 Ω
A34-19 (A1A+) - C14-3 (A1A+)	Always	Below 1 Ω
A34-5 (HA1A) - C14-2 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-18 (A1A-) or C14-4 (A1A-) - Body ground	Always	10 kΩ or higher
A34-19 (A1A+) or C14-3 (A1A+) - Body ground	Always	10 kΩ or higher
A34-5 (HA1A) or C14-2 (HA1A) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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46.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	PROCEED TO
Initial Engine Coolant Temp, Ambient Temp for A/C, Initial Intake Air Temp	Difference in temperature between each item is less than 10°C*1	A
	Difference in temperature between each item is 10°C or more*2	B

HINT:

- *1: A long time had elapsed after stopping the engine.
- *2: A long time had not elapsed after stopping the engine.

B READ FREEZE FRAME DATA

A

47.	READ FREEZE FRAME DATA

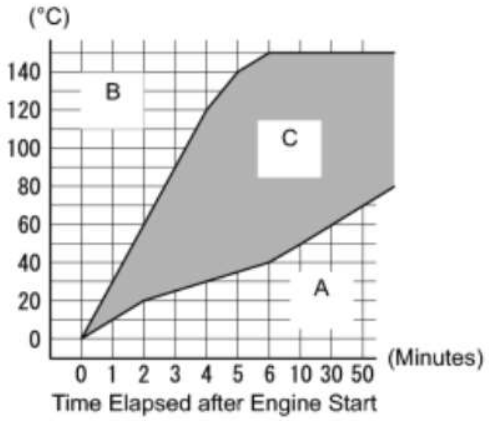
(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

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Engine Coolant Temperature Increase after Engine Start
(Engine Coolant Temperature - Engine Coolant Temperature at Engine Start)



Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Initial Engine Coolant Temp, Coolant Temp, Engine Run Time	Range A	• Engine coolant temperature sensor • Thermostat	A
	Range B	Engine coolant temperature	B
	Range C	-	C

HINT:

This step is not directly related to engine stall.

B ▶ **INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

C ▶ **CHECK FUEL SYSTEM**

A ▼

48.	INSPECT THERMOSTAT

HINT:

For the thermostat inspection, refer to the following procedures INFO **.**

Result

RESULT	PROCEED TO

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Abnormal	A
Normal	B

HINT:

This step is not directly related to engine stall.

B ▶ **INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

A ▶ **REPLACE THERMOSTAT**

49.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Coolant Temp	120°C or higher	Engine coolant temperature sensor	A
Coolant Temp, Ambient Temp for A/C	Engine coolant temperature is lower than outside temperature by 15°C or more	Engine coolant temperature sensor	
Both freeze frame data items listed above	Values are other than above	-	B

B ▶ **CLEAR DTC**

A ▼

50.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

HINT:

For the engine coolant temperature sensor inspection, refer to the following procedures INFO .

Result

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RESULT	PROCEED TO
Normal	A
Abnormal	B

B ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

A ▼

51.	CHECK HARNESS AND CONNECTOR (ECM - ENGINE COOLANT TEMPERATURE SENSOR)

(a) Disconnect the ECM connector.

(b) Disconnect the engine coolant temperature sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) - C35-2 (THW)	Always	Below 1 Ω
A36-29 (E1) - C35-1 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) or C35-2 (THW) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C35-1 (E2) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ CHECK FOR INTERMITTENT PROBLEMS

52.	CHECK IGNITION SYSTEM

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(a) Perform ignition system On-vehicle Inspection INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

53.	READ FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Total of ISC Learning Value and ISC Feedback Value	Below 80% of the current value of the vehicle	Intake air volume insufficient	A
	80% or more of the current value of the vehicle		B

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT LINEAR)**

A ▼

54.	CHECK INTAKE SYSTEM

(a) Check for air leakage in the intake system [vacuum hose disconnection, cracks, damaged gaskets, etc.] INFO .

HINT:

- If the accelerator pedal is released after racing the engine, the inspection is easier to perform because the vacuum inside the intake pipes increases and the air suction noise becomes louder.
- If Short FT and Long FT are largely different from the normal values when idling (the intake air volume is small) and almost the same as the normal values when racing the engine (the intake air

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volume is high), air leakage may be present.

OK:
There is no air leakage.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

55.	CHECK INTAKE SYSTEM

(a) Check the intake system.

- Inspect the brake booster assembly INFO .
- Inspect the mass air flow meter INFO .
- Check the PCV hose INFO .
- Inspect the PCV valve INFO .
- Inspect the purge valve INFO .

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ **READ FREEZE FRAME DATA**

A ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

56.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT LINEAR)

(a) Connect the Techstream to the DLC3.

(b) Turn the Techstream on.

(c) Warm up the engine.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank1) or Control the VVT Linear (Bank2).

HINT:

When performing the Active Test, make sure the A/C is on and the shift lever is in P, N or neutral.

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(e) Check the engine speed while operating the camshaft timing oil control valve using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
36 deg (CA)	Engine idles roughly or stalls

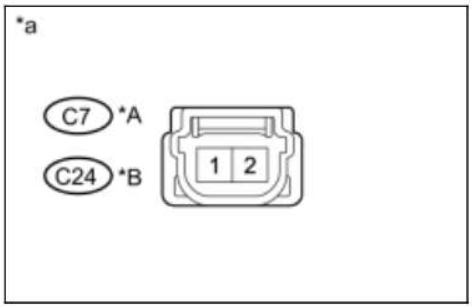
HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When the results of the inspection using the Active Test are normal but the valve operating noise is abnormal, check the valve for any signs of problems.
- If the camshaft timing oil control valve is stuck on, the valve overlap increases and combustion worsens due to the internal EGR which may cause rough idle or cause the engine to stall.

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE**

OK ▼

57.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE - ECM)**



(a) Disconnect the camshaft timing oil control valve connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C7-1 - Body ground	Ignition switch ON	11 to 14 V
C24-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

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*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to Camshaft Timing Oil Control Valve for Intake Side)

(c) Disconnect the ECM connector.

(d) Measure the voltage according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-17 (OC1) - C7-2	Always	Below 1 Ω
A36-16 (OC2) - C24-2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-17 (OC1) or C7-2 - Body ground	Always	10 kΩ or higher
A36-16 (OC2) or C24-2 - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

58.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT EXHAUST LINEAR)**

(a) Connect the Techstream to the DLC3.

(b) Turn the Techstream on.

(c) Warm up the engine.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Exhaust Linear (Bank1) or Control the VVT Exhaust Linear (Bank2).

HINT:

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When performing the Active Test, make sure the A/C is on and the shift lever is in P, N or neutral position.

(e) Check the engine speed while operating the camshaft timing oil control valve using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
51 deg (CA)	Engine idles roughly or stalls

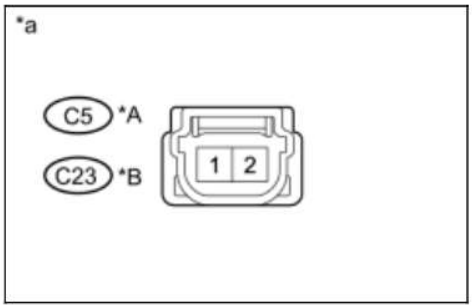
HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When the results of the inspection using the Active Test are normal but the valve operating noise is abnormal, check the valve for any signs of problems.
- If the camshaft timing oil control valve is stuck on, the valve overlap increases and combustion worsens due to the internal EGR which may cause rough idle or cause the engine to stall.

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE**

OK ▼

59.	**CHECK HARNESS AND CONNECTOR (CAMSHAFT TIMING OIL CONTROL VALVE - ECM)**



(a) Disconnect the camshaft timing oil control valve connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C5-1 - Body ground	Ignition switch ON	11 to 14 V
C23-1 - Body ground	Ignition switch ON	11 to 14 V

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Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to Camshaft Timing Oil Control Valve for Exhaust Side)

(c) Disconnect the ECM connector.

(d) Measure the voltage according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-7 (OE1) - C5-2	Always	Below 1 Ω
A36-5 (OE2) - C23-2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-7 (OE1) or C5-2 - Body ground	Always	10 kΩ or higher
A36-5 (OE2) or C23-2 - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

60.	**READ FREEZE FRAME DATA**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

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FREEZE FRAME DATA ITEM		SUSPECTED AREA	PROCEED TO
IGN ADVANCE	KNOCK CORRECT LEARN VALUE		
Differs from the current value of the vehicle by 10° or more	Less than 3°	• Engine coolant temperature sensor • Mass air flow meter • Knock sensor	A
	3° or more	-	B
Differs from the current value of the vehicle by less than 10°	-	-	

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A

61.	**INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

HINT:

For the engine coolant temperature sensor inspection, refer to the following procedures INFO .

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

62.	**CHECK HARNESS AND CONNECTOR (ECM - ENGINE COOLANT TEMPERATURE SENSOR)**

(a) Disconnect the ECM connector.

(b) Disconnect the engine coolant temperature sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) - C35-2 (THW)	Always	Below 1 Ω
A36-29 (E1) - C35-1 (E2)	Always	Below 1 Ω

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Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) or C35-2 (THW) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C35-1 (E2) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

63.	INSPECT MASS AIR FLOW METER (INTAKE AIR TEMPERATURE SENSOR)

(a) Inspect the mass air flow meter INFO .

HINT:

If the intake air temperature sent to the ECM is higher than the standard due to the mass air flow meter (intake air temperature sensor) malfunctioning, the ignition timing may become delayed.

NG ▶ **REPLACE MASS AIR FLOW METER**

OK ▼

64.	READ VALUE USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

(c) Idle the engine.

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(d) Using the Techstream, read the value of IGN Advance and Knock Correct Learn Value in the Data List.

Result

FREEZE FRAME DATA ITEM		PROCEED TO
IGN ADVANCE	KNOCK CORRECT LEARN VALUE	
Differs from the current value of the vehicle by 10° or more	Less than 3°	A
	3° or more	B
Differs from the current value of the vehicle by less than 10°	-	

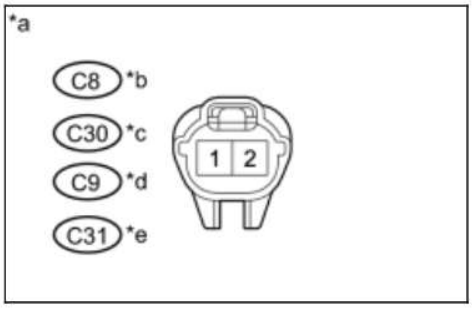
HINT:

If the results of the checks performed in steps 56 to 64 were all normal and the sum of ISC Feedback Value and ISC Learning Value in the Data List is 120% of the normal value or more, check for carbon deposits in the throttle with motor body assembly. If there are carbon deposits, clean them off to finish the troubleshooting procedure.

B ▶ **END**

A ▶ **CHECK KNOCK SENSOR CIRCUIT**

65.	CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)



(a) Disconnect the fuel injector assembly connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

CYLINDER	TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
No. 1	C8-1 - Body ground	Ignition switch ON	11 to 14 V
No. 2	C30-1 - Body ground	Ignition switch ON	11 to 14 V
No. 3	C9-1 - Body ground	Ignition switch ON	11 to 14 V

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No. 4	C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly (for Port Injection))
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.
- A rapid decrease in engine speed may have been caused by a malfunction in all or multiple cylinders. (There may be an electrical malfunction in the wiring shared by all the cylinders.)

NG ▶ **REPAIR FUEL INJECTOR POWER SOURCE CIRCUIT**

OK ▼

66.	**CHECK IGNITION SYSTEM**

(a) Perform ignition system On-vehicle Inspection INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

67.	**CHECK FREEZE FRAME DATA**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which

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were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM		SUSPECTED AREA	PROCEED TO
A/C SIGNAL	AIR CONDITIONER FB VAL		
A/C Signal display does not change from OFF	-	Except for A/C system	A
A/C Signal display changes from OFF to ON*1	Value displayed for Air Conditioner FB Val does not increase		
	Value displayed for Air Conditioner FB Val increases	A/C system	B

HINT:

- *1: Check not only the on/off state of the air conditioner but also the change in air conditioner load.
- The normal value for the ISC learned value is engine displacement (liters) x 0.9.
- Even if the results are normal, the power steering system and/or A/C system may have been malfunctioning. If there are no problems with other parts, inspect the power steering system and/or A/C system.

B ▶ **CHECK AIR CONDITIONING SYSTEM**

A

▼

68.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM				SUSPECTED AREA	PROCEED TO
ELECTRIC LOAD FEEDBACK VAL		DIFFERENCE BETWEEN ENGINE SPEED AND SPD (NT)	VEHICLE SPEED		
Electrical Load Signal display	Value displayed for Electric Load Val changes	-	-	Electrical load signal circuit	C
		At least 1 of the 5	Less than 30	Automatic transmission	B

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changes from OFF to ON*3, or value displayed for Electric Load Feedback Val increases*1	Value displayed for Electric Load Val does not change	sets of freeze frame data is less than 100 rpm	km/h	system	
			30 km/h or more	-	A
		All 5 sets of freeze frame data are 100 rpm or more	-	-	A
Electrical Load Signal display does not change from OFF, or value displayed for Electric Load Feedback Val does not increase	-	At least 1 of the 5 sets of freeze frame data is less than 100 rpm	Less than 30 km/h	Automatic transmission system	B
			30 km/h or more	-	A
		All 5 sets of freeze frame data are 100 rpm or more	-	-	A

HINT:

- *1: If the Electrical Load Signal display changes from OFF to ON, or the "Electric Load Feedback Val" increases, it probably is a malfunction due to a change in electrical load. Check the generator and the continuity and connections between the generator and ECM.
- The normal value for the ISC learned value is engine displacement (liters) x 0.9.
- Even if the results are normal, the electrical load signal system and/or Automatic transmission system may have been malfunctioning. If there are no problems with other parts, inspect the electrical load system and/or Automatic transmission system.

B ▶ **CHECK AUTOMATIC TRANSMISSION SYSTEM**

C ▶ **CHECK GENERATOR CIRCUIT**

A ▼

69.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM		SUSPECTED AREA	PROCEED TO
SHIFT SW STATUS (P RANGE) SHIFT SW STATUS (N RANGE)	NEUTRAL POSITION SW SIGNAL		

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P and N position are both OFF in at least one data set	In D or R, NSW is ON	Park/neutral position switch assembly	A
	In D or R, NSW is OFF	Automatic transmission system	B
All 5 sets of freeze frame data are ON	-	-	C

HINT:

Even if the results are normal, the park/neutral position switch assembly and/or Automatic transmission system may have been malfunctioning. If there are no problems with other parts, inspect the park/neutral position switch assembly and/or Automatic transmission system.

B ▶ **CHECK AUTOMATIC TRANSMISSION SYSTEM**

C ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **INSPECT PARK/NEUTRAL POSITION SWITCH ASSEMBLY**

70.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Throttle Sensor Position, Calculate Load	Calculate Load decreases while Throttle Sensor Position increases	Mass air flow meter	A
	Calculate Load does not decrease while Throttle Sensor Position increases	-	B

B ▶ **CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)**

A ▼

71.	CHECK MASS AIR FLOW METER

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(a) Remove the mass air flow meter.

(b) Check for foreign matter in the airflow passage of the mass airflow meter.

Result

RESULT	PROCEED TO
Visible foreign matter is not present	A
Visible foreign matter is present	B

B ▶ **REPLACE MASS AIR FLOW METER**

A ▼

72.	CHECK HARNESS AND CONNECTOR (ECM - MASS AIR FLOW METER)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
A33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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▼

73.	PERFORM DRIVE TEST

(a) Connect the Techstream to the DLC3.

(b) Start the engine and warm it up until the engine coolant temperature stabilizes.

HINT:

The A/C switch and all accessory switches should be off.

(c) Idle the engine.

(d) Using the Techstream, read the value of Calculate Load in the Data List.

Standard:

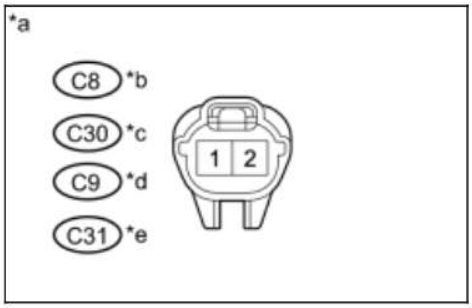
DATA LIST	SPECIFIED CONDITION
Calculate Load	90 to 110% of the current value of the vehicle

NG ▶ **REPLACE MASS AIR FLOW METER**

OK

▼

74.	CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)



(a) Disconnect the fuel injector assembly connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

CYLINDER	TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
No. 1	C8-1 - Body ground	Ignition switch ON	11 to 14 V

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No. 2	C30-1 - Body ground	Ignition switch ON	11 to 14 V
No. 3	C9-1 - Body ground	Ignition switch ON	11 to 14 V
No. 4	C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly (for Port Injection))
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.
- A rapid decrease in engine speed may have been caused by a malfunction in all or multiple cylinders. (There may be an electrical malfunction in the wiring shared by all the cylinders.)

NG ▶ **REPAIR FUEL INJECTOR POWER SOURCE CIRCUIT**

OK ▼

75.	**CHECK IGNITION SYSTEM**

(a) Perform ignition system On-vehicle Inspection INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▼

76.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP DUTY)**

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump Duty.

(e) When performing the Active Test, check for an operating sound from the fuel pump.

Standard:

CONTROL THE FUEL PUMP DUTY	SPECIFIED CONDITION
25 or 80%	Operating sound heard
OFF	Operating sound not heard

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- While performing the Active Test, make sure that there is no fuel leakage from the pipes, no signs that fuel has leaked, and no fuel smell.
- If the fuel pump operating noise is abnormal, proceed to step 77.

B ▶ **CHECK FUEL SYSTEM**

A ▼

77.	INSPECT FUEL PUMP ASSEMBLY

(a) Inspect the fuel pump assembly INFO .

NG ▶ **REPLACE FUEL PUMP ASSEMBLY**

OK ▶ **CHECK FUEL PUMP CONTROL CIRCUIT (LOW PRESSURE SIDE)**

78.	CHECK FUEL SYSTEM

(a) Check the fuel system.

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Check the fuel pump operation.

- Check the fuel leaks.
- Check the fuel pressure.
- Check the fuel pressure (for high pressure).
- Perform the Active Test [D-4S (Fuel Cut)].

HINT:

For the fuel system On-vehicle Inspection, refer to the following procedures INFO .

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▼

79.	**CHECK FUEL SYSTEM**

(a) Check for foreign matter such as iron particles around the fuel pump assembly (fuel pump, fuel pump filter and inside the fuel tank), and for signs that the fuel pump was stuck.

Result

RESULT	PROCEED TO
There is foreign matter or signs that fuel pump was stuck	A
There is no foreign matter and no signs that fuel pump was stuck	B

HINT:

If there is foreign matter such as iron particles on the fuel pump, fuel filter or fuel tank, remove the foreign matter.

B ▶ **REPAIR OR REPLACE FUEL SYSTEM**

A ▼

80.	**CHECK FUEL SYSTEM**

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(a) Check the fuel system.

- Check the fuel pump operation.
- Check the fuel leaks.
- Check the fuel pressure.
- Check the fuel pressure (for high pressure).
- Perform the Active Test [D-4S (Fuel Cut)].

HINT:

For the fuel system On-vehicle Inspection, refer to the following procedures INFO .

NG ▶ **REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA**

OK ▶ **END**

81.	CLEAR DTC

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

NEXT ▶ **END**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM0000021150D5X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P1604: Startability Malfunction (2013 FR-S)		

DTC	**P1604**	**Startability Malfunction**

DESCRIPTION

This DTC is stored when the engine does not start even though the starter signal is input or when the engine takes a long time to start, and when the engine speed is low or the engine stalls just after the engine starts.

Using the Techstream, the conditions present when the DTC was stored can be confirmed by referring to the freeze frame data. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.

It is necessary to check if the vehicle ran out of fuel before performing troubleshooting, as this DTC is also stored when there is engine starting trouble due to running out of fuel.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P1604	One of the following conditions is met (1 trip detection logic): • The engine speed is less than 500 rpm with the starter signal on for a certain amount of time (Depending on the engine coolant temperature and atmospheric pressure). • After the engine starts (engine speed is 500 rpm or more), the engine speed drops to 300 rpm or less immediately.	• Engine immobiliser system • Engine assembly (excess friction, compression loss) • Starter assembly • Crankshaft position sensor • VVT sensor • Engine coolant temperature sensor • Fuel pump assembly • Fuel pump control circuit (low pressure side) • Fuel pipes • Fuel injector assembly (for port injection) • Throttle with motor body assembly • Pressure regulator • Battery • Flywheel (for Manual Transmission) • Drive plate (for Automatic

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		Transmission) • Spark plug • Ignition coil circuit • Intake system • Camshaft timing oil control valve • Mass air flow meter • Air fuel ratio sensor • Valve timing • Fuel • Purge valve • Intake valve • Exhaust valve • ECM

INSPECTION PROCEDURE

HINT:

- In contrast to normal malfunction diagnosis for components, circuits and systems, DTC P1604 is used to determine the malfunctioning area from the problem symptoms and freeze frame data when the user mentions problems such as starting difficulty.

  As these DTCs can be stored as a result of certain user actions, even if these DTCs are output, if the customer makes no mention of problems, clear these DTCs without performing any troubleshooting and return the vehicle to the customer.
- If any other DTCs are output, perform troubleshooting for those DTCs first.
- When the Data List item "Immobiliser Fuel Cut" is ON, the engine cannot be started.
- Read freeze frame data using the Techstream. Freeze frame data records engine conditions when a malfunction occurs. This information can be useful when troubleshooting.
- When confirming the freeze frame data, be sure to check all 5 sets of freeze frame data INFO .
- When confirming freeze frame data, if there are multiple items related to the cause of the malfunction, perform troubleshooting for all related items.
- Try to start the vehicle under the conditions recorded in the freeze frame data which were present when the malfunction occurred. Confirm the data at this time and compare it with the freeze frame data.
- If the malfunction does not reoccur, carefully check the vehicle conditions from when the malfunction occurred using freeze frame data.
- When performing inspections, jiggle the relevant wire harnesses and connectors in an attempt to reproduce malfunctions that do not always occur.
- If the same inspection or replacement procedure appears 2 times when performing an inspection procedure, it is not necessary to repeat the procedure the second time.

1. Malfunction Recurrence and Inspection Areas

(a) Freeze frame data exists, but the malfunction (starting difficulty) has not reoccurred and the malfunction conditions are unknown.

(1) The engine speed recorded in the freeze frame data is 0 rpm (the engine does not crank).

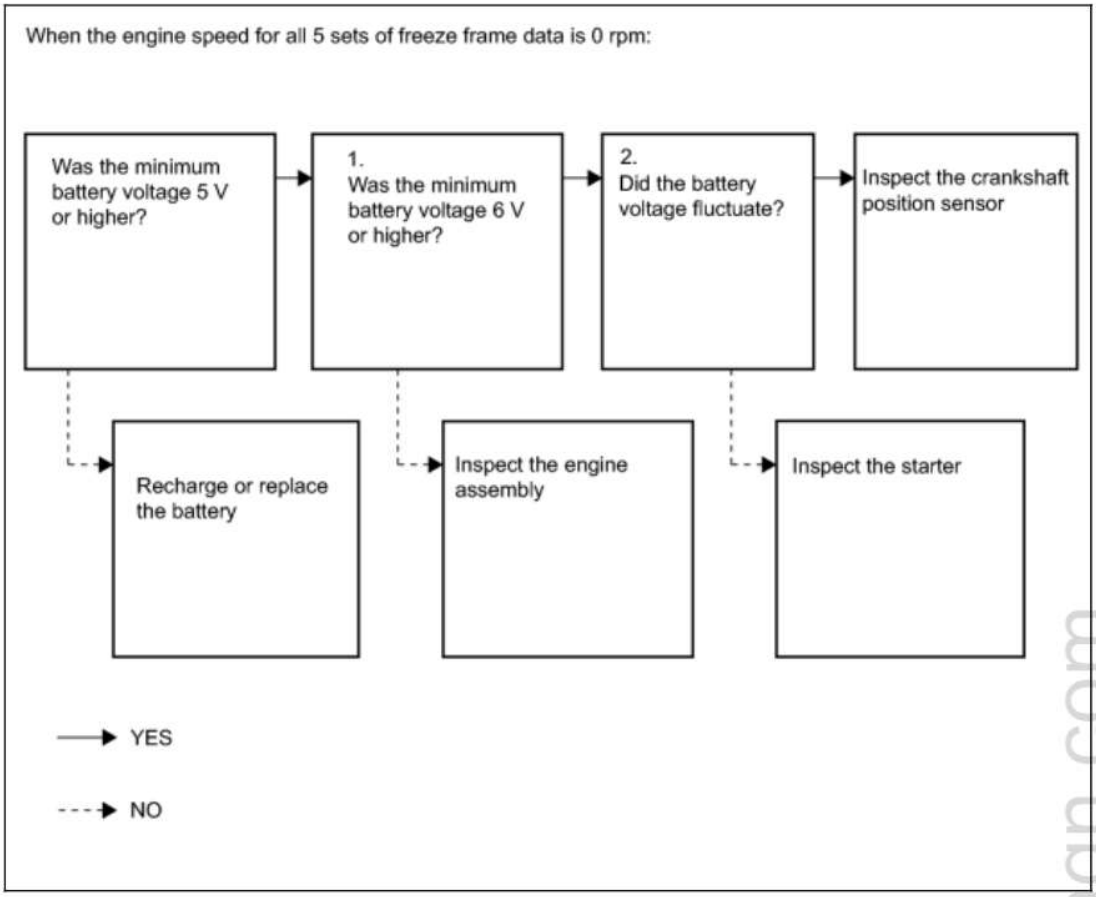
HINT:

One of the following problems may be present: battery depletion, excess engine friction, a starter malfunction or a crankshaft position sensor malfunction.

- If the battery voltage is less than 9 V during cranking, there is a high probability that engine friction is abnormal.
- If the battery voltage drops to 5 V or less when starting the engine, the battery may be malfunctioning.

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- If the battery voltage fluctuates while cranking the engine, it can be concluded that cranking is being performed. When the engine speed is 0 rpm, the crankshaft position sensor and/or ECM may be malfunctioning.



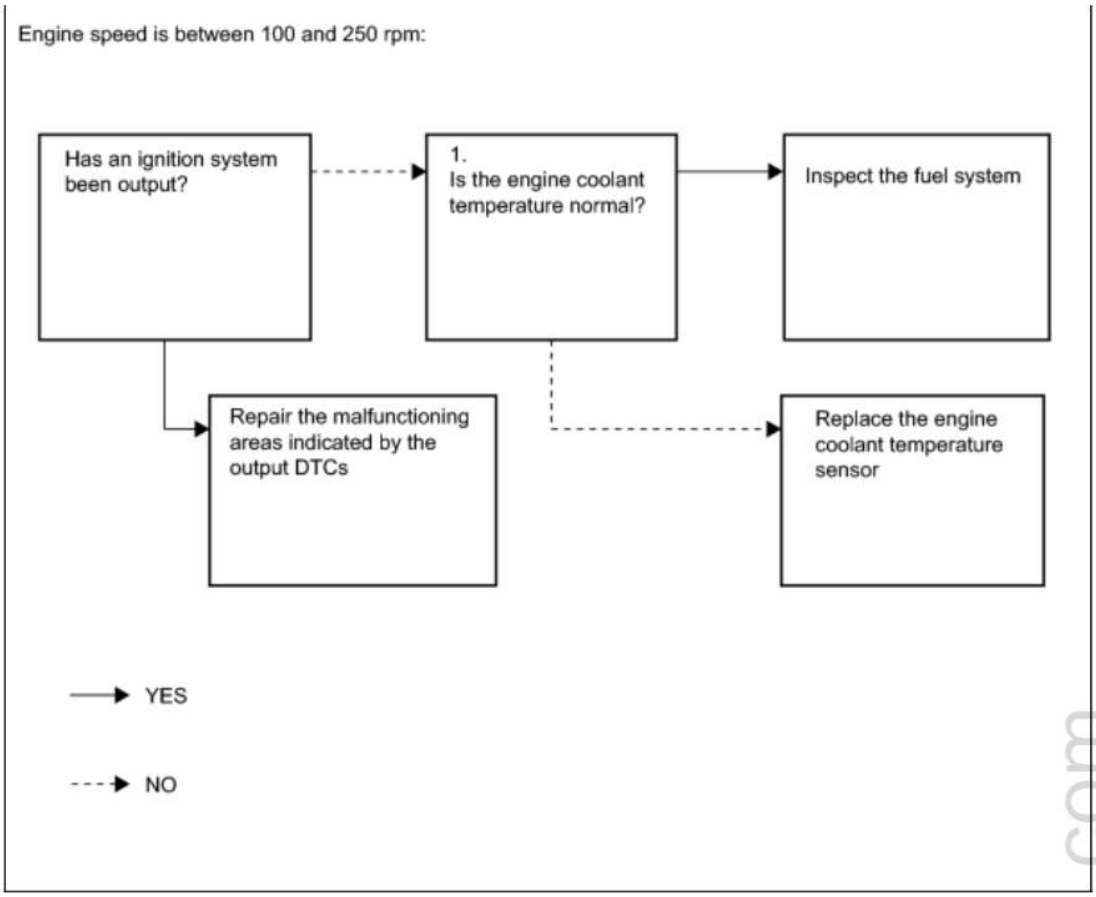
(2) All engine speeds recorded in the freeze frame data are between 100 and 250 rpm (the engine cranks but there is no combustion).

HINT:

If the engine speed is between 100 and 250 rpm (no initial combustion), there may be a wiring problem or a complete failure of an ignition or fuel system part.

- Due to an engine coolant temperature sensor malfunction, the fuel injection volume is extremely high or low and the engine may not be able to be started.

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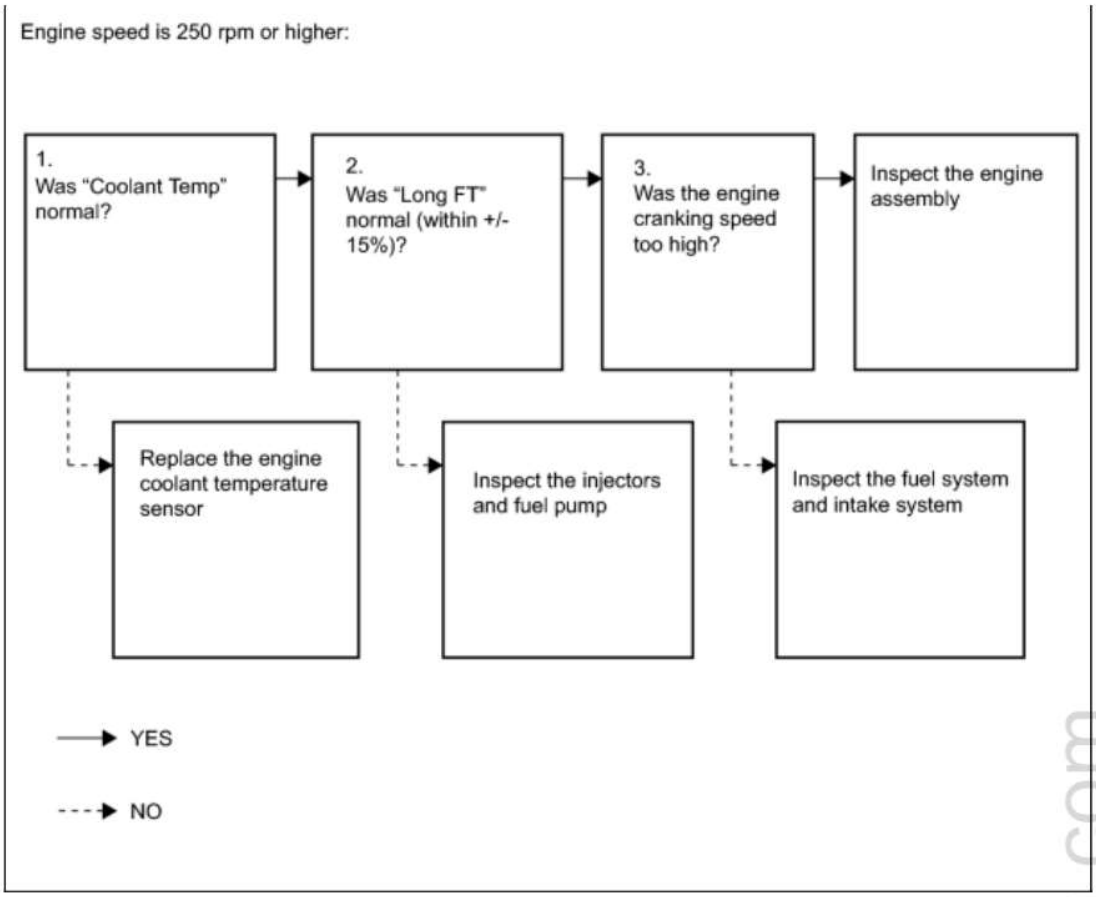
(3) The engine speed recorded in the freeze frame data is 250 rpm or higher (the initial combustion and starter turnoff timing is too late).

HINT:

If the engine speed is 250 rpm or higher (combustion occurs but the initial combustion and starter turnoff timing is too late), the fuel injection volume is often incorrect (too low or too high) and determining the cause of the malfunction is often difficult.

- Due to an engine coolant temperature sensor malfunction, the fuel injection volume is extremely high or low and engine starting trouble may occur.
- If Long FT is incorrect, there may be a fuel supply problem due to the injectors or fuel pump being clogged, etc.
- If the engine cranking speed is too high, compression loss may have occurred due to carbon interfering with the valve operation.

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(b) When the malfunction (starting difficulty) can be reproduced, or malfunction conditions are known, perform the following inspections ("Problem Symptoms" and "Systems to Inspect").

(1) Problem Symptoms

1. The engine does not crank.

HINT:

The starter is normal if a noise that indicates the starter pinion gear is extending is heard. The battery may be fully depleted or there may be excess engine friction.

2. The engine cranking speed is abnormal.

HINT:

If the engine cranking speed is too high (for example, 300 rpm or higher with no combustion), compression loss may have occurred because carbon interfered with valve operation, etc.

3. There is no initial combustion.

HINT:

If there is no initial combustion, there is probably a wiring problem or an ignition or fuel system part malfunction.

4. The engine stalls after starter turnoff.

HINT:

If the engine stalls after starter turnoff, the air-fuel ratio may be incorrect or the VVT may have a problem returning.

5. The initial combustion and starter turnoff occur late.

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HINT:

If the initial combustion and starter turnoff occur late, the fuel injection volume is probably incorrect (too low or too high).

HINT:

Causes of fuel system malfunctions according to conditions present at the time of the malfunction.

- When 2 to 3 minutes have elapsed after stopping the engine: Fuel pressure loss due to the pressure regulator failing to maintain the fuel pressure.
- When 15 to 120 minutes have elapsed after stopping the engine: Problem with injector fuel seal.
- When a long time has elapsed after stopping the engine: Pressure regulator is stuck open.

(2) Systems to Inspect

1. Intake system
2. Ignition system
3. Fuel system

2. INSPECTION FLOW

(a) Freeze frame data exists, but the malfunction (starting difficulty) has not reoccurred and the malfunction conditions are unknown.

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEDURE
Engine Speed	0 rpm (no engine cranking at all)	• Battery fully depleted • Engine assembly (excess friction) • Starter assembly • Engine immobiliser system • Crankshaft position sensor • ECM	4 to 9
	100 to 250 rpm (engine cranks but no initial combustion*1)	• Fuel pump control circuit (Low pressure side) • Ignition system • Engine coolant temperature sensor • Fuel injection system	10 to 14
	250 rpm or higher (combustion occurs but initial combustion and starter turnoff*2 occur late)	• Engine assembly (compression loss) • Fuel injection system • Fuel pump control circuit (low pressure side)	15 to 23

HINT:

- *1: First combustion after cranking begins.
- *2: Condition when engine speed increases and starter can be turned off.

(b) When the malfunction (starting difficulty) can be reproduced, or when malfunction conditions are known.

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(1) Problem Symptoms

PROBLEM SYMPTOM	SUSPECTED AREA	SUSPECTED COMPONENT	PROCEDURE
The engine does not crank	Battery malfunction	• Battery fully depleted	26 to 31
	Starting system	• Starter assembly (includes pinion gear wear or tooth damage) • Starting system	
	Engine immobiliser system	• Engine immobiliser system	
	Engine assembly	• Engine assembly (excess friction) • Drive plate wear or tooth damage	
Cranking speed too low	Battery malfunction	• Battery fully depleted	32 to 34
	Starting system	• Starter assembly	
	Engine assembly	• Engine assembly (excess friction)	
Cranking speed too high	Engine assembly	• Engine assembly (compression loss)	
There is no initial combustion	Fuel supply problem	• Cannot maintain pressure due to pressure regulator malfunction • Fuel injector leak • Fuel leak from fuel line • Fuel pump control circuit (Low pressure side) • Fuel pump assembly	35 to 49
	Ignition system malfunction	• Spark plug • Crankshaft position sensor • Ignition coil assembly	
Engine stalls after starter turnoff	Air suction	• Intake system connections	50 to 56
	Deposits in throttle body	• Throttle with motor body assembly	
	VVT valve does not return properly	• Camshaft timing oil control valve	
	Mass air flow meter malfunction	• Mass air flow meter	
	Engine coolant temperature sensor malfunction	• Engine coolant temperature sensor	
	Mass air flow meter malfunction	• Mass air flow meter	
	Abnormal A/F learned value	• Air fuel ratio sensor	

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The initial combustion and starter turnoff occur late	Deviation from fuel injection characteristics	• Fuel injector assembly (for port injection)	57 to 71
	Wet-fouled or dry-fouled spark plug	• Spark plug	
	Lack of fuel pressure	• Pressure regulator • Fuel pump assembly • Fuel pump control circuit (low pressure side)	

(2) Systems to Inspect

TROUBLESHOOTING BY SYSTEM	SUSPECTED AREA	SUSPECTED COMPONENT	PROCEDURE
Fuel system troubleshooting A	Abnormal A/F learned value	• Fuel injector assembly (for port injection)	87 to 94 95 to 102
	Rough idling	• Crankshaft position sensor	
	Abnormal fuel pressure	• Fuel • Fuel leak from fuel line • Fuel pump assembly • Pressure regulator	
Fuel system troubleshooting B	Abnormal concentration of HC in surge tank	• Purge valve system • Fuel injector assembly (for port injection) • Intake valve	103 to 105
Fuel system troubleshooting C	Injection signal system malfunction	• Fuel injector assembly (for port injection) • Crankshaft position sensor • VVT sensor • ECM	73 to 76
Intake system troubleshooting	Difference between ISC target value and opening angle when idling	• Engine assembly (compression loss) • Valve timing • Engine coolant temperature sensor • ECM	84 to 86 106 to 108
Ignition system troubleshooting	Camshaft and/or crankshaft position sensor signal malfunction	• Crankshaft position sensor system (including sensor installation) • VVT sensor system (including sensor installation) • ECM	77 to 83 109 to 115

PROCEDURE

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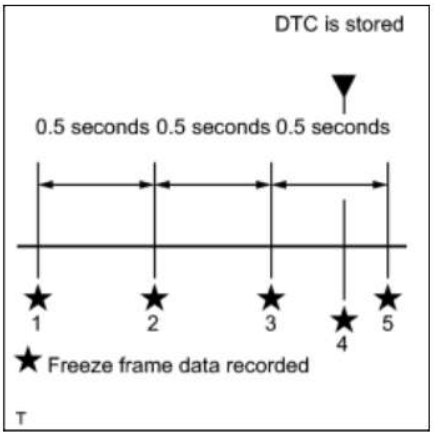
1.	CHECK FOR ANY OTHER DTCS OUTPUT AND RECORD FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Trouble Codes.

(d) Read the DTCs and record the freeze frame data.



HINT:

- This freeze frame data shows the actual engine conditions when engine starting trouble occurred.
- When confirming the freeze frame data, be sure to check all 5 data sets of freeze frame data.
- The fourth set of freeze frame data is the data recorded when the DTC is stored.

Result

RESULT	PROCEED TO
Only DTC P1604 is output	A
DTCs other than P1604 are output	B

B ▶ **GO TO DTC CHART**

A ▼

2.	CHECK ENGINE IMMOBILISER SYSTEM

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Immobiliser Fuel Cut.

(e) Read the value displayed on the Techstream.

OK:
Immobiliser Fuel Cut is OFF.

HINT:

After reconnecting the battery cable, if the engine is started immediately (without waiting 1.8 seconds after turning the ignition switch to ON), the engine will stop (due to the key verification process). The engine can be started after that.

NG ▶ **REPAIR ENGINE IMMOBILISER SYSTEM**

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OK

3.	CHECK MALFUNCTION CONDITION

(a) Confirm the problem symptoms.

Result

RESULT	PROCEED TO
Freeze frame data exists, but the starting difficulty cannot be reproduced and it is unknown what kind of starting difficulty occurred	A
The problem symptoms can be reproduced, or the malfunction conditions are known	B

B ▶ **CONFIRM PROBLEM SYMPTOM**

A

4.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM		SUSPECTED AREA	PROCEED TO
ENGINE SPEED	BATTERY VOLTAGE		
All 5 sets of freeze frame data are 0 rpm (no engine cranking at all)	Minimum voltage is below 5 V	Battery fully depleted	A
	Minimum voltage is 5 V or higher	• Starter malfunction • Crankshaft position sensor system • Excess engine friction • Engine immobiliser system • ECM	B
60 to 250 rpm (engine cranks but no initial combustion)	-	• Fuel pump control circuit (low pressure side) • Ignition system • Engine coolant	C

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		temperature sensor • Engine immobiliser system • Fuel injection system	
250 rpm or higher (combustion occurs but initial combustion and starter turnoff occur late)	-	• Engine assembly • Fuel injection system • Fuel pump control circuit (low pressure side)	D

HINT:

When DTC P1604 is stored, either "Engine Start Hesitation"*1 or "Low Rev for Eng Start"*2 in the freeze frame data will be ON. If "Low Rev for Eng Start" is ON, proceed to E.

***1: This value turns ON when the engine speed does not reach a certain value for a certain period of time when starting the engine.**

***2: This value turns ON when the engine stalls immediately after starting the engine. If "Low Rev for Eng Start" is ON, as there is a possibility that the low engine speed or engine stall was caused by the user, confirm the following freeze frame data items.**

- Immobiliser Fuel Cut
- Engine Speed (Starter Off)
- Shift SW Status (R, D Range)

B ▶ **CHECK FREEZE FRAME DATA**

C ▶ **CHECK FREEZE FRAME DATA**

D ▶ **CHECK FREEZE FRAME DATA**

A ▶ **CHARGE OR REPLACE BATTERY**

5.	**CHECK FREEZE FRAME DATA**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

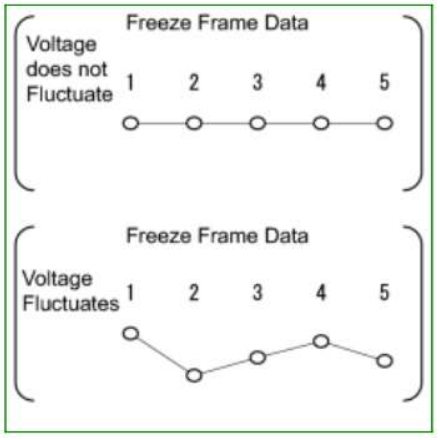
FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Battery Voltage	Minimum voltage is 9 V or higher and voltage fluctuates*2, *3	• Crankshaft position sensor system • ECM	A
	Minimum voltage is 9 V or higher and voltage does not fluctuate*1	Starter system	B

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	Minimum voltage is 5 to 9 V*4	• Excess engine friction • Battery fully depleted	C

HINT:

- *1: The 5 sets of freeze frame data show approximately the same battery voltage.



- *2: The 5 sets of freeze frame data show different battery voltages.
- *3: If the voltage fluctuates, it can be determined that cranking is being performed. When the engine speed is 0 rpm, the crankshaft position sensor system and/or the ECM may be malfunctioning.
- *4: There may be excess engine friction. Make sure that the crankshaft rotates smoothly when turning it by hand. Excess engine friction may have occurred temporarily. Remove the cylinder head cover and oil pan, and check for foreign matter such as iron fragments. If there is a malfunction or signs of a malfunction present, perform a detailed inspection by disassembling all the parts.

B ▶ **CHECK STARTER SIGNAL CIRCUIT**

C ▶ **CHECK AND REPAIR ENGINE OR BATTERY**

A ▼

6.	**CHECK CRANKSHAFT POSITION SENSOR (SENSOR INSTALLATION)**

(a) Check the tightening and installation condition of the crankshaft position sensor bolt.

(b) Check the connection of the crankshaft position sensor connector.

Result

RESULT	PROCEED TO
Normal	A
Abnormal	B

B ▶ **SECURELY REINSTALL SENSOR**

A

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7.	CHECK CRANKSHAFT POSITION SENSOR

(a) Disconnect the crankshaft position sensor connector.

(b) Check for oil on the connector terminals.

OK:

No oil on the terminals.

NG ▶ REPLACE CRANKSHAFT POSITION SENSOR

OK ▼

8.	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) - C33-1 (NE+)	Always	Below 1 Ω
A34-27 (NE-) - C33-2 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) or C33-1 (NE+) - Body ground	Always	10 kΩ or higher
A34-27 (NE-) or C33-2 (NE-) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

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9.	CHECK CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **REPLACE ECM**

OK ▶ **END (CRANKSHAFT POSITION SENSOR IS DEFECTIVE)**

10.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM			SUSPECTED AREA	PROCEED TO
COOLANT TEMP, AMBIENT TEMP FOR A/C, INTAKE AIR	COOLANT TEMP, AMBIENT TEMP FOR A/C	FUEL PUMP DUTY		
Difference between Coolant Temp, Ambient Temp for A/C and Intake Air is 10°C or more*1	Coolant Temp is 125°C or higher, or below Ambient Temp for A/C by 15°C or more	-	Engine coolant temperature sensor	A
	Other than above	No sets of freeze frame data are 0%	-	B
		At least 1 of the 5 sets of freeze frame data is 0%	Fuel pump control circuit (low pressure side)	C
Difference between Coolant Temp, Ambient Temp for A/C and Intake Air is less than 10°C*2	-	At least 1 of the 5 sets of freeze frame data is 0%	Fuel pump control circuit (low pressure side)	C
		No sets of freeze frame data are 0%	-	B

HINT:

- *1: A long time had not elapsed after stopping the engine.
- *2: A long time had elapsed after stopping the engine.

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

C ▶ **CHECK FUEL PUMP CONTROL CIRCUIT (LOW PRESSURE SIDE)**

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A ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

11.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for an operating sound from the fuel pump.

OK:

CONTROL THE FUEL PUMP / SPEED	SPECIFIED CONDITION
ON	Operating sound heard
OFF	Operating sound not heard

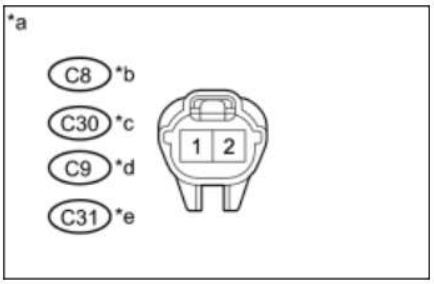
HINT:

Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.

NG ▶ REPAIR FUEL PUMP CONTROL CIRCUIT (LOW PRESSURE SIDE)

OK ▼

12.	CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)



(a) Disconnect the fuel injector assembly connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

CYLINDER	TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
No. 1	C8-1 - Body ground	Ignition switch ON	11 to 14 V
No. 2	C30-1 - Body ground	Ignition switch ON	11 to 14 V

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No. 3	C9-1 - Body ground	Ignition switch ON	11 to 14 V
No. 4	C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR FUEL INJECTOR POWER SOURCE CIRCUIT**

OK ▼

13.	**PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for fuel leakage from the fuel pipes.

Result

RESULT	PROCEED TO
Fuel leakage or signs of fuel leakage are present	A
No fuel leakage or signs of fuel leakage	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When performing the Active Test, if there is no operating noise from the fuel pump, the fuel pump system may be malfunctioning.
- Check if the vehicle ran out of fuel, as engine starting trouble due to running out of fuel is also detected.

B ▶ **CHECK FUEL SYSTEM**

A ▶ **REPAIR OR REPLACE FUEL LINE**

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14.	CHECK FUEL SYSTEM

(a) Check for foreign matter such as iron particles around the fuel pump assembly (fuel pump, fuel pump filter, and inside the fuel tank), and for signs that the fuel pump was stuck.

Result

RESULT	PROCEED TO
There is foreign matter or signs that fuel pump was stuck	A
There is no foreign matter and no signs that fuel pump was stuck	B

B ▶ **PERFORM SIMULATION TEST**

A ▶ **REPAIR OR REPLACE FUEL SYSTEM**

15.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM				SUSPECTED AREA	PROCEED TO
COOLANT TEMP, AMBIENT TEMP FOR A/C, INTAKE AIR	COOLANT TEMP, AMBIENT TEMP FOR A/C	LONG FT	ENGINE SPEED		
Difference between Coolant Temp, Ambient Temp for A/C and Intake Air is 10°C or more	Coolant Temp is 125°C or higher, or below Ambient Temp for A/C by 15°C or more	-	-	Engine coolant temperature sensor	A
	Other than above	-15% or less, or +15% or more	-	• Fuel pump control circuit (low pressure side) • Fuel injector assembly (for port injection)	B
			Minimum speed is 300 rpm or	Engine assembly	C

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		-15 to +15%	more*1		
			Minimum speed is less than 300 rpm	• Fuel system • Intake air system	D
Difference between Coolant Temp, Ambient Temp for A/C and Intake Air is less than 10°C	-	-15% or less, or +15% or more	-	• Fuel pump control circuit (low pressure side) • Fuel injector assembly (for port injection)	B
		-15 to +15%	Minimum speed is 300 rpm or more*1	Engine assembly	C
			Minimum speed is less than 300 rpm	• Fuel system • Intake air system	D

HINT:

***1: Compression loss may have occurred in the engine assembly.**

B ▶ **INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

C ▶ **CHECK AND REPAIR ENGINE**

D ▶ **CHECK FREEZE FRAME DATA**

A ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

16.	INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Check that no carbon is stuck to the fuel injector assembly (for port injection).

OK:

No carbon present.

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

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OK

17.	CHECK FUEL SYSTEM

(a) Check for foreign matter such as iron particles around the fuel pump assembly (fuel pump, fuel pump filter, and inside the fuel tank), and for signs that the fuel pump was stuck.

Result

RESULT	PROCEED TO
There is foreign matter or signs that fuel pump was stuck	A
There is no foreign matter and no signs that fuel pump was stuck	B

B ▶ **PERFORM SIMULATION TEST**

A ▶ **REPAIR OR REPLACE FUEL SYSTEM**

18.	CHECK FREEZE FRAME DATA

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Using the Techstream, confirm the vehicle conditions recorded in the freeze frame data which were present when the DTC was stored INFO .

Result

FREEZE FRAME DATA ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Coolant Temp	Engine coolant temperature is 40°C or less*1	Pressure regulator	A
	Engine coolant temperature is 40 to 90°C*2	Fuel injector	B
	Engine coolant temperature is 90°C or higher*3	Pressure regulator	A

HINT:

***1: If the engine coolant temperature is 40°C or less (after stopping the engine and the vehicle has not been driven for a long period of time), the pressure regulator may be stuck open. Attach a fuel pressure gauge and check the ability of the system to maintain fuel pressure after stopping the engine.**

***2: If the engine coolant temperature is 40 to 90°C (15 to 120 minutes have passed after stopping the engine), there may be fuel leaking from a fuel injector.**

***3: If the engine coolant temperature is 90°C or more (2 to 5 minutes have passed after stopping the engine), there may be a problem with the pressure regulator failing to maintain the fuel pressure. Attach a fuel pressure gauge and check the ability of the pressure regulator to maintain fuel pressure after stopping the engine.**

B ▶ **CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

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A

19.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

HINT:

For the fuel pressure inspection, refer to the following procedures INFO .

(a) Attach a fuel pressure gauge and check the fuel pressure after stopping the engine.

Standard:

147 kPa (1.5 kgf/cm ^{2}) or higher (5 minutes after stopping the engine)

HINT:

If the engine cannot be started, read the values after cranking the engine.

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ PERFORM SIMULATION TEST

A ▶ REPLACE FUEL PRESSURE REGULATOR ASSEMBLY

20.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Clean the inside of the surge tank with compressed air.

(b) After stopping the engine, measure the HC concentration inside the surge tank for 15 minutes.

Result

RESULT	PROCEED TO
4000 ppm or more	A
Less than 4000 ppm	B

HINT:

If the concentration is 4000 ppm or more, a fuel injector assembly may have a sealing problem.

B ▶ CHECK THROTTLE WITH MOTOR BODY ASSEMBLY

A

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21.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Inspect the fuel injector assemblies (for port injection) INFO .

Result

RESULT	PROCEED TO
Abnormal	A
Normal	B

B ▶ **CHECK THROTTLE WITH MOTOR BODY ASSEMBLY**

A ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

22.	CHECK THROTTLE WITH MOTOR BODY ASSEMBLY

(a) Check if carbon is in the airflow passage.

Result

RESULT	PROCEED TO
Carbon in passage	A
No carbon present	B

B ▶ **CHECK INTAKE SYSTEM**

A ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

23.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:

No leaks in intake system.

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK ▼

24.	PERFORM SIMULATION TEST

(a) Check if the engine can be started.

Result

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RESULT	PROCEED TO
Engine can be started	A
Engine cannot be started	B

B ▶ CONFIRM PROBLEM SYMPTOM

A ▶ END

25.	CONFIRM PROBLEM SYMPTOM

(a) Confirm the problem symptoms.

HINT:

The problem symptoms below can be determined by reading the freeze frame data.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
The engine does not crank	• Battery fully depleted • Starter assembly (includes pinion gear wear or tooth damage) • Starter system • Engine assembly (excess friction) • Flywheel wear or tooth damage (for Manual Transmission) • Drive plate wear or tooth damage (for Automatic Transmission)	A
Abnormal cranking speed	• Battery fully depleted • Starter assembly • Engine assembly (excess friction, compression loss)	B
There is no initial combustion (combustion does not occur even once)*1	• Pressure regulator fuel pressure maintenance • Fuel injector leak • Fuel leak from fuel line • Fuel pump control circuit (low pressure side) • Fuel pump assembly • Spark plug • Crankshaft position sensor system • Ignition coil system	C
	• Intake system connections	

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The engine stalls after starter turnoff (engine stalls immediately after the first time the engine speed increases)*2	• Throttle with motor body assembly • Camshaft timing oil control valve • Mass air flow meter system	D
The initial combustion and starter turnoff occur late*3	• Engine coolant temperature sensor • Mass air flow meter • Air fuel ratio sensor • Heated oxygen sensor • Fuel injector assembly (for port injection) • Spark plug • Pressure regulator • Fuel pump assembly • Fuel pump control circuit (low pressure side)	E

HINT:

- If there is hesitation (cranking speed is slow and combustion occurs before passing TDC) during the initial cranking period, the battery charge may be insufficient or the starter may be malfunctioning.
- *1: If there is no initial combustion, a wire harness may be malfunctioning, or the ignition or fuel system may be malfunctioning.
- *2: If the engine stalls after starter turnoff, the air-fuel ratio may be incorrect or the camshaft timing oil control valve may have a problem returning.
- *3: If the initial combustion and starter turnoff occur late, the fuel injection volume may be incorrect (too low or too high).

B ▶ **PERFORM SIMULATION TEST**

C ▶ **CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

D ▶ **INSPECT MASS AIR FLOW METER**

E ▶ **INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

A ▼

26.	PERFORM SIMULATION TEST

(a) When cranking the engine, check for a noise indicating that the starter pinion gear is extending, and check that the starter pinion gear is not spinning freely.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
A noise indicating that the starter pinion gear is extending is heard and	• Battery • Excess engine friction	A

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the starter pinion gear is not spinning freely*1	• Starter assembly	
A noise indicating that the starter pinion gear is extending is heard but the starter pinion gear is spinning freely	• Fly wheel (for Manual Transmission) • Drive plate (for Automatic Transmission) • Starter assembly	B
A noise indicating that the starter pinion gear is extending is not heard	• Battery • Starter assembly • Starter system	C

HINT:

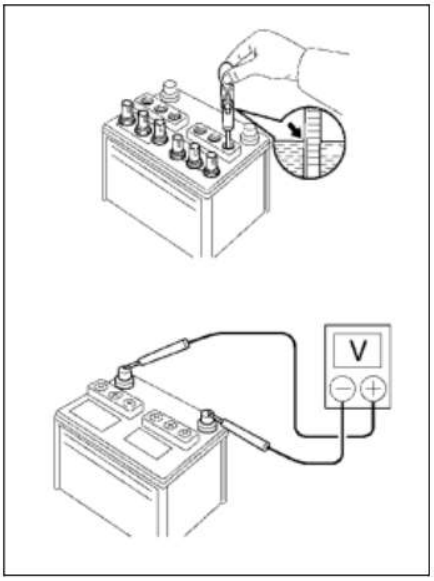
***1: The battery may be fully depleted or there may be excess engine friction.**

B ▶ **CHECK STARTER ASSEMBLY**

C ▶ **INSPECT BATTERY**

A

27.	**INSPECT BATTERY**



(a) Check the electrolyte quantity.

OK:
Electrolyte quantity is within the specified range.

(b) Inspect the specific gravity.

(1) Inspect the specific gravity of each cell.

Standard specific gravity:
1.25 to 1.29 (electrolyte is at 20°C (68°F))

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HINT:

- If the result is not as specified, recharge or replace the battery.
- It is not necessary to inspect a maintenance-free battery.

(c) Inspect the battery voltage.

(1) Turn the ignition switch off and turn on the headlights for 20 to 30 seconds. This will remove the surface charge from the battery.

(2) Measure the battery voltage.

Standard voltage:
12.5 to 12.9 V (electrolyte is at 20°C (68°F))

HINT:

If the result is not as specified, recharge or replace the battery.

(3) Measure the battery voltage when cranking the engine.

Standard:
Approximately 6 V or higher (0°C (32°F) or higher)

HINT:

When the battery is depleted, the horn becomes quieter.

NG ▶ **CHARGE OR REPLACE BATTERY**

OK ▼

28.	**CHECK ENGINE ASSEMBLY**

(a) Check that the crankshaft rotates smoothly when rotating it by hand.

OK:
Crankshaft rotates smoothly.

HINT:

Excess engine friction may have occurred temporarily. Remove the cylinder head cover and oil pan, and check for foreign matter such as iron fragments. If there is a malfunction or signs of a malfunction present, perform a detailed inspection by disassembling all the parts.

NG ▶ **REPAIR OR REPLACE ENGINE ASSEMBLY**

OK ▶ **INSPECT STARTER ASSEMBLY**

29.	**CHECK STARTER ASSEMBLY**

(a) Remove the starter assembly INFO .

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(b) Check for starter pinion gear wear and damage.

OK:

There is no wear or damage.

Result

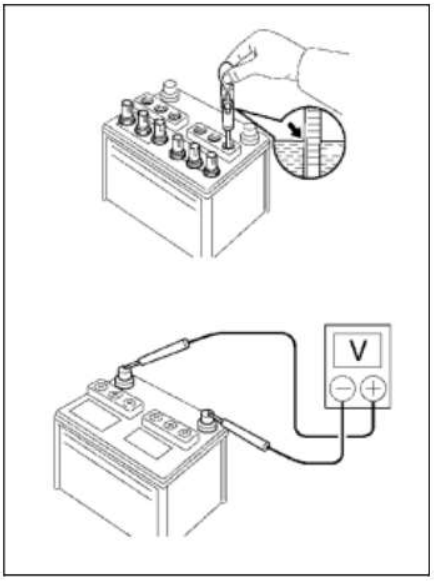
RESULT	PROCEED TO
Abnormal	A
Normal (for Manual Transmission)	B
Normal (for Automatic Transmission)	C

B ▶ **REPLACE FLYWHEEL SUB-ASSEMBLY**

C ▶ **REPLACE DRIVE PLATE AND RING GEAR SUB-ASSEMBLY**

A ▶ **REPLACE STARTER ASSEMBLY**

30.	INSPECT BATTERY



(a) Check the electrolyte quantity.

OK:

Electrolyte quantity is within the specified range.

(b) Inspect the specific gravity.

(1) Inspect the specific gravity of each cell.

Standard specific gravity:

1.25 to 1.29 (electrolyte is at 20°C (68°F))

HINT:

- If the result is not as specified, recharge or replace the battery.
- It is not necessary to inspect a maintenance-free battery.

(c) Inspect the battery voltage.

(1) Turn the ignition switch off and turn on the headlights for 20 to 30 seconds. This will remove the surface charge from the battery.

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(2) Measure the battery voltage.

Standard voltage:
12.5 to 12.9 V (electrolyte is at 20°C (68°F))

HINT:

If the result is not as specified, recharge or replace the battery.

(3) Measure the battery voltage when cranking the engine.

Standard:
Approximately 6 V or higher (0°C (32°F) or higher)

HINT:

When the battery is depleted, the horn becomes quieter.

NG ▶ **CHARGE OR REPLACE BATTERY**

OK ▼

31.	INSPECT STARTER ASSEMBLY

(a) Inspect the starter assembly INFO .

NG ▶ **REPLACE STARTER ASSEMBLY**

OK ▶ **CHECK STARTER SIGNAL CIRCUIT**

32.	PERFORM SIMULATION TEST

(a) Check the cranking speed.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
Cranking speed is slow (100 rpm or less)	• Battery • Starter assembly • Excess engine friction	A
Cranking speed is fast (300 rpm or more)*1	Engine compression loss	B

HINT:

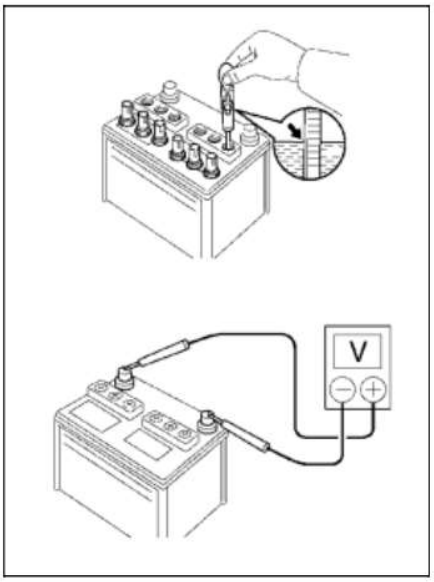
***1: If the cranking speed is fast, there may be compression loss.**

B ▶ **CHECK AND REPAIR ENGINE ASSEMBLY**

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A

33.	INSPECT BATTERY



(a) Check the electrolyte quantity.

OK:

Electrolyte quantity is within the specified range.

(b) Inspect the specific gravity.

(1) Inspect the specific gravity of each cell.

Standard specific gravity:

1.25 to 1.29 (electrolyte is at 20°C (68°F))

HINT:

- If the result is not as specified, recharge or replace the battery.
- It is not necessary to inspect a maintenance-free battery.

(c) Inspect the battery voltage.

(1) Turn the ignition switch off and turn on the headlights for 20 to 30 seconds. This will remove the surface charge from the battery.

(2) Measure the battery voltage.

Standard voltage:

12.5 to 12.9 V (electrolyte is at 20°C (68°F))

HINT:

If the result is not as specified, recharge or replace the battery.

(3) Measure the battery voltage when cranking the engine.

Standard:

Approximately 6 V or higher (0°C (32°F) or higher)

HINT:

When the battery is depleted, the horn becomes quieter.

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NG ▶ CHARGE OR REPLACE BATTERY

OK ▼

34.	CHECK ENGINE ASSEMBLY

(a) Check that the crankshaft rotates smoothly when rotating it by hand.

OK:

Crankshaft rotates smoothly.

HINT:

Excess engine friction may have occurred temporarily. Remove the cylinder head cover and oil pan, and check for foreign matter such as iron fragments. If there is a malfunction or signs of a malfunction present, perform a detailed inspection by disassembling all the parts.

NG ▶ REPAIR OR REPLACE ENGINE ASSEMBLY

OK ▶ INSPECT STARTER ASSEMBLY

35.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Using a sound scope or screwdriver, check for fuel injector operating noise while cranking the engine.

OK:

Fuel injector operating noise is heard.

NG ▶ READ VALUE USING TECHSTREAM (ENGINE SPEED)

OK ▼

36.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

(a) Inspect the fuel pressure INFO .

NG ▶ PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

OK ▼

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37.	CHECK SPARK PLUG AND SPARK

(a) Check for sparks INFO .

NG ▶ CHECK SPARK PLUG

OK ▼

38.	CONFIRM VEHICLE CONDITION

(a) Confirm the conditions present when the malfunction occurred based on the customer problem analysis.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
When the engine is stopped and a long time has passed, engine starting trouble occurs*1	Pressure regulator is stuck open	A
When the engine is stopped and approximately 15 to 120 minutes have passed, engine starting trouble occurs*2	Fuel injector leak	B
When the engine is stopped and approximately 2 to 3 minutes have passed, engine starting trouble occurs*3	Failure to maintain fuel pressure by pressure regulator	A
Condition other than above, or there is an inconsistency in the conditions present when engine starting trouble occurs	-	C*4

HINT:

***1: The pressure regulator may be stuck open. Attach a fuel pressure gauge and check the ability of the system to maintain fuel pressure after stopping the engine.**

***2: Fuel may be leaking from a fuel injector assembly.**

***3: The pressure regulator may not be able to maintain the fuel pressure. Attach a fuel pressure gauge and check the ability of the pressure regulator to maintain fuel pressure after stopping the engine.**

***4: From step 72, perform fuel system troubleshooting C (steps 73 to 76).**

B ▶ CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

C ▶ CHECK MALFUNCTION CONDITION

A ▼

39.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

HINT:

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For the fuel pressure inspection, refer to the following procedures INFO .

(a) Attach a fuel pressure gauge and check the fuel pressure after stopping the engine.

Result

RESULT	PROCEED TO
Below 147 kPa (1.5 kgf/cm ^{2}) (5 minutes after stopping the engine)	A
147 kPa (1.5 kgf/cm ^{2}) or higher (5 minutes after stopping the engine)	B*1

HINT:

- If the engine cannot be started, check the fuel pressure after cranking the engine.
- *1: From step 72, perform fuel system troubleshooting C (steps 73 to 76).

B ▶ **CHECK MALFUNCTION CONDITION**

A ▶ **REPLACE FUEL PRESSURE REGULATOR ASSEMBLY**

40.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) After stopping the engine, measure the HC concentration inside the surge tank for 15 minutes.

Result

RESULT	PROCEED TO
4000 ppm or more	A
Less than 4000 ppm	B*1

HINT:

- If the concentration is 4000 ppm or more, a fuel injector assembly may have a sealing problem.
- *1: From step 72, perform fuel system troubleshooting C (steps 73 to 76).

B ▶ **CHECK MALFUNCTION CONDITION**

A ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

41.	CHECK SPARK PLUG

(a) Inspect the spark plugs INFO .

HINT:

Even if the spark plug of only one cylinder is malfunctioning, replace the spark plugs of all cylinders.

NG ▶ **REPLACE SPARK PLUG**

OK ▼

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42.	READ VALUE USING TECHSTREAM (ENGINE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Data List / Engine Speed.

(d) Start the engine.

(e) While running the engine, read the value of Engine Speed.

OK:

A value that matches the actual engine speed is constantly output.

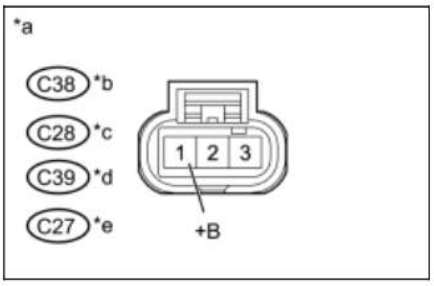
HINT:

- Check the engine speed using a line graph.
- If the engine cannot be started, check the engine speed while cranking the engine.
- If the engine speed is 0 rpm, the crankshaft position sensor may have an open or short circuit.

NG ▶ **CHECK CRANKSHAFT POSITION SENSOR CIRCUIT**

OK ▼

43.	CHECK TERMINAL VOLTAGE (IGNITION COIL POWER SOURCE)



(a) Disconnect the ignition coil assembly connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
C38-1 - Body ground	Ignition switch ON	11 to 14 V
C28-1 - Body ground	Ignition switch ON	11 to 14 V
C39-1 - Body ground	Ignition switch ON	11 to 14 V
C27-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

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*a	Front view of wire harness connector (to Ignition Coil Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **CHECK IGNITION COIL POWER SOURCE CIRCUIT**

OK ▼

44.	CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - ECM)

(a) Disconnect the ignition coil assembly connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-21 (IGT1) - C38-3	Always	Below 1 Ω
A36-10 (IGT2) - C28-3	Always	Below 1 Ω
A36-31 (IGT3) - C39-3	Always	Below 1 Ω
A36-8 (IGT4) - C27-3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-21 (IGT1) or C38-3 - Body ground	Always	10 kΩ or higher
A36-10 (IGT2) or C28-3 - Body ground	Always	10 kΩ or higher
A36-31 (IGT3) or C39-3 - Body ground	Always	10 kΩ or higher
A36-8 (IGT4) or C27-3 - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

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NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

45.	CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - BODY GROUND)

(a) Disconnect the ignition coil assembly connector.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C38-2 - Body ground	Always	Below 1 Ω
C28-2 - Body ground	Always	Below 1 Ω
C39-2 - Body ground	Always	Below 1 Ω
C27-2 - Body ground	Always	Below 1 Ω

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.
- If the wire harness is normal, after replacing the ignition coil assembly, check if engine starting trouble occurs again. If engine starting trouble occurs again, proceed to step 72 and perform troubleshooting for the ignition system (steps 78 to 83).

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ REPLACE IGNITION COIL ASSEMBLY

46.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for an operating sound from the fuel pump.

OK:

CONTROL THE FUEL PUMP / SPEED	SPECIFIED CONDITION
ON	Operating sound heard
OFF	Operating sound not heard

HINT:

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Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.

NG ▶ **CHECK FUEL PUMP CONTROL CIRCUIT (LOW PRESSURE SIDE)**

OK ▼

47.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for fuel leakage from the fuel pipes.

Result

RESULT	PROCEED TO
Fuel leakage or signs of fuel leakage are present	A
No fuel leakage or signs of fuel leakage	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Check if the vehicle ran out of fuel, as engine starting trouble due to running out of fuel is also detected.
- If there are no fuel leaks, after inspecting the fuel pump control circuit, check if engine starting trouble occurs again. If engine starting trouble occurs again, proceed to step 72 and perform fuel system troubleshooting C (steps 73 to 77).

B ▶ **CHECK FUEL PUMP CONTROL CIRCUIT (LOW PRESSURE SIDE)**

A ▶ **REPAIR OR REPLACE FUEL LINE**

48.	READ VALUE USING TECHSTREAM (ENGINE SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Data List / Engine Speed.

(d) Start the engine.

(e) While running the engine, read the value of Engine Speed.

OK:

A value that matches the actual engine speed is constantly output.

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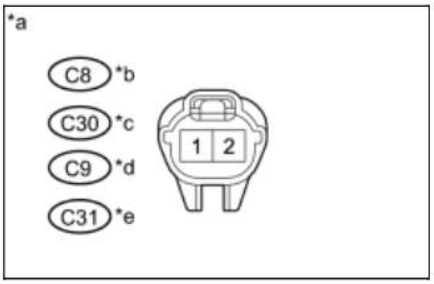
HINT:

- Check the engine speed using a line graph.
- If the engine cannot be started, check the engine speed while cranking the engine.
- If the engine speed is 0 rpm, the crankshaft position sensor may have an open or short circuit.

NG ▶ **REPLACE CRANKSHAFT POSITION SENSOR**

OK ▼

49.	CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)



(a) Disconnect the fuel injector assembly connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

CYLINDER	TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
No. 1	C8-1 - Body ground	Ignition switch ON	11 to 14 V
No. 2	C30-1 - Body ground	Ignition switch ON	11 to 14 V
No. 3	C9-1 - Body ground	Ignition switch ON	11 to 14 V
No. 4	C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

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NG ▶ REPAIR FUEL INJECTOR POWER SOURCE CIRCUIT

OK ▼

50.	INSPECT MASS AIR FLOW METER

(a) Inspect the mass air flow meter INFO .

NG ▶ INSPECT ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

51.	CHECK INTAKE SYSTEM

(a) Check for air leakage in the intake system [vacuum hose disconnection, cracks, damaged gaskets, etc.] INFO .

HINT:

- If the accelerator pedal is released after racing the engine, the inspection is easier to perform because the vacuum inside the intake manifold increases and the air suction noise becomes louder.
- If Short FT and Long FT are largely different from the normal values (differ by more than 15%) when idling (intake air volume is small) and almost the same as the normal values when racing the engine (for example, when maintaining a speed of 3000 rpm) (intake air volume is high), air leakage may be present.

OK:
There is no air leakage.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

52.	CHECK THROTTLE WITH MOTOR BODY ASSEMBLY

(a) Disconnect the throttle with motor body assembly connector.

HINT:

When the connector is disconnected, the vehicle enters fail-safe mode.

(b) Crank the engine and check that it starts.

Result

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RESULT	PROCEED TO
Engine starts	A
Engine does not start	B

(c) Connect the throttle with motor body assembly connector.

HINT:

When this inspection is performed, the MIL may illuminate. After finishing the inspection, check and clear DTCs INFO **.**

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT LINEAR)**

A ▼

53.	CHECK THROTTLE WITH MOTOR BODY ASSEMBLY

(a) Check if carbon is in the airflow passage.

OK:

No carbon present.

NG ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

OK ▼

54.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT LINEAR)

(a) Connect the Techstream to the DLC3.

(b) Turn the Techstream on.

(c) Warm up the engine.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Linear (Bank1) or Control the VVT Linear (Bank2).

HINT:

When performing the Active Test, make sure the A/C is on and the shift lever is in P, N or neutral position.

(e) Check the engine speed while operating the camshaft timing oil control valve using the Techstream.

OK:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
36 deg (CA)	Engine idles roughly or stalls

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HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When the results of the inspection using the Active Test are normal but the valve operating noise is abnormal, check the valve for any signs of problems.
- If the camshaft timing oil control valve is stuck on, the valve overlap increases and combustion worsens due to the internal EGR which may cause the engine to stall.

NG ▶ **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR INTAKE SIDE)**

OK ▼

55.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE VVT EXHAUST LINEAR)

(a) Connect the Techstream to the DLC3.

(b) Turn the Techstream on.

(c) Warm up the engine.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the VVT Exhaust Linear (Bank1) or Control the VVT Exhaust Linear (Bank2).

HINT:

When performing the Active Test, make sure the A/C is on and the shift lever is in P, N or neutral position.

(e) Check the engine speed while operating the camshaft timing oil control valve using the Techstream.

OK*1:

TECHSTREAM OPERATION	SPECIFIED CONDITION
0 deg (CA)	Normal engine speed
51 deg (CA)	Engine idles roughly or stalls

Result

RESULT	PROCEED TO
NG	A
OK	B

HINT:

- *1: From step 72, perform intake system troubleshooting (steps 84 to 86). If engine starting trouble still occurs, perform fuel system troubleshooting A (steps 87 to 94).
- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When the results of the inspection using the Active Test are normal but the valve operating noise is abnormal, check the valve for any signs of problems.
- If the camshaft timing oil control valve is stuck on, the valve overlap increases and combustion worsens due to the internal EGR which may cause the engine to stall.

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B ▶ CHECK MALFUNCTION CONDITION

A ▶ REPLACE CAMSHAFT TIMING OIL CONTROL VALVE (FOR EXHAUST SIDE)

56.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
A33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.
- If the wire harness is normal, after replacing the mass air flow meter, check if engine starting trouble occurs again. If engine starting trouble occurs again, proceed to step 72 and perform intake system troubleshooting (steps 84 to 86). If engine starting trouble still occurs, perform fuel system troubleshooting A (steps 87 to 94).

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ REPLACE MASS AIR FLOW METER

57.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO .

HINT:

If the engine coolant temperature sensor is malfunctioning, after replacing it, check if engine starting trouble occurs again. If engine starting trouble occurs, replace the ECM. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 114), in that order.

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

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NG ▶

OK ▼

58.	CHECK HARNESS AND CONNECTOR (ENGINE COOLANT TEMPERATURE SENSOR - ECM)

(a) Disconnect the engine coolant temperature sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) - C35-2 (THW)	Always	Below 1 Ω
A36-29 (E1) - C35-1 (E2)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-30 (THW) or C35-2 (THW) - Body ground	Always	10 kΩ or higher
A36-29 (E1) or C35-1 (E2) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.
- If the wire harness or connector is malfunctioning, after replacing or repairing it, check if engine starting trouble occurs again. If engine starting trouble occurs, replace the ECM. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

59.	INSPECT MASS AIR FLOW METER

(a) Inspect the mass air flow meter INFO .

HINT:

If the mass air flow meter is malfunctioning, after replacing it, check if engine starting trouble occurs again. If

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engine starting trouble occurs, replace the ECM. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

NG ▶ **REPLACE MASS AIR FLOW METER**

OK ▼

60.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
A33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher
A33-29 (E2G) or C16-4 (E2G) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.
- If the wire harness or connector is malfunctioning, after replacing or repairing it, check if engine starting trouble occurs again. If engine starting trouble occurs, replace the ECM. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

61.	READ VALUE USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Data List / Atmospheric Pressure and Long FT.

Result

DATA LIST ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Long FT	+25% or more or less than -25%	• Air fuel ratio sensor • Heated oxygen sensor • Mass air flow meter • Fuel injector assembly (for port injection) • ECM	A
Atmosphere Pressure	80 kPa or less (when elevation is 0 m)		
Both Data List items listed above	Values are other than above	-	B

B ▶ **CHECK FUEL PRESSURE (LOW PRESSURE SIDE)**

A ▼

62.	**PERFORM SIMULATION TEST**

(a) Remove the EFI MAIN and ETCS fuses from the engine room relay block assembly.

(b) After 60 seconds or more elapse, install the EFI MAIN and ETCS fuses.

(c) Check if the engine can be started.

Result

RESULT	PROCEED TO
Engine can be started	A
Engine cannot be started	B

B ▶ **CHECK FUEL PRESSURE (LOW PRESSURE SIDE)**

A ▼

63.	**INSPECT AIR FUEL RATIO SENSOR**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

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(c) Turn the Techstream on.

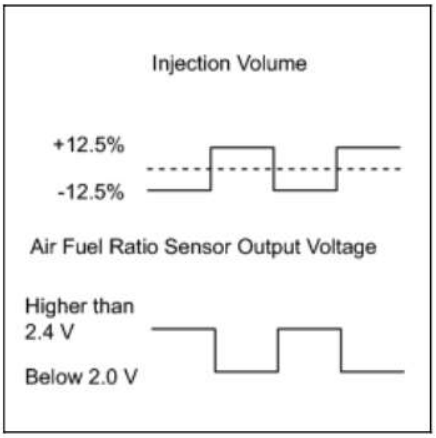
(d) Enter the following menus: Powertrain / Engine / Data List / Fuel System Status #1.

(e) Confirm that Fuel System Status #1 is CL.

(f) Enter the following menus: Powertrain / Engine / Data List / AF Lambda B1S1.

(g) Confirm that AF Lambda B1S1 is both within the range of 0.95 to 1.05 when idling.

(h) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F sensor.



(i) Read the output voltage from the air fuel ratio sensor when increasing and decreasing the fuel injection volume.

Standard:

TECHSTREAM DISPLAY	INJECTION VOLUME	SPECIFIED CONDITION
AFS Voltage B1S1	+12.5%	Air fuel ratio sensor output voltage is below 2.0 V
	-12.5%	Air fuel ratio sensor output voltage is higher than 2.4 V

Result

RESULT	PROCEED TO
Normal	A
Abnormal	B

HINT:

- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the air fuel ratio sensor is malfunctioning, after replacing it, check if engine starting trouble occurs again. If engine starting trouble occurs, replace the ECM. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

B ▶ **REPLACE AIR FUEL RATIO SENSOR**

A ▼

64.	**PERFORM SIMULATION TEST**

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(a) Check if the idling speed is stable after starting the engine.

OK:

Speed is stable.

HINT:

After replacing the fuel injector assembly or mass air flow meter, check if engine starting trouble occurs again. If engine starting trouble occurs, replace the ECM. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

OK ▶ **REPLACE MASS AIR FLOW METER**

65.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

(a) Inspect the fuel pressure INFO .

NG ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

OK ▼

66.	CHECK SPARK PLUG

(a) Inspect the spark plugs INFO .

Result

RESULT	PROCEED TO
All cylinders are normal	A
One cylinder is abnormal*1	B
All cylinders are abnormal*2, *3	C

HINT:

- *1: If one cylinder is abnormal, replace the spark plug of that cylinder and inspect the ignition and fuel system for that cylinder. After performing repairs, check if engine starting trouble occurs again. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.
- *2: If all cylinders are abnormal, replace the spark plugs of all cylinders and check if engine starting trouble occurs again. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.
- *3: Engine starting trouble may occur if the vehicle is driven extremely short distances repeatedly.

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B ▶ REPLACE SPARK PLUG (ABNORMAL CYLINDER)

C ▶ REPLACE SPARK PLUG (ALL)

A ▼

67.	CONFIRM VEHICLE CONDITION

(a) Confirm the conditions present when the malfunction occurred based on the customer problem analysis.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
When the engine is stopped and a long time has passed, engine starting trouble occurs*1	Pressure regulator is stuck open	A
When the engine is stopped and approximately 15 to 120 minutes have passed, engine starting trouble occurs*2	Fuel injector leak	B
When the engine is stopped and approximately 2 to 3 minutes have passed, engine starting trouble occurs*3	Failure to maintain fuel pressure by pressure regulator	A
Condition other than above, or there is an inconsistency in the conditions present when engine starting trouble occurs	-	C*4

HINT:

***1: The pressure regulator may be stuck open. Attach a fuel pressure gauge and check the ability of the system to maintain fuel pressure after stopping the engine.**

***2: Fuel may be leaking from a fuel injector assembly.**

***3: The pressure regulator may not be able to maintain the fuel pressure. Attach a fuel pressure gauge and check the ability of the pressure regulator to maintain fuel pressure after stopping the engine.**

***4: From step 72, perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 114), in that order.**

B ▶ CHECK PURGE VALVE

C ▶ CHECK MALFUNCTION CONDITION

A ▼

68.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

HINT:

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For the fuel pressure inspection, refer to the following procedures INFO .

(a) Attach a fuel pressure gauge and check the fuel pressure after stopping the engine.

Result

RESULT	PROCEED TO
Below 147 kPa (1.5 kgf/cm ^{2}) (5 minutes after stopping the engine)	A
147 kPa (1.5 kgf/cm ^{2}) or higher (5 minutes after stopping the engine)	B*1

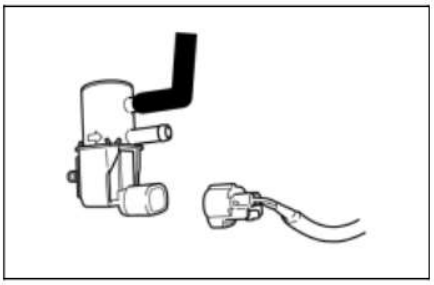
HINT:

- If the engine cannot be started, check the fuel pressure after cranking the engine.
- *1: From step 72, perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 114), in that order.

B ▶ CHECK MALFUNCTION CONDITION

A ▶ REPLACE FUEL PRESSURE REGULATOR ASSEMBLY

69.	CHECK PURGE VALVE



(a) Disconnect the purge hose (on the canister side) of the purge valve.

(b) Start the engine.

(c) Idle the engine.

(d) Disconnect the connector of the purge valve.

(e) Check if air flows through the purge valve.

OK:
Air does not flow.

(f) Connect the connector of the purge valve.

(g) Connect the purge hose of the purge valve.

HINT:

When this inspection is performed, the MIL may illuminate. After finishing the inspection, check and clear DTCs INFO .

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

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OK

70.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Clean the inside of the surge tank with compressed air.

(b) After stopping the engine, measure the HC concentration inside the surge tank for 15 minutes.

Result

RESULT	PROCEED TO
4000 ppm or more	A
Less than 4000 ppm	B*1

HINT:

- If the concentration is 4000 ppm or more, a fuel injector assembly may have a sealing problem.
- *1: From step 72, perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

B ▶ **CHECK MALFUNCTION CONDITION**

A ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

71.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for fuel leakage from the fuel pipes.

Result

RESULT	PROCEED TO
Fuel leakage or signs of fuel leakage are present	A
No fuel leakage or signs of fuel leakage	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Check if the vehicle ran out of fuel, as engine starting trouble due to running out of fuel is also detected.
- If there are no fuel leaks, after inspecting the fuel pump control circuit, check if engine starting trouble occurs again. If engine starting trouble still occurs, proceed to step 72 and perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 114), in that order.

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B ▶ CHECK FUEL PUMP CONTROL CIRCUIT (LOW PRESSURE SIDE)

A ▶ REPAIR OR REPLACE FUEL LINE

72.	CHECK MALFUNCTION CONDITION

(a) If the malfunction could not be identified during the inspections in steps 38, 39, 40 and 47, perform fuel system troubleshooting C (steps 73 to 76).

Result

PERFORMED STEP	TROUBLESHOOTING BY SYSTEM	PROCEDURE	PROCEED TO
Steps 38, 39, 40 and 47	Fuel system troubleshooting C	73 to 76	A

(b) If the malfunction could not be identified during the inspection in step 45, perform ignition system troubleshooting (steps 77 to 83).

Result

PERFORMED STEP	TROUBLESHOOTING BY SYSTEM	PROCEDURE	PROCEED TO
Step 45	Ignition system troubleshooting	77 to 83	B

(c) If the malfunction could not be identified during the inspections in steps 55, 56 and 57, perform intake air system troubleshooting (steps 84 to 86). If engine starting trouble still occurs, perform fuel system troubleshooting A (steps 87 to 94).

Result

PERFORMED STEP	TROUBLESHOOTING BY SYSTEM	PROCEDURE	PROCEED TO
Step 55, 56, 57	Intake air system troubleshooting	84 to 86	C
	Fuel system troubleshooting A	87 to 94	

(d) If the malfunction could not be identified during the inspections in steps 58, 59, 60, 63, 64, 66, 67, 68, 70 and 71, perform fuel system troubleshooting A (steps 95 to 102), fuel system troubleshooting B (steps 103 to 105), intake air system troubleshooting (steps 106 to 108), and ignition system troubleshooting (steps 109 to 115), in that order.

Result

PERFORMED STEP	TROUBLESHOOTING BY SYSTEM	PROCEDURE	PROCEED TO
Steps 57, 58, 59, 60, 63, 64, 66, 67, 68, 70 and 71	Fuel system troubleshooting A	95 to 102	D
	Fuel system troubleshooting B	103 to 105	
	Intake air system troubleshooting	106 to 108	
	Ignition system troubleshooting	109 to 115	

B ▶ CHECK CRANKSHAFT POSITION SENSOR

C ▶ READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

D ▶ CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

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A

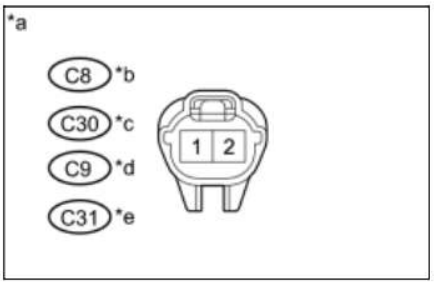
73.	INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Inspect the fuel injector assemblies (for port injection) INFO .

NG ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

OK

74.	CHECK TERMINAL VOLTAGE (FUEL INJECTOR POWER SOURCE)



(a) Disconnect the fuel injector assembly connectors.

(b) Turn the ignition switch to ON.

(c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

CYLINDER	TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
No. 1	C8-1 - Body ground	Ignition switch ON	11 to 14 V
No. 2	C30-1 - Body ground	Ignition switch ON	11 to 14 V
No. 3	C9-1 - Body ground	Ignition switch ON	11 to 14 V
No. 4	C31-1 - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Front view of wire harness connector (to Fuel Injector Assembly)
*b	No. 1 cylinder
*c	No. 2 cylinder
*d	No. 3 cylinder
*e	No. 4 cylinder

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HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR FUEL INJECTOR POWER SOURCE CIRCUIT**

OK
▼

75.	CHECK CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **CHECK VVT SENSOR**

OK ▶ **END (CRANKSHAFT POSITION SENSOR IS DEFECTIVE)**

76.	CHECK VVT SENSOR

(a) Replace the VVT sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **REPLACE ECM**

OK ▶ **END (VVT SENSOR IS DEFECTIVE)**

77.	CHECK CRANKSHAFT POSITION SENSOR

(a) Check the tightening and installation condition of the crankshaft position sensor bolt.

(b) Check the connection of the crankshaft position sensor connector.

OK:
Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL SENSOR**

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OK

78.	CHECK VVT SENSOR

(a) Check the tightening and installation condition of the VVT sensor bolt.

(b) Check the connection of the VVT sensor connector.

OK:

Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL SENSOR**

OK

79.	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) - C33-1 (NE+)	Always	Below 1 Ω
A34-27 (NE-) - C33-2 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) or C33-1 (NE+) - Body ground	Always	10 kΩ or higher
A34-27 (NE-) or C33-2 (NE-) - Body ground	Always	10 kΩ or higher

HINT:

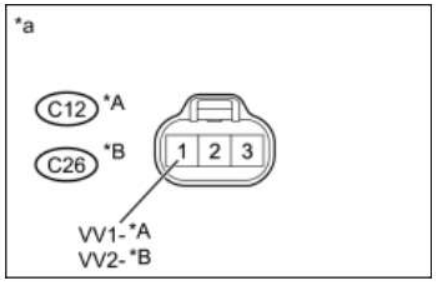
- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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80.	CHECK HARNESS AND CONNECTOR (VVT SENSOR (INTAKE SIDE) - ECM)



(a) Disconnect the VVT sensor connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C12-1 (VV1-) - Body ground	Ignition switch ON	11 to 14 V
C26-1 (VV2-) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to VVT Sensor (Intake Side))

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-26 (VV1+) - C12-2 (VV1+)	Always	Below 1 Ω
A34-34 (VCV) - C12-3 (VC)	Always	Below 1 Ω
A34-15 (VV2+) - C26-2 (VV2+)	Always	Below 1 Ω
A34-34 (VCV) - C26-3 (VC)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-26 (VV1+) or C12-2 (VV1+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C12-3 (VC) - Body ground	Always	10 kΩ or higher
A34-15 (VV2+) or C26-2 (VV2+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C26-3 (VC) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always

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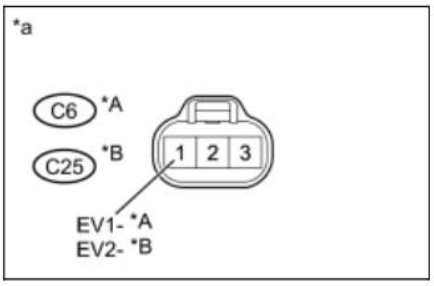
occur.

- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

81.	CHECK HARNESS AND CONNECTOR (VVT SENSOR (EXHAUST SIDE) - ECM)



(a) Disconnect the VVT sensor connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C6-1 (EV1-) - Body ground	Ignition switch ON	11 to 14 V
C25-1 (EV2-) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to VVT Sensor (Exhaust Side))

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-14 (EV1+) - C6-2 (EV1+)	Always	Below 1 Ω
A34-34 (VCV) - C6-3 (VC)	Always	Below 1 Ω
A34-25 (EV2+) - C25-2 (EV2+)	Always	Below 1 Ω
A34-34 (VCV) - C25-3 (VC)	Always	Below 1 Ω

Standard Resistance (Check for short):

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TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-14 (EV1+) or C6-2 (EV1+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C6-3 (VC) - Body ground	Always	10 kΩ or higher
A34-25 (EV2+) or C25-2 (EV2+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C25-3 (VC) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

82.	CHECK CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **CHECK VVT SENSOR**

OK ▶ **END (CRANKSHAFT POSITION SENSOR IS DEFECTIVE)**

83.	CHECK VVT SENSOR

(a) Replace the VVT sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **REPLACE ECM**

OK ▶ **END (VVT SENSOR IS DEFECTIVE)**

84.	READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

(a) Connect the Techstream to the DLC3.

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(b) Turn the ignition switch to ON.

(c) Start the engine and warm it up until the engine coolant temperature stabilizes with the A/C switch and all the accessory switches off.

(d) Enter the following menus: Powertrain / Engine / Data List / ISC Learning Value.

Result

DATA LIST ITEM	RESULT	SUSPECTED AREA	PROCEED TO
ISC Learning Value	(engine displacement (liters) x 0.9) or more	• Valve timing • Compression	A
	Less than (engine displacement (liters) x 0.9)	-	B

B ▶ **INSPECT ENGINE COOLANT TEMPERATURE SENSOR**

A
▼

85.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Inspect the compression INFO .

NG ▶ **REPAIR OR REPLACE ENGINE ASSEMBLY**

OK ▶ **ADJUST VALVE TIMING**

86.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO .

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK
▼

87.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

HINT:

For the fuel pressure inspection, refer to the following procedures INFO .

(a) Attach a fuel pressure gauge and check the fuel pressure when cranking the engine and after stopping the engine.

Result

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VEHICLE STATE	SPECIFIED CONDITION
Cranking engine	304 to 343 kPa (3.1 to 3.5 kgf/cm ^{2})
5 minutes after stopping engine	147 kPa (1.5 kgf/cm ^{2}) or higher

NG ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

OK ▼

88.	READ VALUE USING TECHSTREAM (LONG FT)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Data List / Long FT.

Result

DATA LIST ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Long FT	-15 to +15%	• Wire harness or connector • Fuel	A
	+15% or more, or less than -15%	Fuel injector assembly	B

B ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

A ▼

89.	PERFORM SIMULATION TEST

(a) Check if the idling speed is stable after starting the engine and if an unstable idling speed has ever occurred in the past.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
Current unstable idling speed or history of unstable idling speed	Crankshaft position sensor system	A
All current and past idling speeds are stable	Fuel	B

HINT:

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Through the customer problem analysis, confirm the fuel being used and the location at which the fuel was added to check if the malfunction is caused by the fuel in the vehicle.

B ▶ **REPLACE FUEL**

A

▼

90.	CHECK CRANKSHAFT POSITION SENSOR

(a) Check the tightening and installation condition of the crankshaft position sensor bolt.

(b) Check the connection of the crankshaft position sensor connector.

OK:

Sensor is installed correctly.

NG ▶ **SECURELY REINSTALL SENSOR**

OK

▼

91.	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) - C33-1 (NE+)	Always	Below 1 Ω
A34-27 (NE-) - C33-2 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) or C33-1 (NE+) - Body ground	Always	10 kΩ or higher
A34-27 (NE-) or C33-2 (NE-) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

REPAIR OR REPLACE HARNESS OR CONNECTOR

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NG ▶

OK ▼

92.	CHECK CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

(b) Check the engine start operation.

OK:

Malfunction has been repaired successfully.

NG ▶ REPLACE ECM

OK ▶ END (CRANKSHAFT POSITION SENSOR IS DEFECTIVE)

93.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for fuel leakage from the fuel pipes.

Result

RESULT	PROCEED TO
Fuel leakage or signs of fuel leakage are present	A
No fuel leakage or signs of fuel leakage	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When performing the Active Test, if there is no operating noise from the fuel pump, the fuel pump system may be malfunctioning.
- Check if the vehicle ran out of fuel, as engine starting trouble due to running out of fuel is also detected.

B ▶ INSPECT FUEL PUMP ASSEMBLY

A ▶ REPAIR OR REPLACE FUEL LINE

94.	INSPECT FUEL PUMP ASSEMBLY

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(a) Inspect the fuel pump assembly INFO .

HINT:

- Make sure there is no foreign matter such as iron particles on the fuel pump assembly and no signs that the fuel pump was stuck.
- Make sure the internal connector is securely connected.
- Make sure the fuel pump filter is not clogged.

NG ▶ **REPLACE FUEL PUMP ASSEMBLY**

OK ▶ **REPLACE FUEL PRESSURE REGULATOR ASSEMBLY**

95.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

HINT:

For the fuel pressure inspection, refer to the following procedures INFO .

(a) Attach a fuel pressure gauge and check the fuel pressure after stopping the engine.

Result

RESULT	PROCEED TO
147 kPa (1.5 kgf/cm ^{2}) or higher (5 minutes after stopping the engine)	A
Below 147 kPa (1.5 kgf/cm ^{2}) (5 minutes after stopping the engine)	B

B ▶ **PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)**

A ▼

96.	READ VALUE USING TECHSTREAM (LONG FT)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Data List / Long FT.

Result

DATA LIST ITEM	RESULT	SUSPECTED AREA	PROCEED TO
Long FT	-15 to +15%	• Wire harness or connector • Fuel	A
	+15% or more, or less than -15%	Fuel injector assembly	B

REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT

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B ▶ INJECTION)

A ▼

97.	PERFORM SIMULATION TEST

(a) Check if the idling speed is stable after starting the engine and if an unstable idling speed has ever occurred in the past.

Result

PROBLEM SYMPTOM	SUSPECTED AREA	PROCEED TO
Current unstable idling speed or history of unstable idling speed	Crankshaft position sensor system	A
All current and past idling speeds are stable	Fuel	B

HINT:

Through the customer problem analysis, confirm the fuel being used and the location at which the fuel was added to check if the malfunction is caused by the fuel in the vehicle.

B ▶ REPLACE FUEL

A ▼

98.	CHECK CRANKSHAFT POSITION SENSOR

(a) Check the tightening and installation condition of the crankshaft position sensor bolt.

(b) Check the connection of the crankshaft position sensor connector.

OK:
Sensor is installed correctly.

NG ▶ SECURELY REINSTALL SENSOR

OK ▼

99.	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

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(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) - C33-1 (NE+)	Always	Below 1 Ω
A34-27 (NE-) - C33-2 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) or C33-1 (NE+) - Body ground	Always	10 kΩ or higher
A34-27 (NE-) or C33-2 (NE-) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

100.	CHECK CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **REPLACE ECM**

OK ▶ **END (CRANKSHAFT POSITION SENSOR IS DEFECTIVE)**

101.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE FUEL PUMP / SPEED)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Enter the following menus: Powertrain / Engine / Active Test / Control the Fuel Pump / Speed.

(d) When performing the Active Test, check for fuel leakage from the fuel pipes.

Result

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RESULT	PROCEED TO
Fuel leakage or signs of fuel leakage are present	A
No fuel leakage or signs of fuel leakage	B

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- When performing the Active Test, if there is no operating noise from the fuel pump, the fuel pump system may be malfunctioning.
- Check if the vehicle ran out of fuel, as engine starting trouble due to running out of fuel is also detected.

B ▶ **INSPECT FUEL PUMP ASSEMBLY**

A ▶ **REPAIR OR REPLACE FUEL LINE**

102.	INSPECT FUEL PUMP ASSEMBLY

(a) Inspect the fuel pump assembly INFO .

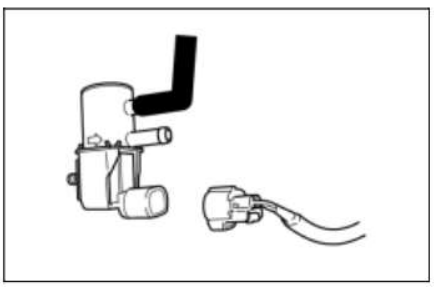
HINT:

- Make sure there is no foreign matter such as iron particles on the fuel pump assembly and no signs that the fuel pump was stuck.
- Make sure the internal connector is securely connected.
- Make sure the fuel pump filter is not clogged.

NG ▶ **REPLACE FUEL PUMP ASSEMBLY**

OK ▼

103.	CHECK PURGE VALVE



(a) Disconnect the vacuum hose (on the canister side) of the purge valve.

(b) Start the engine.

(c) Idle the engine.

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(d) Disconnect the connector of the purge valve.

(e) Check if air flows through the purge valve.

OK:
Air does not flow

(f) Connect the connector of the purge valve.

(g) Connect the vacuum hose of the purge valve.

HINT:

When this inspection is performed, the MIL may illuminate. After finishing the inspection, check and clear DTCs INFO **.**

NG ▶ **INSPECT PURGE VALVE**

OK ▼

104.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Clean the inside of the surge tank with compressed air.

(b) After stopping the engine, measure the HC concentration inside the surge tank for 15 minutes.

Result

RESULT	PROCEED TO
4000 ppm or more	A
Less than 4000 ppm	B

HINT:

If the concentration is 4000 ppm or more, a fuel injector assembly may have a sealing problem.

B ▶ **CHECK INTAKE VALVE**

A ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)**

105.	CHECK INTAKE VALVE

(a) Check if carbon is on the intake valves.

Result

RESULT	PROCEED TO
Carbon present	A
No carbon present	B

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B ▶ READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

A ▶ CLEAN INTAKE VALVE

106.	READ VALUE USING TECHSTREAM (ISC LEARNING VALUE)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Start the engine, turn off all accessory switches and warm up the engine until the engine coolant temperature stabilizes.

(d) Enter the following menus: Powertrain / Engine / Data List / ISC Learning Value.

Result

DATA LIST ITEM	RESULT	SUSPECTED AREA	PROCEED TO
ISC Learning Value	(engine displacement (liters) x 0.9) or more	• Valve timing • Compression	A
	Less than (engine displacement (liters) x 0.9)	-	B

B ▶ INSPECT ENGINE COOLANT TEMPERATURE SENSOR

A ▼

107.	CHECK CYLINDER COMPRESSION PRESSURE

(a) Inspect the compression INFO .

NG ▶ REPAIR OR REPLACE ENGINE ASSEMBLY

OK ▶ ADJUST VALVE TIMING

108.	INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Inspect the engine coolant temperature sensor INFO .

NG ▶ REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK ▼

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109.	CHECK CRANKSHAFT POSITION SENSOR

(a) Check the tightening and installation condition of the crankshaft position sensor bolt.

(b) Check the connection of the crankshaft position sensor connector.

OK:

Sensor is installed correctly.

NG ▶ SECURELY REINSTALL SENSOR

OK ▼

110.	CHECK VVT SENSOR

(a) Check the tightening and installation condition of the VVT sensor bolt.

(b) Check the connection of the VVT sensor connector.

OK:

Sensor is installed correctly.

NG ▶ SECURELY REINSTALL SENSOR

OK ▼

111.	CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)

(a) Disconnect the crankshaft position sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) - C33-1 (NE+)	Always	Below 1 Ω
A34-27 (NE-) - C33-2 (NE-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-16 (NE+) or C33-1 (NE+) - Body ground	Always	10 kΩ or higher
A34-27 (NE-) or C33-2 (NE-) - Body ground	Always	10 kΩ or higher

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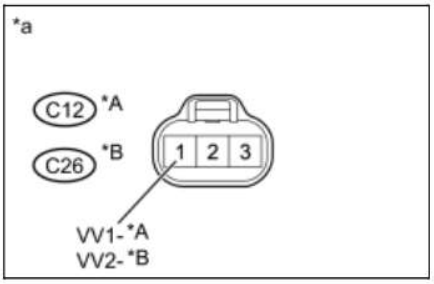
HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

112.	CHECK HARNESS AND CONNECTOR (VVT SENSOR (INTAKE SIDE) - ECM)



(a) Disconnect the VVT sensor connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C12-1 (VV1-) - Body ground	Ignition switch ON	11 to 14 V
C26-1 (VV2-) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to VVT Sensor (Intake Side))

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-26 (VV1+) - C12-2 (VV1+)	Always	Below 1 Ω
A34-34 (VCV) - C12-3 (VC)	Always	Below 1 Ω
A34-15 (VV2+) - C26-2 (VV2+)	Always	Below 1 Ω
A34-34 (VCV) - C26-3 (VC)	Always	Below 1 Ω

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Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-26 (VV1+) or C12-2 (VV1+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C12-3 (VC) - Body ground	Always	10 kΩ or higher
A34-15 (VV2+) or C26-2 (VV2+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C26-3 (VC) - Body ground	Always	10 kΩ or higher

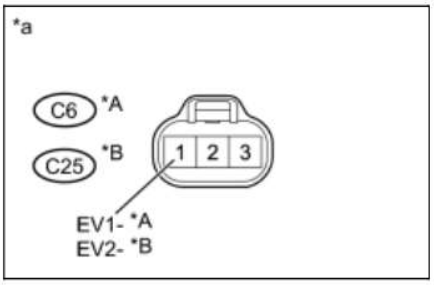
HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

113.	CHECK HARNESS AND CONNECTOR (VVT SENSOR (EXHAUST SIDE) - ECM)



(a) Disconnect the VVT sensor connector.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C6-1 (EV1-) - Body ground	Ignition switch ON	11 to 14 V
C25-1 (EV2-) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*A	Bank 1
*B	Bank 2
*a	Front view of wire harness connector (to VVT Sensor (Exhaust Side))

(c) Disconnect the ECM connector.

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(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-14 (EV1+) - C6-2 (EV1+)	Always	Below 1 Ω
A34-34 (VCV) - C6-3 (VC)	Always	Below 1 Ω
A34-25 (EV2+) - C25-2 (EV2+)	Always	Below 1 Ω
A34-34 (VCV) - C25-3 (VC)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-14 (EV1+) or C6-2 (EV1+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C6-3 (VC) - Body ground	Always	10 kΩ or higher
A34-25 (EV2+) or C25-2 (EV2+) - Body ground	Always	10 kΩ or higher
A34-34 (VCV) or C25-3 (VC) - Body ground	Always	10 kΩ or higher

HINT:

- Jiggle the wire harness and connector to increase the likelihood of detecting malfunctions that do not always occur.
- Make sure there is not an excessive amount of force applied to the wire harness.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

114.	CHECK CRANKSHAFT POSITION SENSOR

(a) Replace the crankshaft position sensor INFO .

(b) Check the engine start operation.

OK:
Malfunction has been repaired successfully.

NG ▶ **CHECK VVT SENSOR**

OK ▶ **END (CRANKSHAFT POSITION SENSOR IS DEFECTIVE)**

115.	CHECK VVT SENSOR

(a) Replace the VVT sensor INFO .

(b) Check the engine start operation.

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OK:

Malfunction has been repaired successfully.

NG ▶ REPLACE ECM

OK ▶ END (VVT SENSOR IS DEFECTIVE)



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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000WC30M5X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P2096,P2097: Post Catalyst Fuel Trim System Too Lean (Bank 1) (2013 FR-S)		

DTC	P2096	Post Catalyst Fuel Trim System Too Lean (Bank 1)

DTC	P2097	Post Catalyst Fuel Trim System Too Rich (Bank 1)

DESCRIPTION

The sub fuel trim is related to the feedback compensation value, not to the basic injection time. The sub fuel trim consists of both the short-term and the long-term fuel trim between the front catalyst and rear catalyst.

The short-term fuel trim is fuel compensation that is used to constantly maintain the air fuel ratio at stoichiometric levels. The signal from the air fuel ratio sensor indicates whether the air fuel ratio is rich or lean compared to the stoichiometric ratio. This triggers a reduction in the fuel injection volume if the air fuel ratio is rich and an increase in the fuel injection volume if it is lean.

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the ideal theoretical value. The long-term fuel trim controls overall fuel compensation. The long-term fuel trim compensates for long term deviations of the fuel trim from the ideal theoretical value. These long term deviations result from the corrections made by the short-term fuel trim.

If both the short-term fuel and long-term fuel trim are lean or rich beyond predetermined values, it is interpreted as a malfunction, the ECM illuminates the MIL and sets a DTC.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2096	With warm engine and stable air fuel ratio feedback, sub fuel trim considerably in error to lean side (2 trip detection logic)	• Intake system • Fuel injector assembly (for port injection) • Fuel injector assembly (for direct injection) • Mass air flow meter • Engine coolant temperature sensor • Fuel pressure • Gas leaks from exhaust system • Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • PCV valve and hose • PCV hose connections • ECM • Wire harness or connector
P2097	With warm engine and stable air fuel ratio feedback, sub fuel trim considerably in error to rich side (2 trip detection logic)	

HINT:

- When DTC P2096 is set, the actual air-fuel ratio is on the lean side. When DTC P2097 is set, the actual air-fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P2096 may be set. The MIL is then illuminated.

MONITOR DESCRIPTION

Under closed loop fuel control, fuel injection volumes that deviate from those estimated by the ECM cause changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim values. Deviations from the ECM's estimated fuel injection volumes also affect the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air fuel ratio). If the average fuel trim learning value exceeds the malfunction threshold, the ECM interprets this as a malfunction in the fuel system and sets a DTC.

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MONITOR STRATEGY

Related DTCs	P2096: Post Catalyst Fuel Trim System Too Lean (Bank 1) P2097: Post Catalyst Fuel Trim System Too Rich (Bank 1)
Required Sensors/Components (Main)	Fuel system Heated oxygen sensor
Required Sensors/Components (Related)	Air fuel ratio sensor Mass air flow meter Crankshaft position sensor
Frequency of Operation	Continuous
Duration	1 second (1 time)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0037, P0038 (Heated oxygen sensor - heater) P0122, P0123, P0222, P0223 (Throttle position sensor) P0137, P0138 (Heated oxygen sensor - a lack of circuit continuity) P0140 (Heated oxygen sensor - output voltage) P0171, P0172 (Fuel system main feedback control) P0604, P0605 (ROM in ECM) P1160 (Throttle return spring) P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Post catalyst long term fuel trim system control	Active

TYPICAL MALFUNCTION THRESHOLDS

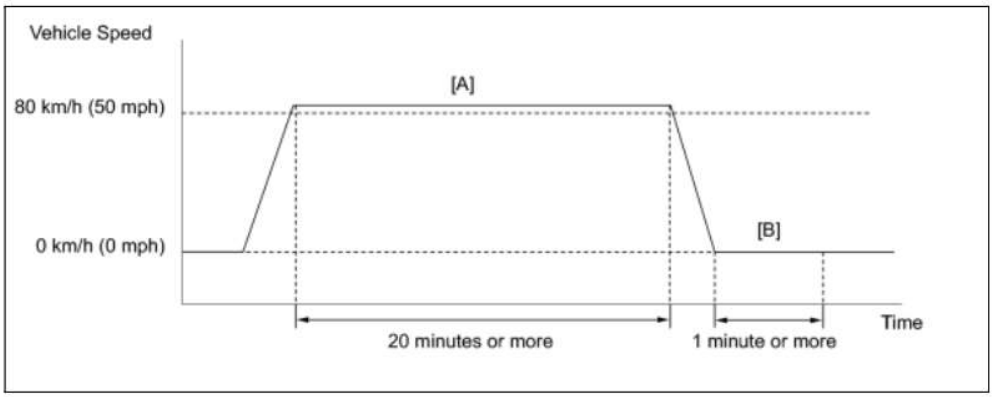
P2096

Post catalyst long term fuel trim value	Less than -0.037

P2097

Post catalyst long term fuel trim value	0.028 or higher

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.

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2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

HINT:

Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P2096 or P2097.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0030 INFO .

INSPECTION PROCEDURE

HINT:

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Malfunctioning areas can be identified by performing the Control the Injection Volume for A/F Sensor function provided in the Active Test. The Control the Injection Volume for A/F Sensor function can help to determine whether the air fuel ratio sensor, heated oxygen sensor and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the Control the Injection Volume for A/F Sensor operation using the Techstream.

1. Connect the Techstream to the DLC3.
2. Start the engine.
3. Turn the Techstream on.
4. Warm up the engine at an engine speed of 2500 rpm for approximately 90 seconds.
5. Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor / Gas AF Control / AFS Voltage B1S1 and O2S B1S2.
6. Perform the Active Test operation with the engine idling (press the RIGHT or LEFT button to change the fuel injection volume).
7. Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

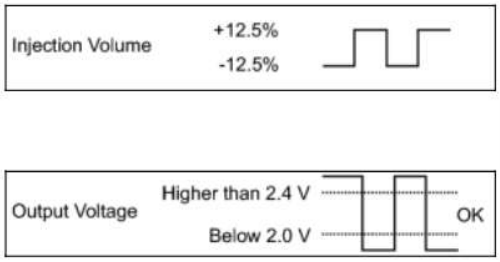
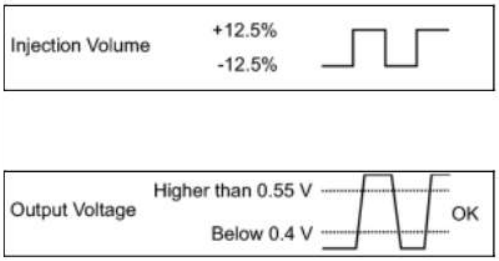
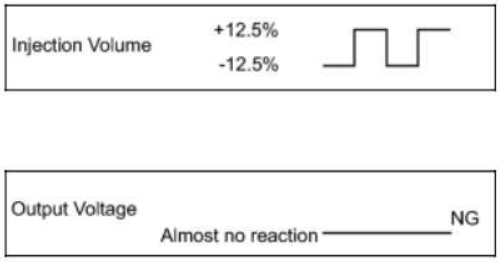
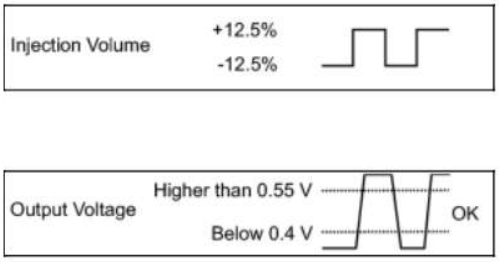
HINT:

- Change the fuel injection volume within the range of -12.5% to +12.5%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

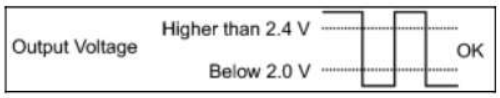
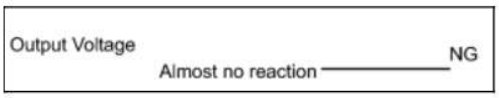
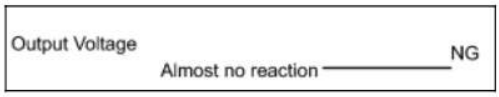
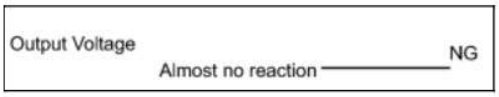
TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	+12.5%	Rich	Below 2.0 V
	-12.5%	Lean	Higher than 2.4 V
O2S B1S2 (Heated oxygen)	+12.5%	Rich	Higher than 0.55 V
	-12.5%	Lean	Below 0.4 V

NOTICE:

The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.

CASE	AIR FUEL RATIO SENSOR (SENSOR 1) OUTPUT VOLTAGE	HEATED OXYGEN SENSOR (SENSOR 2) OUTPUT VOLTAGE	MAIN SUSPECTED TROUBLE AREA
1			-
2			• Air fuel ratio sensor • Air fuel ratio sensor heater • Air fuel ratio sensor circuit
			• Heated oxygen sensor • Heated

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3			oxygen sensor heater • Heated oxygen sensor circuit
4	 	 	• Fuel injector assembly • Fuel pressure • Gas leak from exhaust system (Air fuel ratio extremely rich or lean)

- Following the Control the Injection Volume for A/F Sensor procedure enables technicians to check and graph the voltage outputs of both the air fuel ratio and heated oxygen sensors.
- To display the graph, enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor / Gas AF Control / AFS Voltage B1S1 and O2S B1S2; and then press the graph button on the Data List view.

HINT:

- Bank 1 refers to the bank that includes the No. 1 cylinder*.

  *: The No. 1 cylinder is the cylinder which is farthest from transmission.
- Bank 2 refers to the bank that does not include the No. 1 cylinder.
- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can be helpful in determining whether the vehicle was moving or stationary, whether the engine was warmed up or not, whether the air fuel ratio was lean or rich, as well as other data recorded at the time of a malfunction.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	**CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P2096 AND/OR P2097)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

Result:

RESULT	PROCEED TO
P2096 or P2097	A

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P2096 and/or P2097 and other DTCs	B

HINT:

If any DTCs other than P2096 or P2097 are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

A ▼

2.	**PERFORM SYSTEM CHECK (CONTROL THE INJECTION WAY)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Port.

(f) Read the value Short #1 and Long FT #1.

OK:
Short FT #1 + Long FT #1 = Between -19% and +19%

(g) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

(h) Read the value Short FT #1 and Long FT #1.

OK:
Short FT #1 + Long FT #1 = Between -19% and +19%
Result:

ITEM		PROCEED TO
PORT	DIRECT	
OK	OK	A
OK	NG	B
NG	OK	C
NG	NG	D

B ▶ CHECK FUEL PRESSURE SENSOR

C ▶ CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

D ▶ CHECK PCV HOSE CONNECTIONS

A ▼

3.	**CHECK IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

(a) Has the vehicle run out of fuel in the past?

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NO ▶ CHECK FOR INTERMITTENT PROBLEMS

YES ▶ DTC CAUSED BY RUNNING OUT OF FUEL

4.	CHECK PCV HOSE CONNECTIONS

(a) Check the PCV hose connections INFO .

OK:
PCV valve and hose are connected correctly and are not damaged.

NG ▶ REPAIR OR REPLACE PCV HOSE

OK ▼

5.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:
No leaks in intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

6.	PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn Techstream on.

(d) Warm up the engine and run the engine at an engine speed of 2500 rpm for approximately 90 seconds.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume for A/F Sensor / AFS Voltage B1S1 and O2S B1S2.

(f) Perform the Control the Injection Volume for A/F Sensor operation with the engine in an idling.

(g) Monitor the output voltages of the A/F and HO2 sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12.5% to 12.5%.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

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TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (A/F)	12.5%	Rich	Less than 2.0 V
	-12.5%	Lean	More than 2.4 V
O2S B1S2 (HO2)	12.5%	Rich	More than 0.55 V
	-12.5%	Lean	Less than 0.4 V

Result:

STATUS AFS VOLTAGE B1S1	STATUS O2S B1S2	A/F CONDITION AND A/F SENSOR CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	A
Lean	Lean	Actual air-fuel ratio lean	• Ventilation valve and hose • Ventilation hose connections • Injector for port injection • Gas leakage from exhaust system • Air induction system • Fuel pressure • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor	A
Rich	Rich	Actual air-fuel ratio rich	• Gas leakage from exhaust system • Ignition system • Fuel pressure • Mass air flow meter • ECT sensor	A
Lean	Lean/Rich	A/F sensor malfunction	• Air fuel ratio sensor	B
Rich	Lean/Rich	A/F sensor malfunction	• Air fuel ratio sensor	B

Lean: During the Control the Injection Volume for A/F Sensor Active Test, the air fuel ratio sensor output voltage (AFS Voltage) is consistently higher than 2.4 V, and the heated oxygen sensor output voltage (O2S) is consistently below 0.4 V.

Rich: During the Control the Injection Volume for A/F Sensor Active Test, the AFS Voltage is consistently below 2.0 V, and the O2S is consistently higher than 0.55 V.

Lean/Rich: During the Control the Injection Volume for A/F Sensor Active Test, the output voltage of the heated oxygen sensor alternates correctly.

HINT:

Refer to "Data List / Active Test" [AFS Voltage B1S1 and O2S B1S2] INFO .

B ▶ **INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)**

A ▼

7.	**READ VALUE USING TECHSTREAM (COOLANT TEMP)**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

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(d) Enter the following menus: Powertrain / Engine / Data List / Coolant Temp.

(e) Read the Coolant Temp twice, when the engine is both cold and warmed up.

Standard:

With cold engine

Same as ambient air temperature.

With warm engine

Between 75 and 100°C (167 and 212°F)

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK ▼

8.	READ VALUE USING TECHSTREAM (MAF)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / MAF, Coolant Temp and Engine Speed.

(f) Allow the engine to idle until Coolant Temp reaches 75°C (167°F) or higher.

(g) Read MAF with the engine speed at 3000 rpm.

Standard:

Between 13.0 gm/sec and 14.0 gm/sec (shift lever: N, A/C: Off).

NG ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

OK ▼

9.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

OK ▶ **PERFORM CONFIRMATION DRIVING PATTERN**

NG ▶ **REPAIR OR REPLACE EXHAUST SYSTEM**

10.	INSPECT AIR FUEL RATIO SENSOR (HEATER RESISTANCE)

(a) Inspect the air fuel ratio sensor INFO .

NG ▶ **REPLACE AIR FUEL RATIO SENSOR**

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OK

11.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR - ECM)

(a) Disconnect the air fuel ratio sensor connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-19 (A1A+) - C14-3 (A1A+)	Always	Below 1 Ω
A34-18 (A1A-) - C14-4 (A1A-)	Always	Below 1 Ω
A34-5 (HA1A) - C14-1 (HA1A)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A34-19 (A1A+) or C14-3 (A1A+) - Body ground	Always	10 kΩ or higher
A34-18 (A1A-) or C14-4 (A1A-) - Body ground	Always	10 kΩ or higher
A34-5 (HA1A) or C14-1 (HA1A) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

12.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

NEXT

13.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Clear the DTCs INFO .

(d) Turn the ignition switch off and wait for at least 30 seconds.

(e) Turn the ignition switch to ON and turn the Techstream on.

(f) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

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NEXT

14.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P2096 AND/OR P2097)**

(a) Enter the following menus: Powertrain / Engine / Trouble Codes.

(b) Read the pending DTCs.

Result:

RESULT	PROCEED TO
P2096 and/or P2097	A
DTC is not output	B

B ▶ **END**

A

15.	**CHECK FUEL PRESSURE (LOW PRESSURE SIDE)**

(a) Check the fuel pressure (low pressure side) INFO .

Result:

RESULT	PROCEED TO
NG	A
OK	B

B ▶ **CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)**

A

16.	**CHECK FUEL PUMP OPERATION (LOW PRESSURE SIDE)**

(a) Check the fuel pump operation INFO .

NG ▶ **REPLACE FUEL PUMP ASSEMBLY**

OK

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17.	CHECK FUEL LEAK (LOW PRESSURE SIDE)

(a) Check for fuel leaks (low pressure side).

OK:
No leaks.

NG ▶ REPAIR OR REPLACE FUEL SYSTEM (LOW PRESSURE SIDE)

OK ▶ CHECK AND REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL LINE AND FILTER

18.	CHECK FUEL PRESSURE SENSOR

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

(e) Enter the following menus: Powertrain / Engine / Data List / Fuel Press.

(f) While revving the engine, check that the fuel pressure fluctuates.

Standard:
Idling
3000 to 5000 kPa (30.6 to 50.9 kgf/cm ^{2} , 436 to 725 psi).

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the N, P or neutral position, and the engine should be fully warmed up.

NG ▶ CHECK MISFIRE COUNT

OK ▼

19.	READ VALUE USING TECHSTREAM

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the N, P or neutral position, and the engine should be fully warmed up.

(e) Read the value Short FT #1, Long FT #1 and Fuel Pump Duty.

Result:

ITEM	PROCEED TO

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FUEL PUMP DUTY	SHORT FT #1 + LONG FT #1	
10% to 40%	-	A
40% or more	-20% or less	B
10% or less	+20% or more	B
40% or more	+20% or more	C
10% or less	-20% or less	D

B ▶ **REPLACE FUEL PRESSURE SENSOR**

C ▶ **INSPECT INJECTOR DRIVER (EDU)**

D ▶ **REPLACE ECM**

A

20.	**READ VALUE USING TECHSTREAM**

(a) Connect the Techstream to the DLC3.

(b) Start the engine.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Way / Direct.

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the N, P or neutral position, and the engine should be fully warmed up.

(e) Read the value Short FT #1, Long FT #1 and Fuel Pump Duty.

Result:

ITEM		PROCEED TO
FUEL PUMP DUTY	SHORT FT #1 + LONG FT #1	
10% to 40%	-25% or less	A
10% to 40%	-25% to +25%	B
10% to 40%	+25% or more	A

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

A ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

21.	**CHECK MISFIRE COUNT**

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Start the engine.

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(e) Enter the following menus: Powertrain / Engine / Active test / Control the Injection Way / Direct.

(f) Allow the engine to idle.

(g) Monitor all of the misfire count values that are displayed on the Techstream: Powertrain / Engine / Data List / Cylinder #1 Misfire Count to Cylinder #4 Misfire Count.

If no misfire counts occur for any of the cylinders, perform the following procedure:

(1) Move the shift lever to D.

(2) Monitor all of the misfire rate values that are displayed on the Techstream.

Result:

MISFIRE COUNT	PROCEED TO
No misfire counts, or misfire counts occur randomly in all cylinders	A
Misfire counts occur in particular cylinder	B

B ▶ **REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)**

A ▼

22.	INSPECT INJECTOR DRIVER (EDU)

(a) Replace the injector driver (EDU) with known good ones from another vehicle.

NOTICE:

Do not disconnect and reconnect the connectors with the ignition switch to ON, as the injector driver (EDU) may be damaged.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Clear the DTCs INFO .

(f) Turn the ignition switch off and wait for at least 30 seconds.

(g) Turn the ignition switch to ON and turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Trouble Codes.

(k) Read the pending DTCs.

Result:

RESULT	PROCEED TO
P2096 and/or P2097	A
DTC is not output	B

B ▶ **END (INJECTOR DRIVER (EDU) IS DEFECTIVE)**

A ▶ **REPLACE FUEL PUMP ASSEMBLY (FOR HIGH PRESSURE)**

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23.	CHECK FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Check the injection volume (whether fuel volume is high or low, and whether injection pattern is poor).

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

OK ▶ REPLACE ECM

24.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER CONNECTOR CONNECTION)

(a) Check the connection and terminal contact pressure of connectors and wire harness between the mass air flow meter and ECM INFO .

HINT:

Repair any problems.

NEXT

25.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Clear the DTCs INFO .

(d) Turn the ignition switch off and wait for at least 30 seconds.

(e) Turn the ignition switch to ON and turn the Techstream on.

(f) Start the engine and warm it up.

(g) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

NEXT

26.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2096 AND/OR P2097)

(a) Enter the following menus: Powertrain / Engine / Trouble Codes.

(b) Read the pending DTCs.

Result:

RESULT	PROCEED TO
P2096 and/or P2097	A
DTC is not output	B

B ▶ **END**

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A

27.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)

(a) Disconnect the mass air flow meter connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C33-22 (VG) - C16-5 (VG)	Always	Below 1 Ω
C33-29 (E2G) - C16-4 (E2G)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C33-22 (VG) or C16-5 (VG) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

28.	REPLACE MASS AIR FLOW METER

(a) Replace the mass air flow meter INFO .

HINT:

If the result of the inspection performed in step 8 indicated no problem, proceed to the next step without replacing the mass air flow meter.

NEXT

29.	PERFORM CONFIRMATION DRIVING PATTERN

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON and turn the Techstream on.

(c) Clear the DTCs INFO .

(d) Turn the ignition switch off and wait for at least 30 seconds.

(e) Turn the ignition switch to ON and turn the Techstream on.

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(f) Start the engine and warm it up.

(g) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

NEXT

30.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2096 AND/OR P2097)

(a) Enter the following menus: Powertrain / Engine / Trouble Codes.

(b) Read the pending DTCs.

Result:

RESULT	PROCEED TO
P2096 and/or P2097	A
DTC is not output	B

B ▶ **END**

A ▶ **REPLACE ECM**

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Last Modified: 3-27-2012	6.4 C	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PFU0P5X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P2101-P2103: Throttle Actuator Control Motor Circuit Range/Performance (2013 FR-S)		

DTC	**P2101**	**Throttle Actuator Control Motor Circuit Range/Performance**

DTC	**P2102**	**Throttle Actuator Control Motor Circuit Low**

DTC	**P2103**	**Throttle Actuator Control Motor Circuit High**

DESCRIPTION

The throttle actuator is operated by the ECM and opens and closes the throttle valve using gears.

The opening angle of the throttle valve is detected by the throttle position sensor, which is mounted on the throttle with motor body assembly. The throttle position sensor provides feedback to the ECM. This feedback allows the ECM to appropriately control the throttle actuator and monitor the throttle opening angle as the ECM responds to driver inputs.

HINT:

This Electronic Throttle Control System (ETCS) does not use a throttle cable.

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2101	One of the following conditions is met (1 trip detection logic): • Throttle actuator current is 8 A or more. • Internal temperature of throttle actuator driving circuit is 175°C (347°F) or higher.	• Throttle with motor body assembly • ECM
P2102	ECM is turning ETCS relay on but throttle actuator power supply voltage is 5 V or less. (1 trip detection logic)	• Open in throttle actuator circuit • Throttle with motor body assembly • ETCS relay • ECM
P2103	ECM is turning ETCS relay off but throttle actuator power supply voltage is 5 V or more. (1 trip detection logic)	• Short in throttle actuator circuit • Throttle with motor body assembly • ETCS relay • ECM

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MONITOR DESCRIPTION

The ECM monitors the electrical current through the electronic actuator, and detects malfunctions and open circuits in the throttle actuator based on this value. If the current is outside the standard range, the ECM determines that there is a malfunction in the throttle actuator. In addition, if the throttle valve does not function properly (for example, stuck on), the ECM determines that there is a malfunction. The ECM then illuminates the MIL and stores a DTC.

MONITOR STRATEGY

Related DTCs	P2101: Throttle actuator control motor circuit continuity P2102: Throttle actuator control motor circuit continuity P2103: Throttle actuator control motor circuit continuity
Required Sensors/Components (Main)	Throttle actuator (throttle with motor body assembly)
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.512 seconds: P2101 0.353 seconds: P2102 0.6 seconds: P2103
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs not stored	None

P2101

ETCS relay	On
CPU communication	No failure
Previous diagnosis result	No failure
Battery voltage	6.2 V or more

P2102

ETCS relay	On
Battery voltage	11 V or more

P2103

ETCS relay	Off
Battery voltage	6 V or more

TYPICAL MALFUNCTION THRESHOLDS

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P2101

Malfunction flag from throttle actuator operation IC	Set

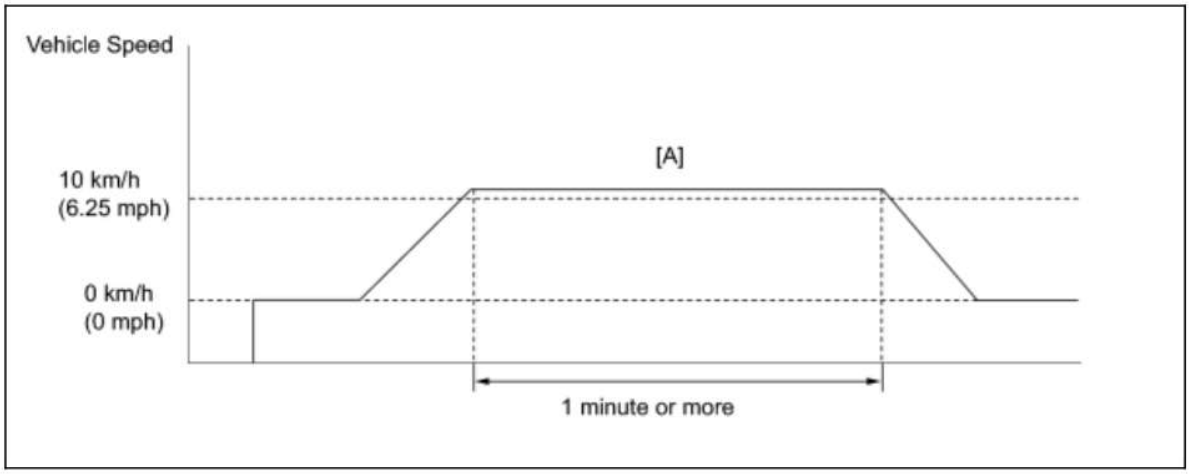
P2102

Throttle actuator supply voltage	Less than 5 V

P2103

Throttle actuator supply voltage	More than 5 V

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Depress the accelerator pedal fully and release the accelerator pedal.
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [A].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.
10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P2101, P2102 or P2103.
13. Check the DTC judgment result.

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TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

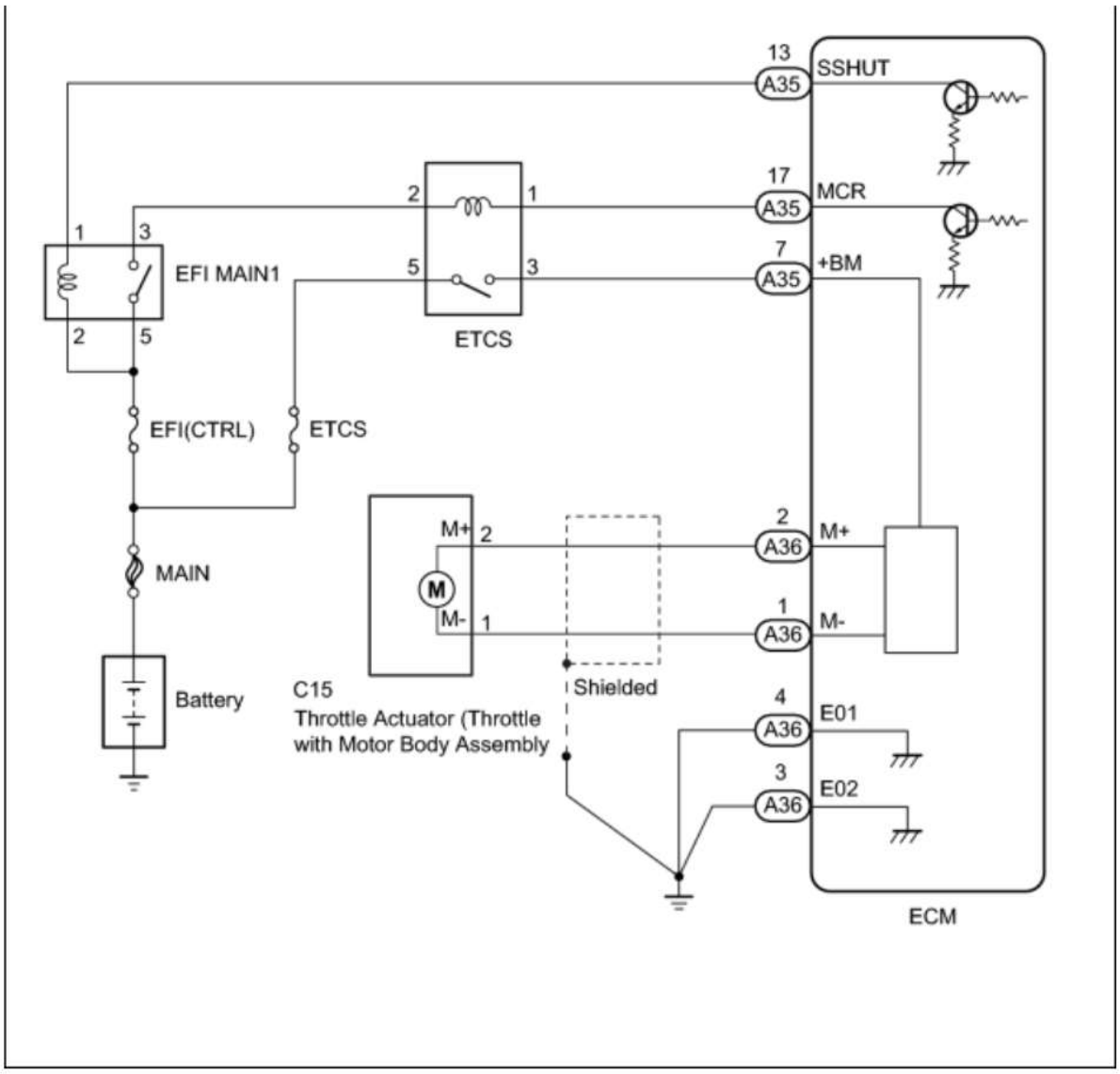
FAIL-SAFE

When either of these DTCs or other DTCs relating to ETCS (Electronic Throttle Control System) malfunctions are stored, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts the current to the throttle actuator, and the throttle valve is returned to a fully closed throttle angle by the return spring. The ECM then adjusts the engine output by controlling the fuel injection (intermittent fuel-cut) and ignition timing, in accordance with the accelerator pedal opening angle, to allow the vehicle to continue running at a minimal speed. If the accelerator pedal is depressed firmly and gently, the vehicle can be driven slowly.

Fail-safe mode continues until a pass condition is detected, and the ignition switch is then turned off.

WIRING DIAGRAM

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INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

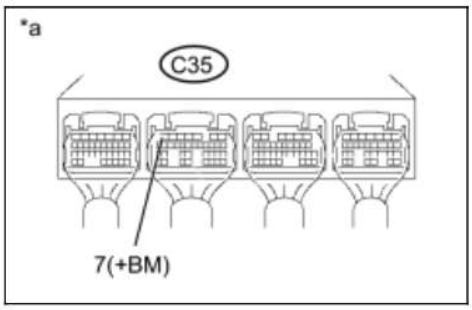
HINT:

- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- The throttle actuator current (Throttle Motor Current) and the throttle actuator duty ratio (Throttle Motor Duty (Open) / Throttle Motor Duty (Close)) can be read using the Techstream. However, the ECM shuts off the throttle actuator current when the electronic throttle control system malfunctions.

PROCEDURE

1.	**INSPECT TERMINAL VOLTAGE (POWER SOURCE OF THROTTLE WITH MOTOR BODY ASSEMBLY)**

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(a) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
C35-7 (+BM) - Body ground	Ignition switch ON	11 to 14 V

Text in Illustration

*a	Component with harness connected (ECM)

NG ▶ **INSPECT RELAY (ETCS)**

OK ▼

2.	**INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (RESISTANCE OF THROTTLE ACTUATOR)**

(a) Inspect the throttle with motor body assembly INFO .

NG ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

OK ▼

3.	**CHECK HARNESS AND CONNECTOR (THROTTLE WITH MOTOR BODY ASSEMBLY - ECM)**

(a) Disconnect the throttle with motor body assembly connector.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION

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A36-2 (M+) - C15-2 (M+)	Always	Below 1 Ω
A36-1 (M-) - C15-1 (M-)	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-2 (M+) or C15-2 (M+) - Body ground	Always	10 kΩ or higher
A36-1 (M-) or C15-1 (M-) - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK ▼

4.	**INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (VISUALLY CHECK THROTTLE VALVE)**

(a) Check for foreign objects between the throttle valve and the housing.

OK:

No foreign objects between the throttle valve and housing.

NG ▶ **REMOVE FOREIGN OBJECT**

OK ▼

5.	**INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY (THROTTLE VALVE)**

(a) Check if the throttle valve opens and closes smoothly.

OK:

Throttle valve opens and closes smoothly.

NG ▶ **REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY**

OK ▶ **REPLACE ECM**

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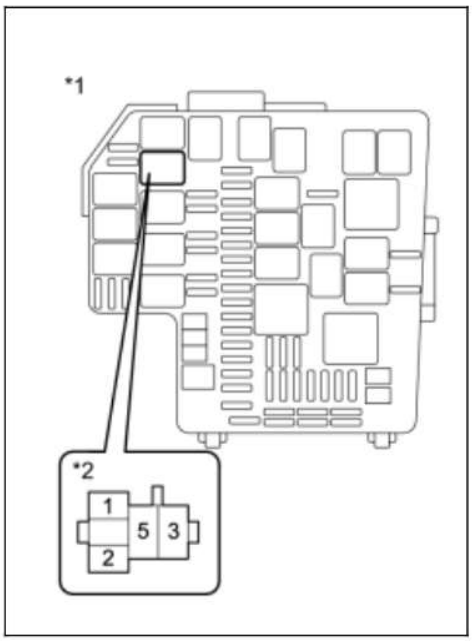
6.	INSPECT RELAY (ETCS)

(a) Inspect the ETCS relay INFO .

NG ▶ REPLACE RELAY (ETCS)

OK ▼

7.	CHECK HARNESS AND CONNECTOR (ETCS RELAY - EFI MAIN1 RELAY - BATTERY)



(a) Remove the ETCS relay from the engine room relay block assembly.

(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
5 (ETCS relay holder) - Body ground	Always	11 to 14 V
2 (ETCS relay holder) - Body ground	Ignition switch ON	11 to 14 V

Result:

RESULT	PROCEED TO
Normal	A
ETCS relay terminal 5 is abnormal.	B

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ETCS relay terminal 2 is abnormal.	C

Text in Illustration

*1	Engine room relay block assembly
*2	ETCS relay terminal

B ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

C ▶ **INSPECT RELAY (EFI MAIN1)**

A

8.	**CHECK HARNESS AND CONNECTOR (ECM - ETCS RELAY)**

(a) Remove the ETCS relay from the engine room relay block assembly.

(b) Disconnect the ECM connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-17 (MCR) - ETCS relay terminal 1	Always	Below 1 Ω
A35-7 (+BM) - ETCS relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-17 (MCR) or ETCS relay terminal 1 - Body ground	Always	10 kΩ or higher
A35-7 (+BM) or ETCS relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

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9.	INSPECT RELAY (EFI MAIN1)

(a) Inspect EFI MAIN1 relay INFO .

NG ▶ REPLACE RELAY (EFI MAIN1)

OK ▼

10.	CHECK HARNESS AND CONNECTOR (ETCS RELAY - EFI MAIN1 RELAY)

(a) Remove the ETCS relay from the engine room relay block assembly.

(b) Remove the EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 - ETCS relay terminal 2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
EFI MAIN1 relay terminal 3 or ETCS relay terminal 2 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ CHECK ECM POWER SOURCE CIRCUIT

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Last Modified: 4-14-2014	6.6 C	Doc ID: RM000000PFZ0PHX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P2122,P2123,P2127,P2128,P2138; Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input; 2013 MY FR-S [03/2012 - 05/2013]		

DTC	P2122	Throttle / Pedal Position Sensor / Switch "D" Circuit Low Input

DTC	P2123	Throttle / Pedal Position Sensor / Switch "D" Circuit High Input

DTC	P2127	Throttle / Pedal Position Sensor / Switch "E" Circuit Low Input

DTC	P2128	Throttle / Pedal Position Sensor / Switch "E" Circuit High Input

DTC	P2138	Throttle / Pedal Position Sensor / Switch "D" / "E" Voltage Correlation

DESCRIPTION

HINT:

- These DTCs relate to the accelerator pedal sensor assembly.
- This electronic throttle control system does not use a throttle cable.

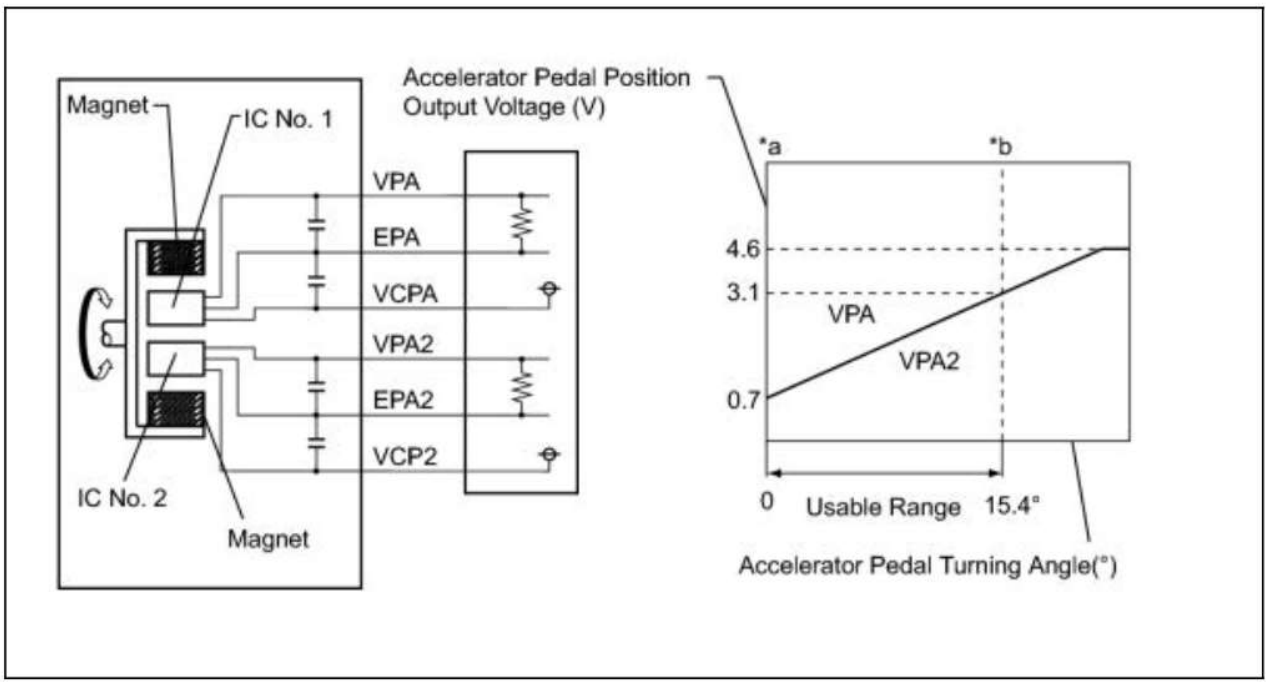
The accelerator pedal sensor assembly is mounted on the accelerator pedal bracket and has 2 sensor circuits: VPA (main) and VPA2 (sub). This sensor is a non-contact type. It uses Hall-effect elements in order to yield accurate signals, even in extreme conditions. The voltage, which is applied to terminals VPA and VPA2 of the ECM, varies between 0 V and 5 V in proportion to the operating angle of the accelerator pedal (throttle valve).

The ECM monitors the actual accelerator pedal operating angle (throttle valve opening angle) through the signals from VPA and VPA2, and controls the throttle actuator according to these signals.

HINT:

The accelerator pedal position output voltages of VPA and VPA2 are almost the same.

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Text in Illustration

*a	Accelerator pedal fully released	*b	Accelerator pedal fully depressed
-	-	-	-

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2122	VPA voltage is less than 0.303 V. (1 trip detection logic)	• Open or short in accelerator pedal sensor circuit • Accelerator pedal sensor assembly • ECM
P2123	VPA voltage is 4.737 V or more. (1 trip detection logic)	
P2127	VPA2 voltage is less than 0.303 V. (1 trip detection logic)	
P2128	VPA2 voltage is 4.737 V or more. (1 trip detection logic)	
P2138	Difference in the signals from VPA and VPA2 exceeds the threshold. (1 trip detection logic)	

MONITOR DESCRIPTION

The accelerator pedal position sensor is mounted on the accelerator pedal bracket. The accelerator pedal position sensor has 2 sensor elements and 2 signal outputs: VPA and VPA2. VPA is used to detect the actual accelerator pedal angle (used for engine control) and VPA2 is used to detect malfunctions in VPA. When the difference between the output voltages of VPA and VPA2 deviates from the standard, the ECM determines that the accelerator pedal position sensor is malfunctioning. The ECM turns on the MIL and stores the DTC.

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MONITOR STRATEGY

Related DTCs	P2122: Accelerator pedal position sensor circuit continuity (Low voltage) (Sensor 1) P2123: Accelerator pedal position sensor circuit continuity (High voltage) (Sensor 1) P2127: Accelerator pedal position sensor circuit continuity (Low voltage) (Sensor 2) P2128: Accelerator pedal position sensor circuit continuity (High voltage) (Sensor 2) P2138: Accelerator pedal position sensor correlation rationality check
Required Sensors/Components (Main)	Accelerator pedal sensor assembly
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.1 seconds: P2122, P2127, P2128 0.032 seconds: P2123 0.116 seconds: P2138
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P2122, P2123, P2127, P2128

Monitor runs whenever following DTCs not stored	None
Battery voltage	6 V or more

P2138

Monitor runs whenever following DTCs not stored	P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit)
Battery voltage	6 V or more

TYPICAL MALFUNCTION THRESHOLDS

P2122

VPA voltage (Accelerator pedal position)	Less than 0.303 V (1.6%)

P2123

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VPA voltage (Accelerator pedal position)	4.737 V (25.02%) or more

P2127

VPA2 voltage (Accelerator pedal position)	Less than 0.303 V (1.6%)

P2128

VPA2 voltage (Accelerator pedal position)	4.737 V (25.02%) or more

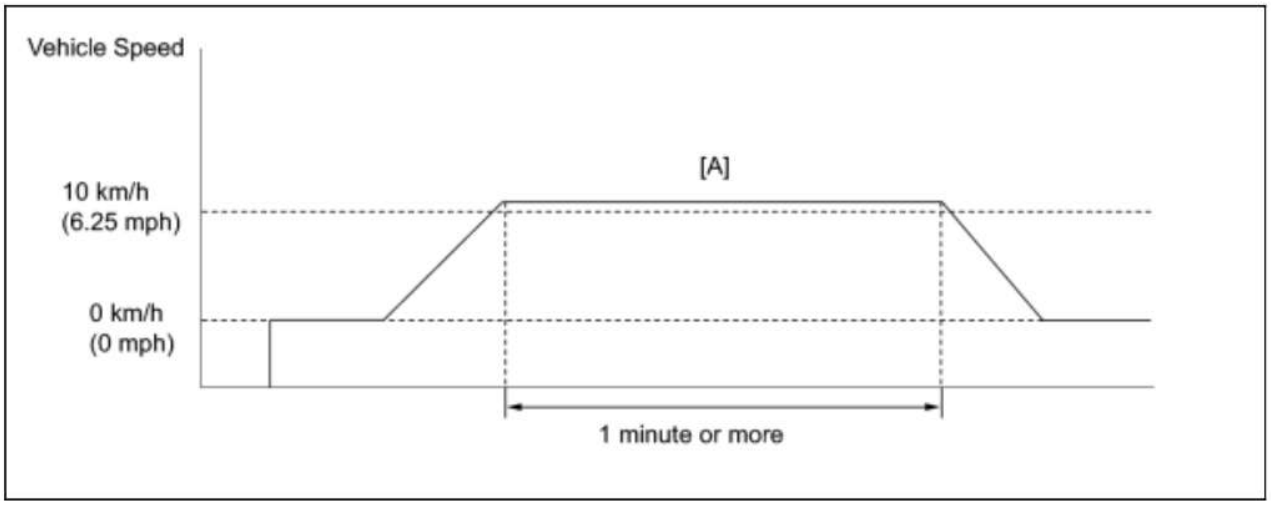
P2138

VPA - VPA2	4.44% (varies with VPA2) or more

COMPONENT OPERATING RANGE

VPA voltage (Accelerator pedal position)	0.394 to 4.729 V (2.08 to 24.97%)
VPA2 voltage (Accelerator pedal position)	0.394 to 4.729 V (2.08 to 24.97%)

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.
7. Depress the accelerator pedal fully and release the accelerator pedal.
8. Drive the vehicle at 10 km/h (6.25 mph) or more for 1 minute or more [A].

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

9. Enter the following menus: Powertrain / Engine / Trouble Codes.

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10. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

11. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
12. Input the DTC: P2122, P2123, P2127, P2128 or P2138.
13. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

14. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

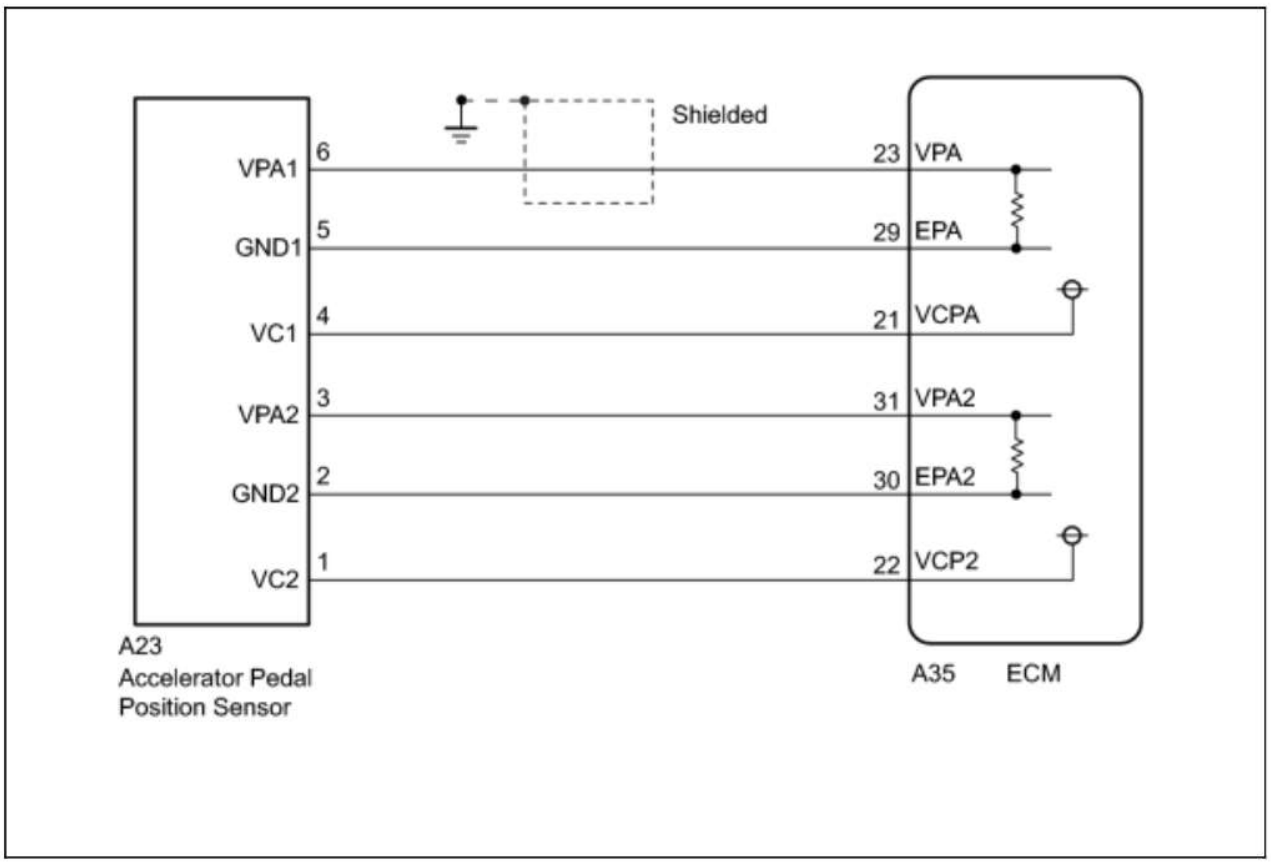
FAIL-SAFE

The accelerator pedal position sensor has 2 (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between the 2 sensor circuits and switches to fail-safe mode. In fail-safe mode, the functioning circuit is used to calculate the accelerator pedal opening angle to allow the vehicle to continue driving. If both circuits malfunction, the ECM regards the opening angle of the accelerator pedal as being fully closed. In this case, the throttle valve remains closed as if the engine is idling.

If a pass condition is detected and then the ignition switch is turned off, the fail-safe operation stops and the system returns to normal.

WIRING DIAGRAM

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INSPECTION PROCEDURE

HINT:

- This DTC relates to the accelerator pedal position sensor.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	READ VALUE USING TECHSTREAM (ACCELERATOR PEDAL POSITION SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

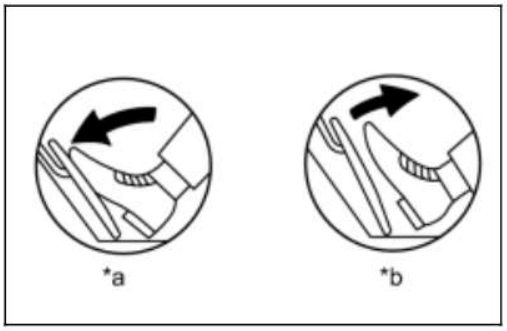
(d) Enter the following menus: Powertrain / Engine / Data List / Accel Sensor Out No. 1 and Accel Sensor Out No. 2.

(e) Read the values displayed on the Techstream.

Text in Illustration

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*a	Depressed
*b	Released



Standard Voltage:

ACCELERATOR PEDAL OPERATION	ACCEL SENSOR OUT NO. 1	ACCEL SENSOR OUT NO. 2	DIFFERENCE BETWEEN ACCEL SENSOR OUT NO. 1 AND ACCEL SENSOR OUT NO. 2
Released	0.5 to 0.8 V	0.5 to 0.8 V	Less than 10%
Depressed	2.4 to 3.5 V	2.4 to 3.5 V	

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ CHECK FOR INTERMITTENT PROBLEMS

A ▼

2.	CHECK HARNESS AND CONNECTOR (ECM - ACCELERATOR PEDAL SENSOR)

(a) Disconnect the ECM connector.

(b) Disconnect the accelerator pedal sensor connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-23 (VPA) - A23-6 (VPA1)	Always	Below 1 Ω
A35-29 (EPA) - A23-5 (GND)	Always	Below 1 Ω
A35-21 (VCPA) - A23-4 (VC1)	Always	Below 1 Ω
A35-31 (VPA2) - A23-3 (VPA2)	Always	Below 1 Ω

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A35-30 (EPA2) - A23-2 (GND2)	Always	Below 1 Ω
A35-22 (VCP2) - A23-1 (VC2)	Always	Below 1 Ω

Standard Resistance (Check for short):

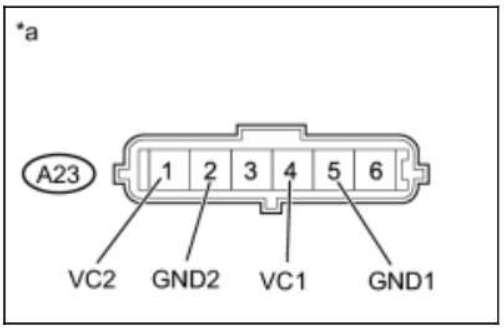
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-23 (VPA) or A23-6 (VPA1) - Body ground	Always	10 kΩ or higher
A35-29 (EPA) or A23-5 (GND) - Body ground	Always	10 kΩ or higher
A35-21 (VCPA) or A23-4 (VC1) - Body ground	Always	10 kΩ or higher
A35-31 (VPA2) or A23-3 (VPA2) - Body ground	Always	10 kΩ or higher
A35-30 (EPA2) or A23-2 (GND2) - Body ground	Always	10 kΩ or higher
A35-22 (VCP2) or A23-1 (VC2) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

3.	INSPECT ECM (VC VOLTAGE)

(a) Disconnect the accelerator pedal sensor connector.



(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A23-4 (VC1) - A23-5 (GND)	Ignition Switch ON	4.5 to 5.5 V
A23-1 (VC2) - A23-2 (GND2)	Ignition Switch ON	4.5 to 5.5 V

Text in Illustration

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*a	Front view of wire harness connector (to Accelerator Pedal Sensor)

NG ▶ REPLACE ECM

OK ▼

4.	REPLACE ACCELERATOR PEDAL SENSOR ASSEMBLY

(a) Replace the accelerator pedal sensor assembly INFO .

NEXT ▼

5.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2122, P2123, P2127, P2128 OR P2138)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON and turn the Techstream on.

(g) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(h) Enter the following menus: Powertrain / Engine / Trouble Codes.

(i) Read DTCs.

Result

RESULT	PROCEED TO
DTC is not output	A
DTC P2122, P2123, P2127, P2128, and/or P2138 is output	B

▶

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B REPLACE ECM

A END

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Last Modified: 4-14-2014	6.6 C	Doc ID: RM000000WC40OFX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P2195,P2196; Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1); 2013 MY FR-S [03/2012 - 05/2013]		

DTC	P2195	Oxygen (A/F) Sensor Signal Stuck Lean (Bank 1 Sensor 1)

DTC	P2196	Oxygen (A/F) Sensor Signal Stuck Rich (Bank 1 Sensor 1)

DESCRIPTION

HINT:

- Although the DTC titles say oxygen sensor, these DTCs relate to the air fuel ratio sensor.
- Sensor 1 refers to the sensor mounted in front of the three-way catalytic converter and located near the engine assembly.

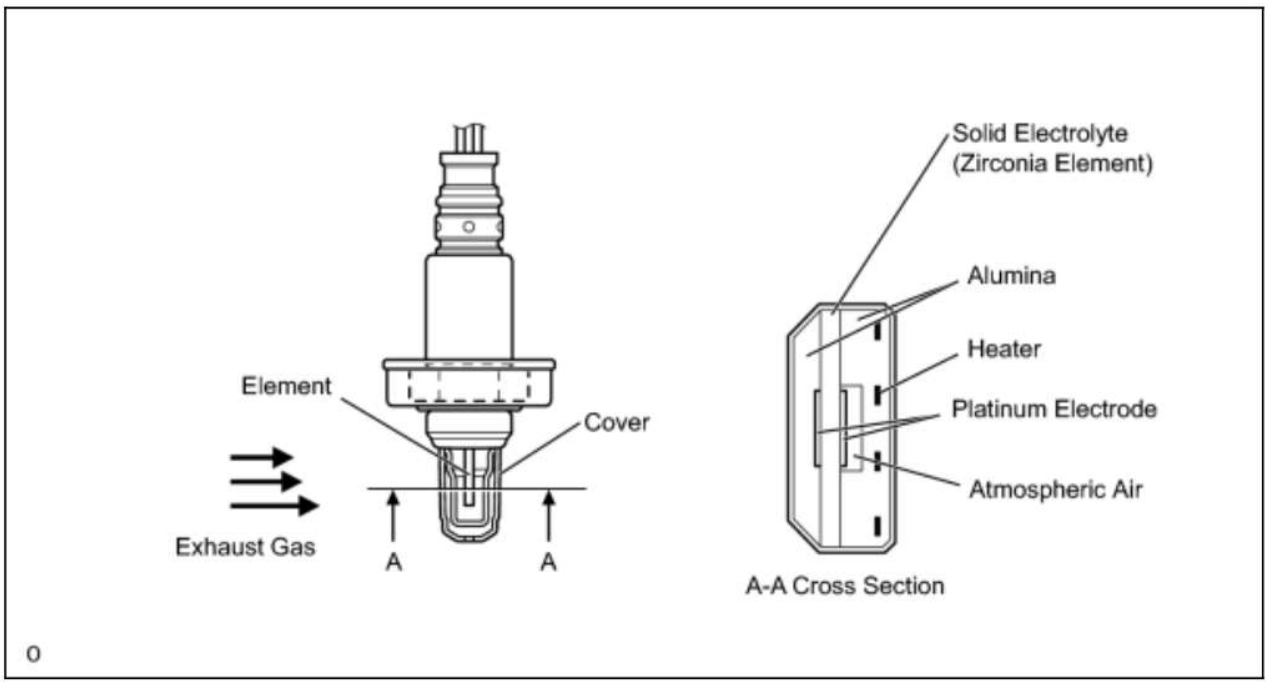
The air fuel ratio sensor generates a voltage* that corresponds to the actual air fuel ratio. This sensor voltage is used to provide the ECM with feedback so that it can control the air fuel ratio. The ECM determines the deviation from the stoichiometric air fuel ratio level, and regulates the fuel injection time. If the air fuel ratio sensor malfunctions, the ECM is unable to control the air fuel ratio accurately.

The air fuel ratio sensor is the planar type and is integrated with the heater, which heats the solid electrolyte (zirconia element). This heater is controlled by the ECM. When the intake air volume is low (the exhaust gas temperature is low), a current flows into the heater to heat the sensor, in order to facilitate accurate oxygen concentration detection. In addition, the sensor and heater portions are the narrow type. The heat generated by the heater is conducted to the solid electrolyte through the alumina, and therefore the sensor activation is accelerated.

In order to obtain a high purification rate of the carbon monoxide (CO), hydrocarbon (HC) and nitrogen oxide (NOx) components in the exhaust gas, a three-way catalytic converter is used. For the most efficient use of the three-way catalytic converter, the air fuel ratio must be precisely controlled so that it is always close to the stoichiometric level.

*: Value changes inside the ECM. Since the air fuel ratio sensor is a current output element, the current is converted into a voltage inside the ECM. Any measurements taken at the air fuel ratio sensor or ECM connectors will show a constant voltage.

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DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2195	Lambda is less than 0.85 for 10 seconds in air fuel ratio feed back control (2 trip detection logic)	• Open or short in air fuel ratio sensor circuit • Air fuel ratio sensor • Intake system • Fuel pressure • Fuel injector assembly (for port injection) • Fuel injector assembly (for direct injection) • ECM
P2196	Lambda is more than 1.15 for 10 seconds in air fuel ratio feed back control (2 trip detection logic)	

HINT:

- When any of these DTCs is stored, check the air fuel ratio sensor voltage output by entering the following menus on the Techstream: Powertrain / Engine / Data List / AFS Voltage B1S1.
- Short-term fuel trim values can also be read using the Techstream.
- The ECM regulates the voltages at the A1A+ and A1A- terminals of the ECM to a constant level. Therefore, the air fuel ratio sensor voltage output cannot be confirmed without using the Techstream.
- If an air fuel ratio sensor malfunction is detected, the ECM stores a DTC.

MONITOR DESCRIPTION

ECM calculates lambda based on air fuel ratio sensor output voltage. If lambda is out of the thresholds for 10 seconds or more, ECM judges the air fuel ratio sensor is stuck and stores a DTC.

MONITOR STRATEGY

	P2195: Primary oxygen sensor - Output voltage out of range

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Related DTCs	P2196: Primary oxygen sensor - Output voltage out of range
Required Sensors/Components (Main)	Air fuel ratio sensor
Required Sensors/Components (Related)	Heated oxygen sensor
Frequency of Operation	Continuous
Duration	10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	P0030 (Air fuel ratio sensor - heater) P0037, P0038 (Heated oxygen sensor - heater) P0068, P0107, P0108 (Manifold absolute pressure (MAP) sensor) P0101, P0102, P0103 (Mass air flow (MAF) sensor) P0111, P0112, P0113 (Intake air temperature (IAT) sensor) P0117, P0118 (Engine coolant temperature (ECT) sensor) P0122, P0123, P0222, P0223 (Throttle position sensor) P0137, P0138 (Heated oxygen sensor - a lack of circuit continuity) P0140 (Heated oxygen sensor - output voltage) P0171, P0172 (Fuel system main feedback control) P0300, P0301, P0302, P0303, P0304 (Misfire) P0458, P0459 (Solenoid valve for purge control) P0461, P0462, P0463 (Fuel level sensor (FL)) P0500 (Vehicle speed sensor (VSS)) P0604 (RAM in ECM) P0605 (ROM in ECM) P1160 (Throttle return spring) P2101, P2102 (Throttle actuator control motor) P2109 (Throttle position sensor minimum stop) P2119 (Throttle actuator control) P2122, P2123, P2127, P2128 (Accelerator pedal position sensor (APPS) circuit) P2135 (Throttle position sensor (TPS) correlation) P2138 (Accelerator pedal position sensor (APPS) correlation)
Engine coolant temperature	60°C (140°F) or higher
Atmospheric pressure	Higher than 75.06 kPa(abs) [563 mmHg(abs)]
Battery voltage	10.9 V or more
Fuel system status	Closed loop

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Change of intake air mass during 1/2 engine	Less than 0.02 g/rev
Impedance of primary oxygen sensor	0 to 65 Ω
Elapsed time after engine start	60 seconds or more
Vehicle speed	20 km/h (12.4 mph) or more
Intake air mass per second	6 g/sec or more
Integrated time of canister purge after engine start	19.9 seconds or more
Learning value of EVAP density during purge	Less than 0.2
Target lambda load correction coefficient	-0.05 to 0.05
Either of following condition is met	A, B or C
A. Heated oxygen sensor output voltage feedback target	Less than 0.1 V and Higher than -0.2 V
B. Heated oxygen sensor feedback adjust	On minimum limit
C. Heated oxygen sensor feedback adjust	On maximum limit

TYPICAL MALFUNCTION THRESHOLDS

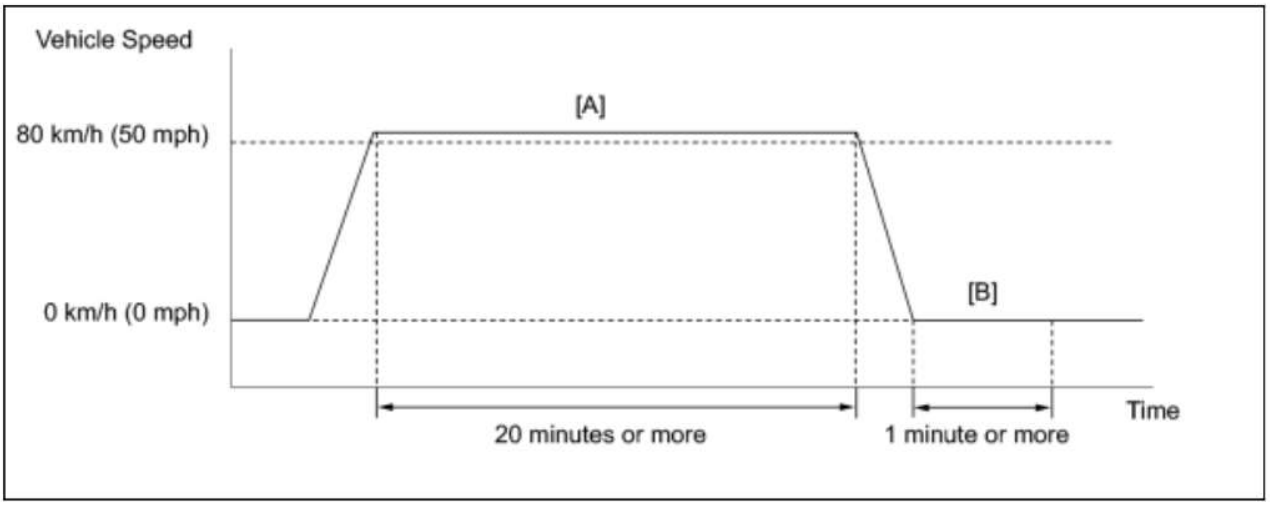
P2195

Output lambda	0.85 or less

P2196

Output lambda	1.15 or more

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.

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2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

HINT:

Check the engine coolant temperature is 20°C (68°F) or less at engine started.

7. Perform the following the confirmation driving pattern.

CAUTION:

When performing the confirmation driving pattern, obey all speed limits and traffic laws.

a. Drive the vehicle at 80 km/h (50 mph) or more for 20 minutes or more [A].
b. Stop the vehicle.
c. Idle the engine for 1 minute or more [B].

8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

HINT:

- If a pending DTC is output, the system is malfunctioning.
- If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P2195 or P2196.
12. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no DTC is output, perform a universal trip and check for permanent DTCs INFO .

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HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0030 INFO .

INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A low air fuel ratio sensor voltage could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A high air fuel ratio sensor voltage could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read DTCs.

Result

RESULT	PROCEED TO
DTC P2195 or P2196 is output	A
DTC P2195 or P2196 and other DTCs are output	B

HINT:

If any DTCs relating to the air fuel ratio sensor (DTCs for the air fuel ratio sensor heater or air fuel ratio sensor admittance) are output, troubleshoot those DTCs first.

B ▶ GO TO DTC CHART

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A

2.	CONFIRM IF VEHICLE HAS RUN OUT OF FUEL IN PAST

(a) Has the vehicle run out of fuel in the past?

NO ▶ GO TO STEP 4

YES

3.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P2195 or P2196 is output)	A
NORMAL (DTC is not output)	B

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B ▶ DTC CAUSED BY RUNNING OUT OF FUEL

A ▼

4.	READ VALUE USING TECHSTREAM (TEST VALUE OF AIR FUEL RATIO SENSOR)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(f) Enter the following menus: Powertrain / Engine / Monitor Status / O2S(A/FS) Monitor CMPL.

(g) Check that the status of O2S(A/FS) Monitor CMPL is Complete.

If the status is still Incomplete, drive the vehicle according to the driving pattern again.

(h) Enter the following menus: Powertrain / Engine / Data List / AFS Current B1S1.

(i) Check the test value of the air fuel ratio sensor output current during fuel-cut.

Result

RESULT	PROCEED TO
Within normal range (0.7 mA or higher, and lower than 2.2 mA)	A
Outside normal range (lower than 0.7 mA, or 2.2 mA or higher)	B

B ▶ GO TO STEP 16

A ▼

5.	READ VALUE USING TECHSTREAM (OUTPUT VOLTAGE OF AIR FUEL RATIO SENSOR)

(a) Connect the Techstream to the DLC3.

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(b) Start the engine.

(c) Turn the Techstream on.

(d) Warm up the air fuel ratio sensor at an engine speed of 2500 rpm for 90 seconds.

(e) Enter the following menus: Powertrain / Engine / Active Test / Control the Injection Volume.

(f) Perform the Control the Injection Volume operation with the engine idling.

(g) Monitor the output voltages of the air fuel ratio and heated oxygen sensors (AFS Voltage B1S1 and O2S B1S2) displayed on the Techstream.

HINT:

- Change the fuel injection volume within the range of -12% to +12%. The injection volume can be changed in fine gradations.
- The air fuel ratio sensor has an output delay of a few seconds and the heated oxygen sensor has a maximum output delay of approximately 20 seconds.
- If the sensor output voltage does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

TECHSTREAM DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	VOLTAGE
AFS Voltage B1S1 (Air fuel ratio)	+12%	Rich	Below 2.0 V
AFS Voltage B1S1 (Air fuel ratio)	-12%	Lean	Higher than 2.4 V
O2S B1S2 (Heated oxygen)	+12%	Rich	Higher than 0.55 V
O2S B1S2 (Heated oxygen)	-12%	Lean	Below 0.4 V

Result

STATUS OF AFS VOLTAGE B1S1	STATUS OF O2S B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	PROCEED TO
Lean	Lean	Actual air fuel ratio lean	A
Rich	Rich	Actual air fuel ratio rich	A
Lean	Lean/Rich	Air fuel ratio sensor malfunction	B
Rich	Lean/Rich	Air fuel ratio sensor malfunction	B
Lean/Rich	Lean/Rich	Normal	B

Lean: During the Control the Injection Volume Active Test, the air fuel ratio sensor output voltage (AFS Voltage) is consistently higher than 2.4 V, and the heated oxygen sensor output voltage (O2S) is consistently below 0.4 V.
Rich: During the Control the Injection Volume Active Test, the AFS Voltage is consistently below 2.0 V, and the O2S is consistently higher than 0.55 V.
Lean/Rich: During the Control the Injection Volume Active Test, the output voltage of the heated oxygen sensor alternates correctly.

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HINT:

Refer to "Data List / Active Test" [AFS Voltage B1S1 and O2S B1S2] INFO .

B ▶ GO TO STEP 16

A ▼

6.	CHECK INTAKE SYSTEM

(a) Check the intake system for vacuum leaks INFO .

OK:

No leaks in the intake system.

NG ▶ REPAIR OR REPLACE INTAKE SYSTEM

OK ▼

7.	CHECK FOR EXHAUST GAS LEAK

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

NG ▶ REPAIR OR REPLACE EXHAUST SYSTEM

OK ▼

8.	CHECK FUEL PRESSURE (LOW PRESSURE SIDE)

(a) Check the fuel pressure (low pressure side) INFO .

NG ▶ GO TO STEP 18

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OK

9.	INSPECT FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

(a) Check the fuel injector assembly (whether fuel volume is high or low, and whether injection pattern is poor) INFO .

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR PORT INJECTION)

OK

10.	CHECK FUEL PRESSURE (HIGH PRESSURE SIDE)

(a) Check the fuel pressure (high pressure side) INFO .

NG ▶ REPAIR OR REPLACE FUEL SYSTEM (HIGH PRESSURE SIDE)

OK

11.	INSPECT FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)

(a) Check the fuel injector assembly (for direct injection) INFO .

NG ▶ REPLACE FUEL INJECTOR ASSEMBLY (FOR DIRECT INJECTION)

OK

12.	REPLACE AIR FUEL RATIO SENSOR

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(a) Replace the air fuel ratio sensor INFO .

NEXT

13.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

RESULT	PROCEED TO
ABNORMAL (DTC P2195 or P2196 is output)	A
NORMAL (DTC is not output)	B

B END

A

14.	REPLACE ECM

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(a) Replace the ECM INFO .

NEXT

15.	CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	• DTC judgment completed • System normal
ABNORMAL	• DTC judgment completed • System abnormal
INCOMPLETE	• DTC judgment not completed • Perform driving pattern after confirming DTC enabling conditions
N/A	• Unable to perform DTC judgment • Number of DTCs which do not fulfill DTC preconditions has reached ECU

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	memory limit

NEXT ▶ END

16.	REPLACE AIR FUEL RATIO SENSOR

(a) Replace the air fuel ratio sensor INFO .

NEXT ▼

17.	CHECK WHETHER DTC OUTPUT RECURS (DTC P2195 OR P2196)

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and warm it up.

(i) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

(j) Enter the following menus: Powertrain / Engine / Utility / All Readiness.

(k) Input the DTC: P2195 or P2196.

(l) Check the DTC judgment.

Result

RESULT	PROCEED TO
NORMAL (DTC is not output)	A
ABNORMAL (DTC P2195 or P2196 is output)	B

B ▶ REPLACE ECM

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A ▶ END

18.	CHECK FUEL LINE

(a) Check the fuel lines for leaks or blockage.

NG ▶ REPAIR OR REPLACE FUEL LINE

OK ▶ REPLACE FUEL PUMP ASSEMBLY

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Last Modified: 4-14-2014	6.6 C	Doc ID: RM000002BHB05SX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P2401,P2402,P2419,P2420; Evaporative Emission System Leak Detection Pump Control Circuit Low; 2013 MY FR-S [03/2012 - 05/2013]		

DTC	P2401	Evaporative Emission System Leak Detection Pump Control Circuit Low

DTC	P2402	Evaporative Emission Leak Detection Pump Stuck ON

DTC	P2419	Evaporative Emission System Switching Valve Control Circuit Low

DTC	P2420	Evaporative Emission Pressure Switching Valve Stuck OFF

DTC SUMMARY

DTC NO.	MONITORING ITEM	MALFUNCTION DETECTION CONDITION	TROUBLE AREA	DETECTION TIMING	DETECTION LOGIC
P2401	Leak detection pump stuck OFF	P2401, P2402, P2419 and P2420 stored when one of following conditions met during EVAP monitor: • Leak detection pump OFF malfunction • Leak detection pump ON malfunction • Vent valve ON (closed) malfunction • Vent valve OFF (opened) malfunction	• Canister pump module • Connector/wire harness (Canister pump module - ECM) • ECM	While EVAP monitor	1 trip
P2402	Leak detection pump stuck ON				
P2419	Vent valve circuit low				
P2420	Vent valve circuit high				

DESCRIPTION

The description can be found in EVAP (Evaporative Emission) System INFO .

MONITOR DESCRIPTION

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While the ECM monitors the EVAP system, it also monitors the status of the leak detection pump and the vent valve within the canister pump module. If the ECM detects an abnormality in the leak detection pump or vent valve operational statuses, the ECM stores the DTC, and illuminates the MIL.

MONITOR STRATEGY

Related DTC	P2401: Evaporative emission system leak detection pump circuit continuity P2402: Evaporative emission system leak detection pump circuit continuity P2419: Evaporative emission system switching valve circuit continuity P2420: Evaporative emission system switching valve circuit continuity
Required Sensors/Components (Main)	Canister pump module
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	2.5 seconds
MIL Operation	Immediately
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not stored	None
Battery voltage	10.9 V or more
Either of the following conditions is met:	A or B
A. Ignition switch	On
B. Activated by soak timer	Satisfied

TYPICAL MALFUNCTION THRESHOLDS

P2401

Drain voltage of FET for leak detection pump	Battery voltage X 0.38 V or less
Command signal from ECM	Off

P2402

Current of FET for leak detection pump	3.5 A or more
Command signal from ECM	On

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P2419

Drain voltage of FET for vent valve	Battery voltage X 0.38 V or less
Command signal from ECM	Off

P2402

Current of FET for vent valve	3.5 A or more
Command signal from ECM	On

CONFIRMATION DRIVING PATTERN

NOTICE:

- The Evaporative System Check (Automatic Mode) consists of 5 steps performed automatically by the Techstream. It takes a maximum of approximately 24 minutes.
- Do not perform the Evaporative System Check when the fuel tank is more than 90% full because the cut-off valve may be closed, making the fuel tank leak check unavailable.
- Do not run the engine during this operation.
- When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the Evaporative System Check, keep the fuel temperature below 35°C (95°F) and the coolant temperature below 45°C (113°F).

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Enter the following menus: Powertrain / Engine / Utility / Evaporative System Check / Automatic Mode.
7. After the "Evaporative System Check" is completed, check for All Readiness by entering the following menus: Powertrain / Engine / Utility / All readiness.
8. Input the DTC: P2401, P2402, P2419 or P2420.
9. Check the DTC judgment result.

TECHSTREAM DISPLAY	DESCRIPTION
NORMAL	○ DTC judgment completed ○ System normal
ABNORMAL	○ DTC judgment completed ○ System abnormal
INCOMPLETE	○ DTC judgment not completed ○ Perform driving pattern after confirming DTC enabling conditions
N/A	○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

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HINT:

- If the judgment result shows NORMAL, the system is normal.
- If the judgment result shows ABNORMAL, the system has a malfunction.

10. If the judgment result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

WIRING DIAGRAM

Refer to DTC P0451 INFO .

INSPECTION PROCEDURE

NOTICE:

- Do not disassemble the canister pump module.
- Inspect the fuses for circuits related to this system before performing the following inspection procedure.

PROCEDURE

1.	INSPECT CANISTER PUMP MODULE (POWER SOURCE)

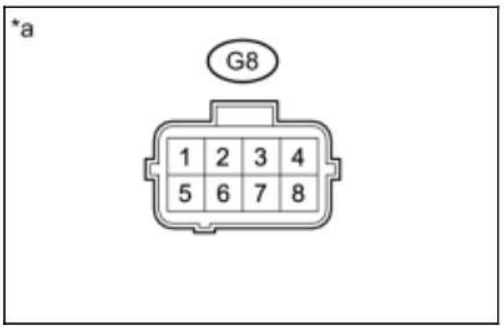
(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	SWITCH CONDITION	SPECIFIED CONDITION
G8-3 - Body ground	Ignition switch ON	11 to 14 V
G8-5 - Body ground	Ignition switch ON	11 to 14 V



Text in Illustration

*a	Component without harness connected (Canister Pump Module)

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NG GO TO STEP 4

OK

2.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)

(a) Turn the ignition switch off.

(b) Disconnect the canister pump module connector.

(c) Disconnect the ECM connector.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-8 (MPMP) - G8-4	Always	Below 1 Ω
A35-1 (VPMP) - G8-1	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-8 (MPMP) or G8-4 - Body ground	Always	10 kΩ or higher
A35-1 (VPMP) or G8-1 - Body ground	Always	10 kΩ or higher

NG REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

3.	INSPECT CANISTER PUMP MODULE

(a) Inspect the canister pump module INFO .

NG REPLACE CANISTER PUMP MODULE

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OK ▶ CHECK INTERMITTENT PROBLEMS

4.	INSPECT RELAY (EFI MAIN1)

(a) Inspect the EFI MAIN1 relay INFO .

NG ▶ REPLACE RELAY (EFI MAIN1)

OK ▼

5.	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - EFI MAIN1 RELAY)

(a) Turn the ignition switch off.

(b) Remove EFI MAIN1 relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G8-3 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω
G8-5 - EFI MAIN1 relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
G8-3 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher
G8-5 or EFI MAIN1 relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ GO TO ECM POWER SOURCE CIRCUIT

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Last Modified: 4-14-2014	6.6 C	Doc ID: RM000000T6X0B4X
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: P2610; ECM / PCM Internal Engine Off Timer Performance; 2013 MY FR-S [03/2012 - 05/2013]		

DTC	P2610	ECM / PCM Internal Engine Off Timer Performance

DTC SUMMARY

DTC NO.	DTC DETECTION CONDITION	TROUBLE AREA
P2610	One of the following conditions is met (2 trip detection logic): Timer diagnosis • [(Engine ECU counter - soak timer IC counter) / Engine ECU counter] is 0.24 or more. Full count diagnosis • Soak timer IC counter is not 1023. Timer diagnosis • The setting time written to the soak timer IC is different to the value read. Full count diagnosis during wake-up. • When the engine ECU counter is 1.636 seconds or less, the soak timer IC counter is 1023.	ECM

DESCRIPTION

The soak timer operates after the ignition switch is turned off. When a certain amount of time has elapsed after turning the ignition switch off, the soak timer activates the ECM to perform malfunction checks which can only be performed after the engine is stopped. The soak timer is built into the ECM.

MONITOR DESCRIPTION

1. While the engine is running, the ECM monitors the synchronization of the soak timer and the CPU clock. If these two are not synchronized, the ECM interprets this as a malfunction, illuminates the MIL and stores the DTC.
2. If the soak timer activates the ECM even though only a short amount of time has elapsed since the ignition switch was turned off, or if the soak timer does not activate the ECM even though a considerable amount of time has elapsed since the ignition switch was turned off, the ECM determines that the soak timer is malfunctioning, illuminates the MIL and stores a DTC the next time the ignition switch is turned ON.

MONITOR STRATEGY

Related DTCs	

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	P2610: ECM engine off timer performance (soak timer IC)
Required Sensors/Components	ECM
Required Sensors/Components	-
Frequency of Operation	Once per driving cycle
Duration	0.128 seconds: Timer Diagnosis, Full Count Diagnosis and Timer Diagnosis (Case 1) Immediately: Timer Diagnosis (Case 2) and Wake-up Diagnosis
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Monitor runs whenever following DTCs are not present	None

Timer Diagnosis

Ignition switch	Off
Battery voltage	10.9 V or more
Elapsed time after engine start	10 minutes to 17.05 hours

Full Count Diagnosis

Ignition switch	Off
Battery voltage	10.9 V or more
ECM timer	4 seconds or more

Timer Diagnosis (Case 1)

Ignition switch	Off
Battery voltage	10.9 V or more

Timer Diagnosis (Case 2)

Ignition switch	Off
Battery voltage	10.9 V or more

Wake-up Diagnosis

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Ignition switch	On
Soak time	1 hour or more

TYPICAL MALFUNCTION THRESHOLDS

Timer Diagnosis

[(ECM counter) - (Soak timer IC counter)] / ECM counter	More than 0.24

Full Count Diagnosis

Soak timer IC counter	Not 1023 counts

Timer Diagnosis (Case 1)

Value commanded by ECM = Value received by soak timer IC	Yes

Timer Diagnosis (Case 2)

Either of the following conditions is met:	A or B
A. Soak timer IC counter when ECM timer is less than 1.636 seconds	1023 counts
B. Soak timer IC counter when ECM timer is more than 2.456 seconds	Not 1023 counts

Wake-up Diagnosis

Number of record wake-up counts is less than Number of record wake-up commands	Yes

CONFIRMATION DRIVING PATTERN

1. Connect the Techstream to the DLC3.
2. Turn the ignition switch to ON and turn the Techstream on.
3. Clear DTCs (even if no DTCs are stored, perform the clear DTC operation) INFO .
4. Turn the ignition switch off and wait for at least 30 seconds.
5. Turn the ignition switch to ON and turn the Techstream on.
6. Start the engine.
7. Idle the engine for 10 minutes or more.
8. Enter the following menus: Powertrain / Engine / Trouble Codes.
9. Read pending DTCs.

   HINT:
   - If a pending DTC is output, the system is malfunctioning.
   - If a pending DTC is not output, perform the following procedure.

10. Enter the following menus: Powertrain / Engine / Utility / All Readiness.
11. Input the DTC: P2610.
12. Check the DTC judgment result.

TECHSTREAM	DESCRIPTION

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DISPLAY	
NORMAL	◦ DTC judgment completed ◦ System normal
ABNORMAL	◦ DTC judgment completed ◦ System abnormal
INCOMPLETE	◦ DTC judgment not completed ◦ Perform driving pattern after confirming DTC enabling conditions
N/A	◦ Unable to perform DTC judgment ◦ Number of DTCs which do not fulfill DTC preconditions has reached ECU memory limit

HINT:

If the judgment result shows ABNORMAL, the system has a malfunction.

13. If the test result is INCOMPLETE or N/A and no pending DTC is output, perform a universal trip and check for permanent DTCs INFO .

HINT:

- If a permanent DTC is output, the system is malfunctioning.
- If no permanent DTC is output, the system is normal.

INSPECTION PROCEDURE

HINT:

- DTC P2610 is stored if an internal ECM problem is detected. Diagnostic procedures are not required. ECM replacement is required.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air fuel ratio was lean or rich, and other data from the time the malfunction occurred.

PROCEDURE

1.	REPLACE ECM

(a) Replace the ECM INFO .

NEXT

2.	CHECK WHETHER DTC OUTPUT RECURS (IN ADDITION TO DTC P2610)

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(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Clear the DTCs INFO .

(e) Turn the ignition switch off and wait for at least 30 seconds.

(f) Turn the ignition switch to ON.

(g) Turn the Techstream on.

(h) Start the engine and wait for 10 minutes or more.

(i) Enter the following menus: Powertrain / Engine / Trouble Codes / Pending.

(j) If no pending DTC is output, the repair has been successfully completed.

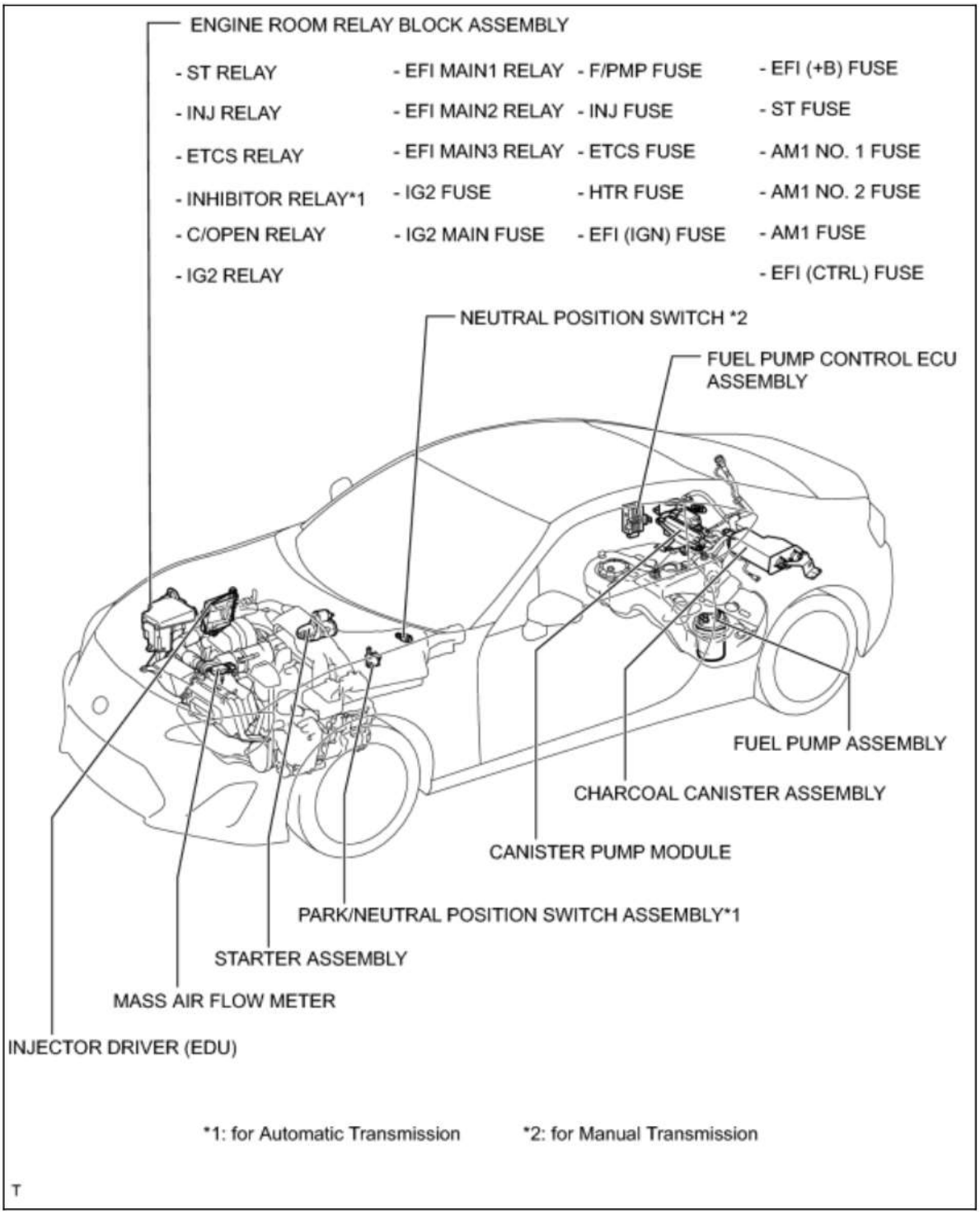
NEXT ▶ END

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Last Modified: 3-27-2012	6.4 R	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000004G5U006X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: PARTS LOCATION (2013 FR-S)		

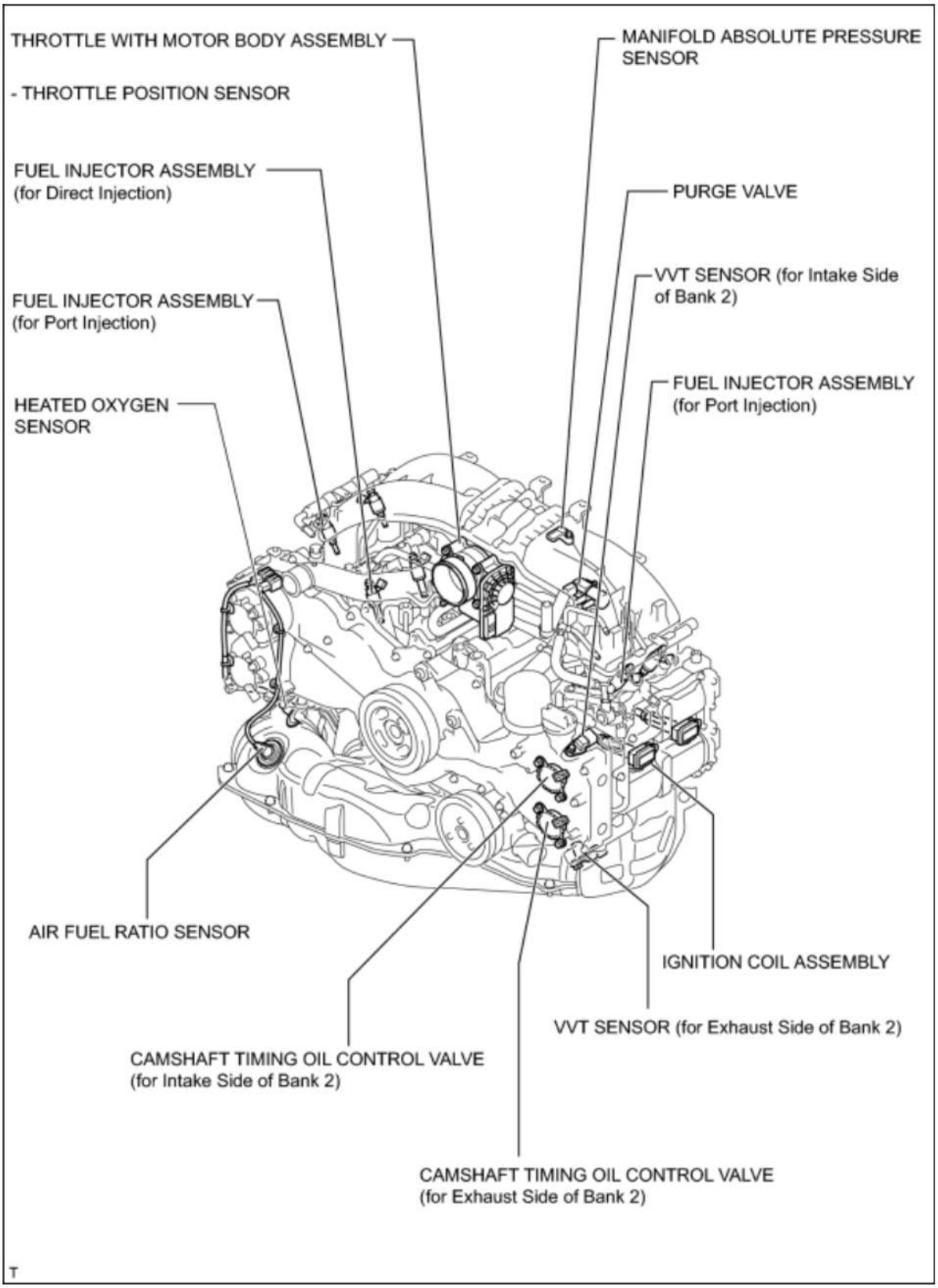
PARTS LOCATION

ILLUSTRATION



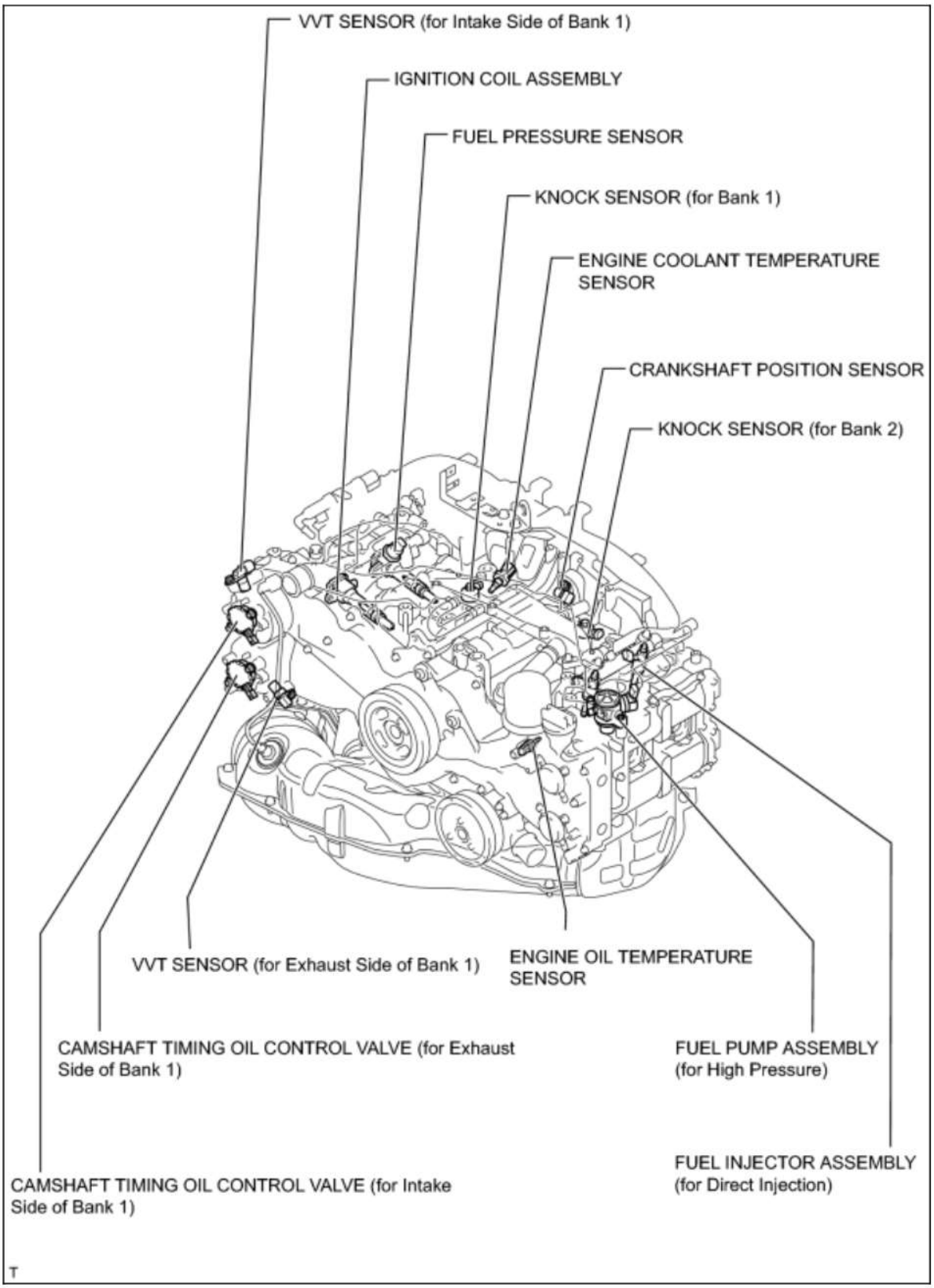
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ILLUSTRATION



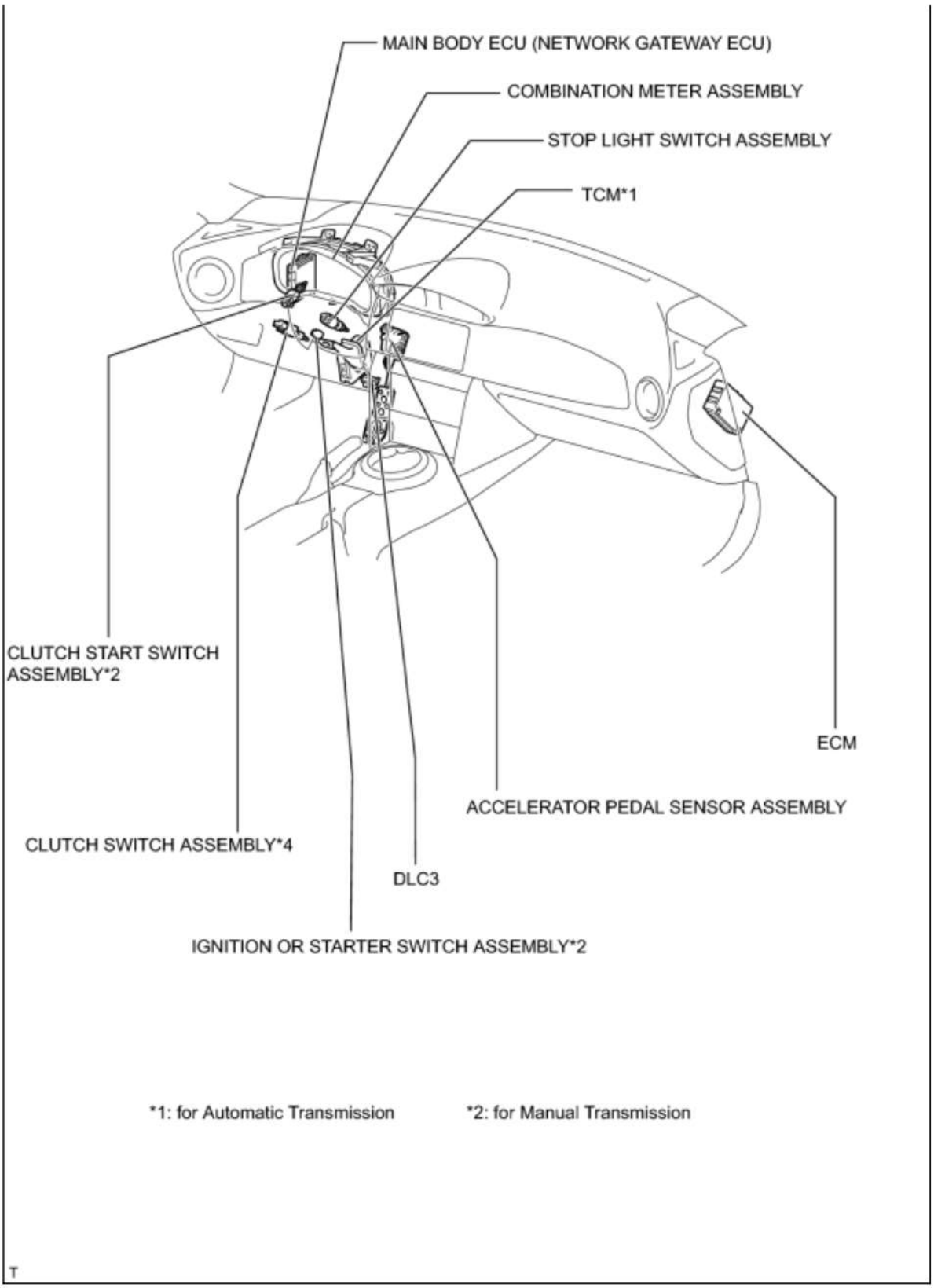
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ILLUSTRATION



ILLUSTRATION

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Last Modified: 3-27-2012	6.4 L	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PD80E1X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: PRECAUTION (2013 FR-S)		

PRECAUTION

1. INITIALIZATION

NOTICE:

- If the ECM is replaced, register the ECU communication ID for Immobiliser System INFO .
- Perform Registration (VIN registration) when replacing the ECM INFO .

2. WHEN USING TECHSTREAM

CAUTION:

Observe the following items for safety reasons:

- Before using the Techstream, read the instruction manual.
- Prevent the Techstream cable from being caught on the pedals, shift lever or steering wheel when driving with the Techstream connected to the vehicle.
- When driving the vehicle for testing purposes using the Techstream, 2 persons are required. One is for driving the vehicle, and the other operates the Techstream.

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Last Modified: 3-27-2012	6.4 L	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PD80E1X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: PRECAUTION (2013 FR-S)		

PRECAUTION

1. INITIALIZATION

NOTICE:

- If the ECM is replaced, register the ECU communication ID for Immobiliser System INFO .
- Perform Registration (VIN registration) when replacing the ECM INFO .

2. WHEN USING TECHSTREAM

CAUTION:

Observe the following items for safety reasons:

- Before using the Techstream, read the instruction manual.
- Prevent the Techstream cable from being caught on the pedals, shift lever or steering wheel when driving with the Techstream connected to the vehicle.
- When driving the vehicle for testing purposes using the Techstream, 2 persons are required. One is for driving the vehicle, and the other operates the Techstream.

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Last Modified: 3-27-2012	6.4 T	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDG0O4X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: PROBLEM SYMPTOMS TABLE (2013 FR-S)		

PROBLEM SYMPTOMS TABLE

HINT:

- Use the table below to help determine the cause of problem symptoms. If multiple suspected areas are listed, the potential causes of the symptoms are listed in order of probability in the "Suspected Area" column of the table. Check each symptom by checking the suspected areas in the order they are listed. Replace parts as necessary.
- Inspect the fuses and relays related to this system before inspecting the suspected areas below.

SFI System

SYMPTOM	SUSPECTED AREA	SEE PAGE
Engine does not crank (Does not start)	Battery	INFO
	Starter	INFO
	Park/neutral position switch assembly*1	INFO
	Clutch start switch assembly*2	INFO
	Starter signal circuit	INFO
No initial combustion (Does not start)	ECM power source circuit	INFO
	Crankshaft position sensor	INFO
	Ignition system	INFO
	Fuel pump control circuit	INFO
	Fuel pump	INFO
	Fuel injector circuit	INFO
	Valve timing	INFO
	VC output circuit (ECM 5 V output)	INFO
	VVT sensor (for intake side)	INFO
	VVT sensor (for exhaust side)	INFO
	Starter signal circuit	INFO
	Engine immobiliser system	INFO
	ECM	INFO
	Fuel pump control circuit	INFO
	Fuel pump (for high pressure)	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly (for port injection)	INFO

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Engine cranks normally but difficult to start	Fuel injector assembly (for direct injection)	INFO
	ECM power source circuit	INFO
	Starter signal circuit	INFO
	Engine coolant temperature sensor	INFO
	Intake system	INFO
	Ignition system	INFO
	Spark plug	INFO
	Throttle with motor body assembly	INFO
	Compression	INFO
Incomplete intermittent combustion occurs (Does not start)	Fuel pump control circuit	INFO
	Fuel line	INFO
	Ignition circuit	INFO
	Ignition system	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly (for port injection)	INFO
	Fuel injector assembly (for direct injection)	INFO
	ECM power source circuit	INFO
	Starter signal circuit	INFO
	Crankshaft position sensor	INFO
	VVT sensor (for intake side)	INFO
	VVT sensor (for exhaust side)	INFO
	Engine immobiliser system	INFO
	Valve timing	INFO
High engine idle speed	Throttle with motor body assembly	INFO
	Intake system	INFO
	A/C signal circuit	INFO
	ECM power source circuit	INFO
	Engine coolant temperature sensor	INFO
	PCV valve and hose	INFO
Low engine idle speed (Poor idling)	Throttle with motor body assembly	INFO
	A/C signal circuit	INFO
	Fuel pump control circuit	INFO
	Fuel pump	INFO
	Intake system	INFO
	PCV valve and hose	INFO

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Rough idling	Compression	INFO
	Ignition system	INFO
	Spark plug	INFO
	Fuel injector circuit	INFO
	ECM power source circuit	INFO
	Fuel pump control circuit	INFO
	Fuel injector assembly (for port injection)	INFO
	Fuel injector assembly (for direct injection)	INFO
	Fuel pump (for high pressure)	INFO
	Fuel line	INFO
	Throttle with motor body assembly	INFO
	Intake system	INFO
	Purge valve	INFO
	PCV valve and hose	INFO
	Air fuel ratio sensor	INFO
	Heated oxygen sensor	INFO
	Mass air flow meter	INFO
	Knock sensor	INFO
Hunting (Poor idling)	Throttle with motor body assembly	INFO
	Intake system	INFO
	PCV valve and hose	INFO
	Air fuel ratio sensor	INFO
	Mass air flow meter	INFO
Hesitation/poor acceleration	Fuel pump control circuit	INFO
	Fuel pump (for high pressure)	INFO
	Fuel line	INFO
	Spark plug	INFO
	Ignition system	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly (for port injection)	INFO
	Fuel injector assembly (for direct injection)	INFO
	ECM power source circuit	INFO
	Knock sensor	INFO
	Mass air flow meter	INFO

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	Throttle with motor body assembly	INFO
	Intake system	INFO
	Valve timing	INFO
	Compression	INFO
	Brake override system	INFO
Surging (Poor driveability)	Spark plug	INFO
	Fuel pump control circuit	INFO
	Fuel pump (for high pressure)	INFO
	Ignition system	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly (for port injection)	INFO
	Fuel injector assembly (for direct injection)	INFO
	ECM power source circuit	INFO
	Mass air flow meter	INFO
	Variable Valve Timing (VVT) system	INFO
	Compression	INFO
Engine stalls soon after starting	Fuel pump control circuit	INFO
	Fuel pump (for high pressure)	INFO
	Spark plug	INFO
	Ignition system	INFO
	Fuel injector circuit	INFO
	Fuel injector assembly (for port injection)	INFO
	Fuel injector assembly (for direct injection)	INFO
	ECM power source circuit	INFO
	Mass air flow meter	INFO
	Variable Valve Timing (VVT) system	INFO
	Throttle with motor body assembly	INFO
	Intake system	INFO
	PCV valve and hose	INFO
	Compression	INFO
Engine stalls only during A/C operation	A/C signal circuit	INFO
	ECM	INFO
Unable/difficult to refuel	Fuel system (canister, refueling valve, roll over valve, fuel tank, etc.)	-

*1: for Automatic Transmission

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*2: for Manual Transmission



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Last Modified: 3-27-2012	6.4 D	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000SXQ07MX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: READINESS MONITOR DRIVE PATTERN (2013 FR-S)		

READINESS MONITOR DRIVE PATTERN

1. PURPOSE OF READINESS TESTS

- The On-Board Diagnostic (OBD II) system is designed to monitor the performance of emission related components, and indicate any detected abnormalities using DTCs (Diagnostic Trouble Codes). Since various components need to be monitored during different driving conditions, the OBD II system is designed to run separate monitoring programs called Readiness Monitors.
- To view the status, enter the following menus: Powertrain / Engine / Monitor / Current Monitor / Current.
- When the status of a Readiness Monitor reads Complete, the necessary conditions have been met for running the performance tests for that Readiness Monitor.
- A generic OBD II scan tool can also be used to view the Readiness Monitor status.

HINT:

Many state Inspection and Maintenance (I/M) programs require the status of vehicle Readiness Monitor to show Complete before beginning emission tests.

The Readiness Monitor is reset to Incomplete if:

- The ECM has lost battery power or blown a fuse.
- DTCs have been cleared.
- The conditions for running the Readiness Monitor have not been met.

If the Readiness Monitor status shows Incomplete, follow the appropriate Readiness Monitor Drive Pattern to change the status to Complete.

CAUTION:

Strictly observe posted speed limits, traffic laws, and road conditions when performing these drive patterns.

NOTICE:

These drive patterns represent the fastest method of satisfying all conditions necessary to achieve complete status for each specific Readiness Monitor.

In the event of a drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed. In most cases, the Readiness Monitor will still achieve complete status upon completion of the drive pattern.

To ensure completion of the Readiness Monitors, avoid sudden changes in vehicle load and speed (driving up and down hills and/or sudden acceleration).

2. VVT SYSTEM MONITOR

(a) Refer to Confirmation Driving Pattern [P0011] INFO .

(b) Refer to Confirmation Driving Pattern [P0014] INFO .

3. CATALYST MONITOR (ACTIVE AIR FUEL RATIO CONTROL TYPE)

(a) Refer to Confirmation Driving Pattern [P0420] INFO .

4. EVAP SYSTEM MONITOR (KEY OFF TYPE)

(a) Refer to Confirmation Driving Pattern [EVAP System] INFO .

5. AIR FUEL RATIO (A/F) AND HEATED OXYGEN (HO2) SENSOR MONITORS (ACTIVE AIR FUEL RATIO CONTROL TYPE)

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(a) Refer to Confirmation Driving Pattern [P0176] INFO .

(b) Refer to Confirmation Driving Pattern [P2195] INFO .

6. AIR FUEL RATIO (A/F) AND HEATED OXYGEN (HO2) SENSOR HEATER MONITORS (FRONT A/F AND REAR HO2 SENSOR TYPE)

(a) Refer to Confirmation Driving Pattern [P0031] INFO .

(b) Refer to Confirmation Driving Pattern [P0037] INFO .



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Last Modified: 3-27-2012	6.4 M	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDT0ACX
Title: FA20 ENGINE CONTROL: SFI SYSTEM: REGISTRATION (2013 FR-S)		

REGISTRATION

NOTICE:

The Vehicle Identification Number (VIN) must be input into a replacement ECM.

HINT:

The VIN is a 17-digit alphanumeric vehicle identification number. The Techstream is required to register the VIN.

1. DESCRIPTION (Using the Techstream)

HINT:

This registration section consists of 2 parts: Read VIN and Write VIN.

(a) Read VIN: This process allows the VIN stored in the ECM to be read in order to confirm that the 2 VINs, provided with the vehicle and stored in the vehicle ECM, are the same.

(b) Write VIN: This process allows the VIN to be input into the ECM. If the ECM is replaced, or the ECM VIN and vehicle VIN do not match, the VIN can be registered, or overwritten in the ECM by following this procedure.

2. READ VIN

(a) Confirm the vehicle VIN.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Utility / VIN / VIN Read.

3. WRITE VIN

(a) Confirm the vehicle VIN.

(b) Connect the Techstream to the DLC3.

(c) Turn the ignition switch to ON.

(d) Turn the Techstream on.

(e) Enter the following menus: Powertrain / Engine / Utility / VIN / VIN Write.

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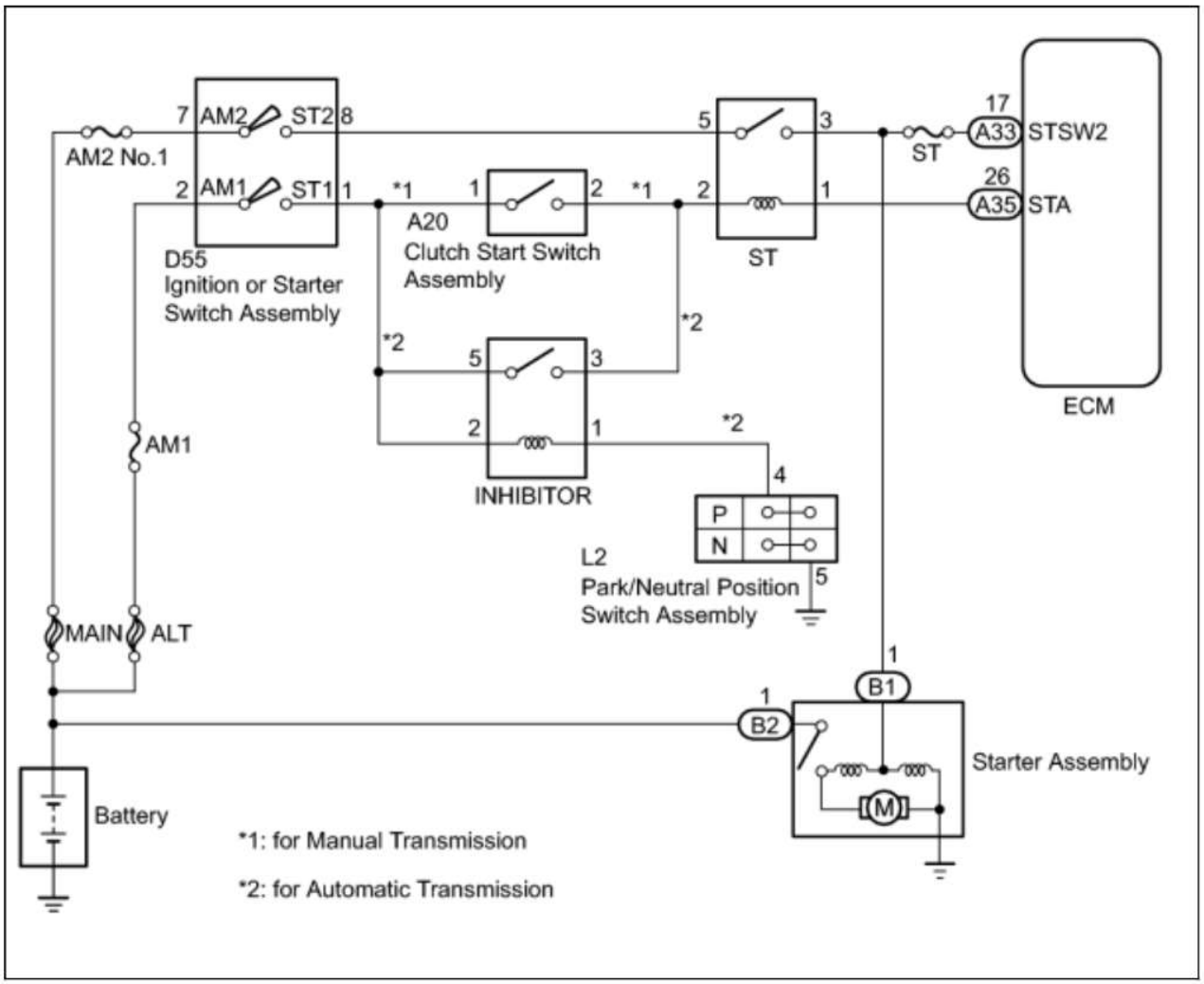
Last Modified: 4-14-2014	6.6 J	Doc ID: RM000002XN20D5X
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: Starter Signal Circuit; 2013 MY FR-S [03/2012 - 05/2013]		

Starter Signal Circuit

DESCRIPTION

While the engine is being cranked, the current from the ST relay flows to the ECM STSW2 terminal. The starter start signal flowing to the STSW2 terminal is mainly used to increase the fuel injection quantity while the engine is starting.

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

Inspect the fuses for circuits related to this system before performing the following inspection procedure.

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PROCEDURE

1.	CHECK WHETHER ENGINE CAN BE CRANKED

(a) Check if the engine can be cranked.

Result

RESULT	PROCEED TO
Engine cannot be cranked	A
Engine can be cranked	B

B ▶ GO TO STEP 16

A ▼

2.	READ VALUE USING TECHSTREAM (STARTER SIGNAL)

(a) Connect the Techstream to DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Starter Signal.

(e) Check the value displayed on the Techstream when the ignition switch is turned to the ON and START positions.

OK

IGNITION SWITCH POSITION	STARTER SIGNAL
ON	Close (OFF)
START	Open (ON)

NG ▶ GO TO STEP 4

OK ▼

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3.	CHECK HARNESS AND CONNECTOR (ECM - ST RELAY - STARTER ASSEMBLY)

(a) Disconnect the ECM connector.

(b) Disconnect the starter assembly connector.

(c) Remove the ST relay from the engine room relay block assembly.

(d) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
B1-1 - A33-17 (STSW2)	Always	Below 1 Ω
B1-1 - ST relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A33-17 (STSW2), ST relay terminal 3 or B1-1 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

4.	INSPECT IGNITION OR STARTER SWITCH ASSEMBLY

(a) Inspect the ignition or starter switch assembly INFO .

NG ▶ REPLACE IGNITION OR STARTER SWITCH ASSEMBLY

OK ▼

5.	CHECK HARNESS AND CONNECTOR (IGNITION OR STARTER SWITCH ASSEMBLY - ST RELAY)

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(a) Disconnect the ignition or starter switch assembly connector.

(b) Remove the ST relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-8 (ST2) - ST relay terminal 5	Always	Below 1 Ω

Standard Resistance (Check for short):

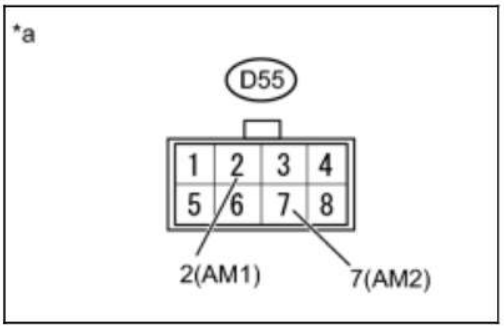
TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-8 (ST2) or ST relay terminal 5 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

6.	INSPECT TERMINAL VOLTAGE (+B OF IGNITION OR STARTER SWITCH ASSEMBLY)

(a) Disconnect the ignition or starter switch assembly connector.



(b) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-2 (AM1) - Body ground	Always	11 to 14 V
D55-7 (AM2) - Body ground	Always	11 to 14 V

Text in Illustration

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*a	Front view of wire harness connector (to Ignition or Starter Switch Assembly)

Result

RESULT	PROCEED TO
NG	A
OK (for automatic transmission models)	B
OK (for manual transmission models)	C

B ▶ GO TO STEP 7

C ▶ GO TO STEP 12

A ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

7.	INSPECT PARK/ NEUTRAL POSITION SWITCH ASSEMBLY

(a) Inspect the park/neutral position switch assembly INFO .

NG ▶ REPLACE PARK/ NEUTRAL POSITION SWITCH ASSEMBLY

OK ▼

8.	CHECK HARNESS AND CONNECTOR (PARK/ NEUTRAL POSITION SWITCH ASSEMBLY - INHIBITOR RELAY)

(a) Disconnect the park/neutral position switch assembly connector.

(b) Remove the INHIBITOR relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
L2-4 - INHIBITOR relay terminal 1	Always	Below 1 Ω
L2-5 - Body ground	Always	Below 1 Ω

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Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
L2-4 or INHIBITOR relay terminal 1 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

9.	CHECK HARNESS AND CONNECTOR (IGNITION OR STARTER SWITCH ASSEMBLY - INHIBITOR RELAY)

(a) Disconnect the ignition or starter switch assembly connector.

(b) Remove the INHIBITOR relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-1 (ST1) - INHIBITOR relay terminal 5	Always	Below 1 Ω
D55-1 (ST1) - INHIBITOR relay terminal 2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-1 (ST1), INHIBITOR relay terminal 2 or INHIBITOR relay terminal 5 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

10.	CHECK HARNESS AND CONNECTOR (INHIBITOR RELAY - ST RELAY)

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(a) Remove the INHIBITOR relay and ST relay from the engine room relay block assembly.

(b) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
INHIBITOR relay terminal 3 - ST relay terminal 2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
INHIBITOR relay terminal 3 or ST relay terminal 2 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

11.	CHECK HARNESS AND CONNECTOR (ECM - ST RELAY)

(a) Disconnect the ECM connector.

(b) Remove the ST relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-26 (STA) - ST relay terminal 1	Always	Below 1 Ω
A33-17 (STSW2) - ST relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-26 (STA), A33-17 (STSW2), ST relay terminal 1 or ST relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR

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CONNECTOR

OK ▶ PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE

12.	INSPECT CLUTCH START SWITCH ASSEMBLY

(a) Inspect the clutch start switch assembly INFO .

NG ▶ REPLACE CLUTCH START SWITCH ASSEMBLY

OK ▼

13.	CHECK HARNESS AND CONNECTOR (IGNITION OR STARTER SWITCH ASSEMBLY - CLUTCH START SWITCH)

(a) Disconnect the ignition or starter switch assembly connector.

(b) Disconnect the clutch start switch assembly connector.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-1 (ST1) - A20-1	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
D55-1 (ST1) or A20-1 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

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14.	CHECK HARNESS AND CONNECTOR (CLUTCH START SWITCH ASSEMBLY - ST RELAY)

(a) Disconnect the clutch start switch assembly connector.

(b) Remove the ST relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A20-2 - ST relay terminal 2	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A20-2 or ST relay terminal 2 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▼

15.	CHECK HARNESS AND CONNECTOR (ECM - ST RELAY)

(a) Disconnect the ECM connector.

(b) Remove the ST relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-26 (STA) - ST relay terminal 1	Always	Below 1 Ω
A33-17 (STSW2) - ST relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-26 (STA), A33-17 (STSW2), ST relay terminal 1 or ST relay terminal	Always	10 kΩ or higher

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3 - Body ground		

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE

16.	READ VALUE USING TECHSTREAM (ST SIGNAL)

(a) Connect the Techstream to DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Data List / Starter Signal.

(e) Check the value displayed on the Techstream when the ignition switch is turned to the ON and START positions.

OK

IGNITION SWITCH POSITION	STARTER SIGNAL
ON	Close (OFF)
START	Open (ON)

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE

A ▼

17.	CHECK HARNESS AND CONNECTOR (ECM - ST RELAY)

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(a) Disconnect the ECM connector.

(b) Remove the ST relay from the engine room relay block assembly.

(c) Measure the resistance according to the value(s) in the table below.

Standard Resistance (Check for open):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-26 (STA) - ST relay terminal 1	Always	Below 1 Ω
A33-17 (STSW2) - ST relay terminal 3	Always	Below 1 Ω

Standard Resistance (Check for short):

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A35-26 (STA), A33-17 (STSW2), ST relay terminal 1 or ST relay terminal 3 - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

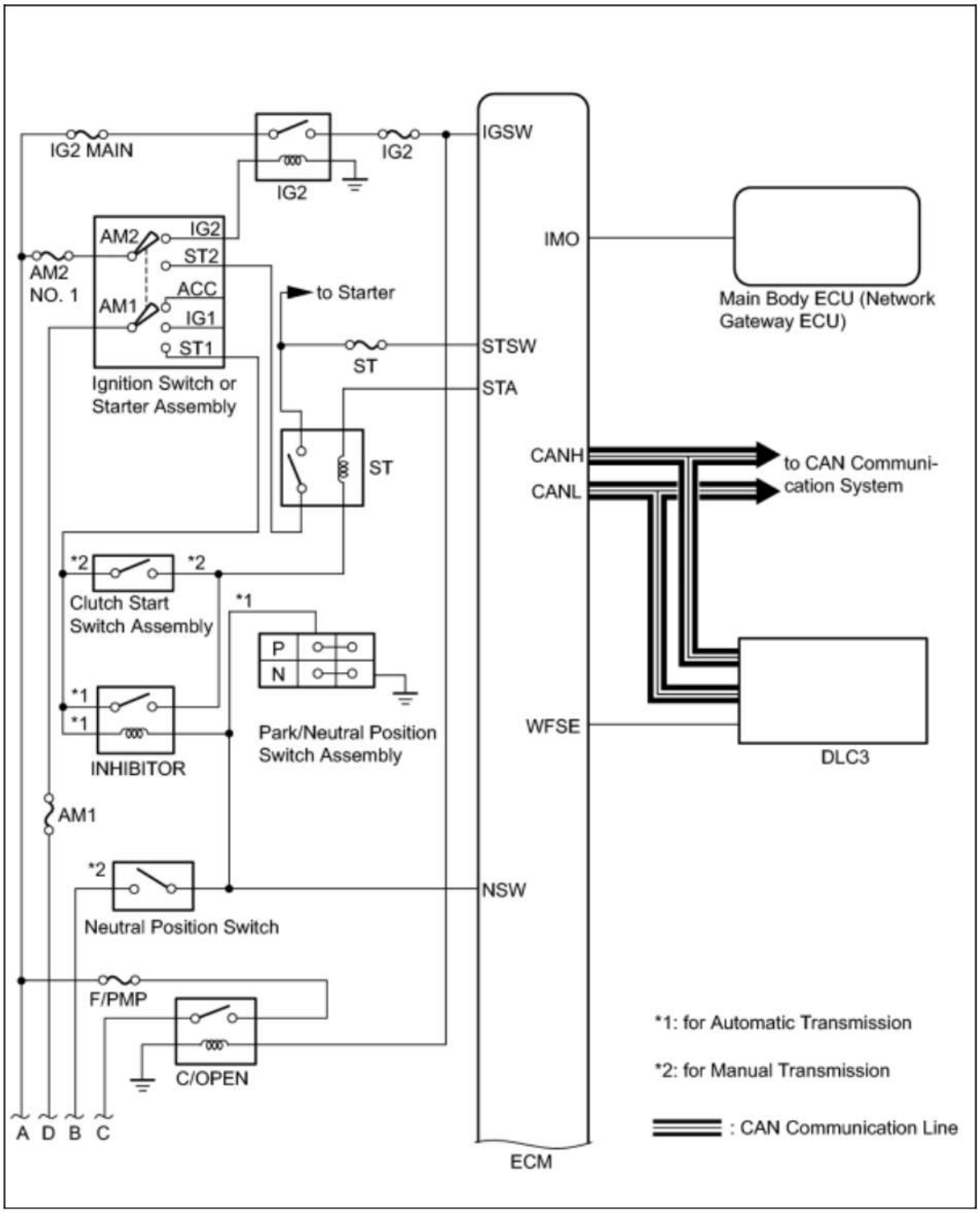
OK ▶ REPLACE ECM

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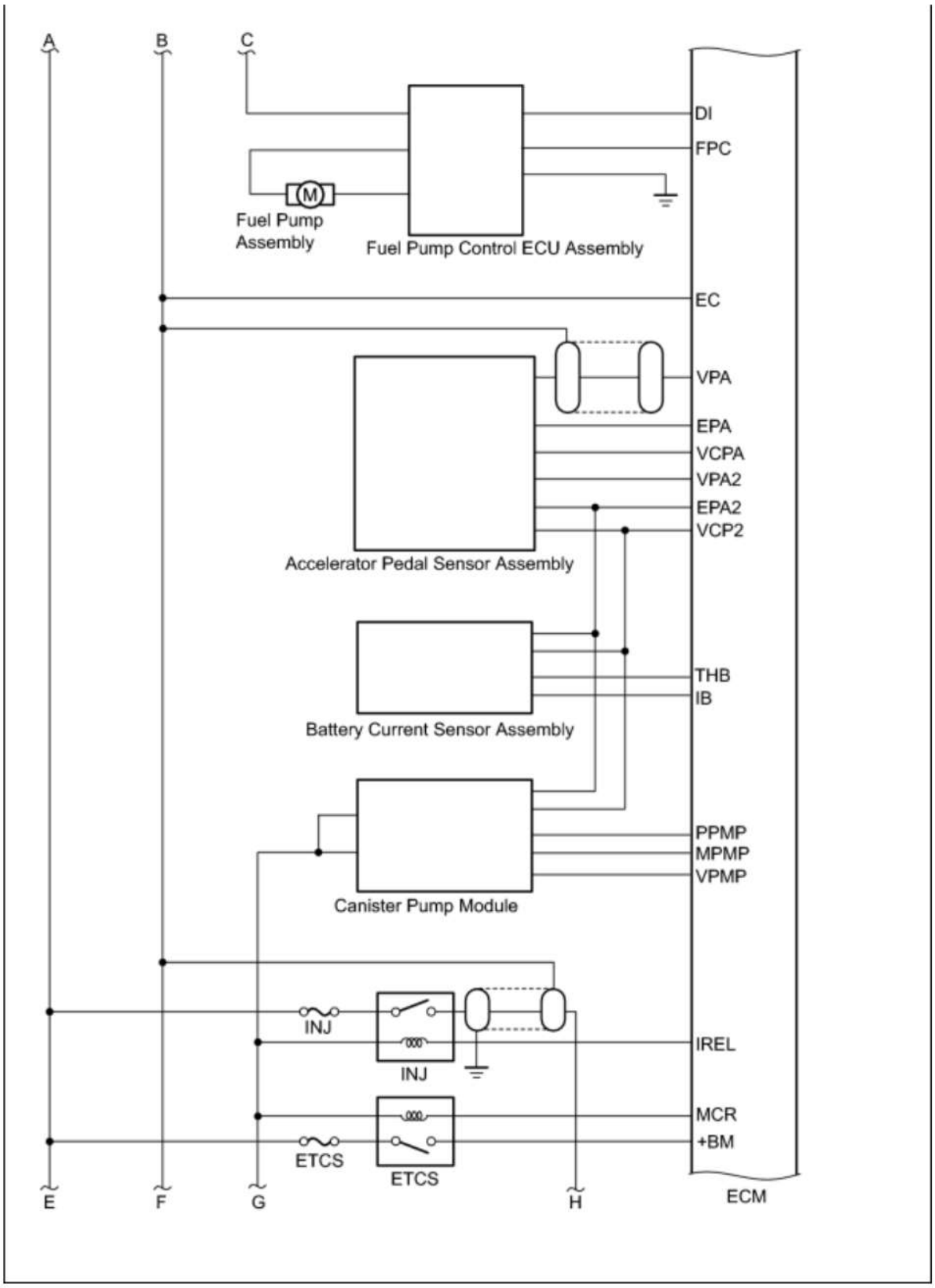
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Last Modified: 3-27-2012	6.4 U	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDB0D3X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: SYSTEM DIAGRAM (2013 FR-S)		

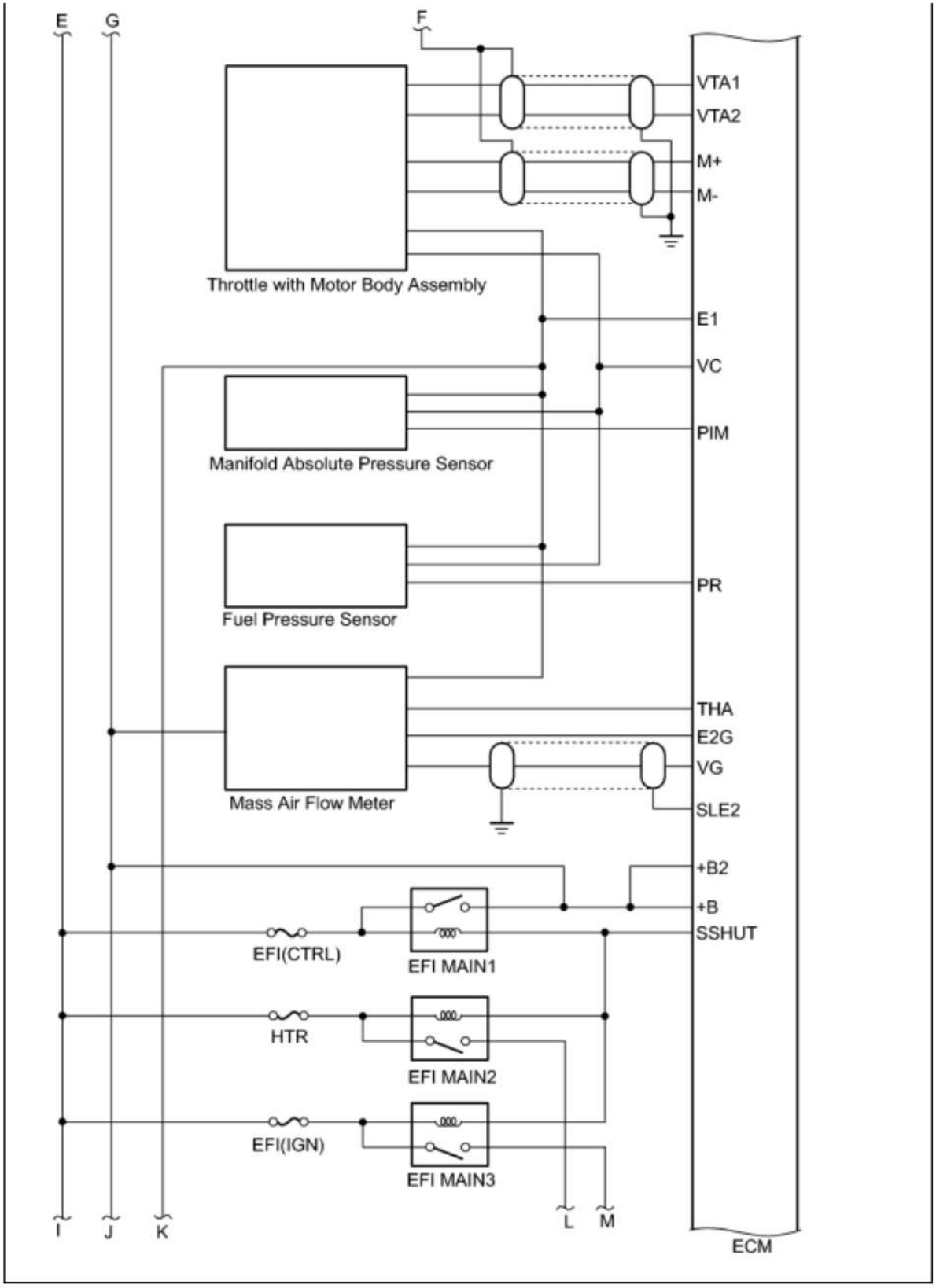
SYSTEM DIAGRAM



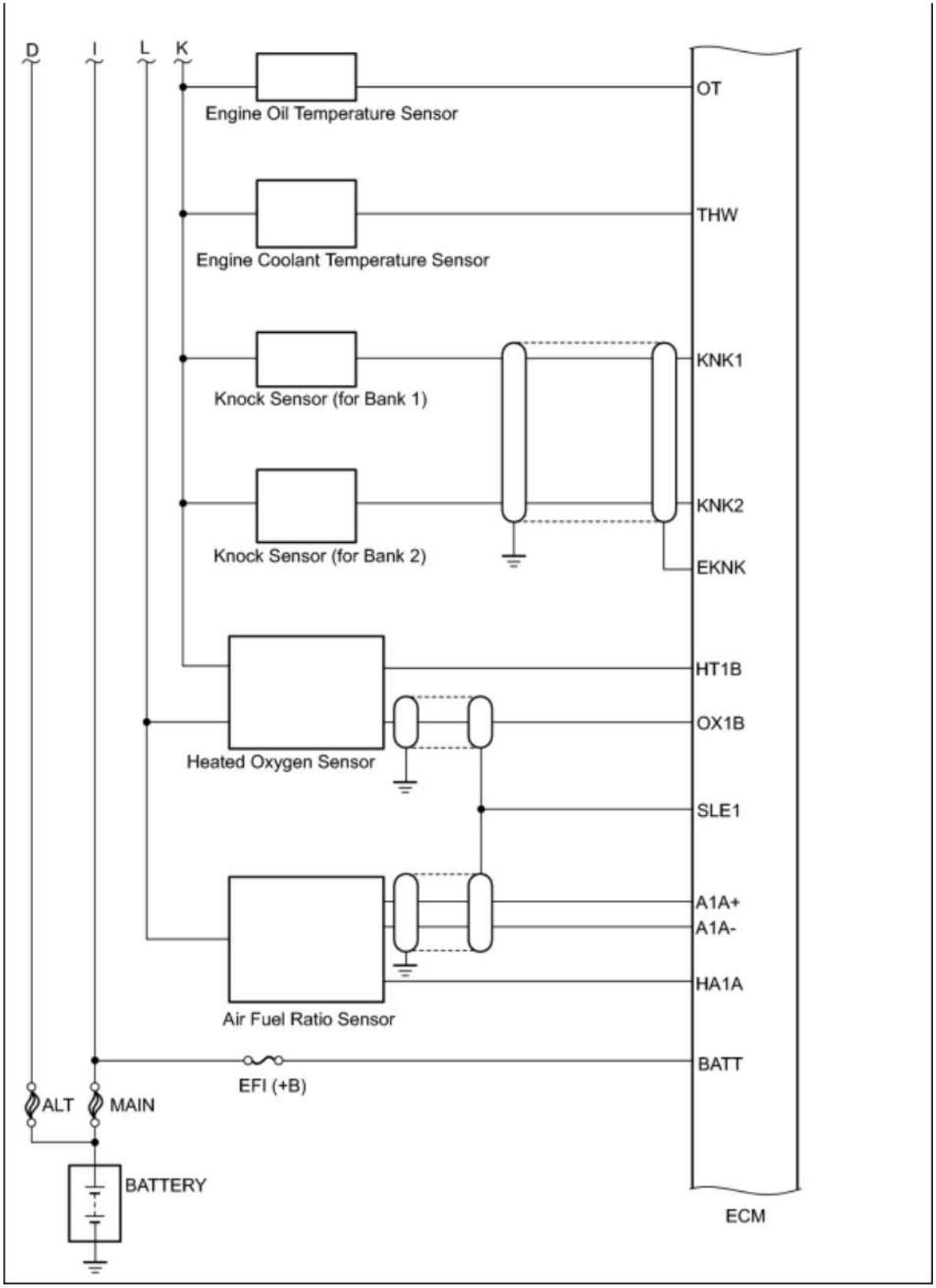
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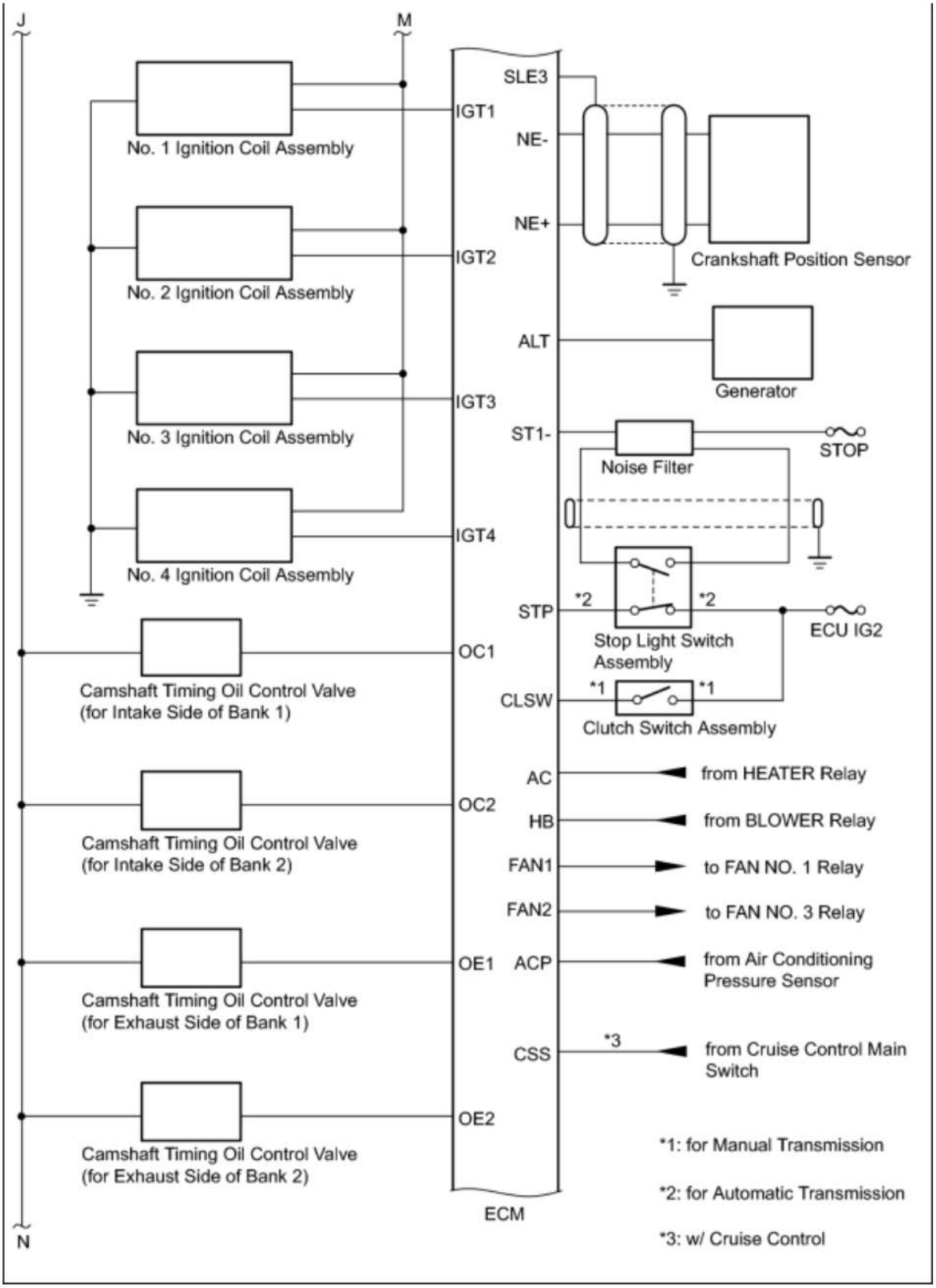
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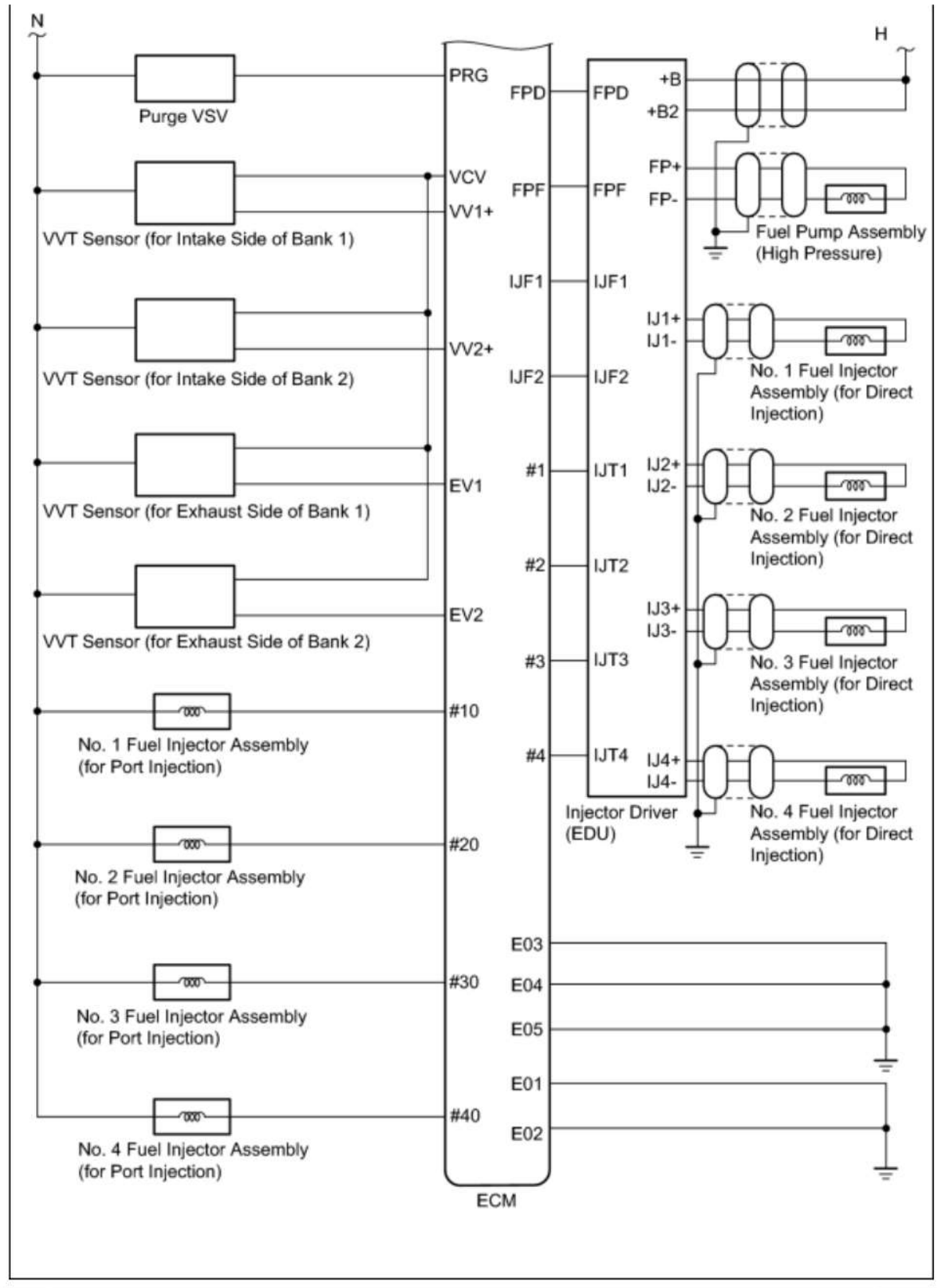
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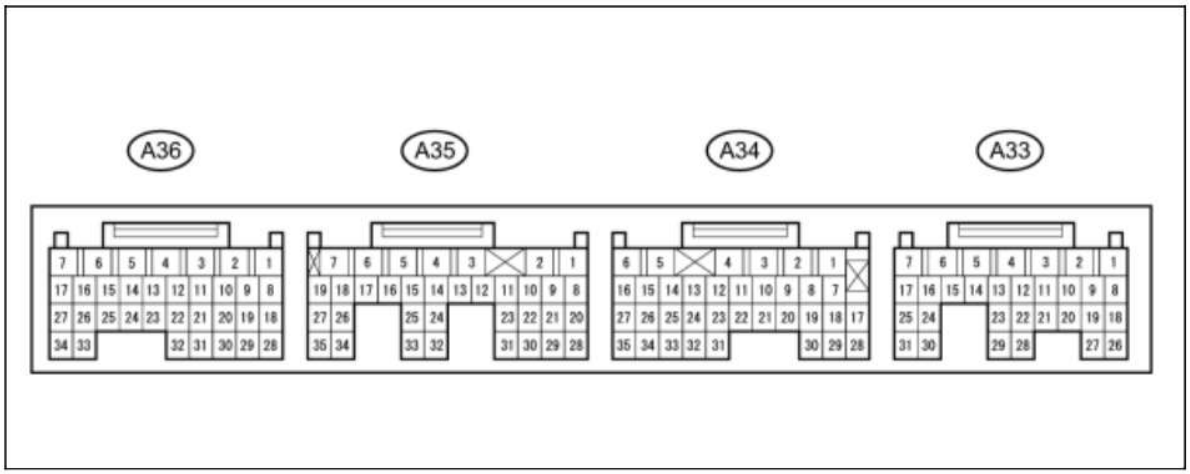
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Last Modified: 3-27-2012	6.4 U	**From:** 201203
Model Year: 2013	**Model:** FR-S	**Doc ID:** RM000000PDH0K9X
Title: FA20 ENGINE CONTROL: SFI SYSTEM: TERMINALS OF ECM (2013 FR-S)		

TERMINALS OF ECM



HINT:

The standard voltage between each pair of the ECM terminals is shown in the table below. The appropriate conditions for checking each pair of the terminals are also indicated. The result of checks should be compared with the standard voltage for that pair of the terminals, and displayed in the "Specified Condition" column. The illustration above can be used as a reference to identify the ECM terminal locations.

TERMINAL NO. (SYMBOL)	WIRING COLOR	TERMINAL DESCRIPTION	CONDITION	SPECIFIED CONDITION
A33-1 (+B2) - A36-4 (E01)	V - B-L	Power source of ECM	Ignition switch ON	12 to 14 V
A33-2 (BATT) - A36-4 (E01)	W - B-L	Battery(for measuring battery voltage and for ECM memory)	Always	10 to 13 V
A33-3 (ST1-) - A36-4 (E01)	BR-B - B-L	Stop light switch	Brake pedal depressed	11 to 14 V
			Brake pedal released	0 to 1 V
A33-7 (STP) - A36-4 (E01)*1	R - B-L	Stop light switch	Brake pedal depressed	0 to 1 V
			Brake pedal released	11 to 14 V
A33-8 (ACP) - A36-4 (E01)	G - B-L	Air conditioning pressure sensor	Ignition switch ON with A/C on	0 to 1 V
			Idling with A/C off	12 to 14 V
A33-12 (THA) - A36-29 (E1)	BR-G - Y-B	Intake air temperature sensor (built into mass air flow meter)	Ignition switch ON	0.3 to 4.6 V
A33-14 (STSW2) -	BR - B-		Ignition switch ON	0 to 1 V

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A36-4 (E01)*3	L	Starter signal	Cranking	6 to 13 V
A33-15 (CLSW) - A36-4 (E01)*2	R-Y - B-L	Clutch switch	Ignition switch ON with clutch pedal depressed	0 to 1 V
			Ignition switch ON with clutch pedal released	10 to 13 V
A33-16 (NSW) - A36-4 (E01)	W-R - B-L*1 G-B - B-L*2	Neutral switch signal	Ignition switch ON, shift lever in P or N*1 Ignition switch ON, shift lever in Neutral*2	0 to 1 V
			Ignition switch ON, shift lever not in P or N*1 Ignition switch ON, shift lever not in Neutral*2	10 to 13 V
A33-17 (STSW2) - A36-4 (E01)	BR - B-L	Starter signal	Ignition switch ON	0 to 1 V
			Cranking	6 to 13 V
A33-18 (CANL) - A36-4 (E01)	B-P - B-L	CAN communication line	Ignition switch ON	Pulse generation (See waveform 1)
A33-19 (CANH) - A36-4 (E01)	O - B-L	CAN communication line	Ignition switch ON	Pulse generation (See waveform 2)
A33-20 (HB) - A36-4 (E01)	G-Y - B-L	BLOWER relay	Ignition switch ON with blower fan switch on	0 to 1 V
			Ignition switch ON with blower fan switch off	10 to 13 V
A33-22 (VG) - A33-29 (E2G)	Y - B-G	Mass air flow meter	Idling with warm engine	0.9 to 4.5 V
A33-27 (IGSW) - A36-4 (E01)	GR - B-L	IG2 relay	Ignition switch ON	10 to 13 V
A34-5 (HA1A) - A36-4 (E01)	V - B-L	Air fuel ratio sensor heater	Idling with cold engine	Pulse generation (See waveform 3)
A34-6 (+B) - A36-4 (E01)	V - B-L	Power source of ECM	Ignition switch ON	12 to 14 V
A34-9 (PR) - A36-29 (E1)	V-B - Y-B	Fuel pressure sensor	Idling with warm engine	1.0 to 1.7 V
A34-11 (IJF1) - A36-4 (E01)	R-Y - B-L	Injector for direct injection confirmation signal	Idling	Pulse generation (See waveform 4)

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A34-13 (FPF) - A36-4 (E01)	R-B - B-L	High pressure side fuel pump (Spill valve)	Idling	Pulse generation (See waveform 5)
A34-14 (EV1+) - A36-4 (E01)	Y-BR - B-L	Variable valve timing (VVT) sensor (Exhaust side (bank 1))	Idling with warm engine	Pulse generation (See waveform 6)
A34-15(VV2+) - A36-4 (E01)	Y-V - B-L	Variable valve timing (VVT) sensor (Intake side (bank 2))	Idling with warm engine	Pulse generation (See waveform 7)
A34-16 (NE+) - A34-27 (NE-)	B - W	Crank position sensor	Idling with warm engine	Pulse generation (See waveform 6 or 7)
A34-17 (KNK2) - A36-29 (E1)	G - Y-B	Knock sensor	Ignition switch ON	Approximately 2.5 V
A34-18 (A1A-) - A36-4 (E01)	O - B-L	Air fuel ratio sensor	Ignition switch ON	2.4 to 2.7 V
A34-19 (A1A+) - A36-4 (E01)	W - B-L	Air fuel ratio sensor	Ignition switch ON	2.8 to 3.2 V
A34-20 (PIM) - A36-29 (E1)	BR-B - Y-B	Manifold absolute pressure sensor	Idling with warm engine	1.1 to 2.0 V
A34-21 (OX1B) - A36-4 (E01)	L-W - B-L	Heated oxygen sensor	Idling with warm engine	0 to 0.9 V
A34-25 (EV2+) - A36-4 (E01)	BR-Y - B-L	Variable valve timing (VVT) sensor (Exhaust side (bank 2))	Idling with warm engine	Pulse generation (See waveform 6)
A34-26 (VV1+) - A36-4 (E01)	Y-P - B-L	Variable valve timing (VVT) sensor (Intake side (bank 1))	Idling with warm engine	Pulse generation (See waveform 7)
A34-28 (KNK1) - A36-29 (E1)	G - Y-B	Knock sensor	Ignition switch ON	Approximately 2.5 V
A34-31 (IJF2) - A36-4 (E01)	R-G - B-L	Injector for direct injection confirmation signal	Idling	Pulse generation (See waveform 4)
A34-32 (FPD)	R-W -	High pressure side fuel pump		Pulse generation

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- A36-4 (E01)	B-L	(Spill valve)	Idling	(See waveform 5)
A34-34 (VCV) - A36-4 (E01)	G-B - B-L	Power source of camshaft timing oil control valve (OCV)	Ignition switch ON	4.5 to 5.5 V
A35-1 (VPMP) - A36-4 (E01)	D-L - B-L	Vent valve (built into canister pump module)	Ignition switch ON	10 to 13 V
A35-5 (IREL) - A36-4 (E01)	D-W - B-L	INJ relay	Idling	10 to 13 V
			Ignition switch ON	0 to 1 V
A35-7 (+BM) - A36-4 (E01)	R-L - B-L	ETCS relay	Ignition switch ON	10 to 13 V
A35-8 (MPMP) - A36-4 (E01)	O-L - B-L	Leak detection pump (built into canister pump module))	Ignition switch ON	10 to 13 V
			Leak detection pump ON	0 to 1 V
A35-10 (DI) - A36-4 (E01)	W-B - B-L	Fuel pump control (for fuel pump control malfunctioning detection)	Ignition switch ON	10 to 12 V
A35-11 (FAN1) - A36-4 (E01)	R-W - B-L	FAN NO. 3 relay	Ignition switch ON Cooling fan not operated	10 to 13 V
			Idling with A/C on or High engine coolant temperature Cooling fan operated	0 to 0.5 V
A35-12 (FAN2) - A36-4 (E01)	B-R - B-L	FAN NO. 2 relay	Ignition switch ON	10 to 13 V
			Idling with A/C on or High engine coolant temperature Cooling fan operated	0 to 0.5 V
A35-13 (SSHUT) - A36-4 (E01)	LG - B-L	EFI MAIN1 relay	Ignition switch ON	0 to 1 V
A35-15 (TACH) - A36-4 (E01)*3	GR-R - B-L	Engine speed	Engine speed maintained at 1500 rpm	Pulse generation (See waveform 8)
A35-17 (MCR) - A36-4 (E01)	L-R - B-L	ETCS relay	Ignition switch ON	0 to 1 V
A35-19(FPC) - A36-4 (E01)	SB - B-L	Fuel pump control	Ignition switch ON	Pulse generation (See waveform 9)
A35-20 (PPMP) - A36-4 (E01)	O-B - B-L	Canister pressure sensor (built into canister pump module)	Ignition switch ON	1.5 to 4.0 V
A35-21 (VCPA) - A36-4 (E01)	L-Y - B-L	Power source of accelerator pedal position sensor	Ignition switch ON	4.5 to 5.5 V
A35-22 (VCP2) - A36-	G-B -	Power source of accelerator	Ignition switch ON	4.5 to 5.5 V

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4 (E01)	B-L	pedal position sensor		
A35-23(VPA) - A35-29 (EPA)	W - L	Accelerator pedal position sensor (for engine control)	Ignition switch ON, Accelerator pedal fully released	Approximately 0.7 V
			Ignition switch ON, Accelerator pedal fully depressed	Approximately 3.1 V
A35-26 (STA) - A36-4 (E01)	B-W - B-L	ST relay	Ignition switch ON	10 to 13 V
			Cranking	0 to 1 V
A35-31 (VPA2) - A35-30 (EPA2)	O - Y-B	Accelerator pedal position sensor (for sensor malfunctioning detection)	Ignition switch ON, Accelerator pedal fully released	Approximately 0.7 V
			Ignition switch ON, Accelerator pedal fully depressed	Approximately 3.1 V
A35-35 (AC) - A36-4 (E01)	L-O - B-L	HEATER relay	Idling with A/C on	0 to 0.5 V
			Idling with A/C off	12 to 14 V
A36-1 (M-) - A36-4 (E01)	SB - B-L	Throttle actuator	Idling with warm engine	Pulse generation (See waveform 10)
A36-2 (M+) - A36-4 (E01)	G-Y - B-L	Throttle actuator	Idling with warm engine	Pulse generation (See waveform 10)
A36-5 (OE2) - A36-4 (E01)	BR-L - B-L	Camshaft timing oil control valve (OCV) (Exhaust side (bank 2))	Ignition switch ON	11 to 14 V
			Idling with warm engine	Pulse generation (See waveform 11)
A36-6 (HT1B) - A36-4 (E01)	R-B - B-L	Heated oxygen sensor heater	Ignition switch ON	11 to 14 V
			Idling with cold engine	Pulse generation (See waveform 12)
A36-7 (OE1) - A36-4 (E01)	R-W - B-L	Camshaft timing oil control valve (OCV) (Exhaust side (bank 1))	Ignition switch ON	11 to 14 V
			Idling with warm engine	Pulse generation (See waveform 11)
A36-8 (IGT4) - A36-4 (E01)	W-L - B-L	Ignition coil (ignition signal)	Idling with warm engine	Pulse generation (See waveform 13)
A36-10 (IGT2) - A36-4 (E01)	Y-R - B-L	Ignition coil (ignition signal)	Idling with warm engine	Pulse generation (See waveform 13)

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A36-11 (PRG) - A36-4 (E01)	R-G - B-L	Purge valve	One of the following conditions is met: • Ignition switch ON • Idling with warm engine, under purge control	Pulse generation (See waveform 14)
A36-12 (#10) - A36-4 (E01)	P - B-L	Injector for port injection	Idling with warm engine	Pulse generation (See waveform 15)
A36-13 (#40) - A36-4 (E01)	P-G - B-L	Injector for port injection	Idling with warm engine	Pulse generation (See waveform 15)
A36-14 (#1) - A36-4 (E01)	W - B-L	Injector for direct injection	Idling with warm engine	Pulse generation (See waveform 4)
A36-16 (OC2) - A36-4 (E01)	GR - B-L	Variable valve timing (VVT) sensor (Intake side (bank 2))	Ignition switch ON	11 to 14 V
			Idling with warm engine	Pulse generation (See waveform 11)
A36-17 (OC1) - A36-4 (E01)	G-W - B-L	Variable valve timing (VVT) sensor (Intake side (bank 1))	Ignition switch ON	11 to 14 V
			Idling with warm engine	Pulse generation (See waveform 11)
A36-18 (VTA1) - A36-29 (E1)	LG - Y-B	Throttle position sensor (for engine control)	Ignition switch ON, Accelerator pedal fully released	Approximately 0.6 V
			Ignition switch ON, Accelerator pedal fully depressed	Approximately 4.2 V
A36-19 (VC) - A36-29 (E1)	R - Y-B	Power source for sensor (specific voltage)	Ignition switch ON	4.5 to 5.5 V
A36-20 (OT) - A36-29 (E1)	BR - Y-B	Oil temperature sensor	Idling	0.5 to 1.4 V
A36-21 (IGT1) - A36-4 (E01)	W-R - B-L	Ignition coil (ignition signal)	Idling with warm engine	Pulse generation (See waveform 13)
A36-22 (#20) - A36-4 (E01)	P-L - B-L	Injector for port injection	Idling with warm engine	Pulse generation (See waveform 15)
A36-23 (#4) -	LG-R -	Injector for direct injection	Idling with warm engine	Pulse generation

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A36-4 (E01)	B-L			(See waveform 4)
A36-24 (#3) - A36-4 (E01)	LG-W - B-L	Injector for direct injection	Idling with warm engine	Pulse generation (See waveform 4)
A36-25 (#2) - A36-4 (E01)	LG-B - B-L	Injector for direct injection	Idling with warm engine	Pulse generation (See waveform 4)
A36-28 (VTA2) - A36-29 (E1)	R-Y - Y-B	Throttle position sensor (for sensor malfunction detection)	Ignition switch ON, Accelerator pedal fully released	Approximately 1.5 V
			Ignition switch ON, Accelerator pedal fully depressed	Approximately 4.3 V
A36-30 (THW) - A36-29 (E1)	BR-W - Y-B	Engine coolant temperature sensor	Idling, Engine coolant temperature 60 to 120°C (176 to 248°F)	0.8 to 1.8 V
A36-31 (IGT3) - A36-4 (E01)	W-G - B-L	Ignition coil (ignition signal)	Idling with warm engine	Pulse generation (See waveform 13)
A36-32 (#30) - A36-4 (E01)	P-B - B-L	Injector for port injection	Idling with warm engine	Pulse generation (See waveform 15)
A33-4 (EC) - Body ground	B-L - Body ground	Ground	Always	Below 1 Ω
A33-28 (SLE2) - Body ground	-	Shield	Always	Below 1 Ω
A34-1 (E03) - Body ground	B-R - Body ground	Ground	Always	Below 1 Ω
A34-2 (E04) - Body ground	B-W - Body ground	Ground	Always	Below 1 Ω
A34-3 (E05) - Body ground	B-W - Body ground	Ground	Always	Below 1 Ω
A34-29 (EKNK) - Body ground	-	Shield	Always	Below 1 Ω
A34-30 (SLE1) - Body ground	-	Shield	Always	Below 1 Ω
A34-35				

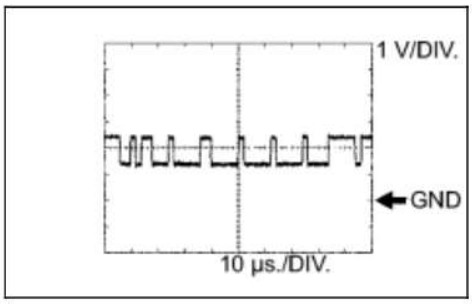
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(SLE3) - Body ground	-	Shield	Always	Below 1 Ω
A35-29 (EPA) - A36-4 (E01)	L - B-L	Ground	Ignition switch ON	0 to 1 V
A35-30 (EPA2) - A36-4 (E01)	Y-B - B-L	Ground	Ignition switch ON	0 to 1 V
A36-3 (E02) - Body ground	B-Y - Body ground	Ground	Always	Below 1 Ω
A36-4 (E01) - Body ground	B-L - Body ground	Ground	Always	Below 1 Ω
A36-29 (E1) - Body ground	Y-B - Body ground	Ground	Ignition switch ON	0 to 1 V

*1: for Automatic Transmission
*2: for Manual Transmission

1. WAVEFORM 1

CAN Communication Signal



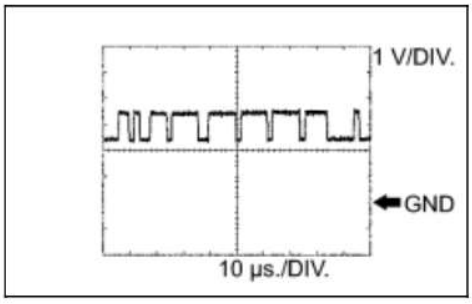
ECM Terminal Name	Between CANL and E01
Tester Range	1 V/DIV., 10 µs./DIV.
Condition	Ignition switch ON

HINT:

The waveform varies depending on the CAN communication signal.

2. WAVEFORM 2

CAN Communication Signal



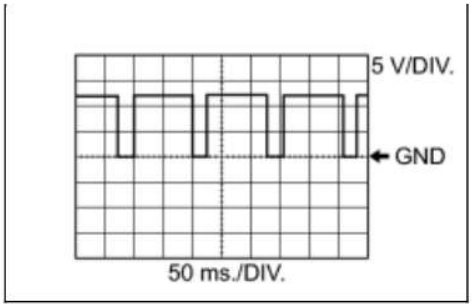
ECM Terminal Name	Between CANH and E01
Tester Range	1 V/DIV., 10 µs./DIV.
Condition	Ignition switch ON

HINT:

The waveform varies depending on the CAN communication signal.

3. WAVEFORM 3

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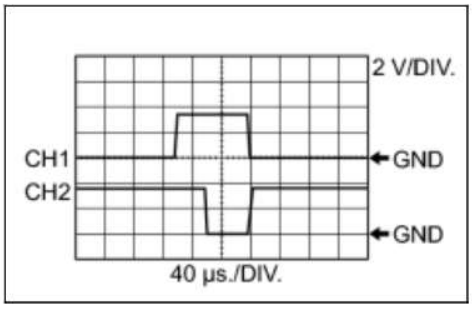


Air Fuel Ratio Sensor Heater

ECM Terminal Name	Between HA1A and E01
Tester Range	5 V/DIV., 50 ms./DIV.
Condition	Idling with cold engine

4. WAVEFORM 4

Injector for Direct Injection No. 1 (to No. 4) Injection Signal



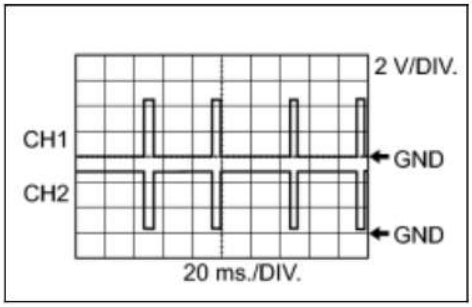
ECM Terminal Name	CH1: Between #1 (to #4) and E01 CH2: Between IJF1or IJF2 and E01
Tester Range	2 V/DIV., 40 µs./DIV.
Condition	Idling with warm engine

HINT:

The wavelength becomes shorter as the engine speed increases.

5. WAVEFORM 5

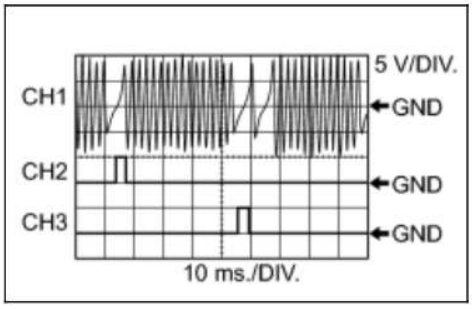
Fuel Pump for High Pressure (Spill Valve)



ECM Terminal Name	CH1: Between FPD and E01 CH2: Between FPF and E01
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling with warm engine

6. WAVEFORM 6

Crankshaft Position Sensor and VVT Sensor for Exhaust Camshaft



ECM Terminal Name	CH1: Between NE+ and NE- CH2: Between EV1+ and E01 CH3: Between EV2+ and E01
Tester Range	5 V/DIV., 10 ms./DIV.
Condition	Idling with warm engine

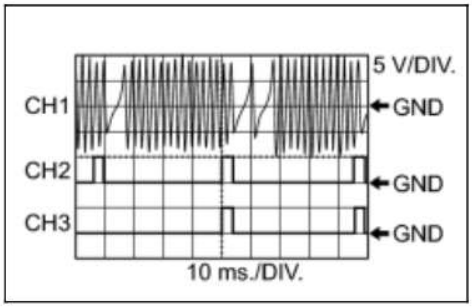
HINT:

The wavelength becomes shorter as the engine speed increases.

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7. WAVEFORM 7

Crankshaft Position Sensor and VVT Sensor for Intake Camshaft



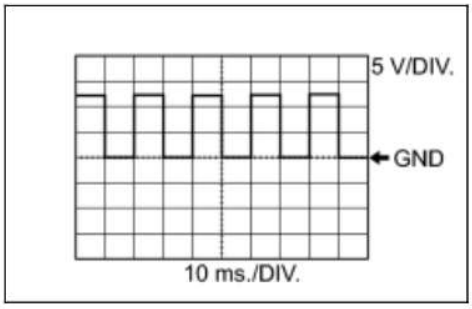
ECM Terminal Name	CH1: Between NE+ and NE- CH2: Between VV1+ and E01 CH3: Between VV2+ and E01
Tester Range	5 V/DIV., 10 ms./DIV.
Condition	Idling with warm engine

HINT:

The wavelength becomes shorter as the engine speed increases.

8. WAVEFORM 8

Engine Speed Signal



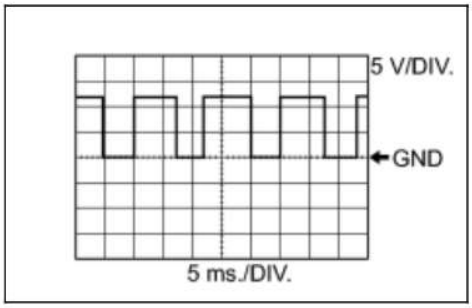
ECM Terminal Name	Between TACH and E01
Tester Range	5 V/DIV., 10 ms./DIV.
Condition	Engine speed maintained at 1500 rpm

HINT:

The wavelength becomes shorter as the vehicle speed increases.

9. WAVEFORM 9

Fuel Pump Control



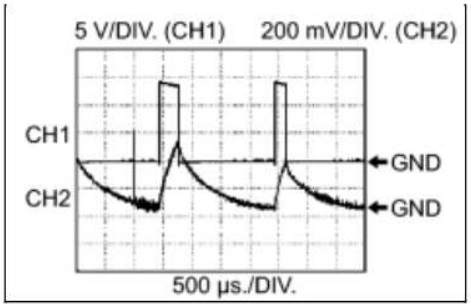
ECM Terminal Name	Between FPC and E01
Tester Range	5 V/DIV., 5 ms./DIV.
Condition	Ignition switch ON

10. WAVEFORM 10

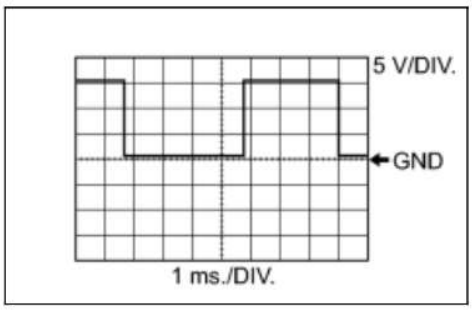
Throttle Actuator

ECM Terminal Name	CH1: Between M+ and E01 CH1: Between M- and E01
Tester Range	CH1: 5 V/DIV., 500 µs./DIV. CH2: 200 mV/DIV., 500 µs./DIV.

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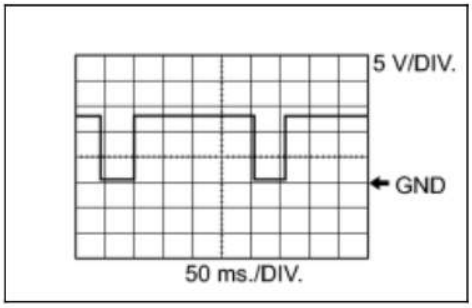
Condition	Idling with warm engine



11. WAVEFORM 11

Camshaft Timing Oil Control Valve (OCV)

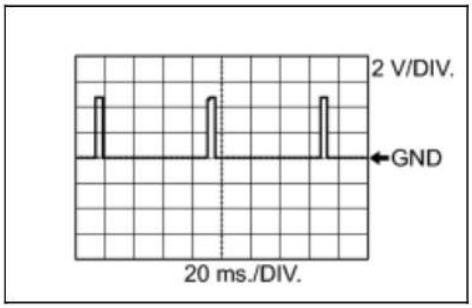
ECM Terminal Name	Between OC1, OC2, OE1 or OE2 and E01
Tester Range	5 V/DIV., 1 ms./DIV.
Condition	Idling with warm engine



12. WAVEFORM 12

Heated Oxygen Sensor

ECM Terminal Name	Between HT1B and E01
Tester Range	5 V/DIV., 50 ms./DIV.
Condition	Idling with cold engine



13. WAVEFORM 13

Ignition Coil (Ignition Signal)

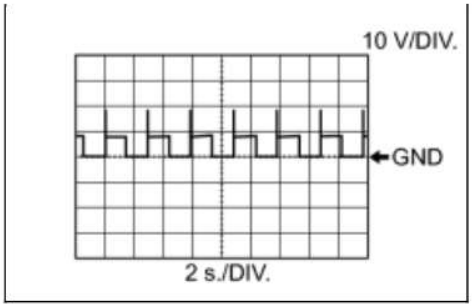
ECM Terminal Name	Between IGT (1 to 4) and E01
Tester Range	2 V/DIV., 20 ms./DIV.
Condition	Idling with warm engine

14. WAVEFORM 14

Purge Valve

ECM Terminal Name	Between PRG and E01
Tester Range	10 V/DIV., 2 s./DIV.
	One of the following conditions is met:

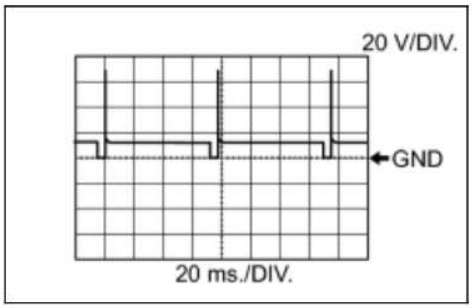
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Condition	• Ignition switch ON • Idling with warm engine, under purge control

15. WAVEFORM 15

Injector for Port Injection No. 1 (to No. 4) Injection Signal



ECM Terminal Name	Between # (10 to 40) and E01
Tester Range	20 V/DIV., 20 ms./DIV.
Condition	Idling with warm engine

HINT:

The wavelength becomes shorter as the engine speed increases.

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Last Modified: 4-14-2014	6.6 C	Doc ID: RM0000020H3028X
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 - 05/2013]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: U0073,U0101,U0122,U0140,U0155,U0402,U0416,U0423; Control Module Communication Bus "A" Off; 2013 MY FR-S [03/2012 - 05/2013]		

DTC	U0073	Control Module Communication Bus "A" Off

DTC	U0101	Lost Communication with TCM

DTC	U0122	Lost Communication with Vehicle Dynamics Control Module

DTC	U0140	Lost Communication with Body Control Module

DTC	U0155	Lost Communication with Instrument Panel Cluster (IPC) Control Module

DTC	U0402	Invalid Data Received from TCM

DTC	U0416	Invalid Data Received from Vehicle Dynamics Control Module

DTC	U0423	Invalid Data Received from Instrument Panel Cluster Control Module

DESCRIPTION

Refer to CAN communication system for system description INFO .

DTC NO.	DTC DETECTION CONDITIONS	TROUBLE AREAS
U0073	Bus off state for 0.436 seconds or more (1 trip detection logic)	• Wire harness (CANL and CANH circuits) • ECM
U0101	No communication between ECM and TCM for 0.5 seconds or more	• Wire harness (CANL and CANH circuits) • ECM

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	(1 trip detection logic)	• TCM
U0122	No communication between ECM and skid control ECU for 0.5 seconds or more (1 trip detection logic)	• Wire harness (CANL and CANH circuits) • ECM • Skid control ECU (Brake actuator assembly)
U0155	No communication between ECM and combination meter assembly for 0.5 seconds or more (1 trip detection logic)	• Wire harness (CANL and CANH circuits) • ECM • Combination meter assembly
U0402	Invalid data received from TCM for 2 seconds or more (1 trip detection logic)	• Wire harness (CANL and CANH circuits) • ECM • TCM
U0416	Invalid data received from skid control ECU for 2 seconds or more (1 trip detection logic)	• Wire harness (CANL and CANH circuits) • ECM • Skid control ECU (Brake actuator assembly)
U0423	Invalid data received from combination meter assembly for 2 seconds or more (1 trip detection logic)	• Wire harness (CANL and CANH circuits) • ECM • Combination meter assembly

MONITOR DESCRIPTION

The ECM, TCM, skid control ECU (brake actuator assembly) and combination meter assembly communicate with each other via the CAN communication line. If there is a problem in this communication, the ECM stores the DTC.

MONITOR STRATEGY

Related DTCs	U0073: Control Module Communication Bus Off U0101: Lost Communication with TCM U0122: Lost Communication with Vehicle Stability Control Module U0155: Lost Communication with Instrument Panel Cluster Control Module (Combination Meter) U0402: Invalid Data Received from TCM U0416: Invalid Data Received from Vehicle Stability Control Module

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	U0423: Invalid Data Received from Instrument Panel Cluster Control Module
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	TCM Skid control ECU (Brake actuator assembly) Combination meter assembly
Frequency of Operation	Continuous
Duration	0.436 seconds: U0073 0.5 seconds: U0101, U0122 and U0155 2 seconds: U0402, U0416 and U0423
MIL Operation	1 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All

Battery voltage	10.9 V or more
Starter switch	Off
Engine	Running

U0073

Monitor runs whenever following DTCs are not present	U0101, U0122, U0155, U0402, U0416, U0423 (CAN system (ECM))

U0101

Monitor runs whenever following DTCs are not present	U0073, U0122, U0155, U0402, U0416, U0423 (CAN system (ECM))

U0122

Monitor runs whenever following DTCs are not present	U0073, U0101, U0155, U0402, U0416, U0423 (CAN system (ECM))

U0155

Monitor runs whenever following DTCs are not present	U0073, U0101, U0122, U0402, U0416, U0423 (CAN system (ECM))

U0402

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Monitor runs whenever following DTCs are not present	U0073, U0101, U0122, U0155, U0416, U0423 (CAN system (ECM))

U0416

Monitor runs whenever following DTCs are not present	U0073, U0101, U0122, U0155, U0402, U0423 (CAN system (ECM))

U0423

Monitor runs whenever following DTCs are not present	U0073, U0101, U0122, U0155, U0402, U0416 (CAN system (ECM))

TYPICAL MALFUNCTION THRESHOLDS

U0073

State of Control module communication bus "A" OFF	On

U0101

State of lost communication with TCM	On

U0122

State of lost communication with skid control ECU	On

U0155

State of lost communication with combination meter assembly	On

U0402

Communication counter between ECM and TCM	Not count up

U0416

Communication counter between ECM and skid control ECU	Not count up

U0423

Communication counter between ECM and combination meter assembly	Not count up

INSPECTION PROCEDURE

Go to CAN communication system for troubleshooting INFO .

HINT:

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- When DTCs indicating a CAN communication system malfunction are output, repair the CAN communication system before repairing each corresponding sensor.
- Read freeze frame data using the Techstream. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If the CAN communication malfunctions, there is no data output from the ECM. In this case, some of the freeze frame data are not correct and not identical with the ECM data, but the ECM data are correct.

PROCEDURE

1.	CHECK ANY OTHER DTCS OUTPUT

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Enter the following menus: Powertrain / Engine / Trouble Codes.

(e) Read the DTCs.

RESULT	PROCEED TO
DTC U0073, U0101, U0122, U0155, U0402, U0416 or U0423 is output	A
DTC U0073, U0101, U0122, U0155, U0402, U0416 or U0423 and other DTCs are output	B

B ▶ GO TO DTC CHART

A ▶ GO TO CAN COMMUNICATION SYSTEM

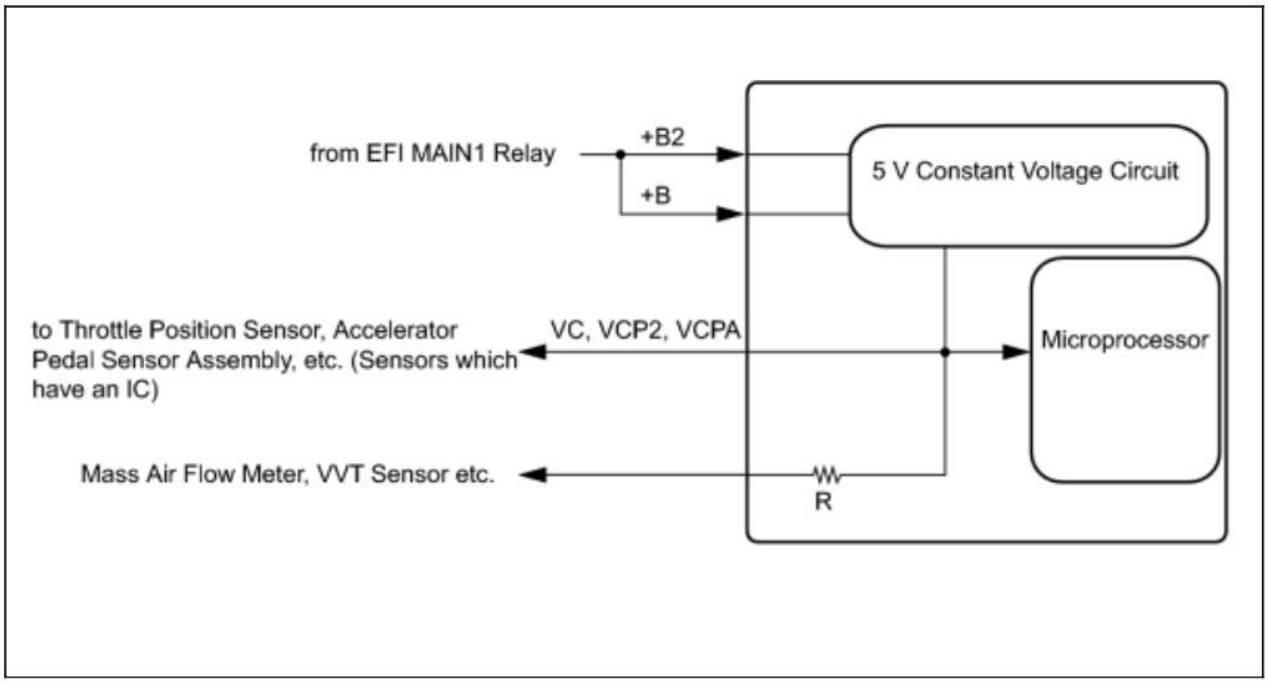
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Last Modified: 4-14-2014	6.6 J	Doc ID: RM000001D6V0LTX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: SFI SYSTEM: VC Output Circuit; 2013 MY FR-S [03/2012 -]		

VC Output Circuit

DESCRIPTION

The ECM constantly generates 5 V power from the battery voltages supplied to the +B terminal and +B2 terminal to operate the microprocessor. The ECM also provides this power to the sensors through the VC output circuit.



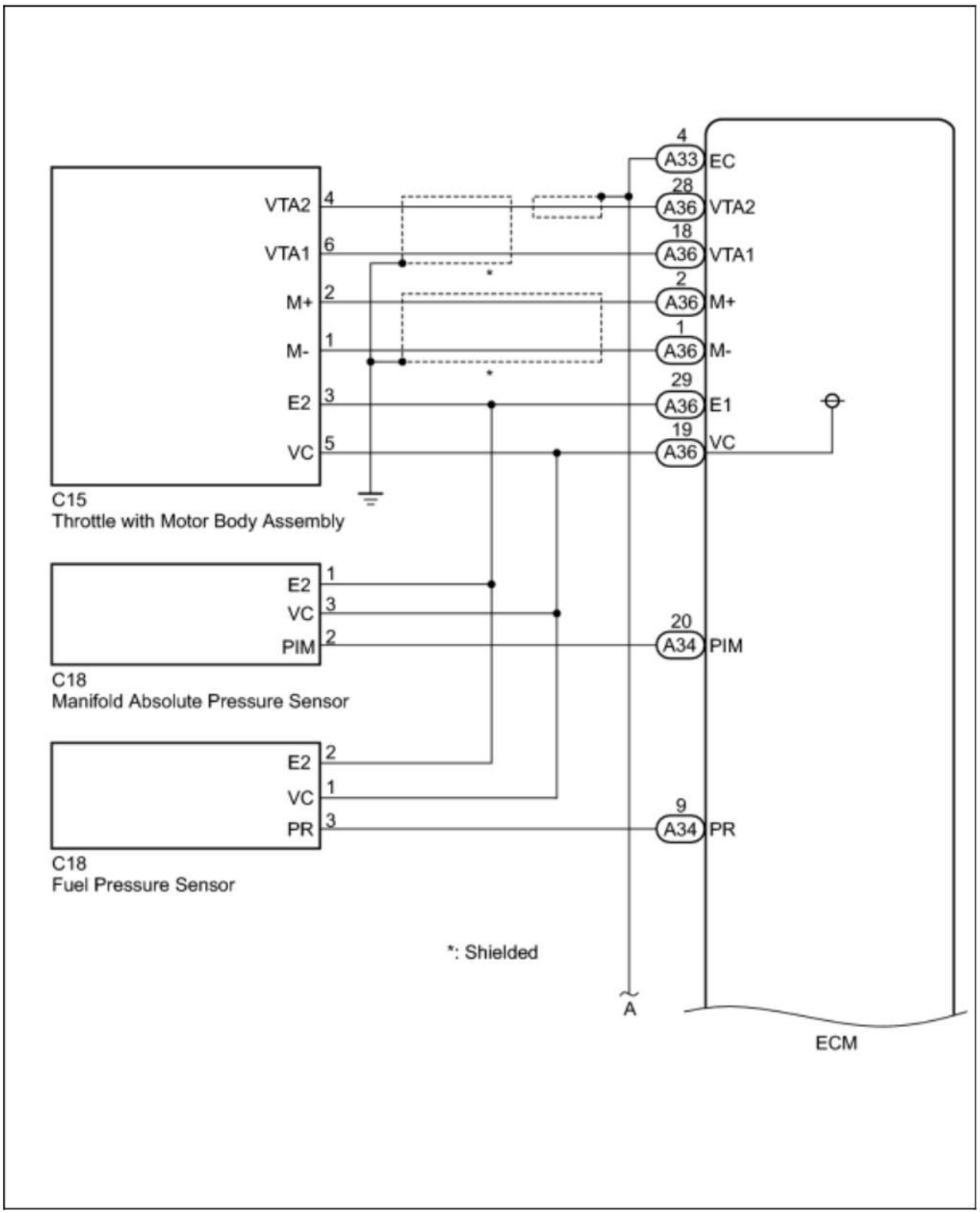
When the VC circuit is short-circuited, the microprocessor in the ECM and sensors that are supplied with power through the VC circuit are deactivated because the power is not supplied from the VC circuit. Under this condition, the system does not start up and the MIL does not illuminate even if the system malfunctions.

HINT:

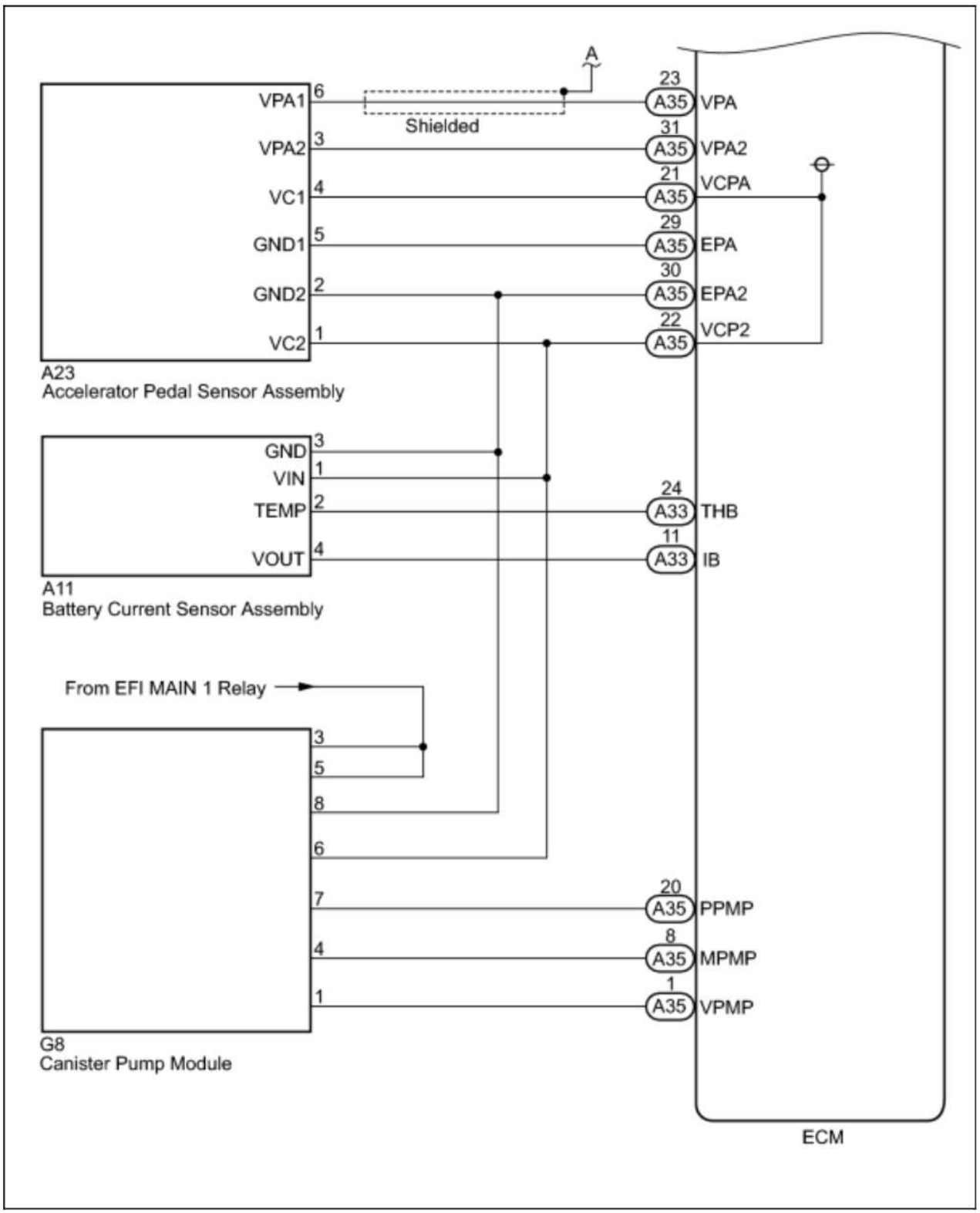
Under normal conditions, the MIL is illuminated when the ignition switch is turned to ON. The MIL goes off when the engine is started.

WIRING DIAGRAM

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INSPECTION PROCEDURE

PROCEDURE

1.	CHECK MIL CONDITION

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(a) Check that the Malfunction Indicator Lamp (MIL) lights up when turning the ignition switch to ON.

OK:

MIL lights up.

Result

RESULT	PROCEED TO
NG	A
OK	B

B ▶ PROCEED TO NEXT SUSPECTED AREA SHOWN IN PROBLEM SYMPTOMS TABLE

A ▼

2.	CHECK CONNECTION BETWEEN TECHSTREAM AND ECM

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON.

(c) Turn the Techstream on.

(d) Check for communication between the Techstream and ECM.

Result

RESULT	PROCEED TO
Communication is not possible	A
Communication is possible	B

B ▶ GO TO MIL CIRCUIT

A ▼

3.	CHECK MIL (THROTTLE POSITION SENSOR)

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(a) Disconnect the throttle with motor body assembly connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result

RESULT	PROCEED TO
MIL does not illuminate	A
MIL illuminates	B

B ▶ REPLACE THROTTLE WITH MOTOR BODY ASSEMBLY

A ▼

4.	CHECK MIL (MANIFOLD ABSOLUTE PRESSURE SENSOR)

(a) Disconnect the manifold absolute pressure sensor connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result

RESULT	PROCEED TO
MIL does not illuminate	A
MIL illuminates	B

B ▶ REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

A ▼

5.	CHECK MIL (FUEL PRESSURE SENSOR)

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(a) Disconnect the fuel pressure sensor connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result

RESULT	PROCEED TO
MIL does not illuminate	A
MIL illuminates	B

B ▶ REPLACE FUEL PRESSURE SENSOR

A ▼

6.	CHECK MIL (ACCELERATOR PEDAL SENSOR ASSEMBLY)

(a) Disconnect the accelerator pedal sensor assembly connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result

RESULT	PROCEED TO
MIL does not illuminate	A
MIL illuminates	B

B ▶ REPLACE ACCELERATOR PEDAL SENSOR ASSEMBLY

A ▼

7.	CHECK MIL (BATTERY CURRENT SENSOR ASSEMBLY)

(a) Disconnect the battery current sensor assembly connector.

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(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result

RESULT	PROCEED TO
MIL does not illuminate	A
MIL illuminates	B

B ▶ REPLACE BATTERY CURRENT SENSOR ASSEMBLY

A ▼

8.	CHECK MIL (CANISTER PUMP MODULE)

(a) Disconnect the canister pump module connector.

(b) Turn the ignition switch to ON.

(c) Check the MIL.

Result

RESULT	PROCEED TO
MIL does not illuminate	A
MIL illuminates	B

B ▶ REPLACE CANISTER PUMP MODULE

A ▼

9.	CHECK HARNESS AND CONNECTOR (EACH SENSOR - ECM)

(a) Disconnect the throttle with motor body assembly connector.

(b) Disconnect the manifold absolute pressure sensor connector.

(c) Disconnect the fuel pressure sensor connector.

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(d) Disconnect the accelerator pedal sensor assembly connector.

(e) Disconnect the battery current sensor assembly connector.

(f) Disconnect the canister pump module connector.

(g) Disconnect the ECM connectors.

(h) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
A36-19 (VC) - Body ground	Always	10 kΩ or higher
A35-22 (VCP2) - Body ground	Always	10 kΩ or higher
A35-21 (VCPA) - Body ground	Always	10 kΩ or higher

NG ▶ REPAIR OR REPLACE HARNESS OR CONNECTOR

OK ▶ REPLACE ECM

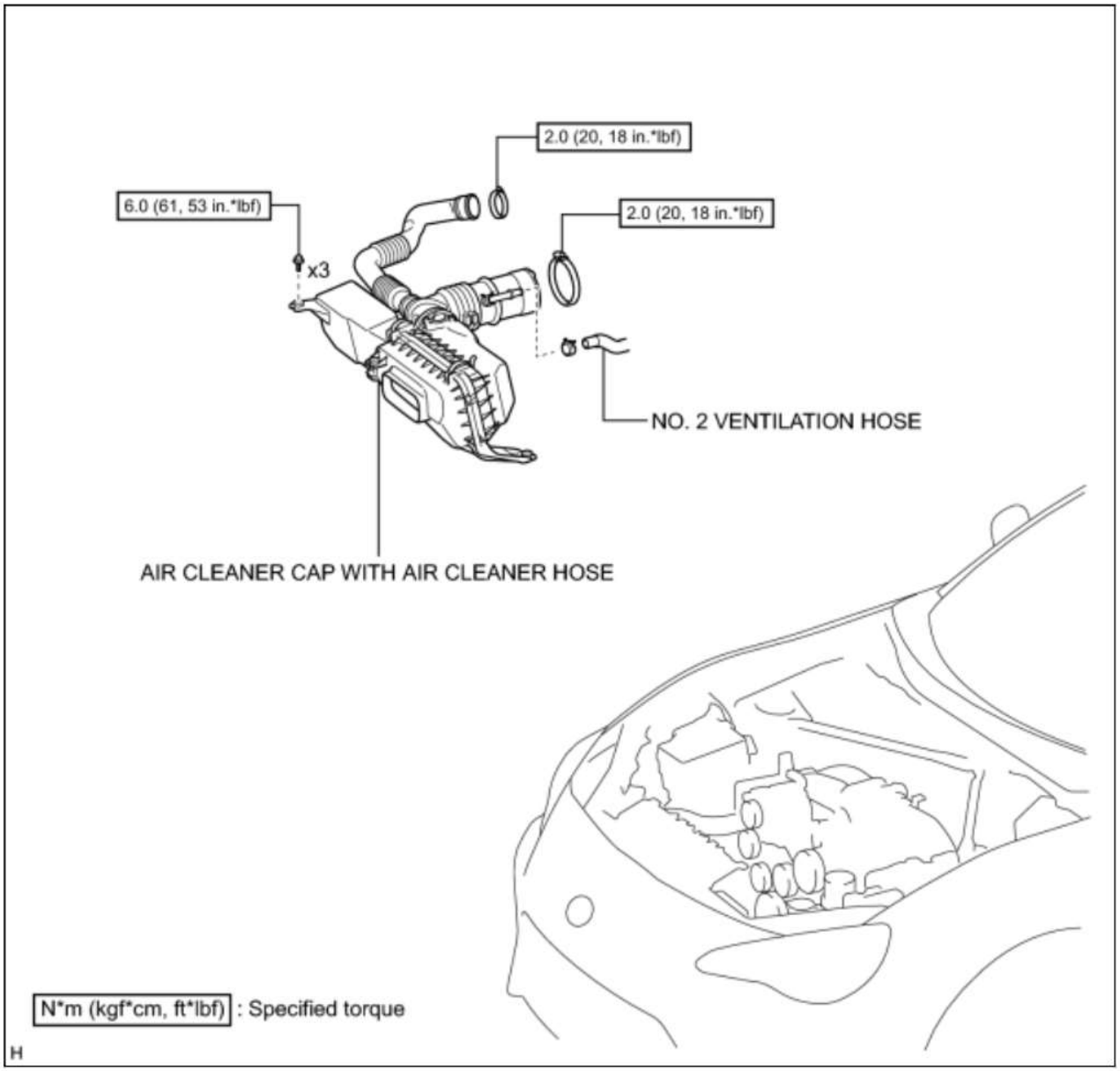
TOYOTA

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Last Modified: 4-14-2014	6.6 K	Doc ID: RM000001BQK00HX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: THROTTLE BODY: COMPONENTS; 2013 MY FR-S [03/2012 -]		

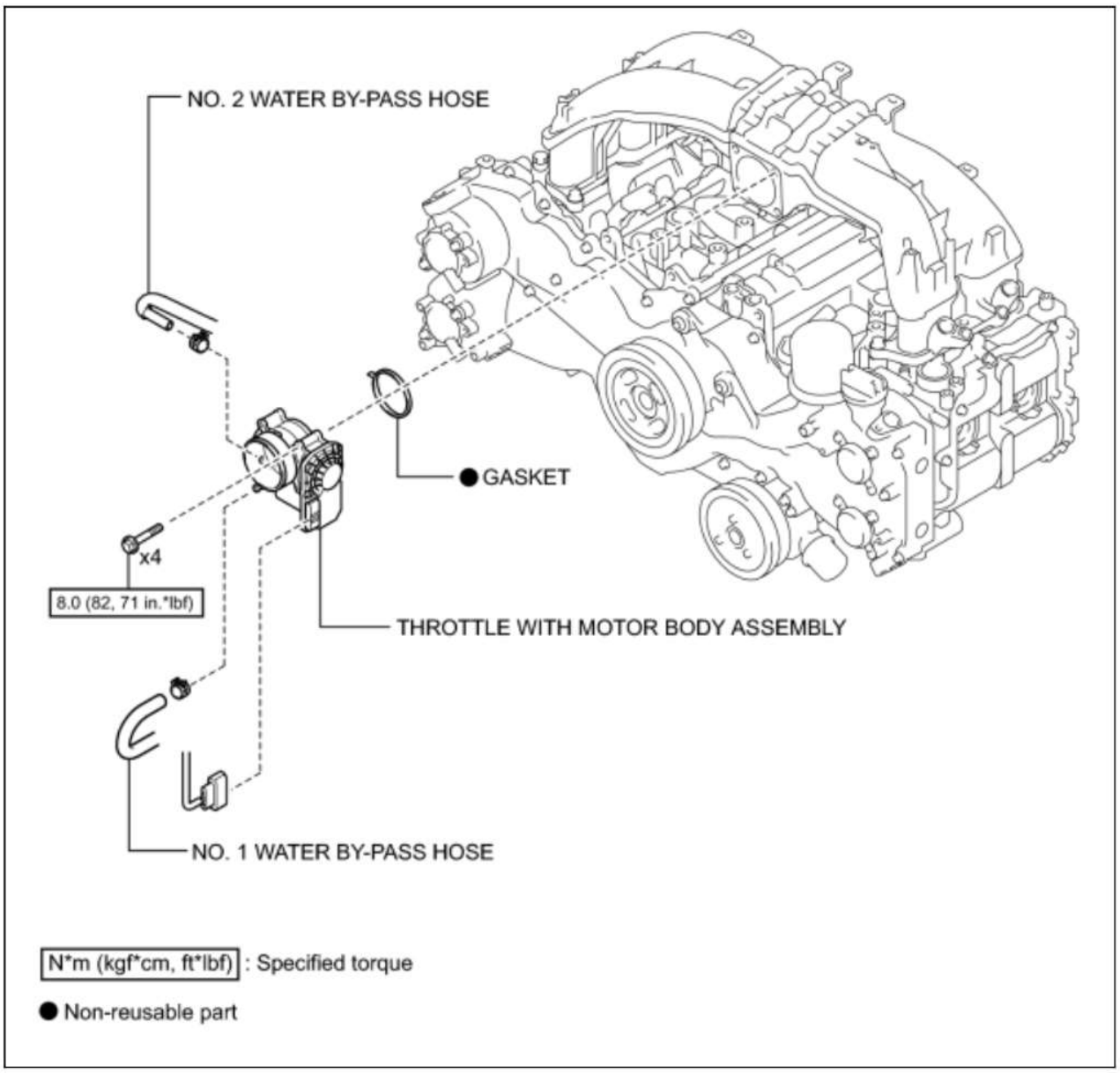
COMPONENTS

ILLUSTRATION



ILLUSTRATION

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TOYOTA

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Last Modified: 4-14-2014	6.6 G	Doc ID: RM000000MTB00SX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: THROTTLE BODY: INSPECTION; 2013 MY FR-S [03/2012 -]		

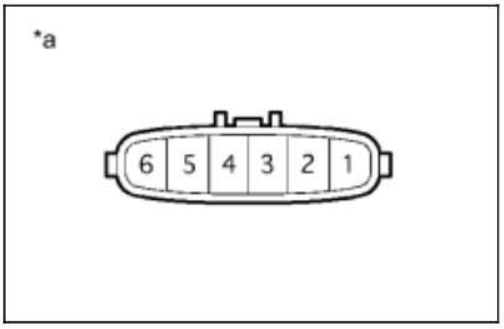
INSPECTION

1. INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY

(a) Measure the resistance according to the value(s) in the table below.

Text in Illustration

*a	Component without harness connected (Throttle with Motor Body Assembly)



Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION
1 - 2	20°C (68°F)	0.3 to 10 Ω

If the result is not as specified, replace the throttle with motor body assembly.

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Last Modified: 4-14-2014	6.6 A	Doc ID: RM000000MTA00VX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: THROTTLE BODY: INSTALLATION; 2013 MY FR-S [03/2012 -]		

INSTALLATION

1. INSTALL THROTTLE WITH MOTOR BODY ASSEMBLY

(a) Install a new gasket to the intake manifold.

(b) Connect the 2 water by-pass hoses to the throttle with motor body assembly with the 2 clamps.

(c) Install the throttle with motor body assembly to the intake manifold with the 4 bolts.

Torque:

8.0 N·m {82 kgf·cm, 71 in·lbf}

(d) Connect the throttle with motor body assembly connector.

2. INSTALL AIR CLEANER CAP WITH AIR CLEANER HOSE INFO

3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

4. ADD ENGINE COOLANT INFO

5. INSPECT FOR COOLANT LEAK INFO

6. INSPECT THROTTLE WITH MOTOR BODY ASSEMBLY

NOTICE:

Perform the following procedure after replacing the ECM, throttle with motor body assembly or any throttle with motor body assembly components.

(a) Turn the ignition switch to ON without operating the accelerator pedal.

NOTICE:

If the accelerator pedal is operated, perform the above steps again.

(b) Connect the Techstream to the DLC3 and clear the DTCs INFO .

(c) Start the engine and check that the MIL is not illuminated. After the engine is warmed up, check that the idle speed is within the specified range when the A/C is switched off.

Standard:

CONDITION	ENGINE IDLE SPEED
A/C switched off	650 to 800 rpm

NOTICE:

- Be sure to perform this step with all accessories off.
- Make sure that the shift lever is in neutral (for manual transmission).
- Make sure that the shift lever is in N or P (for automatic transmission).

(d) Enter the following menus: Data List / Throttle Sensor Volt%. Fully depress the accelerator pedal and check that the value is 80 to 90%.

(e) Perform a road test and confirm that there are no abnormalities.

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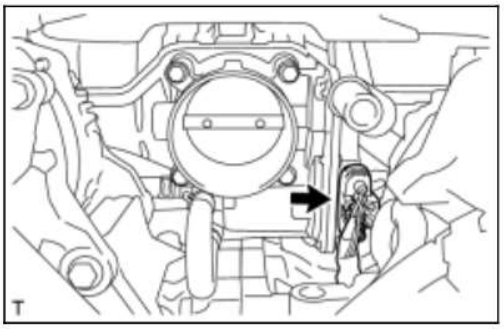
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Last Modified: 4-14-2014	6.6 A	Doc ID: RM000000MTD00TX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: THROTTLE BODY: REMOVAL; 2013 MY FR-S [03/2012 -]		

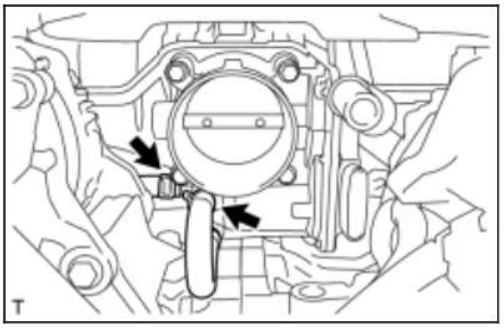
REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO
2. DRAIN ENGINE COOLANT INFO
3. REMOVE AIR CLEANER CAP WITH AIR CLEANER HOSE INFO
4. REMOVE THROTTLE WITH MOTOR BODY ASSEMBLY

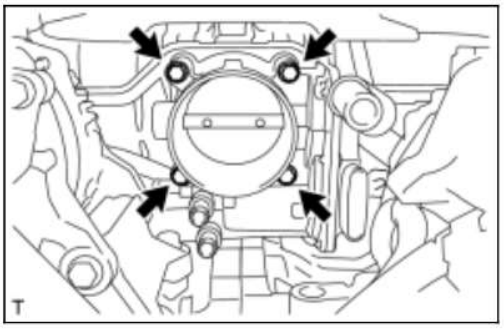
(a) Disconnect the throttle with motor body assembly connector.



(b) Disconnect the 2 water by-pass hoses from the throttle with motor body assembly.



(c) Remove the 4 bolts and the throttle with motor body assembly from the intake manifold.



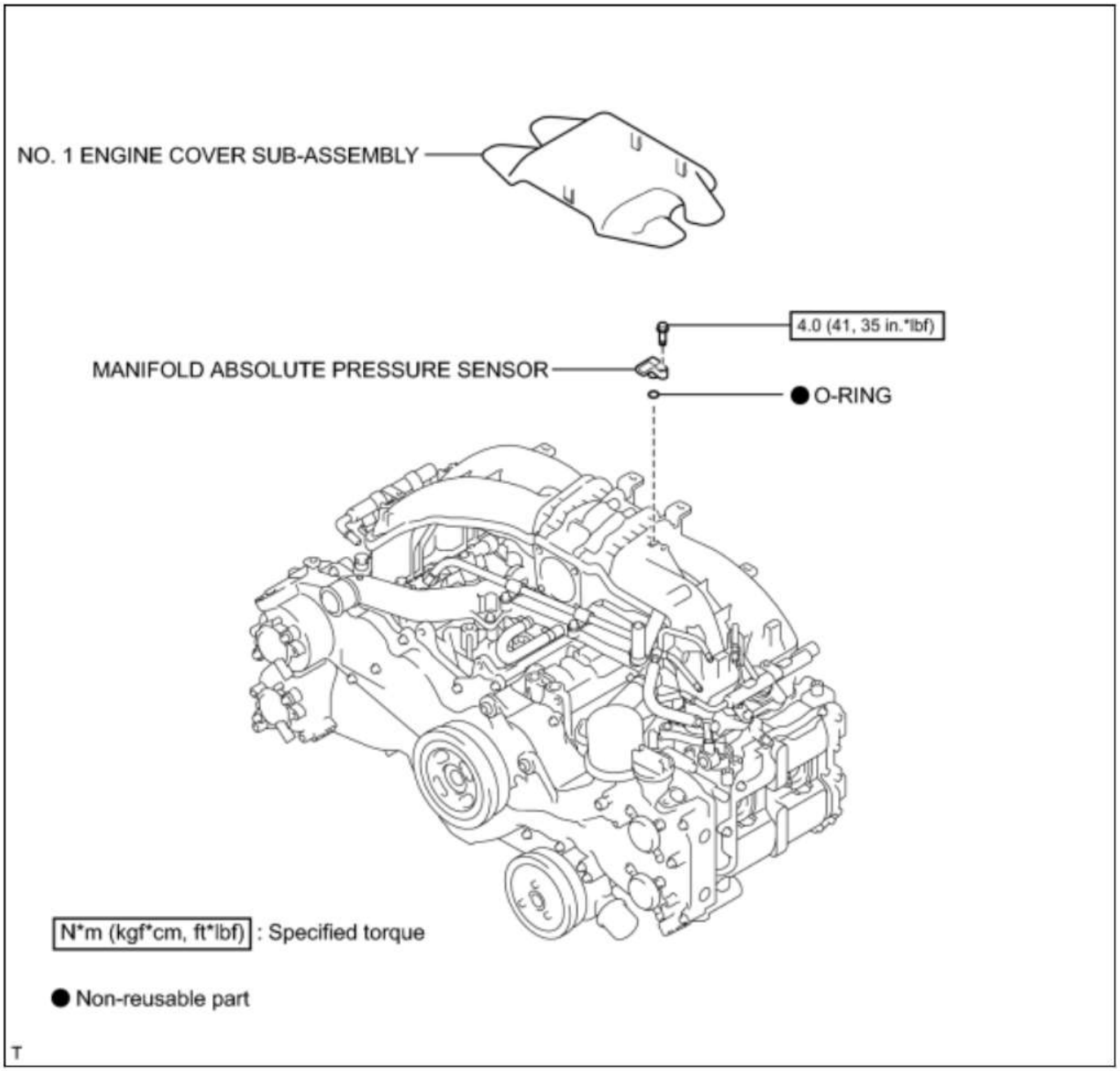
(d) Remove the gasket from the intake manifold.

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Last Modified: 4-14-2014	6.6 K	Doc ID: RM000001BO600RX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: VACUUM SENSOR: COMPONENTS; 2013 MY FR-S [03/2012 -]		

COMPONENTS

ILLUSTRATION



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Last Modified: 4-14-2014	6.6 A	Doc ID: RM000001BO500QX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: VACUUM SENSOR: INSTALLATION; 2013 MY FR-S [03/2012 -]		

INSTALLATION

1. INSTALL MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Apply a light coat of engine oil to a new O-ring and install it to the manifold absolute pressure sensor.

(b) Install the manifold absolute pressure sensor with the bolt.

Torque:

4.0 N·m {41 kgf·cm, 35in·lbf}

NOTICE:

- If a component has been dropped or subjected to a strong impact, replace it.
- Make sure that the O-ring is not damaged or does not jump out of position during installation.

(c) Connect the manifold absolute pressure sensor connector.

2. INSTALL NO. 1 ENGINE COVER SUB-ASSEMBLY INFO

3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL INFO

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Last Modified: 4-14-2014	6.6 G	Doc ID: RM000003IHI00BX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: VACUUM SENSOR: ON-VEHICLE INSPECTION; 2013 MY FR-S [03/2012 -]		

ON-VEHICLE INSPECTION

1. INSPECT MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Connect the Techstream to the DLC3.

(b) Turn the ignition switch to ON with the engine off.

(c) Inspect the manifold absolute pressure sensor.

(1) Enter the following menus: Powertrain / Engine / Data List / Atmosphere Pressure.

(2) Check the atmoshere pressure.

OK:

Almost the same as ambient pressure

HINT:

- The standard atmospheric pressure is 101 kPa (1.03 kgf/cm2, 14.6 psi).
- The atmospheric pressure decreases by 1 kPa (0.01 kgf/cm2, 0.1 psi) as the altitude increases by 100 m.
- The atmospheric pressure varies depending on the weather.



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Last Modified: 4-14-2014	6.6 A	Doc ID: RM000001BO700RX
Model Year: 2013	Model: FR-S	Prod Date Range: [03/2012 -]
Title: FA20 ENGINE CONTROL: VACUUM SENSOR: REMOVAL; 2013 MY FR-S [03/2012 -]		

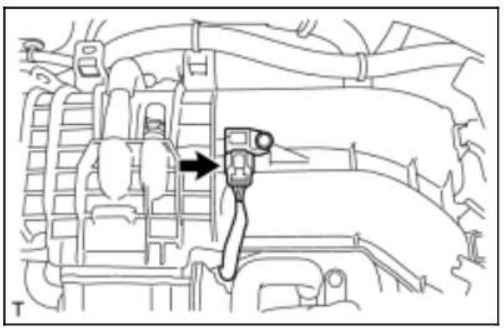
REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL INFO

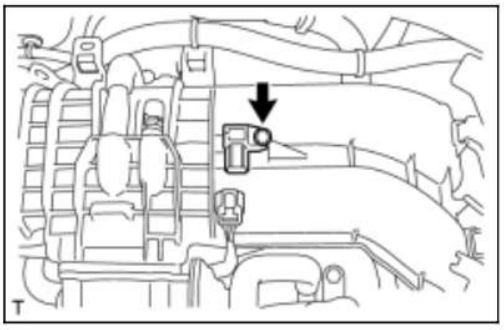
2. REMOVE NO. 1 ENGINE COVER SUB-ASSEMBLY INFO

3. REMOVE MANIFOLD ABSOLUTE PRESSURE SENSOR

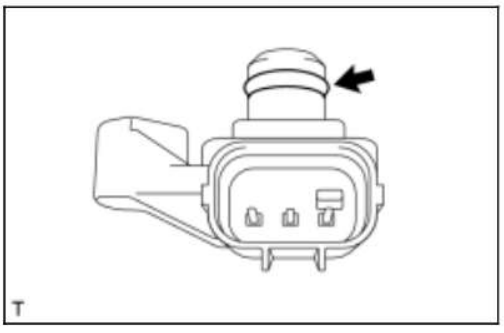
(a) Disconnect the manifold absolute pressure sensor connector.



(b) Remove the bolt and manifold absolute pressure sensor.



(c) Remove the O-ring from the manifold absolute pressure sensor.



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