Last Modified: 12-04-2024	6.11:8.1.0	**Doc ID:** RM100000002BLVG
Model Year Start: 2023	**Model:** Prius Prime	**Prod Date Range:** [03/2023 -]
Title: M20A-FXS (ENGINE CONTROL): SFI SYSTEM: P017100,P017200,P117000,P117B00; System Too Lean Bank 1; 2023 - 2024 MY Prius Prius Prime [03/2023 -]		

DTC	**P017100**	**System Too Lean Bank 1**

DTC	**P017200**	**System Too Rich Bank 1**

DTC	**P117000**	**Fuel Performance/Port Injector**

DTC	**P117B00**	**Fuel Performance/Direct Injector**

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection duration. The fuel trim consists of both the short-term and long-term fuel trims.

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 (sensor 1) 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 lean.

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the central value. The long-term fuel trim, which controls overall fuel compensation, compensates for long-term deviations in the fuel trim from the central value caused by the short-term fuel trim compensation.

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
P017100	System Too Lean Bank 1	With a warm engine and stable air fuel ratio feedback, the fuel trim is considerably in error to the lean side (2 trip detection logic).	• Intake system • Port fuel injector assembly • Direct fuel injector assembly • Mass air flow meter sub-assembly • Engine coolant temperature sensor • Fuel pressure	Comes on	Engine	B	SAE Code: P0171

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
			• Fuel pressure sensor (for high pressure side) • Gas leak from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit • Air fuel ratio sensor (sensor 1) • PCV valve and hose • PCV hose connections • EGR valve assembly • Wire harness or connector • ECM				
P017200	System Too Rich Bank 1	With a warm engine and stable air fuel ratio feedback, the fuel trim is considerably in error to the rich side (2 trip detection logic).	• Port fuel injector assembly • Direct fuel injector assembly • Mass air flow meter sub-assembly • Engine coolant temperature sensor • Ignition system • Fuel pressure • Fuel pressure sensor (for high pressure side) • Gas leak from exhaust system • Open or short in air fuel ratio sensor (sensor 1) circuit	Comes on	Engine	B	SAE Code: P0172

DTC NO.	DETECTION ITEM	DTC DETECTION CONDITION	TROUBLE AREA	MIL	DTC OUTPUT FROM	PRIORITY	NOTE
			• Air fuel ratio sensor (sensor 1) • EGR valve assembly • Wire harness or connector • ECM				
P117000	Fuel Performance/Port Injector	Although a DTC is stored for a rich or lean condition, the amount of fuel trim during direct injection is normal (1 trip detection logic)	• Port fuel injector assembly • Direct fuel injector assembly • Fuel pressure • ECM	Does not come on	Engine	B	SAE Code: P1170
P117B00	Fuel Performance/Direct Injector	Although a DTC is stored for a rich or lean condition, the amount of fuel trim during port injection is normal (1 trip detection logic)	• Port fuel injector assembly • Direct fuel injector assembly • Fuel pressure • ECM	Does not come on	Engine	B	SAE Code: P117B

HINT:

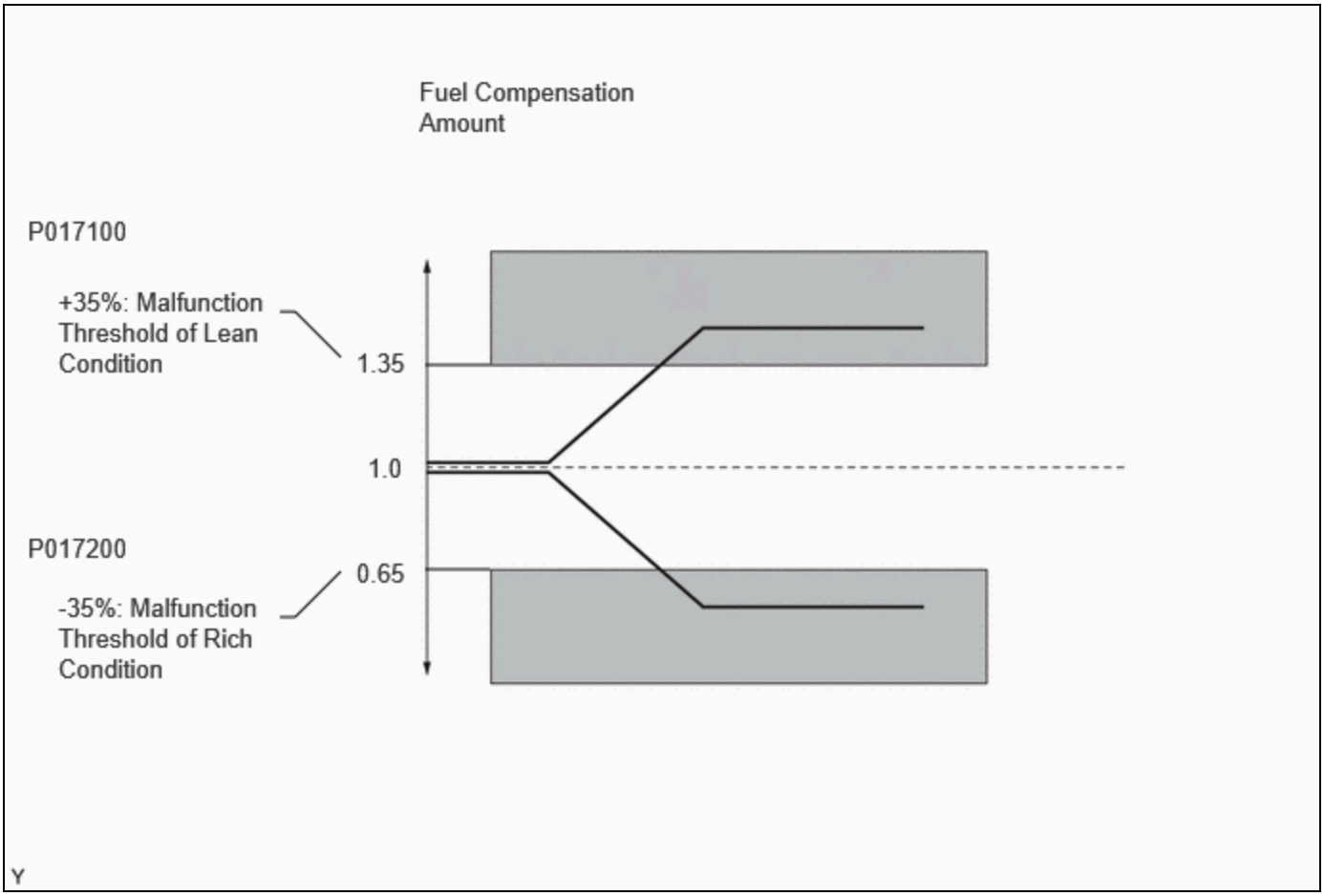
- When DTC P017100 is stored, the actual air fuel ratio is on the lean side. When DTC P017200 is stored, the actual air fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air fuel ratio is lean and DTC P017100 may be stored. The MIL is then illuminated.
- When DTC P117000 or P117B00 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 Mode) 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 fuel injection volumes estimated by the ECM also affect the average fuel trim learned value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learned value of the air fuel ratio). If the average fuel trim learned value exceeds the malfunction thresholds, the ECM interprets this as a malfunction of the fuel system and stores a DTC.

Example:

The average fuel trim learned value is +35% or higher, or -35% or less, the ECM interprets this as a fuel system malfunction.



MONITOR STRATEGY

Related DTCs	P0171: Fuel trim lean P0172: Fuel trim rich P1170: Fuel trim (port injection fail) P117B: Fuel trim (direct injection fail)
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	Air fuel ratio sensor (sensor 1) Mass air flow meter sub-assembly Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds
MIL Operation	2 driving cycles: P0171 and P0172 Immediate: P1170 and P117B
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever the following DTCs are not stored	P0010, P1360, P1362, P1364, P1366, P2614 (Motor drive VVT system control module) P0011 (VVT system - advance) P0012 (VVT system - retard)

	P0013 (Exhaust VVT oil control solenoid) P0014 (Exhaust VVT system - advance) P0015 (Exhaust VVT system - retard) P0016 (VVT system - misalignment) P0017 (Exhaust VVT system - misalignment) P0031, P0032, P101D (Air fuel ratio sensor (sensor 1) heater) P0101, P0102, P0103 (Mass air flow meter) P0107, P0108 (Manifold absolute pressure) P0117, P0118 (Engine coolant temperature sensor) P0121, P0122, P0123, P0222, P0223, P2135 (Throttle position sensor) P0125 (Insufficient coolant temperature for closed loop fuel control) P0191, P0192, P0193 (Fuel pressure sensor (for high pressure side)) P0201, P0202, P0203, P0204, P062D, P21CF, P21D0, P21D1, P21D2 (Fuel injector) P0335, P0337, P0338 (Crankshaft position sensor) P0340, P0342, P0343 (Camshaft position sensor) P0365, P0367, P0368 (Exhaust camshaft position sensor) P0401 (EGR system) P107B, P107C, P107D (Fuel pressure sensor (for low pressure side)) P11EA, P11EC, P11ED, P11EE, P11EF, P219A, P219C, P219D, P219E, P219F (Air-fuel ratio imbalance)
Fuel system status	Closed loop
Auxiliary battery voltage	11 V or higher
Either of the following conditions is met	1 or 2
1. Engine speed	Less than 1100 rpm
2. Engine load	10% or higher
Catalyst monitor	Not executed

TYPICAL MALFUNCTION THRESHOLDS

P0171 and P0172: Fuel-Trim Lean/Rich

EVAP purge-cut	Executing
Either of the following conditions is met	1 or 2
1. Average between short-term fuel trim and long-term fuel trim	35% or higher (varies with engine coolant temperature)
2. Average between short-term fuel trim and long-term fuel trim	-35% or less (varies with engine coolant temperature)

P1170: Fuel Trim (Port Injection Fail)

DTCs of fuel system have already been set	-
EVAP purge-cut	Executing
Direct injection	100%
Both of the following conditions are met	1 and 2

1. Average between short-term fuel trim and long-term fuel trim	Less than 35% (varies with engine coolant temperature)
2. Average between short-term fuel trim and long-term fuel trim	Higher than -35% (varies with engine coolant temperature)

P117B: Fuel Trim (Direct Injection Fail)

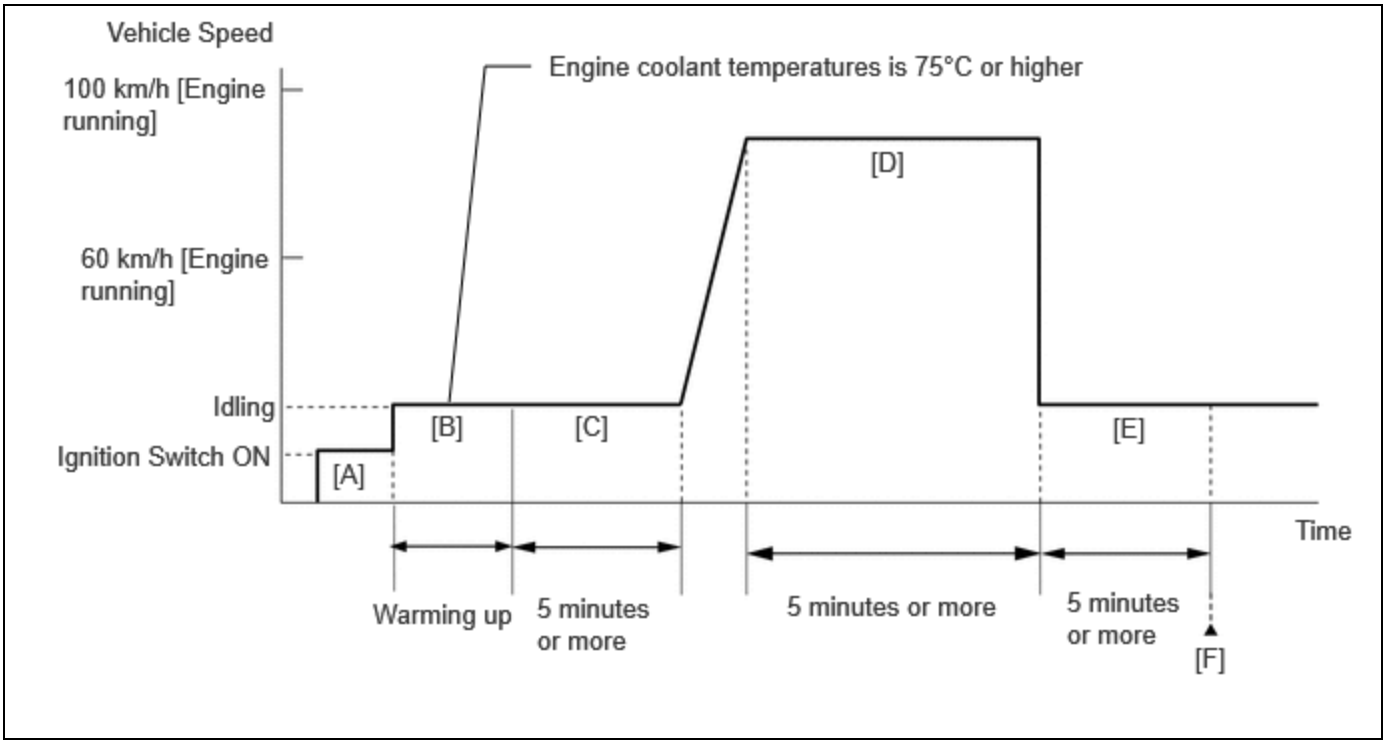
DTCs of fuel system have already been set	-
EVAP purge-cut	Executing
Port injection	100%
Both of the following conditions are met	1 and 2
1. Average between short-term fuel trim and long-term fuel trim	Less than 35% (varies with engine coolant temperature)
2. Average between short-term fuel trim and long-term fuel trim	Higher than -35% (varies with engine coolant temperature)

CONFIRMATION DRIVING PATTERN

HINT:

- When clearing the permanent DTCs, refer to the "CLEAR PERMANENT DTC" procedure.

  Click here INFO
- Permanent misfire and fuel system DTCs can only be cleared when performing the universal trip driving pattern when no malfunction is detected.



1. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure).
2. Turn the ignition switch off and wait for at least 30 seconds.
3. Turn the ignition switch to ON [A].
4. Put the engine in Inspection Mode (Maintenance Mode).

Click here INFO

5. Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher with all the accessories switched off [B].
6. With the engine warmed up, idle the engine for 5 minutes or more [C].
7. Press the EV/HV mode selection switch to select HV mode. (for PHEV Model)
8. With the engine running, drive the vehicle at a speed between 60 and 100 km/h (37 and 62 mph) for 5 minutes or more [D].

CAUTION:

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

HINT:

If the engine stops, further depress the accelerator pedal to restart the engine.

9. Stop the vehicle, and idle the engine for 5 minutes or more [E].
10. Enter the following menus: Powertrain / Engine / Trouble Codes [F].
11. Read the pending DTCs.

HINT:

If a pending DTC is output, the system is malfunctioning.

WIRING DIAGRAM

- Refer to DTC P010012 for the mass air flow meter sub-assembly circuit.

  Click here INFO
- Refer to DTC P003012 for the air fuel ratio sensor (sensor 1) circuit.

  Click here INFO

CAUTION / NOTICE / HINT

NOTICE:

- Inspect the fuses for circuits related to this system before performing the following procedure.
- Vehicle Control History may be stored in the hybrid vehicle control ECU if the engine is malfunctioning. Certain vehicle condition information is recorded when Vehicle Control History is stored. Reading the vehicle conditions recorded in both the freeze frame data and Vehicle Control History can be useful for troubleshooting.

  for HEV Model: Click here INFO

  for PHEV Model: Click here INFO

  (Select Powertrain in Health Check and then check the time stamp data.)
- If any "Engine Malfunction" Vehicle Control History item has been stored in the hybrid vehicle control ECU, make sure to clear it. However, as all Vehicle Control History items are cleared simultaneously, if any Vehicle Control History items other than "Engine Malfunction" are stored, make sure to perform any troubleshooting for them before clearing Vehicle Control History.

  for HEV Model: Click here INFO

  for PHEV Model: Click here INFO

HINT:

- Sensor 1 refers to the sensor closest to the engine assembly.
- Sensor 2 refers to the sensor farthest away from the engine assembly.
- A low air fuel ratio sensor (sensor 1) 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 (sensor 1) 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 P017100, P017200, P117000 AND/OR P117B00)**

(a) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
P017100, P017200, P117000 or P117B00 and other DTCs are output	A
P017100, P017200, P117000 or P117B00 is output	B

HINT:

If any DTCs other than P017100, P017200, P117000 and/or P117B00 are output, troubleshoot those DTCs first.

A ▶ GO TO DTC CHART

B ▼

2.	**PERFORM ACTIVE TEST USING GTS (CONTROL THE INJECTION MODE)**

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) According to the display on the GTS, read the Data List with the Active Test "Control the Injection Mode" set to Port.

Powertrain > Engine > Active Test

ACTIVE TEST DISPLAY
Control the Injection Mode

DATA LIST DISPLAY
Injection Mode
Short FT B1S1
Long FT B1S1

OK:

GTS DISPLAY	SPECIFIED CONDITION
Total of Short FT B1S1 and Long FT B1S1	Between -20 and 20%

(d) According to the display on the GTS, read the Data List with the Active Test "Control the Injection Mode" set to Direct.

OK:

GTS DISPLAY	SPECIFIED CONDITION
Total of Short FT B1S1 and Long FT B1S1	Between -20 and 20%

ITEM		PROCEED TO
PORT	DIRECT	
OK	OK	A
OK	NG	B
NG	OK	C
NG	NG	D

Post-procedure1

(e) None.

B ▶ **GO TO STEP 4**

C ▶ **GO TO STEP 11**

D ▶ **GO TO STEP 12**

A

3.	**CHECK IF VEHICLE HAS RUN OUT OF FUEL IN PAST**

(a) Has the vehicle run out of fuel in the past?

YES ▶ **DTC CAUSED BY RUNNING OUT OF FUEL**

NO ▶ **CHECK FOR INTERMITTENT PROBLEMS**

4.	**READ VALUE USING GTS (FUEL PRESSURE (HIGH))**

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) According to the display on the GTS, read the Data List.

Powertrain > Engine > Data List

TESTER DISPLAY
Engine Speed

TESTER DISPLAY
Fuel Pressure (High)
Injection Mode

HINT:

During charge control, the engine speed is set at idle. Therefore, the engine speed will not increase when the accelerator pedal is depressed. In this case, read the Data List after charge control has completed.

Standard:

GTS DISPLAY	CONDITION	SPECIFIED CONDITION
Fuel Pressure (High)	• Shift position: P • A/C: Off • Engine warmed up • Engine Speed: 2500 rpm • Injection Mode: Direct	3000 to 25000 kPag

RESULT	PROCEED TO
The value of Fuel Pressure (High) is between 3000 and 25000 kPag	A
None of the above conditions are met	B

Post-procedure1

(d) None.

B ▶ **GO TO STEP 7**

A

5.	**PERFORM ACTIVE TEST USING GTS (CONTROL THE INJECTION MODE (DIRECT))**

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) According to the display on the GTS, read the Data List with the Active Test "Control the Injection Mode" set to Direct.

Powertrain > Engine > Active Test

ACTIVE TEST DISPLAY
Control the Injection Mode

DATA LIST DISPLAY
High Pressure Fuel Pump Duty Ratio (D4)
Injection Mode
Short FT B1S1
Long FT B1S1

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the P position, and the engine should be fully warmed up.

ITEM			PROCEED TO
INJECTION MODE	HIGH PRESSURE FUEL PUMP DUTY RATIO (D4)	TOTAL OF SHORT FT B1S1 AND LONG FT B1S1	
Direct	10% to 50%	-	A
	50% or higher	-20% or less	B
	10% or less	+20% or higher	
	50% or higher	+20% or higher	C
	10% or less	-20% or less	D

Post-procedure1

(d) None.

B ▶ **REPLACE FUEL PRESSURE SENSOR (FOR HIGH PRESSURE SIDE)**

C ▶ **GO TO STEP 8**

D ▶ **REPLACE ECM**

A ▼

6.	**PERFORM ACTIVE TEST USING GTS (CONTROL THE INJECTION MODE (DIRECT))**

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) According to the display on the GTS, read the Data List with the Active Test "Control the Injection Mode" set to Direct.

Powertrain > Engine > Active Test

ACTIVE TEST DISPLAY
Control the Injection Mode

DATA LIST DISPLAY
High Pressure Fuel Pump Duty Ratio (D4)

DATA LIST DISPLAY
Injection Mode
Short FT B1S1
Long FT B1S1

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the P position, and the engine should be fully warmed up.

ITEM			PROCEED TO
INJECTION MODE	HIGH PRESSURE FUEL PUMP DUTY RATIO (D4)	TOTAL OF SHORT FT B1S1 AND LONG FT B1S1	
Direct	10 to 50%	-25% or less	A
	10 to 50%	+25% or higher	
	10 to 50%	-25 to +25%	B

Post-procedure1

(d) None.

A ▶ **REPLACE DIRECT FUEL INJECTOR ASSEMBLY**

B ▶ **CHECK FOR INTERMITTENT PROBLEMS**

7.	CHECK MISFIRE COUNT OF DIRECT INJECTION

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) According to the display on the GTS, read the Data List with the Active Test "Control the Injection Mode" set to Direct.

Powertrain > Engine > Active Test

ACTIVE TEST DISPLAY
Control the Injection Mode

DATA LIST DISPLAY
Injection Mode
Misfire Count Cylinder #1
Misfire Count Cylinder #2
Misfire Count Cylinder #3
Misfire Count Cylinder #4

HINT:

The A/C switch and all accessory switches should be off, and the shift lever should be in the P position, and the engine should be fully warmed up.

INJECTION MODE	MISFIRE COUNT	PROCEED TO
Direct	No misfire counts, or misfire counts occur randomly in all cylinders	A
	Misfire counts occur in particular cylinder	B

Post-procedure1

(d) None.

B ▶ **REPLACE DIRECT FUEL INJECTOR ASSEMBLY**

A

8.	**REPLACE FUEL (ENGINE ROOM SIDE) PUMP ASSEMBLY (FOR HIGH PRESSURE SIDE)**

HINT:

Click here INFO

NEXT

9.	**CLEAR DTC**

Pre-procedure1

(a) None.

Procedure1

(b) Clear the DTCs.

Powertrain > Engine > Clear DTCs

Post-procedure1

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

NEXT

10.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

Pre-procedure1

(a) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

Procedure1

(b) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A
P017100, P017200, P117000 or P117B00 is output	B

Post-procedure1

(c) None.

A ▶ **END**

B ▶ **REPLACE ECM**

11.	**INSPECT PORT FUEL INJECTOR ASSEMBLY**

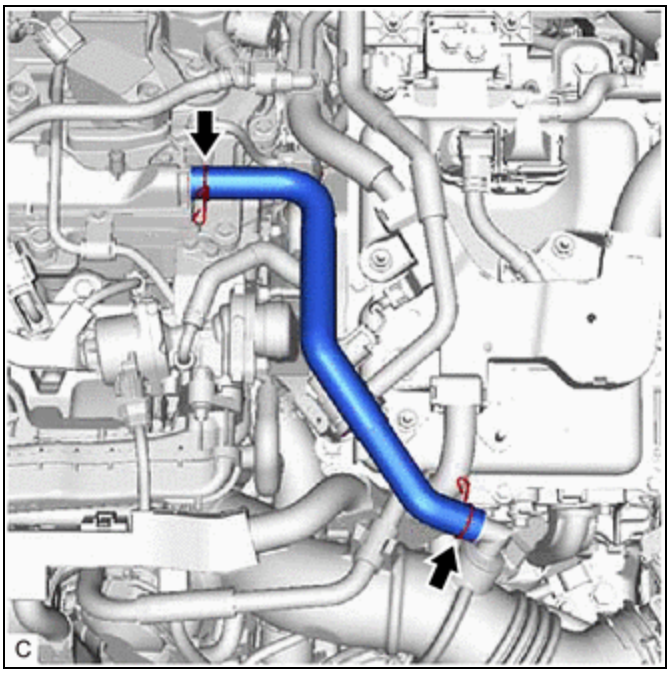
(a) Check the injection volume (whether fuel volume is high or low, and whether injection pattern is poor).

Click here INFO

OK ▶ **REPLACE ECM**

NG ▶ **REPLACE PORT FUEL INJECTOR ASSEMBLY**

12.	**CHECK PCV VALVE AND HOSE CONNECTIONS**



(a) Check the PCV hose connections.

(b) Check the PCV valve.

Click here INFO

OK:
PCV hose and PCV valve are connected correctly and are not damaged.

NG ▶ **REPAIR OR REPLACE PCV VALVE OR HOSE**

OK

13.	**CHECK INTAKE SYSTEM**

(a) Check the intake system for vacuum leaks.

Click here INFO

OK:
No leaks in intake system.

HINT:

Perform "Inspection After Repair" after repairing or replacing the intake system.

Click here INFO

NG ▶ **REPAIR OR REPLACE INTAKE SYSTEM**

OK

14.	**PERFORM ACTIVE TEST USING GTS (CONTROL THE INJECTION VOLUME FOR A/F SENSOR)**

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

(c) Idle the engine for 5 minutes or more with the shift lever in P.

Procedure1

(d) Perform the Control the Injection Volume for A/F Sensor operation with the engine idling.

Powertrain > Engine > Active Test

ACTIVE TEST DISPLAY
Control the Injection Volume for A/F Sensor

DATA LIST DISPLAY
A/F (O2) Sensor Current B1S1
A/F (O2) Sensor Current B1S2

(e) Monitor the output values of the air fuel ratio sensor (sensor 1) and air fuel ratio sensor (sensor 2) (A/F (O2) Sensor Current B1S1 and A/F (O2) Sensor Current B1S2) displayed on the GTS.

HINT:

- The Control the Injection Volume for A/F Sensor operation lowers the fuel injection volume by 12.5% or increases the injection volume by 12.5%.
- The air fuel ratio sensor (sensor 1) has an output delay of a few seconds and the air fuel ratio sensor (sensor 2) has a maximum output delay of approximately 20 seconds.
- If the sensor output value does not change (almost no reaction) while performing the Active Test, the sensor may be malfunctioning.

Standard:

GTS DISPLAY (SENSOR)	INJECTION VOLUME	STATUS	CURRENT
A/F (O2) Sensor Current B1S1 (Air fuel ratio (sensor 1))	12.5%	Rich	Below -0.075 mA
	-12.5%	Lean	More than 0.037 mA
A/F (O2) Sensor Current B1S2 (Air fuel ratio (sensor 2))	12.5%	Rich	Below -0.86 mA
	-12.5%	Lean	More than 0.33 mA

STATUS A/F (O2) SENSOR CURRENT B1S1	STATUS A/F (O2) SENSOR CURRENT B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
Lean/Rich	Lean/Rich	Normal	-	A
Lean	Lean	Actual air fuel ratio lean	• PCV valve and hose • PCV hose connections • Gas leak from exhaust system • Intake system • Fuel pressure • Mass air flow meter sub-assembly • Engine coolant temperature sensor	

STATUS A/F (O2) SENSOR CURRENT B1S1	STATUS A/F (O2) SENSOR CURRENT B1S2	AIR FUEL RATIO CONDITION AND AIR FUEL RATIO SENSOR CONDITION	SUSPECTED TROUBLE AREA	PROCEED TO
			• EGR valve assembly	
Rich	Rich	Actual air fuel ratio rich	• Gas leak from exhaust system • Ignition system • Fuel pressure • Mass air flow meter sub-assembly • Engine coolant temperature sensor • EGR valve assembly	
Lean	Lean/Rich	Air fuel ratio sensor (sensor 1) malfunction	• Air fuel ratio sensor (sensor 1)	B
Rich	Lean/Rich	Air fuel ratio sensor (sensor 1) malfunction	• Air fuel ratio sensor (sensor 1)	

Lean: During the Control the Injection Volume for A/F Sensor Active Test, the air fuel ratio sensor (sensor 1) output current (A/F (O2) Sensor Current B1S1) is consistently more than 0.037 mA, and the air fuel ratio sensor (sensor 2) output current (A/F (O2) Sensor Current B1S2) is consistently more than 0.33 mA.
Rich: During the Control the Injection Volume for A/F Sensor Active Test, the air fuel ratio sensor (sensor 1) output current (A/F (O2) Sensor Current B1S1) is consistently below -0.075 mA, and the air fuel ratio sensor (sensor 2) output current (A/F (O2) Sensor Current B1S2) is consistently below -0.86 mA.
Lean/Rich: During the Control the Injection Volume for A/F Sensor Active Test, the output current of the air fuel ratio sensor (sensor 1) or air fuel ratio sensor (sensor 2) alternates correctly.

HINT:

Refer to "Data List / Active Test" [A/F (O2) Sensor Current B1S1 and A/F (O2) Sensor Current B1S2].

Click here INFO

Post-procedure1

(f) None.

B ▶ **GO TO STEP 24**

A

15.	**READ VALUE USING GTS (COOLANT TEMPERATURE)**

(a) Enter the following menus.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

(b) Read the Data List twice, when the engine is both cold and warmed up.

Standard:

GTS DISPLAY	CONDITION	SPECIFIED CONDITION
Coolant Temperature	Cold engine	Same as ambient air temperature
	Warm engine	Between 75 and 100°C (167 and 212°F)

NG ▶ **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK ▼

16.	PERFORM ACTIVE TEST USING GTS (CONTROL THE EGR STEP POSITION)

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or higher.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

HINT:

The A/C switch and all accessories should be off.

Procedure1

(c) Confirm that the value of Data List item Engine Independent is "Operate" then check the value of Intake Manifold Absolute Pressure while performing the Active Test.

Powertrain > Engine > Active Test

ACTIVE TEST DISPLAY
Control the EGR Step Position

DATA LIST DISPLAY
Intake Manifold Absolute Pressure
Engine Independent

NOTICE:

- Do not leave the EGR valve open for 10 seconds or more during the Active Test.
- Be sure to return the EGR valve to step 0 when the Active Test is completed.
- Do not open the EGR valve 30 steps or more during the Active Test.

OK:

The value of Intake Manifold Absolute Pressure changes in response to the EGR step position when the value of Engine Independent is "Operate".

Standard:

-	CONTROL THE EGR STEP POSITION (ACTIVE TEST)	
	0 STEPS	0 TO 30 STEPS
Intake Manifold Absolute Pressure (Data List)	(EGR valve is fully closed)	Intake Manifold Absolute Pressure value is at least +10 kPa (1.45 psi) higher than when EGR valve is fully closed

HINT:

- If the value of Data List item Engine Independent is "Not Opr" when the engine is idling, charge control is being performed. Perform the Active Test after charge control is complete ("Operate" is displayed).
- While performing the Active Test, if the increase in the value of Intake Manifold Absolute Pressure is small, the EGR valve assembly may be malfunctioning.
- Even if the EGR valve assembly is malfunctioning, rough idling or an increase in the value of Intake Manifold Absolute Pressure may occur while performing the Active Test. However, the amount that the value of Intake Manifold Absolute Pressure increases will be smaller than normal.

RESULT	PROCEED TO
Intake Manifold Absolute Pressure value is at least +10 kPa (1.45 psi) higher than when EGR valve is fully closed	A
None of the above conditions are met	B

Post-procedure1

(d) None.

A ▶ **GO TO STEP 18**

B

17.	INSPECT EGR VALVE ASSEMBLY

Pre-procedure1

(a) Remove the EGR valve assembly.

HINT:

Click here INFO

Procedure1

(b) Check if the EGR valve is stuck open.

OK:

EGR valve is tightly closed.

Post-procedure1

(c) None.

NG ▶ **REPLACE EGR VALVE ASSEMBLY**

OK

18.	READ VALUE USING GTS (MASS AIR FLOW SENSOR)

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) Read Mass Air Flow Sensor while maintaining an engine speed of 2500 rpm.

Powertrain > Engine > Data List

TESTER DISPLAY
Engine Speed
Mass Air Flow Sensor

HINT:

During charge control, the engine speed is set at idle. Therefore, the engine speed will not increase when the accelerator pedal is depressed. In this case, read the Data List after charge control has completed.

Standard:

GTS DISPLAY	CONDITION	SPECIFIED CONDITION
Mass Air Flow Sensor	• Engine warmed up • Shift position: P • A/C: Off • Engine Speed: 2500 rpm	Between 5.5 and 18.6 gm/sec

RESULT	PROCEED TO
The value of Mass Air Flow Sensor is between 5.5 and 18.6 gm/sec	A
None of the above conditions are met	B

Post-procedure1

(d) None.

B ▶ **GO TO STEP 31**

A ▼

19.	CHECK FUEL PRESSURE (FOR LOW PRESSURE SIDE)

Click here INFO

NG ▶ **GO TO STEP 23**

OK

20.	**CHECK FOR EXHAUST GAS LEAK**

(a) Check for exhaust gas leaks.

OK:

No gas leaks.

HINT:

Perform "Inspection After Repair" after repairing or replacing the exhaust system.

Click here INFO

NG ▶ **REPAIR OR REPLACE EXHAUST SYSTEM**

OK ▼

21.	**INSPECT SPARK PLUG**

Click here INFO

NG ▶ **REPLACE SPARK PLUG**

OK ▼

22.	**CHECK FOR SPARK (SPARK TEST)**

(a) Perform a spark test.

Click here INFO

HINT:

- If the result of the spark test is normal, proceed to the next step.
- Perform "Inspection After Repair" after replacing the spark plug or ignition coil assembly.

Click here INFO

NEXT ▶ **GO TO STEP 31**

23.	**CHECK FUEL LINE**

(a) Check the fuel lines for leaks or blockage.

OK ▶ **GO TO FUEL PUMP CONTROL CIRCUIT**

NG ▶ **REPAIR OR REPLACE FUEL SYSTEM**

24.	**INSPECT AIR FUEL RATIO SENSOR (SENSOR 1) (HEATER RESISTANCE)**

Click here INFO

NG ▶ **REPLACE AIR FUEL RATIO SENSOR (SENSOR 1)**

OK

25.	**CHECK TERMINAL VOLTAGE (POWER SOURCE OF AIR FUEL RATIO SENSOR (SENSOR 1))**

Pre-procedure1

(a) Disconnect the air fuel ratio sensor (sensor 1) connector.

(b) Turn the ignition switch to ON.

Procedure1

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

Standard Voltage:

EWD INFO

Click Location & Routing(C44)
Click Connector(C44)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
C44-2 (+B) - Body ground	Ignition switch ON	11 to 14 V	V

Post-procedure1

(d) None.

NG ▶ **GO TO STEP 34**

OK

26.	CHECK HARNESS AND CONNECTOR (AIR FUEL RATIO SENSOR (SENSOR 1) - ECM)

Pre-procedure1

(a) Disconnect the air fuel ratio sensor (sensor 1) connector.

(b) Disconnect the ECM connector.

Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(C44,C52)
Click Connector(C44)
Click Connector(C52)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
C44-1 (HA1A) - C52-9 (HA1A)	Always	Below 1 Ω	Ω
C44-3 (A1A+) - C52-95 (A1A+)	Always	Below 1 Ω	Ω
C44-4 (A1A-) - C52-94 (A1A-)	Always	Below 1 Ω	Ω
C44-1 (HA1A) or C52-9 (HA1A) - Body ground and other terminals	Always	10 kΩ or higher	kΩ
C44-3 (A1A+) or C52-95 (A1A+) - Body ground and other terminals	Always	10 kΩ or higher	kΩ
C44-4 (A1A-) or C52-94 (A1A-) - Body ground and other terminals	Always	10 kΩ or higher	kΩ

Post-procedure1

(d) None.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK
▼

27.	REPLACE AIR FUEL RATIO SENSOR (SENSOR 1)

HINT:

Click here INFO

NEXT
▼

28.	**CLEAR DTC**

Pre-procedure1

(a) None.

Procedure1

(b) Clear the DTCs.

Powertrain > Engine > Clear DTCs

Post-procedure1

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

NEXT

29.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

Pre-procedure1

(a) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

Procedure1

(b) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A
P017100, P017200, P117000 or P117B00 is output	B

Post-procedure1

(c) None.

A **END**

B

30.	**READ VALUE USING GTS (MASS AIR FLOW SENSOR)**

Pre-procedure1

(a) Put the engine in Inspection Mode (Maintenance Mode).

Powertrain > Hybrid Control > Utility

TESTER DISPLAY
Inspection Mode

(b) Start the engine and warm it up until the engine coolant temperature is 75°C (167°F) or higher with all the accessories switched off.

Powertrain > Engine > Data List

TESTER DISPLAY
Coolant Temperature

Procedure1

(c) Read Mass Air Flow Sensor while maintaining an engine speed of 2500 rpm.

Powertrain > Engine > Data List

TESTER DISPLAY
Engine Speed
Mass Air Flow Sensor

HINT:

During charge control, the engine speed is set at idle. Therefore, the engine speed will not increase when the accelerator pedal is depressed. In this case, read the Data List after charge control has completed.

Standard:

GTS DISPLAY	CONDITION	SPECIFIED CONDITION
Mass Air Flow Sensor	Engine warmed up Shift position: P A/C: Off Engine Speed: 2500 rpm	Between 5.5 and 18.6 gm/sec

Post-procedure1

(d) None.

NEXT

31.	**CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY CONNECTOR CONNECTION)**

(a) Check the connection and terminal contact pressure of connectors and wire harnesses between the mass air flow meter sub-assembly and ECM.

HINT:

- Click here INFO
- Repair any problems.

NEXT

32.	**CLEAR DTC**

Pre-procedure1

(a) None.

Procedure1

(b) Clear the DTCs.

Powertrain > Engine > Clear DTCs

Post-procedure1

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

NEXT

33.	**CHECK WHETHER DTC OUTPUT RECURS (DTC P017100, P017200, P117000 OR P117B00)**

Pre-procedure1

(a) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

Procedure1

(b) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A

RESULT	PROCEED TO
P017100, P017200, P117000 or P117B00 is output	B

Post-procedure1

(c) None.

A ▶ **END**

B ▶ **GO TO STEP 38**

34.	INSPECT EFI-MAIN NO. 2 RELAY

Click here INFO

NG ▶ **REPLACE EFI-MAIN NO. 2 RELAY**

OK ▼

35.	CHECK TERMINAL VOLTAGE (POWER SOURCE OF EFI-MAIN NO. 2 RELAY)

Pre-procedure1

(a) Remove the EFI-MAIN NO. 2 relay from the No. 1 engine room relay block and No. 1 junction block assembly.

Procedure1

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

Standard Voltage:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
3 (EFI-MAIN NO. 2 relay) - Body ground	Always	11 to 14 V	V

Post-procedure1

(c) None.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (AUXILIARY BATTERY - EFI-MAIN NO. 2 RELAY)**

OK

36.	**CHECK HARNESS AND CONNECTOR (EFI-MAIN NO. 2 RELAY - BODY GROUND)**

Pre-procedure1

(a) Remove the EFI-MAIN NO. 2 relay from the No. 1 engine room relay block and No. 1 junction block assembly.

Procedure1

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

Standard Resistance:

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
1 (EFI-MAIN NO. 2 relay) - Body ground	Always	Below 1 Ω	Ω

Post-procedure1

(c) None.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

37.	**CHECK HARNESS AND CONNECTOR (EFI-MAIN NO. 2 RELAY - AIR FUEL RATIO SENSOR (SENSOR 1))**

Pre-procedure1

(a) Remove the EFI-MAIN NO. 2 relay from the No. 1 engine room relay block and No. 1 junction block assembly.

(b) Disconnect the air fuel ratio sensor (sensor 1) connector.

Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(C44)
Click Connector(C44)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
5 (EFI-MAIN NO. 2 relay) - C44-2 (+B)	Always	Below 1 Ω	Ω
5 (EFI-MAIN NO. 2 relay) or C44-2 (+B) - Body ground and other terminals	Always	10 kΩ or higher	kΩ

Post-procedure1

(d) None.

OK ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR (EFI-MAIN NO. 1 RELAY - EFI-MAIN NO. 2 RELAY)**

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

38.	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER SUB-ASSEMBLY - ECM)

Pre-procedure1

(a) Disconnect the mass air flow meter sub-assembly connector.

(b) Disconnect the ECM connector.

Procedure1

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

Standard Resistance:

EWD INFO

Click Location & Routing(C27,C52)
Click Connector(C27)
Click Connector(C52)

TESTER CONNECTION	CONDITION	SPECIFIED CONDITION	RESULT
C27-4 (VCC) - C52-78 (VCVG)	Always	Below 1 Ω	Ω
C27-3 (FG) - C52-101 (VG)	Always	Below 1 Ω	Ω
C27-2 (E2G) - C52-79 (E2G)	Always	Below 1 Ω	Ω
C27-4 (VCC) or C52-78 (VCVG) - Body ground and other terminals	Always	10 kΩ or higher	kΩ
C27-3 (FG) or C52-101 (VG) - Body ground and other terminals	Always	10 kΩ or higher	kΩ
C27-2 (E2G) or C52-79 (E2G) - Body ground and other terminals	Always	10 kΩ or higher	kΩ

Post-procedure1

(d) None.

NG ▶ **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

39.	**INSPECT MASS AIR FLOW METER SUB-ASSEMBLY**

Click here INFO

NEXT

40.	**CLEAR DTC**

Pre-procedure1

(a) None.

Procedure1

(b) Clear the DTCs.

Powertrain > Engine > Clear DTCs

Post-procedure1

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

NEXT

41.	**CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED**

Pre-procedure1

(a) Drive the vehicle in accordance with the driving pattern described in Confirmation Driving Pattern.

Procedure1

(b) Read the DTCs.

Powertrain > Engine > Trouble Codes

RESULT	PROCEED TO
DTCs are not output	A

RESULT	PROCEED TO
P017100, P017200, P117000 or P117B00 is output	B

Post-procedure1

(c) None.

A ▶ **END**

B ▶ **REPLACE ECM**