

DTC

P0401

Exhaust Gas Recirculation Flow Insufficient Detected

DESCRIPTION

Based on the driving conditions, the ECM regulates the volume of exhaust gas that is recirculated to the engine's combustion chambers and thus lowers the combustion temperature to reduce NOx emissions. The ECM monitors signals such as engine speed, coolant temperature, electric load, and vehicle speed. When the EGR permission conditions are fulfilled, the ECM controls the opening of the EGR valve linearly through signals to the EGR step motor.

DTC No.	DTC Detection Condition	Trouble Area
P0401	Change in intake manifold pressure is small when the EGR valve is opened and closed during idle fuel cut operation. (2 trip detection logic)	<ul style="list-style-type: none"> • EGR valve assembly • EGR passage • EGR with cooler pipe sub-assembly • Manifold absolute pressure sensor • ECM

MONITOR DESCRIPTION

The ECM monitors the pressure inside the intake manifold while opening and closing the EGR valve during fuel cut operation. If there is no change in the manifold absolute pressure sensor value, the ECM interprets this as a malfunction in the EGR valve assembly, illuminates the MIL and stores the DTC (2 trip detection logic).

MONITOR STRATEGY

Related DTC	P0401: EGR valve high flow rate / low flow rate
Required sensors / components (Main)	EGR valve assembly, manifold absolute pressure sensor
Required sensors / components (Related)	Engine coolant temperature sensor, vehicle speed sensor
Frequency of operation	Continuous
Duration	3 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

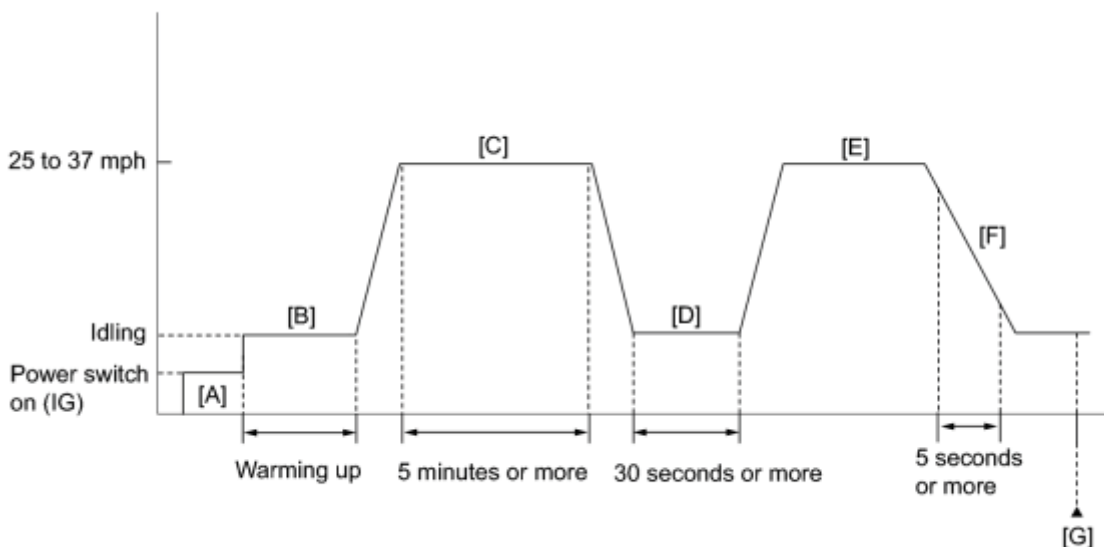
Monitor runs whenever following DTCs are not present	None
Time after engine started	3 seconds or more
Time after engine fuel cut	2000 msec or more
Engine speed	950 to 1600 rpm
Vehicle speed	12.5 mph (20 km/h) or more

Engine speed change	-20 to 20 rpm
Time after engine load becomes stable (HVAC, Brake, Lockup)	More than 1.2 sec
Engine coolant temperature	70°C (158°F) or more
Battery voltage	11 V or more
Intake air temperature	-10°C (14°F) or more
Atmospheric pressure	76 kPa or more

TYPICAL MALFUNCTION THRESHOLDS

Manifold pressure change	Less than 1.0 kPa
At engine speed	1050 rpm

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or more [B].

HINT:

The A/C switch and all accessory switches should be off and shift lever in P or N.

8. Drive the vehicle at 25 to 37 mph (40 to 60 km/h) for 5 minutes or more [C].
9. Idle the engine for 30 seconds or more [D].

10. Accelerate the vehicle to 25 to 37 mph (40 to 60 km/h) with the shift lever in B [E].
11. Perform fuel cut operation for 5 seconds or more, with the accelerator pedal fully released [F].

CAUTION:

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

HINT:

When fuel cut is operating "Idle Fuel Cut" in Data List is ON.

12. Enter the following menus: Powertrain / Engine and ECT / Monitor / Exhaust Gas Recirculation/VVT / Status2 [G].
13. Check that the Exhaust Gas Recirculation/VVT / Status2 monitor is Complete.

HINT:

If the monitor is Incomplete, perform the driving pattern again.

14. Enter the following menus: Powertrain / Engine and ECT / Monitor / Exhaust Gas Recirculation/VVT/Details.
15. Check the Details (EGR FLOW INSUFFICIENCY).

HINT:

Make sure that the value is between MIN and MAX.

16. If the monitor is still Incomplete, perform the following procedure.
17. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.
18. Read Pending DTCs.
19. If a pending DTC is output, the system is malfunctioning,

HINT:

If a pending DTC is not output, perform the following procedure.

20. Enter the following menus: Power train / Engine and ECT / Utility / All Readiness.
21. Input the DTC: P0401.
22. Check the DTC judgment result.

Techstream Display	Description
NORMAL	<ul style="list-style-type: none"> ○ DTC judgment completed ○ System normal
ABNORMAL	<ul style="list-style-type: none"> ○ DTC judgment completed ○ System abnormal
INCOMPLETE	<ul style="list-style-type: none"> ○ DTC judgment not completed

Techstream Display	Description
	<ul style="list-style-type: none"> ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	<ul style="list-style-type: none"> ○ 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 judgement result shows NORMAL, the system is normal.
 - If the DTC judgment result is INCOMPLETE or UNKNOWN and no pending DTC is output, accelerate the vehicle again at 25 to 37 mph (40 to 60 km/h) with the shift lever in B, perform fuel cut operation for 5 seconds or more with the accelerator pedal fully released, and check the DTC judgment result.
23. If the test result is INCOMPLETE or UNKNOWN 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:

- By using the Control the EGR Step Position Active Test, the operation of the EGR valve can be checked.
- When the engine is idling steadily with the EGR valve fully closed, if the EGR valve is normal and it is opened using the Active Test, the Data List value changes as follows.

Data List	Change in Data List when Number of Steps is Increased Using Control the EGR Step Position Active Test
Engine Speed	Idle becomes rough
MAP	Pressure rises

- 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 P0401)

- (a) Connect the Techstream to the DLC3.
- (b) Turn the power switch on (IG).
- (c) Turn the Techstream on.
- (d) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
- (e) Read the DTC.

Result:

Result	Proceed to
DTC P0401 is output	A
DTC P0401 and other DTCs are output	B

B ► GO TO DTC CHART

A
▼

2. PERFORM ACTIVE TEST USING TECHSTREAM (CONTROL THE EGR STEP POSITION)

- (a) Connect the Techstream to the DLC3.
- (b) Turn the power switch on (IG).
- (c) Turn the Techstream on.
- (d) Put the engine in inspection mode **INFO**.
- (e) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.

HINT:

The A/C switch and all accessory switches should be off and shift lever in P or N.

- (f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.
- (g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- 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:

MAP and idling condition change in response to EGR step position as follows.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling or engine stalls
MAP (Data List)	-	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Outside of standard range	A
Within standard range	B

NG [▶ REPLACE EGR VALVE ASSEMBLY](#)

OK

3. INSPECT EGR VALVE ASSEMBLY

(a) Check if the EGR valve are clogged with deposits.

(b) Check if the EGR valve is closed.

OK:

EGR valve is closed and no deposits.

Result:

Result	Proceed to
NG	A
OK	B

B [▶ CHECK FOR DEPOSIT \(INTAKE PORT TO EGR VALVE ASSEMBLY\)](#)

A

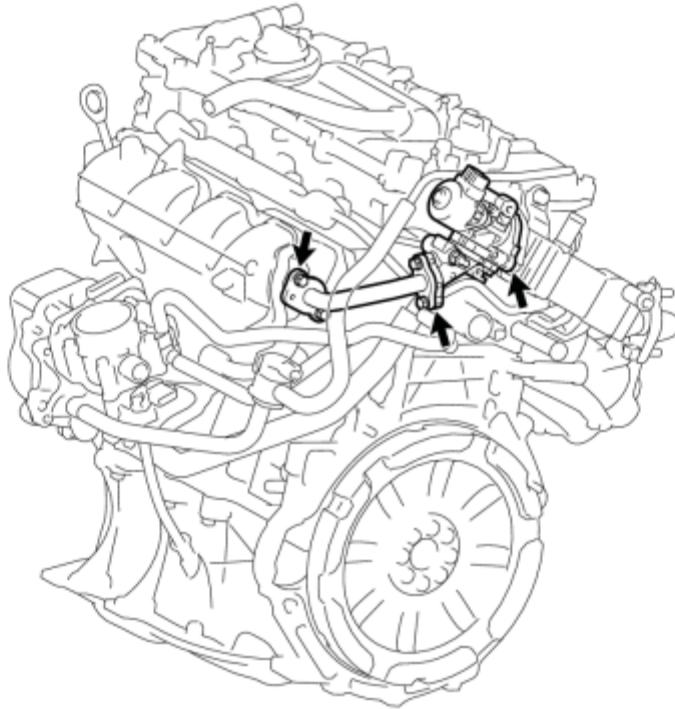
4. REPLACE EGR VALVE ASSEMBLY

(a) Replace the EGR valve assembly INFO.

NEXT



5. CHECK FOR DEPOSIT (INTAKE PORT TO EGR VALVE ASSEMBLY)



P

- (a) Check for exhaust leaks at each connection point.
- (b) Check for cracks, damage, and clogs in the pipes between the intake manifold and the EGR valve assembly.
- (c) This check may require the removal of components.
- (d) Check if there is a built-up of deposits in the EGR valve of pipes.

OK:

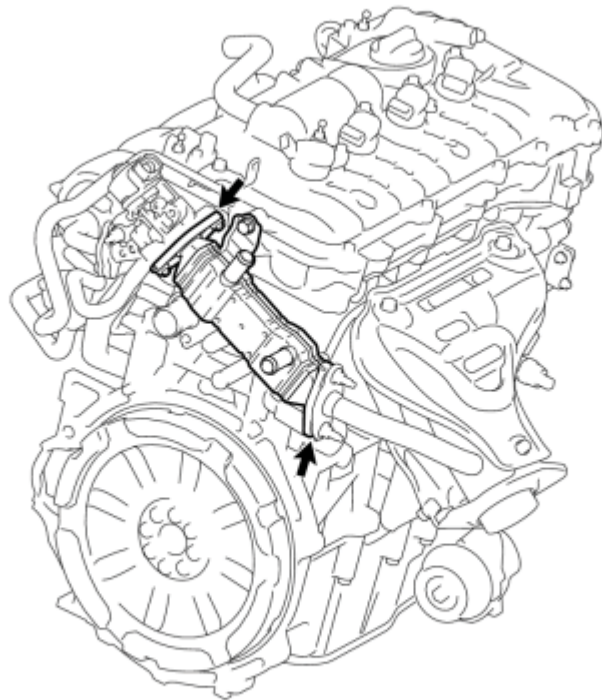
No deposits.

NG ► REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK



6. CHECK FOR DEPOSIT (EXHAUST MANIFOLD SUB-ASSEMBLY TO EGR VALVE ASSEMBLY)



P

- (a) Check for exhaust leaks at each connection point.
- (b) Check for cracks, damage, and clogs in the pipes between the exhaust manifold sub-assembly and the EGR valve assembly.
- (c) This check may require the removal of components.
- (d) Check if there is a built-up of deposits in the EGR valve or pipes.

OK:

No deposits.

NG ► REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

OK



7. INSPECT EGR WITH COOLER PIPE SUB-ASSEMBLY
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- (a) Check for blockage of the EGR with cooler pipe sub-assembly.

NG ► REPAIR OR REPLACE EGR WITH COOLER PIPE SUB-ASSEMBLY

OK




8. READ VALUE USING TECHSTREAM (MANIFOLD ABSOLUTE PRESSURE SENSOR)

- (a) Connect the Techstream to the DLC3.
- (b) Turn the power switch on (IG).
- (c) Turn the Techstream on.
- (d) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP.
- (e) Read the MAP value.

Standard:

Switch Condition	Techstream Display
Power switch on (IG)	80 to 110 kPa (600 to 825 mmHg)

- (f) Put the engine in inspection mode .
- (g) Start the engine and warm it up until the engine coolant temperature reaches 75°C (167°F) or more.
- (h) Enter the following menus: Powertrain / Engine and ECT / Data List / MAP.
- (i) Read the MAP value when idling the engine with the A/C switch and all accessory switches should be off and shift lever in P or N.

Standard:

Engine Condition	Techstream Display
Idling	Less than 80 kPa (600 mmHg)

Result:

Result	Proceed to
NG	A
OK	B

[B ► CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED](#)

A



9. CHECK INTAKE SYSTEM

- (a) Check the intake system for vacuum leaks .

OK:

No leaks in intake system.

NG ► REPAIR OR REPLACE INTAKE SYSTEM

OK

10. REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

(a) Replace the manifold absolute pressure sensor **INFO**.

NEXT

11. CONFIRM WHETHER MALFUNCTION HAS BEEN SUCCESSFULLY REPAIRED

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Clear the DTC **INFO**.

(e) Turn the power switch off and wait for 30 seconds.

(f) Turn the power switch on (IG) and turn the Techstream on.

(g) Put the engine in inspection mode **INFO**.

(h) Start the engine and warm it up until the engine coolant temperature reaches 70°C (158°F) or more.

HINT:

The A/C switch and all accessory switches should be off and shift lever in P or N.

(i) Drive the vehicle at 25 to 37 mph (40 to 60 km/h) with the shift lever in B.

CAUTION:

Strictly observe speed limits and traffic laws when performing the confirmation drive pattern.

(j) Perform fuel cut operation for 5 seconds or more with the accelerator pedal fully released.

HINT:

If the deceleration was not completed, perform the Confirmation Driving Pattern again.

(k) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes / Pending.

(l) Read Pending DTC.

(m) If the pending DTC is output, the system is malfunctioning.

HINT:

If a pending DTC is not output, perform the following procedure.

(n) Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.

(o) Input the DTC: P0401.

(p) Check the DTC judgment result.

Techstream Display	Description
NORMAL	<ul style="list-style-type: none">• DTC judgment completed• System normal
ABNORMAL	<ul style="list-style-type: none">• DTC judgment completed• System abnormal
INCOMPLETE	<ul style="list-style-type: none">• DTC judgment not completed• Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	<ul style="list-style-type: none">• Unable to perform DTC judgment• Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

HINT:

If the pending DTC is not output and the DTC judgment result is INCOMPLETE or UNKNOWN, drive the vehicle again at 25 to 37 mph (40 to 60 km/h) with the shift lever in B, perform fuel cut operation for 5 seconds or more with the accelerator pedal fully released, and check the DTC judgment result.

NEXT  END

DTC	P0403	Exhaust Gas Recirculation Control Circuit
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DESCRIPTION

Refer to DTC P0401 INFO.

DTC No.	DTC Detection Condition	Trouble Area
P0403	Open or short in EGR valve circuit (1 trip detection logic)	<ul style="list-style-type: none"> Open or short in EGR circuit EGR valve assembly ECM

HINT:

DTC P0403 is set when the power switch is on (IG).

MONITOR DESCRIPTION

This DTC is designed to detect an open or short in the EGR valve assembly circuit.

Example:

- If the EGR1, EGR2, EGR3 or EGR4 terminal output voltage is excessively low, but the step motor is still operating, the ECM determines that there is a short in the EGR valve assembly circuit, and sets the DTC.
- If the EGR1, EGR2, EGR3 or EGR4 terminal output voltage is excessively low, and the step motor is not operating, the ECM determines that there is an open in the EGR valve assembly circuit, and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0403: EGR valve circuit range check
Required sensors / components (Main)	EGR valve assembly
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 are not present	None
Engine	Running
Battery voltage	10.5 V or more

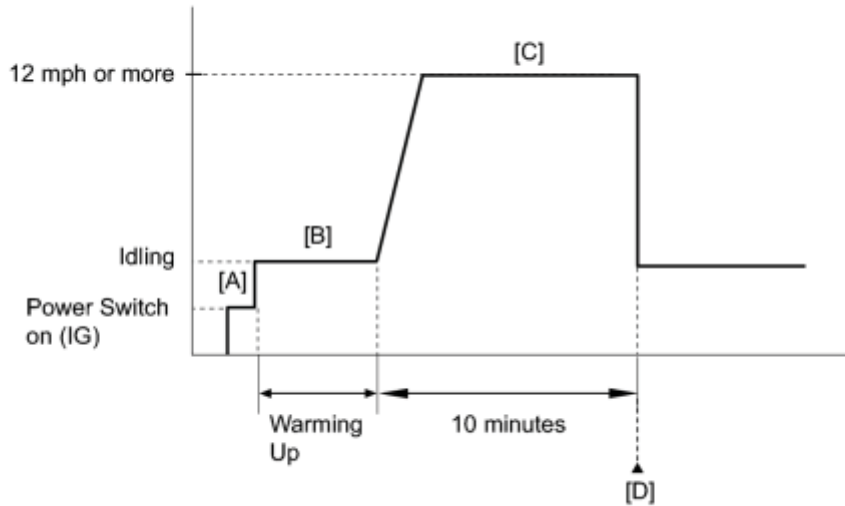
Time after power switch off to on (IG)

More than 0.5 seconds

TYPICAL MALFUNCTION THRESHOLDS

One of the following conditions is met:	Conditions A, B, C or D
A. All of the conditions are met:	Conditions 1 and 2
1. EGR1 output terminal voltage	Low voltage
2. Either of the following conditions is met:	Condition (a) or (b)
(a) Step motor	Driving
(b) EGR1	Not operating
B. All of the following conditions are met:	Conditions 3 and 4
3. EGR2 output terminal voltage	Low voltage
4. Either of the following conditions is met:	Condition (c) or (d)
(c) Step motor	Driving
(d) EGR2	Not operating
C. All of the following conditions are met:	Conditions 5 and 6
5. EGR3 output terminal voltage	Low voltage
6. Either of the following conditions is met:	Condition (e) or (f)
(e) Step motor	Driving
(f) EGR3	Not operating
D. All of the following conditions are met:	Conditions 7 and 8
7. EGR4 output terminal voltage	Low voltage
8. Either of the following conditions is met:	Condition (g) or (h)
(g) Step motor	Driving
(h) EGR4	Not operating

CONFIRMATION DRIVING PATTERN



1. Connect the Techstream to the DLC3.
2. Turn the power switch on (IG) and turn the Techstream on.
3. Clear the DTCs (even if no DTCs are stored, perform the clear DTC procedure) INFO.
4. Turn the power switch off and wait for 30 seconds.
5. Turn the power switch on (IG) and turn the Techstream on [A].
6. Put the engine in inspection mode INFO.
7. Start the engine and warm it up [B].
8. Drive the vehicle at 12 mph (20 km/h) or more for 10 minutes [C].
9. Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
10. Read the DTCs [D].
11. If the DTC P0403 is output, the system is malfunction.

HINT:

If a DTC is not output, perform the following procedure.

12. Enter the following menus: Powertrain / Engine and ECT / Utility / All Readiness.
13. Input the DTC: P0403.
14. Check the DTC judgment result.

Techstream Display	Description
NORMAL	<ul style="list-style-type: none"> ○ DTC judgment completed ○ System normal
ABNORMAL	<ul style="list-style-type: none"> ○ DTC judgment completed ○ System abnormal
INCOMPLETE	<ul style="list-style-type: none"> ○ DTC judgment not completed

Techstream Display	Description
	<ul style="list-style-type: none"> ○ Perform driving pattern after confirming DTC enabling conditions
UNKNOWN	<ul style="list-style-type: none"> ○ Unable to perform DTC judgment ○ Number of DTCs which do not fulfill DTC preconditions has reached ECU's memory limit

CAUTION:

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

HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
 - If the judgment result shows NORMAL, the system has a normal.
15. If the test result is INCOMPLETE or UNKNOWN, drive the vehicle at 12 mph (20 km/h) or more for 10 minutes, and check the DTC judgment result.

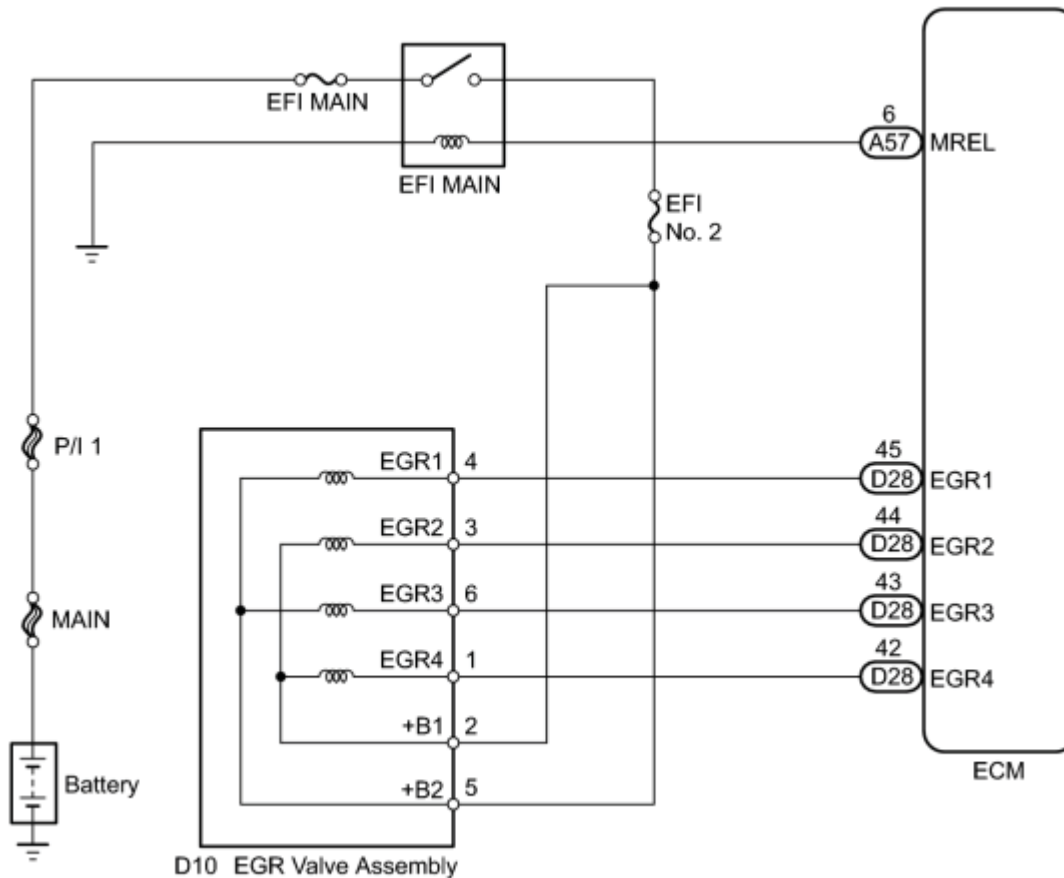
HINT:

- If the judgment result shows ABNORMAL, the system has a malfunction.
 - If the judgment result shows NORMAL, the system has a normal.
16. If the test result is INCOMPLETE or UNKNOWN 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:

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

(a) Connect the Techstream to the DLC3.

(b) Turn the power switch on (IG).

(c) Turn the Techstream on.

(d) Put the engine in inspection mode .

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

HINT:

The A/C switch and all accessory switches should be off.

(f) Enter the following menus: Powertrain / Engine and ECT / Active Test / Control the EGR Step Position.

(g) Confirm the Throttle Idle Position is ON and check the engine idling condition and MAP values in the Data List while performing the Active Test.

HINT:

- 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:

MAP and idling condition change in response to EGR step position when Throttle Idle Position is ON in Data List.

Standard:

-	EGR Step Position (Active Test)	
	0 Steps	0 to 30 Steps
Idling condition	Steady idling	Idling changes from steady to rough idling
MAP (Data List)	MAP value is 20 to 40 kPa (150 to 300 mmHg) (EGR valve is fully closed)	MAP value is at least +10 kPa (75 mmHg) higher than when EGR valve is fully closed

HINT:

During Active Test, if the idling condition does not change in response to EGR step position, then there is probably a malfunction in the EGR valve.

Result:

Result	Proceed to
Within standard range	A
Outside of standard range	B

B [INSPECT EGR VALVE ASSEMBLY](#)

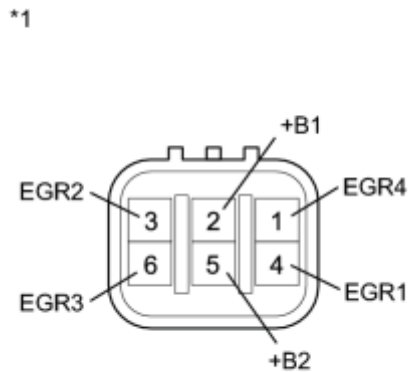
A CHECK FOR INTERMITTENT PROBLEMS

2. INSPECT EGR VALVE ASSEMBLY

- (a) Disconnect the EGR valve assembly connector.
- (b) Measure the resistance according to the value(s) in the table below.

Standard Resistance:

Tester Connection	Condition	Specified Condition
2 (+B1) - 3 (EGR2)	20 °C (68 °F)	20 to 22 Ω
2 (+B1) - 1 (EGR4)		
5 (+B2) - 4 (EGR1)		
5 (+B2) - 6 (EGR3)		



Text in Illustration

*1	Component without harness connected (EGR Valve Assembly)
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- (c) Reconnect the EGR valve assembly connector.

NG REPLACE EGR VALVE ASSEMBLY

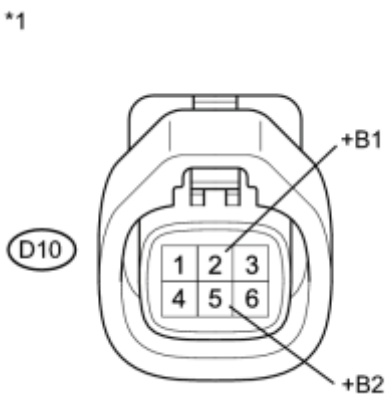
OK

3. INSPECT EGR VALVE ASSEMBLY (+B1 OR +B2 VOLTAGE)

- (a) Disconnect the EGR valve assembly connector.
- (b) Turn the power switch on (IG).
- (c) Measure the voltage according to the value(s) in the table below.

Standard Voltage:

Tester Connection	Switch Condition	Specified Condition
D10-2 (+B1) - Body ground	Power switch on (IG)	11 to 14 V
D10-5 (+B2) - Body ground		



Text in Illustration

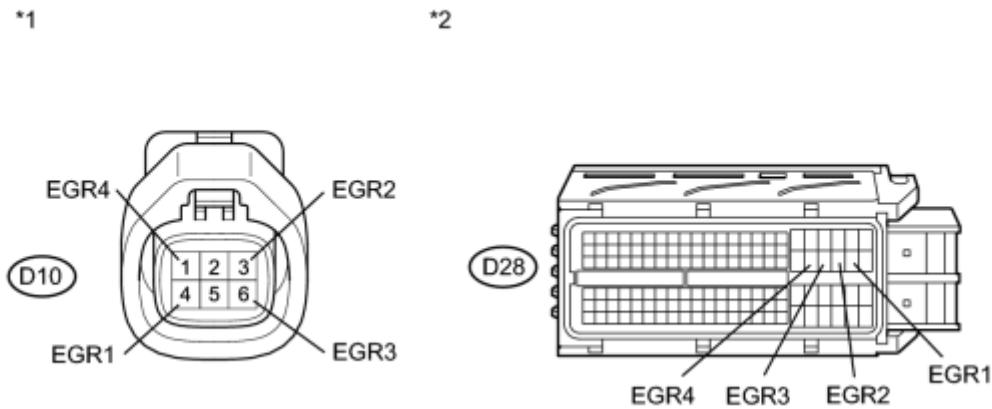
*1	Front view of wire harness connector (to EGR Valve Assembly)
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(d) Reconnect the EGR valve assembly connector.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR (EGR VALVE ASSEMBLY - EFI MAIN RELAY)

OK ↓

4. CHECK HARNESS AND CONNECTOR (ECM - EGR VALVE ASSEMBLY)



- (a) Disconnect the EGR valve 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
D28-45 (EGR1) - D10-4 (EGR1)	Always	Below 1 Ω
D28-44 (EGR2) - D10-3 (EGR2)		
D28-43 (EGR3) - D10-6 (EGR3)		
D28-42 (EGR4) - D10-1 (EGR4)		

Standard Resistance (Check for Short):

Tester Connection	Condition	Specified Condition
D28-45 (EGR1) or D10-4 (EGR1) - Body ground	Always	10 kΩ or higher
D28-44 (EGR2) or D10-3 (EGR2) - Body ground		
D28-43 (EGR3) or D10-6 (EGR3) - Body ground		
D28-42 (EGR4) or D10-1 (EGR4) - Body ground		

Text in Illustration

*1	Front view of wire harness connector (to EGR Valve Assembly)	*2	Front view of wire harness connector (to ECM)
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- (d) Reconnect the ECM connector.
- (e) Reconnect the EGR valve assembly connector.

NG▶ REPAIR OR REPLACE HARNESS OR CONNECTOR (ECM - EGR VALVE ASSEMBLY)

OK
▼

5.	CHECK DTC OUTPUT RECORDS (DTC P0403)
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- (a) Connect the Techstream to the DLC3.
- (b) Turn the power switch on (IG) and turn the Techstream on.
- (c) Clear the DTCs INFO.
- (d) Put the engine in inspection mode INFO.
- (e) Start the engine warm it up.
- (f) Drive the vehicle in accordance with the driving pattern described in the Confirmation Driving Pattern.
- (g) Enter the following menus: Powertrain / Engine and ECT / Trouble Codes.
- (h) Read the DTCs.

Result:

Result	Proceed to
DTC is not output	A
DTC P0403 is output	B

B▶ REPLACE ECM

A▶ END