

MOTION EFI SYSTEM DIAGNOSIS GUIDELINE

EFI SYSTEM

1. Introduction

Because of the EFI, there are many possibilities for the engine issues. In other word, one issue may be caused by the mechanical problem or the EFI components. And the diagnostic tools cannot 100% indicate the root cause. So this manual shows the way to dig out the root cause with the help of the diagnostic tools.

2. Precautions

- 1) Do not disassemble the components arbitrarily. It may damage the components if the water or the oil seep into the parts.
- 2) Turn the ignition off, before connect or disconnect the connectors.
- 3) Make sure the temperature of the ECU is below 80°C.
- 4) The fuel pressure is much high (about 350kPa or 250kPa), so please do not disassemble the fuel pipe arbitrarily. If have to, please release the pressure at first, and make sure the operation is delivered in the ventilated environment by the the professional maintenance persons.
- 5) When disassemble the fuel pump from the pump, make sure the power is off. Or it may cause the fire.
- 6) The fuel pump cannot work in air or water, it will shorten the service life. And the positive and negative connectors cannot be exchanged.
- 7) The ignition system check only could be delivered when it is necessary. When check the spark plug out of the engine, if start the engine, please make sure the throttle is closed. Or too much unburned gasoline coming to the catalyst may damage the catalyst.
- 8) The idle speed is adjusted by the ECU. The idle pintle is not allowed to adjust.
- 9) The Positive and Negative of the battery cannot be reversed. It may damage the EFI components.

10) It is forbidden to remove the battery when the engine is running.

11) Cannot measure the signal by pierce the harness.

3. Tools

1) Multimeter: Measure the voltage, the resistance and the harness connection.

2) Diagnostic tool: reading the malcode, and engine parameters.

3) Oil pressure gauge: Measure the fuel pressure.

4) Cylinder pressure gauge: Measure the pressure gauge.

4. Maintenance depending on the malcode

Description

1) If the issue cannot repeat, the issue analysis may be wrong.

2) The multimeter below means the digital type. Pointer-type is forbidden.

3) If the malcode shows the voltage is low, it means maybe the wire is short to ground. If the malcode shows the voltage is high, it means maybe the wire is short to battery. If the malcode shows the components signal abnormal, it means the wire is open or short to other wires.

Diagnostic help:

1) If the malcode shows again after clearance, check whether the connector is connected well.

2) Do not ignore the affect of the engine maintenance situation, the cylinder pressure, and the mechanical ignition timing.

3) Change another ECU to do the test. If the malcode disappears, the root cause is the ECU. If the malcode is still there, then use the old ECU to

do the test.

4) Malcode: P0263

5) Information: MAP Circuit Low Voltage or Open

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|-------------------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |
| 2 | Check the data of 'BARO'. Make sure whether it is about 100kPa (depending on where you are) | Yes | Step 5 |
| | | No | next |
| 3 | Remove the connector, and use the multimeter to check whether the voltage between pin B and D is about 5V. | Yes | Step 5 |
| | | No | Next |
| 4 | Check whether the following pins is short to ground: pin 31, pin 28, pin 23 of the ECU and pin A, D, B of the connector. | Yes | Check the harness |
| | | No | Next |
| 5 | Crank the engine to stay at idle. Check whether the MAP is about 30-50kPa. Then go to WOT, check whether the MAP goes to about 90kPa. | Yes | Diagnostic help |
| | | No | Change the sensor |

Malcode: P0264

Information: MAP Circuit High Voltage

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|-----------|--------|-----------|
|------|-----------|--------|-----------|

| | | | |
|---|---|-----|-------------------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |
| 2 | Check the data of 'BARO'. Make sure whether it is about 100kPa (depending on where you are) | Yes | Step 5 |
| | | No | next |
| 3 | Remove the connector, and use the multimeter to check whether the voltage between pin B and D is about 5V. | Yes | Step 5 |
| | | No | Next |
| 4 | Check whether the following pins is short to battery: pin 31, pin 28, pin 23 of the ECU and pin A, D, B of the connector. | Yes | Check the harness |
| | | No | Next |
| 5 | Crank the engine to stay at idle. Check whether the MAP is about 30-50kPa. Then go to WOT, check whether the MAP goes to about 90kPa. | Yes | Diagnostic help |
| | | No | Change the sensor |

Malcode: P0274

Information: IAT Circuit Low Voltage

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|-----------|
| 1 | Connect the diagnostic tool, and ignition on. | | NEXT STEP |

| | | | |
|---|--|-----|--------------------|
| 2 | check whether the data of 'intake air temperature' equals to the real intake air temperature. | Yes | Step 5 |
| | | No | Next |
| 3 | Remove the connector, and use the multimeter to check whether the resistance between pin B and D is reasonable according to the temperature. | Yes | Step 5 |
| | | No | Next |
| 4 | Remove the connector and check whether the voltage between pin B and D is about 5V. | Yes | Next |
| | | No | Check harness |
| 5 | Check whether the following pins are short battery: pin 33, pin 28 of the ECU and pin C, D of the connector. | Yes | Change the harness |
| | | No | Next |
| 6 | Crank the engine and stay idle. Check whether the 'intake air temperature' goes up when the engine temperature goes up. | Yes | Help |
| | | No | Change the sensor. |

Malcode: P0275

Information: IAT Circuit High Voltage

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|-----------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |
| 2 | check whether the data of 'intake air temperature' equals to the real intake air temperature. | Yes | Step 5 |

| | | | |
|---|--|-----|--------------------|
| | | No | Next |
| 3 | Remove the connector, and use the multimeter to check whether the resistance between pin B and D is reasonable according to the temperature. | Yes | Step 5 |
| | | No | Next |
| 4 | Remove the connector and check whether the voltage between pin B and D is about 5V. | Yes | Next |
| | | No | Check harness |
| 5 | Check whether the following pins are short to ground or open: pin 33, pin 28 of the ECU and pin C, D of the connector. | Yes | Change the harness |
| | | No | Next |
| 6 | Crank the engine and stay idle. Check whether the 'intake air temperature' goes up when the engine temperature goes up. | Yes | Help |
| | | No | Change the sensor. |

Malcode: P0279

Information: Coolant/Oil Temperature Sensor Circuit Low Voltage

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|-----------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |
| 2 | check whether the data of 'engine temperature' equals to the real | Yes | Step 5 |

| | | | |
|---|---|-----|-------------------|
| | temperature. | No | Next |
| 3 | Remove the connector and use the multimeter to check whether the resistance between pin A and C of the sensor is reasonable according to the temperature. | Yes | Step 5 |
| | | No | Next |
| 4 | Use the multimeter to measure whether the voltage between A and C is about 5V. | Yes | Next |
| | | No | Check the harness |
| 5 | check whether the following pins are short to ground or open: pin 28, pin 15 of the ECU and pin C and D of the sensor. | Yes | Harness issue |
| | | No | Next |
| 6 | Use multimeter to check whether the voltage between pin A and B is about 5V. | Yes | Help |
| | | No | Step 5 |

Malcode: P0305/P0306

Information: O2S 1 Circuit Low/High Voltage

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|---------------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |
| 2 | Use multimeter to check whether the connection between pin B of the oxygen sensor and pin 16 of the ECU is open, and whether the pin B of sensor is short to pin A. | Yes | Harness issue |
| | | No | Next |

| | | | |
|---|---|-----|--------------------|
| 3 | Crank the engine and stay idle. When the engine gets warm, use multimeter to check whether the voltage between pin A and B keeps jumping between 100-900mV. | Yes | Help |
| | | No | Next |
| 4 | A、 emission pipe: block/leakage or not. B、 injector: leakage or not C、 fuel pressure too big or not D、 valve clearance is to small or not | Yes | Engine maintenance |
| | | No | Change sensor |

Malcode: P0609

Information: Injector 1 Circuit Malfunction

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|---------------------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |
| 2 | Remove the connector of injector 1, use multimeter to check whether the voltage of Pin A is about 12V. | Yes | Step 4 |
| | | No | Next |
| 3 | Check whether the connection between pin A and the main power relay is short to ground or open. | Yes | Harness issue |
| | | No | Next |
| 4 | Use multimeter to measure whether the resistance between pin A and B of the injector is about 10-14 Ω @ 20°C | No | Change the injector |
| | | Yes | next |

| | | | |
|---|--|-----|---------------|
| 5 | Use the multimeter to check whether the voltage of Pin B is about 12V. | Yes | Help |
| | | No | Next |
| 6 | Check whether the connection between pin B of the injector and 25 of the ECU is open or short to battery/ground. | Yes | Harness issue |
| | | No | Help |

Malcode: P0560/P0562

Information: FPR Coil Circuit Low/High Voltage or Open

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|-----------------|
| 1 | Connect the diagnostic tool, and ignition off | | next |
| 2 | Wait about 30s. Remove the fuel pump relay, ignition on. Check whether voltage of the relay feeder ear is about 12V | Yes | Change the pump |
| | | No | Next |
| 3 | Check whether the feeder ear is short to ground or open. | Yes | Harness issue |
| | | No | Help |

Malcode: P8960

Information: Cylinder 1 Ignition Coil Malfunction

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|---|--------|-----------|
| 1 | Connect the diagnostic tool, and ignition on. | | next |

| | | | |
|---|--|-----|---------------|
| 2 | Remove the connector and check whether the voltage of pin + is about 12V. | Yes | Step 4 |
| | | No | Next |
| 3 | Check whether the connection of the pin + and main power relay is open or short to ground | Yes | Harness issue |
| | | No | Next |
| 4 | Use multimeter to check whether the resistance of the two coil pins is 0.5-0.65Ω @20°C | Yes | Change coil |
| | | No | Next |
| 5 | Use multimeter to check whether the voltage of pin B is about 12V. | Yes | Help |
| | | No | Next |
| 6 | Check whether the connection of pin 2 of the coil and pin 1 of ECU is open or short to battery/ground. | Yes | Harness issue |
| | | No | Help |

Malcode: P1285

Information: Idle Speed Control Error

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|----------------------|
| 1 | Connect the diagnostic tool, and ignition off | | next |
| 2 | Remove the connector. Use multimeter to check whether the resistance between pin A and pin D, pin B and pin C is about 53±5.3Ω | Yes | Next |
| | | No | Change stepper motor |

| | | | |
|---|--|-----|---------------|
| 3 | Check whether the 4 wires are short to battery/ground or open. | Yes | Harness issue |
| | | No | Help |

5. Maintenance depending on the performance.

Before issue analysis, please check:

- 1) The MIL works well.
- 2) Clear the history malcode.
- 3) When the malcode comes again, note the conditions.

Check the appearance

- 1) Whether there is leakage of the fuel pipe or not.
- 2) Whether there is block/leakage or damage of the intake pipe.
- 3) Aging level of the high-voltage cable.
- 4) Whether the ground connection is strong enough.
- 5) All the connectors connected well.

Note: if any item above exists, please do the fix it at first before issue analysis.

Diagnostic Help:

- 1) Make sure there is no any issue record of the engine.
- 2) Make sure the issue could repeat.

- 3) Have checked follow the instructions above and no cause found.
- 4) Do not ignore the maintenance situation, cylinder pressure, mechanical timing and fuel quality.
- 5) Change the ECU and repeat the test, if the issue is gone, then the root cause is the ECU. Or change the old one back to check the root cause.
- 6) Engine cannot start

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|-------------------------|
| 1 | Check whether the voltage of the battery is around 8-12V. | Yes | Next |
| | | No | Change the battery. |
| 2 | Crank the engine, and check whether the voltage is above 8V. | Yes | Next |
| | | No | Change the battery. |
| 3 | Check whether the start motor working well or not. | Yes | Next |
| | | No | Change the start motor. |
| 4 | If the issue only occurs in winter, check the oil and gear box oil | Yes | Change the oil |
| | | No | Next |
| 5 | Check whether the engine rotation resistance is too big or not. | Yes | Check the engine |
| | | No | Help |

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|---------------------------|
| 1 | Check whether the fuel pump pressure is about 250kPa at idle. | Yes | Next |
| | | No | Check the pump. |
| 2 | Check whether the 'RMP' data on the diagnostic tool shows the real engine RPM. | Yes | Next |
| | | No | Check the crank sensor. |
| 3 | Pull out the spark plug, check whether the spark over is normal. | Yes | Next |
| | | No | Check the ignition system |
| 4 | Check whether the cylinder pressure is normal. | Yes | Engine is good. |
| | | No | Check the engine |

7) Start Difficult.

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|---------------------------|
| 1 | Check whether the fuel pump pressure is about 250kPa at idle. | Yes | Next |
| | | No | Check the pump. |
| 2 | Pull out the spark plug, check whether the spark over is normal. | Yes | Next |
| | | No | Check the ignition system |

| | | | |
|---|--|-----|--|
| 3 | Remove the connector of the engine temperature sensor, and check whether the engine start well | Yes | Check the engine temperature sensor |
| | | No | Next |
| 4 | With a little bigger throttle, check whether the engine starts well | Yes | Clean the throttle body and bypass channel |
| | | No | Next |
| 5 | Pull out the injector, and crank the engine. Check whether the injection is normal | Yes | Next |
| | | No | Clean or change the injector. |
| 6 | Pull out the spark plug, check whether it is wet or not | Yes | dry the plug and combustion chamber. |
| | | No | Next |
| 7 | Check whether the cylinder pressure is normal or not | Yes | Engine is good |
| | | No | Check the engine |

● Unstable idle

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|---------------------------|
| 1 | Check whether the air filter is blocked and whether the intake pipe leaks. | Yes | Intake system maintenance |
| | | No | Next |

| | | | |
|---|---|-----|------------------------------|
| 2 | Whether there is carbon deposit at the throttle body and bypass channel | Yes | Clean the TB |
| | | No | Next |
| 3 | Check whether the IACV works well | Yes | Next |
| | | No | Check the IACV |
| 4 | Check whether the fuel pressure is about 250kPa. | Yes | Next |
| | | No | Check the pump |
| 5 | Check whether the injector is blocked | Yes | Clean or change the injector |
| | | No | Next |
| 6 | Make sure using the right type spark plug | Yes | Next |
| | | No | Change the spark plug |
| 7 | Check whether the cylinder pressure is normal | Yes | Next |
| | | No | Check the engine |
| 8 | Remove the engine temperature sensor, and check whether the engine works well | Yes | Change the sensor |
| | | No | Next |
| 9 | Remove the TPS, check whether the engine works well | Yes | Change the sensor |
| | | No | Help |

● High idle

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|-------------------|
| 1 | Check whether the throttle cable is stuck | Yes | Adjust the cable |
| | | No | Next |
| 2 | Check whether the idle pintle has been adjusted | Yes | Change the TB |
| | | No | Next |
| 3 | Check whether there is any leakage of the intake pipe. | Yes | Maintenance |
| | | No | Next |
| 4 | Check whether the IACV works well | Yes | Next |
| | | No | Change IACV |
| 5 | Remove the engine temperature sensor and check whether the engine works well | Yes | Help |
| | | No | Change the sensor |

● Acceleration gets worse

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|-----------|--------|-----------|
|------|-----------|--------|-----------|

| | | | |
|---|--|-----|--|
| 1 | Check whether the air filter is blocked and whether the intake pipe leaks. | Yes | Intake system maintenance |
| | | No | Next |
| 2 | Check whether the fuel pressure is about 250kPa. | Yes | Next |
| | | No | Check the pump |
| 3 | Pull out the spark plug, check whether it is wet or not | Yes | dry the plug and combustion chamber. |
| | | No | Next |
| 4 | Check whether the TMAP, TPS and the connections works well. | Yes | Next |
| | | No | Change the sensor or harness maintenance |
| 5 | Check whether the injector is blocked | Yes | Clean or change the injector |
| | | No | Next |
| 6 | Check the type and the clearance of the spark plug. | Yes | Next |
| | | No | Change the spark plug |
| 7 | Check whether the cylinder pressure is normal | Yes | Next |
| | | No | Check the engine |
| 8 | Check whether the exhaust pipe is blocked or not | No | help |
| | | Yes | maintenance |

● Backfire

| ITEM | OPERATION | RESULT | NEXT STEP |
|------|--|--------|------------------------------|
| 1 | Pull out the spark plug, check whether the spark over is normal. | Yes | Next |
| | | No | Check the ignition system |
| 2 | Check whether the timing is right | Yes | Next |
| | | No | Adjust the timing |
| 3 | Check whether there is leakage of the valve | Yes | Adjust the valve |
| | | No | Next |
| 4 | Check whether the injector is blocked | Yes | Clean or change the injector |
| | | No | Next |
| 5 | Check whether the oxygen sensor works well | Yes | Help |
| | | No | Change the sensor |

| System or Component | DTC Number | DTC Description | Related Calibration | DTC |
|---------------------|------------|-----------------|---------------------|-----|
|---------------------|------------|-----------------|---------------------|-----|

| | | | | |
|--|-------|--|--------------|-----|
| Intake Air Pressure | P0263 | IAP Circuit Low Voltage or Open | COBDM_IAP_LO | 263 |
| | P0264 | IAP Circuit High Voltage | COBDM_IAP_HI | 264 |
| Intake Air Temperature Sensor (IAT) | P0274 | IAT Circuit Low Voltage | COBDM_IAT_LO | 274 |
| | P0275 | IAT Circuit High Voltage or Open | COBDM_IAT_HI | 275 |
| Engine/Oil Temperature Sensor | P0279 | Engine/Oil Temperature Sensor Circuit Low Voltage | COBDM_ETS_LO | 279 |
| | P0280 | Engine/Oil Temperature Sensor Circuit High Voltage or Open | COBDM_ETS_HI | 280 |
| Throttle Position Sensor (TPS) | P0290 | TPS Circuit Low Voltage or Open | COBDM_TPS_LO | 290 |
| | P0291 | TPS Circuit High Voltage | COBDM_TPS_HI | 291 |
| Oxygen Sensor(O21S) | P0305 | O21S Circuit Low Voltage | COBDM_O21_LO | 305 |
| | P0306 | O21S Circuit High Voltage | COBDM_O21_HI | 306 |

| | | | | |
|--|-------|---|--------------------|------|
| Oxygen Sensor Heater Circuit (OXYAHD) | P0050 | O21S Heater Circuit High Voltage | COBDM_O21Heater_HI | 50 |
| | P0049 | O21S Heater Circuit Low Voltage or Open | COBDM_O21Heater_LO | 49 |
| Fuel Injector | P0610 | Fuel Injector Circuit High Voltage | COBDM_INJA_HI | 610 |
| | P0609 | IFuel Injector Circuit Low Voltage or Open | COBDM_INJA_LO | 609 |
| Fuel Pump Relay (FPR) | P0560 | FPR Coil Circuit Low Voltage or Open | COBDM_FPR_LO | 560 |
| | P0562 | FPR Coil Circuit High Voltage | COBDM_FPR_HI | 562 |
| Crank Angle Sensing(CAS) | P0822 | CAS Sensor Noisy Signal | COBDM_CAS_Noise | 822 |
| | P0823 | CAS Sensor No Signal | COBDM_CAS_Lost | 823 |
| Ignition Coil | P8961 | Ignition Coil Ignition Coil High Voltage | COBDM_IGNA_HI | 8961 |
| | P8960 | Ignition Coil Ignition Coil Low Voltage or Open | COBDM_IGNA_LO | 8960 |
| Idle Control System | P1285 | Idle Control Speed Control Error | COBDM_ICS | 1285 |
| System Voltage | P1378 | System Voltage Low | COBDM_VLT_LO | 1378 |
| | P1379 | System Voltage High | COBDM_VLT_HI | 1379 |
| MIL | P1616 | MIL Control Circuits | COBDM_MIL | 1616 |

| | | | | |
|--|-------|---------------------------------------|---------------------|------|
| Tachometer Circuit (TACH) | P5779 | Tachometer Circuit Low Voltage | COBDM_TACH_LO | 5779 |
| | P5780 | Tachometer Circuit High Voltage | COBDM_TACH_HI | 5780 |
| Vehicle Speed Sensor | P1280 | VSS No Signal | KsDGDM_VSS_NoSignal | 1280 |
| Park Neutral Switch (PNSWD) | P2128 | Park Neutral Switch Error | COBDM_PNSW | 2128 |
| Evaporative Emission (EVP) | P1093 | EVP short to high | COBDM_EVAP_HI | 1093 |
| | P1092 | EVP short to low/open | COBDM_EVAP_LO | 1092 |
| ECU Check Error | P1537 | ECU diagnostic by self | COBDM_ROMChecksum | 1537 |
| VoltageRegulator | P0791 | VoltageRegulator Circuit High Voltage | COBDM_FAN_1_HI | 792 |
| | P0792 | VoltageRegulator Circuit Low Voltage | COBDM_FAN_1_LO | 791 |