

**Function Test**

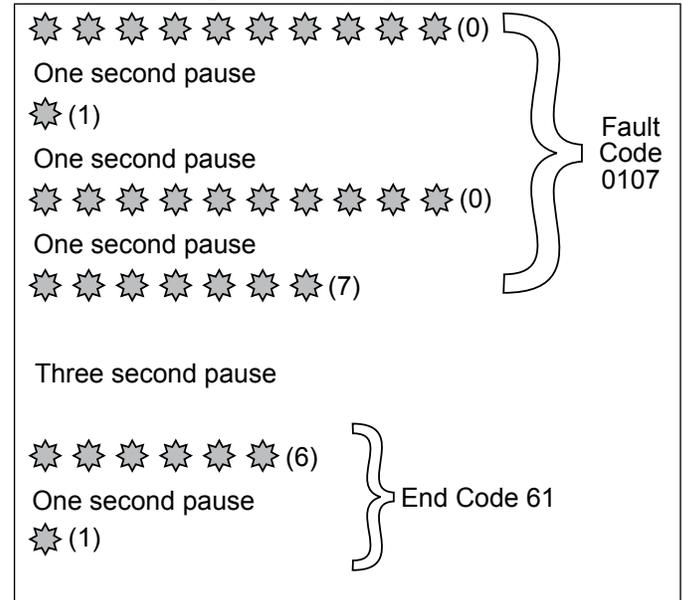
	<b>WARNING</b>
	<p>High Pressure Fluids can puncture skin and cause severe injury or death.</p> <p>Do not work on fuel system without proper training or safety equipment.</p>
<p>Fluid puncture injuries are highly toxic and hazardous. If an injury occurs, seek immediate medical attention.</p>	

Function of fuel system is to provide sufficient delivery of fuel at system operating pressure of 39 psi ± 3. If an engine starts hard, or turns over but will not start, it may indicate a problem with EFI fuel system. A quick test will verify if system is operating.

1. Disconnect and ground spark plug leads.
2. Complete all safety interlock requirements and crank engine for approximately 3 seconds.
3. Remove spark plugs and check for fuel at tips.
  - a. If there is fuel at tips of spark plugs fuel pump and injectors are operating.
  - b. If there is no fuel at tips of spark plugs, check following:
    1. Make sure fuel tank contains clean, fresh, proper fuel.
    2. Make sure that vent in fuel tank is open.
    3. Make sure fuel tank valve (if equipped) is fully opened.
    4. Make sure battery is supplying proper voltage.
    5. Check that fuses are good, and that no electrical or fuel line connections are damaged or broken.
    6. Test fuel pump module operation as described earlier under Fuel Pump.

**Fault Codes**

**Example of Diagnostic Display**



**Diagnostic Fault Code Summary**

Fault Code	Connection or Failure Description
0031	Oxygen Sensor Heater Circuit High Voltage
0032	Oxygen Sensor Heater Circuit Low Voltage
0107	Manifold Absolute Pressure Sensor Circuit Low Voltage or Open
0108	Manifold Absolute Pressure Sensor Circuit High Voltage
0112	Intake Air Temperature Sensor Circuit Low Voltage
0113	Intake Air Temperature Sensor Circuit High Voltage or Open
0117	Coolant/Oil Temperature Sensor Circuit Low Voltage
0118	Coolant/Oil Temperature Sensor Circuit High Voltage or Open
0122	Throttle Position Sensor Circuit Low Voltage or Open
0123	Throttle Position Sensor Circuit High Voltage
0131	Oxygen Sensor 1 Circuit Low Voltage, or Open
0132	Oxygen Sensor 1 Circuit High Voltage
0171	Maximum Adaptation Limit Exceeded
0172	Minimum Adaptation Limit Exceeded
0174	Lean Fuel Condition at High Load (Open Loop)
0201	Injector 1 Circuit Malfunction
0202	Injector 2 Circuit Malfunction

# EFI SYSTEM-ECH

0230	Fuel Pump Module Circuit Low Voltage or Open
0232	Fuel Pump Module Circuit High Voltage
0336	Crankshaft Position Sensor Noisy Signal
0337	Crankshaft Position Sensor No Signal
0351	Cylinder 1 Ignition Coil Malfunction
0352	Cylinder 2 Ignition Coil Malfunction
0562	System Voltage Low
0563	System Voltage High
61	End of Code Transmission

ECU continuously monitors engine operation against preset performance limits. If operation is outside limits, ECU activates MIL, if equipped, and stores a diagnostic code in its fault memory. If component or system returns to proper function, ECU will turn off MIL. If MIL stays illuminated, it warns customer a fault is currently happening, and dealer service is required. Upon receipt, dealer technician can access fault code(s) to help determine what portion of system is malfunctioning.

Codes are accessed through key switch and displayed as blinks or flashes of MIL. Access codes as follows:

1. Check that battery voltage is above 11 volts.
2. Start with key switch OFF.
3. Turn key switch to ON and OFF, then ON and OFF, then ON, leaving it on in third sequence. Do not start engine. Time between sequences must be less than 2.5 seconds.
4. MIL will blink a series of times. Number of times MIL blinks represents a number in blink code.
5. A sequence of four digits make up a fault code. There is a one (1) second pause between blinks of a fault code. There is a three (3) second pause between separate fault codes. After fault code(s) are blinked a two digit 61 is blinked to indicate program has completed.
  - a. It's a good idea to write down codes as they appear, as they may not be in numerical sequence.
  - b. Code 61 will always be last code displayed, indicating end of code transmission. If code 61 appears immediately, no other fault codes are present.

After problem has been corrected, fault codes may be cleared by following ECU Reset and TPS Learn Procedures.

Diagnostic Fault Code Summary lists fault codes, and what they correspond to. Diagnostic Code Summary is a list of individual codes with an explanation of what triggers them, what symptoms might be expected, and probable causes.

A MIL may not be provided with engine. If equipment manufacturer has not added a MIL to equipment, one can be added easily for quick diagnostics. Main engine to vehicle connection will have a tan wire which is ground for MIL. Either incandescent or LED type bulbs can be used for MIL as long as they do not draw more than 0.1 amps. Bulb needs to be rated at 1.4 Watts or less, or needs to have a total resistance of 140 Ω or more. LEDs typically draw less than 0.03 amps. Attach +12 volts to positive terminal of bulb and attach ground terminal of bulb to tan wire.

## Diagnostic Code Summary

### Code 0031

Component:	Oxygen Sensor Heater
Fault:	O2S Heater Circuit High Voltage
Condition:	System voltage too high, shorted connection or faulty sensor.
Conclusion:	<p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring problem.</li> <li>• Sensor damaged.</li> <li>• Pin circuit wiring or connectors at Black 7.</li> </ul> <p>ECU Related</p> <ul style="list-style-type: none"> <li>• ECU-to-harness connection problem.</li> </ul>

### Code 0032

Component:	Oxygen Sensor Heater
Fault:	O2S Heater Circuit Low Voltage
Condition:	System voltage too low, open connection or faulty sensor.
Conclusion:	<p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• Pin circuit wiring or connectors. ECU black pin 7 or broken wire.</li> </ul> <p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring problem.</li> </ul> <p>Poor system ground from ECU to engine or battery to engine.</p>

### Code 0107

Component:	Manifold Absolute Pressure Sensor
Fault:	MAP Circuit Low Voltage or Open
Condition:	Intake manifold leak, open connection or faulty sensor.
Conclusion:	<p>MAP Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor malfunction.</li> <li>• Vacuum leaks from loose manifold or sensor.</li> </ul> <p>Wire Harness Related</p> <ul style="list-style-type: none"> <li>• Poor grounding or open circuit.</li> <li>• Wire harness and connectors loose, damaged or corroded.</li> <li>• Pin circuit wiring or connectors at Black 10, 11 and 16.</li> </ul> <p>Bad TPS Learn.</p>

## Code 0108

Component:	Manifold Absolute Pressure Sensor
Fault:	MAP Circuit High Voltage
Condition:	Intake manifold leak, shorted connection or faulty sensor.
Conclusion:	<p>MAP Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor malfunction.</li> <li>● Vacuum leaks from loose manifold or sensor.</li> </ul> <p>Wire Harness Related</p> <ul style="list-style-type: none"> <li>● Poor grounding.</li> <li>● Pin circuit wiring or connectors at Black 11.</li> </ul> <p>Bad TPS Learn.</p>

## Code 0112

Component:	Intake Air Temperature Sensor
Fault:	Intake Air Temperature Sensor Circuit Low Voltage
Condition:	Shorted connection, faulty sensor or shorted wire.
Conclusion:	<p>Temperature Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor wiring or connection.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Pin circuits Black 10 and Black 8 may be damaged or routed near noisy signal (coils, alternator, etc.).</li> <li>● ECU-to-harness connection problem.</li> </ul>

## Code 0113

Component:	Intake Air Temperature Sensor
Fault:	Intake Air Temperature Sensor Circuit High Voltage or Open
Condition:	Shorted connection, faulty sensor, broken wire or connection.
Conclusion:	<p>Temperature Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor wiring or connection.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Pin circuits ECU Black pin 10 and 8 may be damaged.</li> <li>● ECU-to-harness connection problem or broken wire.</li> </ul>

## Code 0117

Component:	Coolant/Oil Sensor
Fault:	Coolant/Oil Temperature Sensor Circuit Low Voltage
Condition:	Shorted connection, faulty sensor or shorted wire.
Conclusion:	<p>Temperature Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor wiring or connection.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Pin circuits Black 10 and Black 14 maybe damaged or routed near noisy signal (coils, stator, etc.).</li> <li>● ECU-to-harness connection problem.</li> </ul>

## Code 0118

Component:	Coolant/Oil Sensor
Fault:	Coolant/Oil Temperature Sensor Circuit High Voltage or Open
Condition:	Shorted connection, faulty sensor, open connection or broken wire.
Conclusion:	<p>Temperature Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor wiring or connection.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Pin circuits ECU Black pin 10 and 14 may be damaged.</li> <li>● ECU-to-harness connection problem or broken wire.</li> </ul> <p>System Related</p> <ul style="list-style-type: none"> <li>● Engine is operating above 176°C (350°F) temperature sensor limit.</li> </ul>

## Code 0122

Component:	Throttle Position Sensor (TPS)
Fault:	TPS Circuit Low Voltage or Open
Condition:	Open connection, broken wire or faulty sensor.
Conclusion:	<p>TPS Related</p> <ul style="list-style-type: none"> <li>● TPS bad or worn internally.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Broken or shorted wire in harness. <ul style="list-style-type: none"> <li>ECU Black pin 10 to TPS pin 1.</li> <li>ECU Black pin 12 to TPS pin 3.</li> <li>ECU Black pin 16 to TPS pin 2.</li> </ul> </li> </ul> <p>Throttle Body Related</p> <ul style="list-style-type: none"> <li>● Throttle shaft inside TPS worn, broken, or damaged.</li> <li>● Throttle plate loose or misaligned.</li> <li>● Throttle plate bent or damaged allowing extra airflow past, or restricting movement.</li> </ul> <p>ECU Related</p> <ul style="list-style-type: none"> <li>● Circuit providing voltage or ground to TPS damaged.</li> <li>● TPS signal input circuit damaged.</li> </ul>

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## Code 0123

Component:	Throttle Position Sensor (TPS)
Fault:	TPS Circuit High Voltage
Condition:	Shorted connection or faulty sensor.
Conclusion:	<p>TPS Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring.</li> <li>• Sensor output affected or disrupted by dirt, grease, oil, wear.</li> <li>• Sensor loose on throttle body manifold.</li> </ul> <p>Throttle Body Related</p> <ul style="list-style-type: none"> <li>• Throttle shaft or bearings worn/damaged.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• ECU pins Black 10, 12 and 16 damaged (wiring, connectors).</li> <li>• ECU pins Black 10, 12 and 16 routed near noisy electrical signal (coils, alternator).</li> <li>• Intermittent 5 volt source from ECU (pin Black 16).</li> <li>• ECU-to-harness connection problem.</li> </ul>

## Code 0131

Component:	Oxygen Sensor
Fault:	O2S 1 Circuit Low Voltage
Condition:	Open connection, broken wire or faulty sensor.
Conclusion:	<p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring problem.</li> <li>• Sensor contaminated, corroded or damaged.</li> <li>• Poor ground path.</li> <li>• Pin circuit wiring or connectors. ECU Black pin 10 or 17.</li> </ul> <p>TPS Learn Procedure Incorrect</p> <ul style="list-style-type: none"> <li>• Lean condition (check oxygen sensor signal with VOA and see Oxygen Sensor).</li> </ul> <p>Engine wiring harness related such as a cut wire, broken or pinched.</p>

## Code 0132

Component:	Oxygen Sensor
Fault:	O2S 1 Circuit High Voltage
Condition:	Shorted connection or faulty sensor.
Conclusion:	<p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring problem.</li> <li>• Sensor contaminated or damaged.</li> <li>• Poor ground path.</li> <li>• Pin circuit wiring or connectors. ECU Black pin 10 or Black pin 17.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• Difference in voltage between sensed voltage and actual sensor voltage.</li> <li>• Short in wire harness.</li> </ul>

## Code 0171

Component:	Fuel System
Fault:	Maximum adaptation limit exceeded
Condition:	Fuel inlet screen/filter plugged, low pressure at high pressure fuel line, TPS malfunction, shorted connection, faulty sensor, low fuel or wrong fuel type.
Conclusion:	<p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>• Corrosion or poor connection.</li> <li>• Sensor contaminated or damaged.</li> <li>• Air leak into exhaust.</li> <li>• Poor ground path.</li> <li>• Pin circuit wiring or connectors. ECU Black pin 10 or Black pin 17.</li> </ul> <p>TPS Sensor Related</p> <ul style="list-style-type: none"> <li>• Throttle plate position incorrect during Learn procedure.</li> <li>• TPS problem or malfunction.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• Difference in voltage between sensed voltage and actual sensor voltage.</li> <li>• Problem in wiring harness.</li> <li>• ECU-to-harness connection problem.</li> </ul> <p>Systems Related</p> <ul style="list-style-type: none"> <li>• Ignition (spark plug, plug wire, ignition coil).</li> <li>• Fuel (fuel type/quality, injector, fuel pressure too low, fuel pump module or lift pump).</li> <li>• Combustion air (air cleaner dirty/restricted, intake leak, throttle bores).</li> <li>• Base engine problem (rings, valves).</li> <li>• Exhaust system leak (muffler, flange, oxygen sensor mounting boss, etc.).</li> <li>• Fuel in crankcase oil.</li> </ul>

## Code 0172

Component:	Fuel System
Fault:	Minimum adaptation limit exceeded
Condition:	Too high pressure at high pressure fuel line, TPS malfunction, shorted connection, faulty sensor or fuel pump module failure.
Conclusion:	<p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor connector or wiring.</li> <li>● Sensor contaminated or damaged.</li> <li>● Poor ground path.</li> <li>● Pin circuit wiring or connectors. ECU Black pin 10 or 17.</li> </ul> <p>TPS Sensor Related</p> <ul style="list-style-type: none"> <li>● Throttle plate position incorrect during Learn procedure.</li> <li>● TPS problem or malfunction.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Difference in voltage between sensed voltage and actual sensor voltage.</li> <li>● Problem in wiring harness.</li> <li>● ECU-to-harness connection problem.</li> </ul> <p>Systems Related</p> <ul style="list-style-type: none"> <li>● Ignition (spark plug, plug wire, ignition coil).</li> <li>● Fuel (fuel type/quality, injector, fuel pressure too high, fuel pump module or lift pump).</li> <li>● Combustion air (air cleaner dirty/restricted).</li> <li>● Base engine problem (rings, valves).</li> <li>● Fuel in crankcase oil.</li> <li>● Fuel pump module is over filled.</li> <li>● Lift pump diaphragm is ruptured.</li> </ul>

## Code 0174

Component:	Fuel System
Fault:	Lean fuel condition
Condition:	Fuel inlet screen/filter plugged, low pressure at high pressure fuel line, TPS malfunction, shorted connection or faulty sensor.
Conclusion:	<p>TPS Learn Incorrect</p> <ul style="list-style-type: none"> <li>● Lean condition (check oxygen sensor signal with VOA and see Oxygen Sensor).</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Pin circuit wiring or connectors. ECU pin Black 10, 12, 16 and 17.</li> </ul> <p>Low Fuel Pressure</p> <ul style="list-style-type: none"> <li>● Plugged filters.</li> <li>● Bad lift pump.</li> </ul> <p>Oxygen Sensor Related</p> <ul style="list-style-type: none"> <li>● Sensor connector or wiring problem.</li> <li>● Exhaust leak.</li> <li>● Poor ground.</li> </ul> <p>Poor system ground from ECU to engine, causing rich running while indicating lean.</p> <p>Fuel pump module connection. See Fuel Components.</p>

## Code 0201

Component:	Fuel Injector
Fault:	Injector 1 Circuit Malfunction
Condition:	Injector damaged or faulty, shorted or open connection.
Conclusion:	<p>Injector Related</p> <ul style="list-style-type: none"> <li>● Injector coil shorted or opened.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Broken or shorted wire in harness. ECU pin Black 5.</li> <li>● Wiring from Ignition.</li> </ul> <p>ECU Related</p> <ul style="list-style-type: none"> <li>● Circuit controlling injector #1 damaged.</li> </ul>

# EFI SYSTEM-ECH

## Code 0202

Component:	Fuel Injector
Fault:	Injector 2 Circuit Malfunction
Condition:	Injector damaged or faulty, shorted or open connection.
Conclusion:	<p>Injector Related</p> <ul style="list-style-type: none"> <li>• Injector coil shorted or opened.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• Broken or shorted wire in harness. ECU pin Black 6.</li> <li>• Wiring from Ignition.</li> </ul> <p>ECU Related</p> <ul style="list-style-type: none"> <li>• Circuit controlling injector #2 damaged.</li> </ul>

## Code 0230

Component:	Fuel Pump
Fault:	Circuit Low Voltage or Open
Condition:	Shorted or open connection.
Conclusion:	<p>Fuel Pump Related</p> <ul style="list-style-type: none"> <li>• Fuel pump module open or shorted internally.</li> </ul> <p>Engine Wiring Harness related</p> <ul style="list-style-type: none"> <li>• Broken or shorted wire in harness. ECU pin Black 9 or Grey 17.</li> </ul> <p>ECU Related</p> <ul style="list-style-type: none"> <li>• ECU is damaged.</li> </ul>

## Code 0232

Component:	Fuel Pump
Fault:	Circuit High Voltage
Condition:	Shorted connection.
Conclusion:	<p>Fuel Pump Related</p> <ul style="list-style-type: none"> <li>• Fuel pump module damaged internally.</li> </ul> <p>Charging Output System Too High.</p>

## Code 0336

Component:	Crankshaft Position Sensor
Fault:	Crankshaft Position Sensor Noisy Signal
Condition:	Air gap incorrect, loose sensor, faulty/bad battery, shorted or faulty connection, faulty sensor or faulty sensor grounding.
Conclusion:	<p>Crankshaft Position Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring.</li> <li>• Sensor loose or air gap incorrect.</li> </ul> <p>Crankshaft Position Sensor Wheel Related</p> <ul style="list-style-type: none"> <li>• Damaged teeth.</li> <li>• Gap section not registering.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• Pin circuit wiring or connectors. ECU pin Black 4 and Black 13.</li> <li>• ECU-to-harness connection problem.</li> </ul> <p>Ignition System Related</p> <ul style="list-style-type: none"> <li>• Non-resistor spark plug(s) used.</li> <li>• Faulty or disconnected ignition coil or secondary lead.</li> </ul>

## Code 0337

Component:	Crankshaft Position Sensor
Fault:	Crankshaft Position Sensor No Signal
Condition:	Air gap incorrect, loose sensor, open or shorted connection or faulty sensor.
Conclusion:	<p>Crankshaft Position Sensor Related</p> <ul style="list-style-type: none"> <li>• Sensor connector or wiring.</li> <li>• Sensor loose or air gap incorrect.</li> </ul> <p>Crankshaft Position Sensor Wheel Related</p> <ul style="list-style-type: none"> <li>• Damaged teeth.</li> </ul> <p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>• Pin circuit wiring or connectors. ECU pin Black 4 or Black 13.</li> <li>• ECU-to-harness connection problem.</li> </ul> <p>If code is stored in fault history and starts normally. Clear code, no other service required.</p>

**Code 0351**

Component:	Ignition Coil
Fault:	Cylinder 1 Ignition Coil Malfunction
Condition:	Broken wire in harness (may not be visible), shorted connection or faulty sensor.
Conclusion:	<p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Connection to ignition or fuse.</li> <li>● Pin circuit wiring or connectors.</li> <li>● ECU pin Black 1.</li> <li>● ECU-to-harness connection problem.</li> </ul> <p>Ignition System Related</p> <ul style="list-style-type: none"> <li>● Incorrect spark plug(s) used.</li> <li>● Poor connection to spark plug.</li> </ul>

**Code 0352**

Component:	Ignition Coil
Fault:	Cylinder 2 Ignition Coil Malfunction
Condition:	Broken wire in harness (may not be visible), shorted connection or faulty sensor.
Conclusion:	<p>Engine Wiring Harness Related</p> <ul style="list-style-type: none"> <li>● Connection to ignition or fuse.</li> <li>● Pin circuit wiring or connectors.</li> <li>● ECU pin Grey 10.</li> <li>● ECU-to-harness connection problem.</li> </ul> <p>Ignition System Related</p> <ul style="list-style-type: none"> <li>● Incorrect spark plug(s) used.</li> <li>● Poor connection to spark plug.</li> </ul>

**Code 0562**

Component:	System Voltage
Fault:	System Voltage Low
Condition:	Faulty voltage regulator, bad fuse or shorted connection.
Conclusion:	<p>Corroded Connections</p> <p>Bad Stator</p> <p>Bad Battery</p> <ul style="list-style-type: none"> <li>● Low output charging system.</li> <li>● Poor magnet in flywheel.</li> <li>● Bad or missing fuse.</li> </ul>

**Code 0563**

Component:	System Voltage
Fault:	System Voltage High
Condition:	Faulty voltage regulator or shorted connection.
Conclusion:	<p>Faulty Rectifier-Regulator</p> <p>Bad Stator.</p> <p>Bad Battery.</p>

**Code 61**

Component:	End of Code Transmission
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**Troubleshooting Flow Chart**

Following flow chart provides an alternative method of troubleshooting EFI system. Chart will enable you to review entire system in about 10-15 minutes. Using chart, accompanying diagnostic aids (listed after chart), and any signaled fault codes, you should be able to quickly locate any problems within system.

**Flow Chart Diagnostic Aids**

**Diagnostic Aid #1 SYSTEM POWER**

(MIL does not illuminate when key is turned ON)

NOTE: MIL is installed by vehicle OEM. Twelve volt supply to bulb will be part of vehicle wire harness. Kohler key switch model will have MIL on engine with 12V supply to bulb.

**Conclusion**

- Battery
- Main system fuse
- MIL light bulb burned out
- MIL electrical circuit problem
  - Pin circuits Grey 3.
- Ignition switch
- Permanent ECU power circuit problem
  - Pin circuit Black 18.
- Switched ECU power circuit problem
  - Pin circuit Black 15.
- ECU grounds
- ECU

**Diagnostic Aid #2 FAULT CODES**

Refer to Diagnostic Fault Code Summary.

**Diagnostic Aid #3 RUN/ON**

(MIL remains ON while engine is running)\*

**Condition**

NOTE: Either incandescent or LED type bulbs can be used for MIL as long as they do not draw more than 0.1 amps. Bulb needs to be rated at 1.4 Watts or less, or needs to have a total resistance of 140 Ω or more. LEDs typically draw less than 0.03 amps.

All current fault codes will turn on MIL when engine is running.

**Diagnostic Aid #4 CRANKSHAFT POSITION SENSOR**

(MIL does not turn off during cranking)

**Condition**

- Crankshaft position sensor
- Crankshaft position sensor circuit problem, pin circuits Black 4 and Black 13.
- Crankshaft position sensor/toothed wheel air gap
- Toothed wheel
- Flywheel key sheared
- ECU

**Diagnostic Aid #5 FUEL PUMP**

(fuel pump not turning on)

**Condition**

- Main fuse
- Fuel pump circuit problem, pin circuits Black 9 and Grey 17.
- Fuel pump module

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## Diagnostic Aid #6 IGNITION SYSTEM

(no spark)

### Condition

- Spark plug
- Plug wire
- Coil
- Coil circuit(s), pin circuits Grey 10 and Black 1.
- ECU grounds
- ECU
- Vehicle safety interlocks, ground signal on safety wire.

## Diagnostic Aid #7 FUEL SYSTEM ELECTRICAL

(no fuel delivery)

### Condition

- No fuel
- Air in high pressure fuel line
- Fuel valve shut OFF
- Fuel filter/line plugged
- Injector circuit(s), pin circuits Black 5 and Black 6
- Injector
- ECU grounds
- ECU
- Lift pump not working

## Diagnostic Aid #8 FUEL SYSTEM

(fuel pressure)

### Low Fuel Pressure-Condition

- Low fuel
- Fuel filter plugged
- Fuel supply line plugged
- Lift fuel pump - insufficient fuel supply
- Fuel pump (lift or module) - internally plugged

### Low Fuel Pressure-Condition

- Pressure regulator not functioning properly inside fuel pump module.

## Diagnostic Aid #9 BASIC ENGINE

(cranks but will not run)

### Condition

- Refer to basic engine troubleshooting charts within Troubleshooting, Electronic Fuel Injection-ECH EFI, and Electrical Systems.